sandvine®
Intelligent Broadband Networks

Customer, Service and Network Design in 5G: Operational and Management Challenges

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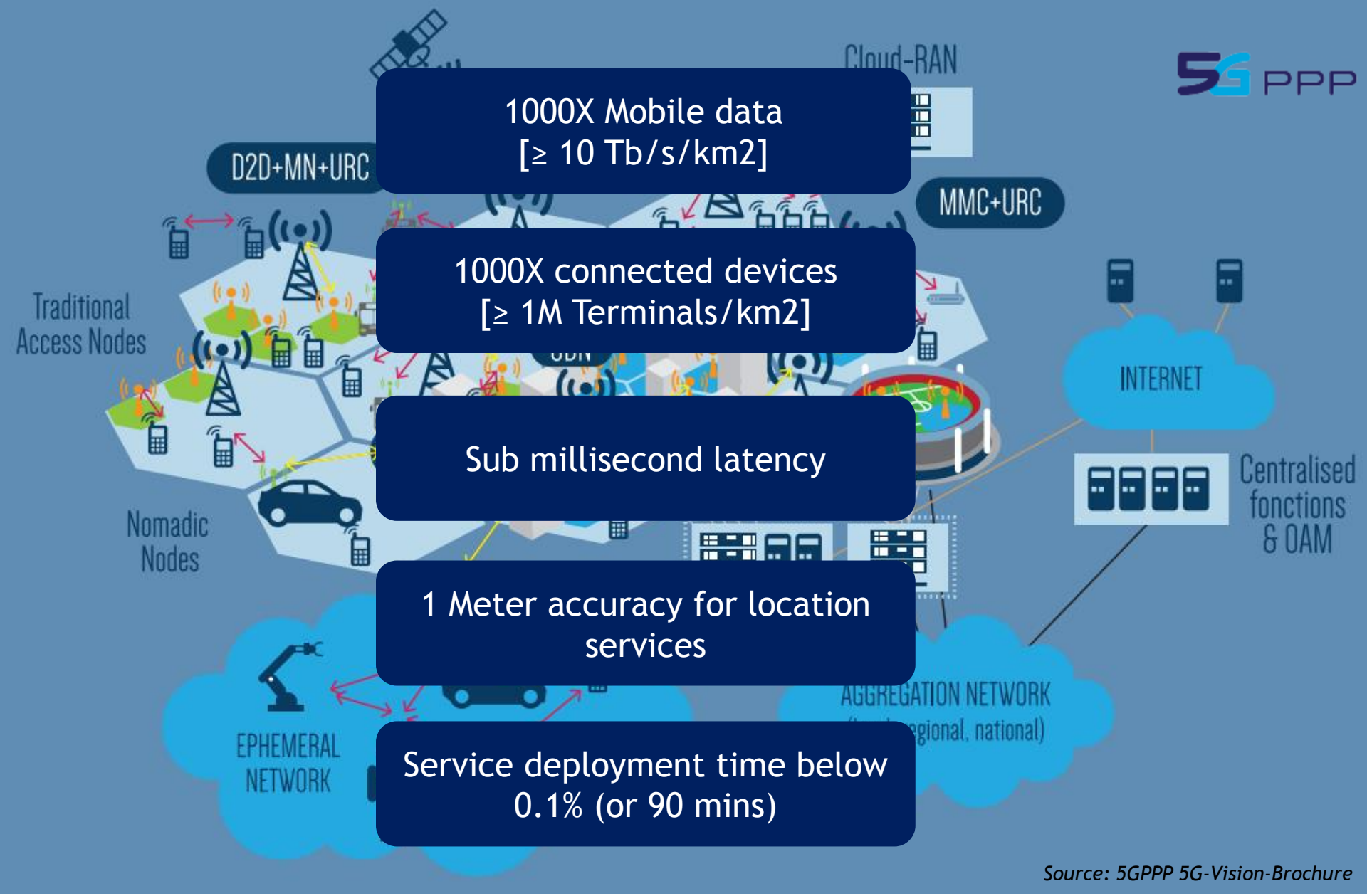
VTC2016-Fall
MONTRÉAL
A Connected World at your Fingertips

Sandvine at a Glance

- Founded in 2001 and HQ in Waterloo, Canada
- Any access technologies (e.g., 3G, 4G/LTE, Cable, DSL, Fiber, PON, Satellite, WiFi, WiMAX), any scale
- Available in a completely virtualized solution



Source: 5GPPP 5G-Vision-Brochure

URC: Ultra Reliable Communications, MN: Moving Networks, MMC: Massive Machine Communication, UDN: Ultra Dense Network

Operators need strong data engineering and analytics to better understand customers' behavior

Streaming real-time events are going to be critical for driving intelligent (supervised and automatic) decisions to maintain the right level of QoE

- Application Oriented QoE metrics

Customer Experience Management

Uses and needs vary depending on the operator's business units and teams

Net Promoter Score

Customer Experience Score

Customer Experience Management

Collecting, Analyzing, and Predicting NPS are drivers behind the need for more advanced analytics and subscriber engagement systems

Net Promoter Score

Customer Experience Score

Net Promoter Score

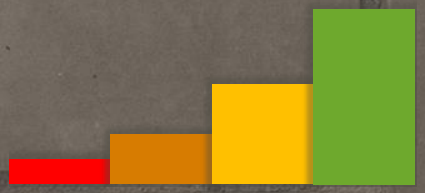
"The only path to profitable growth may lie in a company's ability to get its loyal customers to become, in effect, its marketing department."

https://hbr.org/2003/12/the-one-number-you-need-to-grow/ar/1

Get to know your subscribers.

Quality of Experience

Glued to the screen?



Data Hungry?

Favorite Apps

5G takes QoE to the next level as use cases expand drastically

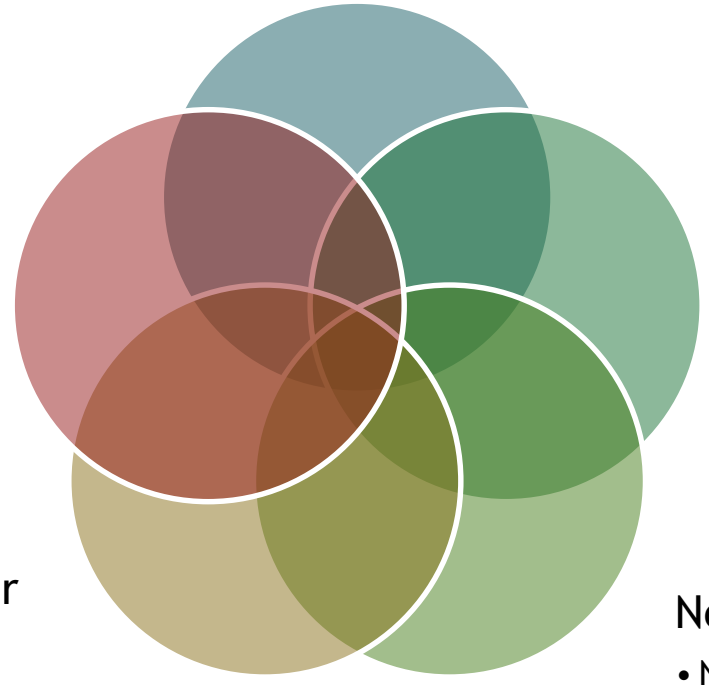
5G Use Cases and Key Aspects

Critical Communications

- Industrial Control, Gaming, Telemedicine

Massive Machine Type Communications

- eHealth, Subway, Smart Stadium, Smart City



Enhanced Mobile Broadband

- Augmented & Virtual Reality, Plane and Train Broadband, Ultra High Definition Media

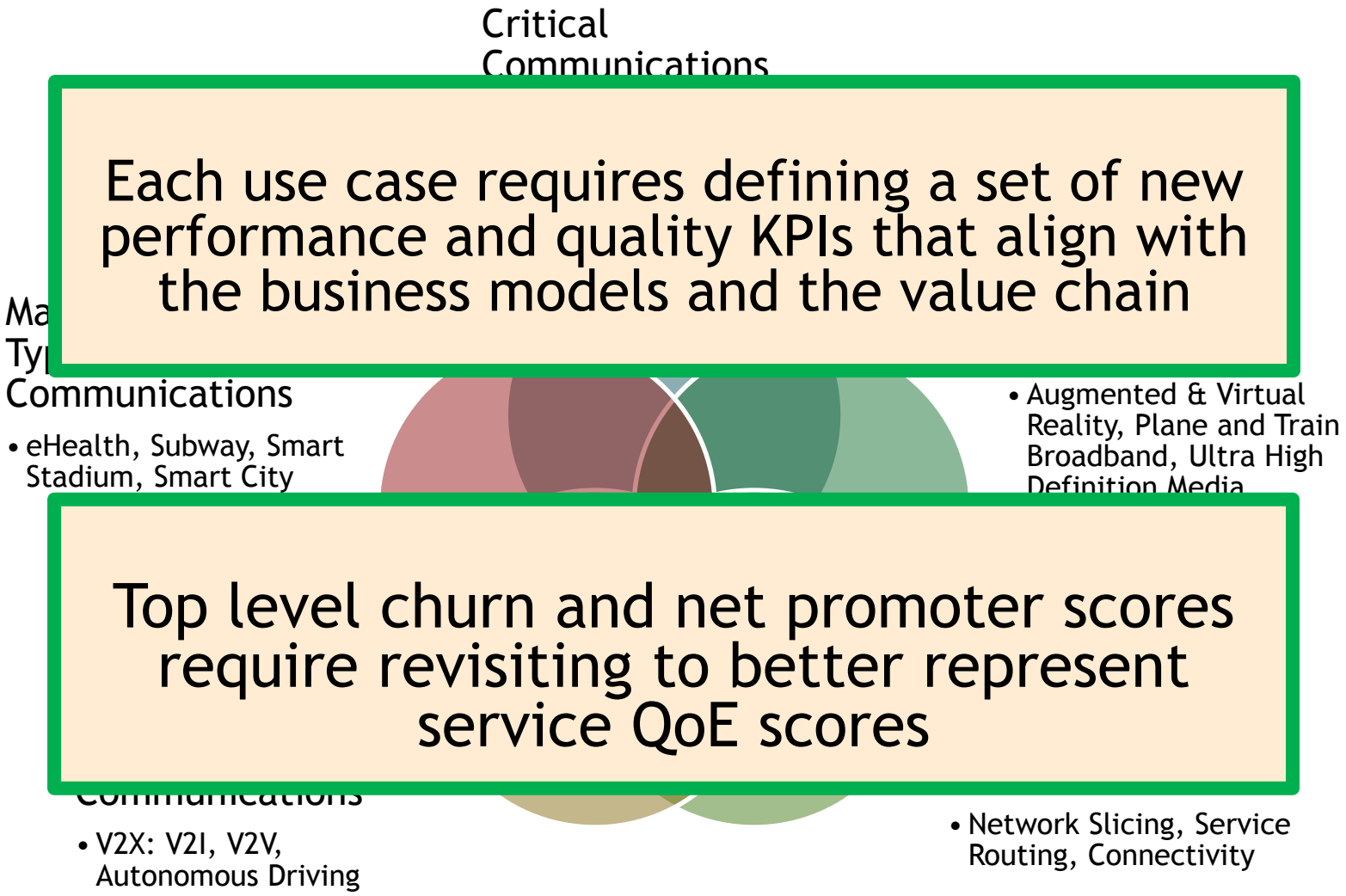
Evolved Vehicular Communications

- V2X: V2I, V2V, Autonomous Driving

Network Operation

- Network Slicing, Service Routing, Connectivity

5G Use Cases and Key Aspects

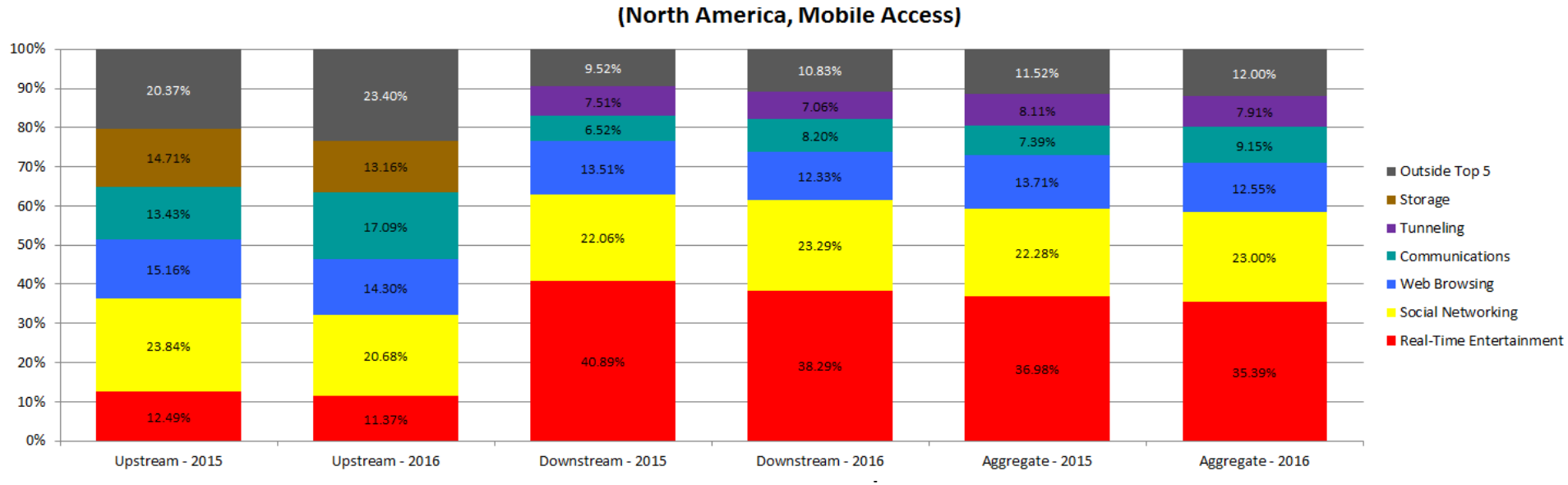


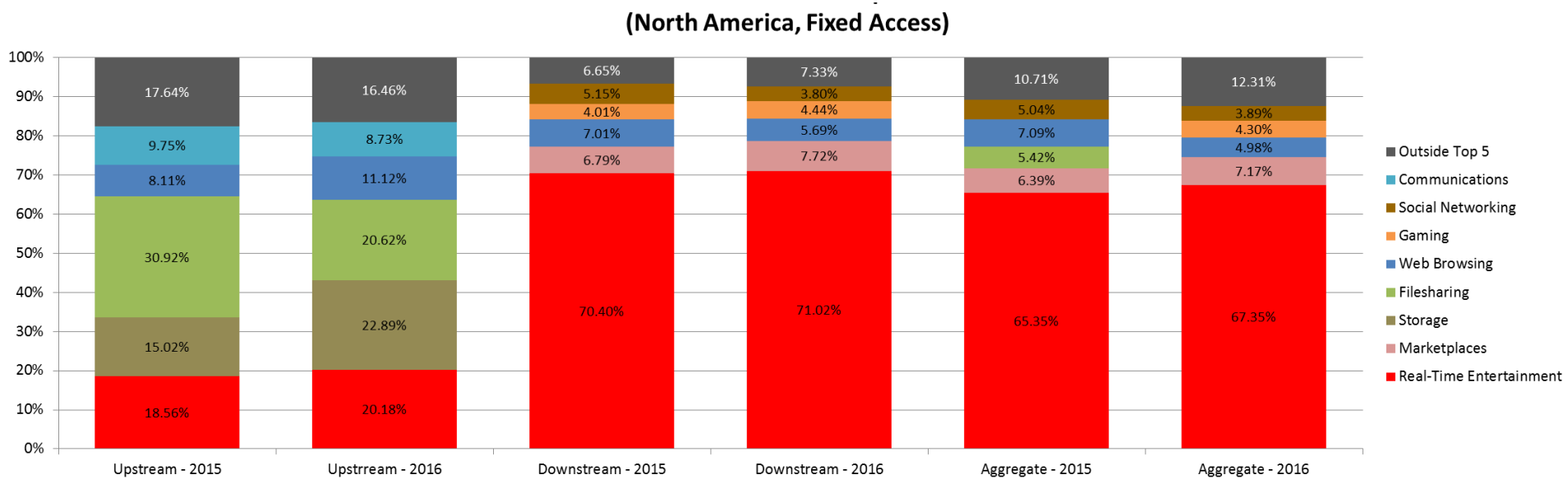
Each use case requires defining a set of new performance and quality KPIs that align with the business models and the value chain

Top level churn and net promoter scores require revisiting to better represent service QoE scores

Traffic Profiles Today

Source: Sandvine Internet Phenomena Report 2016





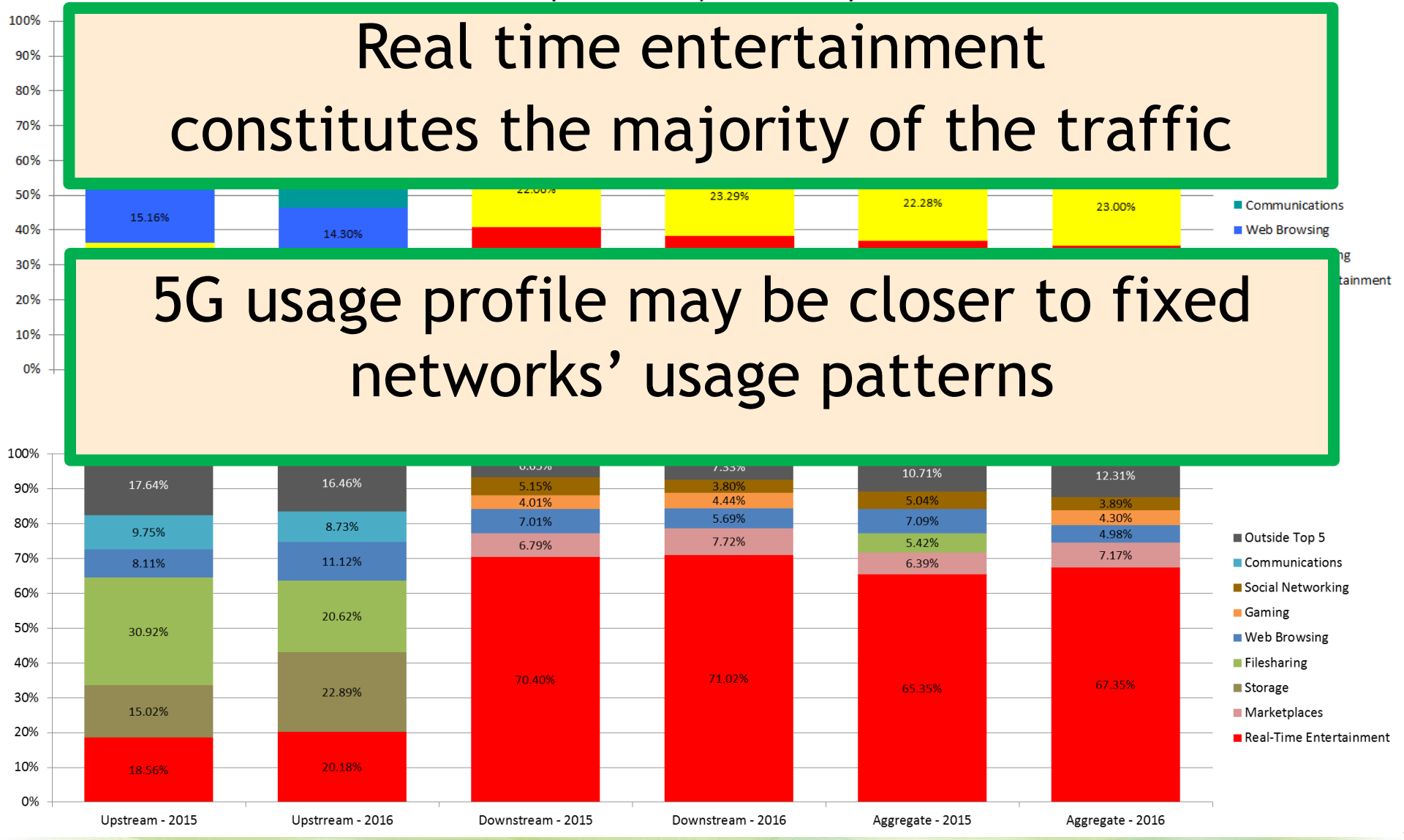
Traffic Profiles Today

Source: Sandvine Internet Phenomena Report 2016

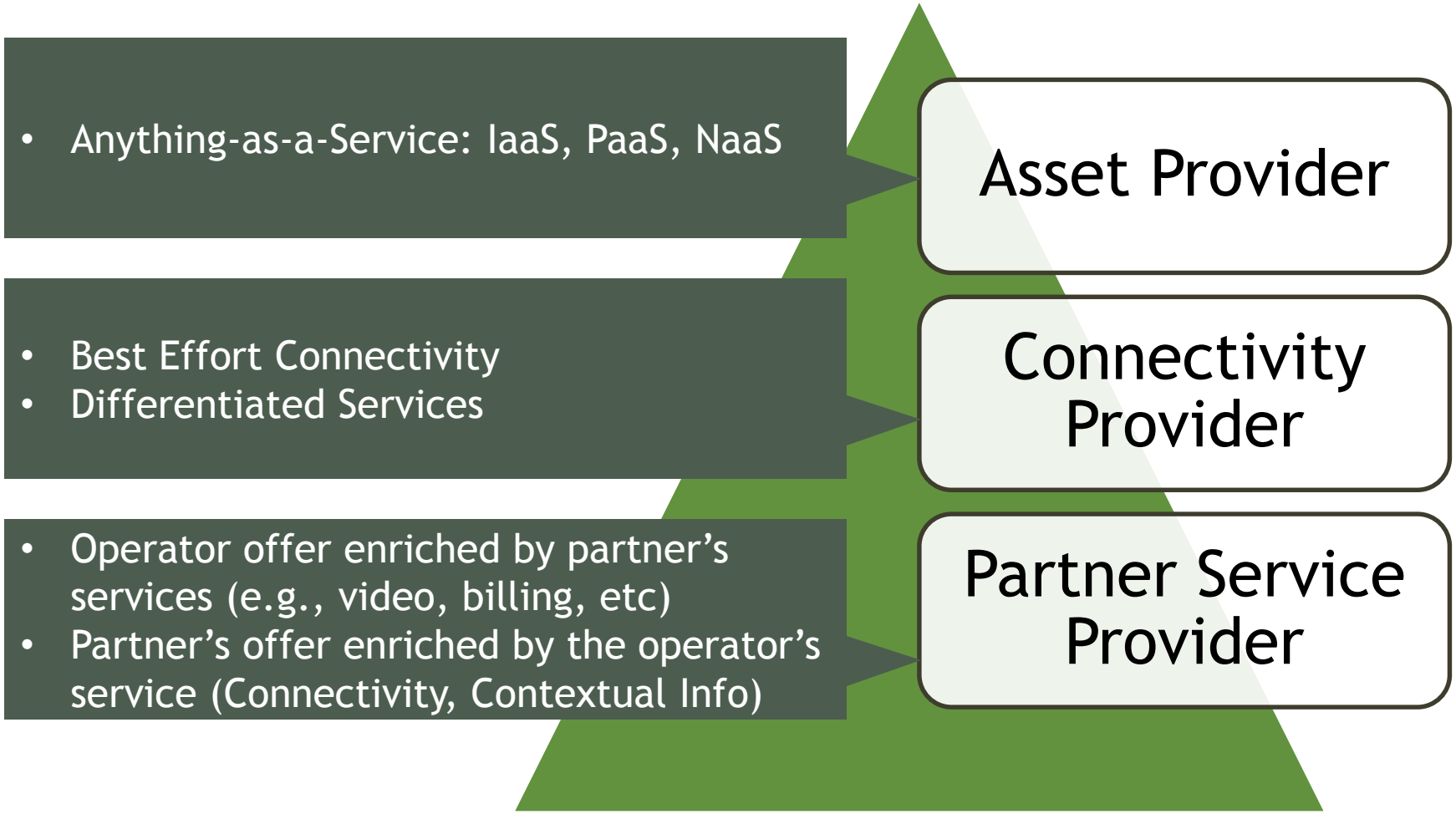
(North America, Mobile Access)

Real time entertainment constitutes the majority of the traffic

5G usage profile may be closer to fixed networks' usage patterns



Business Models for 5G



Adapted and modified from NGMN's 5G White Paper

Business Models for 5G

- Anything-as-a-Service: IaaS, PaaS, NaaS

Asset Provider

The CEM needs to be tailored the business models and roles

- Operator offer enriched by partner's services (e.g., video, billing, etc)
- Partner's offer enriched by the operator's service (Connectivity, Contextual Info)

Partner Service Provider

Adapted and modified from NGMN's 5G White Paper

Application Evolution and QoE

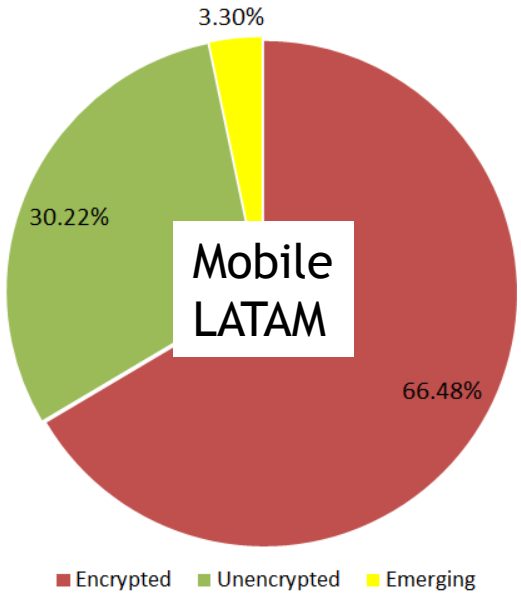
Microsoft HoloLens

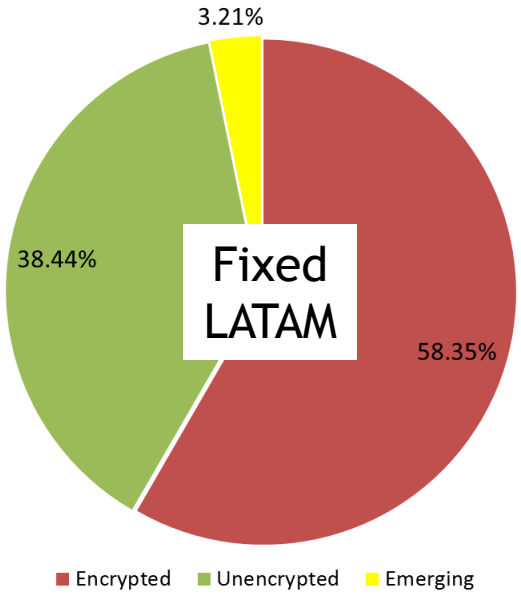
Applications combine multiple services to deliver the desired functionality (e.g., location service and game service). QoE estimation must cover all services

Current QoS model based 5-tuple descriptions of applications needs revisiting

Encryption

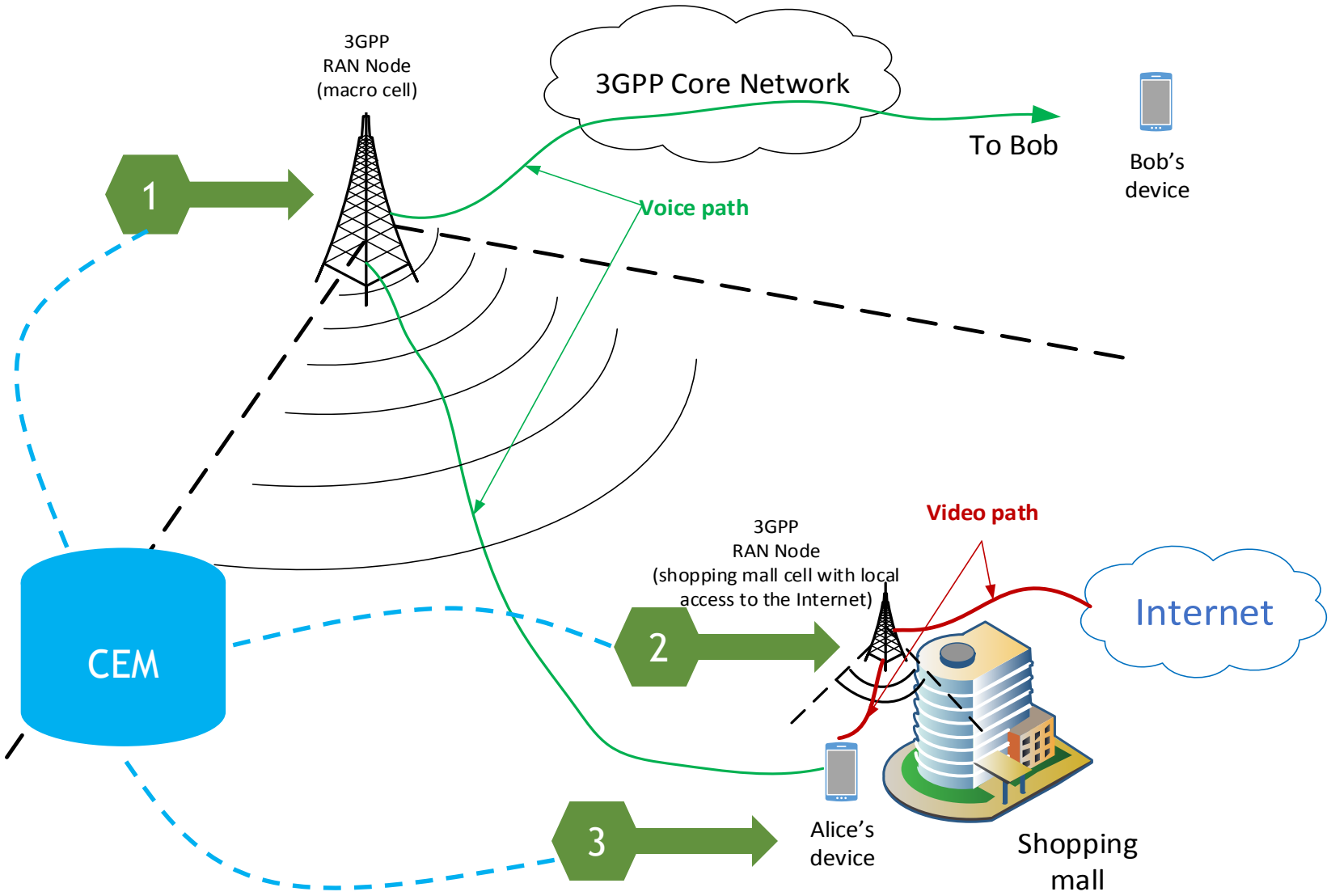
- An increasing number of OTT services are encrypting their traffic for various reasons
- Challenges for QoE estimation
  - Detection requires correlating multiple events
    - (DNS, TLS handshake, traffic signatures)
  - The 5-tuples are not enough to describe sub flow components.
    - Facebook chat versus browsing
  - CDNs serving multiple services





Sandvine Internet Phenomena Report 2016

Challenges: Multiple Networks

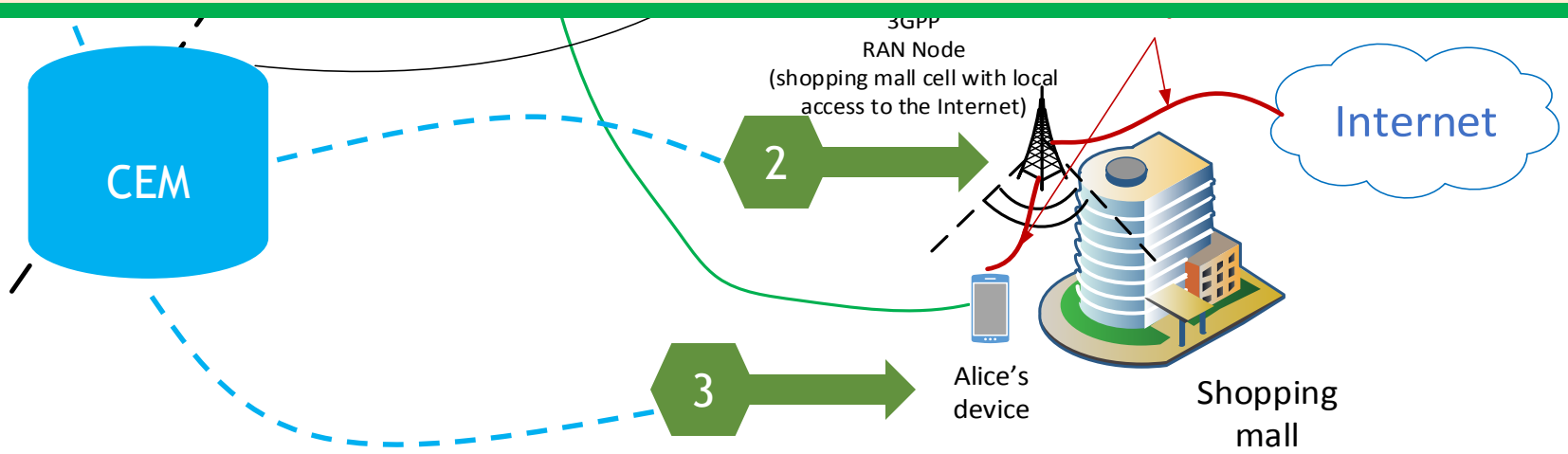


Source: 3GPP TR 22.891e10

Challenges: Multiple Networks

CEM may need to collect QoE information from each access

Access needs to become more intelligent about traffic classification to provide the right level of reporting to the CEM



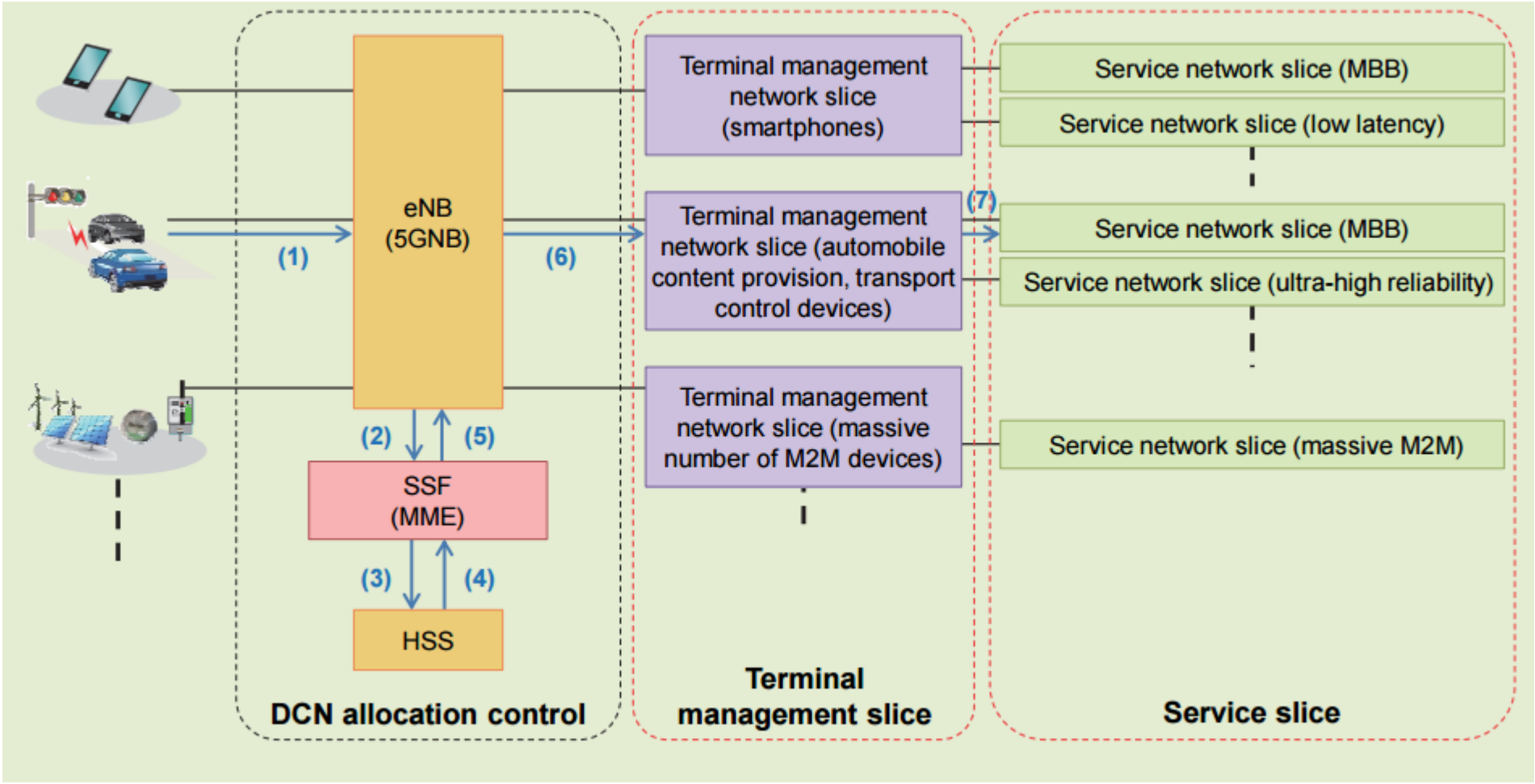
Source: 3GPP TR 22.891e10

Intelligence Towards the Edge

- There is an unprecedented opportunity for developing application level awareness near the edge
  - Mobile Edge Computing and Core-RAN
- New use cases for traffic management especially for Ultra Dense Networks (UDNs)
  - Application and subscriber aware
  - The traffic management decisions can be completely influenced by the results of predictive analytics on the real-time QoE data from the CEM system

Network Slicing

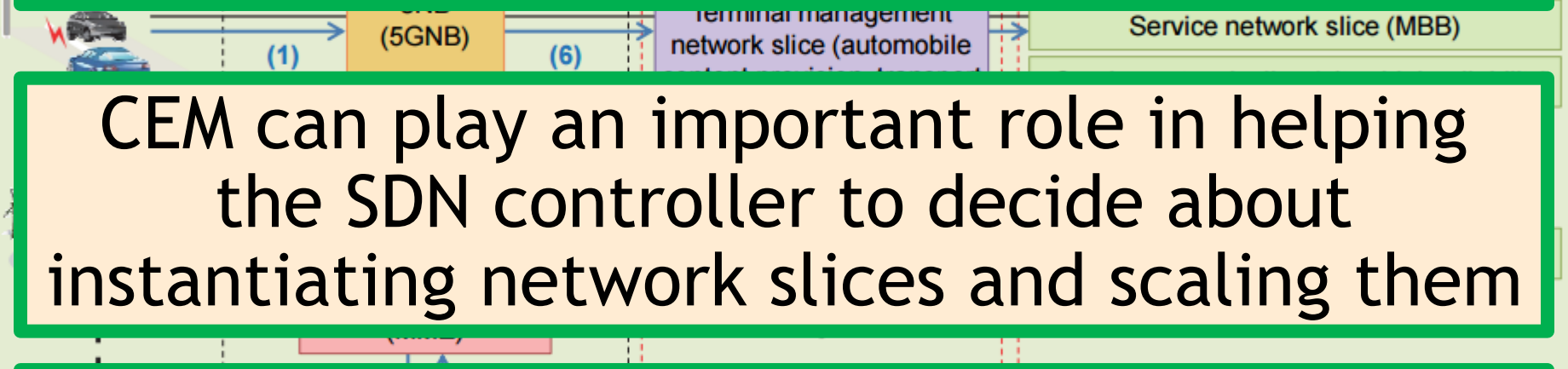
DCN: Dedicated Core Networks



Source: Future 5G Network for the 5G Era, NTT DOCOMO Technical Journal, V17No4, 2016

Network Slicing

CEM needs to monitor and predict the performance of network slice based on realtime end to end QoE measurements



CEM can play an important role in helping the SDN controller to decide about instantiating network slices and scaling them

CEM can also play an important role in slice selection for the service

Source: Future 5G Network for the 5G Era, NTT DOCOMO Technical Journal, V17No4, 2016

Challenges: Data Gathering

CEM systems need to integrate with a significant number of proprietary products and data formats requiring in some cases some thick layers of mediation and long professional services projects

- Data Gathering Technologies
  - Flume, NiFi, Kafka, Quarks
  - Increased focus on IOT streaming data
  - Distributed decision logic
- Real-time Processing Technologies
  - Spark Streaming, Strom, Flink
  - Machine learning on streaming data

Other Challenges

- Correlation of control plane signaling events with data plane and application layer
- Open APIs for customer care solutions
- Open APIs for billing systems
- Open APIs for subscriber data management
- Data mining technologies
  - Impact of competitive activity on churn
  - Increased social network integration
- Modern methods of engaging with the customers
  - Social, Push Messaging, Email, etc

Summary

There are many untapped opportunities with CEM today and much more in the 5G era.

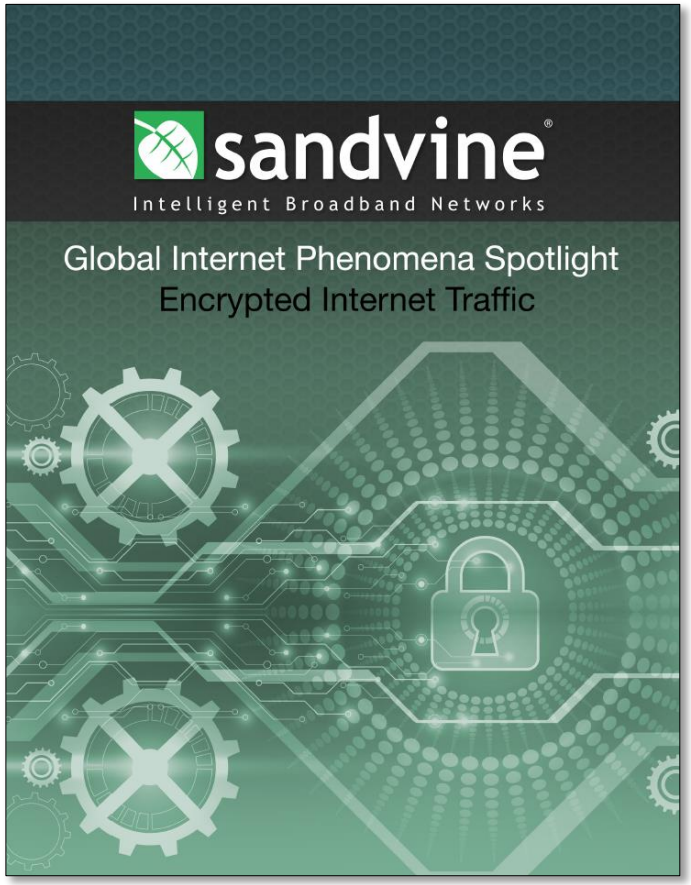
5G pillar technologies offer a significantly richer user experience and new business models.

CEM systems will evolve to incorporate real-time event correlation, predictive analytics, and real-time actions

THANK YOU

We Advance Industry Awareness

"In 2016, almost two-thirds of traffic on North American fixed access networks will be encrypted. It is important for subscribers and operators to understand that encryption does not mean something is undetectable or unidentifiable, it just means that the content is private."



Current State of Encryption Adoption

Sandvine worked with a North American fixed access network in April 2015 with the goal to demonstrate just how much traffic is encrypted currently.

One common misinterpretation from previous Global Internet Phenomena Reports made by some readers was that an application listed as "SSL" encapsulated the entirety of encrypted traffic on the Internet. The reality is that, in Sandvine's reports the data presented in those reports are direct outputs of Sandvine's reporting products, and that the "SSL" category listing typically representsthe very long tail (thousands of websites or applications, representing a fraction of Internet traffic each) of SSL traffic that Sandvine has consciously chosen not to separately classify (for example, your bank's encrypted traffic, secure payment systems, etc.) as individual applications.

At the same time, leading SSL-based applications such as Facebook, YouTube, or Twitter, have used SSL for many years and have been reported accurately and separately under their own proper names because of Sandvine's decision to assign an application name to them in our reports. To arrive at an accurate total, the traffic related to the "SSL" category and these major applications must be added together.

Figure 1 below shows a breakdown of our research and how 29.1% of total downstream traffic is now encrypted, with 65% remaining unencrypted.

Figure 1 - Encryption Composition - North America, Fixed Access - April 2015

The 6% emerging traffic refers to traffic yet to be classified by Sandvine, so a determination of whether it is encrypted or unencrypted was not possible. Sandvine's philosophy towards traffic identification is to focus on accuracy first, and completeness second. That is, we will not sacrifice accuracy (i.e., we will not accept false positives) to reduce the amount of traffic that is unrecognized. Simply put, false positives are unacceptable, as they can have a disastrous impact across a range of use cases for both subscriber (e.g., billed incorrectly) and operator (e.g., harm to reputation from mis-managing or incorrectly charging for certain traffic). That said, we routinely see traffic recognition rates upward of 95%[4].

As for the leading sources of encrypted traffic, YouTube, which is typically the second largest source of total traffic on North American fixed access networks, is also the largest source of encrypted traffic. YouTube as a whole accounts for 13.69% of total downstream traffic on the one network in this study, with the encrypted portion (HTTPS) of YouTube accounting for 11.45% of traffic. Based on observations in other markets, the exact ratio of encrypted to unencrypted YouTube traffic actually varies by country, but on this particular North American network 83.6% of YouTube traffic is

4. Our Global Internet Phenomena program lets us carefully monitor the rates of unrecognized traffic at our deployments around the world, and these rates are consistently less than 5% of traffic volume. The precise level in any network will vary, of course, based on local characteristics, management policies, and the frequency with which customers update their Loadable Traffic Identification Packs. That said, this average is based upon a mix of some customers - some of whom update frequently, and some of whom don't - and it's not uncommon to see a recognition rate of more than 97%.

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For more information, visit: https://www.sandvine.com/trends/encryption.html