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Contact during exam

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Fall exam

TTM4150 INTERNET NETWORK ARCHITECTURE

Wednesday December 5, 2007
Kl. 0900 - 1300

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No remedies.

Results will be ready before 07.01.08.

Glance over all pages before you start answering the exercises.
Take care to share your time between the exercises.
It is better to answer a little on all the exercises than to answer a lot on a few.

If you feel there is a lack of information to solve an exercise, state the assumptions you make.

Exercise 1 Internet architecture

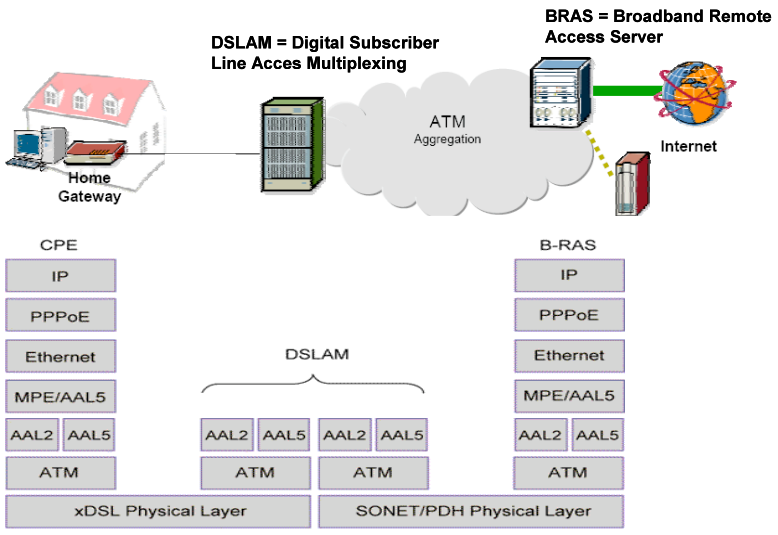
In a Norwegian newspaper article Google's" chief Internet evangelist" Vinton Cerf is quoted as follows: "*If Internet is to continue its development and stimulation of innovation, it cannot be divided into two. Internet is big, and the point is that nobody owns it. The network shall be open and neutral*".

(a) Comment on this statement, and specifically on the point of view of how internet providers want to use "next generation internetwork" mechanisms to "divide the internet into two".

In the Internet best-effort packet-switched network end-to-end congestion control is a major issue for its success. Internet as a multi-service network needs to support the transport of real-time applications.

(b) Describe how quality-of-service and end-to-end congestion control are two of a kind when it comes to supporting real-time application streams to avoid congestion collapse in the Internet. Relate your discussion to the end-to-end argument.

The figure below shows the network architecture and protocol stack for an xDSL-based access network. The public IP-address is handed out by PPPoE (Point-to-point Protocol over Ethernet).



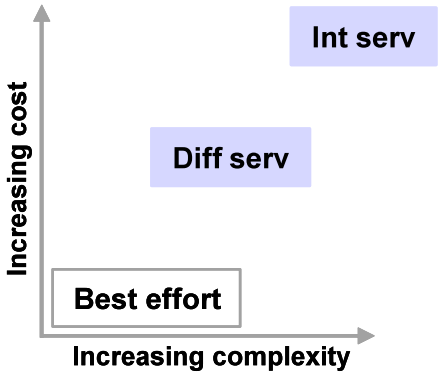
(c) Which challenges do you see to implement the TV component of 3-play (internet access, VoIP, and TV broadcast) in this architecture?

(d) Routers perform statistical multiplexing. What are tradeoffs related to the size of the buffers of a router performing statistical multiplexing?

Exercise 2 Quality of service

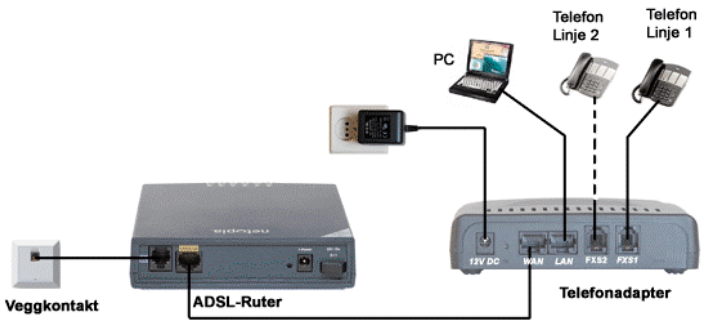
(a) What quality of service parameters can be affected by statistical multiplexing

Integrated Services (IntServ) and Differentiated Services (DiffServ) are two architectures for quality of service through bandwidth management:



(b) Compare the IntServ and DiffServ architecture. Use a table.

The figure below is a picture of a voice over IP set-up. The "Telefonadapter" (phone adapter) connects a standard analog telephone to an IP-based network.



(c) How do you think quality of services is assured the application of voice over IP in this set-up?

(d) There is another set-up that also could provide quality of service to the voice application. Sketch this set-up, and comment on advantages/disadvantages of the two set-ups as seen from a voice service provider.

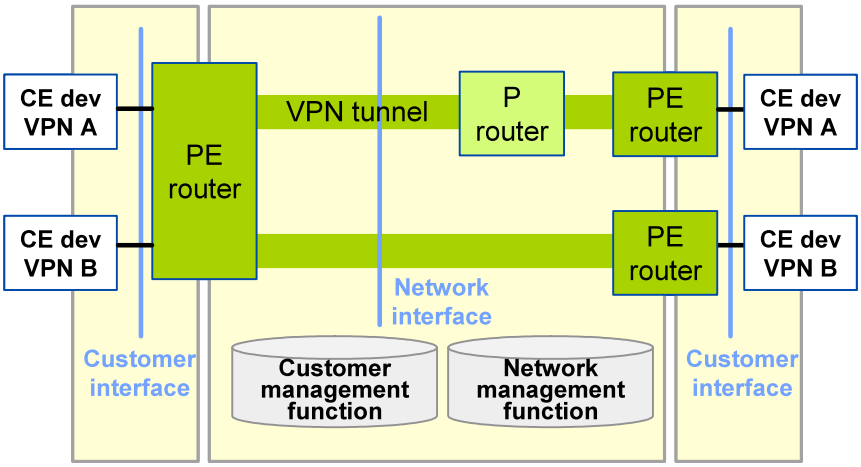
Exercise 3 Virtual private networks

An IPVPN is an emulation of a private wide area network facility using IP technology.

(a) Give some details to the VPN requirements: opaque packet transport, tunneling mechanism, quality of service, and data security.

(b) What is a provider-provisioned VPN compared to a customer-provisioned VPN? Give an example on each of these VPN types.

(c) Briefly describe three functional components of a provider-provisioned provider-edge layer 3 VPN of which the reference model is pictured in the figure below.



Exercise 4 Multicast

(a) Why is UDP the preferred transport protocol for multicast?

(b) Why is there a need for an inter-domain protocol when PIM-SM is deployed? What is the weakness of this protocol (MSDP)?

(c) Describe what is meant by scoping, and how it is done for multicast in IPv4 and IPv6.

(d) Explain the difference between shared and source-specific trees.
Describe why core/RP is a part of most of the shared tree multicast protocols.

Exercise 5 Ad-hoc networks

(a) What is the potential performance bottleneck in AODV (Ad-Hoc Distance Vector)?

(b) In geographic unicast routing there are two components. Besides the forwarding component what is the other major component?
Describe a few of the different design choices for this component.

(c) If a regular link state routing protocol were used in an ad-hoc network, why wouldn't the solution scale?

Exercise 6 Mobility

(a) Describe two methods SIP (Session Initiation Protocol) can use to handle session mobility.

(b) Address translation is an important function in mobility systems at the IP level. Are there any limitations on the placement of this function in a network? Describe two examples with different placements.

(c) Describe the flaw in the IP addressing model that makes mobility a problem. Why will HIP (Host Identity Protocol) be usable for handling mobility?

(d) What are the two major security problems that mobility handling protocols must concern themselves with? Explain why.