



# Network Element Access: The Evolution of System Management Techniques



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# Pre-NOC World

- Each operating company responsible for its own “mux room” operation
  - “Home” location for alarm masters
- Relied on Transmission Operations Dispatchers to monitor Telecommunications Systems
  - Some Masters not monitored during the day
- Service Impact was a relatively unknown term
  - Knowledge of MW outage impact localized

# Early NOC Operations

- **First Centralized operation at AEP began operation in the late 1980s**
  - Provided centralized monitoring of analog microwave and SCADA networks
  - Monday – Friday, 8 a.m. – 5 p.m.
- **Co-incident with centralized management of operating companies**
  - Delivered operating efficiencies
  - Improved response to events
- **Enabled staffing reductions at Operating Companies**
  - Centralized “watching” of alarms



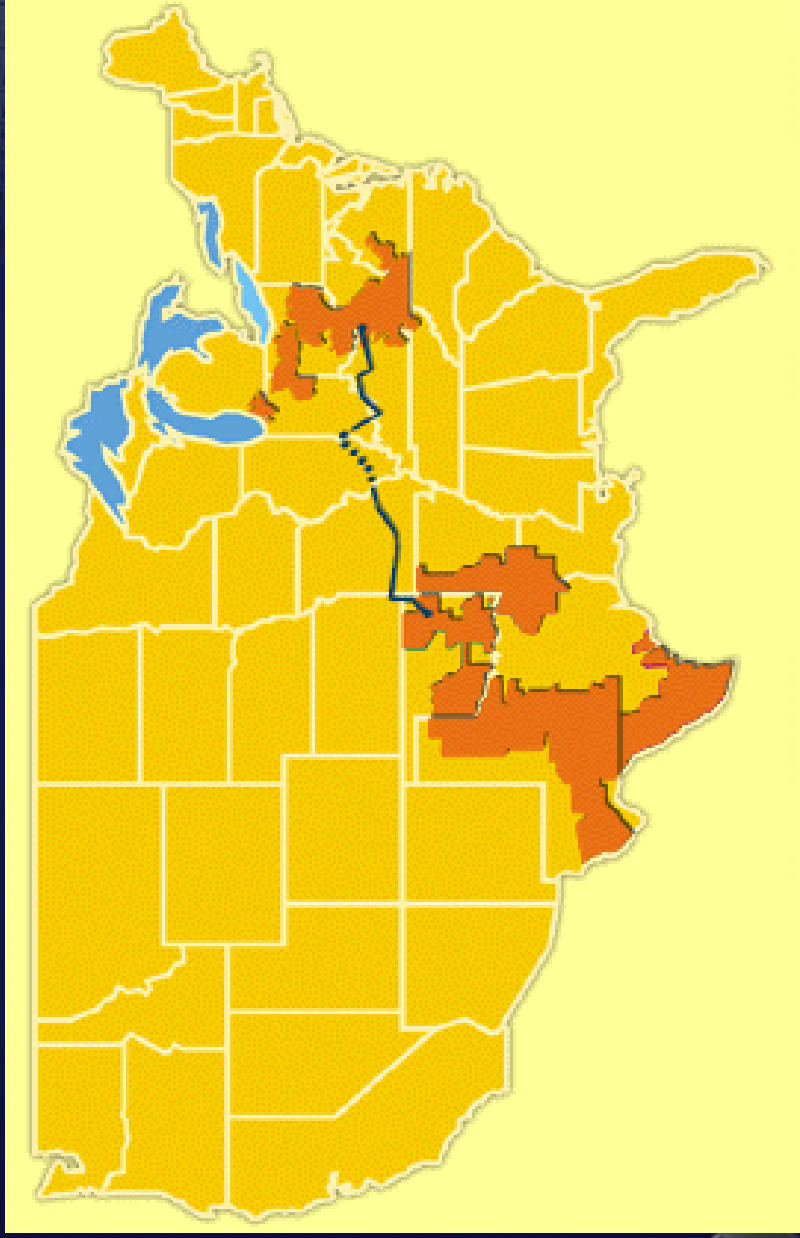
# Enter the “Digital Age”

- **Rollout of Digital Systems included requirement for centralized alarm aggregation**
  - Early fiberoptic systems used a “concentrator” approach for consolidating all alarms from network nodes
  - Nortel’s Netman, Alcatel’s ADM & STS150
- **Utility migration to trunked radio systems required some centralized system management**
  - Ericsson’s System Manager
- **Telephone networks interconnected with SS7-based signaling, allowing for Least Cost Routing**
  - Centralized, networked Voicemail systems
- **Routed data networks provisioned across MW & Fiber Networks**

# Utility NOCs - A New Phenomenon

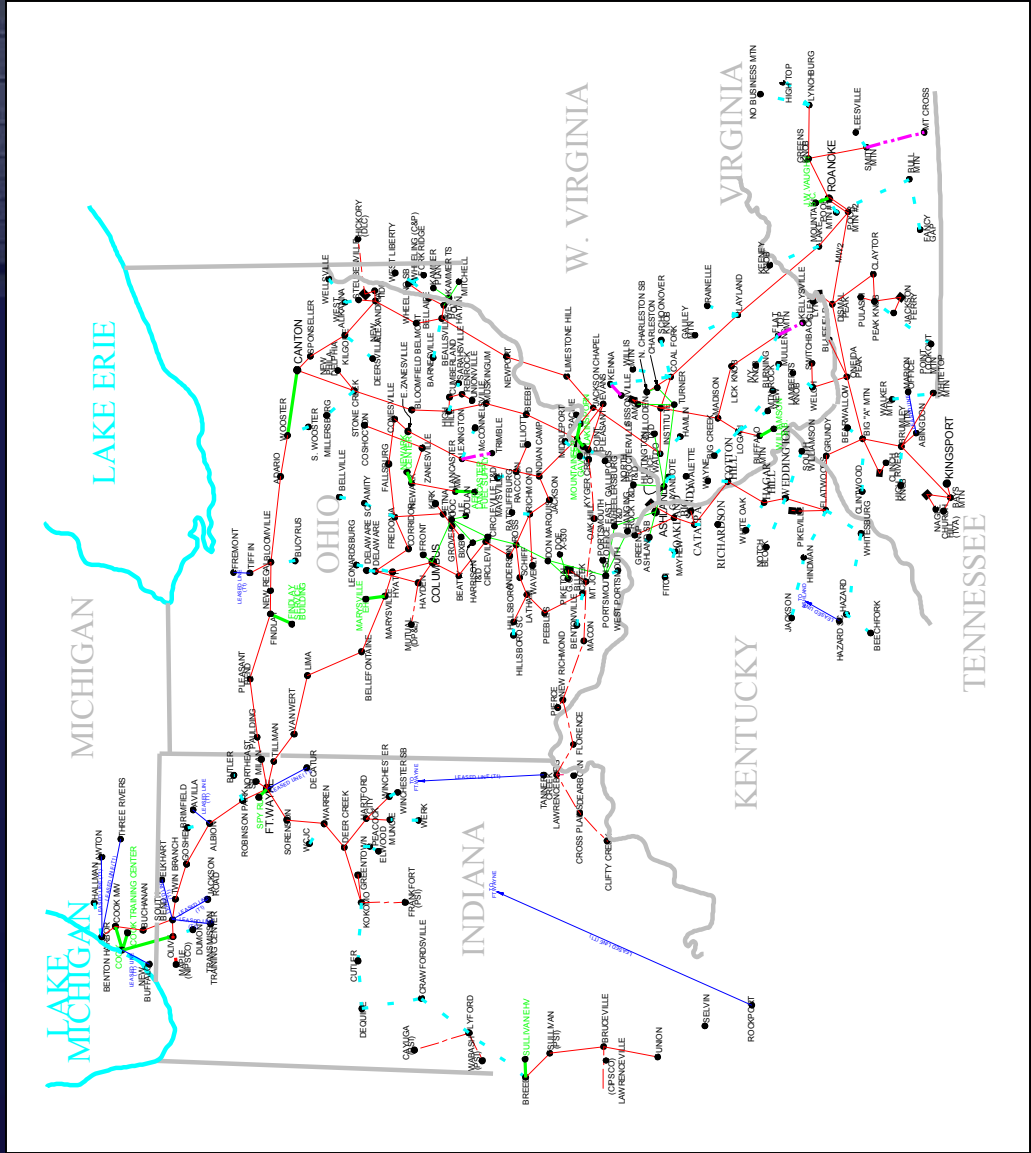
- **AEP's NOC established in its current form in 1995**
  - First began 7 x 24 operations
- **Response to many internal drivers**
  - Continued expansion of digital networks – Fiber, MW, Voice, Video, LAN/WAN, SCADA, 800 MHz radio
  - Development of UTELCO “Carrier’s Carrier” business
  - Exponential increase in number of provisioned circuits
  - Evolution of technology – elimination of many antiquated alarm systems
- **Advent of Service Level Agreements**
  - Internal “Customers” becoming more reliant on systems, looking to establish performance basis
  - UTELCO-required problem management and service provisioning processes

# Today's NOC has extensive reach



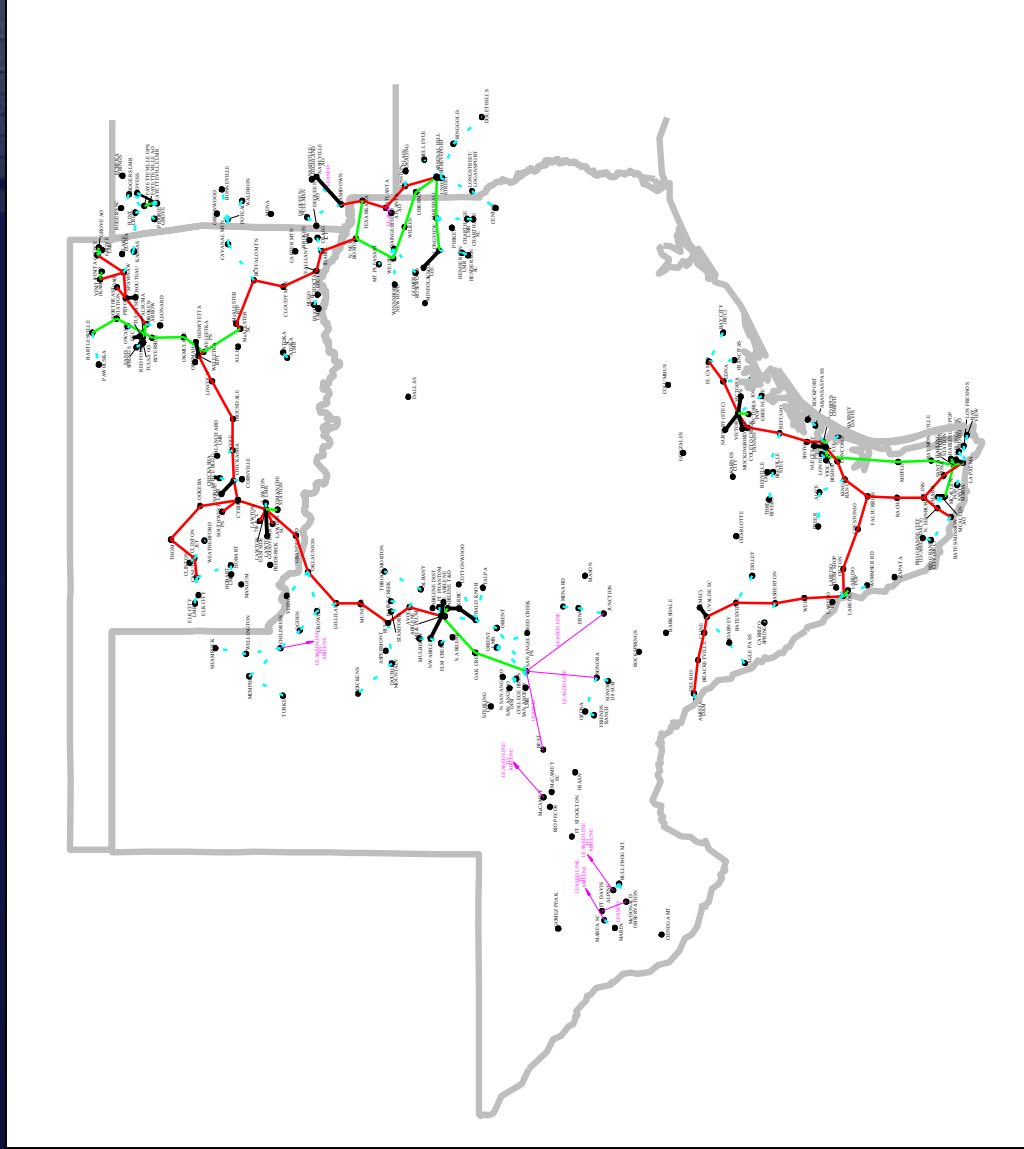
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# AEP's Eastern Network



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# AEP's Western Network



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# Today's NOC has large asset base

- **Fiber Optic Network**
  - 2000 High Density route Miles - 85,000 fiber miles
  - 120 Network Elements, OC-3 & above
- **Microwave Network**
  - 5600 Path Miles, 375 Paths in 11 States
- **40 Digital Cross Connect Systems**
- **Common Carrier Network (8,429 circuits) augments owned transport network**
  - Local, IXC, ISP Access
  - Point-to-point, Multi-drop private line
- **Telephone Network**
  - 33,312 Active stations; 14,000 voicemail subscribers, 495 locations
  - 315 PBX and Key Systems; 36 Voicemail systems
  - 192 Conferencing ports



# Today's NOC has large asset base

- **Video Conference Network**
  - 28 Locations (12 Public and 16 Private); Two 15-port bridges
- **LAN/WAN Network**
  - 46,500+ LAN Access Ports
  - 500 Locations interconnected with 56kbs to 45Mbps links
  - 11-node ATM Backbone
    - Interconnected with 45 Mbps to 155Mbps links
  - Four Internet Access points
    - Two full DS3, two burstable DS3
    - Two VPN head-end access points
  - Two Remote Dial-in Access Points
  - 1,422 Cisco network devices managed
- **SCADA Network**
  - 1570 RTUs (Remote Terminal Units), 1925 Data Modems
  - MAS (Multiple Address Radio System) - 43 Masters, 283 Remotes
  - 25 Circuit Concentration Points
  - 70+ Routers
  - 50+ LAN Segments



# Today's NOC – System Convergence

- **Four Optical Element Managers,**
  - Nortel Preside & Netman, Alcatel 1353 GEM, Alcatel FTS 150 & ADM50, Cisco CTM & CTC
- **Seven System Alarm Monitors**
  - Harris Netboss, HP Openview, Symon, DAQ, Cisco CTM, Nortel Netman, Stargate
- **Four legacy alarm systems**
  - Westronic WS2000, DAQ/Larse, Badger/MCS-11, Tetragenics
- **Ericsson EDACS Site Manager Terminal**
- **Other centralized tools**
  - Cisco WAN Manager, Momentum, Octel, Centest 650, Tellabs 5500 & 532, Sonet DCCS
- **Harris microwave division equipment**
  - DVM6-45, DVL, DVT, Megastar, Constellation microwave, DVA, CAU alarm units



# What to control & monitor?

- **Modern systems allow extensive array of remote monitoring & control capabilities**
  - Limited only by the imagination of engineers...and wallet size!!
- **Develop expertise in single system (e.g. Harris Netboss, Micromuse, NetCool)**
  - Buy/Build probes & interfaces
  - Allow definition of business rules for alarm response in one environment (e.g. “Critical”, “Major”, “Maintenance”, etc.)
- **Maintain literacy in “native tongue” of telecommunications systems**
  - Nortel’s Preside, Alcatel’s GEM, etc.
- **Determine “customer” tolerance for outage duration, frequency**
  - Develop SLAs with both internal and external customers

# Looking Forward

- Continued pressure for shorter response time to outages
  - Will place greater emphasis on NOC analysis and control capabilities
- Applications with ZERO TOLERANCE for outages
  - Better application and network management systems
  - Protected ring transport designs in environments previously overlooked
- Tighter integration between Application monitoring, computing & Telecommunications infrastructure control
- Greater focus on Disaster Recovery

