

BUILDING MULTIPROTOCOL IOT NODES

WITH THREAD, BLE, AND ZIGBEE

ALIN LAZAR

FEBRUARY 23, 2017
PORTLAND, OR



SECURE CONNECTIONS
FOR A SMARTER WORLD



OpenIoT Summit



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

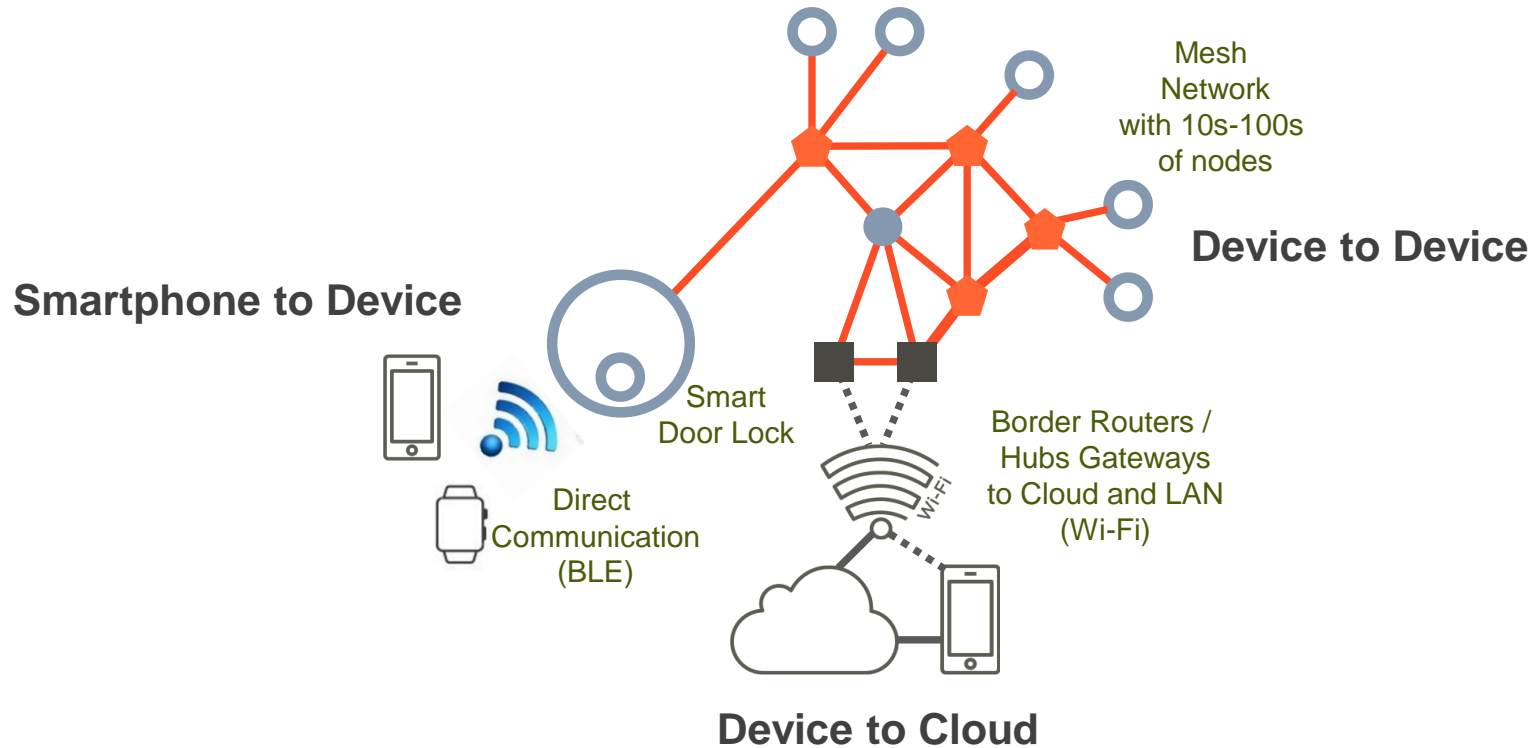


IPv6 network layer scalable to low power IoT
Mesh network without Single Point of Failure
Border Routers: IP network gateways for mobile and cloud



Use Cases

Use Cases for Multiprotocol Edge Nodes

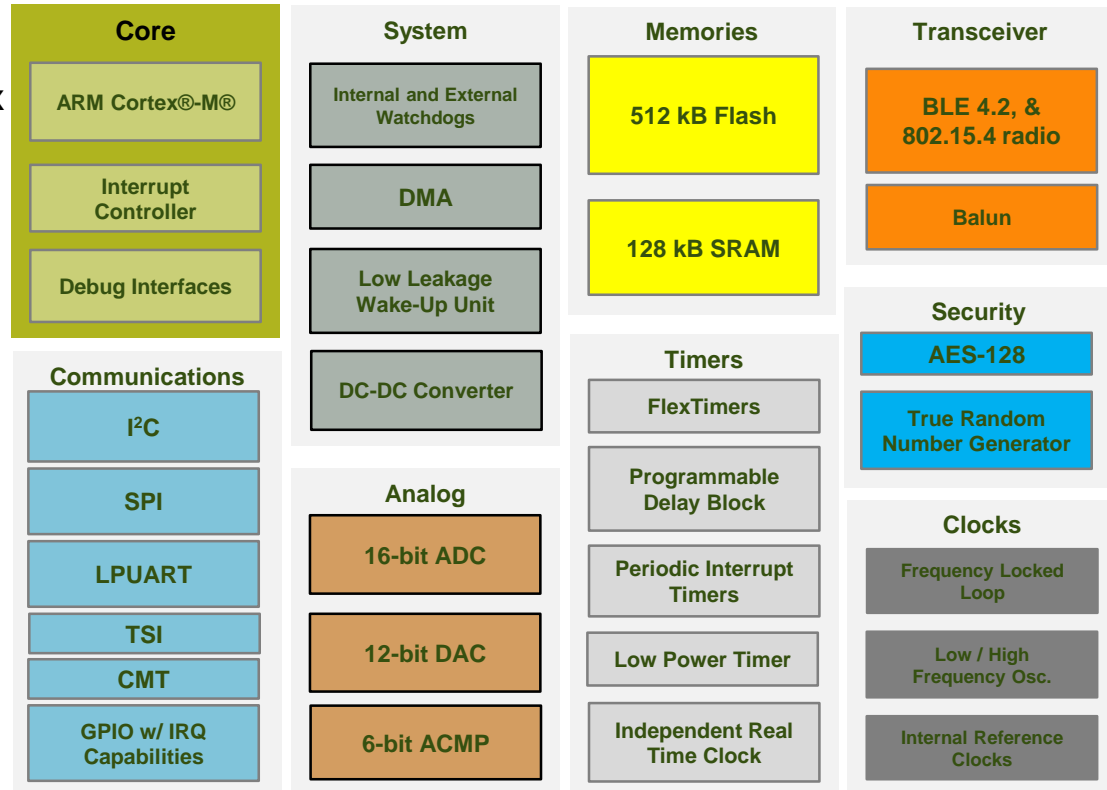




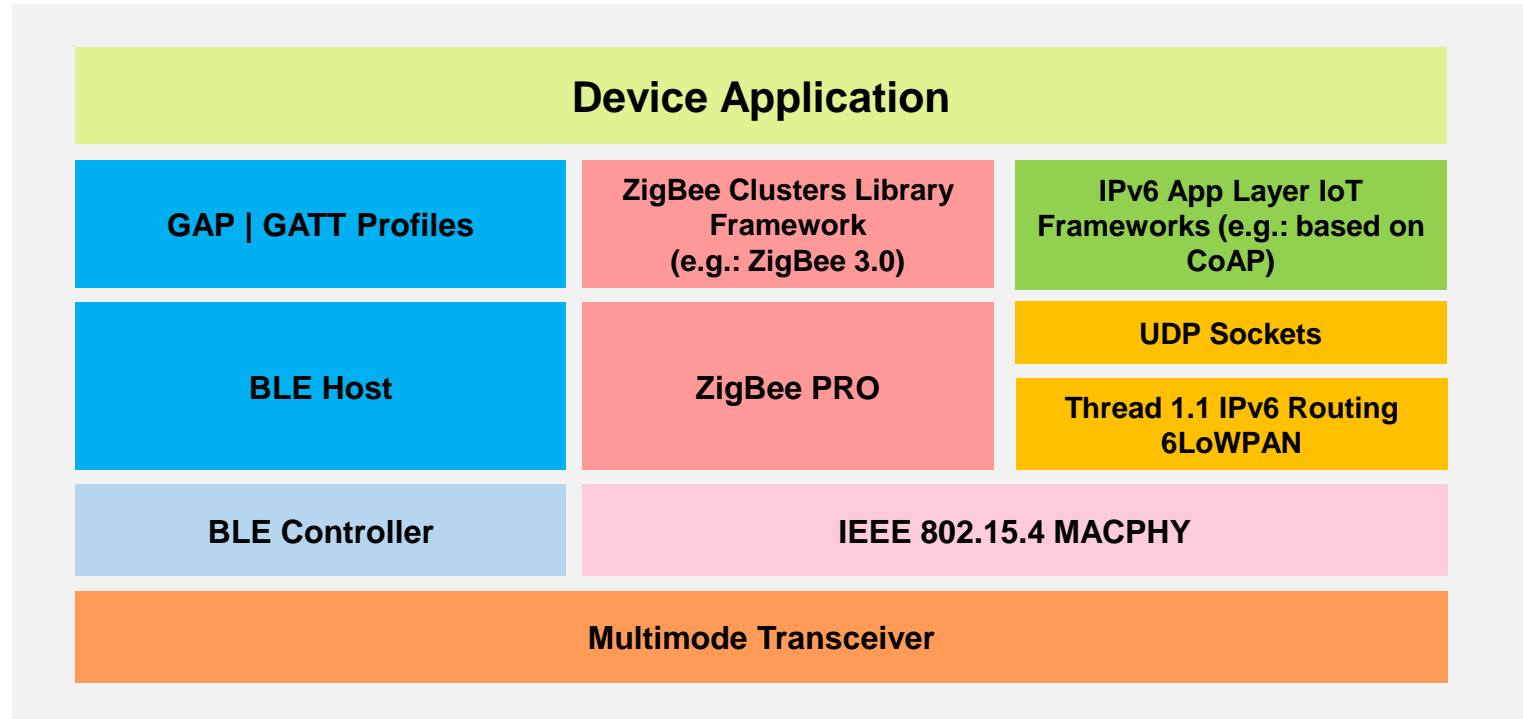
Multiprotocol Platforms and Stacks

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





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

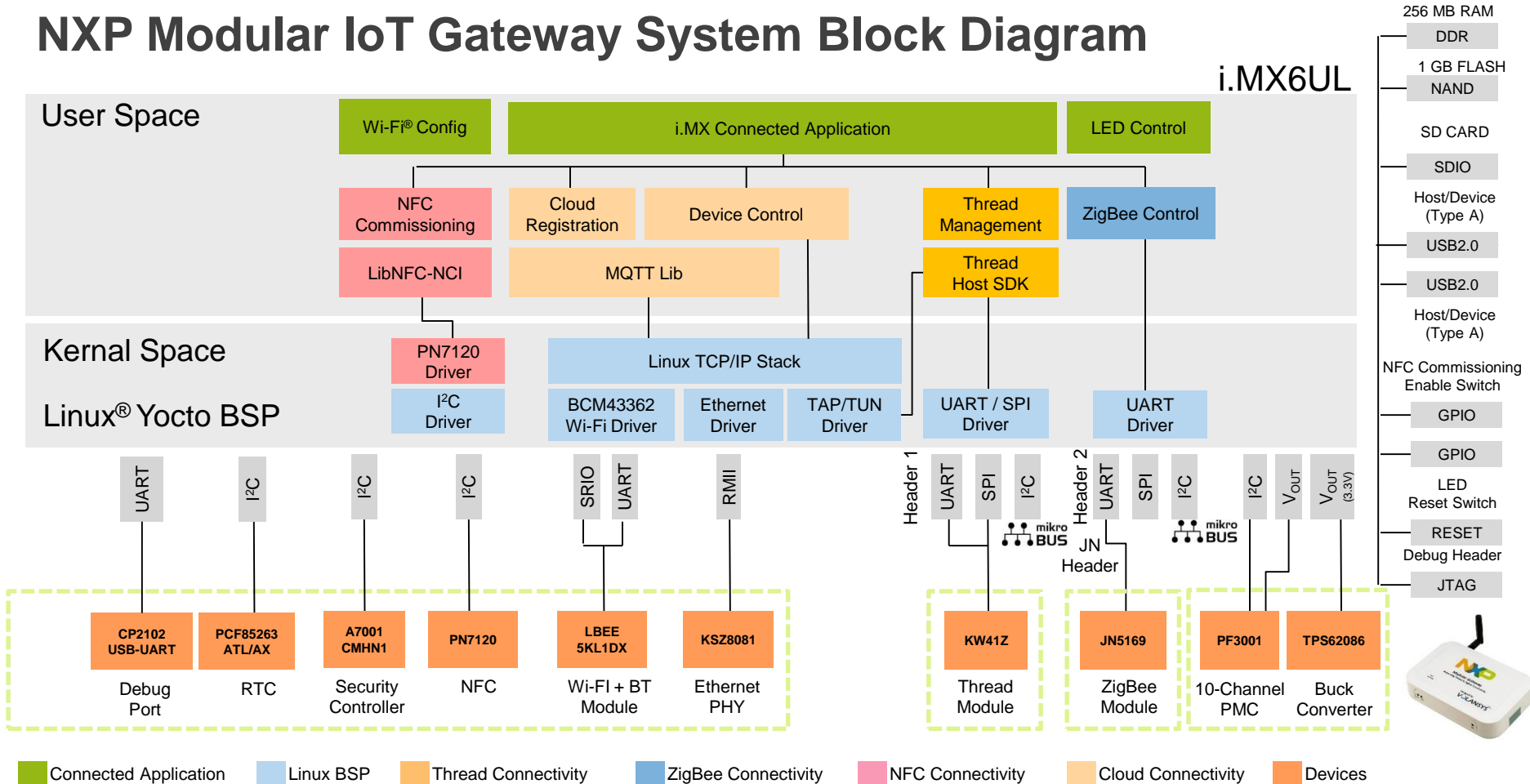
Gradual Transition from Application Layer Gateway to Network Layer Gateway



Ethernet



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

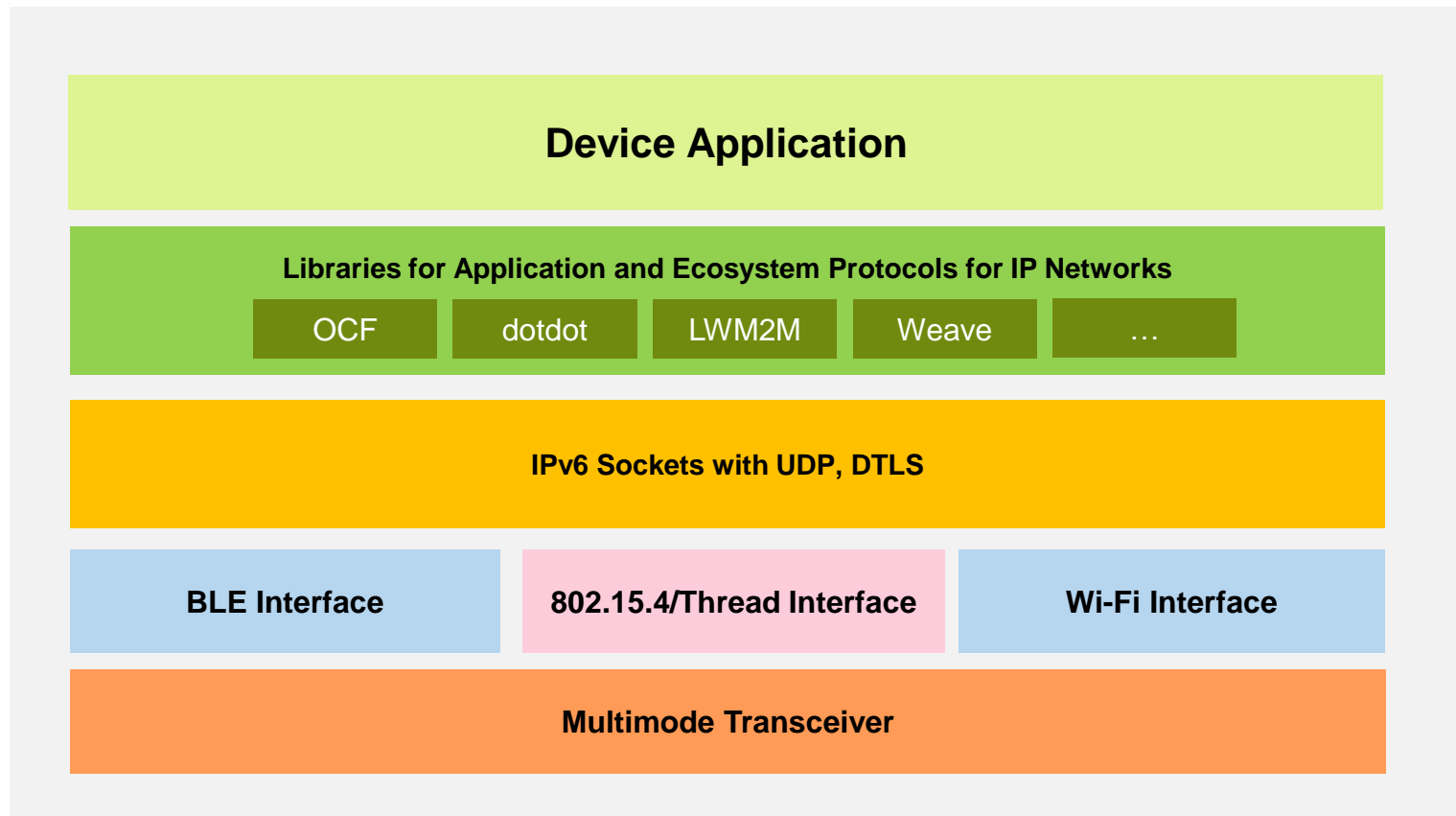
Commercial / Professional use cases

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

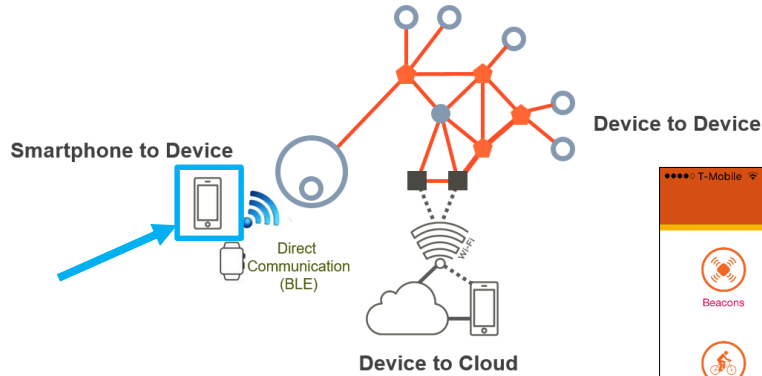
Contribute to OSS (most OSS support is WIP and needs your help):

[Zephyr](#), [Mynewt](#), [NimBLE](#), [IoTivity](#), [OpenThread](#)

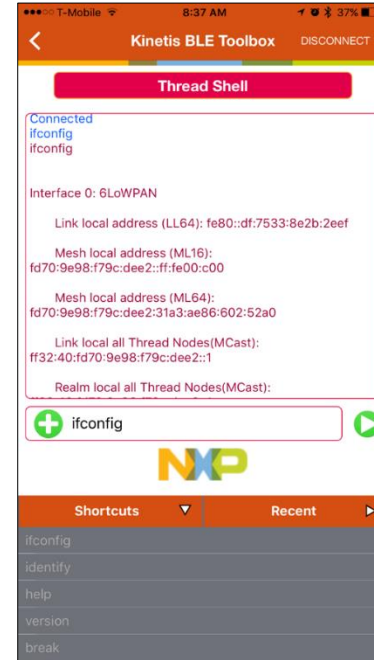


Hands-on Examples

Example 1: Thread Network Shell with Kinetis BLE Toolbox App



[App Store](#)
[Google Play](#)

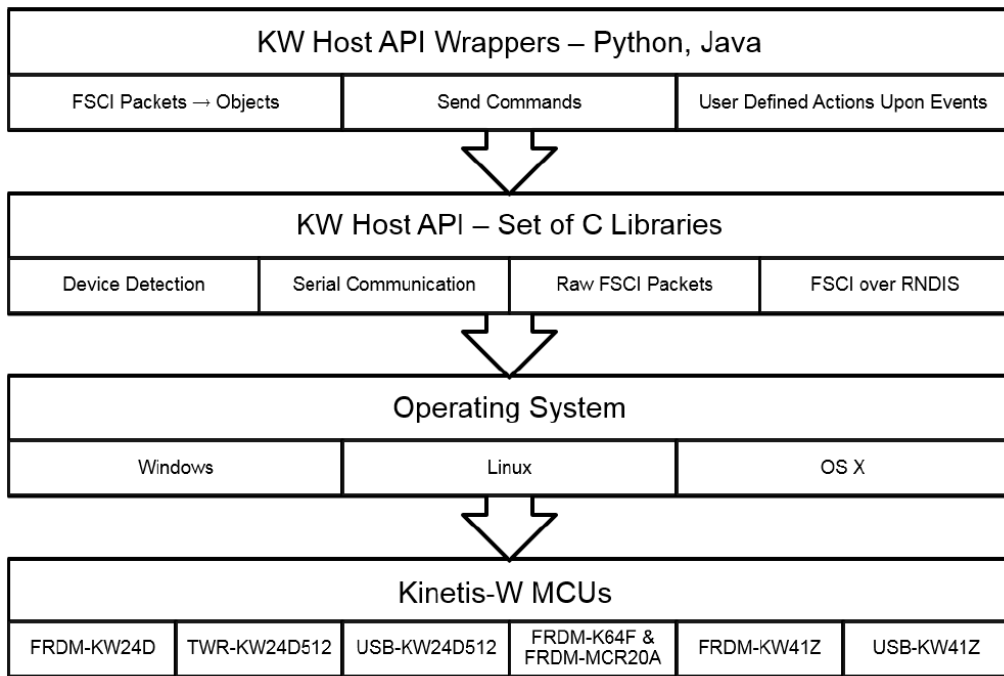


Example 2: Host SDK

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

Available as part of [KW41Z Connectivity Software Package](#)

tools\wireless\host_sdk\h SDK-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>