nRF5 SDK for Mesh

Software Development Kit for Bluetooth mesh solutions using the nRF52 Series

Overview

Nordic offers a complete solution for the Bluetooth® mesh specification released by the Bluetooth SIG in 2017. The addition of mesh networking capabilities to Bluetooth enables extended range and increases the number of nodes compared to "traditional" Bluetooth networks. The mesh functionality is a significant update and enables new applications for Bluetooth. Nordic offers a dedicated SDK i.e., the nRF5 SDK for Mesh with support for the nRF52 Series System-on-Chips, for product developers to take advantage of this new capabilities introduced by Bluetooth mesh.

nRF5 SDK for Mesh

The Bluetooth mesh networking protocol was designed to easily and securely connect hundreds of devices to each other in a large network. Figure 1 shows a Bluetooth mesh network and node features supported by the nRF5 SDK for Mesh.

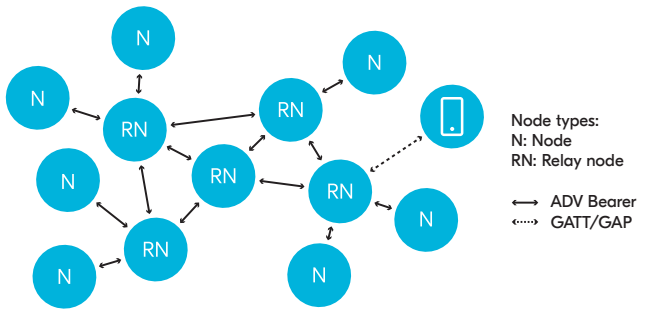

Figure 1: a Bluetooth mesh network which can be created with the nRF5 SDK for Mesh

All nodes in a Bluetooth mesh network is capable of sending and receiving messages, a relay node has the additional capability of rebroadcasting messages. All nodes can communicate with all nodes; they can be individually addressed or part of a group address. (To support battery powered nodes; the low power nodes and friend nodes are defined in the Bluetooth SIG spec.)

Bluetooth mesh relies only on scanning and advertising, so every received packet is broadcasted, until the packet is received by the destination node (a so called flooding mesh.) A simple, but effective way of spreading information across the mesh network with no single point of failure. To avoid excessive and unnecessary network traffic, there are mechanisms to reduce traffic, for example adjustable scanning and advertising intervals and a time-to-live (TTL) counter, which defines how many times a packet can be broadcasted.

KEY FEATURES

- Bluetooth mesh software core stack
- Support for Node and Relay Node roles
  - Configurable scanning interval and duty cycle (from 3ms-10240ms)
  - Configurable advertisement interval (from 20ms-10240ms)
- Broadcast flooding mesh
  - Theoretically up to 32,000 nodes
  - No routing feature or routing tables
  - No single point of failure
  - Node to Node and Node to group communication
  - Configurable time to live (TTL)
- Example applications and proprietary models
- Two-layer 128-bit AES-CCM network and transport security
- Provisioning support
  - Provisioning over advertisement bearer
  - Proprietary remote provisioning over relaying nodes
- Support for concurrent standard GATT/GAP and Mesh connections
  - For connectivity to PCs and tablets
  - For beaconing
- Serializer to support network processor configurations
- Python shell based test and demo framework for PC
- Support for over-the-air secure background DFU
- Cross-platform toolchain
  - ARM GCC support
  - Segger Embedded Studio project files

APPLICATIONS

- Connected lighting
  - Commercial
  - Industrial
  - Home
- Smart Home
- Sensor networks
- Industrial networks
- Beacon networks

The network latency and node power consumption is related to how much of the time is spent in scanning and advertising. The latency is on average 15ms per hop when configured for minimum latency and the power consumption is determined to a large extent by the receive current by the device (Radio is on 100% of the time).

Architecture

The architecture of the nRF5 SDK for Mesh is shown in figure 2. The Bluetooth mesh stack is a new stack consisting of new layer as specified by the Bluetooth SIG, i.e., Bearer, Network, Transport, Access and Foundation models. Above those layers mesh models are defined (lighting model, sensor model) which are similar to the profiles in standard Bluetooth Low Energy. As shown in figure 2, the mesh stack utilizes the SoftDevice time-slot API to allow for concurrent operation with GATT/GAP services. This makes it possible to connect with phones/tablets/PCs supporting Bluetooth Low Energy and be part of a Bluetooth mesh at the same time.

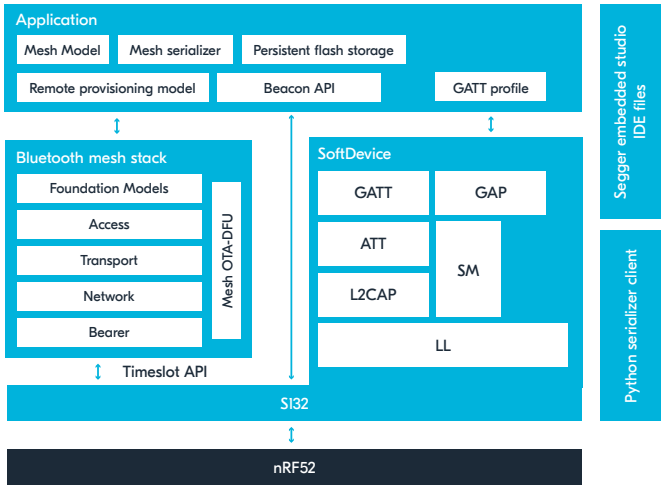

Figure 2: Block diagram of the nRF5 SDK for Mesh.

Beacon API

A common use case for a Bluetooth mesh is to have beacon functionality with a Bluetooth mesh as a back bone network to push out updates etc. The nRF5 SDK for Mesh have a simple beacon firmware API to support concurrent beaconing and mesh networking.

Mesh serializer

In the nRF5 SDK for Mesh, a mesh serializer module, with support for UART will control the mesh from an external host. This is especially suitable for 2 chip implementations of a Bluetooth mesh gateway i.e., to bridge between a Bluetooth mesh and other protocols such as Ethernet/WIFI/LTE. In the SDK a Python shell script to communicate with the mesh network from a PC via the serializer, a Bluetooth mesh SDK is included.

Over-the-Air firmware upgrade

A key feature needed when developing products for an evolving standard such as Bluetooth mesh is the capability to upgrade nodes. There is support for two different over-the-air modes. One is a side-by-side DFU, to minimize network down time and the other which is designed to minimize the flash memory footprint with the disadvantage that the application/network is down during the roll out of the new FW.

Provisioning

Before a device can participate in a mesh network, it must be provisioned. During provisioning, a device gets added to the network and is assigned a range of unicast addresses, a network key, and a device key. The provisioning is done by a Provisioner, which is a trusted device with access to the full list of devices in the network and their addresses. The SDK also supports remote provisioning (not part of the Bluetooth SIG mesh 1.0 spec), that allows provisioning nodes outside of direct radio contact with the provisioner.

Development kits

The nRF5 SDK for Mesh have support for the nRF52 DK. The nRF52 DK is a single board development kit with an on board debugger and all GPIOs exposed.

DOWNLOAD INFORMATION

nRF5 SDK for Mesh	nordicsemi.com/mesh

RELATED PRODUCTS

nRF52840	Multi-protocol Bluetooth 5/ANT/802.15.4 /2.4GHz SoC
nRF52832	Multiprotocol SoC supporting Bluetooth 5, ANT, 802.15.4 and 2.4GHz applications
nRF52840 DK	Development Kit for Bluetooth 5/ ANT/802.15.4/2.4GHz applications
nRF52 DK	Development kit for the nRF52832 and nRF52840

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For more information
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About Nordic Semiconductor
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