



Introduction to Communication Networks

TE 156

WEEK 1: INTRODUCTION



About Instructor

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Research Interests: Internet of Things, Networks and Application Security, Applied Artificial Intelligence, Applied Cryptography, Reverse Engineering, Blockchain Technology.



About This Course

This course is aimed at:

- Introducing the various transmission backbone systems; microwave system, fiber optics systems and satelllite systems.
- Introducing the various telecommunication access systems.
- Introducing basic computer (data) network topologies.



About This Course

Course Grading:

| | |
|--|------|
| Assignments | 10% |
| Mid-Semester Exams | 20% |
| Semester Project | 20% |
| End of Semester Exams (Theory & Practicals) | 50% |
| Total | 100% |



Recommended Books

- "Transmission System Design, Handbook for Wireless Networks" by H. Lehpamer.
- "Data Communication Networks" by B. Forouzan.

NB: Not limited to the above books.



Tools & Resources

- Cisco Packet Tracer.
- eNSP.
- OPNET Network Modeler.
- GNS3.



Communication Networks and Services



Communication Networks and Services



Radio & Television
Broadcasting



Telephone



Email

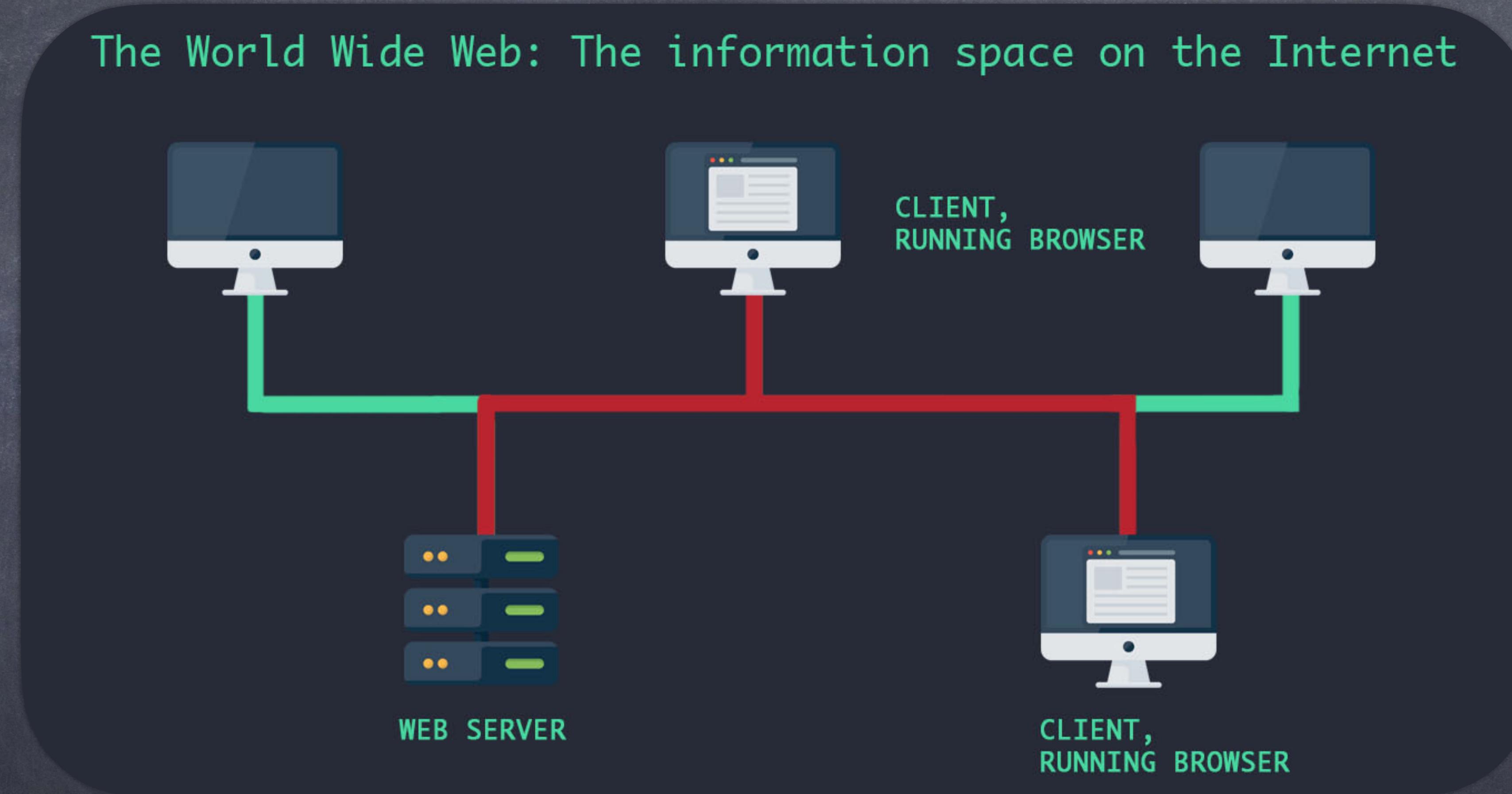


WWW



The Internet and the WWW

The World Wide Web: The information space on the Internet



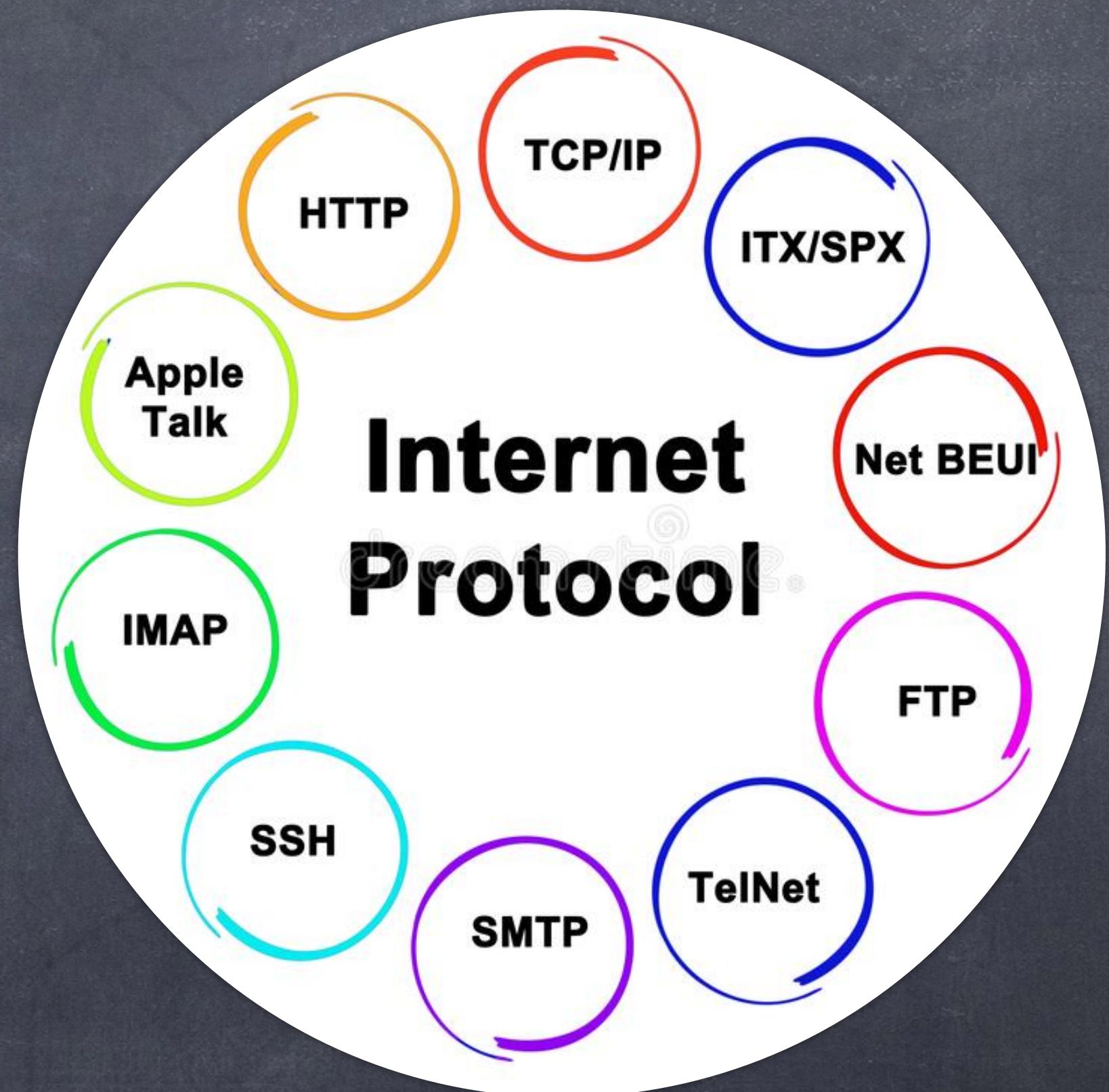
ALL network systems operate on a set of agreed protocols.



Communication Networks and Services

What is a protocol?

A protocol is a set of rules that governs how two communicating parties are to interact.





Communication Networks and Services

Approaches to Network Design

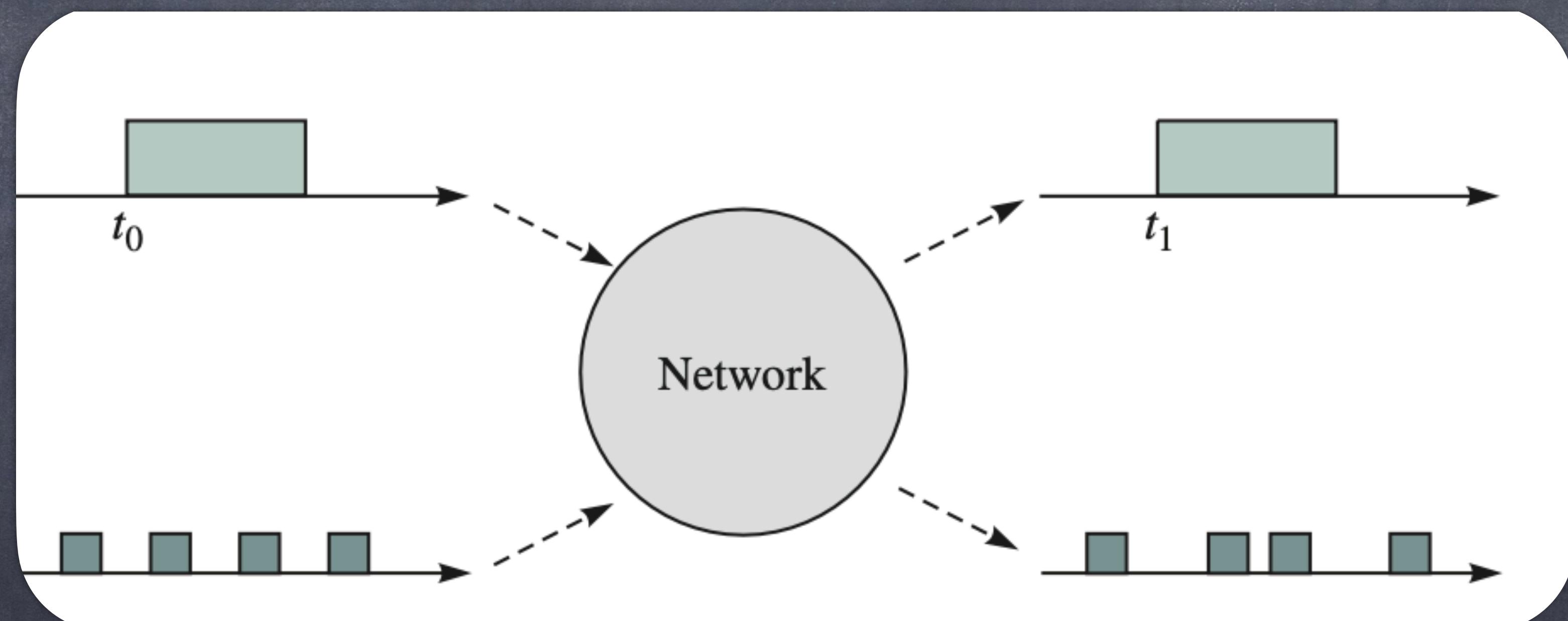
Different user applications impose different requirements on the services provided by the network in terms of

- transfer delay, reliability of service,
- accuracy of transmission,
- volume of information that can be transferred, and,
- of course, cost and convenience.



Approaches to Network Design

Network Functions and Network Topology

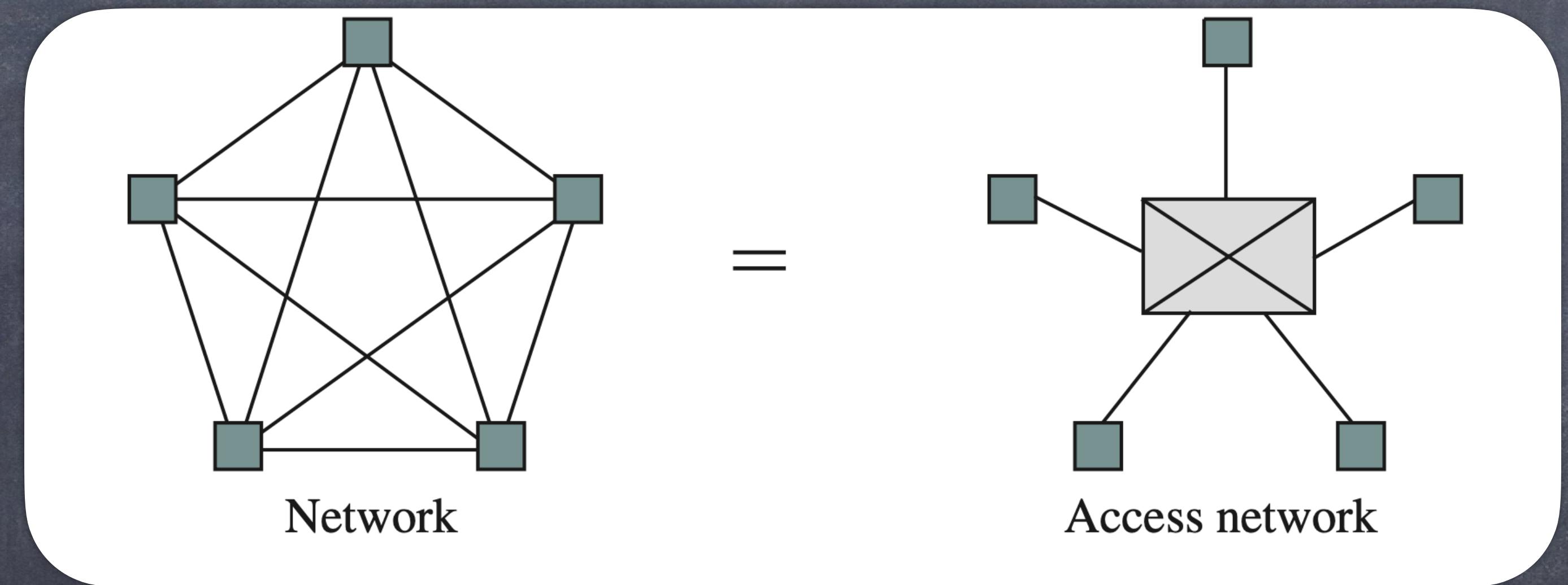


A network transfers information among users



Approaches to Network Design

Network Functions and Network Topology

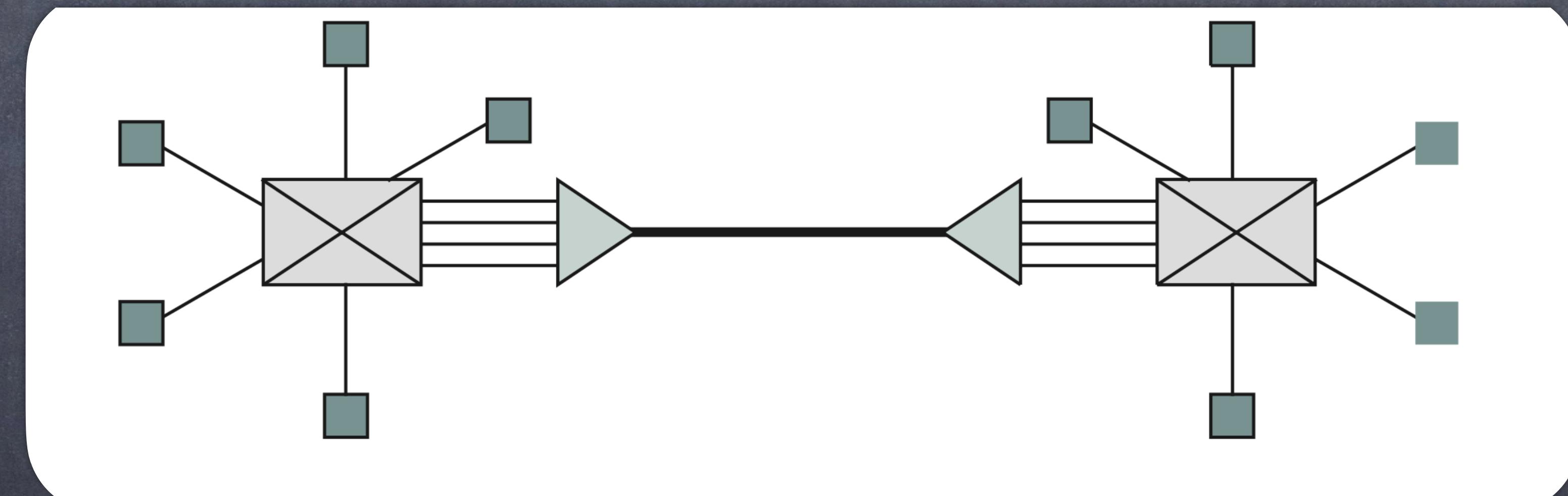


A switch provides the network to a cluster of users.



Approaches to Network Design

Network Functions and Network Topology

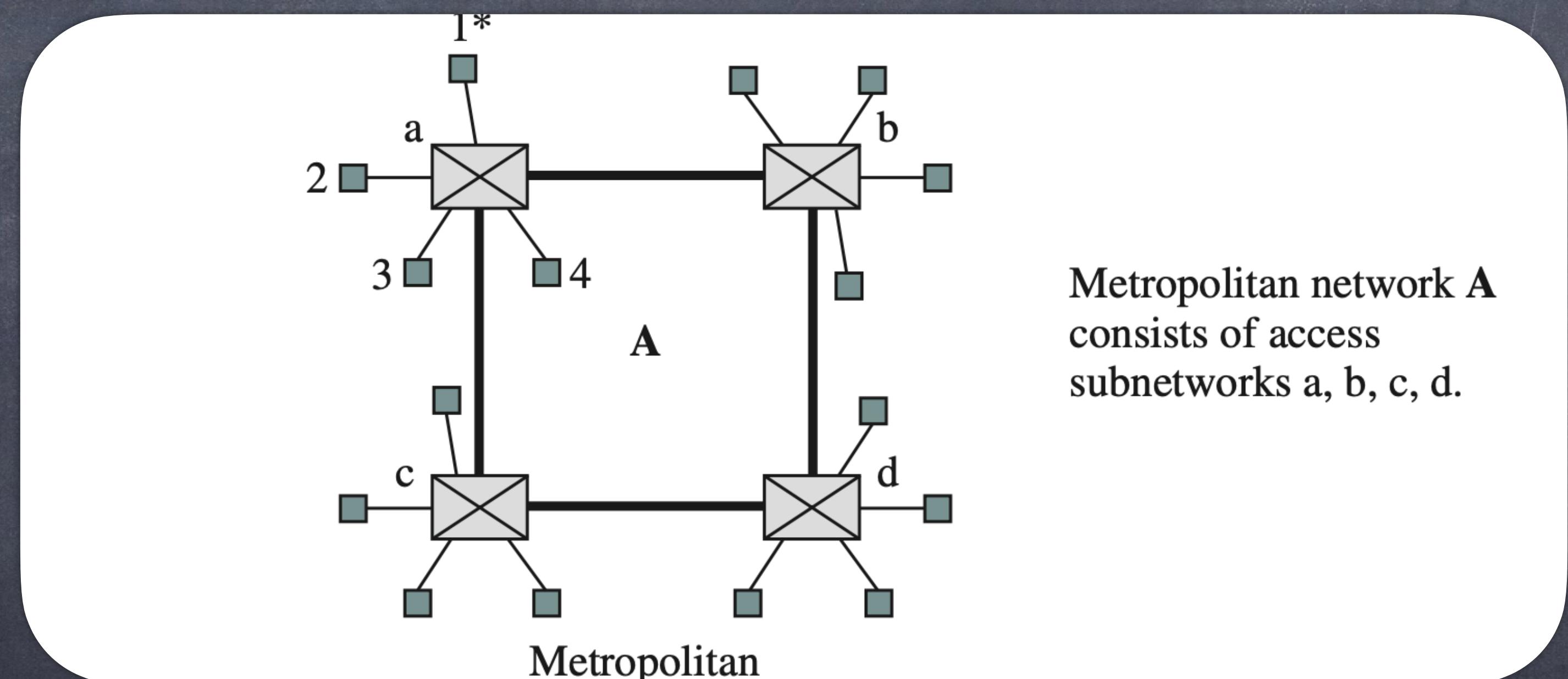


A multiplexer connects two access networks.



Approaches to Network Design

Network Functions and Network Topology

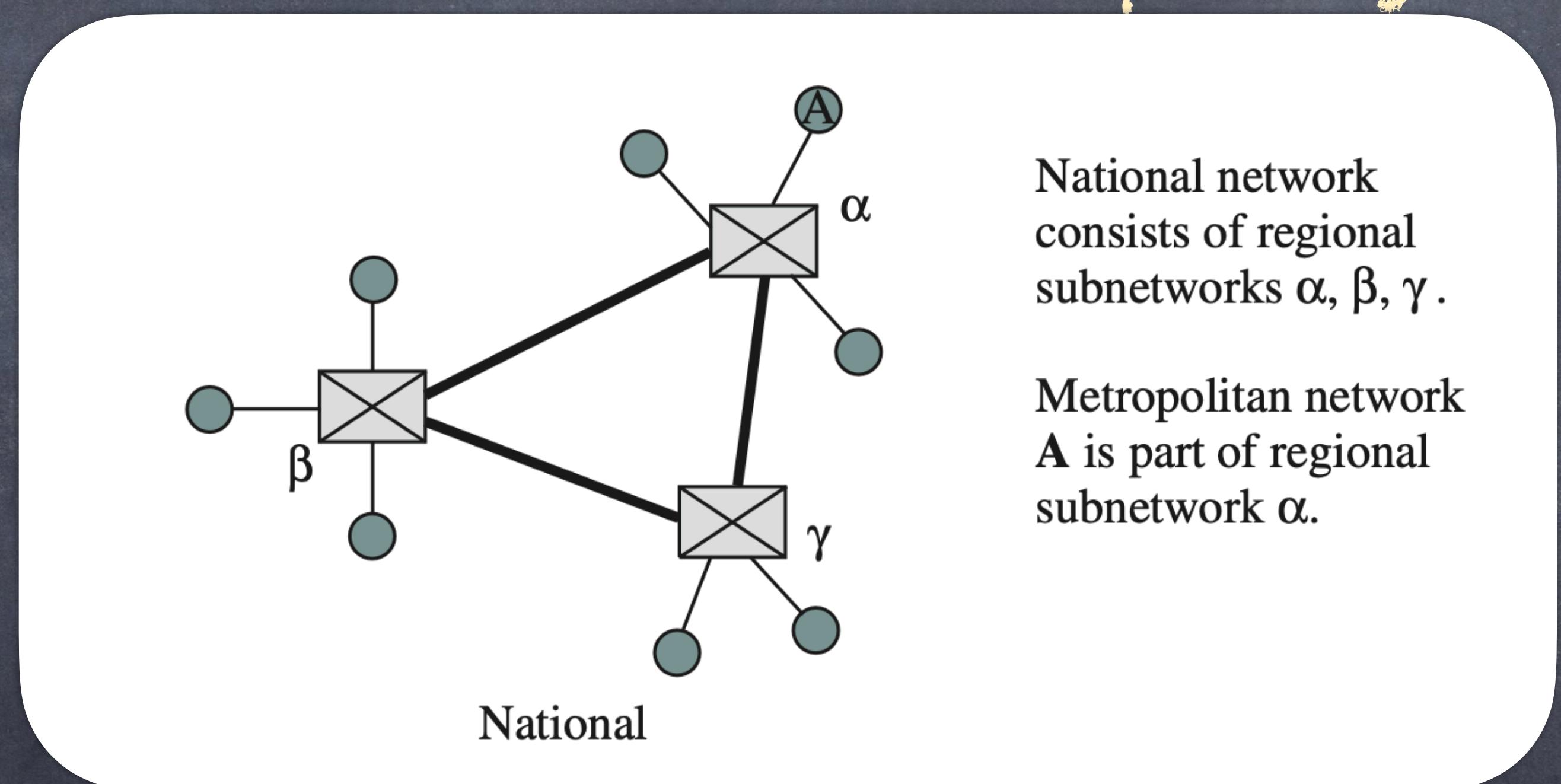


Hierarchical Network Topology: Metropolitan



Approaches to Network Design

Network Functions and Network Topology



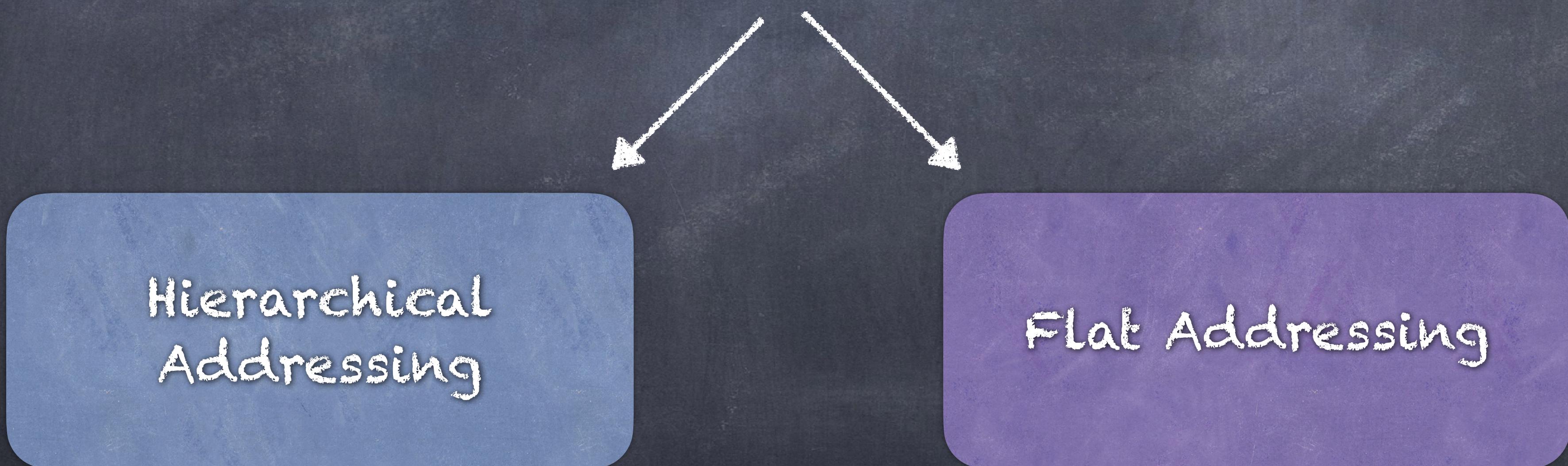
Hierarchical Network Topology: National



Approaches to Network Design

Addressing

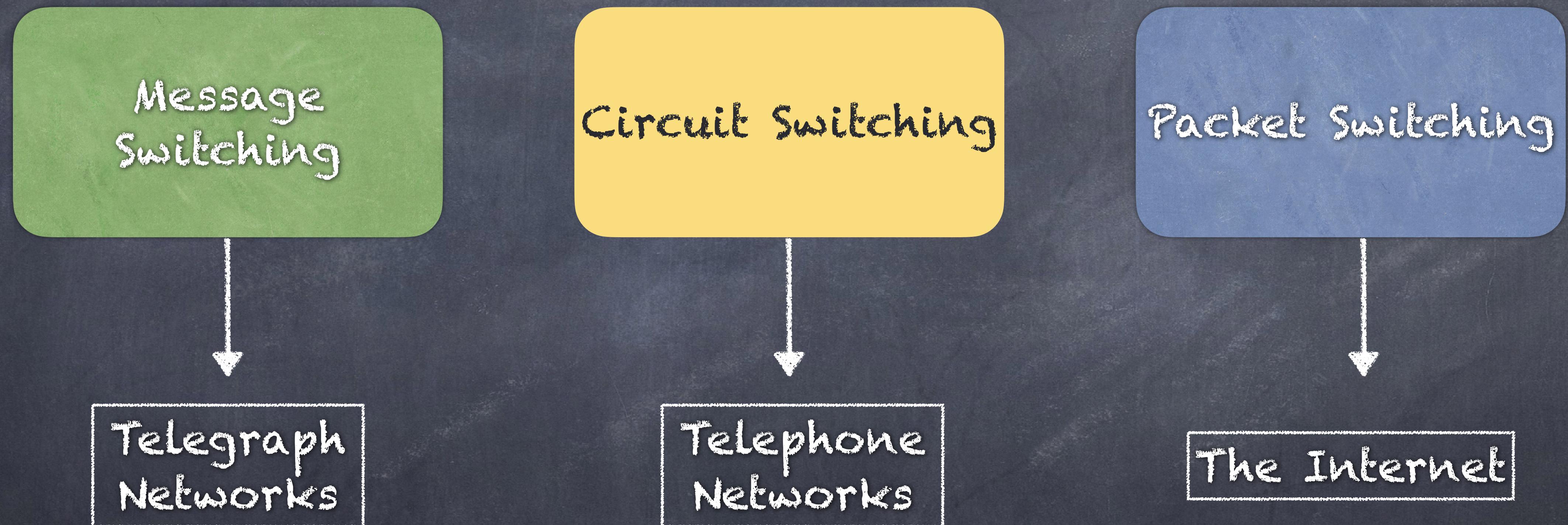
Addressing is required to identify which network input is to be connected to which network output.





Approaches to Network Design

Message, Circuit Switching and Packet Switching





Approaches to Network Design

Message, Packet and Circuit Switching

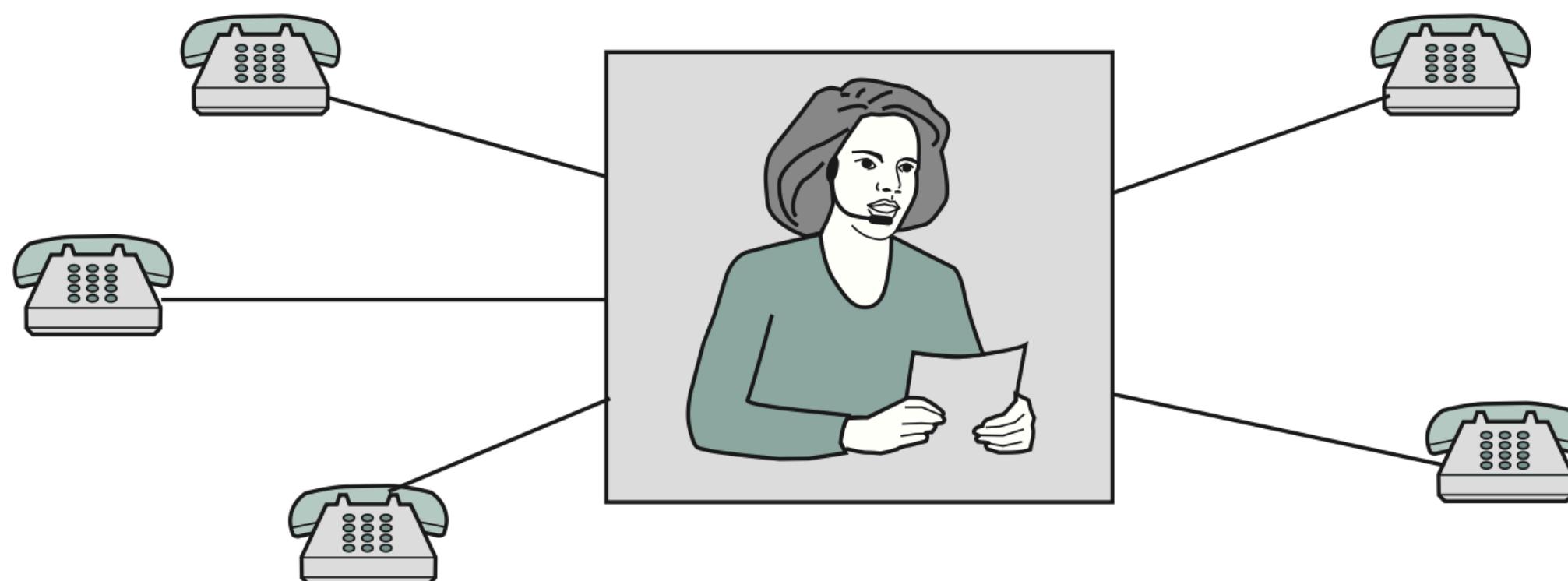
| Function | Telegraph network | Telephone network | Internet |
|----------------------------|--|--|--|
| Basic user | Transmission of telegrams | Bidirectional, real-time transfer of voice signals | Datagram and reliable stream service between computers |
| Switching approach | Message switching | Circuit switching | Connectionless packet switching |
| Terminal | Telegraph, teletype | Telephone, modem | Computer |
| Information representation | Morse, Baudot, ASCII | Analog voice or PCM digital voice | Any binary information |
| Transmission system | Digital over various media | Analog and digital over various media | Digital over various media |
| Addressing | Geographical addresses | Hierarchical numbering plan | Hierarchical address space |
| Routing | Manual routing | Route selected during call setup | Each packet routed independently |
| Multiplexing | Character multiplexing, message multiplexing | Circuit multiplexing | Packet multiplexing, shared media access networks |



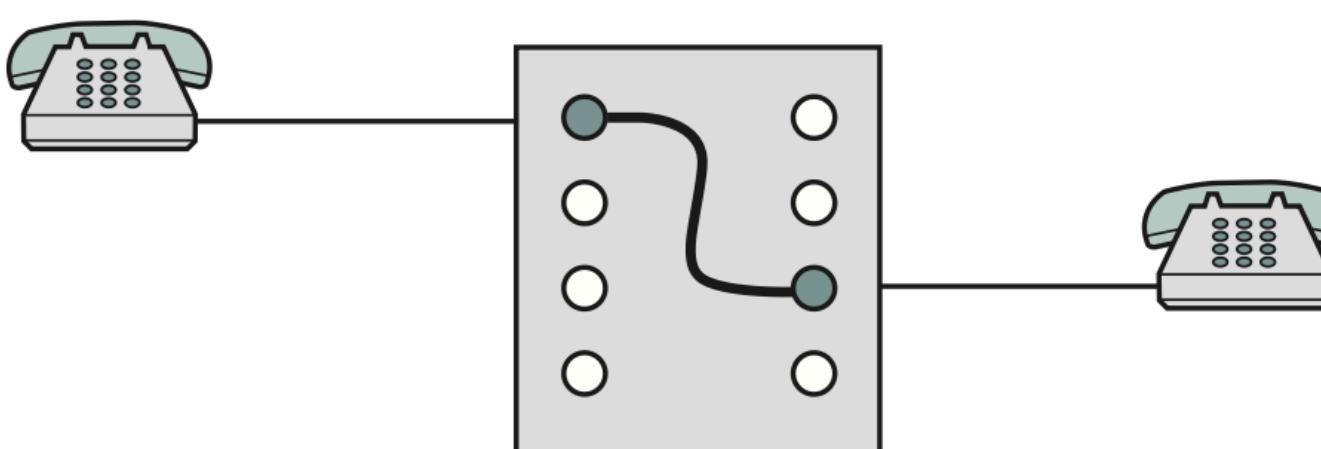
Approaches to Network Design

Message, Packet and Circuit Switching

(a) A switch in the form of an operator with a patch cord panel (not shown).



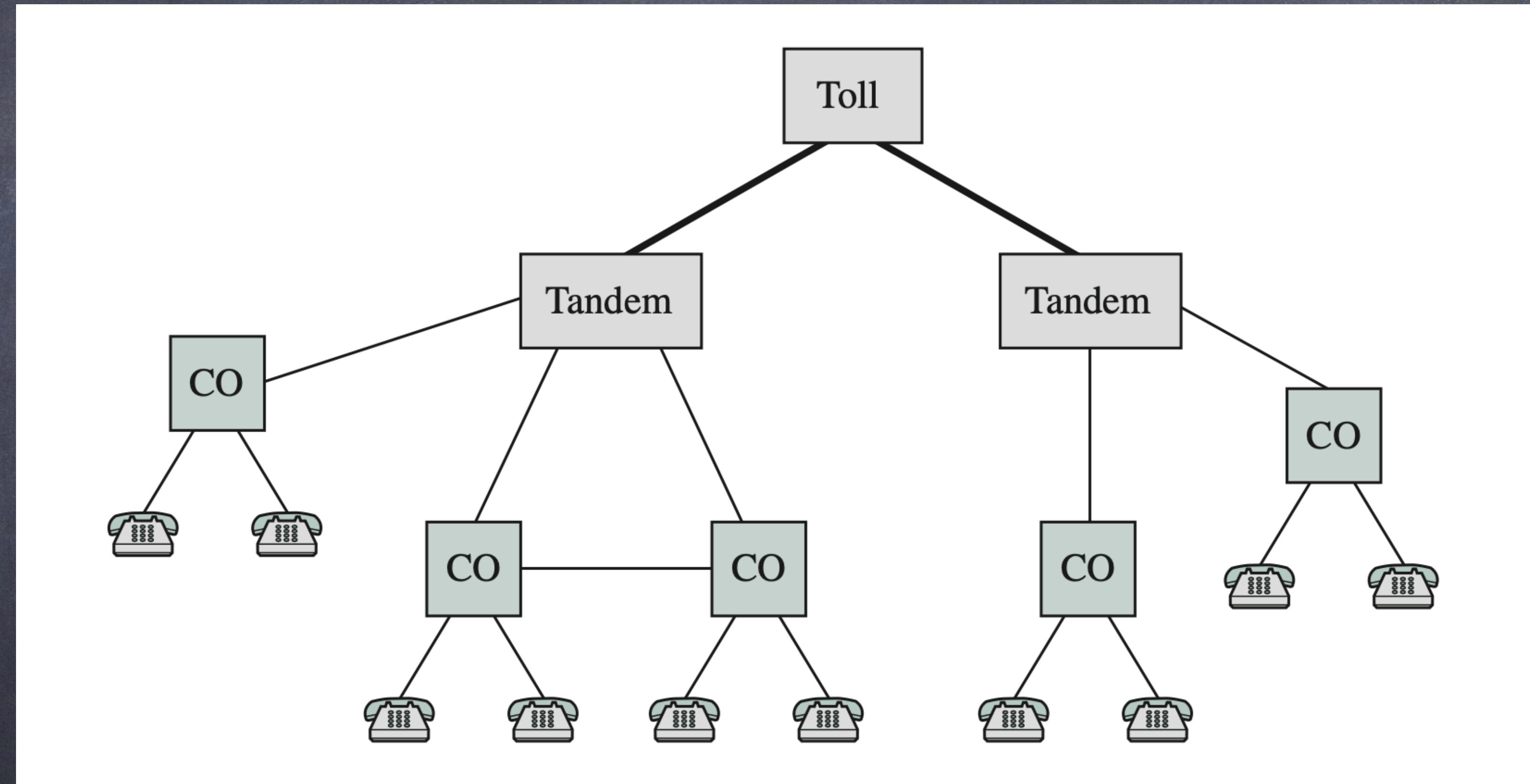
(a) Cords interconnect user sockets providing end-to-end connection.





Approaches to Network Design

Message, Packet and Circuit Switching



Hierarchical Telephone Network Structure.



Approaches to Network Design

The Internet and Packet Switching

The Internet Protocol (IP) provides a means for transferring information across multiple, possibly dissimilar, networks.

Evolution of the Internet

ARPANET is born

a computer network that brought together the best ideas from MIT, NPL and RC

First virus

in history created by a 15-year-old student

1958



1967



Founding of the ARPA

with the aim of creating direct communications between computers

1980

1982



HTML language, URL & HTTP

Although it was not until 1991 that the first website was published

1994

1996



First search engine

WebCrawler

2004

2005



2006

2008



2010



Today

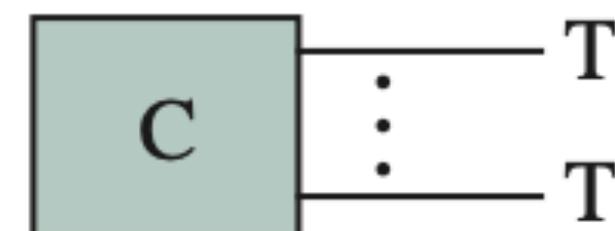
.Ghana
Connect to the future



Approaches to Network Design

Terminal Oriented Networks

(a) Time-shared computers & cables for input devices



(b) Dial in

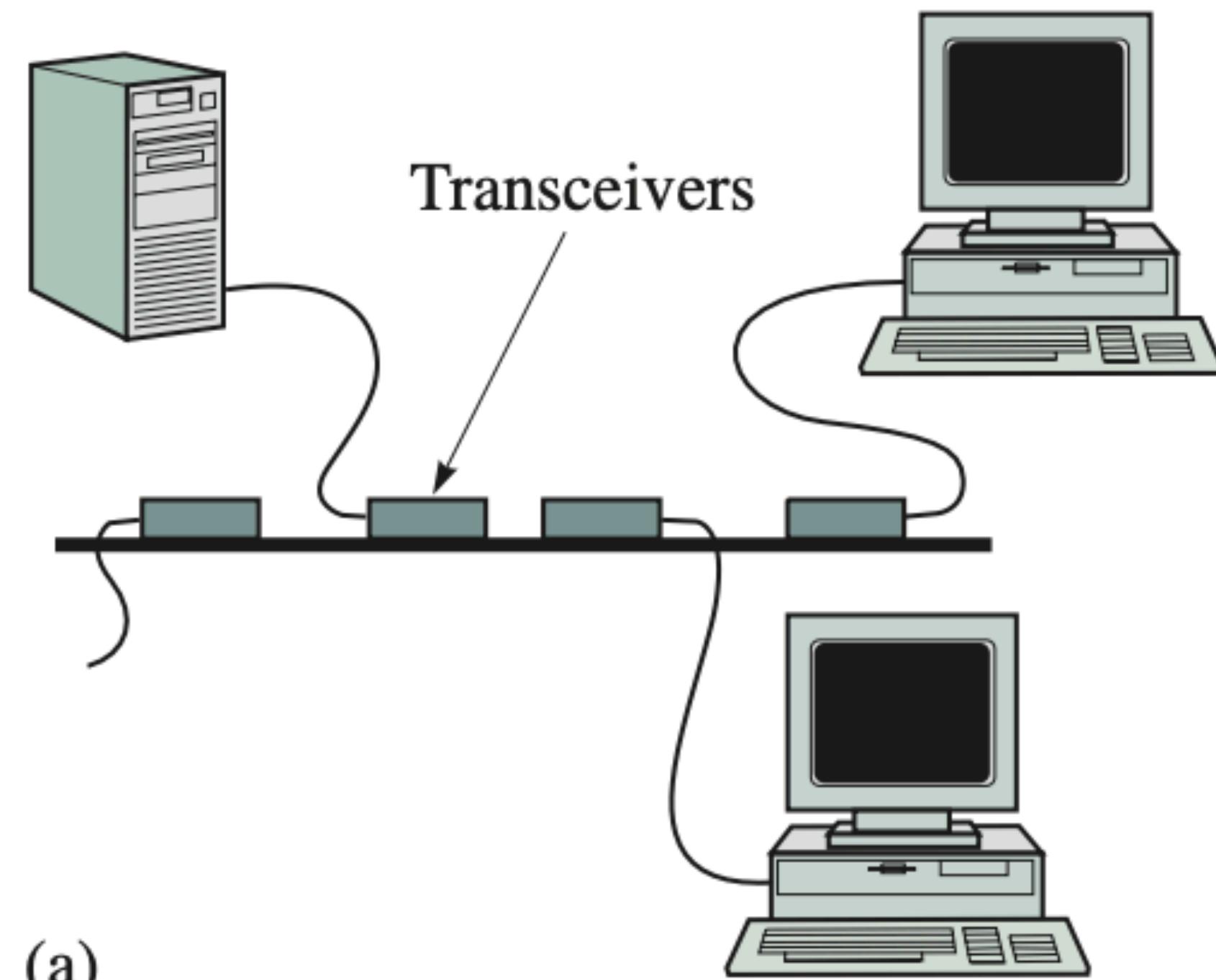


T = terminal

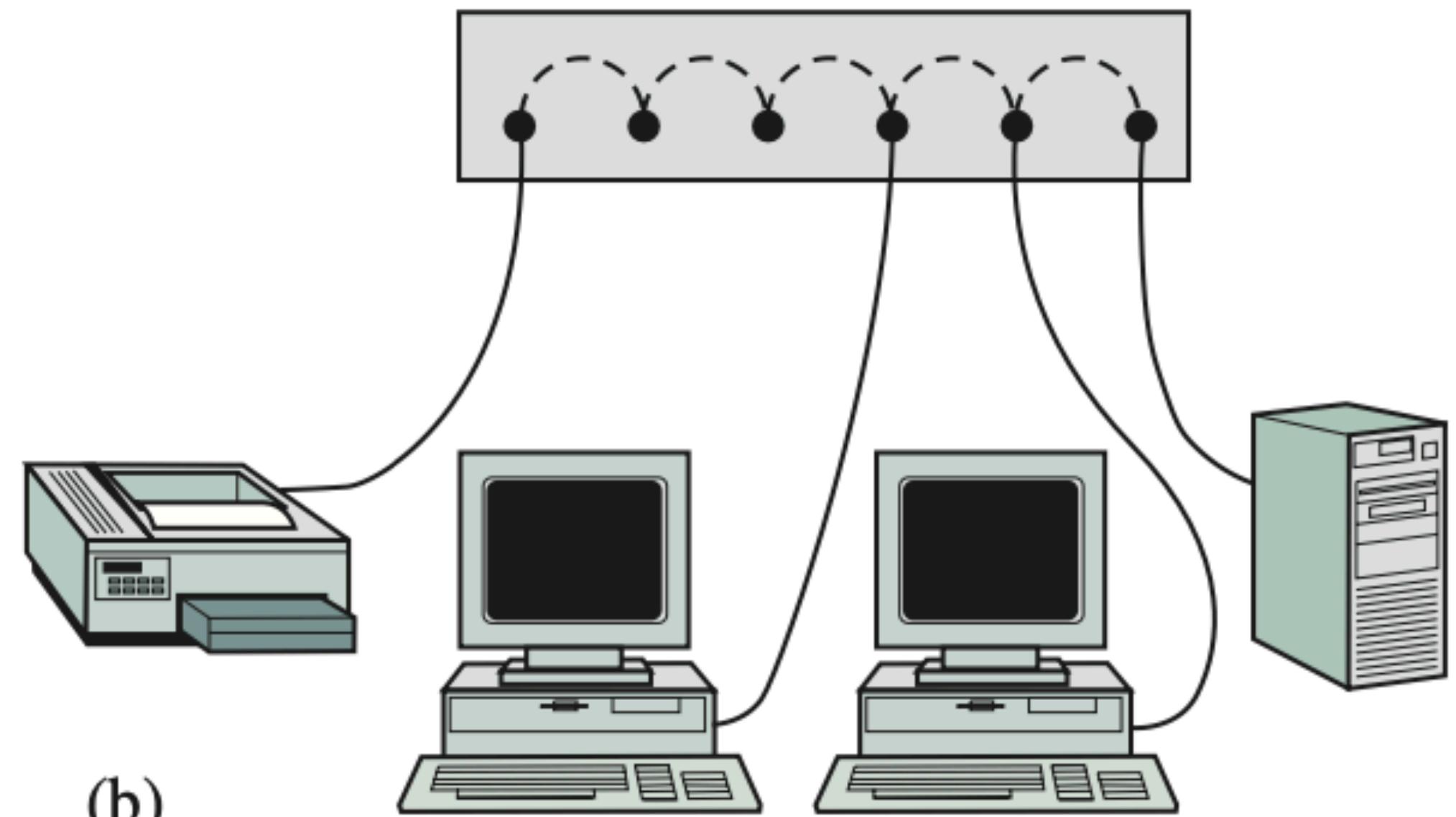


Approaches to Network Design

Computer-to-Computer Networks



(a)

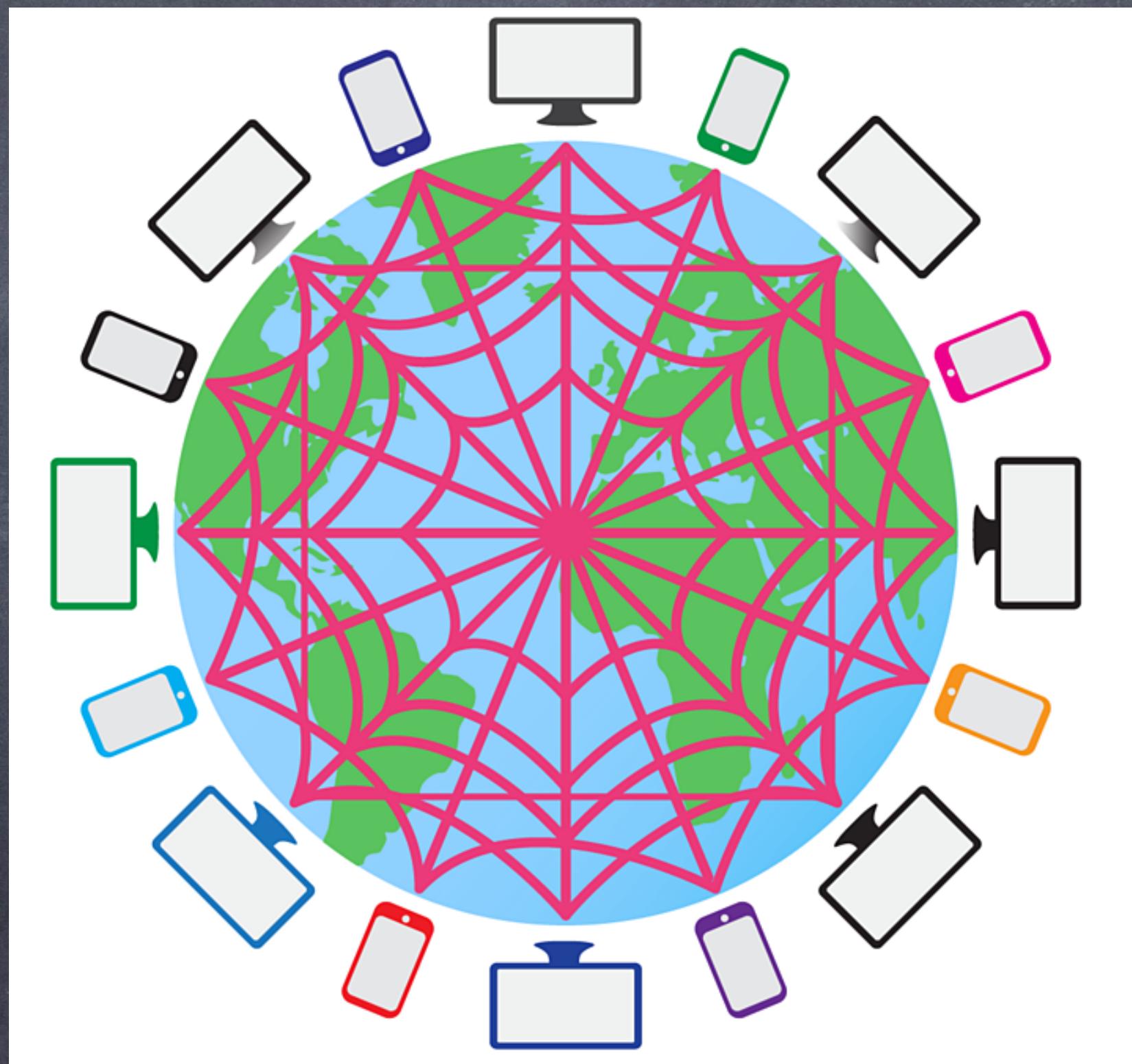
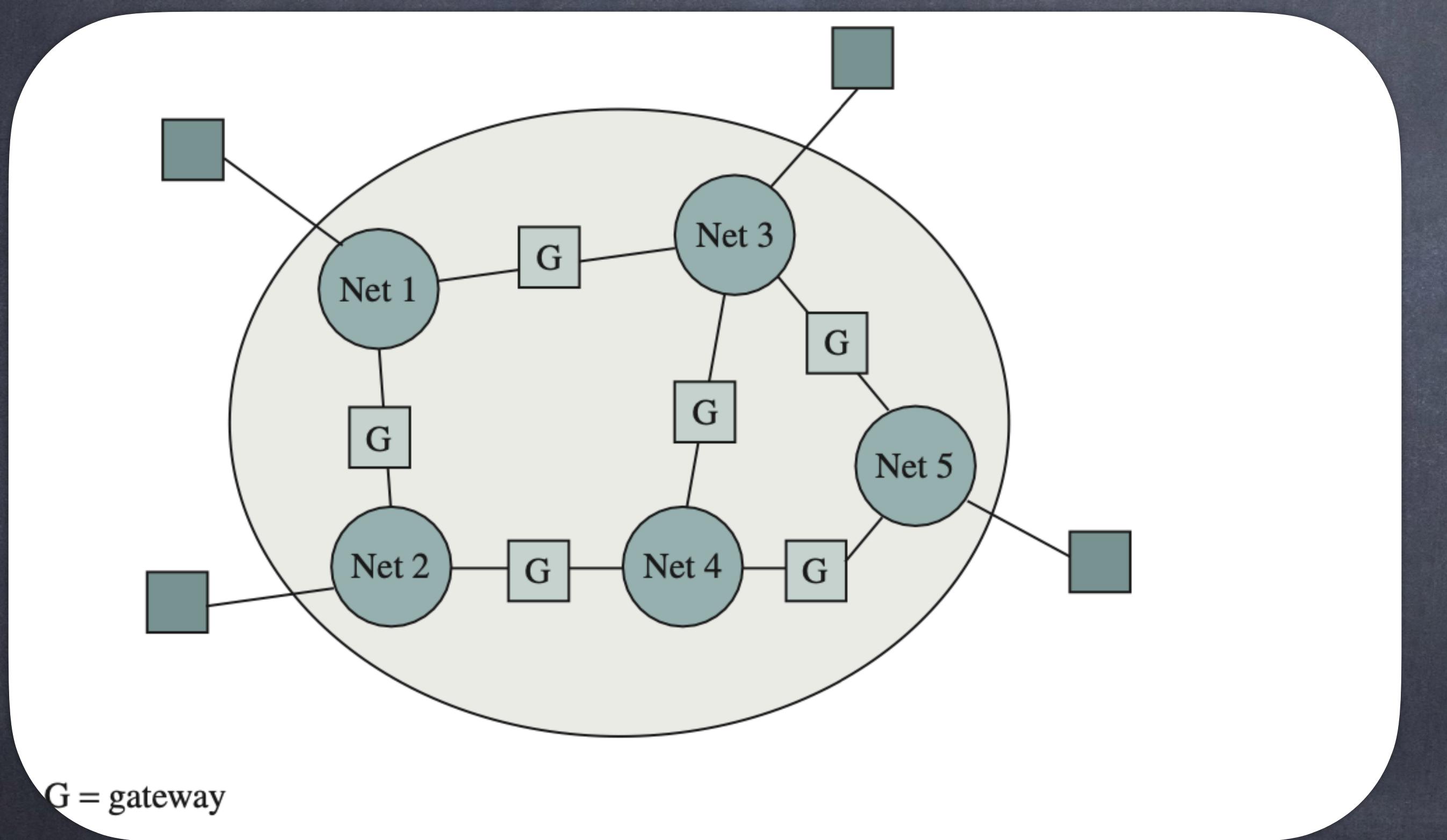


(b)



Approaches to Network Design

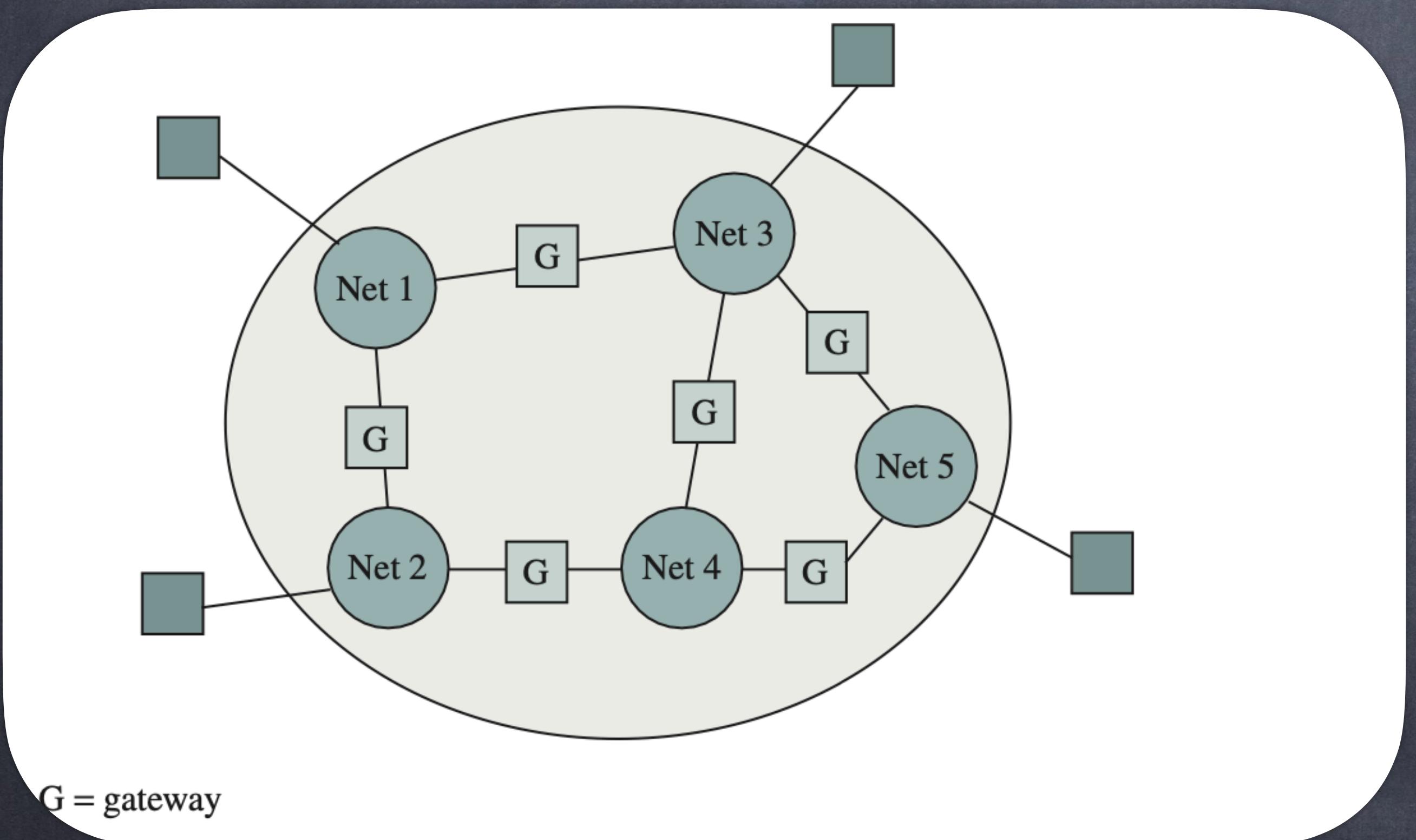
The Internet





Approaches to Network Design

The Internet



An Inter-Network

IP Addresses

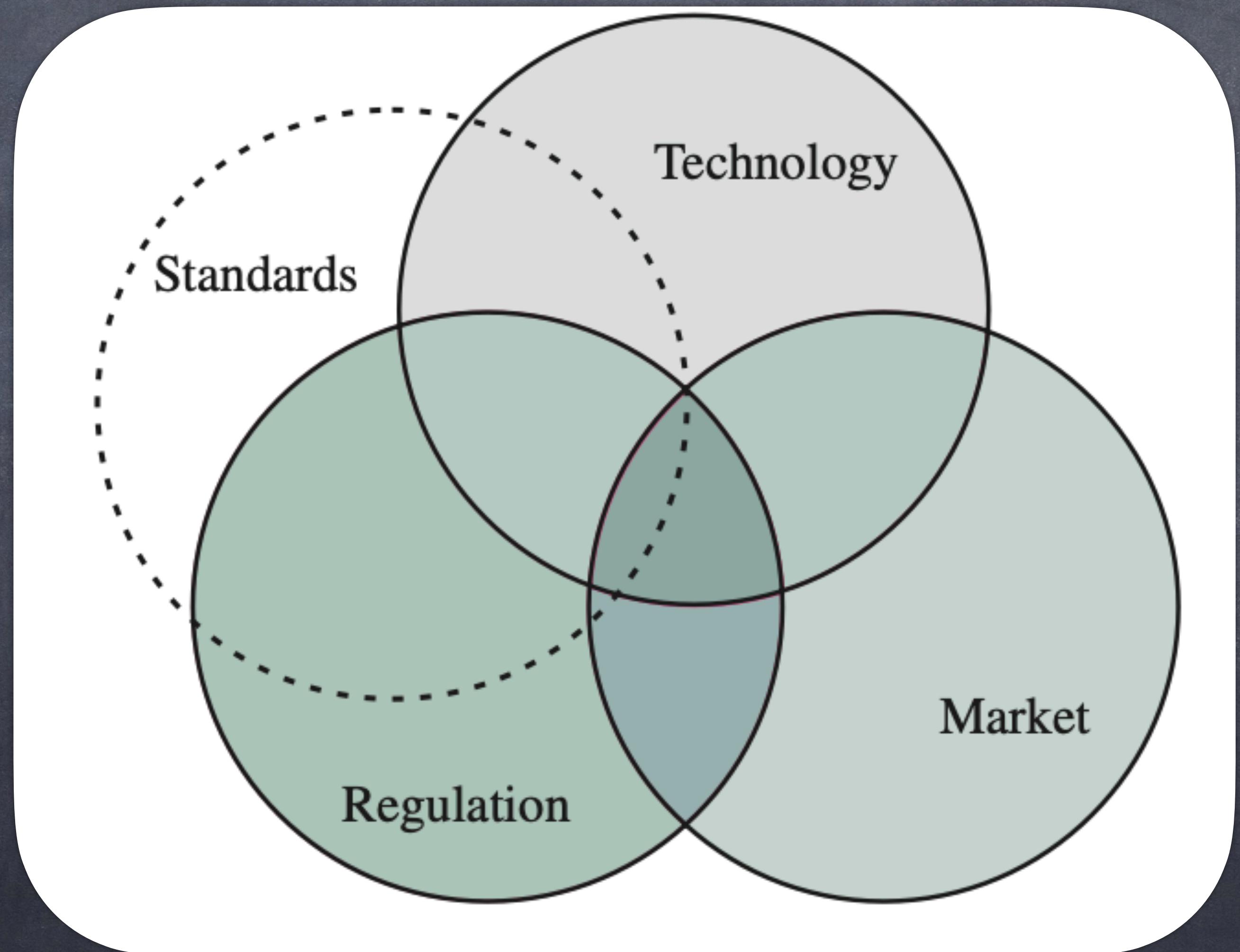
TCP/IP

Domain Name System

Key Components of the Internet



Key Factors in Communication Network Evolution





Next ...

Applications & Layered Architectures