In-Network Computing Enablers for Extended Reality
draft-montpetit-coin.xr-01

Marie-José Montpetit, Ph.D.
NWCRG
IETF 103
5 November 2018
Draft Overview

• Review of the XR requirements
• What in-network computing brings to the networked XR challenge
• Open issues
The Network XR Challenge

- The Multisource Multidestination Problem
  - Combine, video, Haptics Tactile Internet
  - XR= AR/VR/MR and 360° video

- Shared experiences across the network
  - Interconnected, distributed and federated XR nodes for global immersive experiences
  - Principles:
    - Allow joint collaboration in XR
    - Multi-view XR
    - Add extra streams (IoT) to experiences

- Challenges:
  - On time delivery of the multiple streams with rendering of the content across the multiple participants
  - Sensitivity to packet loss and loss induced delay especially for non video components
  - Low end to end delay/delay variation
  - Optimized caching and rendering
In-Network Computing and XR Summary

• Optimized location and type of resources for the multisource/multi-destination (mutiparty/multi-input) by using of AI/ML and advanced load balancing

• Distribute functionality between datacenters and edge
  • Functional decomposition of the XR elements
  • Federation of nodes to provide the required experience
  • Evaluation of local caching/micro datacenters with pre-rendering

• **Multicast distribution and processing as well as peer to peer to minimize delay and re-use capacity**

• Trend/ML based congestion control to favor AR and VR sessions
  • Joint learning algorithms across both data center, edge computers and goggle/glasses to allocate functionality and creation of semi permanent datasets and analytics for usage trending

• Dynamic allocation of control, forwarding and storage resources and related usage model

• **Performance optimization by tunneling, session virtualization and loss protection**
Architecture

Smart Manufacturing

Smart Cities

Fog Network

Peer-to-peer networking
Blockchain trust model

Program mobile element

Edge Network/Microdatacenter

Cache

Geolocalized content

L2/L3 Transit Network

Datacenter/cloud

Content Provider Network(s)

Live and stored video

Augmented 3D Content

Graphics

Sensor inputs

Live and stored video

Augmented 3D Content

Graphics

Sensor inputs

COIN Option

COIN Option

COIN Option

COIN Option

COIN Option

COIN Option

COIN Option

Sensor inputs

Peer-to-peer networking

Blockchain trust model
Link to NWCRG

- Networked XR is very delay sensitive
- Erasure coding used to provide the packet erasure coding to maximize peer to peer and multipath efficiency and reduce the need for any form of retransmission
- Direct link to current in-network computing and programmable network elements
Next Steps

• Request comments from the COIN and NWCRG community and find co-authors from the XR community
• Generate a v1 for IETF 104 (Prague)
• (Eventually) have it adopted as a COIN RG Document
Join us for the COIN side meeting

Friday Nov. 9 from 10am to 12pm Bangkok time (GMT+7) in room Boromphimarn 3
(https://datatracker.ietf.org/meeting/103/floor-plan)

Remote access via the IETF Webex:
link: https://ietf.webex.com/ietf/j.php?MTID=m4d74e60aecea8c08e8532decfa823a4a
Meeting number: 642 054 101
Meeting password: y7evFtMt

marie@mjmontpetit.com