



nRF Connect SDK v1.2

Exciting new nRF9160 features

Webinar

Nordic Semiconductor

February 2020

Duration: 50-60 min

Today's hosts

Petter Myhre



Product Marketing
Manager



Peder Rand

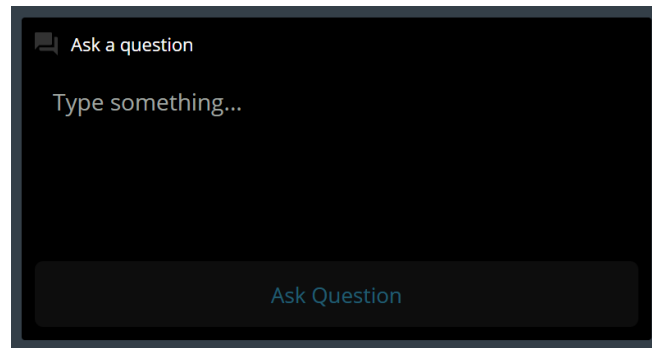


Product Manager
Cellular IoT



Practicalities

- Duration: 50-60 mins
- Questions are encouraged!
- Please type questions in the top of the right sidebar
 - All questions are anonymous
- We will answer questions towards the end
- If you have more questions please use DevZone
- A recording of the webinar will be available together with the presentation at webinars.nordicsemi.com

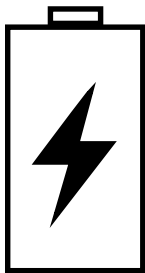


Content

- nRF9160 overview and architecture
- Assisted GPS with SUPL protocol
- Cloud assisted GPS with nRF Connect for Cloud
- New options for updating firmware over-the-air (FOTA)
- Serial LTE Modem
- New carrier certifications
- Q&A

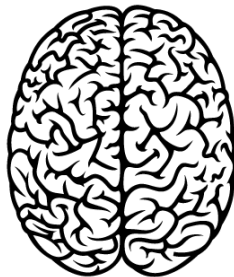
The nRF9160 Advantage in cloT

Low Power



Build everything from scratch for low power
Integrate memories and use low-leakage process features

Ease of Use



Enable self-service for thousands of customers and hundreds of applications

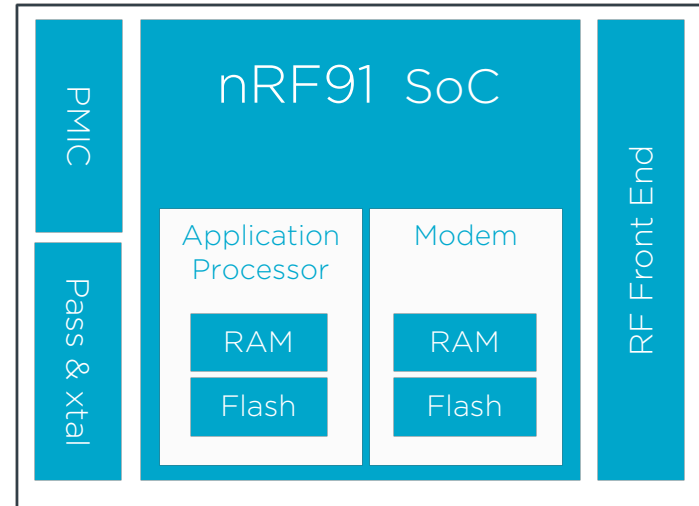
Integration



Integrate and use advanced packaging techniques to reduce solution size

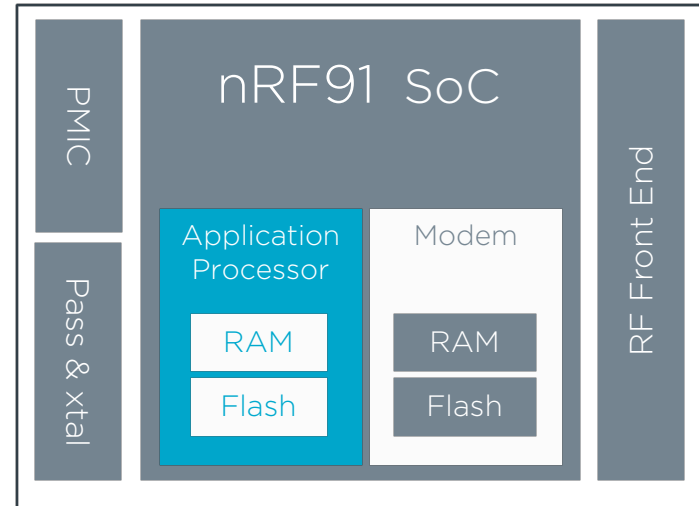
nRF9160 – Fully integrated

- Fully integrated SiP for cloT applications
- Dedicated application processor and memory
- LTE-M/NB-IoT/GPS
- Pre-certified for global operation – single SKU
- 10x16x1 mm LGA package



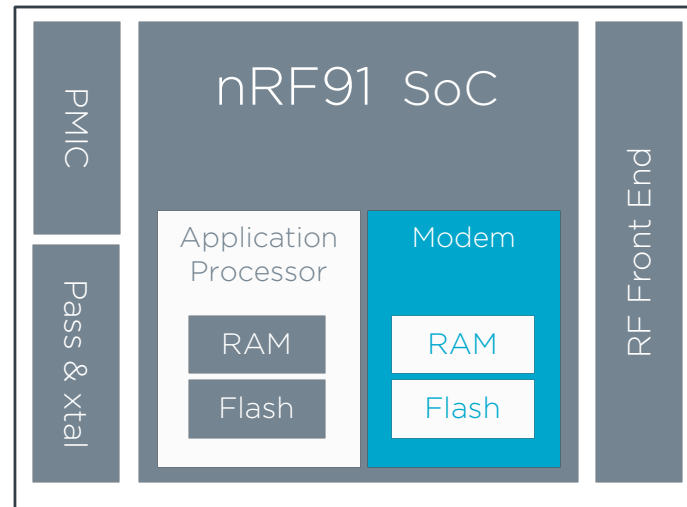
Dedicated application processor

- 64 MHz Arm® Cortex®-M33 CPU
- Arm TrustZone® for trusted execution
- Arm CryptoCell® 310 for application layer security
- 1 MB Flash & 256 KB RAM for application
- 4 x SPIM/SPIS/UART/TWIM/TWIS
- PDM, I2S, PWM, ADC
- 32 GPIOs

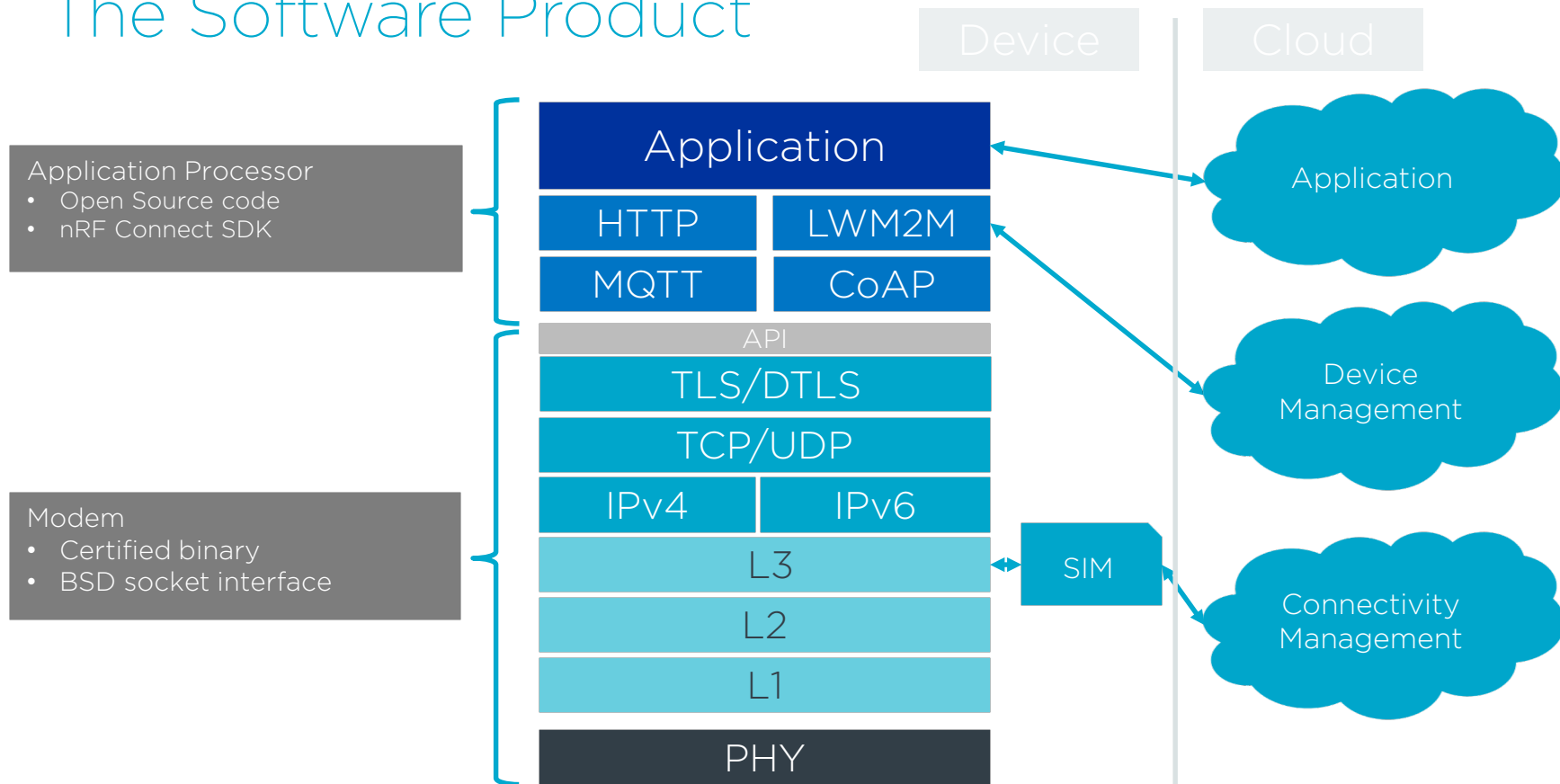


Multimode LTE-M / NB-IoT / GPS modem

- Built from scratch for low power
- Automatic scheduling of GPS acquisition around LTE operations
- eDRX and PSM power saving modes
 - 21 μ A @ 81.92 s eDRX
- UICC interface with support for eUICC/eSIM



The Software Product



The nRF Connect SDK

Nordic Application Frameworks & Reference Designs

Asset tracker, FOTA, Cloud connector, GPS, LTE BLE gateway...

Zephyr kernel & middleware

CoAP, HTTP, MQTT, LWM2M
GPS and positioning

System

Memory
management
Firmware update
File systems

Nordic Low Layer Firmware

Root of Trust bootloader & secure domain architecture.
Device Drivers inc. Crypto, SPI, UART, ADC

- The SDK for nRF9160
 - Free and open source
 - Continuously developed and improved
 - Integrates the Zephyr RTOS
- Managed releases
 - Publicly hosted on GitHub
 - Tested and tagged releases by Nordic for production

nRF Connect for Cloud



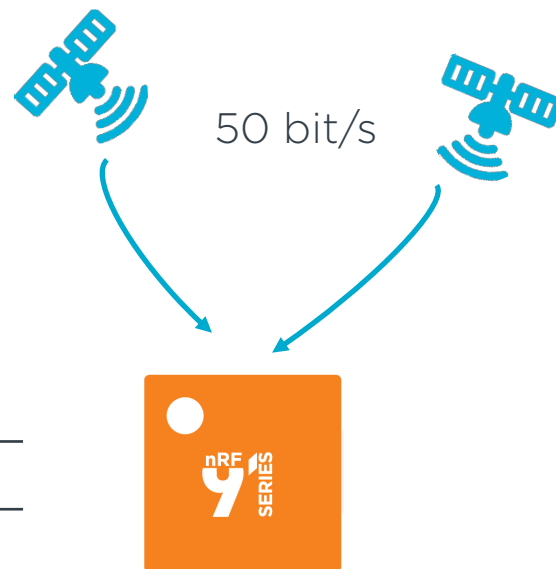
Assisted GPS

Speeds up Time To First Fix

GPS Overview

- Devices download position data from satellites
 - Almanac: Valid for several months
 - Ephemeris: Valid for approximately 2 hours
- Low bandwidth impacts Time To Fix (TTF)
- Sensitivity and TTFF greatly improved in MFW 1.1

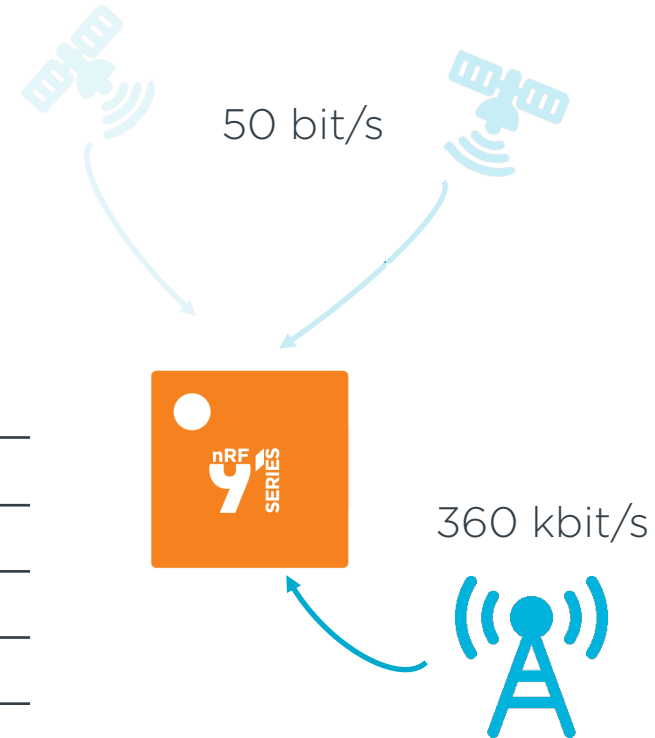
| Device Condition | GPS | Typical TTF |
|----------------------------------|------------|-------------|
| Off/sleeping for many days | Cold start | 40 seconds |
| Sleep cycles of a few hours | Warm start | 20 seconds |
| Always-on, or short sleep cycles | Hot start | <10 seconds |



Assisted GPS Overview

- Assisted GPS improves Time To First Fix
 - Ephemeris and Almanac downloaded over fast LTE-M
- Ideal for low power devices that need fast TTF

| Device Condition | GPS | Typical TTF |
|----------------------------------|------------|-----------------------------------|
| Off/sleeping for many days | Cold start | <10 seconds 40 seconds |
| Sleep cycles of a few hours | Warm start | <10 seconds 20 seconds |
| Always-on, or short sleep cycles | Hot start | <10 seconds |



Assisted GPS cont.

- Fast GPS fix for low power devices with long sleep cycles
- Nordic offers two A-GPS alternatives

1. The Industry standard:

- Secure User Plane Location (SUPL) protocol
- Used by cell phones
- Example application and documentation
- A library for the A-GPS core - free of charge
- Cost of use depending on service agreement with 3rd party

2. The cellular IoT optimized:

- nRF Cloud Assisted GPS
- Optimized for embedded devices

1. SUPL Server

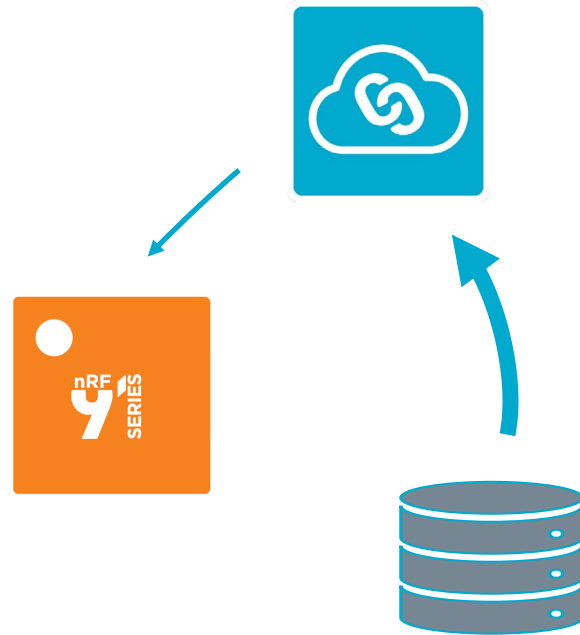


2. nRF Cloud A-GPS



nRF Connect for Cloud Assisted GPS

- **Three key advantages**
 1. Reduced cost of data transfer
 2. Increased battery life
 3. Reduced code overhead
- **The nRF Cloud**
 - Received location data from 3rd party service
 - Creates device optimized data packet
- **nRF9160 Device**
 - Fast download and efficient parsing
- **Experimental version in February**

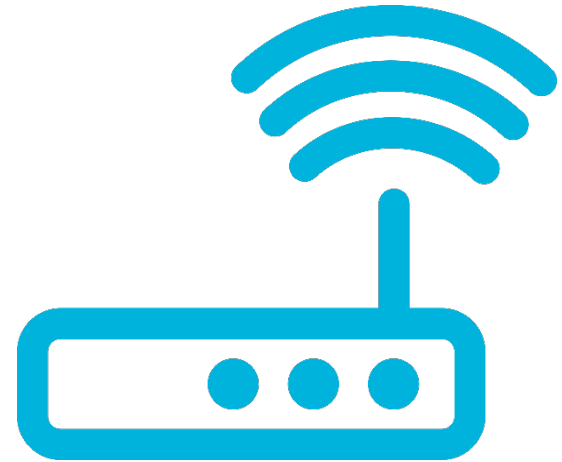


Serial LTE Modem

AT Command interface to nRF9160

Flexible serial LTE Modem

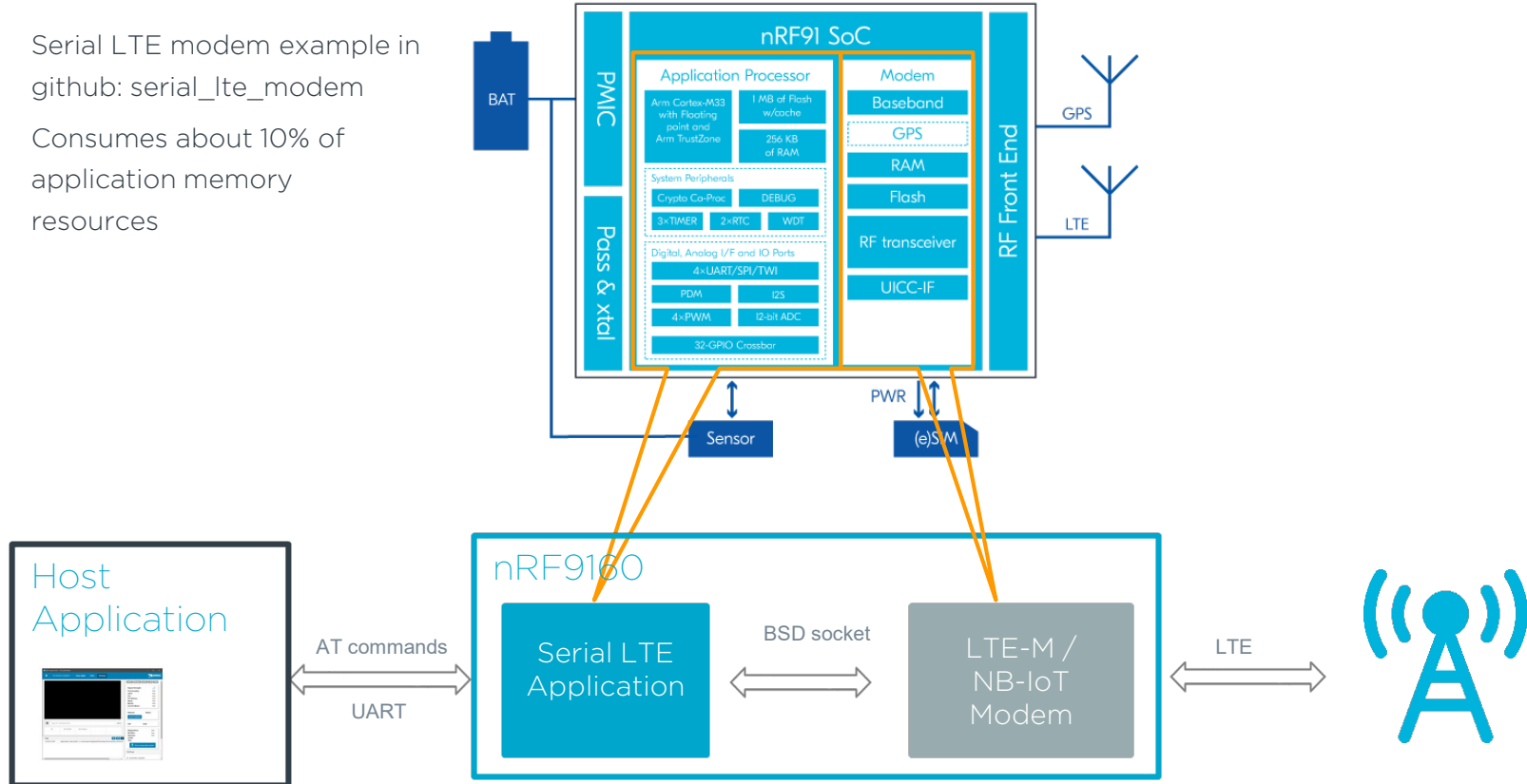
- nRF9160 as modem with a serial interface (USART)
- Flexible modem for external application processor
 - Connect and control over USART
 - Interface device with standard AT Command set
 - Customize and add functionality using the SDK
- When to use the nRF9160 as a serial LTE modem:
 - Step 1: Quick modem evaluations
 - Step 2: Keep existing application host and use nRF9160 as modem
 - Step 3: Migrate host to nRF9160 application and save power, cost and board space



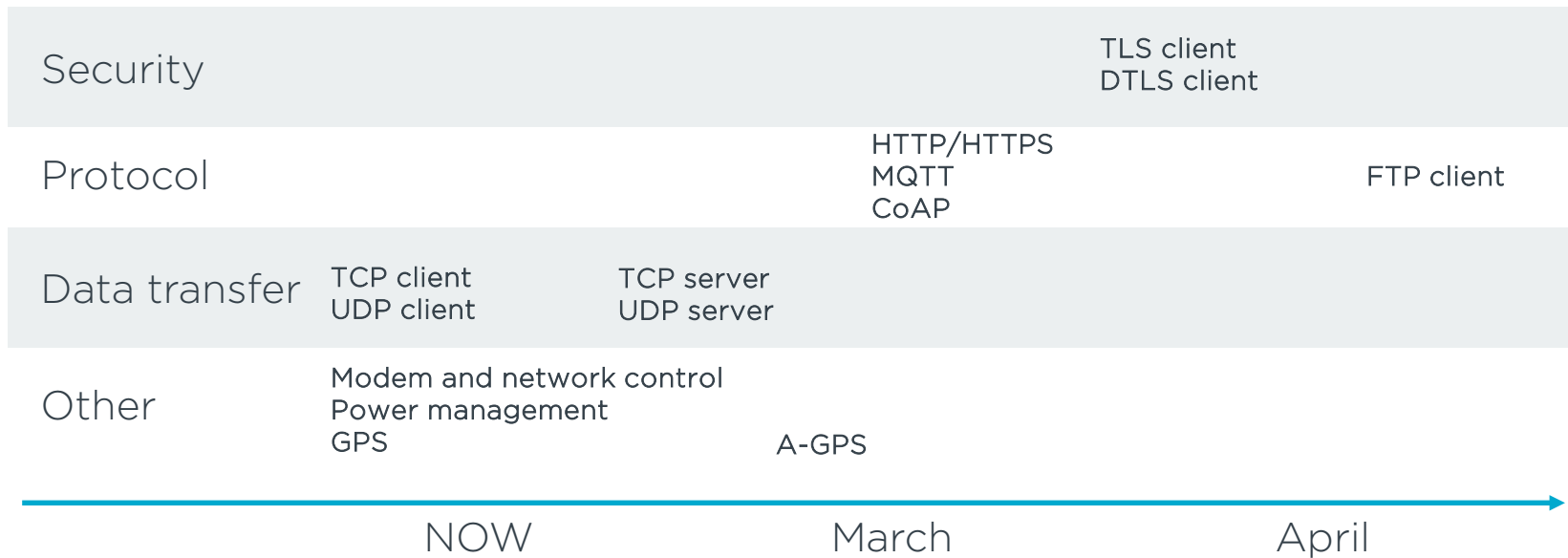
Serial LTE Modem Application

Serial LTE modem example in
github: serial_lte_modem

Consumes about 10% of
application memory
resources



Serial LTE Modem Roadmap



Firmware Over The Air

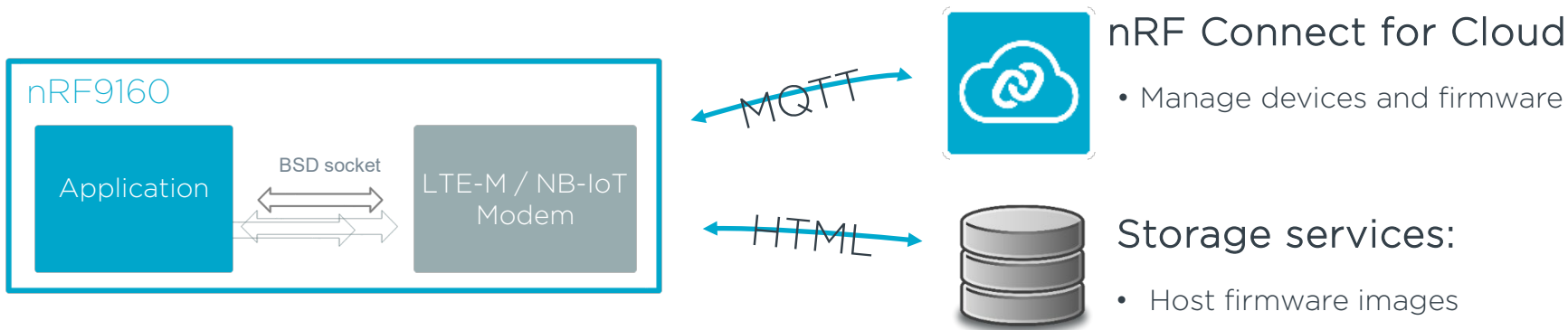
cellular IoT device management

Firmware Over The Air (FOTA)

- Firmware Over The Air updates
 - Lifecycle management feature in cellular IoT
 - Keep deployed devices running securely
 - Bug fixed and feature updates to products in the field
 - Remote management reduces cost
- Nordic offers application and modem FOTA for the nRF9160
 - One optimized and coherent device management system for application and modem



FOTA Overview



Application FOTA

1. Application downloads new image
 - Complete image stored in application swap space
2. Verifies and authenticates the image
3. Re-boots to swap/replace active application

Modem FOTA

1. Application downloads new image
 - Differential image – small size
2. Application transfers image to modem
3. Modem decrypt and authenticate new image
4. Modem re-boots to apply changes

Differential Modem FOTA

- Optimized to limit download cost for data and battery
 - Small, differential images
 - Historically 20-60KB size



- Modem FOTA is designed to
 - Fix bugs and security issues (not add new features)
 - Keep devices in the field running

FOTA in nRF Connect SDK

- Open Source with documentation
- Default Configuration
 - Uses nRF Connect for Cloud device management
 - HTTP file download from file server
- Can be changed to accommodate other needs
 - Connect to different device management systems
 - Support other file protocols

nRF9160 Certification

Leading worldwide coverage with single SKU

Certifications

Mobile Network Operator



Separate certification for LTE-M and NB-IoT

Regulatory standards



Regional certification

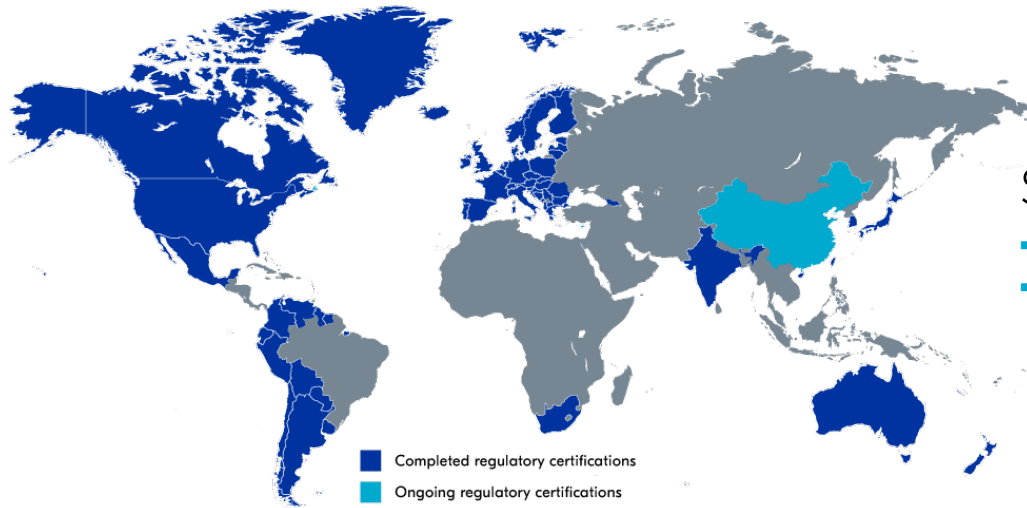
3GPP



3GPP compliance

Full overview on nordicsemi.com/9160cert

Leading worldwide coverage with single SKU



Supported LTE Bands:

- LTE-M: 1,2,3,4,5,8,12,13,14,17,18,19,20,25,26,28,66
- NB-IOT: 1,2,3,4,5,8,12,13,17,19,20,25,26,28,66

Completed Carrier Certifications

| Carrier | Coverage | Protocol |
|------------------|----------------------|----------------|
| Verizon | USA | LTE-M |
| Vodafone | UK, Germany, NZ ... | NB-IoT |
| Deutsche Telekom | Germany, Austria ... | NB-IoT + LTE-M |

- More in progress to reach worldwide carrier certifications by 2020





Thank You !

Questions ?

Q&A