

The Internet of Things Is Coming, Is Your Facility Ready?

Presented by
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- What is IoT, why now, and what does it enable
- IoT technologies, and why it matters
- Building IoT and applications, and how it leads to savings
- Challenges to IoT adoption

The Internet of Things Is Coming, Is Your Facility Ready?

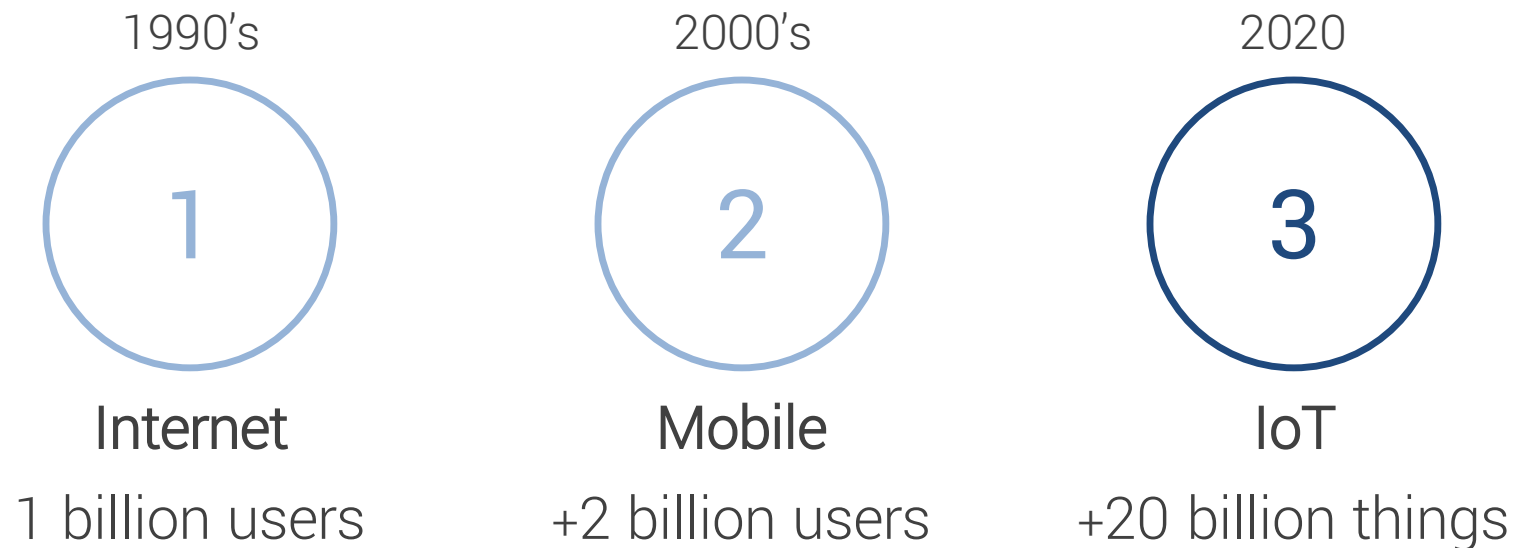
YES



Internet of Things - IoT

a proposed development of the Internet in which everyday objects have network connectivity, allowing them to send and receive data

IoT represents the 3rd wave of the Internet



All you need to enable IoT is an Internet connection

**Internet
connection**

Send and receive
data to/from the
cloud

+ IoT Device(s)

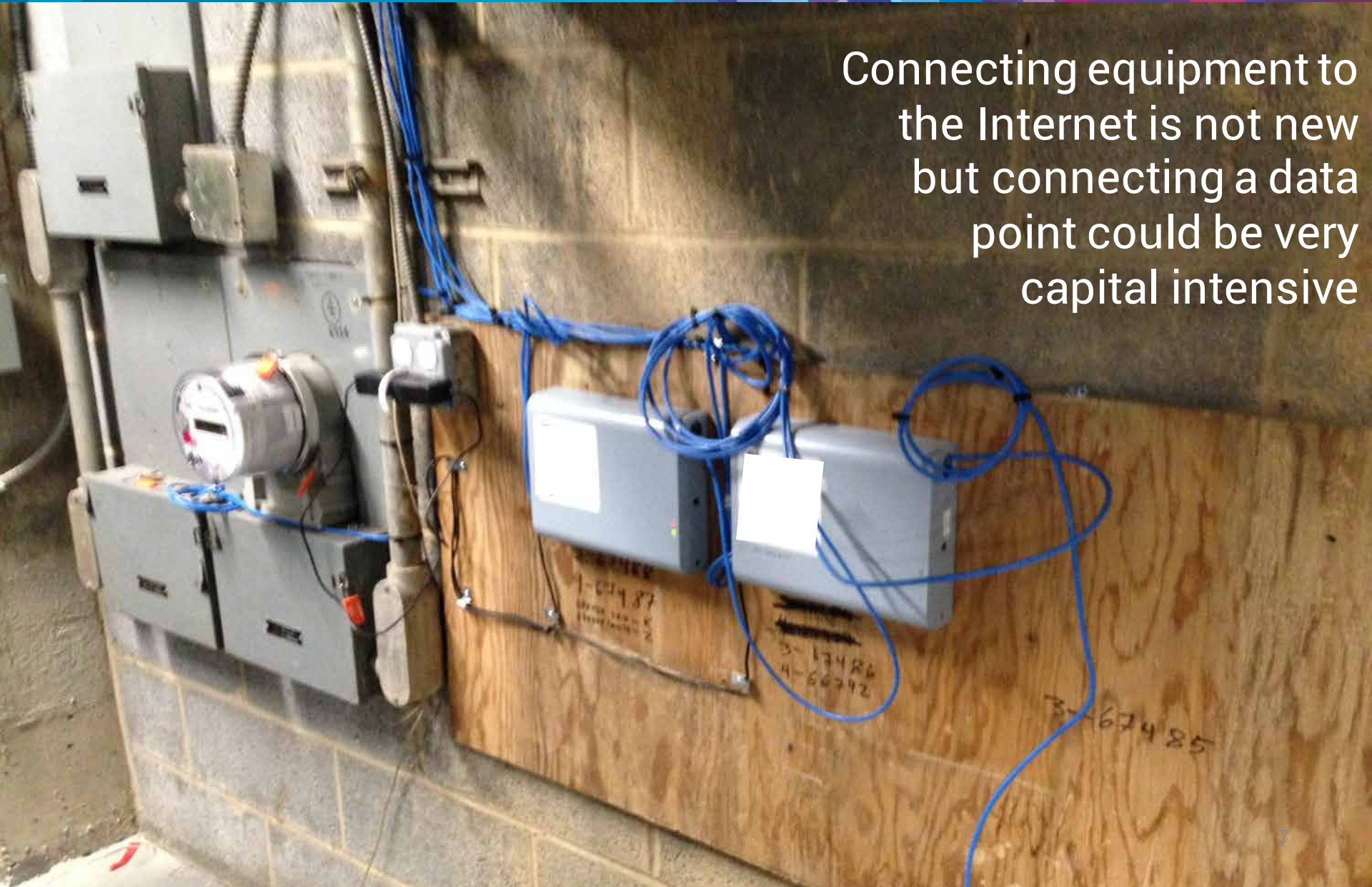
Collect data and
control one or
more devices

+ Service

Manage and
make sense of
your data

Can be one or multiple products/services

Connecting equipment to the Internet is not new but connecting a data point could be very capital intensive



Why now?

There has been a shift in balance

Barriers to adoption

No Data

Energy Indifference

High Cost of technology solutions

Lack of reliable case studies



Technology enablers

Cheap sensors, wireless, & hardware

Wide Internet coverage

Cloud computing

Big Data Analytics

Industry trends

Tighter codes & regulations

Green building market

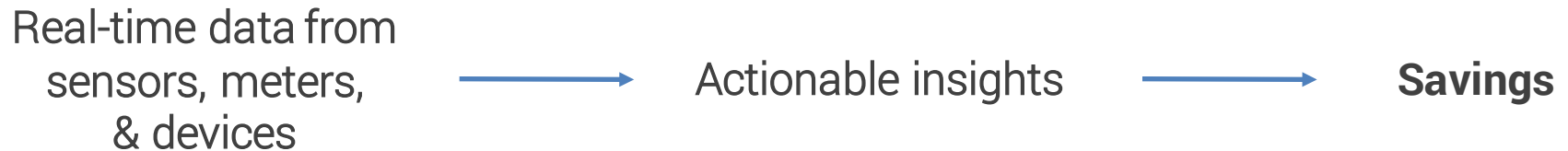
Corporate sustainability

Utility incentives for demand management

What does IoT enable?

In more than 80% of buildings, data is collected manually

IoT is turning 'dumb' machines into smarter machines



Real-time data from sensors, meters, & devices



Actionable insights

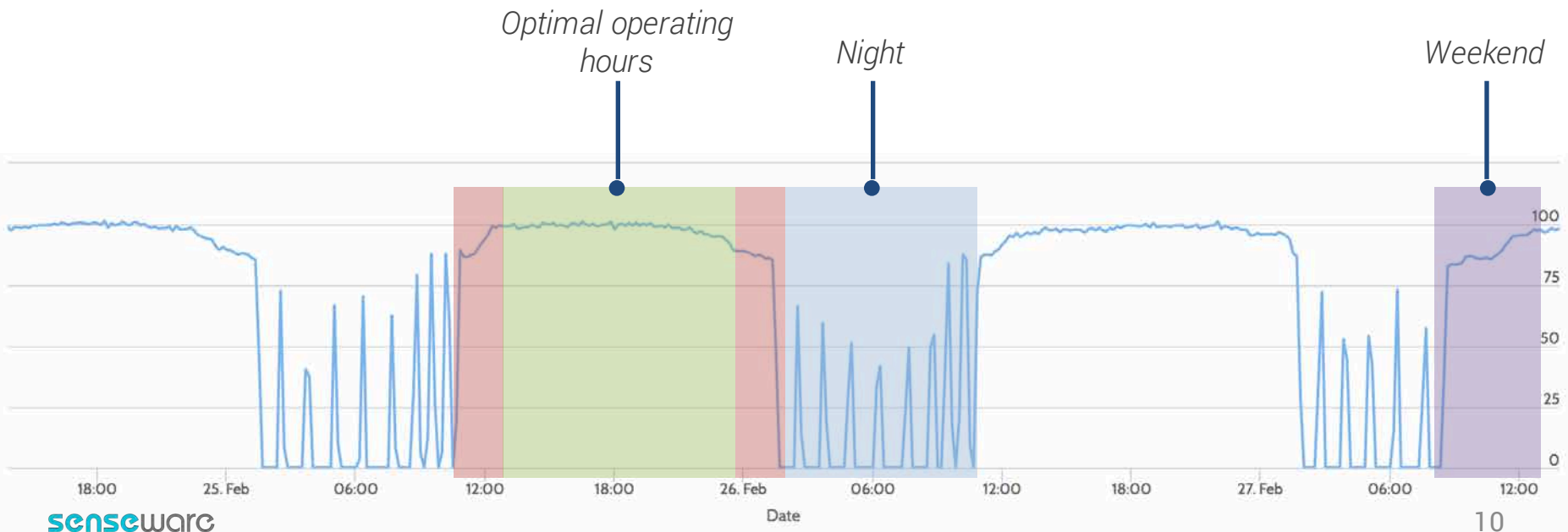


Savings

Real-time equipment power consumption monitoring

- ✓ Start and end time can be shifted
- ✓ Equipment should be off at night
- ✓ Equipment should be off during weekend

Thousands to hundreds of thousands of dollars can be saved every year



IoT Spectrum & Applications

Consumer Space

Industrial Space

& more

Wearables



Real-time health monitoring

Connected Cars



Smarter traffic management

Connected Homes



Remote AC control

Building Efficiency



Tenant Billing

Manufacturing



Real-time process optimization

Healthcare



Medicine inventory tracking and management

Agriculture



Real-time soil moisture

Oil & Gas



Real-time process management

Types of IoT devices & services

One type of data
 Low volume

Multiple types of data
 or High volume

| Data specific system with service | Data specific system without service | IoT platform without service | IoT platform with services |
|---|--|--|--|
| Collects 1 type of data | Collects 1 type of data | Collects multiple types of data | Collects multiple types of data |
| Data & Analytics usually not available on the outside | Data sent to 3 rd party application for visualization and analytics | Data sent to 3 rd party application for visualization and analytics | Data can optionally be sent to 3 rd party application for visualization and analytics |



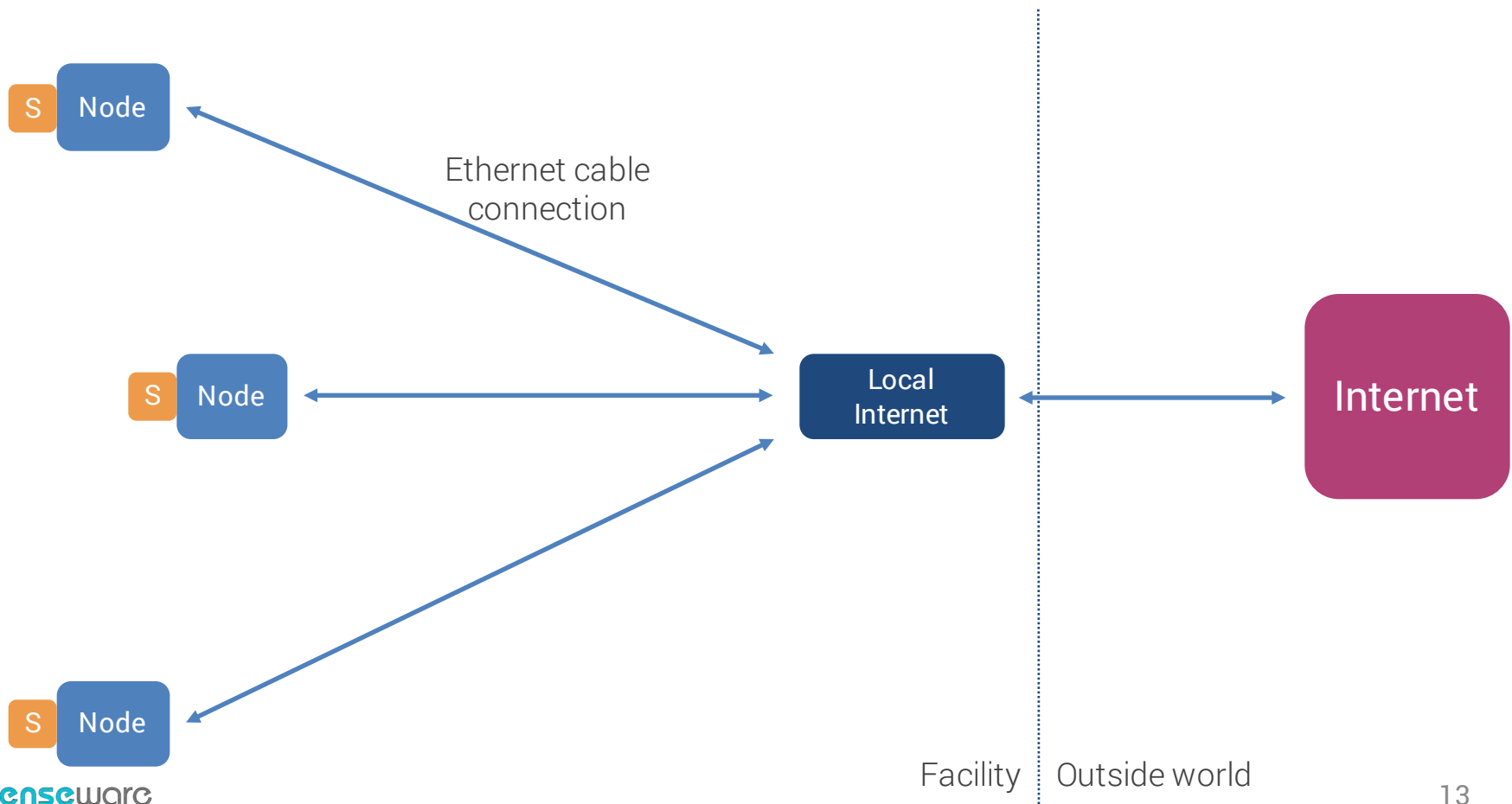
Non-wireless

Pros:

-

Cons:

Very expensive
Labor intensive



IoT wireless technologies

Consumer Space

Industrial Space



802.15.4

Cellular

**LoRa
SigFox**

Pros:
Familiar to users

Pros:
Cost Effective
Simple

Pros:
Long range

Pros:
Long range

Cons:
Power consumption
Range
Complex setup

Cons:
Range can be limited

Cons:
Expensive

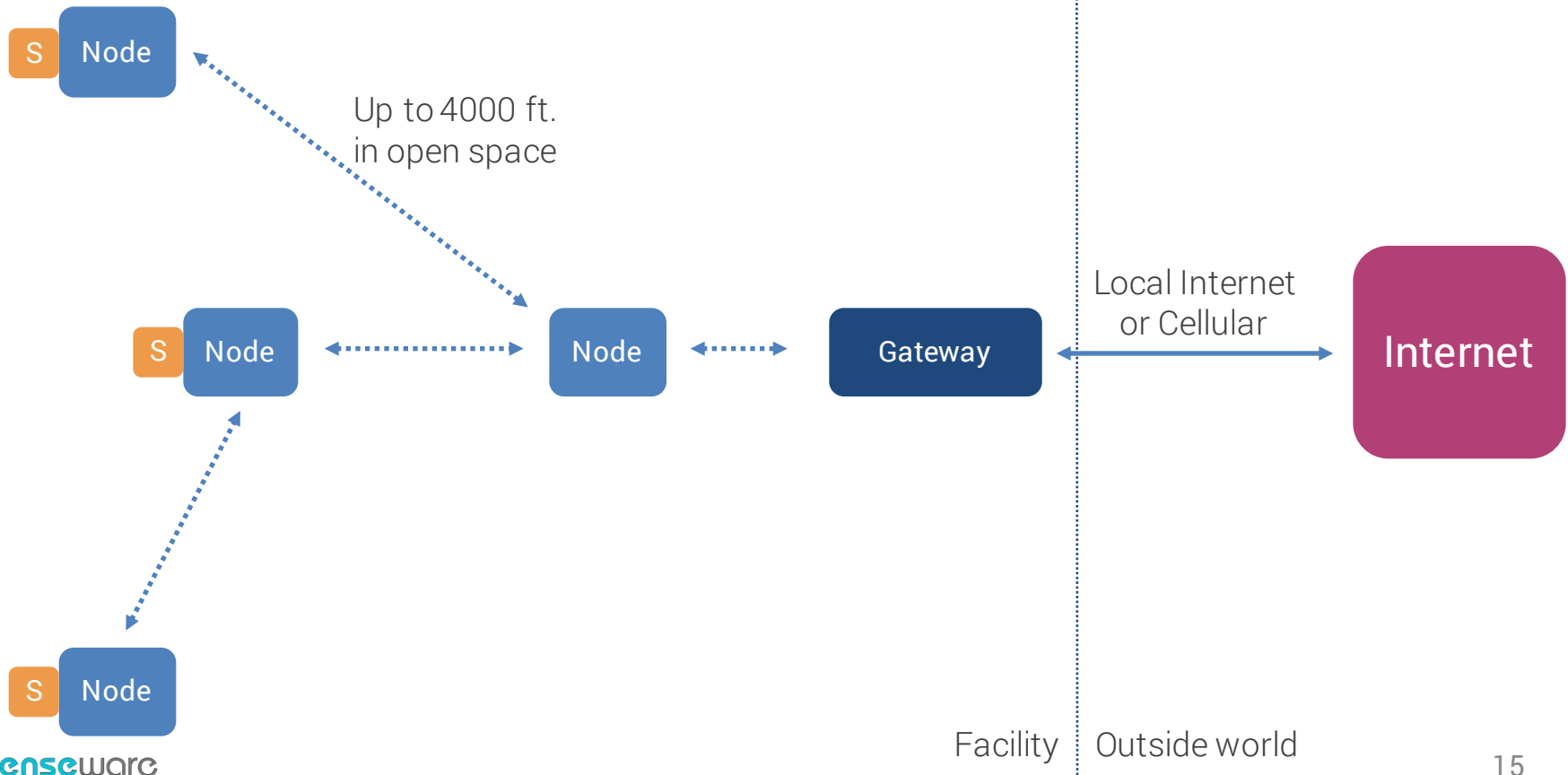
Cons:
Requires new infrastructure

Not suitable for Industrial space

IEEE 802.15.4 (Zigbee, Thread, etc.)

Pros:
Cost effective
Simple

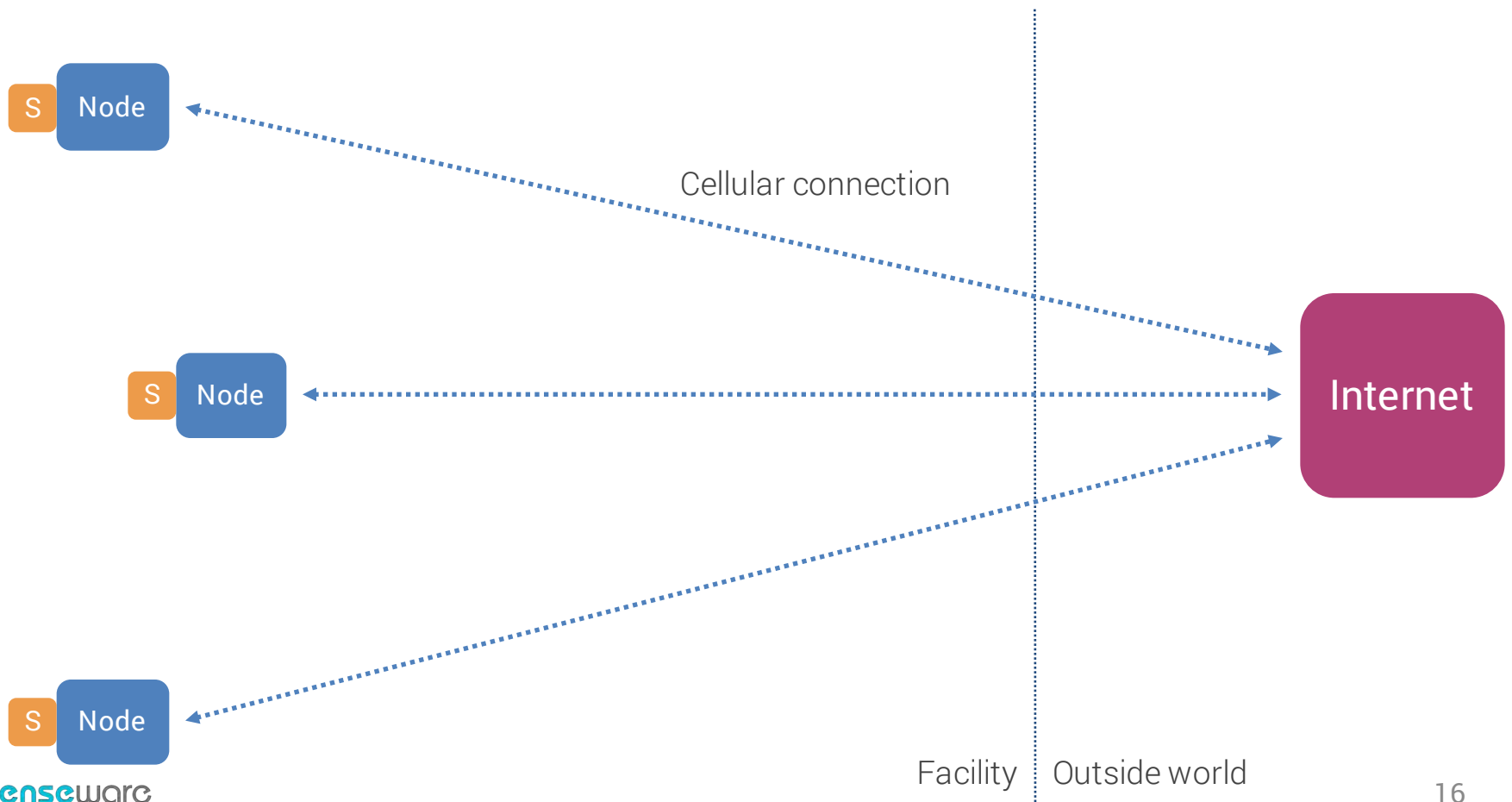
Cons:
Range can be an issue



Cellular

Pros:
Long range

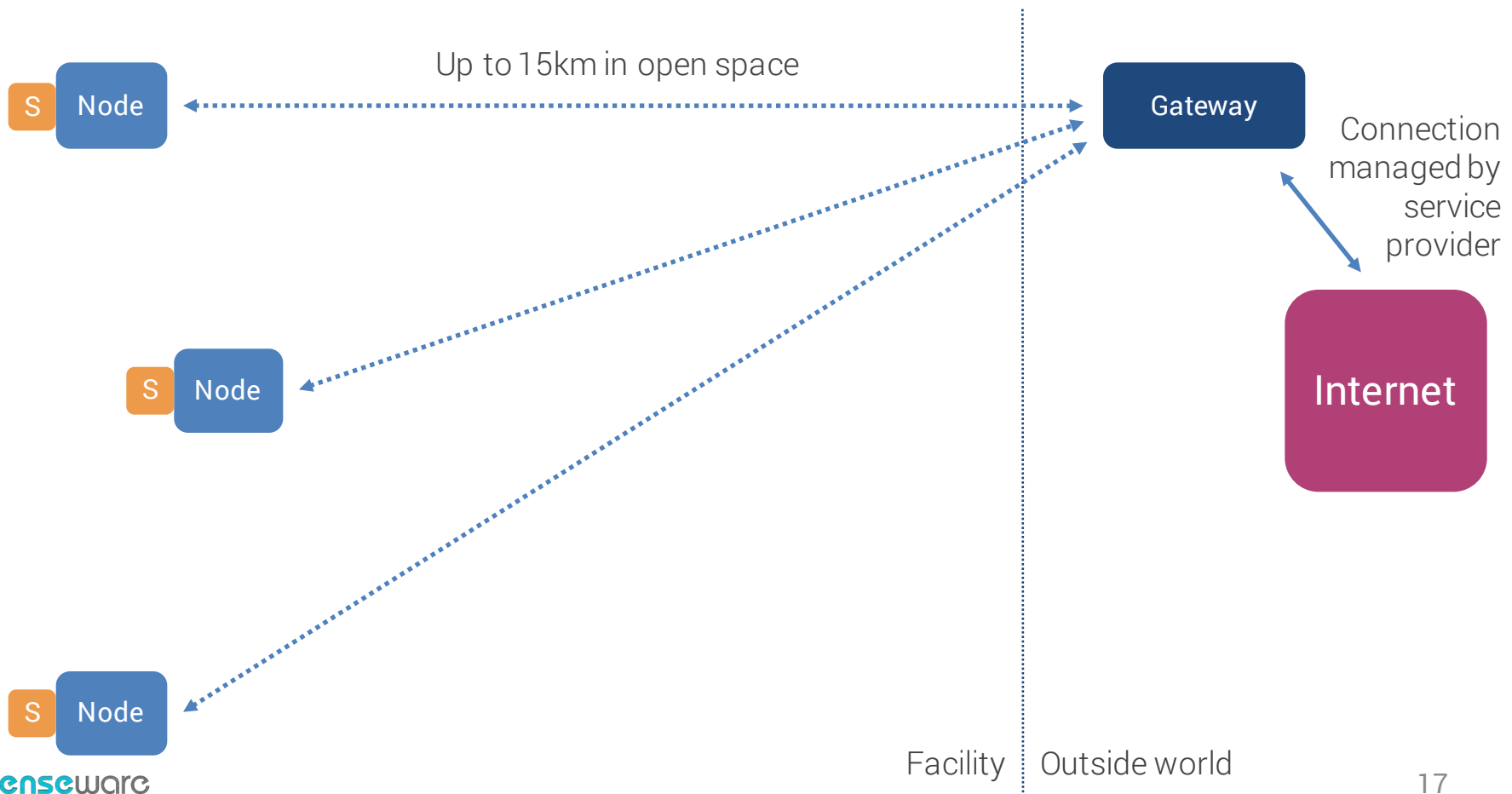
Cons:
Expensive



LoRa – SigFox – etc.

Pros:
Long range

Cons:
Requires new infrastructure



Building Efficiency IoT Applications

Operational efficiency

Energy Efficiency

Tenant Billing

Predictive Maintenance

Critical Area Monitoring

Health & Comfort

Industrial Space

& more

Building
Efficiency



Manufactu-
ring



Healthcare



Agriculture



Oil & Gas



Types of data needed for Building Efficiency IoT

Power
consumption

Water
consumption

Gas
consumption

Pipe
temperature

Equipment
status:
boilers
sump pumps
chillers,
etc.

Temperature

Humidity

VOC

Light

CO2

Vibration

Pressure

Tilt

What about my Building Management System (BMS)?

BMS control some systems of a building

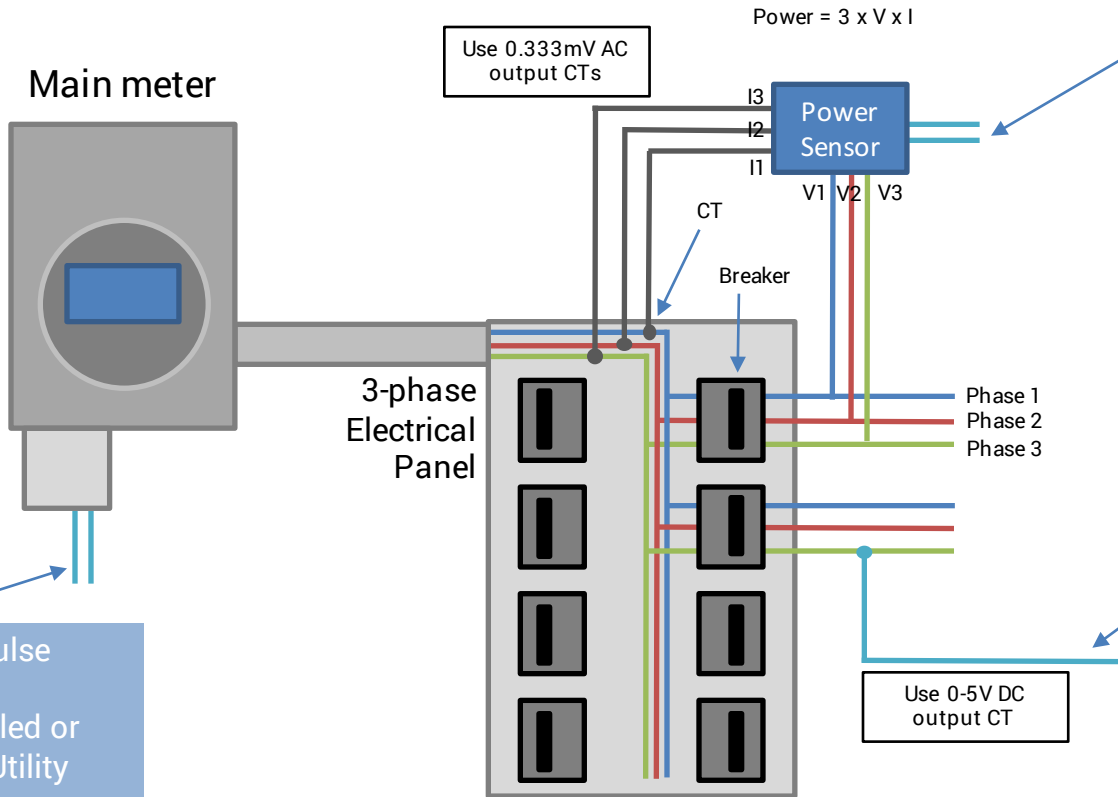
BMS don't provide insights on how operations run or how it performs

Sometimes it is possible to extract some data from the BMS
(newer buildings, can be expensive)

Data sent to a BMS is limited

Data analytics from IoT devices can be used to optimize BMS

How to monitor power consumption

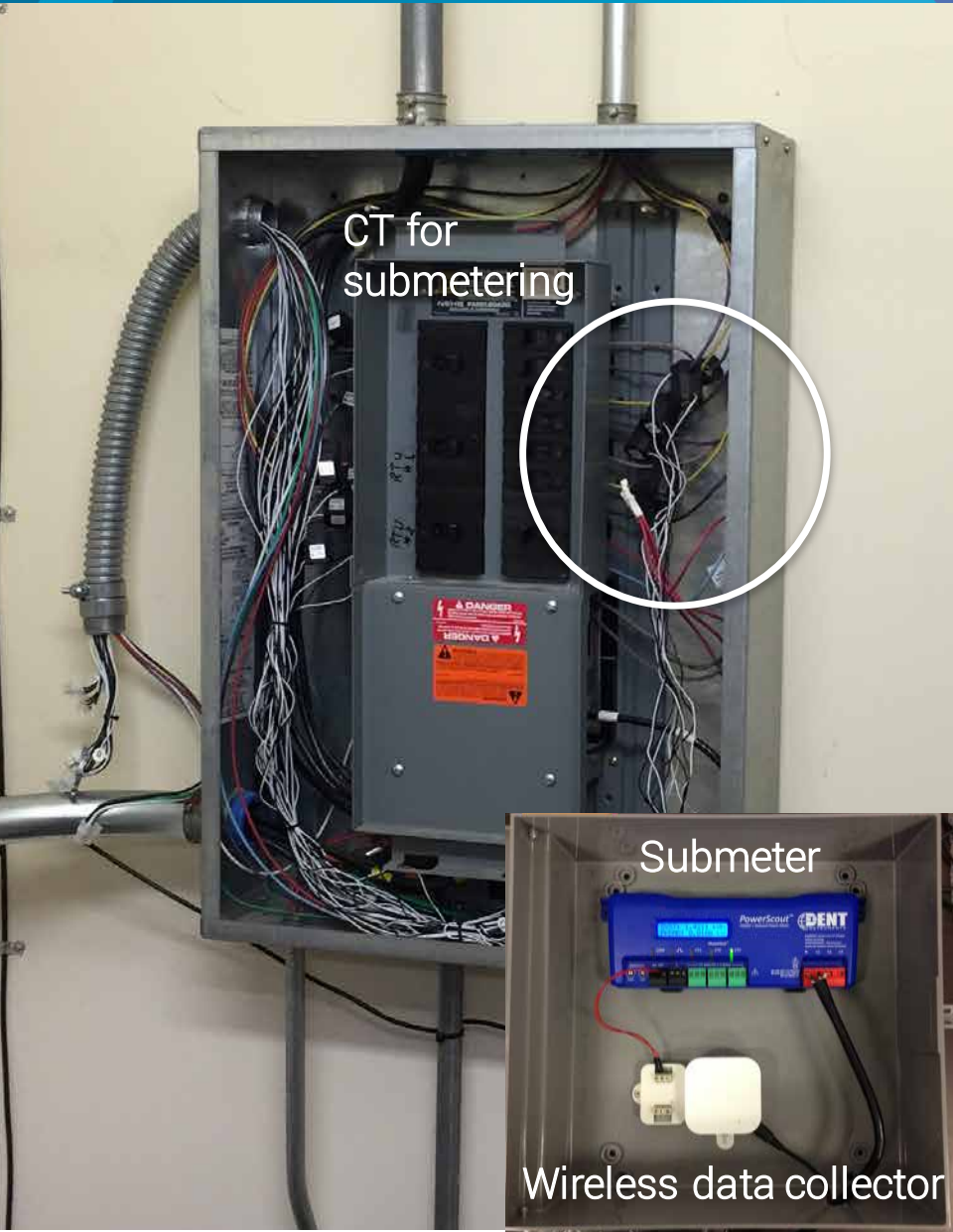


Option 1: Pulse
 Already installed or installed by Utility Company

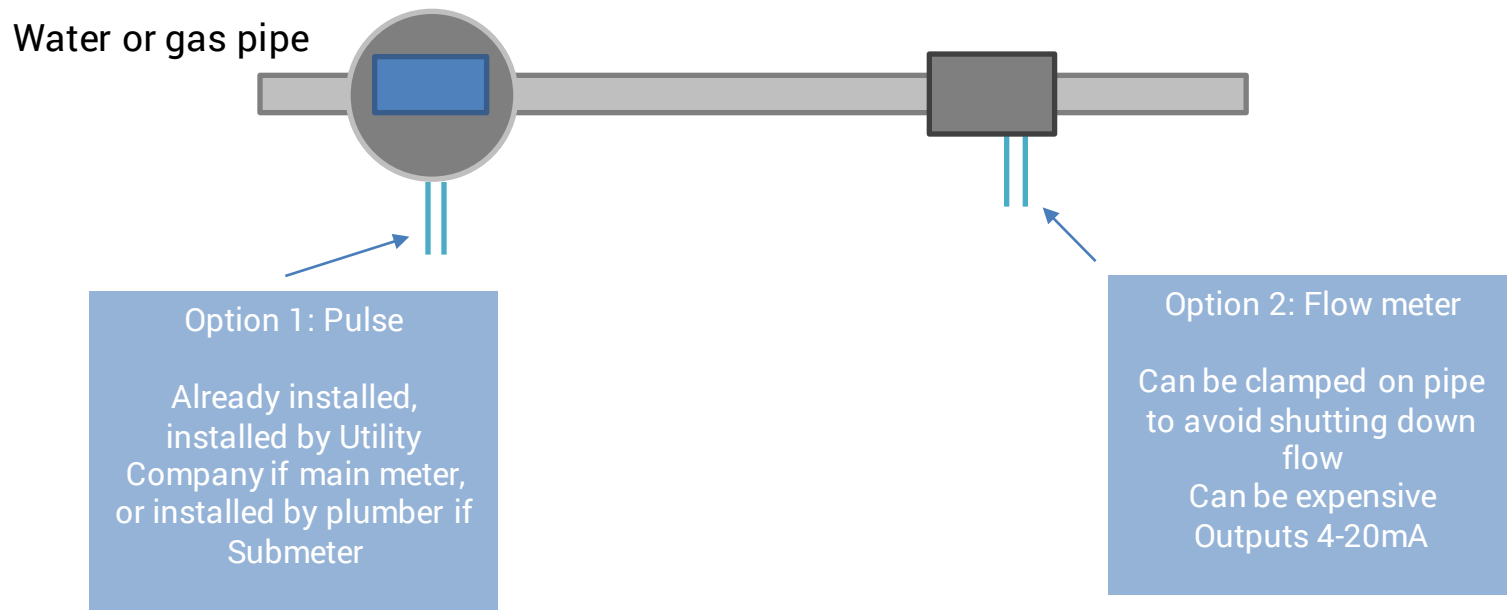
Option 2: Submetering
 Requires **Power Sensor**
 More expensive
 Required for tenant billing if no pulse available
 Uses Pulse, Modbus, or BACnet

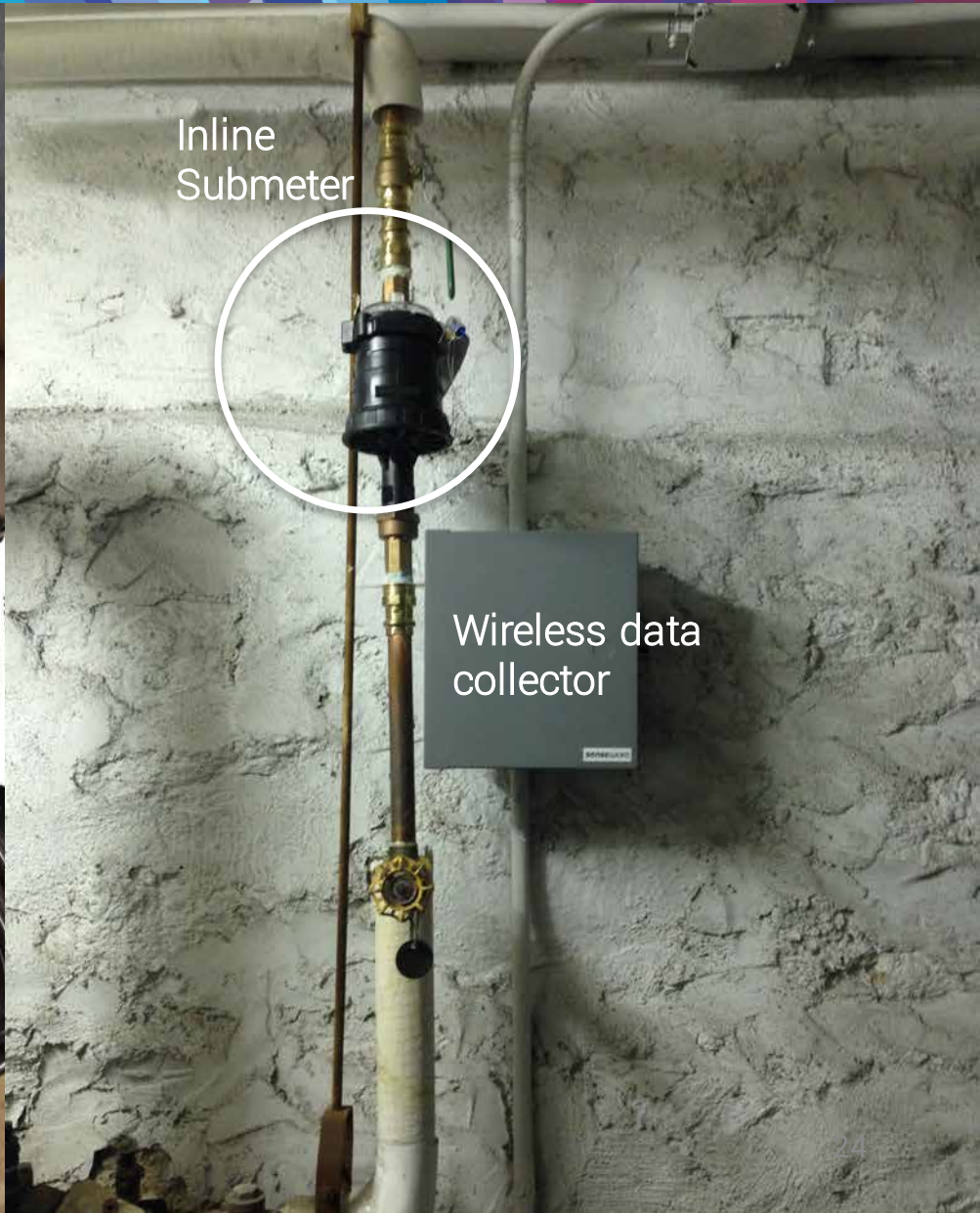
Option 3: CT only
 Measures current only and approximate Power
 Cheapest option
 Less precise but OK for monitoring

Voltage is same for each breaker → Measured directly from any breaker
 Current is different for each breaker → Measured using CTs at the panel level for metering
 → Measured using CT at the breaker level for equipment monitoring



How to monitor water/gas consumption





How to monitor ambient conditions

Option 1: from the BMS

If your BMS receives the data and can export the data. May be expensive and not real-time
Limited data

Option 2: from 3rd party sensor

Can be from single data collection system or universal IoT platform to collect any sensor data



Building Efficiency IoT Applications

Operational efficiency

Energy Efficiency

Tenant Billing

Predictive Maintenance

Critical Area Monitoring

Health & Comfort

Optimize Equipment Runtime

Save at minimum 10-15% in energy spending through real-time actionable insight on energy consumption

Determine Best Energy Efficiency Project

Use Real-time data to choose the best commissioning investment, for example change lighting vs. upgrade HVAC



Exhaust Fans, Roof Top Units,
Energy Efficiency, M&V

Temperature, Humidity,
Chillers, Pumps, Air Handler
Units, Compressors
Energy Efficiency, M&V

Roof Top Units
Energy Efficiency, M&V

Submetering of power data allowed to identify \$91,000 in savings in only 3 months



Submetering of power data and adjustment of schedule allowed to identify \$80,000 in savings in only 2 weeks



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Provide timely and accurate utility bills to Tenants

Tenants with full gross leases do not get an extra bill for their utilities each month, but tenants with triple net and net of electric leases do

Eliminate costly and manual meter reading

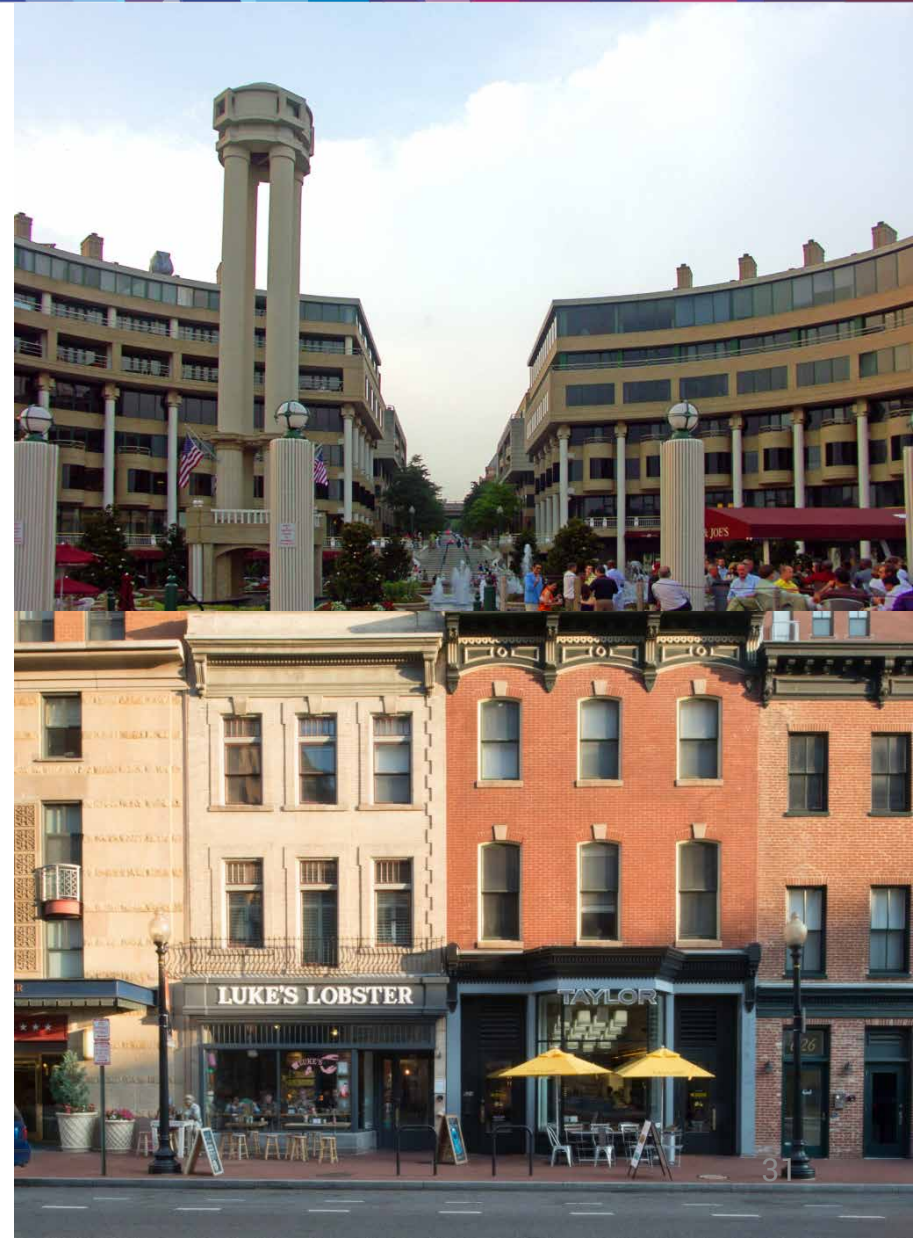
For a fraction the cost of a meter reading service provider, IoT can automate monthly tenant billing and invoicing



Power Pulse Meters &
Submeters
Tenant Billing

Real-time data reduced delays in billing by 75% on the low end and eliminated the need for a meter reading company

Significant reduction of account receivables and improvement of tenant satisfaction



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Know equipment problems before they
become costly

Save 12% on scheduled repairs

Reduce by 30% maintenance costs

Eliminate breakdowns up to 70%

Lower Insurance Premiums

Prevent equipment to become less efficient over time

Temperature & Humidity in Server Room
Critical Asset Management



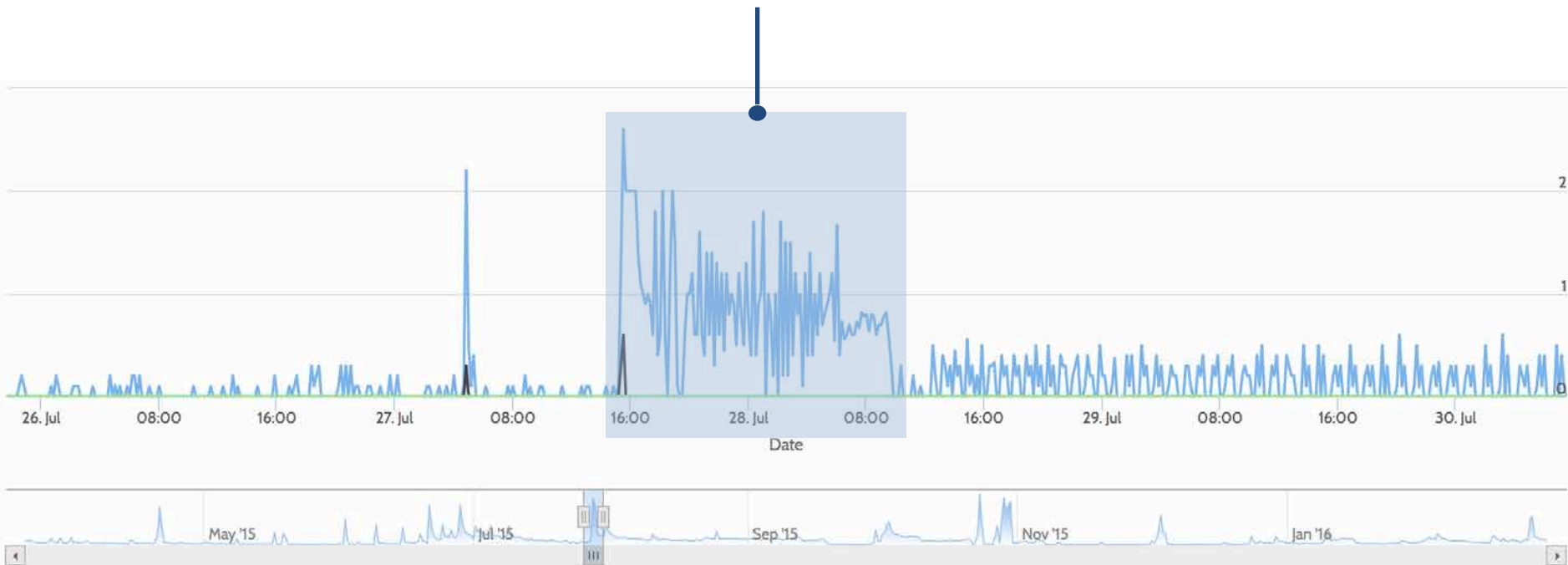
Sump Pump, Chillers, Boilers in Basement
Predictive Maintenance



Power, Gas, & Water Meters
Utility Efficiency & Billing

Real-time detection of faulty equipment can prevent costly consequences

*Defective
check valve on pump*



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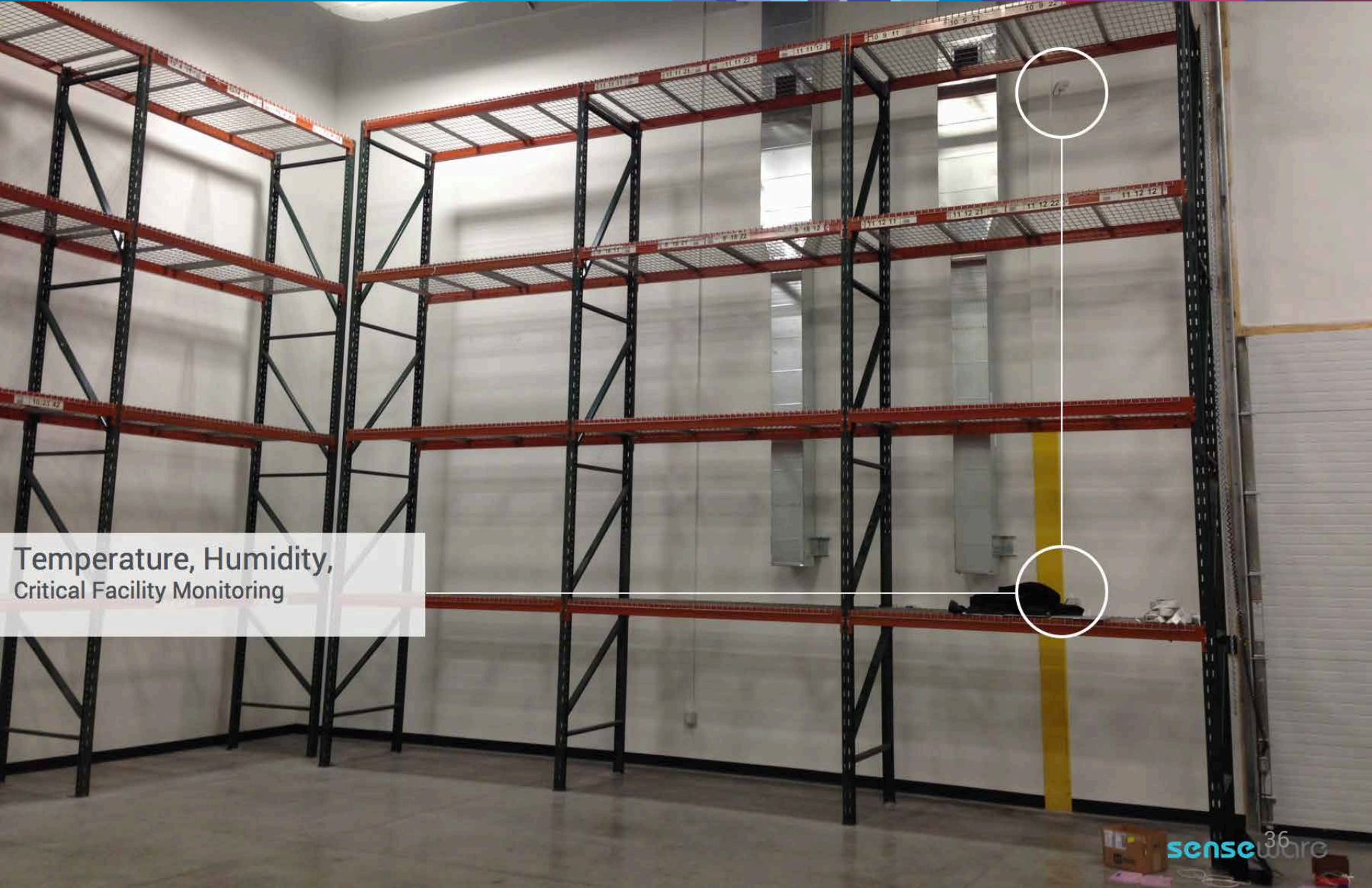
Health & Comfort

Keep your critical assets under control

Keep your servers from overheating

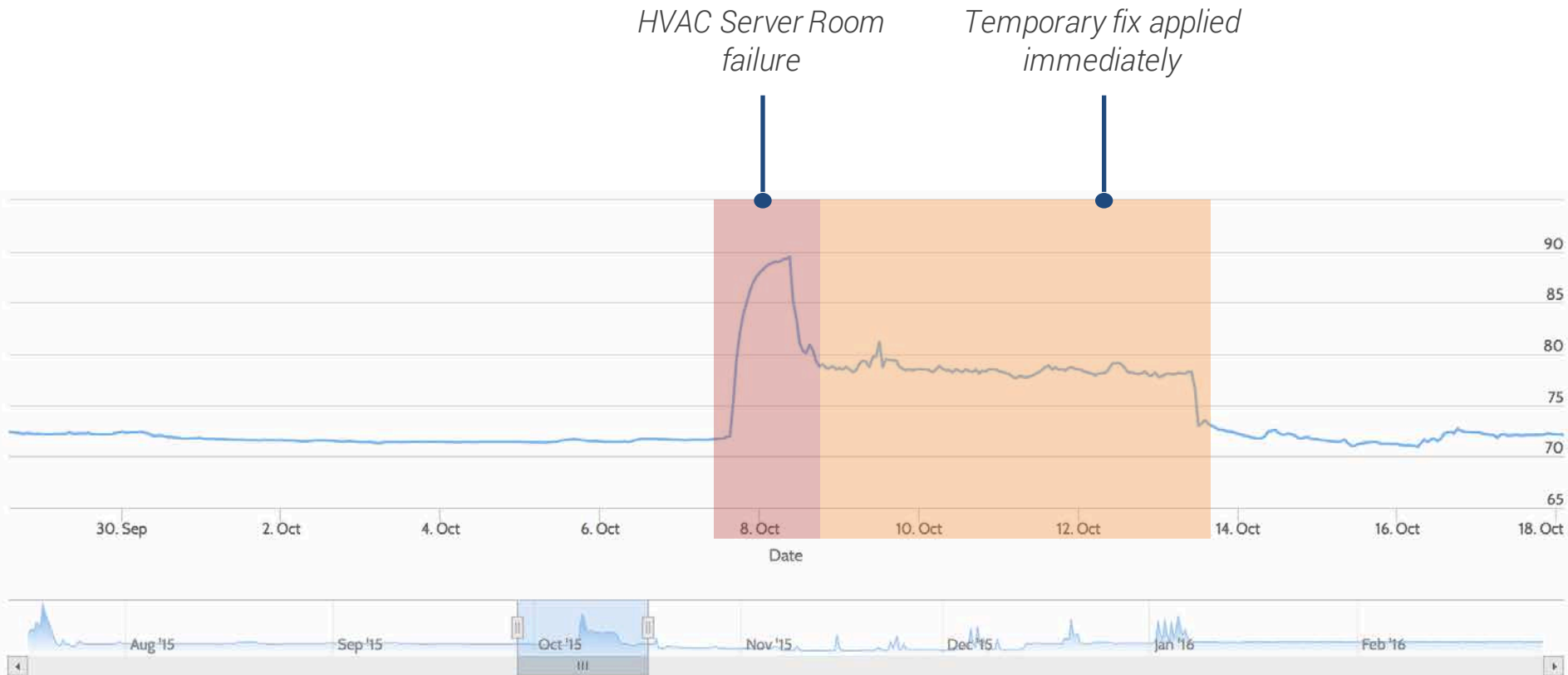
Maintain regulatory compliance

Avoid spoilage



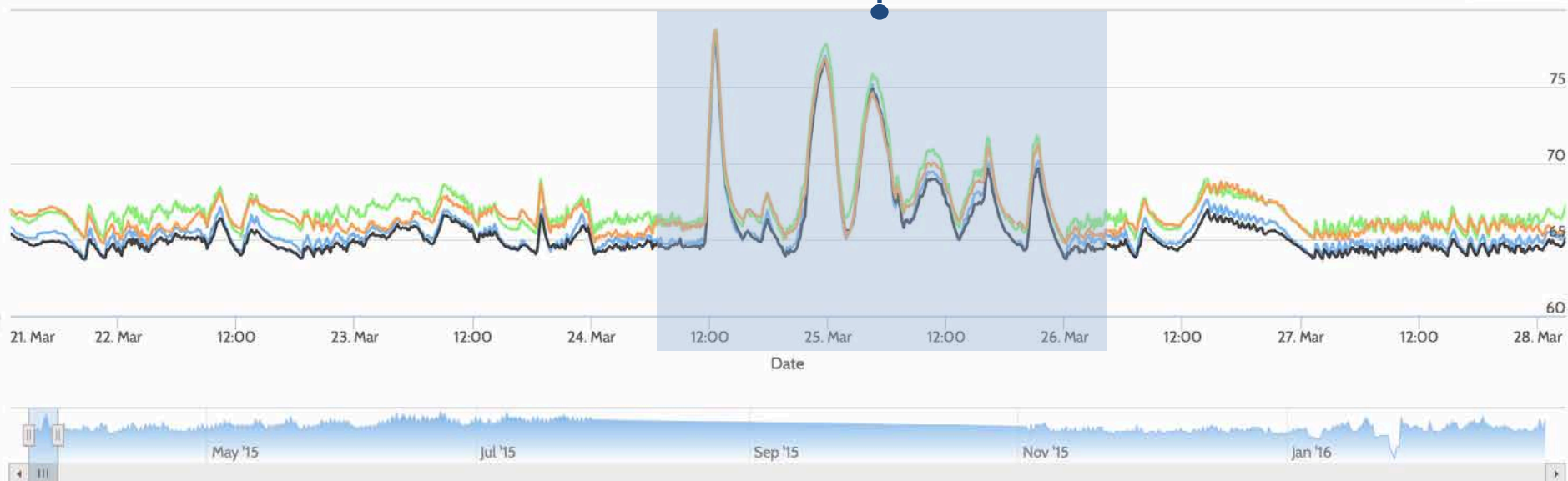
Temperature, Humidity,
Critical Facility Monitoring

Detection of HVAC issue before servers overheat



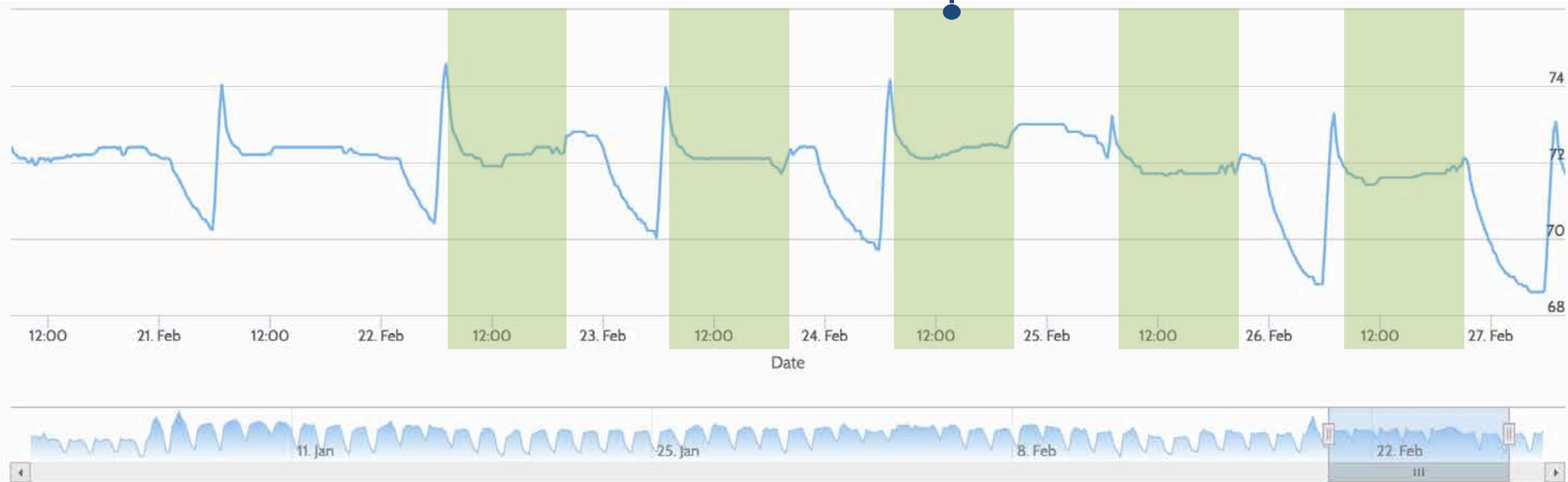
Detection of HVAC issue before pharmaceutical products spoilage

HVAC issue due to frozen pipe



Maintain compliance and get alerted if something goes wrong

*Compliance during
operating hours*



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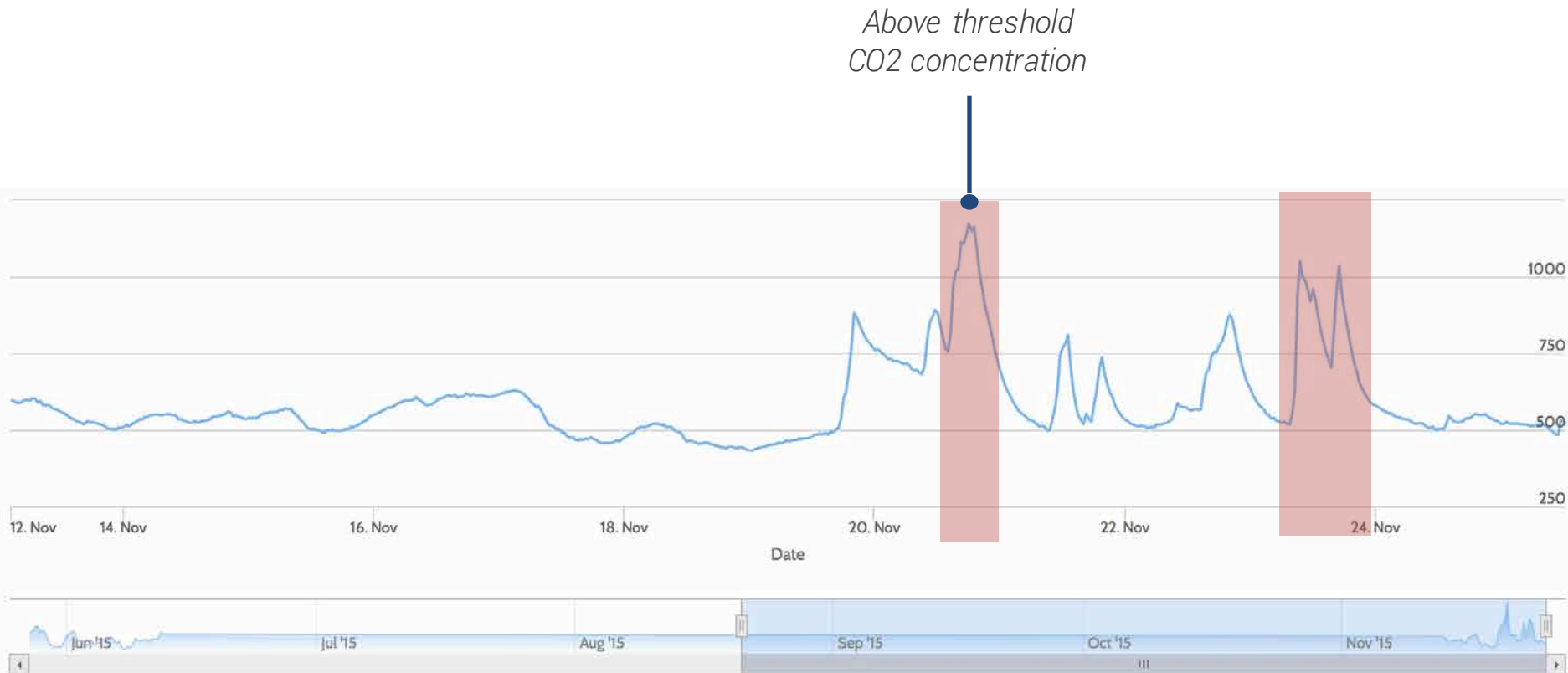
Maintain Acceptable Ambient Air Quality

Know when temperature, humidity, CO₂,
Volatile Organic Compounds (VOC)
- and more - become at critical and
compromising levels

Temperature, Humidity, Light, Noise, and CO2
Tenant Health & Comfort



Maintain Healthy Living Conditions and prevent dangerous gas exposure



Challenges for IoT adoption

The challenge for IoT adoption is getting facility businesses to understand the IoT opportunities and committing to making technological changes to their properties

Starting to collect data in your building doesn't require big upfront investments and can show huge savings with minimal monthly expenses for IoT data and services

*Deployment can be done in a matter of hours
First savings can be detected in a matter of days*

The Internet of Things Is Coming,
Your facility is ready. *Are you?*



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Questions?

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