AMI: State of the industry and technology overview for water utilities

E Source Technology Planning and Implementation Consulting

E Source

POWERING WHAT'S NEXT

Thursday, February 16, 2023

Agenda

- Introductions
- AMI technology overview
- Metering and endpoints
- Networks
- Headend system (HES)
- Meter data management system (MDMS)
- Evolving technologies
- Avoiding project pitfalls
- Vendors
- AMI success story: WaterOne

Note: E Source is vendor agnostic.

The material we present is not an endorsement of any particular vendor solution.

Presenter introduction: Don Rankin

- Manager of Technical Consulting and Field Operations, E Source
- Utility director for 19 years
  - Water, wastewater, and stormwater operation and maintenance
  - Customer service and billing operations
  - Capital improvement programs
- Focus areas:
  - Analytics
  - Reporting
  - Water operations
  - Large meter programs

Presenter introduction: Brian Schade

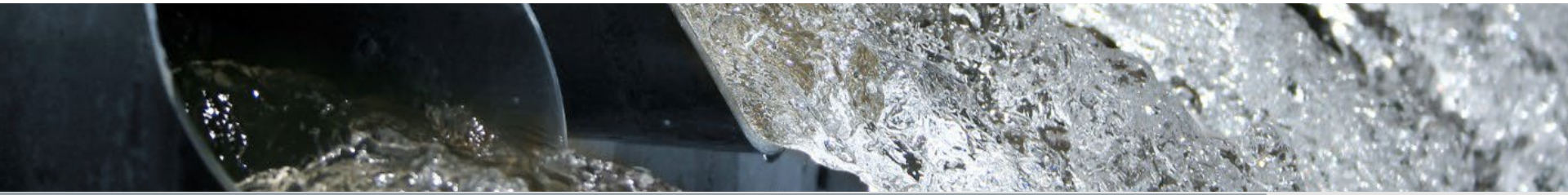
- Meter Services Manager, WaterOne
- 26 years at utility
  - Engineering—production and distribution
  - Developer services and water quality
  - Meter specification and maintenance
  - Field services
- AMI implementation
  - Replace existing automatic meter reading (AMR) network
  - Use AMI technology and information

WaterOne
Water District No. 1 of Johnson County

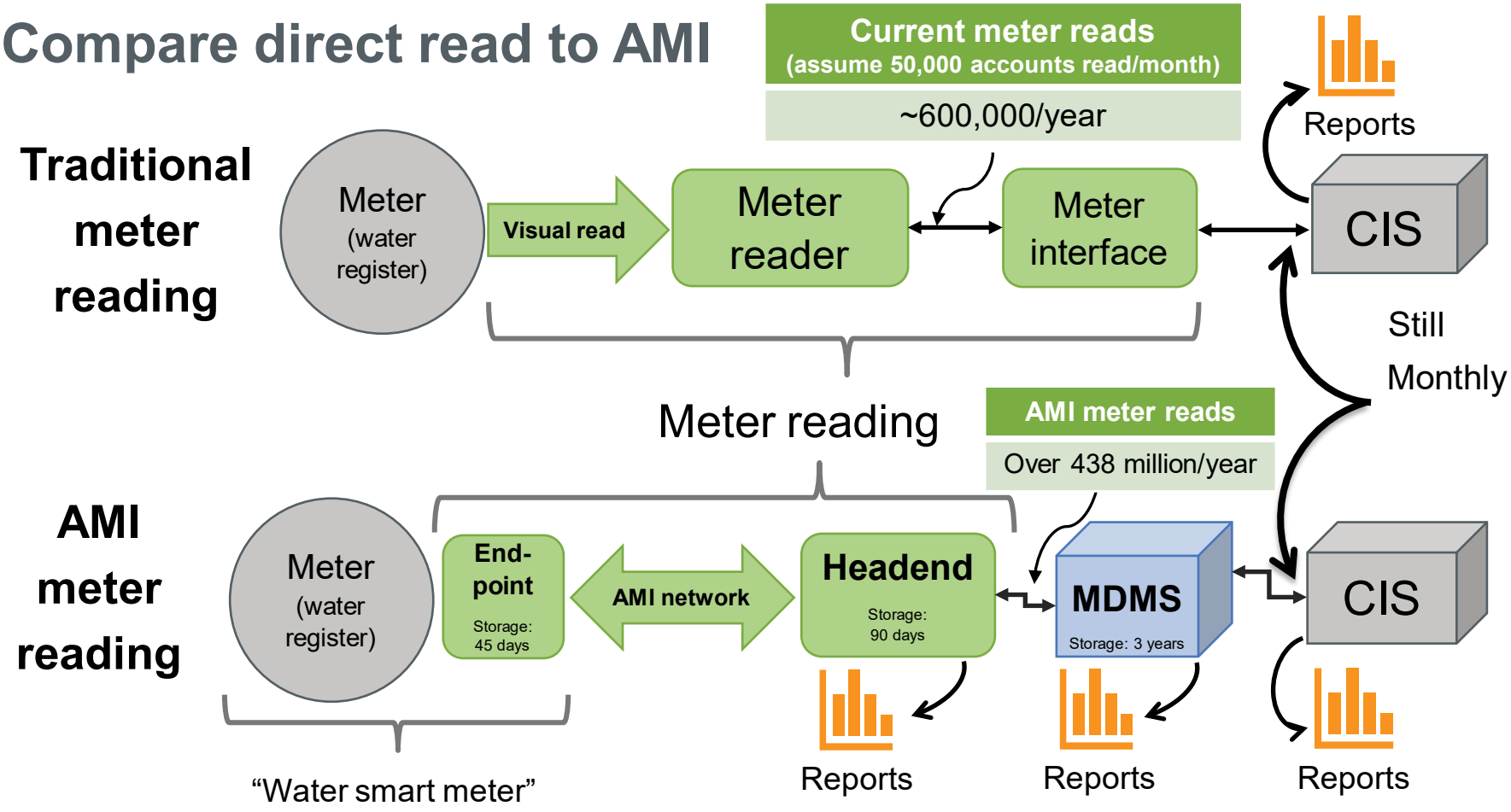
AMI technology overview

Target audience:

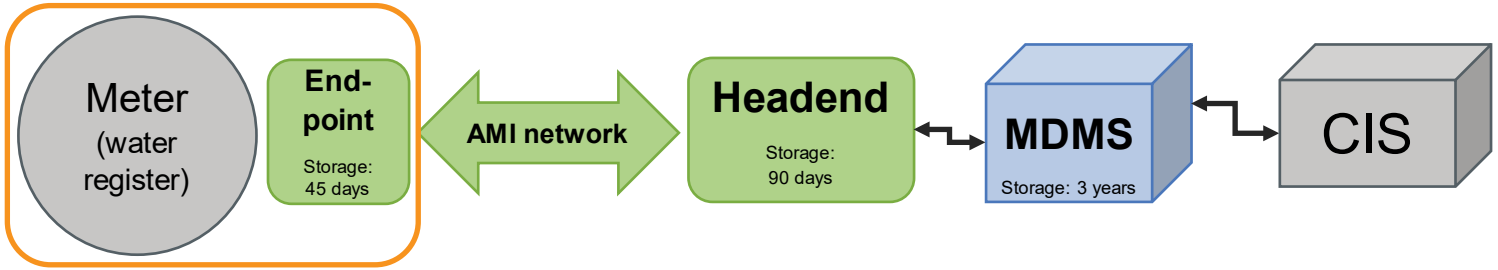
- Executives
- Supervisors
- Meter shop
- Customer service
- Billing
- Operations
- Engineering
- IT



Compare direct read to AMI

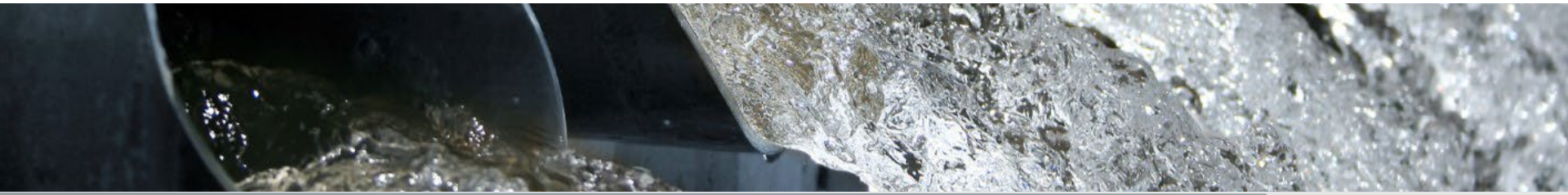


Metering and endpoints



Target audience:

- Meter shop
- Customer service
- Billing
- Engineering



Smart meters

Meter alone

- Examples:
  - Sensus Ally
  - Neptune MACH 10
- Alarms
  - Empty pipe, high flow, reverse flow, low and high pressure and temperature, customer leak, magnetic tamper, low battery
  - Generally, factory-set thresholds
  - Only work on vendor network

Meter + endpoint

- Example: Mechanical meter
  - No “smart” features
- Endpoint makes the combination a “smart” meter

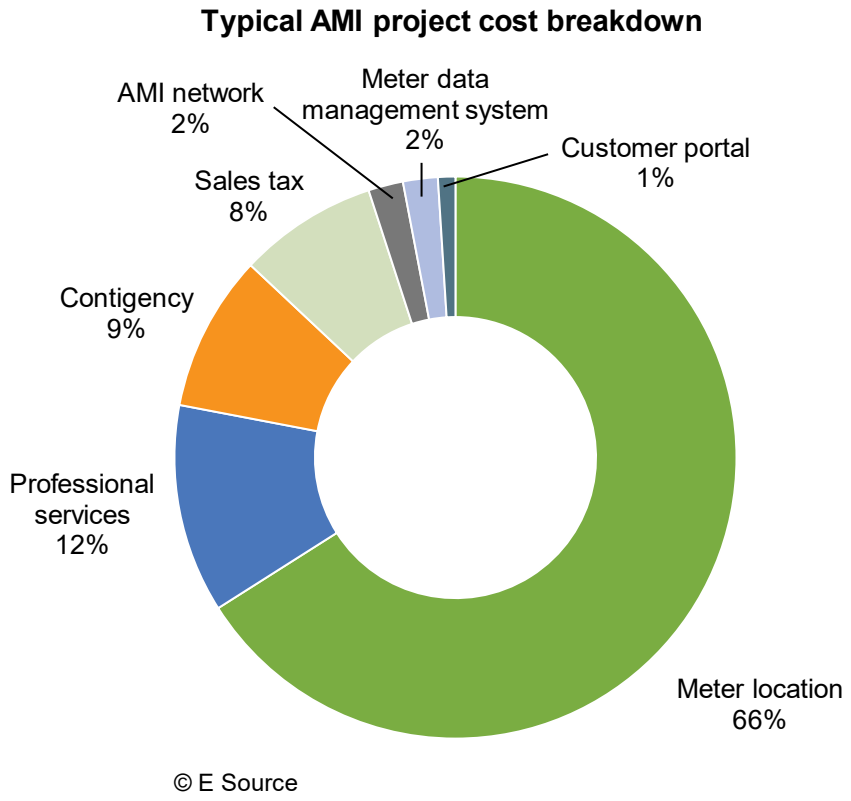
Endpoint

- Endpoint alarms:
  - Leak detection, backflow, high flow, communication fail, register error, low battery
  - Utility can generally determine thresholds

Importance of understanding meter placement

- During an AMI project, meter placement* generally represents more than 60% of project cost
- Water loss impact
- Large meter impact
- AMI system capabilities

**Includes meters, registers, endpoints, installation services, lids, repairs, etc.*

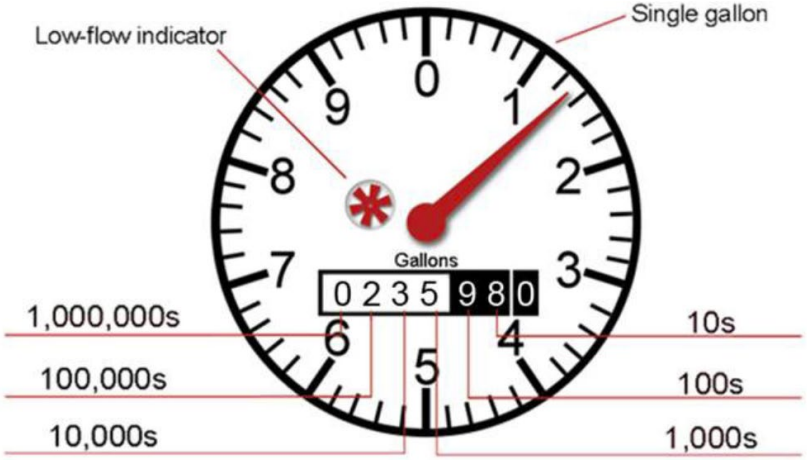


Life-cycle costs are greatly influenced by multiple visits to a meter location.

Key factor: Meter resolution

For AMI, we want readings at 1 gallon

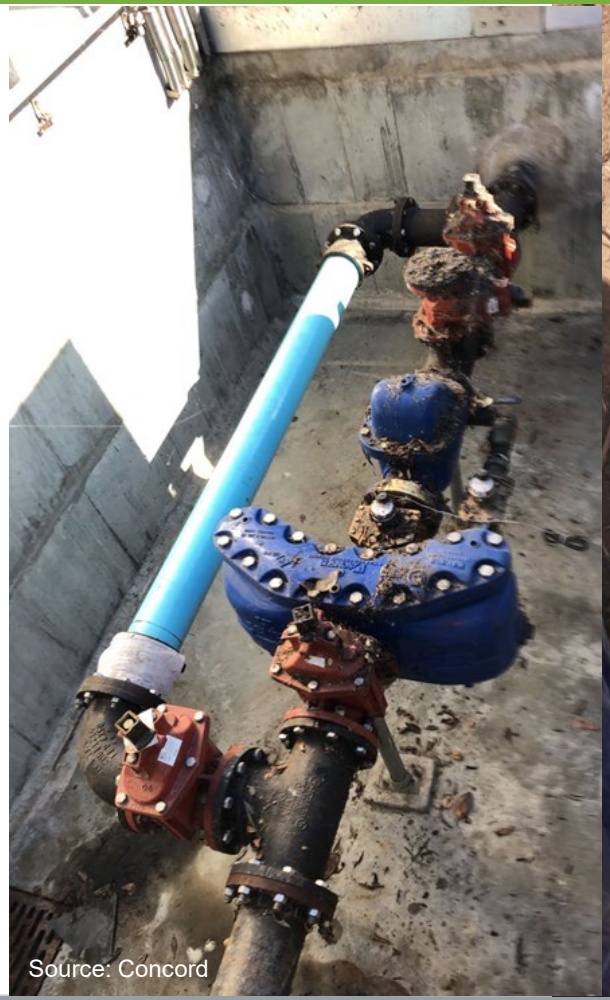
- Need seven-digit resolution from meter register
- Can continue billing at current level



Large meters

Consider:

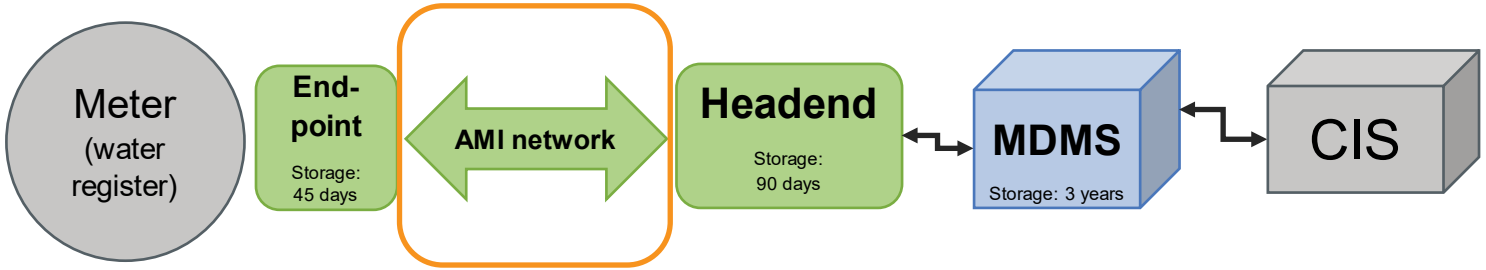
- Installation of test ports
- Evaluation of vault
- Valve exercise/testing
- Installation standards
- Who will install?
- Replace or retrofit?
- Meter accuracy
- Proper application

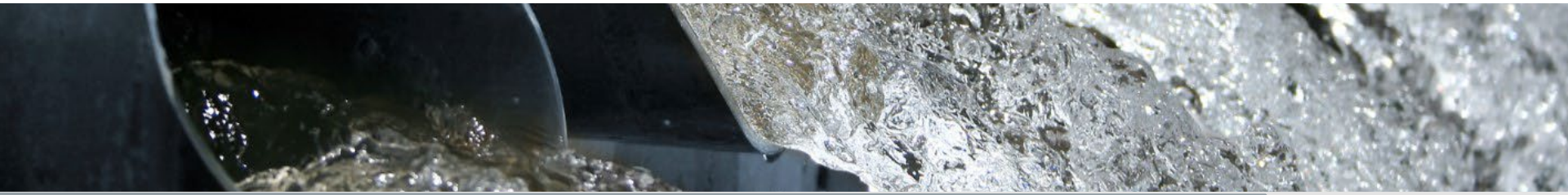


Source: Concord

Target audience:
- IT
- Billing
- Meter shop

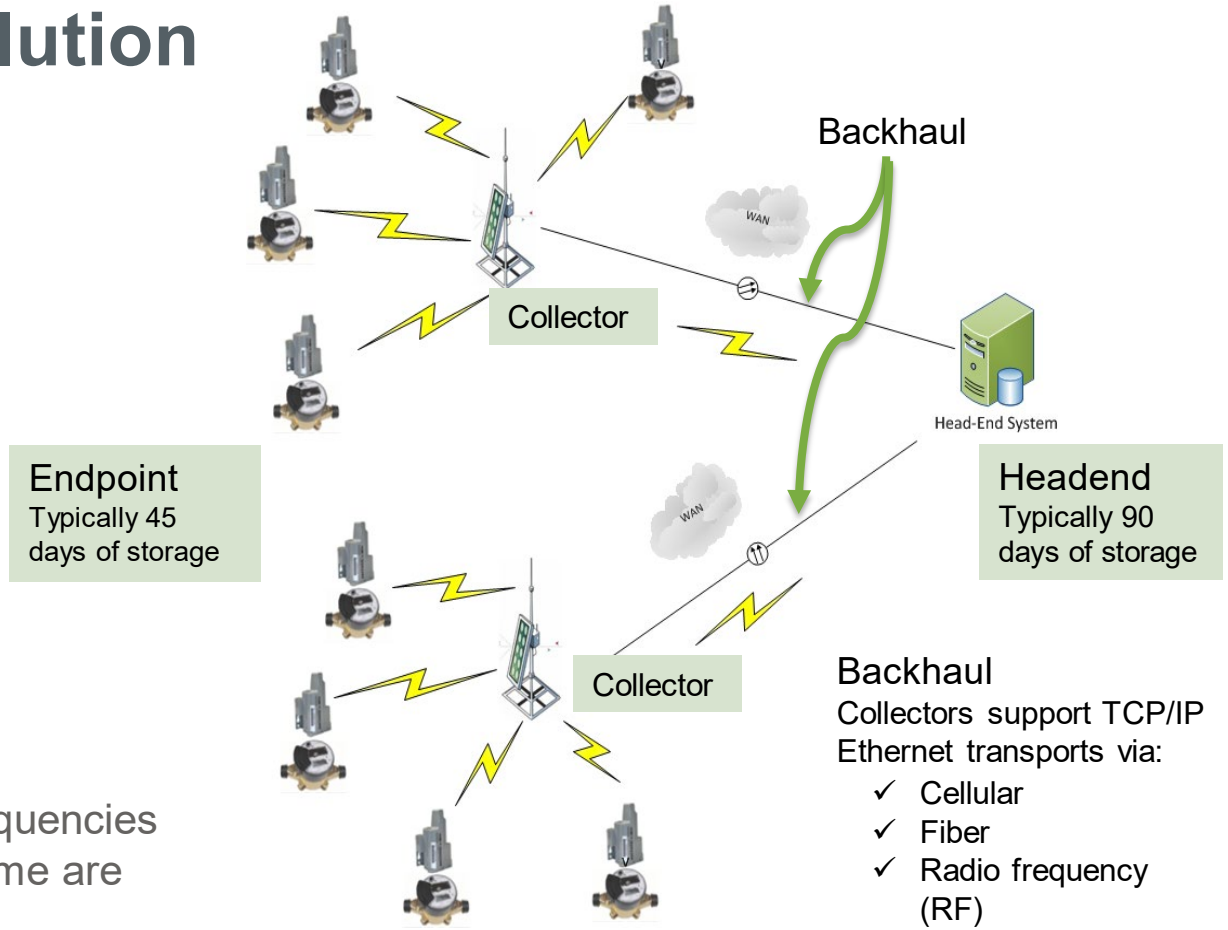
Networks





RF P2MP: Star solution (cellular)

Communications direct from endpoints to “collectors” or a cell tower



Typical traits:

- Licensed or unlicensed frequencies
- Some are tower based, some are neighborhood based

Backhaul

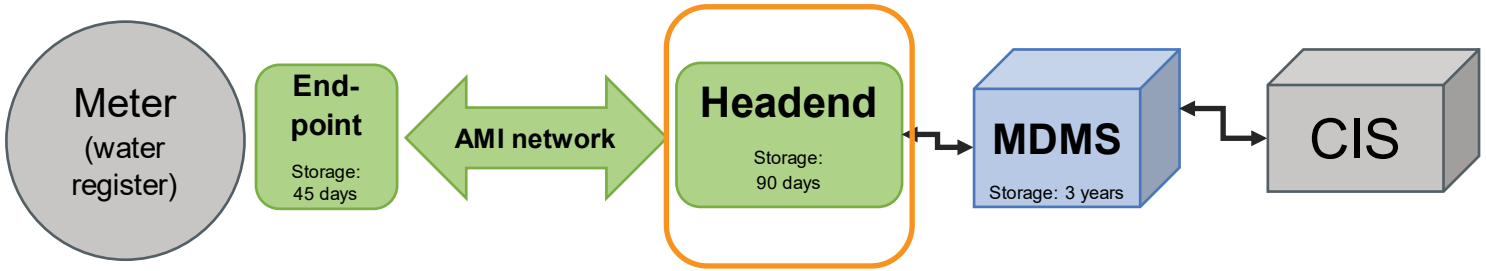
Collectors support TCP/IP Ethernet transports via:

- ✓ Cellular
- ✓ Fiber
- ✓ Radio frequency (RF)

“Typical” network characteristics

- Cellular
  - 15-minute intervals
  - Minimal alarms
  - Strong backfill
  - No new towers
  - Needs public cell coverage
  - Weak on Internet of Things
- Unlicensed RF
  - 1-hour intervals
  - Endpoint alarms
  - Minimal backfill
  - Requires more infrastructure
  - Shorter distance
  - LoRaWan exists here
- Licensed RF
  - 1-hour intervals
  - Endpoint alarms
  - Minimal backfill
  - Requires less infrastructure
  - Longer distance

Headend system (HES)



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- Managers
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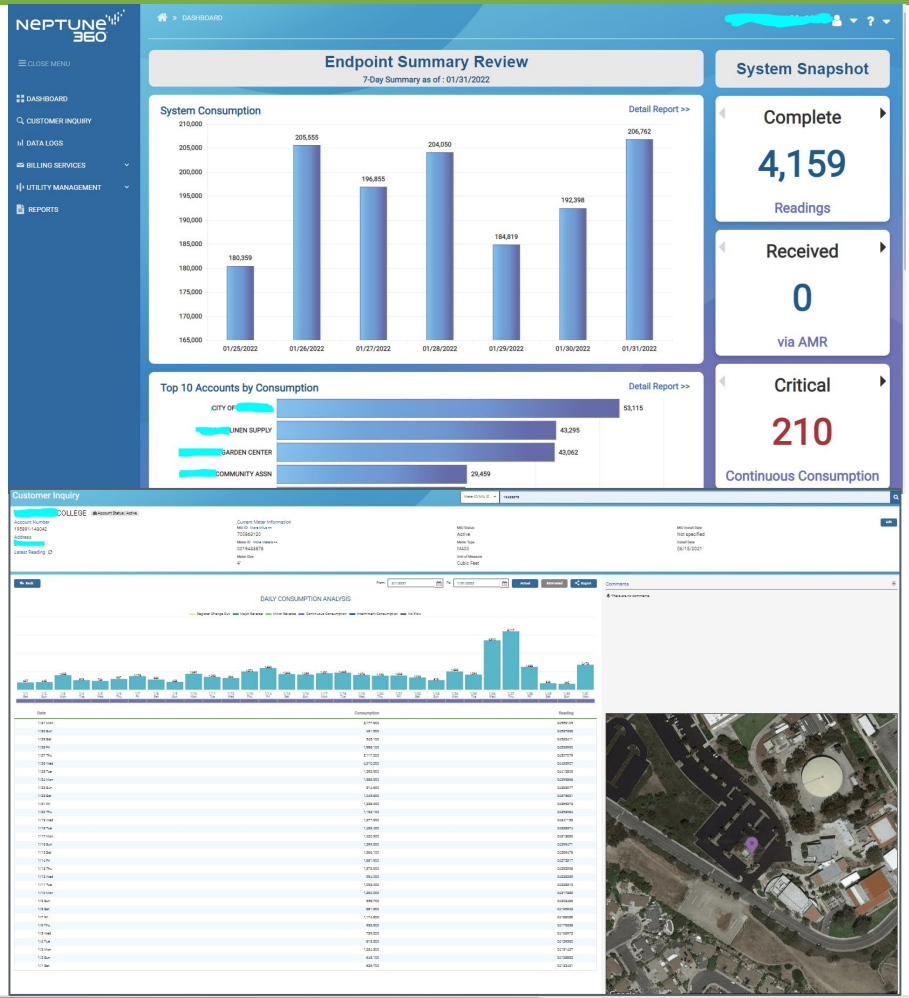
HES

- Short-term storage—typically 90 days
- Dashboards and KPIs for AMI network are common
- Some will do very basic analytics
- Source of customer portal data if no MDMS
- Can be integrated directly with CIS (if no MDMS) to provide billing reads
- Generally only integrated with CIS or MDMS



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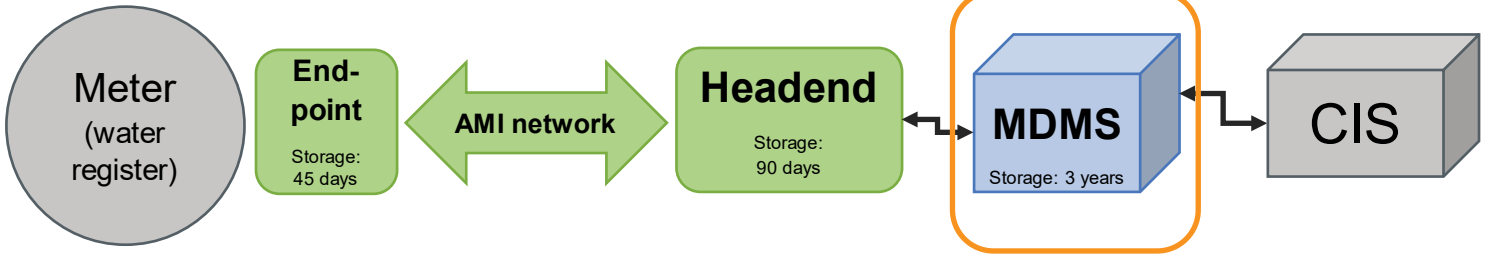
Meter data management system (MDMS)



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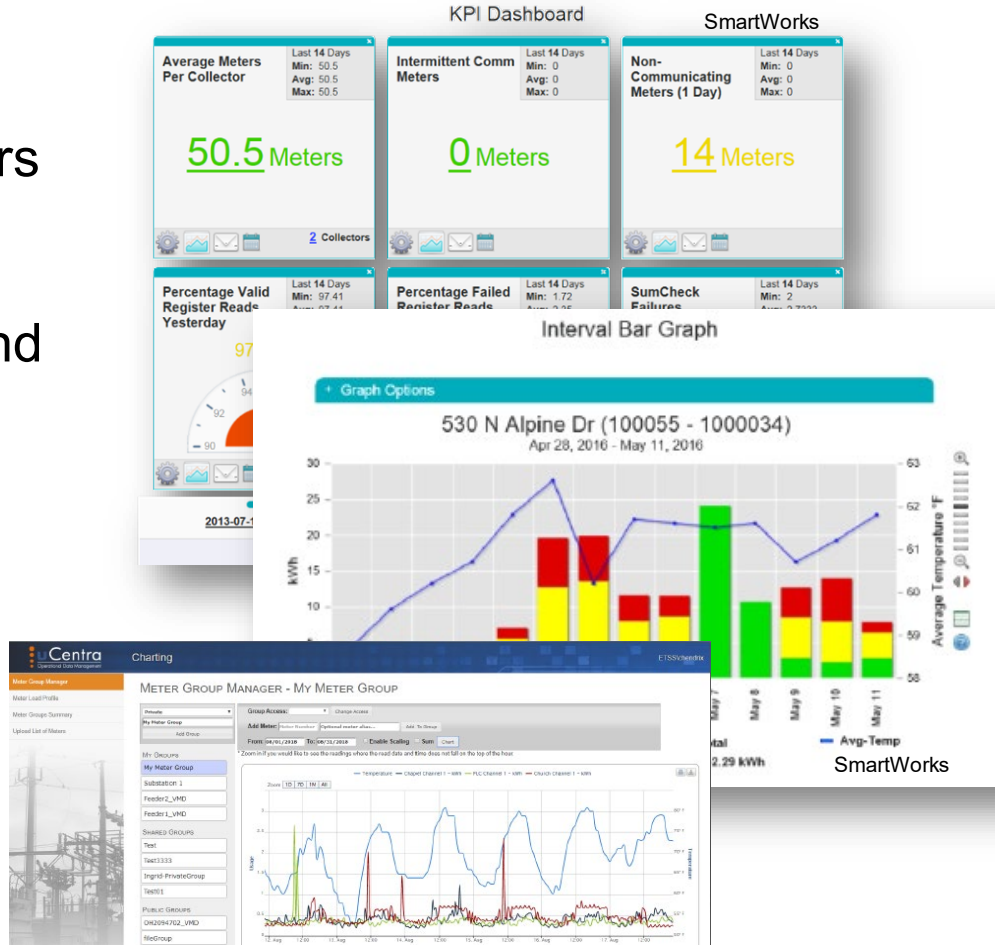
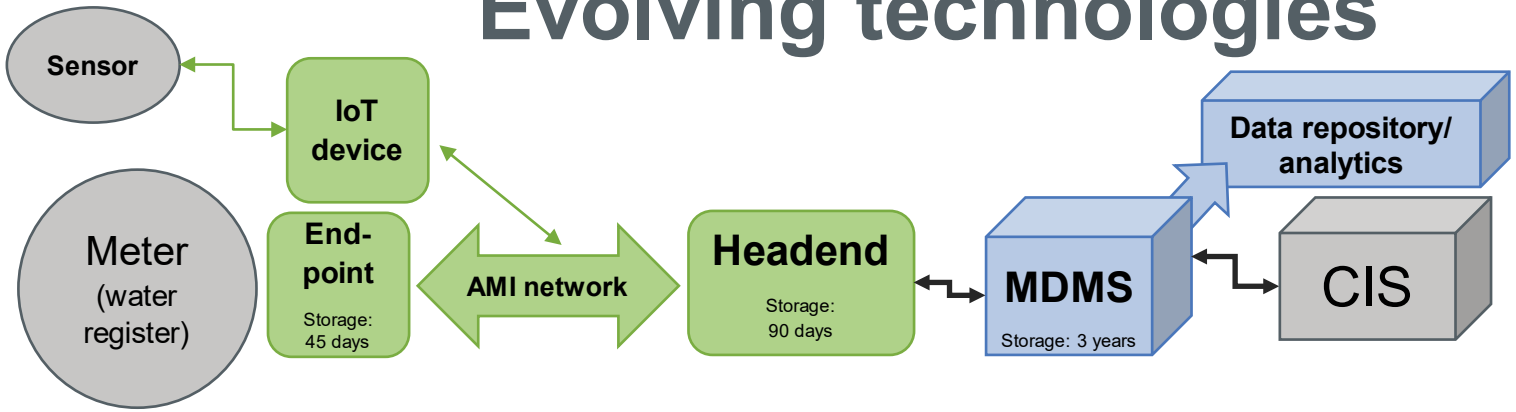
MDMS

- Long-term storage—typically 3 years
- Basic analytics
- Geared more toward operational end users compared to HES
- Source of customer portal data
- Integrations facilitate greater uses
- Validating, estimating, and editing functionality (not all have this functionality)



Evolving technologies



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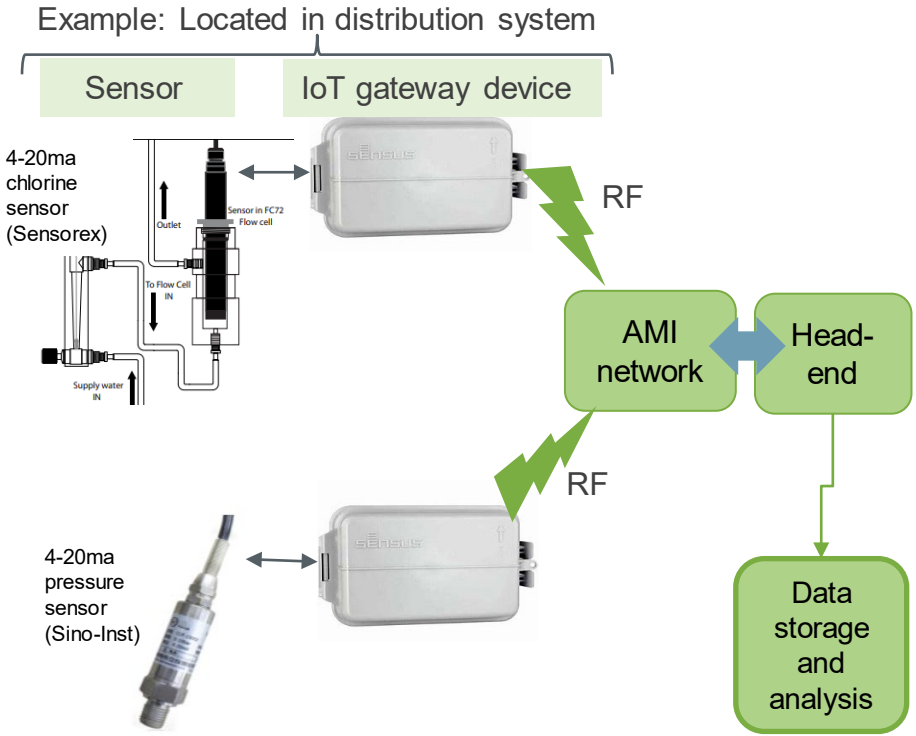
Evolving AMI-related technologies

- Functionality
  - Pressure and temperature sensors (on meters)
  - IoT devices using AMI network
  - Remote disconnect/reconnect meters or water valves
  - Prepay
  - Electronic bill presentment and payment (EBPP)
- Capabilities
  - Analytical use to support decision-making
  - Data repositories and data science as a service (DSaaS)
  - Integrations with core utility systems (GIS, SCADA, CMMS)
  - More-advanced customer engagement options
    - Customer portals
    - Pay as you go
  - Smart city support

Evolving AMI-related technologies

IoT devices: “Gateway” devices allow sensor data to transmit over AMI network

- Pressure and temperature sensors (not from meter)
- Leak-detection sensors
- Water quality monitoring
- Lower-cost SCADA node
- Level sensors—sewer, reservoirs, streams, wells, lift stations, trash
- Water quality—pH, dissolved oxygen, chlorine



Data management considerations: On-premise versus software as a service (SaaS)

	On-premise utility-managed software	Cloud-hosted, vendor-owned software (SaaS)
	On-premise hardware and software; utility owns and manages servers and hardware and maintains software licenses and upgrades	Cloud-based hardware and software; vendor owns and manages servers and hardware and maintains software licenses and upgrades
PROS	▪ Utility can colocate server hardware ▪ More data control ▪ More easily introduce customizations and new integrations ▪ Security is within utility's control	▪ Faster to implement ▪ More easily supports remote access ▪ Single contract with defined service level agreement results in a "hands off" approach ▪ Reduced demand on staff; potential to pursue other activities ▪ Superior data protection ▪ Lower cost of ownership
CONS	▪ Becoming less common ▪ Additional hardware and security monitoring required ▪ More difficult to scale and longer planning process ▪ Additional burden on existing staff ▪ Additional training required ▪ Requires software maintenance and upgrades ▪ Less efficient backup and recovery	▪ Troubleshooting done off-site (responsiveness) ▪ Utility doesn't own software or control when releases occur ▪ License management needed to avoid cloud overspending

Network management options

	Utility-owned, utility-managed AMI network	Utility-owned, vendor-managed AMI network (maintenance as a service [MaaS])	Vendor-owned, vendor-managed AMI network (network as a service [NaaS])
	Utility owns and manages meters, endpoints, and network infrastructure	*Utility owns and manages meters and endpoints; utility owns and vendor manages network infrastructure*	*Utility owns and manages meters and endpoints; vendor owns and manages network infrastructure*
PROS	▪ Typically lower cost ▪ Ability to expand network devices without added infrastructure cost or bandwidth concerns	▪ Vendor monitors and troubleshoots network issues ▪ Vendor repairs or replaces network components at utility's expense ▪ Reduced demand on staff ▪ Decreased need for staff related to network maintenance	▪ Single contract with defined SLA results in a "hands off" approach ▪ Vendor troubleshoots and repairs or replaces network components at vendor's expense ▪ Reduced demand on staff ▪ Decreased need for staff related to network maintenance
CONS	▪ New skill sets may be needed ▪ Added burden on existing staff ▪ Additional training required ▪ Additional equipment warranties to manage	▪ Loss of network maintenance as core skill competency ▪ Typically higher cost	▪ Loss of network maintenance as core skill competency ▪ Utility doesn't "own" network; additional purposes require vendor approvals ▪ Typically higher cost

Avoiding project pitfalls

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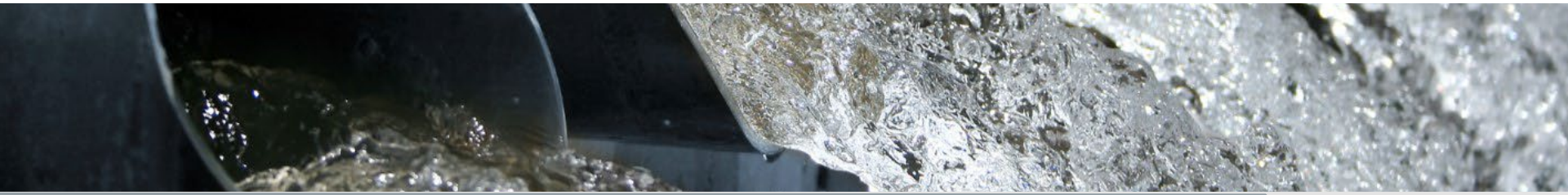
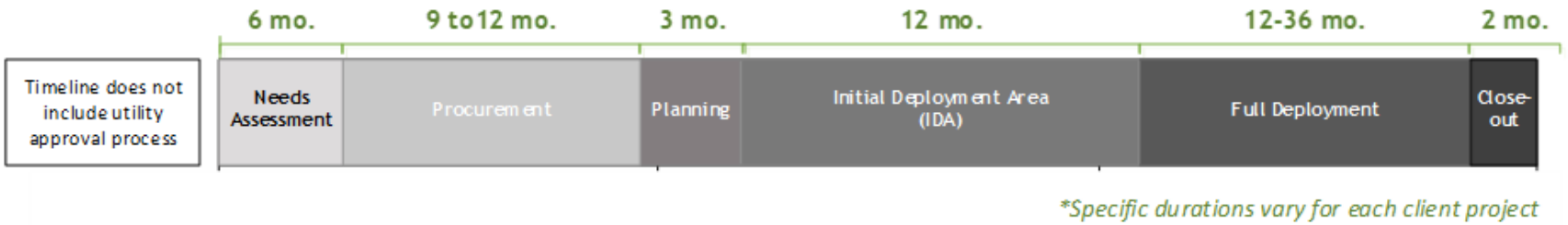


Project phasing



We recommend a phased deployment approach

- Planning: meter orders, training, configuration workshops
- Systems integration/user acceptance testing ($$)
  - Bench test
  - Limited deployment
- Full deployment: largely logistics tasks; big $$$ spend occurs here

This approach minimizes risks to the utility

Lessons learned

- AMI projects are large and complex and include operations, IT, and construction
- An effective start is critical
- Get the contracts, SLAs, and scopes of work
- Spend the time to create a single, integrated project schedule with vendor buy-in
- Clearly identify vendor dependencies
- Get a governance/decision framework in place
- Plan for change requests, but work to avoid them (starts with the RFP)
- Project communications are vital—internal and external
- Proper staffing (either internally or with contract support) is essential
- Learn from others that have already deployed AMI

Key decisions ahead

- What will you do and what will vendors do?
- On-premise or SaaS?
- Do you want an MDM or separate analytics platform?
- Do you want to own, install, and maintain the network equipment? Traditional versus NaaS
- Use existing meters, replace like for like, or move to ultrasonic or electromagnetic water meters?
- What work must be done at each service?

Vendor solutions

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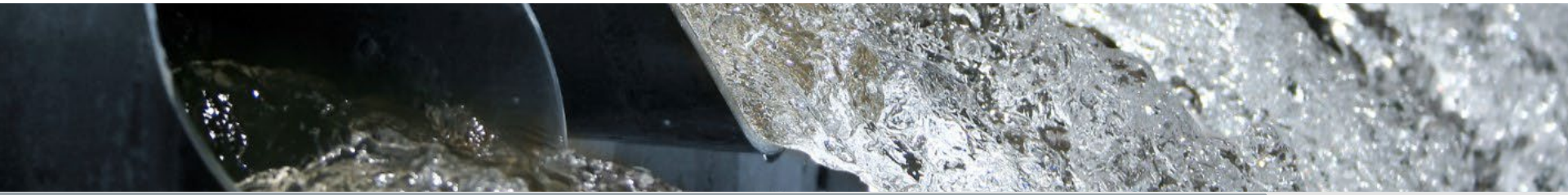


Complex vendor marketplace

Meter manufacturers

AMI solutions

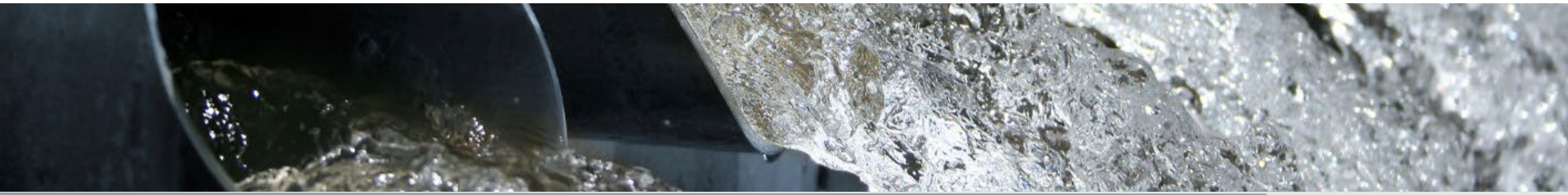
Meter data management systems

Customer engagement platforms*

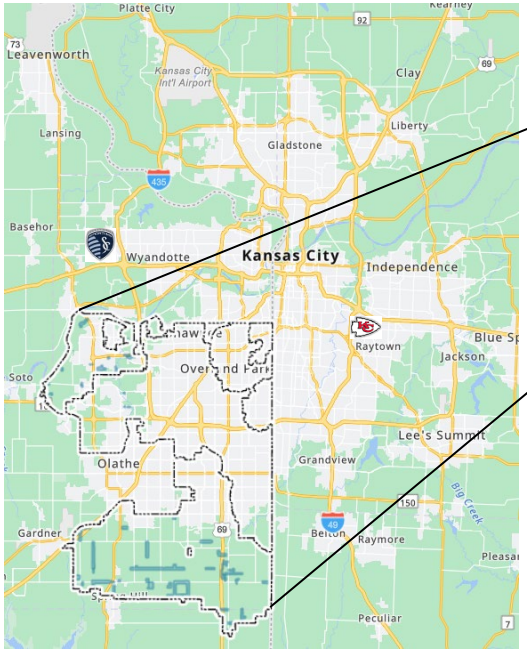
*Includes CEP without customer portals

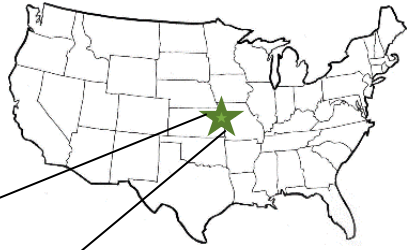
AMI success story:

WaterOne
Water District No. 1 of Johnson County



WaterOne: Kansas City suburbs





WaterOne
Water District No. 1 of Johnson County

272 square miles

154.7K service connections

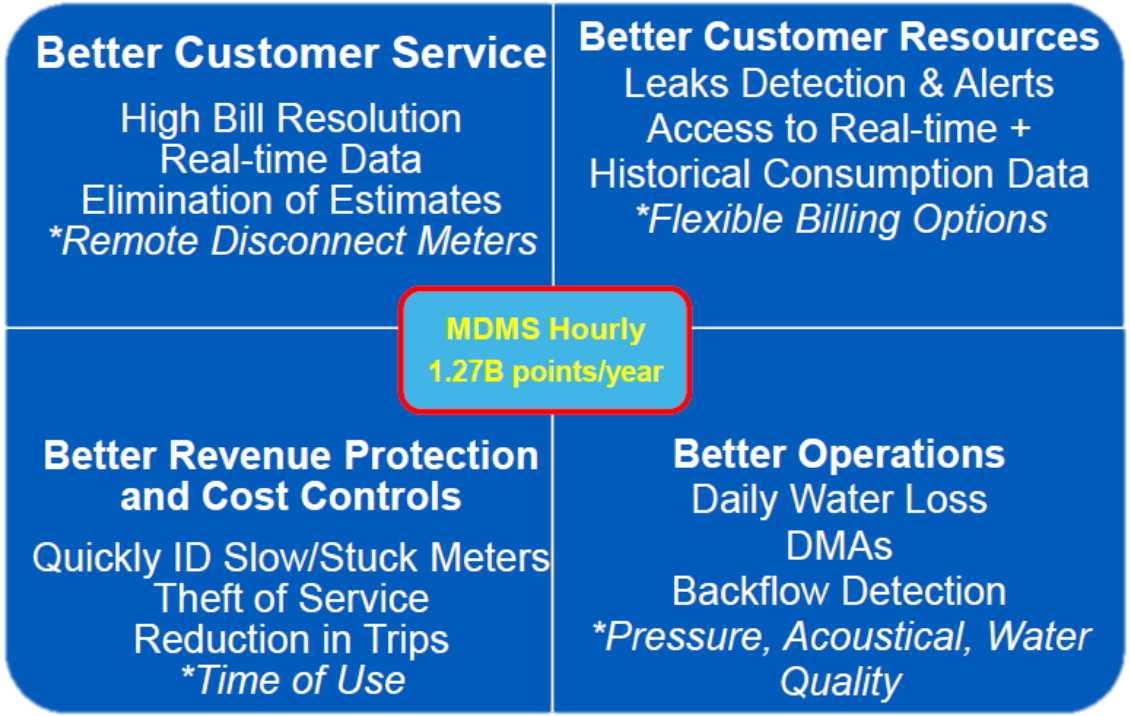
200 MGD supply capacity

475,000 population served

2,830 miles of infrastructure

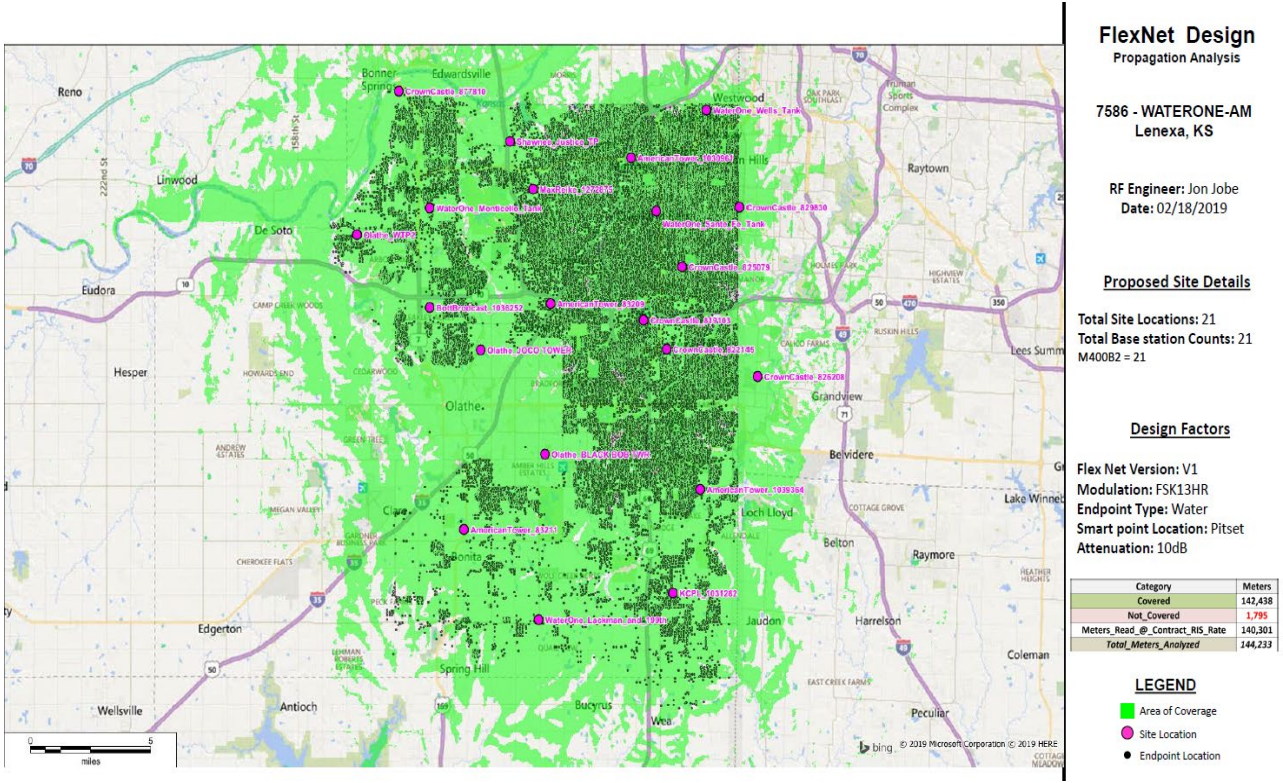
1957 WaterOne incorporated as water provider

WaterOne
Water District No. 1 of Johnson County



WaterOne AMI journey

WaterOne
Water District No. 1 of Johnson County



FlexNet Design
Propagation Analysis

7586 - WATERONE-AM
Lenexa, KS

RF Engineer: Jon Jobe
Date: 02/18/2019

Proposed Site Details

Total Site Locations: 21
Total Base station Counts: 21
M400B2 = 21

Design Factors

Flex Net Version: V1
Modulation: FSK13HR
Endpoint Type: Water
Smart point Location: Pitset
Attenuation: 10dB

Category	Meters
Covered	142,438
Not_Covered	1,795
Meters_Read_@_Contract_RIS_Rate	140,301
Total_Meters_Analyzed	*144,233*

LEGEND

- Area of Coverage
- Site Location
- Endpoint Location

- Reused meter population
- Consultant for RFP
- 1 to 4 contracts
  - Installation
  - Network
  - MDM
  - Customer portal
- 20-year network contract
- 5-year MDM/portal
- Reprogrammed “OTA”

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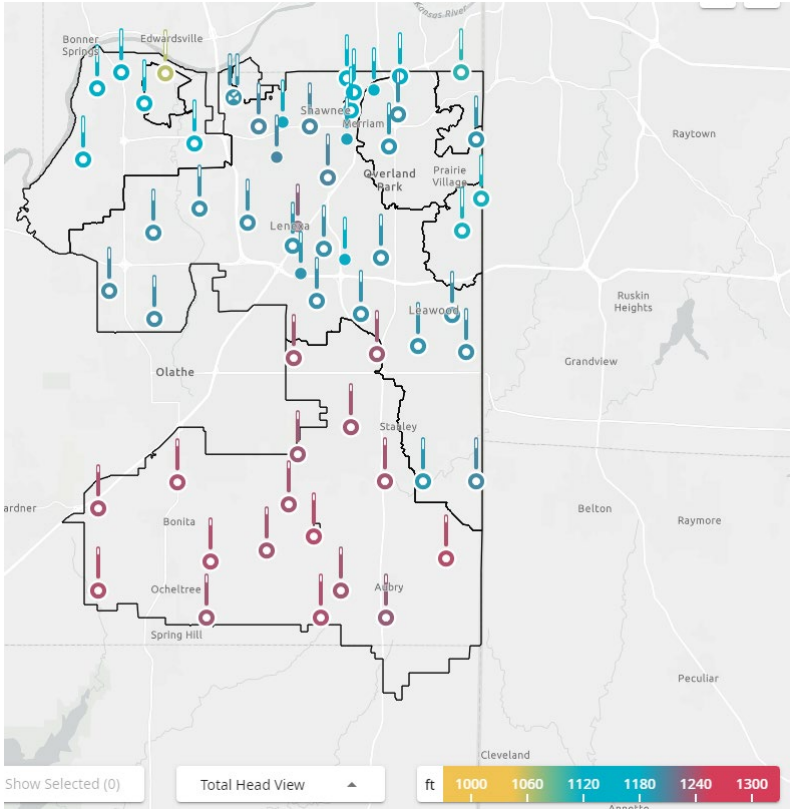
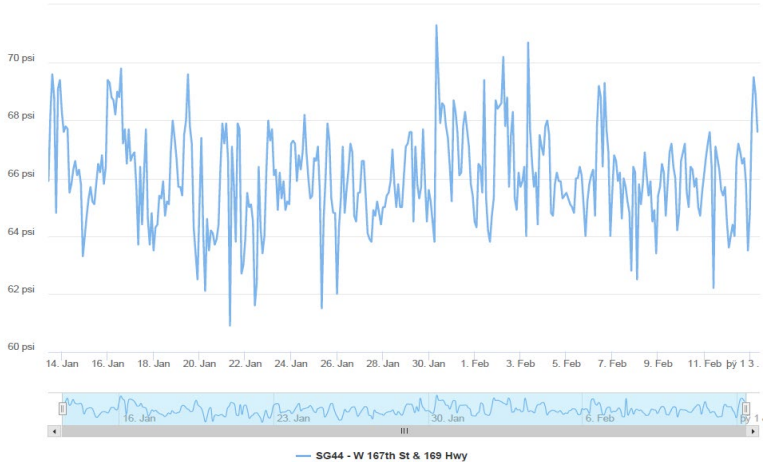
WaterOne beyond AMI: Pressure

WaterOne
Water District No. 1 of Johnson County





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Questions?

Thank you!

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