Smart Grid Initiatives @ JMI

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Jamia Millia Islamia (JMI)

- One of the Central Government Universities in India
- 9 Faculties and 21 centers of learning
- Education, Languages, Law, Social sciences, Natural sciences, Engineering, Dentistry, Fine arts etc.
- 210 courses,19,000+ students, 900 faculty members
- 220 acres of lush green campus in the heart of Delhi.

http://jmi.ac.in/

Smart Grid Stakeholders

- **Policy Makers**
- **Industry Standard Developers**
- **Utilities**
- **Equipment Manufacturers and Vendors**
- **Technology Companies**
- **Researchers and Research Labs**

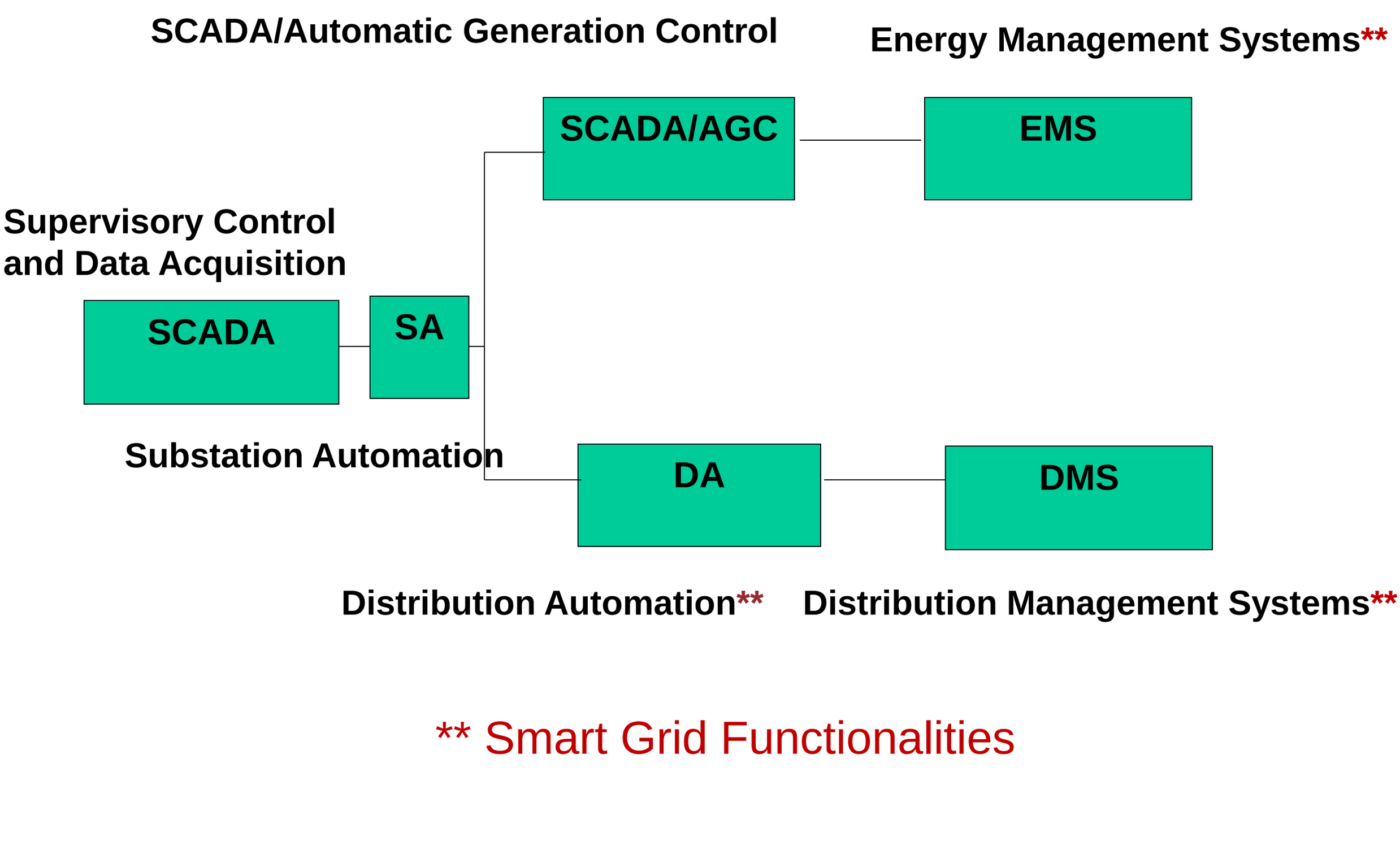
Smart Distribution

- **Demand Side Management & Demand Response**
- **Distributed Energy Resources and Energy Storage**
- **Advanced Metering Infrastructure**
- **Smart Homes and Home energy Management Systems**
- **Plugged Hybrid Electric Vehicles**
- **Microgrids**

Significance of SCADA Systems

- The Smart Grid Functionalities are application functions added to the Basic SCADA functions of
- Data Acquisition
- Remote control
- Report generation etc

Use of SCADA Systems



** Smart Grid Functionalities

SCADA LABS @ JMI

1. SCADA/ EMS Lab
2. SUBSTATION AUTOMATION Lab

Publications describing the labs

1. **IEEE Transaction on Power Systems, Vol 19, August 2004**
2. **IEEE P& E Magazine, July/August 2010**
3. **IEEE Transaction on Education, Vol 54, May 2011**

1. SCADA LAB

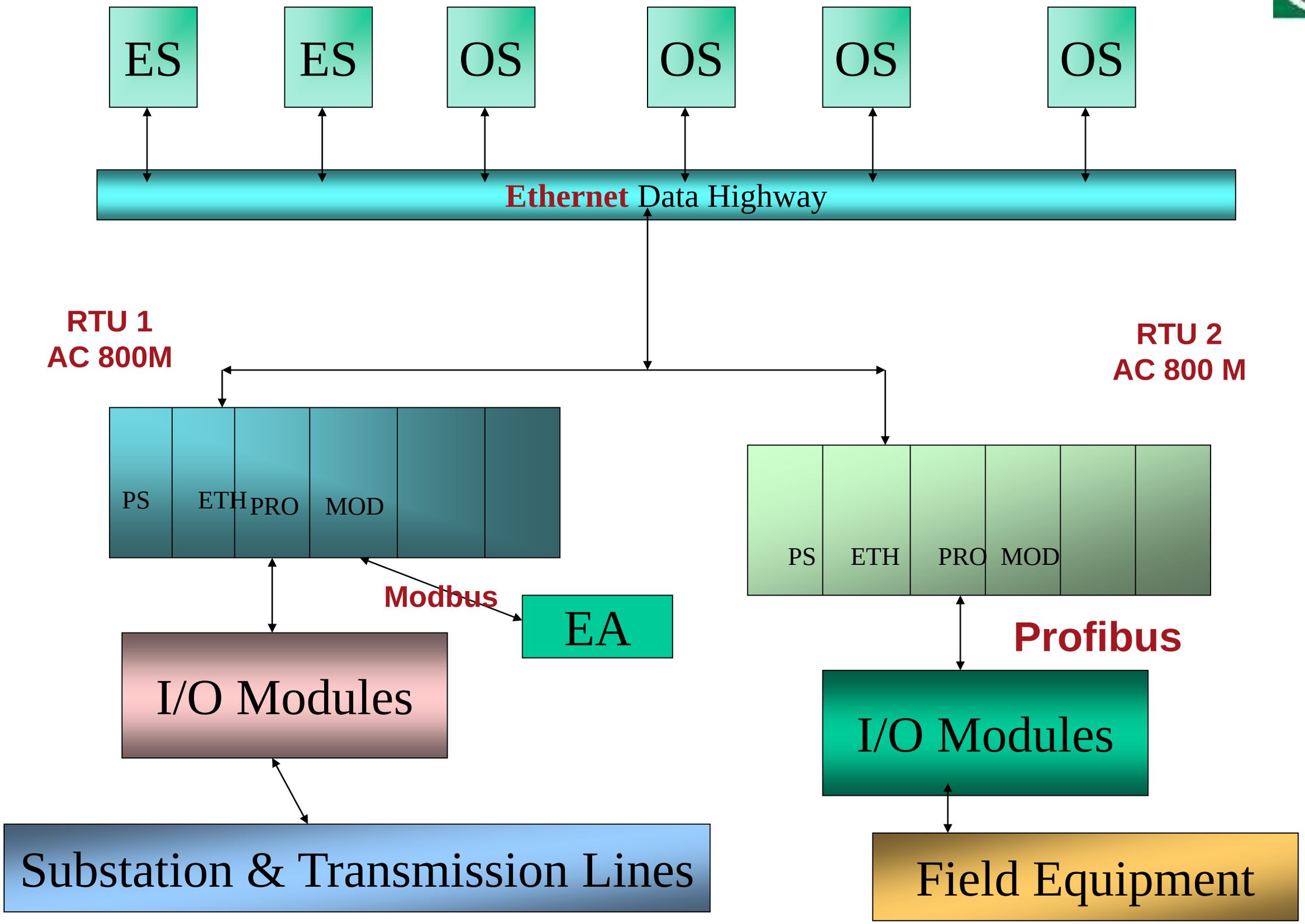
Lab for GENERAL Automation Components

DCS Processors used for Power Automation

- A Substation & Transmission system is created in the lab, monitored & controlled
- Hands-on-training of how analog and digital signals from the field reaches the control center HMI and the commands from the control center gets implemented in the field

SCADA Lab Overview

SCADA Labs

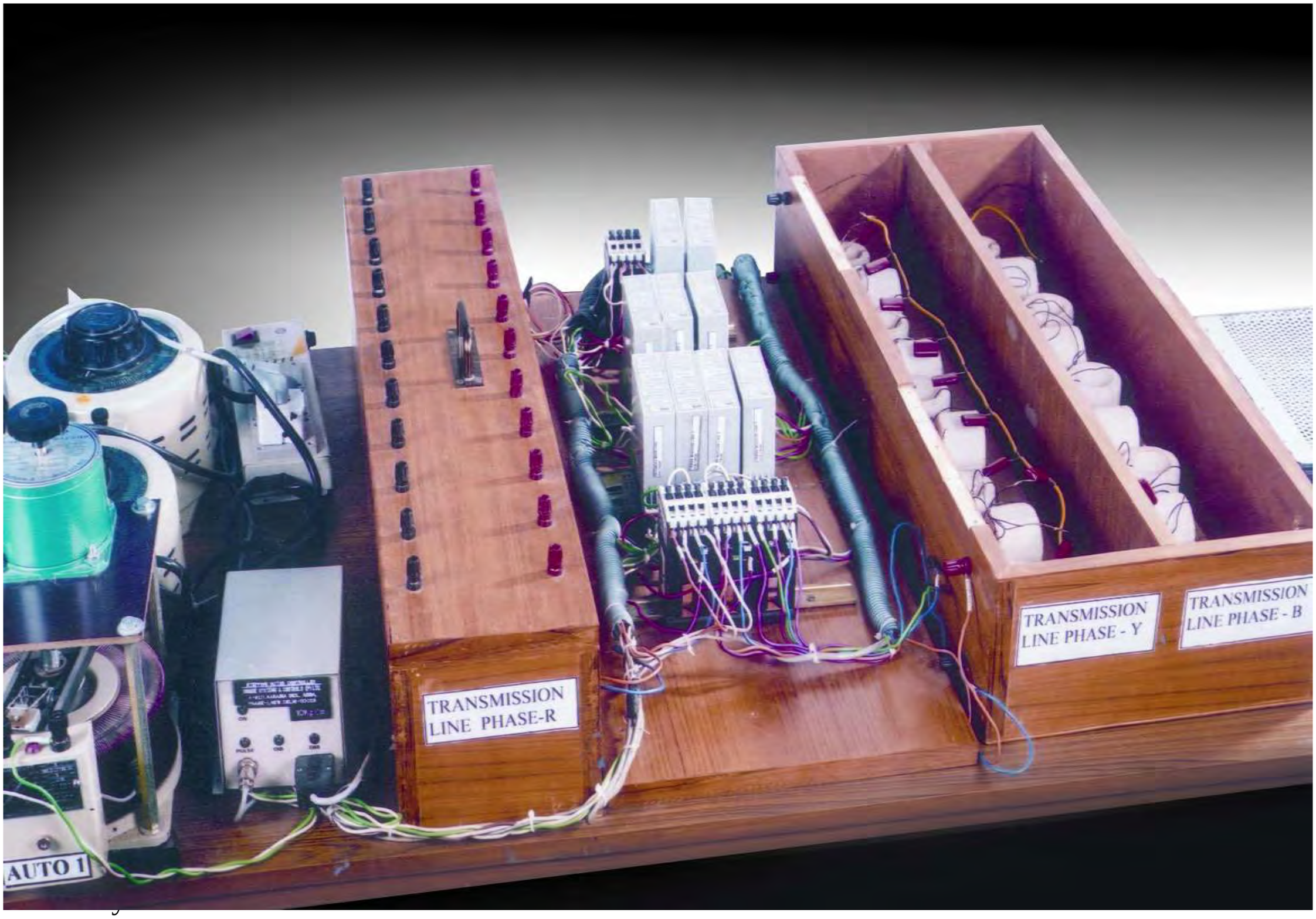


SCADA Lab

THE RTUs

The DCS Processor

Substation & Transmission line model

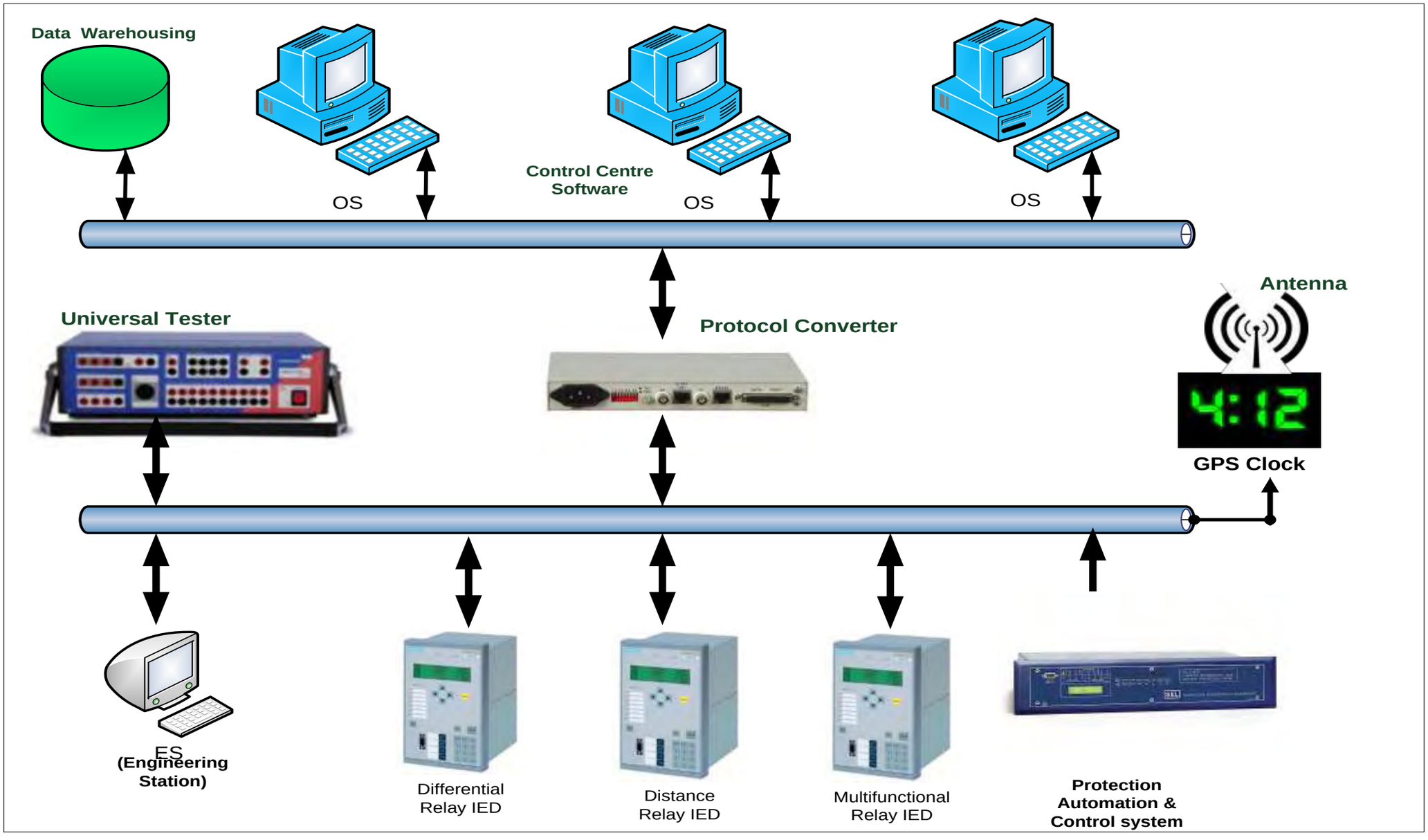


2. Substation Automation Lab

Main Features

- Relay IEDs with IEC 61850, UCA communication protocols
- Universal Secondary Test kit
- GPS clock
- Protocol Gateway
- Variety of PS Software
- Source code libraries
- BPL

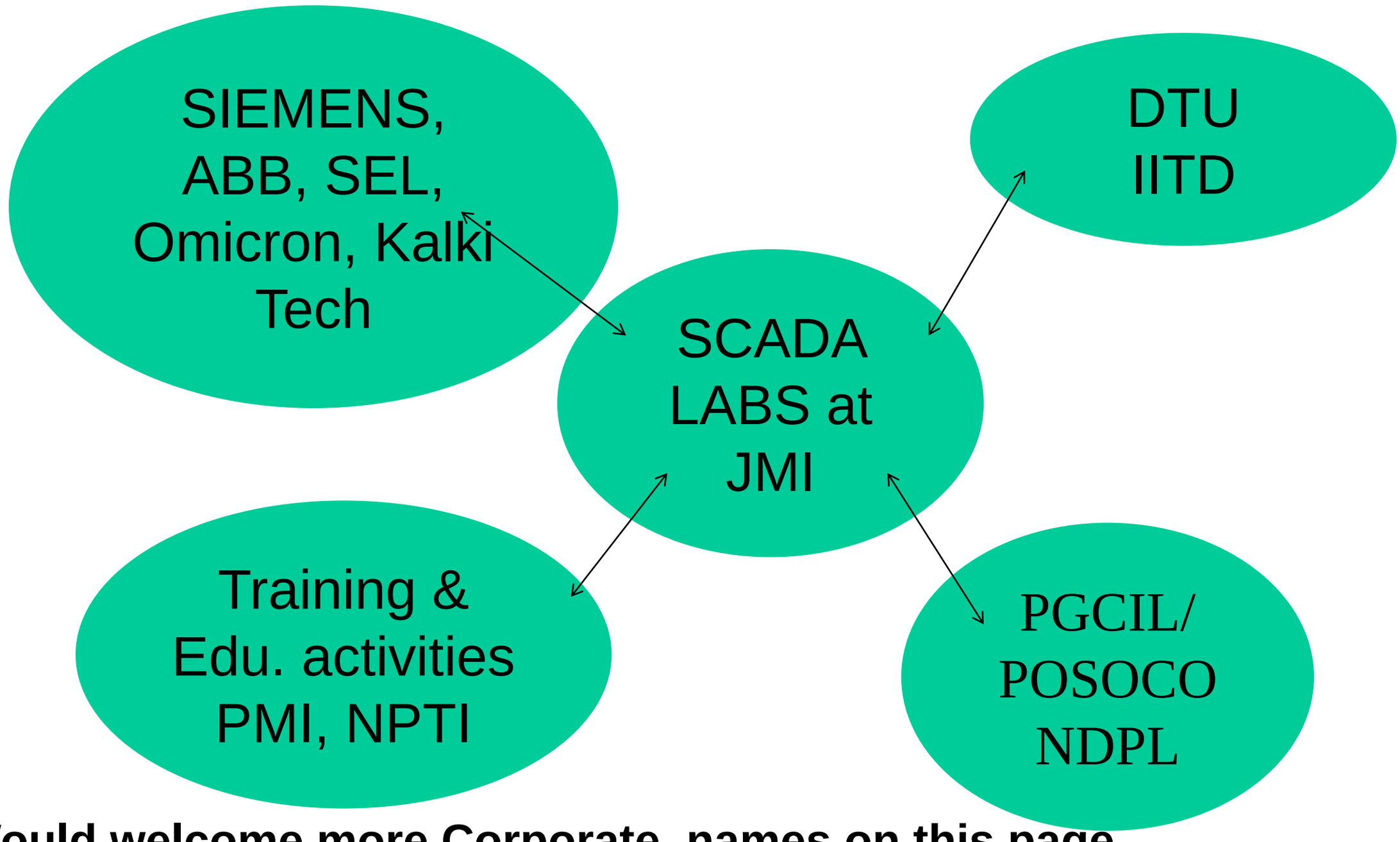
SYSTEM ARCHITECTURE



Substation Automation Lab set up

SCADA Lab @ Jamia

Industry Institute Interaction



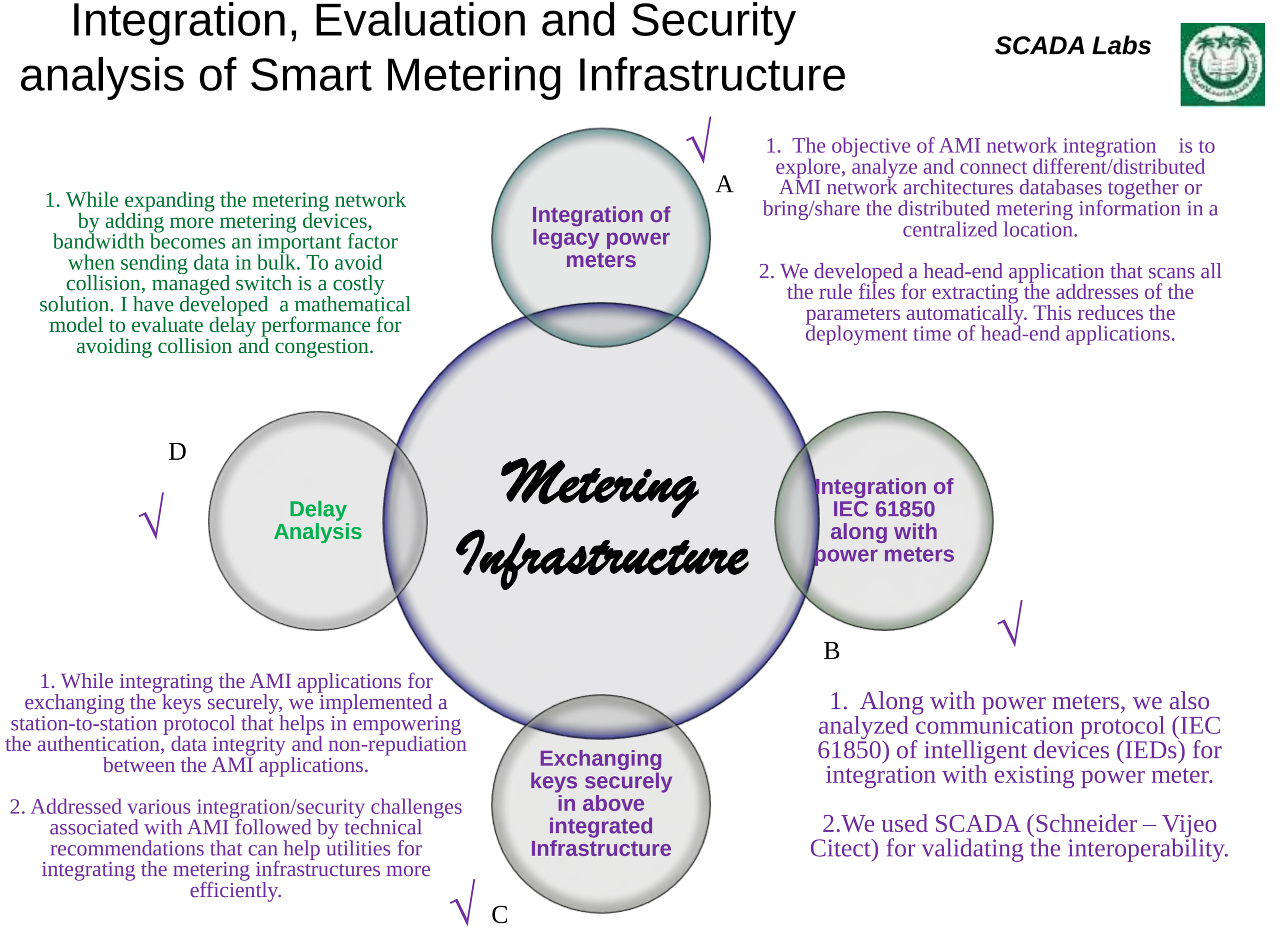
Would welcome more Corporate names on this page

Recent Research work in the Labs

Sl No	Name of PhD Scholar	Title of PhD Thesis (Smart Distribution)
1	Nitin Gupta	Integration, Evaluation and Security analysis of Smart Metering Infrastructure
2	Amira Nisar	Design and Implementation of a Self Reliant Intelligent Distribution System
3	Seema Arora	Simulation of Multi-structured Broadband over Power-line system
4	Pawan Kumar	Optimal Operation of Automated Radial and Meshed Distribution System
5	Praveen P Terang	Distribution Generation Interface in a Smart Grid

Integration, Evaluation and Security analysis of Smart Metering Infrastructure

SCADA Labs



1. While expanding the metering network by adding more metering devices, bandwidth becomes an important factor when sending data in bulk. To avoid collision, managed switch is a costly solution. I have developed a mathematical model to evaluate delay performance for avoiding collision and congestion.

1. The objective of AMI network integration is to explore, analyze and connect different/distributed AMI network architectures databases together or bring/share the distributed metering information in a centralized location.

2. We developed a head-end application that scans all the rule files for extracting the addresses of the parameters automatically. This reduces the deployment time of head-end applications.

1. While integrating the AMI applications for exchanging the keys securely, we implemented a station-to-station protocol that helps in empowering the authentication, data integrity and non-repudiation between the AMI applications.

2. Addressed various integration/security challenges associated with AMI followed by technical recommendations that can help utilities for integrating the metering infrastructures more efficiently.

1. Along with power meters, we also analyzed communication protocol (IEC 61850) of intelligent devices (IEDs) for integration with existing power meter.

2.We used SCADA (Schneider – Vijeo Citect) for validating the interoperability.

Design and Implementation of a Self Reliant Intelligent Distribution System

Objectives

- Design & Simulate a Microgrid network operating under islanded mode and non-islanded mode
- Operate the MG with Demand response mechanism with comprehensive Control strategies with PHEV
- Demand response of a domestic customer household with different load models
- Control strategies for customer demand response for optimum operation

Recent Research work in the Labs

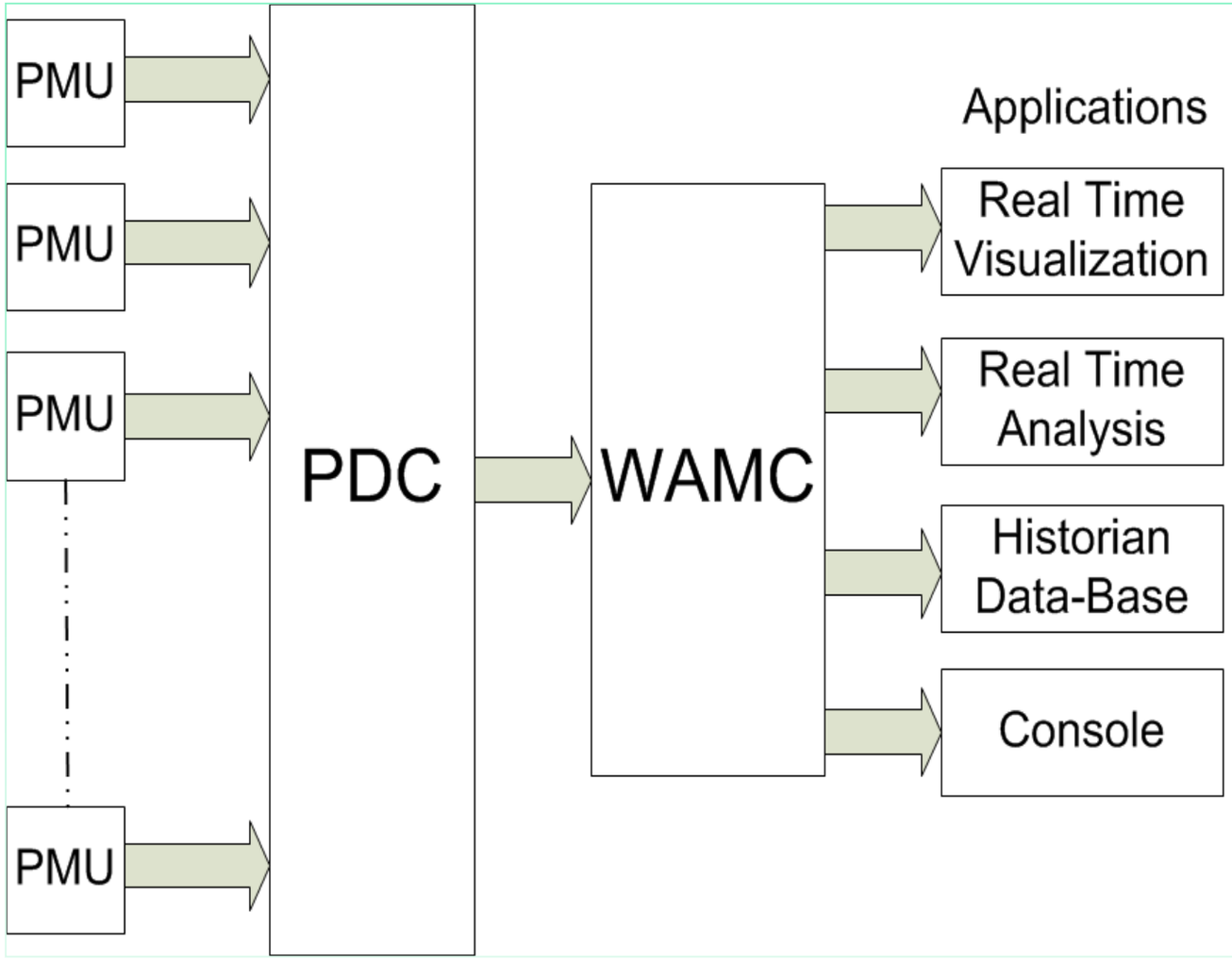
Sl No	Name of PhD Scholar	Title of PhD Thesis (Smart Transmission)
1	Ankur Rana	Performance Analysis of Wide Area Measurement and Control Systems
2	Saeed Roostaee	Reliability and availability assessment of transmission line protection functions based on IEC 61850 standards.
3	Afroz Ali	Designing of Wide Area Protection Scheme For Smart Grid
4	Sunil Gupta	Impact of IEC 61850 Protocol on Substation Performance

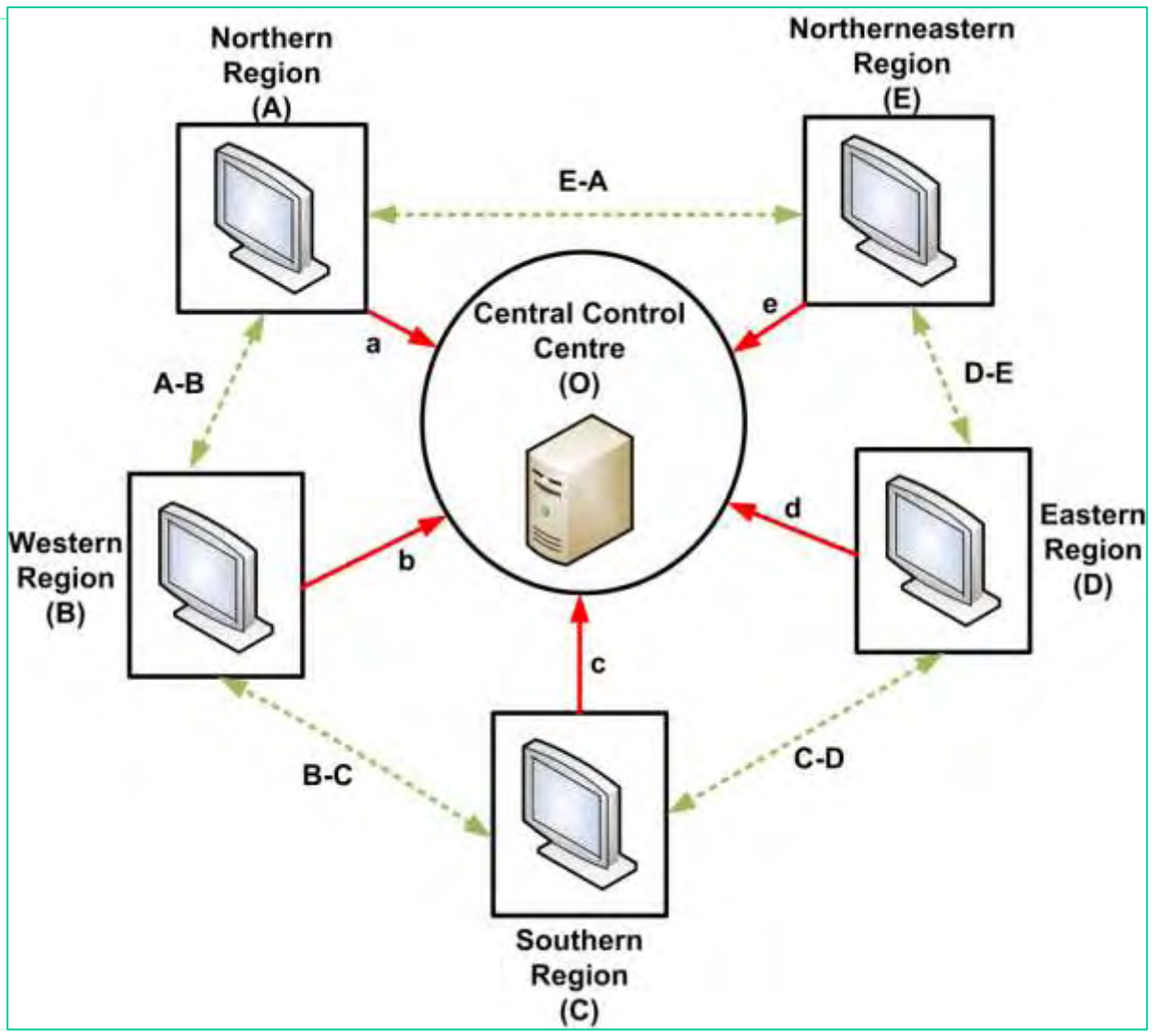
Performance Analysis of Wide Area Measurement and Control Systems

OBJECTIVES:

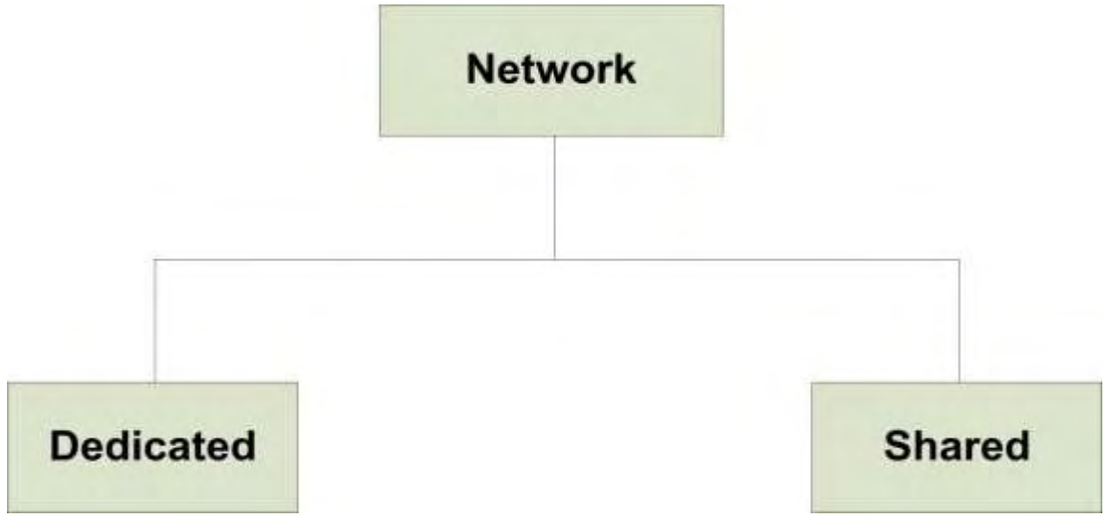
- Latency in WAMS Network
  - ✓Investigate the communication delays in WAMC systems due to the core components in the communication system.
  - ✓Identify the impact of the communication architecture on data quality specifically, the currency and completeness of the data for system configurations.
- Reliability Evaluation in WAMS

WAMS Architecture

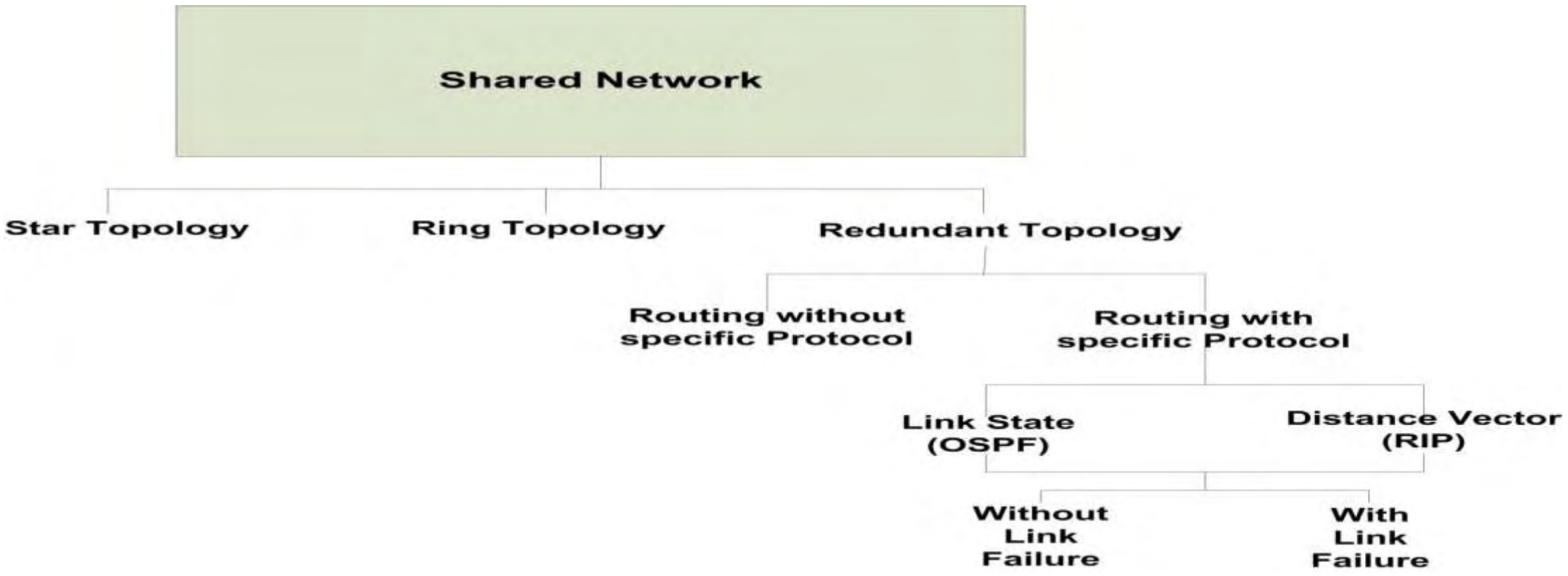




Network Configuration



Fiber optic is used as Communication medium



Latency Comparison among Topologies

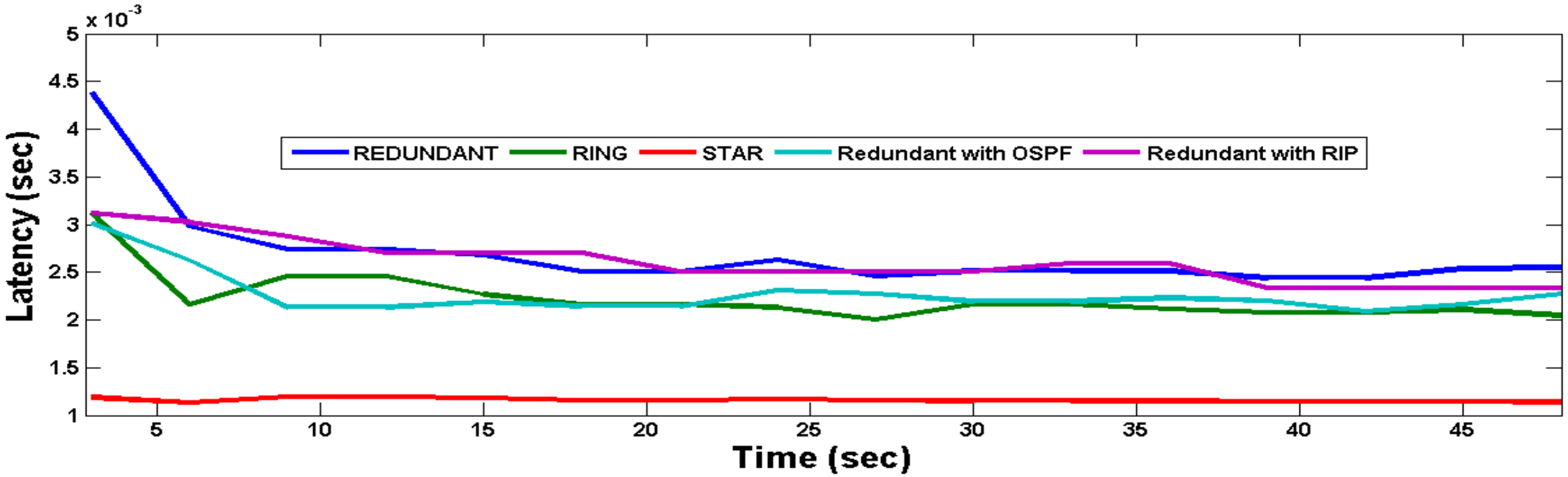
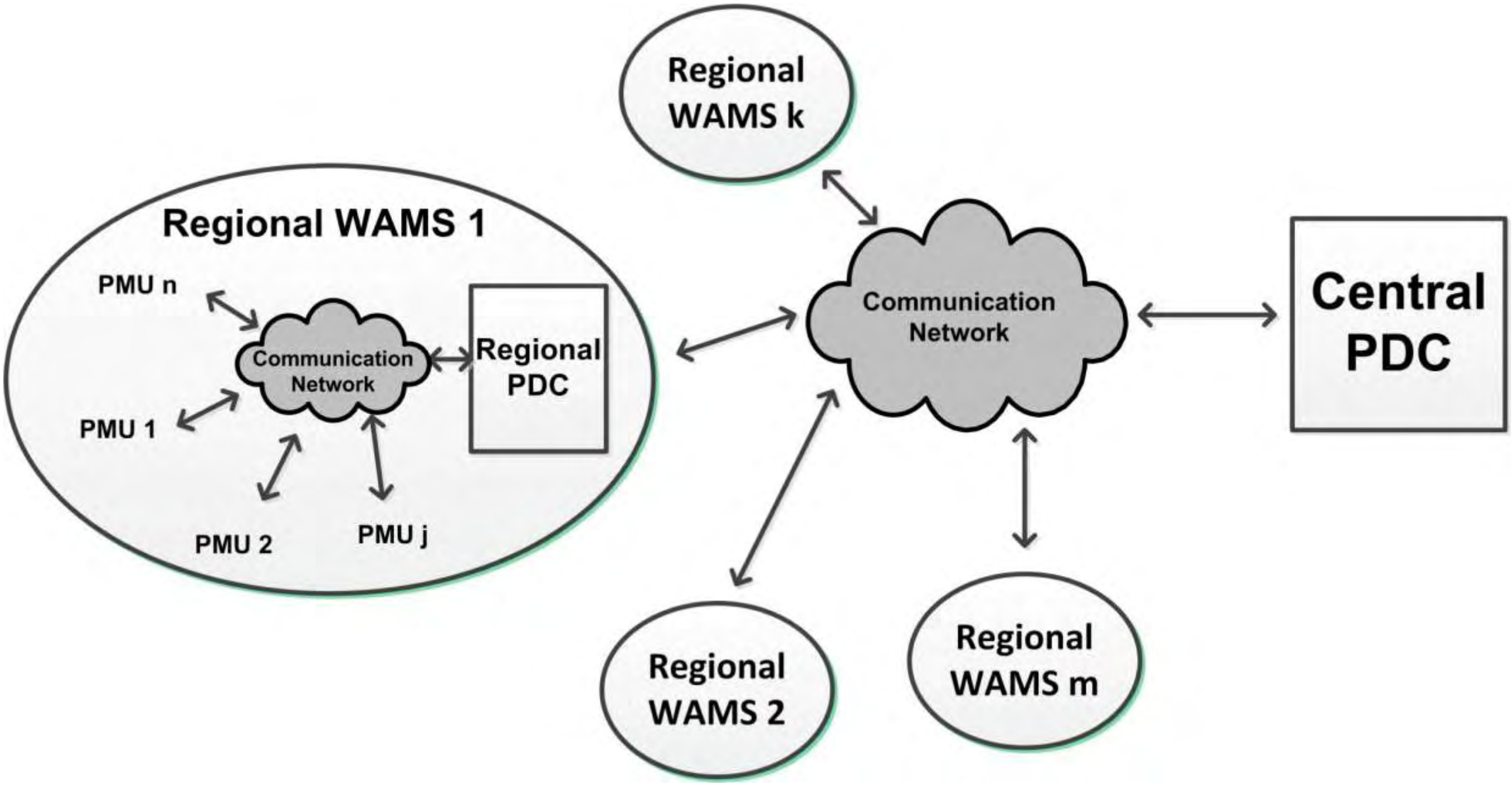
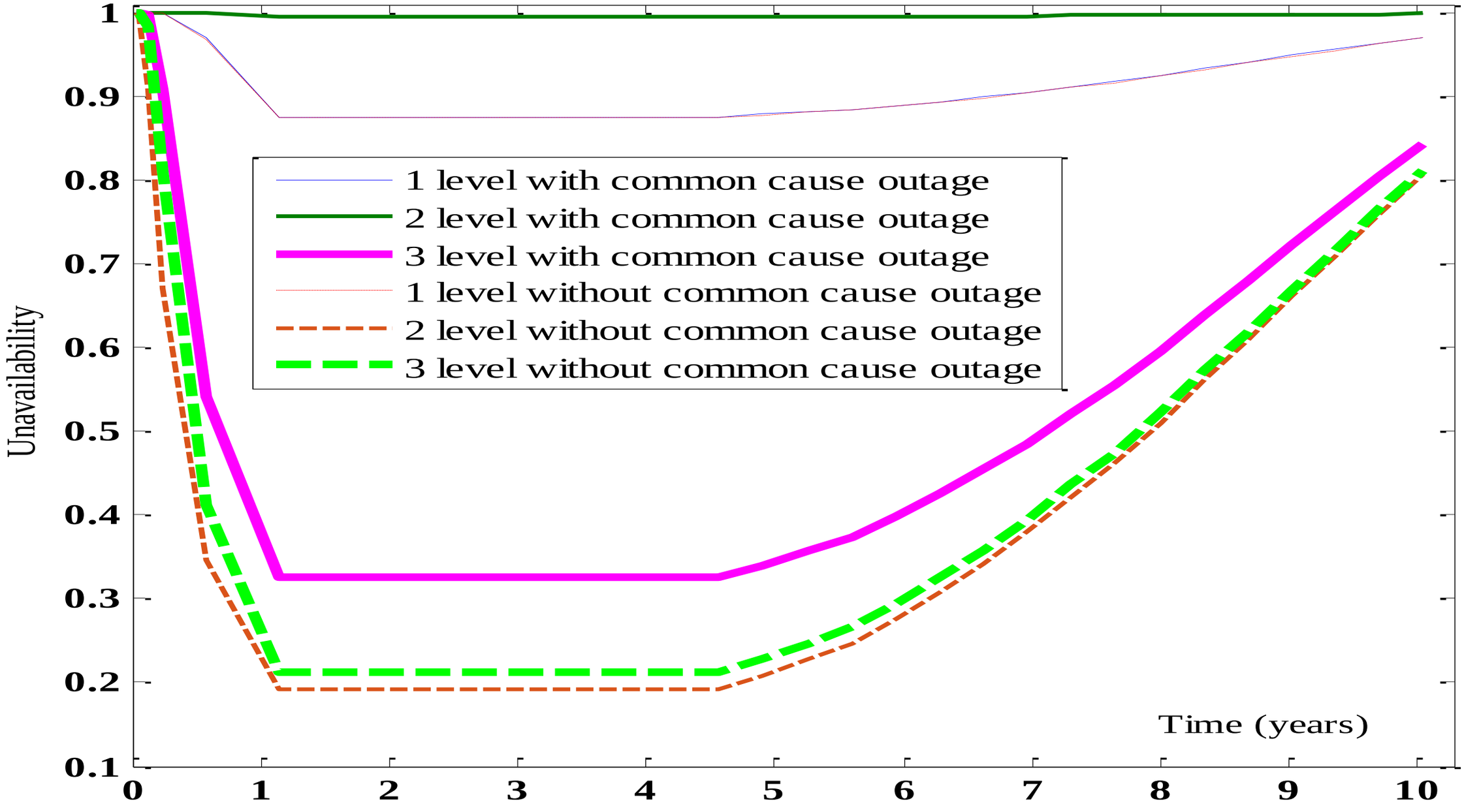


Table 1	
Scenarios	**Max. Latency (msec)**
Star	1.189509
Ring	3.117714
Redundant Network without Protocol	4.383211
Redundant Network with OSPF	3.010169
Redundant Network with RIP	3.121255
PDC timeout value used in INDIA is around 20-32 sec for PDCs (waiting time)	

Reliability Evaluation in WAMS



Reliability Assessment of WAMS



Request to NSGM

- Create an incubation Centre for Smart Grid related innovations
- Institute Scholarships for Smart Grid Research (eg. Visweshwaraya Scheme, DeitY)
- Coordinate Industry-Academia interaction for research collaboration
- Repository of problems faced by the industry & Repository of Professors with specialities and research facilities available, Handshaking will benefit both parties

NOVEL INITIATIVE:

❖MOU with PGCIL/POSOCO

❖ First Initiative, to train & certify the POSOCO system operators in the SCADA Lab

❖ First program conducted from Aug 2010, then 8 more one week programs

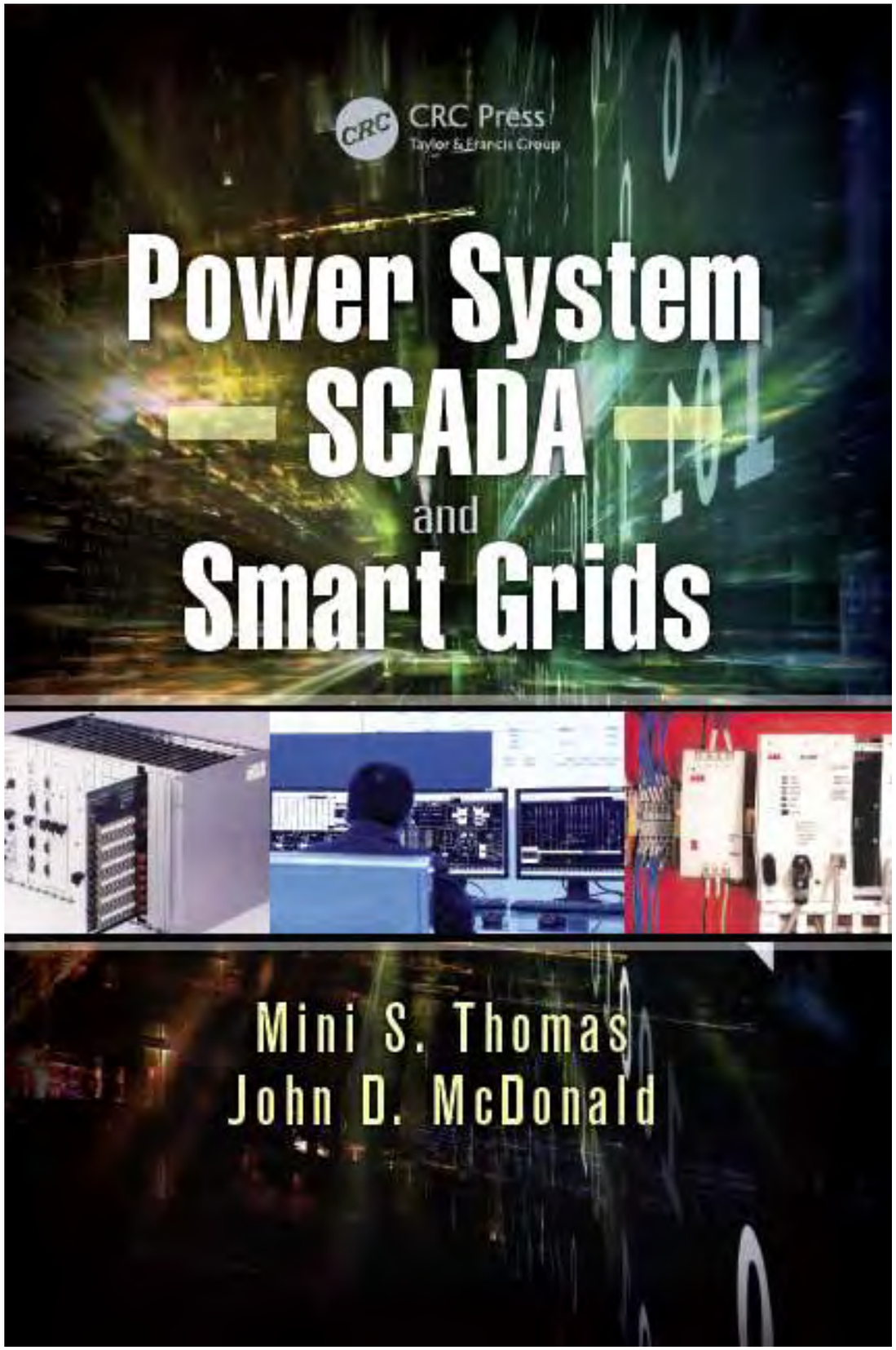
❖ Certified 157 System operators on ‘SCADA Basics’ & 15 on ‘Advanced SCADA/EMS’

❖ Applying for accreditation by CEA

M. Tech In
Electrical Power System Management

- Curriculum includes SCADA, Substation Automation, Distribution Automation, Data communication, restructuring, deregulation, etc in addition to basic PS courses
- Hands on training in the SCADA & SA Labs
- Sponsored candidates admitted

The New Text Book: April 2015 release



Power System
SCADA
and
Smart Grids

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SCADA Labs

Power System SCADA and Smart Grids

Mini S Thomas & John D McDonald

CRC Press (Taylor & Francis) USA

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You are most welcome to visit the Labs at the beautiful Jamia campus

THANK YOU!

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