

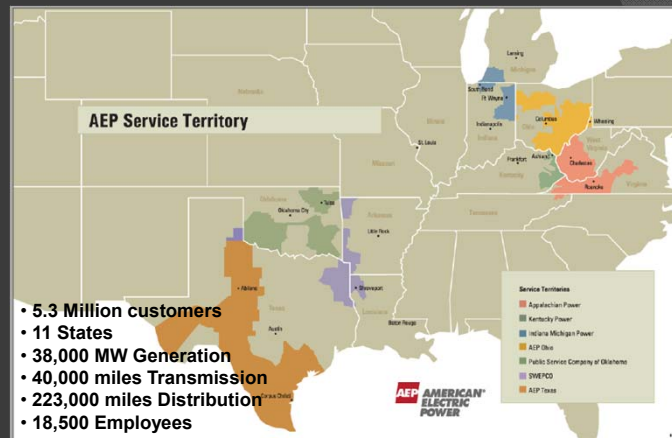
UTILITY TELECOMMUNICATIONS SYSTEMS

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Agenda

- Introduction
- Overview of American Electric Power
- Overview of utility telecom systems
- In depth discussion about utilities' critical data applications
- Importance of utilities' critical data applications having priority access
- Guaranteed bandwidth vs. prioritization

AEP System



How Do Utilities Use Telecommunications Systems?

- Millions of times per day utilities' telecommunications systems around the world operate to prevent injury or loss of life, and to protect property of the electric utility, personal residences and the general public
- Utilities use telecommunication systems for many applications every day and many of these telecommunication applications are not critical. However, some applications are extremely critical to the utility and to the general public

How Do Utilities Use Telecommunications Systems?

- Teleprotection
- Synchrophasors
- SCADA (Transmission)
- SCADA (Distribution)
- SCADA (Generation)
- SCADA (Gas Operations)
- Land Mobile Radio
- Metering
- Downline Distribution Automation
- Distributed Generation
- Mobile Data
- Demand Response
- Substation Voice
- Substation Video

Critical Data Applications for Utilities

- What applications are critical?
 - Land Mobile Radio (not in scope of FirstNet network)
 - Distribution Automation (DA)
 - Distributed Generation
 - Mobile Data
 - Supervisory Control and Data Acquisition
 - Synchrophasors
 - Teleprotection

Critical Data Applications for Utilities

- Land Mobile Radio and Mobile Data – Voice and data telecommunications between field personnel and from field personnel to system operations.
- Distribution Automation (DA) – Remote monitoring and control of electrical equipment typically located down-line from a distribution substation
- Distributed Generation – Monitoring and control of distributed generation such as solar, wind, industrial generators, and electrical vehicle equipment

Critical Data Applications for Utilities

- Supervisory Control and Data Acquisition (SCADA) systems monitor and control the electrical grid and protect equipment, public property and people, and to reliably provide electricity to society.
- Synchrophasors provide real-time measurement of electrical parameters across the power system to assist with electric grid stability
- Teleprotection uses telecommunications to notify a device, called a relay, that a fault or problem on the powerline has occurred and the relay immediately takes that line or piece of equipment out of service before excessive damage to equipment or to a person occurs.

Critical Data Applications for Utilities



Critical Data Applications for Utilities



Critical Data Applications for Utilities

- The data that is transmitted over these types of telecommunications systems is extremely critical to the protection of people and property.
- Failures of these telecommunications systems can result in fires, explosions, electrocutions and can damage not only electrical equipment and personnel, but also public property and can cause injury or death to the general public. Examples of failures of these telecommunications systems can be seen in the above photos.

Critical Data Applications for Utilities

- Utilities DO NOT have access to dedicated spectrum and must compete with industrial business users such as taxi companies, cement delivery companies, etc., to run the critical telecommunications networks the electric power system uses.
- It is paramount that utilities have access to priority access and spectrum for these critical systems

Critical Data Applications for Utilities

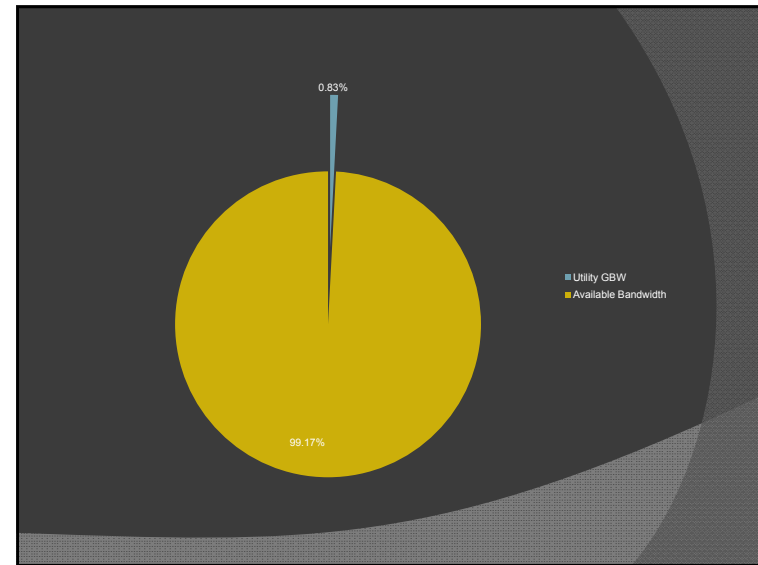
The bandwidth requirements for these systems are not high by today's broadband standards and could easily co-exist with other critical data applications for which public safety would use the Public Safety Broadband (PSBN) network.

Guaranteed Bandwidth vs. Prioritization

- Utilities would prefer a minimum guaranteed bandwidth
- Collectively for all electric utilities, on a per sector basis, a guaranteed bandwidth of 250 kbps would be adequate to allow these critical teleprotection and SCADA applications to operate.
- This is less than 1% of the bandwidth that will be available on one eNodeB LTE sector which typically has a capacity of at least 30,000 kbps!

Guaranteed Bandwidth vs. Prioritization

Application	Minimum Data Rate (kbps) and Its Percentage of the Cell Capacity (30,000 kbps)							
	Dense Urban		Urban		Suburban		Rural	
	Data Rate	%	Data Rate	%	Data Rate	%	Data Rate	%
DA IEDs	29	0.10%	43	0.14%	241	0.80%	361	1.20%
DLR IEDs	4	0.01%	7	0.02%	72	0.24%	217	0.72%
IG, DS, EVCS, IEDs	29	0.10%	54	0.18%	361	1.20%	759	2.53%
SCADA (Transmission)	72	0.24%	72	0.24%	271	0.90%	452	1.51%
SCADA (Distribution)	54	0.18%	81	0.27%	361	1.20%	406	1.36%
SCADA (Gas Operations)	4	0.01%	4	0.01%	27	0.09%	7	0.02%
Mobile Workforce Push-to-Talk Voice	151	0.50%	151	0.50%	99	0.30%	60	0.20%
Mobile Workforce - conversational voice	482	1.61%	482	1.61%	331	1.10%	271	0.90%
Mobile Workforce - Data	412	1.37%	412	1.37%	247	0.82%	165	0.55%
Mobile Workforce - Live video	550	1.84%	550	1.84%	550	1.84%	550	1.84%
Synchrophasers	302	1.01%	302	1.01%	755	2.52%	1511	5.04%
Substation Voice	211	0.70%	211	0.70%	421	1.41%	542	1.81%
Substation Data	99	0.33%	99	0.33%	363	1.21%	511	1.70%
AMI	7	0.02%	9	0.03%	145	0.48%	233	0.78%
Demand Response	12	0.04%	14	0.05%	226	0.75%	363	1.21%
CTV	1,100	3.67%	1,238	4.13%	3,715	12.38%	4,266	14.22%



Guaranteed Bandwidth vs. Prioritization

- These telecommunications systems need to be in place and operational before hazards occur and cannot be done on an ad hoc basis when the accident or disaster occurs.
- While many utility applications, such as meter reading, are not critical and would not require priority access on the FirstNet network, the critical applications mentioned above clearly fall into the definition of public safety which is “to protect the welfare of the general public”. These applications should be considered priority access on the FirstNet Network.

PSBN Construction & Sustainability

- If allowed priority access to PSBN for critical applications, utilities would bring resources and funding into the initial construction of the PSBN network. This contribution could be in the form of infrastructure sharing and/or Capital funding, as well as being strong anchor users of the PSBN network.
- By utilities having access to the PSBN for critical applications, other utility non-critical applications could also be users of the PSBN on a secondary basis.

PSBN Construction & Sustainability

- Utilities use telecommunications systems for a wide range of applications that are not considered critical. One such application is Advanced Metering Infrastructure (AMI). This is two way metering to allow for communication between the electric utility and the end user. There are over 50 Million smart electric meters currently in the United States. While user fees for applications such as AMI needs to be very low and the data requirements are very low, a \$1 per month charge per meter would result in over \$50 million per month in user fees to the PSBN for meters alone.

Conclusion

- Utilities would make excellent partners and users on the PSBN and could help provide sustainability for the PSBN
- Utilities have a wide variety of applications which require telecommunications and only a few of these applications are critical. These applications prevent injury or loss of life, and protect the property of the electric utility and the general public

