Mobile & Financial Services Need for Accurate Timing and Monitoring

Timing & Mobile Content Services and Financial Service Connectivity with SD_WAN

Ian Goetz, Juniper Networks

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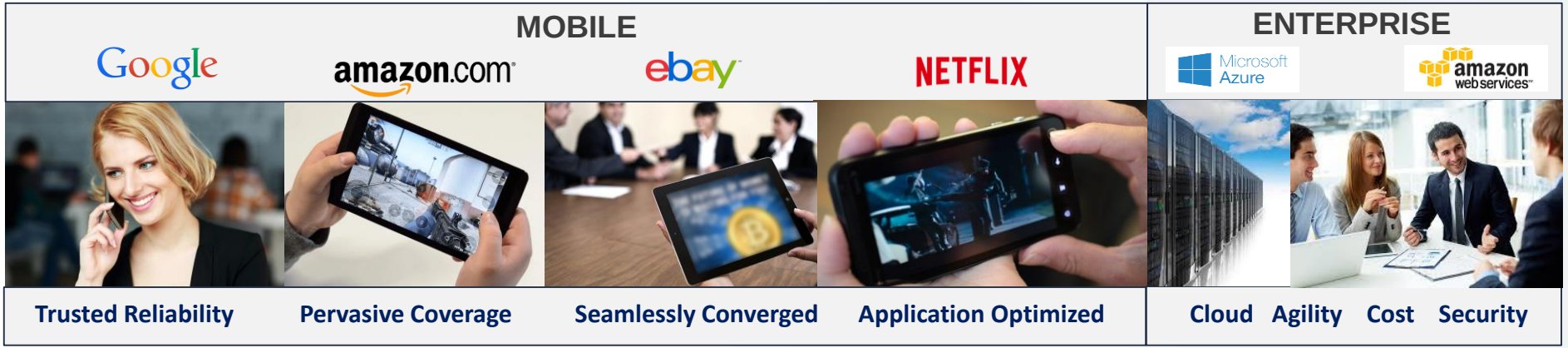
Market Trends:
Cloud, Agility, Virtualisation &
Content

Mobile & Enterprise Market Trends: The Customer Experience

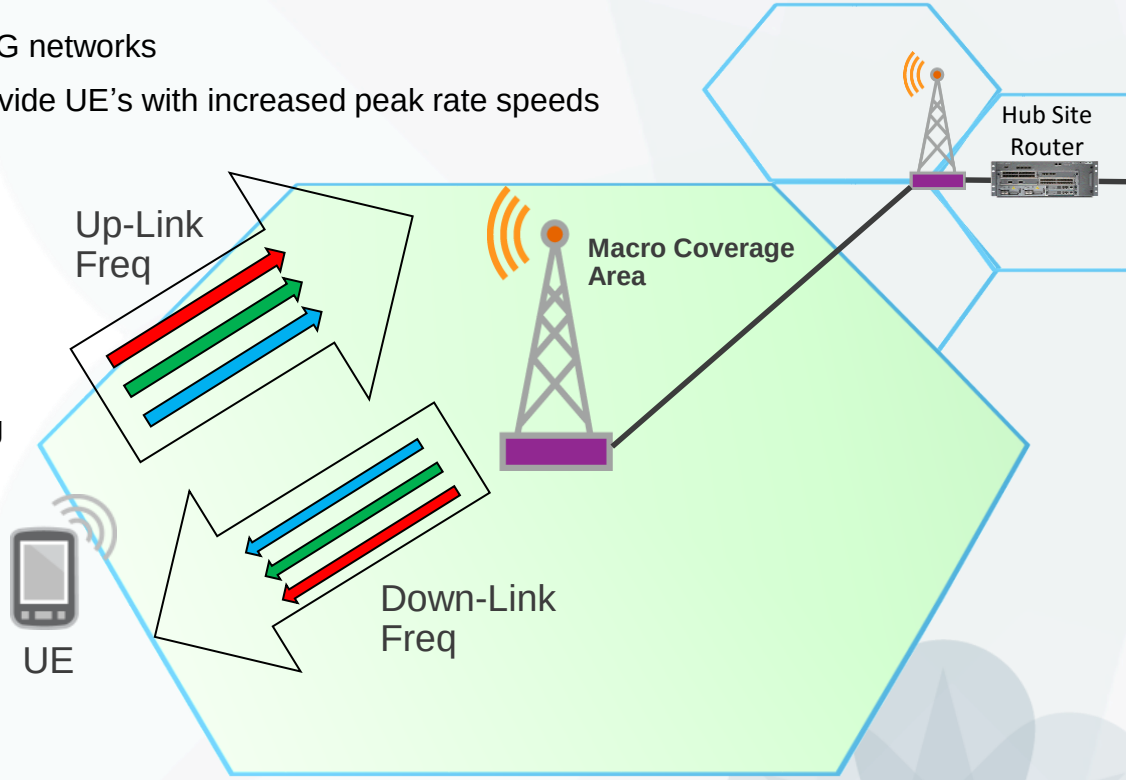


- **MOBILE**:
  - The Smartphone and Tablet, combined with 3G HSPA and 4G have driven the proliferation of applications for business, lifestyle and pleasure – BUT Most Value Added Services are now OTT
  - 4G Advanced and 5G drive towards low latency for IoT and Content is key for consumer segment
- **ENTERPRISE**:
  - Moving applications to the cloud for scale, agility and cost reduction
  - Security becoming paramount
  - Agile, cost effective connectivity – the rise of SD_WAN


MOBILE: RAN Evolution & Content
Driving Timing Requirements

“I Have LTE-A & No Timing Problem”: LTE-Advanced: Carrier Aggregation

- LTE-A is already with us and deployed in many 4G networks
- Carrier Aggregation is the simplest method to provide UE’s with increased peak rate speeds
- Using 3GPP R8 & 9 compatible carriers
  - Component Carriers are aggregated
  - Can be 1.4, 3, 5, 10 or 20MHz (Max)
  - Maximum 5 Component carriers = 100MHz
  - Can be different in UL & DL
- The eNode B requires only LTE Frequency timing
  - 16ppB

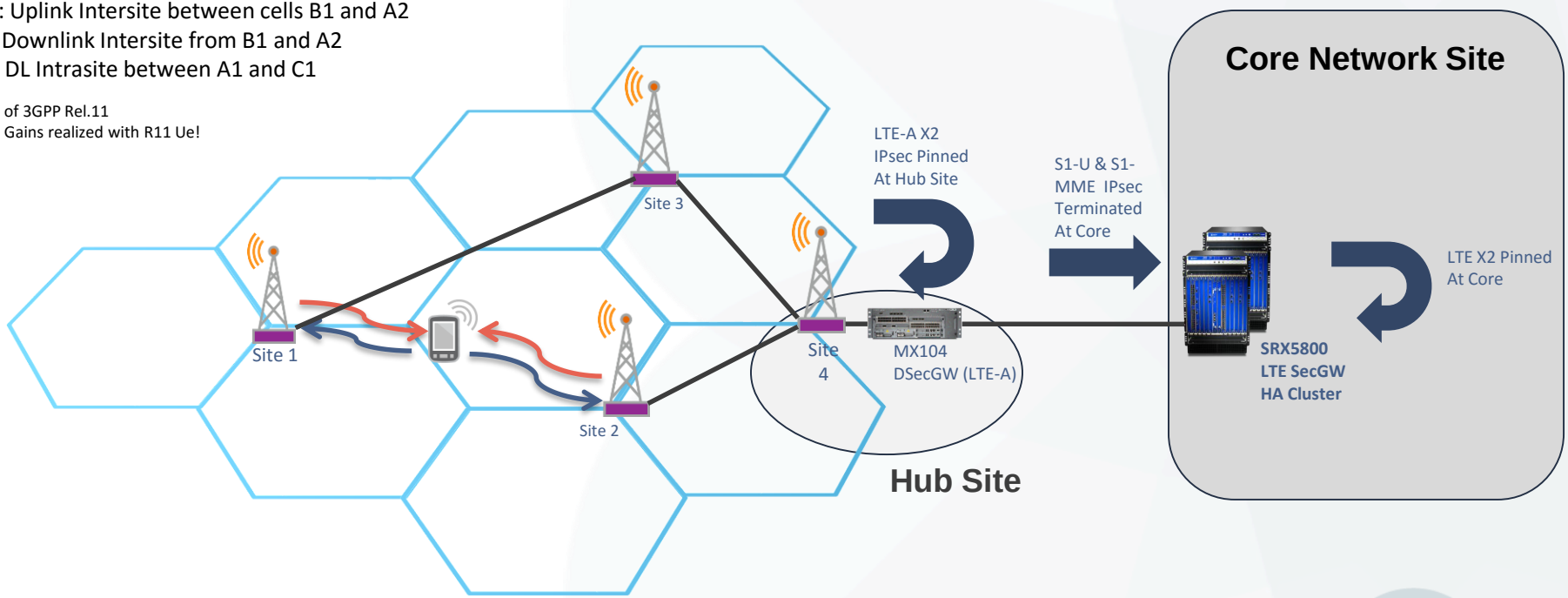


LTE-Advanced: Coordinated Multipoint

Accurate Timing (Phase & Frequency) & Low Latency Are Key

- Black: Uplink Intersite between cells B1 and A2
- Red: Downlink Intersite from B1 and A2
- Grey: DL Intrasite between A1 and C1

Feature of 3GPP Rel.11
NB: Full Gains realized with R11 Ue!



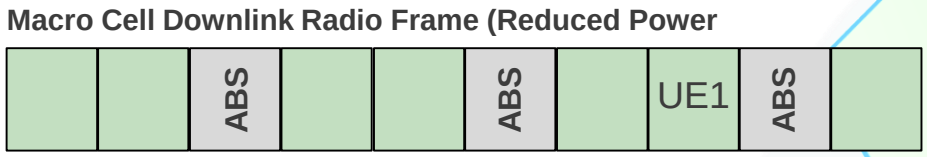
- LTE Requires Frequency Timing: 50ppB
- LTE-A (Uplink CoMP & eICIC) Require Frequency & Phase:
  - Frequency16ppB, Phase +/- 0.5µSecs

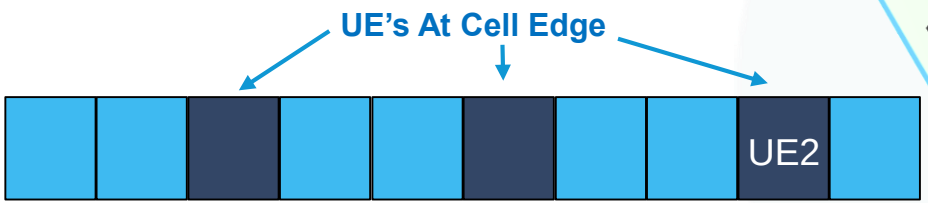
eICIC: enhanced Inter-Cell Interference Coordination

Accurate Timing (Phase & Frequency) Are Key

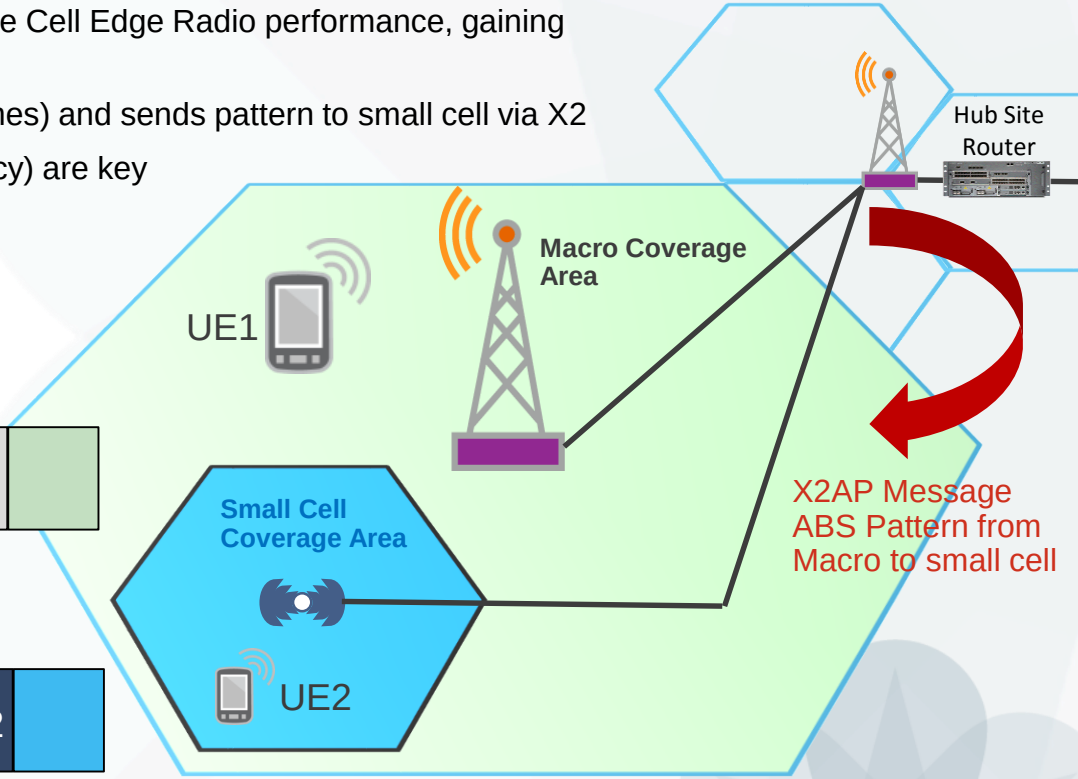
eIC IC Feature of 3GPP Rel.10

- eICIC was introduced in 3GPP R10, aim is to improve Cell Edge Radio performance, gaining more from valuable spectrum
- The Macrocell transmits ABS (Almost Blank Subframes) and sends pattern to small cell via X2
- Low Latency and accurate timing (Phase & Frequency) are key



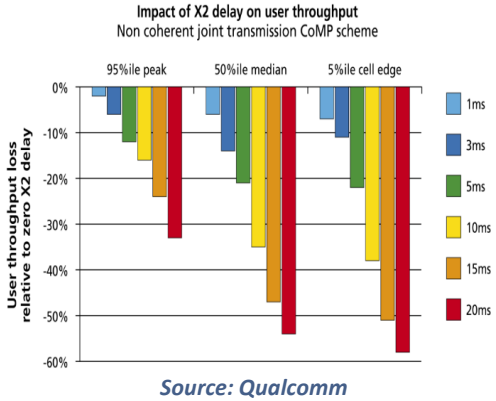


Small Cell Downlink Radio Frame, Cell Edge UEs told to transmit in ABS subframes

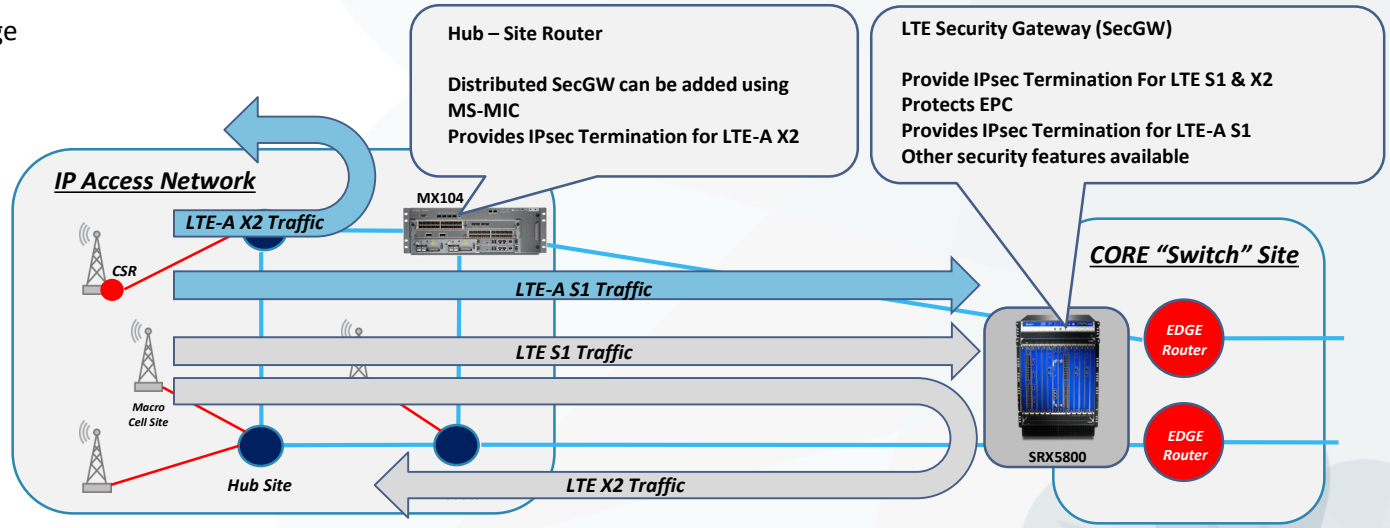


Mobile Backhaul Environment: The Move To LTE-A And On To 5G

- LTE-A Features such as Coordinated Multi-Point (CoMP) and Enhanced Inter-cell Interference Coordination, (eICIC) become available as s/w upgrades to 4G base stations from 2016
- These features drive close coordination between cell sites and place requirements on the backhaul network:
  - **Timing**: Frequency & Phase: Frequency16ppB, Phase +/- 0.5µSecs
  - **Distributed Security**: X2 Handover Interface requires a latency of ≤3-5ms
- Accurate timing with many vendors current and installed backhaul solutions is a major change as accuracy relies on hardware
- The Core LTE Security Gateway remains at the Core site to terminate the S1 IPsec tunnels and to protect the EPC, Distributed LTE-A SecGW For X2, on the Hub-Site, deployed at Fibre Edge

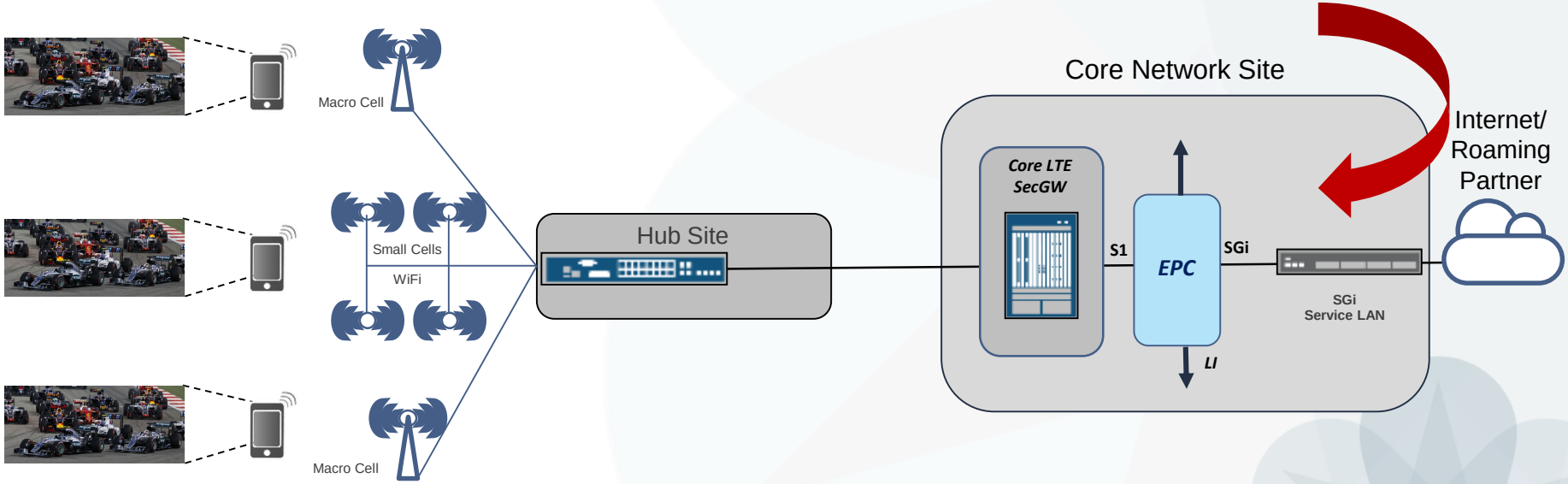


Source: Qualcomm



eMBMS: Broadcast Requires Tight Timing - Phase

- Some content is consumed by many users at the same time
- Mobile broadcast is the efficient method of delivery: eMBMS
- eMBMS Requires Accurate Timing: Frequency16ppB, Phase +/- 1.5µSecs
- Current, purely frequency timing based IP Backhaul networks cannot support this service without addressing timing distribution



Multi-Access Edge Computing (MEC) & eMBMS

Multi-Access Edge Computing (MEC) offers application developers and content providers cloud-computing capabilities and an IT service environment at the edge of the mobile network

MEC Characteristics

- Proximity
- Ultra-low latency
- High bandwidth
- Real-time access to radio network information
- Location awareness

MEC Standardised by ETSI ISG MEC

- Mobile Video Delivery Optimization using throughput guidance for TCP
- Local content caching at MEC
- Mobile Backhaul Optimization
- Traffic De-duplication

Network performance and QoE Improvements

- Security, safety, data analytics
- Active device location tracking
- MEC edge video orchestration
- Enterprise Mobility Services inc. Local Breakout
- V2I

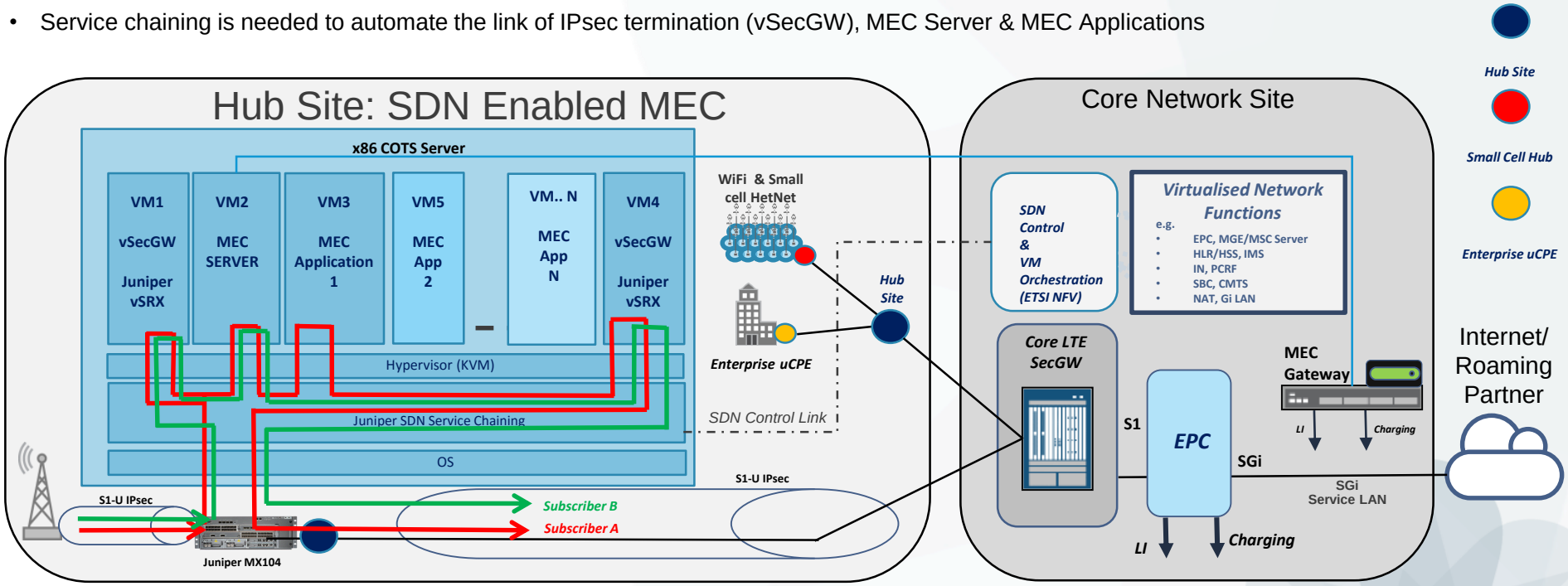
Operator and 3rd party services

- Augmented reality, assisted reality, cognitive assistance
- Gaming and low latency cloud applications
- Edge video orchestration

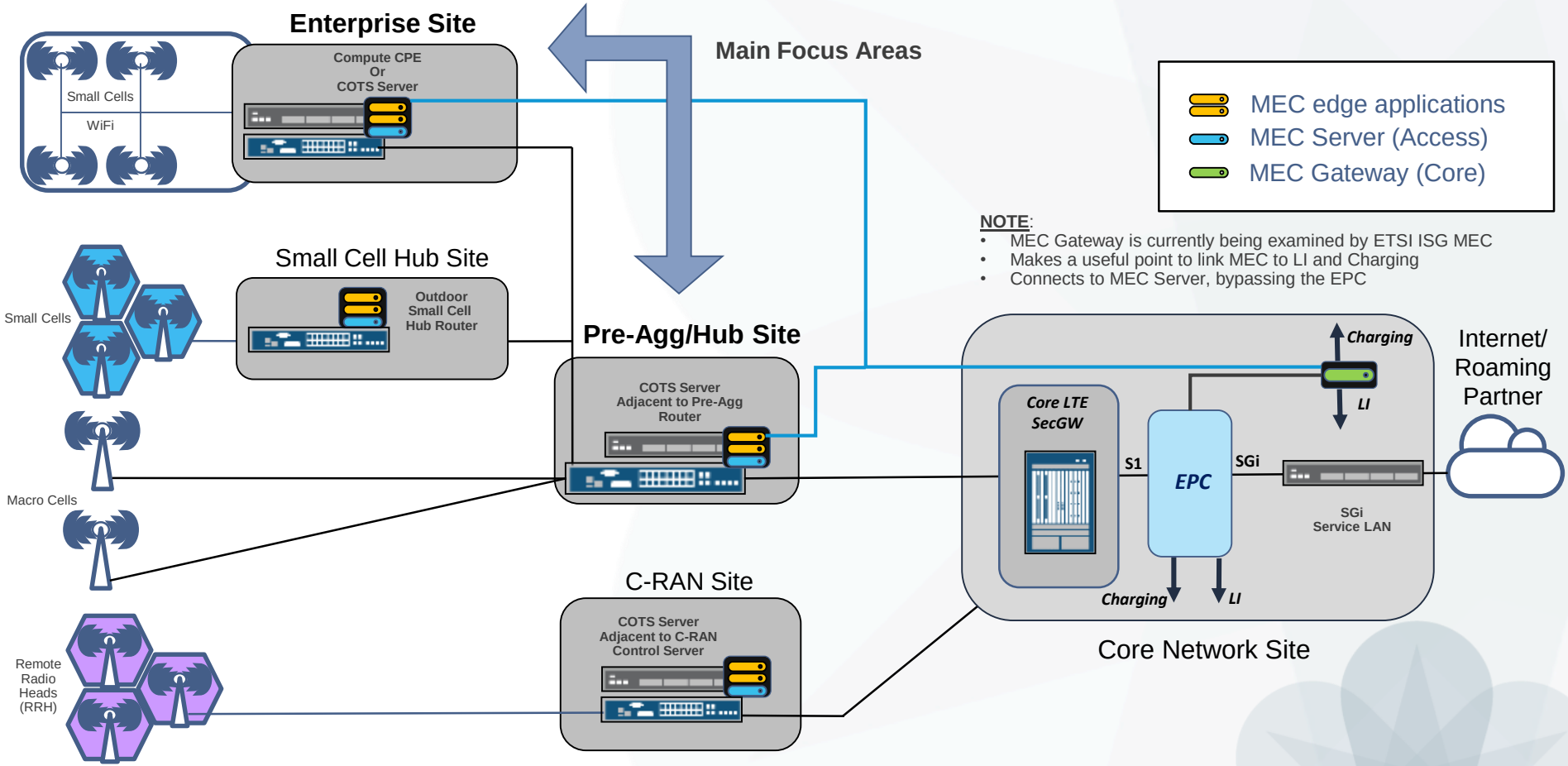
Consumer-oriented services

Edge Compute Services: MEC & SDN Automation

- MEC Enables applications to be deployed at the mobile network edge
- SDN Enables the chaining of MEC Applications and the Life-cycle Management of MEC Application VNFs using automation
- SDN Automation & Creation of services chains in the Telco Cloud DC and MEC Eco-system
- VNF Orchestration, such as Juniper Contrail Service Orchestrator, can be used to instantiate VNFs and manage their Life-Cycle
- Service chaining is needed to automate the link of IPsec termination (vSecGW), MEC Server & MEC Applications

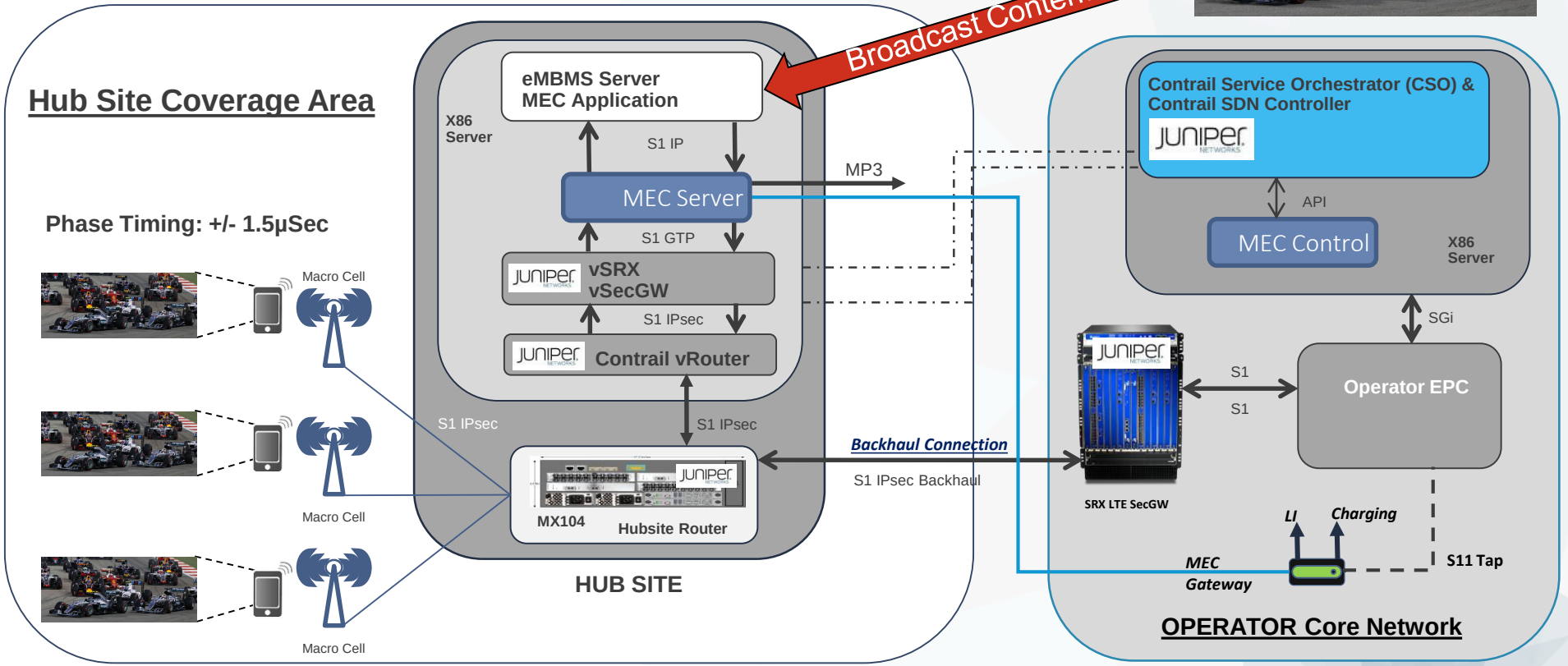


MEC Deployment options



Multi-Access Edge Computing (MEC) & eMBMS

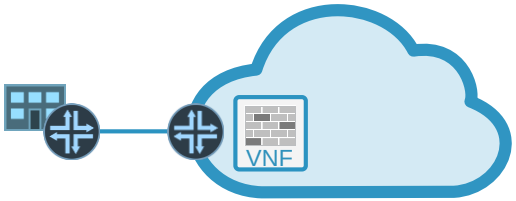
- MEC Allows high bandwidth content to be distributed into the RAN
  - Reduced EPC load
- However, timing accuracy is now from the MEC Application – eMBMS server to the base stations

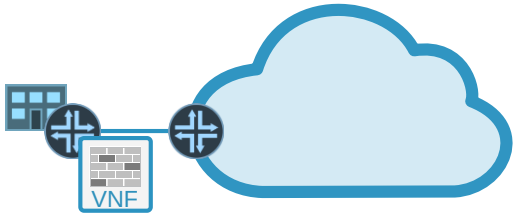


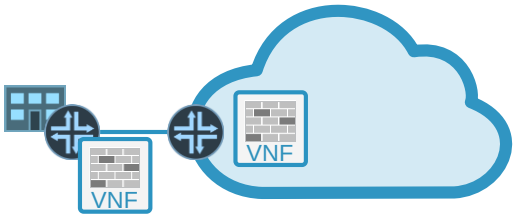
ENTERPRISE:
SD_WAN & MIFID2

Cloud CPE Solutions

Centralized and Distributed







Cloud CPE Centralized

VNF on server in Telco Cloud

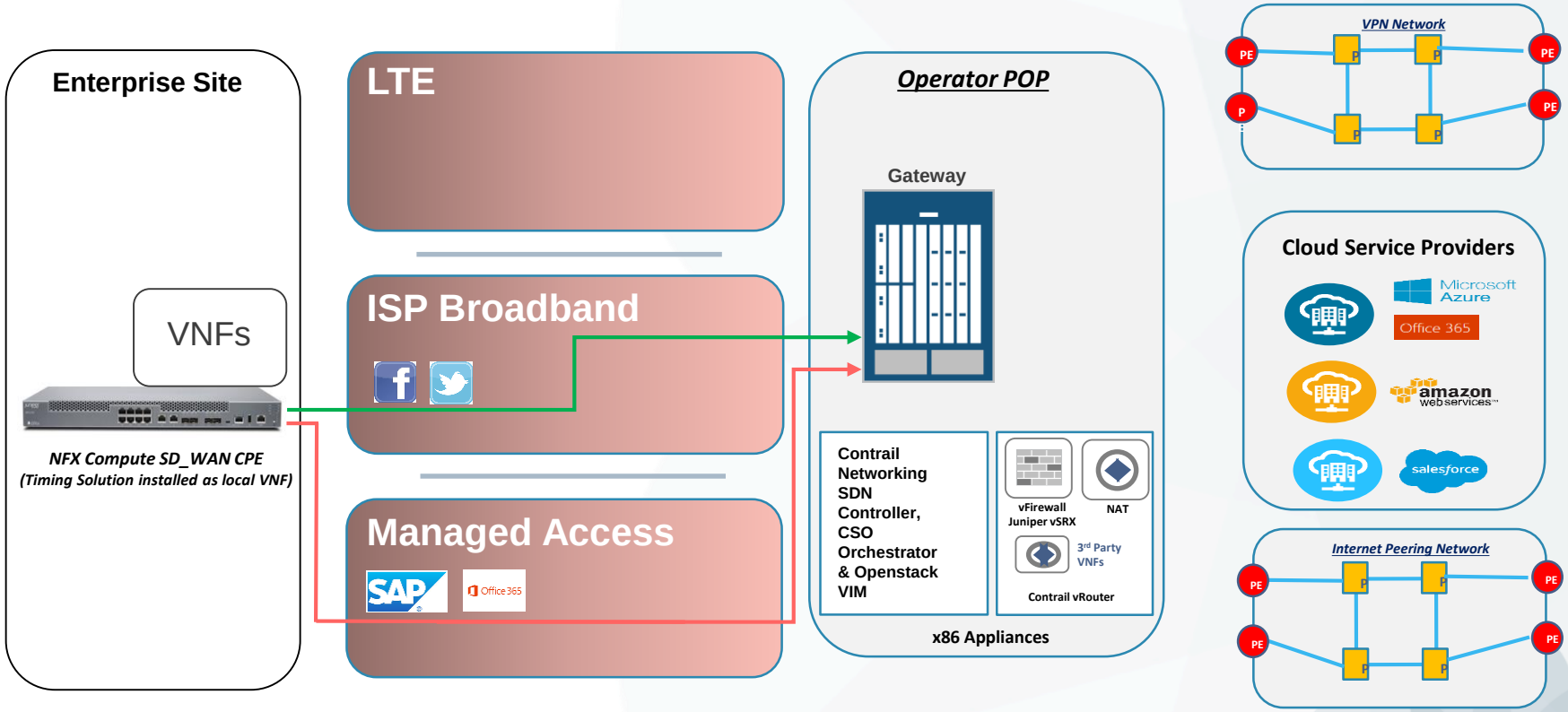
Cloud CPE Distributed

VNF on Juniper NFX device

Cloud CPE Hybrid

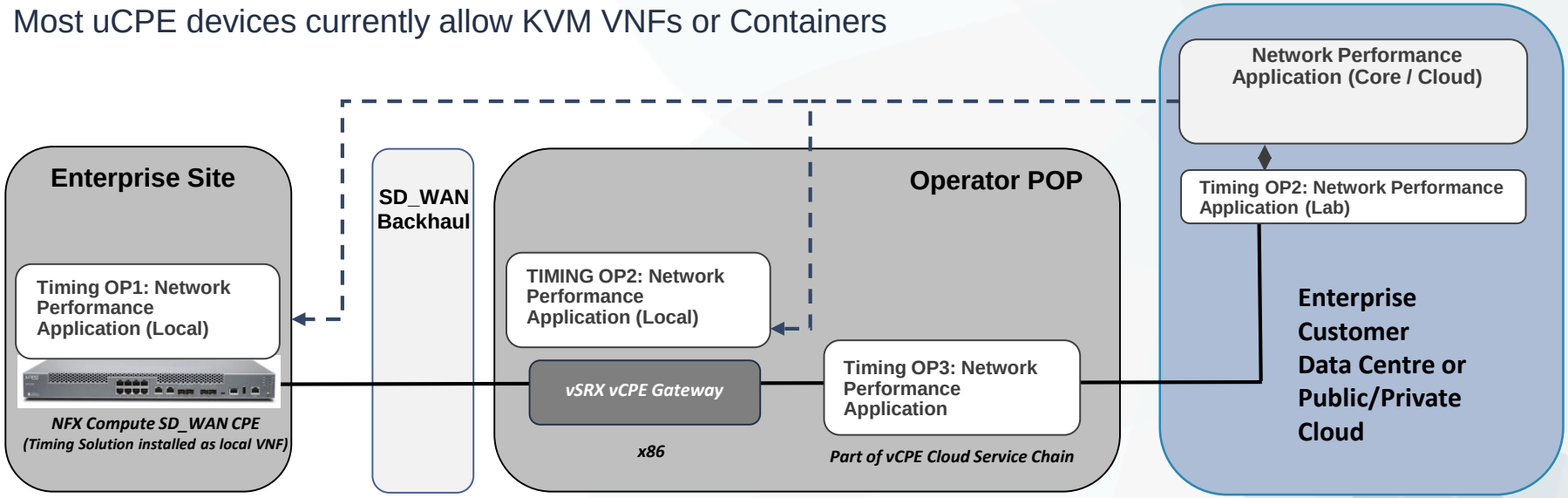
Combined

Juniper SD_WAN Cloud CPE



Financial Service: SD_WAN With MIFID2 Compliance

- From 2018: US & EU Regulation Requires Financial Trading to time stamp all packets to sub - µSecond level
- Remote Trading sites with SD_WAN will need to comply
- Requires uCPE to run a suitable timing based application to time stamp all packets for the trading service
- Most uCPE devices currently allow KVM VNFs or Containers



Thank you