



Benefits of Synchrophasor Technology

➤ **Power System Restoration**

- Better picture – better confidence level – better decisions.
- More remote actions–Remote synchronization

➤ **Benchmarking and parameter validation**

➤ **Post Mortem Analysis**

Reduction in investigation time and improves quality of investigation)



Benefits of Synchrophasor Technology

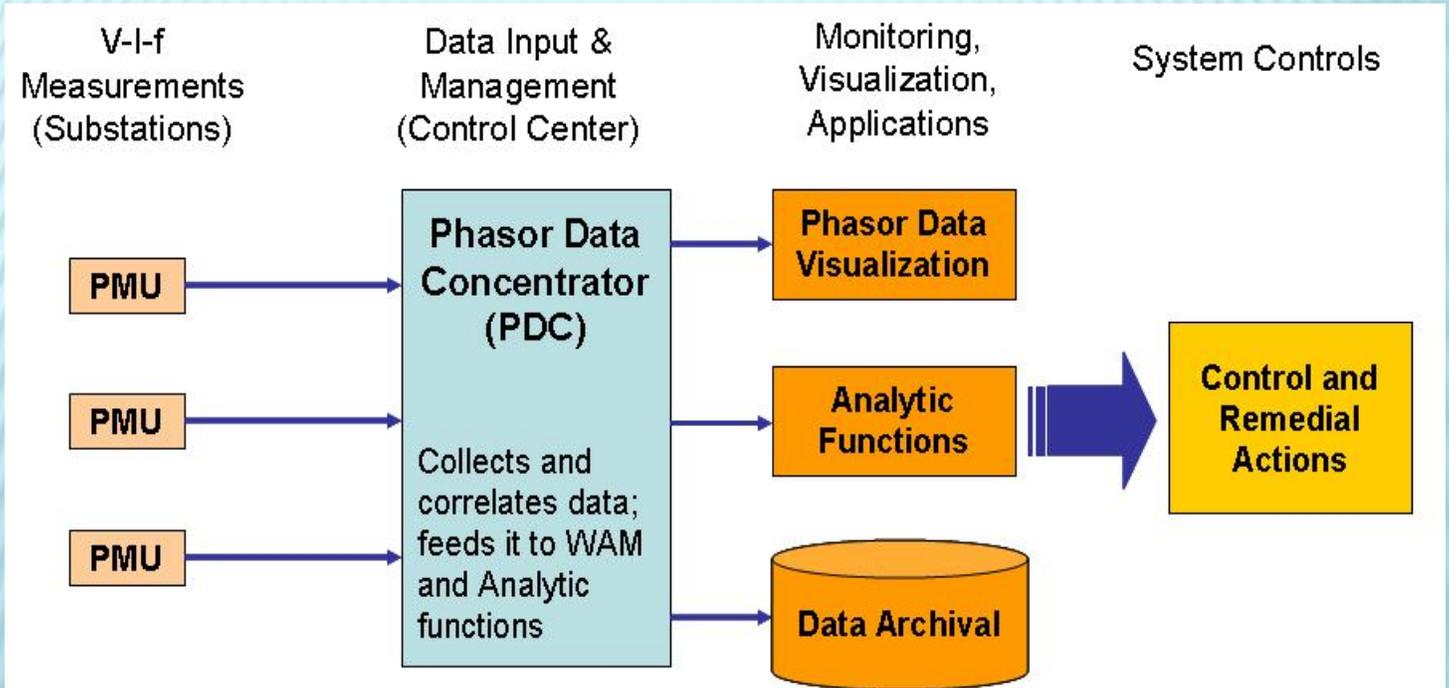
➤ **State Estimation**

- Development of Dynamic State Estimator

➤ **Protection Schemes**

- will improve Selectivity, sensitivity, dependability & security of both the apparatus and system
- To take control decision, like relay blocking, tripping or transfer tripping, the prediction about stability will have to be done fast enough i.e., before damage is manifested in the system

WAM Architecture



Benefits of WAMs

- ✘ Predicts the system.
- ✘ Provides means to monitor emerging threats to stability of system.
- ✘ The WAMS system can aid automated special protection schemes



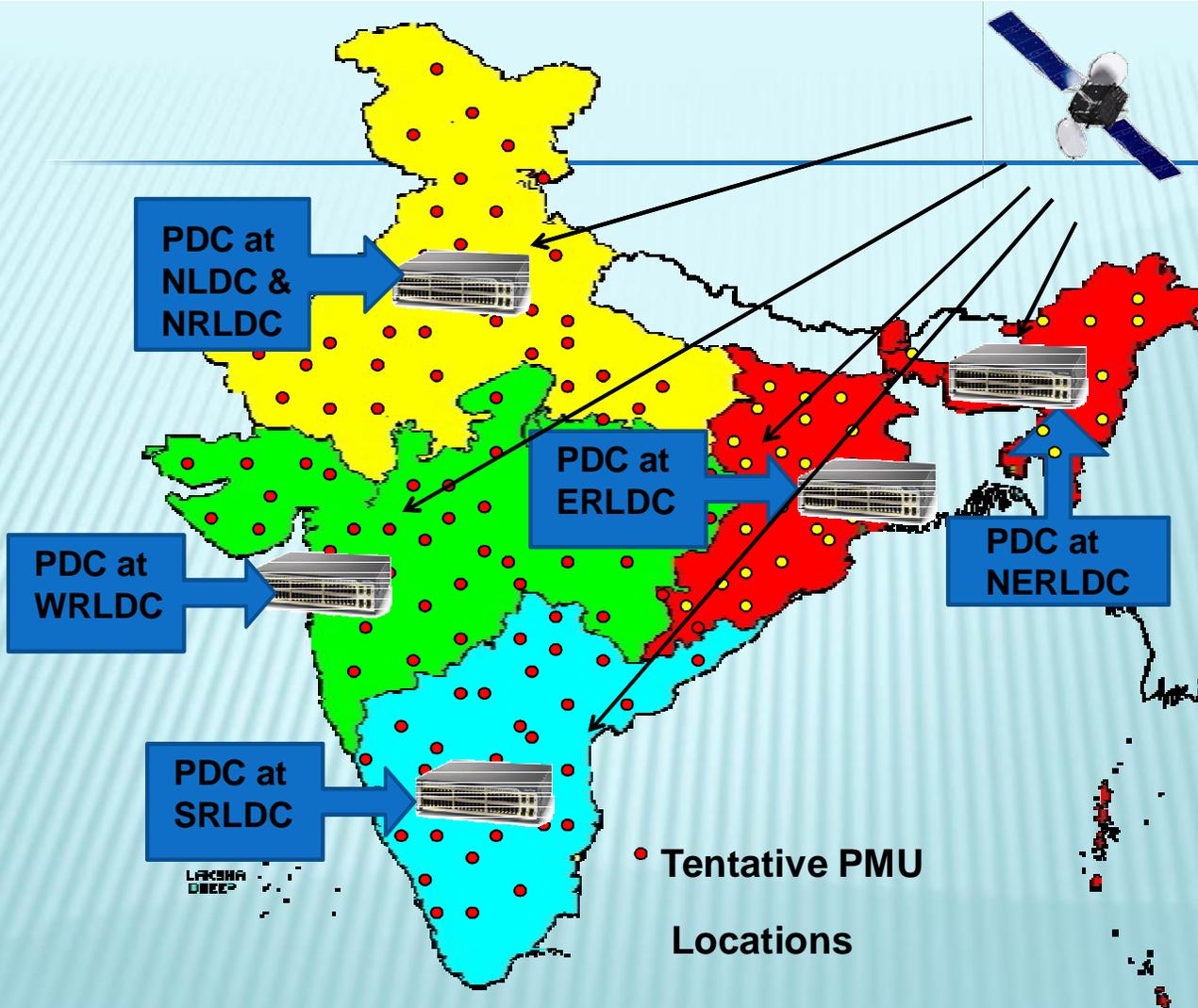
Road Map for WAMS Technology

- Awareness & learning
 - POWERGRID has conducted two Workshops during Aug'09 & Jan'10 wherein representatives from Electricity Boards, Regional Power Committees, Power Ministry, IITs and Industry have participated
 - The faculty for the workshop were Prof A.G. Phadke, Professor emeritus from Virginia Tech. USA and Mr. Ken Martin, EPG Group, USA along with Indian Experts



Road Map for WAMS Technology

- **Implementation of WAMS technology in all over India (about 750 nos)**
 - Estimate of 'CAPEX' Required:250 cr
- **Project for installing PMUs & PDCs to cover entire Power System**
- **Train manpower across Indian Power Sector to build capabilities**





Pilot Projects on PMUs & WAMS Applications



Northern Region Pilot Project

- **PMU (Phasor Measurement Units) at four Locations with GPS Facility**
- **PDC at NRLDC**
 - **Visualization application software for situational awareness.**
 - **Data archiving for post mortem analysis**
- **Already implemented : April '2010**



Western Region WAMS Project

Project Details:

- Installation of PMUs at around 25 Locations in Western Region Grid with data acquisition at Western Regional Load Dispatch Center (WRLDC)
- Development of software for Optimal placement of PMUs
- Dynamic State estimator/Monitor
- Emergency control schemes for mitigating system instabilities

Learning from Past & Things to do....

- ✘ To establish an automation, the primary building blocks (signals, communication, controls) need to exist and talk to each other rather than to modify existing systems to provide electronic sensing and control interface.
- ✘ Modifying process equipments does not facilitates large scale automation and hinders fast roll out of automation projects.
- ✘ POWERGRID has taken initiative for regulatory requirement establishment for all the Grid Stations to be electronically visible to remote control centre. Automation community can take it to next higher level by creating awareness for all manufacturers to deliver equipments with sensors and interoperable electronic visibility.



In Built Automation - Need of the Hour

- × In built Automation is needed at Product Level and not as an afterthought.
- × Automation of process regularly runs into equipments adaptability issues.
- × Electronic visibility of the products are few and are non interoperable hence creating control and application systems for a process takes more time, and effort becomes costlier
- × In ICT time, Instrumentation is not only local display, it means Electronic remote sensing and control.

Standards Identified for maintaining interoperability



- × IEEE C37.118 - for synchrophasor
- × IEC 61850- for substation automation
- × IEC 61970- For common information modeling (CIM)



THANK YOU



Network Topology – Challenges faced

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