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Internet Technology and E-Business

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Routing and Ports

- TCP and UDP work on Static Port Numbers
  - ftp: 21 & 20
  - telnet: 23
  - SMTP Mail: 25
  - HTTP: 80
  - POP3 Mail: 110

Quality of Service Paper

- Delay: elapsed time for a packet to go from the sender through the network to the recipient
- Jitter: variation (variance) of the delay
- Bandwidth: max. sustainable data transfer rate
- Reliability: average error rate, mean expected time to error
- Business Issues
- Service Quality v. Quality of Service

Quality of Service Paper

- TCP Rate Control
  - Slow Start
    - Transmission rate doubled as each ACK received
  - Congestion Avoidance
    - Transmission rate halved for when packet loss, to create threshold, and subsequently increased from there

Moore's Law ?

- By Coffman and Odlyzko
- Internet traffic doubling each year
  - What does this mean for E-Business?
  - Valuing Cash flows
- Data traffic expected to pass voice traffic in 2002?
- Transmission Technology appears to be sufficient to handle a doubling of traffic each year for at least a decade
- Data traffic will likely continue to increase

Moore's Law ?

- What are some reasons for data traffic continuing to increase?
- Is there a Moore's law for data bandwidth?
- What are some cautions about measuring phone line traffic and Internet traffic independently?
- There is enough data on disks and tapes to completely saturate all communications media
- One of the paper's contentions: bandwidth glut will not happen

Outline

- The Story So Far . . .
- Why the Internet works so well?
- Internet Application Protocols
- Dell
- HTTP, SGML, HTML & XML
- Personal Web Pages
- Electronic Marketing
- The Story So Far . . .

The Story So Far . . .

- Comer:
  - Chapters 1-2: The revolutionary impact of the Internet & some links
  - Chapter 3: Ubiquitous access
  - Chapter 4: Analog v. digital
  - Chapter 5: Digital data (Morse code)
  - Chapter 6: Modulation-demodulation
  - Chapter 7: Local area networks

The Story So Far . . .

- Comer:
  - Chapter 8-11: History of the Internet:
    - Many incompatible LANs
    - LANs incompatible with WANs
    - DARPA (Defense Advanced Research Projects Agency)
    - ARPANET (late 70s) – backbone WAN
    - TCP/IP
      - Open system
      - RFCs (Request for Comments) online
    - 1982 Prototype Internet using TCP/IP

The Story So Far . . .

- Comer:
  - Chapter 8-11: History of the Internet:
    - TCP/IP integrated into UNIX
    - NSF funds CSNET using TCP/IP
    - IAB (Internet Activities/Architecture Board)
    - IETF (Internet Engineering Task Force)
    - NSFNET
      - Mid-level Networks
      - NSF backbone

The Story So Far . . .

- Comer:
  - Chapter 8-11: History of the Internet:
    - 1992: ANSNET
    - 1995: vBNS
    - Internet 2
    - Other networks:
      - BITNET
      - FIDONET
      - JANET
      - EBONE

The Story So Far . . .

- Comer:
  - Chapter 12-19: Underlying Technologies:
    - Packet switching
      - Label packets
      - Computer addressing
      - Variable size packets
      - *Slow start – increasing transmission rates*
      - *TTL (Time To Live)*
    - Routers

The Story So Far . . .

- Comer:
  - Chapter 12-19: Underlying Technologies:
    - Access
      - ISPs (Internet Service Providers)
      - Dial-Up/Modems
      - Cable modems
      - ADSL
      - Wireless

The Story So Far . . .

- Comer:
  - Chapter 12-19: Underlying Technologies:
    - IP (Internet Protocol)
      - Software on every (?) machine
      - Datagrams: Internet packets
      - Dotted quad addresses
    - TCP (Transmission Control Protocol)
      - ACK
      - Resend
      - TTL

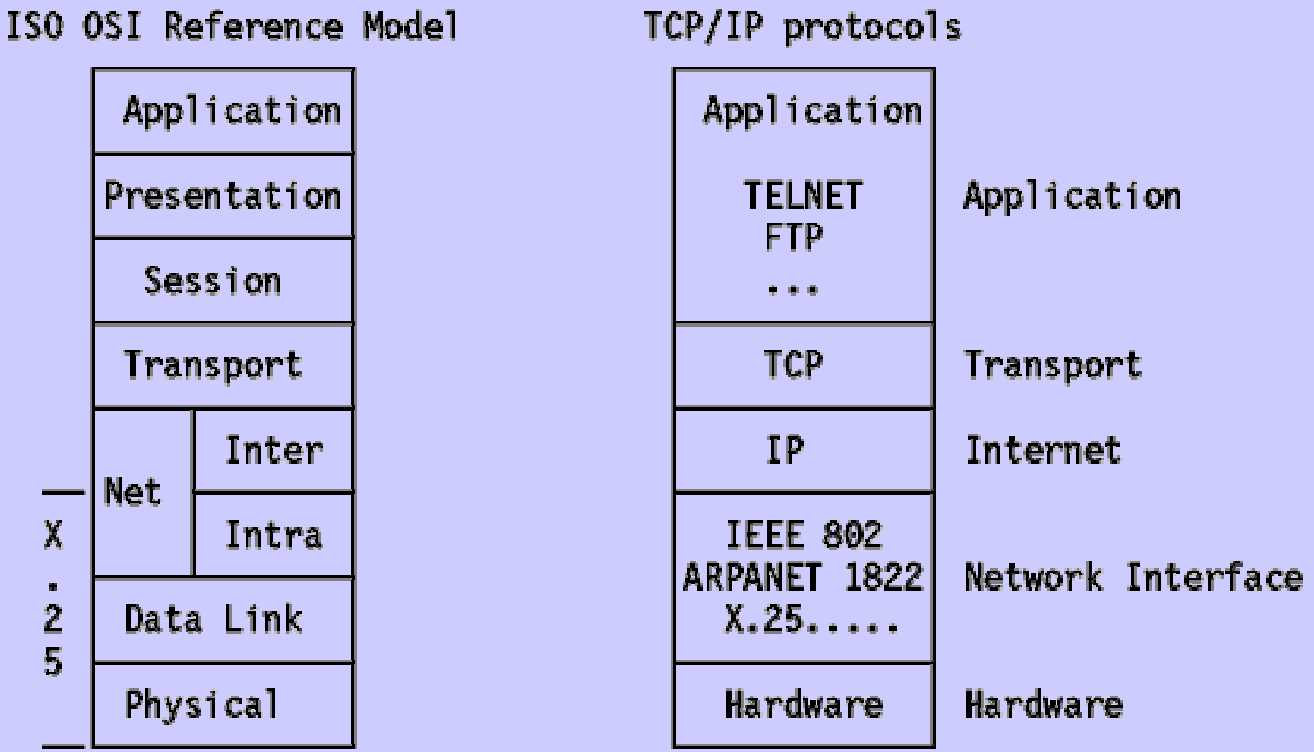
The Story So Far . . .

- Comer:
  - Chapter 12-19: Underlying Technologies:
    - DNS (Domain Name Servers)
- Other Protocols:
  - HTTP
  - SMTP
  - POP3
  - IMAP

The Story So Far . . .

- Quality of Service
  - Delay
  - Jitter
  - Bandwidth
  - Reliability

The Story So Far . . .



Why the Internet Works So Well

- Today, typical computers are 1000 times faster than they were when TCP/IP was first used (around 1982)
- Switching technology is 2500% faster
- The Internet is a very complex system
- TCP/IP is well documented and it was well studied before it was put in action
- Dr. David Clark (Internet Architect from 1983 to 1989) said: “rough consensus and working code”

IP Provides Flexibility

- Extremely flexible!
- Makes NO assumptions about the underlying hardware
- Works on WANs and LANs
- Any speed networks
- Guaranteed no packet loss or just best effort
- Any media (level 1 or 2 of OSI model), such as fiber, twisted pair, cellular, etc.

TCP Provides Reliability

- Adaptability of TCP allows it to manage IP datagrams across various media
- Compensates for differences in underlying network hardware
  - WANs can loose many packets, where LANs rarely do
  - Speed differences for different network links
- Handles rapid changes in performance due to changing network loads

Long Term Research's Role

- TCP/IP developed by dedicated and talented people
- Researchers were allowed to experiment and look at fundamental problems
- Researchers insisted each part work well before TCP/IP was released

Email, Bulletin Boards & Browsers

- Email is credited to Ray Tomlinson
- Economic Impact
  - Small and Large Companies
  - The earth's distance shrunk again
- Internet based communities
  - How to profit from them?
  - How to support them for business?
  - Extremely specialized
  - How do these impact professionals? Business people, physicians and lawyers?

Chat Rooms, Talk, etc.

- What are the opportunities for Business?
  - Helping clients and potential clients
  - Competitive Information
  - Others?
- Will Chat rooms evolve into interactive conference calls?
  - Do people want this? Is there good from some anonymity?
  - Business Issues
  - ATM networks, etc.

ftp and telnet

- ftp: file transport protocol: predates the Internet back to the Arpanet days
- telnet: predates the present Internet as well, remote logins, MIT X Windows, etc.
- Purpose was to allow the use of remote resources
- ftp and telnet USE (sit on top of) TCP/IP
- The notion of time sharing!
  - Discussion, what exactly is this?
  - Classical examples, IBM VM, Unix, Multix

Industrial Interlude: Dell

- The Dell Example
  - Over $35 billion in sales expected this F Year (2003)
  - Larger and larger portion of sales over the Internet
- The Beginning: Mike Dell at Univ. of Texas
  - The market he sold to
  - The change in 1993

Dell

- 30% to 40% growth rates
- Some observations:
  - Dell's initial market was the hobbyist
  - Later, their market grew to business and home customers
  - This change required re-engineering!
  - The Web suited this well,& also fits the small computer shipping paradigm

Dell

- Compaq and the 1993 price war
- Dell lost $65 million, close to bankruptcy
- Response: fundamental change in business
- Re-engineering
  - Just-in-time manufacturing
  - Mass customization
  - Employees monitor their own productivity
  - Later: moved to customized electronic catalogues
  - Build web sites at Dell, for their large customers

HTTP

- Another protocol on top of TCP/IP
- How does it work?
  - Client/Server
  - Serves Web Pages
    - CGI bin, Common Gateway Interface, typical of Unix Servers
    - ASP: Active Server Pages, typical of Microsoft servers
    - Can dynamically, on demand, build varying pages to be served
  - Uses HTML for presentation

HTML

- History and place in industry
  - Hypertext named in the 1960 by T. Nelson in his book: “Literary Machines”
  - Scientists working on a generalized markup languages GMLs
  - ISO standardized SGML in 1986
    - Mark up documents independent of computer hardware and software
    - Very exacting language: DOD, Assoc. American Publishers, Hewlett-Packard, Kodak, etc., use SGML

SGML

- Key Attributes and Advantages of SGML
  - Can last a long time due to standards of the ISO
  - Nonproprietary and software/hardware independence give it long lasting ability
  - Supports user defined tags
- Disadvantages and difficulties
  - Expensive to set up and run
  - Expensive compared to HTML
  - Has a steep learning curve

HTML and XML

- Both have their own DTDs (Document Type Definitions)
- T. Berners-Lee (and others?) trimmed down SGML to create HTML
- HTML only places and formats text!
  - Only static details, no “page state” is kept
  - Cannot interpret the meaning of parts of a page
- XML (eXtensible Markup Language)
- XML is also based on SGML
- XML is designed to have some understanding of the semantics of data on a page

HTML's Weakness

- Lacking the ability to maintain the state of a visitor has lead to:
  - XML
  - JavaScript
  - Java applets, etc.
  - Visual Basic (as applied to the web)
- Lacking the ability to understand details of its own data has given way to complex servers

XML

- See www.xml.com
- XML both
  - Retains the state of a page or web surfer
  - “Understands” the content of a page
- Has metadata: information about data in a page
- Helps automatic processing on web pages

XML

From www.xml.com :

```
<?xml version="1.0"?>

     <oldjoke>
     <burns>Say <quote>goodnight</quote>,
        Gracie.</burns>

     <allen><quote>Goodnight,
         Gracie.</quote></allen>

     <applause/>

     </oldjoke>
```

XML

- <!ELEMENT oldjoke (burns+, allen, applause?)>
- Syntax:
  - X+ means one or more
  - X means exactly one
  - X? means perhaps one
  - Similar to Regular Expression Syntax

HTML Basics

- <tag_name properties> Text to be Displayed </tag_name>
- Example: <B> Wow! </B>
- **Wow!**
- Tags not case sensitive
- Opening and closing tags, one sided tags: <P align="right">

HTML Basics

- The main attraction: html links!
- Visit Rutgers!
- RU Business!
- Click Here to Go There
- <a name="ref_1"> !!!

HTML

- Check out: www.loc.gov/global/internet/html.html
- Also: www.w3.org
- Current specification since 24-Apr-1998 is 4.0, revised 24-Dec-1999 to 4.01
- Varying link structures
  - Linear
  - Trees
  - Other

Personal Web Pages

- Various HTML editors
- MS Word, for example
- The public_html directory
- The file index.html
- Everything in public_html is viewable by the world!

Creating a Web Page

- Create a subdirectory public_html:
  - md public_html
- Enable public access:
  - chmod a+xr public_html
- Logout
- ftp the content of the “Homepage” directory to public_html
  - ftp ftp.eden.ruters.edu
  - Login using your account name and password
  - cd public_html
  - put index.html
  - etc.
- Test! Test! Test!

Personal Web Pages

- <HTML>
- <HEAD>
- <TITLE>
- Peter R. Gillett
- </TITLE>
- </HEAD>
- <BODY>
- This is a test.
- This is a test.
- This is a test.
- This is a test.
- This is a test.
- This is a test.
- This is a test.
- This is a test.
- This is a test.
- </BODY>
- </HTML>

Personal Web Pages

- http://rucs.rutgers.edu/websupport.html
- http://www.nbcs.rutgers.edu/www.html
- http://www.eden.rutgers.edu/template-body.html
- http://newarkwww.rutgers.edu/pubadmin/TPA/TPA-Spring2000/webpages/webpages.PPT

Testing, testing and testing!

- Which web browsers
- Which versions of which web browsers?
- Loads - how many web pages served?
- Interactive speed on weak home computers
- Regression Testing
- Unit Testing
- Market Research Testing

Internets, Intranets and Extranets

- Internet: World-Wide WAN
- Intranet: web-based private network
- Extranet: intranet connecting business partners, certain customers or suppliers
- Extranets and Wal-Mart's inventory management: letting the suppliers see the inventory moving off the shelves

A Start on E-Marketing

- Two key issues of building web pages
  - Marketing (Issue for most B2C and B2B)
  - Logistics (Wal-Mart example)
- Profit = Revenue – Cost
- Marketing focuses on Revenue
- Logistics focuses on Costs
- Both part of the same equation!

E-Marketing

- Selling is hard: sell commodity X
  - Makes potential buyers of X aware you are selling X
  - Brand positioning of you with other vendors
  - Sales strategy
  - Make the Sale!
- Flavors: relationship marketing, one-to-one marketing, mass marketing

What can the Internet Offer?

- Mass marketing? Yes, but more!
  - Demographics of the Internet still pretty good
  - Make it easy for your customers to find you
- Relationship marketing? Yes,
  - Use the Internet as another contact media
  - See the Dell example and my-yahoo: make customers dependant on you
- One-to-one marketing?
  - Gigantic Advances!

Some Details

- New brand image media
  - Media of its own
  - Enhancing other media
- Product comparison transparency
- Transaction costs/friction minimized
- Changing vendors costs/friction minimized (oops!)
  - How can we change this?

Internet One-to-One Marketing

- Computers and Humans: complementary
  - In general what machines can do enhances what humans can do
- Know your potential customer!
  - Who looked in my window? How much do they spend on shoes a year?
  - How many people that look in my window make a purchase?
  - Those days I have a red background do I sell more than when I have a green background?

Direct Marketing

- Tools
  - Sign up!
  - Email marketing
    - Very low cost
    - Click a link and explore more offerings
    - Most direct marketing details translatable
      - Coupons
      - Frequent-flyer miles (even easier)
    - Other things?
    - Beware of spam!

Classical Purchase Model

1. There is a need for a solution
2. Search for a solution, explicitly or implicitly
3. Discovery or examination of different solutions
4. Possible refinement of needs
5. Evaluation of different solutions
6. Purchase
7. Possible service or follow up

Internet Effects on Purchase Model

- How has the Internet effected this?
- Has every step been effected?
- Where are the traps and pitfalls?
  - Have you seen any traps and/or pitfalls?
- How could different firms use such models to enhance their web sites
- What is your web site's goal?
- Web site strategies and planning
- WIIFM?

Choi et. al.'s Cube of EC

- http://uts.cc.utexas.edu/~soon/vita/selling-online.html
- X-axis: type of delivery agent: from physical to electronic (to virtual)
- Y-axis: type of product: from physical to electronic (to virtual)
- Z-axis: market processes: from physical to electronic (to virtual)

Lessons from Choi et. al.'s Cube

- The New Economy
- How extensive is it *really*? At least as seen through this cube?
- Does the virtual dimension make any sense?
  - How can we exploit virtual information?
- What good do such models give us?
- Where to next?

The Story So Far . . .

- Comer:
  - Chapter 20: Email
    - Mailboxes
    - Email addresses
    - Client/Server!
    - Mailing lists
  - Chapter 21: Bulletin Boards/News
    - Subscribing
    - Netiquette

The Story So Far . . .

- Comer:
  - Chapter 22: Web Browsers
    - Gopher
      - Gopherspace
      - Veronica Very Easy Rodent-Oriented Net-wide Index to Computerized Archives
    - URLs
  - Chapter 25: Automated Web Search
    - Search Engines
    - Directories
    - String matching
    - Boolean Logic

The Story So Far . . .

- Comer:
  - Chapter 27: Faxes and FTP:
    - Anonymous FTP
    - Archie (database of FTP sites and their contents)
  - Chapter 28: TELNET
    - Remote access

Class Projects

- Personal Web Pages
  - Will be due March 5
- Projects
  - Will be group projects
  - Produce a paper or demonstration relevant to the class
    - Proposals due March 26
    - First Draft due April 16
    - Presentations and Final versions due April 30