

Computer Networks

Quality of Service Overview

(§5.4.1)



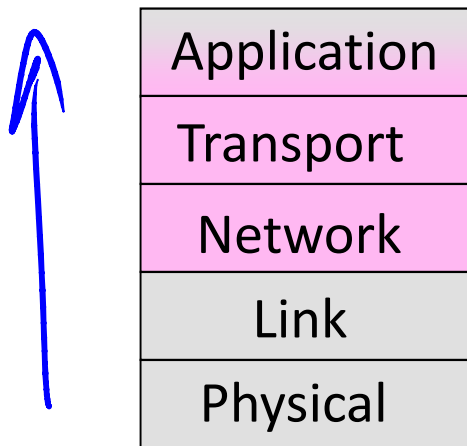
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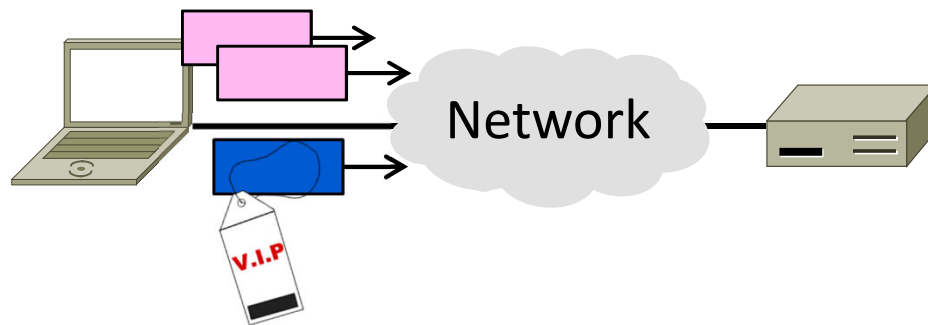
Where we are in the Course

- Revisiting the layers
 - Quality of Service (QOS) involves both the Network and its users/applications



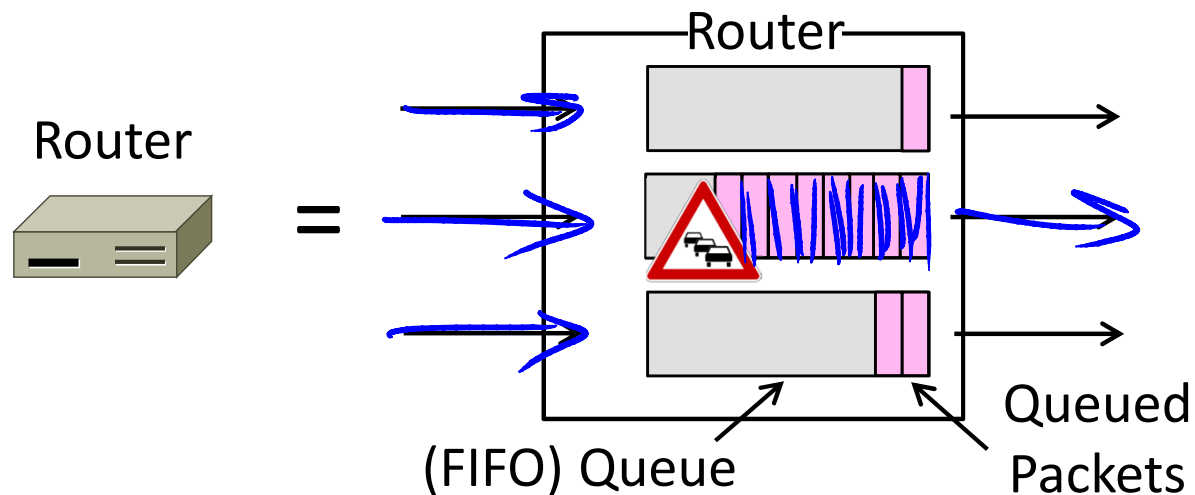
Topic

- QOS relates to the kind of service a user gets from the network
 - E.g., high/low bandwidth, delay, loss
- Important issue for future Internet



“Best Effort” Service

- What we get in the Internet today with FIFO routers
 - Apps compete for bandwidth; queues add delay and loss
 - Try to deliver but no guarantee of bandwidth, delay, loss

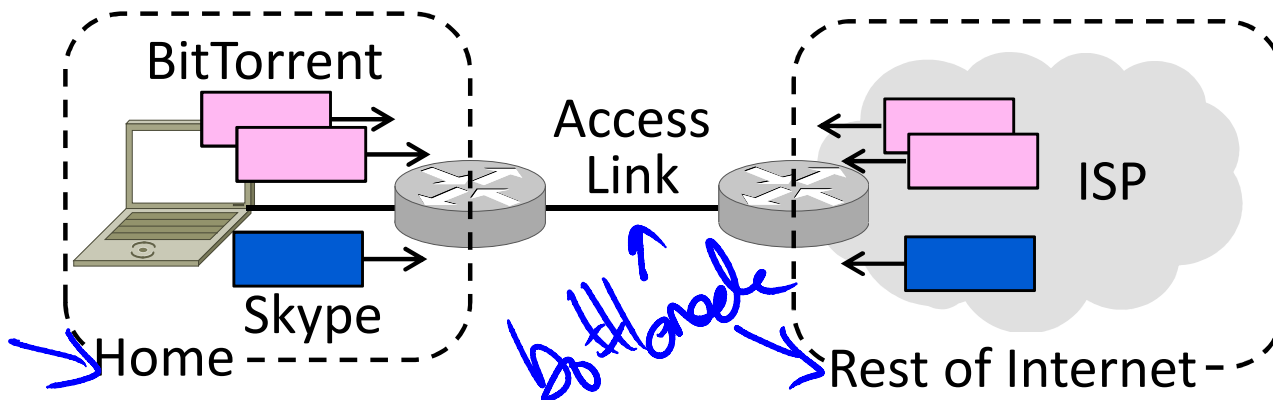


QOS Motivation

- Best effort is not always enough!
 - May want performance guarantees
- What can't be done:
 - Guarantee more bandwidth or lower delay than exists in the network
- What can be done:
 - Control how bandwidth (hence delay/loss) is allocated to different users

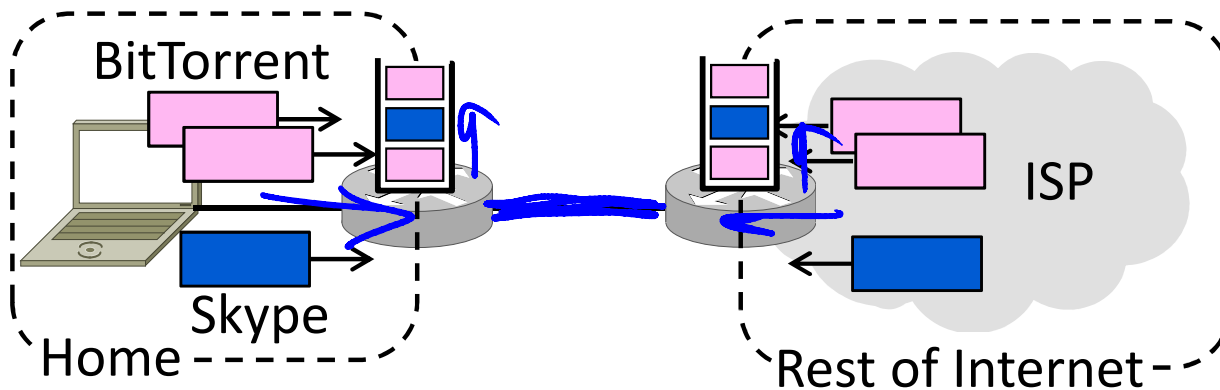
Example – Skype and BitTorrent

- Home user runs Skype (VoIP only) and BitTorrent at the same time
 - Want low latency for Skype (real-time),
 - high throughput for BitTorrent (bulk)



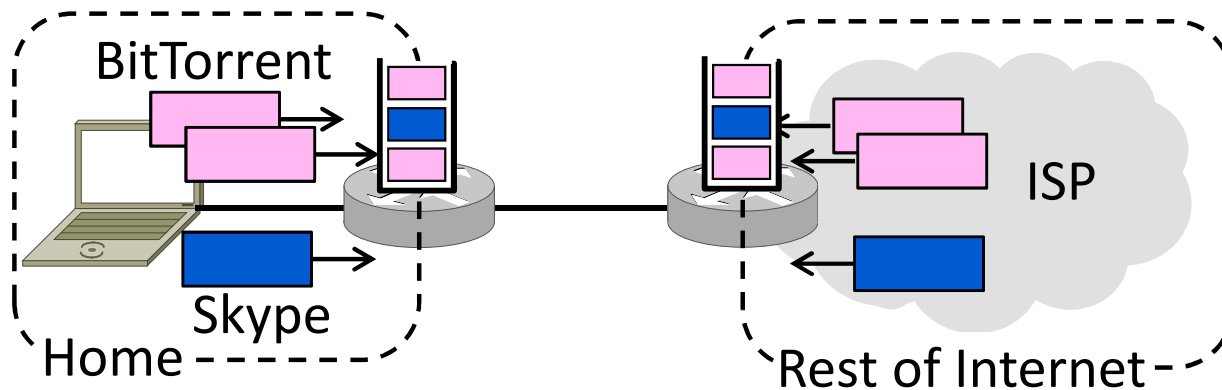
Skype and BitTorrent (2)

- What happens with FIFO routers?
 - Skype and BitTorrent compete for bandwidth on access link (bottleneck)
 - Queues build at access routers ...



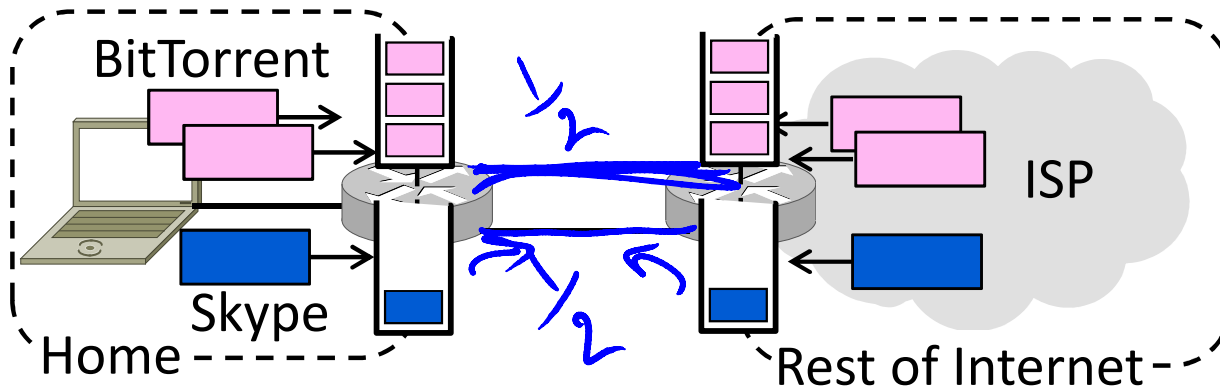
Skype and BitTorrent (3)

- What happens?
 - ➔ Skype call quality falls due to delay/loss
 - ➔ BitTorrent mostly unaffected by Skype



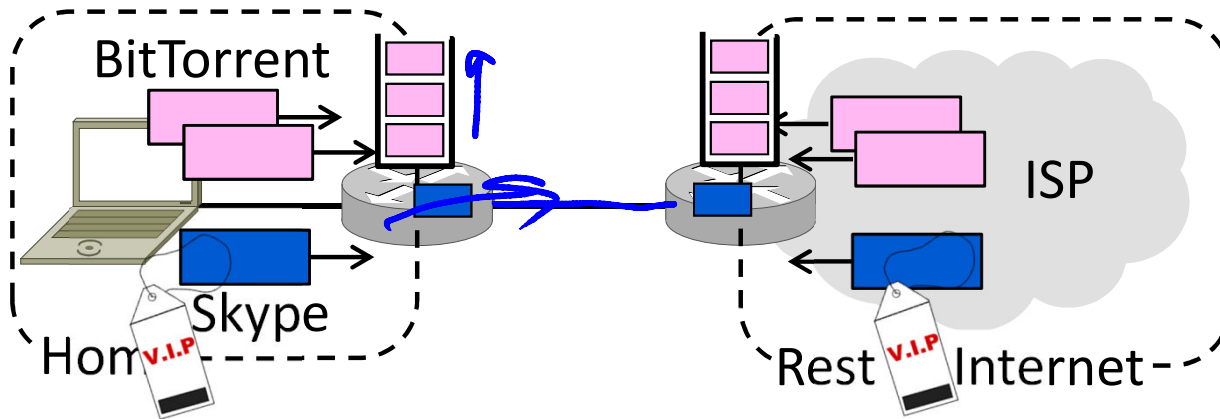
Skype and BitTorrent (4)

- What if we split the access link?
 - ➔ Now Skype call quality is good ...
 - ➔ But BitTorrent loses bandwidth!



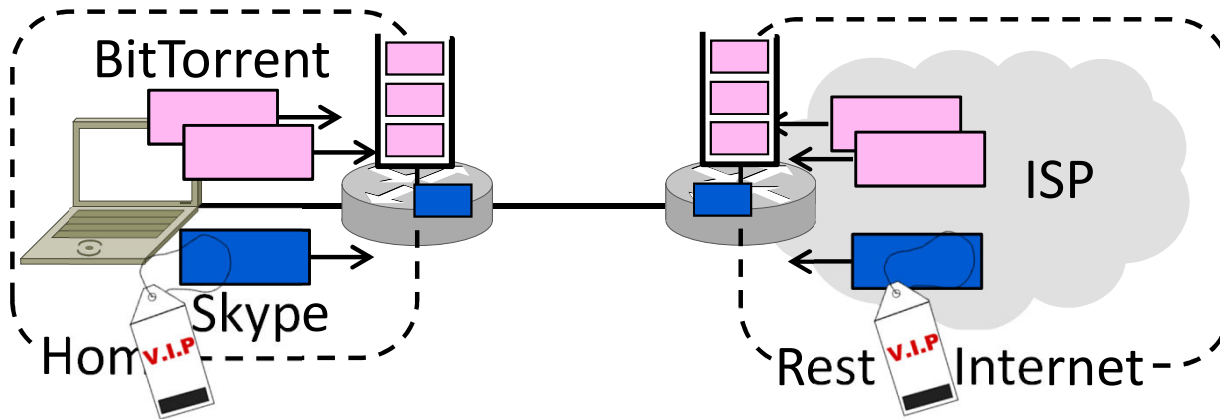
Skype and BitTorrent (5)

- A better idea to try?
 - ➔ Modify access routers to give priority to Skype packets on access link!





Skype and BitTorrent (6)

- What happens now?
 - ➔ High Skype call quality and high BitTorrent throughput – both win!



Quality of Service

-  Allocate bandwidth in a way that improves app/user performance
 - Guarantee bandwidth to an app
 - Satisfy multiple apps at once
 - Will explore ideas beyond priority
-  To provide QOS, we need to know what apps require of the network
 - Need for bandwidth, delay, loss

Application Requirements

- HIGH stringency means high bandwidth, low delay, low jitter, low loss

Application	Bandwidth	Delay	Jitter	Loss
Email	Low	Low	Low	Medium
File sharing	High	Low	Low	Medium
Web access	Medium	Medium	Low	Medium
Remote login	Low	Medium	Medium	Medium
Audio on demand	Low	Low	High	Low
Video on demand	High	Low	High	Low
Telephony	Low	High	High	Low
Videoconferencing	High	High	High	Low

Variation
in delay

Over-Provisioning

- A caveat is that QOS matters only when there is a network bottleneck
 - Otherwise no queuing or loss ...
 - ➔ And hence no opportunity to improve
- Leads to over-provisioning approach:
 - ➔ Build heaps of network capacity!
 - ➔ Simple alternative to QOS, but not cost-effective and no guarantee

Topics

- Application requirements
 - Real-time transport (VoIP)
 - Streaming media (video)
 - Fair Queuing
 - Traffic Shaping
 - Differentiated services
 - Rate/Delay guarantees
- Future Internet
-
- The diagram illustrates the progression of network topics. A vertical dashed line with arrows at both ends is positioned to the right of the list. To the right of this line, a pink curly bracket labeled 'This time' spans the first three items (Application requirements, Real-time transport (VoIP), and Streaming media (video)). Another pink curly bracket labeled 'Next time' spans the next three items (Fair Queuing, Traffic Shaping, and Differentiated services). The final item, Rate/Delay guarantees, is positioned below the 'Next time' bracket. The text 'Future Internet' is centered below the list.

END

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