Video quality estimation of DCCP streaming over wireless networks

Sébastien LINCK, Emmanuel Mory, Julien Bourgeois, Eugen Dedu and François Spies

firstname.lastname@pu-pm.univ-fcomte.fr
LIFC Montbéliard France
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Introduction

- Two modes of video visualization on Internet
  - Downloading then playing
  - **Streaming**
- Many streaming solutions developed, but always RTP/UDP-based and without any real congestion control
- Our objectives
  - Streaming with congestion control
  - Validate our method by simulation
  - Compare final quality between various solutions of streaming

Plan

- Problematics
- Context
- Environment of simulation
- Case study
- Conclusion and future work

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- **Problematics**
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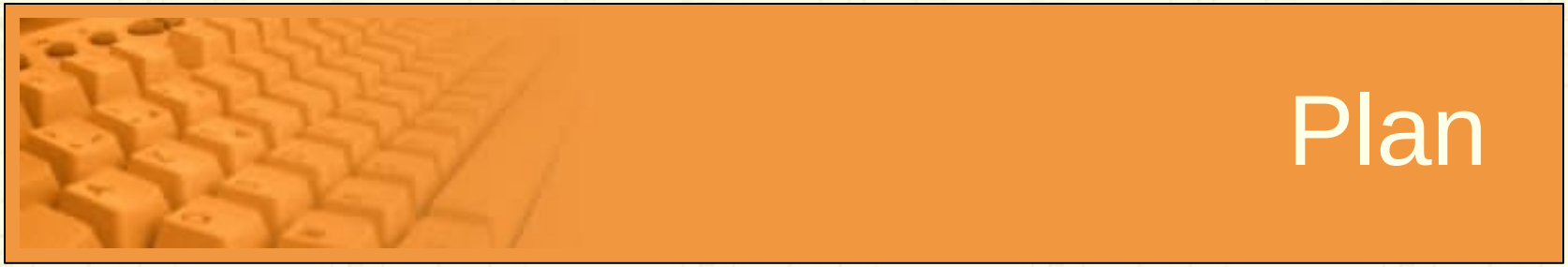
Problematics

- Mobile client
  - Heterogeneous mobile terminals
  - Wireless technologies with various bandwidths
- Transport layer : congestion control
  - Bandwidth estimation
  - Losses management over wireless networks
- Wireless MAC layer
  - Interferences management + other particularities

=> Adaptation of multimedia flow according to the terminal and the network



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Context (1/3)

- Application layer
  - Standard RTP/RTCP
  - RTCP gives only losses informations
- Mixer
  - Software component
  - Intercalated between the server and the client
  - Goal: adaptation of quality (different resolutions, coding, ...)

Context (2/3)

- Transport layer: new protocol
- DCCP (*Datagram Congestion Control Protocol*)
  - UDP combined with congestion control (CC)
  - Separation transport / congestion control
  - 2 CC implemented:
    - TCP-like: like TCP!
    - TFRC
- TFRC (*TCP-Friendly Rate Control*)
  - Equation-based congestion control
  - Smoother adaptation of the throughput

Context (3/3)

- MAC layer
- Wireless network: 802.11
  - ARQ (Automatic Repeat reQuest)
    - MAC layer acknowledgements
    - After N attempts, a packet is no longer retransmitted and is removed
  - Interferences are
    - Independent
    - Temporary
    - But Frequent
  - Retransmissions => time loss

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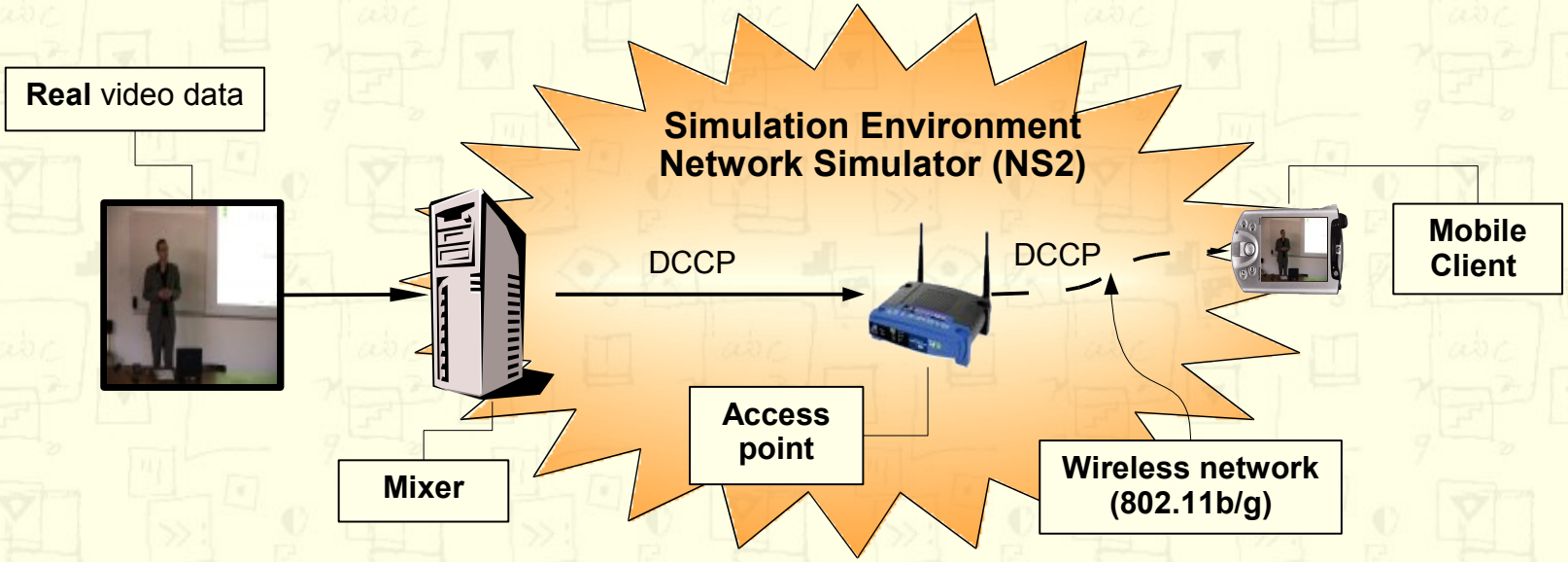
Environment (1/3)

- Our Video On Demand Simulation Architecture
  - **Simulated** transfer of **real** data

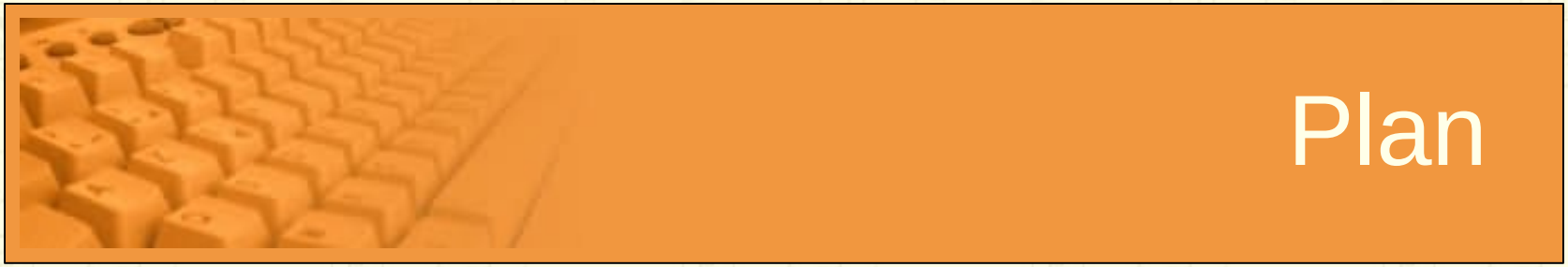


Environment (2/3)

- Wireless network 802.11
  - Interferences => MAC retransmissions
  - Retransmissions => RTT (*Round Trip Time*) increase
- For a transport protocol, generally:
  - RTT increase = congestion => throughput decrease
- Our solution, for each packet, the wireless card:
  - Sums the "time lost"
  - Inserts it in a new optional field of DCCP header
  - New calculation method of RTT => optimal throughput

Environment (3/3)

- Our NS2 contributions
  - Mixer integration
    - New RTP module
      - Transport protocol switching
      - Real video utilization
    - Adaptation module
  - Creation of a cross-layer module which transmits the DCCP estimated bandwidth from transport to application layer
  - Correction of TFRC wireless implementation



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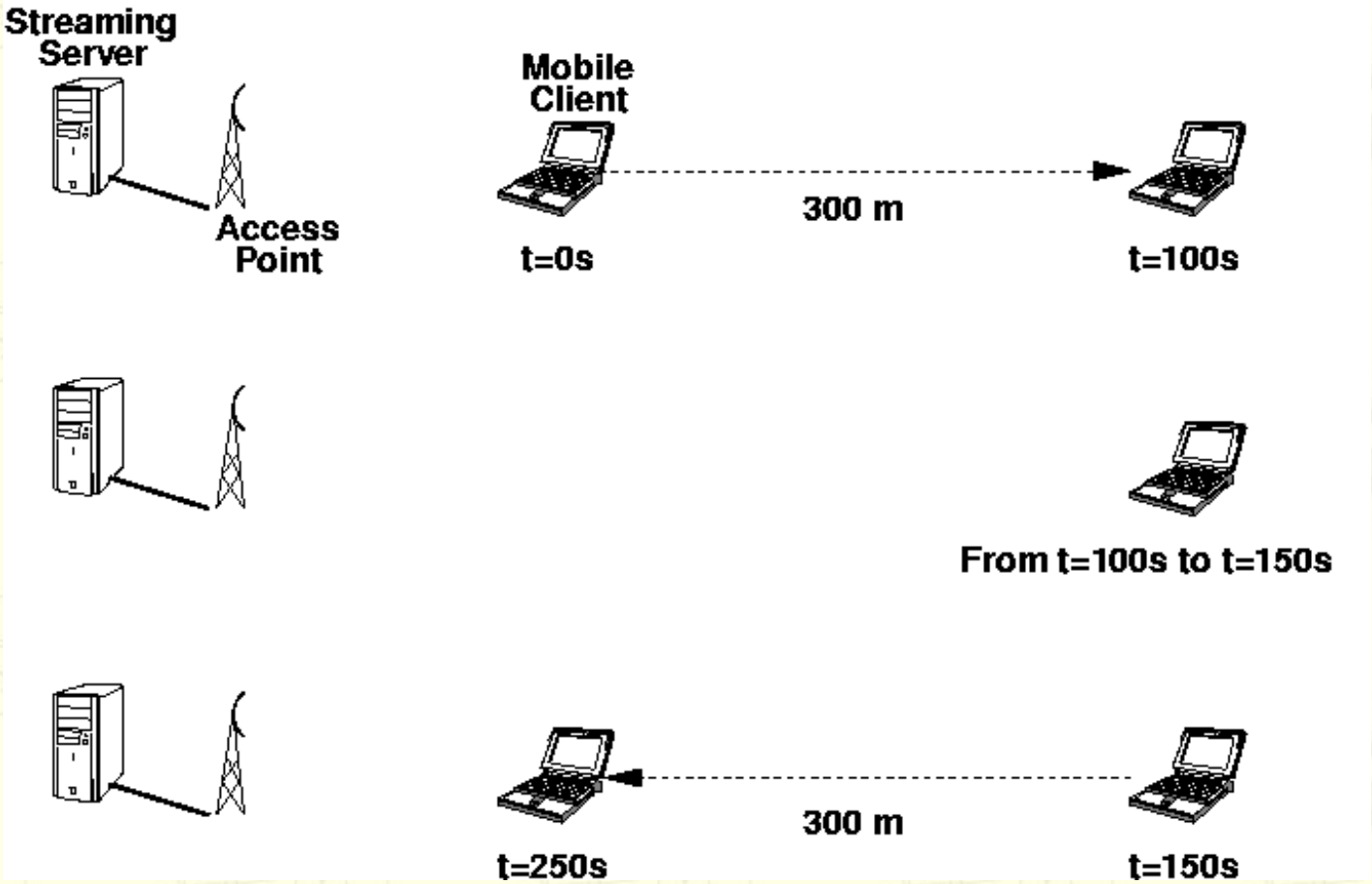
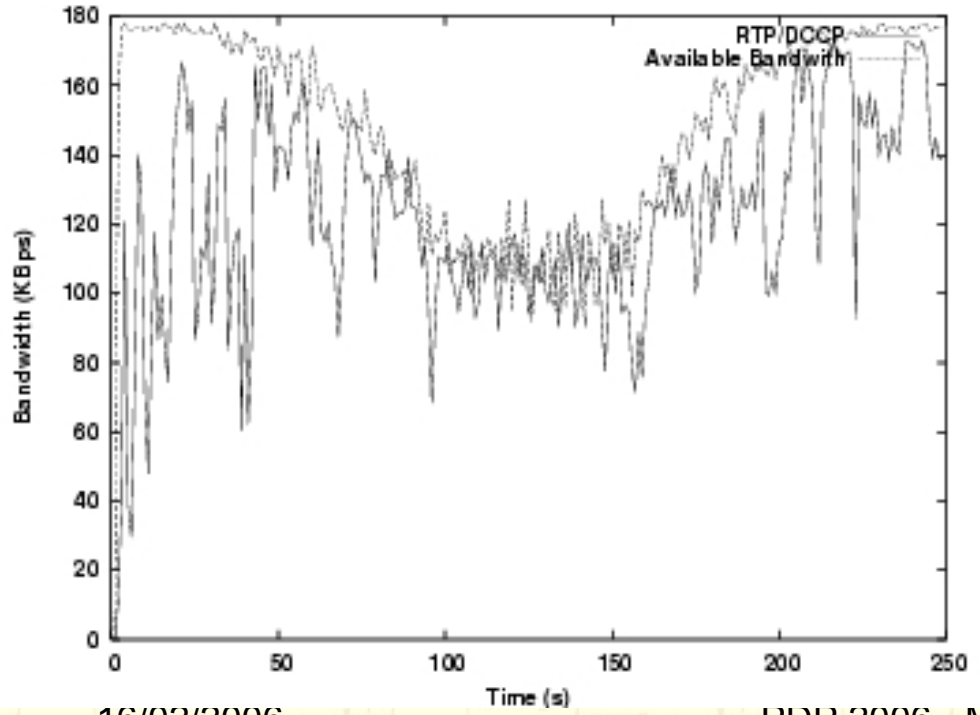
Case study (1/5)

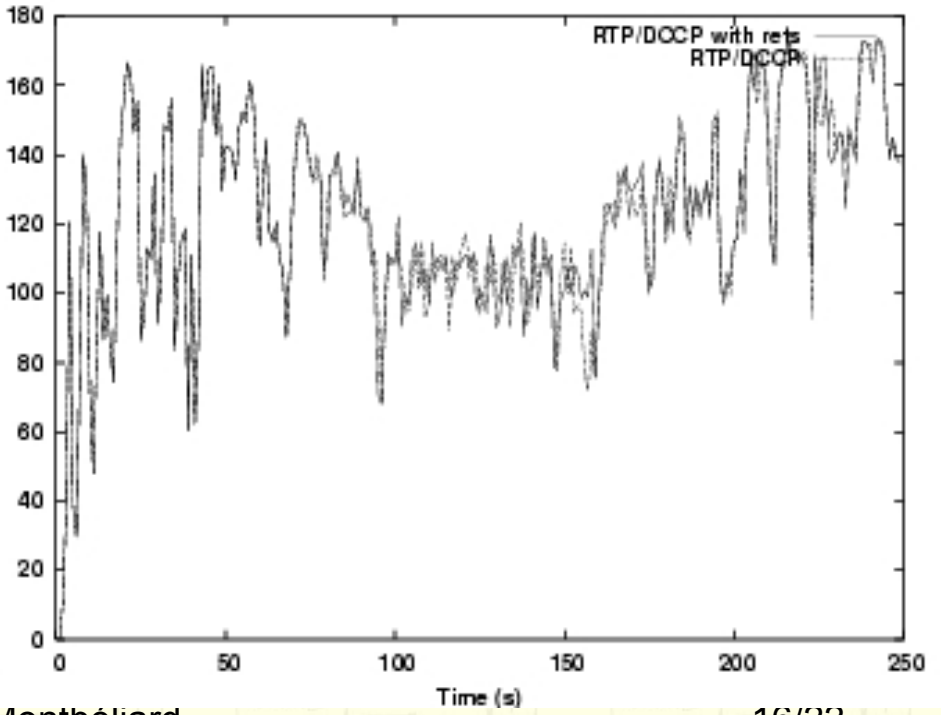
- Scenario



Case study (2/5)

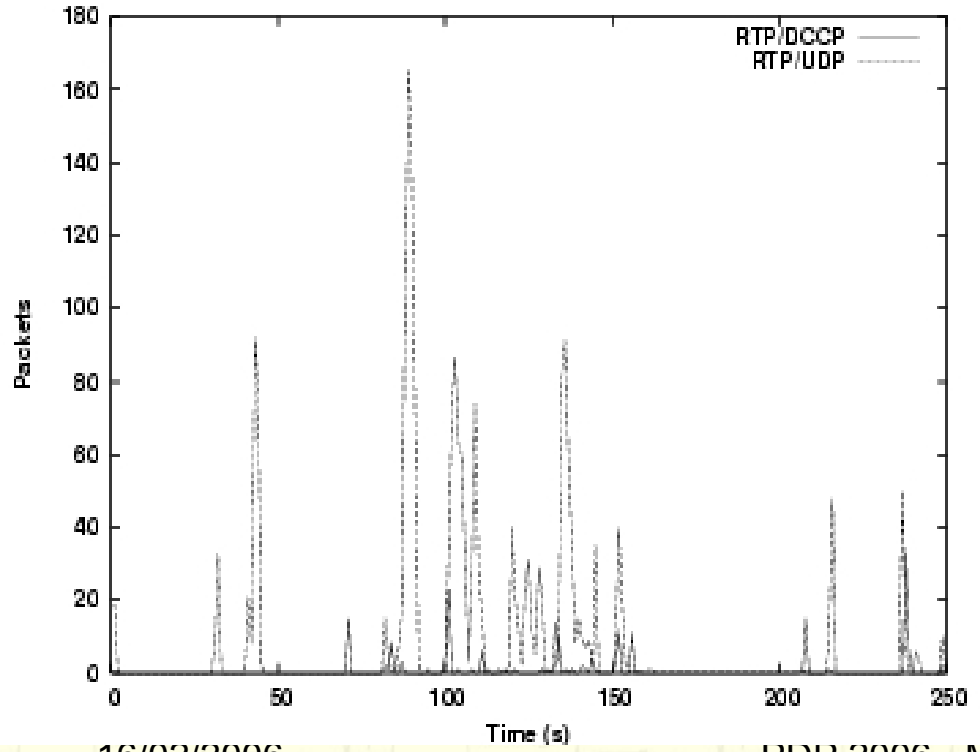
- Results
  - Comparison available bandwidth / bandwidth estimated by DCCP

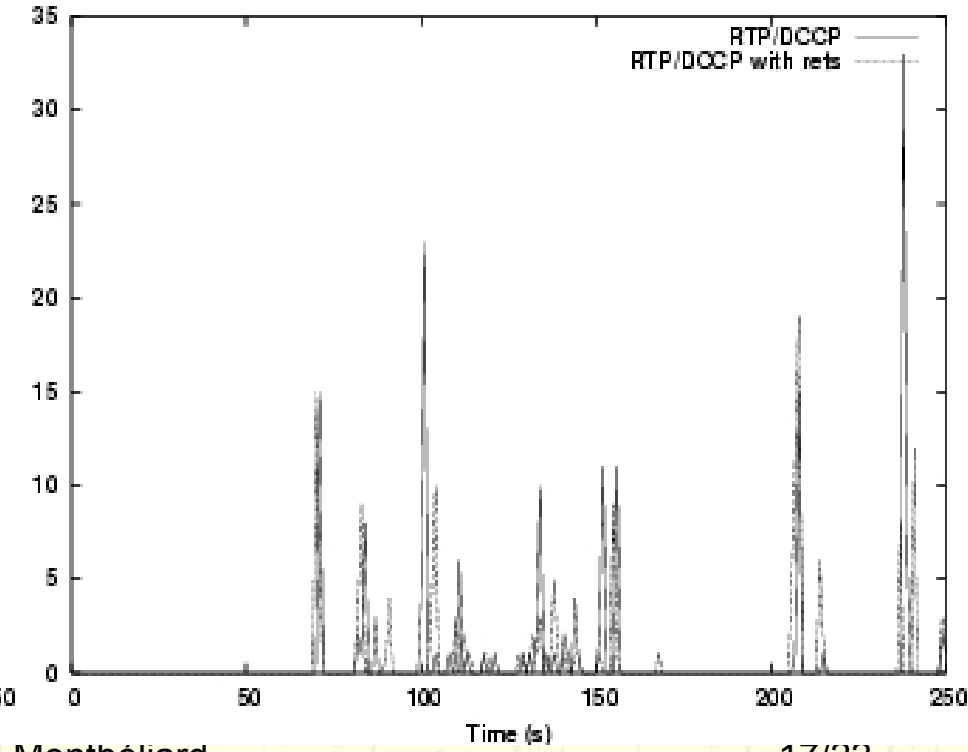




Case study (3/5)

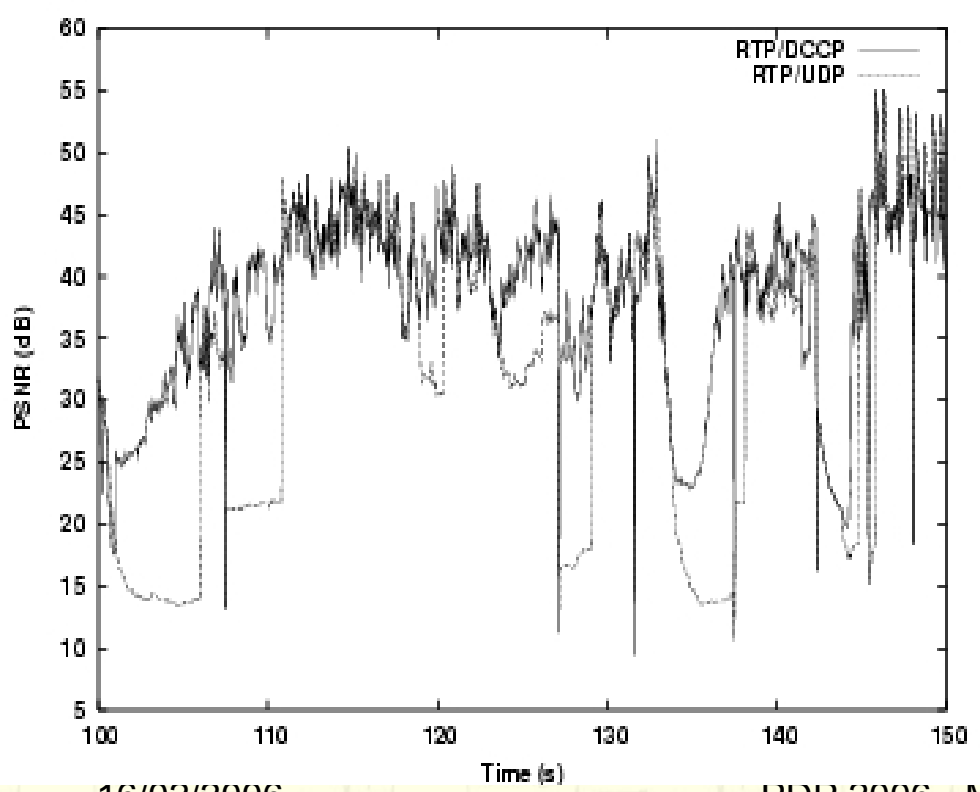
- Results
  - Packets losses

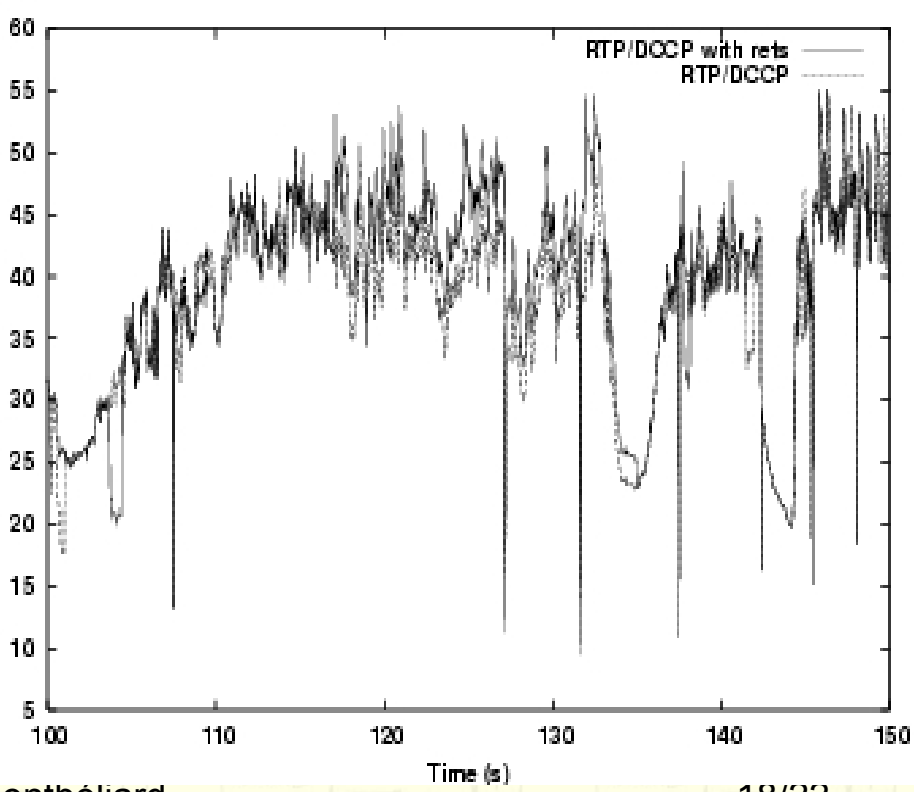




Case study (4/5)

- Results
  - PSNR (Peak Signal to Noise Ratio) = quality





Case study (5/5)

- Conclusion on the results
  - Adaptation necessary in wireless networks
  - DCCP/TFRC is a valid transport solution for RTP
  - Taking into account of the MAC retransmissions
    - Improvement of the video rendering quality during interference stage
    - Optimal use of the bandwidth in the event of multiple interferences

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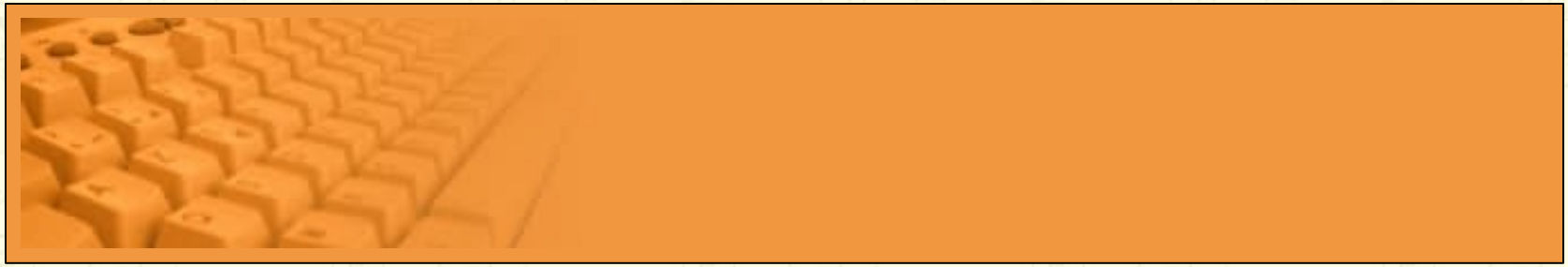
Conclusion – Future work

- Presentation of a complete DCCP streaming simulation environment
- RTP/DCCP
  - Better quality due to more accurate network information from DCCP
- Taking into account of MAC retransmissions

  => benefit
- Future work
  - Simulations on a large scale
  - Low power consumption



Questions ?