Today’s Presenters

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Pepco Holdings, Inc (PHI)

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Agenda

1. Utility communications requirements
2. INOC definitions and purposes
3. INOC costs, benefits, challenges, components
4. Pepco’s planning and implementation steps
5. Lessons learned from INOC projects
<table>
<thead>
<tr>
<th><strong>Name</strong></th>
<th><strong>Background</strong></th>
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<tbody>
<tr>
<td>Vaibhav J. Parmar</td>
<td><strong>Global Lead for Wireless Network Consulting- Accenture</strong></td>
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<td></td>
<td>• <strong>Global lead</strong> for wireless technology projects of wireless networks and solutions, mobile applications and devices, and carrier</td>
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<td>infrastructure and systems integration.</td>
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<td>• <strong>Extensive background in mobility services</strong>, cloud-based offerings and network and infrastructure security.</td>
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<td>• <strong>Frequent speaker</strong> at industry events like UTC Telecom, CTIA Wireless, Distributech, WiMax Forum and TeleManagement Forum.</td>
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<td>• <strong>Masters Degree Electrical Engineering</strong> and a BS in Electrical Engineering both from Georgia Institute of Technology.</td>
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Utilities’ Typical Communications Network Requirements

**Wider Coverage**
- Utility networks have very stringent coverage requirements
- Lot of sparsely populated areas need to be provided coverage

**Higher Reliability**
- The networks should be designed with higher reliability to withstand disasters
- Very high level of security should be ensured for physical assets and data

**Unique Types of Devices**
- Unique set of devices with limited economy of scale
- High level of hardening and security requirement
- Possible need for inclusion of satellite devices

**Different Usage Patterns**
- Traffic load is mostly dictated by unforeseen events rather than regular periodic usage patterns
- High volumes of highly localized traffic with no predictable busy hour or location

**User Groups & Prioritization**
- Utilities have different users groups and devices who might have different communication needs
- There may be high level of prioritizations needs based on user groups or traffic type
Communications Network Domains and Operations

**Apps & Systems**
- **Grid Ops & Management**
  - DMS
  - OMS
  - GIS
- **Meter Data**
  - Data Warehouse
  - MDMS
  - AMI Headends
- **Customer**
  - CIS/Billing
  - Web Presentment
  - Demand Response
- **IT, Telco, Security**
  - Network Ops & Mgmt
  - Security
  - IT Ops & Mgmt
- **Other Business Apps**

**Core Network**

**Edge Networks**
- Public Leased Lines (TDM/IP)
- Public Satellite
- Public 3G/4G Cellular
- Private Narrowband* (LMR/RFMAS)
- Private Broadband (WiMAX/LTE)
- Private RF Mesh (AMI)

**Key Technologies**
- Fiber Optic
- Leased Lines
- Microwave
- IP Enabled
- MPLS

*Includes legacy and next generation private narrowband

Note: Items called out on this slide are examples.
Communications Network Domains and Operations

**Planning & Engineering**
- Strategy and Planning
- Program and Project Management
- Supply Chain and Procurement
- Systems Development and Integration

**Design and Deployment**
- Network Traffic Analysis
- Network Cost Modeling
- Architecture Planning
- Design / Build / Test Services
- Embedded SW and Distributed Analytics

**Network Operations and Management**
- Processes / Operating Models
- Organizational Models
- Software Solutions with pre-defined interfaces and integration
- NOC Facility and Operations Centers

**Security**
- Controls, Authentication and Encryption
- Device and User Management
- End-to-end Cyber and Physical Security Frameworks and Standards
What is an Integrated Network Operations Center (INOC)?

**Integrated Operations** is the on-going process of effectively monitoring, managing and reporting on Smart Grid and AMI infrastructure and communications network to meet IT, Network and **Business** service levels.

**Integrated Operations** focuses on the challenges Utility seek to address when managing critical Smart Grid and AMI infrastructure and the communications network, including proactive management of performance, improving control and auditing, and management of service levels.

**Integrated Operations** addresses the following key challenges:

- Efficiency
- Performance Management
- Complexity Management
- Compliance Enforcement
- Service Level Management
Accenture believes a high-performance Integrated Operations Center (IOC) is needed for every Utility to manage and monitor its Smart Grid and AMI infrastructure and network.

Key trends in delivering a high-performance IOC:

- Consolidate Operations Management for End-to-End Service Management
- More Efficient Processes and Increased skill set of OC Personnel
- Automate Operations for increased Productivity
- Provide an integrated set of tools
- Focus on Performance and Applications monitoring
Questions?
# Challenges for an INOC

A Smart Grid & AMI device **not** managed properly can seriously impact business performance. To better manage costs and the complexity of the Smart Grid & AMI Infrastructure, the trend within the Utility Industry is to deploy a high performance Integrated Operations Center (IOC). Challenges facing the Utility Industry can be addressed by an Integrated Operations Center.

<table>
<thead>
<tr>
<th>Category</th>
<th>Challenges</th>
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<tr>
<td>Efficiency</td>
<td>• Reduction of faults, infrastructure operational costs &amp; redundancies</td>
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<tr>
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<td>• Improve enterprise sourcing model (outsourcing, out-tasking, …)</td>
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<td>• Optimize network configuration &amp; usage according to workload</td>
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<tr>
<td>Performance Management</td>
<td>• Convergence places more stringent performance and availability requirements</td>
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<tr>
<td></td>
<td>• Lack of effective network performance and capacity planning results in an inefficient allocation of resources</td>
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<tr>
<td>Complexity Management</td>
<td>• Network infrastructures are increasingly complex (multiple vendors, technologies) becoming more difficult to support</td>
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<td></td>
<td>• Management of new UCC technologies deployed</td>
</tr>
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<td>• Multitude of network management tools are ineffective without integration</td>
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<tr>
<td>Enforce Compliance</td>
<td>• Adherence to array of regulatory requirements (e.g., NERC CIP, SOX, …)</td>
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<td>• Lack of reliable and auditable method for discovering/managing network devices</td>
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<td>Service Level Management</td>
<td>• Business demands adherence and visibility to Service Level Agreements.</td>
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<td>• Automated root-cause analysis is required to proactively identify issues and minimize downtime.</td>
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Typical Elements of an INOC

An Integrated Operations Center (IOC) is recommended for the constant monitoring and troubleshooting of Smart Grid and AMI infrastructure and network to ensure the round the clock management of critical utility service delivery functions.

The continuous improvements related to processes, organization & technology will result in significant business benefits...

Processes
- Individual process and routine improvements
- Optimized processes across technology domains
- Operations Level or Service Level Agreements
- KPIs

Organization
- New organizational structure (process organized)
- Clear role descriptions
- Co-localization, common OC IT/building infrastructure
- Competency management, incentive program etc.

Technology
- Unified alarm correlation system
- Unified fault handling system
- Automated production performance management
INOC Solution Architecture

The integrated OC is built upon varying levels of integration within People, Process, and Technology for each of the individual operation domains.
## INOC Solution Components

### FCPS

<table>
<thead>
<tr>
<th>Fault (F)</th>
<th>Configuration (C)</th>
<th>Performance (P)</th>
<th>Security (S)</th>
</tr>
</thead>
</table>
| • Fault Detection  
• Fault Isolation  
• Alarm Handling  
• Alarm Correlation  
• Alarm Filtering  
• Alarm Clearing  
• Impact Analysis  
• Root Cause Analysis  
• Event Enrichment  
• Escalations  
• Diagnostics Tests  
• Manager of Managers | • Network provisioning  
• Auto-discovery  
• Change Management  
• Remote Configuration  
• Resource Initialization  
• Job initiation, tracking and execution  
• Automated Software distribution | • Performance data collection  
• Performance data analysis  
• Capacity Planning  
• Utilization & error rates  
• Maintaining and examining historical logs  
• Performance data and exception reporting | • Security alarm / event reporting  
• Validation of User access rights and log verification  
• Identify security breaches & attempts  
• Security audit trail log analysis |
# INOC Systems Integration

## Manager of Managers (MoM)

### Network Management Suite
- Incident Management
- Security Management
- Configuration Management
- Service Impact Analysis
- Performance Management
- Systems Management
- Fault Management and Correlation

## Mobile Field Force Management
- Trouble Ticket Updates

## Customer Details – Event Enrichment
- Distribution Automation Events
- Substation Automation Events
- Meter Comms Fall Events
- Security Events
- Backhaul Comms Events
- Switching/Routing Events
- Events/Metrics

## GIS Info
- Network Fault Information

## Reporting/Performance Information
- Distribution
- Substation
- SMI
- Security
- Wireless
- IP/MPLS EMS
- Date Center

## GIS
- AM
- CIS
- OMS/DMS
- GIS

## BI/Information Centre
Benefits and Value of an INOC

The Utility OC operators and the business should realize the following benefits:

**Technical Benefits**
- Ability to Ping any Smart Grid and AMI infrastructure and network device at any time
- Ability to Ping a meter & verify a no-light call
- Ability to evaluate the entire circuit or feeder
- Provide the network operator with prediction validation
- Provide additional information for locating the faulted device and reduce MTTR
- Outage restoration verification
- Identification of potential nested outages
- Improved Network Operator System Visualization

**Operational and Business Benefits**
- Decreased time to resolution
- Increased up-time
- Reduced operational costs
- Lower customer care costs
- Improved customer satisfaction
## INOC in the Real World

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<tr>
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<tr>
<td>Karen Lefkowitz</td>
<td>Vice President, Business Transformation – Pepco Holdings Inc</td>
</tr>
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<td></td>
<td>• <strong>Responsible for the planning, design and implementation</strong> of PHI Smart Grid’s Advanced Metering Infrastructure program</td>
</tr>
<tr>
<td></td>
<td>• Other positions held during her 30 years with Pepco have been <strong>Director of System Operations</strong> and <strong>Director of Customer Relations</strong></td>
</tr>
<tr>
<td></td>
<td>• <strong>MBA from Marymount University</strong> and B.A. in Business from George Washington University</td>
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PHI Overview

• The PHI group’s principal activity is power delivery, consisting of transmission and distribution of electricity and the distribution of natural gas.

• PHI is headquartered in Washington, D.C.

• Approximately 1.9 million customers

• PHI's family of energy-related businesses includes:
  o **Pepco** is a regulated electric utility delivering electricity to more than 778,000 customers in Washington, D.C., and its Maryland suburbs.
  o **Delmarva Power (DPL)** is a regulated utility to approximately 498,000 electric delivery customers in Delaware and the Delmarva Peninsula and about 120,000 natural gas delivery customers in Delaware.
  o **Atlantic City Electric (ACE)** is a regulated electric utility delivering electricity to nearly 547,000 customers in southern New Jersey.
  o **Pepco Energy Services** is a leading provider of deregulated energy and energy-related services for residential, small business and large commercial customers.
Smart Grid Builds on the Communications and Information Infrastructure

Communications Infrastructure

Substation Automation

Feeder Automation

Advanced Metering Infrastructure

T&D Operations
- T&D Planning & Engineering
  - Systems Planning
  - Maintenance Mgmt
  - Asset Mgmt
- Distribution Management
  - GIS
  - OMS
  - MWM
- Customer Services
  - MDMS
  - CIS
  - Call Center
  - Billing

Power Procurement & Market Ops
- Planning & Forecasting
- Bidding & Scheduling
- Trading & Contracts
- Resource Dispatch
- Settlements

Enterprise Application & Data Integration
- Executive Dashboards
- 3rd Party Suppliers
- My Account

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PHI historically monitored various private telecommunications networks and systems from a variety of locations supported by various staff. This includes Corporate IT and Power Delivery communication systems and associated data networks.

The implementation of the Integrated Network Operations Centers (NOC) consolidates this monitoring activity into one organization, under one system. There are two NOC locations that will operate simultaneously or independently to provide 24x7 coverage for all regions. The equipment being monitored is expanding significantly. Control capability will be added.

PHI will develop the ability to monitor and control existing and new communications infrastructure assets in an effective and efficient manner.

- **Phase I** – Communication Infrastructure and AMI Head-End System SSN UIQ (up to Access Points and Relays)
- **Phase II** – Power Delivery (T&D) Infrastructure (excluding Facilities)
- **Phase III** – Corporate IT Systems
One Company - One Process – One System. There is an identified need to consolidate existing monitoring facilities

Monitoring all the planned network elements not possible with existing systems

Automatic Metering Infrastructure (AMI)

Efficiencies through joint planning, construction, and operation

Prepare for traditional SCADA being replaced with distributed intelligence

Decreased down time and root cause correlation (Improved reaction to storms, equipment failures, and outages).

- Consolidates existing monitoring facilities for reduced cost and improved coordination

- Creates the capability to manage incoming smart grid devices

- Improved outage information results in improved response results

- Increased network performance visibility

- Provide operational and change management support and redesign operational processes

- Two high availability Network Operation Centers

- Provides a platform enabling the effective support of legacy equipment
**PHI – NOC Systems Environment**

**NOC Environment**

**Northern Network Operations Center (NOC)**

- Shift driven operational hours
- Covers all regions
- High Availability Production Environment
- Office Design: Large Wall Mounted Displays; 24" desktop displays; Small Conference Table; Whiteboard Wall; Office space adjacent to System Operations; Whiteboard Wall

**Southern Network Operations Center (NOC)**

- Includes EMS Support Operations
- Shift driven operational hours
- Covers all regions
- Office Design: Same as Northern NOC
The PHI NOC Organization is a customer focused, innovative organization providing credible and responsive monitoring, analytical, and operational services to the business.

<table>
<thead>
<tr>
<th>Shift Supervisor</th>
<th>NOC Engineer</th>
<th>NOC IT</th>
<th>NOC Operator</th>
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<tbody>
<tr>
<td>The Shift Supervisor works weekdays and on-call, ensuring adequate staffing and emergency responses. Performs as a subject matter expert for the Operators of the NOC.</td>
<td>The NOC Engineer works weekdays and on-call to properly support the NOC Operators and the business customers.</td>
<td>The NOC IT analysts work weekdays and on-call to support NOC Operators; the Engineers; and business customers.</td>
<td>The NOC Operator works shift work to provide 24x7 operations.</td>
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<tr>
<td>The Shift Supervisor will have the knowledge of a NOC operator and the holistic view of the Engineer.</td>
<td>The NOC Engineer will have a detailed understanding of all aspects of the software used in the NOC.</td>
<td>Has detailed understanding of application configuration; optimization; and interfaces. Supports engineers in device integration and management.</td>
<td>Has an intimate knowledge of the monitored devices; interaction of IT and PD systems; diagnostics and troubleshooting.</td>
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NOC Considerations for PHI Telecom, IT and AMI Networks

• People
  • Training NOC staff on the tools, systems and procedures
  • Define the roles and responsibilities of NOC Staff
  • Ability to recruit and hire skilled resources for the NOC

• Process and Procedures
  • NERC Compliance
  • Establish a governance process
  • Modify (ITIL) processes to relate an event with IT or OT
  • Integrate existing PHI processes with the NOC

• Technology
  • Better Correlation and Root Cause Analysis
  • Ability to integrate with both IT and OT systems including key systems such as SCADA, OMS, EMS, DMS, Work Order Systems, Trouble Ticketing, Billing, and Customer Facing Applications
  • Improved SLA Monitoring
  • Visualization to assist in trouble resolution
Questions?
Thank You!

You will receive a link to download a copy of the slides to the email you used to register.

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