Lab course

Networked Multimedia Systems

Spring term 2017
Sample Flavors of Internet Multimedia

- **Real-time interactive media** [was: telephony]
  - sipgate, Google hangouts, skype, WebEx, …
  - Very likely your fixed phone line (over cable or DSL, or indirectly)

- **Semi-interactive** [was: walkie talkie]
  - Push-to-talk

- **Messaging** [was: voice mail, pagers]
  - Snapchat

- **Offline media** [was: VHS tapes, DVD rental, original Netflix]
  - Podcasts

- **On-demand streaming** [?]
  - YouTube, Netflix (2007), Amazon Prime, Google Play, Spotify, …
  - Radio stations all over the world
  - P2P streaming

- **Live streaming** [TV]
  - IPTV solutions by ISPs, over-the-top (OTT) streaming
  - P2P streaming (e.g., PPlive)
Interactive Multimedia, Messaging, Presence: Hardware SIP phones, soft clients, (mobile) phones
Web-based Real-time Media + Mobiles
Do-It-Yourself

Search for friends: 

Logged in as Varun Singh (http://www.facebook.com/vr000m) | Logout

(14:58:17) Varun Singh: joins
(15:03:00) Varun Singh: hi
(15:03:02) Albert Abello Lozano: gasdf
(15:03:18) Varun Singh: hoi
(15:03:23) Varun Singh: it works
(15:03:27) Albert Abello Lozano: hello
(15:03:29) Albert Abello Lozano: asdf
(15:03:34) Albert Abello Lozano: asdfgv
(15:03:44) Varun Singh: facebook+websocket+webrt
Telepresence
Market in 2016

<table>
<thead>
<tr>
<th>Upstream</th>
<th>Downstream</th>
<th>Aggregate</th>
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<tbody>
<tr>
<td>BitTorrent</td>
<td>Netflix</td>
<td>Netflix</td>
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<tr>
<td>18.37%</td>
<td>35.15%</td>
<td>32.72%</td>
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<td>YouTube</td>
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<td>Netflix</td>
<td>Amazon Video</td>
<td>HTTP - OTHER</td>
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<td>4.26%</td>
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<tr>
<td>SSL - OTHER</td>
<td>HTTP - OTHER</td>
<td>Amazon Video</td>
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<tr>
<td>8.55%</td>
<td>4.19%</td>
<td>3.96%</td>
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<tr>
<td>Google Cloud</td>
<td>iTunes</td>
<td>SSL - OTHER</td>
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<td>2.91%</td>
<td>3.12%</td>
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<tr>
<td>iCloud</td>
<td>Hulu</td>
<td>BitTorrent</td>
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<td>HTTP - OTHER</td>
<td>SSL - OTHER</td>
<td>iTunes</td>
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<td>Facebook</td>
<td>Xbox One Games Download</td>
<td>Hulu</td>
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<td>2.18%</td>
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<td>FaceTime</td>
<td>Facebook</td>
<td>Xbox One Games Download</td>
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<td>1.89%</td>
<td>2.01%</td>
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<td>BitTorrent</td>
<td>Facebook</td>
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What?
What we’ll look at (1): Protocols

- IP [v4|v6] / IP Multicast
- Integrated / Differentiated Services Forwarding + Queuing

**Media**
- Resource Control
- Audio
- Video
- Data channel
- Directory (“EPG”)

**Web RTC**
- Forwarding + Queuing
- RTP / RTCP
- RTSP
- SIP
- HTTP
- Web Sockets

**Control**
- Telephony
- SDP
- SDP/DASH
- Conferencing
- RSVP

**TCP**
- TCP / TLS
- SCTP
- QUIC
- DCCP

- UDP
What we’ll look at (2): Architectures

- **Web Server A** to **Web Server B**: Signaling path (e.g., SIP, XMPP, ...)
- Application defined over HTTP / Web sockets

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- **Node A**:
  - Web browser
  - Real-time comm. function
  - JavaScript / HTML / CSS
  - WebRTC API

- **Node B**:
  - Web browser
  - Real-time comm. function
  - JavaScript / HTML / CSS
  - Other web browser APIs

- **SDP**

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- **Media path** (e.g., RTP / DTLS / UDP)
What we’ll look at (3): Systems
How?
NMS class in a nutshell

- Focus: specs, design and implementation
- Interoperability with real-world systems
- Lectures to introduce the background, concepts, tools, …
- Hands-on exercises for warm-up
- Coding and experimental validation
- 10 ECTS
- Working in groups of 2 – 3
- Grading based upon documentation, running code, contributions
## Rough schedule

<table>
<thead>
<tr>
<th>Week</th>
<th>Content</th>
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<tbody>
<tr>
<td>Week 1</td>
<td>Lectures on media transport basics</td>
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<tr>
<td>Week 2</td>
<td>Warm-up coding on media transport and infrastructure</td>
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<td>Week 3</td>
<td>Media streaming</td>
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<tr>
<td>Week 4</td>
<td>Interactive media</td>
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<tr>
<td>Week 5</td>
<td>Lab assignments start</td>
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<tr>
<td>Week 6</td>
<td>Networking aspects and NAT traversal</td>
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<td>Week 7</td>
<td>Multimedia measurements and evaluation</td>
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<td>...</td>
<td>Regular exercise sessions</td>
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<tr>
<td>Week 12</td>
<td>Recap &amp; summary; demos and presentations</td>
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Tools & prerequisites

• Use your own device
  • Laptop + mic + camera
  • Smart phone or tablet

• Expectations
  • OS knowledge (e.g. Linux)
  • System-level programming experience
  • As appropriate: know your development frameworks
  • C/C++ or Java
  • Scripting (e.g., PHP, python, perl, shell, … -- whatever you’ll need)
  • Web technologies: HTML 5, Javascript
  • iOS or Android native development (optional)
Next steps

• Moodle course details to come shortly

• Lectures + exercise slots
  • Mon 14 – 16
  • Tue 12 – 14
  • Fri 10 – 12

• We’ll start in week 17
  • 24 April, 14 – 16
  • 25 April, 12 – 14
  • **27 April, 12 – 14 (Thursday!)**