BUILDING MULTIPROTOCOL IOT NODES

WITH THREAD, BLE, AND ZIGBEE

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NXP | SECURE CONNECTIONS FOR A SMARTER WORLD | OpenIoTSummit

Summary

- Benefits of Multiprotocol Systems
- Protocol Standards
- Use Cases
- Platforms and Stacks
- Application Considerations
- Examples

Speaker: Alin Lazar

Software Engineering Manager at NXP Semiconductors

10+ years experience with low power wireless protocols

Shipped ZigBee, Thread, BLE network stacks and tools for microcontrollers

Focus on standardization and certification

Vice Chair of Thread Group Technical Committee

Benefits of Multiprotocol Systems

Benefits of Multiprotocol Systems

Connect++

Expanded, flexible connectivity from the same Device

Reduce Design Costs

One SKU, single firmware build

Opens Path to IoT Convergence

Applications can leverage best aspects of multiple standards, reduce lock-in

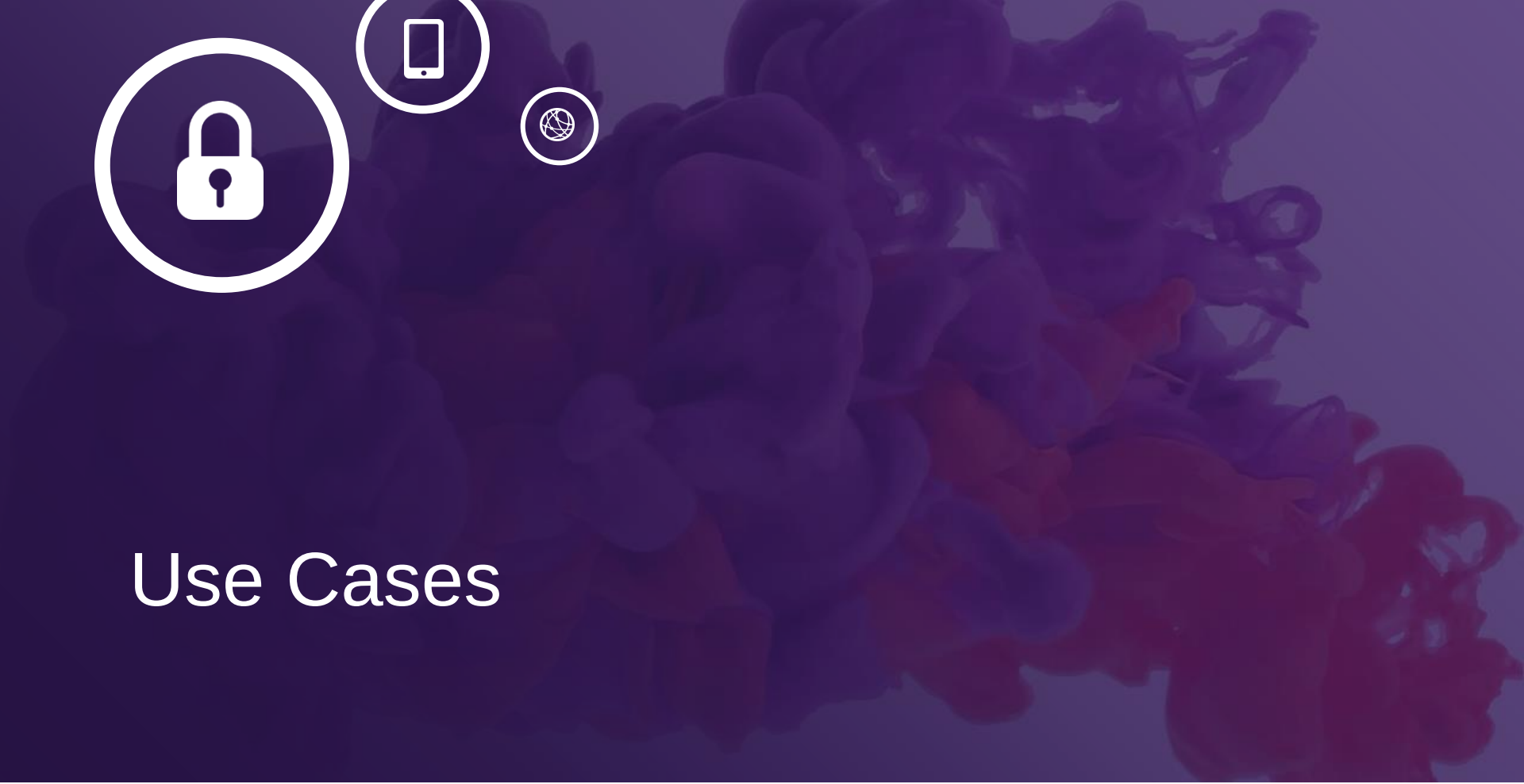
Protocol Standards

Wireless Protocol Standards of Focus

Bluetooth LE (4.0+)
Connect to smartphones, PCs
Accessories, Wearables, Beacons

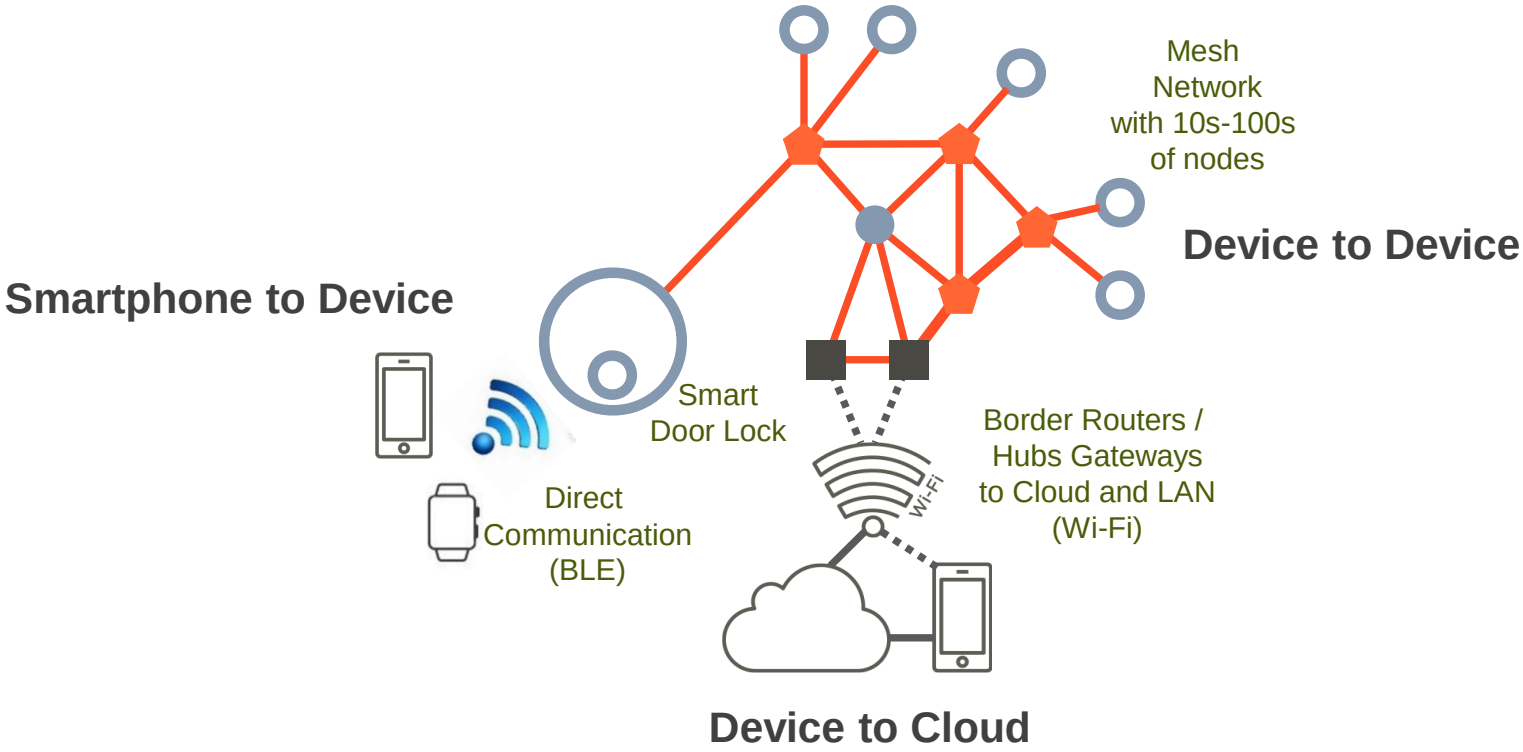
Low power mesh protocol
Connect to smart home hubs
100s of smart home & lighting certified products

IPv6 network layer scalable to low power IoT
Mesh network without Single Point of Failure
Border Routers: IP network gateways for mobile and cloud



Use Cases

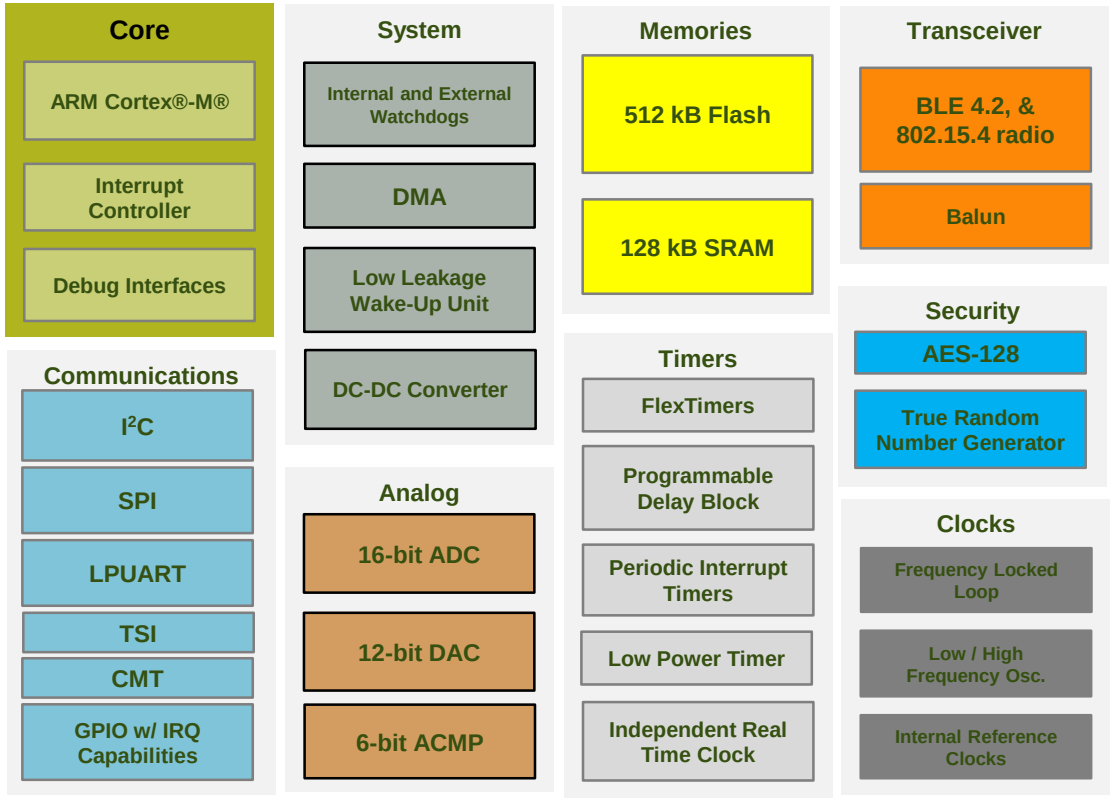
Use Cases for Multiprotocol Edge Nodes



Multiprotocol Platforms and Stacks

Integrated Microcontrollers with Multimode Radios

- Available from several MCU vendors
- Commonly based on ARM® Cortex®-Mx
- Most common multimode Transceiver configuration: BLE and IEEE 802.15.4
- Various on-chip memory sizes
- Optimized for deep sleep low power
- Integrated security/TRNG acceleration



Multi-Protocol Stacks for IoT Edge Nodes

Device Application

GAP | GATT Profiles	**ZigBee Clusters Library Framework (e.g.: ZigBee 3.0)**	**IPv6 App Layer IoT Frameworks (e.g.: based on CoAP)**
BLE Host	**ZigBee PRO**	**UDP Sockets**
		Thread 1.1 IPv6 Routing 6LoWPAN
BLE Controller	**IEEE 802.15.4 MACPHY**	

Multimode Transceiver

Application Considerations

Multiprotocol MCU Application Considerations

- Firmware System and RTOS
- Manage Radio Concurrent Operation and Co-Existence
- Sleep modes and wake-up patterns
- OTA Updates
- Application layer protocol and ecosystem
- Security

Concurrent Radio Protocol Operation API

```
typedef enum
{
    gMWS_BLE_c,
    gMWS_802_15_4_c,
    gMWS_ANT_c,
    gMWS_GENFSK_c,
    gMWS_None_c
} mwsProtocols_t;


mwsStatus_t MWS_Register    (mwsProtocols_t protocol, pfMwsCallback cb);
mwsStatus_t MWS_Acquire     (mwsProtocols_t protocol, uint8_t force);
mwsStatus_t MWS_Release     (mwsProtocols_t protocol);
mwsStatus_t MWS_SignalIdle  (mwsProtocols_t protocol);
mwsStatus_t MWS_Abort       (void);

uint32_t MWS_GetInactivityDuration (mwsProtocols_t currentProtocol);
mwsProtocols_t MWS_GetActiveProtocol (void);
```

Radio Co-Existence with MWS API

```
void MWS_CoexistenceEnable (void);
void MWS_CoexistenceDisable (void);

mwsStatus_t MWS_CoexistenceInit(void *rfDenyPin, void *rfActivePin, void *rfStatusPin);
mwsStatus_t MWS_CoexistenceRegister (mwsProtocols_t protocol, pfMwsCallback cb);
void MWS_CoexistenceSetPriority(mwsRfSeqPriority_t rxPrio, mwsRfSeqPriority_t txPrio);

mwsStatus_t MWS_CoexistenceRequestAccess(mwsRfState_t newState);
mwsStatus_t MWS_CoexistenceChangeAccess(mwsRfState_t newState);
uint8_t MWS_CoexistenceDenyState(void);
void MWS_CoexistenceReleaseAccess(void);

typedef uint32_t(*pfMwsCallback) (mwsEvents_t event);
typedef enum
{
    gMWS_Init_c,
    gMWS_Idle_c,
    gMWS_Active_c,
    gMWS_Release_c,
    gMWS_Abort_c,
    gMWS_GetInactivityDuration_c
}mwsEvents_t;
```

Multiprotocol IoT Gateways

Gateways, Hubs, Border Routers

Gradual Transition from Application Layer Gateway to Network Layer Gateway

zigbee

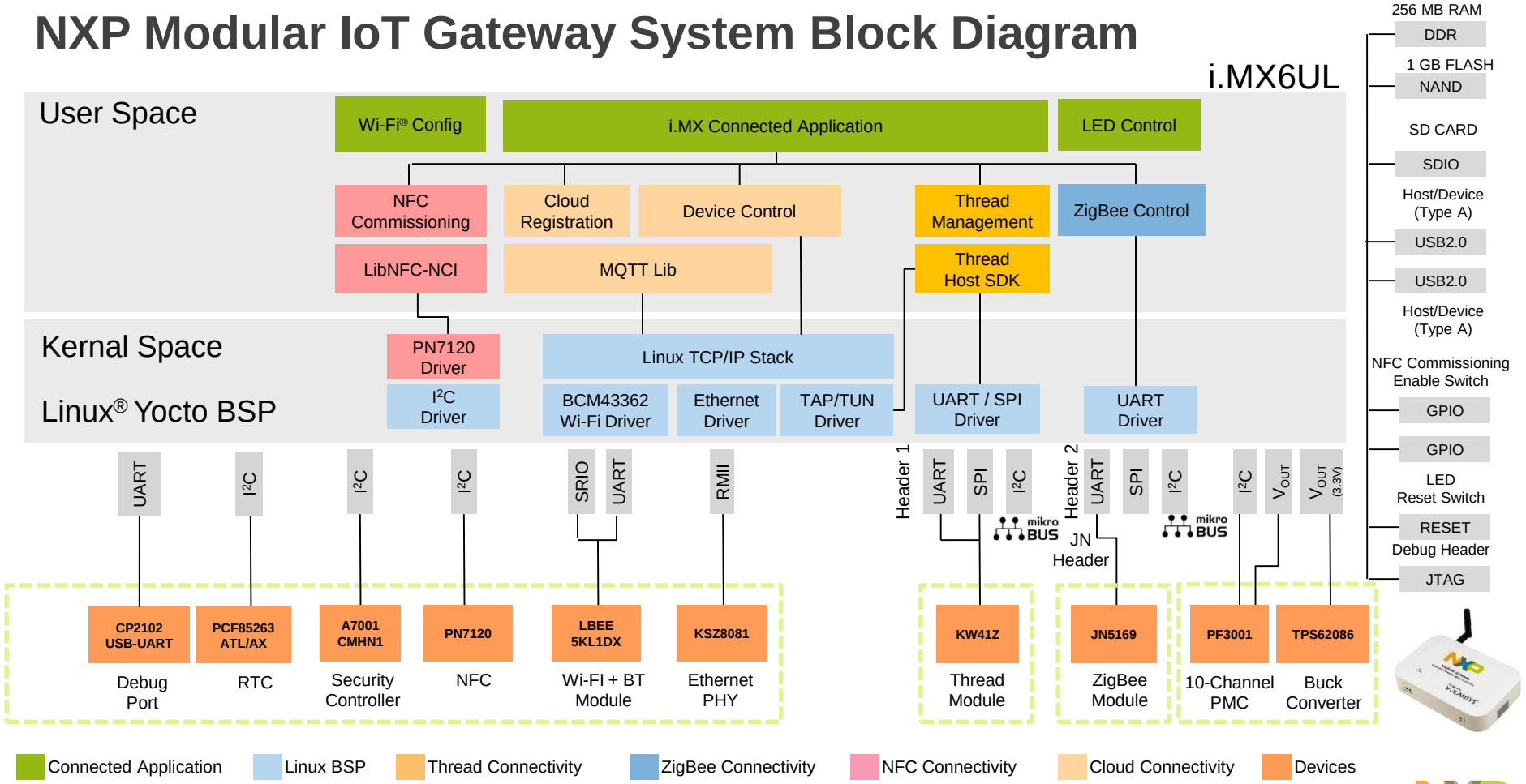
THREAD

Wi Fi

Ethernet

NFC Tap & Connect Commissioning

NXP Modular IoT Gateway System Block Diagram



What’s Next for Multiprotocol IoT

What's Coming Next for Multiprotocol IoT Systems

Even more standards / protocols integrations at the edge:

Wi-Fi

LPWAN

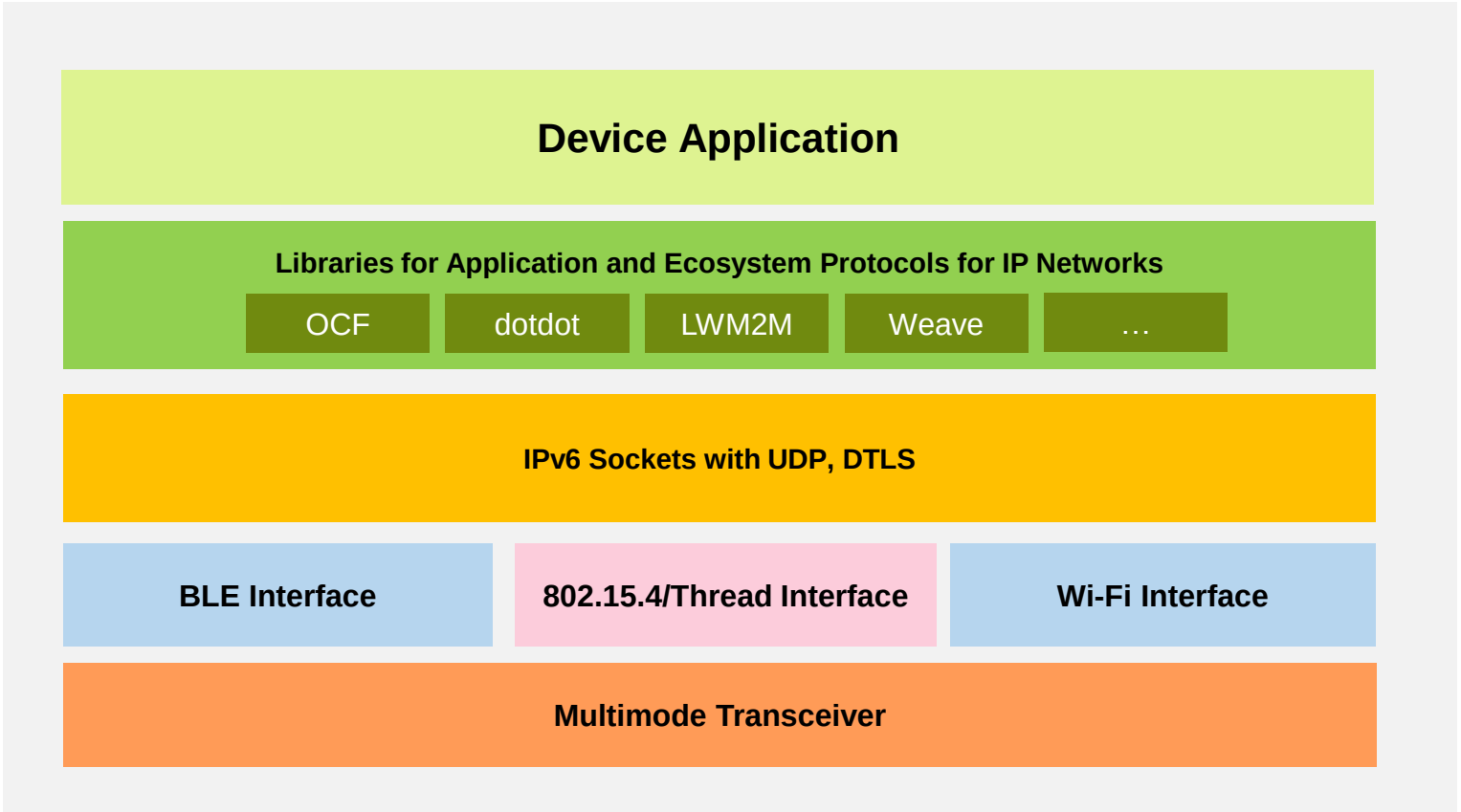
Commercial / Professional use cases

Even more flexible radios

Mesh networks everywhere!

IPv6 (and end-to-end) everywhere!

IP as Network Convergence Layer (Projection)



Your Next Steps

Get some Multiprotocol IoT platforms:

NXP KW41Z
FRDM-KW41Z
USB-KW41Z
Modular Gateway Reference Design



Get platform drivers, firmware SDKs, Linux Host SDKs:

NXP MCUXpresso Config Tools
KW41Z SDK Software and Design Tools

Join and contribute to the standard groups:

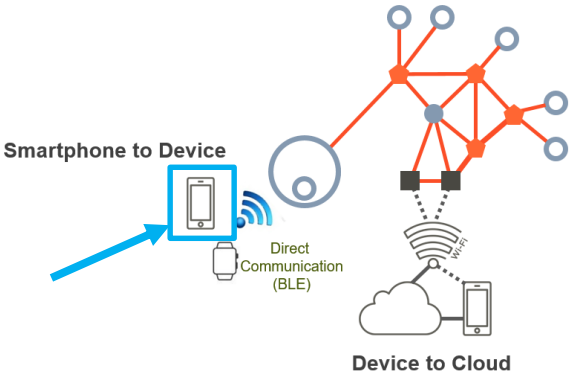
Influence standard spec definitions
Achieve quicker, certified interoperability
www.bluetooth.com www.threadgroup.org www.zigbee.org
Public events: ZigBee Winter Summit – Monday March 6, Austin, TX
Thread Technology Workshop – Monday March 27, Mountain View, CA

Contribute to OSS (most OSS support is WIP and needs your help):

Zephyr, Mynewt, NimBLE, IoTivity, OpenThread

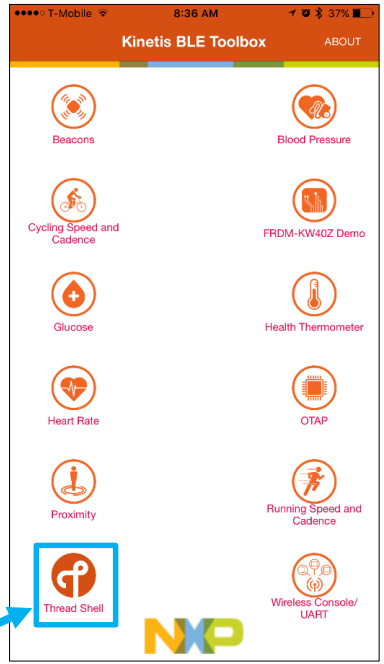
Hands-on Examples

Example 1: Thread Network Shell with Kinetis BLE Toolbox App



[App Store]

[Google Play]

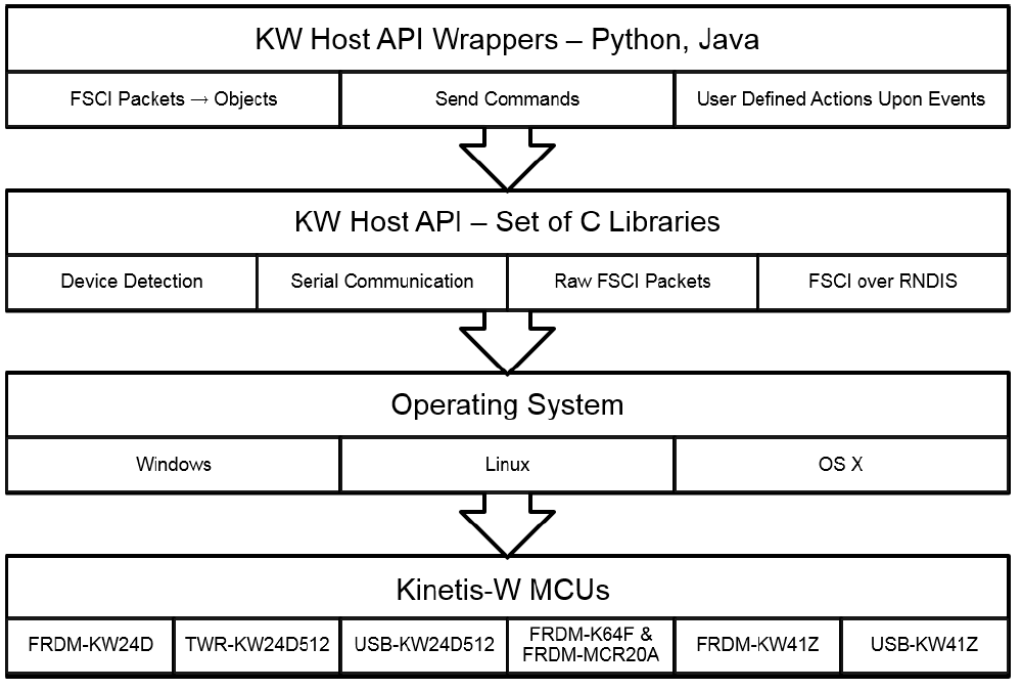


Example 2: Host SDK

Using Python Bindings (multimode.py) for Linux Host scenario

Available as part of KW41Z Connectivity Software Package

tools\wireless\host_sdk\hsdk-python\src\com\nxp\wireless_connectivity\test\multimode.py



Looking forward to your

Questions

alin.lazar at nxp.com

https://community.nxp.com/community/wireless-connectivity