



## Opportunities for Remote Use a Powerful Computer

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**Abstract.** As cloud computing advances, more and more corporations and private users choose ways in which to take advantage of the convenience of these services. The essential task of users is the choice of client machines or software to access network-shared resources. This paper explores the different ways of working with a remote powerful computer.

**Keywords:** client–server, remote desktop, thin client.

### 1. INTRODUCTION

Client-server architecture has been known since the 1960s and 1970s. Individual hosts assign tasks to one or more powerful machines, called servers. After a certain waiting period, the server sends the answer to the host, named Terminal client. The Client-server model was a very good solution for the computer technology in the past. The main computer was large, and there was no possibility of using many personal computers – these are the main advantages of Client-server architecture.

This was all good until the operating systems began implementing the Graphical user interface (GUI). Terminal client users can easily send tasks to the server and receive the results in command-line interfaces. Even today, for work with graphical interface, the great development of the so-called Thin clients continues. The name Thin does not refer to the price of the device, but to its low energy consumption.

Three are the main options for connecting to a remote computer – Zero client, Thin client and Remote Desktop in Windows. Accounting this situation, the exploration of the positive and negative peculiarities of the above listed architectures have a great practical importance.

Due to this reason the aim of this paper is the estimation of the performance characteristics for connecting to a remote computer by Zero client, Thin client or Remote Desktop in Windows. The results of such a study could be used

by companies and universities, working with CAD/CAM software.

### 2. ZERO CLIENT

The most common are Zero clients, which are small memory devices without storage, and instead of operating systems they have firmware – a specific class of computer software that provides low-level control for the specific hardware. They also have Hardware acceleration. These zero clients use the PCoIP protocol to facilitate remote connection, accelerate and dedicate hardware to the endpoint and promote user experience.

Zero clients provide too limited (simple) access to servers, so they can even work with wireless LAN connection. The advantages of Zero client are low cost, low energy consumption, easy technical support, system administrator's work is centralized on the server. Their shortcoming is the limited range of applications which is due to the poor graphics that can be worked on. The zero clients we are researching are hosted in a computer lab (Fig. 1).

These are NComputing L300. The best thing about them is that with the vSpace Server software, the powerful PC is transformed into a server even with a simple Windows 10, which saves you more money.

On Fig. 2 is shown connection interfaces of zero client NComputing L300.



Fig. 1 Laboratory with NComputing.



Fig. 2 NComputing L300.

Many schools in the Republic of Bulgaria have equipped computer labs with these zero clients. The teachers who worked there were not happy with the overall work of the installed server and client system. After consulting, we have found that the servers have extremely unsatisfactory technical features. We considered this to be an issue and made a very good server (Table 1).

TABLE 1. Characteristics of a server computer.

CPU	Intel® Core™ i7-5820K Processor 15M Cache, up to 3.60 GHz
RAM	64 GB Quad Channel DDR4 (8 × 8 GB)
Chipset	Intel® X99
Storage	Intel® RAID 0 Volume (6 × 1 TB)
OS	Windows 8.1

They do a great job in simple graphic mode. Zero clients cannot work in busy graphics mode, video and sound transmission is very poor.

For example, when working with AutoCAD, zero clients make the system crash and need to be restarted. For all working clients, the server cannot be substantially loaded (Wenhui, 2008).

The tests we made show that zero clients cannot handle heavy graphical programs. We do not recommend the use of zero clients in computer labs, despite their cost-effective and compact layout.

### 3. THIN CLIENT

Thin clients are designed to replace desktops in a virtual work environment. They have processors, memory, storage, USB ports and OS. They use Hardware acceleration in hardware to reduce latency and increase throughput. They are easy to install and manage. Thin clients are cost effective computing solutions that can be used to work with protocols like Microsoft RDP, Teradici PCoIP, Citrix HDX and VMware Blast Extreme. This makes it easy to connect to a virtual or physical remote device that allows access to virtualized applications (Agacayak, 2000; Michael, 2012).

One of the current models is the Hewlett Packard T730 (Fig. 3), support for quad UHD/4K displays and support for up to six UHD/4K displays with AMD FirePro™ graphics card. with AMD’s next-generation quad-core APU with Turbo Core technology, that can throttle CPU action and kick it up to 3.6 GHz to full performance VDI and local applications. integrated HP management software like HP Device Manager, HP Velocity, HP True Graphics and HP Easy Shell. with advanced I/O connectivity from a range of legacy ports and PCI Express x4 expansion slots. support screen sharing, video chatting, instant messaging, and more.

However good the results of the HP t730 are, the base price of \$639, the thin client will not be as good as a computer. A PC with a popular software for the same amount will be with greater resource. In addition, the PC can provide

user independence, as well as opportunities for unified work in a corporation.



**Fig. 3** HP t730 Thin Client.

#### 4. REMOTE DESKTOP IN WINDOWS

When the server and client have Windows operating systems, the client could be a remote powerful PC, using Remote Desktop Protocol (RDP) directly. In this situation both computers have a large computational resource and are

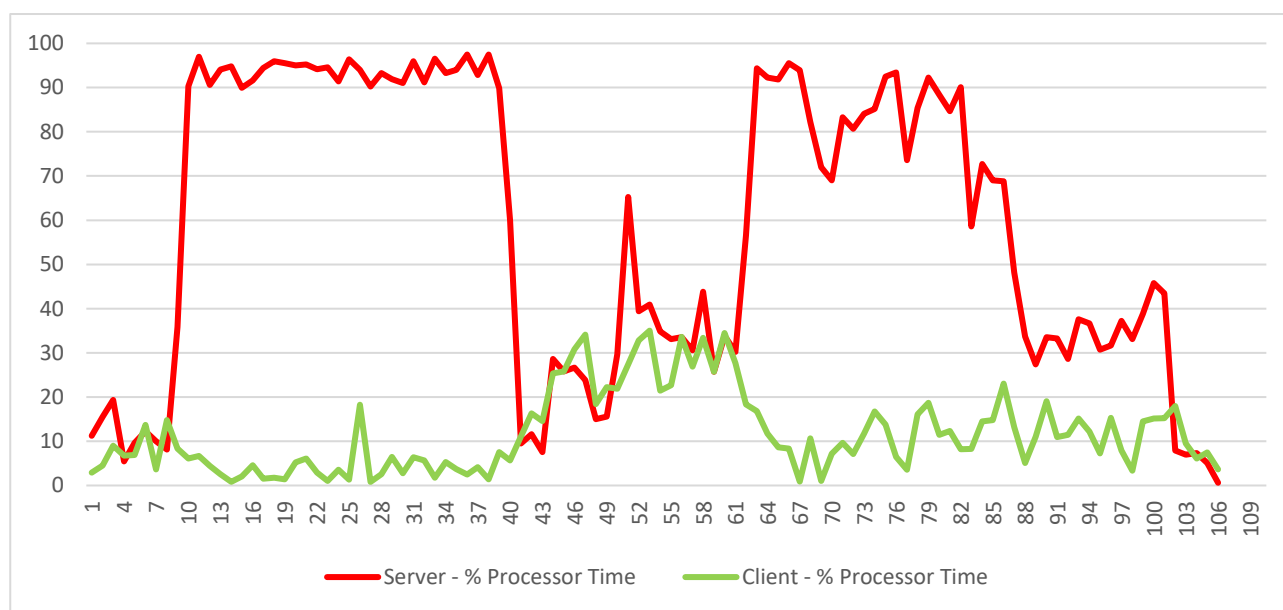
reversible – the client could be the server and vice versa (Singh, 2008).

In order to explore this architecture, the server machine and the client machine have been placed in a local Gigabit Ethernet network.

During the experiments we set peak tasks on the client machine.

The duration of the test was about 100 seconds. During the first forty seconds, the server load was entirely on the CPU, then the load was stopped and FHD video streaming was started.

In terms of CPU load, a much lighter load on the client machine was demonstrated. It is, of course, much above the potential of Zero and Thin clients (Fig. 4).



**Fig. 4** CPU load.

When loading on the local network, almost complete alignment occurred with the server machine and the client machine. Losses were minimal and were proportional to the number of packages (Fig. 5).

The graphical processor examination was the most illustrative. There was a minimal

difference in server GPU and client GPU load. Consequently, we cannot compromise with the GPU when a full-fledged GUI have to be used (Fig. 6).

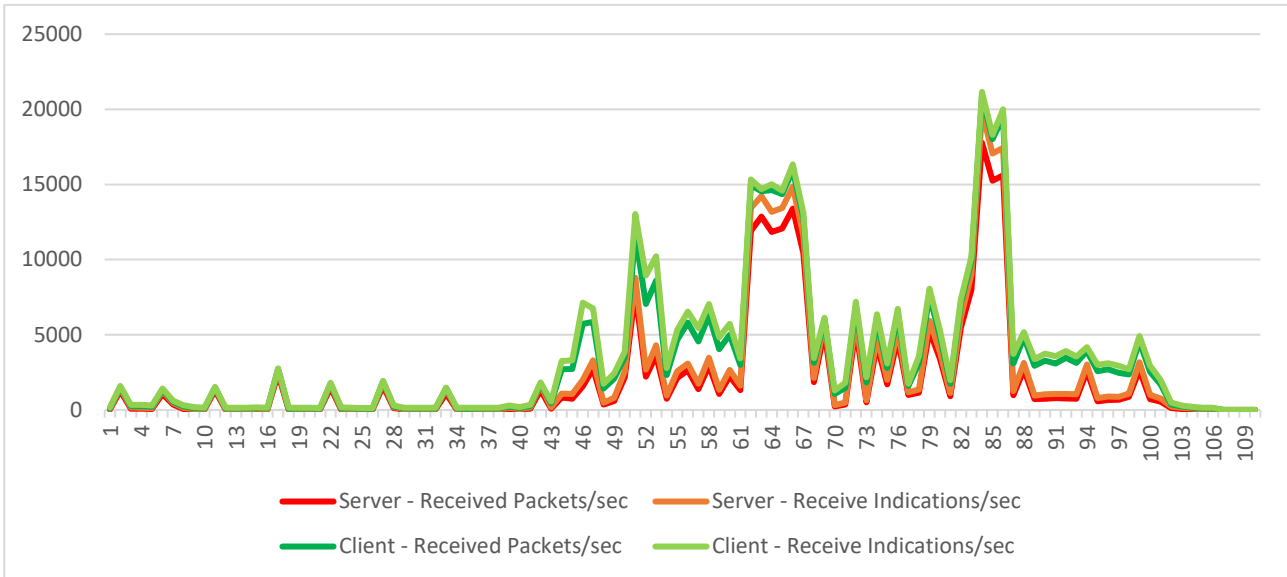


Fig. 5 Local network load.

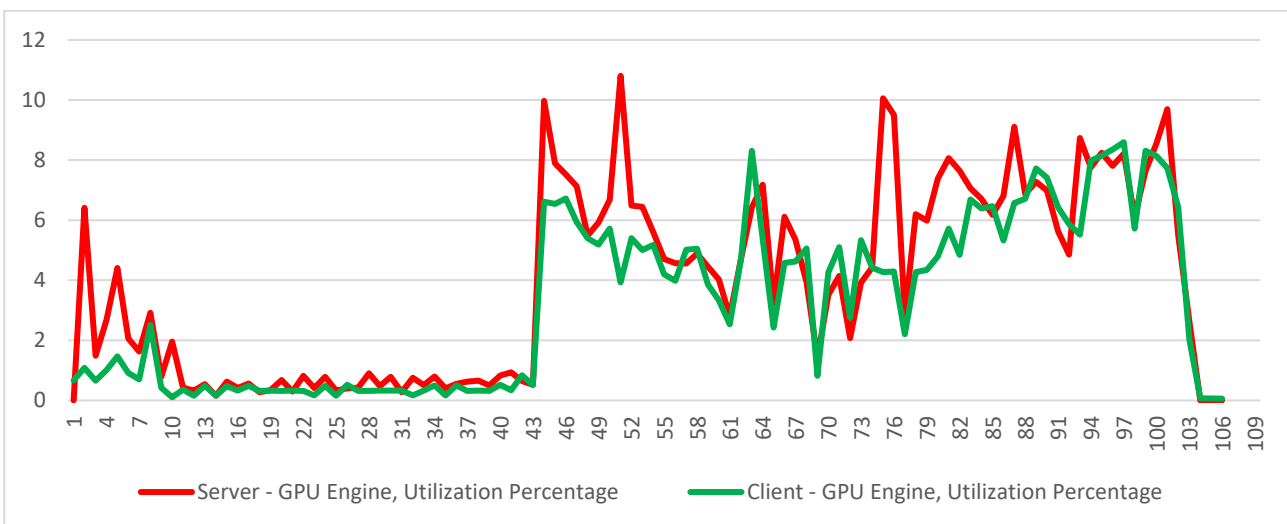


Fig. 6 GPU load.

### 5. MICROSOFT REMOTE DESKTOP ON ANDROID

Remote desktop to Windows can be done also from a mobile device – a smartphone or a tablet. The Android app is Microsoft Remote Desktop. Touchscreen is used for a touchpad that moves the course on the screen. With convenient input devices and good features, the smartphone becomes a very good client on a remote computer.

There are also some quick desktop sharing options such as TeamViewer and Chrome Remote Desktop. To make a connection, only

an app is needed on the computers, which issues a contact number. Security is guaranteed through developer servers.

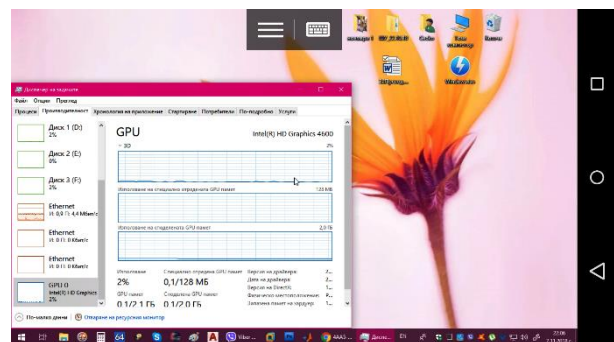


Fig. 9 Microsoft Remote Desktop for Android.

This software is used for technical assistance in emergency situations and is not intended for Cloud computing.

## 6. COMMENTS AND CONCLUSIONS

The results of experiments, presented in the paper, show that a careful estimation of the necessary capabilities and the price of the hardware and the software have to be made before the purchasing the equipment.

When designing a corporate computer network, consider what kind of individual hosts there are. For chains of hypermarkets or agencies with many payouts, Zero clients will be the most suitable, and the server machine group will work as a whole with a high degree of redundancy.

Higher Thin clients can also work on a centralized server group. These customers can work with more sophisticated software and also provide large savings on licenses for individual software products. Their disadvantage is their high price.

When working with heavy software, the ability to use terminal clients should be avoided. Such software is for example video processing, sound processing and graphic design. It is unlikely that the client-server model will be improved so much in the future because new releases of heavy software are always have very high recommended system requirements.

After viewing the results of our study, users of CAD/CAM software possibly will avoid Client-server technology, because only the architecture “server - powerful PC” is able to perform all graphic modes.

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