Best Practices for Designing and Deploying Robust VoLTE networks

Architectural Alternatives, and Product Choices

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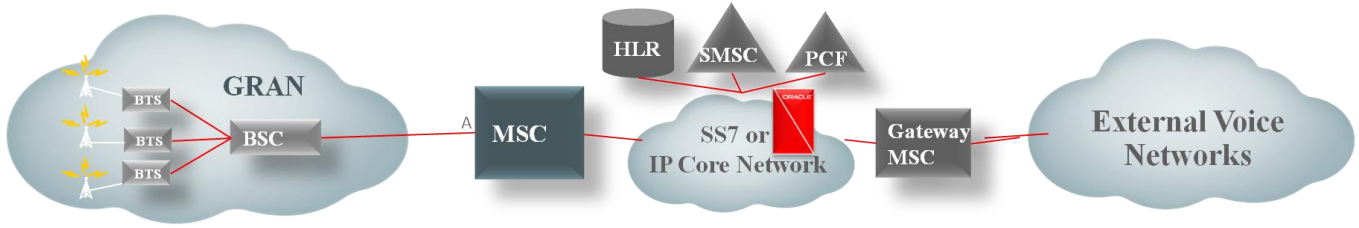
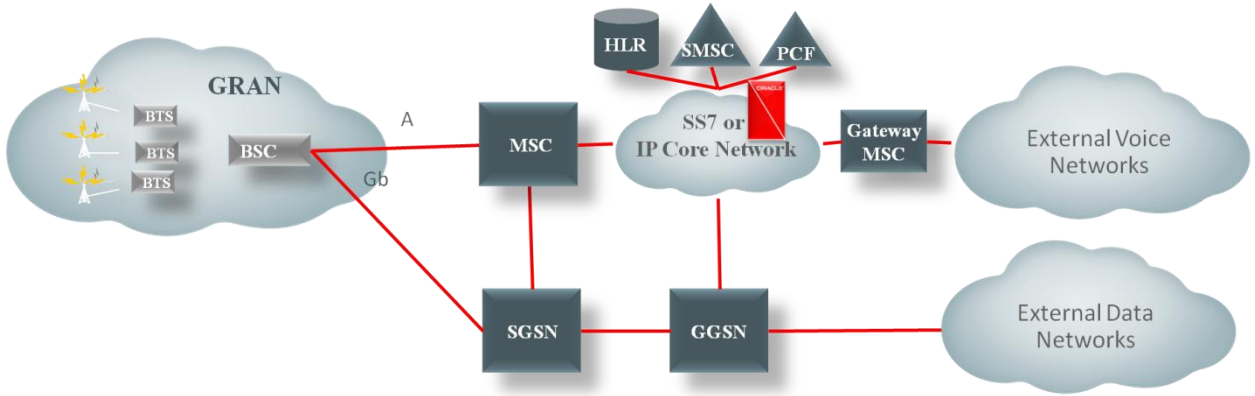
3 Questions in This Session

1. How did we get to VoLTE?
2. What are the challenges of building a functional and robust VoLTE network?
3. What are the architectural and product choices available for overcoming these challenges?

Core Network Evolution - GSM

- GSM covered both the RAN and the core network supplying Circuit Switched Telephony

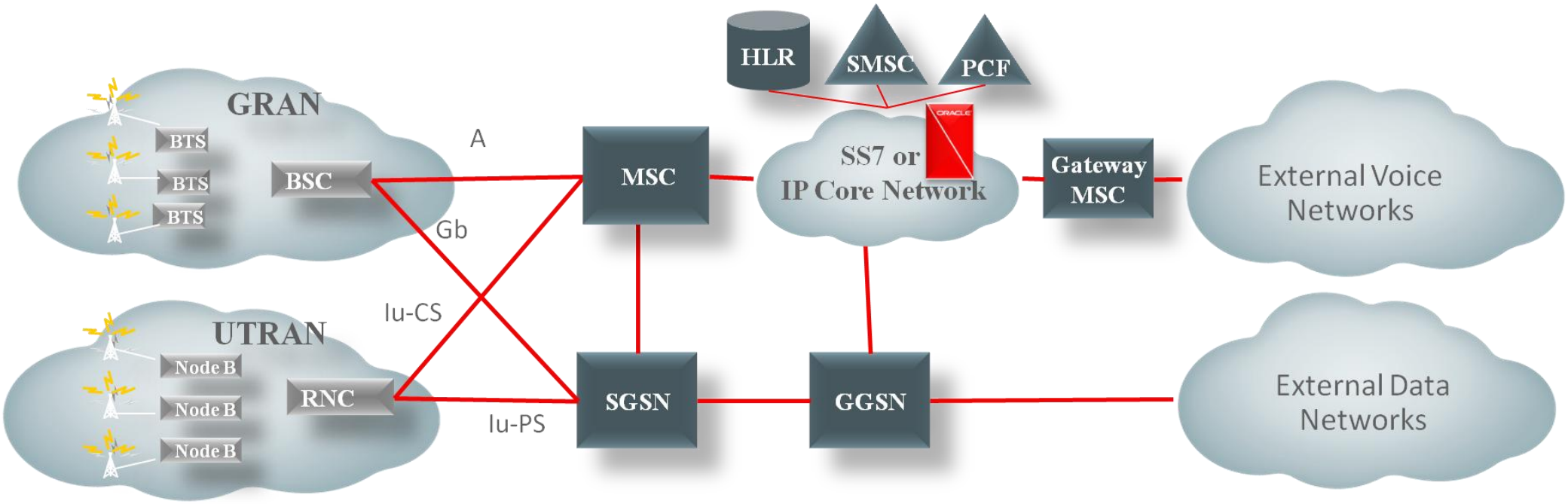




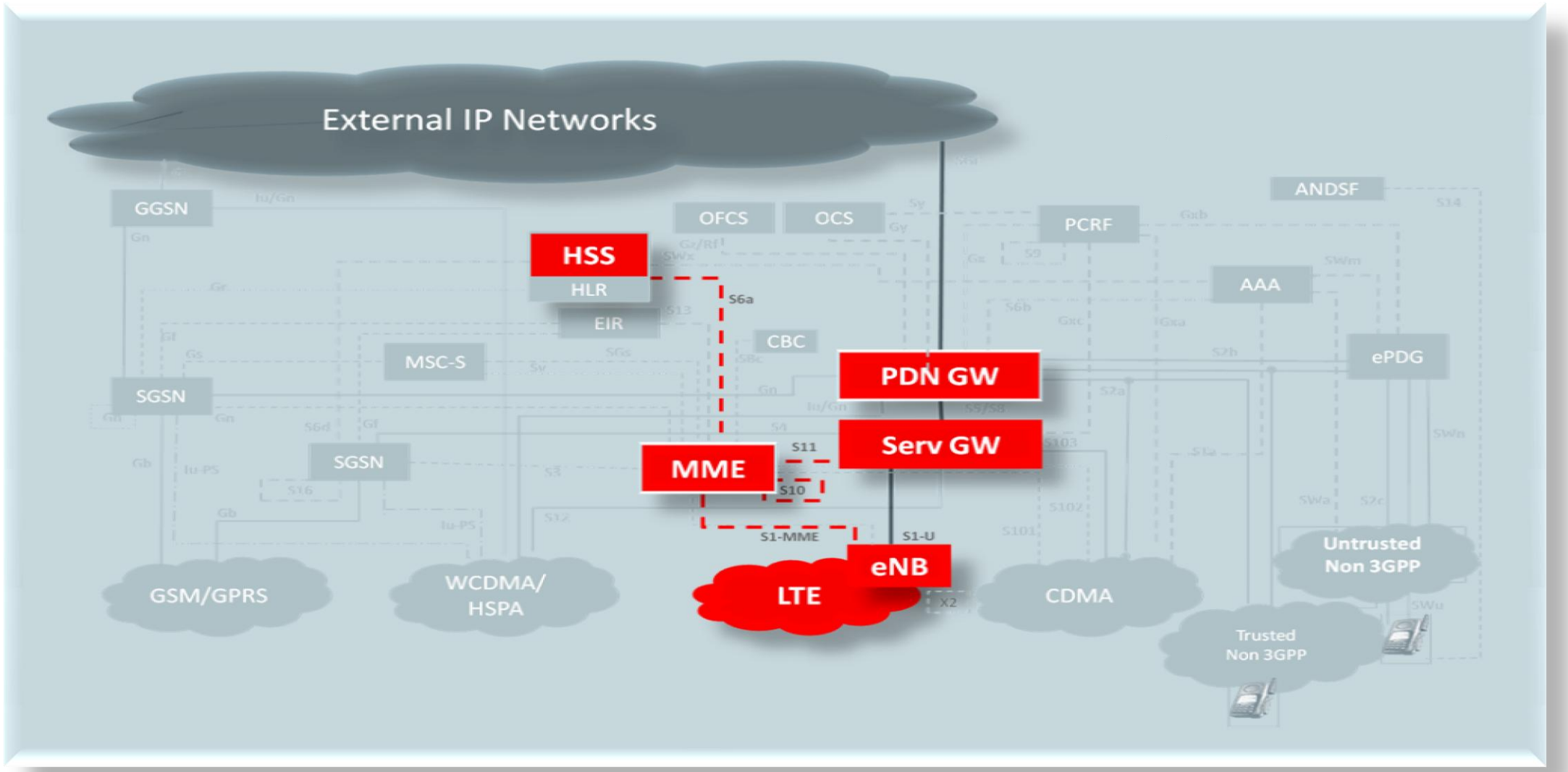
- Over time the need to support IP traffic was identified and the GPRS system was created
- Packet-switched core was developed

Core Network Evolution – UTRAN

- Core Network reused much of the GERAN core network and added IU-CS and IU-PS interfaces that represented one common way to access the network
- GSM/GPRS and WCDMA/HSPA form the basis for the evolution towards Evolved Packet Core

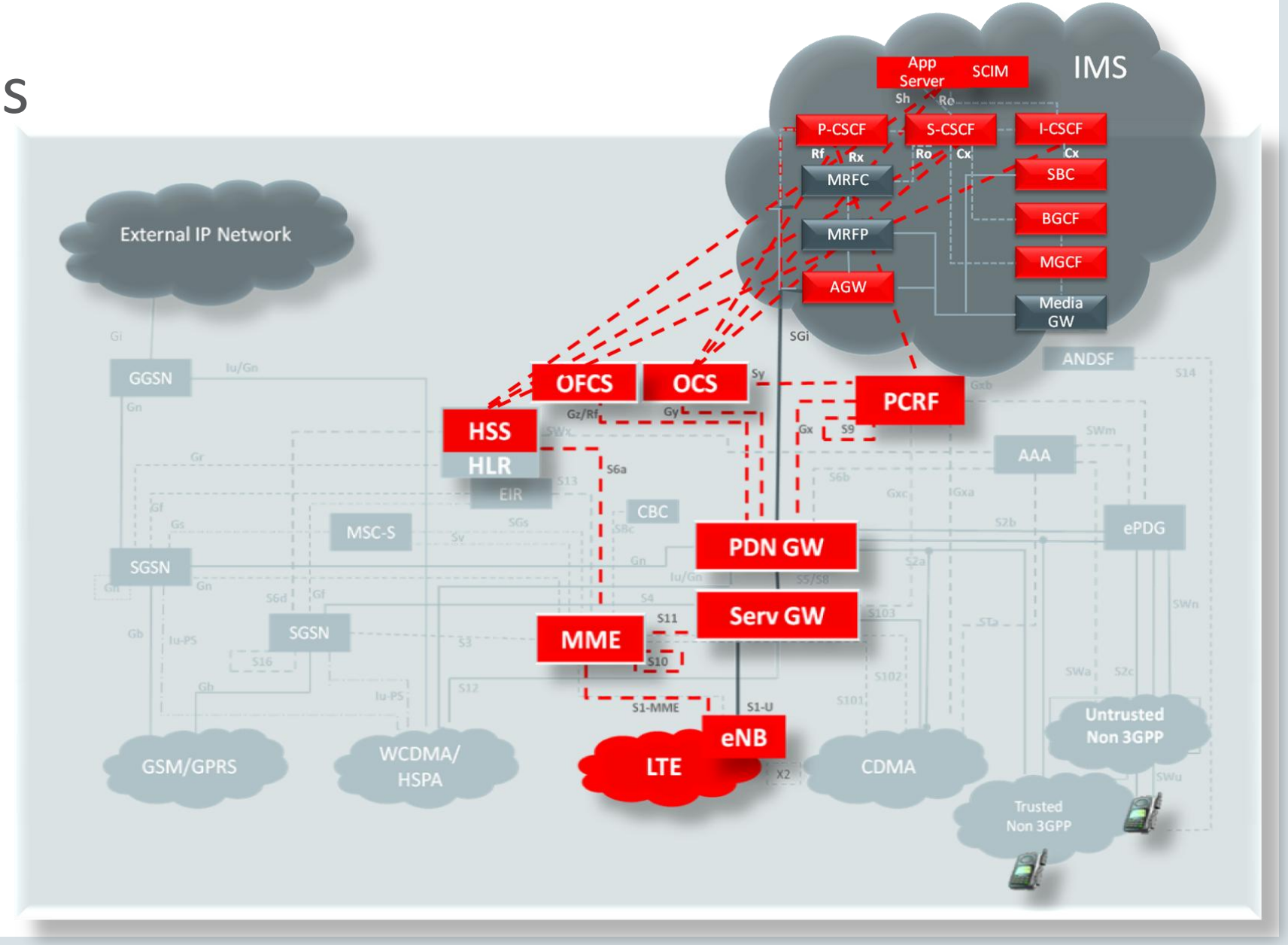


Basic EPC Architecture

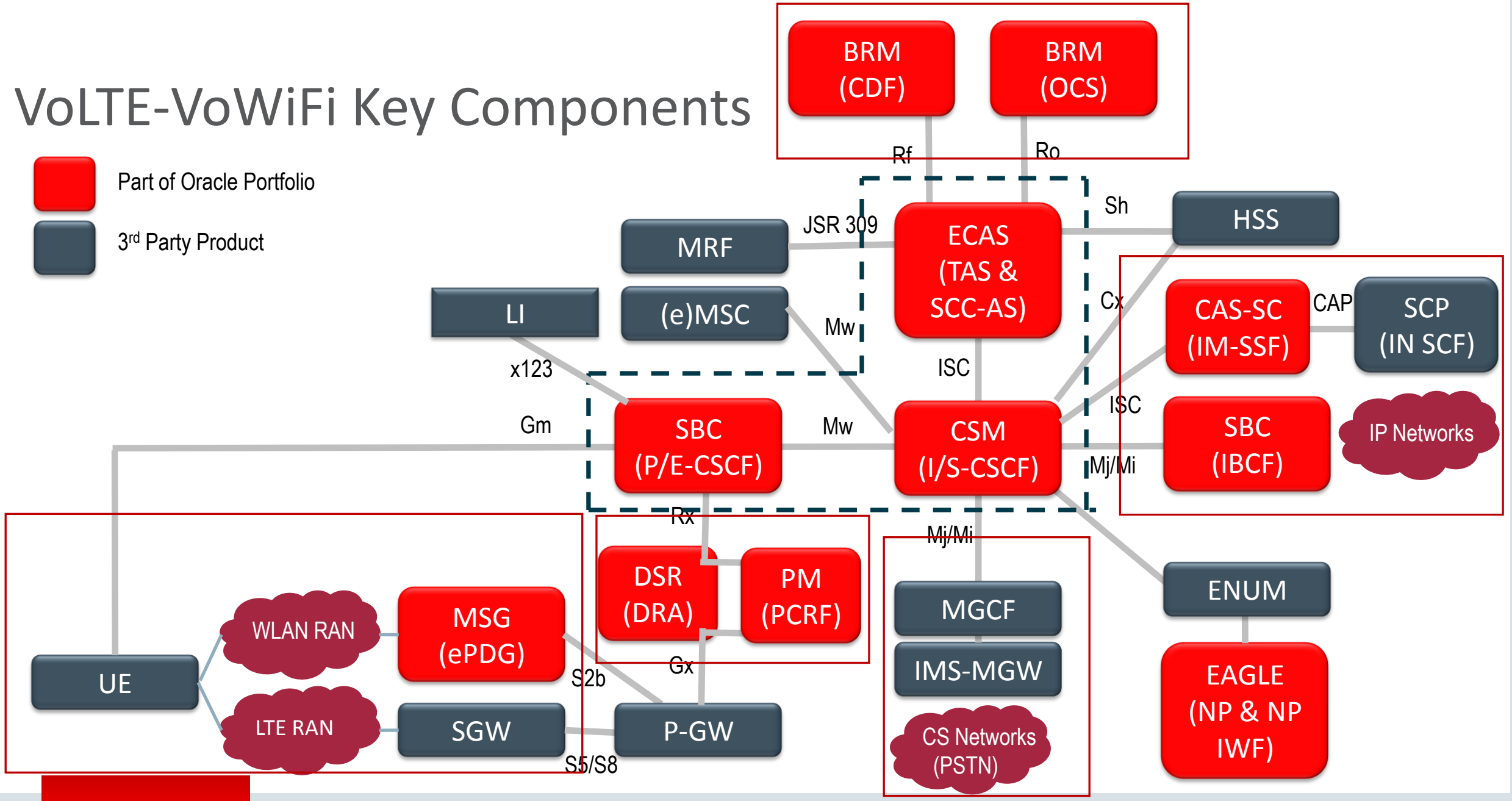


VoLTE Components

- VoLTE – only way in 4G/LTE networks to deliver voice services
- Just another data service - fully IP based with no CS components
- Solution based on IMS/MMTEL architecture
- Utilizes both SIP and Diameter signaling



VoLTE-VoWiFi Key Components



VoLTE Building Blocks

Network Element(s)	Function
P-CSCF, E-CSCF, IMS-AGW	Network edge security, interoperability enablement, regulatory compliance and media anchoring
S-CSCF	Provides Session Routing functions and Service Invocation logic
TAS and SCC-AS	Provides IR.92/IR.94 Supplementary Services (e.g. Call Diversion, Call Barring, Multi-Party Conferencing) and Call Continuity support (i.e. SR-VCC)
PCRF	Provides Network Resources mediation for the IMS Network and the (e.g. QoS reservation) and Charging Control rules
ePDG	Provides an anchoring to the EPC network for the non-3GPP untrusted accesses (WiFi)
MRF	Media Resource Function responsible for Announcements playing (i.e. in Call Barring) and Media Mixing for Conferencing (e.g. Multi-Party calls)
MGCF, IMS-MGW	Media Gateway and respective Control function to secure IP Voice (RTP and SIP) interworking with CS Voice (TDM and SS7)
HSS, ENUM	Subscriber Data base, mainly responsible for IMS Subscriber authentication, Mobility Management and Service Profiles; IMS network Call Routing enabler and Number manipulation

VoLTE Technical Challenges

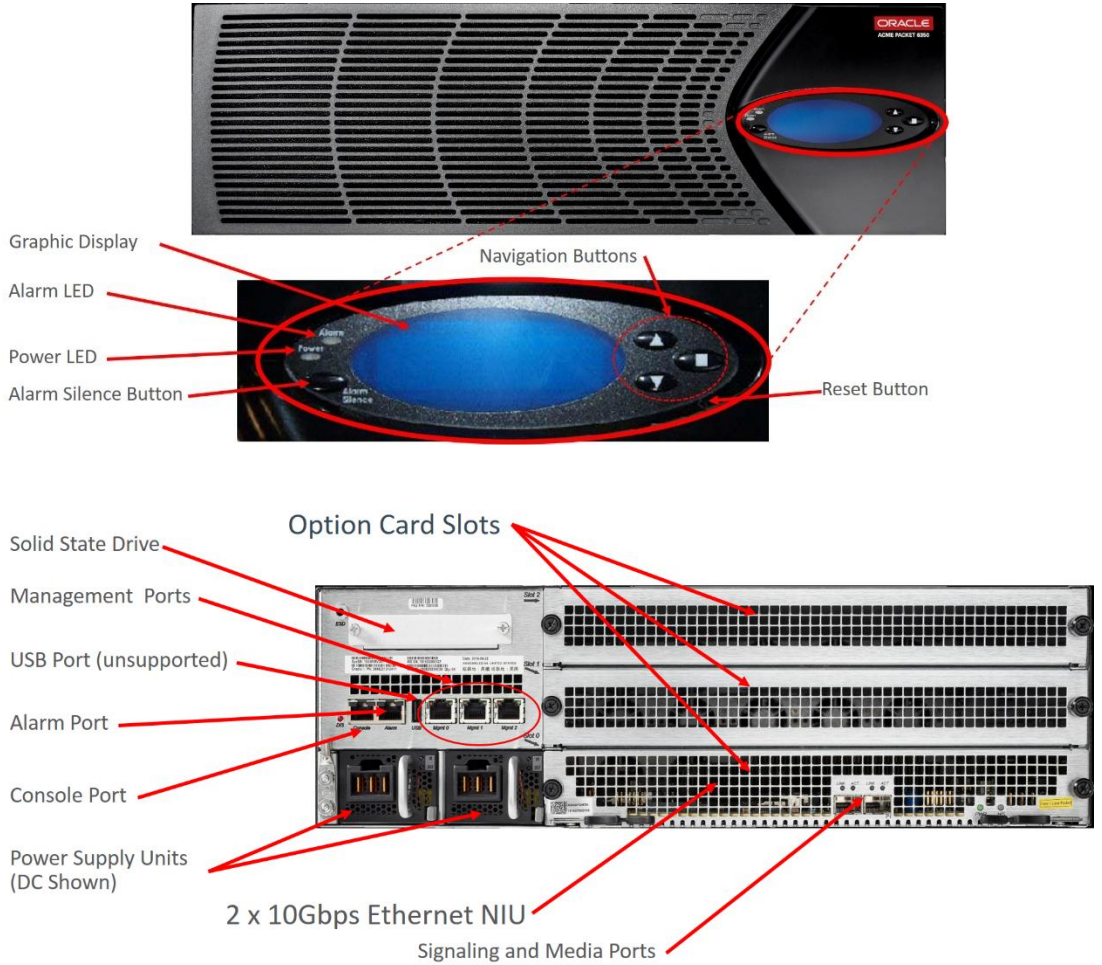
Challenges	Description
Architectural complexity	There are many IMS interfaces, protocols, and components
QoS and location recovery	Complex integration with PCRF of multiple elements to ensure QoS and location retrieval
Integration with legacy	Many popular services continue to be in legacy SS7 networks with no clear way for access them from IMS. Also required for call continuity
Integration with other vendors & UEs	VoLTE networks are built with equipment from different vendors. UEs from a number of vendors need to be supported
Linear scalability from a few to millions of subscribers	Operators like to start small but grow linearly to millions in a controlled manner
Wire rate encryption and high capacity transcoding	VoLTE mandates use of IPSec tunnels using IMS-AKA encryption. Transcoding may be required for interconnects, PS to CS handoff, etc.
Regulatory	Several requirements such as emergency calling, local number portability, and lawful interception need to be built-in from day one

Key Considerations in VoLTE Deployments

- Easy to use Network Service Design
- Voice Call Continuity and IMS Service Centralization
- Scalability
- Crucial for NFV with IP front end load balancing
- Regulatory Compliancy
- Interconnect & Roaming
- Security
- Quality of Experience

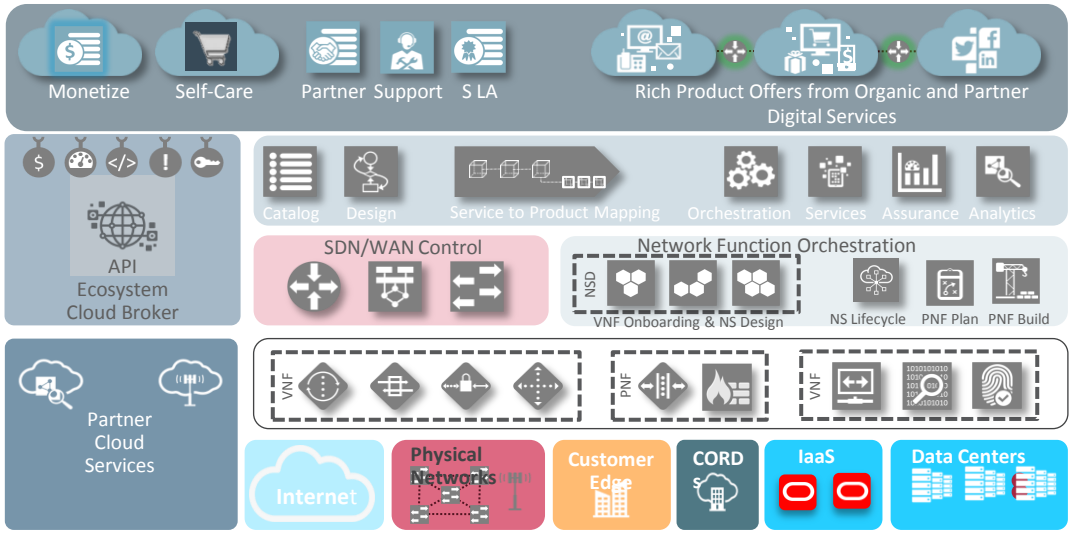
VoLTE Strategy: High Performance Purpose-Built

- Add to your existing purpose-built network
- Pros & Cons
  - Uncompromised and predictable performance
  - Leverage years of experience
  - But, potentially viewed as legacy
- How
  - Choose products that facilitate easy migration to NFV (cap-and-go not rip-and-replace)
  - Assured coexistence
  - Hybrid MANO



VoLTE Strategy: Flexible, Virtualized, and Cloud Oriented

- Start a greenfield or take steps to transform your existing appliance network to NFV
- Pros & Cons
  - Future oriented – gain from coming technological innovations
  - But, lack of standards and potentially immature products could add to risk
- How
  - Since this is a "multi-disciplinary" technology, choose well established vendors with deep telecom, IT, and cloud expertise

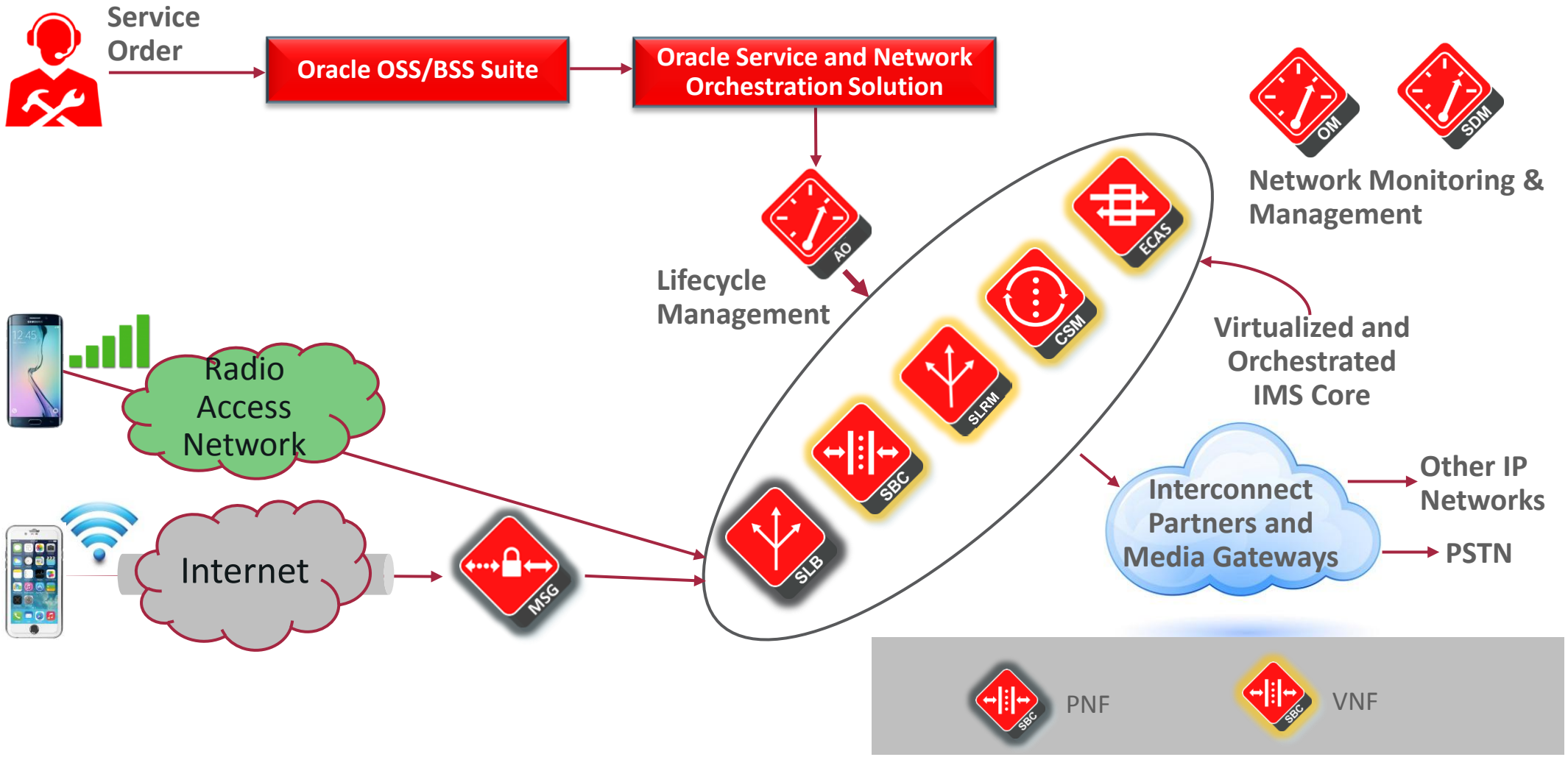


VNFs – Reality & Promise

1. Forklift VNFs
   - Simply porting network-appliance code onto a virtual machine does not make it ready for NFV. Instead, it adds an extra layer of complexity, causing significant performance degradation
2. NFV is too complex and costly
   - 67% of operators cite integration as a barrier to NFV deployment
3. Physical and virtual do not coexist
   - Utilizing VNFs means building and managing an additional network in parallel with the existing physical network

1. Network function code has been built from the ground up to be cloud-native. VNFs need to:
   - Leverage a microservices architecture
   - Dynamically adjust compute and network resources
   - Support full lifecycle orchestration to achieve automation
2. Rapid VNF Onboarding
   - Select well-enabled VNFs, which include all the technical and business data needed to allow same-day onboarding and deployment
3. Hybrid MANO
   - Leverage an NFV-management and orchestration architecture that makes the most of the capabilities and coexistence of physical and virtual functions

Creating VoLTE & VoWiFi Services on Demand



VoLTE Strategy: Pay-as-you-go Managed Service

Visit the Demo Floor

- Leave the hard work for others
- Pros & Cons
  - Best of breed and proven components pre-integrated for smooth deployment
  - Budget-friendly pay-as-you-go growth model (graduated deployments means lower costs/capacity in early stages)
  - Someone else manages your core competency & user satisfaction
- How
  - Find a reliable provider - Oracle + Tech Mahindra

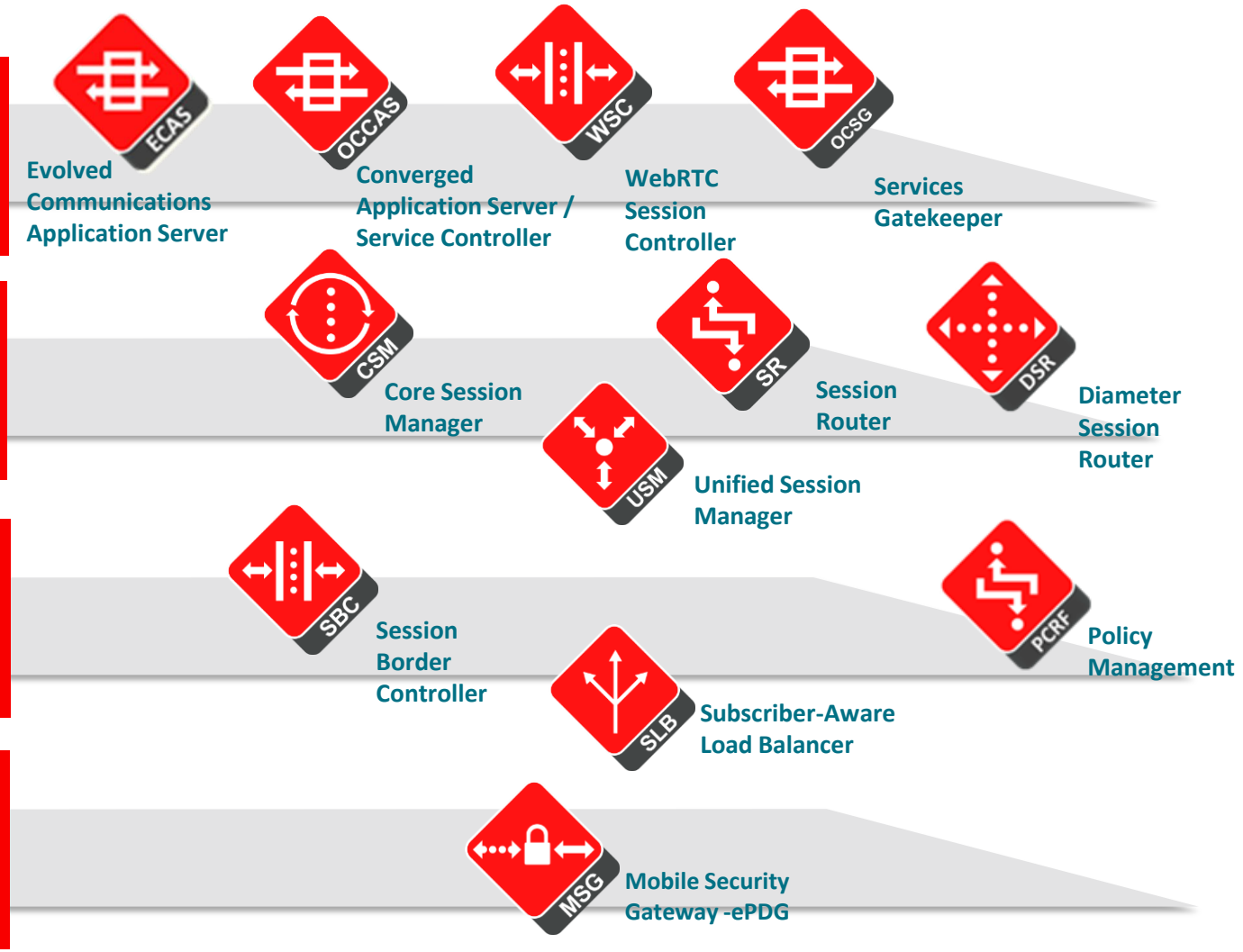
Oracle Communications Service Provider Portfolio

- SIP Application Execution
- IMS-Legacy integration
- API Exposure and Control

- Core Session Management
- IMS S/I-CSCF
- Session Routing

- Edge Session Management
- IMS P/E-CSCF
- Security, Quality, Interworking

- Small Cell & WiFi Access
- Secure Tunnel Termination
- Secure Backhaul



Network Visibility, Orchestration & Management

Platforms: Acme Packet Appliances, COTS, Common NFV, Transcoding, Compliance

ORACLE

Oracle Communications Key VoLTE Products

- Session Border Controller
  - Security, interoperability, regulatory, media processing, QoS, interconnect & roaming, voice call continuity
  - P/E-CSCF, IMS-AGW, ATCF, ATGW, IBCF, TrGW

- Core Session Manager
  - SIP session management and coordination with other network entities for session control
  - S/I-CSCF, BGCF

- Evolved Communications Application Server
  - IR.92/IR.94 supplementary services and call continuity; IMS Centralization Services; GSM, MMTel Supplementary Services
  - TAS, SCC-AS

- Policy Management
  - Network resource mediation, charging control rules, programmable multimedia policy, configuration management platform, subscriber profile repository
  - PCRF

Oracle Communications Key VoLTE Products

- Mobile Security Gateway
  - Security for non-3GPP access such as WiFi; Small-Cell; WiFi backhaul
  - ePDG

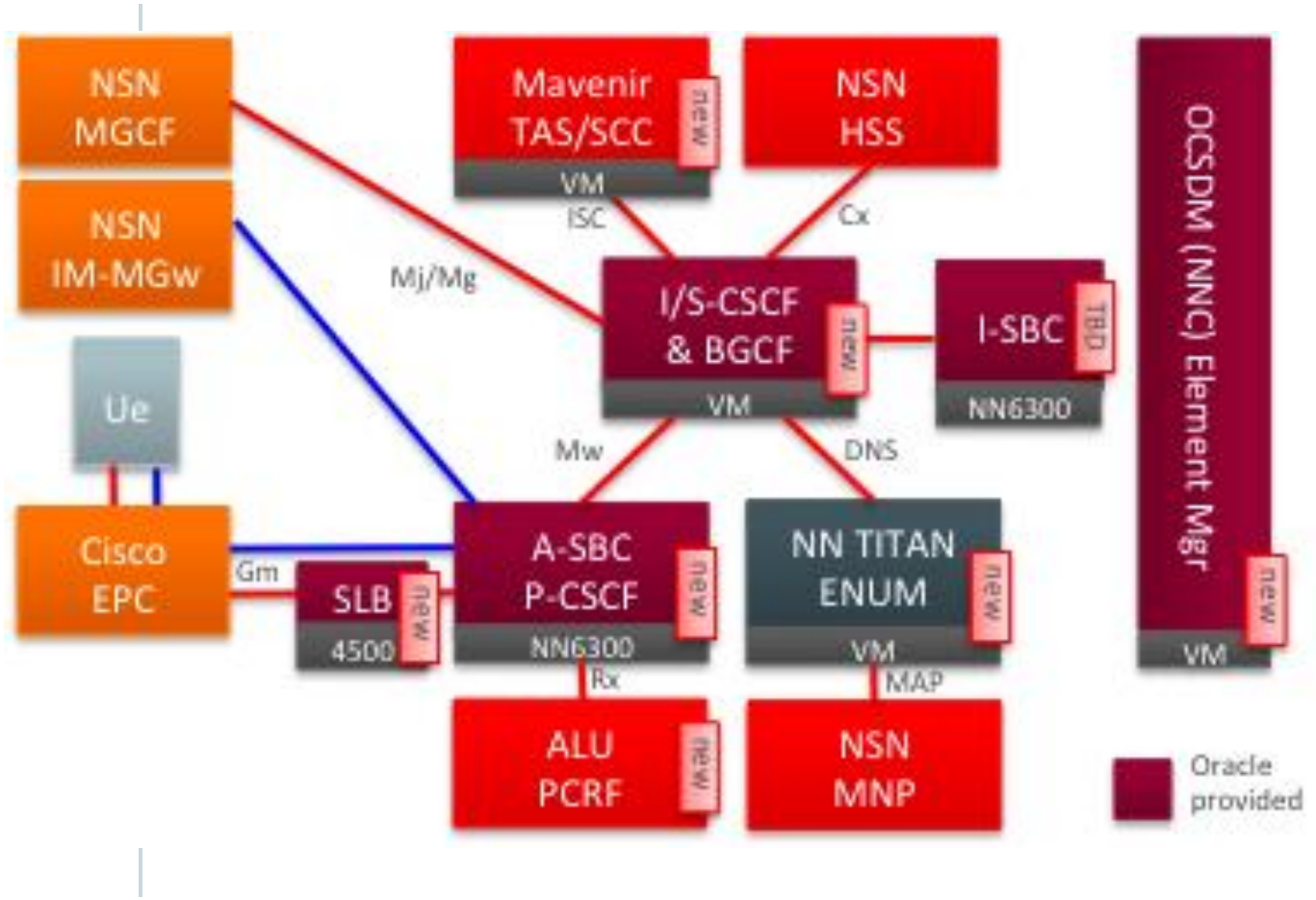
- Session Delivery Manager
  - Full FCAPS (fault, configuration, audit, performance, security) element system management; report generation; software upgrades

- Diameter Signaling Router
  - Secure signaling architecture for elastic growth, interoperability and rapid introduction of new services, enhances network visibility by providing a centralized monitoring point
  - DRA

- Operations Monitor
  - Deep visibility into network operations, rapid troubleshooting, growth planning, voice quality analysis and reporting, SLA enforcement

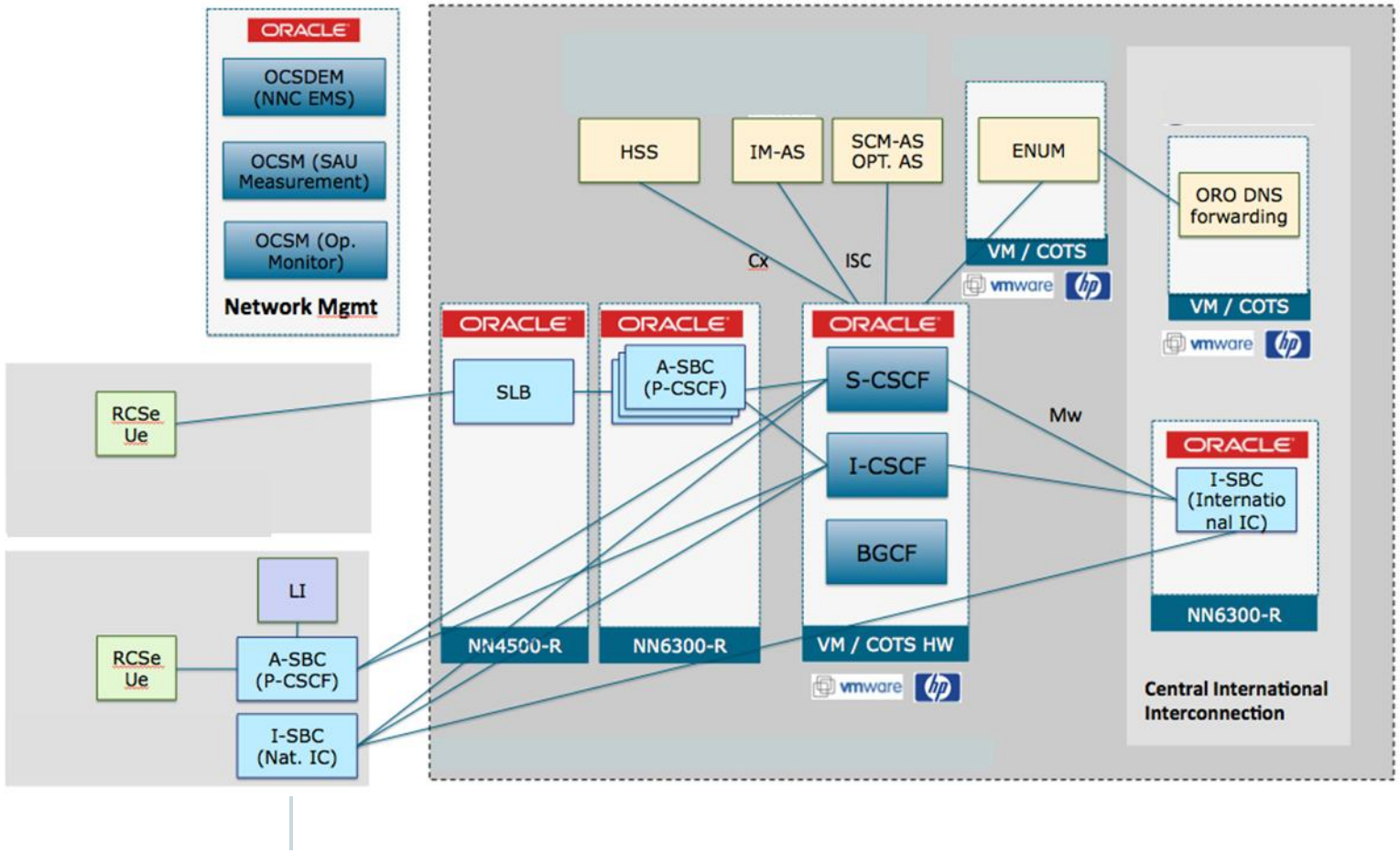
Vodafone Germany
First virtualized IMS network for VoLTE services

- VoLTE service launch & SR-VCC in Q1 2014
- Oracle involvement in E2E network design and implementation
- 3x Site Geo-Redundant solution for 1.2M subscribers in the initial phase
- A-SBC clustering (w/ SLB) to create a logical single entity A-SBC/P-CSCF distributed over multiple sites
- First VoLTE launch within the Vodafone Group
- First NFV Core Network implementation within the Vodafone Group



Vodafone Group
IMS For Messaging

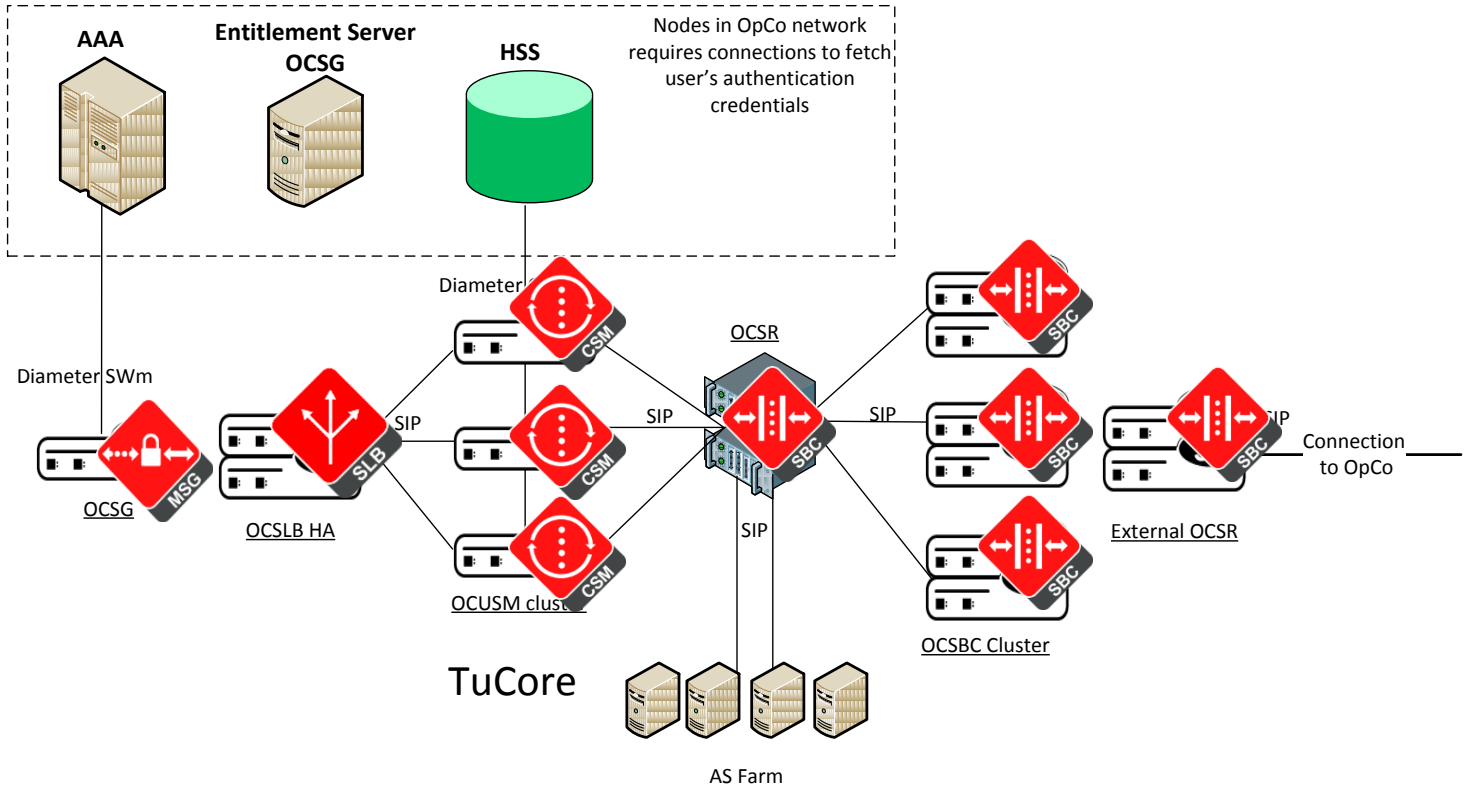
- Access SBC: 56x AP6300
- SLB: 8x HA pairs of AP4500
- Interconnect SBC: 1x HA pair of AP6300
- CSCF: 90x CSM HA VM
- OCOM 1x ME, 1x Standalone Probe and 18x Embedded SBC probes, used for both network monitoring and Sub usage measurement
- OCSDM single cluster used for Element Management
- Installed Capacity for 15M registered subs (>9M active users already). Live since early 2015



Telefonica Digital

IMS for VoWiFi and Messaging

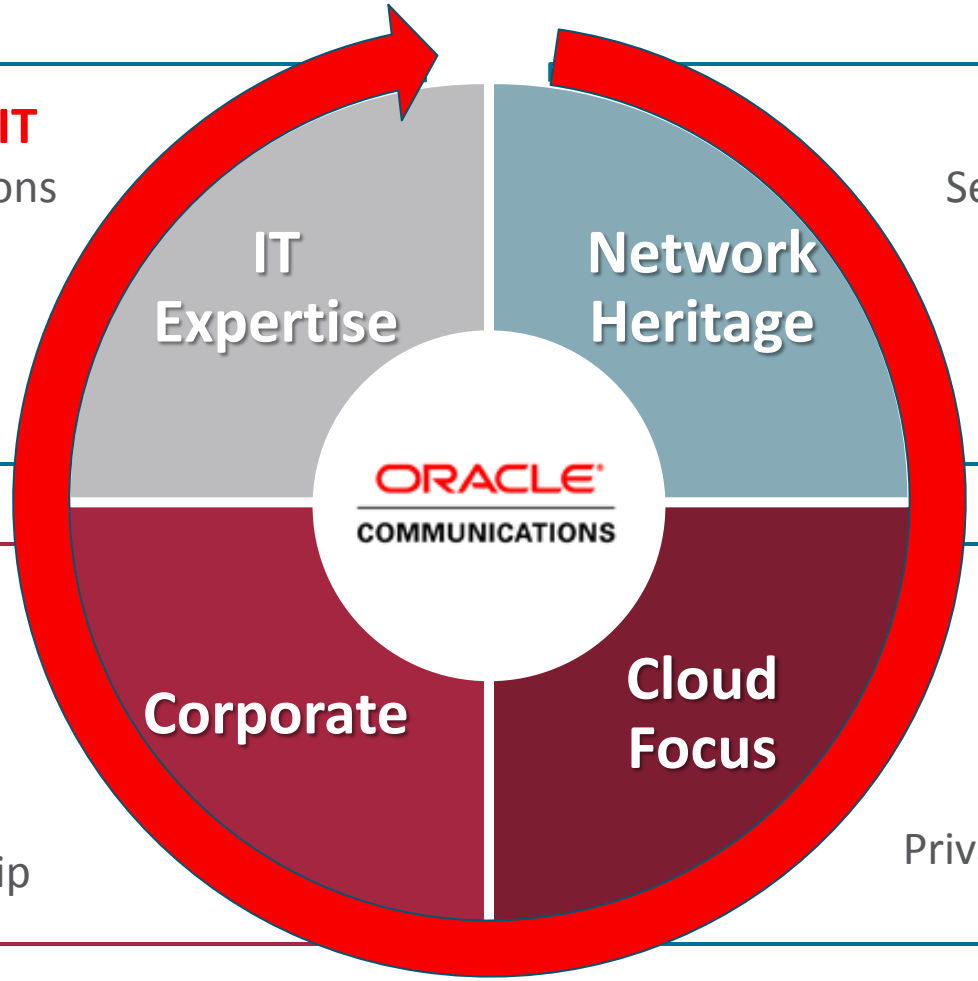
- OTT service for Voice, Chat, file sharing, location sharing
- Based on Oracle Communications USM, SBC, SLB, SR
- Based on home-based client for iPhone, Android, PC, MAC, Windows Phone
- OCUSM used as P-CSCF with IMS-AKA termination
- 3M subs in UK
- 4M subs in LATAM affiliates



Why Oracle Communications?

Unparalleled in IT
Industry Applications
HW/SW Platforms
Robust Portfolio
Analytics

Network Depth
Servers & Gateways
Session Control
Signaling
Policy



Trusted Ally
Global Reach
Partner Network
Reliable Support
Expert Consulting
Industry Leadership

Cloud
SDN/NFV
Telco Cloud
IaaS, PaaS, SaaS
Private, Public, Hybrid

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