Moving UPF functionalities at the edge for private 5G networks

www.sma-rtty.com
Passionate team with AI, 5G and embedded computing skills

8+ core engineers with PhDs
2 R&D centers in Europe
2 Scientific Advisors
8+ Industrial & academic partnerships
∞ Willingness to accept new challenges

Who are we

Luca, PhD, CEO
Heterogeneous hardware architecture and computer vision algorithms

Kamel, PhD, R&D engineer
Deep Learning and Artificial Intelligence

Federico, PhD, R&D engineer
Parallel computing optimizations for embedded systems

François, Scientific advisor
Expert in smart camera and embedded vision
Professor UCA
Where are we

Clermont Ferrand
Sma-RTy SAS
Institut Pascal
4 Avenue Blaise Pascal
63178 Aubière France

Milano
Sma-RTy Italia SRL
Via dell’Artigianato 2, Carugate
20061 Italia
Vision

Interconnected services from different vendors

5G communication infrastructure

Digital Twin applications
5G NPN development trend

5G Mobile devices in 2025, accounting for 20% of total connections

UPF is the key to expand the B2B market in the 5G era.

69% of mobile operators consider that the B2B market plays a crucial role for 5G profitability

source: The mobile Economy 2020, GSM Association
UPF definition

- User Plane Function (UPF) is a basic NF (Network Function) in the 5GC architecture defined by 3GPP
- As a user-plane NF, UPF is controlled and managed by SMF in 5G network,
- It performs service flow identification (DPI), packet processing, and charging in accordance with various policies delivered by SMF.
Typical UPF scenarios

Large bandwidth
- Video applications, drone live broadcast, HD video monitoring, AR/VR, and machine vision, require UPF to provide large bandwidth.

Low latency
- Industrial control, Internet of Vehicles (IoV), rail transit, smart grid, and other applications, require UPF to provide micro-second ultra-low latency forwarding capability.

High reliability
- Remote surgery, precision manufacturing, and other applications with special requirements for reliability require UPF to provide multi-level reliability assurance such as dual connectivity and dual tunnels.
### SLA requirements for UPF

To meet differentiated SLA requirements for latency, bandwidth and reliability, UPF needs to be deployed at different positions.

<table>
<thead>
<tr>
<th>Location</th>
<th>Performance Throughput</th>
<th>E2E Latency</th>
<th>Function Set</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central UPF</td>
<td>&gt;200 Gbps</td>
<td>&gt;50 ms</td>
<td>Full function set</td>
</tr>
<tr>
<td>Regional UPF</td>
<td>100~200 Gbps</td>
<td>&gt;30 ms</td>
<td>Full function set</td>
</tr>
<tr>
<td>Edge UPF</td>
<td>&lt;100 Gbps</td>
<td>&lt;15 ms</td>
<td>Edge offloading Customized function enhancement</td>
</tr>
</tbody>
</table>
UPF edge deployment

5GC

Regional UPF

Edge UPF

UPF

UPF

Internet

MEC APP

APP

Internet

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UPF edge deployment benefits

- Directly process high-bandwidth services at the edge, saves the bandwidth consumption of the backbone network.
- Latency-sensitive services need to be deployed at the edge of a network to be close to users.
- Some industry applications have high data confidentiality and need to be restricted to specific edge areas. It needs to reduce the risk of network data leakage and protect user data security and privacy.
UPF HW acceleration

Regional UPF

Edge UPF

UPF HW accel

MEC APP

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UPF HW acceleration

UPF App
Guest OS
Host OS

Control interface

Input traffic

HW Accel

Processed output traffic

Edge micro datacenter
Sma-RTy application

Remote

5G NR

5G NR

5G CN

AMF

SMF

UPF

Cloud

On-site

RRU

RRU

gNB

RRU

Tracking

Intrusion Detection

Live Monitoring

MEC App
Sma-RTy/OAI integration

- OAI UE, OAI gNB, and CN are already deployed in our facilities
- We are currently working on the OAI code to understand:
  - Already implemented functionalities
  - Useful functionalities that miss for Sma-RTy application
- As next step, we foresee to test and improve the system stability
Conclusion

- UPF is an important network function (NF) of the 5G Core Network, UPF processes and routes data traffic.
- 5G private network can benefit from using an edge UPF deployments for different slices.
- Sma-RTy 5G private network has been presented with a focus on the exploitation of edge UPF.
- Next steps consider the implementation of the presented architecture in OAI framework.
Thanks for your attention

www.sma-rtty.com  info@sma-rtty.com