Chapter 1
Living in a Network Centric World
Introduction

- The globalization of the Internet has succeeded faster than anyone could have imagined.
- The manner in which social, commercial, political and personal interactions occur is rapidly changing to keep up with the evolution of this global network.
Network Centric World
Using Networks in our lives
Using Networks in our work
Using Networks in outside of work
Networks – Behind the scenes

- More than just connecting cables… (that’s the easy part)
- Today’s networks are complex and sophisticated combination of protocols, software, hardware, algorithms, configurations, policies, and more
- Security
- Privacy
- 24 x 7 availability and access
- Quality of Service
- Video on Demand
- Voice over IP (over the Internet)
- Redundancy and backup
- Mission critical applications
- Productivity and user expectations
- Wireless
Networks Supporting the Way We Live

- The original idea about networks and the Internet was about sharing computer resources – **computer-to-computer** communications.
- That quickly changed to **people-to-people** communications.
Today’s networks carry between many different types of devices:

- Voice
- video streams
- Text
- graphics

http://www.youtube.com/watch?v=1
The Global Community

- Technology helps to create a world in which national borders, geographic distances, and physical limitations become less relevant.
Examples of Today’s Popular Communication Tools

- Instant Messaging: AOL AIM and MSN Messenger
  - Developed from earlier Internet Relay Chat (IRC)
  - Incorporates features such as:
    - file transfer
    - voice
    - video communication (web cam)
    - chat
Weblogs (blogs)

- Weblogs (Blogs) are web pages that are easy to update and edit.
- Unlike commercial websites, which are created by professional communications experts, blogs give anyone a means to communicate their thoughts to a global audience without technical knowledge of web design.
• Wikis are web pages that groups of people can edit and view together.
• There is a public wiki, called Wikipedia, that is becoming a comprehensive resource - an online encyclopedia - of publicly-contributed topics.
• Private organizations and individuals can also build their own wikis to capture collected knowledge on a particular subject.
Supporting Learning

- E-Learning
- On-line discussions and access to resources
- On-line assignments and assessments
- Blended distance learning
NetLab

<table>
<thead>
<tr>
<th>Reservation Calendar</th>
<th>INSTRUCTOR</th>
<th>Galactica SECURITY ROUTER POD</th>
<th>Pegasus SECURITY PIX POD</th>
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Select a pod and reservation time for Antonio’s FIS Class by clicking on a +.

12am +
1am +

Networks Supporting the Way We Work

- **Intranets**, private networks in use by just one company, enable businesses to communicate and perform transactions among global employee and branch locations.

- Companies develop **extranets**, or extended internetworks, to provide suppliers, vendors, and customers limited access to corporate data to check order status, inventory, and parts lists.
Networks Supporting the Way We Play

- Email
- Personal Web Sites
- Sharing photos and videos (YouTube)
- Travel: Expedia, Priceline, Travelocity, etc.
- IM
- Gaming

The way we play is supported by services delivered by the data network.
Communication
What is Communications?

- **Different expectations** depending on whether we are chatting via the Internet or participating in a job interview.
- Before beginning to communicate with each other, we **establish rules** or agreements to govern the conversation.
- These rules, or **protocols**, must be followed in order for the message to be successfully delivered and understood.
- A **protocol** is nothing more than an agreement or rules to govern a way of communicating.
- Among the protocols that govern successful human communication are:
  - An identified sender and receiver
  - Agreed upon method of communicating (face-to-face, telephone, letter, photograph)
  - Common language and grammar
  - Speed and timing of delivery
  - Confirmation or acknowledgement requirements
Protocol

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Quality of Communications

- Examples
  - An identified sender
  - An identified receiver
  - Confirmation or acknowledgement requirements
  - Format or order of information
Quality of Communications

- **Internal factors:** nature of the message itself.
  - The size of the message
  - The importance of the message

It is more difficult to deliver a large bulky package, quickly and without damage, than it is to deliver a number of smaller, less complex packages.
Network as a Platform
What is Networking?

**Networking** - the interconnection of workstations, peripherals, terminals and other devices.

**Whatis.com:** “In information technology, networking is the construction, design, and use of network, including the physical (cabling, hub, bridge, switch, router, and so forth), the selection and use of telecommunication protocol and computer software for using and managing the network, and the establishment of operation policies and procedures related to the network.”
Devices on a network

Common Data Network Symbols

- Desktop Computer
- Laptop
- Server
- IP Phone
- LAN Switch
- Firewall
- Router
- Wireless Router
- Cloud
- LAN Media
- Wireless Media
- WAN Media
Network Medium

Wired networks use physical cables to connect devices.

Wireless networks use radio waves to communicate between devices.

Wireless networks are also connected to wired networks, at some point.
Network Applications and Protocols

- Some other applications:
  - DNS, DHCP, HTTP, SMTP, FTP

- Some other protocols
  - TCP/IP suite of protocols
  - Ethernet
  - Routing protocols
Converged Networks

- Traditional telephone, radio, television, and computer data networks each have their own individual versions of the four basic network elements.
- Technology advances are enabling us to consolidate these disparate networks onto one platform - a platform defined as a converged network.

Converged data networks carry multiple services on one network.
Architecture of the Internet
Network Architecture

- A fault tolerant network is one that limits the impact of a hardware or software failure and can recover quickly when such a failure occurs.

- A scalable network can expand quickly to support new users and applications without impacting the performance of the service being delivered to existing users.
Voice and live video transmissions require a level of consistent quality and uninterrupted delivery that was not necessary for traditional computer applications.
The security and privacy expectations that result from the use of internetworks to exchange confidential and business critical information exceed what the current architecture can deliver.
Circuit Switched (connection oriented) vs Packet Switched (connectionless)

Circuit Switched
- Dedicated circuit
- Guaranteed level of service (bandwidth) - QoS
- Inefficient use of medium
- Single path, no redundancy

Packet Switched
- Shared circuit
- Messages divided into packets
- More efficient use of medium
- Redundancy, multiple possible paths
Scalable Network Architecture

- Tier-1 providers: ISPs provide national and international connections. (Verizon, Sprint, AT&T, NTT, cable systems, etc.)
- Tier-2 providers: Provide regional service, pay Tier-1 for connectivity.
- Tier-3 providers: Provide service directly to end users, usually connected through Tier-2 providers.
Quality of Service

Queuing according to data type enables voice data to have priority over transaction data, which has priority over web data.
QoS Matters

- **Without** properly designed and implemented QoS mechanisms, data packets will be dropped without consideration of the application characteristics or priority.
- Dropped distress call to an emergency response center, or of a lost control signal to an automated piece of heavy machinery.
- A key responsibility for the **network managers** is to establish a QoS policy.

### Quality of Service Matters

<table>
<thead>
<tr>
<th>Communication Type</th>
<th>Without QoS</th>
<th>With QoS</th>
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<tbody>
<tr>
<td>Streaming video or audio</td>
<td>Choppy picture starts and stops.</td>
<td>Clear, continuous service.</td>
</tr>
<tr>
<td>Vital Transactions</td>
<td>Time : Price</td>
<td>Time : Price</td>
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<tr>
<td>02:14:05 $1.54 Just one second earlier...</td>
<td>02:14:04 $1.52 The price may be better.</td>
<td></td>
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<tr>
<td>Downloading web pages (often lower priority)</td>
<td>Web pages arrive a bit later...</td>
<td>But the end result is identical.</td>
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Providing Network Security

- Securing a **network infrastructure** includes the physical securing of devices that provide network connectivity and preventing unauthorized access.
- **Content security** refers to protecting the information contained within the packets being transmitted over the network and the information stored on network attached devices.
Networking
Trends

- Three major trends that are contributing to the future shape of complex information networks:
  - Increasing number of mobile users
  - Proliferation of network capable devices
  - Expanding range of services