A Hierarquical MEC Architecture: Experimenting the RAVEN Use-Case

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Intel

Introduction and Objective

- General or high-level objective: provide user-oriented service with quality of experience
  - Heterogeneous classes of users, consumers, machines, other services
- Service-level objective: provide optimized video streaming service using commercial terminals
  - Perceived live video quality
  - High traffic demand, low latency, real-time network information, guarantee QoS, etc.
- Solution-level objective: real-time adaptive video streaming employing a MEC platform - hierarchical architecture and aware of RAN conditions
  - RAVEN - Radio Aware Video optimization in a fully Virtualized Network

ETSI MEC PoC

PoC#1: Video User Experience Optimization via MEC - A Service Aware RAN MEC PoC

PoC#2: Edge Video Orchestration and Video Clip Replay via MEC

PoC#3: RAVEN - Radio Aware Video Optimization in a Fully Virtualized Network

PoC#4: FLIPS – Flexible IP-based Services

PoC#5: Enterprise Services

PoC#6: Healthcare – Dynamic Hospital User, IoT and Alert Status Management

PoC#7: Multi-Service MEC Platform for Advanced Service Delivery

PoC#8: Video Analytics

PoC#9: MEC platform to enable low-latency Industrial IoT

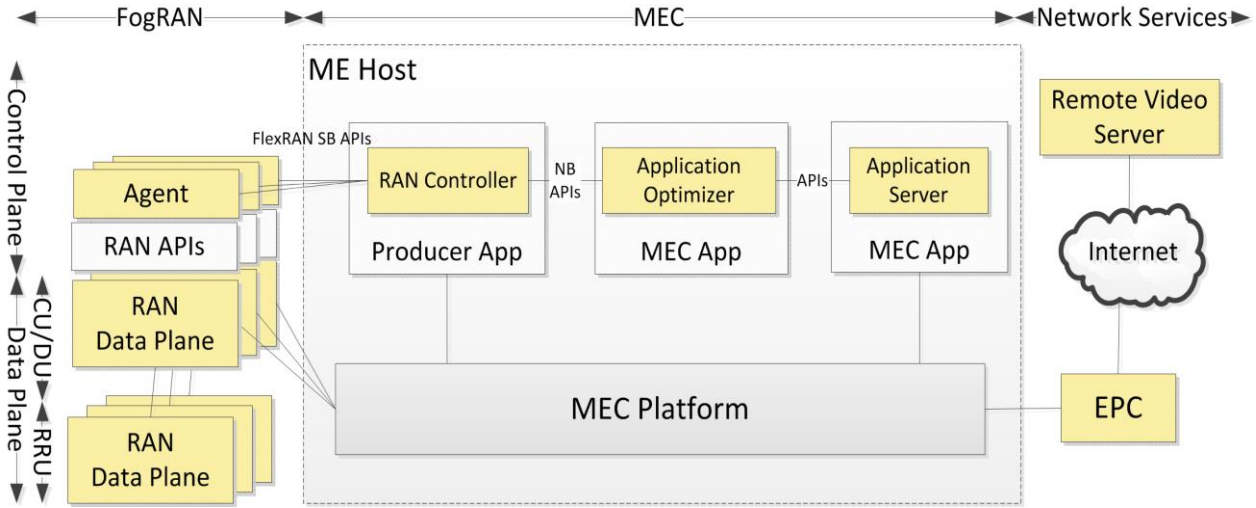
PoC#10: Service-Aware MEC Platform to Enable Bandwidth Management of RAN

PoC#11: Communication Traffic Management for V2X

PoC#12: MEC platform to enable OTT business

Hierarchical MEC Architecture

- LTE-based but general design suitable for future RAN technologies (e.g. 5G NR)
- Three components: FogRAN (Cloud-RAN), MEC (incl. RAN Controller), Network services
- Realized through FlexRAN software defined-RAN: defines southbound APIs and control protocols for interfacing RAN controller and agents
- Agents gather real-time radio information



PoC#3 - RAVEN – Radio Aware Video Optimization in a Fully Virtualized Network

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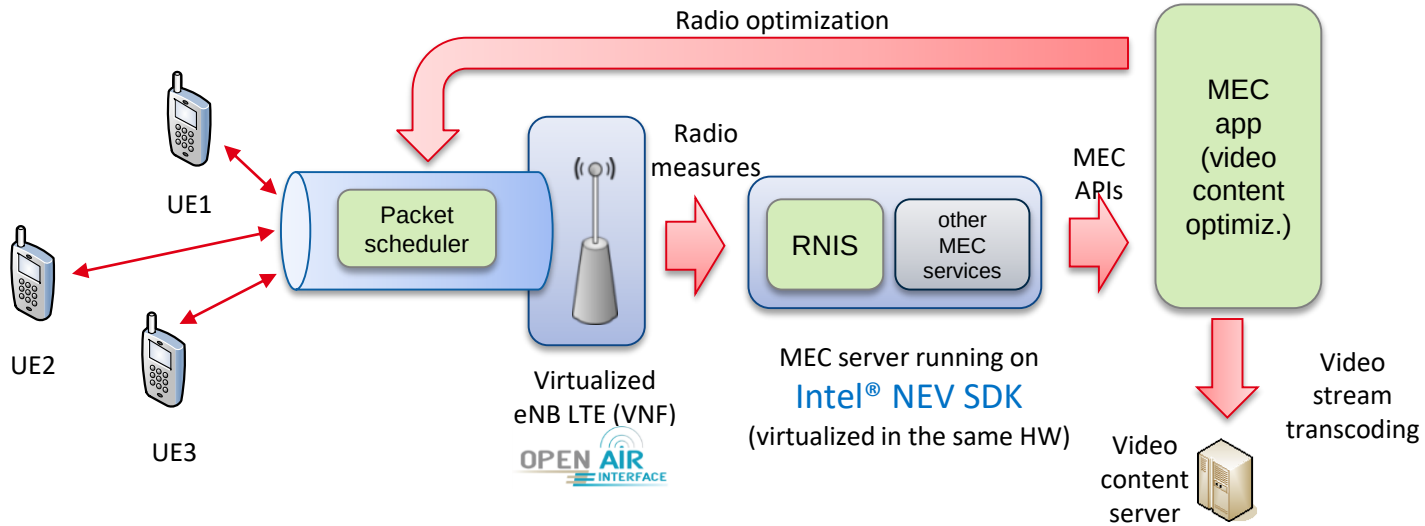
- Video optimization application aware of the radio conditions in the cell
- MEC application co-located with eNB and communicating with video content server.
- Quality of the video streams adjusted according to radio conditions of users.



- Video streams and quality perceived by users improved thanks to proximity and usage of MEC Video Optimization Application

PoC#3 - RAVEN – Radio Aware Video Optimization in a Fully Virtualized Network

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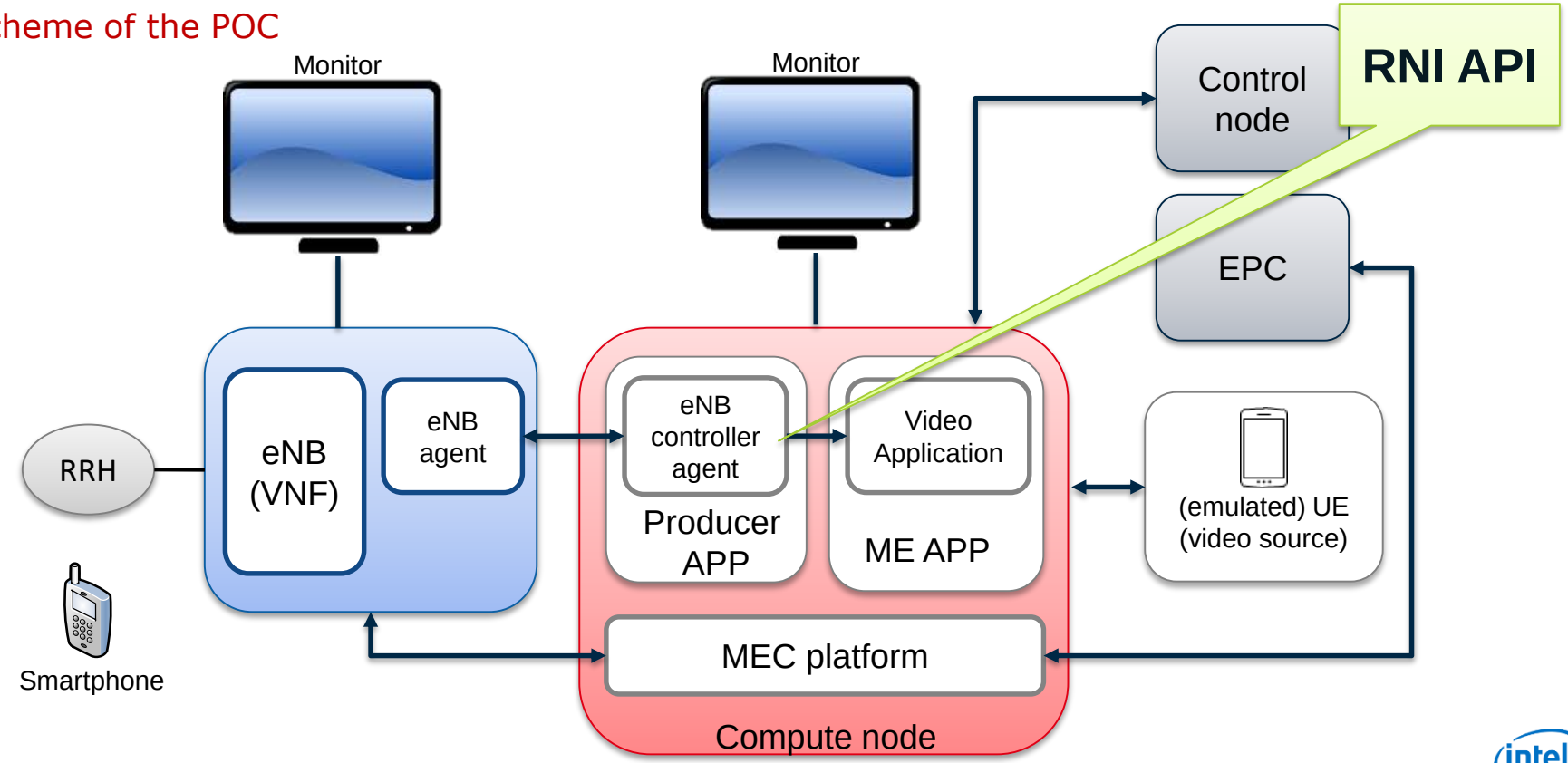
Scheme of the POC



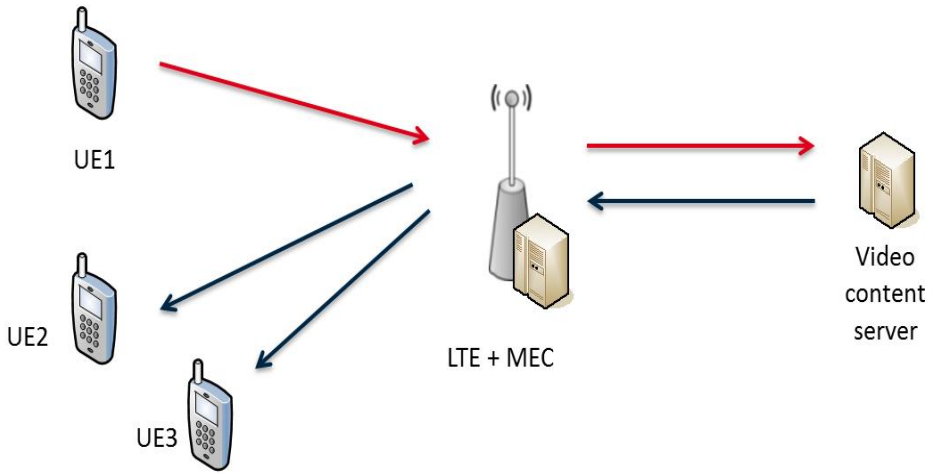
RAVEN use case demonstration

- Three steps:

1. One UE records and sends a video stream to the video server in uplink (e.g. UE1);

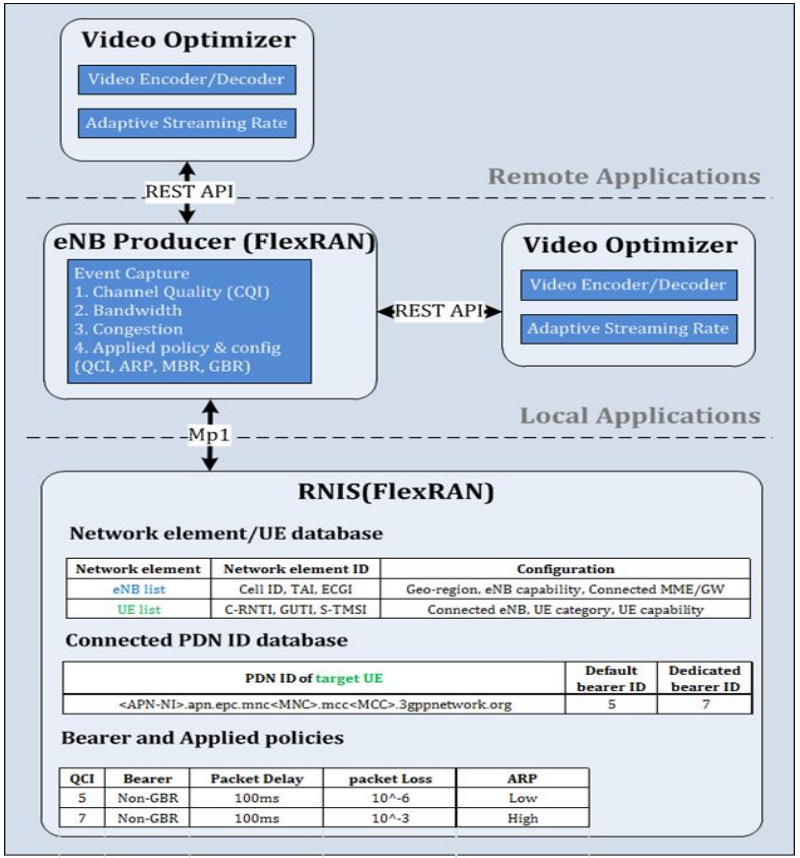
2. Server receives and distributes video stream to the registered UEs in downlink (e.g. UE2 and UE3);

3. MEC platform captures the congestion or channel quality event and sends a trigger to the application optimizer, so that adjusts accordingly the quality of the video streams at the application server



RAVEN: RNIS API in eNB producer

- Rich set of RNIS API specified and developed by ETSI MEC
- Both RESTFUL and message-based Application API supported
- Event-driven, periodic, and one-shot
- Support eNB status monitoring and fine-grain configuration
- Video optimizer registers to a set of events at the eNB producer



RAVEN: tests of RNI implementation

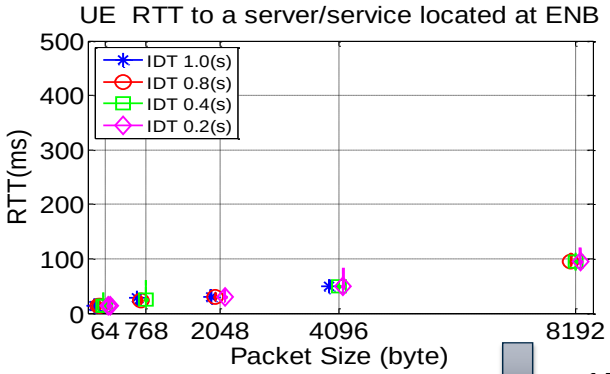
- Measured maximum sustainable TCP bitrate with discrete congestion level based on CQI.

CQI	Congestion Level	Downlink (Mb/s)	Uplink (Mb/s)
11- 15	Low	15.224	8.08
9- 11	Low	11.469	6.04
7- 9	Medium	9.88	4.47
4- 7	Medium	5.591	2.49
0-4	High	1.08	0.69

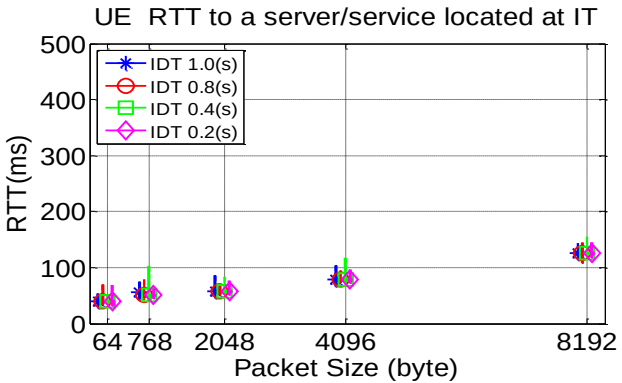
- Measured results reveals the maximum sustainable bitrate as a function of user channel quality indicator (CQI), which is combined with the cell congestion level to adapt the streaming quality

RAVEN PoC: Measured packets RTT

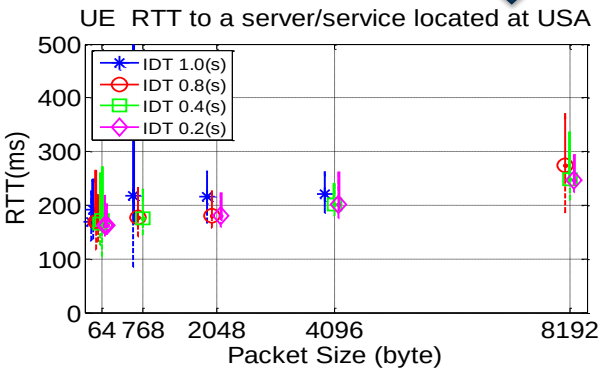
- Comparison of two MEC deployment options and related performances

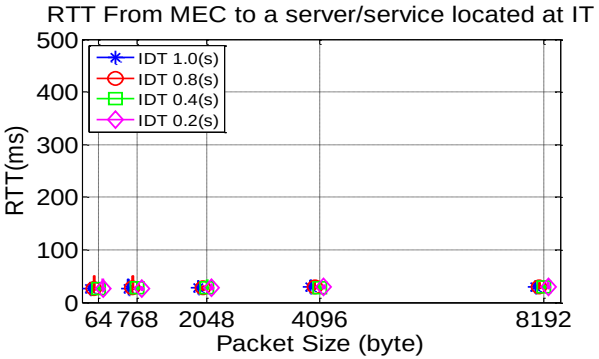


~30ms



~150ms





Conclusions

- Proposed hierarchical MEC architecture demonstrated via PoC of RAVEN use-case
- PoC assembled in a small-scale open-source virtualized LTE environment and using commercial terminals
- PoC demonstrates real-time adaptive video streaming empowered by Edge Computing
- Experiments demonstrate the benefit of radio information in optimizing the video streaming
- Quality perceived improved with the help of RNI API specified by ETSI MEC

Thank you!

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