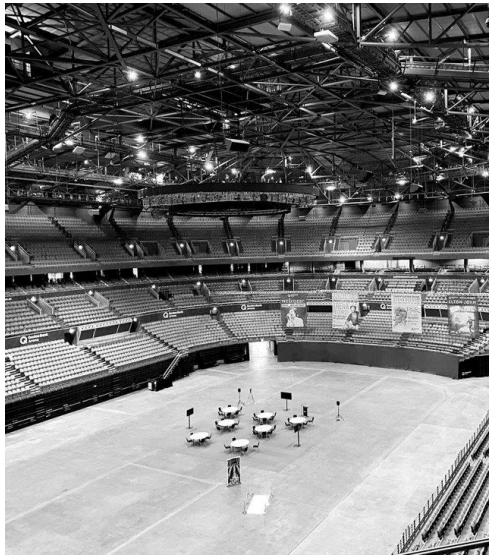
Non-cellular mesh-based radio access technology

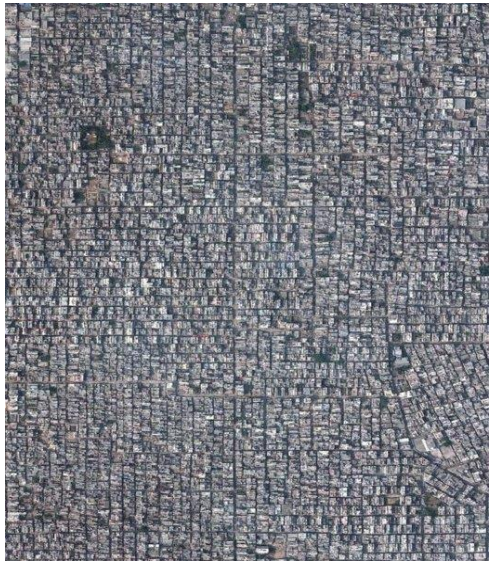
6G Test Network Finland (6GTNF) workshop

Sept. 26, 2024

Juho Pirskanen, Wirepas

USWA project coordinator





Non-Cellular mesh-based radio technology

USWA: Consortium Partners - countries

Austria

Beia CONSULT INTERNATIONAL

Finland

Wirepas

KONE

SATEL

SCHAEFFLER

Valmet

Tampere University

VTT

Turkey

ACD

arçelik

C2TECH

İNOVASYON MÜHENDİSLİK

PROFEN

SAMPAS HOLDING

Germany

Fraunhofer IIS

Leibniz Universität Hannover

NXP

SEW EURODRIVE Driving the world

RFmondial

TECHNISCHE UNIVERSITÄT DRESDEN

NUROMEDIA

Spain

fonlabs AN AGILE CONTENT BRAND

ETSI DECT-2020 NR Technology

or simply NR+

What is DECT-2020 NR? - NR+

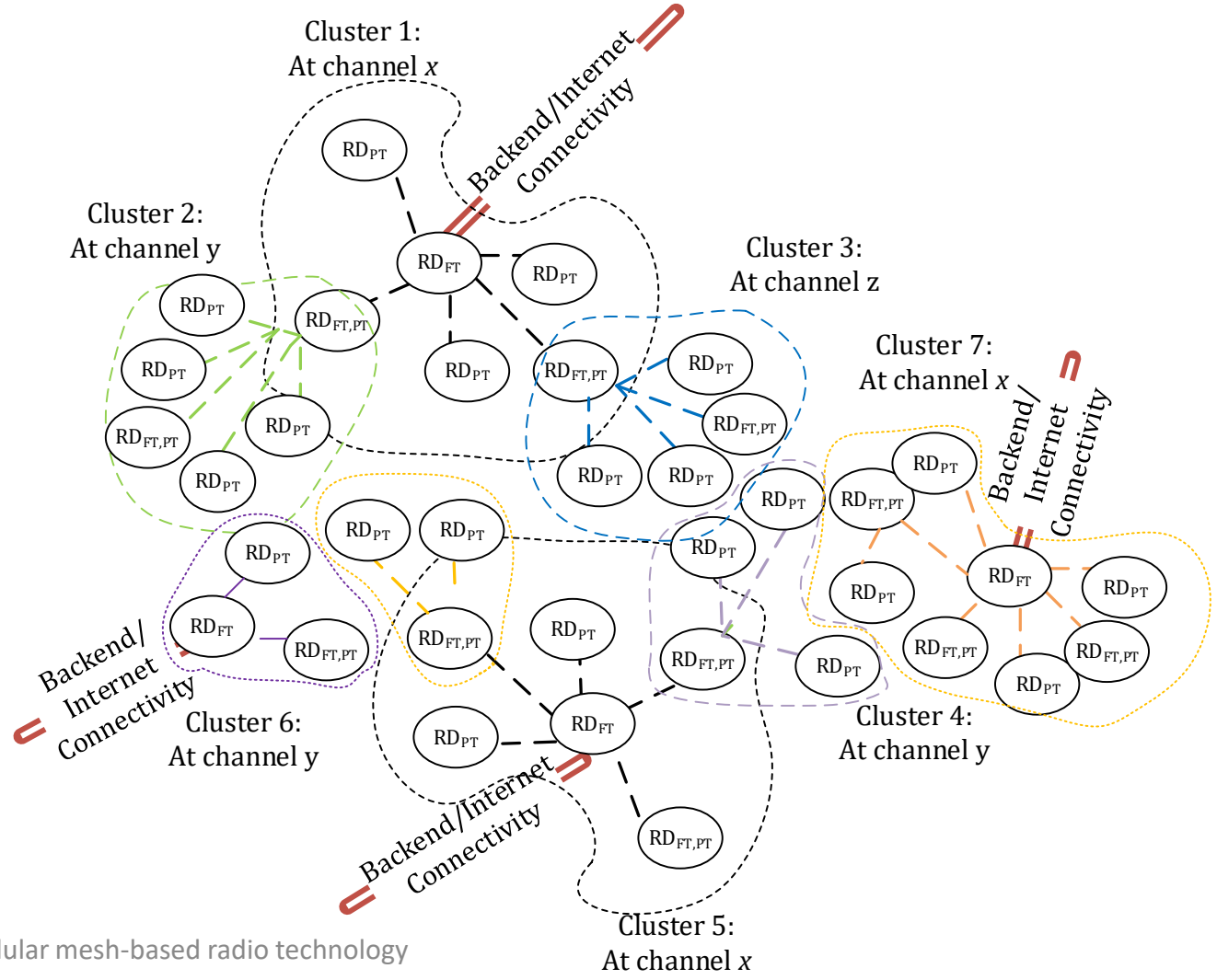
- Wireless communication technology which can be deployed by anyone, be operated by anybody, and used anywhere
- Provides simple and autonomous operation, is able to co-exist with other local networks in the same area sharing the spectrum and is easy to introduce into new frequency bands
- Application agnostic enabling rapid adoption of different use cases and fostering digitalization
- Supports ultra-reliable low-latency communication
- Designed for massive-scale machine communication networks exploiting mesh communication
- Adopted by ITU-R as part of the IMT-2020 family, Recommendation ITU-R M.2150

ETSI Specification structure

- ETSI has published Release 1 DECT-2020 NR specifications:
  - TS103.636-1, DECT-2020 New Radio (NR); Part 1: Overview;
  - TS103.636-2, DECT-2020 New Radio (NR); Part 2: Radio reception and transmission requirements;
  - TS103.636-3, DECT-2020 New Radio (NR); Part 3: Physical layer;
  - TS103.636-4, DECT-2020 New Radio (NR); Part 4: MAC layer;
  - TS103.636-5, DECT-2020 New Radio (NR); Part 5: DLC and Convergence layers;
- ETSI has approved the first publication of Release 2 of the above specifications.
- ETSI EN 301 406-2 Harmonized standard for DECT-2020 NR
  - Defines minimum device requirements entering into market.
- Radio Profiles
  - TS 103 874-2 DECT-2020 New Radio (NR); Access Profile Part-2; Smart Metering, City and Buildings
  - TS 103 874-3 DECT-2020 New Radio (NR); Access Profile Part 3; IPv6 Profile
- TC-DECT is working on Conformance Test Specifications.

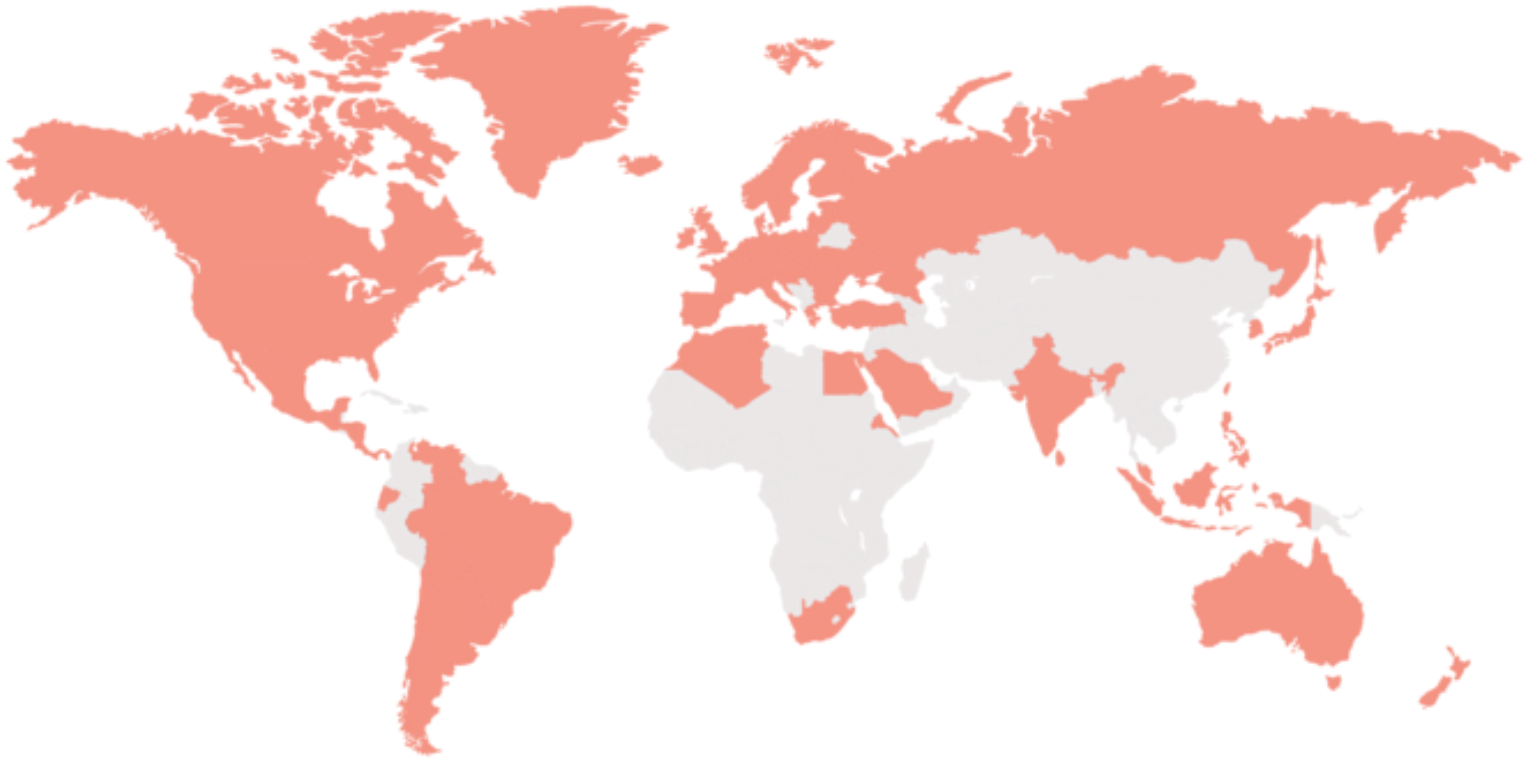
System topologies – Mesh Network

- Cluster tree mesh network architecture
- A Single Network can extend its operations to different channels.
- Independent from the backend/ internet connectivity solution.
- Unlimited number of Backend/ Internet connectivity points.
- A simple to increase capacity or extend the network



Spectrum at 1900 MHz for NR+

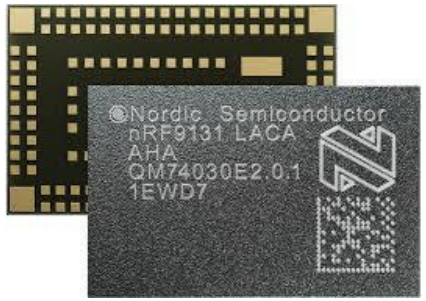
- License exempt spectrum with some country-specific variants

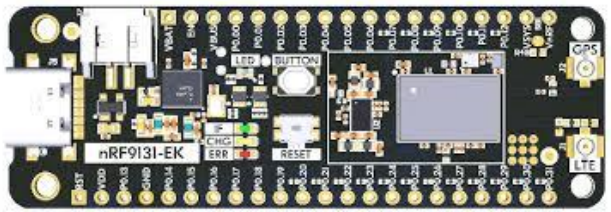


Is this available?

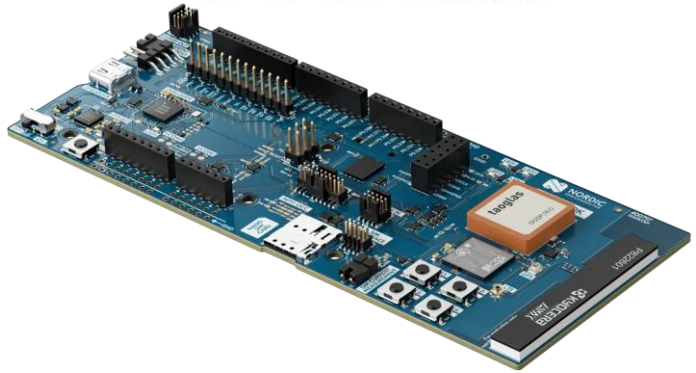
Nordic Semiconductor NR+ offering

nRF9131





nRF9151

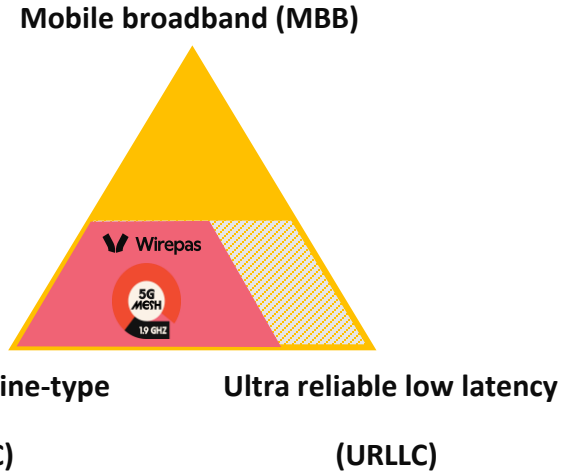


nRF9151

Non-Cellular mesh-based radio technology

Wirepas 5G Mesh 1.1 for mMTC use cases

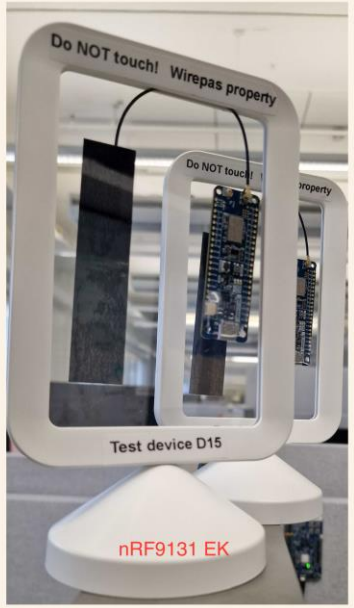
- **CVG Layer**
  - Segmentation and reassembly
  - PDU max 1500 bytes (including IPv6 payload)
  - OTAP, for Physical layer modem, protocol and application software.
- **DLC Routing support**
  - Uplink packet routing to the selected next hop with backend addressing,
  - Downlink packet routing with selective flooding to unicast/multicast/broadcast addresses.
- **DLC Transmission support**
  - QoS with two traffic classes,
  - Cumulative transfer delay, through the mesh network,
  - DLC Service type 2 with ARQ for lower layer failures or route changes.
- **MAC layer spectrum management support**
  - Dynamic operating channel selection
  - Synchronized operating channel change,
  - Optimized Cluster Beacon transmission timing,
  - Auto role mode selection between router and non-router modes (FT and PT or PT only),
  - Dynamic route cost calculations with load balancing.
- **MAC layer next-hop selection support**
  - Dynamic next hop selection based on minimum signal quality and minimum route cost.
  - Network Beacon scanning and synchronized Cluster Beacon detection,
  - Neighboring cluster discovery from own cluster and Synchronized neighbouring cluster detection,
- **MAC transmissions support**
  - Transmission power control.
  - Random Access transmission with Listen Before Talk (LBT) and exponential backoff.
  - Transmission length adaptation with a single sub-slot granularity.
  - Maximum transport block size 1664 bits with TX duration 1.66ms (8 sub-slots)
- **Compatibility to the following ETSI standards:**
  - TS103.636 series core specification
  - HS EN301.406-2 Harmonized standard
  - TS103.874-2 Access Profile Part-2; Smart Metering, City and Buildings



- **Physical layer and chipset**
  - Nordic Semiconductor nRF9161 and NRF9131 System-in-Package chipsets
- **Long range profile – radio parameters**
  - 1880-1900 MHz (band 1, 11 ch)
  - Physical layer with 1.728MHz per channel, MAC Layer data rate is 1.1 Mbps
  - Max +19 dBm outpower, min power -40 dBm.
  - Retransmissions for data reliability.
  - Range over 5 km Line of Sight

DEMO


Thingy:91x (nRF9151)


Do NOT touch! Wirepas property
Test device D15
nRF9131 EK