

5G-Crosshaul Media Use Case

**NEM 2016  
SUMMIT**

# 5G-Crosshaul

## Project intro

The 5G-Crosshaul project aims at developing an adaptive and cost-efficient solution for the 5G transport network, integrating both fronthaul and backhaul segments.

The envisioned solution requires a fully integrated and unified management of fronthaul/backhaul resources in a sharable, scalable and flexible way.

The control and management of such an integrated transport network, namely 5G-Crosshaul, will be based on the Software Defined Network (SDN) principles and architecture defined by the Open Networking Foundation (ONF) and will adopt Network Function Virtualisation (NFV) concepts and mechanisms as well as the ETSI Management and Orchestration (MANO) architecture.

The controller plane, namely the 5G-Crosshaul Control Infrastructure (XCI), is composed of a hierarchy of network and cloud controllers, together with orchestration and management entities for Virtual Network Functions (VNFs).

5G-Crosshaul H2020 project available at <http://5g-crosshaul.eu>



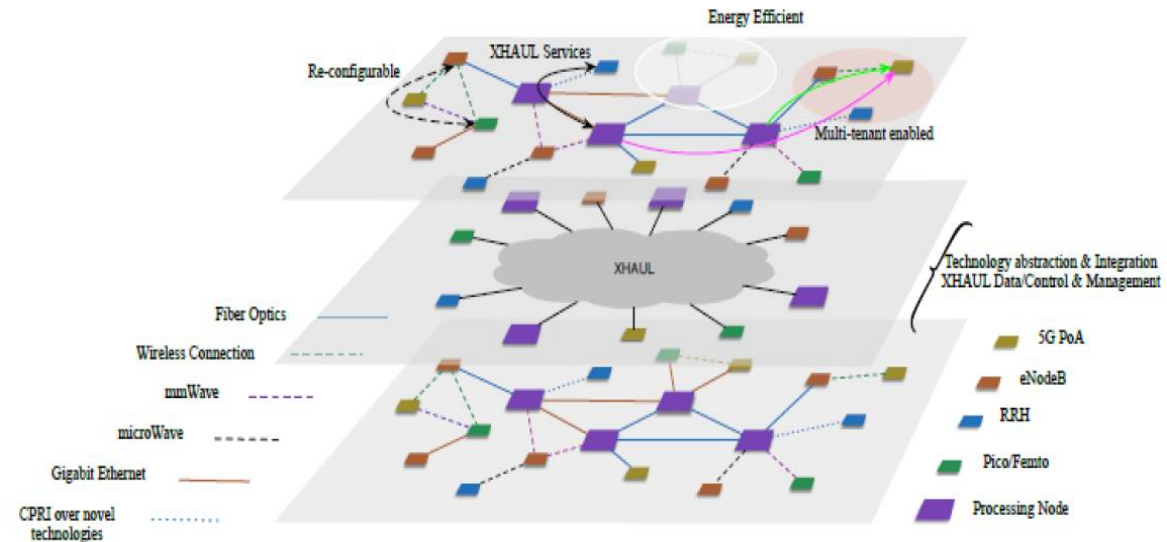
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# 5G-Crosshaul architecture

Crosshaul architecture has three layers:

- The lowest layer corresponds to the overlay of all infrastructure layers.
- The middle layer represents one of the key concepts of the Crosshaul vision: the integration of the different technologies (for both fronthaul and backhaul) in a common packet-switched network based on technology abstraction, and a unified data and control plane.
- The uppermost layer presents the applications layer envisioned on top of the Crosshaul infrastructure in order to support the features related to:
  - Re-configurability
  - Energy efficiency
  - Multi-tenant operation



# 5G-Crosshaul Control Interface (XCI)

The controller plane, namely the 5G-Crosshaul Control Infrastructure (XCI), integrates SDN principles control in ETSI/NFV MANO architecture.

XCI is composed of a hierarchy of network and cloud controllers, together with orchestration and management entities for Virtual Network Functions (VNFs).

The controllers will be in charge of allocating, controlling and configuring resources within the underlying network, computing and storage infrastructure in order to offer services in an optimal and efficient manner.

The XCI interacts with the data plane entities via a Southbound interface (SBI) and offers a Northbound Interface (NBI) through which the appropriate resource abstractions are exposed to applications.

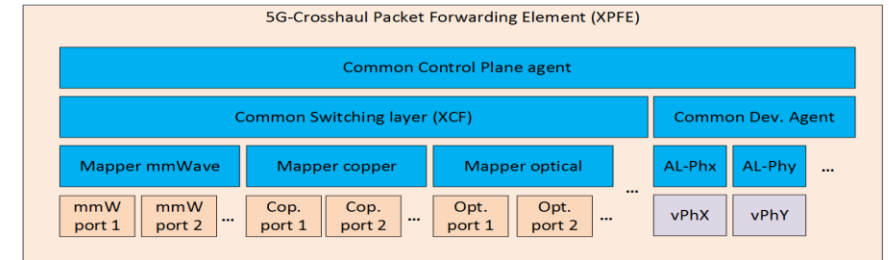
The data plane needs to allow the integration of heterogeneous technologies for the fronthaul and backhaul links into a common packet based network.

# 5G-Crosshaul Dataplane

## XFEs

5G-Crosshaul network Forwarding Elements (XFEs) interconnect a broad set of novel technologies building in effect a flexible packet-based network with high diversity.

A unified, versatile frame format and the corresponding protocol suite will transport Crosshaul data over heterogeneous technologies that may span from fiber optics to wireless mmWave for instance.



## XPU

Crosshaul data plane is also comprised of 5G-Crosshaul Processing Units (XPUs) that are in charge of carrying out the bulk of operations in Crosshaul.

These operations shall support C-RAN, thus hosting Base Band Unit (BBU), but also 5GPoA functionalities and a heterogeneous set of services like the TVBA.

# Motivation

Video is expected to contribute ~70% of all the mobile traffic by 2018.

Content distribution is expected to be the dominant contributor to the mobile data traffic demand, therefore content media distribution is being more and more present in everyday life communications, anywhere, any time and in end-user multi-device environments.

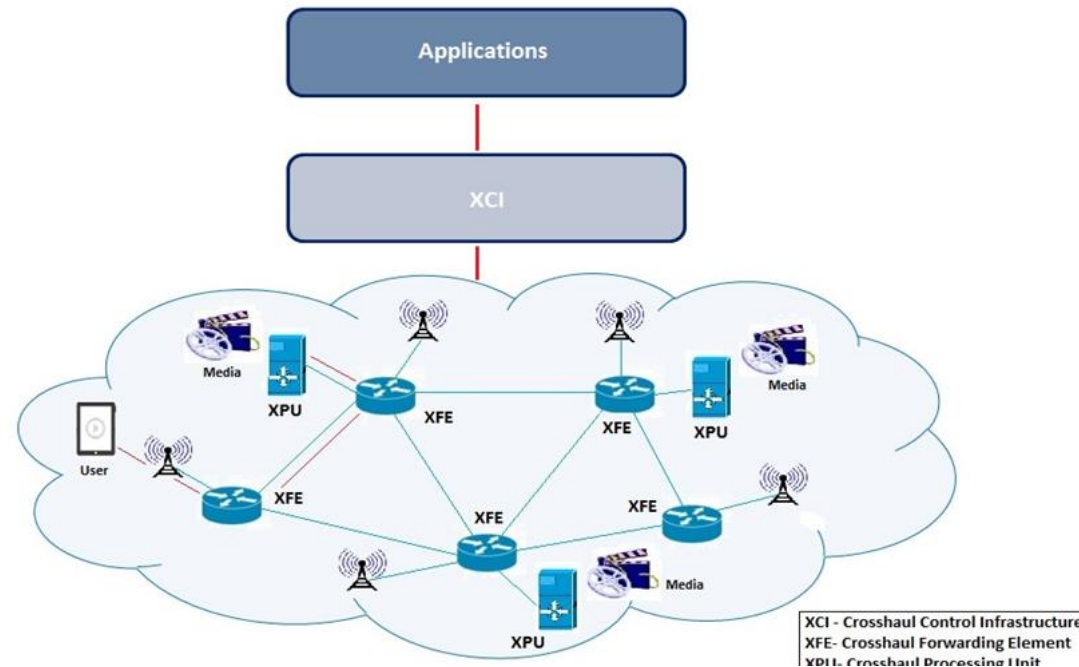
It is widely accepted that people expect more features from their TV experience than just watching linear broadcast programmes. The consumption is moving towards on-demand services so that anyone can watch the content whenever they like.

Consumers want to watch TV anytime, anywhere and regardless of the device type. And quality is going further very quickly, in most European countries people have become accustomed to high-definition (HD) TV and are now expecting even Ultra HD quality.

# Media distribution use case

Media content distribution takes advantage of an adaptive and cost-efficient solution for the 5G transport network, integrating both fronthaul and backhaul segments.

The envisioned solution requires a fully integrated and unified management of fronthaul/backhaul resources in a sharable, scalable and flexible way.



# Broadcast solution

Media/TV broadcasting & multicasting services utilizing the 5G using the same network with a controlled quality and offered as a Broadcast-as-a-service.

The focus is on minimizing both the cost and the network resources consumption and increasing cost-effectiveness of transport technologies for media distribution.

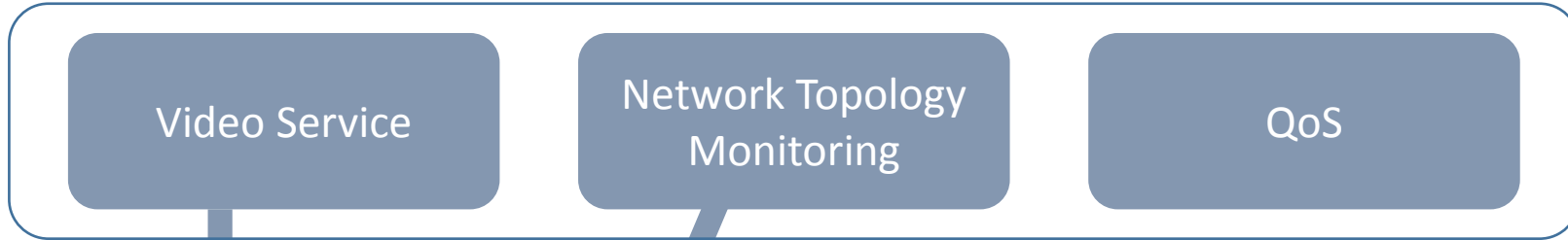
Use case of media distribution has been designed to demonstrate the feasibility of 5G objectives such as front and backhaul-integrated (control/planning) applications.

QoS based decision on the service provision (routing and quality adaptation) enables real-time decision XPU capabilities are used for in-network adaptation if needed.

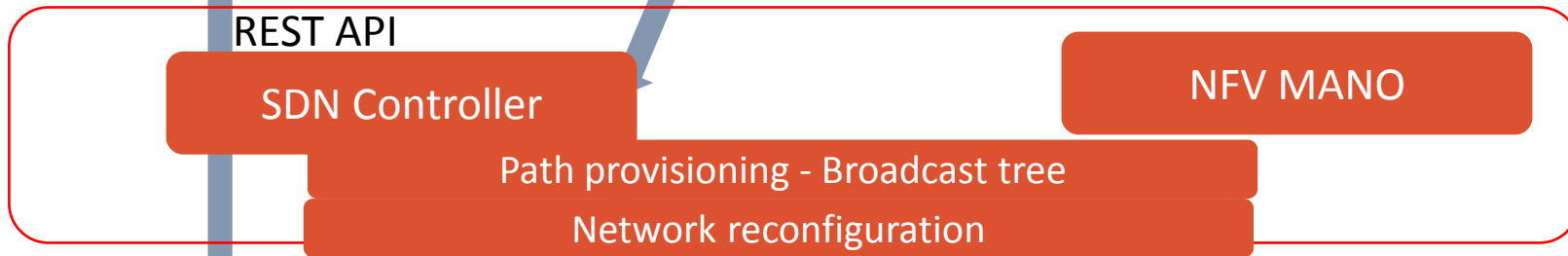


# Broadcast solution architecture

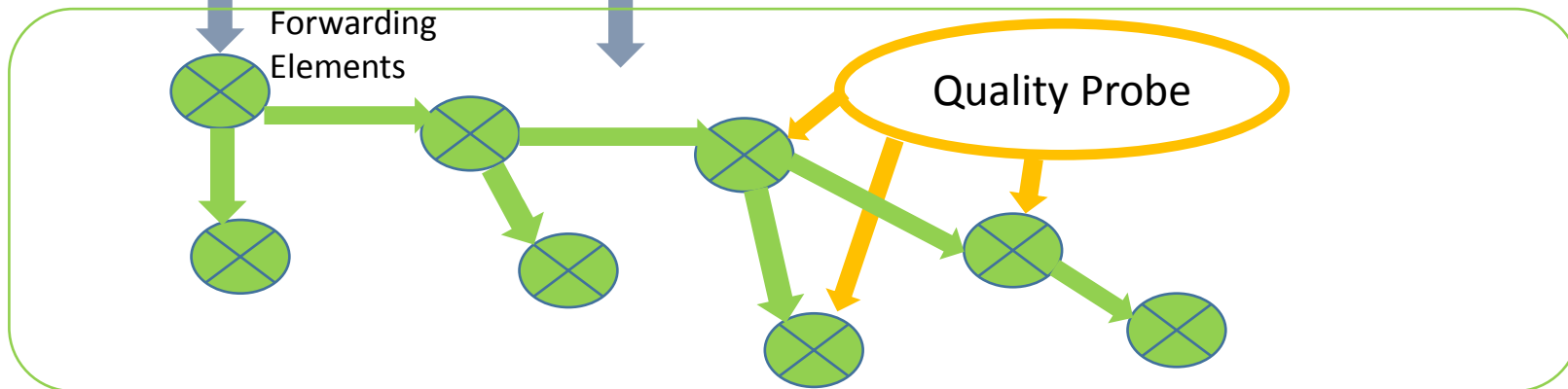
Application Plane



Control Plane



Data Plane



# Quality Probe

**Monitoring routing** is important to understand reachability and network paths that can affect network performance, leading to high packet loss or latency. Loss – Latency – Jitter

**Network performance** is typically measured by the success of IP forwarding, the time and variation for packets to make it to the destination, and the theoretical capacity and actual bandwidth available.

Packet loss

Latency and jitter

Bandwidth

Undersized Path MTU and oversized TCP MSS

# Quality Probe

**Video quality assessment** is used for detecting transmission problems on the image and NR metrics are used to feed back the service.

- Frozen frames
- Black frames
- Blurring



# Broadcast solution

