Part 1: Introduction

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Introduction

- streaming means…
  - “instantaneous” play of video content
  - in fact there’s a small delay (a few tens of seconds)
  - due to jitter compensation, packet erasure recovery
  - video content can be live (e.g. sport event)…
  - … or recorded (e.g. film)

- two viewpoints
  - video coding viewpoint
  - networking viewpoint
  - they are complementary, not opposed

Challenges

- challenge 1: scalability
  - 1, 100s, 1000s, 1000000s of receivers
  - how to accommodate it?

  - at routing level…
    - goal is to reduce the amount of data sent over the network or over some links
  
  - at control level…
    - goal is to reduce the amount of feedback sent to the source(s)

- challenge 2: heterogeneity
  - group members can be largely different

  - low speed access network versus xDSL
  - congested networks versus over-provisioned networks

  - unavoidable with large groups of receivers
  - how to accommodate this heterogeneity?

Introduction… (cont’)

- this tutorial focuses on “Large scale video streaming techniques for the Internet”…

  - a subset of streaming techniques
  - e.g. we don’t cover unicast streaming

  - we try to be as general as possible concerning the underlying network

  - we don’t limit ourselves to specialized networks (e.g. DVB)

  - we clearly identify scalability as a key aspect…

  - but two other challenges will be discussed!

  - we follow both the video and networking viewpoints

Challenges… (cont’)

- …possible solutions

  - at the routing level…
    - multicast routing and other group communication services
    - hierarchy of streaming servers
    - see Parts 3 and 4

  - at the control level…
    - RTCP feedback limitation
    - assistance nodes to aggregate feedback
    - see Part 4

Challenges… (cont’)

- …possible solutions

  - at the routing level…
    - multicast routing and other group communication services
    - hierarchy of streaming servers
    - see Parts 3 and 4

  - at the control level…
    - RTCP feedback limitation
    - assistance nodes to aggregate feedback
    - see Part 4

...
Challenges… (cont’)

● possible solutions

○ solution 1: adjust transmission rate to the slowest receiver without going below a threshold min_rate
  ○ ok for slow receivers…
  ○ … but good receivers won’t be happy!
  ○ requires a group management scheme to remove bad receivers
  ○ see Part 4

○ solution 2: use various homogeneous reception groups
  ○ better but at the cost of extra traffic
  ○ requires a group management scheme to move receivers to the appropriate groups
  ○ see Part 4

Challenges… (cont’)

● challenge 3: robustness

○ users need robust transmissions
  …or they will altogether give up the technology!
○ more important than intrinsic stream quality
○ problems due to network defects
  ○ losses (random, per burst, long cut-offs)
  ○ jitter

Goals of this tutorial

● This tutorial covers
  ○ video coding
  ○ networking aspects
  ○ streaming solutions
  ○ some existing tools

● This tutorial does not…
  ○ cover any of the previous aspects in details
  ○ focus on any commercial solution

Challenges… (cont’)

● possible solutions (cont’)

○ solution 3: use multi-rate transmissions
  ○ addressed by the congestion control protocol itself
  ○ elegant and excellent solution to the problem
  ○ see Parts 3 and 4

Challenges… (cont’)

● possible solutions

○ use robust audio/video coding
  ○ see Part 2
○ use of Forward Error Correction (FEC)
  ○ see Part 3
○ use other forms of redundant transmission
  ○ see Part 3
○ … or a mixture of the above techniques!