

Connectionless Services for M-CORD

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Why LTE can not be used to adopt IoT and future mobile communication?

Why should M-CORD team study/POC connectionless?

- **LTE Latency** :- Mission critical services will require network latency as low as 1 ms, which is not possible with LTE as it takes minimum 10 ms delay.
 - Is this delay because of the error correction mechanism LTE uses or and because it needs to attach and use GTP-Tunles?
 - What if the GTP-Tunnels and connectionless bears are pre established and can be shared by all IOT devices in a cell?
- **LTE is connection oriented**:- With wide deployment of IoT the radio access network need to handle 10,000s devices per square mile.
- **QOS vs throughput** :- We have now reached at a stage where we need data throughput without affecting the QOS for critical IOT. How do we provide continues QoS for critical IOT flows? Is smart Cookies an option where the devices tags the critical flows at the source? Can critical IOT and best effort share the same bearer, and utilize core slicing for further isolation and support for critical IOT? How about Massive IOT
- **LTE was designed to operate in specific spectrum**:- Expected traffic growth in high density zones (study of licensed vs unlicensed above 6 GHZ) access technologies optimized for new spectrum bands
- **New improved security**:- How do we evolve security and chain of trust ...

Current M-CORED Motivation

- Software-defined M-CORD slicing manager and its Core technologies are expected to enable flexibility to assign resource management at both RAN and CORE. The M-CORD control applications will have access to:
 - Flexible Radio Resource allocation on per device and flow categories.
 - Flexible assignment of CORE functions including classification, Acceleration, Storage, time shifting, and EPC core functions (MME, SGW, PGW).
 - A group of resources (M-CORD VNF) will be self organized to manage IOT loads on a specific slice
 - Self organizing control applications for each slice will influence; RRB per slice, load balancing functions, multi-RAT access, Multi-RAT handover
- architectures, which enables the flexibility to create new services and applications.
 1. The new 5G (new Radio) proposed by 3GPP and 802.11 family should be combined together with LTE and Wi-Fi to provide universal high-rate coverage and a seamless QOE.
 2. Do we need a new physical layer (large Scale cooperative signal Processing) for critical IOT/New radio to meet 1 MS requirements?
 3. What are the software defined air interfaces that can be influenced by SDN/ONOS? The M-CORD slice manager for radio access infrastructures eventually is expected to provide on-demand resource processing, delay-aware storage, and coordinated high fabric capacity wherever is needed.
 4. Lets continue on M-CORD Rack-2 path while we are evaluating alternatives
 - What are shortcomings with current approach
 - What are fail fast KPIs? / Scale, impact, Power, Effectiveness

Xilinx ; Sasan Ahmadi's comments

- The summary of my comments are as follows:
- Legacy support and maintaining interoperability (in the new base stations) would create a significant overhead and increase operators OPEX. Migration is also not smooth.
- Bearer setup and teardown are associated with system and UE states and directly related to guaranteeing QoS/QoE (defined per bearer), security of connections, etc.
- LTE is already suffering from mobile IP anchoring on HA (P-GW) in the home network when users roam in visited networks and relying on mobile IP to handle mobility would not solve this issue.
- Operator SLAs and policy and charging practices are based on QoS and service provisioning for users based on the bearer system. Breaking the bearer architecture would require a significant effort to replicate similar functionalities.
- The connectionless concept may be attractive for massive MTC use cases, but may not ideal for mission-critical and low-latency applications.
- Link adaptation and retransmissions required to mitigate over-the-air and network transport errors will incur more delay and will be more difficult without established connections and bearers.
- Even if this concept applies to one network slice (mMTC), it is always desirable to maintain as much commonality as possible among different slices in terms of operation.

Connectionless M-CORD POC proposals

- Stage 1:

- Minimum RAN side changes of LTE, focus on connectionless core network for PoC
- Analysis of connectionless RAN based on LTE air interface (capacity, performance)

- Stage 2:

Connectionless RAN + connectionless core for **Stationary IoT/Nomadic device** PoC

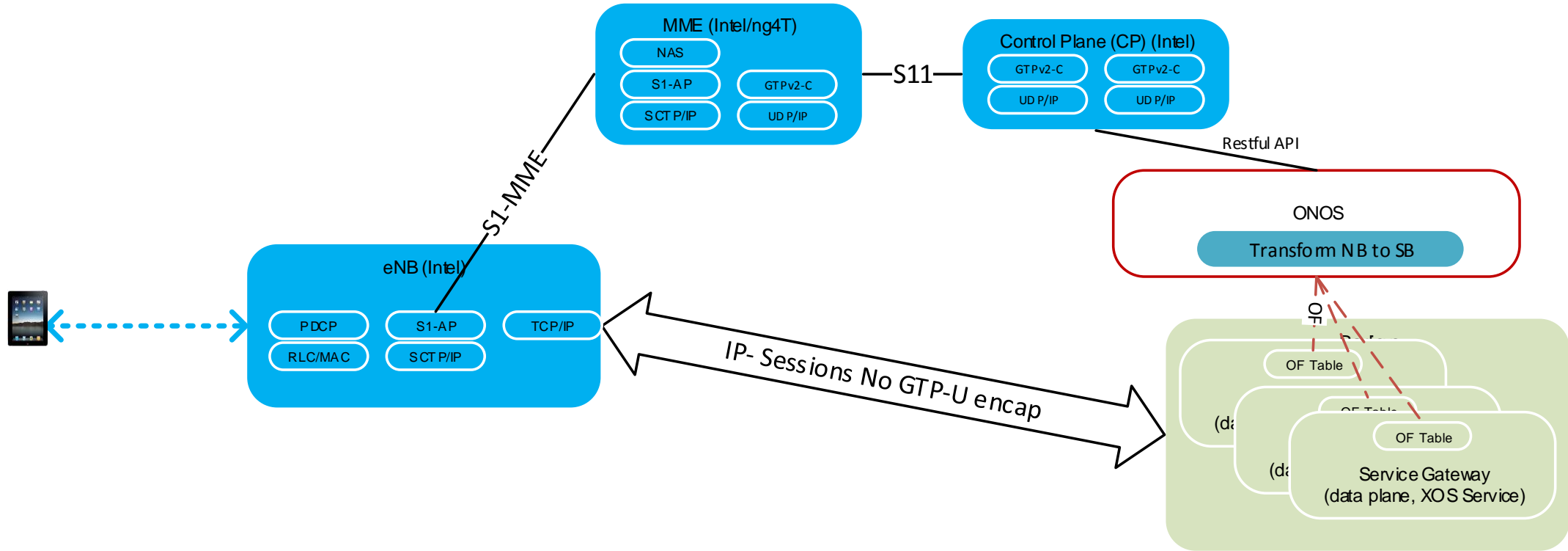
- Other requirements

If possible, keep the RAN backward compatible to existing LTE terminals (i.e. co-current support of legacy LTE terminal and connectionless IoT devices)

Stage 1 focus on connectionless core network

- Stage 1 objectives:
 - Data plane **of core network** will be made connectionless (no GTP). In the signaling side, **S11 (MME to S-PGW) will be extended to an SDN controller**. However, the S1-MME (eNB to MME) will be largely intact. eNB will, however, be modified to make sure of following
 - Do not use GTP for data bearer. Essentially, ignore the GTP setup parameters on S1-MME interface.
 - **Provide a provisioning aspect to use tagging/tunneling mechanism between eNB and SGW.**
 - **Connectionless RAT will be explored by Intel – optional for integration with connectionless core network**
 - Stage 1 will also involve integration of vendor solution in CORD service framework. This includes
 - Use of ONOS as SDN controller.
 - Development of “SGW/PGW application” in ONOS. Role of this application will be to map restful API’s from MME+ application to OF rules towards Radisys SGW/PGW data plane component.
 - Development of XOS service model for eNB service, MME+ service and SGW/PGW data path service.

Stage 1 PoC Overview



Intel provides: UE, eNB, MME(NG4T) and Control Plane
 No change on RAT interface, S1-MME interfaces
 Changes on the network interface of eNB

Radisys provides: Service Gateway

Stage 2: End-2-End Connectionless LTE

Stage 2 objectives:

- Stage 2 only start after we finish stage 1; and need to start consideration for mobility.
- Stage 2 may target to end-2-end connectionless PoC