Towards building ICN network slice in mobile networks

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Introduction

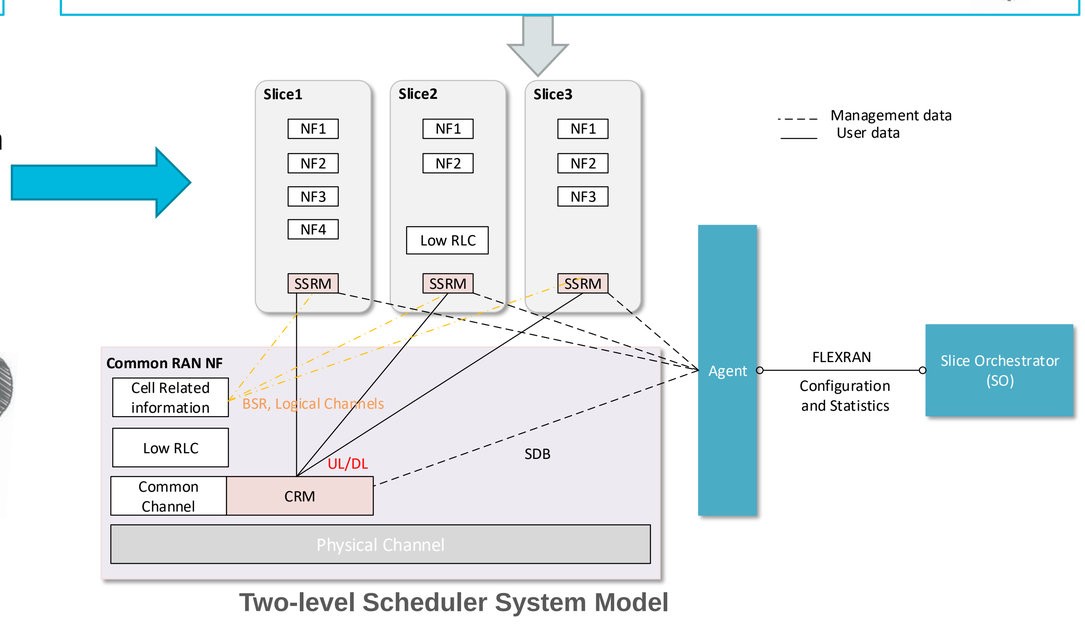
- In the 5G systems, the current “one fits all” network architecture is no more efficient.
- Information Centric Networking (ICN) aims at enriching network-layer functions with content awareness, hence routing, forwarding, caching and data-transfer operations are performed on topology-independent content names rather than on IP addresses.
- In this thesis, we envision to enable ICN in mobile network by using the concept of Network Slicing.

Context

Network Slicing requires a sophisticated mechanism to share resources among the running slices.

- The core and transport network resources can be easily dimensioned and isolated for slices.
- The RAN resources are still difficult to share. Several research have been launched in this context [1] , including the concept of **two-level scheduler**

- **Level 1** slice specific: consists in allowing each slice to use its own scheduler and schedules UE with virtual Resource Blocks (vRB).
- **Level 2** considers the slice-specific proposal to assign UE to pRB.



Two-level Scheduler System Model

Challenge

- **How to compute the number of pRB values for each slice in the second level that respects the SLA of a Network Slice?**

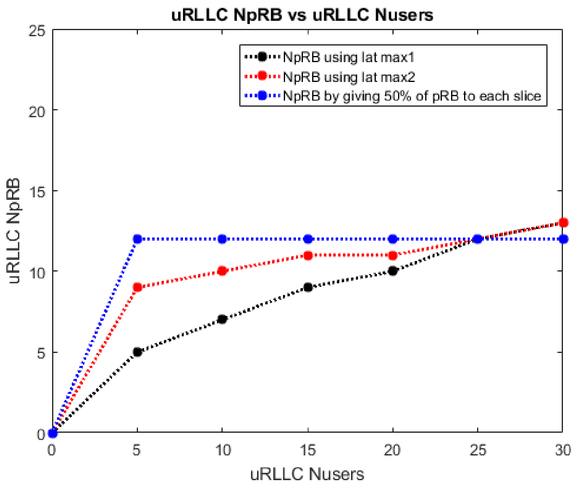
Our contribution

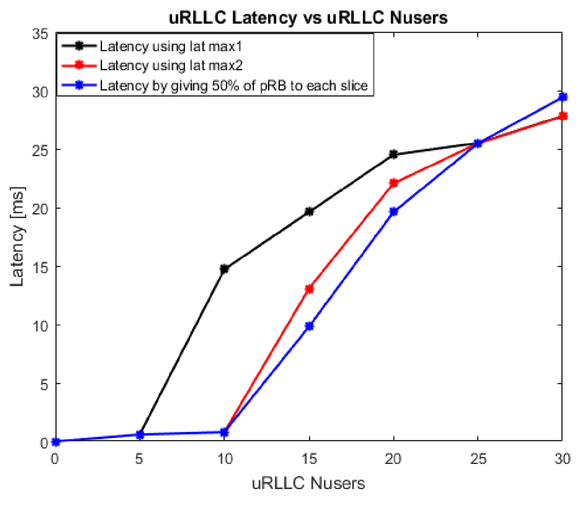
- ✓ A novel algorithm, which first derives the number of pRB (NpRB) per slice using the information obtained from the slice template, filled by the Slice owner.
- ✓ The algorithm is run at the Slice Orchestrator level.
- ✓ Periodically the SO computes the number of pRB for a slice according to the CQI feedbacks obtained from the eNodeB and communicate this information via the FlexRAN protocol (programmable RAN) to the eNodeB

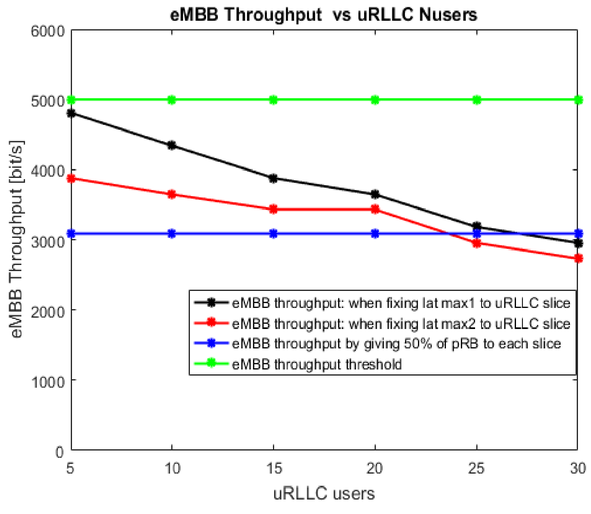
Slices

- **eMBB** (enhanced Mobile BroadBand) requests high bandwidth. → Estimation of the NpRBs required based on the number of users of an eMBB slice as well as the data rate required by the application running on top of the slice
- **uRLLC** (ultra-Reliable Low-Latency communications) aims to minimize the latency and maximize reliability. → Estimation of the NpRBs by keeping the delay below a threshold as specified by the slice owner. We use queuing theory by assuming that all user of the uRLLC slice share the same queue, which is modeled as M/M/1/K. Using Little law we can estimate the delay, and control the later by deriving the service rate (i.e. NpRBs).

Results







- The determination of the NpRB values in each slice of the second level in [1] was by percentage, without taking into account the requirements of the slices.
- Our algorithm consists in assigning the NpRB according to the requirement of slice.
  - **uRLLC slice**: we consider that lat_max 1 and lat_max 2 are the latencies required by uRLLC slice users, with lat_max 1=1s lat_max2=0.1s.
  - **eMBB slice** : we consider that the required throughput is 5000 bit/s

Conclusion

The preliminary results obtained via computer simulation, show that the proposed algorithm is able to well drive the NpRB value for each type Network Slice (i.e. uRLLC and eMBB) that allows to respect the SLA (Service Level Agreement) defined in the slice template

Reference

[1]: Ksentini, Adlen and al.” **PROVIDING LOW LATENCY GUARANTEES FOR SLICING-READY 5G SYSTEMS VIA TWO-LEVEL MAC SCHEDULING” ,** IEEE Network, November 2018

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