

## Remote Witness of Steam Turbine Testing

by  
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### Category:

Prototype/Test

### Products Used:

NI LabVIEW 8.5  
NI Remote Panels  
LabVIEW Web Publishing Toolkit

### The Challenge:

Develop an interactive application accessible through the Internet that allows multiple users to log in and remotely witness live product acceptance testing. The application must also provide the ability for all test witnesses (regardless of physical location) to communicate via text-based chat.

### The Solution:

Data Science Automation created an application with the ability to communicate with National Instruments Remote Panels, and National Instruments Web Server. The program also has access to a centralized database server containing all necessary product test results along with the current text chat interaction for that same product.

### Abstract:

In conjunction with the production of steam turbines our client provides remote monitoring of the certification testing, thus eliminating the need for an international client to travel thousands of miles to witness a test lasting a few hours. This application integrated LabVIEW 8.5 using interactive Remote Panels in which multiple users have the ability to communicate via text chat while viewing live data being acquired during the certification testing.

### Overview

A manufacturing company of steam turbines wanted the ability to provide a service to their customer for remotely viewing the certification process of the customer's steam turbine. Prior to the development of this application, onsite test witnessing meant that most of their clients had people traveling thousands of miles just to witness a test lasting a few hours.

In order to deliver to our client's customers the ability to remotely monitor, witness and interact with their clients during the testing of a purchased steam turbine, Data Science Automation (DSA) created an application that integrated LabVIEW 8.5 with interactive Remote Panels. Multiple observers had the ability to communicate using text chat through a facility that utilized a relational database as a temporary storage mechanism, while viewing live data being captured during the testing procedure.

As the system architecture diagram (Fig 1) shows, the certification process for a steam turbine encompasses the collection of multiple sensors installed within the turbine along with the capturing of images. The sensors monitor vibration, temperature, noise, and speed. The test itself is conducted on one of several stationary test stands that accommodate a variety of turbine sizes and sensor configurations. The manufacturing company customizes the sensor configurations based on their customers' requirements.

Each test stand shares a common data acquisition vibration monitoring subsystem from Bentley-Nevada that LabVIEW communicate with through a dedicated Ethernet connection.

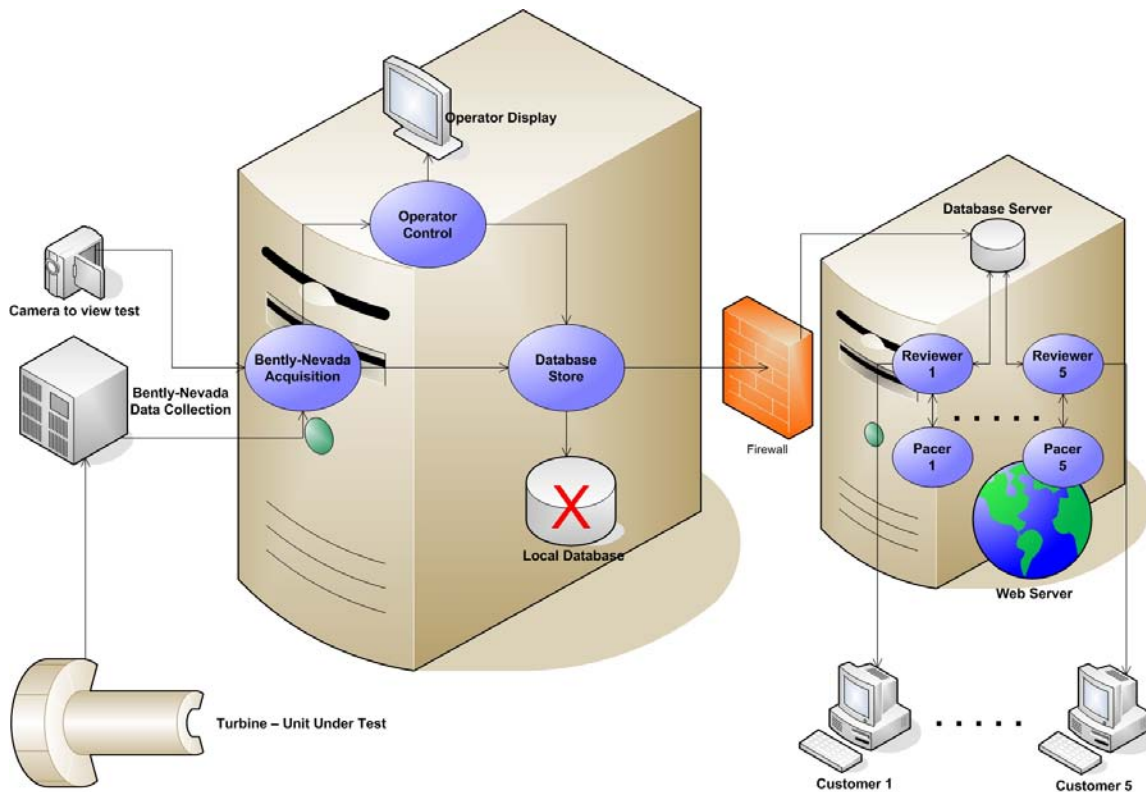


Figure 1 - System Network Architecture

### Tag Teaming

The remote monitoring application is actually a pair of programs that interact to synthesize the desired functionality. First is the operator application. This software executes on the operator's host computer and performs the following functions:

- Providing text based chat
- Configuring data channels
- Displaying raw channel data
- Displaying live video feedback from a IEEE-1394 (Firewire) camera (Fig 2)
- Displaying a graphical turbine representation with data points
- Displaying a spreadsheet with calculated data points
- Committing data to the database on demand
- Committing and Displaying text based chat with all witnesses of the turbine being certified

Second, the remote witness application executes on the Database Server and provides a web interface for the following functionality:

- Text based chat while viewing data currently being collected
- Selecting a product/turbine to view
- Displaying data either in real time or via a play back routine
- Displaying a video feed or still images
- Displaying a graphical turbine representation with data points
- Displaying a spreadsheet with calculated data points



**Figure 2 – This screen show live video of a test in progress, along with the chat window that supports real-time communications between the test operator and multiple remote witnesses.**

### Making it Work

With this composite application, Data Science Automation gave the manufacturer the ability to collect data while broadcast the information via the Internet to remote witnesses. The solution for these obstacles lay in LabVIEW's ability to communicate with a SQL server database and the National Instruments Remote Panel Software.

Data Science Automation created a database in which the manufacturer's test engineer could select either a previously defined test configuration or modify an existing configuration. Once the test engineer had configured the test stand, the data collection would start. During collection all configured data points would be sent to two separate databases. One database was located on the local PC which was located within a few feet of the data acquisition device and was used primarily as a backup in the case of a network failure with the web server. The secondary database was located on the manufacturer's corporate network which had access to the web.

To support an architecture utilizing multiple databases, DSA created a bidirectional replication process. In one direction (called upstream replication), this process was used if the corporate network connection was lost. In this case, the local PC database would store the information and once the corporate network connection came back online, the process would replicate the missed data points to ensure both databases contained the same test data. Data moving in the other direction (called downstream replication) consists of setup parameters that should be constant across all test stands. When this information is entered on the database server, it is automatically transmitted to all attached test stands to update them.

The manufacturer's requirement was for test data to be easily viewed remotely via the internet by up to five remote witnesses while allowing for text based chat between the test engineer and the remote witnesses. To implement this, DSA utilized National Instruments remote panel server. Five dynamically launched clones of a common application operate

simultaneously on the web server. These five instantiations are controlled remotely via the remote witness. The individual web applications communicate with the web server database to display data stored by the test engineer's computer based on a common order number supplied by the manufacture along with all text based communication.

**Conclusion:**

The final solution for this application provides the manufacturer's customers with a unique opportunity to be able to remotely monitor their product's certification process while having the ability have text based communication with the test engineer – all from the comfort of their offices.