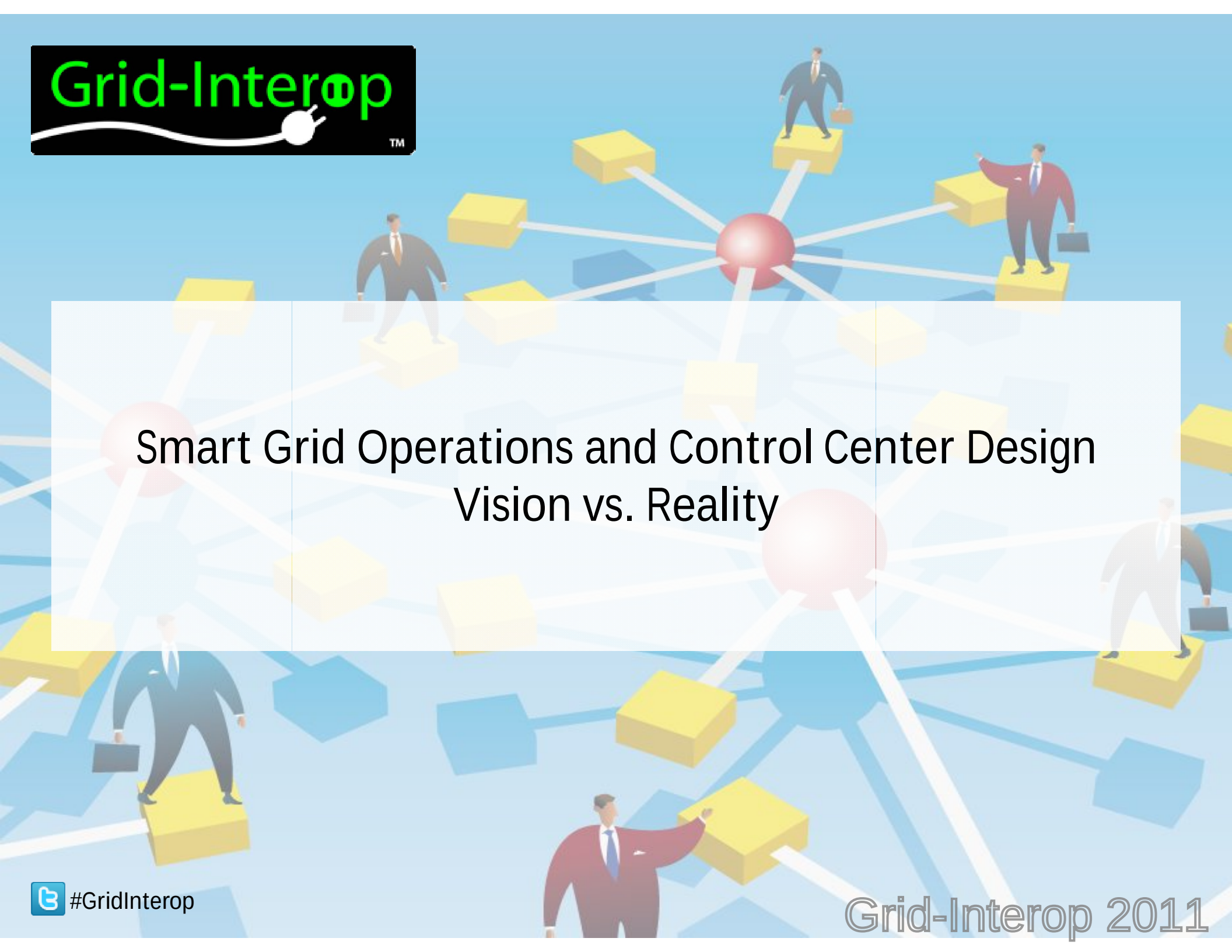
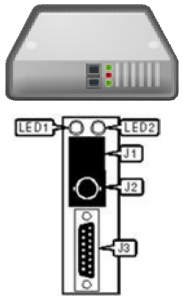

Grid-Interop
™
Smart Grid Operations and Control Center Design
Vision vs. Reality
#GridInterop
Grid-Interop 2011

Advanced Distribution Management

Control Centers & Systems

SCADA Bridges/Converters



Wireless Substation Computers

Automated Switched Cap Banks

Automated Sectionalizers & Switches

Smart Transformers (Regulators, Sensors, Meters)

PV Generation

Wind Generation

FIELD AREA NETWORKS

Community Storage

Wireless Line Sensors & Feeder Metering

EV Charge Management

Direct Load Control

- **Distributed Intelligence & Management**
- **Field Automation**
- **Heterogeneous 2-Way Communications**
- **Remote Operations**
- **Security Monitoring, Protection, Controls**

Field Area Network Communications Environment and Its Data

- Traditional SCADA supplemented by highly distributed and numerous sensors and controls
  - Tightly integrated, high density embedded field hardware
- Wireless communications are predominate solution
- Multiple wireless technologies with different network topologies and deployment strategies
  - Proprietary Private Networks (open 900 MHz and licensed bands)
  - Cellular Data
  - “Industrial” WiFi Solutions
  - WiMax
- Typical operations and control centers not designed for information types or data volumes
- New operations management processes, workgroup functions, operations centers
  - Improve network reliability
  - Reduce OPEX
  - Integrate renewable energy resources
  - Flexible energy services
  - Support emerging energy applications

AMI Data Value Example

1. Meter usage measurements
   - Meter to cash business process
   - Typically addressed first
2. Automated operations
   - Customer support & meter provisioning
   - Remote connects & disconnects
3. Energy state, state change at meter
   - Valuable to distribution management operations
   - Control of power quality
   - Outage restoration management
4. AMI state & health information
   - Network connectivity, performance, optimization, bandwidth allocation, latency, routing, access node utilization, traffic statistics, trending,
   - Value to telecom & network planners, engineers
5. Security related information
   - Maintain FAN security controls – key provisioning, authentication & password management, security monitoring, logging, intrusion detection

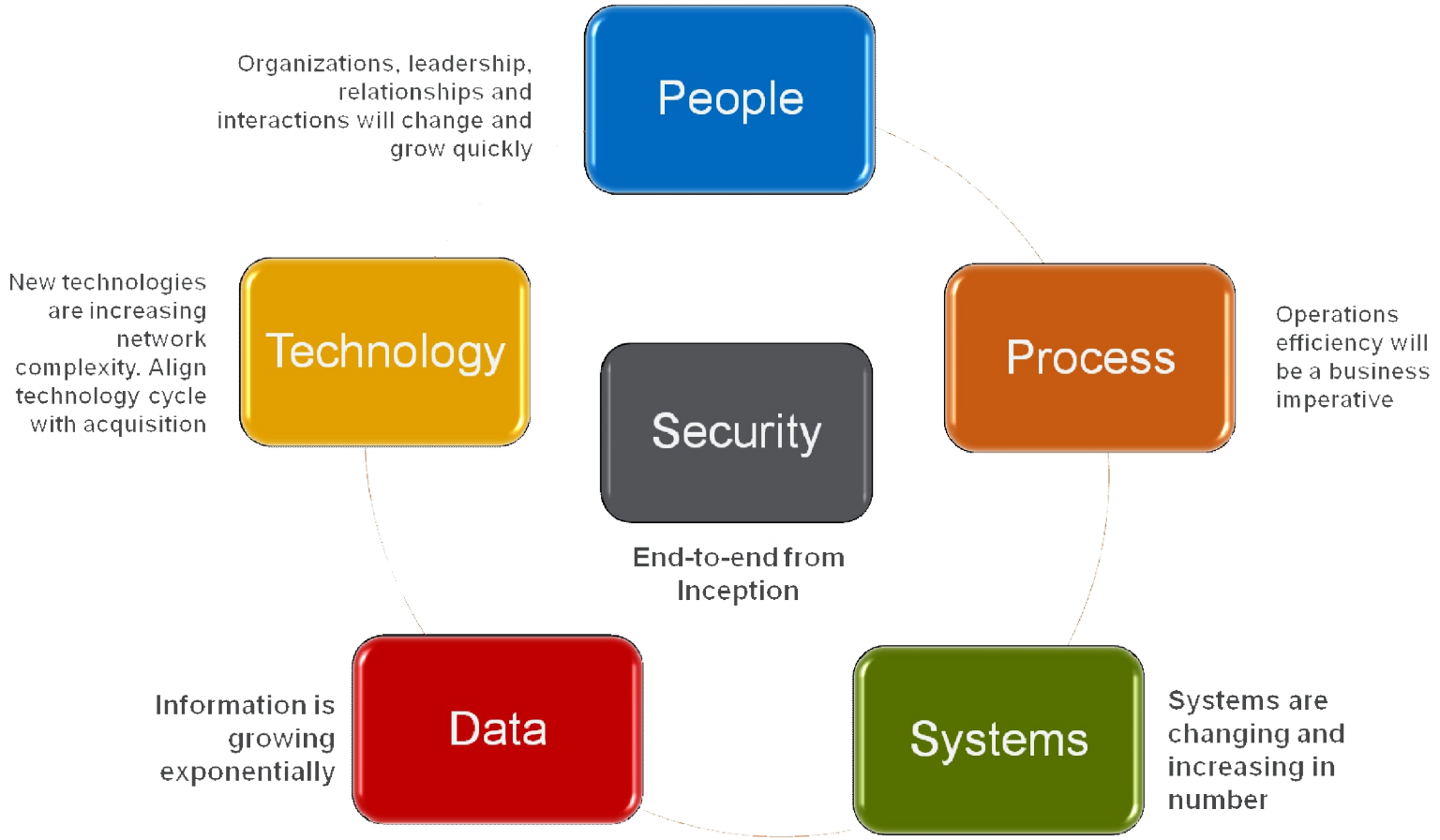
Distribution Automation Data Value Example

1. Distribution network operations & health
2. Electric service provided to customers
3. Control and sensor oriented
   - Command automation and monitoring
   - Security operations
4. Communications network performance
5. SCADA & DA supports operations centers & systems
6. State / condition changes triggers predetermined device actions
   - Analysis by control center personnel
   - What is data saying?
   - What more can is say if combined with data from other systems
   - Priorities, tasks, responsibilities, processes changes needed
   - Transformation executive sponsor critical

Challenges to Address

- Technology is the typical focus
- AMI operations & data analysis is typically orphaned looking for home
- Value of FAN management typically not recognized as critical asset
- Functionality not always mapped to EMS operations, IT NOC, OT NOC
- Value of FAN, AMI, DA operations & data analysis integration can be quickly realized
  - Not an “install it and forget it” proposition
  - Environment requires monitoring, management, maintenance,
- IT, OT work centers not typical targets, thus new SMOC often deployed & staffed to handle:
  - New technology, data types, high volumes, data correlation

Take Holistic View of New Technology Lifecycle



Telcordia Operations Planning Recommendation #2

- Analyze endpoint & network monitoring capabilities
- Gather flow of data, identify important information, map element data to proper work center and operations process – exploit power of data
- Backhaul limitation preclude “pack rat” approach & important information may be buried
- Align device data with planning & definition of new supporting processes & work center(s)
  - Can be driven top-down or bottom-up
  - Resources, training & collaboration critical
  - Don’t just store it for the future

Telcordia Operations Planning Recommendation #3

- Plan & integrate AMI & DA operations into existing distribution energy management operations during deployment; avoid doing after deployment
- If not practical, have clear integration roadmap with intermediate milestones & resources needed
  - Use realistic cost-benefit & insightful assumptions to reach objectives; e.g. data correlation
- Have well documented Technology Introduction Process & roadmap

Telcordia Operations Planning Recommendation #5

- Cover the holistic domains in Plan-Design-Build-Operate stages of Smart Grid Lifecycle
- Plan – include not only technology but all domains to avoid gaps later
- Design – apply when designing architecture, developing requirements, engineering networks, designing test cases
- Build – when deploying AMI & DA devices and FAN equipment, test deployments against acceptance criteria
- Operate – “Plan your work and work your plan.” Document policies & processes, provide guidelines for field to follow and adapt

Telcordia Operations Planning Recommendation #4

- Include FAN communications infrastructure management into operations center integration
- FAN should be managed as the critical power asset is now is
  - Primary Smart Grid enabler
  - Provides situational awareness to avoid jeopardizes
- Pursue achieving situational awareness on FAN as well as grid
- Requires planning & deployment of tools & systems
- Includes inventory systems, network monitoring, service assurance, security management, correlation tools

Telcordia Operations Planning Recommendation #6

- Exploit the power of data – potential for improved:
  - Reliability
  - Safety
  - Efficiency
  - Security
  - Business benefits
- Requires planning and resources initially but results promise greater ROI
- AMI data value example:
  - Add capabilities to gain visibility into AMI & FA, even if Managed Solution
  - Build data analytic capabilities
  - Asset management & reliability – correlate with equipment lot numbers, geographic, environmental – to identify problems & premature failures
  - Change from “run-to-failure” to prognostics & conditioned-based maintenance
  - Security monitoring, intrusion detection work center activities to identify and assess security anomalies
  - Revenue assurance – detect power theft by correlating billing & customer account information without dispatching a technician

In Conclusion - State of the Smart Grid

- The Smart Grid is an explosion of distributed intelligent devices, field automation and remote management and control
- Its deluge of endpoint data is strong stimulus for functional integration of Distribution Management capabilities
- The power of AMI, DA and FAN data can enable improved efficiency, operations, costs, reliability and safety
- Smart Grid Operation is not a one time event – it will evolve with the Smart Grid over the next decade
- Largely due to urgency in stimulus funds, many utilities deployed without the time to define a Smart Grid integrated architecture, control centers, design work centers deploy integrated capabilities
- FAN Situational Awareness is growing need and concern
  - FAN Protocol Analysis tools
  - FAN Visibility tools
  - Extending Intrusion Detection Systems into FAN environments