

Traffic Types and Growth in Backbone Networks

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Outline

- **Overview of a US carrier inter-city backbone optical network:**

- Services running on ROADMs
- Breakdown of IP services by business

This is not an industry-wide view, rather a single US ISP data point

- **IP Services drill down:**

- Application Mix
- Growth over the last decade

- **Implications on content distribution efficiency:**

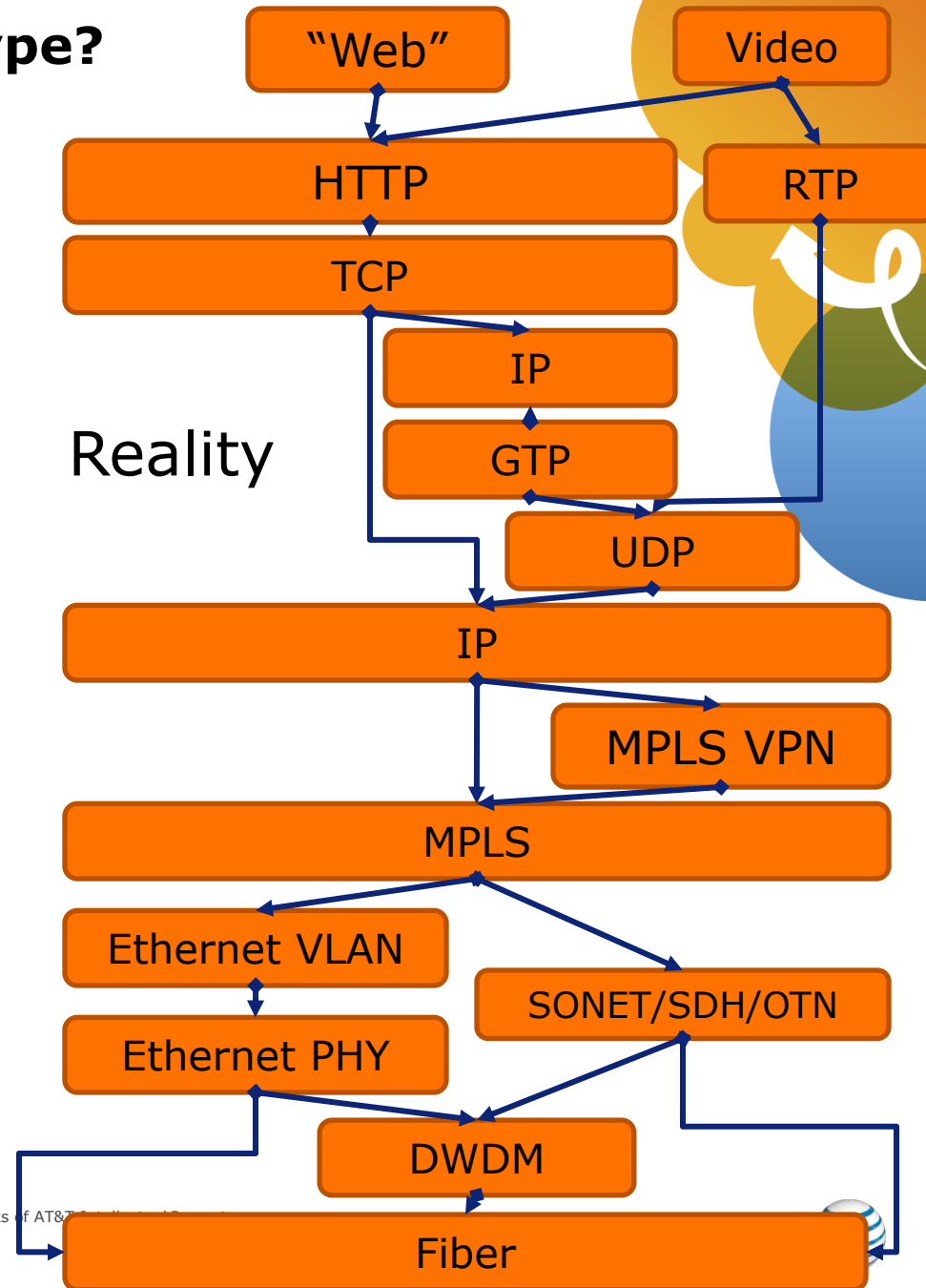
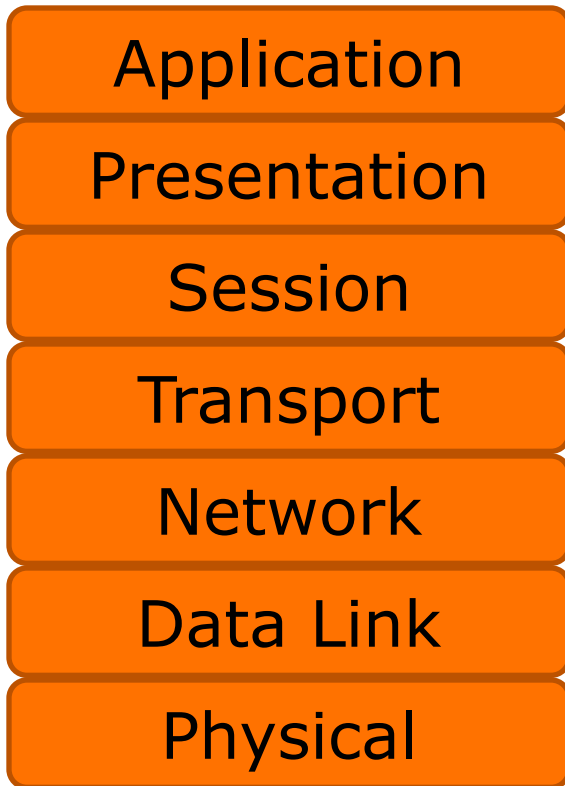
- CDNs
- Migration of TV content and Multicast



What's on the top of fibers in backbone?

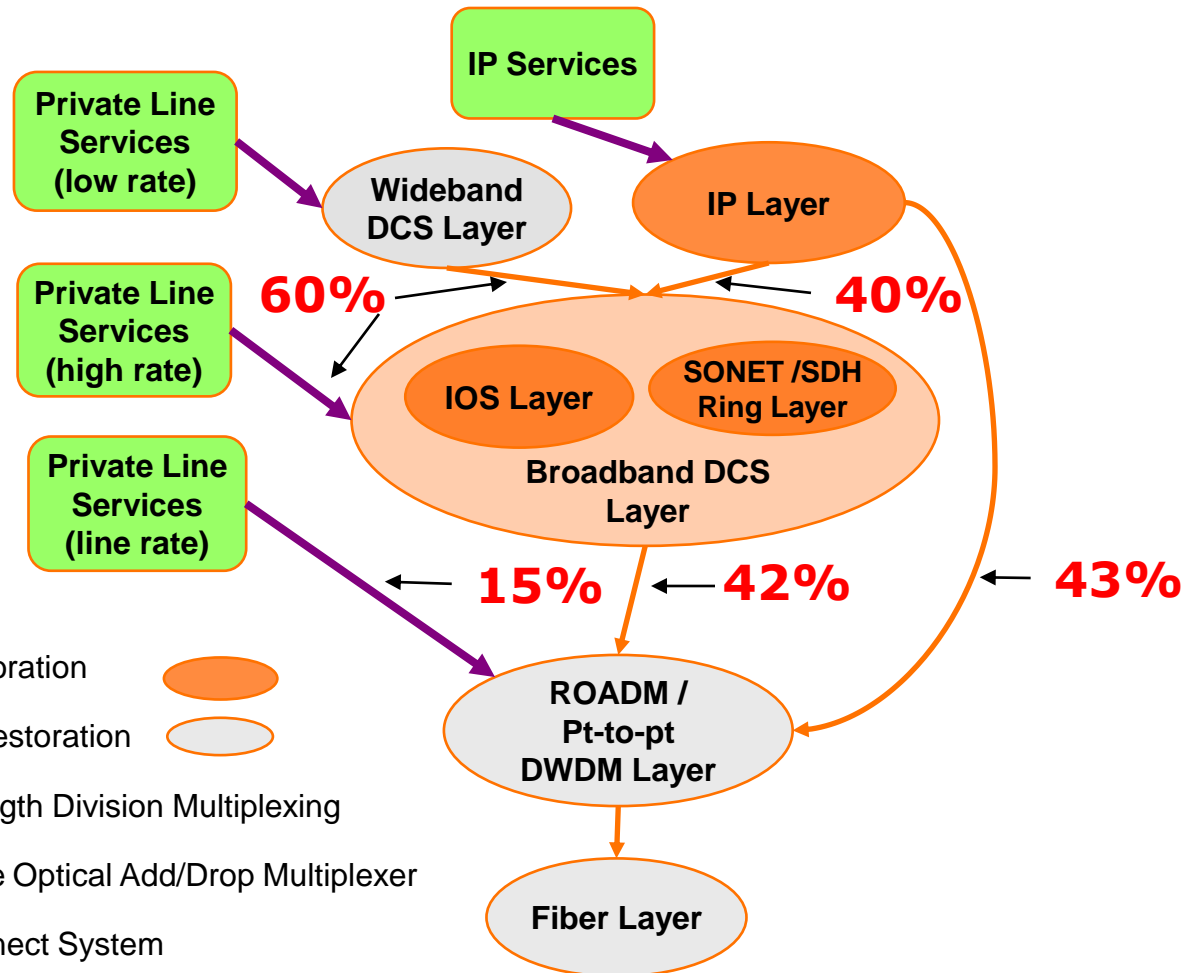
What do we mean by traffic type?

OSI 7 layer model



Private Line vs. IP Services

Simplified depiction of core-segment network layers



Layer with automatic restoration



Layer without automatic restoration



DWDM = Dense Wavelength Division Multiplexing

ROADM = Reconfigurable Optical Add/Drop Multiplexer

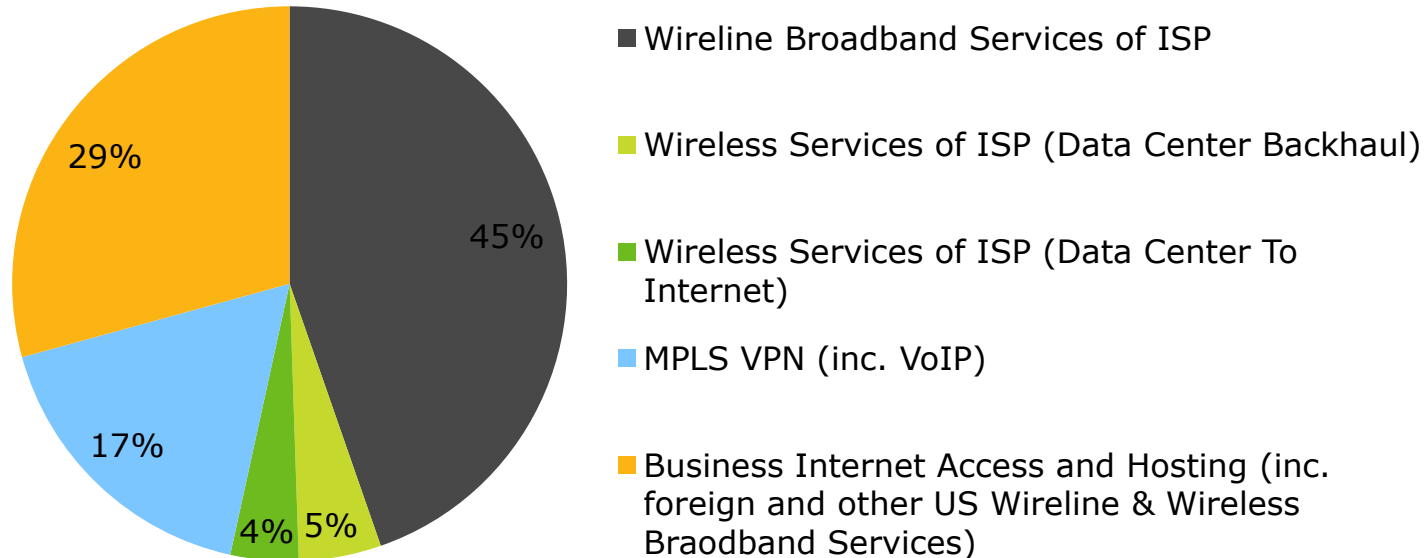
DCS = Digital Cross-Connect System

IOS = Intelligent Optical Switch

Source: US ISP, Summer2010.



What are these IP Services?



Takeaway: Wireline Broadband Services is the largest source of traffic. Business traffic accounts for a large share, too. Wireless is not significant yet.

Source: US ISP, Average traffic. Summer 2010.

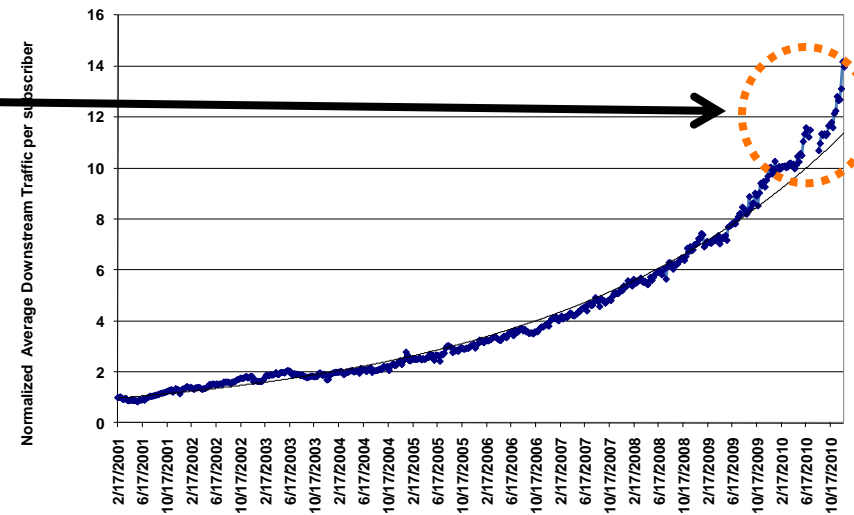


2 components of IP Services growth

A. Organic growth per Broadband subscriber

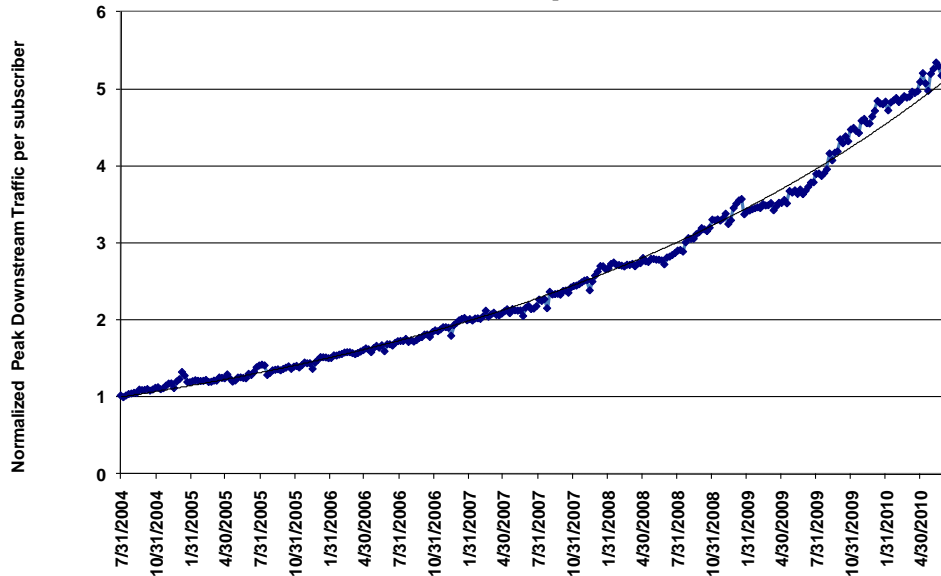
Takeaway: stable organic growth over the last couple of years (32% CAGR). Slight acceleration over the last 2 years.

Normalized Average Traffic per sub 2001-2010



Takeaway: this is a good data point to predict the long term growth rate of the Internet.

Normalized Peak Traffic per sub 2004-mid2010



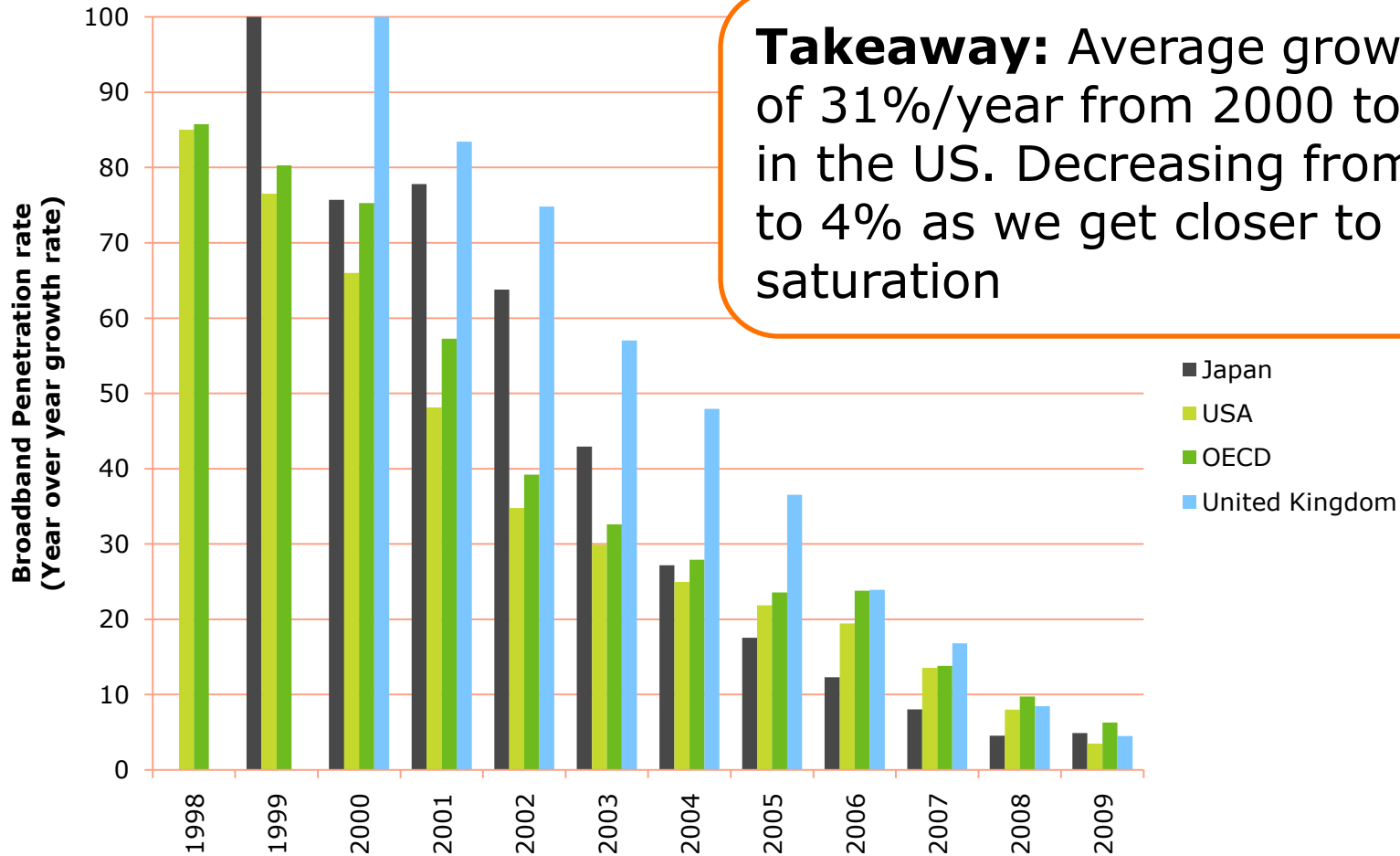
Source: US DSL Downstream traffic per subscriber.



2 components of IP Services growth

B. Growth of Broadband penetration rate

Takeaway: Average growth rate of 31%/year from 2000 to 2009 in the US. Decreasing from 48% to 4% as we get closer to market saturation



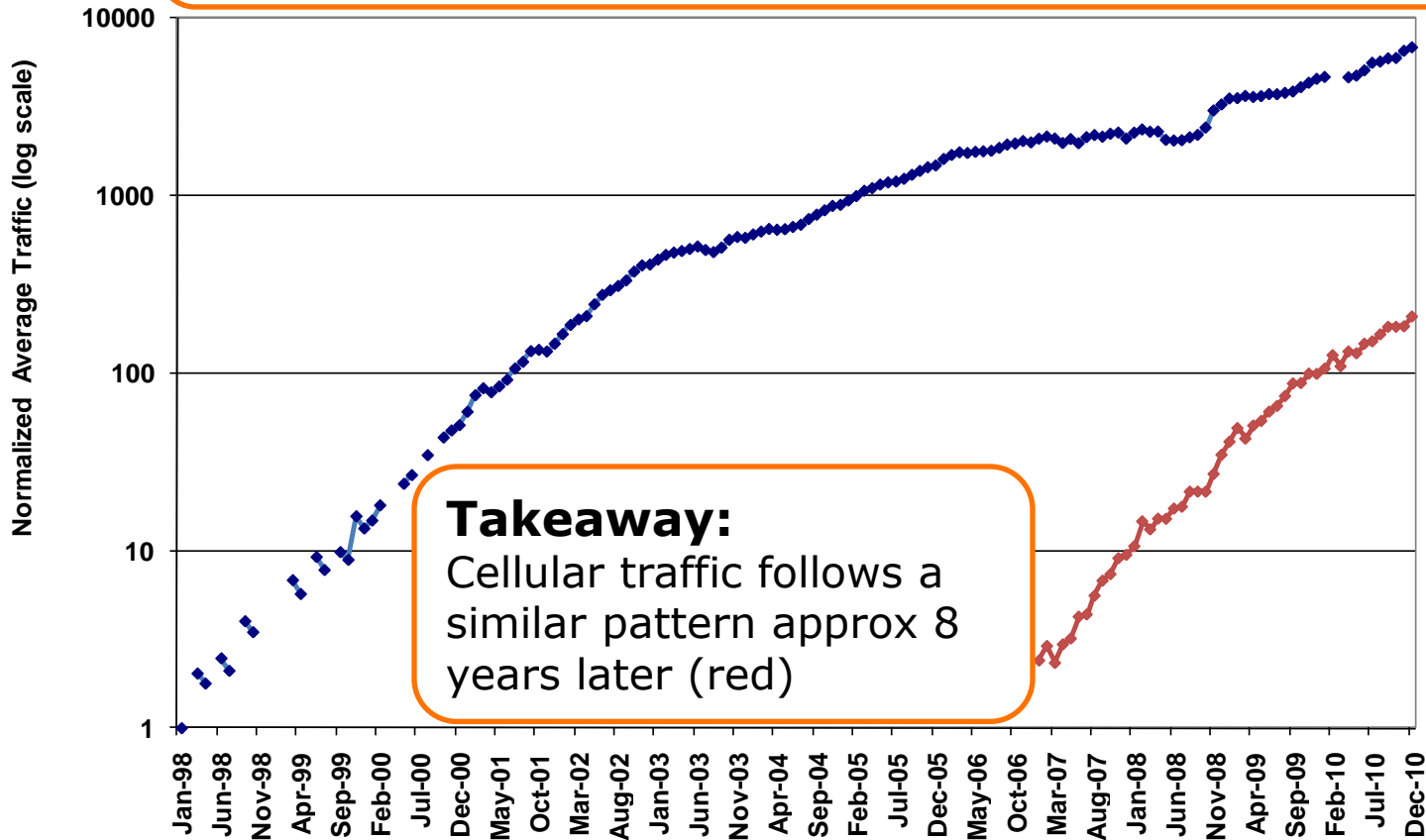
Source: OECD.



IP Services growth

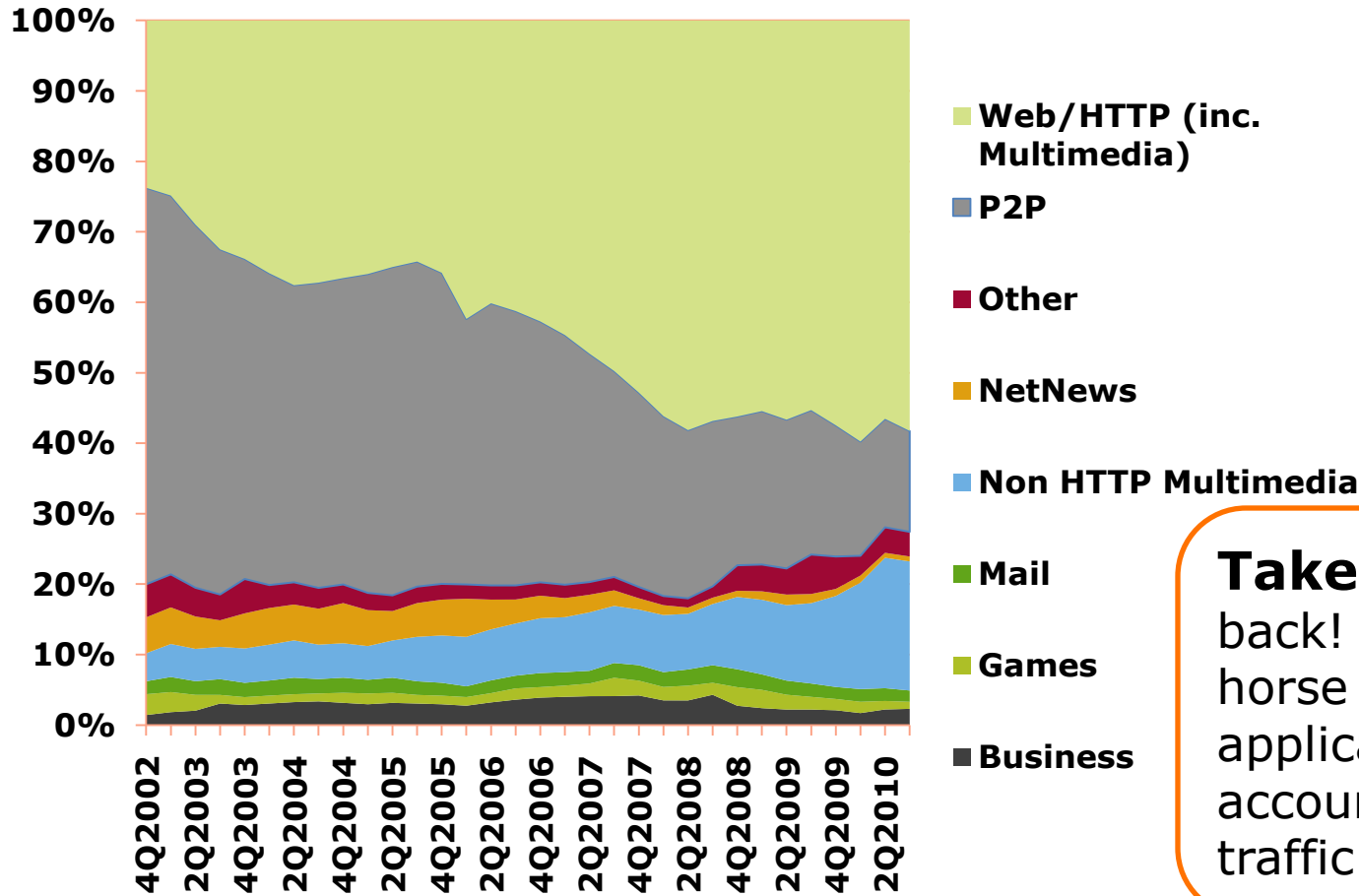
A US ISP view over the last 12 years

Takeaway: combining the 2 types of growth, we see a growth of almost 4 orders of magnitude on that backbone over the last 12 years (blue) with a clear saturation over time.



What is that traffic?

Layer 4 Protocol breakdown



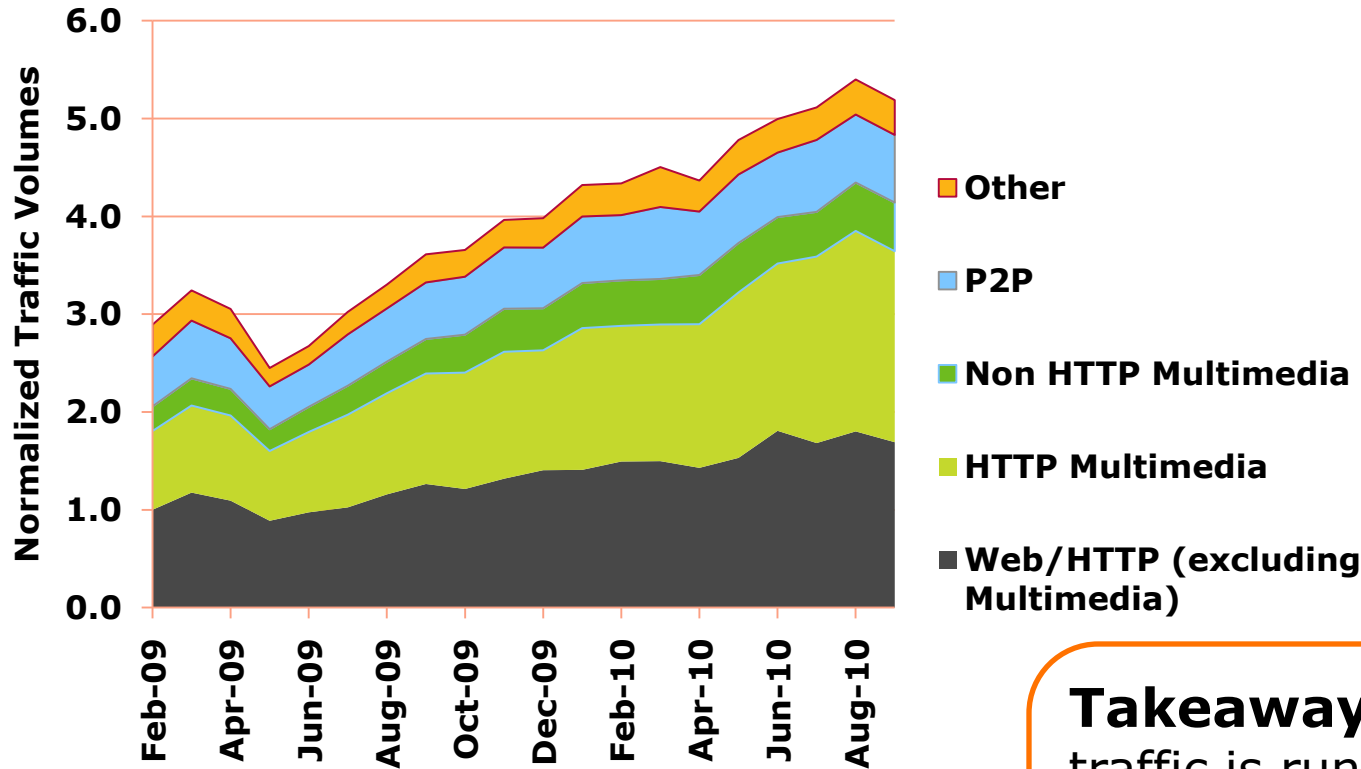
Takeaway: HTTP is back! It is now the work-horse protocol of many applications and it accounts for 60% of the traffic.

Source: US ISP Backbone. Netflow.



What is that traffic?

Layer 7 Protocol breakdown: the rise of video



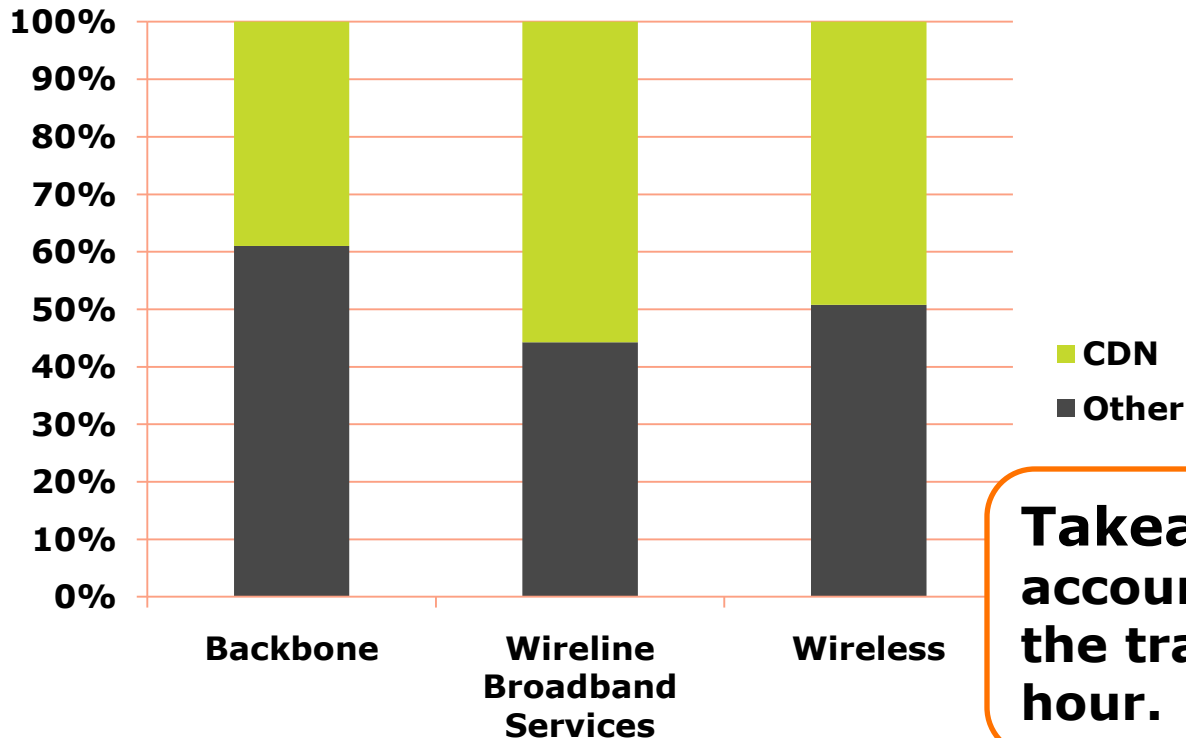
Takeaway: Video traffic is running on the top of HTTP. Lately it has been growing at an annualized growth rate of 83%. How will it evolve?

Source: US DSL Downstream Traffic per subscriber during the busy hour.



Implications of video growth

Rise of the Content Distribution Networks (CDN)



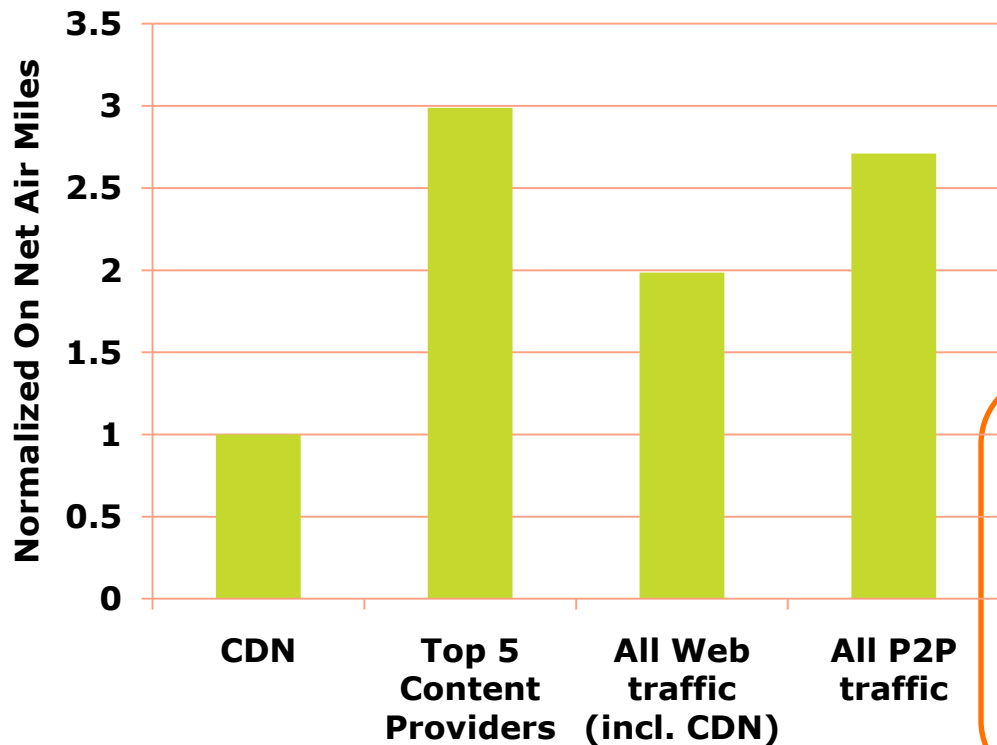
Takeaway: A few CDNs account for 39% to 55% of the traffic during the busy hour.

Source: US ISP, August 2010. CDN traffic identified in Netflow records based on IP addresses.



Are CDNs doing a good job?

Yes!

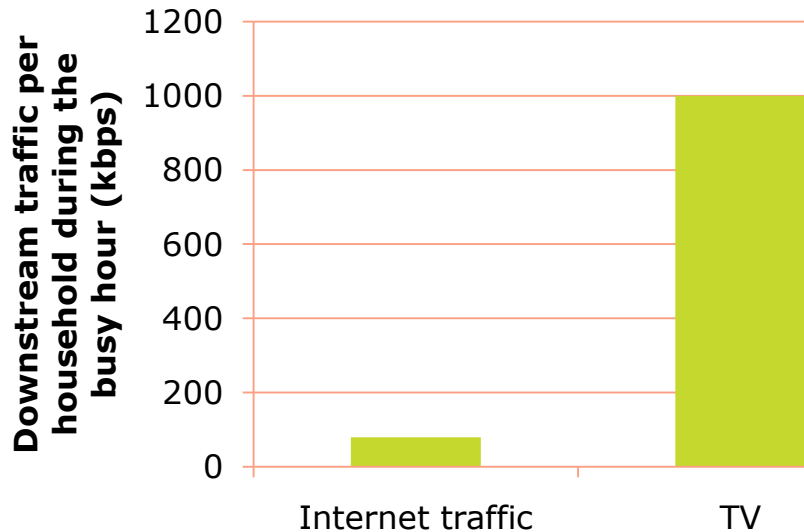


Takeaway: The distance traversed by CDN traffic on the backbone is 3 times shorter than the distance traversed by other content providers.

Source: US ISP, August 2010. OnNet traffic only (no hot potato peering traffic). Average air miles defined as the distance between the ingress access router and the egress access router weighted by the amount of traffic.



But TV traffic is delivered much more efficiently today than “Over the Top Videos”



Takeaway: Internet traffic is still much smaller than TV content consumed today. That TV content is distributed today much more efficiently via Broadcast or Multicast (IPTV).

Takeaway: The growth rate of backbone traffic will be determined by how much of that TV traffic will be migrated onto the Internet, how fast and how it will be distributed (e.g. Multicast vs. Unicast)?

Source: Internet: Cisco VNI 2010: 14.9 GB/month/sub. Peak/average ratio 1.72. Video: assumes 2Mbps video stream to 50% of the households during the peak.



Summary

- **What is running on a US carrier backbone optical network?**
 - The largest single source of traffic is video traffic for Wireline broadband subscribers over HTTP over TCP over MPLS over IP over ROADM.
 - But there are many more traffic types: Private Lines, MPLS VPN, etc.
- **How fast is the traffic growing?**
 - Combination of a stable organic growth of 32% per year with a deceleration of the growth of number of Wireline Broadband users.
 - Strong growth of video traffic recently; overall organic growth recently above average
- **What will happen to that video traffic?**
 - In the hands of a couple of CDNs that deliver traffic more efficiently than other content providers.
 - But there is much more video traffic out there. If it migrates at a fast pace from Broadcast/Multicast to Unicast streams on the Internet, it will significantly impact backbones.



Thank You!

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