Reactor Data at Your Desk

Isaac H. Khader
Joe Reyenga

NIST

August 8, 2013
1 Control Room Upgrade
   - The Console
   - PAC Room
   - Data on the Network

2 Desktop Application
   - Data I/O With MySQL
   - Mimics
   - Historical Data
   - Extensions
Goal: Consolidate and display real-time and historical trend data from the reactor console so that operations and engineering can access it at their desk.
Analog indications such as temperature and flow rate converted from a current from the physical device.
Analog indications such as temperature and flow rate converted from a current from the physical device.

Boolean indications are hard-wired to their respective components.
The Console

- Analog indications such as temperature and flow rate converted from a current from the physical device.
- Boolean indications are hard-wired to their respective components.
- There are hundreds of indications.
The analog (current-based) signal is converted to a stream of bits. This digital signal is transferred via Ethernet.

- Direct console data goes through a Modbus read-only firewall.
Digitization of Data

The analog (current-based) signal is converted to a stream of bits. This digital signal is transferred via Ethernet.

- Direct console data goes through a Modbus read-only firewall.
- Other data is acquired from the PAC panels.
The analog (current-based) signal is converted to a stream of bits. This digital signal is transferred via Ethernet.

- Direct console data goes through a Modbus read-only firewall.
- Other data is acquired from the PAC panels.
- Data is consolidated on a central Ethernet switch.
Network Architecture

Control Room

- Leak Detector System
- Shim Position DAQ
- Data Acquisition Panels
Process Automation Control (PAC) Room

**PAC Computer**

- Data is displayed on the screens via LabVIEW.
- Data subset is formatted and pushed through the data diode every 2 seconds by the DiodeTx program.
Data on the Network

NIST Administrative Network

Client Displays of Reactor Data

Data Diode Firewall

RS-232 to Ethernet

Virtual Server

DiodeRx .NET Program

MySQL Database

Webserver

Lobby
Thermal Power Display

C#.NET historical data programme

nbsr.nist.gov website
A current values table in MySQL updates every 2 seconds.

Every 20 seconds, the DiodeRx program takes the current value data and inserts it into a cumulative table.
A current values table in MySQL updates every 2 seconds.

Every 20 seconds, the DiodeRx program takes the current value data and inserts it into a cumulative table.

A range of programmatic data selection/manipulation is available.
Storing Data on the Virtual Server

- A current values table in MySQL updates every 2 seconds.
- Every 20 seconds, the DiodeRx program takes the current value data and inserts it into a cumulative table.
- A range of programmatic data selection/manipulation is available.

MySQL Workbench

```
SELECT * FROM nbsr.hist;
```
The C# .NET program translates user input into queries mySQL understands, and mySQL returns the data.
The C#.NET program translates user input into queries mySQL understands, and mySQL returns the data.

Sample SELECT statement in C# code

```csharp
string query = "SELECT " + tag + "', Timestamp FROM nbsr.hist WHERE " + tag + "' NOT REGEXP 'NaN' AND " + tag + "' IS NOT NULL AND Timestamp>'" + lowTimeLimit + "' AND Timestamp <'" + upTimeLimit + "'";
```
Displaying Data

How should all of this reactor data be displayed?
How should all of this reactor data be displayed?

Diagrams of reactor systems are complicated, and can take a long time to decipher.
New mimics display key data visually, without as much clutter.
Data on Mimics

The C#.NET and web program query current value data from the SQL database and display it in the relevant location.

Isaac Khader (2013)
The C#.NET and web program query current value data from the SQL database and display it in the relevant location.
Data on Mimics

The C#.NET program has tabs to select various systems. Clicking a label will display historical data.
The C# .NET program has tabs to select various systems. Clicking a label will display historical data.
Website mimics are accessible through a password protected index page.
### Chart Features
1. Link with mimics  
2. Interface with mySQL  
3. Date Range Selection  
4. Multiple Traces/Tags  
5. Sparse Data  
6. Save/Print  
7. Export

### Accomplished Through
1. C# loops on lists  
2. dbConnect C# class  
3. Timestamp logic in SQL statement  
4. Manipulating Lists of data in C#  
5. SELECT every nth row  
6. WinForms Chart class  
7. C# Export Class
Graphs

Why is this useful?

- Troubleshooting
Graphs

Why is this useful?

- Troubleshooting
- Ease of use
Why is this useful?
- Troubleshooting
- Ease of use
- Lots of data in one place
Extensions

- Build a more robust database and UI program.
- Make changes to interface based on user feedback.
- Add the rest of the control room values.
Acknowledgements

- Joe Reyenga
- Mike Middleton
- Bob, Mike Rowe, Paul and Dennis
- Dr. Huber, Dr. Dimeo
- SURF Directors
- Grant and Max

[Logo: NSF, Center for High Resolution Neutron Scattering]