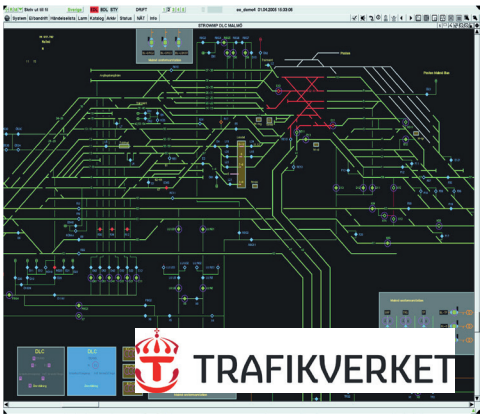


Reference Project
PSIcontrol at Trafikverket

PSI

PSI*control* at Swedish Railways

The Project:

Trafikverket (previously Banverket) is the authority responsible for rail and road traffic in Sweden. Trafikverket tracks market development and conducts research and development in the railway sector. It also advises Government on railway issues. Moreover, Trafikverket is responsible for the operation and management of state track installations, they coordinate the local, regional and interregional railway services and provide support for research and development in the rail sector.

Trafikverket operates a 132 kV (transmission) and 15 kV (catenary) network. The 15 kV network is divided in 8 distribution areas.

PSI has been awarded the contract to supply and install the new nation-wide control center for Trafikverket. In the first stage the eight formerly uncoupled SCADA systems for electric supply management were replaced by one single integrated system. In a second step, the scalability of PSI*control* was used to integrate the supervision of a public railway tunnel.

*PSI*control* serves as nation-wide SCADA platform for electrical supply management and infrastructure supervision.*

Project Objectives:

An important purpose of the new system is to improve trouble detection and removal.

As a result train service interruptions are minimized and higher safety for the maintenance personnel involved in planned work is achieved.

Due to the distributed but integrated system structure, personnel at different locations can easily cooperate in case of risky large scale disturbances.

As a result, single dispatch center evacuations (e.g. due to accidents) can be tolerated, as the unique system architecture allows other centers to seamlessly take over operation.

*One PSI*control* system:*
- *eight dispatch centers*
- *better disturbance detection*
- *higher safety*
- *supervision of a public railway tunnel*

The new system provides:

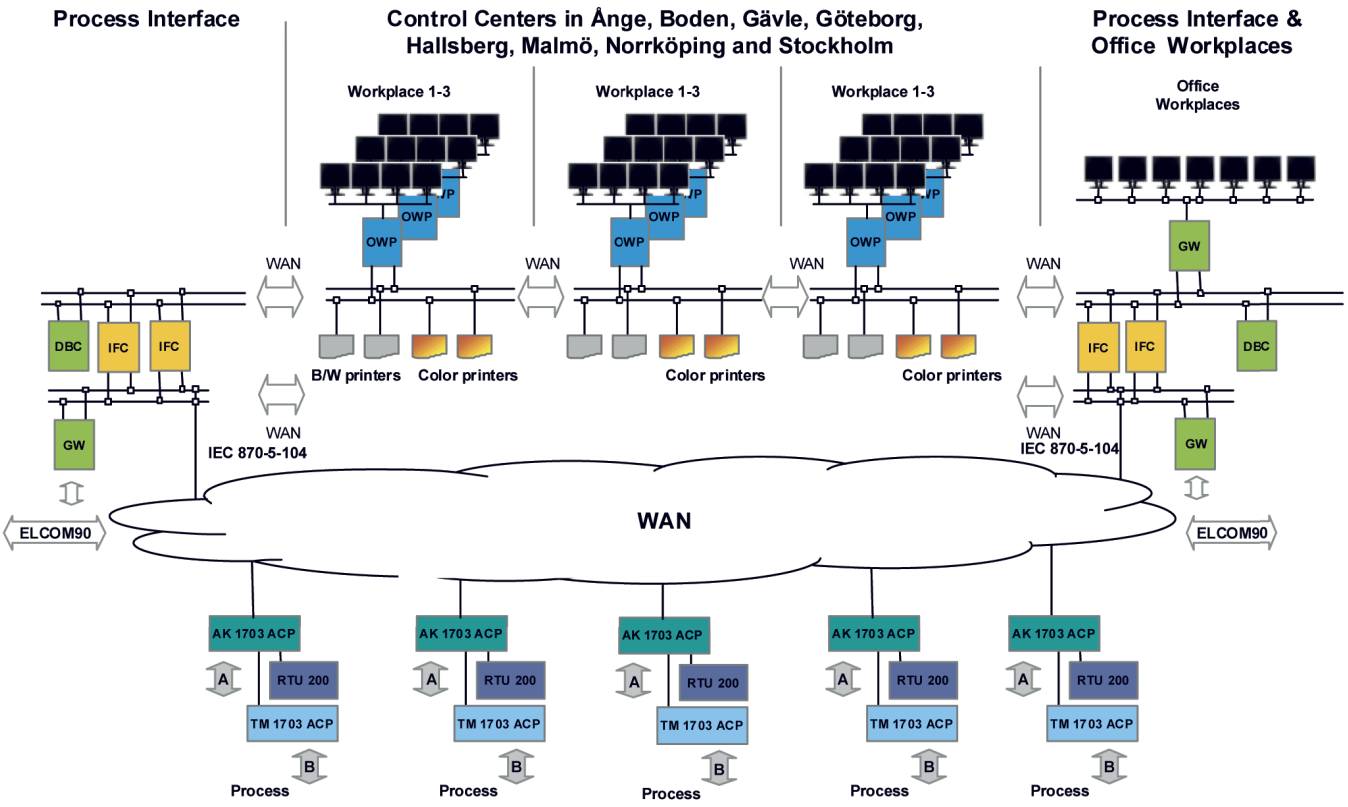
1. Secure power supply at all times
2. Improved follow-up following disruption in train services
3. Higher reliability of data acquisition communication
4. Fast removal of disruptions
5. Improved safety of personnel
6. Reduced management costs

System Engineering:

To fulfill the high availability requirements of Trafikverket, the system is installed with a fourfold redundancy. Two redundant central system components are installed at two completely independent locations.

The PSI*control* system for Trafikverket is designed to allow up to 50 concurrent operators and 25 maintenance engineers to work in parallel. The workplaces are installed in 8 different dispatch centers as well as in the training center.

Highest availability due to multiple redundancies.



Specific Functions

Switching programs and target data preview support the dispatcher in switching operations.

For the purpose of railway catenary segment switching, PSI*control* provides sophisticated switching programs especially developed for railway operators to speed up the switching process of complex catenary systems.
It is possible to preselect complex switching operations with one click. PSI*control* automatically selects the best sequence to achieve the target state without unwanted temporary energization or deenergization of adjacent segments. The result shows the outcome of the switching operation in the online mode without executing the operation (preview mode).

Training Simulator for the Railway Catanary System

The integrated training simulator provides a quasi-live system environment for education.

The integrated dispatcher training simulator (DTS) provides for a realistic environment for the education of new dispatchers or for refresher courses. In order to start a typical training session, two or more regular workplaces (otherwise used as dispatcher or data engineering workplaces) are started in trainer and trainee mode, respectively. From creating a single alarm to activating complex disturbance scenarios, the trainer has full control of the information flow to all trainee workplaces. With the help of PSI*control*'s relay toolkit, realistic system behavior can be achieved (e.g. time-triggered automatic reenergization attempts, modelling local hardware interlocks, etc.)
Based on actual timetable the movement of trains is simulated, which leads to a realistic network load in the DTS. Also, since the position of the trains on the tracks is displayed, the trainee is able to use a quasi-live system basically indistinguishable from the real thing.

CityTunneln Malmö - Supervision and Control of a Public Railway Tunnel

Introduction

*PSI*control* is the top-level SCADA system for the tunnel supervision.*

CityTunneln Malmö is a railway infrastructure project in southern Sweden, which substantially improves the public transport system in the Öresund region (local area around Malmö including the Öresund bridge to Copenhagen, Denmark). At its core are two 6 km long parallel railway tunnels below the city of Malmö including three new underground train stations.
PSI*control* is used for the supervision and control of the infrastructure. As

the top-level SCADA system it monitors lower-level security systems and acquires fire and fault alarms to be sent to the Operations Management Centre. The SCADA system can also coordinate the control of different actions, for example to ensure rapid response to accidents.

Supervised Infrastructure

Support for correct decisions and quick actions in a case of emergency.

The SCADA system controls several technical subsystems like ventilation, fire detection, fire water supply, etc. via PSI*control*'s HMI. Furthermore, all elevators and escalators in the three new train stations are supervised and the operation status of the video cameras is monitored.

In total the technical status of the tunnel is monitored via the help of ~6500 binary indications and several hundred analog signals. In the control direction there are ~600 double commands towards technical subsystem, which, in turn, control several thousand devices (fans, pumps, valves, illumination, door controls, etc.).

Action Plans

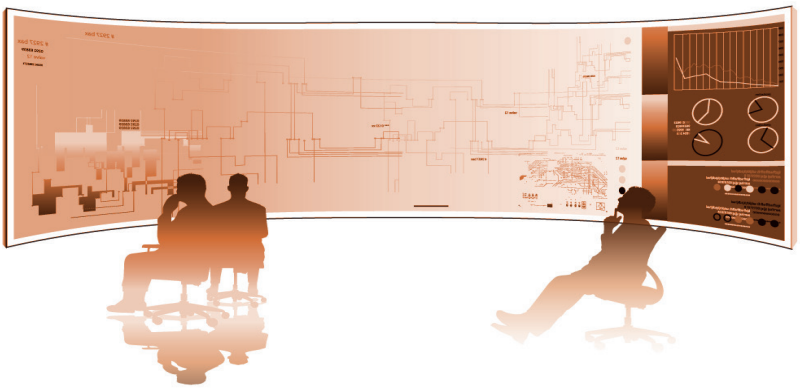
In case of an emergency (e.g. fire alarm or train accident) there is a need to locate the problem as precisely as possible and to start appropriate actions quickly. For this purpose the software package ActionPlans has been developed which helps the operator in selecting the correct rescue program and guides him through the necessary steps. Roughly 20 action plans have been implemented, which for any foreseeable critical situation in the tunnel or on the platforms contain the appropriate actions. By starting a particular action plan, specific commands are sent to technical subsystems, which in turn trigger a sequence of actions. An example would be to properly activate the ventilation system in order to keep the platforms free of smoke. Specific responses from the process are displayed within the action plan dialog which enables the operator to take further actions, if necessary.

Integration of Videostreams

Integrated video streams can show every place in the tunnel where an alarm might come up.

An independent third-party video system has been installed in the tunnels and on the platforms which maintains approximately 200 video cameras. The corresponding video streams are fully integrated within the SCADA system, i.e. they are part of PSI*control*'s HMI. It is possible to switch between single and quadruple stream depiction. Furthermore the cameras can be constrolled (panning, zooming) via the interaction with a video server.

Using PSI*control*'s Drag&Drop philosophy a specific video stream can be accessed by simply dropping the corresponding camera in the video dialog.
The operator can select an individual video camera out of any event/alarm list to get the corresponding station display selected.
As a typical PSI*control* feature, by clicking on an entry of an alarm/event list, the operator can directly access the corresponding station display. In addition, by preselecting the video mode, the operator can also select from the alarm/event list up to four associated video streams.



PSI*control* at Swedish Railways in keywords

The System is designed for:

- 50 Operator work places
- 25 data engineering places
- 1 500 RTUs
- 140.000 indications/alarms,
- 20.000 dual controls and
- 20.000 measurands.

The System Provides:

- A nation-wide distributed and highly scalable system architecture.
- Highest system availability due to fourfold redundancy.
- An integrated work management solution.
- Railway-specific SCADA and DMS functionality.
- Data exchange with Bombardier train management systems via Elcom90.
- More than 80 SAT AK 1703 data concentrators are distributed over Sweden to communicate with up to 1.500 regular RTUs.
- Supervision and control of a public railway tunnel.

Catenary Specific Functions:

- Target State Preview,
- Switching programs for all (single and multiple) network switching operations with substitute supply and
- Dispatcher training simulator.

Tunnel Specific Functions:

- Action plans for emergency situations (fire, train accident, etc.) and
- Integration of video streams.

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