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FIBER & DIRECTCONNECT SOLUTIONS

TESCO's Meter School

TESCOOL

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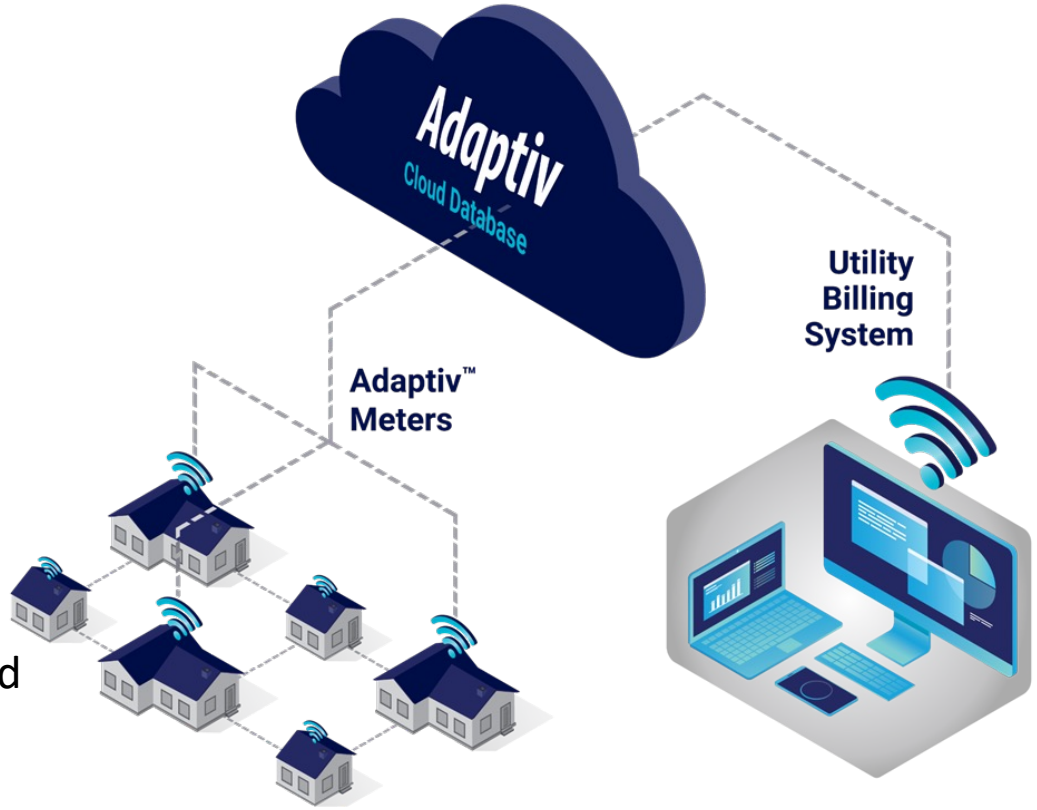
ADAPTIV ARCHITECTURE

Adaptiv Benefits

- Zero Infrastructure
  - Easy to deploy
  - No costly infrastructure to install or maintain
- Billing Data Transfer
  - Standards-based integration to utility billing applications
  - Multispeak, MV-RS, CMEP
- Solution as a Service
  - Seamless Cloud Software and Support
  - No IT hardware to buy or databases to manage
  - Nighthawk provides all hosting and support
- Secure, Reliable Reads scheduled or on demand
  - Daily consumption
  - Move in/move out reads
  - Disconnects



ADPATIV DEPLOYMENT OPTIONS

- Full AMI
  - Typically targeted at small – medium-size municipalities/cooperatives.
  - Cell + Mesh
  - Multi-service
    - Full two-way AMI for electric or electric + water (no water-only).
    - Gas remote reading is handled through ERT collection using our ERT Collector Hub Meters. NOT full two-way AMI for Gas.
- Gap Fill
  - Typically targeted at larger utilities to fill in gaps in existing AMI systems.
- Tactical/Targeted Solutions
  - Used for targeted applications like remote disconnect, remote reading, Christmas Lights, crypto-mining, etc.
  - When dealing with a utility, can naturally grow into a full AMI system.
- ERT Collection
  - For electric and water customers, can be used as a bridge to Full two-way AMI.
  - Rarely do we reliably collect ALL electric, water and gas ERT signals.

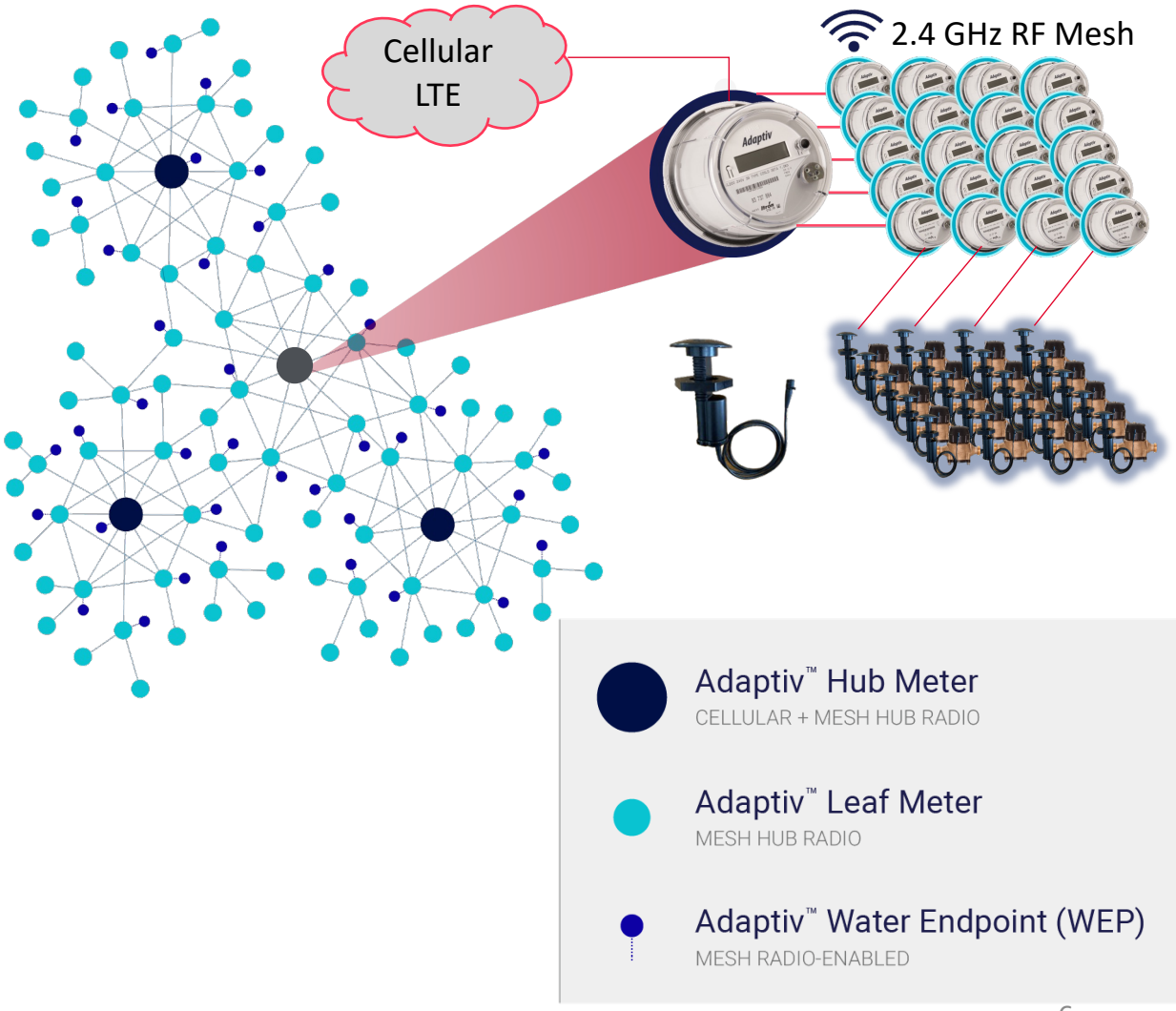
ADAPTIV ENDPOINTS

- All Adaptiv devices contain a 2.4GHz RF Mesh transceiver connecting all devices, including HUBS
- Cellular Hubs manage multiple LEAF devices
- Population diversity: ~10% HUB to 90% LEAF
- Electric meters available in all S Base form factors and classes

Device Type	Cellular + RF Mesh HUB	ERT Reader Cell+Mesh HUB	RF Mesh only LEAF	Disconnect option
Aclara kV2c	✓	---	---	---
Aclara I-210+c	✓	---	✓	✓
Itron Centron II	✓	✓	---	✓
Water End Point	---	---	✓	---

ADAPTIV™ | ONE HUB TO MANY LEAFS

- Scalable, self-healing, self-configuring RF Mesh network
- High bandwidth LTE cellular-mesh
  - One HUB per cluster of 10 -20 LEAF devices – electric and water
  - LEAF devices provide up to 4 hops to maximize coverage
- Built-in security and redundancy
- Water interval data and leak detection with exceptional battery life
- Simple installation and maintenance



WHAT DOES THIS HAVE TO DO WITH FIBER?

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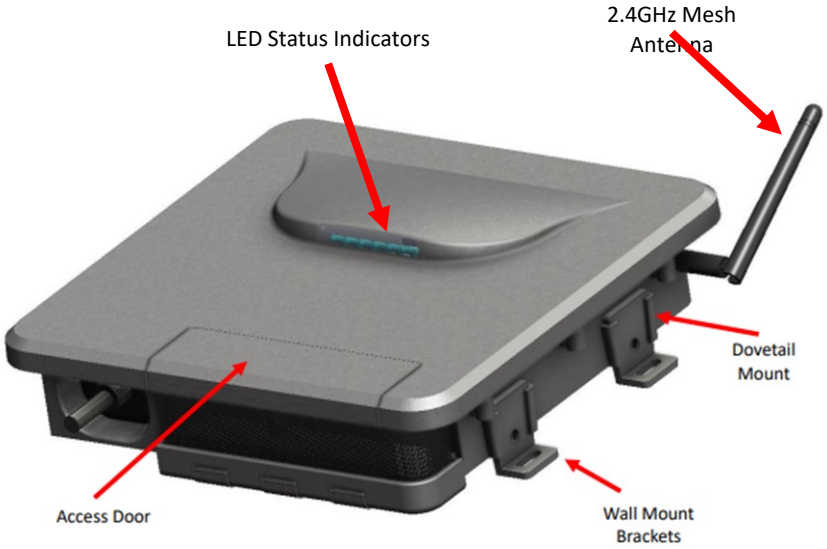
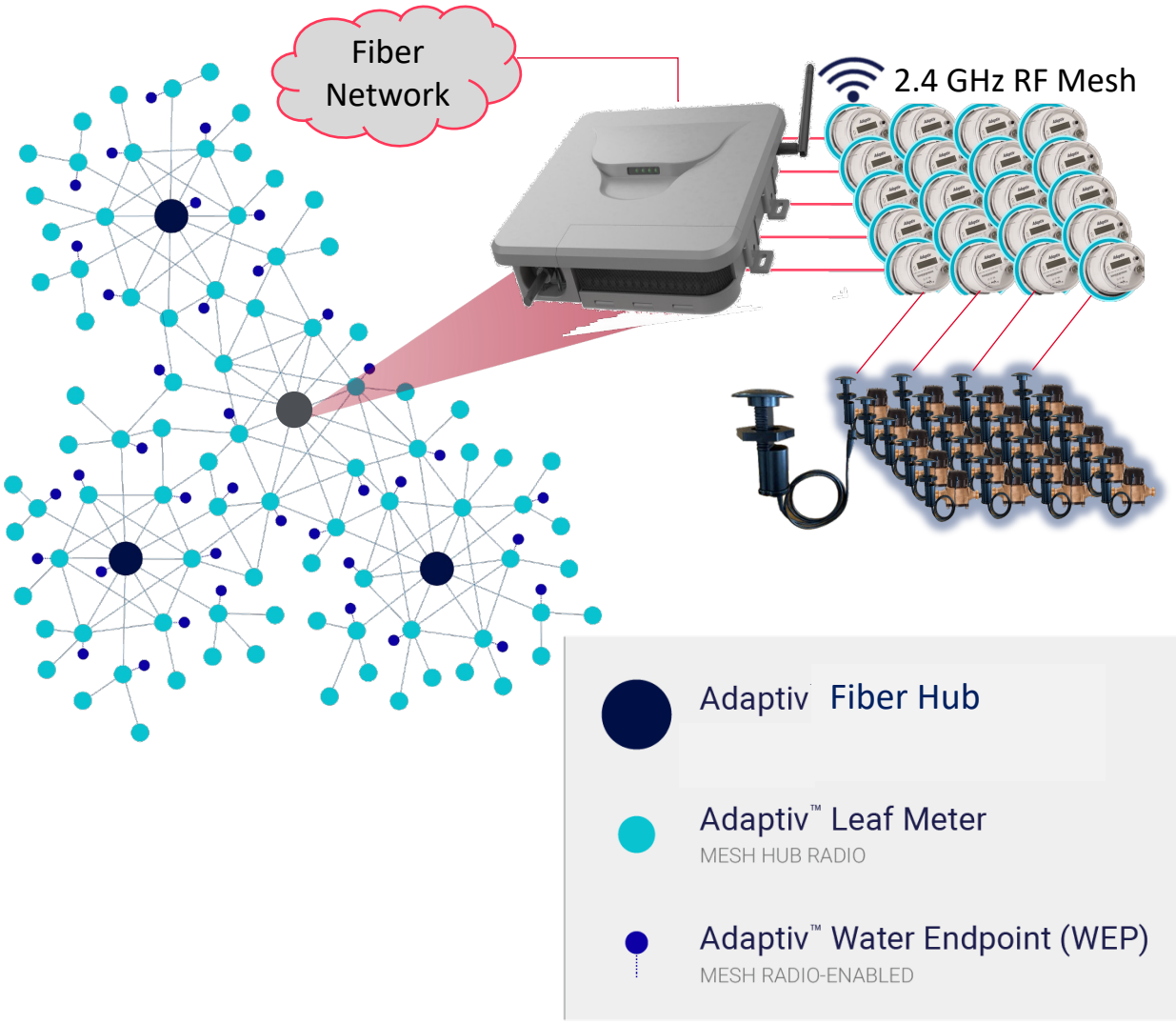
Fiber Hub Intro

- Introducing late 4th quarter 2023
- The Nighthawk Ethernet HUB product is a self-contained mesh HUB device with a wired Ethernet uplink.
  - Fiber hub is Adaptiv compatible – uses same Synapse mesh module
  - Acts as a collector for multiple devices
  - Technically an infrastructure device
- “Fiber” is used because the initial product offering has been designed to work with customer deployed PON networks
  - With further development, network uplink could be connected to any copper Ethernet interface
  - Circuitry included to support cellular based version (replaces PON) – reduces operating costs (less cellular outtakes)
- Customer assisted testing and validation ongoing



ADAPTIV™ | ONE HUB TO MANY LEAFS

- Scalable, self-healing, self-configuring RF Mesh network
- Utilize High bandwidth Fiber backhaul
  - One HUB per cluster of greater than 20 LEAF devices – electric and water
  - LEAF devices provide up to 4 hops to maximize coverage
- Built-in security and redundancy
- Water interval data and leak detection with exceptional battery life
- Simple installation and maintenance



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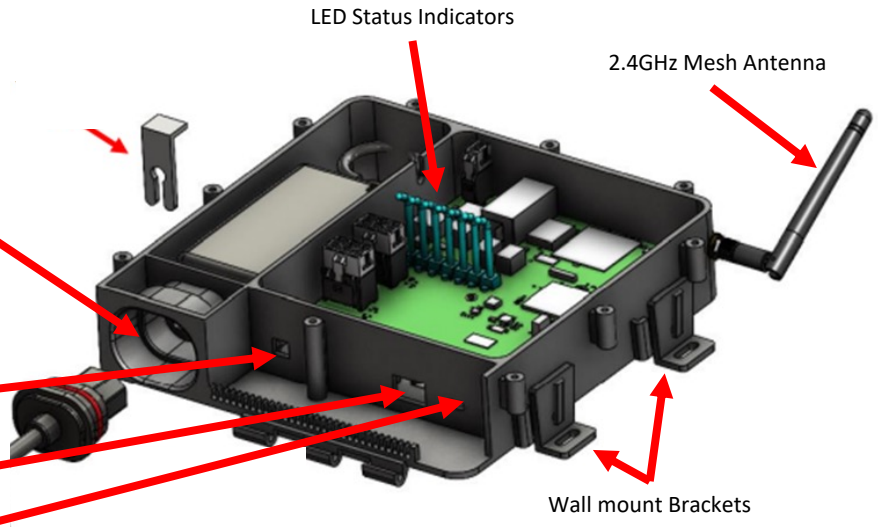
Fiber Hub Use Cases

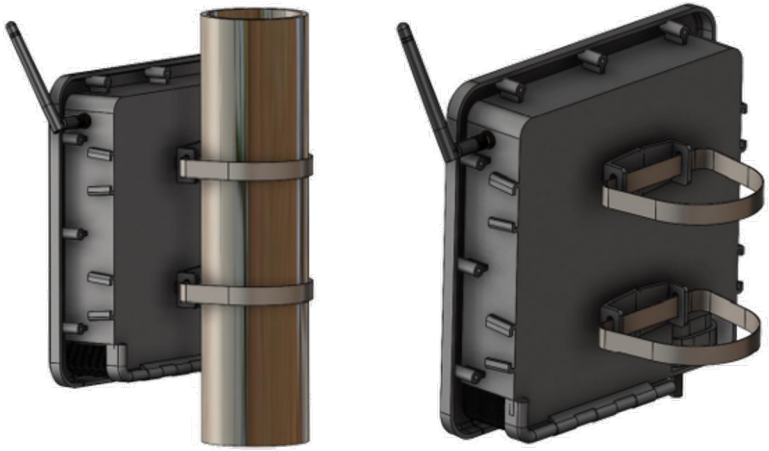
- Ideal for utilities who have mostly fiber throughout service territory
  - Federal government incentivizing rural coop fiber to the home
  - Utilities looking for applications to use the deployed fiber
- Allows for network performance tuning
  - Mounting on a pole improves device connectivity – increased RF range
  - Allow stranded devices network access
- To be confirmed in validation testing:
  - Connect > 20 devices via mesh
  - Height is our friend
  - Standard hub averages up to 10-20 leaf devices
  - Maximum hub capacity 150 leafs

Fiber Hub Features

- 120/240 VAC power input
  - Locking power cord
- Size: 7” x 6” x 2.5”
  - Wall or Pole mounting
- Operating Temp: -20C / +65C
- External I/O’s:
  - 12 VDC output for downstream devices (optional)
  - RJ-45 sealed connector – 100Base-TX
  - USB-C sealed Terminal Access Port for configuration, diagnostics, and Synapse script upgrades
- LED Status Indicators for power, network uplink, and alarm status
- Microprocessor based to support multiple peripherals
  - ST Micro STM32F767ZIT6
  - Processor firmware OTA upgradable



Pole Mount Option



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Fiber Hub Features – con't

- Advanced Outage Management power fail detection
  - Configurable blink and sustained outage event thresholds, event logging and data upload
- Rechargeable Battery Backup of 10 minutes to allow for last gasp transmissions
  - Powers internal circuitry only
- Supports OTA firmware upgrades to associated mesh devices
- Robust end to end security and encryption

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DIRECTCONNECT

Compatible with all data acquisition software that supports TCP/IP connections

Itron MV-90 xi

PrimeStone
Intelligent Data Collection + Analytics

Trilliant

Aclara MeterMate™

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DIRECTCONNECT SOLUTION

- Introducing Nighthawk DirectConnect TCP/IP connectivity on the Aclara kV2c mid second quarter 2023
  - Connects directly to the meter's C12.19 data structure
- Connects directly with **Itron MV-90**, **Aclara MeterMate**, **Trilliant PrimeRead**, or **Trilliant UnitySuite** data acquisition software
- Robust, secure, and efficient bidirectional message delivery mechanism
- Utilizes same proven LTE hardware as Adaptiv HUB solutions (less RF mesh module)
  - Cellular devices only – not compatible with Leaf (mesh) meters
- In final testing now
  - Full data retrieval
  - Features such as last gasp, modem configuration and firmware update supported
  - Can use MeterMate to update meter firmware and configuration
  - Compatible with Nighthawk kV2c meters – full meter functions supported
    - Itron Poly to follow late 2023/early 2024
  - Currently supported on Verizon or AT&T

DirectConnect Solution

- Does not require any middleware
  - Stand alone solution that does not require Adaptiv HES or other Adaptiv endpoints
- No recurring fees from Nighthawk. Utilize existing utility private contract with AT&T or Verizon
  - Customer provides SIMs
  - Other carriers can be supported
    - Other carriers can be supported with purchase commitments
    - Requires testing and certification
- Warranty Term: 1 year

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MODULE SPECIFICATIONS

Radio Performance

protocols	• TCP/IP
modulation	OFDM (Orthogonal Frequency Division Multiplex)
data rate	LTE Cat-1 (5 Mbps ↑, 10 Mbps ↓)
frequency band	LTE Bands 2, 4, and 12 or 13
transmit EIRP	+20 dBm (including antenna gain)
sensitivity	-103 dBm (@ 1% PER; incl. antenna gain)

DirectConnect Functionality

connectivity	AT&T or Verizon LTE cellular
security	ANSI C12.22 128-bit AES/EAX' (combined encryption/authentication)
memory	40 kB
clock synch	to LTE network
firmware	over-the-air upgradable
power outage & restoration reporting	aggregated real-time reporting

Power, Physical, & Environmental

burden (including module)	• 120 V: 1.3 W • 240 V: 1.6 W • 277 V: 1.7 W • 480 V: 2.4 W
S-Base	• 6.95"/17.65 cm (diam). x 4.38"/11.11 cm (D) • 4 lbs / 1.8 kg net
temperature	-22° F / -30° C to +158°F / +70° C
humidity	5 to 95% non-condensing

Compliance

radio emissions	• FCC Part 15 Class A • Industry Canada ICES-003 Class A
device IDs	• FCC ID: RI7LE910NAV2 • IC ID: 5131A-LE910NAV2
safety	• ANSI C37.90.1 • ANSI C62.41
metrology	• ANSI C12.1 • ANSI C12.18 • ANSI C12.19 • ANSI C12.20 • ANSI C12.21

SIMPLE CONFIGURATION