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*Internet Technology and
E-Business*

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Outline

- Another (closer) look at TCP
- Multicast and the Mbone
- Ubiquitous Computing
- Skepticism on Information Appliances
- Wearable meets Ubiquitous
- Audio and Video Communication
- Information in places
- Legal Issues and the Internet
- More on Internet Prices!
- Wall Street Journal: April 15, 2002

TCP up close

■ Best Effort

- * No promises to when or if a packet will arrive
- * This leads to problems when there is congestion

■ Dynamic adjustment of packet routing

- * Packet losses automatically slow the send rate
- * Packet delivery success automatically increases the send rate

■ Lots of empirical studying lead to these adjustment routines

TCP up close

- These increases and decreases are not directly proportional
- AIMD: additively increase, multiplicatively decrease
 - * On success: Additively increase the send rate by one-unit
 - * On failure: multiplicatively decrease the send rate by half

TCP up close

- Is AIMD the best algorithmic approach for the Internet?
- This is a question of on-line competitive analysis
 - * *We don't have all inputs in advance*
 - * *We do have the range of parameters of the possible inputs*
 - * *Empirical evidence is very important*
- What does this tell us about business in general?

TCP: Details of The Protocol

- Client/Server Paradigm
- To establish a connection
 - * Server prepares to accept a connection
 - ◆ Socket, bind and listen
 - * Client tries to open a connection
 - ◆ Connect
 - * Client sends SYNC with number of first packet
 - * Server sends ACK matching SYNC with number of first packet
 - * Client sends back SYNC

TCP: Details of The Protocol

- Shutting down a client/server TCP link
 - * Client: sends FIN to Server
 - * Server: sends ACK to Client
 - * Server: sends FIN to Client
 - * Client: sends ACK to Server

UDP

- User Datagram Protocol
- Simple but Unreliable
- Point to many peers
- Lacks handshakes
- What is the purpose?

Multicast and the Mbone

- Multicast over the virtual Mbone
- Some Internet routers support multicast
- Standard method: point-to-point: TCP/IP
- UDP gives us the ability to go point-to-many
- First seen on Ethernet, “everyone can listen to one or two channels”
- Ethernet’s broadcast address

Multicast and the Mbone

- Where is this going?
 - * Large dynamic trunks of circuit switching for routing the packets?
 - * Visio-Phones, etc.?
- Virtual trunk lines?
- VPNs?
- Net2Phone?
- In the convergence of the Internet, this seems like a natural step

Ubiquitous Computing

- What is it? (From Mark Weiser, Xerox Parc)
 - * Mainframe and mini-computer: one computer serves many people
 - * Personal computer: one computer per person
 - * Ubiquitous computing: many computers per person
- Two Types
 - * Nomadic (PDAs, computing in cell phones, etc.)
 - * Fixed in an environment (in your car, in your toaster, etc.)

Ubiquitous Computing

- The Internet is the glue of Ubiquitous Computing
 - * Especially, the wireless Internet
 - * Why?
- What is so important about wireless for Ubiquitous Computing?
- Why is even very short distance wireless significant?

Ubiquitous Computing

- Many developments can be traced to Xerox PARC (see M. Weiser)
 - * Mouse
 - * A. Kay's Dynabook is today's PDA
 - * Modern GUIs: Xerox Dolphin Computer
 - * Ethernet
- Why is it said that ubiquitous computing is the “opposite” of virtual reality?

Ubiquitous Computing

- Some interesting differences between humans and computers (some are debated)
 - * Precision
 - * Speed & tirelessness
 - * Accuracy and size of memory
 - * Interconnectivity (Internet!)
 - * Intelligence
 - * Life
- What a symbiosis mixing these factors offers us!

Ubiquitous Computing

■ Needs/Requirements:

- * **Low power**
- * **Autonomy**
- * **Internet Connectivity**
- * **Human Interfaces**
 - ◆ Voice Control
 - ◆ Speech Generation
 - ◆ Good deployment

■ TCP/IP shortcoming: geographic dependence, problem for nomadic Ubiquitous Computing?

■ Use Phone Network? Last mile problem again?

Ubiquitous Computing

- Weiser's idea of "Scrap Computers"
- Analogy to scrap paper, the next giant step after writing was invented?
- Autonomous agents? Intelligent agents?

Ubiquitous Computing

- Calm Technology
 - * Inter Office Windows
 - * Internet Multicast
 - * Dangling String

Skepticism on Info. Appliances

- By A. M. Odlyzko
- Challenges Ubiquitous Computing, comments on “The PC is Dead”
- The three premises he focuses on:
 - * Proliferation of Info. Appliances
 - * Info. Appliances will eliminate PC frustrations
 - * Microsoft and PC domination will end

Skepticism on Info. Appliances

- The three premises he focuses on:
 - * Proliferation of Info. Appliances: A.M.O: “YES”
 - * Info Appliances will eliminate PC frustrations: A.M.O: “NO”
 - * Microsoft and PC domination will end: A.M.O: “Maybe”

Skepticism on Info. Appliances

- Info. appliances will fit well into their spots
- However, they will likely come with their own complexity and frustration
 - * *What do you think?*
 - * *Nomadic vs. fixed?*
- Usability and flexibility: natural conflict?
- The marketing of flexibility
 - * *Direct*
 - * *Indirect*

Skepticism on Info. Appliances

- Threshold based measures of frustration and complexity
 - * Mosaic: enabled the web
 - * A.M.O.: paraphrase “Internet from research toy to revolutionary tool”
- Trying to temper over-optimistic promises of Info. Appliances
- There are good uses and examples of Info. Appliances in use: PDAs, Cell-Phones in Finland, etc.

Skepticism on Info. Appliances

- The average American household has about 40 microprocessors in it!
 - * Microwaves, cell phones, cars, self-focusing cameras, etc.
 - * Generally, none of these microprocessors communicate with each other or with any other computers
 - * Very specific functioning
 - * Leaving the microprocessors massively underutilized and very rarely processing at all
 - * Very specialized interfaces to human interaction

Skepticism on Info. Appliances

- Notions of the “Invisible computer” of D. Norman
- From radio to the Internet
 - * The first generation of radio required experts
 - * The first generations of radio evolved radio programs
- The Internet
 - * The expert phase is gone
 - * Now we are evolving the “Internet programming”
- Info. Appliances-Internet Based
 - * The expert phase is here now?
 - * What will they really do if they are all connected?

Skepticism on Info. Appliances

- Human Interfaces
 - * Voice recognition
 - * What about voice recognition feed-back?
 - * Palm-Pilot: new scripts
- What will my toaster say to my refrigerator?
- The complexities of 40 internet connections, never mind 400 in your house!

Wearable meets Ubiquitous

- B.J. Rhodes, N. Minar and J. Weaver
- Challenges of Wearable and Ubiquitous computing
- Ubiquitous Computing challenges:
 - * Privacy
 - * Personalization
- Wearable Computing
 - * Localized information and resource control
 - * Resource management between different people

Wearable meets Ubiquitous

- Ubiquitous computing includes smart rooms
 - * Sensors for people, etc. - badges on the people
 - * Air-conditioning, blinds, lights, etc.
 - * Routing the printing of documents, incoming faxes, etc.
- Privacy issues abound!
- Legal issues: “central databases are prime targets for subpoena”
- Updating profiles, etc. for new employees is a problem

Wearable meets Ubiquitous

- Put the sensors on the humans, not in the smart rooms!
- Data distributed to employees, etc.
- Still susceptible for traffic analysis
- TCP/IP has no provision for anonymity
- Use of system to breach information

Wearable meets Ubiquitous

■ Problems with Wearable

- * Localized information: updates information about a room, then all wearables must be updated
- * Don't put too much control in the wearable, otherwise it is a drag on the device
- * Several people sending signals, can be a problem, overload sensors or airwaves

Wearable meets Ubiquitous

- Communication needs
- Maintenance needs
- Computing needs
- Human interface needs
- Power needs
- Other issues?

Information in places

- By J. C. Spohrer
- WorldBoard: proposed world-wide Information standard
- Vannevar Bush, director of US office of Scientific Research and Development
 - * “called for a new relationship between people and the sum of their knowledge”
- The Internet is enabling this!

Information in places

■ Information objects

- * Geo-coded signs with animation and special effects should be in physical space:
Worldboard channels
- * Associate information with places
- * Enhance information/perception services
- * GPS enabled devices help these goals along with the (wireless) Internet

Information in places

- The virtual red-carpet in your glasses leading you around
- Started with Ivan Sutherland (famous graphics person)
- Augmenting the physical world with virtual reality to enhance our real experience, not to make it artificial
- Augmented Reality vs. Virtual Reality
- Complex visual effects on demand!
- Detailed history or local customs

Information in places

- Extending human perception
- Magnifying:
 - * Microscope
 - * Telescope
- Enhancing:
 - * Telescope that can find the constellation you are interested in
 - * Then it points out particular details and discusses the best time to look at it: more ubiquitous computing?

Information in places

- This can be built to exploit human perception to enhance information and understanding
- Discussions and human interaction are filled with mental models
 - * **Make them explicit**
 - * **Save them over time**
 - * **Share them with others**
 - * **Build on them**

Information in places

■ Interesting issues

- * **Inherently distributed media**
 - ◆ Low bandwidth, usually
 - ◆ Low computation, often
 - ◆ Lower storage requirements
- * **Store history on location!**

Information in places

- Where is the problem!?!?
 - * Initial Concept
 - * Historical Background
 - * Technical Feasibility
 - * Potential Applications
 - * Social Implications
 - * Reflections
- Which order should these be approached in?

Information in places

■ Design Goals

- * Planetary
- * Improve with technology
- * Simple and useful

■ Augmented reality systems are around (see paper for details)

Legal Issues and the Internet

■ The Global Perspective

- * Privacy
- * Copyright
- * Patents
- * Taxes
- * Judicial
- * Enforcement

Legal Issues and the Internet

- International Standards
 - * Harmonization of laws and standards
- Globalization of enforcement
 - * Who does what to whose citizens?
- Amelioration
 - * Pareto optimality
 - * Rawlsian justice

Legal Issues and the Internet

- Computers used in harmonization, globalization and amelioration?
- Encode laws and see if they are consistent
- Let computers make the call for you on the issues of what is legal and what is illegal?

More on Internet Pricing!

- Fixed v. floating pricing
- Are fixed prices floating over time?
- Does 'Internet time' make fixed prices float in shorter spans of time?
 - * *Just-in-time manufacturing*
 - * *Instant delivery of digital products*
- How has the Internet's try at floating pricing worked?
- Is running Dell's configurator making you a subcontractor of Dell?

More on Internet Pricing!

- Exactly where do Internet Auctions fit in?
- Auctions are effectively floating prices
 - * Supply and demand is up front and center
- Negatives for auctions
 - * Add complexity and time to a purchase
 - * You may not get what you make an offer on, in fact this is likely, unless you pay too much
 - * What about your time setting up your bid?
 - * Do most people like the excitement?

More on Internet Pricing!

- How closely can we tie configurators and Internet auctions?
- Auctions focus everything on price
- Configurators focus on the attributes and components with price a constraint
- What else?

The Price We pay

- Wall Street Journal: April 15, 2002
 - * More Web Sites are charging consumers for information that once cost nothing
 - ◆ Will it stick?
 - * Pop-up ads may be intrusive and annoying
 - ◆ But they are here to stay
 - * Court Battle: Who sets the rules for Cyberspace?
 - ◆ California?