Bandwidth Estimations and it's Applications

Bandwidth Estimation Meeting

CAIDA/SDSC

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Overview

- Interested areas of research
- Focus
- Help from other resources
- Status

Measurement Tool Development

- Interested areas of research
  * Provide information applications need
    - General
      - Capacity
      - Available bandwidth (Cross traffic information)
      - Achievable throughput of TCP and/or UDP
      - RTT
    - Application specific
      - # of parallel streams
      - optimal window size
      - etc.
  * Aim on High-speed network
    - Link speed above OC-3
    - NIC speed exceeds I/O bus speed
  * Be Time efficient, accuracy and less intrusive
    - High utilized and high dynamic network, such as LBNL-net, ESNet
    - Request measurement done in a short period of time without history information

- Focus

  * Research these issues on top of the current technologies and algorithms we have

  * Emphasize on develop algorithms to provide information about network characteristics to TCP applications, this will allow them to better utilize the available bandwidth and increase performance.

  * Expect to develop time efficient algorithms to measure link characteristics in short period of time of measurement with limited resources.
    - Collaborate other projects and share their resources

  * Integrate the result into SciDAC projects

- Get help from other resources

  * Joined adventure with SCNM and DMF
    - Use SCNM to analyze network traffic and measurement traffic
    - Work with ESNet, LBNL, NERSC, ORNL and other folks to deploy and use SCNM and optical fiber analyzer
    - Add our tools into DMF to do statistics and tests and to refine algorithms

Network Characteristics

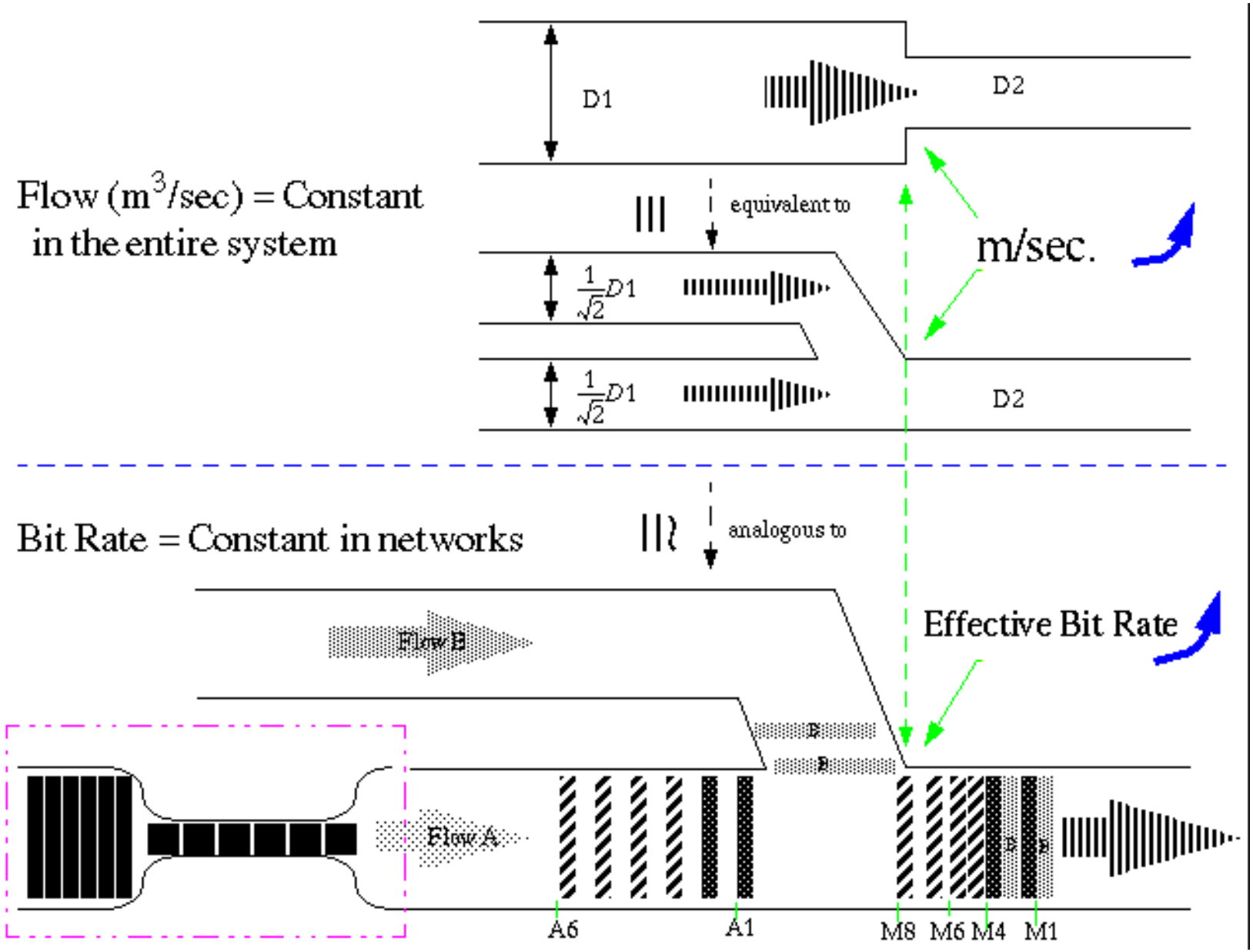
- Info for traffic control and cross traffic analysis
  * Difficulty — bandwidth shaping
    - Capacity
  * More difficulty — time frame (measuring window)
    - Available bandwidth
- Info for improving applications' productivity
  * Relatively easier if networks are not so dynamic
    - Achievable throughput
    - Optimal TCP window size
    - Number parallel streams
    - RTT

Measure High-speed Network

- Link speed over 155 Mbit/s
  * Technique to send packet trains
    - Ensure the packets sent with less gaps
      - routers reply multiple ICMP to a large UDP packet is good for synchronous train probe, bad for asynch probe.
      - routers reply one ICMP to a large UDP packet is good for asynchronous train probe, but less efficient for synch probe.
    - Ensure no self disruptive
    - Avoid method based on kernel modification (PeriScope — Linux API, Boston Univ.; the other company makes similar API for MS Window) which may be good for commercial product.

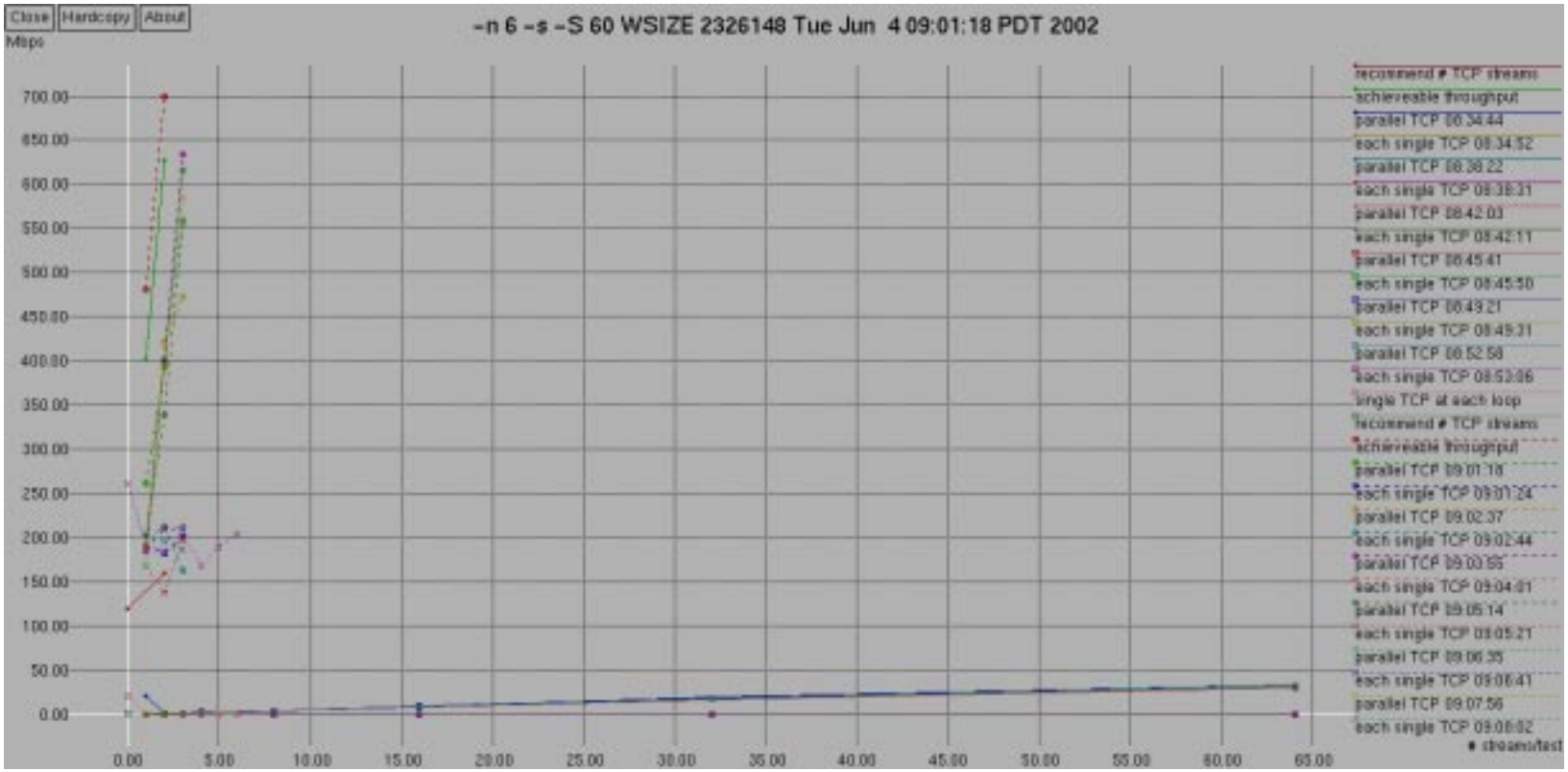
- Link speed over 2480 Mbit/s or exceed the system I/O bus
  * Signal to noise ratio is low (< 1)
    - Use on NIC timer
      - availability
    - Use long train — large MTU may not be a solution
      - Train length may be limited by RTT on hop-by-hop measurement
  * Inherit from NCS technologies
    - Multiple convergency steps — many algorithms depend on a certain condition or ideal status
    - Multiple algorithms

Link Characteristics Measurement Tool Developments

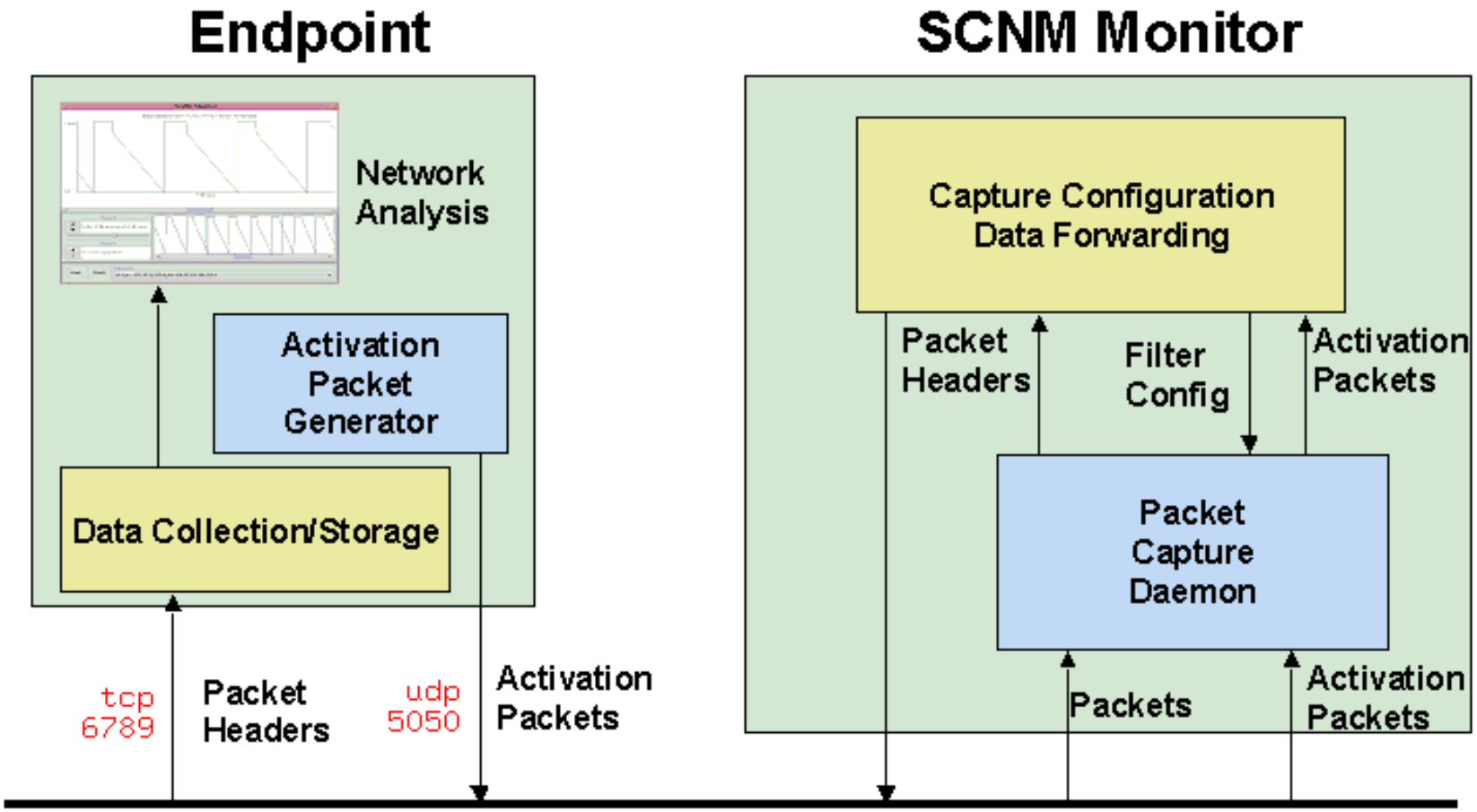


Develop and Improve Algorithms

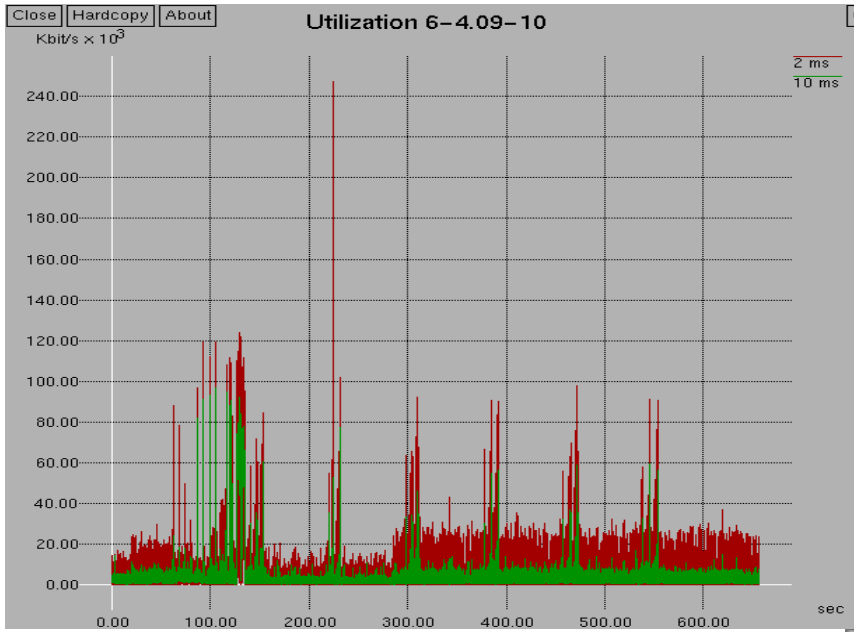
* Capture Dynamic Info.
  - Fast measurement algorithm to accommodate the volatility of networks
  - Keep measurement results accurate
  - Non intrusive

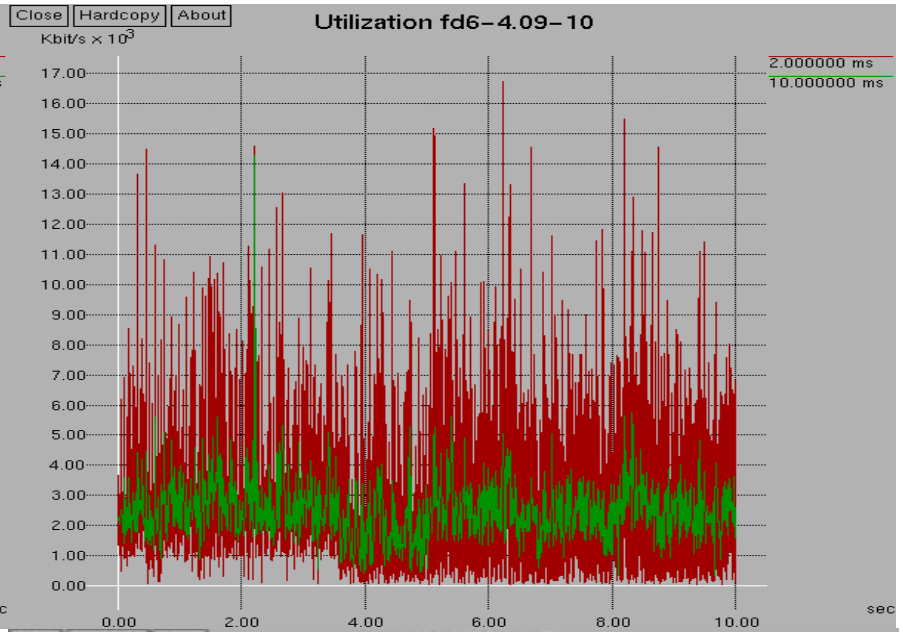


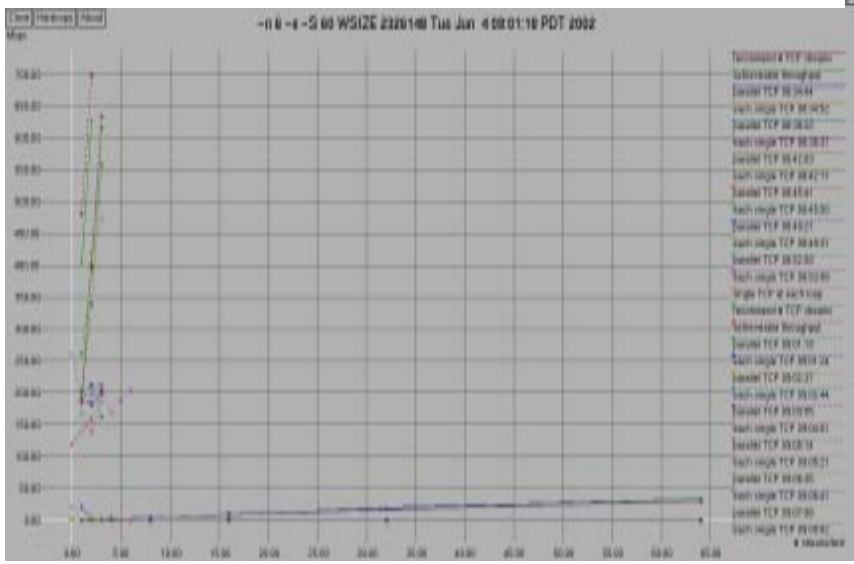
- Use SCNM and DMF to assist development

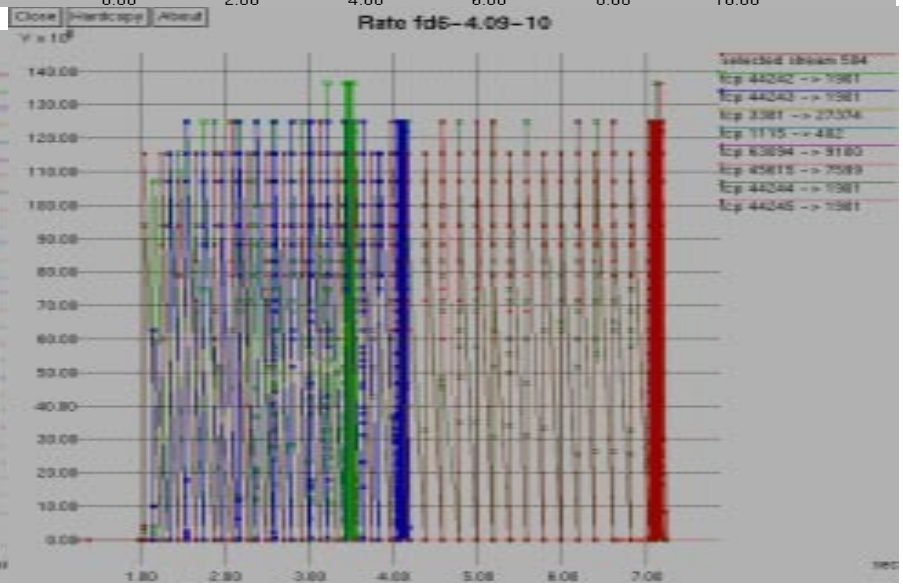


Link Characteristics Measurement Tool Developments









Netest

Used for automatically detecting the maximum throughput of different applications and traffics.

A simple output format:

--- General section ---
Round Trip Time (RTT): 54.3600 ms
Burst size (largest): 1675504 Bytes

--- UDP section ---
Single stream UDP throughput: 471.1614 Mbps
Multi- stream UDP throughput: 915.8085 Mbps
Use multiple streams to gain UDP throughput is recommended

--- TCP section ---
Optimal TCP Window size: 2505463 Bytes
Single stream TCP throughput: 94.6152 Mbps
Use parallel TCP streams: is recommended
6 TCP streams can improve the throughput friendly
9 TCP streams can maximize throughput aggressively

Integration

- Apply developed tools to SciDAC, GIRD, and applications where they need.