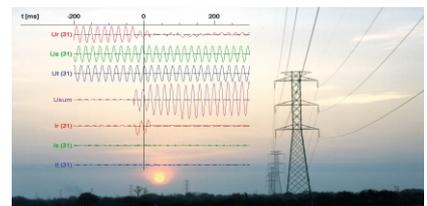


# Inform<sup>IT</sup> Power System Monitoring

The PSM solution transforms bay level data into valuable utility decision support



**ABB**

# First class decision support to improve outage management, power grid reliability and investment planning



## ...supporting the Operator

Alarm in the control room. After an emergency shutdown of two generators, part of the grid is without energy. In weighing up the various possibilities you are aided by precise fault location and information. The printed short fault report helps you to take the right decisions and restore the power in one go.

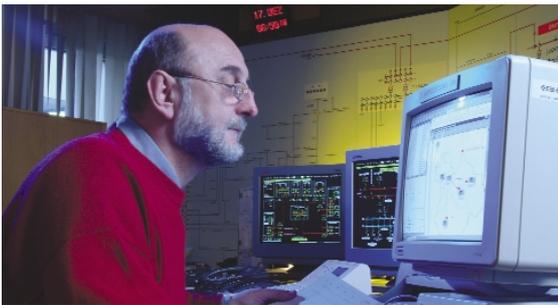
*This is one of many possible stories. –  
The story of PSM with a workplace and a printer  
installed in the control room.*



## ...supporting Maintenance management

Imagine you are out in the field and your mobile rings, displaying brief information on the type and location of a recently occurred fault. You confirm with your outage manager, who tells you that your colleague is on his way with the needed tools and spare parts. Doesn't it sound convenient and highly efficient?

*This is one of many possible stories. –  
The story of PSM installed with the notification service  
for faster fault repair.*



### **...supporting the Protection engineer**

Imagine a fax notifies you of two serious faults on important transmission lines in the morning and by lunchtime you hand in your detailed written report containing the results of your analysis. You have made efficient use of the meantime analysing all automatically collected disturbance records in detail with a powerful evaluation tool helping you to draw the right conclusions.

*This is one of many possible stories. –*

*The story of PSM where a protection engineer's workplace makes postmortem analysis easy.*



### **...supporting the Manager**

You are busy planning the investment budget for next year contemplating the many ideas received from your departmental managers. One of them has sent you a statistic clearly showing the weak points in the power grid and proposing actions to improve both its uptime and reliability.

You finalize the budget proposal and, considering the statistic, you add an investment to extend the tool, that provided it.

*This is one of many possible stories. –*

*The story of PSM, which allows incremental implementation in both functionality and the area covered.*

# PSM is a comprehensive, automated solution to improve utility performance

## PSM provides decision support information around the clock and wherever you need it:

- By making use of automatically uploaded data from system-wide sources\* to a central database and evaluating it with embedded expertise.

- By providing the right people in your organization with relevant evaluation results for swift response to disturbances in the power system.

- By facilitating analysis of long-term statistical data and information to reveal possible weak points in order to prevent recurring problems.

The need for utilities to increase profitability and to raise supply quality to consumers is ever present. One way to achieve this is by increasing power system uptime whilst saving on maintenance costs.

A Power System Monitoring (PSM) solution can help you do just that.

### **Fast access to precise information from anywhere is the key to reducing outage time.**

Upon the occurrence of a disturbance in the power system, the associated data must be gathered and analyzed expediently. Adequate information must be generated to enable the operation and maintenance engineers to take the right decision for corrective action rapidly.

PSM takes care of all this for you, all automated and timesaving.

### **Efficient utilization of resources is the key to saving maintenance cost.**

The scalable PSM solution serves different user groups in operation, maintenance, protection and planning departments in efficiently gaining access to system-wide information for their tasks: fault information, parameters, statistics and trends.

Automated data collection and evaluation, faster fault location and repair, quicker power restoration as well as identification and elimination of weak spots in the power system – all support efficient use of sparse resources.

### **The network level system solution provides:**

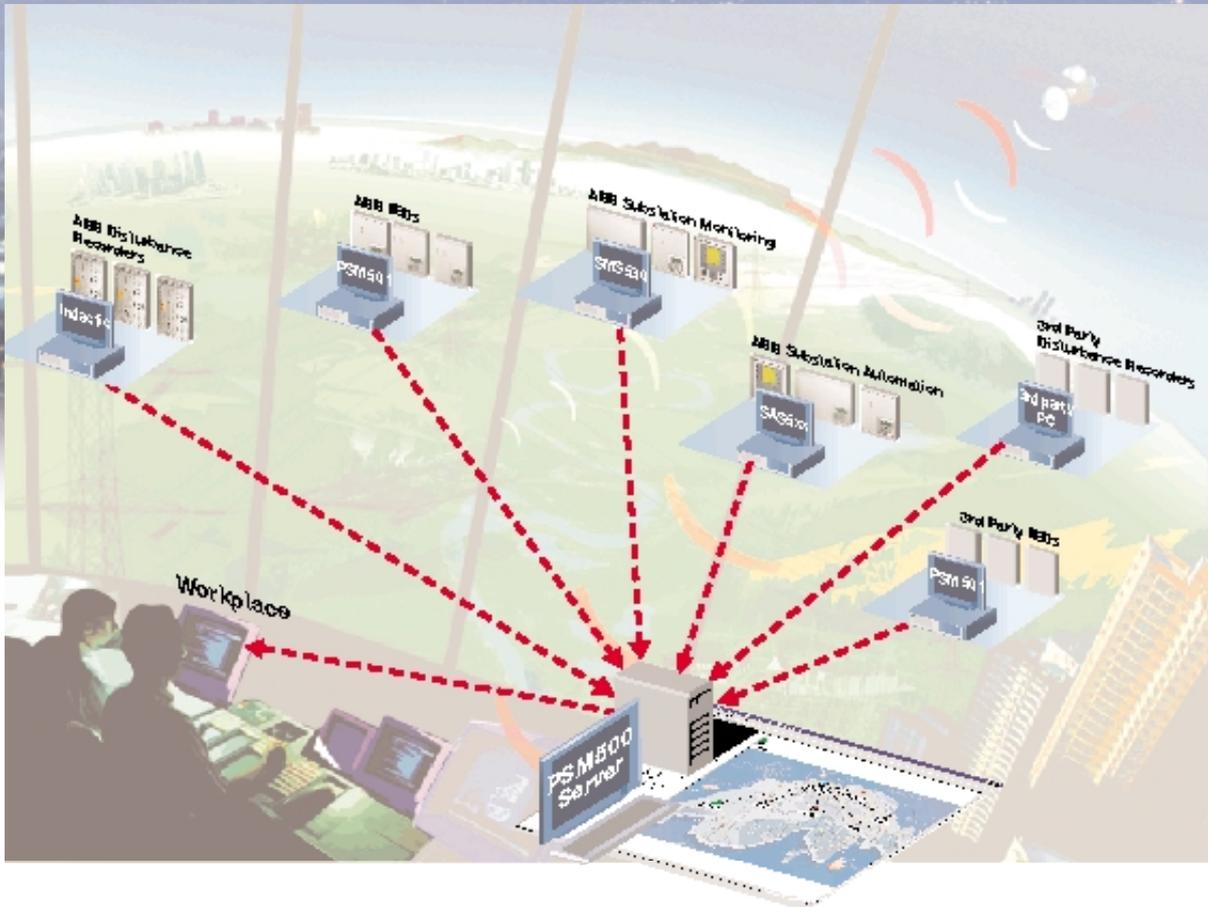
Seamless integration of your installed base of secondary equipment\* to the system via diverse communication channels facilitates the automated collection of data such as disturbance records, events, alarms, process values and parameters.

Embedded expertise ensures consistent and accurate data evaluation. Concise information is available within minutes of the fault occurrence.

Automated notification and report services instantaneously alert designated users via various communication means.

Utility-wide access to all stored data and information supports the protection engineer in conducting detailed analysis of any occurrence, if required.

\*Intelligent electronic devices (IEDs) for protection, control and monitoring as well as station automation and/or monitoring systems, disturbance recording systems and any Windows based PC (NT, 2000, XP).



### Flexible implementation

The scalability of PSM affords customers the choice to start with the implementation for one substation and to add further substations as needed.

Similarly the modular functionality can be implemented step-wise, starting with the functions that elicit most immediate benefits. You can add any of the self-contained function modules such as the geographical information system, web interface, data exchange with own or customer's IT applications at any time to suit your needs.

The incremental implementation supports scalable investment patterns, yet gives you benefits right from the onset.

### Main benefits

- Up to 40% cost reduction in maintenance owing to automated data collection, evaluation and precise dispatch of the repair team
- Increase in uptime and reduction in earning losses through faster repair
- Shorter response time through instantaneous messaging services providing the right information to the right persons at the right time
- Prolonged lifetime of primary system components
- Prompt availability of short, precise and dependable information to swiftly locate and correct problems
- Support with identification of problems and weak spots causing disruption of power delivery

# The PSM solution provides benefits on every level...

## ...for the Operator:



The automatically generated short fault report gives you the relevant information around the clock.

## ...for the Protection engineer:

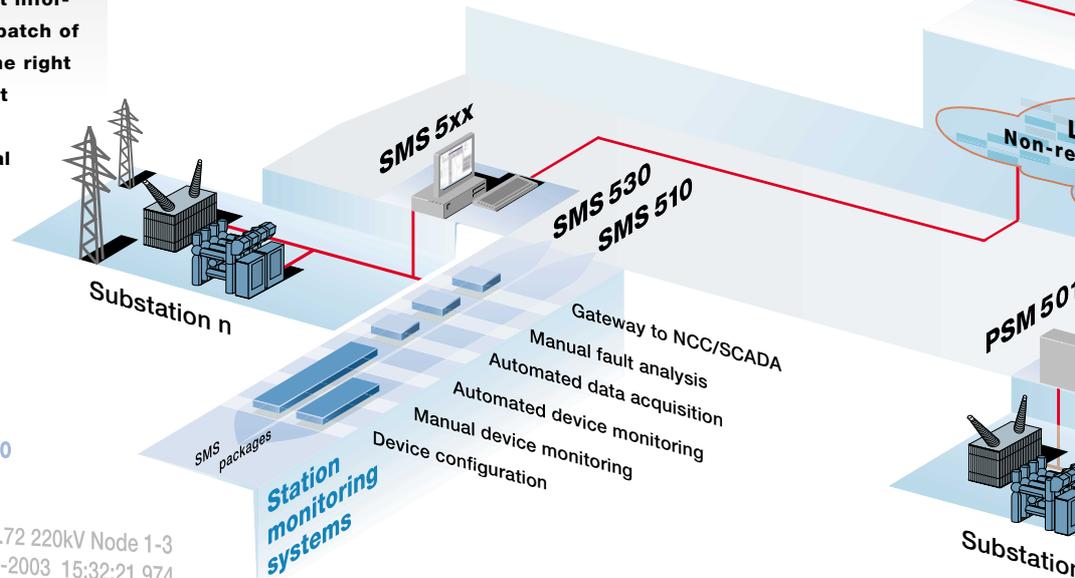


Fault evaluation algorithms are applied automatically on the server. All disturbance records and calculation results are organized in a central database. Powerful tools provide you with user-friendly support in manual post-mortem analysis.

## ...for Maintenance management:



Instantaneously provided fault information allows the prompt dispatch of the maintenance team with the right equipment to the precise fault location. Response can be further enhanced by the visual fault location display on GIS.



### Automatic Fault Location FLT3.0/0

#### 1. Event:

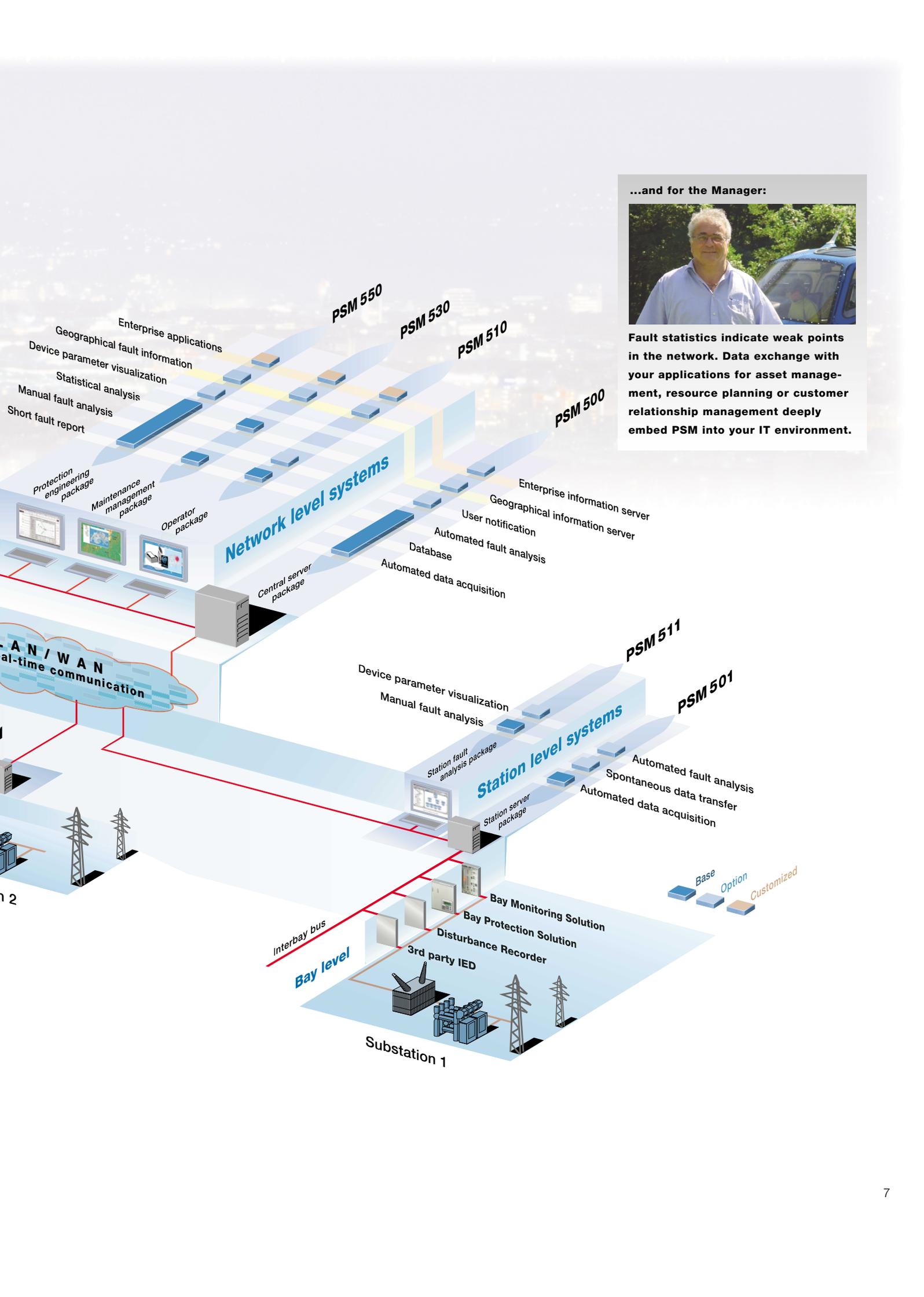
Station name = Acq.St.72 220kV Node 1-3  
 Event date and time = 19-Jun-2003 15:32:21.974  
 Line name = Katturi to Highland Ville  
 Line length = 26.0 km

#### 2. Trigger:

Type of trigger (6) = Analog limit high  
 Trigger signal = D01220 IR

#### 3. Fault Location:

Fault type = R - 0  
 Fault duration = 457.5 ms (-18.3 ms .. 439.2 ms)  
 Impedance at 103.3 ms = 4.21 Ohm, 80° primary  
 Distance to fault = 13.1 km (± 3.0 % = ± 0.4 km)



...and for the Manager:



Fault statistics indicate weak points in the network. Data exchange with your applications for asset management, resource planning or customer relationship management deeply embed PSM into your IT environment.

# The PSM system is open, flexible and modular — ready for tailor-made monitoring solutions

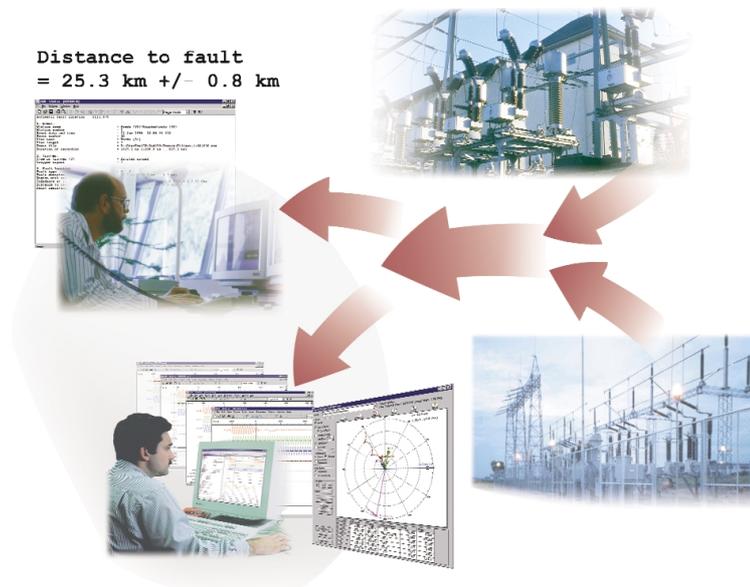
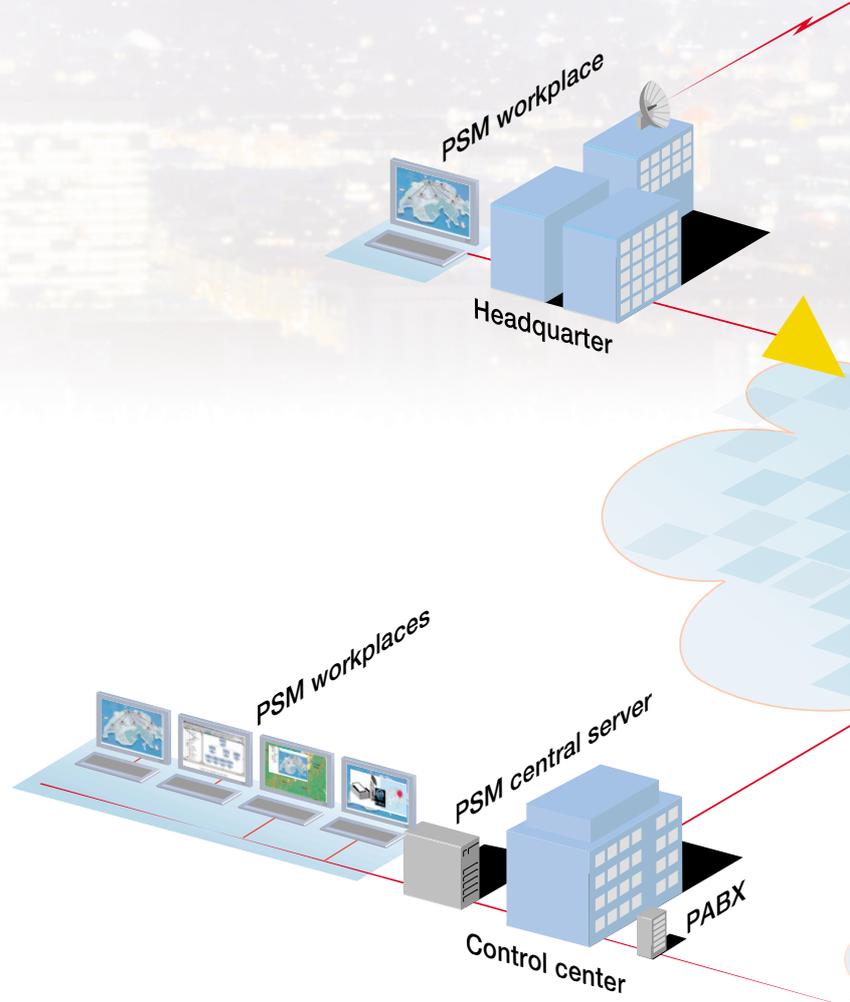
## Open architecture allows step-by-step integration

The system architecture allows a utility to begin with the functions that provide the most immediate benefits. The system can be extended step by step, both with additional functions and with more connected stations to cover the utility's entire power grid. This allows the system investment to be matched to the presence of the numerical devices and fault recorders installed, as well as to the communication available to particular stations.

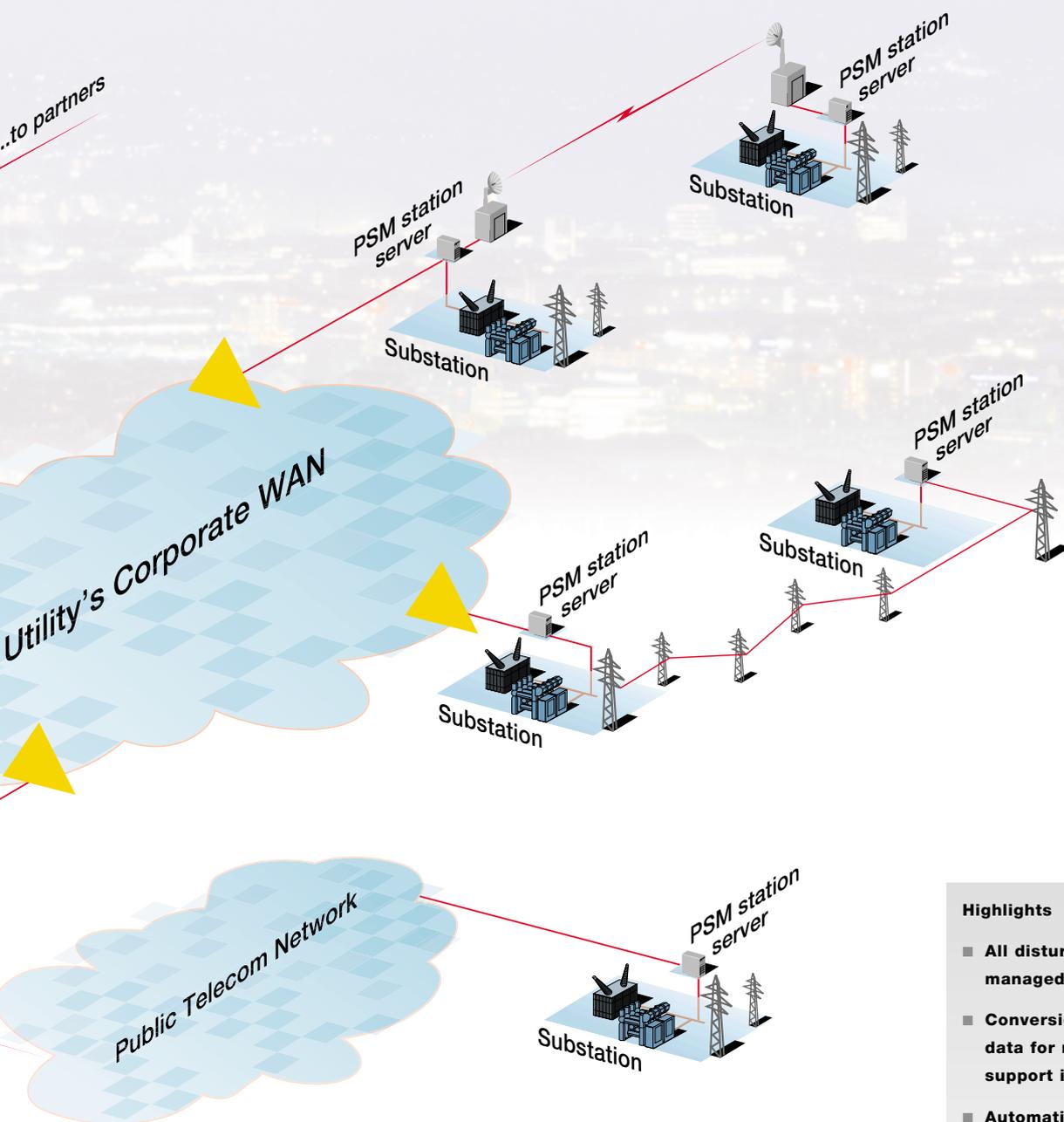
## State-of-the-art communication allows easy integration

Depending on the utility's communication network and policy, the PSM data flow uses (any available) fiber-optic links, radio or digital Power Line Carrier links. Public telecom or Internet communication services can also be used. PSM offers a secure data encryption based on today's data encoding technology.

The transmission of PSM data is independent of the proprietary communication links used by SCADA/RTU systems. This guarantees that the PSM data communication does not interfere with time-critical network control applications.



to partners

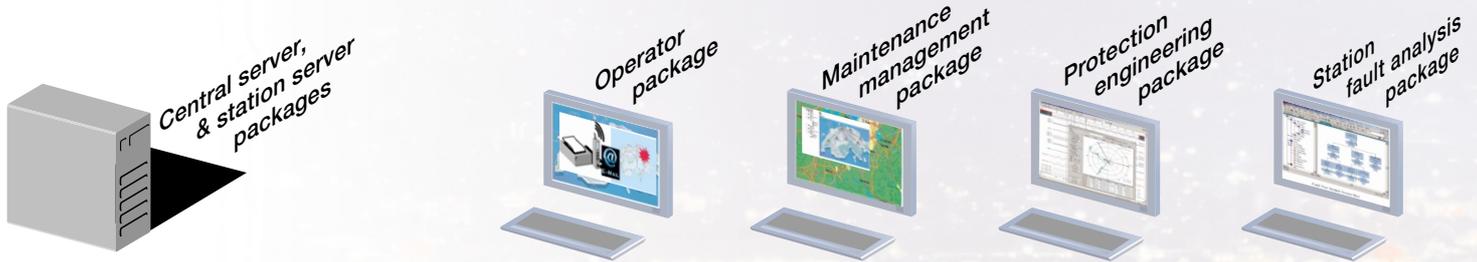


#### Highlights

- All disturbance records are stored and managed in a central database
- Conversion and evaluation of disturbance data for reliable and consistent decision support information
- Automatic filtering of data to obtain relevant information for critical decision making
- Flexible use of all communication media
- Standardized interfaces for customized integration with enterprise applications
- Preservation and enhancement of existing investments

# Packages and modules of the PSM solution

## Packages



**PSM 500, PSM 501 servers** take care of all automated services like data acquisition, fault location, printing of short fault reports and notification of registered users.

### **PSM 500 Central server package**

The central, network level server of PSM automatically collects the data from all connected stations. It references all uploaded data in its SQL database and applies automated fault location and evaluation. A graphic view of the PSM communication network containing all the recording devices simplifies the configuration of PSM and facilitates easy navigation to all devices and settings.

**Available options:** automated printing of short fault reports, Internet information server, user notification service, geographic information server, high-performance database.

### **PSM 501\* Station server package**

This package is designed for automated data acquisition from the connected devices such as disturbance recorders, control units or protection relays in the station. It makes the collected data available to the central server and/or the optional station fault analysis workplace.

**Available options:** spontaneous data transfer (for considerable performance increase), automated fault location and evaluation (for local printing of short fault reports) and data prioritizing (for preferential transmission of selected data).

### **PSM 510, 511, 530 and 550 workplaces**

are connected to PSM servers and provide pre-packaged functionality for different user groups in operation, maintenance, protection and planning departments.

### **PSM 510 Operator workplace package**

This network level package is intended for the operator in the control centre. It provides reading access to all short fault reports.

**Available options:** geographic fault information service, manual fault analysis.

### **PSM 511\* Station fault analysis workplace package**

The manual fault analysis module enables the station personnel to conduct further fault investigations based on locally collected data from a dedicated workplace.

**Available option:** device parameter visualization and setting.

### **PSM 530 Maintenance management workplace package**

This package provides reading access to all short fault reports as well as a tool for statistical analysis to locate weak points in the network.

**Available options:** geographic fault information service, customized modules for interaction with Enterprise Resource Planning applications (to extend PSM to a full outage management system).

### **PSM 550 Protection engineer workplace package**

This package supports the protection engineer with a very powerful disturbance record evaluation tool in manual fault analysis as well as statistical analysis.

**Available options:** geographic fault information service, device parameter visualization and setting.

\*The packages 501 and 511 are designed for use on station level.

## Modules



### Database

The central database allows fast access to all fault calculation results and references all disturbance record files from the entire network. Most of the configuration data are also stored in this relational SQL database.

### Automated data acquisition

takes place first at the station and subsequently at the network level. The station server continuously polls protection and control devices as well as dedicated disturbance recorders. The central server at the network level polls the station servers in configurable time intervals to upload the collected data. It also simultaneously monitors the communication quality. Automatic acquisition can be switched off to enable manual uploads of disturbance records. This is supported by a graphically aided navigation interface with a Windows look and feel.

### Spontaneous data transfer

This powerful module increases the performance of PSM significantly, especially when the polling is typically configured at hourly intervals. The station server initiates the file transfer to the central server immediately when an event file has been uploaded from any bay-level device.

### Automated fault analysis

is performed at the PSM server. The results of these calculations are stored in the database and constitute the basis for Short Fault Reports.

### Short fault report

is an automatically generated result in text form of a fault location calculation (automatically printed). The PSM system passes this report to the "User notification service". Among other results, the fault location, type, and duration are reported. Optionally, the pre-fault and post-fault conditions as well as the curves of the disturbance records are appended.

### User notification

initiates the instant transmission of the fault information, via fax or e-mail, to all configured recipients. Optionally, a SMS message giving the fault location can be sent to mobile phones (SMS service).

### Manual fault analysis

for in-depth analysis of disturbance records. It provides freely programmable signal calculations and a combined analysis of multiple disturbance record files. The phasor display feature shows phase information and impedance calculations in a polar chart as vectors, and as a locus over a selected time period.

### Geographic fault information

is precisely displayed on a detailed map, which is provided by a "Geographical Information System" (GIS). It supports e.g. repair teams in faster finding the precise location of a fault.

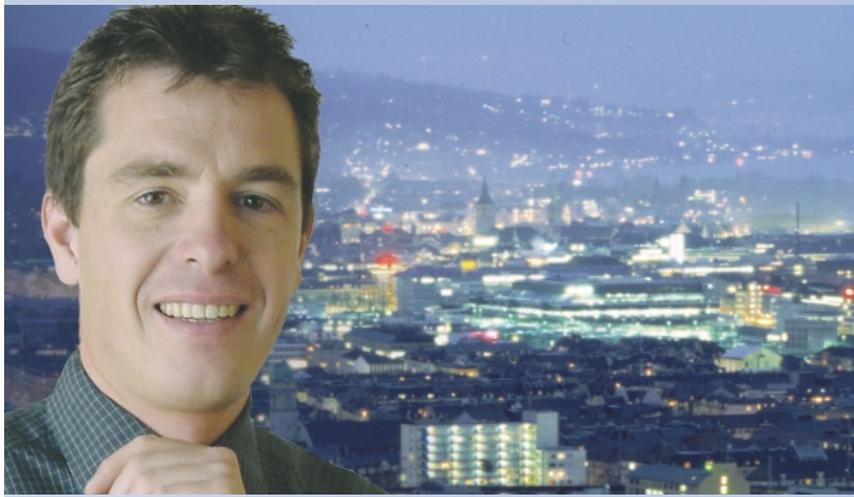
### Statistical analysis

provides statistical information on faults which occurred over a selected time period in a specified part of the network. Lines with a high fault rate, or disturbance recorders, which generate an exceptionally large number of records, are immediately apparent. Fault statistics are the basis for the economic justification of investments to improve power network reliability.

### Enterprise applications

are foreseen for customized solutions. For example, a gateway to an Enterprise Resource Planning application to combine the duty roster with the notification service for maintenance staff, or the exchange of information with an asset management application providing additional information for the correction of the fault, e.g. drawings of poles close to the fault, and a list of recommended tools and spare parts that may be necessary for the repair of the line.

A further possibility to extend the statistical analysis tool is to use data from a public lightning database and to combine lightning information with fault locations. Ask our sales staff. Together with you, they will work out the specifications that represent your system requirements for the generation of long-term profitability.



## **ABB guarantees full success of your PSM project**

A happy customer is our highest satisfaction. Therefore, our engagement in a PSM project typically starts with a workshop, that takes place in close co-operation and trust between the utility experts and ABB. The following workflow describes a PSM project, which typically goes beyond the acceptance test at the customer's site.

### **Your need is the central point in a common workshop**

We are pleased to organize a workshop, at which we will present the concept, the architecture and functions of PSM. Your technical requirements and also your business development planning are the starting points to define a suitable PSM installation and work out concrete benefits together.

### **A pilot installation is the best way to get in touch with PSM**

The modular structure of PSM allows you to start with a small installation. Key features can be verified and the benefits of a big installation can be easily estimated. ABB will provide you with full support for this first practical step.

### **Creating value through learning!**

The ABB University can offer you a wide range of courses, both held locally or in our training centers. Standard courses on monitoring systems, or training on detailed disturbance record analysis and special courses for PSM are all part of our course program.

### **PSM grows with technology and time.**

Step-by-step extensions with further substations, or adding relays for different voltage levels are possible at any time. ABB can integrate new functions and data exchange to enterprise applications at later stages, where ABB brings in its competence in all fields of substation automation, power network management, and communication.



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