Exciting new features in nRF Connect SDK v1.9

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SEMICONDUCTOR

Today's hosts

Bjørn Kvaale

Product Marketing Engineer

Pål Kastnes

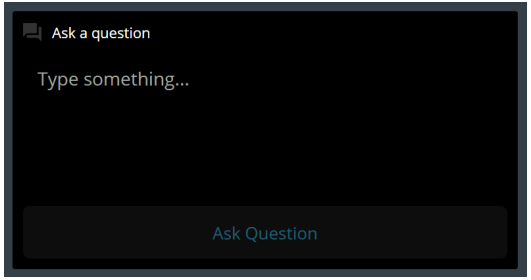
Technical Marketing Manager
Short-range wireless

Martin Lesund

Technical Marketing Manager
Cellular IoT

Practicalities

- Duration: 45 min presentation, 15 min Q&A
- Questions are encouraged!
  - Please type questions in the top of the right sidebar
  - All questions are anonymous
  - Try to keep them relevant to the topic
  - We will answer them towards the end
- The chat is not anonymous, and should not be used for questions
- Go to DevZone if you have more questions
- A recording of the webinar will be available together with the presentation at webinars.nordicsemi.com/on-demand



{ DevZone

Agenda

- Intro to the nRF Connect SDK and basic terminology (15 min, Bjørn)
- Short-range updates in nRF Connect SDK v1.9 (15 min, Pål)
- Cellular IoT updates in nRF Connect SDK v1.9 (15 min, Martin)
- Q&A (15 min)

Communities

Webinars

Technology intros and trainings

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Nordic Developer Zone

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Nordic tech support center & online community
29k+ users, 80k+ Posts Q&A
3 million page visits last 6 months

devzone.nordicsemi.com

Nordic GitHub

121 Repos, C/C++
Python, Javascript

github.com/NordicSemiconductor

nRF Connect SDK intro

and basic terminology

nRF Connect SDK

- One code base and toolchain for nRF91, nRF53, nRF52 and nRF21 Series
  - Optional for nRF52 Series (>= v1.3.0)
- Includes LTE-M, NB-IoT, GPS, Bluetooth Low Energy, Bluetooth mesh, Thread, Zigbee, Matter, ESB, Gazell, NFC
- Bluetooth v5.2 qualified Host and Controller stack since v1.4.1

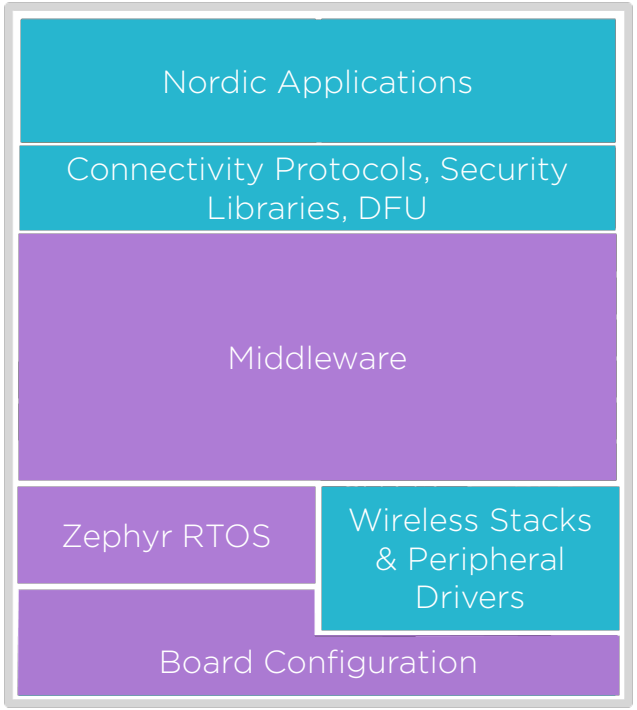
nRF52 Series SDK Support

- nRF5 SDK
  - Good if you do not require an RTOS
  - If you are used to this SDK and do not require newer features after Bluetooth 5.0, Bluetooth mesh 1.0.1, Thread 1.1 or Zigbee 3.0 (R22)
- nRF Connect SDK support optional
  - Will support newer features after Bluetooth 5.0, Bluetooth mesh 1.0.1, Thread 1.1 or Zigbee 3.0 (R22)
  - Optional for the nRF52 Series
- See this statement for more info

nRF52 Series Supported SDKs
nRF5 SDK
nRF5 SDK for Bluetooth mesh
nRF5 SDK for Thread/Zigbee
nRF Connect SDK

Code Base

- Contains app code, connectivity protocols, wireless stacks and peripheral drivers
- Code is organized in 7 main repositories (Nordic and Open Source (OS) code):
  - nRF – Application & Connectivity Protocols
  - nrfxlib – RTOS independent libraries
  - Zephyr – RTOS & Board configuration (OS)
  - MCUBoot – Secure Bootloader (OS)

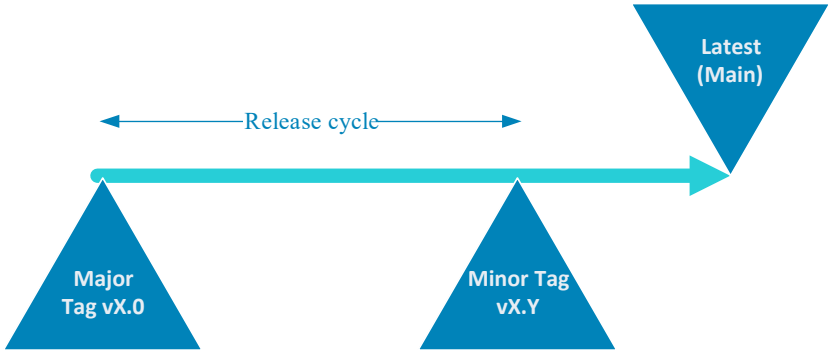


nRF Connect SDK Basic Terminology

- Git
  - An open-source distributed version-control system for managing source code changes
- West
  - Command line tool for multi-repository management and building and flashing examples
- Repository
  - A version-controlled project folder e.g. nrf, zephyr
  - Every code commit creates a repository “version” with unique SHA identifier

nRF Connect SDK Basic Terminology

- Tag
  - Points to a specific commit SHA identifier, immutable
  - A human readable version reference
  - Nordic DevZone support is available
- Main branch (master)
  - Points to the most recent commit SHA, mutable
  - Start testing newest features earlier
  - No DevZone support available



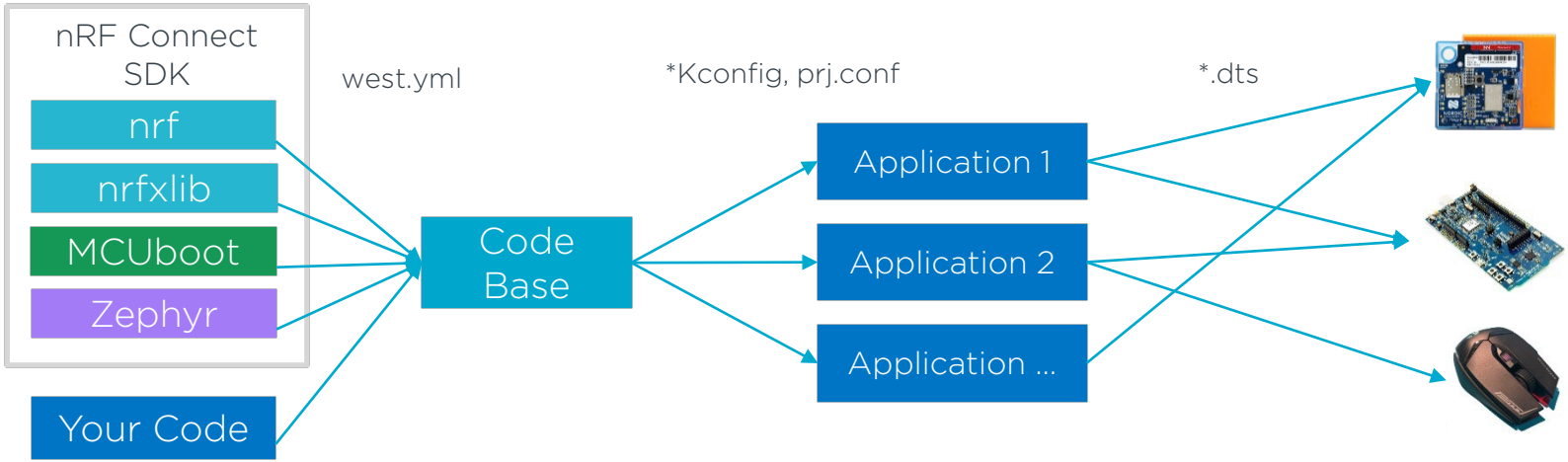
Manage Source Code and Configurations

West
Multi-repository management tool

Kconfig
Source module / feature configuration for compile

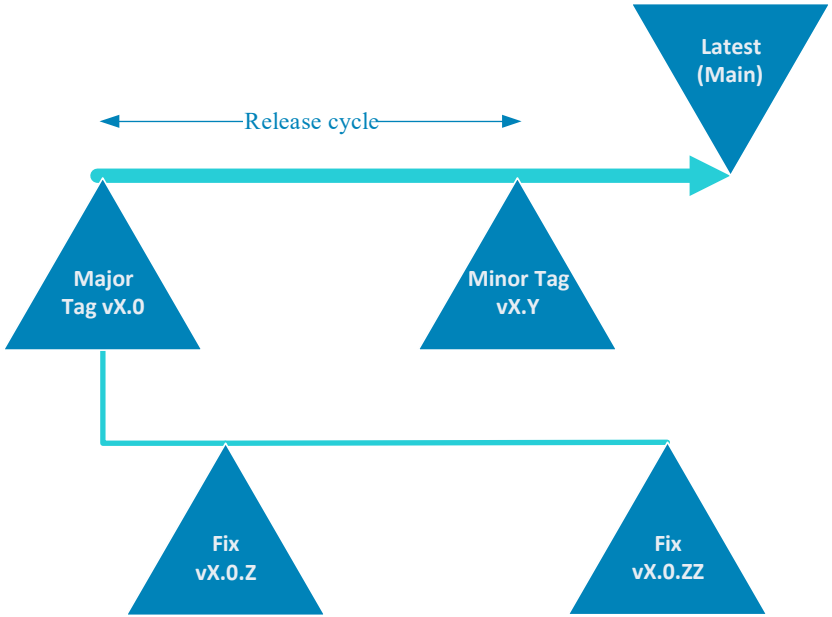
Device Tree
Target Board / Device description

Clone / update → Configure features → Configure target



Release Cycles

- Regular releases (e.g. quarterly)
- Publicly hosted on GitHub
- Fixes released as needed
  - Long term supported releases can have fixes applied and delivered after new releases
- Latest development version available
- Version control management with Git:
  - manage new version and fix adoption
  - tool supported merging



Supported for Development and Production

Features “supported for **Development**” may be used for development, but not recommended for volume production.

- Technical support is available
- Reported bugs may not be resolved until supported for Production
- Implementation may be partial
- APIs may change going to production
- Incomplete verification

- Suitable for prototype / evaluation

Features “supported for Production” will be maintained and are suitable for product development.

- Technical support is available
- Reported critical bugs will be resolved in both Main and latest Tag version of nRF Connect SDK.
- Complete implementations
- Verified for product development

- Suitable for integration in end-products

Experimental vs Supported

Experimental features/components may be used for development, but not recommended for volume production.

- Technical support available (tagged versions only)
- Reported bugs may not be resolved until feature/component is supported
- Implementation may be partial
- APIs may change going to supported
- Incomplete verification

- Suitable for prototype / evaluation

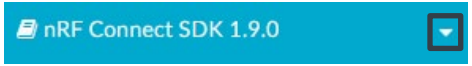
Supported features/components will be maintained and are suitable for product development.

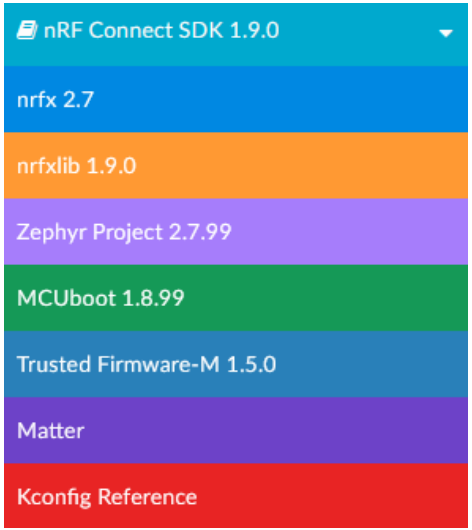
- Technical support is available (tagged versions only)
- Reported critical bugs will be resolved in both Main and latest Tag version of nRF Connect SDK.
- Complete implementations
- Verified for product development

- Suitable for integration in end-products

nRF Connect SDK documentation

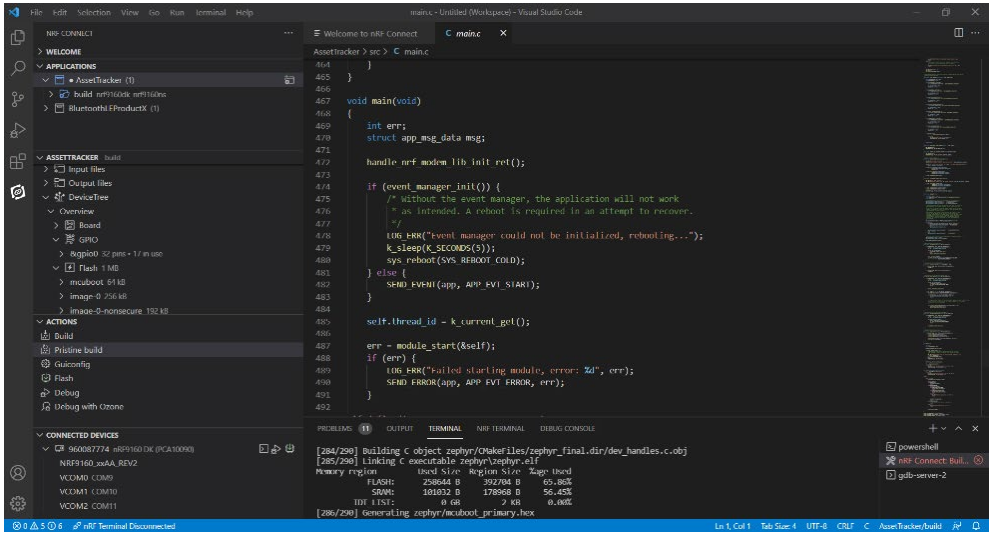
- Documentation link
- Click on arrow in top left to choose documentation tag
  - 1.9.99 refers to main branch
  - Latest tag is 1.9.0
- Click on arrow in bottom left to switch to nrfxlib, Zephyr, MCUboot or other documentation





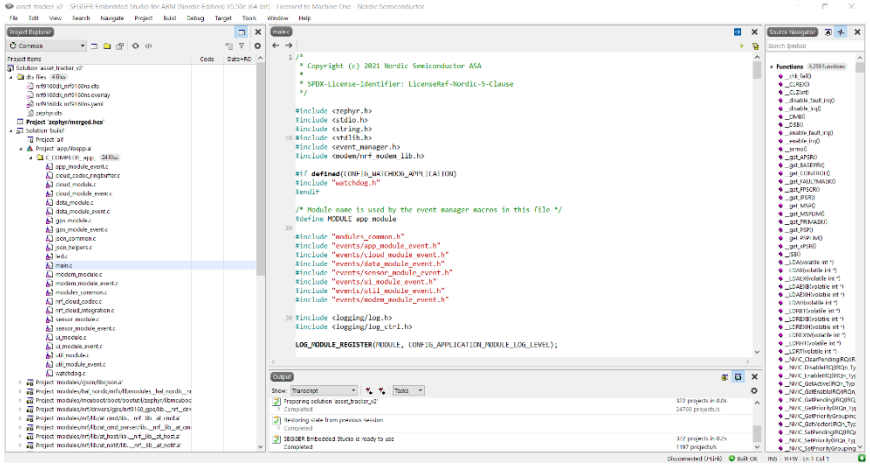
IDE support

- nRF Connect for Visual Studio Code
  - Built from the ground up for nRF Connect SDK
  - Highly extendable and configurable
  - CLI and GUI Interfaces
  - Cross-platform support
    - Windows, macOS, Linux
  - Create new board wizard
  - Rich set of tutorial videos



IDE support

- SEGGER Embedded Studio (Nordic Edition)
  - Cross-platform support (Windows, macOS, Linux)
- Any other IDE can be used with nRF Connect SDK
  - No nRF Connect SDK/toolchain integration.

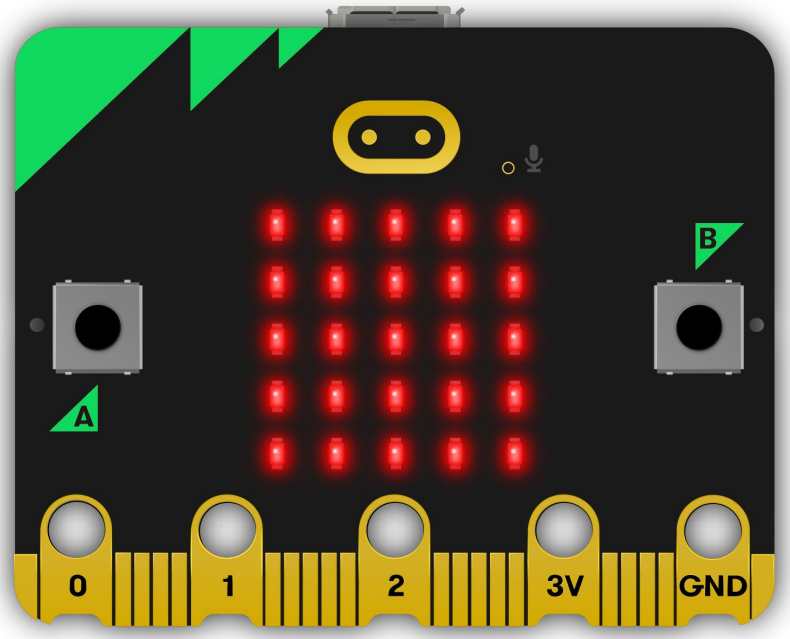


Generic Updates

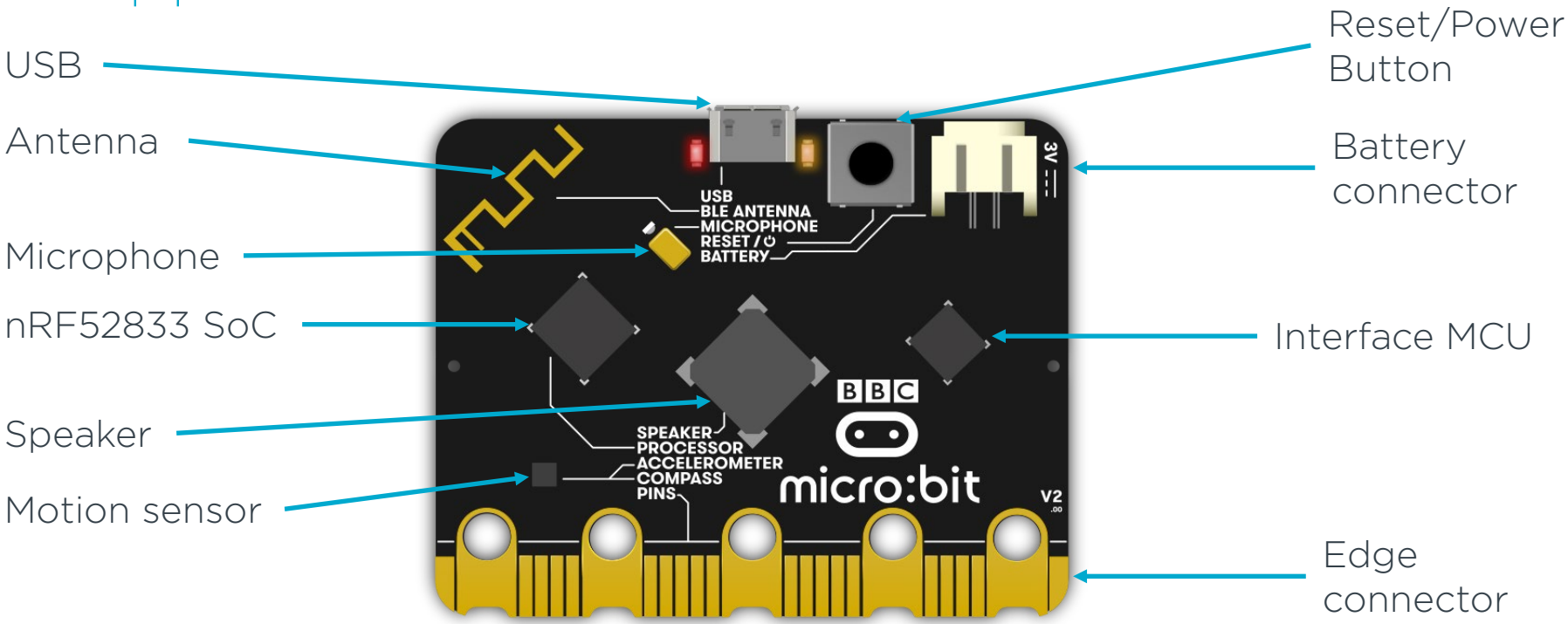
nRF Connect SDK v1.9

Support for micro:bit v2

- Versatile, programmable IoT device designed for classroom use
- Nordic nRF52833 SoC, 5x5 LED matrix, push buttons, touch sensor, motion sensor (accelerometer and magnetometer), microphone, speaker
- Edge connector to connect various accessories



Support for micro:bit v2



QSPI Driver Update

- Added support for external flash suspend mode
- Trigger flash Deep Power Down mode through
  - `pm_device_action_run(qspi_dev, PM_DEVICE_ACTION_SUSPEND);`
  - Will also deactivate the QSPI interface
- Reactivate the QSPI interface and the external flash through
  - `pm_device_action_run(qspi_dev, PM_DEVICE_ACTION_RESUME);`

- Enables use of External flash QSPI devices in low power systems
  - Similar support for External flash SPI devices supported in older releases

Short-range updates

nRF Connect SDK v1.9

SoftDevice Controller – new features

- Periodic Advertising support is now out of experimental
  - Will be covered by QDID when certification completed

What is Matter?

- Matter (formerly *Project Connected Home over IP* or *Project CHIP*) is a standard unifying the smart home industry
- Matter is a promise of reliable, secure connectivity where devices work seamlessly together. Matter simplifies development for manufacturers and increases compatibility for consumers

Some founding partners:

Frustration Free Setup for Matter

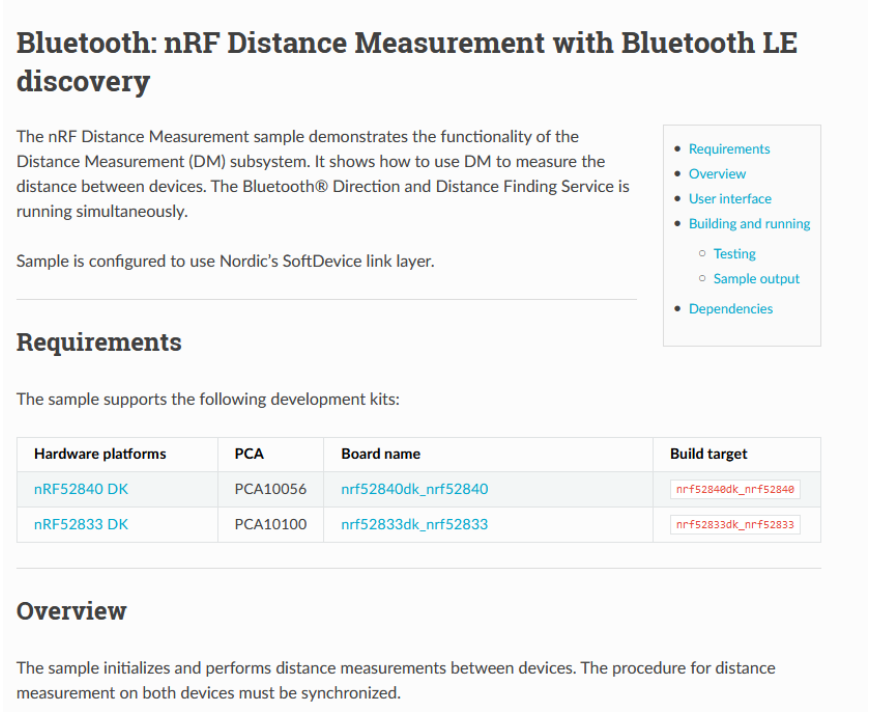
- Amazon Frustration Free Setup (FFS) helps customers to simplify their device setup experience. With FFS, eligible customers can simply unbox the device and power it on, following which the device gets connected onto their network automatically
- Amazon and Nordic have been collaborating to simplify development of Matter devices that support Amazon's Frustration Free Setup
- nRF Connect SDK v1.9.0 provides an experimental support for Amazon FFS for Matter on our nRF5340 and nRF52840 SoCs (the functionality is still being in qualification process and has not been yet certified by Amazon)

matter

Zigbee updates

- Updated the Zigbee solution on nRF5340. It is no longer experimental and is now Zigbee Platform Certification compliant. The certification process is ongoing
- Experimental support for Zigbee Cluster Library v8 (ZCL8) and Zigbee Base Device Behavior v3.0.1 (BDB 3.0.1)

Nordic Distance Toolbox (NDT)



Bluetooth: nRF Distance Measurement with Bluetooth LE discovery

The nRF Distance Measurement sample demonstrates the functionality of the Distance Measurement (DM) subsystem. It shows how to use DM to measure the distance between devices. The Bluetooth® Direction and Distance Finding Service is running simultaneously.

Sample is configured to use Nordic's SoftDevice link layer.

Requirements

The sample supports the following development kits:

Hardware platforms	PCA	Board name	Build target
nRF52840 DK	PCA10056	nrf52840dk_nrf52840	nrf52840dk_nrf52840
nRF52833 DK	PCA10100	nrf52833dk_nrf52833	nrf52833dk_nrf52833

Overview

The sample initializes and performs distance measurements between devices. The procedure for distance measurement on both devices must be synchronized.

- Proprietary distance measurement solution
- Utilizing phase based ranging
- Initial release
  - Experimental support
- Supports
  - nRF52833
  - nRF52840

Nordic Distance Toolbox (NDT)

```
*** Booting Zephyr OS build v2.6.99-ncs1  ***
Starting Distance Measurement example
I: SoftDevice Controller build revision:
I: 3f 47 70 8e 81 95 4e 86 |?Gp...N.
I: 9d d3 a2 95 88 f6 30 0a |......0.
I: 7f 53 49 fd             |.SI.
I: HW Platform: Nordic Semiconductor (0x0002)
I: HW Variant: nRF52x (0x0002)
I: Firmware: Standard Bluetooth controller (0x00) Version 63.28743 Build 1318420878
I: Identity: C4:90:D5:4E:C2:20 (random)
I: HCI: version 5.2 (0x0b) revision 0x125b, manufacturer 0x0059
I: LMP: version 5.2 (0x0b) subver 0x125b
DM Bluetooth LE Synchronization initialization

Measurement result:
      Addr DB:49:E9:62:DF:6D (random)
      Quality ok
      Distance estimates: mcpd: ifft=0.29 phase_slope=0.28 rssi_openspace=0.28 best=0.29

Measurement result:
      Addr CF:4E:38:D5:C0:ED (random)
      Quality ok
      Distance estimates: mcpd: ifft=0.94 phase_slope=1.10 rssi_openspace=0.22 best=0.94

Measurement result:
      Addr CF:4E:38:D5:C0:ED (random)
      Quality ok
      Distance estimates: mcpd: ifft=0.79 phase_slope=1.08 rssi_openspace=0.25 best=0.79
```

- Phase based solution for ranges up to 8 meters
  - Most accurate ranging solution
- Multiple algorithms used
  - IFFT
  - Phase Slope
  - RSSI
  - Best fit of all algorithms

Nordic Distance Toolbox (NDT)

```
*** Booting Zephyr OS build v2.6.99-ncs1  ***
Starting Distance Measurement example
I: SoftDevice Controller build revision:
I: 3f 47 70 8e 81 95 4e 86 |?Gp...N.
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I: HCI: version 5.2 (0x0b) revision 0x125b, manufacturer 0x0059
I: LMP: version 5.2 (0x0b) subver 0x125b
DM Bluetooth LE Synchronization initialization

Measurement result:
      Addr CF:4E:38:D5:C0:ED (random)
      Quality ok
      Distance estimates: rtt: rtt=1.75

Measurement result:
      Addr CF:4E:38:D5:C0:ED (random)
      Quality ok
      Distance estimates: rtt: rtt=1.70

Measurement result:
      Addr DB:49:E9:62:DF:6D (random)
      Quality ok
      Distance estimates: rtt: rtt=2.75
```
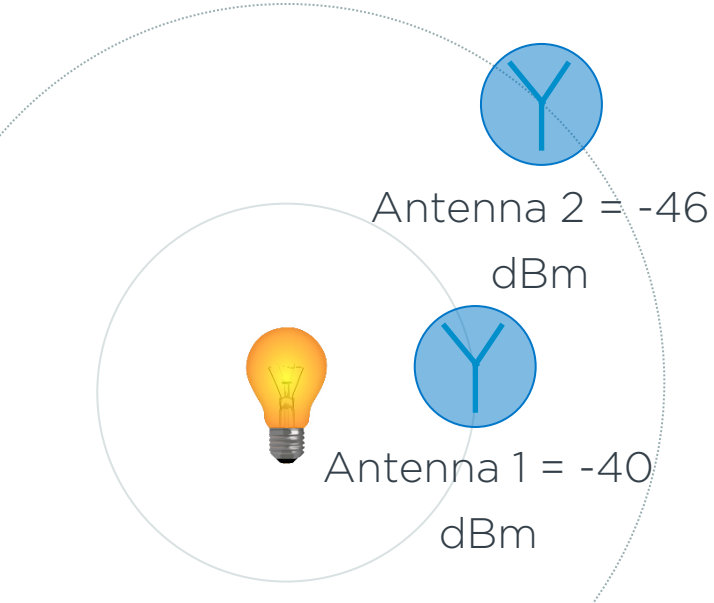

- Round Trip Timing solution for longer ranges
  - Less accurate than Phase based ranging

NDT: Distance affects intensity of the light



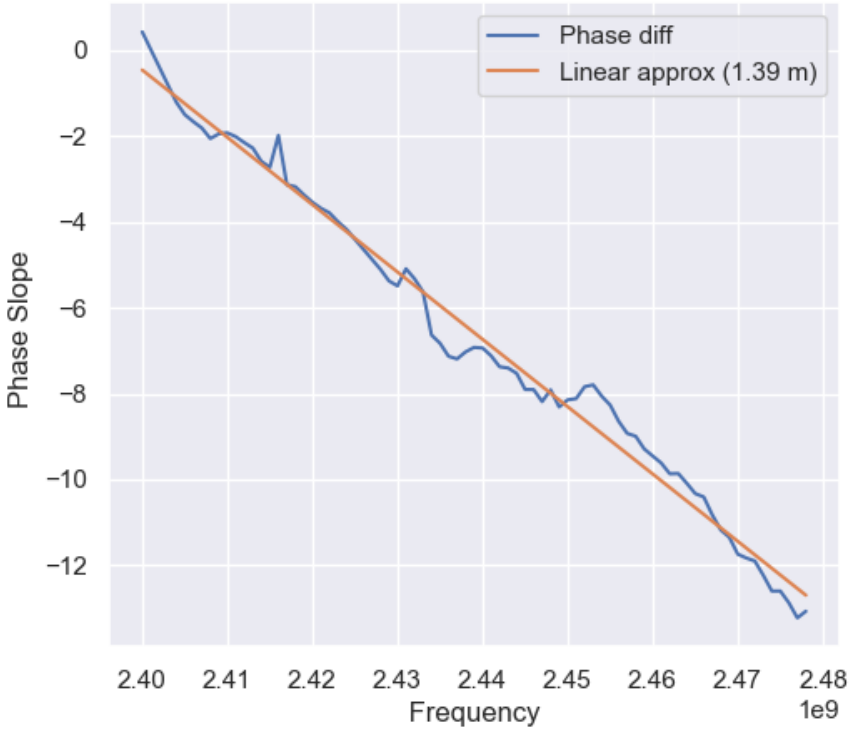
- Intensity is the power per unit area
- The transmit power is assumed to be constant
- The intensity is assumed to be inversly proportional to the area of a sphere ($4 \pi r^2$)
- Thus, we expect the recieved power to reduce with ~ $1/r^2$, which translates to a -6 dB per doubling of the distance

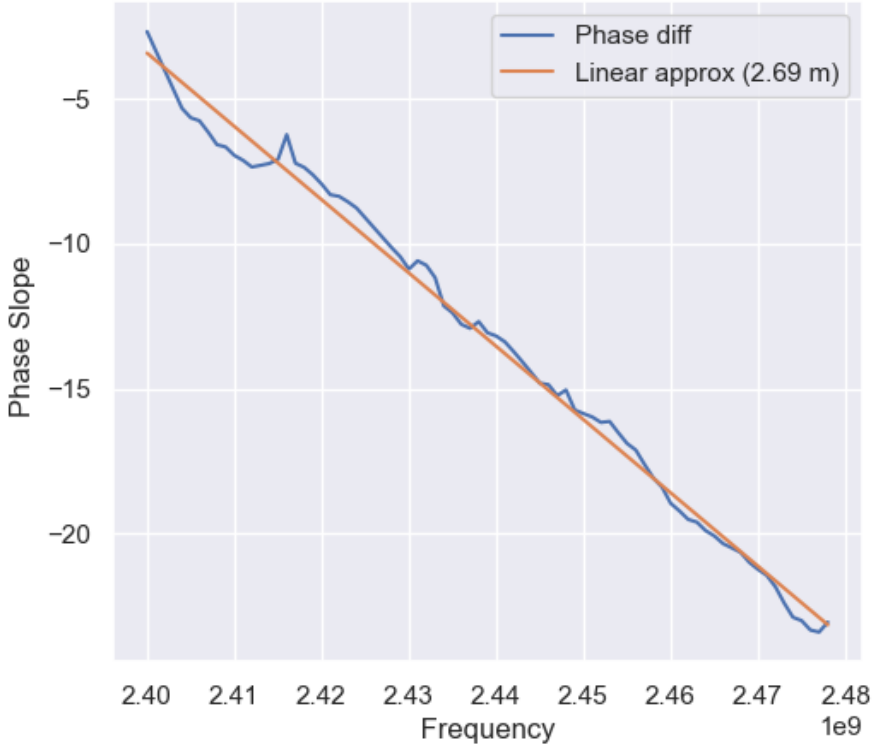
NDT: RSSI Real World Complications

- Loss is usually modelled as ~ $1/r^n$
- *n* is called the path loss factor. Most of the time the path loss factor is determined based on measurements in a certain environment.
- For example, in a home *n* might be measured to be 4.5, but that might be in a new house with walls of wood. In a home with walls of concret it might be different.
- *n* can vary between 1.6 and 6

n	Link loss = - 56 dBm	Link loss = - 46 dBm
1.6	10.0 m	2.4 m
2	6.3 m	2.0 m
3	3.4 m	1.6 m
4	2.5 m	1.4 m
5	2.1 m	1.3 m
6	1.8 m	1.3 m

Slope of phase vs frequency vs distance



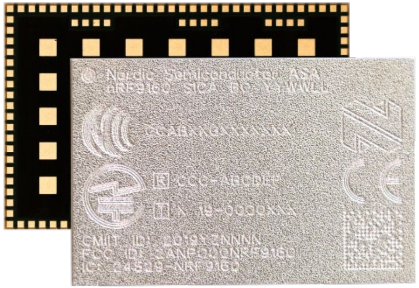


Cellular IoT updates

nRF Connect SDK v1.9

Complete low power cellular IoT solution

nRF9160



Dedicated application processor and memory

Multimode LTE-M / NB-IoT modem with integrated RFFE and GNSS support

Ultra Low Power

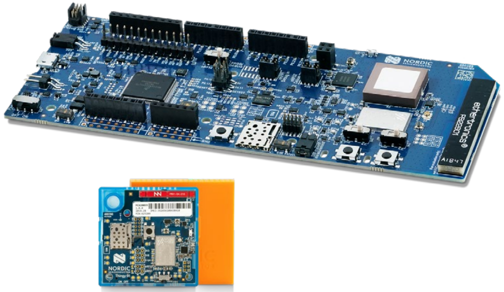
nRF Connect

nRF Connect SDK

nRF Connect for Desktop

nRF Cloud

nRF9160 DK & Thingy:91



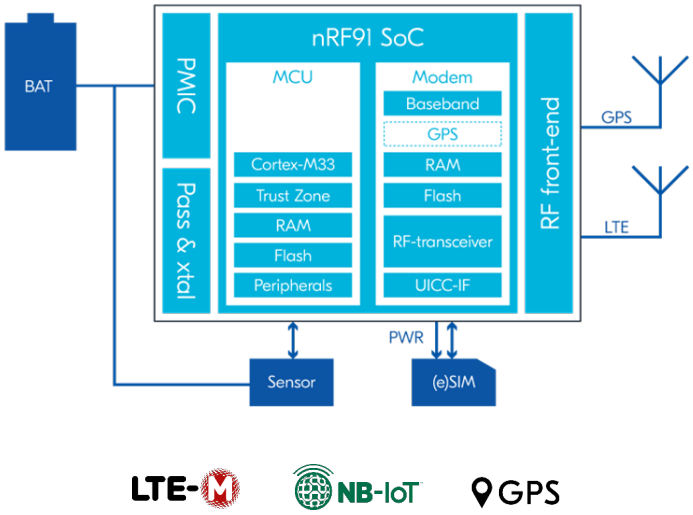
Standalone development kit & prototyping platform

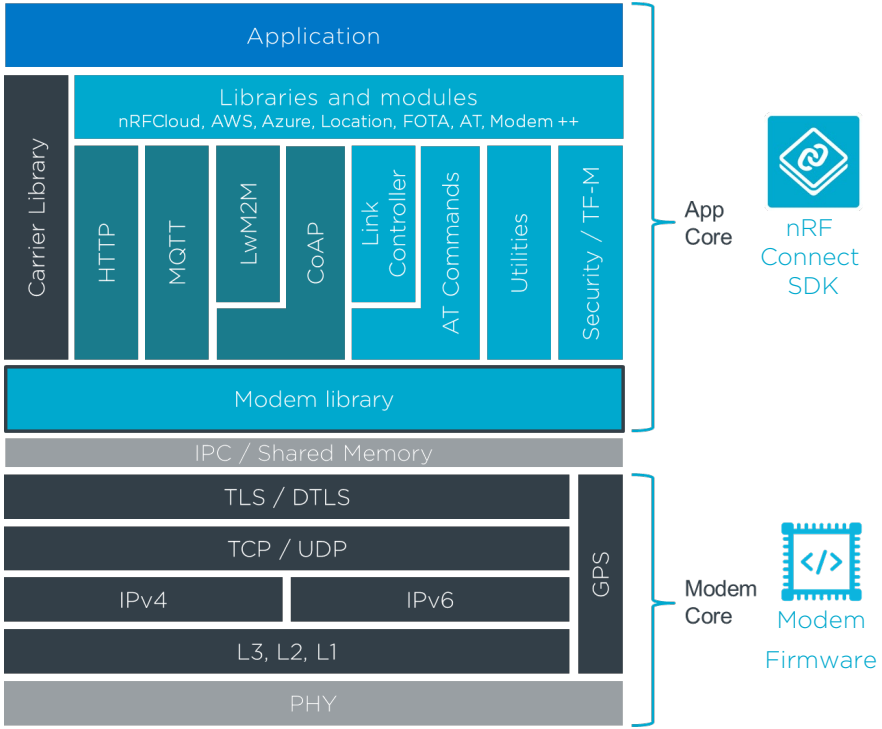
eSIM from iBasis

nRF52840 board controller with Bluetooth LE

LTE, GNSS, and 2.4 GHz antennas

nRF Connect SDK overview





Documentation

- Getting started with Thingy:91 guide moved to nRF Connect SDK documentation from infocenter
- Getting started with nRF9160 DK guide moved to nRF Connect SDK documentation from infocenter
- Reworked and renamed the “Working with Thingy:91/nRF9160DK” user guide to “Developing with Thingy:91/nRF9160DK”.

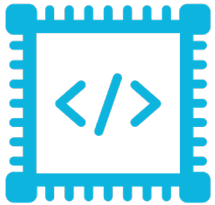
Subpages:

- Features of nRF91 Series
  - Introduction
  - GNSS
  - Band lock
  - Network mode
- Getting started with nRF9160 DK
  - Minimum requirements
  - Installing the required software
  - Updating the DK firmware
  - Connecting the DK to nRF Cloud
  - Testing the DK
- Developing with nRF9160 DK
  - Board controller
  - Updating the nRF Cloud certificate
  - Build targets
  - Building and programming
  - Board revisions
  - Available drivers, libraries, and samples
- Getting started with Thingy:91
  - Requirements for setting up the Thingy:91
  - Preparing for setup
  - Updating firmware
  - Creating an nRF Cloud account
  - Activating the iBasis SIM card
  - Connecting to nRF Cloud
- Developing with Thingy:91
  - Connecting to Thingy:91
  - Operating modes
  - GNSS
  - LTE Band Lock
  - LTE-M / NB-IoT switching
  - Building and programming from the source code

Modem

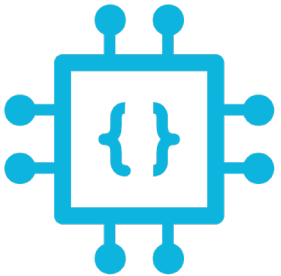
Modem firmware 1.3.1

- Full changelog
- Compatibility matrix



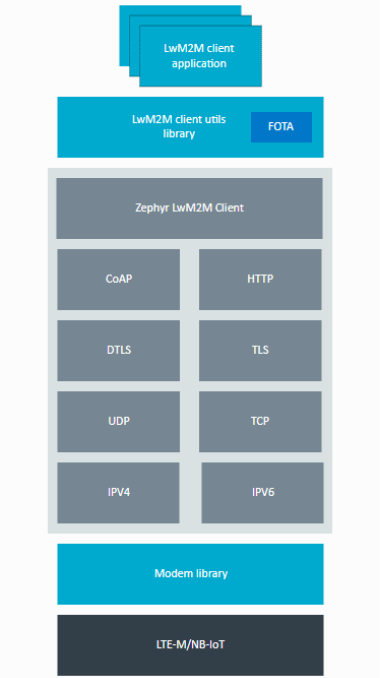
Modem library 1.5.1

- Replaced proprietary sockets with nrf_modem APIs that include link-time optimization, thereby reducing memory usage.
- Removed:
  - The DFU/AT socket has been removed.
  - *The DFU/AT Socket got deprecated in modem lib. v1.3.0*
- General bug fixes and improvements



Device management

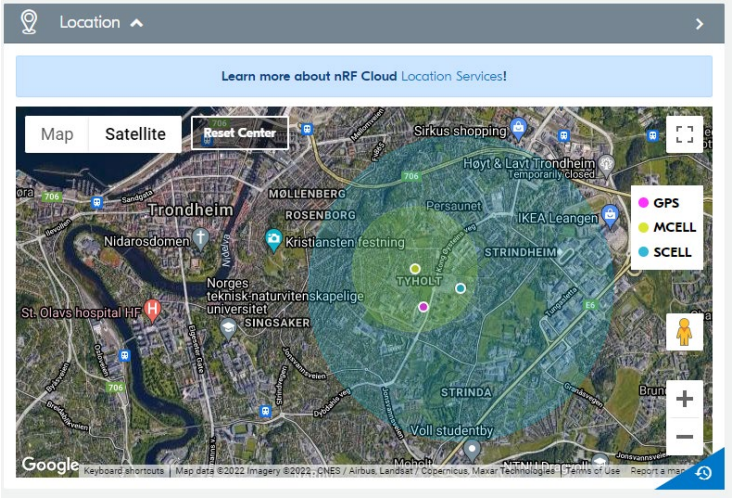
- LwM2M carrier library v0.22.0
  - Added event that triggers when unregistered SIM card is used
  - Removed dependency on deprecated libraries and added dependency for the AT monitor lib. In the glue layer
- LwM2M client utils library
  - Based on Zephyrs LwM2M stack
  - Added support for LwM2M object “ECID-Signal Measurement Information”
- FOTA download library
  - Skip host name check when connecting to TLS service using just IP address
  - Standardized bootloader FOTA download to accept only full dual path names. e.g. “path/to/s0.bin path/to/s1.bin”
- Full list of all the libraries updates



Using nRF Cloud with nRF Connect SDK

- User guide updated to include:
  - Choosing a protocol (MQTT or REST)

- [New feature] Filtered ephemeris
  - Filtering out ephemeris from satellites below the horizon. *(Not visible satellites)*
  - Improves A-GPS download size with more than 2x.
  - Supported by
    - Location API/sample, GNSS sample, modem shell and Asset Tracker V2



Cell based location displayed on nRF Cloud with Asset Tracker v2

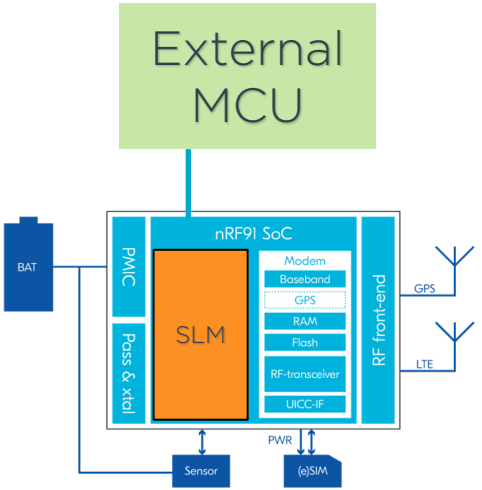
Asset Tracker v2

Asset Tracker v1 removed

- Support for nRF cloud A-GPS filtered ephemerides
- New documentation for following modules:
  - App module
  - Cloud module
  - Data module
  - GNSS module
  - Modem module
  - Sensor module
  - Ui module
  - Util module
  - Api module common
  - Api cloud wrapper
- Support for atmospheric pressure readings retrieved from the BME680 (Thingy:91)
- Improved support for P-GPS
- General improvements and bug fixes

Serial LTE Modem

- Added documentation and support for running SLM on the Thingy:91 Prototyping Platform
- Added TWI AT Commands
- Added #XSLMUART command (Set baudrate, hwfc)
  - Configuration options to enable change at runtime

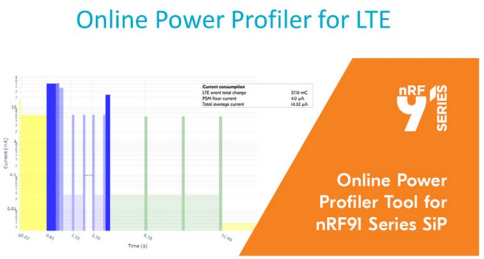


Samples

- HTTPS application update sample
  - Support for application downgrade
- Modem Shell sample
  - Added commands to connect to nRF Cloud + A-GPS filtered ephemeris
  - Various PPP updates
- GNSS sample
  - Support for “minimal assistance”
  - Support for “TTFF test mode”
  - Support for nRF Cloud A-GPS filtered mode
- LwM2M client sample
  - Support for triggering neighbor cell measurements

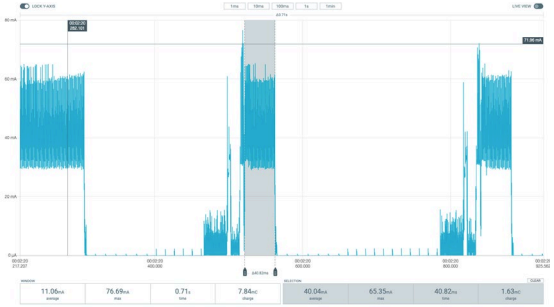
Tools for saving power

Online Power Profiler



Power Profiler Kit II

Power optimization guide



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Q&A