OPEN SOURCE EPC

OPERATORS' JOURNEY TOWARDS THE CLOUD NATIVE ONF-BASED TELCO CORE

Michal Sewera
T-Mobile PL

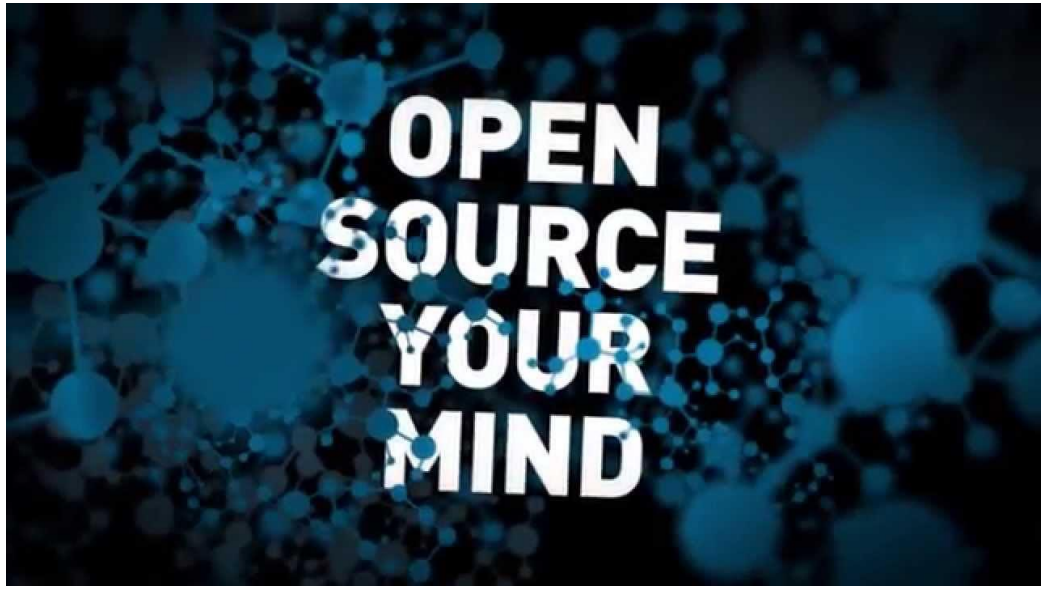
LIFE IS FOR SHARING.

KEY MESSAGE: IT'S ALL ABOUT DISRUPTION

- New technology as a main source of disruption
  - Radical change instead of „small adjustments"
  - Significant increase of efficiency
- Examples
  - Transistor
  - Integrated circuits
  - Linux OS

WHY OPEN SOURCE ?

- New business model - it's about transparency of the software deliverables
- Telco service based architecture with higher flexibility and programmability (REST APIs) in the area of integration with 3rd party systems (i.e. network exposure functions)
- Cloud native ecosystem with micro service based architecture is already providing more transparent solutions exposing open source based components (i.e. istio service mesh) – this is true even for commercially available EPC solutions
- Operators perspective – gradual transition from RFQ/SLA mode of action towards full DevOps with build, run, release responsibilities

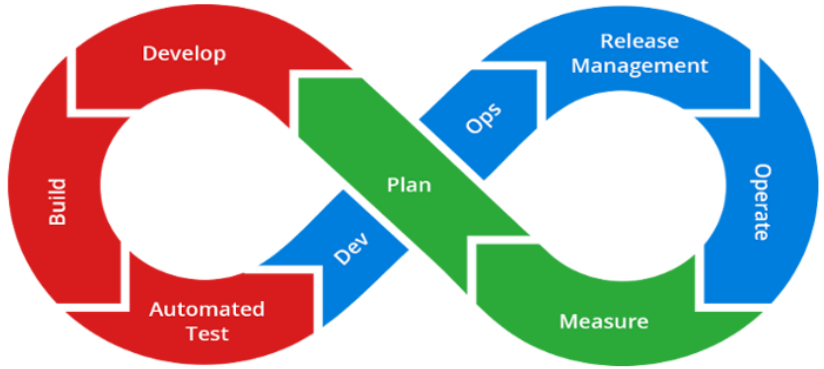


JOURNEY TOWARDS THE CLOUD NATIVE

TOWARD TELCO GRADE WEBSCALE FRAMEWORKS

- 12 Factors – properties of the cloud native apps*
  - *Codebase* – use one codebase, even when building cross-platform apps
  - *Dependencies* – explicitly declare and isolate all dependencies
  - *Configuration* - don't store config as constants in code
  - *Backing services* – loosely-coupled resources attached to the app
  - *Build, release, run* – strictly separate build and run stages
  - *Processes* – execute the app as one or more stateless processes
  - *Port binding* – use port binding to export services
  - *Concurrency* – scale out apps horizontally, not vertically
  - *Disposability* – use fast start-ups and graceful shutdowns
  - *Dev/Prod parity* – facilitate continuous deployment
  - Logs – treat logs as event streams
  - *Admin processes* – run admin tasks as one-off processes from a machine in the production environment

*https://12factor.net/



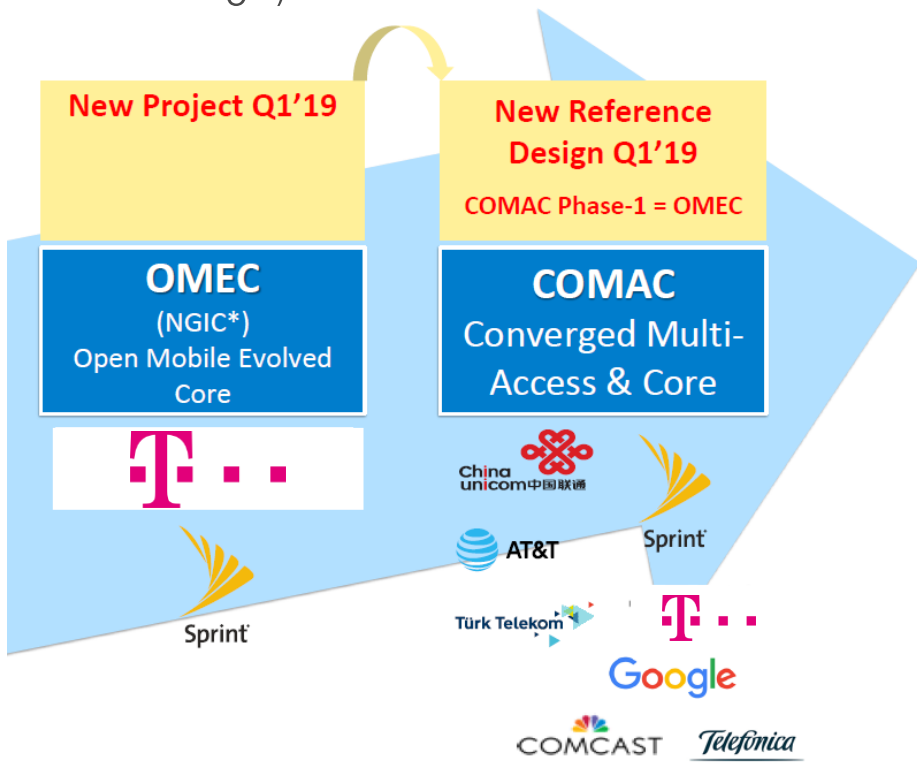
Architecture / Criterion	SOA	µ-service architecture	SBA	Monolithic
Agility	Low	High	Medium	Low
Deployment	Low	High	Medium	Low
Testability	Low	High	Medium	Medium
Scalability	Medium	High	Medium	Low
Performance	Low	Medium	Medium	High
Simplicity	Low	Medium	Medium	High

Source: 5G-PPP Software Network Working Group (From Webscale to Telco, the cloud native journey)

OPEN SOURCE EPC – CASE STUDY

HIGH LEVEL STRATEGY & MAIN ASSUMPTIONS

- Fundamental shift towards Open Source based systems
- Initial Focus on FMS/FMC use case (high throughput but minimal set of EPC features)
- Bare-metal based distributed architecture (with DPDK) to simplify design and minimize cost per Gbps
- ONF based framework (based on OMEC and COMAC reference design)



TMPL FMS 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)
- 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 business 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 (initially only 4G for MVP POC)

FOCUS ON EPC GATEWAY (SGW/PGW)

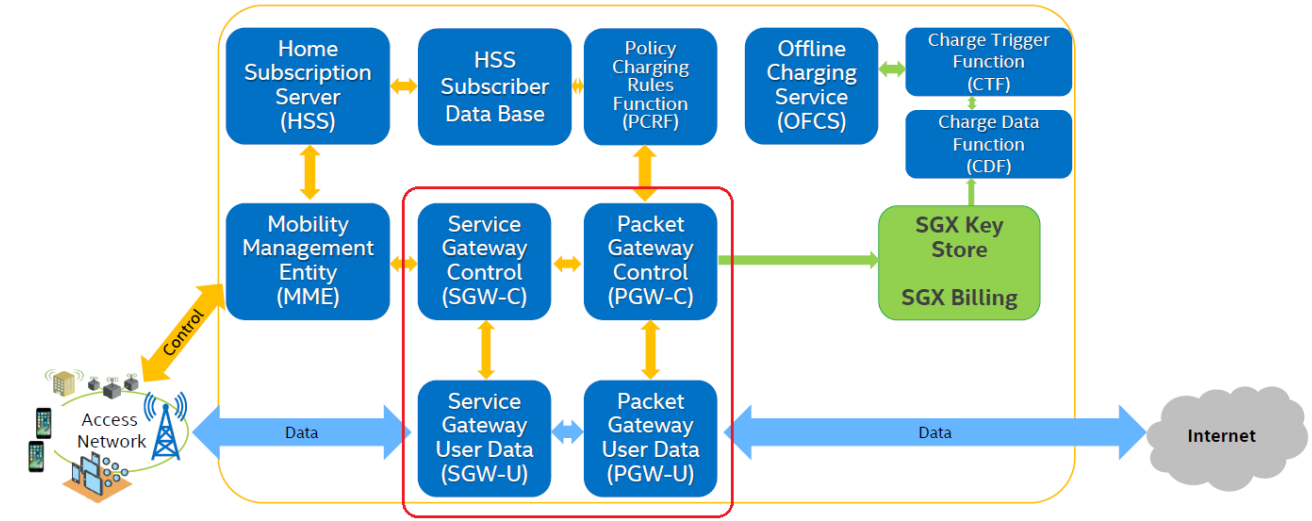
- Solution architecture:
  - FMS traffic can be routed to relevant EPC Gateway (based on APN and subscriber charging characteristics profile – using APN resolution extension mechanism)
  - Initially – only EPC Gateway will be used based on COMAC reference design

OMEC – (COMAC RD Phase-1)

https://www.opennetworking.org/omec/

MME: Mobility Management Engine
HSS: Home Subscriber Services
PCRF: Policy and Charging Rules Function
SGW-C: Service Gateway Control
SGW-U: Serving Gateway User
PGW-C: Packet Gateway Control
PGW-U: Packet Gateway User
OFCS: Offline Charging Service
CTF: Charge Trigger Function
CDF: Charge Data Function

- Complete connectivity, billing and charging
  - Default bearers
  - Offline billing
  - Child protections (domain or 5-tuple)
  - Basic MME (initial attach/detach, etc)
- 3GPP Rel 13 compatibility
- DPDK based data plane, large number of subs
- Optimized for lightweight cost effective deployment
- ONF CI/CD test and verification infrastructure
  - Performance (w/ Polaris emulator)
  - 3GPP compliance (w/ Polaris)
- Future
  - TBD: Based on users' requests and contributions



KEY TECHNICAL REQUIREMENTS

Interfaces to be implemented:

- S1-U
- S11
- S5/S8
- Sgi
- X1/X2/X3 (Lawful interface)
- GTPP (Offline billing)
- Gn (in case of implementing 2G/3G)

Generic functions

- Multiple MME support – ability to define MME IP range (CP config)
- CG-NAT (Optional support)
- GTP-C Echo sequence number
- DNS in PCO
- DHCP function (IP pool for APN configuration)
- Offiline billing & LI

Packet routing and forwarding functions:

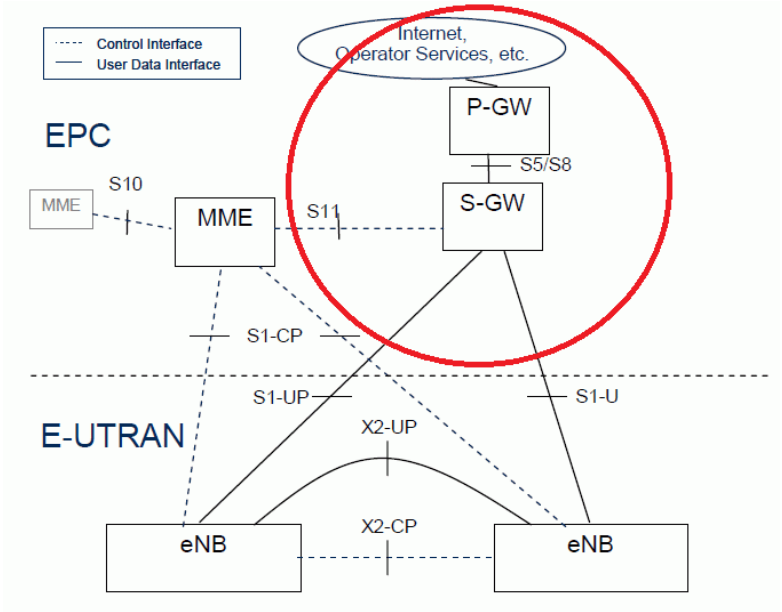
- MTU management (limitation)
- Support for IP packets fragmentation
- Static IP routing
- Dynamic IP routing
- User plane Ipv6 support (not in scope of MVP POC)

EPC procedures

- Attach / Detach
- Tracking Area Update / Routing Area Update
- Service Request
- S1 release
- Subscribed QoS Modification

Mobility management functions

- S/PGW overload control (signalling storm, restoration procedures)
- UL and DL rate enforcement based on APN-AMBR
- ARP/APN-AMBR/QCI for default bearer



CLI - Zero outage configuration management:

- configuration should be changed w/o stopping the S-PGW service e.g. MME IP range, APN Pool, ...

CONTINUOUS INTEGRATION / CONTINUOUS DELIVERY

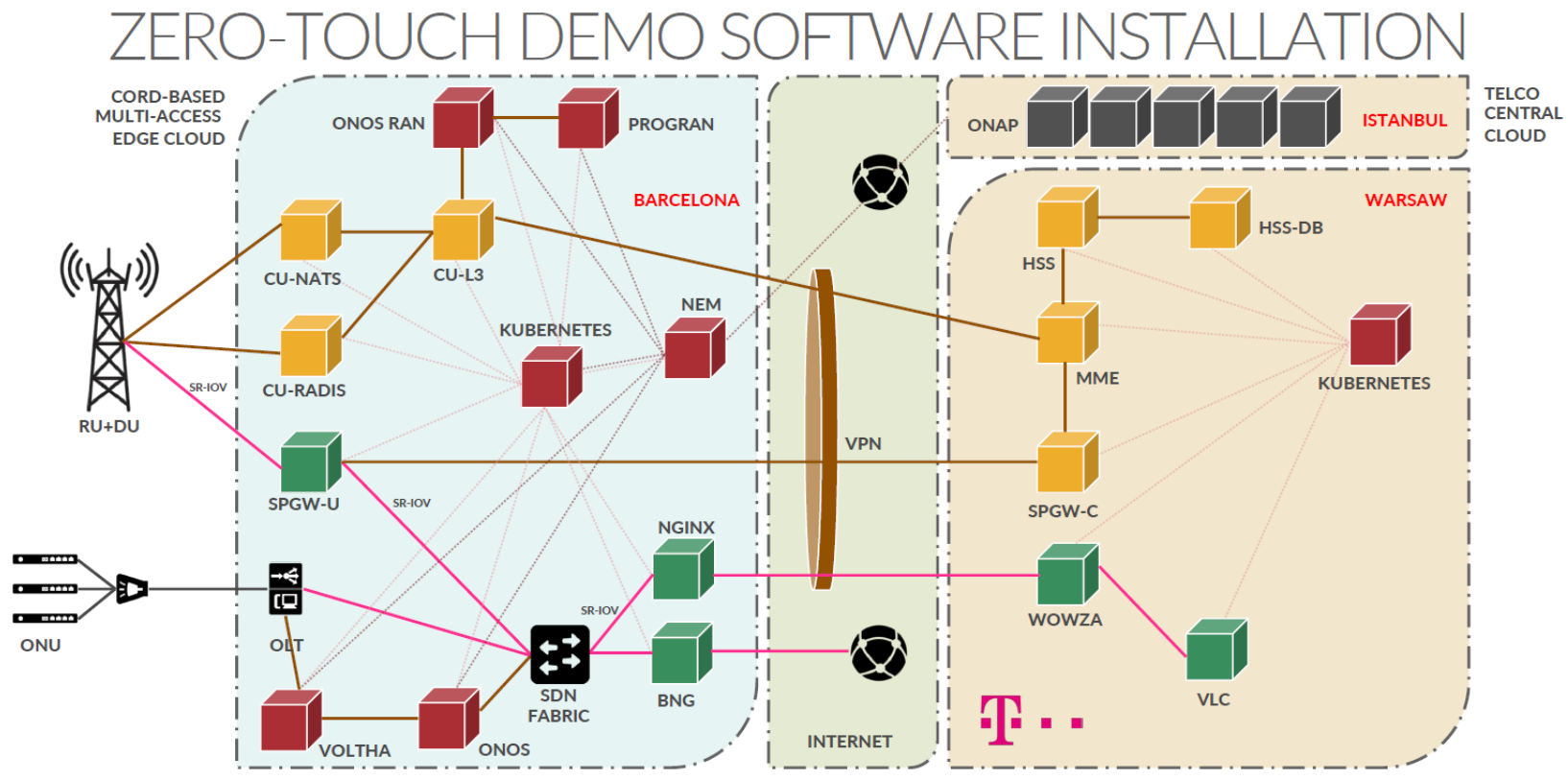
FOCUS ON QUALITY IN BASICS

- Initially it is not about quantity, but **quality!**
- Basic features related with low level EPC core procedures must work perfectly – only if this is fulfilled You can start thinking about new features
- Operator perspective: platform lifecycle management aspects (integration with 3rd party systems, configuration, change management and troubleshooting)
- Recent work in the area of quality was addressing:
  - UE IP allocation
  - IP fragmentation and reassembly
  - CP & DP CLI
  - Billing & LI

DEMO @ MWC 19

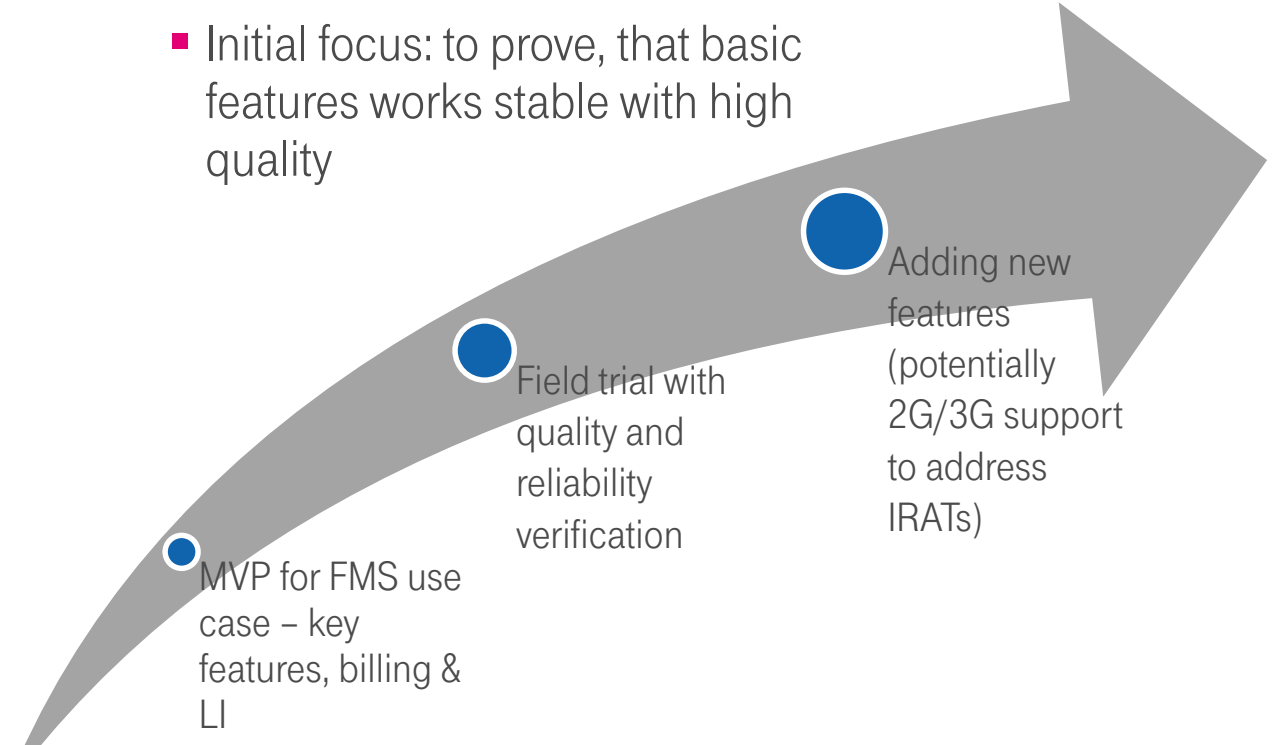
MULTI-CLOUD DEPLOYMENT WITH CUPS

- ONF based multi-cloud environment with SPGW-C in Warsaw and user plane in Barcelona demonstrated @ MWC
- Kubernetes based cloud native environment



OPEN SOURCE EPC - NEXT STEPS

- Thing Big, start small, scale fast...
  - Quality is King!
  - Initial focus: to prove, that basic features works stable with high quality



THANK YOU