



Multi-User Computing Frequently Asked Questions

www.ncomputing.com

What is multi-user computing?

- When a single computer supports two or more simultaneous users, each running their own applications.

What is NComputing's multi-user computing environment?

- The NComputing environment is simple: Our technology allows standard PC's to simultaneously support many user sessions. Up to 30 additional individual users are enabled to share the resources of that PC with excellent performance.
- Ncomputing taps the vast unused power of standard PC's by allocating this power across many users.
- Each station requires a monitor, keyboard*, mouse and speakers; however, instead of connecting directly to a PC, these peripherals connect to a small NComputing access terminal on their desk. These access terminals then connect to the host PC either directly via PCI or over Ethernet and provide a unique computing station for each user.
- The user's performance experience is excellent. The OS, software applications and the internet performance will be similar to that of the host PC.
- The existence of a multi-user computing environment is completely transparent to the majority of users. Each work station will have its own unique user account that is assigned from the host OS.
- Our access terminals enable greater access to new or existing computing resources.

Does it take a huge server to run this environment?

- No. Traditional thin clients require fat servers, but the NComputing technology works with standard desktop PCs. By today's computing standards, our minimum host PC hardware requirements are modest, but a low-end inexpensive server can be used for hosting, if desired.
- Our solution is easy to set up and install. Unlike most terminal server products, our software installs in just minutes on the host computer and is managed just like a control panel application.
- Desktops OSes can support up to 10 users; Server OSes support up to 30.

What do you mean by "greater access"?

- Today there are about 850,000,000 PC users in the world. It is our goal to expand access to computing to another 1,000,000,000 (who can't afford PCs) by using the excess power of PCs and inexpensive access terminals.
- We don't compete against PCs; we complement and augment their power. We are expanding the number of individual seats for users that have limited access to computing capabilities. Here are some examples of where we are expanding markets:
 - o Emerging economies
 - Businesses: Many are forced to limit their computer use to a few key employees due to capital and support costs. With NComputing, they can expand access to a greater number of employees and therefore improve productivity.

- Schools: Rarely do schools have a student-to-computer ratio that supports effective learning. Many schools today are adding the X300 to existing PC's and getting up to 6 new users on an existing PC or deploying new PC's with additional access terminals.
- Libraries: Most do not provide computing resources for productivity or web surfing. Those that do rarely have enough to serve their customers, and maintenance of unreliable PCs can be extremely burdensome. With NComputing's access terminal 3, 10 or up to 30 more users can be supported from a single host PC.
- Internet cafés: for email, web surfing and more.
- o Developed regions
 - Student access: Even in rich countries, school funding lags and rarely supports 1:1 computing. With our X300 solution, schools can get at least twice the number of seats per a given budget. For the US student population, which has 3.8 students per PC, this solution can provide more students individual access to computing.
 - Expanded reach: A PC is generally fixed to a single location; what if you are in another room and just want to do a quick web search? NComputing can provide a simple and inexpensive access terminal for another room that provides exactly the same data as your host PC.
 - Manufacturing: No moving parts and a very small parts count means a robust design that survives extremely harsh environments.

What are the advantages?

- The are many, but the four largest are:
 - o Lower computing cost per individual user. As low as \$70 per seat.
 - o With fewer PCs to maintain, support headaches and costs are greatly reduced.
 - o Our access terminals use less than 5 watts of power. This is generally only 5% of the power of a typical PC.
 - o All of the NComputing software and hardware products are designed to be easy to set-up, secure and maintain by anyone with basic PC skills.

Feature	PC	NComputing X-Series	NComputing L-Series	Notes
Environment	Single User	Multi-User	Multi-User	
Users Supported	Only One	Up to 7 (with the Host)	Up to 30	1, 2
Cost per User	Typically \$399 to \$799	from \$70 per seat	from \$189 per seat	
Power Usage	Typically 115 Watts	< 5 Watts	< 5 Watts	
Installation Time	Time to set up, configure and install apps on each PC	Simple & Quick: Set up the terminals, install host s/w & utilize the resources of the host	Simple & Quick: Set up the terminals, install host s/w & utilize the resources of the host	
Reliability	Many moving parts in this complex & hot system	No moving parts enables extended product life time.	No moving parts enables extended product life time.	
Noise and Space	Large system with fans and many moving parts	No Noise. Small form factor access terminal.	No Noise. Small form factor access terminal: Zero footprint for L130/L230 monitor mount.	
Eco Friendliness	High power consumption, lower life cycle, more e-waste	Longer product life cycle, much lower power and much less e-waste	Longer product life cycle, much lower power and much less e-waste	
IT Support Cost	Per PC	Fewer PC's to maintain = fewer IT headaches = lower costs	Fewer PC's to maintain = fewer IT headaches = lower costs	

See second matrix for notes

How should I think about multi-user computing?

- The appeal of multi-user computing is that many more users can access the same computing resources at the same time. The model used to be one user per PC; it is now 4 or 7 or even up to 30 users per single PC or server.
- With a simple installation, NComputing access terminals, along with a mouse, keyboard, speakers and monitor, supply another individual session or user account that is supported by the host OS.
- The host provides the computing resources, the operating system and access to an internet or intranet connection. NComputing access terminals connect to the host and provide individual sessions to each user.
- NComputing's multi-user technology delivers a rich PC experience that is usually identical to using a dedicated PC. However, there are some times where people need their own PCs:
 - o CD-ROM/DVD: The CD-ROM is shared by all users and cannot stream different files to all users at the same time. However, a similar one-on-one experience can be achieved by downloading the file from the CD to the hard drive and then streaming the music, or if no one else in the multi-user LAN is using the CD, then one access terminal can stream directly from the CD.
 - o 3D acceleration: NComputing access terminals do not provide 3D acceleration support for applications such as 3D games.
 - o Most applications support Microsoft's terminal services API and work well in a multi-user environment, but some applications that are not ported for a multi-user environment and may not work across all the terminals. It is advised to check your application suite for multi-user support.
 - o Power users: usually need a dedicated late-model PC to run applications that need the majority of the processor's bandwidth. This type of computing is not advised for a multi-user environment.
 - o USB: certain models of our access terminals support USB memory devices and operate at speeds slightly slower than USB 1.1. This port is not a universal USB port is designed for supporting USB memory devices

How does the NComputing solution save me money?

- By providing individual computing stations at a much lower cost per seat, and by spreading the higher cost of the host PC over multiple users. Also, because of the increased reliability of the access terminals and the need to support fewer PCs, support costs also go down. Please see the white papers on our web site at www.ncomputing.com for more details.

What are the user and processor bandwidth limits?

- The typical processor utilization for a productivity application (like Microsoft Office) is only about 1-10%* of the processor's bandwidth. Therefore, if the users are typing a report, entering data into a spreadsheet or preparing a presentation, the number that can be supported is up to 30 users^{1,2}.
- Today's PCs have dual-core processors that run up to 3GHz and deliver more than ten times the computing power of a typical PC from just 5 or 6 years ago. That is plenty of processing power for users in a multi-user environment.
- One way to think of the multi-user experience is as the local power grid. Many people will draw power from it for their use; some will be using it just for lighting, while others will be running their clothes washer and dryer and still others have industrial needs. The multi-user environment is similar to a grid where everyone shares the processor resources; but the great thing about PCs is that the processors are hugely fast and peak requirements are generally measured in milliseconds or at most seconds, not the cycle time of a dryer. Therefore, if the power needs to run above 100%, it is likely for a very short period of time. These periods may be so short that a person typing a report could experience >100% processor needs from others in the multi-user environment but never even notice it.
- If more processing power is consistently needed, then tuning of the environment can solve the issue. The multi-user environment can be reconfigured to allow more power for all applications by upgrading the host or reducing the number of access terminals per host.
- Typical web browsing also takes little processor bandwidth, and the majority of the time it also takes little networking bandwidth⁶.
- Some applications demand huge performance capability such as 3D games, desktop publishing, full screen video streaming and full time CAD (computer aided design). Power users are accustomed to having their own PCs and should stay with that model.
- But this doesn't mean that performance can't be supplied to users in the multi-user environment. For example, if someone is manipulating image files and needs some extra performance, there is available bandwidth. Even if this activity takes 80% of the processors capabilities, there are still resources available to the other users, and most of these "peak performance requirements" last a very short period of time so that overall performance is restored quickly.

The following guidelines provide some additional information on the Multi-User Experience.

Feature	PC	L-Series	X-Series	Notes
Environment	Single User	Multi-User	Multi-User	
Processor	Dedicated	Shared by all users	Shared by all users	
Memory	Dedicated	Shared	Shared	
Users Supported	Only One	Up to 30	Up to 7 (with the Host)	1, 2
Cost per User	Typically \$399 to \$799	from \$189 per seat	from \$70 per seat	3
IT Support Cost	Per PC	Fewer PC's to maintain	Fewer PC's to maintain	
Computer or Access Terminal Power Usage	Typically 115 Watts	< 5 Watts	~ 1 Watt per User (3 Watts per card)	
CD	Dedicated	Shared from host, one user at a time	Shared from host, one user at a time	
Multimedia	Dedicated	Yes, web quality video streaming	Yes, mid quality video streaming	
3D Graphics	Dedicated chip set	No 3D acceleration	No 3D acceleration	
Sound-out (speakers)	Yes	Yes, stereo	Yes, stereo	4
Mice & Keyboard	USB	PS/2 (only)	PS/2 (only)	
USB Memory Support	Yes	Yes (L200, L230)	Through the host	5
USB Devices	Yes	Limited Support	Through the host	6
Web Access	Yes	Yes	Yes	
Networking (WAN)	Yes, whatever WAN/LAN the PC is connected to	Yes, whatever WAN/LAN the Host is connected to	Yes, whatever WAN/LAN the Host is connected to	7
IP Address	Yes	Yes, and MAC ID	For the Host	
VoIP	Yes	Yes (L230)	No Microphone	8
Monitor Support	Dependent upon video card installed	Up to 1440 x 900 or 1280 x 1024 @ 24 bit	Up to 1024 x 768 x 16 bit	9
Distance from Host	n/a	Metro Area WAN	7 -10 meters	10
Multi Monitor support	Dependent upon video card installed	No	No	
Application Support	Generally All Supported	Generally All, need to be Multi-User Friendly	Generally All, need to be Multi-User Friendly	11

1. For the L-Series access terminal the maximum number of users is 30 (including the host). The number of users a customer's installation will support depends upon the host's configuration & performance expectations of the customer. Performance results are dependent upon the individual host hardware, memory, video card, applications being used, OS software & network conditions within any LAN/WAN. Windows Server & Linux up to 30 users, Windows XP up to 10 users.

2. For the X-Series up to two PCI cards can be added that allow 6 new users to be added to the PC or 7 Users total.

3. US pricing at the time of publication. Prices vary region to region due to other costs, such as tariffs.

4: Microphone support is in the L230

5: Transfer rates are slightly slower than USB 1.1

6: Due to huge number of varied USB devices and their enumeration requirements, some devices are not supported.

7: The networking connection is shared by all. There may be peak periods of times where multiple users are making demands on the internet connection, so a high bandwidth connection is recommended.

8: VoIP is not supported within a single NComputing LAN between access terminals.

9: See product for specific support (only the L230 supports 24-bit). Frequency support is 60 or 75 Hz for 1024 x 768 or less, 63Hz for 1280 x 1024. Emulation methods are used. Using 24-bit video will use more CPU resources than 16-bit. With 24-bit some users may see some screen redraws. Monitors larger than 19 inches are not supported and may display resolutions improperly.

10. L-Series host systems should be located within the same city or metro region as the NComputing access terminal, low latency through switching is important.

11. Some apps may not support a multi-user mode. Additional software licenses may be required by the software licensors. Please check your software user license agreements to ensure your continued compliance with such agreements.

^ http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=CO

*Application performance will vary by host environment and application

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