APROL R 4.0 - Installation APROL System

A2 Getting Started

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The following documentation ***A2 Getting Started***

(Version 6.07 / 26.09.2014) refers to APROL **R 4.0**

The *APROL System Installation* manual group includes the following manuals

- **A1 Release Notes**
- **A2 Getting Started**
- **A3 Upgrade Notes**

Order number of the *APROL System installation* manual group:

MAAPINST40-ENG

Contents
A2 Getting Started V6.07

APROL Documentation
A2 Getting Started V6.07

belongs to the manual set
Installation APROL System

Target group, conventions, and format

The manual **A2 Getting Started** is intended for users or system administrators who are responsible for the installation and upgrade of the Linux operating system, the installation of the APROL system software, and the configuration of the CC-Account on a Linux machine.

In this documentation the following formatting is used:

Key	**[Esc]**-Key
Menu item	**„Module-Groups/open“**
Directory name	`HOME/ENGIN/HTML/049`

In this manual the following icons are used to highlight special information:

Listing

Listing

Listing

Tipp or suggestion

Note

Warning

Reference

This description is under construction at present.

Please inform yourself in regular intervals about the current APROL documentation on our internet side **www.br-automation.com**, in the area Material related downloads.

ToDo This point is to be carried out by the user

List of necessary configuration steps	
Next step	
Configuration finished	

A2-1 Linux Installation

1.1 Introduction

*Information about the revision history can be obtained in the chapter Revision history in the **appendix**.*

Thank you very much for deciding to use APROL, the system for automation technology and process control systems.

The information contained in Chapters 1 to 6 can be used as a guideline for installing the above program package from the DVD, and for the basic configuration of the CC-Accounts. In the manual 'A3 Upgrade Notes', you can find extensive information about an upgrade or an update of the APROL software packages.

Here you will find a step-by-step description of how to pre-configure the various CC-Accounts (**Engineering system**, **Runtime system**, **Operator system**). These configurations can be made after the initial installation when the **AprolConfig** script is launched automatically. These configurations can be made after the initial installation when the *aprolconfig* script is launched automatically.

The following information serves to provide an understanding of the term 'CC-Account' in Linux.

In accordance with Linux conventions, a CC-Account is assigned to a Linux user with a Linux login name. Since several people generally work on one CC-Account, it makes more sense to refer to a "system login", which needs to be familiar to all concerned. Every user / operator who uses the system must know this login and corresponding password.

In a CC-Account, the people mentioned above (*users* and *operators*) can administer different tasks. In order to carry out these tasks, they are assigned an additional login name that has the necessary user rights. A login mechanism is in place (login name and password) in every system to check these user rights.

The illustration shown below shows the systems that can be set up on a computer once the APROL software has been installed completely. Please note that some computer types are only intended for a certain system type.

The system architecture (32 bit or 64 bit) of the server for the engineering system must be the same as the system architecture of the (redundancy) server of the corresponding runtime system!

The respective operator stations can be of any desired architecture.

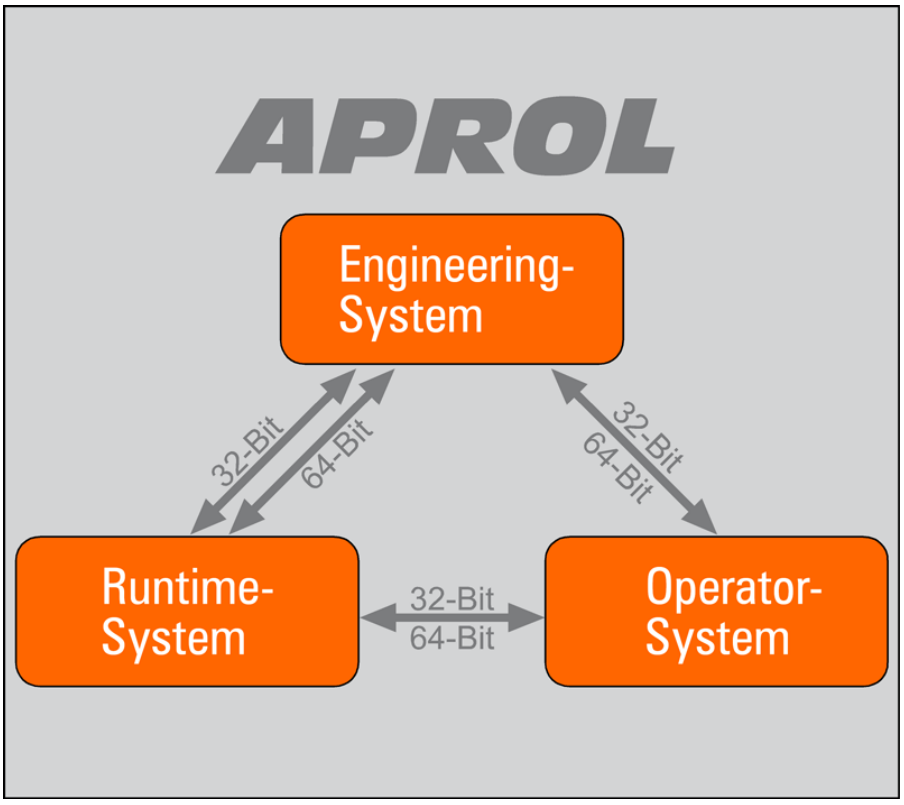


Illustration 1: Overview of the system architectures

The APROL **System Software** DVD contains the individual software packages in RPM format. These packages include the corresponding files, are arranged according to their functionality, and are installed in the /`opt/aprol/` directory of the respective PC.

The following information must be observed in order to ensure that the later installation and basic configuration of APROL are handled correctly!

Linux operating system and packages
In order to install or update APROL, an appropriate distribution version of **Linux** must already be installed.
The current version is SUSE Linux Enterprise Server 11 (SLES 11). Notes about valid operating system versions can be found in the ***system requirements*** contained on the APROL System Software DVD.

B&R's AutoYaST installation DVD provides a quick and easy way to install the operating system.

This DVD has been specially made. Installing similar packages from the SLES 11 DVD (CDs) may cause errors! The DVD created by B&R contains updates for the SLES 11 distribution.
Only this DVD is allowed to be used for updates!
In case a Linux update is necessary, the manual 'A3 Upgrade Notes' chapter Updating the operating system (SLES) from the AutoYaST installation DVD supplies the required information.

Detailed information about the operating system installation can be found in chapter The installation of SLES.

Conventions for Linux in APROL:

Computer name convention (host name) according to RFC 1123
The characters a - z, numbers 0 - 9, and the special character '-' (hyphen) are allowed.

The host name must contain at least one letter and is not allowed to begin or end with a hyphen.

CC-Account login name (Linux user) convention

Only the characters a - z, 0 - 9, and the special characters '.' (period) and '_' (underscore) are allowed. The CC-Account is not allowed to begin with a number or a '.'.

A maximum of 11 characters are permitted.

Non-permissible names for CC-Accounts: 'aprol' and 'aprolsys'.

CC-Account password (Linux user) conventions

All letters, characters and numbers are permitted.
Upper and lower case letters are distinguished (case-sensitive).

4 to 32 characters are allowed.

1.2 APROL delivery contents

APROL comes supplied with:

✓	3 pieces. The APROL *System Software DVD, internationalized* with all of the packages necessary for installation, including the online documentation.
✓	The *AutoYaST installation DVD* with Linux package selection. This DVD is also created by B&R. This DVD could contain an update if you are already using SLES 11. Your existing Linux installation must be updated! You can find information about this **update** in chapter *Updating the operating system (SLES) from the AutoYaST installation DVD*.
✓	APROL Language DVD (*optional*)
✓	1 License certificate with license key (sticker) for **licensing** the **VMware workstation**
✓	1 license certificate with product key (sticker) for **licensing Microsoft Windows XP Professional**
✓	1 License certificate with license key (sticker) for **licensing** the **B&R APROL Automation Studio Single**
✓	and optionally: 1 License certificate with license key (sticker) for **licensing** the **B&R SafeDESIGNER**

Illustration 2: License certificate

Illustration 3: Sticker with license key

APROL internationalization means:

The entire system software is also created in UNICODE, making it possible for all APROL systems to be translated into any language and displayed using any character set. The output language of APROL is English. The standard delivery comes in both German and English by default. A simple configuration procedure allows the programs to be used in the respective language on the desktop.

The packages on the APROL **Language DVD** can be installed to create a translation system. It is then only necessary to carry out the translations on the basis of the English language in the form of a table. After the translations are finished, the newly created files can be installed in the CC-Account. Once this installation takes place, APROL is available in the new language.

Further information about the translation system for APROL can be found in chapter Language localization in manual "D1 System manual".

The documentation included on the APROL System Software CD should definitely be installed. After the system has been configured and you have logged in, the documentation should be read in electronic form and printed out.

The documentation mentioned above is also available in electronic form (PDF files in A5 format) from the B&R server.

1.3 New installations and updates at a glance

The illustration below gives an overview of the individual steps that result in a completed process control system once an installation or update has taken place. It is mandatory that the Linux distribution version required for the APROL release version has been installed on the computer.

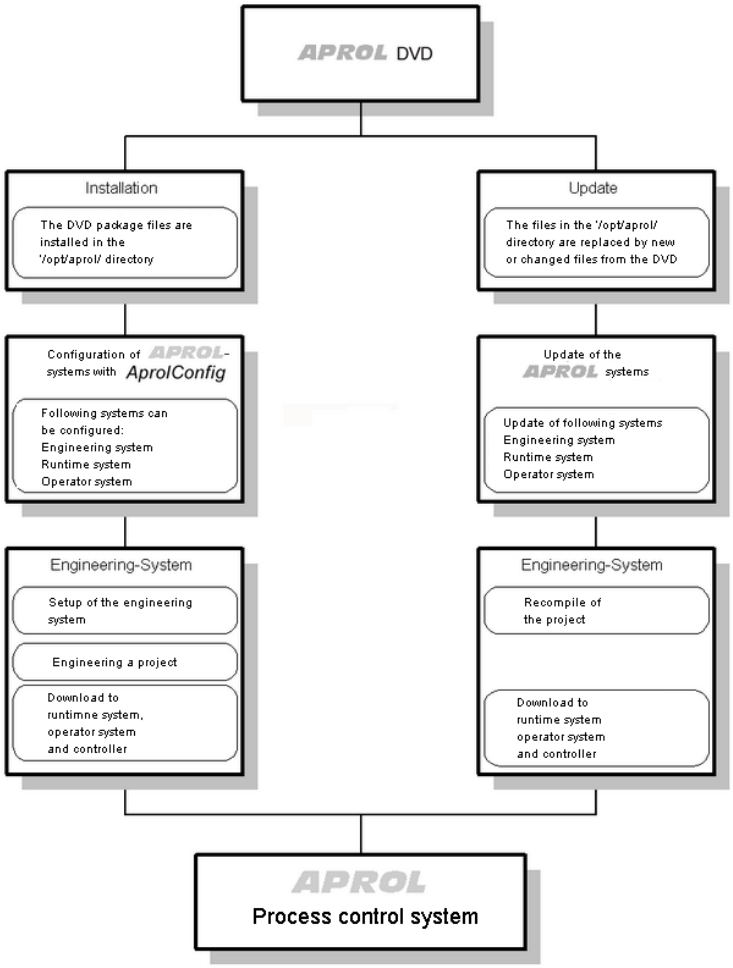


Illustration 4: Everything at one glance

1.4 The installation of SLES

The existing 'ext3' standard file system was replaced with the 'XFS'.

XFS is one of the oldest available journaling file system for UNIX, and distinguishes itself with a mature and almost entirely error-free code base.

The file system can be changed as desired during the installation.

Installing the operating system is quick and easy when done from B&R's ***AutoYaST installation DVD*** (included in delivery).

The BIOS clock must be set to the actual date and the actual time before the Linux installation takes place!

After installing the Linux operating system, you also need the APROL system software DVD to complete the installation.

Please note that the root partition must be at least 50 GB in size, so that an APROL installation can be carried out.

*In order to carry out an update, or upgrade, the **root partition** must have at least 15 GB free space available!*

You must also take the space into account for any CC-Account that already exists.

***A separate hard-disk, or a separate partition**, should exist and be set up on the respective logging servers for the data recorded in the scope of the ChronoLog mechanism (e.g. Audit Trail, system messages, alarms, compressed data)!*

*When using B&R approved hardware, almost all of the values to be configured (Graphics cards and settings, keyboard layout, etc.) have either already been preconfigured for standard PCs or will be recognized by the **Plug and Play mechanism**.*

It is possible to make changes to the pre-configuration. Knowledge about the SuSE installation tool YaST is necessary.

All equipment, which will be used with the PC at a later stage, should be connected before the installation. Only then can the hardware recognition recognize and configure the connected peripheral devices. It is also recommended to already connect the keyboard and mouse that is to be used later during the installation.

If you are using a DVI interface, please note the Notes about using the DVI interface in SLES in this manual's appendix.

The following configurations must be carried out manually:

- Modem
- Internet connection
- /etc/hosts (with more than one network card)

Please note that all of the data is deleted when the hard disk is formatted. If you want to keep the existing data you must carry out a backup of the data beforehand. Details can be found in the APROL documentation 'D4 Backup & Recovery'.

The suggestion must be confirmed with [**Adopt**] in a dialog during the installation. The next installation step can only take place after this.

Necessary information for the installation:

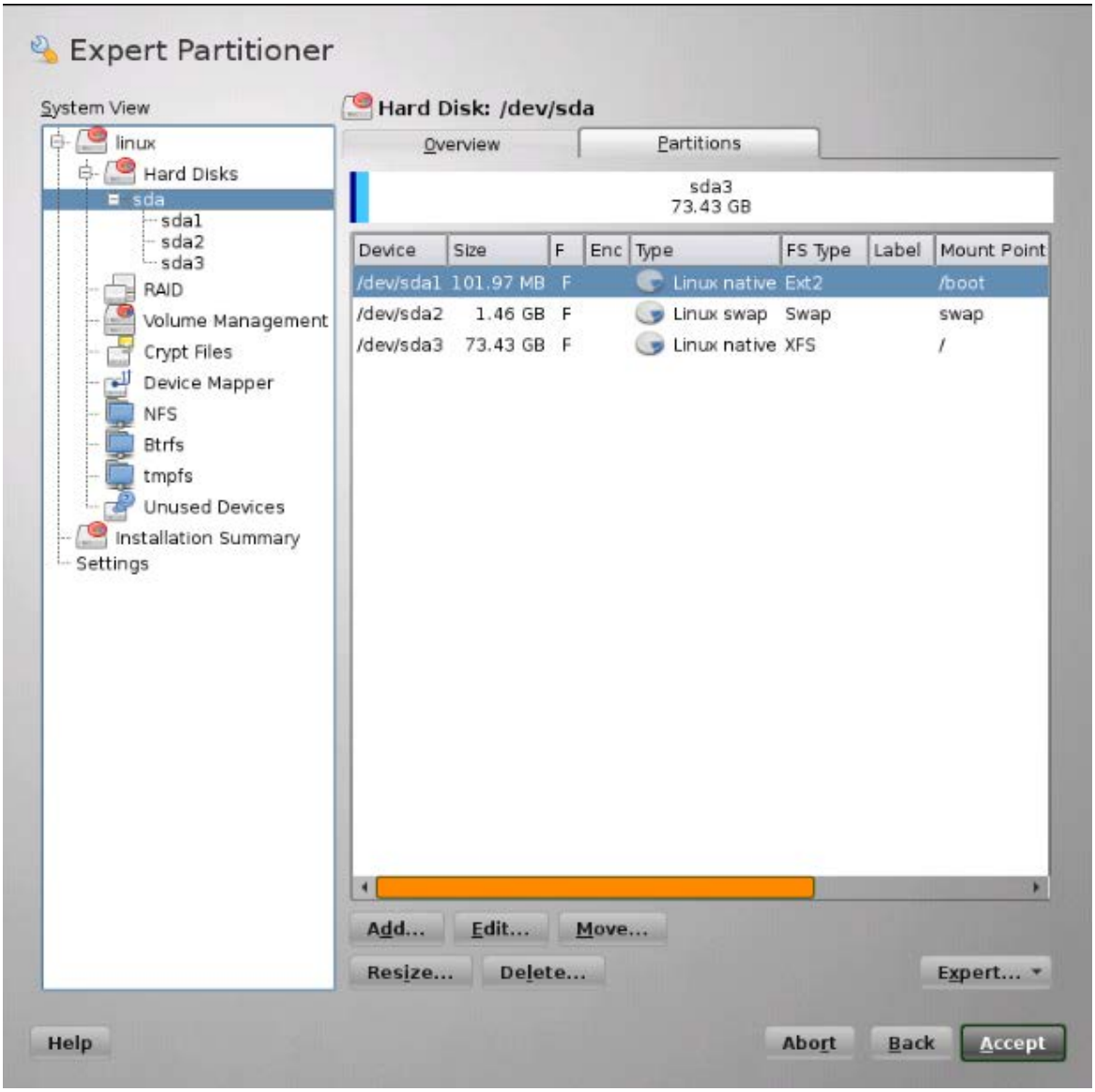
The following information should be available before you begin with the Linux installation:

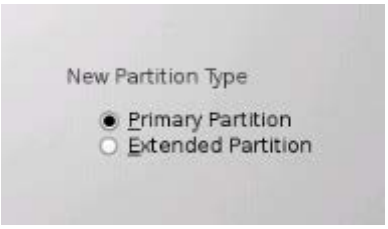
- Host name
- Domain name
- IP address
- Net Mask
- Gateway
- DNS 1
- DNS 2

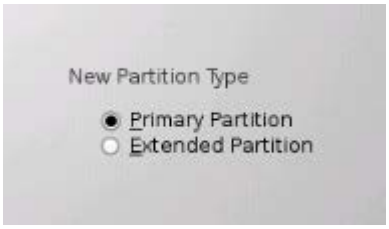
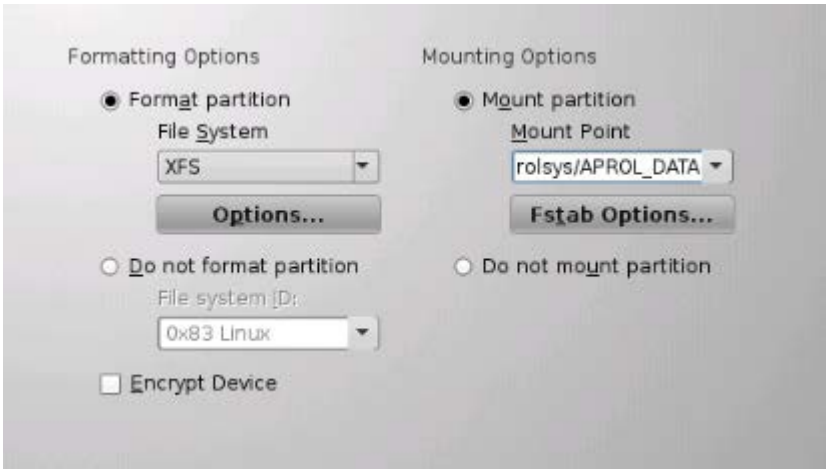
If using a touchscreen, see chapter 'Touchscreen configuration'

Linux operating system installation in table form:

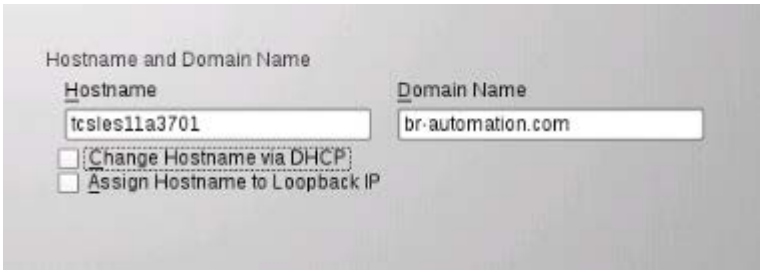
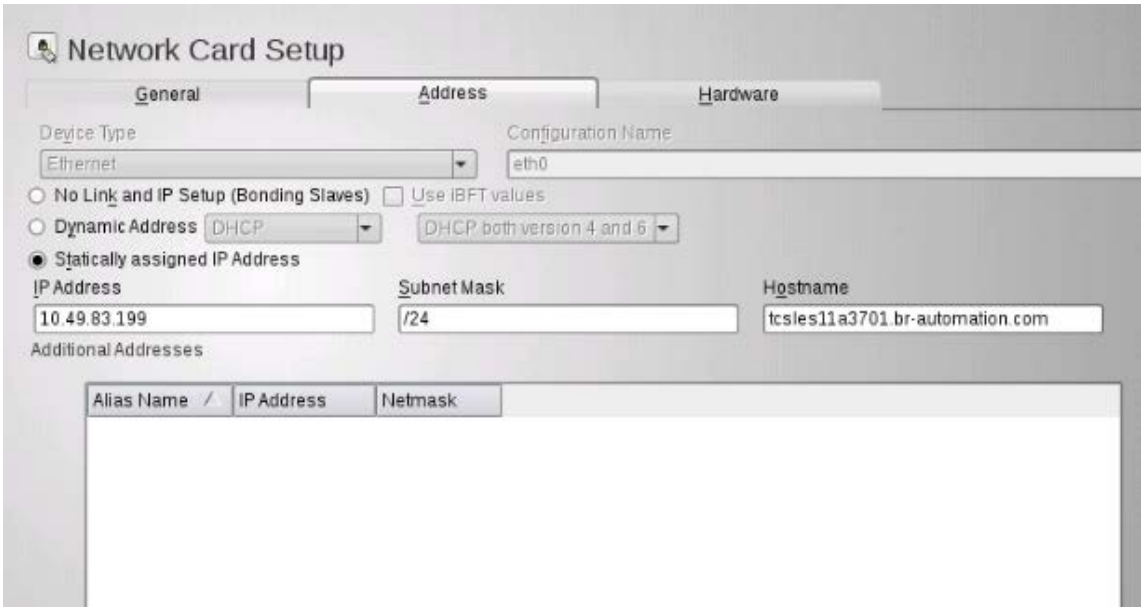
Step	Description
0	The BIOS clock must be set to the actual date and the actual time before the Linux installation takes place!
1	Insert the **AutoYaST installation DVD** into the respective DVD drive and reboot the computer. If a boot from the DVD does not take place then a check should be made to see if it is possible to boot from the drive. The boot order in the BIOS settings should also be checked.
2	**Selection of the installation language** A selection list is offered via the [**F1**] function key. Select the desired language.
3	**Selection of architecture:** A selection can be made via the [**F5**] function key. X86 | X86-64 Confirm the selection with [**Enter**].
4	If the protocol and runtime server are one and the same then it is recommended **to install a separate hard-disk** for a smooth operation. **If this is not possible, we recommend an additional partition** for the preservation of the historical data. ***An additional hard-disk / partition for the area 'APROL_DATA' is strongly recommended**, because data is collected permanently while the plant is running and continuously demands more space on the hard-disk. The process monitoring and operation are always guaranteed by separating the partitions and / or hard-disks, and that the computer does not stop its operation because of a hard-disk that is too full.* The following **partial steps 4a-4e** describe how you set up a partition with the volume label 'APROL_DATA', and mount it automatically in the start system under /home/aprolsys/APROL_DATA.

Step	Description
	The separated logging concerns all data that are recorded with the help of the ChronoLog mechanism. These are trend data, AuditTrail, System messages, alarms, compressor data, etc. For this, choose the ***Partitioning*** item in the right window of the 'installation settings' side. The partition creation that is suggested here must be adapted to your own needs.
	The actual configuration can be checked in the 'Installation settings' dialog, and eventually changed. **Partitioning**  *Illustration 5* Choose a hard disk to be partitioned, and press [**Create**] to partition the additional hard disk, or choose the root "/" partition and press [**Resize**] to split a single hard drive.

Step	Description
4a	If the computer only has one hard-disk, you can change the allocation of space on the hard-disk in the next step, in order to make space for a new partition. The root partition '/' must be at least 50 GB in size. For this, delete the existing partition and then specify the desired partitioning (via [**Add**] button). Then choose the 'Primary partition' partition type.  Illustration 6
4a	Confirm the choice with [**OK**]. Then enter the desired partition size in the dialog that follows. Carry out these settings in the following dialog: 'Formatting options' section Choose 'XFS' entry **'Mounting options' section** Mount point '/' entered.  *Illustration 7* Confirm your choice with [**OK**].

Step	Description
4b	Now mark the hard disk on which the partition for the historical data records should be created in the '**Prepare hard disk: Expert mode**' dialog. Then press the [**Add**] button. Now choose the 'Primary partition' partition type.  *Illustration 8* Confirm the choice with [**OK**]. Then enter the desired partition size in the following dialog.
4c	Carry out these settings in the following dialog: 'Formatting options' section Choose 'XFS' entry **'Mounting options' section** Mount point `/home/aprolsys/APROL_DATA` entered**.**  *Illustration 9* Press the [**Fstab options**] button.

Step	Description
4e	Carry out these settings in the following dialog: - Activate the '**Volume label**' radio button, - Enter 'APROL_DATA' in the '**Volume label**' field, - Enable the '**Mount by user**' checkbox,  *Illustration 10* Confirm your settings with **[OK]**.
(5) **when partitions were changed**	You are directed back to the menu with the overview. Select ***System start*** from this menu. Click on the [**Other**] button at the bottom of the next window **(The actual configuration is detected!**) and select ***Suggest new configuration*** from the drop-down menu. Confirm your entries with [**OK**].
(6) **See 5**	Once you have returned to the ***Installation settings*** menu, press the [**Accept**] button.
7	The installation process is started after pressing the [**Install**] button in the dialog that follows.
7b	The computer boots automatically at the end of the installation. **The *'Boot from hard drive'* option is set in the following boot menu and should not be modified.** Confirm the choice with [**Enter**].
8	The installation routine is continued, and in the next step you enter the password for the Linux superuser 'root' in the 'Password for system administrator' dialog Confirm the root password by entering it again and the confirming with the [**Continue**] button.

Step	Description
9	It is necessary to configure any existing network cards and to assign the computer names. **Entering the computer name is mandatory**, and amongst other things is the prerequisite for the following basic configuration of the computer with the script *AprolConfig*. (Definitely pay attention to the naming rules in chapter *Introduction*.) *As of SLES 11, the Fully Qualified Host Name (complete host name and domain name) must be entered for each network card.* *Example: 'tchwte36.br-automation.com'* *When there are several network cards, a unique name must be used for each of these cards.*  *Illustration 11* The 'Assign Hostname to Loopback IP' option should be set. The host name is linked (`/etc/hosts` file) to the IP address 127.0.0.1 (Loopback) with the help of this option.
10	 *Illustration 12* The following basic possibilities are available for the network configuration: A) Assignment of an IP address via DHCP B) Use of a static IP addresses

Step	Description
11	If network printers are connected, they will be detected automatically by the System *CUPS*. If not, they will have to be set up later with *YaST*. Confirm the dialog with [**Continue**]. **This ends the Linux installation:**
12	After the first login as superuser **root**, the APROL installation routine is started automatically. The installation can alternatively be aborted at this stage, and continued later. All further installation steps are described in chapter *APROL installation and update*.

Some computers (e.g. ThinkPad T400, DELL 6420, 6520, 6220, 5520, 2008 MacBook Pro) may freeze during a 'reboot'.

*Adding the **'reboot=pci'** parameter to the other boot parameters is a possible solution.*

*If this is successful, **'reboot=pci'** should be added to the other boot parameters in the `/boot/grub/menu.lst` file.*

Example in the /boot/grub/menu.lst file:

```
...
###Don't change this comment - YaST2 identifier: Original name: linux###¶
title SUSE Linux Enterprise Server 11 - 3.0.26-0.7¶
    root (hd0,0)¶
    kernel /vmlinuz-3.0.26-0.7-default root=/dev/sda3 vga=0x31a cciss.cciss_allow_hpsa=1
cciss.cciss_allow_any=1 hpsa.hpsa_allow_any=1 video=LVDS-1:d video=1280x1024@60 reboot=pci¶
    initrd /initrd-3.0.26-0.7-default¶
...
```

*If you need to install **two operating systems** (e.g. Linux and Windows) on one computer, be aware of the following time zone setting:*
***Local time zone** for **Linux**.*
If only Linux is installed, select UTC for the time zone.

It is absolutely necessary to re-adjust the file /etc/hosts when using more than one network card and a post-configuration of the cards is carried out with YaST2. (see chapter Configuring /etc/hosts)

1.4.1 Later installation of an additional hard disk for trend records and ChronoLog data

This chapter deals with the subsequent installation of an additional hard disk in an APROL server.

It is not possible to change the size of the root partition during an APROL upgrade on an APROL server that already has an installation with a single hard disk.

A new hard disk partition without loss of data can only be made with a separate tool (e.g. 'GParted'). The operation of a separate partition tool is not contained in this documentation!

A new partitioning of single hard drives is thus only described in the scope of a new installation.

Step	Description
1	Backup data for this see manual "D4 Backup & Recovery", chapter *Backup of the Runtime environment (Trend & ChronoLog) in APROL R 3.6)*. and chapter *backup of the engineering environment* (for compact systems)
2	Install new hard disk. Open YaST2 in the KDE menu via the 'SUSE menu/System/System settings (YaST)' menu item to install the additional hard disk, and choose "System/Partitioning". You then arrive at point 4 in the chapter *The installation of SLES*, *and can carry on from this point after having completed point 4*.
3	Recovering the backup data for this see manual "D4 Backup & Recovery", chapter *Recovery of the Runtime environment (Trend / ChronoLog) in APROL R 3.6*. and chapter *backup of the engineering environment* (for compact systems)

1.5 Updating the operating system (SLES) from the AutoYaST installation DVD

It is possible that Linux must also be updated from the AutoYaST DVD provided by B&R if a new release resulting update of the APROL system software is carried out.

An overview of the necessary steps follows:

Step	Description
1	The '**SUSE Menu / System / System Settings (YaST)'** KDE menu item must be opened. The *YaST Control Center* is started after entering the **password** of the Linux super user '**root**'.
1a	The DVD drive must eventually be added and activated with '**Software / Software Repositories**' in YaST2.
2	Choose the '**Install or delete software'** point in YaST2, in '**Software**'. In the following dialog, the '**Schemes'** point must be selected in the '**Display**' drop-down menu. All of the *schemes* are displayed in the list shown.

Step	Description
3	Select the '**Install'** menu item in the context menu (Right mouse button) of each 'Pattern'. The patterns are then marked with a green checkmark.
4	Select the '**Update if newer version available**' item from the '**Package / All packages**' menu.
4b	Choose the 'Unreferenced packages' item in the 'Package group' tab. Only APROL packages are allowed to be present here (with the prefix 'APROL-'), and one *'sles-release'* package if applicable. All other packages must be deleted (via the 'Delete' context menu).
4c	It may also be necessary to uninstall further individual packages. Which these may be, can be found information about the APROL release.
	The respective packages of MySQL are installed on CC-Accounts where an installation of MySQL is not necessary and are then uninstalled during the installation of the APROL system software. *The MySQL packages should therefore be un-selected.*
5	The update can then be started with the [**Adopt**] button.
6	When the update ends, exit the *YaST Control Center* and remove the DVD from the drive.
7	If a new kernel has been installed then the computer must be shut down and then re-booted. YaST makes you aware of this with a dialog.
8	After rebooting the computer, the APROL system software must be installed.

It may be that the installation of the appropriate graphic driver is necessary during the AutoYaST installation of a new kernel.

Information about the download source and the driver installation can be found in chapter 'Installation of the NVIDIA driver'.

1.5.1 Particularities when expanding the memory

In the scope of the operating system installation, the respective kernel to the existing hardware is automatically installed.

Following kernels are present for 32 bit, or 64 bit systems:

Hardware	respective kernel
32 bit system / single processor / up to 4 GB memory	*kernel default*
32 bit system / multi-processor / up to 4 GB memory	*kernel-smp*
64 bit system / single processor	*kernel default*
64 bit system / multi-processor	*kernel-smp*

If you want to manually change the kernel, the following information is to be observed:

This installation must be carried out as the Linux super user "***root***", and should only be performed by an experienced system administrator.

Before the installation of a new kernel, a backup copy of the directory /lib/modules/<Kernel to be installed>/kernel/drivers aprol with the necessary kernel modules should be made! After the installation of the new kernel the saved directory, with the modules therein, can be copied again to /lib/modules /<installed kernel>/kernel/drivers

Step	Description
1	The item **System/YaST** (System settings) must be launched in the KDE menu. The *YaST Control Center* is started after the **root password** is entered.
2	Select the installation source. See chapter *Change installation source*
3	Un-install, or **delete**, undesired kernels (also the corresponding nongpl-packet, if present). See chapter *Installing kernel sources*
4	If the update has been finished, then leave the YaST control center with "**Finish**". The DVD can be taken out of the drive.
5	Re-start the system in order to activate the new kernel.

1.6 Configuring /etc/hosts

It is absolutely necessary to re-adjust the file /etc/hosts when using more than one network card and a post-configuration of the cards is carried out with Yast2. Unfortunately, Yast2 makes incomplete changes to this file.

It is important to make sure that the same computer name is not used twice in this file, and that the names laid down in the control computer settings (Tab "Network") do not disappear.

It is therefore recommended to make a backup copy of the file after an installation, in order to be able to restore it without problems, if it is needed at a later stage.

1.7 Necessary adjustments after changing the host name

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1.7.1 Goal

If the host name of a servers in a group of APROL servers must be changed, not only the configuration data on that server is affected, but also the configuration data on the other servers.

A series of adjustments must therefore be made to serveral APROL servers, with the exception of single compact systems.

The *AprolChangeHost* script carreis out all of the adjustments which can be made automatically without having any knowledge of the CAE project.

All other necessary adjustments must then be carried out manually. The Adjustments to be carried out chapter serves as a guide.

*In order to avoid inconsistencies, it is recommended that **the host name is only changed when all of the affected servers and APROL processes have been terminated**, e.g. **DownloadManager, Loginserver**. All users and operators must log out of the APROL systems and CC-Accounts for this purpose.*

The AprolLoader and APROL systems are stopped by the AprolChangeHost script (see below).

1.7.2 Examples

The most important basic scenarios wich involve the use of the AprolChangeHost script and the above mentioned guide are in the following illustration.

The symbols have the following meanings:

Background color if the host name of the server will be changed, otherwise gray

Execution of the script **together with change of host name and configuration**

Execution of the script **with only a change in configuration**

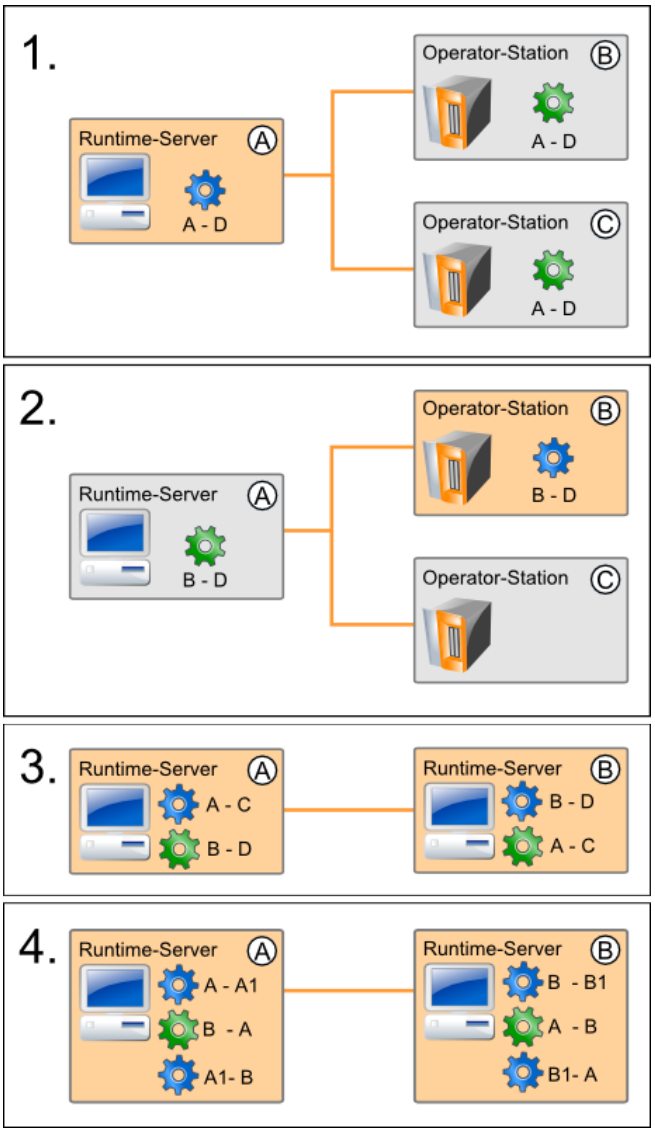


Illustration 13: Examples

Example 1: The host name of a runtime server is changed from A to D here. The change of the host name of A must be adjusted in the configurations of the operator stations B and C, which do not change their host name.

Example 2: Only one operator station changes its name from B to D here. The configuration of runtime server A must be adjusted accordingly. Operator station C does not have a direct relationship to operator station B and must therefore not have its configuration changed.

Example 3: The host name is changed from A to C on the left runtime server. From B to D on the right runtime server. Both servers have a direct relationship to each other, e.g. in a multi-runtime group, which means that the configuration changes that are necessary because of the other host name change must also be made The script must therefore be executed twice on each of the runtime servers. The order of execution is irrelevant.

Example 4: The swapping of two host names is depicted here. The left runtime server should be renamed from A to B, the right server from B to A. A direct swap is not possible, because the runtime server B is used in the configuration from A. A solution with a 'temporary host name' (hier A1 and B1) must be used, meaning that the script must be executed three times on each

runtime server.
The order of execution on the servers is important in this case. It must be avaioded that both servers have the same name at any one time. This irregular state (same host name) happens if the first step of one server is carreid out before the last step of the other server has been completed.

1.7.3 Automatic adjustment via AprolChangeHost

The AprolChangeHost script only makes adjustments to the local server and must therefore be executed on all servers which are affected by the host name change.

Apart from the server for which the host name is changed, these are all others which have been configured to use the server as a target for different purposes.

The *AprolChangeHost* script must be executed first of all. The old and new names must be given to the script ('-oldhost' and '-newhost' options). Both entries must include either the pure host name, the FQHN (Fully Qualified Host name) which includes the domain name, or only the domain name, i.e. the entries must be made in the same way for both options.

The following areas are covered by the script:

 **Configurations concerning *AprolConfig***

 **Hosts files (`/etc/hosts, /home/<user>/.rhosts`)**

 **Runtime databases**

 **Eventually the own host name**

The host name of the local server is changed when it corresponds to the specifications of the old host name ('-oldhost' option, see below). The adjustments in the configurations are also carried out if the server with the old host name is only configured as a target for the local server.

The script uses the following options:

	Option:	Description:
1	-oldhost	old host name
2	-newhost	New host name
3	-user	User identification for the changes concerning *AprolConfig*
4	-test	(optional) only display the changes to be made
5	-gui -nogui	(optional) Use the *AprolConfig* graphic interface (-gui) or only text mode via AprolConfigCmd (-nogui). Default setting: -gui

After the script is started, all changes which can be made in the above mentioned areas are detected by the script. These changes are shown to the user, who must make a confirmation before the changes are carried out. The script will finish at this point if no confirmation is made or the '-test' option is used.

The next steps are as follows if the changes are confirmed:

 **All AprolLoaders and APROL systems are stopped by the script.**

- **The changes which are displayed are activated by *AprolConfigCmd* if the script is started with the '-nogui' option.**

  ***Aprolconfig* is started with the graphical user interface if the script is started with the '-gui' option.**

  The changes shown previously can be seen as modified configuration aspects and must be confirmed with [Activate all]. *AprolConfig* must then be closed. The script checks if the changes have been activated in both the GUI and the text mode. If this is not the case, the respective message is shown, the differences between the awaited and found configuration files are shown, and the script is terminated.
- **The hosts files (/etc/hosts, /home/<user>/.rhosts) are adjusted by the script.**
- **The runtime databases in CC-Accounts of the type runtime, operator, and gateway on the server are adjusted by the script. A consitent state is thus ensured before the next download takes place.**
- **The own host name will only then be changed by the script if the name up-to-now is the same as the value in 'oldhost' option. This is carried out in a permanent manner via a system function (non-interactive YaST module), so that the change is still valid after a reboot.**
- **If the script could NOT carry out all adjustments successfully, the AprolLoaders and APROL systems remain stopped. If the own host name has been changed, they also remain stopped and a reboot is recommended. otherwise, in the case of a success, the AprolLoader and APROL systems are restarted.**

The following table shows **which** script **option** changes **which** configuration value and **how**.

The following abbreviations are used in the table:

OH: old host name

NH: new host name

OD: old domain name

ND: new domain name

FQHN: Fully Qualified Host Name

	Input (option)		Changes	
	oldhost	**newhost**	**old value**	**new value**
1	<OH> (without domain)	<NH> (without domain)	<OH>	<NH>
			<OH>.<OD>	<NH>.<OD>
2	<OH>.<OD> (FQHN)	<OH>.<ND> (FQHN)	<OH>	<OH>
			<OH>.<OD>	<OH>.<ND>
			<OD>	<ND>
3	<OH>.<OD> (FQHN)	<NH>.<ND> (FQHN)	<OH>	<NH>
			<OH>.<OD>	<NH>.<ND>
			<OD>	<ND>
4	<OH>.<OD> (FQHN)	<NH>.<OD> (FQHN)	<OH>	<NH>
			<OH>.<OD>	<NH>.<OD>
			<OD>	<OD>
5	<OD>	<ND>	<OH>.<OD>	<OH>.<ND>

	Input (option)		Changes	
	oldhost	**newhost**	**old value**	**new value**
	(only domain)	(only domain)	<OD>	<ND>

1.7.4 Manual adjustments to be carried out

Further adjustments must eventually be made after the *AprolChangeHost* script has carried out all of the adjustments which can be made automatically. This particularly concerns CAE projects.

The following listing is to be seen as a guideline:

	Change	GUI	Memory location
1	**Project engineering**: Adjust control computer data	**CaeManager** / Project / ... "Control computer" project part	Basis data / Host name

Illustration 14:

	Change	GUI	Memory location
2	**Project engineering**: Constants for CC monitoring in blocks and code	**CaeManager** / Project / ... 'Block' project part Pins and code	Custom created blocks and code

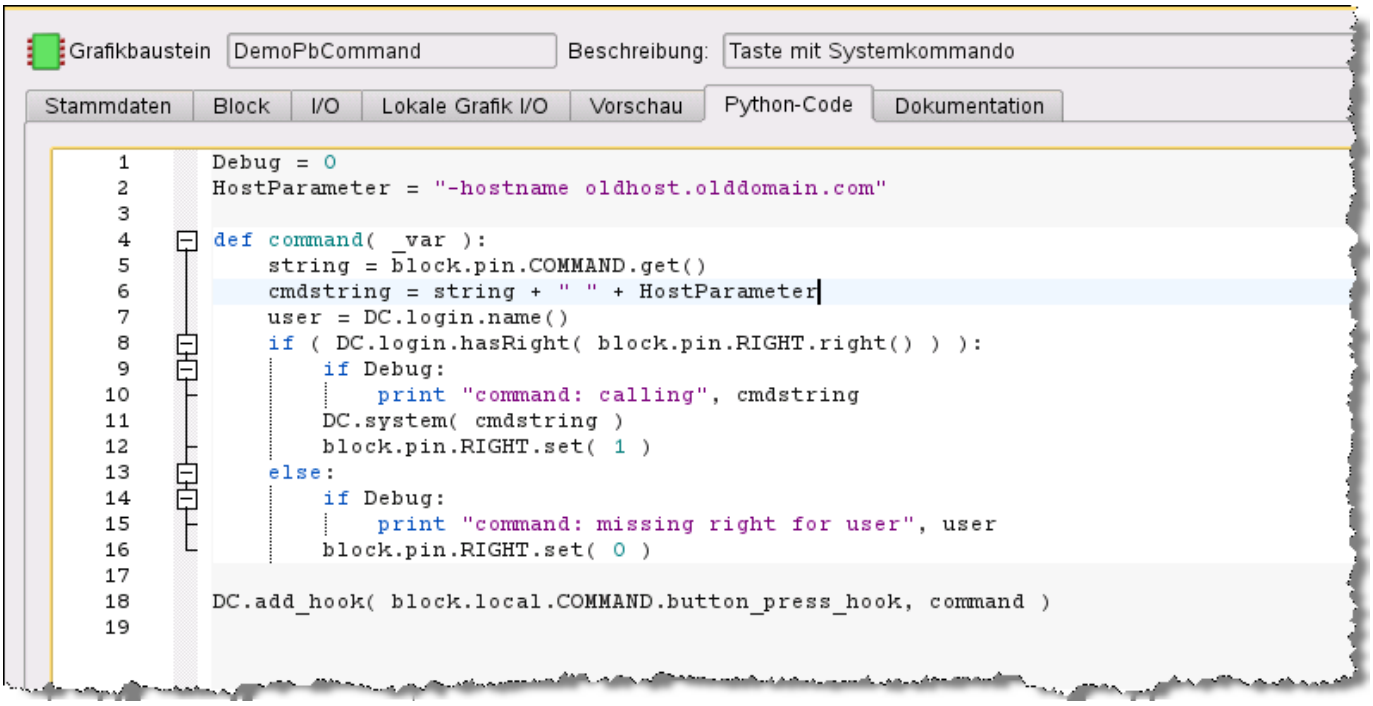


Illustration 15:

	Change	GUI	Memory location
3	**Project engineering**: Constants for CC monitoring in hyper macros	**CaeManager** / Project / ... 'Hyper macro' project part	Properties / Inputs Properties / HM constants

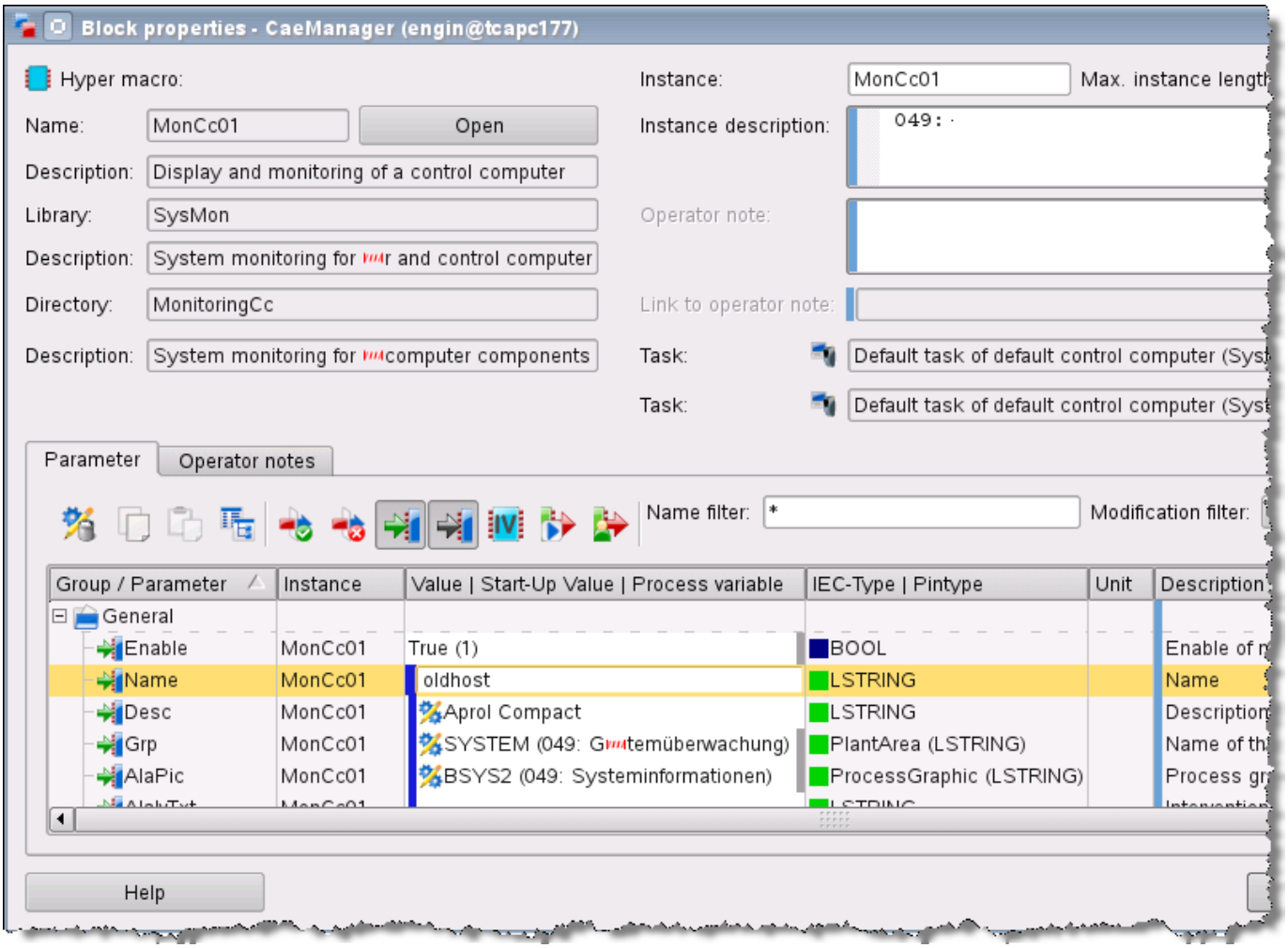


Illustration 16:

	Change	GUI	Memory location
4	**Project engineering**: Plant-specific debugging	**CaeManager** / Project properties / Engineering 1/2	Plant-specific debug connections

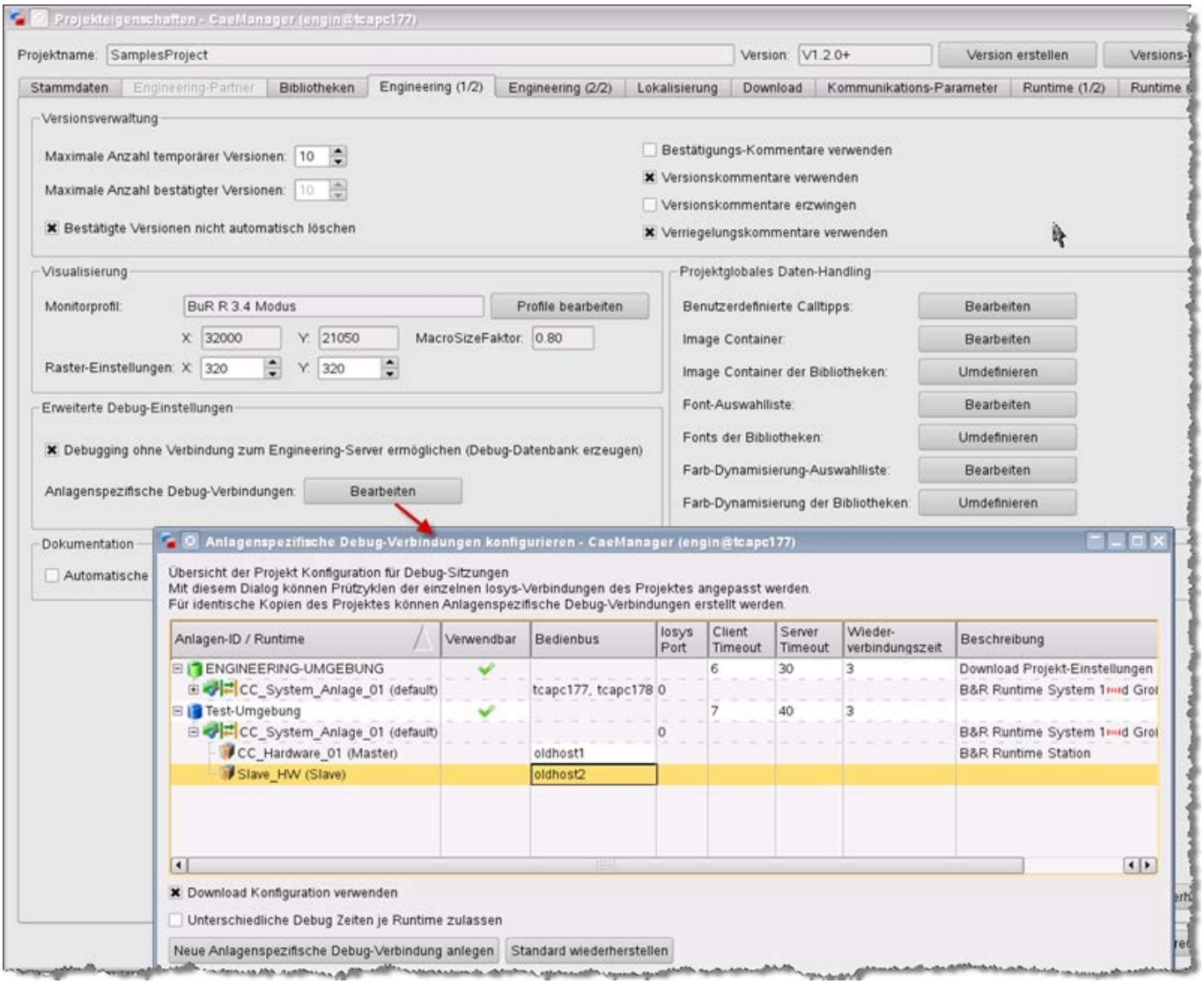


Illustration 17:

	Change	GUI	Memory location
5	**Search index** of the as-built documentation	**CaeManager** / Libraries / Edit / Actualize search index	`/home/<system>/ENGIN/LIBRARIES/search-cgi`
6	**Project documentation**	**CaeManager** / Project / Edit / Build all (Project)	`/home/<sys>/ENGIN/PROJECTS/<Project>.pgp/<WEB | GENERATED>`
7	**Other**: Confiuration and usage of other services	**Examples**: VNC, FTP, NFS	Configuration files of the respective clients

1.8 Optional adjustments to the firewall

A firewall serves to protect a computer from undesired network connections. The firewall controls the data flow of the protected computer with certain criteria such as protocols, port and IP addresses.

The use of X11 on a runtime server, and the use of internet services in an APROL network are basically not recommended.

Then following section describes the function of the SuSE firewall that is used in APROL.

B&R delivers a suitable default configuration that does not normally have to be adjusted.

APROL offers an overview of the open, firewall allowed, and APROL required ports in the web-based 'APROL System Diagnostics Manager (via the **'Overview / Port Status'** menu item). Details can be found in the chapter *Overview of the port status*.

*The **S**ystem **D**iagnostics **M**anager is only supported by the APROL standard web browser 'Firefox'.*

During the AutoYaST DVD installation (from at least version 3.6-03), only the ports that are necessary for this are unlocked. After the installation, all of the ports that are necessary for the APROL system are unlocked. Ports that are not necessary are locked.

If it necessary to adjust the port enabling because of your special demands then the configuration files must be edited manually after the APROL installation.

The changing of the firewall configuration lies solely in the hands of the system administrator that is responsible for the APROL server.

The SuSE firewall that is used in APROL is activated automatically after the installation of the AutoYaST DVD.

Certain services are locked in the default configuration. But, it is possible that these are enabled selectively. If you want to offer these services in your network then the configuration of the APROL firewall must be adjusted.

You need 'root' rights in order to make changes to the function and configuration of the firewall.

The configuration file for the SuSE firewall is in `/etc/sysconfig/SuSEfirewall2`

All of the important firewall settings are made here.

1.8.1 Configuration via the YaST Control Center

The firewall can be controlled over the YaST Control Center. For this purpose, select **'Security and User / Firewall'** in YaST.

The configuration is divided into eight configuration aspects that can be reached directly with the tree structure on the left hand side.

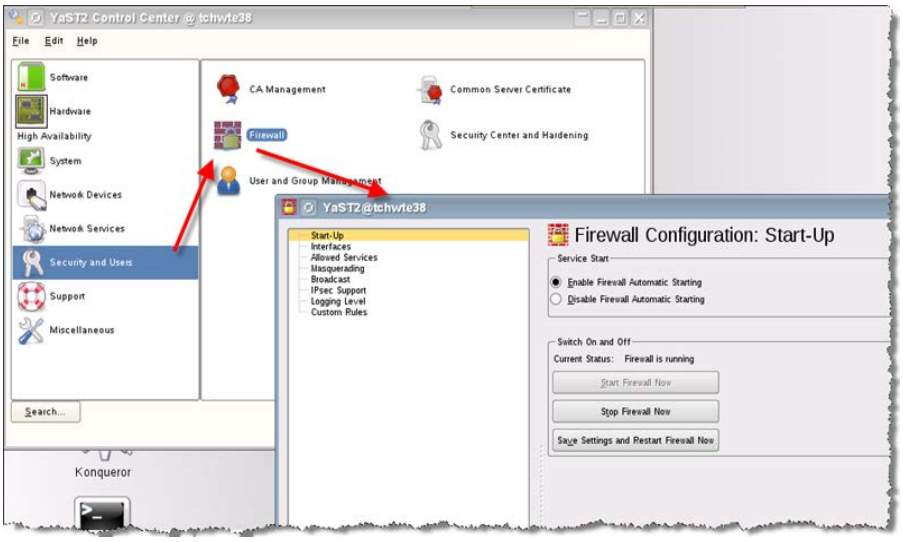


Illustration 18: Configuration of the firewall with YaST

Start:

The start behavior is specified in this dialog. The `SuSEfirewall2` is started automatically in the scope of a standard installation. Apart from that, you can start and stop the firewall in this dialog field. In order to adopt the new settings for an active firewall, choose the **[Save settings and restart firewall now]** button.

Interface:

All of the known network interfaces are listed here.

Allowed Services:

You need this option to allow services to be made available to external hosts. The rules about which services are allowed are defined via templates.

The templates for the generally allowed ports (File: `NonAprolPorts`) are in `/etc/sysconfig/SuSEfirewall2.d/services`, and for the ports especially for APROL (File: `AprolPorts`). Modify these templates to adjust the firewall settings.

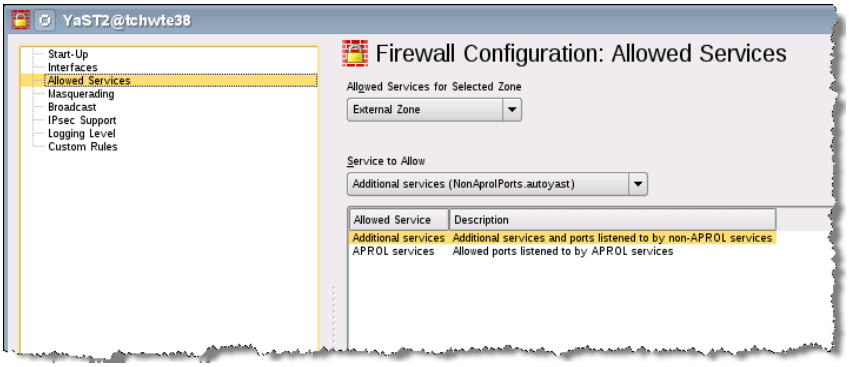


Illustration 19: Configuration of the allowed services

Masquerading:

The masquerading is basically turned off.

You prohibit the ability of addressing the internal network from outside the firewall by using the masquerading function.

The masquerading is configured on a router, for example, in order to change the IP address of outgoing packets and does therefore not make sense on an individual computer.

Broadcast:

You configure the UDP ports that allow a broadcast in this dialog field. Further information can be found in the `/etc/services` file.

IPsec Support:

The IPsec support is basically turned off.

The security protocol IPsec (**I**nternet **P**rotocol **S**ecurity) should guarantee privacy, authenticity, and data integrity while communicating over IP networks. The function can also be used to establish *virtual private networks* (VPN) and does therefore not make sense on an individual computer.

Logging Level:

There are two rules for the logging: one rule for 'accepted' and one rule for 'not accepted' packages. Non-accepted packages are discarded (DROPPED) or rejected (REJECTED). There is also the possibility to set a logging level. Choose one of the 'Log all', 'Log only critical', or 'No log' options for both rules.

The protocols are output to the `/var/log/firewall` file. The protocols can only be read as the Linux super-user 'root'.

User-defined rules:

Special firewall rules that allow new conforming connections can be set with the 'User-defined rules'.

*Detailed information about the individual configuration aspects can be found in the YaST2 help (by selecting the corresponding entry and pressing the [**Help**] button).*

1.8.2 Adjusting the configuration files

The services that are open for the system result from the ports that are open and allow a flow of data. These are defined in a template for generally allowed ports (File: `NonAprolPorts`) and a template for ports especially used by APROL (File: `AprolPorts`). Modify these templates in `/etc/sysconfig/SuSEfirewall2.d/services/` to adjust the firewall to your own needs.

Please note that the limitations of the AprolPorts can lead to a malfunction in APROL.

Due to security reasons, the NonAprolPorts and AprolPorts files are reset to their delivery state when carrying out a new installation / update of the APROL system software. Therefore, make a backup of the configuration files that you have modified.

The `NonAprolPorts.autoyast` and `NonAprolPorts.installed_by_aprol` files are only needed during the AutoYaST installation.

Necessary restart of the firewall after changes

Changes that have been made to the firewall configuration only take effect after a restart of the firewall. The firewall must then be stopped with

`rcSuSEfirewall2 stop`, and then reactivated with `rcSuSEfirewall2 start`.

The APROL default settings are restored if `AprolPrepare` is executed on the command line (as the Linux super user 'root').

1.8.3 Overview of the port status

An overview of the configuration of the ports that are open, and those that are needed by APROL, can be obtained over the 'APROL System Diagnostics Manager', in the **'Overview / Port Status'** menu item.

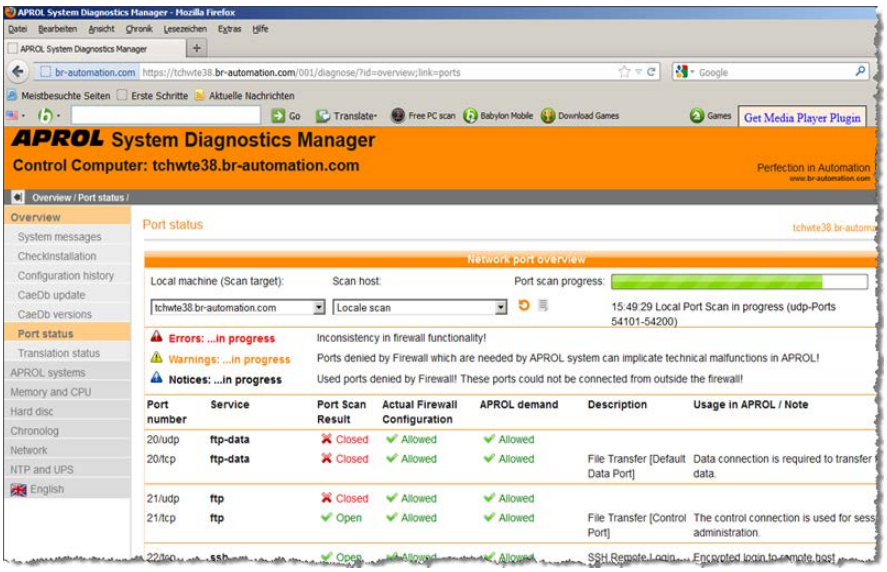


Illustration 20: Port status in the APROL SDM

The APROL SDM provides a list of the port states of a port scan, so that the actual status of all ports can be detected with respect to TCP and UDP. The status 'Unknown' is output during a scan, until it has been detected if a port is 'open' or 'closed'.

The 'port scan' sends queries from the 'Scan host' to the 'Scan target'.

The APROL SDM is started on the chosen computer when the scan target is selected (i.e. a remote access is started). This can also be seen in the address line of the web browser after selecting another scan target.

*A **local** port scan checks the ports from the inside, i.e. behind the firewall.*

*A local port scan is much quicker than an external port scan because **the scan process runs on the scan target**. It provides an overview of the status of the TCP and UDP ports on this computer. Thereby, it also shows the locally used and open ports, which could not be addressed from an external computer (because of the firewall having blocked them).*

In order to get a statement of the ports that are open from the network, please carry out an external port scan with a second computer. You can select this via the 'Scan host' combo box.

Necessary settings for the local port scan.

***'Scan target'**: Choice of the computer to be checked*

***'Scan host'**: Selection of the 'Local scan' entry*

*An **external** port scan checks the ports from the outside, i.e. in front of the firewall. In this case, the scan process runs on another computer (Scan host) and the firewall lies between that and the scan target.*

In this case, the following settings must be made:

***'Scan target'**: Choice of the computer to be checked*

***'Scan host'**: Choice of any computer*
*(**not** the 'Local scan' entry)*

All APROL servers with a release 3.6-03 or higher and a running APROL system are capable of carrying out an external port scan automatically on the target server, i.e. without making any further configuration on the target server.

Illustration 21: Port scan with an external scan server in the APROL SDM

1. The locking of ports that are necessary according to the APROL requirements can lead to a malfunction of the APROL system!

2. Ports that have been configured as open with the firewall configuration and APROL specifications may be detected as being closed because the necessary services were not started.

Port number	Service	Port Scan Result	Actual Firewall Configuration	APROL demand	Description	Usage in APROL / Note
20/udp	ftp-data	Closed	Allowed	Allowed		
20/tcp	ftp-data	Closed	Locked	Allowed	File Transfer [Default Data Port]	Data connection is required to transfer file da
21/udp	ftp	Open	Locked	Locked		
21/tcp	ftp	Open	Allowed	Allowed	File Transfer [Control Port]	The control connection is used for session administration.
22/tcp	ssh	Open	Allowed	Allowed	SSH Remote Login Protocol	Encrypted login to remote host
23/tcp	telnet	Open	Locked	Locked	Telnet	Non-encrypted login to remote host
25/tcp	smtp	Closed	Allowed	Allowed	Simple Mail Transfer	Protocol for electric mail transmission accross networks
53/udp	domain	Closed	Allowed	Allowed		
53/tcp	domain	Closed	Allowed	Allowed	Domain Name Server	Resolving of host names to IP adresses
67/udp	bootps	Closed	Allowed	Allowed	Bootstrap Protocol Server	Bootstrap Protocol Server
79/udp	finger	Closed	Allowed	Allowed		

Illustration 22: Error in the APROL SDM port scan

Errors are marked with a red icon. An error is displayed when the current port status is open and the port should be locked according to the configuration.

Notes are marked with a blue icon (only with a local scan). A note marks locally used ports that are locked by the firewall. These ports cannot be reached over the network.

Warnings are marked with a yellow icon. A warning marks a port that is locked by the firewall, but which is required by APROL. In this case, the APROL system may malfunction.

1.9 Configuration of a firewall with MAC address filtering

The following documentation allows you to modify the firewall that is delivered by SuSE in such a way that only certain remote computers can access the local computer.

This configuration is made with a MAC address filtering.

The firewall software that is supplied with the *SuSE Linux Enterprise Server* works with the *'iptables'* tool to create rules for port filtering and regulations.

The MAC address filtering is a special functionality which is not available in the standard installation of *'iptables'*. A special kernel module must be loaded in order to be able to use this functionality with *'iptables'*.

Kernel modules that are loaded in the context of *'iptables'* have the prefix *'xt_'*.

In this case, the kernel module **'xt_mac'** must be loaded to be able to carry out a MAC filtering.

The configuration of a MAC address filtering in this documentation is **carried out as an example** with the VNC port 5901. The MAC address filtering for other ports can be carried out in the same way as described in this documentation.

The port 5901 supplies a VNC connection with a configured resolution of 1280x1024 to a target computer.

Port 5901 offers a direct access to a VNC client, such as *krdc* or *tightvnc* for example.

The user interface of the 'YaST2' configuration tool from the *SuSE Linux Enterprise Server* does not offer the possibility to carry out this special configuration.

*Because of this, **it is absolutely necessary to have previously made backup copies of the following files which must be edited manually**. So that the original state can be restored in the case of an erroneous configuration.*

The complete configuration must be carried out in a console as the Linux super user 'root'.

Preparations:

Log in with the Linux command 'su -' in an existing console to obtain the super user status.

Create backup copies of the **following files** which must be modified, so that the original state can be restored in case of an erroneous configuration.

```
/etc/sysconfig/SuSEfirewall2
/etc/sysconfig/SuSEfirewall2.d/services/NonAprolPorts
/etc/sysconfig/scripts/SuSEfirewall2-custom
```

Modification of the file `/etc/sysconfig/SuSEfirewall2`:

- Search for the target which begins with `'FW_CUSTOMRULES='`.

- Enter the storage location of the file with the custom firewall rules within the quotation marks.

In this case `/etc/sysconfig/scripts/SuSEfirewall2-custom`.

- The following lines must be visible after modification:

```
 FW_CUSTOMRULES="/etc/sysconfig/scripts
/SuSEfirewall2-custom"
```

Modification of the file `/etc/sysconfig/SuSEfirewall2.d/services/NonAprolPorts`:

- Port 5901 (direct VNC port) must be removed from the list of open TCP ports.

- Search for the line that begins with 'TCP=' and delete the port number 5901 within the quotation marks.

Modification of the file `/etc/sysconfig/scripts/SuSEfirewall2-custom`:

- The kernel module *'xt_mac'* must be loaded.

The command `modprobe xt_mac` must be entered in the first line of this file for this purpose.

- The *'iptables'* commands for the MAC address filtering are now entered within the `fw_custom_before_masq` function.

The following Linux command must be used for this:

```
iptables -A input_ext -p tcp --dport <dport> -d <dIp> -m mac --
mac-source <macaddress> -j ACCEPT
```

<dport> : Port which should be protected on the target machine

<dIp> : IP address on which the port should be protected

<macaddress> : The MAC address of the Ethernet card of the client computer from which the VNC query is to be started.

Example:

```
iptables -A input_ext -p tcp --dport 5901 -d 10.49.83.101 -m mac
--mac-source d8:d3:85:7d:ca:89 -j ACCEPT
```

Restarting of the firewall:

The firewall is restarted with the command `rcSuSEfirewall2 restart`.

The firewall rules and the MAC address filtering are then active.

Please note the following information:

1) Ports which are configured with a MAC address filtering are shown as being closed when carrying out a port scan via the APROL SDM that is triggered from a computer which cannot reach the ports.

2) If the network card fails on the computer that can reach the ports on the target computer, then the extended configuration of the firewall in 'SuSEfirewall2-custom' must be re-adjusted after the card has been changed. The MAC address of the new network card must of course be known.

3) Presently, the configurations in the 'NonAprolPorts' and 'SuSEfirewall2' files are reset after an update or new installation of the APROL system software. They must be re-adjusted after an upgrade or new installation, and the firewall must be re-started. The changes in the 'SuSEfirewall2-custom' file remain untouched.

1.10 Relocation of a logging server

The following chapter explains how to relocate a logging server and preserve the data (**data backup**), start-up the new logging server (**working configuration after relocation**), and guarantee a gap-free recording of the data (**continuity of the data**).

It may be necessary to relocate a logging server for the following reasons:

- Deployment of a more powerful hardware
- Failure of existing hardware
- New structuring of the CAE project

If a non-redundant server has a hardware defect (production stop), the restoration of the APROL system which operates the plant will have the highest priority. The data which is recovered from the logging server can then be restored to the new logging server after it is running.

The following three scenarios depict a planned, controlled, exchange of the logging server.

1. Scenario: Hardware exchange

Exchange of existing hardware and use of **the same** IP addresses, host name, and existing runtime systems.

2. Scenario: Relocation

Use of a different hardware as logging server with **existing** IP addresses and host names. The old hardware still remains in use (e.g. as runtime server). At least one runtime system must exist on the new server.

3. Scenario: New creation

Leaving the runtime systems on the old server, and the new creation of the logging server on another server with **new** IP addresses and **new** host name. At least one runtime system must exist on the new server.

Scenario			Affected data
1	2	3	
✓	✓	✓	**ChronoLog**
✓	✓	?	**Trend** For new creation (3) if the trend forwarding was already configured.
✓	✗	✗	**Only for redundant systems:** **ChronoLog/trend data which is not replicated to the redundancy partner** If the hardware remains in use, data will be forwarded to the new logging server instead of the redundancy partner.
✓	✓	✗	**Runtime system data**: • Runtime system remanence data • MySQL parameter set which were changed via Python API or ParameterCenter
✓	✓	✓	**Jaspersoft Reports** (if available)

Affected processes/configurations:

The logging server normally serves for other central duties, because the powerful hardware (which is redundant at best) has a key role in the CAE project.

Scenario			Server processes/configurations
1	2	3	
✓	?	?	**LDAP server** This service must relocate in the scenario hardware exchange (1), otherwise it is optional.
✓	?	?	**Central AprolJobDispatcher** This service must relocate in the scenario hardware exchange (1), otherwise it is optional.
✗	✗	✗	**Documentation server** The documentation server must only be activated in the CAE engineering (checkbox in 'Control computer' project part), in order to provide the content for download.
?	?	?	**'Global cluster' configuration** A global cluster address must be configured with AprolConfig for a redundant logging/documentation server. The same IP address can be used by a redundant LDAP server.

*The logging is still carried out locally if there is a connection loss to the logging server. Data is also saved in a forwarding buffer (max. 50 GB per container). Because these sizes could exceed the space on the hard-disk, the **free space must be checked** when the logging server is switched off, in order to guarantee the preservation of the data and its further operation. This can be checked with the help of the APROL System Diagnostics Manager (ASDM).*

Detailed information about the APROL System Diagnostics Manager (ASDM) can be found in manual 'B5 Download & Debugging', chapter APROL System Diagnostics Manager.

Procedure:

Scenario 1: Hardware exchange

No.	Old logging server	New logging server	Logging server clients
1	**Export the AprolConfig** configuration. See: Server configuration	**Import the AprolConfig** configuration (ChronoPlex, etc.). See: Server configuration	
2	If the engineering system is on the server, carry out a **CAE backup**.	If the engineering system is on the server, carry out a **CAE restore**.	
3	Save old logging server data (**ChronoLog, customer reports, trend**). See: Saving the data	Adopt **ChronoLog and customer reports**. See: Adopt data	
4		If engineering and new logging server are **independent** of the plant network (to avoid network conflicts): **Carry out build and download**. See: Download	
5	Stop the runtime systems affected by the relocation. Save **remanence data and eventual parameter sets**. See: Saving the data	Adopt **remanence data** See: Adopt data	
6	**Remove** old logging server **from network**.	**Connect** new logging server to network. The data is forwarded from other servers as of now.	

No.	Old logging server	New logging server	Logging server clients
7		If no download was made up-to-now: **Perform download** See: Download	
8		After the download: Adopt **trend and parameter data** See: Adopt data	
9	Save the **recording gaps** See: Saving the data	Transfer of the **recording gaps** See: Adopt data	

Scenario 2: Relocation

No.	Old logging server	New logging server	Logging server clients
1	Remove old logging server **configuration** in the CaeManager See: Engineering configuration	**Configure** the new logging server in the CaeManager See: Engineering configuration	
2	**Export the AprolConfig** configuration See: Server configuration	**Import the AprolConfig** configuration (ChronoPlex, etc.) See: Server configuration	
3	Save old logging server data (**ChronoLog, customer reports, trend**). See: Saving the data	Adopt **ChronoLog and customer reports**. See: Adopt data	
4		Carry out build and download The server is now the logging server, but is used when the CAE project has been updated completely. See: Download	
5			**AprolConfig / 'ChronoPlex' aspect:** New logging server entry on each control computer See: Server configuration

No.	Old logging server	New logging server	Logging server clients
6			**Download** to all runtime systems Immediate forwarding to new logging server See: Download
7	The runtime systems which are to relocate must be stopped now to save the **remanence data and eventual parameter sets**. See: Saving the data		
8	Eventual **download** to remaining APROL systems. Immediate forwarding to new logging server See: Download		**Download** of all APROL systems Immediate forwarding to new logging server See: Download
9	Save the **recording gap** See: Saving the data	Transfer of the **recording gap** See: Adopt data	

Scenario 3: New creation

No.	Old logging server	New logging server	Logging server clients
1	Remove old logging server **configuration** See: Engineering configuration	**Configure** the new logging server See: Engineering configuration	
2	**Export the AprolConfig** configuration See: Server configuration	**Import the AprolConfig** configuration (ChronoPlex, etc.) and eventual adjustment of the redundancy partner See: Server configuration	
3		Carry out **download** See: Download	

No.	Old logging server	New logging server	Logging server clients
4	**AprolConfig / 'ChronoPlex' aspect: Enter the** new logging server See: Server configuration		**AprolConfig / 'ChronoPlex' aspect: Enter the** new logging server on each control computer See: Server configuration
5	**Download** to all APROL systems Immediate forwarding to new logging server See: Download		**Download** to all APROL systems Immediate forwarding to new logging server See: Download
6	Save old logging server data (**ChronoLog, customer reports, trend forwarding**) See: Saving the data		
7		Adopt **ChronoLog, customer reports, and trend forwarding**. See: Adopt data	
-	Saving of **recording gaps** not necessary.	There are no **recording gaps** to adopt.	

1.10.1 Engineering configuration

1. **Scenario**: Hardware exchange
2. **Scenario**: Relocation
3. **Scenario**: New creation

Scenario			Affected data
1	2	3	
✗	✓	✓	The **logging/documentation server is configured** in the 'Control computer' project part. 1. Deactivate the configuration for the old logging server. 2. New 'Control computer' project part: Set 'Logging server' checkbox. A global cluster, which is configured in AprolConfig, must be available for redundant logging servers.

Scenario			Affected data
1	2	3	
✗	✓	✓	The **'Control computer assignment'** to the new logging server must be carried out for the runtime systems **which are to relocate or are newly created**. At least one runtime system must exist on the logging server. With the existence of at least one runtime system on the logging server, the necessary system information is made available after a build and download. A CAE project build must then be carried out, so that all runtime databases in all APROL systems have the information about which logging server is to be used.
✗	✓	✓	**System monitoring via SysMon**: If the logging server is monitored, the host name and respective runtime system instance must be adjusted.
✗	✓	✓	If system variables are used to **diagnosis the ChronoPlex data forwarding**, the knowledge of which runtime systems are on the logging server is important.

Information about the system variables for the ChronoPlex data forwarding diagnosis

The trend forwarding is switched on with the '-enable_forwarding' TrendServer launching option. The '**<ASI>_[M|S]_ChronoPlex_<Suffix>**' system variable can be used for diagnosis.

If a diagnosis is made, the runtime system variables for which there is expected data should be used when the logging server is relocated.

Variable name	Description	Runtime system is on the logging serer	Runtime system is NOT on the logging serer
<ASI>_[M|S]_ChronoPlex_*NetReadRate	Read rate to other servers	filled	empty
<ASI>_[M|S]_ChronoPlex_*_FifoReadRate	The local FIFO read rate	empty	filled
<ASI>_[M|S]_ChronoPlex_TRD_Fwd*	Information about forwarding	Only filled for redundant runtime systems	filled
<ASI>_[M|S]_ChronoPlex_total_Fwd*	Summed information about forwarding	Only filled for redundant runtime systems	filled

Key:

<ASI>: APROL system instance

[M|S]

M: The variable comes from a master or stand-alone control computer

S: The variable comes from a slave control computer

Detailed information about ChronoPlex system variables can be found in manual 'D2 System API', chapter 'Schematic display of the ChronoPlex system variables'.

1.10.2 Server configuration

The size of the ChronoPlex containers and logging server address is specified in the 'ChronoPlex' aspect in AprolConfig.

Other aspects (e.g. runtime systems) can also be activated in AprolConfig if required.

*Please note that the container size is **identical to the size on the old logging server**. A difference in configuration can be avoided by using the AprolConfig export/import.*

Detailed information about AprolConfig can be found in chapter Import and export functionality.

Information about logging server diagnosis can be found in manual 'C1 Interactive Process Control', chapter 'Logging server diagnosis'.

The address for forwarding the alarm data, the APROL system messages, and the AuditTrail is configured with the ChronoPlex configuration in AprolConfig of each hardware. Live data now starts to come about from the APROL systems.

*A **download is necessary** to broadcast the address for the trend forwarding. The configuration in the CAE project is made available in this way.*

It is only possible to access the new logging server after a download to the corresponding APROL system.

1.10.3 Data backup:

1. **Scenario**: Hardware exchange
2. **Scenario**: Relocation
3. **Scenario**: New creation

Scenario			Affected data
1	2	3	
✓	✓	✓	**ChronoLog data** Storage location: `/home/aprolsys/APROL_DATA/chronolog` Information about this can be found in manual 'D4 Backup & Recovery', chapter 'Backup of historical records (trend & ChronoLog)'.
✓	✗	✗	**ChronoLog replication data storage:** `/home/aprolsys/APROL_DATA/chronolog/replication` Redundant logging servers store data which has not been replicated in this directory. These files are normally empty. If not, the exported data already has a format which can be read.

Scenario			Affected data
1	2	3	
			If the old logging server remains in the CAE project and still has one APROL system on it, the data which was not replicated will be forwarded to the new logging server.
✓	✓	✗	**Trend:** **Storage for local runtime systems** on the logging server: `/home/aprolsys/APROL_DATA/chronotrend/<project name>/<runtime system instance>` A container exists for each placed trend block, which is why an export is preferred.
?	?	?	If the trend forwarding was turned on (via '-enable_forwarding' TrendServer launching option). **Storage for forwarded trend data** of other CAE project runtime systems: `/home/aprolsys/APROL_DATA/chronotrend/replication/<project name>_forward_.TRD.log` This data is already in export format, and can be copied. Information about this can be found in manual 'D4 Backup & Recovery', chapter 'Backup of historical records (trend & ChronoLog)'.
?	?	?	**Jaspersoft reports** If custom reports have been created, they must also be relocated to the new logging server. Information about Jaspersoft report import and export can be found in manual 'X14 Jaspersoft reports in APROL - Installation guide English', chapter 'Export/import of server content'.
✓	✓	✗	**Runtime parameter sets (MySQL)** Runtime parameter sets can be exported completely and imported comfortably to the new runtime server with the ParameterCenter. This is only relevant in scenario 'hardware exchange' (1) or 'relocation' (2). If runtime parameter sets exist and the runtime system relocates. Manual 'D1 System Manual', chapter 'AprolConfigParameterManagement MySQL'

✓	✓	✗	**Remanence data**
			The data backup can only take place with a stopped APROL system. Therefore, this step should be carried out when all preparations have been made.
			Storage of the runtime system remanence data:
			`/home/<CC-Account>/RUNTIME/`
			File names:
			`<Host name>: <Iosys port>.remanence_[32|64].in`
			`<Host name>: <Iosys port>.remanence_[32|64].bak`

Scenario			Affected data
1	2	3	
			The file names must be **adjusted** to the new host name, Iosys port, and hardware architecture. The `bak` backup should also be saved, because the Iosys uses the `bak` file if the `in` file is defect or empty. The corresponding configuration file is made available with a download. *Please note that timer data cannot be transferred corectly with a change of architecture from 32 bit to 64 bit, and vice versa.*

ChronoLog and Trend:

It is possible to move containers in the same partition while the system is running with the 'mv' system command. ChronoPlex creates a new container for the new entries, which must be exported when the relocation has finished and imported into the new logging server in order to close the recording gaps.

Alternatively, an container data export can be carried out. This procedure is recommended for trend data, which is stored in many single containers.

The command for importing and exporting containers can be found in manual 'D2 System API'. See chapter 'Export and import', 'Data backup' (ChronoLog), and 'Export and import of trend records with ChronoLog' (trend).

If the old logging server is **still in use after the backup has taken place**, a recording gap will come about on the new logging server, which must then be saved and transferred to the new logging server.

1.10.4 Adopt data

1. **Scenario**: Hardware exchange
2. **Scenario**: Relocation
3. **Scenario**: New creation

Scenario			Affected data
1	2	3	
✓	✓	✓	**ChronoLog** The previously exported data must be imported. *The commands for importing and exporting ChronoLog containers can be found in manual 'D2 System API', chapter 'Export and import' and 'Data backup'.* *Information in manual 'D4 Backup & Recovery', chapter '../../049/D4_BackupRecovery/creatingabackupoftheruntimeenvironmentR36.htmRestoration of historical records (trend data / ChronoLog)'.*

Scenario			Affected data
1	2	3	
✓	✓	?	**Trend** For new creation (3), existing trend forwarding must be restored. The trend data directories are created during the first download. The trend data can be imported afterwards. *Information about the trend data import can be found in manual 'D2 System API', chapter 'Export and import of trend recordings with ChronoLog'.* *Information in manual 'D4 Backup & Recovery', chapter '../../049/D4_BackupRecovery/creatingabackupoftheruntimeenvironmentR36.htmRestoration of historical records (trend data / ChronoLog)'.*
?	?	?	**Jaspersoft reports** If custom reports exist. *The procedure is in manual 'X14 Jaspersoft reports in APROL - Installation guide English', chapter 'Jaspersoft reports in APROL - Installation guide English'.*
✓	✓	✗	**MySQL parameter sets** If modified parameter sets exist for the runtime system which is to be relocated, the data import can be carried out comfortably with the ParameterCenter.

✓	✓	✗	**Remanence data**
			The data transfer to the new serer ,ust be carried out when the APROL system is stopped, so that the start takes place with the restored values.
			The name of the remanence file must be adjusted, so that it can be used in the following place of storage:
			`/home/<CC-Account>/RUNTIME/<host name>: <Iosys port>.remanence_[32|64].in`
			`/home/<CC-Account>/RUNTIME/<host name>: <Iosys port>.remanence_[32|64].bak`
			Please note that timer data cannot be transferred corectly with a change of architecture from 32 bit to 64 bit, and vice versa.

1.10.5 Downloading the project configuration

The logging server address is provided together with the download of the runtime database and the system configuration files for all runtime services and GUI applications. The specified address is used when the application is restarted. The structure for the trend records and parameter management is also prepared together with a download. It is only possible to restore trend data and parameter sets (which do not originate from the engineering) after a download.

A download should be made to the new logging server first of all and after the preparations for the relocation have been carried out. If the plant cannot be shut down for the relocation, the old logging server will still be written to until the 'ChronoPlex' is set up on all control computers and

they receive a download. This results in having to transfer the recording gaps after the relocation has been carried out.

A2-2 APROL installation and basic configuration

2.1 APROL installation and update

Please note that APROL does not normally support dual boot systems.

A manually created dual boot configuration is overwritten because the boot loader's `/boot/grub/menu.lst` configuration file is newly created after each APROL installation.

Within the scope of the APROL installation, you have the possibility to choose between a **full installation**, a **computer-type dependent installation**, or an **update of the APROL system software packages belonging to the computer type**.

You obtain the following benefits through this:

- The possibility of a "2 click full installation", or a "2 click update",
- Optional packages can be unselected depending on the chosen computer type (or types).
- **Great flexibility (Starting the computer as an engineering, runtime, or gateway server, or as an operator station),**
- **Automatic installation of the system software belonging to all computer types,**
- **Quick and resource orientated installation (smaller disk-space needs),**

  Example: Installation of an operator station on an APC's memory card,

Optional packages that are not necessary for a computer type can be deselected from the selection via the 'Computer-type dependent installation'.

The de-selection of optional packages is solely reserved for experienced APROL users!

In case you are not sure, you should not exclude any of the optional packages that are suggested in the list!

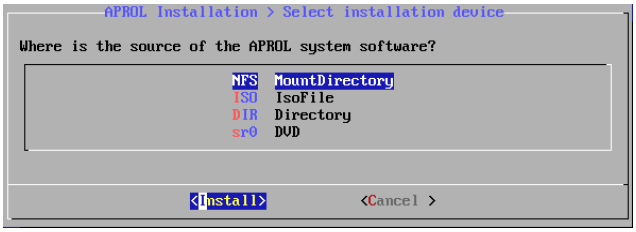
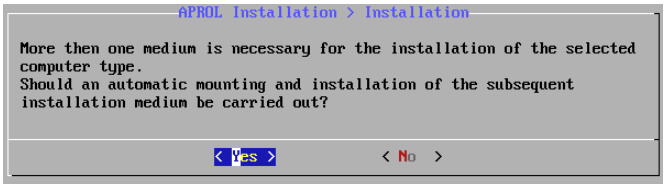
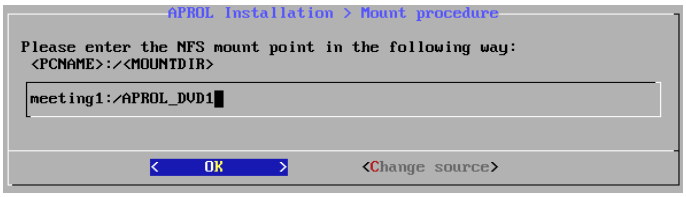
The cursor keys or the [**Tab**] key are used to navigate within the menus. Use the [**Space**] key to select / de-select (E.g. the driver packages).

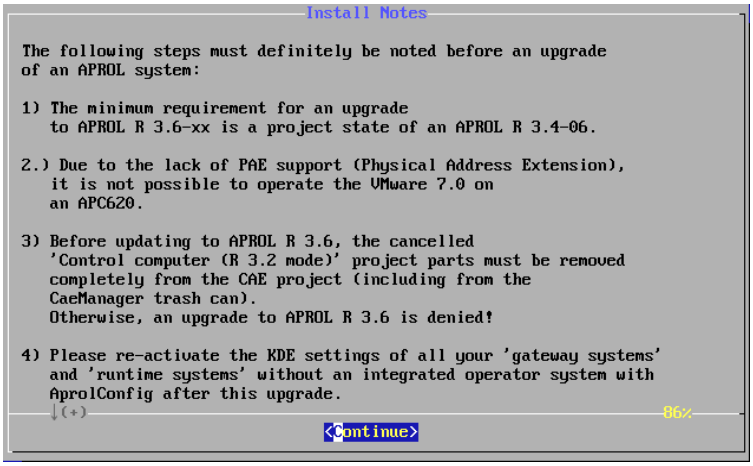
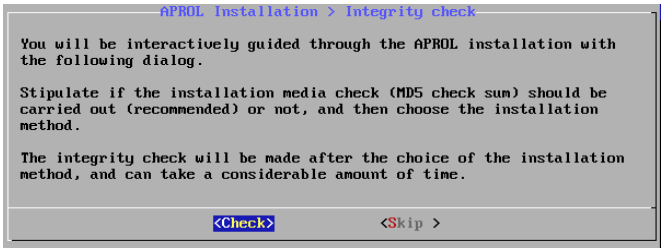
When a confirmation is necessary this can be made via the [Enter] key.

All of the APROL applications, as well as all remote sessions, are to be stopped on this computer if the APROL system software is to be updated.

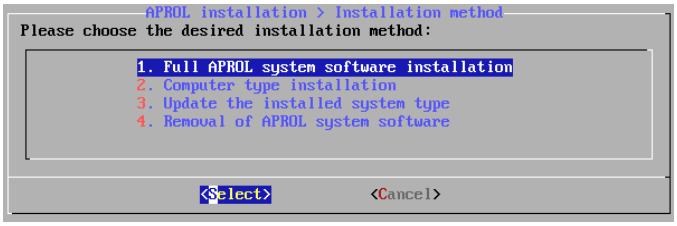
General order of execution:

Step	Short description
1	Log yourself in as LINUX super user "root".

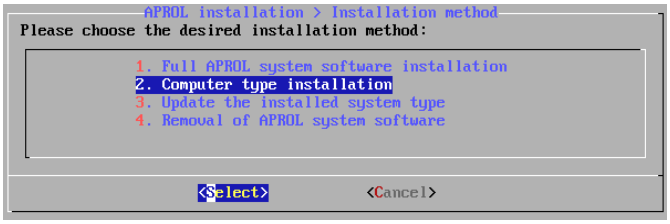
Step	Short description
2	Switch the computer to the Linux runlevel 3 (Linux command '`init 3`'). **Please note that applications that have been started on other computers must also be stopped!**
3	Execute the *AprolInstall* script in a Linux console. Then select the installation source:  *Illustration 23* The automatic installation of the second (or third) medium can be selected in an additional dialog for all installation media (with the exception of DVD). This possibility depends on the computer type and can therefore only be made after the selection of the computer type.  *Illustration 24* This offers the advantage that the next media must not be confirmed explicitly and the installation can continue automatically without any further interaction. The installation of the next media must be triggered manually in the case of the DVD installation because of having to change the DVD in the drive. **Important information:** Pre-requisite for the automatic installation of the second and third media is that the name of the first source (e.g. NFS mount point) contains the string 'DVD1' (e.g. 'APROL_INSTALLATION_DVD1') and the name of the second and third source the string 'DVD2' and 'DVD3' (e.g. 'APROL_INSTALLATION_DVD2'). Then either the NFS or the ISO mount point must be entered, depending on the existing installation source. When installing from a directory, the respective installation directory must be specified.
	No additional entry is necessary for the 'cdrom' installation source. The installation can be started after confirming with [**OK**] in the next dialog and inserting the DVD.  *Illustration 25* Then the chosen source is mounted automatically. Any errors are shown during the mount process and the entry can be made again.

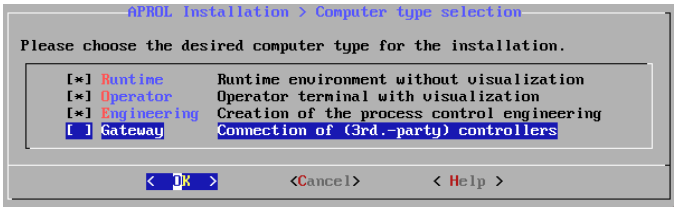
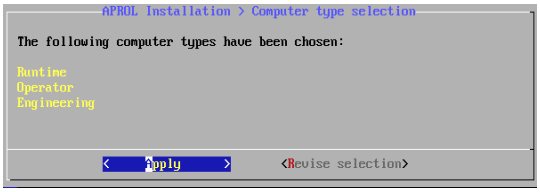
Step	Short description
	If the error message 'AprolInstall reports errors during the mounting' occurs during the installation from DVD then the following information must be observed: 1.) Only confirm the 'Please insert the APROL DVD ...' dialog when the status LED no longer blinks on the DVD drive! This is relevant for APCs, amongst others, where the draw cannot be closed automatically! The dialog can be confirmed while the draw is still open if the computer is not an APC.
	2) Check if the type of blank DVD can be read by the respective DVD drive. The steps that are necessary before the upgrade are shown before the actual APROL installation begins.  *Illustration 26* At the beginning of the APROL installation, a check for the current AutoYaST DVD is carried out. **If necessary, an update must be carried out before the installation of the APROL system software**.
4	Then stipulate if an installation medium check (MD5 check sum) should be carried out. **The execution of the integrity check is strongly recommended!**  *Illustration 27* The menu for the APROL installation method is then started.

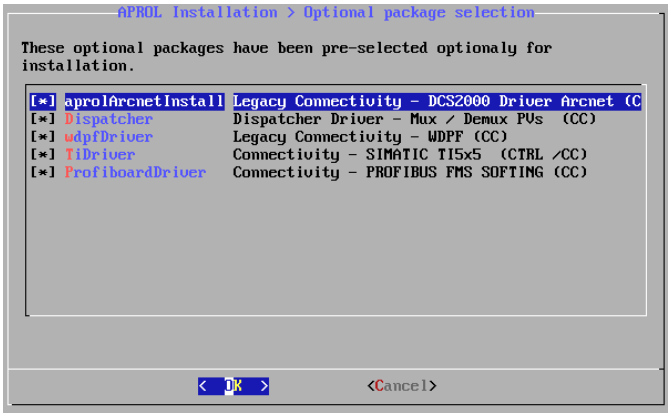
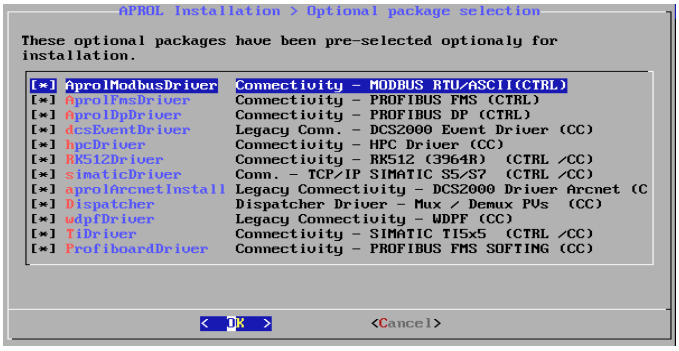
Full installation of the APROL system software

Step	Short description
5a	Choose the "**Full installation APROL system software**" menu item:  *Illustration 28* The installation of the complete APROL system software then takes place automatically. The APROL DVDs 2/3 and 3/3 must definitely be installed for a full installation. Details about this can be found in the description for step 7). **Acceptance of the Simba license agreement:** It is now possible to query and evaluate APROL historical data via the APROL SQL server and an SQL client. APROL uses the third -party software 'SimbaEngine' to provide an SQL database structure. The Simba license agreement is opened during each installation and cannot be revoked. The acceptance of the Simba license agreement can be made with the [**Accept**] button.

Computer type dependent installation

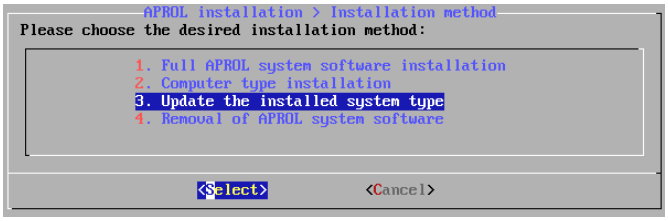
Step	Short description
5b	Choose the **"Computer type dependent installation"** menu item: Depending on the computer type, you have the possibility to exclude individual drivers from the installation.  *Illustration 29*

Step	Short description
6b	Then select the desired computer type.  *Illustration 30* Only the packages that are necessary for the chosen CC-Accounts are installed. If the 'Engineering' computer type has been included in the selection, it is mandatory that the APROL DVD 2/3 and 3/3 are installed. Please note that the installation source (NFS, ISO, DIR, CDROM) that has been chosen for DVD 1/3 cannot be changed and remains for DVD 2/3 and 3/3. Please refer to the details in the description for step 7). The chosen computer types are to be confirmed again in a subsequent dialog.  *Illustration 31* **Case 1:** **Only computer type 'operator' chosen:** After confirming the 'Operator' computer type, the installation of the APROL system software that belongs to this computer type is carried out. No optional packages are installed for this computer type! **Case 2:** **Only computer type 'Engineering' chosen:** No optional packages are offered for de-selection. **Please note:** All of the controller drivers, the INA driver, and the event driver are automatically installed and cannot be de-selected! The installation of the APROL system software is carried out after confirming with [**OK**].

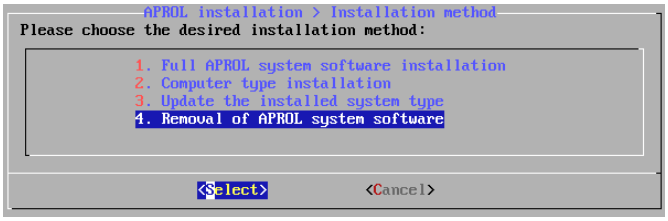
Step	Short description
	Case 3: **Computer type 'Engineering' contained in choice:** All of the optional packages for the installation are shown in an overview (this does not apply to the combination of 'Engineering' and 'Operator', because no drivers run on an operator system). It is possible to de-select individual drivers. **Please note: The INA driver and the event driver are automatically installed and cannot be de-selected!**  *Illustration 32* **Case 4:** **Computer type 'Runtime or Gateway' contained in choice:** All of the optional packages for the installation are shown in an overview. It is possible to de-select optional packages. **Please note:** The INA driver and the event driver are automatically installed and cannot be de-selected!  *Illustration 33*

*If a computer-type specific installation is carried out in which optional packages are de-selected, they are shown as missing in the 'CheckInstallation repot' ('**Installed libraries**' section).*

Update of the APROL system packages that belongs to a computer type

Step	Short description
5c	The APROL system software that belongs to the installed computer type is updated by selecting the **'Update the installed computer type'** menu item.  *Illustration 34* **Please note:** All of the packages belonging to this computer type are installed. The selection of the optional packages that was made beforehand is preserved. In order to de-select individual optional packages you must choose the 'Computer type dependent installation' menu item. **The update basically consists of the following three phases:** 1. Deletion of APROL packages that are no longer needed 2. Installation of APROL packages that have not yet been installed 3. Update of the existing APROL packages The header shows how many of the installed packages have been update during phase three in the form 'X / Y'.

Un-installation of the APROL system software

Step	Short description
5d	The "APROL **Un-installation**" menu item can only be chosen when there is an existing APROL installation.  *Illustration 35* The APROL system software is completely removed from the hard disk after choosing the "Remove APROL" menu item.
6d	After the un-installation has finished, you automatically return back to the dialog for choosing the installation method in case a re-installation of the APROL system software is necessary.

When upgrading the APROL system software (Release change), there is only the 'Un-install APROL system software' menu item!

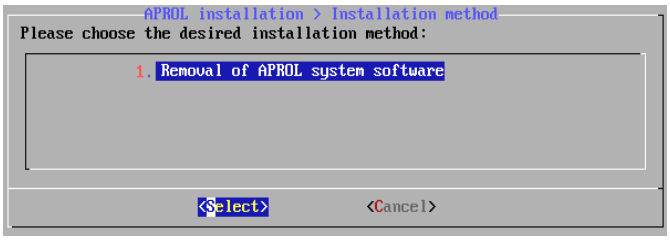
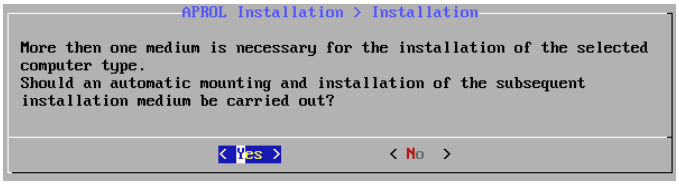
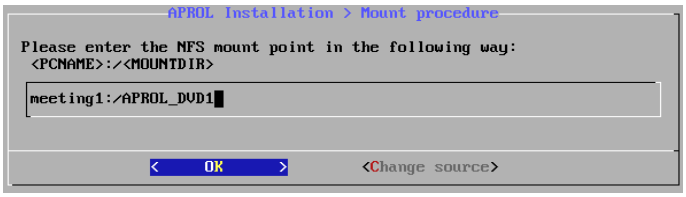


Illustration 36: Menu when upgrading the APROL system software

Installation of the DVD 2/3 and 3/3 (Computer type 'Engineering' contained in the selection)

Step	Short description
7	If the 'Engineering' computer type has been included in the selection, it is mandatory that the APROL DVD 2/3 and 3/3 are installed.  *Illustration 37* Please choose [**Install**] and enter the NFS or ISO mount point, or the directory in the following dialog depending on your installation source. The entry that was made for DVD 1/3 is adjusted automatically for DVD2 (and DVD3). **The automatic suggestion must be checked in each case.**  *Illustration 38* Please note that the installation source (NFS, ISO, DIR, CDROM) that has been chosen for DVD 1/3 cannot be changed and remains for DVD 2/3 and 3/3.

The system software DVD 2/3 and 3/3 can also be installed at a later stage with the *AprolInstall -dvd2* and *AprolInstall -dvd3* option.

*Please note during the full installation (as well as the 'Computer-type dependent installation') or VMware upgrade that it is additionally necessary to manually confirm the 'VMware VIX API EULA' when **no** VMware or VMware VIX has been installed up to now.*

The VMware OVF tool license must also be confirmed. This allows the platform-independent operation of a pre-configured VM without any further configuration.

In this case follow the instructions that are output on the console.

Please note that the VMware >=9.0 must be used for the host system in order to be able to use the VMware >=9.0 within a virtual machine (VM).

The following steps are to be carried out, regarding the chosen installation method, **after the actual installation has finished**.

ToDo	Short description
✓	The installation of the APROL system software is finished **with the message "The installation has been successfully completed**.
✓	When the APROL system software is installed for the first time, the basis configuration of the APROL server is then made with the **AprolConfig** configuration tool. Details about the basic configuration can be found in chapter *AprolConfig*.
✓	The APROL system software DVD must be removed from the drive after the installation or update via DVD.
⚠	*If you want to use special ports or services, you must adjust the firewall settings manually after the installation.* These changes will be lost during a new installation. With reference to this, see chapter '*Necessary adjustment of the firewall*'
✓	Subsequently switch the computer back to the Linux runlevel 5 (via Linux command '`init 5`').

The start of the runtime system can only take place after a subsequent 'Build all' in the engineering system and a download to the target systems!

Please note that all of the respective computers must have the same version of the APROL system software.

2.2 General information about basic configuration

Normally, only one of the CC-Accounts described in chapter *Introduction* is configured as the basis from the APROL packages. It is only recommended to install all three systems on a computer when using a minimum configuration (e.g. a compact system), which is only possible with select computers.

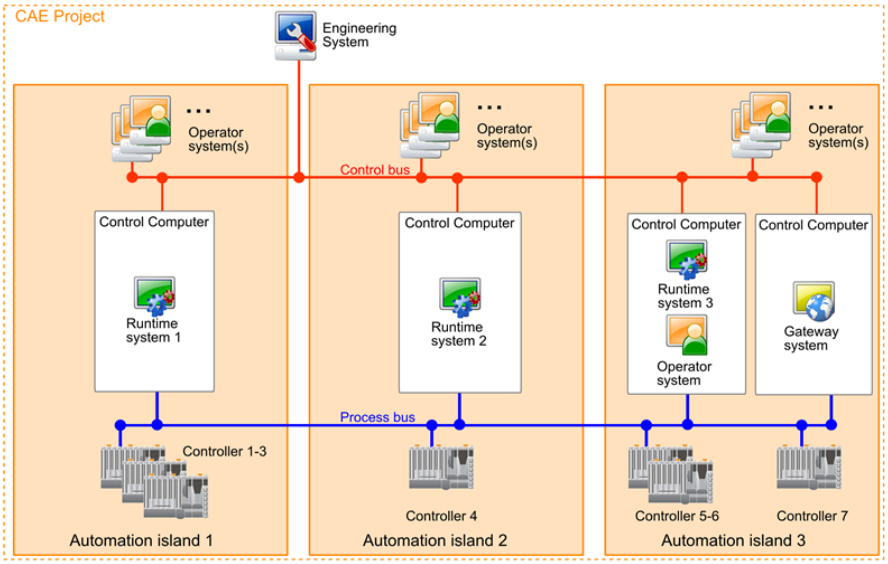


Illustration 39: A process control system with APROL

After all three systems have been pre-configured you have a system configuration that meets two conditions:

A	A system that can be used to uniformly design a process control system, the 'Engineering system'.
B	The process control system is available after it has been engineered and downloaded. It consists of a Runtime system and at least one Operator system.

The following image shows a schematic of the data flow from the Engineering system to the other systems and down to the field level when the project is downloaded from the Engineering system for the first time. A process control system – represented by the Runtime system, Operator systems, and the field level – is only available after it has been engineered and downloaded.

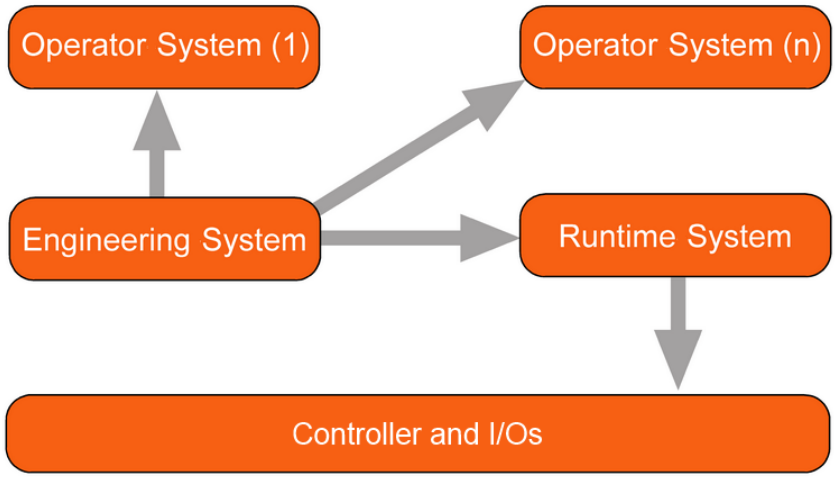


Illustration 40: Data flow from the Engineering system

The next image shows all of the download possibilities available from an Engineering system. You can read detailed information about downloading in the '*B5 Download and Debugging*' manual, in the chapter *DownloadManager*.

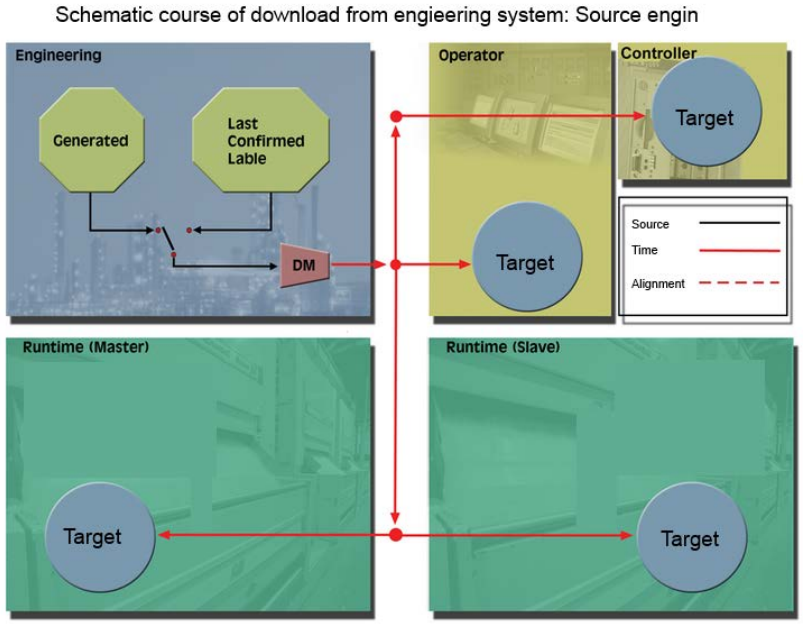


Illustration 41: All downloads starting from the Engineering system

The DownloadManager is marked with the abbreviation "DM" in the overview.

The image above is only meant to depict an extremely condensed structure that provides the foundation for the later engineering as well as showing how a process control system works with CC-Account configurations.

As is the case during installation, pre-configuration also requires you to be logged in as the super user (***root***).

The core configuration of the CC-Account is **basically** taken care of with the *AprolConfig* configuration tool. Configuring a system also includes the creation of a login name and a password in Linux for the respective system. During configuration, APROL copies mandatory system files from the installation directory to the new system's directory.

Information about the term CC-Account, engineering system, runtime system, and operator system can be found in chapter Introduction.

System names are assigned during the installation and pre-configuration of the individual systems.
Never assign the name aprol or aprolsys for a system!
If you have already assigned your system one of these names, it should never be deleted from your computer. Deleting a system with the name aprol will also delete important internal APROL components, causing all systems on this computer to fail.

2.3 The aprolsys Linux user

The ***aprolsys*** Linux user has a special function in an APROL process control system. Available on all APROL servers, it has all of the access rights for the CC-Accounts that are necessary to exchange data and information between these systems (computers).

A majority of APROL system functions span over computers. Although this mode of operation is permitted in a Linux system, the Linux login and the corresponding password of the other Linux users (CC-Accounts) must be entered at the appropriate places.

This mode of operation cannot be applied to a process control system, but it must be kept in a Linux system for security reasons. This is why the ***aprolsys*** Linux user is automatically created when APROL is installed.

aprolsys handles the transfer of data that is necessary for logging all of the historical data.

2.4 AprolConfig

AprolConfig is the tool with which you carry out the basic configuration of your APROL server.

AprolConfig is started automatically after the initial installation or an APROL update so that all configurations can be carried out.

In order to create additional systems at a later stage, you can start it manually. For this, log in as the user 'root'. There various possibilities to start **AprolConfig**:

From an engineering system via the KDE menu 'System Configuration / AprolConfig' (The root password is queried here),

Login as 'root' from the KDE login, whereby the KDE environment is started for the user 'root', in which **AprolConfig** can be started via the KDE menu or from the desktop icon.

From another computer in the network via SSH, whereby the display must be diverted via -X (e.g. via ssh –X root@aprolhost.domain.de),
and then call AprolConfig from the command line

2.4.1 Redesign

A text-based script was responsible for the configuration of an APROL server in previous APROL releases. APROL R 3.6 has been completely re-designed.

Modern design with graphic user interface

Easy and intuitive operation

Clear display of the state of configurations, including changes in comparison to the active configuration

Uniform user guidance

Better help for the user with tool tips

- **Integration in the project engineering and the start-up workflow**

  Planning, engineering and configuration of the control computer hardware with respective CC-Account in the CAE project

  Use of the engineering data (via import / export) for automatic configuration, including the creation of CC-Accounts on the target hardware

  Exchange or comparison of configuration changes between target computer and CAE project

- **Higher security and error tolerance**

  Backup of current configuration

  Restoration of old configurations

- **Comfortable workflow with transactions (based on databases)**

  Configurations are always activated explicitly

  Possibility to discard non-activated configurations

  The configuration can be interrupted without loss of data

- **Importing and exporting**

  Export from activated configurations and RecoveryPoints (AprolConfig GUI and the command line version), as well as non-activated configurations (only AprolConfig GUI)

  Export of the configuration state from control computer project parts in the CaeManager

  Import of a configuration state in the CaeManager and in AprolConfig

- **Central data storage of all aspects**

- **Uniform data format of the configurations in XML**

- **Management of states of configurations, also via command line**

  Automatic, non-interactive application

  The application can be executed in environments without a graphic interface

  Use of exchange (import / export), activation, restoration of configuration states

2.4.2 AprolConfig structure

The graphical **AprolConfig** has the following appearance when no configuration has been made.
A banner is in the uppermost part that shows where one is, i.e. the actual theme. The '**System**' aspect is currently chosen in the illustration.

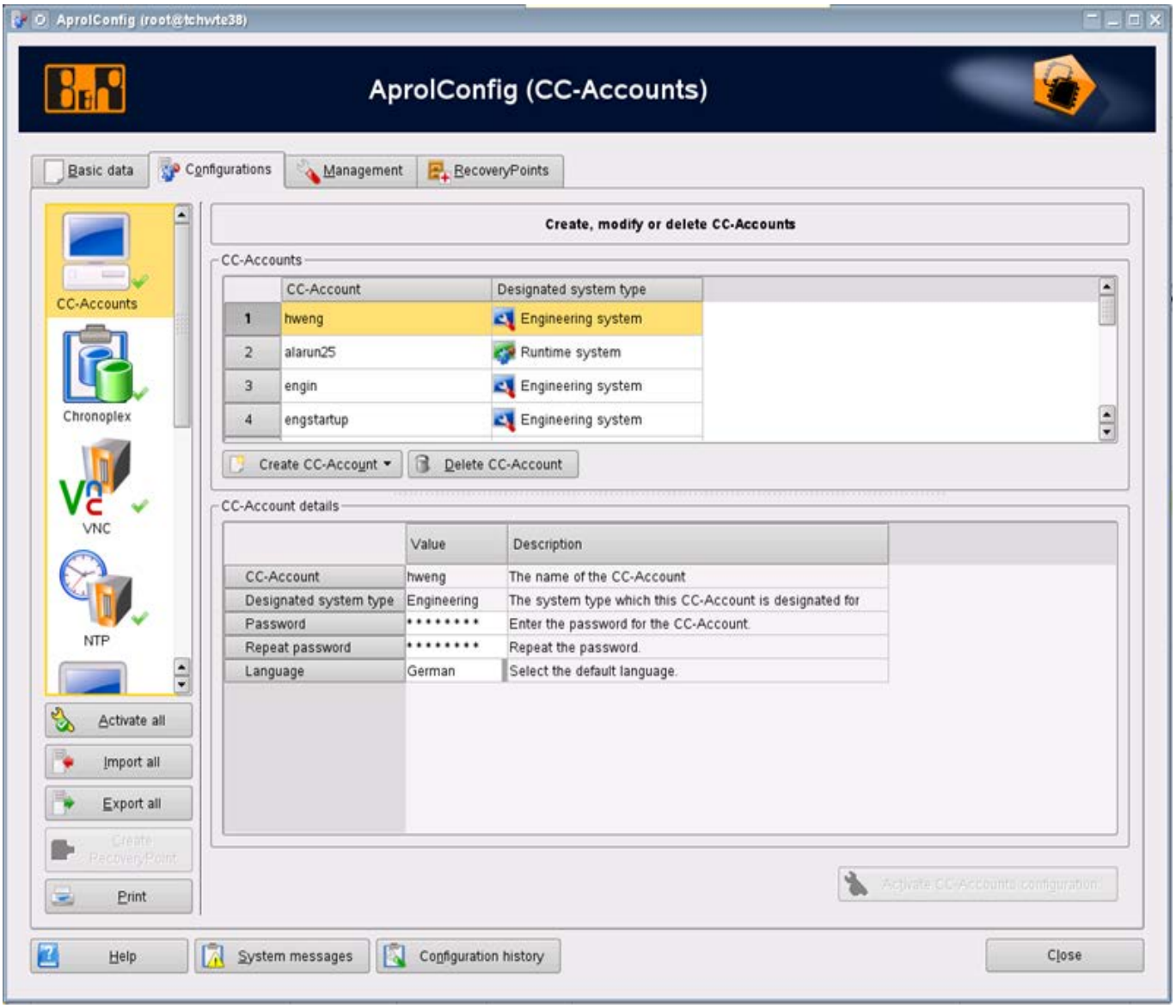


Illustration 42: Structure of the AprolConfig graphical interface

The tabs are directly underneath. The configurations are carried out in the 'Configuration aspects' tab, which is already chosen when **AprolConfig** is started.

Illustration 43: Tabs in AprolConfig

The different themes for which configurations can be made are called 'configuration aspects' or just simply 'aspects' in the following.
No CC-Account has been created yet in the example.

When an aspect is chosen, the corresponding configuration module is faded in on the right of the navigation bar. This is the 'ChronoPlex' aspect in the example.

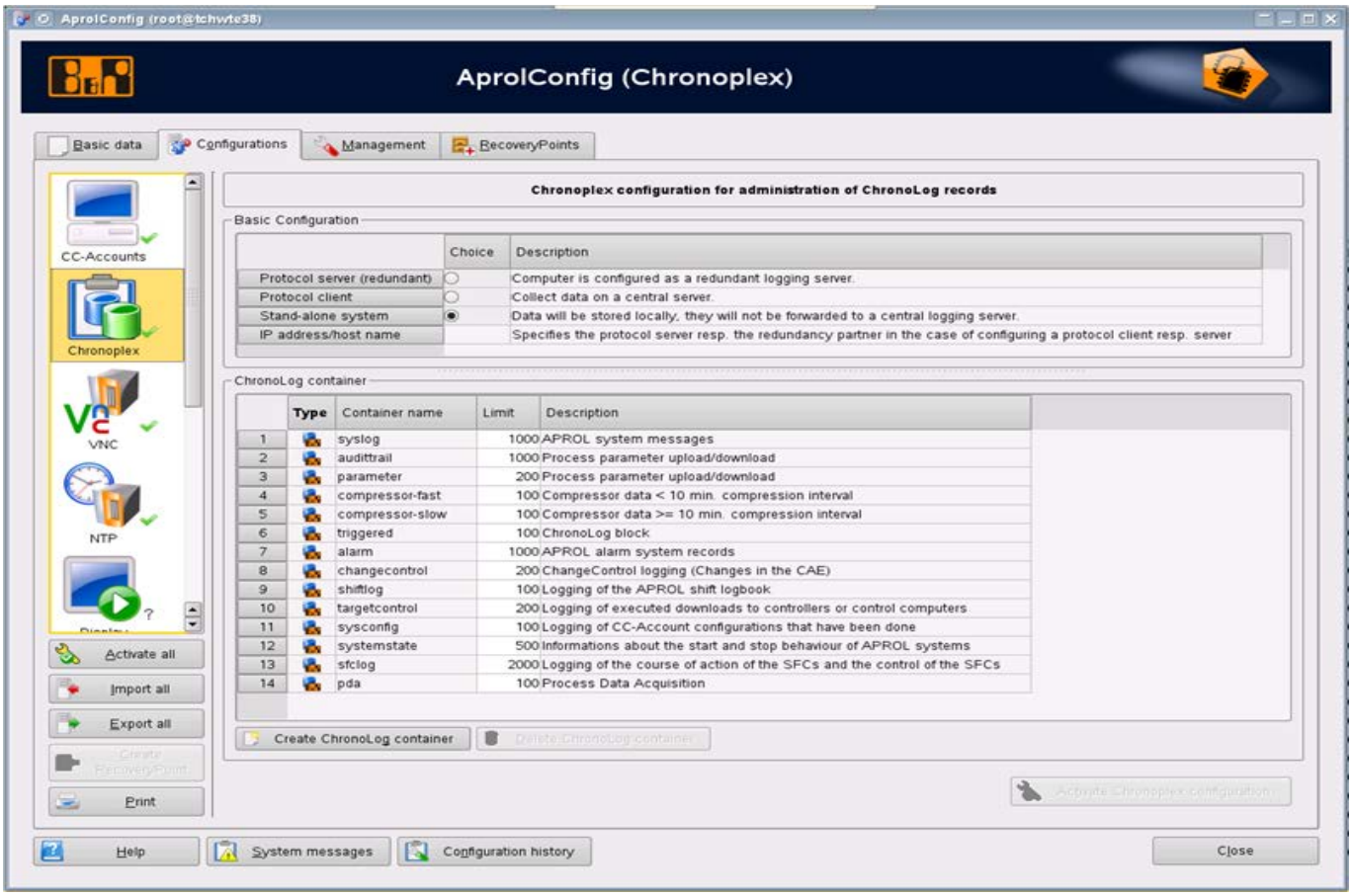


Illustration 44: Example for a configuration module

The configuration of each different aspect is handled in its own section further below. Apart from the configuration of the CC-Account (which is explained in the ensuing chapters) and the configuration of auto-start applications for Multiscreening (see chapter *X displays for auto-start of configured applications*), all other aspects are explained in the *Services* chapter.

In the '*Master data*' tab, there is information about the installation, network, and the CC-Account types that can be installed. The APROL system types that can be installed are also shown here (Not in grey).

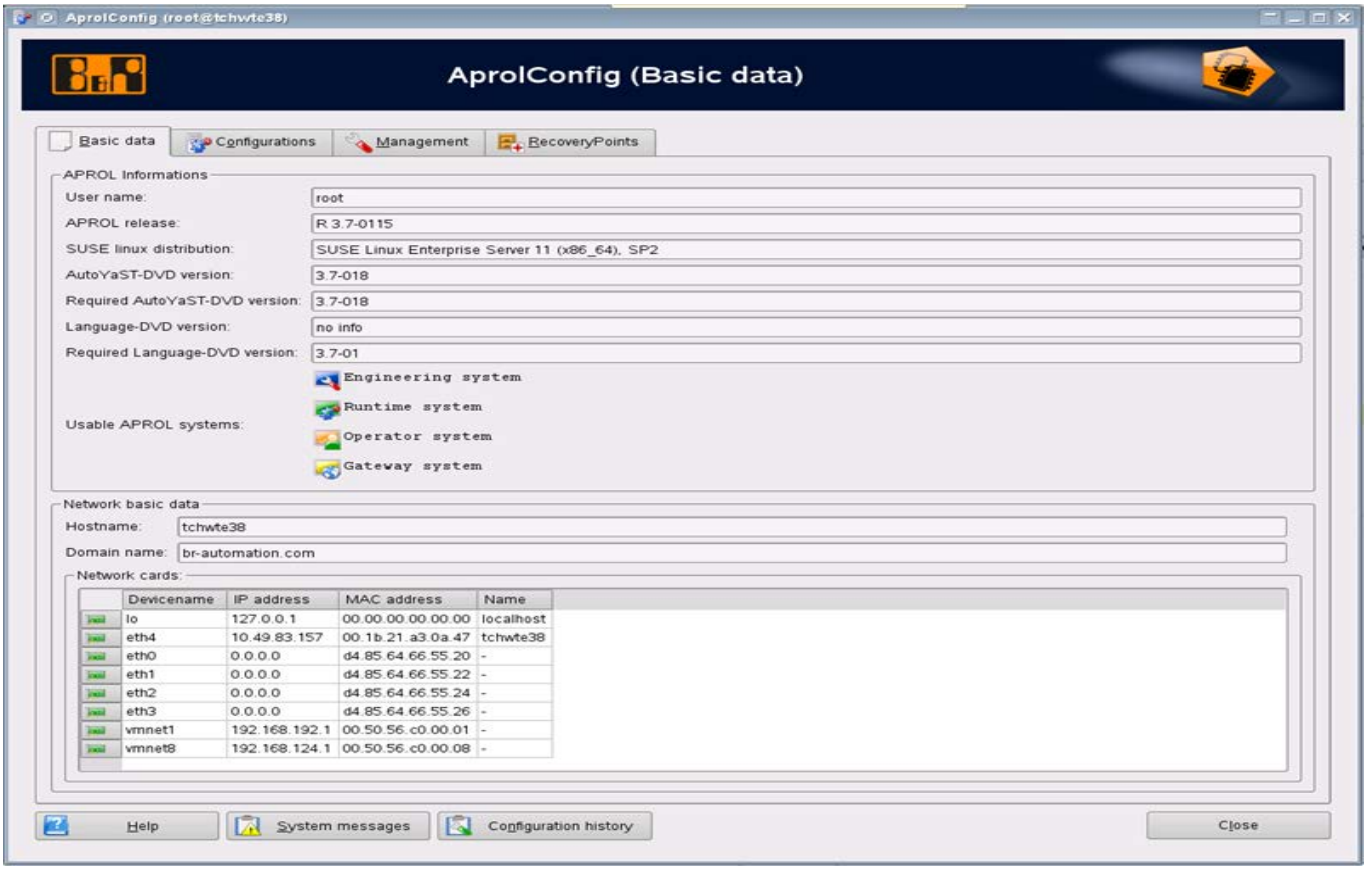


Illustration 45: Master data tab

The '*Administration*' tab is where administration functions can be carried out, which the type of configuration to save or information about the local computer is generated or needed. There is only one administration function at present.

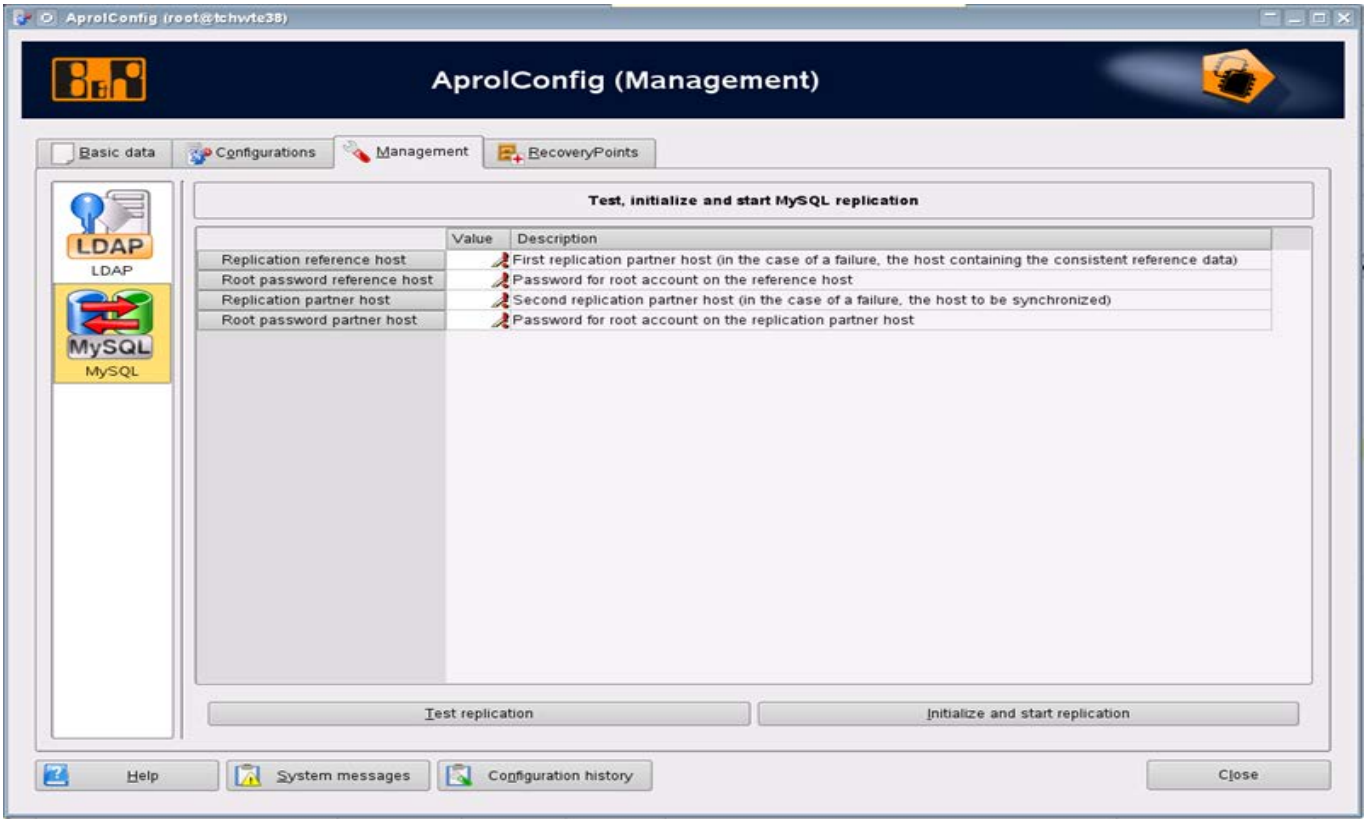


Illustration 46: Administration tab

The RecoveryPoints that have been created are listed in the *RecoveryPoints* tab.

The tab is insensitive when no RecoveryPoints exist.

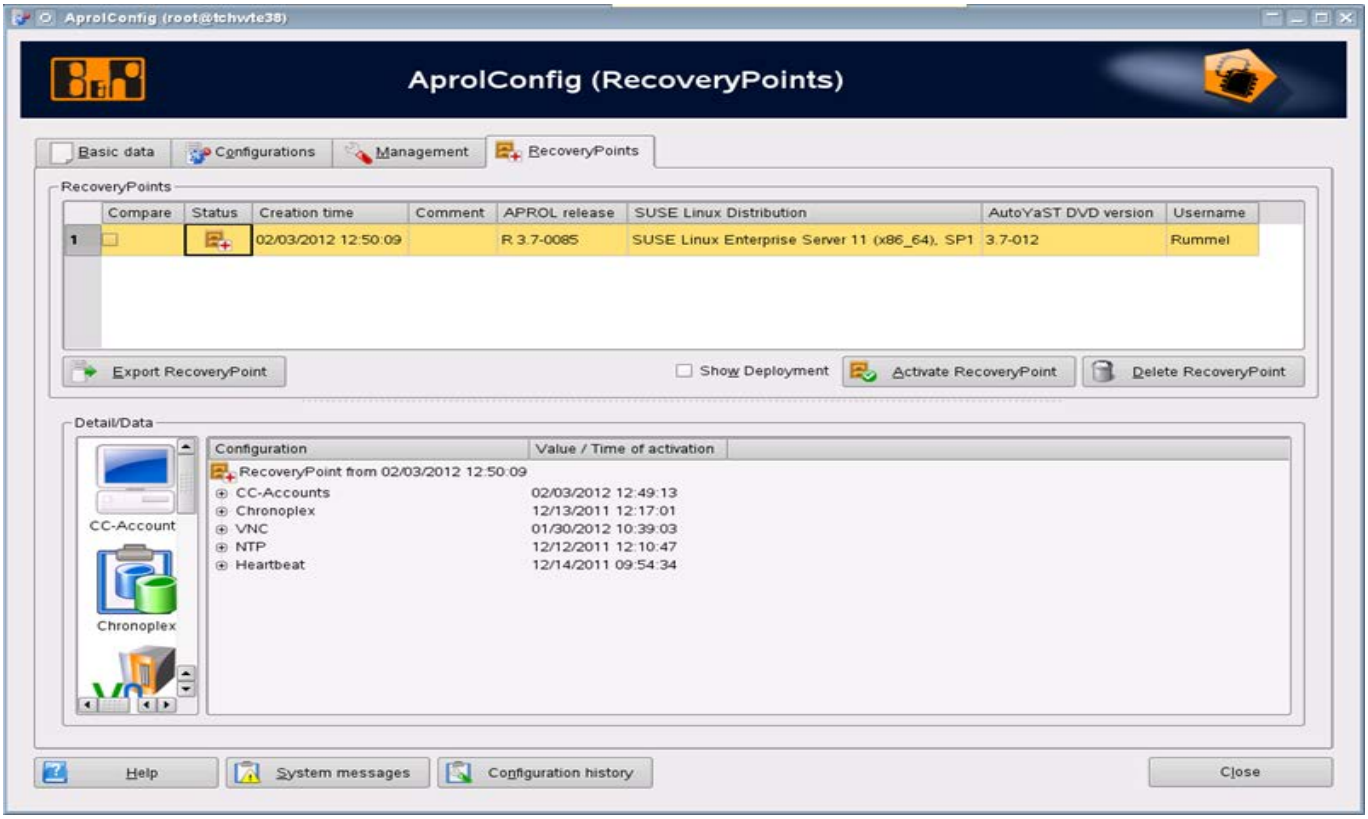


Illustration 47: RecoveryPoints tab

2.4.3 Editing the configurations

In order to configure an aspect, this must be chosen in the navigation bar. The corresponding configuration module appears on the right, and displays all of the necessary parameters that have to be configured in one view. Tool tips on the line identifiers (to the left of the input column), the column headings, and the other operating elements help you with the configuration.

Different icons for the state of the configuration are show next to the icons for the configuration aspects. There is a differentiation between the state of the activation (lower icon) and the state of the actual configuration (upper icon).

The icons are explained as follows:

Activation status:

There was a successful activation (green tick, example System)

There is no activated configuration, e.g. after a new installation (grey question mark, example Display)

The last activation failed (red X, example Remote Compiling) This icon is volatile and is set back to the last status (Question mark or green tick) when AprolConfig is re-started.

Processing status:

The configuration that is displayed corresponds to the activated configuration (no icon, example VCN)

The configuration that is shown does not correspond to the activated configuration. No erroneous entries have been made. (yellow wrench, example System and UPS)

The configuration that is shown does not correspond to the activated configuration. At least one mandatory input field does not have an entry. (red exclamation mark with pencil, example ChronoPlex)

The configuration that is shown does not correspond to the activated configuration. An invalid value has been entered in at least one input field. (red error triangle, example NTP)

The configuration that is shown does not correspond to the activated configuration. A value the least to a validator warning has been entered in at least one input field.

The corresponding icons for the editing status are shown on the input fields within a configuration module.

2.4.4 Save incomplete configuration

When you have made changes to configurations and **AprolConfig** is terminated without having activated them, you are asked if you would like to save the configurations that have not been activated. In this way, you can interrupt the configuration without having to re-enter the parameters that have already been made.

The next time that **AprolConfig** starts, you are asked if you would like to restore the incomplete configuration. If you refuse, the configuration modules that are displayed correspond to the activated configuration.

2.4.5 Activate configuration

It is possible to either activate each configuration aspect individually with the [**Activation of the <aspect> configuration**] button at the bottom of the configuration module, or all of the aspects with the [**Activate All**] button under the navigation bar.

An aspect can only be activated when changes have been made to the active configuration and there are no errors. Otherwise the button is insensitive.

The [**Activate All**] button is only active when there are no errors in any module, and changes to the activated configuration have been made in at least one aspect. Aspects that have not been activated (grey question mark) can only be activated individually. This avoids that the user activates a configuration (with its default settings) by mistake, without having seen it first.

The dialog that is shown below is shown during the activation after entering the user name and any comments (see illustration in chapter *Exporting and saving*, but without customer directory).

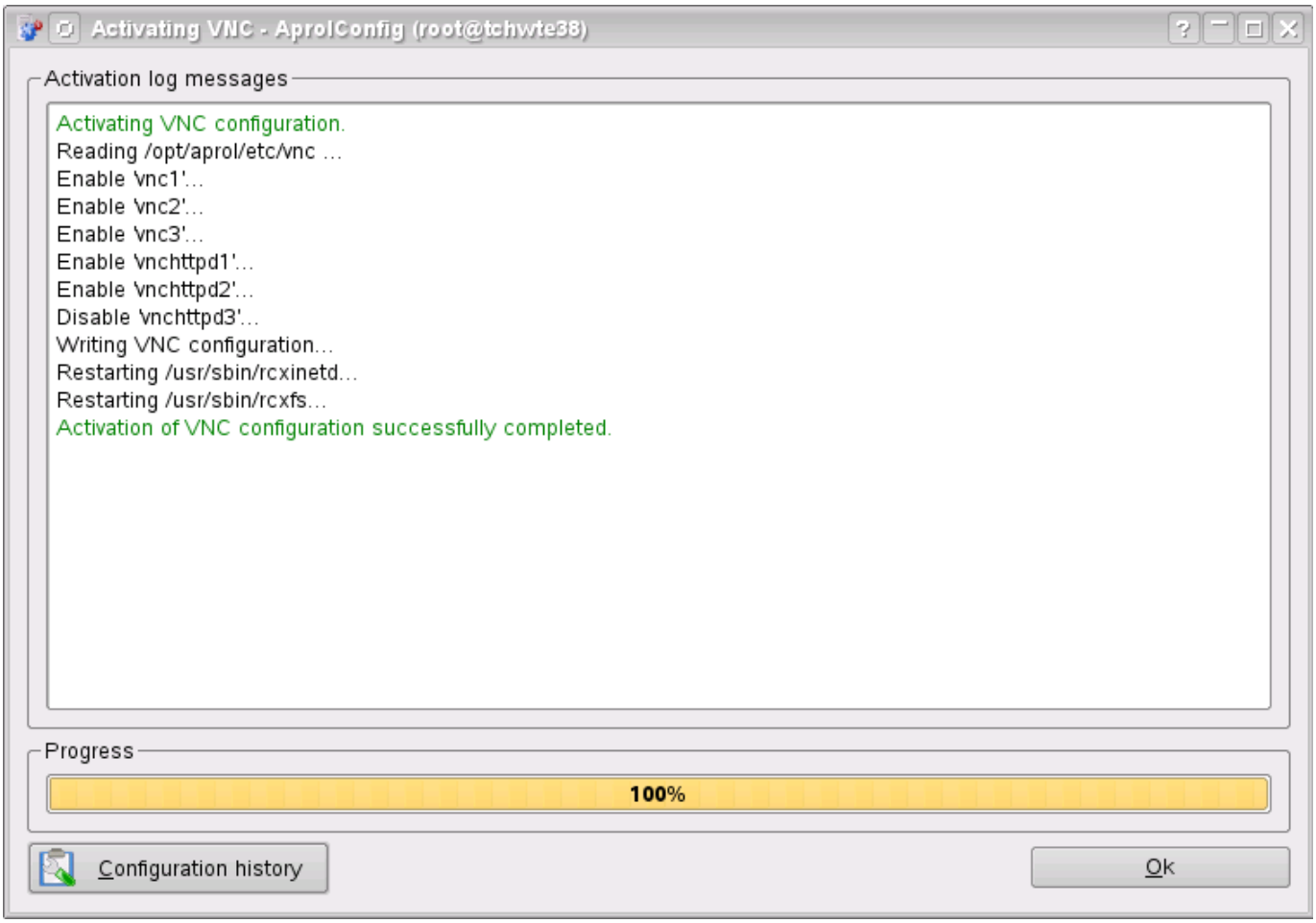


Illustration 48: Activation dialog

Messages about the progress of the activation (for VNC in the example) are written in this activation dialog, and are also saved in the configuration history in the APROL system messages.

Only the messages belonging to this activation process are shown when pressing the [**Configuration history**] button in the activation dialog. This is also valid when several aspects are activated at the same time with the [**Activate all**] button.

If the button is pressed when the *Configuration aspects* tab is active and an aspect has been chosen then the messages that belong to the previous activation process of the aspect are shown.

2.4.6 Error status

Possible errors are output in a red font when the aspect is activated (activation messages).

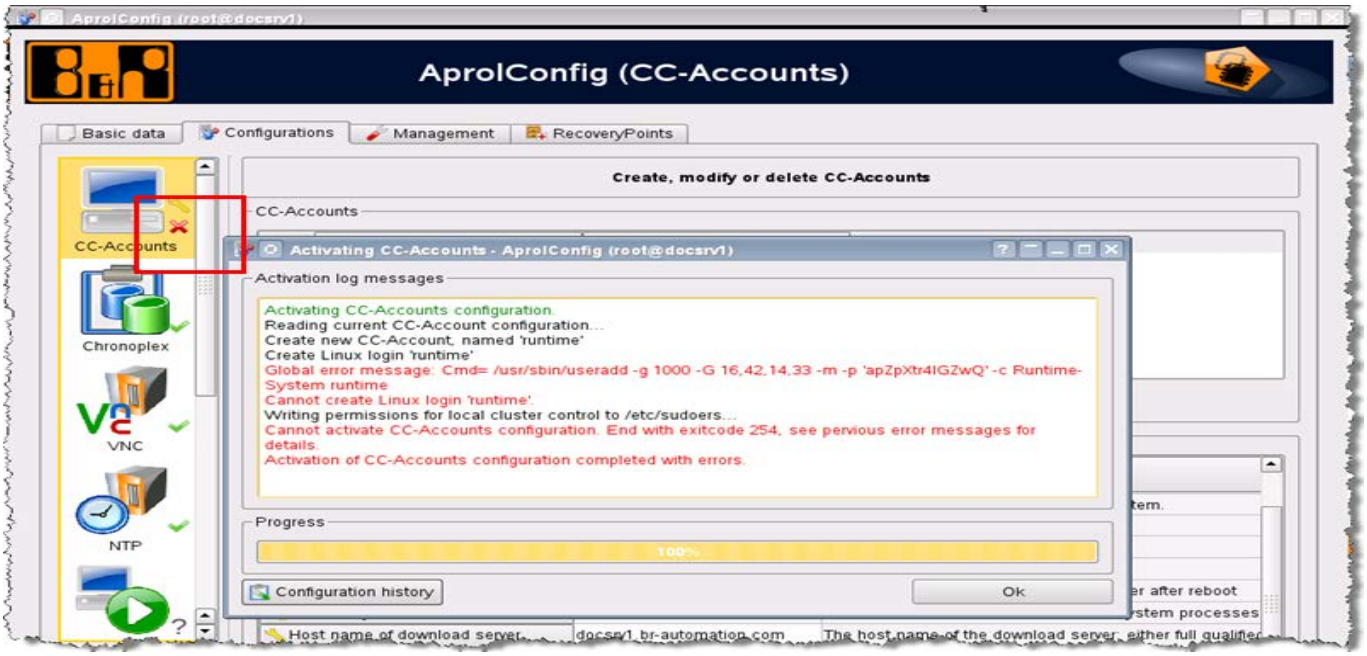


Illustration 49: Output of error messages when activating an aspect

Unsuccessful activation is also marked graphically in the navigation bar. Detailed information about the meaning of the icons can be found in the chapter *Editing the configurations*.

2.4.7 Locking against a multiple start

It is prevented that several AprolConfig applications run at the same time on one computer. Otherwise, inconsistent configurations could come about on the computer if changes are made in the background. This leads to the fact that the configuration data shown in the user interface are no longer up-to-date.

The following situation applies:

An AprolConfig has already been started from a remote computer, and AprolConfig is started again locally. There is now the possibility of closing the running AprolConfig in a controlled manner, as long as a activation is not being carried out. This may make sense when somebody has forgotten to close the running AprolConfig.

It is not allowed to close the running AprolConfig with 'kill' because an activation process may then be interrupted and an inconsistent configuration state would then result.

In order to carry out the controlled closure, the user of the newly started AprolConfig is asked if they want to close the running AprolConfig in a dialog. After confirming with [**Yes**], the running AprolConfig is sent a signal to close and the termination is awaited. If an activation process is being carried out then the end of the activation process is awaited, or a cancellation takes place with a message after a timeout of 30 seconds.

The following message appears in the running AprolConfig after the signal has been received:

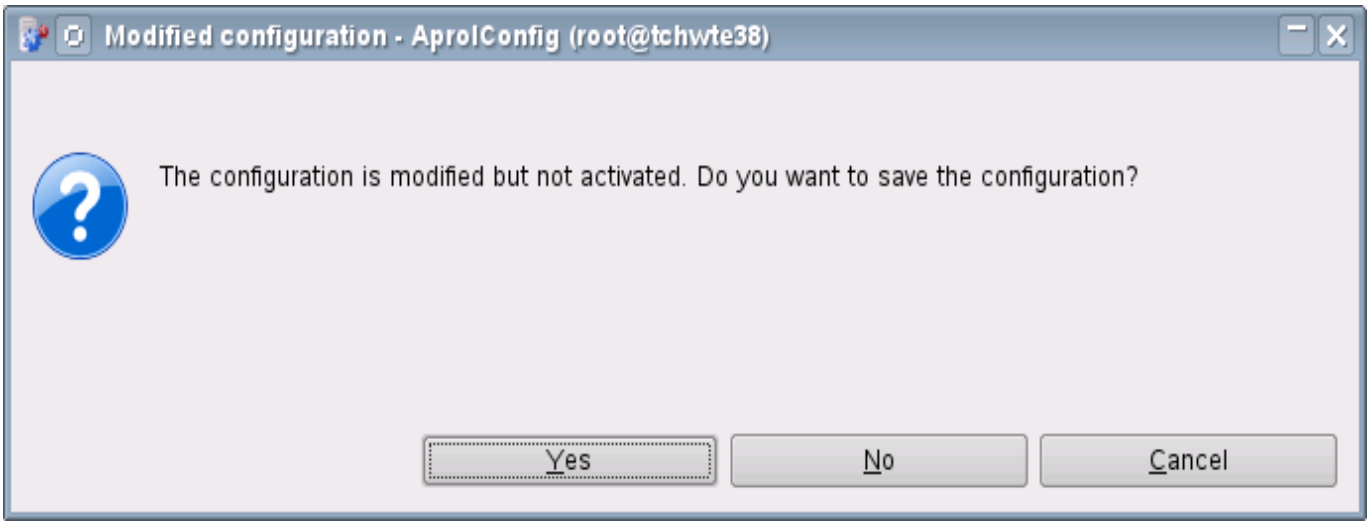


Illustration 50: Message about adopting changes

2.5 Creating an Engineering System

After installing the APROL software, it is not mandatory that the CC-Account basic installation is carried out. They can be created later with the help of **AprolConfig**. General information about AprolConfig and how it is started can be found in chapter *AprolConfig*.

All CC-Accounts are created, edited, and deleted in the 'System' configuration aspect. The CC-Account type is chosen with the 'Create CC-Account' pull-down menu (Engineering system in this case). The entries that must be made in the configuration table that appears are self-explanatory and are supported with tool tips.

The main entry is the name of the CC-Account. This name is also the Linux login name used to log into the CC-Account. After entering the name in the lower table, it also appears in the upper table, where there is an overview of the configured CC-Account. It is not possible to enter anything in the upper table.

The password and choice of standard language for the CC-Account are other entries that must be made.

When the configuration is complete, the CC-Account can be created with the [**Activate the system configuration**] button. A comment field appears, in which the user must enter his name, and can enter a comment to describe the purpose of his actions.

After confirming the dialog with [**OK**], the steps for activating the CC-Account and the possible error messages are listed in the activation dialog window.

The CC-Account has been created when the final succeeded message appears, and the dialog can be closed with [**OK**].

2.6 Creating a runtime system

The basic installation of a runtime system takes place in the same way as that of an engineering system. It is created by choosing a runtime system in the pull-down menu for creating a CC-Account.

If there are several runtime systems configured on one computer then please ensure that the relevant project names must be different! If this is not the case, there will be errors in the historical data logging!

The specifications for a runtime system encompass all of the entries for an engineering system (see chapter 'Creation of an engineering system'). The following entries are also necessary:

AprolLoader port: It is possible to choose this manually or to let it be chosen automatically. In this case, a check takes place during the activation for which port is free on the computer, and the next free port is allocated and displayed directly in the configuration module after the activation. If an existing port is specified in the manual configuration, another free port is detected and allocated.

AprolLoader start and APROL system start: The AprolLoader is a program that starts and stops all background programs in a certain order. If AprolLoader start is chosen, the runtime system can be started with the StartManager immediately after booting. Otherwise, the AprolLoader must be started manually by the root user in order for it to start the Runtime system. If APROL system start is chosen, the runtime system is started immediately. This setting has no effect if there is no run-capable Runtime system available.
Summary of the possible combinations of both specifications:

No selection: An existing Runtime system can only be started if the user has the possibility to start the *AprolLoader*.

Choice of only *AprolLoader start*: The Runtime system is started with the StartManager.

Choice of only APROL *system start*: The *AprolLoader* is started before the runtime system and then the runtime system is started.

Both selected: corresponds to the choice APROL *system start*

Host name of the download server and **name of the engineering system: The first field is pre-assigned with the host name of the local computer. If the engineering system from which the download is to take place is on another computer then this must be entered there together with the domain name. The name of the engineering system is then entered in the second field.**

Basic or *Standard* can be entered for the **KDE configuration**. With this, the menu structure, the desktop, and the background are set for the login to the runtime system.
If the *Integrated operator station* option is not activated then only the *Service* KDE configuration can be carried out. Detailed information can be found in chapter KDE configuration 'Service'.

Parameter management: If a parameter management is needed or not in the runtime system and the corresponding MySQL database must be created is set here. A license is not necessary for MySQL when a runtime system cannot be installed on the computer, or if a parameter management is not needed for any runtime system.

Integrated operator system: Computers that are solely used as runtime machines are normally operated without a graphical user interface. With this option, the graphical user interface is activated in order to be able to use the functions of an operator system. Also see the *KDE configuration* option and chapter KDE configuration 'Service'

Depending on the computer type being used, up to twelve APROL runtime systems can be run separately from each other on a single computer. These systems can then be installed using **AprolConfig** later on.

2.7 Creating an operator system

When a Runtime system is base configured, an Operator system is integrated into it at the same time. The APROL process control system that has been designed is operated from this system. In these types of integrated systems, the login name for the Operator system is the same as the login for the Runtime system. Multiple operator systems are required for large CC-Accounts. They are configured on computers that are then used as operator computers or stations.

The basic installation of an operator system is made in the same way as that of a runtime system, by choosing an operator system in the pull-down menu for the creation of a CC-Account.

The specifications for an operator system encompass all of the entries for a runtime system (see chapter 'Creation of a runtime system'), apart from the entries for parameter management that can only exist on a runtime system.

Entries that go further than a runtime system refer to the cluster for a web query of historical data. The corresponding computer information is entered here for the control computer project part that is configured as a logging server in the CAE project. The actual cluster is entered in the case of a redundancy system (in 'Redundancy configuration' in the project part); the APROL server information in the case of a system that is not redundant (the host name from the master data and the resource IP address). The cluster domain name in both cases is the domain name that is specified in the master data.

2.8 Creating a gateway system

The basic installation of a gateway system is like that of a runtime system (see chapter 'Creating a runtime system'). The only differences are that the parameter management configuration (also see operator system) is missing and the *Basic* KDE configuration is available on a gateway system.

Gateway or runtime systems without an integrated operator system can basically be run in Linux runlevel 3 (i.e. without a graphical user interface).

A special KDE 'Service' configuration is provided, as of APROL R 3.6-03, in order to be able to use a graphical user interface for administration duties in these systems, e.g. to install a patch.

Detailed information can be found in chapter KDE configuration 'Service'.

2.9 File selection dialog

This description is under construction at present.

Please inform yourself in regular intervals about the current APROL documentation on our internet side **www.br-automation.com**, in the area Material related downloads.

2.10 Import / Export function

Configuration states of different instances can be swapped with AprolConfig. These instances can be APROL servers on the one side, and control computer project parts with the corresponding APROL system project parts in the CAE project on the other.

Configuration states are.

RecoveryPoints

The currently activated and displayed configuration

The configuration that is currently displayed, but has been changed in contrast to the activated state

Configuration states that have been exported to the file system

Configuration states that are saved in the CAE project

2.10.1 Exporting and saving

A comment dialog appears when saving a configuration state (creation of a RecoveryPoint and exporting the displayed configuration). The user can enter a name and a comment here, similar to the activation of a configuration.

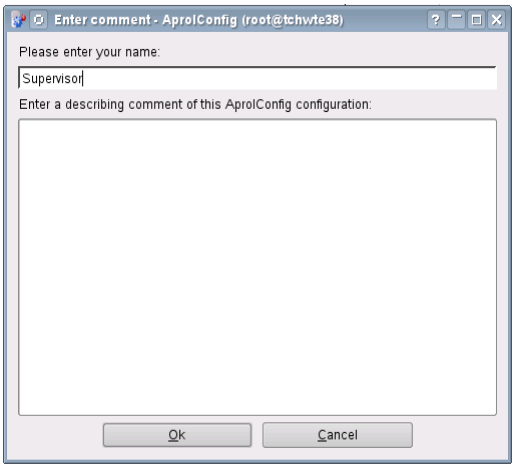


Illustration 51: Comment

The comment field is already filled in the case of an export.

The name that has been entered is adopted when the dialog is re-opened if the action was confirmed with [**OK**] and not cancelled. The input field can also be pre-set with the command line option '-user <name>'.

A customer directory can be specified in addition to the configuration files. An additional TGZ is created with the content of this directory. This is saved in the RecoveryPoint's directory and packed together with the export of the TAR file. The TGZ ends with `'_customer.tgz'`.

The checkbox must be activated to use a customer directory. The directory name is pre-set and can be changed in the input filed and with the button on the right of the input field, which provokes a file selection dialog.

Directories below `/home/aprolsys` are excluded from the export.

If a RecoveryPoint is exported then no comment is specified and no customer directory is added, as these actions were already carried out when the RecoveryPoint was created.

2.10.2 Import dialog

The import dialog appears after pressing the [**Import all**] button. The following illustration shows the appearance of the '*General Information*' tab in the import dialog after the choice.

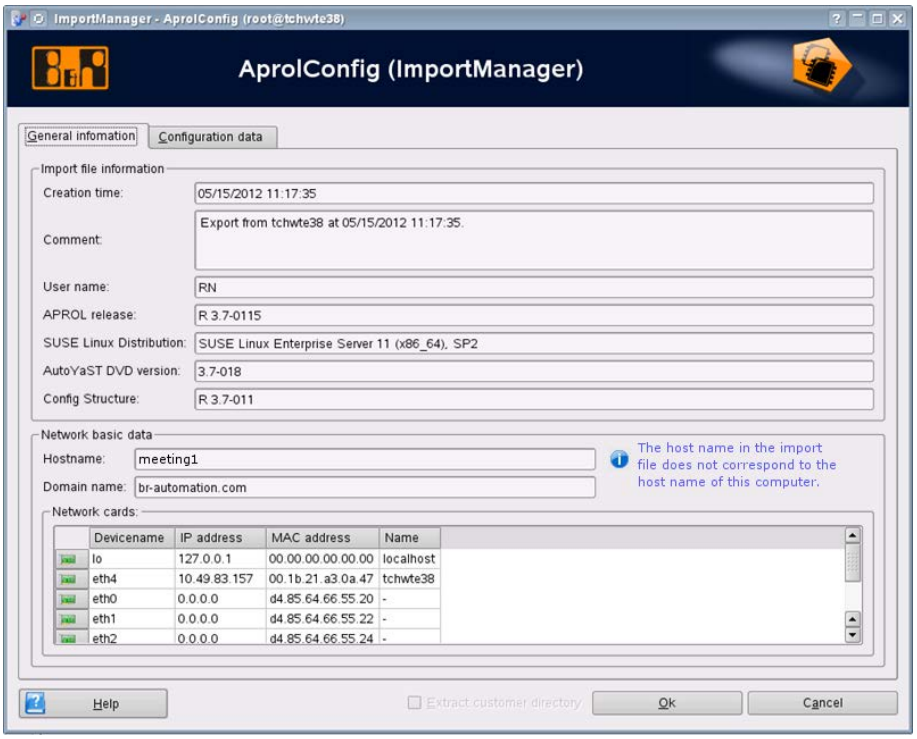


Illustration 52: Import dialog, 'General Information' tab

There are differences in the general information in the example between the local computer where **AprolConfig** is running and the computer where this configuration state was exported. In this case, this is another computer with correspondingly different network data. You will be informed of these types of differences. This is helpful in checking if it is the correct import file or the correct target computer.

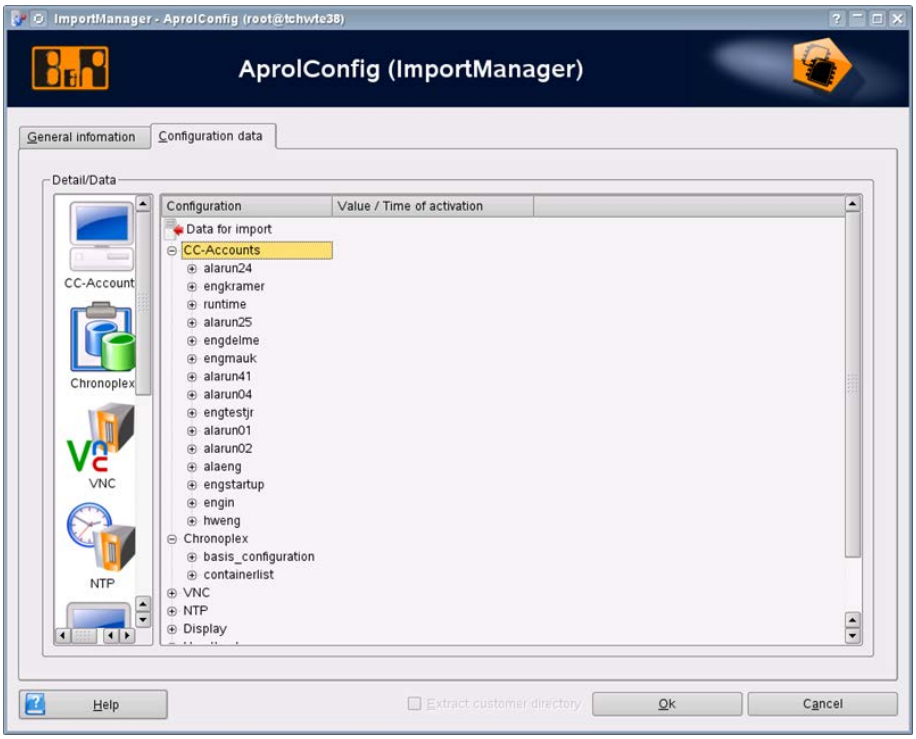


Illustration 53: 'Configuration Data' import dialog

All of the data in the import file are displayed in the tree view in the '*Configuration data*' tab. The aspect icons are equivalent to the navigation bar in the configuration aspects. They open the corresponding branch in the tree structure on the right. This view corresponds to the *Detail/Data* view in the RecoveryPoints.
The 'Unpack customer directory' checkbox is activated when a TGZ exists in the import file contains a customer directory. Otherwise, the tick is not set and the checkbox is inactive. When the checkbox is active and the import is confirmed, a choice dialog appears to specify the target directory for the files from the customer directory.

2.10.3 CaeManager

There is a section for **AprolConfig** in the 'Control computer' project part in the **CaeManager**.

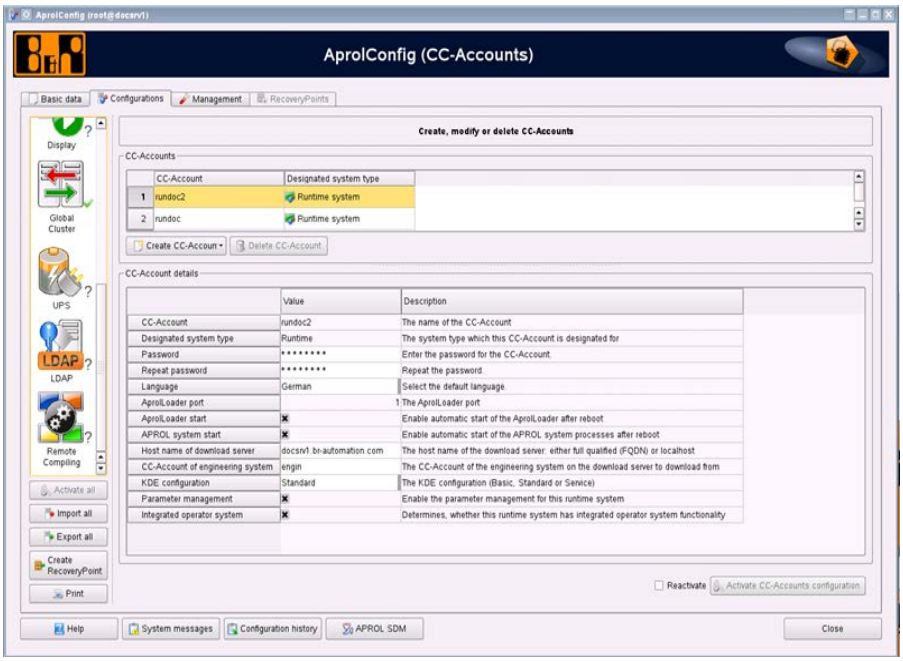


Illustration 54: AprolConfig in the CaeManager

The same configuration aspects as in the stand-alone application are found here, with the exception of 'System'. These aspects are supplied with parameters from other areas in the CAE project. The redundancy configuration is carried out in the master data and the respective interface is configured in the resources. The configuration of the CC-Account is completed with the allocation of the '**APROL** system' project part to a 'Control computer' project part.
The **AprolConfig** configuration can be imported and exported with the corresponding buttons. The **APROL** systems that are activated and allocated to the control computer are also exported from the project.
No new **APROL** system project parts are created when importing an **AprolConfig** configuration into the project part. The configuration data from the import is adopted when an **APROL** system already exists (the name of the target system must be the same).

2.10.4 Command line tool

In addition to the **AprolConfig** GUI, there is an '*AprolConfigCmd*' command line tool. A configuration cannot be carried out with it. The following actions can be carried out:

Show the configuration state and individual configurations

Export configuration states

Create RecoveryPoint from configuration state

Activate existing RecoveryPoint

Activate imported configuration

The function to show configurations and to query individual parameters is used throughout **APROL** in different places.

The available commands and options are listed with `AprolConfigCmd -h`. Commands are marked with the *Command* key word in the description column.

2.10.5 Simplified workflows

Simplified workflows are possible with the import and export function and the command line orientated *AprolConfigCmd*.

Creation of the entire control computer hardware in the CAE project

All APROL servers are configured in the control computer project part.

All respective APROL systems in the corresponding project parts with allocation to the control computer

Configuration aspects are configured in the control computer project part via an embedded **AprolConfig** (see previous illustration).

AprolConfig configuration is exported for each control computer

The resulting file is copied to the target computer (with the suitable media) and is activated there with *AprolConfigCmd*:

```
AprolConfigCmd –activate –file DATEINAME –user USER
```

Result: a pre-configured APROL server with all of the desired APROL systems

Creation of several similar operator stations

An operator station is installed and configured with **AprolConfig**

The configuration is exported

Further operator stations can be created with this export file. No adjustments must be made to the configuration because the host name of the operator station is not contained in the configuration.

Result: The configuration state from the export file cannot be made interactively with *AprolConfigCmd*.

2.11 RecoveryPoints

The RecoveryPoint concept is to save the currently activated configuration state of the computer, and if there is an error in the system due to a faulty configuration at a later stage, you have the possibility to read and/or restore this saved configuration state.

It is thus possible to ensure that there is on functional configuration state that can be used as a reference or as fallback in the case of a problem.

A RecoveryPoint can also be exported. Detailed information can be found in chapter *Import and Export Function*.

It is possible to compare and show the difference in the configuration of a RecoveryPoint with the configurations in a configuration module. For this, open the context menu (right mouse) on the input column's heading and choose one of the RecoveryPoints in the 'Compare with' entry. These are chosen according to the timestamp and creation comment. The following illustration shows an example with VNC.

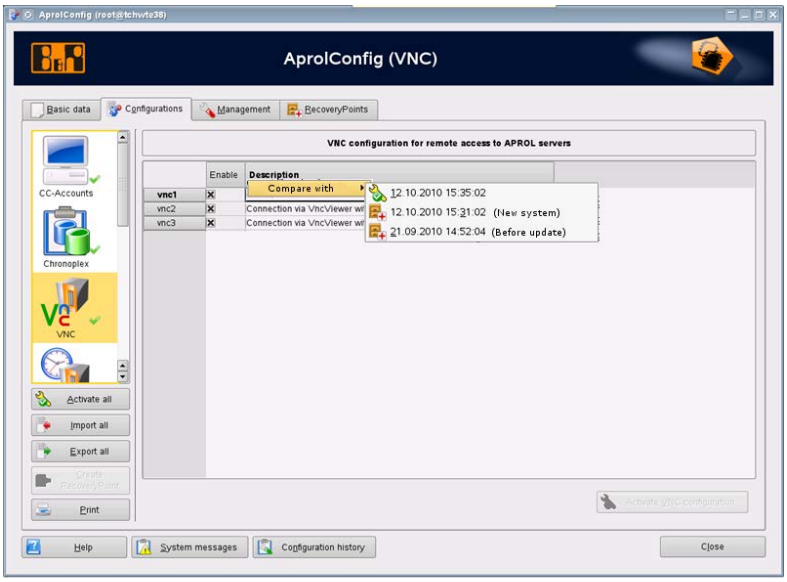


Illustration 55: Compare with RecoveryPoint

Comparisons with several RecoveryPoints can be made simultaneously if several comparison columns are activated. The following illustration shows the comparison of a configuration that has been changed (yellow wrench in the input column) with the actually activated configuration (green tick in the column heading of the comparison column) and another RecoveryPoint.

	Enable	12.10.2010 15:35:02	12.10.2010 15:31:02	Description
vnc1	☒	☒	☒	Connection via VncViewer with resolution 1280 x 1024 and port 5901
vnc2	☒	☒	☒	Connection via VncViewer with resolution 1600 x 1200 and port 5902
vnc3	☒	☒	☒	Connection via VncViewer with resolution 1920 x 1200 and port 5903

Illustration 56: Comparison columns

Comparison columns can also be faded in by activating the respective RecoveryPoint in the 'Compare' column, in the *RecoveryPoints* tab. This blends the respective comparison column into all configuration editors. If there is no configuration contained in the RecoveryPoint for a certain aspect, then the column there is marked accordingly, i.e. that the values of the fields do not contain any data. The 'Activate display' checkbox blends in the comparison column together with the currently activated configuration into all configuration editors where there is an activated configuration.

The fading in and out of the comparison column only affects this editor and does not affect the respective checkbox in the *RecoveryPoints* tab.

The (de-)activation of the checkbox in the *RecoveryPoints* tab always has an effect on all configurations.

Apart from hiding a comparison column, the corresponding configuration can be restored with the comparison column's context menu.

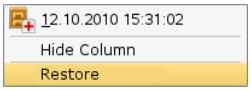


Illustration 57: Restoration of a CC-Account

The data are copied in the value column with this. The change icon is set in all lines where the values are other than the activated configuration. The configuration must be activated in order to complete the restoration.

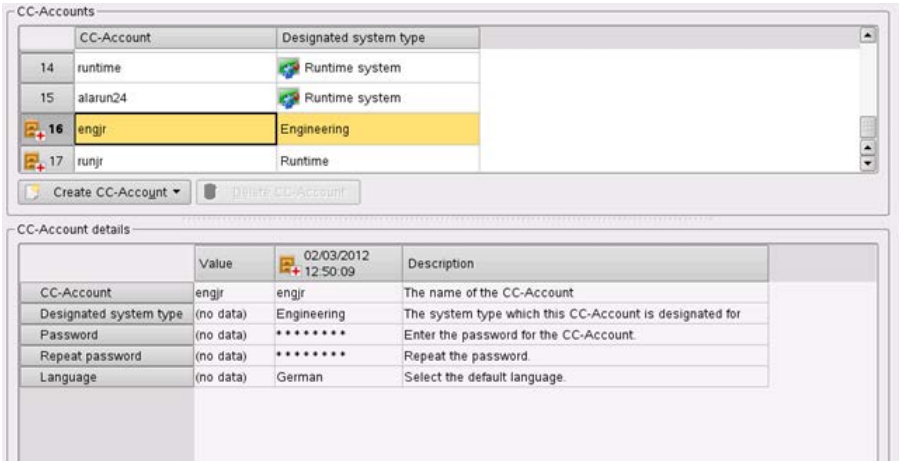


Illustration 58: Display of the CC-Accounts from the RecoveryPoint

If a RecoveryPoint is show and it contains CC-Accounts that do not exist in the currently activated configuration then they are displayed as in the illustration above. The RecoveryPoint icon is shown in the uppermost table of the CC-Accounts, next to the corresponding line. An empty column appears in the main table when the CC-Account is selected. A deleted CC-Account can thus be restored, by restoring a comparison column and then activating the configuration. It is not possible to create a new CC-Account via 'Create CC-Account' if a RecoveryPoint contains a CC-Account with the same name. The input is discarded and a corresponding message is output if such a name is used. The RecoveryPoints from which the system can be restored in the above mentioned way are listed there.

If the [**Configuration history**] button is pressed in the *RecoveryPoints* tab, all configuration history messages that belong to the activation process in the RecoveryPoint are shown. This is the last activation process that was carried out for each configuration aspect before the RecoveryPoint was created.

2.12 MySQL replication

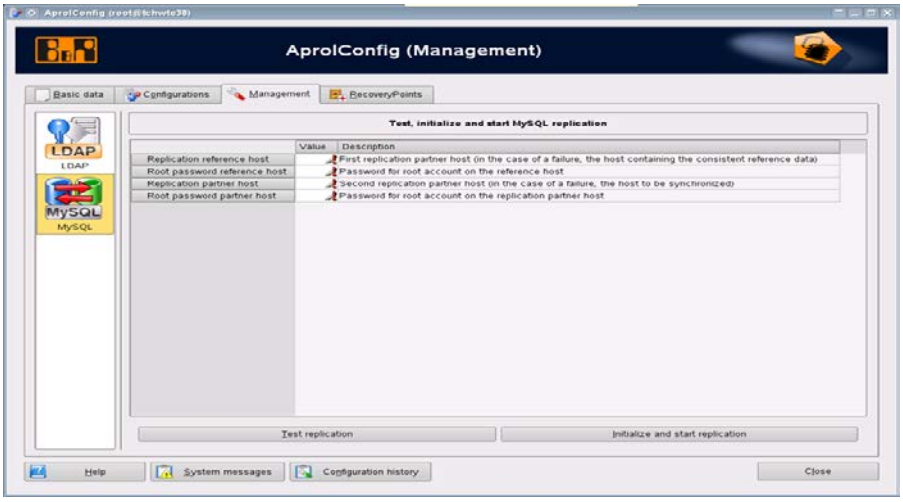


Illustration 59: MySQL replication

Using this management function, a MySQL database replication can be created and tested for parameter sets on redundancy runtime computers. The respective fields must be filled with the host names and the 'root' passwords of both computers involved.

The runtime master must be entered in the 'Replication reference host' field and the runtime slave in the 'Replication partner host' field when a replication is set up for the first time.

If there is an inconsistent database then the computer that is not effected by the error must be entered in the 'Replication reference host' field because the reference database with the consistent state is there. The input fields are not labeled with master or slave because this can also be the computer that normally acts as a slave. This sort of error state may be the complete crash of a redundancy partner, or a hard-disk crash with subsequent new installation.

In the above mentioned cases (First-time installation, or case of errors), the [**Initialize and start replication**] button must be pressed after inputting the parameters. Inputting a false host name, or especially specifying the master as 'Replication reference host' when it was the one that had the hard-disk crash, can lead to a complete loss of data. For this reason, the data that was entered in the fields is not saved but must be entered each time that AprolConfig is started.

It is possible to test a replication with the [**Test replication**] button before a first-time installation or during running operations. A test database is used for this purpose, so that the proper parameter database is not affected by the test.

2.13 Language DVD

The German and the English language environments are available to you, upon having installed the APROL system software. Further languages can be installed with the Language DVD. The Language DVD language packages must be installed on all CC-Accounts which need the corresponding language environment.

If language packets from the Language DVD were already installed before the APROL system software update, then it is absolutely necessary to uninstall and reinstall these packets after the update according to the following instructions.

Un-installation of the 'APROL Translation-devel' (Development environment for localization) leads to a deletion of the 'aproltr' user and its home directory together with all of the translations within it.

Therefore, a backup of the translations that have been made must be carried out before the un-installation.

2.13.1 Installation requirements

The following packages must be installed:

APROL AutoYaST DVD for LINUX with following patterns:

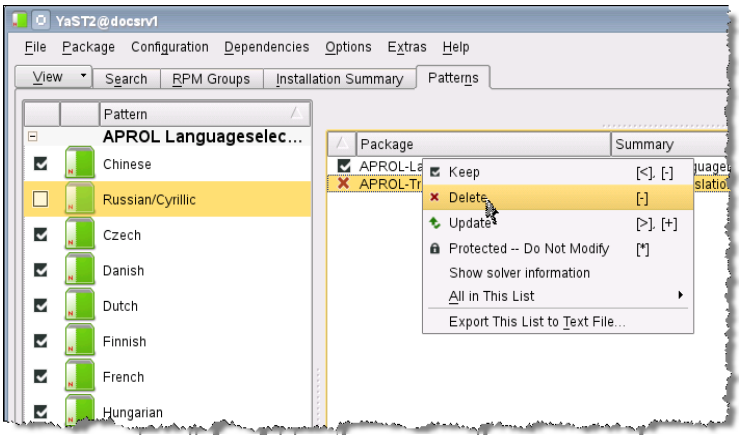
"APROL Basis" with the included language packages

"Basis technology"

APROL system software DVD

2.13.2 Un-installation of language packages (when present)

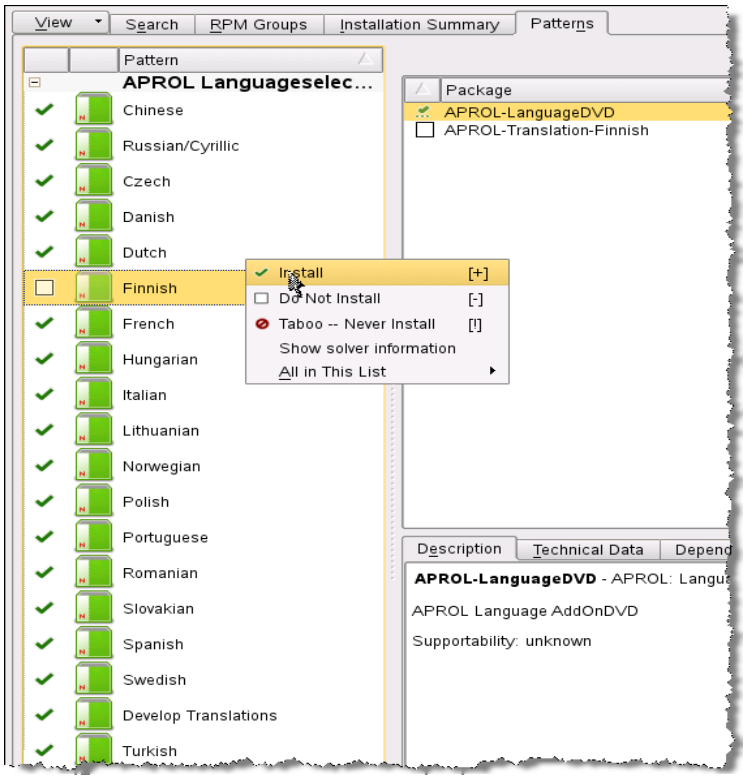
An overview of the necessary steps follows:

Step	Description
1	The item **System/System settings (YaST)** must be launched in the KDE menu. The *YaST Control Center* is started after the **root password** is entered.
2	**Delete existing APROL language support packages** Choose **Software/Install or delete software** in the *YaST control center*. In the dialog box that is opened, "**Patterns**" must be selected in the "**Filter**" pull-down menu. Consequentially select all of the entries on the left hand side of the dialog in APROL **Language support**, and mark them together with the respective packets on right hand side of the dialog for un-installation via the '**Delete**' shortcut menu. The entries/packets that are to be deleted are marked with the corresponding symbol.  *Illustration 60* Confirm the changes with [**Accept**], whereby the packets are then un-installed.
3	Choose the following for the "Install or delete further packets?" query: **[No]**. For the installation of the packages from the APROL **language support**, please pay attention to the notes in chapter *Installation of language packages*.
4	Please log yourself out of, and back into the CC-Account in order to actualize the KDE menu immediately.

2.13.3 Installation of language packages

An overview of the necessary steps follows:

Step	Description
1	The Language DVD should be placed in the drive. The item **System/System settings (YaST)** must be launched in the KDE menu. The *YaST Control Center* is started after the **root password** is entered.

Step	Description
2	Choose **Software/change installation source** in the *YaST control center*, and eventually insert the installation source. The installation source is to be activated with "**Activate or de-activate**" via the "**Source settings**" pull-down menu. In order to guarantee the access to the current installation source data, please choose "**Source settings/actualize now...**" (See chapter *Change installation source*).
3	**Install the APROL language support packages** Choose the "**Patterns**" item in the "**Filter**" pull-down menu. If the **APROL language support** is already installed, the language packages are not allowed to be actualized. Instead, these packages must be deleted and newly installed (see chapter *Un-installation of language packages*). Select the desired languages on the left hand side of the dialog in **APROL Language support**, and mark them together with the respective packets on right hand side of the dialog for installation via the '**Install**' shortcut menu. A "tick" marks the respective entry/packet.  *Illustration 61* Confirm the changes with [**Accept**], whereby the packets are then installed. Important: The warning message "Signature check" can be confirmed with [**Yes**].
4	Choose the following for the "Install or delete further packets?" query: **[No]**.
5	When the update ends, exit the *YaST Control Center* and remove the DVD from the drive.
6	Please log yourself out of, and back into the CC-Account in order to actualize the KDE menu immediately.

2.13.4 Actualization of language packages

To actualize Language DVD language packages, please carry out the described steps in *Uninstallation of language packages*, as well as in *Installation of language packages*.

2.14 APROL patch installation

2.14.1 General information about the Patch mechanism

B&R regularly supplies new functionalities, expansions, and bug fixes in the form of an upgrade to the current APROL release, as well as with updates to the newest build of the current APROL release.

Pay attention to the entry of the Linux super user password "root", as well as the notes about the ssh security dialog.

*The installation of an APROL patch is only possible **when no offline state is present**. All of the project parts that have been checked out must be checked in. Only thereafter is it possible to carry out the installation of an APROL patch in online mode!*

Additionally, there is a comfortable mechanism available with which databases, APROL applications, configuration files (APROL or LINUX), as well as shared libraries can be integrated quickly and simply into the existing APROL system environment.

The necessary changes and optimization in the APROL system software can thus be made available and installed promptly with an APROL patch.
A patch can be made available for different CC-Accounts (engineering, runtime, operator system).
In the current patch, all of the affected CC-Accounts **are shown in the overview dialog, in which this patch must be installed.**

There is a further advantage in the transparency and traceability of the new mechanism due to the continuous recording in the scope of the APROL system messages. Here, the applications are acquired, which are activated from the patch installation (stating the patch ID, as well as the patch name), as well as all of the actions carried out by the system internal script *patchCmd*.

The exchanged APROL applications, configuration files (APROL or LINUX), shared libraries, or databases within the scope of the patch installation are saved with the name `<Patch TGZ name>_<Date_time>_Save` in the directory `/home/<CC-Account>/tmp/`.

2.14.2 Preparatory measures

The following preparatory steps are to be observed before a patch installation:

- When offline engineering is in use, it is necessary to check in the project parts that have been checked out, and to terminate the offline engineering.
- For security reasons, a backup of the CAE environment (CaeBackup) should be made before the patch installation is carried out.

- In order to install an APROL patch on a runtime or operator system, an operator must have the "APROL patch: Install" right allocated to his operator group.
- The password for the LUNIX super user "root" must be known for all of the affected computers!
- There should already be an overview of all of the existing CC-Account, CAE projects, and computers.

Please pay attention to the dependencies, which are explained in the chapter Specifics of various system topologies.

2.14.3 Executing the patch installation

The installation of an APROL patch can be initiated from the APROL user interface applications (e.g. **CaeManager, DisplayCenter**).
Please start the respective application using the KDE menu, or with the corresponding icon on your desktop.

*Please note that a patch installation **using the StartManager in the engineering environment** is not possible!*

All of the other APROL applications should be terminated before the installation of a patch!

A CAE message is displayed that informs about the start of a patch when multiple access to a "system local" CAE database (in directory `/home/engineering system>/ENGIN/`) takes place.

After calling up the menu item "**Help / APROL Info database**" in one of the user interface applications, the installation procedure can take place after pressing the button [**Install cumulative patch**].

A patch installation is possible with all applications in a runtime or operator system, and is available via the 'Help / APROL Info database' menu item.

Applications are for example the StartManager (not available in KDE basic) or the TrendViewer.

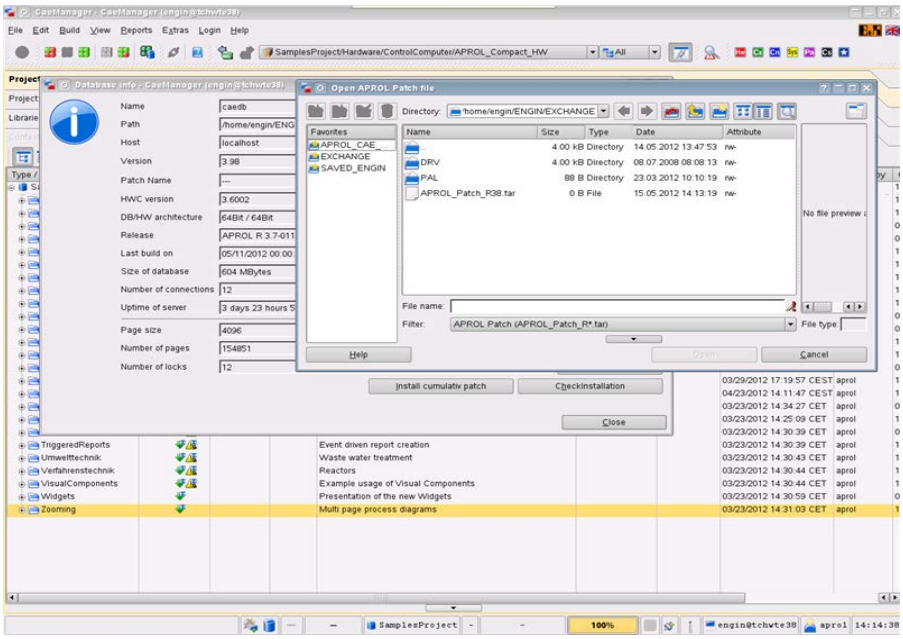


Illustration 62: Calling up the patch mechanism with the database info dialog

*The supplied B&R TAR archive must be saved to the file system beforehand. The name of the TAR file is fixed and **is not allowed to be changed**.*

The directory `/home/<Engineering system>/ENGIN/IMPORT` is accessed per default in the selection dialog.

Detailed information can be called up with the [**Details**] button in the "**Database info**" dialog if a patch has been installed with this mechanism. Otherwise the button is switched insensitive.

The TAR file contains the patch as TGZ, as well as the corresponding check file with the prefix tgz.md5 to ensure the validity of the TGZ. Further information about this can be found in chapter TAR archives with MD5 check sum.

*As of APROL R 3.2-03, **one** TAR file is used for the patch mechanism, which contains not only the archive but also the MD5 check file. In older releases, both files are needed separately for the installation of a patch.*

A dialog is shown with detailed information about the chosen patch after selecting the TAR file in the choice dialog, and the subsequent click on the [**Open**] button.

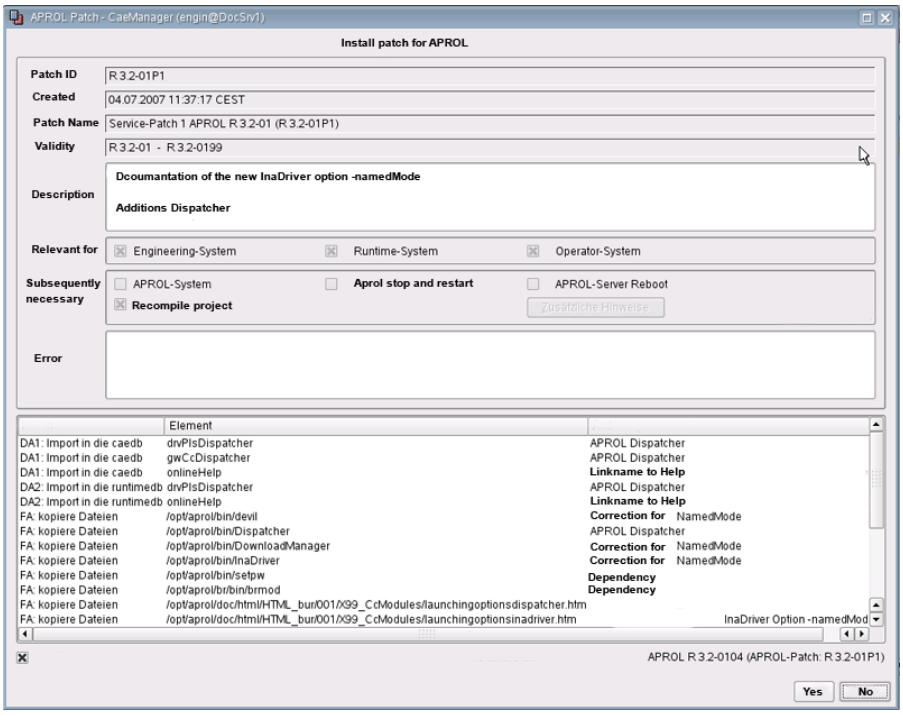


Illustration 63: Detailed information about the chosen patch

Confirm the progress of the installation with [**Yes**]. You return back to the "**Database info**" dialog after choosing the [**No**] button.

If the chosen patch has already been installed, then you are informed of this situation with a respective dialog.

There is the possibility of re-installing the most current APROL patch. It is not possible to install an older patch version!

In dialog that follows there is an information about the necessity of entering the password for the LINUX super user "root". The dialog is to be confirmed with [**Continue**].

Illustration 64: Information about entry of the root password in the ssh authentication dialog

If the application from which the patch installation has been started was called up using the KDE menu, then the entry of the password must take place immediately after the following ssh authentication dialog is displayed, using the keyboard.

Please note the special user guidance. No further login dialog is called up!

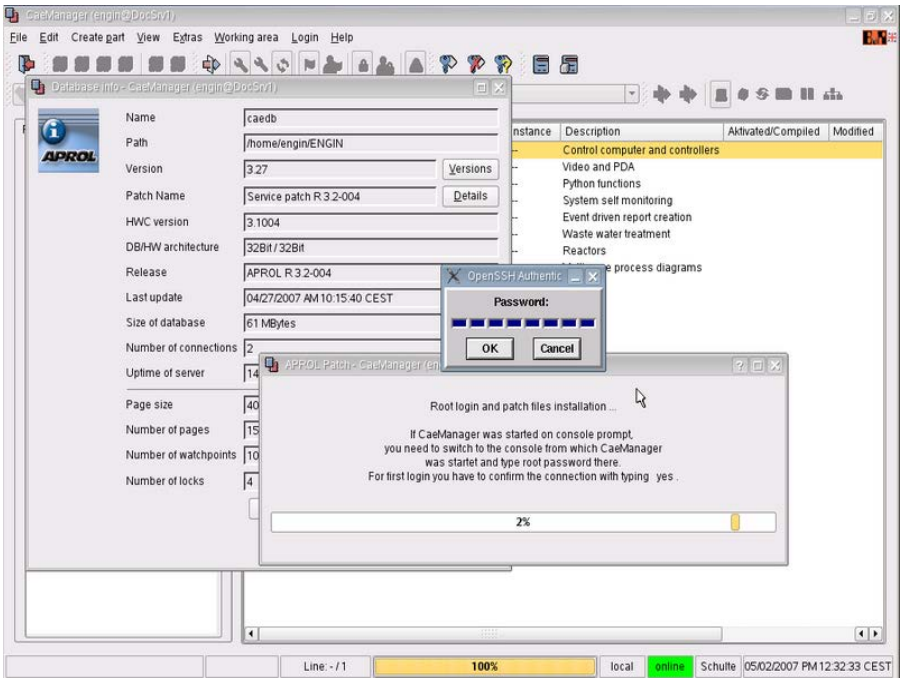


Illustration 65: Entering the root password

Contrary to common practice, if you want to start the application from the console then do not use a script.

If the application (e.g. CaeManager) was started from a console, then you must change the window to this console, and enter the password in this console. Note that the console may eventually be in the background!

An APROL **patch can contain the execution of scripts**. For this reason, it may be necessary **to enter the password for the LINUX super user "root"** several times in the scope of a patch installation.

The following dialog is displayed after a successful patch installation. **The execution of the listed actions is absolutely necessary for a consistent state of the system!**

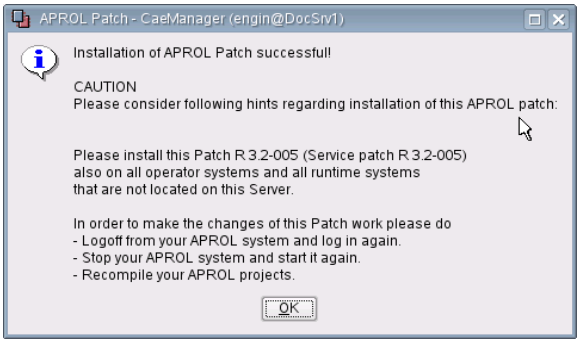


Illustration 66: Important information after a successful patch installation

1. At the end of the patch installation, all of the CC-Accounts (engineering, runtime, operator system) are listed again in the "Overview dialog", which are affected from the current patch. Please also install the current patch in the additionally named system environments. After the APROL patch installation in the engineering - as well as in the runtime system, it is necessary to generate at least one control computer task in the engineering system, and to carry out a download to the corresponding runtime system, an operator system.

2. A necessary re-start of the runtime system, a necessary computer reboot, or a necessary recompilation of your CAE project, if it is needed by the actual patch, is explicitly pointed out in the final dialog!

If the patch has not been installed on all of the necessary systems, and the necessary generation and download steps have not been carried out, then the respective APROL **LoginServer** message is output.

Simultaneously, this inconsistent state is marked in color in the "**Database info**" dialog of the respective application. In this case, the "patch name" field is marked yellow.

A patch installation with errors is marked with an orange color in the "Patch name" field.

A more specific description of the state can be obtained with the [**Details**] button.

If there are other notes to be observed after a patch installation, this information can be called up when choosing the [**Additional information**] button.

2.14.3.1 First use of the patch mechanism.

When an APROL patch installation is being carried out for the first time, **and there has never been an ssh call on a console by the LINUX super user "root"** , then the following ssh security message is shown:

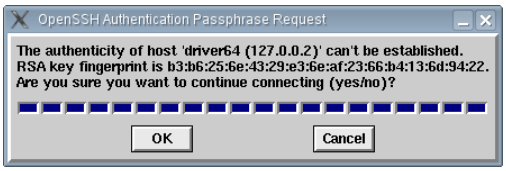


Illustration 67: Security message with the first use of the patch mechanism

When the security message is displayed then enter the letters **y e s**, and confirm your entry afterwards with [**OK**].

After entering the word "yes", the first three placeholders change their color from "blue" to "green".

After successful entry, the ssh authentication dialog mentioned before is called up for the entry of the root password.

2.14.3.2 Notes and error messages

Possible error messages during the patch installation	Meaning
The chosen patch can only be used in the context of APROL R 3.2-00 to APROL R 3.2-xx. Your APROL system has the state APROL R 3.4-xx.	**The chosen patch** is **not permitted** for the existing installation (APROL Release / Build).
The installation of the chosen patch is not necessary. The changes contained in the patch have already been supplied with the APROL patch version that was installed beforehand.	A newer patch **has already been installed**.

If the copy procedure is unexpectedly not properly finished, this is recorded in the file `/home/<CC-Account>/tmp/<Patch-TGZ-Name>_<Date_Time>_Save/<Patch-TGZ-Name>_errorlog`

Possible errors are also logged in the APROL system messages.

A message about an inconsistent state takes place in the system environment in which the necessary steps for a complete patch installation have not been carried out.

The message happens when:

- the APROL patch has been installed in the engineering system, the recompile process and the download have taken place, **but no** patch installation has taken place in the runtime, or operator system.
- an installation of the APROL patch has taken place in the engineering, runtime, and operator systems, **but no** download to the target system has taken place.
- an update of the CAE database is necessary for an engineering system. This is the case when a patch installation on this computer has taken place in another (engineering) system.

You can obtain information about the installed patch by calling "`GetEnvi -patchVersion`*", e.g. in an x-term.*

2.14.4 Specifics of various system topologies

Basically to note:
If there are several engineering systems, or several projects on one computer, then the patch is to be installed on all of the runtime and/or operator systems that belong to this engineering system or project.

System environment	Procedure
Compact system	An installation of the APROL patch must take place in the engineering system. Finally, the control computer task must be generated and a download to the runtime system / operator system must take place.
Several engineering systems on one computer	An installation of the APROL patch must take place in <engineering system A>. An update of the CAE database must take place on the <engineering system B> where the patch was not installed. Finally, at least one control computer task must be generated in all of the projects of each engineering system, and a download to each affected runtime / operator system must be carried out. **Please note the following overview image 2.**
Distributed Systems	The installation of an APROL patch should take place, as next, in the engineering system. Afterwards, the patch installation should be carried out in all of the corresponding runtime and operator systems on the respective computer. Finally, the control computer task must be generated and a download to the runtime system / operator systems must take place. **please note the following overview images 1 and 2!**
Redundancy systems	The sequence corresponds to the procedure with distributed systems. The patch installation can take place on the redundancy partners one after the other, so that no impedance of the running system comes into consideration.
Gateway system	The patch is installed from the **StartManager**. As of APROL R 3.2-01 P2, or APROL R 3.2-02, the **StartManager** can be configured as a CC module within a gateway system. If an older version of the APROL system software is present, the **StartManager** must be started out of a console for the purpose of installing the patch. Do not use a start script to launch the application.

*The current state of a patch on a **remote computer** can be **shown with the StartManager in the "Database info" dialog**. In this case, a patch installation is not possible.*

2.14.4.1 Example topology 1

The following graphical overview describes the following system topology:

Computer:	Description:
Computer 1	The computer contains an engineering system and an operator station. The patch installation has the effect of an actualization of the files **for all of the computer's systems** and the CAE database. During the patch installation, all of the other applications that are connected to this CAE database receive a CAE message about the patch installation with the request to terminate the application. A subsequent generation of at least one control computer task, and the subsequent download has the effect that the runtime database is actualized on the computer that the operator station is located.
Computer 2	The runtime system that belongs to computer 1 resides on the computer. The download from the engineering system has the effect that the runtime database is actualized. As a patch installation has not been carried out on this computer, a respective message is output from the **LoginServer**. Additionally, it is pointed out in the patch details view that a patch installation must be carried out on this computer.

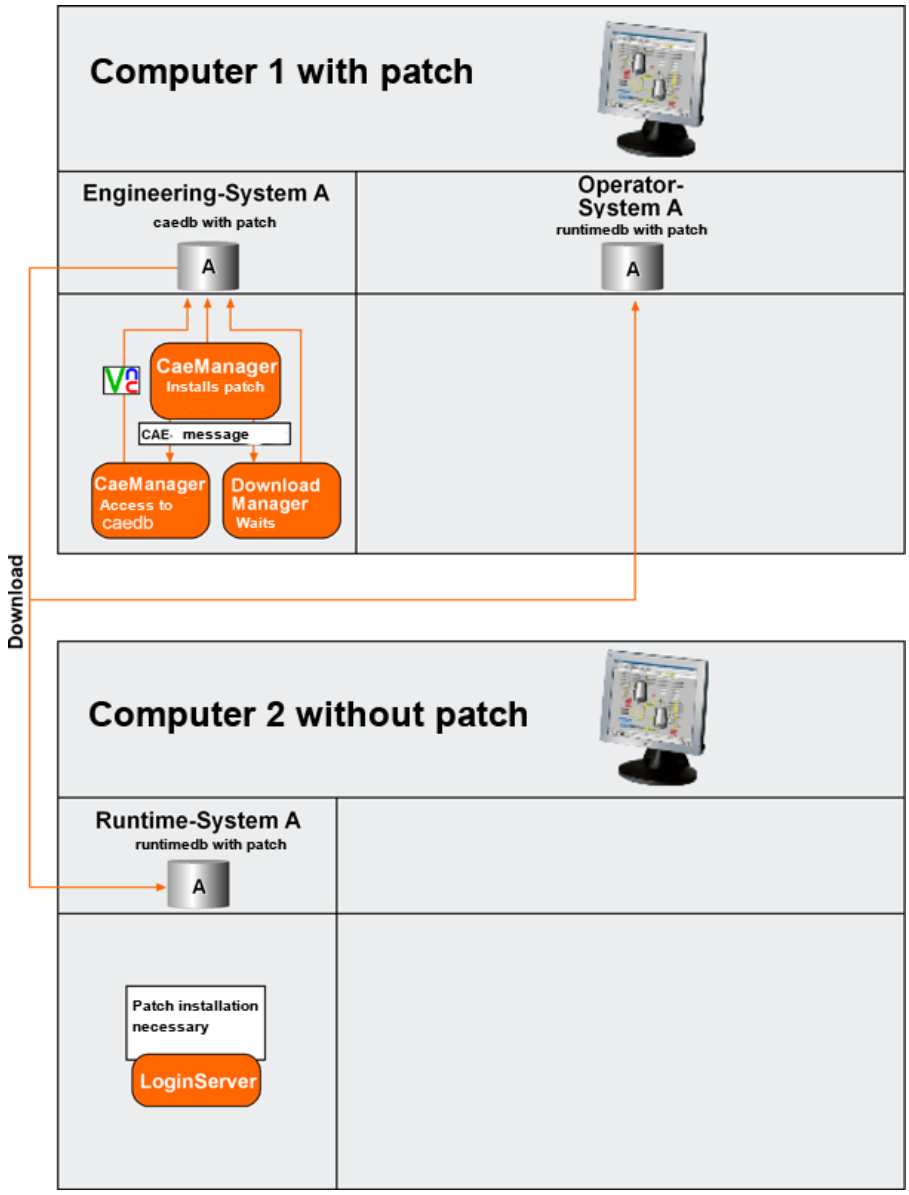


Illustration 68: Example topology 1

2.14.4.2 Example topology 2

The following graphical overview describes the following system topology:

Computer:	Description:
Computer 1	There are two engineering systems configured on the computer, as well as two operator systems. The engineering system A, on which the patch installation is carried out, contains two CAE projects. The patch installation has the effect of an actualization of the files **for all of the computer's systems**. Furthermore, the CAE database of the engineering system in which the patch installation was carried out is actualized. A subsequent generation of at least one control computer task, as well as the subsequent download of the CAE project "A1" has the effect that the runtime database of the operator system "A1" on this computer is actualized. The LoginServer in engineering system "B" notifies of a difference between the local CAE database and the installed patch on this computer. A CAE database update is necessary. Moreover, generating a control computer task in CAE project "A2", as well as a subsequent download to the operator system "A2" is necessary.
Computer 2	The runtime systems "A1", "A2", and "B" are configured on the computer. Downloading the CAE project "A1" from the engineering system "A" has the effect of actualizing the runtime database in runtime system "A1". As a patch installation has not been carried out on this computer, a respective message from the **LoginServer** occurs. As no download has taken place from the CAE projects "A2" and "B", and up until now no patch installation has been carried out, there is not inconsistency reported for these systems!

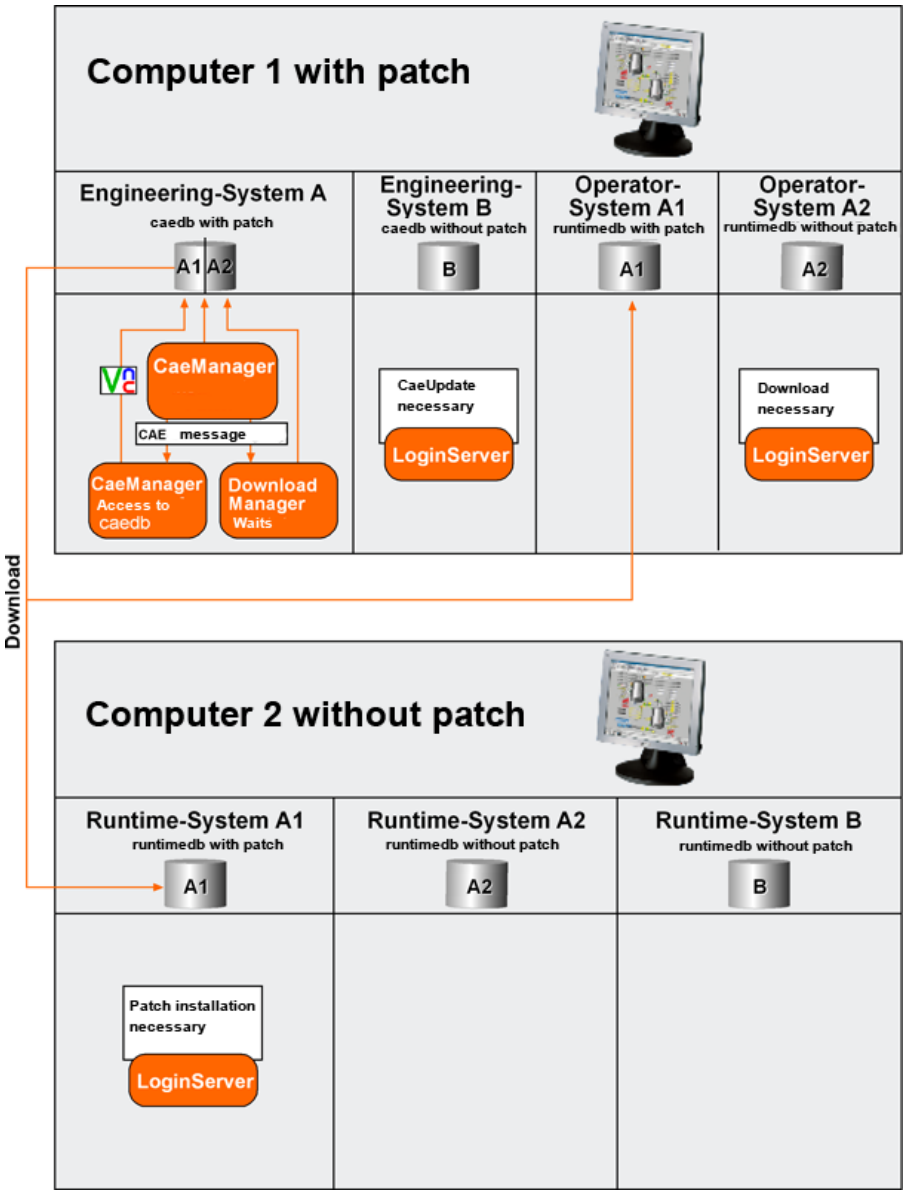


Illustration 69: Example topology 2

2.15 KDE configuration 'Service'

Gateway or runtime systems without an integrated operator system can basically be run in Linux runlevel 3 (i.e. without a graphical user interface).

A special KDE 'Service' configuration is provided, as of APROL R 3.6-03, in order to be able to use a graphical user interface for administration duties in these systems, e.g. to install a patch.

The KDE menu encompasses, amongst others, the StartManager application, with which an APROL patch can be installed, the SUSE tools, the APROL reports, the IosDiagnosticManager, and the ControllerManager.

Illustration 70: KDE configuration 'Service'

The graphic user interface can also be opened in Linux runlevel 3 with the 'AprolStartServiceX' script.

A2-3 Services

3.1 Information about services

The special services used in APROL are configured with ***AprolConfig***. Services can be reconfigured at any time. The Runtime system must be stopped in order to configure *ChronoPlex*.

The configuration of the different services takes place in the configuration aspects from **AprolConfig**. These can be chosen in the navigation bar with the respective icons, see the previous illustration. Apart from the 'System' configuration aspect, there are seven further configuration aspects to configure the services.

3.2 ChronoPlex

The ChronoPlex reads data streams from *named pipes* and (called FIFOs) starts *ChronoLog child processes* so that these recorded data streams can be stored to a container.

Detailed information can be found in manual 'D2 System API', chapter The ChronoPlex.

The basic configuration offers the following possibilities:

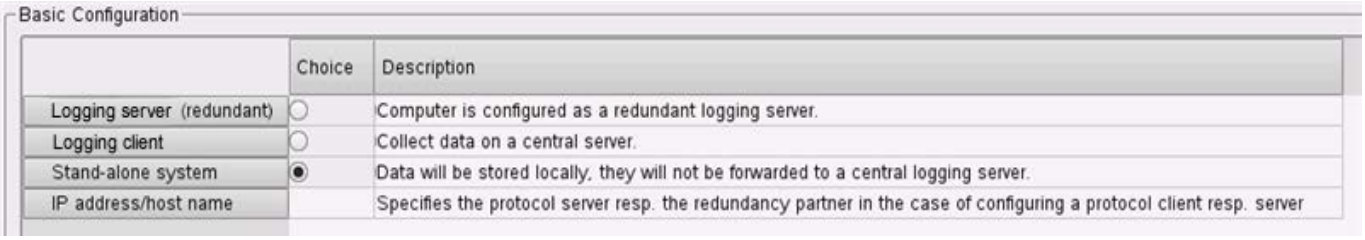


Illustration 71: Selecting the basic configuration for ChronoPlex

A basic configuration and its sections cannot be deleted! However, changes can be made to it at any time.

Selection	Description
Logging server (redundant)	This server is configured as a **redundant loggin server**. The host name or IP address of the **redundancy partner** must also be specified in the 'IP address/Host name' field. If a synchronization bus is being used, then its address should be used.

Selection	Description
Logging client	The ChronoLog and trend data on this server should also be **forwarded to a central logging server**. The host name or IP address of the logging server must also be specified in the 'IP address/Host name' field. If the logging server is redundant, the virtual cluster name or cluster IP address must be specified.
Autonomous System	This server is a **non-redundant logging server** or a **stand-alone server**. ChronoLog and trend data can be forwarded to this logging server.

ChronoPlex automatically restarts so that the configuration can be enabled.

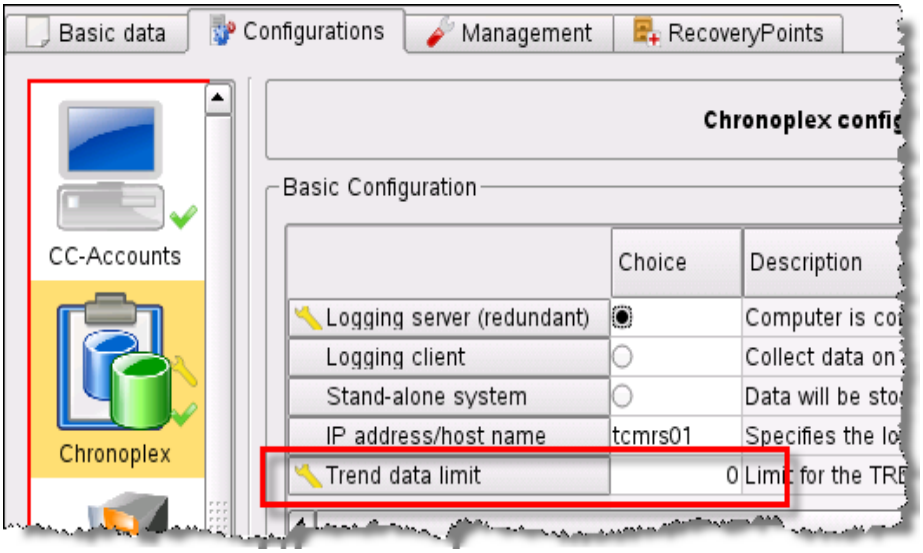


Illustration 72: Size limit for trend data

Size limit for trend data:

The customer has the responsibility to ensure for substantial mechanisms to limit the storage space on the logging server. The space limit for forwarded trend data on the logging server is deactivated in AprolConfig per default. A size limit can only be specified by the customer and therefore, the following notes about sizing the limit (configuration of the ring-buffer) must be adhered to.

Detailed information can be found in manual 'D2 System API', chapter System variabls for recording forwarded trend data.

Example limit:

APROL server with 1 terabyte hard-disk, 1 project, 2 runtime systems, 2 control computer.

Range	MB
APROL 'root' partition	50
Local ChronoLog container	13000
Local trend records (with '-limit' = 1000 MB) times factor 10	10000

Range	MB
Runtime system 1 - ChronoLog forwarding (local default settings)	6400
Runtime system 1 - Trend forwarding (with '-limit' = 1000 MB) times factor 10	10000
Runtime system 2 - ChronoLog forwarding (local default settings)	6400
Runtime system 2 - Trend forwarding (with '-limit' = 1000 MB) times factor 10	10000
Trend forwarding (limit = 20000) for each project/runtime times factor 10	200000
Total:	**255850**

Containers **for the ChronoLog data** can be added or deleted with the 'ChronoLog container' pull-down menu and [Delete ChronoLog container] button.

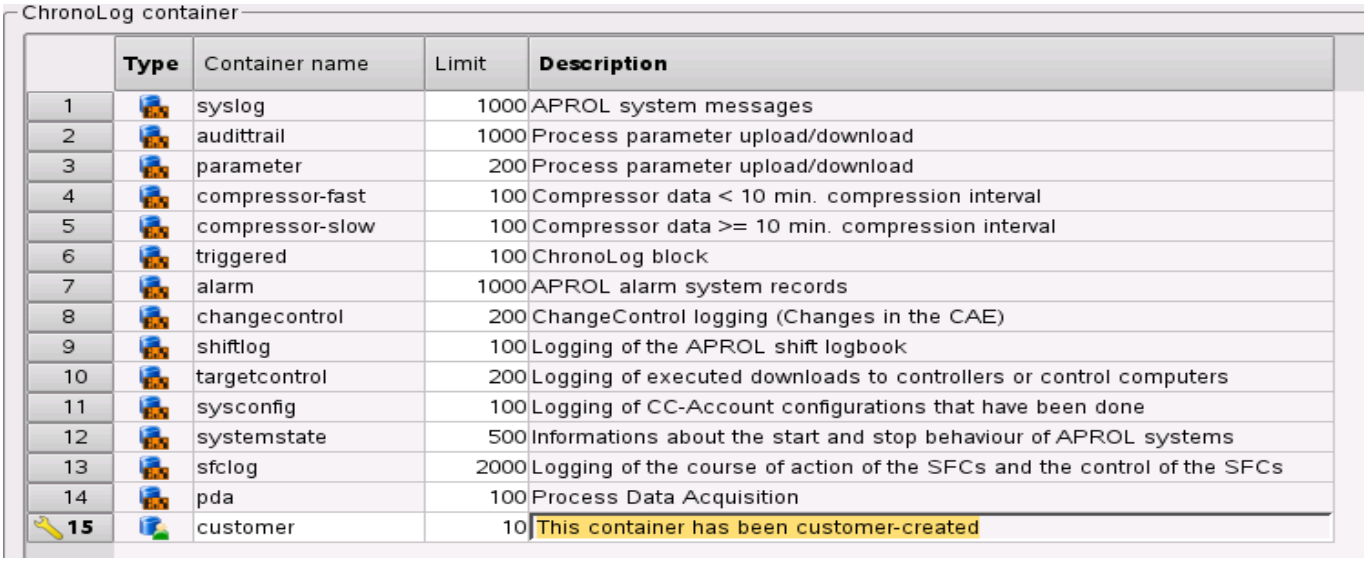


Illustration 73: Adding a ChronoLog container

*After a change in the ChronoPlex configuration, the script ReduceChronoLogContainer is automatically called up with the '-useChronoPlexConfig' option. **The physical size of the container in the file system** is checked according to the configuration that was made, and is eventually reduced to the newly configured value.*

Please note that this procedure may take some time, depending on the size of the container. Furthermore, attention should be paid to:

*1. Additional disk space in the file system where the container resides will be needed during the export and import procedure. **This additional memory** is the container size + 5% of the total file-system space, as reserve for a run-able LINUX and APROL system. The memory is released again at the end.*

2. The internal structure of the ChronoLog container is optimized through the export and import procedure. Thereby, the disk space used in the file system for the container can be smaller (up to ca. 40%) as the given size limit.

3.3 Using a UPS

When a sudden power-loss occurs on a computer without UPS (**u**ninterruptable **p**ower **s**upply) monitoring it is put into an undefined state, which can lead to data loss and/or irreparable damage to the hardware (e.g. the hard disk).

As a result, computers running the runtime and engineering systems should be equipped with a UPS.

Brief power failures can be bridged by the *UPS* battery. During a power failure, the UPS software monitors the battery's charge capacity and shuts down the connected load system in a correct manner when the rest capacity is too low.

As long as the respective load system supports starting after the power supply has been re-established, a correct system state will be restored.

3.3.1 The UPS concepts

Two concepts can be implemented when a UPS is installed and configured:

Concept 1 Each computer possesses its own a UPS, and carries out the monitoring of the UPS.

Concept 2 Several computers are connected to one UPS

In this case, one computer (the UPS "master") communicates with and monitors the UPS.

The other computers (UPS "slaves") receive information about the UPS from the master over the LAN.

3.3.2 Configuring the UPS

The UPS support is configured on a computer with **AprolConfig**.

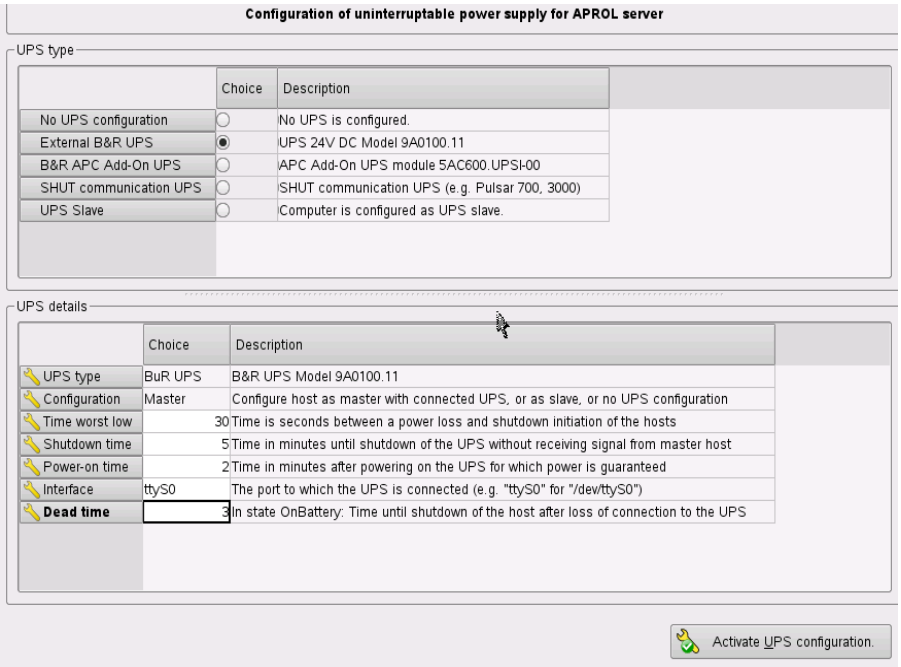


Illustration 74: AprolConfig with the UPS configurations aspect

The previous illustration shows **AprolConfig's** *UPS* configuration aspect. A 'B&R UPS (External)' is configured as an example.
The UPS must be connected to the computer in order to activate the configuration.

The *UPS* type is chosen in the uppermost part of the configuration module. The default is set so that no UPS is used or configured. The corresponding UPS configuration is made in the lower '*UPS details*' part, depending on the UPS type.

The 'Configuration' field differentiates between a master and a slave configuration, or shows that no UPS has been configured regarding the UPS type in the uppermost area.

The following UPS types (master operation) are supported by B&R:

- B&R-UPS (External)
  Model '9A0100.11'
- B&R-UPS (APC Add-On)
  Model '5AC600.UPSI-00'
- SHUT Communication UPS
  (e.g. Pulsar 700, 3000)

3.3.3 B&R-UPS (External)

*The **B&R UPS (External)** is intended only for devices with a 24-volt supply voltage. For example, they should be used with 24-volt APCs from B&R. They can be mounted on a mounting rail in switching cabinets.*

Parameter	Description
Time worst-low	Time worst-low is the time (specified in seconds) that must pass between when a power failure occurs and when the signal is sent to shut down the load system (the connected computer). Default value: 30 [s] Permissible value range: 30 [s] ... 999 [s]
Shutdown time:	The "**Shutdown**" time is the time in [min] that the UPS switches itself off, as long as no signal to shutdown the UPS has been sent beforehand. Default value: 5 [min] Permissible value range: 2 [min] ... 60 [min]
Power-on time	After switching on the UPS, the power supply for the load system is guaranteed for the period "**Power-on time**". Default value: 2 [min] Permissible value range: 1 [min] ... 10 [min] **Recommendation:** Time period in [min] needed for the connected computer to boot.
interface	Choose the interface on which the UPS is connected, and confirm the choice with [**OK**].
DEADTIME	If the system is in "OnBattery" state, then when the monitoring connection (computer / UPS) is lost the computer is automatically shut down after the time period configured here. Default value: 3 [min] Permissible value range: 0 [min] ... 60 [min]

3.3.4 B&R-UPS (APC Add-On)

Parameter	Description
DEADTIME	If the system is in "OnBattery" state, then when the monitoring connection (computer / UPS) is lost the computer is automatically shut down after the time period configured here. Default value: 3 [min] Permissible value range: 0 [min] ... 60 [min]

3.3.5 SHUT Communication UPS

Parameter	Description
Minimal charge state	Enter the **minimal charge state of the battery** in [%]. When the charge state falls below what is configured here (whilst the UPS is discharging), then the load systems (e.g. connected computer) are shut down in a correct manner. Default value: 30 [%] Permissible value range: 25 [%] ... 99 [%]

On delay	At the point in time in which the UPS has switched off the power supply, a timer starts with the time configured here. If the supply voltage is restored during this period of time then the UPS's power supply outputs are activated again after the time configured here. If the supply voltage has not been restored by the time that has been set then UPS's outputs are only activated again after the online state (battery operation) has been reached. Default value: 5 [min] Permissible value range: 2 [min] ... 60 [min]
Off delay	Subsequently enter the "**Off delay**" in [min]. After the load system shutdown has been initiated, the UPS is switched off after the time configured in [s] here. **Please note that the configured time for the "On delay" parameter must be larger than that of the Off delay parameter.** Default value: 3 [min] Permissible value range: 2 [min] ... 60 [min]
interface	Subsequently choose the port on which the UPS is connected. Another valid interface (e.g. "ttyUSB0") can be configured for the UPS connection after choosing the "**Other interface**" entry.
DEADTIME	Enter the "**DEADTIME**" in [s]. If the system is in "OnBattery" state, then when the monitoring connection (computer / UPS) is lost the computer is automatically shut down after the time period configured here. Default value: 3 [min] Permissible value range: 0 [min] ... 60 [min]

3.3.6 UPS in slave operation

Step	Description
Computer name / IP address	Enter the computer name (including domain), or the IP address of the computer that is configured as UPS master (meaning which the UPS is connected to)
DEADTIME	Enter the "**DEADTIME**" in [s]. If the system is in "OnBattery" state, then when the connection (computer / UPS) is lost the computer is automatically shut down after the time period configured here. Default value: 3 [min] Permissible value range: 0 [min] ... 60 [min]

3.3.7 Monitoring the UPS

3.3.7.1 Overview possible system states

Possible system states are sketched out in the following overview that could arise from a loss of power and/or due to a loss of connection (computer/UPS):

System state		Result
1	**System is in an online state (connection to supply voltage) / communication between computer and UPS is undisturbed**	System is in a safe state
2	**System is in "OnBattery" state (UPS is discharging) / communication is undisturbed**	A message appears pointing out that the system is in the "OnBattery" state.
	The minimal charge state of the battery has been reached ("Low battery" state)	A message appears pointing out that the computer will be shut down shortly. Thereafter the computer is shut down. Subsequently, the UPS is shot down.
3	**System is in "OnBattery" state (UPS is discharging) / serial communication is interrupted**	The computer is shut down after the time configured in DEADTIME has expired.
4	**System is in an online state (connection to supply voltage) / serial communication between computer and UPS is interrupted**	After an interval of 5 minutes, a message appears pointing out that there is no connection to the UPS. **Please note that a correct shutdown of the computer cannot be guaranteed with a continued loss of connection to the UPS.**

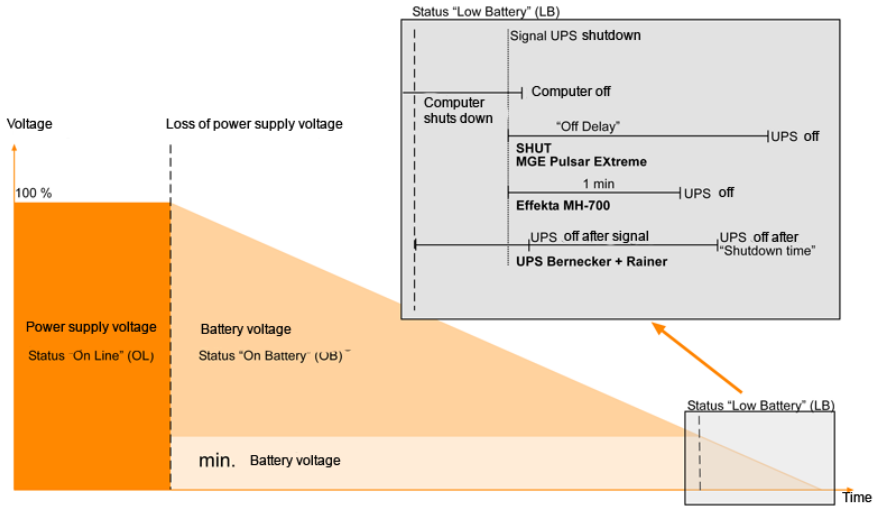


Illustration 75: Loss of supply voltage and having reached the minimal charge state of the UPS

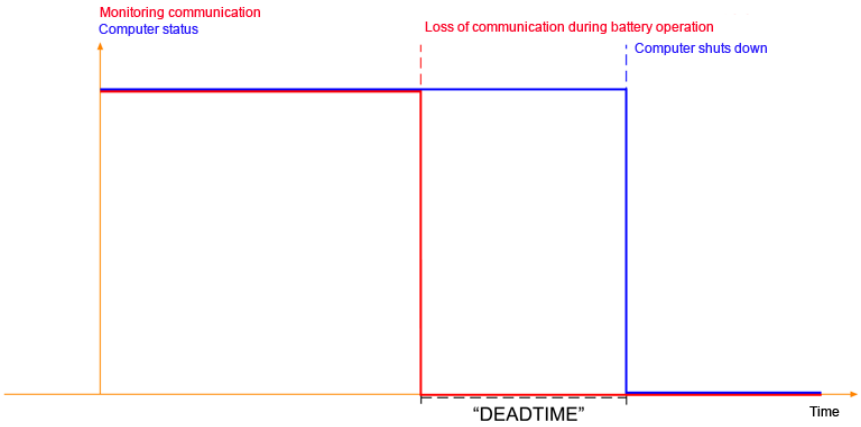


Illustration 76: Loss of communication to the UPS operating on battery (OnBattery state)

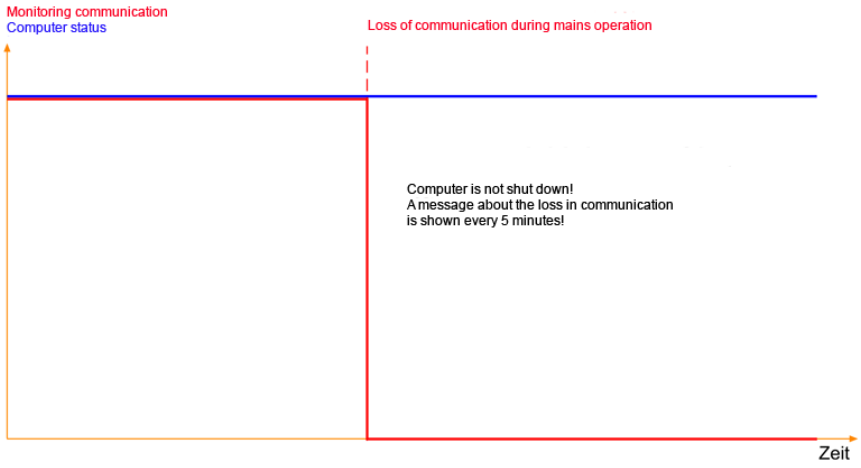


Illustration 77: Loss of communication to the UPS operating on supply voltage (Online state)

3.3.7.2 Using a CAE block and system variables to monitor the UPS

The state of the **UPS** and the current state of the power supplies in the individual computers (powered with **UPS** or supply voltage) are to be monitored by the process control system itself.

The corresponding '*MonCc01*' hyper macro is provided in the *library_UCB* group of the '*SysMon*' library for this purpose.

An example can be found in the SamplesProject in 'System / Visualisierung / PbSystemauslastung'

Detailed information about the status flags and operation data of the UPS can be found in the respective implementation guide of the APC / PPC,
e.g. 'APC810 / PPC800 Implementation Guide', chapter 'UPS service Register'. This can be downloaded from the B&R homepage.

If APROL supported hardware is being used (APC910/810, PPC800), the system variables of the 'ApcHwInfo' system service can be used in the CAE logic.

See manual 'D1 System Manual', chapter '*Variables for the uninterrupted power supply (optional)*'

3.4 Remote operation via VNC

VNC makes it possible to access CC-Accounts in Linux from any platform and operating system. VNC can be used without any extra configuration and guarantees excellent performance when operating and observing your process control system.

While installing and configuring the APROL server, you **make a basic decision** whether *VNC access* should be used.

You have the following options, depending on whether you want to access an APROL server from a **Windows computer** or from a **Linux computer**.

- When accessing an APROL server from a **Windows computer**, you can use a ***VNC client***.
- If accessing from a **Linux system**, you can use a *VNC client* (for Linux), or *krdc* (**K** Remote **D**esktop **C**onnection).

  krdc allows a scaled full-screen display.

If the VNC service is set up and the desired VNC service is selected, you can then use the Linux login mechanism to log in to the desired CC-Account on the remote computer.

3.4.1 Configuring VNC

In order to use the VNC service it is necessary to configure it with **AprolConfig**, in the VNC configuration aspect.

VNC access is basically possible after at least one checkbox, i.e. a resolution, has been enabled.

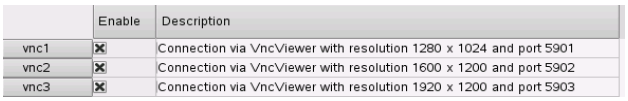


Illustration 78: AprolConfig with the VNC configurations aspect

Start a VNC session in the VNC client:

<Host name | IP address>:<Port>

Starting from *krdc*:

Start using the KDE menu *Execute command* and enter ***krdc***. **krdc** shows a further dialog for which computers are functioning as VNC servers, and can be chosen.

3.4.1.1 Special notes about the use of the VNC service

Please note that a correctly and completely configured network connection must be present in order that the connection queries are answered from the VNC server to the VNC client!

It must be especially ensured, for both computers, that the name of the respective computer can be detected on the basis of the IP address (reverse lookup).

For this purpose

- an entry must be present in the DNS server for **both computer names** (VNC server and VNC client), or alternatively
- a respective entry in the `/etc/hosts` file of both computers (VNC server and VNC client).

  This file can be edited after logging in as `root`. The following syntax is to be noted for the correct name resolution (as in the example of the VNC server):

  ```
  <IP address of the VNC client> <Fully qualified host name> <Short host name>
  ```

  E.g.:

  ```
  10.49.83.89  gatew01.br-automation.com  gatew01
  ```

  Correspondingly, the information for the VNC server must be entered on the VNC client.

Do not abort the VNC connection in order to terminate processes that are no longer needed, and to free the resources that are occupied by these processes. End the connection in an orderly manner:

After closing all applications and files, please choose the KDE '**Logout**' menu item and close the VNC client with the [**End current session**] button.

Please note that special characters are not always correctly displayed or interpreted by the VNC service. Please check your entries to that effect.

Display of VC visualizations on the controller via VNC viewer

APROL supports the integration of visualizations that have been created with *Visual Components* in the *Automation Studio* environment.

The configuration of process graphics for a direct visualization on the PowerPanel unit's display, or on a virtual display via VNC viewer, can now be enabled in *Automation Studio*, so that these graphics can be provided directly with project variables from the APROL engineering.

The Linux VNC viewer must be started with the '-bgr233' input parameter, so that the *Visual Components* visualization can be displayed.

3.4.2 VNC recordings

The creation and monitoring of VNC recordings can be reached via the following KDE menu:

Diagnosis/Record VNC Session
Diagnosis/View VNC Session

Switching operations that lead to problems can be locally recorded as a video with VNC recordings, in order to evaluate them at a later stage.

Special points with a Multiscreening environment:

The following information is to be taken into account with a Multiscreening environment:

No limitations are known with the use of **2 monitors**.

No limitations are known with the use of **3 monitors** that have an entire monitor geometry of 4:3

(e.g. 3 monitors in an L form).

A recording of **3 monitors** is not possible if the entire monitor geometry exceeds the ratio 8:3

(e.g. 3 monitors in a row, next to each other).

No limitations are known with the use of **4 monitors** that have an entire monitor geometry of 4:3

(e.g. 4 monitors ordered in an 'square').

A recording of **4 monitors** is not possible if the entire monitor geometry exceeds the ratio 8:3

(e.g. 4 monitors in a row, next to each other).

To start a recording of the monitor, choose the '**Diagnosis/Record VNC Session**' KDE menu.

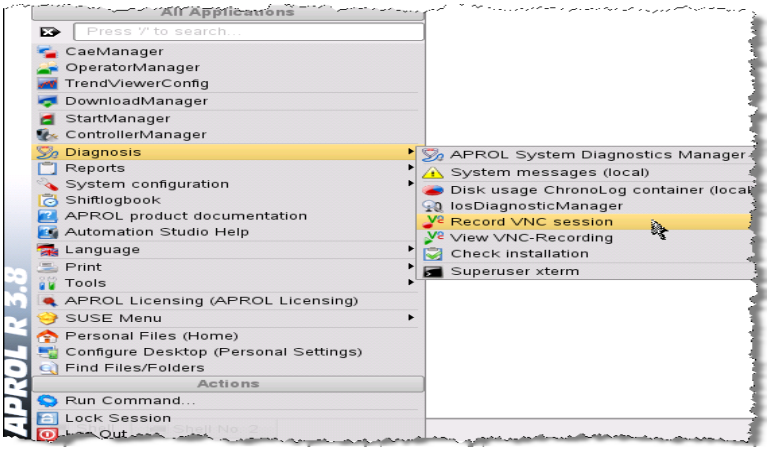


Illustration 79: 'Diagnosis' KDE menu

The 'Pyvnc2swf' application is then started and a control window with a green [**Start**] button is opened.

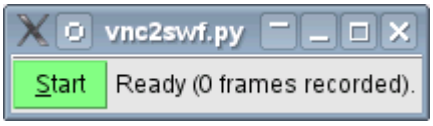


Illustration 80: Start VNC recording

The recording begins as soon as the [**Start**] button is pressed. The recording is stopped with the [**Stop**] button.

Illustration 81: Stop VNC recording

If the recording is stopped several times, the resulting sequences are merged into one file after the application is closed.

When the application is closed with the window manager's '**X**', the recording and the corresponding HTML page are finalized.

I.e. the new recording is only saved after the widow has been closed.

Using the '**View VNC recording**' menu item, a web browser is opened with the recording that was made last.

Technical digression:

The script '*AprolStartVncRecording*' is started in the background, as well as an x11vnc process that makes the desktop available on the port 5900.

The recording is located in `/home/aprolsys/vnc2swf/` and has the name `vnc2swf.swf`.

There is an **additional HTML file** called `vnc2swf.html` here, with which the `vnc2swf.swf` file is played.

When the window is closed (with **'X'**), the x11vnc server and the '*AprolStartVncRecording*' script are stopped.

The '**View VNC Recording**' KDE menu item opens the browser that has been set for the operator or user ('*PccStartBrowser*') with the URL '`/home/aprolsys/vnc2swf/vnc2swf.html`'.

3.5 Time synchronization with NTP

3.5.1 General information about Time Synchronization with NTP

All computers in an APROL process control system can be automatically subjected to time synchronization with **one** central clock.

The time synchronization of all computers functions at best when a DCF77, or a GPS clock is used as the time source.

It is recommended to use the runtime server as a time server. A radio-controlled clock, if available, should be connected to the runtime server!

All other APROL servers (e.g. operator stations, gateway server) should use this runtime server as a time server.

APROL uses the standardized **NTP** service for synchronization. This service works with a platform-independent protocol to synchronize the computer clocks on a network. The heart of this service is the **NTP** Daemon. The computer designated as the server for time synchronization supplies the time; the client simply takes the time supplied by the server.

The initial synchronization between the client and time server may last for several minutes, because the client requires some time to check the delivered time.

If several time sources are configured, the service determines the time nearest to the exact time from the NTP cluster, and adjusts to it.

Further information about the theme NTP can be **taken from** the site *http://www.ntp.org*.

The configuration of the NTP daemon can be changed later at any time via *AprolConfig*.

3.5.2 Configuration of NTP

The NTP configuration aspect must be chosen after starting **AprolConfig**.

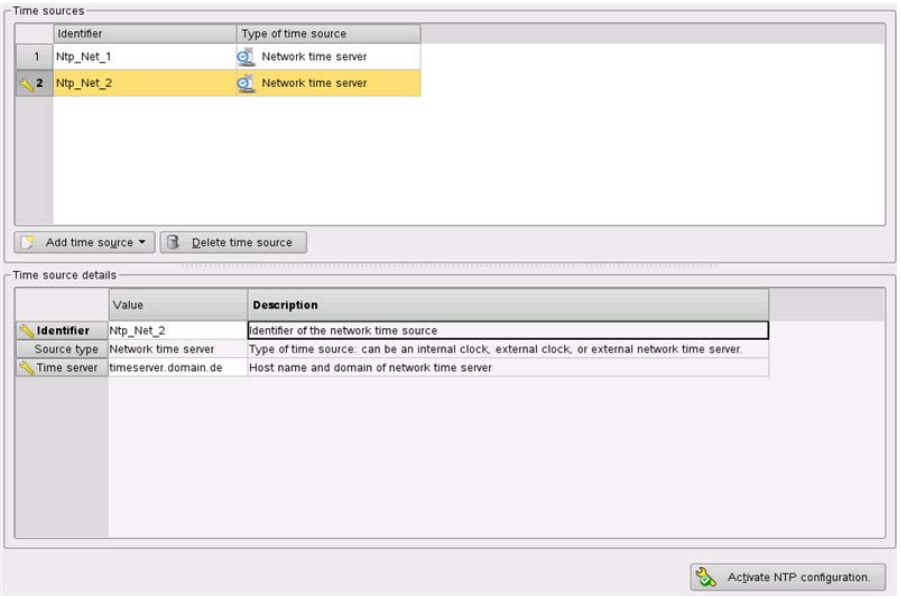


Illustration 82: AprolConfig with the NTP configurations aspect

The previous illustration shows **AprolConfig's** NTP configuration aspect. There is already an internal BIOS clock configured as the time source in the example, and a network time server is being configured.

A time source is inserted with the 'Time source' pull-down menu. There are three types of time sources available:

internal BIOS clock (can only be specified once)

another time server that is queried over the network

an external clock that is connected physically to the local computer

If several time sources are configured, the NTP service determines the most exact time from the NTP cluster, and adjusts to it. The internal clock is entered automatically as time server with a minimal weighting.

As soon as the time source for the computer is configured, the computer acts as an NTP server in the network, and can be entered in the NTP configuration of other computers as a network time server.

Principally, any number of time sources can be configured. As already mentioned, only one BIOS clock can be entered, and more than one physically connected external clock does not make any sense. When a time source falls out, the NTP service ensures that the most dependable time source available takes its place.

The 'Identifier' field only has an internal meaning for **AprolConfig**. There must be a unique situation between the different time sources that have been configured.

Configuration as time server without external time source

No further configuration is necessary if only the internal BIOS clock is used as a time source. After activating the NTP configuration, one is made aware that the internal clock cannot be set to the correct time and one has to set it manually with, for example, YaST.

Configuration of a network time server

Enter the computer name in the '*Time server*' field (including the domain), or alternatively the IP address of the computer that serves as time server.

Configuration of a physically connected clock

Choose the '*Add an External Clock*' menu item in the '*Add Time Source*' pull-down menu. The possible options are listed in the tooltips in the table headers '*Type of clock*' and '*Interface*'.

The clocks that APROL supports, and for which the clocks have the necessary settings of the chosen serial interface are listed in the following table:

Clock	Baud rate	Data bits	Stop bits	Parity
Gude radio clock *EMC Professional*	9600	7	1 stop bit	even parity
Hopf radio clock *HOPF 6870*	9600	8	1 stop bit	no parity bit
HKW radio clock *CID 03000*	300	7	1 stop bit	even parity
Meinberg GPS clock *GPS16x receiver*	19200	8	1 stop bit	no parity bit
Meinberg FM clock *DCF PZF 535/509 / TCXO*	9600	7	1 stop bit	even parity
Meinberg FM clock *DCF PZF 535/509/OCXO*	9600	7	1 stop bit	even parity
Meinberg DCF77 clock *DCF77 C51*	9600	7	1 stop bit	even parity
CEP220C GPS clock	4800	8	1 stop bit	no parity bit

Specifics for configuring the HOPF 6870 radio clock:

The **HOPF 6870** radio clock must be configured as follows:

Clock	Baud rate
Baud rate	9600
Data bits	8
Parity	None
Stop bits	1
Time string	hopf6021 (Standard (hopf6021) with Year)
Time basis	UTC / Local time (no meaning, is also transferred)
Seconds feed	Off
Control character:	On
Control character for Sec.change	Off

Clock	Baud rate
CR/LF:Order	LF/CR -> not equal to the default value for hopf6870, Firmware 11.xx, driver version v0006
Sending time point	Every second

3.6 Remote compiling

As of APROL R 3.2, the compiling time has been reduced with a new mechanism for RemoteCompiling.

Remote compiling uses the available operator stations for generating libraries, control computer tasks, and controller tasks. The generation is distributed parallel to the operator stations with a scheduler. Whereby the system load of the individual clients is taken into account to guarantee an optimal performance. The necessary LINUX packet **icecream** is installed per default with the AutoYaST DVD.

3.6.1 Configuration of the remote compiling

The integration of the operator stations and the engineering system into the compiling group takes place with ***AprolConfig***. In order to activate the remote compiling it is necessary to configure not only the engineering system, but also all of the operator stations that are tied to this process.

Illustration 83: AprolConfig with the Remote Compiling configuration aspect

Specify if the computer should take part in the remote compiling in the '*Activate remote compiling*' field, and if the computer starts the job scheduler as manager of this group.

The scheduler should only be started on one engineering system. For this purpose please select not only RemoteCompiling, but also Scheduler. Only the remote compiling should be activated on an operator system.

If the scheduler is not selected then the field for entering the name, or IP address of the job scheduler can be edited. This is pre-set with the name of the local computer and should be respectively adjusted.

The RemoteCompiling should never be installed on a runtime system with a large working load so that the performance is not impaired.

After a successful configuration of the remote compiling you have the possibility to show the job distribution during compiling in the CaeManager.

In the generation dialog you get an overview of the involved operator systems with the button [**Show RemoteCompiling**]. The following illustration shows a view of the compiler group in the icecream monitor (icemon). Instructions about the operation of the icecream monitor can be found in icemon, in **'Help / Icecream Monitor Handbook'**.

*You also have the possibility to launch the icecream monitor from the KDE menu with "**APROL/Tools/Icecream monitor (icemon)**".*

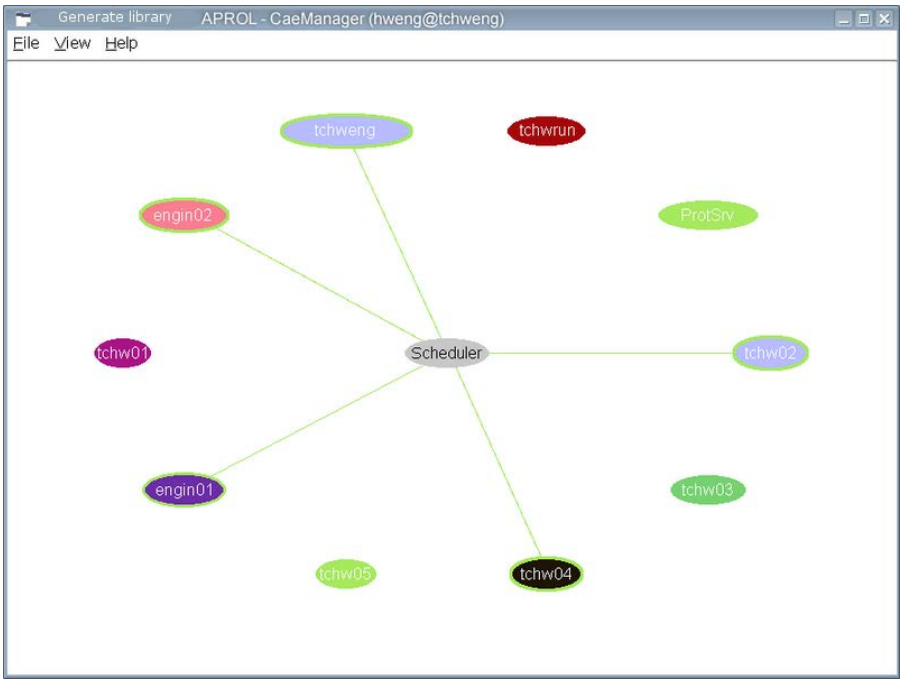


Illustration 84: Display of the compiling group in the icecream monitor

3.7 APROL LDAP server

3.7.1 General information about the use of an LDAP server

The **L**ightweight **D**irectory **A**ccess **P**rotocol (**LDAP**) is an application protocol that is derived from the network technology. It allows the query and modification of a directory service (that is a hierarchical database distributed over the network) via an IP network.

APROL allows the use of a separate **LDAP server** or **Active Directory Server** for the authentication of an engineering user or an operator.

The users / operators that are defined in the APROL user management or OperatorManager are awaited as configured users on the LDAP server. They are authenticated with their password that is stored in the LDAP server.

Information about the use of an LDAP server or an Active Directory Server in APROL can be found in the manual '***D1 System Manual', chapter*** *Authentication via LDAP / Active Directory Server**.*** The background, implications, and motivation for its use in APROL are explained there.

3.7.2 Configuration

The configuration parameters are divided in four sections. Different sections are relevant, depending on the type of usage.

3.7.2.1 General information

The *LDAP type of usage* is selected first in the *General* section.

There are basically the following categories of usage:

- No LDAP
- Configuration **solely as LDAP server**
- Configuration **solely as LDAP client**
- Configuration as **LDAP server and client**

No LDAP is selected if an LDAP server should not run on the computer and the APROL systems do not authenticate the users via and LDAP or Active Directory server. It is then not possible to edit the configuration parameters.

All further explanations are based on the other above mentioned types of usage.

The *basis DN* represents the root of the LDAP directory, which is built up as a tree, on the LDAP server. This must correspond with the entry in the user management, or in the

OperatorManager. It must also correspond with a computer that is only an LDAP client and the LDAP server which is configured there.

The *server host name* must be the actual host name of a computer which is configured as an LDAP server; a computer which is configured as an LDAP client has the host name of the computer where the LDAP server or Active Directory server is running.

The host name must be the fully qualified host name (including domain name). An IP address is not permitted here. This is necessary when an APROL LDAP server is being used, because the LDAP server needs an SSL certificate. It is also used when the configuration is not encrypted (see below), and amongst others, for the communication between the redundancy partners.

SSL/TLS (no encryption) and *With START_TLS* (encryption and authentication with SSL certificate) cannot be selected for the *Security protocol* parameter. A further selection *With SSL* (encryption and authentication with passwords) is only offered in a configuration as a stand-alone LDAP client, i.e. the *Server type 'APROL LDAP server'* is not selected.

Detailed information about this can be found in manual '***D1 System Manual', chapter Extended security via SSL / TLS for the openLDAP server***

3.7.2.2 LDAP server (non-redundant)

The sections *General* and *Server* are relevant for the configuration of a non-redundant LDAP server (usage *Only LDAP server* or *LDAP server and client*). The fields in these sections can only be edited in these cases.

The *Administrator* parameter is the name of the administrator for the LDAP server. It is used to administer the LDAP server. Command line commands can be used for this, or a GUI such as the Apache Directory Studio. You can compare chapter ***Authentication via LDAP / Active Directory Server in manual 'D1 System Manual'.***

This user has all rights and is not a normal user. It is not contained in the LDAP database (DIT - Directory Information Tree) and is a configuration parameter (together with the *Admin password*) for the LDAP server.

The password is configured as usual with an additional field for the password repetition. *Admin password (confirmation)*. It is saved in an encrypted form.

3.7.2.3 LDAP server (redundant)

Apart from the *General* and *Server* sections which are necessary for a non-redundant LDAP server, the *Redundancy* section is relevant for a redundant LDAP server.

The *Redundant server* checkbox is activated in this case. All of the fields in the *Redundancy* section can then be edited.

A redundant LDAP server that has been configured with AprolConfig is composed of two computers. It must be possible to reach them both via a mutual cluster name, because a switch is made to the redundancy partner when the active computer cannot be reached. The 'Global cluster' aspect must also be configured when a redundant LDAP server is configured. The parameters for the global cluster can also be found in the master data of the 'Control computer' project part in the CAE project. See section Globaler cluster configuration with AprolConfig The two computers which build the global cluster must both also contain the redundant LDAP server.

There is no explicit differentiation between master and slave in a redundant LDAP server configuration. Both redundant partners are seen as having the same rights. The service that assigns and switches the cluster address of the global cluster specifies the active LDAP server. This takes place in the background and is not noticed by the LDAP server process.

The host name (fully qualified) of the second computer involved in the redundant LDAP server is specified.

The fully qualified 'host name' is specified as *cluster name*, and is used to reach the active computer in the cluster. This must be the same as the composition of *cluster name* and *cluster domain name* in the *Global cluster* aspect.

The cluster name must also be fully qualified (including domain name), because it is also entered in the server certificate. This is necessary for a client to recognize the validity of the server certificate when it has connected to the server with the cluster name.

The following three parameters are for experts. The default values can normally be adopted without change and deliver a stable replication of the LDAP data between the redundancy partners.

A deeper knowledge of the replication of openLDAPv3 servers is necessary in order to be able to adjust the parameters, and can be accumulated by reading the appropriate literature.

The *Retry configuration* specifies the interval in seconds between two connection attempts if the redundancy partner is not reachable, and the number of retries until cancellation. There is no cancellation if other number pairs are added, then there is a continuation with the values of the next number pair. If a '+' is specified for retries, this means unlimited, and there is no cancellation. The default value "5 10 60 +" means 10 repetitions with 5 seconds interval, then unlimited repetitions with 60 second intervals.

The *Checkpoint configuration* specifies after how many operations (1st number) and after how many minutes (2nd number) changed files are written to the database after the last check (checkpoint). Whichever limit is reached first is counted.

The size of the history (number of entries) that is kept in memory for synchronization search operations is specified in the *Session log configuration*. This session log improves the performance during a replication.

3.7.2.4 LDAP Client

If a computer is used as an *LDAP server and client,* no further parameters must be configured for the client than have already been specified in the configuration of the LDAP server.

*It is **not possible** to configure a computer with an APROL LDAP server and LDAP client when the LDAP client should connect with a different LDAP or Active Directory server. This limitation is built into AprolConfig as it is un-typical and should be avoided.*

1) Each computer which has an operator and/or gateway system must be configured as LDAP client if the operators must make their authentication via LDAP.

2) Operator and/or gateway systems which run on the same computer can only use the same LDAP server, even if they originate from different projects.

Both points are also valid for the engineering systems.

If a computer is configured a pure LDAP client, the *Client* section is important in addition to the *General* section.

The server type selection offers the possibilities of *APROL LDAP server*, *External OpenLDAPv3 Server* and *External Win2008 AD Server*.

An *APROL LDAP server* is an LDAP server that has been configured using AprolConfig.

If a configuration is made with the type of usage 'Only LDAP client' and server type 'APROL LDAP server', then the LDAP server host name cannot be the host name of the own computer. It is not possible that an LDAP server can run on the computer, because one has not been configured.

The *Query user* is a user in the LDAP database and is allowed to read from the database. This is required for the LoginServer. The parameter specifies the DN of the user (without the basis DN), i.e. the position in the DIT.

The *Query user* password is configured in the *Password query user* field and the respective repetition field. It is not saved in an encrypted form.

The above mentioned parameters for the query user and its passwords cannot be edited when using an APROL LDAP server. They are then set to the default values, which can be read in the tool tips of the column headings.

3.7.2.5 Using another server

It is possible to select the *Type of LDAP server* when using the type *Only LDAP client*. Apart from the default APROL *LDAP server*, the following server types can be used:

External openLDAPv3 server:
An LDAP server that runs with the same software as the APROL LDAP server. The server is running on a non-APROL server and is not influenced by APROL or its administration.

External Win2008 AD server:
A Kerberos-capable Windows Active Directory server can be used. The configuration and the user management of such a server are described in chapter ***Authentication via LDAP / Active Directory Server in manual 'D1 System Manual'.***

The parameters and password for the *query user* can be edited when using this server type.

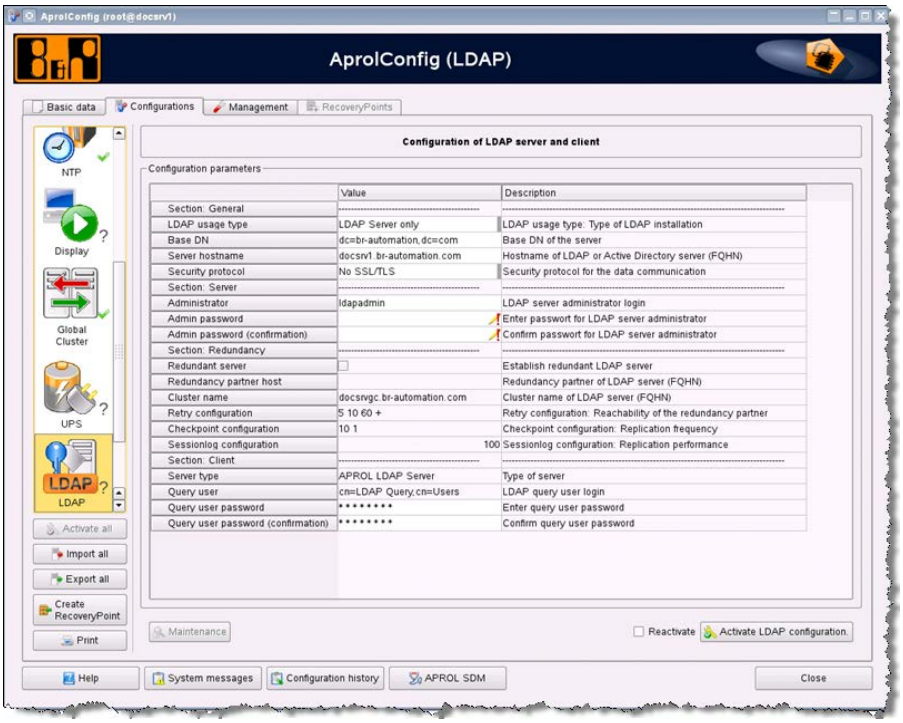


Illustration 85: LDAP configuration

3.7.3 Activation

When activating the configuration, the corresponding system files are created and adjusted, services are started or stopped, and the LDAP database is eventually initialized. This differs according to the type of usage.

If the configuration is activated with the *No LDAP* type of usage, the system configurations are reset in the history and running LDAP servers are stopped.

The steps that are carried out after activation in the specified order can be seen in the following table. The columns S, C, A, show if a step is relevant for the type of usage. This signifies:

S: LDAP server
C: LDAP client connected to an openLDAPv3 server
(Server type *APROL LDAP server* or *External openLDAPv3 server)*
A: LDAP client connected with an Active Directory Server
(Server type *External Win2008 AD Server)*

No.	S	C	A	Step carried out
1	x	x	x	Stop running server
2	x			Write configuration file for LDAP server /etc/openldap/slapd.conf

3	x	x	x	(De)activate auto-start for LDAP server /etc/sysconfig/openldap
4		 x x	 x	Write configuration file for LDAP client /etc/ldap.conf /etc/openldap/ldap.conf /etc/krb5.conf
5		x	x	Write PAM configuration file for LoginServer /etc/pam.d/aprolloginserver
6	x	x	x	Adjust configuration for NSS /etc/nsswitch.conf
7	x			Link root CA to /etc/openldap/certs/ca.crt
8	x			Check and recreate server certificate when necessary: /etc/openldap/certs/server.crt /etc/openldap/certs/server.key /etc/openldap/certs/ldapimport.crt /etc/openldap/certs/ldapimport.key
9		x		Check and recreate client certificate when necessary: /home/aprolsys/APROL/certs/ldapquery.crt /home/aprolsys/APROL/certs/ldapquery.key
10	x			Start server
11	x			Create database structure for query user

It is always ensured that a running server process is stopped during the start of activation. A running process can be regular (server configuration) or be the result of a previous configuration.

3.7.4 Maintenance dialog

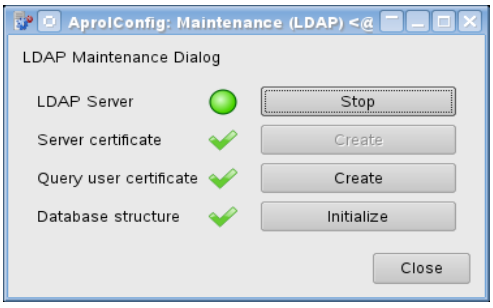


Illustration 86:

There is a maintenance dialog for checking the status of the LDAP server components and for its control. This modular dialog is opened with the [Maintenance] button under the configuration table, on the left.

The button is only active when the configuration being shown corresponds to the activated configuration. The dialog cannot be opened if the configuration has not been activated or has been modified.

All of the action which are possible here are carried out during the activation of a configuration, and normally there is no need to make any changes via the dialog.

If changes have been made to the components outside of AprolConfig, i.e. by another process, the dialog will point this out. The result can simply be displayed in the dialog after a configuration has been activated successfully.

The following functions are available for all components:

An icon shows the status.

The tool tip of the icon names the status and shows detailed information if it is available.

The button is either activated or deactivated according to the state of the configuration. The description (and the action linked to the button) can also change: If the LDAP server is running, the topmost button is intended for stopping the server, otherwise to start it.

The tool tip on the button shows which action is carried out when the button is pressed. If the button is deactivated, the tool tip on the button shows the reason for this.

A2-4 Web server

4.1 Why a Web server and browser?

The following advantages arise from supporting a web server with PHP 4 and a web browser with Flash:

- APROL product documentation as well as documentation for function block libraries and controller hardware is available at a central location in the form of HTML pages.
  These pages can be opened in a Web browser from various places as the **online documentation** (from the KDE menu), **help** (function blocks), or **module documentation** (when putting together a controller).
- The **texts for intervening** with individual alarms are displayed on separate HTML pages. Implementing Flash can provide considerable advantages in this regard.
- XML data can be exported as HTML pages as well as in CVS format.
- Finally, you may create product documentation of your own in the Engineering system using HTML pages that can be retrieved later from a central location while the system is being operated.
  Implementing PHP 4 and Flash may be particularly useful in this regard.
- All HTML pages are displayed in a Web browser and are provided from a central location on a Web server.

The HTML format was developed for the high-speed transfer of data pages and has become an integral part of the Internet and intranets alike. A Web browser is required to display these pages.

The standard web browser in APROL is the Konqueror. If you are using a different web browser, please make sure that it has a plug-in for Flash.

4.2 Installing and configuring the Web server

In order to make computers suitable for the web when performing the installation, the ***APACHE*** Web server is installed and launched when using APROL.
The configuration of the web server is carried out automatically within the scope of the APROL installation, an upgrade, or an update of the system software.

For this purpose, the file *apache2.conf* is created **specifically for each computer** in the directory `/home/aprolsys/APROL/cnf/apache2/`.

4.2.1 SSL protocol

The **http TCP/IP communication** between client and server (Web browser and Web server) in APROL only works via the SSL protocol. SSL stands for **S**ecure **S**ocket **L**ayer and has been implemented in order to protect queries to the APROL Web server against potential ***interception***. Certificates are created for these secure queries, which are then counter-checked by the browser and web server. In the event that these certificates are no longer valid or have expired, communication will not be possible.

Using this data, a **unique certificate** is created for the APROL Web server and counter-signed by a certification organization. Upon the first call of a documentation page, or a CGI query using the HTTPS protocol in the format:

```
https://
```

is notified to the browser that the following side is secured with a 128 bit key. The browser will question whether this connection should really be established because it does not recognize the certification or the computer.

In this context please see the notes in chapter Importing the APROL SSL CA certificate.

If due to application reasons the **SSL encryption should not be used, then the file *apache2.conf* must be edited**, e.g. with *vi*.

A corresponding adjustment of the file *apache2.conf* can be carried out in several ways. For this, pay attention to the instructions in the head of the file.

E.g. it is possible **to release the port 8000 for an access without SSL encryption.**

Note that after a successful change in the apache2.conf, the web server must be restarted.

To make sure that the changes made are also present after an update of the APROL system software, these must be separately backed up-
The new apache2.conf file must be readjusted after an update.

4.2.2 Importing the APROL SSL CA certificate

With release APROL R 3.0-02, a new SSL CA certificate is being delivered that is used as a signature for all APROL server certificates.

With these server certificates, the SSL connections are encoded and signed for web queries (e.g. reports).

The new CA certificate, also called *certificate from the certificate authority* or *certificate from the SSL subscriber* (Konqueror), is – unlike older APROL releases – **identical on all APROL servers.**

After completing the update to APROL R 3.0-02, the new CA certificate should be imported into the web browser that is being used. Afterwards, all SSL access to the APROL server starting with release R 3.0-02 will take place without requiring confirmation.

*The import is to be **carried out once on each** CC-Account from any APROL server with Release 3.0-02 installed.*

For web-based access on Windows computers, it's necessary to import the new CA certificate into the web browser being used there.

4.2.2.1 Importing the certificate in Konqueror:

Open the following URL in Konqueror

http://<APROL Server>.<domain name>.<domain suffix>/crt/ca.crt auf.

Select the "*Process Automation*" entry and acknowledge importing the certificate with [**Import**]. Then exit the import dialog box using the [**Finish**] button.

The CA certificate "Process Automation – APROL Root CA" is self-signed. Corresponding warnings can be ignored.

4.2.2.2 Importing the certificate in Internet Explorer

First, enter the URL `http://<APROL Server>.<domain name>.<domain suffix>/crt/ca.crt`.

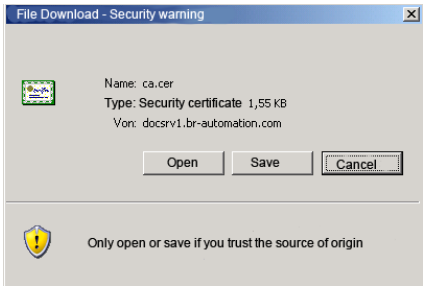


Illustration 87: Dialog to download file

Select [**Open**] in '***File Download – Security Warning***' dialog.

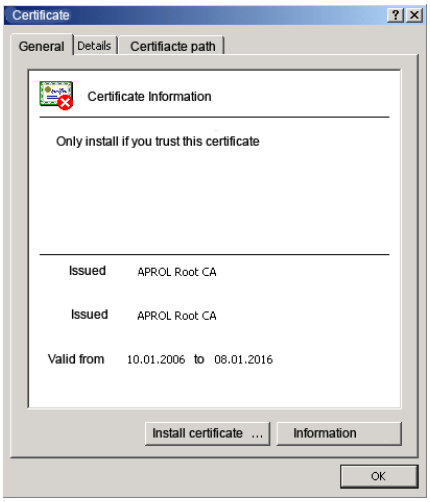


Illustration 88: Installing a certificate

In the "**Certificate**" dialog box, the certificate import wizard must be started using the [**Install Certificate**] button.

The information dialog box shown is confirmed by clicking on [**Next>**].

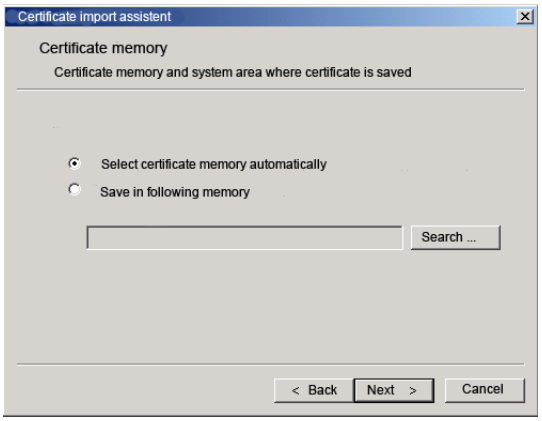


Illustration 89: Automatically select the certificate store

Then select the option "**Automatically select the certificate store ...**".

Confirm the selection by clicking on [**Next>**].

In the next dialog box shown, you can complete the import by clicking on [**Finish**].

*Other warnings can then be ignored. The request to install the certificate must be answered with "**Yes**"!*

4.2.2.3 Importing the certificate in Mozilla Firefox

After opening the URL `http://<APROL Server>.<domain name.<domain ending>/crt/ca.crt`, it's necessary to activate the "***This certificate can identify web sites***" checkbox in the following dialog box.

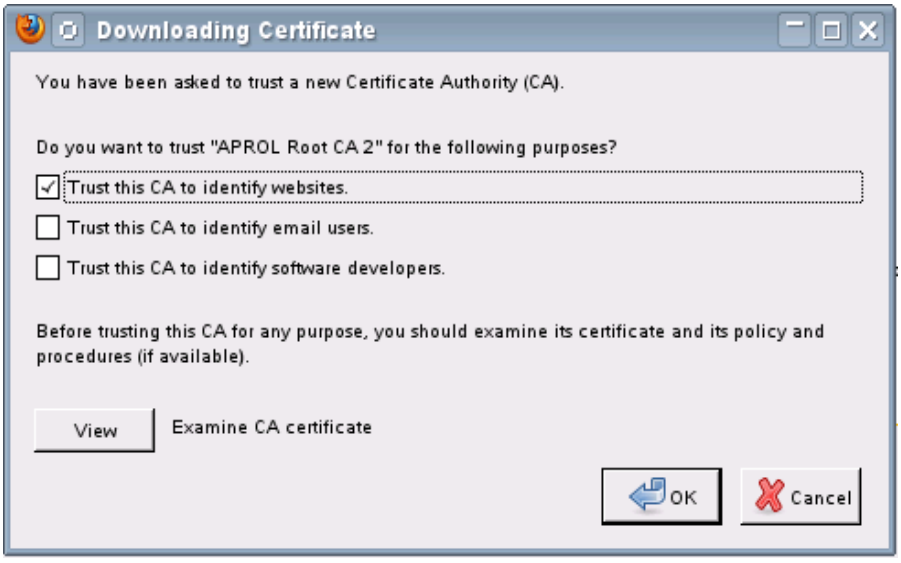


Illustration 90: importing the 'APROL Root CA' in Mozilla Firefox

Using the [**View**] button, you can check the details about the certificate to be imported. Acknowledge importing the certificate with [**OK**].

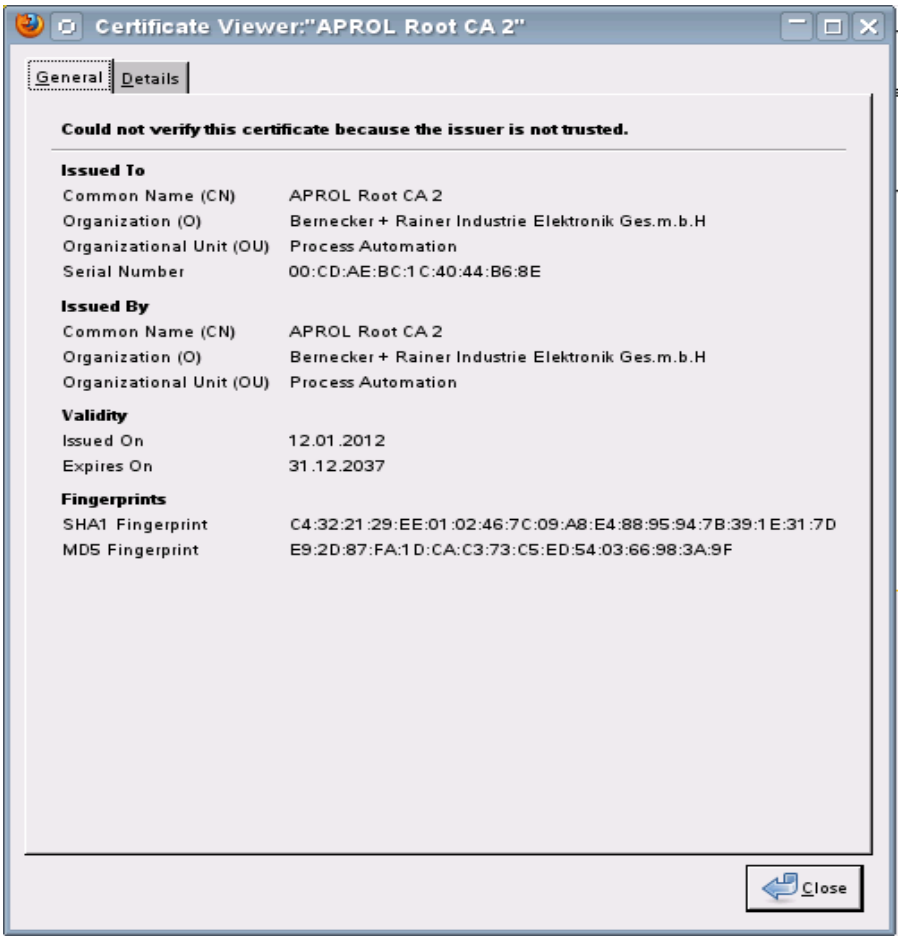


Illustration 91: Viewing the certificate to be imported

With all web browsers, there may be earlier imported CA certificates that must be removed!

4.2.3 Web server and browser features

Configuring the Web server is done in the **CaeManager** in the *Control Computer* project part under the **Network** tab. This determines whether the Runtime computer is simultaneously the server for the documentation and logging.

4.3 Web server in a redundant environment

The problem with web-based requests for data from a redundant Runtime environment is that the name of the current process control computer (master) must be entered/selected.

When using APROL, this switch between the respective process control computers occurs automatically – in this case, we are dealing with access redundancy.

For this purpose an APROL cluster is created during a configuration of a redundant runtime server.

You can find further information in chapter Cluster for redundant runtime servers.

Web-based requests are always responded to by the current process control computer because these requests are made using only the name of the APROL cluster.

Web-based requests are always made via the APROL cluster even in non-redundant systems.

A2-5 System licensing

5.1 General information about APROL licensing

As of APROL R 3.4-04, the known licensing via dongle is replaced with the web based licensing procedure.

It is necessary to license all of the APROL servers with the web based procedure after an update to APROL R 3.4-04.

The web based licensing procedure offers you the following advantages:

- no additional hardware necessary,
- no dongle swap necessary for an APROL release change

B&R delivers a unique serial number for each APROL license.

The 11 digit B&R serial numbers, which are noted on the supplied license certificate, are contained by B&R together with the respective delivery date in a license database.

The APROL major release date, which contains the release date of the major release (e.g. R 3.6.-00), is used in order to simplify the rights for an APROL update / upgrade.

The APROL major release date is identical for all builds of this major release and can be viewed in the 'License information' dialog of the LoginServer.

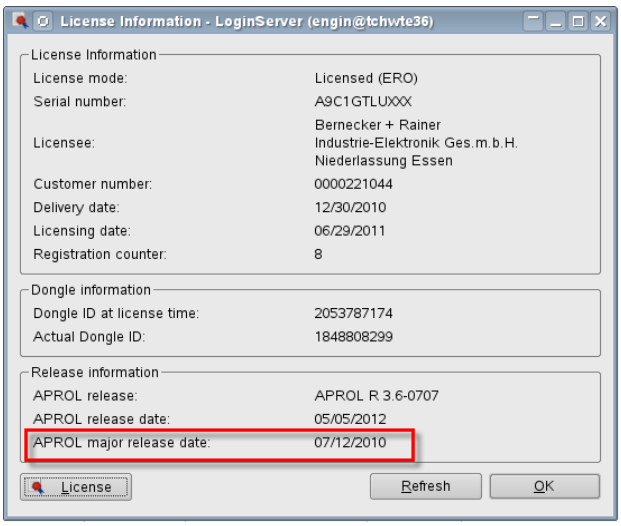


Illustration 92: 'License information' dialog

The following advantages result for you:

Unlimited update right:

By purchasing an APROL license for R 3.x, you have the right to update free of charge to all builds of this major release.

The update right also encompasses all builds of APROL releases with a lower major release.

Limited update right:

If a new major release is publicized within a period of up to 6 months after receiving the license (delivery date), it can be used without an additional upgrade license being charged for.

In this case, all update from the new major release can be used.

A separate dialog makes you aware when there is no right to upgrade.

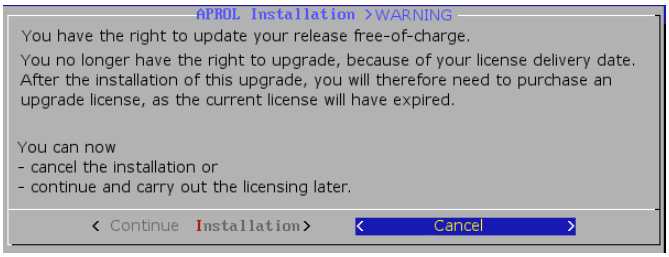


Illustration 93: Check of the upgrade right:

5.1.1 Use of an APROL evaluation license

The `BrLicense` license database is created in the `/etc/BrLicense` directory when installing the APROL system software.

The license database, which contains amongst others computer specific information, is not allowed to be manipulated, moved, or copied!

This would result in that the license mechanism no longer recognizes the APROL system as being "licensed" and the APROL system can no longer be operated.

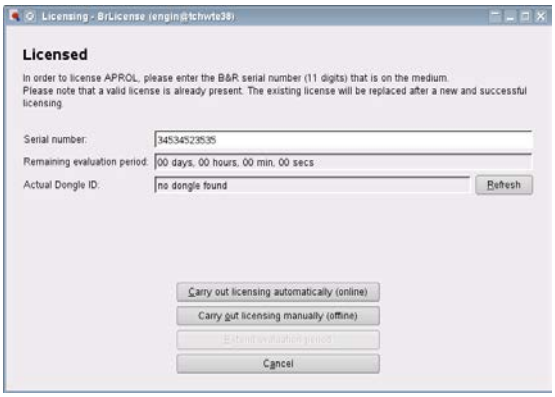
The APROL server is in 'evaluation mode' if no licensing takes place after the installation. The evaluation time period is 90 days, and you are made aware of this in regular intervals.

The necessity to license is reported again after the evaluation period has expired.

You should buy a valid APROL license, at the latest, at this point in time.

5.1.2 Automatic licensing

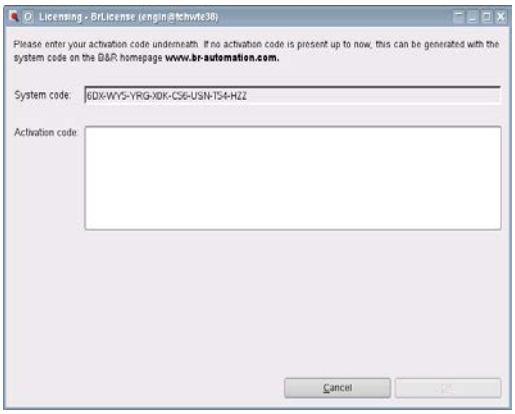
You basically have the possibility of an automatic licensing when the computer to be licensed has an existing internet connection. If there is no internet connection then it is only slightly more effort to choose the manual licensing procedure, by which the licensing takes place on a suitable computer's browser.

Step	Description
1	Call up the "**License status**" menu item from the **LoginServer's** context menu and subsequently confirm with the [**License**] button. Alternatively, a call via the "**APROL licensing**" menu is possible.
2	Enter the 11 digit B&R serial number in the following dialog. The serial number can be taken from the license certificate that belongs to the scope of delivery.  *Illustration 94*
3	Start the automatic licensing by choosing the [**Carry out licensing automatically (online)**] button. Through this, an internet connection is built up to the license database, and the system's licensing is automatically carried out.

5.1.3 Manual licensing

The existence of an internet connection **on the computer to be licensed is not necessary** for the manual licensing.

Step	Description
1	Call up the "**License status**" menu item from the **LoginServer's** context menu and subsequently confirm with the [**License**] button. Alternatively, a call via the "**APROL licensing**" menu is possible.
2	Enter the 11 digit B&R serial number. The serial number can be taken from the license certificate that belongs to the scope of delivery.
3	Start the manual licensing by choosing the [**Carry out licensing manually (offline)**] button.

Step	Description
4	A corresponding system code, which must be subsequently registered via the B&R homepage, is output in the following dialog. Note the system code that is output.  *Illustration 95* *The dialog is not allowed to be closed in the meantime, because a new system code is generated when it is opened again.* *If a registration has taken place via the B&R homepage with the system code that has been previously generated, **without** having licensed the APROL system via activation code, then it is also necessary to contact B&R (per telephone) in order to carry out the licensing with the serial number that has been made available.*
5	Select the "**Service / Software registration**" menu item on the B&R homepage "www.br-automation.com" **from a computer with an existing internet connection**. Open the "**Registration**" link in the "**APROL Process Automation**" section. Please enter the system code that was previously detected in the dialog and confirm your entry with [**Register**]. Registering the B&R Automation Studio and detecting the APROL activation code takes place with the same dialog. **See the following illustration for this.**

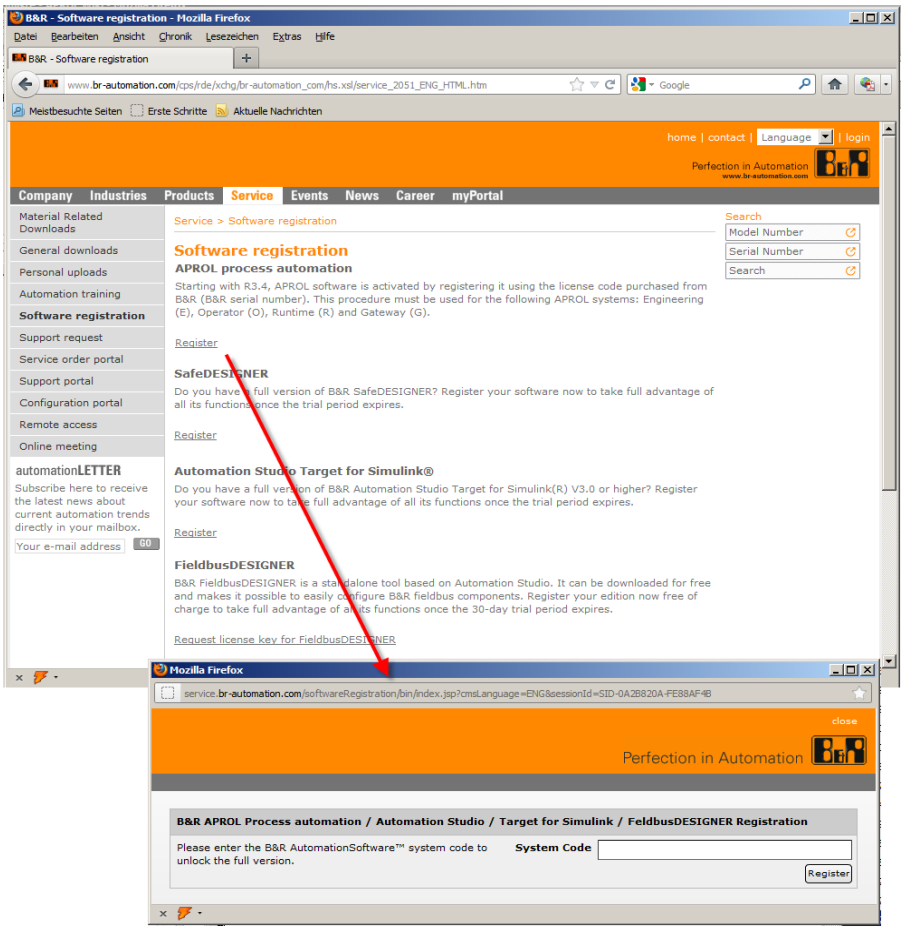
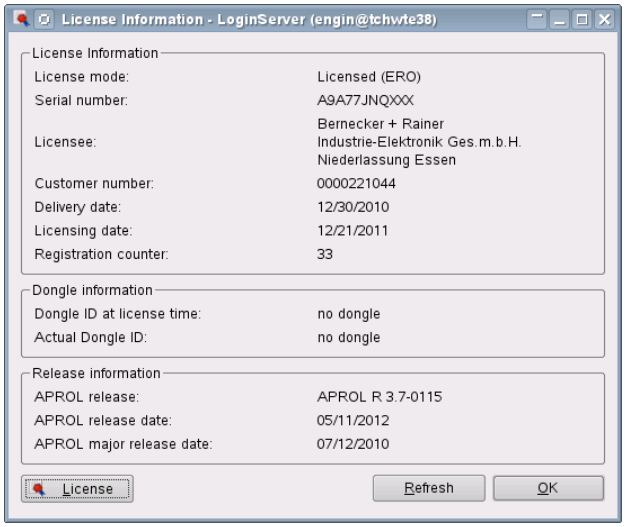


Illustration 96: Determining the activation code

*If the system code has been incorrectly entered (e.g. incomplete or wrong format) then a corresponding error message is output after pressing the [**Register**] button!*

Step	Description
6	**Note** the activation code that is returned on the B&R homepage, **or copy** the activation code in a file and transfer it subsequently to the APROL server.

Step	Description
7	Enter the activation code in the dialog mentioned in step 4, and confirm your entry with [**OK**]. The manual licensing is completed thereafter. The licensing success is confirmed in the dialog that follows. The licensing success is shown when calling the "**License status**" context menu in the **LoginServer**.  *Illustration 97*

5.1.4 Monitoring the license status via system variables

The "SysMon" CAE library functionality should be used for the system and self-monitoring.

The license status can be monitored in the scope of the system and self-monitoring with the new 'LicenseState' and '_LicenseEvalTime' system variables.

Please note that the new "_LicenseState" system variable does not replace the old "_DongleState" variable with the same functions. Adjustments to the logic may be necessary because of this.

The **old** "_DongleState" system variable could adopt the following values:

0 Dongle detected, license mode is active

1 No dongle present, demo mode is active

2 Demo time has expired

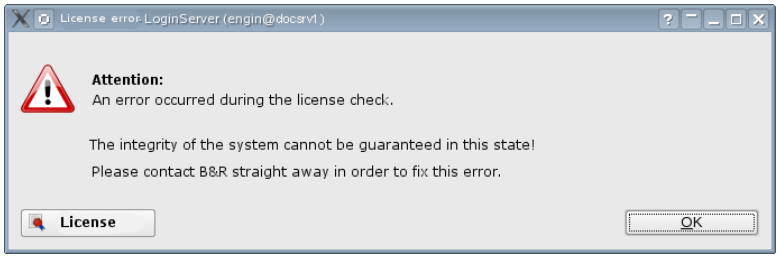
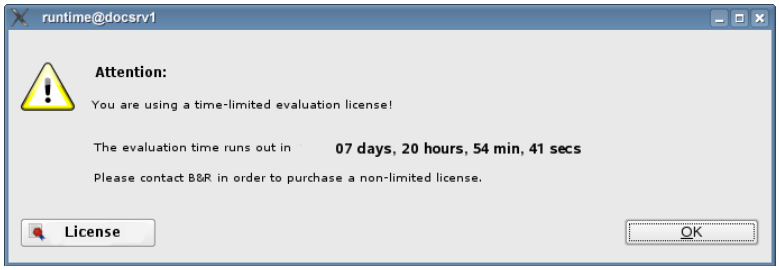
3 unknown error

The system variables have the following prefix:
`<Instance name of the computer>_<M | S >`

The following applies for the nomenclature of the system variables:
If a redundancy system is present then the configured slave is marked with the letter 'S'.

Variable	Description	Type
_LicenseEvalTime	This system variable states the remaining time in evaluation mode. The value is output in [sec]. The value "0" is displayed after a successful licensing.	DINT
_LicenseState	This system variable provides the license status. -1 = Unknown license error 0 = Unknown status 1 = Evaluation mode active 2 = Evaluation period expired 3 = Licensed 4 = License expired	INT

The following dialogs are output depending on the license status:

License status:
Error while checking the license (_LicenseState = - 1)    *Illustration 98* **The message appears every 60 seconds**
APROL evaluation mode (*_LicenseState = 1*)    *Illustration 99* **The message appears every 60 minutes**

License status:
Evaluation period expired *(_LicenseState=2)*  *Illustration 100* **The message appears every 5 minutes**
License expired *(_LicenseState=4)*  *Illustration 101* **The message appears every 5 minutes**

Additionally, a complete licensing check is carried out when the following APROL applications are started and you are made aware of the current license status with the respective dialog:

CaeManager, DisplayCenter, StartManager, DownloadManager, ControllerManager

5.1.5 Logging of the APROL license state change

The APROL system messages, based on the ChronoLog mechanism, allow a comfortable and flexible display and analysis of all state changes in the APROL licensing.

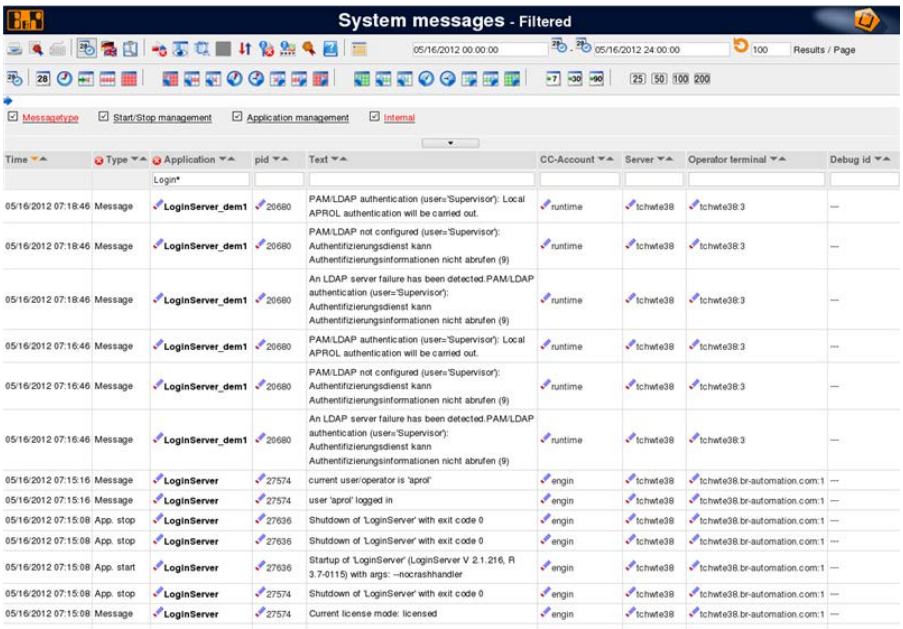


Illustration 102: Logging of the license status in the APROL system messages

Furthermore, all status changes are entered in the **APROL Configuration Report**.

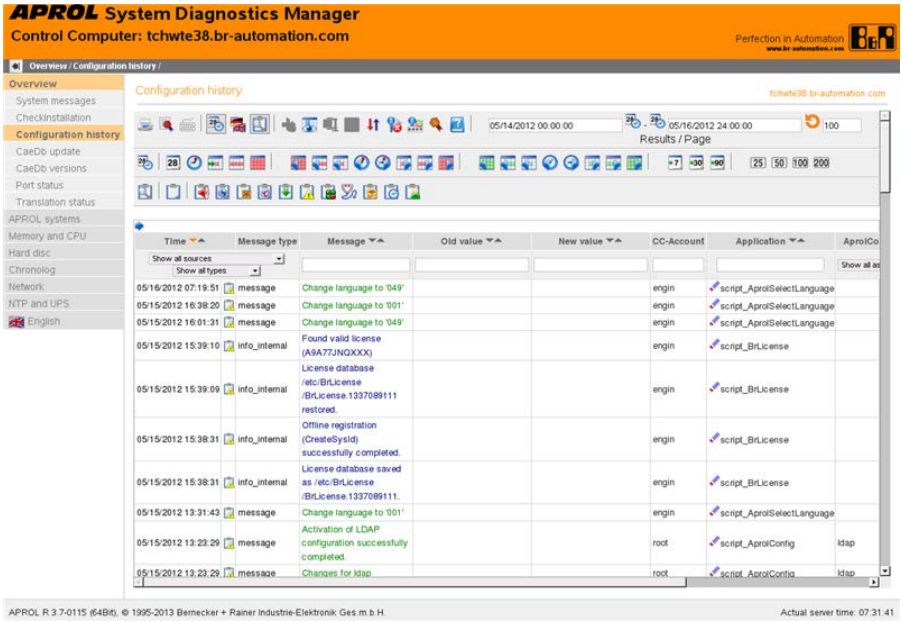


Illustration 103: Display of the status change in the Configuration Report

5.1.6 License loss due to hardware exchange

A new licensing is always necessary if the root partition hard drive is exchanged.

The hard drive exchange should be reported to B&R support at soon as possible, in order that the corresponding license counter is increased and a new licensing with the same serial number is then possible.

By using the (optional) 'License Protection Hardware Key', you can avoid the loss of the license because of a hardware exchange until the new license is available. There is no license loss as long as the same dongle remains insterted which was inserted at the time of licensing. If the

dongle is removed and there is no new licensing, an invalid license environment will be signalized.

Detailed information can be found in the following chapter Optional use of the 'License Protection Hardware Key'.

5.1.7 Special information about the 'B&R Partner License'

B&R provides a 'B&R Partner License' for system integrators.

This license contains all system functionalities (without any kind of limitation) and is **only allowed to be used for engineering operations**.

*A use on productive systems is **not allowed!***

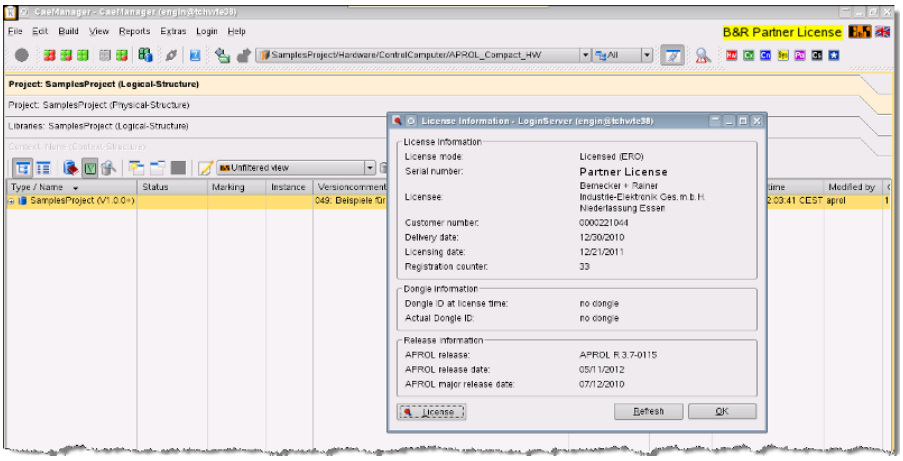


Illustration 104: Characterization of a B&R Partner License

5.1.8 Optional use of the 'License Protection Hardware Key'

The `BrLicense` license database is created in the `/etc/BrLicense` directory when installing the APROL system software.

The license database, which contains amongst others computer specific information, is not allowed to be manipulated, moved, or copied!

This would result in that the license mechanism no longer recognizes the APROL system as being 'licensed' and the APROL system can no longer be operated.

In addition to the existing web based licensing, you also have the possibility to use the so-called 'License Protection Hardware Key'.

The APROL system licensing (Software registration) can take place **via the additional use of a 'License Protection Hardware Key'** for use on a USB port and allows the **creation of a 'mobile license'**.

For this, a B&R USB dongle must be inserted **at the moment of installation** (online or offline). After the dongle has been inserted, the device `/dev/aks/hasp/*` should have been created. In doing so, **the unique ID of the hardware key is recorded in the licensing file during the licensing**.

If the system has already been licensed, the use of the hardware key is only then possible by re-licensing completely.

This allows the copy of the license file on one or more physical control computers, so that these can then be operated **alternatively** with the hardware key.

The USB dongle thus allows for example, the preparation of a substitute control computer, which can be put into operation when a redundant server crashes by simply plugging the hardware key.

A simultaneous operation of the license in the license file on the installed control computer and the substitute control computer is not allowed.

The APROL License Protection hardware Key can be ordered from B&R with the following material number:

B&R material number:	B&R material text:
AP.ACC-1500	APROL License Protection Hardware Key

*The **Linux package** 'aksusbd-suse', which is installed per default, is necessary in order to license via the 'License Protection Hardware Key'.*

A2-6 Multiscreening

6.1 General information about Multiscreening

Multiscreening on APROL servers is handled using multiple (in this case two) graphics cards. That means this type of Multiscreening cannot be compared with **Multiscreening via a VGA splitter**.

With the VGA splitter solution, the entire picture coming from the computer is distributed to several monitors using special hardware (VGA splitter).

The Multiscreening solution introduced here uses the installation and configuration of additional graphics cards and a second display to extend the desktop **or** work with a completely separate APROL system on the second screen.

The use of Multiscreening offers you the following basic benefits:

- **Better overview** in the CAE and during operation,
- **The swapping of docked application modules** to another monitor,
- **Swapping of faceplates** to another monitor,
- **Swapping of the alarm list** to another monitor
- **Simultaneous display** of engineering and runtime environments

6.1.1 Multiscreening with APC 910

Because of the 5AC901.LDPO-00 and 5AC901.LSDL-00 interface cards, up to 3 monitors can be connected and operated without an external NVIDIA card.
The BIOS and firmware on B&R equipment must always be up-to-date in order to correctly configure the 3x screening.
New versions can be downloaded from the B&R homepage (www.br-automation.com).
At the time of this document, this is version 1.16.
Section from the APC910 user manual. Please always refer to this manual, because it may not be possible to adopt certain newer versions at all or partialy.

A BIOS upgrade might be necessary for the following reason:

To update implemented functions or to add newly implemented functions or components in the BIOS setup (information about changes can be found in the 'readme' files of the BIOS upgrade).

What information do I need?
Custom BIOS settings are deleted during a BIOS upgrade.
It makes sense to record the different software versions before an upgrade is carried out.

Which BIOS version and firmware are already installed on the APC910?
This information can be found of the following BIOS setup page. After switching on the APC910, you can get to the BIOS Setup by pressing [DEL]. From the BIOS main menu 'Advanced', select 'OEM Features' sub-item.

Procedure with MS-DOS

Step	
1	Download the ZIP file from the B&R homepage www.br-automation.com
2	Create a boot-able media Information about creating a boot-able media can be found in the APC910 user manual: *Creating an MS-DOS boot disk in Windows XP* *USB Memory Stick for B&R Upgrade Files* *Mass Memory for B&R Upgrade Files*
3	Copy the content of the *.zip file to the boot-able media. This step is not necessary If the B&R upgrade was already created via the 'B&R embedded OS installer'.
4	Connect the boot-able media to the B&R equipment and reboot
5	The following boot menu is shown after startup: 1) U p g r a d e A M I B I O S f o r A P C 9 1 0 (5 P C 9 0 0 . T S 7 7 - 0 x) 2) Exit Concerning point 1: BIOS is automatically upgraded (default after 5 seconds). Concerning point 2: Return to the shell (MS-DOS). If you do not press a button within 5 seconds, then step 1 'Upgrade AMI BIOS for APC910 (5PC900.TS77-0x)' is automatically carried out and the industry PC is independently updated.
6	The system must be rebooted after a successful upgrade. Reboot and press the [DEL] key to enter the BIOS setup menu and load the setup defaults; then select 'Save Changes and Exit'. Information: If this is the current BIOS, select the default seetings (F9) and then 'Save Changes and Exit'.

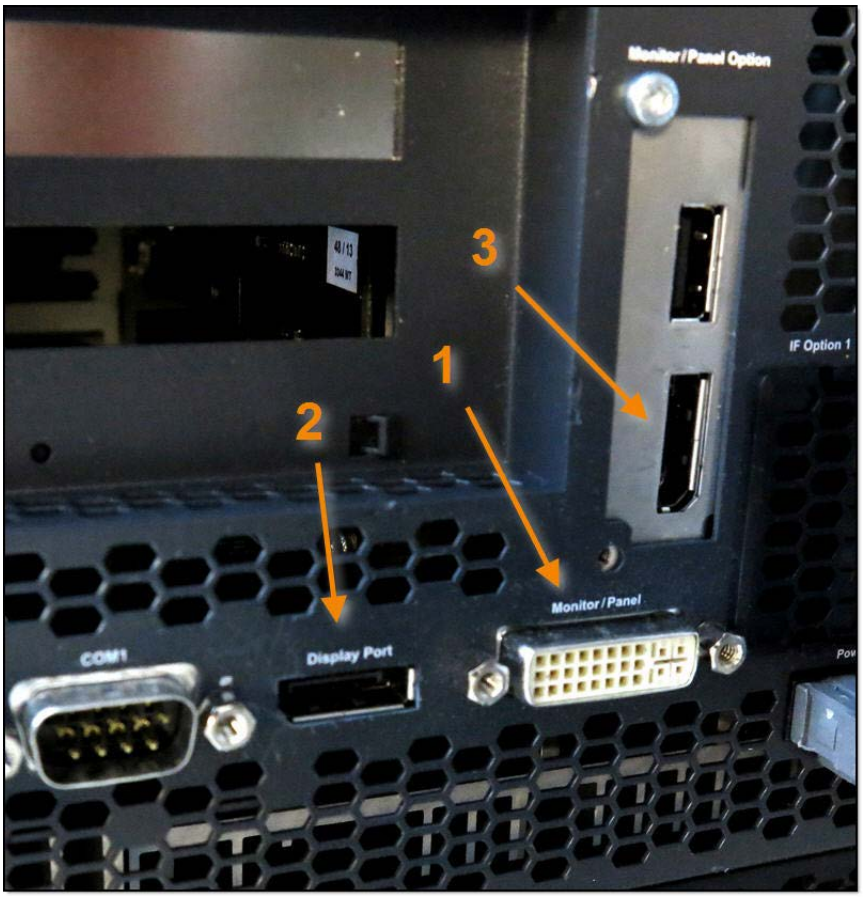


Illustration 105: Connections APC910

1. DVI interface

2. Display port1 (additonal DVI adapter necessary)

3. Extension card with display port 2 (additonal DVI adapter necessary)

6.2 Graphics cards for Multiscreening

A current listing of all B&R supported and tested graphic cards, respective of the computer hardware, can be found in the B&R Product Catalog 'APROL Process Automation' or on the B&R web side 'www.br-automation.com'.

An overview can be found on the web page in 'Products / Process Control / APROL Hardware / Multiscreening'.

A current overview can alternatively be obtained via the B&R support.

The necessary graphic card drivers can be found on the homepage of the respective graphic card manufacturer.

6.3 Setup of the Multiscreening for NVIDIA graphic cards

The following pages describe the steps that are necessary for configuring a Multiscreening with NVIDIA graphic cards. These steps go from the installation to the setup of the driver and up to the adjustment of the KDE environment (Desktop environment).

The following points should be checked beforehand in order to be able to carry out these configurations:

Point:	Description:
1	**Use of monitors of the same type** (recommended, to avoid complications)
2	Connection of the monitors with the same cables (VGA or DVI (Recommended)), as otherwise complications may arise with the driver
3	**Setting of the signal type used in the monitor**, so that all monitors are addressed when identifying the monitors.
4	**Use of the correct driver** There are 2 driver variations available: - for PCI express cards. V185.18.XX - for PCI cards and mixed operation with PCI express: V173.14-XX
6	**Use of the current driver version** The driver can be obtained from the NVidia homepage (www.nvidia.de).
6	**Deactivation of the onboard graphic card** in the BIOS

6.4 Installing the NVIDIA driver

In any case, **the current driver version should be used** for the installation of the driver. The current driver can be found in the NVIDIA homepage on www.nvidia.de.

The computer that is to be configured must be switched to runlevel 3 after the driver has been downloaded. This takes place in the console, as Linux superuser 'root', with the `init 3` Linux command.

Then the installation of the driver can take place. Now change into the directory in which the driver is located.

The installation is started with the `sh <Name of the driver>` command.

Example: `sh NVIDIA-Linux-x86-1.0-9755-pkg1.run`

The message regarding the license agreement follows.

In this step, the question "**Download kernel from FTP side (via internet connection)?**" should be answered with "**NO**".

Confirm all other questions with "**Yes**" or [**OK**].

After the installation, execute the following command in runlevel 3 (init 3) on the console:

```
sax2 –r –m 0=nvidia
```

This command creates a new configuration file by using the NVIDIA driver.

The X configuration normally takes palce with the sax2 tool. The configuration information for X is then written to the /etc/X11/xorg.conf file.

It must be noted that there may always be small changes to the delivered hardware in the normal course of the product lifetime; this concerns graphic chip sets, etc.. Therefore, the /var/log/Xorg.0.log file should be checked for possible error messages after the X has started.

These error messages can be processed simply in the /etc/X11/xorg.conf file by experienced members of staff.

There is no general 'recipie' or instructions for a correct configuration of all possible hardware combinations as this is not practicable. This documentation contains an example xorg.conf which should function in the most cases.

6.5 Configuration of the graphic card

.

6.5.1 3x screening with APC910

The xorg.conf file

Unnecessary sections have been removed and are not visible in this example.
Changed parts are marked in blue.

```
# /.../
# SaX generated X11 config file
# Created on: 2014-07-09T09:41:48+0200.
#
# Version: 8.1
# Contact: Marcus Schaefer <sax@suse.de>, 2005
# Contact: SaX-User list <https://lists.berlios.de/mailman/listinfo/sax-users>
#
# Automatically generated by [ISaX] (8.1)
# PLEASE DO NOT EDIT THIS FILE!
#


...

Section "Files"
  FontPath    "/usr/share/fonts/misc:unscaled"
  FontPath    "/usr/share/fonts/local"
  FontPath    "/usr/share/fonts/75dpi:unscaled"
  FontPath    "/usr/share/fonts/100dpi:unscaled"
  FontPath    "/usr/share/fonts/Type1"
  FontPath    "/usr/share/fonts/URW"
  FontPath    "/usr/share/fonts/Speedo"
  FontPath    "/usr/share/fonts/PEX"
  FontPath    "/usr/share/fonts/cyrillic"
  FontPath    "/usr/share/fonts/latin2/misc:unscaled"
  FontPath    "/usr/share/fonts/latin2/75dpi:unscaled"
  FontPath    "/usr/share/fonts/latin2/100dpi:unscaled"
  FontPath    "/usr/share/fonts/latin2/Type1"
  FontPath    "/usr/share/fonts/latin7/75dpi:unscaled"
  FontPath    "/usr/share/fonts/baekmuk:unscaled"
  FontPath    "/usr/share/fonts/japanese:unscaled"
  FontPath    "/usr/share/fonts/kwintv"
  FontPath    "/usr/share/fonts/truetype"
```

```
  FontPath     "/usr/share/fonts/uni:unscaled"
  FontPath     "/usr/share/fonts/CID"
  FontPath     "/usr/share/fonts/ucs/misc:unscaled"
  FontPath     "/usr/share/fonts/ucs/75dpi:unscaled"
  FontPath     "/usr/share/fonts/ucs/100dpi:unscaled"
  FontPath     "/usr/share/fonts/hellas/misc:unscaled"
  FontPath     "/usr/share/fonts/hellas/75dpi:unscaled"
  FontPath     "/usr/share/fonts/hellas/100dpi:unscaled"
  FontPath     "/usr/share/fonts/hellas/Type1"
  FontPath     "/usr/share/fonts/misc/sgi:unscaled"
  FontPath     "/usr/share/fonts/xtest"
  FontPath     "/opt/kde3/share/fonts"
  InputDevices "/dev/gpmdata"
  InputDevices "/dev/input/mice"
EndSection

Section "ServerFlags"
  Option       "AIGLX" "on"
  Option       "AllowMouseOpenFail" "on"
  Option       "AutoAddDevices" "off"
  Option       "ZapWarning" "on"
EndSection

Section "Module"
  Load         "dri"
  Load         "dbe"
  Load         "freetype"
  Load         "extmod"
  Load         "glx"
EndSection

Section "InputDevice"
  Driver       "kbd"
  Identifier   "Keyboard[0]"
  Option       "Protocol" "Standard"
  Option       "XkbLayout" "de"
  Option       "XkbModel" "microsoftpro"
  Option       "XkbRules" "xfree86"
  Option       "XkbVariant" "nodeadkeys"
EndSection


Section "InputDevice"
  Driver       "mouse"
  Identifier   "Mouse[1]"
  Option       "Buttons" "12"
  Option       "Device" "/dev/input/mice"
  Option       "Name" "Logitech USB Optical Mouse"
  Option       "Protocol" "explorerps/2"
  Option       "Vendor" "Sysp"
  Option       "ZAxisMapping" "4 5"
EndSection


Section "Screen"
  DefaultDepth 24
  SubSection "Display"
    Depth      15
    Modes      "1280x1024" "1280x960" "1280x800" "1152x864" "1280x768" "1280x720" "1024x768" "1280x600" "1024x600"
"800x600" "768x576" "640x480"
    Virtual    3840 1200
  EndSubSection
  SubSection "Display"
    Depth      16
```

```
    Modes     "1280x1024" "1280x960" "1280x800" "1152x864" "1280x768" "1280x720" "1024x768" "1280x600" "1024x600"
"800x600" "768x576" "640x480"
    Virtual    3840 1200
  EndSubSection
  SubSection "Display"
    Depth     24
    Modes     "1280x1024" "1280x960" "1280x800" "1152x864" "1280x768" "1280x720" "1024x768" "1280x600" "1024x600"
"800x600" "768x576" "640x480"
    Virtual    3840 1200
  EndSubSection
  SubSection "Display"
    Depth     8
    Modes     "1280x1024" "1280x960" "1280x800" "1152x864" "1280x768" "1280x720" "1024x768" "1280x600" "1024x600"
"800x600" "768x576" "640x480"
    Virtual    3840 1200
  EndSubSection
  Device      "Device[0]"
  Identifier  "Screen[0]"                    # Connection to definition section device
  Monitor     "EXT1"                         # Here monitor 1
EndSection

Section "Screen"
  DefaultDepth 24
  SubSection "Display"
    Depth     15
    Modes     "1280x1024" "1280x960" "1280x800" "1152x864" "1280x768" "1280x720" "1024x768" "1280x600" "1024x600"
"800x600" "768x576" "640x480"
    Virtual    3840 1200
  EndSubSection
  SubSection "Display"
    Depth     16
    Modes     "1280x1024" "1280x960" "1280x800" "1152x864" "1280x768" "1280x720" "1024x768" "1280x600" "1024x600"
"800x600" "768x576" "640x480"
    Virtual    3840 1200
  EndSubSection
  SubSection "Display"
    Depth     24
    Modes     "1280x1024" "1280x960" "1280x800" "1152x864" "1280x768" "1280x720" "1024x768" "1280x600" "1024x600"
"800x600" "768x576" "640x480"
    Virtual    3840 1200
  EndSubSection
  SubSection "Display"
    Depth     8
    Modes     "1280x1024" "1280x960" "1280x800" "1152x864" "1280x768" "1280x720" "1024x768" "1280x600" "1024x600"
"800x600" "768x576" "640x480"
    Virtual    3840 1200
  EndSubSection
  Device      "Device[0]"
  Identifier  "Screen[1]"
  Monitor     "EXT2"
EndSection

Section "Screen"
  DefaultDepth 24
  SubSection "Display"
    Depth     15
    Modes     "1280x1024" "1280x960" "1280x800" "1152x864" "1280x768" "1280x720" "1024x768" "1280x600" "1024x600"
"800x600" "768x576" "640x480"
    Virtual    3840 1200
  EndSubSection
  SubSection "Display"
    Depth     16
    Modes     "1280x1024" "1280x960" "1280x800" "1152x864" "1280x768" "1280x720" "1024x768" "1280x600" "1024x600"
"800x600" "768x576" "640x480"
```

```
   Virtual    3840 1200
  EndSubSection
  SubSection "Display"
    Depth      24
    Modes      "1280x1024" "1280x960" "1280x800" "1152x864" "1280x768" "1280x720" "1024x768" "1280x600" "1024x600"
"800x600" "768x576" "640x480"
    Virtual    3840 1200
  EndSubSection
  SubSection "Display"
    Depth      8
    Modes      "1280x1024" "1280x960" "1280x800" "1152x864" "1280x768" "1280x720" "1024x768" "1280x600" "1024x600"
"800x600" "768x576" "640x480"
    Virtual    3840 1200
  EndSubSection
  Device       "Device[0]"
  Identifier   "Screen[2]"
  Monitor      "EXT3"
EndSection

Section "Device"
  BoardName    "Ivybridge M GT2"
  Driver       "intel"
  Identifier   "Device[0]"
  Option       "monitor-VGA1" "VGA1"                  # Here is the defition of the 3 monitors
  Option       "monitor-HDMI1" "EXT1"                 # Monitors are defined and addressed
  Option       "monitor-HDMI2" "EXT2"                 # via the name EXT?
  Option       "monitor-HDMI3" "EXT3"
  Option       "monitor-DP1" "DPS"                    # These entries are necessary.
  Option       "monitor-DP2" "DPS"
  Option       "monitor-DP3" "DPS"
  VendorName   "Intel"
EndSection

Section "Monitor"
     Identifier "DPS"
     Option "Ignore" "true"
EndSection

Section "Monitor"
       Identifier "VGA1"                            # DVI connections are used
       Option "Ignore" "true"                       # Deactivieren of VGA
EndSection

Section "Monitor"
  HorizSync    30-82
  Identifier   "EXT1"                               # See device section
  ModelName    "1280X1024@60HZ"                     # Definition of an LCD monitor without vendor
  VendorName   "--> LCD"
  VertRefresh  50-60
EndSection

Section "Monitor"
  HorizSync    30-82
  Identifier   "EXT2"                               # See device section
  ModelName    "1280X1024@60HZ"
  Option       "RightOf" "EXT1"                     # Right of monitor 1
  VendorName   "--> LCD"
  VertRefresh  50-60
EndSection

Section "Monitor"
  HorizSync    30-82
  Identifier   "EXT3"                               # See device section
  ModelName    "1280X1024@60HZ"
  Option       "LeftOf" "EXT1"                      # Left of monitor 1
```

```
  VendorName   "--> LCD"
  VertRefresh  50-60
EndSection

Section "ServerLayout"
  Identifier   "Layout[all]"
  InputDevice  "Keyboard[0]" "CoreKeyboard"
  InputDevice  "Mouse[1]" "CorePointer"
  Option       "Clone" "off"
  Option       "Xinerama" "off"                    # Xinerama is not possible
EndSection

Section "DRI"
    Group      "video"
    Mode       0660
EndSection

Section "Extensions"
  Option       "Composite" "on"
EndSection
```

6.5.2 Other multiscreening configurations

Then put the computer in runlevel 5 (as Linux superuser 'root' with the `init 5` command) and log in as a CC-Account user (Engine / runtime / operator).

Log yourself in on a console as the Linux superuser (via `sux - root` command) and then execute the "`nvidia-settings`" command.

Prerequisite for the configuration via 'NVIDIA X server settings' is that all monitors are connected.

Start the '*NVIDIA X server settings*' tool and choose the "**X server display configuration**" item. You should find all of the screens here, which are connected to the graphic card(s).

If this is not the case then actualize the view with the [**Detect Displays**] button. It may be necessary to press the button several times.

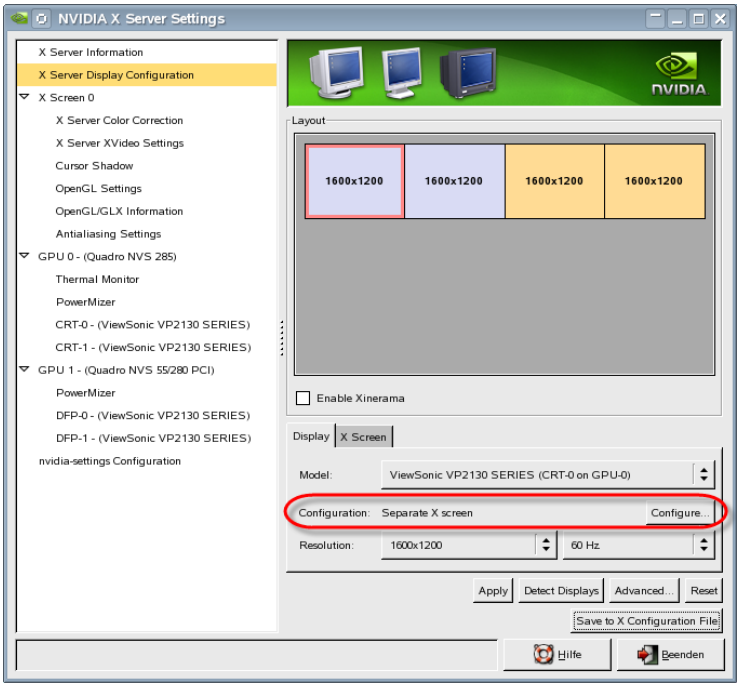


Illustration 106: NVIDIA X Server Settings

If one selects a screen, one obtains the current configuration.

The configuration type of the current display is shown in the "**Configuration**" item. This field can have the following values:

a) **Disabled**:
The screen is deactivated

b) **Separate X-Screen**:
The screen has its own workspace with program bar and menu

c) **TwinView:**
The screen builds a common workspace with a second screen, in which one can move windows and maximize them to the entire workspace.
Limitation: There can always only be 2 screens in a group.

A solution for this is the "Xinerama" mode, which will be described in the point d).

d) **Xinerama:**
All of the configured screens build a common workspace in "Xinerama" mode. All of the screens must possess the "**Separate X-Screen**" type as basis for the Xinerama mode. This option can be activated with the "Enable Xinerama" option.

Resolution and screen frequency are set with "**Resolution**". It is recommended **to set definite values here** and not to use the "Auto" option.

After choosing the *X Screen* tab, the position of the screen is stated in "**Position**". We recommend that the left monitor obtains the absolute position, and the rest of the monitors are adjusted according to it.

If one has configured a 4-times Multiscreening and "**TwinView**", the leftmost screen of the "screen pair" is to be configured as absolute and the rightmost monitor adjusted according to it.

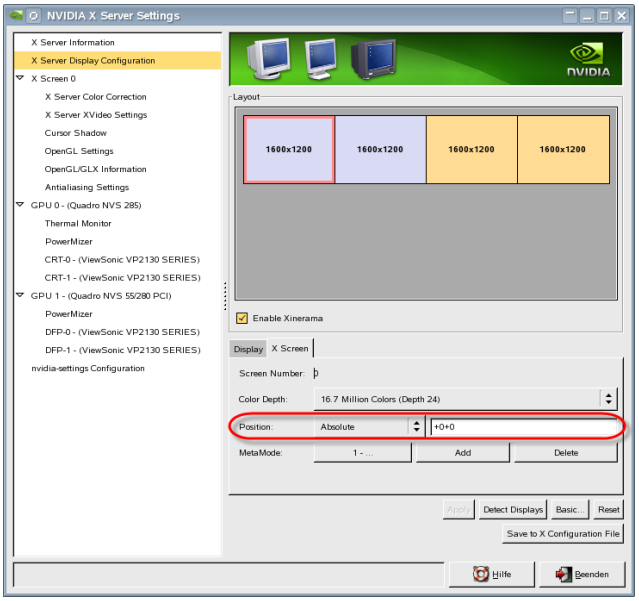


Illustration 107: Defining the position

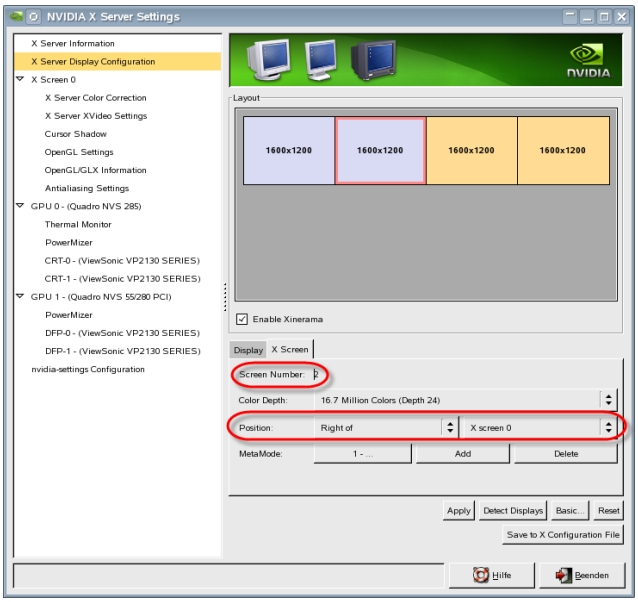


Illustration 108: Alignment of the 2nd monitor

After the configuration has finished it must be saved with the [**Save to X Configuration File**] button. The following window appears.

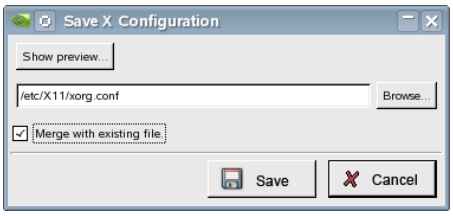


Illustration 109: Saving the X configuration

One can see the configuration (`xorg.conf`) beforehand, and eventually change it, with the [**Show preview**] button.

This could be necessary for example when using the "*Xinerama*" configuration type. If a configuration has been previously created with "Sax2" then the configuration file contains entries (lines) that cannot be interpreted by the Nvidia driver, which could leads to that the "*Xinerama*" mode does not work.

*When using the "Xinerama" mode open the configuration file via [**Show preview**] and check the configuration for the following marked lines.*

*If they are present then both lines are to be removed, the configuration then saved via [**Save**], and the program closed.*

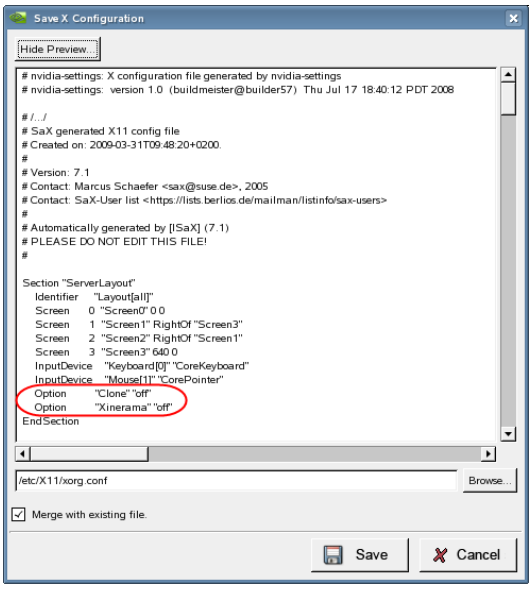


Illustration 110: Removal of the lines in the configuration file

An X server restart is necessary in order to load the configuration. This can be done either with [**STRG**] + [**ALT**] + [**Backspace**], or with the combination of an `init 3` Linux command on the console followed by `init 5`.

All open programs are to be saved and closed before the graphic is restarted.

If the configuration has been properly carried out then all screens must now light up briefly and show the NVIDIA symbol.

It is recommended to make a backup copy of the current configuration.

The configuration file is stored in the `/etc/X11` directory with the name `xorg.conf`.

6.6 Display and order of the monitors

Open the 'System settings' in the KDE menu and select the 'Display' item in the 'System management' section in order to display and check the monitor configuration in KDE.

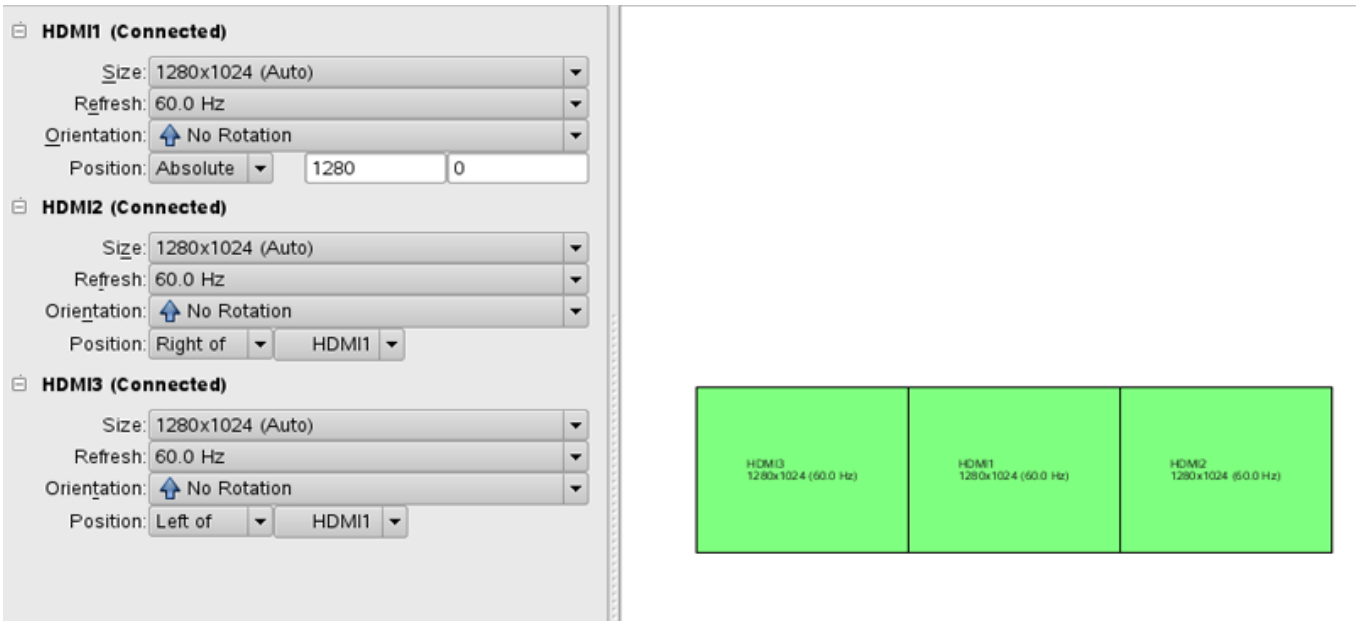


Illustration 111: Display of the monitor configuration

6.7 X displays for auto-start configured applications

The applications configured for auto-start in the APROL system can be duplicated on different monitors with **AprolConfig**. This take place in the 'Display' configuration aspect.

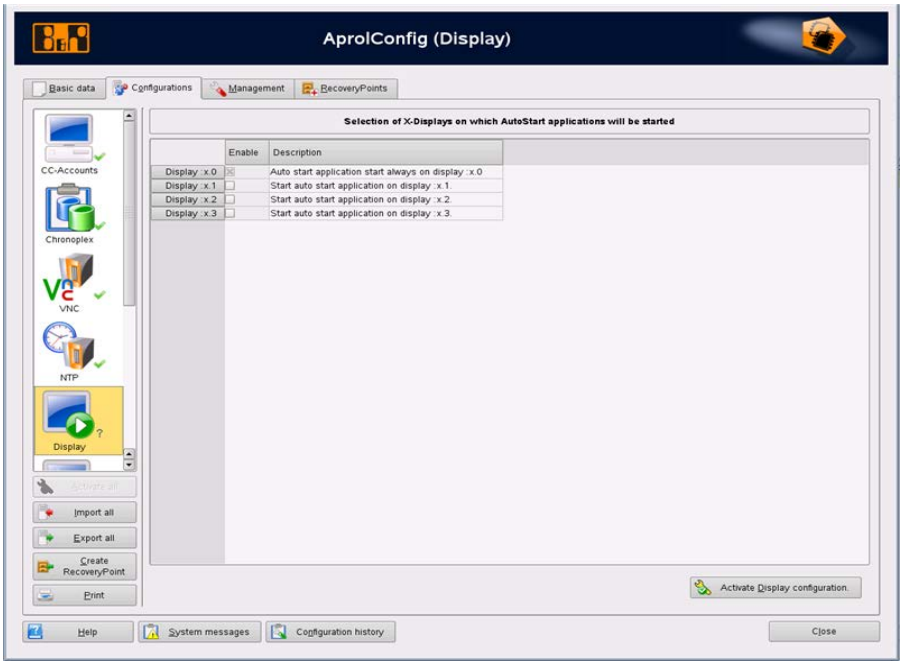


Illustration 112: AprolConfig: Display configuration aspect

Thereby, up to a maximum of **three** displays can be additionally chosen. The *Display :x.0* is always active. On application instance is started up to a maximum of **four times**.

A2-7 Touch-screen configuration

Multitouch Panel:

5AP933.240C-00

Chapter 'Multitouch Panel 5AP933.240C-00 and 5AP933.215C-00 installation / configuration'

5AP933.215C-00

Chapter 'Multitouch Panel 5AP933.240C-00 and 5AP933.215C-00 installation / configuration'

5AP933.156B-00

Does not have native APROL resolution and is not supported.

5AP933.185B-00

Does not have native APROL resolution and is not supported.

Other panel installation / configuration

Under constuction

If graphic problems occur during the AutoYaST installation (e.g. a continuous black screen), see chapter Problems when using the Intel graphic chip set in SLES 11

7.1 Multitouch Panel 5AP933.240C-00 and 5AP933.215C-00 installation / configuration

The following chapter explains how to operate a multitouch panel with an APROL server

Connection on the link module 5DLSDL.1001-00:

After the 24 volt B&R power supply is attached to the multitouch panel, connect the panel USB port with a USB type B -> USB type A cable, and a display cable (see the delivered instruction manual).

7.1.1 64 bit installation of the 3M driver

Download the 3M driver from the 3M support

Navigation: Enter link in web browser

For 64 bit:

```
http://solutions.3m.com/3MContentRetrievalAPI/BlobServlet?lmd=1336767763000&locale=en_US&assetType=MMM_Image&assetId=1319228114026&blobAttribute=ImageFile
```

Executing the driver for the respective architecture

Navigation: In a console as Linux superuser 'root'.

1) Change rights and call driver

`chmod +x MT7.14.0_0.bin64 ; ./MT7.14.0_0.bin64`	64 bit

2) Confirm the 'Software License Agreement Document' with 'Y'.

```
Y
```

3) Unpack the resulting twscreen.7.14.0.tar.gz.

```
tar xvfz twscreen.7.14.0.tar.gz -C /usr/local
```

4) Change to the new 'twscreen' directory.

```
cd /usr/local/twscreen
```

5) Install driver.

```
./Install
```

6) Re-link library

```
cd /usr/lib64/ ; ln -sfv /usr/local/twscreen/libTwSystemRnR.so libTwSystem.so
```

7) Re-link TwMonitor

```
cd /usr/local/twscreen ; ln -sfv TwMonitorRnR.bin TwMonitor
```

8) Configure boot service.

```
insserv -f /etc/init.d/TWDrvStartup
```

9) Set the **'AutoAddDevices'** entry in the **'ServerFlags'** section of the `/etc/X11/xorg.conf` file to **'on'** or expand the section with the entry if does not exist.

```
vi /etc/X11/xorg.conf
```

10) Reboot server.

Configuration finished 

7.1.2 32 bit installation of the 3M driver

Download the 3M driver from the 3M support

Navigation: Enter link in web browser 

For 32 bit:

```
http://solutions.3m.com/3MContentRetrievalAPI/BlobServlet?lmd=1336767758000&locale=en_US&assetType=MMM_Image&assetId=1319208999149&blobAttribute=ImageFile
```

Executing the driver for the respective architecture

Navigation: In a console as Linux superuser 'root'.

1) Change rights and call driver

```
chmod +x MT7.14.0_0.bin ; ./MT7.14.0_0.bin
```

32 bit

2) Confirm the 'Software License Agreement Document' with 'Y'.

```
Y
```

3) Unpack the resulting twscreen.7.14.0.tar.gz.

```
tar xvfz twscreen.7.14.0.tar.gz -C /usr/local
```

4) Change to the new 'twscreen' directory.

```
cd /usr/local/twscreen
```

5) Install driver.

```
./Install
```

6) Re-link library

```
cd /usr/lib/ ; ln -sfv /usr/local/twscreen/so6/libTwSystemRnR.so
libTwSystem.so
```

7) Re-link TwMonitor

```
cd /usr/local/twscreen ; ln -sfv TwMonitorRnR.bin6 TwMonitor
```

8) Configure boot service.

```
insserv -f /etc/init.d/TWDrvStartup
```

9) Set the **'AutoAddDevices'** entry in the **'ServerFlags'** section of the `/etc/X11/xorg.conf` file to **'on'** or expand the section with the entry if does not exist.

```
vi /etc/X11/xorg.conf
```

10) Reboot server.

Configuration finished 

7.1.3 Post configuration / uninstallation of the 3M driver

A post configuration (calibration) can be made with the 'StartCP' tool.

```
/usr/local/twscreen/StartCP
```

An uninstallation is carried out with 'Remove'.

```
cd /usr/local/twscreen ; ./Remove
```

7.2 Other panel installation / configuration

This description is under construction at present.

Please inform yourself regularly about the current APROL documentation in the 'Downloads' section of our internet page **www.br-automation.com**.

Possible connection types

Connection based on DVI cable + serial cable

Connect your automation panel per DVI cable (5CADVI.00xx-00) with the servers DVI connection. The display must be connected with the serial interface (COM1) of the server with the help of the serial cable (9A0014.xx).

This design can be used for all conventional graphic cards, and standard computers.

Connection based on SDL cable

The automation panel must be equipped with an SDL card (5DLSDL.1001-00). A connection between APC and automation panel takes place with SDL cable (5CASDL.00xx-0x or 5CASDL.0400-13).

SDL uses a conventional DVI plugs, and can only be used with B&R APCs.

A configuration in BIOS must be carried out for a touch-screen connection based on SDL.

In advanced ? The parameters of the serial port B must be noted I/O Device Configuration.

Thereafter, the serial port B is disabled.

You can access COM port C with **Advanced ► Baseboard/Panel Features ► Legacy Devices.** This is enabled and contains the parameters of serial port B. Subsequently the changes can be saved with F10, and the APC booted.

Attention: The touch-screen is now interpreted as ttyS1, as the serial port B is disabled. Therefore: Serial Port A … ttyS0, COM C … ttyS1

.

7.2.1 Configuration with SaX2

Start "sax2" in the console as root in order to configure the touch-screen.

In
[Change configuration]
► Setting according to image

[**Change Configuration**]

► ***[OK/]***

Pay attention to changed connection port (ttyS0/ttyS1) with connection based on DVI cable + serial cable, or alternatively connection based on SDL cable!

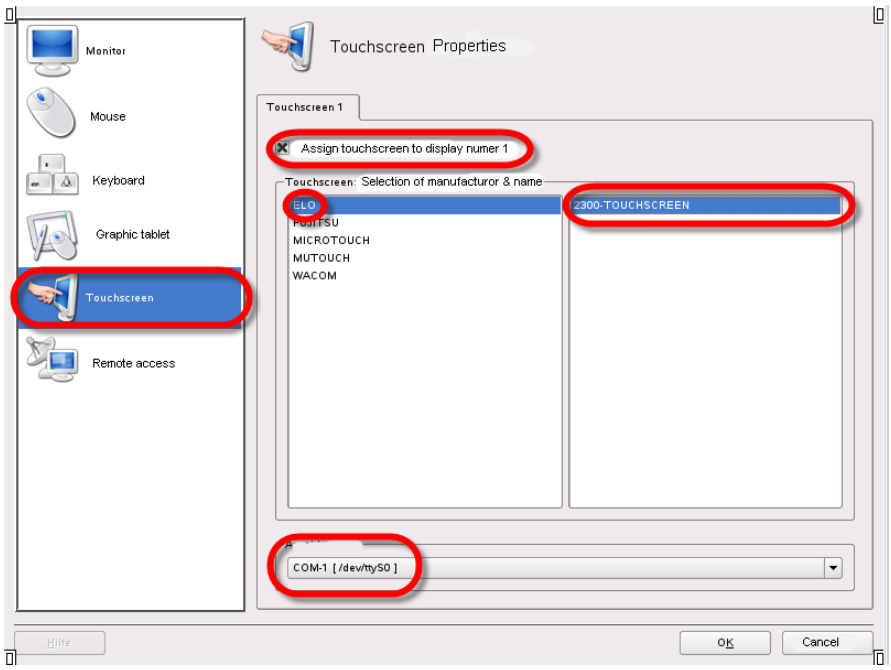


Illustration 113:

► *[Test/]* ► ► *[Save]* ► *[Close SAX2 -Yes]*

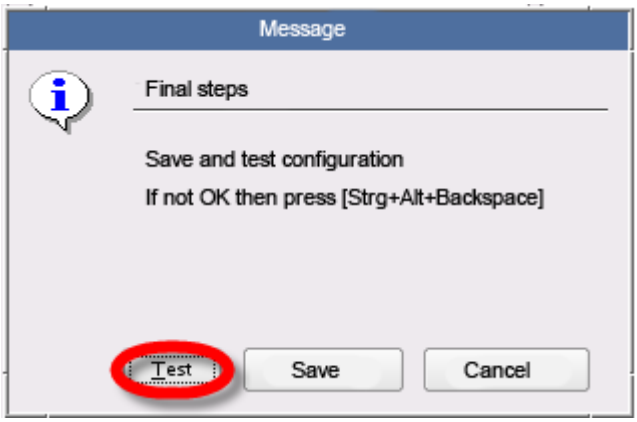


Illustration 114:

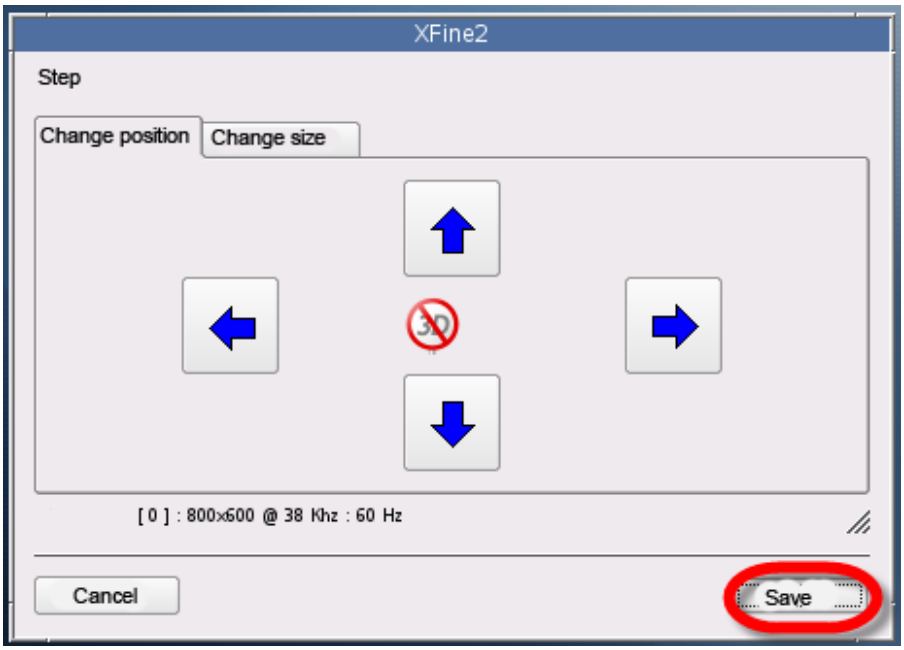


Illustration 115:

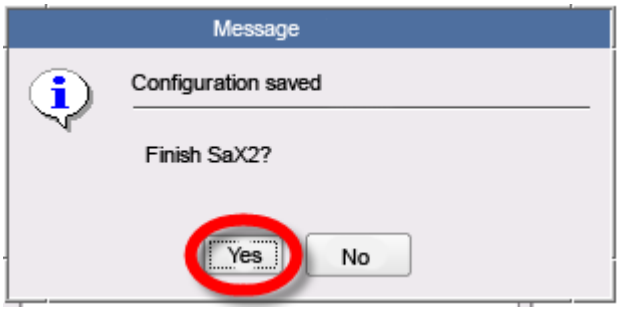


Illustration 116:

Init 3

Init 5

Thereby, the graphical user interface is re-started.

Log in and start the following command in the console:
od -h -w10 </dev/ttyS0

If the touch-screen is touched after the command has been carried out, then it returns the coordinates of the touch. The general functionality of the touch-screen can be tested with this.

7.2.2 Touch-screen calibration

There are different possibilities to calibrate an Automation Panel or a touch-screen.

7.2.2.1 Use of the Linux tool 'touchcal'

The automatic panel can be calibrated with the Linux tool *touchcal*.

Proceed as follows to calibrate the touch-screen:

Step	Description

Step	Description
1	Log on as LINUX superuser "**root**".
2	Switch the computer into runlevel 3 with the `init 3` command.
3	Change to the [F2] console, for example, with the key combination Ctrl + Alt + [F2]. Basically, with the exception of console [F1], any console can be chosen.

The APROL banner is shown on the console [F1] in the bottom area of the screen. The complete screen area must be available for the calibration.

Step	Description
4	Enter the command "touchcal e /dev/ttyS<x>". Enter "ttyS0" as the interface description, for example, for the COM1 interface.
5	Thereafter, 4 points are displayed after another on the touch screen. Please touch the points that are displayed one after the other, and confirm each your actions by pressing the [**Enter**] key.
6	4 coordinates are returned (MinX, MaxX, MinY, MaxY), which must be noted and subsequently entered in the configuration file `xorg.conf`. For this, please note chapter *Adjusting the configuration file*.
7	The calibration is finished.

When entering the coordinate values for MinX, MaxX, MinY, MaxY into the configuration file, please pay attention that there is an exact match of the detected values, as well as to their order.

The configuration file `xorg.conf` is located in the directory `/etc/X11/`.

7.2.2.2 Use of the ELOCALIB.exe tool

You need a "DOS boot disk" with the following additional DOS programs in order to re-start the APC with DOS.

ELOCALIB.EXE---> (DosWin3_1_V2_Oc.zip)
(Calibration tool)

ELODEV.EXE----> (Elodev_update_dos.zip)
(Touch-screen driver)

Download:
http://www.br-automation.com/cps/rde/xchg/br-productcatalogue/hs.xsl/service_67768_ENG_HTML.htm

Note:

A USB stick can be used as a DOS boot disk with the freely available tool „HP_USB_Boot_Utility.exe“!

The files for the creation of the USB stick can be found packed on the APROL DVD in the root directory `/windows_drivers_and_tools`.

The name of the archive is:

BootableUSBStick_ELO_TouchScreen.zip.

Format the USB stick giving the path of the DOS directory

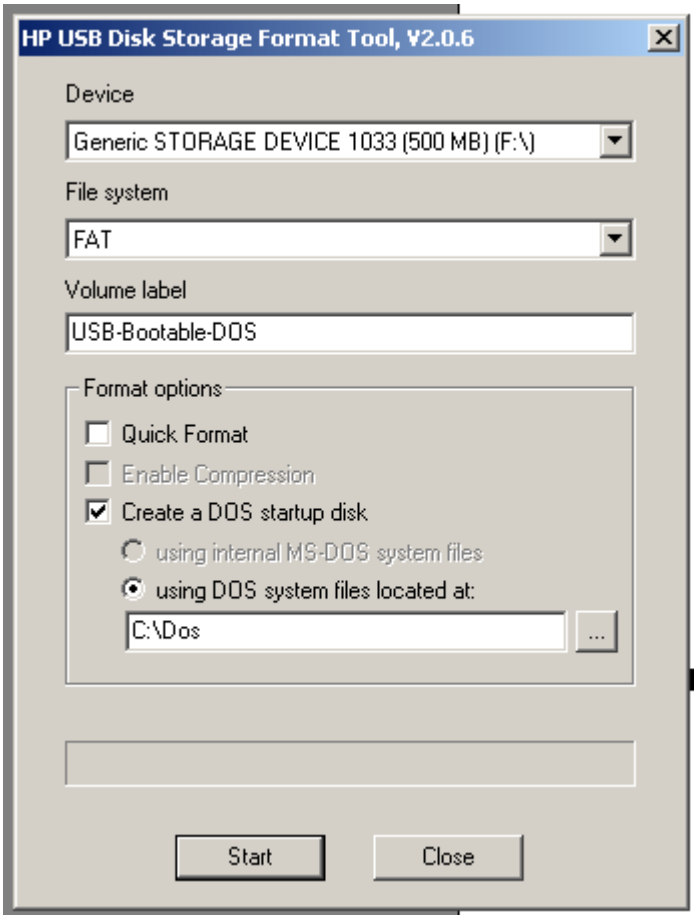


Illustration 117

Afterwards, both of the files ELOCALIB.EXE and ELODEV.EXE must be additionally copied to the USB stick.

After booting, the start of the touch-screen driver takes place with the following command:

ELODEV 2310,1,9600

2310 … Type
1 … COM port
9600 … Transfer rate

Afterwards, the calibration toll is started:

ELOCALIB.EXE

The first step in this tool is the choice of the resolution (e.g.: 1280x1024 with a 19" automation panel). The choice is confirmed with ENTER, and the actual calibration is accessed with "C". 3 points are shown here after another, which must be pressed on the touch-screen.

4 coordinate values are returned **(XLow.... YHi)** and must be written down and entered into the configuration file later on.

7.2.2.3 Adjusting the configuration file

The following entries can be found in the file xorg.conf (opened for example with vi or kwrite) in the
/etc/X11/
directory, in the "InputDevice" section:

Identifier "touchscreen1" (the entry „Mouse[3]“ is also possible)
Driver "elographics"
Option "Device" "/dev/ttyS0"
Option "AlwaysCore"
Option "screenno" "0"
Option "MinX" "600"
Option "MaxX" "3600"
Option "MinY" "600"
Option "MaxY" "3600"
…

These 4 coordinate values must now be adapted to the returned values from the calibration.

MinX = **XLow** (z. B. 444)
MaxX = **XHi** (z. B. 3654)
MinY = **YLow** (z. B. 468)
MaxY = **YHi** (z. B. 3574)

The computer must be newly started after this configuration file has been customized.

A2-8 Redundant networks

8.1 General information about network redundancy

More and more demands are constantly being placed on process control systems. The most frequent demand is a high degree of availability. In the worst case, a failure of the PCS can lead to a production standstill.

By using the network redundancy mechanism, the first step is taken to secure against the failure of a network line or card in one of the PCS servers. The machines in the PCS that handle the **process control** (Runtime server) and **interactive process control** (operator stations) components should always be connected to one another.

8.2 APROL network redundancy

Every computer, which is set up as an operator station, engineering, or runtime server can be equipped with **two or more network cards**. Parts of the communication system can therefore exist twice, even the lines to the connections (bus). However, each bus (Control bus / process bus) can only have one IP address. Several network cards must be grouped to one device in order to achieve this. This functionality is realized via bonding.

Bonding is a driver that groups several network cards and is integrated as a module in the kernel.

With the structure mentioned above, one line can be disconnected (cable break) or a network card can fail without the connection between the computers being disrupted. A loss of data does therefore not occur in the scenarios that have been mentioned.

*Equipping a computer with several network cards is not the problem. What's important is that the computer can be accessed using **both network cards** but **ONE IP address**! Linux **bonding** makes this possible.*

The following illustration shows a schematic overview of bonding:

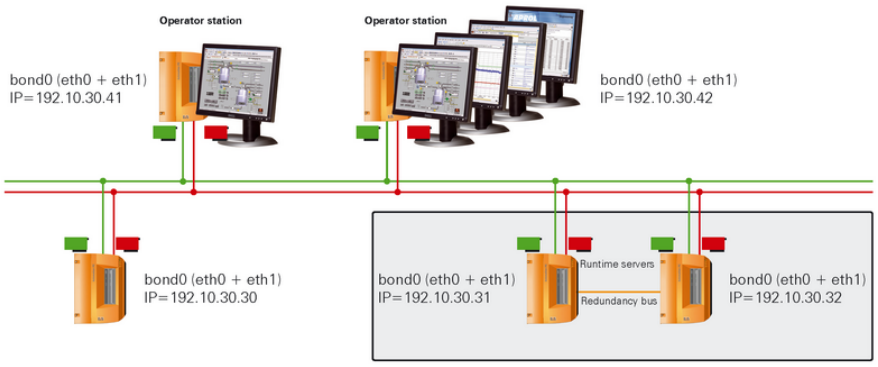


Illustration 118: Network redundancy between the PCS's computers

8.3 Technical information about bonding

The following describes how several physical network cards can be grouped together into a single virtual network card.

The configuration is carried out as Linux super user 'root'.

*You normally have to use network cards that support **MII link status detection**. Configuring bonding for all other technologies is much more difficult, requiring kernel sources that are normally included with the AutoYaST Installation DVD.*

If you need information about this, please read the following file when the kernel source is being installed:

`/usr/src/linux/Documentation/networking/bonding.txt`

Or visit the website of the bonding project:

http://sourceforge.net/projects/bonding/

The network cards being used and their respective drivers must be able to check whether a network connection or link exists. There are two ways to carry out driver-dependent checks using software tools:

Tool	Description
ethtool	For MII link status detection. This tool is located in `/usr/sbin/`. Options listed using `ethtool`.
arp (special case)	This tool is located under `/sbin/`. Options listed using `arp -help`.

Furthermore, there are three common ways to check the link status using the network card drivers.

Check	Description
MII link status detection	Checking with MII link status detection is the method supported by most new network cards. This method should always be the one to be used.

Check	Description
ARP monitoring with register *last_rx* or *trans_start*	Using ARP monitoring is also a common method. However, it may cause slight problems with bonding and should only be chosen if the kernel source is installed on the computer (**special case!**). This source has to determine whether the network card drivers are working with these registers. This is only detected with the help of the driver source. With the *ARP monitoring method*, the driver must either support the *last_rx* or the *trans_start* register. In the *via-rhine.c* driver source code, you have to run a search for *last_rx* or *trans_start*.
Via the *netif_carrier* register in the driver	This method should be chosen only if the kernel source is installed on the computer (**special case!**). This source has to determine whether the network card drivers are working with these registers. This is only detected with the help of the driver source. For the method via the *netif_carrier* register, search for that exact string in the driver's source code (via-rhine.c).

*We recommend the **MII link status detection**. You get important information in the kernel source, which is normally on the AutoYaST installation DVD, for the other checking methods.*

The following requirements should be met to avoid problems during installation and configuration:

- It is important that **all of the drivers being used support the same method**. It is not possible to combine the different methods for checking the link status.
- **Identical network cards** should be used.
- If it's not possible to use identical network cards, then the respective drivers should use the same option (method) for checking whether the network card has a link or network connection.
- Your cards should be installed from YaST2 and the drivers should be monitored to see how they work.

***Fixed IP addresses** should be used for the bonding configuration. The allocation of IP addresses via DHCP is also principally possible, although in this case it is not recommended by B&R.*

*It is **absolutely necessary** to **check / re-adjust the file `/etc/hosts`** when using more than one network card and a post-configuration of the cards is carried out **with YaST2**.*

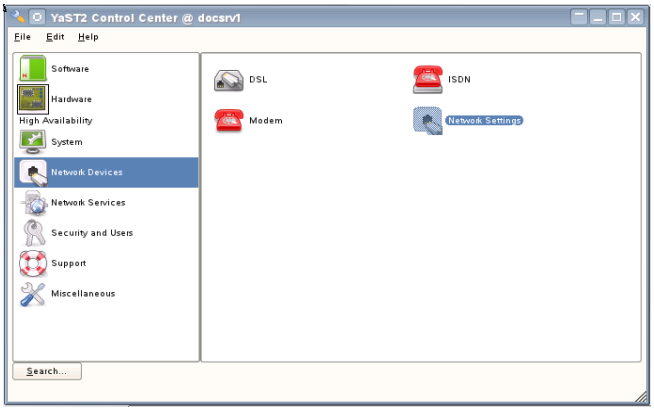
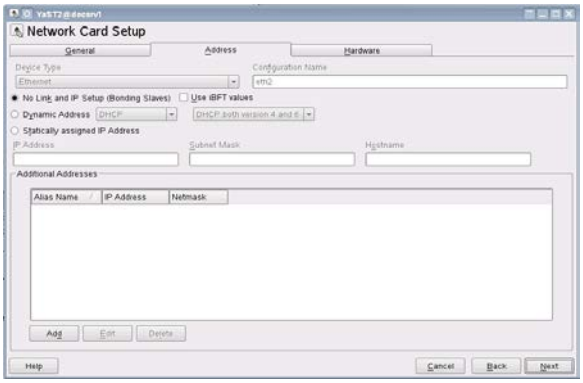
See chapter Configuring /etc/hosts)

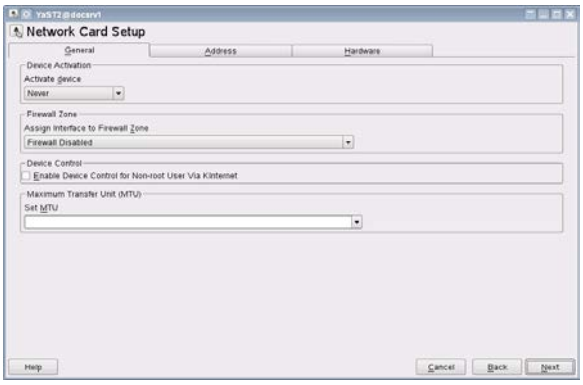
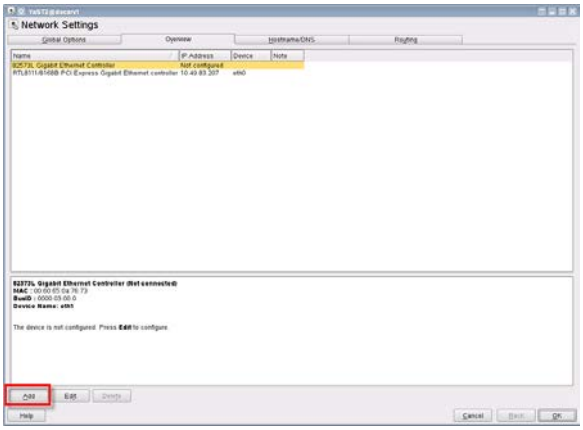
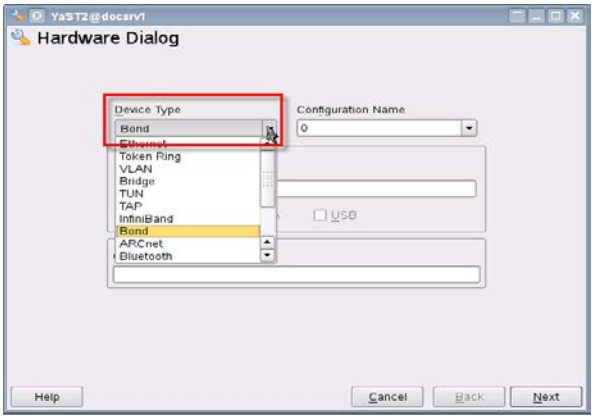
Bonding should only be set up once you have determined that there is a common method being used to check the link status.

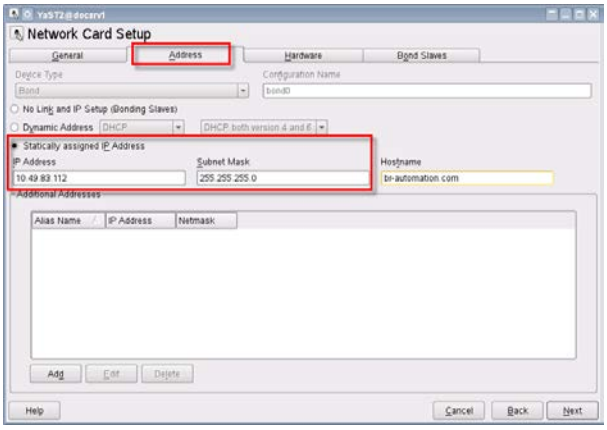
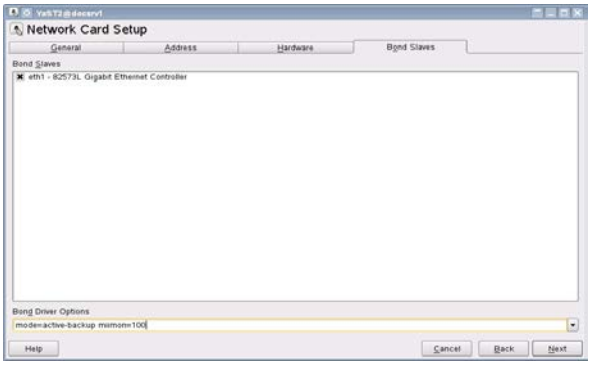
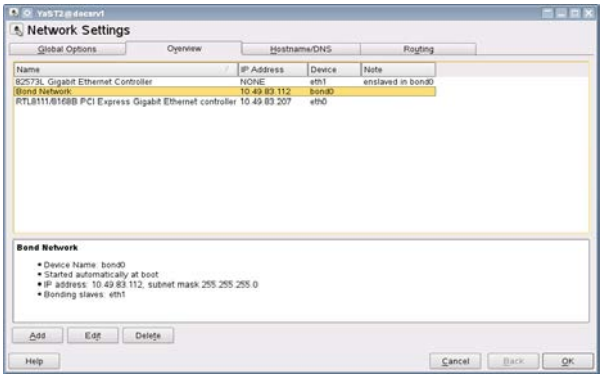
8.4 Bonding configuration via YaST

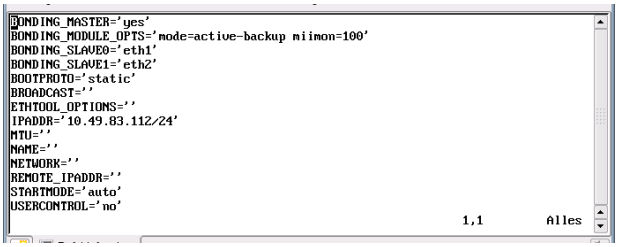
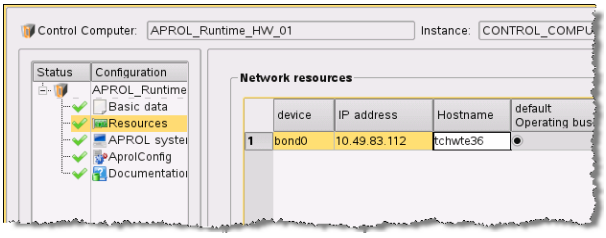
The following example configuration describes the combination of double network cards for an active backup (Bonding mode=1).

It is therefore recommended to make a backup copy of the `/etc/hosts` file before carrying out a configuration with YaST, in order to be able to restore it without problems if it is needed at a later stage.

Step	Short description
1	Start YaST with the '**SUSE menu / System / System Settings (YaST)**' KDE menu. You need the rights of the Linux super user 'root' in order to do this.
2	Select the '**Network Devices / Network Settings**' entry in the YaST control center.  *Illustration 119*
3	Press the [**Add**] button in the **'Network settings'** dialog in order to create a new network card as bond slave or the [**Edit**] button to configure an existing network card. The device type must be 'Ethernet'. If creating, select the **'Ethernet'** entry (default) in the **'Device type'** drop down menu in the **'Hardware dialog'** and confirm the dialog with [**Continue**].
4	'No IP Address (for linked device)' must be selected in the **'Address'** tab in the **'Configure Network Card'** dialog (instead of 'Dynamic Address' or 'Static IP Address'). By doing so, the network card is shown for selection in the bonding configuration ('Bonding slaves' tab).  *Illustration 120*

Step	Short description
5	The **'Device activation'** combo box must be set to **'Never'** in the **'General'** tab.  *Illustration 121* Repeat this configuration for another network card, so that two bonding slaves are available.
6	Press the [**Add**] button in the **'Network settings'** dialog in order to carry out a new bond configuration.  *Illustration 122*
7	Select the **'Bond'** entry in the **'Device type'** drop down menu in the **'Hardware dialog'** and confirm the dialog with [**Continue**].  *Illustration 123*

Step	Short description
8	Enter the IP address and the sub-net mask in the **'Address'** tab of the following **'Configure network card'** dialog.  *Illustration 124*
9	Select the **'Bond slaves'** tab in the same **'Configure network card'** dialog. Select the 'eth' interfaces (network cards) that should be consolidated to a bonding device. Then select the '**mode=active-backup miimon=100**' from the 'Bond driver options' drop-down menu. Confirm the dialog with [**Continue**].  Illustration 125
10	The configured bond network is shown in the **'Network settings'** dialog in the **'Overview'** tab. Confirm the finalization of the configuration by pressing the [**OK**] button. The respective configuration file is written by doing this.  *Illustration 126*

Step	Short description
11	The automatically created configuration file `ifcfg-bond0` is located in the directory `/etc/sysconfig/network/`.  *Illustration 127*
12	An adjustment / checking of the `/etc/hosts` file must definitely be carried out afterwards. E.g. double entries which may have occurred must be removed. See chapter Configuring /etc/hosts
13	The respective data (device / IP address / host name) must be entered for the process buss, control bus, and alignment bus in the CaeManager, **'Control computer'** project part, aspect **'Resources'**.  *Illustration 128*

8.4.1 Additional information (kernel source required)

Some network cards need longer for the initialization in combination with the *bcm5700* or *tg3* drivers. When restarting the system, this may result in that the bonding interface cannot be started. Once the network is restarted, however, bonding works again with no problems. This problem can be avoided by loading the corresponding driver shortly after the system start takes place.

To do so, edit the `/etc/sysconfig/kernel` file and add the respective driver for the network card with the `MODULES_LOADED_ON_BOOT` parameter.

Example:

```
MODULES_LOADED_ON_BOOT="tg3"
```

8.5 Improved availability due to process bus redundancy

The following are possibilities in APROL for reaching a maximum protection against failure of the process control system.

The process bus redundancy can be implemented for connecting the controller to the runtime system. A specification for this is that the controller has two Ethernet interfaces. The interfaces must be configured with IP addresses from two separate network segments.

In the case of redundant runtime servers, any network interfaces that are configured for redundancy on the control bus must have the same IP address because the APROL process database 'Iosys' manages exactly two IP addresses (one for the master and one for the slave) The Linux bonding must be used for the control bus because of this.

The Linux bonding must also be used for the process bus, as only one process bus exists from the controller's point of view. In doing so, IP addresses from both segments of the redundant process bus must be configured for the bonding devices.

Detailed information can be found in the following example.

Both networks (control and process bus) in the following example are already redundant due to the ring structure (regarding the failure of a switch or a connection between the switches).

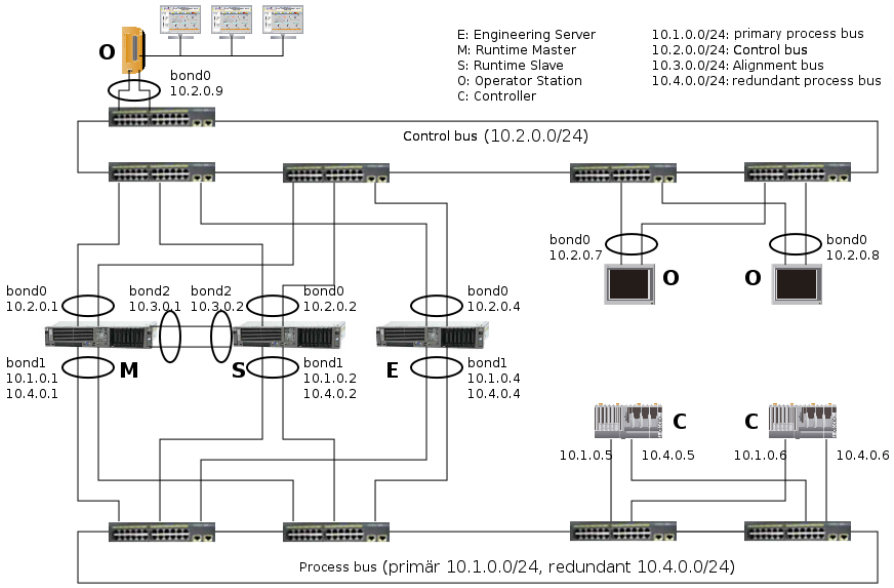


Illustration 129: Example of a process control system with process bus redundancy

Controller:

The controller must have two Ethernet interfaces for the process bus redundancy.
This is the onboard interface for controllers of the 'B&R System 2005' series (E.g. CP382) and an 'IF781' interface card. Controllers in the 'X20' series have two onboard interfaces.

A bonding configuration on the controller is not possible with the current AR.

The Ethernet interfaces must be configured with different network segments, one with an IP address from the primary and one with an IP from the redundant process bus.

These are as follows for the left controller in the example: 10.1.0.5 and 10.4.0.5, as well as 10.1.0.6 and 10.4.0.6 for the right controller.

The '-ipPrimary' and '-ipSecondary' parameters must be set to the respective IP addresses in the configuration of the InaDriver in the APROL system project part; in out example, 10.1.0.5 and 10.4.0.5 for the left, and 10.1.0.6 and 10.4.0.6 for the right controller. The '-inaPortPrimary' and '-inaPortSecondary' options must be different. 1159 and 1160 are used here as default. Either the 'EthernetRedundancy' or 'EthernetNodeRedundancy' value must be selected for the '-medium' option. The InaDriver options are explained in detail in the manual X99.

The connections are not connected with the same switch in order to ensure an additional protection against failure regarding a cable connection or the failure of a switch.

Operator stations:

The operator stations can be operated with bonding. In this case, the cable connections are also connected to two switches. The bonding device has an IP address from the control bus network (10.2.0.7 and 10.2.0.8 in the example). If only one switch can be reached by an operator station, it can be connected like the operator station on the top left of the illustration (IP address 10.2.0.9).

If it is necessary to have a connection from an operator station to a controller, e.g. when the ControllerManager is opened, a runtime server must be configured as a network gateway, over which the data traffic can be routed to the process bus. If the possibility exists in operating another network interface, the connection to the process bus can be established with it. If this is not the case, then a bonding cannot be carried out.

Runtime server:

The boding devices with which the runtime servers are connected to the control bus have the respective IP addresses (10.2.0.1 and 10.2.0.2 in the example). The cluster for the control bus also runs over these devices (With the IP address 10.2.0.3 in the example).

The boding devices with which the servers are connected to the control bus have the respective IP addresses from the primary process bus network (10.1.0.1 and 10.1.0.2 in the example). The cluster for the process bus also runs over these devices.

In the case of a redundant process bus, these bonding devices need a further IP address from the redundant process bus network (10.4.0.1 and 10.4.0.2 in the example). This is necessary so that the runtime server can be reached over an IP address from the redundant process bus network if the primary process bus connection of a controller fails.

The addition of another IP address is carried out via YaST (See following illustration). The alias that is specified for the additional IP address can be chosen freely; 'R' is used in the example.

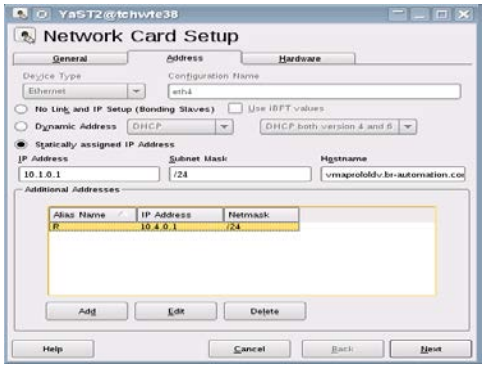


Illustration 130

The resulting configuration file '`ifcfg-bond01`' is located in the directory `/etc/sysconfig/network` and has the following contents in the example:

```
BONDING_MASTER='yes'
BONDING_MODULE_OPTS='mode=active-backup miimon=100'
BONDING_SLAVE0='eth0'
BONDING_SLAVE1='eth1'
BOOTPROTO='static'
BROADCAST=''
ETHTOOL_OPTIONS=''
IPADDR='10.1.0.1/24'
MTU=''
NAME=''
NETWORK=''
REMOTE_IPADDR=''
STARTMODE='auto'
USERCONTROL='no'
IPADDR_0='10.4.0.1/24'
LABEL_0='R'
```

The alignment bus (10.3.0.1 and 10.3.0.2 in the example) represents an eventual direct connection over a separate network (also redundant in this case).

A further network card must be used if this connection is to be configured for redundancy.

Engineering server:

The engineering server is connected to the control and process bus in the same way as the runtime server. The bonding device on the control bus has the IP address 10.2.0.4. The bonding device on the process bus has an IP address 10.1.0.4 from the primary process bus network and an additional IP address 10.4.0.4 from the redundant process bus network. Thus, a download is still possible if a controller's primary process bus connection fails.

A controller must be able to reach the cluster via the cluster IP address from the primary process bus, amongst others, for the logging of events in SFCs. If the primary process bus connection of a controller has failed, it cannot reach this cluster because a second cluster IP address from the redundant process bus network cannot be configured.

Detailed information about this can be found in chapter Cluster for redundant runtime servers.

A2-9 Cluster for redundant runtime servers

A **'Cluster'** is a group of computers and ensures that redundant control computer pairs can be reached with one virtual computer name and one virtual network address.

Clusters are used in APROL to increase the **availability** (High Availability-Cluster).

If a computer (hardware) fails, a second is available to adopt the tasks immediately, without any data loss.

A cluster consists of:

- 2 redundantly configured control computers
- Mutual cluster names (like host names)
- Mutual cluster IPs (Unique IP addresses in the network)

The functionality of a cluster is shown in the following illustration:

The operator station 'aprolop' contacts a redundant logging server via the virtual cluster name 'aprolredugc' and always contacts the master (Control Computer) with process control.

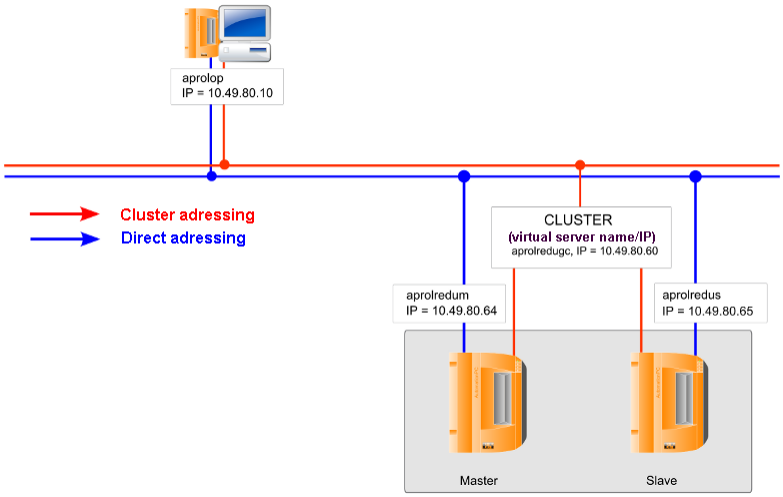


Illustration 131: Overview of a simple cluster

9.1 Why are clusters necessary in APROL?

A cluster is used to offer security when a control computer on which a runtime system is running fails. The redundantly configured control computers build a cluster together with their mutual cluster name and cluster IPs.

APROL differentiates between a **'Global cluster'** and a **'Local cluster'**.

Global cluster

The use of a protocol or documentation server on a redundant control computer necessitates the configuration of a global cluster.

The protocol / documentation server is used for the web-based operator queries of the historical data (apart from trend data) and the documentation.

The global cluster is composed of one global cluster name and one global cluster IP.

The redundancy switching of the global cluster depends on the status of a control computer and not a runtime system (Iosys) and is controlled by the 'keepalive' daemon (see chapter *Global cluster*)

It is definitely necessary to configure an APROL system of the type 'Runtime system' on the control computer which is being used as a logging server. This does not depend on the fact that the control computer is set up for redundancy.

Local cluster

A local cluster is necessary when a runtime system is assigned to a redundant control computer.

The local cluster is composed of one local cluster name and one local cluster IP. At least one local cluster name and one local cluster IP are required for the control bus of each runtime system.

If the process bus is different to the control bus, a further local cluster (process buss cluster) must be configured for each runtime system.

The redundancy switching of a local cluster depends on the state of a runtime system (Iosys) and not that of a control computer.

The following table gives an overview of which data is assigned to which cluster:

Cluster type	
Global	Logging server (report access) E.g. Audit Trail, Shift logbook, ChangeControl
	Product documentation
Local	Trend recording
	Alarm and messaging system
	Diagnostics and system messages
	Parameter management
	SFC logging
	Iosys web interface
	Project documentation

The following illustration shows a redundant control computer pair (master / slave) with a multi-runtime system (Runtime1 and Runtime2).

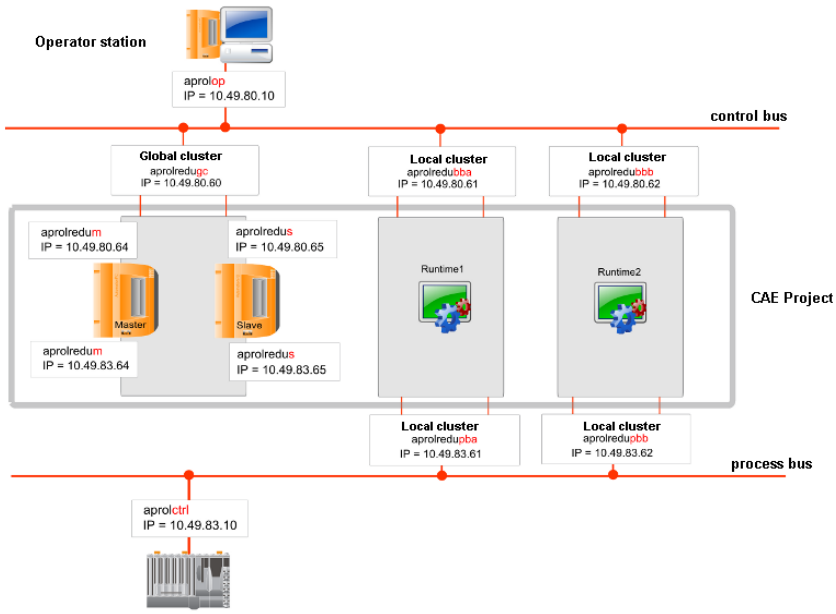


Illustration 132: Example of cluster configuration in APROL

9.2 Cluster configuration

Following requirements must be met for the configuration of a cluster:

- ✔ As of APROL release 3.6-00 (operating system SLES 11)
- ✔ Two computers to run redundantly
- ✔ Cluster names must be assigned / exist
  (unique virtual host name)
  1-2 global cluster names (protocol / documentation server)
  1-n local cluster names (1-2 each runtime system)
- ✔ IP addresses names must be assigned / exist
  (Unique virtual IP addresses)
  1-2 global cluster IPs (protocol / documentation server)
  1-n local cluster IPs (1-2 each runtime system)

The following steps must be carried out:

- ✔ *Global cluster configuration with AprolConfig*
- ✔ *Cluster configuration in the CAE project*
- ✔ *Necessary adjustments in Linux*

9.2.1 Global cluster configuration with AprolConfig

AprolConfig is used for configuring the **'Global cluster'** on an APROL server.

*This configuration must be carried out on **both redundant computers**. The configuration must be identical apart from the 'Master / Slave / Backup' mode.*

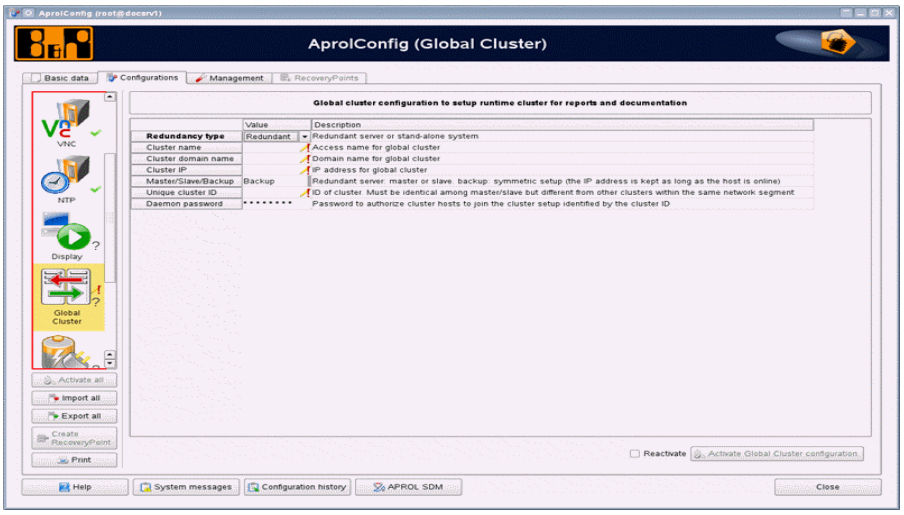


Illustration 133: AprolConfig with the 'Global cluster' configuration aspect

Navigation: AprolConfig / **'Global cluster'**	
Redundancy type	**Redundant**
Cluster name	**<Global cluster name>**
Cluster domain name	**<Global cluster domain name>**
Cluster IP	**<Global cluster IP>**

If it is desired that the protocol and documentation server are on different redundant control computers, then **one global cluster must be configured for each of them**.

Master/Slave/Backup	**<Master | Slave | Backup>**

Backup

The global cluster is normally configured as 'Backup' (Default) on both computers.

In doing so, both obtain the same priority and the control computer which boots first is the master with process control. Unnecessary redundancy switching is avoided in this way.

Master / Slave

It is also possible to configure on control computer as master (configured master) and the second as slave (configured slave).

In doing so, the configured master is always preferred, because it obtains a higher priority in the configuration. It always becomes the 'process control master' when it is ready.

This may be useful if different hardware with different hardware performance is being used. The hardware with the higher performance should therefore be the master.

The switching is controlled from the 'keepalived' daemon according to the priority that has been configured (see chapter *Global cluster*).

Unique cluster ID	**<Cluster ID>**

The same cluster ID is to be assigned to both master and slave.

*It must be ensured that the cluster ID is **unique in each network segment**.*

Daemon password	**<Daemon password>**
Confirm with [**Activate**]	
Continue with *Cluster configuration in the CAE project*	

This 'Global cluster' must also be entered in the corresponding 'Control computer' project part in the CAE project.

A simplification is to export the global cluster configuration at this point, and to import the global cluster configuration in the project part in the CaeManager.

(see Import and export functionality)

The export from AprolConfig can be done with [**Export all**] *and is stored in the file system for a later import in the 'Control computer' project part.*

After the 'Global cluster' that is used as documentation or logging server has been changed in the CAE project, in the 'Control computer', the 'Global cluster' aspect in AprolConfig must be checked and eventually adjusted.

9.2.2 Cluster configuration in the CAE project

The following configuration is necessary in the CAE project:

- 'Control computer' project part of the master and slave
- global cluster names (1-2 protocol / documentation server)
- global cluster IP (1-2 protocol / documentation server)
- local cluster names (1-2 each runtime system)
- local cluster IPs (1-2 each runtime system)
- 'APROL system' project parts

9.2.2.1 Master data of the master

The 'Control computer' project part must be configured for redundancy.

Illustration 134: Redundancy master

Navigation: Project / Control computer (master) / **Master data**	
Documentation server	**Enabled**
Logging Server	**Enabled**
Redundancy server	**Enabled**
Master	**Enabled**

When the slave configuration has been made, the respective slave will be entered automatically in the 'Configured slave' field.

The checkboxes must be activated respectively if the redundant control computer is used as 'Documentation server' and/or 'Logging server'. This is the case in our example.

Illustration 135: Server usage

If the control computer is used as an APROL documentation and/or APROL logging server, **the specification of a 'Global cluster' must definitely be made**.

The 'Global cluster' is independent of the redundancy switching for individual runtime systems, because the data being queried is from the entire CAE project.

It is still possible to enter a global cluster for other purposes if no documentation or logging server is used on this hardware (E.g. For a redundant LDAP server).

The benefit of this central acquisition in the CAE project is the plausibility check in APROL, i.e. names that are repeated are marked as an error.

Enter the cluster data which were already allocated in AprolConfig in the 'Global cluster' aspect.

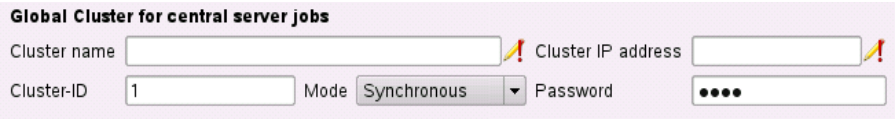


Illustration 136: Global cluster

Alternatively, you can use the import mechanism if the data were exported from AprolConfig beforehand (see *Import and export functionality* / *Global cluster configuration with AprolConfig*).

Navigation: Project / Control computer (master) / **Master data**	
Cluster name	**<Global cluster name>**
Cluster IP address	**<Global cluster IP>**
Mode	**<Master | Slave | Synchronous>**
Cluster ID	**<Cluster ID>**
Password	**<Daemon password>**

Enter the local clusters, which are intended for the individual runtime systems.

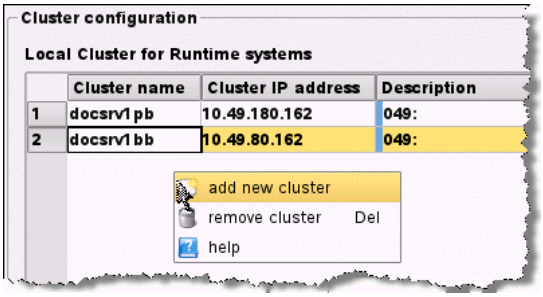


Illustration 137: Local cluster

Navigation: Project / Control computer (master) / **Master data / Cluster configuration**	
Right mouse button	**Insert new cluster**
Cluster name	**<Cluster name>**
Cluster IP address	**<Cluster IP>**
Continue with *Resources of the master*	

A local cluster is mandatory for the **control bus** of each runtime system.

If the control bus and the process bus are different (i.e. they use different network interfaces), an additional local cluster is required for the **process bus**.

The clusters are only configured in the 'Control computer' project part. An assignment of the type of usage takes place in the 'APROL system' project part.

9.2.2.2 Resources of the master

Enter the existing physical network interfaces and check the default suggestions for assigning the busses.

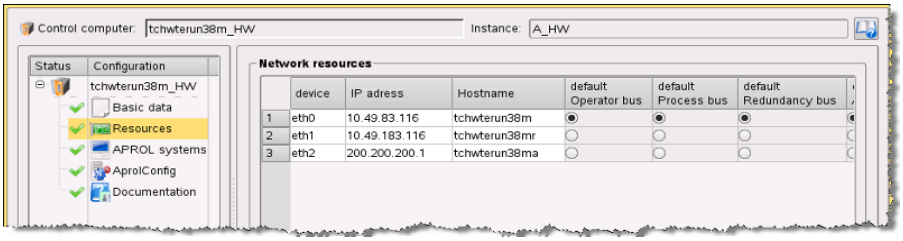


Illustration 138: 'Resources' section of the master

Navigation: Project / Control computer (master) / **Resources**	
Device	**<Network device>**
IP address	**<IP address>**
Host name	**<Host name>**
Default control bus	**<Device>**
Default process bus	**<Device>**
Default alignment bus	**<Device>**
Default alternative alignment bus	**<Device>**
Continue with *Master data of the slave*	

Switch to the project part of the respective slave after having saved, activated, and compiled.

9.2.2.3 Master data of the slave

After configuring the master, the slave is assigned to it.

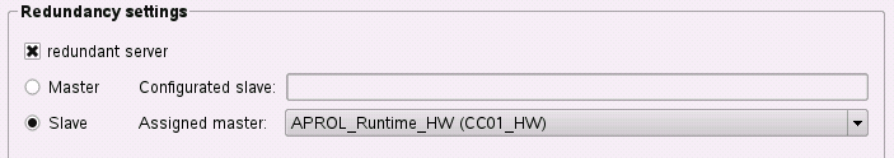


Illustration 139: 'Master data' section of the slave

Navigation: Project / Control computer (Slave) / **Master data**	
Redundancy server	**Enabled**
slave	**Enabled**
Assigned master	**<Master control computer>**
Continue with *Resources of the slave*	

- The cluster names and cluster IPs are entered automatically after the respective master has been selected.
- The server usage is entered automatically after the respective master has been selected.

9.2.2.4 Resources of the slave

Enter the existing physical network interfaces and check the default suggestions for assigning the busses.

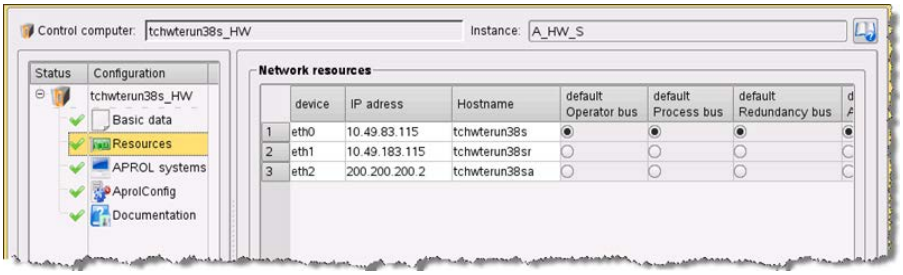


Illustration 140: 'Resources' section of the slave

Navigation: Project / Control computer (Slave) / **Resources**	
Device	**<Network device>**
IP address	**<IP address>**
Host name	**<Host name>**
Default control bus	**<Device>**
Default process bus	**<Device>**
Default alignment bus	**<Device>**
Default alternative alignment bus	**<Device>**
Continue with *Assignment in the APROL system*	

9.2.2.5 Assignment in the APROL system

The assignment to the control computer is done in the APROL system project part.

Illustration 141: Control computer assignment

Navigation: Project / APROL system / Master data / **Control computer assignment**	
<Control computer>	**<Master control computer>**
CC-Account	**<CC-Account of the runtime system>**

The corresponding control computer settings are detected automatically and are offered in the pending configuration.

The basis configuration that was made before in the 'Control computer' project part for the control bus, process bus, and local cluster names are only thought of as default values. An actual usage and final assignment is made in the '**APROL** system' project part.

A local cluster name must be assigned to each redundant **APROL** system. This cluster can be seen as '**APROL** system'-local. It is used to establish contact to the active Iosys of the **APROL** system.

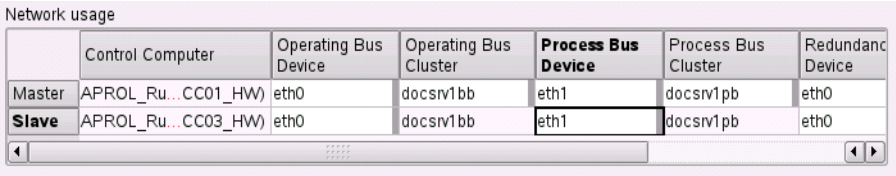


Illustration 142: Network usage

Navigation: Project / APROL system / Master data / **Network usage**	
Control bus device	**<Network interface>**
Control bus cluster	**<Cluster name>**
Process buss device	**<Network interface>**
Process bus cluster	**<Cluster name>**
(alignment bus)	**<Network interface>**
Alternative alignment bus device	**<Network interface>**
With that, the cluster configuration is finished.	

9.2.3 Special points for the SFC logging

If you are using the **Logging of the course of action of the SFC**, the local cluster of the process bus of each runtime system is used for that.

The local cluster IP is always active on the computer where the Iosys of the runtime system is running (actual master).

9.3 Necessary adjustments in Linux

A respective entry must exist in the `/etc/hosts` file of both computers.

This file can be edited after logging in as the Linux super user 'root'. The following syntax must be observed for a correct name resolution:

```
<IP address> <Fully qualified host name> <Host name>
```

E.g.:

```
10.49.83.89  docmaster.br-automation.com  docmaster
```

The `/etc/hosts` file must be adjusted manually on all of the servers which are involved.

Navigation: **Console**
`vi /etc/hosts`

Host names and IP addresses are only allowed to exist once in this file.

9.4 Checking the cluster

The result of the cluster configuration be controlled as described in the following chapter:

9.4.1 Global cluster

The 'keepalived' daemon is responsible for switching the global cluster.

The configuration file `keepalived.conf` (in the `/etc/keepalived/` directory) should be similar to the following sample file:

Navigation: **Console**
`vi /etc/keepalived/keepalived.conf`

```
! Configuration File for keepalived

global_defs {
   # string identifying the machine
   # APROL: clustername will be used here
   router_id tcsquishvmredu
   #(Global cluster name)
}

vrrp_instance VI_1 {
        # Initial state, MASTER|BACKUP
        # If state is MASTER:
        # As soon as the other machine(s) come up,
        # an election will be held and the machine
        # with the highest "priority" will become MASTER.
        # If state is BACKUP:
        # Disregarding the "priority" the machine stays "MASTER"
        # until it fails or goes down.
        state MASTER
        # interface for inside_network, bound by vrrp
        interface eth0
        # arbitary unique number 0..255
        # used to differentiate multiple instances of vrrpd
        # running on the same NIC (and hence same socket).
        virtual_router_id 152
        # VRRP Advert interval, secs (use default)
        advert_int 1
        # for electing MASTER, highest priority wins.
        # to be MASTER, make 50 more than other machines.
        priority 150
        # in case of state == BACKUP: nopreempt
        # nopreempt
        authentication {
            auth_type PASS
            auth_pass BuR1
        }
        virtual_ipaddress {
            10.49.83.152/24 brd 10.49.83.255 dev eth0 label eth0:GC
            #(Global cluster IP)
```

':GC' is the APROL identification of the global cluster and allows a unique identification when additional local clusters exist on the control computer.

The device **<Network device>:GC only** exists **on the current master of the global cluster**.

The result can be controlled with the command *ifconfig*.

```
tcsquishvm01:/ # ifconfig
eth0      Link encap:Ethernet  HWaddr 00:0C:29:8B:5D:26
          inet addr:10.49.83.44  Bcast:10.49.83.255  Mask:255.255.255.0
          inet6 addr: fe80::20c:29ff:fe8b:5d26/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:25760885 errors:0 dropped:14700 overruns:0 frame:0
          TX packets:24105571 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:2114704558 (2016.7 Mb)  TX bytes:31331022871 (29879.5 Mb)

eth0:GC   Link encap:Ethernet  HWaddr 00:0C:29:8B:5D:26
          inet addr:10.49.83.152  Bcast:10.49.83.255  Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
```

Illustration 143: Global cluster with Linux command 'ifconfig' on active master

Navigation: **Console**
`/sbin/ifconfig`

The master and slave can be switched by entering the *rckeepalived stop* command (only executable as Linux super user 'root') in the `/etc/init.d` directory on the master. The device **<Network device>:GC** switches to the inactive control computer, which becomes the master.

The configured state can be restored with the *rckeepalived start* command.

Navigation: Console
`cd /etc/init.d/`
`rckeepalived <stop | start>`

All computer switches can be seen in `/var/log/messages`.

Navigation: Console
`vi /var/log/messages`

The keepalived signal can be checked with the *tcpdump –i <Network device>:GC* command on the console.

Navigation: Console
`su -`
`tcpdump –i <Network interface>:GC`
This ends the global cluster check.

9.4.2 Local cluster

The virtual IP address of the local cluster can be checked on the runtime system which has the process control with the command *ifconfig*. A download to the APROL runtime system is necessary for this.

The 'ifconfig' command lists all network devices. The device **<Network device>:<Cluster name> only** exists **on the active master of the local cluster**.

The runtime system which has process control can be detected in the StartManager. It is the runtime system where the Iosys is running.

The cluster number is a running number and assigned automatically to each local cluster by the operating system.

Illustration 144: Local cluster with Linux command 'ifconfig' on active master

Navigation: Console
`/sbin/ifconfig`

A redundancy switching of the runtime system can be carried out in the StartManager.

For this, see manual 'B5 Download & Debugging', chapter *General information about the StartManager*.

9.5 Detail information

9.5.1 'AprolCluster' and 'keepalived'

With the '*AprolCluster'* script and the 'keepalived' daemon, there are virtual **IP addresses** and virtual **computer names** are available, with which all other computers can connect. This is also the case even if one of the two computers is shut down or disconnected from the network.

Because of the use of a cluster, it is no longer important to the operator which computer offers the data. The 'AprolCluster' and 'keepalived' ensure which computer in the cluster answers the queries.

The 'keepalived' daemon is configured via AprolConfig and is responsible for switching the **'Global cluster'**.

The other computer is upgraded to the master if *'keepalived'* determines that the active master has missed its life-signs. This redundancy switching is independent of the status of the runtime systems.

The **local cluster** is controlled by the 'AprolCluster' script.

The AprolLoader controls if a cluster switching is necessary. This redundancy switching depends on the status of a runtime systems.

9.5.2 Protocol and runtime server

The majority of PCS historical data is normally stored on the control computer running the runtime System.
If the protocol and runtime server are one and the same then it is recommended to install a separate hard-disk for a smooth operation. If this is not possible, we recommend creating an additional partition for the preservation of the historical data. This can be read in chapter *The installation of SLES*

9.5.3 System communication

The communication between DisplayCenter and Iosys (Runtime system) is configured with the host name and the Iosys port. A cluster is not used for this.

This applies to all applications and tools which establish an Iosys connection.

Example:

```
pio -iosys runtime1:1,runtime2:1
```

Call of 'pio' which connects to runtime1. If runtime1 cannot be reached, 'pio' tries to connect to runtime2. The Iosys is running on Iosys port 1 in both cases.

A2-10 Tools in the KDE menu

Useful Linux programs are available using the KDE menu in engineering, and also that of the operator system. These should help the operator and user in their activities, and with solving problems.

The scope of the tools that can be chosen in the operator system is defined by the KDE menu configuration. The choice of the KDE configuration takes place with the **AprolConfig** script (via -*changestartupkde* option).

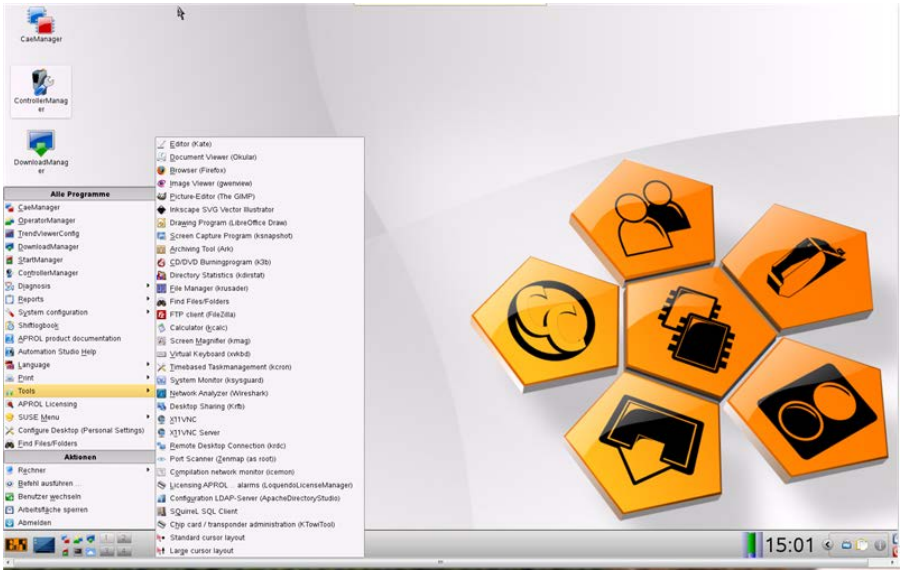


Illustration 145: Calling the tools from the KDE menu

The following tools are offered to the user in an engineering system in the KDE menu "**Tools**":

10.1.1 Editor (Kate)

The program editor Kate offers, amongst others, a syntax highlighting and code-wrap for programming languages such as C, C++, and the markup language HTML.

Kate can open many files at the same time and create and manage projects.

10.1.2 Document viewer (Okular)

Okular is a universal document viewer that supports, amongst others, the PDF format.

10.1.3 Browser (Firefox)

The Firefox is a free web browser from the Mozilla project.

10.1.4 Drawing program (LibreOfficeDraw)

LibreOfficeDraw is a graphic program from the LibreOffice package. LibreOffice is a free compilation of useful software for work in the office.

10.1.5 File/Directory search (KFind)

KFind searches for files, directories, and expressions in files.

10.1.6 FTP client (FileZilla)

FileZilla is a graphic FTP client which, amongst others, allows the continuation of uploads/downloads which have aborted.

10.1.7 Calculator (kcalc)

Kcalc masters, amongst others, trigonometric functions, logical operations and can carry out statistical calculations.

10.1.8 Screen magnifying glass (kmag)

KMag allows you to magnify parts of the screen in the manner of a magnifying glass.

10.1.9 Publicize working area (krfb)

Krfb allows a mutual use of the current monitor environment with a user from another computer.

10.1.10 Port scanner (Zenmap)

Zenmap is a port scanner with a graphical user interface and scans a computer for open ports over the network.

10.1.11 Licensing of the software for speech output for alarms (LoquendoLicenseManager)

Opens the tool for licensing the Loquendo TTS7 software which converts the APROL text information of alarm events into a synthetic speech output.

10.1.12 LDAP server configuration (Apache Directory Studio)

The Apache Directory Studio allows the complete analysis and configuration of the openLDAPv3 or Active Directory server. This tool is also suitable for the import / export of LDIF files.

10.1.13 SQL client (SQuirreL)

SQuirreL SQL client is a Java-based graphic SQL client which allows you to view meta data from a JDBC-conform database, to browse in SQL tables, to send SQL queries, etc.

10.1.14 Administration chip cards for hardware-supported login (KTowiTool)

APROL allows hardware-based log in via keyboards which have an integrated chip card reader, or a separate card reader.

The following devices are supported:

- Towitoko keyboard, or separate Towitoko readers
- USB reader "*SCR3311*" from the company *SCM Microsystems*.

The administration of the chip card takes place with the **KTowiTool** tool. Different card types can be described and read out. You can find further details about this in manual 'C1 Interactive Process Control', chapter *Hardware supported log in*.

10.1.15 XML editor (kxmleditor)

XML files can be created, edited, and administered with the XML editor The drag & drop functionality makes a quick modification of the clearly arranged tree structure possible.

Application examples:

- View of the trend composition
- Creating categories, and defining individual time ranges in the **Shift logbook** configuration.
- View of the alarm line configuration
- View of the **DisplayEditor** menu configuration

*You have the possibility to attach a button to the **DisplayCenter's** toolbar to comfortably launch the XML editor. This toolbar, for quickly starting APROL applications in the Operator System, can be freely configured.*
After having been configured by the user, any of the functions or applications can be started from the toolbar. The toolbar can be defined separately for each operator.

10.1.16 Image viewer (gwenview)

The image viewer caters for a clearly arranged display of the directory structure, and display of the images in preview mode. Many functionalities, and an individual configuration of the surface allow a comfortable administration and editing of images possible.

Application examples:

- Viewing images, which have been created for visual error analysis by the UCB block *AprUcVideo*.
- Self-made engineering images/graphics for individual documentation, or for use as background images

10.1.17 Picture editing (gimp)

gimp is a powerful program for picture editing. Different file formats can be read, and saved.

Application examples:

- Preparation of pictures/photos for the use as static parts of an image, and as background images

10.1.18 Screenshots (ksnapshot)

The monitor's display can be saved as an image file in different formats. After a previously set time, either the whole screen content, or a certain area is copied.

Application examples:

- Documentation of certain system states, e.g. Error states
- Additional to the system messages for diagnostics
- Help with support

*Please use the 'Defect Tracking' from APROL for the documentation of unexpected system events, and as help with support queries (via '**pyvnc2swf**' tool).*

With this, you can document all of your interactions and all necessary information in the form of a shockwave flash film.

It is launched via the 'Diagnosis / VNC Session' KDE menu.

10.1.19 Diagram editor (kivio)

This editor, for creating flow charts, contains an extensive library with diagram elements.

Application examples:

- Display of flow diagrams
- Display of system topology

10.1.20 Archiving (ark)

Data can be packed and saved in the formats *tar, zip,* and *lha* with drag & drop functionality.

Application examples:

- Compression of own data for data exchange between projects
- Compression of diagnostic data for support and documentation

*This tool is not allowed to be used as an alternative to the **CaeBackup** mechanism!*

10.1.21 CD/DVD burning program (k3b)

k3b makes it possible to archive data to CD / DVD. A wizard, when creating a data medium, offers setting possibilities. A file explorer clearly shows the chosen data to be archived. The efficient burning program offers many setting possibilities, and special functions.

Application examples:

- Save a CAE database backup to a medium
- Backup of runtime system data to a medium
- Saving ChronoLog and trend data

10.1.22 Directory statistic (kdirstat)

The program examines defined memory areas for directory structure, and shows the areas graphically, as well as in list form. Thereby, the size of the graphical element is proportional to the file size. Files can be marked directly, and simple operations carried out (e.g. deleting).

Application examples:

- Detecting directories that use a lot of memory, and are possibly no longer needed.
- Optimizing the free memory
- Help with backup of directories
- Administration of an APROL server

10.1.23 File manager (krusader)

The extensive tool for the administration of files and directories offers many features for the management of files. Files and directories can be easily copied, moved, or re-named. The drag & drop functionality is integrated into the clearly arranged two-frame design.

Application examples:

- Administration of an APROL server

10.1.24 FTP client (kftpgrabber)

The tool is very good for a quick connection to FTP servers, and bidirectional data transfer, as long as the FTP service is activated. Bookmarks can be configured for servers, which are contacted often.

Application examples:

- Data transfer between CC-Accounts

10.1.25 Calculator (kcalc)

The complex calculator can be run in different modes, and contains many constants. Therefore, it is useful for many purposes, for example for binary and statistical calculations.

10.1.26 Screen magnifying glass (kmag)

The program for enlarging screen areas increases the readability of data, even from larger distances to the monitor. To guarantee the functionality of the tool, the magnifying glass remains in the foreground until the magnifying glass is closed.

Application examples:

- Enlarged display of parts of the screen

*You do not need the magnifying glass to enlarge the visualization of the process images, as there is a zoom function in the **DisplayCenter**.*

10.1.27 Virtual keyboard (xvkbd)

This tool makes an input possible, even on systems without a keyboard. The virtual keyboard stays in the foreground after being started in order to ensure its functional use. In the **DisplayCenter**, the virtual keyboard can be started not only using the menu items, but also using the toolbar (see manual "C1 interactive process control", chapter *The DisplayCenter menu bar*, and chapter *The DisplayCenter toolbar*).

Application examples:

- Operation after a keyboard fall-out
- Operation of devices that do not have a physical keyboard, e.g. touch-screen monitors

The virtual keyboard is started automatically when using touch screens as soon as an input field gets the focus. The virtual keyboard is closed as soon as the focus leaves the input field.

Please note that the environment variable USE_TOUCHSCREEN must be set in order to make this functionality possible.

10.1.28 Time driven task management (kcron)

Time based tasks in LINUX can be carried out with this tool. In this way, periodical tasks can be accurately controlled, and automated. Root rights are necessary for the use of this tool.

Application examples:

- Reduction of the memory for recorded data from the ChronoLog mechanism in preset time intervals.

10.1.29 System monitoring (ksysguard)

ksysguad shows system values graphically on a time scale. Several sensors can be chosen, and placed parallel on the monitor. Each sensor represents a system resource, which is displayed optically for analysis.

Application examples:

- Evaluation of the system load (e.g. in case of an error)
- Creation of protocols
- Remote access to another server, as long as the corresponding service has been started

10.1.30 Program for network analysis (wireshark)

The communication of an Ethernet interface can be recorded and analyzed with this tool.

Application examples:

- Error analysis on network interfaces

10.1.31 Connection to a foreign computer (krdc)

krdc is for logging in to other computers, which have the VNC service installed. The remote maintenance of a computer using a graphical interface is made possible. Further explanations about the VNC service can be found in manual "A2 Getting Started", chapter *Remote operation via VNC*.

Application examples:

- comfortable remote operation and monitoring of another CC-Account with great performance, and without functional restrictions

10.1.32 Desktop Sharing (X11vnc)

X11vnc routes X-Window displays to any other VNC client. *X11vnc* makes the so called *Desktop Sharing* possible with implemented SSL encryption and authentication.

Desktop Sharing (or Desktop Monitoring) generally refers to the state when the visible screen content of one computer is transferred over a private network, or the internet, to one or more other computers.

Application examples:

- *X11vnc* can be utilized for example for support, presentation and training purposes.

10.1.33 Network scanner (linscope)

linscope is an IP scanner with listed Windows network permitted access (SMB). You can add different IP ranges, and scan these together or separately. Optionally, FTP and HTTP services can also be searched for with this tool. **linscope** supports the use of favorites.

Application examples:

- Search for controllers during error analysis
- Creation of an overview for projected controllers

10.1.34 Icecream monitor (icemon)

You can show the configured compiler group for remote compiling with the Icecream monitor. This tool makes it possible to view the activities during a remote compiling. **icemon** can be launched in the KDE tools without starting a generation process. Detailed information about this can be found in the chapter *Remote Compiling*.

The scope of the tools in the operator system depends upon the KDE menu configuration . The KDE configurations "Basic" and "Standard" are available to you in the current APROL release.

In this way, you can select a limited KDE menu for the system operator's desktop, which allows him or her to concentrate on the most important aspects for operation and monitoring the system.

A foreman or shift manager, on the other hand, may have additional menus at his or her disposal, which allows him to use more advanced APROL or KDE functions.

The choice of the KDE configuration takes place with the **AprolConfig** script (via -*changestartupkde* option).

The configuration chosen with **AprolConfig** is loaded when logging into an operator or runtime system.

10.1.35 Vector graphic editor (inkscape)

Inkscape is an open source vector graphic editor, which has comparable capabilities as Illustrator, Freehand, CorelDraw, or Xara X. The special thing about **inkscape** is that it uses SVG (**S**calable **V**ector **G**raphics) as its native format.

By using the SVG format it is possible to display graphic objects in all zoom factors without loss of quality

Other than the definition of individual pixel or pixel areas (bitmaps), the SVG format contains graphic elements, the position of the elements, and their properties in the form of an XML file.

Further **inscape** functions:

- Unicode, word-wrapping, and "Text-to-path"
- Effects, cloning, and levels
- Addition of license and other information to the graphic as RDF

The **inkscape** vector graphic editor can be used in the APROL system for creating image objects, static background images, or icons on buttons.

10.1.36 LDAP server configuration (Apache Directory Studio)

The **'Apache Directory Studio'** (ADS) allows the complete analysis and configuration of the openLDAPv3 or Active Directory Server. This tool is also suitable for the import / export of LDIF files.

Amongst others, the **Apache Directory Studio** also has an LDAP browser, an editor for LDIF files, and a tool for scheme management.

10.1.37 Linux analysis tools

The atop, htop, ftop and iftop Linux analysis tools are explained in the following chapter. These offer more options as the **top** standard application.

Note that each of these four tools is suitable for a different case.

You obtain the following benefits through this:

- Detailed system monitoring in different situations
- Analysis of the current system state

The use of the Linux analysis tools may lead to a higher system load.

10.1.37.1 Extended system monitoring (atop)

The **atop** Linux analysis tool offers an overview of the current activity of the Linux system. After starting, the upper area shows general system information, and the lower area shows a detailed view of single processes. The information is based on the average value of the last time interval (also called snapshot), which can be seen in the upper right corner. Values are highlighted in color (green, blue, red) to indicate values which produce an unusual load. Desired information can be acquired with the listed interactions.

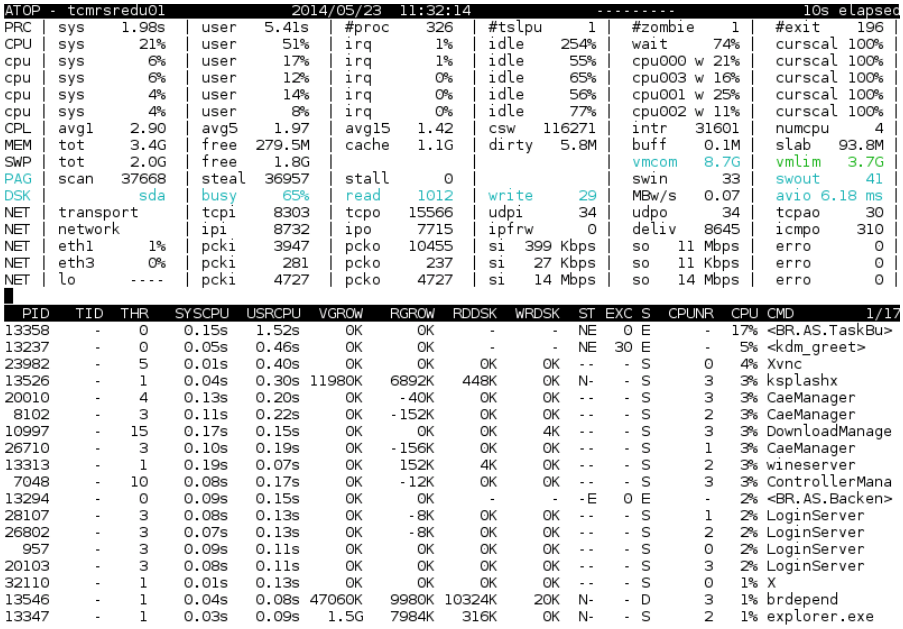


Illustration 146: 'atop' output

Overview of the important information in the upper area:

Abbreviation	Meaning
PRC	Elapsed CPU time in the system and user level
CPU (cpu)	CPU load (load on single CPU kernels)
MEM	Information about working memory

Abbreviation	Meaning
SWP	Information about swapping
DSK	Information about hard-disk load
NET	Information about network load

Overview of important interactions:

Key	Action
[q]	Quit
[h]	Help
[z]	Pause
[m]	Sorting according to memory usage
[g]	Sorting according to CPU load
[c]	Sorting according to CPU load / Display of the call
[i]	Change of time interval (snapshot)
[u]	Mask display for one user
[y]	Display single process threads

Areas of use:

- **Detection of short and otherwise non-detectable processes**
- Detection of short (and otherwise non-detectable) processes
- **Overview of the current system state**
- **'Look into the past'**
- **Analysis of performance problems**

*The system information since the last reboot can be displayed when starting atop and pressing the [**z**] key.*

Further information can be found at http://www.atoptool.nl/.

10.1.37.2 Interactive system monitoring (htop)

The **htop** analysis tool offers a detailed overview of the current system state. A user can customize the display. There are many different values and visualizations. You can see an example layout with basic information in the following screenshot. The control takes place via the [**F1**] - [**F10**] keys listed at the bottom of the window. Information about the current system state is in the upper area, and an overview of the processes and threads in the lower area.

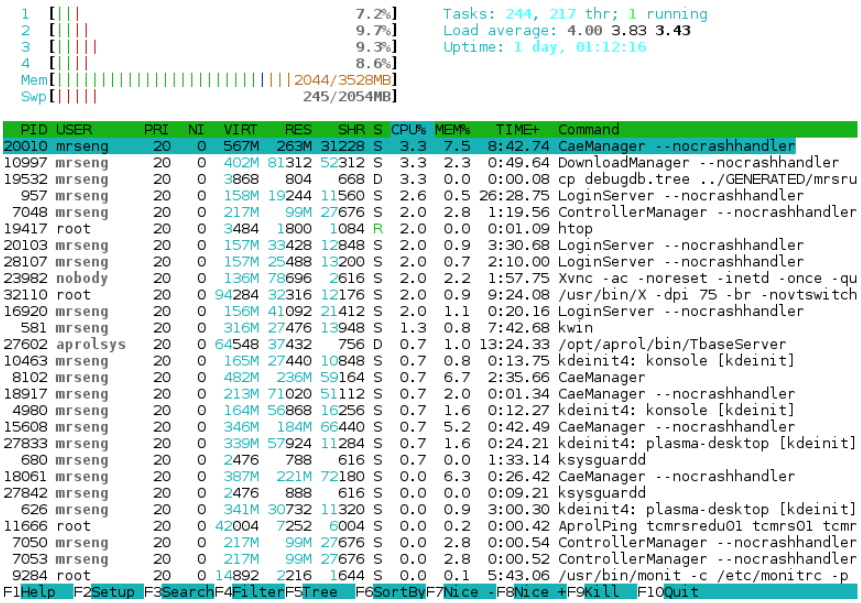


Illustration 147: 'htop' output

Overview of the function keys

Key	Action
[F1]	Open the help
[F2]	Layout adjustment by user
[F3]	Search function
[F4]	Display filter
[F5]	Display in a tree view on/off
[F6]	Sorting according to user, CPU load, etc.
[F7] / [F8]	Change priority
[F9]	Terminate process (kill)
[F10]	Close htop

Evaluation information:

Abbreviation	Meaning
1,2,… (CPU)	Load of single CPU kernels The colors have the following meanings: Red: Kernel threads Green: User threads with normal priority blue: User threads with low priority
Mem	Information about working memory. Meaning of the colors: Green: Used memory Blue: Buffer Orange: Cache
Swp	Information about swapping

Areas of use:

- **Overview of the current system state**
- **Comfortable termination of processes**
- **Display of processes in a tree view**
- **Priority change of processes**

Further information can be found at http://linux.die.net/man/1/htop.

10.1.37.3 Monitoring the hard-disk (ftop)

The **ftop** analysis tool monitors the hard-disk activity. The refresh time interval should be changed with the [**d**] key when the application is started, in order to have a clear view. Information about the number of open files and running processes is shown in the upper area of the window. Underneath, there is a detailed display of the applications (bold lines) which write and read (in normal print). The progress of a read/write procedure is shown with a black, horizontal bar which contains the remaining time and speed. If the write procedure is interrupted, 'stalled' is shown in the bar.

Overview of important interactions:

Key	Action
[h]	Open the help
[o]	Open options
[d]	Refresh time interval
[u]	Mask according to user
[f]	Mask according to search term
[q]	Quit

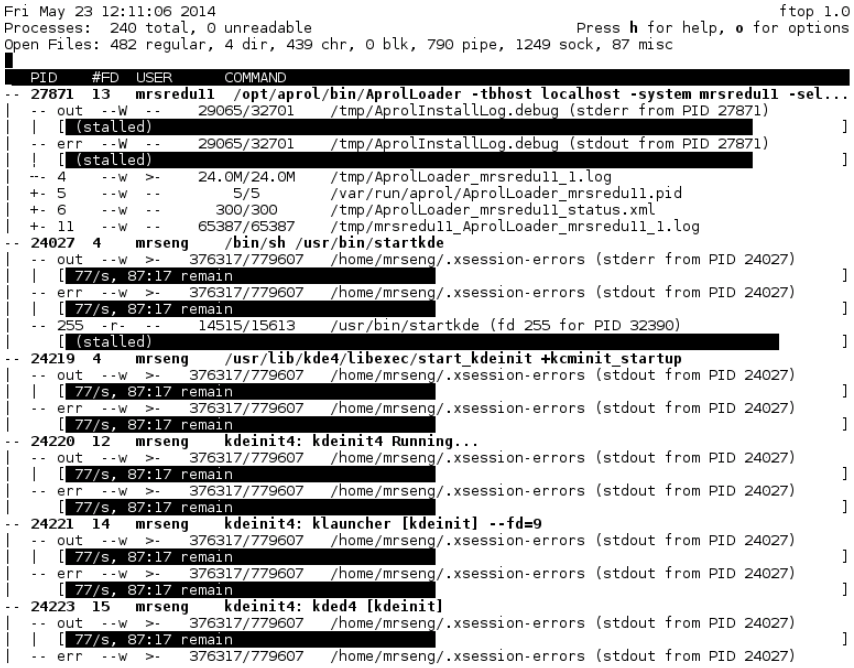


Illustration 148: 'ftop' output

Evaluation information:

Field	Meaning
Access mode (3rd. column)	-r- : read mode --w : write mode --W : append mode -rw : read/write mode
Read/Write activity (4th. column)	-- : inactive ->, >-, >> : Activity growing -<, <-, << : Activity sinking <> : Activity irregular
Progress (5th. column)	Progress of read/write procedure

Areas of use:

- Exact analysis when hard-disk load is high
- Overview of all read/write procedures
- Duration of a read/write procedure

Further information can be found at http://linux.die.net/man/1/ftop.

10.1.37.4 Monitoring the network (iftop)

Linux superuser 'root' rights are necessary to execute iftop, because it accesses the `/proc` directory.

The **iftop** Linux analysis tool offers extensive information about the network activity. If the computer has several network interfaces, the one that is found first is used. The name of the interface is shown at the top left corner after starting.

If another network interface should be monitored, **iftop** must be started via the console. The name of the interface must then be specified as a parameter (*iftop –i name*). The general view is shown in the next screenshot. The scale at the top edge shows the current data transfer rate of the network connections. The single connections are listed underneath, and the data transfer rate is shown as a black bar. The three columns to the right edge contain the average transfer rate of the last 2, 10, and 40 seconds. All information is summarized at the bottom part of the screen in an overview.

Overview of important interactions:

Key	Action
[h]	Open the help
[n]	DNS resolution on/off
[p]	Port display on/off
[L]	Linear or logarithmical scaling
[o]	Preserve display order
[P]	Pause
[q]	Quit

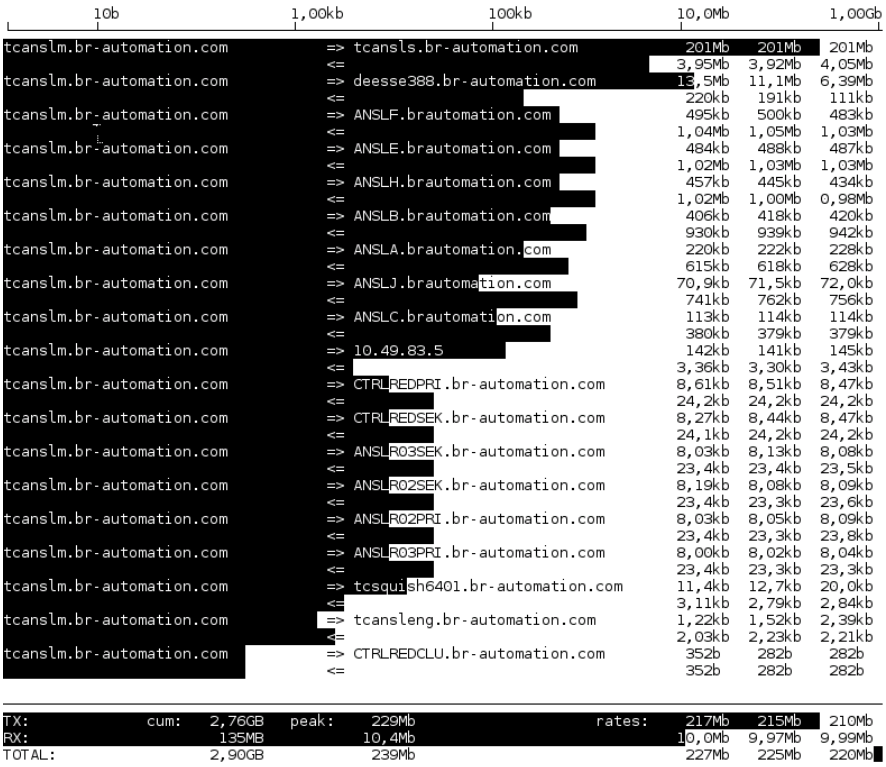


Illustration 149: 'iftop' output

Evaluation information in bottom part:

Row	Meaning
TX	Upstream
RX	Downstream
TOTAL	Upstream + Downstream
cum	Transferred amount of data since iftop start
peak	Highest transfer rate since iftop start
rates	Average transfer rate in the last 2, 10, and 40 seconds

Areas of use:

- **Exact analysis of the network load**
- **Determination of the computer's communication partner**
- **Use of the bandwidth**

Further information can be found at http://linux.die.net/man/8/iftop..

10.1.37.5 Example analysis procedure

A high system load may occur in different cases. Build and download procedures are among these. It is a good idea to use the **atop** and **htop** tools for the first analysis of a high system load. With them, you obtain a clear overview of the relevant system components such as CPU, memory, network, and hard-disk load. The findings can then be analyzed in depth with the other two tool **iftop** and **ftop**.

For example, there may be a high hard-disk load during a build process (recognized with DSK in **atop**). This can then be analyzed more precisely with **ftop**, so that possible problems can be identified. A download has a similar behavior. The communication with different computers must be made with a limited bandwidth. If several components are downloaded in parallel, there may be a high network load. With **iftop**, you can monitor exactly which amounts of data are exchanged between the systems and where there may be possible weak points in the system.

A2-11 Appendix

11.1 List of the saved blocks via AprolSaveObsoleteBlocks

The following overview contains all blocks, which are saved with the script *AprolSaveObsoleteBlocks,* and are moved into the library "SavedBlocks".

It must be observed that the use of the script AprolSaveObsoleteBlocks must definitely be carried out before an update of the CAE database to APROL R 3.2. Finally the library must be generated in the context of your CAE project.

CAE library	Blocks taken into account
APROL	AprFbDelayedSignal, AprFbGetAvg, AprFbGetRtcDint, AprFbNCycleMax, AprFbNCycleMin, AprFbSetRtcDint,

CAE library	Blocks taken into account
IEC61131	BYTE_BCD_TO_DINT, BYTE_BCD_TO_INT, BYTE_BCD_TO_SINT, BYTE_TO_BCD_DINT, BYTE_TO_BCD_INT, BYTE_TO_BCD_SINT, DELAY, DINT_BCD_TO_BYTE, DINT_BCD_TO_DINT, DINT_BCD_TO_DWORD, DINT_BCD_TO_INT, DINT_BCD_TO_SINT, DINT_BCD_TO_UDINT, DINT_BCD_TO_UINT, DINT_BCD_TO_USINT, DINT_BCD_TO_WORD, DINT_TO_BCD_BYTE, DINT_TO_BCD_DINT, DINT_TO_BCD_DWORD, DINT_TO_BCD_INT, DINT_TO_BCD_SINT, DINT_TO_BCD_UDINT, DINT_TO_BCD_UINT, DINT_TO_BCD_USINT, DINT_TO_BCD_WORD, DINT_TO_TIME, DIV_TIME_DWORD, DIV_TIME_WORD, DT_TO_TOD, DWORD_BCD_TO_DINT, DWORD_BCD_TO_INT, WORD_BCD_TO_SINT, DWORD_TO_BCD_DINT, DWORD_TO_BCD_INT, DWORD_TO_BCD_SINT, EXPT_REAL_REAL, INT_BCD_TO_BYTE, INT_BCD_TO_DINT, INT_BCD_TO_DWORD, INT_BCD_TO_INT, INT_BCD_TO_SINT, INT_BCD_TO_UDINT, INT_BCD_TO_UINT, INT_BCD_TO_USINT, INT_BCD_TO_WORD, INT_TO_BCD_BYTE, INT_TO_BCD_DINT, INT_TO_BCD_DWORD, INT_TO_BCD_INT, INT_TO_BCD_SINT, INT_TO_BCD_UDINT, INT_TO_BCD_UINT, INT_TO_BCD_USINT, INT_TO_BCD_WORD, ROL_UDINT, ROL_UINT, ROL_USINT, ROR_UDINT, ROR_UINT, ROR_USINT, RS, SEL, SINT_BCD_TO_BYTE, SINT_BCD_TO_DINT, SINT_BCD_TO_DWORD, SINT_BCD_TO_INT, SINT_BCD_TO_SINT, SINT_BCD_TO_UDINT, SINT_BCD_TO_UINT, SINT_BCD_TO_USINT, SINT_BCD_TO_WORD, SINT_TO_BCD_BYTE, SINT_TO_BCD_DINT, SINT_TO_BCD_DWORD, SINT_TO_BCD_INT, SINT_TO_BCD_SINT, SINT_TO_BCD_UDINT, SINT_TO_BCD_UINT, SINT_TO_BCD_USINT, SINT_TO_BCD_WORD, TIME_TO_DINT, UDINT_BCD_TO_DINT, UDINT_BCD_TO_INT, UDINT_BCD_TO_SINT, DINT_TO_BCD_DINT, UDINT_TO_BCD_INT, UDINT_TO_BCD_SINT, UINT_BCD_TO_DINT, UINT_BCD_TO_INT, UINT_BCD_TO_SINT, INT_TO_BCD_DINT, UINT_TO_BCD_INT, UINT_TO_BCD_SINT, USINT_BCD_TO_DINT, USINT_BCD_TO_INT, USINT_BCD_TO_SINT, USINT_TO_BCD_DINT, USINT_TO_BCD_INT, USINT_TO_BCD_SINT, WORD_BCD_TO_DINT, WORD_BCD_TO_INT, WORD_BCD_TO_SINT, WORD_TO_BCD_DINT, WORD_TO_BCD_INT, WORD_TO_BCD_SINT
STANDARD	DELAY, DINT_TO_TIME, DT_TO_TOD, RS, TIME_TO_DINT

11.2 Deactivate energy saving function / screensaver

In order to guarantee a continuous monitoring of the actual system state, the energy saving function for the operator station screens must be turned off as a rule.

Please carry out the configuration in the following places:

- `home/<Operator system>/.xinitrc`
- KDesktop configuration
- SaX2

As of APROL R 3.2-02, the energy saving function is deactivated per default in the `.xinitrc` as well as in the KDesktop configuration files.

Please note that the X-Server configuration is saved in the `/etc/X11/xorg.conf` file. Certain configurations that are carried out afterwards, and also have an effect on the X system, can overwrite or delete the current entries in the `xorg.conf`. This is for example the case when saving a SaX2 configuration, or a configuration using the "NVIDIA X-Server settings" tool. To avoid loss of data, save the `xorg.conf` file before you carry out further X-Server configurations so that you can eventually re-insert the entries manually into this configuration file.

11.2.1 deactivate DPMS in the .xinitrc

You can deactivate the energy saving function by modifying the `/home/<operator system>/.xinitrc` configuration file. Insert the line `xset -dpms` as the following illustration shows. This entry is present per default as of APROL R 3.2-02.

```
#
# Add your own lines here...
xset -dpms
xset s off
xmodmap $APROL/etc/Xmodmap.aprol 2>/dev/null 1>/dev/null
xhost +
#
```

Illustration 150: Deactivation of the energy saving function in the -xinitrc file

11.2.2 Configuration in the KDE control center

The next step is to configure KPowersave. You can open the KDE control center with "**Configure desktop**" in the desktop's shortcut menu. You can open the configuration dialog for KPowersave with "Display" in the "Energy control" tab. For this purpose choose the [**Configure KPowersave...**] button. The check box "**Deactivate the screen's energy saving function**" must be activated (Default setting as of APROL R 3.2-02).

The screen saver is switched off in "Display/Screen saver" by deactivating the "Start automatically" check box. This affects the following entries in the `/home/<Runtime system>/.kde/share/config/kdesktop` file:

```
[ScreenSaver]
Enabled=false
```

(As of APROL R 3.2-02, this is the case per default.)

11.2.3 Deactivate DPMS in the SaX2 configuration

A configuration in SaX2 is necessary to deactivate the "DPMS" energy saving function. Choose the "**System/Configuration/Configure X11 system (SaX2)**" KDE menu.

After logging in as the LINUX superuser "root", choose the [**Change...**] button in "**Monitor**". The "Activate DPMS" check box in the *Monitor for card <name of graphic card>* tab must be switched off.

Through this, the entry of the "DPMS" option in the `/etc/X11/xorg.conf` file, in the "Monitor" section is deleted.

*Please note that the SaX2 configuration must take place **before** the configuration of the graphic card. A SaX2 configuration **after** the graphic card has been set up overwrites the `/etc/X11/xorg.conf` file, and thereby the configuration of the graphic card. In order to avoid this, you can deactivate the DPMS directly in the `xorg.conf` file when you delete the "DPMS" option in the "Monitor" section.*

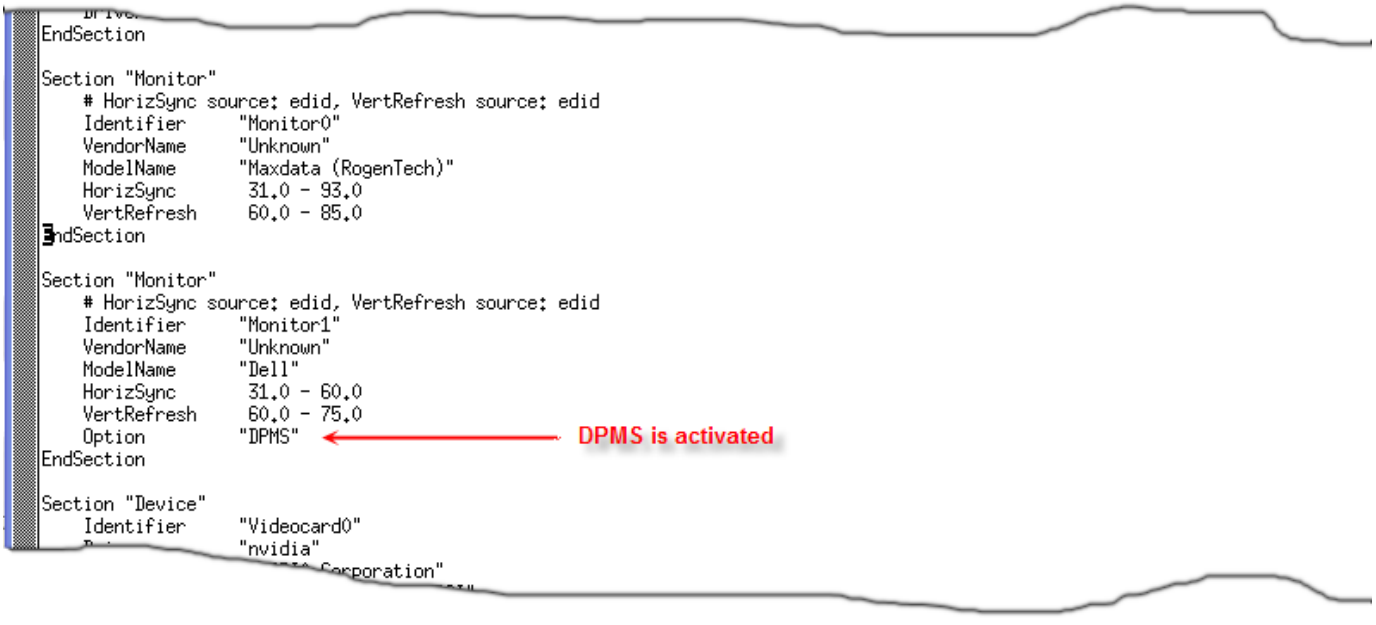


Illustration 151: Deactivation of the energy saving function in the xorg.conf file

11.3 Information about the usage of the DVI interface with SLES

DVI (Digital Visual Interface) represents a standard interface for the transmission of digital video data with the connection of TFT monitors to the PC's graphic card.

The following must be observed when a TFT monitor is connected via DVI interface (without adapter) to a B&R APC with the graphic chip set '855G':

It must be made sure that the "NoAccel" and "SWcursor" parameters are entered in the actual X-configuration.

The change in the configuration must take place with *SaX2* in the Linux runlevel 3.

The change in the configuration applies to all B&R APCs, which have the '855G' graphic chip on the on-board graphic card.

11.4 TAR archives with MD5 check sum

Data archives (<file name>.tgz) are checked for correctness before use. This is done with the corresponding audit file <File name>.tgz.md5. Discrepancies between the proof sum and audit file inhibit the further usage of this archive.

In R 3.2-01 and R 3.2-02, the data archive and check file must be in the same directory.

As of APROL R 3.2-03, a TAR file is used for the TAR archive that contains not only the data archive (<file name>.tgz) but also the check file (<file name>.tgz.md5). Both files are required separately in older releases.

In order to create a TAR archive from older releases' data archive (<file name>.tgz) and the check file (<file name>.tgz.md5) please use the following command

```
tar cvf <file name>.tar <file name>.tgz <file name>.tgz.md5
```

Example:

```
tar cvf  CAE_BACKUP_3.2-02_testsrv_engin_20071004_212344.tar  CAE_BACKUP_3.2-
02_testsrv_engin_20071004_212344.tgz  CAE_BACKUP_3.2-
02_testsrv_engin_20071004_212344.tgz.md5
```

This check mechanism is automatically used for packed data, in the

- patch mechanism
- Backup and restore of the engineering environment
- Checking out and checking in offline engineering
- OS manager for OS export, and OS import
- Demo project installation

The check files must be created before restoring APROL projects, which have been saved with an APROL release < R 3.2-01 without patch R 3.2-00P6. The following call creates a valid check file:

```
md5sum file_name.tgz > file_name.tgz.md5
```

11.5 Change installation source

It must be ensured that an APROL **AutoYaST** installation source is available for the APROL **release that has been installed**.

As a rule, this is the APROL AutoYaST DVD in a local drive.

The stipulation of other sources is also possible. In case you are not sure which sources are available, please ask your system administrator.

First of all, the respective AutoYaST DVD must be placed into the drive.

The next step is to open the YaST control center in its graphic interface. For this purpose, choose the "**System / system settings (YaST)**" menu item in the KDE bar.

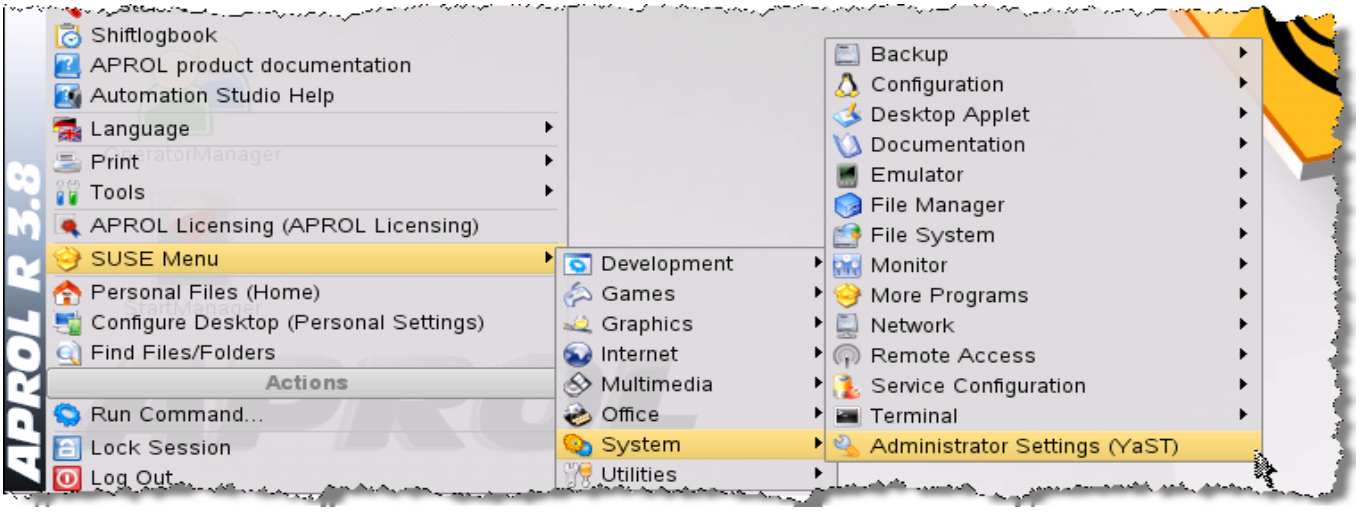


Illustration 152: Starting YaST

Subsequently, there is the request to log in as Linux superuser 'root'.

In the YaST control center, the "**Software**" menu item on the left should be chosen. The corresponding applications appear in the right window. Choose "**Change installation source**".

If the installation source is not present after starting this application it must be added ([**Add**]).

For our example, choose the "DVD" radio button and confirm with [**Next**].

Finally, it must be made sure that the installation source is activated and actualized.

If this is not the case, the activation takes place with the [**Source settings**] button.

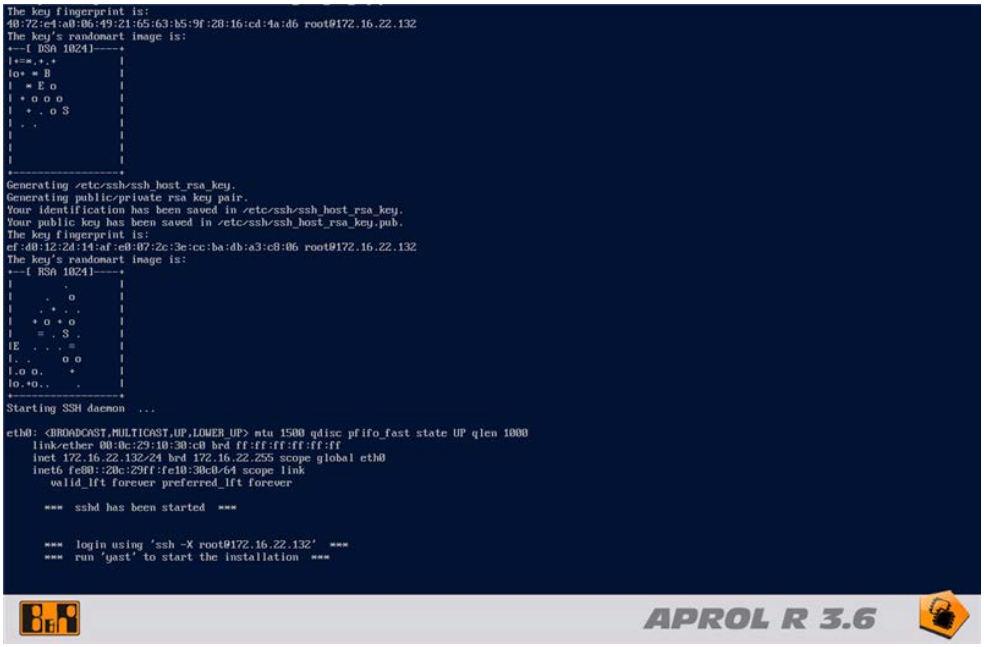
Close the application.

Please note that with a [**Cancel**] all of the changes are lost.

11.6 Problems when using the Intel graphic chip set with SLES 11

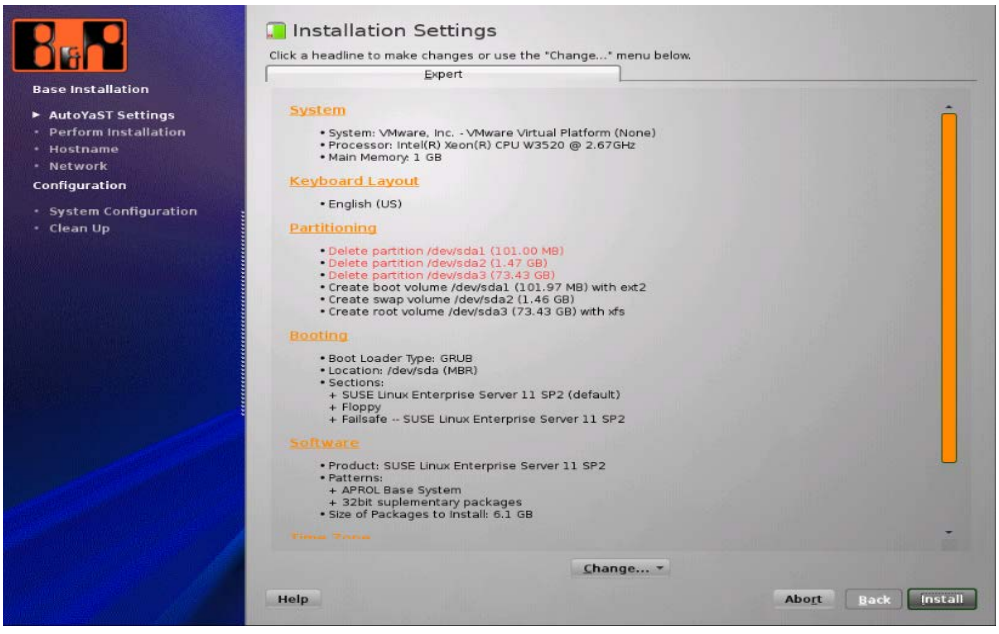
If there are graphic card problems during the AutoYaST installation (e.g. a continously black screen), B&R recommends carrying out the AutoYaST installation from a remote computer via an 'ssh' session.

Now proceed for this as follows:

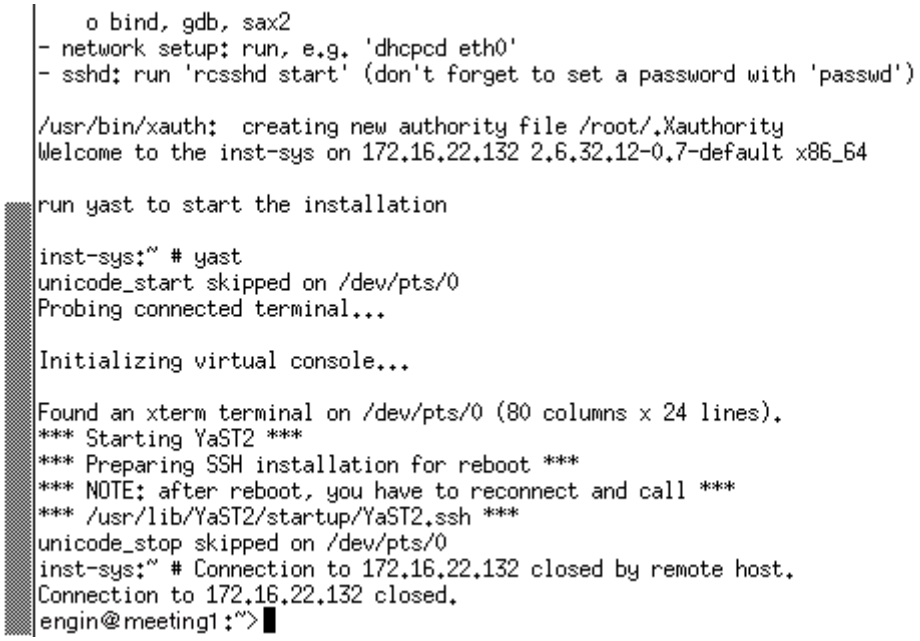
Step	Description
1	**On the computer that is to be installed:** Add the following option in the 'Boot options' field when the computer is booted: **`usessh=1 ssh-password=.aprol`**
2	**On the computer that is to be installed:** The start of the 'ssh' daemon is then output as follows on the computer that is to be installed:  *Illustration 153* The IP address for 'ssh' connection can be found in the output.
	After carrying out step2, there is a query if the network configuration should be made automatically via DHCP or manually. *The illustrations in the following steps are only examples in which the IP address and host name may vary.*

Step	Description

3	**On the remote computer (from which the installation is to be started):**
	
	Start an 'ssh' session on the computer, from which the installation is to be started, with the Linux command:
	`ssh -X root@<IP address of the target computer>`
	
	Answer the question '**Are you sure you want to continue?**' with 'yes' and then enter the 'ssh' password that was specified in the previous boot options.
	
	`engin@meeting1:~> ssh -X root@172.16.22.132`
	`The authenticity of host '172.16.22.132 (172.16.22.132)' can't be established.`
	`RSA key fingerprint is ef:d0:12:2d:14:af:e0:07:2c:3e:cc:ba:db:a3:c8:06.`
	`Are you sure you want to continue connecting (yes/no)? yes`
	`Warning: Permanently added '172.16.22.132' (RSA) to the list of known hosts.`
	`Password:`
	
	`SUSE Linux Enterprise Server 11 Installation`
	
	`- there are shells running on consoles 2, 5, 6, 9`
	`- use 'extend' to load extensions (remove with 'extend -r'); extensions are:`
	`  o bind, gdb, sax2`
	`- network setup: run, e.g. 'dhcpcd eth0'`
	`- sshd: run 'rcsshd start' (don't forget to set a password with 'passwd')`
	
	`/usr/bin/xauth:  creating new authority file /root/.Xauthority`
	`Welcome to the inst-sys on 172.16.22.132 2.6.32.12-0.7-default x86_64`
	
	`run yast to start the installation`
	
	`inst-sys:~ #`
	
	Illustration 154
	
	Enter 'yast' at the prompt and confirm with [**Return**] in order to start the remote installation.

4	**On the remote computer (from which the installation is to be started):** Carry out the AutoYaST installation.  *Illustration 155*

Step	Description

5	**On the remote computer (from which the installation is to be started):**
	After successfully rebooting the computer that is to be installed, you must log in again with the following command:
	`ssh -X root@<IP address of the target computer>`
	 
	Illustration 156
	Continue the AutoYaST installation with the following command:
	`/usr/lib/YaST2/startup/YaST2.ssh`

11.7 Remote maintenance via Devolo MicroLink 56k PCI modem

This chapter explains the installation of the Devolo MicroLink 56k PCI modem in SLES 10, from the driver installation to the configuration of the PPP service.

The aim is dial-up from a Windows XP computer to an APROL server for the purpose of remote maintenance.

11.7.1 Installing the modem driver

The current driver is to be obtained from the manufacturer's homepage. A direct download is possible with the following link:

http://download.devolo.net/webcms/06232030011600577 67/ml-56k-pci-2.0.i386.rpm

Save the file in `/tmp` on your APROL computer, and follow these steps:

Start an xterm (e.g. [**Alt**]+[**F2**], enter `xterm`, and press [**ENTER**] and log yourself in as root:

```
sux - root
```

Please enter the root password.

Change to the `/tmp` directory

```
cd /tmp
```

and install the driver, or RPM packet, from here:

```
rpm –i ml-56k-pci-2.0.i386.rpm
```

Queries during the installation can be confirmed with [**ENTER**].

Carry out this command for the configuration of the modem:

```
hsfconfig
```

Here, queries can also be confirmed with [**ENTER**]. The output looks like this, for example:

```
apc3201p2:/home/engin/tmp # hsfconfig
Conexant HSF softmodem driver, version 7.47.00.02oem

If you need assistance or more information, please go to:
       http://www.linuxant.com/

When reporting a problem for the first time, please send
us the file generated by "hsfconfig --dumpdiag".

Warning: existing driver modules found under:
       /lib/modules/2.6.18.2-35-default/
Would you like to keep using them? [no]
```

Illustration 157: Dialog from hsfconfig

If the configuration is completed successfully, a link is automatically created from `/dev/modem` to, for example, `/dev/ttySHSF0`:

```
Building modules for kernel 2.6.18.2-35-default, using source directory
/lib/modules/2.6.18.2-35-default/build. Please wait...
done.

Please enter region name for modem unit 0 [GERMANY]:

Setting region for modem unit 0: "GERMANY"

To change, use "hsfconfig --region" or "AT+GCI=<T35code>"
The current region can be displayed by entering "ATI9" in a terminal program.

Note: HDA support not compiled in the driver

Note: kernel module snd-via82xx-modem overridden by hsfmc97via
Note: kernel module snd-intel8x0m overridden by hsfmc97ich hsfmc97sis
Note: kernel module snd-atiixp-modem overridden by hsfmc97ati

Current parameters: ("hsfconfig --info")

Config for modem unit 0: /dev/ttySHSF0
       Device instance: 0-PCI-14f1:2f30-14f1:2014
       HW revision    : Basic2 2.18 Standard DAA 3VoltsIA
       HW profile name: hsfpcibasic2hsfi
       Current region : GERMANY (T.35 code: 0004)

The /dev/modem alias (symlink) points to ttySHSF0
apc3201p2:/home/engin/tmp #
```

Illustration 158: final dialog from hsfconfig

This link can be checked in the following way:

```
cd /dev
l modem
```

The output should look like this:

Illustration 159: Output from l modem

11.7.2 Configuration of the modem in YaST2

Start YaST2 and enter the root password here:

In "Network devices" you can find the "Modem" entry.

A click with the left mouse button on "Modem" opens the configuration of the modem.

As this modem is not automatically recognized by SLES 10, it must be inserted manually with the [**Add**] button.

The device choice follows:

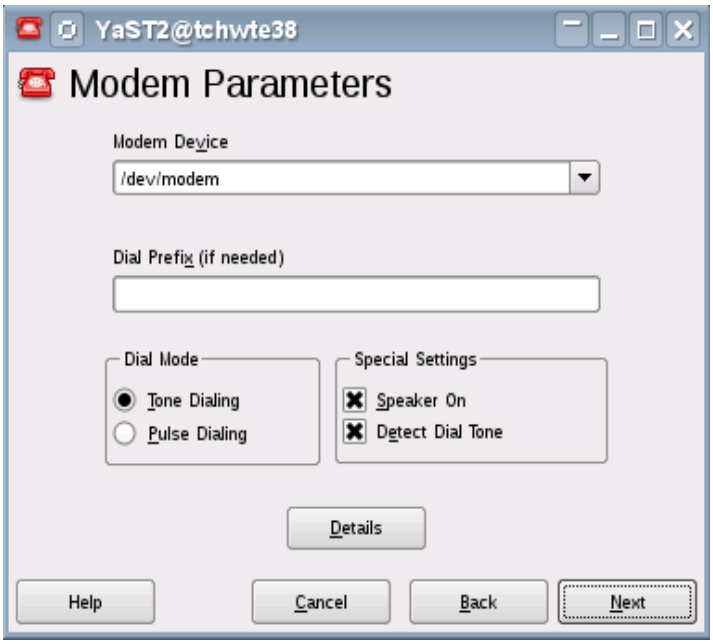


Illustration 160: Device choice

As the link `/dev` already exists, it is possible to choose `/dev/modem` as modem here.

The choice of provider is necessary when configuring a modem in YaST, but it is not necessary for this type of dial-up. Therefore you can choose a standard provider by clicking [**Next**] twice.

The modem has now been created, and the configuration can be finished with the [**Finish**] button.

11.7.3 Creating the PPP user

A new user must be created in YaST2 for the dial-up. This takes place in "Security and users".

A click with the left mouse button on "Create and edit user" opens a new window.

Illustration 161: Management of users and groups

Click on [**Set filter**] in the lower right corner, and choose "**System user**".

Please change to the next dialog with [**Add**].

The user ppp has been chosen here as an example:

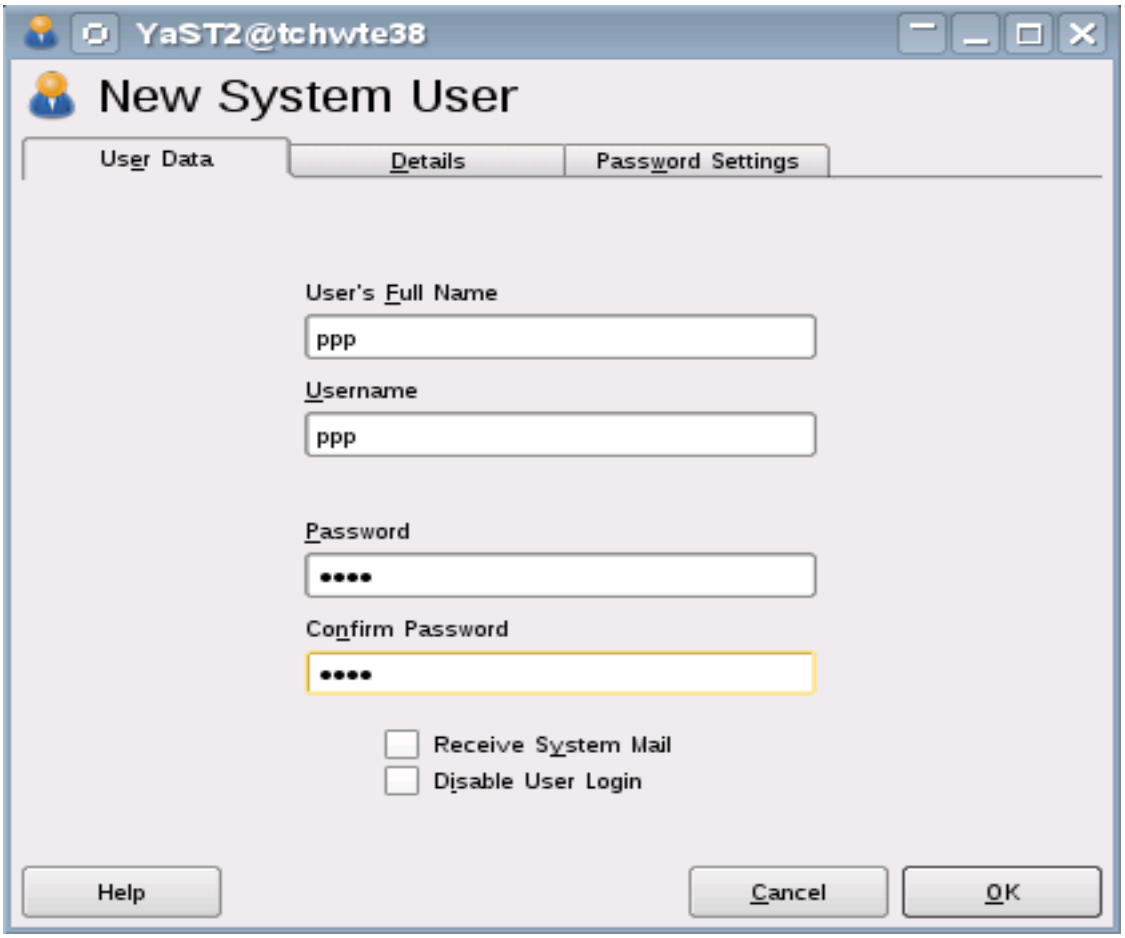


Illustration 162: Dialog for adding a user

After filling out the fields click on the *Details* tab:

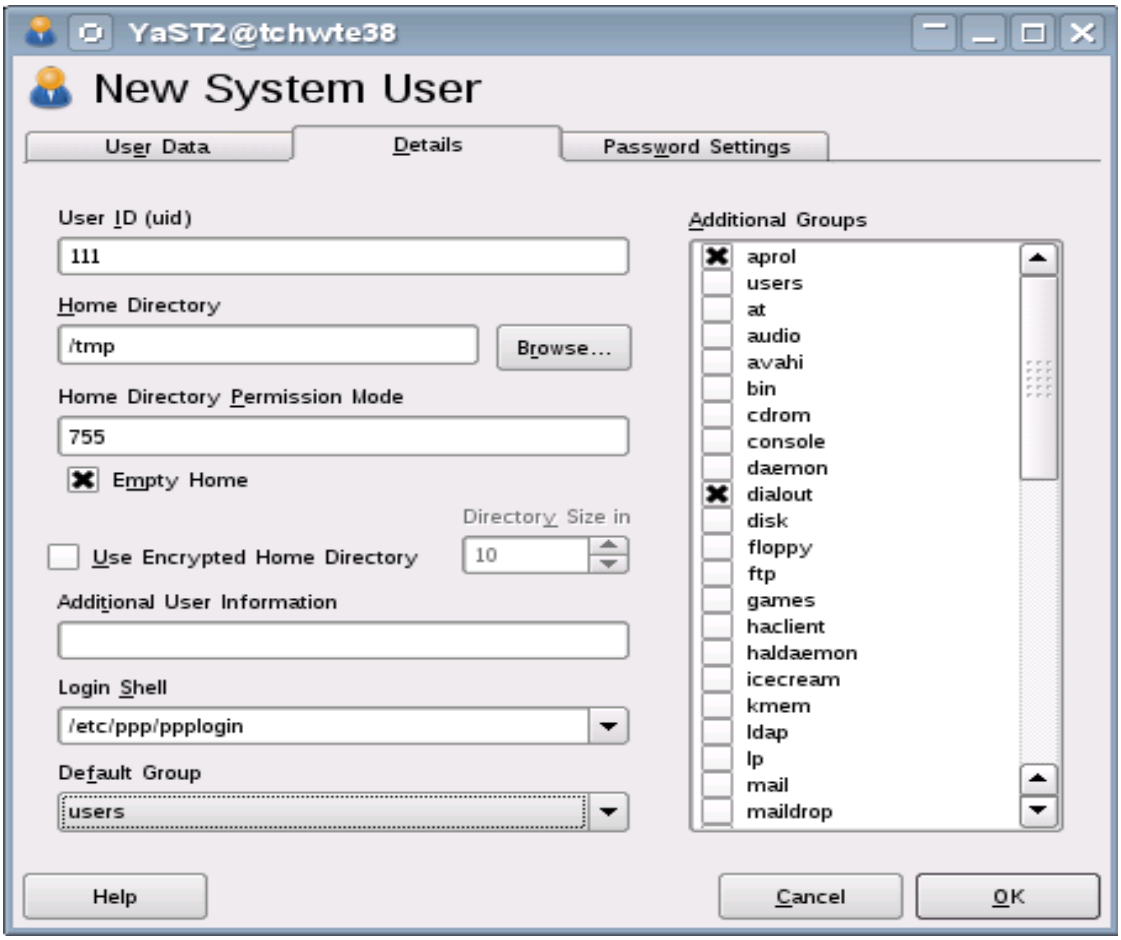


Illustration 163: Management of users and groups, Details tab

Enter the directories as shown in the illustration, and choose the groups.

The user is created with the [**Accept**] button.

Subsequently click on [**Finish**].

11.7.4 Configuration of the PPP service

Start an xterm and log in as root.

Change to the directory `/etc/ppp`:

```
cd /etc/ppp
```

To edit the `options` file, please enter the following command:

```
kwrite options
```

The "noipdefault" parameter in the upper area must be commented out with a #.

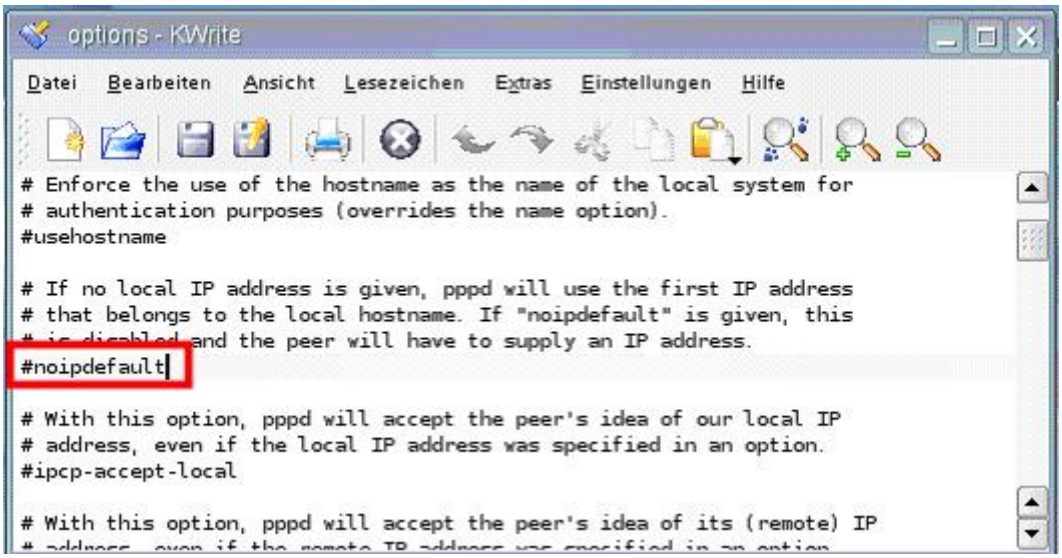


Illustration 164: Editing options file with kwrite

Choose "File/Save", and terminate kwrite with "File/Terminate".

In order to insert the user in the `pap-secrets` file, please enter the following command:

```
kwrite pap-secrets
```

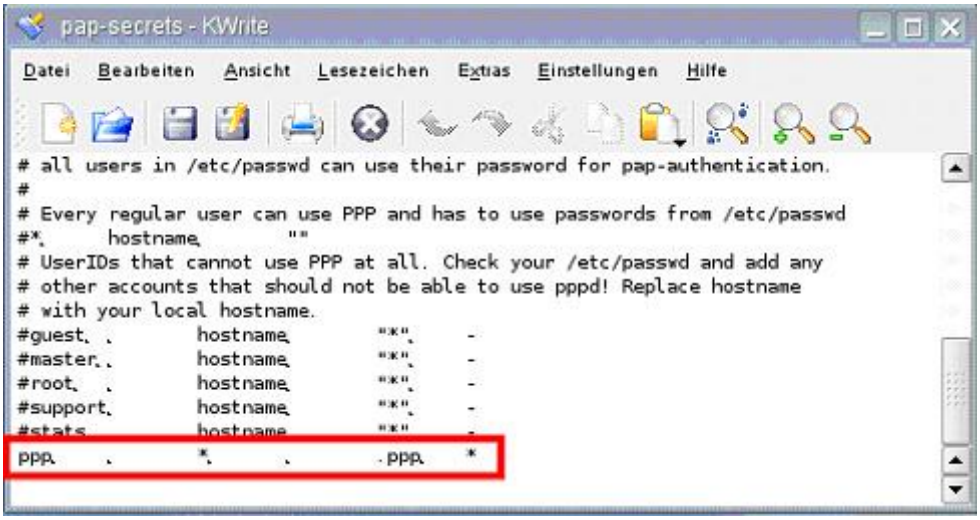


Illustration 165: Editing the pap-secrets file with kwrite

Please edit the file according to the illustration above.

Choose "File/Save", and terminate kwrite with "File/Terminate".

With the following command you create the *ppplogin* file.

```
kwrite ppplogin
```

Illustration 166: Editing ppplogin file with kwrite

Diagram Explanation:

192.168.2.2 is the IP address of the server

192.168.2.22 is the IP address of the client

IP addresses that are already in use should not be entered here.

Choose "File/Save", and terminate kwrite with "File/Terminate".

11.7.5 Setup automatic answering

To activate an automatic answering of the modem, the `inittab` file in `/etc` must be adapted.

Start an xterm and log in as root:

Change to the directory `/etc`:

```
cd /etc
```

With the following command you open the `inittab` file with the kwrite editor:

```
kwrite inittab
```

You find the following lines in the lower part of the file:

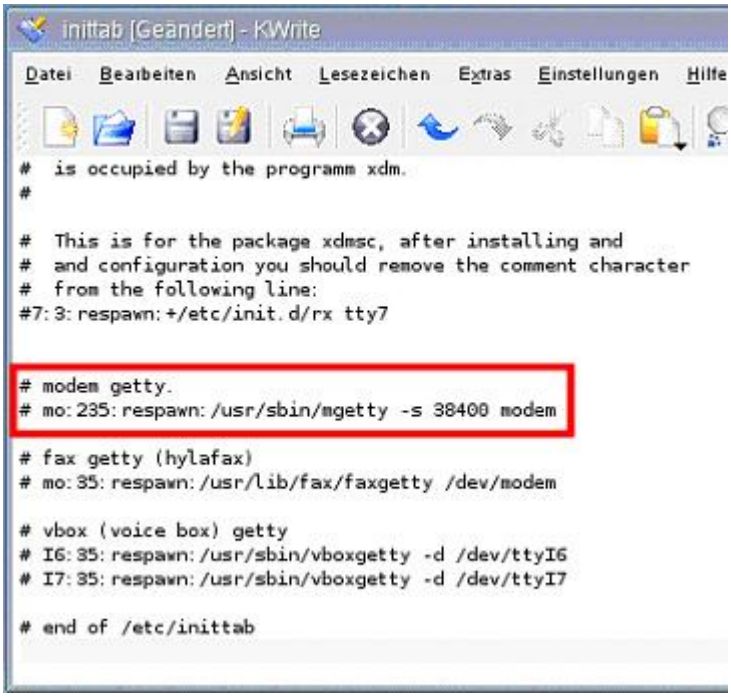


Illustration 167: Editing inittab file with kwrite

Please remove the # character according to the following illustration:

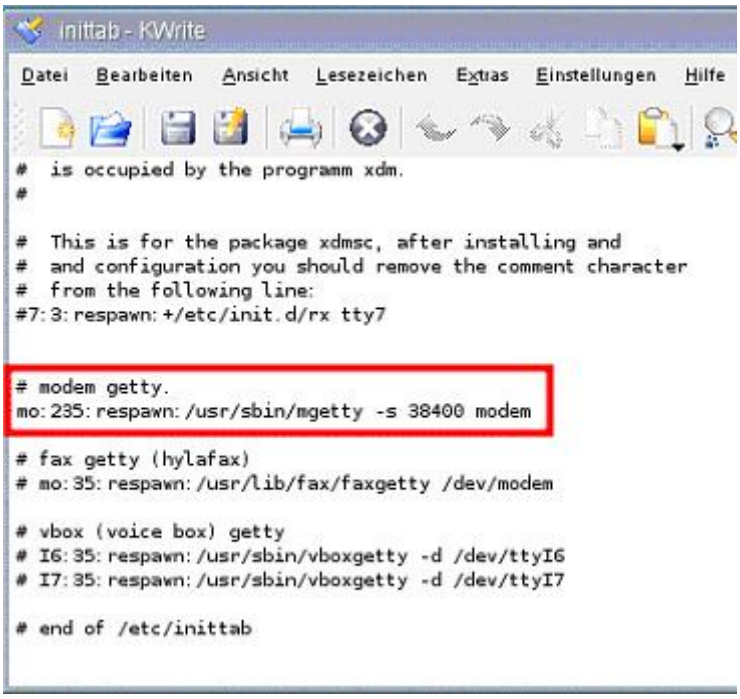


Illustration 168: Editing inittab file with kwrite

Choose "File/Save", and terminate kwrite with "File/Terminate".

Please enter the following in the xterm for the initialization:

```
init q
```

With the command

```
ps ax |grep mgetty
```

it can be checked if the process has really been started. If the process is running, the output looks something like this:

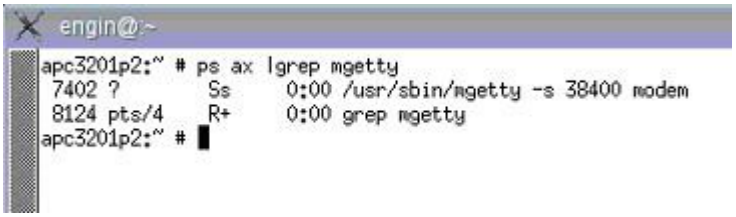


Illustration 169: Modem search in the process list

11.7.6 Configuration of the connection in Windows XP

The pre-requisites are that a modem is available, and is installed. In the control panel in "Network and internet connections" please choose the "Internet options" entry.

Click on [**Add**] in the *Connections* tab.

Please choose the first listed connection type (modem):

After a click on [**Next**], the telephone number is asked for. Enter the number of the target here. Afterwards, the entry of the dial-up connection's name (e.g. APROL_32_Remote_Maintenance) takes place.

The configuration is finished and following dialog is opened with the [**Finish**] button.

Enter the LINUX user's user name (ppp) and password here, and then click on [**Properties**].

It must be made sure that a modem and the telephone number are entered in the *General* tab.

The following default values are stored in the *Options* tab.

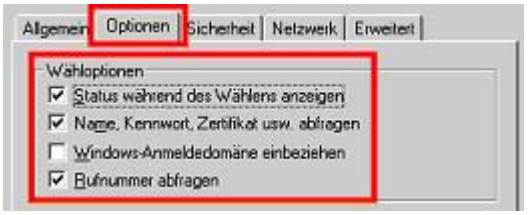


Illustration 170: Dial-up connection - Entry of options

Please select "Internet protocol (TCP/IP)" in the *Network* tab, and choose [**Properties**].

In the dialog that opens, please enter the IP address of the client:

Confirm the entry with [**OK**]:

A new connection is now shown in the internet options:

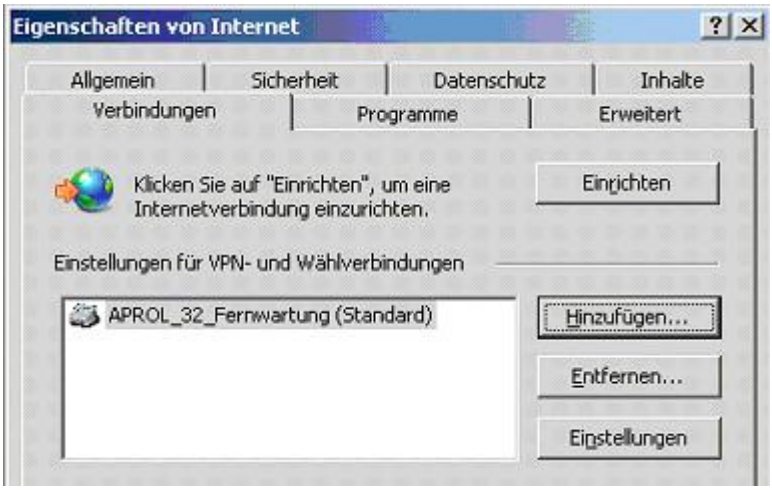


Illustration 171: XP internet properties

You can start the connection by double-clicking on it.

11.7.7 Error handling

11.7.7.1 Termination of the connection establishment with Windows error number 619

The error can occur when the user name is not properly entered in the `pap-secrets` file in `/etc/ppp`. Information about entering the user name can be found in chapter *Configuration of the PPP service*.

11.7.7.2 Termination of connection establishment with /var/log/messages - "Could not determine local IP address"

Please check if the entry "noipdefault" is commented out with a # in the file `options` in `/etc/ppp`.

11.7.7.3 Connection successfully created - no answer to ping

If the Windows client does not answer the `ping` command from the APROL server, this may have something to do with the APROL server's firewall configuration. Check in YaST, in "Security and users" / Firewall, if it is active:

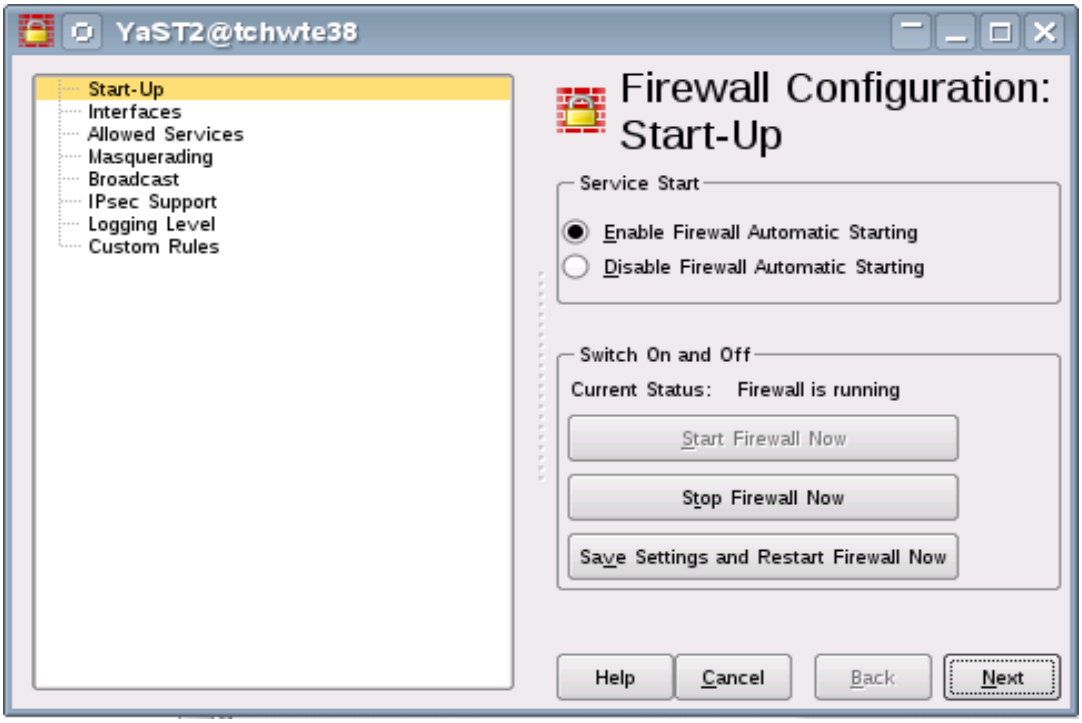


Illustration 172: Configuration of the firewall

11.8 Substitute blocks CAE libraries SYSTEM and SysMon2005

Substitute blocks for CAE library "SYSTEM"

Old block (CAE library SYSTEM)	Substitute block (CAE library SysMon)
SysHmPlcChk01_SG4	MonCtrl2005Cpu01
SysHmSrvCheck01	MonCc01
SysHmSrvProcStat01	MonCcApp01

Substitute blocks for CAE library "SysMon2005"

Old block (CAE library SysMon2005)	Substitute block (CAE library SysMon)
MemXInfo01	MemXInfo01
MonCtrl2005Cpu	MonCtrl2005Cpu
MonCtrl2005Cpu01	MonCtrl2005Cpu01
MonCtrl2005CpuState01	MonCtrl2005CpuState01
ReadEthCfg01	ReadEthCfg01
ReadIoDp01	ReadIoDp01
SysFbMonAlaMod01	AlaMod01
SysFbMonHwRec01	HwRec2005

Old block (CAE library SysMon2005)	Substitute block (CAE library SysMon)
SysFbMonHwSnd01	HwSnd01
SysFbMonPlSlState	PlSlSt01
SysHmMon2005	MonCtrl2005Hw
SysHmMonAlaMod01	MonCtrlAlaMod
SysInfo01	SysInfo01
SysPbMonBP15	MonCtrl2005BP15
TcCalc01	TcCalc01
Txt20	Txt20

11.9 Installation notes for computers of the 'HP ProLiant' series

11.9.1 Goal

The **hardware technical** monitoring and administration of servers of the 'HP ProLiant' series can be carried out comfortably with a web based GUI.

11.9.2 Requirements

The monitoring and maintenance of the 'ProLiant' HP server series demands the installation of the 'ProLiant Support Pack' package supplied by HP.

Several daemons that monitor the state of the hardware components permanently, and report the error states, are installed on the server.

Monitored are:

- the CPUs (Load and temperature)
- the fans
- the working memory
- the power supplies
- the network cards
- the RAID system and each individual hard disk
- the file system

Without these daemons, for example, a monitoring and maintenance of the RAID system is not possible.

11.9.3 Installation of the 'ProLiant Support Pack'

Information about the installation of the 'ProLiant Support Pack' can be found on the HP web page.

The 'ProLiant Support Pack' can be downloaded from the HP website with the following URL:

`http://h18013.www1.hp.com/products/servers/management/psp/`

Choose the '*Download Software*' link for the download.

11.9.4 Error messages in the file system and via the mail system

In the case of an error, the Linux user 'root' obtains a message via mail and error messages are stored in the `/var/log/messages` file.

11.9.5 Use of the web interface (System Management Homepage)

The web interface can be opened in the browser as follows:

`https://<IP of the computer>:2381`

A more comfortable possibility of analyzing the errors is via the web browser interface.

You must authenticate yourself on the website as 'root' with the respective password.

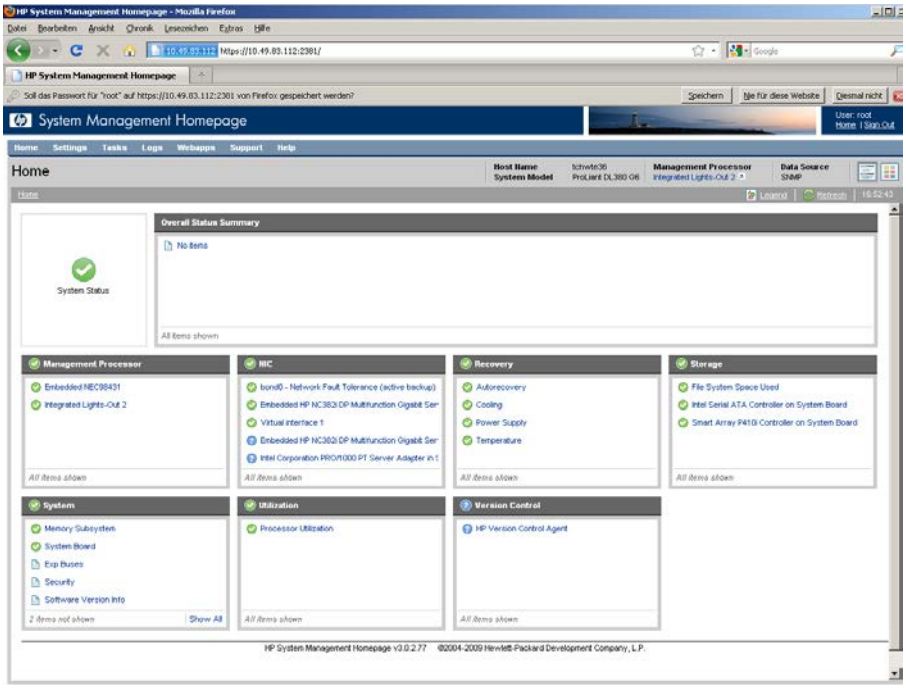


Illustration 173: Use of the web interface 'System Management Homepage'

11.10 Connecting a NAS system to an existing APROL environment

A **N**etwork **A**ttached **S**torage (NAS) is a file server that is simple to manage.

NAS systems are used to offer independent storage capacity in a computer network without a great amount of bother.

11.10.1 General information about access to the NAS system via iSCSI

The following chapter describes the connection of the *ReadyNAS NVX* NAS system *business edition* form the company NETGEAR.

The access to this hardware can basically be made in different ways. The firmware version 4.2.15, at the point of this manual, supports the access via *FTP, SAMBA, NFS, UPnP, rsync, http* and *iSCSI*.

The following description only describes the iSCSI configuration.

iSCSI is the abbreviation for '**I**nternet **S**mall **C**omputing **S**ystem **I**nterface' and uses the iSCSI protocol over a TCP connection.

Excerpt from Wikipedia, the free encyclopedia:

'...iSCSI specifies the transfer and operation of direct saving protocols that are native to TCP. *In this process, SCSI data are packed in TCP & IP packages and transferred over the IP networks....* '

iSCSI is implemented to allow the access to the saving network over a virtual point-to-point connection without having to provide own storage devices.

The access to the hard-disk takes place on the basis of blocks, and is also suitable for databases. Furthermore, the access over iSCSI is transparent; it appears as an access to the local hard-disk in the user level.'

11.10.2 Use of a NAS system in APROL

B&R recommends the use of the ReadyNAS system as a storage device for backups within the CC-Account.

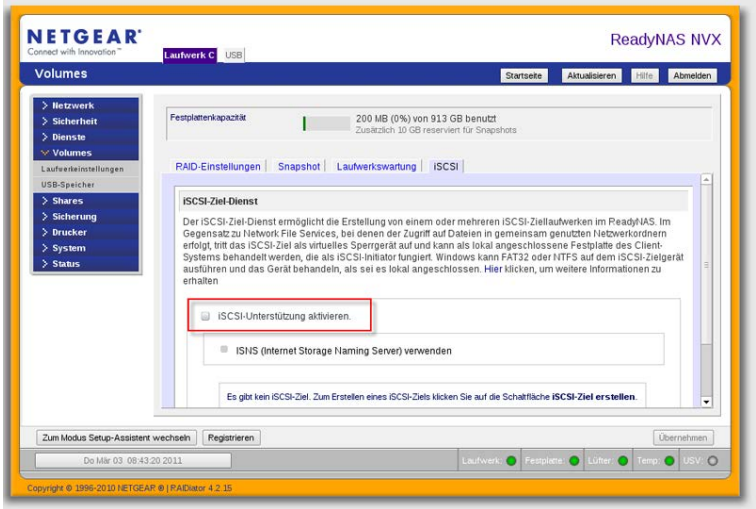
A use of the NAS system as storage medium for the direct recording of ChronoLog / ChronoTrend data (i.e. a use as the 'APROL_DATA' partition) has not yet been enabled by B&R.

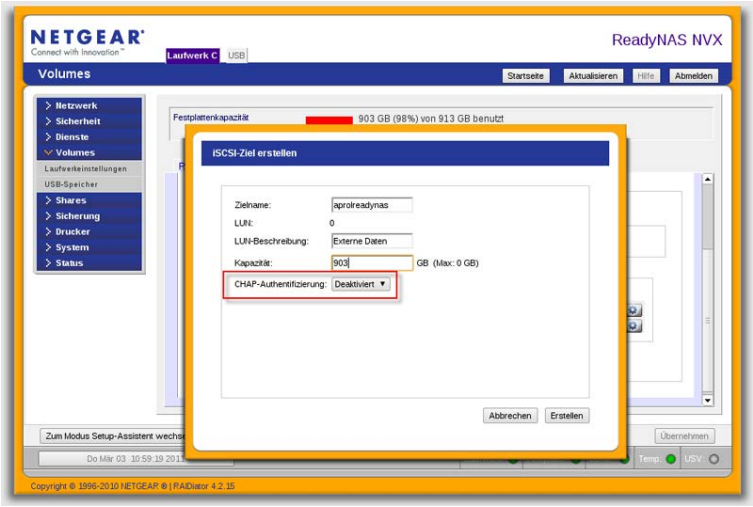
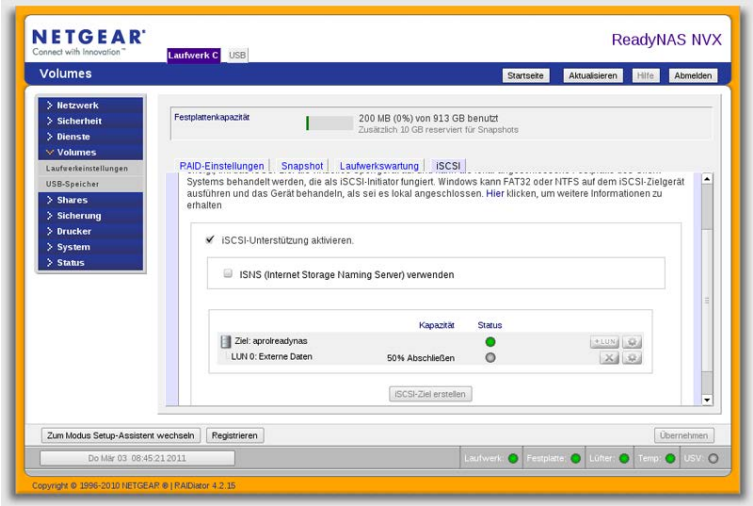
11.10.3 Configuration of the NAS system

The setup of the iSCSI target on the ReadyNAS system is described in following chapter, and in the chapter thereafter, the configuration of the 'iSCSI' initiator. The iSCSI drive is made available in a Linux system with the 'iSCSI Initiator'.

The description is based on the current firmware version 4.2.15.

Proceed as follows for the configuration:

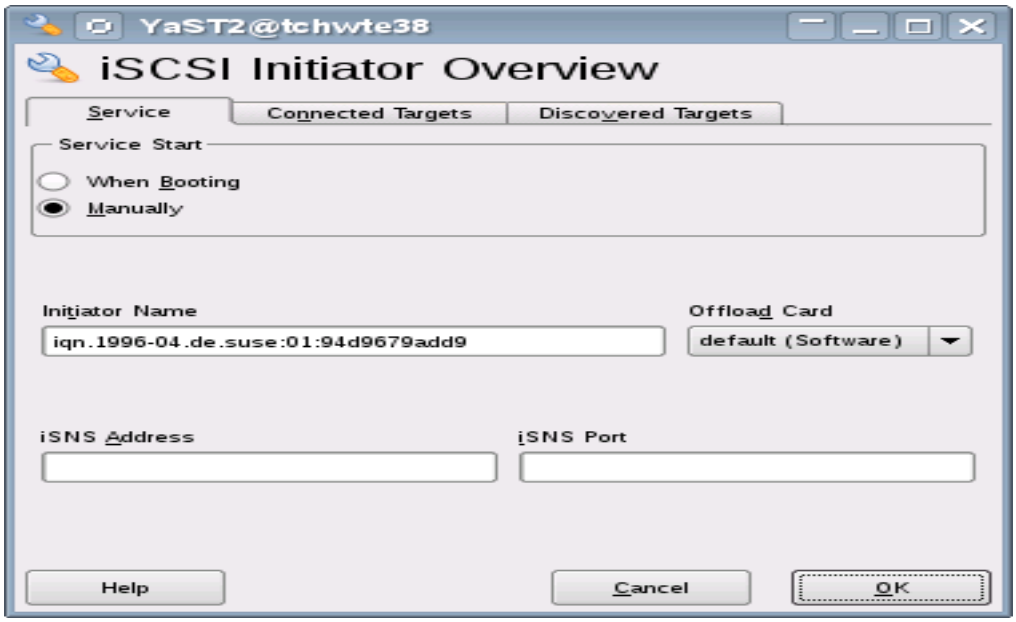
Step	Short description
1	Log in as the 'admin' user on the ReadyNAS NVX: For this, enter the following URL in your web browser: `http://<IP Address>/admin/'` The standard administrator password can be found in the ReadyNAS NVX instruction manual.  *Illustration 174*
2	Choose the 'Volumes / Drive Settings' entry in the navigation frame. Select the tab 'iSCSI' and choose the 'Activate iSCSI support' checkbox.  *Illustration 175*

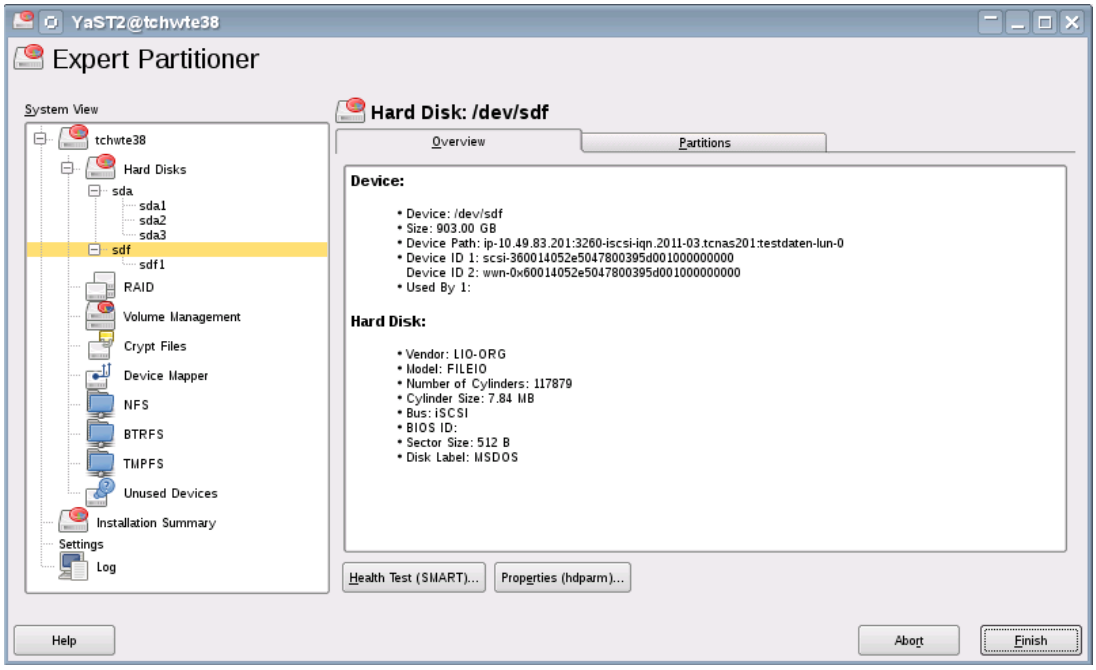
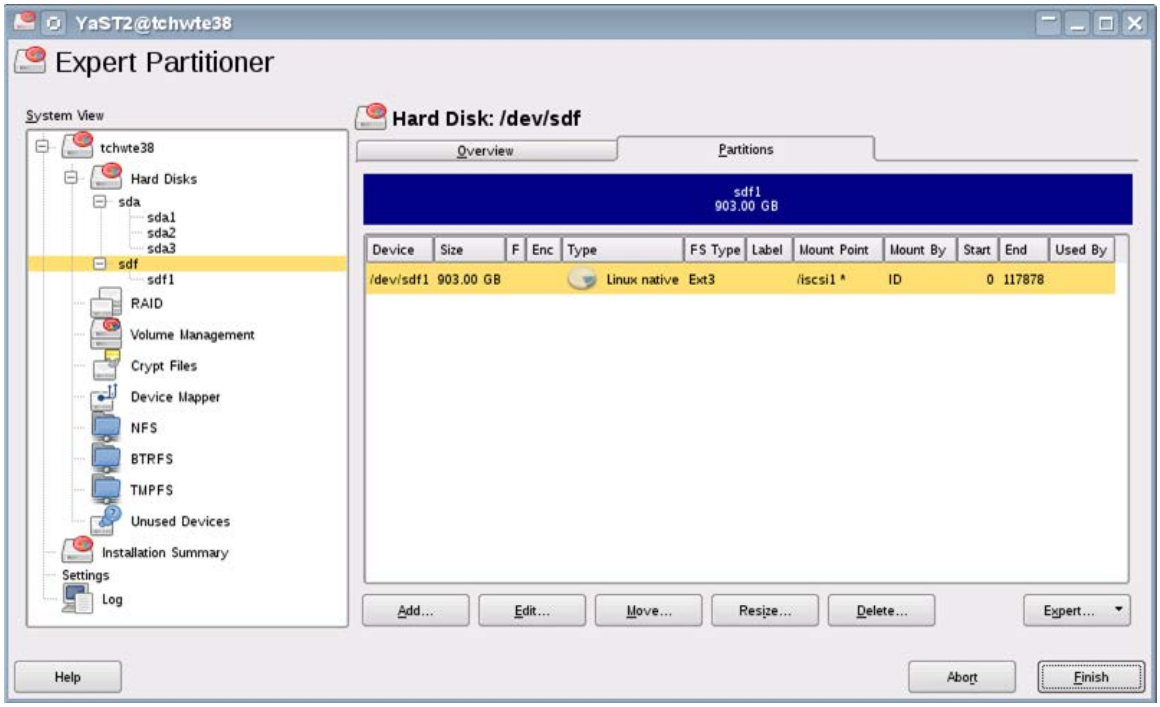
Step	Short description
3	Click on the 'Create iSCSI Target' to create a new entry. The 'Deactivated' entry must be preserved for the 'CHAP Authentication'.  *Illustration 176* Confirm the entries made with the **[Create]** button.
4	The completed configuration is then shown in a similar screen.  *Illustration 177*

11.10.4 Configuration of the 'iSCSI Initiator'

Subsequently, the 'iSCSI Initiator' must be opened in YaST2 to make the iSCSI drive available in a Linux system.

Step	Short description
1	Select the 'iSCSI Initiator' in the 'Network Services' section of YaST2.

Step	Short description
2	The following configuration dialog is displayed after it is opened.  *Illustration 178* Select the 'On System Start' entry in the 'Start Service' section. **The name of the initiator is fixed and is not allowed to be changed.**
3	The iSCSI drive must then be made available to the Linux system. For this, select the 'Detected Targets' tab and press the **[Detection]** button there.
4	Enter the IP address of the ReadyNAS NVX in the 'IP Address' input field of the following 'iSCSI Initiator Detection' dialog Further settings are not necessary in this dialog. Confirm the dialog with [**Continue**].
5	A ReadyNAS drive entry is displayed after the detection has taken place. The entry 'False' then appears as the status in the 'Connected' column. Confirm the [**Register**] button to register the drive in the system. The status is set to 'True' after the registration. Afterwards the 'iSCSI Initiator' is closed with the [**Finish**] button.
6	Select the 'automatic' entry in the 'Startup' section. Further configurations are not necessary in this dialog.

Step	Short description
7	The iSCSI drive that is newly registered can be incorporated into the system and formatted in YaST2 like a new locally connected hard drive. *It must be noted that it is not allowed to write to this 'local hard disk' from several computers. Otherwise, a complete data loss is the result.*  *Illustration 179*
8	Partitioning in YaST.  *Illustration 180* If the hard-disk is already partitioned, please click on the [**Edit**] button to create a mount-point.

11.11 Configuration of the operating system file indexing

An indexed file search can be made on the Linux server with the Linux 'locate' command.

The necessary indexing of the hard-disk takes place with the 'find' process that is normally carried out during the night and can be configured in a 'cron' job.

Depending on the hardware being used and the complexity of the CAE project, the indexing (i.e. execution of the 'find' process) can increase the system load considerably.

11.11.1 Deactivation of the regular indexing

The execution of the indexing can be controlled with the 'RUN_UPDATEDB' attribute in the `/etc/sysconfig/locate` file. The Linux superuser 'root' must set the attribute to 'no' if no automatic indexing is to take place.

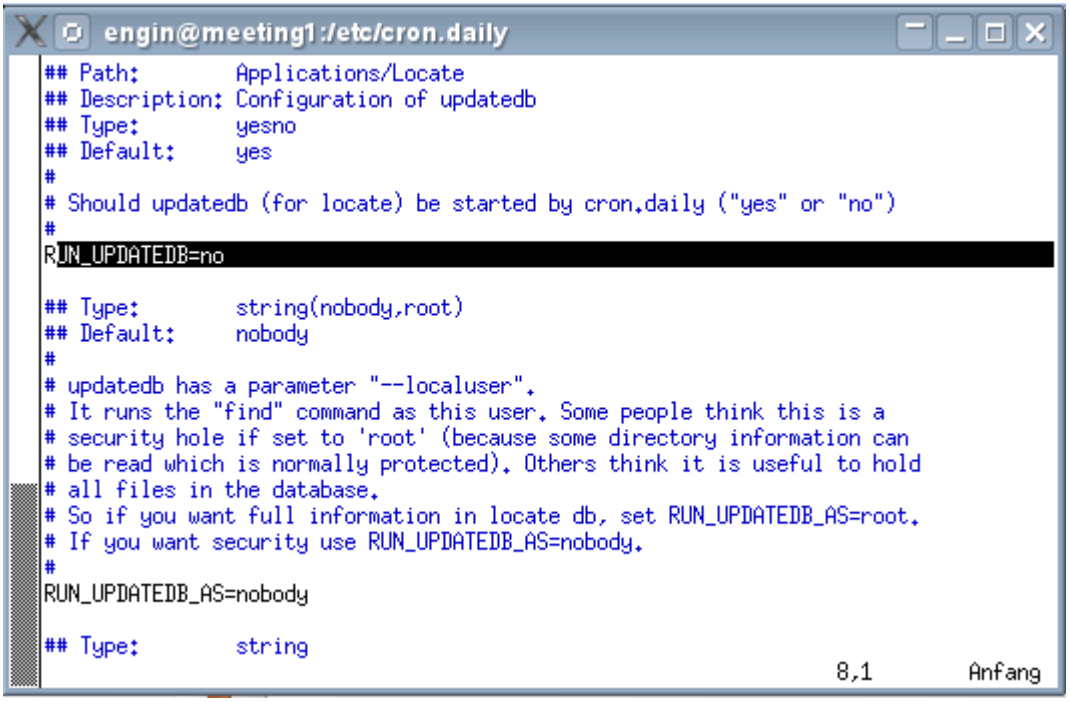


Illustration 181: 'RUN_UPDATEDB' attribute

11.11.2 Manual update of the database for locate

The following script must be executed as the Linux superuser 'root' in order to trigger the index creation when the indexing is turned off:
`/etc/cron.daily/suse.de-updatedb`

Further information can be found in the APROL **Fehler! Kein Name für eine Eigenschaft übergeben.***documentation 'X13 SUSE LINUX Enterprise Server Documentation'*

11.12 Special features of the VMware

11.12.1 Motivation / benefits of the hardware configuration via Automation Studio in a VM

The hardware configuration via *Automation Studio* in a VM offers the following benefits:

Use of the original *Automation Studio* software

The respective current version of *Automation Studio* is used in the APROL environment.

When using the original *Automation Studio* in APROL, only functionalities that are explicitly approved for APROL are activated.

Preinstalled VMware for *Windows* with one-time licensing

The VM is delivered with a preinstalled *Windows* operating system. This must be **licensed and activated** with the delivered customer product key, **only one time** upon using it for the first time.

Automatic connection to the network without configuration

The VMware installation is configured with NAT (**N**etwork **a**ddress **t**ranslation). It is therefore not necessary to configure computer names and networks within the VM when starting it for the first time.

Standard installation of Automation Studio and B&R SafeDESIGNER with one-time licensing

Automation Studio is automatically installed when using the hardware configuration for the first time via the controller editor.

The installation is identical to the installation on an external Windows computer.

Subsequently, it is necessary to license *Automation Studio* **one time only** in the normal way with the delivered serial number.

The licensing procedure must not be carried out again when updating or upgrading the APROL system software.

11.12.2 Usage of the VMware workstation version 9.0.0

The *VMware* workstation is supplied in the version 9.0.0.

The version 9.0.0 contains many bug fixes and correction of security issues.

Detail information: http://www.vmware.com/support/ws90/doc/workstation-90-release-notes.html

11.12.2.1 Use of an existing VMware 8.0.1 license

A new license key is supplied optionally in order to license the VMware work-station 9.0.0.

*The 'AprolDowngradeVMware' script is delivered **in order to be able to work with an existing VMware 8.0.1 license after an upgrade**.*

The script uninstalls the VMware workstation version 9.0.0 and then installs the version 8.0.1 by using the '-downgrade VM8' launching option.

The 'license-ws-80-e1-201010' license file must exist in '/etc/vmware' for the version 8.0.1.

11.12.2.2 Specifics for using a virtual engineering environment in a VMware work-station

It has been possible, since the *VMware* version 8.0.1, to use an APROL engineering system in a *VMware*.

If the APROL engineering system is within a virtual environment, the following must be noted:

ToDo

1) After the installation of the AutoYaST DVD, APROL is not allowed to be installed directly afterwards.
It is necessary to update the *vmware tools* in the guest system.
Thus, please select the 'Continue without installation' option in the dialog and confirm this choice.

2) It is absolutely necessary to install the actual version of the *vmware tools* for the virtual engineering system. The installation and configuration of the vmware tools is described in the official *VMware* documentation.

http://vmware-tools-installation-configuration_DE.pdf

3) After a successful installation of the vmware tools, start the APROL installation by entering `'AprolInstall'` in the command line.

11.12.3 Changing the Windows configuration within the VM

In certain cases it may be necessary to make subsequent changes to the *Windows* configuration (within the VM).
This may be necessary for example in the following cases:

- to configure an expansion of a B&R series 2010 controller (activation of the "Legacy mode")
- or for the installation of drivers for card readers.

You have the possibility of carrying out a subsequent change in the *Windows* configuration (within the VM) directly from the **CaeManager**.

The VM is started after choosing the '**Configuration Windows (VMware)**' menu item.
Thereafter, changes can be made in the Windows environment. A new snapshot is created in

the VM after the subsequent confirmation of the configuration changes, which will be used for future controller configurations.

If all of the dialogs (amongst others, Windows auto-start dialog) which have appeared because of mounting the new ISO image and the auto-start of the AS setup contained therein are not closed, then the dialogs are recorded in the snapshot.

*Use the **'Windows Configuration (VMware)'** menu item to clear up, and create a new snapshot when the dialogs have been closed.*

11.12.4 Handling the VMware images

Basically you have the following possibilities in the scope of the upgrade to APROL R 3.6 for using the VMware images

Backup of the VMware image in the scope of APROL R 3.4 (recommended)
a) Upgrade of the system software to APROL R 3.6 including new installation of the VMware version 7.0 b) Restoration of the VMware image backup from APROL R 3.4 c) **No actions to be taken** with respect to Windows licensing d) If the restored VMware is <= version 6.5, an update of the VMware tools is definitely mandatory. **Details can be found in the following chapter!** **Advantage:** A new licensing of Windows is **not necessary**

Use of a new VMware image
a) Upgrade of the system software to APROL R 3.6 including new installation of the VMware version 7.0 b) Use of the newly installed VMware image c) Windows licensing is **necessary** d) No further actions with respect to the VMware tools **Disadvantage:** A **new licensing** of Windows is **necessary.**

11.12.4.1 Procedure for updating the VMware tools

Now proceed for this as follows:

Step:	Description:
1	A test license for the *VMware* 7.0 is installed in this engineering environment (Engineering system) during the CAE update. **This license is to be exchanged immediately after the update with the delivered *VMware* license.** Details about licensing can be found in the APROL documentation "E1 Controller & I/O", chapter *Licensing the VMware*.
2	Call up the **'Extras / Configure Windows (VMware)'** menu item in the **CaeManager**.
3	After Windows has started, a necessary update of the *VMware* tools is signalized by a yellow triangle on the *VMware* tools icon (in the info area of the Windows status bar). The '**VMware tools properties**' dialog is opened with a double-click on the yellow triangle. Confirm the [**Update tools**]´button in this dialog, in the '*Options*' tab.
4	A *VM* reboot is necessary after the update has been carried out successfully. Confirm executing the reboot in the '**VMware tolls Setup**' dialog with [**Yes**].
5	Log into the Windows environment as the 'APROL' user after the reboot.
6	A new snapshot can be created afterwards in the context of the **CaeManager**. Thereafter, the *VMware* can be used as normal.

These steps must definitely be carried out before a controller is opened for the first time.

The necessary steps are shown in the following overview:

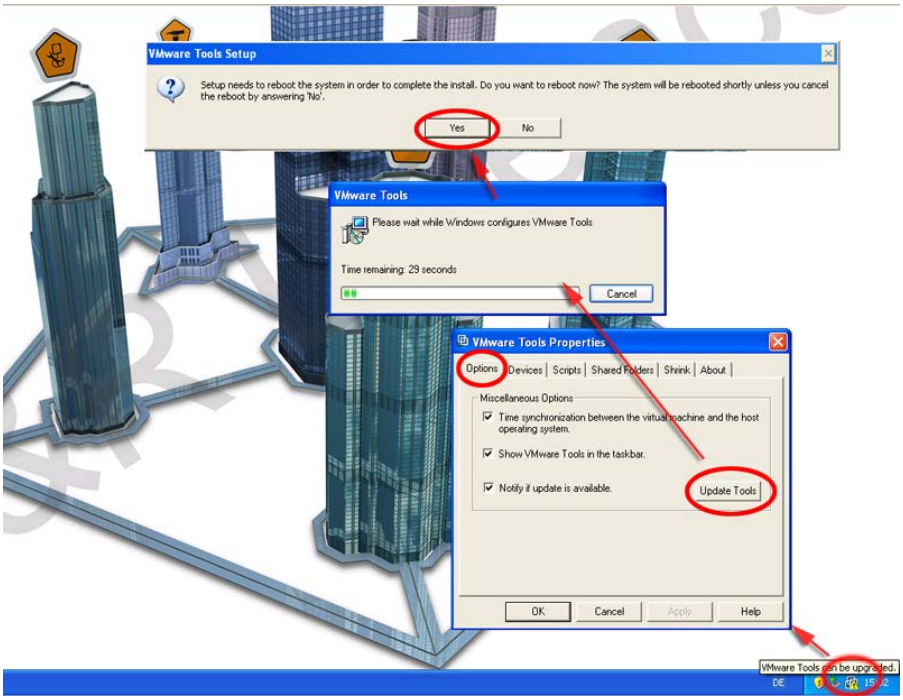


Illustration 182: Update of the VMware tools

11.12.5 Transfer of all types of files from the VMware

It is now possible to pack files from the VMware file system in an archive, after an Automation Studio hardware configuration, by providing a file list in the engineering environment.

This archive is then saved in the version of the controller that is open. If this version of the controller is compiled in the CaeManager, an archive is written in the in the file system of the engineering system, where it can subsequently be edited.

The file list, which specifies the scope of the data to be transferred must be stored in the directory '/home/<Engineering system>/ENGIN/PROJECTS/<Project name>/cnf/VM_Data'.

The above mentioned intentionally directory must be created in the Linux file system.

It is possible to differentiate between one special instance of a controller and all controllers by selecting the appropriate file name of this file list.

`Global.FileList`
Files with absolute path specifications can be entered in this file list, which will then be packed in the VMware environment and transferred to the Linux file system. This file is evaluated when there is **no specific file for the controller instance that is currently open**.

`<CtrlInst>.FileList`

Files with absolute path specifications can be entered in this file list, which will then be packed **for this controller** in the VMware environment and transferred to the Linux file system.

After a build of the controller in Automation Studio, a TGZ that contains the files listed in the configuration files is created automatically.

When compiling the corresponding 'Controller' project part in the APROL environment, the TGZ is stored in the Linux path 'home/<Engineering system>/ENGIN/PROJECTS/<Project name>/pgm/<Controller instance>/AS30/Customer' with the name 'VM_Data.tgz'.

The TGZ there can be unpacked and used for further processing.

The archive size is currently limited to 100 MB. It must be noted that the archive is contained in each version of the controller, and thus increases the size of the database.

11.13 Provision of a 'SamplesProject'

B&R delivers an example project in the form of a 'SamplesProject', in which diverse APROL system functionalities are used and documented.

*The as-built documentation for the CAE project and project parts can be opened via the **'Show Documentation (as-built)'** context menu after the project / project part is selected.*

You are offered a quick overview of examples and problem solutions in a structure that is ordered according to different topics.

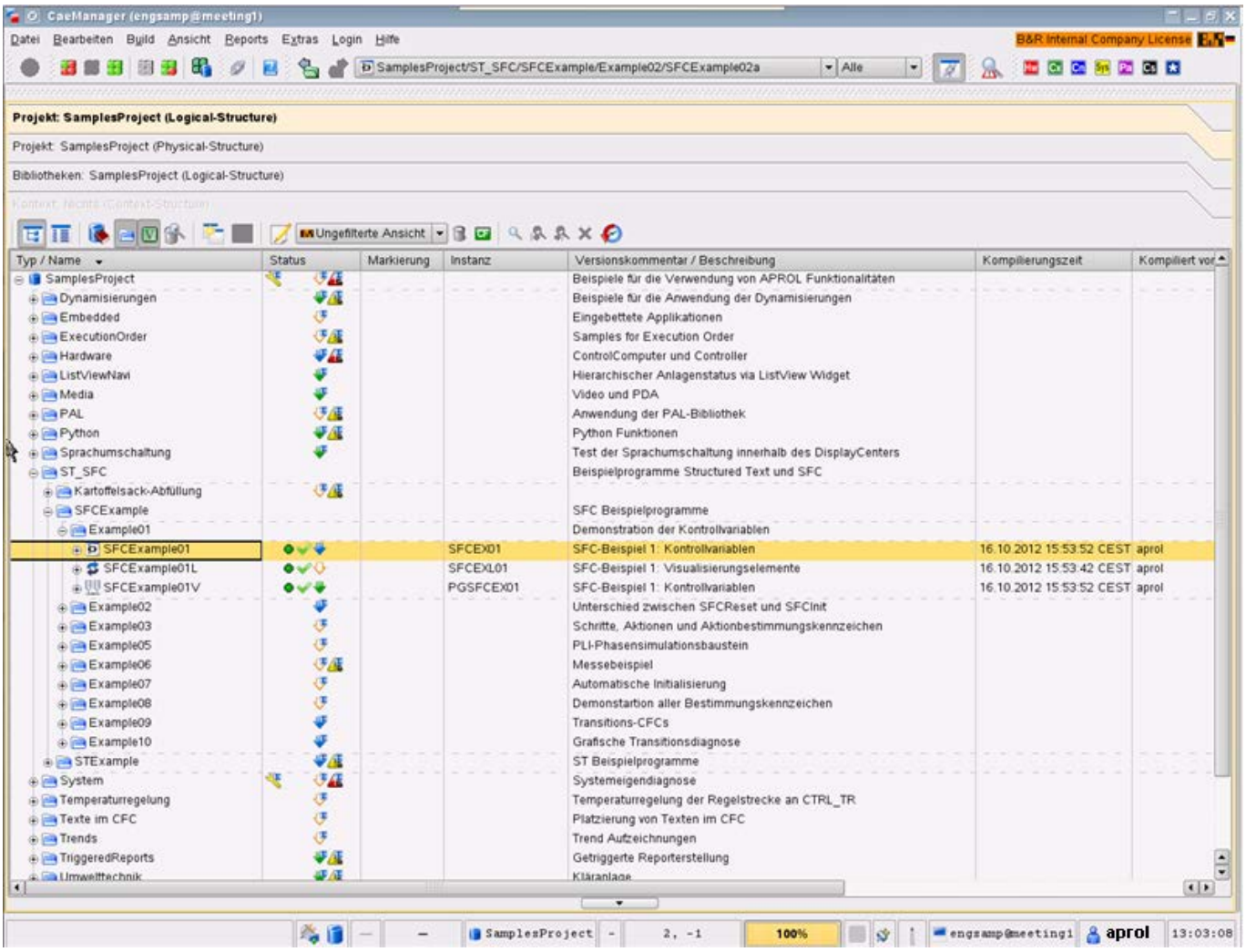


Illustration 183: Logical structure 'SamplesProject'

The engineering system and the runtime system are on the same hardware. In the scope of the installation of the APROL system software, the **'Complete installation'** item is to be chosen for this purpose.

11.13.1 Installation of the 'SamplesProject'

The 'SamplesProject' can be installed in the engineering environment via CaeRestore (**'File / CAE Database / CaeRestore'** menu item) in the CaeManager.

Please note that the existing system environment (e.g. CAE libraries, projects, users) is replaced completely after a CaeRestore.

Navigate to the `/opt/aprol/ENGIN/DEMOPROJECTS/` directory in the file selection dialog, and select the TAR archive `CAE_BACKUP_<APROL release>_SamplesProject'_<Time stamp>.tar`.

The standard user, who has all global and project rights is the user 'aprol' with the password 'BuR1.aprol'.

The standard operator in the runtime environment is the 'Operator' with the password 'BuR1.operator'.

You can find all configured users and operators, including the respective passwords, in the as-built documentation of the 'SamplesProject'.

The additional CAE libraries 'DEMO' and 'Python' are installed together with the 'SamplesProject' and their blocks are used in the 'SamplesProject'.

A build of all CAE libraries must always be carried out.

11.13.2 Necessary adjustments in the project

The following configurations are to be adjusted after the CaeRestore:

- **The entry of the current host name (instead of 'localhost') and the domain name** in the **'Control computer'** project part, **'Master data'** tab.

  The affected 'APROL_Runtime_HW_01' and 'APROL_Runtime_HW_02' project parts are in the **'Hardware / Control Computer' directory**.

  Activate and compile the project parts thereafter.

- The following is necessary in the respective ' 

system' project parts to adopt the host name that was changed in the 'Control computer' project parts.

  Reactivate (active version) and compile the 'APROL_Runtime_SYS' and 'APROL_Runtime_2_SYS' project parts.

- **Creation of the CC-Accounts** 'runtime' and 'runtime2' **with AprolConfig**

  Basically, the identifiers of the CC-Accounts in the 'APROL systems' must correspond to the identifiers specified in AprolConfig (Default: 'runtime' and 'runtime2').

  The **'integrated operator system'** option must be set in **'CC-Account details'** for both runtime systems in AprolConfig.

- Because the hyper macros of the 'SysMon' library read the names and instances of controllers and control computers, **the following is necessary if these attributes are changed**:

  The changed names / instances must be adjusted in the properties of the SysMon hyper macros which are placed in CFCs the 'System / Logik' directory.

Afterwards, a 'Build (Project)' and a download to all target systems must be carried out.

11.13.3 Hardware for use of the 'SamplesProject'

- The controller 'CTRL_TR' must be present for the SFC functionalities and for the examples in the 'PAL' CAE library.

- The 'SamplesProject' is built to have an operator system on a separate hardware.

  The above mentioned adjustments to the runtime systems are also to be carried out for the operator system.

11.13.4 First steps in the 'SamplesProject'

Log in to the runtime environment.

The DisplayCenter is started automatically and the 'Operator' is logged in as default operator.

You must log in to the LoginServer as the operator 'Demonstration' (Password 'BuR1.demonstration') in order to start a slide show with selected process graphics.

Configuration in the DisplayCenter:

After the first download, some faceplates from the 'PAL' CAE library have an 'Inhibit' state and therefore cannot be operated.

Illustration 184: 'inhibit' icon

The 'inhibit' state must be switched off in the faceplate 'special modes'. Detailed information about this can be found in the manual '*L1 PAL Documentation*'.

11.14 Typical reported problems / solutions (FAQ)

The following overview contains **frequently asked questions** (FAQ) which concern the installation of the **Linux operating system**, the installation of the APROL **system software**, and the basic configuration of the **CC-Account**.

The list is not sorted by themes and will be extended on the basis of support queries.

1	**Problem report:**
	The KDE configuration in the engineering environment should be set back to the original delivery state of the respective APROL release.
	Solution approach:

1	**Problem report:**
	Now proceed for this as follows: 1) Log out of the graphic environment of the engineering system. 2) Log in to the console of the engineering system. 3) Open the '`.APROL-rel`' file in edit mode in the home directory of the engineering system. 4) Change the release identifier in the head of the file to a previous release. Example: Change from: *APROL R 3.6-09* to *APROL R 3.6-08* 5) Save the changes in the '`.APROL-rel`' file. 6) Log back in to the graphic environment of the engineering system, so that the changes can take effect.

11.15 Revision history

Manual version	Date	Change	Author / *checked by*:
6.07	26.09.2014	Chapter *'ChronoPlex', 'Later installation of an additional hard disk for trend records and ChronoLog data'*, *'Automatic adjustment via AprolChangeHost'* and *'The installation of SLES'* Trend data forwarding	RN
	17.09.2014	Chapter *TrendData replacement solutions* deleted and revised in manual D2	RN
	17.09.2014	Chapter *ChronoPlex*: Size limit for trend data	KSc
	12.09.2014	Revision of chapters in the *Appendix*	RN *PS, SO, EM*
	02.09.2014	Corrections in chapter *Linux installation / Introduction*	KSc *PS, ELa*
	02.09.2014	New chapter *License loss due to hardware exchange*	KSc *MHa*
6.06	13.08.2014	Revision of chapter *Multiscreening* (3x with APC910)	RN *DD, DA*
	30.07.2014	Revision of chapter *Touchscreen configuration* (multitouch) and *The installation of SLES* (Link)	RN *PS, DA*
6.05	01.07.2014	New chapter *Relocation of a logging server*	IS, RN *RM*
6.04	03.06.2014	New chapter *Linux analysis tools*	TP
	03.06.2014	New chapter *Relocation of a logging server*	IS, RN, KSc
6.03	09.04.2014	Revision of chapters *Configuring VNC*, *Configuration of a firewall with MAC address filtering*, *Remote operation via VNC*	KSc *ELa*
6.02	13.03.2014	Term 'APROL computer' -> 'APROL server'	RN
6.01	13.02.2014	Revision of chapter *Necessary adjustments after changing the host name*	ELa *KSc*
	16.01.2014	Additional notes about the license database in chapter *Optional use of the 'License Protection Hardware Key'*	KSc

Manual version	Date	Change	Author / *checked by*:
6.00	28.11.2013	Formatting to DIN A4 and fonts	RN
	25.11.2013	Revision of chapter *Necessary adjustments after changing the host name (AprolChangeHost)*	ELa
	11.07.2013	New chapter *Transfer of all types of files from the VMware*	KSc
	27.05.2013	Extension of chapter *Special notes about the use of the VNC service*	KSc
	06.05.2013	Additions in chapter *First steps in the 'SamplesProject'*	RN *MHe*
	30.04.2013	Chapter *Graphics cards tested for Multiscreening* Information for supported hardware / matrix removed	KSc *MHe*
	29.04.2013	Addition to chapter *Bonding configuration via YaST*	RN *JH*
	25.04.2013	Update of chapter *Graphics cards tested for Multiscreening*	KSc
	22.04.2013	Update of chapter *Using a CAE block and system variables to monitor the UPS*	RN *EM*
	19.04.2013	New chapter *Typical reported problems / solutions (FAQ)*	KSc *PSt, DD*
	15.04.2013	New chapter *Optional use of the 'License Protection Hardware Key'*	KSc *MHa, PSt*
	05.04.2013	Extension of chapter *Tools in the KDE menu*	KSc
	04.03.2013	Extension of chapter *Provision of a SamplesProject*	KSc
	19.02.2013	Update of the screenshots	Ksc
	11.02.2013	Additional information in chapter *Configuration of the 'iSCSI Initiator'*	KSc *ELa*
	07.02.2013	New chapter *APROL LDAP server*	EL
	24.01.2013	New chapter *Special features of the VMware*	KSc
	14.01.2013	New chapter *Provision of a SamplesProject*	KSc
	11.01.2013	New chapter *LDAP configuration*	KSc
	20.12.2012	Revision of chapter *Linux Installation*	KSc *MM*
	04.12.2012	Chapter *APROL* installation and update, Note VMware 9.0	RN
	04.09.2012	Revision of terms (APROL system / CC-Account)	KSc

Manual version	Date	Change	Author / *checked by*:
5.24	29.05.2012	Boot parameter entry in chapter *The installation of SLES*	RN *MT EL*
	23.04.2012	Chapter The installation of language packages Screenshot for available languages updated	KSc
		Update of chapter *General information about APROL Licensing*	KSc
5.23	30.03.2012	Adjustment of chapter *Use of the Linux tool 'touchcal'*	RN *MM*
5.22	08.03.2012	New chapter *Configuration of a firewall with MAC address filtering*	PS *MM*
5.21	08.02.2012	New chapter *Configuration of the operating system file indexing*	KSc *PS*
5.20	12.01.2012	Revision of chapter *APROL* installation and update	KSc *ELa*
	02.11.2011	New chapter *Necessary adjustments for the authentication via LDAP*	KSc *AW*
	24.10.2011	Chapter *Configuration of NTP* Description of Hopf radio clock changed	KSc
5.19	10.10.2011	Chapter *APROL delivery contents*: License certificate exchanged	KSc
	26.09.2011	Expansion of the chapter *The installation of SLES*	KSc
	20.09.2011	Correction of the chapter *Updating the operating system (SLES) from the AutoYaST installation DVD*	KSc MRa
5.18	06.09.11	Revision of chapter *Language DVD*	KSc
5.17	15.08.11	New chapter *'Use of bonding (active backup) for realization of a bur redundancy with a separate control and process bus*	ELa, KSc
	06.07.11	New chapter *APROL File Selection Dialog*	RN
5.15	16.06.11	Revision of chapter *Redundant networks* Bonding configuration via YaST	KSc *MHe*
5.14	27.05.11	Extension of the chapter APROL installation and update	KSc
	24.05.11	Revision of chapter *Redundant networks* Extension of the chapter *Tools (Apache Directory Studio)*	KSc *MHe*
	18.05.11	Revision of the chapter *Cluster for redundancy runtime systems*	KSc, RN *JRu, DD*

Manual version	Date	Change	Author / *checked by*:
5.13	18.04.11	Revision of chapter *Optional adjustments to the firewall*	KSc, RN *CKo, PS*
	31.03.11	New chapter *Connecting a NAS system to an existing APROL environment*	KSc *PS, MHe, MT*
5.12	03.03.11	Information about overwriting the dual boot configuration in chapter *APROL Installation and Update*	KSc *PS*
5.11	11.02.11	Update of chapter *AprolConfig*	ELa
	27.01.11	Addition to chapter *Cluster requirements and configuration*	ELa
	21.01.11	Note in chapter *APROL Installation and Update* about error message during mounting	KSc *Ela*
5.10	17.01.11	New chapter *Optional adjustments to the firewall*	RN, CKo *PS, ELa*
	02.11.10	Chapter *Installation of the 'ProLiant Support Pack'* Note about installation according to HP web page	KSc *MHe*
5.09	02.11.10	Update of the chapter *Updating the operating system (SLES) from the AutoYaST installation DVD*	KSc / RN
	01.10.10	Update of chapter *AprolConfig*	ELa
5.08	27.09.10	Adjustment of chapter *Problems when using the Intel graphic chip set with SLES 11* for APROL R 3.6-02	KSc *MT, PS, AT*
	22.09.10	Chapter *The installation of SLES* Note about setting the BIOS clock	KSc
5.07	12.08.10	Revision of terms: ST, SFC, CFC	RN
	06.08.10	Adjustment of the chapter *Installation of SLES* to SLES 11	KSc, *JR*
	06.08.10	New chapter *VNC Recordings*	RN, KSc *JR, CKo, MT*
	29.07.10	New description of AprolConfig	ELa
	27.07.10	Chapter The installation of SLES Information about using the 'Fully Qualified Host names'	KSc *PS*
	29.07.10	New chapter *Problems when using the Intel graphic chip set with SLES 11*	KSc, RN *MT, JR, CKo*
5.06	30.06.10	Revision of the chapter APROL installation and update	KSc *DD* *JR*
5.05	30.06.10	Revision of the chapter *Redundant networks* (due to SLES11)	KSc *JR*

Manual version	Date	Change	Author / *checked by*:
5.04	17.06.10	Chapter *Screenshots (ksnapshot)* Note about use of 'pyvnc2swf' tool for Defect Tracking.	KSc
5.03	07.06.10	Information about patch installation in a runtime / operator environment in chapter *Execution of patch installation*.	KSc
5.02	08.04.10	Chapter *Updating the operating system (SLES) from the AutoYaST installation DVD* adopted from manual 'A3 Upgrade Notes'.	KSc
5.01	07.04.10	Revision (due to AprolConfig) of chapter *Necessary adjustments after changing the host name*	RN, KSc
	25.03.10	New chapter *Installation notes for computers of the 'HP ProLiant' series*	KSc *MHe*
	09.11.09	Information about the 'B&R Partner License'	KSc
	10.09.09	New description of 'Multiscreening'	MB, KSc *JR*
5.00	19.05.09	Extension of chapter *Installation of SLES*, additional hard disk	RN

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