UNLOCK THE FUTURE OF PROJECT CHIP WITH NXP

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MARCH 2021

SECURE CONNECTIONS FOR A SMARTER WORLD

AGENDA

- NXP Wireless Connectivity Introduction
- Project CHIP Introduction
- NXP's Project CHIP Approach
- Smart Door Lock Use Case
  - Requirements
  - NXP Implementation
  - Video Demo
- Summary

A UNIQUE VALUE PROPOSITION IN THE IOT INDUSTRY

WORLD-CLASS CONNECTIVITY PORTFOLIO

Wi Fi™ Bluetooth™

UWB NFC

zigbee THREAD

Project CHIP

Multiprotocol

Secure OTA

Flexible architectures

COMBINED WITH UNIQUE PROCESSING CONTINUUM

i.MX 6, 7, 8, 8M MPUs
High performance,
3D graphics

Layerscape MPUs
High-speed Ethernet, TSN

i.MX RT Crossover MCUs
Highest performance
Low Power

LPC & Kinetis MCUs
Low cost to high integration

ADDING TRUSTED SECURITY & IOT SOLUTIONS

EdgeLock™ IoT Secure Elements: Plug & Trust

Secure Processors for IoT

eIQ™ Machine Learning Software Development

Locationing

Ecosystems support (Voice assistants, cloud)

EASE OF USE WITH UNIFIED APPROACH

Common Development Tools

Common network & protocol stacks

Wi-Fi Drivers for MCU/MPU Portfolios

Interoperability & co-existence

Open Source & Software Compatibility

Pre-integration of h/w and s/w

Customer Commitment: Product Longevity, Quality, Global Support. Online Community, Standards & Open Source Leadership

NXP'S WIRELESS CONNECTIVITY VALUE PROPOSITION

Broad Wireless Connectivity Portfolio

Wi-Fi 4/5/6, **Zigbee**, **Thread**, **Bluetooth** Classic and Low Energy, **NFC**, **UWB**
Multiprotocol and combo radios
Secure **Over-the-Air** updates

Flexible Architectures

Wireless MCUs and Hosted **options**
RTOS, Linux and Android across a **wide compute platform**
Chip-on-Board, partner Module or System-On-Module

Unified Development Environment

MCUXpresso SDKs, IDE, Config Tools
Wi-Fi Drivers **pre-integrated** into SDK/BSP for MCUs/MPUs, **maintained** by NXP

Enabling Technologies

Commissioning (NFC, Bluetooth LE), **Locationing** (UWB, Bluetooth LE, Wi-Fi)
Security (Secure Element and/or embedded in MCU/MPU)
Ecosystems support

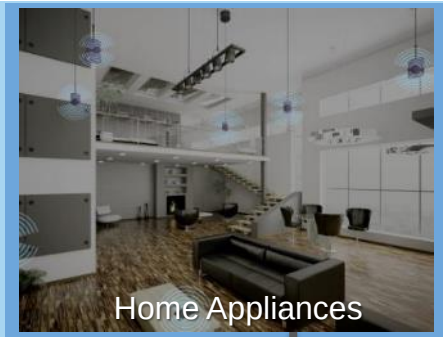
Customer Commitment

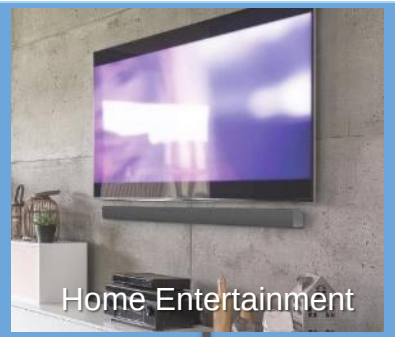
Total product **quality, longevity** for 10-15 years
Global Support & online Community for 10,000s of customers across thousands of applications
Continued **investment** in Wireless and IoT, leading **contributor** to connectivity standards

BROAD WIRELESS TARGET MARKETS, IOT TECHNOLOGIES AND PORTFOLIOS

Broad Wireless Connectivity Portfolio

PAN | LAN | WAN





Devices (Batt)

UWB

zigbee

THREAD

Bluetooth

Wi Fi 4 5 6

Small & Large Devices

Audio, Voice, Video, Gaming Devices

Automation, Sensors, Access, Controllers & Mesh

Cellular

LPWA

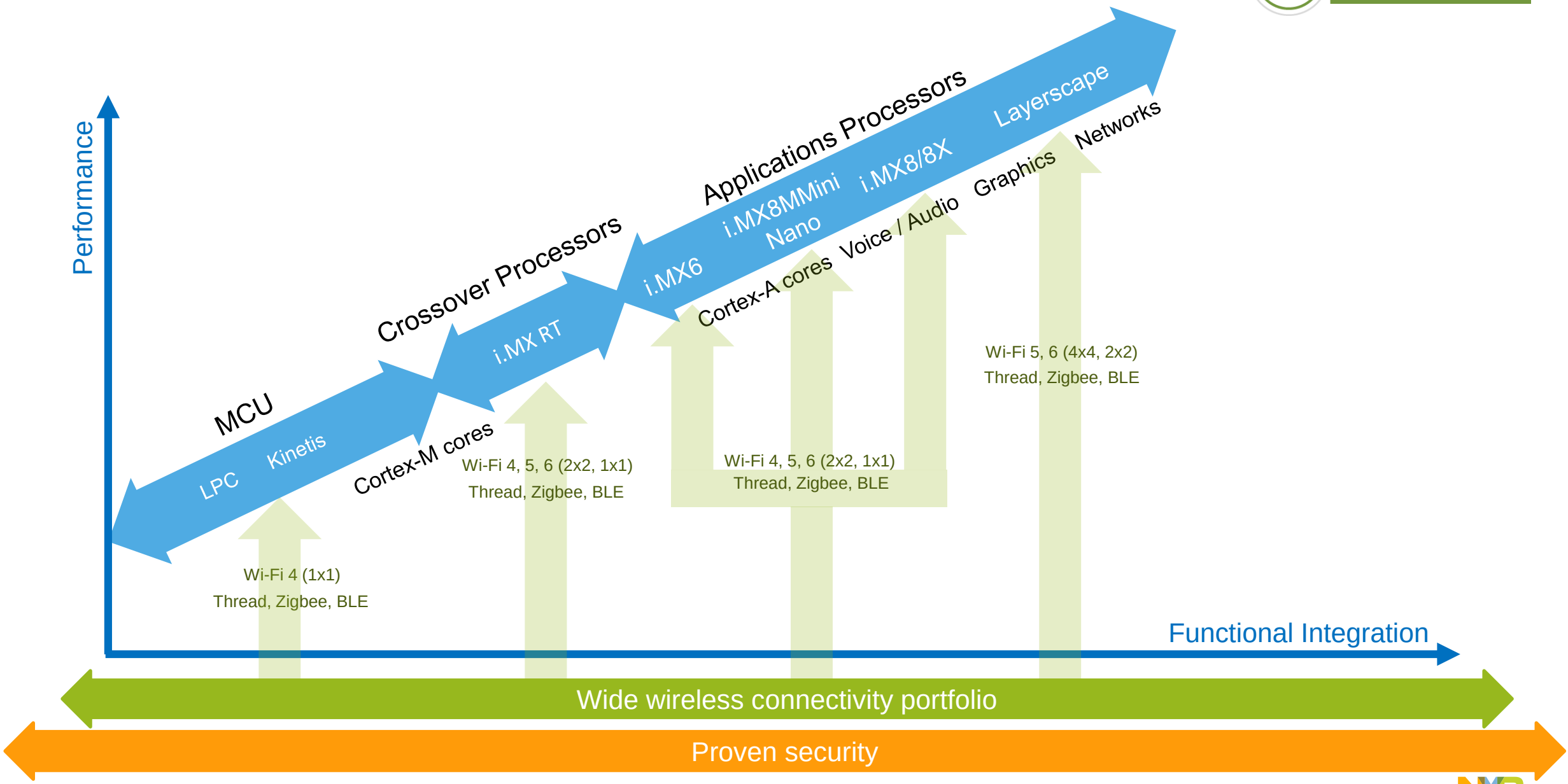
Imaging, Sensors, Actuators, Asset Mgt, Controllers & Mesh

Access Control, Lighting, Energy, Sensors, Actuators, Controllers & Mesh

NFC & UWB portfolio	BLE *KW, NXH*	Wireless Multiprotocol MCUs *JN, QN, KW, MW32, RW*	Wi-Fi, BT/BT LE, Multiprotocol Hosted *88W89xx,IWxxx*	Sequans LPC Ref Design, Third party modem

ADDING WIRELESS TO EDGE COMPUTING CONTINUUM

Flexible Architectures



UNIFIED DEVELOPMENT EXPERIENCE

Unified Development Environment

SCALE FROM LOW-COST MCUS	TO FEATURE-RICH MPUS
LPC/Kinetis MCUs for low-power, small size, range of performance and integration.	**i.MX applications processor** for full OS, rich HMI and machine learning.
i.MX RT Crossover MCU for high-performance, real-functionality and high integration.	**Layerscape processor** for high-performance, networking

Linux

Linux Long Term Support (LTS) OS, supported in the Yocto Project; Android OS

WITH INTEGRATED SOFTWARE ENABLEMENT

Wireless radio stacks
Bluetooth LE, Thread, Zigbee, Wi-Fi, NFC, Multiprotocol

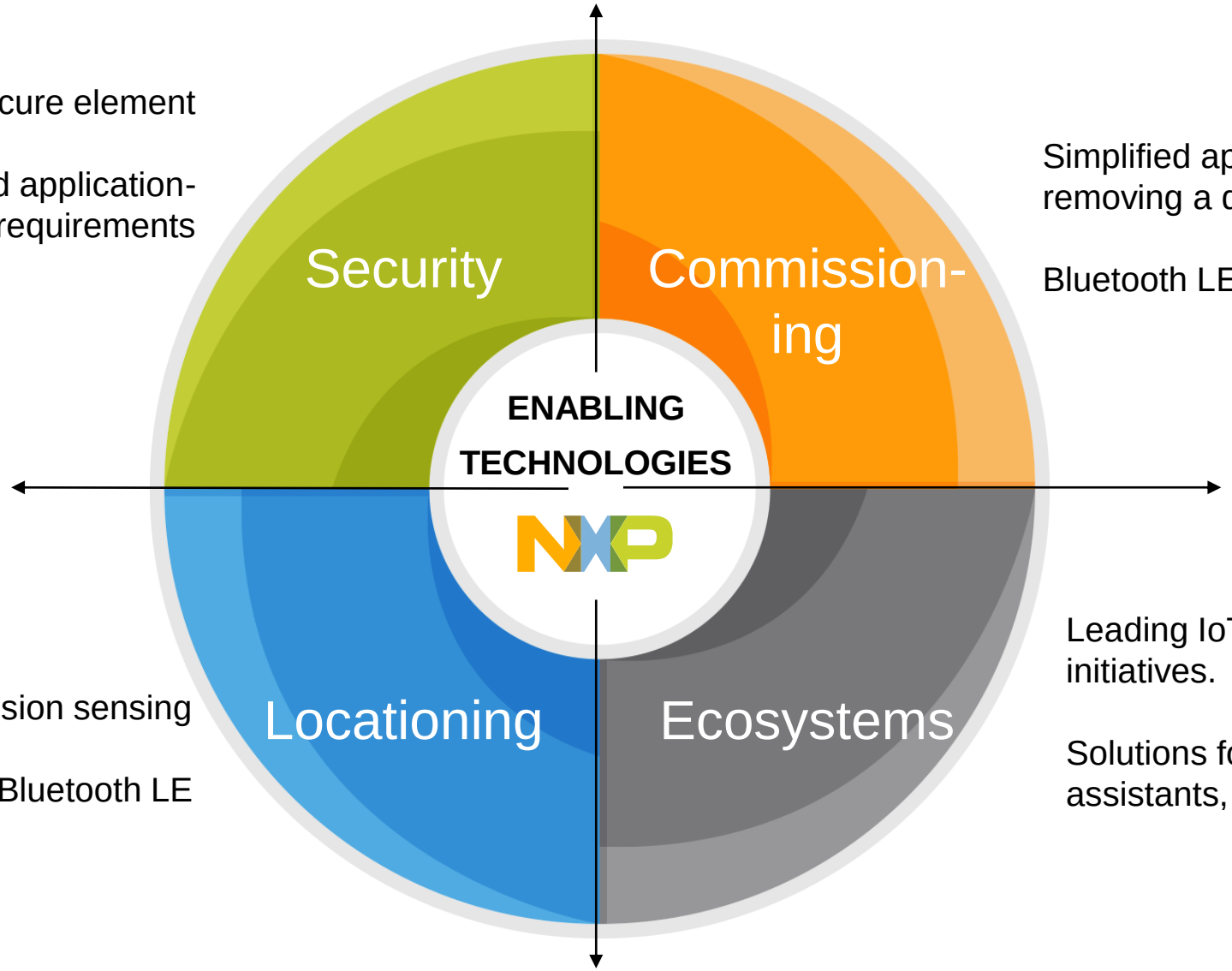
Common drivers & middleware
Connectivity, security

Simpler development for the building blocks, focus innovation on the application

WIRELESS CONNECTIVITY ENABLING TECHNOLOGIES

Discrete or integrated secure element

Wireless standards and application-specific security requirements



Simplified approaches for joining and removing a device to a wireless network

Bluetooth LE or contactless NFC

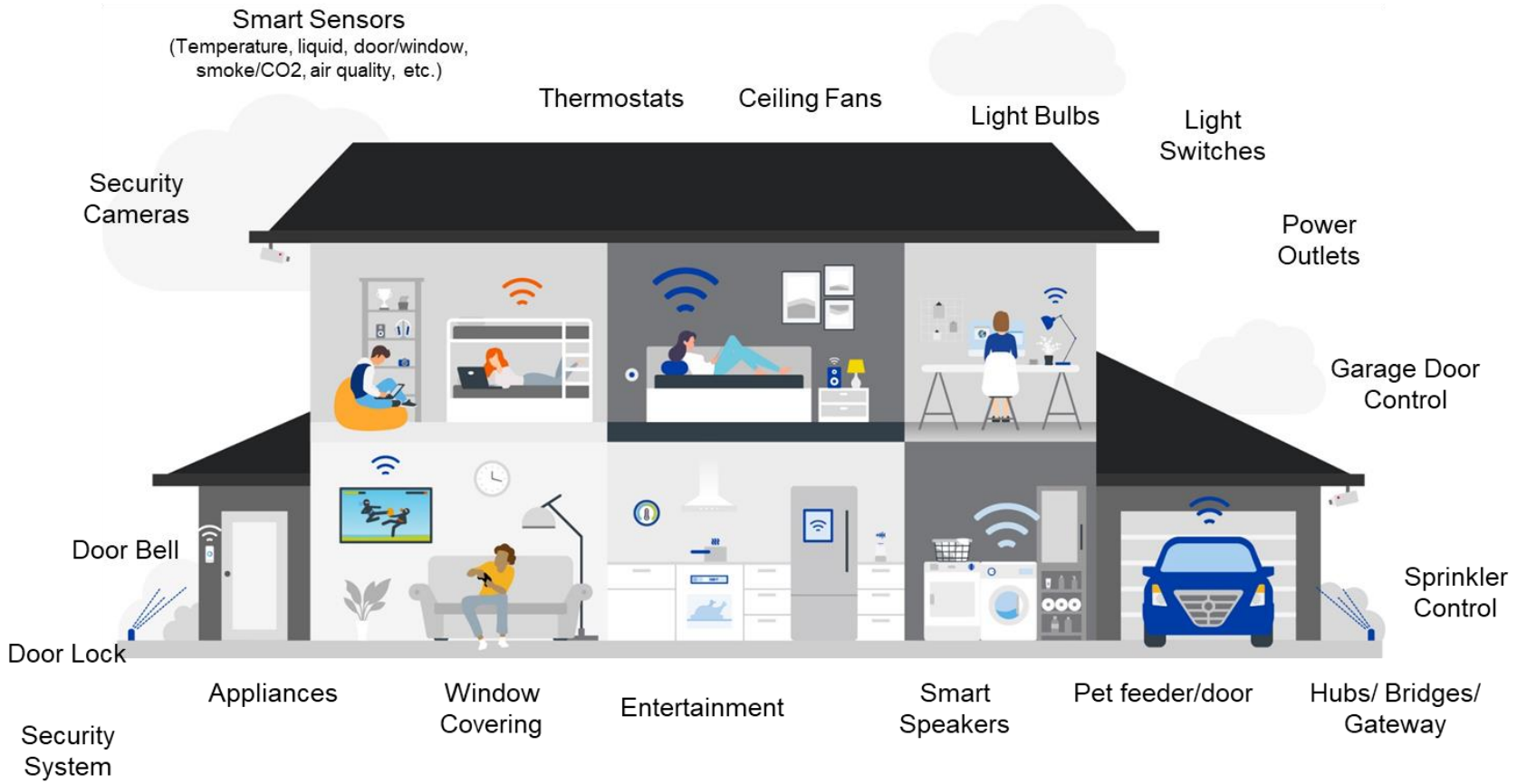
Secure ranging and precision sensing

UWB and Bluetooth LE

Leading IoT standards and open-source initiatives.

Solutions for major ecosystem voice assistants, cloud connectivity

SMART CONNECTED HOMES FOR CONVENIENCE, SAFETY AND PRIVACY



100+ IoT Devices

Interoperability challenge

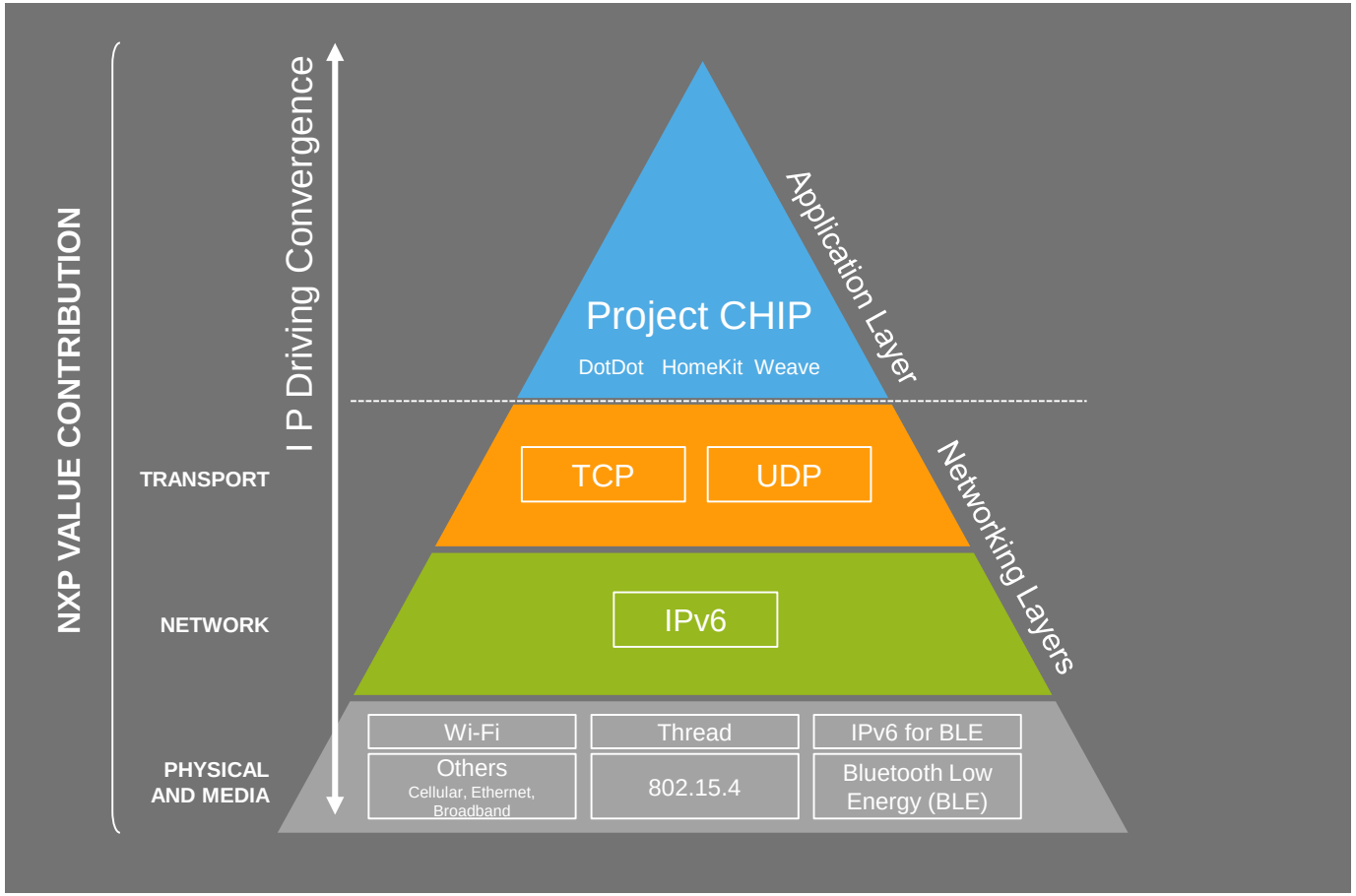
20+ Protocols

Smart Home may include:

- 3 outside doors with locks
- Video doorbell
- 2 garage doors
- 4 outdoor cameras
- 2 indoor cameras
- 5 smart speakers
- 8 appliances
- ~20 light switches
- ~30 light bulbs
- 3+ audio systems
- 3+ entertainment systems
- Security system with 20+ sensors
- 2 thermostats
- Sprinkler system
- Pet feeder/door
- 3+ hubs/bridges

PROJECT CONNECTED HOME OVER IP (CHIP) FOR IOT DEVICES

A single IP-based protocol to securely and robustly connect a large ecosystem of products and every smart home system



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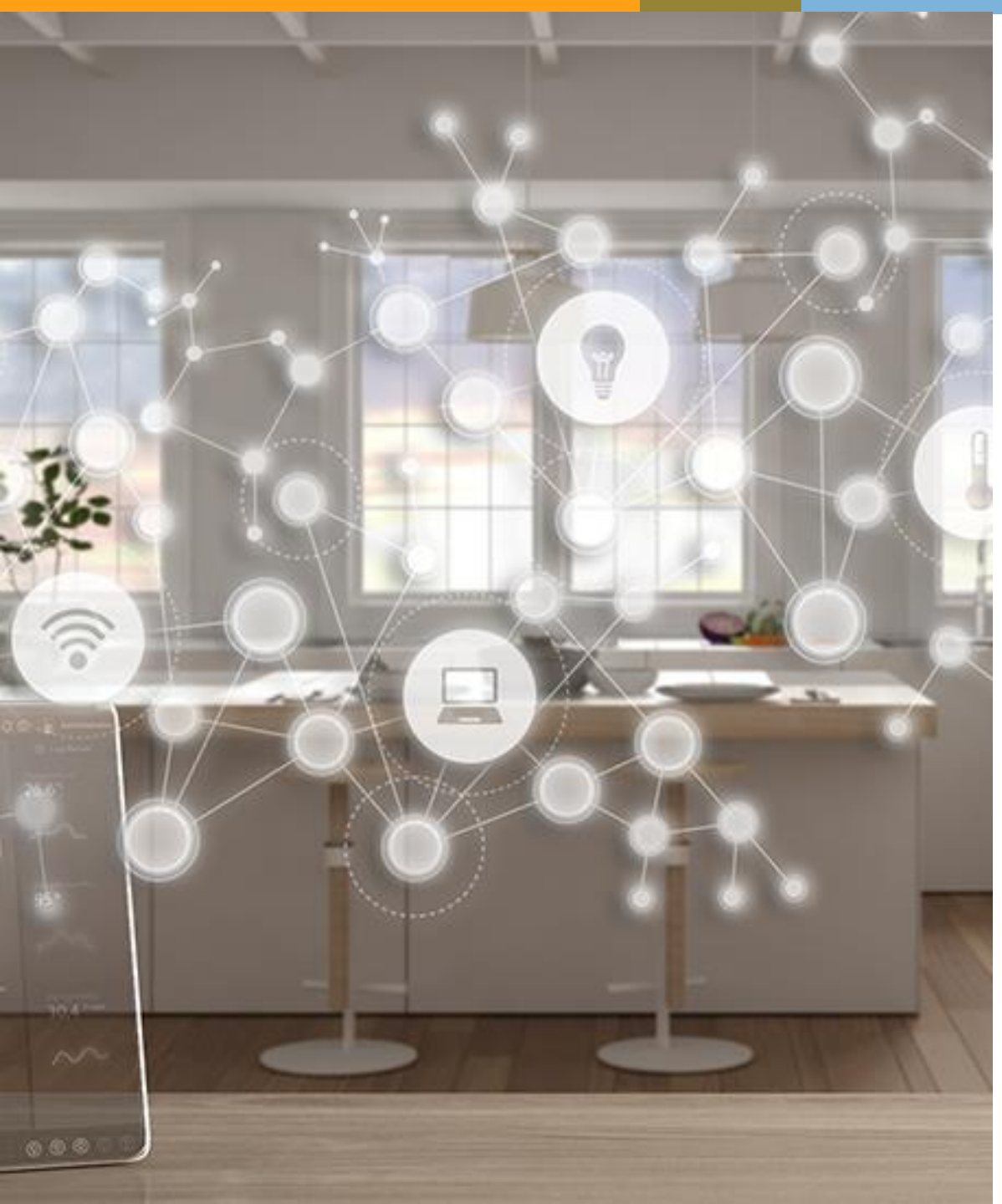


Project Connected Home over IP (CHIP) improves smart home device compatibility with **security, provisioning** and **compliance** as fundamental tenets

Goals

- Simplify development for “things”
- Increase compatibility for consumers
- Ensure security and privacy

Approach

- IP-based connectivity specification
- Open, royalty-free standard
- Open-Source software

SIMPLIFIED DEVELOPMENT

- Device manufacturers can focus on their products
  - Easier integration with Amazon's Alexa, Apple's Siri, Google's Assistant, and others
- Flexibility to choose appropriate network protocol(s)
  - Wi-Fi for high bandwidth
  - Thread (15.4) for robust low-power, low-bandwidth
- Standardization of lifecycle events
  - Provisioning/onboarding, removal, error recovery, and software updates

SMART DEVICES COMPATIBILITY

- Platform and ecosystem-agnostic technology
  - All “Things” becoming interoperable by design
  - Common language so smart devices can speak to each other on any network
- Built on market-proven technologies
  - Elements of Apple’s HomeKit, Zigbee Alliance’s Dotdot, Google’s Weave
- Interoperability across IP networks
  - Enables devices to communicate across IP protocols
  - Consistent cloud and device data models

WEAVE

dotdot

HomeKit

BUILT-IN SECURITY AND PRIVACY

- Simple and secure device commissioning
- Leverage security investment already part of IP
- Direct, private and secure end-to-end communications
- Enable application-level privacy and integrity
- Cryptographically secure over-the-air s/w updates
- Reduce attack points

WIRELESS MCU PORTFOLIO

HS: 2Mbit/s PHY
LR: Long Range
Loc: Localization
Audio
#x: simultaneous connections

IOT

Auto and Industrial

Wi-Fi

1x1 **MW320/322**

200 MHz M4F, QSPI flash, 512 kB SRAM, 68QFN/88QFN

802.15.4/Multiprotocol

4.2, 2x **KW41/31/21**

48 MHz M0+, 512 kB Flash, 128 kB SRAM
48LQFN, 75WLCSP

JN5168/69

32-bit RISC, up to 512 kB Flash &160 kB SRAM, 40QFN

5.0 w/ HS , 8x **K32W061/41**

48 MHz M4, 640 kB Flash, 152 kB SRAM, 40QFN

JN5189/88

48 MHz M4, 640 kB Flash, 152 kB SRAM, 40QFN

K32W041AM

K32W041 + 1MB Data Flash, +15dBM

K32W041A

K32W041 with +15dBM

Bluetooth LE

5.0 HS, 16x **QN9083/80/80SIP**

32 MHz M4F, 512 kB Flash, 128 kB SRAM
48QFN, WLCSP

5.0 w/ HS, 8x **QN9090/30**

48 MHz M4, 640/320 kB Flash, 152/88 kB SRAM, 40QFN

5.2 w/ HS, Audio, 8x **NXH3675 (Audio)***

48 MHz M0+, 96MHz dual DSP, 640 kB Flash, 160 kB SRAM, WLCSP

5.0, 8x **KW36/35/34**

48 MHz M0+, 512 kB Flash w/ ECC, 64 kB SRAM, EEPROM, AES-128, CAN FD (KW36), LIN
4048 QFN, AEC-Q100 Grade 2, Industrial

48HVQFN Pin/Package Compatible

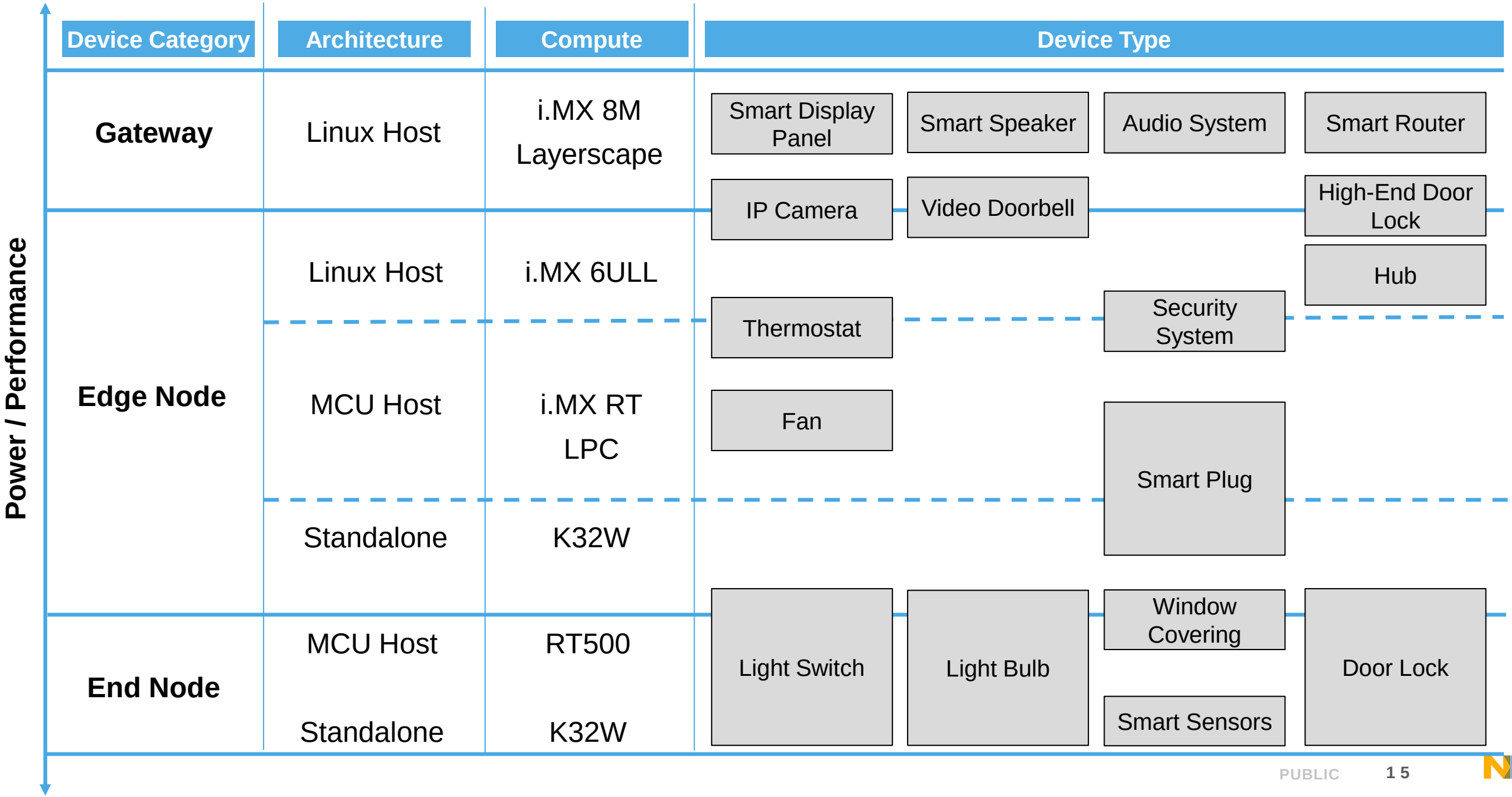
5.0 LR, HS, 8x **KW39/38/37**

48 MHz M0+, 512 kB Flash w/ ECC, 64 kB SRAM, EEPROM
AES-128, CAN FD (KW38), LIN
48HVQFN, AEC-Q100 Grade 2, Industrial

Legacy | 2019 | 2020 | 2021

* Not supported by MCUXpresso

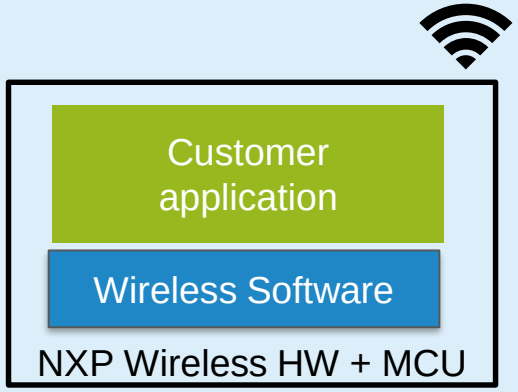
PROJECT CHIP REFERENCE PLATFORM: TYPICAL COMPUTE USE CASES



FLEXIBLE CONNECTIVITY ARCHITECTURES (I)

Wireless MCU architecture:

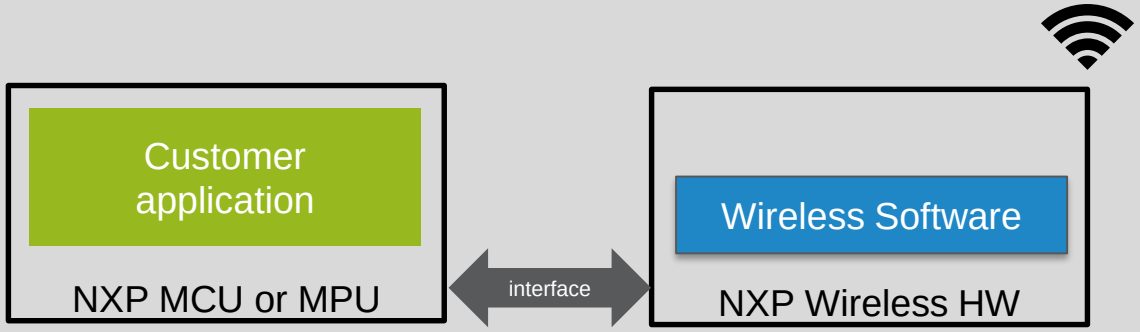
"Host-less", customer application runs on the Wireless device



or

Hosted architecture:

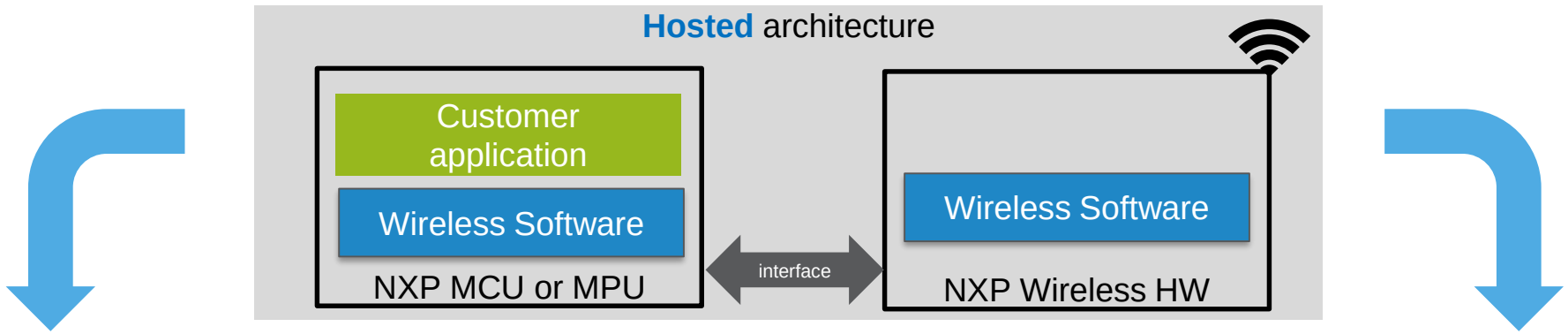
Customer application runs on a host system

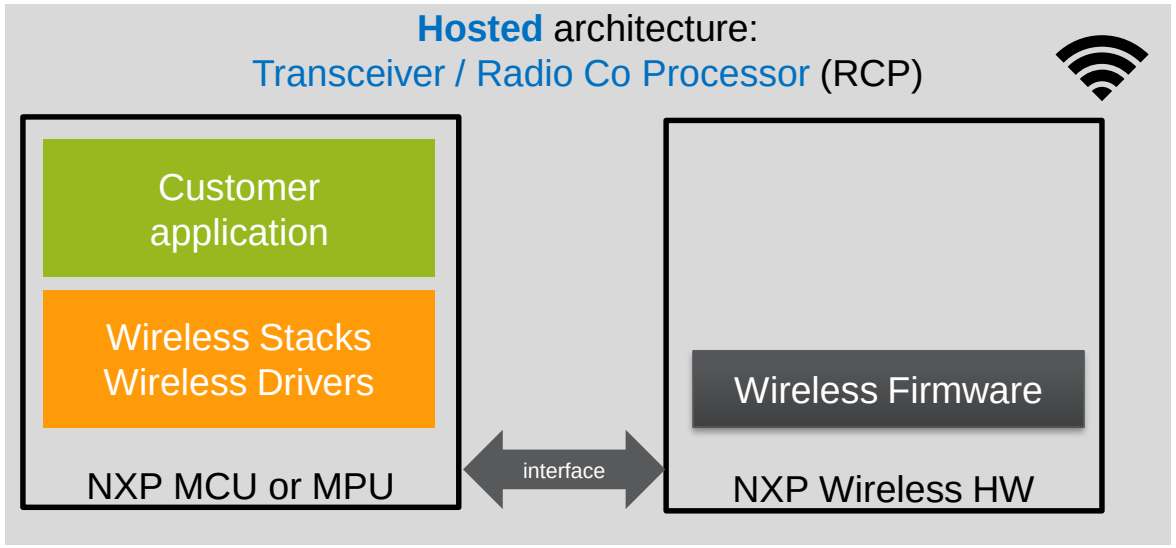


Wide choice for memory size, I/O's, MCU/MPU features, multiple concurrent wireless protocols supported

Fully integrated solution (low power consumption, smaller size, lower cost, simpler HW design)

FLEXIBLE CONNECTIVITY ARCHITECTURES (II)





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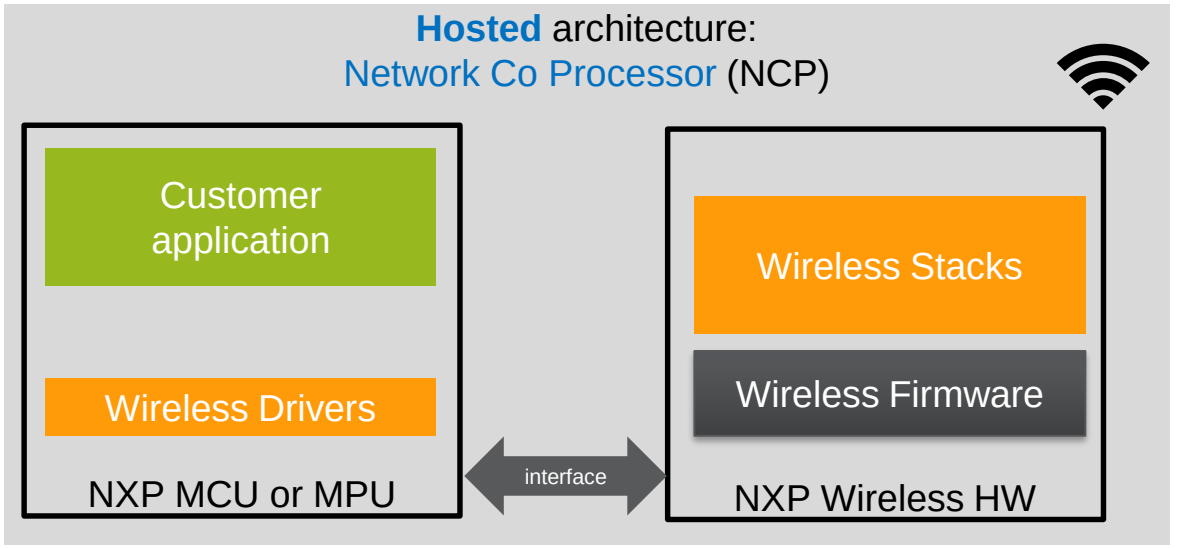


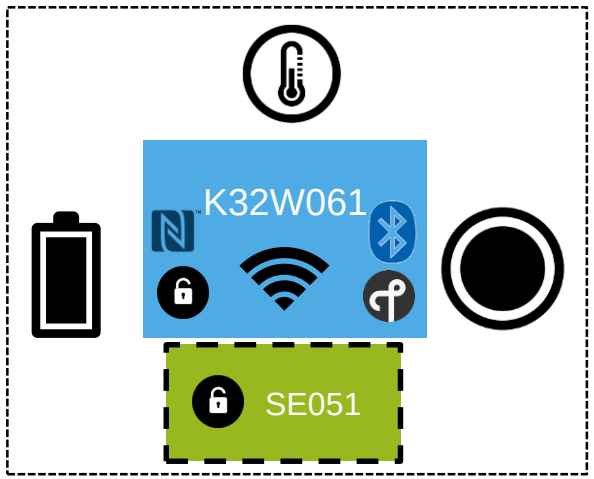
Lower cost / simpler host (but limited Wireless feature set over serial API)

Expanded Wireless feature set (but MCU needs enough memory to run Wireless stacks)

NXP PROJECT CHIP ENABLEMENT

Sensors / End Nodes

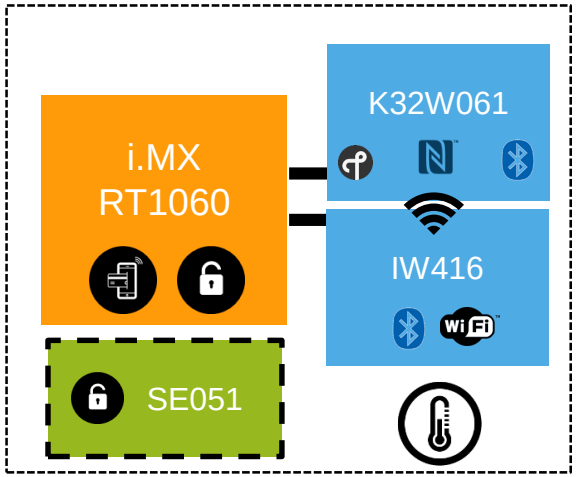
Hostless: Standalone



Project CHIP, Thread, Bluetooth LE

Edge & End Nodes

Hosted: MCU

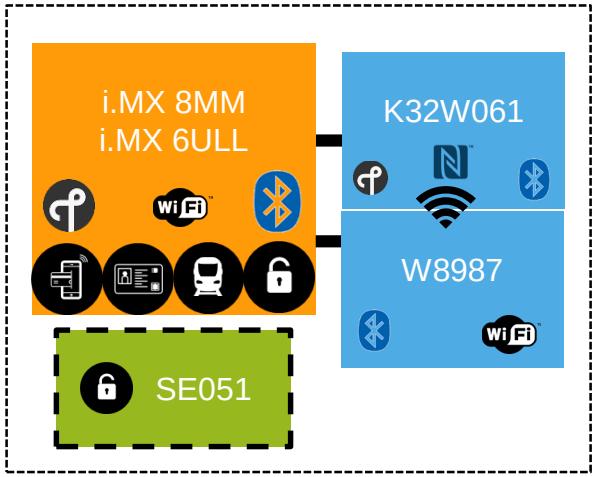


Project CHIP, Thread, Wi-Fi, BLE

Architecture: NCP or RCP

Gateways, Routers & Edge Nodes

Hosted: MPU



Project CHIP, Thread, Wi-Fi, BLE

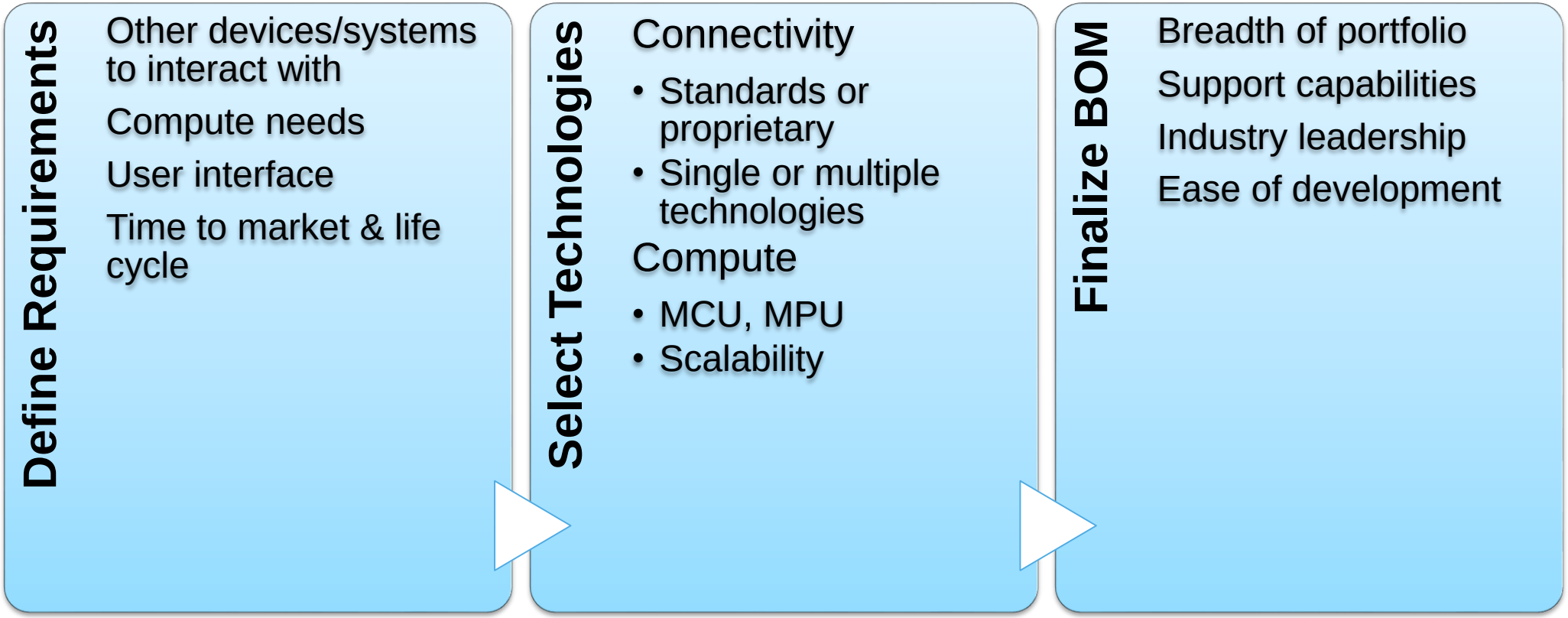
Architecture: NCP or RCP

Flexible approach, comprehensive software enablement focused

- Wireless MCU and Hosted architectures to support range of use cases
- Support for Wi-Fi, Thread and Bluetooth LE transports
- Compute options: Standalone Wireless MCUs, MCU RTOS-based host or MPU Linux host
- Enabled with proven security – discrete (SE051) or embedded

CHIP Smart Door Lock Use Case & Demo

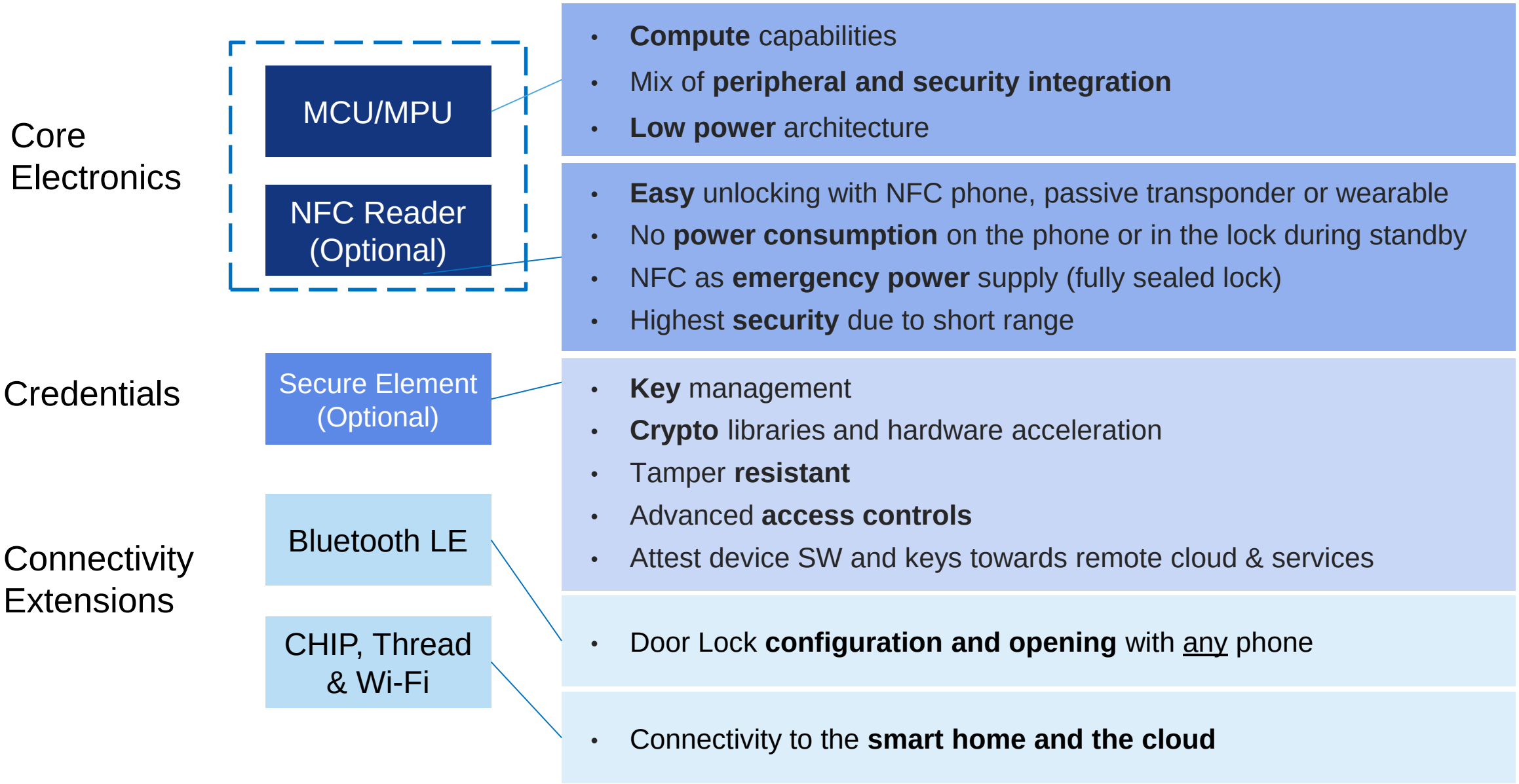
FUTURE PROOF YOUR DESIGN: CONSIDERATIONS



SMART DOOR LOCK MARKET NEEDS

- Security – peace of mind
- Keyless entry - low risk of locking yourself out
- Ease of use – remote monitor and control
- Access awareness - temporary access for visitors, renters, service or delivery staff
- Easy lock and credential management

SMART DOOR LOCK TECHNOLOGY BUILDING BLOCKS



NXP PROJECT CHIP SMART LOCK TECHNOLOGY BUILDING BLOCKS

Core Electronics

MCU/MPU

NFC Reader (Optional)

Credentials

Secure Element (Optional)

Connectivity Extensions

Bluetooth LE

CHIP, Thread & Wi-Fi

iW416

K32W061/41 BLOCK DIAGRAM – MCU, THREAD, BLUETOOTH LE

CPU

- 48 MHz ARM Cortex-M4 core
- **640kB Flash, 152kB RAM and 128kB ROM**

2.4 GHz radio transceiver

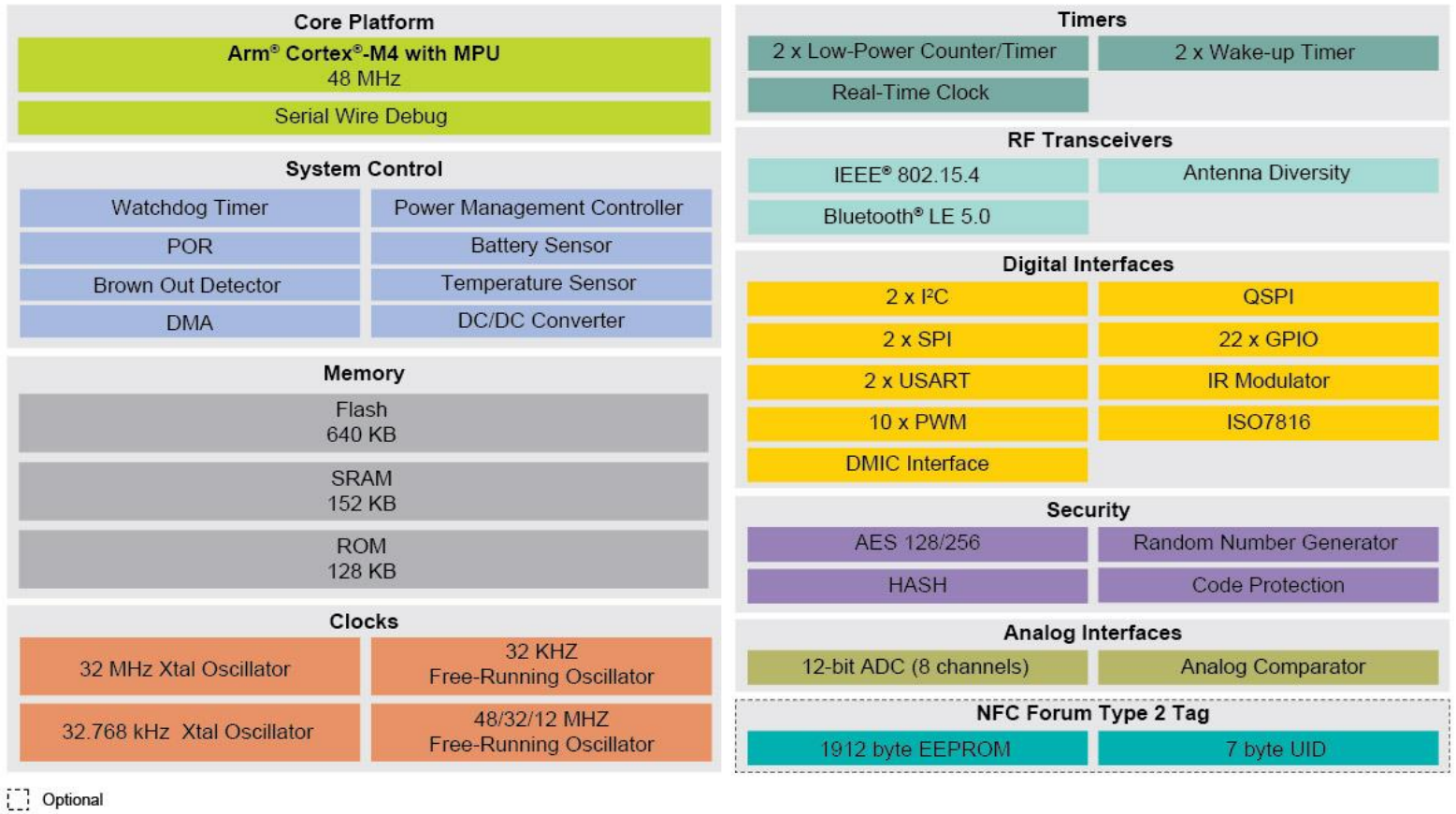
- Zigbee 3.0, Thread and Bluetooth 5 with High Speed support
- IEEE-802.15.4 compliant
- Antenna diversity control
- +10 dBm power amplifier
- 15.4: -100 dBm Rx sensitivity
- Bluetooth LE:-97dBm Rx sensitivity
- Peak typical current:
  - 20.3mA Tx @ +10dBm**, 7.4mA @ +0dBm**
  - **4.3mA Rx**
- Power down Mode current < 1uA
  - 0.8uA Power Down Mode current with no RAM retention
- Improved Wi-Fi coexistence

Security

- **Crypto engine: AES 128-256, RNG**

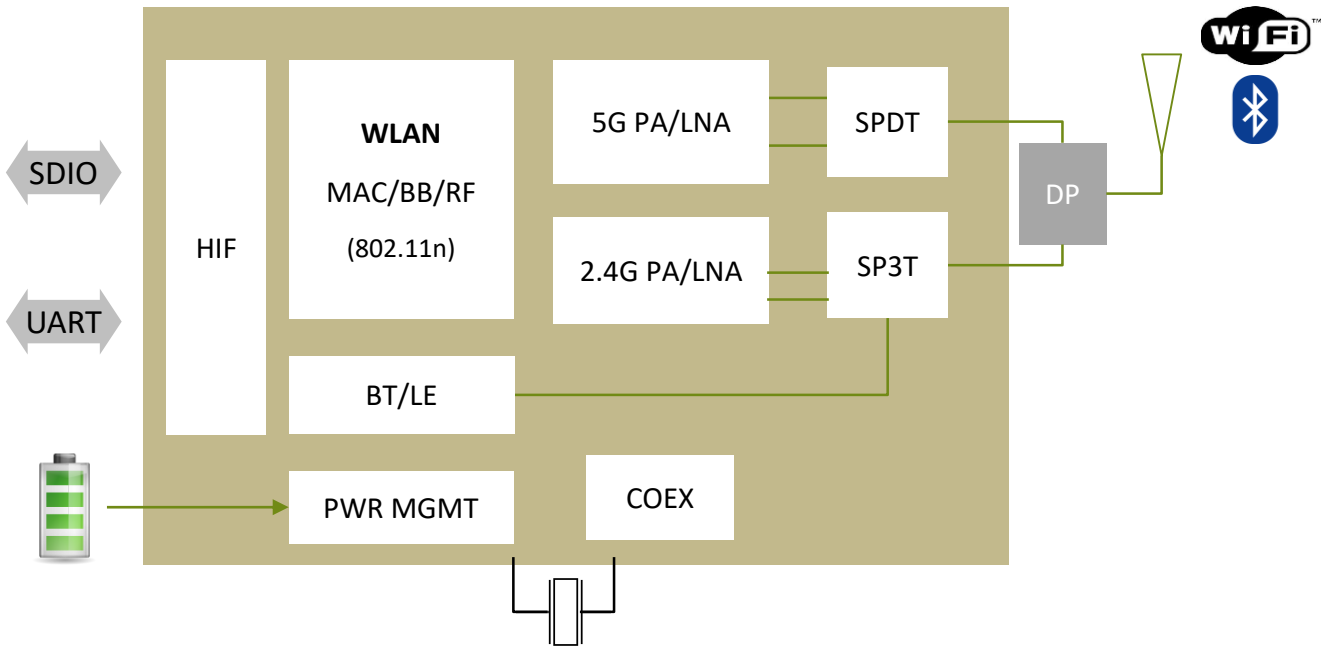
System

- NFC Tag (K32W0**6**1)
- Supported by Over-the-Air Device Firmware Upgrade
- Tj: -40°C to +125°C
- HVQFN40 6x6 mm



IW416 BLOCK DIAGRAM

Low power 1x1 11n DB Wi-Fi, BT5.1 IoT



Key Features

- 28nm SoC enabling low power consumption
- Bluetooth Classic and LE, BT 5.1 compliant
- 1x1 802.11n Dual-Band
  - Integrated PA/LNA/TR-SW
  - 802.11mc ranging
  - Low power consumption
- Wi-Fi/BT coex, WCI2 and PTA
- Drivers: Linux, Android, FreeRTOS
- Low RBOM cost with integrated PA/LNA/SW
- Package: 8x8 68-pin QFN, 74-pin eWLP

Key Specifications

- Technology: Wi-Fi 11n, BT/Wi-Fi coex
- Temp: Commercial (0°C to +70°C) or Industrial (-40°C to +85°C)
- Customer Value: low cost, low power, drivers integrated in MCUXpresso SDK and i.MX 6/7/8 BSP

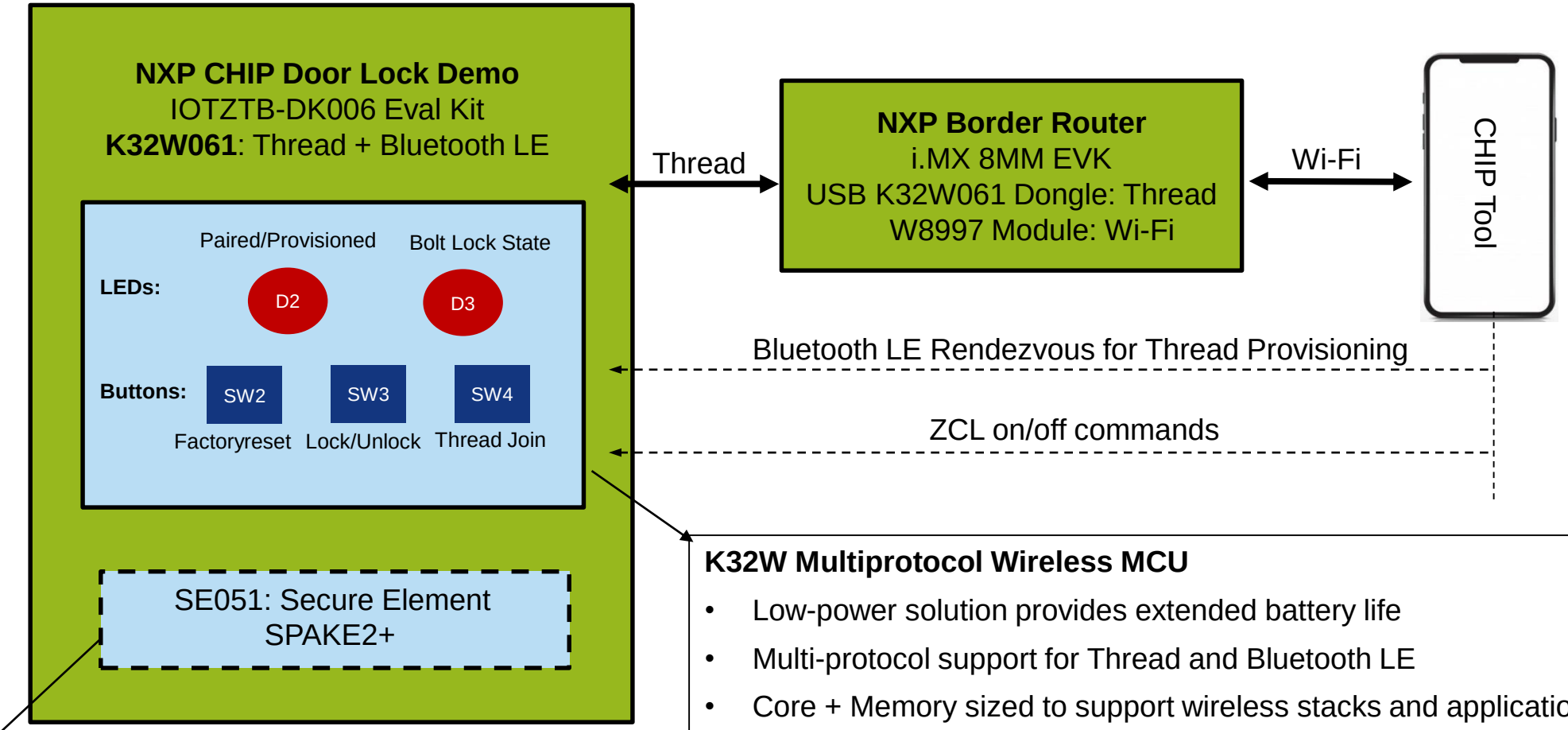
Schedule

- Production (QFN): March 2021, samples available
- Production (CSP): May 2021, samples available

EDGELOCK SE051 SECURE ELEMENT

- SE051 allows you to easily manufacture and deploy Project CHIP compliant IoT devices
- Enable Project CHIP compliance across your family of IoT devices in a scalable way: maximize re-use, minimize R&D investments by harmonizing key management & device onboarding into CHIP ecosystem and using SE051 across fleet of branded products and SKUs
- Further secure your devices and enable additional protections such as: secure connections to multiple cloud & services, device configuration attestation, secure remote device administration, secure sensing and actuation
- SE051 features SEMS Lite technology for applet update OTA, and NXP Edgelock 2GO Cloud Service for OTA remote key management

NXP E-LOCK DEMO – PROJECT CHIP CONNECTIVITY



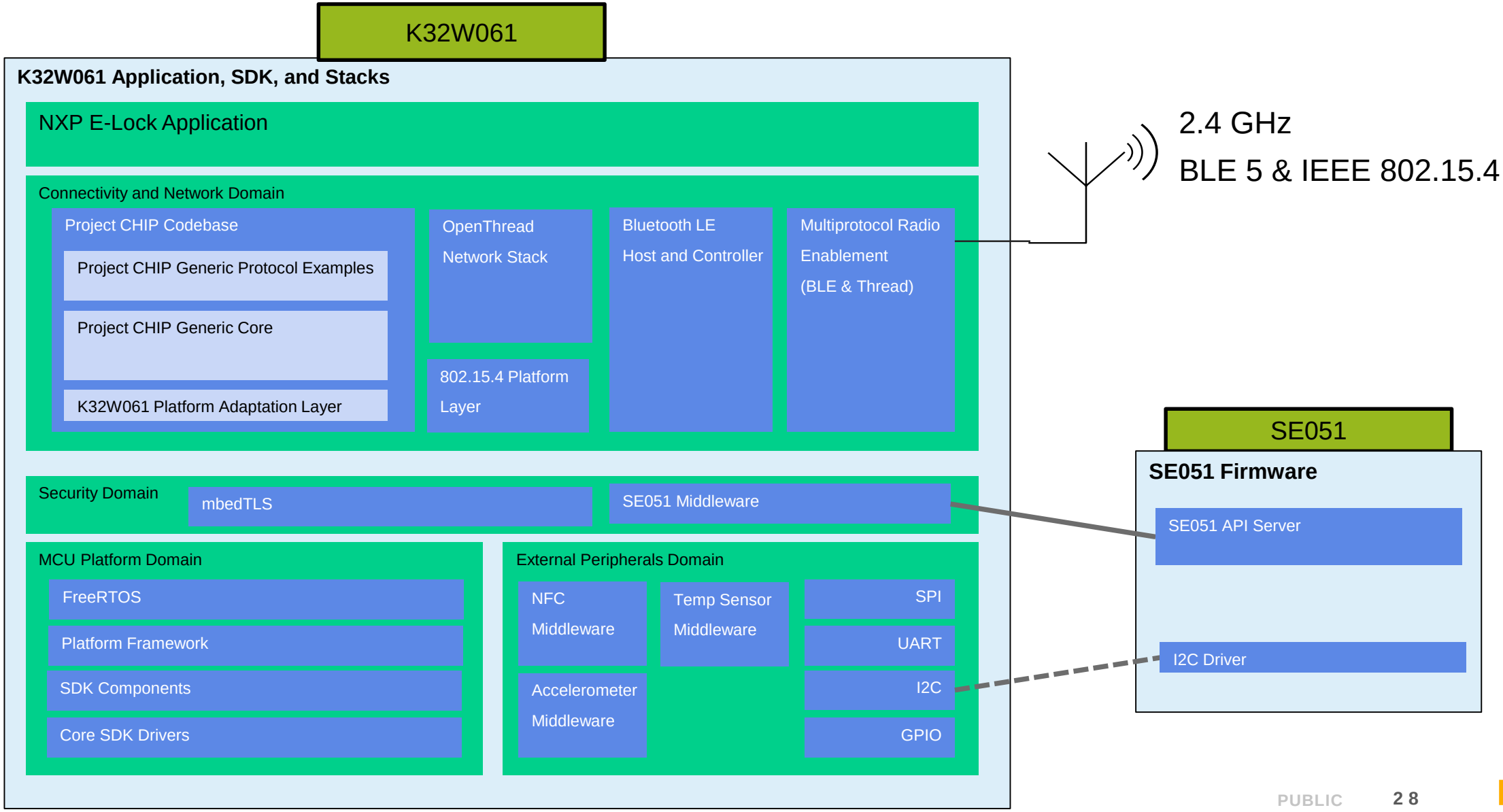
K32W Multiprotocol Wireless MCU

- Low-power solution provides extended battery life
- Multi-protocol support for Thread and Bluetooth LE
- Core + Memory sized to support wireless stacks and applications
- Demo can be scaled for sensors, switches (lower power, less memory resources)

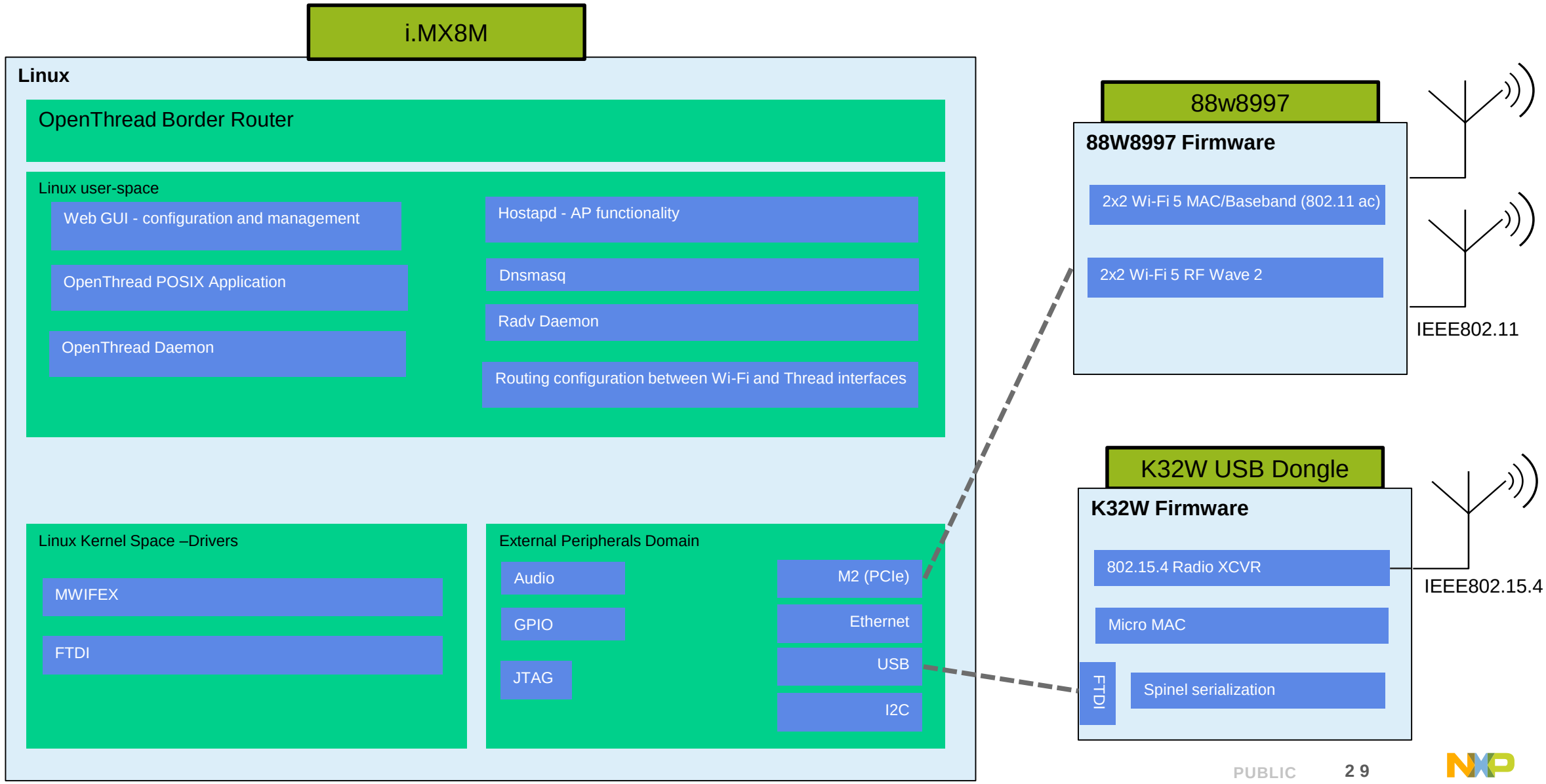
OPTIONAL: SE051 Secure Element

- Additional security attack protections

K32W061 - STANDALONE ARCHITECTURE – BLOCK DIAGRAM – SOFTWARE INTEGRATION



I.MX8 - STANDALONE ARCHITECTURE – BLOCK DIAGRAM – SOFTWARE INTEGRATION



NXP E-LOCK DEMO APP - GITHUB CONTRIBUTIONS

README for NXP E-Lock Demo App: https://github.com/project-chip/connectedhomeip/tree/master/examples/lock-app/k32w

NXP Project CHIP PRs:

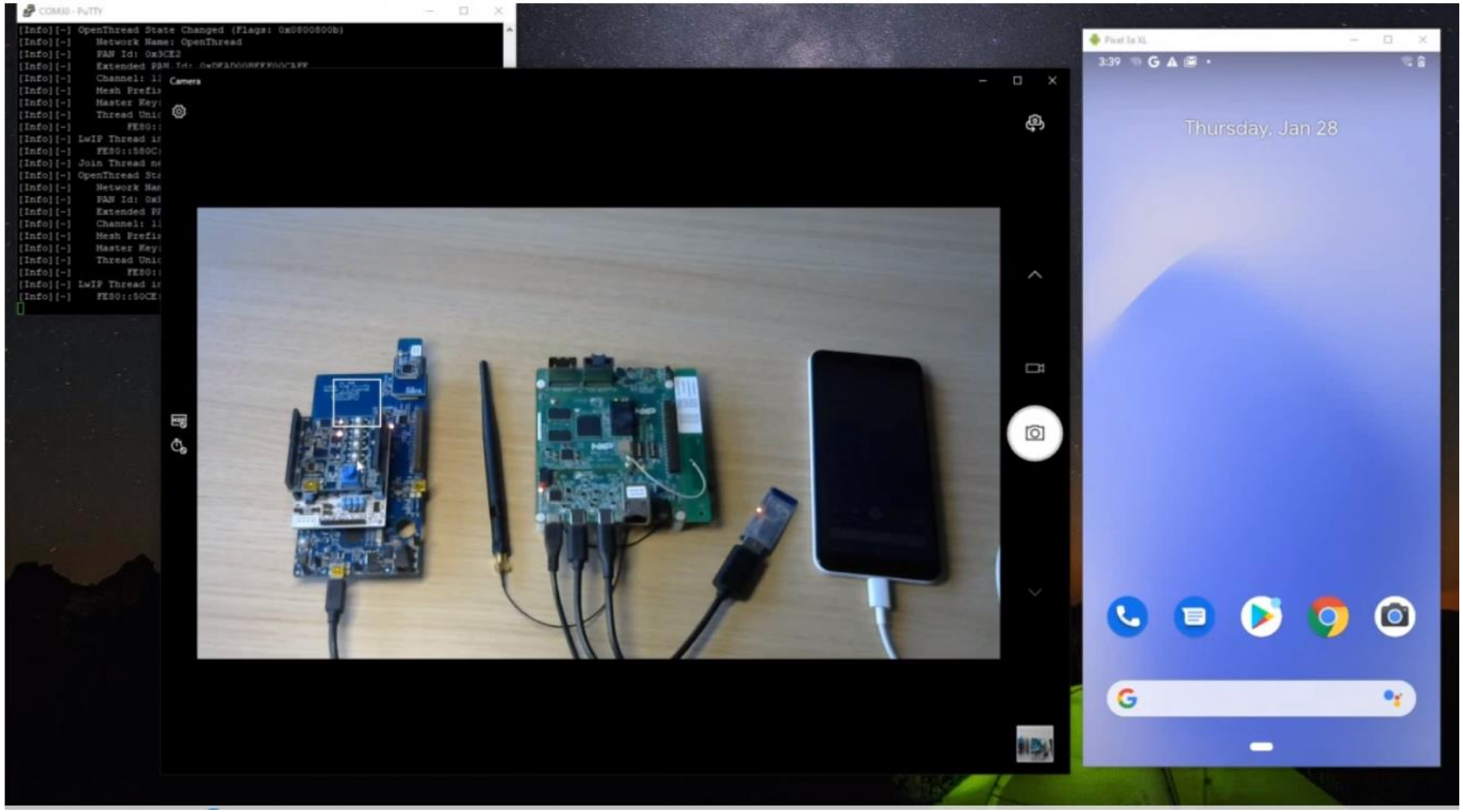
- Generic adaptation Layer: https://github.com/project-chip/connectedhomeip/pull/1420
- App v1: Basic functionality
  - https://github.com/project-chip/connectedhomeip/pull/2234
- App v2: Sync E-Lock app with the public SDK (https://mcuxpresso.nxp.com/), allowing an external party to build the example
  - https://github.com/project-chip/connectedhomeip/pull/2340
- App v3: Thread enablement
  - https://github.com/project-chip/connectedhomeip/pull/2379
- App v4: ZCL enablement. Control of the E-Lock using ZCL.
  - https://github.com/project-chip/connectedhomeip/pull/2714
- App v5: GN/Ninja build system
  - https://github.com/project-chip/connectedhomeip/pull/3192
- App v6: BLE enablement
  - https://github.com/project-chip/connectedhomeip/pull/4448

NXP OpenThread PRs related to Project CHIP:

- UART/Radio/FreeRTOS fixes:
  - https://github.com/openthread/openthread/pull/5451
- Persistent Data Manager support:
  - https://github.com/openthread/openthread/pull/5496
- Dynamic mode support (802.15.4 + BLE)
  - https://github.com/openthread/openthread/pull/6099

- **Related activities:**
  - CHIP Tool Building: https://github.com/project-chip/connectedhomeip/issues/2529
  - README/Logging fixes: https://github.com/project-chip/connectedhomeip/pull/2729
  - GN/Ninja Build: https://github.com/project-chip/connectedhomeip/issues/2250

DEMO VIDEO



SUMMARY

Future-Proofing the Smart Home

The Zigbee Alliance's Project CHIP promises to deliver what Smart Home needs to meet its full potential. Here's why we're on board.

Read the whitepaper>

Project CHIP brings compatibility across ecosystems

NXP provides leadership in IoT with comprehensive portfolio for compute, connectivity and security

NXP is committed to providing scalable, flexible and compelling Project CHIP solutions

SECURE CONNECTIONS
FOR A SMARTER WORLD