

CSE332

Computer Networks

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Encounters

☐ CN – ECE

- Monday 04:00-05:00 PM
- Wednesday 03:00-04:00 PM
- Friday 02:00-03:00 PM

Encounters

- ❑ I can be reached via email at:
 - kshitizv@lnmiit.ac.in
- ❑ A classroom has been created. Those who like to receive spam, please join ;-)
- ❑ Still not happy??
 - Drop in my office at any time after 3:00 PM
 - Room number 1062

References

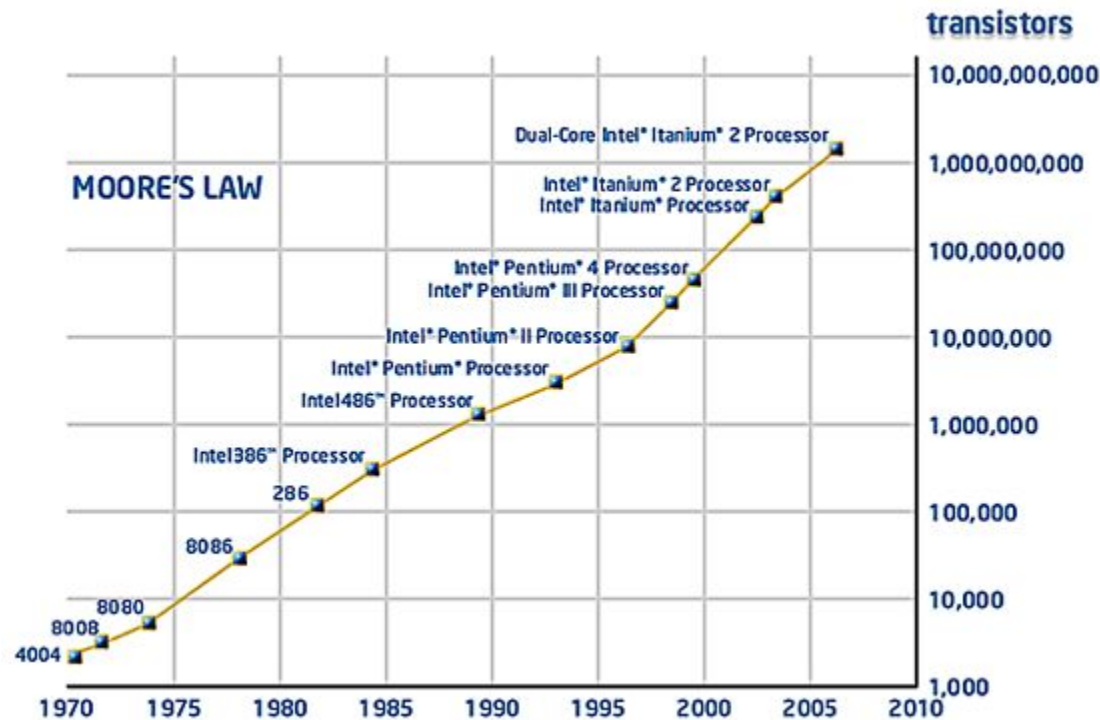
- ❑ Primary: (We will religiously follow this book)
 - Computer Networks: A systems approach
 - Peterson & Davie
- ❑ Secondary
 - Computer Networks
 - Andrew S. Tanenbaum
- ❑ Wikipedia: Not a reference, but very helpful
- ❑ Research papers (optional)

Computers are precious!! Really?

- ❑ “I think there is a world market for maybe five computers” – Thomas J. Watson (1943)
 - See T. J. Watson’s Wikipedia page.
- ❑ Computer technology has been incremental in nature.
 - It was not foreseen that computing devices will be ubiquitous.
 - Things got added as they came along.

Increasing CPU power

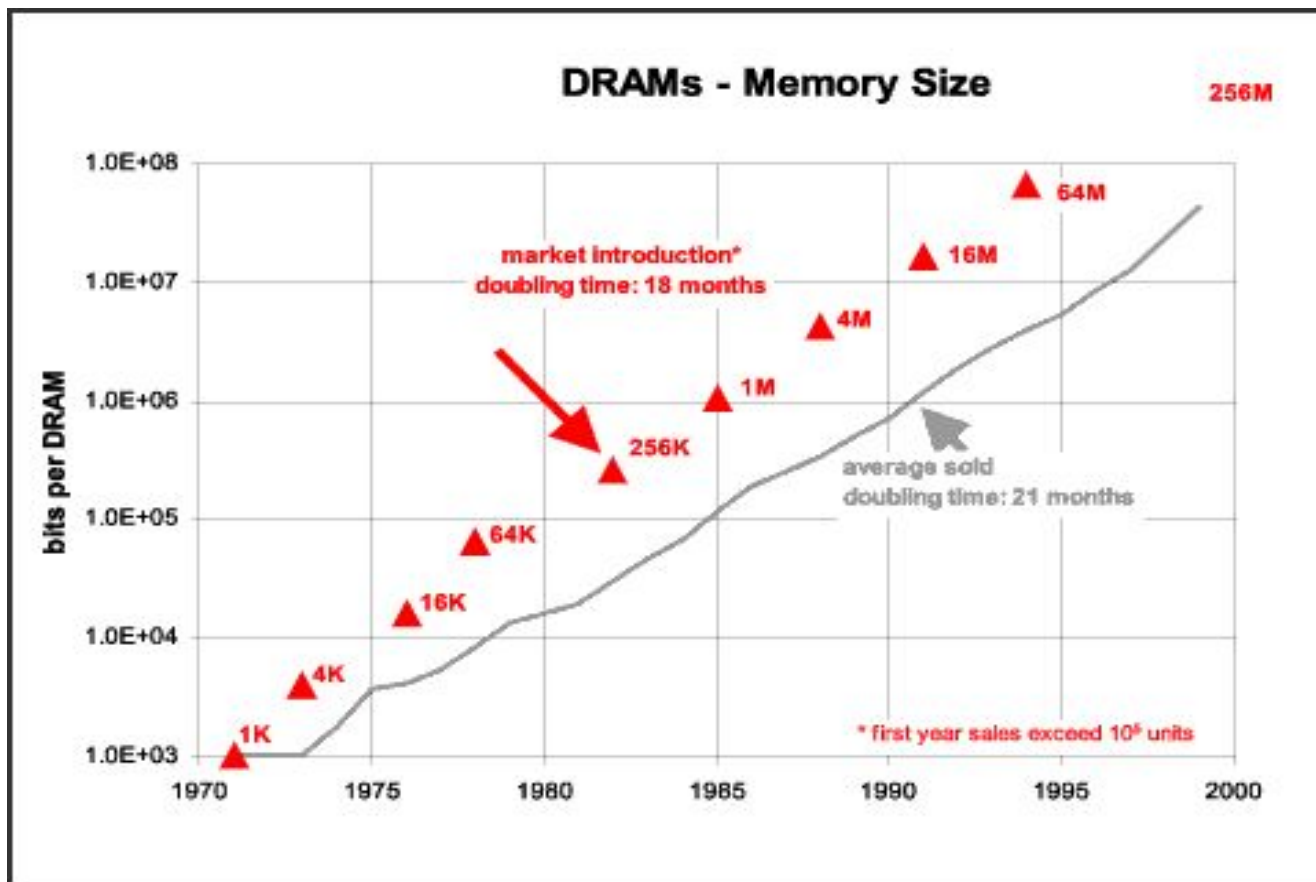
- ❑ The growth has been exponential, not easy.
- ❑ A bit digression from CN:
What triggered dual core processors?



Source: <http://njtechreviews.com/wp-content/uploads/2011/09/varian-moores-law-graph.gif>

Memory technology

- ❑ Not comparable to CPU power but the growth has been tremendous

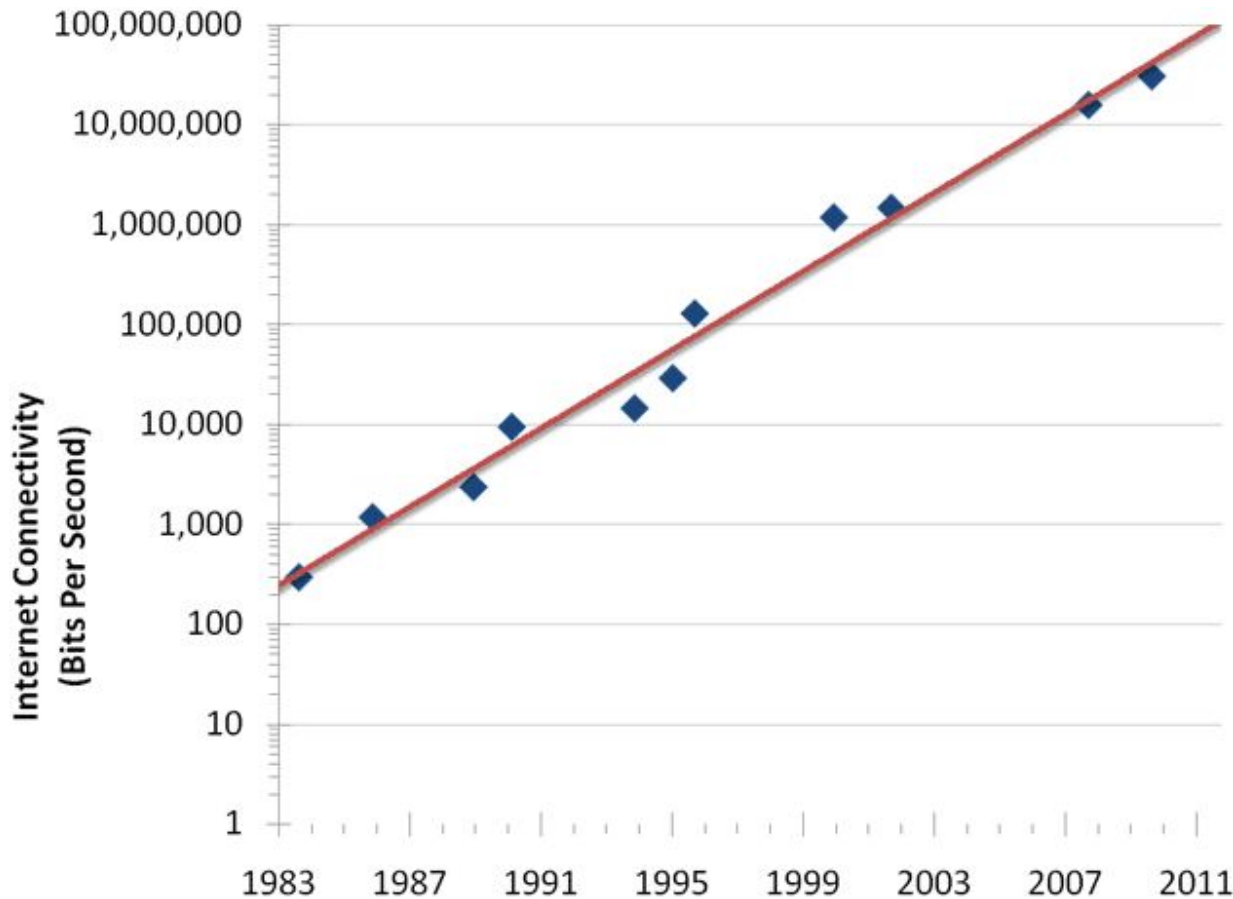


Unit of data

- ❑ Like in all streams of computer science or engineering, unit of data is a bit
- ❑ Transmission of data is measured in bits per second
 - 1 bit/second (abbreviated as 1 bps)
 - 56 Kbps
 - 50 Mbps
- ❑ We focus only on digital communication

Increasing networking power

□ Exponential increase in network bandwidth



Source: <http://www.useit.com/alertbox/trend-internet-connectivity-bandwidth.gif>

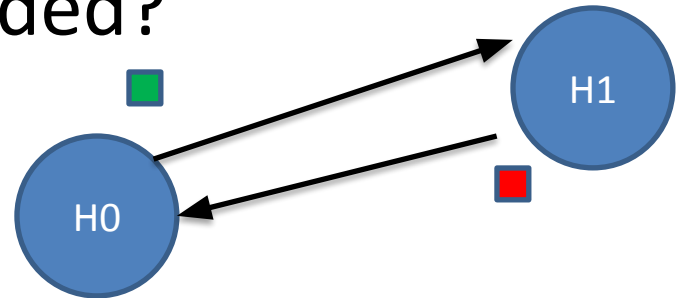
Putting all together

- ❑ Advancing technology has led to ever increasing demand from users and vice versa
 - Interestingly, there has been exponential advancement in all three important sectors!
- ❑ Better processing, storage and bandwidth leads to high user expectations, triggering economics behind it.
- ❑ Lacking behind in any of the above means low user satisfaction!!!

A basic network

- ❑ One machine wants to talk to the other
- ❑ What infrastructure is needed?

- A physical connection
- Both hosts should support network operations
- Programs that make this connectivity happen over the physical connection
- Two hosts should “understand” each other!
 - Worry about scaling!

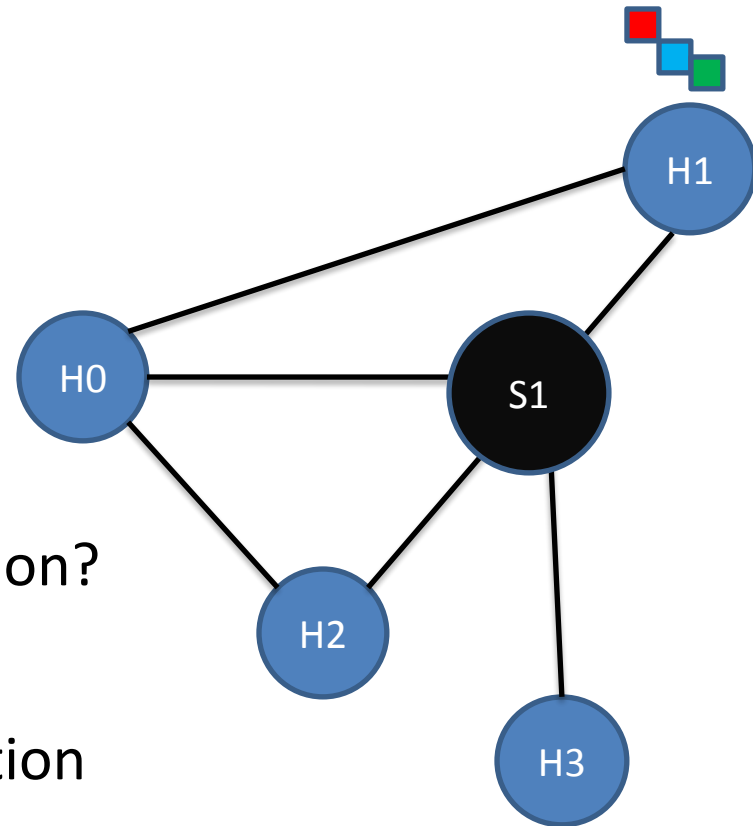


Protocols

- ❑ Machines “understand” each other through protocols.
- ❑ According to Wikipedia, a communications protocol is a system of digital message formats and rules for exchanging those messages in or between computing systems and in telecommunications.
- ❑ One of the complex machinery that makes all communication possible.

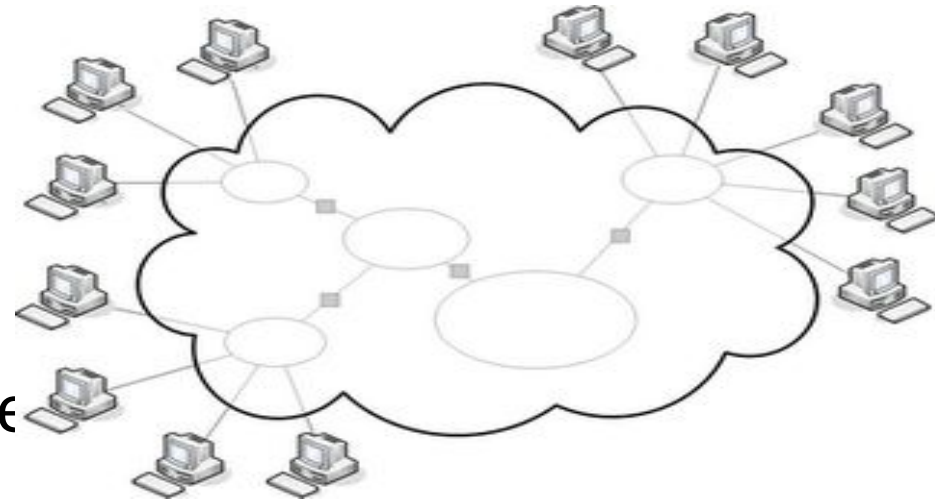
A more complex network

- ❑ Multiple machines want to connect and exchange data
- ❑ Identify problems:
 - Addressing
 - Who is who..
 - Switching
 - Who sends in the right direction?
 - Routing
 - Paths from source to destination
 - Many more...



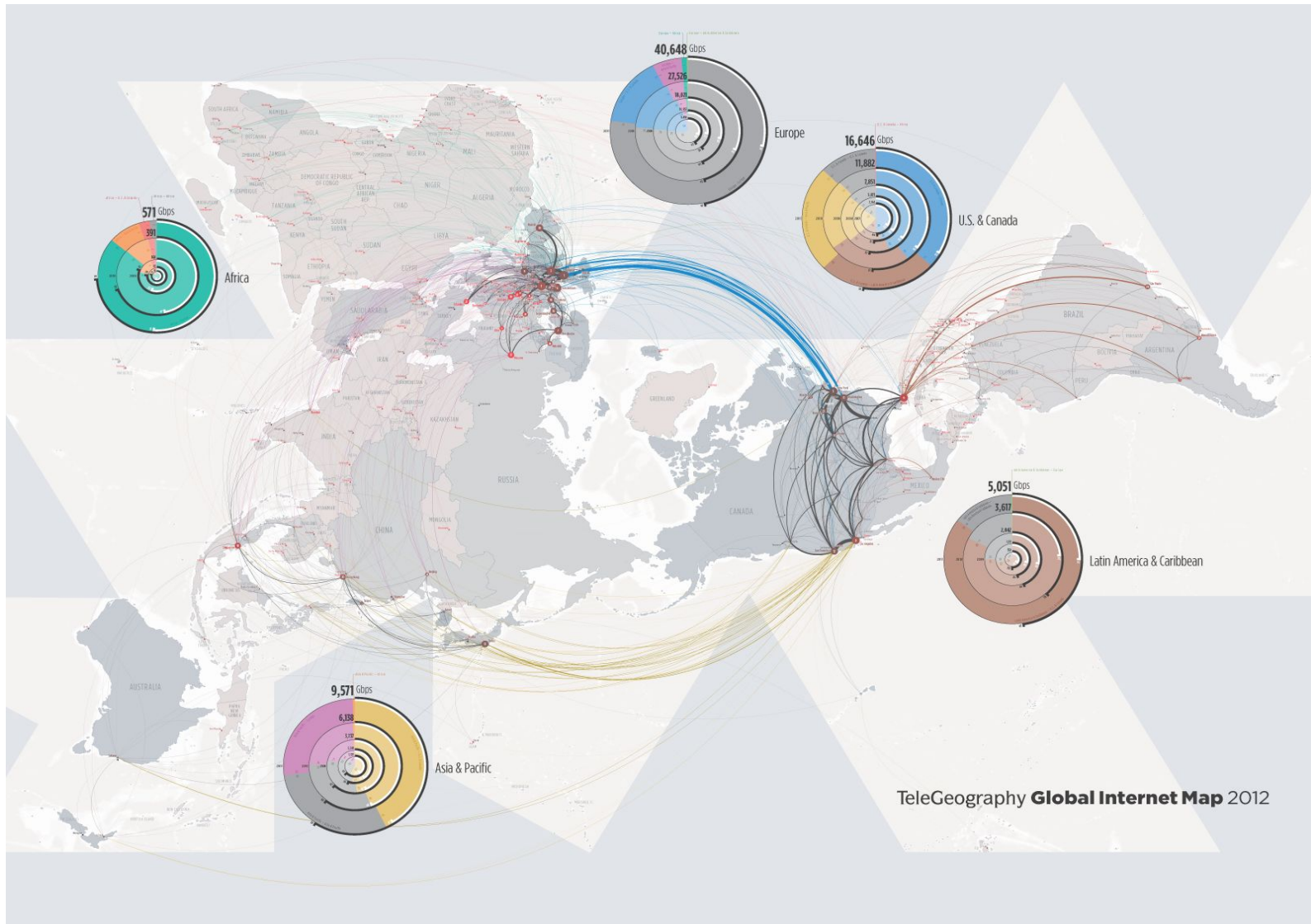
Network of networks

- ❑ Networks are connected to another networks
- ❑ Networks are connected to another
 - Each has different topology and architecture



- ❑ How to integrate such heterogeneity
 - Of hosts, devices, companies, compatibilities, operating systems, laws, culture, politics, societies.

The Global Internet



Source: Telegeography

How does it work?

- ❑ How does one machine talk to the other?
 - Very simple question to ask
 - Complicated answer
 - One of the objectives of the course
- ❑ Which abstraction suits the best?
- ❑ Why is abstraction important?
 - Can we do away without abstraction?
 - How do we understand such a complicated phenomenon without abstraction?

Requirements

- ❑ Applications require guarantee that:
 - time taken should not be too high
 - bound on errors in transmission
- ❑ Communication should not be too “costly”
 - Users will not be attracted if costly
- ❑ Ease of management for service providers
 -

Bottleneck in a network

❑ At nodes

➤ Processing power

- Determines maximum data that can be sent by a machine

➤ Memory

- Processor is faster than memory
- Processor speed doubles every 18 months, memory latency 7 percent/year

❑ At links

➤ Bandwidth

- Yet slower and more expensive...

Resource sharing

- ❑ Network resources are the costliest
- ❑ Use same physical infrastructure
 - Similar philosophy as sharing CPU among jobs
 - Multiple transmissions
 - Need for multiplexing de-multiplexing!

