ABSTRACT
Commercial Telemetry & Supervisory Control and Data Acquisition (SCADA) systems are rapidly embracing Internet and Intranet technologies to remain competitive. These developing technologies offer many opportunities and challenges for the Natural Gas industry. As a technology, issues such as security, performance, availability, reliability and methods will be discussed. The presentation will demonstrate hands-on techniques.

INTRODUCTION & RECENT HISTORY
The past decade has seen significant advances in computing capabilities with broad and rapid acceptance of technology in industry, office and home. These advances, although swift, have come with a significant cost in change management. These costs have ranged from the tangible dollars associated with refitting workspaces for computers to the intangible emotional toll on people who resisted change.

In step with these advances, there has been notable change in how technology is deployed. Not that long ago, mainframe computers with dumb-terminals were a standard platform. These legacy systems were eventually integrated within networks of desktop PCs. The propagation of PCs in conjunction with advances in the capabilities of PC-based servers began to replace the legacy systems.

As the networked office PC became widespread and a standard tool, a number of factors began driving toward "Thin-Client" technologies. In some form, these technologies have been around for quite some time. Data Warehouses and Data Marts quickly became prominent in Information Technology strategic planning processes. This dependence on data and client/server technology further pushed the need for better application performance at remote locations. In particular, Telemetry systems in general became database-centric. This database-centric nature demonstrated fairly good local performance but poor remote performance. As the "Thin-Client" need developed, a number of methods and solutions evolved.

THE BASICS & STANDARDS
In order to set the stage for Telemetry & SCADA specific implementations and methods, a brief introduction to the basics of thin-client and web-based technologies is needed. First, there are frequent misunderstandings when thin-client technologies are discussed. The marketing efforts of many companies have not helped in the understanding of the differences.

One of the common misconceptions is that thin-client equates to web-based technology. Longstanding technologies such as Citrix Metaframe and more recently, Microsoft Windows Terminal Server (WTS), provide client access using standard low-end PCs. These technologies provide benefits such as reduced hardware costs, minimized desktop support, and better WAN performance. However, there are drawbacks to these technologies that include increased server costs, reduced flexibility, and system interoperability issues. Regardless, the remote terminal session capability provided by these methods does work acceptably well in most instances.

Although using a remote terminal session method over the Internet works, it is not what you would describe as web-based. A web-based strategy uses established standards defined by the World Wide Web Consortium (W3C). As a grounding, a few of these standards are described:

HTML - HyperText Markup Language
This language has changed substantially over the past nine years. At present, W3C has recommended version 4.01 as the current standard. Version 4.01 provides the addition of stylesheets to support the separation of content from format. Since version 3.2 and prior placed the formatting information within the content of the page, extensive edits and labor were required to make significant changes to website format.

XML - Extensible Markup Language
The use of XML provides for the definition of content rather than the display of content. Since an XML file can define itself, it provides greater flexibility in data interoperability and exchange.

XHTML 1.0 - Extensible HyperText Markup Language
On January 26, 2001, XHTML 1.0 became a W3C Recommendation. Defined as a standard, XHTML is almost identical to HTML 4.01 and provides for both the description and display of data. Since it is HTML defined as an XML application, the document is stricter and cleaner and provides for a well-formed document. These well-formed documents are becoming necessary since poorly written HTML is not supported by many newer
devices that do not have the computing power of a standard PC.

CSS - Cascading Style Sheets
Once style sheets were supported, the ability to move the formatting of data into external, internal and in-line forms became possible. The use of external CSS files provides greater flexibility in making extensive changes to website format without affecting content.

WAP - Wireless Application Protocol
Unlike HTML, WAP is not defined by W3C. The WAP Forum was created by a number of founding companies, such as Nokia and Ericsson, among others. This protocol is a communication protocol that supports WML (Wireless Markup Language), WMLScript and WTAI (Wireless Telephony Application Interface).

THE IMPORTANCE
The value of Internet and Intranet access to data acquired and housed within Telemetry & SCADA systems is founded on a number of criteria. These typically include cost, common access and availability, ease-of-use, and remote access. There are many other benefits that are intangible or very difficult to measure, yet may provide extraordinary customer value and benefit.

It is not uncommon to believe that web-based access provides lower-cost data access. These cost metrics are typically based on:

- Lower client PC hardware costs;
- Lower client support costs;
- Lower client training expenses; and
- Significantly lower costs in software licensing.

Many of these metrics do not hold up to analysis. For example, higher costs for WTS or Citrix servers may offset savings from lower cost PCs. Client support issues can be shifted from native client issues to web-based connectivity issues making the expected savings evaporate. Lower training costs are often offset by change management costs associated with wholesale changes in methods and techniques. Many software vendors are closing loopholes in their license agreements where “branching” is occurring. Those who have not closed these loopholes may close them in future releases without notice, effectively orphaning a company that has expended significant financial resources in development efforts in the hopes of lower software costs. Even with difficulty in defining a dollar-for-dollar reduction, the effective improvement in productivity and performance can overwhelmingly offset these direct costs.

Although directly lowering operating costs may be difficult to achieve, common access and availability are shining points for web-based systems. In conjunction with remote access, a common user interface does lend itself to access from a number of computing platforms, in the LAN, WAN or on the Internet. Given significant advances in wireless technology, the ability to access near-realtime SCADA data in both operational/control and roll-up corporate use is available now.

The Ease-of-Use metric is difficult to apply. There are systems that are incredibly easy-to-use. Likewise, there are systems that are quite difficult to use. Part of the problem associated with ease-of-use is the trade-off of functionality in traditional native-client environments in favor of web-based access. Many client applications have been developed over many years. Transitioning these efforts to web-based clients has produced a number of new clients, but their implementations are very new and feature-light. Typically, less complex software systems are easier to use. Unfortunately, they also suffer from the inability to deliver full value. It is in the failure to deliver the expected features that cause more problems with adoption of these technologies than any other.

METHODS
Given that access to data across a company has become a requirement in industry, a number of methods may be used to improve the adoption of Internet/Intranet Telemetry & SCADA technology.

Thin-Client vs. Web
Although many companies market thin-client and web-based access in the same context improperly, it is not necessarily incorrect to implement a mix of these technologies where appropriate. For example, if actual remote access to control capability is required, it may be in your best interest to use the native client application using Citrix Metaframe or Windows Terminal Server to allow an operator to make decisions from remote offices when alarms occur. In the same light, using purely web-based methods for reporting, B2B or B2C customer self-service, or light-weight device support is an efficient use of technology.

Native Clients
Not all systems require the use of thin-client or web-based access to operate in WANs, remote areas or over the Internet. The evaluation of existing systems and their ability to operate without additional significant development efforts should be considered.

Reliability
Where native client systems provide reliable control systems, web-based systems typically decrease this reliability. Given that the native systems have been in development for many years, the web-based counterparts are effectively in their 1.0 state. Like any application in its initial incarnation, bugs, stability, and feature-loss are typical. It may not be in the best interest of a pipeline to move their existing and functional control system to a web-based...
system in the hopes that improved remote-access will offset these risks. However, the use of web-based data access methods may be of great value for other client uses, such as engineering, accounting/financial and remote access in conjunction with native methods in the physical field location.

Security
A common oversight of many SCADA systems is the integrity of the security implementation. Since many systems were implemented at the field location and remote access to data and controls were not possible, many security features were disabled or ignored. As these systems become more interoperable within a company, many more clients have access to both data and control capabilities. It becomes imperative that security issues be addressed.

Beyond the original native SCADA system security, the actual web-based system needs to be adequately secured. Although it is desired to make the SCADA data more easily usable, it is typically not desired to improperly share this same data with direct competitors. Nor is it desired for a teenager in a foreign country to shut down a plant.

In a web-based environment, security is implemented through user-authentication & authorization, encryption (including PKI & certificate-based methods), and physical or logical access security. Physical methods can include dialup, Virtual Private Network (VPN) tunnels, card or token-based security, intrusion detection systems, and adaptive preventative systems. Adequately securing the web-based system can be more difficult than the development of an online reporting package.

RECOMMENDATIONS
A number of recommended practices can improve potential success in a Telemetry or SCADA Internet initiative.

What are the Success Measures?
Define the value propositions and success measures for the initiative in advance. A mix of tangible and intangible measures and metrics should be defined for the project. These measures should have probable, possible & potential outcomes.

What are the Costs?
Determine the costs associated with each value proposition, success measure, metric or stakeholder feature. Use these costs to assist in developing priorities with all stakeholders.

Sponsorship
Any significant initiative requires senior management sponsorship. Projects that involve Telemetry, particularly in B2B situations, will touch upon a number of stakeholders across a number of divisions in an organization. Competing interests can overwhelm and ultimately doom the initiative if a senior sponsor is not identified.

Core Competency
Recognize the limitations within any project group that is coordinating an internal initiative. Identify core competencies that the team members exhibit. Likewise, identify skills and competencies that are lacking for successful completion.

Business Alignment
The use of thin-client technology for Telemetry should fit within an organization’s strategic plan prior to deployment. A tactical deployment allows for very pointed and defined development projects. These tactical projects should be aligned with short-term needs and long-term strategic goals.

Many Projects vs. Big Project
An accepted development style referred to as Extreme Programming (XP) is designed around the need for small teams to develop software quickly in rapidly changing environments. Some attributes of XP may provide many benefits to a Telemetry Internet initiative. A number of key benefits to rolling out a strategic plan as a number of tactical projects include:
- Demonstrating short-cycle performance;
- Maintaining sponsor interest; and
- Rapid delivery of services for the differing stakeholders.

CLOSING REMARKS
The rollout of Internet and Intranet access to Telemetry system content is possible using today’s technology. Great gains are possible in providing common access to critical data at various levels within a company. These gains can be measured and can return on their investment if prudent steps are taken to provide these tools in an effective and efficient manner. Like all development efforts, using improper metrics or methods can yield very expensive systems that are difficult to use and do not return the value required for the investment. Delivering quantifiable results in this rapidly changing environment is a challenge — but a manageable challenge if the proper methods are used.