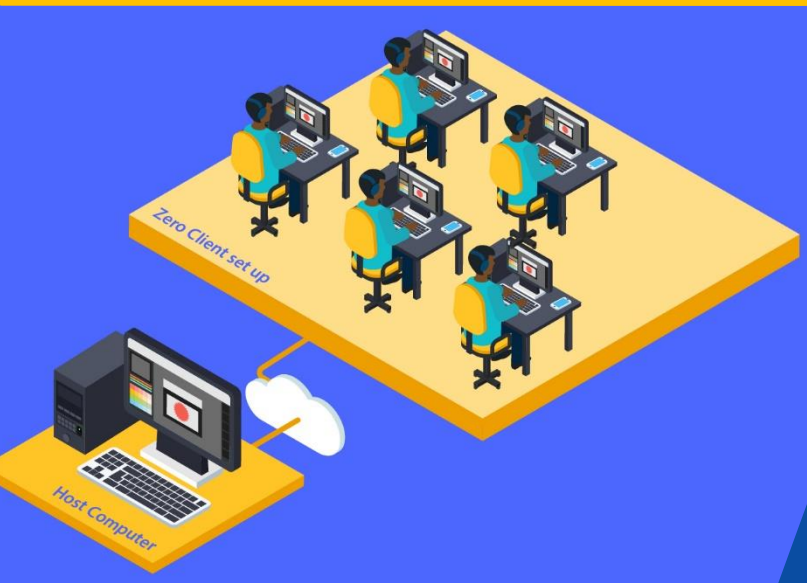
RQF LEVEL 5





NITZC501

NETWORKING AND INTERNET TECHNOLOGIES

Zero Client Application

TRAINEE'S MANUAL

October, 2024

ZERO CLIENT APPLICATION

KOICA Korea International Cooperation Agency

TQUM TVET Quality Management Project

2024

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ACRONYMS

CBT/A: Competency-Based Training/Assessment

CPU: Central Processing Unit

DVI: Digital Visual Interface

HDD: Hard Disk Drive

HDMI: High-Definition Multimedia Interface

ICT: Information and Communication Technology

KOICA: Korea International Cooperation Agency

LAN: Local Area Network

PoE: Power over Ethernet

RAM: Random Access Memory

RTB: Rwanda TVET Board

TQUM: TVET Quality Management

UPS: Uninterruptible Power Supply

VGA: Video Graphics Arr

INTRODUCTION

This trainee's manual includes all the knowledge and skills required in Networking and Internet Technologies, specifically for the module of **"Zero Client Application".** Trainees enrolled in this module will engage in practical activities designed to develop and enhance their competencies. The development of this training manual followed the Competency-Based Training and Assessment (CBT/A) approach, offering ample practical opportunities that mirror real-life situations.

The trainee's manual is organized into Learning Outcomes, which is broken down into indicative content that includes both theoretical and practical activities. It provides detailed information on the key competencies required for each learning outcome, along with the objectives to be achieved.

As a trainee, you will start by addressing questions related to the activities, which are designed to foster critical thinking and guide you towards practical applications in the labor market. The manual also provides essential information, including learning hours, required materials, and key tasks to complete throughout the learning process.

All activities included in this training manual are designed to facilitate both individual and group work. After completing the activities, you will conduct a formative assessment, referred to as the end learning outcome assessment. Ensure that you thoroughly review the key readings and the 'Points to Remember' section.

MODULE CODE AND TITLE: NITZC501 ZERO CLIENT APPLICATION

Learning Outcome 1: Prepare Zero Client Environment
Learning Outcome 2: Install NComputing System
Learning Outcome 3: Maintain NComputing System

Learning Outcome 1: Prepare zero client environment



Indicative contents
1.1 Conducting site survey
1.2 Selection of tools and equipment
1.3 Design of zero client topology
1.4. Zero client system cost estimation /Estimate zero client system cost

Key Competencies for Learning Outcome 1: Prepare zero client environment

Knowledge	Skills	Attitudes
• Description of zero client technology • Description Zero Client materials, tools and equipment • Description of Ncomputing system • Description of Ncomputing topologies	• Conducting site survey • Producing site survey report • Selecting transmission media • Selecting Topology designing tools • Designing topology diagram • Estimating Ncomputing installation cost • Elaborating cost estimation report	• Having attention to details. • Being rapid during work execution. • Being organized to achieve the required result.



Duration: 20 hrs

Learning outcome 1 objectives:



By the end of the learning outcome, the trainees will be able to:

1. Describe correctly zero client technology based on types and features
2. Describe correctly Ncomputing topologies based on their types
3. Conduct properly site survey in line with business requirements
4. Identify effectively Ncomputing installation tools and hardware equipment based on system requirements.
5. Select properly tools and equipment according to the system requirement
6. Design neatly zero client topology based on system requirement analysis
7. Estimate properly zero client system cost based on system requirement



Resources

Equipment	Tools	Materials
● Computer ● Keyboards ● Mouses ● Monitors ● Switch ● Router	● Screws drive ● Flash disk ● Fixing tools ● Cutting tools ● Firewall ● Cable Tester ● vSpacePro software	● Operating system ● Ethernet Cables ● Internet access

Indicative content 1.1: Conducting Site Survey

Duration: 5 hrs

Theoretical Activity 1.1.1 Description of Zero Client and NComputing Technology

Tasks:

1: Answer the following questions:

i. Define the term “desktop virtualization”
ii. Describe Zero Client technology.
iii. Give the difference between a zero client and a traditional computer.
iv. Differentiate between Zero Clients and other virtualization clients like Thin Clients.
v. Describe NComputing and relates it to Zero Clients
vi. Give the role of NComputing in shared computing environments.

2: Write the answers on the paper or flip chart

3: Present your findings to the whole class.

4: Ask question for clarification where needed.

5: For more clarification, read the Key readings 1.1.1 in this manual.

Key readings 1.1.1 Description of Zero Client and NComputing Technology

1. Definition of key terms

1.1. Desktop virtualization

Desktop virtualization refers to the process of running a user's desktop environment (the graphical user interface, applications, and data) on a remote server rather than on the user's physical computer. The user interacts with their desktop through an endpoint device known as computer clients like a thin client, zero client, or PC, but the desktop and applications are processed and stored on a central server.

There are several technologies under desktop virtualization, including **Virtual Desktop Infrastructure (VDI), Remote Desktop Services (RDS),** and **shared computing**.

Note: Among computer clients, zero clients and thin clients both offer virtual desktop access.

1.2. Computer Clients

In a computing environment, clients are devices or applications that connect to a central server or network to access resources, services, or data. Here are the main types of computer clients, including thick client, thin client and Zero client:

1.2.1. Thick Client (Fat Client)

Thick clients are full-featured computers, such as desktops or laptops, with local storage, processing power, and an operating system. They can operate independently from the server and perform significant processing on the local machine.

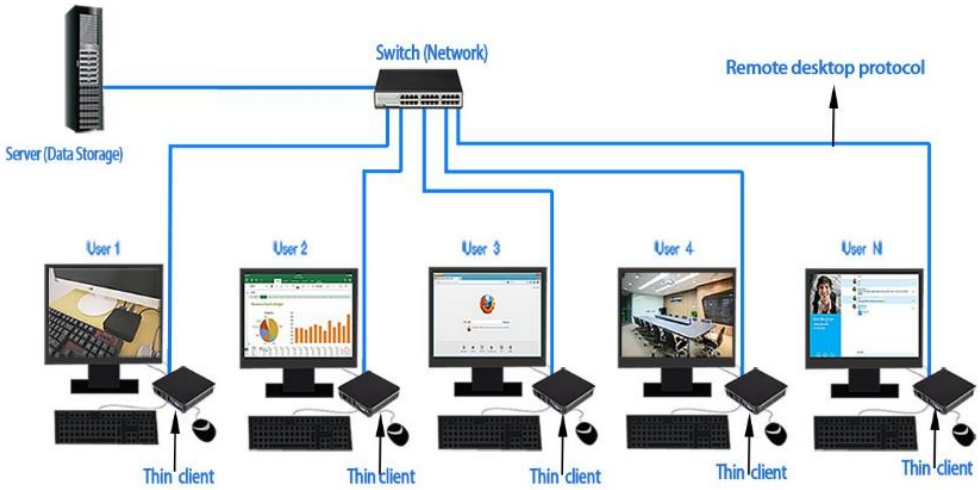
• **Example**: A desktop PC running office software that occasionally connects to a network for updates.



1.2.2. Thin Client

Thin clients are lightweight computers that rely heavily on a server for processing and storage. They have minimal hardware resources, enough to display content and send inputs to the server, with no dependency on local storage.

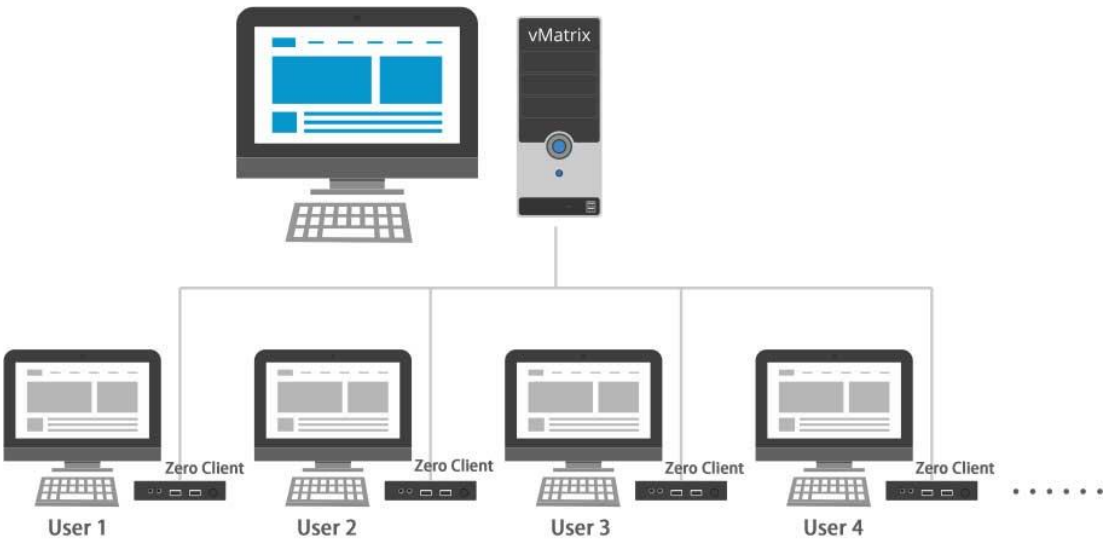
• **Example**: A lightweight workstation in a call center that connects to a virtual machine on a central server for software and data access.



1.2.3. Zero Client

Zero clients have no local storage or operating system. They're dedicated to connecting with a VDI environment and rely entirely on a server for processing and storage, making them extremely low maintenance.

• **Example**: A device used in a hospital that connects directly to a server for accessing patient records and healthcare applications.



Notes: Zero clients and thin clients both offer virtual desktop access (desktop vitalization), but they aren't the same when it comes to performance and scalability. These devices rely on a centralized server to deliver a virtual desktop environment to the user.

Thick clients do not typically use virtual desktops. Because a thick client is a traditional computer that has its own operating system, software, and hardware resources.

Here's a comparison to highlight the key differences between them:

Feature	Thick Client	Thin Client	Zero Client
Local Processing Power	High - processes most applications locally	Moderate - relies partly on the server for processing	Very Low - relies entirely on the server for processing
Local Storage	Has local storage for data and applications	Minimal or no local storage	No local storage
Operating System	Runs a full OS, like Windows or Linux	Runs a lightweight OS	No OS, uses firmware for basic connectivity
Independence	Can work independently without a server	Requires a server for some functions, but may work partially offline	Requires constant server connection, cannot work offline
Maintenance	High - requires regular updates, security patches	Moderate - some updates required but managed centrally	Minimal - no updates needed on the device
Boot Speed	Slower, due to the full OS loading	Faster, lightweight OS	Fastest, as there is no OS to load
Security	Moderate - data stored locally increases risk	Higher - limited local data	Highest - no local data or storage, inherently secure
Use Case	High-performance,	Centralized environments	Secure environments

	stand-alone tasks	needing basic app access	needing strict centralized control
Examples	Desktops, laptops	Thin-client workstations in offices	Medical or financial terminals connected to VDI
Cost	Higher cost due to more hardware and processing needs	Lower than thick clients, more than zero clients	Lowest cost as they contain minimal hardware

2. Zero client technology

Zero client technology refers to a computing model that utilizes zero clients—devices that have no local processing power, storage, or operating system.

These devices connect to a centralized server or cloud infrastructure where all computing tasks are performed.

A **Zero Client** is a lightweight, endpoint device used in desktop virtualization. It doesn't have a local operating system or storage and relies entirely on a central server to deliver computing resources.

2.1. Key Points:

- **No Local OS**: Zero clients have no operating system or significant processing power on the device itself.
- **No Local Storage**: No files or applications are stored locally on the device, improving security and reducing the risk of data theft.
- **Fully Dependent on the Server**: All computing, storage, and software run on a centralized server, and the zero client simply acts as a display terminal.
- **Protocols**: Zero clients use protocols like **PCoIP** (PC-over-IP), **HDX** (Citrix), or **RDP** (Remote Desktop Protocol) to connect to a virtual desktop or application hosted on the server.



2.2. How Zero Clients Work

- When a user logs into a Zero Client, it connects to the virtual desktop or application hosted on a remote server using specialized protocols.
- The **server processes everything**: computing power, application execution, and file storage all happen on the server.
- The **Zero Client simply displays** the graphical interface, relaying mouse and keyboard inputs back to the server.

2.3. Benefits of Zero Clients:

- **Security**: No local data storage means there is no risk of sensitive data being stolen or lost from the device.
- **Easy to Manage**: With no local OS or software, Zero Clients are easier to maintain and require little to no software updates.
- **Cost-effective**: Zero Clients are cheaper than full desktop computers, reducing both capital and operating costs.
- **Low Power Consumption**: They consume less power, making them ideal for large deployments such as schools or offices.

2.4. Drawbacks of Zero Clients:

- **Server Dependency**: If the server goes down or the network connection is poor, users lose access to their desktop and applications.
- **Limited Local Flexibility**: Since Zero Clients don't run local software, they are not suitable for environments that require local processing or application use.

2.5. Use Cases or application of Zero Clients Technology

- **Education**: Schools can deploy zero clients in computer labs where students access virtual desktops for learning without the need for expensive individual computers.
- **Enterprise**: Businesses use zero clients for office workers who need secure, centralized access to applications and data without managing individual desktops.

3. The difference between a zero client and a traditional computer.





Size: The size of the Zero Client is much smaller than the size of the computer, resulting in space savings and zero noise and heat produced by the computer.

Components: Zero Client does not contain the components that the computer relies on in operation, such as a hard disk, RAM and central processor, so the Zero Client user does not need more than a keyboard, mouse and display.

Cost: The cost of buying a Zero Client device is lower than the cost of buying a computer, as we mentioned that Zero Client does not contain computer components.

Update: The computer periodically needs maintenance and upgrade of its components to ensure the continuation of its work, while Zero Client does not need to be renewed because, as we agreed, it does not contain computer components.

4. Ncomputing Technology

NComputing is a company that specializes in cost-effective desktop virtualization and **thin client/zero client** solutions. Their technology allows multiple users to share a single computer or server, reducing the need for individual machines.

4.1. Key Points:

- NComputing offers both **thin clients** and **zero clients**.
- Their key technology is the **vSpace** platform, which enables shared computing by allowing multiple users to access a single instance of an operating system.

- **Target Market**: NComputing is popular in educational institutions, small businesses, and government agencies due to its cost efficiency and simplicity.



4.2. How NComputing Works

- **vSpace Software**: NComputing's **vSpace** software runs on a host computer (typically a server) and allows multiple users to connect to that computer simultaneously. Each user gets their own session, but all are sharing the same OS instance.
- **Client Devices**: NComputing's **thin clients** and **zero clients** (like the RX300 and RX-HDX) connect to the vSpace server and allow users to access their desktop sessions.

4.3. NComputing's Zero Clients

RX-HDX Zero Client: This is an example of a zero client from NComputing that uses **HDX protocol** to connect to Citrix environments. It has no local storage or OS and is optimized for remote desktop performance.

4.4. Advantages of NComputing

- **Cost Efficiency**: Instead of buying a full PC for each user, multiple users can share a single computer using NComputing technology.
- **Simplicity**: The devices are easy to manage since everything is centralized on the server.
- **Scalability**: Perfect for organizations that need to scale quickly and affordably.

4.5. NComputing in Action (Use Cases)

- ✓ **Education**: Schools can use NComputing to provide multiple students with desktops using just one server. This is especially helpful in underfunded educational environments where costs need to be kept low.
- ✓ **Small Businesses**: NComputing helps small businesses by reducing the cost of individual desktop hardware and simplifying IT management through centralization.

5. Comparing Zero Clients and NComputing's Solutions

5.1. Zero Clients:

- **No Local Processing**: 100% dependent on the server.
- **Protocol Driven**: Uses specific protocols (e.g., PCoIP, HDX) to connect to virtual desktops.
- **Security**: Excellent for secure environments with sensitive data.

5.2. NComputing's Solutions:

- **Shared Computing**: Unlike traditional zero clients, NComputing focuses on **shared computing**, where multiple users share the same OS instance.
- **Flexible**: NComputing offers both zero client and thin client options, depending on the organization's needs.
- **Use in Education/Business**: Popular in schools and small businesses where cost savings are crucial.

Note: NComputing offers both zero client and thin client options, depending on the organization's needs.

Theoretical Activity 1.1.2 Description of types of zero clients

Tasks:

1: Answer the following questions:

i. Briefly describe Major protocols used by zero clients.
ii. Explain different types of zero clients.
iii. Describe key features of Zero client technology

2: Write the answers on the paper or flip chart

3: Present your findings to the whole class.

3: Ask question for clarification where needed.

4: For more clarification, read the Key readings 1.1.2 in this manual.

Key readings 1.1.2.: Description of types of zero clients

1. Major protocols used by zero clients

The major protocols used by zero clients in Virtual Desktop Infrastructure (VDI) environments are essential for enabling communication between the zero client and the centralized server. Here are the most widely used zero client protocols:

1.1. PCoIP (PC-over-IP)

Developed by Teradici, now owned by HP.

Primarily used in **VMware Horizon** environments, but also supported by Amazon Workspaces. PCoIP is designed to deliver high-quality graphics and performance over a network. It compresses and encrypts the desktop's audio and video content, sending it to the zero client.

1.2. HDX (High-Definition User Experience)

Created by Citrix. Used in **Citrix Virtual Apps** (formerly XenApp) and **Citrix Virtual Desktops** (formerly XenDesktop). HDX suite the delivery of virtual desktops and applications. It delivers high-performance applications and desktops, even in low-bandwidth environments.

1.3. RDP (Remote Desktop Protocol)

Developed by Microsoft, RDP is widely used for connecting to Windows-based servers. It allows users to access their desktops and applications remotely. Provides remote desktop access to Windows-based environments.

Widely used with **Microsoft Remote Desktop Services** (RDS) and **Windows Virtual Desktops**.

1.4. Blast Extreme

Developed by VMware, Utilized in **VMware Horizon** environments as an alternative to PCoIP. It allows users to access their desktops and applications remotely.

1.5. SPICE (Simple Protocol for Independent Computing Environments)

Developed by Red Hat, Spice is an open-source protocol designed for virtualized environments. It is particularly used with KVM (Kernel-based Virtual Machine) and provides a good user experience for remote desktops and applications, and supports various peripheral devices.

1.6. EOP (Enterprise Office Protocol)

Developed by Ncomputing, Used in **NComputing**'s virtual desktop solutions.
It is a proprietary protocol designed to optimize the delivery of virtual desktops and applications in a networked environment. Tailored for low-cost, low-power **thin clients** and **zero clients**

2. Types of zero clients

Zero clients can be categorized into several types based on their architecture or the protocols they use for connecting to the server.
Here are some common types of zero clients:

2.1. Zero client types based on the Architecture:

- Dedicated Zero Clients
- Universal Zero Clients
- Integrated Zero Clients

2.2. Zero client types based on the Protocols:

- PCoIP Zero Clients
- HDX Zero Clients
- Blast Extreme Zero Clients
- RDP Zero Clients
- Cloud Zero Clients

Here are some details of types of zero clients:

2.2.1. **PCoIP (PC over IP) Zero Clients:** These devices use the *PCoIP* protocol developed by Teradici. These are commonly used with VMware Horizon environments. They are designed to deliver high-quality graphics and performance, making them suitable for applications that require rich media, such as CAD or video editing.

2.2.2. **HDX Zero Clients:** These devices use the *HDX (High-Definition User Experience*) protocol. Developed by Citrix. Typically used with Citrix XenDesktop and Citrix Virtual Apps. HDX zero clients are optimized for Citrix environments, providing high-performance multimedia and graphic capabilities over the network.

2.2.3. **Blast Extreme Zero Clients:** These devices use the *VMware Blast Extreme* protocol, which is designed for VMware Horizon environments. These clients utilize the Blast Extreme protocol. They offer high performance and efficient bandwidth usage, especially for multimedia and 3D graphics and efficient video and audio streaming.

2.2.4. **4. RDP (Remote Desktop Protocol) Zero Clients:** These devices use the *RDP (Remote Desktop Protocol)* Protocol. Designed for environments using Microsoft's RDP. These clients connect to remote desktops via Windows Remote Desktop Services (RDS) and are suited for standard office applications.

2.2.5. **Unified Zero Clients:** These devices use the Multiple protocols like PCoIP, RDP, HDX, Blast, etc. These are multi-protocol zero clients that can be used in different VDI environments, offering flexibility in deployment. They automatically switch protocols based on the server they connect to.

2.2.6. **Cloud Zero Clients:** These are designed specifically for cloud-based environments and can connect to various cloud services. They provide flexibility and scalability, allowing users to access their desktops and applications from anywhere with an internet connection.

Thin Clients vs. Zero Clients: While technically different, it's worth mentioning that thin clients are often compared to zero clients. Thin clients have a lightweight operating system and some local processing capabilities, whereas zero clients do not have any local OS or processing power.

3. Key features of Zero client technology

Here are key features of zero client technology:

3.1. **No Local Operating System:**

- ✓ Zero clients don't have their own operating systems installed.
- ✓ This eliminates the need for software updates, patches, and antivirus software, reducing maintenance overhead.

3.2. No Local Processing:

- ✓ Zero clients have minimal or no local processing power. They rely on a remote server to perform all computing tasks, which reduces the need for powerful hardware on the client side.

3.3. Centralized Management:

- ✓ All configurations, updates, and security policies are managed centrally from the server.
- ✓ This simplifies IT management and ensures consistent user experiences.

3.4. **Enhanced Security:**

- ✓ With no local storage, zero clients minimize the risk of data breaches and malware infections.
- ✓ Sensitive data resides on the secure server, protecting it from unauthorized access.

3.5. **Cost-Effective:** Zero clients is less expensive than traditional PCs in terms of both hardware and maintenance costs.

3.6. **Low Power Consumption:**

- ✓ Zero clients consume minimal power, reducing energy costs and environmental impact.
- ✓ This makes them ideal for large-scale deployments in offices or classrooms.

3.7. **Green IT:**

Zero clients align with green IT initiatives by reducing energy consumption and electronic waste.



Theoretical Activity 1.1.3: Description of key aspects of environment evaluation for zero client system installation

Tasks:

1: Answer the following questions:

i. What does environment evaluation mean for zero client system installation?
ii. What is a site survey?
iii. List key aspects of environment evaluation for zero client system installation
iv. What is the primary goal/purpose of conducting a site survey for installing zero client system?
v. List key advantages of conducting a site survey before installing zero client system.
vi. What is an ending result of site survey for zero client system installation?

2: Write the answers on the paper or flip chart

3: Present your findings to the whole class.

3: Ask question for clarification where needed.

4: For more clarification, read the Key readings 1.1.3 in this manual.



Key readings 1.1.3: Description of key aspects of environment evaluation for zero client system installation

1. Definition

1.1. Environment evaluation

Environment evaluation for zero client system installation is a process aimed at assessing all relevant factors that will impact the successful deployment and performance of zero client systems within a given setting.

1.2. Site survey

A site survey is the process of evaluating and analyzing a specific physical location to gather crucial information necessary for planning, designing, and implementing a project.

In the context of zero client system installation, a site survey is the process of assessing the physical and technical environment where the zero-client system will be deployed.

2. Key aspects of environment evaluation for zero client system installation

Here are the key aspects of environment evaluation for zero client system installation:

1. Physical Site Survey
2. User needs and System Usage evaluation

2.1. Physical Site Survey

A physical site survey is an important step in preparing for the installation of zero client systems.

Here's a detail of what to focus on during this phase:

2.1.1 Workstation Layout and Positioning

The first consideration during a site survey is identifying the ideal location for zero client devices and their peripherals within the workspace.

- **Optimal Placement of Workstations**: Assess how many workstations are needed and determine their placement in the room. Take into account the accessibility of power outlets, network ports, and physical space constraints.
  - ✓ **Distance from Central Server**: Ensure that the distance between workstations and the central server is within the allowed limits for network cabling (e.g., Cat5e, Cat6). Long distances can lead to signal degradation or latency issues.
  - ✓ **Space Allocation**: Ensure that enough space is allocated for each workstation, leaving room for future expansion if additional zero clients are

needed. Consider the movement of users in the space to avoid crowding and ensure comfort.

- ✓ **Multi-Monitor Setup**: If the zero client workstations will be using multiple monitors, ensure there is enough desk space and proper ergonomics for positioning them.

2.1.2 Cable Management

Efficient cable management is essential for maintaining a clean, organized, and functional workspace. Poor cable management can lead to clutter, confusion, and difficulty troubleshooting later.

- **Cable Pathways**: Plan out clear cable pathways for **power** and **network connections**. Depending on the workspace layout, this may involve running cables under floors, along walls, or through ceiling trays.
  - ✓ **Trunking or Conduits**: plan to Install appropriate **cable trunking** or **conduits** to house power and data cables. This not only keeps the installation organized but also protects the cables from damage and minimizes tripping hazards.
  - ✓ **Cable Lengths**: Ensure that cables are of sufficient length to reach from the workstation to the network switches, power outlets, or other devices without stretching or bending.
  - ✓ **Labeling**: plan Labeling each cable at both ends (e.g., workstation and network switch) for easy identification and troubleshooting. This becomes critical in environments with multiple zero client systems
  - ✓ **Power-over-Ethernet (PoE)**: If using PoE switches, ensure that the network cabling supports PoE standards and that the cables can handle the additional power load without interference. PoE reduces the number of power outlets needed near zero clients by delivering power over the same cable as data.

2.1.3 Network Ports and Power Outlets

A successful physical site survey involves mapping out the **availability of power and network connections**.

- **Power Availability**: Zero clients have low power requirements compared to traditional PCs, but they still require a power source. Check the proximity and availability of power outlets near each workstation.
  - ✓ **Additional Power Requirements**: Consider the need for powering peripheral devices such as monitors, keyboards with backlighting, and

other USB-powered equipment. Ensure enough outlets are available or plan for power strips or surge protectors where necessary.

- ✓ **Uninterruptible Power Supplies (UPS)**: For critical environments, evaluate whether zero clients should be connected to a UPS to avoid downtime during power fluctuations or outages. If zero clients and their peripherals rely on external power, this can be an important consideration.

- **Network Port Locations**: Assess the availability and accessibility of network ports (Ethernet jacks) near each workstation. Zero clients need a direct connection to the central server through the LAN, so ensure there are enough ports to accommodate all zero clients.
  - ✓ **Switch Placement**: If network switches are being installed, they should be positioned in a way that minimizes the distance between them and the zero clients to avoid the need for long cable runs.
  - ✓ **Switch Capacity**: Ensure that network switches have enough ports to support all zero clients and any additional networked devices. Also, consider **Power-over-Ethernet (PoE)** options if you want to minimize power cables by powering zero clients over the network.

2.1.4 Peripheral Device Setup and Integration

Zero clients may need peripheral devices such as monitors, keyboards, mice, printers, and scanners. Evaluate how these devices will be integrated into the workstation setup.

- **Monitor Placement**: Ensure that monitors are properly positioned for comfort, especially in multi-monitor setups where multiple displays may be needed. Zero clients usually support multiple monitors, so ensure that space and cable routing accommodate this.
- **Peripheral Compatibility**: Verify the compatibility of peripheral devices with zero clients, especially in environments that may need specialized equipment (e.g., touchscreen monitors or biometric scanners). Ensure that USB peripherals are close enough to zero clients for easy access and that cables can be managed properly.
- **Printer and Scanner Locations**: If printers or scanners will be shared among users, evaluate the placement of these devices to ensure ease of access for all users without cluttering the workstation area.

2.1.5 Environmental Factors

Assess any environmental factors that could affect zero client performance or user comfort.

- **Lighting**: Evaluate the lighting conditions in the workspace to ensure they are suitable for using monitors and other visual displays. Excessive glare or poor lighting can cause discomfort for users over time.
- **Ventilation and Temperature Control**: Although zero clients generate less heat than traditional PCs, adequate ventilation is still necessary to maintain a comfortable working environment and prevent overheating of any connected devices.
- **Cooling for Server Room**: Since zero clients rely on a central server, it's critical to assess the cooling and ventilation of the server room. Ensure that it can handle the continuous operation of the server(s) without overheating.

3. User Requirements and System Usage Evaluation

The success of a zero-client system heavily relies on understanding the end-users' needs and the nature of the workloads that the system will support. This phase involves the following considerations:

- **User Profile Analysis:**
  - ✓ **User Roles and Workflows:** Understand the tasks that users perform, whether they are general office workers, developers, designers, or healthcare professionals. Different roles have varying demands in terms of application performance, multimedia usage, and connectivity.
  - ✓ **Application Usage:** Assess the types of applications that users rely on, including the resource intensity of those applications (e.g., graphic design software, 3D rendering tools, office suites). High-performance applications may require more powerful server-side hardware.
  - ✓ **Peripheral Requirements:** Identify the peripherals (printers, scanners, barcode readers, etc.) that users need to connect to their zero client systems. Ensure that the system can support these devices, including USB redirection and other necessary compatibility features.
- **System Load and Performance:**
  - ✓ **Concurrent Users:** Determine how many users will be connected simultaneously to the centralized servers. This will help assess the

server's required processing power, memory, storage, and network capacity to avoid slowdowns.

- ✓ **Peak Usage Patterns:** Evaluate the usage patterns, such as peak times when more users are likely to be active. This information helps in planning resource allocation and optimizing performance.
- ✓ **Graphics and Multimedia:** Assess whether users need support for high-definition video, 3D graphics, or other multimedia tasks. Depending on the workload, you may need to provision additional GPU resources in the server infrastructure.

4. Goals of conducting a Site survey for zero client system installation

The primary goal of conducting a site survey for installing a zero clients' system is to gather all necessary information to ensure the proper planning, design, and implementation of the zero clients' infrastructure.

It also assesses the existing infrastructure and environment to ensure that the new system can be effectively integrated.

5. Key Advantages of Conducting a Site Survey before Installing a Zero Client System

- Ensures the system design meets the specific needs of the environment and users.
- Identifies potential challenges and obstacles in advance, allowing for proactive solutions.
- Assesses network capacity and physical layout to ensure smooth operation and minimal downtime.
- Helps avoid costly mistakes and over-provisioning by accurately assessing the necessary resources.

6. The ending result of site survey for zero client system installation

The **ending results** of a site survey for zero client system installation is Comprehensive **Site Survey Report**,

Site Survey Report, is detailed document summarizing all findings from the site survey. It is typically including the following key outcomes:

- **Physical Layout Analysis**: Diagrams and notes on the physical arrangement of the site, including locations for zero client devices, servers, and networking equipment.
- **Network Infrastructure Assessment**: Evaluations of existing network capacity, recommendations for upgrades, and potential configurations to support zero client operations.



Practical Activity 1.1.4: Conducting a site survey



Task:

1: Read the task described below:

> Your school needs to install computers in school's computer LAB using Zero client technology. As an IT Technician, go in computer LAB of your school, conduct a site survey for Zero clients' system installation and produce the site survey report.

2: Referring to the key reading 1.1.4, perform the task described above.

3: Apply safety measures

4: Conduct a site survey for zero clients' system installation and produce the site survey report

5: Present your findings to the whole class and ask for clarification where is needed



Key readings 1.1.4 Conducting a site survey

1. Steps of conducting a site survey for a zero clients system installation

Conducting a site survey for a zero clients system installation involves a systematic approach to gather all necessary information about the environment. Here are the key steps to follow:

1.1. Define Objectives and Scope

- ✓ Identify what you aim to achieve with the site survey, such as determining network capacity, assessing physical space, or understanding user requirements.
- ✓ Define the boundaries of the survey, including which areas will be assessed and what specific systems will be installed.

1.2. Gather Preliminary Information

- ✓ **Review Existing Documentation**: Look at any existing plans, network diagrams, or infrastructure documentation to understand the current setup.
- ✓ **Identify Stakeholders**: Determine who will be involved in the survey, including IT staff, facility managers, and end users.

1.3. Conduct a Physical Site Walkthrough

- **Assess Physical Layout**: Walk through the site to observe the arrangement of rooms, furniture, and existing equipment. Take measurements if necessary.
- **Check Infrastructure**: Inspect power outlets, cabling pathways, and ventilation systems to ensure they meet the requirements for zero client devices and servers.

1.4. Understand User Requirements

- **Interview Users**: Speak with potential users to gather insights on their needs, workflows, and any specific applications they will be using.
- **Analyze Usage Patterns**: Identify peak usage times and concurrency levels to understand the demand on the system.

1.5. Document Findings and Recommendations

- **Create a Site Survey Report**: Compile all gathered data, including diagrams, network assessments, user needs, and environmental conditions.
- **Make Recommendations**: Based on your findings, provide recommendations for server specifications, network upgrades, and peripheral integration.

1.6. Review and Finalize the Survey

- **Consult Stakeholders**: Share the findings with stakeholders for feedback and incorporate any necessary adjustments.
- **Obtain Approval**: Get formal approval from decision-makers to move forward with the proposed plan based on the site survey.

2. Sample of the site survey report

Scenario and its survey report

Scenario: Zero Client System Installation in a Secondary School

A secondary school is looking to implement a zero clients' system in its computer lab and several classrooms. The goal is to provide students with access to centralized computing resources, reduce hardware maintenance costs, and improve overall system management. The school has identified the need for 30 zero clients in total, with 20 in the computer lab and 10 in three classrooms.

Site Survey Report

1. Executive Summary

This report outlines the findings from the site survey conducted at X_WISDOM School. The survey was carried out to assess the physical environment, network infrastructure, and user requirements for the installation of a zero clients' system. Based on the evaluation, recommendations are provided for optimizing the installation process.

2. Objectives

- Evaluate the physical layout of the computer lab and classrooms.
- Assess the existing network infrastructure for capacity and performance.
- Identify power supply and cooling requirements.
- Understand user needs and workflows.

3. Site Overview

- **Location**: X_WISDOM School, Muhanga District
- **Date of Survey**: 20-10-2024
- **Participants**: Eng. ISHAMI AGWIZE and Eng. AGABA MUGABE

4. Physical Layout Assessment

- **Computer Lab**:
✓ Dimensions: 30 m x 25 m
✓ Existing furniture includes 20 desks with chairs and a teacher's station.
✓ Space for a server cabinet in the corner (3 m x 3 m).
- **Classrooms**:
✓ Classroom A: 25 m x 20 m (3 desks for students).
✓ Classroom B: 25 m x 20 m (3 desks for students).
✓ Classroom C: 25 m x 20 m (4 desks for students).

5. Network Infrastructure Evaluation

- **Current Setup**:
✓ 1 Gigabit Ethernet switch located in the IT room serving the entire building.
✓ 20 existing Ethernet ports in the computer lab, 10 in each classroom.
- **Network Performance**:
✓ Bandwidth test results: 200 Mbps download, 50 Mbps upload, 10 ms latency.
✓ No significant congestion detected during peak hours.
- **Recommendations**:

- ✓ Upgrade the switch to a managed switch with at least 48 ports to accommodate future expansion.
- ✓ Implement VLANs for better network management and security.

6. Power Supply Assessment

- **Current Power Availability**:
- ✓ Computer lab has 12 power outlets; each desk has a dedicated outlet.
- ✓ Classrooms have 4 power outlets each.
- **Cooling Requirements**:
- ✓ Adequate ventilation present; additional cooling may be required in the server cabinet.

7. User Requirements Assessment

- **User Interviews**: Conducted with teachers and IT staff.
- **Findings**:
- ✓ Teachers require access to educational software and collaborative tools.
- ✓ Students need access to the internet, productivity applications, and online learning platforms.
- ✓ Peak usage expected during class hours (8 AM to 3 PM).

8. Challenges Identified

- Limited space in the server cabinet for additional equipment.
- Potential need for cabling adjustments to accommodate new devices.

9. Recommendations

- **Server Specifications**: A centralized server with at least 32 GB RAM and multi-core CPU for handling concurrent users.
- **Power Management**: Consider adding a UPS for backup power in the server room.
- **Installation Plan**: Schedule installation during summer break to minimize disruption.

10. Conclusion

The site survey indicates that X_WISDOM School is well-positioned for the installation of a zero clients' system. With the recommended upgrades to the network infrastructure and careful planning of the installation, the school can

achieve its goal of providing efficient and reliable access to computing resources for students.

Approval and Signatures

Client Representative: _____

Surveyor: _____



Points to Remember

- Zero client, also known as ultrathin client, is a server-based computing model in which the end user's computing device has no local storage.
- Types of zero client technology: PCoIP Zero Clients (PC-over-IP), HDX Zero Clients, RDP Zero Clients (Remote Desktop Protocol), RemoteFX Zero Clients, SPICE Zero Clients, Proprietary Zero Clients and VESA Zero Clients
- Zero clients typically include a processor with basic firmware installed on it, and some combination of ports including HDMI, DVI, DisplayPort, USB and Ethernet.
- Everything is stored away on a remote server and managed centrally by IT staff.
- Fast boot-up times, little to no maintenance or involvement from IT, and high graphic capabilities
- Some key applications of zero client technology: Virtual Desktop Infrastructure (VDI), Call Centers, Healthcare, Education, Manufacturing and Industrial Operations, Retai, Banking and Finance, Public Kiosks, Design and Engineering Firms, Digital Signage, Research and Development.
- Applications of zero client technology involves Virtual Desktop Infrastructure (VDI), Call Centers, Healthcare, Education, Manufacturing and Industrial Operations, Banking and Finance….
- There are the key aspects of environment evaluation for zero client system installation:
- Physical Site Survey
- User needs and System Usage evaluation
- Site Survey Report is detailed document summarizing all findings from the site survey.
- Steps of conducting a site survey for a zero clients system installation

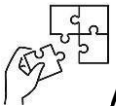
    1. Define Objectives and Scope
    2. Gather Preliminary Information

3. Conduct a Physical Site Walkthrough

4. Understand User Requirements

5. Document Findings and Recommendations

6. Review and Finalize the Survey



Application of learning 1.1.

A local school, M Academy, is upgrading its computer lab to better accommodate its growing number of students and to reduce the administrative and maintenance costs associated with traditional desktop computers. The lab is used by students from various age groups, with usage ranging from basic computer literacy to advanced programming and multimedia courses. The school has decided to switch to a zero clients' system for the computer lab to centralize computing resources, make management easier and reduce hardware and software costs.

The computer lab consists of 4 rows of 10 desks each. And the room sits on 20m X 18m. As a Network Engineer, you have been contracted to conduct a site survey and produce site survey report.

Indicative content 1.2: Selection of Tools and Equipment

Duration: 5 hrs

Theoretical Activity 1.2.1: Description of Zero client installation tools, materials and equipment

Tasks:

1: Answer the following questions:

i. Describe Zero client's installation hardware and software tools
ii. Describe the zero-client installation hardware equipment and materials
iii. Explain selection criteria of selecting Zero client's installation tools and equipment

2: Present your findings to the whole class and ask for clarification where needed

4: Read the Key readings 1.2.1 in trainees manuals

Key readings 1.2.1 Description of Zero client installation tools, materials and equipment

1. Hardware and software tools for Zero Client Installation

1.1. Hardware Tools:

When installing **Zero Clients**, several hardware tools, materials and equipment are required to ensure a successful setup. These tools can be grouped based on their functionality in the installation process:

1.1.1. Mounting Tools:

✓ **Screwdriver Set:** Used for mounting zero clients on walls, desks, or back of monitors.



✓ **Drill:** Needed for making holes in walls or other surfaces for mounting brackets.





- **Cabling Tools:**

✓ **RJ-45 Crimping Tool:** Used to crimp connectors onto Ethernet cables.



✓ **Cable Tester**: To check the integrity of Ethernet cables after crimping to ensure proper connectivity.



✓ **Network Analyzers:** Network analyzers help monitor the performance of the network to ensure that it can handle the demands of zero clients.



✓ **Multimeter:** Used to check voltage, current, and continuity for various hardware components, including power adapters, cables, and electrical outlets.



1.1.2. Cabling Tools:

- **RJ-45 Crimping Tool:** Used to crimp connectors onto Ethernet cables.
- **Cable Tester**: To check the integrity of Ethernet cables after crimping to ensure proper connectivity.
- **Network Analyzers:** Network analyzers help monitor the performance of the network to ensure that it can handle the demands of zero clients.
- **Multimeter:** Used to check voltage, current, and continuity for various

hardware components, including power adapters, cables, and electrical outlets.

1.2. Software Tools

When installing Zero Clients, various software tools are necessary to manage, configure, and test the system effectively. Here's a breakdown of the software tools used during zero client installation:

1.2.1. Zero Client Management Software:

- Teradici Management Console
- NComputing vSpace Console

1.2.2. Virtual Desktop Infrastructure (VDI) Software:

- VMware Horizon
- Citrix Virtual Apps and Desktops
- Microsoft Remote Desktop Services (RDS)

1.2.3. Configuration Tools:

- DHCP Server Configuration Tool
- TFTP Server Software
- Firmware Update Tools

1.2.4. Network Monitoring and Testing Tools:

- Ping and Traceroute Utilities
- Wireshark
- SolarWinds Network Performance Monitor (NPM)

2. Use of software tools

Here is details of use of each:

2.1. Zero Client Management Software:

2.1.1. **Teradici Management Console:** This software is widely used for managing and configuring zero clients in PCoIP environments. It allows administrators to:

- Monitor device health and performance.
- Update firmware.
- Configure network settings and device profiles.

2.1.2. NComputing vSpace Console: Specifically designed for NComputing zero clients, this software helps in managing multiple devices, assigning sessions, and monitoring user activity.

2.2. Virtual Desktop Infrastructure (VDI) Software:

2.2.1. VMware Horizon: Provides a virtual desktop and application delivery

platform for zero clients. It allows centralized management of desktop environments delivered to end users.

2.2.2. Citrix Virtual Apps and Desktops: Another VDI solution, Citrix helps deliver virtual desktops and apps to zero clients, ensuring a seamless user experience.

2.2.3. Microsoft Remote Desktop Services (RDS): Enables zero clients to connect to Windows virtual desktops or applications through a remote desktop protocol.

2.3. Configuration Tools:

2.3.1. DHCP Server Configuration Tool: Zero clients often use DHCP (Dynamic Host Configuration Protocol) to automatically receive an IP address. Configuring the DHCP server ensures that each zero client can communicate with the network.

2.3.2. TFTP Server Software (Trivial File Transfer Protocol): This may be used to deliver firmware or boot files to zero clients during their initial setup.

2.3.3. Firmware Update Tools: Used to upgrade the firmware on zero clients, ensuring that they run the latest software versions for performance improvements and security patches.

2.4. Network Monitoring and Testing Tools:

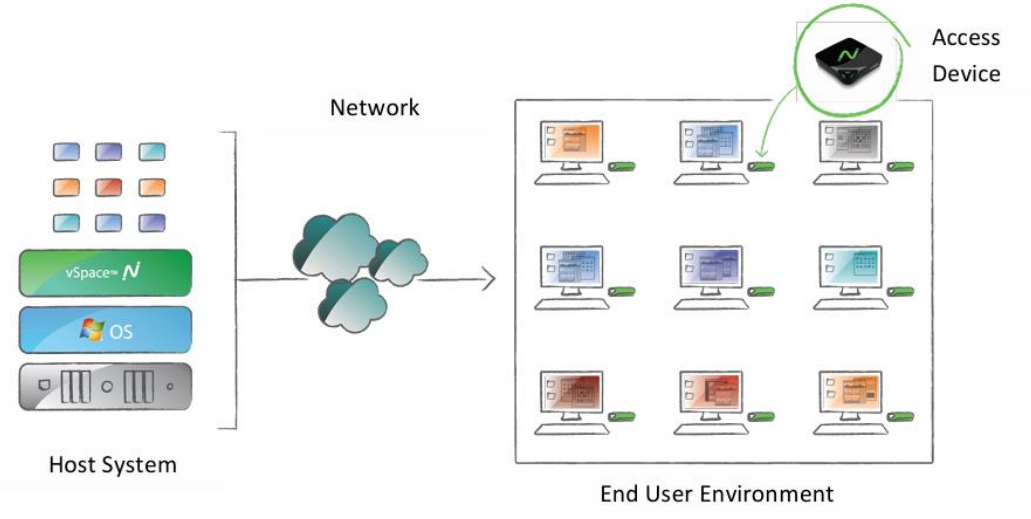
2.4.1. Ping and Traceroute Utilities: These command-line tools are used to test the network connectivity of zero clients to the server and ensure proper network paths.

2.4.2. Wireshark: A network protocol analyzer that helps troubleshoot network issues by capturing and analyzing packets exchanged between zero clients and the server.

2.4.3. SolarWinds Network Performance Monitor (NPM): A more advanced tool for monitoring the performance of network devices and checking if zero clients are experiencing any connection bottlenecks.

3. Hardware Equipment and Materials for Zero client installation:

3.1. Hardware Equipment



3.1.1. Server or Host Machine (if not using Cloud-Based VDI)

Hosts the virtual desktops or applications accessed by zero clients.

- **Considerations:**

✓ **Processing Power:** High-performance CPUs and sufficient RAM are needed to handle the number of concurrent sessions.

✓ **Storage:** Fast SSDs are preferred to minimize access time, especially for data-intensive applications.

✓ **Redundancy:** Features like RAID for storage, multiple network interfaces, and backup power can help ensure continuous availability.



✓

3.1.2. Access device or Access Terminal

- **Zero client:** It is a primary device that connects the user to the central server, virtual desktop infrastructure (VDI) or cloud-based desktop.



Notes: Once Ncomputing technology used, the access terminal used, called Ncomputing access terminal. Means, the access terminal got a name from the technology the device use.

3.1.3. Peripheral Devices:

- Monitors
- Keyboards
- Mice



Notes: Monitors, Keyboards, and Mice: Each zero client will need to be connected to a monitor, keyboard, and mouse for user interaction.

3.2. Materials:

3.2.1. Cables and Connectors:

- **Ethernet Cables (CAT5e or CAT6):** For network connectivity between zero clients and the server or switch.
- **HDMI or VGA Cables:** Depending on the type of monitors used,

these cables are required for display connectivity.

- **Cable Ties and Clips:** For organizing and securing cables to prevent tangling.

3.2.2. Mounting Accessories:

- **Mounting Brackets:** Brackets used to securely attach zero clients to monitors or desks.



- **Cable Tray or Conduit:** For cable management, ensuring a neat and organized installation.





4. Criteria for Selecting Zero Client Installation Tools and Equipment:

Selecting the right **tools and equipment** for a **Zero Client** installation is essential to ensure a smooth deployment, user satisfaction, and long-term reliability. Here are the criteria to consider when choosing tools and equipment for zero client installations:

4.1. Compatibility with Zero Client Infrastructure

- **Server and Network Compatibility:** Ensure that selected equipment (access devices, networking hardware, etc.) is compatible with the centralized server infrastructure, protocols (like PCoIP, RDP, HDX), and any other requirements of the zero-client system.
- **Peripheral Device Compatibility:** Tools like access devices and peripherals (monitors, keyboards, mice) should be compatible with the zero client's specific connectors and protocols.

4.2. Ease of Integration and Scalability

- **Easy Setup and Configuration:** Equipment should be simple to integrate and configure with existing network components, reducing installation time and minimizing troubleshooting.
- **Scalability:** Choose equipment that supports expansion. This includes network switches that can handle additional zero clients, centralized servers that can support increased loads, and tools that streamline adding devices to the network.

4.3. Reliability and Durability

- **Reputable Brands and Warranties:** Opt for tools and equipment from

reputable brands with good customer support and warranty options to ensure long-term functionality and quick resolution if issues arise.

4.4. Network Performance and Bandwidth Optimization

- **Low Latency and High Bandwidth:** Choose network equipment, such as switches and routers that can handle high bandwidth and maintain low latency to ensure smooth operation for zero clients, especially if they are used for video streaming or other intensive tasks.

4.5. Power Efficiency and Environmental Considerations

- **Low Power Consumption:** Zero clients are known for their energy efficiency. Choose power-efficient devices and power supplies to reduce operating costs and environmental impact.

4.6. Compliance with Industry Standards and Regulations

- **Certifications:** Select equipment that complies with industry standards and certifications (e.g., FCC, UL, RoHS), which is especially important in regulated industries like healthcare and finance.





Practical Activity 1.2.2: Selecting tools and equipment for Zero client installation

Task:

1: Read the task described below:

Imagine you are setting up an NComputing system in a school's computer lab, the computer Lab will accommodate 20 users. The users will primarily perform tasks such as web browsing, word processing, video playback, and light graphical work. You will be working with NComputing devices (L300 series), and a host PC that runs Windows 10 or 11 Operating System. Select tools and equipment to be used in Ncomputing installation for this scenario.

2: Referring to the key reading 1.1.4, perform the task described above.

3: Apply safety measures

4: Select tools and equipment to be used in Ncomputing installation

5: Present your findings to the whole class and ask for clarification where is needed



Key readings 1.2.2: Selecting tools and equipment for Zero client installation

Process of Selecting Zero Client Tools and Equipment

Selecting the right zero client tools and equipment is important step for a successful deployment. Here's a detailed process to follow:

1. **Assess Your Needs:**

   - **Number of Users:** Determine the exact number of users who will require zero client access.
   - **Required Performance:** Evaluate the necessary processing power and graphics capabilities for your specific applications.
   - **Security Requirements:** Assess the level of security needed for your organization's data.
   - **Scalability:** Consider your future growth and the ability to add more zero clients.
   - **Budget:** Set a realistic budget for the initial purchase and ongoing maintenance costs.

2. **Choose the Right Zero Client Type:**

   - **PCoIP Zero Clients:** Ideal for high-performance applications like CAD or video editing.
   - **RDP Zero Clients:** Primarily designed for Microsoft environments and offer good performance for standard office applications.
   - **HTML5 Zero Clients:** Browser-based solutions, easy to deploy but might have performance limitations.

3. **Select Compatible Hardware:**

   - **Zero Client Devices:** Choose devices compatible with your chosen protocol and performance requirements.
   - **Monitors, Keyboards, and Mice:** Select peripherals that are compatible with your zero clients and ergonomic needs.

4. **Consider the Server Infrastructure:**

   - **Virtualization Platform:** Choose a platform that can handle the workload of your zero client deployment.

- **Server Hardware:** Ensure your servers have sufficient processing power, memory, and storage.
- **Network Infrastructure:** A robust network is crucial for optimal performance.

5. **Test and Pilot:**

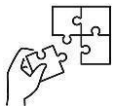
- **Pilot Deployment:** Conduct a pilot to test performance and functionality.
- **User Feedback:** Gather feedback to identify issues or areas for improvement.



Points to Remember

- Here are essential tools, materials and equipment required When installing **Zero** Clients: hardware tools essentially include mounting and cabling tools. Software tools includes: management software, configuration and network monitoring tools.
- The materials required incudes: Cables and Connectors, Mounting Accessories and Cable management materials.
- Zero client installation also require equipment such as: Host Machine, access device, and peripheral devices.

- Here's a detailed process to follow while selecting Zero Client Tools and Equipment:
  - **Step 1:** Assess Your Needs
  - **Step 2:** Choose the Right Zero Client Type
  - **Step 3:** Select Compatible Hardware
  - **Step 4:** Consider the Server Infrastructure
  - **Step 5:** Test and Pilot



Application of learning 1.2.

MIFOTRA wants to install computer lab with 30 users' workstations by zero client technology. The users will be using the computers mainly for passing work exams. MIFOTRA has a modest budget and wants to use a single server or host PC. As IT technician you have been asked to select tools, materials and equipment necessary to setting up such Zero client system.

Indicative content 1.3: Design of Zero Client Topology

Duration: 5 hrs

Theoretical Activity 1.3.1 Description of zero client topology

Tasks:

1: Answer the following questions:

i. Explain the types of zero client topologies
ii. What are the key components of a Zero Client topology?

2: Write the answers on the paper or flip chart

3: Present your findings to the whole class.

3: Ask question for clarification where needed.

4: For more clarification, read the Key readings 1.3.1 in this manual.

Key readings 1.3.1 Description of zero client topology

1. Categories of zero client topologies

Zero Client topologies can be categorized based on the different ways in which zero clients can be connected to a server and the network structures used to deploy and manage zero client devices

2. Types of zero client topologies

1.1. Referring to the different ways in which zero clients can be connected to a server and how data and applications are delivered to the user's device.

For this, we distinguish the following types:

1.1.1. Client-Server Topology

In this topology a single server hosts all virtual desktops and applications. Zero clients connect directly to the server or through a network switch. It is easy to manage and configure and it is easy to be scaled by adding more servers or virtual machines.

1.1.2. Brokered Topology

In this topology a dedicated server manages connections between zero clients and virtual desktops. It distributes workload across multiple servers. Centralized

control over user access and data. Requires careful configuration and management.

1.1.3. Cloud-Based Topology

In this topology Virtual desktops and applications are hosted in a cloud environment. Zero clients connect to the cloud provider's infrastructure via the internet. It is reliable and scalable cloud infrastructure and it requires a stable internet connection.

1.1.4. Hybrid Zero Client Topology

This topology refers to a combination of on-premise server infrastructure and cloud-based services. Zero Clients may connect to a local server for certain tasks and a cloud-based server for others, balancing local and remote resources. Higher costs due to maintaining both local and cloud infrastructure.

1.2. Referring to the network structures used to deploy and manage zero client devices within a Virtual Desktop Infrastructure (VDI) we identify the following type:

1.2.1. Star Topology

In a star topology, all zero clients connect to a central hub (such as a network switch or centralized server) that serves as the core point for data transmission. Each zero client has a direct link to the hub, and all communication passes through it.

This is ideal for small to medium-sized environments where zero clients are used in localized settings, such as computer labs or offices.

Advantages:

- ✓ Star topology is simple to set up and manage, making it suitable for smaller installations.
- ✓ Since each zero client has an individual link to the hub, a failure in one connection doesn’t impact the rest of the network.
- ✓ Adding more zero clients is relatively simple; you can connect new devices to the central hub.

Disadvantages:

- ✓ If the central hub (e.g., switch or server) fails, the entire network is affected.
- ✓ The hub manages all data traffic, which can create congestion in high-traffic scenarios, especially if the network is not designed to handle heavy loads.

1.2.2. Tree Topology

Tree topology is a hierarchical structure that combines multiple star networks. In this setup, smaller groups of zero clients connect to local hubs, which then connect to a higher-level central server or switch. It's essentially a layered version of star topology.

This topology works well in multi-level buildings or large environments like campuses where zero clients are distributed across floors or departments.

Advantages:

✓ The hierarchical setup allows for easy grouping and segregation of zero clients by department, floor, or room.

✓ A failure in a lower-level hub or client affects only a subset of the network, not the entire structure.

✓ Adding new zero clients can be done at the local hub level without impacting other groups.

Disadvantages:

✓ Tree topology is more complex to install and maintain than a simple star network.

✓ If a higher-level hub fails, all lower-level connected devices are impacted, making redundancy essential for reliability.

1.2.3. Hybrid Topology

Hybrid topology combines elements of star, tree to create a customized network structure tailored to specific requirements. This approach allows flexibility and can be designed to balance cost, redundancy, and performance.

Ideal for large organizations or multi-building campuses where departments have different networking needs and zero clients are distributed widely.

Advantages:

✓ Allows a tailored approach to meet specific requirements, combining the simplicity of a star with the redundancy of mesh as needed.

✓ Provides an adaptable foundation that can grow with the organization's needs.

✓ By incorporating multiple topologies, failures can be isolated to specific segments without affecting the entire network.

Disadvantages:

✓ Configuring and maintaining a hybrid network requires careful planning and technical expertise.

✓ Combining multiple topologies can increase costs due to additional equipment and cabling needs.

2. Components of Zero Client Topology

2.1. Zero Clients: Lightweight devices used by end-users to connect to the central server. They provide the display and input interfaces but no local processing or storage.

2.2. Central Server/VDI: Hosts virtual desktops or applications for all users. This server handles all the computation, storage, and processing required by the clients.

2.3. Hypervisor: Software that virtualizes hardware resources on the server to create multiple virtual machines. Each user gets their own virtual desktop or session.

2.4. Network Infrastructure: The local or wide area network that connects Zero Clients to the central server. This infrastructure must be robust to handle the load, with low latency and high bandwidth.

2.5. Storage: Centralized storage is required to hold the virtual desktops, applications, and user data. This could be Network Attached Storage (NAS), a Storage Area Network (SAN), or attached local storage on the server.

2.6. Connection Protocols: Protocols like **PCoIP**, **HDX**, or **RDP** manage the communication between the Zero Clients and the server, ensuring smooth video, audio, and input/output operations.

3. Selection of transmission media in Zero client installation

3.1. Description of transmission media

In a zero-client installation, choosing the right transmission media is essential for reliable, low-latency connections between zero clients and the central server or data center. The choice depends on factors like network requirements, distance, and the physical environment.

- **Ethernet Cables (Wired Connections):**

✓ **Cat 5e/Cat 6/Cat 6a:** These are commonly used twisted-pair cables for Ethernet connections. Cat 5e supports speeds up to 1 Gbps, while Cat 6 and Cat 6a can support speeds up to 10 Gbps over shorter distances. Wired connections generally provide lower latency and higher reliability compared to wireless.

✓ **Fiber Optic Cables:** For environments requiring high bandwidth and long-distance transmission, fiber optic cables are an excellent choice. They offer higher speeds and are immune to electromagnetic interference, making them ideal for data centers or large office spaces.

- **Wireless Connections:**

Wi-Fi (Wireless LAN): In scenarios where cabling is impractical or where mobility is needed, Wi-Fi can be used. It's essential to select the latest standards (like Wi-Fi 6) to ensure sufficient bandwidth and low latency.

- **Power over Ethernet (PoE):**

If zero clients support PoE, using Ethernet cables can also provide power to the devices, eliminating the need for separate power outlets. This simplifies installation and reduces cable clutter.

3.2. Considerations for Selecting transmission media for Zero client installation

- **Bandwidth Requirements:** Assess the bandwidth needs based on the applications and workloads that the zero clients will handle. High-definition video streaming or graphic-intensive applications may require higher bandwidth.
- **Distance:** Evaluate the distance between the zero clients and the servers or switches. For longer distances, fiber optics may be more suitable.
- **Interference:** Consider potential sources of electromagnetic interference, especially when using copper cables. Fiber optics are immune to such interference.
- **Scalability:** Choose a transmission medium that can easily accommodate future growth, whether that means more users or increased bandwidth demands.
- **Cost:** Evaluate the budget for installation. While fiber optics may offer superior performance, they can also be more expensive than copper solutions.

3.3. Selecting the right topology design tools

3.3.1. Designing tools

Selecting the right topology design tools for zero client deployments is essential for creating an effective and efficient virtual desktop infrastructure (VDI).

Here are recommended Tools:

- Microsoft Visio
- Draw.io:
- Lucidchart
- Cisco Packet Tracer
- SolarWinds Network Topology Mapper
- GNS3 (Graphical Network Simulator)
- VMware Horizon Design Tool
- Citrix Virtual Apps and Desktops Service

3.3.2. Key factors to consider when choosing a designing tool

- **Compatibility:** Ensure that the design tools are compatible with the zero client hardware and the virtual desktop solutions you plan to use

- **User-Friendly Interface:** The tool should be easy to learn and use, with a user-friendly interface.
- **Simulation and Testing:** Select tools that offer simulation features, allowing you to test different configurations and assess performance before implementation.
- **Flexibility:** The tool should be able to accommodate different network topologies and complexities.
- **Collaboration:** The tool should support collaboration and sharing of diagrams with team members.
- **Cost:** Consider your budget for design tools, including any licensing fees or subscription costs.



Practical Activity 1.3.2: Drawing a zero-client topology diagram



Task:

1: Read the task described below:

Your school want to draw a Zero Client topology diagram for its computer lab. The lab will be consisting of 25 Zero Clients and one Host computer. Draw an appropriate zero client topology for the Lab

2: Referring to the key reading 1.3.2, perform the task described above.

3: Apply safety measures

4: Draw a zero client topology for the lab

5: Present your findings to the whole class and ask for clarification where is needed

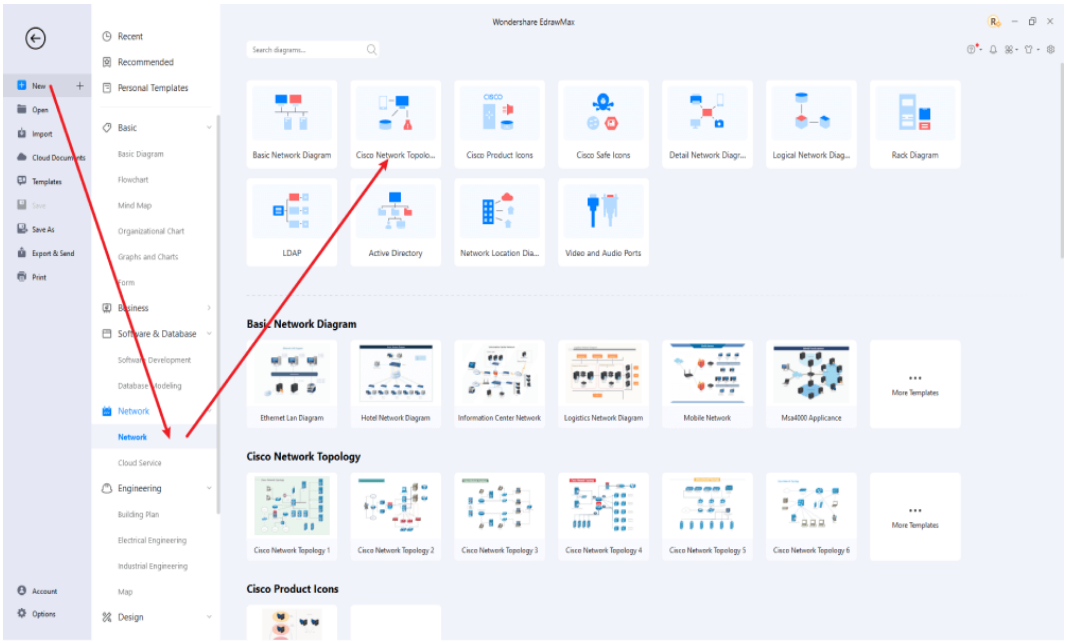


Key readings 1.3.3 Drawing a topology diagram

Draw Network Topology Diagrams from Scratch

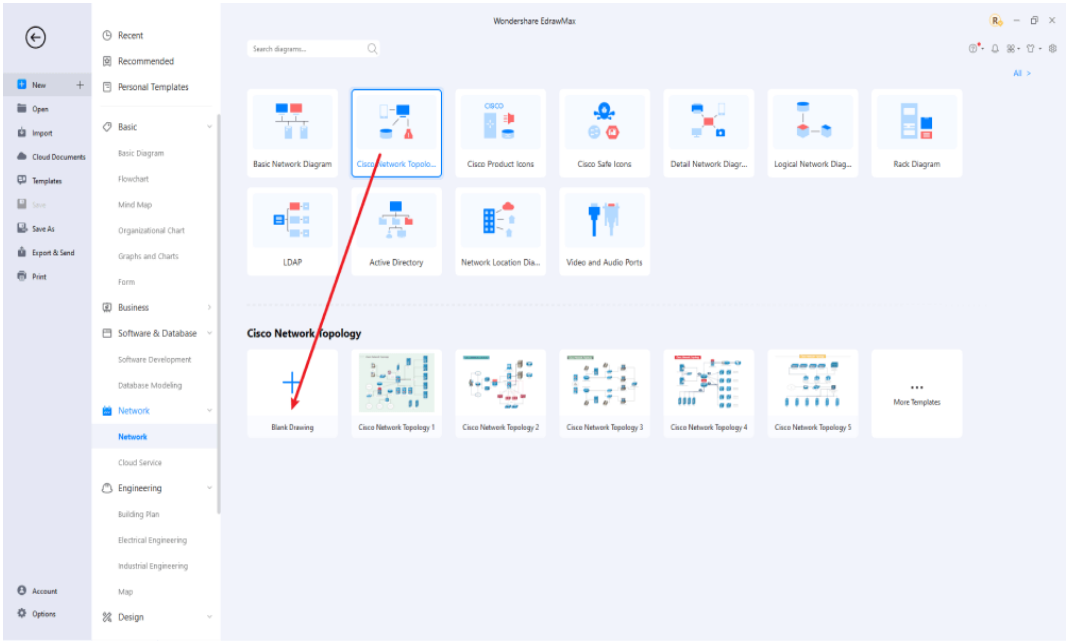
Step 1: Open EdrawMax & Login

If you are using the offline version of EdrawMax, then open the tool in your system. If you wish to have remote collaboration, head to EdrawMax Download and log in using your registered email address. If this is your first time using the tool, you can register yourself using your personal or professional email address.



Step 2: Open a New Canvas

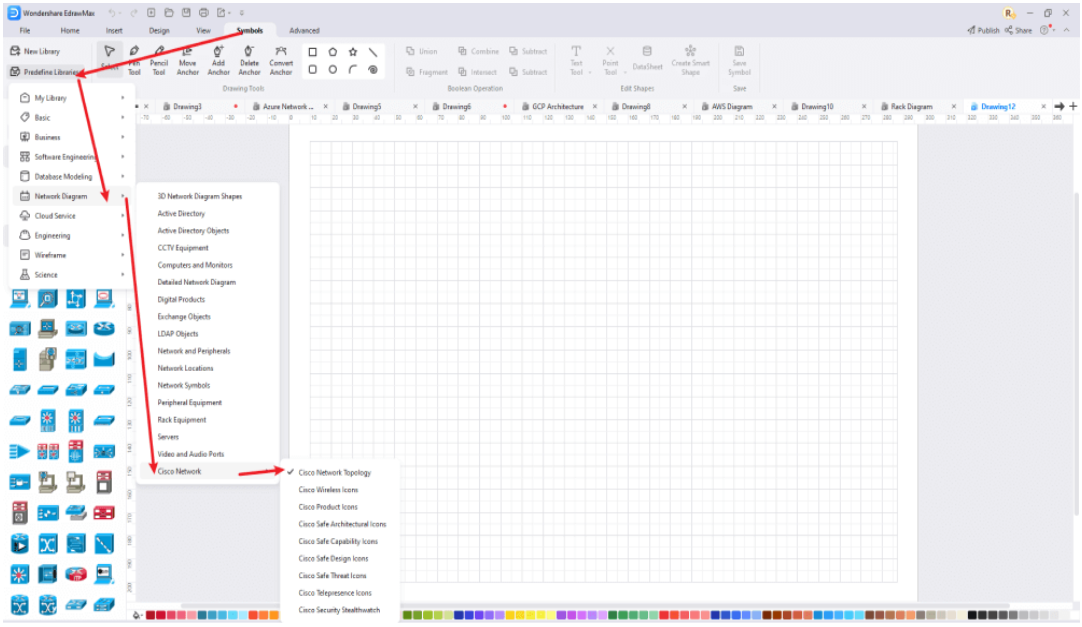
Once EdrawMax launches, go to Network and Select Network. Now, select a blank canvas since you create a network diagram from scratch. The canvas comes with multiple drawing features and tools with a built-in library of vector-enabled symbols.



Step 3: Select Symbols

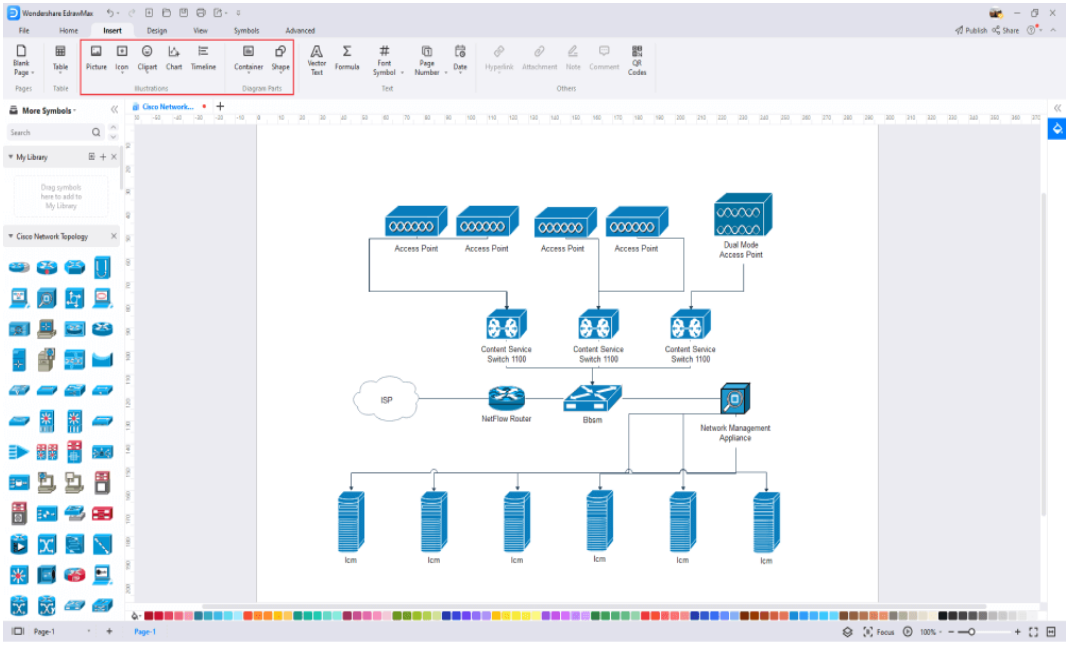
Create the basic outline of your network topology diagram. Go to Symbols Tab and click on Predefine Libraries > Network Diagram to get more symbols. Now, select the type of network symbols you want. To add any item on your drawing page,

select it, drag it towards the page, and place it where you want it.



Step 4: Add Elements

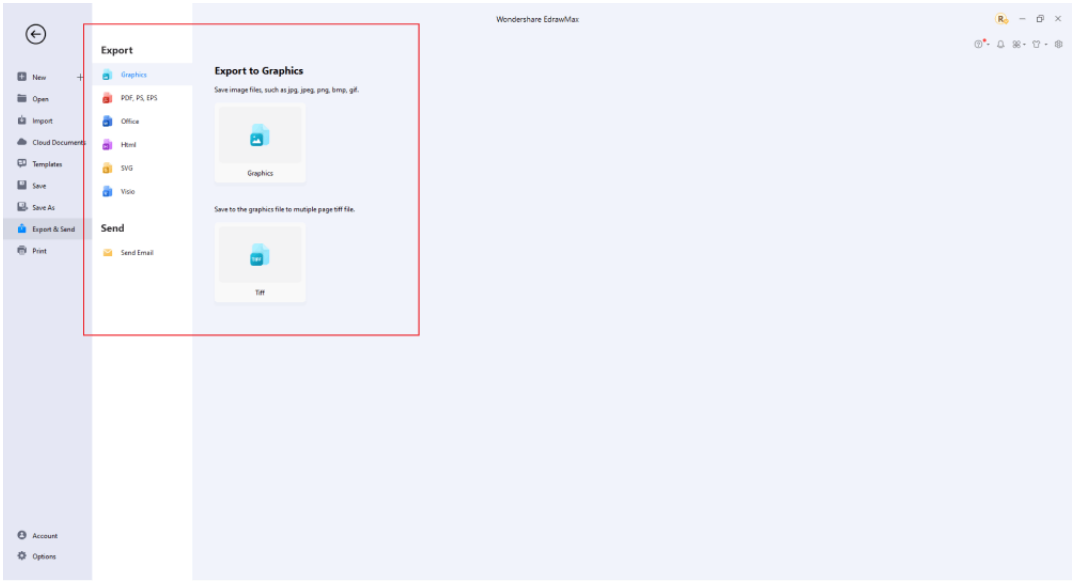
After you've imported all of the symbols into the network topology diagram drawing, you can place them on the canvas. You can add hardscape and softscape drawings and all the other elements. Use the toolbars on the right side of the screen to change the color, size, font, etc.



Step 5: Save & Export

Once you have completed the network topology diagram, you can save it for later edits and online sharing. EdrawMax lets you export documents in several commonly used file types: Excel, PDF, Graphics, PowerPoint, or Word. To save an

Edraw file in another software, click on File and go to Export. Now, select the file type you want to choose. EdrawMax also allows you to save on the cloud or directly share online on social media platforms and email.



Points to Remember

- For Small to Medium Deployments: Cat6 or Cat6a Ethernet cables (up to 100 meters) will typically provide adequate performance.
- For Large or High-Performance Deployments: Fiber optics (single mode for long distances, multi-mode for shorter distances) will be the best choice.
- For Wireless Setup: Wi-Fi is feasible for small setups but comes with potential performance and reliability trade-offs.

Application of learning 1.3

A company wants to implement a zero-client solution to centralize computing resources and improve security. They have 50 employees, 20 in first floor and 30 in second floor who require access to various centralized applications and data.

You are hired to design the zero client's topology diagram for the company, and submit the diagram to the IT Team

Indicative content 1.4: Zero client system cost estimation/Estimate zero client system cost

Duration: 5 hrs

Practical Activity 1.4.2: Estimating cost for zero client system installation

Task:

1: Read the given task

Based on the topology diagram created in Practical Activity 1.3.3, please estimate the cost of the planned zero client system.

2: Follow the demonstration of trainer

3: Repeat the activity following trainer's demonstration

4: Ask for assistance where is needed

5: Read key readings 1.4.2 in trainee's manual

Key readings 1.4.2 Estimating zero client system cost

1. Identification of items with specification

Estimating the cost of a zero-client system involves several components, including hardware, software, network infrastructure, and ongoing maintenance. Here are key factors to consider when estimating the costs associated with a zero-client deployment:

1.1. Hardware Costs

Zero Client Devices: The primary cost will be the zero-client hardware itself. Prices can vary significantly based on brand, specifications, and features (e.g., support for multiple monitors, USB ports, etc.). Typical prices range from $100 to $500 per device.

Servers: If you're deploying a virtual desktop infrastructure (VDI), you'll need powerful servers to host the virtual machines. The cost will depend on the number of users, the required performance, and whether you choose to buy or lease the servers.

Networking Equipment: This includes switches, routers, and potentially wireless access points if using Wi-Fi. The cost will depend on the number of devices and the required bandwidth.

1.2. Software Costs

VDI Software Licensing: Depending on the VDI solution you choose (e.g., VMware Horizon, Citrix Virtual Apps and Desktops, Microsoft Windows Virtual Desktop), you'll need to account for licensing costs. These can be based on per-user or per-device models and can range from $50 to several hundred dollars per user annually.

Management and Monitoring Tools: Additional software for managing and monitoring the zero client environment may also incur costs. This could include tools for performance monitoring, security, and backup solutions.

1.3. Implementation Costs

Installation and Configuration: Consider the costs associated with deploying the zero client system, including labor for installation, configuration, and any necessary training for IT staff and end-users.

Consultation Services: If you require external expertise for planning and implementing the system, factor in consulting fees.

1.4. Ongoing Costs

Maintenance and Support: Include costs for ongoing technical support, software updates, and hardware maintenance. This could be a monthly or annual fee, depending on your service agreements.

Power and Cooling: Although zero clients consume less power than traditional PCs, you should still estimate the cost of electricity for both the zero clients and the servers.

Network Costs: Ongoing costs for internet and network services should also be considered, especially if you're using cloud services or remote access solutions.

1.5. Scalability Considerations

When estimating costs, consider the potential for future growth. It may be more cost-effective to invest in scalable infrastructure from the outset rather than having to make significant upgrades later.

1.6. Total Cost of Ownership (TCO)

To get a comprehensive understanding of the cost, calculate the Total Cost of Ownership (TCO) over a defined period (e.g., 3-5 years). This should include all

initial costs, ongoing expenses, and any potential savings from reduced energy consumption and lower maintenance needs compared to traditional PCs.

Example Cost Estimation

Here's a simplified example for a small organization with 20 users:

- ✓ Zero Clients: 20 x $300 = $6,000
- ✓ Servers: 2 x $3,000 = $6,000
- ✓ Networking Equipment: $2,000
- ✓ VDI Software Licensing: 20 x $100 = $2,000 annually
- ✓ Implementation Costs: $3,000
- ✓ Ongoing Maintenance and Support: $1,500 annually

Initial Costs: $6,000 (zero clients) + $6,000 (servers) + $2,000 (networking) + $3,000 (implementation) = **$17,000**

Annual Costs: $2,000 (software) + $1,500 (maintenance) = $3,500

Over 5 years, the TCO would be:

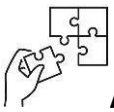
- Initial costs: $17,000
- Ongoing costs: $3,500 x 5 = $17,500
- Total TCO: $34,500



Points to Remember

Here are key factors to consider when estimating the costs associated with a zero-client deployment:

1. Hardware Costs
2. Software Costs
3. Implementation Costs
4. Ongoing Costs
5. Scalability Considerations
6. Total Cost of Ownership (TCO)



Application of learning 1.4

XYZ Company is planning to implement NComputing technology and is looking for a qualified individual to estimate the cost of the necessary 50 NComputing devices. This individual will be responsible for determining the total cost associated with the implementation of 50 NComputing devices, including hardware, software, networking equipment, peripherals, installation, and any other relevant expenses.

you are requested to estimate required cost for implementing this project.

Learning outcome 1 end assessment

Written assessment

Circle the letter corresponding to the right answer

1. **What is a Zero Client?**
    a. A device with no operating system or local storage that relies on a central server for computing.
    b. A fully functional personal computer with its own CPU and storage.
    c. A cloud storage service for small businesses.
    d. A virtual machine hosted in a cloud environment.
2. **How does a Zero Client connect to a virtual desktop?**
    a. Through local processing on the device itself.
    b. By downloading a copy of the desktop to the Zero Client.
    c. By using the remote desktop protocol to access the virtual desktop on a server.
    d. By copying the server's data onto the client's local storage.
3. **Which of the following is a key advantage of Zero Clients?**
    a. Requires high maintenance and regular software updates.
    b. Low power consumption and reduced local computing resources.
    c. Extensive hardware upgrades required to support new software.
    d. High cost and increased complexity in network management.
4. **What makes Zero Clients different from Thin Clients?**
    a. Zero Clients have their own operating system, while Thin Clients don't.
    b. Thin Clients have limited local storage, while Zero Clients have none.
    c. Zero Clients process data locally, while Thin Clients process it remotely.
    d. Thin Clients require more server resources than Zero Clients.
5. **Which scenario best suits the use of Zero Client technology?**
    a. In a home office requiring high-performance gaming PCs.
    b. In an organization with a centralized IT infrastructure and frequent remote desktop use.
    c. In a small business that requires minimal IT support but large local storage.
    d. In a factory environment where offline processing is critical.
6. **What is a potential limitation of Zero Client technology?**
    a. High upfront cost of deploying Zero Client devices.
    b. Frequent need for hardware upgrades and replacements.
    c. Reliance on a strong network connection to function.
    d. Difficulty in integrating with cloud-based applications.
7. **Zero Client technology is most commonly used in which of the following environments?**
    a. Gaming and entertainment industries.
    b. Video editing and graphic design studios.

c. Corporate offices with centralized IT infrastructure.

d. Home offices with decentralized workflows.

8. **How do Zero Clients contribute to security in IT environments?**

a. They store sensitive data locally for faster access

b. They prevent data from being stored on the device, minimizing security risks.

c. They use advanced firewalls and antivirus software locally.

d. They automatically back up data to multiple external hard drives.

9. **What kind of updates are typically required for Zero Clients?**

a. Firmware updates.

b. Operating system updates.

c. Frequent driver and software updates.

d. Hardware updates every few months.

10. **In terms of management, Zero Clients are typically:**

a. Easier to manage than traditional PCs and Thin Clients.

b. More difficult to manage than Thin Clients due to hardware limitations.

c. Managed entirely on the device itself, without the need for external tools.

d. Not managed at all, as they operate independently of the network.

11. What is the primary factor influencing the total cost of deploying Zero Clients in an organization?

a. Cost of the Zero Client devices themselves

b. Cost of training employees on new technology

c. Cost of the central server infrastructure

d. Cost of software licenses for remote access

12. How does the initial investment in Zero Clients compare to traditional PCs over a five-year period?

a. Zero Clients generally have a higher total cost due to server requirements.

b. Traditional PCs often have a lower total cost due to their autonomous functionality.

c. Zero Clients usually result in lower total costs due to reduced maintenance and energy expenses.

d. Both options have equivalent costs over time.

13. What ongoing cost should organizations consider when estimating the total cost of ownership for Zero Clients?

a. Regular software updates for individual devices

b. Increased energy consumption compared to traditional PCs

c. Network maintenance and bandwidth costs

d. Higher insurance premiums for server equipment

14. When calculating the budget for Zero Client implementation, which additional cost should organizations include?

a. Cost of individual user licenses for each Zero Client

b. Cost of server virtualization software

c. Cost of physical office space for hardware

d. Cost of upgrading existing internet service plans to support increased traffic

Practical assessment

A call center, handling customer service for multiple companies, is growing and needs to securely and efficiently support up to 500 agents. Each agent requires consistent, reliable access to several applications, including a CRM, call management, and ticketing systems. The call center also prioritizes data security and cost-efficiency, making zero client technology an ideal choice.

You have been hired as part of the IT team that tasked to conduct a site survey, design a zero client topology diagram, determine the installation tools and equipment, and Estimate zero client system cost.

END



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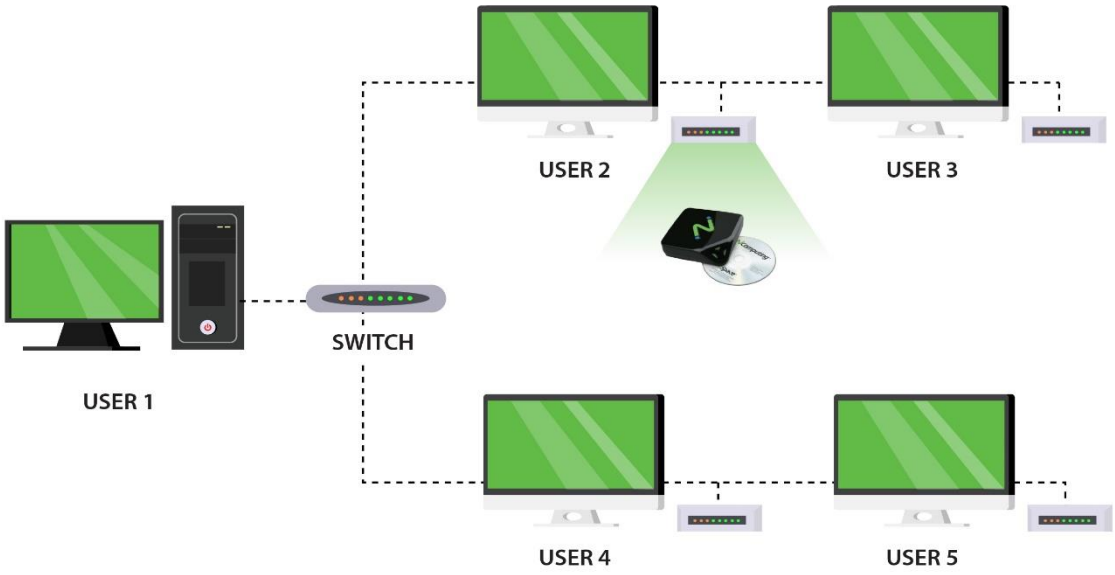
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NComputing System





Indicative contents
2.1 Interconnecting Ncomputing Devices
2.2 Installing Ncomputing Software
2.3 Testing Ncomputing System

Key Competencies for Learning Outcome 2: Install Ncomputing

Knowledge	Skills	Attitudes
• Identification of Ncomputing devices • Identification of Ncomputing installation tools • Description of Ncomputing devices fixing techniques • Description of documentation elements of Ncomputing installation	• Interpreting Ncomputing topology diagram • Fixing Ncomputing devices • Interconnecting Ncomputing devices • Installing Ncomputing software • Testing Ncomputing system • Documenting Ncomputing installation	• Having attention to details. • Being rapid during work execution. • Being organized to achieve the required result.

Duration: 35 hrs

Learning outcome 2 objectives:

By the end of the learning outcome, the trainees will be able to:

1. Interpret correctly Ncomputing topology diagram based on system requirements
2. Identify properly Ncomputing devices based on installation requirements and topology design
3. Describe properly Ncomputing devices' fixing techniques based on manufactures guidelines
4. Identify properly Ncomputing installation tools based on their intended use
5. Fix properly Ncomputing devices based on topology diagram
6. Interconnect properly Ncomputing devices according to system requirement
7. Install successfully Ncomputing software based on system requirement
8. Test correctly Ncomputing system according to system functionality
9. Describe properly documentation elements of Ncomputing installation based on Ncomputing system.
10. Document appropriately Ncomputing installation based on topology diagram.

Resources

Equipment	Tools	Materials
• Computer • Keyboards • Mouses • Monitors • Switch • Router	• Screws drive • Flash disk • Fixing tools • Cutting tools • Firewall • Cable Tester • vSpacePro software	• Operating system • Ethernet Cables • Internet access • Ties and clips • Labelling tags • Screws

Indicative content 2.1: Interconnecting Ncomputing devices

Duration: 10

Theoretical Activity 2.1.1: Description of Ncomputing devices Interconnection

Tasks:

1: Answer the following questions:

i. Explain NComputing system installation requirements and their functions in Ncomputing system.
ii. Describe process of installing Ncomputing system.
iii. Identify different ports and buttons of Ncomputing terminal.
iv. Describe the ways of mounting/fixing Ncomputing devices.
v. Describe the connecting procedure of Ncomputing component.
vi. Differentiate two methods of setting up NComputing hardware using PCI slot and network equipment.
vii. Explain the way of testing Ncomputing interconnection.

2: Write the answers on the paper or flip chart

3: Present your findings to the whole class.

3: Ask question for clarification where needed.

4: For more clarification, read the Key readings 2.1.1 in this manual.

Key readings 2.1.1.: Description of Ncomputing devices Interconnection

1. **NComputing Physical Components**

NComputing systems consist of various hardware components designed to enable multiple users to share a single computer (or server) through virtual desktops. Here's a detailed description of the essential physical components involved in an NComputing setup:

1.1. NComputing Thin Clients

The thin clients are lightweight, low-power devices used to connect individual users to a shared computer (or server) running NComputing's vSpace software.

- **Key Features**:

- ✓ **Ports**: Thin clients typically have USB ports for connecting peripherals (e.g., keyboards, mice), as well as audio jacks for headphones and speakers.
- ✓ **Network Interface**: Most thin clients come with an Ethernet port for connecting to the local network, allowing them to communicate with the server.
- ✓ **Monitor Connection**: These devices usually feature **VGA**, **HDMI**, or **DVI** ports to connect to a display monitor.
- ✓ **Power Source**: Thin clients may either use a traditional power adapter or **Power over Ethernet (PoE)**, which provides both data and electrical power through a single Ethernet cable.

- **Models**: Common models include the **L-series**, **M-series**, and **X-series**, each designed for different use cases and user capacities.



1.2. vSpace Server (Host Computer)

The vSpace server is the central computing device that hosts the operating system, applications, and user sessions. All the thin clients connect to this server to access virtual desktops.

- **Key Features**:
  - ✓ **High Performance**: The server typically requires a multi-core processor, a significant amount of RAM, and storage space to handle multiple concurrent users.
  - ✓ **Network Connectivity**: The server must be connected to the local network to communicate with the thin clients. It may also need multiple network interface cards (NICs) for high-demand setups.

✓ **Virtualization Software**: The server runs **NComputing vSpace** software, which manages the thin client connections and virtual desktop sessions.

✓ **Redundancy**: In some setups, there may be multiple vSpace servers for failover and load balancing.



1.3. Monitors

Each user connected to the NComputing system requires a monitor to view their virtual desktop session.

- **Key Features**:

  ✓ **Connectivity**: Monitors are connected to thin clients via **HDMI**, **VGA**, or **DVI** cables, depending on the display ports available on the thin clients.

  ✓ **Size and Resolution**: Depending on user needs, monitors can range from basic low-resolution screens to large, high-definition displays.



1.4. Keyboards and Mice

Each thin client needs a keyboard and mouse for user interaction.

- **Connection**: These peripherals are typically connected to the thin client through **USB ports**, although **wireless keyboards and mice** with dongles can also be used.
- **Power**: Most keyboards and mice are powered via USB, though wireless versions require batteries.



1.5. Ethernet Cables

Ethernet cables are used to connect thin clients and the vSpace server to the local area network (LAN).

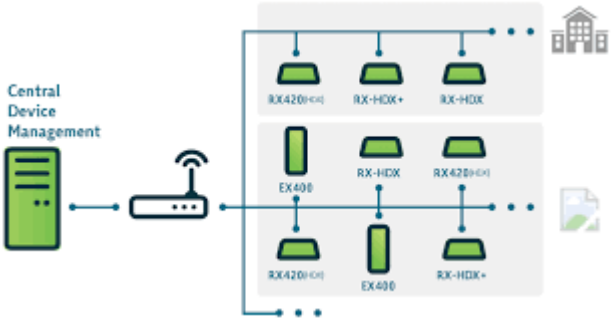
- **Types**:
  - ✓ **Cat5e**: Supports up to 1 Gbps speeds over distances of up to 100 meters.
  - ✓ **Cat6**: Offers better performance and can support higher bandwidth (up to 10 Gbps in some cases).
- **PoE Support**: In setups using PoE, Ethernet cables also deliver power to the thin clients, eliminating the need for separate power adapters.



1.6. Network Switches

Network switches are used to manage the data flow between thin clients and the vSpace server within the LAN.

- **Key Features**:
  - ✓ **Gigabit Switches**: Ensure high-speed communication between clients and the server, especially important when there are many thin clients in the network.
  - ✓ **PoE Switches**: Some switches also supply power to the thin clients via PoE, simplifying the setup by reducing the need for separate power supplies.



1.7. Power Adapters (AC or PoE)

Thin clients can be powered either through traditional **AC power adapters** or via **Power over Ethernet (PoE)**.

- **AC Power Adapters**:
  - ✓ These are external power supplies that plug into an electrical outlet to provide power to the thin clients.
- **PoE**:

✓ If using PoE, power is delivered to the thin clients over the Ethernet cables, eliminating the need for separate power adapters.



1.8. USB Devices

- **Function**: USB peripherals such as printers, external drives, and storage devices may be connected to the thin clients or the vSpace server.
- **Usage**:
  - ✓ **USB Redirection**: NComputing allows users to access USB devices connected to the thin clients or server as if they were directly attached to their virtual desktop.
  - ✓ **Compatibility**: Printers, external storage devices, and other peripherals connected via USB are essential for many business and educational environments.

1.9. Audio Equipment

- **Speakers and Headphones**:
  - ✓ Thin clients generally come with **audio output ports** for connecting speakers or headphones, allowing users to access sound from their virtual desktops.
- **Microphones**:
  - ✓ Some setups also include microphones for audio input, particularly useful in conferencing or multimedia environments.



1.10. Printers and Scanners

Printers and scanners may be connected to the NComputing system to allow users to print and scan documents from their virtual desktops.

- **Connection**:
  - ✓ These devices can be connected directly to the vSpace server via USB or network connections, or to individual thin clients depending on the deployment setup.
  - ✓ **Shared Printing**: Network printers can also be shared by all users connected to the vSpace server.

1.11. Mounting and Brackets

Thin clients are often mounted on the back of monitors or on desks using brackets or mounts.

- **Purpose**:
  - ✓ This helps save desk space and organize the workspace, keeping the thin client out of sight while maintaining easy access to ports.



2. NComputing system Installation Requirements

2.1. Introduction:

While preparing Ncomputing system installation, ensure that the host computer meets the necessary specifications for the NComputing software and hardware, such as CPU, RAM, and operating system compatibility.

And check whether all NComputing devices (terminals or thin clients) and peripheral components like monitors, keyboards, and mice are ready for installation.

2.2. **Hardware Requirements**

- **Host Computer:** A powerful computer with sufficient processing power, memory, and storage to handle multiple users. Minimum specifications typically include:
  - ✓ Processor: Intel Core i5 or equivalent
  - ✓ RAM: 8GB or more
  - ✓ Storage: 250GB or more



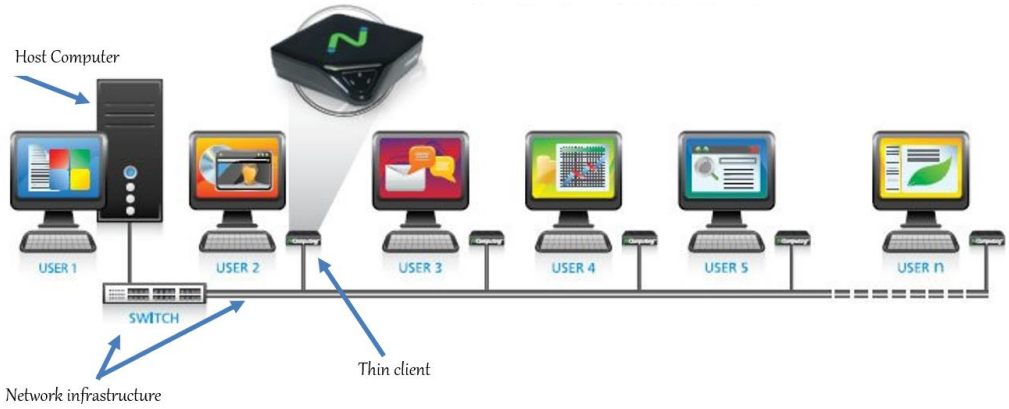
- **Thin Clients:** The number of thin clients you'll need depends on your user base. They are typically small, low-cost devices with limited processing power and storage.



- **Network Infrastructure:** A network switch or router to connect the host computer and thin clients.



Notes. Figure bellow illustrate an Installed Ncomputing system







2.3. **Software Requirements**

- **Operating System for Host Machine:** The host computer and thin clients will need compatible operating systems. Common choices include Windows, Linux, and macOS.



- **vSpace Pro Software:** This is the primary software platform for managing NComputing thin clients. It allows multiple users to share the resources of a single host computer. You'll need to install vSpace Pro on the host machine.





- **NComputing Client Software:** Thin clients may require specific client software to be installed, which allows them to connect to the host machine. It enables them to connect to the host machine running vSpace Pro.

Depending on the model of your thin clients, this software might come pre-installed, or you may need to download it from the NComputing website.

3. **Ncomputing terminal/Thin client ports and buttons**



- ✓ DVI-D digital video
- ✓ 10/100 Mbps ethernet
- ✓ (2) USB 2.0 for keyboard & mouse
- ✓ Microphone
- ✓ Speaker
- ✓ (2) USB 2.0 ports
- ✓ 12V DC In
- ✓ Power Switch

4. Ncomputing hardware Installation

Ncomputing hardware Installation is second step of Ncomputing system installation. Before installing Ncomputing hardware ensure that the host computer meets the necessary specifications and check whether all NComputing devices (terminals or thin clients) and peripheral components are ready for installation.

4.1. Ncomputing hardware installation Activities:

Ncomputing hardware installation activities includes:

1. Mounting/fixing NComputing Devices

- This involves fixing the devices at the desired locations and organize the cables properly to maintain a clean and efficient setup.

2. Connecting Hardware Components

- This involves connecting the NComputing devices to the power source, network, and peripherals (monitor, keyboard, mouse). Link them to the host computer as well.

3. Testing

- This involves powering on the devices, test their interconnections, and ensure proper functioning of peripherals and network access. Adjust settings as needed and troubleshoot any issues.

4.2. Ways/Techniques or methods of mounting(fixing) Ncomputing devices

There are several ways to mount **NComputing devices** (thin clients) depending on the workspace setup and user needs. Here are some common methods:

4.2.1. VESA Mounting (Behind the Monitor)

Many thin clients come with VESA mounting compatibility. The devices directly attached to the back of a monitor using a VESA bracket.





- **How It Works:** Align the device with the VESA holes on the monitor and secure it with screws.
- **Best For:** Saving desk space and creating a clean, integrated workstation.

4.2.2. Under-Desk Mounting

The device is mounted underneath the desk using brackets or trays.







- **How It Works:** Brackets are screwed into the underside of the desk, and the device is secured within.
- **Best For:** Keeping the desk surface clutter-free and hiding devices from view.

4.2.3. Wall Mounting

NComputing devices can be mounted to the wall using specialized wall brackets. For environments where desk space is limited, wall mounting can be an effective solution







- **How It Works:** A wall bracket is installed on the wall, and the device is mounted securely.
- **Best For:** Public spaces or areas where devices need to be kept out of reach.

4.2.4. Rack Mounting

In data centers or server rooms, thin clients can be mounted in a rack. This is useful for managing multiple devices in a centralized location.





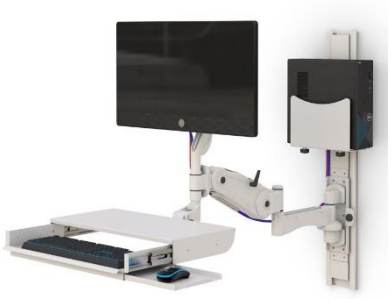
- **How It Works:** Devices are placed in a rack mount, usually in server rooms or centralized IT locations.
- **Best For:** Large-scale deployments with centralized management of multiple devices.

4.2.5. Pole Mounting/All-in-One Stand:

Some manufacturers offer stands that integrate the thin client with the monitor, creating an all-in-one setup. This is ideal for a streamlined and clutter-free workspace.







Notes: When mounting a thin client, it's important to ensure proper ventilation and easy access to ports and cables.

4.3. Connecting hardware components

This stage involves physically connecting all the required hardware components to ensure that the NComputing devices function properly. The steps below detail the process:

4.3.1. Power Connection

Each NComputing device will come with its own power adapter. Connect the power adapter to the designated port on the device and to the power outlet.



4.3.2. Peripheral Connections

- **Monitor Connection:** Use the appropriate video cable (HDMI, VGA, or DVI, depending on the model) to connect the NComputing device to the monitor.

- **Keyboard and Mouse Connection:** Connect a USB keyboard and mouse to the USB ports on the NComputing device. If using wireless peripherals, ensure the dongle is plugged into the USB port and functioning.
- **Other Peripherals (optional):** If needed, connect additional peripherals such as printers, scanners, or external storage devices via USB ports.



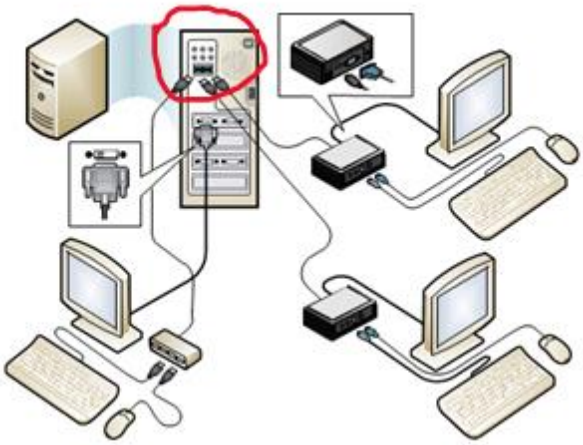


4.3.3. Connecting to Host Computer

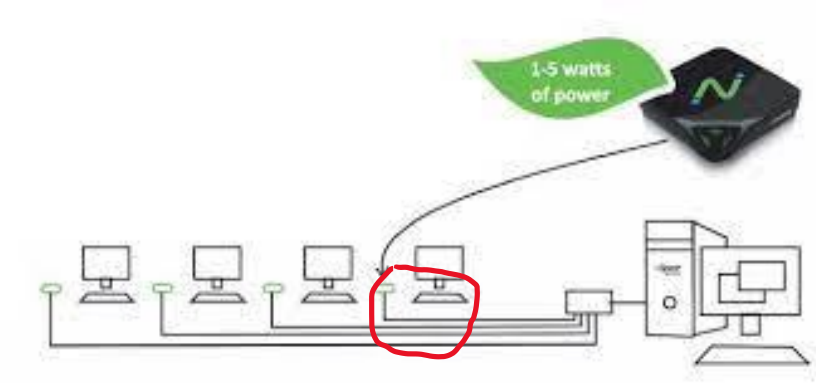
Use the appropriate cables to connect each NComputing device to the host computer. This connection allows the device to access the host's resources and services.

This may involve:

- **Using USB (for certain models):** If the model uses USB connection plug one end of the USB cable into the host computer and the other into the NComputing device.

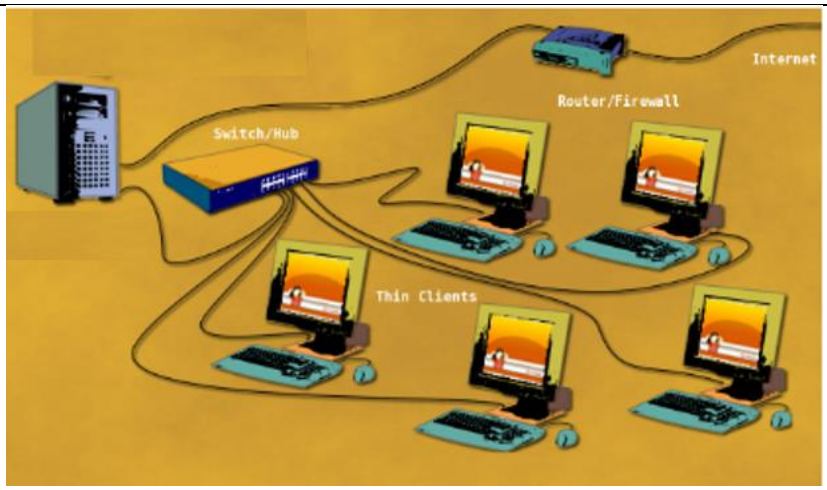


- **Using Ethernet (for network-based models):** If the model uses a network-based connection, ensure that both the NComputing devices and the host computer are connected to the same local network (via a switch, router, or PCI Network card). The host will communicate with the devices over this network.



4.3.4. Connecting to internet

Wired or Wireless Connection: Ensure that the host computer is connected to the internet via a wired Ethernet connection or a wireless network. If using Ethernet, connect the host to a router or switch. For wireless, connect it to the Wi-Fi network.



4.4.Testing Ncomputing interconnection

This phase ensures that the NComputing devices and the entire system are working as intended. It involves powering on the devices, testing their functions, and troubleshooting any issues that arise.

4.4.1. Stages of testing Ncomputing system

Here's a detailed breakdown of this stage:

a) Power On NComputing Devices

- **Turn On Each Device:** Once the devices are connected to the power source, press the power button on each NComputing device. Verify that the power indicators (LEDs) are lit, confirming that the devices are receiving power.
- **Check for Boot Issues:** Ensure that the devices boot up without any errors. If they fail to start, check power connections, adapters, or try a different power outlet.

b) Interconnection Testing

- **Test Host-Device Communication:** Check if the NComputing devices can communicate with the host computer. Depending on the model, this can involve testing USB connections (for USB-based devices) or checking network connectivity (for Ethernet/Wi-Fi-based models).
- **Verify Device Detection:** On the host computer, verify that the installed NComputing software (e.g., vSpace) is detecting the connected devices. Each device should appear in the management interface as an active session.

c) Peripheral Testing

- **Monitor Testing:** Ensure the monitor connected to each NComputing device is displaying correctly. Check the display resolution settings, and confirm there are no flickers or display errors.
- **Keyboard and Mouse Testing:** Test each keyboard and mouse connected to the devices to confirm that inputs are registered correctly. Verify that typing works and that the mouse moves smoothly.
- **Additional Peripheral Testing:** If additional peripherals like printers or external drives are connected, ensure that they are functioning as expected.

d) Network Testing

- **Check Network Access:** Ensure that each NComputing device can access the network. This may include accessing shared network resources or verifying internet connectivity (if applicable).
- **Ping Test:** Perform a basic ping test to check network connectivity between the NComputing devices and the host computer. Open a terminal or command prompt, and ping the host's IP address to confirm the devices are communicating properly.
- **Test Network Performance:** Run a basic network speed test to ensure that the devices are receiving adequate bandwidth and are not experiencing network lag or delays.

e) Session Testing

- **Login to Virtual Sessions:** For multi-user environments, test whether multiple users can log into their virtual desktop sessions simultaneously. Ensure that each NComputing device launches the session without errors.
- **Application Testing:** Open commonly used applications on each device (e.g., word processors, web browsers) to check whether the applications are functioning properly and if they are responsive.

f) Performance Testing

- **Test Device Responsiveness:** Monitor how responsive the NComputing devices are to user inputs and tasks. Ensure that there is no significant delay in performance or connection to the host computer.
- **Load Testing:** If multiple devices are connected, simulate a real-world scenario by having multiple users operate the system at once. Observe the system's performance under load and check for any signs of lag, crashes, or network slowdowns.

4.4.2. Basic Tools required in testing of NComputing hardware interconnection

Here is a list of useful tools for testing NComputing hardware interconnection:

- **Ethernet Cable Tester:** Verifies the integrity of Ethernet cables used to connect NComputing thin clients and servers**.** It tests for continuity and identifies faulty cables, shorts, or incorrect wiring.

  How to Use: Connect one end of the cable to the tester's main unit and the other to the remote unit. The tester will show if the cable is wired correctly by indicating each wire pair's connectivity.



- **Power over Ethernet (PoE) Tester**: Tests the voltage and current being supplied to thin clients through PoE to ensure sufficient power is delivered via Ethernet cables.

  It measures voltage and current to verify that the network switch or PoE injector is delivering the correct power levels.

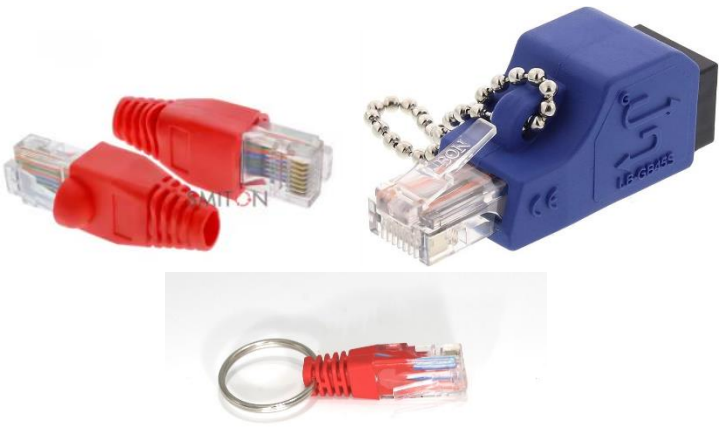
  How to Use: Plug the tester into the Ethernet cable running from the PoE switch to the thin client to measure and confirm power levels.



- **Loopback Plug (Network Testing):** Used to test individual network ports on switches or thin clients to ensure they are functioning properly.

  It Sends a signal from the network port back to itself to verify that the port is operational. Useful in detecting hardware-level issues within network interfaces on thin clients or switches.

  How to Use: Insert the loopback plug into the network port of the thin client or switch and monitor the response through network diagnostic tools.



- **Multimeter:** Used to check voltage, current, and continuity for various hardware components, including power adapters, cables, and electrical outlets.

Measures voltage and current to ensure that power adapters and outlets are supplying the correct amount of power to thin clients. Tests the continuity of wires and cables to confirm they are not broken or damaged.

How to Use: Connect the probes of the multimeter to the device or cable being tested, and check the display for the voltage, current, or continuity reading.



- **USB Tester:** Checks the power and connectivity of USB ports on thin clients, particularly when peripherals like keyboards, mice, or storage devices are not functioning.

It Measures the voltage and current supplied to USB devices, ensuring that the ports are providing sufficient power for connected peripherals. Tests the data pins to ensure that the USB port is fully operational.

How to Use: Insert the tester into the USB port and observe the displayed readings for power levels or connectivity status.



- **Ping and Traceroute (Network Diagnostic Commands):** Used for network diagnostics to test connectivity between thin clients and the vSpace server or between other network devices.

  Identifies the path taken by data packets across the network and highlights any delays or misconfigurations along the way.

  How to Use: Run these commands from a command prompt or terminal on any connected device to check network communication between the thin clients and server.

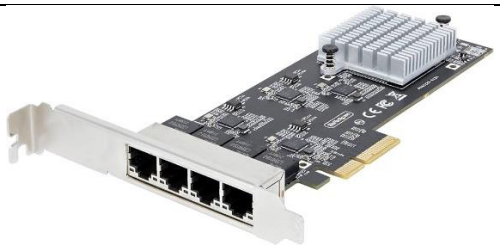
5. Methods of Connecting Ncomputing access devices to the host computer

Connecting NComputing devices to the host computer can be done in two different ways: using a **PCI card** or a **network switch**. Here's a detailed differentiation between the two practices:

When connecting NComputing devices via Ethernet, there are two common methods to establish the network connection: using a **PCI network card** and using a **network switch**. Here's a comparison between the two:

5.1. Connecting Using a PCI Network Card (Direct Connection to Host)

A PCI (Peripheral Component Interconnect) network card is installed directly into the host computer, allowing you to connect NComputing devices via Ethernet. This card provides additional ports for connecting NComputing devices.





Key Steps:

- Install the PCI card into an available PCI slot in the host computer.
- Attach the NComputing devices to the PCI card's ports via dedicated cables.
- Install any necessary drivers or software to configure the NComputing devices.
- Configure the host computer to recognize the connected NComputing devices.

Advantages:

- **Low latency**: Direct connection to the host computer through the PCI card ensures a faster and more stable connection.
- **Simpler network configuration**: Since the devices connect directly, there's less network complexity involved.
- **No dependency on network bandwidth**: The PCI card provides a dedicated connection, independent of network traffic or switches.

Challenges:

- **Limited scalability**: You can only connect a limited number of devices depending on the capacity of the PCI card.

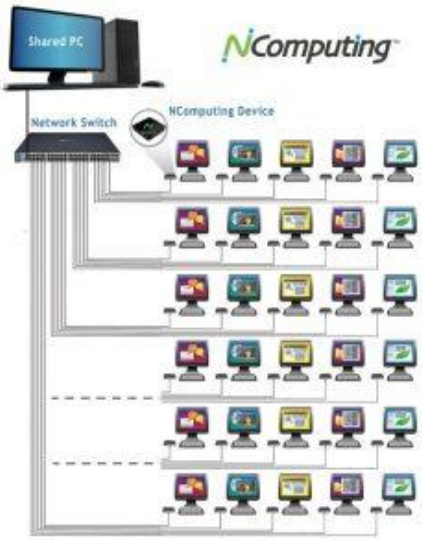
• **Physical limitations**: The devices must be physically close to the host computer due to cable length limitations.
• **Hardware requirement**: Requires a host computer with available PCI slots.

Best Suited For:

• Smaller setups with a few users where devices are physically close to the host computer.
• Environments where minimizing network complexity is important.

5.2. Connecting Using a Network Switch Using a Network Switch (Centralized Network Connection)

In this method, NComputing devices are connected to the host computer through a network switch, which serves as a central hub for data transmission. The devices and the host communicate over the local area network (LAN).
This setup uses Ethernet cables to connect the NComputing devices to the switch, and the host computer is also connected to the switch.



Key Steps:

• Connect the NComputing devices and the host computer to the network switch using Ethernet cables.
• Install the NComputing management software on the host computer.
• Assign IP addresses to each device or let the network dynamically assign them.
• Configure the network and the host computer to communicate with the NComputing devices through the switch.

Advantages:

• **Scalability**: A network switch allows for easier expansion, enabling more NComputing devices to be connected.
• **Flexibility**: Devices can be placed farther from the host computer, as they only need to be connected to the network.
• **Centralized management**: Devices are part of the network and can be managed more easily from different locations.
• **No need for internal modifications**: There's no need to install any PCI cards inside the host computer.

Challenges:

• **Network dependency**: Performance can be affected by network traffic, especially if the network is not properly configured or if bandwidth is limited.
• **Higher setup complexity**: Requires a well-structured network configuration, including IP addressing and possibly VLAN setup for larger environments.
• **Latency issues**: If the network is slow or congested, there may be noticeable delays in communication between the devices and the host computer.

Best Suited For:

• Larger setups where devices nessed to be spread across different rooms or even buildings.
• Environments where scalability is important, and multiple users need to be added over time.
• Networks with existing infrastructure (switches, cabling) that can handle additional devices.

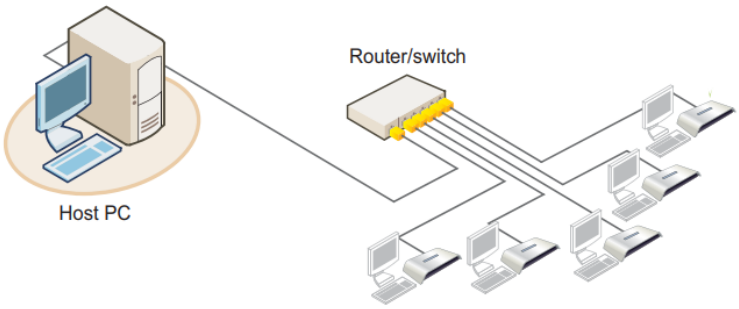


Practical Activity 2.1.2: Interconnecting Ncomputing devices/ Installing Ncomputing hardware

Task:

1: Read the task described below:

Referring to the diagram bellow, go in workshop and interpret the design and implement the design by interconnecting Ncomputing devices.



2: Referring to the key reading 2.1.2, perform the task described above.

3: Apply safety measures

4: interconnect Ncomputing devices according to the given diagram.

5: Present your findings to the whole class and ask for clarification where is needed

Key readings 2.1.2 Interconnecting Ncomputing devices/ Installing Ncomputing hardware

1. Process for Installing Ncomputing system:

- **Preparation:**
  - ✓ **Hardware Requirements:** Ensure you have the necessary hardware, including the host computer, NComputing devices (terminals or thin clients like L-series, M-series, or RX-series), and peripherals (monitors, keyboards, mice).
  - ✓ **Software Requirements:** Obtain the NComputing vSpace software, which is essential for managing the shared computing environment.
- **Hardware installation:**
  - ✓ **Physical Connection:** Connect the NComputing devices to the host computer via Ethernet (for network-based devices) or USB (for direct connection devices).
  - ✓ **Power Up:** Ensure that each NComputing device is powered up and connected to a monitor, keyboard, and mouse.
- **Software installation (vSpace Software):**
  - ✓ **Download vSpace:** Go to the NComputing website and download the appropriate version of vSpace for your operating system.
  - ✓ **Installation:** Run the installer and follow the on-screen instructions to install vSpace on the host computer. This software creates the virtual desktops that will be accessed by the NComputing devices.

- ✓ **Configuration**: After installation, you may need to configure vSpace settings to optimize performance and allocate resources according to your needs.

- **Software Configuration on Devices:**
  - ✓ **Initial Setup:** Power on the NComputing devices and follow the initial setup instructions. This usually involves selecting the host computer and configuring network settings.
  - ✓ **Login:** Users can log in to their virtual desktops using credentials provided by the administrator.
- **User Management:**
  - ✓ **Create User Accounts:** On the host computer, create user accounts for each individual who will be using the NComputing devices.
  - ✓ **Assign Desktops:** Use the vSpace Console to assign virtual desktops to users and manage their access.
- **Testing and Optimization:**
  - ✓ **Test Connections:** Ensure that each NComputing device can connect to the host computer and that users can log in and access their virtual desktops.
  - ✓ **Performance Tuning:** Adjust settings in the vSpace Console to optimize performance, such as allocating more RAM or CPU resources to certain users if needed.

2. Hardware installation

2.1. Host Setup

System Requirements

Starting with vSpace Server 6.5, the maximum number of L-Series users is increased to 100. However, the number of users, intended application suite and overall performance expectation will ultimately determine how powerful a computer must be used in order to deliver the desired multi-user experience.

The tables below give recommended specifications for a vSpace Server host computer running a typical application set, based on the number of users and type of access device. NComputing recommends you always test your environment in advance of deployment to ensure it meets your expectations.

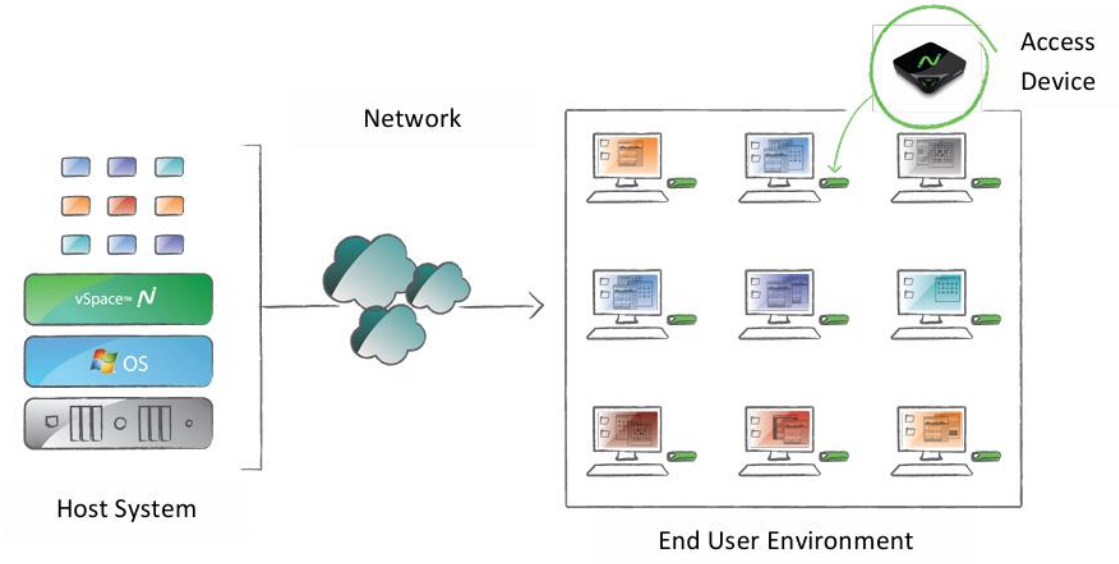
Recommended Host Hardware Configuration

Host Configurations	Number of Users[1]					
	1-10	10-20	20-30	30-50	50-75	75-100
CPU* (minimum or equivalent)	Intel™ Core 2 Quad	Intel Core™ i7	Intel Core i7	Intel Core i7	Dual Xeon™	Dual Xeon
Memory (64-bit OS)	6 GB	8 GB	12 GB	16 GB	24 GB	24 GB

1 The number of users that your installation will support depends upon the host's configuration and your end-users' performance expectations. Performance results are highly dependent upon the individual host hardware, memory, applications being used, OS and network conditions within any LAN. Host requirements will vary, please test your multi-user environment before deployment.

2.2. Installation Ncomputing system by L-Series access terminals

The NComputing L-series access devices with vSpace® desktop virtualization software dramatically cut your computing costs by enabling multiple users to share a single PC, server or virtual machine.



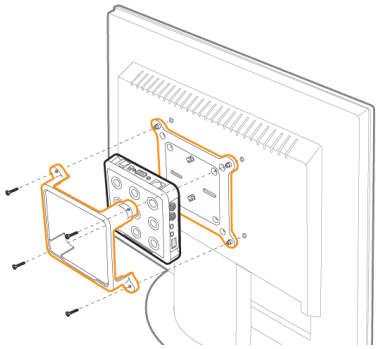
L300 and L350 (L-series) Models

The L series is available in two distinct versions: L300 and L350.

This manual covers the L300 and L350 on Windows operating systems (refer to the NComputing online Knowledge Base at www.ncomputing.com/support and search on "OS Support," for specific Windows operating systems supported). For documentation on available Linux operating system support – refer to the Knowledge Base (search on "L-series Linux"). The following table summarizes the key features of L300 and L350.

2.2.1 Connecting Using a Network Switch (Centralized Network Connection)

- **Mounting Devices:** Install NComputing devices in the desired locations. This involves attaching access terminals (thin clients) to appropriate place like back of monitor, under desk…, depending on mounting technique.



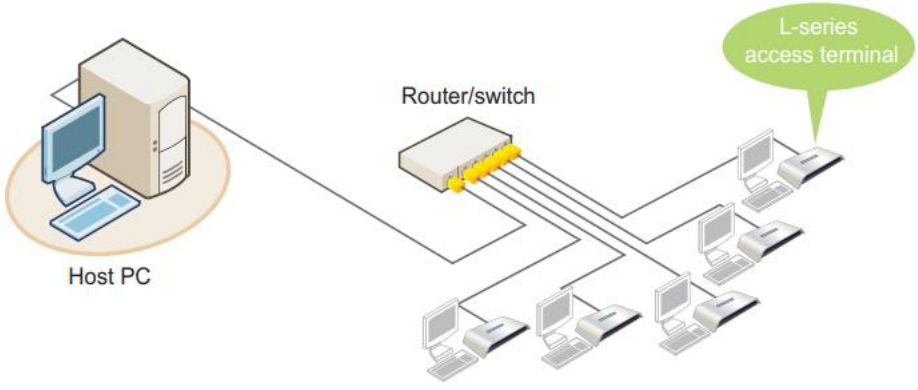


- **Connecting thin client to** peripherals: Use the appropriate cables to connect thin client to monitors and other peripherals accordingly.





- **Network Connectivity:** Connect the NComputing devices to the local network. Typically, this is done via Ethernet, ensuring that each device is correctly plugged into a switch or router for network communication.



- **Powering Devices:** Ensure all devices are properly powered. Thin clients typically use low power, so you may also want to ensure appropriate power management settings.

L--series Hardware Setup

- **Setup NComputing L300 and L350**
  - ✓ **L300 Device Setup**



The L300 must be connected to the host PC via an Ethernet switch, router, or other network connection. The L300 has USB ports dedicated for mice and keyboards, as indicated by the mouse and keyboard symbols below the horizontally oriented USB ports. The vertically oriented USB ports to the left of the audio connections are for other USB devices.

NOTE: The USB keyboard and mouse ports ONLY support these types of devices. No other types of USB devices are supported on these ports. The USB keyboard and USB mouse must be directly connected to these ports and cannot go through a separate USB hub.

Peripherals with integrated USB hubs or combination keyboard/mouse devices are not supported by these ports. Other USB peripherals can be connected to the USB symbol below the USB ports that are t o the left of the 1 2V D C---IN jack.

Note that these generic ports are not active until you have connected to a vSpace session.

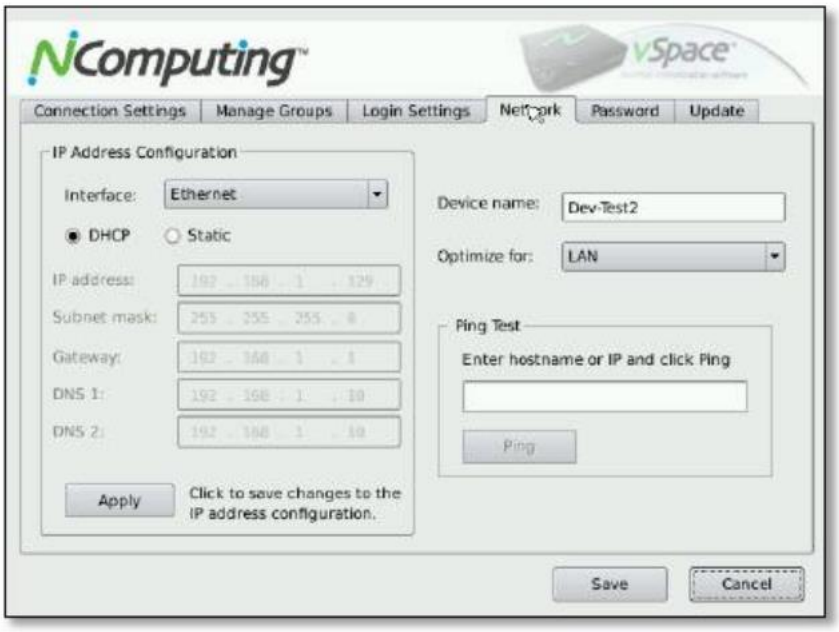
- ✓ **L350 Device Setup**



The L350 must be connected to the host PC via an Ethernet switch, router, or other network connection. Unlike L300 there are no dedicated keyboard or mouse ports on L350. Keyboard and mouse can be connected to any USB 2.0 ports.

- ✓ **Network connection**

The L300 and L350 devices can be configured to use DHCP---assigned network settings, or use static IP settings specified by the user. To use DHCP---assigned settings, power on the device, then go into the Device Setup, click the "Network" tab, and select the bullet labeled "DHCP."



If static addressing configurations are used on the network, select "Static configuration" and supply the appropriate IP, Subnet Mask, Gateway, and DNS server (primary and alternate) information. Click "OK" to save changes and return to the main screen. When your L300 or L350 device is connected to the network the "LNK" light (indicating Ethernet link) on the

front panel should be on and you should see that the Ethernet activity light, “ACT," also blinks when there is active Ethernet traffic to/from the device.

Installation with monitor mount

The L 300 and L 350 devices come with a mounting plate and two mounting screws, which can be secured to a monitor via 75mm or 100mm VESA---compliant mounting holes. The device then attaches to the mounting plate, resulting in a zero---footprint workstation. In general, we recommend using the top two mounting holes on the monitor to give maximum cable access space.



Note: The L300 and L350 products also come with a Kensington™ security lock interface, for additional theft protection.

2.2.2. Connecting Using a PCI Network Card (Direct Connection to Host)

Install the Hardware Before attempting to install the X350/X550 kit, verify that your Windows or Linux OS is supported by vSpace, and that the OS is properly installed, updated and all devices viewable in the OS device manager are working properly. Also, check to be sure your package includes one X550 (or X350) PCI card, five (or three) XD2 devices, the vSpace installation CD, and ten (or six) monitor mounting screws.

- **Install the X-series PCI Card**

1. Disconnect all peripheral and power cables from the host PC.
2. Remove the host PC system cover.



3. Locate an available PCI slot for the X-series PCI card.



4. Insert one PCI card and secure the bracket to the chassis with a retaining screw (or other fastening mechanism specific to your PC). Note: The X550 is a full height PCI card, and the X350 is a half-height PCI card.



5. Replace the system cover and reconnect all peripheral and power cables.

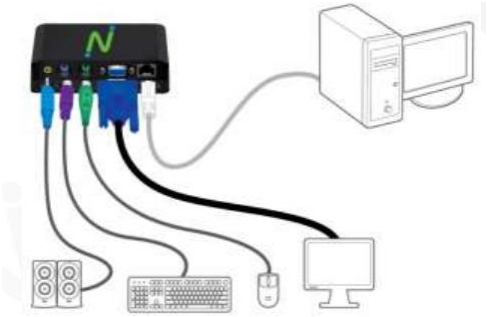


- **Connect Peripheral Devices**
    1. Connect each access device to a port on the PCI card using high-quality Cat 5e or shielded Cat 6 cables.
       These must be standard, straight (not crossover) cables.

    Maximum cable length between the X-series card and an access device is:

    - ✓ Standard Category 5e UTP cable: up to 5 meters
    - ✓ Standard Category 6 STP or FTP cable: up to 10 meters

    2. Connect the desired peripheral devices to each XD2 access device.
       If you plan to use any USB devices, connect these directly to the host PC – these can then be assigned to each XD2 station with the vSpace software.



    3. Using two screws (provided) you can attach the XD2 to the back of an LCD monitor that has VESA-compliant mounting holes, as shown below.



Points to Remember

- NComputing is a technology that allows multiple users to share a single computer, significantly reducing the cost of computing.
- Thin client ports incudes: DVI-D, ethernet, USB, audio and power port
- Steps in installing Ncomputing hardware
  - ✓ Step 1: Install the X-series PCI Card
    - Disconnect all peripheral and power cables from the host PC.
    - Remove the host PC system cover.
    - Locate an available PCI slot for the X-series PCI card.
    - Insert one PCI card and secure the bracket to the chassis with a retaining screw (or other fastening mechanism specific to your PC).
    - Replace the system cover and reconnect all peripheral and power cables.
  - ✓ Step 2: Connect Peripheral Devices
    - Connect each access device to a port on the PCI card using high-quality Cat 5e or shielded Cat 6 cables.
    - Connect the desired peripheral devices to each XD2 access device.

Application of learning 2.1.

X School wants to set up their computer lab using NComputing technology. The lab is required to accommodate 25 client stations for students and one master station for the trainer. As the IT Technician, you have been tasked to Fix Ncomputing devices, Connect Ncomputing components and after test Ncomputing interconnection.

Indicative content 2.2: Installing Ncomputing Software

Duration: 15 hrs

Practical Activity 2.2.1: Installing Ncomputing software

Task:

1: Read the task described below:

Referring to the computer hardware system of Ncomputing installed in Practical Activity 2.1.2. Install Ncomputing software, manage users and install monitoring tool.

2: Referring to the key reading 2.2.1, perform the task described above.

3: Apply safety measures

4: 5: Present your findings to the whole class and ask for clarification where is needed

Key readings 2.2.1.: Installing Ncomputing software

Steps of NComputing Software Installation

Installation of vSpace 4 and 5 software

The following are steps to follow while installing vSpace 4 & 5 Software:

Step 1: Download the appropriate version of Software



Do not install anything from Windows Update for the X350/X550 PCI card. Simply click "Cancel" on this screen.

Step 2. Insert the software installation CD into the host PC's CD drive.

If the installer does not automatically launch, go to "My Computer," open the CD drive icon, and manually start the installation using the .exe file.

Step 3. At the installation screen, follow the prompts to install the software.



Before actual installation starts, the software may attempt to connect to the Internet to

compare the software version on the CD with the latest software version on the NComputing update server. If there is a later version on the NComputing server, a prompt will appear to ask if you want to use the version on the CD or if you want to

download the latest version (installation of the latest software is always recommended).

NOTE: You can also skip using the CD to install vSpace, and simply go to the Software

Download Center on the NComputing website to get the latest software installation files.

Step 4. At the installer's "Welcome" screen, click on the "Next" button which will take you

to the antivirus and firewall warning screen. Read and follow the instructions, and then click on the "Next" button.



Step 5. At the software End User License Agreement and Terms of Use screens, read

the agreements and if you agree, click on the "I agree" checkbox, and then click on the "Next" button.

Step 6. From the "Choose Destination Location" screen, you can choose to install vSpace in the default location, or you can navigate to a different location and install vSpace there. When you are finished, click on the "Next" button.

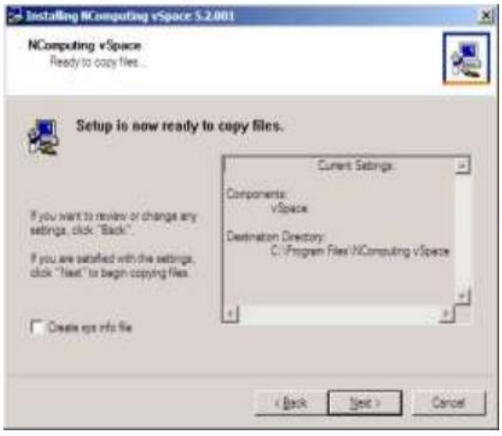
Step 7. At the "Create Password for Administrator" screen, select whether to use or disable use of an administrator password. If you choose to use an administrator password, enter it and retype it. Click on the "Next" button.



Note: This password only applies to the vSpace software installed on the host PC. Resetting a forgotten password will require uninstalling and reinstalling the vSpace software. Therefore, the system administrator needs to manage this password carefully.

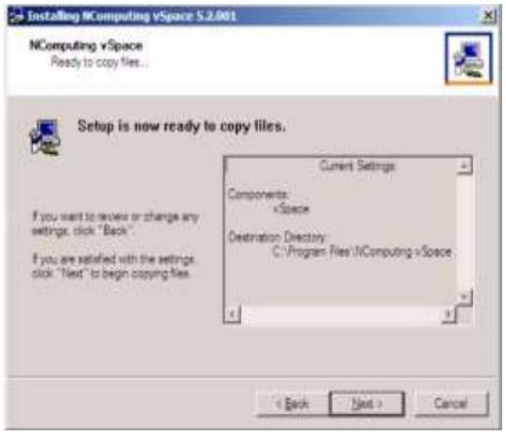
Note: The NComputing Administration Console allows you to administer vSpace software and parameters associated with the access devices on this PC. It will automatically be installed on this system.

At this point, one of the following “ready to copy files” screens will be displayed (vSpace
4 and 5). If this is the first time vSpace has been installed on this system, the “Create
sys info file” check box will appear on the screen. Leave the box unchecked. Review your selections and click on the "Next" button.



First time install screen

OR



Screen if vSpace has previously been installed

Note: “Create sys info file” enables the Windows utility to create a system information file
and place it in your My Documents folder. This process will create a record of your system’s configuration but it may take some time to create. This is only necessary if you
are specifically asked to do so when interacting with NComputing Technical Support.

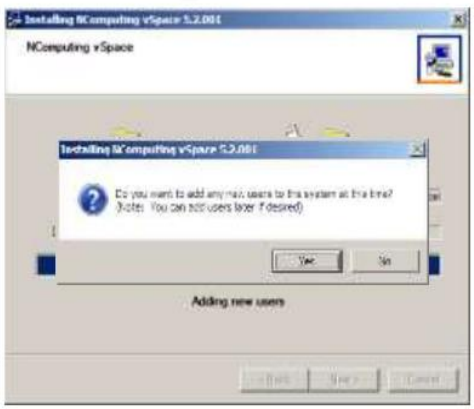
The vSpace software will then be installed.



Step 8: At the "Add new users" pop-up, select whether or not you would like to add new

users to the system. If you click on the "Yes" button, the installation program will launch a screen to administer user accounts on the host computer. If you click the "No" button, the installation process will continue without bringing up the user administration screen.

If you choose to add or set up new User Accounts later, you can do so by going to Start->Control Panel->User Accounts. You can also search on “To add a new user to the
computer” in the Windows Help and Support Center for more information.



Windows Server 2008 install screen



Windows Server 2003 install screen

Note: It is strongly recommended that all users have their own user accounts to enable
control of their own settings. If you click on the “Yes” button, the “Local Users and Groups” Windows utility (screen shot shown below) will be displayed on an otherwise
blank overlay screen. You can right-click and select “New User…” to add each desired
individual user account. When you are finished adding users, close the “Local Users and
Groups” utility and you will be brought back to finish the vSpace installation process.



Windows Server 2008 user account management screen



Windows Server 2003 user account management screen

Step 9. At the "vSpace successfully installed" screen, click “Close” to end the installer,

and select whether or not to immediately restart the computer (a restart is required before vSpace can be used).

NOTE: During installation, you will be prompted to enter a default resolution setting for

the X-series stations. After installing the software you can change the resolution for all

stations connected to a single card from the Management Console. See the sections on

the Management Console for your version of vSpace later in this manual for instructions

on how to set the resolution.

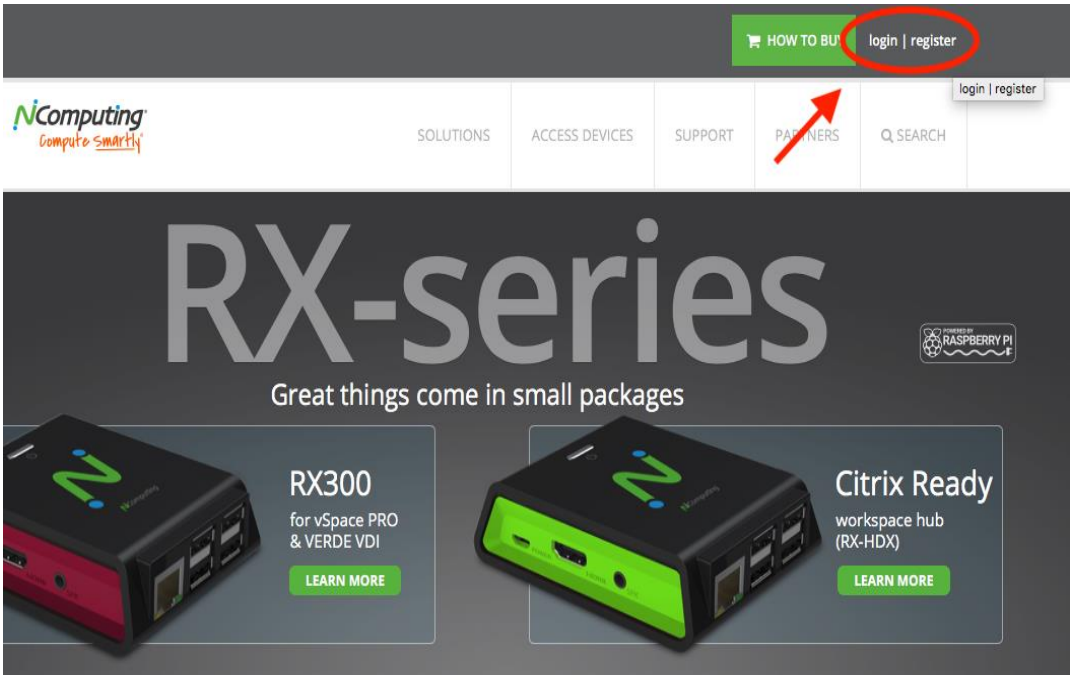
IMPORTANT: Now proceed to the product registration section to register and activate

your system (required for operation beyond 30 days and for sessions longer than 1 hour

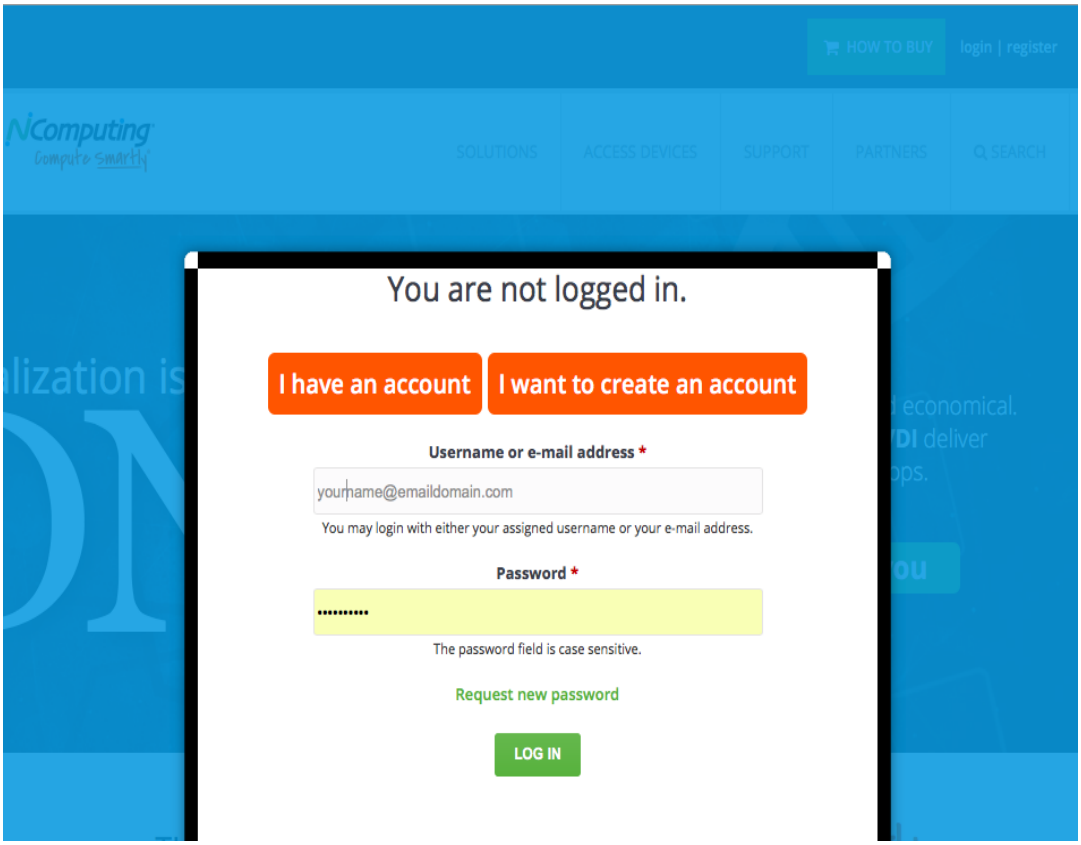
during the trial period).

• **Where can I download the latest vSpace software?**

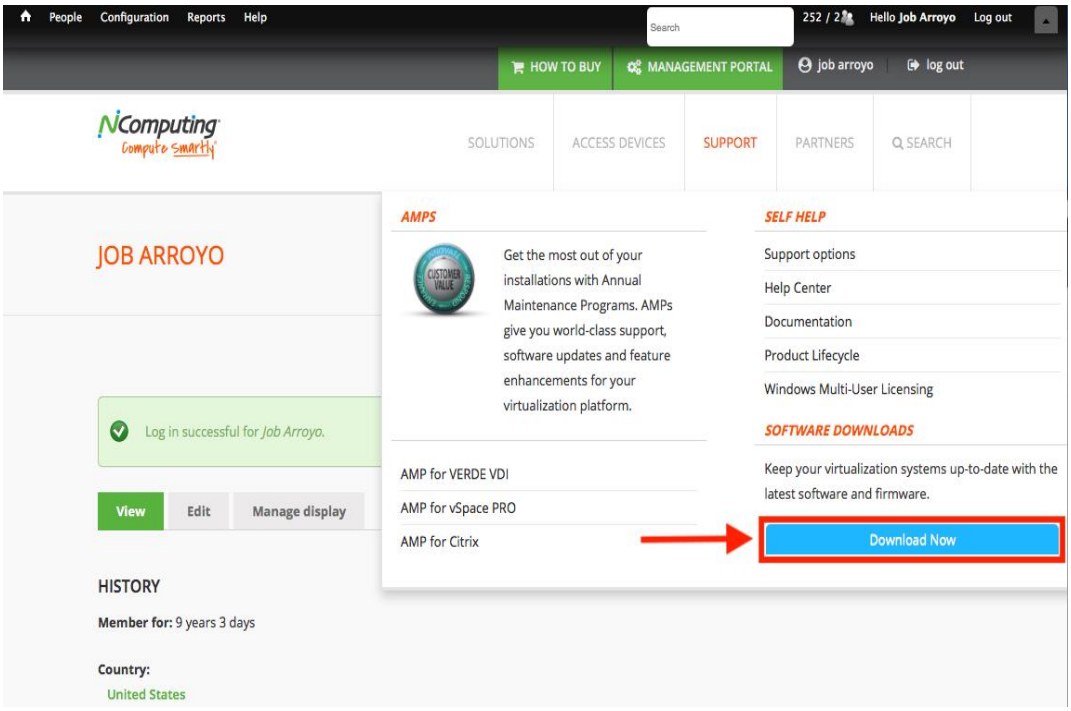
You can obtain our latest software from NComputing's website. Use this web address: https://www.ncomputing.com/en/support/software
However, here are some additional instructions if you are not familiar with our website:
1. Click on the *Login | Register* button.



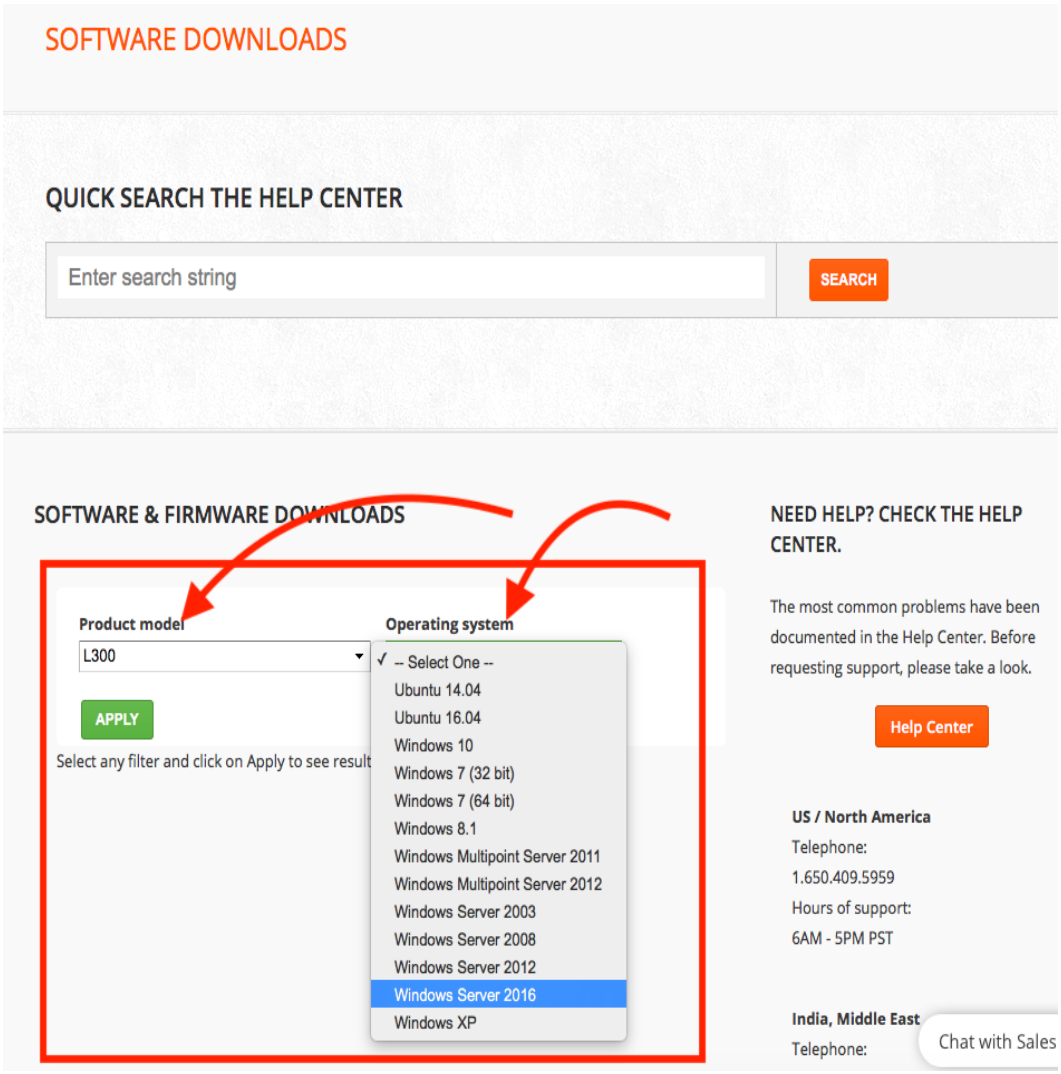
2. Choose whether you want to create an account for the first time. (it is completely free to create) If you already have an account, log in.
When you sign up for an account, pay attention to the spelling of your email address. You will be receiving a confirmation link to your email in order to validate your account.



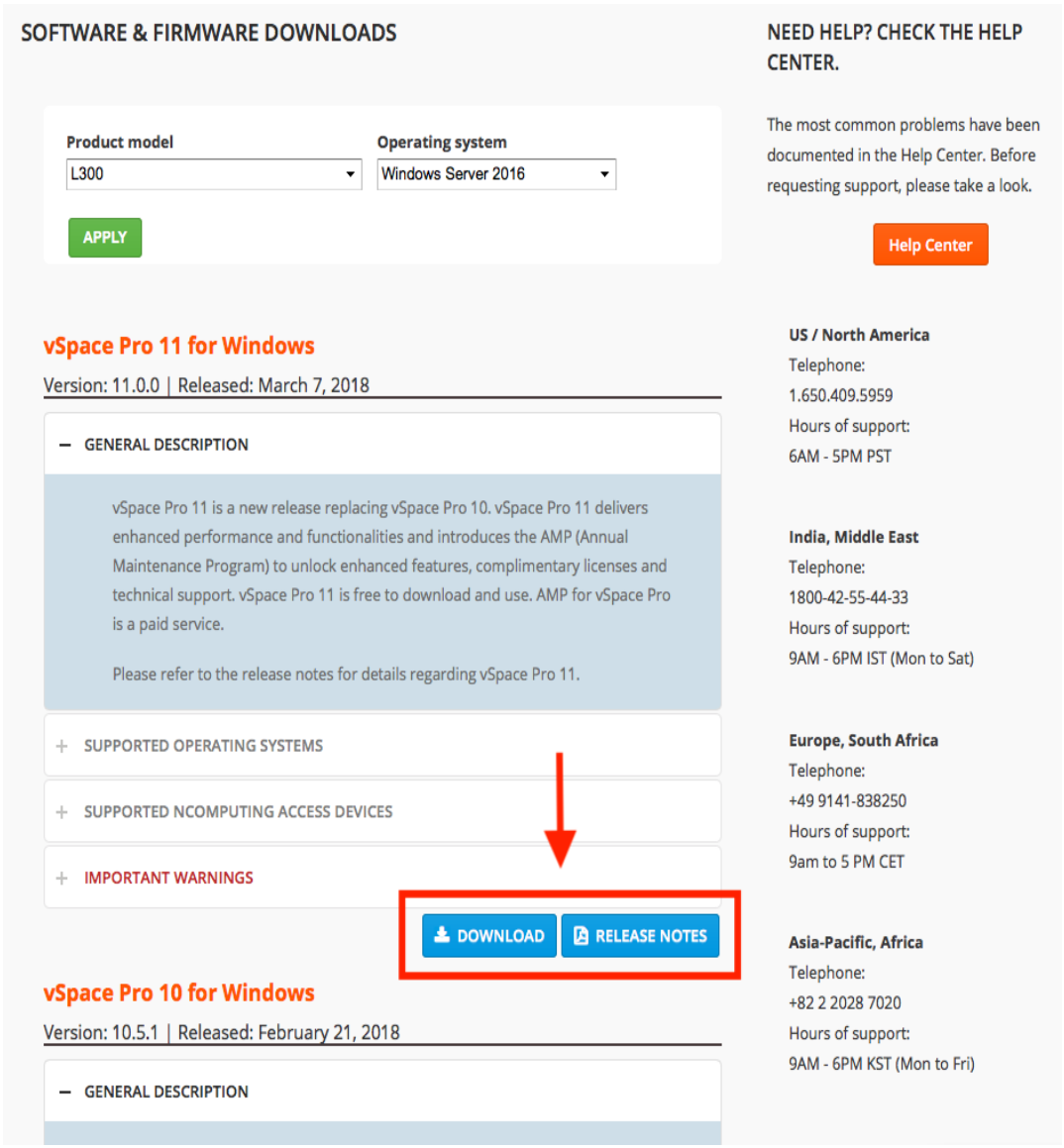
3. Hover the mouse pointer over the *Support* tab and select from the drop down menu *Download Now*



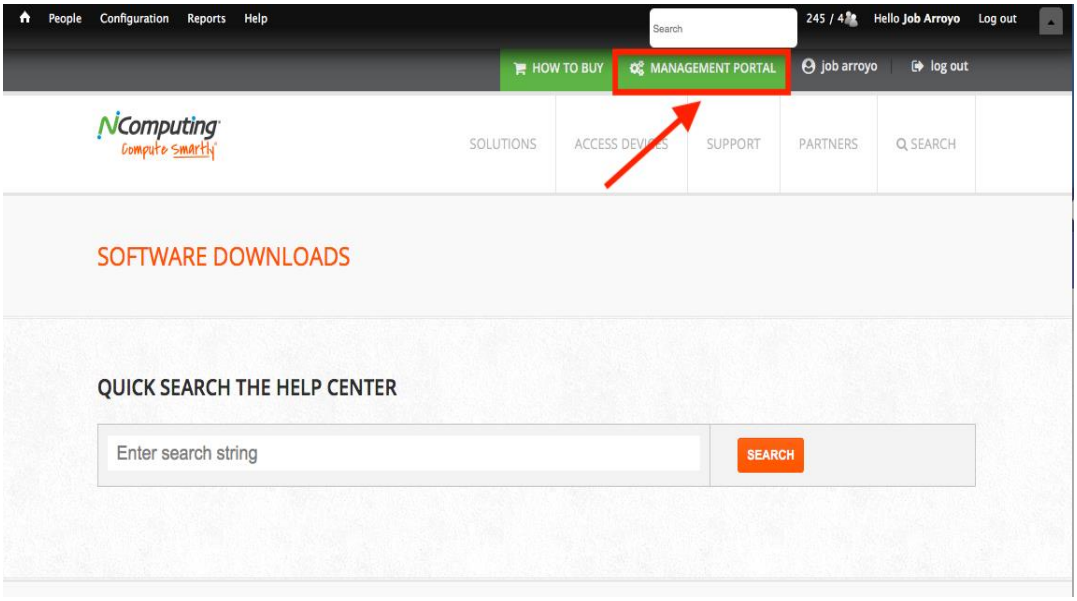
4. Choose the model, desired operating system and click *Apply*



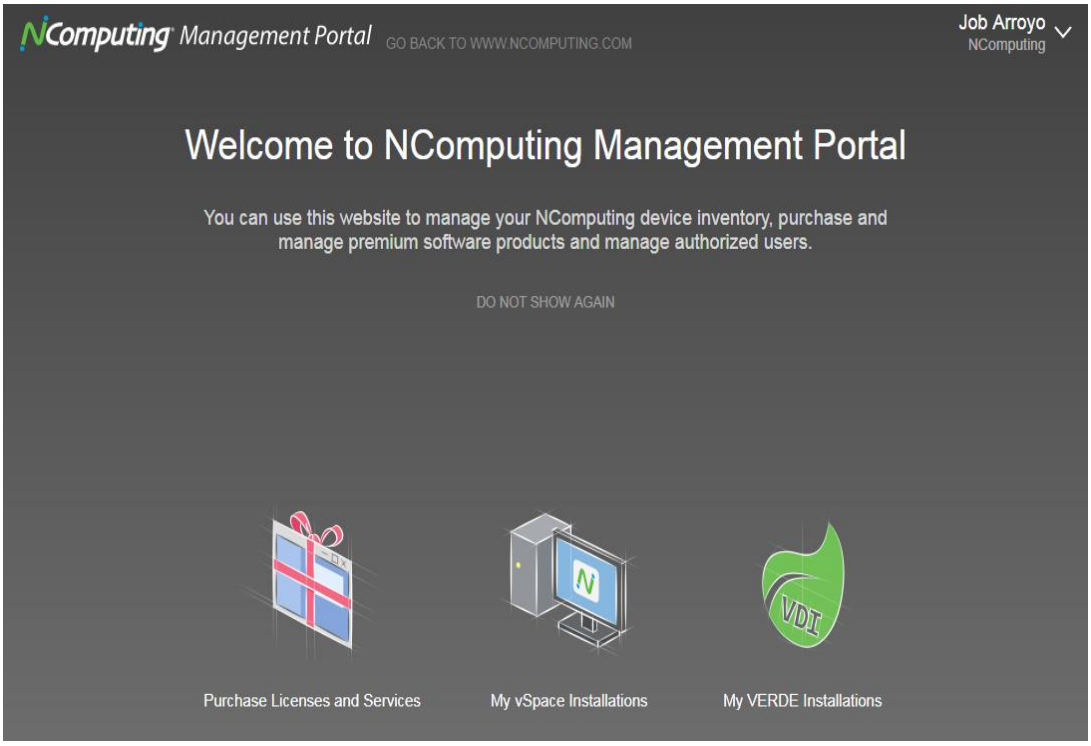
5. You will then see one or different versions of the available software for the selected model and OS. There are expandable informative tabs where you can read additional details about your software. Click on the blue buttons to download the software and the release notes.



6. While your software downloads, If you have never entered the Management Portal, do so now. You will need to have full functionality of this online dashboard before you register your software.



7. Follow any prompts until you are presented with this screen:

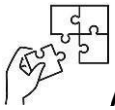


At this point you are ready to install and register our software.

For more information about first time installation best practices:
https://support.ncomputing.com/portal/kb/articles/vspace-first-time-installation-best-practices
about pre-deployment information:
https://support.ncomputing.com/portal/kb/articles/ncomputing-deployment-checklist

Points to Remember

- **Steps NComputing Software Installation**
    1. **Download the Software:** Go to the NComputing website and download the appropriate version of the software.
    2. **Install on Server:** Run the installer on your server and follow the on-screen instructions.
    3. **Configure Network Settings: Ensure** that your network settings are configured correctly to allow client devices to connect.
    4. **Install Client Software:** Install the NComputing client software on the devices that will be connecting to the server.



Application of learning 2.2.

X school want to install Zero Client Technology using Ncomputing into their computer LAB. The computer LAB needed to host 25 clients for students and one Master client for trainer. The installation planned to be completed in two phases, the first one has done and completed by Ncomputing hardware installation.

The school want to hire an IT technician to complete second phase by installing Ncomputing software

Indicative content 2.3: Testing Ncomputing System

Duration: 10

Practical Activity 2.3.1: Checking Ncomputing system connectivity

Task:

1: Read the task described below:

Your school has an installed Ncomputing system that not yet tested. Go in school's workshop and perform Ncomputing system's connectivity testing, after testing document Ncomputing installation.

2: Referring to the key reading 2.3.1., perform the task described above.

3: Apply safety measures

4: Test Ncomputing system's connectivity

5: Present your findings to the whole class and ask for clarification where is needed

Key readings 2.3.1.: Checking Ncomputing system connectivity

1.Introduction

Testing an NComputing system is crucial to ensure it operates efficiently and meets the needs of your users. Let's break this down into two main sections: checking connectivity and performing functionality testing.

2. Check Connectivity

2.1. Verify Network Connection

2.1.1. Steps to Verify Network Connection:

Step 1: Ping Test:

- Open a command prompt or terminal.
- Use the `ping` command to check connectivity between the server and client devices. For example, `ping [server IP]`.
- Ensure you receive responses from the server, indicating that the network connection is active.

Step 2: Network Speed Test:

- Use tools like `iperf` or online speed tests to measure the network speed between the server and clients.
- Ensure the network speed meets the requirements for smooth operation of the NComputing system.

Step 3: Check Firewall Settings:

- Ensure that the necessary ports are open on both the server and client devices.
- Verify that no firewall rules are blocking the communication between the server and clients.

Step 4: Network Configuration:

- Ensure that the IP addresses, subnet masks, and gateways are correctly configured on both the server and client devices.
- Check for any network conflicts or duplicate IP addresses.

2.2. Check Hardware Connection

2.2.1. Steps to Check Hardware Connection

Step 1: Physical Inspection:

- Ensure all cables (Ethernet, power, etc.) are securely connected to both the server and client devices.
- Check for any visible damage to the cables or ports.

Step 2: Checking Device Status:

- On the server, check the device manager (Windows) or equivalent tool (Linux) to ensure all hardware components are recognized and functioning correctly.
- On client devices, ensure they power on and display the initial boot screen.

Step 3: Peripheral Devices:

- Verify that peripheral devices (keyboard, mouse, monitors) are correctly connected and functioning on client devices.
- Test each peripheral to ensure they respond correctly.

3. Perform Functionality Testing

This aspect of testing focuses on verifying that each client device can operate as expected, with minimal performance issues and high reliability.

3.1. Performance Testing considerations

- **User Login Time:**
  - ✓ Measure the time it takes for users to log in to their virtual desktops.
  - ✓ Identify any bottlenecks or delays in the login process.
- **Application Response Time:**
  - ✓ Test the response time of common applications (e.g., web browsers, productivity suites) to assess overall system performance.

- ✓ Use tools like JMeter or LoadRunner to simulate multiple users and measure response times under various load conditions.

- **Resource Utilization:**
  - ✓ Monitor CPU, memory, and disk utilization on both the host server and thin clients to identify potential performance bottlenecks.
  - ✓ Use tools like Task Manager or Performance Monitor to gather performance metrics.

3.2. Reliability Testing:

- **System Stability:**
  - ✓ Conduct long-term tests to assess the system's stability under sustained load.
  - ✓ Monitor for crashes, freezes, or unexpected restarts.
- **Fault Tolerance:**
  - ✓ Simulate hardware failures (e.g., network outages, disk failures) to evaluate the system's ability to recover and maintain user sessions.
  - ✓ Test failover mechanisms and redundancy strategies.
- **Security Testing:**
  - ✓ Conduct vulnerability assessments to identify security weaknesses in the NComputing environment.
  - ✓ Implement security measures (e.g., strong passwords, encryption, firewalls) to protect sensitive data.

3.3. Additional Considerations:

- **User Experience Testing:**
  - ✓ Gather feedback from users to assess their satisfaction with the system's performance, usability, and overall experience.
- **Scalability Testing:**
  - ✓ Evaluate the system's ability to handle increasing numbers of users and workloads.
  - ✓ Test the scalability of the host server and network infrastructure.
- **Compatibility Testing:**
  - ✓ Ensure compatibility with different hardware configurations, operating systems, and applications.
  - ✓ Test with various peripherals (e.g., printers, scanners) to verify their functionality.

Points to Remember

- Steps to Verify Network Connection:
  - ✓ Ping Test
  - ✓ Network Speed Test
  - ✓ Check Firewall Settings
  - ✓ Network Configuration
- Steps to Check Hardware Connection
  - ✓ Physical Inspection
  - ✓ Device Status
  - ✓ Peripheral Devices
- System functionality testing focused on
  - ✓ System performance
  - ✓ And reliability

Practical Activity 2.3.2: Documenting Ncomputing installation



Task:

1: Read the task described below:

Referring to the Ncomputing system that has been installed during Practical Activity 2.1.2 and Practical Activity 2.2.1., document the system and submit the document to trainer.

2: Referring to the key reading 2.3.2, perform the task described above.

3: Apply safety measures

4: Document the system installation

5: Present your findings to the whole class and ask for clarification where is needed

Key readings 2.3.2.: Documenting Ncomputing installation

1. **Introduction**

Documenting Ncomputing installation is crucial for ensuring the proper setup and future maintenance of the system. Here's an outline of the key elements that should be included:

- **Objective**: State the purpose of the Ncomputing installation, including the overall goals of the system, such as improving resource efficiency and supporting multiple users on a single computer infrastructure.
- **Scope**: Define the extent of the installation, the location where it's deployed, and the number of end users expected to utilize the Ncomputing system.

2. Hardware Setup

- **Devices**: Document the specific hardware used in the installation, including the host machines, thin clients, and any accessories like monitors and keyboards.
- **Connection Overview**: Provide a diagram and description showing how the Ncomputing devices are connected, such as the network infrastructure, power sources, and the connection to peripheral devices.

3. Software Installation

- **Software Version**: Specify the version of Ncomputing software used, along with any other essential software for managing the system.
- **Installation Process**: Include a detailed step-by-step process of how the Ncomputing software was installed on the host system. Screenshots can be useful here to show specific installation options selected.
- **Licensing Information**: Record any license keys or activation steps that were part of the software installation.

4. Configuration Details

- **User Management**: Document how users were created or managed within the Ncomputing environment. Include details about access control settings and any user groups established.
- **Monitoring Tools**: Provide information about any monitoring tools installed to manage and track the system’s performance. Mention whether any third-party software was integrated.

- **Network Settings**: Record the network configuration used, such as IP addresses, DHCP settings, and any specific adjustments made to the firewall or security settings to ensure smooth operation.

5. **Testing and Validation**

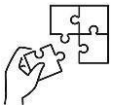
- **Initial Testing**: Document the tests conducted to verify that the Ncomputing system functions properly, including user login tests, resource allocation, and performance under different loads.
- **Issue Resolution**: Record any issues encountered during installation or testing and the solutions implemented to resolve them.



Points to Remember

Here's an outline of the key elements that should be included:

1. Introduction
2. Hardware Setup
3. Software Installation
4. Configuration Details
5. Testing and Validation
6. Maintenance Recommendations
7. Final Report and Handover



Application of learning 2.3.

X School plans to implement Zero Client Technology using NComputing in their computer lab. The lab is designed to accommodate 25 client stations for students and one master station for the trainer.

The installation is divided into two phases: the first phase, which involved the installation of NComputing hardware, has been completed. The second phase, involving the installation of NComputing software, has also been finished.

The school now seeks to hire an IT technician to complete the final task of documenting the installed NComputing system.



Learning outcome 2 end assessment

Written assessment

I. Answer the following questions by true for correct statement and false for incorrect statemen.

1. Ncomputing allows multiple users to share the same physical server while each has their own independent desktop environment.
2. During the installation of Ncomputing, you do not need to configure user accounts since all users will share the same login.
3. The performance of an Ncomputing system depends heavily on the hardware specifications of the server, such as CPU, RAM, and storage.
4. Thin clients in an Ncomputing setup handle most of the processing tasks independently from the server.
5. It is unnecessary to test the Ncomputing system with a full load of users before deployment, as load testing only applies to large enterprise installations.
6. One advantage of Ncomputing is that it reduces the cost of hardware by allowing multiple users to share a single server.
7. Ncomputing requires the use of expensive proprietary networking hardware to function properly.
8. Documenting the Ncomputing installation process is optional, as long as the system is working correctly.
9. Regular monitoring of system performance in Ncomputing is necessary to ensure that all users experience consistent performance.
10. The network configuration in an Ncomputing setup must be optimized to ensure that thin clients can communicate with the server without latency issues.

Practical assessment

A secondary school has decided to implement Ncomputing technology to maximize resources in their computer lab. The goal is to allow up to 30 students to work simultaneously using a single powerful server. The lab has one existing server that is underutilized, and the school wants to use it to host virtual desktops for the students. The solution must be efficient, cost-effective, and easy to manage by the school's IT department.

Task: Install Ncomputing software and hardware in the school's computer lab, enabling 30 students to access individual virtual desktops via thin clients connected to the server. After all test and document, the installation.

END



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Indicative contents
3.1. Assessment of System Monitoring Report
3.2. Fixing Fault.
3.3. Upgrading of Ncomputing System.

Key Competencies for Learning Outcome 3: Maintain Ncomputing system

Knowledge	Skills	Attitudes
● Differentiate function requirement from non-function requirements ● Identification of different common Ncomputing faults ● Description of methods of upgrading Ncomputing system	● Assessing Ncomputing system monitoring report ● Fixing Ncomputing faults ● Updating Ncomputing system ● Testing Ncomputing upgrade	● Having attention to details. ● Being rapid during work execution. ● Being organized to achieve the required result.

Duration: 25 hrs

Learning outcome 3 objectives:

By the end of the learning outcome, the trainees will be able to:

1. Assess properly the system monitoring report based on requirements
2. Differentiate correctly function requirement from non-function requirements based on system monitoring report
3. Differentiate correctly function requirement from non-function requirements
4. Identify correctly different common Ncomputing faults based on system functionality
5. Fix effectively the faults based on report
6. Describe properly methods of upgrading Ncomputing system based on system upgrade requirements
7. Upgrade properly Ncomputing system based on system device

Resources

Equipment	Tools	Materials
● Keyboards ● Mouse ● Monitors ● Computer ● Switch ● UPS ● Firewall ● Router	● Protocol analyser ● Throughput tester ● Hard Disk Sentinel	● Cables ● Cable ties ● Connectors ● Internet bundles ● Screws ● Power extension ● Labelling tags

Indicative content 3.1: Assessment of System Monitoring Report

Duration: 8 hrs

Theoretical Activity 3.1.1: Description of functional and non-functional requirements for Ncomputing monitoring

Tasks:

1: Answer the following questions:

i. Define monitoring report
ii. Explain Key Components of an NComputing System Monitoring Report
iii. List importance of monitoring report
iv. How is important to assess the monitoring report before Ncomputing system maintenance?
v. Identify the functional and non-functional requirements for NComputing System Monitoring.

2: Write the answers on the paper or flip chart

3: Present your findings to the whole class.

3: Ask question for clarification where needed.

4: For more clarification, read the Key readings 3.1.1 in this manual.

Key readings 3.1.1.: Description of Ncomputing monitoring functional and non-functional requirements

1. Monitoring report

1.1. Definition:

A monitoring report is a document or digital summary that provides detailed insights into the performance, health, and usage of a system or network over a specific period.

In an **NComputing system**, a monitoring report is a comprehensive record that provides insights into the performance, health, and usage of virtual desktops and thin clients within the network.

1.2. Key Components of an NComputing System Monitoring Report

- **User Session Data**:

✓ **Active Sessions**: Number of users currently logged in, session duration, and times of peak usage.

✓ **Login/Logout Times**: Tracks when users log in and out, helping to understand usage patterns and system demands.

- **Resource Utilization**:

✓ **CPU and Memory Usage**: Records the load on CPU and memory for the central servers hosting virtual desktops. High usage levels can indicate a need for load balancing or additional resources.

✓ **Disk and Storage Metrics**: Shows the use of storage, especially important if users access or create large files frequently.

✓ **Network Bandwidth**: Monitors network traffic between the NComputing devices and servers to prevent bandwidth bottlenecks that could impact user experience.

- **Device Status**:

✓ **Connected Devices**: Information on each connected NComputing device, including uptime, device model, and firmware version.

✓ **Device Health**: Tracks any malfunctions, device disconnects, or errors, helping IT to preemptively address issues with individual thin clients.

- **Application Performance**:

✓ **Application Access and Latency**: Monitors the performance of applications used by NComputing users, noting any latency or slow loading times that may need attention.

✓ **Application Resource Usage**: Reports which applications are consuming the most resources, allowing for prioritization of resources or potential optimizations.

- **Security Metrics**:

✓ **Access Logs**: Tracks login attempts and any suspicious access patterns or failed logins to help secure the environment.

✓ **Firmware and Software Updates**: Ensures all devices are updated with the latest firmware and software to maintain security and compatibility.

- **Error and Event Logs**:

✓ **System Errors**: Any error messages, warnings, or irregular events on servers or NComputing devices.

✓ **Service Interruptions**: Logs of any server or device downtime, along with durations and reasons if known.

- **Resource Scaling and Capacity Planning**:

✓ **Usage Trends**: Highlights trends in user sessions and resource demands, indicating when scaling may be needed to support additional users.

✓ **Resource Limits**: Data on how close the system is to its capacity limits for memory, CPU, or storage, which assists in planning for future expansions.

1.2. Importance of NComputing System Monitoring Reports

These reports are essential for maintaining a high-performing NComputing environment, helping administrators to:

- Identify and resolve issues before they affect users.
- Optimize resource usage to ensure efficient performance.
- Plan for scaling the system to accommodate future growth.
- Ensure compliance with security standards.
- Reduce downtime and enhance user satisfaction.

2. Importance of assessing the monitoring report before Ncomputing maintenance

Assessing the monitoring report before performing maintenance on an NComputing system is crucial because it allows the IT team to make informed decisions, prioritize tasks, and allocate resources effectively. Here are the key reasons why this assessment is important:

- **Identifying and Diagnosing Issues Proactively**

✓ Monitoring reports highlight performance metrics such as CPU usage, memory consumption, network latency, and error rates. By reviewing these metrics before maintenance, the team can identify potential issues—like resource bottlenecks, overheating, or high latency—before they become critical.

- **Setting Maintenance Priorities and Goals**

✓ The monitoring report provides a clear view of which areas of the system are showing the highest error rates. This helps in prioritizing specific maintenance tasks (e.g., updating firmware on devices with the highest error rates or increasing memory on overutilized servers).

- **Reducing Costs and Preventing Unnecessary Downtime**

✓ Targeted maintenance based on monitoring data minimizes the need for frequent, unplanned interventions, which can be costly and disruptive. By focusing only on necessary updates and replacements, the IT team reduces both downtime and maintenance costs.

3. Functional and Non-functional requirements for NComputing System Monitoring

To assess the monitoring report of an NComputing system for maintenance purposes, it is essential to look at both functional and non-functional requirements.

3.1. Functional Requirements

Functional requirements focus on what the system must do to maintain operational performance and user satisfaction.

Key functional requirements include:

- **User Session Monitoring**: Track active and idle user sessions, login and logout times, and session duration. This information helps determine system usage patterns and identify potential performance issues caused by high demand or long-running sessions.
- **Resource Utilization**:

✓ **CPU Usage**: Monitor CPU load across all virtual desktops and servers. High CPU utilization may indicate the need for load balancing or additional resources.

✓ **Memory Usage**: Keep track of RAM usage for each session and server to ensure there is no bottleneck. Excessive memory use might require an increase in server capacity or optimized configuration settings.

✓ **Network Bandwidth**: Monitor bandwidth consumption for each connected device, ensuring that the network can handle the required data traffic without delay, especially during peak times.

- **System Availability and Uptime**:

✓ Track uptime for both servers and NComputing devices, identifying any periods of unavailability. Consistently high availability is crucial in environments with high service-level agreements (SLAs).

✓ Alerts for server or device downtime allow for immediate troubleshooting to minimize disruptions.

- **Error and Event Logging**:

✓ Record errors, warnings, and events to diagnose issues quickly. This log provides valuable information about recurring issues or potential threats that may require maintenance or system updates.

- **Firmware and Software Update Monitoring**:

✓ Ensure that all devices and server components run on the latest firmware and software versions. This keeps the system up-to-date with the latest security patches and performance improvements.

- **Peripheral Device Compatibility**:

✓ Check compatibility and connectivity for peripherals like printers, scanners, and USB devices across NComputing terminals. This ensures users can seamlessly access necessary devices, avoiding disruptions in workflows.

3.2. Non-Functional Requirements

Non-functional requirements define system qualities like performance, reliability, scalability, and usability, which are essential for a well-maintained NComputing environment.

- **Performance**:

✓ **Latency**: Monitor the response time for each session, as latency can impact user experience, especially when working with real-time applications. Latency reports can highlight if the network or server needs upgrading.

✓ **Load Balancing**: Ensure that user sessions are distributed evenly across resources to avoid overloading specific servers. Load balancing can prevent performance drops during peak times.

- **Scalability**:

✓ Evaluate if the system can support additional users or devices without degrading performance. Monitoring reports should provide insights on system thresholds to predict when more resources might be needed.

✓ If the report shows the current setup is approaching capacity limits, it may indicate a need to upgrade or expand the NComputing setup.

- **Reliability and Fault Tolerance**:

✓ **Error Rate**: Measure the frequency of errors in user sessions or device connections. A low error rate indicates stable and reliable performance, while frequent errors could signal underlying issues.

✓ **Redundancy**: Evaluate redundancy capabilities to avoid downtime in case of hardware or network failures. For instance, if a server fails, a redundant server should take over seamlessly.

- **Security**:

✓ **Access Control**: Monitor access logs to ensure that only authorized users access the system. This enhances security by identifying potential breaches or unauthorized access.

✓ **Data Encryption and Privacy**: Ensure all user data transmitted over the network is encrypted, meeting compliance requirements and protecting sensitive information.

- **Usability and User Satisfaction**:

✓ **Session Responsiveness**: Assess user feedback on system responsiveness and ease of use. Reports on user satisfaction and device response times help gauge overall usability.

✓ **Session Duration and Disconnects**: Analyze session duration data to understand usage patterns. Frequent disconnects or short sessions could indicate issues that might need addressing.

- **Maintenance and Troubleshooting Efficiency**:

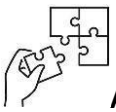
✓ Track the average time taken to resolve issues after they are reported. Quick resolution times indicate an efficient maintenance process, while long times suggest areas for improvement.

✓ Identify repeat maintenance tasks and determine if there are optimizations that could make the system more resilient, reducing the need for frequent intervention.



Points to Remember

- Functional requirements for NComputing devices define the core capabilities and features that must be met to ensure proper functioning and integration within a virtual desktop environment.
- Non-functional requirements (NFRs) for NComputing devices define the quality attributes, performance standards, and operational conditions that the system must meet to function efficiently.



Application of learning 3.1.

Ikaze LTd, a public secretariat located in Kigali City, known for providing essential typing services to local government offices and citizens, is looking to enhance its operational efficiency. To achieve this, they have decided to install an NComputing system, which allows multiple users to access a single computer, thereby reducing costs and optimizing space.

Task: Assist the secretariat in providing full information about functional and non-functional requirements to consider while installing an NComputing system.

Indicative content 3.2: Fixing Faults

Duration: 8 hrs

Theoretical Activity 3.2.1: Description of Ncomputing system troubleshooting process

Tasks:

1: Answer the following questions:

i. Define the term “troubleshooting”
ii. What problems do you think the Ncomputing system can meet?
iii. What are the causes of those problems?

2: Write the answers on the paper or flip chart

3: Present your findings to the whole class.

3: Ask question for clarification where needed.

4: For more clarification, read the Key readings 3.2.1 in this manual.

Key readings 3.2.1. Description of Ncomputing system troubleshooting process

1. Computing system troubleshooting

NComputing systems are designed to enable multiple users to share a single computer, which can lead to various troubleshooting scenarios. Here are some common troubleshooting steps:

Step 1: Check connections:

Ensure that all cables (USB, power, etc.) are securely connected to both the host computer and the NComputing devices.

Step 2: Verify power supply:

Make sure that the power supply for the NComputing device is functioning and that the device is powered on.

Step 3: Make Software configuration:

Check the NComputing software settings on the host computer to ensure that it is configured correctly for the number of users.

Step 4: Check Network issues:

If using a network-based solution, verify that the network is functioning properly and that the NComputing devices are connected to the correct network.

Step 5: Ensure driver updates:

Ensure that the necessary drivers for the NComputing devices are installed and up-to-date on the host computer.

Step 6: Check User profiles:

Check if user profiles are correctly set up and accessible, as issues with profiles can lead to user access problems.

Step 7: Conduct Performance monitoring:

Monitor the host computer's performance to ensure it can handle the load of multiple users. High CPU or memory usage can lead to slow performance.

2. **Problems that NComputing System Can Meet:**
   - **2.1. Slow performance**:
     Users may experience slow response times when interacting with applications or during logins.
   - **2.2. Connection drops**:
     Clients may randomly disconnect from the server or fail to connect altogether.
   - **2.3. Peripheral issues**:
     Devices like keyboards, mice, or printers may not function correctly with the thin or zero clients.
   - **2.4. Session freezing**:
     User sessions can freeze or crash during operation.
   - **2.5. Resource overload**:
     Too many users might overwhelm the server, leading to degraded performance.
   - **2.6. Compatibility issues**:
     Some software applications may not be fully compatible with NComputing environments.
   - **2.7. Display problems**:
     Low resolution, distorted images, or failure to display on connected monitors.
3. **Causes of those problems:**
   - **3.1. Network congestion**:
     Slow or interrupted performance is often caused by network bandwidth issues, especially in large deployments where multiple users share the same network.

3.2. Insufficient server resources:

If the server doesn't have enough CPU, memory, or storage to handle multiple users simultaneously, it can lead to performance degradation or crashes.

3.3. Outdated software or firmware:

Running outdated versions of NComputing software or client firmware can cause compatibility issues and errors.

3.4. Hardware failure:

Faulty hardware, such as damaged cables, malfunctioning thin clients, or defective peripherals, can cause system instability.

3.5. Power supply issues:

Fluctuating power or insufficient power to devices can cause intermittent failures or performance problems.

3.6. Improper configuration:

Incorrect settings on the server or network configuration can lead to connection problems or poor resource allocation.

3.7. Overloaded network infrastructure:

Network switches, routers, or access points might not be capable of handling the demand, causing lag or dropped connections.

3.8. Incompatible or resource-intensive applications:

Running resource-heavy applications on thin or zero clients can overload the system, causing it to slow down or crash.



Practical Activity 3.2.2: Applying Ncomputing system trouble shooting process

Task:

1: Read the task described below:

As an Ncomputing system Engineer, you are in charge of managing an NComputing system setup in a computer lab at your school. Recently, the students from other trades have reported several issues. Go in computer Lab check for the issue and fix the fault.

2: Referring to the key reading 3.2.2, perform the task described above.

3: Apply safety measures

4: Apply Ncomputing system troubleshooting process.

5: Present your findings to the whole class and ask for clarification where is needed



Key readings 3.2.2 Applying Ncomputing system trouble shooting process

Ncomputing troubleshooting process

1. Introduction

Ncomputing Troubleshooting is conducted through the following steps:

- Identify potential issues
- Conducting trouble shooting activities
- Take preventive measures for future issues

Processes of troubleshoot the Ncomputing system problems involves several steps basing on identified problem. The following are some of the problems and related steps through which they can be solved**.**

2. Possible issues and their solutions

2.1. Slow Performance:

Step 1: Check the CPU, memory, and disk usage on the host server to identify any resource bottlenecks. Increase the allocation of resources if necessary.

Step 2: Evaluate the network bandwidth usage to ensure there is no congestion and adjust network settings or upgrade bandwidth if required.

Step 3: Use load-balancing tools to distribute user sessions more evenly across multiple host servers.

Step 4: Check if any specific applications are consuming excessive resources and apply optimizations or limitations.

2.2. Session Freezing:

Step 1: Monitor the resource utilization (e.g., CPU, RAM) on both the server and thin clients to identify potential overloading or memory leaks.

Step 2: Check the network connection stability between thin clients and the server. Ensure there is minimal packet loss or latency.

Step 3: Update the software on the thin clients and the host server to the latest versions to avoid compatibility issues.

Step 4: Review system logs to identify any recurring errors or crashes and address any misconfigurations.

2.3. Peripheral Issues:

Step 1: Verify that peripheral redirection is correctly configured on the host server and that users have permission to use USB devices and printers.

Step 2: Check for updated drivers on the thin clients and ensure compatibility with the connected devices.

Step 3: Test the peripherals on other machines to ensure that the devices

themselves are functional.

Step 4: Reconfigure user permissions or adjust firewall/security settings to allow external devices to be detected by the server.

2.4. User Authentication Failure:

Step 1: Verify that the host server is correctly communicating with the authentication server (e.g., Active Directory) and that there are no network issues.

Step 2: Check time synchronization across the network. Authentication issues often arise from mismatched system times between the server and thin clients.

Step 3: Reset the credentials of the affected users or re-enable their accounts in the Active Directory.

Step 4: Review event logs to identify any specific authentication-related errors and resolve any misconfigurations in the authentication protocols.

3. Preventive Measures

The following are preventive actions that can be taken to avoid similar issues in the future:

Step 1: Monitor System Health Regularly:

Implement continuous monitoring of server and network performance to identify potential bottlenecks before they affect users.

Step 2: User Load Balancing:

Distribute user sessions evenly across multiple host servers to prevent overloading a single machine. Consider scaling resources as the user base grows.

Step 3: Update Software Regularly:

Keep both the thin client firmware and the server software updated to ensure compatibility and fix potential bugs.

Step 4: Network Optimization:

Ensure that the network infrastructure is robust enough to handle the data traffic between clients and the host server, minimizing latency and packet loss.

Step 5: Regular Backups and Maintenance:

Perform regular backups of user data and system configurations. Schedule periodic maintenance windows to address potential hardware or software issues before they escalate.

4. Processes to test the working of Ncomputing system

While testing Ncomputing system, the following activities are considered:

4.1. Initial Setup and Configuration:

Step 1: Ensure the NComputing software is installed and properly configured on the host server.

Step 2: Configure the thin clients to connect to the host server and test the basic connection.

Step 3: Ensure that each client can access its own session with proper user isolation.

Step 4: Set up user accounts for students and teachers, ensuring proper authentication through Active Directory or a similar system.

4.2. Multi-User Load Testing:

Step 1: Have 10–15 users log in simultaneously from different thin client devices. Verify that each user can successfully start their session.

Step 2: Test basic tasks such as opening web browsers, creating documents, and accessing shared network drives. Monitor for lag or performance degradation.

Step 3: Gradually increase the number of users up to 25 (full capacity) and repeat the tests. Pay close attention to:

- CPU and memory usage on the host server
- Response times for launching applications
- Network performance between the server and clients

Expected Outcome: The system should maintain acceptable performance levels (minimal lag and quick response times) while handling multiple users.

4.3. Application Compatibility Testing:

Step 1: Test the compatibility of different applications that students will use. This includes:

- Word processing software (e.g., Microsoft Word, Google Docs)
- Web browsers (e.g., Chrome, Firefox)
- Media players (e.g., VLC) for playing videos or audio files
- Educational software specific to the school's curriculum

Step 2: Ensure each application runs smoothly across multiple user sessions without conflicts or crashes.

Expected Outcome: All key applications should work efficiently without affecting other users' sessions.

4.4. Peripheral Testing:

Step 1: Connect USB flash drives to several thin clients and check if they are recognized within each user's session. Ensure that file transfer works correctly.

Step 2: Test printing functionality by connecting a printer to the network and allowing users to print documents from different thin clients.

Step 3: Ensure peripheral isolation is maintained, meaning one user should not access another user's USB drive or print queue.

Expected Outcome: USB devices and printers should function correctly, and each user should have exclusive access to their peripherals.

4.5. Network and Security Testing:

Step 1: Verify that all sessions are transmitted securely over the network using encryption protocols (e.g., SSL/TLS).

Step 2: Test the authentication process, ensuring that only authorized users can log in. Attempt to log in with incorrect credentials to verify that the system correctly denies access.

Step 3: Test firewalls and antivirus protection on the host server to ensure that security threats are detected and blocked.

Expected Outcome: The system should securely handle user data and prevent unauthorized access.

4.6. System Stress Testing:

Step 1: Push the system to its limits by running more resource-intensive tasks, such as streaming videos, downloading large files, or running graphics-intensive applications.

Step 2: Monitor system resource usage on the host server (CPU, memory, disk I/O) and observe how it handles high demand.

Step 3: Test recovery by simulating hardware failure (e.g., unplugging a thin client or disconnecting the network temporarily) and observing how the system recovers.

Expected Outcome: The system should not crash under high demand, and performance should degrade gracefully without freezing or becoming unresponsive.

4.7. User Feedback and Usability Testing:

Step 1: Ask a few test users (students and teachers) to use the system and provide feedback on usability. Specifically, ask them to comment on:

- Ease of use (logging in, navigating, using applications)
- System responsiveness and performance
- Any difficulties encountered during use

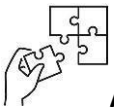
Step 2: Based on feedback, adjust system settings or make improvements to enhance the user experience.

Expected Outcome: Users should report a positive experience, with minimal complaints about system speed or functionality.



Points to Remember

- The Ncomputing troubleshooting processes are the following:
  - ✓ **Identify Potential Issues**
    - Identify Slow performance cause
    - Identify Session Freezing cause
    - Identify Peripheral Issues cause
    - Identify User Authentication Failure cause
  - ✓ **Troubleshooting Steps**
    - Solve Slow Performance
    - Solve Session Freezing
    - Solve Peripheral Issues
    - Solve User Authentication Failure
  - ✓ **Take Preventive Measures for the future issues.**



Application of learning 3.2.

You are an IT administrator in charge of managing an Ncomputing system setup of an Enterprise. The lab consists of a host server running virtual desktops and 20 thin client devices, each connected to the host. Recently, users have reported several issues: Step by step solve the problems to have effective working.



Practical Activity 3.2.3: Documenting troubleshooting findings and solutions



Task:

1: Read the task described below:

Refer to task described in Practical activity 3.2.2, document findings and solutions.

2: Referring to the key reading 3.2.3, perform the task described above.

3: Apply safety measures

4: Document the findings and solutions.

5: Present your findings to the whole class and ask for clarification where is needed



Key readings 3.2.3 Document troubleshooting findings and solutions

Document Findings and Solutions

1. **Definition:**

   Document Findings and Solutions is the process of systematically recording the details, actions, and outcomes involved in diagnosing and resolving a technical issue.

2. **Process of Document Findings and Solutions**

   Documenting the troubleshooting and solution process is essential for future reference, ensuring that similar issues can be quickly addressed.

2.1. **Record the Fault and Symptoms**:

Document the initial symptoms, error codes, user descriptions, and any preliminary observations.

2.2. **Detail the Troubleshooting Steps**:

List each step taken in the troubleshooting process, including tools used, tests run, and configuration changes made.

2.3. **Note the Solution**:

Clearly describe the solution applied, whether it was a configuration adjustment, a software update, or hardware replacement.

2.4. **Create a Reference for Future Issues**:

Save the documentation in an easily accessible system, tagged by type of fault or error code, so that future technicians can reference it if the problem reoccurs.

2.5. **Update System Documentation**:

If new configurations or updates were applied, ensure the master documentation for the system is updated to reflect these changes.

3. Advantages of Documenting Findings and Solutions of system troubleshooting/faults fixation

- Documentation captures the knowledge and expertise of technicians, ensuring that valuable insights are not lost when team members leave or transition roles.
- Access to documented solutions allows technicians to quickly reference previous fixes, reducing the time spent diagnosing and resolving recurring issues.
- New technicians can use documented findings as a training resource, allowing them to learn from real-world scenarios and understand common issues they may encounter.
- Documenting findings creates a clear record of actions taken, which can help establish accountability among team members for resolving specific issues.
- Documentation provides an audit trail that can be useful for internal reviews or external audits, demonstrating how issues were handled and resolved.
- Access to documented solutions allows support teams to take a proactive approach in addressing known issues, further enhancing user satisfaction

4. Sample of documentation of troubleshooting process

SAMPLE OF Ncomputing troubleshooting documentation

Occurred issues/fault: NComputing Thin Client Not Connecting to the Host Server

Issue Description:
A user reports that their NComputing thin client is not connecting to the host server. The screen shows a "Cannot Connect to Server" error message, and the issue started this morning. Other thin clients in the same network appear to be working fine.

Troubleshooting Steps:

Checked Network Connectivity:

Verified that the network cable was securely connected to both the thin client and the network port.

Outcome: Cable connection was secure.

Tested Network Port:

Connected a laptop to the same network port to test connectivity.

Outcome: The laptop connected successfully, so the network port was working correctly.

Checked Thin Client Settings:

Reviewed the network settings on the thin client to ensure they matched the required configuration for accessing the host server.

Outcome: Network settings appeared correct.

Rebooted the Thin Client:

Restarted the thin client to refresh its connection to the server.

Outcome: The issue persisted.

Ping Test to Host Server:

Performed a ping test from the thin client to the host server to verify connectivity.

Outcome: The ping test failed, indicating a potential network issue with this specific client.

Updated Thin Client Firmware:

Checked for firmware updates on the thin client and found an outdated version. Updated the firmware to the latest version.

Outcome: After the update, the thin client successfully connected to the host server.

Solution Implemented:
Updated the thin client firmware to the latest version, which resolved the connection issue.

Outcome:
The user was able to connect to the host server, and the error message did not reappear after testing.

Future Recommendations:

Routine Firmware Checks: Schedule regular firmware updates for all thin clients to prevent compatibility issues with the host server.

Document Known Issues: Add this scenario to the knowledge base as a known issue to help resolve similar problems in the future quickly.

Participants: Eng. ISHAMI AGWIZE and Eng. AGABA MUGABE

Location: Muhanga District

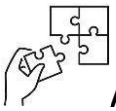
Date of Survey: 27-10-2024

Approval and Signatures
Client Representative: _____
Surveyor: _____



Points to Remember

- The Ncomputing troubleshooting processes are the following:
  - ✓ Identify Potential Issues
    - Identify Slow performance cause
    - Identify Session Freezing cause
    - Identify Peripheral Issues cause
    - Identify User Authentication Failure cause
  - ✓ Troubleshooting Steps
    - Solve Slow Performance
    - Solve Session Freezing
    - Solve Peripheral Issues
    - Solve User Authentication Failure
  - ✓ Take Preventive Measures for the future issues.



Application of learning 3.2.

You are an IT administrator in charge of managing an Ncomputing system setup of an Enterprise. The lab consists of a host server running virtual desktops and 20 thin client devices, each connected to the host. Recently, users have reported several system issues: Step by step solve the problems to have effective working then provide to your manager a comprehensive document about the findings and solutions to the problem.

Indicative content 3.3: Upgrading of Ncomputing System

Duration: 9 hrs

Practical Activity 3.3.1: Updating Ncomputing firmware

Task:

1: Read the task described below:

You are tasked with updating the vSpace software on a network of NComputing devices at your school. The current version of vSpace is outdated, and users are experiencing performance issues. You need to ensure that the update is performed correctly without disrupting the existing user configurations or causing downtime during work hours.

2: Referring to the key reading 3.3.1, perform the task described above.

3: Apply safety measures

4: Update firmware software on network of Ncomputing device.

5: Present your findings to the whole class and ask for clarification where is needed

Key readings 3.3.1 Updating firmware as software

Methods used to update firmware software

Updating firmware software is done in two methods namely updating via vSpace console and updating via thin client device firmware menu.

1. **Update via vSpace console**

The steps to update firmware software are the following:

Step 1: Make sure your L300 devices and at least one vSpace host are on the same ethernet subnet. Out of LAN updates could only be possible if proper configurations to the network have happen to accommodate UDP protocols to pass through. We have KB articles and the L300 / L350 user's manual that will cover this in depth.

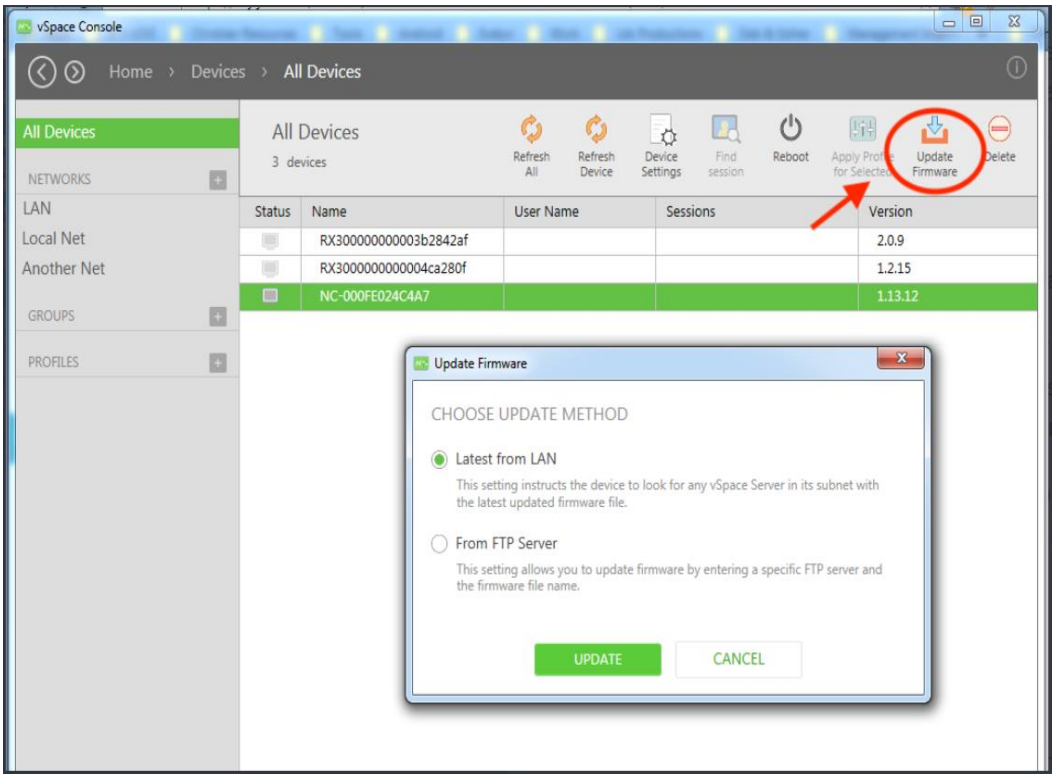
Step 2: On the vSpace host system, launch the NComputing Console by navigating to: Start > All Programs > NComputing vSpace Console. Click on Manage devices.

Step 3: Click on the “Firmware Update” button on the top of the window.

Step 4: Select “Latest from LAN” device and click “Update”

Step 5: The terminal will go through it's firmware update cycle.

Step 6: Your firmware update is now complete. Please refer to the latest user manual for further information on other approaches to updating firmware.



2. Updating firmware via thin client device firmware menu

Steps to update firmware are the following:

Step 1: Turn on the device.

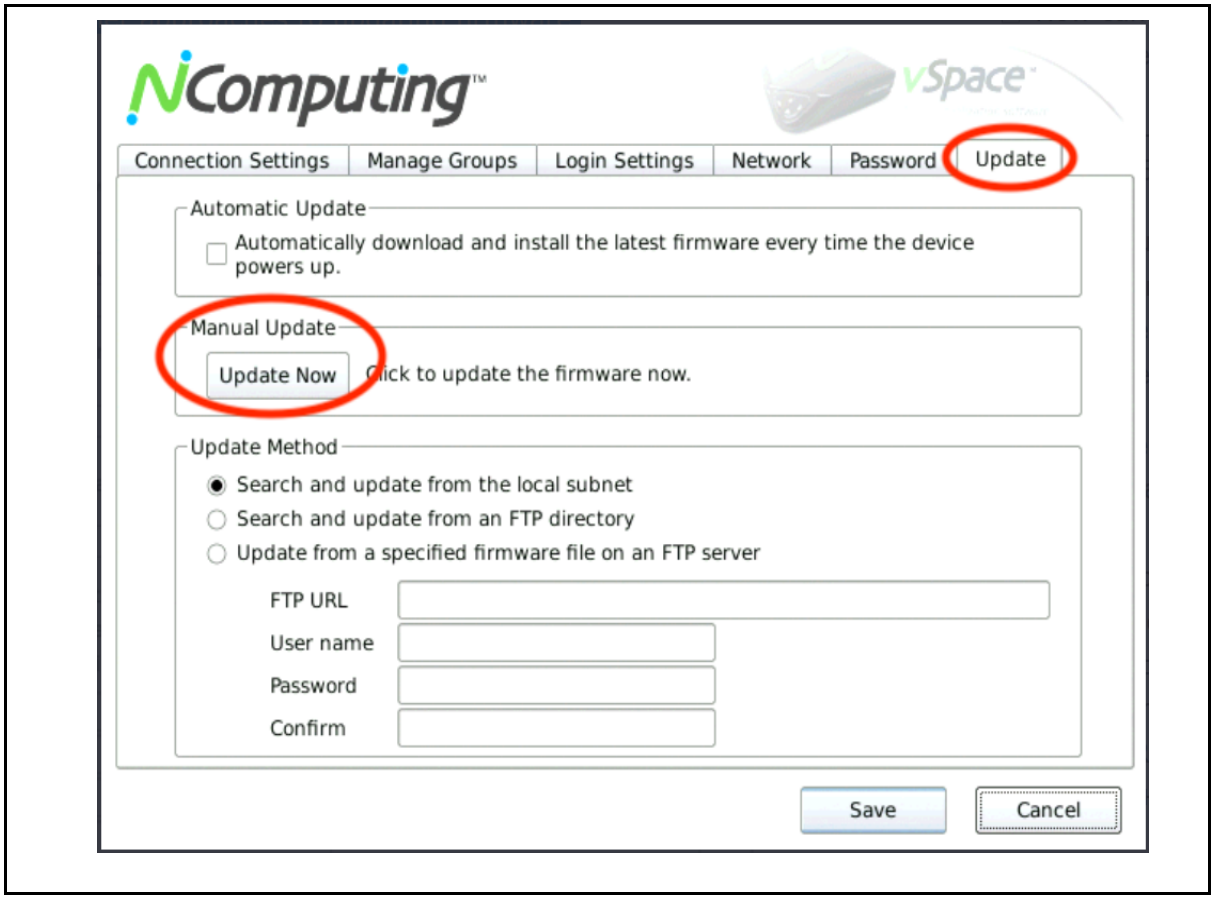
Step 2: Click on Device Setup

Step 3: Click on the Update Tab

Step 4: On the Manual Update section, click on Update Now.

Step 5: Let the device go through the update cycle.

Step 6: Your firmware update is now complete. Please refer to the latest user manual for further information on other approaches to updating firmware.





Practical Activity 3.3.2.: Updating vSpace software



Task:

1: Read the task described below:

> You are tasked with updating the vSpace software on a network of NComputing devices at your school. The current version of vSpace is outdated, and users are experiencing performance issues. You need to ensure that the update is performed correctly without disrupting the existing user configurations or causing downtime during work hours.

2: Referring to the key reading 3.3.2, perform the task described above.

3: Apply safety measures

4: Update vSpace software

5: Present your findings to the whole class and ask for clarification where is needed

Key readings 3.3.2. Updating vSpace software

Update vSpace software

The latest NComputing software can be obtained from http://www.ncomputing.com/downloads

You can check this location periodically for newly posted software. Simply download the installation file, read the release notes, uninstall your current version (if required per the Release Notes) making sure to keep your registration information active (when prompted), and install the new version of software.

Alternatively, you can update the vSpace Server software directly over the Internet by selecting "vSpace

Server Update" from the Start menu.

Note: If the "Enter Password" window appears, enter the vSpace Server administrator password you selected during vSpace Server installation.

Click the "Connect" button to check for a software update. If there is a new version available, click on the "Download" button to start the update process. If there is no new version available, click on the "Exit" button. When the download is complete, the installation of the new version will begin.

Uninstallation of Ncomputing vSpace

To uninstall the vSpace Server software, select "Uninstall vSpace Server" under the "NComputing vSpace Server" folder in the Start menu (or select vSpace Server from the Add/Remove Programs utility in the Windows Control Panel). Follow the uninstall utility's prompts to remove the program components.

After vSpace Server is uninstalled, you must restart the host computer to complete the removal process.



Practical Activity 3.3.3: Upgrading Ncomputing hardware parameters



Task:

1: Read the task described below:

At your school, the number of Ncomputing are being increasing along time and the Ncomputing system is no longer supporting the users, as an IT, you are asked to upgrade the Ncomputing system hardware parameters.

2: Referring to the key reading 3.3.3, perform the above task.

3: Apply safety measures

4: Upgrade Ncomputing hardware parameters.

5: Present your findings to the whole class and ask for clarification where is needed



Key readings 3.3.3. Upgrading Ncomputing hardware parameters

Ncomputing hardware are in three parameters namely CPU, RAM and Hard disk, all of the parameters need to be upgraded due to number of users accessing Ncomputing system.

1. Upgrading CPU

Starting with vSpace Server 6.5, the maximum number of L-- - Series users is increased to 100. However, the number of users, intended application suite and overall performance expectation will ultimately determine how powerful a computer must be used in order to deliver the desired multi-- - user experience.

The tables below give recommended specifications for a vSpace Server host computer running a typical application set, based on the number of users and type of access device. NComputing recommends you always test your environment in advance of deployment to ensure it meets your expectations.

Recommended Host Hardware Configuration						
Host Configurations	Number of Users[1]					
	1-10	10-20	20-30	30-50	50-75	75-100
CPU* (minimum or equivalent)	Intel™ Core 2 Quad	Intel Core™ i7	Intel Core i7	Intel Core i7	Dual Xeon™	Dual Xeon
Memory (64-bit OS)	6 GB	8 GB	12 GB	16 GB	24 GB	24 GB

The number of users that your installation will support depends upon the host's configuration and your end-- - users' performance expectations. Performance results are highly dependent upon the individual host hardware, memory, applications being used, OS and network conditions within any LAN. Host requirements will vary, please test your multi-- - user environment before deployment.

Step 1: Power Down and Disassemble the Server

Power Off the Server:

- Shut down the server properly, ensuring all users are logged out and no sessions are active.
- Disconnect the server from its power source.

Open the Server Case:

- Use appropriate tools to open the server's chassis or case, providing access to the motherboard and CPU.

Step 2: Remove the Existing CPU

Remove Cooling System:

- If the CPU has a heatsink or fan attached, carefully unscrew and detach it.
- Clean any thermal paste from the CPU and heatsink using a microfiber cloth and isopropyl alcohol.

Remove the Old CPU:

- Unlock the CPU socket by lifting the retention arm.
- Gently remove the old CPU, taking care not to bend any pins or damage the socket.

Step 3:Install the New CPU

Insert the New CPU:

- Align the new CPU with the socket, ensuring that the orientation is correct (check for alignment markers on the CPU and socket).
- Carefully lower the CPU into the socket and lock it in place by lowering the retention arm.

Apply Thermal Paste:

- Apply a small, even amount of **thermal paste** to the center of the CPU to ensure efficient heat transfer between the CPU and the heatsink.

Reattach the Cooling System:

- Reinstall the heatsink and fan (or liquid cooling system), ensuring that it is securely fastened.

Step 4: Reassemble and Power On the Server

Reassemble the Server:

- Close the server case and reconnect all necessary power and network cables.

Power On and Test:

- sTurn the server on and immediately enter the **BIOS/UEFI** setup by pressing the appropriate key (usually **Del** or **F2**).
- Check that the new CPU is recognized and functioning correctly.

2. Upgrading RAM

Step 1: Check the Server's Specifications

While checking the server specifications, do the following activities:

i. Identify the Motherboard Model:

- Use a tool like CPU-Z (on Windows) or dmidecode (on Linux) to identify your server's motherboard model.
- Check the maximum RAM capacity and RAM type (e.g., DDR3, DDR4, or DDR5), as well as the number of available RAM slots.

ii. Verify the RAM Type:

- Ensure you purchase the correct type of RAM for your server. Motherboards are generally compatible with only one type of RAM (e.g., DDR4 or DDR5), and they have specific speed requirements (e.g., 2400

MHz, 3200 MHz).

- Check the motherboard or server manual to determine the supported RAM size, speed, and configuration (single-channel, dual-channel, or quad-channel).

iii. Count the Available Slots:

Check how many DIMM slots are available on your server's motherboard. If all slots are occupied, you may need to remove existing RAM modules or replace them with higher-capacity modules.

Step 2: Purchase the Correct RAM

While purchasing the correct RAM, consider the following:

i. Choose Compatible RAM:

- Based on your findings, purchase compatible RAM modules. Look for reputable brands like Crucial, Corsair, Kingston, or Samsung.
- Choose RAM that matches the speed and capacity supported by your motherboard. It's generally recommended to buy identical RAM sticks (in terms of speed and capacity) for better performance.

ii. Buy in Matching Pairs (if possible):

- If your server supports dual-channel or quad-channel memory, buy the RAM in matched pairs or sets to take advantage of the increased bandwidth.

Step 3: Back Up the Server

While backing up the server, consider the bellow point:

Backup Critical Data:

- Before performing any hardware upgrade, back up all important data from your server.
- While upgrading RAM is a low-risk operation, it's always good practice to have backups in place in case of any issues during the upgrade process.

Step 4: Power Down and Open the Server

i. Shut Down the Server:

- Properly shut down the server, ensuring that all users are logged out and no sessions are active.
- Disconnect the power supply and all connected peripherals (such as

network cables, external drives, etc.).

ii. Open the Server Case:

Use appropriate tools to open the server case or chassis to access the motherboard. Typically, this involves unscrewing side panels or a top cover.

Step 5: Remove the Existing RAM (if necessary)

i. Locate the RAM Modules:

Identify the RAM modules currently installed on the motherboard. The RAM sticks will be located in long, rectangular DIMM slots.

ii. Remove Old RAM (if needed):

- If you're replacing old RAM, press down on the clips on either side of the RAM module to release it.
- Gently pull the RAM stick out of the slot, ensuring not to bend or damage the module.

Step 6: Install the New RAM

While installing the new RAM, the below points are considered:

i. Insert the New RAM:

- Line up the notch on the bottom of the RAM module with the slot on the motherboard.
- Firmly press the RAM stick into the slot until the clips snap into place on both sides. Make sure the RAM is securely seated.

ii. Install RAM in the Correct Configuration:

- If your motherboard supports dual-channel or quad-channel memory, install the RAM modules in the appropriate slots. Most motherboards have color-coded slots to indicate which ones should be used for dual-channel (e.g., two sticks in alternating slots).
- Check the server manual to confirm the correct placement for the best performance.

Step 7: Reassemble the Server

While reassembling the server, do the following activities:

i. Close the Server Case:

After installing the new RAM, close the case and secure it with screws.

ii. Reconnect the Power:

Reconnect the power cable and any other peripherals, such as network cables, monitors, and external drives.

Step 8: Power On and Test the RAM

i. Boot the Server:

- Power on the server and immediately enter the BIOS/UEFI setup by pressing the appropriate key (usually Del, F2, or Esc).
- Verify that the new RAM is detected and that the total RAM matches the amount installed.

ii. Load into the Operating System:

Boot into the operating system and check that the server is functioning properly. Use tools like Task Manager (Windows) or free -m (Linux) to verify that the system recognizes the full amount of installed RAM.

iii. Run Stress Tests:

- Use stress-testing or benchmarking tools (such as MemTest86 or Prime95) to ensure the new RAM is stable and performing correctly.
- Monitor the server under load to ensure no issues such as freezes or crashes occur.



Practical Activity 3.3.4: Testing Ncomputing upgrade



Task:

1: Read the task described below:

You recently upgraded the hardware (RAM, CPU, and hard drive) of an NComputing server that supports 50 thin clients across different departments. These clients are used by students (in a school) or employees (in an office environment) to access centralized applications, manage files, and use web-based services. Additionally, the vSpace Pro software was updated to the latest version during the upgrade.

You need to test the system to ensure that the hardware and software upgrades provide improved performance and can handle the load of multiple users simultaneously.

2: Referring to the key reading 3.3.4, perform the task described above.

3: Apply safety measures

4: Test Ncomputing system upgrade following given instructions.

5: Present your findings to the whole class and ask for clarification where is needed



Key readings 3.3.3. Testing Ncomputing upgrade

3. Introduction

Testing your **NComputing server upgrade** (whether it's a hardware upgrade like RAM, CPU, hard disk, or a software update like vSpace Pro) is crucial to ensure everything works smoothly after the changes. Here's a step-by-step guide to test and validate the server and ensure all users and services are running optimally after the upgrade. **Upgrading CPU**

4. Steps to Test the NComputing Server Upgrade

Step 1: Check Hardware Status

While checking hardware status, consider these points:

i. **For RAM:**

- Boot up the server and check if the system recognizes the new RAM.
- On Windows, use Task Manager or System Information (type msinfo32 in the Run box) to see the total amount of RAM installed.

ii. **For CPU:**

On Windows, use Task Manager > Performance tab to check if the new CPU is detected.

iii. **Verify Hard Disk:**

Check the available disk space on the server to ensure that the new hard disk is recognized.

- On Windows, go to This PC and check the available drives and total storage.
- If you've installed an SSD, use benchmarking tools like CrystalDiskMark (Windows).

Step 2: Check vSpace Pro or VERDE VDI

i. Check vSpace Server Status

While checking vSpace status, perform the activities below:

- Log in to the vSpace Console and ensure that the server is functioning properly.
- Verify that all thin clients are connected and showing up in the device list.
- Confirm that user sessions can be initiated without issues, and that users can log in and access their desktops.

ii. Test Licensing and Activation

If you had to reinstall or reconfigure vSpace, verify that your NComputing licenses are still active. This can be done through the vSpace Console:

Ensure that no users encounter licensing errors when trying to log into their sessions.

Step 3: Test Thin Clients (L300, L350, RX300, etc.)

i. Check Client Connectivity

- Power on several NComputing thin clients (e.g., L300, L350, RX300, etc.) and confirm that they can successfully connect to the upgraded server.
- Ensure that each client logs in without errors and that desktop environments load as expected.

ii. Test Performance Under Load

- Have multiple users log in to their thin clients simultaneously to test the server under load.
- Open resource-intensive applications on the thin clients, such as web browsers, productivity suites (Microsoft Office, LibreOffice), or video playback, to monitor how well the server handles the workload.
- Monitor CPU, RAM, and disk usage on the server while users are logged in to ensure that the new hardware upgrades are effectively improving performance.

Step 4: Test System Stability

i. **Run Stress Tests:**

Use stress-testing tools to simulate a high load on the server and check for

any signs of instability.

- For CPU stress testing, use tools like Prime95 (Windows).
- For RAM stress testing, you can use MemTest86 (Windows).
- Monitor the server's performance and ensure no overheating or throttling occurs during the test.

ii. Monitor for Crashes or Errors

- During testing, observe whether any system crashes, freezing, or unexpected reboots occur. These can indicate potential compatibility issues with the new hardware or software.

Step 5: Test User Applications

i. Open User-Specific Applications

- Launch common applications that your users use daily (e.g., Microsoft Office, web browsers, proprietary software).
- Test if these applications work smoothly without lag or crashes when launched from the thin client.

ii. Test Multimedia Performance

- If users rely on multimedia (e.g., video playback, audio streaming, video conferencing), test video and audio playback quality.
- Verify that videos play without buffering or stuttering and that audio is clear and in sync.

Step 6: Network and Connectivity Testing

i. Check Network Performance

- Ensure that network connectivity between the thin clients and the server is stable.
- Test the network latency and ensure there are no significant delays in response time during client-server interactions.

ii. Monitor for Latency Issues

- Use tools like ping or traceroute to check for latency between the server and thin clients.
- High latency can affect user experience, especially when running applications that require real-time responses.

Step 7: Monitor Logs and Errors

i. Check Event Logs

- On Windows, use the Event Viewer to monitor for any critical system errors, warnings, or informational messages related to the new hardware or vSpace server.
- On Linux, check log files under /var/log/ to identify any system errors or misconfigurations.

ii. Check vSpace Logs

vSpace provides log files that track system and user events. Review these logs to ensure that there are no errors related to user sessions, device connectivity, or licensing.

Step 8: User Feedback

i. Test With End Users

- After all technical testing, gather feedback from users who regularly use the thin clients.
- Ask them to report any performance improvements or new issues they notice after the server upgrade.

ii. Adjust Configurations as Needed

- Based on user feedback, you might need to tweak configurations (e.g., adjust resource allocation, fine-tune performance settings) to improve user experience.

Step 9: Test Backup and Recovery

i. Test Backup Procedures

Ensure that your server backup systems are still functioning after the upgrade. Run a manual backup and verify that the backup process completes successfully.

ii. Test Data Recovery

Test restoring a small set of data or a virtual machine to confirm that the recovery process works as expected in case of future system failures.

Step 10: Document the Changes

i. Update Documentation

- Record the server's updated hardware specifications and any changes made

during the upgrade process.

- Include details such as new RAM, hard disk sizes, CPU, or any changes in vSpace or VERDE VDI configurations.

ii. Prepare a Maintenance Plan

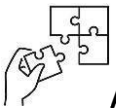
Plan regular system checks, backups, and updates to ensure the server continues performing optimally after the upgrade.



Points to Remember

- Steps to Test the NComputing Server Upgrade

Step 1: Check Hardware Status
Step 2: Check vSpace Pro or VERDE VDI
Step 3: Test Thin Clients (L300, L350, RX300, etc.)
Step 4: Test System Stability
Step 5: Test User Applications
Step 6: Network and Connectivity Testing
Step 7: Monitor Logs and Errors
Step 8: User Feedback
Step 9: Test Backup and Recovery
Step 10: Document the Changes



Application of learning 3.3.

You are an IT administrator in charge of managing an NComputing setup of XY enterprise. The malfunctional are arising in Ncomputing system due to non-update system, you are asked to update the system to fix those problems. And as a part of the post-upgrade testing process, you need to ensure that both the hardware and software improvements are functioning correctly.



Learning outcome 3 end assessment

Written assessment

1. **Match the Upgrading Ncomputing hardware parameters in Column A with their corresponding descriptions in Column B :**

Answers	Hardware parameters	Description
---------	1. CPU (Central Processing Unit)	a) Devices used by individual users to interact with the virtual desktop provided by the central server.
---------	2. RAM (Random Access Memory)	b) Ensures the system doesn't overheat by dissipating the excess heat generated by the hardware components.
--------	3. Storage (HDD/SSD)	c) Controls and executes instructions for all connected thin clients and manages the overall performance of virtual sessions.
--------	4. Network Bandwidth	d) A component that provides the necessary voltage and power to run all hardware parts, especially during high user loads.
----------	5. Graphics Processing Unit (GPU)	e) Increases data transfer speeds between the central server and thin clients, especially for multimedia-rich applications.
---------	6. Peripherals (Keyboard, Mouse, Monitors)	f) A component critical for multitasking, ensuring smooth performance when several users are accessing the system at once.
----------	7. Power Supply Unit (PSU)	g) Improves system startup, program loading times, and overall data access speed, especially when replacing older mechanical drives.
----------	8. Cooling System	h) Required for intensive graphic rendering tasks, particularly when users run media-heavy applications in virtual environments.
----------	9. Thin Client Devices	i) Essential upgrades to the system software that help optimize performance and improve compatibility with newer devices.

----------	10. Firmware Upgrade	j) Devices connected to the central server that are essential for interacting with the virtual desktops and applications

2. Circle the best answer from the given choices at each question number:

I. What is the first step in troubleshooting an NComputing system issue?

a) Restart all thin clients
b) Identify and define the problem
c) Replace hardware components
d) Reinstall the operating system

II. If multiple users are experiencing slow performance on their NComputing sessions, which component is most likely the bottleneck?

a) GPU
b) RAM
c) Power Supply Unit (PSU)
d) Cooling System

iii. What is the most common cause of thin clients not connecting to the host server in an NComputing system?

a) Power supply failure
b) Network connectivity issues
c) Insufficient storage
d) Faulty keyboard or mouse

iv. Which tool would be most useful when troubleshooting network issues in an NComputing environment?

a) Task Manager
b) Ping command
c) Disk Cleanup
d) BIOS settings

v. What should you do if a single thin client is not working, but others are functioning normally?

a) Replace the server hardware
b) Check the network cable and connection for that thin client
c) Reboot the entire NComputing system
d) Perform a firmware update on the server

vi. If a user is reporting display issues, such as a blank screen, on their thin client, what is a potential solution?

a) Restart the server
b) Check the connection between the thin client and the monitor
c) Reinstall the NComputing software
d) Increase the system RAM

vii. **When a thin client repeatedly crashes during usage, which of the following should you check first?**
   a) The server's available storage space
   b) The thin client's power supply
   c) The server's CPU usage
   d) The thin client's firmware version

viii. **What should be checked if users are experiencing intermittent disconnections from the NComputing server?**
   a) Server hard drive status
   b) Network infrastructure (cables, switches, routers)
   c) Monitor resolution settings
   d) User login credentials

ix. **If the server is unresponsive and users cannot connect to their sessions, which of the following is the most appropriate initial step?**
   a) Replace the hard drive
   b) Reboot the server
   c) Check the power supply of the thin clients
   d) Perform a factory reset on the server

x. **If multiple users report issues with peripheral devices (e.g., printers, keyboards), which troubleshooting step should you take?**
   a) Reinstall the operating system on the server
   b) Check the server's USB and peripheral management settings
   c) Reset all user profiles
   d) Upgrade the server's CPU

xi. **What is a common sign that a server's CPU is overloaded in an NComputing system?**
   a) Thin clients fail to boot up
   b) The server automatically restarts frequently
   c) User sessions are slow or unresponsive
   d) Peripheral devices stop working

xii. **What is the recommended action if an NComputing system is running out of storage space, affecting performance?**
   a) Add more RAM to the system
   b) Clear temporary files and unnecessary data
   c) Increase the network bandwidth
   d) Install more cooling fans

xiii. **If users are unable to log in to their sessions after a server update, what is a likely cause?**
   a) Server hardware failure
   b) Corrupted user profiles

c) Misconfigured network settings
d) Incompatible firmware or software version

xiv. What should be done if a firmware update on the NComputing server fails?

a) Reboot the server and attempt the update again
b) Restore the server to factory settings
c) Replace the server's CPU
d) Update the BIOS of all thin clients

xv. If user sessions are consistently freezing, which resource is most likely overutilized?

a) Network bandwidth
b) RAM
c) Power Supply Unit (PSU)
d) Display settings

Practical assessment

BC TSS is a secondary school located in the East Province, KIREHE District. Currently it has two computer labs. Located in two different blocks where lab1 is in Block1 and Lab2 is in Block 2. Where all Students need to access computer Lab in order to perform daily activities. Due to the rising number of students, the school is confronted with numerous challenges including the necessity for five students to share a single computer, exorbitant costs of computers in the market, budget constraints, and the high expenses associated with maintaining computers. Consequently, the school has opted to implement Zero client technology as a means to mitigate costs and solve these challenges effectively.

As Network Infrastructure Engineer you are requested to perform the following tasks:

1. Prepare environment for Ncomputing system
2. Designing the topology
3. Estimate the total cost
4. Estimate the total cost
5. Install and configure Ncomputing devices
6. Maintain Ncomputing system (upgrade and troubleshoot)
7. Generate report

END



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