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Internet Technology and E-Business

Dr. Peter R. Gillett

Associate Professor

Department of Accounting & Information Systems
Rutgers Business School – Newark & New Brunswick

OVERVIEW

- Finish Introduction to Internet and E-Commerce
- Survey how the Internet works

Electronic Commerce

- B2C or B2B
- Intel on the Web (B2B)
  - From 0 to about $1 billion in orders a month
  - 45,000 faxes/quarter from Taiwan alone
- Started with EDI
- Extranets, Intranets today
- Very large opportunities

EC Pros for Firms

- 24/7
- Global, giant market place, more customers
- Pull technology & inventory management
- Reduces capital costs
- Level playing field for small business?
- Enables niche markets

EC Pros for Society

- Public services better
- Cheaper prices
- More competition
- More mixing of different economies
- New and larger communication media

EC Pros for Customers

- Cheaper products or services?
- More choices, larger market
- 24/7
- Customizable products
- Virtual auctions (distance & size)
- Electronic communities

Problems for EC

- Questionable EC Patents
  - Patents for Business Processes
  - Questionable Business Models
  - “Dot-Coms with patents are worth 10% more”
- Standards for quality, reliability & security
- Bandwidth issues
- Legacy application integration
- Cost
- Taxation
- International Issues

More Problems for EC

- Consumer hesitation
- Brick & mortar still good alternative
- Zealous government regulation
- Money problems lately: market shakeout
- Depends on complex systems
- Disintermediation & displacement

EC Business Models

- Advertising
- Market research/Data Marts
- Merchants
- Transactions, Finance
- Auctions
- Logistic details/services
- Support brick & mortar

Advantages of Ads on the Web

- Interactive & immediate feedback/purchase
- Data mining and other targeting techniques
- Benevolent demographics on the Web
- 24/7 interactive - pull & more one-to-one
- Going to multimedia
- Direct e-mail ads almost Free
- Often the ad runs on consumers machine
- Personalization and customization

E-Marketing

- Interactive Marketing - Instant
- Primary Data on the Web: OLAP & Simulation (http://www.olapreport.com)
- The Web has lots of secondary data
  - Government sites, proprietary data
  - Observe consumer's movements
- Ask customers what they want: one-to-one
- CRM: Customer Relationship Management
- Market Intelligence & Bots

E-Commerce Infrastructure

- Networks
- Web servers
- Web server support and software
- E-catalogues
- Web Page Design and Construction Software
- Transaction Software (POS)
- Internet Access Components
- Other: Firewalls, email, etc.

How the Internet Works

- Packet switching
- TCP/IP
- IP Addresses
- Ping / tracert
- Client/Server and TCP/IP
- Domain Name Servers
- HTTP, SMTP, POP, IMAP
- OSI
- Ethernet
- Routing
- Quality of Service
- Moore's Law?

Packet Switching

- We have already had a taste of this from prior lecture
- What does sharing network links do for us?
- Sharing by essentially taking turns, by the packets
- Variable sized packets are possible, though up to some limit
- Universal protocol eases use

Conflicting Network Technologies

- Incompatibility of net technology, even in the same firm
- Router: special computer to route packets
- ISP
  - Interesting pricing issues
  - Interesting connection topology issues
- Leased circuits are expensive
- The Last-Mile Problem
  - DSL and ADSL
  - Cable Modems
- Simulate continuous connectivity

TCP/IP

- Two layered protocol
- TCP controls the assembly and reassembly of packets
- IP is responsible for routing packets and the addressing details for the packets
- Routing Algorithms
- Other protocols: UDP for broadcasting (not peer to peer like TCP)

IP: Internet Protocol

- IP datagrams: packet in the format specified by the IP
- Notion of Virtual Network: IP and routing allows appearance of a completely connected network

TCP

- TCP provides reliable and error free communication
- Uses ACKs, that is acknowledgments and sequencing in the IP datagram packets
- Can force retransmission
- Automatically adjusts timeout based on network loads, distance, etc.

IP Addresses

- 32-bit numbers being phased into 128-bit numbers (IPv6)
- Packet contains source and destination address
- Dotted quads: 255.255.255.255
- Uniquely identifies each computer on the internet
- Name servers and domain names as syntactic sugar for the dotted quad numbers (URLs, etc.)
- Generally, computers on the same “subnet” or LAN have the same prefixes

Ping

- Answers: “Tell me how fast ‘very important’ packets take to get from my computer and back?”
- General network connectivity
- Also, tracks the order the packets are received in
- Internet Control Message Protocol (ICMP) Echo Request Packets sent by ping
- ICMP: what IP uses to communicate network information: “send fewer packets”, “send your packets over there”, etc.

Ping

- TTL: time to live
- TTL packet field set to 255
- TTL decremented by 1 for each router traveled through
- Normal message packets usually have TTL field set to 60
- Time field: round-trip time in milliseconds
- Watch the variance of the round trip time

traceroute

- Answers: “What path do my packets take to get to your computer?”
- Which router hops, how many and the time between the hops
- Uses TTL tricks to discern paths
  - First packets TTL = 1, when first router discards the packets (since TTL = 0), it sends back an ICMP message saying “discarded packet since TTL = 0” from router X
- Interesting asymmetric issues

Ping and traceroute

- Important Network diagnostics
- Carefully applied: eat lots of resources
- ping www.rutgers.edu or ping www.andromeda.rutgers.edu
- tracert www.rutgers.edu
- tracert www.google.com
- VisualRoute

Client/Server Model and TCP/IP

- Master/Slave or Resource Sharing
- Allows or Encourages Specialization
- Important model in Enterprise Computing
- Money Saver:
  - Shared resources
  - Virtual Network
- Common protocol, good and easy to interconnect with everyone

Client/Server Model and TCP/IP

- Peer to peer
- Today's classic: http and web browser
  - Which is the client? Which is the server?
- TCP/IP allows easy communication
- Use of TCP/IP can be programmed into large distributed programs!
- Pipes and sockets
- TCP/IP allows one part of a program to wait for information from another computer without negative ramifications
- Real distributed computing - the power of parallelism

Client Server/Business Aspects

- Redundancy
- Cost
- Well understood paradigm
- Often based on well understood protocols (TCP/IP)
- Easy to plug into
- Can handle giant loads and jobs

Domain Name Servers (DNS)

- Like directory assistance
- Translates name (like www.rutgers.edu) into IP number (128.6.4.5)
- Essentially allows easy-to-use names for Client/Server paradigm to work
- Each computer on the Internet knows its DNS
- What if your DNS is not secure?

HTTP

- http: hypertext transfer protocol
  - Protocol responsible for transferring and displaying web pages
  - 1991 Tim Berners-Lee, at the time in CERN
- The transport part runs “on top of” TCP/IP
  - Movies, sound, graphics, etc. the http client automatically requests these from the http server
- HTML is the major display part that is used to display things in particular ways

SMTP, POP, IMAP

- Mail servers
- So far, email is one of the biggest “killer apps”
- SMTP: simple mail transfer protocol
  - Specifics and standards for email servers
- POP: post office protocol
  - Gets email from SMTP mail server
  - MIME: Multipurpose Internet Mail Extensions, that is attachments
- IMAP: Internet Message Access Protocol: more flexible and advanced than POP

Old Friends

- ftp, telnet and finger
- All can be used also for network debugging
- ftp and telnet for network movements

ISO/OSI Reference Layer Model

- www.it.kth.se/edu/gru/Telesys/95P2_Telesystem/HTML/Module4/ISO-1.html
- Based on Frank Reichert's notes
- Describe Computer Communication Services and Protocols without making assumptions of
  - Programming languages bindings
  - Operating systems bindings
  - Application and User interface issues
- Models organize knowledge for discussion and dissemination

Define Communication Layers

- Where we must clearly define interfaces for development
- To group related functions together
- Use layering to insulate different places where changes occur
- Layers to expose and standardize important services
- Isolate the changes and the effects of changes as things evolve
- Documentation of existing services in a clear and independent manner

Famous Seven Layers

1. Physical Layer, electric, optical, or acoustic, etc.
2. Link Layer: reliable transfer across link layer, framing of data blocks, error detection, link control flow
3. Network Layer: data transmission, switching technology, topology of the network and paths for data
4. Transport Layer: reliable transparent data transfer between points, error recovery

Famous Seven Layers cont.

5. Session Layer: establishing a session, management of communications
6. Presentation Layer: Encryption, compression, attachments, etc.
7. Application Layer: Managing communication of applications at a high level.

ISO/OSI Layers

- Where does all the stuff we talk about fit in?
- TCP/IP?
- Business Applications?
- Why is the ISO/OSI model useful?

Daryl's TCP/IP Primer

- www.ipprimer.windsorcs.com/section.cfm
- Ethernet
- ISO Model
- IP addresses and masks
- Subnetting
- TCP and UDP
- DNS
- Q&A

Ethernet in some Detail

- XEROX PARC in early 1970s
- Simple, High speed, Reliable and one of the most long-lasting network protocols ever
- Most popular forms:
  - 10BaseT, unshielded twisted pair all connect in a star to a single hub
  - 10Base2, single coaxial cable in “bus configuration”
  - 10BaseF, fiber optic cables, often star with central hub

Ethernet in some Detail

10baseT	Reliable	Short dist to hub	Small Office or home
10Base2	No hub, 200m dist.	One break, no network	Small networks
10BaseF	1km dist. No electrical interference	Costly	Large Scale

Ethernet in some Detail

- Daryl: “A bunch of loud people in an unmediated meeting room”
- Collision detection and random retries:
  - CSMA/CD: Carrier Sense Multiple Access with Collision Detection
- Famous RJ45 connectors: like large phone connectors
- 100BaseTX is used too, likewise Gigabit or 1000Mbps

Bottom of the OSI Model

- Network: IP, AppleTalk, IPX, all use routers
- Datalink: Ethernet, token ring, PPP, SLIP: bridges repeaters and hubs
- Physical: twisted pair, coax, serial cable, fiber: use modems, CSU/DSUs
- Each model cannot see the model below it

IP addresses in Detail

- RFC 1812 the basis of present IP
- Go to www.freesoft.org/CIE/RFC/1812
- Old RFC had class “A”, “B” or “C” IP addresses
- New CIDR (Class Internet Domain Routing)
- This gives a CLASSLESS addressing scheme, allows subnetting more easily

Net Masks

- Binary: AND, OR and XOR
- Allows subnetting, by forcing the packets addressing to pay attention only to part of the IP address
  - Convert IP to binary
  - AND subnet mask: leaves only a part of the IP address
- What is this for?

Net Masks

- Suppose my computer is 129.66.240.15
- I want to send a message to 129.65.15.240
- Are they on the same subnet?
- What is my subnet mask?

Net Masks

- Say it is 255.255.0.0
- I am at
  10000001 01000010 11110000 00001111
- I want to send to
  10000001 01000001 00001111 11110000
- My subnet mask is
  11111111 11111111 00000000 00000000

Net Masks

- Say it is 255.252.0.0
- I am at
  10000001 01000010 11110000 00001111
- I want to send to
  10000001 01000001 00001111 11110000
- My subnet mask is
  11111111 11111100 00000000 00000000