Introduction to Bluetooth mesh

Nordic Tech Webinar

Eirik Midttun / Technical Product Manager

November 2021

Today's hosts

Bjørn Kvaale

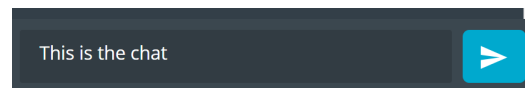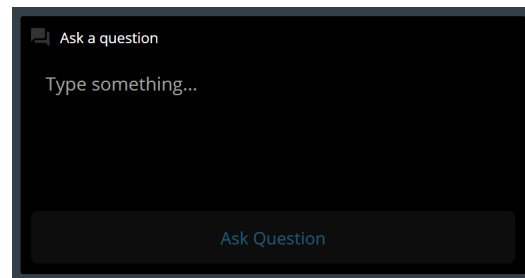Eirik Midttun

Product Marketing Engineer

PMT

Technical Product Manager

PMT

Practicalities

- Duration: about 60 minutes

- 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 towards the end

- The chat is not anonymous, and do not use 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

Ask a question

Type something...

Ask Question

This is the chat

DevZone

What is Bluetooth mesh?

What is Bluetooth mesh technology?
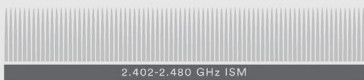
(Source: Bluetooth SIG)

From point-to-point to mesh
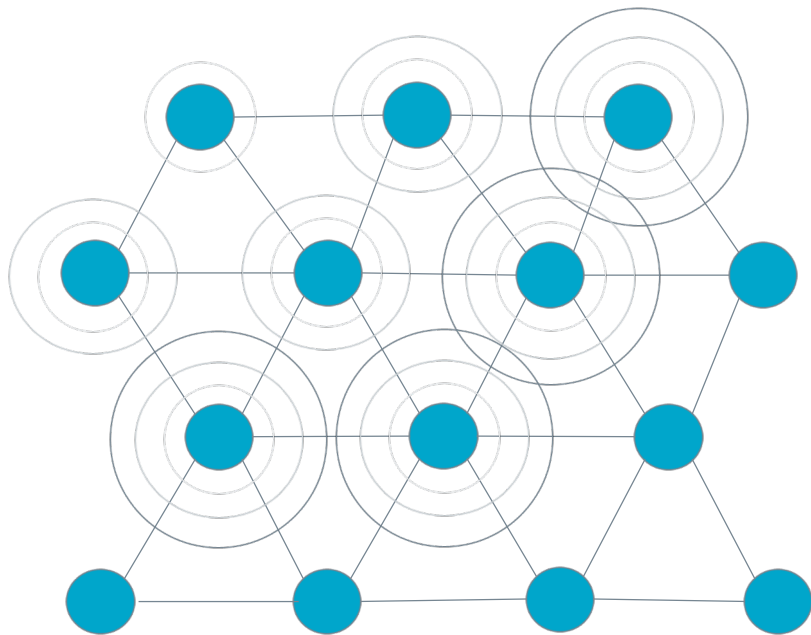
- Based on Bluetooth LE
- Network technology
- Many-to-many communication
- Whole building coverage
- Managed flooding

Bluetooth mesh roles
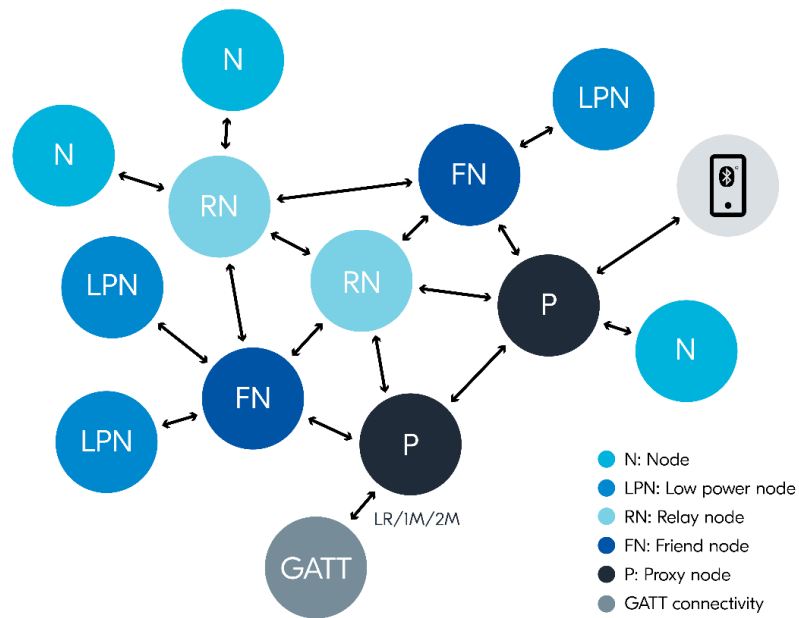
Bluetooth mesh is designed to be:

Reliable

Multipath transmission

Gateway independent

Scalable

Large node-count

Covering large areas

Secure

Built-in security

Multi-level encryption

Privacy

Fast

Responsive - low latency

Multicast based

(Does not mean high bandwidth)

Multi-hop and multi-path
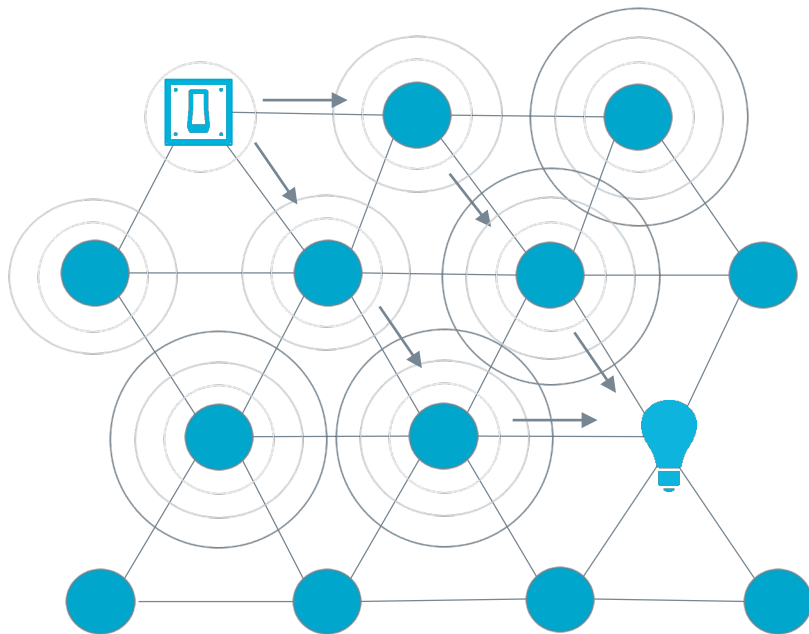
Multi-hop (message relay)

- Extends range beyond RF
- Near unlimited range
- Avoid physical obstacles

Multi-path

- Increases reliability
- Creates redundancy
- Ideal for multiple receivers

Group addressing and publish/subscribe
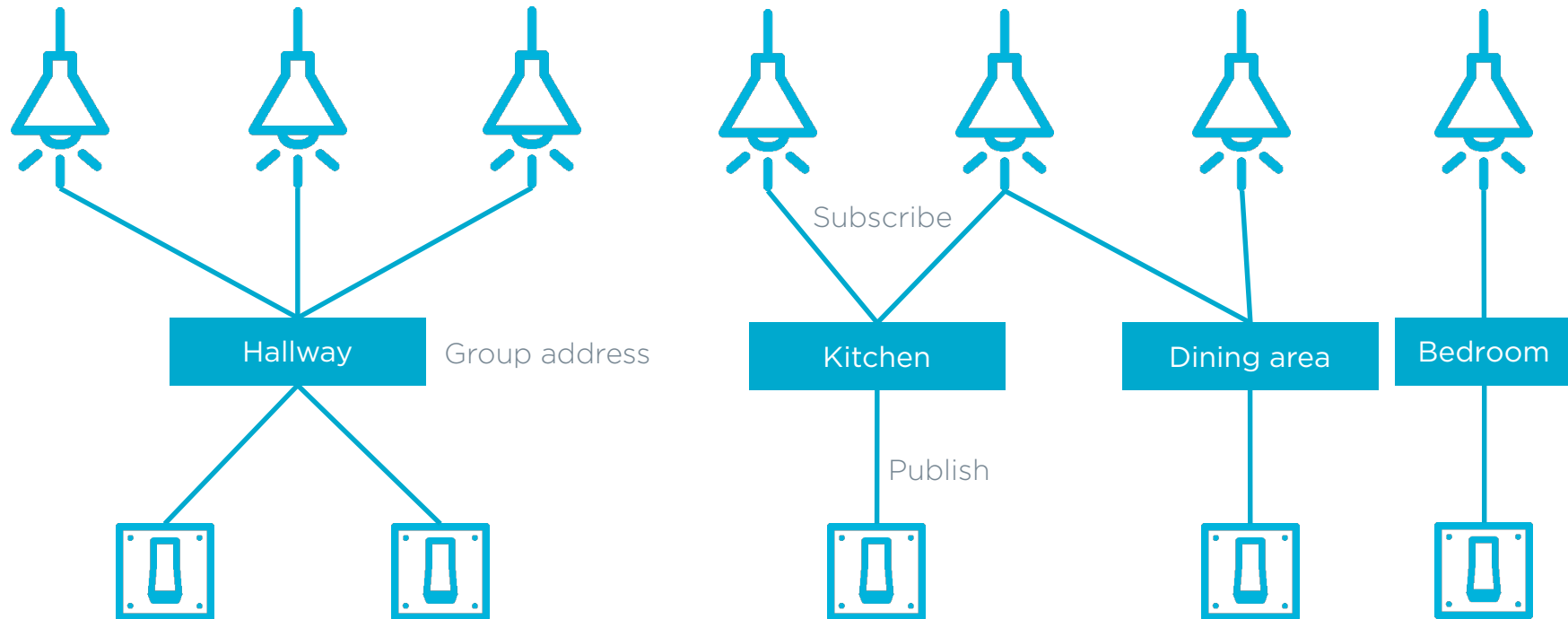
Bluetooth mesh has built-in security

PDU structure
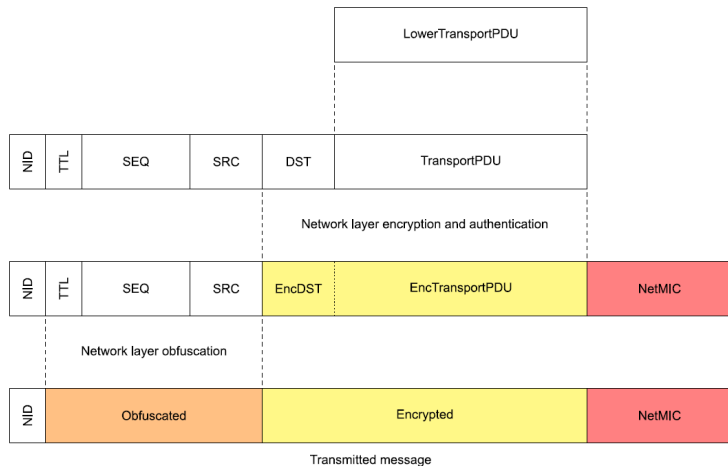
Encryption keys
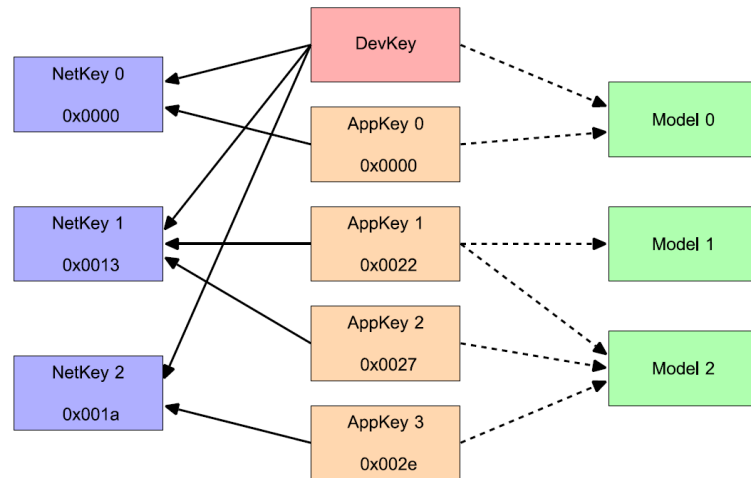
Industrial grade security

Delta panel light, first smart lighting

product to receive UL IoT security rating

Industry grade security

- Multi-level encryption

- Privacy

Protected from the ground up

- Brute-force attack

- Replay attack

- Man-in-the-middle attack

- Trash-can attack

Continuous improvement on security

How many nodes can you have in a Bluetooth mesh network?

Answer: Technically 32767, but it really depends!

Largest Bluetooth mesh lighting network

- **3685** mesh nodes
  - Expanded to 3923
- Light controllers with PIR/ALS sensors
- 17 floor office building in Minnesota
- Project by EMC, Silvair, and McWong International
- Runs on nRF52832!

(Source: Silvair)

Bluetooth mesh models

- Application layer concepts
- Light weight, backwards compatible
- Models defined for:
  - Generic features
  - Sensors
  - Time and Scenes
  - Lighting

Models used in a lighting control system

GENERIC DEVICES

FOR LIGHTING ONLY

SWITCH
Configuration Server
Health Server
Generic OnOff Client

LEVEL SLIDER
Configuration Server
Health Server
Generic Level Client

SCENE SELECTOR
Configuration Server
Health Server
Scene Client

DIMMER
ON
OFF
Configuration Server
Health Server
Light Lightness Client
Generic OnOff Client

**ON/OFF
DIMMING
SCENE RECALL**

SMART LUMINAIRE

SENSOR
Configuration Server
Health Server
Sensor Server
Sensor Setup Server

CONTROLLER
Generic OnOff Server
Light LC Server
Light LC Setup Server

**OCCUPANCY SENSING
LIGHT LEVEL SENSING**

SENSOR CONFIGURATION

LIGHT SOURCE

**SCENE CONFIGURATION
GROUP CONFIGURATION**

Configuration Server
Health Server
Generic OnOff Server
Generic Power OnOff Server
Generic Power OnOff Setup Server
Generic Level Server
Generic Default Transition Time Server
Scene Server
Scene Setup Server
Light Lightness Server
Light Lightness Setup Server

SMARTPHONE APP
Configuration Client
Health Client
Generic Power OnOff Client
Generic Default Transition Time Client
Scene Client
Sensor Client
Light Lightness Client
Light LC Client

CONTROLLER CONFIGURATION

Models used in a lighting control system

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CONTROLLER CONFIGURATION
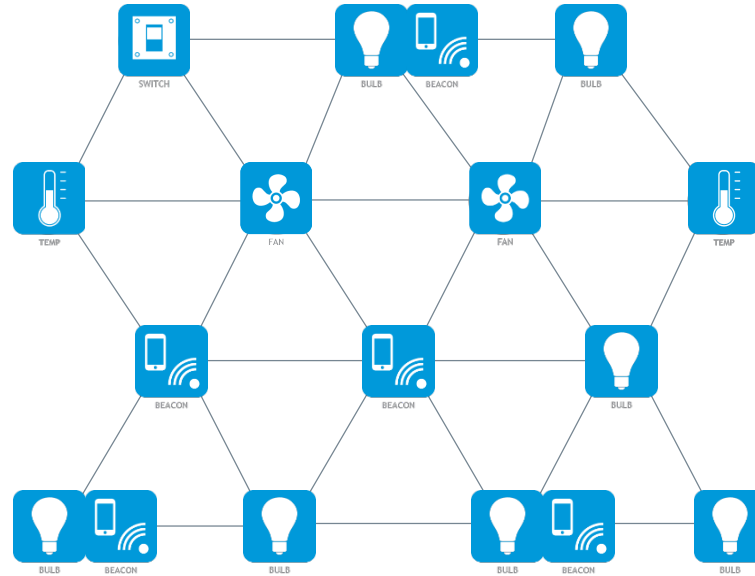
From smart light to smart building

- Asset tracking

- Beacon management

- Occupancy control

- Predictive maintenance

- HVAC

- Emergency lighting

- Building automation
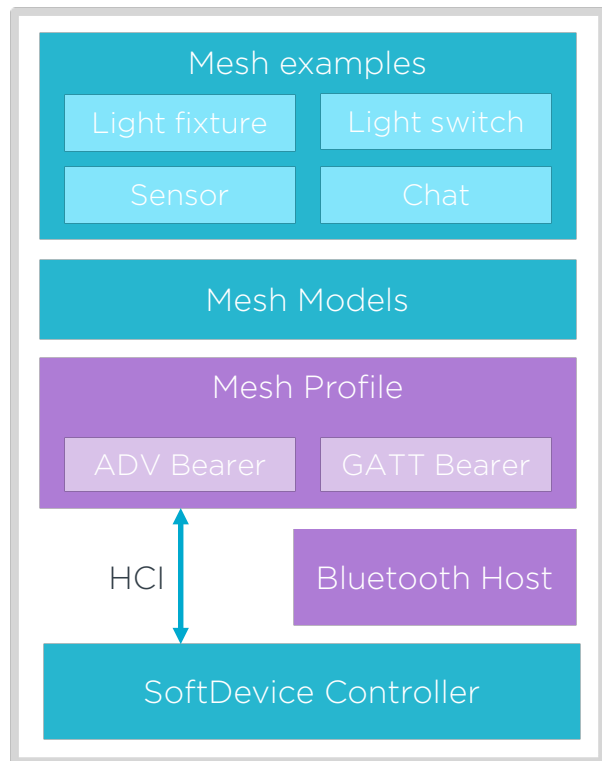
nRF Connect SDK

Bluetooth mesh support

nRF Connect SDK

- Unified SDK for nRF91, nRF53, nRF52 Series, and future products
- Supports all wireless technologies from Nordic Semiconductor
- Combines source code and tools from Nordic, the open-source community, and partners
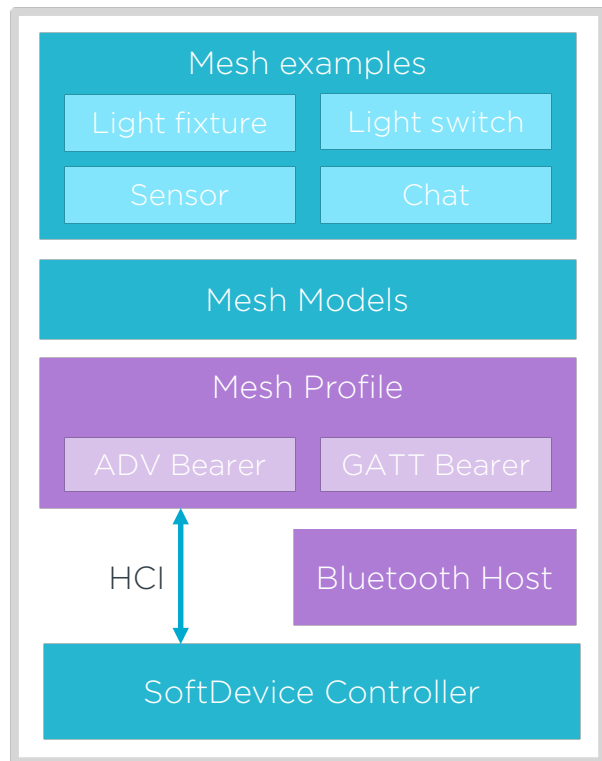
Bluetooth mesh in nRF Connect SDK

- Relevant examples for Bluetooth mesh
  - Lighting control systems
  - Chat example to show vendor specific models
- Complete Mesh Models implementation
- Complete Mesh Profile from Zephyr Project
- Bluetooth Host from Zephyr Project
- Rock solid SoftDevice Controller
- Zephyr components are actively maintained by Nordic engineers!

nRF Connect SDK mesh features

- Rich samples for prototyping

- Roles are configurable in KConfig
  - Relay
  - Friend
  - Low Power Node
  - Provisioner
  - GATT Proxy and PB-GATT

- EnOcean Switch integration
  - Battery-free, energy harvesting switch module
  - Silvair EnOcean Proxy Server implementation

Bluetooth mesh qualified from v1.7.1

Mesh examples	
Light fixture	Light switch
Sensor	Chat

Mesh Models

Mesh Profile

ADV Bearer	GATT Bearer

HCI
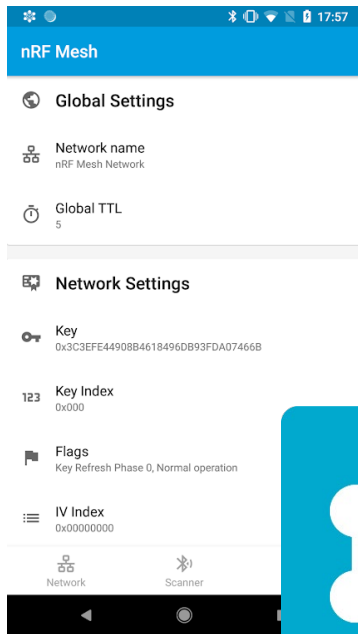
Bluetooth Host

SoftDevice Controller

- Mesh Profile and Mesh Models specifications completely qualified
- Combine with Bluetooth LE Controller and Host QDIDs for end-product

QDID: 178269

QDID: 176697
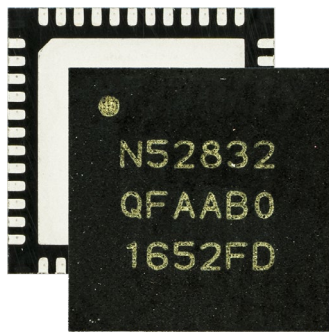
QDIDs: 170216 (nRF52) and 170219 (nRF5340)

nRF Mesh mobile app

- Direct connection to the nodes
- Provisioning and configuration tool
- Available for both Android and iOS
- Configuration database (Mesh CDB)
- Source code available
- Designed as library
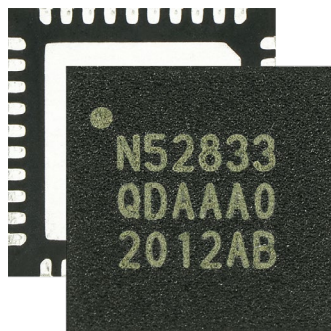
Supported Nordic SoCs
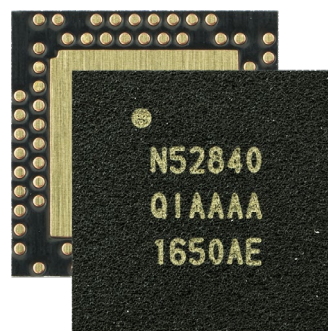
nRF52832	nRF52833	nRF52840	nRF5340
Cortex-M4 64MHz	Cortex-M4 64MHz	Cortex-M4 64MHz	Cortex-M33 128 MHz
512 KB Flash	512 KB Flash	1024 KB Flash	1280 KB Flash
64 KB RAM	128 KB RAM	256 KB RAM	576 KB RAM
Bluetooth	Bluetooth & 802.15.4	Bluetooth & 802.15.4	Bluetooth & 802.15.4

New Bluetooth mesh features

Integration and value-adds

Testing and performance

Towards a smarter future

Buildings	Savings	Value
40%	70-75%	3 – 30 – 300 ($/sqf/yr)
Total energy consumption EU and US Commercial and residential	From use of smart controls Numbers from actual installations	Energy savings is just the start Smart buildings are needed Start with lighting!

Q&A

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