

**THE FOURTH WAVE
IN INFORMATION TECHNOLOGY**
And why you should be riding it.

The Four Generations of Business Computing

The mainframes of the 50s and 60s ran batches of data and produced printed reports distributed to management some hours or days later. Interactive computing used text-based display terminals as well as printers and produced more timely results. Client Server brought a rich graphical environment that many users prefer, but also brought poor reliability, and higher overall costs. The fourth wave, Server Based Computing with Thin Client Terminals, promises to improve performance, reduce costs and vastly improve reliability of Windows® applications.

BATCH

Batch processing was the norm in the early days of mainframe computers. The process involved data entry by typists using card punch machines, or key to magnetic tape, and later, key to magnetic disk systems. The media, cards, tapes or disks, contained the input data, such as sales order information, inventory receipts and other transactions. Programs were also stored on the same type of media. The system operator would first load the programs, then the data, and finally execute the programs, which process the data. The output was printed on line printers and the voluminous reports were delivered to managers, usually the next day, or later depending on one's rank in the organization and the priorities assigned by management. Batch processing was slow to deliver information, but generally reliable and accurate.

INTERACTIVE

Real time, on-line, transaction processing was pioneered by Mini-Computers and quickly followed by mainframes like the IBM System 370. The advent of Cathode Ray Tube (CRT) terminals provided the ability to display information immediately and many printed reports were no longer necessary. The high cost of green screen CRT terminals, over \$2000 each, limited the availability of real time information to a relative few VIP users and data entry operators. As costs declined, CRT terminals became more popular, especially in businesses depending heavily on real time information, such as airlines. Many large organizations, such as banks, continue to utilize a combination of batch and interactive processes to this day.

Interactive On Line Transaction Processing (OLTP) systems were a giant step forward but used text-based, green screen displays with a limited view, 80 characters wide by 25 lines from top to bottom. This limited view was dictated by the CRT technology of the day and display screen information was less easily read than a printed report. Many pundits predicted the demise of printers back in the 1970s, but it never happened.

Interactive Data Processing depended on large complex machines that were able to deliver up-to-date information to only a relative few users, but that information was accurate and reliable.

CLIENT SERVER

Personal Computers (PC) made their way into business environments beginning in the early 1980s. Productivity applications, such as spread sheets, word processors, and database programs, allowed users to create their own reports and documents without having to deal with the "Data Processing" personnel, who tended to be elitist and slow to respond to end user's needs. It soon became apparent that the PC needed to access data from the central mainframe machines and to share resources such as data files and printers. Local Area Networks (LAN) became commonplace and most users were connected to their mainframe and mini-computer host systems and the corporate database.

A few significant problems arrived with this distributed approach to data processing. Multiple versions of the corporate data existed due to manipulation by end users. Another problem was the security of that data. Data created by users was often lost due to a lack of discipline regarding backups. There is no doubt that data will be lost when a hard drive fails. The only unknown is when it will fail.

Microsoft operating systems became the standard for most organizations and user interface was improved with each successive Windows version, but reliability and support costs became significant problems. End users failed to manage the powerful systems deployed on their desktops and often used unauthorized and/or unlicensed software. While there is no doubt that PC applications provide the opportunity to improve worker productivity, there certainly is an equal challenge in managing these systems and how they are used.

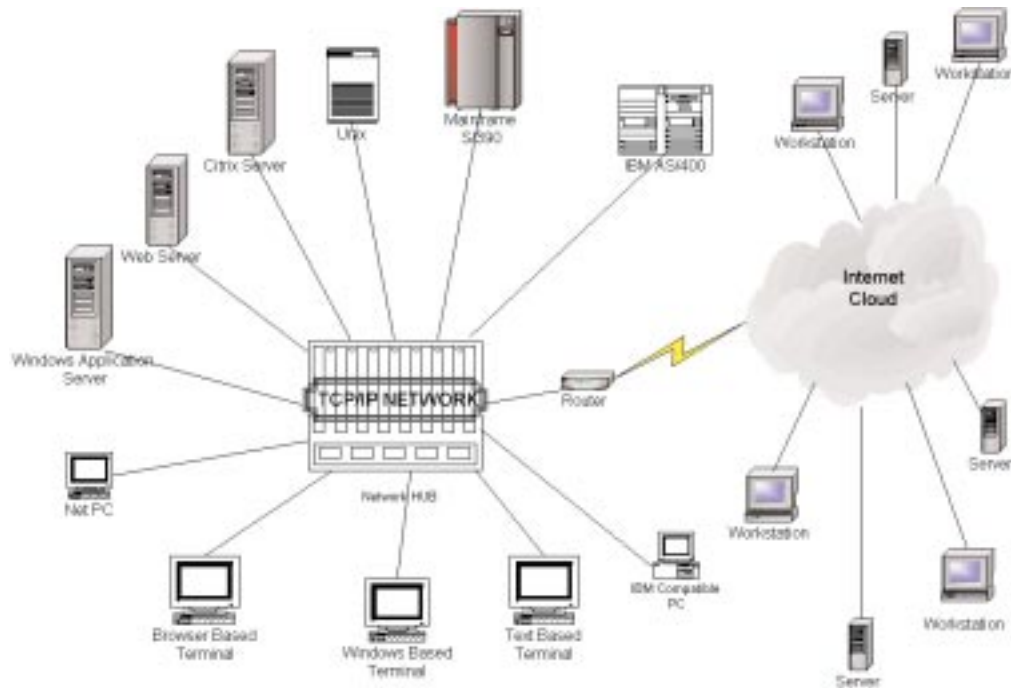
Client Server is viewed by many as a failure due to the very high support costs, problems with data security, lost productivity due to unauthorized applications and fundamental lack of reliability with most Microsoft operating systems. Most of us have experienced the dreaded General Protection Faults (GPF) of Windows 3. When Mr. Gates promised us "reliable 32-bit software" with Windows 95, he flatly stated that there would be no more GPFs. He was right; we now get Fatal Exception Errors (FEE) and blue screens of death.

NETWORK COMPUTING aka THIN CLIENT COMPUTING

Network Computing returns to the architecture of the past by deploying terminals, or Thin Clients, on the desktop instead of PCs, also known as Fat Clients. Thin Client terminals can take many forms. A multi-user Windows Server can support even Fat PCs converted to Thin Clients by installing PC software that collects inputs, such as keyboard and mouse manoeuvres, and displays the screen updates processed by the server. 3270, 5250, VT and other terminal emulations resident in the Thin Client terminal support traditional host/servers such as IBM and UNIX systems. This architecture is identical to the interactive terminals of yesteryear except the data is presented as a Graphical User Interface (GUI) and the communication protocol is Transmission Control Protocol/Internet Protocol (TCP/IP). Programs and data reside on one or more servers maintained by Information Technology (IT) staff. End users are no longer responsible for data backup and applications deployment, yet they are able to run the same application programs as PC users.

Figure 1: Fourth Wave Network Supports a Wide Variety of Servers and Clients

The fourth wave, Network Computing, has many hosts, now referred to as servers. Some servers are company private (intranet), external (extranet) or public (Internet). See figure 1.



Terminal resident Thin Client Software typically includes a Remote Display Protocol (RDP) client for use with Windows NT 4.0 Terminal Server Edition and Windows 2000 Servers, an ICA Client for use with Citrix Servers and one or more terminal emulation clients for accessing Mainframe and Midrange hosted applications. Most current generation Thin Clients also provide local browser capability and a basic email client program.

HISTORY OF MULTI-USER WINDOWS

IBM with the OS/2 Operating System pioneered multi-user Windows in the late 1980s. Later the founder of Citrix left IBM and made an alliance with Microsoft, in 1989, to develop Winframe, a multi-user Windows Server based on NT 3.0. Citrix also developed thin client software for DOS, Windows, UNIX, and Apple PCs, allowing them to run MS Windows Applications on virtually any PC. The fundamental beauty of the Winframe server design was the fact that all applications and data files remained on the server and only screen updates and input data traversed the network. This very low bandwidth requirement was further enhanced by Citrix data compression technology allowing Windows applications to run well over low bandwidth connections, including dial-up.

Initially, Thin Client terminals were converted PCs and MACs. 1995 brought the first Thin Client terminal hardware based on small hardware boxes, usually without moving parts, with support for PC peripherals including keyboards, mice, printers, modems, etc. These small boxes are now known as Windows Based Terminals (WBT) if they run on Windows CE or Network Computers (NC) if they run a different OS. WBTs account for about 70% market share.

The Thin Client market is growing at a compound annual rate of nearly 30% and International Data Corporation expects that trend to continue through 2004. PC growth has been flat or declining in recent years. According to the Gartner Group, 80% of corporate PC users could take advantage of Thin Clients and do not need PCs.

There are only two Microsoft Windows Versions that will exhibit reasonable reliability in multi-user, multi-tasking environments; Windows NT 4.0 and Windows 2000. All of the others will fail on a regular basis due to poor memory management.

MICROSOFT OPERATING SYSTEM SOFTWARE EVOLUTION

Microsoft (MS) acquired and further developed its Disk Operating System (DOS) in the early 1980s. Its first major customer was IBM who used DOS with its PC, XT and AT machines. Later, IBM and MS parted ways briefly as MS developed Windows and IBM developed OS/2. While OS/2 had many technical innovations, IBM eventually went back to MS operating systems due to market demand.

DOS is much maligned but it was in fact a very reliable OS when used as intended, as a single user, single task Operating System. The trouble was with Windows 3X and Terminate and Stay Resident (TSR) programs that attempted to make multitasking work.

Windows 3, 95, 98, Me and Whistler are doomed to fail because they do not properly manage the memory space used by application programs. Intel enabled "Protected Mode" (PM) memory management in 1983. PM, when enabled by the OS, prevents an application program from writing in memory outside its authorized address space. Microsoft has enabled PM on Windows NT 4.0 and Windows 2000. All of the other Windows versions will suffer from General Protection Faults

and Fatal Exception Errors, especially when many windows have been opened. Protected Mode is absolutely required for reliable operation, but MS has ignored that fact while IBM and others have used a similar concept, known as Virtual Machine (VM), since the 1960s.

Microsoft Terminal Services and Citrix Metaframe run on Windows NT Terminal Server Edition (TSE), a specially tuned version that operates as an application server as opposed to a file server. Windows 2000 server also supports multi-user Windows as an application server when the Terminal Services feature is activated. MS Terminal services is a basic application server suitable for use over local area networks while Citrix extensions provide better performance over low-speed networks and more sophisticated server management tools. Citrix works best in a heterogeneous environment supporting a wider variety of operating systems, hardware platforms and connections. Remote Display Protocol (RDP) is less costly and less sophisticated than the Citrix Independent Computing Architecture (ICA) protocol

TOTAL COST OF OWNERSHIP

Total Cost of Ownership (TCO) of PCs deployed in IBM Midrange and Mainframe environments is now being recognized as a huge expense. There are a number of reasons why you should evaluate TCO in your organization:

- 1) Personal Computers and personal-computer technologies are widely used in IBM Hosted Networks. As PCs have evolved from personal productivity tools to office automation platforms and often run mission-critical applications, the money spent on the purchase and maintenance of these desktop systems gets increased attention from the CFO and CEO in most organizations.
- 2) Industry analysts, including the Gartner Group, Meta, Forrester, and Giga are focusing on the rising costs of owning and managing PC platforms. Their reports focus on the difficult task of managing more complex and powerful PC systems performing an increased number of business-critical tasks.
- 3) Proponents of the Thin Clients position Network Computers (NC)s and WBTs as solutions that require minimal management and radically reduce the cost of desktop computing while improving reliability by deploying NT 4.0 and Windows 2000 instead of Windows 95, 98 and Millennium Edition (Me). A Data Pro survey of IT Managers indicated that Windows Based Terminals reduce Tech Support costs by 80% compared with desktop PCs, aka Fat Clients.
- 4) PC-industry participants, such as Dell Computer, believe that lower purchase prices lead to the best value for the customer. Such vendors attempt to focus on initial purchase price alone, while ignoring the impact of life-cycle costs that increase the total cost of ownership.

The most important fact revealed by TCO studies is that 5-year capital costs, including hardware, software and upgrades, are only 21% of the total costs. The initial purchase price may only be 10% of the TCO.

- 5) Network Terminals and Windows Based Terminals using the TCP/IP communications protocol dramatically reduce wide area network communications costs and reduce network complexity at all levels. The elimination of SNA/SDLC controllers reduces equipment costs as well as ongoing communication costs. Only a simple (inexpensive) TCP/IP router is needed at remote sites. The public Internet or a virtual private network can be used for terminal and PC traffic.
- 6) Windows NT 4.0 and Windows 2000 servers are vastly more reliable than other MS Windows versions.
- 7) Thin Clients will end the technology treadmill associated with traditional PCs, which become obsolete every two years as faster and higher-capacity systems are introduced. Install thin clients and you will never need to upgrade the hardware, move it, or worry about theft of the device or your data. Adding or upgrading servers as necessary will accommodate new applications in the future. Performance, particularly program loading, is faster than any PC and there will be no more Fatal Exception Errors.

WHAT IS THIN AND WHAT IS NOT?

There is some confusion as to characteristics of a "true" Thin Client. Here are a few points clarifying the differences between Thin Client Terminals and a Network PCs.

| Feature | Thin | Fat |
|---|-------|------|
| Run any Windows Application | Yes | Yes |
| Access OS/400, Mainframe, UNIX and Web servers | Yes | Yes |
| Hard Drive | No | Yes |
| Runs Windows 95/98/Me/NT/2000 at the desktop | No | Yes |
| Moving parts, such as a cooling fan | No | Yes |
| Processes data at the desktop | No | Yes |
| Files are transferred from the server to desktop & back | Never | Yes |
| User access to Window Control Panel | No | Yes |
| Requires hardware upgrades as technology changes | No | Yes |
| Needs to be moved when the user moves | No | Yes |
| User needs to perform file maintenance | No | Yes |
| Data lost if desktop machine is stolen | No | Yes |
| Virus protection required at each desktop | No | Yes |
| Updates at each desktop | No | Yes |
| Games & Movies possible | No | Yes |
| Work Station or Entertainment Station | Work | Both |

The most reliable MS Operating System, by far, is Windows 2000, or for the technology wary, NT 4.0. You should avoid other Windows versions because they are not robust enough for mission-critical application in business environments. The best way to deploy Windows NT 4.0 and Windows 2000, for most users, is via Thin Client terminals that are tamper proof, virus proof, theft proof and goof proof.

COMPARE 100 PCs WITH 100 WINDOWS BASED TERMINALS

We know that Windows NT 4.0 and Windows 2000 are reasonably reliable due to the implementation of the memory management technique known as Protected Mode. Therefore, our comparison assumes a deployment of Windows 2000 because Windows 35/95/98/Me are not reliable and will experience GPF and FPE problems, lock ups and numerous tech support calls.

100 PC NETWORK

102 Pentium processors, 2 on servers, 100 on desktops
 13GB Total RAM
 612GB Total disk storage
 Windows 2000 License cost = \$32,000
 MS Office licenses = 100
 Upgrade locales = 101
 Upgrade time = 19 days
 Users with access to O/S settings = 100
 Mechanical devices, drives, cooling fans = 500+

100 WBT NETWORK

8 on 2 X 4 way servers
 2GB RAM
 24GB total disk storage
 Client Access License = \$10680
 MS Office licenses = 100
 Upgrade locales = 1
 Upgrade time = 1 day
 Users with access = 0
 Mechanical devices = 26

The above comparison reveals significant initial and long term savings when using WBTs to deploy reliable Windows 2000 applications, and access to traditional 3270, 5250, DEC and UNIX hosts. WBTs can also work with Web-enabled applications using a local browser option. Significant communication savings and network simplification results from the use of the TCP/IP internet protocol instead of IBM's System Network Architecture (SNA).



Affirmative Computer Products specializes in products for the IBM AS/400/iSeries and Mainframe user. We manufacture, sell and support specialty keyboards, Thin Client Terminals and provide related consulting services.

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