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M E D I A S T R E A M I N G



WE MAKE YOUR VIDEOS FLOW
Industry Leading Streaming Solutions

Adaptive Media Streaming over Emerging Protocols

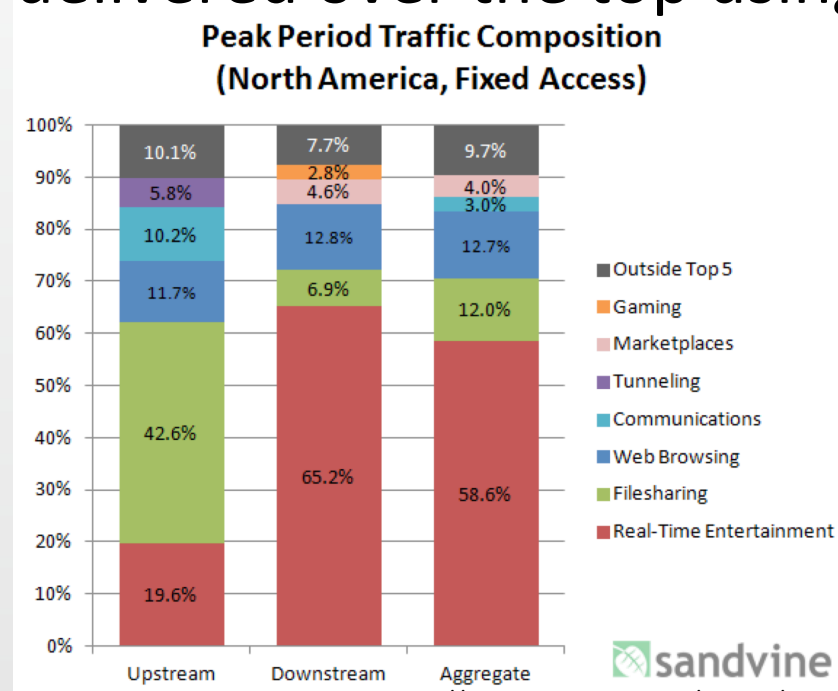
2014 NAB Show
Broadcast Engineering Conference
April 7, Las Vegas, NV, USA

Dipl.-Ing. Dr. **Christian Timmerer**
CIO | bitmovin GmbH & Alpen-Adria-Universität Klagenfurt
christian.timmerer@bitmovin.com
blog.timmerer.com



Video Predominant on the Internet

- Real-time video: > 50% of the traffic
- Mainly delivered over the top using HTTP



2h2013, <https://www.sandvine.com/trends/global-internet-phenomena/>

- ... but the **user frustration is still high!**
⇒ Let's do something

Dynamic Adaptive Streaming over HTTP

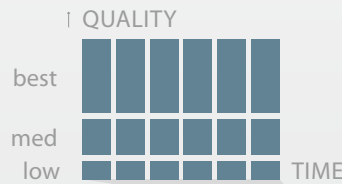
DASH

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DIFFERENT
QUALITY
REPRESENTATIONS



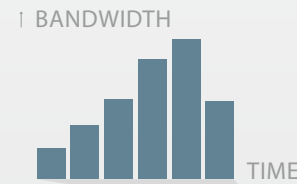
HTTP SERVER
WITH VIDEO CONTENT



CHANGING
BANDWIDTH



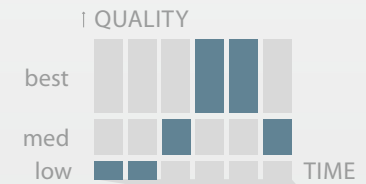
NETWORK
WITH VARIABLE
BANDWIDTH (INTERNET)



CHOOSE THE
APPROPRIATE
SEGMENT



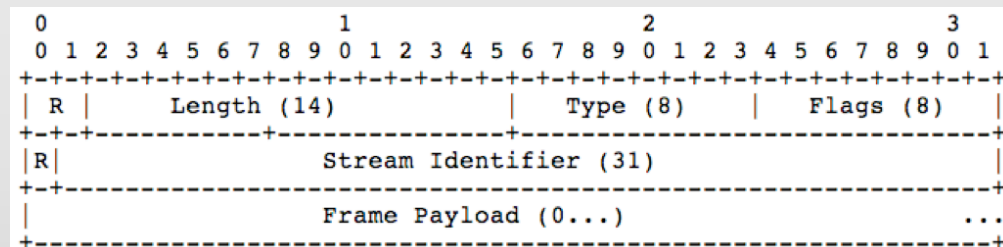
USER
WITH TABLET



- **ISO/IEC MPEG Standard** [ISO/IEC 23009]
 - **Media presentation description** (MPD) and **segment** formats (ISOBMFF, M2TS)
- Dynamic **adaption** to the usage environment
- Usage of **existing** Internet infrastructure
- Adaptation logic & intelligence at the **client**
 - ⇒ **Flexibility** and **scalability**

DASH/2.0

- MPEG-DASH adopts **HTTP-URLs to identify segments** within the MPD but...
 - ... does **not mandate its usage**
 - ... does **not mandate a version**
- HTTP/2.0 currently **under development within IETF** (based on SPDY)
 - Based on **TCP**, single **persistent** connection
 - Allows **multiple streams** between client & server
 - Exchange of **frames**, compatible with HTTP/1.1



DASH/2.0 Client Support

- MPEG-DASH **VLC plugin**
 - World **first MPEG-DASH implementation**
 - Open source, part of well-know VLC
 - ⇒ <http://dash.itec.aau.at>

- **libdash – tree/http2**
 - MPEG-DASH **reference software**
 - Open source & sample player
 - ⇒ <http://bitmovin.com/libdash>

libdash
ACCESS LIBRARY



- Basis for products, e.g., **bitdash**
 - **Adaptation logic** with +100% throughput

bitdash
ADAPTATION FRAMEWORK



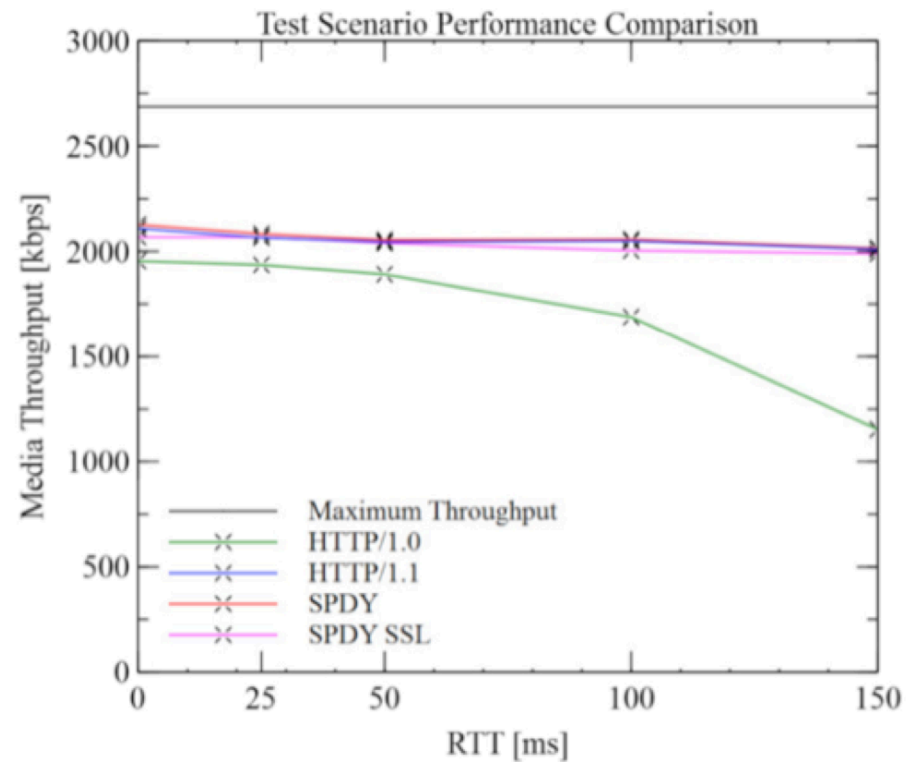
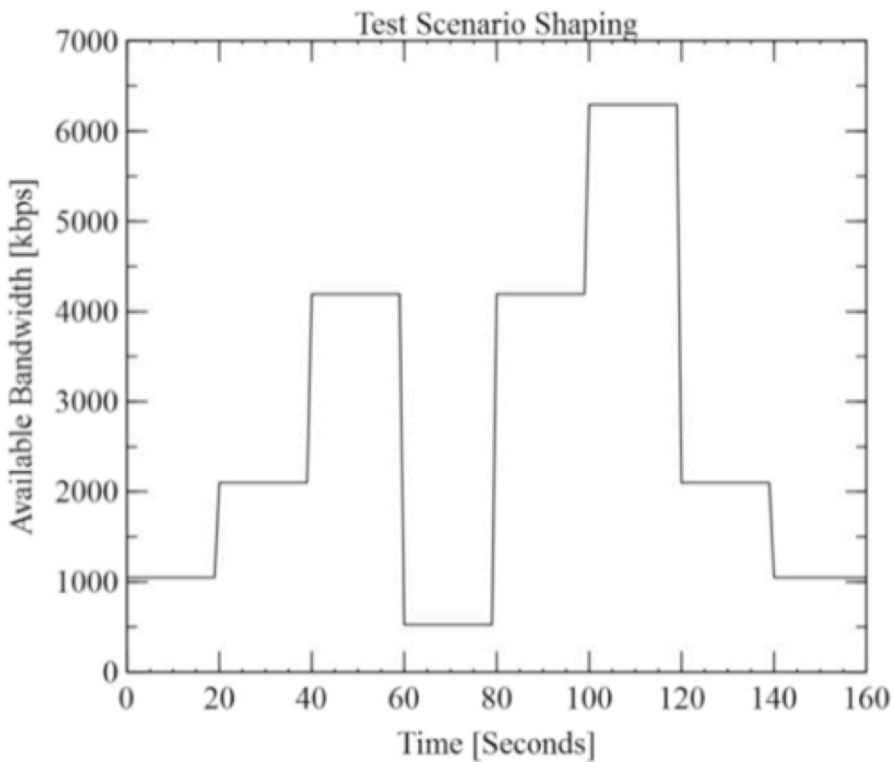
Clients

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MEDIA STREAMING



Performance Evaluation



Content-Centric Networking

- From a **host-centric** to the **content-centric** approach
 - Addressing **location vs. content**
 - Different **terminology**: ICN, NDN, CCN
- **CCN approach**
 - Interest packet: **request** for content
 - Data packet: **delivery** of content
 - Network **actively participates** in the delivery
- **CCN features**
 - Native support for **content caching**
 - Location **independence**
 - **Multi-path, multi-source** delivery
 - **Security and trust** as an integral part of the network

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CCN



DASH and CCN := DASC

- **Common elements**
 - Client-initiated pull approach
 - Content being dealt with in pieces (segments, chunks)
- **Two options for integration**
 - Proxy service acting as a **broker between HTTP and CCN**
 - DASH client implementing a **native CCN interface**
- **Native approach enabled by DASH**
 - CCN **naming scheme** (CCN URIs)

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DASC

DASC Client Support

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libdash
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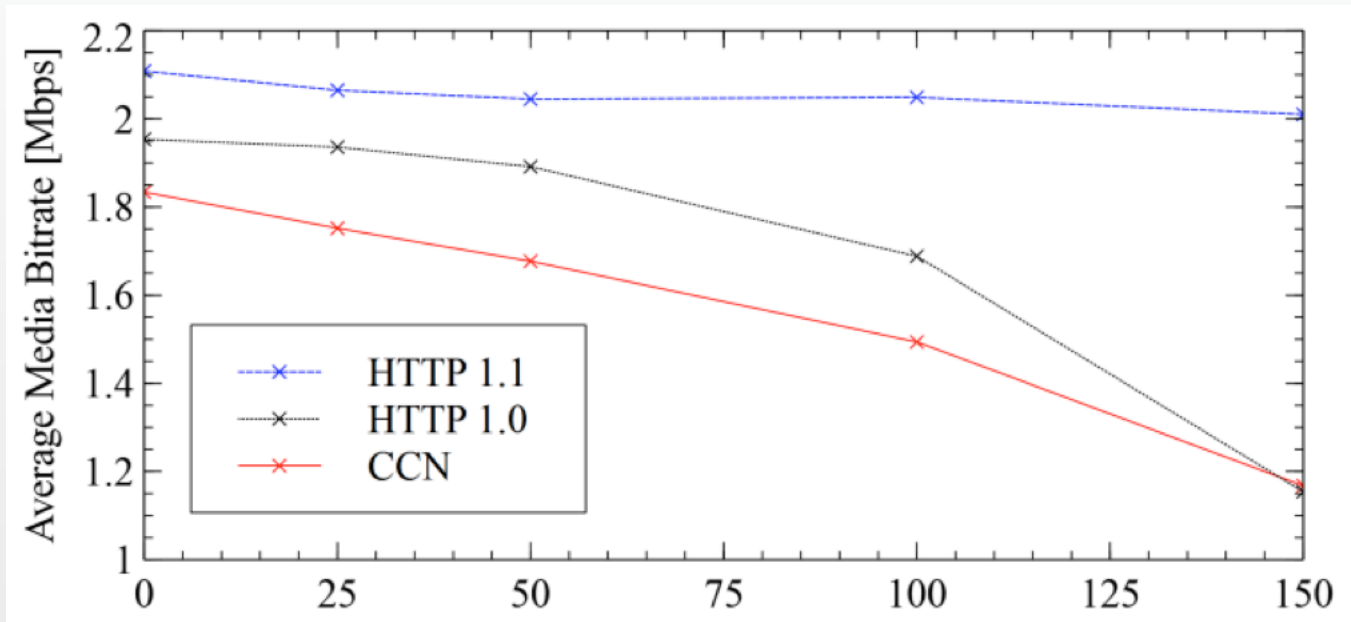
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ADAPTATION FRAMEWORK



Clients

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Performance Evaluation



Average Media Throughput using CCN given a predefined Bandwidth Trajectory for different RTTs

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Performance

Conclusions

- **DASH/2.0**
 - HTTP/2.0 (SPDY) ~ HTTP/1.1 with **persistent connections & request pipelining**
 - Implicitly **solves Head-of-Line** blocking problem
 - HTTP/2.0: **IETF httpbis WG**, proposed standard by end of 2014
- **DASC**
 - It works, **performance comparable** but...
 - Improvements: **request pipelining, caching, encryption/signing**
 - ICNRG within **IRTF**
- Join this activity, **everyone is invited** – get involved in and excited about DASH!

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Conclusions



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MEDIA STREAMING



bitmovin GmbH

Lakeside Science and Technology Park
Building B01 9020 Klagenfurt Austria | Europe
T +43 463 27008747
E office@bitmovin.net

www.bitmovin.com | www.bitcodin.com

@bitmovin

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