MONASH University
Information Technology

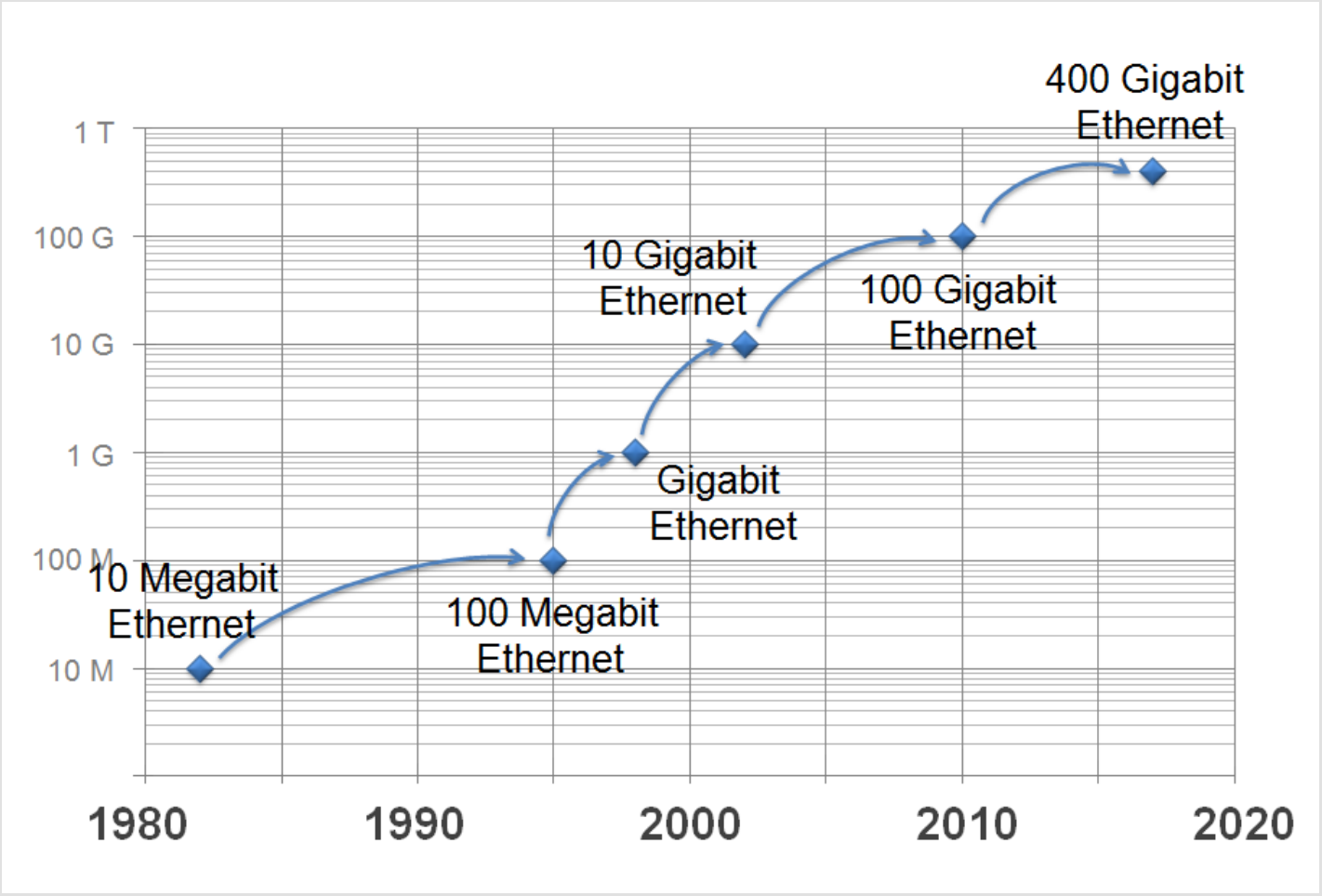
FIT3165 Computer Networks

Part-1 :100 Gigabit Ethernet Future Requirements & Implementation

Part-2 : Final Exam Discussion

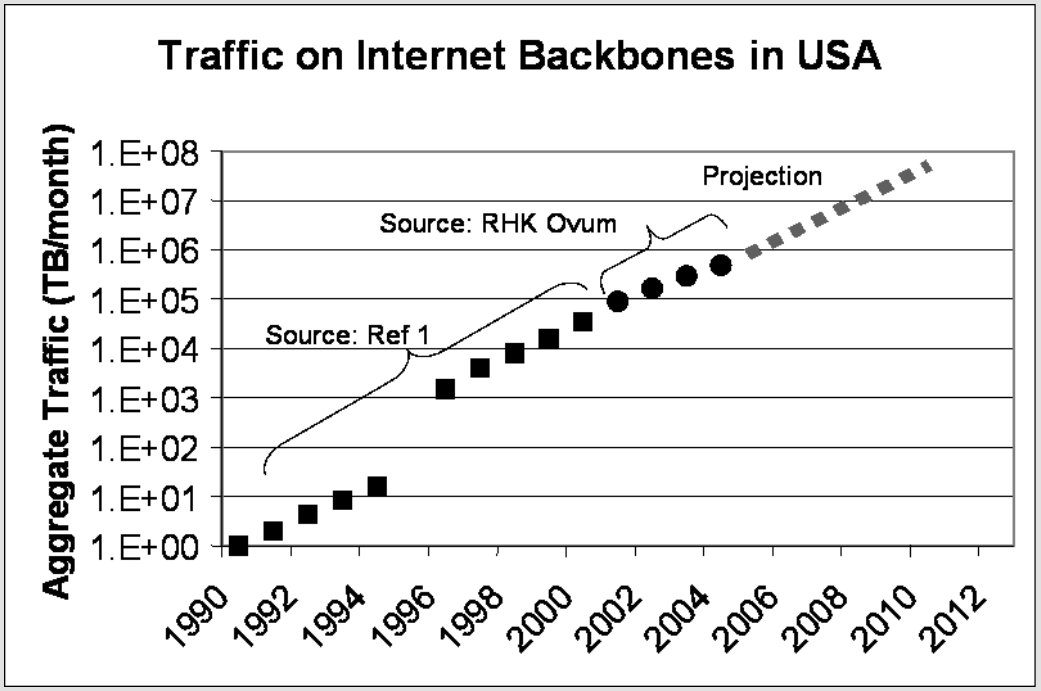
Ref slides: Finisar & Infinera

High speed Ethernet trend



Internet Backbone Growth

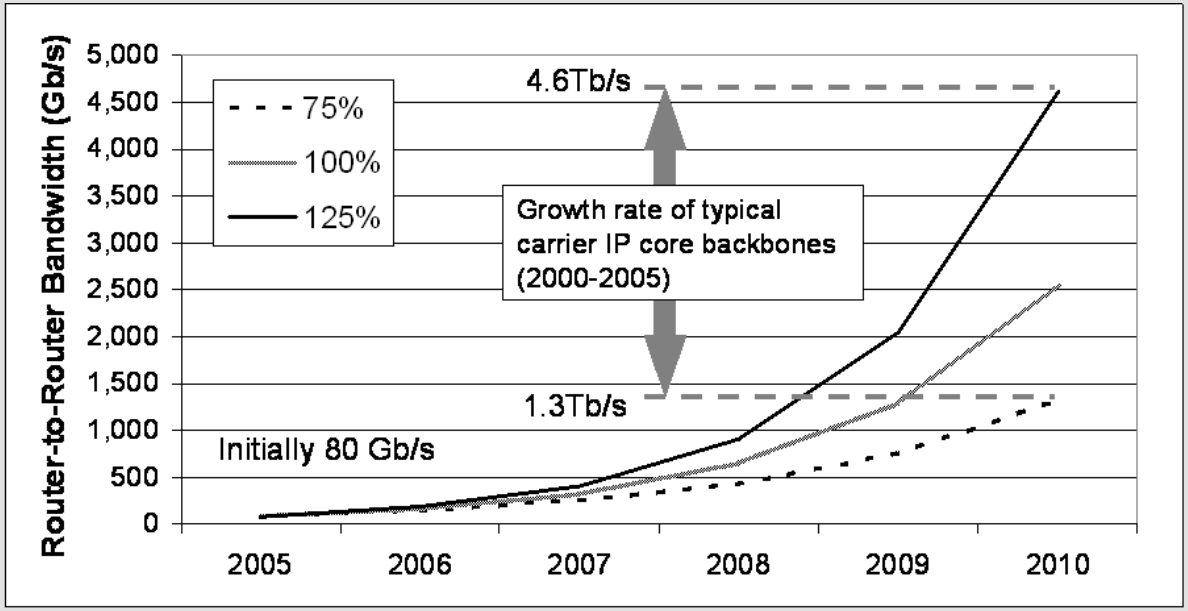
- **Industry consensus indicates future growth rate of 75% each year in aggregate traffic demand**
- **Traffic increased in ranges of 10,000x from 2000 2010**
- **Traffic projected to increase an additional 1,000x from 2015 to 2025**



Ref: K. G. Coffman and A. M. Odlyzko, 'Growth of the Internet', I. P. Kaminow and T. Li, eds. Academic Press, 2002, pp. 17-56.

LAN Future moving towards Tb/s access

- Backend Carriers deployed Nx10 Gb/s networks several years ago
- Now evaluating deployment of (Nx) 40/100 Gb/s router networks
- Current Backbone growth rates, if sustained, will require IP link capacity to scale to > 1 Tb/s by 2020



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Next Gen Higher Speed Ethernet

- **Protocol Extensible for Speed**
  - Ethernet tradition has been 10x scaling
  - But at current growth rates, 100 Gb/s will be insufficient by 2020 and beyond
  - Desirable to standardize method of extending available speed **without re-engineering the protocol stack**
- **Incremental Growth**
  - Most organizations upgrade or install new technologies with a 4-5 year lifetime
  - Pre-deployment based on the speed requirement for current and 5 years in advance planning

Next Gen Higher Speed Ethernet (2)

- **Hitless Growth**
  - Systematic “take down” of core network router & links for a substantial period of time without customer service degradations
  - SLAs may be compromised or require complicated temporary workarounds if substantial down time is required for upgrade.
  - Faultless upgrade of the link capacity should therefore be hitless, or at least only transitorily impacting network services.
- **Resiliency and Graceful Degradation**
  - Setup and transition should provide rapid recovery from failure of an individual channel or component
  - Fault tolerance and performance needs to be taken care off.

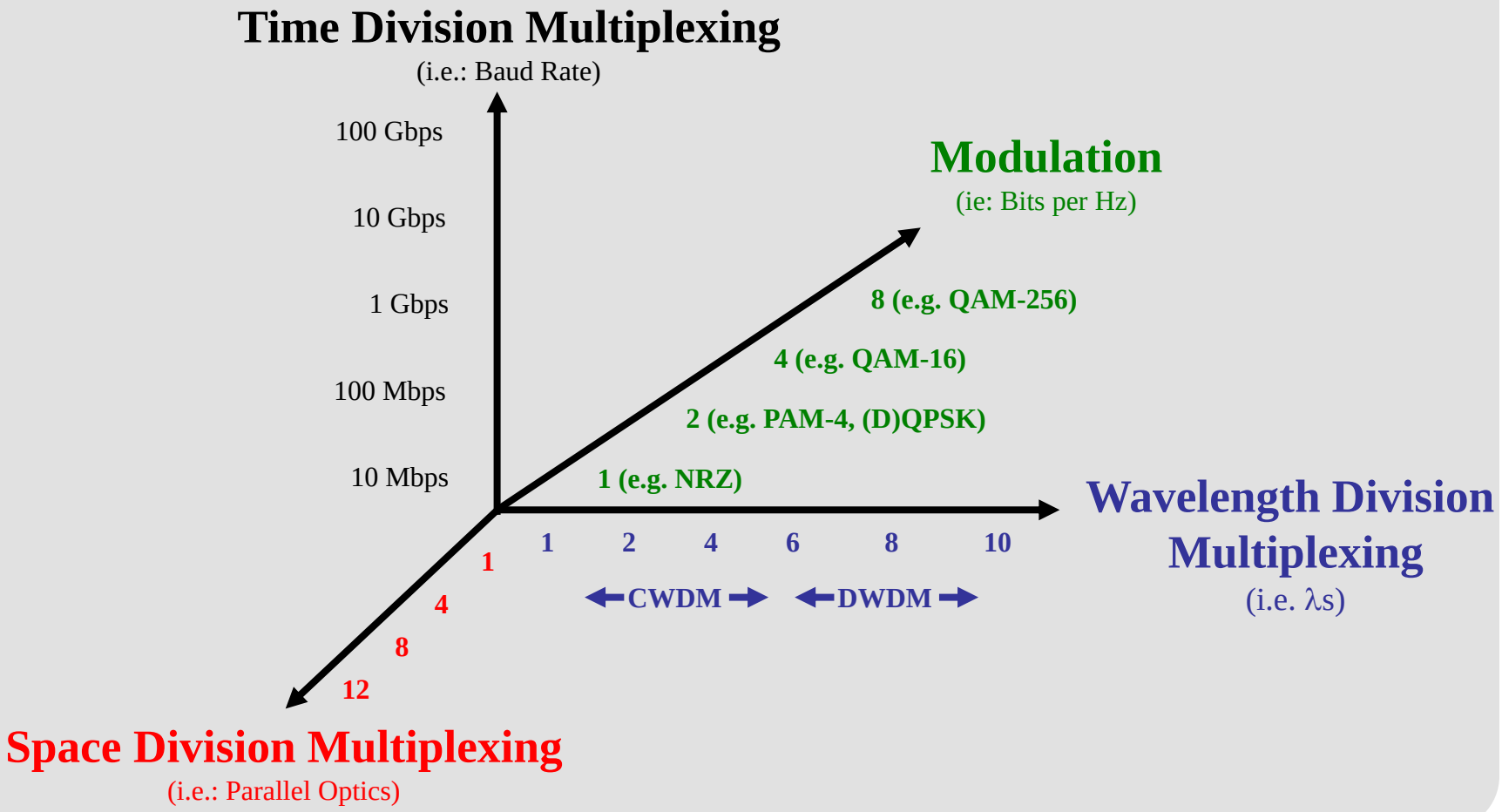
Next Gen Higher Speed Ethernet (3)

- **IEEE 802.3ba standard**
  - for 40/100-Gbit Ethernet provided a framework for data rates of 40 Gigabits per second and beyond
- **Technology Reuse**
  - Highly desirable to leverage existing 10G PHYs, including 10GBASE-R, W, X, S, L, E, Z and LRM in order to foster ubiquity and avoid duplication of standards efforts
  - Highly desirable to leverage existing 40G PHYs, including 40GBASE-R, W, X, S, L, E, Z and LRM in order to foster ubiquity and avoid duplication of standards efforts
- **Deterministic Performance**
  - Latency/Delay Variation should be low for support of real-time packet based services, e.g.
    - > Streaming video
    - > VOIP
    - > Gaming

Next Gen Higher Speed Ethernet (4)

- **WAN Manageability**
  - 40 or 100 GbE will be transported over wide area networks
  - It should include features for low Operational Expenses and should be:
    > Economical
    > Reliable
    > Operationally Manageable (e.g. simple fault isolation)
- **WAN Transportability**
  - Operation over WAN fiber optic networks
  - Transport across regional, national and inter-continental networks
  - The protocol should be resilient to intra-channel/intra-wavelength propagation delay differences (skew)

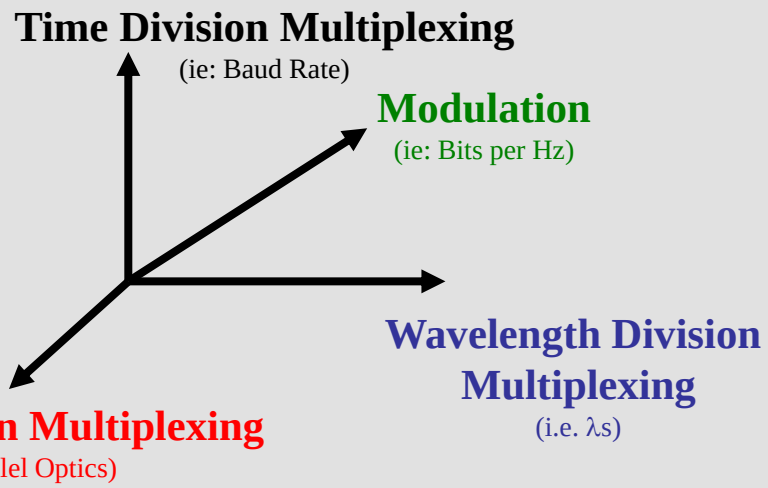
Access technologies achieving 100 Gb/s Transport backend



Which Ethernet Application?

- **Ethernet is used today for many applications over different distances**
  - **Distances > 100m primarily use optical technologies**
- **Performance for each application may be best advanced using a different approach**

Telecom Application Class	Translation	Reach (km)
Very Short Reach (VSR)	Intra-Room	0.1-0.3
Short Reach 1 (SR-1)	Intra-Campus	2
Short Reach 2 (SR-2)	Metro Access	10-15
Intermediate Reach (IR)	Metro Core	40
Long Reach (LR)	Regional	100
Very Long Reach (VLR)	Long-haul	N x 100



Software-Defined Virtual Networking

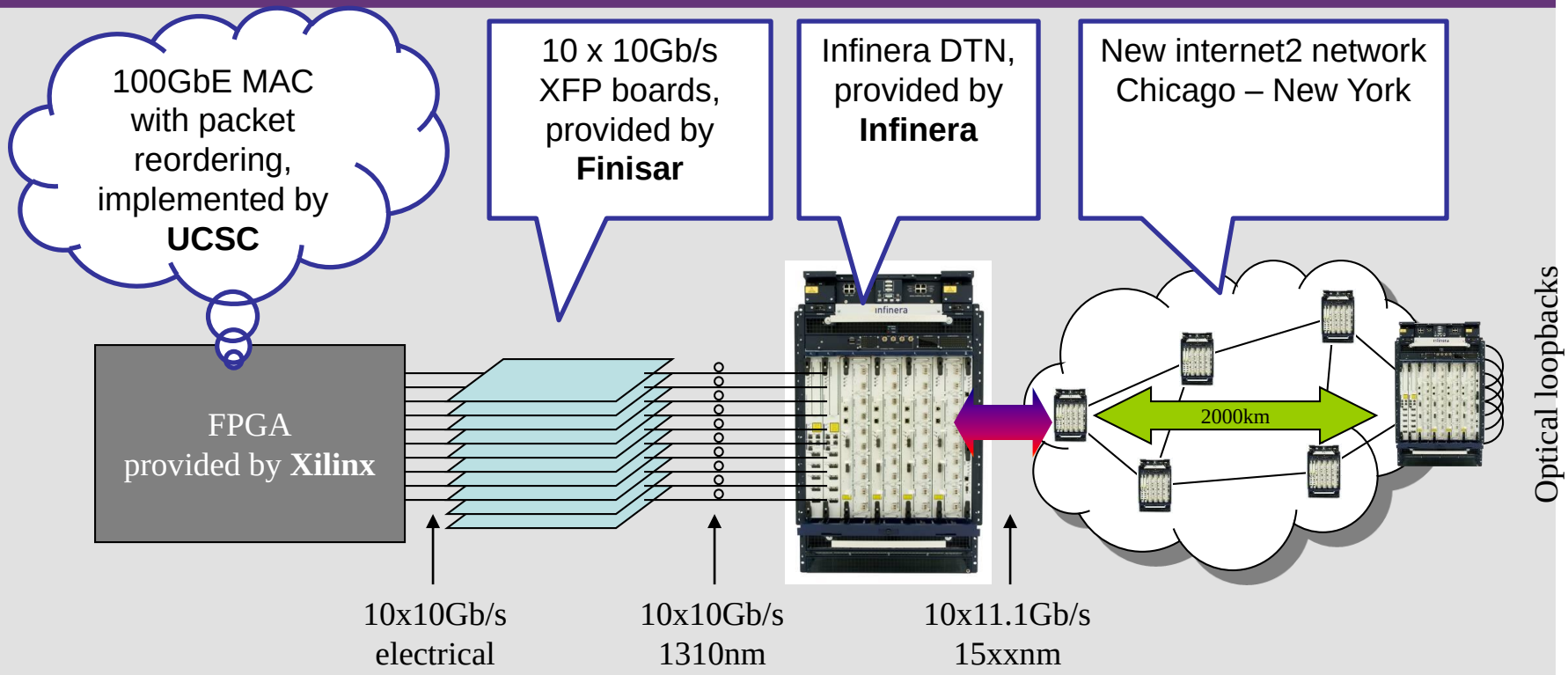
- **Future virtualized and software defined network**
  - changes how services are provisioned and allows for a more flexible response to fluctuations in demand making a more efficient use of the infrastructure.
  - **Networks Functions Virtualization (NFV)** and
  - **Software Defined Networking (SDN)** are the disruptive technologies that enable this model

Software-Defined Virtual Networking

Networks Functions Virtualization (NFV) and **Software Defined Networking (SDN)** are the disruptive technologies coupled together to maximize benefits for Future networks.

- **Network Function Virtualization techniques**
  - hypervisor implements the virtualization layer that abstracts the application from the infrastructure which is viewed as a pool of compute, network and storage resources
- **Software Defined Networking (SDN)**
  - SDN separates the control and data plane, centralizing the network intelligence in a controller that manages white box switches implementing the forwarding function.
  - Network administrators are no longer required to program thousands of devices and can remotely deploy network-wide policies down to the user level within an open software framework that leaves manufacturers' dependency behind.

Live 100 GbE Demo - Chicago to New York



* Ref: Test bed 100 GbE setup by **Finisar & Infinera**
100 GbE first demonstrated Nov 13 at SC06 between Tampa and Houston

Summary

- **100 GbE Requirements**
  - Protocol extensible for speed
  - Hitless, incremental growth
  - WAN transportability
  - Technology reuse
  - Deterministic performance
- **Software-Defined Virtual Networking**
  - Networks Functions Virtualization (NFV) and
  - Software Defined Networking (SDN)
- **Technology proven over real networks**

Final Exam Discussion