INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Université de Toulouse

NB-IoT™

Protocol for Wireless Sensors Network

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SUMMARY

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1. GENERAL FEATURES

NB-IOT
=
NarrowBand
Internet of
Things

Developed by 3GPP (3rd generation partnership project)

Low-power wide-area network (LPWAN)

Compatible with 4G and 5G ready

Wireless protocol specialized:
- in connecting IoT devices on established mobile networks
- handling small amounts of 2-way data

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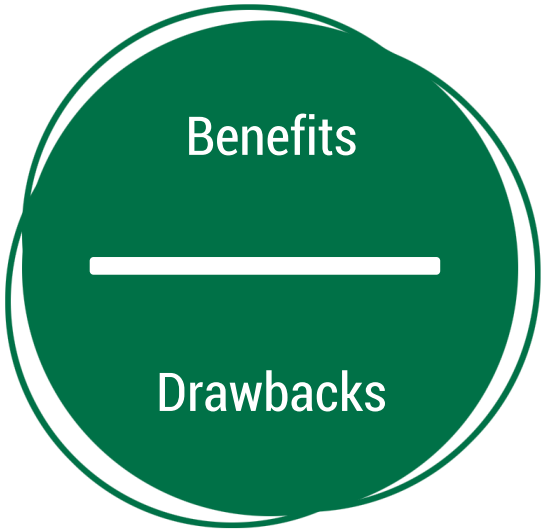

1. GENERAL FEATURES

Very low power consumption

High extended range

Less cost

Easy network deployment

Network security & reliability

Latency period
~
1 to 10 s

Low bit rate
~
20 to 250 kbits/s

Real-time possible depending on the application

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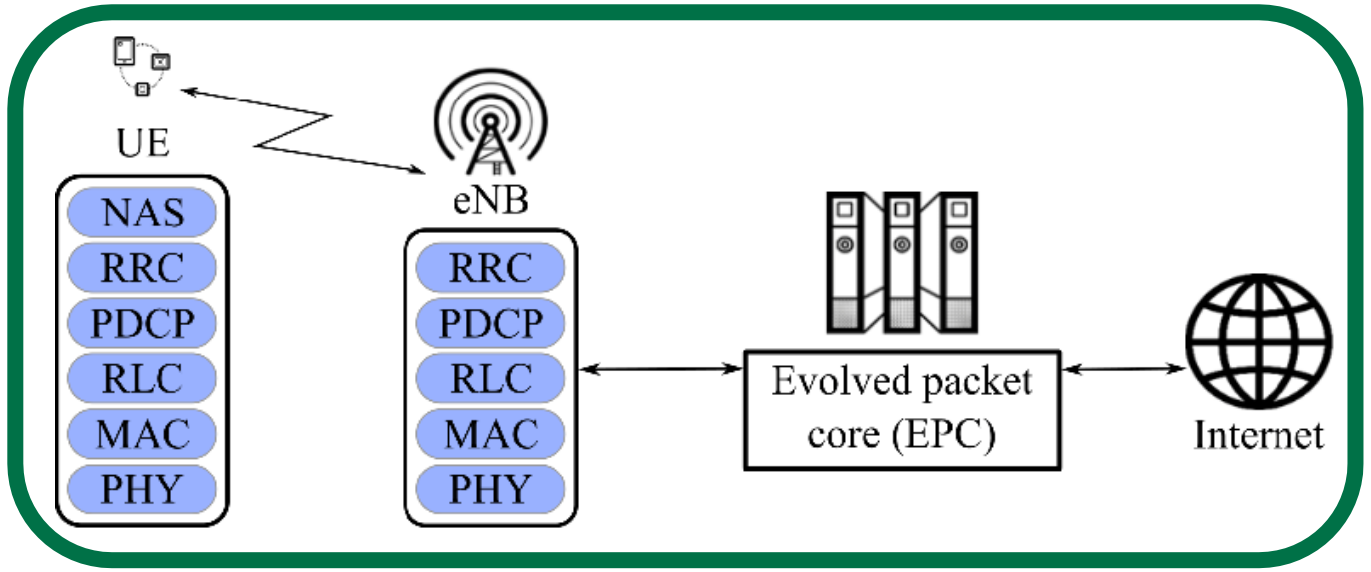

Overview of a NB-IoT network

Ref: Evolved Packet Core (EPC), TechTarget Contributor, accessed 9 October 2021 <https://www.techtarget.com/searchnetworking/definition/Evolved-Packet-Core-EPC>

1. GENERAL FEATURES

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II. PHYSICAL LAYER

The physical layer is the interface between the MAC layer and the Radio Frequency transceiver

Main functions:

- Supports Half Duplex Transmission
- Adapts the MAC layer format for the medium used
- Enables exchange of data between eNB and UE

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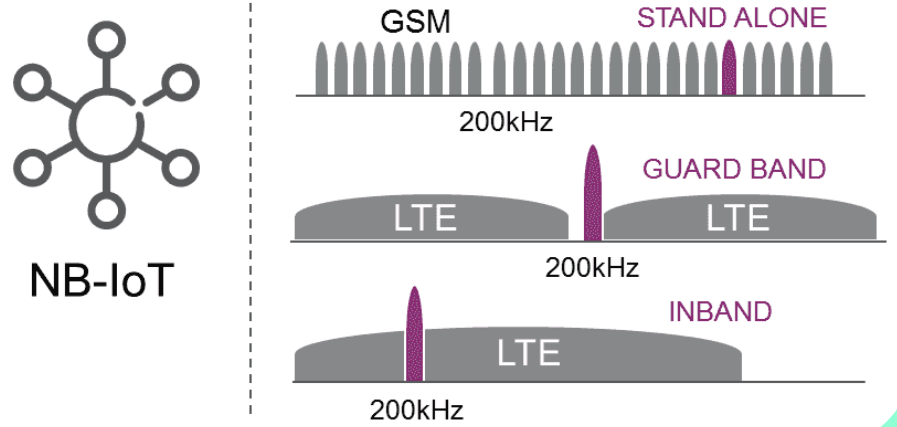
NB-IoT uses a single narrow band of 200kHz (or 180 kHz to be precise)

II. PHYSICAL LAYER

For example, it can be transposed on the LTE or on the GSM NE bandwidth as long as there is at least 200kHz of available bandwidth

Ref: Narrowband IoT in the cloud, Anna Larmo, SEP 01, 2016, accessed 9 October 2021 <https://www.ericsson.com/en/blog/2016/9/narrowband-iot-in-the-cloud>



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III. MAC LAYER

The Medium Access Control layer controls the hardware in charge of the interaction between the wireless transmission medium.

It is responsible for the messages between User Equipment (UE) and the network.

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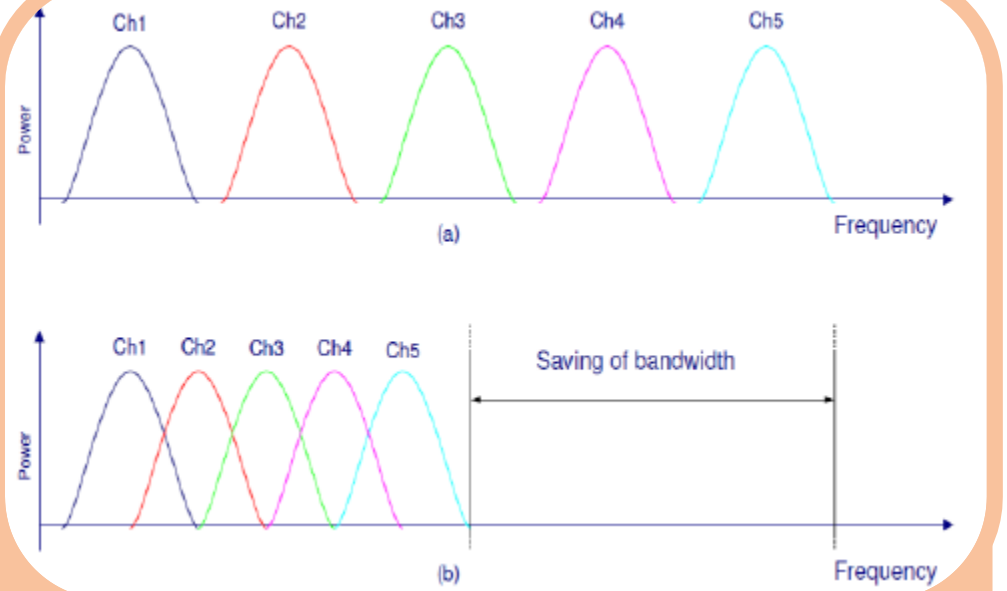
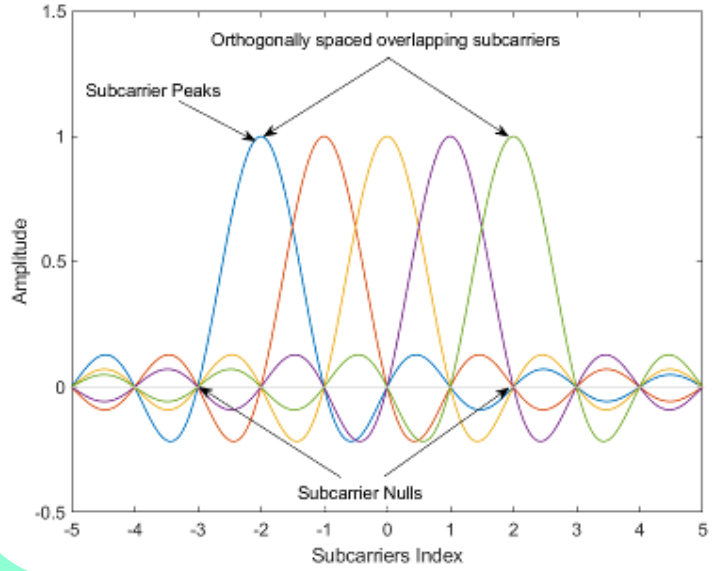


Comparison between FDM (upside) and OFDM (downside)

Ref: Differences between FDM and OFDM, Khaled Elleithy, March 2014, accessed 9 October 2021 <https://www.researchgate.net/figure/Shows-what-the-differences-between-the-FDM-and-OFDM-spectral-efficiencies-are-16_fig2_259649471>



Principle of signal orthogonality

III. MAC LAYER

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III. MAC LAYER

It performs the following functions:

- Mapping of logical channels
- Multiplexing of MAC SDUs
- Error protection
- Priority handling
- Arbitration and prioritization of access

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IV. SECURITY

NB-IoT is a cellular network that inherits the security mechanisms of mobile infrastructures.

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NB-IoT is a cellular network that inherits the security mechanisms of mobile infrastructures.

- Secure communication channels
- Manage communications
- DATA OVER NAS (DoNAS)
- Non-IP Data Delivery (NIDD)

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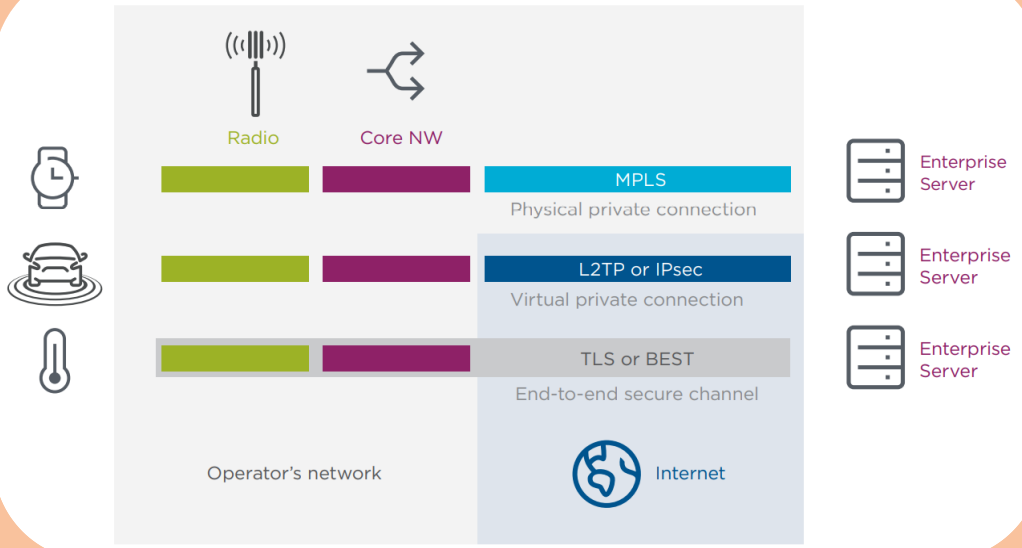
IV. SECURITY

Secure communication channels



Mobile operator's public infrastructure between IoT devices and Enterprise Server

Ref: Security Features of LTE-M and NB-IoT Networks, GSMA, accessed 9 October 2021 <https://www.gsma.com/iot/wp-content/uploads/2019/09/Security-Features-of-LTE-M-and-NB-IoT-Networks.pdf>

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Manage communications

IoT devices or applications need to be connected and communicate only with a set of servers. It is a good security practice to restrict these communication from the device to these specific servers. Thus, these devices will be unable to communicate with any other destination, limiting any potential threats.

IV. SECURITY

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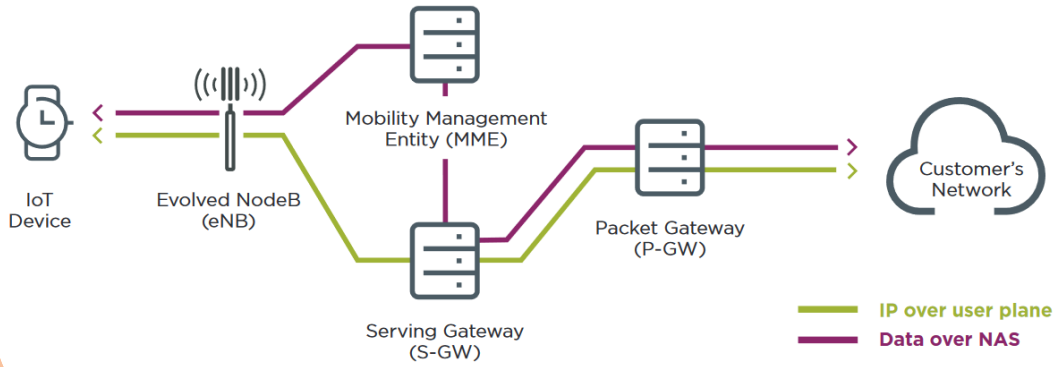
IV. SECURITY

DATA OVER NAS (DoNAS)



Data path for DoNAS and traditional IP over user plane

Ref: Security Features of LTE-M and NB-IoT Networks, GSMA, accessed 9 October 2021 <https://www.gsma.com/iot/wp-content/uploads/2019/09/Security-Features-of-LTE-M-and-NB-IoT-Networks.pdf>

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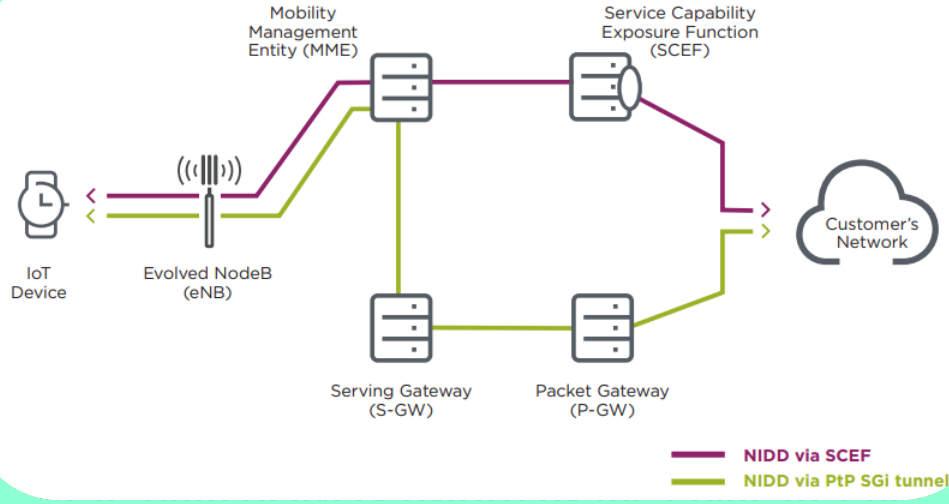
IV. SECURITY

Non-IP Data Delivery (NIDD)



Serving Gateway interface (PtP SGi) and Service Capability Exposure Function (SCEF)

Ref: Security Features of LTE-M and NB-IoT Networks, GSMA, accessed 9 October 2021 <https://www.gsma.com/iot/wp-content/uploads/2019/09/Security-Features-of-LTE-M-and-NB-IoT-Networks.pdf>

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V. POWER CONSUMPTION

When the transmitted power TX = 23 dBm

→ Power consumption ~ 5.64 to 7.74 mW/bytes

→ So up to 968 uW/bit

As of today, there is not enough information.
Tests are yet to be made.

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QUESTIONS?

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