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WEBINARS

Understanding DECT NR+: The first non-cellular 5G standard

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Today's hosts

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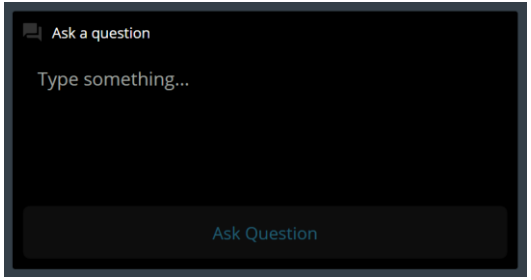
Practicalities

- Duration: about 45 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



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Agenda

- NR+: What is it and why should I care?
- Targeted applications and benefits
- NR+: How?
  - Upper layers, no physical stuff
- Status of the standard
- Status of the Implementation
- Q&A

The What

NR+, aka DECT-2020 NR

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Why DECT NR+

- Opportunity to use existing spectrum allocation
- Utilizing existing cellular technology
- New radio standard

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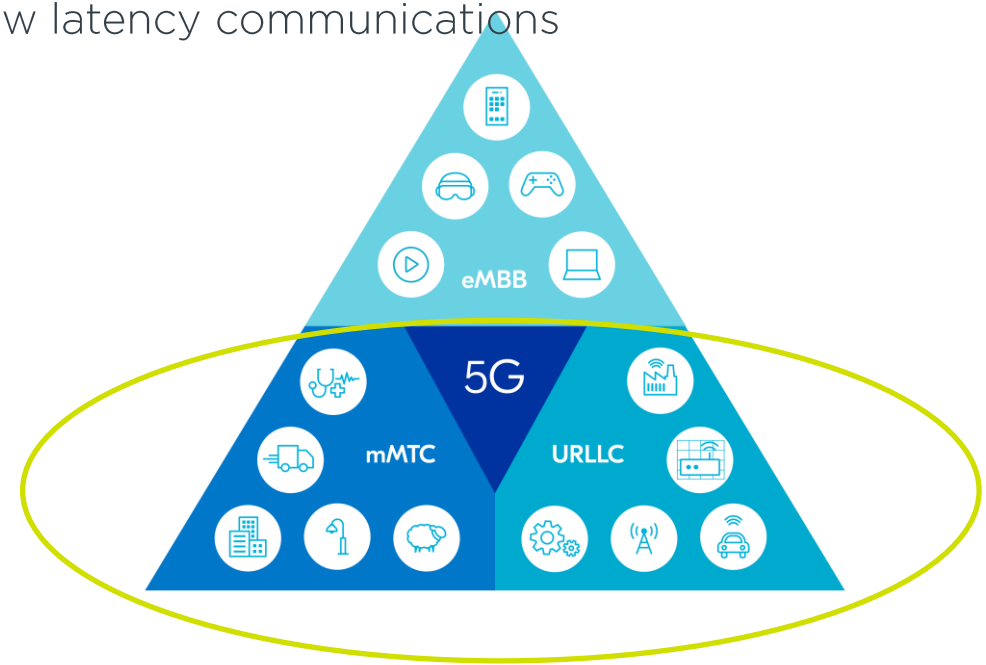
Targeted applications

Made for massive IoT networks and low latency communications

1. Massive IoT
   - Networks of thousands of nodes
   - **Use case**: Smart energy, smart city applications

2. Low latency communications
   - Latency 1 ms
   - **Use case**: Speech and audio, automation control



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DECT NR+

Made for massive IoT networks and low latency communications

1. Massive IoT
   - Networks of thousands of nodes
   - **Use case**: Smart energy, smart city applications

2. Low latency communications
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The benefits of NR+

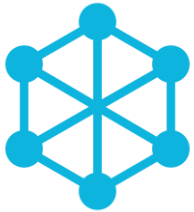
Speed and latency

- **Speed**: 1 to 3.4 Mbps on HW, standard up to gigabits
- **Latency**: 1 ms on star, 10ms per hop minimum for mesh

Low-power

- Long sleep times for devices are possible

Mesh network



- Self healing
- Self load-balancing

Frequency spectrum

- Minimal cost of ownership
- No subscription costs
- Global spectrum 1900MHz, minimal regional variation
- Avoid congested 2.4GHz

The How

Diving into the protocol layers

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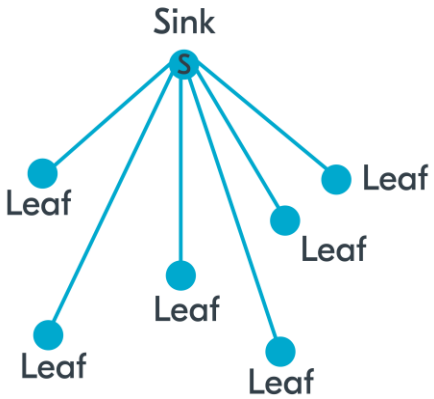
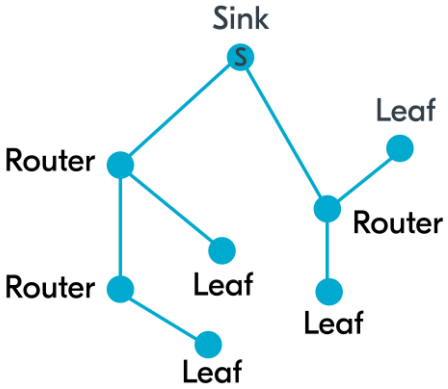
Vocabulary



Star



Tree-Mesh

Synonyms

1. Sink = Gateway / Border Router
2. FT = Relay Node / Router Node / Parent Node
3. PT = Leaf Node / Node / Child Node

"A mesh network is a local area network topology in which the infrastructure nodes connect directly, dynamically and non-hierarchically to as many other nodes as possible and cooperate with one another to efficiently route data to and from clients." Wikipedia

NR+ is a partial mesh, clustered tree topology

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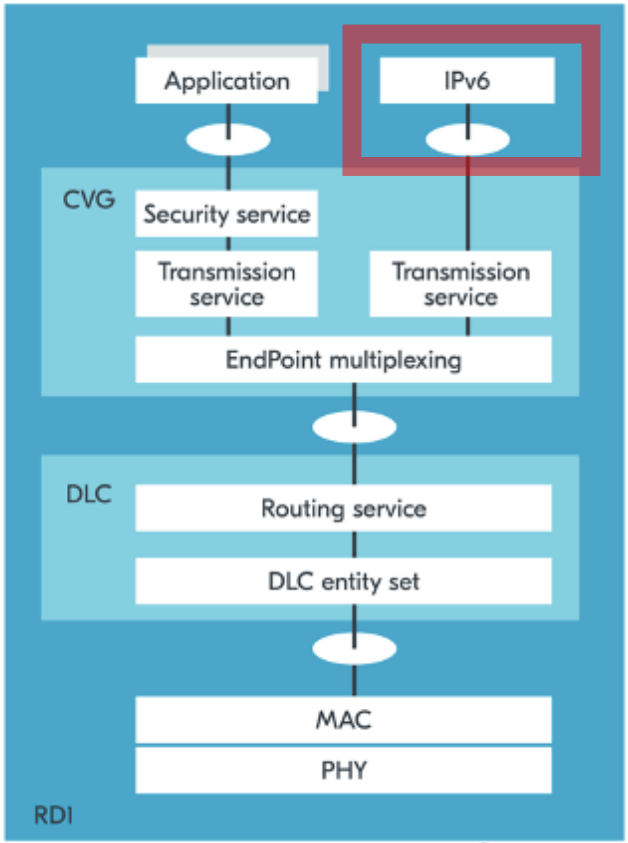
Network protocol layers

- **Convergence (CVG) layer:** Application multiplexing
- **Data Link Control (DLC) layer:** Routing, segmentation
- **Medium Access Control (MAC) layer:** Radio resource control
- **Physical (PHY) layer:** OFDM, HARQ, etc.



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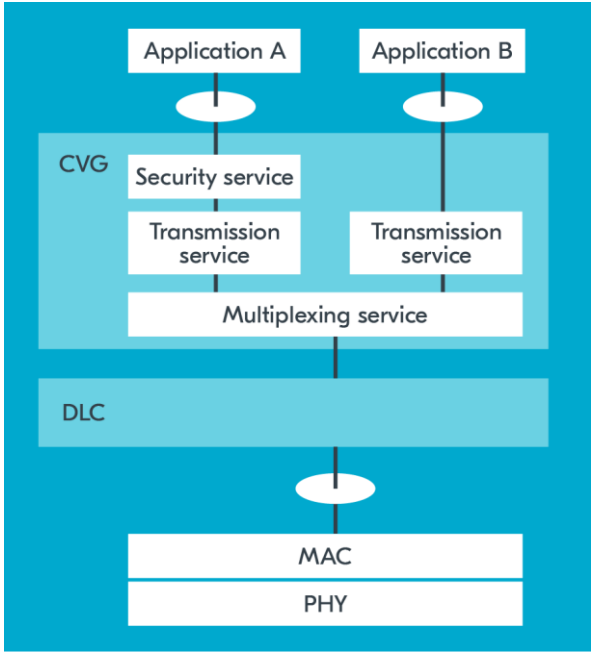
NR+: Convergence (CVG) layer And Data link control (DLC)

- CVG Provides application layer data identification and multiplexing between multiple applications
  - Mesh E2E security
- DLC provides transport service selection
  - 0 Transparent
  - 1 Segmentation
  - 2 ARQ
  - 3 Segmentation and ARQ
- DLC handles routing of packets



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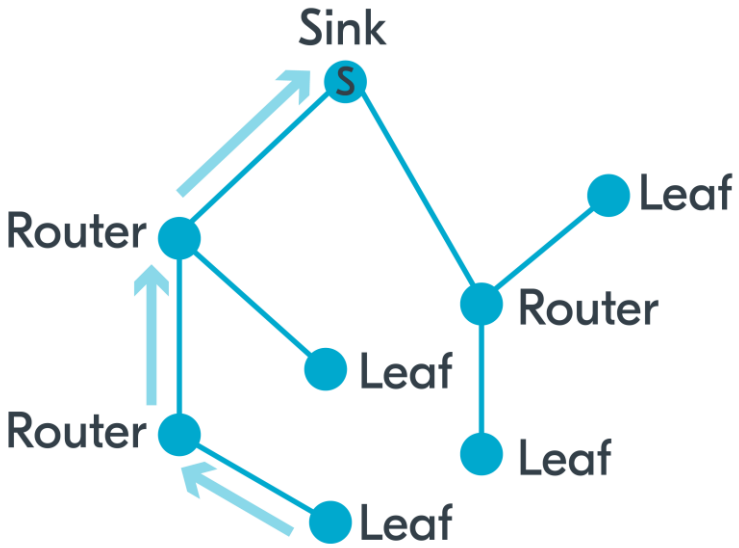
DLC: Network routing

- Up: To sink
  - Forward to parewnt until it reaches sink
- Sink can forward to internet



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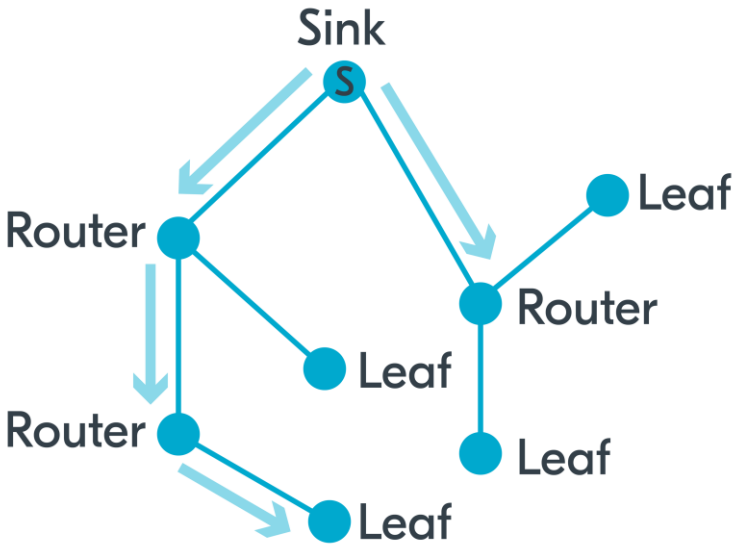
DLC: Network routing

- Down: Flooding
  - From sink, forward to all child relays
  - Relays forward to child relays
- Relay that has the destination as a direct leaf sends only to that leaf

- Flooding with hop limit also for Node-to-Node communication
- Routing is very resilient to changes in network
  - Leafs moving to other Relays is instantenous



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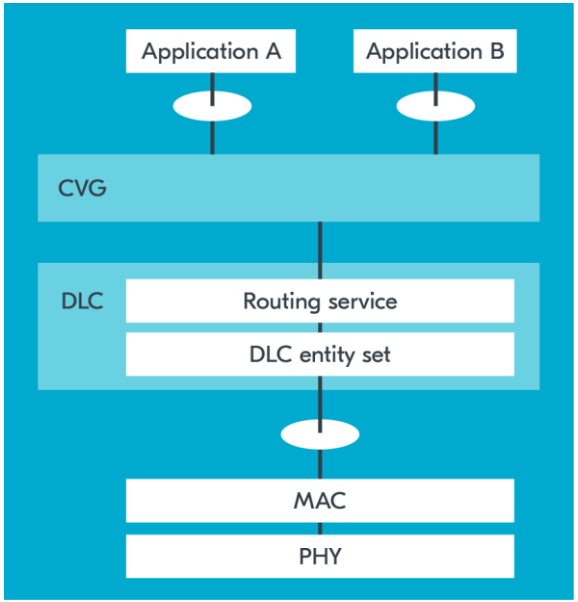
NR+: MAC layer

- Central, lots of features in MAC for the radio resource control
- Broadcast / multicast / unicast
- Dedicated resource or random access
- Radio addresses
  - 32bit network wide address
  - 16bit cluster (link) address
- Beacons for radio resource control
- Hybrid ARQ ACK/NACK to PHY



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MAC: Radio Channel Resource Control (RRC)

Relay, a routing FT device, manages radio resource with Beacons

- Every beacon period need to scan channel, update reservations for next beacon
- Allocating TX time for leafs in beacons

Leaf follows relay beacon

- Following the beacon avoids dedicated reservations, no scans needed
- Listen before talk on random access channel to relay

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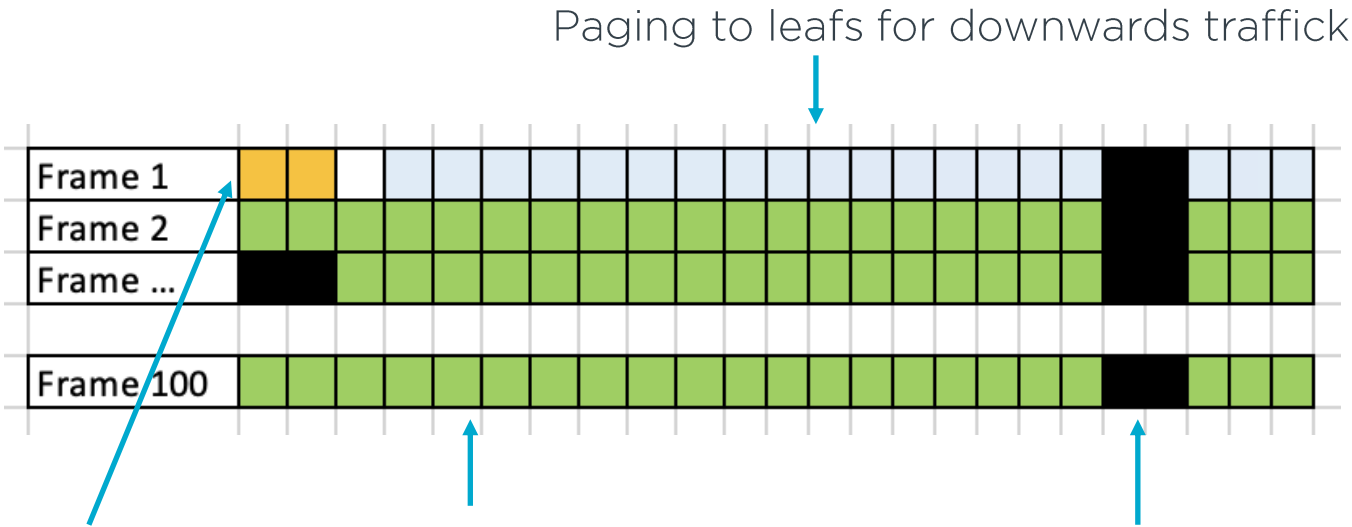
RRC: Beacon is the basis



1. Send own
2. Listen parent relay

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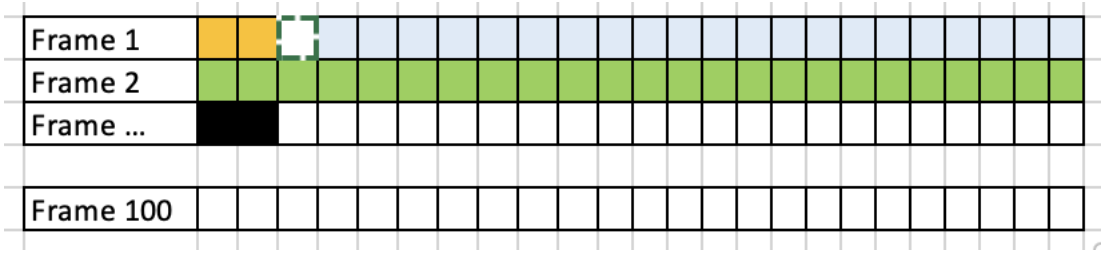
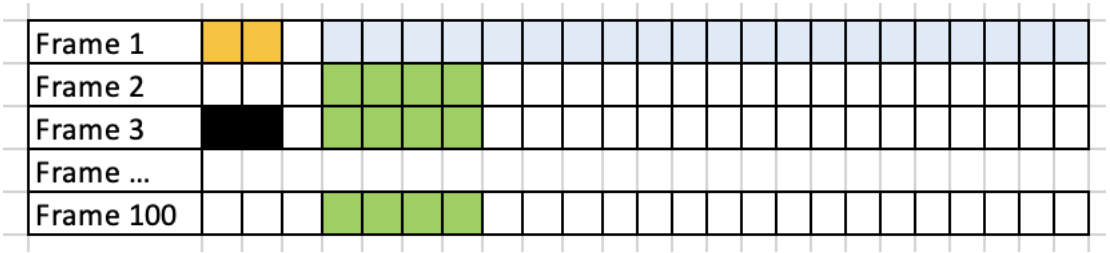
RRC: Power optimization of beacon



Extreme power save,
low data, long latency

Beacon period can be from 10 ms to 32 secs



Moderate power save
moderate data, low latency

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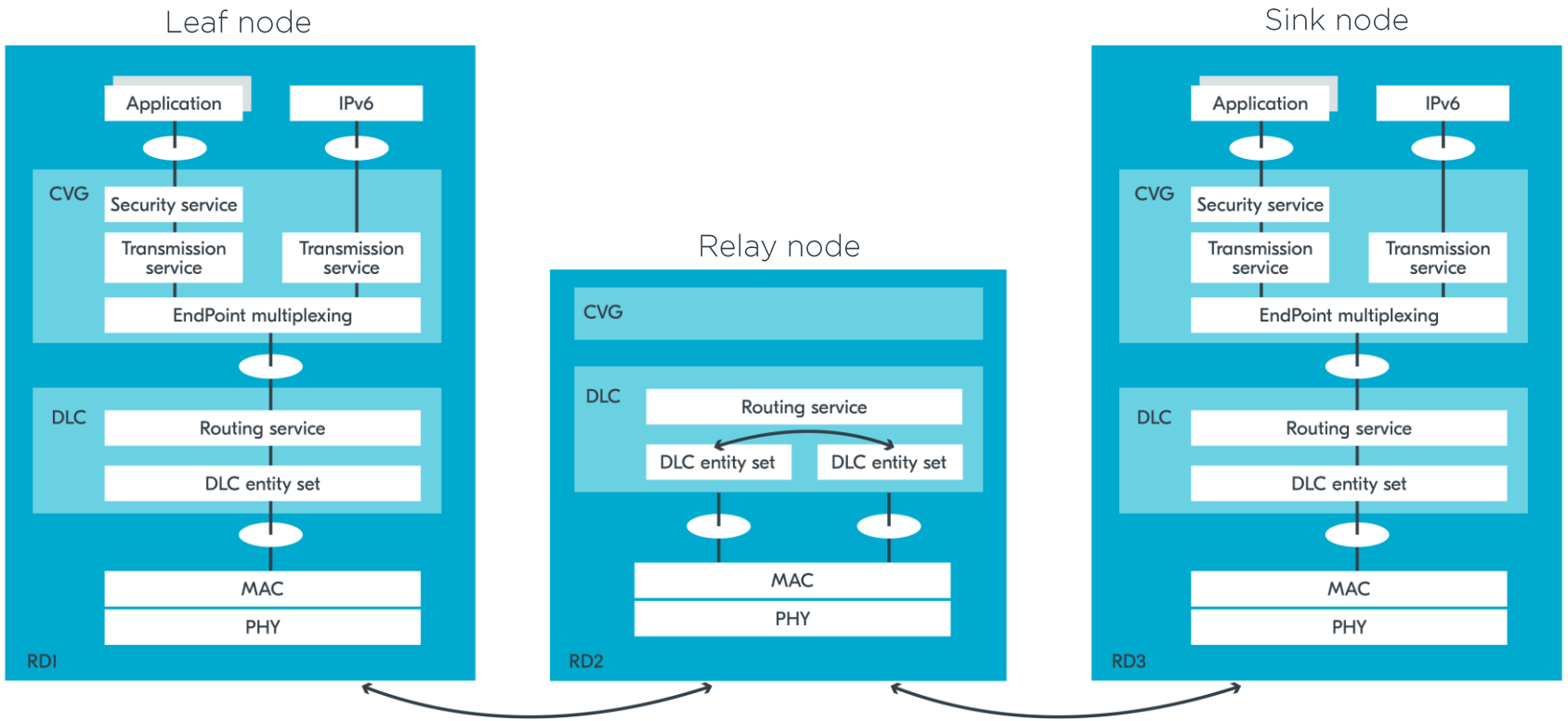
Summary



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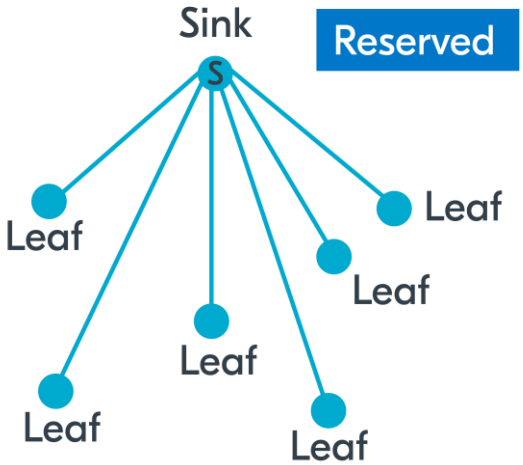
Dedicated flows

- leaf makes an association / modification stating the needed dedicated flow resource
  - How many slots, period, what is the validity period for reservation
- relay verifies the capacity exists and acknowledges
- Dedicated flow slots must be used, the data must be
  ready for sending at the reserved time
- Dedicated flow is over 1 link only



Status of the standard

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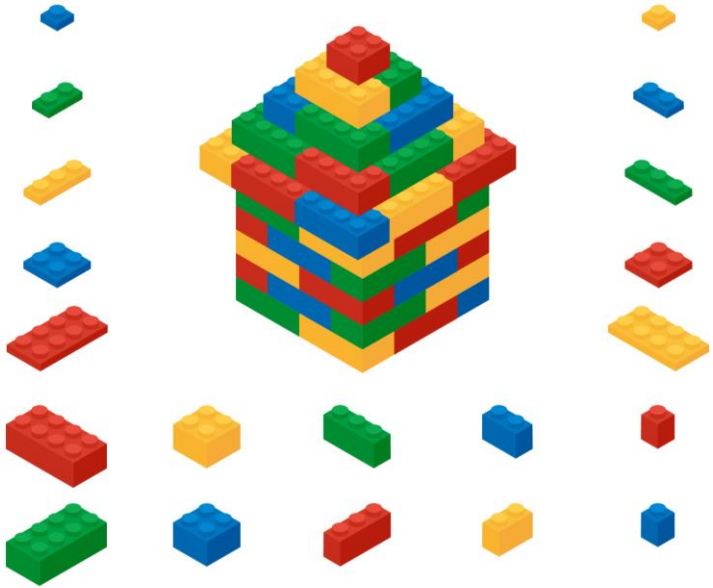
Standard approach

- DECT NR+ standard defines features
- Profile is the selection of features for specific application needs
- No general interop standard, application / device specific networks



(c) Lego, they are just great

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Standard status

- Core standards are approved by ETSI and ITU, 24 February 2022, now version 1.4.1
  - Overview ETSI TS 103 636-1
  - Radio requirements ETSI TS 103 636-2
  - PHY ETSI TS 103 636-3
  - MAC ETSI TS 103 636-4
  - DLC and CVG ETSI TS 103 636-5

- Working on
  - Harmonized test specification EN 301 406-2
  - Application Profile, Metering TS 103 874
- Gathering requirements for Rel 2 update

Status of the implementation

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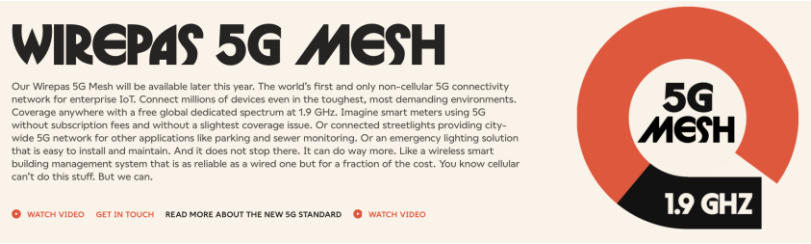
Status of the implementation, as of April -23

- Nordic will release a DECT NR+ PHY SW Variant for nRF91 series end of 2023
- Our partner in standardization and development Wirepas has a full mesh stack solution on top of the Nordic PHY



- For audio and low latency communications Nordic is working with several early access customers

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Q&A