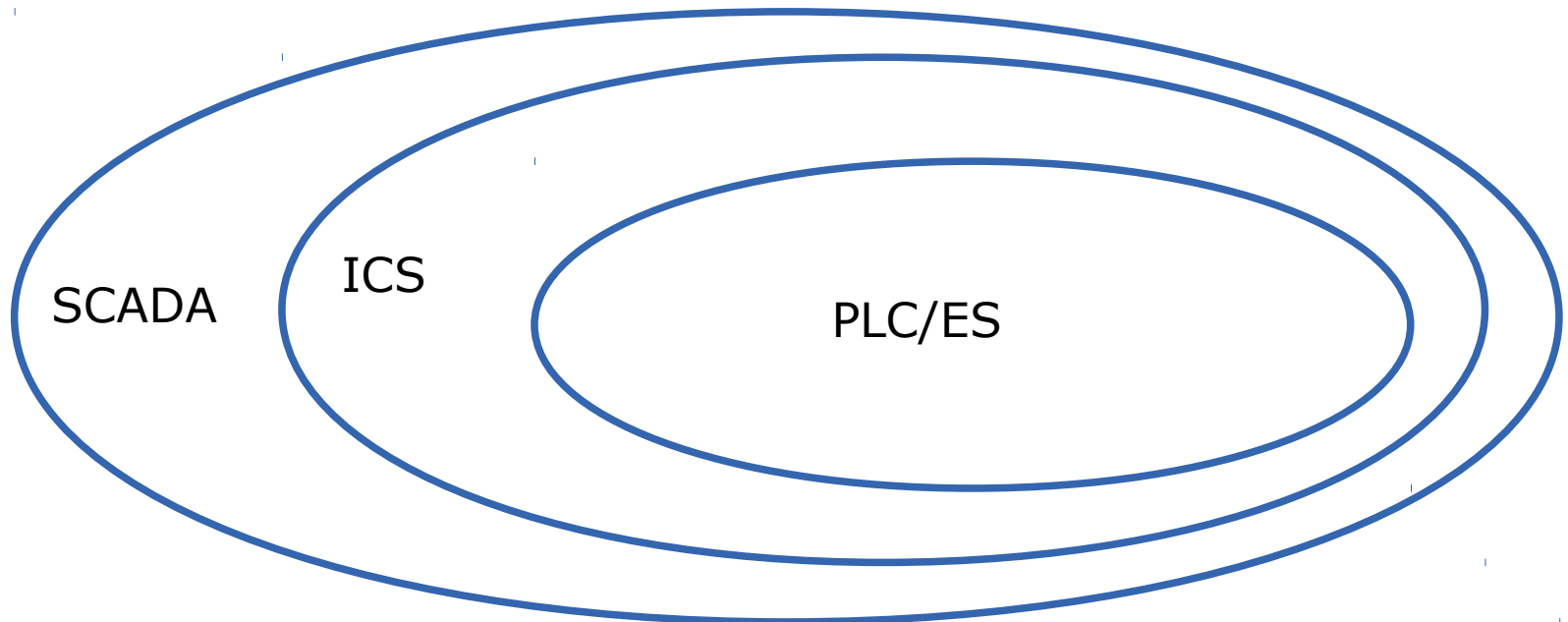


SCADA introduction

- What is SCADA?
- What's the history of SCADA?
- Exemplary SCADA systems
- Systems SCADA – practical applications – an introduction to the remainder of the lecture

Introduction – What is SCADA? Where does it come from?

SCADA (Supervisory Control And Data Acquisition) is a type of industrial control system (ICS). Industrial control systems are computer-controlled systems that monitor and control industrial processes that exist in the physical world. SCADA systems historically distinguish themselves from other ICS systems by being large-scale processes that can include multiple sites, and large distances.



Introduction – What is SCADA? Where does it come from?

SCADA vs. ICS vs. PLC

	Industry	Discipline
PLC/ES	Automotive	Process control
ICS	Refinery	Discrete control
SCADA	Pipeline	Wide area control

Traditionally “SCADA” is used for control systems that cover a wide geographic area.



Introduction – What is SCADA?

SCADA vs. ICS/DCS vs. PLC

Term **spaghetti**:

- Industrial Control System (ICS) - a contender
- Industrial Automation (IA) – another contender
- Manufacturing and Control Systems (M&CS) - used by the ISA-99 (Industrial Automation and Control Systems Security committee) committees until 2006
- Industrial Automation and Control Systems (IACS) – now used by the ISA-99 committee
- Control Systems – too general as it would encompass things like building automation and even home appliances
- SCADA - as an all-encompassing term, SCADA fails because all old-timers think of SCADA as wide area control for pipelines, power transmission, etc. (they all wince when someone points to the DCS (Distributed Control System) in a refinery and tries to call it SCADA).



Introduction – What is SCADA? Where does it come from?

SCADA vs. Telemetry



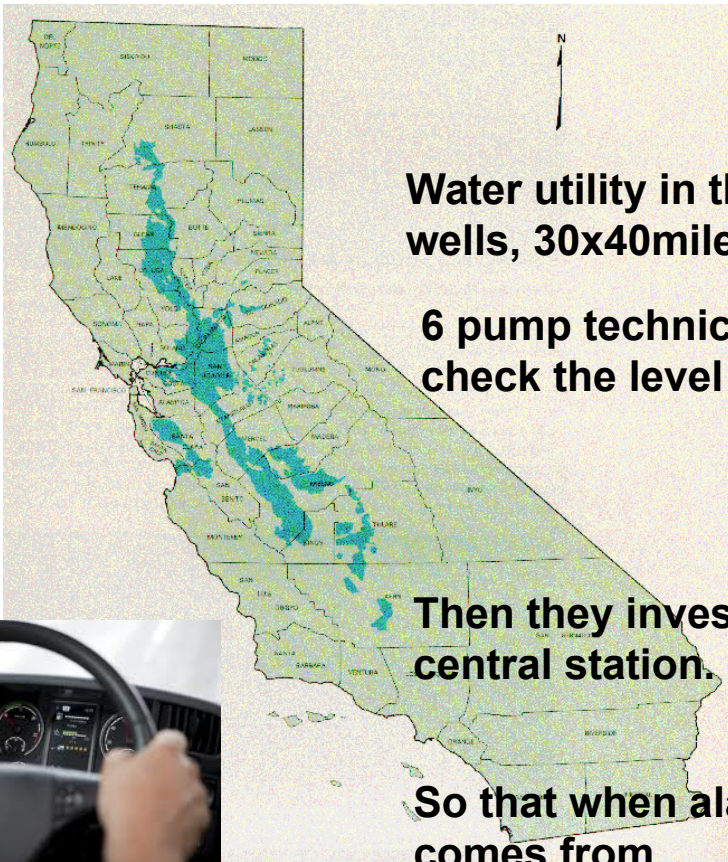
SCADA grew up from space telemetry & control systems

At the time there was very little control...

Why? There was no bandwidth...

Introduction – What is SCADA? Where does it come from?

SCADA vs. Telemetry



Why? There was no bandwidth...

Water utility in the central valley of California (late 60s) – 56 wells, 30x40miles

6 pump technicians – just to drive by car between the wells to check the level of chlorine... All day long

Then they invested in the telephony line from each well to the central station.

So that when alarm occurred technician knew which station it comes from.



Introduction – What is SCADA? Where does it come from?

In usual application SCADA refers to the computer system that performs supervisory role over some *equipment*.

Usually this “*equipment*” is a set of PLC controllers or an embedded system (“worker”) equipped with a range of sensors to gather an information about the state of the installation.

In parallel to this, workers perform control tasks over the processes in the installation.

By means of communication all the data goes to the central system where it is processed and displayed.

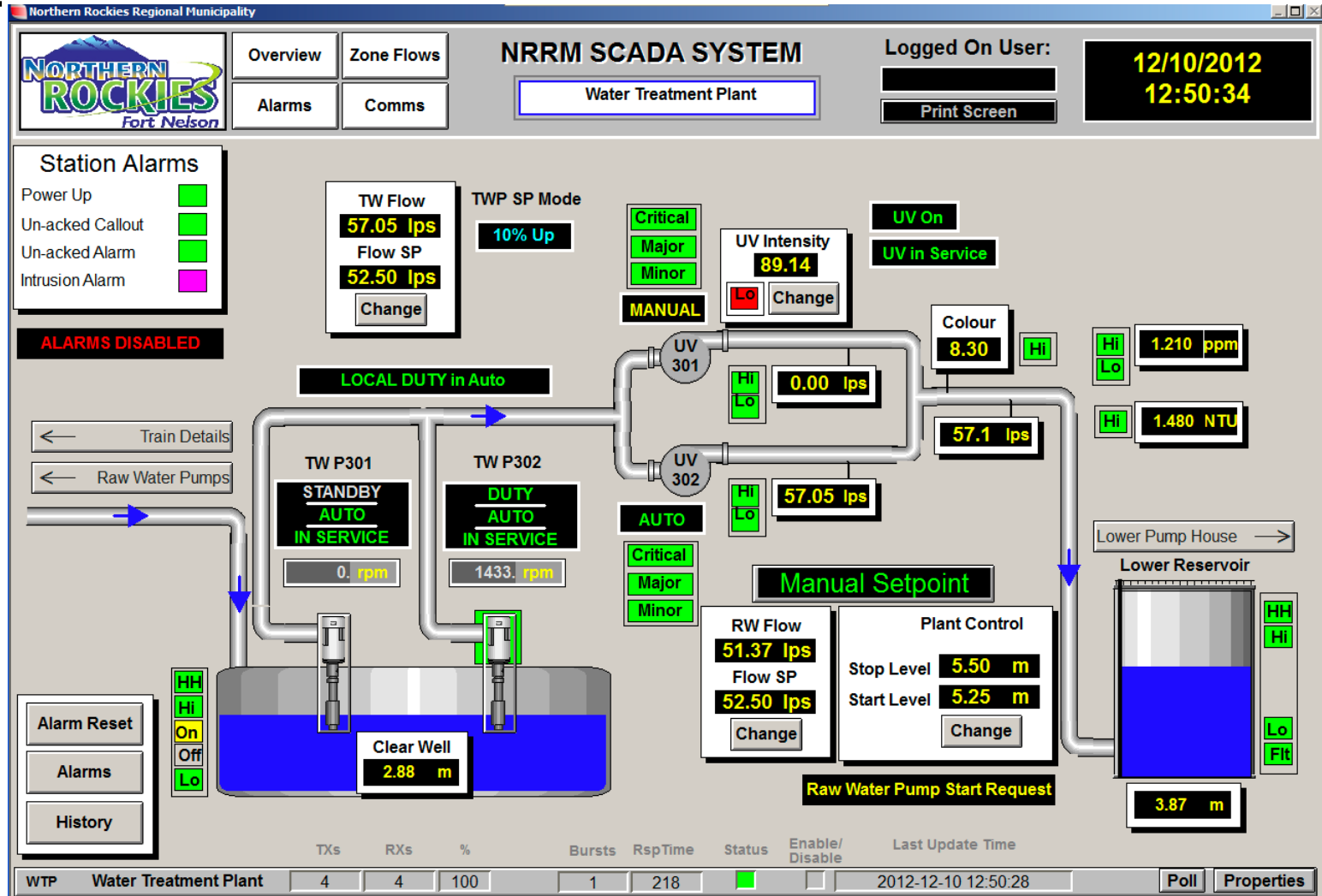
Introduction – What is SCADA? Where does it come from?

Main functions of the SCADA system:

1. Data acquisition
2. Data visualisation
3. Process control
4. Alarm facilities
5. Data archive

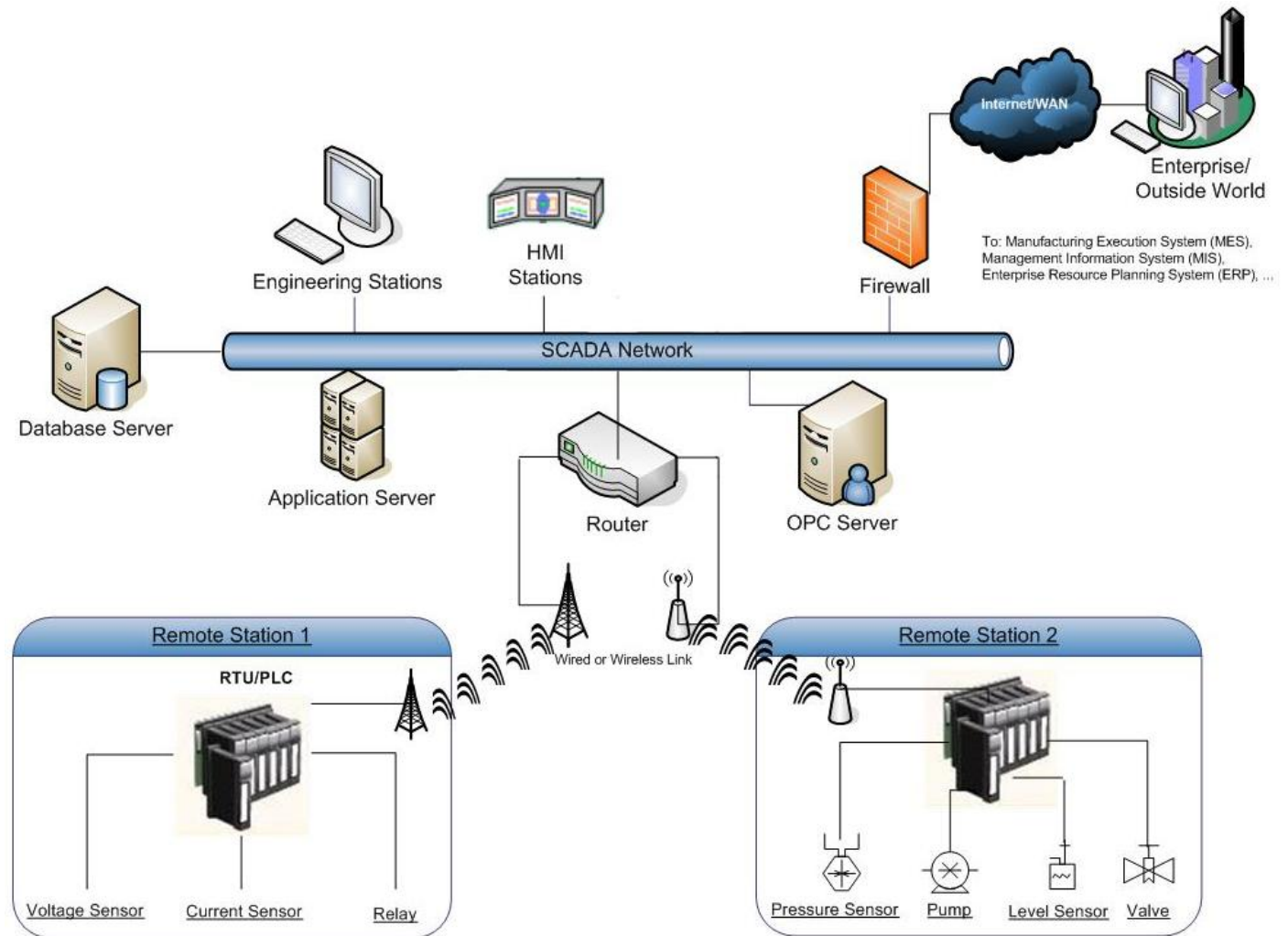
Introduction – What is SCADA? Where does it come from?

Top view:



Introduction – What is SCADA? Where does it come from?

Exemplary architecture:

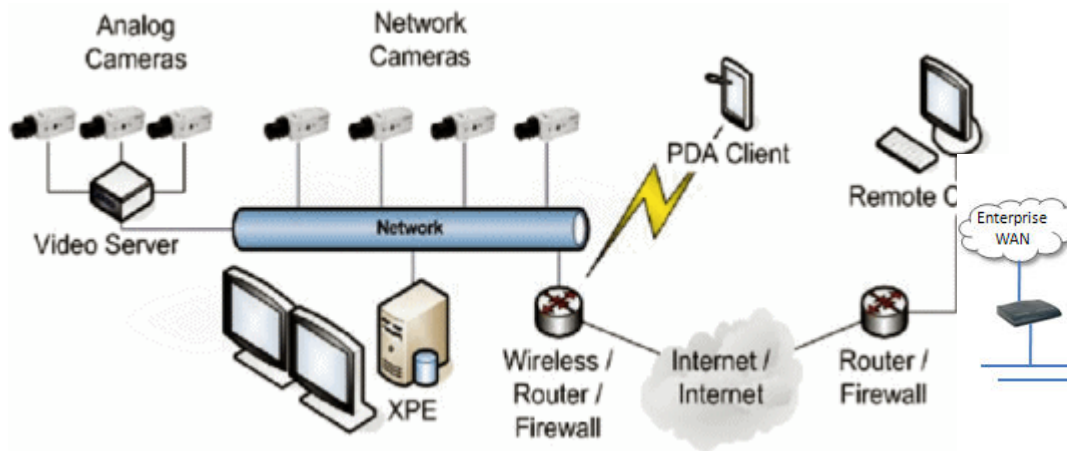


OpenControl SCADA Network Architecture

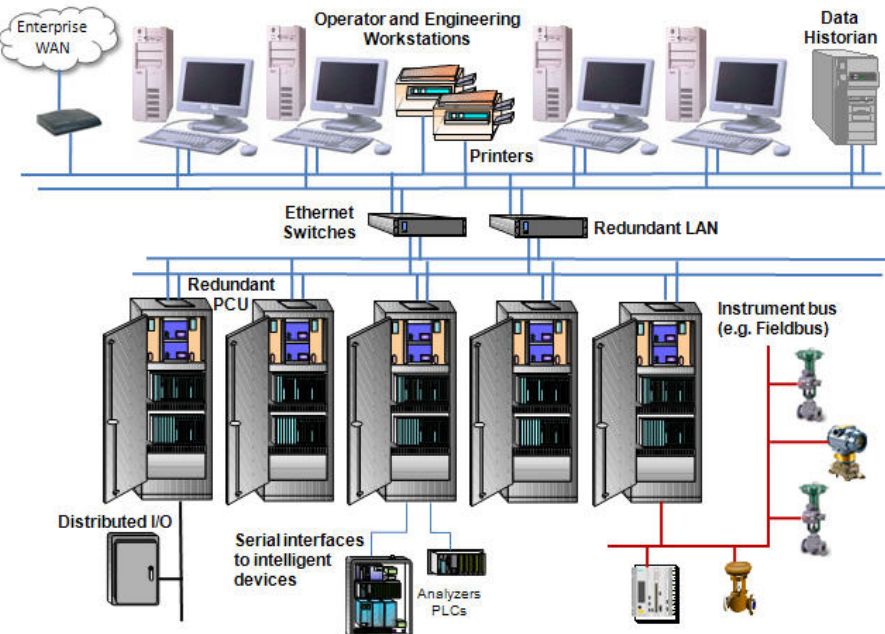
Introduction – What is SCADA? Where does it come from?

Exemplary other architectures:

CCTV system:



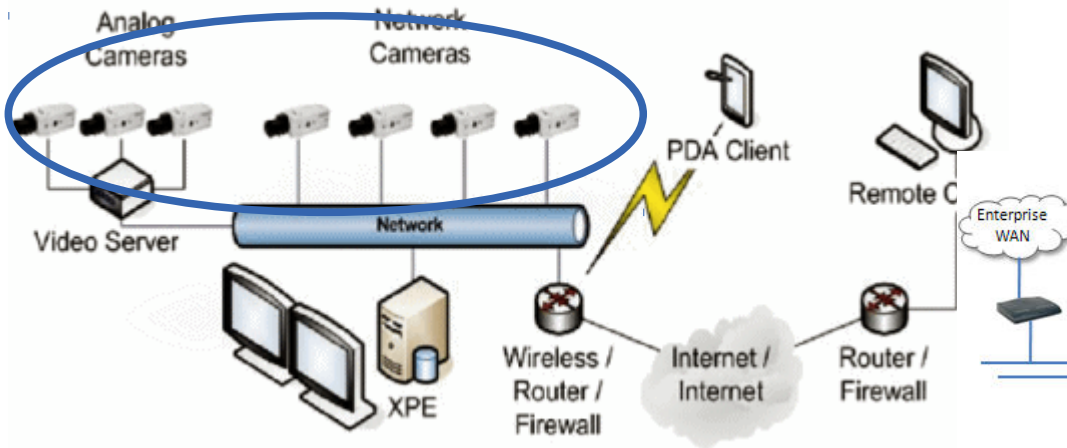
DCS system:



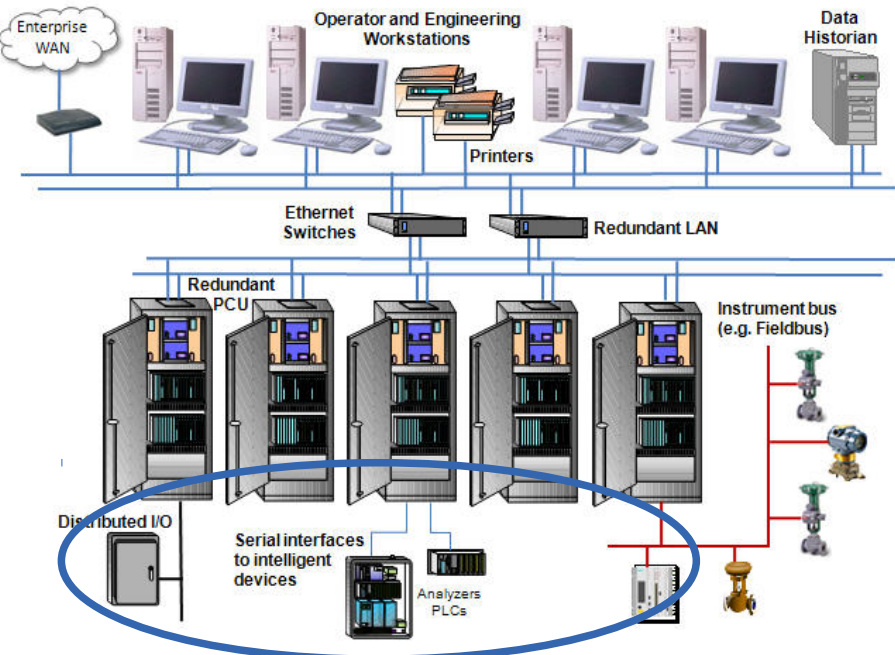
SCADA features - conclusion

Data acquisition

CCTV system:



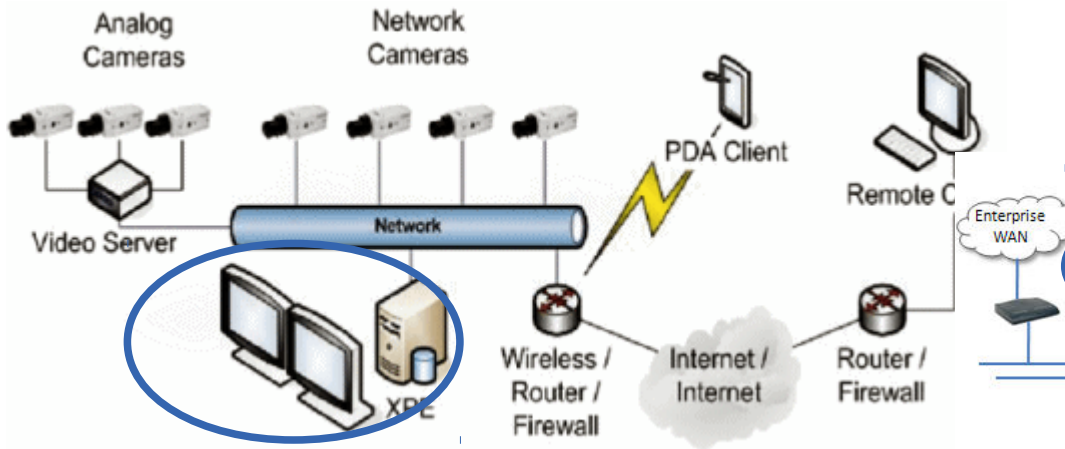
DCS system:



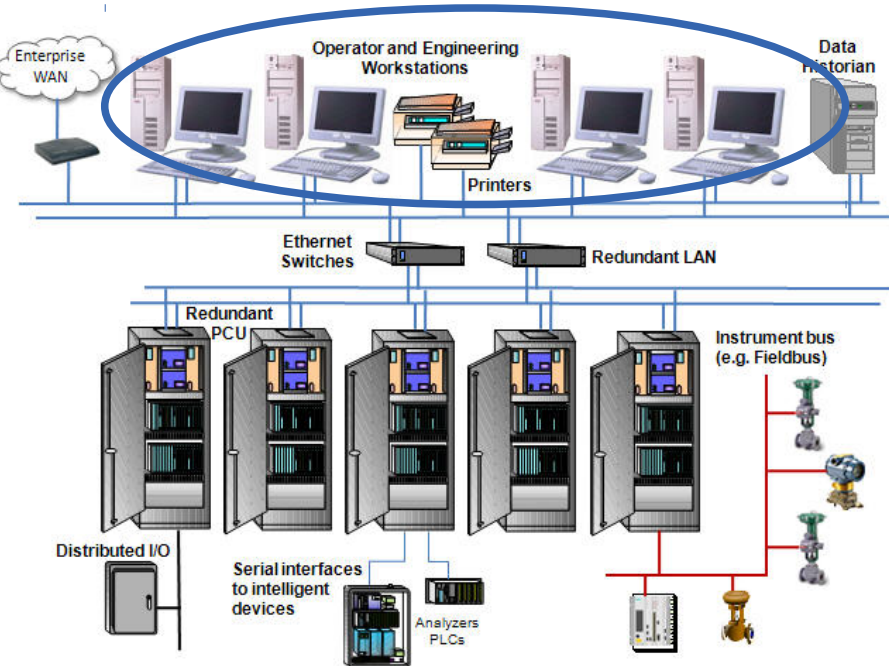
SCADA features - conclusion

Data visualisation

CCTV system:



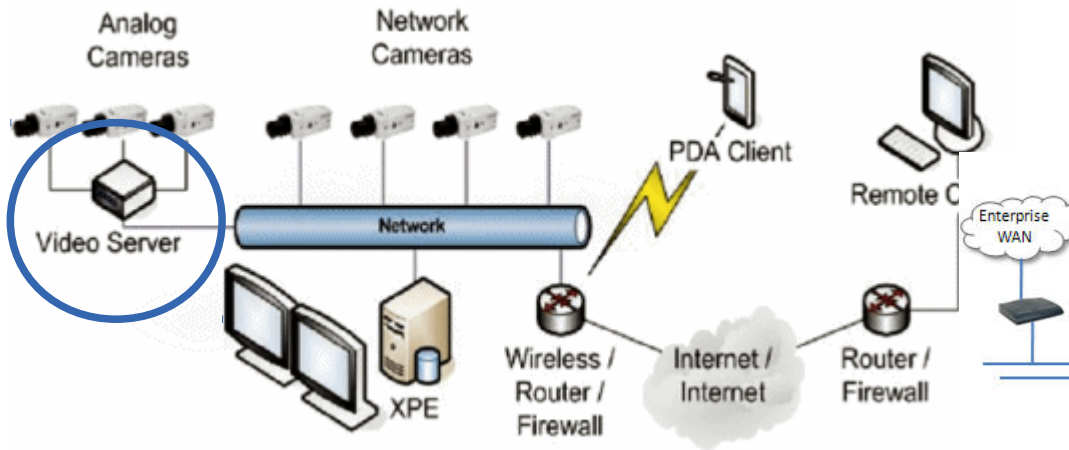
DCS system:



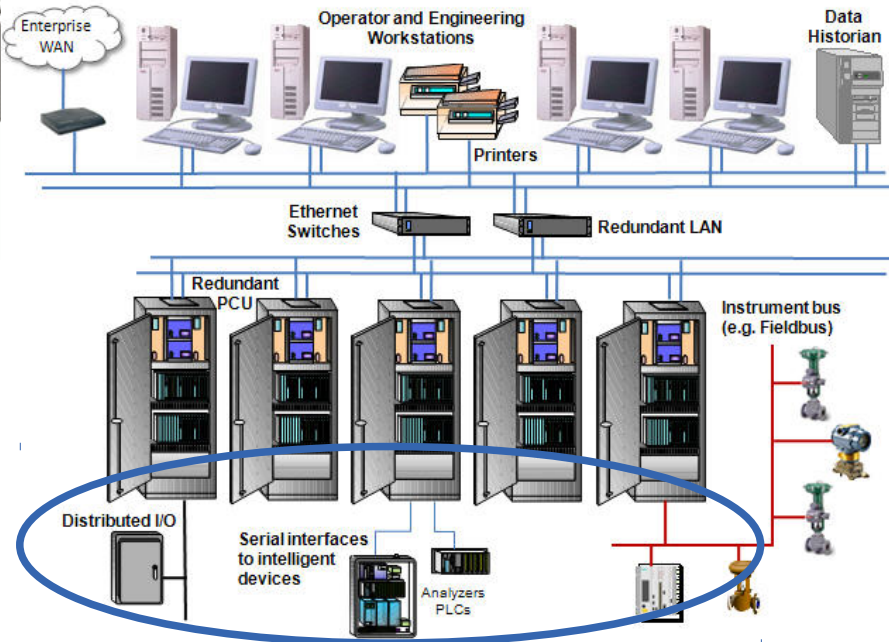
SCADA features - conclusion

Process control

CCTV system:



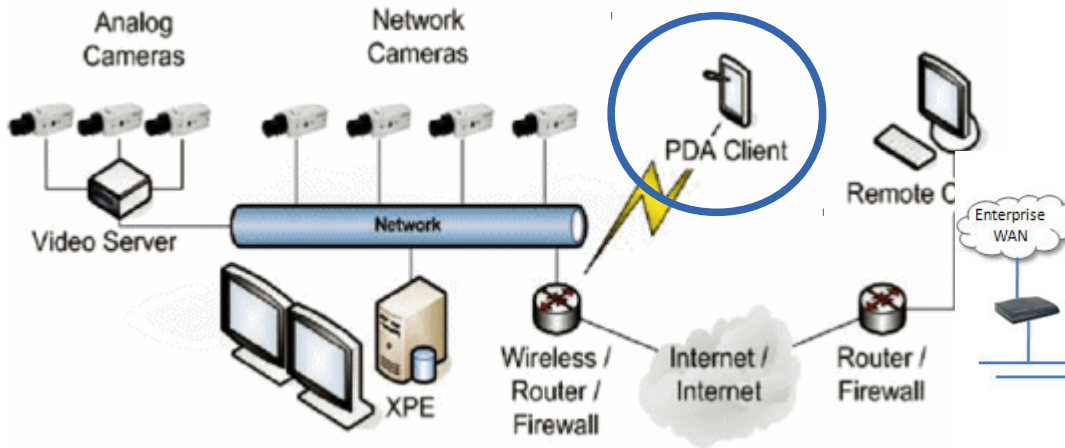
DCS system:



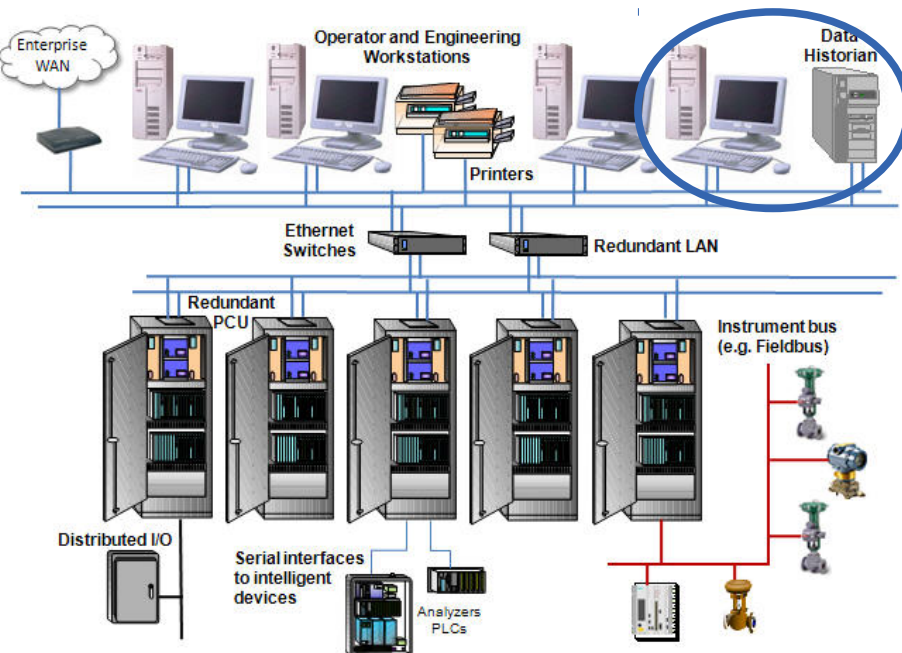
SCADA features - conclusion

Alarm facilities

CCTV system:



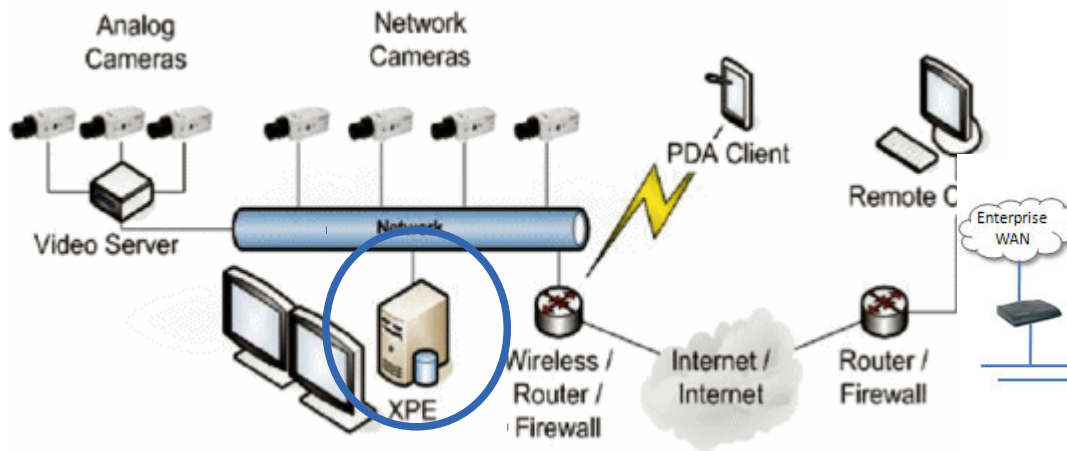
DCS system:



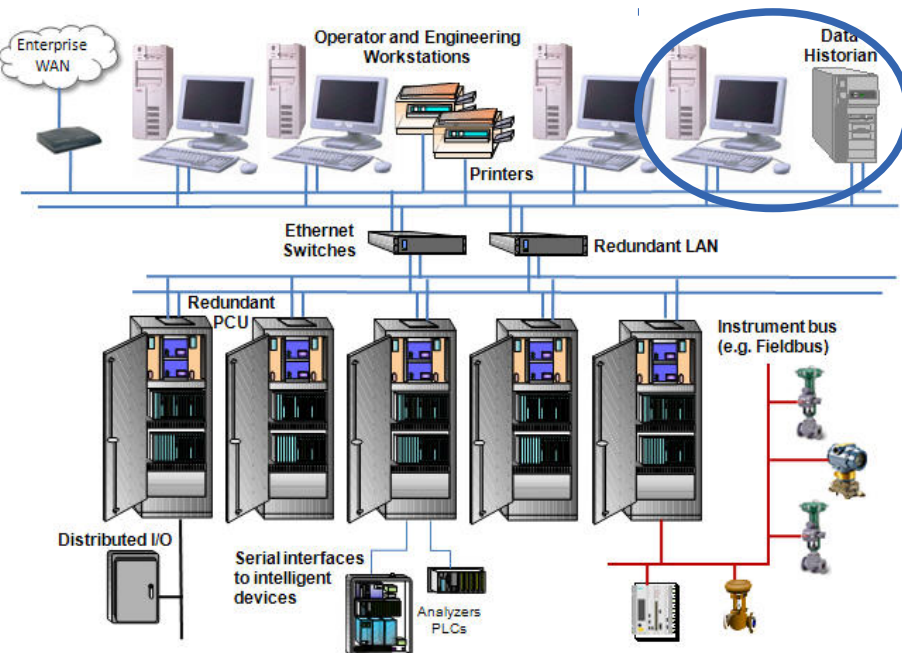
SCADA features - conclusion

Data archive

CCTV system:



DCS system:



SCADA features - conclusion

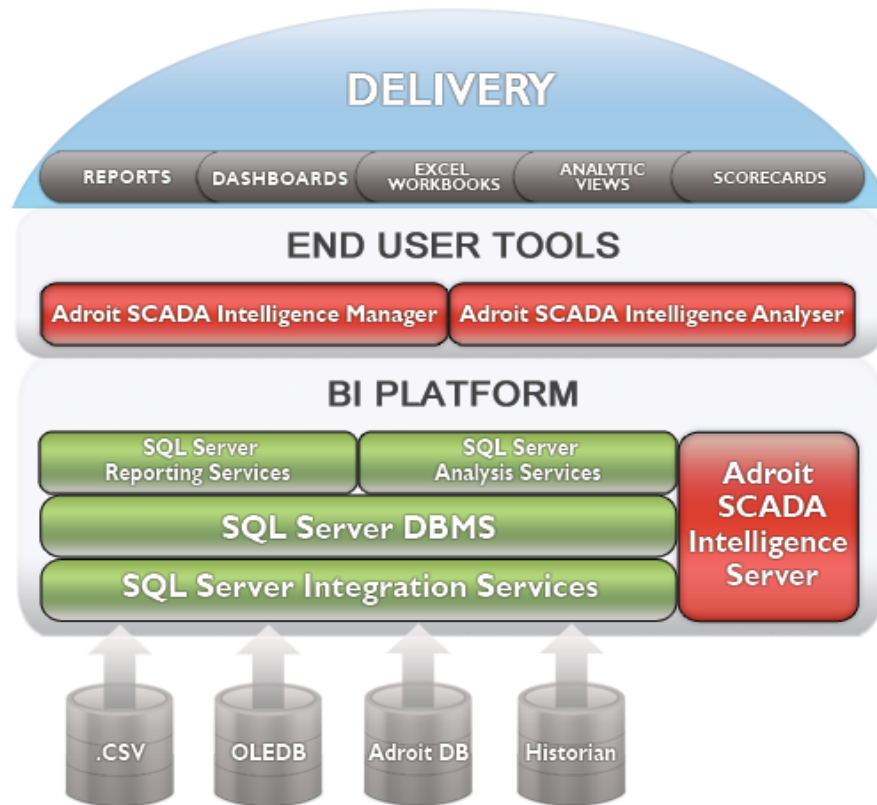
Main functions of the SCADA system:

1. Data acquisition
2. Data visualisation
3. Process control
4. Alarm facilities
5. Data archive

SCADA systems - review

Review of SCADA systems

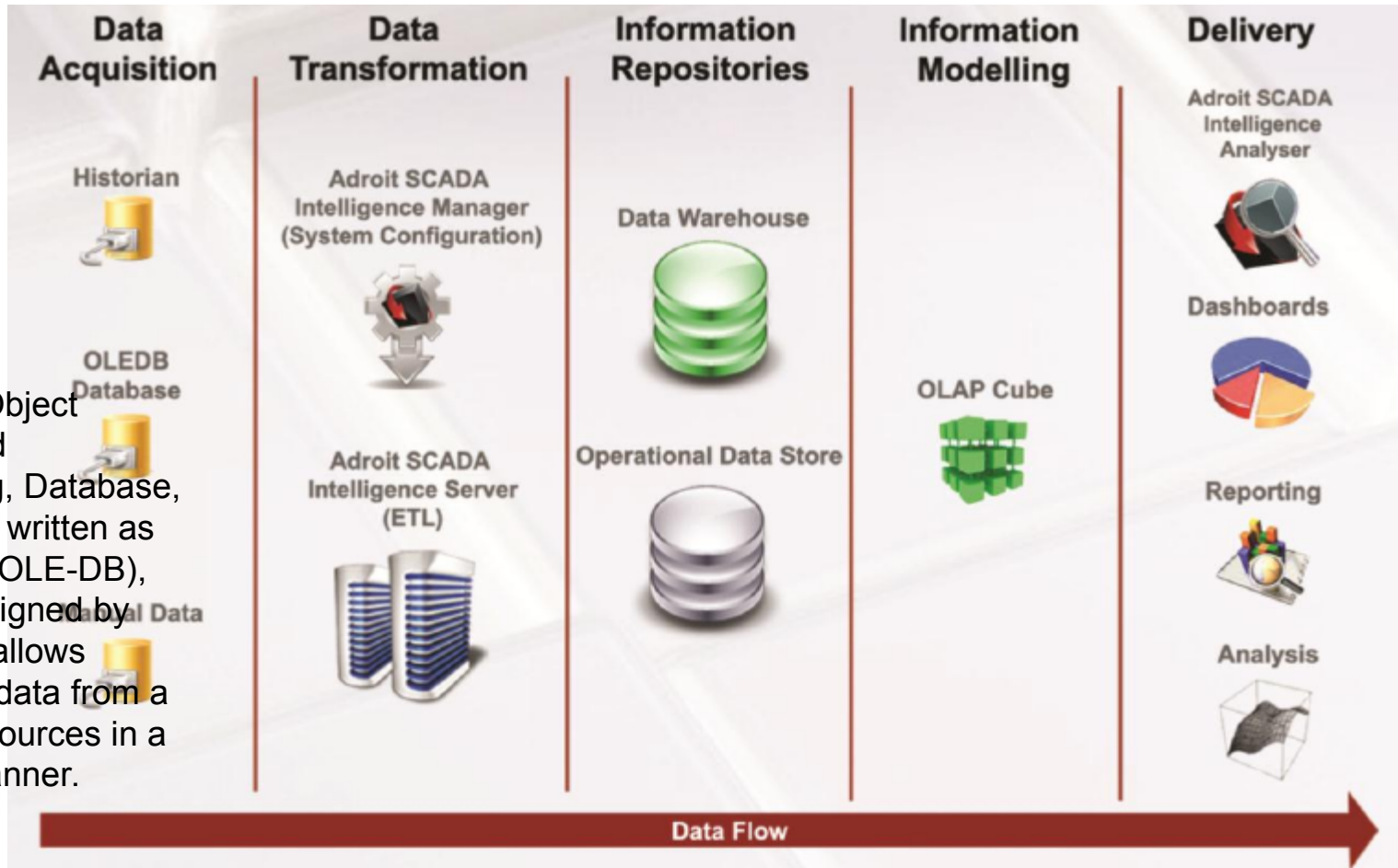
Adroit – SCADA system along with reporting software OPUS and access through web server (VIZNET). Provider: Adroit Technologies



Key Features and Benefits

- Reduced configuration time
- Reporting Templates
- Seamless Excel analysis
- SharePoint capabilities
- Multiple data sources
- Transform raw data into information

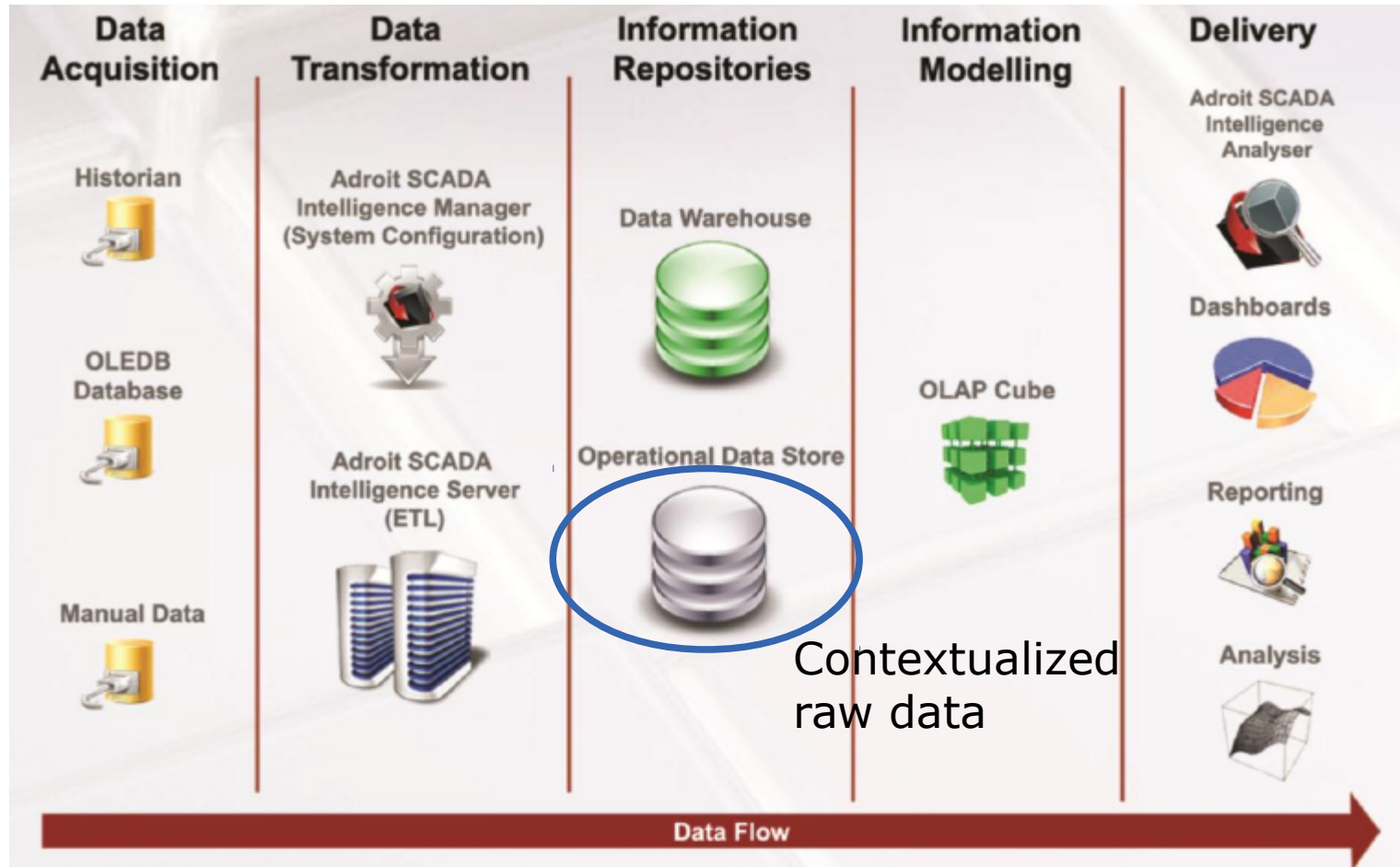
Review of SCADA systems - Adroit



OLE DB (Object Linking and Embedding, Database, sometimes written as OLEDB or OLE-DB), an API designed by Microsoft, allows accessing data from a variety of sources in a uniform manner.

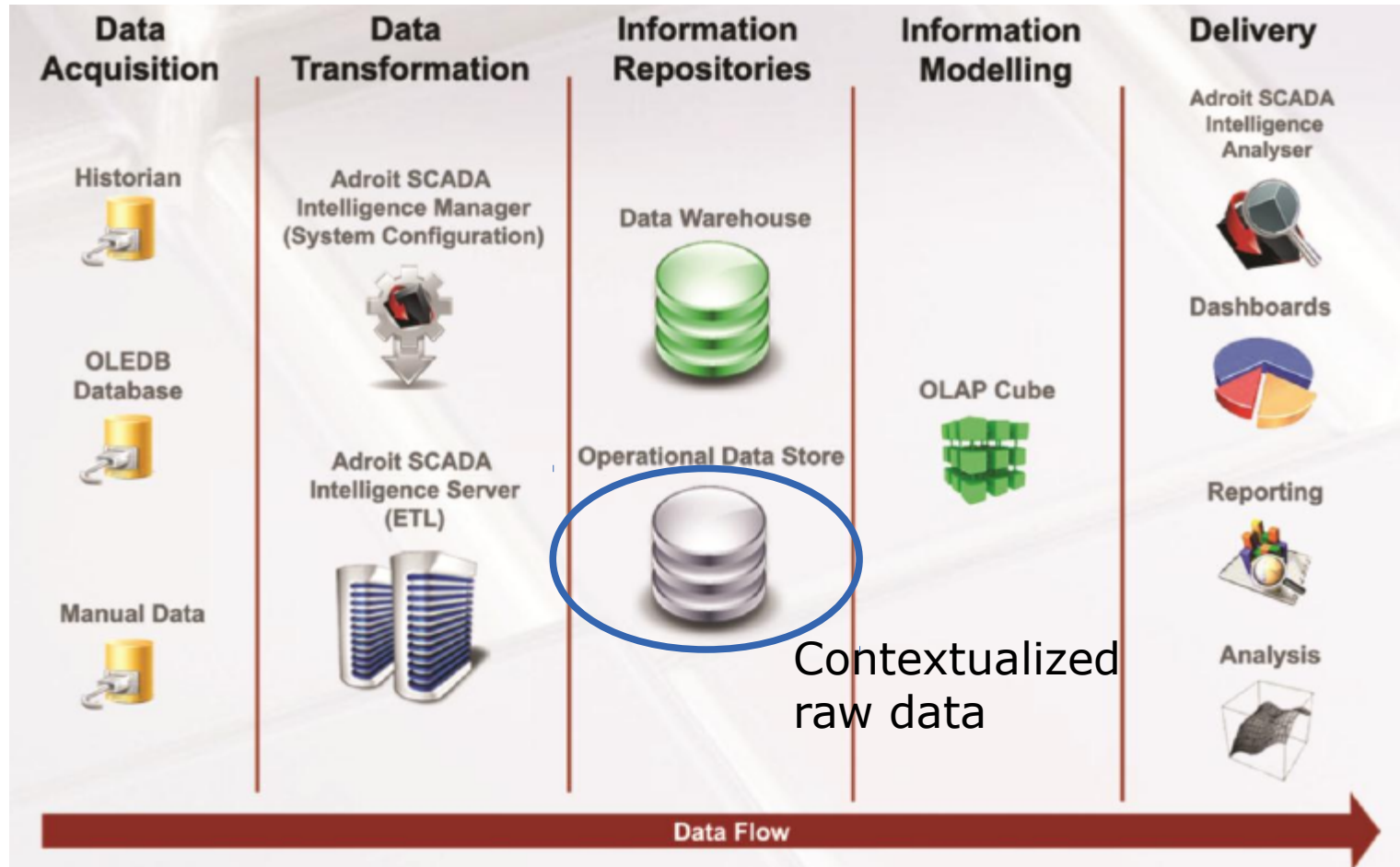
Data acquisition – multiple sources data retrieval

Review of SCADA systems - Adroit



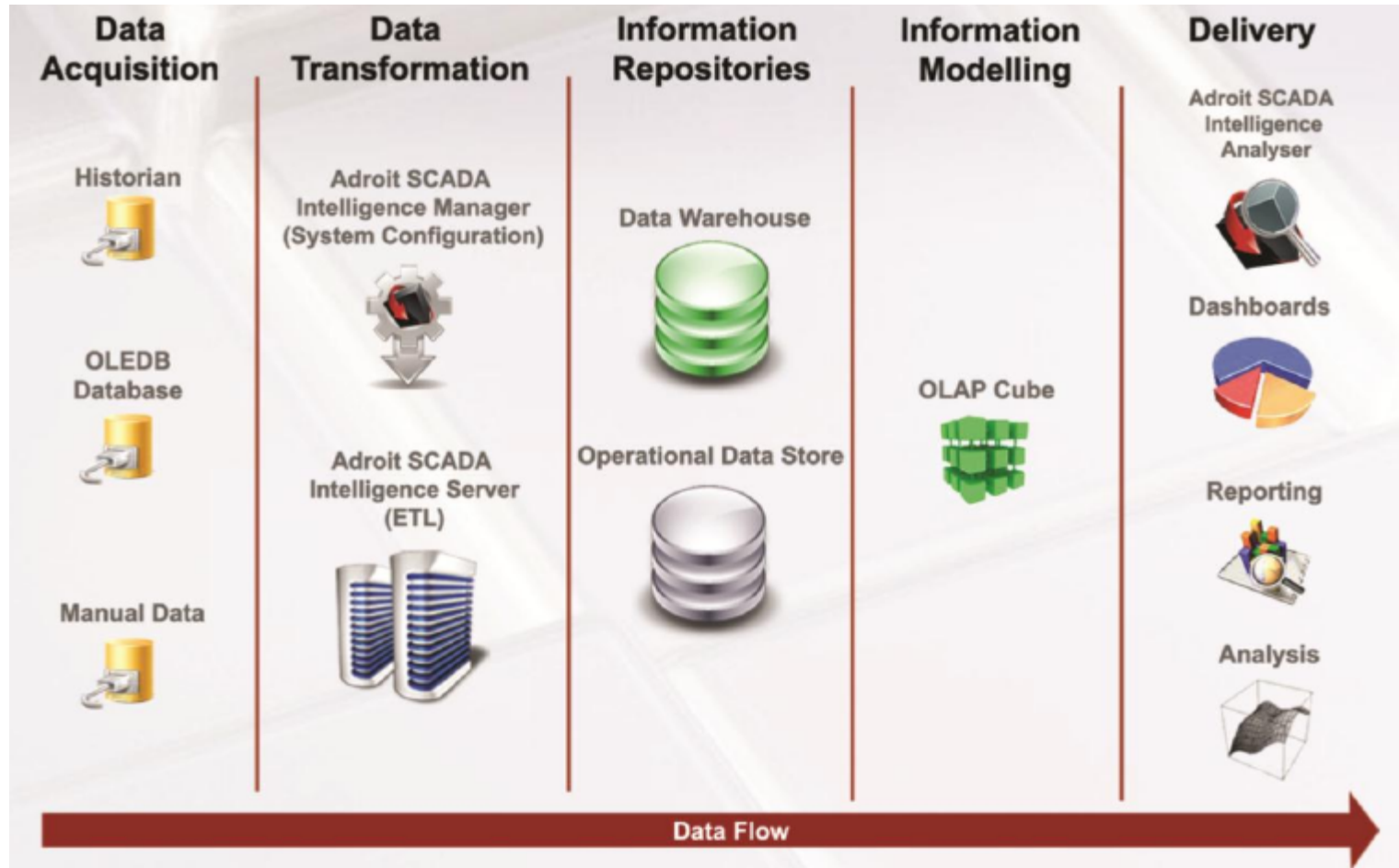
Information repositories – summarised data stored in multidimensional data warehouses

Review of SCADA systems - Adroit



Information repositories – summarised data stored in multidimensional data warehouses

Review of SCADA systems - Adroit

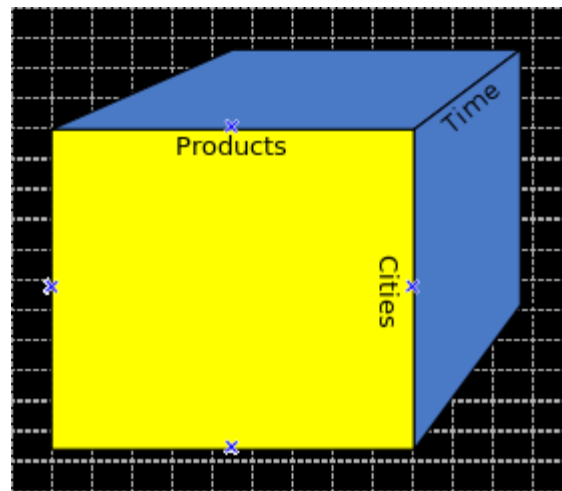


Information modelling – the information is modelled into On-Line Analytical Processing (OLAP) cube for efficient analysis

Review of SCADA systems - OLAP cubes

Information modelling – the information is modelled into On-Line Analytical Processing (OLAP) cube for efficient analysis.

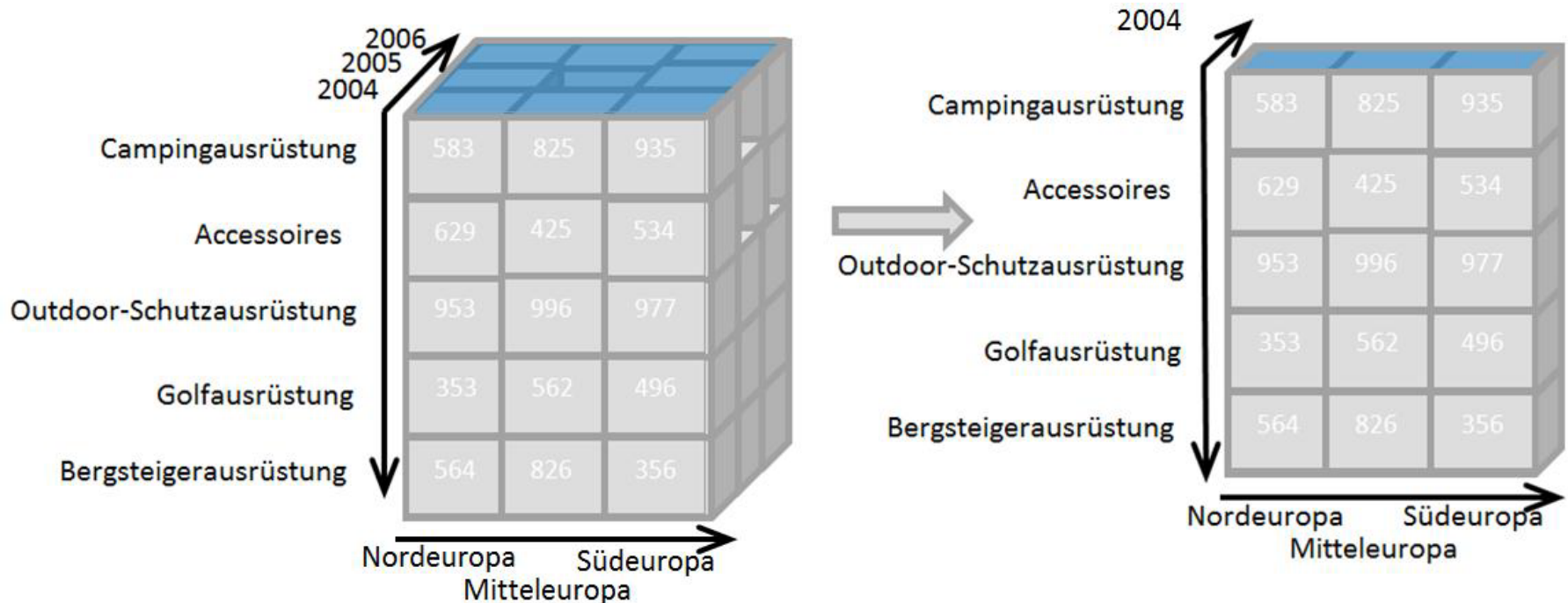
OLAP is a computer-based technique for analyzing business data in the search for business intelligence.



Review of SCADA systems - OLAP cubes

Operations - **SLICE**

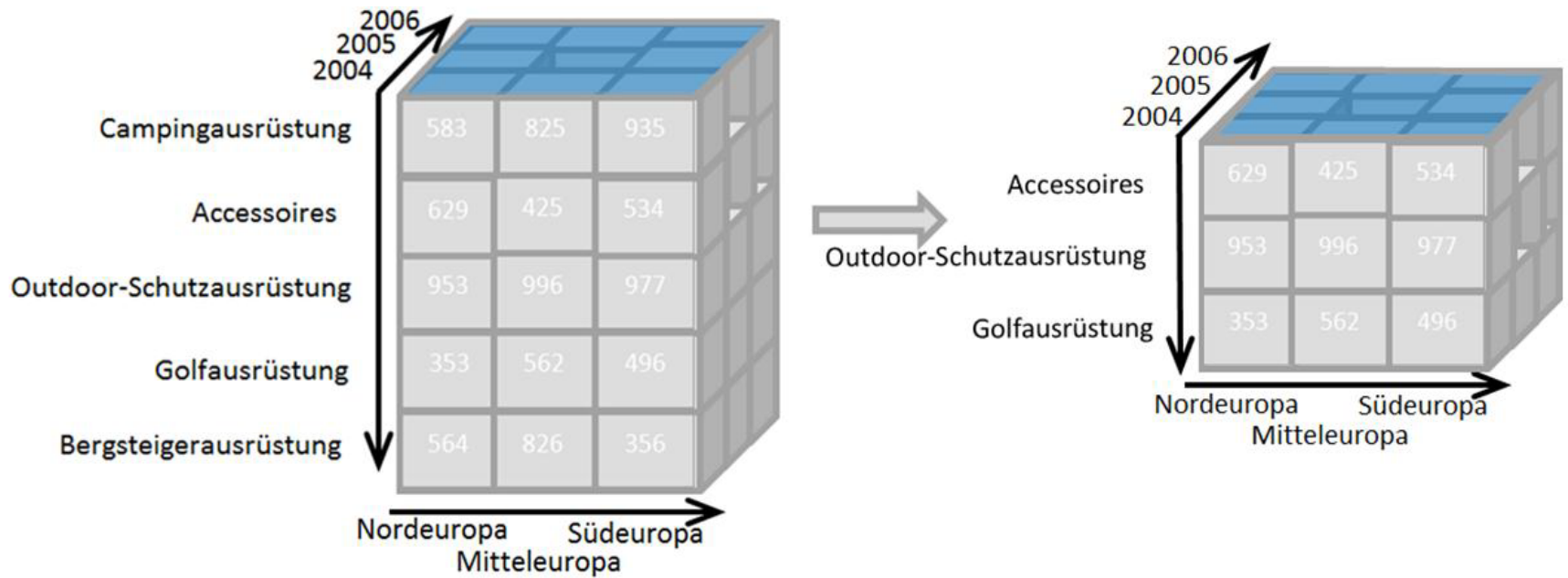
is the act of picking a rectangular subset of a cube by choosing a single value for one of its dimensions, creating a new cube with one fewer dimension.



Review of SCADA systems - OLAP cubes

Operations - **DICE**

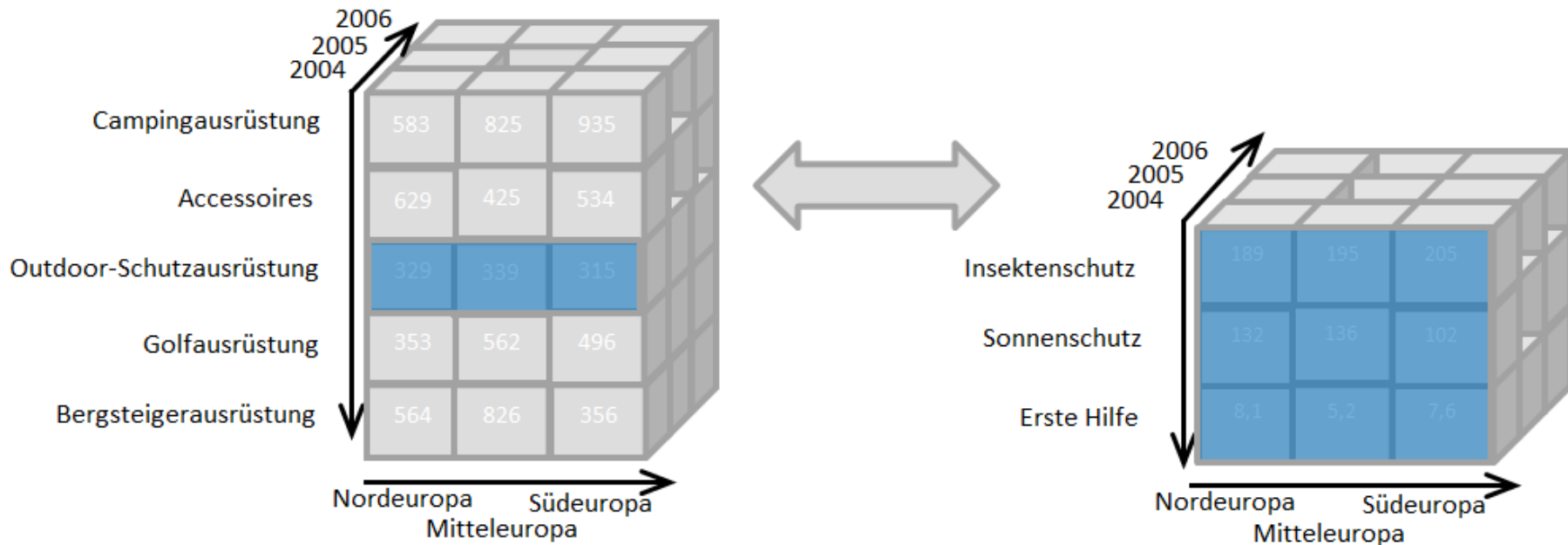
The dice operation produces a subcube by allowing the analyst to pick specific values of multiple dimensions.



Review of SCADA systems - OLAP cubes

Operations - **DRILL DOWN/UP**

allows the user to navigate among levels of data ranging from the most summarized (up) to the most detailed (down).



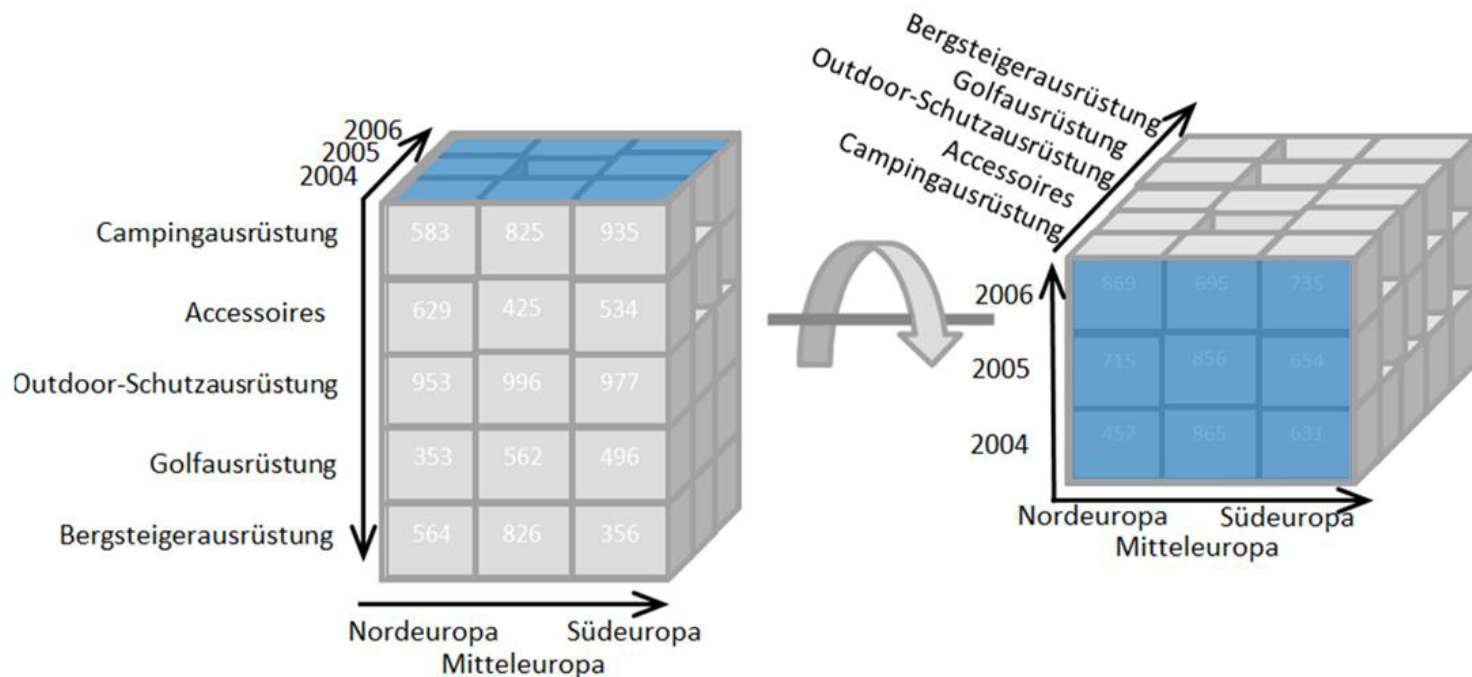
Review of SCADA systems - OLAP cubes

Operations - **ROLL-UP**

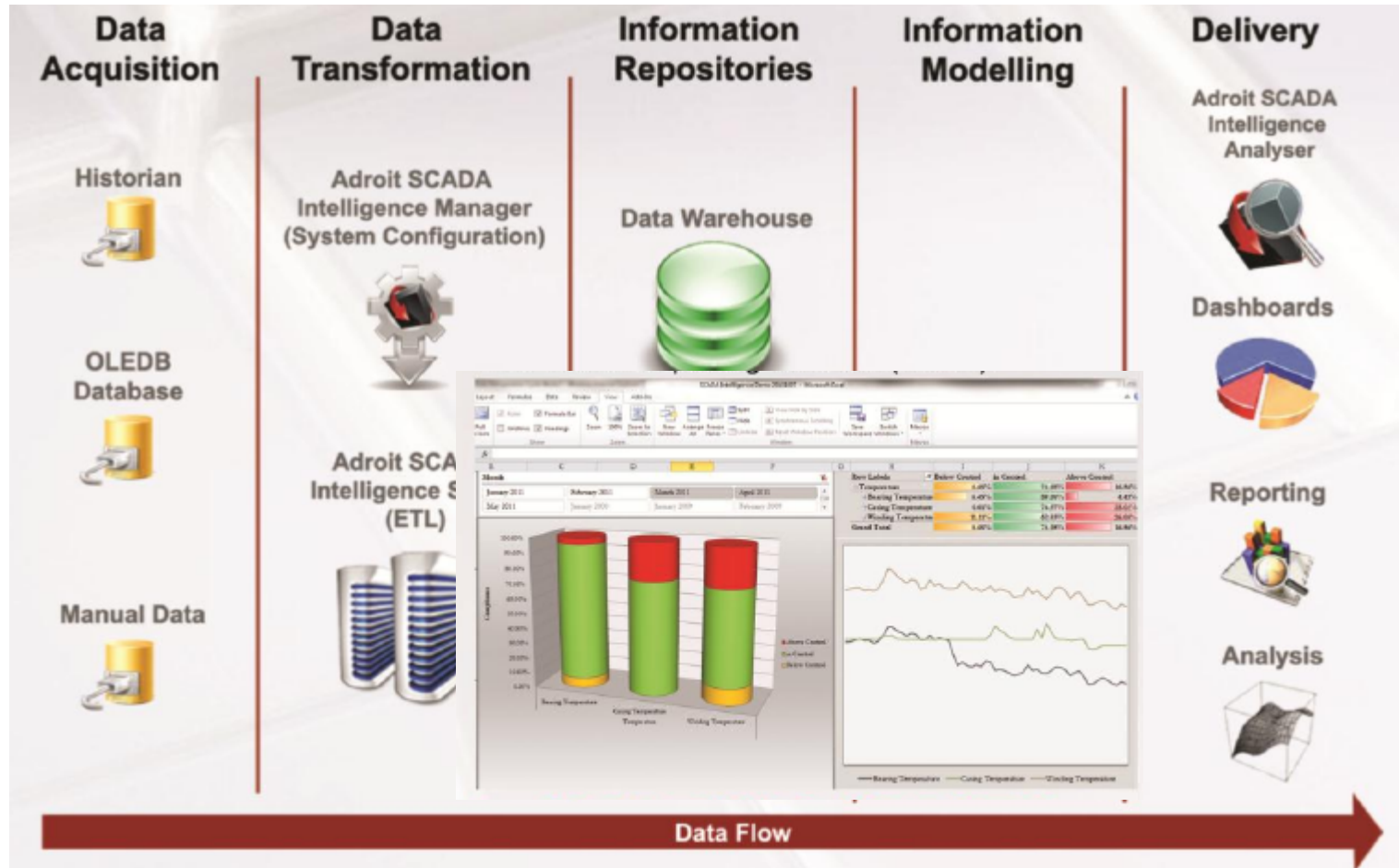
A roll-up involves summarizing the data along a dimension.

Operations - **PIVOT**

allows an analyst to rotate the cube in space to see its various faces.



Review of SCADA systems - Adroit



Presentation layer – it is about how the information (or key performance indicators KPIs) is presented to end-users

Review of SCADA systems - Adroit

Mitsubishi takes a share of Adroit Technologies

08 April 2011

Following the announcement of the release of the Mitsubishi Adroit Process Suite (MAPS) in November 2010, Mitsubishi Electric Europe B.V has now announced that it is to acquire a 14.9% share in its e-F@ctory partner Adroit Technologies.

The MAPS technology was developed jointly by the two companies to address the traditional shortcomings of traditional PLC-SCADA integration tools.

This single integrated package takes users through all the phases of process design, engineering design, control system design, installation, commissioning, acceptance testing and ongoing maintenance; helping to maintain consistency and integrity within an automation system, improving quality and reducing costs.

In process applications where Mitsubishi Electric PLCs are mixed with SCADA solutions from Adroit Technologies, MAPS is said to provide a structured approach to life-cycle engineering. It provides a standards-based approach that reduces the time and effort in automation project design, testing and commissioning phases, with pre-defined and user configurable PLC function blocks and associated SCADA graphics, based on the international S88 and IEC 61131-3 standards.

e-F@ctory Partner



The Integration of Adroit's (MAPS) SCADA

The integration of Adroit's SCADA system into the software of Mitsubishi Electric

Mitsubishi Electric and e-F@ctory Alliance Partner Adroit Technologies have developed a solution with the Mitsubishi Electric-Adroit Process Suite (MAPS) that provides a whole host of advantages in contrast to conventional SPS-SCADA systems. This engineering tool for the complete product life cycle of automation solutions creates a lot of added value for the user, especially in the development and integration phase. In addition, MAPS makes it easier to embed already existing data and allows customers to carry out expansions and maintenance measures independently.

Improved quality at reduced costs

MAPS guides the user through all phases of your project, from process design to engineering, development of the control systems, installation, initial start up and acceptance test right up to continuous repairs. MAPS therefore supports consistency and integration of every automation systems and improves quality while reducing costs.



Review of SCADA systems - Autolink

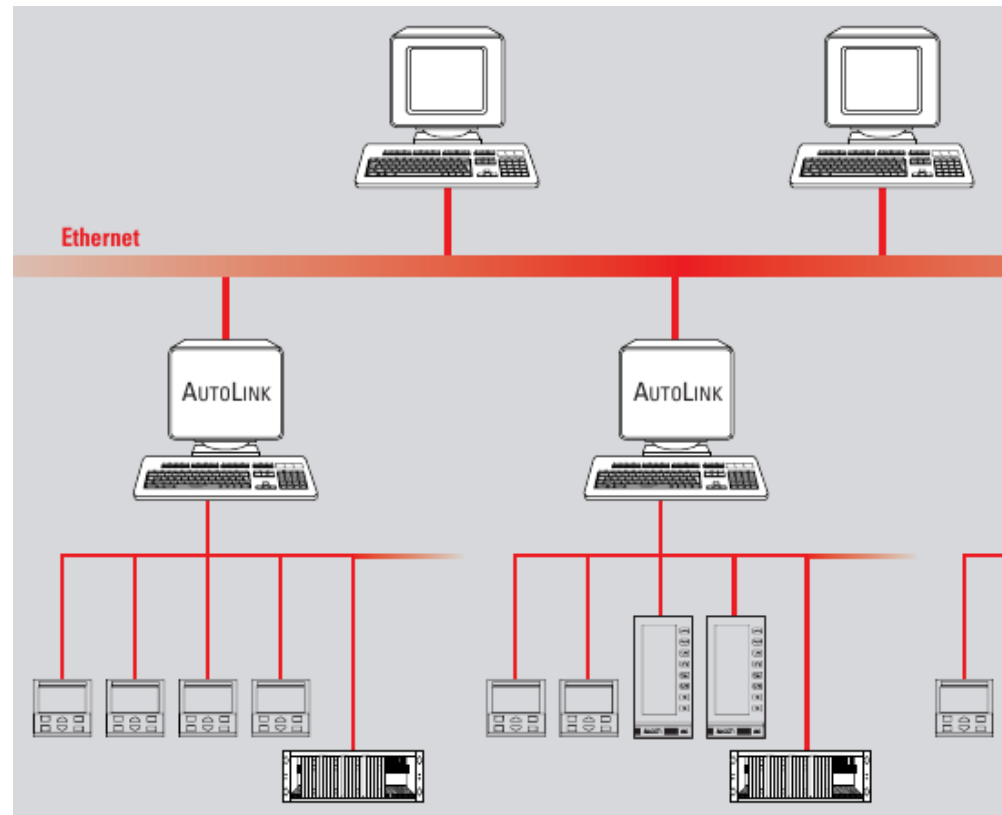
Autolink – SCADA system. Provider: ASCON

AutoLink[®]

Data Acquisition
and Supervisory Control System

Main features:

1. Data acquisition & monitoring
2. Process operations
3. Library of drivers
4. Mimic & pre-formatted pages
5. RT & historical trending
6. Alarm handlers
7. Configurable reporting
8. Recipe management
9. Security operator levels



Review of SCADA systems - Autolink

Autolink – SCADA system. Provider: ASCON

AutoLink[®]
Data Acquisition
and Supervisory Control System

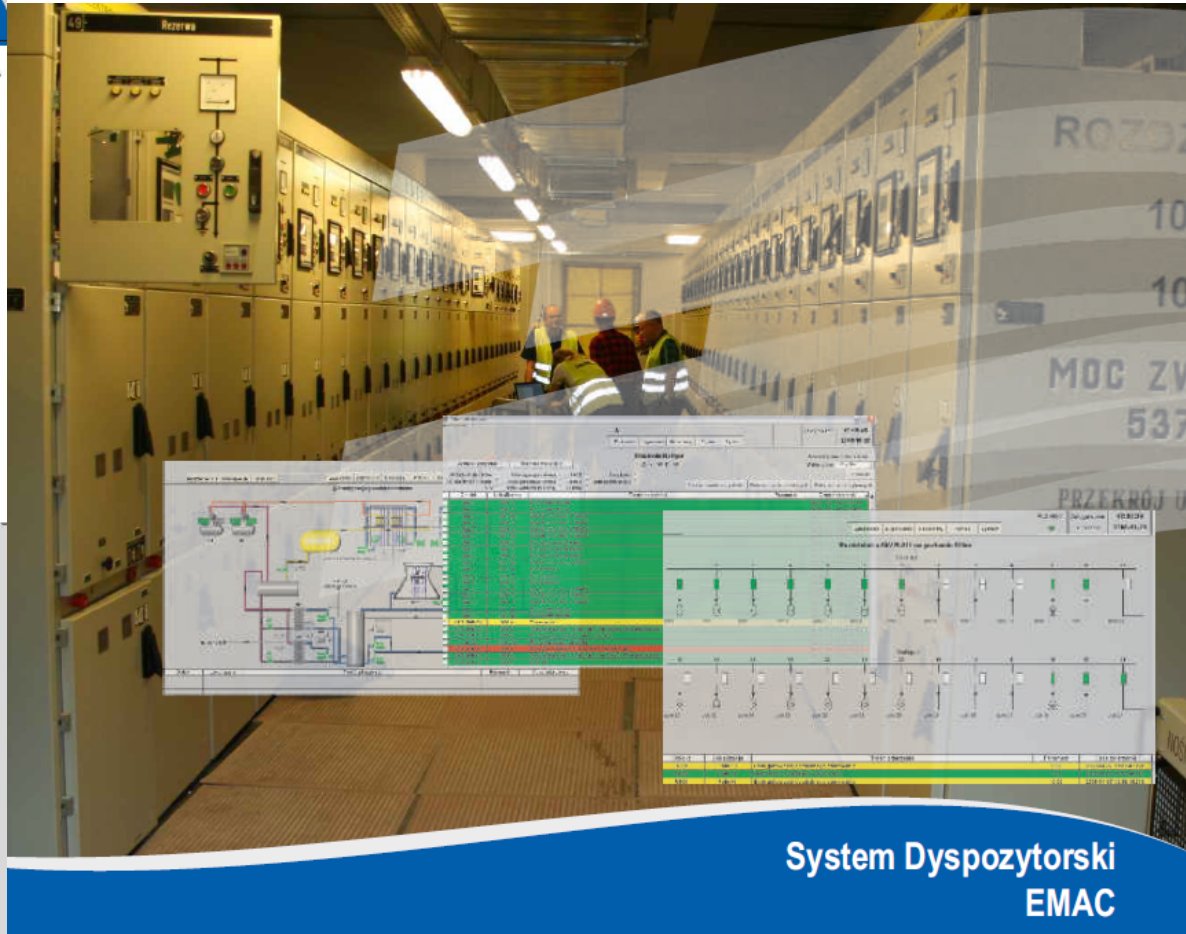
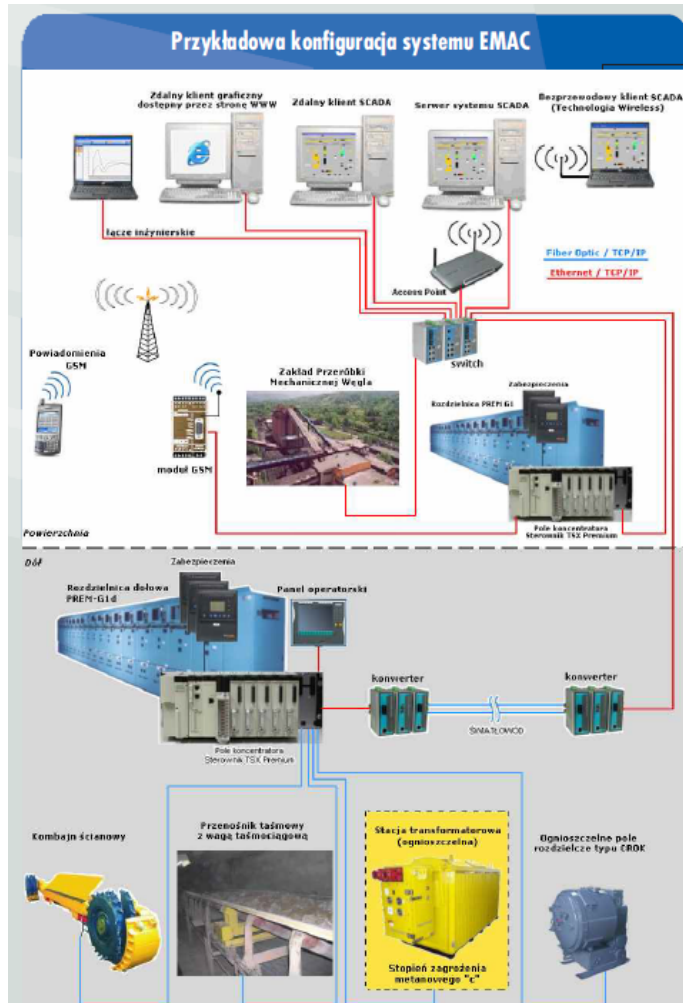
Event and alarm tracking and management system ensures that operators promptly receive notification of process upsets or abnormal conditions.

Archived data can be displayed via multiple pen charts, which provide precise and complete identification of process variables, as well as time scrolling and zooming capability.



Review of SCADA systems - EMAC

EMAC – SCADA system. Provider: ENERGETEST



**System Dyspozytorski
EMAC**

Review of SCADA systems - EMAC

EMAC – SCADA system. Provider: ENERGETEST

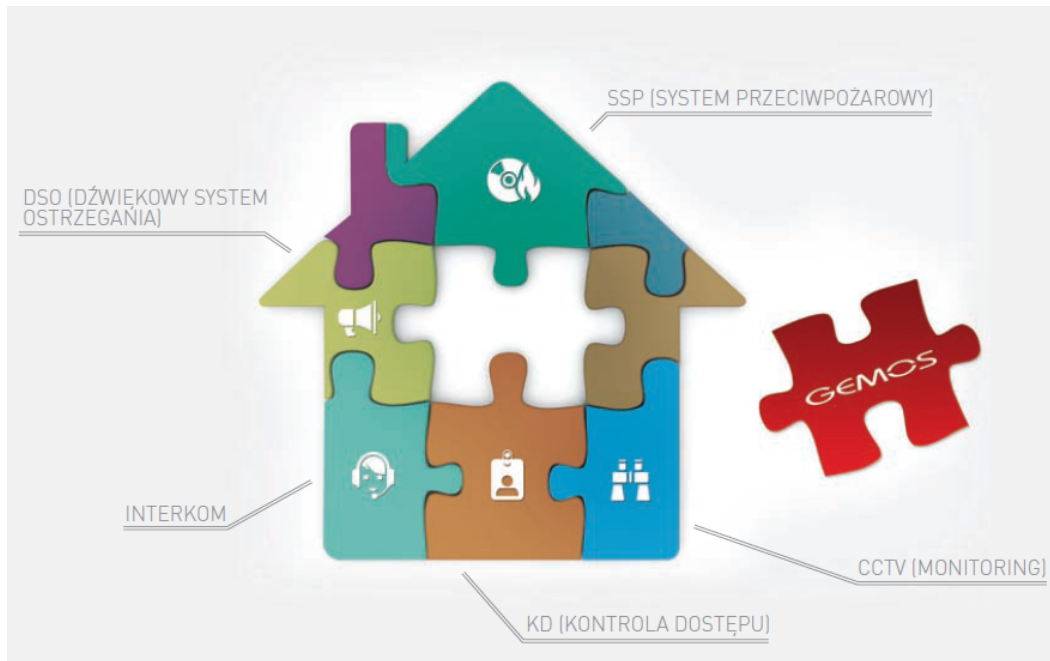
Data layer – EMAC allows to acquire data from range of controllers: PLCs, AD converters, embedded platforms, analysers, flow counters, etc.

Communication layer – EMAC supports a wide range of communication protocols: TCP/IP, Profibus DP, Modbus, Unitelway based on following transmission standards: Ethernet, Profibus, RS 232, RS 485, current loop.

Supervisory layer – supervisory layer is based on local control stations that communicate through client-server protocol.

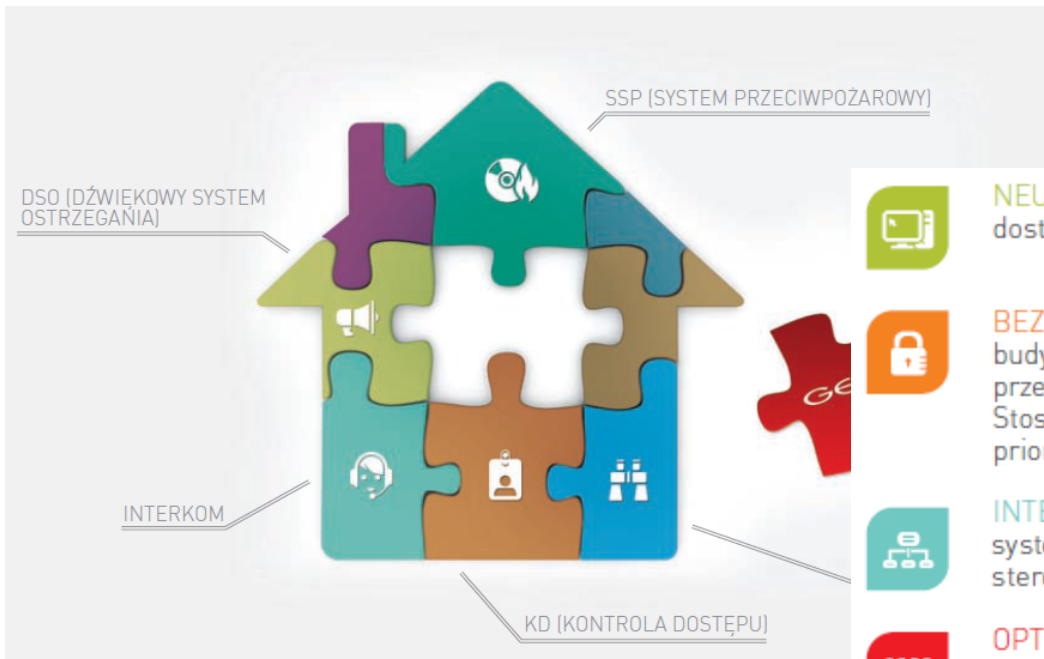
Review of SCADA systems – GEMOS

GEMOS – Intelligent building management. Provider: ELA COMPIL



Review of SCADA systems – GEMOS

GEMOS – Intelligent building management. Provider: ELA COMPIL



NEUTRALNOŚĆ – stworzony na jednolitej platformie system dostosowany jest do pracy z rozwiązaniami wszystkich producentów.



BEZPIECZEŃSTWO – najnowsza generacja systemów zarządzania budynkiem. Gemos jest systemem najczęściej rekomendowanym przez osoby mające bezpośredni wpływ na bezpieczeństwo obiektu. Stosowany wszędzie tam, gdzie bezpieczeństwo jest najwyższym priorytetem.



INTEGRACJA – integruje systemy sygnalizacji pożaru, dźwiękowe systemy ostrzegania, systemy sterowania wentylacją i oddymianiem, sterowania drzwiami ewakuacyjnymi, kontrolą dostępu, wind itp.



OPTYMALIZACJA – Gemos pozwala zoptymalizować koszty ochrony i obsługi technicznej obiektu.



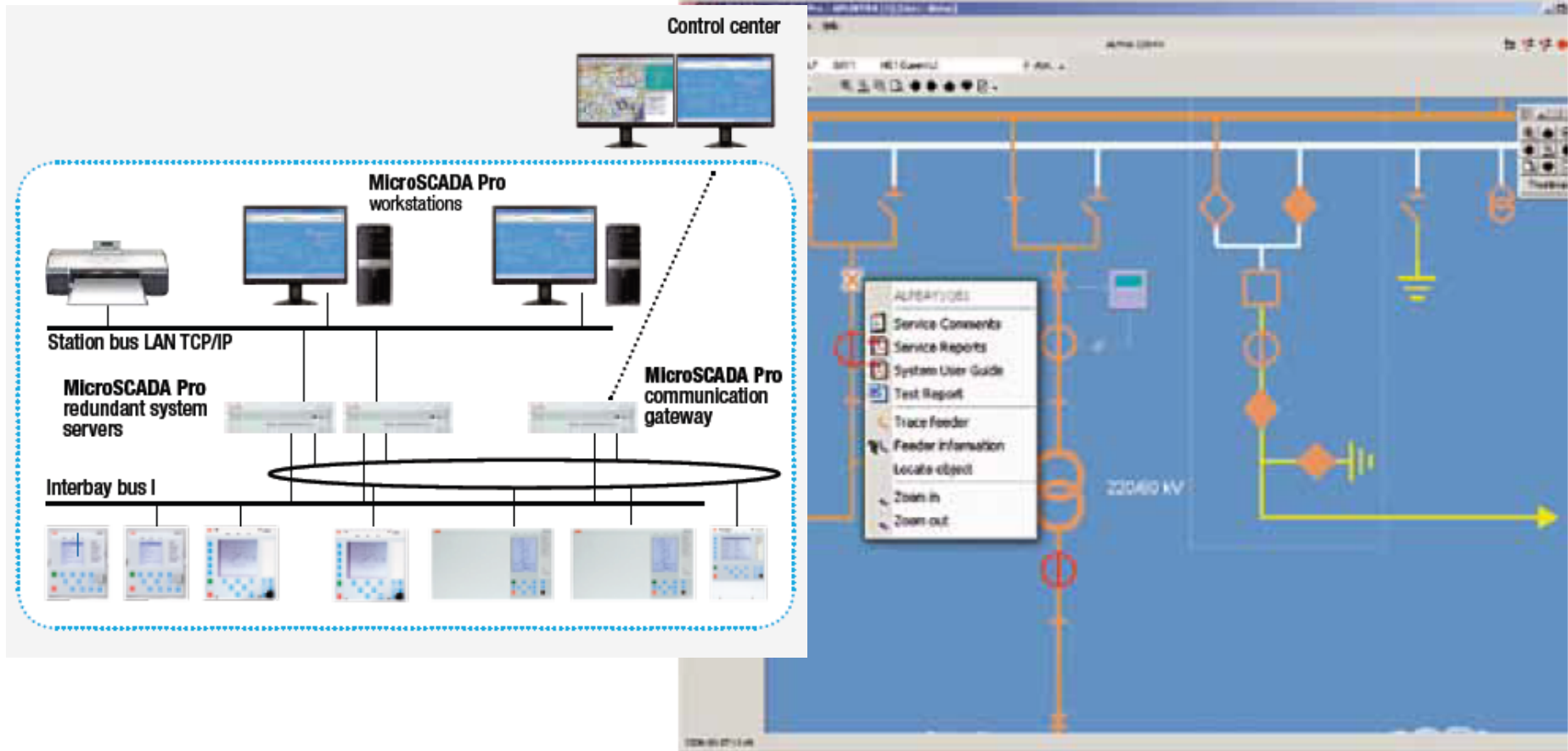
OSZCZĘDNOŚĆ – umożliwia oszczędną gospodarkę mediami i zasobami ludzkimi.



ERGONOMIA – ułatwia organizację czasu pracy, dzięki nowoczesnej platformie zarządzania.

Review of SCADA systems – Micro SCADA

MicroSCADA – SCADA system from ABB



Review of SCADA systems – Micro SCADA

MicroSCADA – SCADA system from ABB

Power distribution monitoring

- Process displays with network coloring, zooming, panning and de-cluttering
- Event, alarm and blocking lists
- Trends
- Historian for high-performance data logging, refinement, analysis and reporting
- **Power-quality monitoring**
- Uploading and analysis of disturbance record files

Communication and interfaces

- Solution libraries for efficient integration with protection and control IEDs
- Master protocols: IEC 61850, IEC 61107, IEC 60870-5-101/103/104, LON, SPA, RP 570/1, DNP 3.0 TCP/serial, Modbus TCP/RTU, ANSI X3.28, I35/P214, ADLP 180, etc.
- Slave protocols: IEC 60870-5-101/104, IEC 60870-5-104, DNP 3.0 TCP/serial, Modbus RTU, RP 570/1, ADLP180, F4F, etc
- **Ethernet redundancy according to IEC 62439/PRP**
- Open interfaces: OPC, ODBC, Application programming interfaces for application and communication extensions
- GPS time synchronization

Review of SCADA systems – Telexus

Telexus – SCADA system from Atrem

Telexus is a professional telemetry system with advanced methods of data acquisition and management.

It is composed of main three modules:

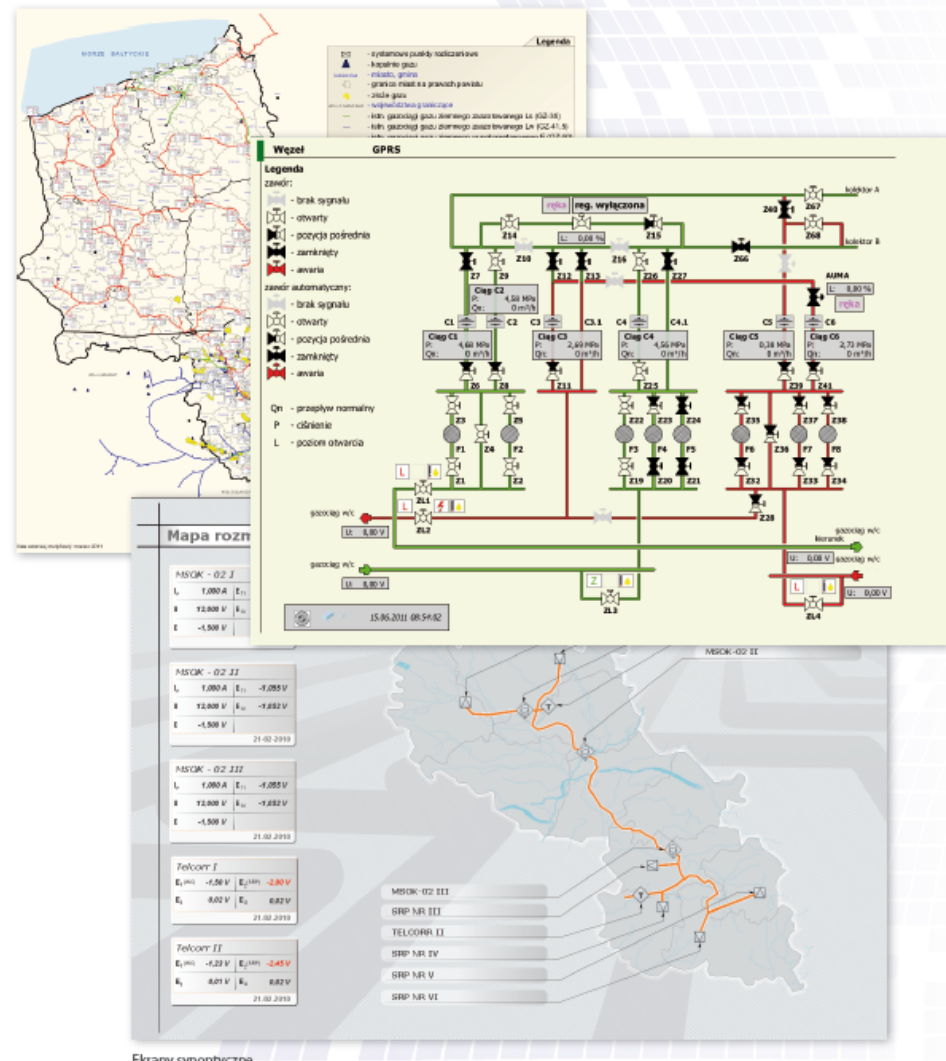
Data acquisition system - TCP/IP also GPRS, RS , modems PSTN i GSM
Protocols: ModBus, Mbus, GazModem.

Visualisation – flexible system that is based on vector graphics (i.e., user can design screens in for example Inkscape

Data reporting and analysis – professional engine for data processing that involves partial data processing; views perspectives etc. Also it is capable of verification and correction of the data.

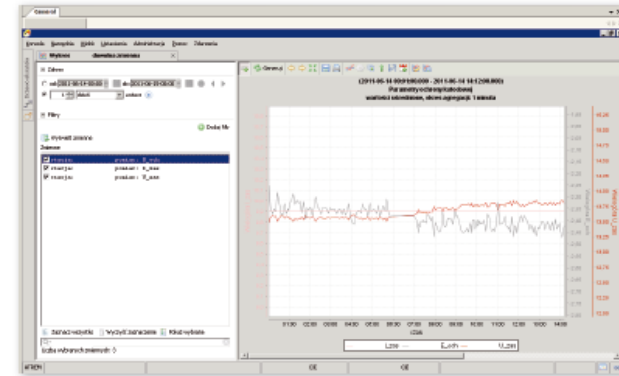
Review of SCADA systems – Telexus

Telexus – view screens

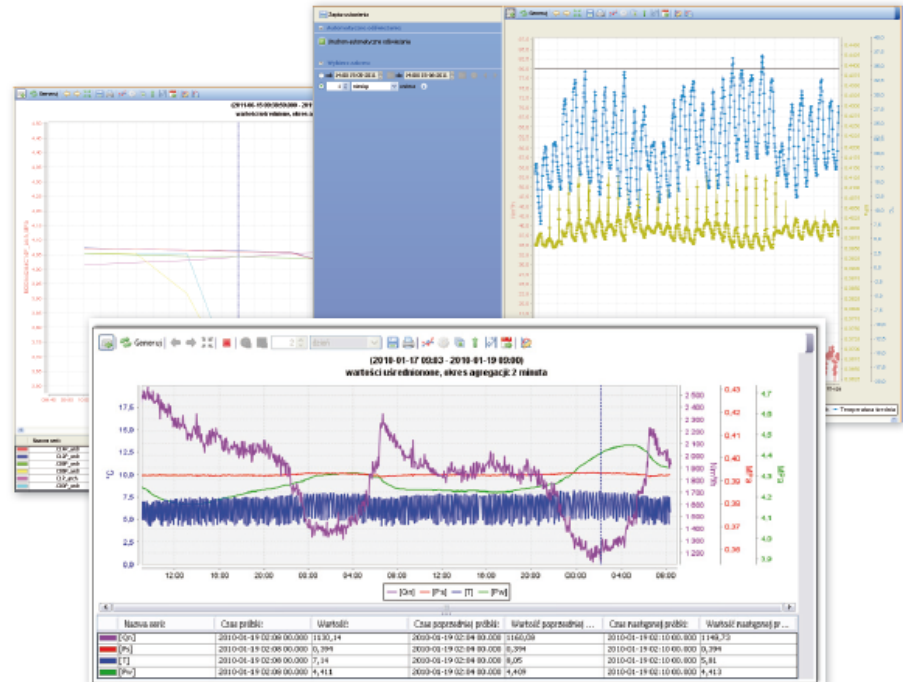


Review of SCADA systems – Telexus

Telexus – charts



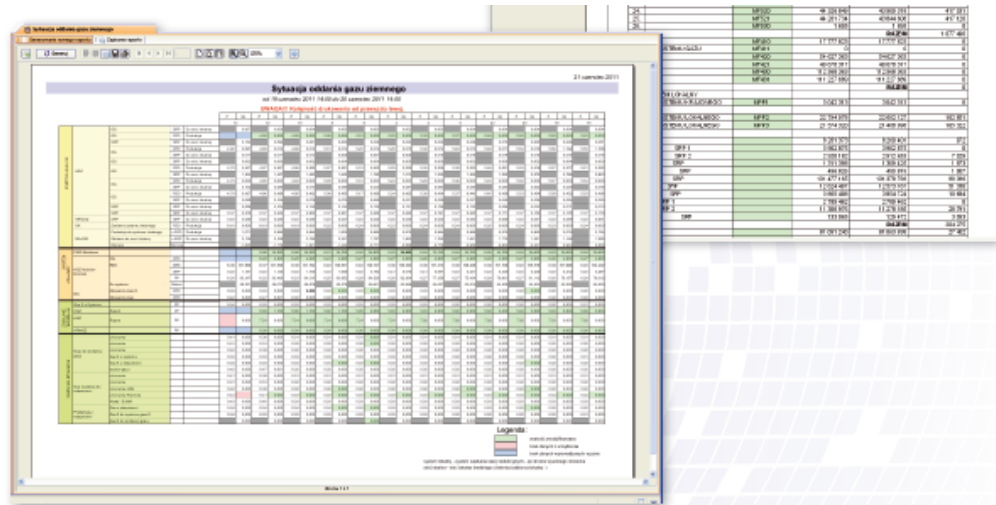
Wykres dowolnej zmiennej



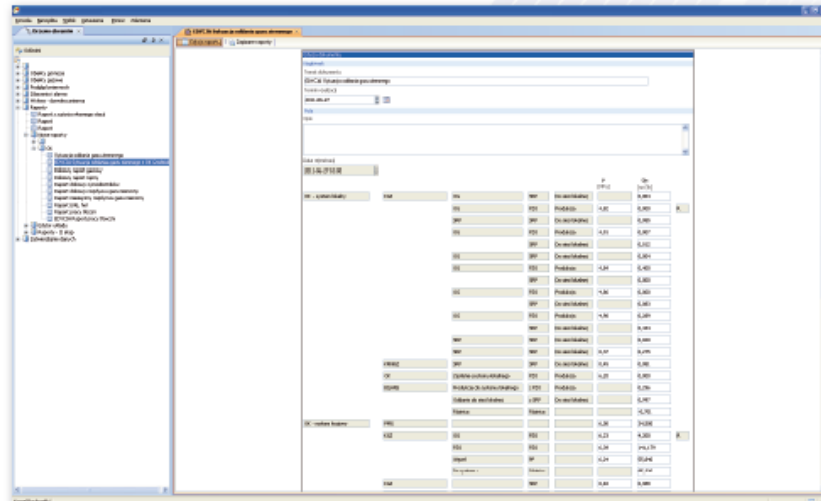
Wykresy

Review of SCADA systems – Telexus

Telexus – data sheets



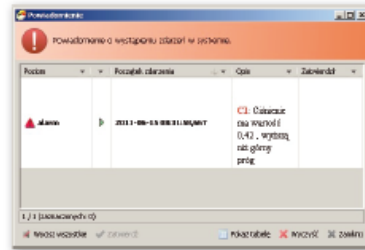
Przykładowe raporty



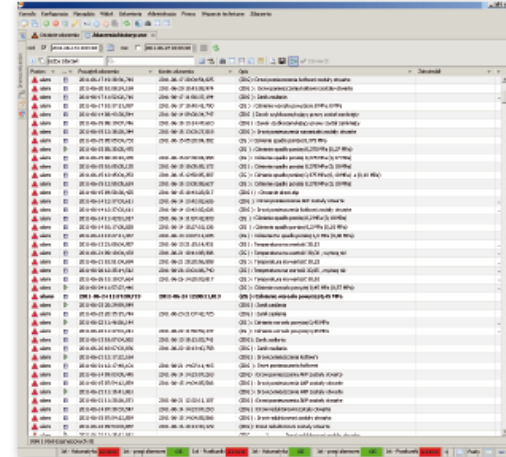
Raport w trybie edycji

Review of SCADA systems – Telexus

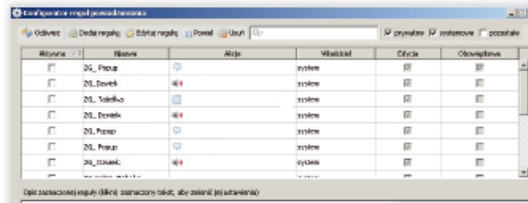
Telexus – alarms



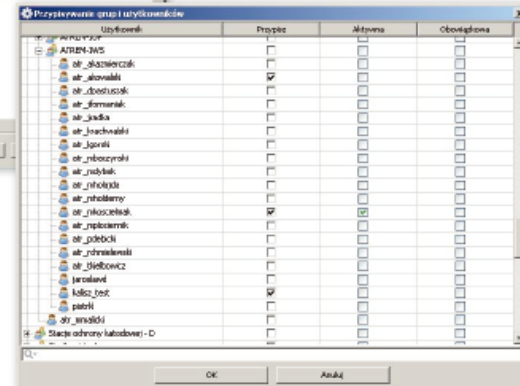
Okno informujące o wystąpieniu alarmu



Lista alarmów



Konfigurator reguł powiadomienia



Okno przypisywania grup i użytkowników

Review of SCADA systems – Telexus

Telexus – user setup

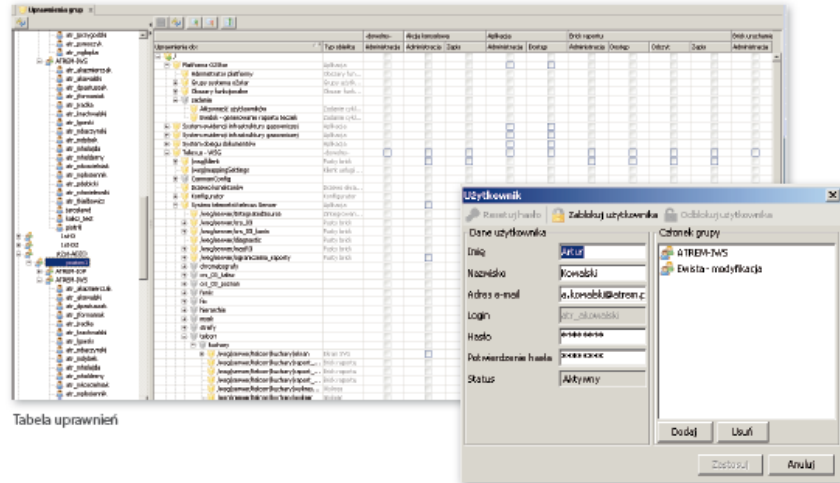
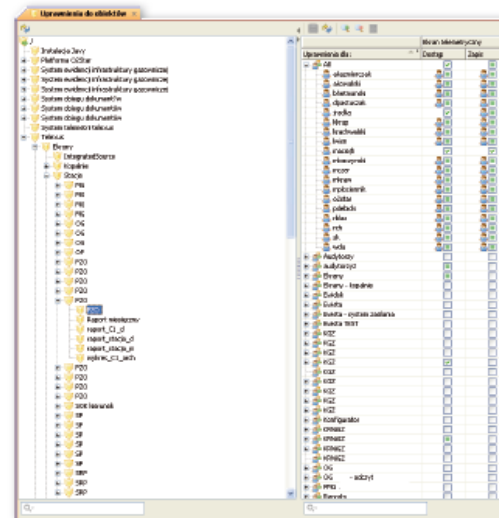


Tabela uprawnień

Okno z danymi użytkownika



Uprawnienia do obiektów

SCADA summary

Practical use of SCADA systems

Fire alarms (forests etc.)

CCTV (data registration, camera control)

Access control

Evacuation route protection

Failure/process interrupts alarms

Remote control

Sensor data collection

Meter data collection