

TM810

APROL Backup Installation Recovery



Requirements

Seminar:	SEM841.5
Software	APROL SuSE LINUX
Hardware	1 control computer, 1 controller

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1 Introduction

This training module contains basic information for setting up an APROL system. A number of **"screen-shots"** are provided in the documentation to make installation of this comprehensive system easier.

We will go through the installation **"step by step"** in order to show you the simple installation and configuration. While learning about the process control system installation, you will automatically gain information about the Linux operating system.

After completing the installation of the Release, you will have no problems setting up APROL systems in the future.



Figure 1: Introduction

1.1 Objective

This training manual deals with three main topics:

- Backup of a runtime and engineering system
- Complete installation of a runtime and engineering system
- Recovery of a runtime and engineering system

The objective of this training is to learn how to backup, set up, configure, and commission an APROL system on your own.

Example projects and the documentation are contained in the APROL system software.

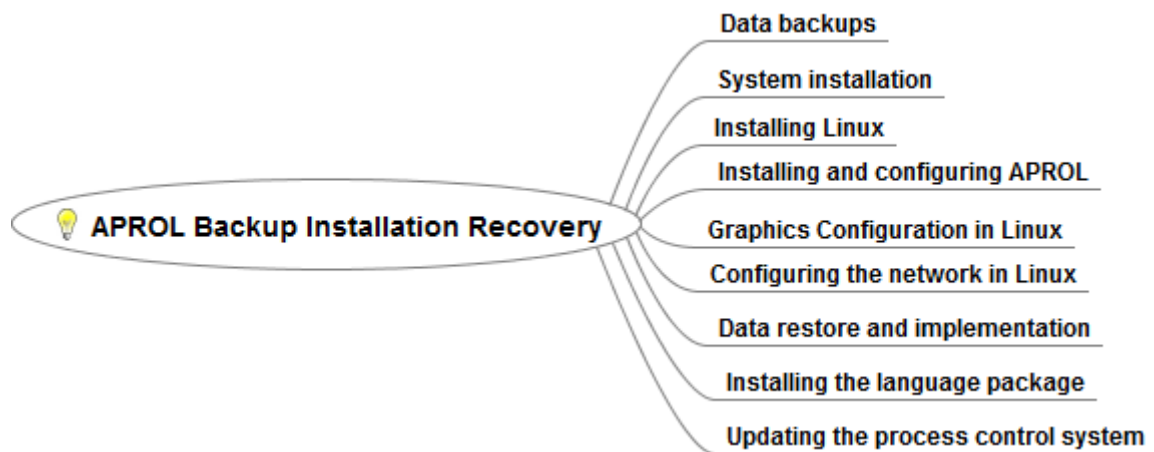


Figure 2: Overview

2 Data backups

It is necessary to backup all of the relevant plant information, so that it can be restored with all of the functionalities at a later date. A differentiation is made between engineering, runtime, and historical data.

Normally, the engineering data is sufficient for a restore. Although, this means that the start-up would have to be done from scratch. This is why this training document also covers all other relevant data (e.g. remanence data in runtime).



Figure 3: Data backups

2.1 Save engineering data

Engineering data can be saved using the CaeManager in an existing system, by using the **"File > CAE Database > CaeBackup"** menu item. The data backup is then stored in the engineering home directory (e.g.: /home/engin) in the path **"APROL_CAE_BACKUPS"**, with the current timestamp of this backup.

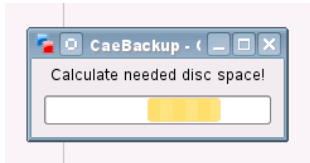


Figure 4: Check if backup possible

The following configuration window appears after a check has been made to see if a backup is possible.

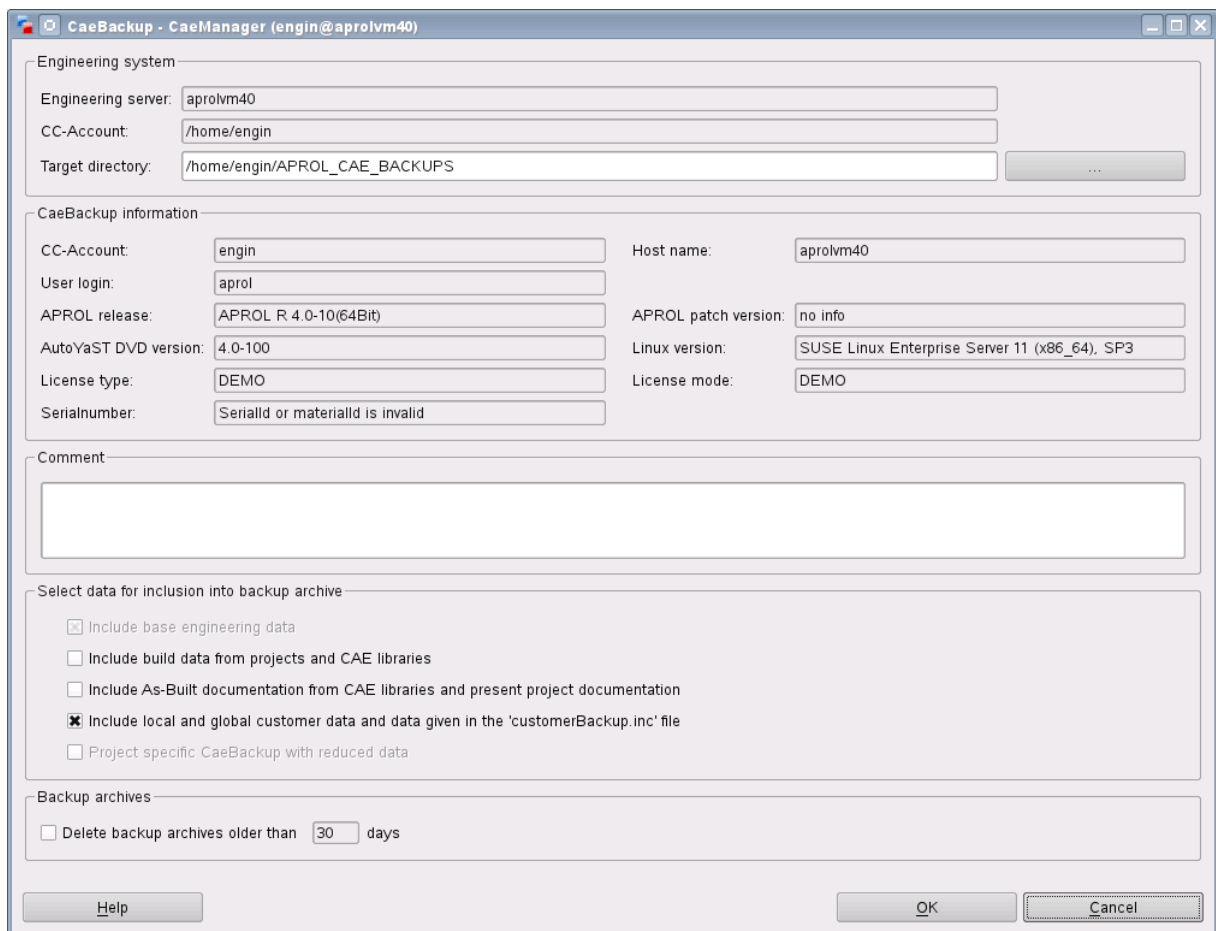


Figure 5: Engineering data backup start window

One can define the scope of the data backup before it is carried out. All of the data (libraries created by GenLib, project data created by devil (tasks, etc.)) can be saved in this way if desired. This means that the data is available immediately after a restore (no additional build required). However, this type of data backup requires more space.

Data backups

The standard setting **"Include base engineering data"** suffices for a restoration of the project. In this case, all of the data (GenLib, devil) must be recreated after the recovery procedure.

Customer-specific directories can also be saved with the "customerBackup.inc" configuration file.

The following screenshot offers an example of multiple data backups:

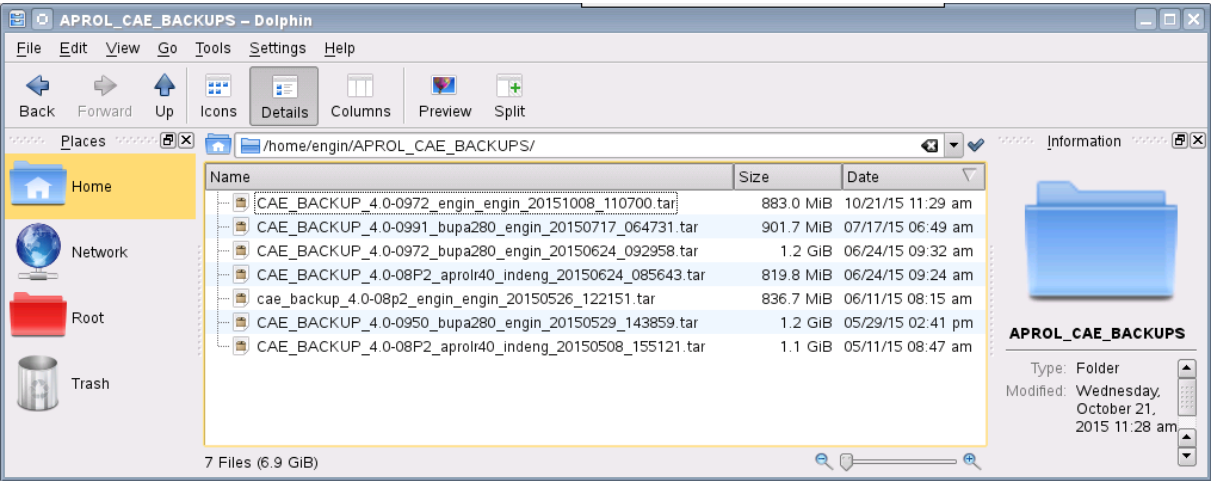


Figure 6: Data backup in the Linux file system

This data can be burned to CD or transferred to another computer via the network. The user has a great degree of flexibility in this case. In our case, we find various data backups available for copying.

**Task:**
Perform a data backup of your project. Save the data to your USB data stick.

2.2 Save runtime data

In a runtime system, there is data of varying types which are useful when restoring the project and starting up again.

The following list shows the most important data, but is not complete.

Identification data	Localization
Remanence data	The most important data is: AlarmServer_<self ID>.remanence <computer name>:<losys port>.remanence_64.bak <computer name>:<losys port>.remanence_64.cfg <computer name>:<losys port>.remanence_64.in These are in the path "/home/<runtime system>/RUNTIME"

Identification data

Localization

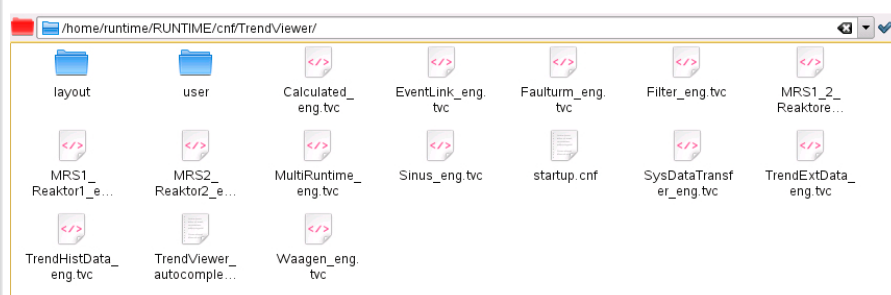


Name	Size	Date
cnf	36 items	11/04/15 03:06 pm
FORMEL	12 items	08/20/15 10:38 am
python	8 items	11/04/15 03:05 pm
REPORTS	0 items	08/25/15 01:33 pm
SOUND	6 items	08/20/15 09:47 am
TASK	10 items	08/20/15 10:38 am
TEXT	25 items	08/20/15 09:47 am
WEB	2 items	08/21/15 07:40 am
AlarmServer_dem1.remanence	8.9 KiB	11/05/15 10:11 am
aprolvm40.0.import.cfg	6.0 KiB	08/20/15 10:38 am
aprolvm40.0.remanence_64.bak	2.5 MiB	11/05/15 09:46 am
aprolvm40.0.remanence_64.cfg	1.2 MiB	08/21/15 07:41 am
aprolvm40.0.remanence_64.in	2.5 MiB	11/05/15 10:01 am
ChronoLogServer.in.txt	187 B	11/05/15 10:14 am
DC_remanence_dem1.pcl	50 B	11/04/15 04:21 pm
debugdb.link	6.8 MiB	08/21/15 07:40 am
debugdb.tree	419.9 MiB	08/21/15 07:40 am
debugdb_old.link	6.8 MiB	08/21/15 07:40 am
debugdb_old.tree	419.9 MiB	08/21/15 07:40 am
hw_config.xml	3.6 KiB	08/20/15 10:38 am
runtime-systems.cnf	1.2 KiB	08/20/15 10:38 am
runtime.db.link	4.8 MiB	08/21/15 07:40 am
runtime.db.tree	25.6 MiB	08/21/15 07:40 am

Trend compositions

A user may have composed many of their own trend curves in the course of time. These should also be backed up, so that they can be copied back to the same place and reused.

The data is generally in the directory "**~RUNTIME/cnf/TrendViewer**". The trend compositions can be found here (ending with ***.tvc**). The layout back-up (ending ***.tvl**) can be found in a subdirectory "**layout**".



Name	Size	Date
layout		
user		
Calculated_eng.tvc		
EventLink_eng.tvc		
Faultum_eng.tvc		
Filter_eng.tvc		
MRS1_2_Reaktore...		
MRS1_Reaktor1_e...		
MRS2_Reaktor2_e...		
MultiRuntime_eng.tvc		
Sinus_eng.tvc		
startup.cnf		
SysDataTransf_er_eng.tvc		
TrendExtData_eng.tvc		
TrendHistData_eng.tvc		
TrendViewer_autocomple...		
Waagen_eng.tvc		

ControllerManager data

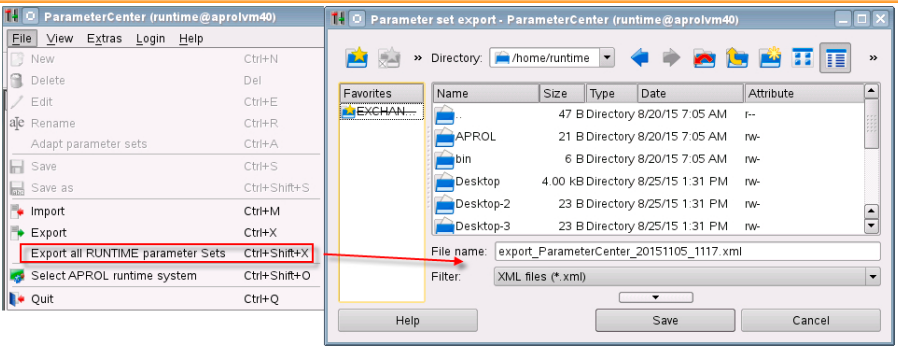
Additional data for the ControllerManager may be connection data (ending ***.eConn**) and Watch compositions (endings ***.Watch** and ***.DefaultWatch**). These can be found in the "**~RUNTIME/cnf/ControllerManager/config**" directory.

ParameterCenter data

All ParameterCenter parameter sets and recipes which do not originate from engineering can be saved via "**File > Export all Runtime Parameter Sets**". An XML file is created and should be saved.

Identification data

Localization



Own data

Customer-specific data

At best, this data should be gathered in one directory and transferred to an external data storage device (USB stick, network, FTP, etc.).



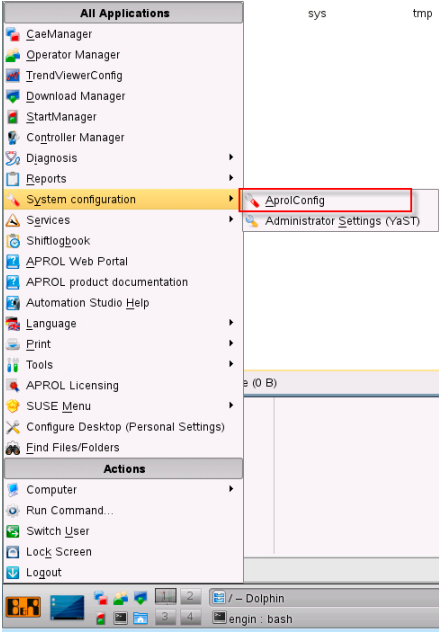
Task:

Save your remanence data to your USB data stick. Also save all other relevant runtime data to your data storage device.

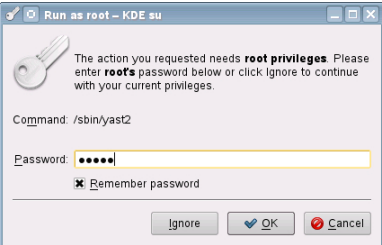
2.3 Save AprolConfig data and additional data

An APROL server must be installed and configured respectively, in order to act as an engineering, runtime, or operator system. This configuration is made via the **"AprolConfig"** tool. Furthermore, there are several configuration files (Linux) which might also have to be saved.

The following list shows the most important data, but is not complete.

Identification data	Localization
AprolConfig data	AprolConfig depicts the entire system-specific configuration. The single AprolConfig aspects are dealt with in detail later in this document. For now, it is important to learn how the configuration data can be saved, in order to use it for the restoration of the system. AprolConfig can be started via the KDE menu or in the root environment from the desktop. 

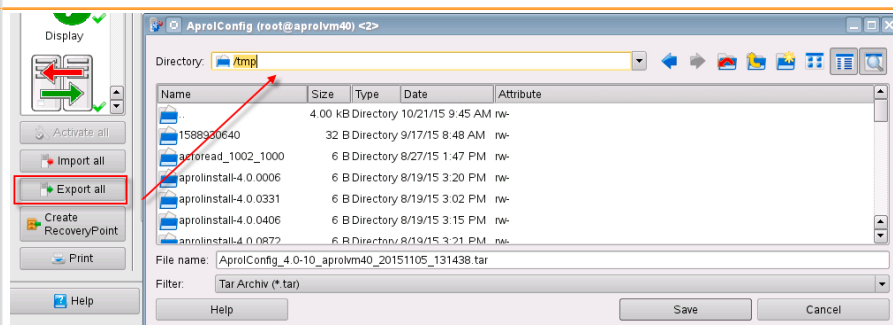
After root authentication, the "AprolConfig" configuration tool starts.



The **"Export all"** button is under the different AprolConfig aspects in the leftmost area. The entire configuration is saved in the intended path after a name and optional description is entered.

Identification data

Localization



Files in /etc

There are many system- specific files in the **/etc** directory. A couple may be of importance for the restoration of the system.

/etc/hosts
 /etc/hosts.equiv
 /etc/fstab
 /etc/services
 /etc/sudoers
 /etc/BrLicense/ (if licensed with a dongle)
 /etc/X11/xorg.conf
 ...

Files in /var/log

The log files may have a significance for analysis at a later stage. The most important are:

messages
 boot.msg
 ChronoPlex.err
 xinetd.log
 Xorg.0.log

There may also be backup files (suffix *.bz2) in addition to the corresponding files.

Own data

Customer-specific data

At best, this data should be gathered in one directory and transferred to an external data storage device (USB stick, network, FTP, etc.).



Task:

Export your APROL configuration and save it to your USB data stick. Also save any data from your Linux system.

2.4 Save historical data

An APROL system saves a lot of data, such as alarms, trends, actions, etc.. This data should also be saved, so that it can be read at a later stage. A rough differentiation is made between **ChronoLog** and **trend** data.



ATTENTION:

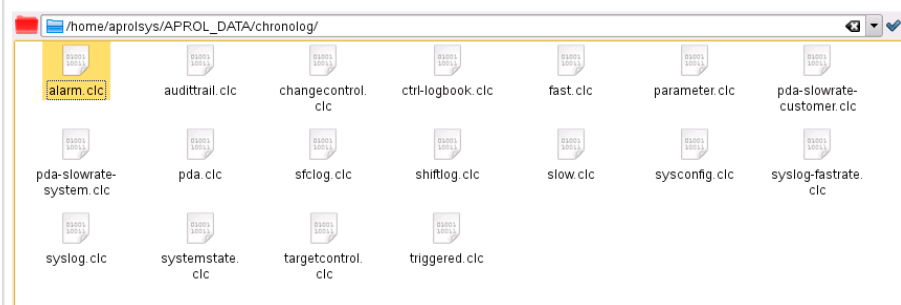
A direct copy is not permitted, because these containers are permanently accessed and written too. The access must therefore be stopped (rcaprollogging stop, TrendServer stop, ...) or the data must be renamed to another container with the **mv** command.

Identification data

ChronoLog data

Localization

This is in the **/opt/aprolsys/APROL_DATA/chronolog** directory.



This data must be saved and eventually renamed.

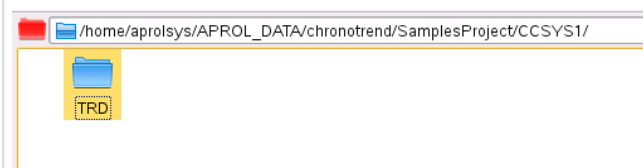
One could do the following, for example:

```
mv alarm.clc alarmsaved<timestamp>.clc
```

.....

ChronoTrend

The trend data is in the **/opt/aprolsys/APROL_DATA/chronotrend** directory.



The data here can be handled in the same way as explained in ChronoLog. The **TRD** must however be noted. If other **TRD-*** directories exist, they can be copied at any time.

```
mv TRD TRDsave>timestamp>
```

The project directory must also be taken into account, as can be seen in the screenshot. This is important if several runtime systems are running on one server.

Apache configuration

Der Apache web server can be modified using the **apache2.conf** configuration file. This is necessary if an additional data directory should be added to the web queries (alarms, trends, etc.). (keyword ARKPATH)
The "**apache2.conf**" configuration file is in **/home/aprolsys/APROL/cnf/apache2/**.

Data backups

Identification data	Localization
Own data	Customer-specific data

At best, this data should be gathered in one directory and transferred to an external data storage device (USB stick, network, FTP, etc.).

**Task:**

Save your alarm and trend data to your USB data stick.

3 System installation

A DVD drive should be present in order to perform the installation. An external USB DVD drive can be used if the PC system does not have a DVD drive. Techniques such as NFS or restoring images (e.g. ACRONIS) are normal procedures and are welcome.

The entire APROL system software package can be obtained from B&R, and is also available for download from the B&R homepage.

www.br-automation.com/en/downloads/#categories=software/aprol-process-control/r-40-10/obligatory

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Software	Automation Studio	R 4.0-10	Obligatory
Industrial PCs and Panels	Automation Runtime	R 4.0-09	Optional
Control and I/O systems	Automation NET/PVI	R 4.0-08	
Safety technology	APROL process control	R 4.0-07	
Networks and fieldbus modules	Automation Studio Target for Simulink	R 4.0-06	
Motion control	Servo Pump Sizing Tool	R 4.0-05	
Power supplies	SafeDESIGNER	R 4.0-04	
Accessories		R 4.0-03	

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- Installation (1)
- System Software DVD1 (1)
- System Software DVD2 (1)
- System Software DVD3 (1)
- System Software DVD4 (1)

Figure 7: B&R website – Downloads section

3.1 APROL software package



An **APROL** system is installed and preconfigured before delivery. Documents in the 'root' environment describe which interventions are necessary to adjust the server to certain customer needs.

All software components (DVDs) are also supplied, so that your system can be re-installed anytime.

The following media are available:

Package description

image

The operating system DVD is included in the delivery. This double layer DVD contains the SuSE Linux 11 operating system. The composition of the Linux packages corresponds to the APROL requirements.

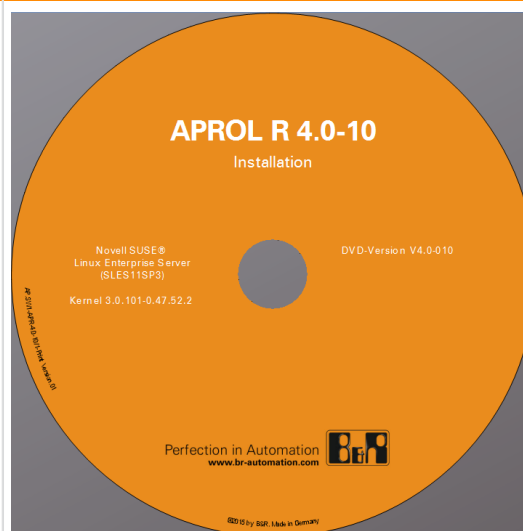


Figure 8: SuSE Linux 11 DVD

All versions of the APROL system software (32 / 64 bit) is on four double layer DVDs. All four media are required for a full installation (ERO). DVD1 is sufficient for an operator station, for example.

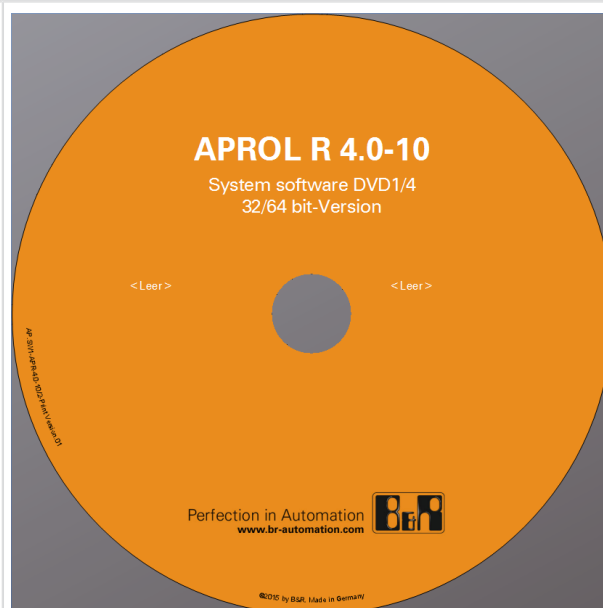


Figure 9: APROL system software

Package description

image

The APROL OPC server and many other tools are on this DVD. The getting started documentation is also there to offer customers information about the installation.

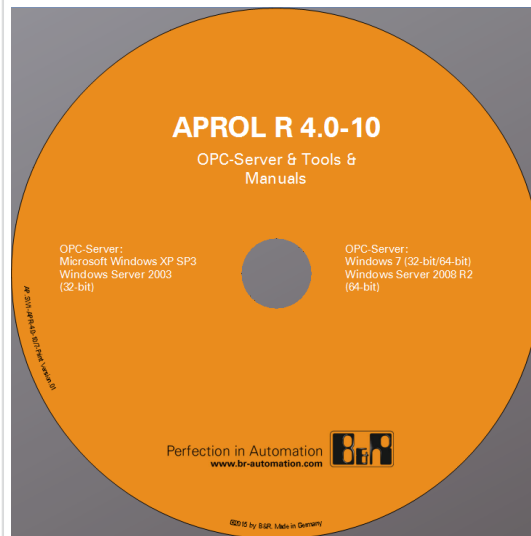


Figure 10: Documentation DVD

The 'Language DVD' installs a multi-lingual APROL systems. This DVD is not necessary for German and English systems. It contains the language packages for Russian and Chinese, for example. A translation environment can also be installed with it, which allows customers to offer their own language support.

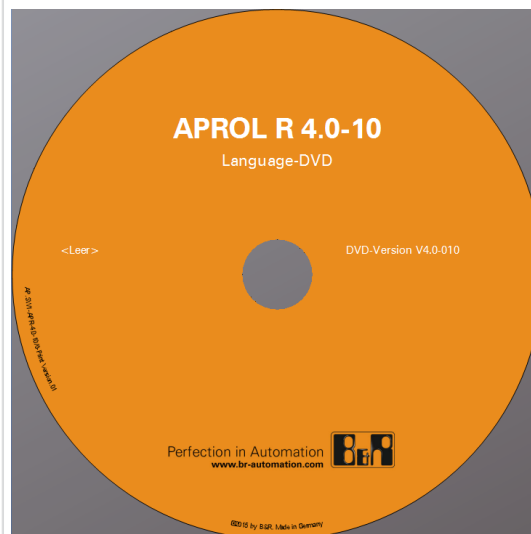


Figure 11: Language DVD

3.2 Configuration

It is very helpful to determine the mentioned point beforehand, in order to install the APROL system exactly as required.

3.2.1 Customer / Project information

Customer:	
Customer contact:	
Responsible sales organization:	
Responsible order processor:	
Order number - Position number:	
Project description:	
Date:	

Table 1: Customer / Project information

3.2.2 Operating system information

Keyboard layout:	
Partition sizes:	
Time zone:	
System language:	
"Super User" password:	

Table 2: Operating system information

3.2.3 Network information

Control bus IP address:	____.____.____.____
Control bus subnet mask:	____.____.____.____
Standard routing:	____.____.____.____
Process bus IP address:	____.____.____.____
Process bus subnet mask:	____.____.____.____

Table 3: Network information

3.2.4 Login information

APROL system (engineering, runtime, operator, etc.):	
Name of the engineering user:	
Domain of the engineering server:	
Password of the engineering user:	

Table 4: Login information

Name of user (runtime, operator, gateway):	
Password of user (runtime, operator, gateway):	
ChronoPlex configuration (logging server):	
Global cluster configuration (redundancy):	
UPS configuration (failsafe power supply):	
VNC configuration (remote access):	
NTP configuration (time server):	
LDAP: Information about LDAP if necessary (Lightweight Directory Access Protocol)	

Table 4: Login information



Note:

In systems which are to be restored, the above mentioned information already partly exists in an AprolConfig export. (see AprolConfig aspect)

4 Installing Linux

The Linux package (SLES --> SuSE LINUX Enterprise Server) is tailored especially for the APROL system. All of the required Linux packages are in the APROL installation DVD.

4.1 Brief overview of SuSE Linux installation

The operating installation takes place quickly and easily with the help of the Linux Installations DVD included in delivery.

You should monitor the installation because you must confirm at certain points in the process. This is normally done with the **[Accept]** button.



Note:

Since this installation scans and automatically configures all of the hardware inside the computer or connected to the computer, the computer must be completely put together before Linux is installed. The peripheral devices that will be used (mouse, keyboard, printer, etc.) should also be connected for this very same reason. Manual changes can of course be carried out at any time.

- **Modem**
- **Network printer**
- **Controller**
- **Computer name (in the scope of the APROL installation)**
- **Second network card, if necessary**
- **Internet connection**
- **Etc.**

After Linux has been installed successfully, the system demands the "APROL System Software DVD" for the further installation.

4.2 Operating system installation

A detailed description of the individual steps is given in the following pages. The following tables provide an overview of the steps to be made.

Step	Description
1	Boot sequence Insert the Linux installation DVD into the respective DVD drive and boot the computer from the DVD drive. (The DVD-ROM drive must be bootable!). The installation source can be selected beforehand (press F11 on an APC910). Other installation sources may be a USB stick or NFS.
2	Installing Linux. In the menu that appears after the SuSE welcome screen, you can set the options for the respective topics using the listed function keys. Then please select "AutoYaST.." . (The setup makes the selection of the 32 or 64 bit processor) Press [Return] to confirm the selection. The installation will now start the initialization process.

Step	Description
3	Installation settings: Basic settings for the computer are made in this menu. Changes can be made to the keyboard layout, mouse, language or partitions here. The time zone and system start can also be set.
4	Start Linux installation: You are directed back to the menu with the overview. Confirm all entries with [Accept] . The basic installation can be continued with [Install] or the settings can be changed with the [Back] button.
5	Network configuration: The installation now runs automatically up to the following point: [computer name / host name] login: This must correspond to the APROL naming convention. The network is then configured.
6	Install 32 / 64 bit version system software: The installation of SuSE Linux is finished. The computer then prompts you to insert the APROL system software DVD. The installation and configuration of an APROL system is described in the following chapter.

4.2.1 Step 1: Boot sequence

To install Linux, the computer must be booted from the Linux DVD. If an operating system is already installed, then the proper boot sequence must be defined in the BIOS. (boot first from CD-ROM or USB – CD-ROM if an external DVD device is present.)

The boot menu can be started (the F11 key on the APC910) to select the boot source.

4.2.2 Step 2: Installing Linux

Linux is installed using the SuSE Linux installation DVD provided by B&R. This DVD contains all of the SuSE packages (Linux) that are relevant to APROL. The first step is to boot the computer from the SuSE Linux installation DVD. The installation is then started with the following window:

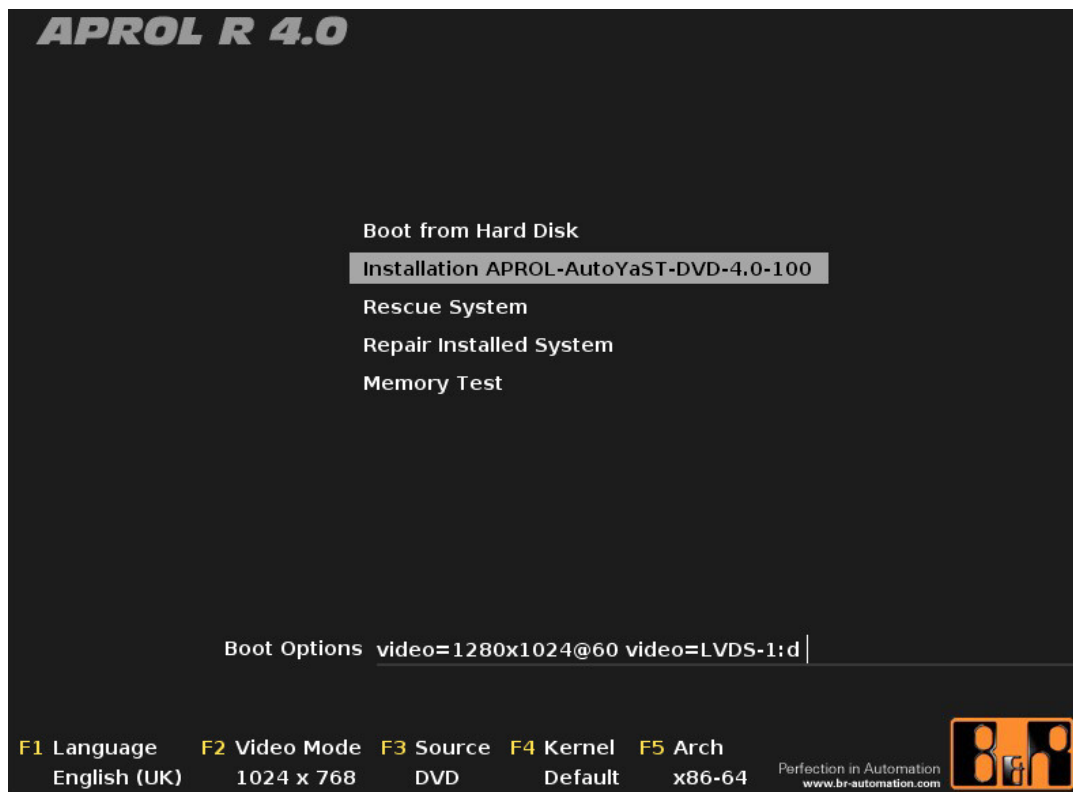


Figure 12: Starting installation via AutoYaST

In the menu that appears after the SuSE welcome screen, you can set the options for the respective topics using the listed function keys.

In this window, select the option.

Function Key	Description
F1 Language	Language selection
F2 Video Mode	The resolution of the monitor can be entered.
F3 Source	Source of the installation.
F4 Kernel	Kernel settings such as "Safe Settings, No ACPI, No Local APIC".
F5 Arch	32 bit or 64 bit architecture.

The basic choice of the desired functionality takes place with the arrow keys. In our case we must select **"Installation APROL AutoYaST DVD-<version number>"**.

Another possibility is to boot the **"Rescue System"** from DVD and then carry out changes to the installed system. The **"Memory Test"** (RAM check) and **"Repair Installed system"** points are also available (may be necessary by incorrect shutdown).

Additional expert entries can be made using **"Boot Options"** during the boot procedure.

4.2.3 Step 3: Installation settings

After the first installation steps have been confirmed, the **"Kernel"** is loaded and the **"Installation Settings"** configuration window is shown.

A default setup is loaded and can be adapted respectively.

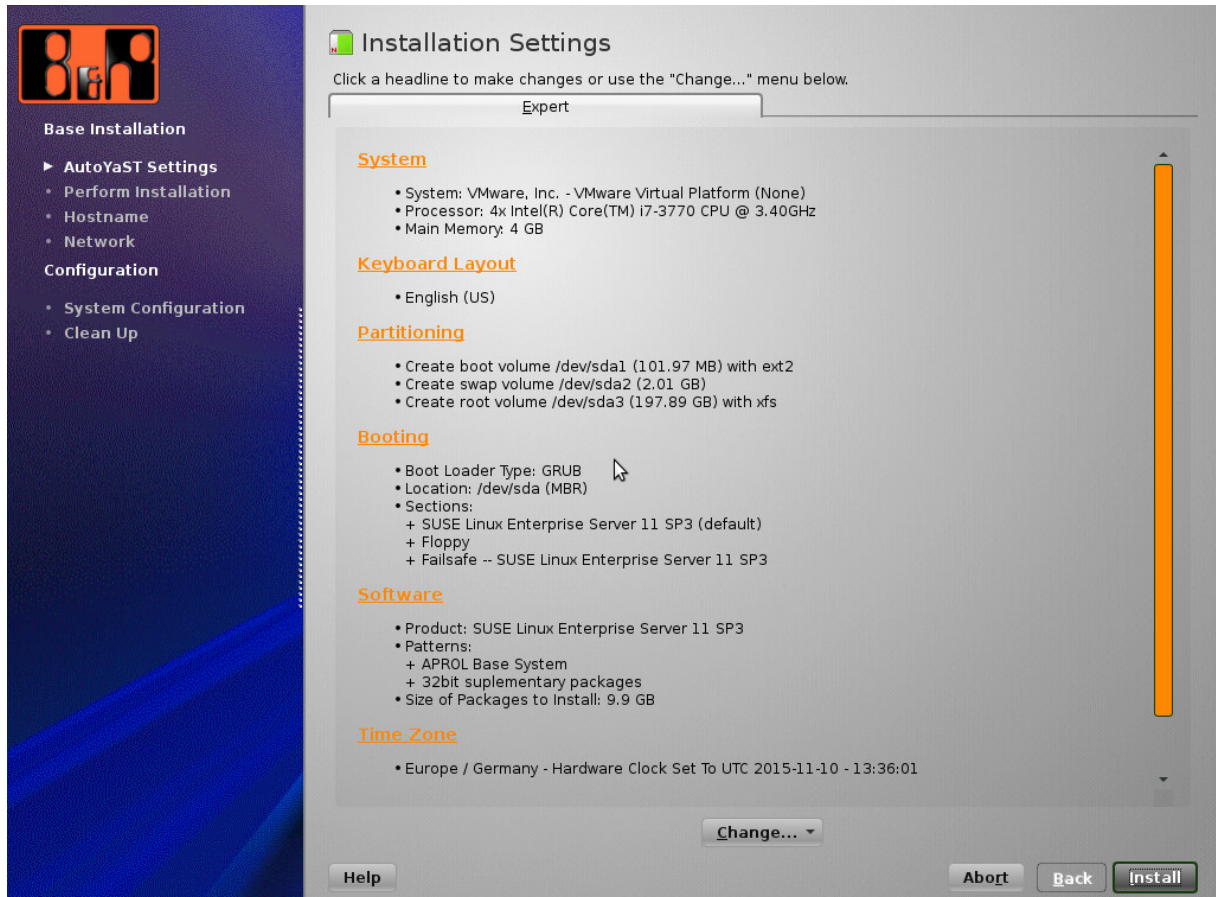


Figure 13: Installation overview

A variety of settings can now be made using the following menu:

- **System**
The connected hardware (processor, RAM, memory, etc.) is displayed by using this menu item.
- **Keyboard format**
Used to select the connected keyboard. Selection is usually not necessary because this is normally detected automatically.
- **partitioning**
The default partition can be changed here to meet the requirements specified in the configuration sheet. Select the menu item Partitioning to do this.

The partitions can be modified accordingly using the menu items **Create, Edit, Delete, Resize**. If an operating system (Windows XP, etc.) is already installed, the **Expert** menu can be used to load and modify the original partitioning table.

**Note:**

An additional data partition for `"/home/aprolsys/APROL_DATA"` can be created here if desired. A subsequent configuration is only possible later with more of an effort.

- **Software**

Additional installation packages can be selected at this point. These are all system-relevant Linux packages.

- **System start**

The Grub boot manager is configured at system start. This is automatically configured, allowing the system to boot correctly. However, the boot loader options can also be modified.

**Caution: Boot manager**

If the system should have two operating systems, the boot loader options must be configured. (for example: Linux – Windows)

The following configuration option is presented by selecting the system start menu:

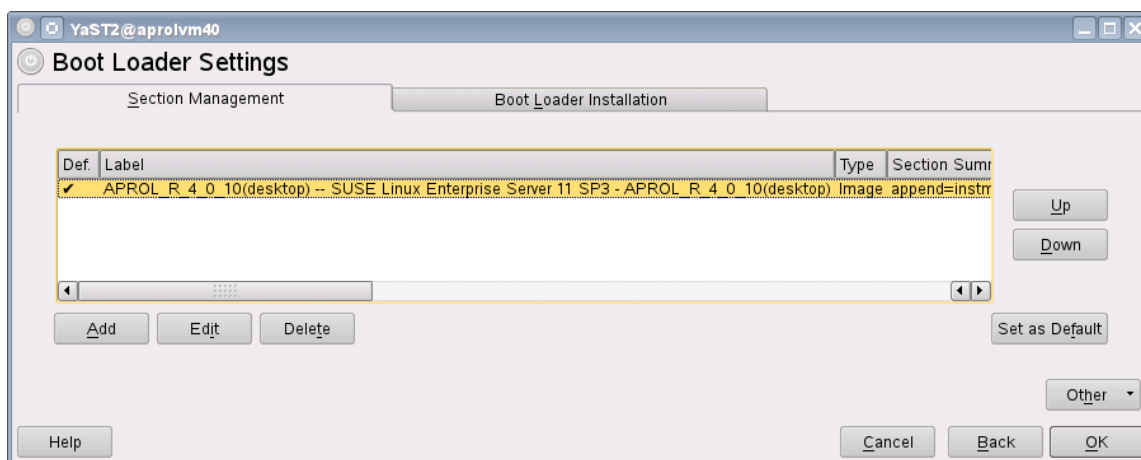


Figure 14: Configuration of Grub Boot Loader

- **Time zone**

The time zone and system time are set in this menu. (UTC)

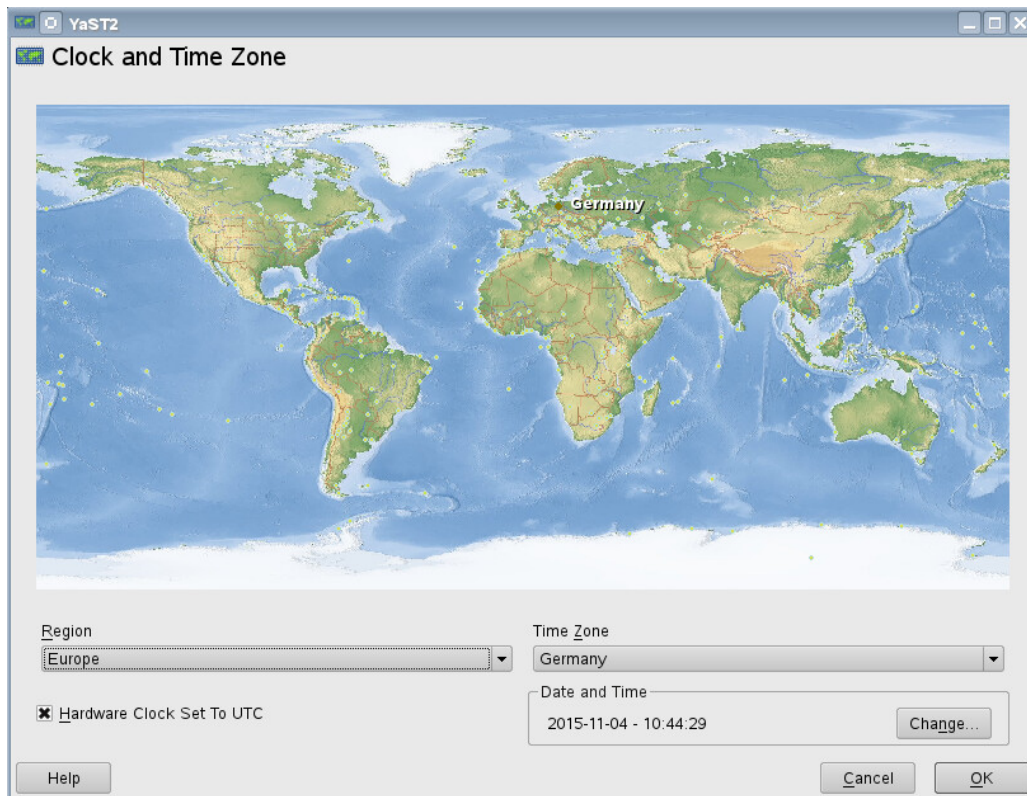


Figure 15: Setting the time zone and time

- **Language**

This menu item is used to define the system's language setting. A primary and secondary language can be selected here. Additionally, the keyboard options can also be changed here.

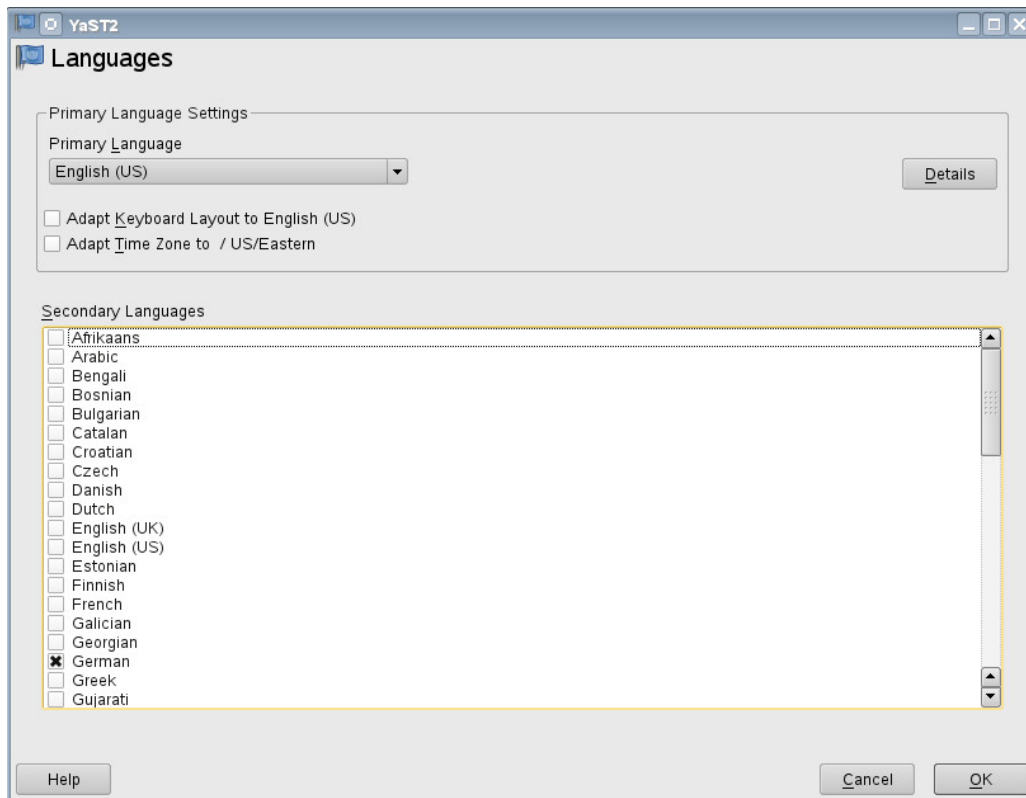


Figure 16: Setting the language

4.2.4 Step 4: Start Linux installation

The **[Install]** button must be pressed after this configuration. A window is then opened informing you that the format process and installation is being started.

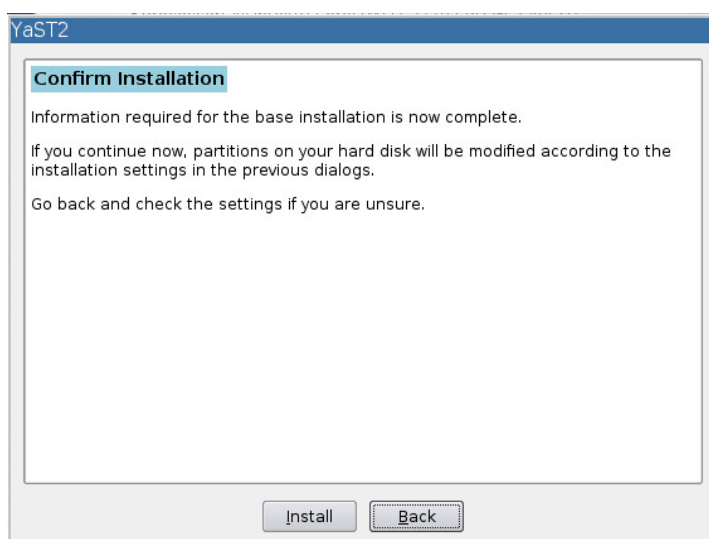


Figure 17: Confirm to start the installation process

The previously defined partitions are now created and formatted. The installation procedure then starts. Depending on the constellation (drive, network, etc.), this may take a considerable amount of time.

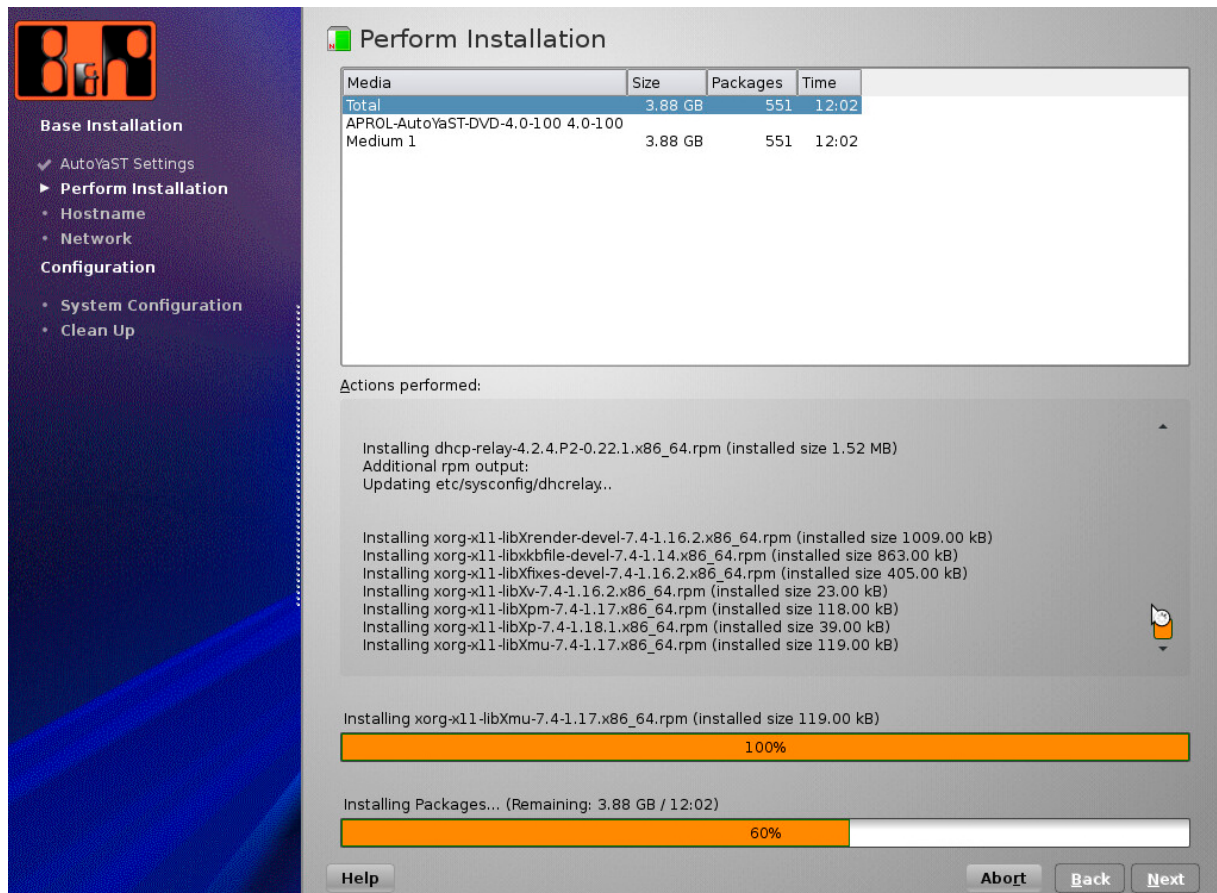


Figure 18: During the installation

4.2.5 Step 5: Administrator password

The system is **"rebooted"** automatically after the installation process. A Linux installation sequence configuration now starts. The superuser password (for the **"root"** user, administrator password) is the first point.

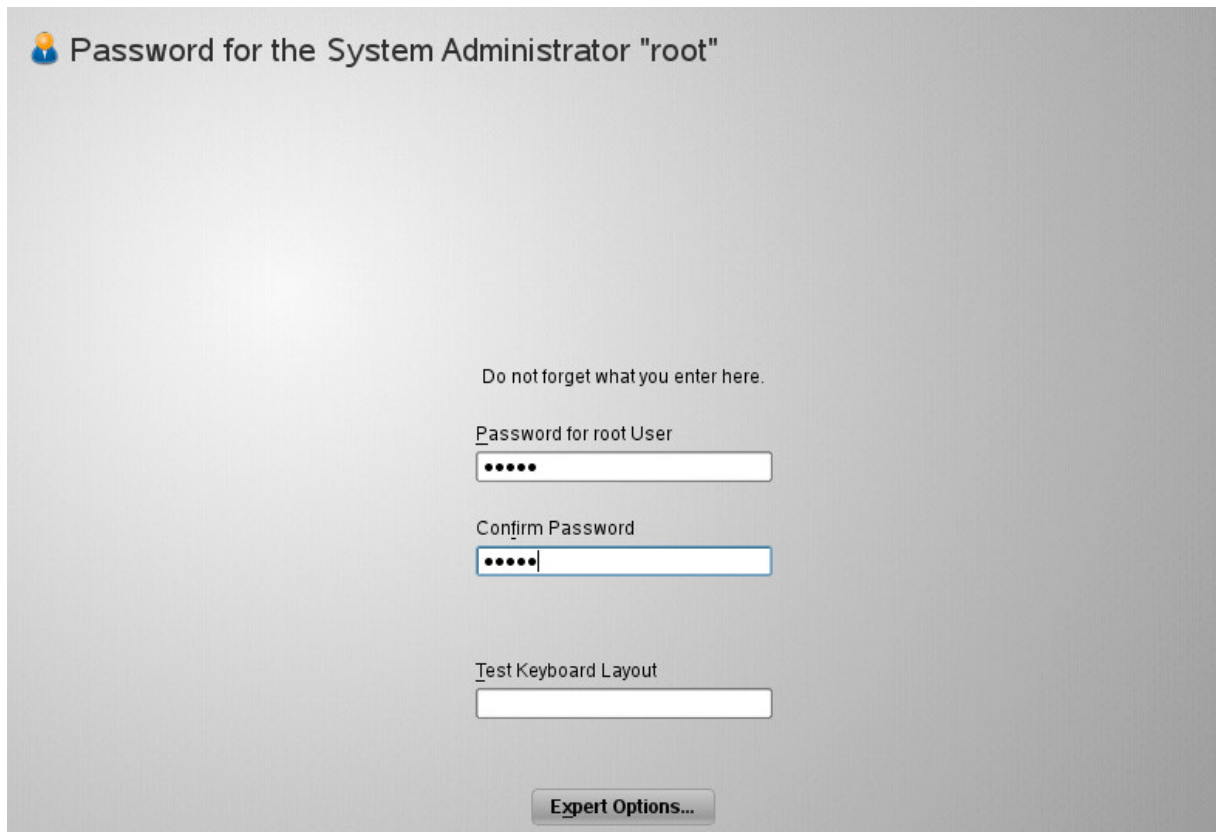


Figure 19: Entering the "root" password

4.2.6 Step 6: Host name and domain

The computer name and domain are set up in the next window. The host name must correspond to the APROL naming conventions. This means that it must be **C-conform** and be made up of **small letters**.

The other options should be disabled, because we do not want the IP address to be changed by a DHCP server. The loopback IP would be 127.0.0.2 and would be entered in the /etc/hosts. This is not desired, because double entries could arise in the **hosts** (the same computer name with two different IP addresses).

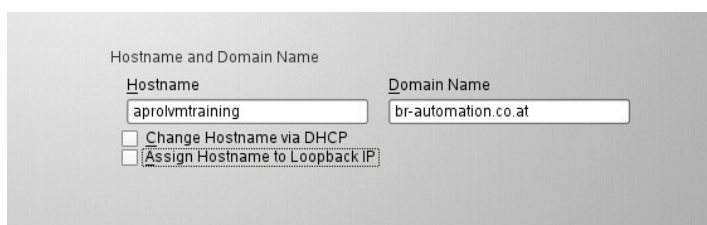


Figure 20: Host name etc.

4.2.7 Step 7: Network installation

All of the network cards in the system are now loaded. They are now offered for configuration.

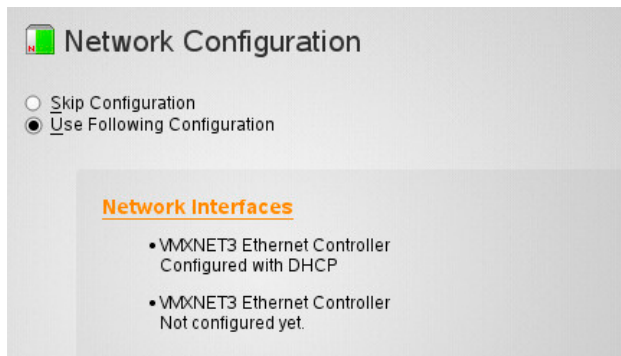


Figure 21: Network card listing

By clicking the orange **"Network Interfaces"** entry, you reach the network interface configuration.

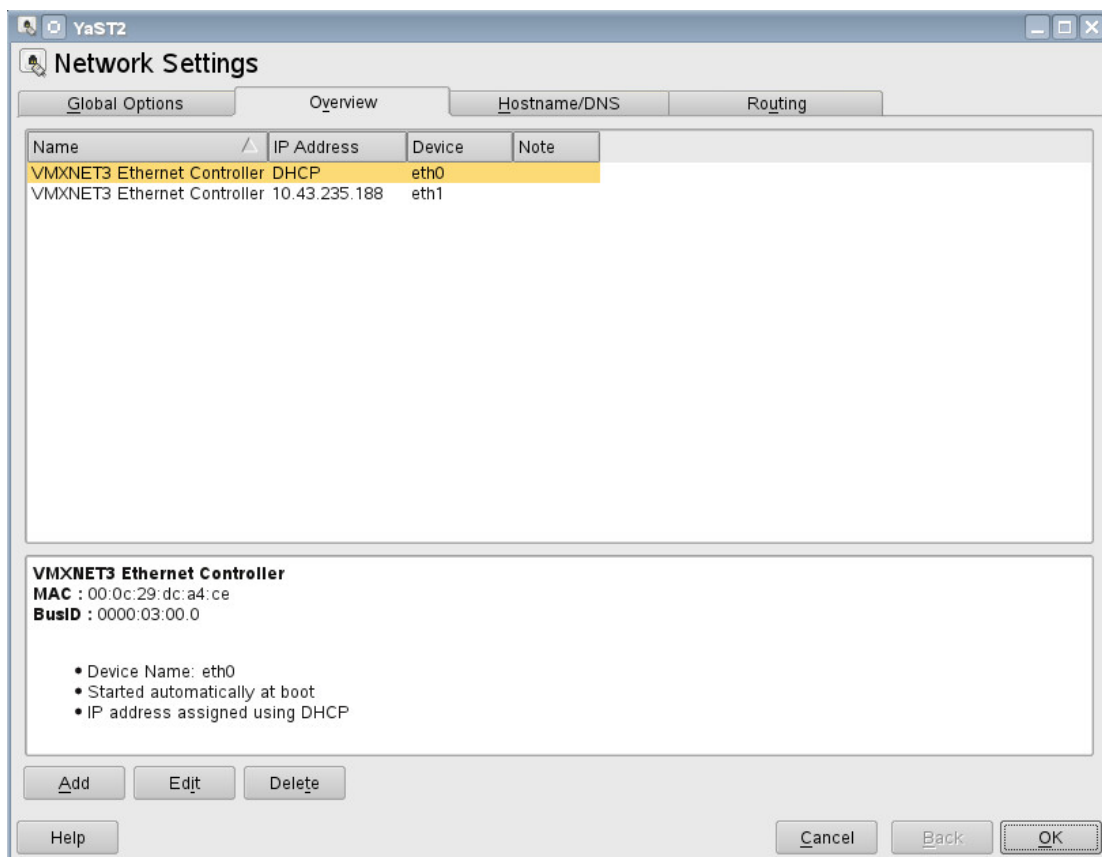
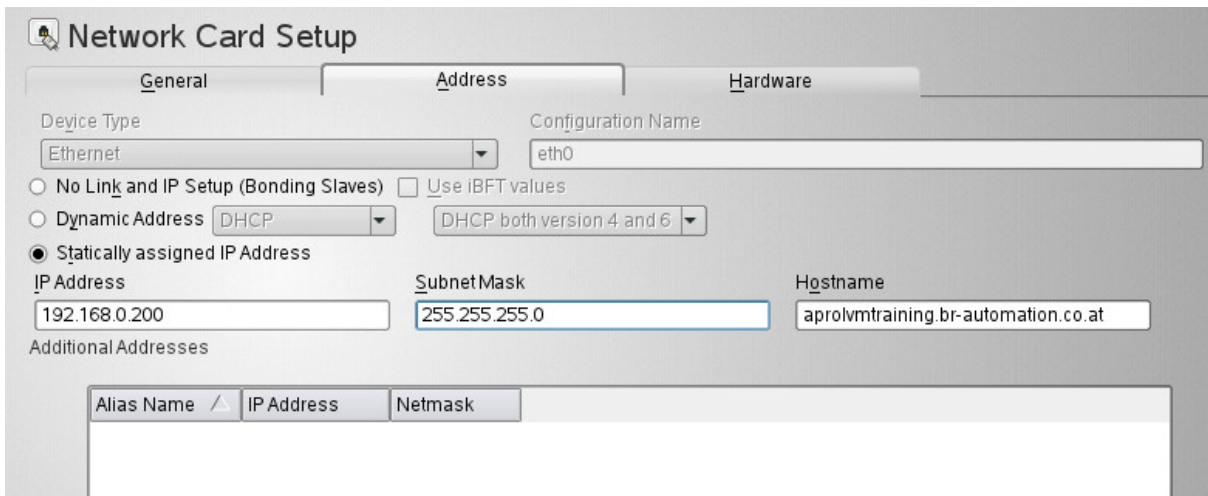


Figure 22: Available network cards

The configured network cards are shown in the upper area of the window which just opened.. Select **[Edit]** to configure the selected network card. Configure the network according to the guidelines and conditions of your plant.

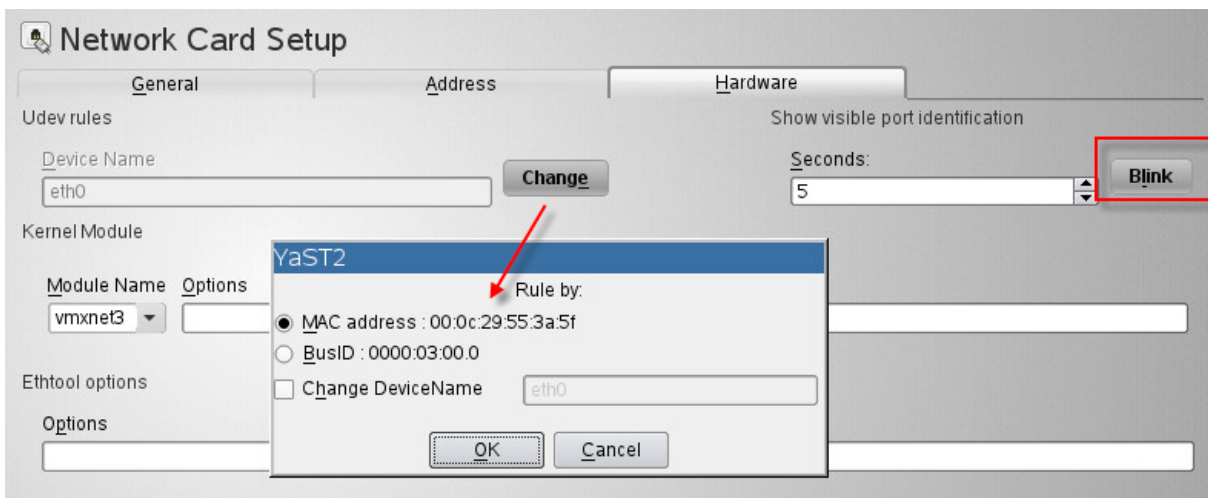
In our case, we configure eth0 to a fixed IP address (e.g. 192.168.0.200) in a TCP/IP network with the class C (IPv4 subnetting reference: 255.255.255.0). The second network card is configured for DHCP in order to be able to work in the private network.



The screenshot shows the 'Network Card Setup' window with the 'Address' tab selected. The 'Device Type' is set to 'Ethernet' and the 'Configuration Name' is 'eth0'. Under 'Dynamic Address', 'DHCP' is selected. Under 'Statically assigned IP Address', the 'IP Address' is '192.168.0.200', the 'Subnet Mask' is '255.255.255.0', and the 'Hostname' is 'aprolvmtraining.br-automation.co.at'. There is an 'Additional Addresses' table with columns for 'Alias Name', 'IP Address', and 'Netmask', which is currently empty.

Figure 23: Network settings

Other details can be entered in the hardware area and the correct interface can be detected with the **"Blink"** button.



The screenshot shows the 'Network Card Setup' window with the 'Hardware' tab selected. The 'Device Name' is 'eth0' and the 'Kernel Module' is 'vmxnet3'. A 'Change' button is next to the device name. A 'YaST2' dialog box is open, showing 'Rule by:' with 'MAC address : 00:0c:29:55:3a:5f' selected. The 'Blink' button is highlighted with a red box. The 'Seconds' field is set to '5'.

Figure 24: Network configuration hardware details



Note:

If the Bus ID is used instead of the MAC address and a created image is restored on an identical hardware, the network settings will be preserved. The network would have to be re-configured after the image is restored if the MAC address was used.

4.2.8 Step 8: 32 / 64 bit version system software:

The system automatically reboots after successful installation. The APROL installation must now be performed.

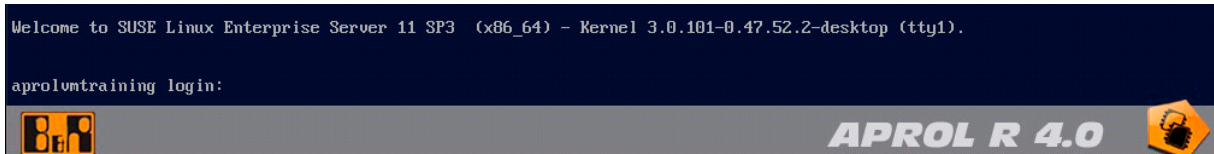


Figure 25: Linux installation finished



Task:

Create a complete working environment by installing the latest APROL release. Configure your system in the same way as the previous constellation.

5 Installing and configuring APROL

This section will cover both types of installation: new installation and update.

Installing the APROL packages

Option: INSTALLATION	Option: UPDATE
The DVD's package files are installed in the / <i>opt/aprol</i> directory.	Files in the " <i>/opt/aprol/</i> " directory are overwrit- ten with newer files from the DVD
Configuration of the APROL systems with "AprolConfig" . The following systems can be configured: - Engineering system - Runtime system - Operator system - Gateway system	The APROL system update takes place auto- matically. The following systems are updated automatically. - Engineering system - Runtime system - Operator system - Gateway system
Engineering system - Setting up the engineering system - Project engineering - Download to the target systems	Engineering system - CAE update - Recompilation of libraries - Recompilation of the project - Download to the target systems

Table 5: APROL 32 / 64 bit version system software (DVD)

5.1 APROL Installation

5.1.1 Introductory notes prior to installation or update

After installing Linux and logging in as superuser (root) in a text shell, the APROL installation procedure appears automatically after Linux has been installed.



Note: Linux version

The required Linux Version must already be installed on the computer in order to perform the installation or update (see "Release notes")!

Throughout the installation procedure, decisions must be made and entries and notifications confirmed. This is generally achieved by pressing the **[UP]**, **[DOWN]** and **[RETURN]** or **[ENTER]** keys on a standard PC keyboard. For the most part, these instructions do not describe how to handle the respective entries and notifications.

5.1.2 Installing APROL

After a successful SuSE Linux installation, the APROL system DVD should be inserted. The **"AprolInstall"** script starts automatically after the DVD has been inserted. The **"AprolInstall"** script must be started manually for an update. This must be done in **Linux runlevel 3**.


Note: Working with ArollInstall

The cursor keys are used to work with ArollInstall. Marking is done with the **[space]**. The **[Enter]** key is used for confirmation.

The menus for this procedure are self-explanatory, which is why this chapter deals only with a few essential items.

The start menu for the APROL installation appears after executing the **"ArollInstall"** script or after a first-time installation; the installation source must be opened.

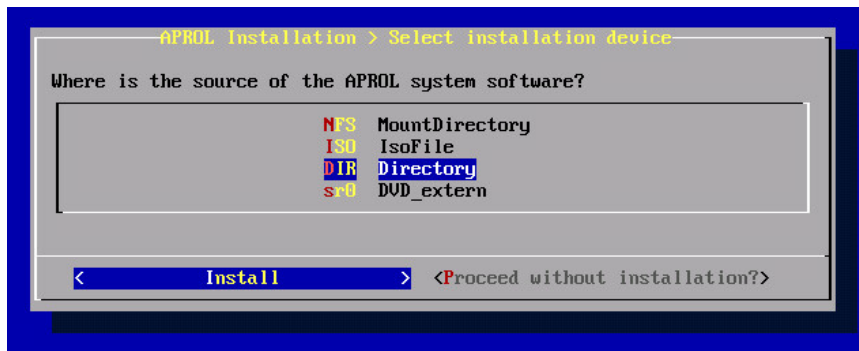


Figure 26: Installation source selection options

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 **"DVD_external"** installation source.

Package selection	Description
APROL system full installation	APROL will be installed on the computer if this menu item is selected. All of the required programs will be installed. The installation is made in the directory <i>"opt/aprol"</i> . This makes an ERO (G) usage possible. (Engineering, Runtime, Operator, Gateway)
Computer type dependent installation	APROL will be installed selectively on the computer if this menu item is selected. The installation is made in the directory <i>"opt/aprol"</i> . This makes it possible to implement an operator station, for example. (low memory and resource requirements)
Updating an existing system	All APROL background processes will be stopped if this menu item is selected. The program parts which should be exchanged are detected. Even the packages that have not yet been installed will be marked for the update. If these packages should no longer be installed, the X must be removed using the [spacebar] .

Table 6: Installation types

Package selection	Description
Uninstall APROL	All packages concerning APROL will be uninstalled from the computer, and the files will be deleted from the <code>/opt/aprol/</code> directory. The <code>"/opt/aprol/"</code> directory could also contain customer data which was inserted into this directory for reasons other than installation. This data will not be erased. However, the directory <code>/aprol</code> will be copied to <code>/aprol.<time-stamp></code> .

Table 6: Installation types



Note: Update

The runtime system is not automatically started after performing the update. The whole project must first be recompiled in the Engineering System and distributed among the different systems. It is automatically launched after the respective download.

Please perform the following steps after re-installation of SuSE Linux X.x and after the APROL installation:

- When performing a first installation (still not having performed an update), The APROL installation starts automatically and the corresponding systems for this computer are installed and configured.
- The **Engineering systems**, **Runtime systems** and **Operator systems** which were saved with the **AprolConfig** tool earlier must be installed and pre-configured with the old names, logins and passwords when updating from APROL RX.X to APROL release Y.Y. (importing the saved data)
- Restoring the saved data into the engineering and runtime systems.
- Restoring the saved historical data

5.2 Configuring APROL systems

5.2.1 General information about the pre-configuration

At least one APROL system must be created after installing APROL. Several APROL systems can be created on a computer. These systems can be created with the **"AprolConfig"** tool. AprolConfig started automatically after an APROL installation and can be started in the engineering and runtime environments at any time and in order to make adjustments.

Possible systems:

- **E - Engineering-System**
This allows the project configuration for the entire plant. All components (controller, gateways systems, operator systems, runtime systems) are configured here.
- **R - Runtime system**
Is configured by the engineering system. All of the data collected at runtime is stored here. Runtime systems transfer signal states from the controllers to the operator systems and send commands from the operator systems to the controllers.
- **O - Operating system**
Is configured by the engineering system. The operator systems contain the data for the visualization of the runtime systems. The monitoring and operation of the plant is done from these computers.
- **G - Gateway system**
Is configured by the engineering system. A gateway system is the connection between APROL and a foreign system. It behaves similarly to a runtime system.

It helps to adhere to the points in the "Configuration" section in order to install the APROL system exactly as required.

Configuration - Example

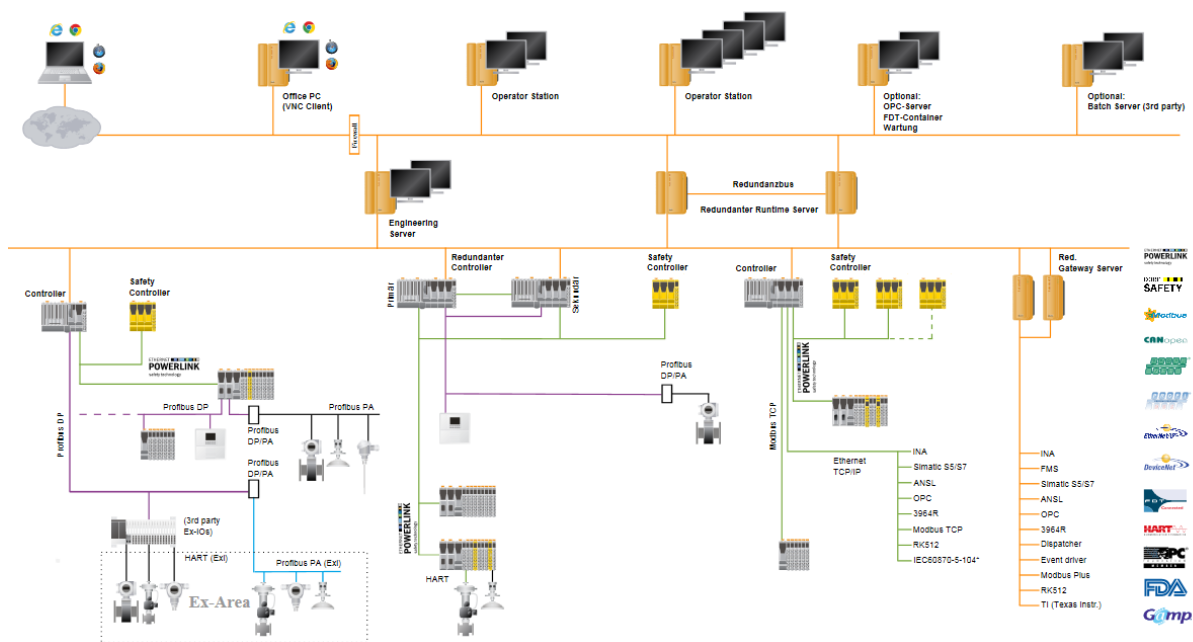


Figure 27: Selection options for APROL installation

Installing and configuring APROL

The image shows an APROL process control system made up of different components.

Operator stations based on APCs with installed operator systems. The operator stations are equipped with Multiscreening. A separate operator station was coupled over a wireless LAN connection.

An engineering sever (APC) with an installed engineering system.

Two redundant runtime servers (APC) with an installed runtime systems.

To round off the system, this example includes several controllers on the field level.

After pre-configuration of all systems, you have a system configuration that **meets two conditions**:

1. A system for completely setting up a process control system.
2. The process control system is ready after it has been engineered and downloaded.

Download data flow

The following illustration outlines how data flows from the engineering system to the other APROL systems and up to the field level. A process control system which is represented by the runtime system, operator systems, and the field level is only available after it has been engineered and downloaded.

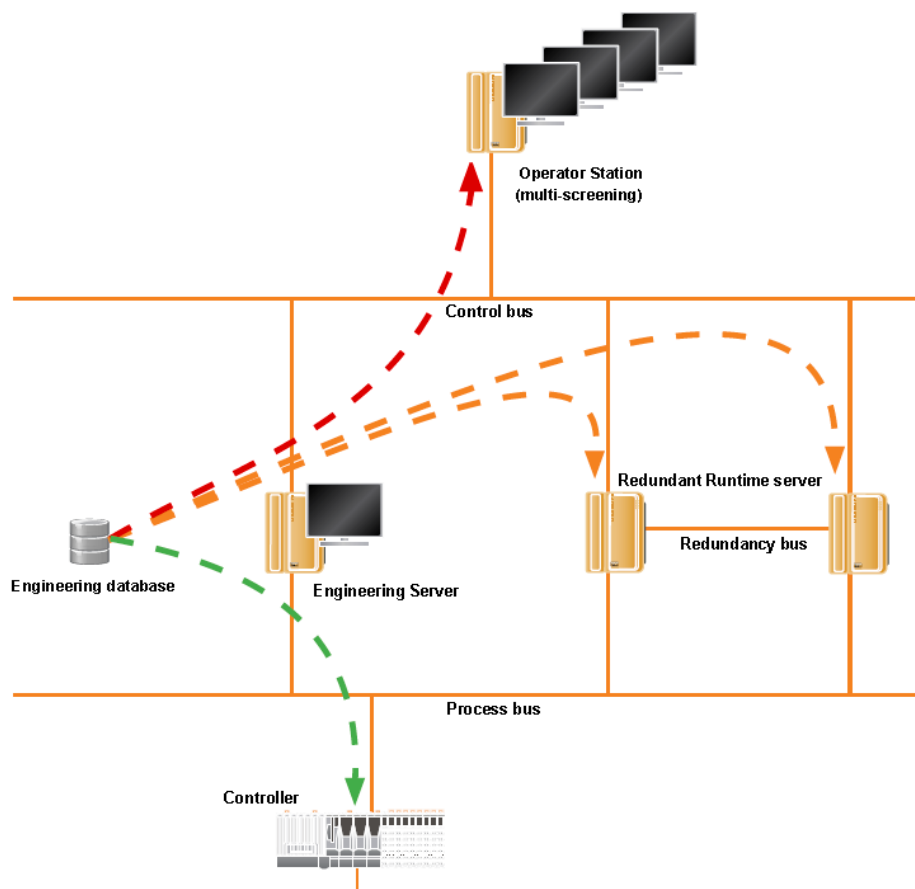


Figure 28: Data flow from the Engineering system

The above mentioned is only meant to depict a condensed structure that provides the foundation for the later engineering as well as showing how a process control system works with APROL system configurations.

As a rule, the pre-configuration of the APROL system is performed with the "**AprolConfig**" tool. Creating a user for the corresponding system under LINUX is also part of the configuration of a system. The data files, which are an integral part of the system, are copied during the configuration from the APROL installation directory to the /home* directory with the same name as the system.

In accordance to the conventions set by Linux, a **Linux user** with a **Linux login** is assigned to an **APROL** system. Since several people generally work on one APROL system, it makes more sense to refer to a "system login", which needs to be familiar to all of these people.

Within an APROL system, the people mentioned above (users) can administer different tasks. In order to carry out these tasks, they are assigned an additional login name that has the necessary user rights. There is another separate login mechanism in every APROL system with login as well as user name and password to check these rights. For this reason, each user must always be given two login names with their respective passwords.

5.2.2 AprolConfig

"AprolConfig" creates a Linux user for the corresponding system during the course of configuration. The script then copies all necessary data from the installation directory (some are also configured automatically) into the home directory of the system.

The following illustration shows the possible launching options.

Installing and configuring APROL

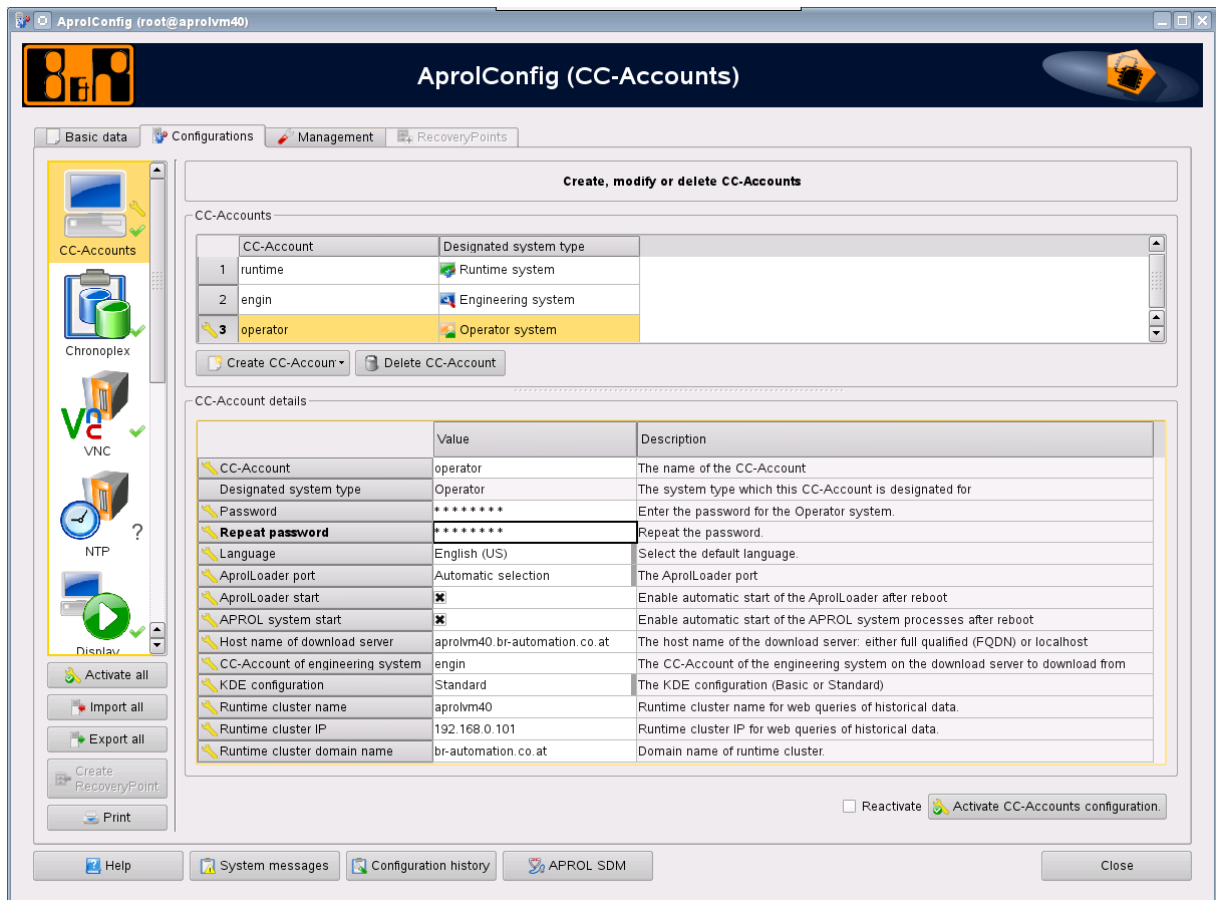


Figure 29: ArolConfig options

Aspects are offered in "ArolConfig":

- System
- ChronoPlex
- VNC
- NTP
- Display
- Global Cluster
- UPS
- LDAP
- Remote compiling
- Job Dispatcher

5.2.3 Pre-configuration of an Engineering and Runtime System

The initial configuration or pre-configuration of the systems mentioned above after installation is described in steps with the respective dialog boxes shown as images. With only a few exceptions, each step is corresponded by a dialog box. Windows, which are only notifications from **ArolConfig** for confirmation, are not always shown visually.

Step 1: System

You can set the computer types for the APROL system in this selection window.

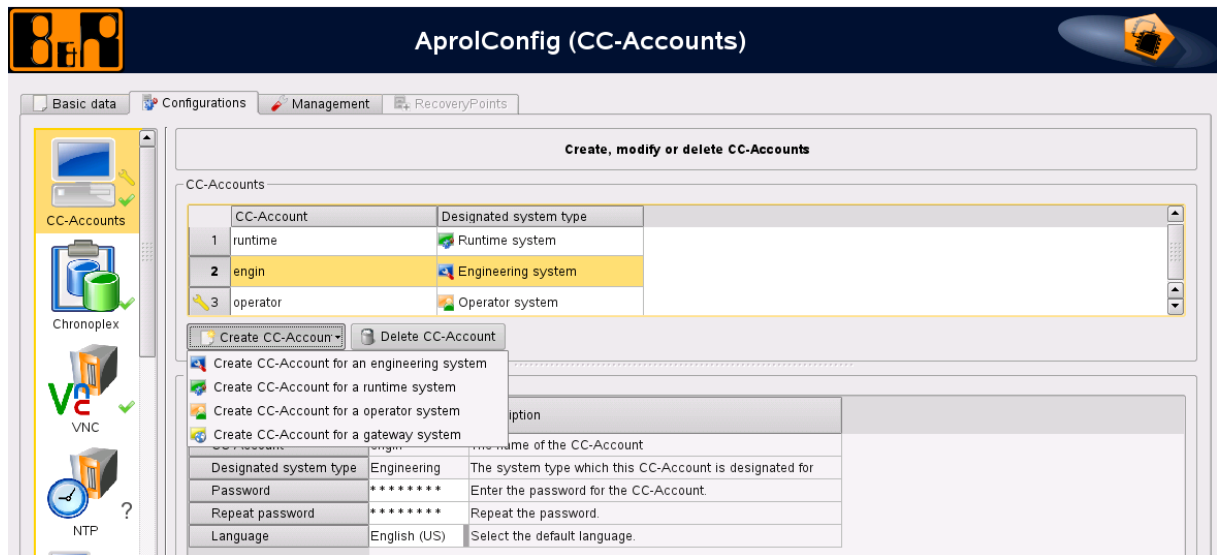


Figure 30: System

Depending on the type of system selected, one or more of the APROL systems described above can be installed and configured on a control computer or an operator station according to license regulations. The letters below indicate which systems (licenses) can be installed. In this example, all three computer types are selected consecutively.

System	Description
R	License for a Runtime System
O	License for an Operator System
E	License for an Engineering System

Table 7: Licenses

Step 2: System name and password

The system name and password are entered in the following menu. The entry is **OK** if the button **[Activate CC Accounts Configuration]** is active after the data has been entered. Confirm your entry with a click on the mentioned button.

CC-Account details

	Value	Description
CC-Account	engin	The name of the CC-Account
Designated system type	Engineering	The system type which this CC-Account is designated for
Password	*****	Enter the password for the CC-Account.
Repeat password	*****	Repeat the password.
Language	English (US)	Select the default language.

☐ Reactivate ☒ Activate CC-Accounts configuration.

Figure 31: Engineering system display



Note:

When configuring an system, the **engineering system should be configured first**. The other systems need the information about the corresponding engineering system when they are configured, because the download is made from the engineering system.

Step 3: Runtime

Enter the name and password of the runtime system in the same way as you did for the engineering system. Enter the name of the engineering system (in this case **engin**) in **[Name of engineering system]**. Select **[Standard]** in **[KDE configuration]**. Confirm the input with **[Activate CC-Accounts configuration]**.

Activate both items **[AprolLoader start]** and **[APROL system start]**.

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.
- **Select both:** The runtime system is started automatically after the boot process.

CC-Account details		
	Value	Description
CC-Account	runtime	The name of the CC-Account
Designated system type	Runtime	The system type which this CC-Account is designated for
Password	*****	Enter the password for the CC-Account.
Repeat password	*****	Repeat the password.
Language	English (US)	Select the default language.
AproLoader port	0	The AproLoader port
AproLoader start	☒	Enable automatic start of the AproLoader after reboot
APROL system start	☒	Enable automatic start of the APROL system processes after reboot
Host name of download server	aprolm40.br-automation.co.at	The host name of the download server: either full qualified (FQDN) or localhost
CC-Account of engineering system	engin	The CC-Account of the engineering system on the download server to download from
KDE configuration	Standard	The KDE configuration (Basic, Standard or Service)
Parameter management	☒	Enable the parameter management for this runtime system
Integrated operator system	☒	Determines, whether this runtime system has integrated operator system functionality

Figure 32: System display of the runtime system

Step 4: Operator

Enter the data for the operator system in the same way as with the engineering system and runtime system. Your cluster data must be entered in the **[Cluster IP]** and **[Cluster Name]** fields.

The runtime server data must be entered if a single system is being configured.

CC-Account details		
	Value	Description
CC-Account	operator	The name of the CC-Account
Designated system type	Operator	The system type which this CC-Account is designated for
Password	*****	Enter the password for the Operator system.
Repeat password	*****	Repeat the password.
Language	English (US)	Select the default language.
AproLoader port	Automatic selection	The AproLoader port
AproLoader start	☒	Enable automatic start of the AproLoader after reboot
APROL system start	☒	Enable automatic start of the APROL system processes after reboot
Host name of download server	aprolm40.br-automation.co.at	The host name of the download server: either full qualified (FQDN) or localhost
CC-Account of engineering system	engin	The CC-Account of the engineering system on the download server to download from
KDE configuration	Standard	The KDE configuration (Basic or Standard)
Runtime cluster name	aprolm40	Runtime cluster name for web queries of historical data.
Runtime cluster IP	192.168.0.101	Runtime cluster IP for web queries of historical data.
Runtime cluster domain name	br-automation.co.at	Domain name of runtime cluster.

Figure 33: System display of the operator system

Step 5: ChronoPlex

The is the ChronoLog control center and is responsible for logging all kinds of APROL data (Audit Trail, Trend, Alarm, etc.).

The following types are differentiated between:

Installing and configuring APROL

- Logging server (Redundant)
- Logging client
- Stand-alone System
- IP address/host name (sensitive if stand-alone system is not selected)
- Trend data size limit (important for MRS)

Chronoplex configuration for administration of ChronoLog records

Basic Configuration

	Choice	Description
Logging server (redundant)	☐	Computer is configured as a redundant logging server.
Logging client	☐	Collect data on a central server.
Stand-alone system	☒	Data will be stored locally, they will not be forwarded to a central logging server.
IP address/host name		Specifies the logging server resp. the redundancy partner in the case of configuring a logging client resp. server
Trend data limit	0	Limit for the TRD path in ring buffer mode of the forwarded trend data [MB]. A limit of 0 means no ring buffer mode!

ChronoLog container

	Type	Container name	Limit	Forwarding	Description
1		syslog	1000	☐	APROL system messages
2		audittrail	1000	☐	Operator activity
3		parameter	200	☐	Process parameter upload/download
4		compressor-fast	100	☐	Compressed process data < 10 min. compression interval
5		compressor-slow	100	☐	Compressed process data >= 10 min. compression interval
6		triggered	100	☐	ChronoLog block
7		alarm	1000	☐	APROL alarm system records
8		changecontrol	200	☐	ChangeControl logging (Changes in the CAE)
9		shiftlog	100	☐	Logging of the APROL shift logbook
10		targetcontrol	200	☐	Logging of executed downloads to controllers or control computers
11		sysconfig	100	☐	Logging of CC-Account configurations that have been done
12		systemstate	500	☐	Informations about the start and stop behaviour of APROL systems
13		sfclog	200	☐	Logging of the course of action of the SFCs and the control of the SFCs
14		pda	200	☐	Process Data Acquisition: fast
15		pda-slowrate-system	200	☐	Process Data Acquisition: slow (system)
16		pda-slowrate-customer	200	☐	Process Data Acquisition: slow (customer)
17		syslog-fastrate	10000	☐	APROL system messages: very fast (no forwarding)
18		ctrl-logbook	1000	☐	Logbook data records read from the controllers

Create ChronoLog container Delete ChronoLog container

Figure 34: ChronoPlex

Depending on the constellation, a forwarding of historical data is should be set up. This protects us from a download. Customer-specific containers can be created here if this is necessary.

each of these containers plays the role of a save function in APROL. Details can be found in the APROL system documentation.



Note:

If a container has reached its defined size, the FIFO principle is applied automatically.

Step 6: VNC

VNC (Virtual Network Computing) is a comfortable possibility for remote access and working in an engineering team.

VNC configuration for remote access to APROL servers		
	Enable	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

Figure 35: VNC

You can enable or disable the VNC connection possibilities here. There are benefits in connection to an APROL server with VNC and it should therefore be activated.

The listed selection possibilities show three different ports. The ports represent the different resolutions of the VNC sessions to be started.

- vnc1 > Port1 (e.g.: 5901) > 1280 x 1024
- vnc2 > Port2 (e.g.: 5902) > 1600 x 1200
- vnc3 > Port3 (e.g.: 5903) > 1920 x 1200

Step 7: NTP

The NTP mechanism (Network Time Protocol) is a protocol for synchronizing the system time via the network.

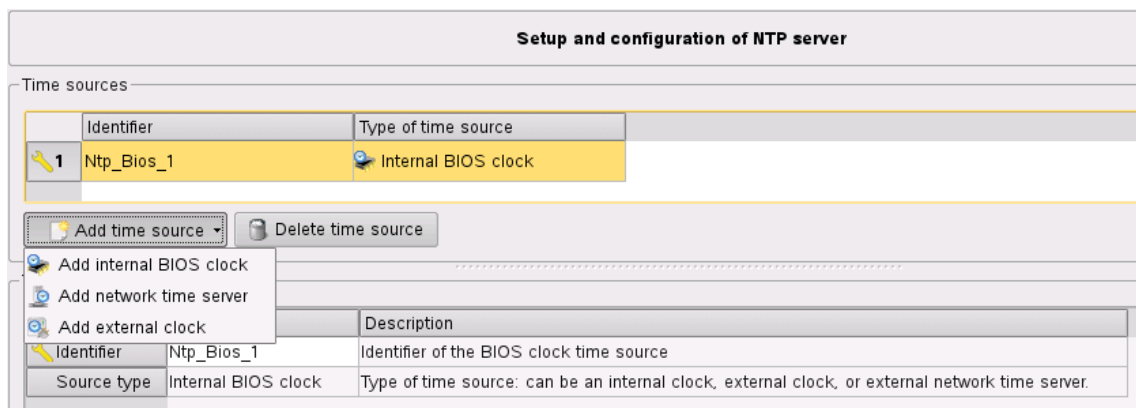


Figure 36: NTP

First, a computer can retrieve the time from a server or client with a reliable time source. (XNTP time server)

The computer can then become the time source for other computers in the network.

This makes it possible to define the absolute time and to synchronize the system time on all computers in the network. In principle, you can enter as many time servers as necessary.

There are three types to choose from:

Installing and configuring APROL

- Internal BIOS clock
- Network time server
- External clock via the serial or USB interface

Step 8: Display

Under "Display" you can assign the auto start application to a specific display. In this way, for example, it is possible to auto-start to monitor 2 in a Multiscreening environment.

Selection of X-Displays on which AutoStart applications will be started		
	Enable	Description
Display :x.0	☒	Auto start application start always on display :x.0
Display :x.1	☐	Start auto start application on display :x.1.
Display :x.2	☐	Start auto start application on display :x.2.
Display :x.3	☐	Start auto start application on display :x.3.

Figure 37: Display

Step 9: Global cluster

This service collects all of the historical data of all system (eventually also redundant) and makes it available. A cluster is configured in this case. A cluster is a work group of several computers. If one node fails, then its services are taken over by another (failover).

Global cluster configuration to setup runtime cluster for reports and documentation		
	Value	Description
Redundancy type	Redundant	Redundant server or stand-alone system
Cluster name	Single	Access name for global cluster
Cluster domain name	Redundant	Domain name for global cluster
Cluster IP		IP address for global cluster
Global cluster mode	Master	Redundant server: master or slave.
Unique cluster ID		ID of cluster. Must be identical among master/slave but different from other clusters within the same network segment
Daemon password	*****	Password to authorize cluster hosts to join the cluster setup identified by the cluster ID

Figure 38: Global cluster

Here you can select the type. **[Single]** for a stand-alone system or **[Redundant]** for a redundant cluster system. Enter the corresponding configuration data. IP addresses normally have to be discussed with IT.

Step 10: UPS

A UPS is a power supply that ensures the system is not interrupted (secure). The system can be configured as master or slave. Access to the master must be defined for a slave configuration.

- No UPS configuration
- B&R-UPS (External)
- B&R-UPC (APC Add-On)
- SHUT Communication UPS
- UPS slave

As a result, computers running the runtime and engineering systems should be equipped with a UPS. **The UPS must be connected to the computer in order to activate the configuration.**

Configuration of uninterruptable power supply for APROL server		
UPS type		
	Choice	Description
No UPS configuration	☒	No UPS is configured.
B&R UPS (external)	☐	UPS 24V DC Model 9A0100.11
B&R UPS (APC Add-On)	☐	APC Add-On UPS module 5AC600.UPSI-00
SHUT communication UPS	☐	SHUT communication UPS (e.g. Pulsar 700, 3000)
UPS Slave	☐	Computer is configured as UPS slave.
UPS details		
	Choice	Description
UPS type	No UPS configured	No UPS is configured.
Configuration	None	Configure host as master with connected UPS, or as slave, or no UPS configuration

Figure 39: UPS

Step 11: LDAP

The APROL login mechanism can be extended with LDAP (Lightweight Directory Access Protocol). This offers the benefit of being able to manage user data externally.

Installing and configuring APROL

Configuration of LDAP server and client		
Configuration parameters		
	Value	Description
Section: General		
LDAP usage type	LDAP Server only	LDAP usage type: Type of LDAP installation
Base DN	No LDAP	Base DN of the server
Server hostname	LDAP Client only	Hostname of LDAP or Active Directory server (FQHN)
Security protocol	Both LDAP Server and Client	Security protocol for the data communication
Section: Server		
Administrator	ldapadmin	LDAP server administrator login
Admin password		Enter password for LDAP server administrator
Admin password (confirmation)		Confirm password for LDAP server administrator
Section: Redundancy		
Redundant server	☐	Establish redundant LDAP server
Redundancy partner host		Redundancy partner of LDAP server (FQHN)
Cluster name		Cluster name of LDAP server (FQHN)
Retry configuration	5 10 60 +	Retry configuration: Reachability of the redundancy partner
Checkpoint configuration	10 1	Checkpoint configuration: Replication frequency
Sessionlog configuration	100	Sessionlog configuration: Replication performance
Section: Client		
Server type	APROL LDAP Server	Type of server
Query user	cn=LDAP Query.cn=Users	LDAP query user login
Query user password	*****	Enter query user password
Query user password (confirmation)	*****	Confirm query user password

Figure 40: LDAP configuration

The requested data must be detected and entered here. Details can be found in the APROL system documentation.

Step 12: Remote compiling

A "remote compiling" can be useful in larger projects. This allows APROL Linux computers in a cluster to adopt work for compilation.

Configuration of remote (distributed) compiling		
	Value	Description
Enable remote compiling	☐	Enable remote compiling for this host
Enable Scheduler	☐	Make this host the scheduler
Scheduler host	aprolvm40.br-automation.co.at	Host name of the scheduler

Figure 41: Remote compiling

Step 13: Job Dispatcher

The JobDispatcher does the job of importing data to the LDAP server.

Configuration of AprotJobDispatcher			
	Value	Description	
NFS server	☒	Mark this host as server to provide transfer path via NFS and main database	
Server hostname		Hostname of server for main state db and NFS mount	

Figure 42: JobDispatcher configuration

6 Graphics Configuration in Linux

The sax2 (graphics configuration)

After installing LINUX and APROL, the default setting for the graphics can be changed using "**sax2**". This program can be started with "**SuSE Menu > System > Configuration > Configure X11 System**". The superuser password must be entered to start sax2.

sax2 can also be started in **Linux runlevel 3** in case a basic configuration is necessary. sax2 then starts its own X server and detects a default configuration.

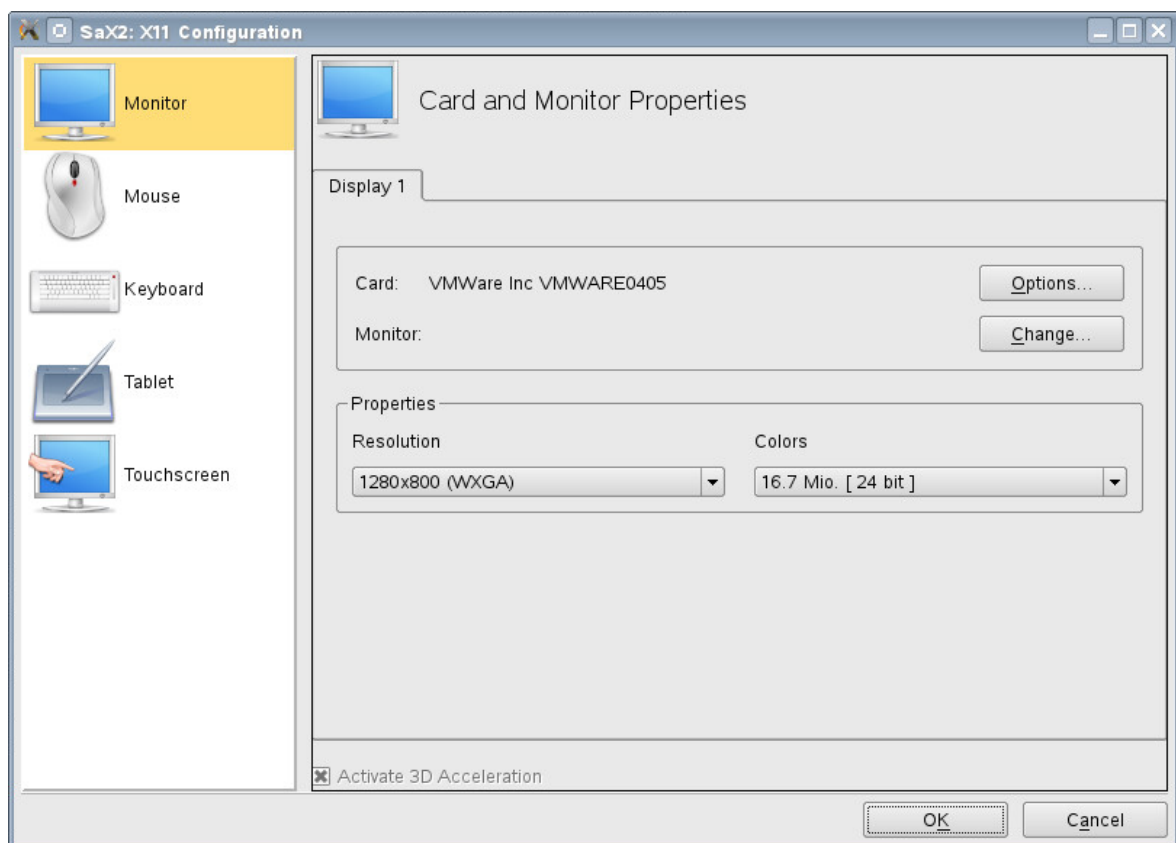


Figure 43: sax2 start window

As you can see in the screenshot here, the menu structure is simple and intuitive. The following items are available by selecting "**Monitor / Display**":

- Monitor
- Graphic card
- Color and resolution,
- to change 3D Acceleration

We will now take a look at the most important items:

Monitor configuration:

Press the **[Change]** button next to the monitor.

The monitor can be selected in the monitor tab. This is normally done automatically. You normally then get the optimal settings for the monitor. If the monitor which is being used is not in the list, the resolution and frequency can be adjusted. When multi-screening is active, it is important to also configure the second monitor.

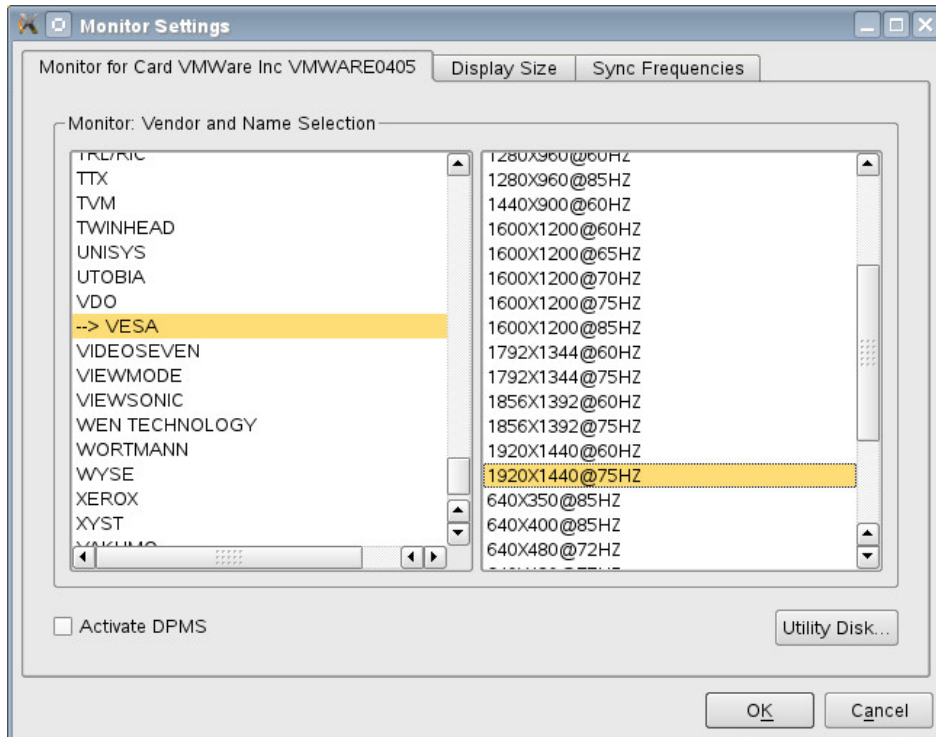


Figure 44: Current monitor configuration

Graphics card configuration:

The graphic card is normally detected and selected **automatically**. Manual adjustments are possible at any time.

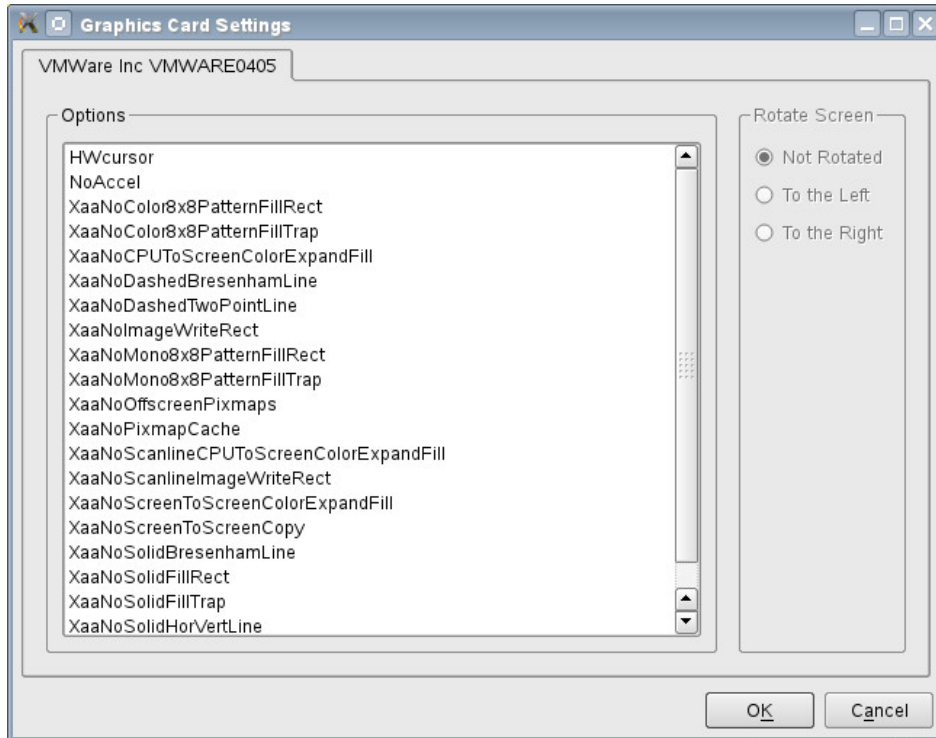


Figure 45: Graphics card selection and settings

The card is configured by selecting the **[Options]** button.

In most cases, no changes are necessary for this setting. The only exception here is when the Linux operating system does not yet support the graphics card. In this case, please contact the APROL support department. Frame buffer devices are then mostly used. The configuration is done in this case by entering the desired resolution in the `/boot/grub/menu.lst` of the PC.

Color and resolution configuration:

A user-defined resolution can be configured in the **"Resolution"** tab.

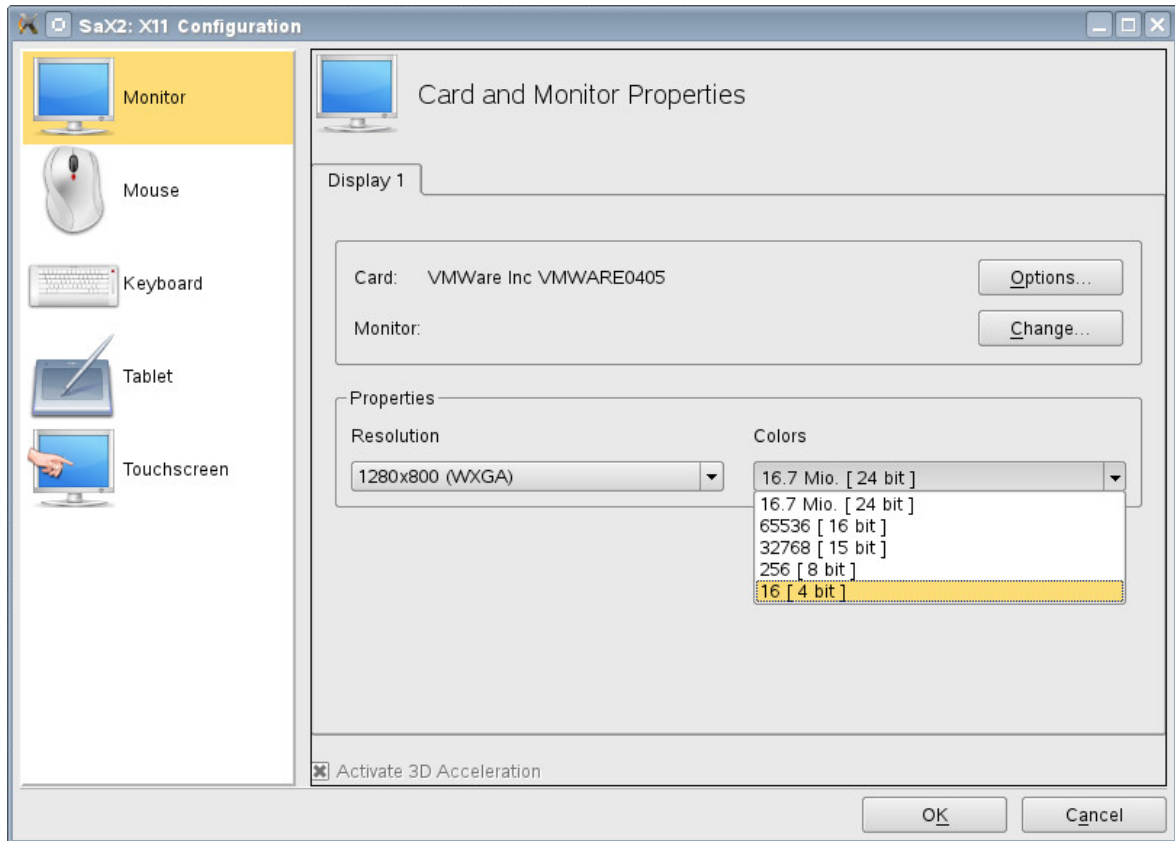


Figure 46: Selecting the colors

The resolution configuration can be set as desired by selecting the item **"Color - Resolution"**.

A logical selection of colors and resolution must be made so that the settings are adapted to the graphics card.

All other menu items are not absolutely necessary for graphics that meet the demands of APROL. Multi-screening can also be installed in this menu. An extra document is available for this installation in the APROL documentation or on the B&R homepage.

The configuration can then be tested. A window where the graphic can be tested opens after pressing the **[OK]** button.

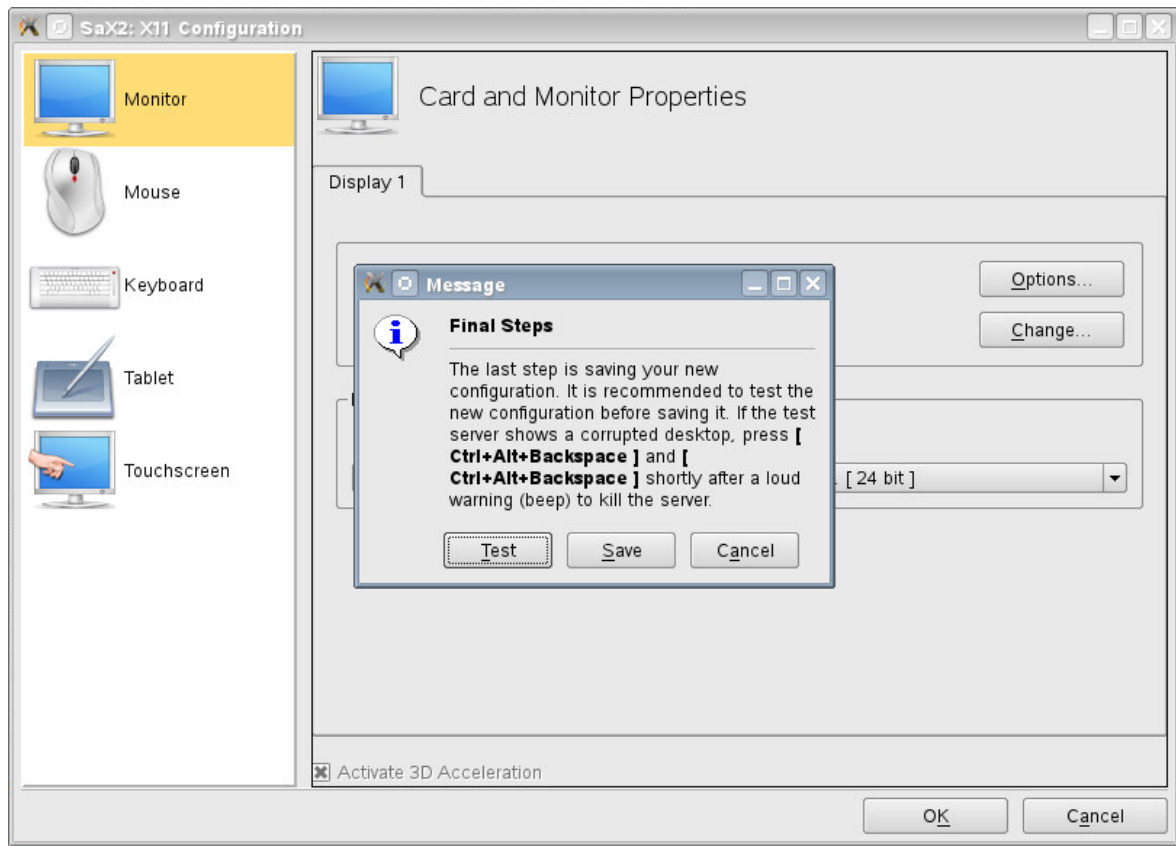


Figure 47: Testing the configuration

Click on **[Test]** to start the test mode. If the test result is satisfactory, the configuration can be saved by selecting **[Save]**.

The new settings are adopted after restarting the Linux system **[reboot]**.

A system restart can be prevented by entering the text console command

"init 3" --> All graphic consoles will be closed

and then

"init 5" --> Graphic console will be restarted - User appears for graphic login
execute.



Task:

Configure the best possible graphic for your system.

7 Configuring the network in Linux

YaST2 can be used to configure the Linux system. This is the equivalent to Windows' Control Panel. Among other things, it is also possible to define the computer's network configuration.

YaST2 must be started as superuser (root) , which can be done graphically or textually. (textually > when starting from a text shell (F1- F6), graphically > via KDE).

The following screenshots are from a graphically started YaST2:

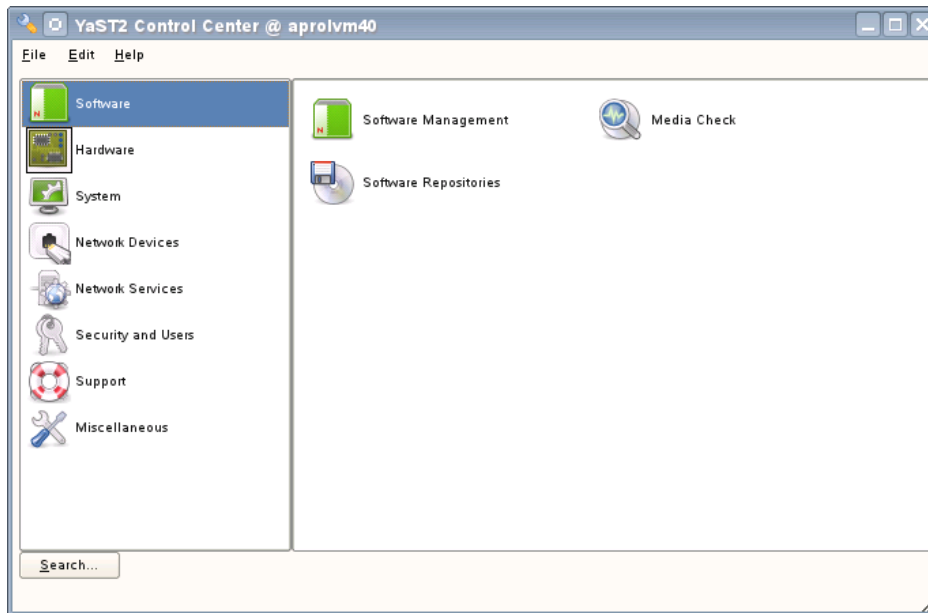


Figure 48: Yast2 start page

The **"Network Devices"** menu and **"Network Settings"** item must be selected to start the network configuration. A window with a list of available network cards is opened.

You should first know the necessary data before configuring the network. The configuration sheet could be useful in this case as well (see chapter "Configuration").

Configuring the network in Linux

Network card overview:

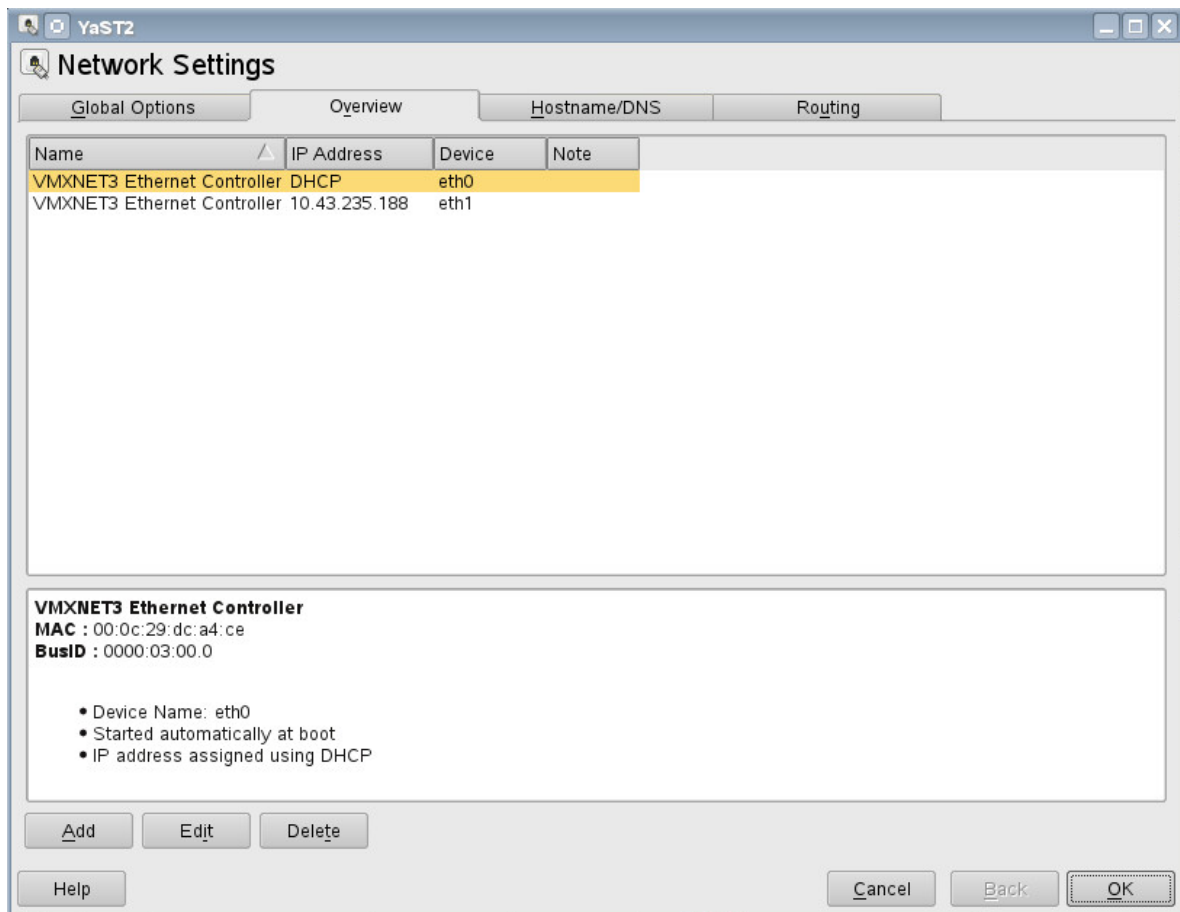


Figure 49: List of network cards

The pre-configured network cards can be chosen for configuration by selecting the **[Edit]** button.

Network configuration:

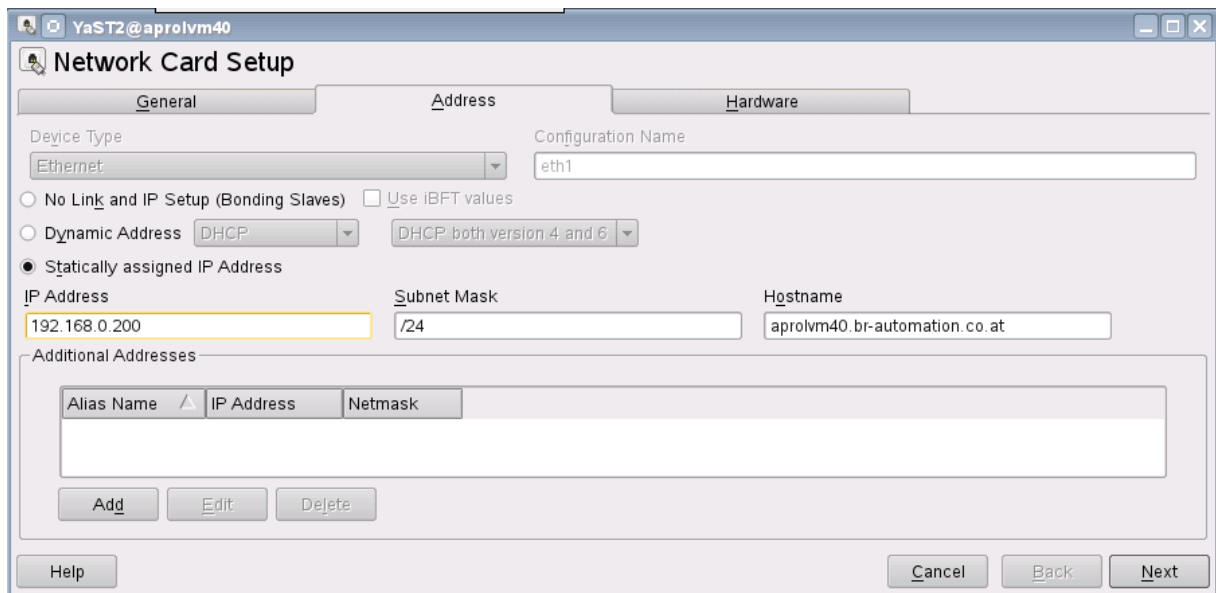


Figure 50: Configuring the network

Address tab:

- No IP address
- choose automatic address assignment (using the DHCP) or configuration of a static address.
- Static IP addresses are mostly used APROL systems because the DHCP service is often not available in the plants. This has the additional advantage of an explicit network topology. The settings are even more important because the computers in the APROL network must recognize each other to guarantee data exchange and downloads.

Hardware details tab:

Generally, the hardware details should not be modified. The kernel module loaded for supporting this network is displayed. If by default, there is no entry here, then this network card is not supported by the current Linux version. In this case, the corresponding driver (rpm packages) can generally be found on the manufacturer's homepage.

Click the **[Next]** button after finishing this configuration. The configuration is written in the background and the network is started.

This can be tested by **"pinging"** a computer located in the network. "YaST" can of course be used to make many other configurations. However, covering these possibilities would exceed the content of this document. These actions are described in detail in the LINUX manual.

**Note:**

Several interfaces must be differentiated in the **"hosts"** file. This can be configured beforehand with YaST2. Double entries in the **"hosts"** file are dangerous and can lead to errors in downloads and communication. A **"pb"** is normally added to the host name of an additional process bus.

As a rule: An additional name per interface.

**Task:**

Configure the network according to the guidelines and conditions given by the trainer. Test the connection to the controller with a ping.

8 Data Restore and implementation

Once Linux and APROL have been completely installed, the actual project setup can be started. It is often the case that an existing data backup is available, which must be imported and used.

This section describes how a data backup is imported and what steps must be taken to implement this data.

8.1 Restore engineering data

Engineering data can be restored using the CaeManager in an existing system, by using the menu items **"Extras / Database Restore"**. To do this, the backup data must be copied to the server's engineering environment.

If the data backup directory was not changed it is in the engineering home directory (e.g. /home/engin) in the path **"APROL_CAE_BACKUPS"**, with the timestamp it was created.

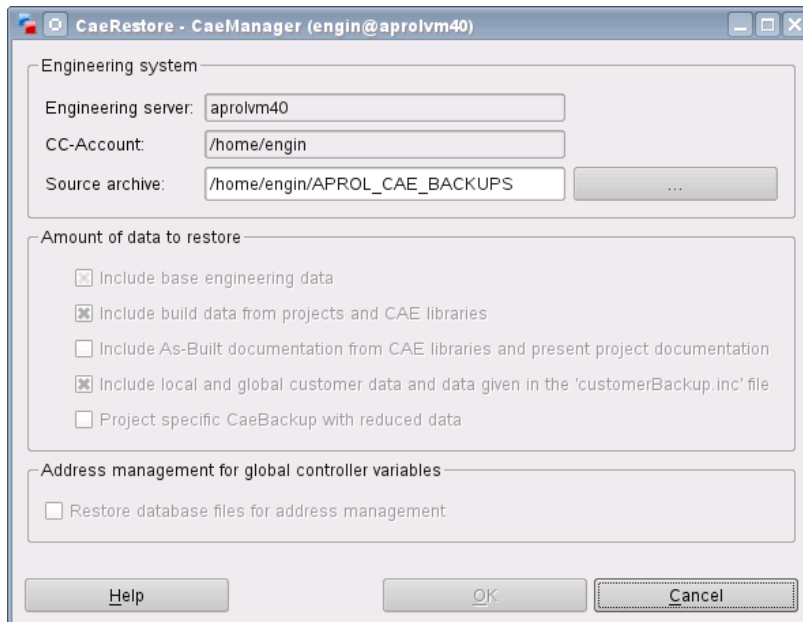
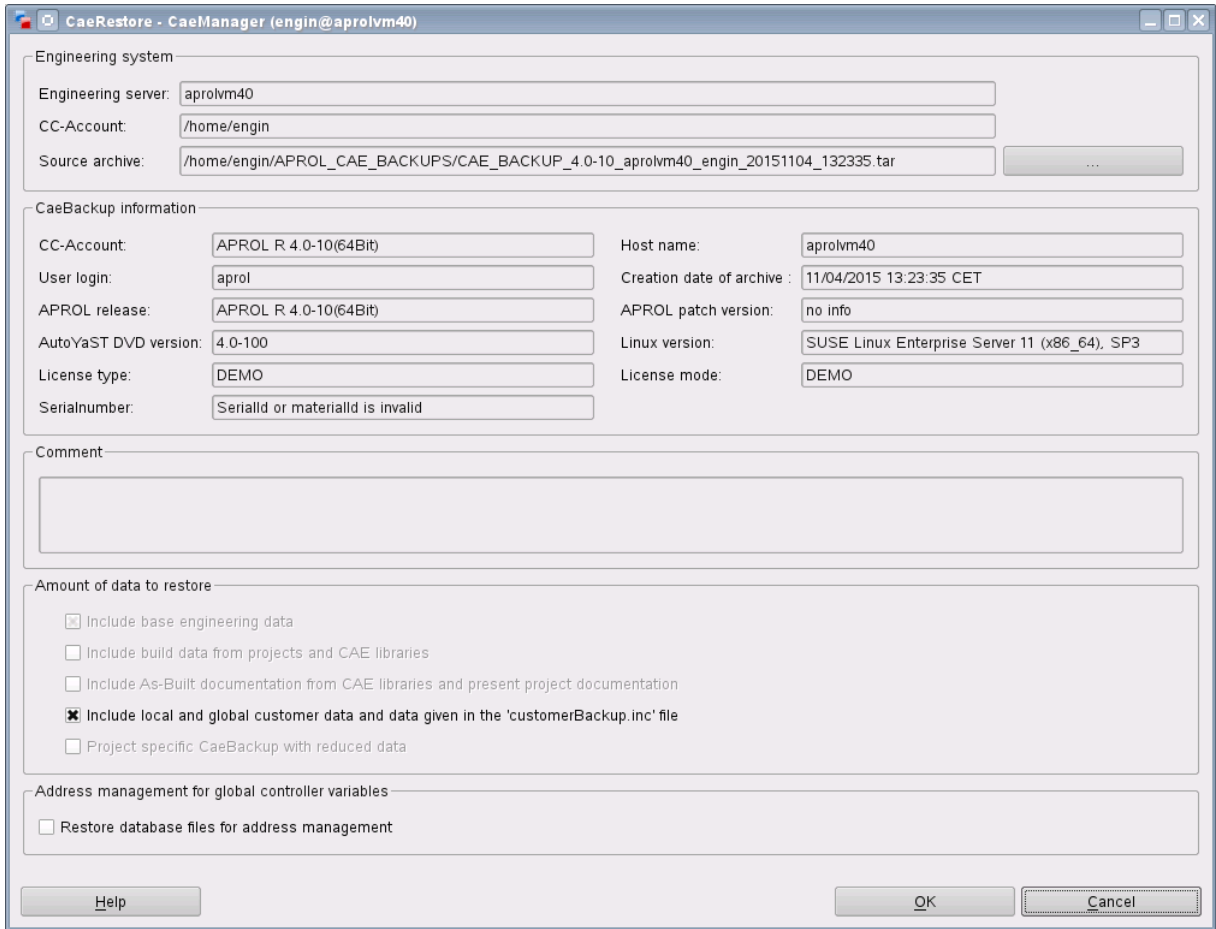


Figure 51: Selecting the restore file

Select the saved file that you want to restore.

Data Restore and implementation



The image shows a Windows-style dialog box titled "CaeRestore - CaeManager (engin@aprolvm40)". It contains several sections for configuring a restore operation:

- Engineering system:** Fields for "Engineering server" (aprolvm40), "CC-Account" (/home/engin), and "Source archive" (/home/engin/APROL_CAE_BACKUPS/CAE_BACKUP_4.0-10_aprolvm40_engin_20151104_132335.tar).
- CaeBackup information:** Fields for "CC-Account" (APROL R 4.0-10(64Bit)), "User login" (aprol), "APROL release" (APROL R 4.0-10(64Bit)), "AutoYaST DVD version" (4.0-100), "License type" (DEMO), "Serialnumber" (Serialid or materialid is invalid), "Host name" (aprolvm40), "Creation date of archive" (11/04/2015 13:23:35 CET), "APROL patch version" (no info), "Linux version" (SUSE Linux Enterprise Server 11 (x86_64), SP3), and "License mode" (DEMO).
- Comment:** A large text area for additional notes.
- Amount of data to restore:** A list of checkboxes:
 - ☒ Include base engineering data
 - ☐ Include build data from projects and CAE libraries
 - ☐ Include As-Built documentation from CAE libraries and present project documentation
 - ☒ Include local and global customer data and data given in the 'customerBackup.inc' file
 - ☐ Project specific CaeBackup with reduced data
- Address management for global controller variables:** A checkbox for "Restore database files for address management" (unchecked).

At the bottom, there are "Help", "OK", and "Cancel" buttons.

Figure 52: Restore file selected



Note: Exclusive database access necessary

All other CaeManagers must be closed and no other users are allowed to access the database.

The following information text appears when this isn't the case.

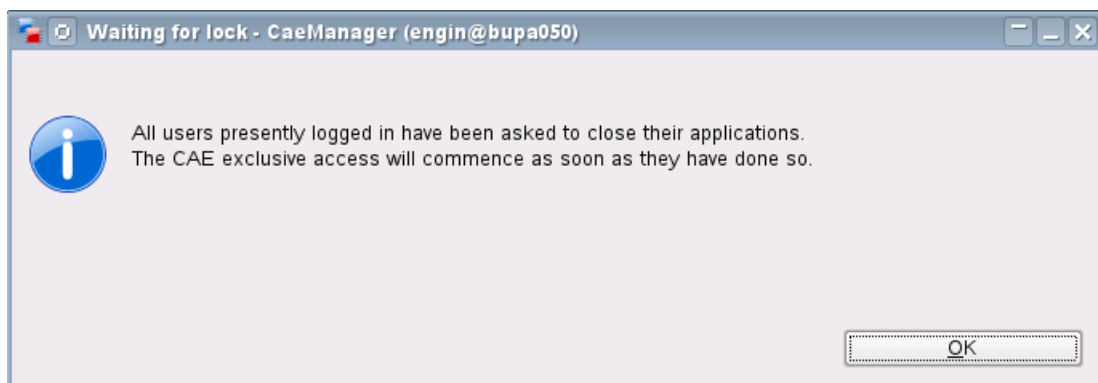


Figure 53: Information box – Restoring a backup

The backed-up data cannot be restored before this state has occurred. If there is an exclusive access, the restoration mechanism starts automatically and the backup data will be restored. A successful restoration is finished with the following message:

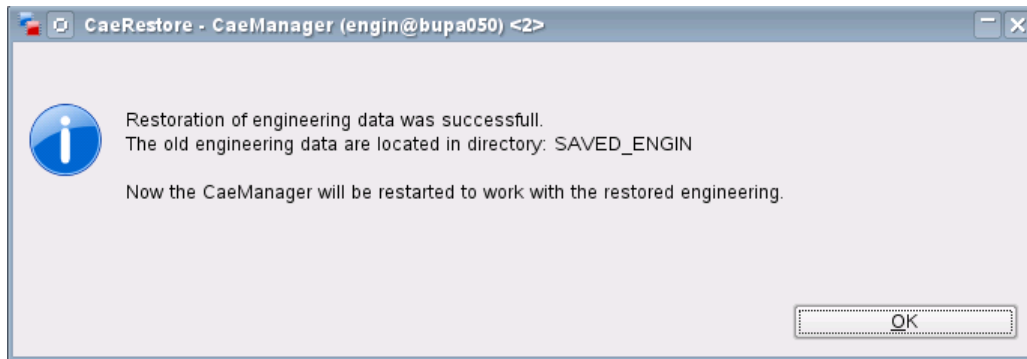


Figure 54: Restore successful

After the message is closed, the CaeManager is closed and restarted automatically. Now please follow the instructions on the screen.



Note: Restore engineering data

Depending on the type of backup, the entire content of the project must be re-processed. This procedure can take a bit of time.

8.2 Implementing the imported backup

After the restore, the project can be commissioned. A few steps must be made to do this:

Control the control computer setting with respect to the **host name, domain, redundancy server, network, etc.** (see illustration)

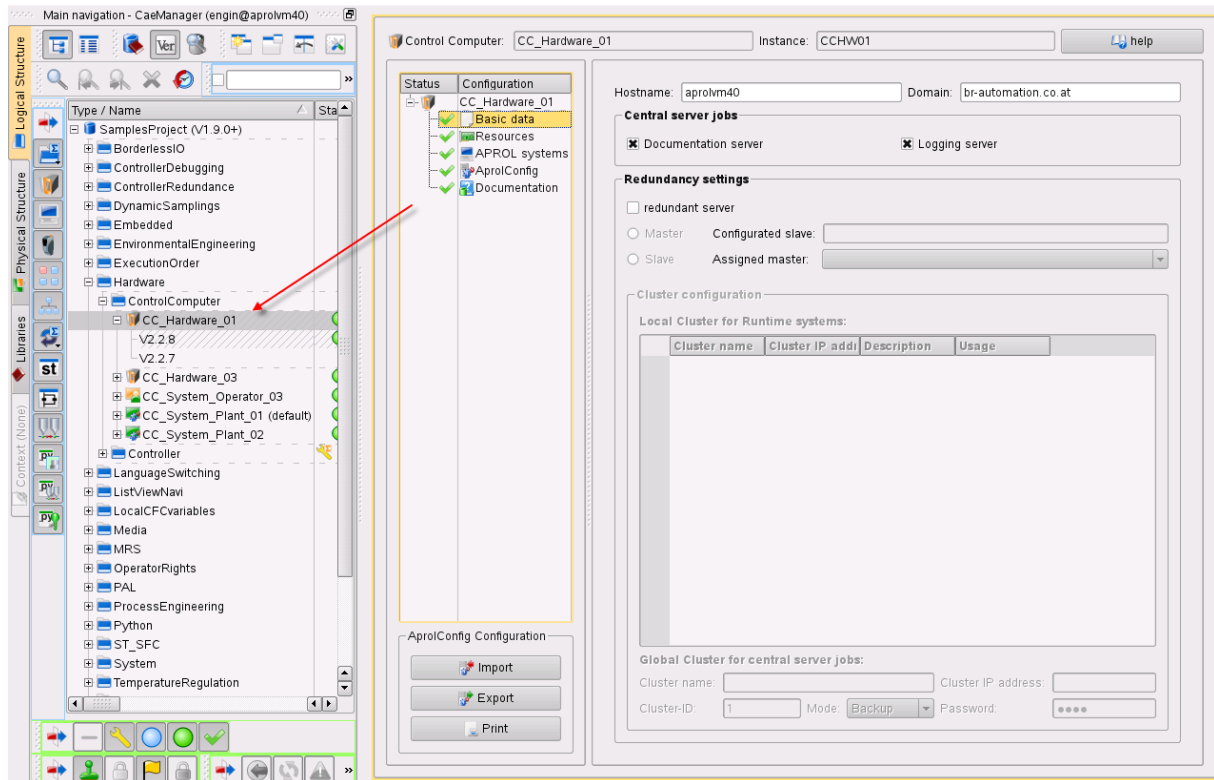


Figure 55: Control computer selection

The computer name and domain must normally be adjusted here. All other settings must of course also be checked.

Check the **"APROL system"** project part with respect to the **losys port**, target system, etc.
(runtime, operator, or gateway system)

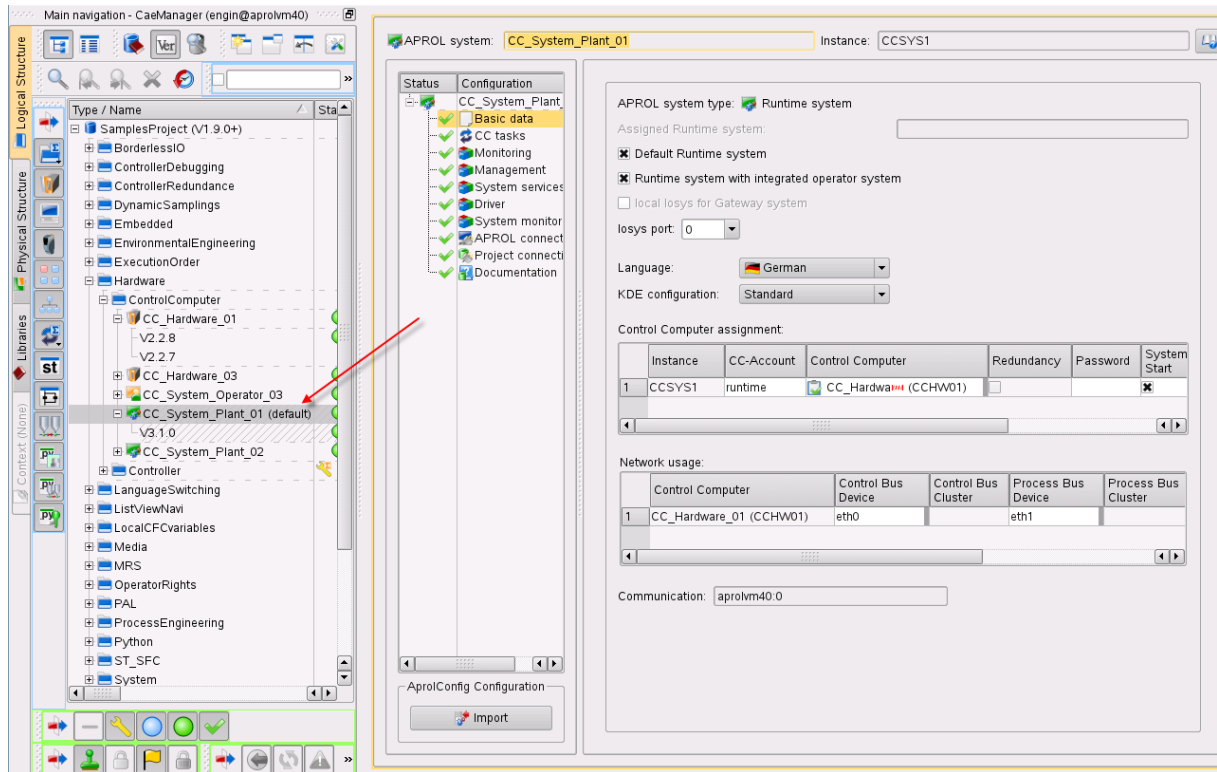


Figure 56: Selection of the APROL settings

These entries may also have to be changed or adjusted.

Check the global project settings under **"Extras / Option"** and make any necessary changes

Data Restore and implementation

All of the libraries must normally be re-created after a successful restore. This is recommended to ensure code is created for all defined environments (AR versions, etc.).

This is done with "**Build > Build all (all Libraries)**" or the project explorer context menu.

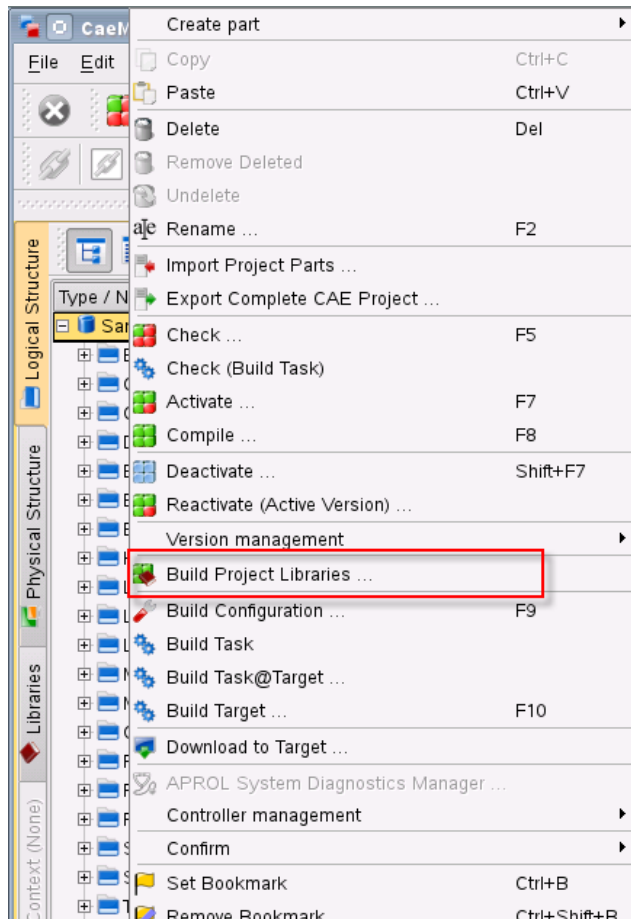


Figure 57: Generate the project library

The results should be checked to ensure that all libraries were created properly.

It makes sense to recompile the entire project ("**Build > Build all (Project)**").

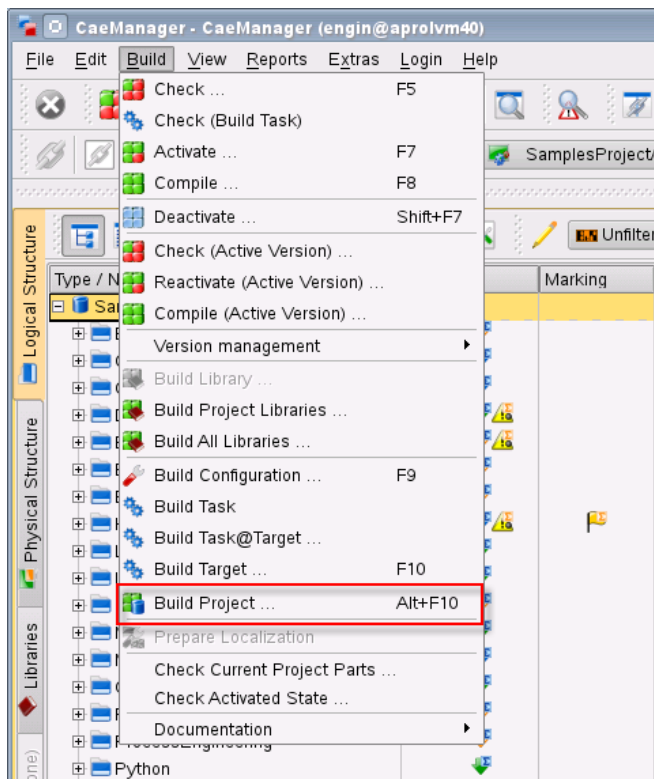


Figure 58: Build of the Project

The output window should be checked to ensure that everything was created properly.

The entire download can now be carried out with the DownloadManager.

- **Runtime**
- **Operator**
- **Controller**

(see the DownloadManager documentation)

Data Restore and implementation

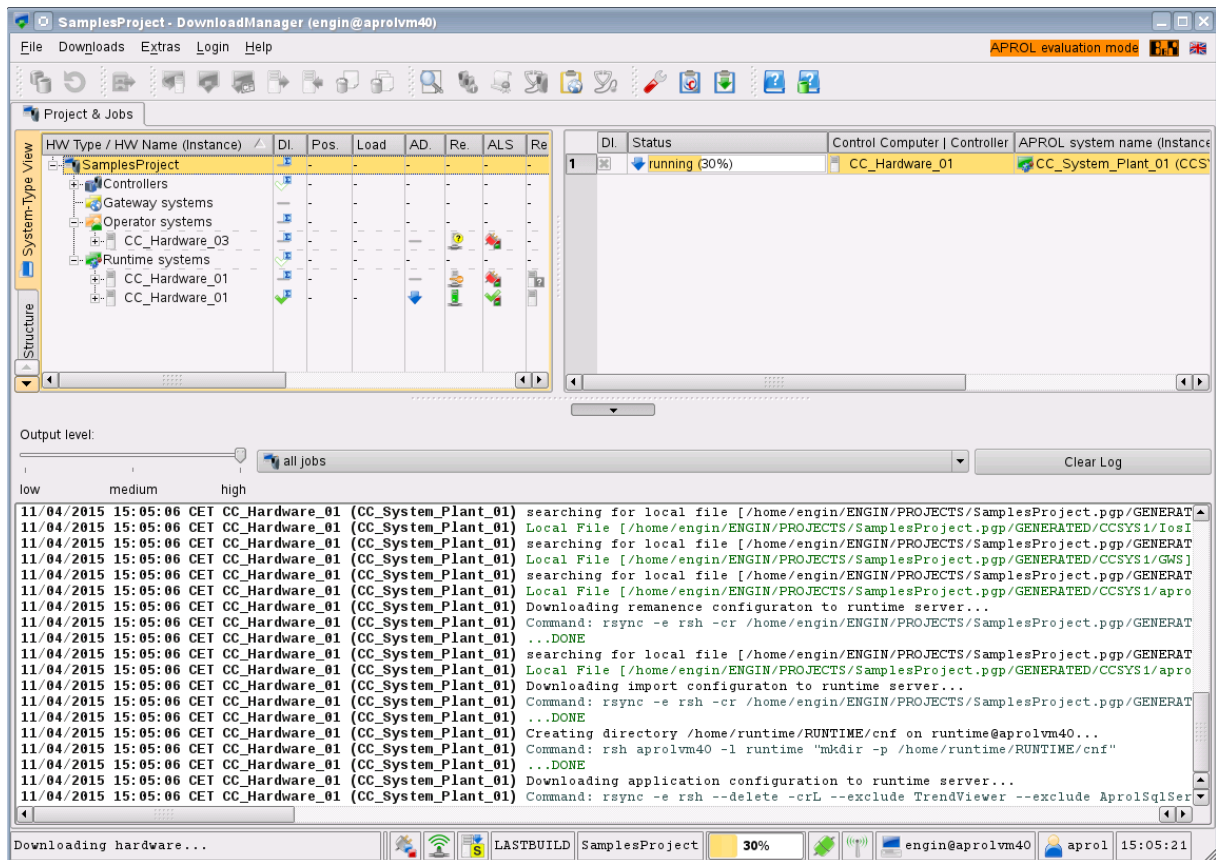


Figure 59: Download

The project functionality can now be checked in the runtime environment.



Task:

Perform a restore from your project which you backed up.

Steps:

Copy data to the PC, in /home/engin/APROL_CAE_BACKUPS.

Start CaeManager and perform CaeRestore.

Re-create the libraries

Re-create project.

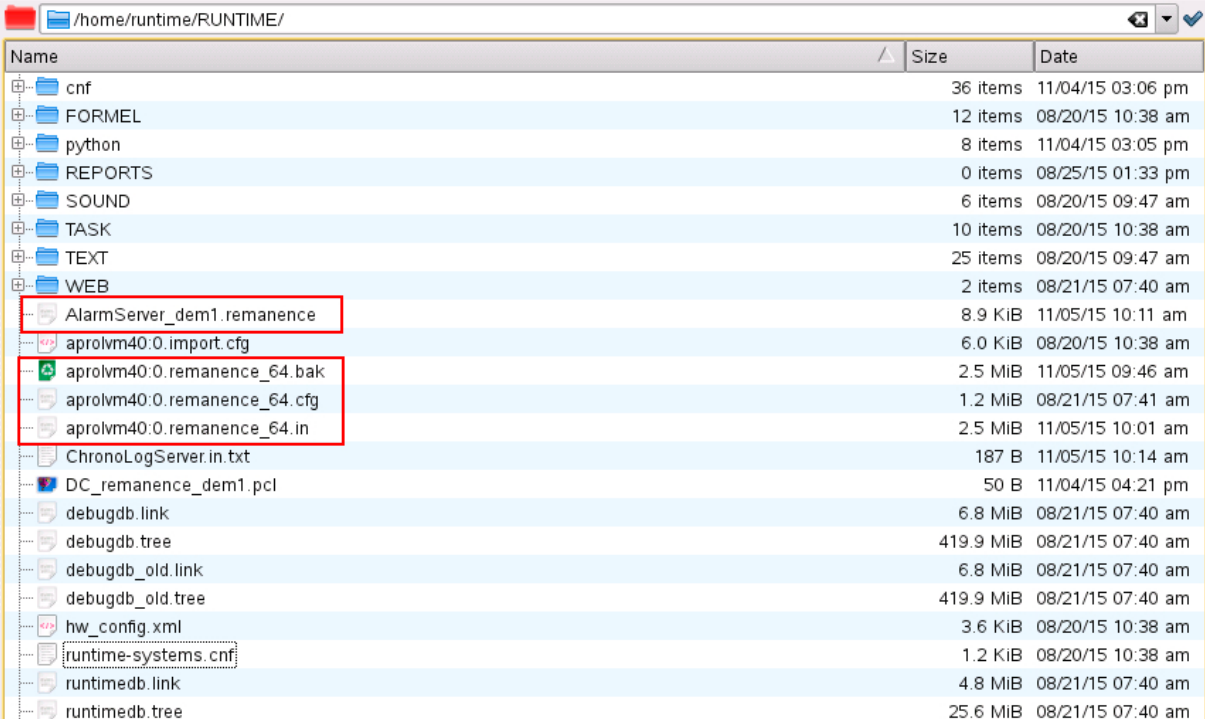
Start-up your training project again. (Download)

8.3 Use of the runtime remanence data

The plant is operated in the runtime and operator environments with many inputs and configurations (controller settings, limits, etc.). This data is stored in **remanence files**. We can restore and activate the configuration which we saved on a USB stick.

The following sequence is necessary to do this:

- Stop APROL runtime system. This is generally done with the StartManager.
- Copy data from USB stick to /home/runtime/RUNTIME.
- Rename the files if the computer name has changed.
- Start APROL runtime system. This is generally done with the StartManager.
- Now use the DisplayCenter to see if the saved data exists.



Name	Size	Date
cnf	36 items	11/04/15 03:06 pm
FORMEL	12 items	08/20/15 10:38 am
python	8 items	11/04/15 03:05 pm
REPORTS	0 items	08/25/15 01:33 pm
SOUND	6 items	08/20/15 09:47 am
TASK	10 items	08/20/15 10:38 am
TEXT	25 items	08/20/15 09:47 am
WEB	2 items	08/21/15 07:40 am
AlarmServer_dem1.remanence	8.9 KiB	11/05/15 10:11 am
aprotvm40:0.import.cfg	6.0 KiB	08/20/15 10:38 am
aprotvm40:0.remanence_64.bak	2.5 MiB	11/05/15 09:46 am
aprotvm40:0.remanence_64.cfg	1.2 MiB	08/21/15 07:41 am
aprotvm40:0.remanence_64.in	2.5 MiB	11/05/15 10:01 am
ChronoLogServer.in.txt	187 B	11/05/15 10:14 am
DC_remanence_dem1.pcl	50 B	11/04/15 04:21 pm
debugdb.link	6.8 MiB	08/21/15 07:40 am
debugdb.tree	419.9 MiB	08/21/15 07:40 am
debugdb_old.link	6.8 MiB	08/21/15 07:40 am
debugdb_old.tree	419.9 MiB	08/21/15 07:40 am
hw_config.xml	3.6 KiB	08/20/15 10:38 am
runtime-systems.cnf	1.2 KiB	08/20/15 10:38 am
runtime.db.link	4.8 MiB	08/21/15 07:40 am
runtime.db.tree	25.6 MiB	08/21/15 07:40 am

Figure 60: Remanence data



Note:

This must be done on both servers if it is a redundant system.



Task:

Install the saved remanence file in the new runtime environment. Check the result with the DisplayCenter.

8.4 Restore historical data

All of the desired and saved archives must now be copied to the server. These can be copied to the intended path with another name as the original archive.

- All saved ChronoLog containers to `"/home/aprolsys/APROL_DATA/chronolog"`
- All saved ChronoLog trends to `"/home/aprolsys/APROL_DATA/chronotrend/...."`

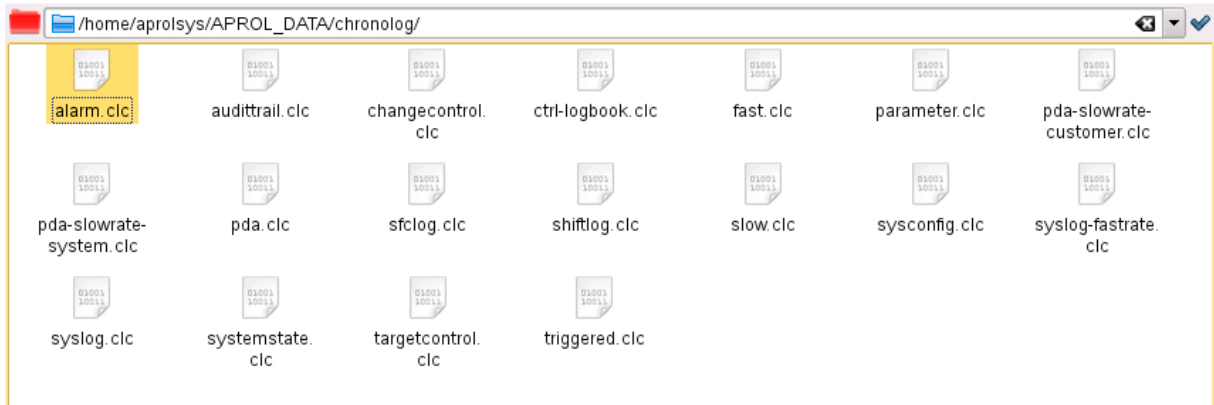


Figure 61: ChronoLog container

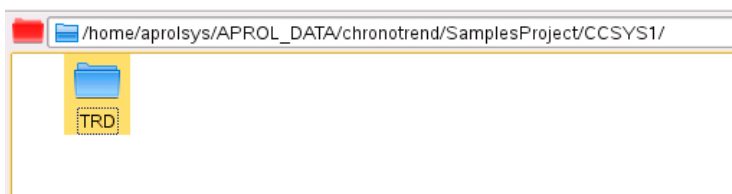


Figure 62: ChronoLog trends

The data is linked immediately, because the paths are implemented in the so-called **!ARKPATH** of the **apache2.conf**.



Note:

This must be done on both servers if it is a redundant system.



Task:

Restore the saved historical data. Start trend and alarm queries to see if the data exists.

9 Installing the language package

The language package is another possible necessity. If the restore data supports another language which is not contained in the standard installation (German and English), this step must be carried out.

Contents

This package includes the following add-on languages: Chinese, Russian, Spanish, French, Italian, Romanian, Japanese,

The list of supported languages is being extended continuously.

graphic



This data package also contains a translator. A user **aproltr** (password: **.aproltr**) is automatically created when the translator is installed. The APROL product documentation provides you with more detailed information.

Installing the language package

9.1 Language package installation process

A detailed description of the individual steps is given in the following pages. The following tables should only be a rough overview of the steps to be made.

Step	Description
1	Insert language DVD Insert the "Language DVD" in the corresponding drive. Then start the YaST control center.
2	Select installation type Then the CD Icon with the label "Change Source of Installation".
3	Select installation source Then press the [Add] button. This lets you select the medium from which to import the data.
4	Create link to data There are several possibilities for reaching the data that must be imported. Select CD (i.e. installation source) when clicking the [Add] button. Now click the [Finish] button which will bring you back to the control center overview.
5	Start software installation Now click on the "Software Management" icon. A window then opens.
6	Software filter In this window, select the filter from the top left. There are several ways to configure the data filter. Switch the view to the "Patterns" function. You will then see the packages that are recommended for installation. Selecting the individual packages activates them, which is indicated by the selection icon.
7	Adopt settings Now the settings just need to be accepted. Start the installation by selecting the [Accept] and [Install] buttons.
8	Installation finished The installation is now complete and you can now remove the CD and close the control center.

9.1.1 Step 1: Insert language DVD

Start the YaST control center. There are several methods available for doing this:

A.) Open the control center in the menu (also with "**System configuration>Administrator Settings / YaST**")

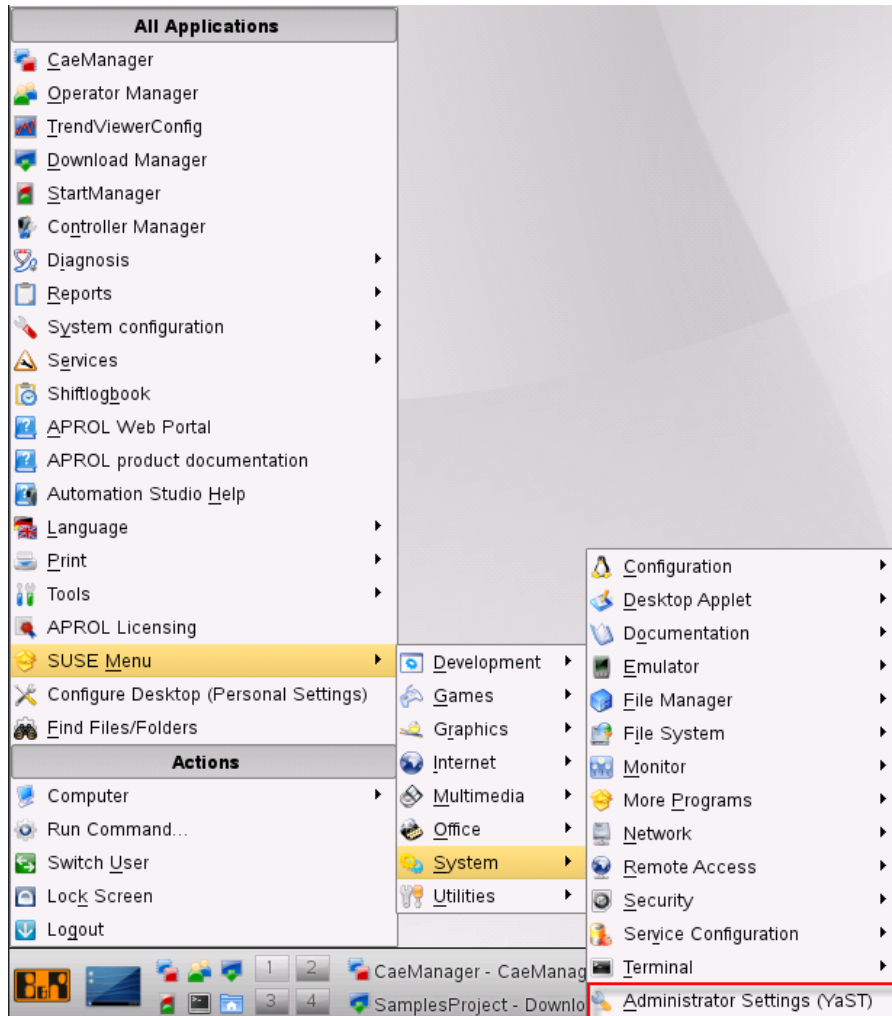


Figure 63: Menu guidance

B.) Opening the control center from an input window

- Open an input window (e.g. xterm) key combination **Alt + F2**, and execute the **xterm** command).
- Log in as **superuser** (**su - root > command** execute). Now enter the required **password** (**.root**).
- Execute the command **"yast2"**.
- The YaST2 control center is opened after executing this command

Installing the language package

9.1.2 Step 2: Select installation type

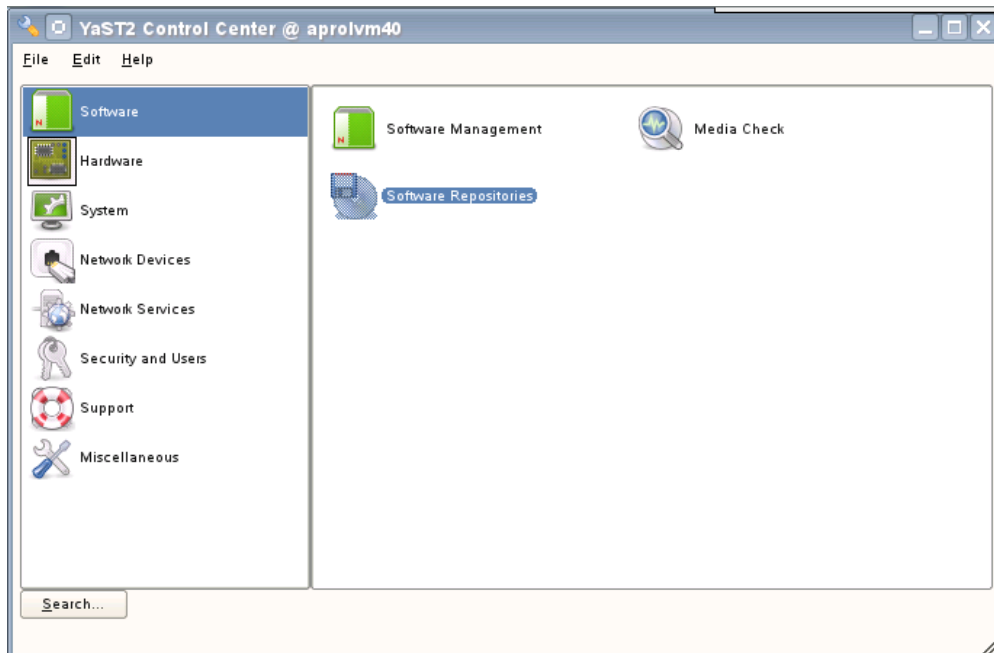


Figure 64: Control center – Software branch

In this figure, it is already evident which categories can be configured in the control center. The software section provides information about installing data.

For this, choose **[Software Repositories]**.

9.1.3 Step 3: Select installation source

The files loaded from a memory medium are listed in this popup. However, since we still don't have any data loaded, we will select **[Add]**. We can then see the different links to the memory media. To reach our data, select DVD as shown in the illustration.

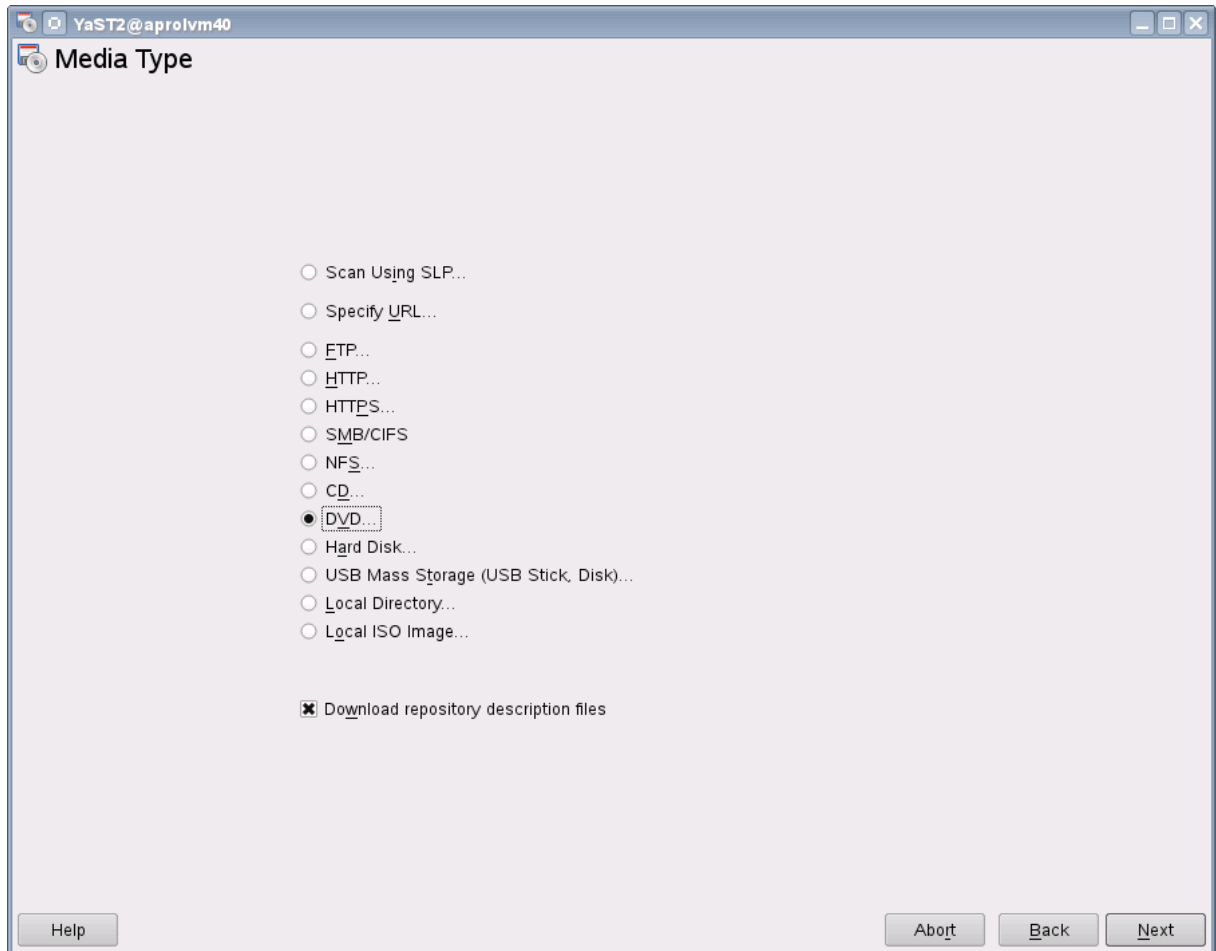


Figure 65: Software source - data storage device DVD

An installation can also be done from the "Local directory, NFS, USB, etc.".

Installing the language package

9.1.4 Step 4: Software management

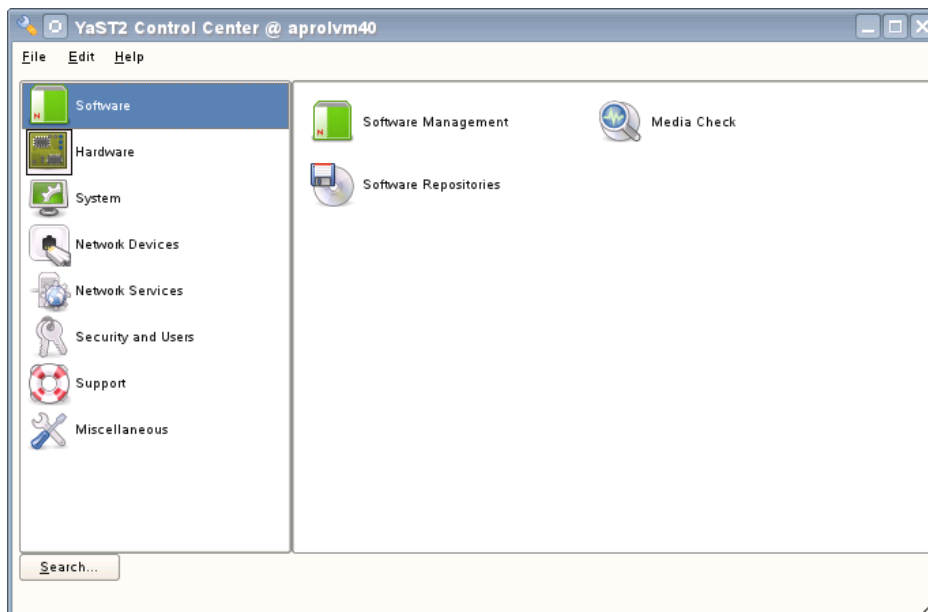


Figure 66: Control center

This brings us back to the control center overview. Now select the icon labeled **[Software / Management]**

9.1.5 Step 5: Software filter

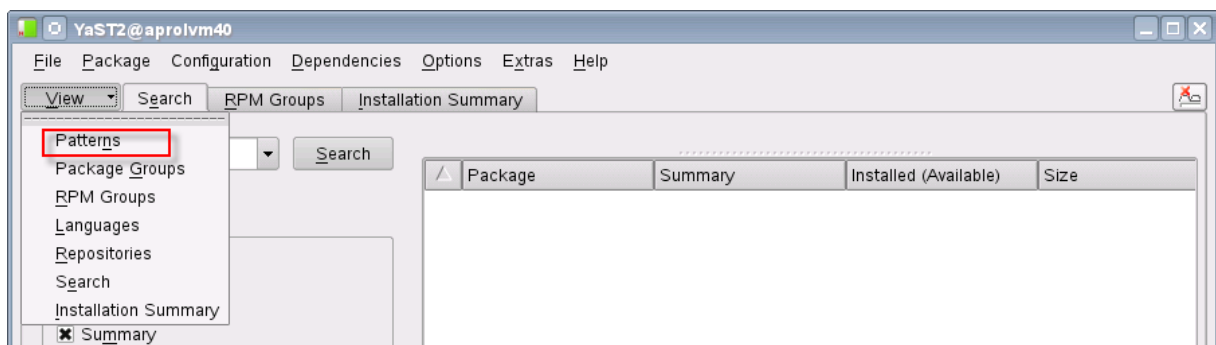


Figure 67: Step 6 Software filter

In this window, select the filter from the top left with **[View]**. There are several ways to configure the data filter. Set the filter to the **[Patterns]** function. You will now see the packages that are recommended for installation. (quasi everything in the repository)

9.1.6 Step 6: Adopt settings

The detailed selection for packages to be installed is now configured.

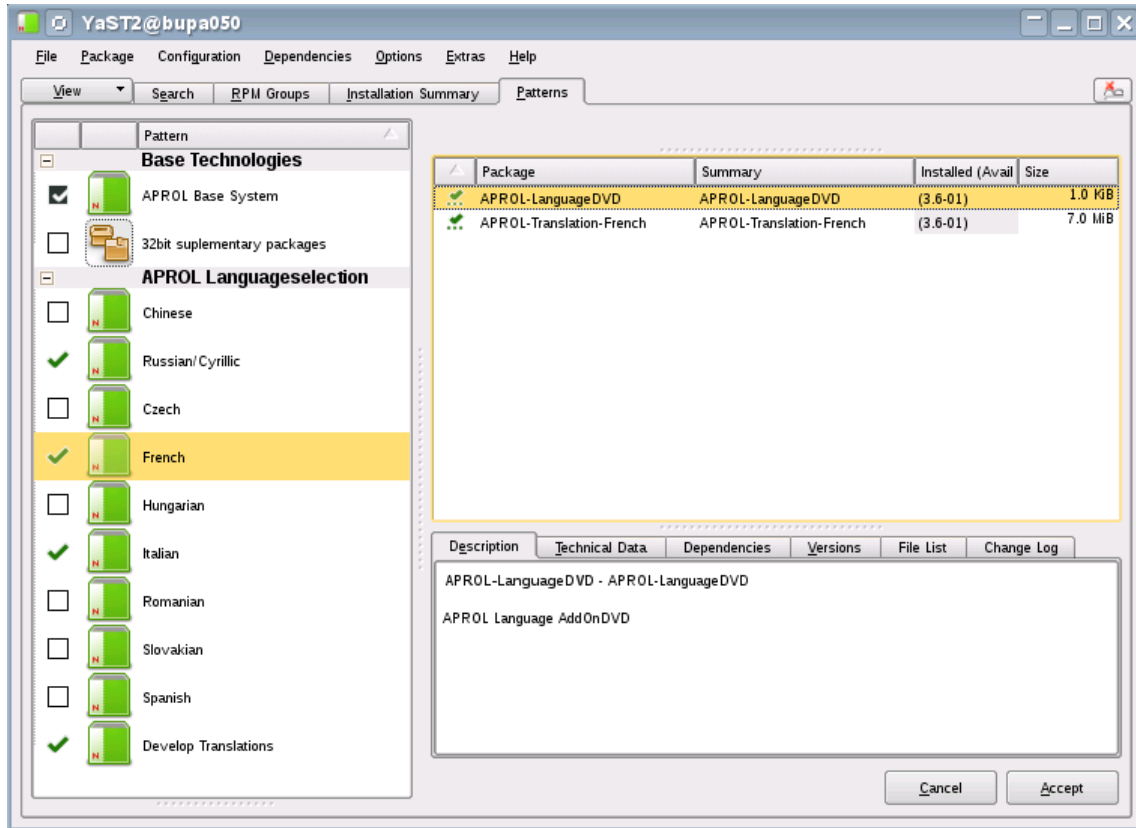


Figure 68: Software overview - Selection

Selecting the individual packages activates them. Click **[Accept]** to start the installation.

9.1.7 Step 7: Installation finished

The installation is now complete and you can now remove the CD and close the control center.

10 Updating the process control system

Software packages are replaced by new versions when a control system update is done. New software packages may be added..

An update should always be carried out on all computers in the process control network. (engineering system, runtime system, operator system, gateway system).



Caution:

A control system update may also contain updating the controller's operating system. This means that a **STOP** will be triggered on the controller. **(PLANT STANDSTILL!)**

10.1 Updating a Linux system

Start the YaST control center to update the Linux system. This can be done using the KDE menu or a text window.

Choose **[Software Repositories]** to start the installation.

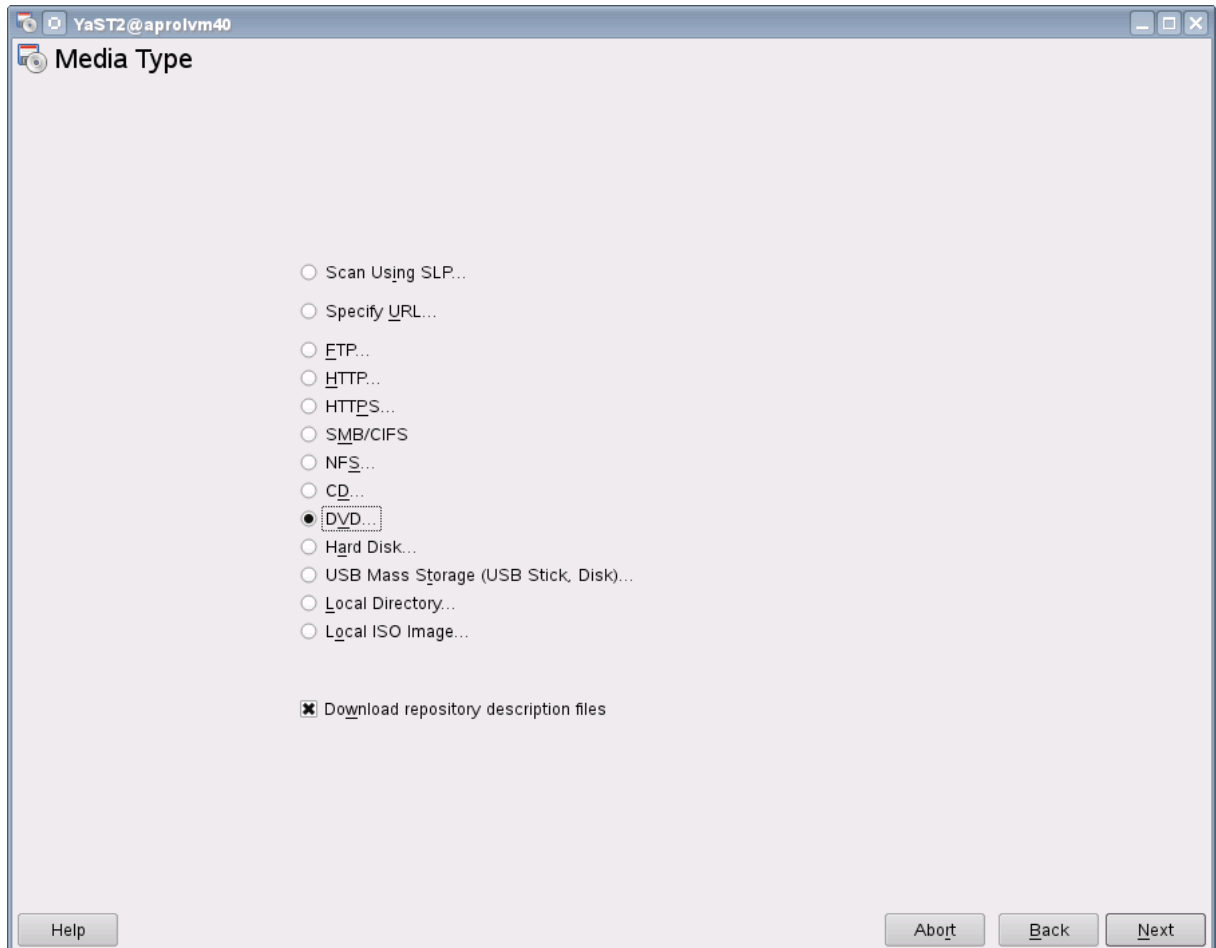


Figure 69: Data from DVD

to reach the data, select **[Add]** and "DVD".

(An installation can also be done from the **[Local directory, NFS, USB, etc.]**).

You can now see which source you have selected in the overview window. After choosing the correct data source, close this menu by clicking **[Finish]**.

Updating the process control system

YaST control center

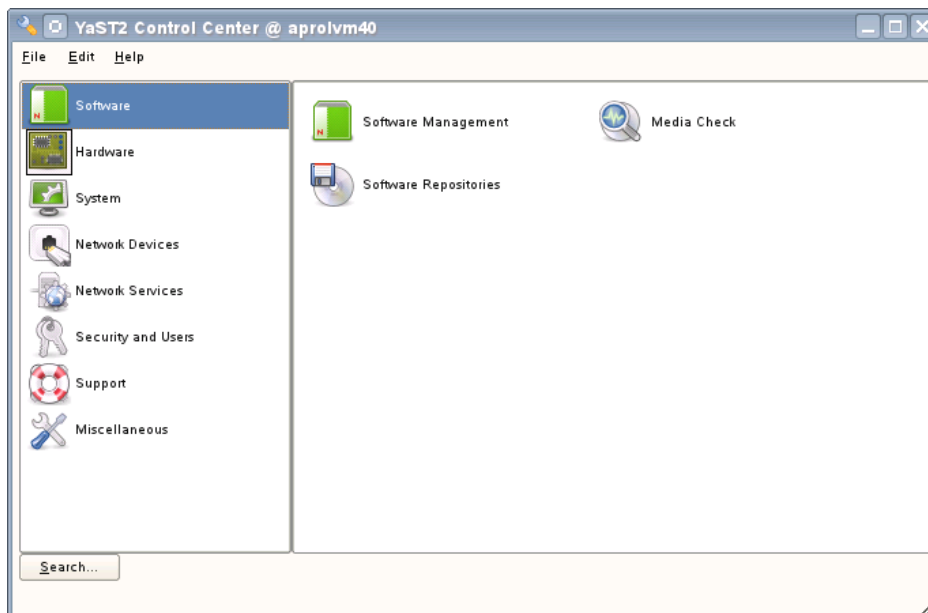


Figure 70: Control center

This brings us back to the control center overview. Now select the icon labeled **[Software Management]** .

Filter options:

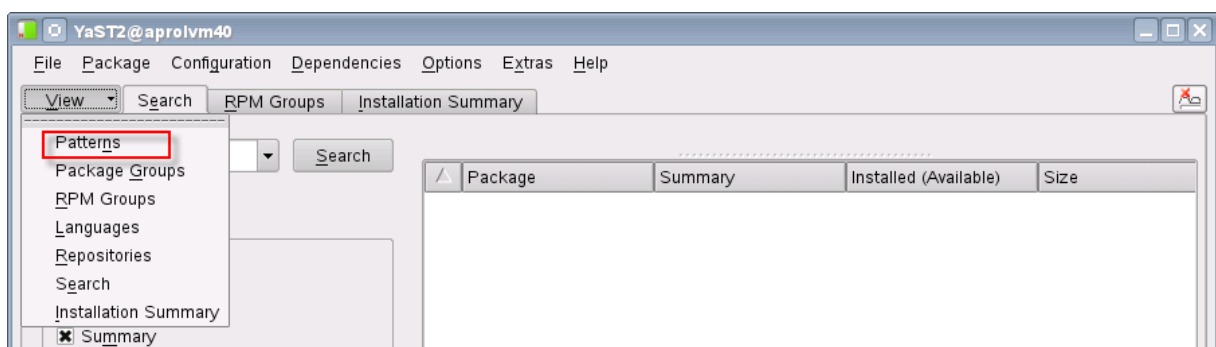


Figure 71: Software filter

In this menu, select the view from the top left. Switch the view to the **[Patterns]** function.

All of the schemes are displayed in the list shown. All of the installed schemes are marked in the first column.

Package menu:

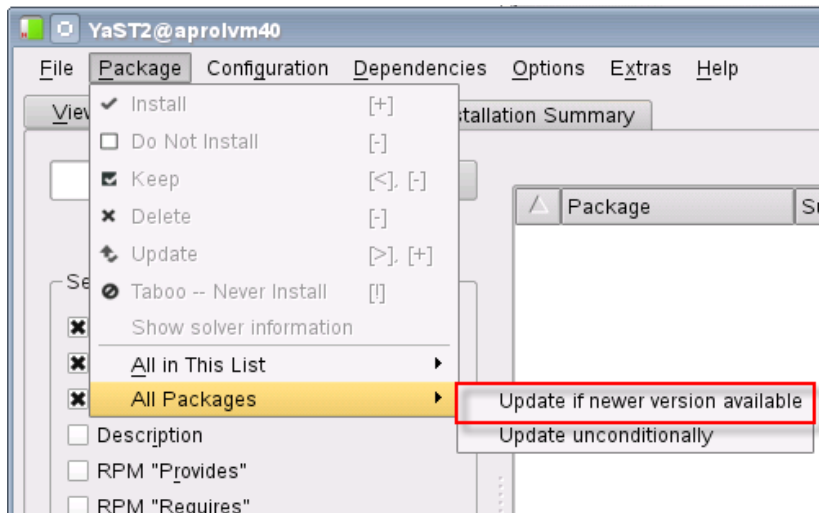


Figure 72: Package options

Now select:

'**Update if newer version available**' item from the 'Package / All packages' menu.

Choose menu **Package > All Packages > Update if newer version available**.

You can now see the packages in the window to the right. Check if all of the packages have been selected. Click **[Accept]** if all of the packages have been selected. Installation is now started.

If a new kernel has been installed, then the computer must be rebooted. YaST2 makes you aware of this.

Updating the process control system

10.2 Updating the system software

The system update is made after updating the Linux package.

Insert the APROL DVD in the respective bootable drive. Then start the setup from the console **[Ctrl] + [F1]**.

Start a text console and log in as the **superuser (root)**. Switch into **"runlevel 3"** with the **"init 3"** command. Then enter the command **"AprolInstall"** to start the setup.

The following selection window is then opened:

Since we are using a DVD as the source , we select **"sr0 DVD_extern"**.

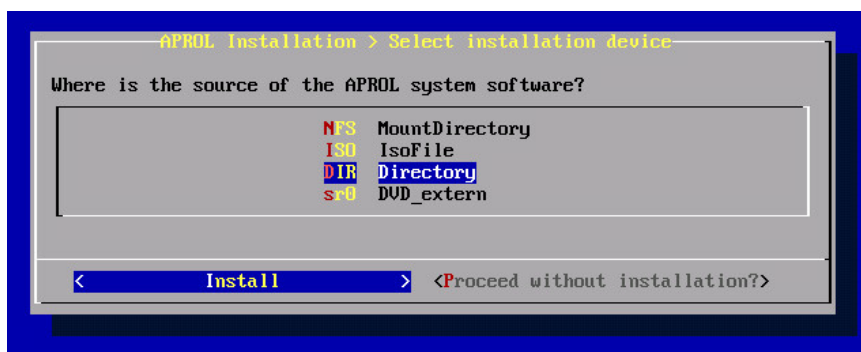


Figure 73: Installation selection

Specify if the installation medium check (MD5 check sum) should be carried out.

The execution of the integrity check is strongly recommended!

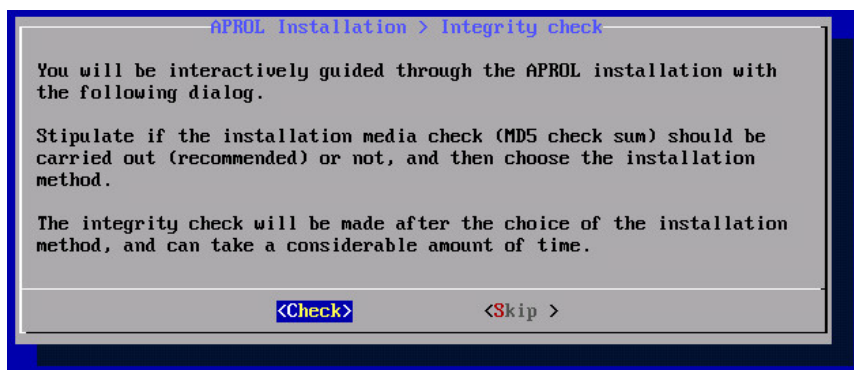


Figure 74: Checksum

We select the third option in the next window, because we are performing an update.

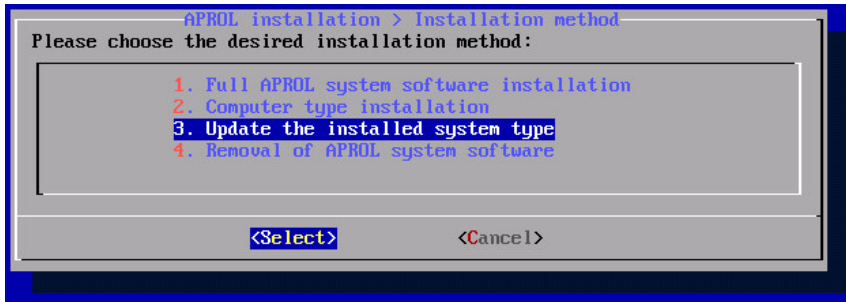


Figure 75: Selection update

Please note:

All of the packages belonging to this computer type are installed. That means that the choice of discarded drivers made during the last installation is not taken into account (drivers that were discarded last time are now installed)

In order to de-select individual drivers you must choose the '**Computer type dependent installation**' menu item.

The services must be stopped before starting installation (APROL logging, TbaseServer, AprotLoader).

The programs are restarted after a successful update.

You are then queried if the configuration should start after the update. This setup involves creating APROL systems. The setup can be closed by choosing [**Quit**] because we have already configured the APROL systems.

The update is now complete and you can switch to the graphic mode.

You may have to enter "**sax2 -l**" to do this.

Starting point for restoring the project:

- Start the CaeManager
- Adjust the CAE database
- Generate the project libraries
- Recompile the project
- Downloading the project

11 Summary

What have we achieved so far?

We have now completed the entire procedure for a new installation and for updating the APROL software. We have also taken a look at topic of data handling. The procedure for installing add-on packages was also covered in detail.

The two most important Linux programs (sax2, YaST) are required for configuring the system software. The procedures described here are identical in other releases.

The backup and restore mechanisms can be used at any time.



Figure 76: TUX und SuSE

12 Appendix

12.1 Objectives checklist (a few on-topic questions)

What needs to be saved?

What is the procedure for restoring a backup project to a functional state?

What is the sequence to follow when configuring APROL users?

Which subprogram is responsible for error-free startup of the runtime system?

Which user is required for making the system settings?

Which programs are used to perform certain Linux system configurations?

What must be considered when performing a system update?

What are the advantages of LINUX?

12.2 Solutions to the objectives checklist

Please take note of the necessary additional information.

12.3 Glossary

DHCP	Stands for Dynamic Host Configuration Protocol, and enables automatic assignment of the correct IP address when starting the system.
HTTP	Hypertext Transfer Protocol: is the protocol used to transfer information between server and clients on the internet.
SSL	SSL (Secure Socket Layer) and the https protocol (secure HTTP) enable information transfer between web browser (client) and web server guaranteed to be secure from spying or imitation.
DPMS	DPMS (Display Power Management System) contains a power-saving function for monitors.
Warm Failover:	Originally, the same services and programs were supposed to be installed on two computers. However, these services and programs only run on the master (i.e. the process controlling computer). If any heartbeats are missed ("heartbeat" = sign of life), the services on the slave are started and the slave becomes the master (and vice versa).
MRS	Multi Runtime System (for larger projects and variable conceptions)
ANSL	Automation Net Service Link (protocol for communicating between B&R controllers and control computers)
VNC	Virtual Networking Computing
FQDN	Fully qualified domain name (e.g. aroltraining01.br-automation.com)
LDAP	Lightweight Directory Access Protocol (organized logins, passwords and access)
NTP	Network Time Protocol (for time synchronization)
UPS / USV	Uninterruptible Power Supply / Unterbrechungsfreie Stromversorgung
YaST2	Yet another Setup Tool
sax2	Graphics Configuration tool in Linux

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* SEM210 - Basics is a prerequisite for this seminar.

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