Enterprise-Level Historian Architecture for Wind Power

For companies that are meeting the ever-increasing demand for “green” energy through the acquisition and development of wind power, the ability to collect, analyze, and report data related to wind-farm facilities is important to the success of the entire enterprise.

A data historian is a specialized database for storage, processing, and retrieval of time-series data such as equipment parameters, measurements, and status values. In particular, an *enterprise-level* data historian is one in which a single historian system covers an entire corporate structure, across multiple plants. This paper presents the benefits, challenges, and architecture particular to an enterprise-level historian in a wind energy environment.

Benefits

An enterprise-level historian is a vital tool for a corporate environment in the wind power industry. Data can be useful to many users within the organization. The historian architecture must be robust and trustworthy. A consistent, well planned approach will result in a reliable, powerful, easy-to-use system.

The data collected can be used for several purposes within the organization:

Accounting: Wind farm revenue streams can be quite complex, as different turbines are on different landowners’ property, and the landowner often gets a share of the revenue from the turbines on their property. The historian data can be interfaced with accounting systems to provide periodic revenue meter readings for accounting purposes. This results in simplified, traceable, and reliable revenue allocation among the involved parties.

Performance Analysis: Turbines come with a manufacturer’s guarantee of certain generation at certain wind speeds (power curve), so the data can be employed to verify that turbines are performing within contract specifications.

Condition-based Maintenance: Equipment parameters can be baselined and then tracked over time to help predict maintenance requirements. The maintenance can then be more intelligently scheduled in parallel with other maintenance tasks or during low-wind conditions.

Event Analysis and Troubleshooting: When an unusual event occurs (such as a fire or major equipment failure), the data can be used to help piece together the precursors in order to find a root cause. This in turn can accelerate recovery from the event; help prevent similar events in the future; and properly assign organizational responsibility for the associated costs (i.e. warranty or non-warranty).

Challenges

The data collection environment is challenging. For example, varied communications paths span thousands of miles, across multiple time zones, resulting in many possible failure modes of communications, and involving multiple parties. Complicating the time and distance challenge, many sites are remote, and inclement weather is a critical factor often times affecting reliability issues in data collection. The system must be able to “ride through” interruptions of service without minimal loss of functionality.

Different wind turbine manufacturers have varying types of data interfaces, with differing amounts and types of data available. Also, vendor interfaces are often not fully debugged and are often plagued with idiosyncrasies. These must be dealt with on a case-by-case basis, working closely with the vendors to resolve issues as they occur.

The historian’s collection and archival parameters must be tuned properly to conserve network bandwidth, control archive size, and reduce retrieval time, but in a way that does not reduce the usefulness of the data. This requires analysis of the content and quality of the data, as well as periodic monitoring of archive performance.

Due to numerous possible points of failure and multiple failure modes, data must be carefully validated and verified. To accomplish this, software mechanisms must be implemented to “test” data for accuracy, consistency, and timeliness.

Architecture

There are usually two data sources at a wind farm:

Wind Turbine-Generator (WTG) SCADA system: The WTG SCADA is provided by the turbine vendor, and provides an operator interface to control and monitor the operation of the turbines. Each wind turbine will generally have 30-150 data points.

Balance-of-Plant (BOP) equipment: The BOP equipment is typically electrical gear in one or more substations, including metering for financial purposes (revenue metering).

Met Towers: In addition, each site has one or more Meteorological Towers (“Met Towers”) to measure wind speed, direction, and other environmental conditions.

A single historian interface computer collects data from the WTG SCADA and the BOP data concentrator. This computer then sends the data on to the central corporate historian (in a data center), typically via a leased data line. The computer temporarily stores (“buffers”) the data if the communications link is not available, and transmits the buffered data when the link is re-established. Administration of the interface computer is accomplished remotely, so there is rarely a need for a site visit.

For the end-users to be able to quickly locate the data they desire, the historian’s tag/point database must be organized in a consistent, logical manner. This can be difficult due to the variations of vendor data structures and types.

Functionality

The historian provides the following advanced functionality beyond simple data archival:

Calculation Engine: A calculation engine is a software component that performs real-time arithmetical operations on points (averaging three phases of electrical current, for example).

The calculation engine also aggregates and summarizes data (for example, power generated last hour, last day, month to date, year to date).

User Interfaces: Users have multiple methods of accessing historian data. “Power users” (those who use the data in their everyday tasks) have client tools installed on their PC’s that allow them to view the data graphically or bring it directly into a spreadsheet. Casual users (those with occasional or simple need for data) can access data through a powerful web-based interface for visualization and analysis. Mobile device users (mobile phones and PDA’s) have access to data through a simplified, mobile-specific web interface – This can be quite valuable to personnel in the field in troubleshooting.

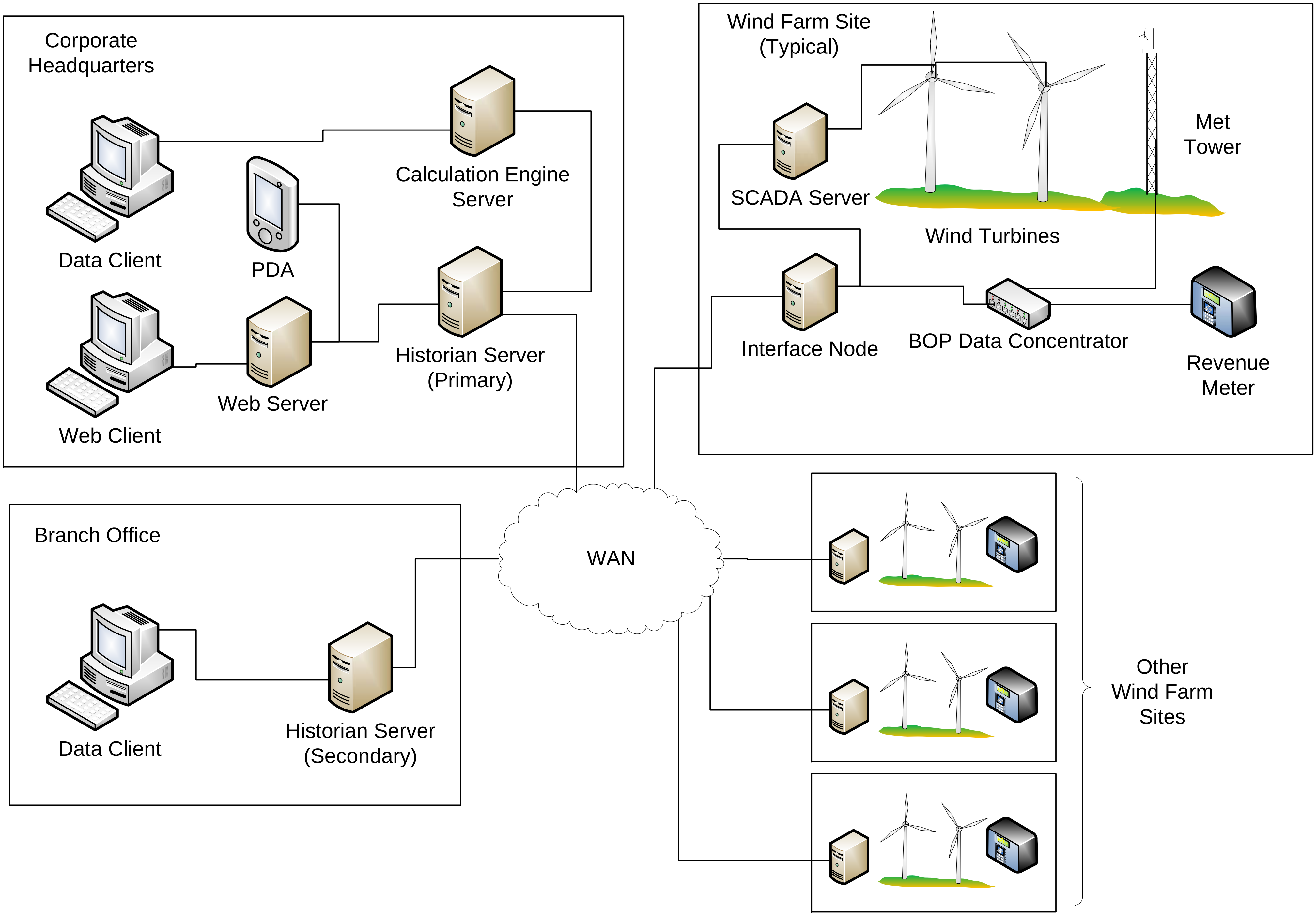
Redundancy: For the most robust system possible, a redundant architecture is desirable. This consists of two or more historian servers receiving and serving data. The redundancy is transparent to the end-user. The servers are ideally located in geographically distant offices, so even major catastrophe will not necessarily decrease the availability of data. In addition, having the servers in multiple offices improves system responsiveness for users within those offices.

Integration with Business Systems: All major historian platforms have the capability of interfacing with business systems via open standards. Data therefore flows seamlessly into other enterprise platforms for financial, management, and planning systems.

Summary

An enterprise historian can provide a reliable, consistent, highly functional platform for getting field-level data, both real-time and historical, to a wide variety of end-users for planning, troubleshooting, and financial purposes. However, the various wind-industry specific challenges must be addressed through a robust architecture and consistent implementation.

Wind Enterprise Historian Architecture



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