



Building the Statewide Public Safety Mobile Backhaul Network

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Aug 3, 2014



Agenda

- Introduction – Dave Christophe, Director, Alcatel-Lucent
- **PA-STARNet** - Robert Barnham, Chief, Radio Applications and Networks, Pennsylvania State Police, Statewide Radio Network Division
- **MO-MSHPNet** - Timothy Raymer, Networking Specialist, Information and Communications Technology Division, Missouri State Highway Patrol
- Summary - Dave
- Q&A - All



PA-STARNet

Robert Barnham

Chief, Radio Applications and Networks,
Pennsylvania State Police, Statewide Radio Network Division

Aug 3, 2014



PA-STARNet



Pennsylvania's Statewide Radio Network administered by the Statewide Radio Network Division within the Pennsylvania State Police Bureau of Communications and Information Services.

- Integrated Voice and Data, no control channel, TDMA
- MPLS Microwave Backhaul Network
- 97% Land area coverage, 98% Population Coverage

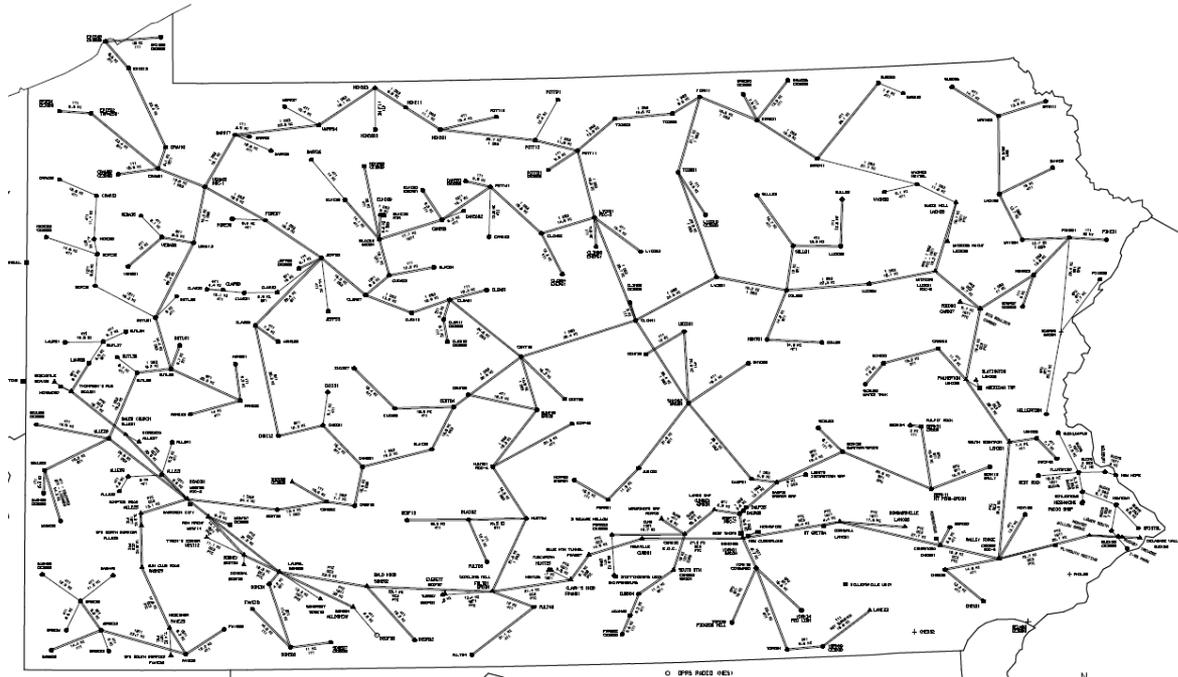


Backhaul Network

- Initially Deployed as a Linear Circuit Switched Network
- Nailed-up DS1s to every site
- Hot Standby Microwave Radios
- No Traffic Rerouting



Early Backhaul Network



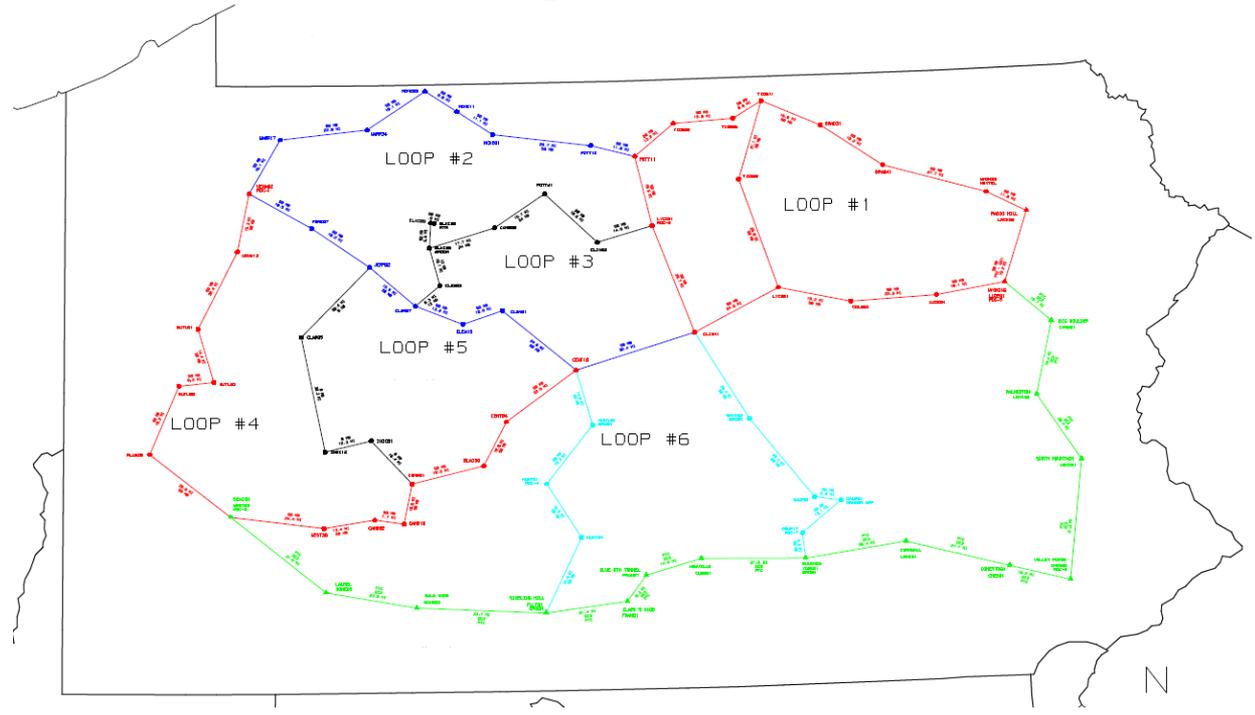


Backhaul Network Evolution

- Ethernet Microwave Radios
- Packet Switched Network
- Close Loops, Reduce Spurs, Automatically Reroute Traffic
- Overbuild Capacity (Broadband Middle Mile)
- MPLS
- Management of Multiple Services via 5620 SAM

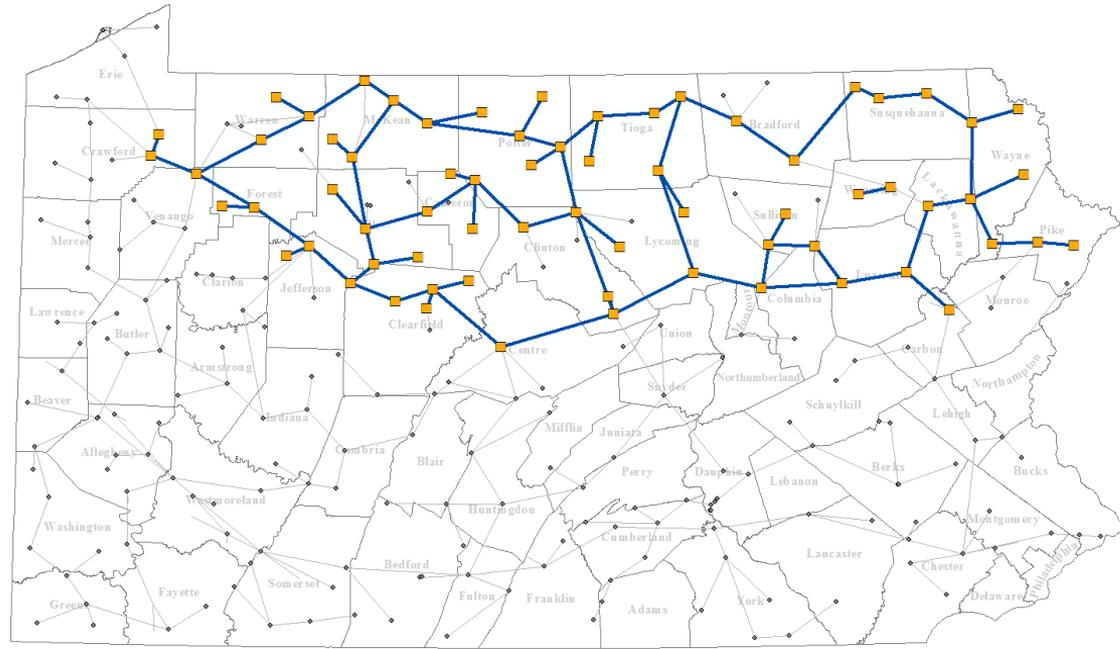


Loop Closure



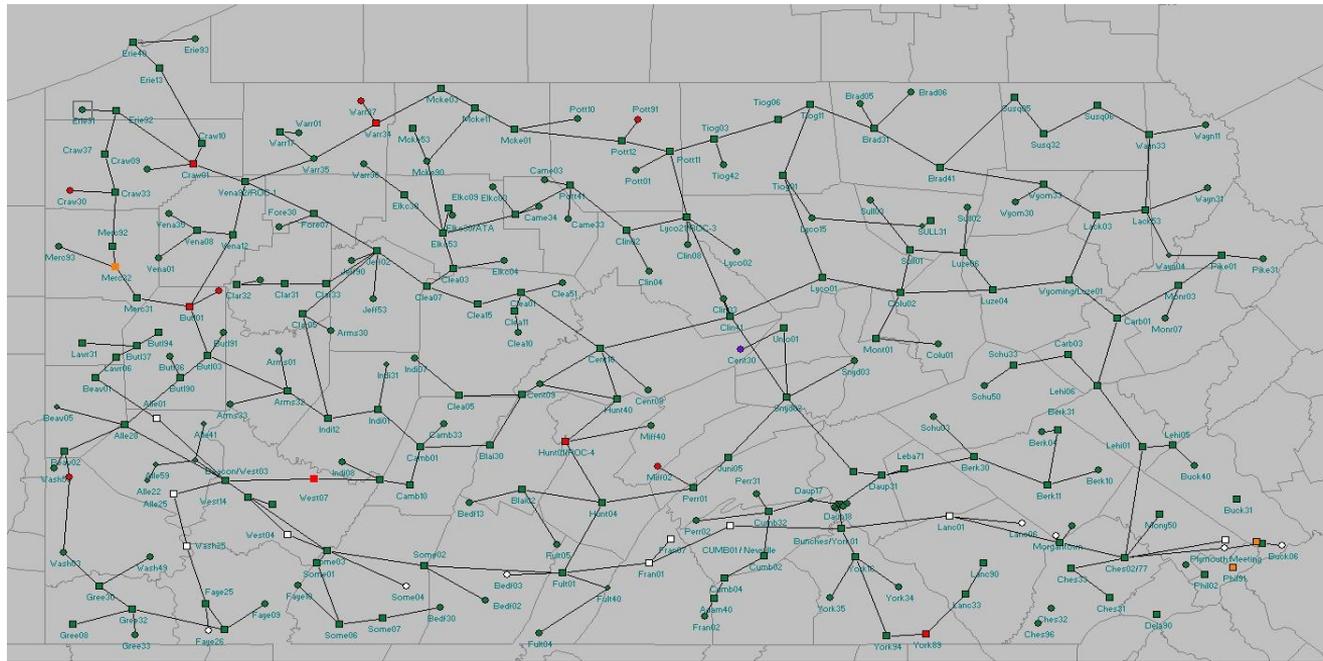


Broadband Middle Mile





Fault Management with TSM-8000

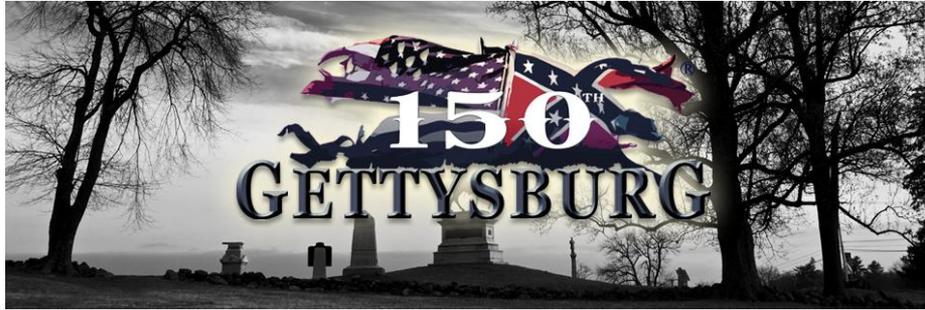




Applications

- OpenSky LMR
- P25 LMR
- Aviation Video Downlink
- Interoperability Overlays
- Broadband Middle Mile
- ESINet
- Network Transport

Success Story





Gettysburg 150th Anniversary

- Network Interoperability County-to-State
- Established Connection from County Dispatch to PA-STARNet
- Seamless Communications - Federal, State, and Local Agencies
- Aviation Video



Lessons Learned

- Box Redundancy vs. Redundant Boxes
- Network Interoperability and Software Revisions
- Radio Comfort Zone and Network Interoperability
- Information Superhighway on/off Ramps
- Need Governance and Agreements
- Self Induced Outages



Governance

- Public Safety Communications Council
- Management Directive
- Executive Order Draft
- Regional Taskforces
- Operations Committee



Future Challenges

- P25 LMR Technology Refresh Planning
- Network Interoperability
- ESINets and Next Generation 911
- Governance
- National Public Safety Broadband Network and LTE



Questions?





MO-MSHPNet

Timothy Raymer

Networking Specialist, Information and Communications
Technology Division, Missouri State Highway Patrol

Aug 3, 2014



MO-MSHPNet

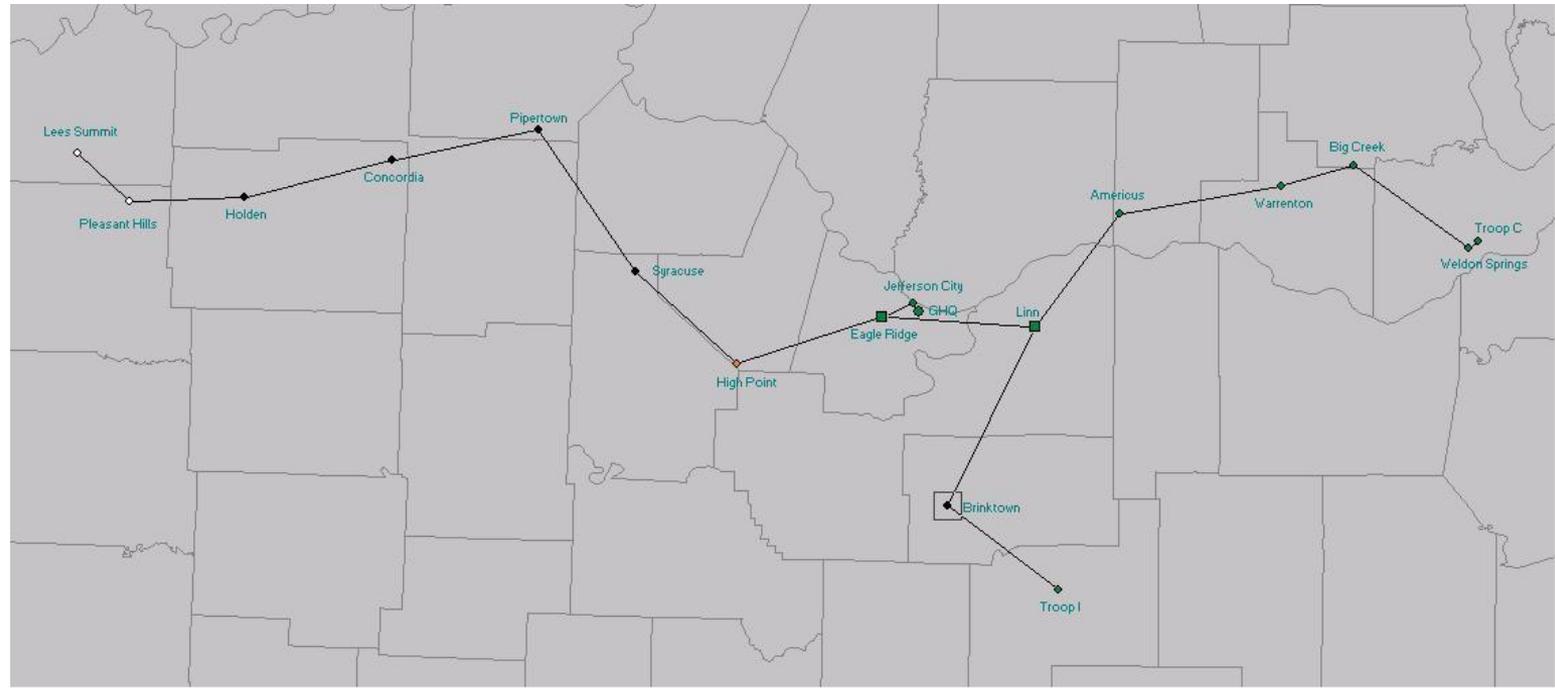


Missouri State Highway Patrol Microwave Network

- Information & Communications Technology Division of MSHP.
- 16 Sites. 14 tower sites, two structure mounted sites.
- Supports MSHP and MO Department of Public Safety.
- MPLS Microwave Backhaul Network.
- T-1 and Ethernet Transport.
- Backhaul for Statewide Radio Network (MOSWIN) sites.



MSHPNet Network Map





Deployment History

- Acquired Lattice and AT&T Microwave sites.
 - Vertical Real Estate investment.
 - Sites and paths aligned with MSHP long term goals.
- MDR-8000 Radios.
 - Hot Standby Microwave Transmitters.
 - Redundant (-10dBm) Receivers.
- T-1 Transport (E&M Channel Banks.)
- Initial system deployed to support Troop Relocation.
 - Limited but **Critical** Initial Use.



Deployment History (Continued)

- Upgraded to MDR-8000 Ethernet Microwave Radios for Ethernet/IP Packet traffic transport.
- Added Alcatel-Lucent 7705 Routers with MPLS, Ethernet, and TDM interfaces. All traffic on Single IP transport network.
- Spatially Diverse Receivers.
- MPLS and QoS provisioning.
- **In-Service System Upgrade (ISSU) Reconfiguration.**
- Expanded to East/West Statewide coverage.
- Southern Leg established to pickup 2 RF Sites and Troop HQ.



Current Network Usage

- Troop data connectivity.
 - 10Mb/s-30Mb/s data rate.
 - VoIP, video conferencing, business data.
- Zone-to-Zone Radio System data backhaul.
- Ethernet backhaul for MOSWIN RF Site connectivity.
- Ethernet backhaul for Site Security.
- Dispatch Console data connectivity.
- Backhaul for legacy Low Band VHF connectivity.
- Adding Sites to extend to problem T-1 sites and MSHP facilities.



Site Security and Access

Not all thieves are what they seem...

Site Intruder?





Site Security and Access

**Site Access Continues to be a
problem for MSHP Staff...**



You want to go where?





Lessons Learned

- Acceptance by traditional Information Technology Shops.
 - It is often a “Challenge.”
- Inherent bandwidth limitations of long-haul Microwave Bands.
 - 150Mb/s can constrict backbone segments.
- You become your own Carrier and Service Provider.
 - Operations
 - Maintenance
 - Spares
- Maintenance is a non-trivial ongoing cost.
- Need steady funding sources.



Lessons Learned (Continued)

- System Management and Monitoring.
 - Use the best tools you have access to.
 - Use the strength of each tool to the maximum.
 - Use the strengths of your staff to the maximum.
- Spares Management
 - Have enough spares to bring multiple sites back before FedEx/UPS can show up.
 - Use maintenance programs provided by vendors to limit initial investment in spares.
- Integrated Systems
 - Radios and Routers from one vendor.
 - “Radio Issue” turned out to be a Router configuration Issue.



Lessons Learned (Continued)

- Long-Haul Microwave systems will show errors.
 - This is how systems with diversity know to do their job.
- Invest in training for your staff.
 - Invest in them. You are investing in your system.
- Test Equipment.
 - Expensive.
 - Have to have it.
 - Need to know how to use it.
- Run teams whenever you can.
 - Knowledge transfer, mistake avoidance, **SAFETY**.

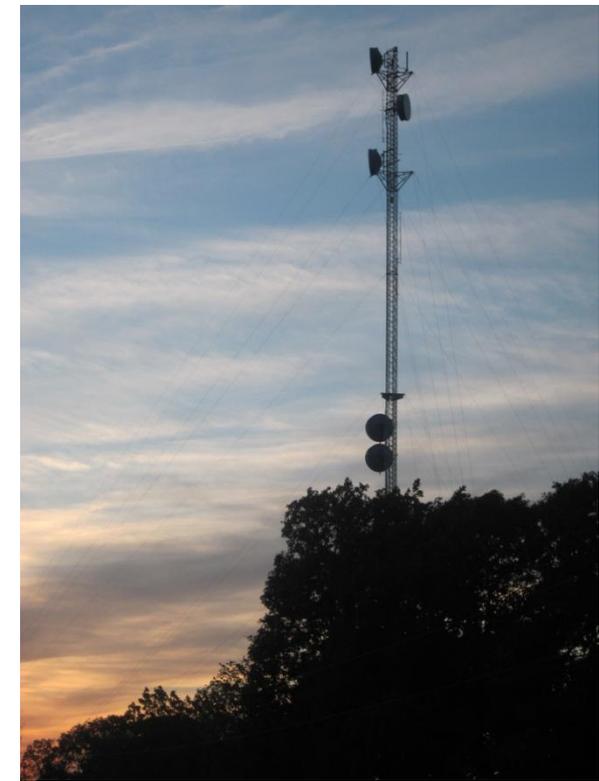


Future Challenges

- “Hybrid Networking”
 - Integrating Microwave and broadband with Carrier-Class MPLS Networking Equipment.
 - You are still the service provider. You just have multiple carriers.
- Network Redundancy.
 - Diminishing returns on expenditures.
- Integration with traditional IT infrastructure of Agencies.
- Training.
- Ongoing operational funding sources.
- FirstNet Connectivity.



**Questions?
Comments?
Thank You!**



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Summary

- Backhaul evolving to a converged IP/MPLS and microwave packet radio network – with opportunities to enhance availability and simplify management
- Important foundation for: greater interoperability, growing number of applications, future Public Safety LTE, ...
- Requires development of multi-agency governance which enhances teamwork with a framework to accelerate Public Safety LTE



Questions?



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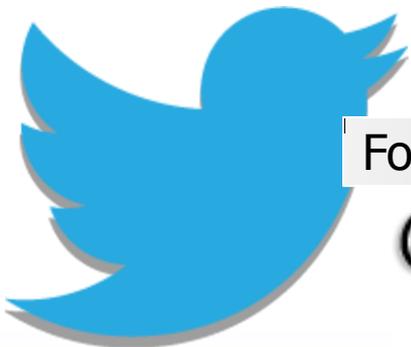
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