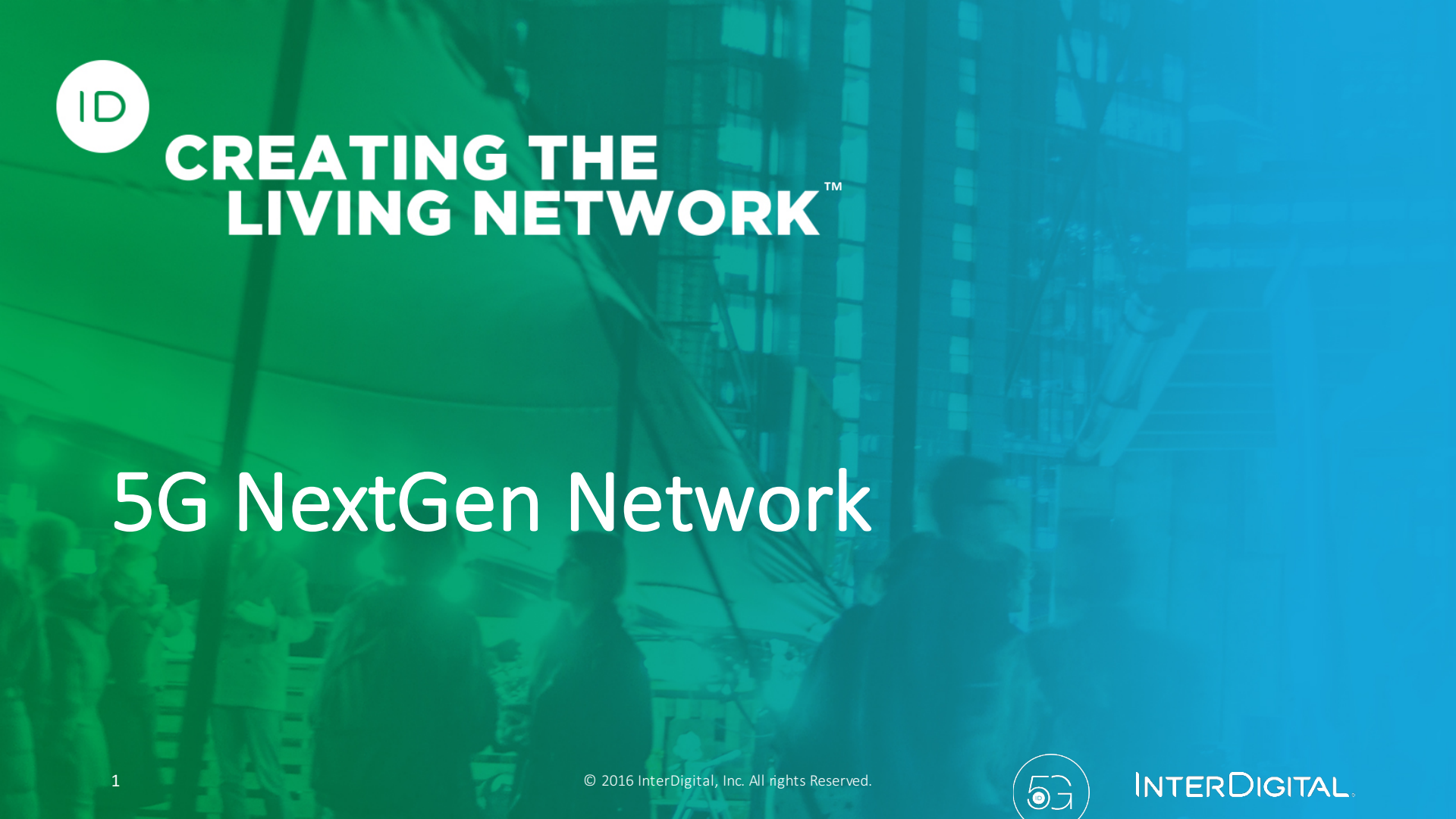
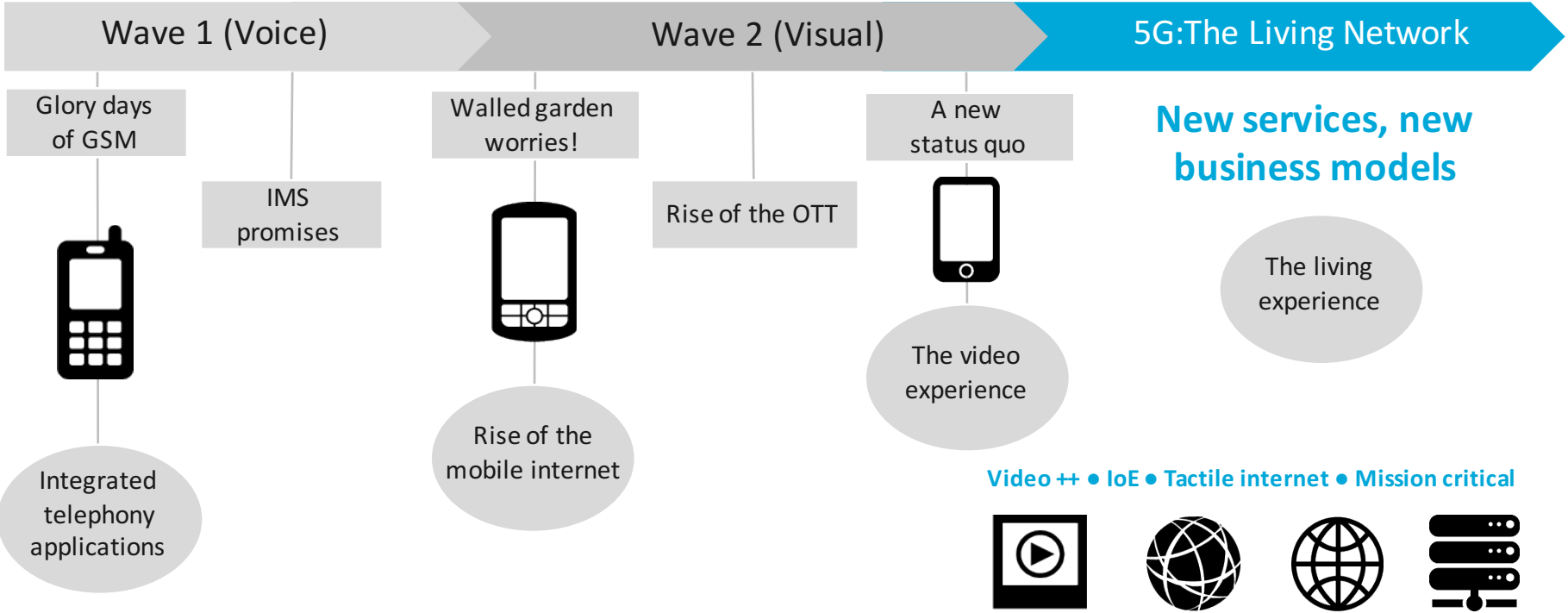


5G NextGen Network

Services: the evolution to the smarter, living network

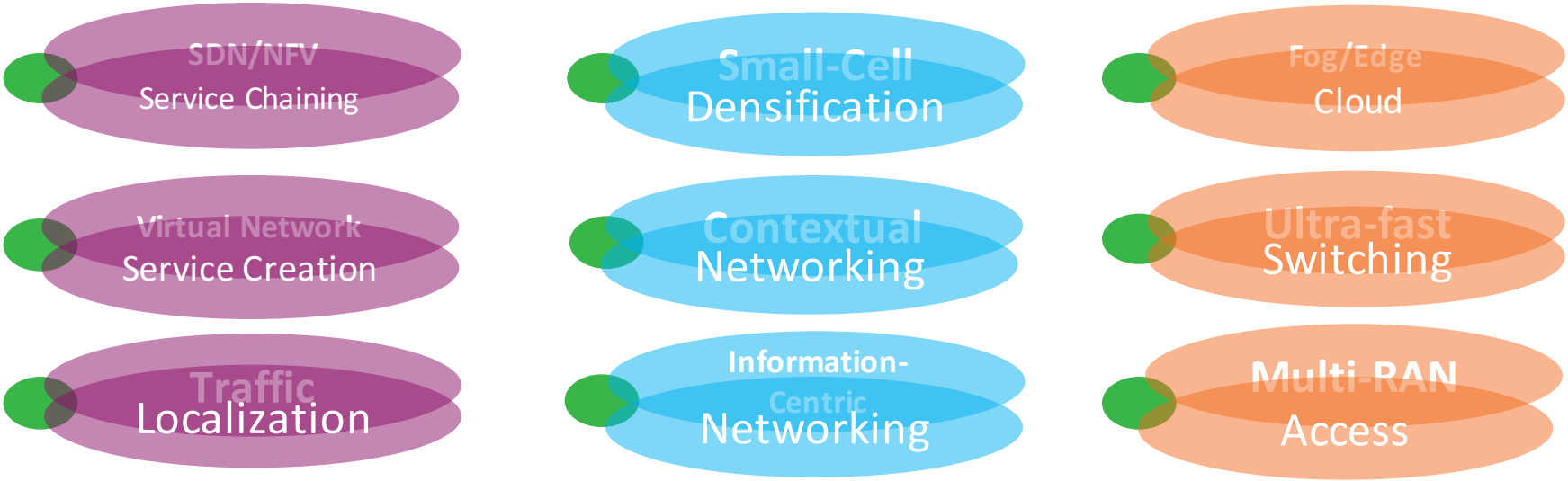
5G will deliver next level of experience and enabling business models



5G Network: initial requirements & enablers

Global consensus emerging on initial requirements and enabling concepts [ITU-R] …

Flat or Reduced	< 1 min	1 to 10 TBps/Km^2	Very Heterogeneous > 10 services / access site	5 mSec	From 100 Mbps To 1 Gbps
TCO	Network Service Creation Time	Area traffic capacity	Network Service Mix	E2E Latency	User Experienced Data Rate



5G Network: technology trends

Network Function Virtualization

- Flexible SW-based implementation of core network components
- Flexible composition (chaining) of services from SW fragments
- Flexible scaling and placement of network functions between the “Cloud” and the “Edge”

Mobile Edge Computing

- Cloud computing and service hosting at the network edge
- End-to-end latency reduction due to user proximity
- Network traffic reduction through traffic localization
- Rich context and RAN co-location support new services

Information Centric Networking

- Name-based packet routing
- Application-neutral on/off-path content caching and computation natively in the network
- Native multicast support and improved mobility, security, privacy, resiliency, etc.

Software Defined Networking

- De-coupled data and control plane
- Efficient tools for service providers to manage traffic flows in their networks
- Enabling a networking fabric across multi-vendor equipment
- Rapid low-cost deployment of new networking solutions

High-performance data-centric services

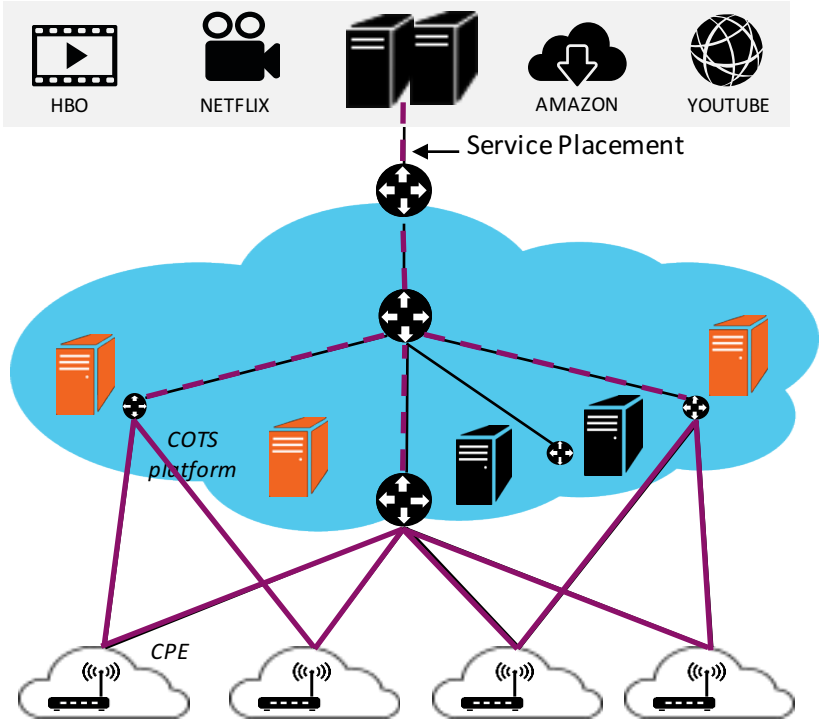
Equality of Experience for all Users in all Locations

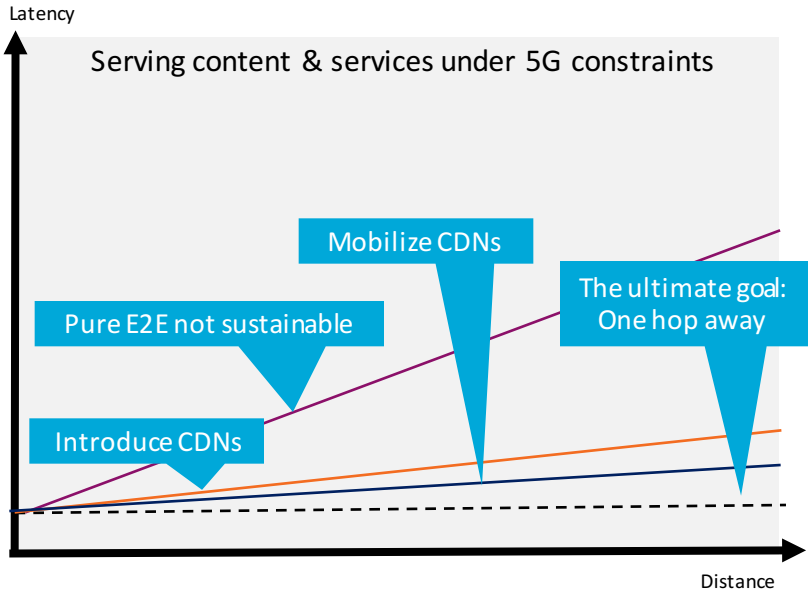
Evolving Network Edge to meet the 5G requirements

Diving Deeper
Flexible Routing for IP-based Services

Meeting 5G KPIs

Your Service Just One Hop Away – Enabled by Our ICN Intelligence

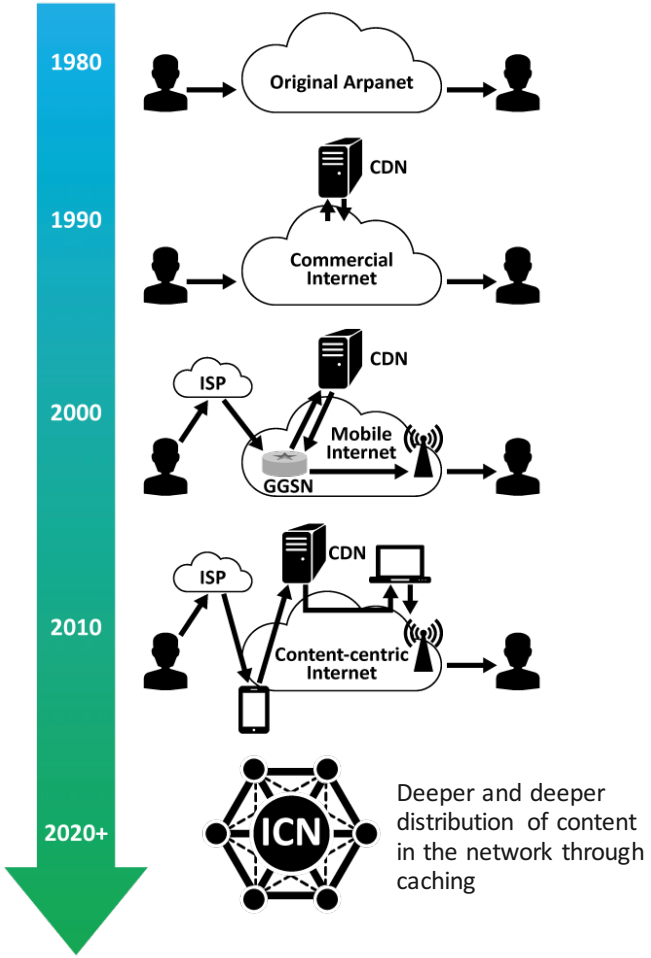




Information Centric Networking:
An inevitable destination?

What is ICN?
- ICN defines a paradigm shift in networking away from host to host communication
- ICN focuses on content and name based addressing concepts
- Brings publish-subscribe model paradigms to core networking principles

Key Trends Driving to ICN Future
- Today's internet would simply not work without content caching moving deeper into network
- 5G latency challenges will push this content literally to the edge
- Married with growing trend of increasingly programmable networks = ICN Perfect storm



Two Traditional Paths

Neither path ideal to market uptake

1. Follow the pure ICN path

- − Huge standardization challenges
- − Challenges to align value chain
- − Backward compatibility challenges
- \+ Better utilization through native multicast
- \+ Better privacy for content consumers
- \+ Better resilience (compared to path resilience)
- \+ Exploit developments for SW-based networks
- \+ Evolution path along existing systems
- \+ Preserve main relationships
- − Potential for inefficient solutions
- − Preserve problems of current IP architecture
- − Hamper new usages, e.g., in IoT space

2. Follow slow IP evolution

InterDigital vision sees a hybrid approach that brings best of both

- \+ Better performance through native multicast
- \+ Better privacy
- \+ Better resilience
- \+ Exploit developments for software-based networks
- \+ Evolution path along existing systems
- \+ Preserve main relationships
- − Need technology solutions and IP building blocks to turn into products

Project Elevator Pitch

Reinventing the approach to IP based services through a backward compatible introduction of new methodologies supported by an SDN/NFV enabled network fabric & designed to meet challenging 5G KPIs

It looks like IP, it smells like IP, BUT with this technology inside networks will simply work better…

The target for this tech: Telcos & Switch Vendors

Project Traction

Partners (15)

Platform provider

Vendors

Operators

SMEs

Academia

Project Duration

Jan 2015 – Dec 2017

6.5mio Euro Funding

Approved as ETSI MEC PoC

*POINT & RIFE are EUH2020 Research & Innovation Programme Funded Projects under grant Nos. 643990 & 644663 (http://www.point-h2020.eu & http://rife-project.eu)
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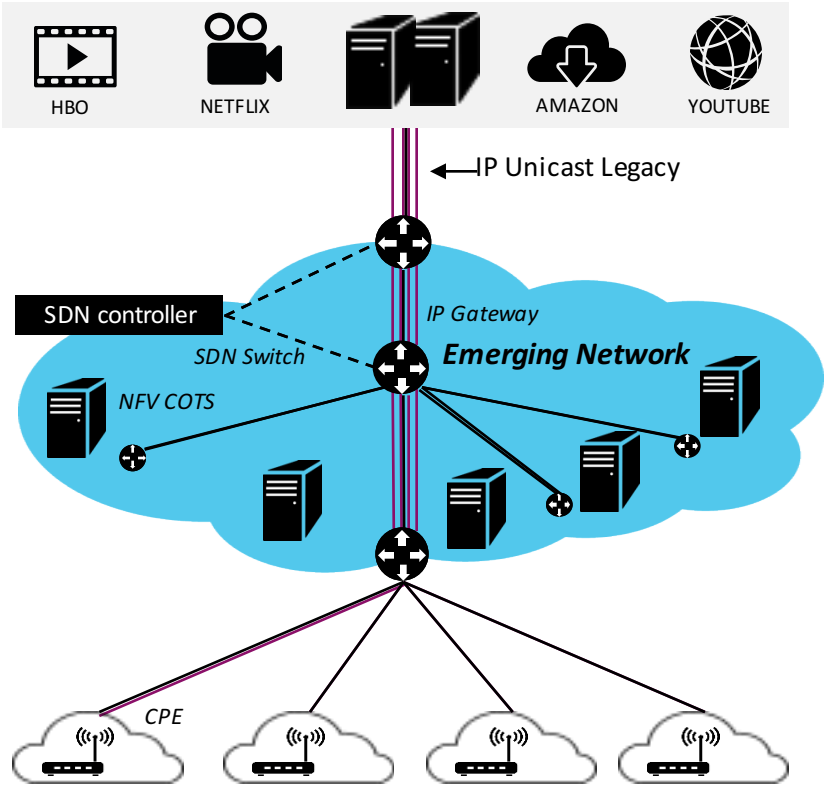
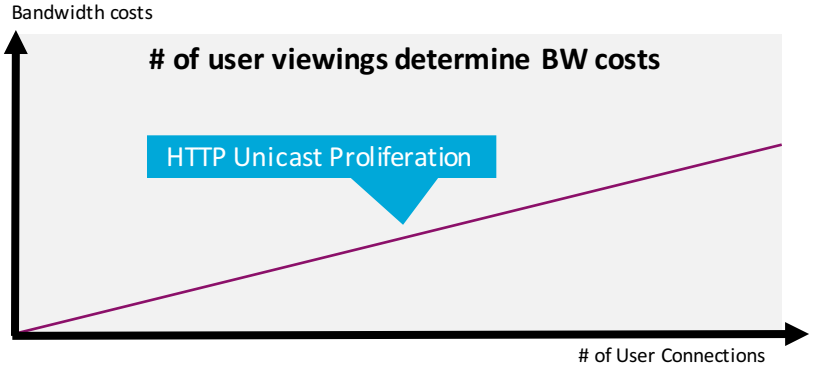
The Problem & Current Approaches



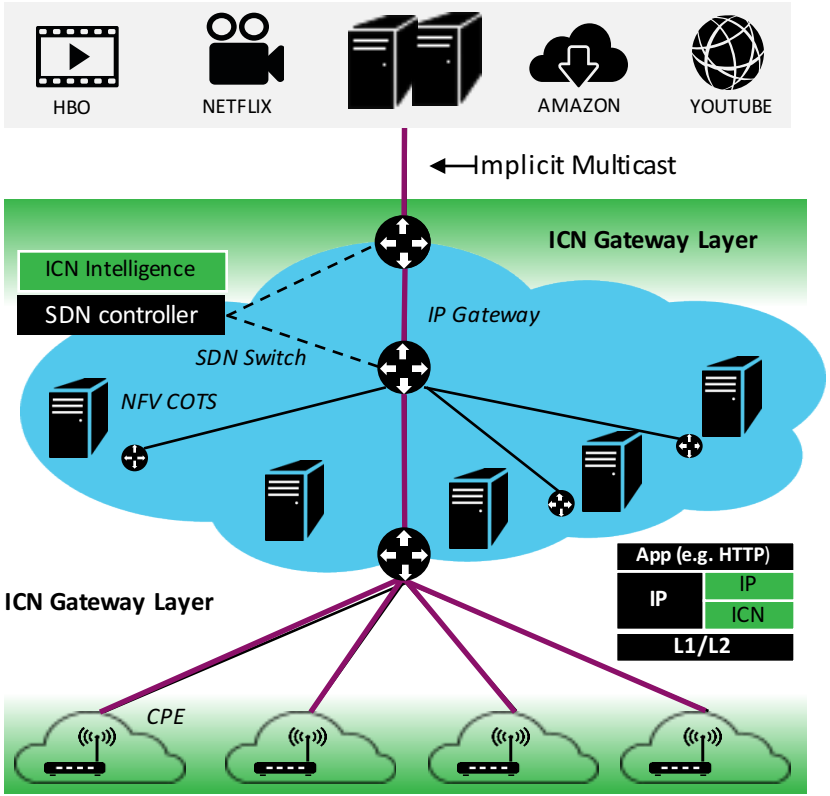


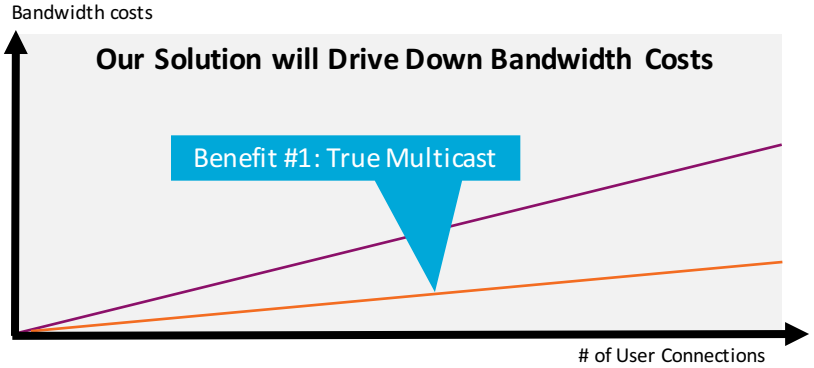
Two current approaches – Two shortcomings

- CDNs are currently used for popular content but this is overly complex and results in inefficiencies associated with indirections
- Overprovisioning of resources drives unsustainable spiraling costs

Both shortcomings are unsustainable for 5G

Our Solution: Re-Introducing Multicast

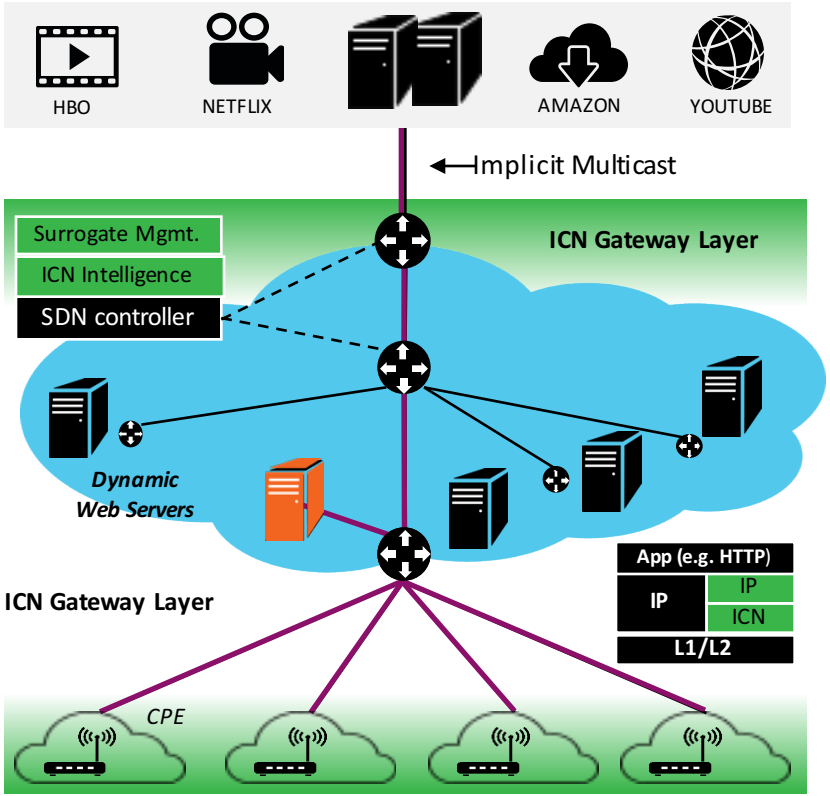


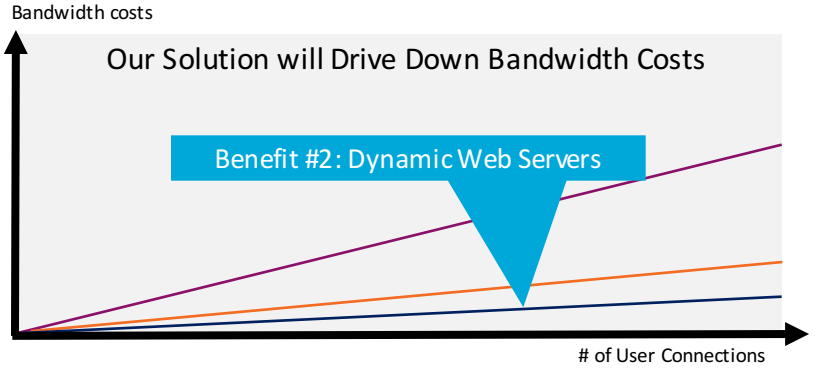


POINT/RIFE: The Innovative ICN approach for competitive 5G (or before) operator networks

- Re-introduce multicast into world of predominantly personalized web experience
  -> **higher network utilization**
- Flexible routing at runtime through *cloudifiable* software elements
  -> **increased resilience, latency reduction**

Our Solution: Localize Communication





The next logical step: Dynamic Web Servers, spun up possibly just one hop away

- Creates new service possibilities for operators, utilizing in-network NFV-based computing capabilities
- Helps meeting challenging 5G KPIs, such as 5ms service-level latency & 1000x capacity increase

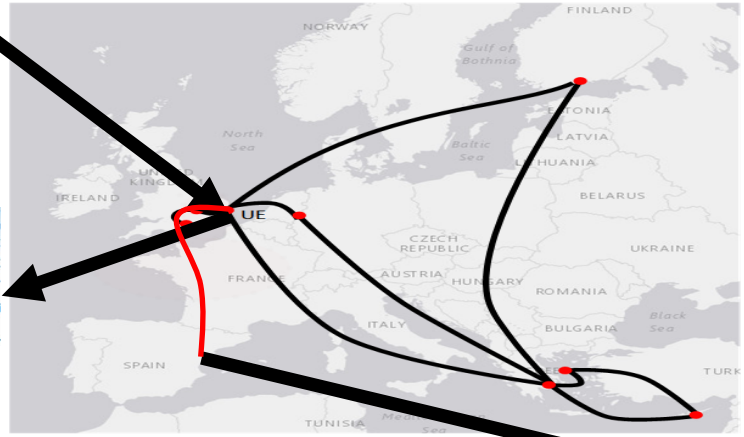
UK NextGen Network
Our Demo

Demo Setup

Improvement:
Improved local playout quality (scale to HD quality)
(while emulated users will continue to receive SD quality from Bristol)

Remote Video Feed

30+ emulated users in data center



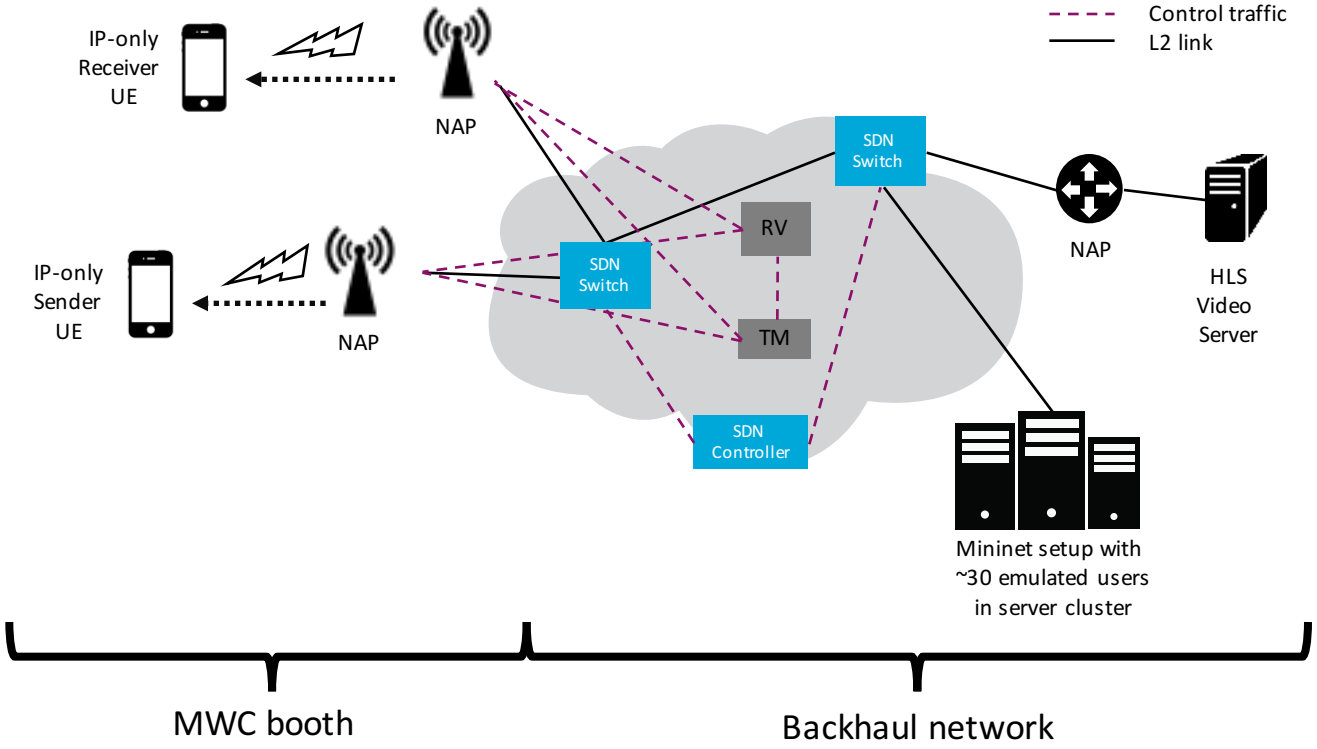
From our POINT/RIFE European Network

Local visitors using IDC-provided demo tablets or their own devices

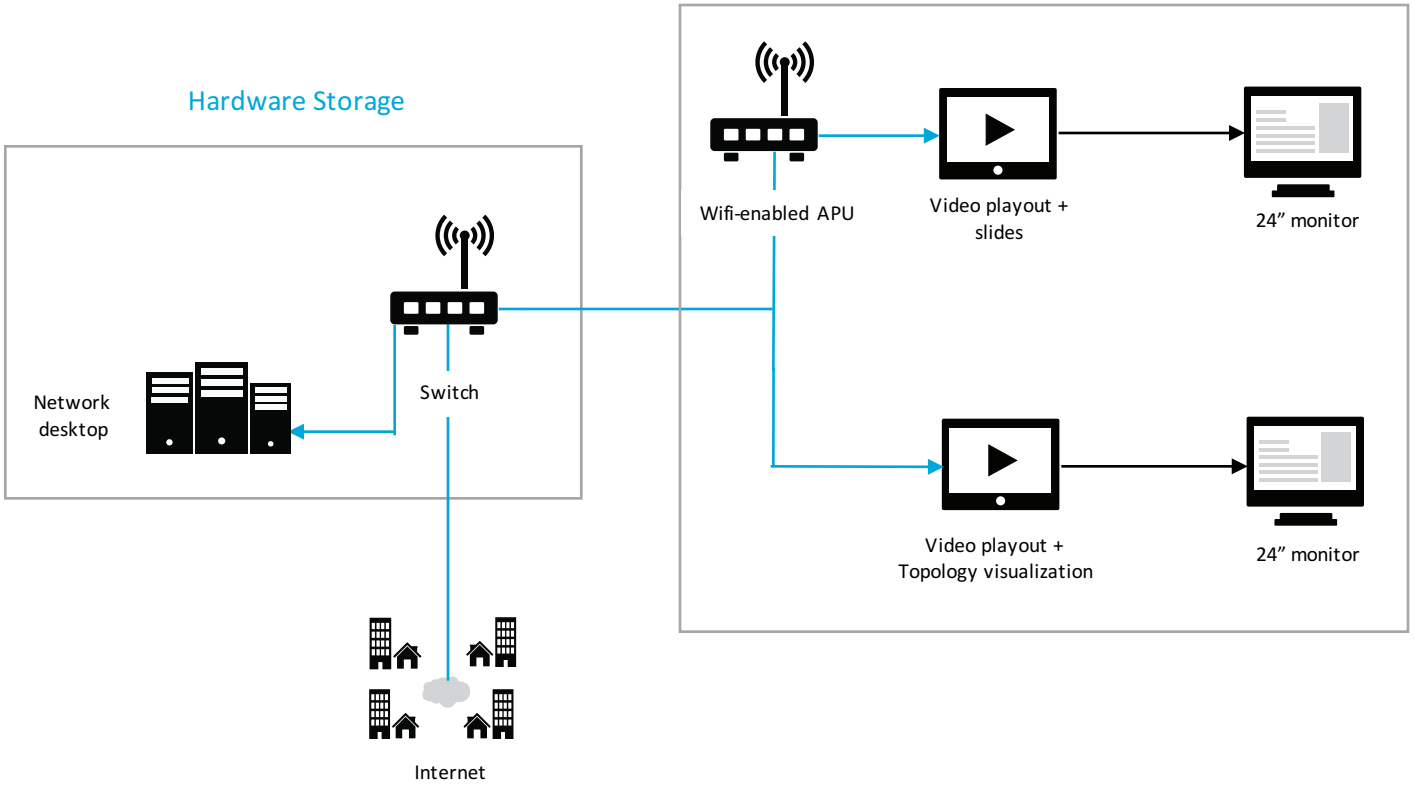
Local Video Feed

…To Our Booth in Barcelona

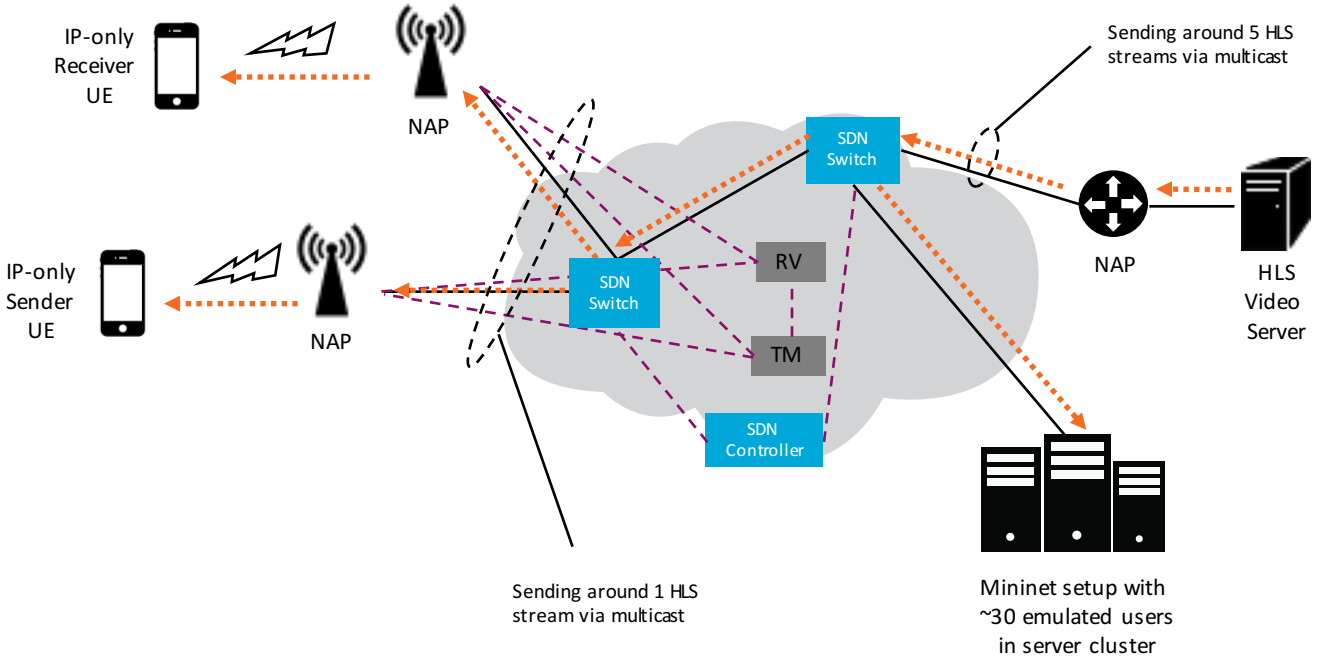
Schematic Setup



Local Setup

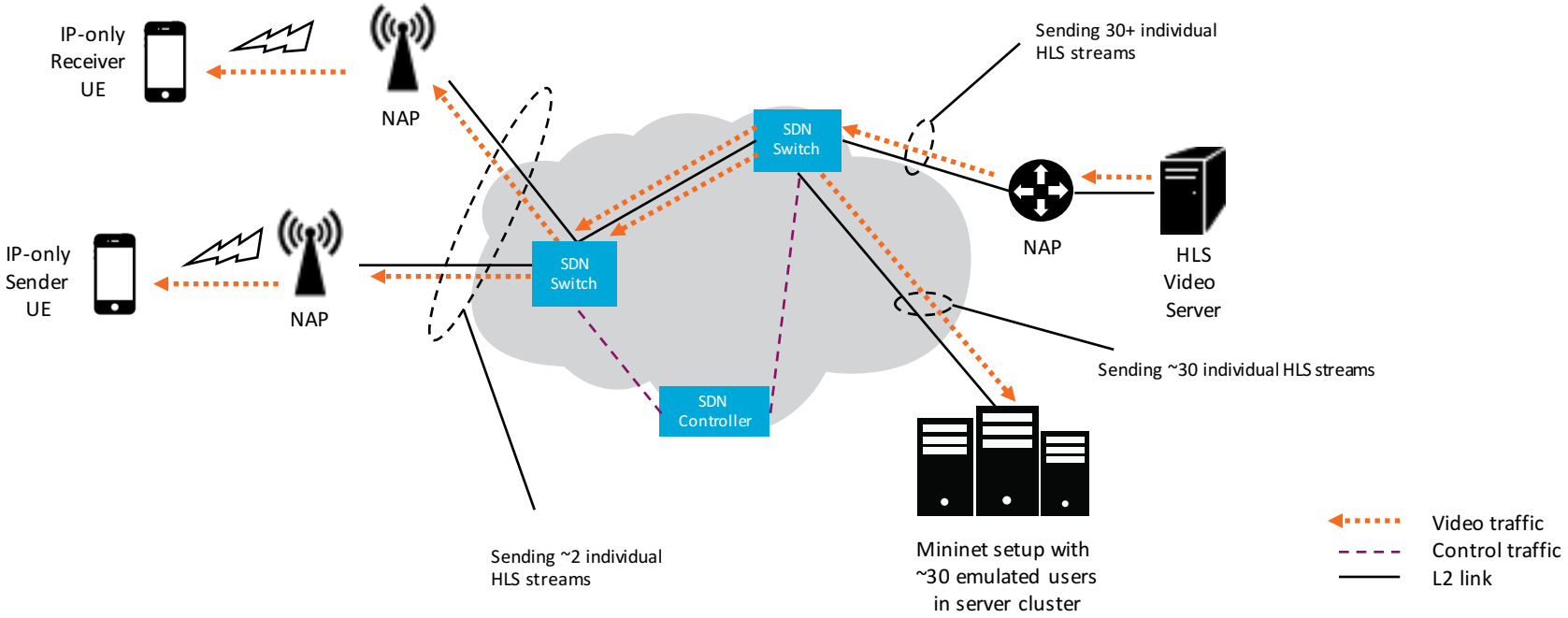


Demo Aspect 1: Multicast Gain

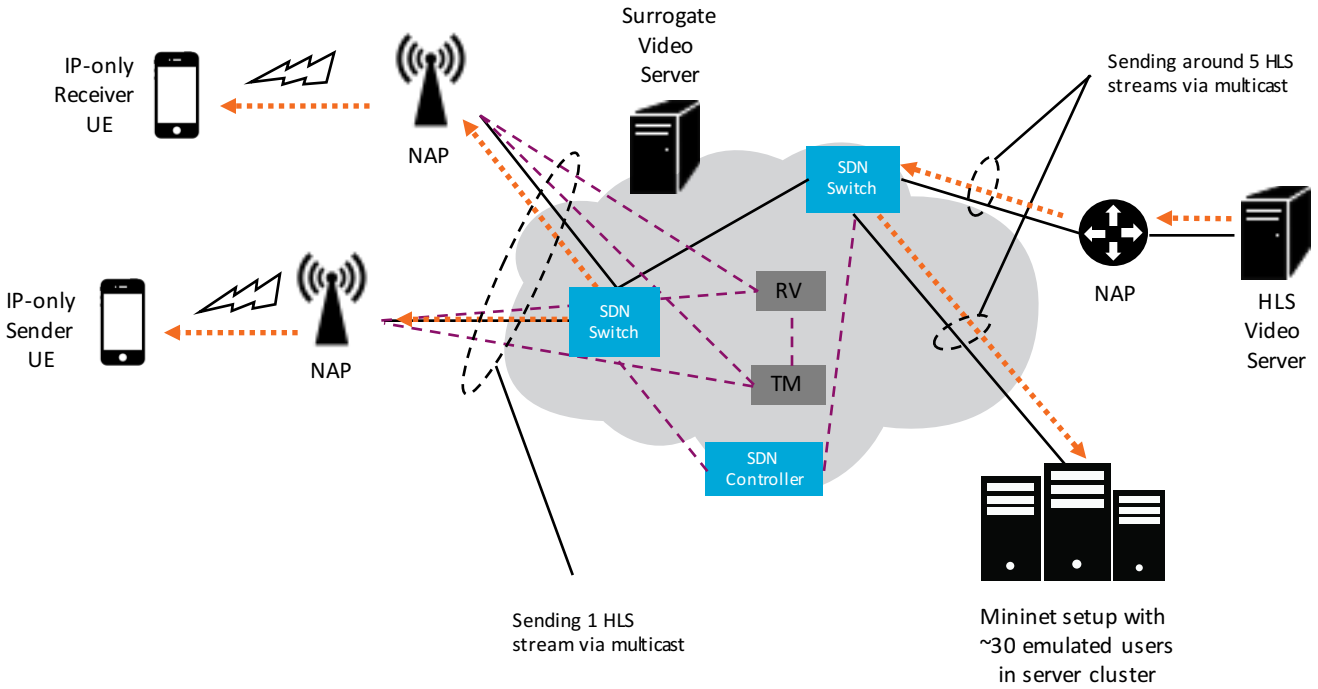


Aspect 1 demonstrates the multicast gain as well as the reduced server load through multicast delivery of HTTP responses in HLS video streaming scenario

Comparison to IP-based Routing



Demo Aspect 2: Surrogate Server for Latency Reduction



Aspect 2 demonstrates the latency reduction and video quality improvement through surrogate server at MWC