zenon manual

Network

v.7.20

Contents

1. Welcome to COPA-DATA help

GENERAL HELP

If you cannot find any information you require in this help chapter or can think of anything that you would like added, please send an email to documentation@copadata.com (mailto:documentation@copadata.com).

PROJECT SUPPORT

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2. Network

zenon networks can be set up very quickly and securely.

zenon in the network allows you to, among other things:

- Complete access to Runtime on different computers, actions such as acknowledgment of alarms to a workspace are therefore visible to all others
- Centralized logging and archiving
- Creation of redundant systems (see redundancy (on page 73), circular redundancy (on page 96))
- Integrated evaluation methods for redundancy switching

- Creation of distributed systems (see multi-project administration (on page 29))
- Use of zenon Web Server and zenon Web Client for mobile access
- Use of zenon in a terminal server environment (on page 58)
- Use of strong encryption (on page 45)
- Concurrent work on a project from several stations (see distributed engineering)

> **License information**
>
> *Part of the standard license of the Editor and Runtime.*

SIMPLE ADMINISTRATION OF THE ZENON NETWORK

The network functionality of zenon makes it possible to implement projects as distributed on different computers and to create complex network constellations (on page 20) very efficiently. In doing so, project constellations can also be though out in such a way that certain project content is only visible at a certain location (a certain computer) for an activity. The zenon Editor supports users in creating and configuring such constellations.

The integrated topology administration (on page 64) creates interrelationships for the individual projects in the process, with the attendant computers in graphical form. A testing routine checks the configured structure to see that it is complete and that there are no configuration errors.

> **Information**
>
> *With network projects, note the roles (on page 8) (Primary Server, Standby Server, Client) in which modules and functions (on page 113) can be administered and executed.*

WAN

Within a network, zenon transfers data spontaneously – and is thus already optimized for use with in a WAN. Depending on the configuration, it is also recommended that the watchdog traffic (on page 19) between the client and Primary Server is limited. The communication distance between client and Primary Server can be automatically closed. The routers then establish a new connection when data exchange is absolutely necessary.

ZENON WEB SERVER

The zenon Web Server allows access to Runtime via the intranet or internet. No adaptations to the project are necessary. Access is via the zenon Web Client. This offers the same look & feel as zenon Runtime. The zenon Web Server is available as:

- zenon Web Server: Pure monitoring functionality.

- zenon Web Server Pro: Complete operation and monitoring functionality. It is possible to directly engage in processes over the web.
- `zenon Web Server Pro Light`: Limited functionality of zenon Web Server PRO for use with zenon Operator.

3. Concepts

With zenon, it is possible to create various network topologies, starting from a simple client-server model through to comprehensive multi-hierarchical models.

IT-specific terms such as Server and Client are also used in zenon. However, in order to achieve unique identification of the individual components for complex multi-hierarchical structures with various computers and projects involved, we always speak of roles in zenon. Roles are always to be considered from the point of view of a project.

zenon Runtime can start one or more projects depending on the project setup (see also multi-project administration (on page 29)). In doing so, the computer on which Runtime is started assumes one of the following roles for the respective projects:

- Primary Server
- Standby Server
- Client

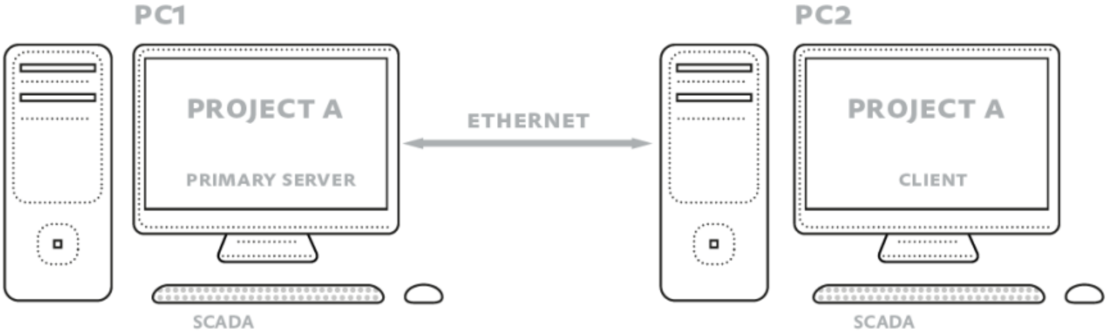
These roles are shown below using examples in different topologies.

Info

If, in the course of this documentation, we speak of Primary Server, Standby Server or Client, the role that the computer takes for the project is always meant.

3.1 Client-server model

In the Client-Server model, one computer is the Primary Server; all other computers are Clients.



- Computer 1 is the Primary Server for Project A.
- Computer 2 is the Client for Project A.

For details, see the `Client-Server model` (on page 23) chapter.

3.2 Redundant model

In the redundant model, one computer is the Primary Server and one computer is the Standby Server. All other computers are Clients.
If the Primary Server fails, the Standby Server takes on this role. All Clients connect to the new Primary Server.

REDUNDANCY WITHOUT CLIENTS

- Computer 1 is the Primary Server for Project A.
- Computer 2 is the Standby Server for Project A.
- If Computer 1 fails, Computer 2 is the new Primary Server for Project A.

REDUNDANCY WITH CLIENTS

- Computer 1 is the Primary Server for Project A.
- Computer 2 is the Standby Server for Project A.
- If Computer 1 fails, Computer 2 is the new Primary Server for Project A. All Clients automatically connect to Computer 2.

For details, see the **Redundancy** (on page 73) chapter.

3.3 Multi-hierarchical models

It is possible to create different multi-hierarchical topologies with the help of multi-project administration (on page 29). In doing so, it is possible to start several projects on one computer. The computer assumes a certain role for the project in the process.

Note: Multi-hierarchical projects can be executed without a network on individual computers.

Examples:

MULTI-CLIENT MODEL

- Computer 1 is the Primary Server for Project A.
- Computer 2 is the Primary Server for Project B.
- Project I runs on Computer 3 (integration project) as a standalone project and starts Projects A and B.
  - Computer 3 is a Client for both of these projects.

MULTI-SERVER MODEL

- Project I runs on Computer 1 (integration project) as a standalone project and starts Projects A and B.
  - Computer 1 is the Primary Server for both of these projects.
- Project I runs on Computer 2 (integration project) as a standalone project and starts Projects A and B.
  - Computer 2 is a Client for both of these projects.
- Computer 3 is the Client for Project A.
- Computer 4 is the Client for Project A.

MULTI-CLIENT-MULTI-SERVER MODEL

- Project I runs on Computer 1 (integration project) as a standalone project and starts Projects A, B, C and D.
  - Computer 1 is the Primary Server for projects A and B.
  - Computer 1 is the Client for projects C and D.
- Project I runs on Computer 2 (integration project) as a standalone project and starts Projects A, B, C and D.

- Computer 2 is the Client for projects A and B.
- Computer 2 is the Primary Server for projects C and D.

- Project I runs on Computer 3 (integration project) as a standalone project and starts Projects A, B, C and D.
  - Computer 3 is the Client for projects A, B, C and D.

For details, see the **multi-project administration** (on page 29) chapter.

4. Requirements

A basic requirement for using zenon is a functional Windows network.

GENERAL

The following requirements must be met:

- TCP/IP as the network protocol
- Functional naming, can be chosen as **DNS**, **WINS** or local **HOST files**.
- Free TCP Port 1100:
  If a network project is loaded, zenon Runtime automatically starts the **zenNetSrv** network service. This program opens port 1100. This must therefore be reachable remotely and may not be blocked by a firewall.

> **Info**
>
> zenon networks work with all supported operating systems.

IPV4 AND IPV6

The zenon network allows the choice of using IPv4 or IPv6. Dual operation is not possible. The setting is made via:

- Network configuration in the Startup Tool
  or
- In zenon6.ini

If this setting is changed, all ongoing zenon processes must be restarted. This concerns **zenAdminSrv**, **zenSysSrv**, **zenLogSrv** and **zenDBSrv** in particular.

The following components are not affected by the setting; they always use IPv4:

- Driver communication with the PLCs

- Protocol communication in the Process Gateway plug-ins
- Workbench and Runtime communication in zenon Logic

> ⚠ **Attention**
>
> *IPv6 only works with zenon version 7.00 onwards. No versions prior to zenon version 7.00 can be started if this is active.*

PORTS USED

For communication within zenon, only TCP ports are used; no UDP ports are used. zenon requires the following ports in a network:

Service	File	Goal	TCP-port
`Network service`	`zenNetSrv.exe`	Runtime communication.	1100
`Transport service`	`zenSysSrv.exe`	Data transfer by means of Remote Transport (Editor).	1101
`zenon Web Server`	`zenWebSrv.exe`	On-site logging machine between web client and Runtime	1102

Port numbers can be amended individually by means of the `Listening ports` tab in the Startup Tool. Note in this case that all devices affected must be amended.

STANDARD PORTS

Application	Standard port
Administration Service	50777
Analyzer Connector Service	50778
Analyzer License Service	50779
DB Service	1103
Logging Service	50780
Network Service	1100
SNMP Trap Service	50782
Transport Service	1101
WEB Service Classic	1102
WEB Service Tunneling	8080

CHECK THE REQUIREMENTS

NAME RESOLUTION

To check the name resolution:

1. Start the windows command line (**`cmd.exe`**)
2. Enter the following command: **`ping COMPUTER NAME`**.
3. If the name resolution is correct, you receive the IP address of the computer with Runtime as the answer; otherwise you receive an error message

TCP PORTS

To check the contactability of the TCP port 1100:

1. Start Runtime with a network project on a Remote computer:
   This starts the program **`zenNetSrv.exe`** and the TCP port `1100` is opened
2. Start the windows command line (**`cmd.exe`**)
3. Enter the following command: **`telnet COMPUTERNAME 1100`**.
4. As soon as a connection is established, the content of the command line window disappears; otherwise there is an error message.

Note: The Telnet command is not part of the Windows operating system and must be installed separately. You can find instructions for this in the operating system help pages (search for: Telnet).

4.1 Time synchronization in the network

With network projects, all computers in the network must be time-synchronized. zenon automatically carries out the synchronization necessary for this.

In a topology with several Primary Servers (such as circular redundancy (on page 96)), it is recommended that time synchronization is implemented by means of an external time service (such as DCF77) or Windows resources. In this case, the automatic time synchronization in zenon must be deactivated.

> ⚠ **Attention**
>
> *If the time difference between the server and the client is more than 5 seconds, no more files are synchronized.*

AUTOMATIC TIME SYNCHRONIZATION IN ZENON

If the time synchronization is to be turned on or off manually, the following entry in **`zenon6.ini`** must be amended:

```
[Netz]
TIMESYNCH=1 -> automatic time synchronization active (default)
TIMESYNCH=0 -> automatic time synchronization inactive
```

EXTERNAL TIME SYNCHRONIZATION USING THE OPERATING SYSTEM

If the automatic time synchronization in zenon was deactivated, synchronization can be carried out via the operating system. To do this, a time server must be specified for this (with or without an external time service such as DCF77), which takes on the time synchronization with the other computers.

In the conventional Client-Server/Standby topology (without multi-project administration), the Primary Server is the active time master. This should keep its own time itself by means of an external time service if possible. The respective clients get the current time from this (depending on the timeout that has been set) and update their own times accordingly. Communication is carried out via SNTP (Simple Network Time Protocol), which takes the delay time into account.

Information

Watchdog

Time synchronization is carried out periodically at the set time-out time.

When using the default setting of 30 seconds for the **Network communication timeout** *property in the* **Startup Tool***, the network service (***zenNetSrv.exe***) of each client sends a Watchdog to the network service (***zenNetSrv.exe***) of the Primary Server every 10 seconds during online operation. If the Primary Server responds to at least one of the three watchdogs within the 30 seconds, the client assumes that the network connection is working.*

Configuration in the Startup Tool:

Application -> Options-> Network configuration tab -> Option Network communication timeout.

Configuration in zenon6.ini:

Alternatively, the setting can be made directly in zenon6.ini:

```
[Netz]
NET_TIMEOUT_MSEC=30000
```

(time-out in milliseconds, default: 30000.)

Note the additional configuration necessary in WAN (on page 19).

Attention: The minimum timeout time is 5 seconds. If a lower value is defined, this is interpreted as 5 seconds.

COMMANDS UNDER WINDOWS

For external synchronization using Windows, enter the following command with the respective necessary arguments in the console for command processing: **`NET TIME [\\Computer name | /DOMAIN[:Domain name] : /RTSDOMAIN[:Domain name]] [/SET] [/YES]`**

Argument	Description
`NET TIME`	- Synchronizes the time of the computer with that of another computer or another domain or - Displays the time for a computer or a domain If this command is executed without further arguments, then the current date and the current time of the computer that was defined as the time server for the domains is displayed.

`Computer name`	The name of the computers that checks or is to be synchronized.
`DOMAIN[:Domain name]`	The time is synchronized with the primary domain controller of the **`Domain name`** domain.

`RTSDOMAIN[:Domain name]`	The time of the computer is synchronized with a reliable time server from the **`Domain name`** domain.
`/SET`	Synchronizes the clock of the computer with the stated computer and/or the stated domain. After the command has been set, the server time is displayed and a request is made to see if this time is to be set.

/YES	Displays the current server time and synchronizes this with the local computer without a further request or confirmation.

Example

```
NET TIME  \\Server /SET /YES
```

4.1.1 Time synchronization in the WAN

In a WAN and for dial-up connection, the standard defined value of 30 seconds for the timeout means that the connection would probably be maintained permanently.

Select a timeout time in the WAN that only initiates the establishment of a connection at the desired interval. However, note: The longer the time-out, the later server failures are detected. For example, if you select `64800` as the time for the timeout, the time-out time is 18 hours. A connection is made every 6 hours and a watchdog is sent. A server failure would thus only be noticed after around 18 hours.

Information

If no entry for the timeout is defined in ***zenon6.ini****, the standard timeout of 30 seconds is used when Runtime is started.*

FUNCTION SCREEN SWITCH

Active data is requested when a screen is switched. Procedure:

- A check is made to see if a watchdog was sent to the Primary Server in the last 30 seconds.
- If this is not the case, a watchdog is sent to the Primary Server immediately. the waiting time for a response is 40 seconds.
- If a Server break down is recognized, the zenon network service automatically tries to reconnect every 30 seconds.

This would lead to a permanent connection establishment in the WAN network. This behavior can lead to entries in `zenon6.ini` being amended:

1. Open zenon6.ini.
2. Navigate to the `[NETZ]` section.
3. Create or edit the entry
   `NET_CONNECTWAIT_MSEC=30000`
   This defines the value for a reconnect in milliseconds.

   Maximum value: Time-out time
4. Create or edit the entry
   `NET_CONNECTCOUNT=`

   This defines the number of repetitions for a reconnect per cycle.

   The default is `0` repetitions, this means 1 attempt at reconnection.

5. Setting up the zenon network

In the zenon network, you work with:

Parameters	Description
`Server:`	Computer with connection to the PLC. The server takes on the administration of process and project data exclusively. Communication is checked by means of a watchdog (on page 14). In the event of a server failure, the Standby Server undertakes its tasks, provided a standby was defined. As soon as the server is ready again, it automatically takes on its tasks and synchronizes all data.
`Standby Server:`	Takes on, in redundant systems, the role of the server, if this fails. It acts like a client in the network, but al saves all data like the server. In the event of hardware redundancy, the standby communicates with the redundant PLC both ways. The standby works with an internal buffer. Data loss during the downtime between server failure and the standby taking on the server role is thus avoided.
`Clients:`	Each computer on which Runtime is started is a client. Clients connect to the server to receive process data or to send this.
`Data server:`	The Data server is a computer with direct communication to the process but no server tasks. In normal operation, the data server sends all data to the Server, which manages data storage and data distribution. In the event of a network or server breakdown, the data server continues to work as a single station and therefore guarantees proper operation of the process. The data is transferred as soon as the server connection is re-established. Field of application: An on-site operating system without powerful hardware, such as an IPC or CE terminal. Complete data archiving and data distribution is carried out by the data server. On-site operation is still possible in the event of a server failure. This is not the case in a conventional Client-Server model.

Information

Server and client are not defined in relation to a computer, but in relation to a project.

If the names of the Server or Standby Server are changed, these cannot be reloaded. They are only updated by restarting Runtime.

TOPOLOGIES

zenon supports several network topologies:

- Client server network (on page 23): The same project runs on the server and all clients.
- Multi-server network: A client can access different servers and thus display the data of different projects at the same time.
- Multi-client-multi-server model: All clients and servers communicate with each other. Other projects can be accessed from each project.

CONFIGURING THE NETWORK

To make a network network-compatible:

1. navigate to the **Network** node in properties
2. Activate the **Network active** property
3. Use the **Server 1** property to define the computer that takes on the server role in the project
   Note: The IP address is not sufficient; the name of the computer must be entered.

If necessary, you still configure the following in this section:

- Standby Server (on page 76): **Server 2** property:
- Redundancy (on page 73): **Redundancy type** property:
- **Termination message**: Defines if, when Runtime is ended on a server, the clients are informed 70 seconds in advance

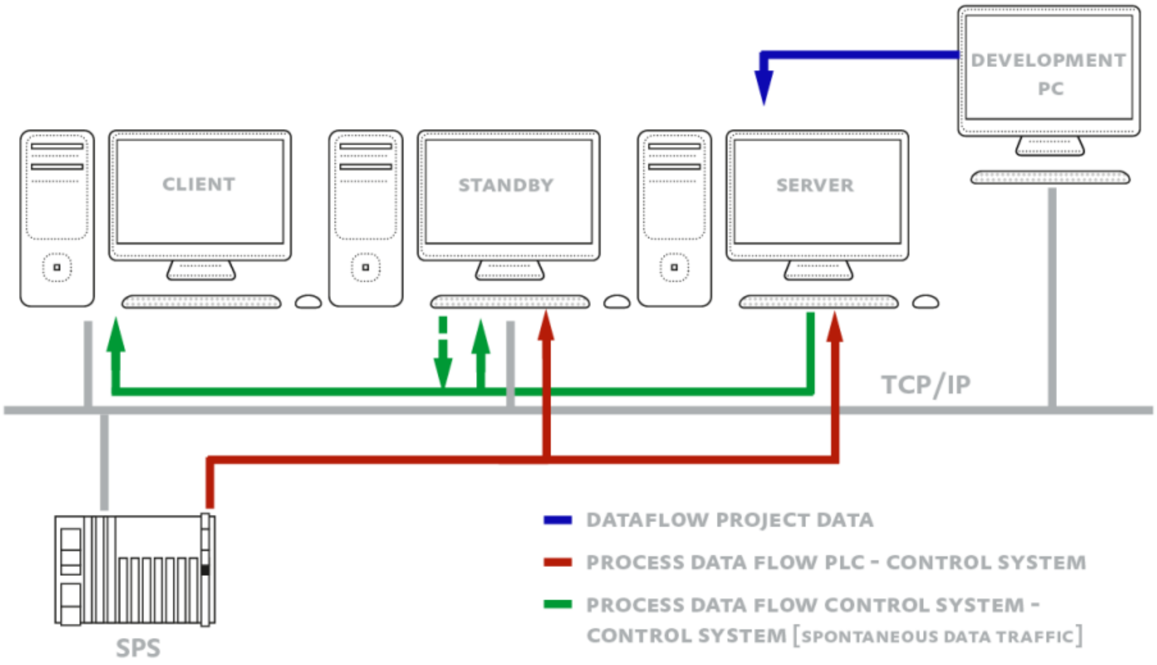
With this, you have configured the basic properties. Repeat these steps for all clients in the zenon network. Remote computers can also be set up using remote transport.

> ⚠ **Attention**
>
> *Issuing a name for Server 1 and Server 2:*
>
> - The computer name must be entered.
>   The IP address is not permitted.
> - `"localhost"` must not be used.

-

5.1 Client-server model

In the conventional Client-Server model, only one project is used, which is started on all computers involved. In doing so, a certain computer is the Primary Server for this project. All other connected computers are Clients.


DEVELOPMENT PC
CLIENT
STANDBY
SERVER
TCP/IP
SPS
DATAFLOW PROJECT DATA
PROCESS DATA FLOW PLC - CONTROL SYSTEM
PROCESS DATA FLOW CONTROL SYSTEM - CONTROL SYSTEM [SPONTANEOUS DATA TRAFFIC]

To set up the Client-Server model, the following must be the case in the project:

- The **Network active** property must be activated
- The name of the computer that is to be the Primary Server is to be entered in the **Server 1** property

Recommendation: Select the most powerful computer in the network as the Primary Server.

In the zenon Client-Server model:

- Only the Primary Server has a direct connection to the PLC
- The Primary Server administers all process data (such as online data, archive data, alarms, recipes, etc.)
- The Primary Server administers all project data (such as screens, functions, defined variables, etc.)
- Each other computer starts as a Client in the network
- Each client establishes the connection to the Primary Server when Runtime is started,
  - synchronizes the project data and

- displays the current process data

> **Information**
>
> *The Client-Server model is fully supported under Windows CE. Windows CE devices can be used as Primary Servers or as a Client.*

5.1.1 Configuring the Primary Server

The Primary Server makes the connection to the PLC and administers all data, both online data and configuration data. The Clients synchronize their data with the Primary Server.

To set up the Primary Server

1. Activate the **Network active** property
2. Define the computer that is to be the Primary Server for the project using the **Server 1** property.
   Note: The IP address must not be used; the name of the computer must be entered.
3. Note the correct configuration of the internal variable drivers (on page 127)
4. Create AUTOSTART and AUTOEND scripts (on page 127) for the clients if necessary

> **Attention**
>
> *Issuing a name for Server 1 and Server 2:*
>
> - The computer name must be entered.
>   The IP address is not permitted.
> - `"localhost"` must not be used.

If the development computer on which you created the project is also the Primary Server, configuration is now complete.

5.1.2 Configuring the clients

Clients can be set up via Remote Transport, via the network topology or manually. Setup via Remote Transport or the network topology is recommended.

For this, the following applies:

- If the development station also is a client, simply start the Runtime there.
- You set up all other clients either by means of Remote Transport (on page 25), network topology (on page 64) or manually (on page 25).

- If special processes are to be executed on the clients, a respective script in the project must be created, which defines the behavior on startup (AUTOSTART_CLIENT script (on page 127)) and when being ended (AUTOEND_CLIENT script (on page 127)).

Set up client with Remote Transport

By default, Remote Transport always transports the Runtime files to the computer that is defined as the server in the network properties. To set up clients from the development computer by Remote Transport, the Remote Transport connection must be set up before the Client is set up.

To set up clients using Remote Transport:

1. Open the **General** node in Project Properties.
2. Click on the **Remote transport** property.
3. The dialog **Remote Transport** is opened
4. Enter, in **Connection** under **Name**, the name of the client in the network.
5. Close the project configuration with **OK**.
6. Establish a connection to Remote Transport.
   To continue to use Remote Transport, it is best to use the tool bar symbols.
7. Transport all Runtime files to the client with Remote Transport.
8. Set the start project for the client with Remote Transport.
9. Start the Runtime on the client with Remote Transport.
10. Close the Remote Transport connection

Setting up a Client by means of network topology

Network topology is suitable for setting up several Clients at the same time. In doing so, Runtime files can be transferred to several computers at the same time by means of multiple selection. For details, see the **network topology** (on page 67) chapter.

Setting up the client manually

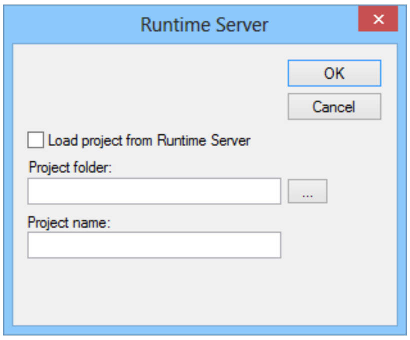
To configure clients for the start of Runtime:

1. Close zenon Editor and zenon Runtime.
2. Open the file **zenon6.ini** with a text editor.
   You can find the file in the folder %ProgramData%\COPA-DATA\System\
3. Remove the line **VBF30=....** or comment this line out.

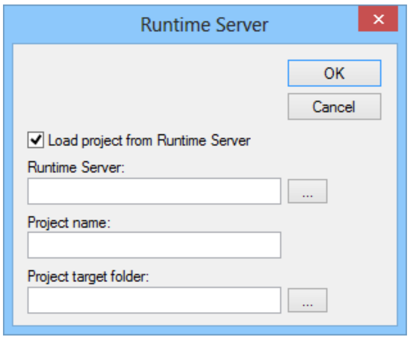
   (This entry defines which project is to be loaded when Runtime is started.)

4. Leave the Editor closed and start Runtime.

5. A request is made in a dialog, requesting which project is to be loaded.



6. Activate the check box for the **Load project from Runtime server** option.



7. Enter:

   a) **Runtime server**: Computer that is set up as the Primary Server (on page 20). The name can be entered directly or selected from a list using the `...` button.

   b) **Project name**: Name of the project that runs on the Primary Server.
   Note: Ensure that the project names are correct. If the folder name does not correspond to the project name, the project name must be changed here!

   c) **Project target folder**: Folder for Runtime on the client's local hard drive. You either can select an existing folder using the ... button or enter a path manually. If a folder that does not exist is entered, this is created automatically.

   d) Confirm the input by clicking **OK**.

8. zenon Runtime:

   a) Creates a connection to the Primary Server

   b) Copies its Runtime files to a project target folder

   c) Starts Runtime

   d) Requests a restart of Runtime if necessary

9. The entry **VBF30=...** in the `zenon6.ini` file is set on the project target folder.

Runtime then starts the network project automatically on the client each time it is started.

Repeat this process for each client.

Behavior in Runtime

Network projects can be operated in the same way in the network by all computers in Runtime and Clients and are visualized in the same way. If there is no valid project defined when Runtime is started, the dialog to define the Runtime projects is opened. For details, see the Set up client manually (on page 25) section.

Differences between the Primary Server and the Client:

- Only the Primary Server of the project has a connection to the hardware and administers the process data.
- The other computers (Clients) receive, from this:
  - Current values of the variables
  - Chronological Event List system messages
  - Alarm information
  - Recipes
  - Archive data
  - etc.

The transfer from the Primary Server to the Clients (such as a value change from a driver) is spontaneous and event-triggered (such as calling up a trend screen, which needs archive data from a Primary Server).

MONITORING THE CONNECTION

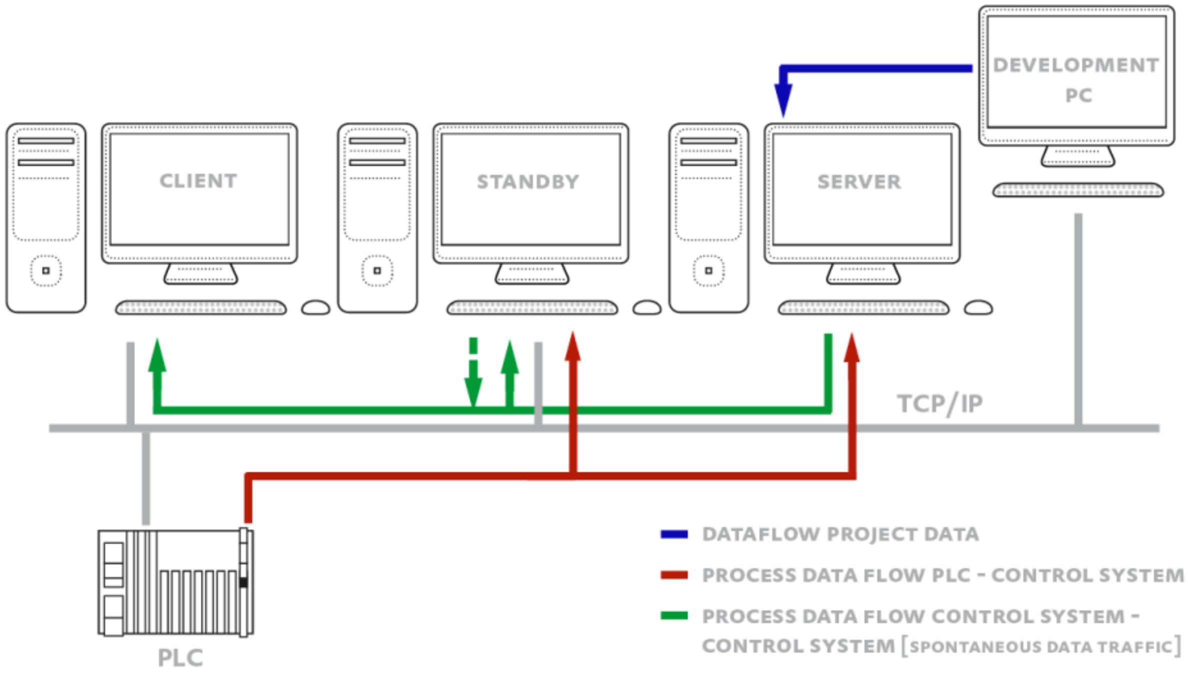
When using the default setting of 30 seconds for the **Network communication timeout** property in the **Startup Tool**, the network service (**zenNetSrv.exe**) of each client sends a Watchdog to the network service (**zenNetSrv.exe**) of the Primary Server every 10 seconds during online operation. If the Primary Server responds to at least one of the three watchdogs within the 30 seconds, the client assumes that the network connection is working.

Redundancy

Redundant SCADA servers are used, if 100% process control and data safety is demanded, even when the server fails.

You achieve this fail safety by defining a second server, a so-called Standby Server, along with the project server. This standby automatically recognized a server failure Then it takes on the entire functionality of the server.

In order to avoid data loss in the time between the server failure and the recognition of the failure the standby always buffers all data. After a server failure this buffer is merged with the last data from the server and the new incoming data, so no data can be lost. So the control system guarantees seamless redundancy.


DEVELOPMENT PC
CLIENT
STANDBY
SERVER
TCP/IP
PLC
DATAFLOW PROJECT DATA
PROCESS DATA FLOW PLC - CONTROL SYSTEM
PROCESS DATA FLOW CONTROL SYSTEM - CONTROL SYSTEM [SPONTANEOUS DATA TRAFFIC]

Depending on the configuration of the redundancy mode property, the original server is started either as a Server or as a Standby after restarting.

Redundancy mode	Description
Non-dominant	The original Server (Server1) starts as a Standby. Server 2 retains the
Dominant	The original Server (Server 1) takes on the role of Server again after a been synced. Server 2 is downgraded to the Standby.
Rated	Depending on the configured evaluation, the original server is startec Server or as a Standby after restarting.

Info

If the standby is running, when the server is started, the server copies all Runtime data from the standby. If you made any changes in the project data, while the server was offline and you have only updated them on the (not running) server, these changes will be overwritten, when the server copies the data from the standby.

In this case you have to update the standby before starting the server; or you close the standby when starting the server. As soon as it is restarted the standby then will get the new data from the (running) server.

CONFIGURING THE STANDBY

- In the network properties, in addition to the **server**, enter the name of the **Standby Server**.
- To transfer the Runtime files, the process is the same as with the client.

The control system supports two different kinds of redundancy:

Software redundancy	The PLC is not redundant. Only the control system is redundant. (standard case)
Hardware redundancy	Both the PLC and the control system are redundant.

5.2 Multi-project administration

Multi-project administration makes decentralized solutions possible. Sub-projects can be distributed to different computers. The individual computers in turn can be the Primary Server, Standby Server or Client for the respective sub-projects.

The following is possible with the help of multi-project administration:

- Several projects in one workspace can be edited in the Editor at the same time
- Several projects can be started at the same time and thus variables, functions, archives etc. from other projects can be accessed directly throughout projects

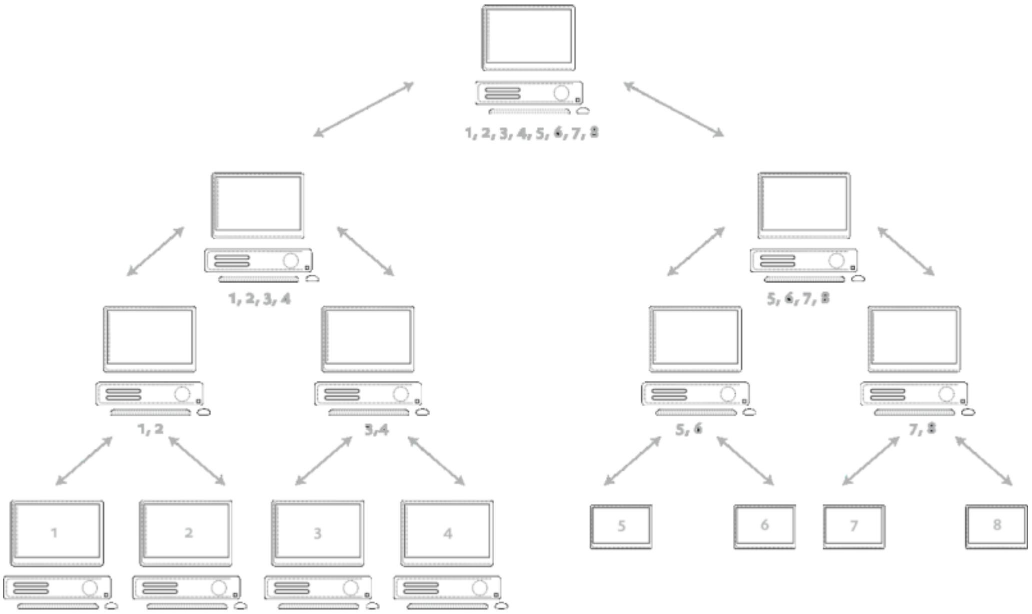
Information

Multi-project administration is not available under zenon Operator. Here, only one project and a global project per workspace can be created and administered in the Editor. Runtime can only start one project.

STRUCTURE

An integration project that is loaded in Runtime as a start project is required.

zenon creates a multi-hierarchical project tree, at the top of which is the integration project. Multi-project administration makes it possible to place the projects in a logical connection to one another.



Information

Configure and check the topology with the zenon network topology (on page 64).

WORK EFFICIENTLY WITH MULTI-PROJECT ADMINISTRATION AND THE PROJECT HIERARCHY

zenon enables you to reuse data and screens from existing projects consistently. zenon multi-project administration makes a logical connection between the individual projects and places these in a hierarchical connection to one another. The user can display this project hierarchy graphically in the zenon Editor, by dragging the projects to the desired position with the mouse and thus creating a multi-hierarchical project tree.

The project that is highest in the hierarchy is the integration project. All other projects are subordinate to this project. The data from individual projects is available throughout all projects in the project structure.

The zenon multi-project structure is comparable to a file folder:

- Additional sheets – zenon projects – can be added at any time. The folder always automatically covers all information of the sheets stored in there. It is possible to browse through the pages at any time and look at the information, without taking the individual pages out. In the zenon multi-project structure, users can change between the individual screens or projects without having to take these out.
- The integration project can be compared to the contents of the file folder. It serves as a central navigation project and makes it possible to display screens or data from the subordinate projects. The individual projects are autonomous and can continue to be operated autonomously. Access from a project to the data or screens of another project is enabled via the zenon standard interfaces. Expansions or amendments to projects are made directly in the individual projects. Any maintenance work that may be carried out only has an influence on the respective project; the overall system remains unaffected by this.

MULTI-PROJECT ADMINISTRATION MEANS

- Small-sized, clear structures.
- Easy, quick and clear maintenance of the individual projects.
  It is possible, for example, to deactivate individual projects without influencing the others. In the same way projects can be distributed to different processors.
- Load distribution.
- Cross-project operation, as all projects on a processor are simultaneously activate.
- Multiple-hierarchy network structure allows the centralization of data (measured values, alarms, plant information, archive data, etc.) in a higher-ranking level.
- No limit on projects per processor.
- Summary of projects to large control rooms.
- Node structure – physical network separation.

5.2.1 Definition of the structure in the Editor

The structure is created by simply dragging & dropping in the Editor. You also need, in addition to productive projects, an integration project that administers all other projects. Because standalone projects do not send data to other computers, a Primary Server must be defined in each (sub-)project. The integration project itself can also be a network-capable productive project.

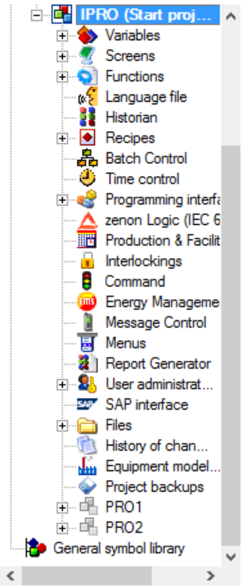
EXAMPLE

Three projects are used in this example:

- Integration project **IPRO**
- Productive project **PRO1**
- Productive project **PRO2**

To create the structure:

1. Create:
   - IPRO
   - PRO1
   - PRO2
   - And define a Primary Server for each computer
     (the integration project can also be implemented as a standalone project)
2. In the Project Manager, drag PRO1 to IPRO by holding the left mouse button
3. Do the same for PRO2
4. PRO1 and PRO2 are now displayed in the Project Manager as branches of the IPRO



IPRO (Start proj...
Variables
Screens
Functions
Language file
Historian
Recipes
Batch Control
Time control
Programming interfa
zenon Logic (IEC 6
Production & Facilit
Interlockings
Command
Energy Manageme
Message Control
Menus
Report Generator
User administrat...
SAP interface
Files
History of chan...
Equipment model...
Project backups
PRO1
PRO2
General symbol library

The hierarchical structure of the network has thus been created.

> **Information**
>
> *In order for elements of sub-projects, such as screens, variables or functions to be able to be selected, the* **`Keep project in the memory`** *function (in the project context menu) must be activated.*

5.2.2 Transferring and starting projects

With the help of the network topology (on page 64), the integration project can automatically be transferred to the respective target computer with all sub-projects. All sub-projects are also automatically transferred if the integration project is also the start project.

For details of network topology, read the Administering and checking network topology (on page 64) chapter. You can find the configuration of the computer with an example for automatic transfer of sub projects in the Configuration of computers in the network (on page 69) section.

TRANSFERRING AND STARTING PROJECTS MANUALLY

Remote Transport can be used to transfer and start projects manually.
Each project is individually transferred to the corresponding computer.

- With Remote Transport, move all Runtime files of PRO1 to its Primary Server.
- Set the start project with Remote Transport.
- Start the Runtime with Remote Transport.
- Stop the online connection.
- Do the same for PRO2.

> **Info**
>
> In order to transfer the integration project and both sub-projects to a Client via Remote Transport, 3 Remote Transport processes are necessary (a process for each project).
>
> Network topology (on page 64) is preferred here, because all projects can also be transferred to several computers at the same time.

5.2.3 Administering projects

You have the following possibilities, among others, for accessing the data from sub-projects:

- Integration project (on page 34)
- Navigation between projects (on page 35)
- Using variables or functions from another project (on page 36)
- Sending recipes to different variables in different projects (on page 40)
- Create archives for use throughout projects (on page 38)
- Creating a joint AML or CEL for different projects (on page 42)

> **Attention**
>
> *During configuration, note the roles in which the modules and functions are executed (Primary Server, Standby Server, Client). You can find a list of the possible configurations here: Behavior of modules in the network (on page 113).*

The integration project

The integration project administers subprojects that can be accessed in Runtime. The integration project can be used as a pure administration project in multi-project administration (for example just for the navigation to the sub-projects) or also as a complete productive project (with its own PLC connection, archiving, etc.). If the integration project is used as a start project, all sub-projects are automatically started in Runtime.

In an integration project, you can for example create central Alarm Message Lists or Chronological Event lists for all subordinate projects with a few mouse clicks. This allows the alarms of all sub-projects in the Alarm Message List of the integration project to be displayed in chronological order.

> **Attention**
>
> *When designing the multi-project administration, ensure that the navigation (on page 35) works.*

> Information
>
> *These must be editable in order to be able to delete subprojects. For example, a subproject that has been created with an earlier editor version than the integration project can only be deleted after conversion.*

Navigation between projects

When administering more than one sub-project in an integration project, it is absolutely necessary to ensure that it is possible to switch from one subproject to another or to the integration project in Runtime.
Hint: Create a template that is always in the foreground. Create a screen with navigation buttons based on this.

SCREEN SWITCH TO SUBPROJECTS

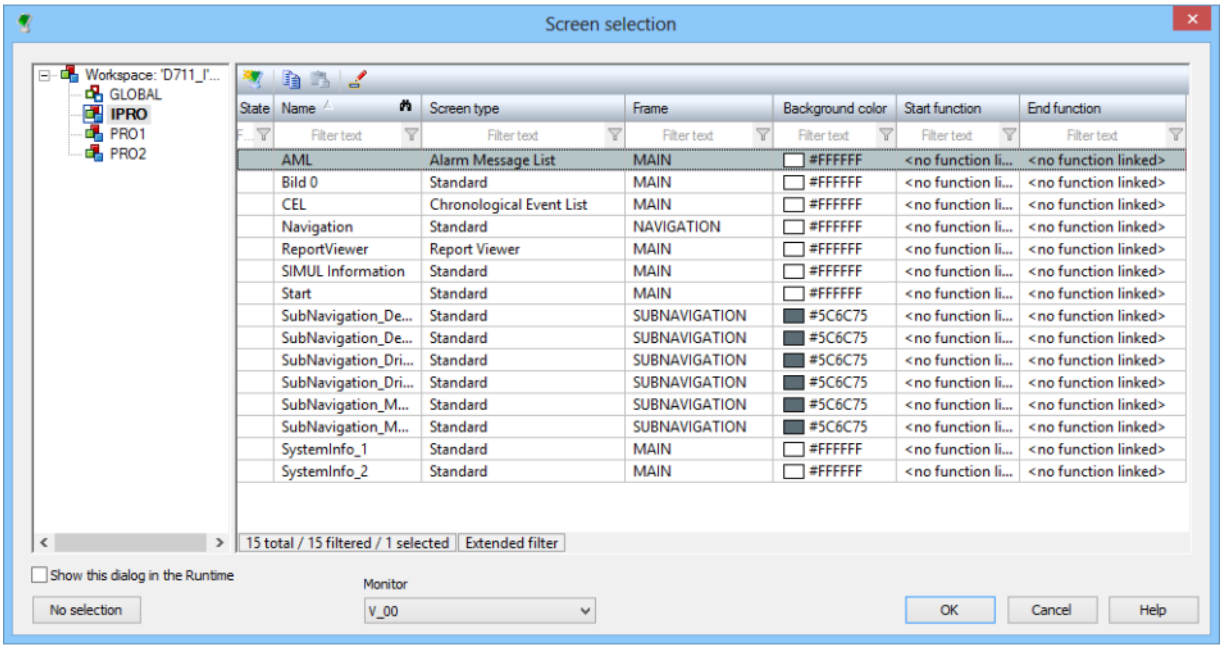
To switch between screens of individual projects, use the zenon screen switching function. In order for the navigation to be available at all times, first create a frame that is always in the foreground:

1. Create a new template that offers space for the navigation controls.
2. Assign it the **Always in the foreground** property.
3. Activate the properties **Border type** and **Title** (this means that the template can be moved in Runtime).
   Of course a template can also be used without a frame and title being in a fixed position.
4. Create a screen with navigation buttons on the basis of this template

EXAMPLE OF SWITCHING BETWEEN PRO1 AND PRO2

1. Create a new Screen switch function.

2. If there is more than one project available in the current workspace, the dialog to select a screen for the selection of a project is expanded.



Screen selection

Workspace: 'D711_I'...
GLOBAL
IPRO
PRO1
PRO2

State	Name	Screen type	Frame	Background color	Start function	End function
	AML	Alarm Message List	MAIN	□ #FFFFFF	<no function li...	<no function linked>
	Bild 0	Standard	MAIN	□ #FFFFFF	<no function li...	<no function linked>
	CEL	Chronological Event List	MAIN	□ #FFFFFF	<no function li...	<no function linked>
	Navigation	Standard	NAVIGATION	□ #FFFFFF	<no function li...	<no function linked>
	ReportViewer	Report Viewer	MAIN	□ #FFFFFF	<no function li...	<no function linked>
	SIMUL Information	Standard	MAIN	□ #FFFFFF	<no function li...	<no function linked>
	Start	Standard	MAIN	□ #FFFFFF	<no function li...	<no function linked>
	SubNavigation_De...	Standard	SUBNAVIGATION	■ #5C6C75	<no function li...	<no function linked>
	SubNavigation_De...	Standard	SUBNAVIGATION	■ #5C6C75	<no function li...	<no function linked>
	SubNavigation_Dri...	Standard	SUBNAVIGATION	■ #5C6C75	<no function li...	<no function linked>
	SubNavigation_Dri...	Standard	SUBNAVIGATION	■ #5C6C75	<no function li...	<no function linked>
	SubNavigation_M...	Standard	SUBNAVIGATION	■ #5C6C75	<no function li...	<no function linked>
	SubNavigation_M...	Standard	SUBNAVIGATION	■ #5C6C75	<no function li...	<no function linked>
	SystemInfo_1	Standard	MAIN	□ #FFFFFF	<no function li...	<no function linked>
	SystemInfo_2	Standard	MAIN	□ #FFFFFF	<no function li...	<no function linked>

15 total / 15 filtered / 1 selected

3. Select **PRO1**.

4. Select the start screen of **PRO1** and close the dialog with **OK**.

5. Repeat the process for **PRO2**.

6. Add two text buttons with the text **PRO1** and **PRO2** to the navigation screen.

7. Link the the two text buttons to the functions that have been created.

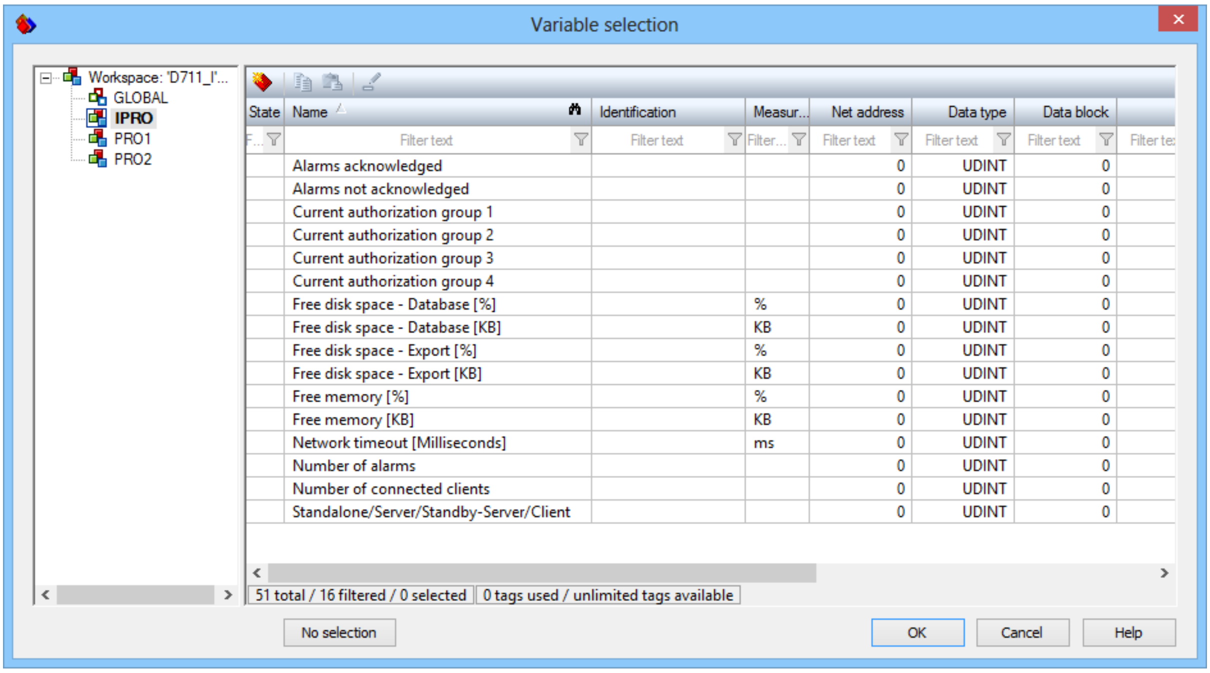
> ### Attention
>
> *zenon does not check in the Editor to see if the network structure in Runtime actually allows access to the selected project/screen.*
>
> *For example, in the Editor, screen switching to a screen in the integration project can be created in the project **PRO1**. This switching only works in Runtime if the integration project has also been started. This screen switching will not work on a computer on which the **PRO1** project (start project) has been started.*

Variables and functions

You can access variables and functions from other projects in the same workspace directly by means of **dynamic elements**.

VARIABLE EXAMPLE

1. Open the IPRO start screen.
2. Add a new `counter value` dynamic element.
3. The variable selection dialog now opens.



State	Name	Identification	Measur...	Net address	Data type	Data block	Filter te:
	Alarms acknowledged			0	UDINT	0	
	Alarms not acknowledged			0	UDINT	0	
	Current authorization group 1			0	UDINT	0	
	Current authorization group 2			0	UDINT	0	
	Current authorization group 3			0	UDINT	0	
	Current authorization group 4			0	UDINT	0	
	Free disk space - Database [%]		%	0	UDINT	0	
	Free disk space - Database [KB]		KB	0	UDINT	0	
	Free disk space - Export [%]		%	0	UDINT	0	
	Free disk space - Export [KB]		KB	0	UDINT	0	
	Free memory [%]		%	0	UDINT	0	
	Free memory [KB]		KB	0	UDINT	0	
	Network timeout [Milliseconds]		ms	0	UDINT	0	
	Number of alarms			0	UDINT	0	
	Number of connected clients			0	UDINT	0	
	Standalone/Server/Standby-Server/Client			0	UDINT	0	

51 total / 16 filtered / 0 selected | 0 tags used / unlimited tags available

4. Here, you can select not just variables from the IPRO. To select a variable from a different project:

   a) Click on a project in the left list area

   b) You are offered the attendant variables

   c) select the variable you want to assign

5. Select a variable from PRO1 or PRO2.

Proceed in the same way for functions.

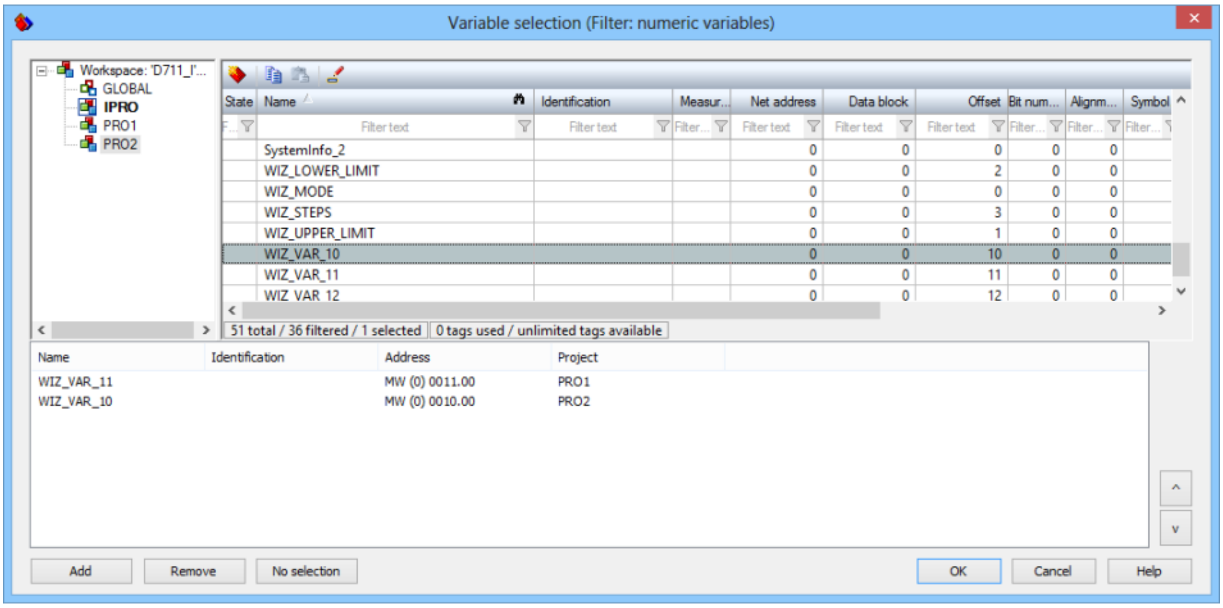
> **Attention**
>
> *zenon does not check in the Editor to see if the network structure in Runtime actually allows access to the selected project and its variables/functions.*
>
> *For example, in the Editor, in project* **`PRO1`***, a variable from the integration project can be selected. This connection only works in Runtime if the integration project has also been started. This connection will not work on a computer on which only project* **`PRO1`** *has been started (start project).*

Archives

Values of variables of different projects of the workspace can be recorded in an archive. The values recorded in this way can be filtered, displayed in list form or trend form, and they can be printed or exported just like data from normal archives.

EXAMPLE OF ARCHIVE

1. In the project **IPRO** open the node **Historian**.
2. Create a new archive named BA – BASIS.
3. Open the context menu of RECIPE1 and select **Add variable**.
4. The dialog for selecting variables is opened



Variable selection (Filter: numeric variables)

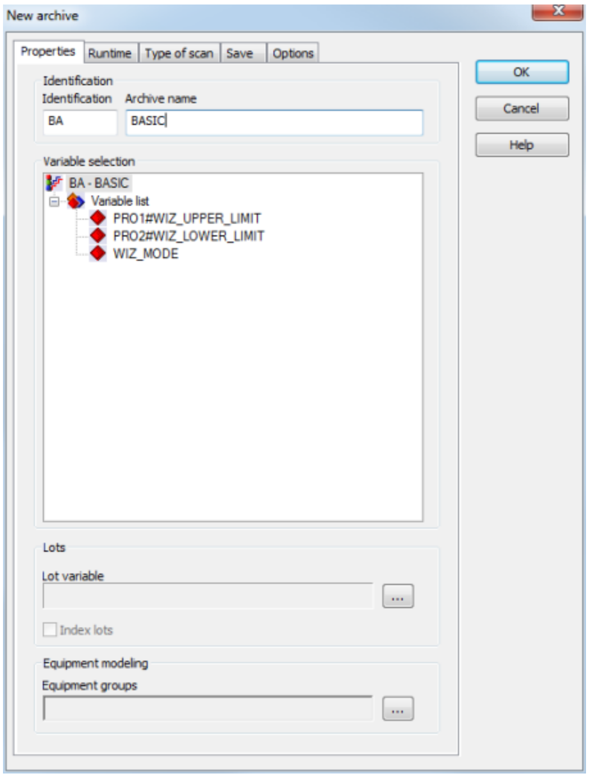
State	Name	Identification	Measur...	Net address	Data block	Offset	Bit num...	Alignm...	Symbol
	SystemInfo_2			0	0	0	0	0	
	WIZ_LOWER_LIMIT			0	0	2	0	0	
	WIZ_MODE			0	0	0	0	0	
	WIZ_STEPS			0	0	3	0	0	
	WIZ_UPPER_LIMIT			0	0	1	0	0	
	WIZ_VAR_10			0	0	10	0	0	
	WIZ_VAR_11			0	0	11	0	0	
	WIZ_VAR_12			0	0	12	0	0	

51 total / 36 filtered / 1 selected | 0 tags used / unlimited tags available

Name	Identification	Address	Project
WIZ_VAR_11		MW (0) 0011.00	PRO1
WIZ_VAR_10		MW (0) 0010.00	PRO2

5. Here, you can select not just variables from the IPRO. To select variables from other projects:
   a) Click on a project in the left list area
   b) You are offered the attendant variables
   c) select the variable you want to assign
6. Select variables from **PRO1** and **PRO2**.

7. The project name is written in front of the variable name in the archive variable list.



New archive

Properties | Runtime | Type of scan | Save | Options

Identification

Identification: BA

Archive name: BASIC

Variable selection

- BA - BASIC
  - Variable list
    - PRO1#WIZ_UPPER_LIMIT
    - PRO2#WIZ_LOWER_LIMIT
    - WIZ_MODE

Lots

Lot variable:

□ Index lots

Equipment modeling

Equipment groups:

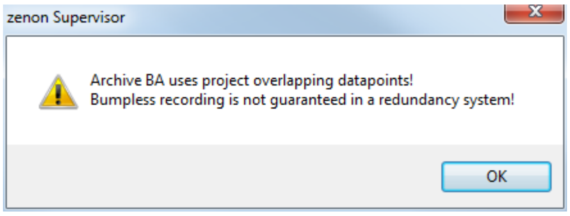
Attention

zenon does not check in the Editor to see if the network structure in Runtime actually allows access to the selected project and its variables.

For example, in the Editor, in project **`PRO1`***, a variable from the integration project can be selected. This connection only works in Runtime if the integration project has also been started. This connection will not work on a computer on which only project* **`PRO1`** *has been started (start project).*

REDUNDANCY

After the selection of variables has been concluded, a message box indicates that seamless recording is guaranteed under all circumstances.



zenon Supervisor

Archive BA uses project overlapping datapoints!
Bumpless recording is not guaranteed in a redundancy system!

EXAMPLE

- The project **PRO1** is executed redundantly; one computer is the Primary Server, a second computer is the Standby Server.
- The same applies for the project **PRO2**.
- The integration project with the subordinate projects **PRO1** and **PRO2** is started on a third computer. This is the client for all sub-projects.

If variables of the projects **PRO1** and **PRO2** are now archived in the integration project, then the computer receives the data about the network from the respective Primary Server from **PRO1** and **PRO2**.
If, for example, the Primary Server of **PRO1** fails, for the time period until the Standby Server of **PRO1** has taken over the Server role, there would be alternative values in the archive for variables from **PRO1**.
Cause: The Standby buffer of the seamless redundancy only caches local project variables and only tracks these.
See also redundancy (on page 73).
Solution: In order to ensure recording without interruptions, the archiving must be local in a redundantly-executed subproject.

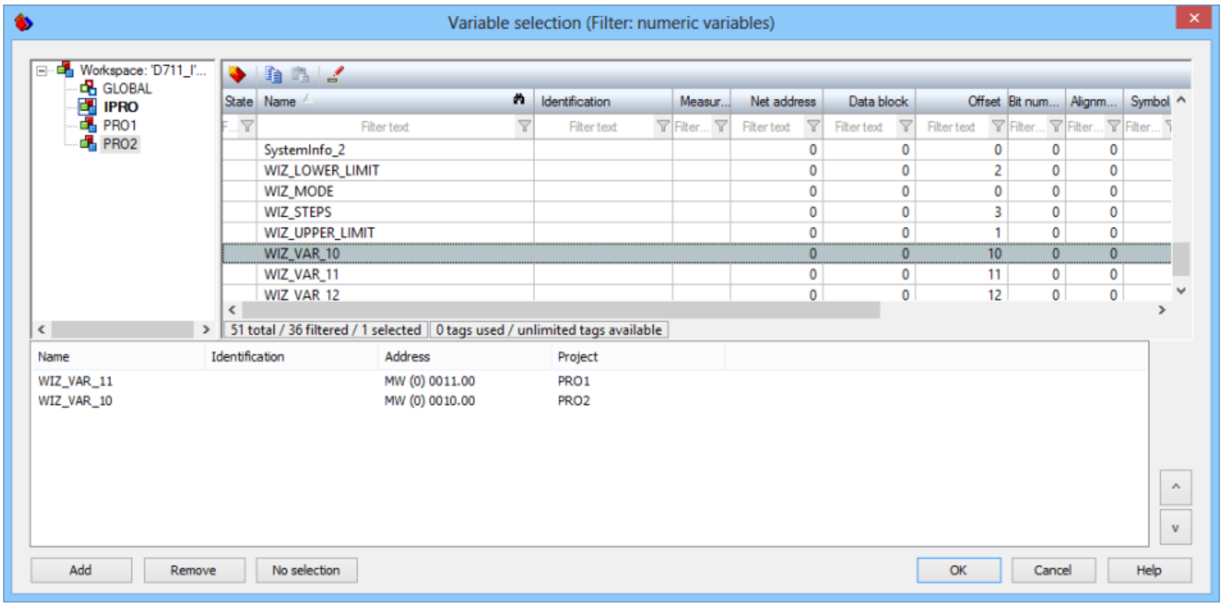
Recipes

You can write values to variables from different projects of the workspace in a recipe.

RECIPE EXAMPLE

1. In the project IPRO open the node **Recipes**.
2. Create, under **Standard recipe recipes** a new recipe with the name **Recipe 1**.
3. Open the context menu of **Recipe 1** and select **Add variable**.

4. The dialog for selecting variables is opened



Variable selection (Filter: numeric variables)

Workspace: 'D711_I'...
GLOBAL
IPRO
PRO1
PRO2

State	Name	Identification	Measur...	Net address	Data block	Offset	Bit num...	Alignm...	Symbol
F...	Filter text	Filter text	Filter...	Filter text	Filter text	Filter text	Filter...	Filter...	Filter...
	SystemInfo_2			0	0	0	0	0	
	WIZ_LOWER_LIMIT			0	0	2	0	0	
	WIZ_MODE			0	0	0	0	0	
	WIZ_STEPS			0	0	3	0	0	
	WIZ_UPPER_LIMIT			0	0	1	0	0	
	WIZ_VAR_10			0	0	10	0	0	
	WIZ_VAR_11			0	0	11	0	0	
	WIZ_VAR_12			0	0	12	0	0	

51 total / 36 filtered / 1 selected | 0 tags used / unlimited tags available

Name	Identification	Address	Project
WIZ_VAR_11		MW (0) 0011.00	PRO1
WIZ_VAR_10		MW (0) 0010.00	PRO2

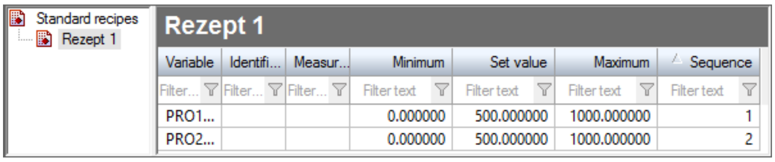
5. Here, you can select not just variables from the IPRO. To select variables from other projects:

   a) Click on a project in the left list area

   b) You are offered the attendant variables.

   c) Select variables from **PRO1** and **PRO2**.

   d) The name of the respective project is also placed in front of the variable name in variable list of the recipe.



Standard recipes
Rezept 1

Rezept 1

Variable	Identifi...	Measur...	Minimum	Set value	Maximum	Sequence
Filter...	Filter...	Filter...	Filter text	Filter text	Filter text	Filter text
PRO1...			0.000000	500.000000	1000.000000	1
PRO2...			0.000000	500.000000	1000.000000	2

Proceed in the same way for the Recipegroup Manager.

Attention

zenon does not check in the Editor to see if the network structure in Runtime actually allows access to the selected project and its variables.

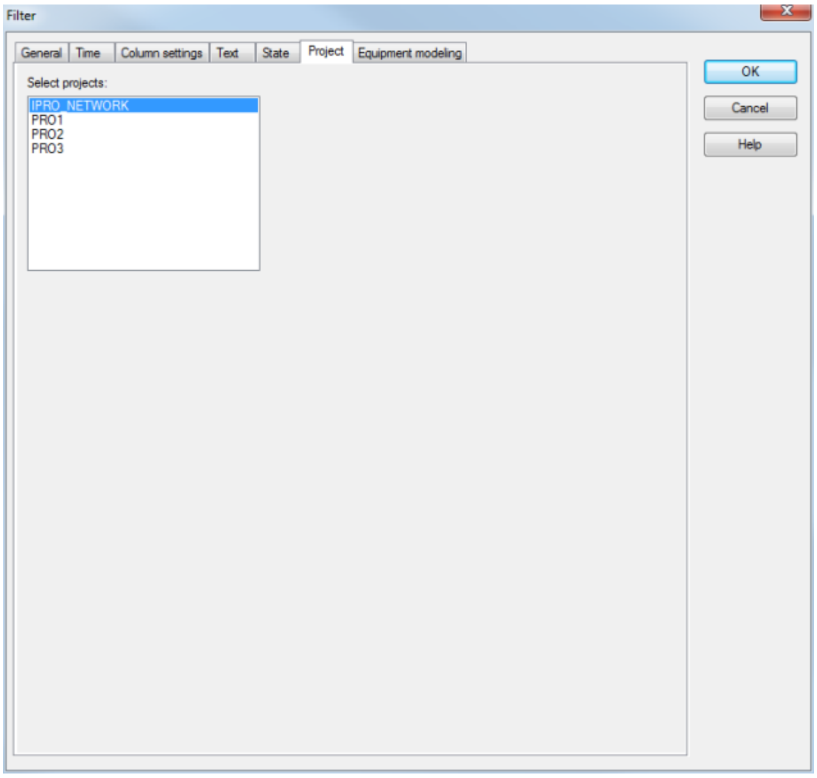
*For example, in the Editor, in project **PRO1**, a variable from the integration project can be selected. This connection only works in Runtime if the integration project has also been started. This connection will not work on a computer on which only project **PRO1** has been started (start project).*

Alarms and CEL

In zenon, system messages and alarms from different projects of a workspace can be displayed together in a list. These entries can be filtered, displayed, printed or exported just the data from normal Alarm Message Lists or Chronological Event Lists.

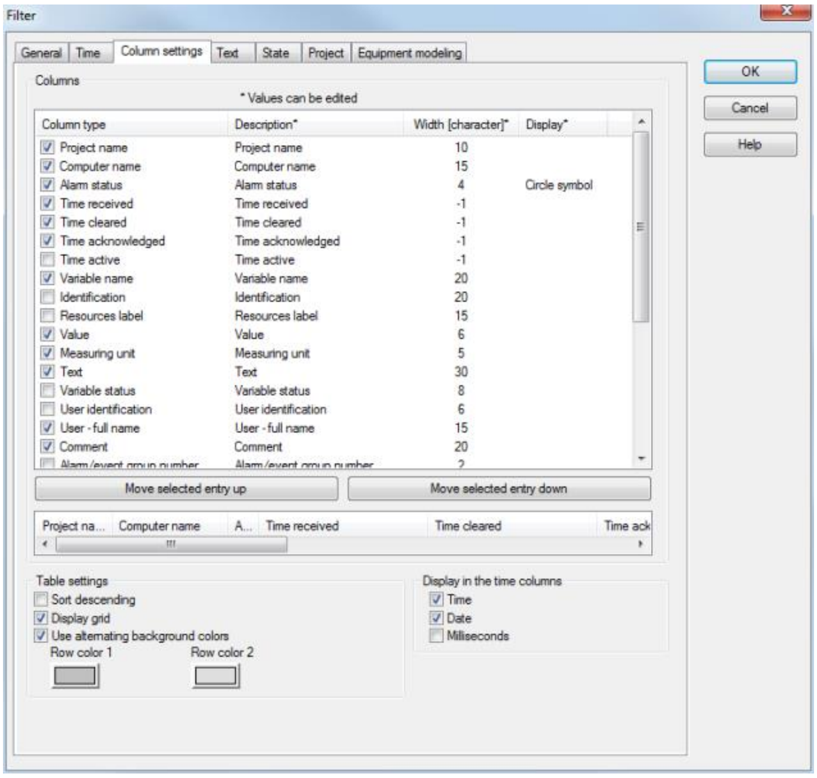
AML example

1. Create an `AML` screen.
2. Add control elements to the screen via Control elements -> Add templates.
3. Create a function Screen switch for this screen.
4. The filter dialog for alarm lists is opened.
5. Open the **`Project`** tab.
6. Select the project that is to be displayed in the AML of the IPRO. Multiple selection button `Ctrl` plus a mouse click.)



7. Open the **`Column settings`** tab.

8. Select the **Project name** property for display in Runtime.
   You thus gain an overview of the project from which an alarm comes in Runtime.



Columns

* Values can be edited

Column type	Description*	Width [character]*	Display*
☑ Project name	Project name	10	
☑ Computer name	Computer name	15	
☑ Alarm status	Alarm status	4	Circle symbol
☑ Time received	Time received	-1	
☑ Time cleared	Time cleared	-1	
☑ Time acknowledged	Time acknowledged	-1	
□ Time active	Time active	-1	
☑ Variable name	Variable name	20	
□ Identification	Identification	20	
□ Resources label	Resources label	15	
☑ Value	Value	6	
☑ Measuring unit	Measuring unit	5	
☑ Text	Text	30	
□ Variable status	Variable status	8	
□ User identification	User identification	6	
☑ User - full name	User - full name	15	
☑ Comment	Comment	20	
□ Alarm/event group number	Alarm/event group number	2	

Project na... | Computer name | A... | Time received | Time cleared | Time ack

Table settings
□ Sort descending
☑ Display grid
☑ Use alternating background colors
Row color 1
Row color 2

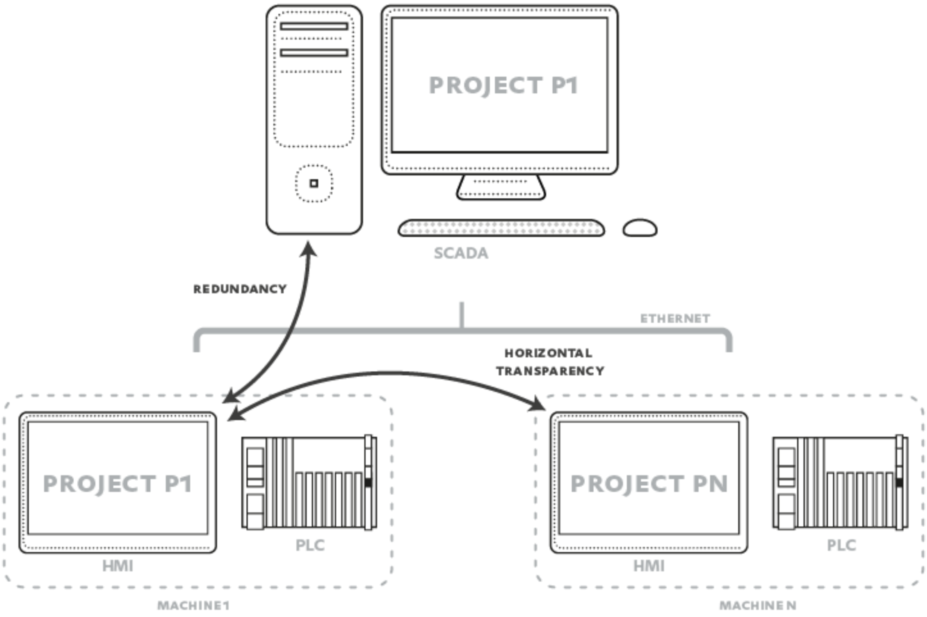
Display in the time columns
☑ Time
☑ Date
□ Milliseconds

Proceed in the same way for the Chronological Event List.

5.3 Horizontal transparency

Multi-project administration also allows `horizontal transparency`.

Horizontal transparency means that all projects that are on the same level can be called up on one computer. The requirement for this is an integration project (on page 34) with corresponding navigation, which starts these projects.



EXAMPLE

Several terminals belong to one machine. Each has its own visualization project. With the help of **horizontal transparency**, it is possible to show and operate, on each terminal, its own project and all other projects. This way the entire machine can be monitored and operated from each terminal.

5.4 Optimization for projects with a large number of Clients

Large network projects can, under certain circumstances with standard settings, place the Primary Server under full load for a period of time by reloading many Clients. The extent of the load depends on several factors (Primary Server resources, available bandwidth, etc.).
Guideline values:

- Runtime files of 10 MB or larger
- More than 50 clients

In this case, the reloading process can be optimized in order to prevent all Clients being reloaded at the same time. You can make this happen with the **RELOADDELAY_SEC** entry in **project.ini**. With this, reloading is delayed by a random value.
For this:

1. Open **project.ini** in the `\Project_SQL_fodler\FILES\zenon\system\` folder
   Hint: Highlight the project in the project manager and press the keys `Ctrl+Alt+E`; the Windows Explorer opens the `\Project_SQL_folder\FILES\` folder
2. Navigate to the **[NETZ]** section
3. Create the entry **RELOADDELAY_SEC=Value**
4. Select a `value` value for the delay.

When reloading, a random delay in seconds is calculated for each client, which is between 0 and the selected value. 0 means no delay (standard action). The selected value has no influence on standalone projects, the Primary Server or the Standby Server.

Note: *This entry should only be set in every large projects with a noticeable delay when reloading. The standard settings provide better performance in normal projects.*

6. Strong encryption of network communication

zenon enables strong encryption of communication in the zenon network. Strong encryption works from zenon Version 7.0 for all supported operating systems and for the Web Client.

If encryption is active, communication between the Primary Server, Standby Server, Clients and Web Clients is in encrypted form; the zenon Web Server only forwards data packets and is not affected by encryption.

> **Information**
>
> *Network communication was also encrypted in earlier versions of zenon. The method has changed with version 7. The term "encryption" in conjunction with zenon 7 or later always means strong encryption.*

6.1 Basics

Encryption for zenon Runtime is available from version 7.0. It is not possible to communicate with earlier versions of zenon if encryption is switched on. Encryption does not impair any zenon functionality.

BASIC ENCRYPTION FROM ZENON 7.00

To use the strong encryption of the zenon network, note:

- The password is encrypted individually on each computer and stored in `zenon6.ini`. That means:
    - The password cannot be transferred by copying `zenon6.ini` to another computer.
    - If hardware components are changed, in the network adapter area in particular, the password may be invalid and need to be re-entered.
- Encryption must always be activated or deactivated for all components involved in the zenon network. Communication between encrypted and unencrypted systems is not possible. Web Servers only act as a proxy computer and are not affected by encryption.
- If encryption is activated on a computer, it always applies for the projects of this computer with the **Network active** property active.

> **Information**
>
> *AES 192 from Microsoft (https://msdn.microsoft.com/en-us/magazine/cc164055.aspx) is used as the encryption algorithm for network communication.*
>
> *SHA 256 from Microsoft (https://msdn.microsoft.com/en-us/library/system.security.cryptography.sha256%28v=vs.110%29.aspx) is used in order to generate the key from the entered password.*

COMPATIBILITY

Encryption is not compatible with versions prior to zenon 7.00 SP0. That means:

System 1	System 2	Communication
zenon 7 encrypted	zenon 7 encrypted	Yes
zenon 7 unencrypted	zenon 7 unencrypted or zenon prior to version 7 unencrypted	Yes
zenon 7 encrypted	zenon 7 unencrypted or zenon prior to version 7 unencrypted	No

Errors (on page 52) are logged in the Diagnosis Viewer's log file.

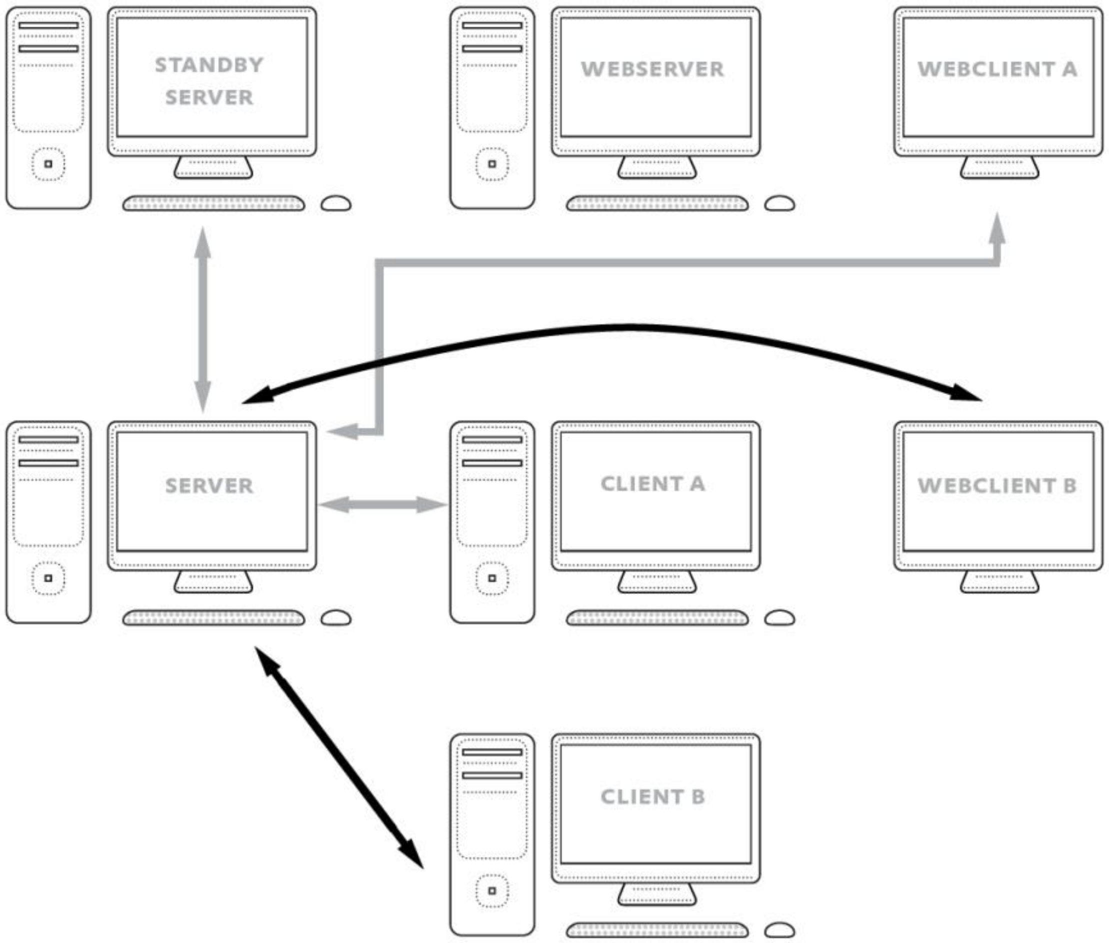
EXAMPLE

The following illustration shows an example of a network with Primary Server, Standby Server, two clients, one Web Server and two Web Clients. All devices are running zenon 7.00 SP0. The devices are configured as follows:

- Encryption is activated on the Primary Server using the Startup Tool (on page 48).
- Encryption is also activated on the Standby Server and client A via Remote Transport (on page 49) when Runtime files are transferred.

- Client B and Web Client B still communicate without encryption.
- On Web Client A, encryption is activated on the server using the Startup Tool (on page 48).
- Because the Web Server does not evaluate the data packets, but instead forwards these on immediately, it does not require encryption. In theory, it can also have an older version, and the Web Clients can nevertheless create encrypted connections.

This configuration leads to the following result:



- The Standby Server communicates successfully with the Primary Server.
- Client A can log in to the Primary Server and exchange data.
- Because client B sends unencrypted messages and these are rejected by the Primary Server because encryption is active, client B cannot communicate with the Primary Server and is therefore offline.
- Web Client A logs on to the server via the Web Server and can exchange data.

- The unencrypted messages from Web Client B are forwarded from the Web Server to the Primary Server, but the server rejects these. Web Client B cannot communicate with the Primary Serverr and is therefore offline.

As soon as encryption via Remote Transport or the Startup Tool configuration on client B and via **`enrcypt network communication`** on Web Client B is activated, these connections can also make connections to the Primary Server.

6.2 Activate encryption

Encryption can be activated in different ways:

- via the Startup Tool (on page 48) for the local computer and the Web Client
- via Remote Transport (on page 49)

HINT

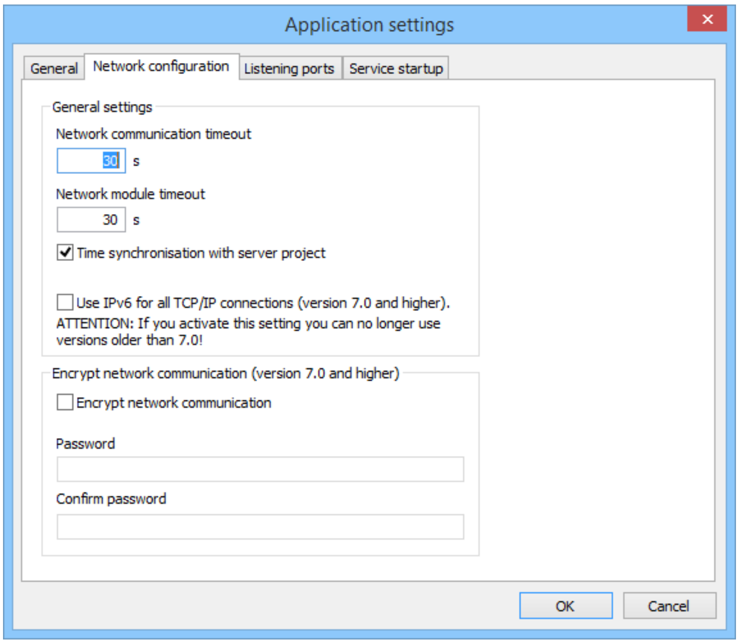
For quick, easy activation of the encryption, it is recommended that the configuration is carried our on a computer using Remote Transport (on page 49).

6.2.1 Locally via the Startup Tool

To activate encryption on the local computer or for the Web Client:

1. Open the zenon Startup Tool
2. Click on Application -> Options
3. The dialog for the settings of the zenon Startup Tool is opened

4. Select the 'Network configuration' tab



General settings

Network communication timeout

30 s

Network module timeout

30 s

☑ Time synchronisation with server project

□ Use IPv6 for all TCP/IP connections (version 7.0 and higher).
ATTENTION: If you activate this setting you can no longer use versions older than 7.0!

Encrypt network communication (version 7.0 and higher)

□ Encrypt network communication

Password

Confirm password

5. Check the checkbox **Encrypt network communication**

6. Enter the password and confirm this

7. confirm the dialog by clicking OK

6.2.2 Via Remote Transport

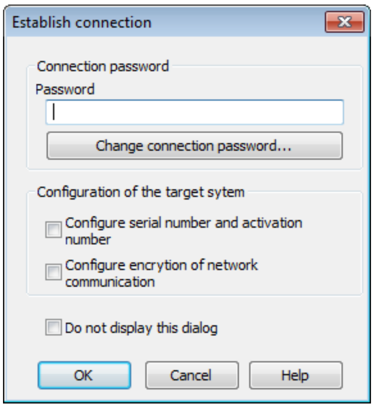
Encryption can be be activated on remote computers using Remote Transport. However, this is only possible if the Remote Transport connection is protected with a password.

To activate encryption using Remote Transport:

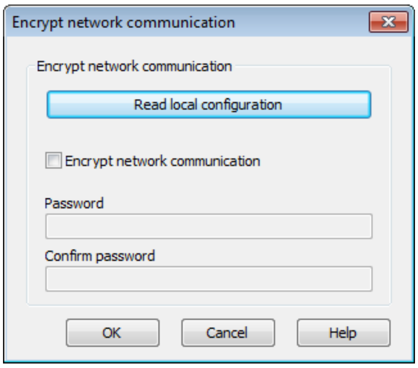
1. Click on the corresponding button in the Remote Transport toolbar

   or select, in the project's context menu: Set up Remote Transport> connection.

2. The dialog for setting up the connection is opened


Establish connection
Connection password
Password
Change connection password...
Configuration of the target sytem
□ Configure serial number and activation number
□ Configure encrytion of network communication
□ Do not display this dialog
OK
Cancel
Help

3. Enter the connection password or create one, if none has been set
4. Activate the **Configure encryption of network communication** checkbox
5. Click on OK.
6. The dialog for encryption of network communication is opened


Encrypt network communication
Encrypt network communication
Read local configuration
□ Encrypt network communication
Password
Confirm password
OK
Cancel
Help

7. Activate the **Encrypt network communication** checkbox
8. Issue a password (for criteria, see the **network password encryption section (on page 50).)** To quickly transfer the local configuration to other computers, the local password can first be read via **Read local configuration**.
9. Confirm the dialog by clicking on the OK button.

6.3 Network encryption password

The following is applicable for encryption of the communication in the network:

- Minimum length `8 characters`
- Maximum length: `20 characters`
  The displayed length is always set at `20 characters`, in order to hide the actual length.
- Permitted characters:
  - Letters: `A - Z; a - z`
  - Digits: `0 - 9`
  - Special characters
- Characters that are not permitted:
  - Space
  - `Enter` key (Return key)
- Summary: a password must contain at least 1 figure and 1 letter

6.4 Checklist for errors

In the event of errors, check:

- Do all computers have access to the network and does the naming resolution work between the computers?
- Was the **Network active** property activated for the project in the Editor?
- Is zenon Runtime version 7.00 SP0 or higher being used? (relevant if encryption is being used)
- Is - for projects with encryption - the configuration correct on all computers?
  (**USE_ENCRYPTION** setting in **`zenon6.ini`**: The same for all computers, either `0`, `1` or not present.)
- Was the password set correctly?
- Was the hardware changed on one of the computers involved after the encryption has been configured?
- Does a ping work on a computer?
  - Yes: Network connection present, fault is with the communication.
  - No: Check the network.
- Is it possible to connect to Telnet?
  - The connection is made: Both computers communicate at the same level. Check the password.
  - The connection is made and lost again: One computer communicates with encryption, one without encryption.
  - Faulty connection: zenon Runtime does not run on the target computer.

Note: Telnet must be installed as an extra on more recent Windows operating systems.
Connection is generally made via port 1100.
The Telnet command is then: `open [IPAdresse] 1100`

- Are the required (operating system) functions available (primarily relevant for CE terminals)?
  - Non-existent functions lead to Runtime not being able to start.
- If the service provider or one of the algorithms is not available, an error message (on page 52) is written to the log file when Runtime is started.

Errors (on page 52) are logged in the Diagnosis Viewer's log file.

6.5 Error message

Errors are either displayed in the output window of the zenon Editors or in pop-ups and/or in the log files of the Diagnosis Viewer.

NO CONNECTION

If a client has been configured with an incorrect encryption password (not the same as the password on the Primary Server) then this is evident from the following events:

- The Client is offline, although the Primary Server can be reached by pinging.
- The Primary Server writes error messages to the log file:

  SysMod Error: Serialize in Object Project: [project name] Modul: [module number]

  or:

  NET Error During Decryption [Error number]

POP-UPS AND ERROR MESSAGES

Encryptions errors are notified by means of pop-ups (on page 52) and entries in log files (on page 55) or in the zenon output window (on page 54).

6.5.1 Error messages in pop-ups

STARTUP TOOL AND WEB CLIENT

The following error messages are output by the zenon **Startup Tool** as a pop-up for local encryption or by **Encrypt Network Communication Tool** for the configuration of the Web Clients. The messages that come directly from the `Startup Tool` or from the `Encrypt Network Communication Tool` are always in English; messages from Runtime itself are in the language that has been set.

Error message	Description
`The password has to be entered in both text boxes!`	When configuring the encryption, the user has left one of the two input fields (`Password` or `Password confirmation`) empty.
`The passwords you typed do not match. Please retype the password in both boxes.`	The content of the input field for password confirmation is different to the content of the input field for the password.

`The network password does not fulfill the password criteria!`
`Password criteria:`
`- Minimum length = 8`
`- Maximum length = 20`
`- At least one character of the Latin charset`
`- At least one number`
`- No spaces`
	The password entered does not meet the password criteria. The password criteria are displayed in the error message.

`The network password could not be encrypted!`	An error occurred when encrypting the network password.

`The network encryption configuration in the file zenon6.ini is invalid.`
`Please enter a new configuration.`
	When opening the `Network configuration` tab, it was established that the `zenon6.ini` file does not contain a valid configuration for the network encryption. A new configuration must be entered.

`The network encryption password in zenon6.ini is invalid.`	The password read in from the `zenon6.ini` file is invalid and must be reentered.
`The password for network encryption is invalid and must be entered again!`	Message when Runtime starts if the password cannot be verified.

REMOTE TRANSPORT

The following error messages are given by `Remote Transport` as a pop-up when the remote computer is encrypted.

Error message	Description
`For configuring the network encryption, the Remote Transport connection must be protected with a password!`	An attempt was made to configure remote encryption without securing the Remote Transport connection by means of a password.
`You must enter the password in both input fields!`	When configuring the encryption, the user has left one of the two input fields (**`Password`** or **`Password confirmation`**) empty.
`The password confirmation does not match the password!`	The content of the input field for password confirmation is different to the content of the input field for the password.

`The password entered does not correspond to the password criteria.`
`Password criteria:`
`At least 8 characters`
`Maximum 20 characters`
`At least one letter`
`At least one number`
`No spaces`
	The password entered does not fulfill the password criteria. The password criteria are displayed in the error message.

`An error occurred when encrypting the password!`	An error occurred when encrypting the password. If this error occurs during configuration via Remote Transport, a more detailed error message is written to the log.
`An error occurred when decrypting the network password from zeon6.ini.`	The password stored in **`zenon6.ini`** cannot be decrypted. If this error occurs during configuration via Remote Transport, a more detailed error message is written to the log.
`The encryption configuration in zenon6.ini is not valid and must be reentered.`	The password read off from **`zenon6.ini`** is invalid. The password must be entered again.

6.5.2 Error messages in the output window

Errors are displayed in the output window as messages:

Message	Level	Description
`The server reports an error when compiling the data for the encryption configuration.`	ERROR	The remote **zenSysSrv** reports an error when compiling the information for the encryption of the password for network encryption. The adapter information cannot be read off.
`*** Configure the encryption of the network communication at the target system.`		This message is at the start of the conclusion message after encryption has been configured on a remote device via Remote Transport. After this, there is a message in relation to the success of the remote configuration.
`The server reports an error when the encryption configuration is changed.`	ERROR	The remote zenSysSrv reports an error when the encryption configuration is saved to the remote device. The configuration was not saved.
`The configuration was successfully saved on the server.`	MESSAGE	The remote zenSysSrv reports that the encryption configuration was successfully saved.
`The version of the remote zenSysSrv is too low. The encryption cannot be configured.`	ERROR	An attempt was made to configure the encryption on a remote device, which has a zenSysSrv from a version prior to version 7.00 SP0. Encryption is only available from zenon version 7.00 SP0; an earlier version of zenSysSrv cannot therefore configure this.

6.5.3 Error messages in log files

ENCRYPTION

Errors in encrypted network traffic are documented in log entries. The **Error IDs** of the error messages in the following summary are system or COM error codes. You can find more information in the MSDN library.

LOG entry	Level	Description
`NET Error During Acquiring Cryptography Context [Error-ID]`	ERRORS	The creation of a service provider for encryption was unsuccessful.
`NET Error During Creating Hash [Error-ID]`	ERRORS	The creation of a hash value was unsuccessful.
`NET Error During Using Hash [Error-ID]`	ERRORS	The processing of a hash value was unsuccessful.
`NET Error During Destroying Hash [Error-ID]`	ERRORS	The release of a hash value that is no longer required was unsuccessful.
`NET Error During Deriving Key [Error-ID]`	ERRORS	The creation of a key for symmetrical encryption was unsuccessful.
`NET Error During Configuring Key [Error-ID]`	ERRORS	The setting of parameters for symmetrical encryption was unsuccessful.
`NET Error Cryptography Not Initialized!`	ERRORS	An encryption or decryption function was called up but initialization of the required parameters (service provider, key) was unsuccessful.
`NET Error Invalid Pointer passed!`	ERRORS	An encryption or decryption function was given invalid parameters.
`NET Error Message Length Must Not Be 0!`	ERRORS	The encryption function was called up with an empty message.
`NET Error During Buffer Length Calculation [Error-ID]`	ERRORS	The calculation of required buffer size for encryption was unsuccessful.
`NET Error Buffer Length Must Not Be 0!`	ERRORS	The buffer for encryption or decryption has not been created.
`NET Error During Decryption 0x%x`	ERRORS	An error occurred during decryption.
`NET Error During Encryption 0x%x`	ERRORS	An error occurred during encryption.
`NET Error: Encryption Is Required And Project [Projekt] Received Plaintext Network Message`	ERRORS	Encryption is active and a decrypted message was received. The message is discarded in this case.
`NET Error: Encryption Is Not Supported And Project [Projekt] Received Encrypted Network Message`	ERRORS	Encryption is not active and an encrypted message was received. The message is discarded in this case.
`NET Cryptography Successfully Initialized`	DEBUG	The parameters required for encryption and decryption were initialized successfully. The parameters are initialized when Runtime is started.
`NET Uninitializing Cryptography`	DEBUG	The parameters required for encryption and decryption were released. This happens when Runtime is ended. If the log connection is separated before release, the message does not appear in the Diagnosis Viewer.

NET Error During Buffer Size Calculation [Error ID]	ERRORS	An error occurred when the necessary buffer size for compiling information for encrypting or decrypting the network password was calculated.
NET Error During Buffer Size Calculation: No Adapters	ERRORS	The computer does not have a network adapter. For this reason, the network password cannot be encrypted or decrypted.
NET Error During Adapter Info Query [Error ID]	ERRORS	An error occurred when the adapter information for encrypting or decrypting the network password was read off.
NET Error Password Not Properly Formatted	ERRORS	The hex dump of the encrypted password is in an invalid format.
NET Error During Password Decryption [Error ID]	ERRORS	An error occurred when decrypting the network password.
NET Error During Encrypting Password [Error ID]	ERRORS	An error occurred when encrypting the network password.
NET Cryptography Is Disabled	DEBUG	Encryption of the network traffic is deactivated.
NET Error No Password	ERRORS	Encryption is active, but no password is entered.
NET Error Password Could Not Be Decrypted	ERRORS	The password for network encryption could not be decrypted.
NET Password successfully loaded	DEBUG	The password for network encryption has been loaded successfully.
Network Cryptography Disabled By Remote Configuration	DEBUG	zenSysSrv reports that encryption of network traffic on the computer was deactivated by the Remote Transport configuration.
Network Cryptography Disabled By Remote Configuration	DEBUG	zenSysSrv reports that encryption of network traffic on the computer was activated by the Remote Transport configuration.
Network Cryptography Remote Configuration Error	ERRORS	A configuration sent by Remote Transport for network encryption is erroneous.
Error During Buffer Size Calculation [Error ID]	ERRORS	An error occurred when the necessary buffer size for compiling information for encrypting or decrypting the network password for the configuration of Remote Transport was calculated.
Error During Buffer Size Calculation: No Adapters	ERRORS	The computer does not have a network adapter. For this reason, the network password cannot be encrypted or decrypted and thus not set via Remote Transport (it must therefore be connected via COM). The use of network encryption on a computer without a network adapter makes no sense however.
Error During Adapter Info Query [Error ID]	ERRORS	An error occurred when the adapter information for encrypting or decrypting the network password for configuration via Remote Transport was read off.

`NET Error During Decrypting Password: The Password is Invalid!`	ERRORS	The password is no longer valid, because the initial data for computer-dependent encryption has changed. This error can be rectified by configuring the password again. The decryption process is usually cancelled before the validity of the password is checked, because the old password cannot be decrypted with the new encryption data. This leads to the "**`NET Error During Password Decryption 0x80090005`**" error, where instead of **`"NET Error During Password Decryption The Password is Invalid!`** is displayed. Another consequence is that a password that is now invalid on the computer in question can lead to error messages when network packages are sent or received. The error message "**`NET Error Cryptography Not Initialized!`**" is written to the log file.

7. zenon on the Terminal Server

The zenon Runtime can also be used together with a terminal server solution.

Limitations:

- The Editor cannot run on a terminal server.
- Project simulation is not available for clients at the terminal server.

> **Information**
>
> *Keep in mind that the name of the terminal client is resolved. That means: The name of the device that initiates the terminal connection is the name of the Clients for the zenon network.*
>
> *Attention: Ensure that all corresponding ports have been unlocked when using a firewall.*

Terminal server solutions are offered by several manufacturers. All tests with zenon were carried out using the Windows terminal server (Windows Remote Desktop Services).

Attention

When using zenon with a terminal server, it must be licensed with a Network dongle.

SEVERAL INSTANCES OF RUNTIME

> *Only one instance of zenon Runtime can be started on a computer at any time. This applies regardless of whether Runtime is started as an EXE file, a Web Client or as Runtime Control (OCX).*

Exception: On the terminal server or terminal client, one instance of Runtime per user can be started as an EXE file, as a Web Client or as Runtime Control (OCX). Only 1 instance can run at any time within a user context.

7.1 How terminal servers work

With terminal servers, it is possible to provide data and applications centrally, regardless of the end device. Terminal servers make it possible to start several shell instances (desktops) that are separate from one another on the terminal server.   If a client connects to the terminal server, a new shell instance is created and the client is assigned its own graphic user interface. The applications are executed on the terminal server itself and the data is saved on the terminal server.   Input (via the keyboard, mouse etc.) and output (display, audio, etc.) is on the Client.

Info

Not all software is compatible with terminal servers.

7.2 Advantages and disadvantages

ADVANTAGES

- Only one computer (the terminal server) has to be maintained.
- Clients do not have to be very powerful (Thin Clients).
- Clients can have different operating systems (Windows, Windows CE, Linux, Unix, MacOS, iOS, Android etc.).
- High degree of data security, because no data is saved on the Client.

DISADVANTAGES

- All started programs of all instances run on one computer (the terminal server).
  This:
  - must have sufficient computing power for all started programs.
  - must have sufficient RAM for all started programs.
- All interfaces have to be shared. E.g. network adapters, COM ports, parallel ports.
- The network load can be high with an appropriate number of Clients (such as transfer of graphic data).
- The screen resolution is defined by the client started first. If screens in different resolutions are to be used, this can be implemented on the terminal server by means of an entry in **zenon6.ini** (**SERIALIZE**=1). All screens are then calculated again for the client, which further increases the necessary performance for the terminal server.

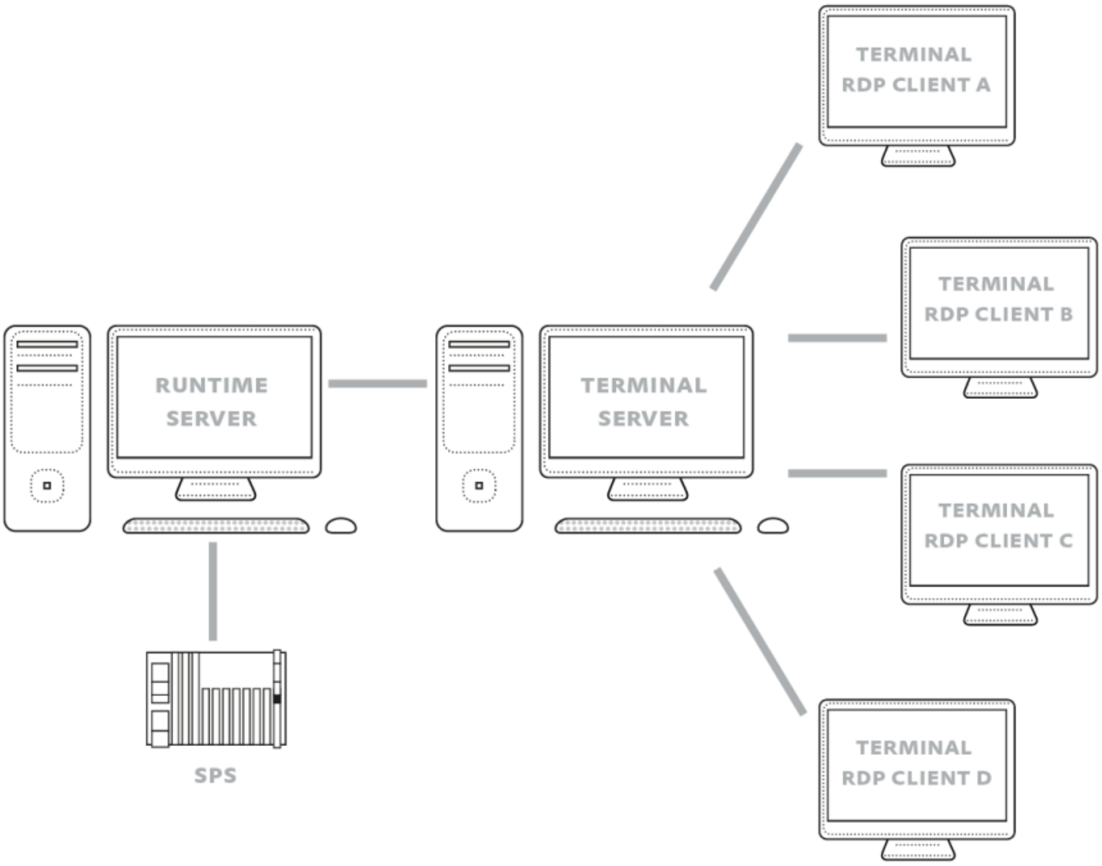
7.3 Operation zenon at the terminal server

On a terminal server, operation is possible as:

- zenon Client possible without limitations
- zenon standalone systems only worthwhile and possible:
  - as a superordinate integration project to start several Client sub-projects
  - without drivers, database connections etc.
- zenon Primary Server not possible

SCHEMATIC DISPLAY

For example, the topology of a Terminal Server network with zenon could look as follows:



Computer	Description
A.	zenon Primary Runtime Server
B.	Terminal Server and n-fold Runtime Client
C.	Terminal Clients (input and output only)

7.4 Required settings

In order for zenon Runtime to be able to be started more than once on the terminal server, several settings must be made. The settings for registration, screen resolution and transfer service can be undertaken with the zenon Startup Tool.

> **Information**
>
> *The following parameters are automatically set with registration via the Startup Tool:*
>
> - INI entries:
>   ```
>   [TERMINAL]
>   CLIENT=1
>   SERIALIZE=1
>   ```
> - Registration of **`ZenSysSrv.exe`** as a service
> - Deregistration of **`ZenDBSrv.exe`**

GENERAL SETTINGS

1. Registration

   Register the use on the terminal server via the zenon Startup Tool.
   Alternatively, you can configure the corresponding INI entries manually.

   zenon6.ini entry:
   The following entry must be added in zenon6.ini on the terminal server. On the Primary Runtime server no settings are needed.

   ```
   [TERMINAL]
   CLIENT=1
   ```

   `1`: The Runtime can be started several times, all settings for the terminal server operation are automatically set by the Runtime.
   `0`: The Runtime can only be started once. Operation on the terminal server is not possible. (standard setting)

2. Automatic adjustment of the screen resolution

   Per default the first client at the terminal server defines the screen resolution. This setting can be amended on the terminal server with the following entry in zenon6.ini:

   ```
   [TERMINAL]
   SERIALIZE=1
   ```

   `1`: Each client gets its own resolution.
   `0`: The first client defines the resolution.

3. Transfer

   The transport service (**`zensyssrv.exe`**) must be registered and started as a Windows service, not as a standard EXE file. This setting is automatically set when registering via the Startup Tool, but can also be set manually.

Manual setting:

a) Start the program from the command line interface with the `-service` option.

For example: `C:\Programs (x86)\COPA-DATA\zenon720\zenSysSrv.exe -service`

b) Then start the Windows Service Manager. The service will be started automatically during every computer restart.

Note: The setup always registers the transport service as a standard EXE. Therefore the transport service must be re-registered as a Windows service after every reinstallation.

4. Runtime folder

   All users must have write access to the Runtime folder. All Windows users (Windows users: `All`) in Windows Explorer must have complete access to the Runtime folder and all its subfolders.

> **Attention**
>
> *If TERMINAL=1 is set, the project simulation is no longer available.*

SELECTIVE RELOADING OF SINGLE PROJECTS

Projects can also be synchronized selectively. In this case clients only reload projects if project changes exist. To activate the selective reloading:

1. open the file `zenon6.ini` with a text editor
2. go to area `[TERMINAL]`
3. edit or create entry: `CLIENT_NO_FILE_ALIGN=`
4. possible values:

   `0`: Projects are always reloaded by all clients

   `1`: selective synchronization active. Only the zenon client which is started in the console session of the terminal server synchronizes the Runtime files with the zenon server

After synchronizing the Runtime files the console client writes file `reloadindicator.tmp` in the directory which contains file `project.ini` of the program . The session clients at the terminal server check every 10 seconds whether this file is available. Does it exist and is its file time stamp newer that the date of the last reload, a session client reloads automatically.

ENTRY IN ZENON6.INI FOR SELECTIVE RELOAD

```
[TERMINAL]

CLIENT=1
```

```
CLIENT_NO_FILE_ALIGN=1

SERIALIZE=1
```

7.5 zenon Remote Desktop versus Terminal Server

The terminal server solution is different from zenon Remote Desktop primarily due to the following points:

zenon Remote Desktop connection	Terminal server connection
All connected stations always see one and the same desktop. If e.g. one user starts a program, all see the same program, the same mouse cursor, the same keyboard input, etc.	Each connected station has its own desktop - an own instance. Only it sees, what happens there. Mouse actions and keyboard inputs only affect this one instance.
	That also means: In each instance a program can be started separate, e.g. a text editor. The program then runs on the terminal server several times and therefore needs more resources.

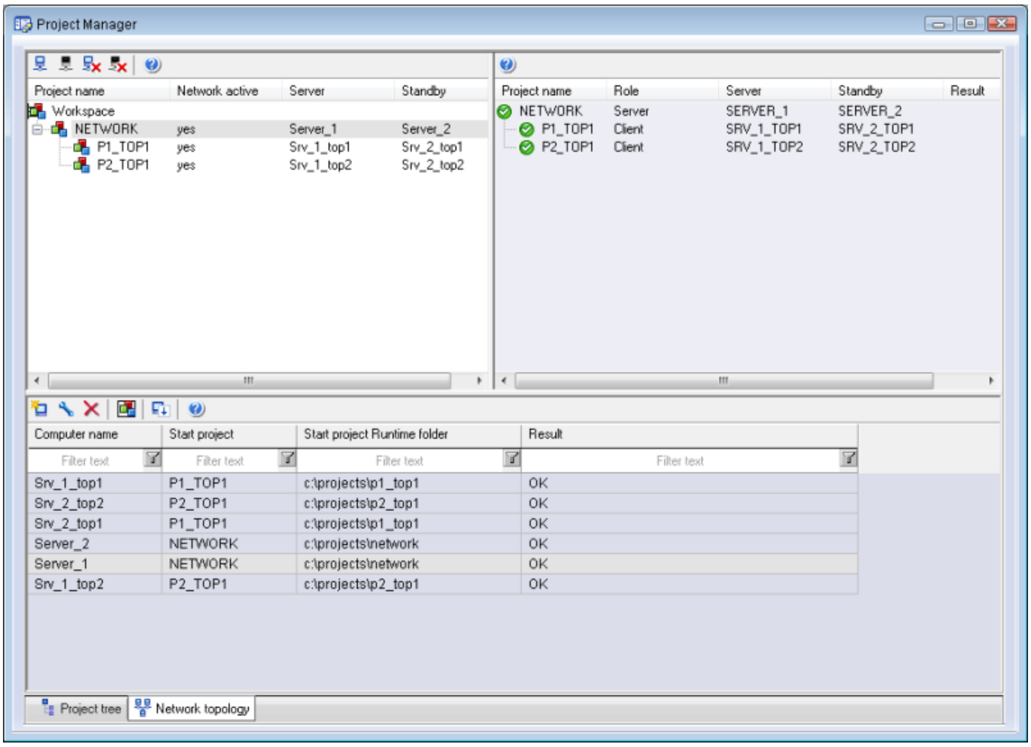
8. Administering and checking network topology

The network topology is displayed in a separate project manager tab.

It consists of three areas:

- Topology tree (on page 65) (top left): shows active projects; the global project is not displayed
- Event tree (on page 66) (top right): only the result is displayed; represents the topology tree of a selected computer

- Computer list (on page 67)(bottom): List display and configuration of computers in the network



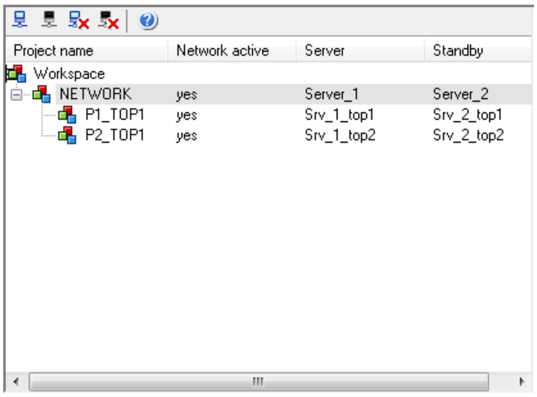
Project name	Network active	Server	Standby
Workspace			
NETWORK	yes	Server_1	Server_2
P1_TOP1	yes	Srv_1_top1	Srv_2_top1
P2_TOP1	yes	Srv_1_top2	Srv_2_top2

Project name	Role	Server	Standby	Result
NETWORK	Server	SERVER_1	SERVER_2	
P1_TOP1	Client	SRV_1_TOP1	SRV_2_TOP1	
P2_TOP1	Client	SRV_1_TOP2	SRV_2_TOP2	

Computer name	Start project	Start project Runtime folder	Result
Filter text	Filter text	Filter text	Filter text
Srv_1_top1	P1_TOP1	c:\projects\p1_top1	OK
Srv_2_top2	P2_TOP1	c:\projects\p2_top1	OK
Srv_2_top1	P1_TOP1	c:\projects\p1_top1	OK
Server_2	NETWORK	c:\projects\network	OK
Server_1	NETWORK	c:\projects\network	OK
Srv_1_top2	P2_TOP1	c:\projects\p2_top1	OK

8.1 Topology tree

The topology tree displays active projects in hierarchical form.



Project name	Network active	Server	Standby
Workspace			
NETWORK	yes	Server_1	Server_2
P1_TOP1	yes	Srv_1_top1	Srv_2_top1
P2_TOP1	yes	Srv_1_top2	Srv_2_top2

Parameters	Description
`Project name`	Is defined in the project tree tab and cannot be changed here.
`Network active`	Displays whether the network option is active for this project. The setting can be changed via the **Network active** property.
`Server 1`	Displays the Primary Server defined for this project. The setting can be changed via the context menu, the symbol in the tool bar or the **Server 1** property.
`Server 2`	Displays the Standby Server defined for this project. The setting can be changed via the context menu, the symbol in the tool bar or the **Server 2** property.

TOOLBAR AND CONTEXT MENU

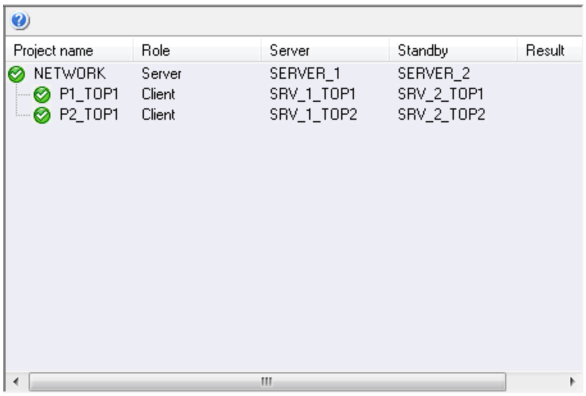
Property	Description
Set computer as Primary Server	Defines the computer highlighted in the computer list (on page 67) as the Primary Server for the project highlighted in the tree.
Set computer as Standby Server	Defines the computer highlighted in the computer list (on page 67) as the Standby Server for the project highlighted in the tree.
Delete Primary Server	Deletes the Primary Server defined for the highlighted project.
Delete Standby Server	Deletes the Standby Server defined for the highlighted project.
Help	Opens online help.

8.2 Result tree

The result tree represents the project tree of the computer selected in the computer list (on page 67) from the project, which is set as a start project for the selected computer and displays these project settings.

The result tree is empty if:

- The start project of the selected computer was not found
- More than one computer in the list was selected

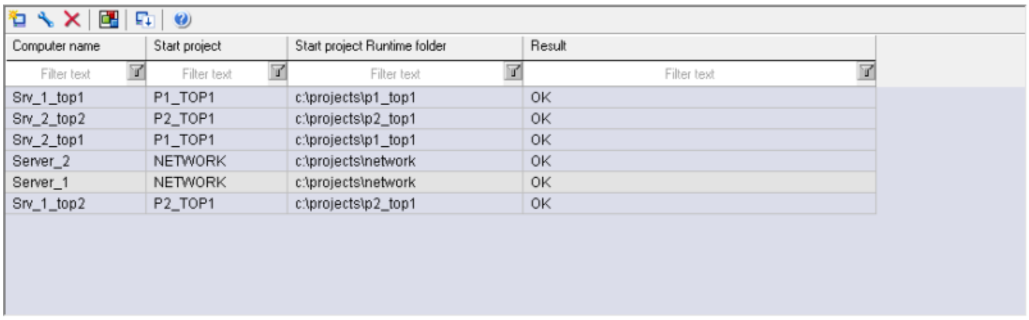


Project name	Role	Server	Standby	Result
✓ NETWORK	Server	SERVER_1	SERVER_2	
✓ P1_TOP1	Client	SRV_1_TOP1	SRV_2_TOP1	
✓ P2_TOP1	Client	SRV_1_TOP2	SRV_2_TOP2	

Parameters	Description
Project name	Projects that are assigned to the selected computer.
Role	Role of the computer: - Primary Server - Standby Server - Client
Primary Server	Name of the computer that acts as a Primary Server to Runtime.
Standby Server	Name of the computer that acts as a Standby Server to Runtime.
Result of test	Shows detailed error messages (on page 70) for topology test.

8.3 Computer list

The computer list shows all computers that have been added and allows them to be configured. The list relates to the workspace and is saved in the workspace file (`*.wsp6`).



Computer name	Start project	Start project Runtime folder	Result
Filter text	Filter text	Filter text	Filter text
Srv_1_top1	P1_TOP1	c:\projects\p1_top1	OK
Srv_2_top2	P2_TOP1	c:\projects\p2_top1	OK
Srv_2_top1	P1_TOP1	c:\projects\p1_top1	OK
Server_2	NETWORK	c:\projects\network	OK
Server_1	NETWORK	c:\projects\network	OK
Srv_1_top2	P2_TOP1	c:\projects\p2_top1	OK

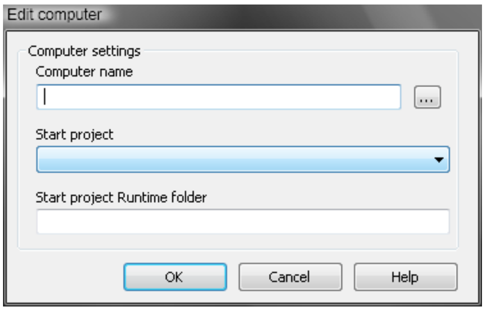
Parameters	Description
`Computer name`	Name of the computer. Can be changed by: - Click in the cell: Clicking on the `...` button opens a drop-down list of the computers currently available in the network. - **`Edit computer`** entry in the context menu or the tool bar - **Computer name** property.
`Start project`	The start project assigned to the computer Can be changed by: - Click in the cell: Select from drop-down list. - **`Set start project`** entry in the context menu or the toolbar Sets the project selected in the topology tree (on page 65) as the start project. - **Start project** property.
`Start project Runtime folder`	Folder for project files on the target computer. The files of the start project are saved in this folder. All other projects relating to this correspond to the structure of the **Runtime folder** set up on the local computer. For example: **Start project Runtime folder**: `C:\Projecs\Top` = location where start project is stored. Sub projects are stored in `C:\Projects\`. Hint: Use the project name as folder name in order to create the same structure as on the engineering computer automatically. The **Start project Runtime folder** can be changed by: - double clicking on the computer: Opens computer configuration dialog (on page 69). - Click in the cell: Manual entry possible. - **Start project Runtime folder** property.
`Result of test`	Shows the result of the topology test. - **`OK:`** All projects are free of errors. - **`Error detected - For details see detail view!`** One or more projects have an error. - **`Critical error detected - For details see the detail view!`** A project has a serious error. Serious errors halt further testing. - **`Not tested, because there is a serious error in the structure`**: The computer was not fully tested, because the test was ended due to a serious error. Detailed error messages (on page 70) are displayed in the result tree.

TOOLBAR AND CONTEXT MENU

Entry	Description
`Add computer...`	Opens the Configure computer dialog (on page 69) in the network.
`Edit computer...`	Opens the dialog to configure the computer (on page 69) in the network for these computers.
`Delete computer`	Deletes computer from the topology after requesting confirmation. Attention: Deletion of the Primary Server or Standby Server leads to serious errors in the topology.
`Set start project`	Sets the project selected in the topology tree (on page 65) as the start project.
`Copy Runtime files from all projects on the computer`	Copies all projects valid for the selected computer to the target computer. The result is displayed in the output window.
`Help`	Opens online help.

8.3.1 Computer network configuration dialog

The following data is necessary to configure the computers:



Parameters	Description
Computer name	Clicking on the `...` button opens a drop-down list of the computers currently available in the network.
Start project	Selection of the start project from a drop-down list.
Start project Runtime folder:	Folder for project files on the target computer. The files of the start project are saved in this folder. All other projects relating to this correspond to the structure of the **Runtime folder** set up on the local computer. Hint: Use the project name as folder name in order to create the same structure as on the engineering computer automatically. For example: Project name = **`I-Project`** at **Start project Runtime folder** enter: `C:\Projects\I_Project` The sub-projects in relation to this path are stored at `C:\Projects\Projektname`, for example: The project name is **`SubProject1`**, then the Runtime folder for this is `C:\Projects\SubProject1`. Requirement: The Runtime folders are left at their default settings and the projects were created at one file level. If this is not the case, it may be the case that subprojects cannot be copied, because the relative folder cannot be created from the start project. Example: The integration project has the following set up as a Runtime folder: `C:\Workspace\Projects\I_Project`. The sub project has the following set up as a Runtime folder: `C:\Subproject`. The start project Runtime folder is set to `C:\Project`. The sub project cannot be transferred, because the relative folder would be `..\..\Project`. This does not work, because the Runtime folder for the sub project would be below `C:\`. Solution: Set the **Runtime folder** project property correctly. It is best to do it so that the Runtime folder is at the same level for all projects.

8.4 Error messages from topological testing

The topology test is always carried out if settings concerning the topology change. The effect of each change can be observed immediately this way. The topology is also tested if the topological view is changed.

TESTS CARRIED OUT

- Is the project defined in the project tree available in the project tree?
- Was a Primary Server defined?

- Were different computers defined for Primary Server and Standby Server?
- Can the client achieve its Primary Server/Standby Server?
- Can the Primary Server reach its clients?
- Can the Standby Server reach its clients?
- Is the Primary Server available for a project in the topology?
- Is the Standby Server available for a project in the topology?
- Is a computer included more than once in the path from Client to the Primary Server?

NOT TESTED:

- Is a client only updated on one path by the Primary Server or do several paths exist?

CLIENT TO SERVER

- Does the client reach its Primary Server via the Primary Server's chain?
- Was a computer that routes switched to its Standby Server?

  Info: The server must also be be able to be reached by the client via the project's Standby Server that routes.

ERROR MESSAGE

Errors that are recognized during the topology test are displayed in the result tree (on page 66) in the test result column.

Error	Reason	Solution
`The start project is unknown!`	Start project cannot be found.	Correct project configuration or include missing project in the workspace.
`The computer is entered as a server and standby!`	Server and Standby Server must be different computers.	Define different computers as Server and Standby Server.
`No computer is entered as server!`	The project is a network project but no server was configured.	Define a computer as a server.
`The project is not started on computer (name)! However it is necessary because higher hierarchic levels need access to it.`	The project is not loaded on the computer stated. The project is however routed via this.	Adapt topology or start project for the computer or deactivate the **Routing active** property.
`Circular access to the server: The computer (name) redirects to the client (name)!`	The routing path from the client to server goes around in a circle. The computer that acts as a node redirects to the client.	Adapt topology or start project for the computer or deactivate the **Routing active** property.
`Circular access to the standby: The computer (name) redirects to the client (name)!`	The routing path from the client to the standby goes around in a circle. The computer that acts as a node redirects to the client.	Adapt topology or start project for the computer or deactivate the **Routing active** property.
`The computer (name) is not included in the list of computers`	Computer is missing in the list of computers for the topology.	Add computer to topology.
`Not checked because there is critical error in the topology`	No check could be made out for this computer because there was a critical error.	Rectify other errors so that the check can also check this computer.
`Circular access path: (computer names)`	The routing path from the client its the server/standby goes around in a circle. The "computer names" field contains the names of the computer that are affected. Structure: The first computer is always the client. The separator between the computer names indicates whether the following computer is a server or standby. ‣ > identifies the following computer as a server. ‣ "+" labels the following	Adapt topology or start project for the computer or deactivate the **Routing active** property.

	computer as a standby. For example: Computer1+Computer2 > Computer3	
`Circular access path exists from server to client!`	The server is found according to the node when searching for the client computer.	Adapt topology or start project for the computer or deactivate the **Routing active** property.
`The server (name) does not reach this client!`	The path is not closed from the stated server to the client. The client is included in the client list on the server but is not updated. (The blue dots do not disappear on the client.)	Adapt topology or start project for the computer or deactivate the **Routing active** property.

9. Redundancy

Redundancy in zenon ensures that processes are not interrupted even in the event of a failure of the Primary Server and that no data is lost. In zenon, we speak of **`seamless redundancy`**.

Seamless redundancy means that the time period between the failure of the Primary Server and detection of the failure is protected from data loss. This is implemented as follows:

- The Standby Server detects the failure of the Primary Server and automatically takes on the complete functionality thereof.
- In order to avoid data loss in the time period between the server failure and the detection of the failure, the Standby Server always buffers all data.
- After a failure of the Primary Server, this buffer is merged with the last data from the server and the new incoming data, so no data can be lost.

Info

*For **zenon Operator**, depending on the role, the following is applicable for connections to the server with Supervisor license:*

Client

- Connection to **Server 1** and **Server 2** is possible.
- Client connects to the Standby Server if the Primary Server fails.
- Several instances of a driver are supported.
- All variables of all drivers are displayed and can be written.
- Archives can be read.
- Redundancy switching can be executed.

Standby Server:

- Start as a Standby Server is possible.
- A warning message must be confirmed.
- Variables of the Standby Server are displayed.
- Archives of the Standby Server are displayed.
- Only the first instance of a driver is started on the Standby Server.
- After redundancy switching, variables of the second instance of a driver have the status INVALID. This status also remains after being switched again.

Data server:

- More than one instance of a driver can be started. However only one of the instances can send values to Runtime. zenon Operator thus behaves along the lines of a CE panel on which only one driver can be started for technical reasons.

Standalone

- A warning message must be confirmed.
- Variables of the Standby Server are not displayed.

Information

Project changes need only be entered on the Primary Server; the standby server and the connected clients automatically synchronize online data. This ensures that the project status is the same on all computers.

SOFTWARE REDUNDANCY AND HARDWARE REDUNDANCY

With redundant systems in zenon, a distinction is made between software redundancy (on page 77) and hardware redundancy (on page 77).

CIRCULAR REDUNDANCY

zenon circular redundancy (on page 96) is a special form of redundancy that allows seamless redundancy for several projects with a low amount of hardware being used and very simple configuration.

ZENON REDUNDANCY AND ZENON LOGIC REDUNDANCY

You can find details on the combination of zenon redundancy and zenon Logic redundancy in the zenon Logic Runtime manual).

> **Info**
>
> *If only one controller is available, which offers only one communication channel, the* ***Stop at the Standby Server*** *option in the general settings of the driver configuration can be activated. The driver is thus stopped at the Standby Server and only started again at the upgrade.*

9.1 Setting up the Standby Server

To set up the Standby Server:

1. Open, in the project properties in the Editor, the **Network** group.
2. Enter, in the **Server 2** property, the name of the computer that is to serve as the Standby Server for the project. (the computer must have a connection to the PLC.)

   You can enter the computer name:

   a) By selecting from the drop-down list after clicking on the `...` button

   b) Manually

Select, in the ***Redundancy type*** *property, the desired redundancy form from (on page 77) the drop-down list:*

> **Information**
>
> *Servers from different domains are permitted!*
> *In this case, configure the server name including the domain name.*
>
> *Eg:* `terminal_01.mydomain.net`

9.2 Types of redundancy

For redundant systems with zenon, a distinction is made between:

- `Software redundancy:` (on page 77)
  Only the Primary Server communicates with the controller in two directions (write and read). The Standby Server communication is read-only.
- `Hardware redundancy:` **(on page 78)**
  PLCs are also designed as redundant. The Standby Server communicates two ways with the controller that is designed as redundant.

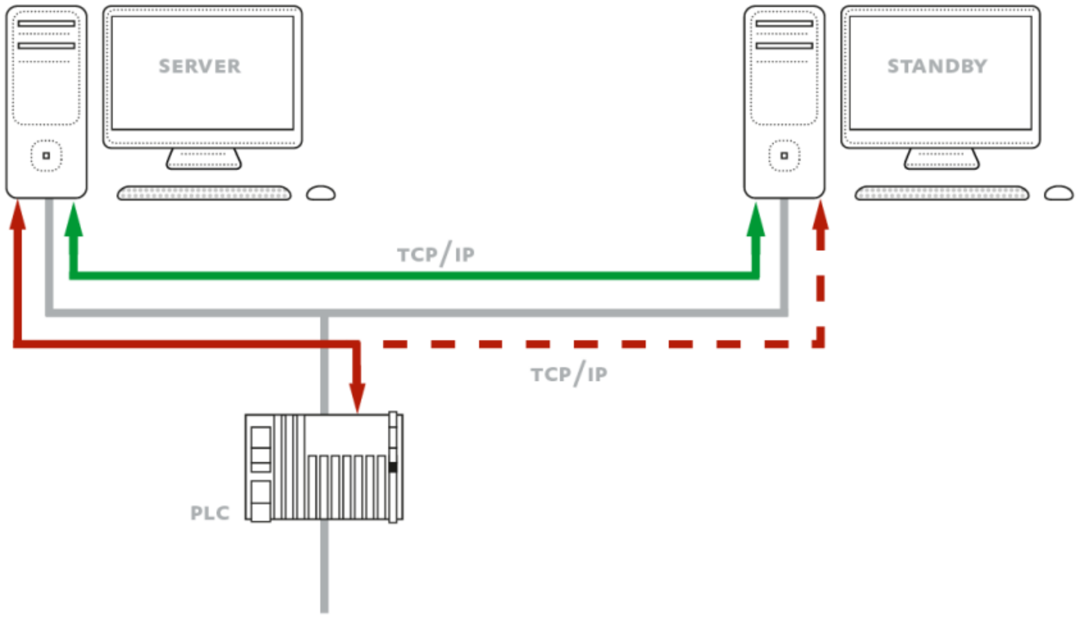
You can find the selection of this in the configuration of the Standby Server (on page 76).

9.2.1 Software redundancy

The following components are required for software redundancy:

- A controller
- Two redundant computers (Primary Server and Standby Server)

In operation, the Primary Server communicates with the controller in two ways, the Standby Server communicates with the controller as read-only and synchronizes its data from the Primary Server.



In the event of a failure of the Primary Server:

- The Standby Server becomes the new Primary Server
- Seamless redundancy (on page 90) ensures that all data is complete without omissions, including data from the time between the failure and the switch
- The new Primary Server communicates with the PLC both ways

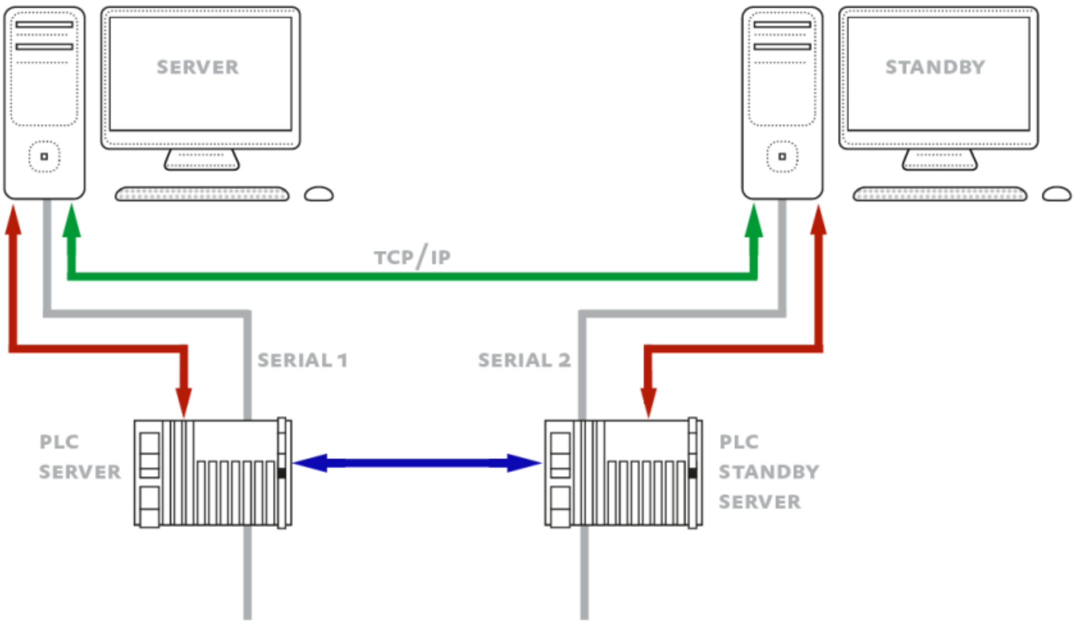
9.2.2 Hardware redundancy

In zenon networks, there are two types of hardware redundancy available:

- Non-dominant (on page 79)
  In a non-dominant network, the Primary Server communicates both ways with the first controller; the Standby Server communicates with the controller both ways.
  The Standby Server synchronizes with the Primary Server; the second PLC synchronizes with the first PLC.
- Evaluated (on page 80)
  In an evaluated network, configurable criteria are evaluated in a matrix. The server roles are given according to the result.
  Caution: Please note the limitations in evaluated networks if a CE terminal acts as a data server.

9.2.3 Hardware redundancy

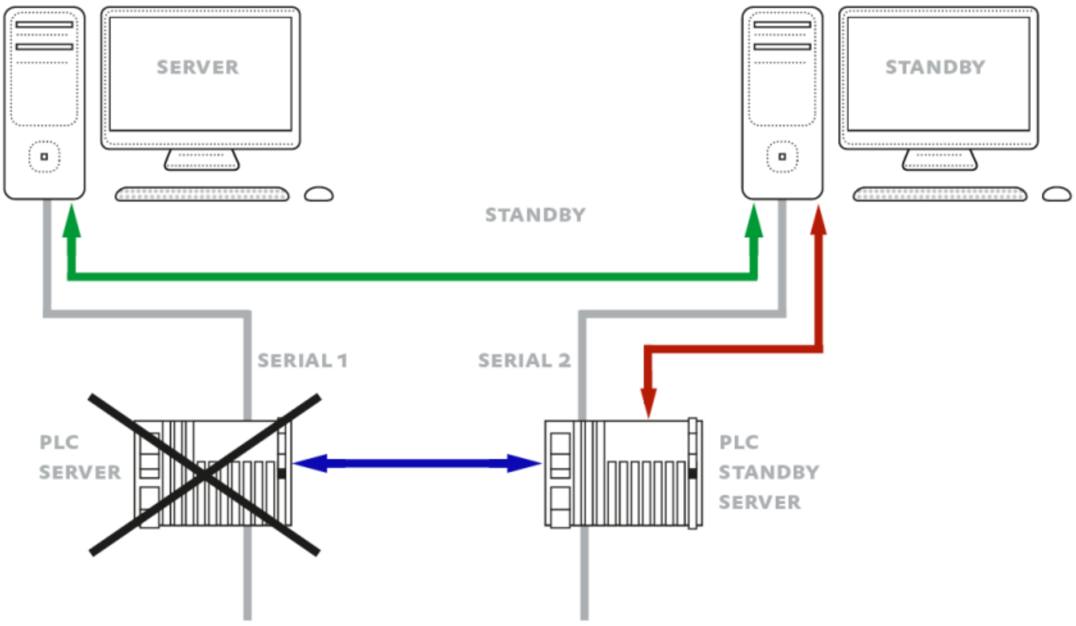
In a non-dominant network, the Primary Server communicates both ways with the the first controller; the Standby Server communicates with the second controller both ways.
The Standby Server synchronizes with the Primary Server; the second PLC synchronizes with the first PLC.



In the event of a failure of the Primary Server or the first controller:

- The Standby Server becomes the new Primary Server
- Seamless redundancy (on page 90) ensures that all data is complete without omissions, including data from the time between the failure and the switch

- The Primary Server communicates both ways with the second controller



9.2.4 Redundancy in an evaluated network

With hardware redundancy in an evaluated network, evaluation criteria (on page 82) decide which computer takes on the role of the Primary Server and which takes on the role of the Standby Server.

This evaluation can be freely configured and can include several different criteria. Each criterion is assigned evaluation points - the weighting. The sum of the weighting points then decides on the respective server role.

> **Information**
>
> If one of the two servers - regardless of whichever role they have - loses the other server (for example: hardware failure), it automatically upgrades to the Primary Server.

REASONS FOR DELAYING THE REGRADING:

- The internal modules have not yet been fully initialized. This is possible if a driver delays the regrading process.
- The regrading is already active and not yet completed.

- The file sync is still active.
- Reloading is taking place.

Note: As a result of the automatic cyclical, renewed activation of the regrading, this is therefore only suspended until the process is permitted.

> ⚠ **Attention**
>
> *If, in an evaluated network, server redundancy switching is triggered due to an evaluation, there is no guarantee that pending functions in the queue of the old Primary Server have also actually been processed successfully before switching.*
>
> *This is because during redundancy switching in evaluated networks, both servers take on the role of the Primary Server for a short time. In this time,* ***Server 1*** *and* ***Server 2*** *synchronize their data. The time period of this status depends on the network load and can be between 200 and 500 milliseconds.*

TIME SYNCHRONIZATION

In an evaluated network, the time synchronization of of **Server 1** and **Server 2** should always be deactivated by means of the zenon network.

The following is recommended for this:

- Deactivate the automatic time synchronization in zenon.
- Activate external time synchronization on **Server 1** and **Server 2** by means of the operating system

You can find detailed information on this in the Time synchronization in the network (on page 14) chapter.

Redundancy in an evaluated network

The following project configurations are used for the operation of an evaluated network:

1. **Server 1** and **Server 2**
2. **Redundancy type** is `software redundancy`
3. **Redundancy mode** is `evaluated`
4. Redundancy evaluation
   You can find details on redundancy evaluation under "Configuration of redundancy evaluation (on page 82)".
5. **Switching delay [s]**
6. **Dead time after switching [s]**

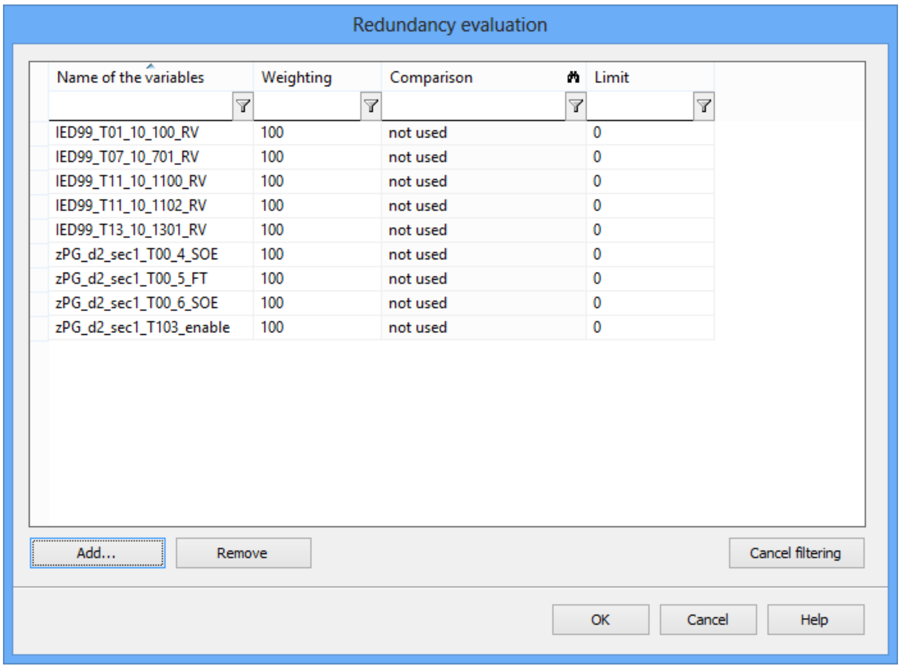
7. **Hysteresis** (the evaluation points)

Configuration of redundancy evaluation

The dialog to configure redundancy evaluation is opened by clicking on " . . . " in the **Assessment** properties field in the **Network** properties group.

The result of this evaluation is evaluated with the system variables **Evaluation result for Server 1** and **Evaluation result for 2**.
Note: You can find further information on the network system variables in the System driver manual, in the Topic - network chapter.

The fields in this dialog can be filtered and sorted.



Redundancy evaluation

Name of the variables	Weighting	Comparison	Limit
IED99_T01_10_100_RV	100	not used	0
IED99_T07_10_701_RV	100	not used	0
IED99_T11_10_1100_RV	100	not used	0
IED99_T11_10_1102_RV	100	not used	0
IED99_T13_10_1301_RV	100	not used	0
zPG_d2_sec1_T00_4_SOE	100	not used	0
zPG_d2_sec1_T00_5_FT	100	not used	0
zPG_d2_sec1_T00_6_SOE	100	not used	0
zPG_d2_sec1_T103_enable	100	not used	0

Parameters	Description
Name of the variable	List of the variables that can be used for the evaluation. Note: A maximum of 200 variables can be used for the redundancy evaluation.
Weighting	Value of the test criteria. Provides the value of the individual test criteria in the entirety of the test results. The weightings, of all variables that are true are counted up. Input range: `0 – 1000` Default: `100`
Comparison	States the type of comparison, from which the value of the weighting is taken into account in the overall assessment. Drop-down list: ▶ `Not used` No comparison to the weighting is carried out. ▶ `Only status OK /value OK` Only a check to see if there is a value is carried out. As soon as there is a valid value, the value of the weighting is used for the overall evaluation. ▶ `Values from limit are OK` Values that are greater than or the same as the limit that has been entered use the value of the weighting in the overall evaluation. ▶ `Values up to limit are OK` Values that are less than or the same as the limit that has been entered use the value of the weighting in the overall evaluation. Default: `not used`
Limit	Limit for comparison with "`Values from limit are OK`" or "`Values up to limit are OK`" Default: `0` Note: If the comparison is "`not used`" or "`Only status OK /value OK`", entries in this field have no influence on the evaluation.
`Add...`	Opens the dialog to select variables.

Remove	Removes the selected variable from the list Note: Multiple selection is possible.
Cancel filtering	Removes the filter criteria

CLOSE DIALOG

Parameters	Description
OK	Applies settings and closes the dialog.
Cancel	Discards all changes and closes the dialog.
Help	Opens online help.

Example

A variable is configured in the evaluation dialog with the following settings:

- Weighting: 50
- Comparison: `Values from limit are OK`
- Limit: 50

Set the value of the variable to 55. The condition becomes true as a result and the weighting of 50 is added to the result of the system variable ***Evaluation result for Server 1****.*

a further variable is configured with the following settings:

- Weighting: 30
- Comparison: `Values up to limit are OK`
- Limit: 10

As long as the value of this second variable =< 10, the weighting is added to the system variable.

If the value of the second variable is 5 for example, the ***evaluation result for Server 1*** *(if the previously-described variable is true) is 80.*

Switching delay, down time and hysteresis

SWITCHING DELAY

The **Switching delay [s]** is the time (tolerance time) in which value changes of the evaluation result do not trigger a regrading. In doing so, short peaks or a brief failure do not lead to an immediate server change.

Note: A further improvement of the evaluation result during the configured switching delay does not reset the timer.

Example

If a **Switching delay [s]** of 30 seconds is configured, the evaluation on the current Standby Server must be at least 30 seconds better than that of the Primary Server in order to trigger regrading.

After successful regrading, the timers of **Dead time after switching [s]** and **Switching delay [s]** switching delay can run at the same time; both must have expired in order to trigger a regrading.

DOWN TIME

This setting prevents resetting on the basis of the Primary server during the configured time.

Note: the "Redundancy switching (on page 109)" function can be executed.

Example

If the evaluation of the current Standby Server - after the last regrading within the set down time - is better than that of the current server, there is not another regrading until this time expires. The start of the "time calculation" is the time in which the role swap of the server is completed.

If the evaluation increases within the down time of the Standby to more than that of the Server, but it goes down again to below or the same as the server before it expires, there is no regrading.

HYSTERESIS (IN EVALUATION POINTS)

If a **Hysteresis** is configured, a check is made before redundancy switching to see whether the evaluation results between the two computers (**Server 1** and **Server 2**) have at least reached this. A difference the same as the hysteresis already triggers switching,

Example

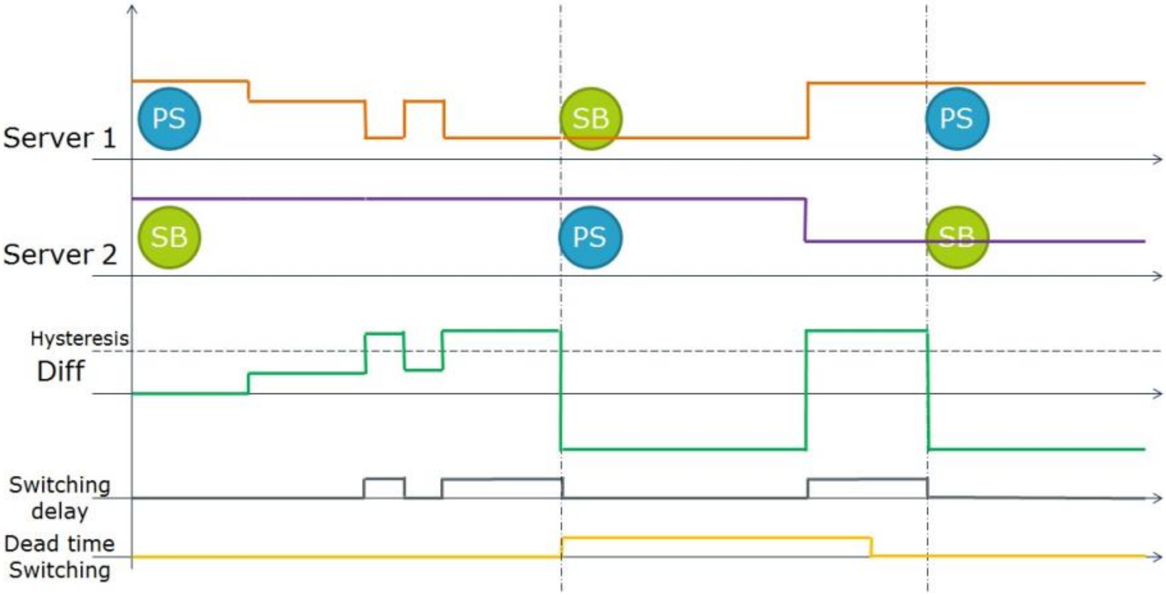
Server 1 is Primary Server.

Server 1 and **Server 2** each have evaluation result 0 .

The **Hysteresis** is configured with value 100.

If the evaluation changes from **Server 2** to 99, nothing happens, but if the value reaches 100a regrading is triggered.

Switching delay - example



In this example, the switching of the two servers is triggered by xxx. Once the reason for switching has occurred, the delay time is waited before Server 2 becomes the Primary Server. Although Server 1 could take on the role of the Primary Server again, the delay time is waited for before Server 1 takes on the role of the Primary Server.

You can see that Server 2 gets Primary Server after the difference between the evaluation system variables was higher than the hysteresis for the time of the Switching delay.
After the switch the Dead time after switching starts to count.

At the point where the difference is again higher than the hysteresis, the switching delay starts to count and Server 2 will get the Standby server.

LOG entries in the evaluated network

The following log entries are written in the Diagnosis Viewer for the evaluated network:

Log entry	Debug Level	Description
`LOG SendData Project:RATED_NET To:CDSBG079.COPA-DATA.INTERNAL Modul:10 Prior:0 Class:CD_CSystemDaten`	**Debug**	Data from the CD_CSystemDaten class is transported via connection 0 (watchdog) to computer `cdsbg079`. The module gives the zenon module to the one that has the data. `Module 10`: Synchronous execution network module
`LOG SendData Project:RATED_NET To:W7X64 Modul:10 Prior:0 Class:CD_CSrv1SystemDaten`	**Debug**	As above, the target is `Server2` and the source is `Server1`
`LOG ReceiveData Project:RATED_NET To:S Modul:10 Class:CD_CSrv2SystemDaten`	**Debug**	As above, the target is `Server` and the source is `Server1`

`<Beschreibung> Prj:<ProjektName> client:<ClientRechner> Cmd:<CommandTxt>(<CommandNum>) Timeout:<Timeout>, ReqId:<ReqId> reload:<Reload> stat1:<SubCommand> stat2:<Stat2> string:<AddText> list:<ItemCnt>`		Description of the function for which the message is created. e.g.: Server received system data.; Client send watchdog; etc.
		`ClientRechner`: Source or target depending on direction
		`CommandTxt`: Command as plain text. e.g.: `Server_REQ_DateiListe`
		`CommandNum`: Numerical identification of the command:
		- `0` = Server_REQ_LifeMsg,
		- `1` = Server_REQ_DateiListe,
		- `2` = Server_REQ_GetDatei,
		- `3` = Client_REQ_UpdateProjekt,
		- `4` = Server_REQ_RedundanzUmschaltung,
		- `5` = NETSRV_ConnectionClosed,
		- `Timeout`: Timeout in ms
		`ReqId`: Request ID
		`Reload`: `1` if Server is in Reload, otherwise `0`
		`SubCommand`: Number of subcommand. Meaning depending on CommandNum
		For Command 0 ServerReqLifeMsg:
		- `1` = STAT_CLIENT_ABGEWIESEN,
		- `2` = STAT_CLIENT_ANGENOMMEN
		- `3` = STAT_CLIENT_SERVERCLOSE

		4 = STAT_CLIENT_SERVERSWITCH 5 = STAT_CLIENT_SB_ANGENOMMEN 6 = STAT_SB_SERVER_TO_SB 7 = STAT_PEER_ALIVE For Command 4 redundancy switching: 0 = IdleChangeOfDominance 1 = AdviseChangeOfDominance 2 = ConfirmChangeOfDominance Stat2: Additional command-specific information. e.g.: With command Server_Req_LifeMsg, subcommand: STAT_CLIENT_ANGENOMMEN, response for a Client logging on to a Server is the project version number in HiWORD. AddText: Additional text. ItemCnt: Number of objects in the list. That is the basic information.

`Client send watchdog. Prj:RATED_NET client:ATSZG-WKS053.COPA-DATA.INTERNAL Cmd:Server_REQ_LifeMsg(0) Timeout:30000, ReqId:0 reload:0 stat1:2(STAT_CLIENT_ANGENOMMEN) stat2:1 string: list:0 quantifier:<Quant> role:<RoleTxt>(<RoleNum>)`		Message from Server1 to Server2 `Quant`: Current evaluation. `RoleTxt`: Current role as text `RoleNum`: Current role as number
`Server received system data. Prj:RATED_NET client:WKS053-W7X64 Cmd:Server_REQ_LifeMsg(0) Timeout:30000, ReqId:0 reload:0 stat1:2(STAT_CLIENT_ANGENOMMEN) stat2:1 string: list:0 expSrv1role:<ExpRoleTxt>(<ExpRoleNum>)`		`ExpRoleTxt`: Role expected by Server2 for Server 1 as text. `ExpRoleNum`: Expected role as number
`Manual role switch for project %s denied.`	**WARNINGS**	Manual redundancy switching cannot be carried out because a regrading is already active.
`Current evaluated server1 role: %s(%i) Performing manual role switch.`	**DEBUG**	A manual redundancy switch is carried out. **Server 1** must switch its role according to the message.
`Unknown standby logon! Project:<PrjName> new client <Pc>!`	**ERROR**	Message is logged if a Client logs on as a Standby Server, but the Client name does not correspond to that of **Server 1** or **Server 2**. The identification is carried out through the host name. `PrjName`: Project that logs on to the Standby Server. `PC`: Name with which the Standby Server logs on.
`Unknown standby logon! Project:<PrjName> new client <Pc>!`	**ERROR**	Message is logged if a Client logs on as a Standby Server, but the Client name does not correspond to that of **Server 1** or **Server 2**. The identification is carried out through the host name. `PrjName`: Project that logs on to the Standby Server. `PC`: Name with which the Standby Server logs on.

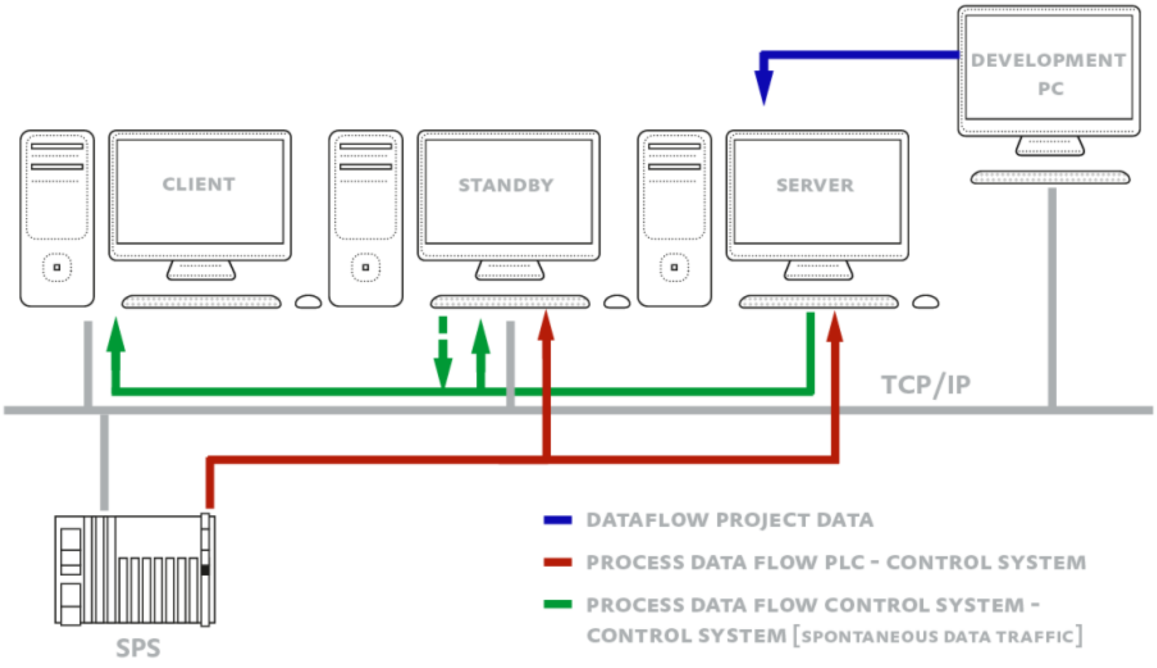
9.2.5 Configuration of seamless redundancy

For the configuration of seamless redundancy for a zenon project, you only need two simple, conventional computers.

Define, in the project properties:

1. A computer that is to be the Primary Server (on page 24) for the project

2. A computer that is to be the Standby Server (on page 76) for the project


DEVELOPMENT PC
CLIENT
STANDBY
SERVER
TCP/IP
SPS
DATAFLOW PROJECT DATA
PROCESS DATA FLOW PLC - CONTROL SYSTEM
PROCESS DATA FLOW CONTROL SYSTEM - CONTROL SYSTEM [SPONTANEOUS DATA TRAFFIC]

PROCEDURE FOR SEAMLESS REDUNDANCY

- One computer is the Primary Server and one computer is the Standby Server for a project.
- As in a normal Client-Server model, the Primary Server has ownership of all data.
- The Standby Server acts outwardly to the user like any other computer on the network that has started the project.
- The Standby Server independently records all historical data such as alarms, events and archives and synchronizes other data (recipes, users, etc.) with the Primary Server.
- If the Primary Server fails, the Standby Server upgrades itself and takes over its tasks.
  - In order to avoid data loss in the time period between the server failure and the detection of the failure, the standby always buffers all data.
    After a failure of the Primary Server, this buffer is merged with the last data from the server and the new incoming data, so no data can be lost.
- All Clients connect to the new Primary Server.
- If the original Primary Server goes online again, a distinction must be made between when redundancy mode is used:

DOMINANT

- The original Primary Server goes online again.
  In doing so:
  - It connects to the current Primary Server.
  - It synchronizes all data.
  - It becomes the Primary Server itself again.
- The original Standby Server becomes the Standby Server again.
- All Clients connect to the new Primary Server.

NON-DOMINANT

- The original Primary Server goes online again.
  In doing so:
  - It connects to the current Primary Server.
  - It synchronizes all data.
  - It becomes the Standby Server itself.
- The current Primary Server remains the Primary Server.
- All Clients retain the connection to this.

RATED

- With evaluated redundancy mode, the roles of Primary Server and Standby Server are given on the basis of an evaluation matrix.
- Both computers each carry out an evaluation calculation on the basis of configured evaluation criteria.
  The current Primary Server is then the computer that has the higher evaluation.
- If both computers have the same evaluation, no exchange of roles is carried out.
- Alarms and CEL entries are each written by the Primary Server.
- The Clients each connect to the Primary Server.

> **Info**
>
> *Project changes need only be entered on the Primary Server; the standby server and the connected clients automatically synchronize online data. This ensures that the project status is the same on all computers.*

SOFTWARE REDUNDANCY AND HARDWARE REDUNDANCY

With redundant systems in zenon, a distinction is made between software redundancy (on page 77) and hardware redundancy (on page 77).

CIRCULAR REDUNDANCY

zenon circular redundancy (on page 96) is a special form of redundancy that allows seamless redundancy for several projects with a low amount of hardware being used and very simple configuration.

ZENON REDUNDANCY AND ZENON LOGIC REDUNDANCY

You can find details on the combination of zenon redundancy and zenon Logic redundancy in the zenon Logic Runtime manual).

> **Info**
>
> *If only one controller is available, which offers only one communication channel, the **Stop at the Standby Server** option in the general settings of the driver configuration can be activated. The driver is thus stopped at the Standby Server and only started again at the upgrade.*

9.3 Special setups in the communication between Primary Server and Standby Server

Note the rules in the following setup:

- The Primary Server has failed
- The Standby Server has taken on its role
- The original Primary Server is restarted
- The original Primary Server gets all Runtime files from the current Primary Server (originally the Standby Server)

In exceptional cases, there may be conflicts if:

1. Changes have only been made to the project of the original Primary Server that has been stopped
2. It is not clear, due to network problems, which computer is the Primary Server.

1. PROJECT CHANGES WITH THE PRIMARY SERVER STOPPED

If, during the time in which Runtime is stopped on the original Primary Server, you make changes to the project and introduce these before synchronizing on this (stopped) computer, these changes are overwritten again as soon as the original Primary Server gets the data from the current Primary Server (the original Standby Server).

To prevent this: Introduce the amended data onto the Primary Server (configured Standby Server) as well, before starting the original (configured) Primary Server.

2. PROJECT CHANGES IN REDUNDANCY MODE AND/OR THE SERVERS USED

The following changes are only accepted after the Primary Server has restarted:

- Change of the **Redundancy mode**.
- Changes in the **Server 1** properties and/or **Server 2** in the **Network** properties group.

> ⚠ **Attention**
>
> In this case, `reloading` the project is not sufficient to apply the necessary changes! To accept all changes, restart the Primary Server.
>
> Runtime on the Standby Server does not need to be restarted. Here, it is sufficient if the Standby Server is restarted.

3. SERVER ROLE NOT CLEAR DUE TO NETWORK PROBLEMS

In exceptional cases, it may happen that both computers are the Primary Server. The cause of this can be, for example, a loss of network connection due to a switch failure, a disconnected network cable etc. In this case, the communication between the Primary Server, Standby Server and Clients depends on the error screen.

If, with this setup, the error screen is resolved and both servers communicate with each other again (at this time), then the original (configured) server has data sovereignty. That means: The standby server's more recent data could be overwritten.

To prevent this:

1. Always check the role distribution with the `current Primary Server` (`SYSDRV.chm::/25959.htm`) system variable:
   You will see the role that Runtime has and discover duplicate Primary Servers.
2. End zenon Runtime on the Primary Server that lost the network connection.
3. Set up the network connection again.
4. Restart zenon Runtime on this computer.
5. Runtime then starts the project with the computer as a Standby Server, updates its data and only then switches back to the Primary Server role.

Hint: Monitor the network connection with the Redundancy Management Tool (on page 98).

> ⚠ **Attention**
>
> *`PNG` graphics files cannot be overwritten if they are currently being displayed in Runtime.*
>
> *`Background:` The Runtime protects opened `.png` files against overwriting.*
>
> *`Solution:` Before Remote Transport is instigated, it must be ensured that screens with `*.png` files:*
>
> - Are not called up in Runtime
> - Are not being used by another program
>
> *This also applies for the reloading of amended Runtime files. The Runtime sync in the network does not work for a `*.png` screen if this is switched on a zenon computer that is involved in the process (standby server, client).*

9.4 Integrated evaluation methods for redundancy switching

In the dominant network, the Standby (as the Primary Server) regularly sends a telegram to the (dominant) **Server 1**, so that this - as soon as it receives a connection - can take on its role again. In an evaluated network, no telegram is sent any more in this case.

If there are two servers, the evaluation decides on the role.

USE OF DOMINANT BEHAVIOR IN ZENON LOGIC

- A driver can delay upgrading to a server on the dominant server. This function is no longer present in an evaluated network with severs that have equal rights.
- Archives also receive an extra byte per entry on the Standby Server as well as on the **Server 2**. This ensures that the archives are different and are included in a synchronization.

- Furthermore, the network topology for the drivers uses the terms Dominant and Standby as well as the roles as Server or Standby. However only the role is evaluated, so no change is therefore necessary.
- zenon Logic is supplied with information on the label and role via `CStratonVM::UpdatePrjSTates`. The only thing that is evaluated is whether a computer is configured as a Standby and not the Primary Server. in this case, zenon Logic is also not active.

9.5 zenon circular redundancy

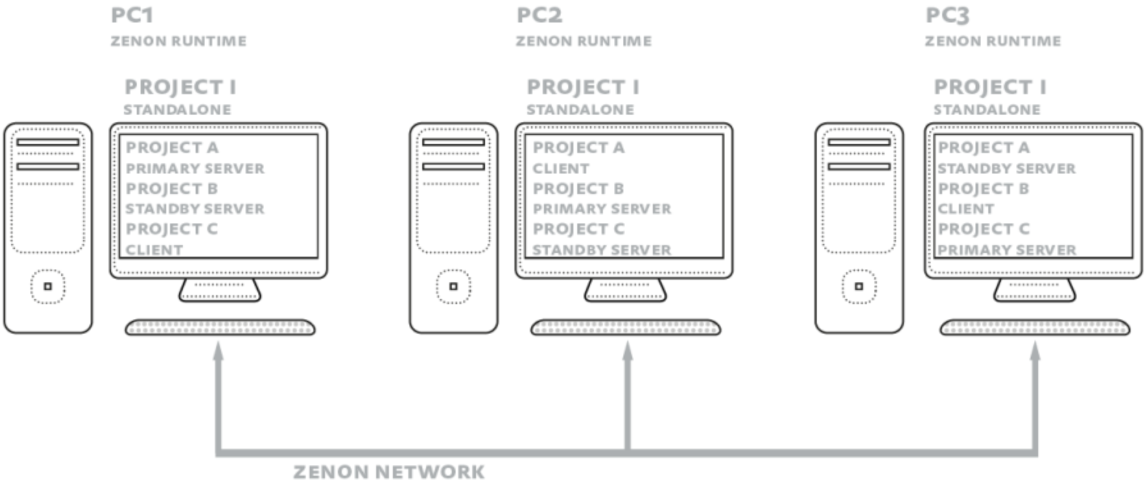
zenon circular redundancy allows seamless redundancy for several projects with a low amount of hardware being used.

Two computers are normally required for each redundant project: one computer as the Primary Server and one computer as the Standby Server. 3 projects would thus require 6 computers. Just three computers are sufficient for implementing three projects with zenon circular redundancy. Another computer is added for each further project. For this, zenon combines multi-project administration (on page 29) with seamless redundancy (on page 73).

CONCEPT OF CIRCULAR REDUNDANCY

Circular redundancy uses the possibility of multi-project administration. Several projects can run simultaneously on one computer. Each computer is the Primary Server for a project and the Standby Server for a second "neighboring project" and can also be the Client for further projects. This results in a circle. Instead of four computers, for example, and licenses for two projects, six for three or eight for four, you only need half of that.

Topology with three projects



- Computer 1 is the Primary Server for Project A and Standby Server for Project B.
- Computer 2 is the Primary Server for Project B and Standby Server for Project C.
- Computer 3 is the Primary Server for Project C and Standby Server for Project A.

  The circle is closed!
- Each computer can be a Client for the other projects at the same time.
- Expense: 3 computers and 3 Runtime licenses

> **Info**
>
> *An integration project (on page 34) is needed to start more than one project on a computer.*

Normally you would need six computers and six Runtime licenses in this example. zenon circular redundancy is of course not limited to three projects, but can connect as many projects as desired in a circle. The fact that the computers can also be clients for other projects allows easy implementation of a low-cost, fail-safe, highly-available production line.

TIME SYNCHRONIZATION FOR ZENON CIRCULAR REDUNDANCY

If zenon time synchronization (on page 14) is active, the Standby Server and clients always receive the current time from the Primary Server. This makes no sense when using zenon circular redundancy, because the individual PCs are Primary Server and Standby Server at the same time. Computer 1 for example, would thus obtain the time from computer 2, computer 2 would obtain it from computer 3 etc.

Recommendation: In this case, deactivate the zenon time synchronization and carry out external time synchronization. You can find instructions for this in Time synchronization in the network (on page 14).

10. Redundancy Management Tool

The **Redundancy Management Tool** monitors the network adapter and its connection to the network. If the device loses the connection to the network - e.g. by removing the network cable, the **Redundancy Management Tool** stops the Runtime. This process can be canceled by the operator within a configurable period of time. If the connection to the network is reestablished, the **Redundancy Management Tool** restarts the Runtime.

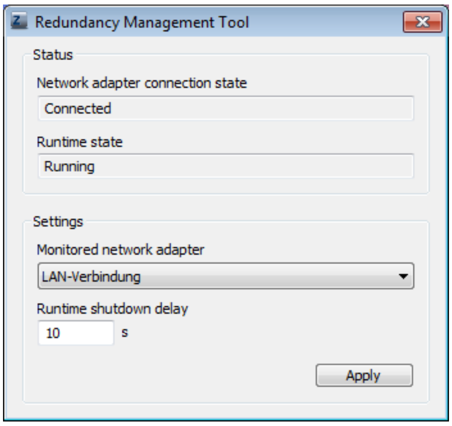
START AND CONFIGURATION

The **Redundancy Management Tool** can be configured via a dialog or via command line.

To open the dialog, there a three possible ways:

- From the Windows start folder: Start -> All programs -> COPA-DATA -> Tools 7.20 -> Redundancy Management Tool
- Via the Startup Tool: Tools -> zenon_redman
- Direct start of the file **zenon_redman.exe** from the zenon program folder

After the start the **Redundancy Management Tool** is also displayed as symbol in the right area of the Windows task bar. Double click on the symbol to open the configuration dialog:



Redundancy Management Tool

Status

Network adapter connection state: Connected

Runtime state: Running

Settings

Monitored network adapter: LAN-Verbindung

Runtime shutdown delay: 10 s

Parameters	Description
Status	Status of the network adapter.
Network adapter connection state	Information about the status: - Connected: Connection to the network established. - Disconnected: Connection to the network interrupted.
Runtime state	Status of the zenon Runtime - Running: Runtime is running. - Stopped by Redundancy Management Tool: Runtime was closed by the tool. - Stopped: Runtime is not running.
Settings	Settings.
Monitored network adapter	Selection of the network adapter which should be monitored from the drop-down list. List displays all found adapters in the device.
Runtime shutdown delay	Setting of the delay time in seconds before the Runtime is closed. In this period of time the operator can cancel the closing of the Runtime. - Maximum value: 2147483647 s. Values above this are interpreted as 0.
Apply	Applies the settings, writes values in the INI file and closes the dialog.

INI FILE

At the configuration via the dialog, file **RedMan.ini** is created in path %ProgramData%\COPA-DATA\System. It contains the following entries.

Parameters	Description
[DEFAULT]	
ADAPTER=	Selected LAN connection.
DELAY=	Value for delay time.

COMMAND LINE

The **Redundancy Management Tool** can also be started via the command line.

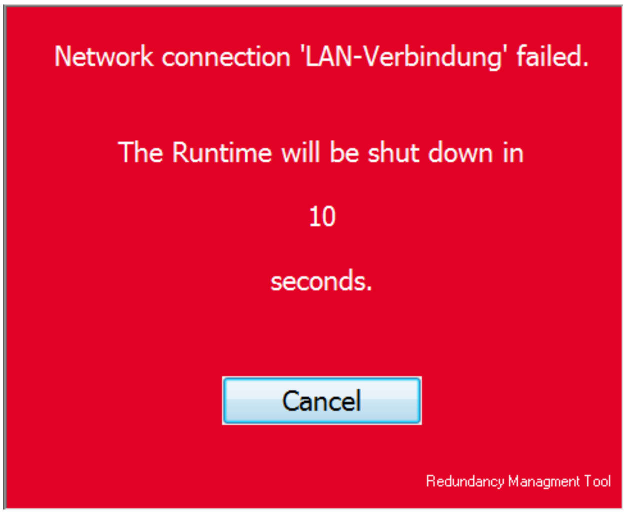
Possible parameters:

- ADAPTER='Name': Defines the network adapter which should be monitored.
- DELAY='Seconds': Defines the waiting time after a connection loss.
  Maximum value: `2147483647`. Values above this are interpreted as `0`.
- HELP,?: Displays help about the command line parameters

> **Information**
>
> *At the configuration via command line:*
>
> - these settings are taken over directly
> - the configuration is deactivated in the dialog
> - no INI file is written

IN THE RUNTIME

During the Runtime the **Redundancy Management Tool** monitors continuously the network connection. If the connection is interrupted, the **Redundancy Management Tool** displays a warning and closes the Runtime after the configured delay time.



Network connection 'LAN-Verbindung' failed.

The Runtime will be shut down in

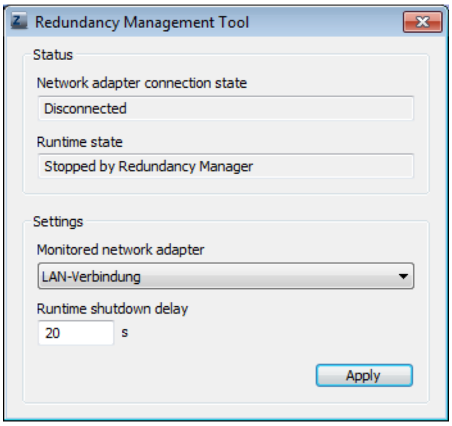
10

seconds.

As soon as the connection is available again, the **Redundancy Management Tool** restarts the Runtime.

Click on button **Cancel** to halt the countdown and prevent the closing of the Runtime. If the connection is reestablished, the dialog is displayed again when the connection fails again. The user can cancel again or let the tool close the Runtime.

The current status of the connection and the Runtime is also always displayed in the configuration dialog.



Redundancy Management Tool

Status

Network adapter connection state: Disconnected

Runtime state: Stopped by Redundancy Manager

Settings

Monitored network adapter: LAN-Verbindung

Runtime shutdown delay: 20 s

ERROR TREATMENT

ERROR MESSAGE

Error are displayed by pop-up messages.

Message	Meaning
GetAdapterAddresses not supported on this patform! Error code '%u'!	Operating system version is not supported
GetAdapterAddresses did not return information about network adapters. Error code '%u'!	No network adapter found.

LOG FILES OF THE DIAGNOSIS VIEWER

In the log file of the Diagnosis Viewer the following is documented:

Entry	Debug Level	Meaning
Network link '%s' down for '%u' seconds. zenon Runtime will be terminated.	Error	Network connection failed: The Runtime is closed.
Network link '%s' is up. Restarting zenon Runtime now.	Information	Network connection available again: The Runtime is restarted

11. Routing

For routing, the packets of subordinate projects are sent to the first client project (**FCP**) in the branch. The computer acts as node computer and can route packets. Thereby all network packets from the outside use this computer. This setting can lead to bottlenecks and influences the possible network topology. It is only worthwhile using it in special network setups, e.g. for WAN networks or routed networks.

- Example:
  If, in a setup consisting of several computers, not all computers can reach the others, a computer can act as a router.
- Technical implementation:
  The **Server 1** and the **Server 2** of the subordinate projects are amended on that of the FCP; this is the **Server 1**/**Server 2** active in runtime.

GENERAL NOTES ON ROUTING

BASIC RULES

Two basic rules must be noted when configuring network structures with routing. If one of these rules is not adhered to, communication problems or other undesired effects may occur depending on the respective structure.

- Rule 1: Server and levels
  A PC that acts as a server may only in one level (circular redundancy) act as a server or Standby several times. It must not be defined as a server a level above or below.
- Rule 2: Standalone

  If the start project is a single-user project, only one single level below can be used for network projects.

CLIENT SENDS TO A SERVER

- The client sends the packet to the server active in the project in Runtime.
- If the project on this computer is not the server, the packet is sent until it arrives at the server.
- This functionality is not affected by an integration project.

SERVER SENDS TO A CLIENT WITH ROUTING

1. If the server has a direct client connection to the client, the packet is sent there.
2. If there is no client connection to the target computer, the server sends the packet to all computers on which the project is running for which it acts as a server.

3. If the node has a direct client connection to the client, the packet is sent there.
4. If the computer works as a node, then the packet is sent to all computers which have connected to the node computer. It the target computer is also the source computer, the packet is not sent any further.
5. The procedure is continued at point 3.

Note: Points 2 and 4 are only carried out if routing is active on these computers.

Information

The Server and Standby need not correspond to what has been configured on the client computers, otherwise they may change themselves depending on the topology of the respective computer.

WHAT IS A CLIENT CONNECTION?

A network service connection is labeled as a client connection if it is made to the server or standby handling the process by a client. This is recognizable in that there is a connection to port 1100 on the target computer.

Attention

It is not guaranteed that that a pure client computer added to a functional, defined topology will work. It is possible that some projects cannot be reached by the server due to routing on client computers in particular.

RULES FOR ROUTING BEFORE ZENON VERSION 6.50:

1. The first client network project of a branch on a PC defines the server and standby for all subordinate projects in the branch. This also applies
   - If a subordinate project on this PC server or standby were
   - for projects that do not really have a Standby Server
2. If the subordinate project is not a network project or is not a server, the branches of the subprojects of the start project are considered in parallel. Different computers can therefore be servers for the subprojects. The rules from item 1 apply for the branches.
3. Single user projects are not taken into account for the topology, with the exception of the start project.
4. If the start project is not a server (i.e. single user, client or standby not handling the process), routing is not activated in the network service. This only affects the direction from the server to the client.

RULES FOR ROUTING FROM ZENON VERSION 6.50:

The **Routing active** property is deactivated as standard from version 6.50 onwards.

WITHOUT ROUTING

If the **Routing active** property is not active for the start project on the computer, routing does not take place. Each project then connects directly to the corresponding computer, where it is the server. The computer is then not a node and packets are also not routed from here.

WITH ROUTING

The rules as they were prior to 6.50 remain valid.

Exception:

- A project that is a server or standby on the computer remains a server or standby, even if the superordinate project uses another server or standby.

CHECKING THE ROUTING

To check the routing settings, use the procedure from "Administering network topology (on page 64)".

12. Authorization in the network

A network project can be operated from all stations in the same way with the basic settings.

Operating here means actively intervening in the process, such as:

- Send values
- Write recipes
- Acknowledge alarms
- etc.

There is thus the danger that two users on two different stations want to set different values for the same variable at the same time.

In this case:

- Both actions are executed
- The values that is entered last overwrites all previous ones

In zenon you have the possibility to allow operation of the project only from one station at the time. In this case the operator has to get the authorization, before he can operate the project. Opening screens, as well as read access to lists such as AML, CEL, recipes, etc. is possible on each station as always.

> **Information**
>
> *Operating authorizations for projects without a network can be implemented by evaluating a binary variable for the project property* **Operation lock***. For details, see the Operating authorizations chapter in the Project administration and workspace manual.*

PROCEDURE

The following is applicable if the **Authorization in network active** property is active:

- Authorization must be obtained if active operation takes place.
- If operation is blocked by another computer, a dialog is opened on the compute that is blocking it.
- The user who is locking it can approve the authorization or keep it locked.
- If there is no response, the authorization is approved after a pre-set time-out.
- If an interruption in the network connection is recognized, then the authorization for this computer is reset.

For details see chapter:

- Configuring authorization (on page 105)
- Authorization in Runtime (on page 107)

SYSTEM VARIABLES FOR AUTHORIZATION

The system variables inform you about authorization:

- `Computer with authorization`: Name of the computer that has the authorization (string)
- `Authorization present for this computer`: Computer has authorization (Bool)
- `Authorization not granted`: Computer requests authorization, but does not receive it (Bool)

For details, see the Network messages from the system driver (on page 129) chapter.

12.1 Configuring authorization

To enable authorization in the network, you must:

- Activating authorizations and setting time-outs

- Configuring functions for getting and approving operating authorizations in Runtime

ACTIVATING AUTHORIZATIONS

The operating authorization in the network must be activated in the project properties.

- navigate to the **Network** group in Project Properties.
- Activate the **Authorization in network active** property.
- Define the **Timeout for request [s]**:

  Defines the period of time in which a computer can respond to an approval request. The authorization is automatically approved after this time has expired.

  Default: `60` seconds
- Define the **Timeout for authorization [s]**:

  Defines the period of time in which a computer that has authorization must report to the Primary Server. The authorization is automatically approved after this time has expired. Connection interruptions in the network are therefore recognized. The authorization can therefore not be blocked by a compute that cannot be contacted.

  Default: `60` seconds.

  Attention: Select the time period as shorter than the network timeout.

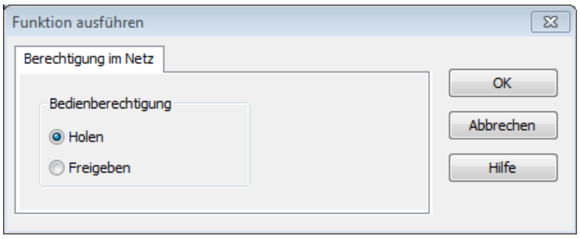
FUNCTIONS FOR AUTHORIZATION IN RUNTIME

To obtain authorizations or to approve these, the corresponding functions must be available in Runtime. To do this, create two buttons that are designated for the corresponding functions:

- Get authorization: Obtains authorization from the user's own computer
- Approve authorization: Approve authorization or explicit request

GET AUTHORIZATION

1. Create a new function.
2. Select the **Authorization in network** function in the `Network` group.
3. The selection dialog for authorizations in the network is opened.



Funktion ausführen

Berechtigung im Netz

Bedienberechtigung

● Holen

○ Freigeben

4. Select **Get**.

If this function is executed in Runtime, the authorization can be obtained from the user's own station.

APPROVE AUTHORIZATION

1. Create a new function.
2. Select the **Authorization in network** function in the `Network` group.
3. The selection dialog for authorizations in the network is opened.
4. Select **Approve**.

If this function is executed in Runtime, the authorization can be approved again.

12.2 Authorization in Runtime

If the **Authorization in network active** property is active, active operations are only executed in Runtime if there is operating authorization for the station.

EXAMPLE

If there is no operating authorization, a set value should be written to a variable:

1. The set value is not sent to the hardware when the button is clicked on.
2. Instead, a message box opens informing you that you do not have the authorization for this project.
3. Click on the button `Obtain the operating authorization`.

DOES NOT BLOCK AUTHORIZATION FOR ANY OTHER COMPUTER:

If the operation is freely available:

- You receive the authorization
- You can write the set value
- You can, after the operation, make this available to others using the `Approve authorization` function

BLOCKS AUTHORIZATION FOR ANOTHER COMPUTER:

If authorization is blocked:

- A dialog is opened on the computer that is blocking
- The user of the computer that is blocking must explicitly release the authorization

- `Yes`: The authorization is passed over to the other computer
- `No`: Authorization remains blocked
- `No reaction`: Countdown corresponding to the time-out time defined in the **Timeout for authorization [s]** property runs out. The authorization is automatically released at 00:00.

13. zenon functions in the network

Special zenon functions for the network:

- `Authorization in network` (on page 108)
- Redundancy switch
  a) in redundancy mode: **Dominant** (on page 109)
  b) in redundancy mode: **Non-dominant** (on page 110)
  c) in redundancy mode: **Rated** (on page 111)

In general, the location of execution (on page 118) must be noted when using functions in the network. For some functions, the location of execution can be freely configured; this is fixed for others.

13.1 Authorization in network

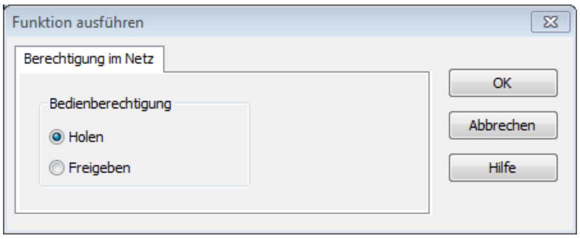
To obtain authorizations or to approve these, the corresponding functions must be available in Runtime. To do this, create two buttons that are designated for the corresponding functions:

- Get authorization: Obtains authorization from the user's own computer
- Approve authorization: Approve authorization or explicit request

GET AUTHORIZATION

1. Create a new function.
2. Select the **Authorization in network** function in the `Network` group.

3. The selection dialog for authorizations in the network is opened.



Funktion ausführen

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● Holen

○ Freigeben

4. Select **Get**.

If this function is executed in Runtime, the authorization can be obtained from the user's own station.

APPROVE AUTHORIZATION

1. Create a new function.
2. Select the **Authorization in network** function in the `Network` group.
3. The selection dialog for authorizations in the network is opened.
4. Select **Approve**.

If this function is executed in Runtime, the authorization can be approved again.

13.2 Redundancy switching in the dominant network

With this function, switching between the Primary Server and Standby Server is possible. The current Primary Server thus becomes the Standby Server and vice versa. The change is permanent until:

- The function is executed again

  or

- Runtime files from the Editor are reloaded

> **Info**
>
> *This function is not suitable for testing redundancy, as the behavior differs from that of a server failure.*

TO CONFIGURE THE FUNCTION:

1. Create a new function.
2. Select, in the Network group, the Redundancy switching function.

   (further configuration is not necessary for the dominant network mode.)

3. Link the function to a button.

13.3 Redundancy switching in a non-dominant network

With this function, switching between the Primary Server and Standby Server is possible. The current Primary Server thus becomes the Standby Server and vice versa. The change is permanent until:

- The function is executed again

  or

- Runtime files from the Editor are reloaded

> **Info**
>
> *This function is not suitable for testing redundancy, as the behavior differs from that of a server failure.*

TO CONFIGURE THE FUNCTION:

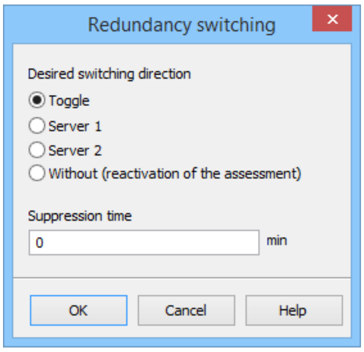
1. Create a new function.
2. Select, in the Network group, the Redundancy switching function.
3. Select the switching direction
4. Link the function to a button.

Scenarios of this being used in practice are, for example: Maintenance work on the Primary Server, improved hardware connection to the Standby Server, etc.

> **Information**
>
> The redundancy switching function is not available if the network has been activated.

13.4 Redundancy switching in an evaluated network

For the **Redundancy switching** function in an evaluated network, the switching direction is also configured in the **Redundancy switching** dialog.



Parameters	Description
Switching direction	
Toggle	**Primary Server** and Standby Server switch roles.
Server 1	**Server 1** becomes (or remains) **Primary Server**.
Server 2	**Server 2** becomes (or remains) **Primary Server**.
Without (reactivation of the assessment)	No switching takes place. Instead, a possible switching for the **suppression time** configured in the properties field is prevented for the configured duration. If the **suppression time** is 0, the switching is carried out immediately. Note: This option is only available in an evaluated network.
Suppression time	The time in minutes, within which no automatic redundancy switching takes place due to an amended evaluation. If the value is 0, the automatic switching is carried out as configured in the evaluation principles. Range of values: 0 to 10080 minutes (= one week) In conjunction with an activated server, this means that the selected server (Server 1 or Server 2) remains the Primary Server during this time, regardless of the current evaluation result. If **Dead time after switching [s]** and the **suppression time** are configured differently in an evaluated network, the greater value prevails here. Note: This option is only available in an evaluated network.

NAVIGATION

Parameters	Description
OK	Applies settings and closes the dialog.
Cancel	Discards all changes and closes the dialog.
Help	Opens online help.

TO CONFIGURE THE FUNCTION:

1. Create a new function.
2. Select, in the Network group, the **Redundancy switching** function.
3. Select the switching direction in the **Redundancy switching** dialog.
4. Enter the `suppression time` (optional).
5. Link the function to a button.

> **Hint**
>
> *Configure a separate redundancy switching function for each switching direction.*

> **Attention**
>
> *After Server 1 has failed and been restarted immediately, the time configured in the* ***Switching delay [s]*** *property at least must expire before redundancy switching can be executed.*
> *If the redundancy switching is executed before expiry of the* ***Switching delay [s]****, two Primary Servers are active before the expiry of the delay time.*

14. Behavior of zenon modules in the network

With network projects, the behavior of individual modules and functions in the network should be noted.

14.1 AML and CEL

ALARMING

The alarming is administered on the Primary Server. The Primary Server answers requests for alarming from the clients. Changes are synchronized between the Primary Server and Standby Server.

CHRONOLOGICAL EVENT LIST

The CEL is administered on the respective Primary Server. Changes are synchronized between the Primary Server and the Standby Standby Server.

In an evaluated network, no CEL entries are created for regrading due to the evaluation.

Hint

In order to log the evaluations in the CEL, create a system driver variable "Evaluation Result Server 1" or "Evaluation result Server 2":

- Select, in the workspace, in the **Variables** node, the **New variable...** entry
- Select SYSDRV - driver for system variables as a **driver**.
- In the **Variables of the system driver** dialog, select the Network entry in the **Theme** entry.
- Select Evaluation Result Server 1 and Evaluation Result Server 2 and add these to those to be created by clicking on the **Add** button.

14.2 Historian

Archiving is carried out on the Primary Server.

The Primary Server synchronizes the archive data with the Standby Server and responds to requests from the Clients (such as calling up an Extended Trend screen).

14.3 Batch Control

The module **Batch Control** is fully capable of using a network in terms of Client/Server technology. This means that Batch recipes can be created, duplicated, edited, deleted, etc. on a Client. The whole recipe management remains always on the server. Likewise the whole process control such as **start** recipe, **pause** recipe, **stop** recipe, etc. can be done from the Client. Also mode changes and manual operations such as **jump** are possible.

Attention

Module Batch Control does not support redundancy. There is no synchronization between Standby Server. When the Server breaks down, the executed Batch recipes are not continued seamlessly on the Standby!

For using Batch Control in a network the following is true:

ALLOCATION

- The forcing of allocations can be carried out be Server and Client.

FUNCTIONS

Functions are always carried out at the Server.

PHASES

- Editing phases in the master recipe:
  - Edit mode: Changes a done locally at the Client.
    If during the editing the recipe is saved on another computer in the network, the current configuration is lost. An appropriate message is displayed and the editing dialog is closed. The new data from the server are displayed.
  - Test mode: Changes a done at the Server.
- Control recipe: Changes a done at the Server.
- If a recipe is saved in the network, all Clients using this recipe are updated.
- If a recipe is opened on a client, the current version on the server is always displayed, even if it has not yet been saved there.
- If a recipe is deleted on a computer, a message is displayed on all computer on which the recipe is opened that the recipe has been deleted.

MODE

- The mode (automatic, semi-automatic, manual) can be switched by the server and the client.
- Jumps in the recipe and step-by-step progress of a recipe can be done from Server and Client.

RECIPES

- Recipes can be started and controlled by the zenon server and by zenon clients.
- If parameters in a recipe are changed whilst the recipe is saved on a different zenon client, the change to the parameters is refused and not carried out.
- A master recipe can be changed on the zenon client whilst it switches to test mode on the zenon server and is sent to the zenon client. The changes that were last saved are transferred. This means: If the zenon client saves last, the recipe is switched to editing mode again. If the zenon server saves last, the change to the zenon clients is discarded and the recipe is in test mode.
- If a communication error occurs when deleting a recipe or an operation template, the deletion is refused with an error message.

WEB CLIENT

With a standard web client:

- The settings for grid and color can be changed
- No recipes can be created or edited
- The size of the editing area cannot be changed
- In the tool bar, all symbols that are not permitted are deactivated; it is not possible to select the corresponding objects.

Web client PRO is not affected by these restrictions.

14.4 User administration

User administration is administered on the Primary Server. Log-in procedure:

1. The login request is sent to the Primary Server.
2. It answers with the list of authorized users.
3. The client verifies the data.

If changes to user administration are made on a client in Runtime, the complete user list is sent from the client to the Primary Server.

> **Info**
>
> **Active Directory, ADAM, ADLDS users**
>
> If Active Directory, ADAM or ADLDS users are used, all computers (regardless of whether they are the Primary Server, Standby Server or Client) communicate directly with the Active Directory, ADAM or ADLDS server.
>
> This means that all computers must be in the corresponding infrastructure (such as Active Directory domains when Active Directory users are used); it is not sufficient that only the Primary Server is in the Active Directory domains with the corresponding users.

14.5 Files

Lists for the files of all modules are created when data is exchanged between the Primary Server and the Standby Server. The Primary Server monitors these lists for changes. Changes that are detected are transferred to the Standby Server.

Attention

The Primary Server does not react to watchdogs that are sent by the Standby Server when lists are created. Note this when stipulating the time for the network timeout.

With Remote Transport, all files required for the project are transferred to the target system.

In doing so, all files are always transferred to the folder:

- Standard

  All files that are in the project's Runtime folder (`...\RT\FILES\zenon\system\`). These files determine the appearance and behavior of the project and are transferred as standard:

  Info

  Files with the following suffixes are not transferred by default:

  - .hot
  - .ho
  - .ret
  - .re

- Optional

  In addition, all files that are embedded into the project must be transferred. They are selected using the **Active** checkbox of the Remote Transport settings. These files are in the following subfolders of the project directory:

  - `\zenon\custom\graphics`: for graphics
  - `\zenon\custom\lists`: for language tables
  - `\zenon\custom\media`: for all media files
  - `\zenon\custom\reports`: for the reports of the Report Generator
  - `\zenon\custom\help`: for help files
  - `\zenon\custom\additional`: for additional files
  - `\zenon\custom\additional`: for Report Viewer files
  - `\zenon\custom\drivers`:for drivers
  - `\straton`: for zenon Logic

  Recommendation: Project basis path, graphics, language tables, report tables and media files are always transferred.

The following are transferred from the basis path by default: The files `project.ini`, `Projekt.vba`, `Monitor.mon` and the `Projekt` folder.

As a default zenon always uses relative paths and not absolute paths, so that the files can easily be found on the target system.

For the files that can be transferred optionally, the original paths should be used (empty field under target), so that zenon can find them on the target system.

GLOBAL PROJECT

> **Attention**
>
> *If the time difference between the server and the client is more than 5 seconds, no more files are synchronized.*

14.6 Extended Trend

Extended Trend shows information from archives and online data. This data is saved in the Primary Server and requested by the Primary Server if required (if a trend screen is called up on the client).

14.7 Functions

For functions that are used in the network:

- The place of execution can be freely configured in some cases
- The place of execution is stipulated in some cases

> **Information**
>
> *Scripts combine several functions. The place of execution then depends on the settings of the* `Execute script` *function. This setting overwrites the settings of the individual functions.*

CONFIGURE PLACE OF EXECUTION

For functions where the place of execution can be freely configured, the corresponding parameters are available in the properties of the function.

To define the place of execution:

1. navigate to the **Execution** group in the Properties.
2. Select the desired place of execution by checking the checkbox. Multiple selection is possible:
   - **Current computer**: Function will be executed on the current computer.
   - **Primary Server**: Function will be executed on the Primary Server.
   - **Standby Server**: Function will be executed on the Standby Server.
   - **Client**: Function will be executed on all clients.

OVERVIEW OF FUNCTIONS IN THE NETWORK

The following table shows which functions are executed and where they are executed.

Key:

- `Adjustable:` Behavior can be configured

  +: Yes

  -: No

  O: Default

- If not adjustable, O identifies the place of execution:
  - Active computer
  - Primary Server
  - Standby Server
  - Client

Function	Adjustabl e	Current computer	Primary Server	Standby Server	Client
AML and CEL					
Alarms: acknowledge flashing	-	O			
Alarms: delete	-		O	O	
Acknowledge alarms	-		O	O	
Alarm/event group log in/log off	-	O			
Activate/deactivate alarm message list / alarm/event groups / alarm/event classes	-		O	O	
Alarm Message List active	-		O		
Alarm Message List active/inactive	-		O		
Alarm message list inactive	-		O		
Export AML	+	O			
Save AML and CEL memory buffer	-		O	O	
Export CEL	+	O			
Print AML or CEL	+	O			
Create/print IPA document	-		O		
Switch online printing on/off	-		O	O	
Online printing start new page	+	O			
Switch online printer	-		O		

Application					
Select printer	+	O			
Start Load Management	-		O		
Stop Load Management	-		O		
Print Extended Trend diagram	+	O			
Switch palette	+	O			
Functions active at limit	-		O	O	
Functions active/inactive at limit	-		O	O	
Functions inactive at limit	-		O	O	
Open Help	+	O			
Reload project online	+	O			
Determine open maintenances	-		O		
PFS - execute user-defined event	+	O			
Activate/deactivate project simulation	-	O			
Simulate right click	+	O			
Save remanent data	+	O			
Exit Runtime	+	O			
Analyze S7 Graph heuristics	+	O			
Execute SAP function	+	O			

Language switch	+	O			
Topology - Search for ground fault	-		O		
Topology - LoadShedding	-		O		
Historian					
Archive: Stop	-		O	O	
Index archive	-		O		
Archive: Start	-		O	O	
Export archives	-	O			
Display open archives	-		O	O	
User administration					
Change user	+	O			
Login with dialog	+	O			
Login without password	+	O			
Logout	+	O			
Change password	-	O			
Screens					
Change ALC source color	+	O			
Indexed screen	-	O			
Close screen	+	O			
Screen: Return to last	-	O			
Screen: Move center	+	O			
Screen switch	+	O			
Activate input to the element with the focus	+	O			
Set focus to frame	+	O			
Move focus	-	O			
Take focus away from frame	+	O			
Show menu	+	O			
Monitor assign	+	O			
Runtime profiles	+	O			
Close frame	+	O			
Setpoint input for keyboard screen	-	O			

Displaying the overview window	+	O			
Fault locating in electric grids					
Acknowledge ground fault message	+	O			
Stop search for ground fault	+	O			
Start search for ground fault	+	O			
Acknowledge short-circuit message	+	O			
Message Control					
Save current queue	-		O		
Suppress groups/classes/areas/equipment	-		O		
Send a Message	-		O		
Send Message: activate	-		O		
Send Message: deactivate	-		O		
Network					
Authorization in network	+	O			
Redundancy switch	-			O	
Report Generator					
Print report	+				
Report: execute	+				
Export Report	+				
Recipes					
Recipegroup Manager	-	O			
Standard recipe	-	O			
Standard recipe single directly	+	O			
Standard recipe single with dialog	-	O			
Standard recipe single with online dialog	-	O			
Script					
Script: execute	+	O			
Script: select online	+	O			
Variable					
Export data	-		O		

Read dBase file	+	O			
Print current values	+	O			
Unit conversion	+	O			
HD administration active	-		O	O	
HD administration inactive	-		O	O	
HD administration inactive/active	-		O	O	
Write set value	-		O		
Driver commands	-	O			
Transfer driver simulation image to the standby	-			O	
Write time to variable	+	O			
Read time from variable	+	O			
VBA					
Open PCE editor	-		O		
Open VBA Editor	+	O			
Execute VBA macro	+	O			
Show VBA macro dialog	+	O			
VSTA					
Open VSTA editor	+	O			
Execute VSTA macro	+	O			
Show VSTA macro dialog	+	O			
Windows					
Play audio file	+	O			
File operations	+	O			
Start continuous tone	+	O			
Stop continuous tone	+	O			
Window to the background	-	O			
Window to foreground	-	O			
Print screenshot	+	O			
Start program	+	O			

14.8 Message Control

Message Control will be executed on the Primary Server.

The Primary Server synchronizes with the Standby Server.

14.9 Programming interfaces

VBA AND VSTA

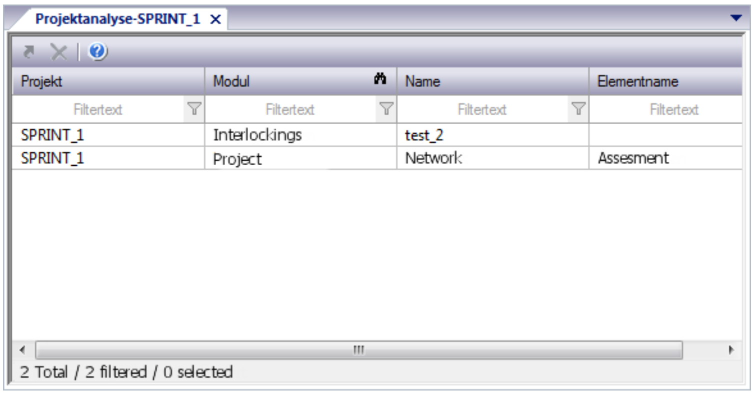
Code in VBA or VSTA is always, by default, executed locally on the system on which it is started or where events occur.

The place of execution can however be defined otherwise when this is called up via the function (on page 118).

PCE

PCE is always executed on the server in the network. On standalone computers in standalone projects.

14.10 Cross reference list



Projekt	Modul	Name	Elementname
Filtertext	Filtertext	Filtertext	Filtertext
SPRINT_1	Interlockings	test_2	
SPRINT_1	Project	Network	Assesment

2 Total / 2 filtered / 0 selected

The use of variables in evaluated networks is also taken into account. The property name of the place of usage is stated as the element name. This is either "`event variable`" or "`evaluations`".

You can find out further information in the cross-reference list manual.

14.11 Report Generator & Report Viewer

The `*.xrs` files of the Report Generator and the `*.rdl` files of the Report Viewer are synchronized on all systems in the network (Clients, Standby Server, Primary Server).

EDITOR

If the file is modified in the zenon Editor, transferred to the Primary Server and reloaded, it is automatically distributed to the other computers in the network.

RUNTIME

If the file is amended in Runtime, the changes are only saved on a temporary basis and replaced the next time a reload takes place or when Runtime is restarted.

14.12 Recipes

The execution of recipes is different for standard recipes and the RGM.

STANDARD RECIPES

Standard recipes are managed on the Primary Server and on the Standby Server.

If a standard recipe is changed by a user in Runtime, the client requests the full recipe list from the Primary Server. In the event of changes, the recipe list is sent back to the Primary Server.

> **Information**
>
> *This list is not identical to the file rezepturen.cmp*

If a recipe is changed and executed in Runtime on the client, it is executed with the new values. When the standard recipe, you are given the option to save the changes.

RECIPEGROUP MANAGER

When the Recipegroup Manager screen is loaded on the client, a list of all recipe names is requested by the Primary Server. As soon as a recipe is selected, it is loaded by the Primary Server.

14.13 Scripts

Scripts combine several functions. The place of execution depends on the settings of the `Execute script` function. This setting overwrites the settings of the individual functions.

The execution of scripts in the network is controlled with predefined scripts:

Script	Description	Place of execution
AUTOSTART	The script is executed automatically when Runtime starts before the start screen is loaded if the project is the Runtime start project. It is not executed when subordinate projects are started.	**Network project:** Primary Server **Single-user project**: Active computer
AUTOEND	The script is executed automatically when Runtime is ended if the project is the Runtime start project. It is not executed when subordinate projects are ended.	**Network project**: Primary Server **Single-user project**: Active computer
AUTOSTART_CLIENT	The script is executed automatically on a client when Runtime starts before the start screen is loaded if the project is the Runtime start project. It is not executed when subordinate projects are started.	Client
AUTOEND_CLIENT	The script is executed automatically on a client when Runtime is ended if the project is the Runtime start project. It is not executed when subordinate projects are ended.	Client
AUTOSTART_SRVPRJ	Script is executed automatically when Runtime is started for any desired project on the Primary Server before the start screen is loaded.	Server
AUTOSTART_SRVPRJ	Script is automatically executed when Runtime of a desired project is ended on the Primary Server.	Server

14.14 Driver - Variables - limit values

In the zenon network, the Primary Server normally communicates with the controller via the driver. Requests from the Client are routed via the Primary Server. This gets the information from the controller and forwards it to the Client. Limit values are monitored by the Primary Server.

DRIVER

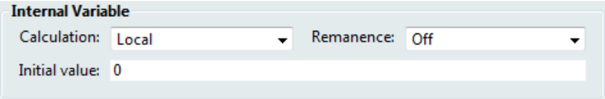
Drivers are executed on the Primary Server and Standby Server.

INTERNAL VARIABLES

For internal variables, it is possible to define whether each individual variable is calculated locally or in the network in zenon.

To do this:

1. Navigate to the **Internal Variable** node in the properties of internal variables



Internal Variable

Calculation: Local

Remanence: Off

Initial value: 0

2. Define the place of execution using the **Calculation** property:

   a) Local: The internal variable is evaluated and managed locally for network projects, i.e. also on the Standby Server and the Clients. The values are not synchronized with other computers in the network.

   b) Network: With network projects, the internal variable is evaluated and administered on the project's Primary Server. It has the same value on the Primary Server and all Clients.

Note: Not available if the CE terminal serves as a data server. You can find further information in the zenon Operator manual in the CE terminal as a data server chapter.

LIMIT VALUES AND REACTION MATRICES

In principle, limit values and reaction matrices are monitored on the Primary Server (where the AML is also administered).

Furthermore, the following applies for local internal variables:

- Limit values and reaction matrices are monitored locally on all computers (Primary Server, Standby Server and Clients).
- Linked limit values are only executed where the limit value of the local internal variable was breached.
- Limit value breaches of these variables on the Standby Server or Client are not an alarm.

14.15 Time control

Time control will be executed on the Primary Server. The function triggered is executed on the systems that were selected for execution of the function in the settings.

14.16 Allocations

Allocations are always executed on the Primary Server.

⚠ **Attention**

This is relevant to local internal variables most of all. These are not executed on the Standby Server or on Clients!

15. Network messages from the system driver

The following system driver variables are available for this subject area:

Name	Data type	Comment
Current Primary Server	STRING local	Computer name of the current Primary Server If the name was acquired from the hosts file, it will be the name used there. For DNS, this is the fully qualified domain name. Note: If the network is deactivated, the variable sends the status INVALID. The **Current Standby Server** remains empty in contrast.
Current Primary Server	STRING local	Computer name of the server which is currently not handling processes. If the name was acquired from the hosts file, this is the name entered there. For DNS, this is the fully qualified domain name.
Number of connected clients	UDINT	Delivers the number of clients currently connected to the server. This number also includes the standby server, if there is one.
Authorization: not granted	BOOL	Shows whether a requested authorization is denied in the network. The value of this variable is changed only for a short time and then changed back to the initial state. - 0 = operating authorization request accepted - 1 = operating authorization request declined
Authorization: Present here	BOOL	Shows whether there is an authorization for the current project on the local computer. - 0 = No - 1 = Yes
Authorization: Computer that owns it.	STRING	Shows the name of the computer that has the authorization for the currently loaded project.
Result of evaluation, Server 1	UDINT	In the event of changes to a variable from the evaluation matrix, this value is written to the corresponding system driver variable for Server 1 and Server 2 after calculation of the new result of the evaluation. The values are equal to one another (server <-> standby), so that the current value is always displayed on both sides. However, after the other side has a failure, this value remains for the attendant variable and only updates itself once it reconnects. Note: You can find further information on evaluation in the Network (on page 6) manual in the Configuration of redundancy evaluation (on page 82) chapter.
Result of evaluation, Server 2	UDINT	In the event of changes to a variable from the

		evaluation matrix, this value is written to the corresponding system driver variable for Server 1 and Server 2 after calculation of the new result of the evaluation. The values are equal to one another (server <-> standby), so that the current value is always displayed on both sides. However, after the other side has a failure, this value remains for the attendant variable and only updates itself once it reconnects. Note: You can find further information on evaluation in the Network (on page 6) manual in the Configuration of redundancy evaluation (on page 82) chapter.
Names of connected clients	STRING	Delivers the names of the clients currently connected to the server. The standby server, if there is one, is also included.
Network timeout [ms]	UDINT	Shows the timeout in milliseconds for the zenon network as configured in the project configuration.
Primary Server <-> Standby Server data synchronization	BOOL	A binary variable that takes the value 1 for a short time when the system performs a redundancy switch between server and standby server. - 0= No Redundancy switch over - 1= Redundancy switch over
Server failure	BOOL local	Indicates that the connection to the process handling server was lost. Depending on the network position of the computer, this means: - Dominant Server: While it is not yet the process handling server, the value changes to TRUE if the connection to the process handling server is lost. Always FALSE after synchronization. - Non-dominant Server: Changes to TRUE if the connection to the dominant server, which was the process handling server, is lost. Changes back to FALSE if the Standby Server was promoted to be the Primary Server. EVALUATION: Preferably via a REMA, as the Alarm Management is also swapped and taken over by the SB at that time. The Online Container is also not suitable because the variables are re-initialized during redundancy switching. - Client: Changes to TRUE if the connection to the process handling server is lost. Changes back to FALSE if the client connects to the SB computer that is now the process handling server.
Primary Server shut down	BOOL	Indicates the regular stop of the process handling server. The value changes to TRUE if the process handling server was

	`local`	stopped properly. FALSE if there is a process handling server in the net. Depending on the network position of the computer, this means: ▸ • Dominant Server: While it is not yet the process handling server, the value changes to TRUE if the process handling server has stopped. ▸ • Non-dominant Server: Changes to TRUE if the dominant server, which was the process handling server, has stopped. Changes back to FALSE if the StandBy was promoted to be the process handling server. ▸ EVALUATION: Preferably via a REMA, as the Alarm Management is also swapped and taken over by the SB at that time. The Online Container is also not suitable because the variables are re-initialized during redundancy switching. ▸ • Client: Changes to TRUE if the dominant server has stopped. Changes back to FALSE if the client connects to the SB computer that is now the process handling server. Is also TRUE while the process handling non-dominant server changes back to be the non-process handling server.
`Standalone/Primary Server/Standby Server/Client`	`DINT`	Shows the type of the local computer in the network. ▸ `-1` = Standalone ▸ `0` = Client ▸ `1` = Primary Server ▸ `2` = Standby Server

`Server-Standby in data update`	`BOOL`	A binary variable that takes on the value 1 if the server and the standby server are synchronizing files after a redundancy switch.
		`0 = no data sync`
		`1 = file sync active`

`Standby Server failure`	`BOOL`	Changes to TRUE if the connection to the currently non-process handling server is terminated unexpectedly. If there is a connection, the value is FALSE. Depending on the network position of the computer, this means: ▸ Dominant Server: The variable only acts as described from the time when the standby became the server handling the process.

		- Non-dominant Server: If, during file synchronization, the connection to a server that is dominant but is not handling the process is interrupted, the value changes to TRUE. Always FALSE if not the server handling the process. - Client: As per server handling the process.

Standby Server shut down	BOOL	Is TRUE on the process handling server, if the non-process handling server was stopped properly and if there is no connection anymore. Changes to FALSE if the non-process handling server has registered at the process handling server. Depending on the network position of the computer, this means: ▸ Dominant Server: Only from the time when the standby became the server handling the process does the variable act as described. ▸ Non-dominant Server: If this is ended during file synchronization with a server that is dominant but is not handling the process, the value changes to TRUE. Always FALSE if not the server handling the process. ▸ Client: As per server handling the process.
Standby Server started:	BOOL	TRUE if the non-process handling server has registered at the process-handling server and if the data update was performed and the connection between the two computers is active. Depending on the network position of the computer, this means: ▸ Dominant Server: Only from the time when the standby became the server handling the process does the variable act as described. ▸ Non-dominant Server: Becomes TRUE if the dominant server not handling the process starts. Changes to FALSE if the computer is the server handling the process. ▸ Client: As per server handling the process.
Switch from Primary Server to Standby Server	BOOL	A binary variable that takes on the value 1 if the server becomes the standby server during a redundancy switch. ▸ 0= registered server is available as server in the network. ▸ 1 = registered server is available as standby server in the network.
Switch from Standby Server to Primary Server	BOOL	A binary variable that takes on the value 1 if the standby server becomes the server during a redundancy switch. ▸ 0 = registered Standby Server is available as standby server in the network. ▸ 1 = registered Standby Server is available as server in the network.