Variable Bandwidth Links and their Impact on Higher Layer Protocols
PILC BOF

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Overview

- What causes variable link bandwidth?
- Impact on higher layer protocols?
- Approaches to solutions

Variable Link Bandwidth

- Wireless: Time varying error characteristics (noise, interference, multipath fading).
  - Packet loss ⇒ bandwidth loss
  - FEC ⇒ trading bandwidth for lower error rate
- Mobility
  - Wireless roaming: From high b/w wireless LAN (WaveLAN) to low speed public access wireless LAN (GSM).
  - LEO route changes

Variable Link Bandwidth

- Shared media
  - MAC protocols usually do not provide sustained bandwidth guarantees
  - Contention based schemes degrade with load
- Effect of bandwidth management policies
  - Higher priority traffic may preempt lower priority traffic
  - Strict priorities cause starvation of best effort traffic
  - Link sharing policies can dynamically allocate/reallocate bandwidth

Impact of Varying Bandwidth

- Changing bandwidth-delay product
- Difficult for TCP to estimate network capacity ⇒ under-utilization or excessive retransmissions due to congestion
- Starvation ⇒ TCP timeout
- Packets may be admitted into the network but dropped in the interior. Better to drop packets at the edge.
- Difficult to provide throughput guarantees
- Unpredictable quality for digital video/voice

Approaches to Solutions

- TCP based approaches
  - TCP socket buffer tuning
  - SSTHRESH estimation
- Network based approaches
  - Dropping versus feedback
  - Dropping early versus dropping late
- Other solutions
  - Digital video: Channel adaptive encoding (wavelet, subband) and filtering.
  - Bandwidth sharing/partitioning policies.
  - Traffic scheduling and channel access
  - Bandwidth managers