Bandwidth Draft

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State of the art

- Many different tools
- Use different base techniques
  - Variable packet size techniques
  - Packet pair/train
  - Packet chirp
- Measure different things
  - link-by-link capacity
  - end-to-end capacity
  - end-to-end available bandwidth
  - "tight link" location

Short survey

Tool	Metric	Methodology
pathchar	Per hop bw	VPS
clink	Per hop bw	VPS
pchar	Per hop bw	VPS
brpobe	end-to-end bw	packet pairs
nettimer	end-to-end bw	packet pairs
pathrate	end-to-end bw	packet pairs & trains
sprobe	end-to-end bw	packet pairs
cprobe	end-to-end avail bw	packet trains
pathload	end-to-end avail bw	self-loading streams
IGI	end-to-end avail bw	self-loading streams
pathChirp	end-to-end avail bw	self-loading chirp
STAB	locate thin link	self-loading chirp
pipechar	link by link bw + avail bw	unknown

Some Difficulties

- ➢ Typical Assumptions
  - ❖ FIFO queues
  - ❖ Cross traffic characteristics "nice"
- ➢ Statistics
  - ❖ Instantaneous "snapshots"
  - ❖ Time-varying processes
  - ❖ Sampling theory?

- ➢ Different L2 technologies
  - ❖ "logical links" vs physical links
  - ❖ Multi-link PPP
  - ❖ PPPoEoA?
- ➢ Wireless links
  - ❖ Varying bandwidth
  - ❖ L2 retransmissions
  - ❖ Added bits for FEC

Some Measures So Far

➢ Available bandwidth:

  ❖ use characteristics of gap between successive probe packets to estimate bandwidth used by competing traffic

  ❖ use increasing probe rate to generate artificial congestion (short term) to estimate available bandwidth.

What should be focus of draft?

- Critical analysis of current tools?
  - Including independent comparison?
  - Recommendation of particular technique or set of permissible techniques?
- New Definitions
  - End-to-end capacity?
    - What would be most useful to ISPs?
    - What would ISPs accept from customers as valid?
  - Available capacity?
    - Same questions - what is most useful?
- Measurement Techniques

What should be included?

- Definitions
- Required measurement techniques
  - How you have to measure it
- Required statistical analysis
  - What is valid
  - What are the limits of accuracy