



Thin clients bridging IT worlds.



Modern enterprises that have to succeed in an extremely competitive, globalized economy, and at the same time protect their financial health are always looking for the optimal balance between innovation and protection of their capital investments. IT departments are facing by an expanding infrastructure, which is no longer adequate to ensure that the business operations will remain stable. Many companies look for cost-effective and efficient ways of updating and upgrading the IT by leveraging their investment in existing equipment. Server-based computing has become an effective means of doing just that.

Centralized Computing with flexibility

Server-based computing (SBC) reverses the trend that dominated the world of computing since personal computers first appeared on the scene: The architecture of shifting computing power from the central computer unit (i.e. mainframe, server or server farm) to the network periphery, (desktops), is reverting to the original concept of a centralized computer network: All applications run on powerful hosts and the terminal (client) serves as an input and output device.

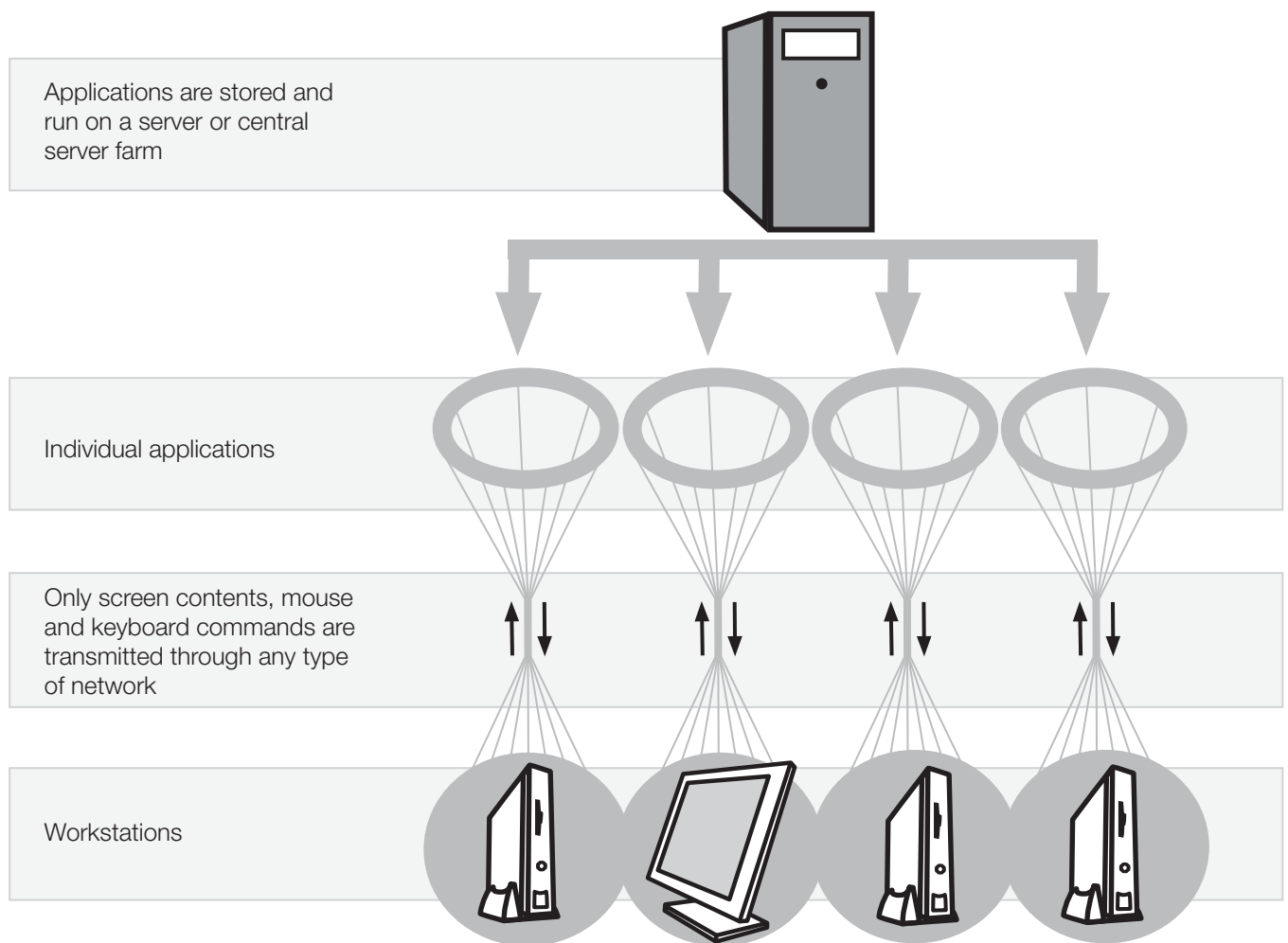
The key difference between the computer architecture of long ago is that the only information transferred between server and clients are mouse clicks, keyboard entries and screen updates. The perception of a thin client desktop can no longer be distinguished from a PC in terms of performance. Modern thin clients have an embedded operating system architecture, which is independent of the server, and provide features and functionality not found in earlier generation terminals.

The major advantage of the concept compared to traditional client/server architectures is that the functions and programs (applications, security systems, etc.) centralized on the server are centrally managed, greatly facilitating upgrades and rollouts of new software. IT permanently reduces administration activities and costs. In addition, workstation PCs replaced by thin clients, means the absence of hard disks, cooling fans, and moving parts will result in considerably smaller terminals, energy savings a longer service life. Experience has shown that up to 70 percent of administrative costs can be saved by using thin clients.



To maximize the efficiency of available IT resources and protect investments, the clients should be highly flexible to work optimally within a growing infrastructure. This especially includes operating systems and central computers. The operating system architecture of modern thin clients is independent of the server, and therefore, the clients represent an enormous improvement compared to earlier terminal generations.

Fig. 1 Information Exchange between Server and thin client



Server developments promote server-based computing

Consistent trends towards increasing server performance capabilities while continuously reducing size has developed over the past years. The steadily growing capacity of modern servers allows for consolidation and standardization of the resources of a data center. Space-optimized server hardware, minimized to 1U standard, for example, and the development of stackable servers have further accelerated this process.

Blade servers are increasingly found in cluster environments. Heat generation is minimal and they can be stacked tightly in racks to save both space and energy. The ratio of computing power per volume was never better, and this trend will continue.

The operating systems of server-based architectures are dominated by Microsoft products including Windows 2000 Server and Windows Server 2003. These include multi-user extensions of the well-known Microsoft Windows editions. A number of products based on open source Linux, such as Red Hat and SuSE have gained market share in the past few years. Unix continues to be strong with respect to servers which has variations based on the manufacturers, such as Sun, IBM and HP (Solaris, IBM AIX, HP-UX). Older, yet critical internal applications, including merchandise information and production control, often still run on Unix systems

Focusing on server-client communication-Bandwidth

The crucial element for the success of SBC is the fast, efficient and secure communication between central server and client, without driving up the network bandwidth requirements.

Client and server communicate through bandwidth efficient protocols. Major protocols on the market include Independent Computing Architecture (ICA) from Citrix, Remote Display Protocol (RDP) from Microsoft, and the X.11R6 protocol for communications with Linux or Unix systems.

ICA is native to a Citrix environment, although it is not tied to a proprietary operating system and supports a wide range of hardware platforms. ICA is responsible for transferring the user's mouse and keyboard input to the server or servers and for sending the graphic elements of the computing output to the thin client. Access to equipment, such as USB CD-ROMs is also possible. For the highly graphics-oriented output processes of modern thin clients, ICA offers particularly effective data compression. ICA also supports audio input and output as well as other multimedia functions such as those occurring in VoIP (Voice over IP) or video conferencing. Open the door to applications such as online training.

The Microsoft RDP protocol permits access to Windows applications through the network. Its basic functions and performance features are not as robust as those of ICA, is less expensive. While ICA offers an exceptional range of functions, required in an enterprise environment, RDP is usually used in somewhat less complex settings.

Comparison thin client vs. PC

Options and applications

In direct comparison the advantage is obvious: installing a thin client network quickly pays off.

	Thin Client	PC
Application software management	Central administration	Individual desktop administration
Service life	In excess of five years	Approx. three years
Ageing factor/upgrade management	Low: new applications require no hardware upgrade	High: new applications often have to be upgraded
Software/hardware interdependencies	Virtually none	High: the hardware must be able to run the application
Security: theft	Data cannot be removed (if specified by the IT Manager)	Data may be removed
Security: viruses	Viruses are unable to enter and settle, local operating system is read-only and therefore cannot be attacked	Viruses are able to attack through USB sticks, e-mail and Internet, for example; the local operating system can be attacked
Reliability	No movable parts that are subject to failure	Disk drives, CD-Rom, fans, etc. are susceptible to wear
Utilization of network bandwidth / anticipated utilization rate	One tenth of the usual fat client utilization	Requires ten times higher bandwidth / highly fluctuating
Effective computer power	Depends on the number of users at anyone time, capacity and number of servers, etc.	100 percent of PC resources, in actuality only ten percent are used
Target users	Task-based personnel, service industry, knowledge workers, public terminals, factories	Power users, information technology personnel, traveling users, technology and graphics industries
Purchase price	Starting at 200 Euro	PCs for businesses start at 650 Euro
Relative total cost of ownership (TCO)	Less than 63 percent	100 percent

Various protocols are utilized in Linux environments X.11R6 (X-Windows), originally developed for Unix, delivers applications to the clients through the network, transferring screen contents with full graphic support. X.11R6 allows "remote control" of any program stored on a remote server by redirecting the screen display to the local terminal and transmitting keyboard and mouse commands.

Communication processes can be accelerated by interconnecting software made by NoMachine called NX, which delivers the highest transmission rates and low bandwidth consumption.

Solutions for any environment

The most widely used SBC environment in the world today is the Citrix Presentation Server 4.0 for Windows, which is certified for use with the Microsoft products Windows 2000 Server and Windows 2003 Server. The fundamental concept of Citrix servers, which are able to cooperate with other operating systems, such as Linux or Unix, is to shift applications that usually run on the workstation computer to a virtual environment on the central server. A Citrix server system consists of Citrix server (Presentation Server for Windows or Unix, for example) and the Citrix ICA client. The latter is a simple software tool stored in the device or thin client. ICA clients are available for most commonly used platforms (Unix, Linux, Solaris, etc.) and for Java.



The Citrix server also works with operating systems, such as Unix or Linux and shifts the applications to a virtual environment on the central server.

Citrix supports the standard operating systems and is most appropriate for integrating large heterogeneous computer architectures involving hundreds of workstations into an SBC landscape. Applications can be distributed to the Presentation Servers of the server farm by means of an integrated installation manager. An important tool for achieving adequate network utilization rate is the integrated load-balancing function.

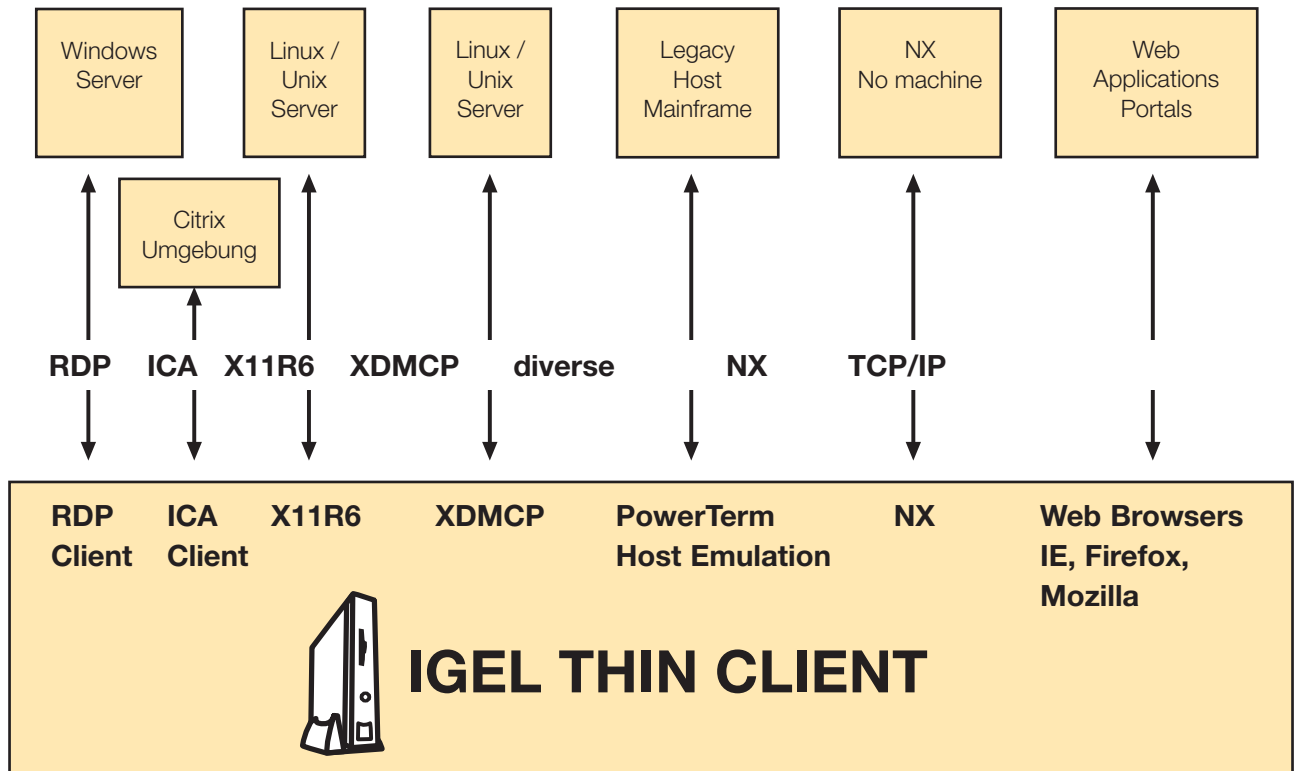
The capabilities of the Microsoft environment (the terminal services of the Microsoft Windows 2000 Server and Windows Server 2003) are similar to the Citrix system. In this environment, the terminal server acts as server software by which applications are distributed to the various connected servers. Server and client communicate through the RDP protocol. The RDP client bundles and transfers the data at a high rate of about 20 Kb/s through the network. The conversion from a PC-based client/server architecture to a server-based computing architecture does not require an increase in the bandwidth. Microsoft terminal server environments now also offer extensive functional capabilities, including multimedia applications.



Load balancing function: When a client calls up an application, the system starts up the application on a server selected by the Citrix server in dependence of the load.

Another supplier on the market which is comparable to Microsoft and Citrix in the SBC space is Tarantella with its Secure Global Desktop, available in the Terminal Server Edition or Enterprise Edition. Tarantella offers very sophisticated functional capabilities and flexibility. The software supports Windows, Unix, Linux, Java, mainframe, and AS/400 applications installed on heterogeneous platforms. The Tarantella client is a special Java program. Adaptive Internet Protocol (AIP) serves as communications protocol. Protocols, such as RDP, are converted to AIP.

Serverworlds and Communication Protocols and Associated Clients on the Thin Client



Emulations to access hosts in heterogeneous environments

Modern thin clients are able to provide access to all major operating system environments in a desktop unit. At this time, thin clients usually run under Windows CE or Linux, but the options of communicating with the servers are limitless. Linux environments, which are preferred by some companies and organizations because of their openness and the absence of license fees, can be controlled with the X.11R6 protocol.



Tarantella combines highly sophisticated functions and extraordinary flexibility. The software supports Windows, Unix, Linux, Mainframe and AS/400 applications installed on heterogeneous platforms.

Many businesses use mainframe and midrange computers that work with a wide variety of operating systems such as Solaris, Unix, AS/400 and other systems. To adapt these environments to for access by thin clients, terminal emulation software is installed enabling the user to access hosted applications. Terminal emulations simulate communications with a terminal for the server. In this case, emulation is a process of the operating system which runs on the server. For example, when X-Windows is used, the terminal emulation converts the text-oriented output of the server via a X.11 graphic interface so that it can be edited on the thin client. In reverse, the program translates the user's keyboard input into the "language" of the central computer.

Applications can be executed on any host or server platform by means of such terminal emulations, regardless of whether it is a mainframe or AS/400 machine, a Linux or Unix system.

Server and client can also communicate through a browser. Examples are web terminals, often also called network computers, which exchange information via fast Internet connections, and all platforms equipped with a Java Virtual Machine (JVM).

Thin client in heterogeneous environments

With the help of the sophisticated connectivity software available today, the advantages of SBC (superior total cost of ownership, flexibility, robustness, longevity, and security) can be transferred to any conceivable environment. Suitable solutions for integrating thin clients are available for any number of servers or clients, any user situation, any type of access.

For example, the thin clients from IGEL Technology (www.igel.com) are designed to be individually adjustable to any application spectrum and cover all applications, all platforms and server worlds. They support all major communications protocols (ICA, RDP, X.11R6, and optionally NX from NoMachine and AIP from Tarantella) and include an integrated web browser. Therefore, they are completely independent of operating systems, hardware and software platforms, and manufacturers.

To take maximum advantage of the benefits of SBC, IGEL Technology optimizes the central administration of thin clients in the network through a "remote management suite". Central management is based on an SQL database in which all configuration details of the thin client network reside. By means of a compatible database server, the administrator is able to configure literally thousands of clients in no time at a console (GUI), which is Java-based and which therefore works in any operating environment.

The exceptionally flexible architecture with maximum connectivity and superior performance in a wide variety of server and host environments, combined with all advantages and the ease of central administration make SBC and thin clients an attractive and future-oriented alternative to traditional client/server infrastructures.

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