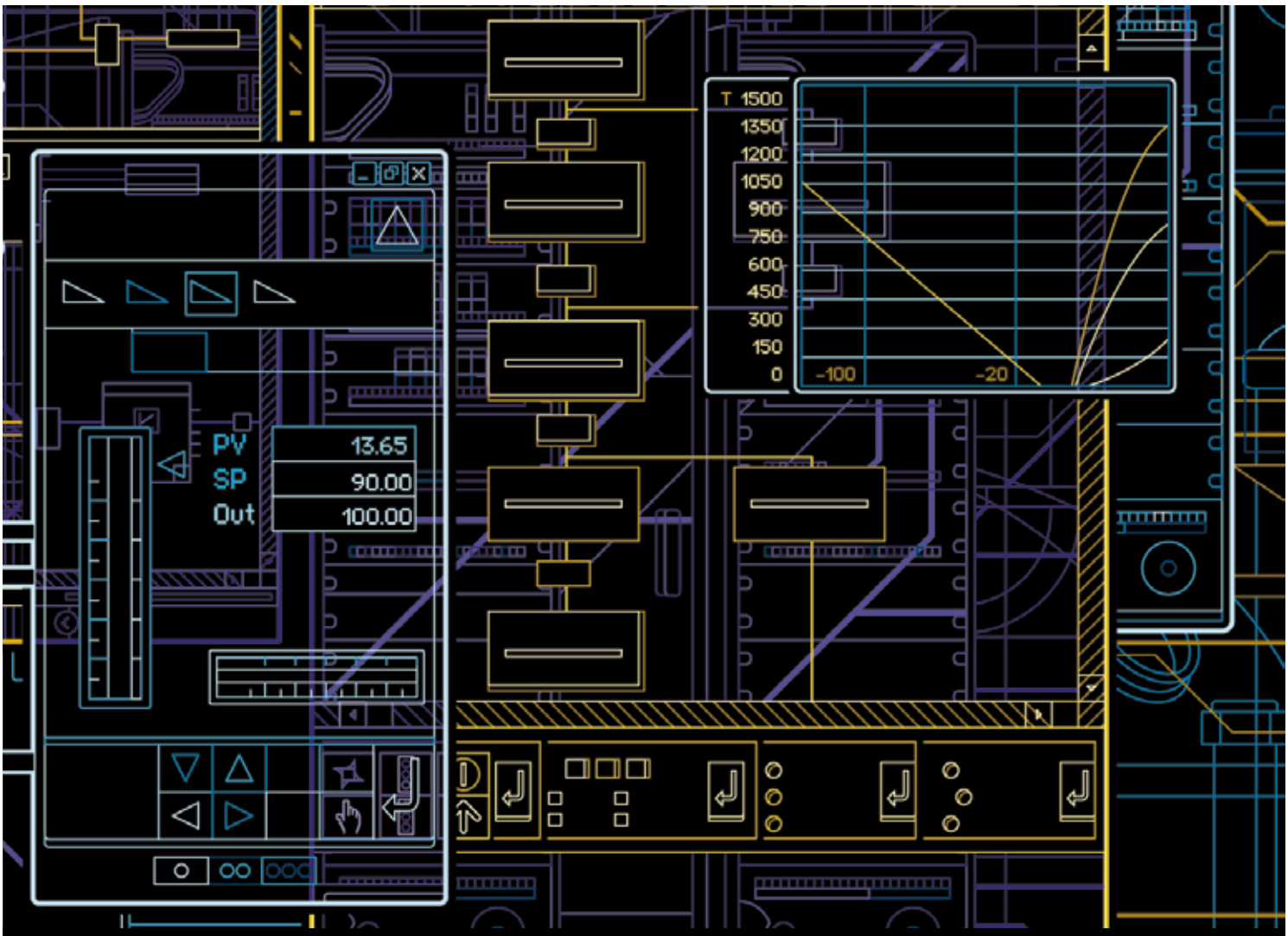


Production, gathering, transmission and distribution

SCADAvantage™ for the oil and gas industry

Future-proofed software and solutions

Power and productivity
for a better world™

SCADAvantage™ core systems offer full featured performance

ABB has been a global supplier of automation to the oil and gas industry for decades. ABB knows that the oil and gas markets are demanding, and we're dedicated to offering solutions that meet our customers' needs. Uniquely designed for challenging oil and gas operations, ABB's SCADAvantage™ was conceived for a dynamic industry that requires safe and reliable control of distributed assets, as well as a bi-directional interface with corporate systems.

A Powerful core

SCADAvantage™ is built on a reliable, high performance, relational database that is ten times faster than typical SQL databases and is truly unique in the market.
Traditional SCADA systems depend upon memory linked lists. SCADAvantage™ uses a real-time relational Database Management System, referential integrity and active queries to enhance data retrieval, data integrity and the speed of data updates. Even with all these capabilities, SCADAvantage™ consumes less computer memory than traditional systems.
The Database Management System combines standard SQL technology with powerful features that improve memory efficiency, performance, data quality and connectivity to external corporate relational databases.
Data consistency is enforced through referential integrity.
An easily configurable polling engine makes data acquisition smooth on low speed networks or over noisy communication lines. Data polled from remote devices is collected and stored in an embedded historian included in the base license package.
Redundancy and database updates by exception provide superior performance and reliability.
Performance is crucial in today's control room environment; SCADAvantage™ 64bit operating system support removes the memory limitation of 32 bit operating systems. In addition, SCADAvantage™ speeds up data interchange by lowering data transfer between servers and clients through a unique feature called active queries. The server's "push engine" updates the clients only when values have changed which significantly reduces network traffic. Last but not least SCADAvantage™ is the most cost effective high end SCADA in the market, characterized by simple, low cost maintenance.

Features are always safe, robust and reliable, under SCADAvantage™ control

Replication

Scalability is a SCADA system key requirement of oil and gas companies in order to cope with very large areas. SCADAvantage™ supports distribution thoroughly through its replication engine.
Live data, databases and operator interface configurations are “replicated” to other servers in real time. Transfer is bidirectional and commands as well as set points can be issued at the local facility or remotely at the regional center, with appropriate interlocking if required (e.g. after hours). Supervision and consolidation of local and regional data provide extensive flexibility in system deployment and maintenance.
Replication occurs in two models:

- Hierarchical (local, regional and corporate levels)
- Peer-to-peer (offsite backup control center for immediate disaster recovery)

Replication allows automatic configuration to be:

- Centralized (remote non-intrusive)
- De-centralized (local to the server)
- Both

Online Disaster Recovery

SCADAvantage™ supports an on-line Disaster Recovery server that allows backing up the system automatically in real-time. The Disaster Recovery server can be part of the system upgrade to offer seamless upgrades with no downtime for critical operations that require permanent control.
Disaster Recovery main features are:

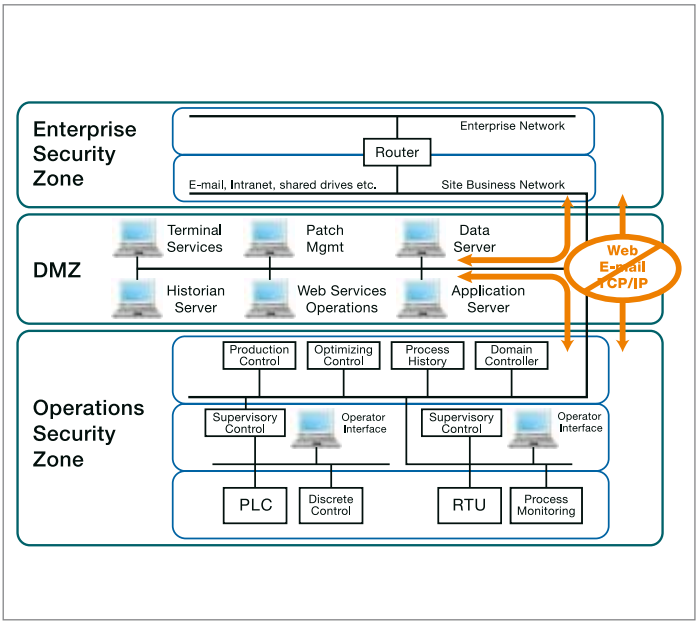
- Complete binary copy of Real-Time Relational Database (RTRDB) and Log Files. Copy can be sent to up to 3 machines
- Up to triple redundancy available also for system upgrades with no downtime
- Journal transactions enable fast failover

Business object templates

Pre-engineered templates allow the user to create multiple instances of objects in the system with the push of a button.
Specific templates permit the creation of:

- RTUs and PLCs
- Flow measurement devices (for liquids and gas)
- Pump-off controllers for rod pumps
- VSDs for PCP and ESP pumps
- Pumping and compressor stations
- Flow stations

The enhanced flexibility required by oil and gas SCADA in order to meet the changing needs of the field is a prime consideration and the result is a remarkable simplification of system maintenance.



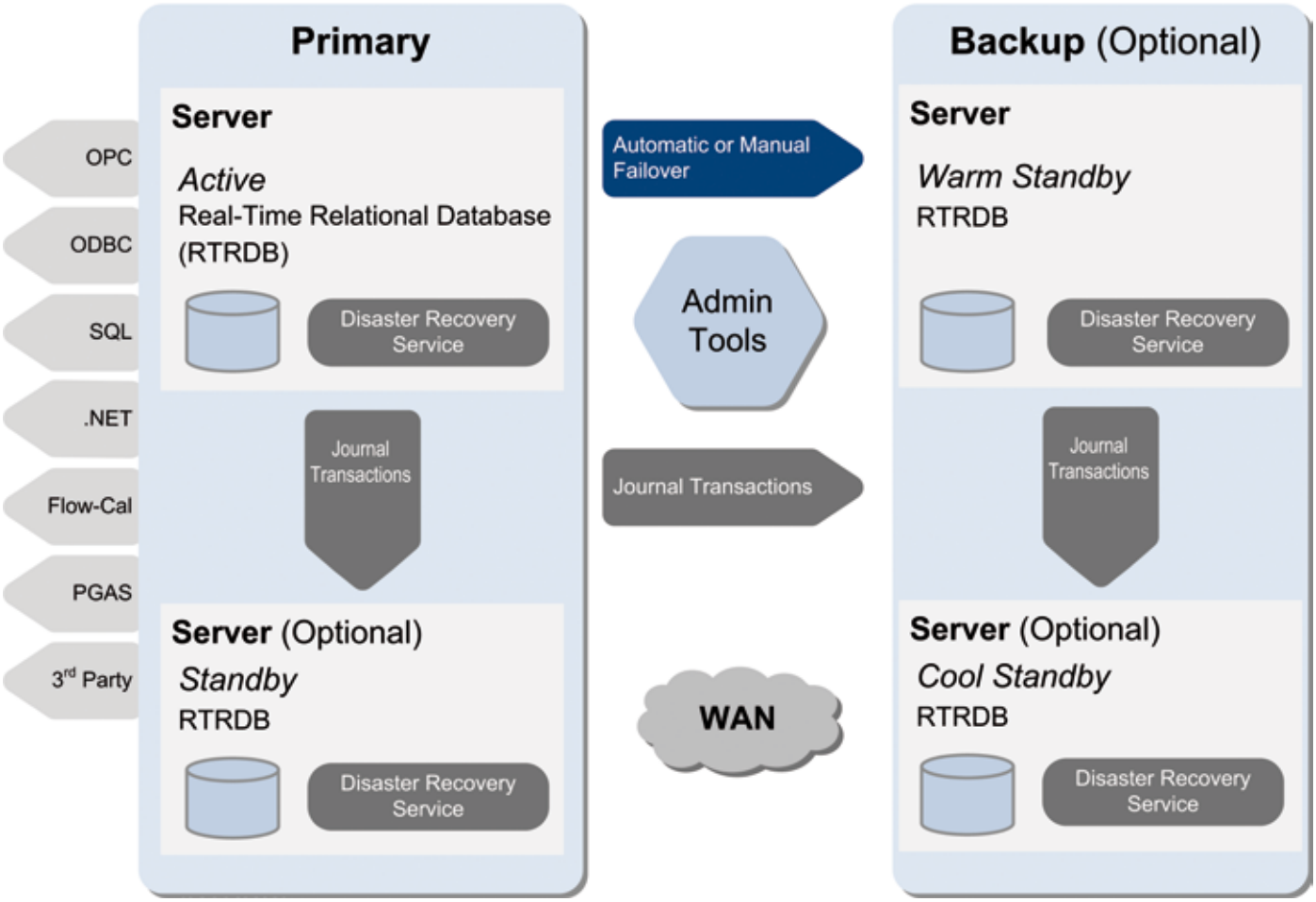
Security

Security is offered through a fully configurable authority system that prevents unauthorized persons from gaining access and activating commands. The multi-level security system conforms to any corporate standard criteria and maintains the history of each user’s access to objects attributes, data, displays, production areas and controls. SCADAvantage™ can be implemented on any security level. From the simple schema of firewall protection to the most sophisticated architecture in the market according to the customer’s requirements:

- Re-routing of alarms for unattended areas
- Zones and zone groups access control
- Encryption and VPN support
- Inactivity logout
- Active directory support for centralized security with a password policy featuring:
  - Strong passwords
  - Automatic password expiration
  - Password re-use
  - Account lockout on repeat violations
  - Password length
  - Login auditing

“In active drilling areas, customers are drilling 20- 30 wells per month. SCADAvantage™ automates and simplifies addition of wells to the system for significant lifecycle cost savings.”

SCADAvantage™ adapts to industry demands



Redundancy

Up to triple real-time server redundancy allows the system to run with an active/standby configuration. Of course redundancy is also supported for communications (network, serial, satellite, radio, leased lines, GPRS, etc.) and through the levels of replication. Unlike many competitors' systems (which monitor hardware only), SCADAvantage™ fully monitors both hardware and software operations to provide advanced protection against failure.

Enterprise Systems Interface

SCADAvantage™ supports open and real-time international standards of connectivity such as: ODBC, OLEDB, OPC DA, AE and HDA. These same standards are supported by most of corporate databases and systems such as SAP, Pi, PVR, FieldView, Maximo and Schlumberger Epinet. This commonality lets external relational databases communicate with SCADAvantage™ real-time database, allowing remote procedure calls for easy bi-directional data transfer meeting any connectivity standard.

A direct interface to Flow-Cal software for editing and analyzing measurement data is available as an add-on application.

Communication

SCADAvantage™ supports and monitors multiple paths of communications such as:

- LAN/WAN and leased lines
- Licensed and spread spectrum radios
- Microwave
- Satellite
- Cellular networks (GPRS and CDMA)

Communications analysis is available through real-time screen shots and trends; the system includes a protocol analyzer for radio and TCP/IP link.

Main protocols supported are:

- ROCTalk and ROC Talk plus
- BSAP (including RBE and immediate mode)
- Modbus (TCP/IP, RTU,ASCII)
- Allen Bradley DF1
- Totalflow
- HP 48000
- Kimray RTU, Galvanic, Eagle, Mercury
- Cameron Adept (ex Barton)
- Hex repearter (Amocams)
- Toshiba G2
- DNP3
- IEC-870-5-101/104

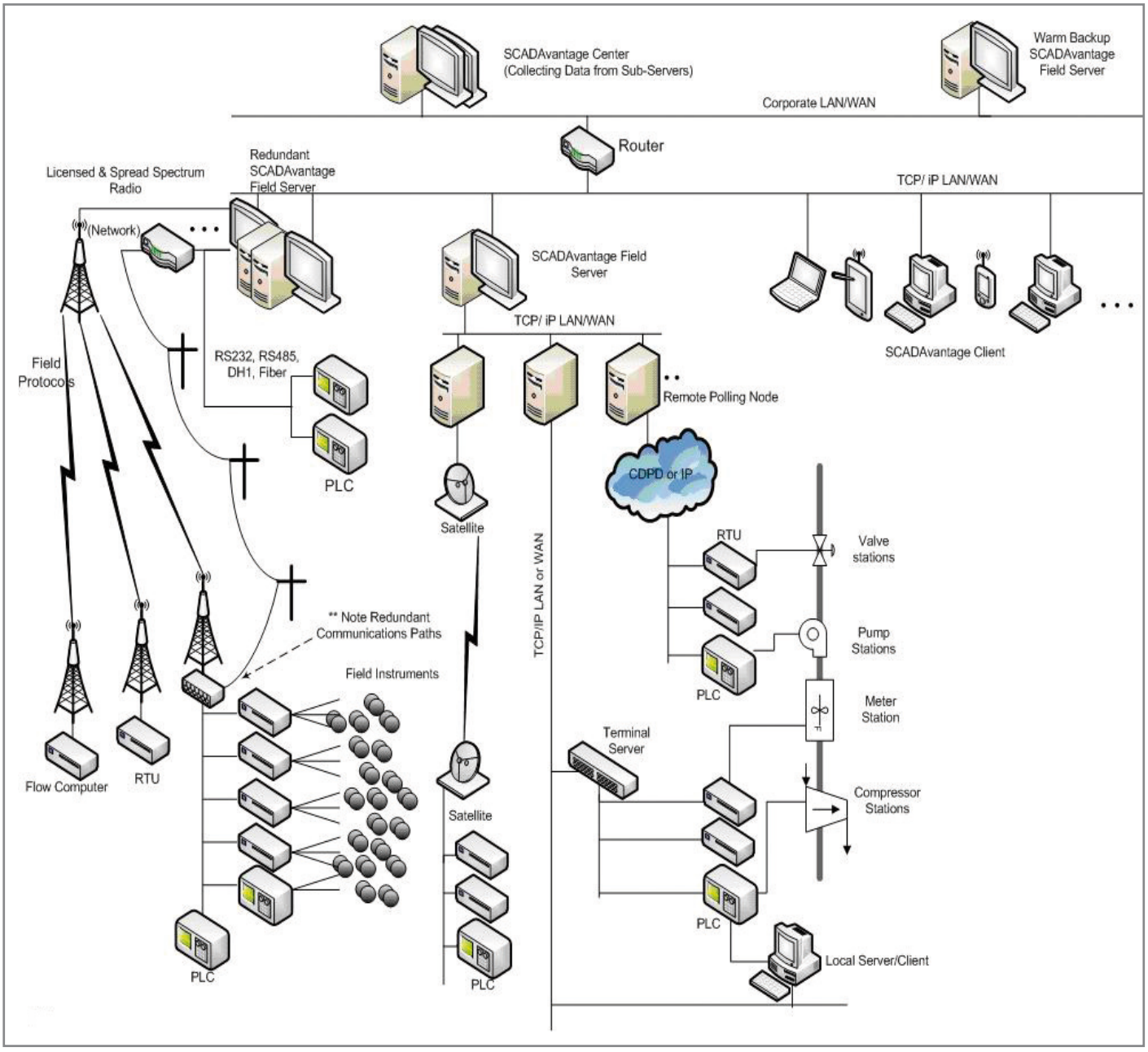
Reports

SCADAvantage™ provides comprehensive data reporting to production, operations, maintenance, engineering, accounting and management.
Database system and communication function logs are available. Reports are provided through Active Reports™: an integrated up-to-the-minute package, one of the leading reporting systems in the market.

Historical data

SCADAvantage™ has two types of historians. The first historian is based on internal logs for polled real-time data and calculated points. As part of the core system, this historian does not require a separate license. The database consists of raw, hourly and daily values, limited only by the size of the disk. This data is used to supply trend values and also supports automatic archiving and de-archiving.
The second historian, based on Microsoft SQL, is called Production Data History. This historian holds regulatory data, such as gas measurement data in compliance with API 21.1 and ERCB Directive 17. With this historian, production data can be uploaded daily.

Flexible, open and scalable architecture



In the current operational environment, it is essential to move operations from reactive to proactive.
SCADAvantage™ applications not only help operative staff with monitoring and control, they provide the right analysis for accurate and timely decisions.

Scalability

The system architecture was designed with future expansions and scalability in mind. SCADAvantage™ can also scale down to a very basic solution with remote data collection, alarming, call-out and reporting capabilities. As the business grows, regional facilities can be connected to a central office. The regional systems provide local applications for daily operations and management of personnel while replicating pertinent information to the centralized system. The central office contains all aggregated data from regional offices and can interface with 3rd party software like Pi, SAP and Maximo to automate business processes and data flow. The topology of the system can be designed to meet business needs and ensure the system availability that is required. Different operational goals and scenarios can help determine how the system is architected. Some example scenarios are shown below:

- Local --> Region --> Enterprise
- Field --> Country --> Headquarters
- Tasks --> Key Performance Indicators --> Strategy

SCADAvantage™ Benefits

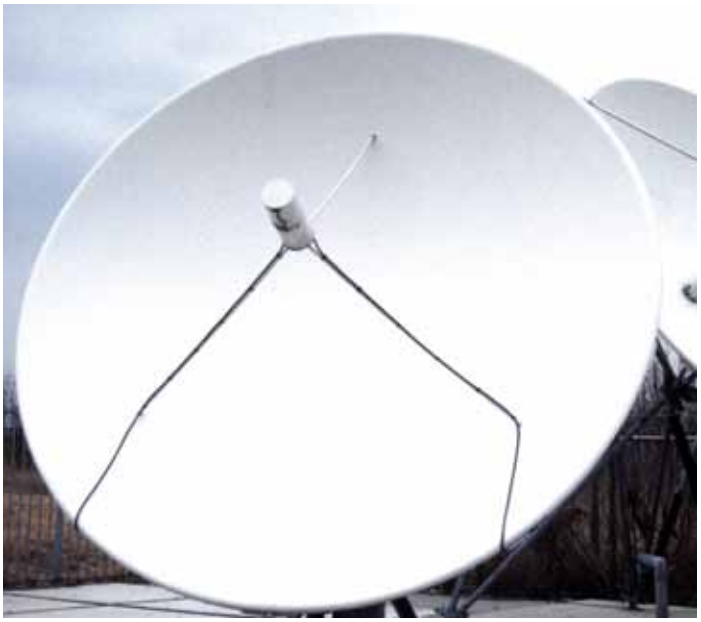
Efficient use of communication bandwidth
- Deadbands
- Data compression
- Publishing and subscribing
- Update by exception

Simple and consistent configuration
- Consistent look and feel in SCADAvantage™ explorer
- Dynamic, self-configuring maps
- 2 step full configuration of wells, metering and compressor stations

Low license cost
- Competitive server licenses
- No license required for client
- No license required for trending historian

Open, standards-based interfaces
- ANSI SQL
- ODBC
- OLEDB
- OPC DA, AE and HDA

Powerful alarm Call-out and Call-in



Alarm Call-out and Call-in application

Targeting reduced operating costs increasingly requires oil and gas companies to implement unmanned remote facilities. To ensure safety, operators need a robust warning system that communicates on any device, anywhere and at anytime.

In addition to screen warnings, Alarm Call-out and Call-in of SCADAvantage™ can force a PLC to sound an alarm horn if the site is experiencing a priority alarm condition.

Designated personnel receive audio or visual notification of operating problems through:

- Mobile or landline phones
- Email and SMS text messaging
- Voice radio
- Communications-enabled Tablets

Authorized personnel can dial into the system and use the phone keypad to request meter pressures, flowrates or temperatures. Request of data for a single well or for a range of meters is obtainable by keying in a pre-defined report number. Reports can also be requested on a mobile phone with text messaging. Basing on the report, operators can plan the appropriate intervention.

The Alarm Call-out and Call-in application is configured to escalate alarms. The system automatically calls out a series of telephones or other devices in an escalating pattern, if the alarm is not acknowledged within the configured response time. The application conforms to all levels of SCADAvantage™ system security, so that an audit trail of the escalation is saved in the database.
Blackout periods can be configured to temporarily disable alarm signals to specific users or groups. The blackout feature is useful if a person is on vacation or off shift as well as for locations where personnel are working onsite and can hear local alarm signals or where operators are monitoring alarm screens from a central control room.

On screen analysis tools, queries and messages complement alarms, realtime and historical graphic trends and reports for managing production facilities, injections sites, wells, metering stations, batteries, satellites, plants and pipelines.

Upstream applications
Full-featured daily production package

Production Data History (PDH)
Daily production reporting is at the heart of upstream production operations.

In upstream, Production Data History (PDH) provides fully regulatory compliant daily production reporting. PDH is based on Microsoft SQL server, using an object-oriented model that gives users the flexibility to add or modify entities.

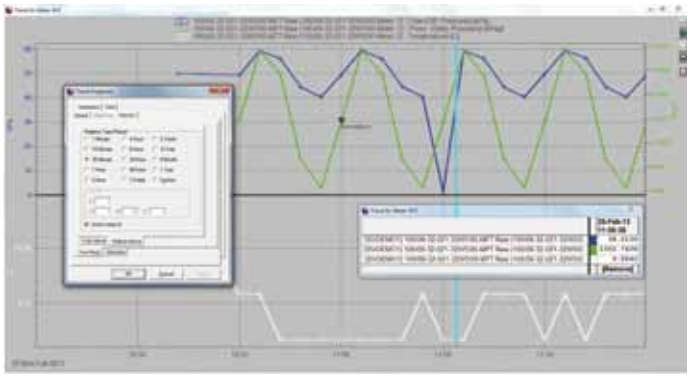
Data and configuration are date sensitive, allowing quick reconfiguration and accurate reporting even when changes occur in the middle of the reporting period.

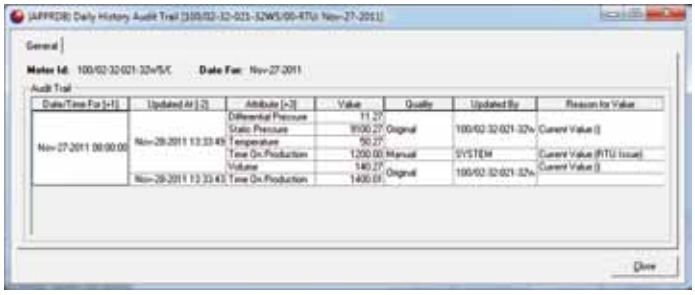
Unlike other databases, PDH also stores relationships between entities, including:
- Facilities, wells, meters, etc.
- Operating areas, business units, operator runs, gathering systems
- Product Ownership interest (working interest) records

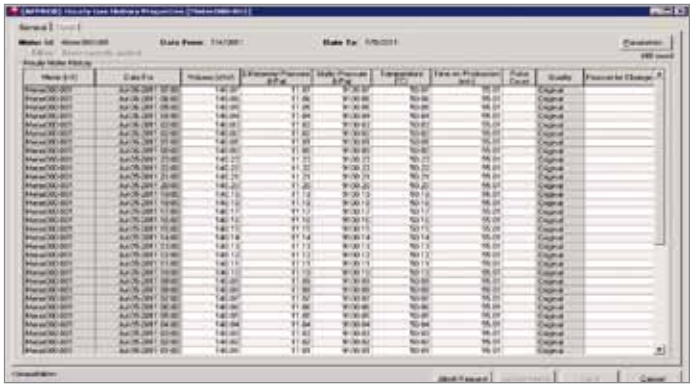
The entity relationships in SCADAvantage help operators understand the particular equipment and system design of a location or facility. By understanding this layout, operators can troubleshoot issues more effectively and validate the accuracy of measurement data.

A comprehensive audit trail is available for:
- Entities (meters, wells, etc.)
- Gas composition and meter parameters
- Measured values
- Edits

PDH meets the requirements of API, government regulations and joint venture partners for maintaining the history of metered, tested, flared and injected volumes.







Upstream applications
Bringing operational efficiency to well test

Automated well test application

When well production is measured at a group meter rather than at the individual wells, such wells must be tested at intervals.This is needed to meet government regulations, partnership agreements or to determine the profitability of each well.

Each well is flowed through a test separation facility for a specified period that typically includes a purge time plus up to 24 hours of stable test time. The test results are used to pro-rate monthly production from the group measurement point back to individual wells and to determine production from a formation or pool.

An automatic well test algorithm, running in a Programmable Logic Controller (PLC) located at the satellite facility, automates well testing steps.

The PLC allows a choice of three well test methods that differ according to level of automation:

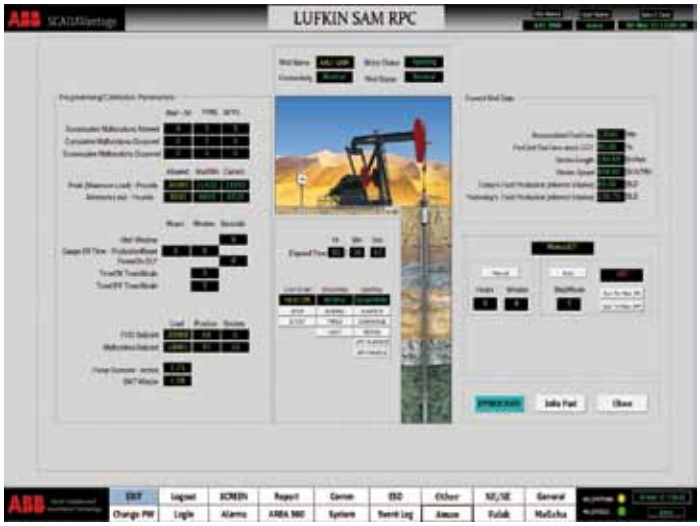
- Semi-automatic valve changes requiring manual intervention.
- Fully automatic valve changes put new wells on test using an ordered list configured in the PLC.
- Statistical well testing which controls valve changes based on a calculated appropriate purge time plus a designated stable flow time.

All test data is stored for viewing in the Production Data History database of SCADAvantage™.

Any authorized user can accept or reject a completed well test. Both accepted and rejected values remain in the database. The application allows users to filter which well is currently being tested and to review results by specifying a device or a unique well identifier or a range of dates.
A user can view or edit automatic well test information for a specified time range and for one or more wells. The integral audit trail and security functions ensure any change to a well test value is accompanied with the reason for change. In some circumstances, certain test values are derived by calculation rather than measurement. In these cases, if an edit is performed, the well test history editor automatically recalculates the derived values.

Well test results can be used to quickly and accurately allocate the volume
measured at a group meter to the associated wells. SCADAvantage can automatically calculate the monthly production on a well-by-well basis to meet contract requirements and government regulations.

Upstream applications
Artificial lift optimization



Rod pump optimization

Production engineers are constantly looking for ways to optimize pump jacks on oil wells with minimum site travel. A dynocard is an important analysis tool for measuring down hole pump efficiency. A series of measurements from the load cell and position indicator over each full pumping cycle are recorded by a pump off controller installed at the well.

The SCADAvantage™ Pump-Off Control (POC) application assists operations personnel to:

- Quickly monitor remote wells
- Focus on problem wells
- Reduce driving time
- Reduce damage to well head equipment
- Detect abnormalities
- Reduce power consumption
- Plan and extend maintenance cycles

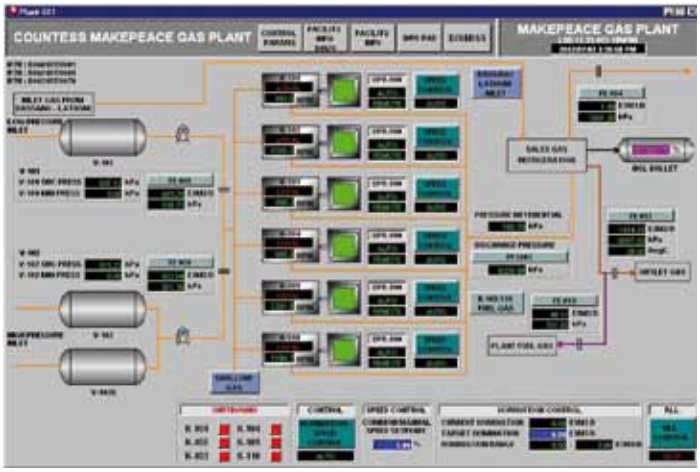
The SCADAvantage™ Pump-Off Control (POC) application interfaces to the most popular pump off controllers. The application reads and graphically displays the results of the measurements as a dynocard. This plot or graph represents a full pumping cycle by displaying measurements of rod position on the X-axis and rod load on the Y-axis.

By using external applications, the downhole card can be calculated or uploaded, if the controller supports it.

Gathering and processing applications
Compressor Optimization

Reciprocating Compressor Efficiency application

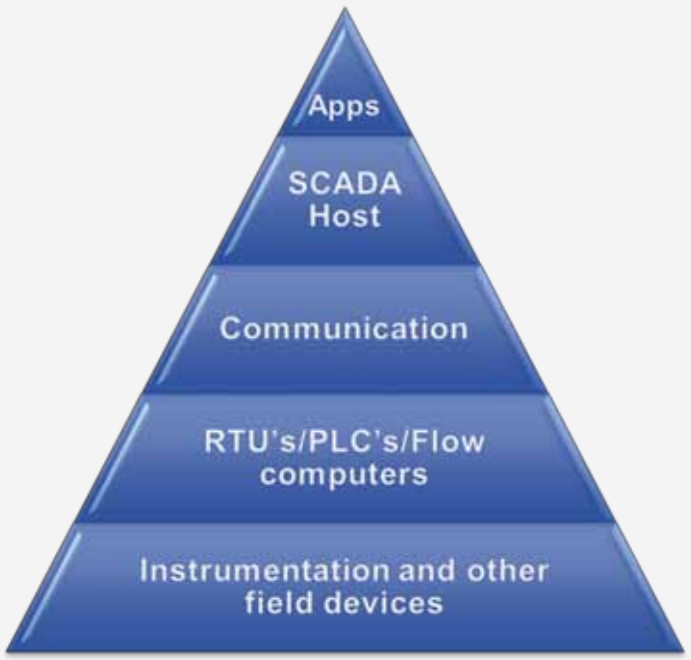
Production and sales of upstream oil and gas depend greatly on available compressor capacity. Accurately monitored and optimized compressors are important in alleviating production bottlenecks.



The Compressor Efficiency applications can be developed to provide a diagrammatic view of reciprocating compressor efficiency. The diagram can be for a single compressor, or several parallel compressors. Various compressor characteristics are displayed including current net flow, maximum capacity and potential maximum capacity that might be expected from the compressor(s).

Engineers use these diagrams to quickly assess a compressor's production capacity and determine what pocket settings or speed changes could optimize production. Zooming to any diagram section reveals additional details. In the case of a parallel compressor efficiency diagram, a composite capacity curve is calculated and displayed.

Current operating conditions, maximum speed conditions and the ultimate maximum curves for all contributing compressors are displayed. If a compressor shuts down, the application automatically re-calculates a composite curve for the remaining compressors.



Midstream and distribution applications
A solid foundation for pipeline operators

Efficient pipeline management is the basis for improving throughput and information management. SCADAvantage™ provides internal and external applications that are integrated with the real-time system to facilitate the collection, management, processing and (optionally) validation of gas flow measurements from a variety of data sources.
SCADAvantage™ meets the information needs of gas transmission, distribution and production systems.

In many cases the distance to pumping or compressor stations and to isolation valves requires local control and buffering of data to cope with possible communication interruption. With other systems interruptions may cause data corruption or data loss. SCADAvantage™ uses configurable data integrity checks and local data storage to ensure data quality and prevent data loss.

Pipeline scalability

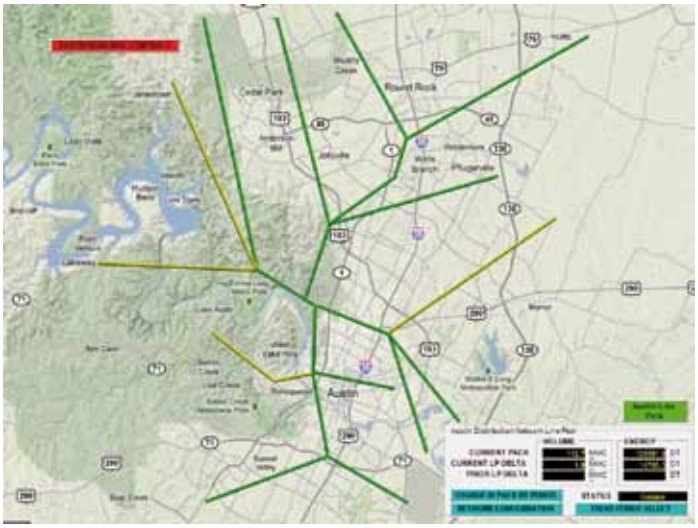
SCADAvantage™ can be deployed as a local HMI, monitoring and controlling block valves as well as pumping or compressor stations.

All stations and valves can be automatically consolidated into a control room system using replication. The control room typically runs the operational and commercial applications that result in efficient pipeline management.
Back up control rooms are easily configured using peer-to-peer replication, which keeps them synchronized with the main control room.

Since SCADAvantage™ supports all standards of connectivity, customers have the freedom to choose ABB or any third-party application that supports such standards as OPC, OLEDB or ODBC in real-time. This becomes especially important for system replacement when a pipeline company already has working applications in place.

On major gas pipelines, customers are adding approximately 2-3 metering stations per week. ABB's competitors typically take 2-3 days to integrate a metering station into their system. Using SCADAvantage™, this task can be completed in 2-3 hours, contributing to significant lifecycle cost savings.
"ABB provided the efficient way to execute and complete our refined products pipeline SCADA project."
Liu Weiguo
Operations Manager
SINOPEC

Midstream and distribution applications
Advanced pipeline management



Linepack

Linepack calculations are performed by the system to maintain an estimated inventory quantity. The system also tracks current pack and change in pack at hourly and daily intervals. Linepack calculation results are processed by the system against customer-definable parameters, allowing operations personnel to define alert levels. Graphical interfaces show Linepack changes over time in the form of trends and colored pipeline segments.

Schedule tracking

Gas schedule tracking calculations are performed periodically to establish the forecast end-of-day (EOD) contract quantity and the required flow rate to meet the quantity required by each contract.

The forecast EOD contract quantity calculation uses real-time input analog points to specify the accumulated volume and current daily flow rate for the current gas day at a particular receipt or delivery point in a pipeline network. It then extrapolates the anticipated total volume or energy.

"The state delay feature in alarms reduces nuisance alarms and keeps controllers from being inundated. Gas schedule tracking prevents missed nominations because of auto-correct where it estimates missing data until communications are restored."

Large Natural Gas LDC Utility

Worldwide support and integration centers

We recognize that service requirements are based on the operational risks and in-house expertise in our operations. ABB service contract agreements are adjusted to complement the in-house expertise and provide additional capabilities needed to maintain asset performance at the required level.

Agreements range from call-up support services to complement a self-maintenance strategy all the way to dedicated on-site resources.
Programs providing software management and version upgrades are also available.
Our experienced service professionals can help implement the right support services contract.
ABB offices are located in most oil producing countries to offer the first line of support. Major execution centers all over the world can be involved when the urgency or complexity of issues should demand further help.
The benefits of this arrangement are:

- Expanded maintenance capabilities
- Improved system and equipment utilization
- Effective maintenance planning

ABB service professionals also provide expert on-site assistance for installation and commissioning of ABB systems, devices and instrumentation, ranging from start-up to full project management.
The benefits are:

- Smoother installations
- Faster start-up at lower cost
- Improved efficiency

"ABB has supported us with SCADA technology for the last ten years, making a continuous expansion and upgrade of the system possible."

Javier Pellón - Technical Manager - ENAGAS

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