

GEO Productivity Portals for Oil and Gas Operations

By

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Abstract:

GEO Productivity Portals unify critical operations management interfaces for distributed system information and supervisory control and include mapping technologies to navigate large geographical spaces. Technology advances now permit real-time connectivity and interactive visual interface with disparate subsystems at both automation and information-technology (IT) levels to allow more effective management of systems and optimize productivity, reduce costs of operation and better manage situations and critical events.

GEO Productivity Portals use technologies such as Web-based portals, service oriented architecture (SOA), business intelligence analytics, geographical mapping and Geographical Positioning Systems (GPS), production management systems, Distributed Control Systems (DCS), Supervisory Control and Data Acquisition Systems (SCADA), alarm management systems, real-time data historians, plant-floor Human-Machine Interface (HMI) and connectivity standards such as OLE for Process Control (OPC). Advances in Web-based technologies from Microsoft and others allow us to securely connect clients to servers for role-based information worker access from wherever they may be. GEO Productivity Portals are applicable to many industries with distributed assets and mobile assets, including energy production, electric utilities, oil and gas, logistics, transportation and distribution, and networks of facility assets such as government buildings and retail chains.



In the Oil and Gas industry, applications include distributed production facilities such as offshore platforms, transportation via water, land or rail, pipeline monitoring, well-head monitoring, energy management and for consolidated productivity dashboards for any distributed system. These distributed networks require real time monitoring for remote management and analysis to maximize productivity. GEO Productivity Portals provide this functionality with unparalleled visibility, control, and analysis of key performance indicators (KPIs).

This paper discusses the technology for developing such portals and benefits for the Oil and Gas sector.

Introduction

The history of automation starts several hundred years ago with simple devices like traps and triggers, cattle driven water pumps and wind mills. Automation systems developed with the advent of the Industrial Revolution of the 18th and 19th centuries through applications such as printing presses and textile mills. Technologies such as pneumatic switches electrical relays, analogue signal measurement and control propagated quickly.

In the late twentieth century, advanced electronics such as digital switching and programmable logical controls became the basis of modern control systems. Most of the early control systems were designed around serial communication from field instruments to remote terminal

units wired to the central monitoring room with huge panels full of meters, gauges, indicators and push buttons & switches. At the same time, business computing applications became widespread. These technologies have, for the most part, developed separately over the recent decades.

The rapid development of PC based applications in late 1980s allowed Human interface to the control systems. Technology advanced from DOS-based systems through the introduction of 16-bit and 32-bit Windows operating systems that brought obvious benefits to production operations and lead to widespread use of HMI and SCADA applications for distributed production and process control applications over the past 25 years.

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HMI/SCADA software provides vital interfaces to monitoring and control of various industrial manufacturing processes. The use of HMI/SCADA applications has revolutionized traditional control rooms. Instead of controlling from large panels with meters, switches and alarm indicators, we can now manage operations via integrated compact computer screens that adapt quickly to changes and allow view of many different systems from a single terminal. Although the first generations of HMI/SCADA applications were based on proprietary protocols, the culture is changing rapidly towards open systems and standards.

Adoption of various industrial standards such as OPC, XML and .NET offer universal connectivity among various client server applications, which simplify the integration and exchange of data between man, machine and enterprise systems.

Coalescence of Business & Manufacturing Intelligence

Most large scale operations have kept business applications and communication networks completely separate from production automation systems. The implementation and maintenance teams of both areas are also segregated and many times do not communicate with each other. This leads to duplication of work and less-than-optimum productivity. Production operations are often not in real-time coordination with business needs, and the business systems lack a real-time view of operations performance. For example, the reports generated by manufacturing systems are often manually re-entered into enterprise applications. This disconnect often leads to incorrect and untimely data propagation and slow and inaccurate decisions.



In recent years, leading technology companies, such as ICONICS Inc. have developed commercial off the shelf software that allows users to quickly create portals and information dashboards for consolidated operations management. Improvements in data connectivity, portal

technology, security, reliability and the introduction of new Web-based and SOA technologies have increased the adoption rate of manufacturing intelligence portals.

By combining business and manufacturing systems information in real time, businesses can now automatically deliver real time information within portals including: reports of Key Performance Indicators (KPIs), process visualization and analytics, critical alarm management, accurate financial and business information. Portals can be delivered at multiple business and departmental levels with personalized custom information for people with different roles and responsibilities.

This integrated concept provides added benefits of lean manufacturing, optimized controls, better return on investment (ROI) and improved quality.

GEO Productivity Portals can readily be integrated within or alongside Corporate management portals containing business, financial and manufacturing information. Users can create and customize personal digital dash boards with information coming from several systems spread across several facilities, cities or countries around the globe. Software such as ICONICS' PortalWorX based on Microsoft SharePoint technologies provides easy development tools for operations portals. The additional integration of Geographical mapping with HMI, SCADA and information portals provides intuitive quick access to critical information in a readily understood format that reduces operator training time and increases responsiveness to situations.

Enabling Technologies

It is also vital to discuss the available range of technology behind the development of Portals. First and foremost is the use of communication architectures that allow real-time connections to information wherever it may be coming from widely disparate and distributed automation and information systems. The OLE for Process Control (OPC) open-standards communication protocol technology plays a key role towards providing interface to multiple hardware controllers, distributed control systems and PLCs, and legacy systems for real-time data gathering. Multiple OPC servers can be connected in real time with one or multiple analytic applications with complete redundancy and throughput optimization. OPC connectors are available to most commercially available production controllers. Other open standards protocols are readily linked through OPC Server bridging technologies. Database connection standards such as ODBC and OLEDB provide a ready path to enterprise data.

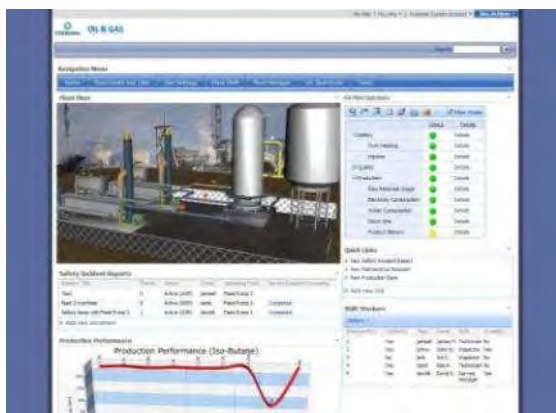
The use of other standard tools such as SQL-based data loggers and real-time data historians, such as the ICONICS Hyper Historian, enable vast amount of data to

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be collected. This historical logged data is an essential component of operations management systems, and is readily integrated into GEO Productivity Portals.

New 64-bit hardware and software platforms now make large consolidated GEO Productivity Portals possible by eliminating physical limits of data management and memory for faster processing, system expansion and scalability.

New Microsoft foundation class technologies such as Windows Presentation Foundation (WPF) provide rich visualization and graphics presentation tools at faster speed, providing intuitive graphics and making rich three-dimensional (3D) interactive Human Machine Interface available over the Web in cost-effective PC server platforms. Several other tools such as XML, .NET, OPC-UA and Microsoft SharePoint are providing basis for corporate portals.



There are also tremendous improvements and changes at the hardware and field instruments level. The communication from the controllers to field instruments is much faster and more reliable. The serial communication has been replaced by high speed industrial Ethernet. Field instruments are becoming more intelligent with local control and data logging, which is useful for system load balancing and in cases of emergency or network interruption. Several of these instruments come with embedded CPUs and even with embedded operating system running embedded web services providing easy integration.

Satellite-based IP service, Wireless connectivity, cellular

telephone data coverage (GPRS, GSM) widely available and affordable Global Positioning System (GPS) tracking and cost effective broad band services help to connect remote sites affordably with relative ease, providing instant real time information to distant Geographical areas.

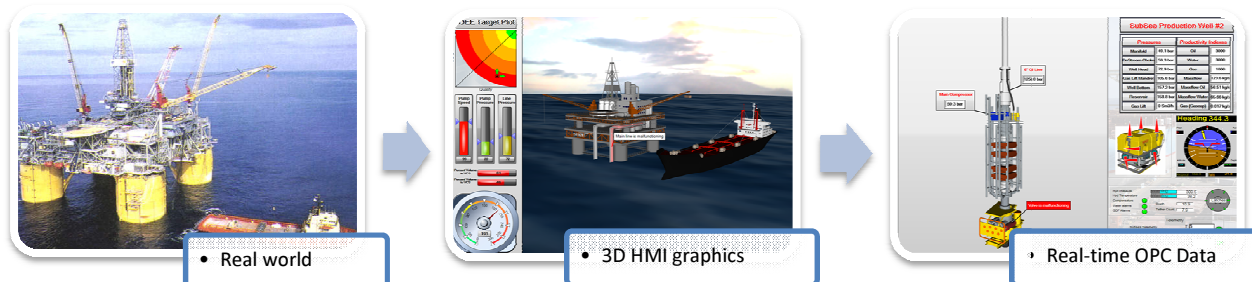
Real Time Analysis & Optimization

Data by itself is not all that useful, one must turn the raw data into real-time contextual information so it may be acted on quickly and intelligently. Effective operation management portals should include real-time alarm information and calculations of KPI's to indicate production results compared to targets, costs, quality issues and asset productivity. They should provide windows into enterprise and production information for ad-hoc analytics, and allow information workers to query their systems.



Analytics can be performed in many platforms within existing business systems such as Enterprise Resource Planning (ERP) or Supply Chain Management (SCM) or Manufacturing Execution Systems (MES) Software and then the data and visuals can be included in a GEO Productivity Portal together with real-time information coming from the many automation systems connected throughout an enterprise.

ICONICS has developed such applications that work as a plug in to existing systems and provide a basis of general corporate portal. For instance, the ICONICS Business Productivity Analytics (BPA) software has capability to provide real-time drill down information of various assets, calculate downtime analysis, price per part and machine



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efficiency and raw material supply and even maintenance schedules. In addition ICONICS provides reporting tools such as ReportWorX, based on Microsoft Excel plug-in technology, to produce reports as needed to analyze and document status from the many disconnected subsystems in an operation. Also, ICONICS provides the BridgeWorX tool for data orchestration between business systems and automation layer data built on a graphical workflow design that greatly reduces complex and costly scripting. These game-changing technologies employ SOA-based services running in the .NET environment for robust and secure applications that monitor and transact many operations simultaneously from cost-effective PC-based servers. Reports and Data are visible through the GEO Productivity Portals.

GEO Productivity Portals

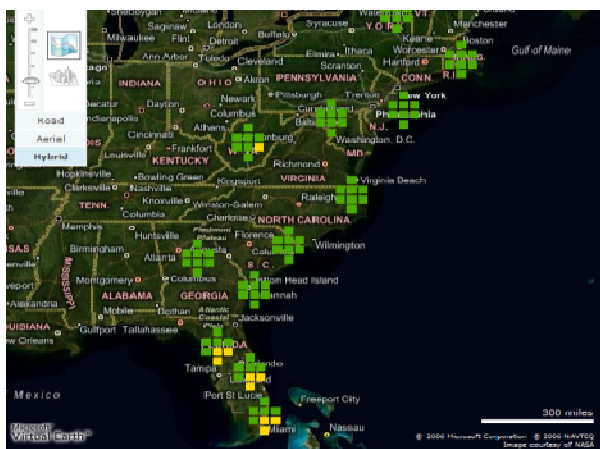
GEO Productivity Portals have emerged as a Web-based platform combining real-time data, enterprise information, analysis, rich visualization with dynamic animated 3D visualization for distributed assets spread over geographical areas.

GEO Productivity Portals are ideal for large manufacturing industries, environmental monitoring, emission controls and management of energy production installations such as wind and solar farms spread over several large areas. These portals can provide a view of overall productivity, alarm information, assets locations, maintenance information and critical online analysis from real-time processes. The portals are built from a combination of technologies including GEO-SCADA, productivity analysis and real-time online collaboration and visualization

pipelines running across different geographical locations and can run either as part of an integrated HMI/SCADA system or stand alone. Existing technology in this area allows for an innovative drill down capability to quickly view alarm conditions and status for any location around the world. Within seconds, an asset can be identified and located, often through integration with an online GIS application such as Microsoft's Virtual Earth™.

Custom visual presentation allows operators to quickly and intuitively comprehend an operational situation. Use of rich graphical and analytic concepts such as the ICONICS Smart Pin technology allows rapid configuration of many data sources. For instance one could take tens of thousands of data points and alarms from the automation or business layers and create a quick graphical view with drill-down capability to highlight important information at a glance. Smart Pin technology allows action and interaction to manage situations and optimize operations productivity. Smart Pins may be developed with HMI tools into virtually any dynamic shape object imaginable. These Smart Pin objects may then be overlaid on geographical maps as layers for quick view of assets location.

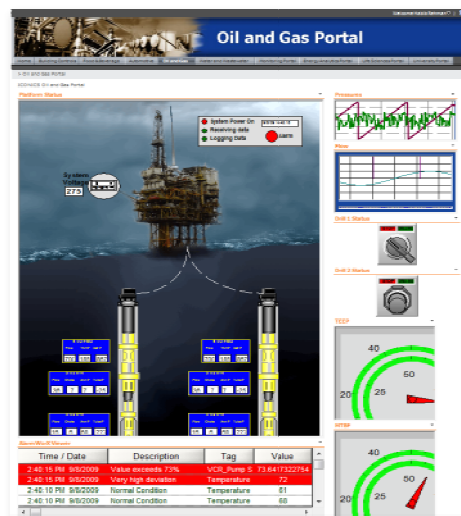
Productivity analysis empowers decision makers at all levels of the enterprise with real-time and accurate information to help drive global operational efficiency and strengthen competitive market advantage. Businesses can gain valuable insight into operations through real-time data aggregation and connectivity to multiple data sources, presented in an intuitive and intelligent manner. A productivity analysis tool can help establish context with KPIs and deliver business intelligence throughout an organization.



dashboards using portal technologies such as Microsoft SharePoint.

Smart Pin technology provides compact, intuitive visualization to quickly understand and analyze large amounts of data. Smart Pins may be placed in geographical context to monitor many assets at once.

GEO Productivity Portals can provide real-time visualization of widely dispersed assets such as oil



Today's business portal technology allows users to easily create and manage custom business portals and visualization dashboards that provide single sign-on collaboration for optimization of KPIs. Premium business

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portals, based on Microsoft SharePoint® Server .NET technology, can provide everything required to access real-time and historical business information. Such solutions should be easy to configure, requiring virtually no administration, in order to deliver data immediately to those who need it.

GEO Productivity Portals for Oil & Gas

Oil and gas pipelines are installed all over the world, requiring software that can visualize and manage them remotely as well as analyze the flow of data in order to ensure the highest productivity. GEO Productivity Portals provide visibility into operational performance for systems as diverse as exploration, wellhead monitoring, pipeline control, processing facilities and distribution.

GEO Productivity Portals will assist in reducing the environmental effects of oil exploration by continuous monitoring of remote facilities, offshore Platforms, FPSO, refineries, pipe lines and distribution facilities.



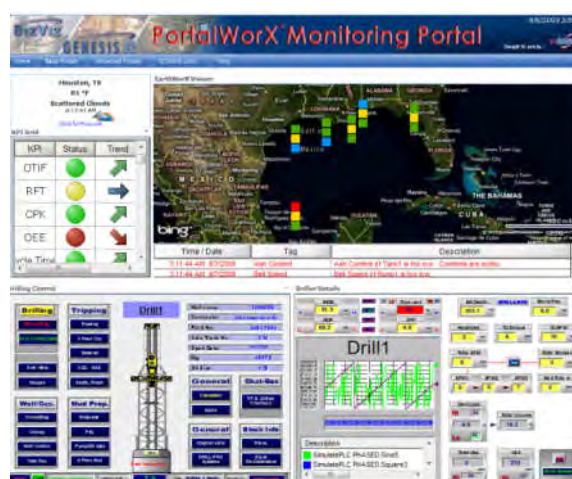
Location of Oil wells spread over huge area in Texas that certainly would emphasize the need for GEO-SCADA with online real time monitoring of production capability.

GEO Productivity Portals can also increase safety and security of these facilities by coordinating alarm management, analysis and control from various subsystems plus real-time data feeds with weather information or GIS position of assets. This will reduce the risk of spillage, fire or other possible disasters.

The working environment on FPSO or offshore Oil & Gas facilities requires strict quality and safety procedures. The collaboration of various teams is the key to successful and safe operations. Due to diverse nature of subsystems, GEO Productivity Portals can provide unified operational information to various teams from operational point of view. For instance, information on work permits, exact location of these permits and information on the working team, duration and safety checks during the work. You may also link the working procedures and

online forms to be completed as a workflow in order to complete the authorized work. The alarms generated from the site of such work permits can easily be associated with maintenance work orders.

A unified view of various systems such as leak detection, well head monitoring, safety systems, storage, distribution, transportation, refining processes can be created with a GEO Productivity Portal with drill-down and zoom-in capabilities. Alarm management and emergency shutdown systems are two critical systems that require constant monitoring and vigilance, GEO Productivity Portal can provide exact information about the nature and location of the alarms and possible procedures to follow on certain alarm conditions.



GEO Productivity Portal are also useful for tracking moving assets with GIS reference and linking these to a particular batch or production performance.

Conclusions

A GEO Productivity Portal brings disparate systems together into a unified view that can significantly improve overall operations productivity. These systems are quick to deploy with low risk and high reward.

GEO Productivity Portals have a special significance for the Oil and Gas sector due to the widely distributed nature of assets and great diversity of technologies installed today. Longer life cycles in exploration and production require even better management of assets. GEO Productivity Portal technology is available today, and continues to advance quickly as companies seek to improve their performance and manage environmental concerns and critical operations activities.

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