USE CASES AND OPPORTUNITIES WITH M-CORD

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LIFE IS FOR SHARING.

AGENDA

M-CORD: Overview and Value Proposition

Lightweight EPC Use Case

Optimizing the User Plane Handling: SDN'ization & VNF Offload

Challenges & Enablers

Summary and Next Steps

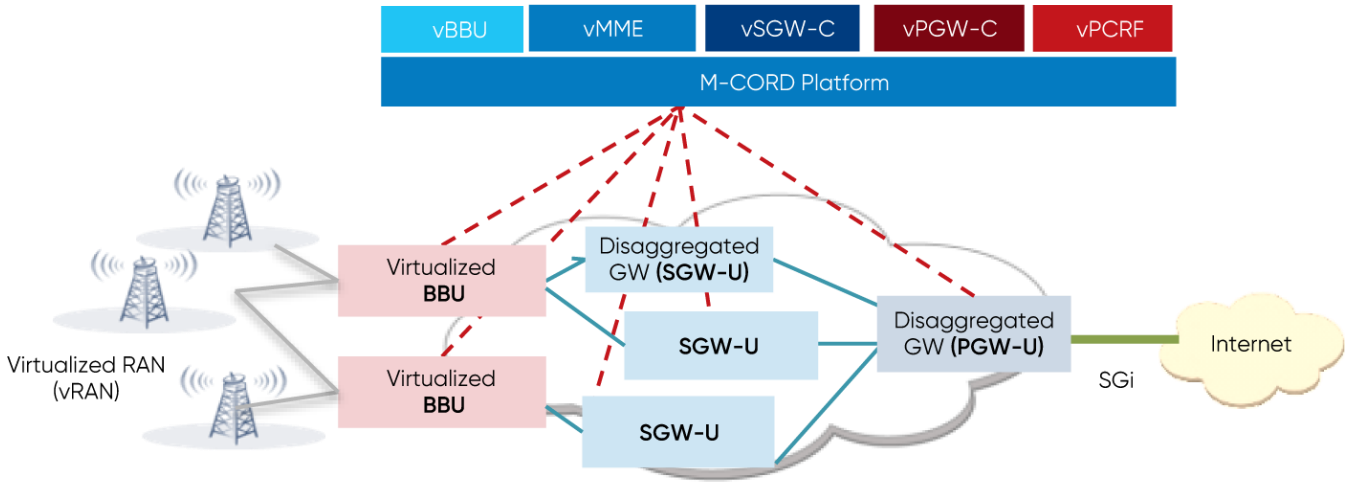
ONF M-CORD – THE PLATFORM AND ITS RELEVANCE

What is M-CORD*?

Solution for mobile & wireless networks, based on CORD open source exemplar platform

- Disaggregated Packet Core (EPC) embracing a cloud-native scale-out design
- Disaggregated, Virtualized and programmable RAN for high flexibility and scalability
- Multi-Access Edge for customized services and improved QoE

Cloud-Native Virtualized & Disaggregated RAN and Core



*Source of text and figure: ONF.

RELEVANCE FOR OPERATORS

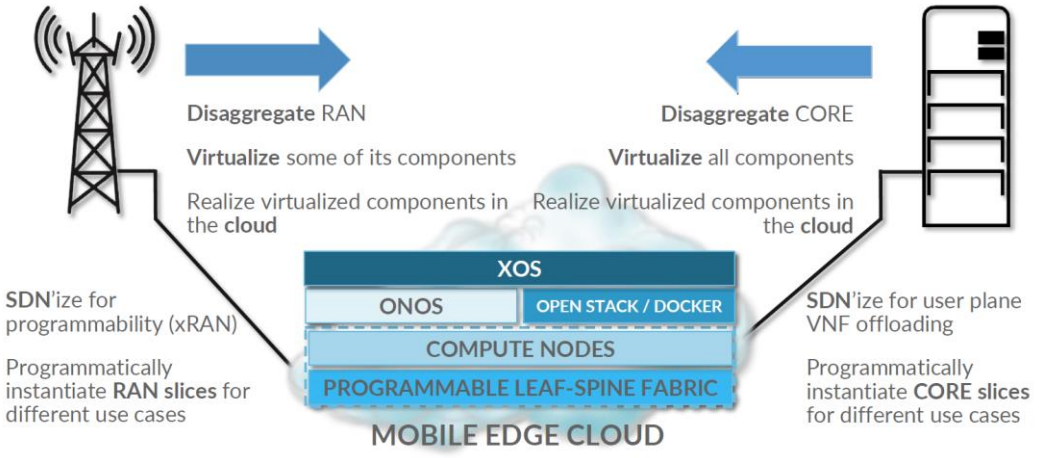
Matches with operators' plans & needs for re-architecting (mobile) network infrastructures

- Enhanced resource utilization and cost-efficient deployment, leveraging commodity hardware and open source software (addressing cost-per-bit & growing diversity of use case and requirements)
- Provide customized services and differentiated QoE to customers
- Platform & Service Automation

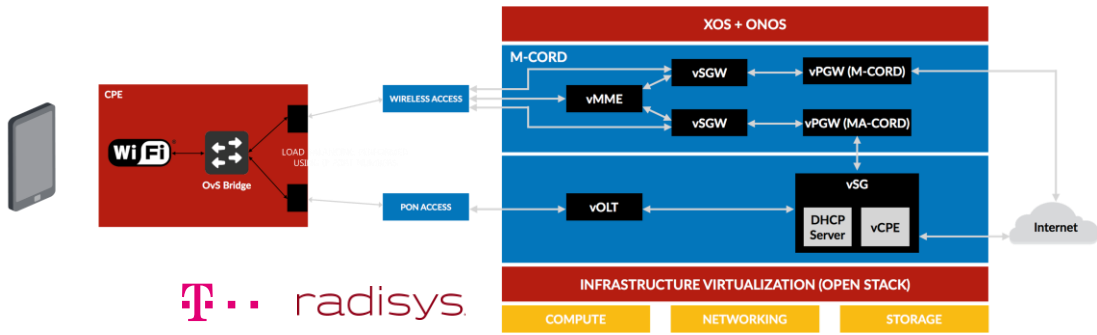
➢ Allows addressing EPC and (v)RAN use cases short-term, serving as foundation for 5G networks and services mid-term

M-CORD'S VALUE AS OPEN SOURCE EXEMPLAR PLATFORM -PROVEN THROUGH PROTOTYPES AND DEMONSTRATIONS

M-CORD covers a multitude of use cases in RAN, Edge and Core



Multi-Access CORD prototype on M-CORD



Based on operators' plans and priorities, interest is forming around a set of use cases, incl.: Lightweight/Converged Packet Core, disaggregated Access and Edge Cloud.

*Source of the figure on the upper-left : ONF.

LIGHTWEIGHT EPC USE CASE

Key business assumptions

„Start-small" approach - focus on Fixed Mobile Substitution service only

Limited to 3GPP Gateway with distributed architecture

Minimum Viable Product approach (only mandatory features required to go for production)

LIGHTWEIGHT EPC USE CASE - REQUIREMENTS

Technical considerations

- Initially no virtualization required (bare metal approach with max efficiency for user plane handling)
- DPDK native application, but with support of standard Linux OS networking mechanisms (routing/switching/monitoring)
- Critical features:
  - Bandwidth cut to 20/60 Mbps per user (derived from subscription)
  - Lawful interception (required by law)
  - Simple billing (for data retention, required by law)
  - 2G/3G/4G support
- Necessary interfaces: S1-U, S11, Sgi, Gn, X1/X2/X3, GTPP, S5/S8

LIGHTWEIGHT EPC USE CASE – STATUS AND NEXT STEPS

What do we have?

M-CORD interest and collaboration group

Comprehensive exemplar platform

Thanks to Intel's and Sprint's contributions to NGIC and C3PO

Scalable on NFVI with Data Plane Acceleration (DPDK, etc.)

M-CORD platform demonstrated multiple times (MWCs, etc.)

ONF core team with architecture, dev and QA expertise

What do we aim for?

A vibrant, sustainable community, led by operators

Exemplar platform for deployments and extensions

Near-production-grade open source code base

User Plane Optimization leveraging programmable hardware

Deployment in production networks

Supply chain with commercial solutions

Next step: establish reference design, strengthen community around near-production-grade code base, take to deployment

OPTIMIZING U-PLANE HANDLING: SDN'IZATION & VNF OFFLOAD

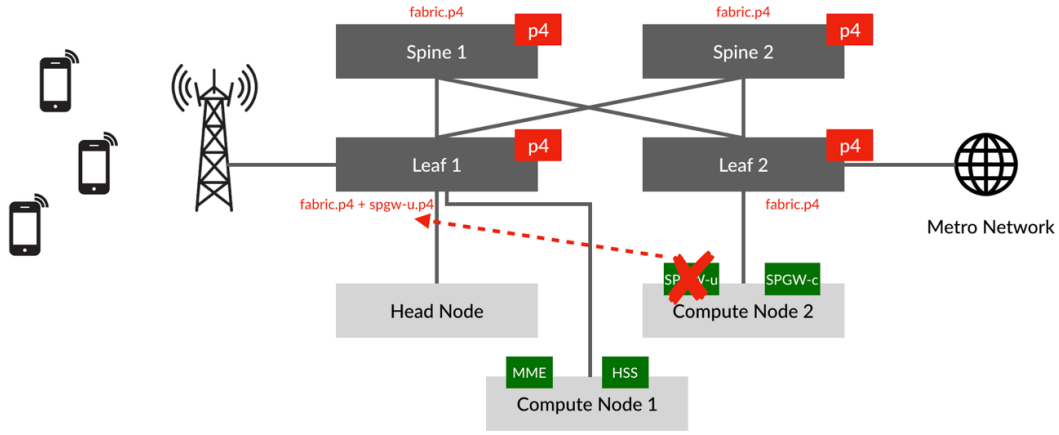
Realization of Control-User-Plane-Separation (CUPS) for fixed and mobile network functions (BNG/SE, S/P-GW):

- Network functions that process and forward user traffic using domain-specific control are realized on high-performance programmable switching hardware with a control plane realized as SDN application
- All other network functions (slow path) continue to be realized on servers running on VMs or containers as VNFs.

Phases: 1) SPGW 2) SE/BNG 3) SPGW+SE/BNG

Use Case addressed with SEBA and UPAN

- Future phases to potentially include disaggregated RAN components



➢ First phase prototype implementation successfully demonstrated by the ONF team at MWC'18

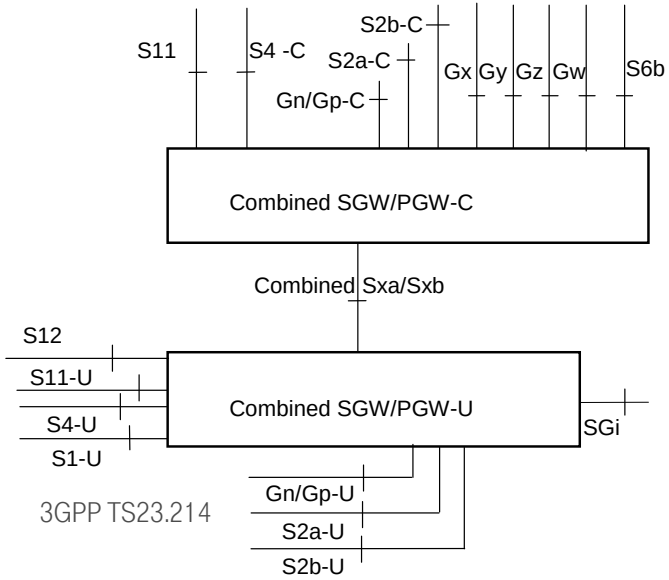
*Source of figure: ONF/Use Case „SDN'ization and Convergence of the 3GPP and BBF User Plane with Programmable Switching Fabric"

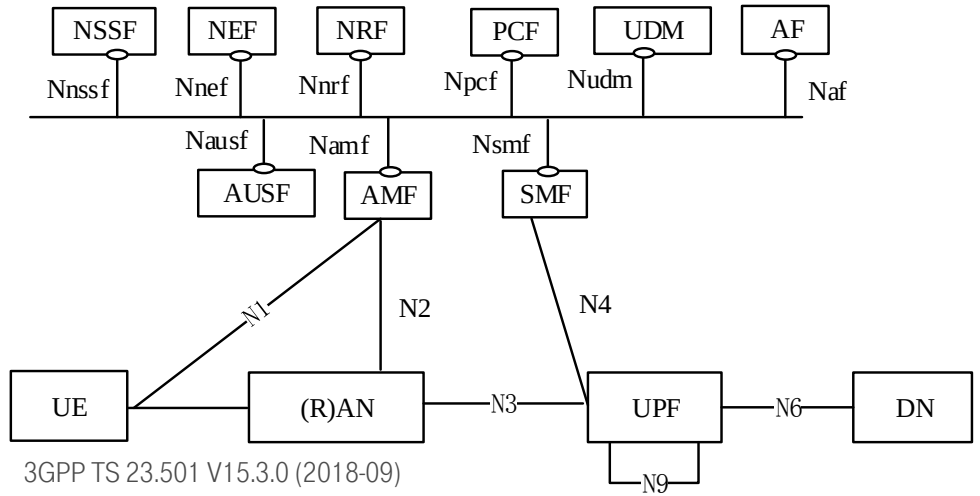
ENABLERS FOR OPTIMIZED USER PLANE HANDLING: CUPS

CUPS: Control and User Plane Separation (of EPC nodes)

Concept enabling a more flexible function deployment

Built into 3GPP architecture since 3GPP Rel.14





Foundational and inherent concept moving to 5G

as well as for Fixed Broadband and FMC functions

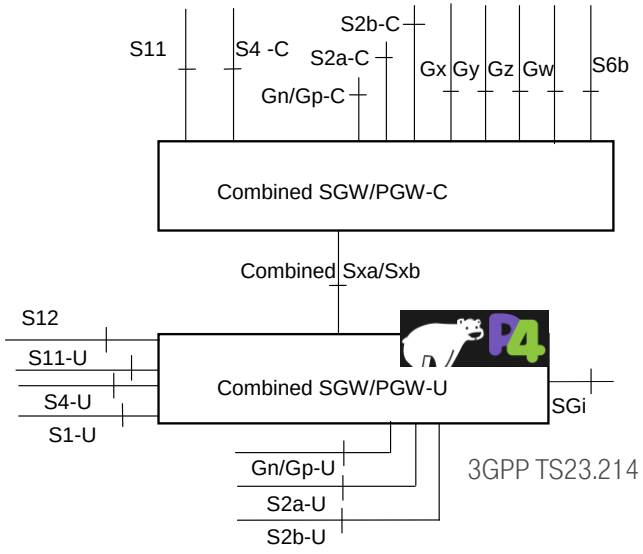
(incl. 5G SMF/UPF, AGF, BNG)

ENABLERS FOR OPTIMIZED USER PLANE HANDLING: P4

Would it be possible to deploy M-CORD User Plane using P4 today?

DT internal analysis identified some key challenges:

- High number of flows (~millions)
- Flow creation rate (~1000/s)
- Enforcement of dynamic policy and QoS
  (incl. number of policers, MBR/GBR support per individual flow)
- Downlink packet buffering (for traffic shaping and UE mobility)



Conclusion: it is challenging to support full-blown centralized EPC using P4 today

Solution approach: Start focusing on Fixed Mobile Substitution/FWA and Hybrid use cases, go from there

EPC USER PLANE HANDLING WITH P4

PoC for the simplest use cases (FMS, Hybrid Access)

- No mobility
- No service awareness and classification
- No policy rule enforcements
- No shaping
- No QoS
- Dynamic IP address assignment

➢ **Test basic functionality and some performance issues**

Analysis

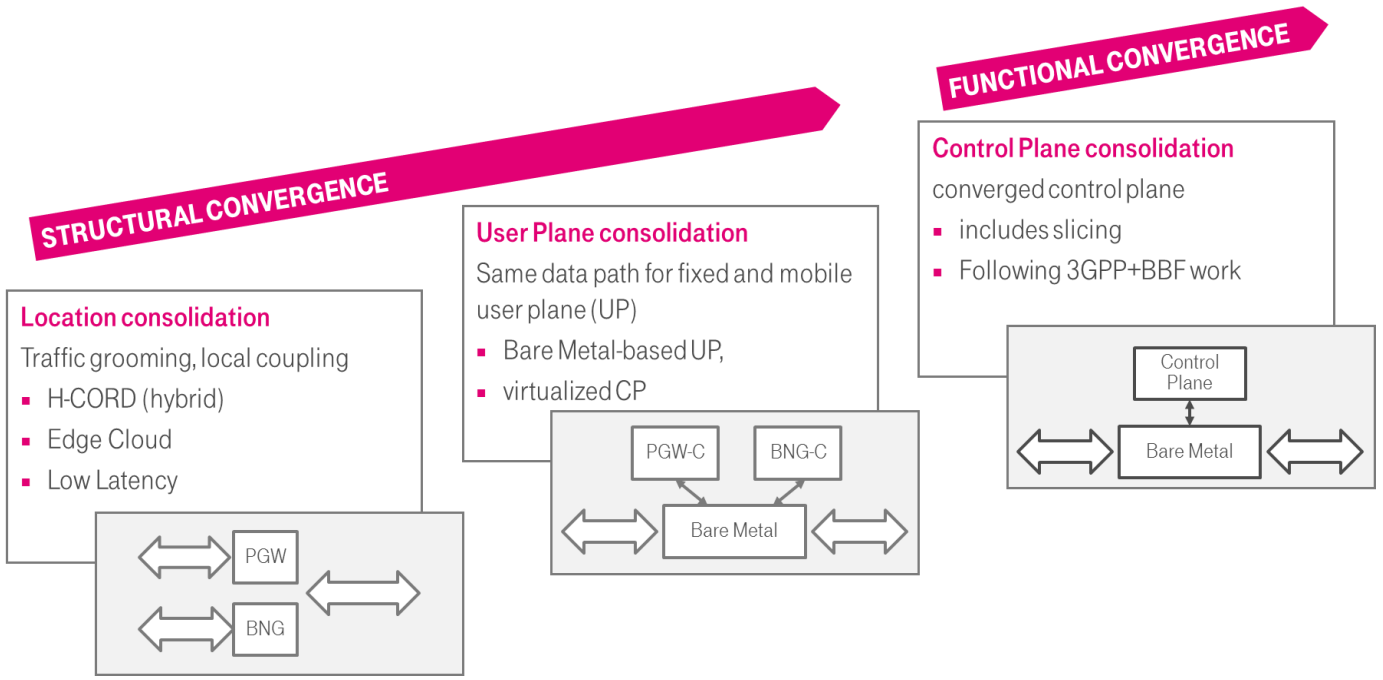
- Performance requirements: number of parallel flows on network level and per site, flow setup rates, rule change rate
- Break-down of Sxa and Sxb: Which sub-functionality is really required?
- Break-down of QoS/queueing/shaping requirements
- Where/how to implement the Control Plane Agent (de/centralized, ONOS application)?

Is there interest in the community for such a proof-of-concept?

5G IS CALLING… CONVERGENCE AN EXPECTED RESULT

Relevant standards work in progress at 3GPP, BBF, IETF

- Service-Based Cloud-Native Architecture
- 5G Fixed Mobile Convergence
- CUPS Concept, Interfaces and Protocols
- Enhanced User Plane Protocols



SUMMARY AND NEXT STEPS WITH M-CORD

Address M-CORD use cases according to priorities and plans for deployments

Lightweight Packet Core: short-term need and low-hanging fruit

Leverage synergies for convergence with SEBA (SDN-Enabled Broadband Access)

Add ORAN compliant RAN components: abstraction & disaggregation, real time/near real time control

Enable Edge Computing: requires support of dynamic service lifecycle, multi-tenancy, full automation

Next Step: establish Reference Designs and collaborate on deployable Exemplar/Reference Platform

Operators jointly taking lead on structuring and defining new RD(s)

Ramp up collaborative community development

Drive hardened components and platforms for deployments at scale

➢ **We are looking forward to teaming up with the community**

THANK YOU