



Fleet Wide Monitoring

Project Idea suggested for SG 1 of Indo-German Energy Forum
February 12th, 2015

Heiko Schierenbeck

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Need of Fleet Monitoring in Power Sector

External Drivers

- Regulatory Requirements
 - Availability Based Tariff
 - PAT Scheme
- Escalating Fuel Costs
- Power trading
- Competition

Internal Drivers

- Lack of adequate trained manpower
- Need for reliable information
- High maintenance cost

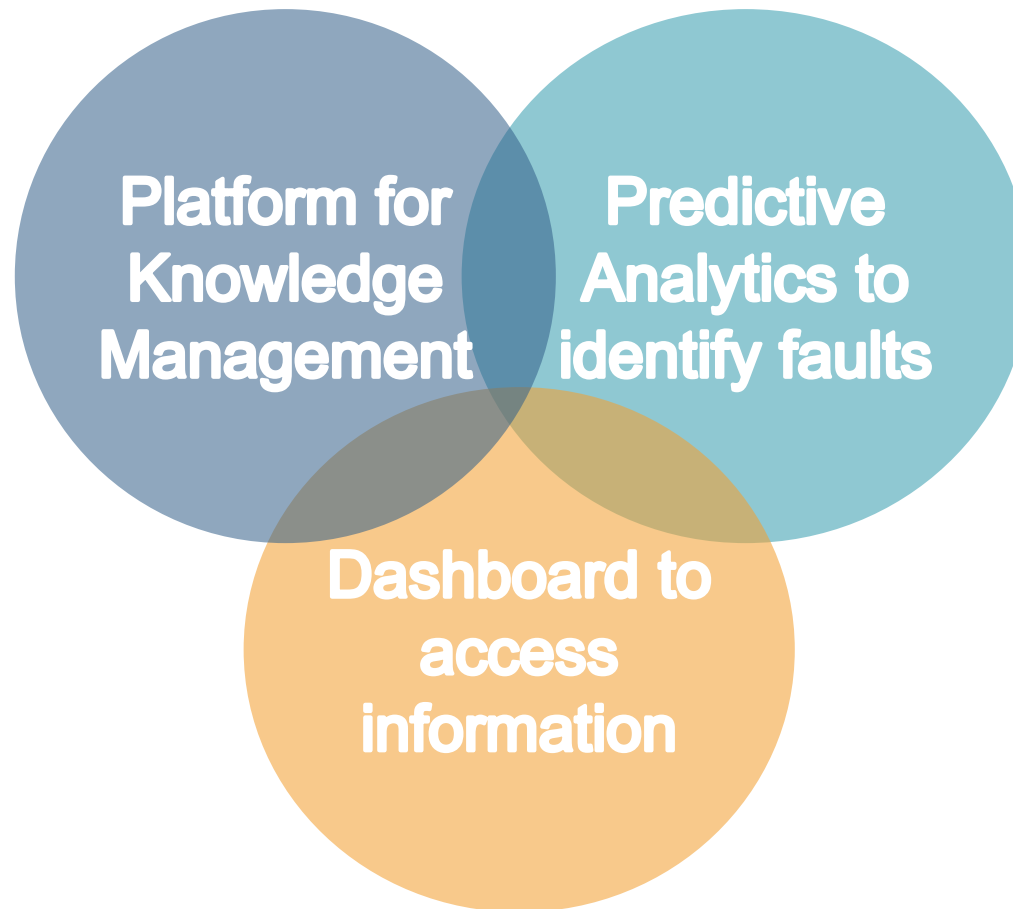
Organization's Needs

- Easy and direct access to information
- Centralized performance & operation monitoring
- Quicker response time
- Economic generation
- Predictive maintenance
- Investment planning
- R&D



Fleet Monitoring

Preconditions of efficient fleetwide predictive maintenance



Conceptual Data Flow for Fleet Monitoring



Power Station

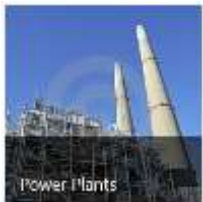
- Performance analysis
- Critical data

Central Monitoring, Head Office

- Operation & performance monitoring
- Emergency response
- Remote fault diagnostics
- Knowledge/experience transfer

Equipment Health Server Use Case: Power Plants

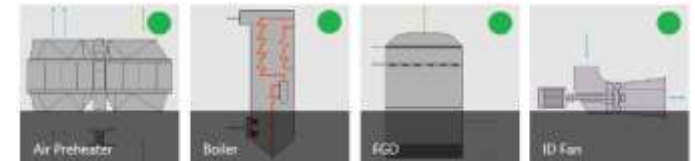
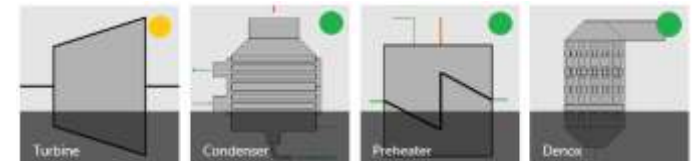
Main Features



Power Plants



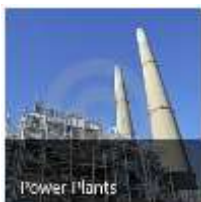
Demo Station



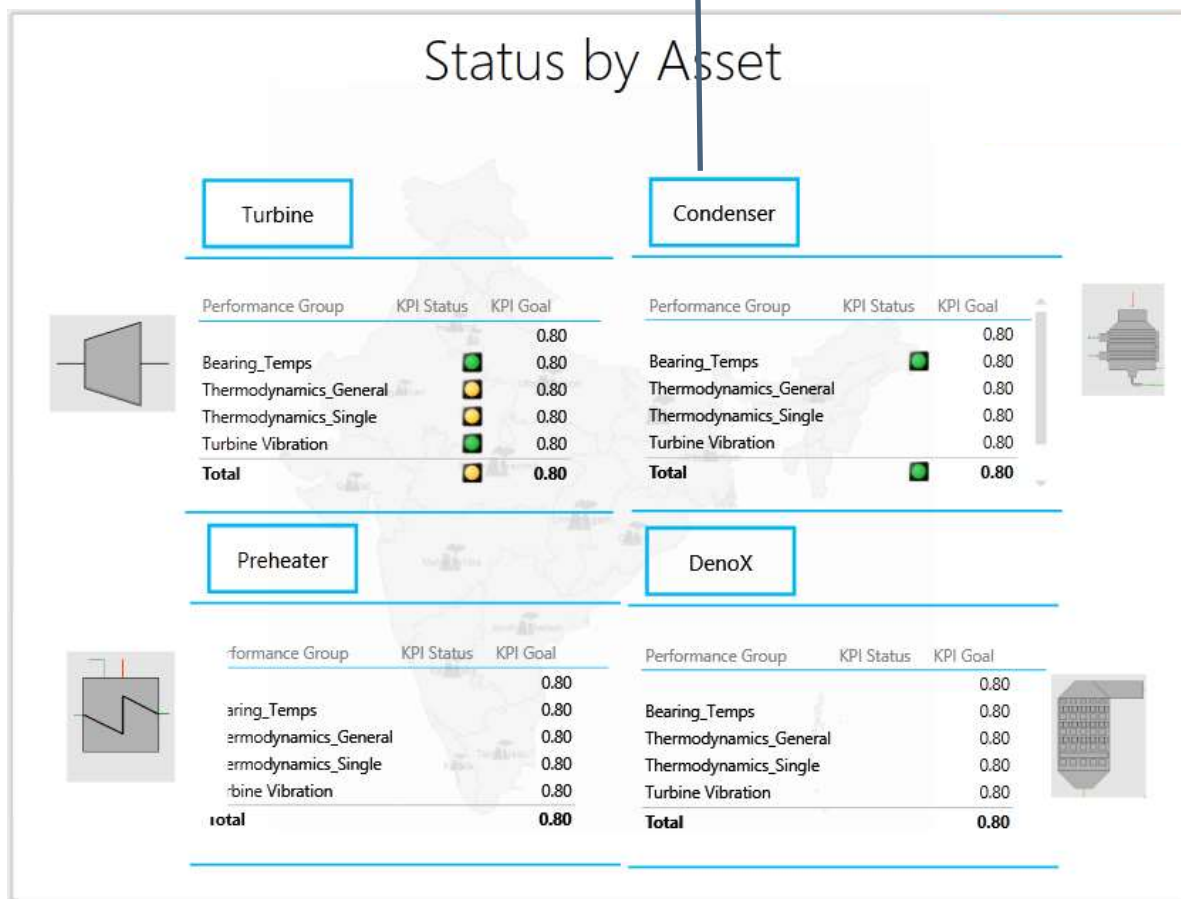
„Meta KPIs“ indicate overall health of station, unit, equipment, component

Equipment Health Server Fleet wide asset overview

Main Features



Drill through allows benchmarking of assets across the fleet

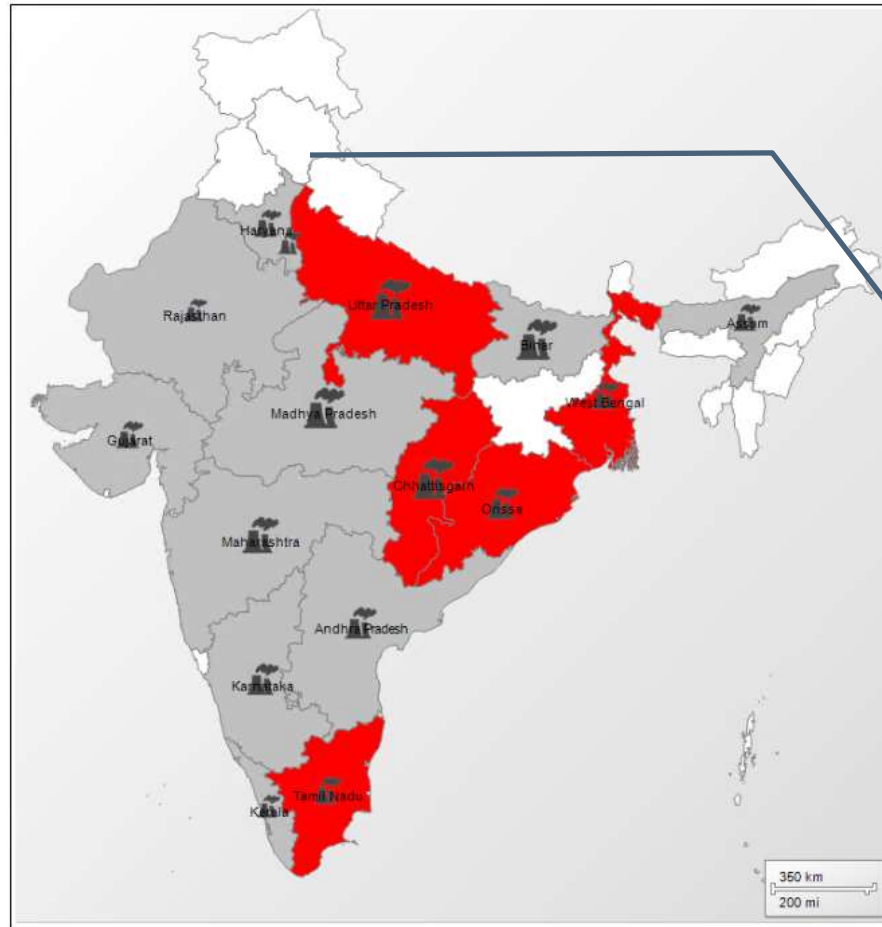


Equipment Health Server Collaborative Platform

Main Features



Collaboration



The Equipment Health Server is a platform to exchange information and to build a fleetwide knowledge base.

Equipment Health Server Learning Organisation

Main Features



Q&A Assets and weather

+ new discussion

Recent My discussions Unanswered questions

Condenser
Condenser fails in case of air moisture over 98% during 48 hours?
By SHAREPOINT\administrator | Latest reply by SHAREPOINT\administrator | October 21

Turbine Vibration Vertical BRG_2
In case all metrics in a 3 day range are over 98 points over 48 hours?
By SHAREPOINT\administrator | Latest reply by SHAREPOINT\administrator | October 20

Boiler warm up takes too long
Heavy latency in boiler pre-heating have been watched during monsun
By SHAREPOINT\administrator | October 20

Condenser

3 replies

SHAREPOINT\administrator
Condenser fails in case of air moisture over 98% during 48 hours?
October 21 | Reply | Edit | ...

All replies
Oldest Newest

SHAREPOINT\administrator
The cooling system and therefore the condenser requires that the humidity of the ambient air is lower than the one in the cooling tower. If there are no other signs of error in the system, this is probably a normal effect.
October 21 | Reply | Edit | ...

SHAREPOINT\administrator
The humidity can certainly influence the condenser. Check the steam temperature and steam function first to be sure.
October 21 | Reply | Edit | ...

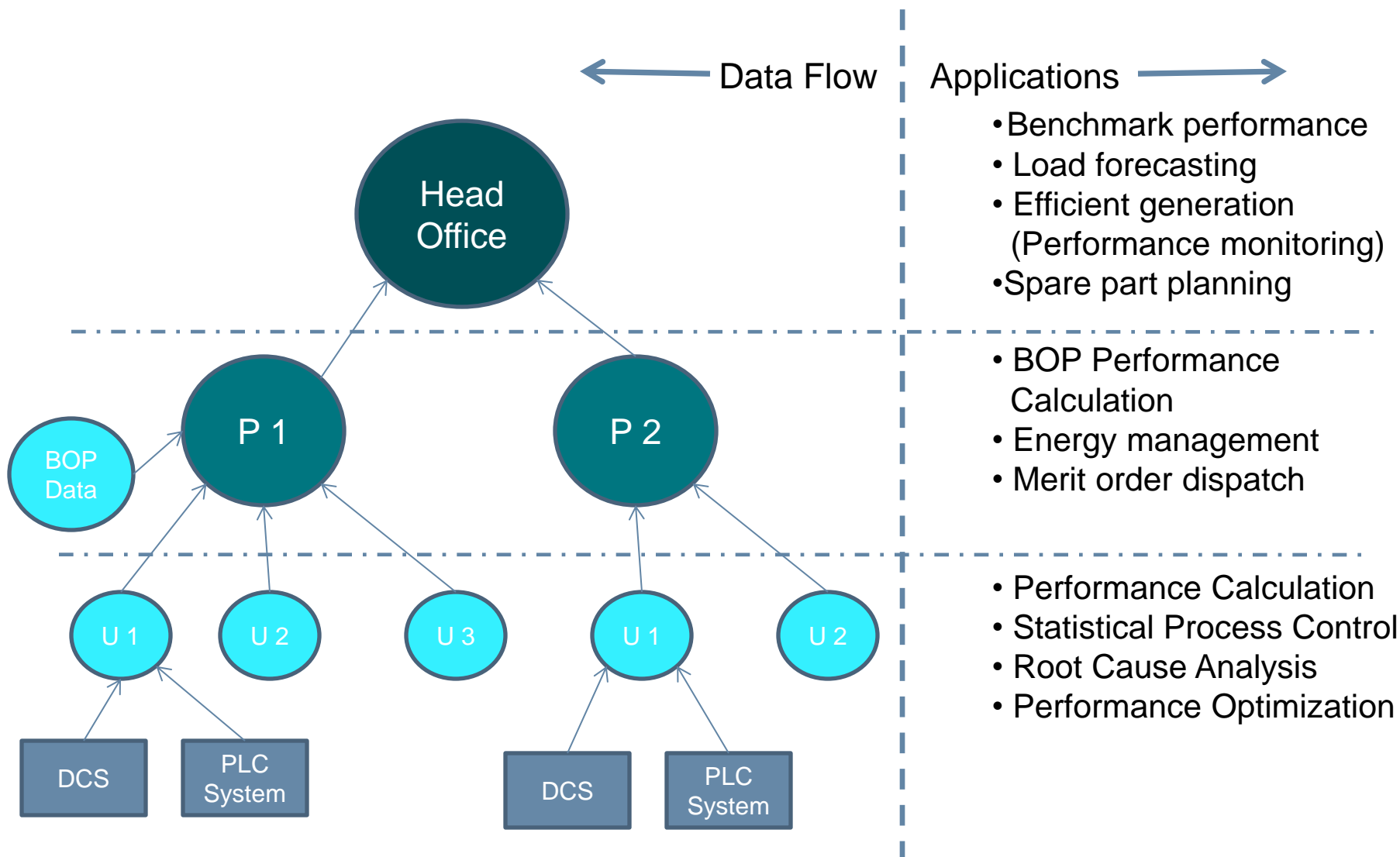
SHAREPOINT\administrator
[Condenser \(2/2\)](#)
October 21 | Reply | Edit | ...

Add a reply

Share data and information to each detected event.

Retrieve this information if a similar fault occurs somewhere in the fleet.

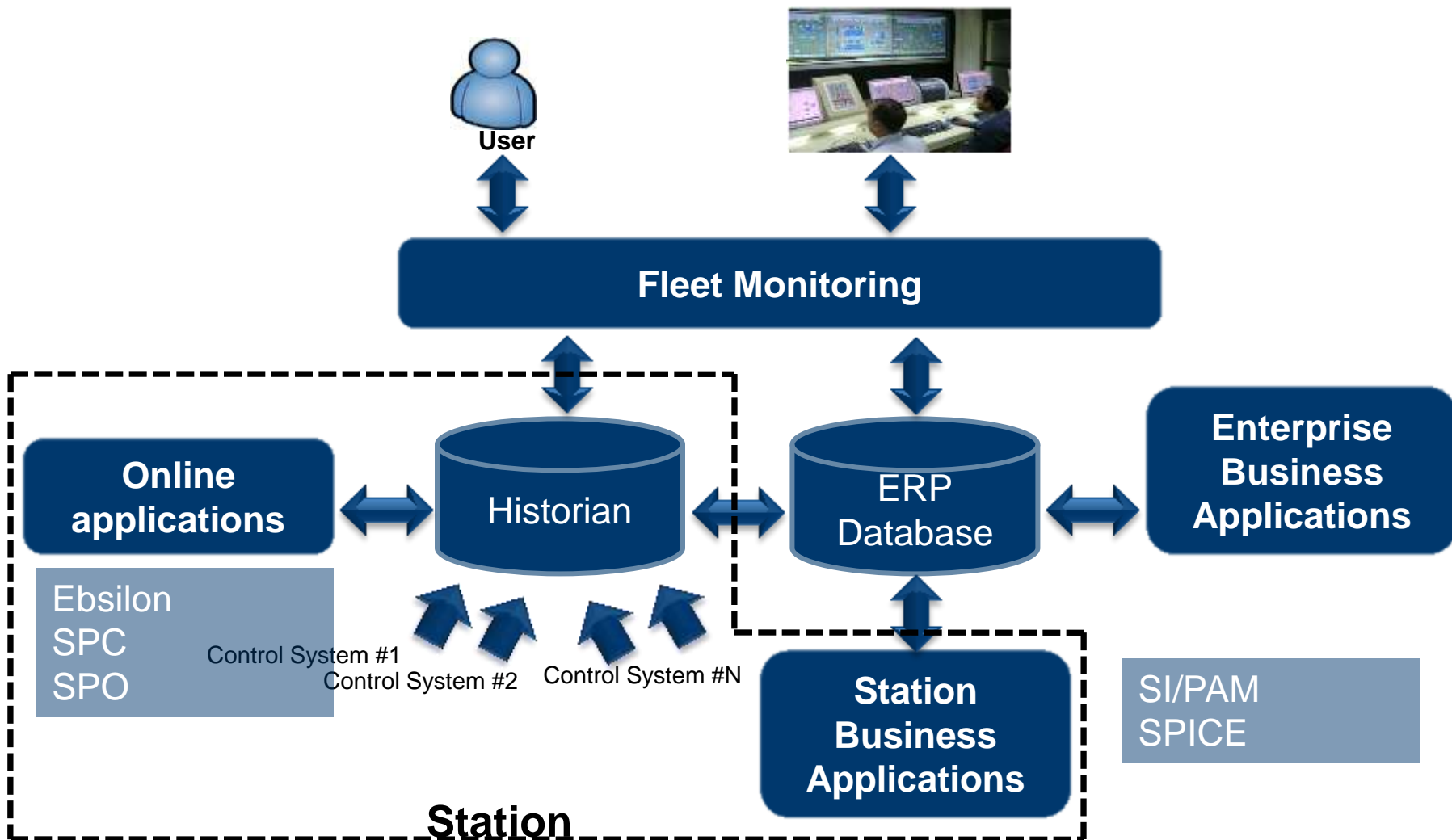
Search for information



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- **Most power generation companies are setting up fleet of power plants**
 - **Adani**
 - **Reliance**
 - **Tata**
 - **Sterlite**
 - **Essar**
- **Companies are looking for information systems which could be extended and integrated with data and information sources like DCS and PADO**

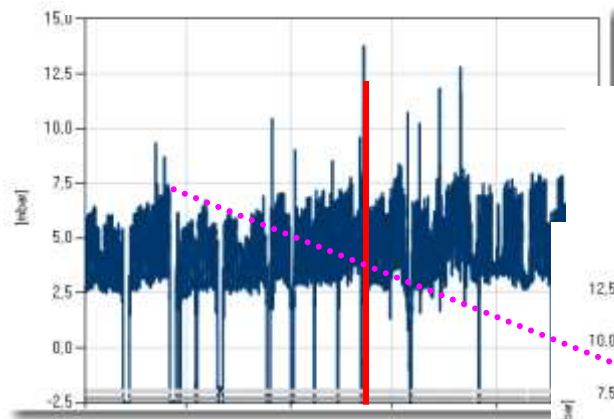
Evolving Information System Architecture



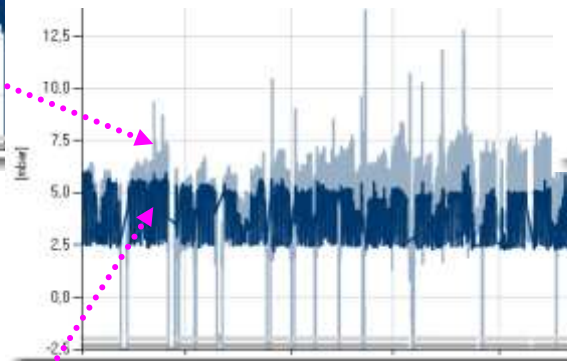
Some Technical Detail: Predictive Analytics for Equipment Health

Early warning system for detecting process changes and process trends by means of statistical analysis of available operational data

1. Actual value from DCS



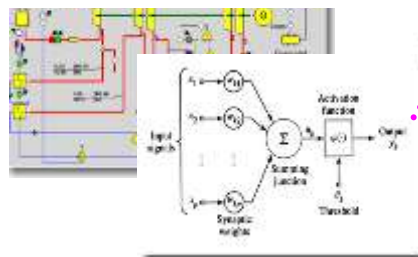
3. Expected values from Advanced Pattern Recognition



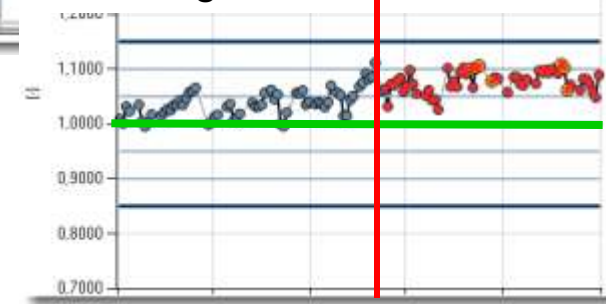
4. KPI from actual vs. expected comparison



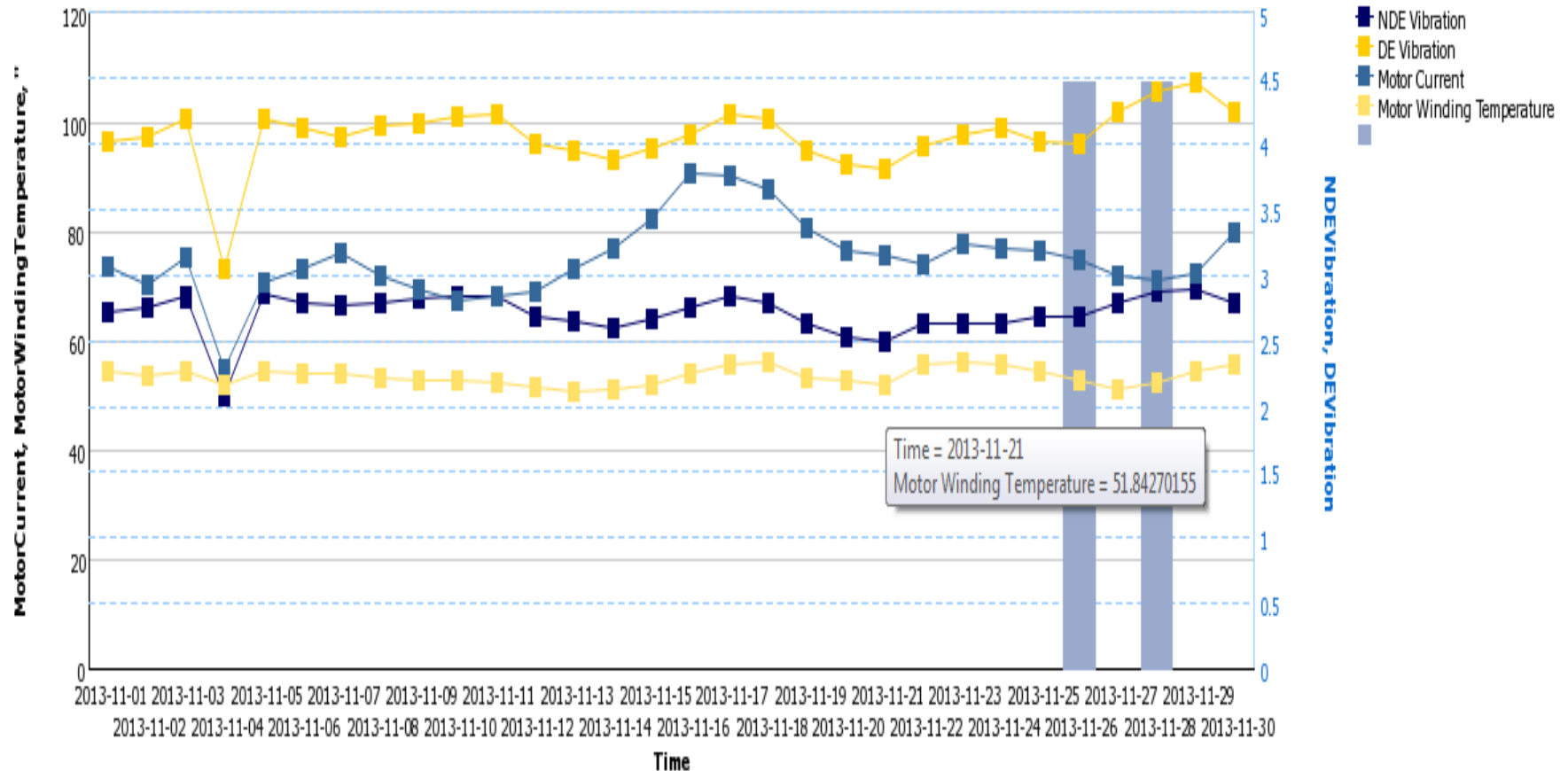
2. First principles based or data driven models



5. Statistics to detect significant faults



SPC Alarm Details of Unit 1-PA Fan A for November 2013



Equipment Health Server

Drill down: Fault Tree Report

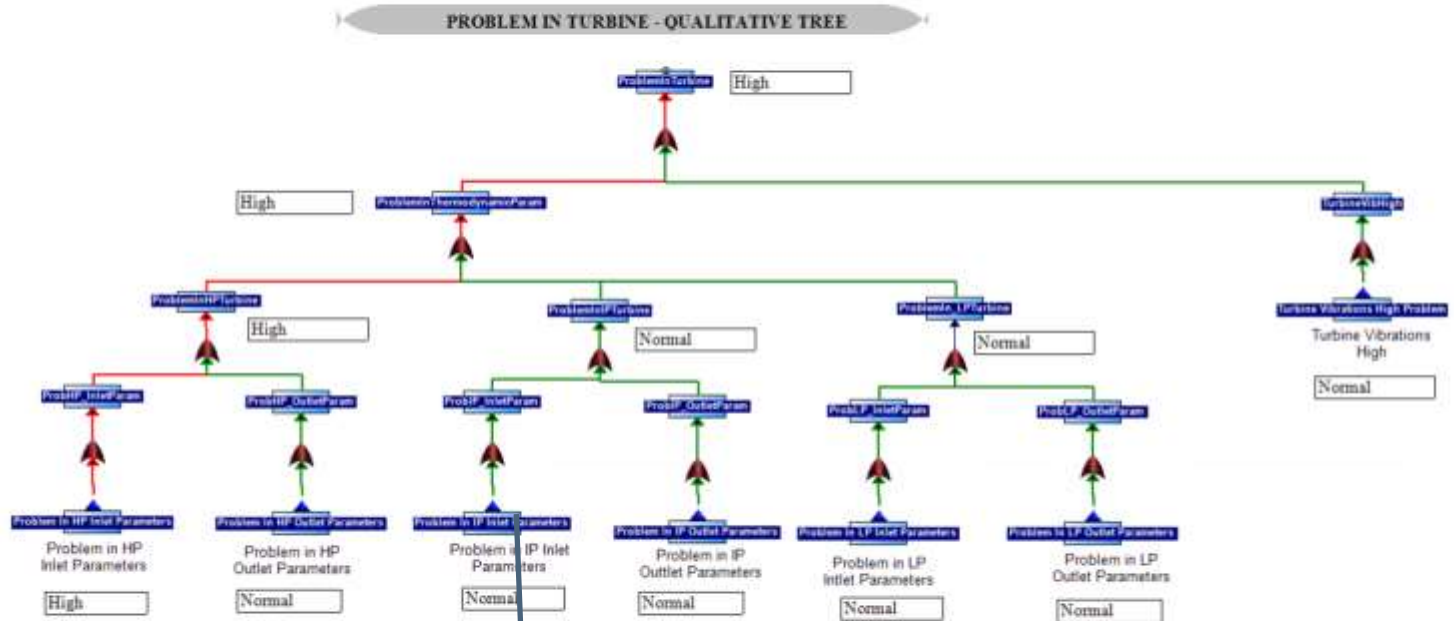
Fault Tree Report

Problem In Turbine

< 19/10/2011 17:22:00 >
Auto refresh Off >

Fault Tree

- ▶ Problem In Turbine
- ▶ Problem In HP Inlet Parameters
- ▶ Problem In HP Outlet Parameters
- ▶ Problem In IP Inlet Parameters
- ▶ Problem In IP Outlet Parameters
- ▶ Problem In LP Inlet Parameters
- ▶ Problem In LP Outlet Parameters
- ▶ Main Steam Pressure High Problem
- ▶ Main Steam Pressure Low Problem
- ▶ Main Steam Temperature High Problem
- ▶ Main Steam Temperature Low Problem
- ▶ Main Steam Flow High Problem
- ▶ Main Steam Flow Low Problem
- ▶ First Stage Pressure High Problem
- ▶ First Stage Pressure Low Problem
- ▶ HP Gland Steam Pressure High Problem
- ▶ HP Gland Steam Pressure Low Problem
- ▶ HP Gland Steam Temperature High Problem
- ▶ HP Gland Steam Temperature Low Problem
- ▶ HP2 Extraction Pressure High Problem
- ▶ HP2 Extraction Pressure Low Problem
- ▶ CRH Pressure High Problem
- ▶ CRH Pressure Low Problem
- ▶ CRH Temperature High Problem
- ▶ CRH Temperature Low Problem
- ▶ Hot Reheat Pressure High Problem
- ▶ Hot Reheat Pressure Low Problem



Fault Trees combine KPIs to identify root causes and possible actions