

# W

LPW-204

## Z-Wave: Why My Sensor is Better Than Yours

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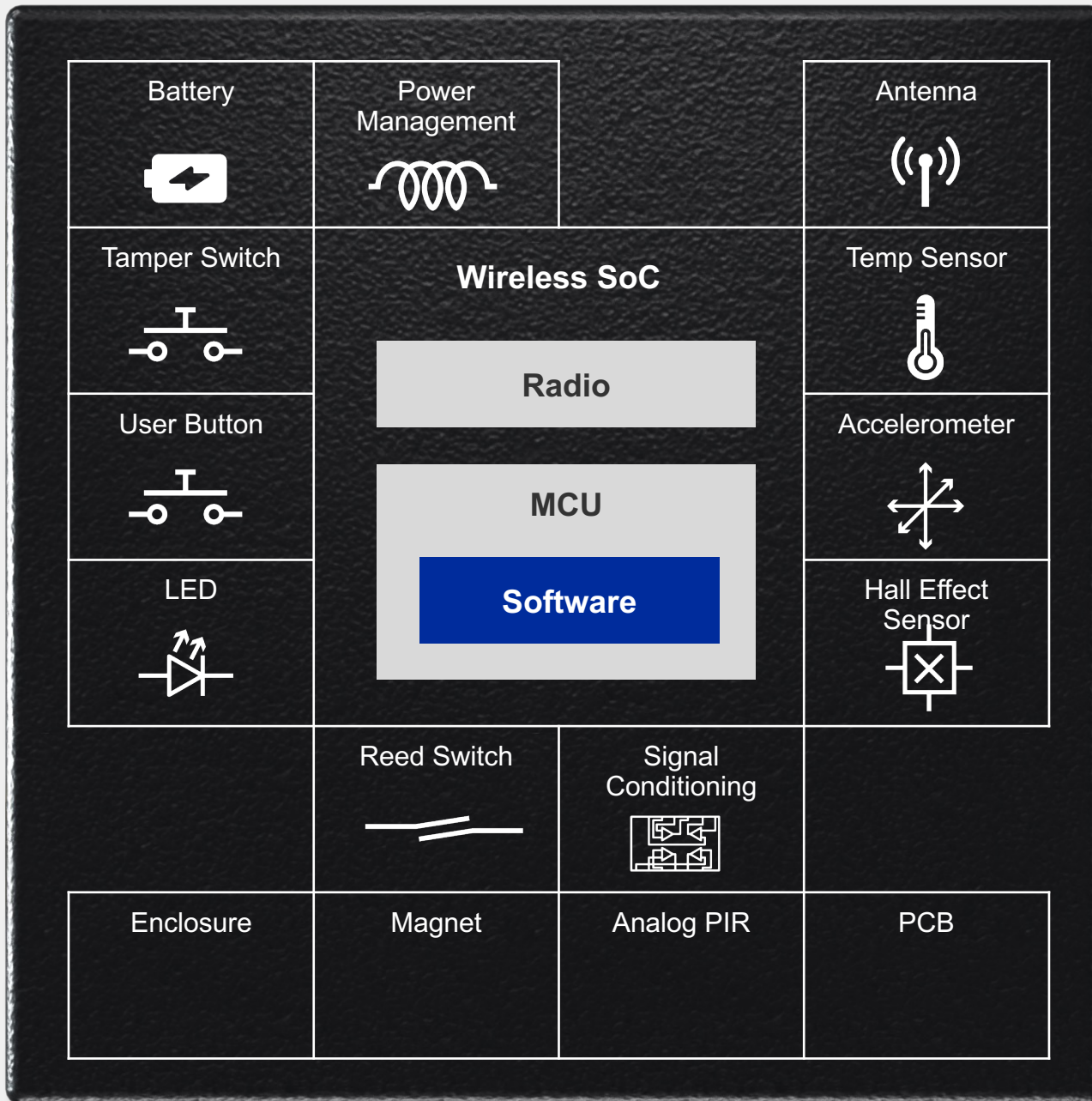
# Agenda

- Anatomy of a sensor
- Wireless sensor requirements
- Z-Wave Long Range for sensors
- Silicon Labs Z-Wave LR Solution for Sensors
- Case Study: Alarm.com Water Dragon

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# Anatomy of a Sensor

## Sensor Components



- **Wireless SoC**
- Battery
- PCB
- Sensing elements (Temp, PIR etc..)
- Buttons, LEDs, Antenna
- Software
- Enclosure

# Wireless Sensors – Three High Level Requirements



## Range

Longer Range  
Resistance to interferences



## Power

Coin cell  
Years of battery life



## Security

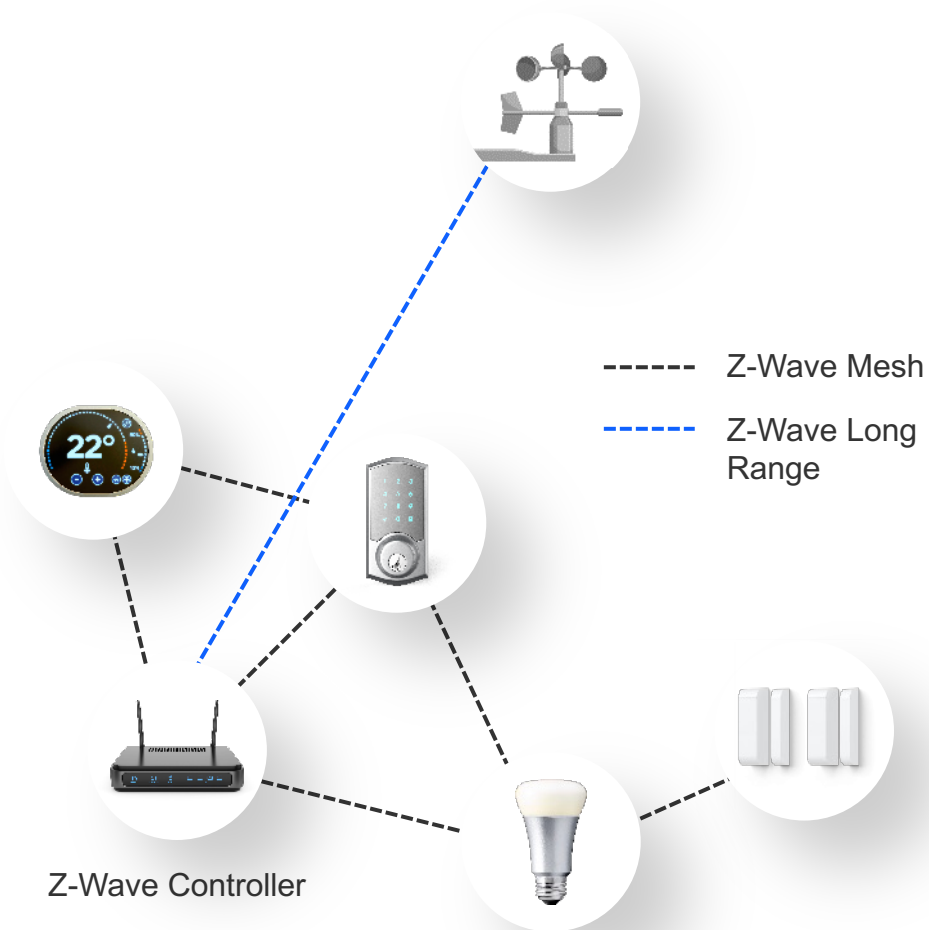
Hardware Security  
Communication Protocol Security

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# Z-Wave Long Range

An Overview

# Z-Wave Long Range Introduction



## Star Network Topology

 **Over 1 Mile\***  
Range

**100 kbps**  
Data Rate

 **Up to 10 Years\*\***  
Battery Life

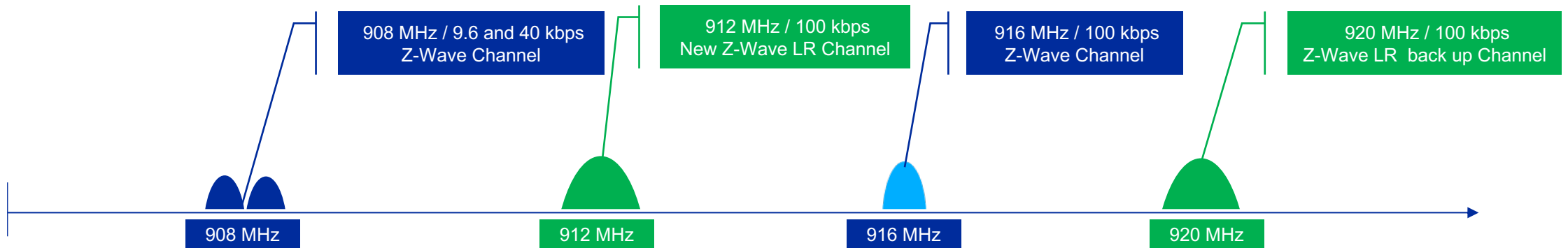
**4000 Nodes**  
Per Controller

 **S2 + SecureVault**  
Security

**Dynamic TX**  
Power Control

\* Outdoor LoS at Max TX Power  
\*\* For a typical sensor use case

# How Z-Wave Long Range Achieve Over 1 Mile Range: PHY Details



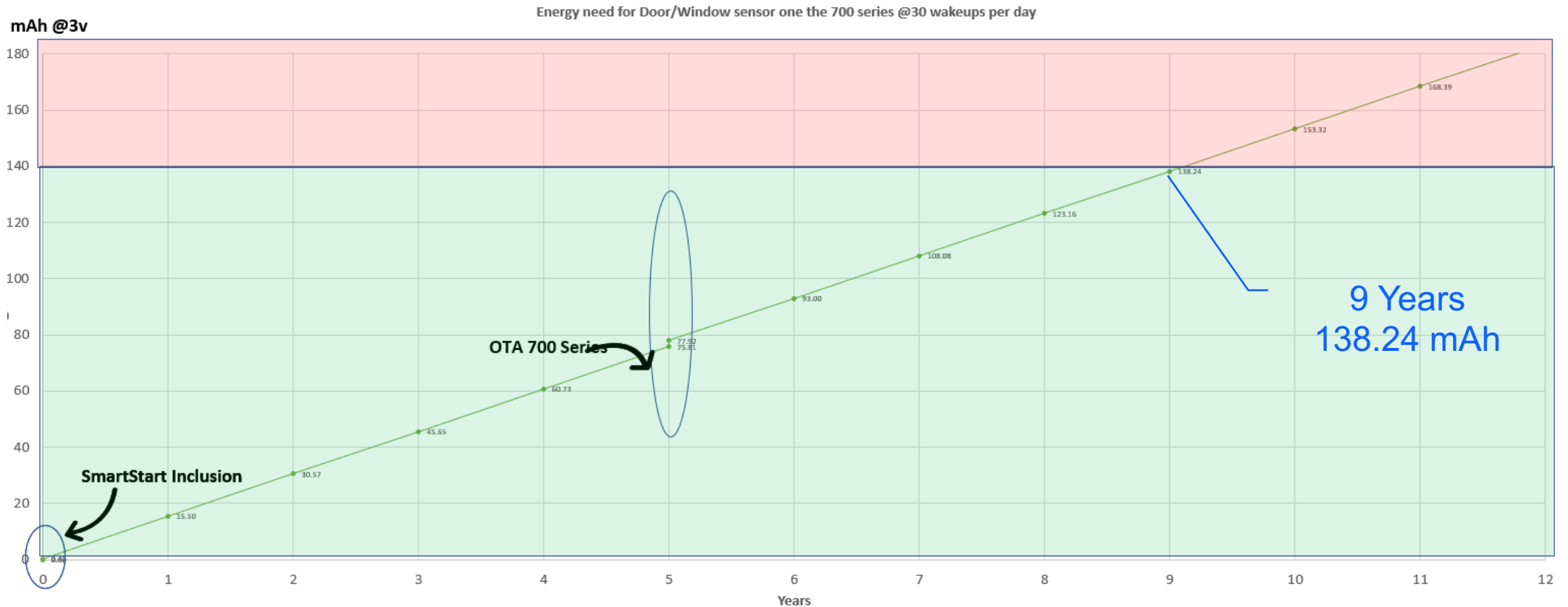
## PHY Details

## Comment

|                               |                    |   |
|-------------------------------|--------------------|---|
| Modulation                    | DSSS-OQPSK         | Better Sensitivity over GFSK Modulation                             |
| Modulation BW                 | BW>500kHz          | Allows transmission up to <b>+30dBm</b> per FCC 15.247              |
| Frequency                     | 912 MHz or 920 MHz | Sub-GHz frequency allows for longer range                           |
| DSSS-OQPSK Sensitivity Gain   | 2 dBm              | For 800 series  |
| Output Power Gain             | 21 dBm             | -1 dBm for Z-Wave MESH to <b>+20 dBm</b> for Z-Wave LR (800 series) |
| Total Link Budget Improvement | <b>23 dBm</b>      | <b>107 dBm for Z-Wave MESH vs 130 dBm for Z-Wave LR</b>             |



# Z-Wave Long Range Battery Life



- 54 Wake-ups / Day : 30 Events + Once an hour checkup
- Each wakeup 2 TX and 5 RX, 0.05 % Retransmission
- 100 Kbps data rate, Transmitting at 13 dBm

- CR2032 with a useful capacity of 140mAh
- A coin cell battery has approximately 235mAh
- Assuming 40 % de-rate factor
  - Due to 43mA peak current & Pulse discharges

# Security - SecureVault

| Base | Mid      | High | Feature  |
|------|----------|------|--|
| ✓    | ✓        | ✓    | True Random Number Generator  |
| ✓    | ✓        | ✓    | Crypto Engine  |
| ✓    | ✓        | ✓    | Secure Application Boot  |
| —    | VSE/HSE  | HSE  | Secure Engine                 |
| —    | ✓        | ✓    | Secure Boot with RTSL  |
| —    | ✓        | ✓    | Secure Debug with Lock/Unlock  |
| —    | Optional | ✓    | DPA Countermeasures  |
| —    | —        | ✓    | Anti-Tamper                  |
| —    | —        | ✓    | Secure Attestation   |
| —    | —        | ✓    | Secure Key Management  |
| —    | —        | ✓    | Advanced Crypto  |

Z-Wave 800 series [ZG23 & ZGM230s] support Secure Vault™ High

Designing Secure IoT Devices



# Z-Wave Security : S2 + SmartStart

## No Universal Password

- Many devices come out of the box with a default password
- Consumers do not change the default password
- Remote hackers can easily gain access to the device

- Z-Wave doesn't use passwords. Uses Certificate
- Z-Wave products come with unique S2 key pair on power up
- SmartSTART commissioning via QR code containing the public key



## Secured Interfaces

- Communication interfaces must be secured against modifications, monitoring, etc...
- Protections against remote or local attacks are device dependent
- Interfaces must be encrypted and authenticated

- S2 Security provides secure interface via Diffie Hellman key exchange and symmetric encryption
- Authentication takes places via SmartStart
- Detection of jamming attacks via periodical heartbeats



## Proven Cryptography

- Proprietary cryptography often leads to security via obscurity
- Standards helps with interoperability and are reviewed by the community

- S2 state-of-the-art crypto is implemented in hardware
- It uses proven algorithms: AES and ECC (Curve25519)
- Keys are stored in SecureVault



## Security By Default

- Products must be secured at the time of purchase
- Consumers should not have to take any actions to make the device secure

- Both end-nodes and gateways SDKs ship with S2 and SmartStart enabled by default
- Pre-commissioning is available

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# Z-Wave LR Solution for Sensors

# 800 Series Hardware Portfolio for Z-Wave MESH and Z-Wave Long Range



## ZGM230S SiP MODULE

- Certified SiP Module
- +14 dBm
- 6.5x6.5 mm



## ZG23 SOC

- SecureVault High & Mid
- +14 dBm, +20 dBm
- QFN40 & QFN48
- Multi-Protocol



## ZG28 SOC

- AI/ML
- SecureVault High & Mid
- +14 dBm, +20 dBm output
- 8x8 QFN68 (49 GPIO)
- Multi-Protocol



# Complete Solution For Z-Wave Long Range Sensor Development



## HARDWARE

- ZG23 & ZG28 SoC
- ZGM230s Module
- Prokit
- DevKit
- Explorer Kit

### Z-Wave Certified Application

- Application Framework
- S2 Security with SmartStart
- Mesh Routing
- Mesh Network
- MESH MAC
- MESH PHYs
- LR Network
- LR MAC
- LR PHYs

EFR32 Platform:  
RAIL | Gecko bootloader | NVM3

## SOFTWARE

- Full Stack - PHY to Applications
- Z-Wave MESH & Z-Wave LR
- Controller reference designs
  - Unify Z-Wave SDK
- SecureVault integration
  - S2 + Vault



## CERTIFICATIONS

- Alliance Certification
  - Z-Wave Plus V2
- Regulatory Test Reports
  - US, Canada, EU & Japan
- UL-1023 Certification
  - Household Burglar-Alarm



## DEV. TOOLS

- Packet sniffer & analyzer
- Energy Profiler
- CTTv3
  - Self certification tool
- PC Controller

# Why Z-Wave Long Range Sensor is the Best



**Over 1 Mile Range**



**Up to 10 years on a coin cell**



**SecureVault, S2 & SmartStart**



**UL1023 and UL 985\***



**Secure Over the Air Update**



**Frequency Agility & Jamming Detection**



# Case Study: Water Dragon

Gustaf Lonaeus  
Director, Product Management





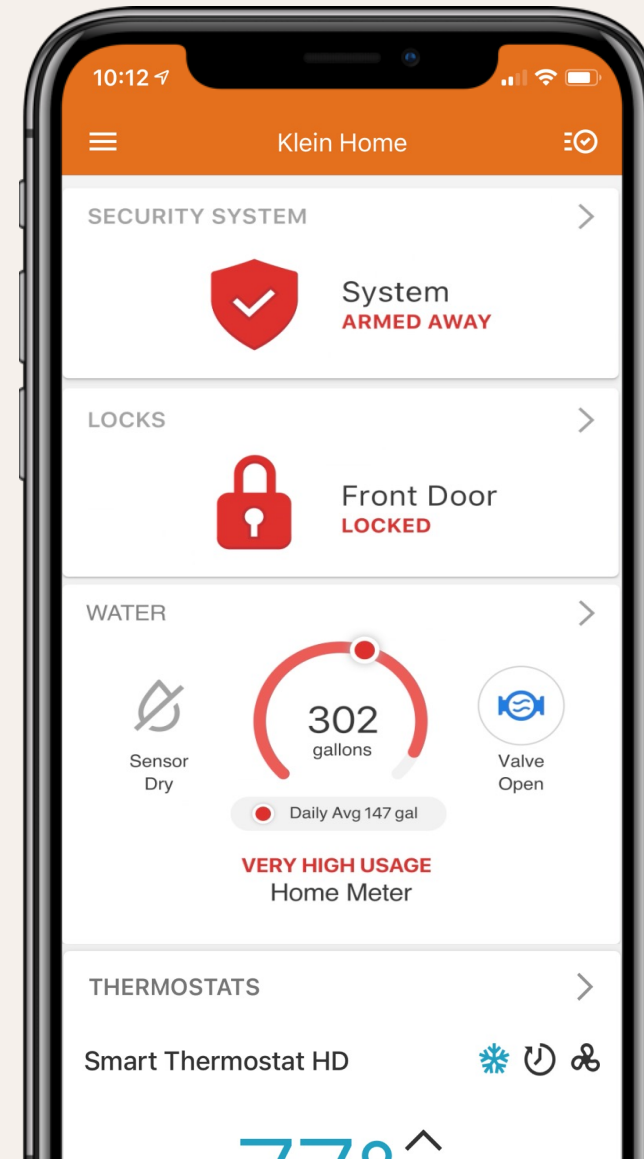
# Water Dragon™

**Affordable, whole-home, no-plumber water solution**

Ultrasonic technology monitors consumption and detect leaks

Provides peace of mind with real-time alerts and helps customers save on utility bills

Pair with Smart Water Valve for automatic shutoff



# Detect, protect, and monitor

Water solutions to meet customer needs



## Prevent water damage

*Detect leaks and receive real-time alerts. Water shut-off prevents costly damage*



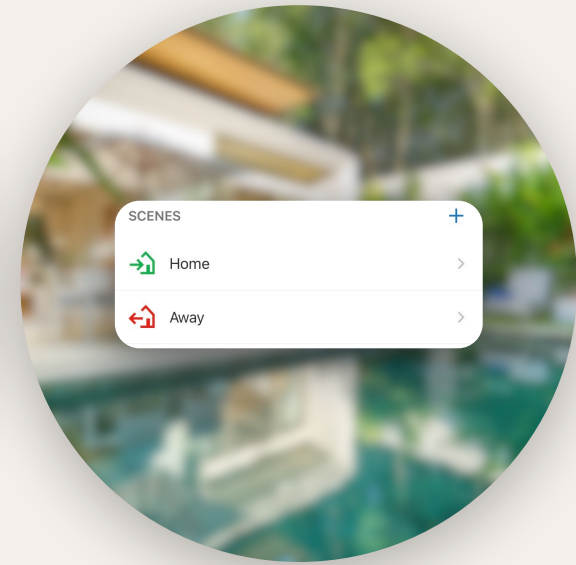
## Monitor consumption

*Monitor usage and track over time. It's good for the planet (and your wallet)*



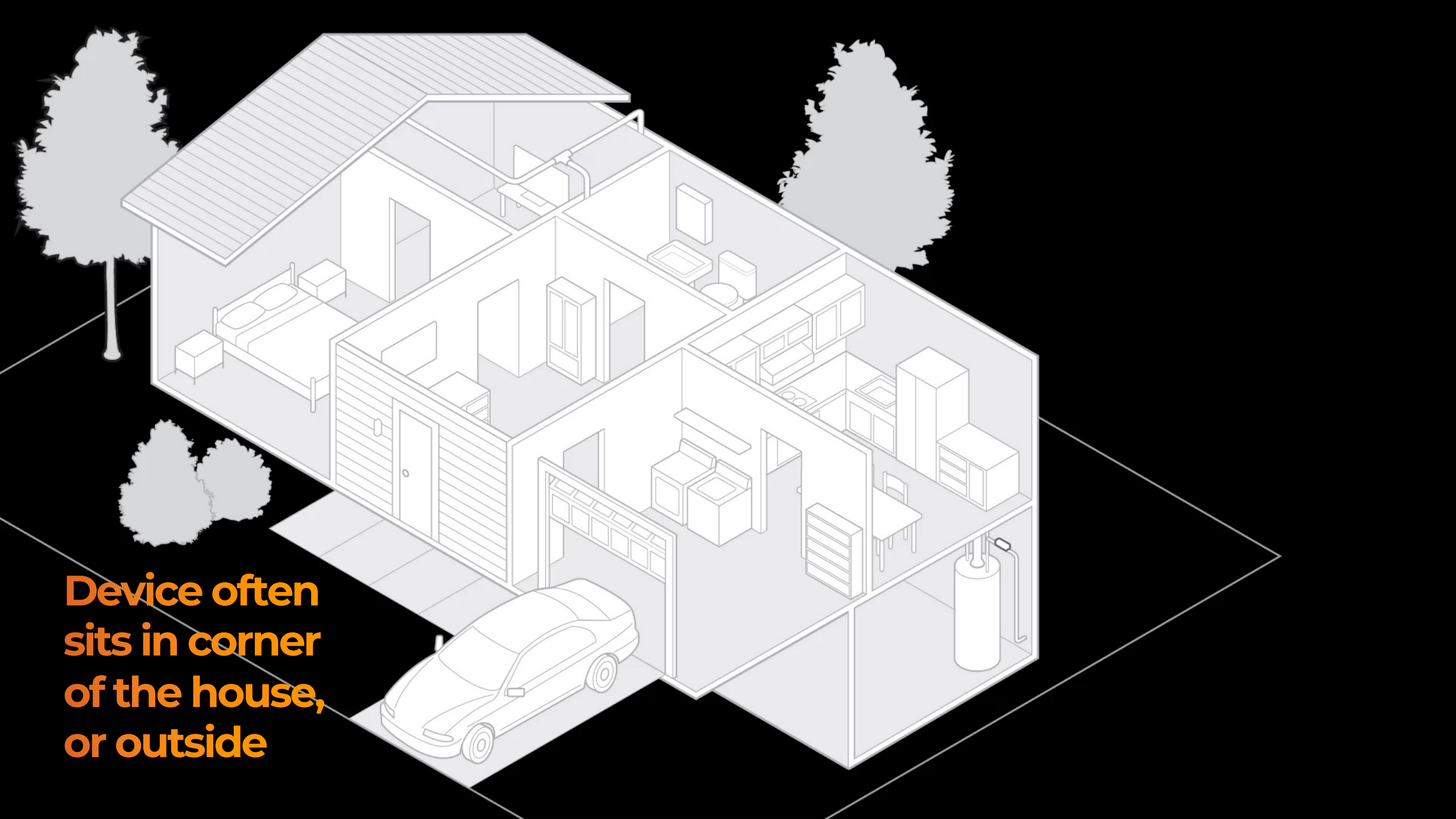
## Safeguard home health

*Round-the-clock leak detection prevents mold and other unsafe conditions*



## Automate for convenience

*Automated shut-off and Away Scenes ensure your home is protected 24/7*



**Device often  
sits in corner  
of the house,  
or outside**

# Z-Wave Long Range

## Greater reliability and flexibility

Extends range beyond what has previously been possible with Z-Wave – no repeaters needed

Easier-than-ever installs and SmartStart for fast enrollment

Backwards compatibility

Optimized battery life (relevant for future products)





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Thank you!



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Q&A

