IOT SECURITY AT THE EDGE

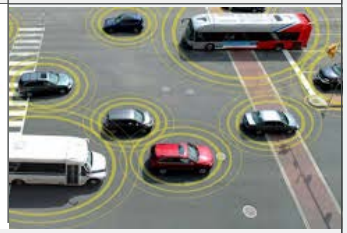
Ian Goetz, Chief Architect – Mobile Solutions

November 2018

juniper NETWORKS | Engineering Simplicity

MOBILE MARKET TRENDS:

CONSUMER	ENTERPRISE	IoT	AUTOMOTIVE
Google, amazon.com, NETFLIX	SAP, salesforce	Microsoft Azure, amazon web services, AWS Greengrass	5GAA Automotive Association



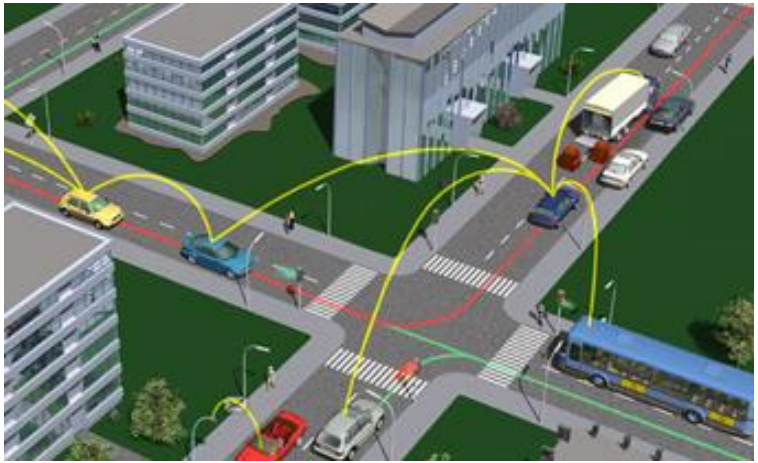
Trusted Reliability | **Pervasive Coverage** | **Seamlessly Converged** | **Ubiquitous-Coverage** | **Low-Latency** | **Security**

• **CONSUMER**:
  • Value Added Services are now OTT
  • Content is key for consumer segment, but is mainly OTT
	eMBB

• **ENTERPRISE**:
  • **Cloud**: Scale, agility & cost reduction
• **IoT & AUTOMOTIVE**:
  • **Ubiquitous Coverage**: *IoT, Augmented/ Fully Autonomous Vehicles & Smart Cities*
  • **Low Latency Services:** *Across 4G & 5G, ≤25ms*
  • **Battery Efficiency**: *key to business case, Often need >10 years*
  • **Security**: *Already seeing attacks from compromised devices*
  • **Drives Edge Cloud**
	Low Latency
	&
	Massive IoT

Transport & SMART City: Low Latency & Security, Augmented / Fully Autonomous Vehicles

- **Augmented & Fully Autonomous Vehicles** – Network information & low latency for automotive systems
  - Lifetime of car is 20 years – on-board compute insufficient through vehicle lifecycle
- **Coverage**: Automotive needs access across large geographies
- **Cost**: Significant Cost For National Coverage – LTE **&** 5G Network usage
- **Business Case**: Efficiency – for fuel, smart cities, efficient journeys for people and goods, congestion etc
- **5GAA**: Vodafone, Telefonica, BMW, VW Audi, Mercedes, Toyota, SKT, DT, Ford, Jaguar Land Rover, Samsung, DoCoMo, Verizon, etc
- **Smart City**: Infrastructure could be from MNO, the City or Wholesale/Managed Service
- **Security and Low Latency** are key to success



Augmented & Fully Autonomous Vehicles

Platooning

THE POWER PROBLEM: 10 YEARS ON BATTERIES

- IoT use cases are different across industry verticals
  - Widely distributed monitoring and sensing
  - Mobile asset tracking
  - Industrial automation and fleet management
  - etc
- Constrained devices
  - Low everything: power, cost, data rate, complexity
  - But not low security

DEVICE TO APPLICATION SECURITY:

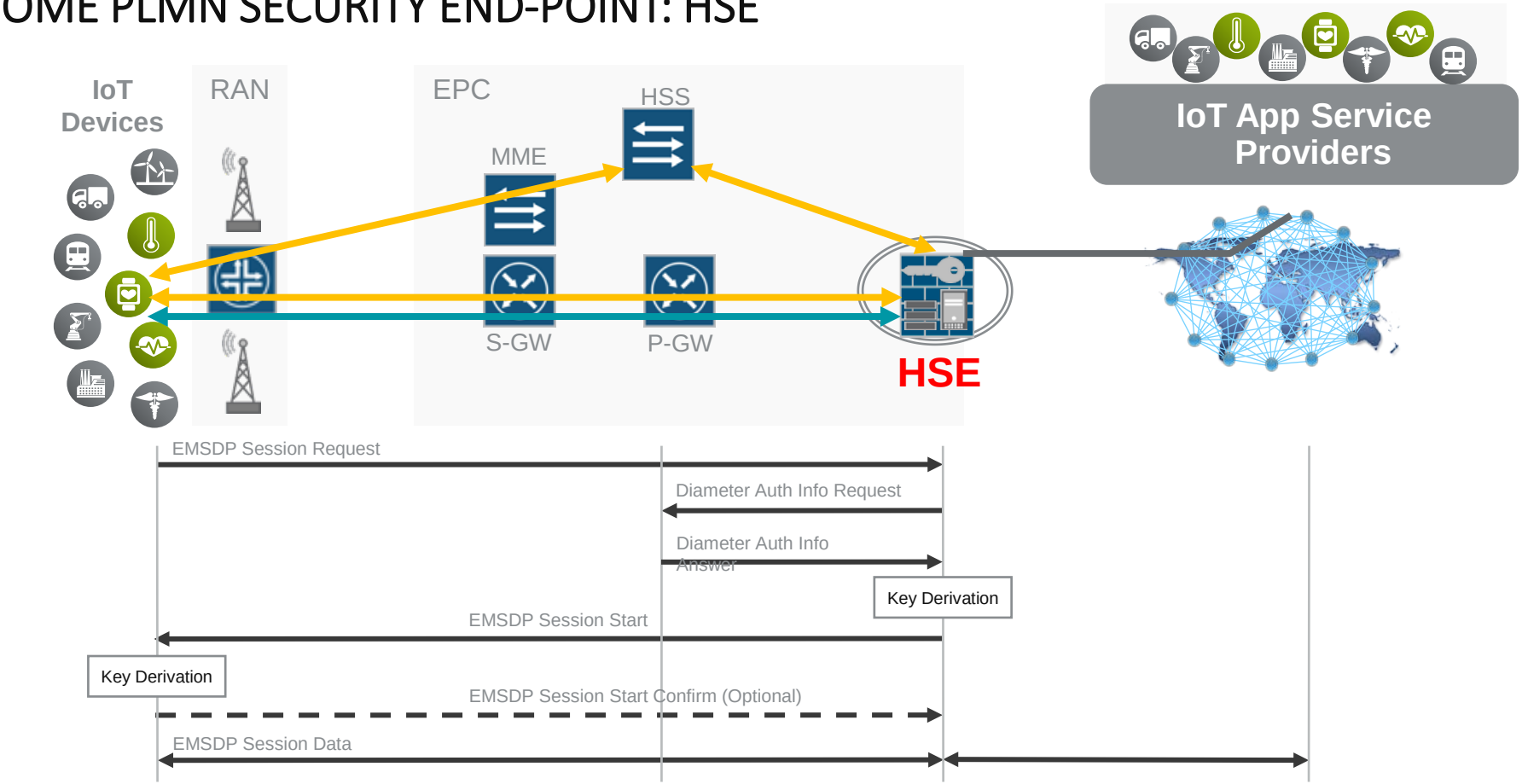
BEST: **B**attery **E**fficient **S**ecurity for very low **T**hroughput IoT

BEST: BATTERY EFFICIENT SECURITY FOR VERY LOW THROUGHPUT IOT

BEST – **B**attery **E**fficient **S**ecurity for very low **T**hroughput IoT:

- **TS33.163 release-1**
- **IoT Access**: Work seamlessly with NB-IoT and LTE-M
- **Power efficiency**: over-the-air & compute cycles
- **Payload**: Support both IP and non-IP data
- **Roaming**: Secure roaming
- **Deployment Models**: End-to-middle and end-to-end security models
  - Operator controlled IoT middle-platform – the HSE
- **5G phase 2**: studies of IoT features are just starting
  - Evolution of Cellular IoT security
  - Authentication and key management for applications based on 3GPP credential

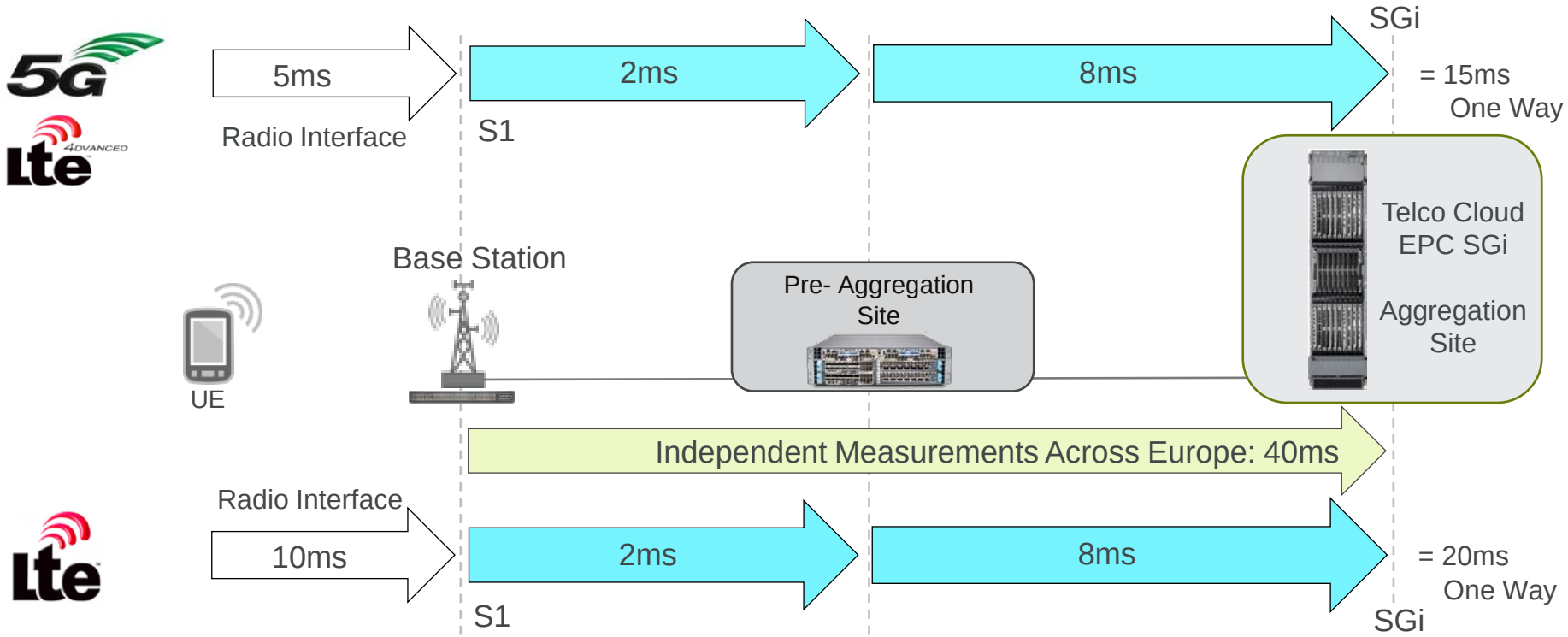
HOME PLMN SECURITY END-POINT: HSE



DISTRIBUTED MOBILE EDGE CLOUD:

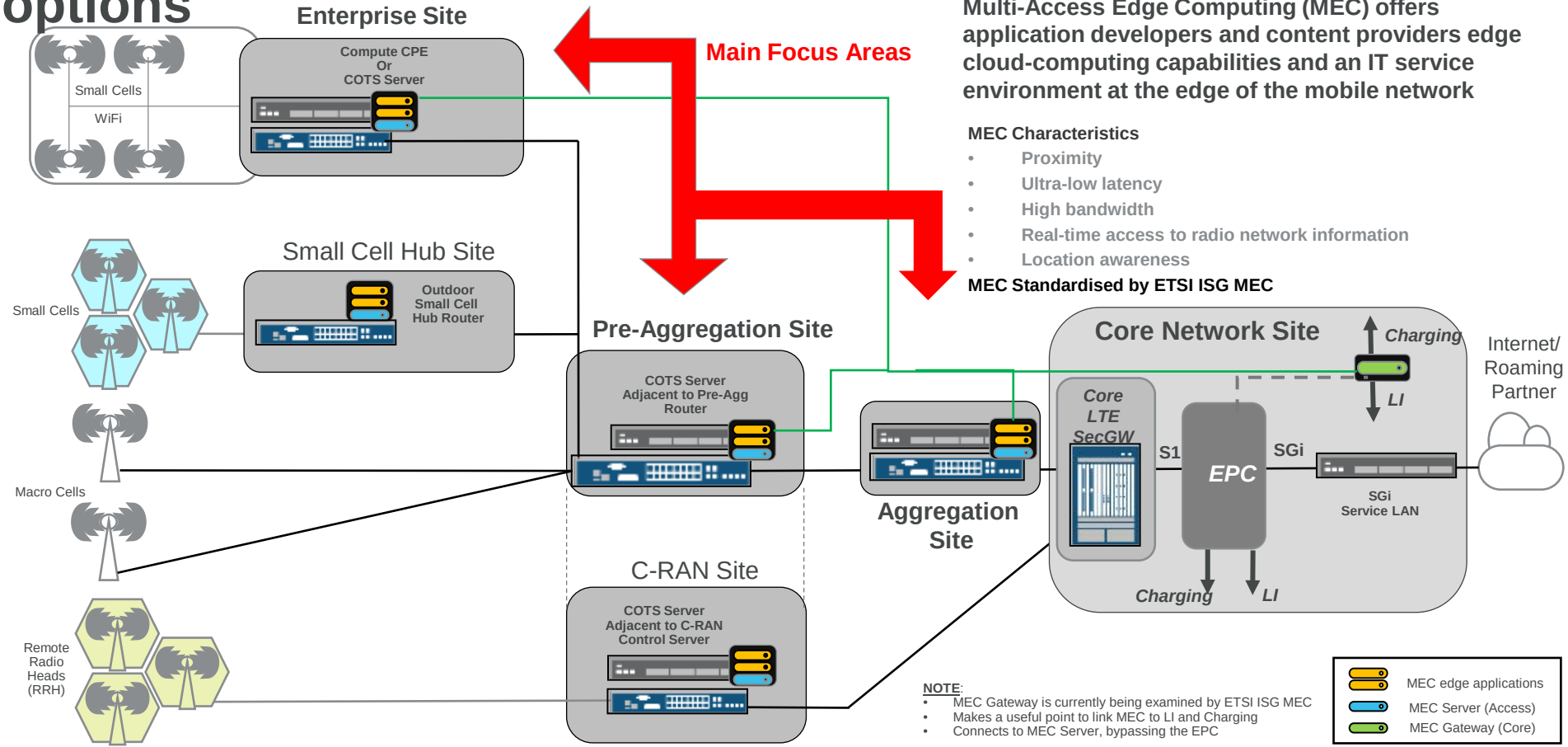
Latency, Location, Software and Hardware

Network Latency: Unloaded .v. Loaded Traffic Latency UE to SGi



- Unloaded Measurements Often Used to show “Low Latency” for deployed networks from Base station to SGi Interface (With or without CUPS)
- When Loaded Traffic Routing is assessed, in deployed 4G networks, from eNode to SGi is 40ms One Way
- Published, Independent Latency tests verify this figure across Europe
- To achieve Low Latency (<25ms RTT), applications must be reachable across 4G and 5G radio at the pre-agg Hub Site.

Multi-Access Edge computing (MEC) Deployment options



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

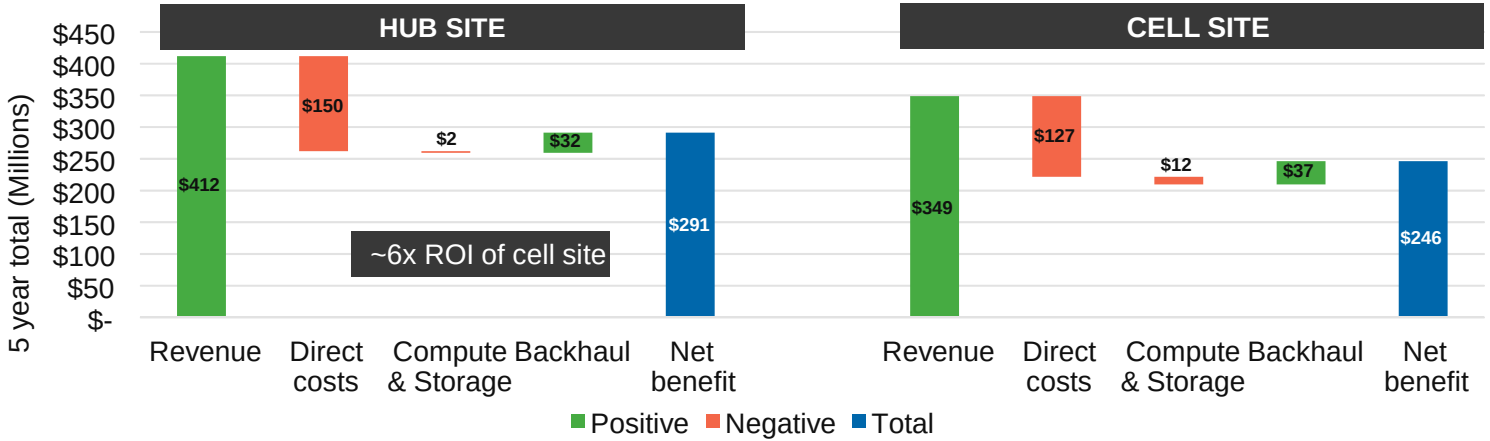
MEC Characteristics

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

MEC Standardised by ETSI ISG MEC

HUB SITE DEPLOYMENT OFFERS BEST BUSINESS CASE*:

COMPROMISE BETWEEN QUALITY, COST & SPEED OF DEPLOYMENT



JUNIPER MODELLING CONCLUSIONS

Faster rollout to hub sites leads to greater average improvement in customer experience (& revenue) due to the faster rollout

Direct costs includes normal opex costs from the business (e.g. sales & marketing, interconnect, etc…)

Significantly higher compute costs at cell site, for limited additional backhaul savings

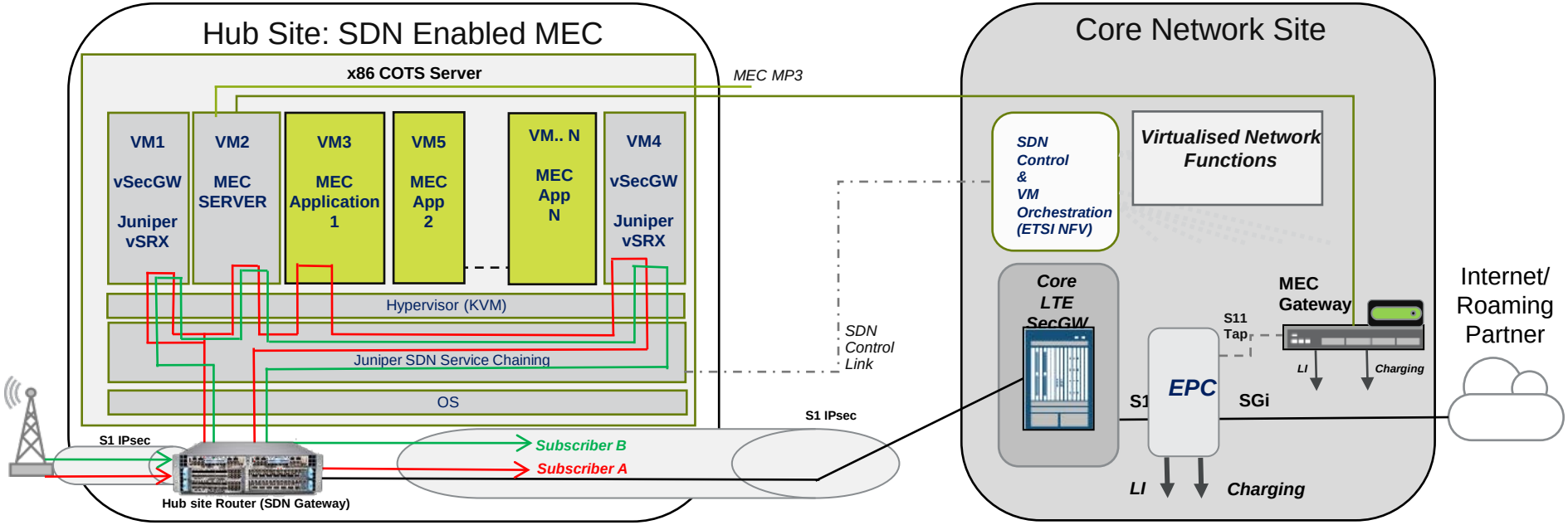
Overall benefits higher at hub site with much greater ROI

Long term service improvements from cell site deployment do not outweigh additional costs and time to deploy

***NOTE**: **Deployment model used reflects Cell sites connecting to aggregation hub sites and then the core site**

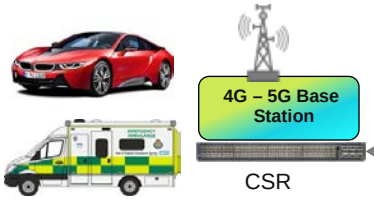
MOBILE EDGE CLOUD: THE SOFTWARE

- 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 (Contrail Edge Cloud) allows the creation of services chains in the 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



MOBILE EDGE CLOUD: THE HARDWARE – Edge Micro Data Centre

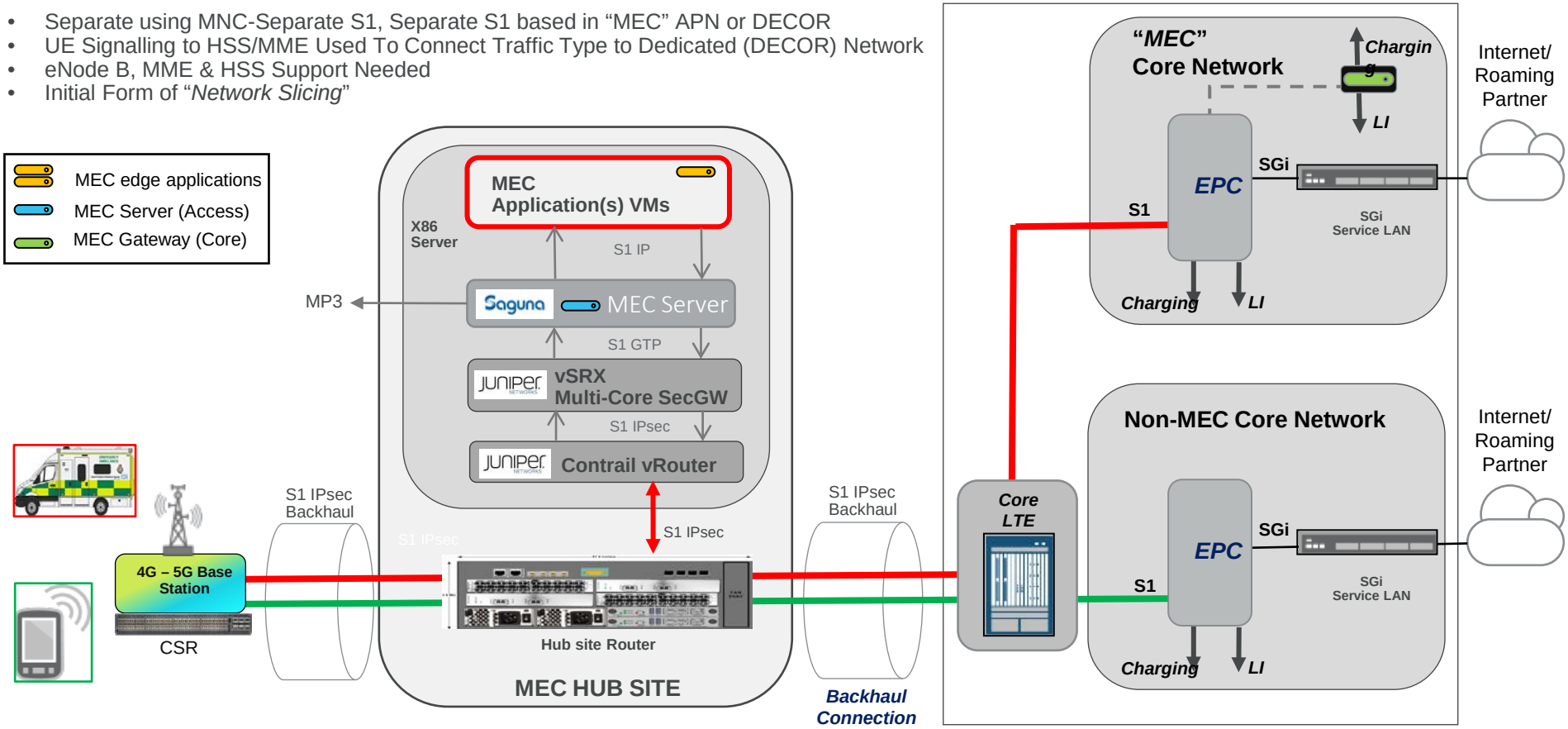
- **To Deliver Low Latency Services an Edge Micro DC Infrastructure is needed**
- **Classic DC architecture … but smaller:**
  - **40 x 2U 24 Core servers/rack**
  - **2U TOR**
  - **Hub site Router “DC Gateway”**
  - **SDN Service Chaining**
  - **Supports MEC & Other services**



Traffic Selection: Separating MEC & Non-MEC Traffic

3GPP R13 DECOR & R14 eDECOR

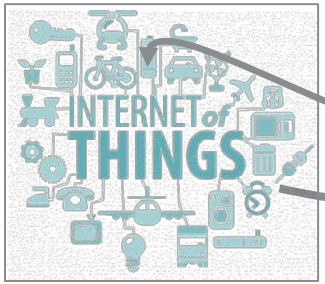
- Separate using MNC-Separate S1, Separate S1 based in “MEC” APN or DECOR
- UE Signalling to HSS/MME Used To Connect Traffic Type to Dedicated (DECOR) Network
- eNode B, MME & HSS Support Needed
- Initial Form of “*Network Slicing*”

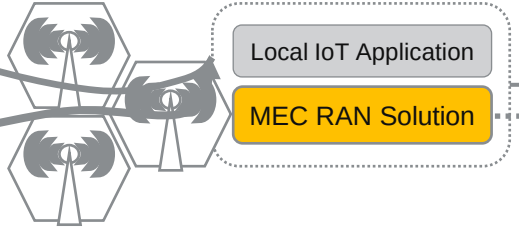


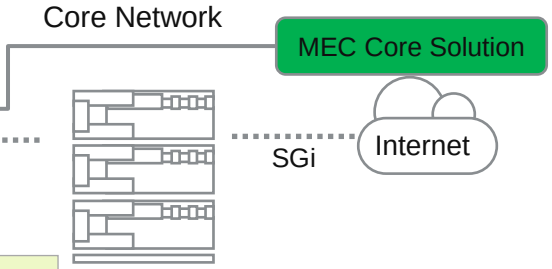
DISTRIBUTED MOBILE EDGE CLOUD:

Multi-Access Edge Computing (MEC) Use Cases

Reducing Latency Directly Benefits IoT Device Battery & Business Case

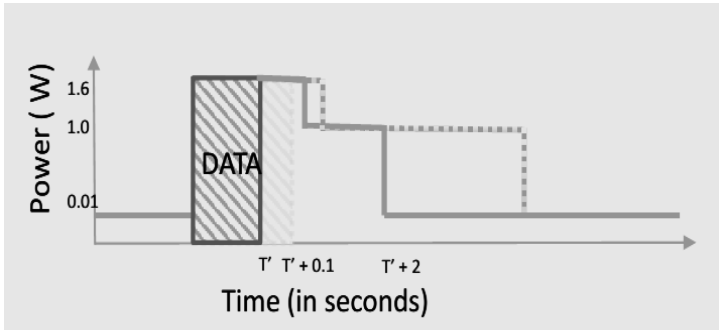


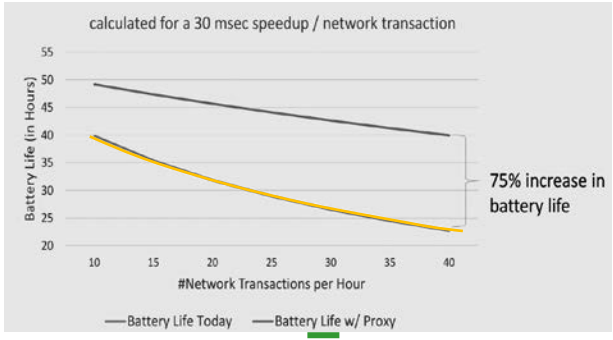




- Also Connected Car as due to connected use whilst engine off, hybrid or electric vehicles
- The more the battery is discharged, the more energy needed for recharge and hence emissions

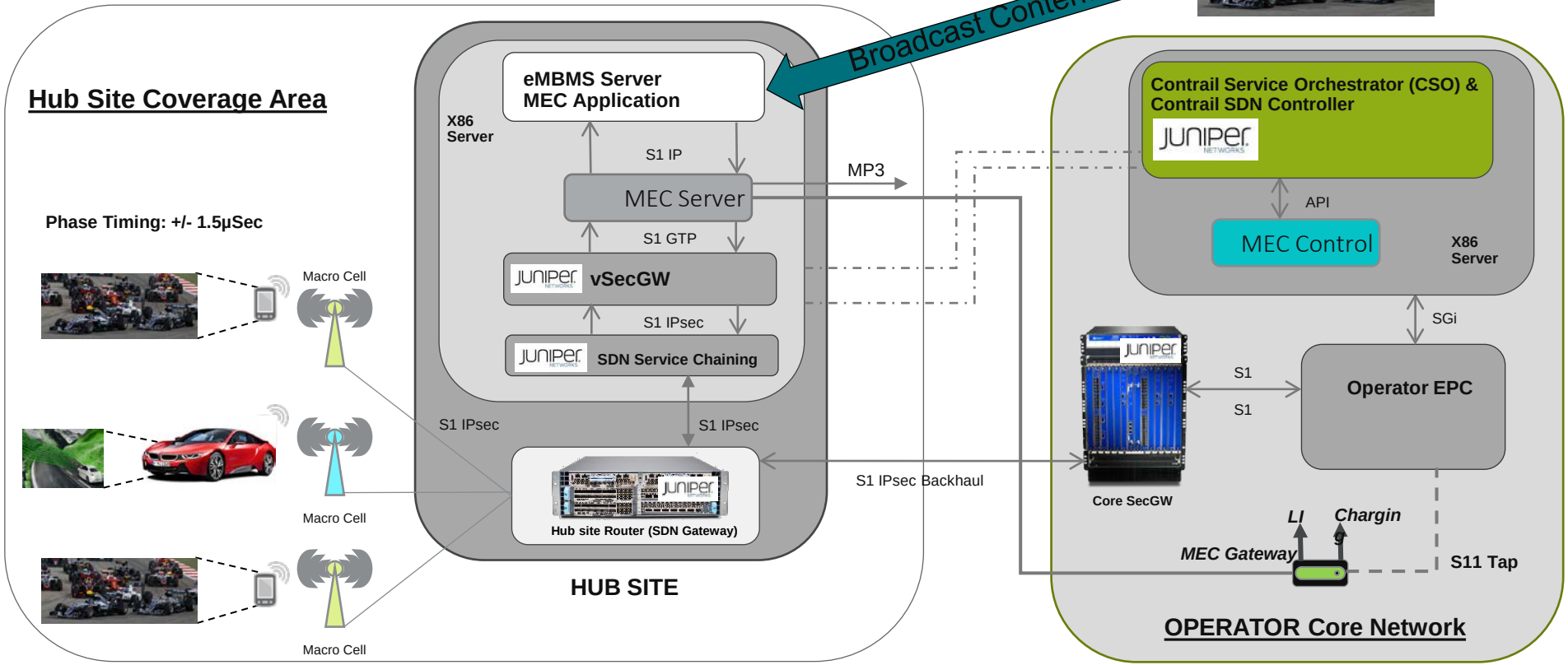
Based on Microsoft cloudlet research by Dr. Victor Bahl



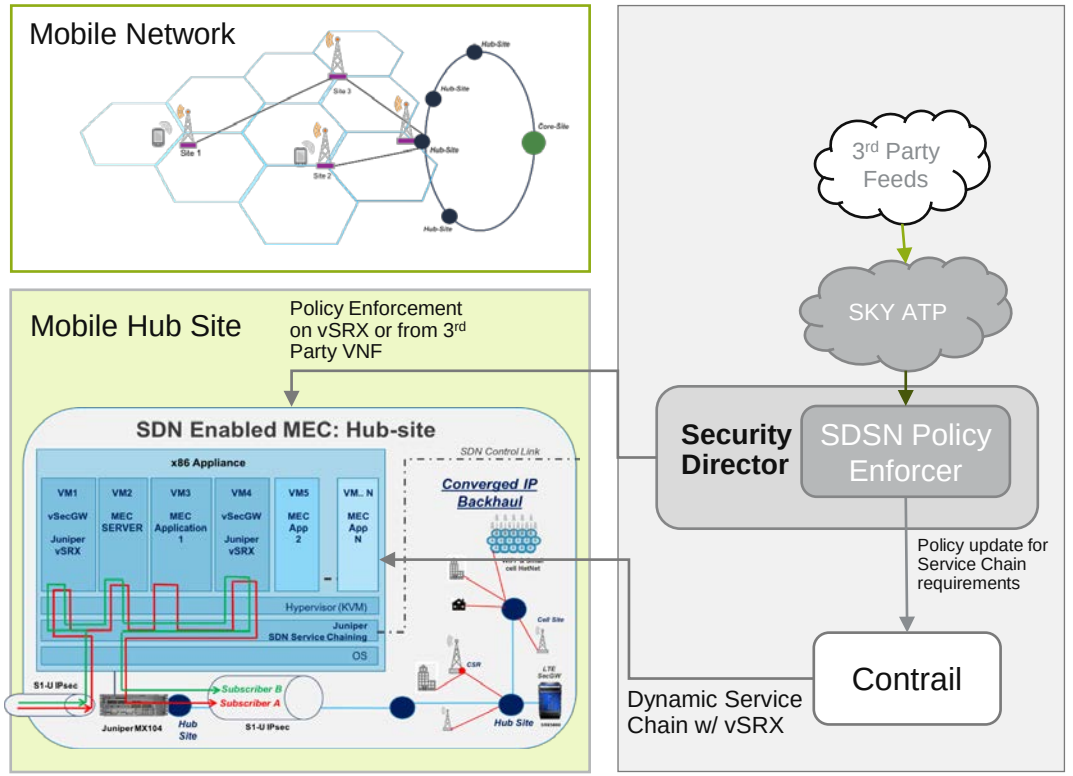


Multi-Access Edge Computing (MEC) & eMBMS

- MEC Allows high bandwidth content (Streaming, Broadcast, Device s/w etc) to be distributed into the RAN
  - Reduced EPC load, **Scales to fit IoT device Maintenance Windows**
- Phase Timing accuracy is now from the MEC Application – eMBMS server to the base stations



EDGE SECURITY: SOFTWARE DEFINED SECURE NETWORKS & MEC



Policy

- Policy defined in Policy Engine
  - "*Attacks from infected mobile devices should be blocked in the Mobile Hub site*"

Detection

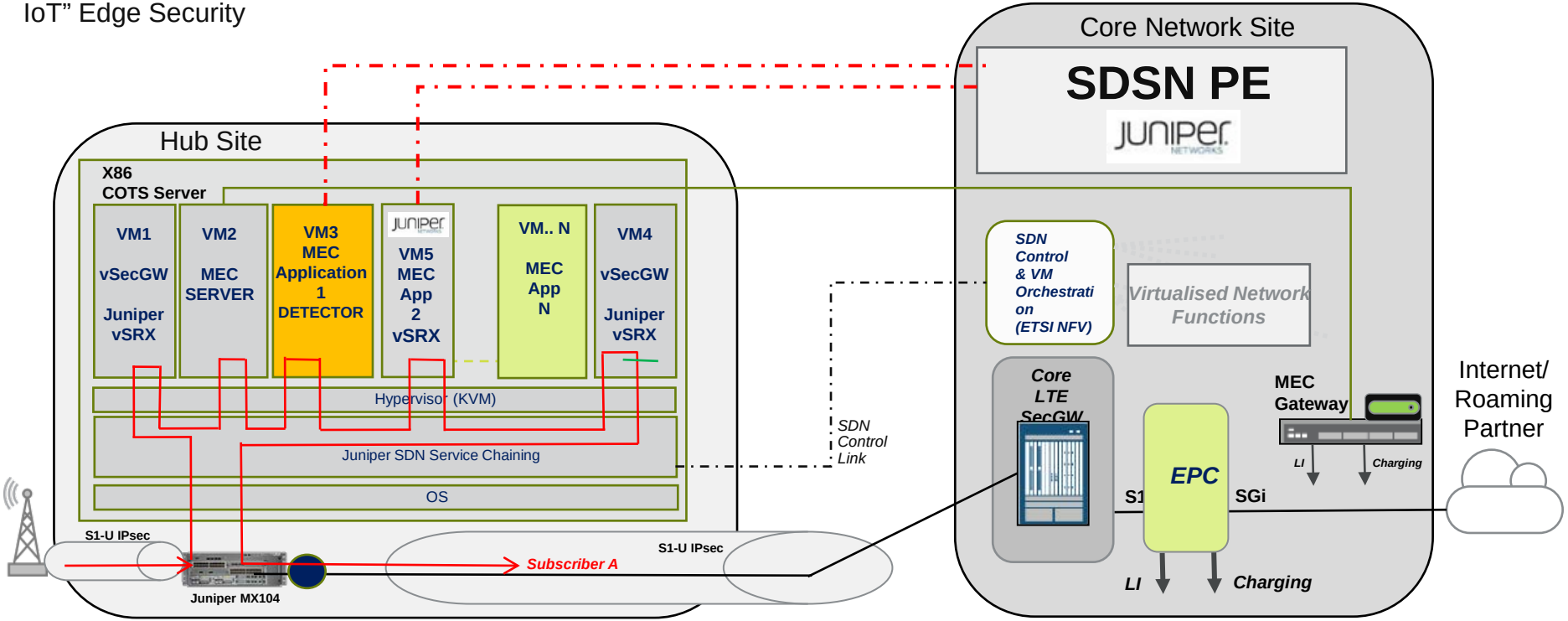
- Sky Infected Host feed
  - 3rd party feeds
  - SRX data to Sky

Enforcement

- Contrail provisions vSRX in the Service Chain
- Traffic from infected mobiles dropped by vSRX

EDGE CLOUD & SDSN: vSRX ENFORCEMENT WITH DETECTION ENHANCEMENT FROM 3RD PARTY DETECTORS

- Deploy other 3rd Party Detectors and vSRX as ME Applications in the MEC Service Chain
- vSRX can spot many attacks and already refer others to SDSN PE
- Many new attack vectors (e.g. MIRAI) needs a 3rd party detector
- Deploy detectors and the vSRX, Linked to SDSN PE for comprehensive 4G/5G “Massive IoT” Edge Security

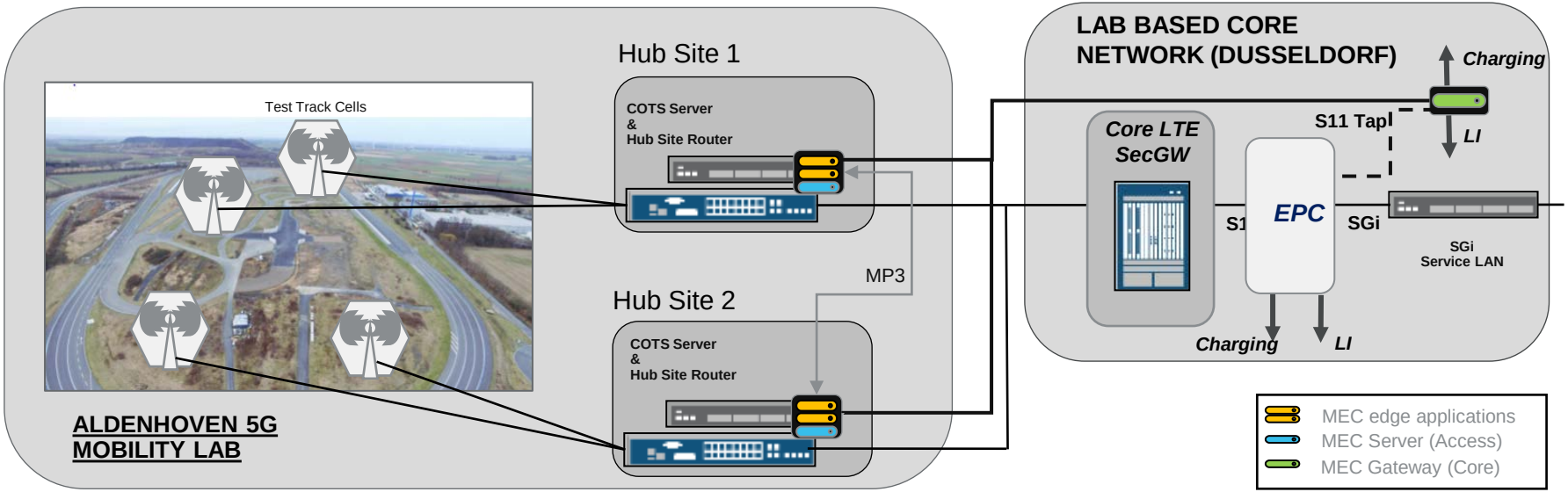


DISTRIBUTED MOBILE EDGE CLOUD:

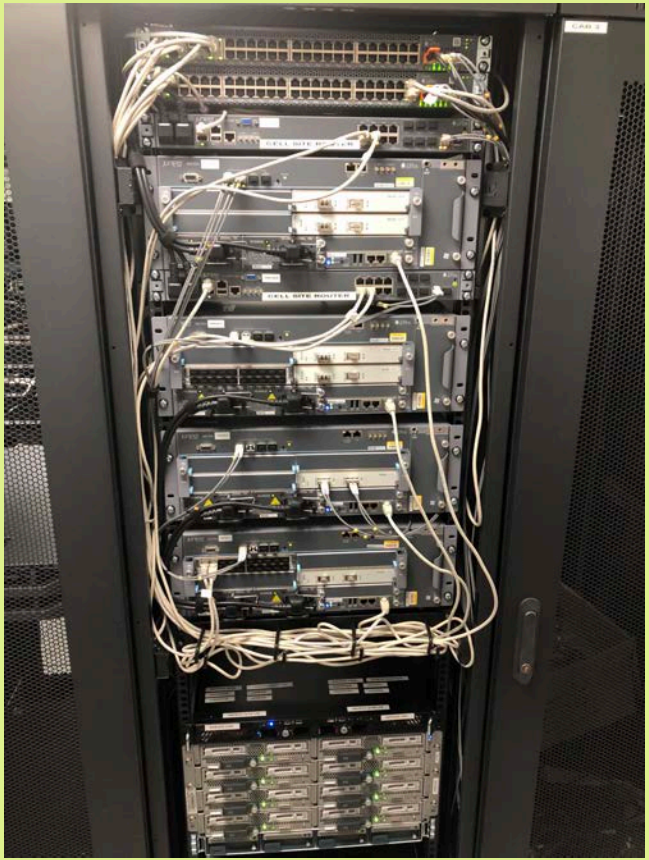
Multi-Access Edge Computing (MEC) PoCs & Projects

VODAFONE GERMANY 5G MOBILITY LAB

- Juniper SDN allows the automated creation of MEC systems and service chains
- The use of the Saguna vEDGE MEC server on the Hub site addresses low latency whilst addressing high speed handover issues
- Application handover between MEC servers (MP3) can be tested
- Since the S1 connections are protected with IPsec, the MEC hubs require a vSecGW in the service chains



United Kingdom 5G TEST BED: JUNIPER UNDERPINS UK 5G Test Bed



THANK YOU!