Network Coding in the SHINE ESA project
IETF98, Chicago
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The SHINE Project

- SHINE: “Secure Hybrid In Network caching Environment”
- An end-to-end secure infrastructure for real-time streaming over integrated satellite terrestrial networks
- A combination of multicast and unicast communication scenarios where satellite links are exploited to support local in network caching
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• An end-to-end secure infrastructure for real-time streaming over integrated satellite terrestrial networks
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SHINE basic concepts

- Use coded multicast across the satellite-enabled trunks of the overall platform
- Use either MPEG-DASH or WebRTC within the edge access networks
**Scenario 1 - overview**

- WebRTC/MPEG-DASH server + network cache + network decoder
- MPEG-DASH/WebRTC delivery
- SAT-enabled Video pre-fetching
- NC Video delivery
- Request-routing signalling
- Dedicated link

- NC-based satellite transmission

- SHINE request-routing

- Sat GW

- CDN domain

- Internet

- Content Provider or OTT

- Origin server farm
Coded multicast

- Improves caching performance
  - thanks to the "multiplexing" of different content chunks into every transmitted frame
- Increases the security level of satellite enabled transmissions
  - by making them resilient to network attacks like snooping and eavesdropping
Coded Multicast

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**Satellite Transmitting station**
- Receives coded multicast frames
- Encapsulates received frames in DVB
- Transmits DVB-encoded coded multicast frames to the receiving earth stations

**Satellite content distribution core network**
- Delivers DVB-encoded coded multicast content to receiving earth stations

**Receiving earth Station**
- Receives DVB-encoded coded multicast frames
- Reconstructs the original coded multicast frames by decoding the DVB stream
- Securely stores reconstructed coded multicast frames
- Acts as an edge cache towards end-users in the access network
What happens @ the edges?

- Secure streaming towards the end-users
- Two options will be investigated
  - MPEG-DASH with Common ENCRYption (CENC)
  - WebRTC (Web Real Time Communications)
MPEG-DASH edge cache:
- Acts as a DASH-enabled streaming server to deliver streaming content to the end-users
- Builds MPD (Media Presentation Description) manifests and related media segments
- Leverages CENC (Common ENCryption) specification to manage DRM information

Access Network:
- Transfers MPD files via HTTP or other protocol
- Transfers MPEG-DASH bit-streams (chunks) via HTTP

MPEG-DASH client:
- Retrieves MPD manifests
- Leverages Encrypted Media Extensions (EME) and Media Source Extension (MSE) APIs for DRM purposes
- Retrieves media segments via HTTP GET requests
WebRTC-enabled edge cache
- Acts as a WebRTC peer towards end-user browsers
- Leverages DTLS to protect data while in transit
- Leverages certificate fingerprint information to manage DRM-like access to content

WebRTC-enabled access network
- Securely transfers real-time streaming content via SRTP over DTLS
- Leverages WebRTC simulcast capabilities (combined with RTCP feedback) for adaptive streaming
- Optimizes QoS parameters (delay, jitter, packet loss)

WebRTC-enabled client
- Dynamically generates client certificates and associated fingerprints
- Leverages fingerprint information for proper management of client’s identity
- Negotiates secure DTLS sessions with the server
- Accesses (if authorized) multimedia content via SRTP
Figure 1: ETSI NFV framework with one VNCF box as part of the set of available VNPs.
Figure 1: ETSI NFV framework with one VNCF box as part of the set of available VNFs.
SHINE and VNCF

• SHINE as a use case for the effective application of VNCF to a real-world scenario
• Preliminary work already ongoing:
  • planning to co-author a draft with Angeles Vazquez-Castro
VNCF-based SHINE scenario

- Caching as a Network Service (NS)
- SHINE orchestrator used to deploy/operate both core and edge cache nodes
- VNCF leveraged in the satellite part of the network to implement coded multicast transmissions
Questions?
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