

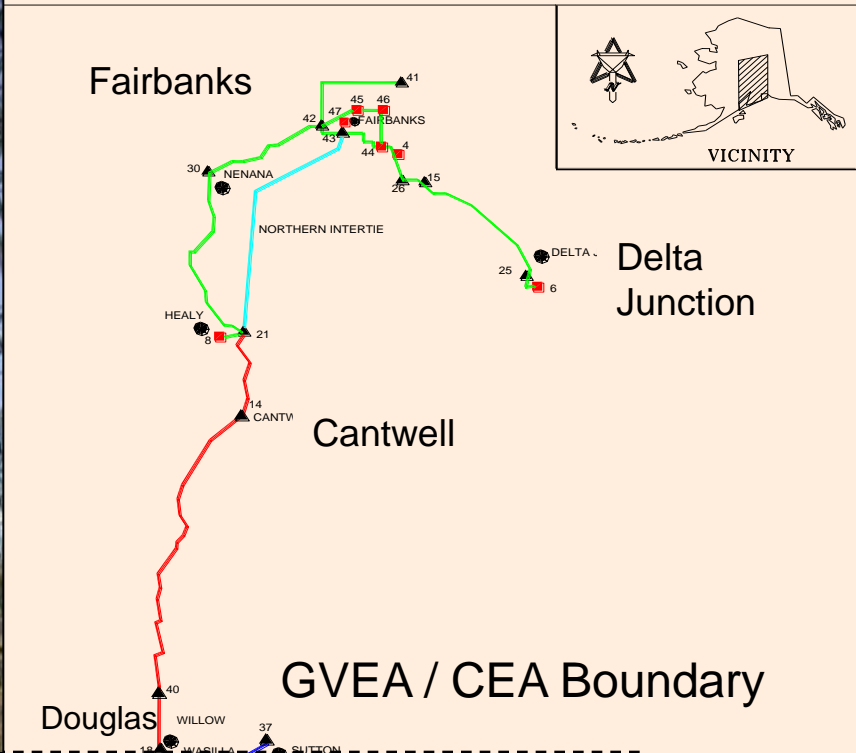
Growing the PI System and New Technology



Your Touchstone Energy® Cooperative 

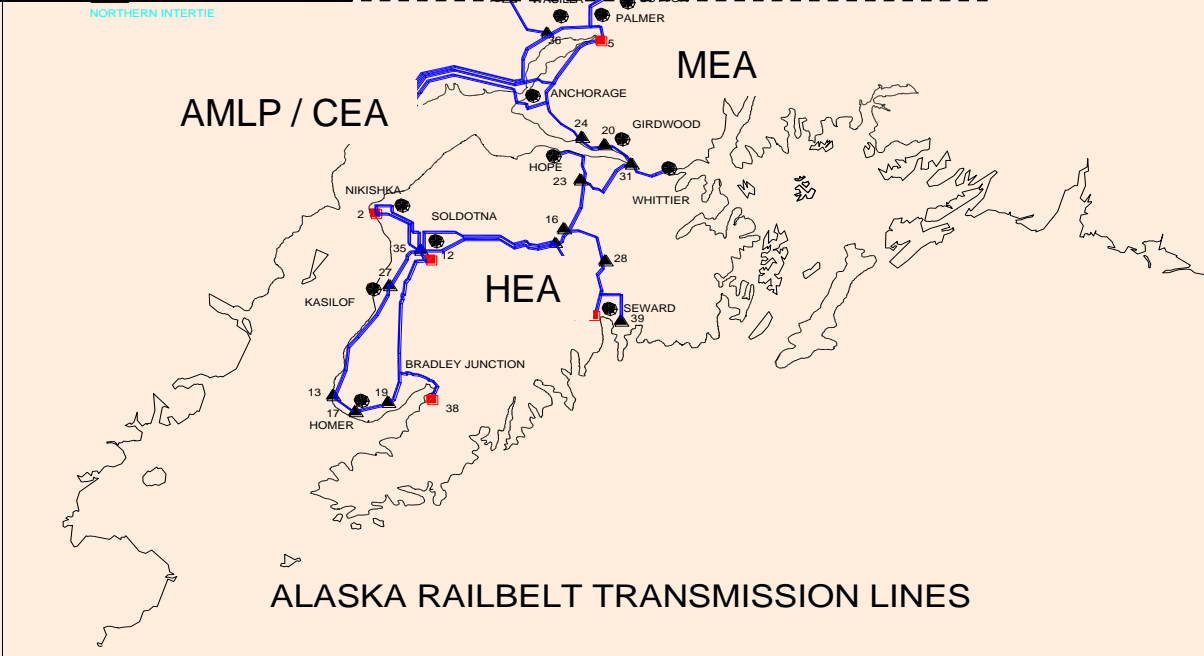


NORTHERN INTERTIE



Railbelt Electrical System

- GVEA has...**
- 296 MW Generation
 - 3077 miles of power line
 - 44300 meter drops
 - BESS - a big battery
 - Telcom subsidiary



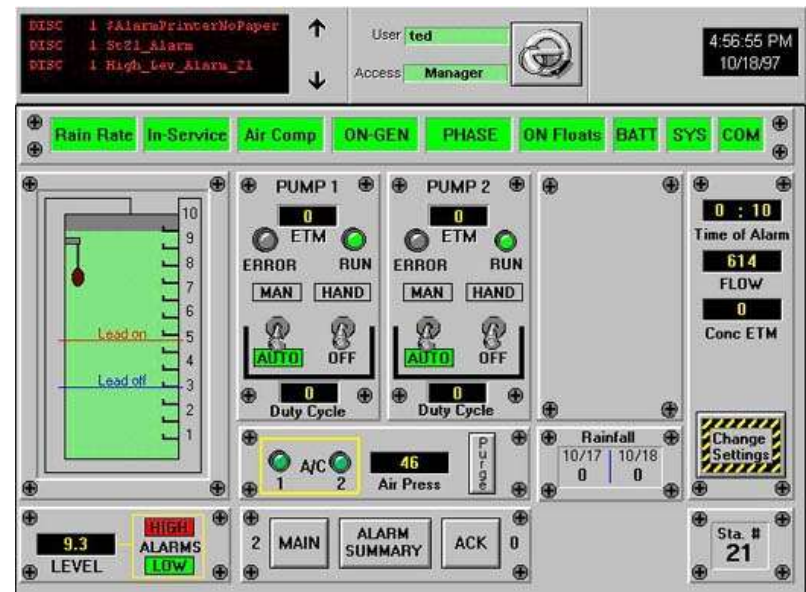
GVEA at a Glance:

- An RUS (Rural Utility System) not-for-profit electric utility.
 - Incorporated 1946. 32,654 owner members. 43,300 meters or service drops
 - 14 consumers per mile of line (NYC has 900+).
 - Approximately 250 employees (more in the summer for brush clearing).
- Long Term Investments.
 - 3,077 miles of power lines, 35 substations.
 - Six generation plants, 296 MW of generation capacity.
 - Generation from oil, coal and hydro.
- Reliable.
 - 99.99% reliability, average down time 60 minutes per member/year.
 - Unlike the other Railbelt utilities GVEA has recent generation additions.
 - Owner of the World's most powerful battery, 46 MW output.
- Future.
 - Renewable generation.
 - Smart Grid – advanced interactive automatically reactive controls

The PI System at GVEA

In 1996 and 1997

- Prior to 1996 plant controls were pneumatic or based on Bourdon tube type gauges.
- Second power plant (HCCP) constructed at Healy and both plants operate within enviro permits for the old plant.
- Bailey Infi 90 distributed control system added to old Healy plant.
- Corporate WAN created.
- FANUC controls added to GT plants.



Reasons the PI System was selected:

- Salient information real time.
 - Decisions can be based on facts rather than theories.
 - Root causes can be accurately and rapidly determined.
 - Deviances can be detected as they are happening rather than in last months reports.
 - Control of any system can be much more accurate and responsive.
- Automation of many functions.
 - Reporting, key for payments, billing, audits, environmental limits, etc.
 - Potential to shift man-hours from operations to maintenance.
 - Those needing information can directly acquire it instead of having to use other personnel.
- Reduced risks and higher credibility.
 - Management can be seen to be doing the right things to maximize return on investment (always a big issue getting projects budgeted.)
 - Potential to reduce environmental permit exceptions.
 - Historical data qualifies staying with or changing practices/hardware.
 - Knowing the facts gives the comfort factor to act decisively.

Corporate Wide Area Network



PI Server



Operations Consoles



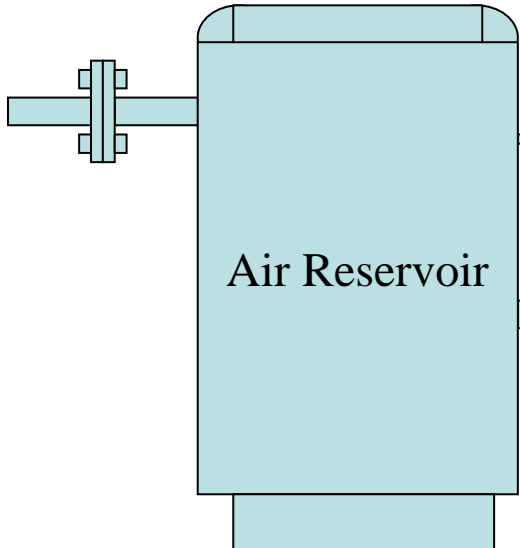
Industrial node

Engineering Work Stations



Plant Control System

Other plant machines

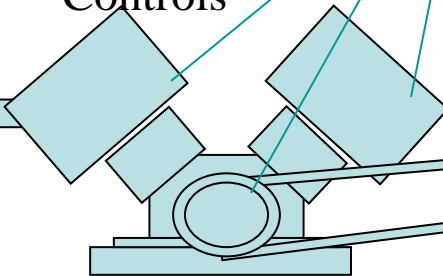


PSI

Higher Level Control

Local Controls

Instrumentation - Feedback -



Compressor

Motor

kW



Industrial Success Stories:

- The Healy plant was upgraded in 1996 to allow both HCCP and Unit One to operate within the existing environmental limits. The burners, pulverizers, and the plant control system were replaced. Previously older pneumatic controls had been used and we changed to a 'turn key' Bailey INFI 90 system.

Initially this change was a disaster with plant trips daily. However Plant Information (PI) and other software packages (ExperTune and DB Doc's) allowed for rapid determination of each trip root cause and subsequent resolution of these issues one by one.

Healy has been the most reliable pulverized coal plant, or close to it, since our 'upgrade issues' were overcome.

- The keys were:

Accurate comprehensive events data and the in-house process of identifying, prioritizing, and permanently resolving issues using the existing resource of competent and capable personnel.

Presentation Outline



- **Architecture** – evolution of the PI system
- **Users** – reliability, diversity and standardization
- **Technology** – virtualization and SAN

Architecture



- Healy
- Move to Fairbanks
- Expanded to other systems



1999

2005

2007

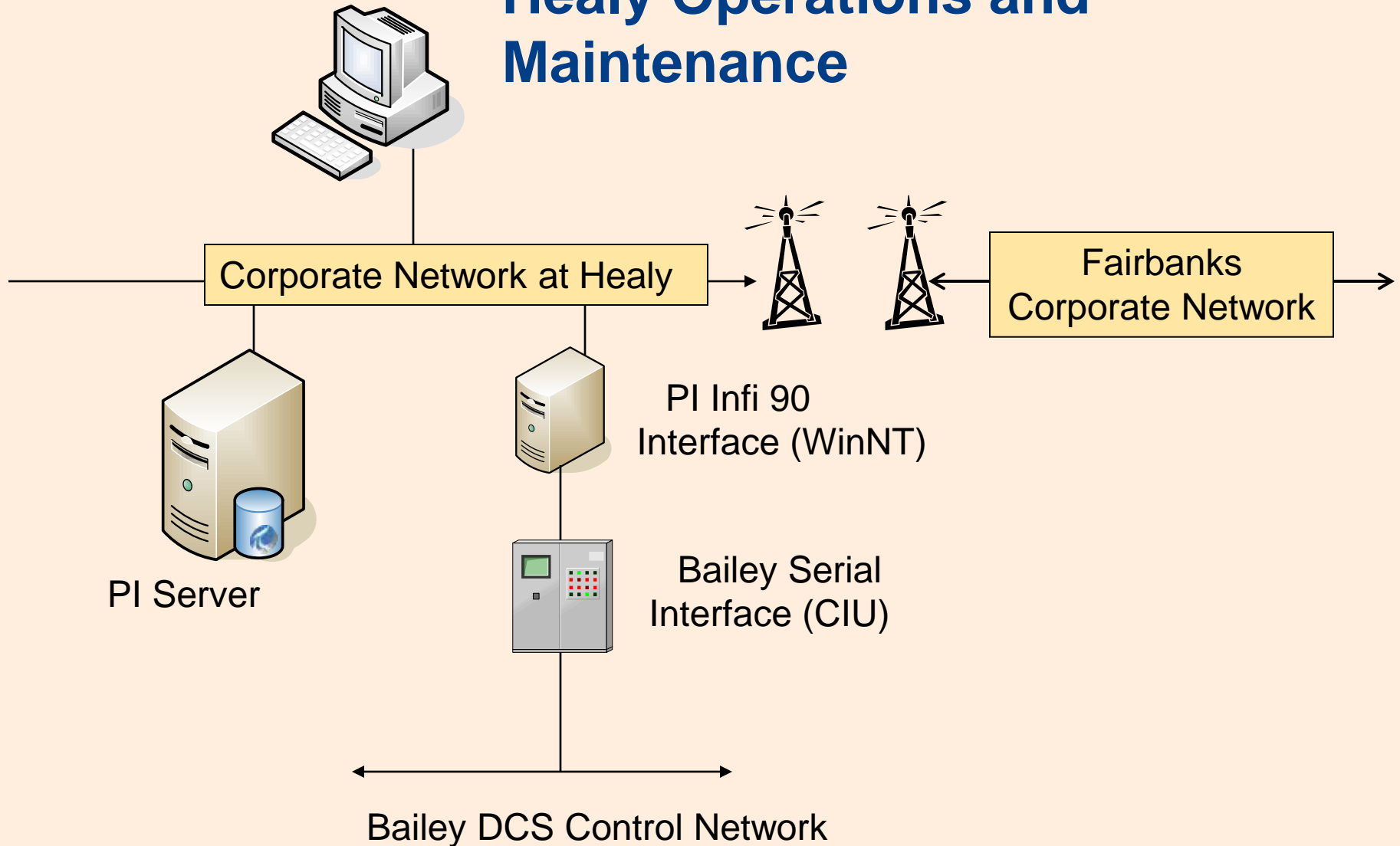
2008

2010



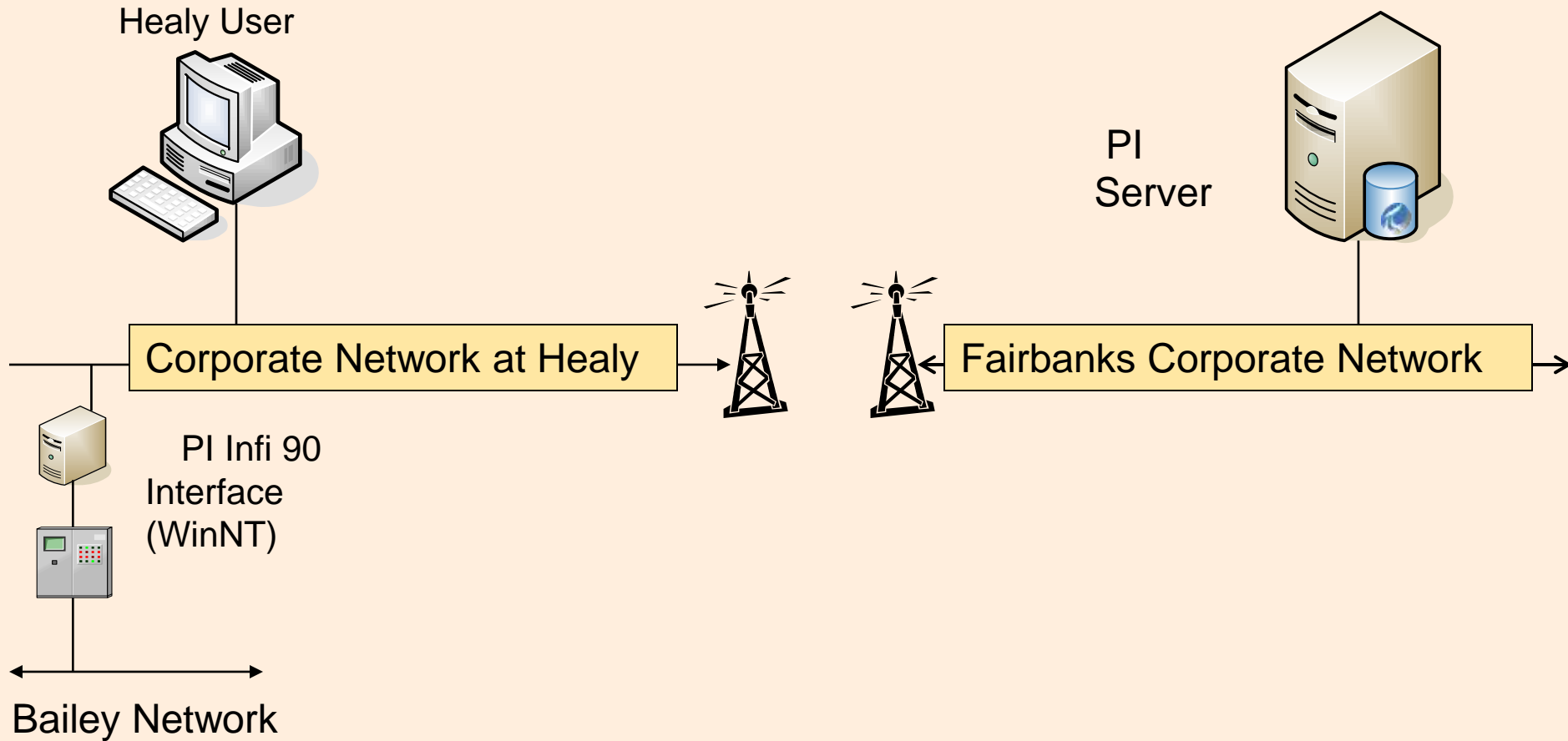
1999

Healy Operations and Maintenance



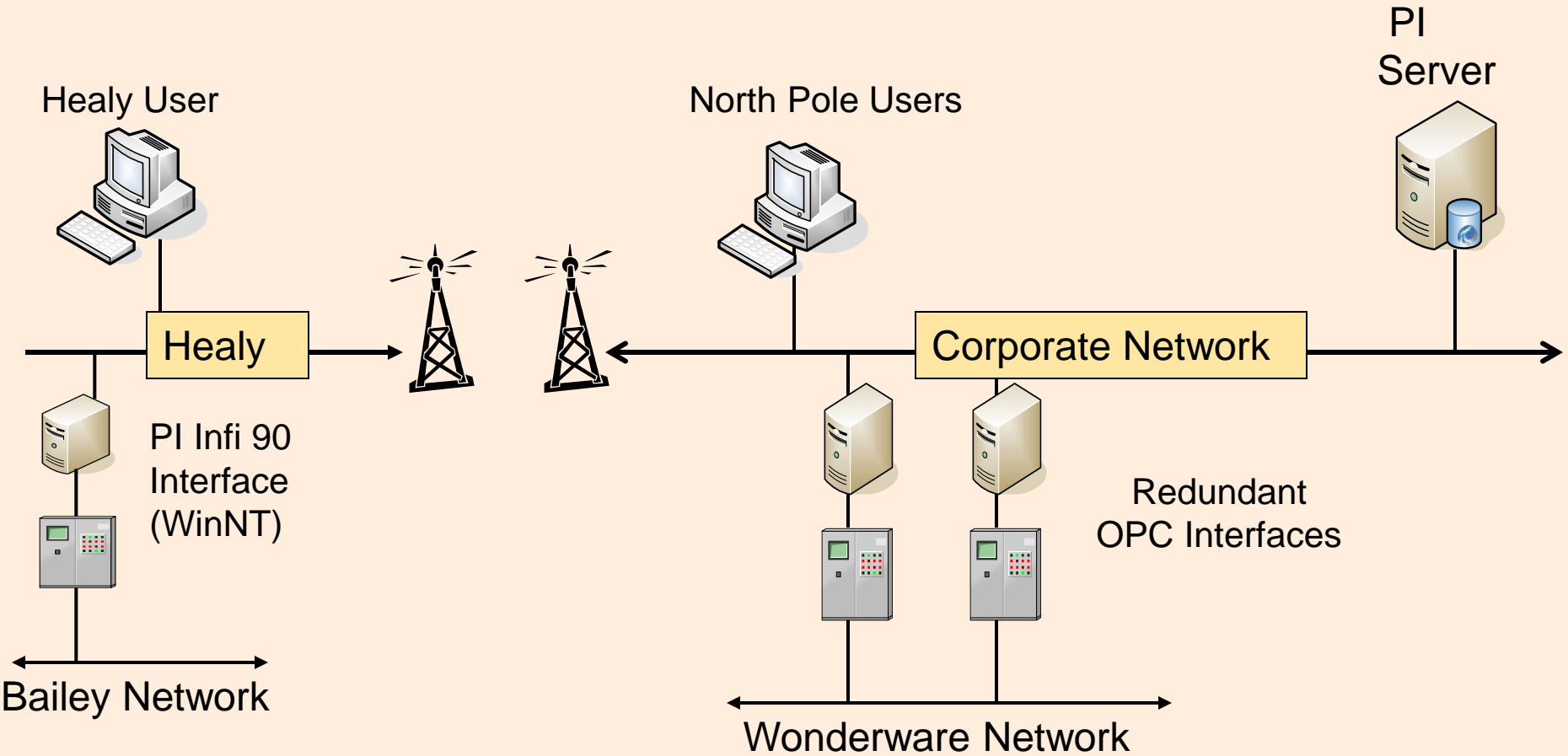
2005

Server Moved to Fairbanks



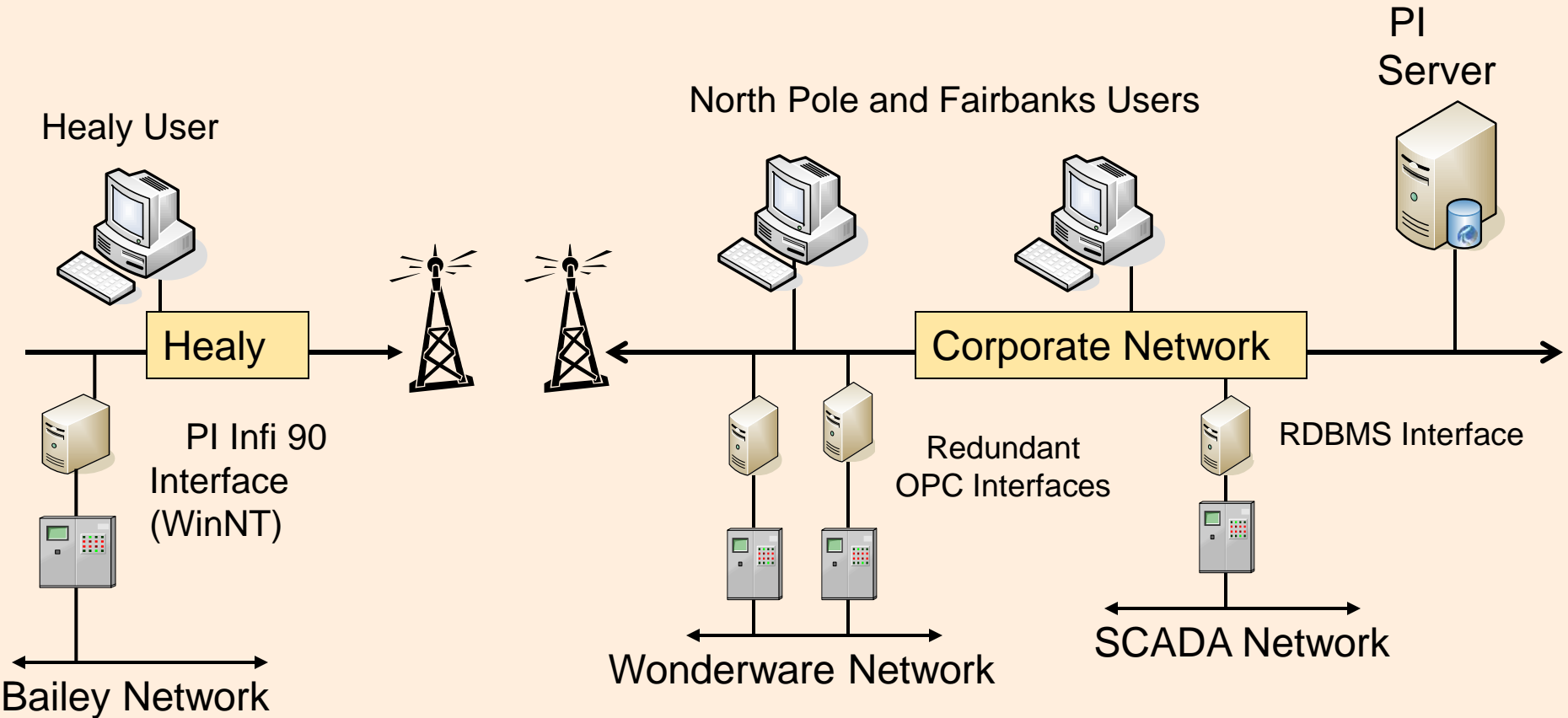
2007

OPC Connection to Turbine Network



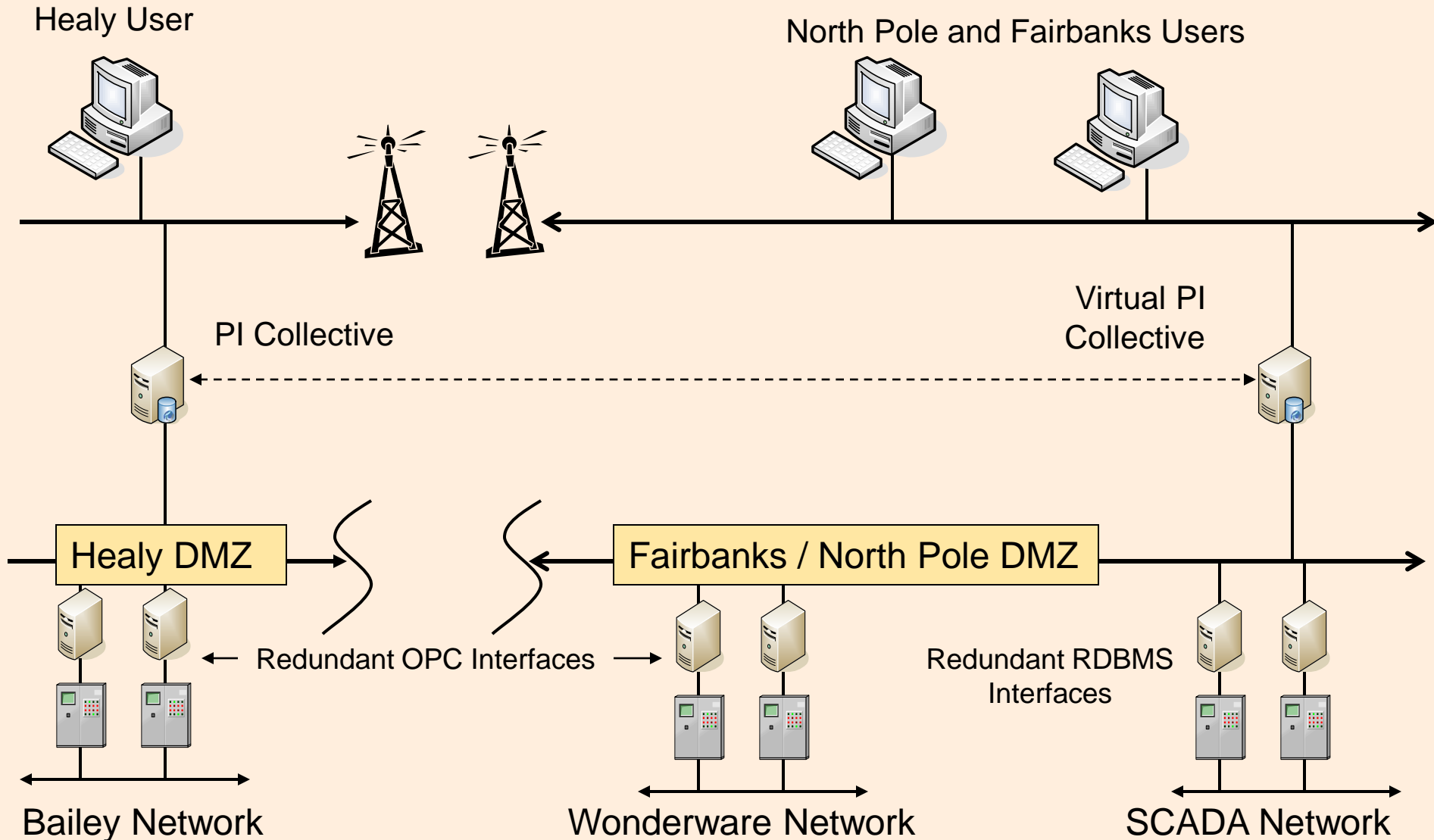
2008

RDBMS Connection to SCADA



2010

Current Projects

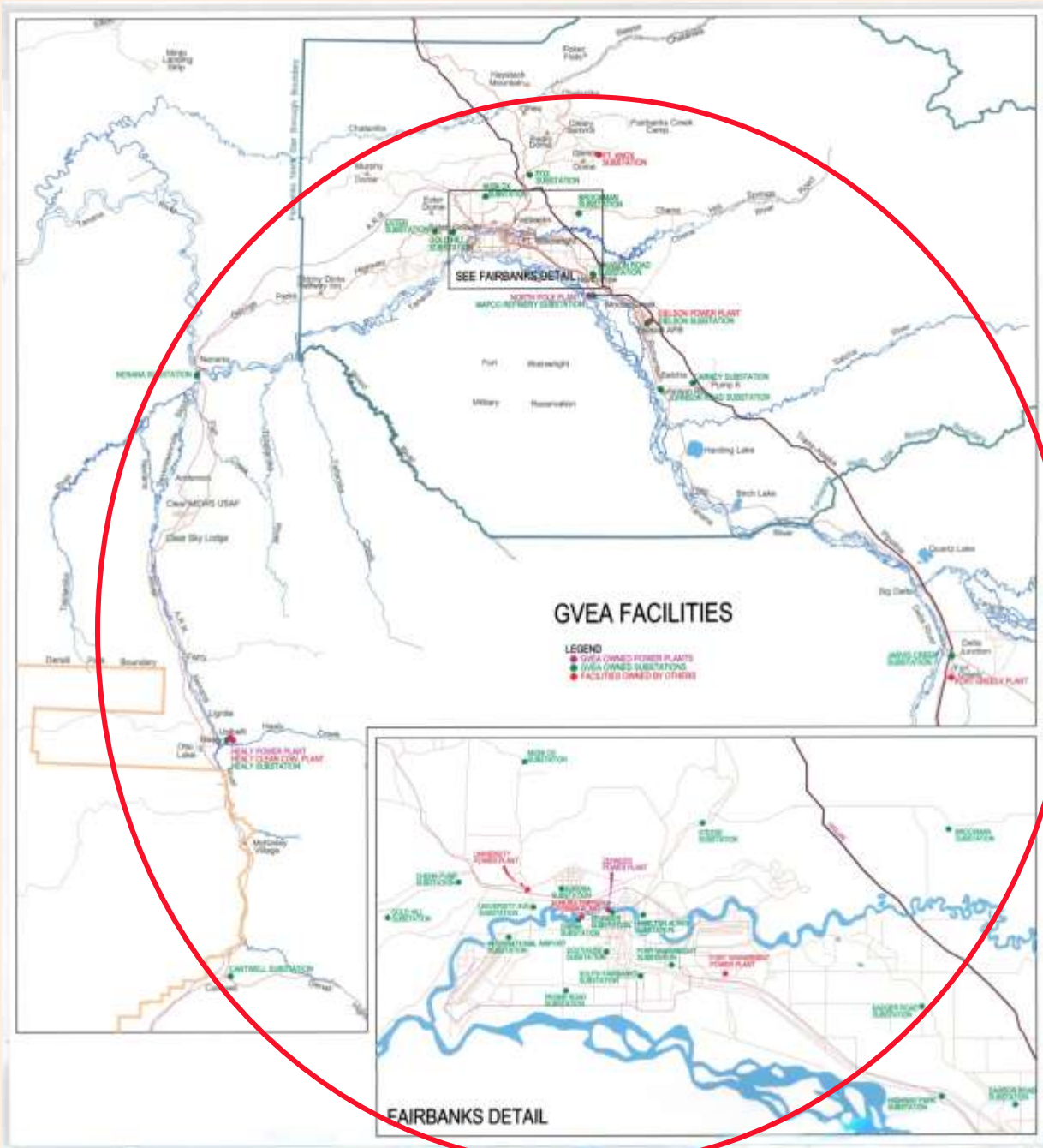


Users



- Healy Operations and Maintenance
- Dispatch Control Center and Engineering
- Environmental and Turbine Group



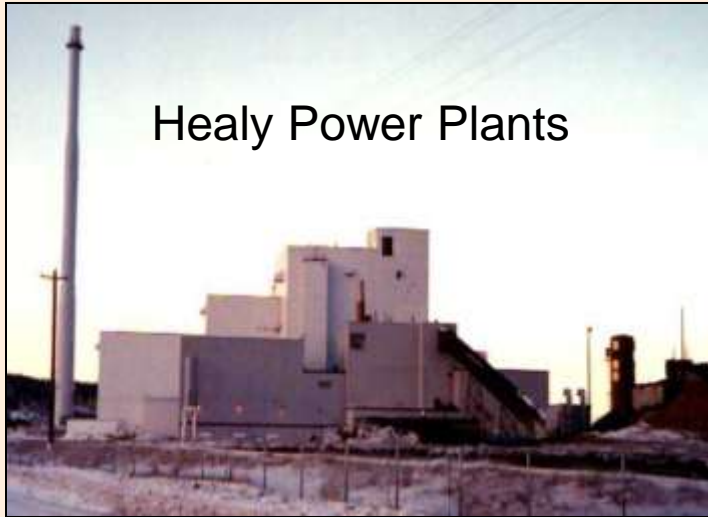


NEED

Collect all power plant, transmission, and distribution data into a common database with easy company wide access.

SOLUTION = the PI System

Reliability



Highest Ranked Capacity Factor
in the Nation 2004 and 2005

In the top five ever since!

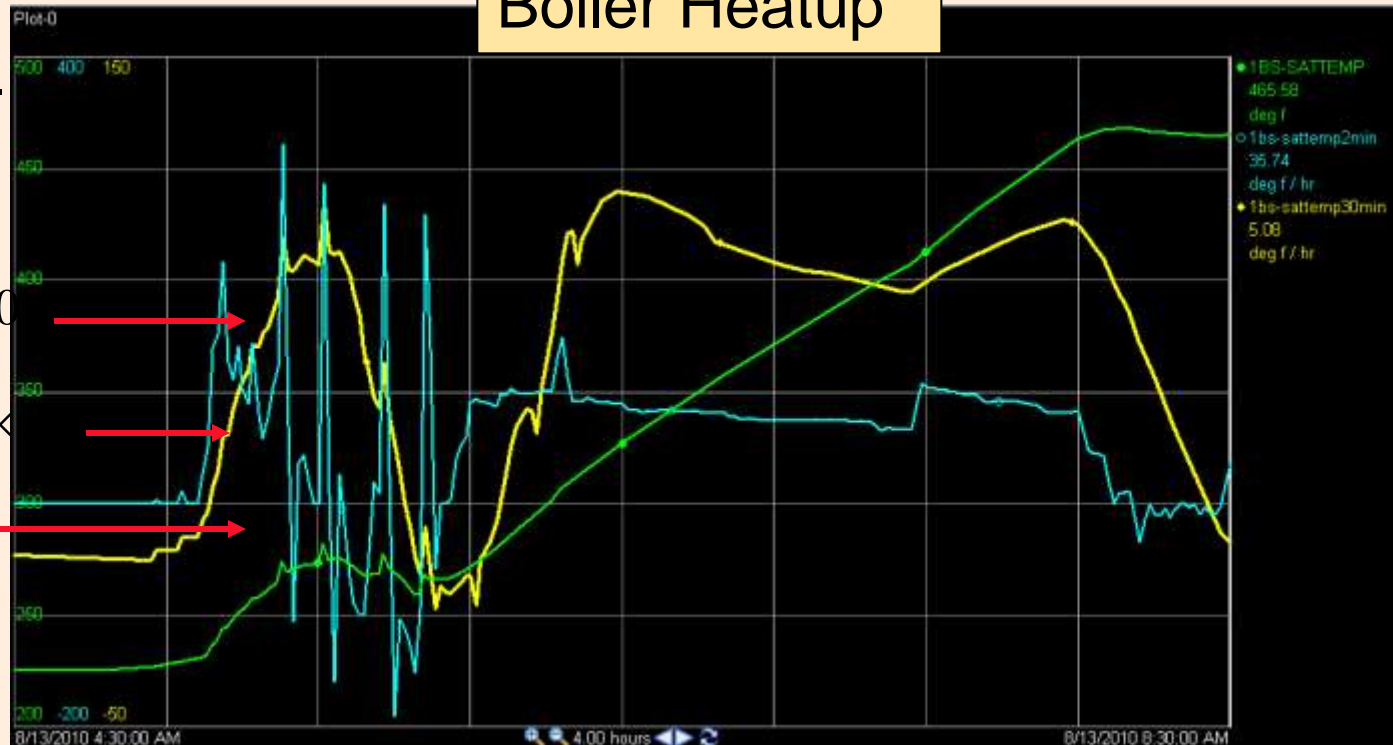
Boiler Heatup

PI PerformanceEqs.
produce one hour
heatup rates

$$predictFAST = \Delta T_{2min} \times 30$$

$$predictSLOW = \Delta T_{30min} \times$$

AverageTempNow

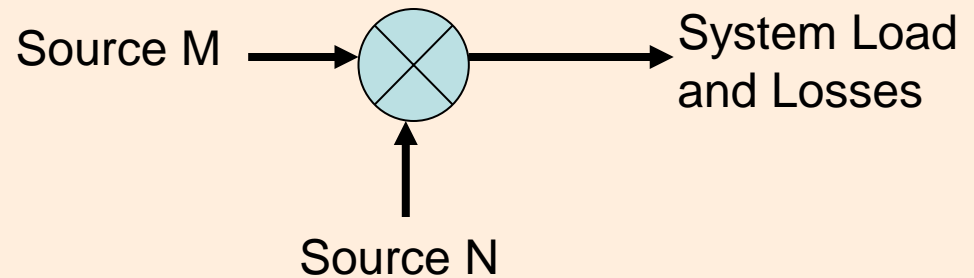


System Reporting, Analysis and Modeling

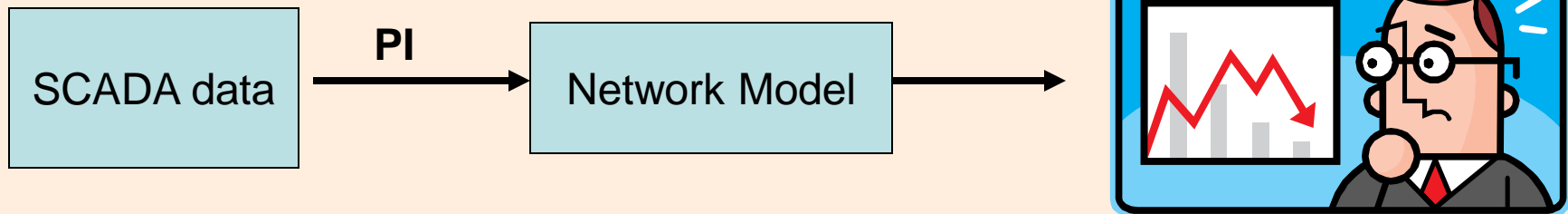
System Control Center (SCADA)



Energy Accounting

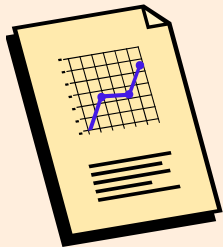


Engineering

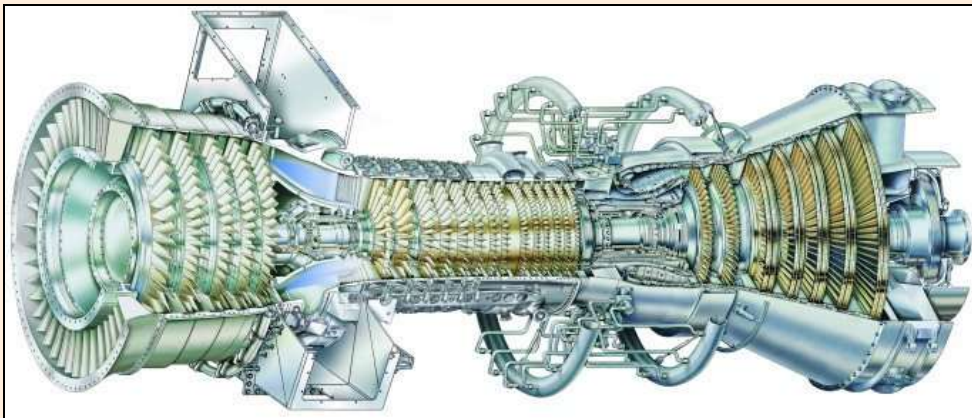
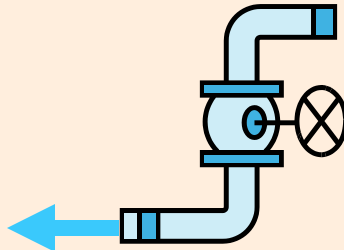


Environmental and Turbines

Water Discharge Permit Compliance



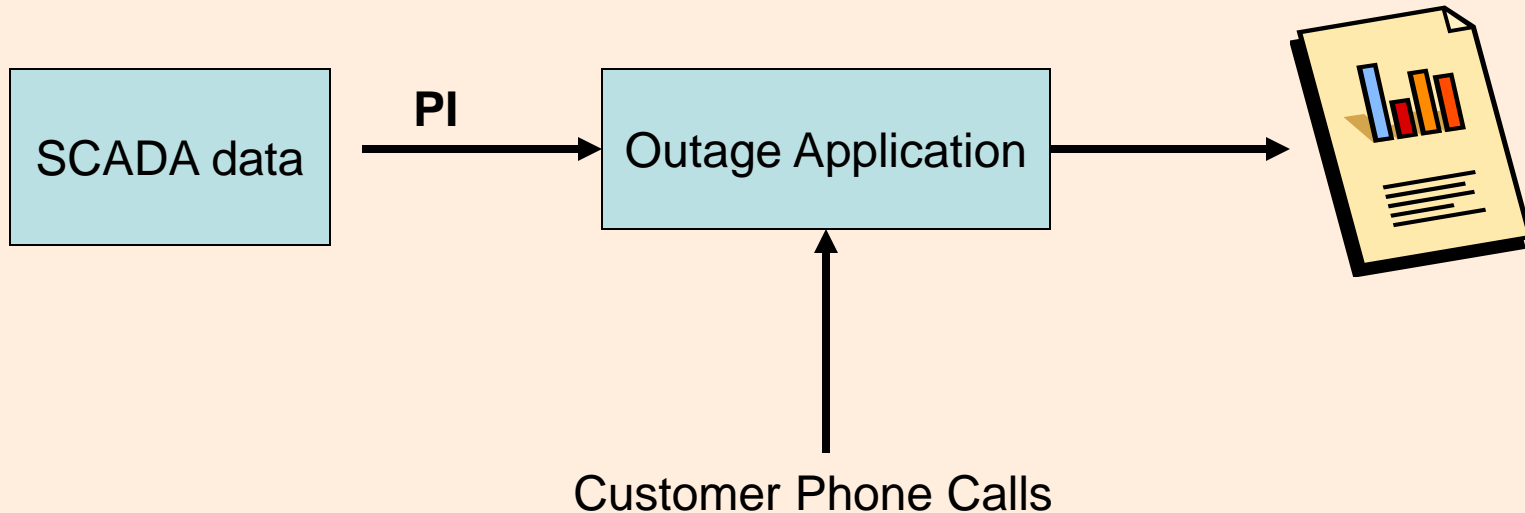
Flow rates,
Temperatures, pH



GE LM6000 Gas Turbine
North Pole Expansion Plant

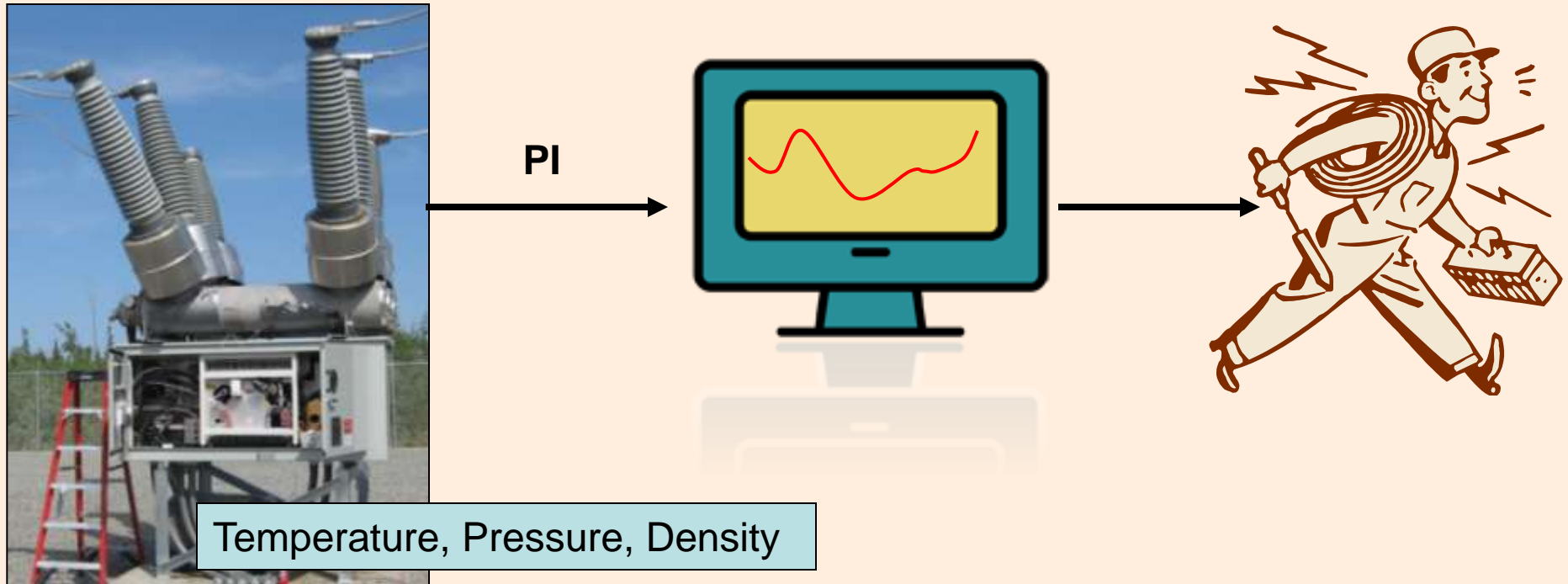
In Progress...

- Automate Reliability Reporting



In Progress...

- Condition Based Maintenance



Technology



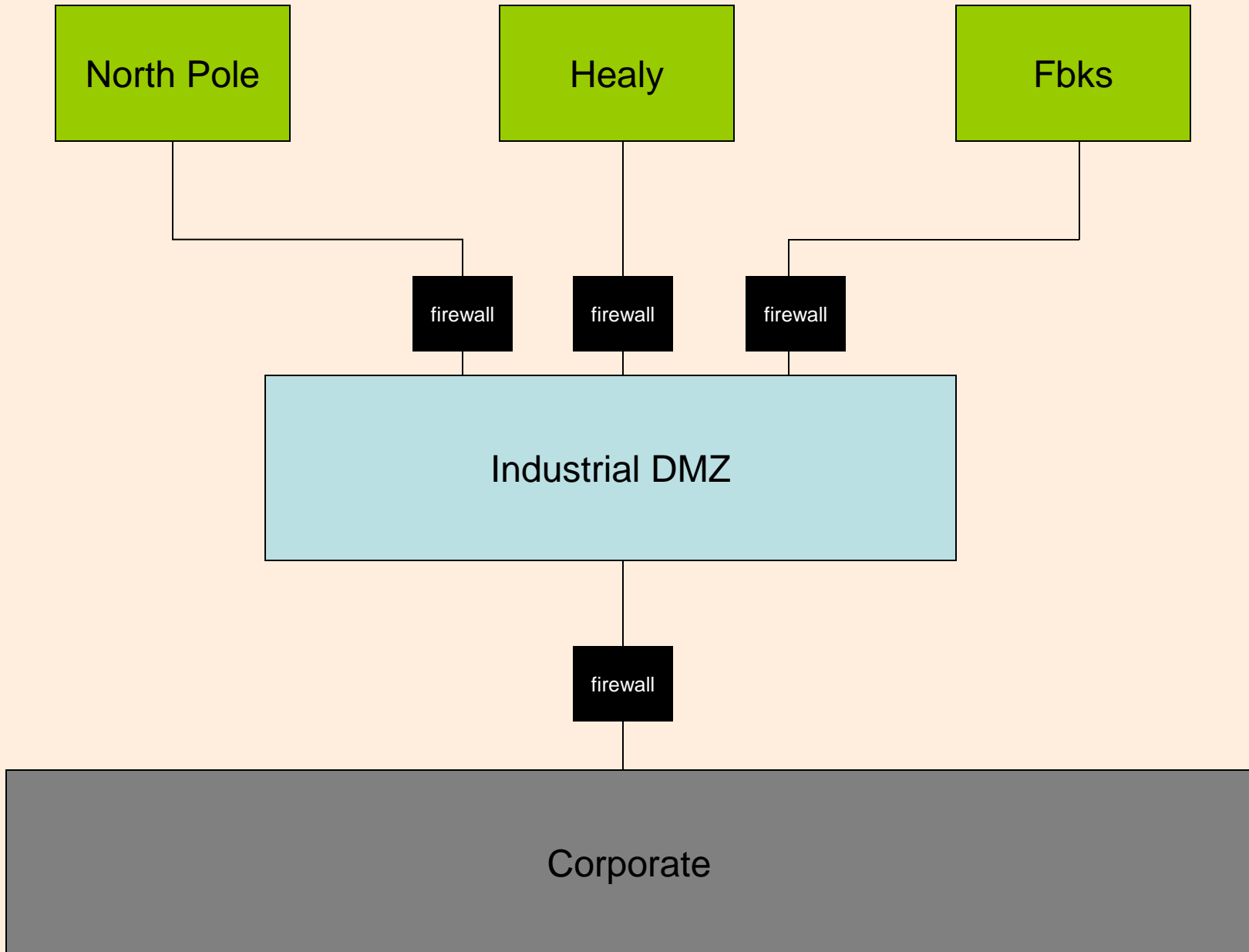
- Distributed Administration
- Virtualization and SAN based archives
- Migration to Active Directory



Planned Industrial Network Setup

- Presently, no DMZ
- Limited Firewalling
- Restrictions on traffic between some of the zones is enforced by router ACL's in lieu of Firewall

Planned Network Setup



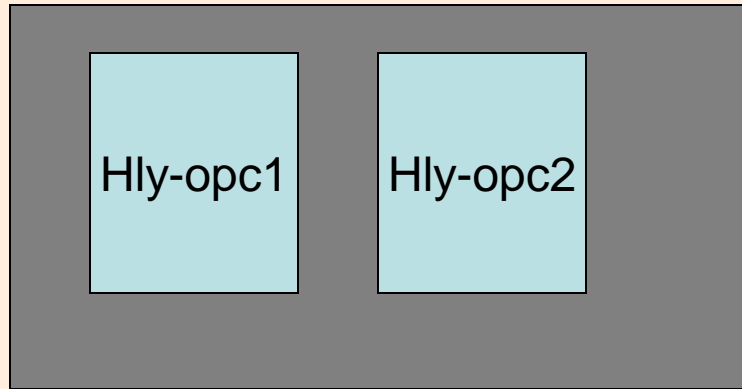
PI System Infrastructure

now / future

- Healy had a PI API that received data from INFI 90 and sent it onto the PI server
- We've migrated away from PI API to a OPC server running OPC90 (vendor RoviSys) which receives data from INFI 90
- PI OPC DA Interface connects to OPC90 and sends it onto PI Server. Both server/interface combo run on same machine

Planned Setup

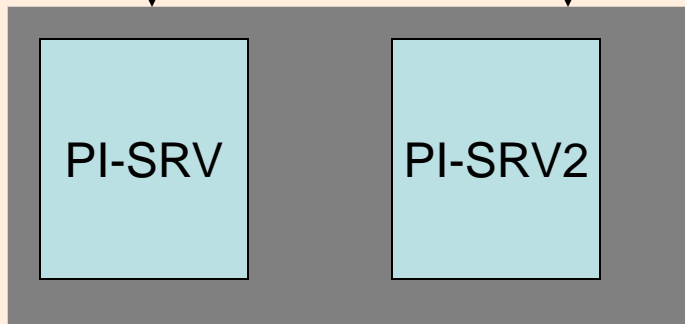
Healy



NP

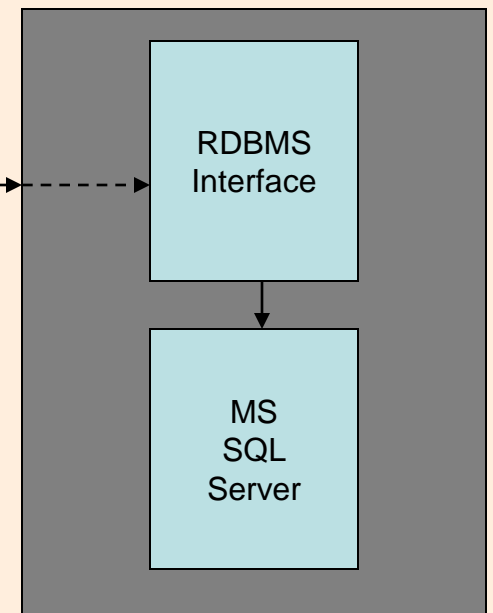


PI Collective



DMZ

Fairbanks



System Administration

- Monitor PI Archives
- Network Connections (PI managed)
- Point allocation is done by client/users
- Performance Monitoring
- Storage (NetApp backend)

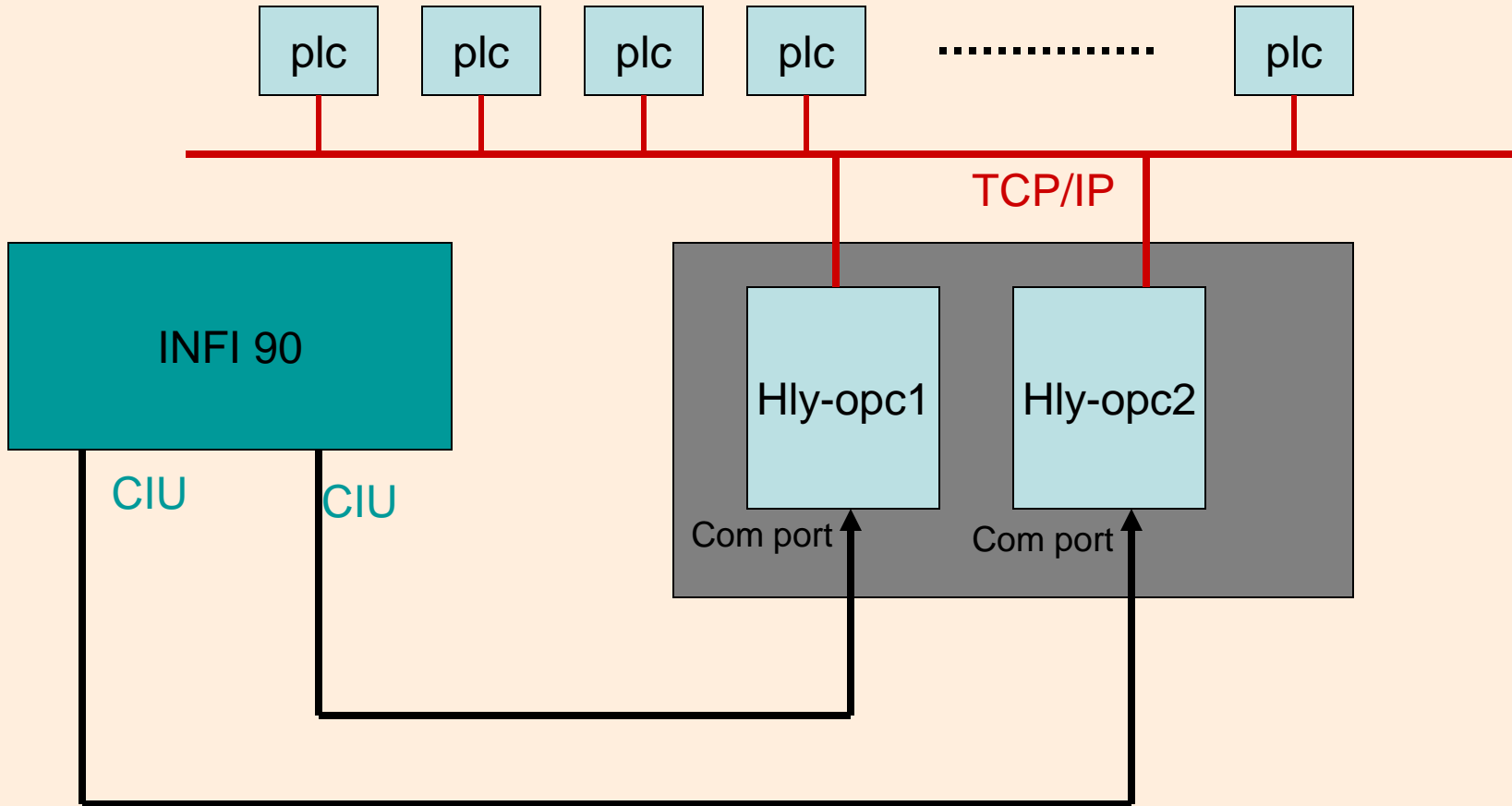
Backups

- Hot backups are problematical
- Hot backups are first done using the PI System initiated Microsoft VSS to hard drive daily
- CommVault delta backups then send data to archive/disaster recovery infrastructure (includes slower HD banks and tape)
- Ideally, hot backups go straight to CommVault, but not supported.

Storage Area Network

- NetApp Backend
- Shelves on RAID 5 with 2 hot standbys
- Tiered storage (high speed/low speed/tape)
- Redundant network connectivity
- iSCSI protocol, very little Fibre Channel
- Offers iSCSI LUN, CIFS, and NFS as storage methodology/protocols

Healy Data Flow (future)



END

GVEA

Golden Valley Electric Association

Your Touchstone Energy® Cooperative 