Advanced Metering Program

Presentation to Painesville, Ohio
Work Session on AMI
Feb. 12, 2018

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AMP Advanced Metering Program

- AMI Overview

- AMP's RFI & RFP Process

- Painesville's AMI Project

- Why AMP?

- Additional Considerations

- Next Steps

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AMI Overview

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Advanced Metering Infrastructure (AMI)

- Advanced meters are digital meters that replace older analog meters used to record electrical usage.

- Rather than relying on a meter reader to manually read meters monthly, digital meters record information (typically every fifteen minutes), sending readings back to the AMI system six times per day.

- Digital meters enable customers to monitor consumption more precisely so they can make more informed energy choices.
    - Economic development advantage for commercial and industrial customers

- Advanced meters report power outages back to the utility, enabling enhanced service restoration.

- Provide the capability to connect and disconnect of electric service remotely.

- In 2016, U.S. electric utilities had approximately 70.8 million advanced (smart) metering infrastructure (AMI) installations.[1]

[1]U.S. Energy Information Administration (EIA), https://www.eia.gov/tools/faqs/faq.php?id=108&t=1

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Utility Business Drivers for AMI

- **Aging utility infrastructure (base case)**
  - Manual meter reading process constraints
  - Handheld/drive-by equipment is aging
  - Water meter modules near end-of-life (batteries)
  - Stopped or under-registering meters

- **Improving business processes and customer service**
  - Enable remote connect/disconnect of electric service
  - Enhanced customer communication
  - Integrations to GIS, OMS, etc.

- **Support for emerging needs – rates, distributed generation**
  - Other technology deployments (LED street lighting control, SCADA system integration)
  - Distributed generation (e.g. solar) metering requirements
  - Rate design changes – time-of-use (TOU), demand metering, seasonal rates
  - Compensate customers for contributions to 1CP and 5CP peak shaving
  - Distribution grid management – automation, Volt/VAR control

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Benefits of Advanced Meters

- **Greater convenience and safety**
  - Because advanced meters use a wireless network to transmit usage information, meter readers no longer need to enter a customer's property to read a meter.

- **Improved power quality and reliability**
  - Advanced meters are capable of communicating data that notifies us when an outage or water leak has occurred and where the problem may be located. This improves our response time and how long a customer is without service.

- **Enhanced customer service**
  - Advanced meters provide online access to near real-time usage data to help manage costs. Plus, we can respond faster to either starting or stopping service.

- **More accurate billing**
  - We are better able to manage our business by providing more accurate and efficient billing. In the future, this can open the door for new programs that benefit the customer, such as real-time pricing and pre-paid services.

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Vision – Cities See a Connected Future

CANOPY APPLICATIONS

STREET LIGHTS

SMART METERS

SMART CITY USE CASES

SMART PARKING · WEATHER SENSORS · DIGITAL SIGNAGE · ACOUSTIC SENSORS · WATER & GAS METERING · TRAFFIC LIGHTS & CONTROLS · ELECTRIC VEHICLE CHARGING · SOLAR INVERTERS · SECURITY AND SURVEILLANCE · WASTE MANAGEMENT
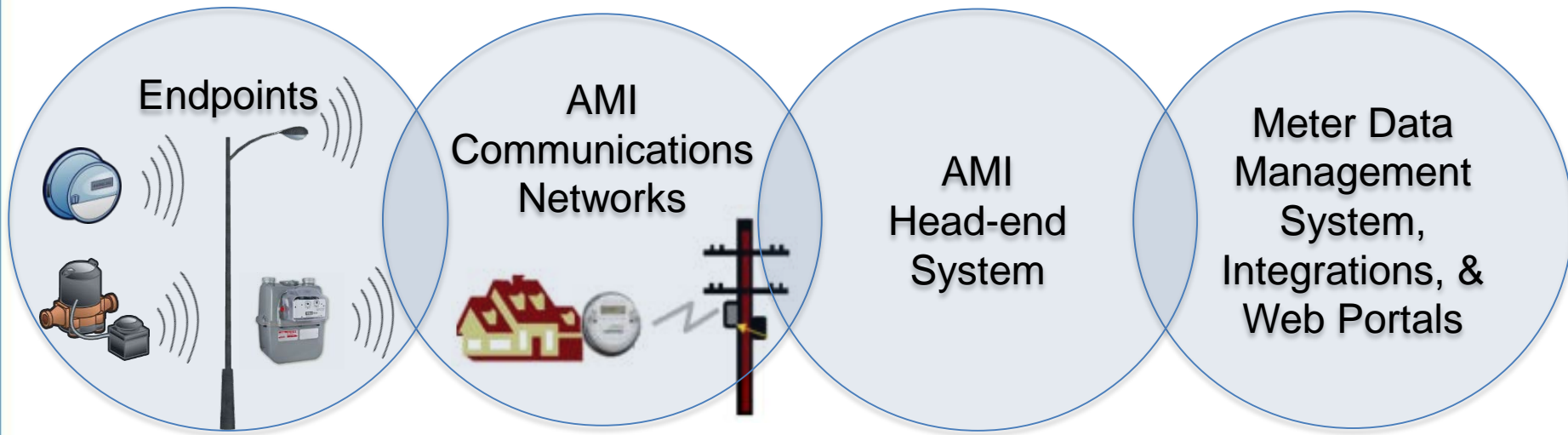
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AMI System Components

Endpoints — **AMI Communications Networks** — **AMI Head-end System** — **Meter Data Management System, Integrations, & Web Portals**
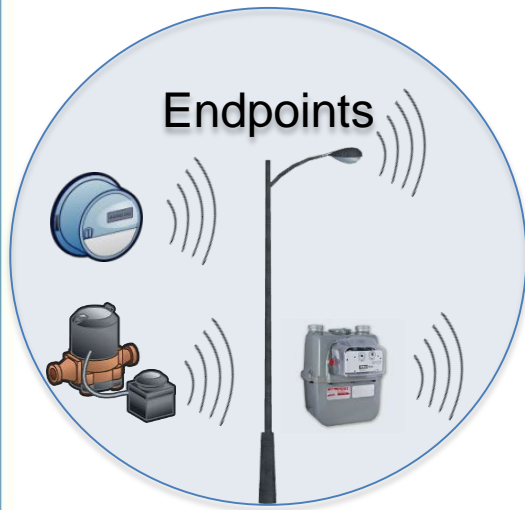
Four Discrete Areas of Functionality

- No one vendor is superior in all four domains
- Vendors combine their use of terminology, leading to confusion
- Vendors partner to create "illusion" of integrated product offerings
- Co-existence of multiple providers will be a requirement

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AMI System Components

Endpoints

Electric Meters
Water meter modules
Gas meter modules
LED Streetlight Photo Cell
Network Interface Card (NIC), or
Network Interface Module (NIM)

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AMI System Components
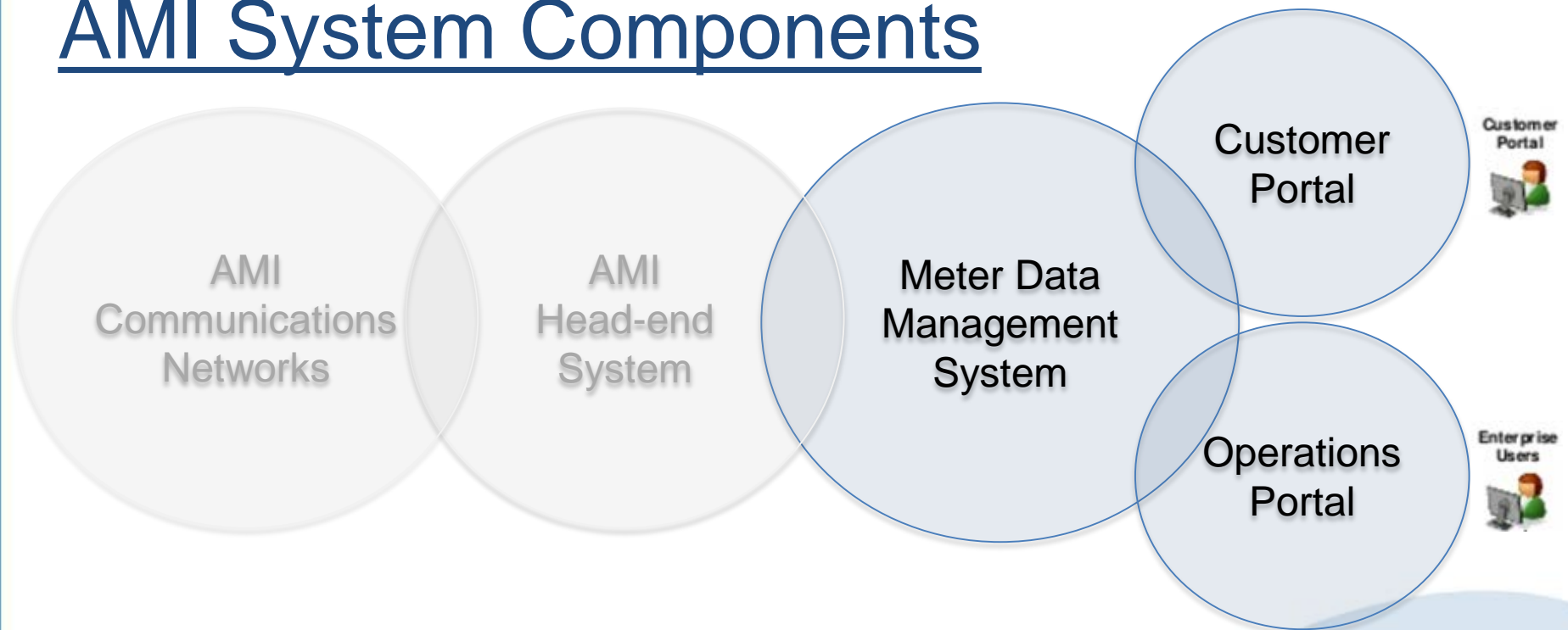
Meters

AMI Communications Networks

- 900 Mhz meshing networks (licensed, or unlicensed)
- Point-to-multipoint, or Tower, networks (licensed)
- Cellular Data Service
- Emerging technologies (Neighborhood Zigbee; Wi-Fi, 5G)

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AMI System Components

Meters

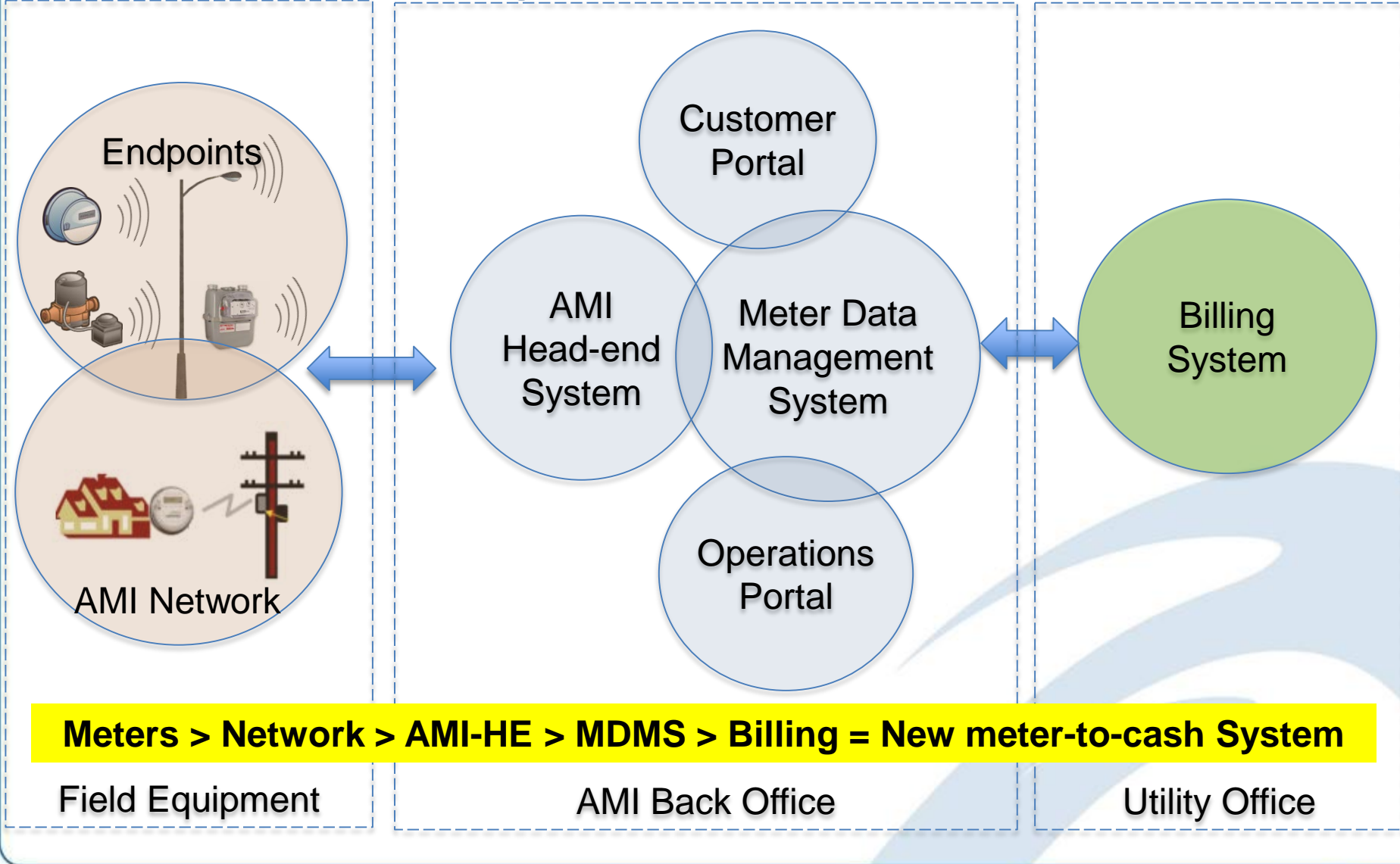AMI Communications Networks
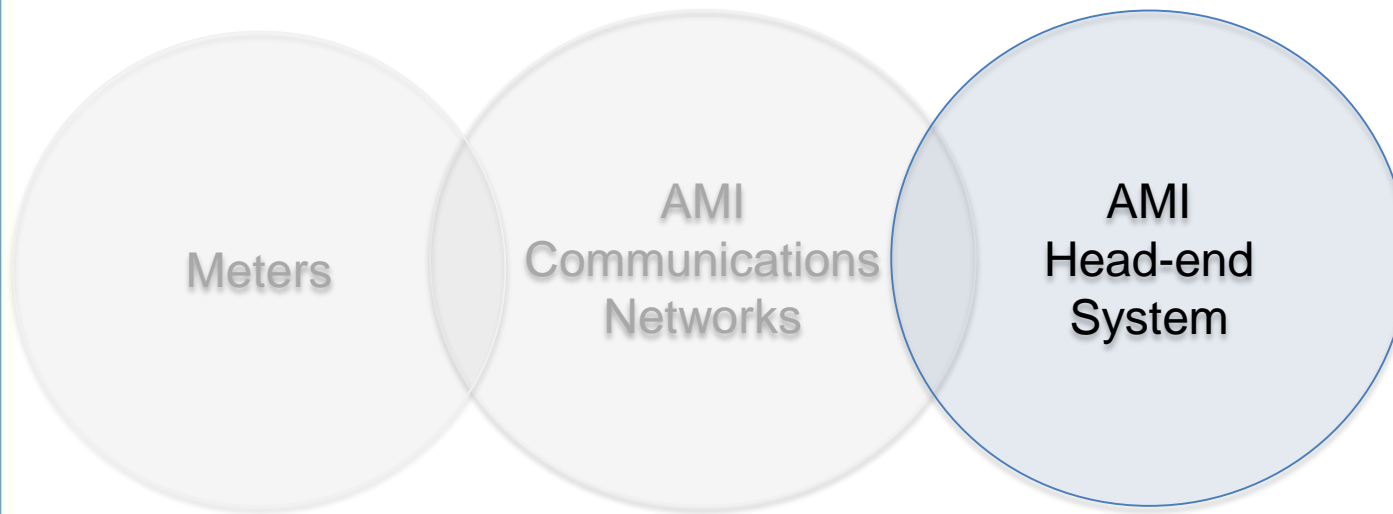
AMI Head-end System

- Manages communications with NIC/NIM
- Stores events and interval usage data for an extended period of time (typically months)
- Some AMI head-end systems have enhanced capabilities
  - Graphical user interfaces
  - Simple billing system interfaces

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AMI System Components

AMI Communications Networks

AMI Head-end System

Meter Data Management System

Customer Portal

Operations Portal

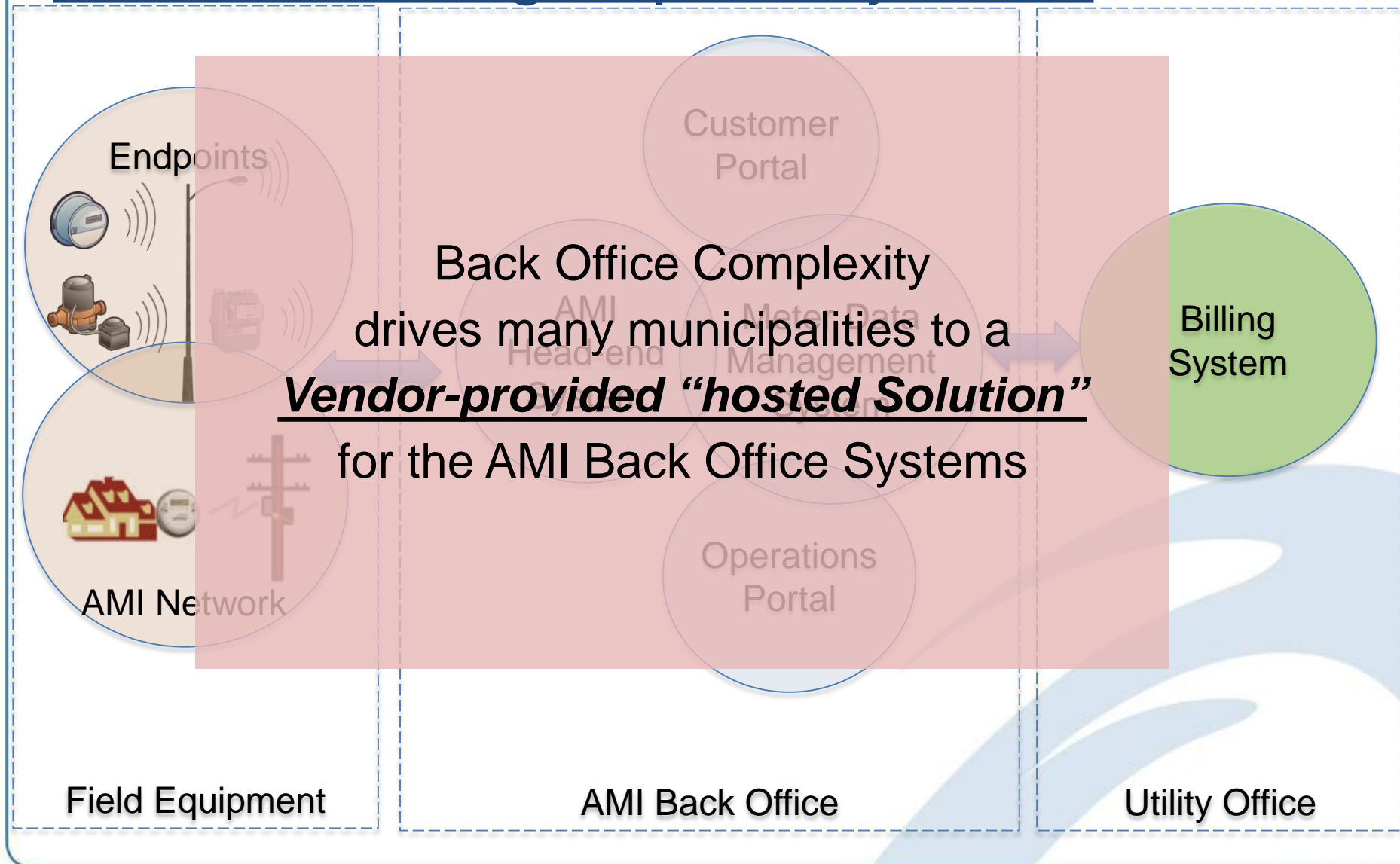Customer Portal

Enterprise Users

- Stores events and interval usage data for longer periods (limited only by storage capacity)
- Allows complicated billing determinants to be extracted
- Platform for analytics and historical reporting
- Usually independent from AMI Head-end
- Typical Source for customer and operations portal

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Three distinct groups of systems

Endpoints

AMI Network

Customer Portal

AMI Head-end System

Meter Data Management System

Operations Portal

Billing System

Meters > Network > AMI-HE > MDMS > Billing = New meter-to-cash System

Field Equipment

AMI Back Office

Utility Office

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Three distinct groups of systems

Endpoints

Customer
Portal

Billing
System

Back Office Complexity
drives many municipalities to a
Vendor-provided "hosted Solution"
for the AMI Back Office Systems

AMI
Head-end
System

Meter Data
Management
System

Operations
Portal

AMI Network

Field Equipment

AMI Back Office

Utility Office

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AMP's RFI & RFP Process

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SGAC & Business Case for AMI

- AMP's Smart Grid Advisory Committee (SGAC) is made up of members and AMP staff, and initiated an advanced metering discussion in late 2012.

- After identifying interest among members in advanced metering, AMP facilitated a competitive RFQ issued in July 2013 to select an advisory partner to develop a business case for an advanced metering program. Leidos Engineering was selected to do the work.

- Leidos' recommendation was that with sufficient scale, an Advanced Metering Program operated by AMP would enable its members to acquire AMI equipment at lower cost by aggregated purchasing, and mitigating the risks associated with local deployment of major technology.

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AMP's AMI Project – Common Hurdles AMP Members Faced

- Limited ability to explore the marketplace

- Managing relationships with a new group of vendors

- Supporting increasingly complex and integrated systems

- Hiring, training, and retaining skilled IT roles

- Rigidity of some vendor-hosted solutions

- Unplanned future expenses

- Dealing with cyber security requirements

- Too small to leverage strategic relationships with partners

- Inexperience with negotiating IT contracts.

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AMP's AMI Project – Common Hurdles AMP Members Faced

- Limited ability to explore the marketplace

AMP's AMI Project Objectives:

1. Provide a cost-effective alternative to Third-Party Hosted Solutions
2. Remove vendor and support risk
3. Achieve economies of scale from bulk purchasing of field components (90,000+ meters in project)
4. Support AMP's Members with the development of customer communications and business case information.

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Member Outreach

- The SGAC decided to do an RFP for an "Owner's Engineer & Project Manager" to lead a program development effort and in July 2014 selected a 30-year utility veteran with 10 years' experience in smart grid for this role.

- The program development effort was initiated in January 2015 and comprised of three separate phases:

    – Member outreach
    – RFI
    – RFP

- The Member Outreach Phase identified 11 members interested in collaborating on an AMI program, ***including Painesville***. The 11 utility systems totaled over 93,000 electric and water meter endpoints.

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AMP's AMI Project - RFI & RFP

- An RFI was issued to 23 vendors:

ABB/Tropos	GE	Mueller Systems	PrimeStone	UMS
Aclara	Itron	N-Dimension	Sensus	UtiliSmart
Eaton	L+G	Nexgrid	Siemens	Wipro
ElectSolve	Leidos	Oracle	Silver Spring	
Elster	MeterSense	OSISoft	Itron/Tantulus	

- The RFIs were reviewed by the SGAC and AMP staff, and 13 vendors were selected for demonstrations. SGAC members attended presentations in person or via WebEx.

- Following the demonstrations, a member workshop was held in May 2015 to develop a vendor short list. Nine vendors were selected as RFP recipients and sent information on the 11 members for the first time.

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RFP Responses Analysis

- A comparative analysis was performed, evaluating the nine respondents across five areas:
  - ✓ Meeting overall requirements (16 items)
  - ✓ Meeting individual member requirements (11 pilot members)
  - ✓ Price
  - ✓ Firm viability
  - ✓ Support for architecture transition from off-premise (hosted) to on-premise
  - ✓ Flexibility and scaling

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Comparative Evaluation

8.   Overall Requirements.

8.1.   Data Center Requirements.

8.2.   Electric meter specifications.

8.3.   Water meter specifications.

8.4.   Water meter module specification.

8.5.   Interval data specification.

8.6.   Polling frequency.

8.7.   Communications Network.

8.8.   End-to-end testing and certification of performance.

8.9.   Installation Services.

8.10.   Meter warranty.

8.11.   Municipality meter data separation.

8.12.   Integration to billing systems.

8.13.   Knowledge Transfer.

8.14.   Future Member Deployment and Integration documentation.

8.15.   Software licensing and transfer.

8.16.   Post-sale support.

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AMI Market Changes & Volatility

Since 12/1/2015

- **GE:** Metering business purchased by Aclara Technologies (Dec 2015)

    - **Aclara Technologies:** Purchased by Hubbell Technologies (Feb 2018)

- **Elster:** Purchased by Honeywell (Jan 2016)

- **Sensus:** Purchased by Xylem (Aug 2016)

- **Landis & Gyr:** Sold by Toshiba (Jul 2017)

- **Silver Spring Networks:** Purchased by Itron (Jan 2018)

The Advanced Metering Infrastructure (AMI) landscape is constantly changing. No vendor is immune to this. The goal of AMP's program is to reduce the risk to municipalities and shield them from market changes, thereby allowing them to realize the full benefit of their AMI investment.

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NETWORK SOLUTIONS FOR SMART CITIES

BUILDING SMARTER CITIES TODAY

- Industry leading network - Over 23 million endpoints
- Open Standards Based (IP Protocol)
- Superior availability and security

- No meter vendor lock-in
- Foundation for future requirements – street lighting control, distribution automation, Volt/VAR control
- Fully monitored network solution – 7x24x365
- Service level commitments

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AMP Advanced Metering Solution – ElectSolve Application Portfolio

- Base "meter-to-cash" includes integrations to Silver Spring Networks (SSN) and Member's billing system

- Provides dashboards and portal access for utility operations

- Includes customer service portal, advanced charting, validation, editing and estimation (VEE), messaging/alerting, scheduler, system tools, importer/exporter, weather, data views

- Optional applications available are a function of available supporting systems (GIS, SCADA, etc.) and the benefits of additional software modules

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AMP Advanced Metering Solution – ElectSolve Application Portfolio

- Optional Interfaces
  - Joint action agency interface
  - Geographic information systems (GIS) interface
  - Supervisory control and data acquisition (SCADA) interface
  - Outage management system (OMS) interface
  - Third-party AMI interface

- Optional Applications
  - Customer portal
  - Power billing module
  - Voltage analysis
  - Transformer load analysis
  - Line loss analysis
  - Event visualization

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Painesville's AMI Project

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Three distinct groups of systems

Endpoints

AMI Network

Customer Portal

AMI Head-end System

Meter Data Management System

Operations Portal

Billing System

Field Equipment

AMI Back Office

Utility Office

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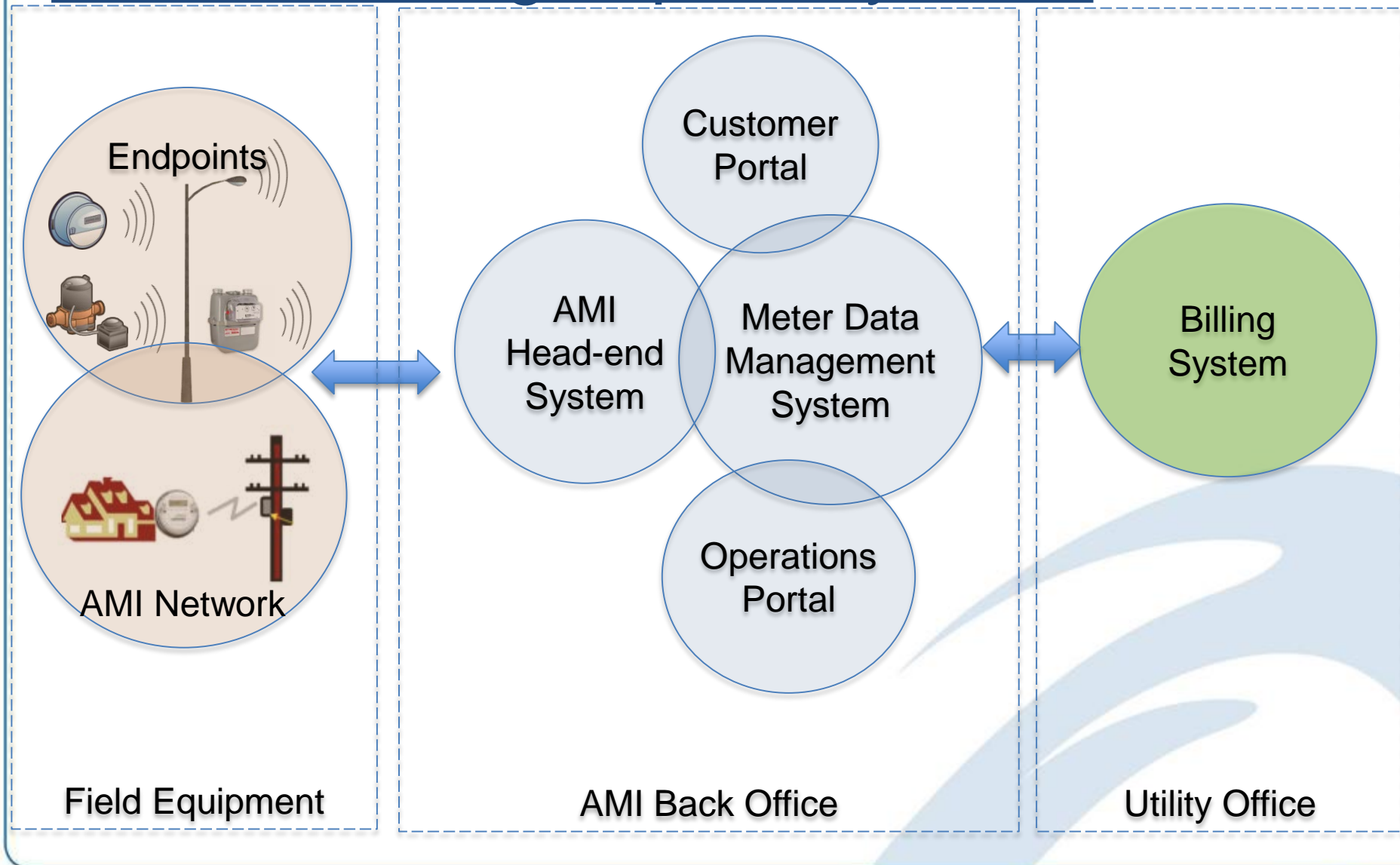
Silver Spring Networks – Access Points/Relays

Pipe

Backup battery

Power from battery

Drip loop

Antenna should always point down

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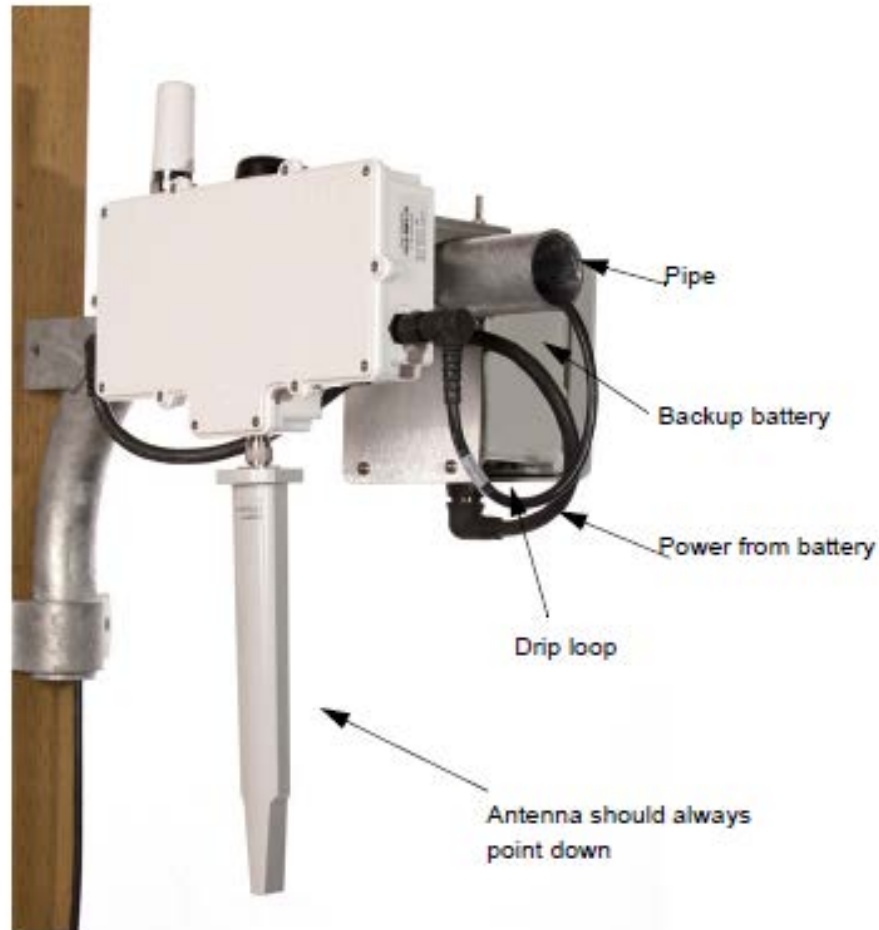
AMP Painesville, OH Network Design RF Mesh Links Map
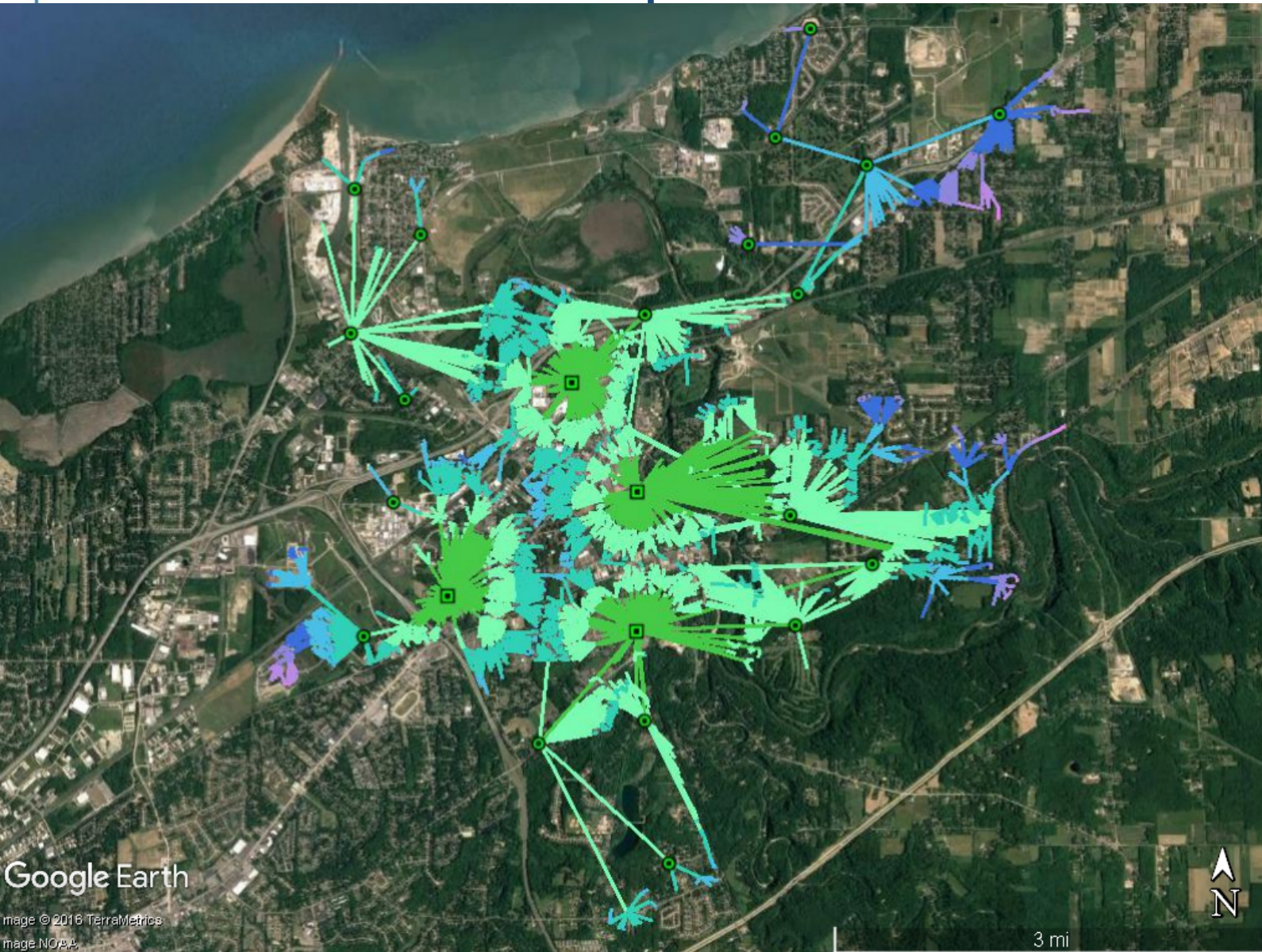
Access Point

Relay

Smart Grid Meters

=	0 hops
=	1 hop
=	2 hops
=	3 hops
=	4 hops
=	5 hops
=	6 hops
=	7 hops

Google Earth

Image © 2016 TerraMetrics
Image NOAA

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Aclara (GE) Electric Meters

- Two residential meter platforms – I210+, I210+C
  - Both can be equipped with remote service switch (up to 200 amps)

- Commercial and industrial metering platform
  - KV2c
  - Available in multiple meter forms

- Stable, mature products

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Register Housing

Allegro Endpoint

Universal Adaptor

Meter Body
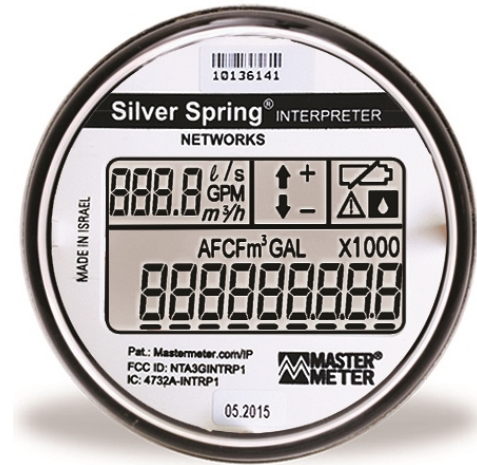
- *Wireless Design!*

**- *Retrofits any meter with a
bayonet-style body***

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SILVER SPRING® NETWORKS END POINT — WALL

Wallmount

Interpreter-register

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Why AMP?

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AMP Background

- ***Development History***
  - **Formed as "not-for-profit" corporation** under Ohio Revised Code
  - Private Letter Ruling permits tax-exempt financings "on behalf of" Members

- ***Corporate Governance***
  - Owned and governed by its 135 Members in nine states
  - Each state with five or more members guaranteed a Board seat

- ***AMP Strengths***
  - **Joint action = Stronger voice in the industry & buying power in the marketplace**
  - Projects based organization
  - **Financial strength = $600 million line of Ccedit**

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How AMP Stacks Up: Meters & Network

	AMP	Competitors
Meter Vendor Flexibility	• Supports a variety of Electric, Water, and Gas meters vendors. • Comm modules installed from the factory.	• Single meter manufacturer creates vendor "lock-in". • Sometimes meters are retro-fitted with comm modules after they ship from factory leading to hardware and support issues.
Network Maturity and Backwards Compatibility	• Fifth generation network. Backwards compatible to first generation network. • Silver Spring/Itron has the most endpoints deployed in the U.S. today. • Notable deployments: AEP, Com-Ed, PG&E, Con-Ed, FP&L, etc.	• Many are not backwards compatible forcing costly upgrades. • AMP's RFP found some vendors had brand new products that had yet to be market proven.
Network SLAs	• Electric: 99% or greater. • Water: 98.5% or greater. • Monitored 24x7x365.	• No SLAs.

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How AMP Stacks Up:
Meters & Network

	AMP	Competitors
Network: Performance & Openness	- Industry leading, high-speed, multi-purpose network. - Reconnects: < 30 sec - Meter reads: < 3 sec - FW downloads: < 1 hr - Built on IPv6 standard +125 partner ecosystem	- Lower speed / lower performance. - Proprietary networks limit integrations and partners.
Meters & Network: Field Installation	Uses professional installers and fully qualified craft labor when prevailing wage requirements apply.	Can use apprentice labor to cut costs.

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How AMP Stacks Up: Applications & Interfaces

	AMP	Competitors
Meter Data Management System	• Electsolve uCentra functions as a single dashboard for billing/customer service staff. • Seamless look and feel. Not bolted together.	• Solutions that are pulled together through acquisitions. • Can feel fragmented to the end user. • Sometimes dated look and feel.
Data Interfaces	• Robust bi-directional integration to billing system. • Electsolve has experience working with municipal billing systems.	• One-way flat file extract leads to swivel chairing between two systems. • Lack of experience with municipal billing systems.
Hosting	• Meter data management system and key data hosted within AMP datacenters. • Municipality owns the data.	• Hosted in the cloud. • Who owns the data?

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How AMP Stacks Up:
IT Systems & Operations

	AMP	Competitors
Disaster Recovery (DR)	• Disaster recovery test performed annually. Written into member agreement.	• DR site may not exist. • Not regularly tested?
Cyber Security	***Core focus*** • Systems are treated as critical as AMP's own SCADA systems. • Certificate based authentication for all devices. • Intrusion detection and prevention, • Data encryption. • 24/7 SOC monitored	• Varies by vendor. • Some may only go through the motions. • Proprietary systems and networks more difficult to secure. • Sometimes there is an additional cost for an adequate level of security.

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How AMP Stacks Up:
IT Systems & Operations

	AMP	Competitors
AMI Operations	- AMI operations team - Manages AMI head-end. - Alleviates municipality workload. - Provides advice, training and issue resolution.	Utility responsible for managing head-end system, troubleshooting reads issues, handling problems and upgrades, etc…
Total Value	- Core focus on delivering a future ready, fully integrated, usable system using best of breed technologies. - Municipals have a voice on the future direction of the program (Joint Action). - AMP's solution is all about reducing the risk of owning and operating AMI.	Can anyone else say this?

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Additional Considerations

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Additional considerations …

- Customer engagement will be critical to project success
  - Providing facts to community stakeholders to dispel misinformation available on the internet
  - AMP has joined the Smart Grid Consumer Collaborative (https://smartenergycc.org/) to provide assistance to Members

- Opt out policy development
  - Options include requiring AMI as a condition of service (no opt out) or developing a set of fees to allow recovery of the City's costs for manual efforts

- Business case development
  - Assessing what work is eliminated with AMI
  - Identifying financial benefits to the City with AMI (e.g. cash flow improvements, reduction in loss, etc.)

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Questions?

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Next Steps

- Assess the City's systems for readiness
  - AMP Provides this as a service to its Members

- Collect required technical information
  - Meter types, IT make-ready work, customer service locations

- Review available software modules to determine applicability and benefit to Painesville's operations

- Present final project proposal to Council for approval

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Thank you.

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