Routing and Addressing Challenges - an Operator Perspective

Panel on *"The Routing and Addressing Challenges for the Internet of the Future"*
2nd Workshop on New Internetworking Protocols, Architecture and Algorithms
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Personal background

- Telecom Engineer (M.Sc.) by the Universidad Politécnica de Madrid (UPM), and M.Sc. and a Ph.D. on Telematics from the Universidad Carlos III of Madrid (UC3M)
- From August 2011 working in Telefónica I+D / Telefónica CTO unit, within the Transport Technology and Planning group
  - working on 5G, SDN, virtualization, transport networks and their interaction with cloud and distributed services, as well as on interconnection topics.
- Previous experience in Orange and Alcatel
  - in Orange (2006-2011), IP Backbone & Mobile Packet Core Network Planning
  - In Alcatel (1996-2006), R&D, Product Development and Customer Engineer
- Involved on innovation projects funded by the EU and the ESA
  - Currently working on the projects EU H2020 5GROWTH, EU-TW 5G-DIVE, and EU GNSS ROOT
- Active contributor to IETF, ETSI, ITU-T and ORAN

Motivation

- More and more sophisticated applications are expected to approach the market in the near future
  - Immersive experience, tactile internet, precision communications, etc
- New advance on technologies for supporting such applications
  - 5G, 6G, FTTH, etc
  - Advanced terminals either with high processing capabilities or leveraging part of the processing in the Network
- Availability of services everywhere
  - Requiring some adaptation depending on the location (i.e., the point of attachment)

What does this impose to the Network?

- ✓ Assured QoE
- ✓ Predictability
- ✓ Robustness

How it can be ("easily") accomplished nowadays?

- ✓ Large throughput and Capacity
- ✓ No congestion
- ✓ Redundancy and diversity

Feasible, but hardly scalable and very costly!!

Need of developing smart and efficient ways of solving such issues

Problem

Routing and Addressing

Delivery

- Optimal delivery fitted to application / user needs
- Leverage on meta-data or other sources of information to forward and processing traffic to meet user expectations

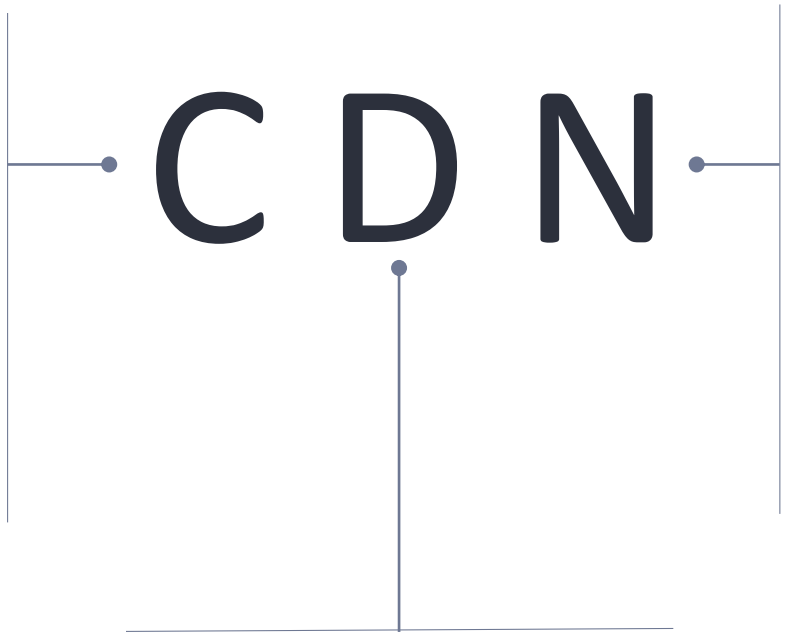
Location

- Identify properly the location of the end-user to optimize delivery
- Obtain from it contextual information affecting the delivery (point of attachment, service meaning, receiver characteristics, etc)

All is about to provide the expectations of diverse Applications/Service on top of a multi-purpose network by considering circumstances related to Networks and Users

Starting from today’s “simplistic” services

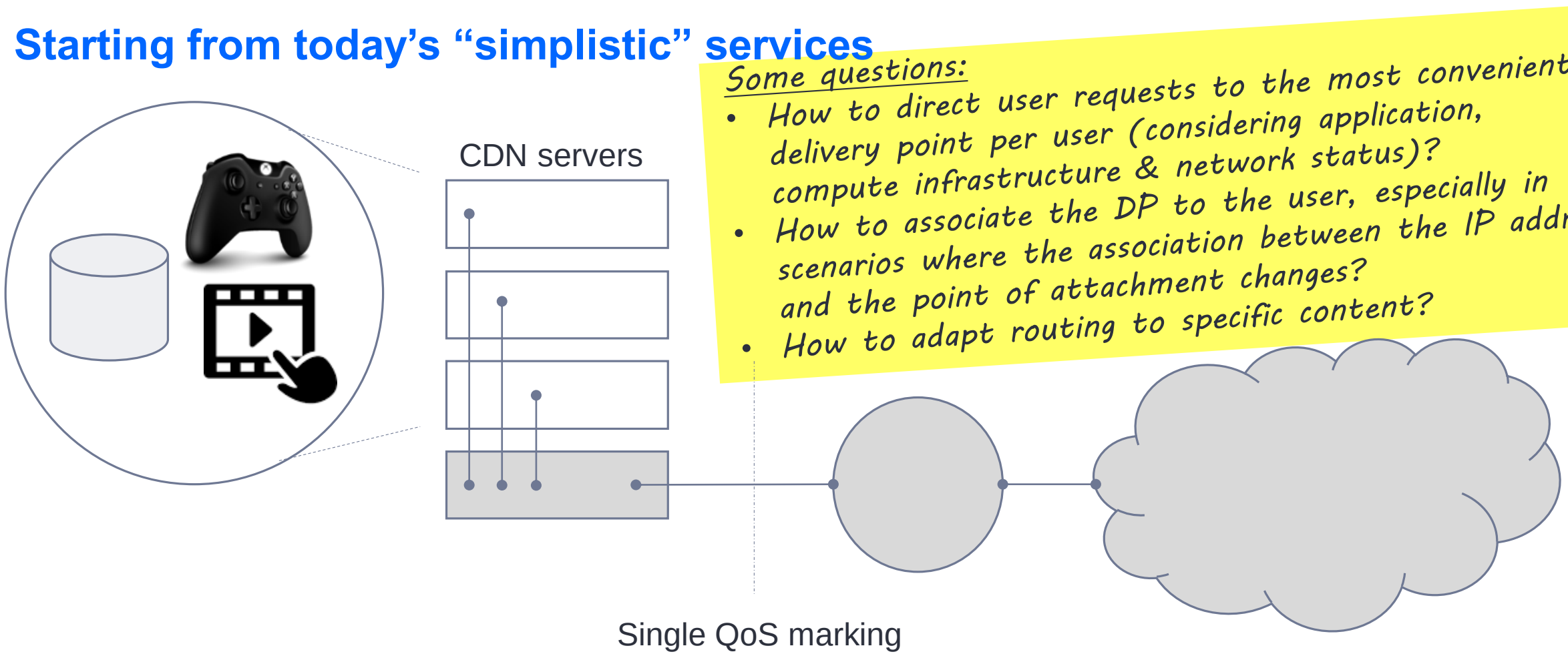
Content
Different kinds of contents targeting different types of services become distributed from CDNs: streaming videos, large files, software upgrades, VR/AR, gaming, etc.
Those services present different characteristics (i.e., SLOs)



Network
Homogeneous behavior should be expected independently of the node that injects the traffic, and the content provider who injects such traffic

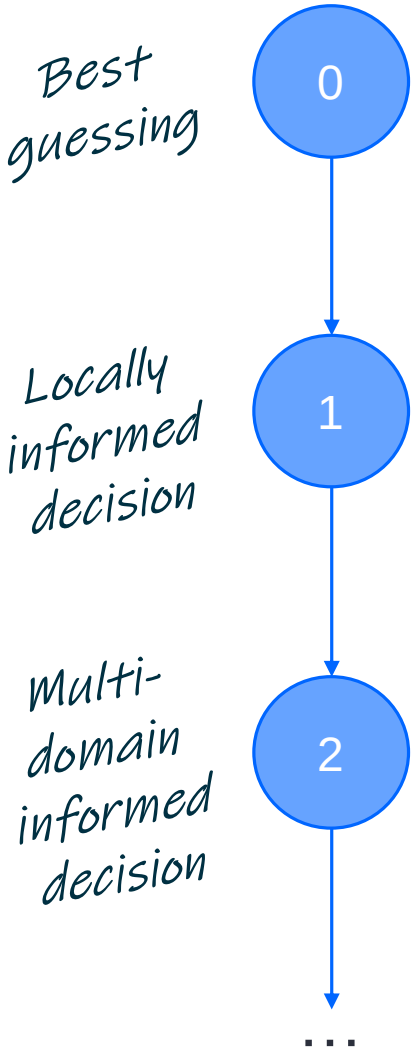
Delivery
Today uniform treatment of CDN traffic, since the Network is unable to get / capture finer details of the transported traffic

Starting from today's "simplistic" services



- Additional information from application (e.g., performance requirements) could be beneficial for assuring service delivery from network perspective
- Information originated by the application, not inferred by the network by any means

Porting it to operational networks



Overlay-like delivery, with decoupled Applications and Networks

- ✓ Inference on Application / Service characteristics
- ✓ Service chains

Semantics handled internally per operator domain

- ✓ Appl/Net Integration | Net/Appl Integration
- ✓ Expression of needs | Capability exposure

Semantics signalled between operator domains

- ✓ Multi-domain mechanisms of disseminating semantics

Challenges

Backward Compatibility

Coexistence with non-semantic-aware equipment

Technological evolution (SDN, whitebox, …)

Interchange of information between domains (i.e., content and network providers)

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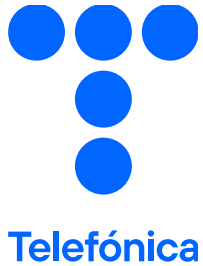

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