POWERLINE

Conference on

Telecom Needs of Power Sector

Strategies and Solutions, Technologies and Applications

May 29-30, 2012

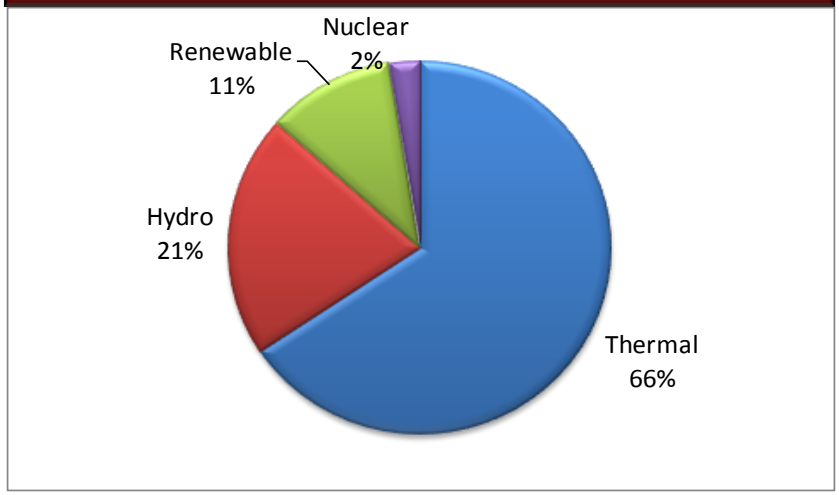
Key Trends and Drivers

Agenda

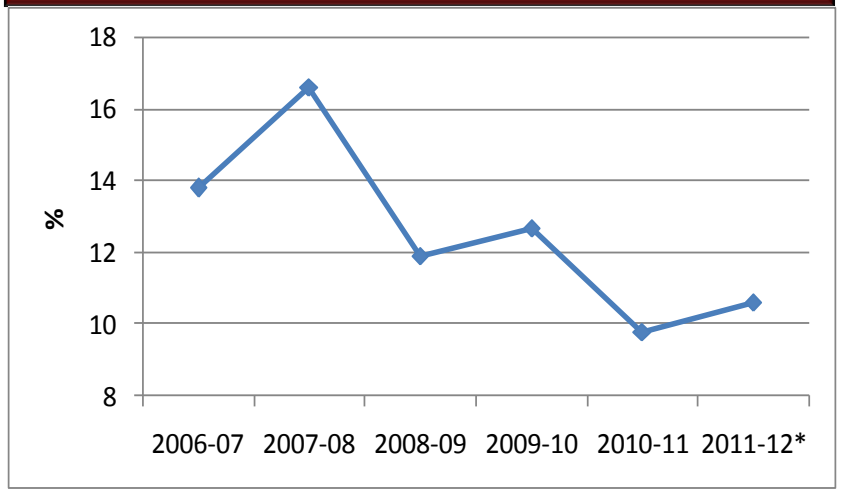
- Power Context in India
- Communication Needs of Power Sector
- Communication Technologies
- Emerging Trends

The Indian Power Context

Installed Capacity by Fuel



Peak Power Deficit



- Peak power deficit continues to remain at levels higher than 10%
- Discoms resort to load-shedding rather than short-term power purchase to meet demand
- Demand curve is skewed by domestic demand, with morning and evening peaks
- Share of renewable energy in the power mix is increasing – most of this is grid-connected
- National grid – transmission network operates as a synchronised network. The southern grid is expected to be integrated in the next few years
- Short-term power market is gaining importance. Market currently operates two power exchanges and a third is in the offing
- Captive power generation contributes over one-fourth of the total installed capacity. Increasing share of surplus captive capacity is being tapped in the grid

Power Sector Issues driving Technology Needs

Key Drivers

- High power shortage
- Erratic supply outages
- Unpredictable demand peaks
- Heavy strain on generation & transmission assets – need to reduce technical losses
- Theft & fraud detection – need to reduce commercial losses

Potential Future Drivers

- ToD & other complex tariff structures gaining prevalence
- Increase in share of renewable energy
- Distributed generation
- Evolution in power trading
- Competition in retail power gaining prevalence
- Synchronised national grid

- Demand for IT and communications in India is essentially driven by the need to reduce the inefficiencies in the system
- Government programme – R-APDRP targeted at reducing AT&C losses, with funding of Rs 500 billion, has provided the much needed push to technology adoption by the distribution utilities
- Increasing competition has forced utiities to focus on consumers and use technology tools to enhance customer service

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Communication Needs of Power Sector

Enterprise System | **Wide Area Network** | **Home Area Network**

Communications

Enterprise system integration (AMI,OMS, SCADA, GIS, etc.)

Leveraged communications network (DA, substation automation, backbone, etc.)

Connected home (smart meters, demand response)

ICT Requirements of Power Utilities

Reliability of Supply

- Forecasting and demand control by engaging consumers
- SCADA and DMS can control system protection failure based on network health data
- On line data and local intelligence to avoid material theft
- Prediction of system break-down

Quality of Supply

- Identification of power fluctuation or network imbalance cause by network health data
- Load management voluntary than by default
- Educate and inform consumers about faulty load

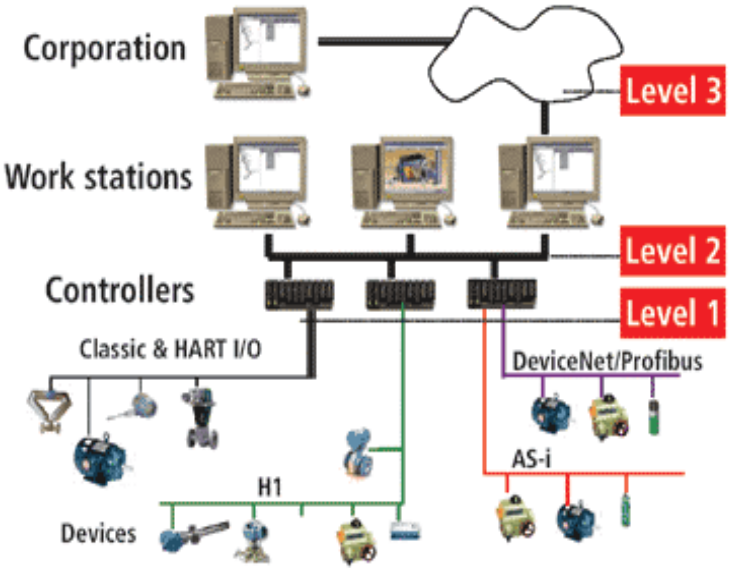
Cost of Supply

- Accurate measurement and reduction of technical and commercial losses
- Meter data acquisition and management
- Proper and efficient utilization of capital assets
- Automation to reduce manpower costs
- Control peak demand by availability based tariffs and demand response

Consumer Services

- Bill reduction by customer engagement
- Better outage handling due to automatic monitoring
- Monitoring of service request status by consumer
- Coordination between supply and demand by appliance control
- Integration of consumer generated green power

Communication Needs in Generation



Communication Solutions

- Communication at three levels:
  - Level one is between the field devices and the controllers
  - Level two is among the controllers and the workstations
  - Level three is from the workstations to the outside world or between control systems
- Wireless communication has found usage at level 3 and not at levels I and 2 because of tight real-time requirement of high predictability and reliability
  - Eliminates cable; easy to install, reconfigure and expand; cost effective for large distances
  - Bandwidth, delay, noise, security issues; challenges at process control level

Wide Area Network

Need	Impact on Performance
• Connect thousands of geographically dispersed communications networks, including field area networks (FANs), T&D, and control and data centers • Gain holistic situational awareness of the entire grid, giving them visibility into issues and enabling prompt remedial measures as required • Exponentially increased demand for reliable and stable power supply • Managing load across the distributed grid and multiple remote systems • Lack of visibility into aging infrastructure equipment • Utilizing existing infrastructure to comply with new security regulations and industry standards • Addition of intermittent renewable energy resources to the grid	• Reliable communications via interoperable devices on a common network • Remote monitoring of station equipment and sensors for better transparency in the station • Improved load balancing based on more accurate information on grid asset • Reduced service disruption due to proactive equipment maintenance • Lower operational costs, reduced lease line charges, and improved worker productivity • Improved incident response, better worker safety, and better loss prevention

Intelligent Metering

Need

- High AT&C losses, with a number of utilities reporting more than 50% losses
  - Around 35% of these losses is due to metering inefficiencies
- Need to prevent energy theft, and increase billing accuracy and collection efficiency
- Implementation of ToD pricing requires smart meters that can record peak vs. off-peak consumption

Utility Experience

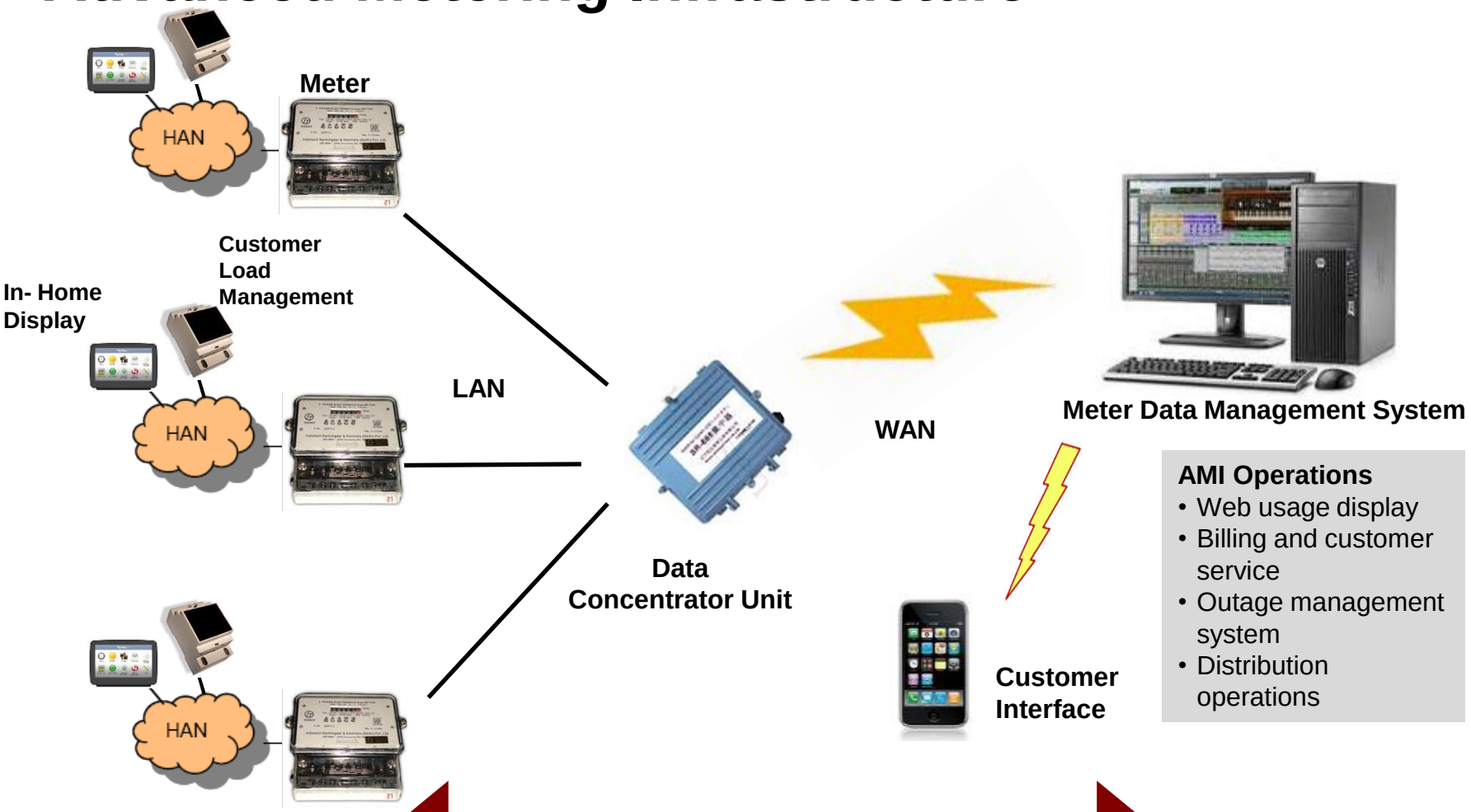
- AMR implemented by certain discoms like NDPL – plans to implement AMI are underway
- BSES has made investments to install 100% ToD compliant, optically downloadable single phase meters
- BESCOM's pilot smart grid project involves deployment of smart metering

Issues and Challenges

- Standardisation of smart meter specifications for utility-scale use has not been implemented
- Regulatory position not clear so far
- PLC and GPRS, which are necessary for implementation of smart metering solutions have their own challenges
  - High quality power cable infrastructure yet to be tested in India
  - GPRS would require enhanced provisioning and service quality

Smart grid task force working on low cost smart meters to enable their widespread deployment

Advanced Metering Infrastructure



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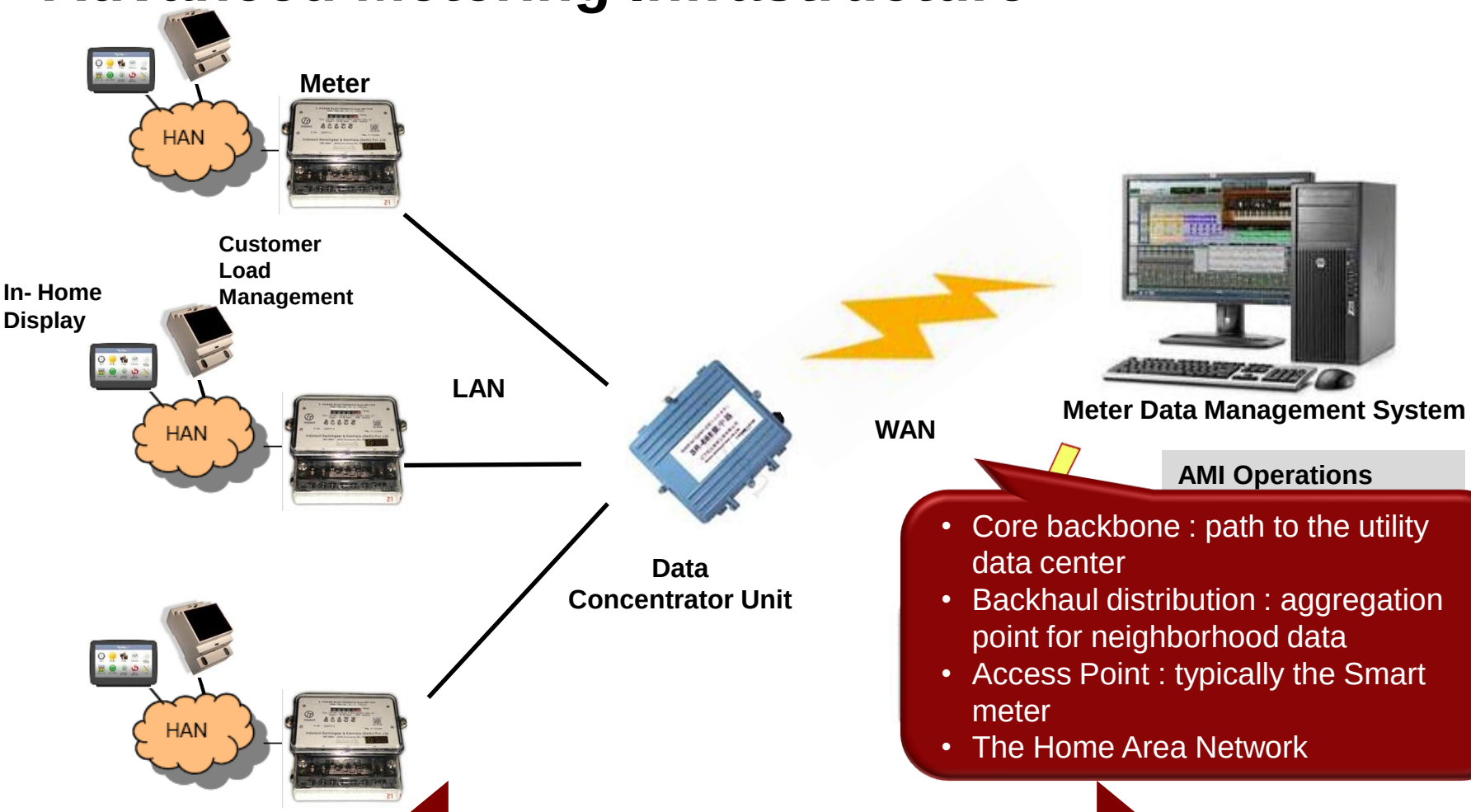
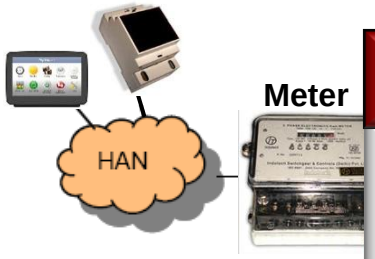


AMI Operations

- Core backbone : path to the utility data center
- Backhaul distribution : aggregation point for neighborhood data
- Access Point : typically the Smart meter
- The Home Area Network

LAN/HAN: PLC, Zigbee RF Mesh
WAN: GPRS / CDMA / BWA
Protocol: DLMS / Independent MDMS

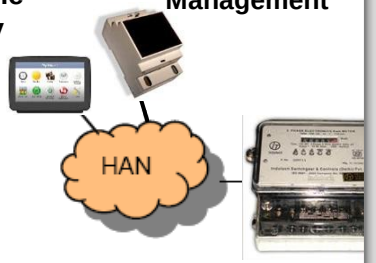
Advanced Metering Infrastructure



Meter

Customer Load Management

In- Home Display



Benefits

- Consumption monitoring & reduction
  - Efficient DSM during peaks ,reducing power purchase costs
  - Load curtailment program, reduced power supply instead of no power scenario
- Time of use metering and dynamic and real time pricing
- Remotely identifying tampering
- Outage management integration
- Quick response
- Demand forecasting
- Reliable meter reads without any manual intervention
- Web based access to meter data to consumer as well as utility

er Data Management System

AMI Operations

- Web usage display
- Billing and customer service
- Outage management system
- Distribution operations

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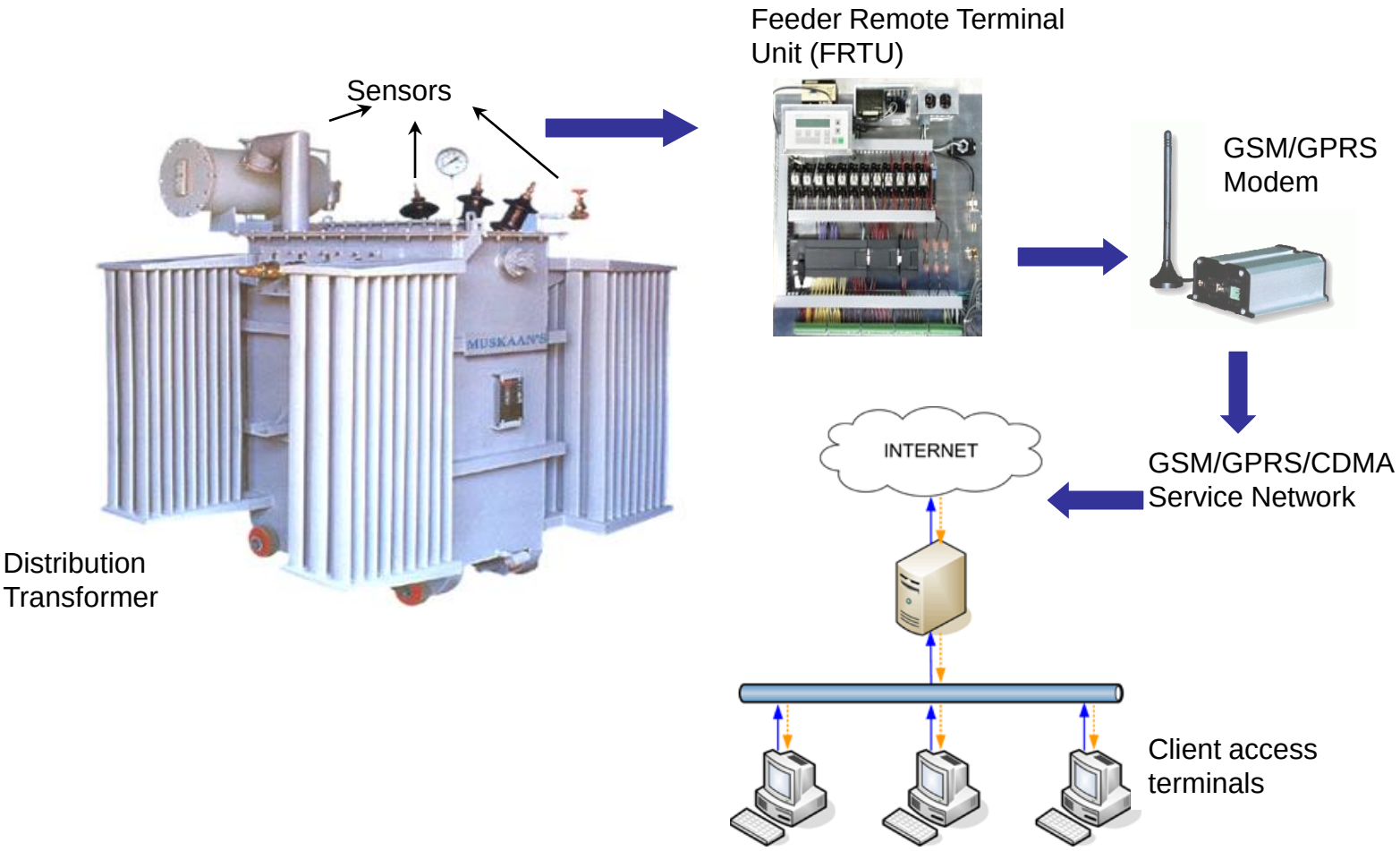
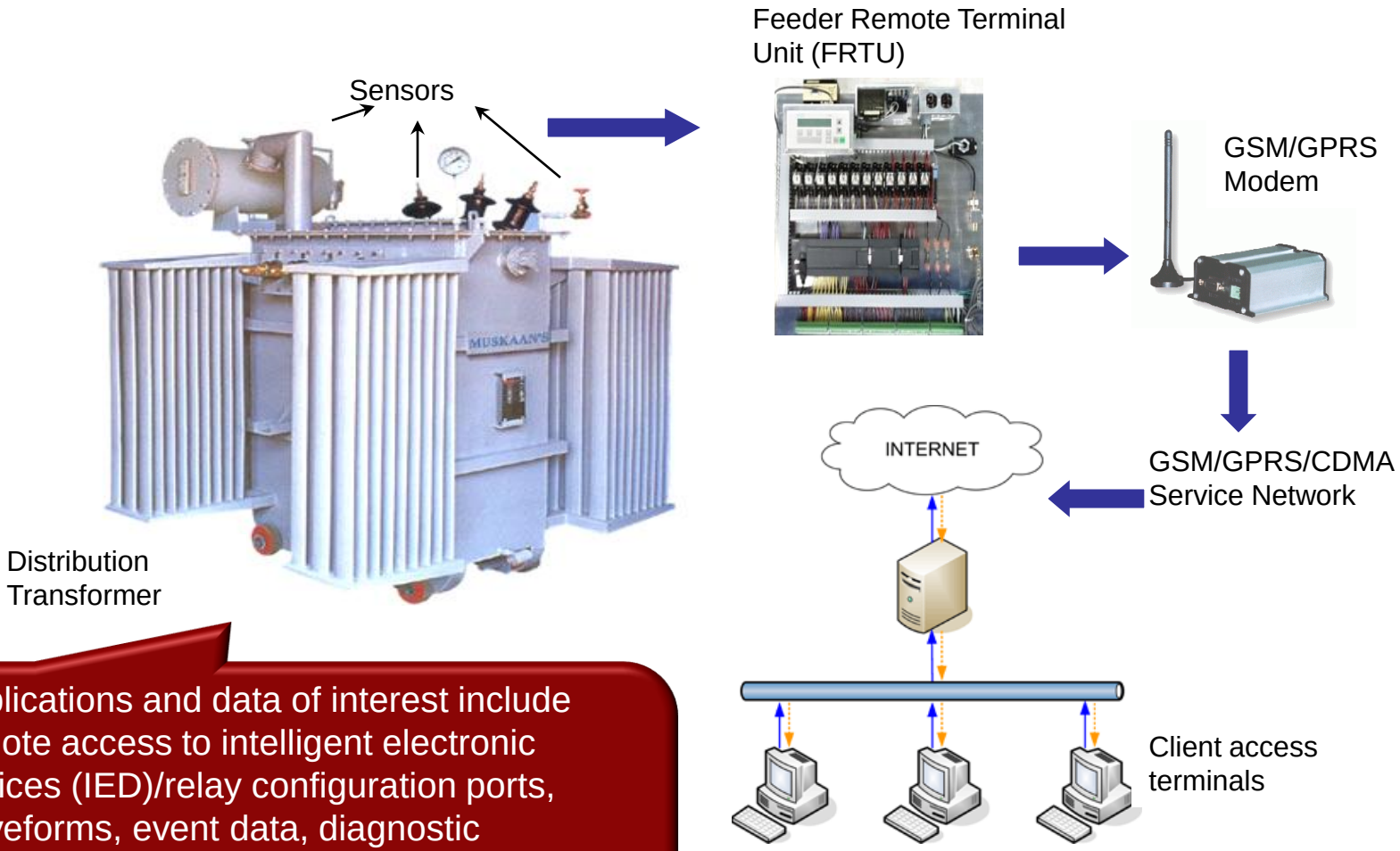
Smart Substation Management



Smart Substation Management



Applications and data of interest include remote access to intelligent electronic devices (IED)/relay configuration ports, waveforms, event data, diagnostic information, video for security or equipment status assessment, metering, switching, volt/VAR management, etc.

Smart Substation Management

Feeder Remote Terminal Unit (FRTU)

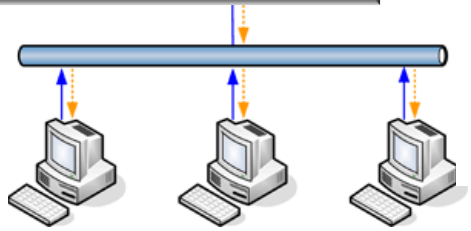
Distribution Transformer

Benefits

- Movement from reactive to predictive environment and maintenance
  - Monitor transformer parameters
  - Intrusion management
  - Meter data management
- Completely integrated to GIS, Outage Management System and Consumer Management System
- Automatic notification of alarm and escalation
- Integration with SMS facility

GSM/GPRS Modem

GSM/GPRS/CDMA Service Network



Client access terminals

Data Centres

Exponential increase in data collected, used and stored; and greater attention to disaster recovery and business continuity strategies are driving the growth of data centres

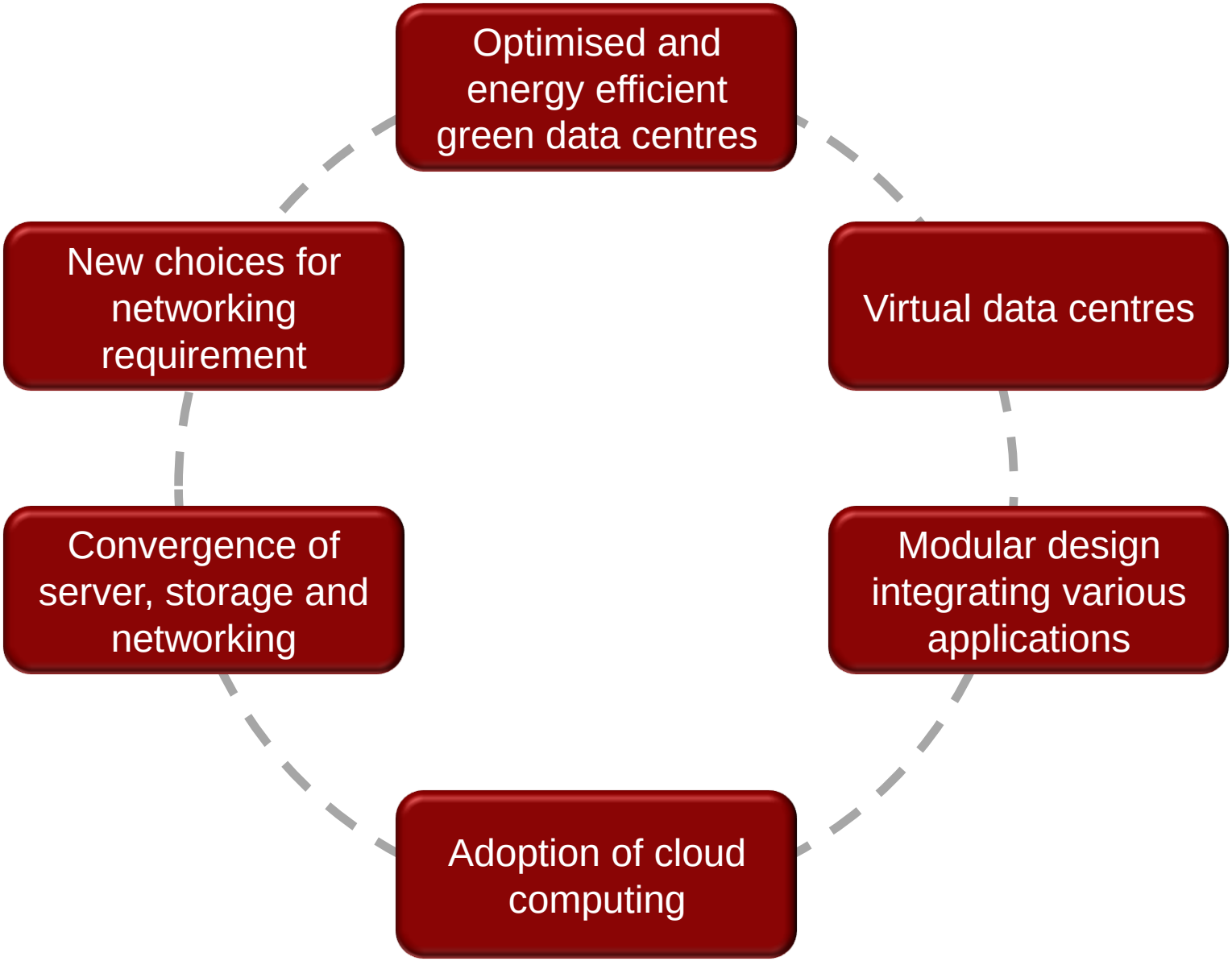
Key Factors

- Open architecture and adaptive communication network based on proven standards and specifications
- Robust and scalable architecture – three-tier architecture for easy modification of business logic and software deployment
- Automated data back-ups and separate database and application servers for mission critical applications
- Consistent infrastructure for data collaboration, communication and interoperability

Issues and Challenges

- Power and cooling issues
- Space limitations
- Disaster recovery
- Optimum floor layout and stacking
- Maintenance and security, data loss

Data Centre Trends



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Communication Technologies

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Fibre	High bandwidth availability	Issues related to laying and maintenance
MPLS	High reliability	Cost effectiveness – requirement of expensive network equipment
Point to point links	Cost effectiveness	Issues regarding feasibility through a single vendor
VSAT	Effective for quick deployment	Issues with costs and reliability to handle critical operations
Radio Frequency	Effective for quick deployment	Issues with reliability to handle critical operations

Communication Technologies

	+	-
PLCC	Effective solution for low voltage level	Untested in Indian conditions, issues regarding bypassing of transformers and frequency of transmission
Mesh Radio	Effective solution for small distances	Untested in Indian conditions, issues regarding availability of frequency ranges
GPRS/CDMA based VPN	Effective for low volume of data transfer	Issues regarding feasibility and reliability
3G based VPN	Effective high speed high volume data transfer	Yet to be tested on various applications

All technologies have their pros and cons – no single technology can meets all the needs of a utility. A mix and match approach is needed.

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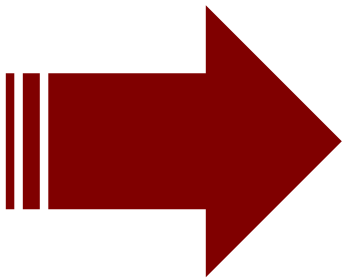
Emerging Trends

- Critical infrastructure investments including development of data centres, secure and efficient communication channels and validation of baseline network data among others
- Increasing quantum of data flow due to electronic meters, SCADA, time-of-day metering, short-term power etc. driving the need for better data storage and retrieval systems
- Leveraging telecom companies to provide end-to-end solution – utilities can reduce capex and opex by not having to build and manage their own network. Speeds up deployment and provides access to technical skills
- Communication service providers leverage their core asset – the network – as well as IT capabilities to provide utilities with the communications fabric over which the smart grid can be deployed

- WAN/LAN
- Meter reading
- SCADA
- Physical Security



- Meter data management
- Demand response
- Cyber security
- Workforce management
- Vehicle tracking

Smart Grid Adoption to Further Drive Communication Needs

Conventional Grid

- Unidirectional flow of power from generator to consumer
- Centralised bulk generation, dominated by conventional sources like coal, gas, etc.

Smart Grid

- Bidirectional flow – power and information
- Decentralised, distributed generation – more flexibility
- Integration of renewable energy sources into the grid
- Demand side management by active customer participation
- Anticipating and responding to system disturbances – self healing capabilities
- Energy efficient homes – allowing consumer control
- More robust and reliable grids, which can dynamically respond to instabilities

- Smart Grid Forum and ISGTF constituted to roll out smart grid implementation in the country
- Discoms like BESCOM and MESCOM are already implementing smart grid pilots
- Proposals received from 14 distribution utilities – for functionalities like AMI, outage management, peak load management, power quality, micro-grid and distributed generation

Thank You