

Adaptive Internet Multimedia Streaming

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Nordunet 3 ADIMUS Institutions

- Norwegian Computing Center (NR), Oslo
- Technical Research Center Finland (VTT)
- Swedish Institute of Computer Science (SICS)
- University of Oslo (UiO) and Department of Informatics (Ifi)



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Goals

- Develop **adaptation technologies** for **streaming** multimedia content based on:
 - Subjective service quality
 - Objective service quality
- Reasonably fair utilisation of available resources
- Video and audio mainly (some voice)
- End to end video streaming with acceptable quality
- Facilitate migration between different network technologies
- We would like to support near-real time interaction

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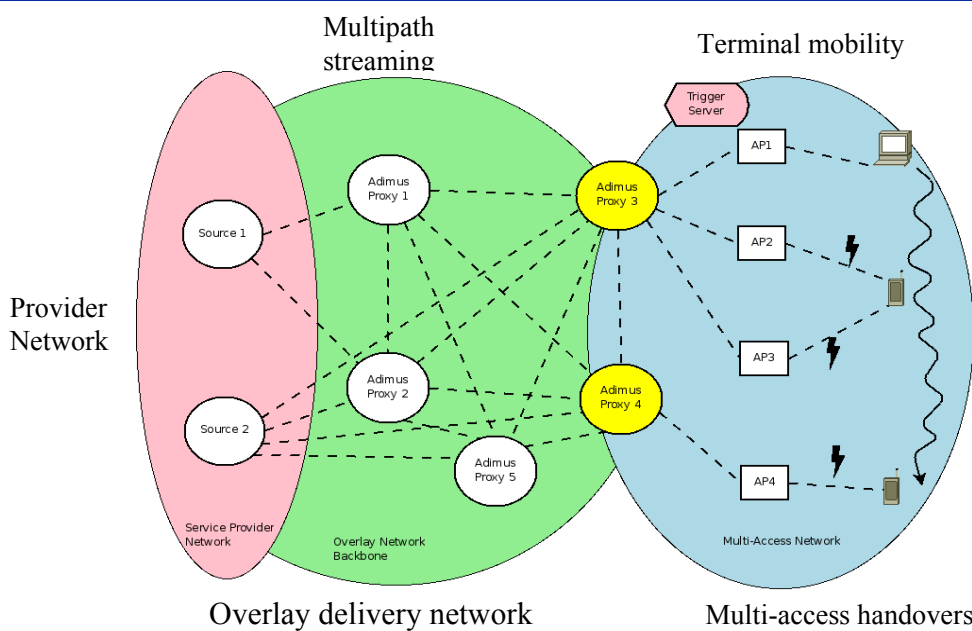
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ADIMUS Architecture



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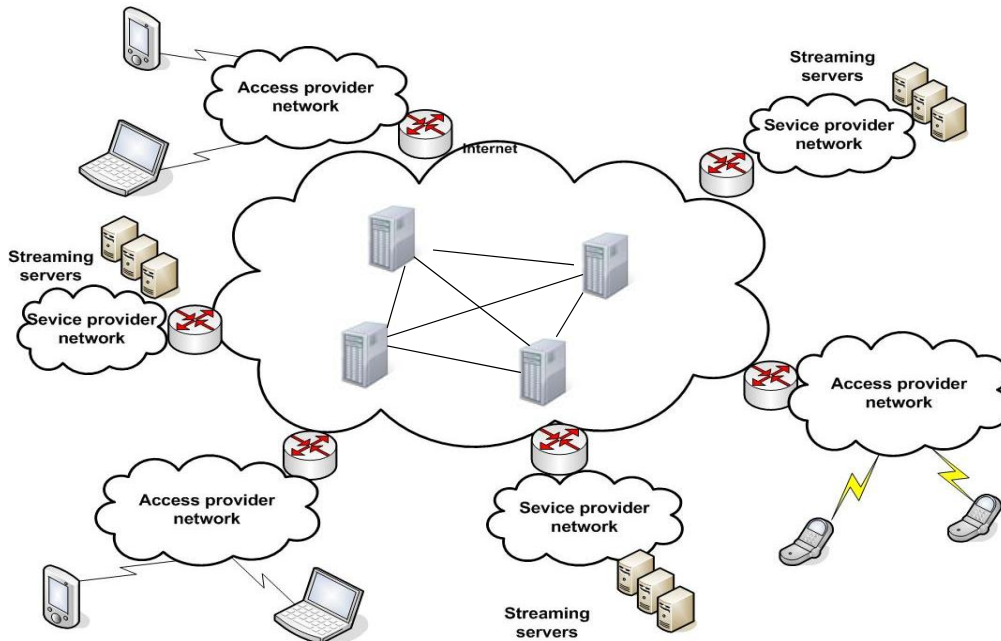
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Network scenario



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Backbone streaming requirements

- The rational utilization of the available resources should be provided. (load balancing)
- Fairness of resource provision should be guaranteed. (all actors get their fair share)
- QoS requirements met in the backbone (by overlay management)
- Optimization of the video distribution over the whole network rather than point-to-point delivery
- Implemented a benchmark for multipath streaming to test against
- Distributed and scalable algorithms for multipath streaming

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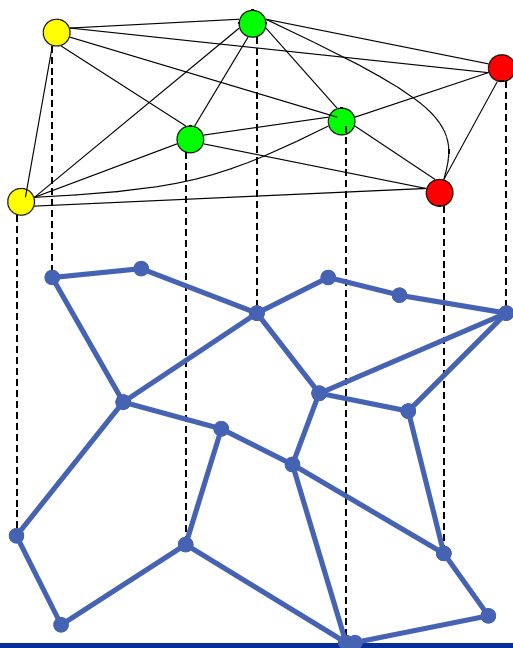
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Benchmark System Model



- *Receivers*
- *Senders*
- *Adimus Overlay Node*

- Modeled as a graph
- Bandwidth and delay functions are defined on the edges
- Maximization of the throughput from the senders to the receivers
- The problem is formulated as an LP problem and solved using the Simplex method

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Overlay Multipath Streaming

- Development of distributed algorithms for multipath construction operating under partial knowledge of the network resources:
 - In particular, bandwidth
- Overlay node together with other basic streaming functionalities:
 - Looking at packet loss
 - Effects of caching and transcoding
 - Adding error correction mechanisms
- Moving now from linear programming to DE simulations

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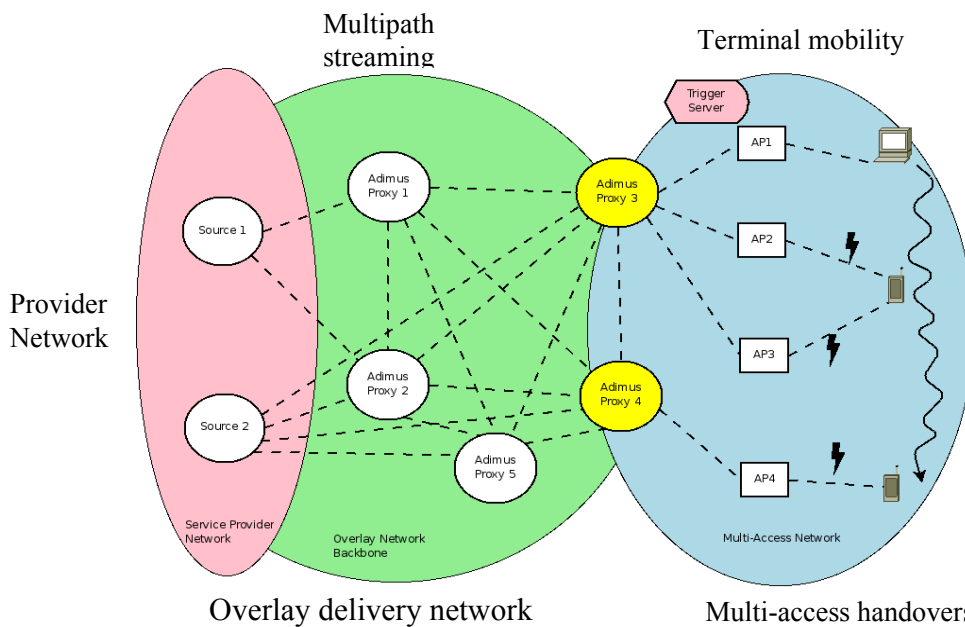


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Moving onto wireless access



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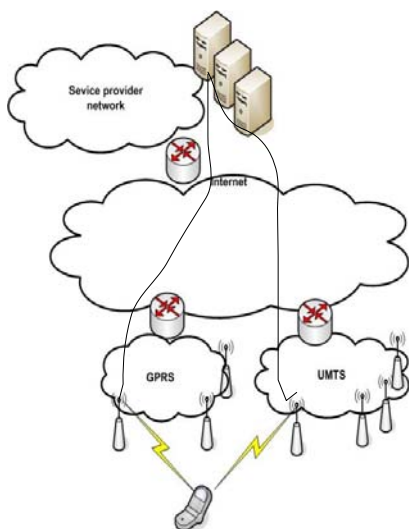
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Multipath in Access networks



Wired paths use multihoming
Wireless using multiple wireless links

Important aspects for wireless:

- Video handovers needs to be quality aware
- Signalling between overlay & mobile node
- Real-time monitoring of bandwidth usage

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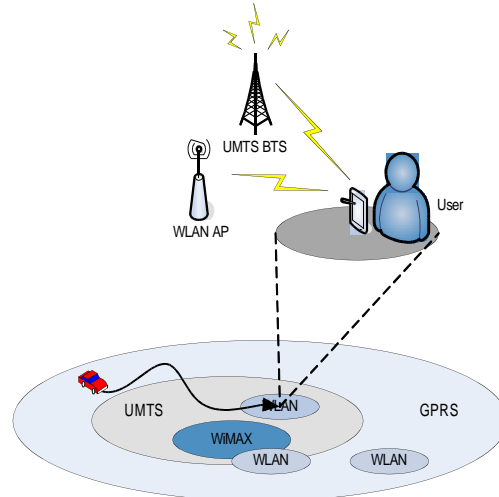
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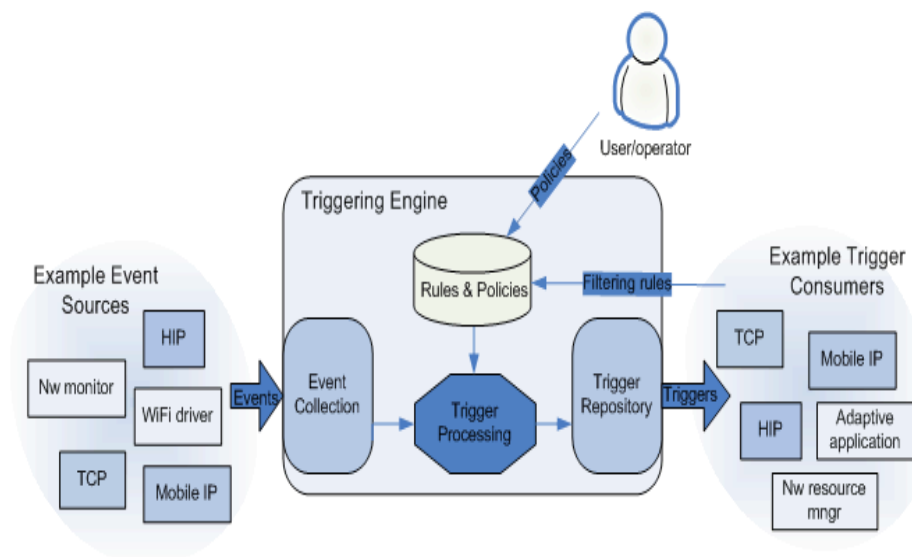
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Wireless access in ADIMUS

- **Problem:** The QoS requirements of applications are not well supported in state-of-the-art vertical handover situations
- **Hypothesis:** Cross-layer aided, QoS-aware multiaccess control can be used for improving multimedia delivery significantly. It is possible to find optimal control algorithm for maximizing user-perceived QoS in multiaccess environments based on the channel characteristics of the different access networks and application QoS requirements.



Wireless access initial design



Back to the title (adaptive)

- Overlay routing based on traffic measurements
 - Will adapt to the current situation
 - Adapt what? - the route
 - + feedback to the content provider
- User QoS satisfied by matching subjective trials (VQEG)
 - With objective network measures
 - Hence including the user aspects in the loop
- Co-operative handover management to maintain when the IP network cannot
 - Handover to the cellular network

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Results so far...

- An initial design for the architecture
- 2 published papers on access network
 - Mobilware '08 and ICC '08
- 1 published paper on backbone overlays
 - IEEE ICME 2008
- 1 paper on the ADIMUS architecture in progress
 - Future Multimedia Networking 2008
- Initial design for bandwidth estimation
 - Based on Kalman filters with incomplete info
 - Basically an efficient recursive filter that estimates the state of a dynamic system from a series of incomplete and noisy measurements

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Little more information

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