



# Measurement to Support Advanced Applications

- **Ground Data Transfer in AMS-02**

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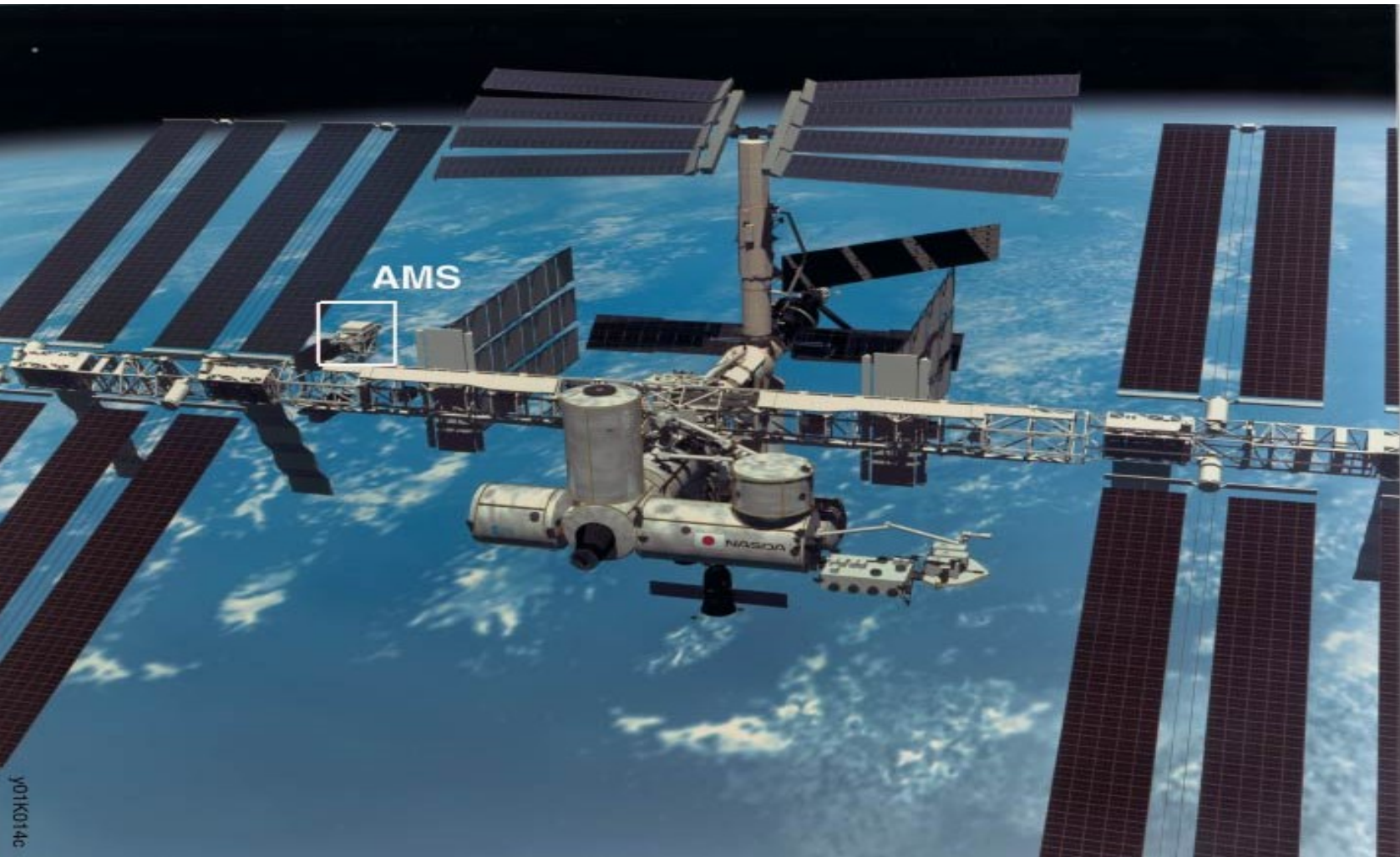
**Department of Computer Sci. & Eng.**

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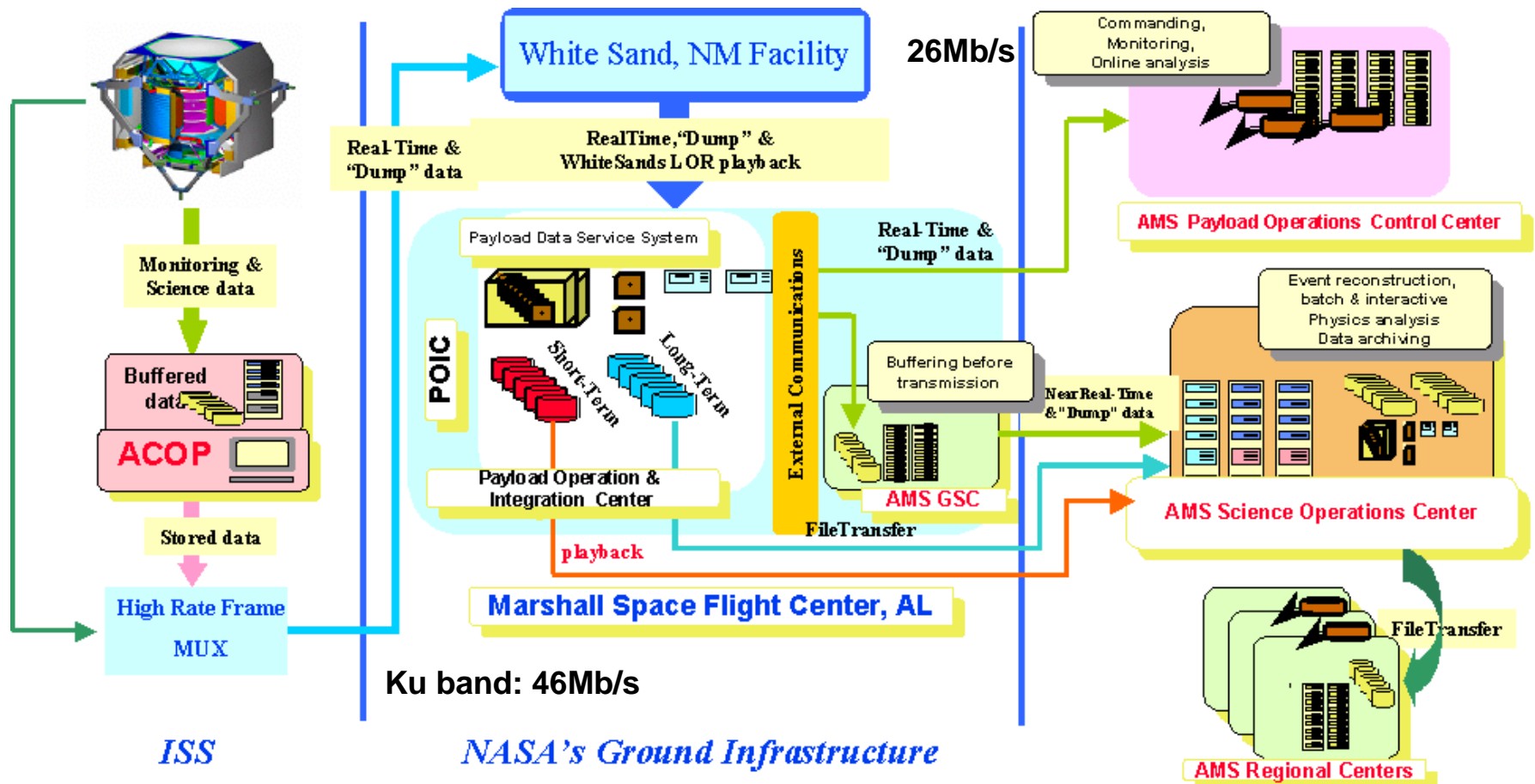
**2005-11-02**

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**The Alpha Magnetic Spectrometer (AMS) is an international cooperative, space-based particle physics experiment that is led by Nobel laureate Samuel Ting of MIT. This experiment will keep a Magnetic Spectrometer on the the International Space Station (ISS) for a period of 3 to 5 years, with the purpose of performing accurate, high statistics, long duration measurements of the spectra of energetic primary charged cosmic rays in space.**



# Data flow from ISS to AMS remote centers



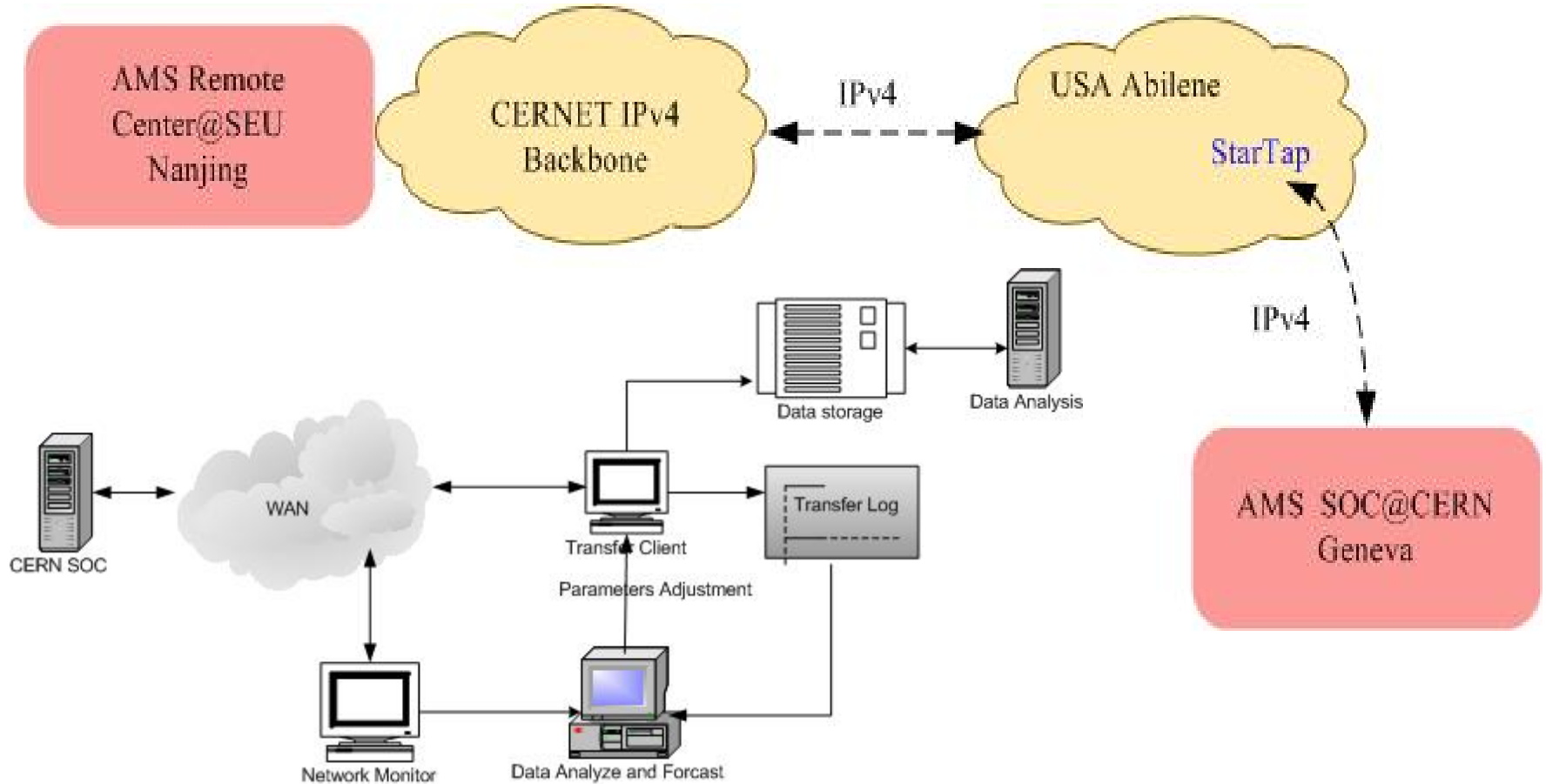
# Requirements

- **A long duration, high bandwidth data transmission task**
  - **Non-stop for 3-5 years**
  - **About 30Mb/s bandwidth for data and Video**
  - **QoS monitoring and bandwidth usage control at user side for dynamic incoming data rate**  
*Not to exceed the applied bandwidth*
  - **IPv4 / IPv6 (Path length  $\approx$  20 hops)**

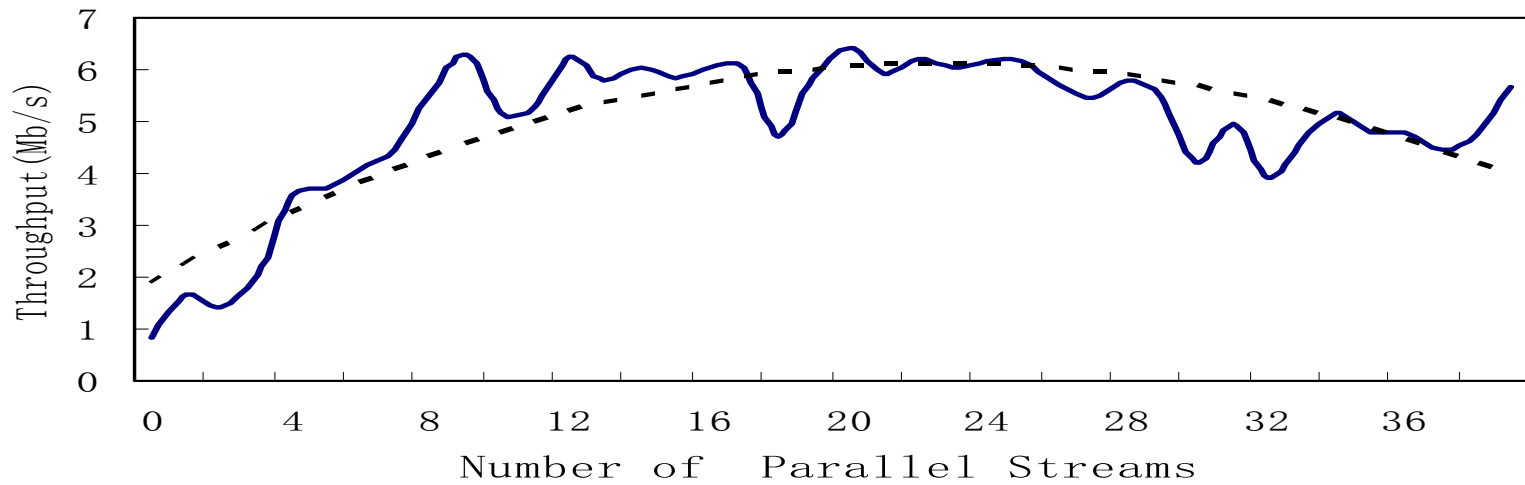
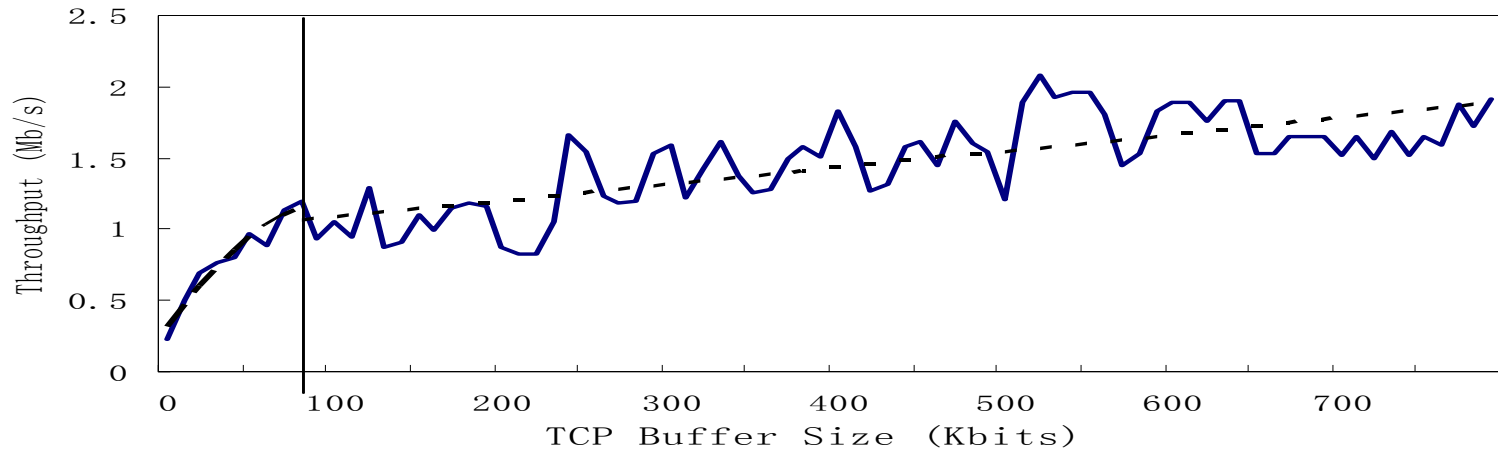
# Network measurement for AMS02

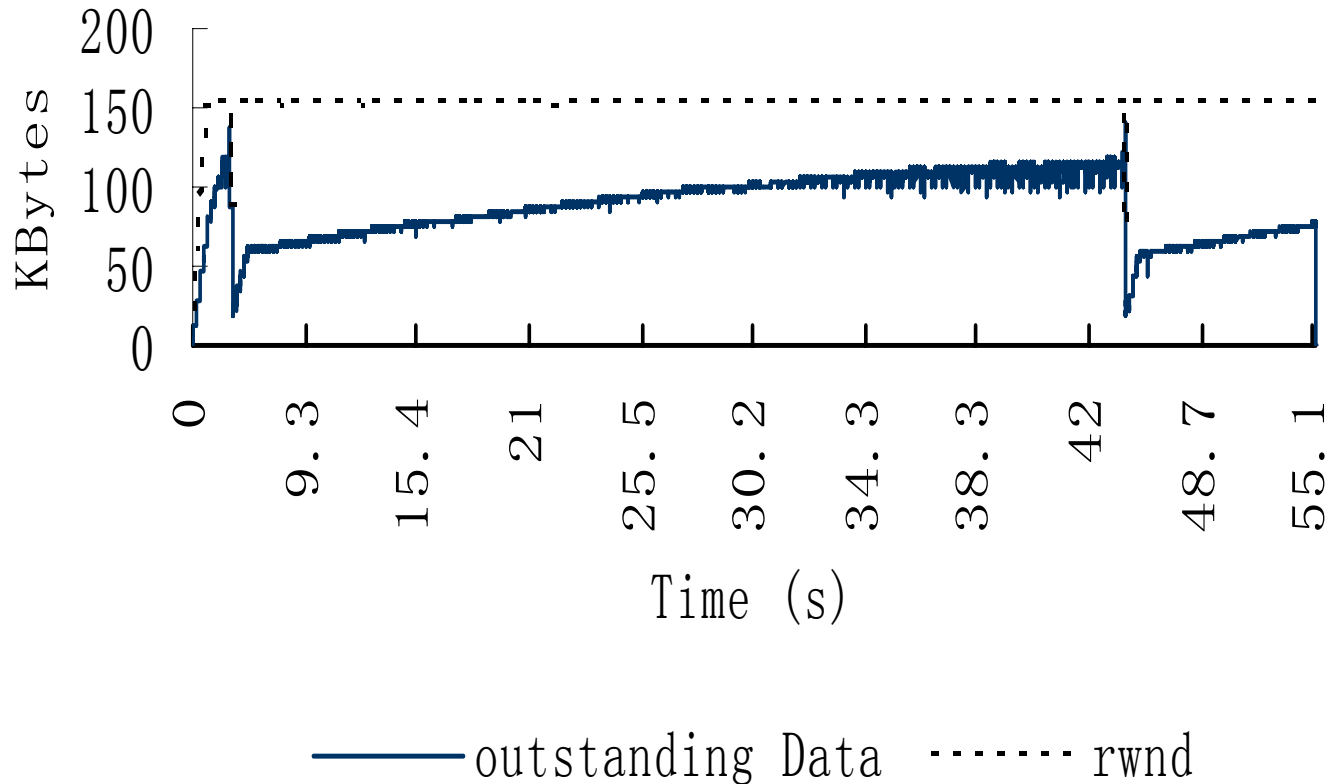
- **Target**
  - to meet the throughput requirement within the applied bandwidth
- **Tool**
  - BBFTP
  - Transmission gateway
- **Means could be used**
  - Parallel stream numbers
  - TCP buffer size

# Data Transfer Test



# Measured with BBFTP





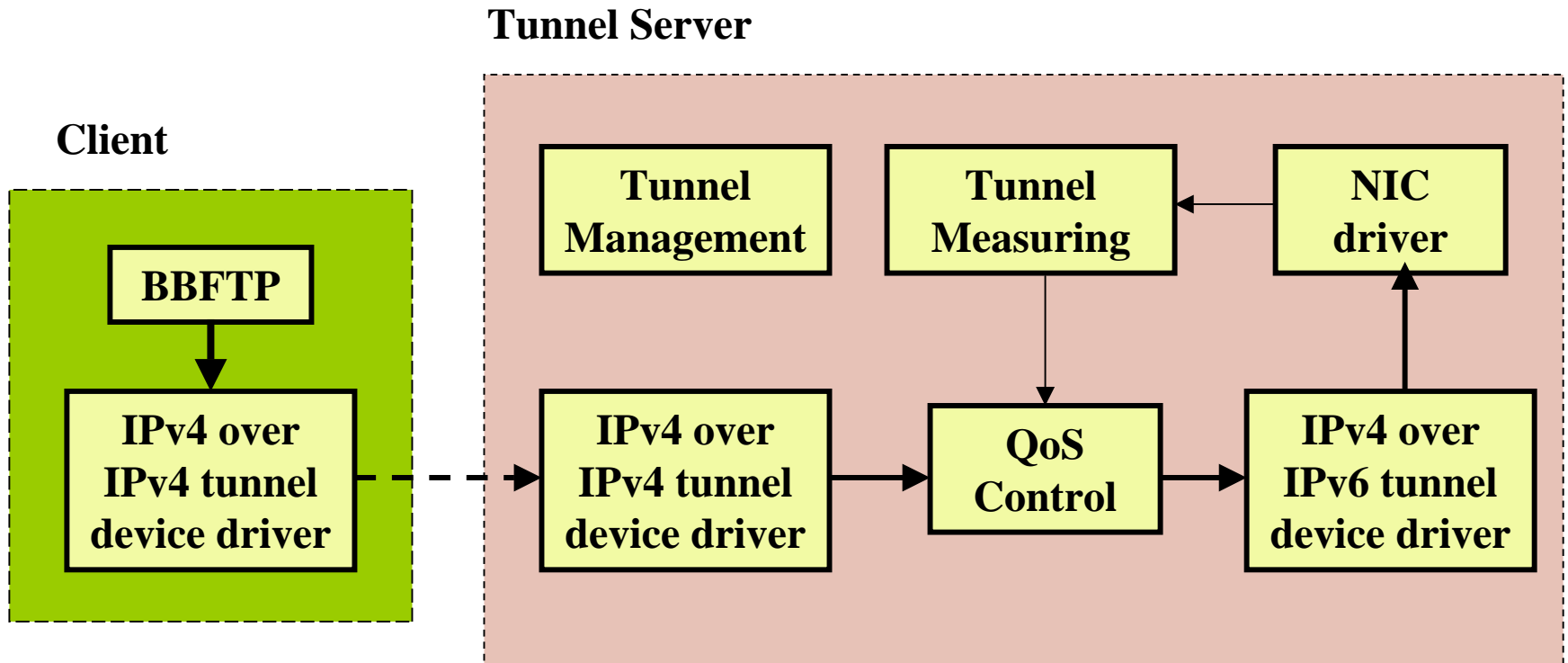
- *Test results over IPv6 were similar*
- *Conclusion: The path between Nanjing and Geneva is not compose of high bandwidth – long delay links, so that the number of parallel streams will be the mean of adjusting the bandwidth usage.*



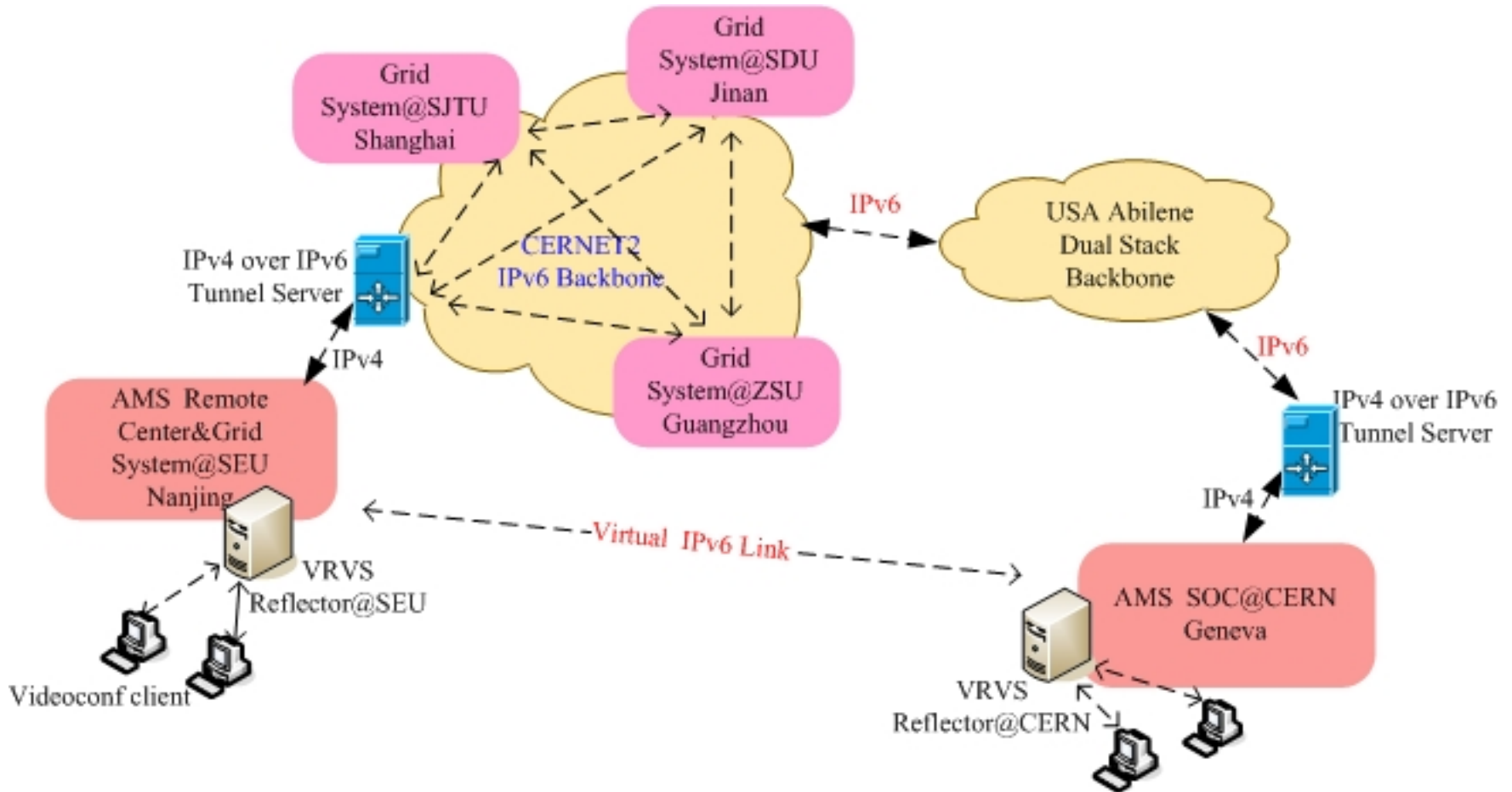
# **Bandwidth usage control**

- **Based on adoptive concurrent stream predictive model**
  - **Adjust stream numbers according to the current network behavior: available bandwidth and the throughput per stream**
  - **New buffer size**
  - **Data size**
  - **Forecasting model: ARIMA**

# System structure



# New Structure



**Thank you**