

**Mueller Water Products**

**echologics**  
A DIVISION OF MUELLER CO.

Where Intelligence  
Meets Infrastructure®

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Permanent Leak Detection:  
Solutions for Transmission and  
Distribution Mains

Corey Keefer, Client Manager  
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# Meet Echologics

- Provider of specialized services for water loss management, large main leak detection and pipe condition assessment
  - ▶ Isolates leaks and determines remaining service life
- History of the company
  - ▶ 2003: Echologics founded as joint venture
    - Federal research institute (National Research Council)
    - Acoustic engineering firm
  - ▶ 2004: Leak detection equipment for non-metallic pipes
  - ▶ 2005: Transmission main leak detection services
  - ▶ 2006: Pipeline condition assessment technique pioneered.
  - ▶ 2008: Pipeline condition assessment technique commercialized
  - ▶ 2011: Echologics acquired by Mueller Water Products, Inc.
  - ▶ 2014: Permanent leak monitoring introduced

# Tool of the Trade

## LeakFinderST Acoustic Correlator

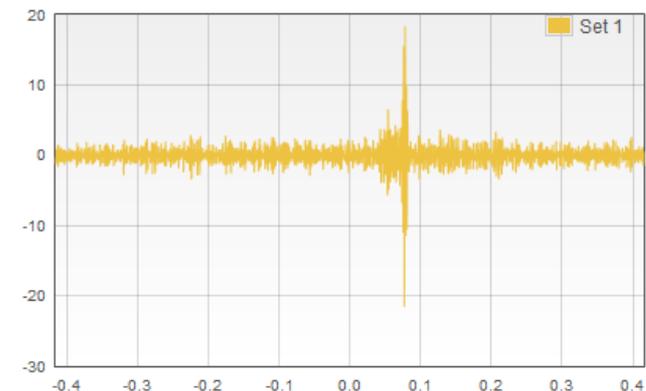
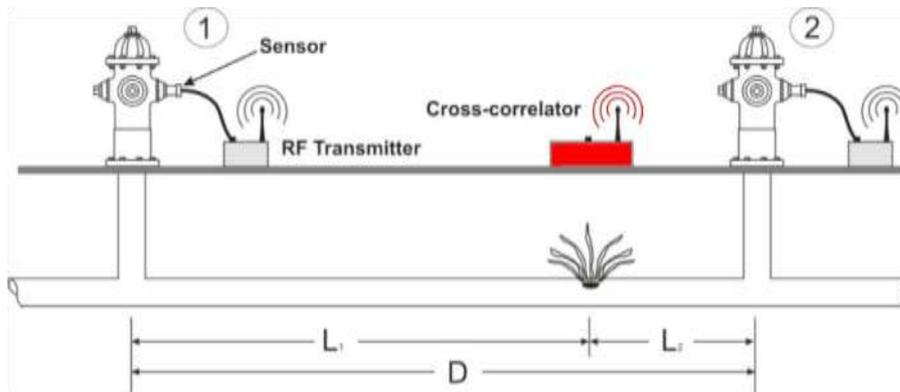


Over 500 Leaks Found on Large Diameter Transmission Mains

# Leak Correlation Acoustic Analysis

## Principle of Operation

1. Bracket the leak with two sensors
2. The leak sound propagates in both directions
3. Correlator measures the time difference to reach each of the sensors to determine the exact leak location



Advances in correlation technology allow for low frequencies & long-distance sensor spacing typical in T-main applications

# Permanent Monitoring

Target: Most Critical Transmission Mains  
Data: Daily or weekly

# Transmission Mains Monitoring

## Next Generation Technologies

| Type                  | Description  | Pros   | Cons                                   |
|-----------------------|--|--|--|
| Fiber Optic           | Acoustic fibre optic continuously installed along section of PCCP main         | Detects and locates wire breaks                      | PCCP only<br>No direct LD              |
| Permanent correlation | Acoustic correlation sensors permanently installed periodically along the main | Detects and locates leaks.<br>Tracks leaks over time | Will not find very small leaks (<1gpm) |

New information available allows utilities to

- Find leaks before a catastrophic failure *as standard practice*
- Repair leaks when they are least expensive *as standard practice*
- Prioritize repair based on leak behaviour *as standard practice*
- Schedule and plan repairs *as standard practice*

## Monitoring Infrastructure

Deconstruct a correlator down to its core high-value components:

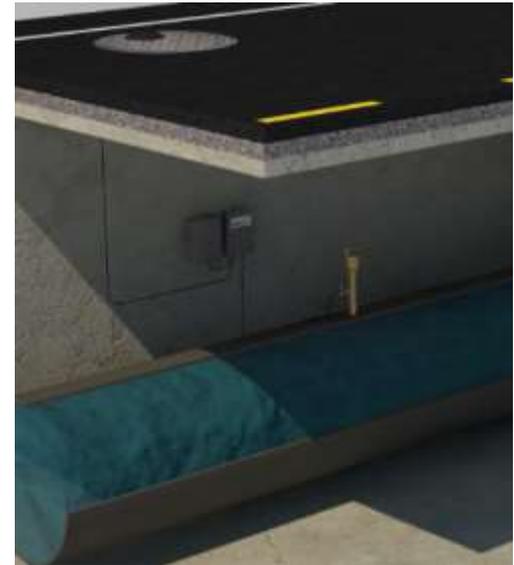


Antenna

Power Source

Processor &  
Comm.  
Hardware

Hydrophone

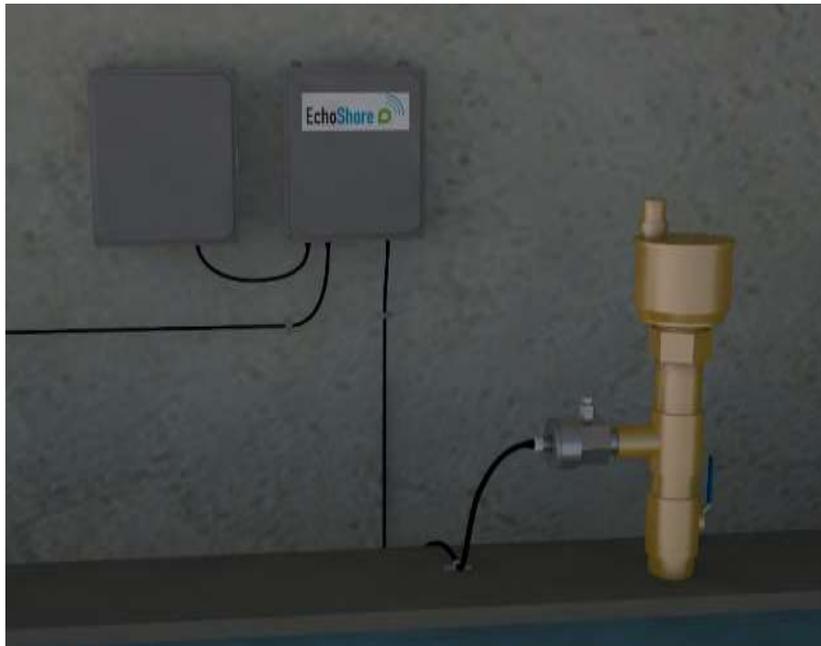


...and permanently install them along a transmission main

Innovative application of proven leak detection technology

## Installation Details

### In-Chamber Equipment



### Antenna Options



Traffic Rated Dome



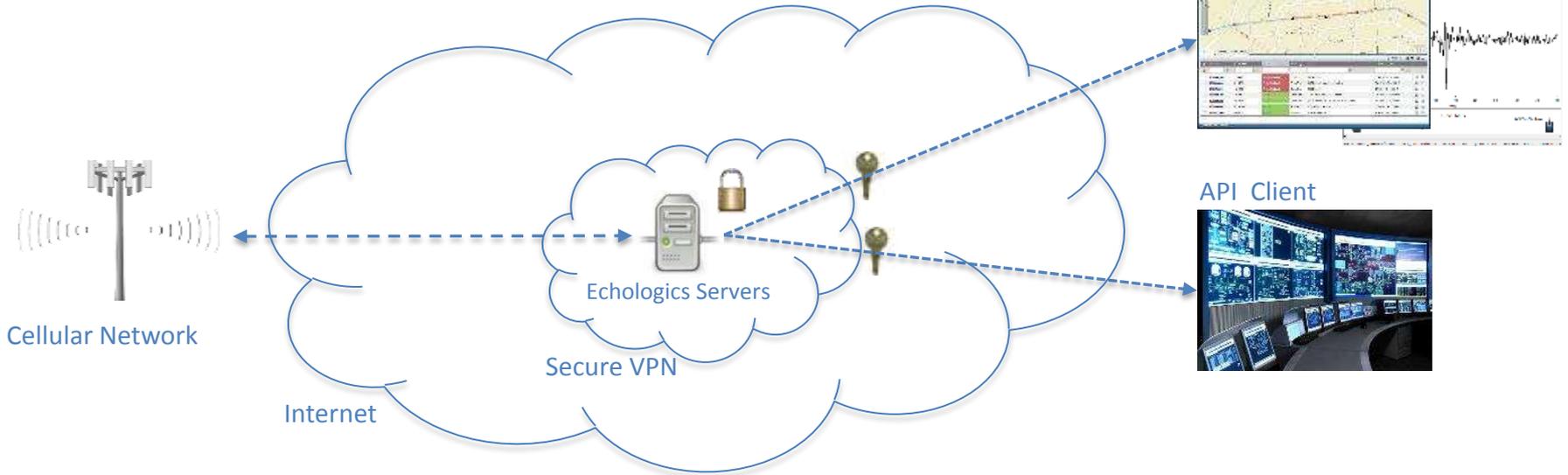
Traffic Rated Flush

### Other Options:

- Pole Mounted
- In-Road

Simple installation reduces total system costs

# Network Architecture



Network of interconnected nodes monitors a service area

# Permanent Leak Detection

## System Operation

### 24 hour leak detection cycle

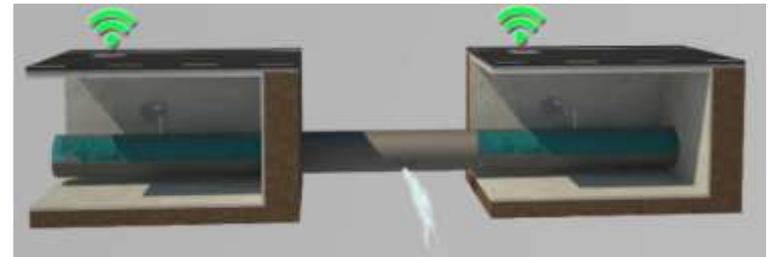
- Time-synced acoustic data capture
- Upload to central server and processed
- Results passed to UI or SCADA

### Autonomous

- Automated correlation peak selection
- Reporting

### On-Demand Functionality

- User can force unscheduled data capture
- Manual correlation
- SCADA data retrieval



Time between leak detection surveys reduced from years to hours

# Transmission Mains

## Operational Risks Revisited

| Risk                    | Past Approach  | Imminent Approach  |
|-------------------------|--|--|
| Bursts                  | Emergency repair crew<br>Insurance claims                                      | Repair leaks prior to burst  |
| Frozen Isolation Valves | Isolate larger service area for<br>emergency repairs                           | Plan leak repairs and inspect<br>valves before emergency<br>occurs |
| Leaks                   | Allow water to surface,<br>respond to citizen reports.<br>Periodic leak survey | Identify and monitor leaks as<br>they occur                        |
| Pressure and flow       | Measure at pump stations   | Monitor out in the system  |

- Mitigate consequential damage from burst, including boil water
- Efficient allocation of labour, reduce repair costs
- Water loss reduction

Permanent transmission main monitoring redefines operational risk, and provides responsible mitigation

## Expandable Functionality

Pressure/Flow



Temperature



Chlorine



Other Customer Requirement

4-20 mA  
Signal

Additional input ports reserved for sensor signals

Opportunity to expand from advanced leak detection to customized pipeline monitoring

# Permanent Monitoring

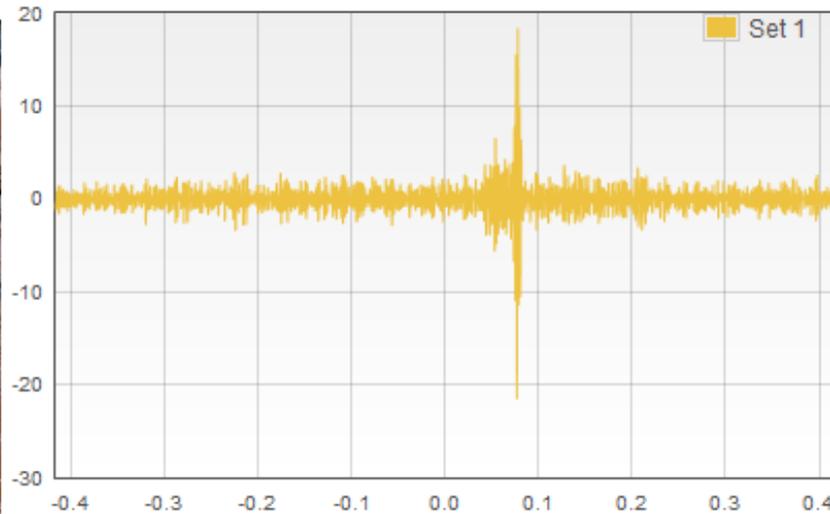
Target: Distribution Mains

Data: Daily

# Permanent Monitoring in Practice

## Monitoring to failure (almost)

Case study in repair prioritization:



+4 weeks

(prior to excavation)



*“It was a time bomb defused”;  
5 gpm leak paid for the system*

# Distribution Mains Monitoring

## Current Technologies and Approaches

| Type            | Description   | Pros                                       | Cons  |
|-----------------|---|--|---|
| DMAs            | Volume of water entering an area is compared against volume of water billed | Quantified NRW in an area                  | Dead zones;<br>Crews required to locate leak(s)                         |
| Sounding Survey | Leak pinpointing using acoustic listening technologies                      | Location pinpointing                       | Experience required;<br>Labour intensive.                               |
| Noise logging   | Single-channel using acoustic loggers. Often 'lift & shift' arrangement     | Ability to survey large distances quickly. | Limited performance;<br>Crews required for deployment & data collection |

- High false positive rate
- Leaks identified, but location is still labour intensive
- Reliant on specialized labour

Current technologies focus on improving a manual process.  
Still an exercise in 'hunting'

# Distribution Mains Monitoring

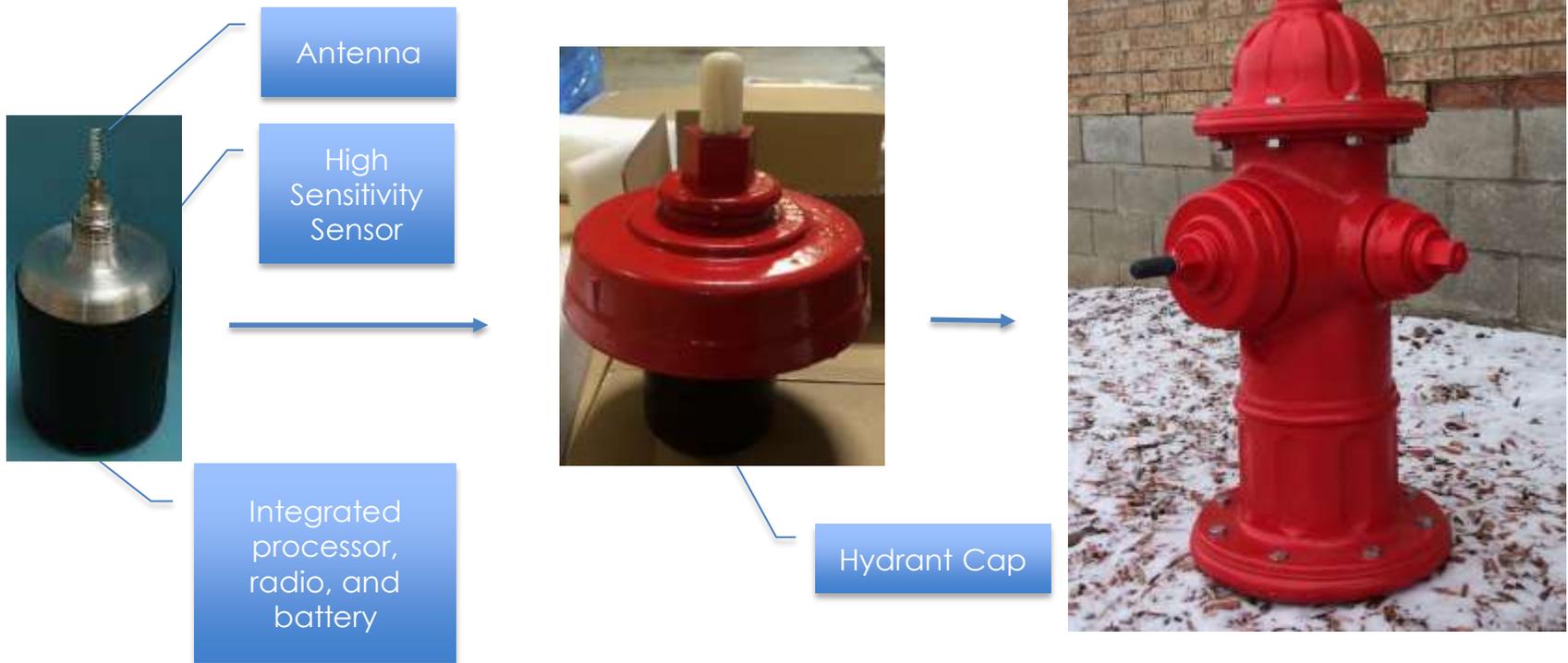
## Next Generation Technologies and Approaches

| Type                     | Description  | Pros  | Cons                                    |
|--------------------------|--|---|---|
| Multi-Parameter analysis | Multiple parameters, including pressure and flow, from a larger area model the network | Improved leak identification                      | Secondary indicators only; No direct LD |
| Permanent correlation    | Mesh network of acoustic correlation sensors installed throughout the network          | Detects and locates leaks. Tracks leaks over time | Reliant on accurate piping data         |

New information available allows utilities to

- Find leaks before customers *as standard practice*
- Monitor leaks in the repair queue *as standard practice*
- Notify customers of repairs/disruptions early *as standard practice*

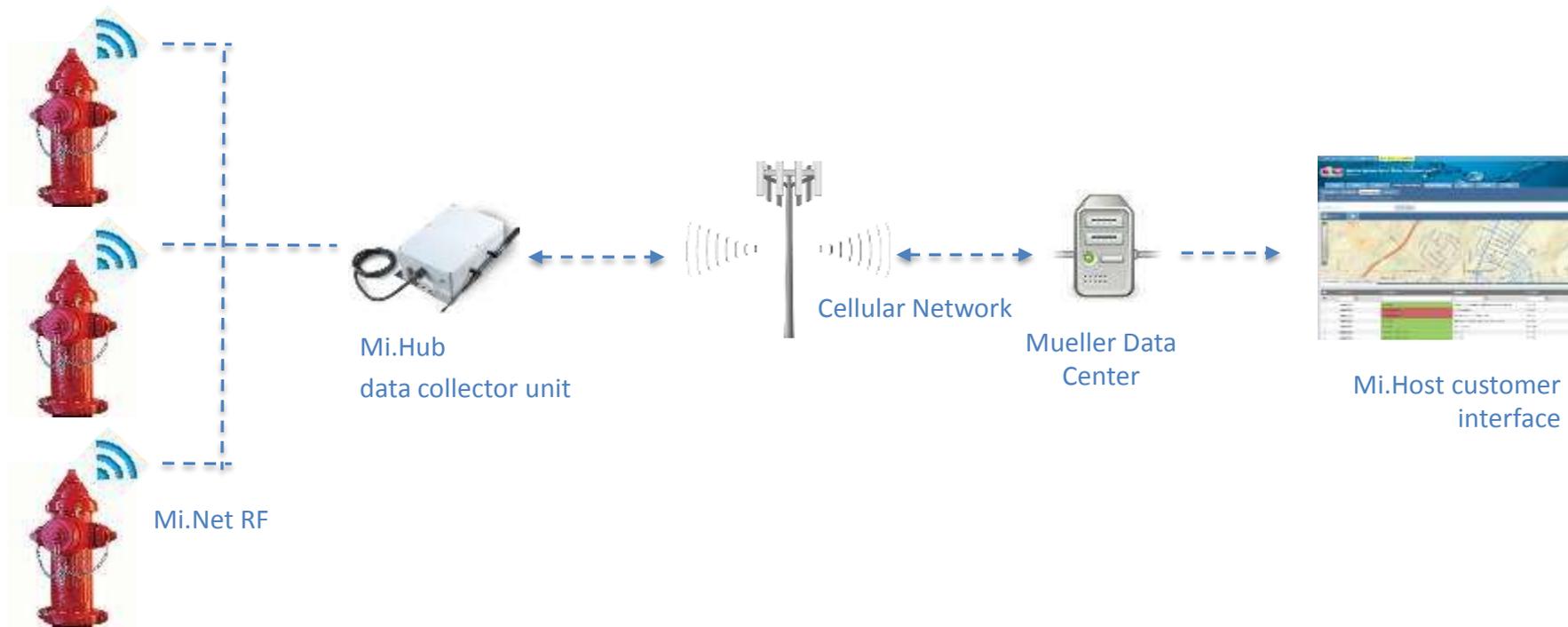
## DX Product Description: Node Sampling node installed in standard hydrant cap



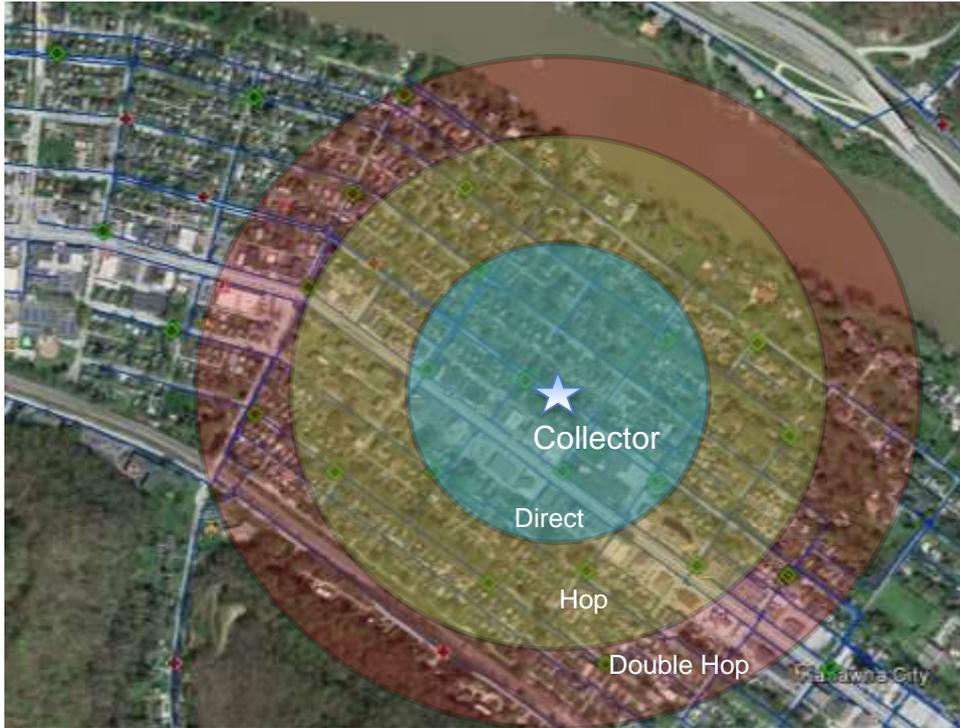
Above-ground is the ideal installation environment;  
Hospitable to equipment and network stability

## **DX** Product Description: System

System comprised of a series of nodes and radio infrastructure:



Network of interconnected nodes monitors a service area



Nodes form mesh network

On initialization, EAM performs a system-wide leak detection and correlation

Baseline background noise level excludes existing leaks

EchoShore DX will identify and locate existing leaks

## Primary Leak Detection at Node Level

### Single Channel Leak Detection:

1. Node collects data over a 2-hr period
2. Node processes the data
3. Nodes determines leak likelihood

Once/day data packet is transmitted to EAM:

- Leak likelihood score
- Node vitals



Node-level intelligence reduces false positive rate and extends battery life

# Distribution Leak Detection

## Secondary Leak Detection at Central Server

### Multi-Channel Leak Detection:

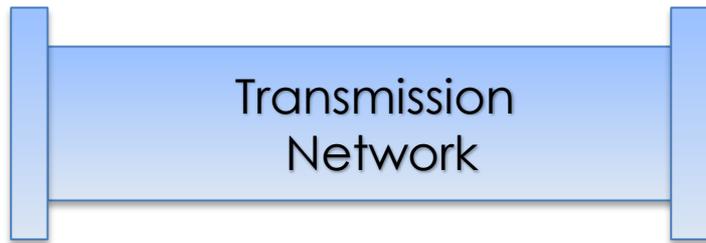
1. Leak groups identified
2. Correlation data files from the leak group are obtained
3. Correlations on all node pairs in the leak group are performed



Server-level intelligence increases LD probability and conserves radio bandwidth & battery life

# Permanent Leak Detection Systems

## Exposing & Addressing Invisible Operational Risk



- ✓ Identify leaks before bursts
- ✓ Plan and inspect before repairs
- ✓ Responsible management of *most critical* mains

Distribution Network



- ✓ Reduce leakage rates
- ✓ Monitor leaks in the repair queue
- ✓ Responsible customer-centric pipeline management

Permanent monitoring is disruptive to traditional practice;  
Risk & Pain that was once tolerated can be alleviated