NextGrid
Illinois

Working Group 2: Metering, Communications, and Data

Meeting No. 3 *"Communications of the Structure" Part 1 of 2*

April 13, 2018

Meeting Summary

[Note: descriptions of presentations and discussion are condensed summaries and paraphrases]

NextGrid Working Group 2 Leader: Matthew Olson, assisted by Chris Raider

Agenda Item 1: Chapter Writing Process
- Goal is to publish draft chapter by June 14, 2018
  - WGMs should address opportunities/challenges that exist/ things that need further consideration/ identify cross cutting issues with other working groups
  - When adding comments- highlight text, identify name as editor
  - If you want to make a comment feel free and we will make sure those comments are addressed.

Agenda Item II: ComEd, Current State Overview
Presentation by, Carol Bartucci, CIO of ComEd and VP of Digital Grid in Exelon Utilities IT

- *See presentation*

ComEd Current Communications Systems:

- Field devices, greater than 10,000- only going to get larger
- 2045 WiMax radios (Tier 2)
- 500 routers
- 100 fire walls
- 18,000 miles of fiber, 12,000 square miles
- 23 microwave assets
- *What are the risks/ implications associated with ComEd talking to outside assets?*
  - Security is a building block into our infrastructure
  - Would like to minimize the number of devices, so we've worked hard to build standards to minimize security issues.
  - Current model, provides flexibility to add devices as needed.
  - Work very hard to build out standards, re-use technology as much as possible.
- *Three Tier Wan Communication Model:*
- Work to the left- telecommunications device
- Tiers:

- Tier 1- Fiber backbone= core of the network
  - Fiber is critical to get the data where its need to be – very secure, fast- our first option- as needed to use other components (Tier 2)
- Tier 2 – middle ground, medium speed
- Tier 3 – slower speed, is unlicensed, but some other tier technologies are licensed.
  - Silver Spring Network is unlicensed
- All come with security capabilities, plus additional capabilities
- Future needs- are great, need more bandwidth, need more devices, want more grid awareness, want to run more effectively, more efficiently, DER, going to be putting a lot of DER on our network and we need to talk to it. Do we need DERS to be able to talk to each other? How are we going to make that happen?
- Communication networks will need to be able to connect. How will we connect all these components? With the data side- what are we going to do with all that data- what is the end result?
- Goal is to be able to connect anything that is build out, securely.
- As ComEd is working to build communication strategy- heavily dependent on a fiber backbone. With extensive needs of the future, lots of wireless technologies can be placed where fiber can't go- what will that look like in the future?
- We want to move communications from public (carries) to private
- ComEd owns a majority of the communications- they have private communication systems. Strategy is privately owned.

Discussion Questions:

- *What is the benefit of being privately owned?*
  - More secure when own all end points, can control what can get into it, can fix our infrastructure faster, when you own it you control it and are not dependent on third parties.
  - Resiliency falls into it, can build in redundancy as well because I control it.
- *What kind of redundancy do you have for the FP network?*
  - Fully redundant. Some spurs for non-critical assets.
  - Another advantage is synergies- ComEd has rights of ways between key point on the system- may not be able to put other carriers on the rights of way right away
  - Other more non-technical solution- if loose visibility, dispatch a crew in a certain amount of time. Also keep track of our dispatching crews' availability.
- *Is there a tier base communication*?
  - Higher level, lower level of information- optic fiber has huge amounts of bandwidth- if you have a fiber ring the whole frame is redundant- if we need the bandwidth in the redundant setting- we built it in- the way the ring works- 1 cut have redundancy- have 2 cuts depends where it happens. (Double cuts are very rare)
- *Does ComEd share its network with anyone?*
- We do have some old contacts where people leased fiber. The assets are all ComEd.

Agenda Item III: Ameren, Current State Overview:
Presentation by Kirby Diller, Consulting Engineer, Ameren IT

- *See presentation*
- In such a high rate of change, looking at where we will go- from physically reading the meter to AMI meter reading system- intention is to move to AMI for meter reading.
    - AMI system - been working on this since 2014. Currently 65% complete. Expect system to be 100% complete by the end of 2019 (electric & gas)
    - Provides 802.15 4G capable
- Pushing for interoperability
- IntelliGrid - moving away from digital microwave - moving towards private fiber optic network across territory
- Goal: Link all assets, even the rural area
- Try our best to limit Spurs - minimize with digital microwave
- Ring within the microwave system - will retire as fiber becomes available
- Bringing up a private LTE system - reduces our reliance in carriers (3rd party) improves reliability - restore service to our own areas and controls our cost. Trying to reduce Operational & Maintenance spending, even if it cost capitol dollars.
- "Hub and Spoke" - working Nokia and AT&T but owned/operated/maintained by Ameren
- Microgrid - we have 120kilowatt solar, wind, natural gas & storage in the Champaign, run in partnership with the University of Illinois, Urbana-Champaign.
- Internal portfolio is using mesh technology -900 MHz (unlicensed) spread spectrum - Intelligent SCADA - using MAS backhaul mesh network
- Trying to eliminate leaded line tech
- AMI network is Lanis & Geir (L&G) - migrating RFIP-802 compliant network
- Ameren is working to convert to a fiber optic network (private). Previously microwave network. Taking advantage of new transmission projects in IL,- and recounter the static line. Adding new fiber to power line and transmission themselves, lowering O & M and puts into capital expenditure.
- AMI network - Backhaul is cellular network - want off- want to move to private LTE network.
- Security of network- getting off public carrier network- we become the "maters of own destiny" for operation and security. Less at risk for outside hack, it's our network, we can control access limits.
    - Can segment out AMI mesh network- know by segment, what you can do with portions of that network. Ex: AMI network can't handle video
    - Have a portfolio of services for customers to match needs up with capabilities.
- Private LTE uses cases:
    - FAN DA Network Backhaul (under construction)
    - Transmission substation backhaul (slide)
    - SMART street light project starting later this year (HD Cameras, Shotspotter, Light Control), East Saint Louis

Discussion Questions:

- *What is network streaming video*? - currently private LTE, considering doing on AMI network- using camera goes out the window- shotspotter can still work- AMI network can hold low band width. Anything goes on AMI- need to tolerate latency
- *Would Ameren sell as a serve the shopspotter that could leverage the AMI network/ communication channel?*
    - o Pilots- yes, can do the technology
    - o If not a regulated business model, in 5 years possibly
    - o Becomes a use case for system level capabilities
    - o Pole monitoring- need to understand how we can move data
    - o Not an earnings driver – cost off setter.
    - o 200K Baud or below on the AMI network
    - o Has to be able to tolerate low latency and low bandwidth
- *Would we offer up the network we're building for private, to third parties, where do we stand with letting water meters on it, and trash sensors on the network?*
    - o If we lower cost for our customers then yes, but they invested in the network so, everyone needs to get benefit from it.
    - o Legal limits are complex involve statutory considerations relating to right in the land where the equipment is installed, may be a distinction for using that network for other regulated services
    - o Primary use will always be for company uses. When we migrate to newer technologies, we set priorities for own traffic.
    - o We do not put any control systems on any public networks - not a requirement or regulation - this is from Ameren and our choice on security
- Whole purpose of this is to speak to the regulators about what we see- from business aspect, and regulatory aspect, what needs to be supported.
    - o Indiana- government is willing to incent public broadband- do we go in and amend those rights?
- PUA prohibits the utility from offering bandwidth for sale for outside agencies- yes. Regulation says utilities currently are not allowed to offer as outside services. Utility would need to register as a different kind of entity. Southern Company has broken apart their company- to Southern Link- they can sell services as communications company.
- *What about the concept of maybe a business puts in their OWN microgrid, have you considered ways to incentives people for doing that, benefit for acting on the system? (private microgrid)*
    - o IEEE is working on a communications standard to bring DERs information across a network. Part of our Champagne Microgrid - it to see how this would work. Systems/relay protections - voltage swings both concerns. Ameren started our own Microgrid to try to understand what that's going to look like. Don't have a good answer.
- Done a lot of work to evaluate DERs on our network - 2016 regulation to make utilities to interconnect - we're looking at ways to do it - we don't have a program or pilot in place if someone wanted to bring a DER onto the grid and let them get some value.

- *There is no standardized approach - the customer can't interconnect?*
  - Customers can interconnect - their ability to monetize it is the issues and we need to be able to monitor the flow of energy - this is where the IEEE is struggling to figure out a standard.
- ComEd agreed to pilot the interconnection - to see if it's feasible (feasibility test)
- *Within the regulatory framework - 5/10 years out, what assets are you looking to monetize?*
  - We're talking "stages of development" we're trying to figure out the technical place. We have yet to fully island a section of our service territory. We just got the green light to put in street lights. Now that we have these up we're in active conversations with municipalities to figure out "what would be a value to you". We're still learning, Illinois in the "smart cites context" we're looking to figure out what is the extension that utilities can provide. The monetization is premature at this point.
- *From the technology perspective - we don't' know what we have to build to accommodate. I want to build for the future - what's the big solution to serve all of our needs?*
  - You're saying for the future, since I've done EV work - if demand for electricity triples in the next decade - which It could - we'll need an Uber approach to manage demand - seems like that would be facilitated at the end node - that communicates the usage schedule "communications gate way" - some control on adding/subtracting.

Agenda Item III. Communications Discussion
Working Group Leader, Matt Olson.
- Recap point- FRAME OF MIND for these questions - Let's try to think 10 years out - in terms of what we're doing with the grid - lots of devices behind the meter the utility doesn't own (solar, batteries fixed storage- Powerwall, transportation solutions in vehicles that are moving for example). Have a dynamic power flow on the gird- distribution heaters to solar collector buses. There are GOV'T incentives for solar, there is rapid growth. Think about operational needs- how do we change to deal with phantom sources, observe them indirectly? Think about the Safety concerns when we think their protective relay devices are not protecting them? Think protection settings, could change with microgrids.

Q1: Common Carriers vs. Private Utility Networks, what is needed?

- *Headed towards private, is there any place where public still makes sense?*
- Comment: Carriers will continue to retire services like coper in the ground and to move to S&P. Utilities need time, have runway to retire. Usually getting 6 months' notice, would like 18months – 3 years. Need years depending on the circuits. Would like to be less dependent on carriers but will need circuits in some places.
- One value of private is the control of the asset lifecycle- helps to replace asset-Looking at lifecycles – 7 years, 4G-5G-4 years, have not gotten all 2G modems off the system- need to be able to extract all the value off the system because utility is a minority user- utility has no voice with the carriers. Public carrier they're on an accelerated pace, they're looking at 5-year

lifecycles and shortening. If we're making an investment when we're tied to a public system - we may not be able to extract all the value.

- Utilities are a minority user - we have no voice with the carriers - from a hardening prospective - AT&T are not hardening FirstNet, so why would they for the utilities, that's why I say controlling our destiny. We need financial system, and legislative environment that will allow us to be profitable. We're not a co-op, we're owned by our shareholders, we need a business case to buy the spectrum - and we need the legislative environment and financial environment that lets us get there.
- Spectrum component- if utilities are outpriced immediately.
- Cell phone example- service level agreement- give you some of your bill back for time you are out of service. Carriers drive a HUGE amount a revenue off what they're selling. What we struggle saying to regulators is 'we have certain things if you want this to work'. We can't go out and buy what we want/need from the common carriers.
- *We're talking about leveraging the communications network - what about licensing parts of the network for other utility needs- water/gas*? To offset some of the costs- not seen as another utility, see as another customer.
- You're combing a technical question with an end result - the technical question literally having someone on our network I leave to the tech experts lots of security concerns - what would that look like? On the other hand, states across the US in other regulated utilities, is there opportunity to find certain efficiencies and other water/gas companies? Do you need 5 to 10 data networks in the state? Then you're more in a services questions. Can customers come out ahead if you're not having to pay for 5 different networks? Start to ask a different question- can you figure out a model where customers are not paying for inefficient investments. Utilities need to get creative with other utilities and municipalities. In Il, have room for a lot of creative arrangements.
- Technically is possible - The biggest question isn't can/can't we - but are we portioning the network correctly - and ensure people are paying for their access?
- Regulatory- unclear- how do we appropriately apportion the benefit of the network? How have other states dealt with this?
- Is there a way to utilize or leverage those networks?
- Until utilities become a priority customer- wont leverage common carrier
- Does 5G affect this?
- 5 G- all about increasing bandwidth and decreasing latency- increasing frequencies up so we can get really wide channels. Talking about going hundreds of feet. Same LTE protocols in 4G.
- You have to be presence aware of anyone in the same spectrum - I don't say it eliminates it but it clouds it.
- First comment - for the report it's worthwhile to say some of the tradeoffs public vs. private- three are more than a handful of utilities that utilize other carriers (cost, maintains, upgrades). Second - What's the plan to allowing those assets to communicate (cars and stuff) 2030.5? What are the utilities plans for what the customers are investing?

- Ameren is looking at 2030.5 (IEEE) is how they hope to get their standard for asset communication.
- One of the architectural questions we need to address - how is a smart inverter sending the info being sent back so it can be monetized or billed correctly - how is going to GET to the utility if they don't use the AMI network?
- If we're controlling these devices - this needs to be in the same network - latency issues if you don't. Real time control - that's a lot of infrastructure - we're going to have to evolve to a scenario that is decentralized. I think we have to talk to these, and we need to talk about how we're going to do it, and how we get those onto the network. If you buy something at Home Depot, how do you connect? Common Carrier has solved this problem easily - look at cell phone, and it happens within seconds.
- Generally, utilities uncomfortable with non-asset communication with their network.
- Enlarge the scope- *to ask what kind of policy changes we may need to effectuate some of the changes we are talking about. If we are constrained by existing policies- we need to identify policy changes so they can be changed- Evs are coming, the use of these networks is going to be much more extensive. ID what policy initiatives are needed? (question for next meeting)*
- Bandwidth growth- have to integrate these smart inverters, look at reliability issues large solar issues have cause- resulting from monitoring- going to need bandwidth- how long does it take to build these bandwidths—Matt Answer- spectrum/ nodes. Spectrum is not a market- auctions held every few year- fiber has a long-life cycle compared to other technologies.
- Is there a technology bar? bridging the transformer gap = a challenge.
- Who has access to the network? If state is going to be directly investing, how do we coordinate?

Question 2: Who has access to the network? Can public and safety agencies and first responders access the network?
- *Who should have access to the network? Only utilities? Should first responders have access? Maybe this is a telecom problem not utility problem?*
- *Physical access to the network, IT system, being able to do x,y,x multiplies the cost? Why does the first responders need physical access? At what point in the system? Is it the information, timely access?*
- It is a prioritization issue.
- There is a robust history in municipality/government/utility working each other.
   - Extract this question and change it.
- Maybe this is a telecom problem not a utility problem - the amount of complexity and extra investment seems huge.
- The access to the network, to the IT system multiplies the security. My question is WHY does safety/first responder, need physical access, if what we're really trying to do with the timeliness, do we have to burden everyone - I think it's a delicate balance. Utilities consider themselves first responders.
- Need sharper definition of access to the network and what use of that bandwidth entails. First responders do not need administrative access to the network.

- What are the uses cases for first responders?
- Fiber is a great use case - if we're allowed to put up fiber cable and its part of a project where there is cost - maybe it's low - dollars per/foot - adding fiber is costing us pennies per food - form societal benefit it's the lowest cost way to get out there. But if build fiber to counties radio tower, to talk to something. Do we allow them to get access to two strands, to a regulatory issue are we allowed to sell to a 3rd party?
- When you talk about them USING the network - subject to another entity - where you must decide if you're trying to remove old fiber that a responder is using ?
- Clarifying question - When you say "use case" what you referring to?
- When we build a network, we're building for the purpose it's being built, and that's the Use Case If you're going to make the pipe bigger, it adds cost and we need to justify it. If you want to add a use case to it, that's fine we need to build it for that. That becomes an "excess capacity question".
- Public safety use case examples: We have a program to put cameras in critical substation, that's a fiber use, if we don't' have it, we have to pull fiber for that.
- First responder receives information about whether feeder is live or not, for crime, fire, healthcare

Question 3: How is the network secured? How is access controlled? Is the network connected to the internet?
- Much segmentation between networks
  - real-time network (OT)
    1. not connected to internet
  - Business network (IT)
    1. Connect to internet
  - What about IoT / DER?
    - E.g. EV charging
      1. One-way information required for EV to receive information
      2. What are the options for control?
         a. Utility can shut down charging port
         b. Utility can send control signals to EV
         c. Utility can engage in two-way communication with EV and make central decisions
         d. Utility can send price signal to EV and EV/consumer will make ad hoc decision
    - Supplier perspective
      1. Share information with customers
      2. Customers utilize information to make money
    - Monopoly perspective
      1. Investment to benefit ratepayers, most efficient use of investments
  - When does utility need to step in to override customer decision?
  - e.g. customers receive price signals, but a significant number of customers ignore price signals and behave in a way that causes grid instability

- o does utility need to override?
- o How does utility send that control signal? Does utility need to send that control signal?

- In an emergency case- tell charging station- no more
  - o What is access to load information- transformer needs to talk to that component- distributed communications between the devices- (DA devices talk amongst themselves) – how do you get that data to the consumer?
    1. Centralized control system- data is completely secure, authenticated- registration ahead of time- all automated.
    2. Connection to the grid, our physical grid assets- access to the IT network- information flow, can happen individual to wifi, common carrier feed.
- Ev use case is an interesting one- 1 piece missing form conversation- plenty of role for 3rd party/ aggregator to network communication flows. How do you do aggregate DER- communication, control, all going to be a part of wholesale network. FERC is deciding.
- GreenButton- all takes place over the internet- utilities using could now- how does SCADA network connect directly to the cloud service?
- At what point do the utilities need direct control?
- Why you have markets- communication is delivered through procurement.
  - o More volatility in prices- more likely people will set fixed prices.

Question 4: What opportunities are there for selling services on the network? Utilities are not allowed to sell services in IL, is there a need to change?

- See notes above and will discuss question 4 next meeting.

Meeting Agenda Item V: Communications Discussion Recap and Future Meetings
- Last in-person meeting- June 15, 2018

Meeting is Adjourned.