



Engineering | Projects | Manufacturing | Technology



Automation of Eastern Region Load Dispatch Management



24th May 2017
K.Nandakumar
Chairman & MD,
Chemtrols Industries Pvt. Ltd.

40 impeccable years of serving the Indian Industry

Segments of Operation

Instrumentation

- Chemtrols undertakes Instrumentation activities through its Analytics, Metering & Measurement, Steam Engineering Business Units ("BUs") housed under "Chemtrols Industries Limited" & "Chemtrols Samil (India) Private Limited" which is a JV with Samil Industries, Korea
- Chemtrols undertakes Engineering, Manufacturing, System integration and Service activities under this vertical
- This vertical caters to a number of industries, including Power, Cement, Chemicals & Petrochemicals, Steel, etc. with Oil & Gas being the biggest sector

Automation

- Chemtrols undertakes its Automation business for Crude Products & Power through its Terminal Automation and Utility Management System Business Units ("BUs") respectively, both housed under "Chemtrols Industries Ltd."
- Chemtrols undertakes Projects, Engineering, Manufacturing, Software, & Service under this vertical

Solar

- Chemtrols carries out its Solar Photovoltaic Business under "Chemtrols Solar Private Limited"
- Chemtrols undertakes Projects, Engineering & Service under this vertical & provides solutions for MW Scale Power Plants, Off-Grid installations & has a portfolio of retail products

International Certifications & Accreditations for Global Needs



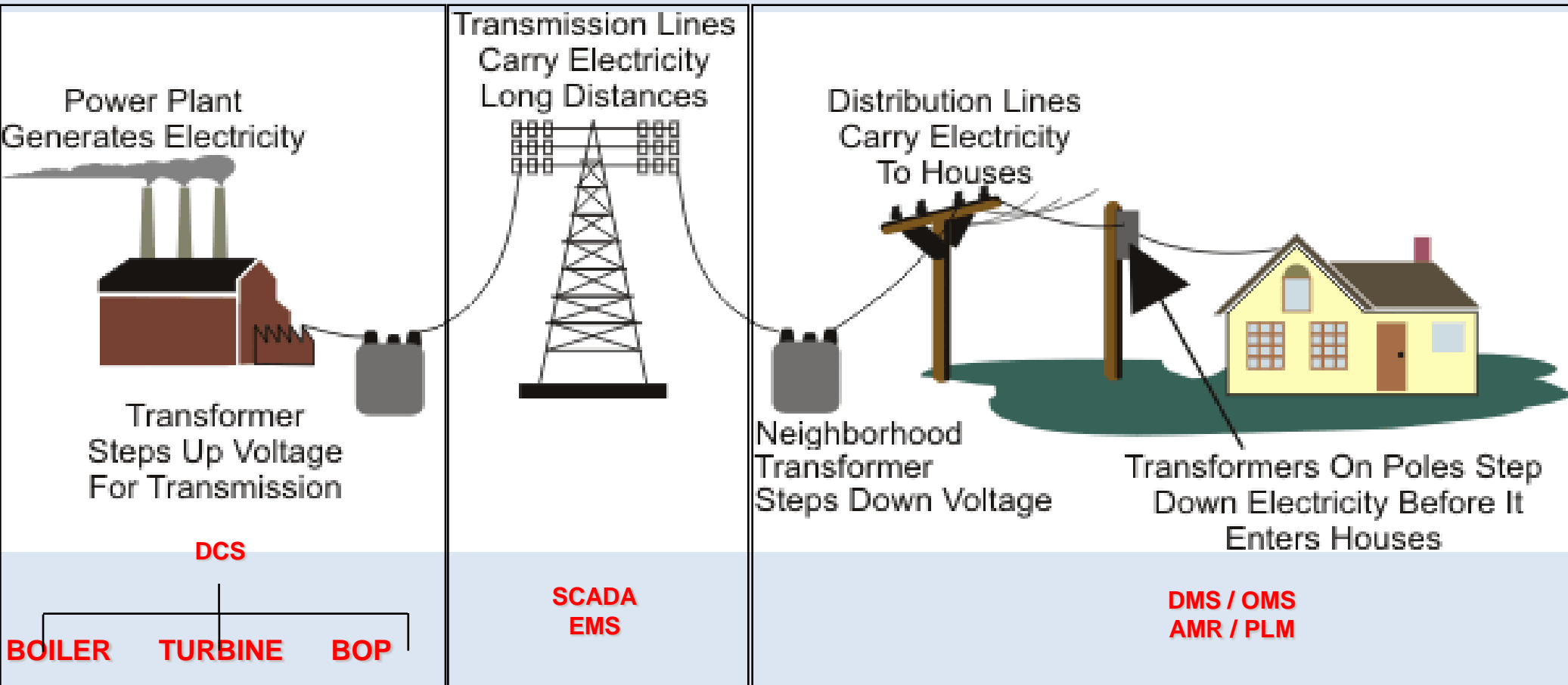
Manufacturing Facilities



Chemtrols – Segments of Operation

Instrumentation				Automation		Solar
Chemtrol Industries		Chemtrols Samil		Chemtrol Industries		Chemtrols Solar
Analytics (BU1)*	Measurement & Metering (BU3)*	Steam Engineering (BU4)*	Chemtrols Samil	Terminal Automation (BU2)*	Utility Management Systems (BU5)*	Chemtrols Solar
Process Analytics	Level Measurement	PRDS	Level Instruments	Terminal Automation	Transmission Automation	MW Scale EPC
	Flow Measurement					
Ambient Air Quality Monitoring	Temperature Measurement	Dump PRDS	Plug Valves	Truck & Wagon Loading	Distribution Automation	Off- Grid Systems
	Interface Devices	Control Valves	Nozzles			
Continuous Emission Monitoring	Mechanical Products	Turbine Bypass Valves	Gas Conditioning Systems	Tank Farm Management	Smart Grid	Solar Retail Products
Gas Detection Systems	Metering Skids Custody Transfer	De-Super heaters	Dust Suppression Systems	Blending & Dosing Systems	RTU/ FRTU	

Automation for Electric Utilities



Power-system automation is composed of several tasks.

Data acquisition

Data acquisition refers to acquiring, or collecting, data. This data is collected in the form of measured analog current or voltage values or the open or closed status of contact points. Acquired data can be used locally within the device collecting it, sent to another device in a substation, or sent from the substation to one or several control centres for use by operators, engineers, planners, and administration.

Supervision

Computer processes and personnel supervise, or monitor, the conditions and status of the power system using this acquired data. Operators and engineers monitor the information remotely on computer displays and graphical wall displays or locally, at the device, on front-panel displays and laptop computers.

Control

Control refers to sending command messages to a device to operate the I&C and power-system devices. Traditional supervisory control and data acquisition (SCADA) systems rely on operators to supervise the system and initiate commands from an operator console on the master computer. Field personnel can also control devices using front-panel push buttons or a laptop computer.

In addition, another task is power-system integration, which is the act of communicating data to, from, or among IEDs in the I&C system and remote users. Substation integration refers to combining data from the IED's local to a substation so that there is a single point of contact in the substation for all of the I&C data.

Power-system automation processes rely on data acquisition; power-system supervision and power-system control all working together in a coordinated automatic fashion.

Data acquisition

The instrument transformers with protective relays are used to sense the power-system voltage and current. They are physically connected to power-system apparatus and convert the actual power-system signals. The transducers convert the analog output of an instrument transformer from one magnitude to another or from one value type to another, such as from an ac current to dc voltage. Also the input data is taken from the auxiliary contacts of switch gears and power-system control equipment.

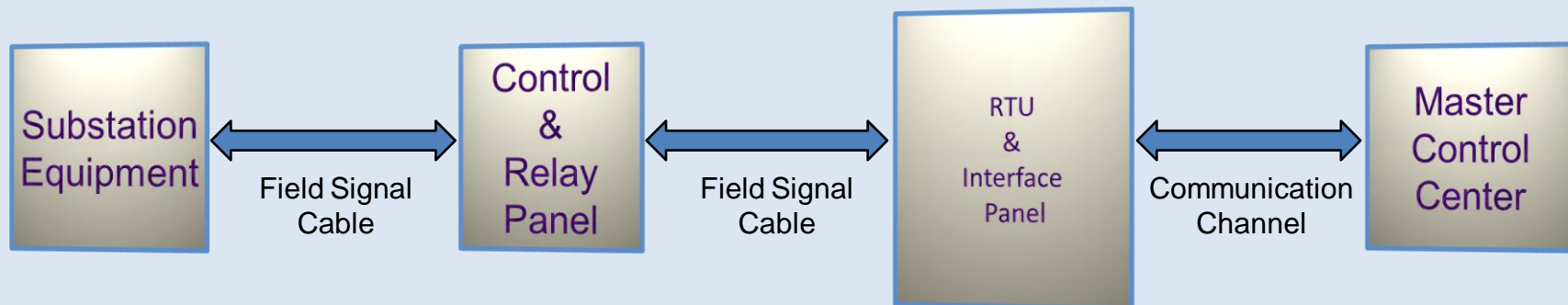
Main processing instrumentation and control (I&C) device

The I&C devices built using microprocessors are commonly referred to as intelligent electronic devices (IEDs). Microprocessors are single chip computers that allow the devices into which they are built to process data, accept commands, and communicate information like a computer. Automatic processes can be run in the IEDs. Some IEDs used in power-system automation are:

Remote Terminal Unit (RTU)

Remote Terminal Unit (RTU) is a Microprocessor controlled electronic device.

RTU provides interface between physical world and a SCADA/Master system, for remote monitoring/control of the physical world.



Role of RTU in Electrical Substation Automation

- Collecting, Processing and Transmitting digital signals (status of Circuit Breakers, Isolators, Protection Signals, etc) to master control center.
- Collecting, Processing and Transmitting analog values (Voltage, Current, Frequency, Power, Energy, etc) to master control center.
- Receiving digital control commands (Opening/Closing Circuit Breakers, Isolators) from master and executing them.
- RTU supports different kinds of protocols like IEC 60870-5-101, IEC 60870-5-103, IEC 60870-5-104, DNP 3.0 Serial, DNP 3.0 TCP/IP, IEC 61850, Modbus RTU (Serial), Modbus TCP, etc.

RTU Interface Panel

- It is a complete wired Panel in which CPU, different kinds of I/O cards and other accessories like Power Supply Unit, Power Distribution TBs, DI TBs, DO TBs, AI TBs, LAN Switch, Modem, HDR etc. are installed.
- MFT: It is a multifunction transducer, which collects data (voltage, current, frequency, power factor, power, energy) from field and reports to RTU on Modbus serial protocol (RS-485).
- OLTC: It is a transducer, which reads online tap changer position of transformer and reports to master on Modbus serial protocol (RS-485).
- Modem: Modem is used for communication between RTU and master station.

Meter

A meter is an IED that is used to create accurate measurements of power-system current, voltage, and power values. Metering values such as demand and peak are saved within the meter to create historical information about the activity of the power system.

Digital fault recorder

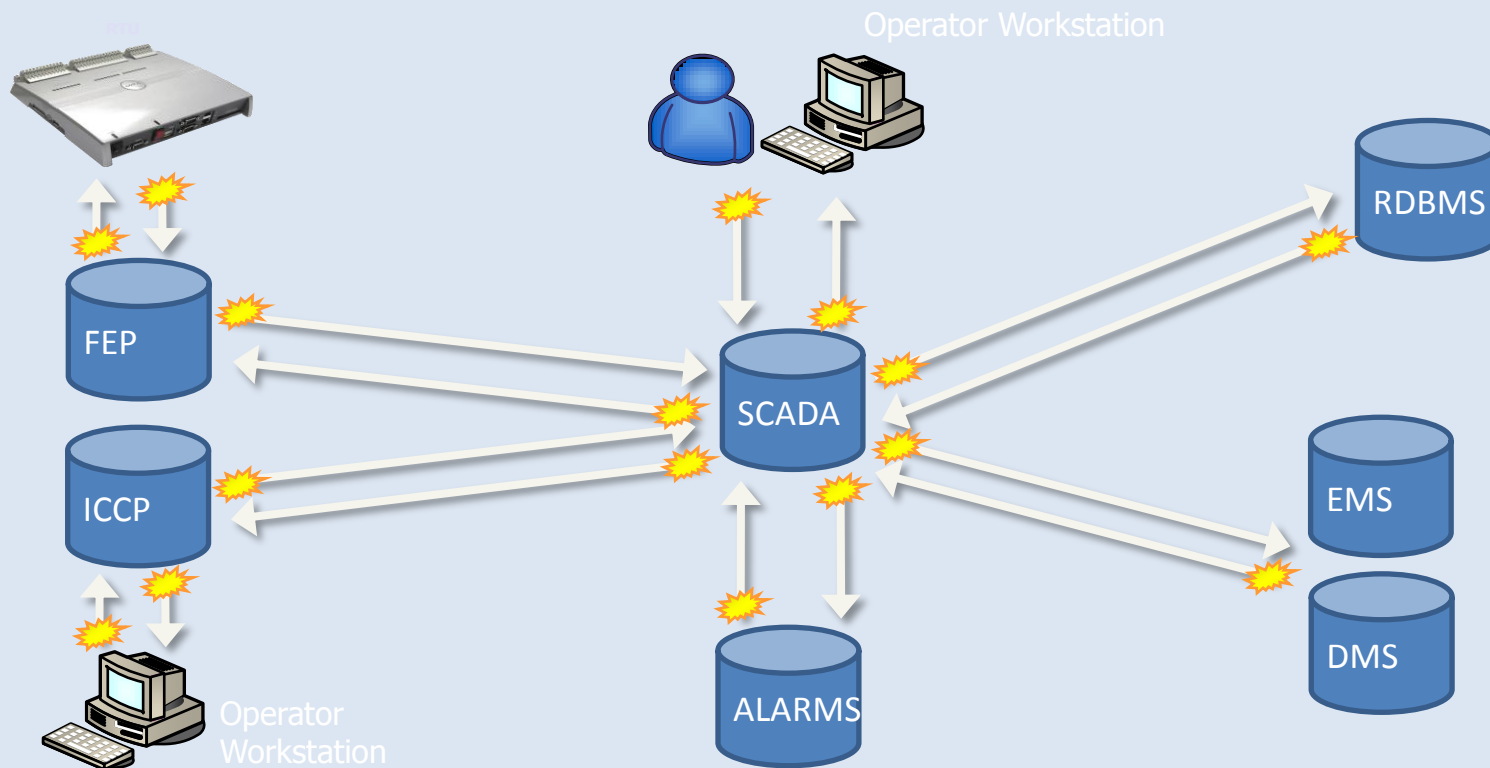
A digital fault recorder (DFR) is an IED that records information about power-system disturbances. It is capable of storing data in a digital format when triggered by conditions detected on the power system. Harmonics, frequency, and voltage are examples of data captured by DFRs.

MASTER STATION AT CONTROL CENTRE:

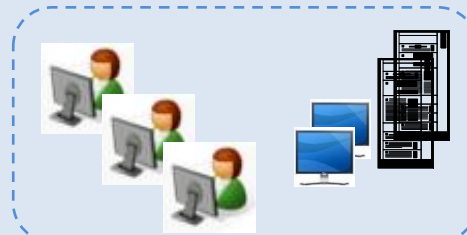
RTU's acquire Plant / Process data and send it to Master Station on request and/or voluntarily

Master station presents the acquired data to the operator in user friendly manner

The operator supervises/Monitors the plant / process, and sends necessary control commands to RTU in the event of anomalies



SCADA System Control room



IEC 60870-5-104

MPLS

Sub Station

IEC 60870-5-104

100/1000 MBPS

SAS

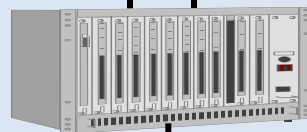


RS 485/MODBUS

MFM
EM1 EM2 EM3 - EMn

RS 485/IEC60870-5-103

Numerical Relays
NR1 NR2 NR3 - NRn



Ethernet Switch

FOP IEC61850

BCPU# 1 BCPU# 2 BCPU# n



Ethernet Switch

IEC61850 – Fibre Optic Fault Tolerant Ring

LIU Panel BCPU# 1 BCPU# 2 BCPU# n LIU Panel

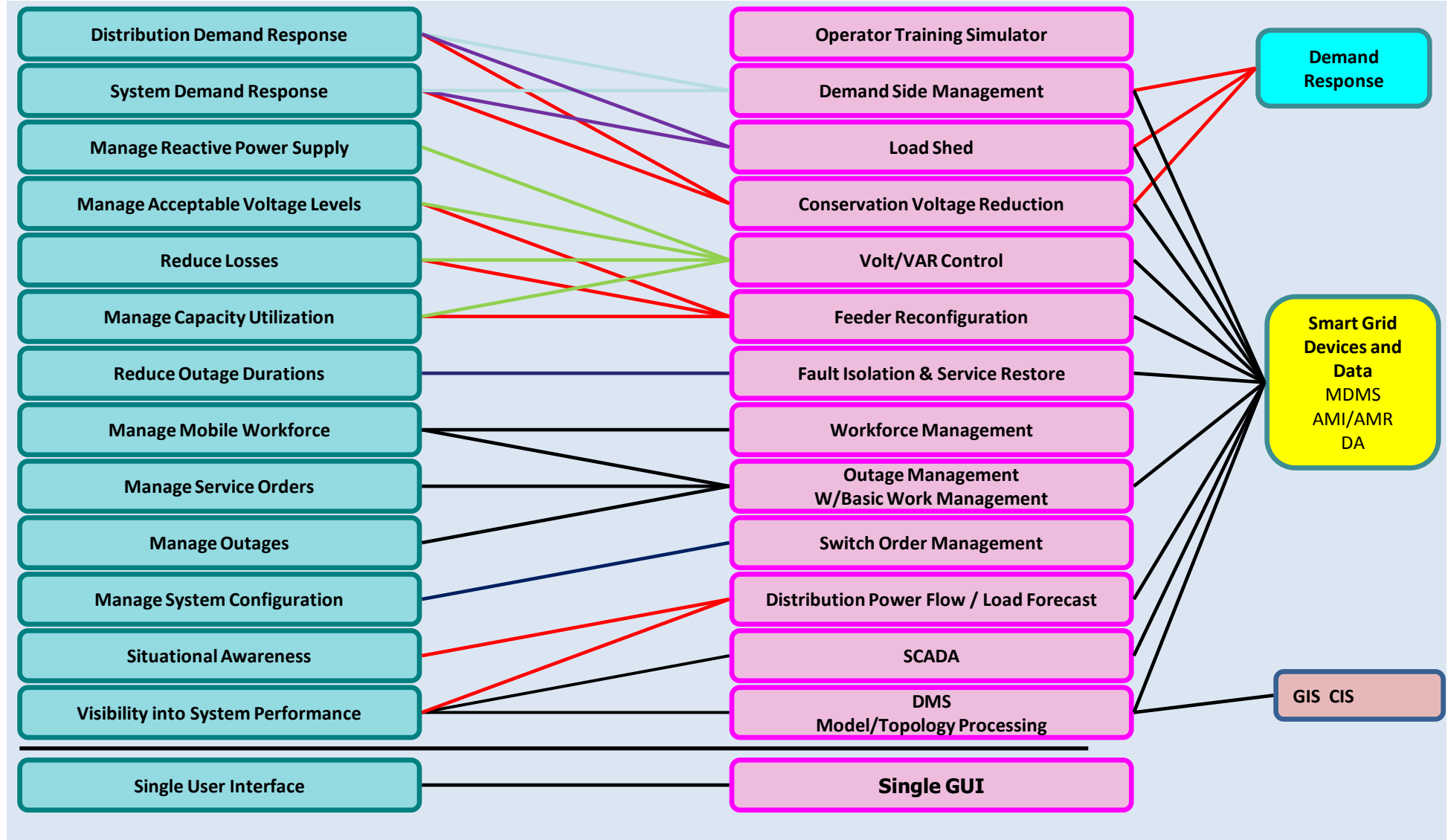


Features:

- Platform and hardware independent system
- Open & modular architecture, incremental expansion possible
- Backup control rooms or Distributed backup control rooms can be incorporated
- Substation Automation Systems (SAS) allow localised monitoring and controls

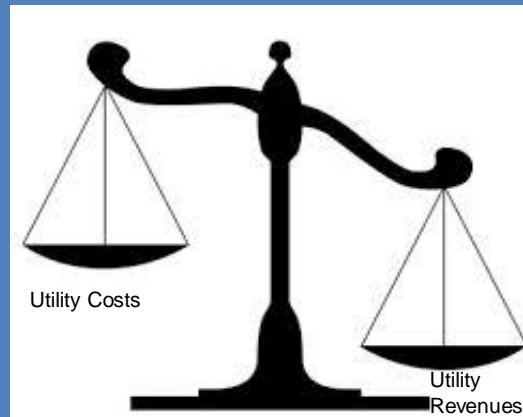
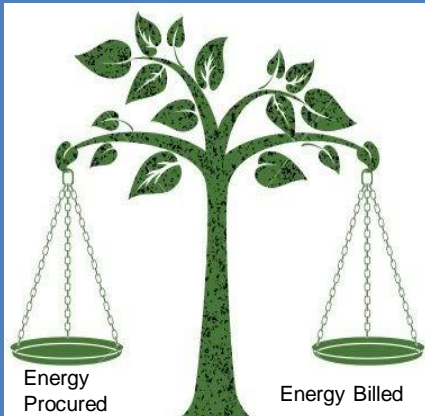
Benefits:

- Centralized operation, reduction in manpower
- Single source of data
- Reduce response time to operate the electrical grid
- Geographical and schematic visualization of the whole electrical infrastructure on one screen
- Supervision and Control for higher reliability of Power System
- Effective Occurrence Analysis and speedy restoration of power supply
- Minimizing Human Errors
- Improved Security and Safety
- Reduced Stress on Operation staff
- Logs, Reports and MIS



Smart Grid

The Objective:



Utility

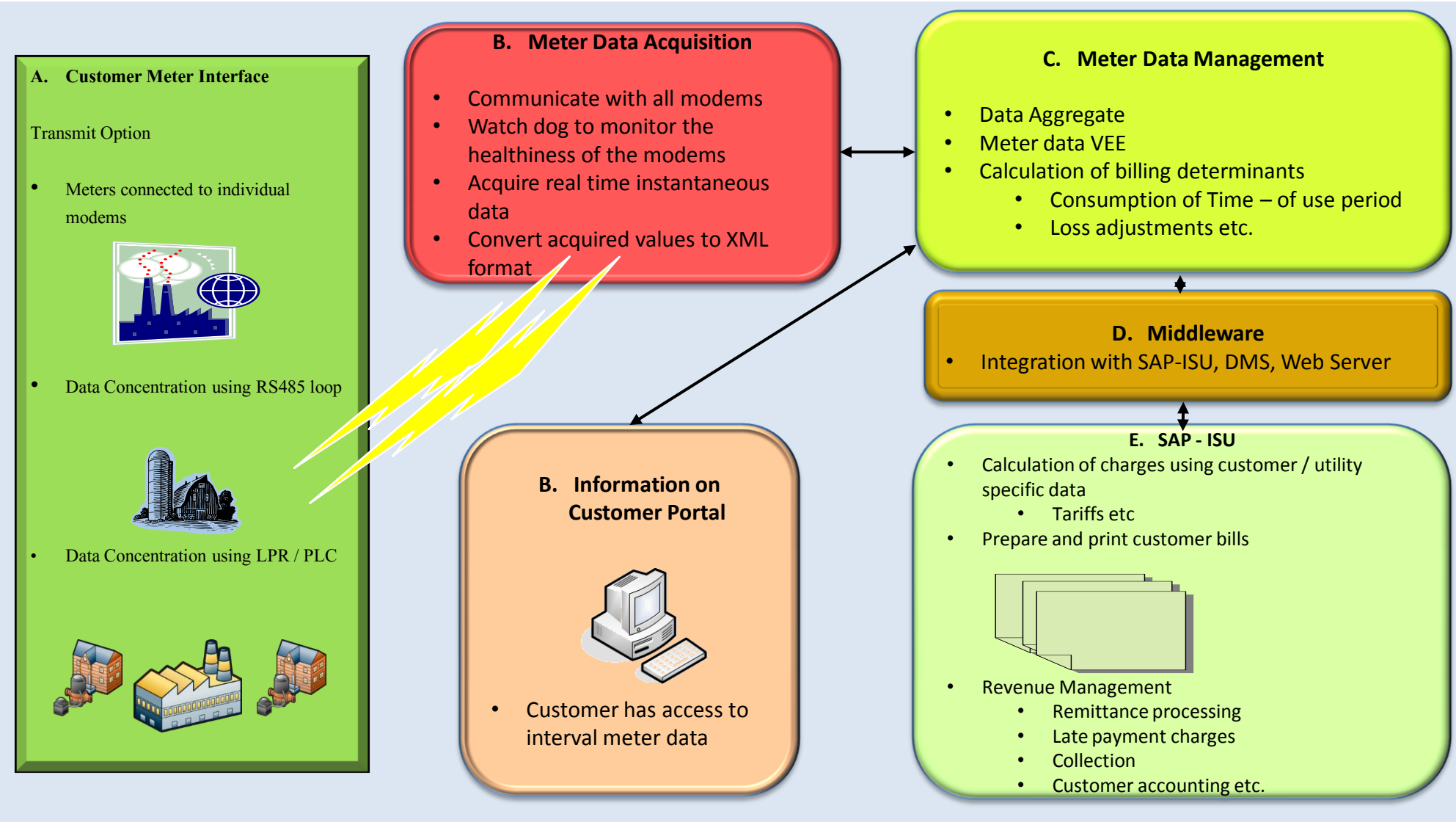


1. 24X7 Power Availability
2. Optimum Price
3. Good Consumer Care

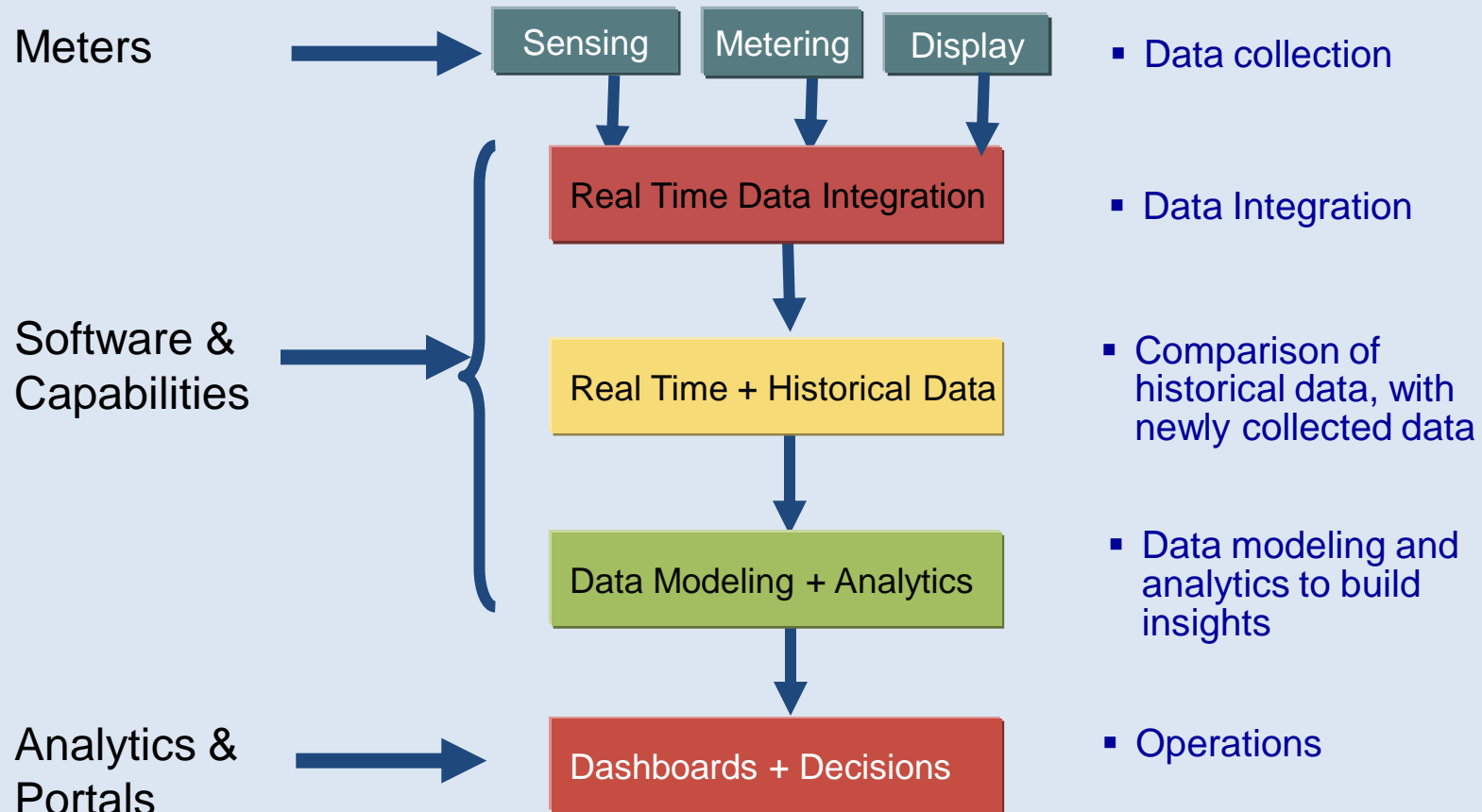
Consumer



“Smart Grid = Electrical Technology + Operation Technology + Information Technology”



Meter Data Acquisition System (MDAS)



Features of MDAS

- AMR & data collection from consumer meters (Single ,Three Phase & LT CT)
- AMR & data collection from HV and selective LV consumers' meters
- Polling of data to the CDC
- Generation of alarms and notifications based on system conditions and validation logic
- Reading of energy usage parameters including instantaneous load, load survey, event logging, etc.
- Use of user defined dashboards
- Activation of connection and disconnection of load
- Time Synchronization of Meter
- Reports based on the above mentioned parameters for consumer MIS.
- Service Oriented Architecture (SOA) enabled

MDAS facilitates configuration of following meter parameters:

- Load profile capture period
- Demand integration period
- Setting of parameters for time of day (TOD/TOU) billing
- Billing date
- Clock setting
- Connect /disconnect of relay load curtailment limit current limit, voltage limit, power limit
- Event setting for connect/disconnect
- Number auto reconnection attempt
- Time interval between auto reconnection attempt
- Lock out period for relay
- Remote firmware upgrade
- Password setting
- Push schedule
- Setting threshold limits for monitored parameters
- Provision for adding more programming features in future

Meter Data Management (MDM):

It performs long-term data storage and management for the vast quantities of data delivered by smart metering systems. This data consists primarily of usage data and events that are imported from the head-end servers managing the data collection in advanced metering infrastructure (AMI) or automatic meter reading (AMR) systems

An MDM system will typically import the data, then validate, cleanse and process it before making it available for billing and analysis.

Products for meter data include:

- Smart meter deployment planning and management;
- Meter and network asset monitoring and management;
- Automated smart meter provisioning (i.e. addition, deletion and updating of meter information at utility and AMR side) and billing cutover;
- Meter-to-Cash system, workforce management system, asset management and other systems.

Furthermore, an MDM provides reporting capabilities for load and demand forecasting, management reports, and customer service metrics.

An MDM provides application programming interfaces (APIs) between the MDM and the multiple destinations that rely on meter data. This is the first step to ensure that consistent processes and 'understanding' get applied to the data. Besides this common functionality, MDM provides facility for remote connect/disconnect of meters, power status verification\power restoration verification and On demand read of remote meters.

Peak Load Management (PLM)

Features & Benefits of PLM:

Rates : The Modules helps to formulate the utility rates for the peak and off peak hours based on the power purchase and power distribution profiles. The suggested rate modules help utility to take decision for making the electricity at low cost to low income groups. helps to discourage the consumers to use high power during peak loads.

Incentives : The Modules help to formulate the incentives to the consumers on shift power usage to non peak hours. It provides the data of the consumers who were shifted the loads to non peak hours and their utilization in peak hours.

Distribution of Information : The PLM module start alerting through SMS to utility and the consumer with the information on the power availability. This will help the both utility and consumer to plan the power usage.

Utility Controls : PLM helps the utility to exercise increased levels of control by direct load control programs to smoothen the demand curve.

Education : Consumer education on demand management is highly essential for their participation in the Peak Load Management program. The modules help utilities to educate the consumers on their role in peak load management. The educational messages are configured based on the consumer power profiles. These messages are delivered through SMS or emails

Consumer Insight and Verification : This helps the utility to take feedback and requests from the consumers and help to provide the better services.

The PLM application in MDM module, integrates with other applications and help utility for the following functionalities.

Consumer wise, Area Wise, Distribution Transformer wise power usage profiles of Time of Use (ToU) tariff , Consumption, Load profiles on daily/weekly/monthly/ quarterly.

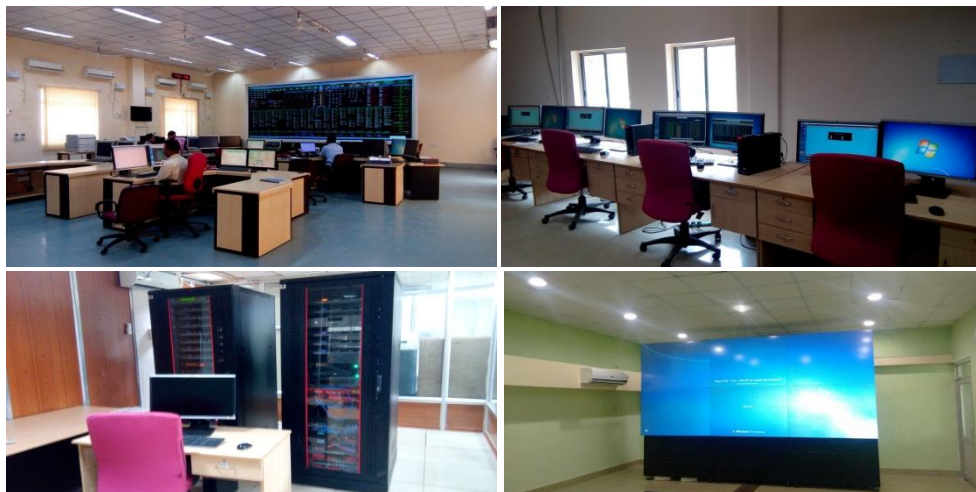
Daily Load Forecasting Consumer wise, Area Wise, Distribution Transformer wise in real time, hourly & Daily basis using SOM algorithms.

GAP Analysis between drawl schedules and the actual drawls, Real Time Load prediction and Block prediction, Consumer power usage behavior analysis.

Chemtrols Industries: BU 5 – Utility Management Systems

Utility Management Systems (BU5): Systems

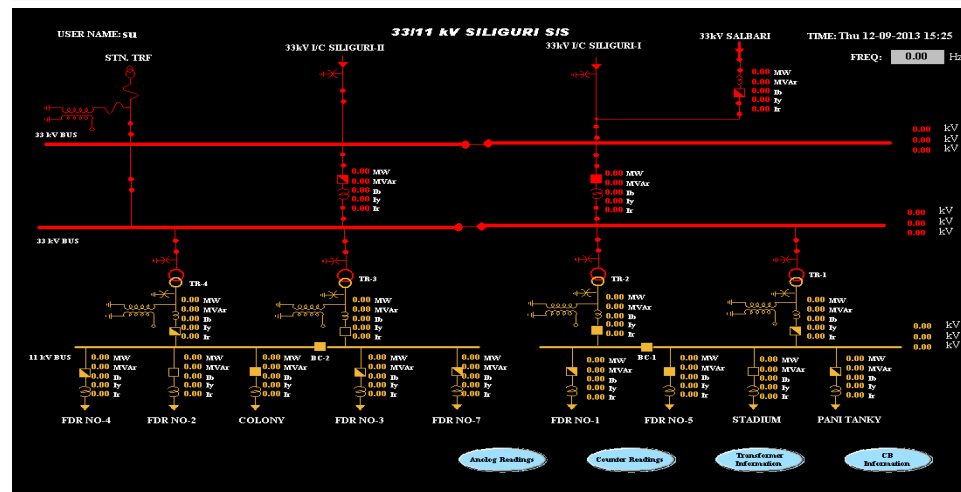
SCADA / EMS / DMS



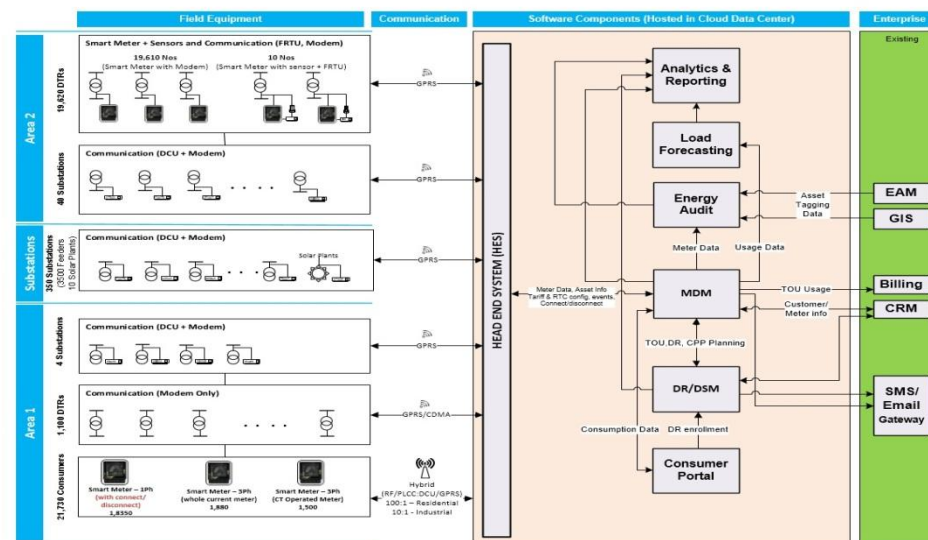
RTU & FRTU



Substation Automation



Smart Grid



Transmission Automation

Distribution Automation

Smart Grid

RTU / FRTU

Transmission Automation

- These are SCADA systems for Energy Management that help Transmission Utilities manage their large region-wise power transmission networks from Load Dispatch Control Centres
- Chemtrols provides a comprehensive solution that includes Remote Terminal Units for Substations, Control Centre Equipment & Software, Engineering of the entire solution, Installation & Commissioning and Comprehensive maintenance subsequently
- Chemtrols uses its Goa facility to manufacture RTUs and stage the control centre for Factory Acceptance testing

Distribution Automation

- These are SCADA systems for distribution Management that help Distribution Utilities manage their city distribution networks from centralized control centres
- Chemtrols provides a comprehensive solution that includes Remote Terminal Units for Substations, FRTUs for field installations, Control Centre Equipment & Software, Engineering of the entire solution, Installation & Commissioning and Comprehensive maintenance

Smart Grid

- Smart Grid projects involve installation of entire Advanced Metering Infrastructure that includes Smart meters, Automated meter reading systems, Peak Load Management, & Meter Data Management Systems
- Chemtrols provides a comprehensive solution that includes engineering the entire smart grid solution, supplying equipment & software and integrating the entire system

RTU / FRTU

- Chemtrols manufactures RTUs & FRTUs at its Goa Manufacturing facility
- LDMS (Local Data Monitoring Systems) software which is supplied by Chemtrols is installed along with the RTUs for real time monitoring of sub-stations
- Chemtrols currently supplies an entire range of RTUs for all types of substations & also ones that are IEC 61850 compliant

Strategic Technology Partners



SCADA, EMS,
DMS, GMS



Remote
Terminal Units



AMI, MDM, MDAS
(Smart grid)

Key Players

ALSTOM



DFM



Smart solutions.
Strong relationships.



Schneider
Electric

SIEMENS

Select Clientele



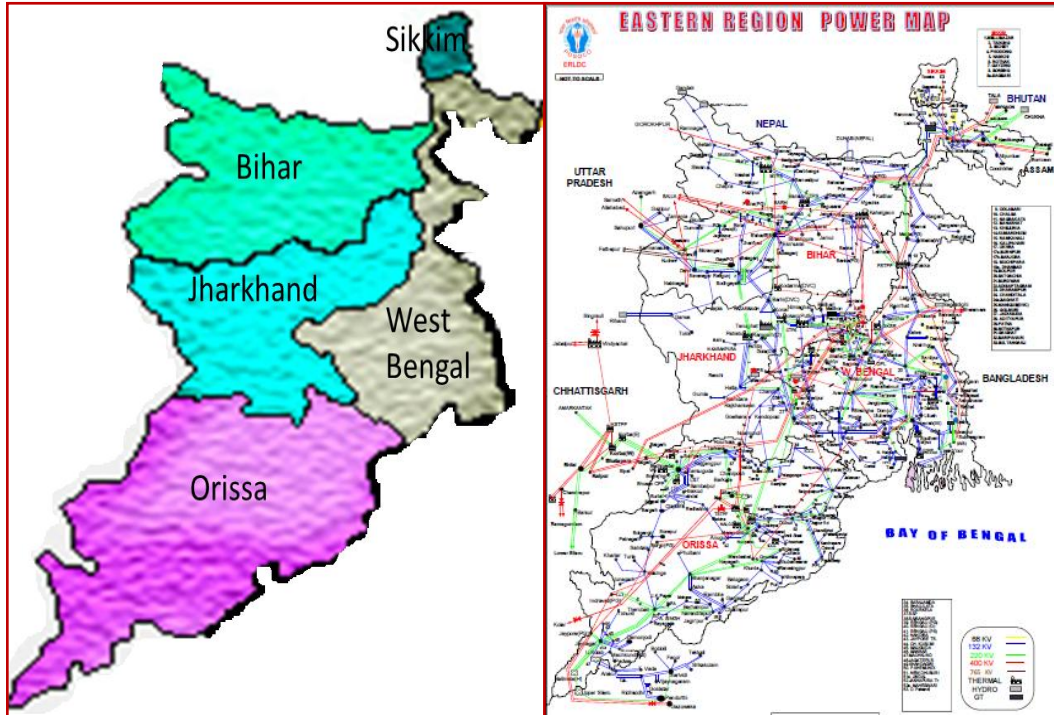
Shreem
ELECTRIC LTD



ALSTOM



SCADA / EMS PROJECT



PROJECT: ERLDC SCADA/EMS

- Contract from POWERGRID
- States - West Bengal, Bihar, Jharkhand, Sikkim
- Main & Backup Control Centres for Regional & State LDCs (9), 230+ New RTUs, Integration of Existing RTUs
- ICCP integration with other Control Centres

PROJECT: OPTCL SCADA/EMS

- Contract from POWERGRID
- State - Odisha
- Main & Backup Control Centres for State LDC, 36 New RTUs, Integration of 100+ Existing RTUs
- ICCP integration with ERLDC

SCADA DMS PROJECTS

SCADA / DMS under R-APDRP Scheme of GoI

States: Assam, West Bengal, Gujarat,
Andhra Pradesh, Telangana

- PFC funded Projects
- Control Centres for 16 Towns + 1
DR Centre per State
- APDCL - 1 Towns
- WBSEDCL - 3 Towns
- GUVNL DISCOMs - 6 Towns
- AP & Telangana DISCOMs - 6
Towns
- 500+ RTUs
- 8000+ FRTUs



RTU / FRTU MANUFACTURING

- Manufacturing Facility at Goa
- Manufacturing Capacity >1000 per year
- Design & Engineering by highly experienced staff
- Panel wiring by skilled technicians.
- Excellent Logistic Service.

Customer

RTU/FRTUs

Reliance Industries Ltd.

600+

Tata Power Company Ltd.

40+

Madhya Pradesh Power Transmission Co. Ltd.

40+

Chhattisgarh State Power Transmission Co.Ltd.

50+

Maharashtra State Transmission Co. Ltd.

10+

Eastern Region Load Dispatch Center

200+

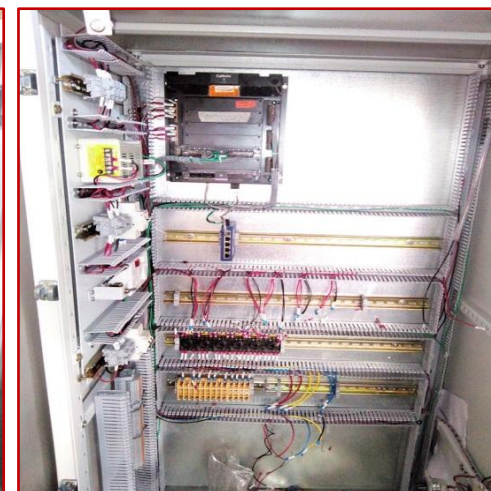
Odisha Power Transmission Co. Ltd.

30+

Assam Power Distribution Co. Ltd.

30+

KSEB, UPPCL, CESE, JSPL, Lloyd Metals and many more.

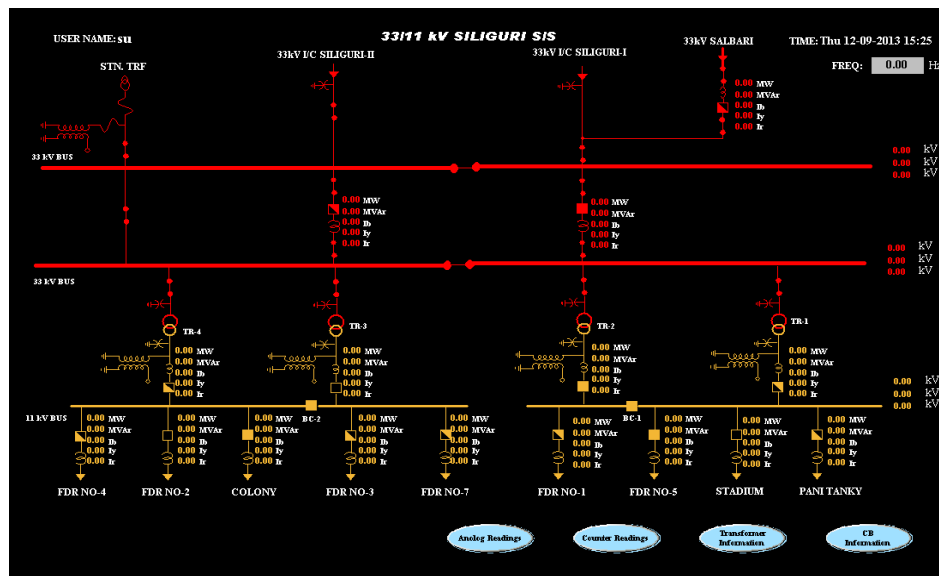


SUBSTATION AUTOMATION

LOCAL DATA MONITORING SYSTEM

CT Meerkat

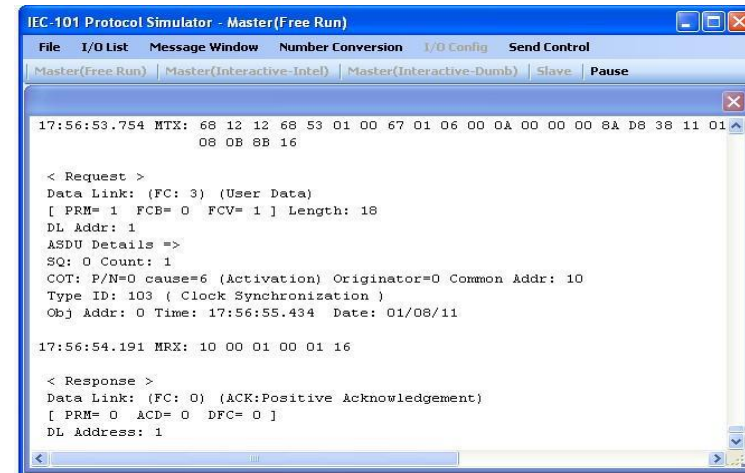
- ✓ Graphical Visualization
- ✓ Intelligent Alarm Management
- ✓ Search enabled Event Listing
- ✓ Real Time Trending
- ✓ Historical Trending
- ✓ ODBC compliant Historical Archived Database for Reports and Analysis



Protocol Analyser Tool CT-SIM

CT-SIM supported Protocols

- IEC-101 (Both Master and Slave)
- IEC-104 (Both Master and Slave)
- Modbus (Both Master and Slave)
- IEC-61850 (Both Client and Server)
- Modbus RTU/TCP



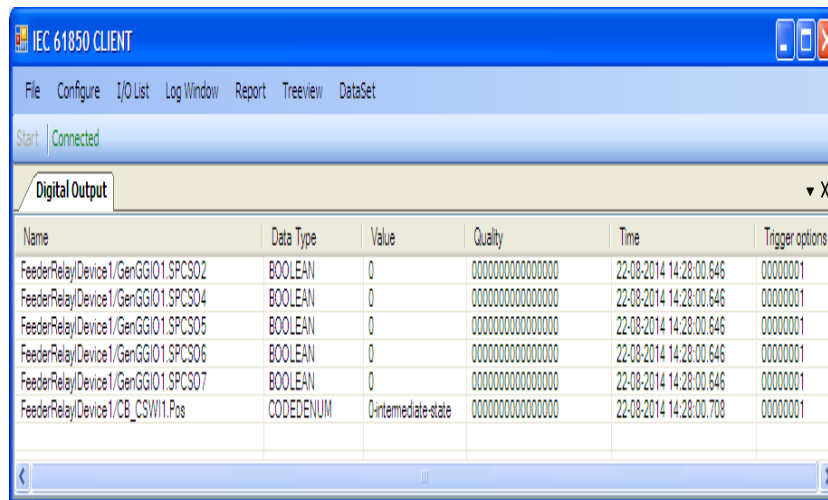
```
IEC-101 Protocol Simulator - Master(Free Run)
File I/O List Message Window Number Conversion I/O Config Send Control
Master(Free Run) Master(Interactive-Intel) Master(Interactive-Dumb) Slave Pause

17:56:53.754 MTX: 68 12 12 68 53 01 00 67 01 06 00 0A 00 00 00 8A D8 38 11 01
08 0B 8B 16

< Request >
Data Link: (FC: 3) (User Data)
[ PRM= 1 FCB= 0 FCV= 1 ] Length: 18
DL Addr: 1
ASDU Details =>
SQ: 0 Count: 1
COT: P/N=0 cause=6 (Activation) Originator=0 Common Addr: 10
Type ID: 103 ( Clock Synchronization )
Obj Addr: 0 Time: 17:56:55.434 Date: 01/08/11

17:56:54.191 MRX: 10 00 01 00 01 16

< Response >
Data Link: (FC: 0) (ACK:Positive Acknowledgement)
[ PRM= 0 ACD= 0 DFC= 0 ]
DL Address: 1
```



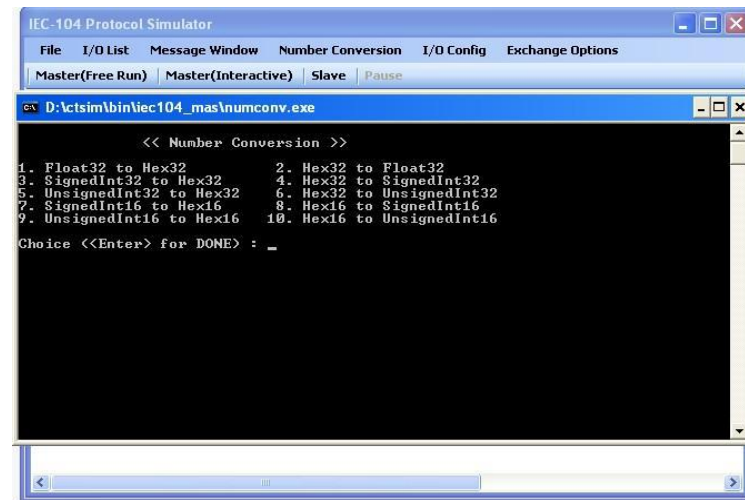
IEC 61850 CLIENT

File Configure I/O List Log Window Report Treeview DataSet

Start | Connected

Digital Output

Name	Data Type	Value	Quality	Time	Trigger options
FeederRelay/Device 1/GenGGIO1.SPCS02	BOOLEAN	0	0000000000000000	22-08-2014 14:28:00.646	00000001
FeederRelay/Device 1/GenGGIO1.SPCS04	BOOLEAN	0	0000000000000000	22-08-2014 14:28:00.646	00000001
FeederRelay/Device 1/GenGGIO1.SPCS05	BOOLEAN	0	0000000000000000	22-08-2014 14:28:00.646	00000001
FeederRelay/Device 1/GenGGIO1.SPCS06	BOOLEAN	0	0000000000000000	22-08-2014 14:28:00.646	00000001
FeederRelay/Device 1/GenGGIO1.SPCS07	BOOLEAN	0	0000000000000000	22-08-2014 14:28:00.646	00000001
FeederRelay/Device 1/CB_CSW11.Pos	CODEENUM	0-intermediate-state	0000000000000000	22-08-2014 14:28:00.708	00000001



```
IEC-104 Protocol Simulator
File I/O List Message Window Number Conversion I/O Config Exchange Options
Master(Free Run) Master(Interactive) Slave Pause

D:\ctsim\bin\iec104_mas\numconv.exe

<< Number Conversion >>

1. Float32 to Hex32      2. Hex32 to Float32
3. SignedInt32 to Hex32  4. Hex32 to SignedInt32
5. UnsignedInt32 to Hex32 6. Hex32 to UnsignedInt32
7. SignedInt16 to Hex16  8. Hex16 to SignedInt16
9. UnsignedInt16 to Hex16 10. Hex16 to UnsignedInt16

Choice <<Enter>> for DONE : _
```

- One of the 14 Pilot projects in India approved by MoP
- Advanced Metering Infrastructure (AMI) and Peak Load Management (PLM) attributes of Smart Grid
- 5275 Smart Meters, DCUs, MDAS, MDM, communication system, Software and Hardware for Control Centre and 5 Year AMC
- Consultant - Power Grid Corporation of India Ltd. (POWERGRID)



Engineering | Projects | Manufacturing | Technology

Thank You

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impeccable years of serving the Indian Industry

