Advantages of Two-Way AMI/Demand Response Systems

MIPSYCON

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Introduction

- Name: Brad Lingen
- Title: Demand Response Technician
- Employment: With MRES since 2013
- Responsibility: Implementing and managing Coordinated Demand Response (CDR) and AMI; Research and development of MRES Smart Grid technologies and programs.

Who is MRES?

Missouri River Energy Services (MRES)

- Headquartered in Sioux Falls, SD
- Joint-action agency that supplies energy and energy-related services to 60 municipal member utilities in Iowa, Minnesota, North Dakota and South Dakota
- Supplemental power provider with 500 MW from MRES.
- Largest MRES municipal member is Moorhead, MN (39,398)
- Smallest MRES municipal member is Pickstown, SD (215)
- All MRES municipal members provide water and electric service. A number of them also provide natural gas service.

The BIG Project

The Red Rock Hydroelectric Project (RRHP)

- RRHP is being constructed at the existing Red Rock Dam on the Des Moines River near Pella, IA.

- RRHP is licensed at 36.4 MW and will be capable of generating up to 55 MW at certain times of the year when the water level is elevated.

  - Or enough energy to meet the needs of about 18,000 homes.

- Construction began in 2014 and the project is expected to become operational in 2018. When operational RRHP will be the second largest hydropower generating facility in Iowa.

MRES Membership

What is CDR & AMI?

- Coordinated Demand Response (CDR) and Advanced Metering Infrastructure (AMI) are MRES hosted programs driven by municipal member demand for MRES to host these services.

- MRES
  - Hosts the software and data
  - Owns and maintains communications to the municipal member
  - Oversees the programs
  - Helps to optimize the performance. MRES also maintains a close working relationship with Eaton on behalf of its municipal members on the program.

- Municipal Members
  - Owns the field equipment
  - Direct how they want their programs operated
  - Choose their level of involvement. Municipal members have access to their programs and data through a portal via the internet.

Why did MRES do it?

- Municipal members request for MRES to host

- Municipal members looking to keep costs down,
(MRES increased demand rates during peak months to encourage participation)

- Municipal members looking for help with IT/Security,
(Municipal members are small and cannot afford their own IT staff)

- Municipal members wanted to implement at their own pace

- Municipal members potentially looking for AMI assistance

- MRES identified demand response as a least cost resource

Benefits of an MRES hosted solution

- MRES IT management and support

- Cost savings on software and system components

- Secure data

- Demand Response strategy and AMI recommendations

- Access the system on the MRES portal from anywhere with internet capability

Drawbacks of an MRES hosted solution

- Single points of failure

(MRES hardware outage, Copper circuit to the Verizon cloud, MRES building blowing away, Cell tower, etc..)

- Loss of functionality

(Access to features such as Database Editor)

Why Cooper?

- Cannon/Cooper was well established. At the time of RFP supporting over 2 million load control devices in the USA.

- Several Municipal Members already had Yukon in place or had dealt with Cannon in the past.

- Considerable options for load control, down to the minute.

- MRES already owned a Yukon server

- References by others using Yukon

- Yukon software demonstration

Why not Cooper?

- Integration with other vendor systems, can it be done?

- Size of project. There was concern MRES would get lost in the shuffle to bigger projects.

- Compared to others during the RFP process, Cooper's prices were higher.

In the beginning..

- Power Line Carrier (PLC) was the only option at the time for the municipal members. Paging was not an option because 2-way communication was desired.

- The original setup was 5 PLC municipal members on 1 shared system.

Challenges

Challenges included:

- Separating the data and creating a unique naming convention to keep everyone separate.

- Security. Making sure municipal members only accessed their portion of the shared system.

- Two-way communication using PLC. For certain municipal members the success rate was not high enough.

- Making sure data was being uploaded to the correct municipal member portion of the shared system.

Original Process
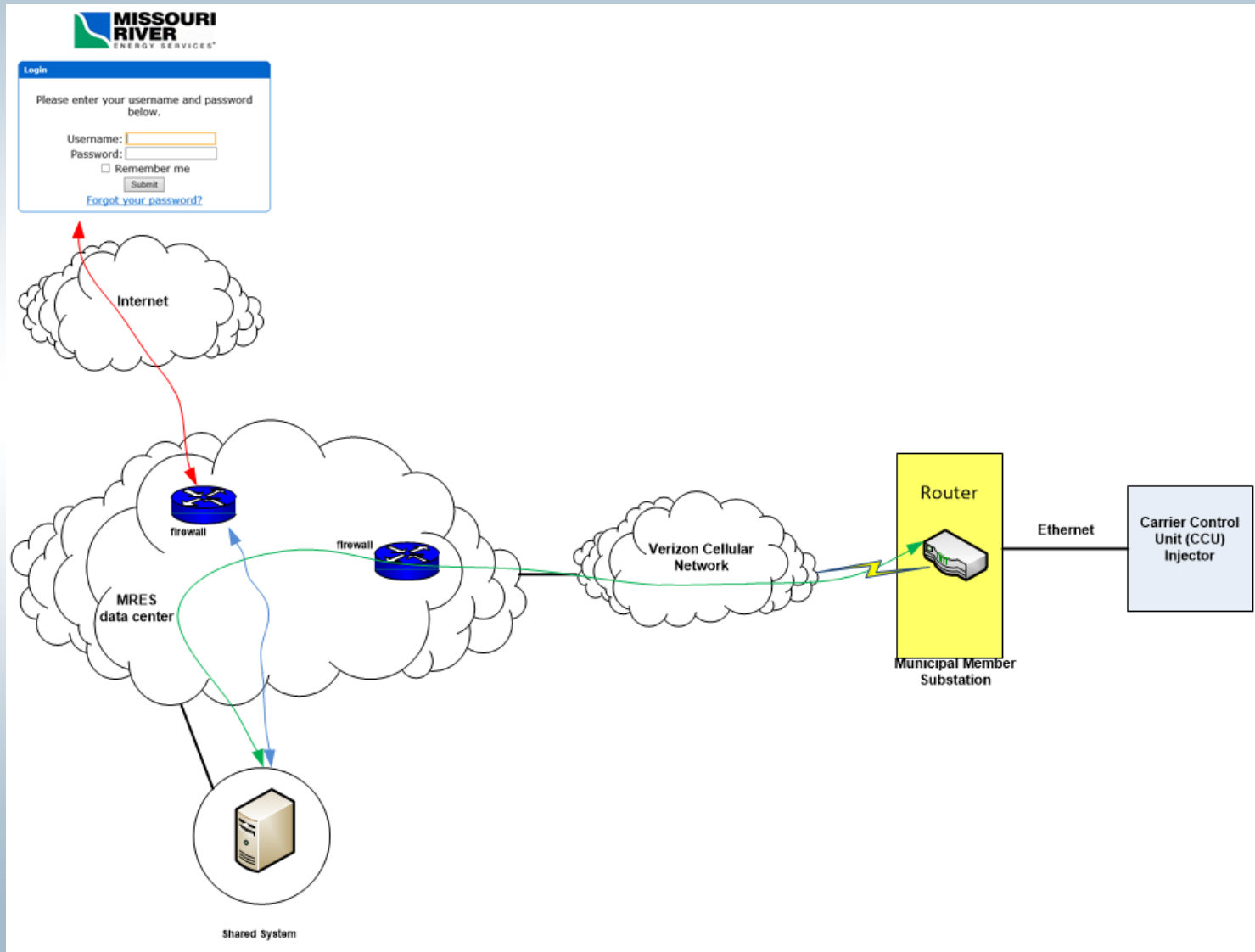
Until….

- In the spring of 2013 Valley City, ND approached MRES about hosting their setup for CDR/AMI using Radio Frequency (RF) technology.

- After some research, MRES agreed to host the Valley City setup and proceed with recommending that RF be the technology of choice going forward with all CDR/AMI installations.

- Instead of hosting a shared system, MRES setup separate Virtual Machines (VM) for each municipal member enrolled in either CDR and/or AMI.

- This effectively wiped out the challenges of the shared system.

Benefits of RF over PLC

- Lower cost field equipment
- Mesh network is self-healing
- Troubleshooting benefits
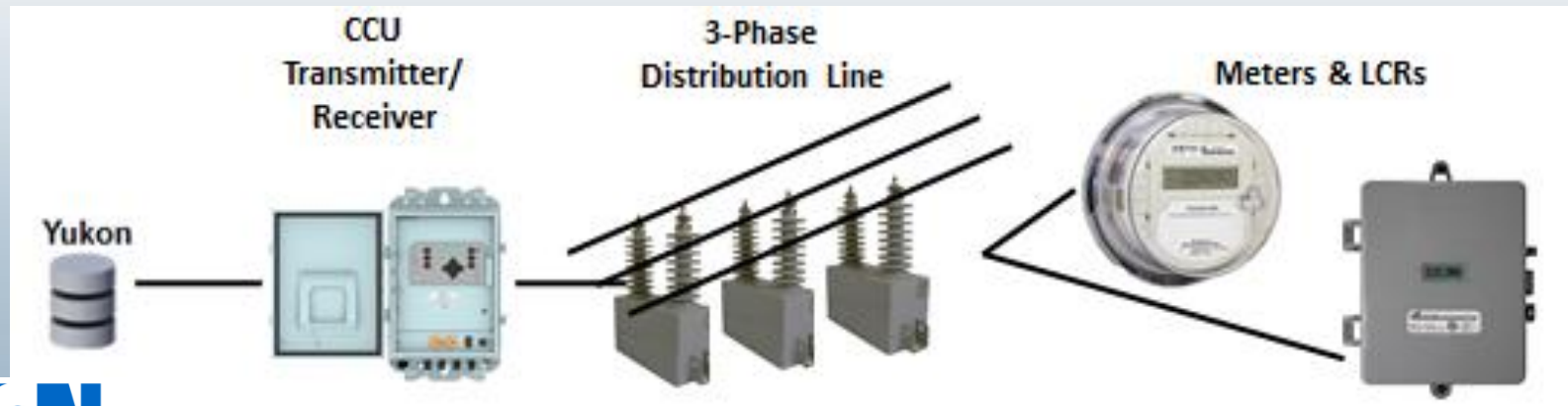- System can be used for CDR and/or AMI
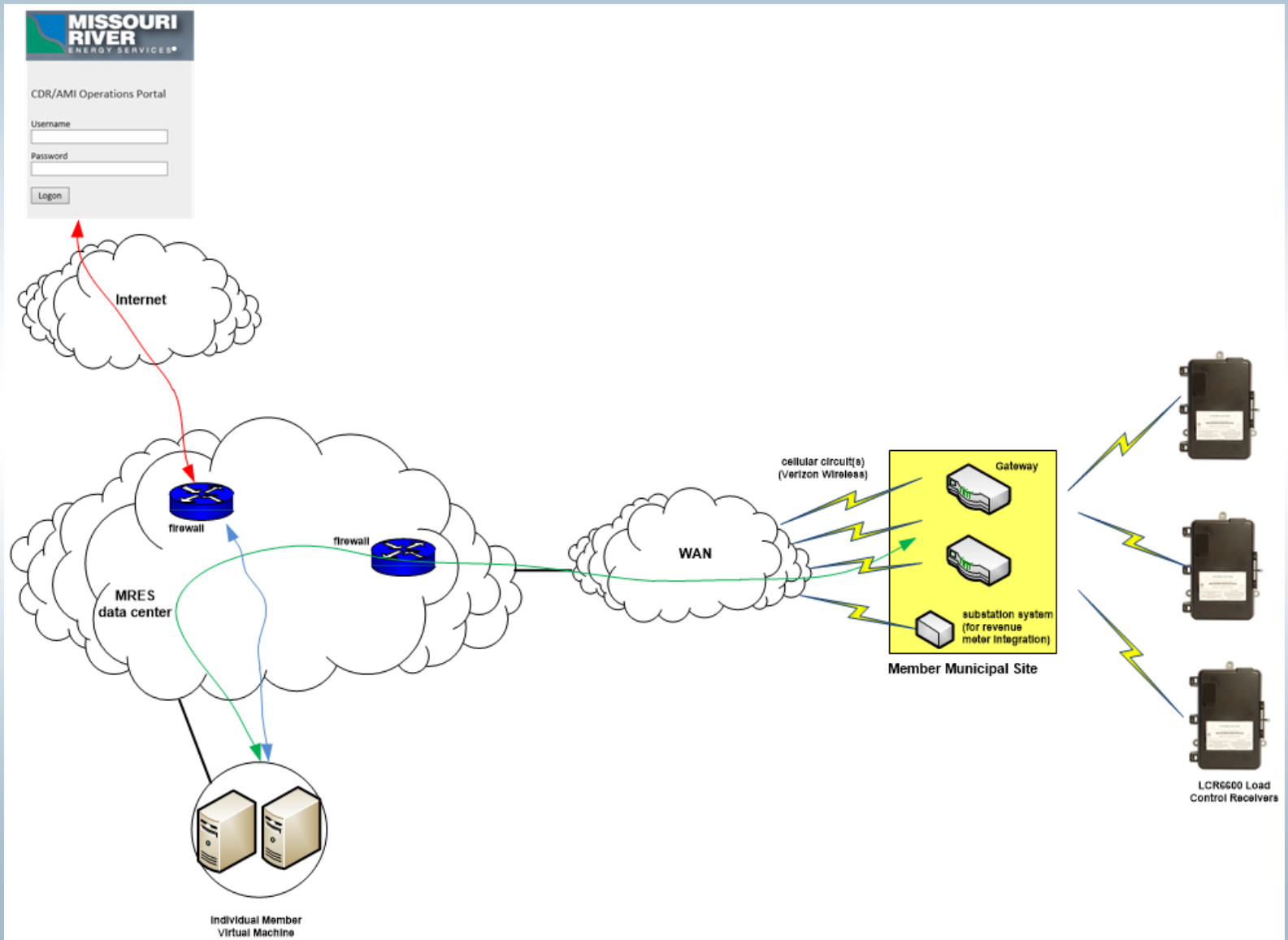
PLC Overview

- Communication over Power Line Carrier (PLC) 12.5 kHz signal on distribution lines
- Ideal for rural, low density areas
- Request data from meters and LCRs individually
- Broadcast DR commands
- Single Software platform for AMI, DR and DA

RF Overview

- Self-Forming
  - Nodes identify neighbors and relationships automatically
- Self-Optimizing
  - Nodes independently determine the most efficient method to get to the gateway
- Self-Healing
  - Nodes automatically identify alternative routes to the gateway when primary communications paths are interrupted
- Broadcast Capable
  - OTA Firmware Updates
  - Broadcast DR commands
- Single Network
  - A full two way network AND a single Software Platform for Electric, Water, DR and DA
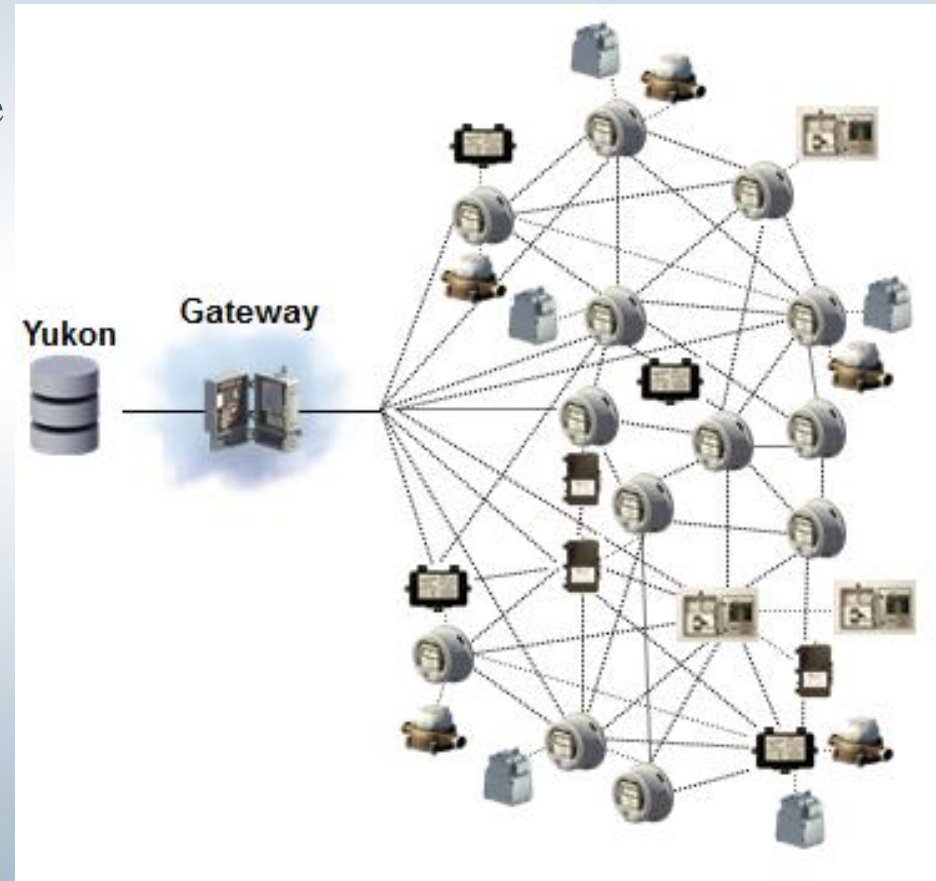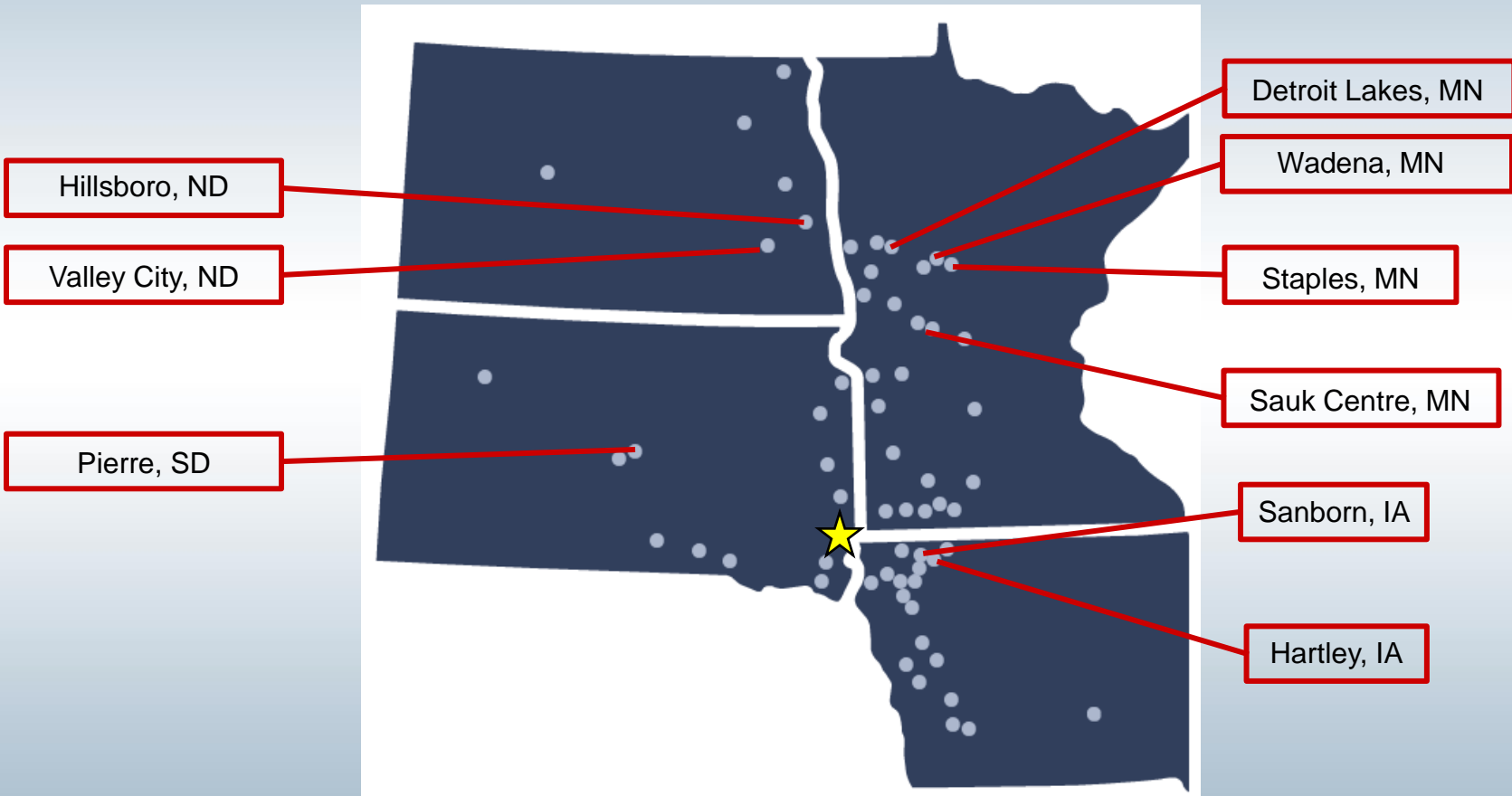
PLC/RF Differences and Similarities

- Communication path
  - PLC – assign a specific comunication route
  - RF – self-building network path back to Yukon
- Data collection
  - PLC – data is polled/collected by Yukon
  - RF – data is reported/pushed up to Yukon

- Demand Response commands are always broadcast on all Eaton communication platforms
  - "One to many"

Lake Park, MN

Hawarden, IA

Woodbine, IA

Who's on board with RF?

Detroit Lakes, MN

Wadena, MN

Staples, MN

Sauk Centre, MN

Hillsboro, ND

Valley City, ND

Pierre, SD

Sanborn, IA

Hartley, IA

By the Numbers

- 12 municipal members from 4 states are enrolled in the CDR and/or AMI programs.

- Roughly 26,000 electric meters and water nodes will be read.

- 3,000 Load Control Receivers have been deployed.

- Those Load Control Receivers are currently connected to:
  - 1,730 Water Heaters
  - 1,270 Air Conditioners
  - 850 Heating Devices (Dual, Slab Heat)

What does the future hold?

- Municipal member interest is there.

- Successful implementation of all deployments is key.

- Eaton developing a working Gas option soon is very important. That is #1 on the wish list of many municipal members.

- What Smart Grid feature will be next? There is some initial interest in features like Meter Data Management (MDM), Outage Management and Conservation Voltage Reduction…to name a few.

Questions?