[ISSUE 49] NOVEMBER 06

TECHNICAL NEWS

INDUSTRIAL SWITCHGEAR & AUTOMATION SPECIALISTS

NHP

THE MODERN SCADA SYSTEM

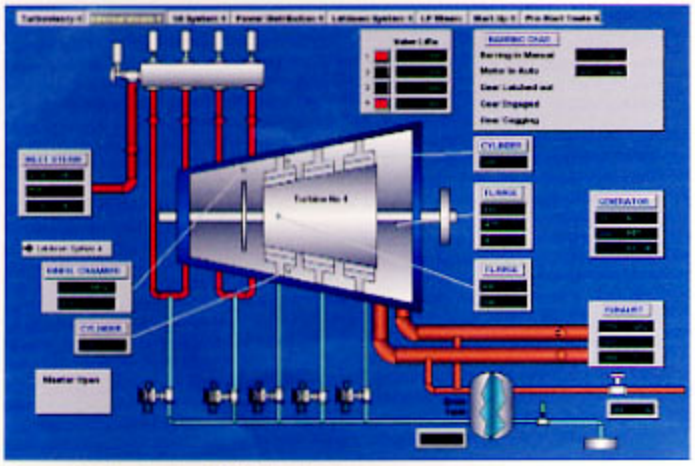
The acronym SCADA is a standard term in industry for Supervisory Control And Data Acquisition. Put simply a SCADA system provides a means of graphically monitoring and controlling a process along with storing historical information.

The SCADA system typically runs on PC based hardware and is connected to the process via process control hardware such as Programmable Logic Controllers (PLCs), Remote Telemetry Units (RTUs), Energy Meters etc.

SCADA software has been around for many years and experienced significant changes. Perhaps the most compelling evolution has been the migration from proprietary technologies to open software standards. Examples of this include standard scripting languages such as Visual Basic and Java, open communications via OPC (OLE for Process Control) and commonly used database standards.

More recently, one of the major influences on SCADA systems is the implementation of Web based technologies greatly enhancing the way in which a SCADA system can be deployed.

In this issue of technical news, we will discuss some of the fundamentals of a modern SCADA system.



Example of a typical SCADA display screen

FEATURES

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Architecture

Hardware Architecture

There are two basic layers in a SCADA system: the "client layer" which caters for the man machine interaction and the "server layer" which handles the process data control activities. The server communicates with devices in the field through process controllers. Process controllers, e.g. PLCs, are connected to the data servers either directly or via networks or fieldbuses that are proprietary (e.g. Hitachi H Protocol), or non-proprietary (e.g. Profibus). If more than one server is present, they are connected to each other and to the client stations via an Ethernet Local Area Network (LAN). The servers and client stations typically run on separate PCs with Windows operating systems.

Software Architecture

The SCADA systems are multi-tasking and are based upon a real-time database located in one or more servers. Servers are responsible for managing communications to the process controllers, data acquisition and handling (e.g. alarm checking, calculations, logging and archiving) on a set of parameters. Clients, connected to the servers, have the capability of configuring, displaying and manipulating the values stored in the serves' database.

Communications

Server-client and server-server communication is in general on a publish-subscribe and event-driven basis and uses a TCP/IP protocol, i.e., a client application subscribes to a parameter which is 'owned' by a particular server application and only changes to that parameter are then communicated to the client application.

The servers poll the controllers at a user defined polling rate. The polling rate may be different for different parameters. The controllers pass the requested parameters to the servers. Time stamping of the process parameters is typically performed in the controllers and this time-stamp is taken over by the data server.

The products provide communication drivers for most of the common PLCs and widely used fieldbus networks, e.g., Modbus. Some of the drivers are based on third party hardware or software products (e.g. Special PC cards, or additional software application) and therefore have additional cost associated with them.

A single data server can support multiple communications protocols; it can generally support as many such protocols as it has slots for interface cards.

Interfacing Via Open Standards

The provision of OLE (Object Linking and Embedding) for Process Control (OPC) client functionality for SCADA to access control devices in an open and standard manner is available.

OPC is a technological basis for the convenient and efficient link of automation components with control hardware or field devices. Most of the controllers' vendors provide OPC Server software for easy connection to an OPC client.

Modern SCADA systems provide users with ways to access and use plant floor data. Along with the OPC support, users can use OLE, ActiveX and connectivity to databases using the Open Data Base Connectivity (ODBC) technology.

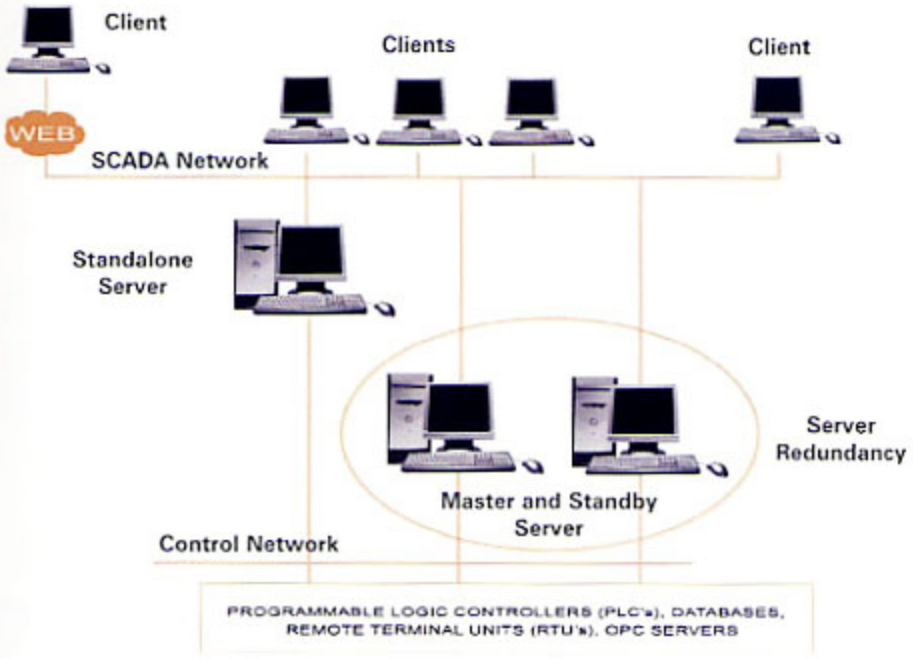
This functionality allows users to provide information to any third party application, which support standard data exchange formats i.e. Spreadsheets or Databases

Scalability

Scalability is understood as the possibility to extend the SCADA based control system by adding more process variables, more servers or more clients. The products achieve scalability by having multiple servers connected to multiple controllers. Each server has its own configuration database and is responsible for handling of a sub-set of the process variables (acquisition, alarm handling, archiving).

Redundancy

The SCADA software has built in software redundancy at a server level, which is normally transparent to the user. The general idea of redundancy is that the master server services all the controller's inputs / outputs (I/O) and client tasks, while the standby server replicates the master server. If the master server or machine fails, the standby server takes over as master.



Typical Hardware Architecture

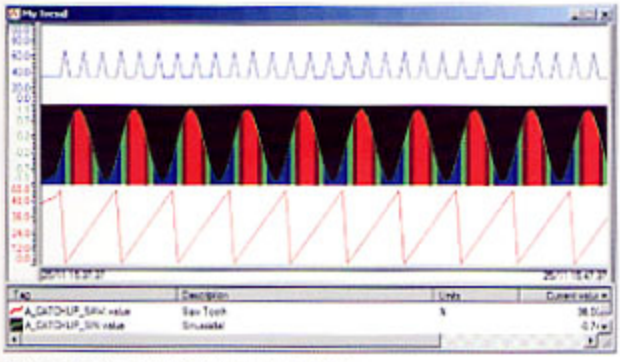
Basic Funcionality of a SCADA System

Access Control

Users are allocated to security groups, which have defined read/write access privileges to the process variables in the system and often also to specific product functionality.

Trending

The SCADA software provides trending facilities that can be used to graphically display a value that is sampled against the time. The user is able to sample more than one variable on a trend window, and view the real-time and/or historical data. Zooming and scrolling functions are also provided.



Example of a SCADA trend window

Alarm Handling

Alarm handling is based on limit and status checking of the variables within the process. The alarms are logically handled centrally, at the server level, i.e., the information only exists in one place and all users see the same status. Local acknowledgement (only on

the current workstation) or global acknowledgement (across the entire SCADA network) is supported as well.

The alarm, when active, can be sent to an alarm list (visible for the operator, and wait for acknowledgement); can be used as a trigger of an audio/video device or a predefined action can automatically be executed in response to the alarm conditions; can be sent to a printer, and/or it can be logged. Also, an alarm message can be sent as an SMS to one or more mobile phones or even emails can be generated and sent to multiple email addresses.

It is generally possible to group alarms and to handle these as an entity (typically filtering on group or inhibiting the alarms during maintenance periods). The filtering of alarms seen on the alarm page or when viewing the alarm log is also possible at least on priority, time, and group.

Example of a SCADA alarm window

Logging

The term logging means medium-term/long-term storage of data either on disk or on another permanent storage medium. Logging is typically performed on a cyclic basis, i.e., once a certain file size, time period or number of points is reached the data is overwritten. Logging of data can be performed at a set frequency, or only initiated if the value changes or when a specific predefined event occurs. The logged data is date and time stamped and can be filtered when viewed by a user. The logging of user actions is in general performed together with either a user ID or station ID. Some SCADA systems offer a video play back utility (VCR), built into the SCADA, to play back logged (historical) data.

Report Generation

SCADA systems can provide information to any third party application, which supports standard data exchange formats i.e. Spreadsheets or Databases, which can be used to create web-based reports, which management can use to directly monitor production and profits from their offices. It is also a user-friendly way of producing reports, charts and graphs relating to activity on the factory floor.

Automation

The SCADA system allows actions to be automatically triggered by events. Scripts are typed in Visual Basic, Java or C, and configured to execute on demand or can be scheduled.

The concept of recipes is also supported. The recipe gives the user/operator the ability to control and manage ingredients for a given product. An example maybe a cement mixing plant that have numerous grades of concrete each requiring varying amounts of sand, water, and aggregate. By selecting the appropriate recipe SCADA will download all relevant parameters to the PLC for processing. In addition to this each mix will be assigned a batch number as a reference, which can be used for tracking purposes.

Industries and Applications

PLC's and thus SCADA are being used in more and more industries everyday. These are a few, but there are lots more out there:

Mining, Petrochemical, Chemical Processing, Pulp and Paper, Automotive, Food and Beverage, Pharmaceutical and Medical, Energy Management, Building Management, Water Treatment/Distribution, Cement, Agriculture, Wine, Packaging, Power Utilities and so on.

Evolution

SCADA vendors release one major version usually once every two years, and one to two additional minor versions once to two times per year. These products evolve thus very rapidly so as to take advantage of new market opportunities, to meet new requirements of their customers and to take advantage of new technologies.

The Impact of the Internet on SCADA

As with IT and computing in general, the most obvious impact of the Internet on SCADA HMI systems is the promise of near-universal access to information, plus an element of standardisation in the user interface. Taken to its most simplistic conclusion this means "anyone able to access anything from anywhere".

Microsoft®.NET and its impact SCADA

The technology and philosophy behind .NET was the biggest advance in software since Windows replaced DOS. As a result of the changes in how businesses and consumers use the Web, the industry is converging on a new computing model that enables a standard way of building applications and processes to connect and exchange information over the Web.

The general idea behind Microsoft®.NET is to enable developers of applications to develop products and services that reside on the Internet. In addition, applications can interact with each other securely and safely, by exposing their data via an XML (extensible markup language) interface technology commonly referred to as a 'Web service'. The Microsoft®.NET development tools and the .NET framework take care of the connection and security or 'plumbing' between such applications allowing developers to concentrate on building the product, rather than the infrastructure.

BENEFITS OF SCADA

- Improved productivity through:
  - Faster response to problems
  - Better control over the process
  - More highly motivated and skilled employees
  - More accurate reporting on the business
- Operators can easily adjust process set points, respond to alarms, and manage the plant more effectively
- Historical data lets operators develop predictive maintenance procedures to avoid unscheduled downtime
- Remote monitoring systems allows the process to be managed off site, 24 x 7

Best of Breed

NHP Electrical Engineering Pty Ltd is exclusive distributor of the Adroit SCADA Software. Adroit is a technologically advanced, native 32 bit SCADA system designed for process control, manufacturing systems and open automation applications.

Developed specifically for Windows NT, Adroit has a flexible object-oriented client server architecture that supports from a standalone implementation to an installation spanning multiple sites.

From the outset, Adroit was designed with the aim of being a "best of breed" SCADA package, and through standard communication interfaces would interact with other best of breed products throughout the IT business model. Adroit not only met this "best of breed" philosophy but is continually being enhanced to include the latest industry standards such as COM/DCOM, OLE DB, OPC and Web technology.

For the user this means a SCADA package that is truly open, offering optimum performance, flexibility for future requirements, and a robustness that you would expect from a "best of breed" product.

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