Managing Telecommunications

Chapter 6
Information Systems Management In Practice 6E
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Introduction

- Telecommunications = electronically sending data in any form from one place to another between
  - People
  - Machines, or
  - Objects

- Generally, IS departments have been responsible for designing, building, and maintaining the information highway in the same way that governments are responsible for building and maintaining streets, roads, and freeways

- Once built, the network, with its nodes and links, provides infrastructure for the flow of information and messages

- Telecom is the basis for the way people and companies work today
  - It provides the infrastructure for moving information and messages

The Evolving Telecommunications Scene

- Even with the recent ‘downturn’ in some countries – the changes in Telecom are coming fast and furiously. Here are some major changes taking place:

  - A New Telecommunications Infrastructure is Being Built:
    - The oldest part of the telecommunications infrastructure is the telephone network
      - This global network was built on twisted-pair copper wires and was intended for voice communications
      - It uses analog technology, which although appropriate for delivering high-quality voice, is inefficient for data transmission
    - The basic traffic-handling mechanism had to change for data
    - Today, the new telecommunications infrastructure is being built around the world aimed at transmitting data, and consists of:
      - Wired - fiber optic links
      - Wireless – radio signals
    - Both use packet switching, where messages are divided into packets, each with an address header, and each packet is sent separately
      - No circuit is created; each packet may take a different path through the network
    - Packets from any number of senders and of any type, whether e-mails, music downloads, voice conversations, or video clips, can be intermixed on a network segment

- The Internet can handle all kinds of intelligent user devices, including:
  - Voice-over-IP (VoIP) phones
  - Personal digital assistants (PDAs)
  - Gaming consoles, and
  - All manner of wireless devices

- The global telecom infrastructure is changing from a focus on voice to a focus on data
The Telecommunications Industry is Being Transformed

• The telecom structure of old was originally provided by (often Government owned) monopolies
• Gradually, the telecom industry has been deregulated
• Bandwidth on fiber is now doubling capacity every four months

The Internet is the Network of Choice

• What has surprised most people is the Internet’s surprisingly fast uptake for business use
• In the late 1990s, the Internet caught most IS departments by surprise, not to mention the hardware and software vendors who serve the corporate IS community
• The Internet actually began in the 1960s when it was called ARPANET, mainly used for electronic mail
• By 1993, it was still mainly a worldwide network for scientists and academics, text only - no graphics

The Internet is the Network of Choice cont.

• That all changed in 1994 when the World Wide Web was invented (By Tim Berners-Lee in Geneva.)
• This graphical “layer” of the Net made it much more user friendly:
  – Web sites had addresses specified by their universal resource locator (URL)
  – Its multimedia Web pages were formatted using hypertext markup language (HTML)
  – All the Web sites could be accessed via an easy-to-use browser on a PC

The Internet is the Network of Choice cont.

• The Internet has three attributes that make it important to corporations:
  – Ubiquity
  – Reliability, and
  – Scalability
• Today, the protocols underlying the Internet have become the protocols of choice in corporate networks, for internal communications as well as communications with the outside world
• The norm is now end-to-end Internet protocol (IP) networks

Extranets

• Not long after creating intranets, businesses realized they could extend the intranet concept into an extranet
  – A special part of the intranet for use by trading partners, customers, and suppliers for electronic commerce
• The notion caught on and extranets have become an important component of B2B e-commerce
Digital Convergence Has Become a Reality

- Digital convergence is the intertwining of various forms of media – voice, data and video
- Convergence is now occurring because IP has become the network protocol of choice
  - When all forms of media can be digitized, put into packets and sent over an IP network, they can be managed and manipulated digitally and integrated in highly imaginative ways
- IP telephony and video telephony have been the ‘last frontiers’ of convergence – and now they are a reality

IP Telephony

- The use of Internet to transmit voice to replace their telephone system
- Few companies have given up their telephone networks for a VoIP network, but as the cost differential continues, more will switch
- Became ‘hot’ in 2004. Previously the voice quality wasn’t there
- Can be managed electronically from e.g. one’s PC = possibility of ad hoc conferencing
- Rather than analog, the IP phone generates a digital signal
- Routed over the LAN like any other data in packets either:
  1. To another IP phone on the LAN
  2. Through the company’s WAN to a distant IP phone on another of the company’s LANs, or
  3. Through an IP voice gateway to the PSTN to a standard telephone
- Video Telephony

OSI Reference Model

- The worldwide telephone system has been so effective in connecting people because it has been based on common standards worldwide
  - Today’s packet-switching networks are also following some standards in most cases
  - The underpinning of these standards is the OSI Reference Model.
- We now live in an “open systems” world, and the most important architecture in the Telecom world is the Open Systems Interconnection (OSI) model

OSI Reference Model cont.

- Analogy of mailing a letter: - see Figure 6-2
  - Control information (address and type of delivery) on the envelope - determines the services provided by the next lower layer and addressing information for next lower layer
  - When a layer receives a “message” from the next higher layer, it performs the requested services and “wraps” the message in its own layer of control information
  - It passes the “bundle” to the layer directly below it. On the receiving end, a layer receiving a bundle from a lower layer unwrap the outermost layer of control information, interprets the information, and acts on it
The Rate of Change is Accelerating

- Although no one seems to know for sure, many people speculate that data traffic surpassed voice traffic either in 1999 or 2000
- E-mail outnumbered postal mail for the first time in 1995
  - Unfortunately now many are Spam (junk)

- The number of PC sales overtook the number of TV sales in late 1995
- Such changes will only accelerate
  - Everyone in business must become comfortable with technology to cope with this brand new world of ever-increasing technological change

The Optical Era Will Provide Bandwidth Abundance

- Decline in cost of key factors:
  - During the industrial era = horsepower
  - Since the 1960s = semiconductors
  - Now = bandwidth
- We are now approaching another "historic cliff of cost" in a new factor of production: bandwidth
  - "If you thought the price of computing dropped rapidly in the last decade, just wait until you see what happens with communications bandwidth"
- Fiber optic technology is just as important as microchip technology. 40 million miles of fiber optic cable have been laid around the world, in the USA at a rate of 4,000 miles per day

The Optical Era Will Provide Bandwidth Abundance cont.

- Half of the cable is dark, that is, it is not used. And the other half is used to just one-millionth of its potential, because every 25 miles it must be converted to electronic pulses to amplify and regenerate the signal

The Optical Era Will Provide Bandwidth Abundance cont.

- Downloading a digital movie, such as The Matrix:
  - Takes 7 hours using a cable modem
  - 1 hour over the Ethernet
  - Four seconds on an optical connection
- Over the next decade, bandwidth will expand ten times as fast as computer power and completely transform the economy

The Wireless Century Begins

- The goal of wireless is to do everything we can do on wired networks, but without the wire
- Wireless communications have been with us for some time
  - Mobile (cell) phones, pagers, VSATs (Very Small Aperture Terminal), infrared networks, wireless LANs etc.
- The 20th century was the Wireline Century, the 21st will be the Wireless Century
Licensed Versus Unlicensed Frequencies

- Some frequencies of the radio spectrum are licensed by governments for specific purposes; others are not
- Devices that tap unlicensed frequencies are cheaper = no big $ licensing fees

Wireless Personal Area Networks (WPANs)
- Provide high-speed connections between devices that are up to 30 feet apart

Wireless Local Area Networks (WLANs)
- Provide access to corporate computers in office buildings, retail stores, or hospitals or access to Internet “hot spots” where people congregate

Wireless Metropolitan Area Networks (WMANs)
- Provide connections in cities and campuses at distances up to 30 miles

Wireless Wide Area Networks (WWANs)
- Provide broadband wireless connections over thousands of miles

Wireless Long Distance

- The first cell phones used analog technology and circuit switching, now called first-generation (1G) wireless
- 2G cellular. 2G, which predominates today, uses digital technology, though it is still circuit switched
  - It aims at digital telephony, not data transmission, but 2G phones can carry data
  - 2G can use a laptop with a wireless modem to communicate
  - 2G can carry messages using short messaging service (SMS)

- 2.5G cellular is extending the life of 2G digital technologies
  - Essentially adds data capacity to a 2G network
  - The problem with adoption has been pricing

- The goals of 3G are to provide WANs for PCs and multimedia devices to access the Internet

- New entrants are looking for 3G alternatives
  - One is mobile broadband IP, which could actually provide 4G services (the user paying for different kinds of services)
  - Wireless mesh networks
    - Links are radio signals not wires
    - More flexible but uses a lot of battery power
  - VSAT (Very Small Aperture Terminal) technology is taking off in some countries because it is seen as the best technology for providing stationary wireless broadband
    - Provided by DSL, coaxial cable and T carriers

Wireless technologies for networks that cover different distances

- Wireless Personal Area Networks (WPANs)
- Wireless Local Area Networks (WLANs)
- Wireless Metropolitan Area Networks (WMANs)
- Wireless Wide Area Networks (WWANs)
Is Wireless Secure?

• Security is a major issue today

• Eavesdroppers need special equipment

• Spread-spectrum technologies add security, encryption protects data, and eventually, 802.11i will provide a framework for security

• Requires eternal vigilance

Is Wireless Safe?

• Although a lot of attention is focussed on all the new wireless services, a troubling question has not yet been answered: Are these transmissions safe for humans?

Messaging Is a Killer App

• What has proven true with data communication technologies over and over again is that the killer application is messaging
  – Original purpose of Internet
  – Email
  – E.g. BlackBerry messaging service
  – SMS in the ‘rest of the world’ (outside the U.S.)

• Instant Messaging = Considered by many to be the ‘killer app.’ of wireless

Messaging Is a Killer App cont.

• The key attribute of Instant Messaging (IM) is that it provides presence, which means that a person on your buddy list can see when you are using a computer or phone and therefore knows you are “present” and available to receive an IM

• Newer technologies will allow messaging to become even more personal
  – Photo messaging
  – Video messaging
  – Video phones

Coming: An Internet of Things

• Wireless communications = not just for people
  – A machine-to-machine Internet is coming
    • Likely to use Wi-Fi as one wireless communication protocol
  – RFID (Radio Frequency Identification)
    – Like the barcode = involves small tags affixed to objects that provide information about the object

• Communication systems = a mix of wired and wireless = one of the many challenges for CIOs

The Role of the IS Department

• IS has three roles:
  – create the telecom architecture
  – run it, and
  – stay close to the forefront of the field

• Sound familiar?
The Role of the IS Department cont.

• The key challenge in network design is connectivity
• Connectivity means allowing users to communicate up, down, across, and out of an organization
• The goal is not a single, coherent network, but rather finding a means to interface many dissimilar networks, so that users think they have one network
  – Like we do with the telephone, Internet etc.

• A truly interoperable network would allow PCs, laptops, and handheld devices to interoperate with servers running Linux and Windows and mainframes and communicating over IP networks
  – This interoperability is the goal of architecture and is the main job of the IS department
• The second job of the IS department is to operate the network
  – Many companies are outsourcing (part of) this work
• The third job of IS is to stay current with the technology

Conclusion

• The Telecom world is big and getting bigger by the day. It is complex, and getting more complex every day
  – Don’t worry – there’s plenty of help available!
• The business world of old has depended on communications, of course, but not to the extent of the ‘New Economy’
• The first generation of the Internet economy has been wired. The second is unwired
• Today telecom is all about connecting and the number of possible connections is about to explode worldwide