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Title of the Report:	IT Infrastructure for NextGen Tech Works
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1 Introduction

1.1 Company

NextGen Techworks is a mid-sized company focused on cloud computing, data science, and artificial intelligence. It provides infrastructure and analytics solutions to improve performance and support data-driven decisions. With the increasing adoption of hybrid environments for cost efficiency, scalability, and remote collaboration, NextGen needs a secure IT foundation to support high-performance computing and data workflows. This project explores the planning and implementation of scalable and secure infrastructure, with an emphasis on systems deployment, data protection, and operational efficiency.

The report documents twelve weeks of guided development, combining academic theory with practical implementation. Each week addresses a core area of infrastructure—hardware, systems, networking, security, mobile integration, and cloud computing:

- ✓ **Two administrative workstations** for general office operations.
- ✓ **Two high-performance workstations** for data analysis and processing.
- ✓ **One dedicated server** for internal storage and backups.

Includes diagrams, cost tables and a Gantt chart to support decisions aligned with industry standards. The goal is to design a robust IT environment tailored to NextGen's operational and strategic growth needs.

2 Objective

2.1 Project Goals

This project aims to build a secure, scalable and energy-efficient infrastructure aligned with NextGen objectives. Outcomes include applying IT theory to practice, strengthening decision-making and acquiring professional skills in implementation, documentation and systems design.

3 Methodology

In This PLR adopted a structured, project-based methodology to develop a scalable IT infrastructure for NextGen Techworks. Weekly academic content was aligned to real business needs, integrating hands-on activities with guided learning and independent research.

Key concepts from the lessons were mapped to practical applications, including systems design, security strategies, and cloud implementation. Visual tools such as cost tables, architecture diagrams, and a Gantt chart assisted in validating tasks and tracking progress.

Data sources included academic texts, technical documentation, vendor platforms (e.g., Microsoft, Google, Newegg), and peer-reviewed articles. This data informed hardware choices, operating system deployment, and cybersecurity configurations.

This methodology fostered analytical thinking, documentation skills, and informed decision-making, with a focus on performance, cost efficiency, and long-term growth.

Key reference materials were consolidated by subject area to ensure consistency and prevent citation repetition, as illustrated below.

Reference Table by Technology	
Technology Area	**Source**
CPUs/GPUs	PCPartPicker, PassMark
Power Supply	Corsair, 80Plus.org
SSDs & Storage	Seagate, Western Digital
Peripherals	Logitech (webcams), Samsung (monitors)
Network (LAN)	Cisco, IEEE 802.3
DHCP/DNS	Microsoft Docs (DHCP, DNS Server Roles)
Project Management	Trello Guide, Microsoft Project
Patch Management	Microsoft Docs (WSUS)
MDM	Microsoft Intune, Apple Business Manager, Google MDM
Cloud Services	Microsoft Azure Docs, Google Workspace Admin Help
Cloud Security	Cloud Security Alliance (CSA)
Virtualization	Azure Monitor, Azure Backup, VMware

Table 1: Reference Sources by Technology Area

4 Weekly Task Summaries

4.1 Week 1: PC Components

This week introduced the foundational elements of computer systems and how each component: CPU, RAM, storage, and I/O devices, contributes to overall performance (Stallings 2020).

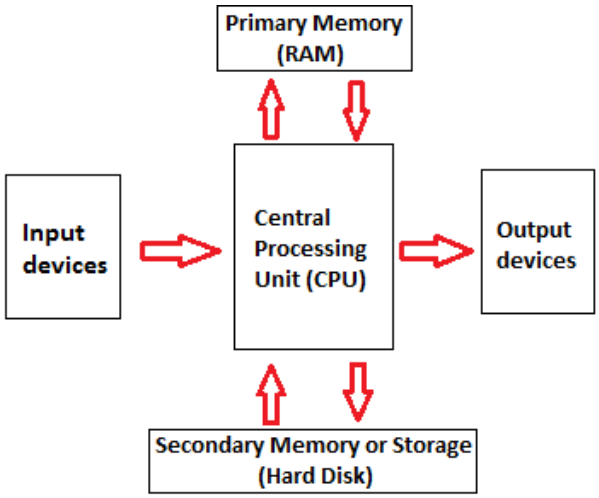

Figure 1: Main Computer Components (tpointtech.com/ 2025)

4.1.1 Recommendations for NextGen Techworks

Based on operational needs, it is recommended that administrative PCs be equipped with mid-range CPUs and integrated graphics, while data analysis workstations use dedicated GPUs to accelerate AI processing.

Component	Admin Workstations	Data Workstations	Backup Server	Approximate Cost (GBP)
CPU	Intel Core i5-12500T (x2)	Intel Core i7-13700K (x2)	Intel Xeon E-2336	£400 / £800 / £500
Motherboard	ASUS Prime H610M-K (x2)	ASUS ROG Strix Z790-E (x2)	Supermicro X12STH-LN4F	£200 / £700 / £250
RAM	16GB DDR4 3200MHz (x2)	32GB DDR5 6000MHz (x2)	16GB ECC DDR4	£160 / £360 / £150
GPU	Integrated Graphics (x2)	NVIDIA RTX 4060 8GB (x2)	Integrated Graphics	£0 / £600 / £0
Total Estimated Cost:				**£4,120**

Table 2: Workstation & Server Hardware Selection

4.1.2 Justification for Infrastructure Selection

The GPU's parallel architecture significantly outperforms CPUs in machine learning tasks. Initially, uniform hardware was considered for all systems, but this would waste resources on basic tasks and underperform on analytical workloads. The final configuration ensures cost-efficiency without sacrificing capability, aligning with NextGen's strategic focus on data analytics.

Component	Admin	Data Analysis	Server
CPU	Balanced performance for document processing and communications.	High-performance CPU for large dataset processing.	Multi-core CPU supports multiple user requests and services.
GPU	Integrated GPU is sufficient; no need for discrete graphics.	Dedicated GPU accelerates data visualization and AI models.	No GPU needed for headless, backend operations.
RAM	Moderate capacity supports multitasking with office tools.	Higher RAM capacity enables concurrent data operations.	Maximized RAM for handling virtualization and high throughput.
Storage	SSD enables fast boot and file access, sufficient for admin use.	Larger SSD for storing and accessing analytical data sets quickly.	High-capacity SSDs and RAID for performance and redundancy.
Cooling System	Standard fan ensures sufficient cooling for low to moderate loads.	Liquid cooling to maintain performance under heavy analytical tasks.	Dual-fan setup for 24/7 operation and thermal stability.

Table 3: Hardware Differentiation & Function

As illustrated in the figure 2, GPUs significantly outperform CPUs in areas such as parallel processing, execution units, and compute density, all of which are critical for tasks involving large-scale data analysis and AI processing.

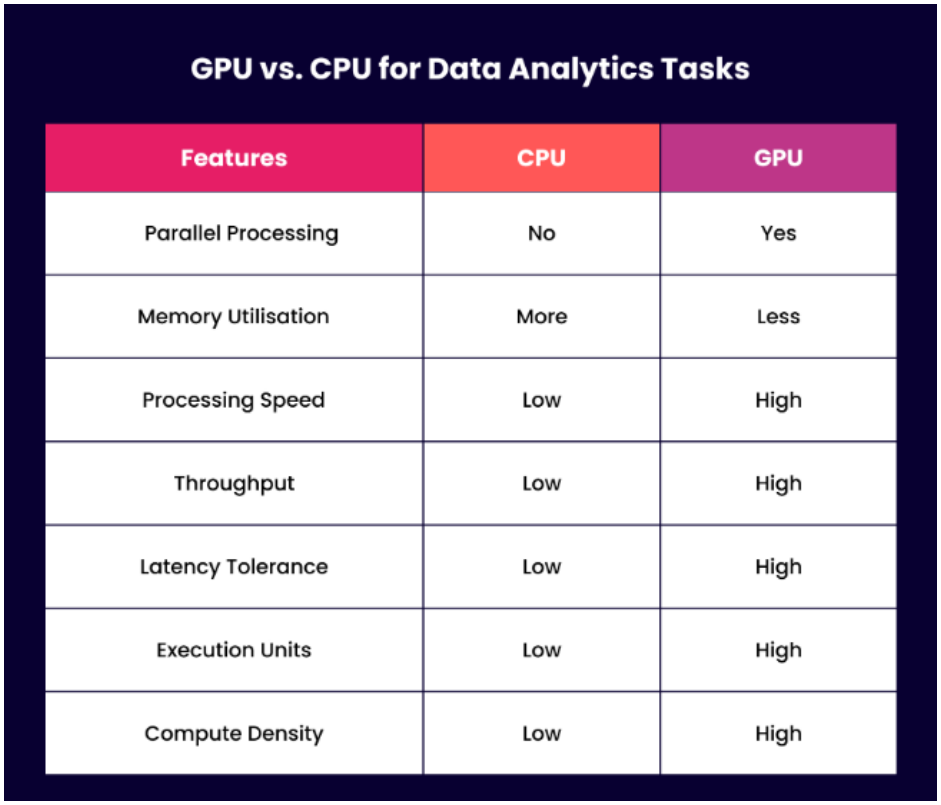

Figure 2: Comparative of CPU vs. GPU (acecloud.ai 2025)

4.1.3 Conclusion

Week 1 introduced the essential hardware components of a computing system. This knowledge informed the design of NextGen Techworks' infrastructure, aligning hardware choices with the specific needs. The selected components provide attributes to support a data-driven, cloud-focused operation.

4.2 Week 2: System Unit Components

4.2.1 Learned Content

This week explored how the CPU, RAM, motherboard, and supporting systems like power supply and cooling work together to ensure stable system performance (Stallings 2016).

80 Plus test type	115V internal non-redundant				230V EU internal non-redundant			
Percentage of rated load	10%	20%	50%	100%	10%	20%	50%	100%
80 Plus		80%	80%	80%		82%	85%	82%
80 Plus Bronze		82%	85%	82%		85%	88%	85%
80 Plus Silver		85%	88%	85%		87%	90%	87%
80 Plus Gold		87%	90%	87%		90%	92%	89%
80 Plus Platinum		90%	92%	89%		92%	94%	90%
80 Plus Titanium	90%	92%	94%	90%	90%	94%	96%	94%

Figure 3: Efficiency Ratings of 80 Plus Certified Power Supplies (appuals.com)

4.2.2 Recommendations for NextGen Techworks

The components adopted for NextGen Techworks were efficient power supplies and custom cooling, liquid cooling for AI-intensive workstations and dual-fan systems for servers, to ensure stability and performance.

Component	System Type	Recommended Model	Price per Unit (GBP)	Total Cost (GBP)
Power Supply	Administrative Workstations (x2)	500W 80+ Bronze PSU	70	140
	Data Workstations (x2)	750W 80+ Gold PSU	120	240
	Backup Server	750W 80+ Platinum PSU	160	160
Cooling System	Administrative Workstations (x2)	Air-cooled fan system	50	100
	Data Workstations (x2)	Corsair iCUE H150i Liquid Cooler	220	440
	Backup Server	Dual-fan airflow cooling system	80	80
Total Estimated Cost:				**£1,160**

Table 4: Power Supply & Cooling System Selection

4.2.3 Justification for Infrastructure Selection

Dual-fan cooling is more energy-efficient and cost-effective for lower-demand systems. The use of 80 Plus certified PSUs also supports long-term energy savings and aligns with sustainability goals.

Power Supply and Cooling Selection		
	Power Supply	**Cooling System**
Administrative PC	A 500W Bronze-rated PSU is suitable for basic office tasks, ensuring energy efficiency and stablity.	Standard air cooling suffices for light workloads, providing reliable temperature control.
Data Workstation	A 750W Gold-rated PSU supports higher performance and future scalability for intensive AI and analytics workloads.	A Corsair iCUE H150i Liquid Cooler is used to manage the heat generated by demanding tasks.
Backup Server	A 750W Platinum-rated PSU offers maximum efficiency and continuous power for 24/7 operations.	A dual-fan airflow system ensures optimal cooling to maintain uptime and data protection.

Table 5: Supply & Colling Justification

Figure 4: Liquid Colling vs Air Cooling (wepc.com 2025)

Criteria	Liquid Cooling	Air Cooling (Fan)
Cooling Efficiency	High. Ideal for high-performance systems and intensive processing tasks	Moderate. Adequate for low to mid-range workloads
Noise Level	Quieter operation, especially under load	Generally higher due to fan speed
Installation Complexity	More complex installation; requires more technical expertise	Easy to install and maintain
Cost	Higher cost due to additional components and complexity	Lower initial investment
Maintenance	Requires periodic checks for leaks, coolant levels, and pump functionality	Minimal maintenance required
Reliability	Effective but with more components that can potentially fail (e.g., pump)	High reliability, fewer points of failure
Use Case Recommendation	Recommended for data workstations or servers with heavy computational workloads	Suitable for administrative or low-load workstations

Table 6: Comparision Liquid & Fan Cooling

4.2.4 Conclusion

Week 2 emphasized infrastructure reliability through thermal and power management. Component choices were refined through analysis and aligned with workload intensity, supporting both performance and sustainability in NextGen's operations.

4.3 Week 3: Storage Devices and Power Supplies.

4.3.1 Learned Content

This week focused on data storage technologies, RAID configurations, and power continuity systems, critical for performance and operational resilience (Stallings 2016; Habash 2023). The table below summarizes the characteristics of key storage types:

Storage Type	Performance	Capacity	Power Efficiency	Ideal Use
HDD	Moderate (slower read/write)	High	Low – mechanical spinning disks	Archival storage, bulk data
SSD	High (fast, no moving parts)	Medium	High – energy efficient	Mission-critical operations, OS and software
Hybrid (SSHD)	Balanced (SSD cache + HDD storage)	High	Moderate – optimized data caching	Budget-friendly performance with storage flexibility

Table 7: Storage Technologies and Energy Efficiency Overview

RAID (Redundant Array of Independent Disks) improves storage reliability and speed by distributing data across multiple disks (Stallings 2016).

RAID Level	Key Application	Advantages (Pros)	Disadvantages (Cons)
RAID 0	High-speed data access (e.g., video editing)	Maximum performance	✗ No redundancy – single disk failure = total data loss
		Full use of all storage space	
RAID 1	Critical data protection (e.g., servers, finance)	Full data mirroring	Storage efficiency cut in half
		High fault tolerance	Higher cost (due to duplication)
RAID 2	Rarely used today (theoretical/academic)	Uses Hamming code for error correction	✗ Complex and inefficient for modern systems
RAID 3	High-speed sequential access (e.g., video servers)	High throughput for large files	✗ Single parity disk can become a bottleneck
RAID 4	Data warehousing (block-level striping + parity)	Good read performance	✗ Write bottleneck at the parity disk
		Can rebuild from parity disk	
RAID 5	Balanced systems (e.g., web servers, databases)	Good balance of speed and redundancy	✗ Rebuild time can be long
		Efficient storage use	⚠ Performance hit during failure
RAID 6	Critical systems needing extra fault tolerance	Can survive 2 disk failures	✗ Slower writes
		Still space-efficient	Complex rebuild process
RAID 10	High-performance + redundancy (e.g., databases)	Fast performance of RAID 0 + safety of RAID 1	✗ Requires 4+ drives
		Quick recovery	50% storage efficiency

Table 8: Comparison of RAID Levels (0 to 10)

4.3.2 Recommendations for NextGen Techworks

To ensure data reliability, performance, and security, the following recommendations are proposed for the NextGen Techworks IT infrastructure. These solutions were chosen to facilitate access to real-time data and ensure operational continuity, especially for the data analytics team.

Component	System Type	Recommended Model	Price per Unit (GBP)	Total Cost (GBP)
Primary Storage	Admin Workstations (x2)	Samsung 980 Pro 1TB SSD	£120	£240
	Data Workstations (x2)	Samsung 990 Pro 2TB SSD	£180	£360
	Backup Server	Seagate IronWolf Pro 8TB HDD (x4 - RAID 10)	£200	£800
RAID Controller	Backup Server	LSI MegaRAID 9361-8i	£350	£350
Data Security	Company-wide	AES-256 Encryption Module	£100	£100
	Company-wide	Acronis True Image Backup Software	£80	£80
Power Management	Company-wide	APC Smart-UPS 1500VA	£400	£400
Total Estimated Cost				**£2,330**

Table 9: Storage, Security, and Power Management Selection

4.3.3 Justification for Infrastructure Selection

Storage, security, and power components selected for NextGen Techworks were based on performance, reliability, and alignment with business continuity goals in a cloud-based, data-driven environment.

Component	Specification	Purpose
Admin Workstation Storage	Samsung 980 SSD, 500 GB	Fast boot & admin task speed
Data Workstation Storage	Samsung 990 Pro SSD, 1 TB	High-performance data processing
Backup Server Storage	4x Seagate IronWolf Pro 4 TB HDD (RAID 10)	Redundancy & data integrity
Data Protection	AES-256 Encryption	Secure sensitive data
Backup Solution	Acronis True Image	Automated backups & recovery
Power Management	APC Smart-UPS 1500VA	Uninterrupted server uptime

Table 10: Justification of Storage, Security, and Power Components

Bellow the relationship between the Power Supply Units (PSUs) installed in each system and the central Uninterruptible Power Supply (UPS) unit. Ensuring clean energy distribution and system continuity during power disturbances.

Component	Function	Role in Power Management	Interaction
PSU (Power Supply Unit)	Converts AC (from wall or UPS) into DC for internal components	Ensures consistent and efficient power delivery to the motherboard, CPU, GPU, and storage devices	Relies on the UPS to receive uninterrupted and stable AC power
UPS (Uninterruptible Power Supply)	Provides temporary power during outages and regulates voltage	Protects systems from power loss, surges, and voltage drops	Supplies clean AC power to PSUs, allowing continuous operation or safe shutdown

Table 11: PSU and UPS Interaction in Power Management

4.3.4 Conclusion

Week 3 reinforced how tailored storage and power choices impact security, speed, and uptime. These selections ensure reliability for cloud-based analytics and minimize operational risk in a data-dependent environment.

4.4 Week 4: Peripherals and External Devices

4.4.1 Learned Content

This week examined how peripherals: keyboards, monitors, external drives, webcams, and printers, enhance productivity, communication, and user experience (Stallings 2016).

Connection Type	Examples	Function	Key Features
USB (2.0, 3.0, USB-C)	Pen drives, external hard drives,	Transfers data and power between	Fast data transfer Wired connection Widely compatible
HDMI & DisplayPort	Monitors, projectors, graphic tablets	Sends video (and sometimes	High-resolution video Audio support (HDMI) Wired, stable signal
Bluetooth & Wi-Fi	Wireless keyboards, mice, printers	Connects devices wirelessly for	No cables Ideal for mobility May affect battery life on devices

Table 12: Peripheral Connection Types

4.4.2 Recommendations for NextGen Techworks

HD webcams and noise-cancelling headsets were chosen to improve remote collaboration. External SSDs and dual-monitor setups were assigned to data analysts for multitasking and fast local storage.

Component	System Type	Recommended Model	Price per Unit (GBP)	Total Cost (GBP)
Keyboard & Mouse	All Workstations (x4)	Logitech MX Keys & MX Master 3S (Ergonomic & Wireless)	£180	£720
Monitors	Admin Workstations (x2)	Dell UltraSharp U2723QE (27” 4K, USB-C)	£400	£800
	Data Workstations (x2)	ASUS ProArt PA32UCX (32” 4K HDR)	£900	£1,800
External Storage	Admin Workstations (x2)	Samsung T7 SSD (1TB) – Portable	£120	£240
	Data Workstations (x2)	WD Black P50 SSD (2TB) – High-Speed	£250	£500
	Backup Server	Seagate IronWolf Pro HDD (8TB)	£260	£260
Printer & Scanner	Admin	HP LaserJet Pro MFP M428fdw	£400	£400
Docking Stations	All Workstations (x4)	CalDigit TS4 (USB-C & Thunderbolt 4)	£300	£1,200
Headsets	All Workstations (x4)	Jabra Evolve2 65 (Wireless & Noise Cancelling)	£180	£720
Webcams	All Workstations (x4)	Logitech Brio 4K Ultra HD Webcam	£180	£720
Biometric Security Devices	Backup Server	Kensington VeriMark Fingerprint Reader	£70	£70
Tablets for Presentations	Admin	Apple iPad Pro 12.9” + Magic Keyboard	£1,300	£1,300
Total Estimated Cost				**£8,730**

Table 13: Peripheral & External Device Selection

4.4.3 Justification for Infrastructure Selection

Peripheral selection was initially generic but adjusted after analyzing workflow requirements. Analysts required faster transfer speeds for large datasets, justifying external SSDs. Connectivity standards such as USB-C and HDMI were prioritized for compatibility, reducing setup friction and future-proofing the infrastructure.

Peripheral Device		Purpose	Strategic Benefit Area	Benefit to NextGen Techworks
	Logitech MX Keys & MX Master 3S	Ergonomic input devices for daily operations	Productivity and Workflow Optimization	Increases comfort and reduces fatigue during long typing and navigation sessions
	Dell UltraSharp / ASUS ProArt Monitors	High-resolution output for visual tasks	Productivity and Workflow Optimization	Improves clarity and accuracy for data visualization and media work
	Samsung T7 / WD Black P50 SSDs	External high-speed storage	Data Storage & Security	Enables fast data transfer and backup of large files
	Seagate IronWolf Pro HDD (RAID 10)	Enterprise-level backup and redundancy	Data Storage & Security	Ensures data integrity and continuous storage availability
	CalDigit TS4 Docking Station	Unified connection hub (USB-C, Thunderbolt)	Seamless Connectivity	Simplifies connectivity and reduces desk clutter
	Apple iPad Pro 12.9”	Portable tool for presentation and collaboration	Seamless Connectivity	Enhances remote work and visual communication
	Jabra Evolve2 65 Headsets	Professional audio input/output	Enhanced Communication & Security	Enhances clarity in virtual meetings and reduces background noise
	Logitech Brio 4K Webcam	High-definition video conferencing	Enhanced Communication & Security	Delivers sharp video for remote client meetings and team communication
	Kensington VeriMark Fingerprint Reader	Biometric security for login authentication	Enhanced Communication & Security	Strengthens security with fast and reliable user access control

Table 14: Peripheral Purpose and Strategic Benefit

To ensure the seamless integration and optimal functionality of all peripheral devices, the following structured workflow is proposed for future implementation at NextGen Techworks.

Peripheral	Setup Instructions	Maintenance Task	Frequency
Monitor	Connect via HDMI to GPU; adjust resolution in display settings.	Clean screen with microfiber cloth	Weekly
Printer	Connect via USB or network; install drivers from manufacturer.	Check toner/ink, clean rollers	Monthly
External SSD	Plug via USB-C; format to NTFS; enable BitLocker encryption.	Check health using SMART tools	Quarterly
Webcam	Connect via USB; adjust resolution in video conferencing app.	Test resolution, update firmware if any	Biannually
Headset	Connect via Bluetooth; test mic input/output in audio settings.	Check battery, clean ear pads	Monthly

Table 15: Peripheral Setup and Maintenance

4.4.4 Conclusion

Week 4 highlighted how strategic peripheral integration improves productivity, user interaction, and system performance. Adopting high-efficiency devices and secure connectivity supports an infrastructure that is future-proofed for cloud operations and data analytics.

4.5 Week 5: Network Concepts

4.5.1 Learned Content

This week introduced foundational networking concepts, including topologies, protocols, and devices that enable secure and scalable communication (Forouzan 2012).

Comparative Analysis									
Network Type	**Definition**	**Coverage**	**Speed**	**Ownership**	**Example Technologies**	**Use Case**	**Real-World Example**	**Pros**	**Cons**
LAN	LOCAL AREA NETWORKING	Small (building or campus)	High	Private	Ethernet, Wi-Fi	Office, Home, Schools	University campus network (Harvard)	*High speed *Low Cost *Secure *Easy to manage	*Limited range *Requires expansion for growth
WAN	WIDE AREA NETWORKING	Large (country/ continent)	Medium to Low	Public/ Private	MPLS, VPN, Internet	Internet, Corporations	Global banking network (JPMorgan Chase)	*Enables global communication *Scalable	*Higher latency *Costly *Prone to congestion
MAN	METROPOLITAN AREA NETWORKING	Medium (city/ metropolitan)	High	Public/ Private	Fiber-optic Ethernet, WiMAX	City Wi-Fi, Large Organizations	NYC LinkNYC project	*High speed, *Connects multiple LANs *Reliable	*Costly to deploy *Requires government investment
PAN	PERSONAL AREA NETWORKING	Very Small (personal space)	Low	Private	Bluetooth, NFC, Zigbee	Wearable Tech, IoT Devices	Smart home network (Amazon Alexa)	*Convenient *Low cost *Ideal for personal use	*Limited range *Prone to interference *Security risk

Table 16: Comparison of Network Types

The image shows the main devices used to connect, manage and secure modern networks.

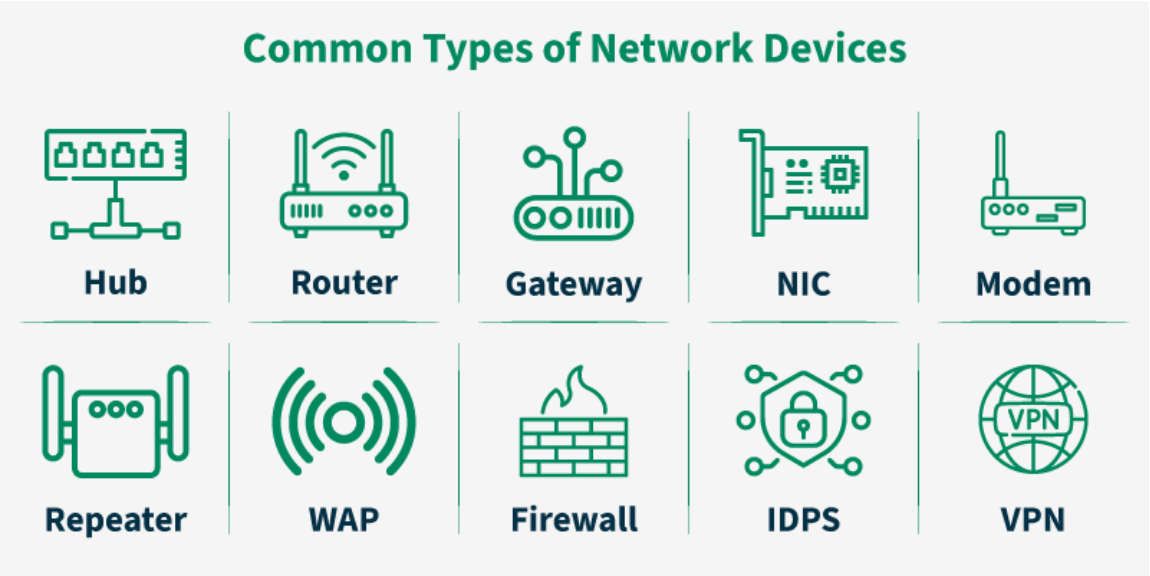

Figure 5: Common types of Network Devices (geeksforgeeks.org 2025)

Different topologies, such as star and mesh, affect fault tolerance, performance, and expansion flexibility in network environments.

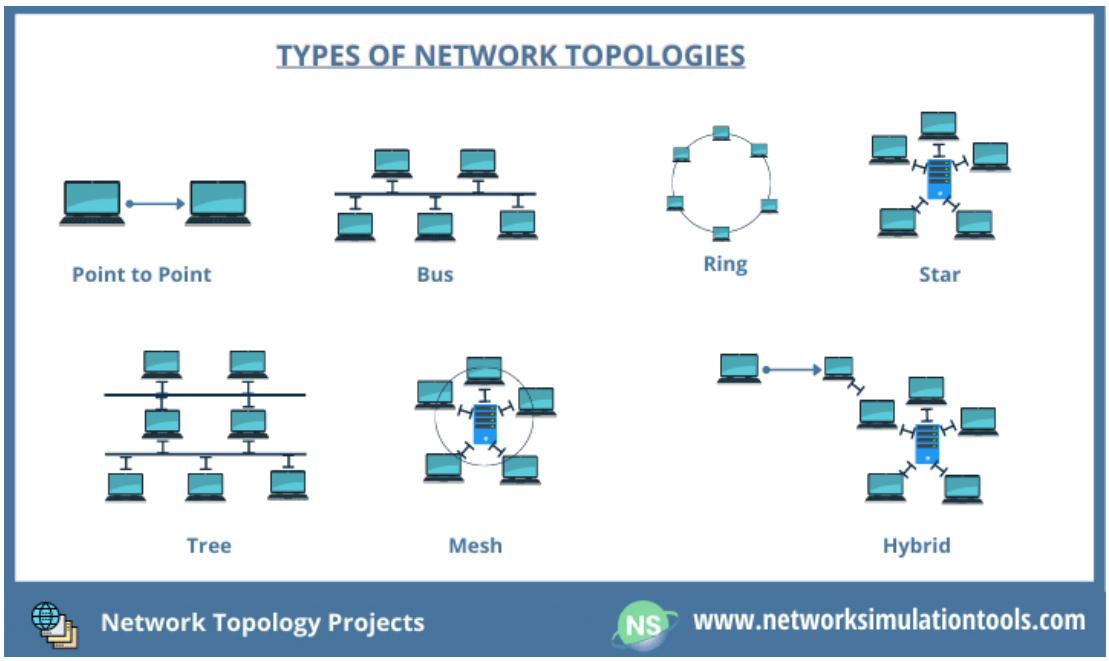

Figure 6: Network Topologies (networksimulationtools.com 2025)

Transmission protocols such as TCP/IP, Ethernet, and Wi-Fi are widely implemented in real-world networks. These protocols govern how data is formatted, addressed, transmitted, and received across different types of devices and platforms (Forouzan 2012).

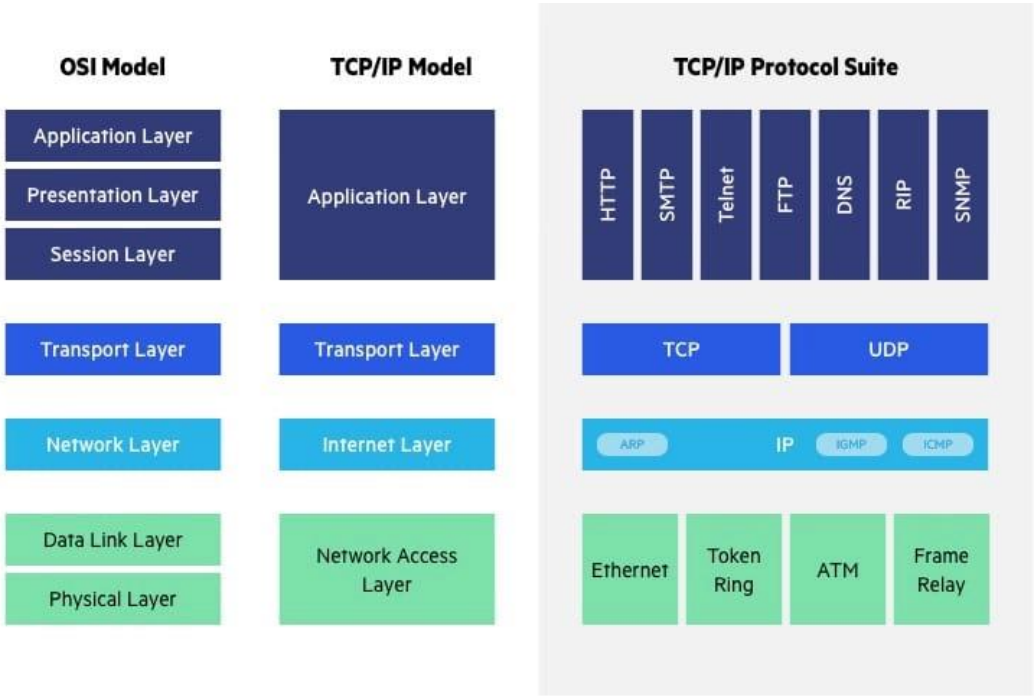

Figure 7: OSI vs. TCP/IP Models & Associated Protocols (imperva.com/learn 2025)

4.5.2 Recommendations for NextGen Techworks

To build a scalable, high-performance, and secure network, the following recommendations are proposed for NextGen Techworks.

Component	Recommended Model	Purpose	Cost (GBP)
Router	Cisco ISR 4331	Secure, high-speed routing for LAN and WAN connectivity	£900
Switch (Core)	Cisco Catalyst 9300	Manages internal network traffic efficiently	£1,200
Switch (Edge)	Netgear GS724TP	Provides connectivity for workstations and peripherals	£300
Wireless Access Points	Ubiquiti UniFi UAP-AC-PRO	Reliable Wi-Fi coverage	£250
Firewall	Fortinet FortiGate 60F	Ensures network security and traffic filtering	£500
Structured Cabling	Cat6 Ethernet Cables	High-speed wired network connectivity	£150
UPS (Power Backup)	APC Smart-UPS 1500VA	Prevents data loss during power outages	£600
Total Estimated Cost			**£3,900**

Table 17: Recommended Components for Networking Infrastructure

The diagram shows the star topology proposed by NextGen Techworks, detailing device interconnections and infrastructure layout for secure and scalable operations.

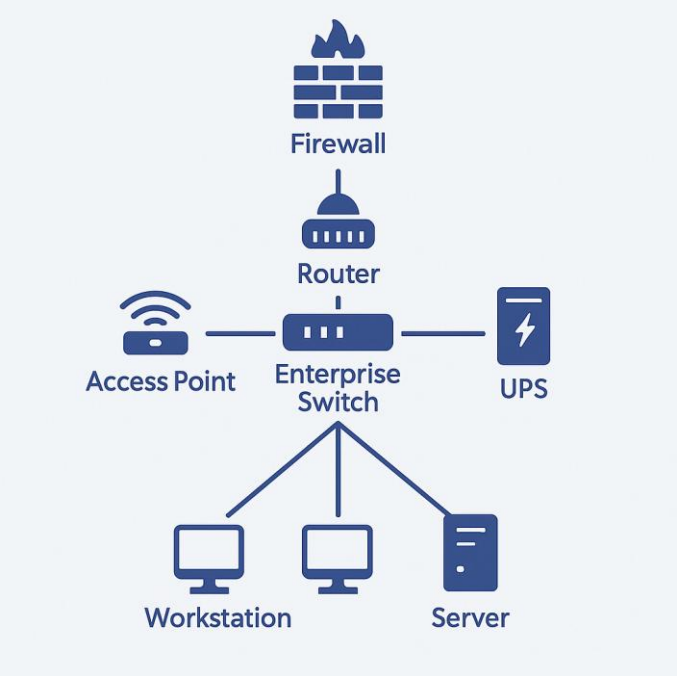

Figure 8: Network Topology Design for NextGen (created using AI tool 2025)

4.5.3 Justification for Infrastructure Selection

To support secure and efficient communication, NextGen Techworks deployed a LAN using star topology with enterprise-grade switches, firewall, access points, and UPS. This setup ensures performance, fault tolerance, and scalability. The table below summarizes the networking models and protocols used to support hybrid operations.

Concept	Description	Example Protocols/Technologies	Application in NextGen Techworks
OSI Model	A theoretical 7-layer framework that explains how data is transmitted across a network.	Not protocols, but layers: Physical, Data Link, Network, etc.	Used for planning and troubleshooting the network infrastructure in a structured way.
TCP/IP Protocol Suite	Real-world protocol suite used for communication across networks and the Internet.	TCP, IP, HTTP, DNS, FTP, SMTP	Powers internal and external communication, ensures reliable data transfer and web access.
Transmission Technologies	The physical or wireless methods of transmitting data.	Ethernet, Wi-Fi, Bluetooth	Enables high-speed wired connections (servers/workstations) and wireless access (laptops, peripherals).

Table 18: Network Protocols and Their Application

4.5.4 Conclusion

Week 5 reinforced the importance of thoughtful network design. Choosing scalable, structured topologies and devices ensures secure, low-latency communication aligned with NextGen's hybrid operations and data-driven services.

4.6 Week 6: Network Protocols and Services

4.6.1 Learned Content

This week focused on key network protocols—TCP/IP, DNS, and DHCP—and how they automate communication and support scalable network infrastructure (Forouzan 2016; Kurose & Ross 2021).

Protocol	Primary Function	Network Role
TCP/IP	Enables reliable data transmission	Transfers and routes data across networks
DNS	Resolves domain names to IP addresses	Simplifies user access to web and network resources
DHCP	Assigns IP addresses automatically	Manages and configures device connectivity

Table 19: Differences and Roles in the Network

The diagram below illustrates how TCP/IP, DNS, and DHCP work together to enable automated addressing, name resolution, and reliable data delivery within a network.

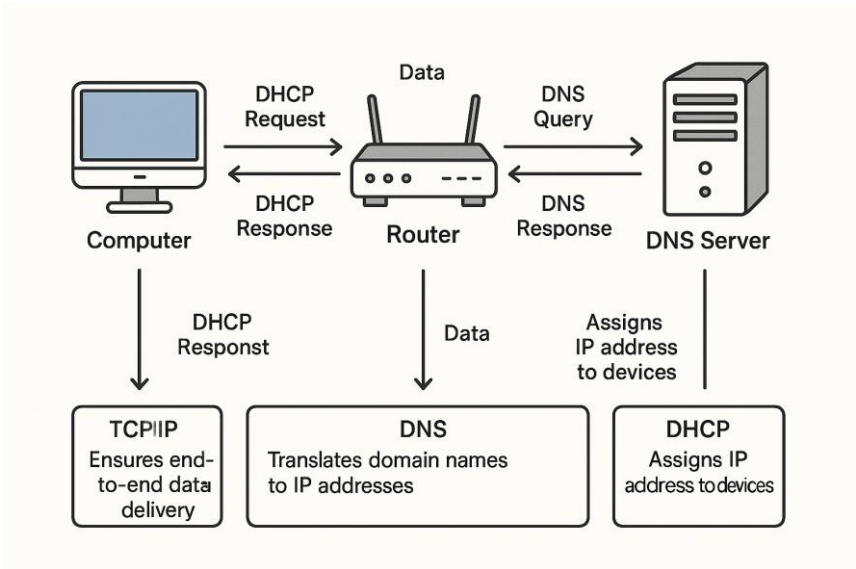

Figure 9: Network Protocol Interaction Diagram (created using AI tool 2025)

4.6.2 Recommendations for NextGen Techworks

Implement DHCP for automatic IP assignment, DNS for internal name resolution, and subnetting to separate departments by function.

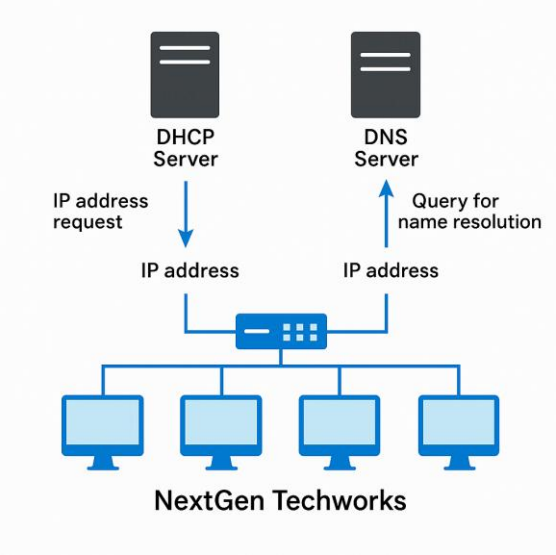

Figure 10: Real-World Visualization of IP Addresses Flow (created using AI tool 2025)

4.6.3 Justification for Infrastructure Selection

Applying the knowledge gained, static IP addressing was initially considered but proved impractical for a growing network. DHCP streamlines IP assignment, reducing configuration errors and installation time. Subnetting improves security by segmenting traffic between departments (e.g., analytics, administration, backup), while DNS simplifies access to internal resources, especially in hybrid work environments. These strategies support performance, scalability, and reduced administrative overhead.

Configuration Log Overview

A sample configuration log demonstrates how these services work in practice: DHCP dynamically assigns IPs, DNS handles resource resolution, and subnetting manages traffic separation. Together, they enable secure and efficient communication and reinforce the practical relevance of the concepts from Week 6.

4.6.4 Conclusion

Week 6 emphasized automation, scalability, and segmentation in network design. Implementing core protocols strategically enhances network efficiency, supports hybrid workflows, and prepares NextGen for future cloud integration.

4.7 Week 7: Project Management

4.7.1 Learned Content

This week introduced key project management principles and frameworks, including Agile, Waterfall, and the five phases of the project life cycle (PMI 2017; Patil 2024).

Figure 11: Overview of project life cycle (orangescrum.com 2025)

4.7.2 Recommendations for NextGen Techworks

A hybrid approach is recommended: Agile for iterative tasks (e.g. software updates) and Waterfall for structured phases (e.g. infrastructure deployment). Tools such as Trello, mind maps, and Gantt charts help with planning and coordination.

Tool	Suggested Plan	Monthly Cost (Per User)	Notes
Trello	Premium	£8.00	Advanced views, unlimited automations, ideal for Agile projects.
Lucidchart	Individual	£7.20	Unlimited diagrams, suitable for process mapping and planning.
Microsoft Project	Project Plan 1	£8.00	Core project management features, suitable for Gantt chart creation.
Microsoft Teams	Essentials	£3.20	Team communication and collaboration.
Google Drive (2TB)	Google One Plan	£8.00	Cloud storage for project files and backups.

Table 20: Monthly costs of project tools

Approximate total: £34.40 per user/month

4.7.3 Justification for Infrastructure Selection

Agile improves responsiveness, ideal for evolving needs and cloud integration, while Waterfall provides structure for fixed-scope tasks. Mind maps helped identify risks and define technical priorities.

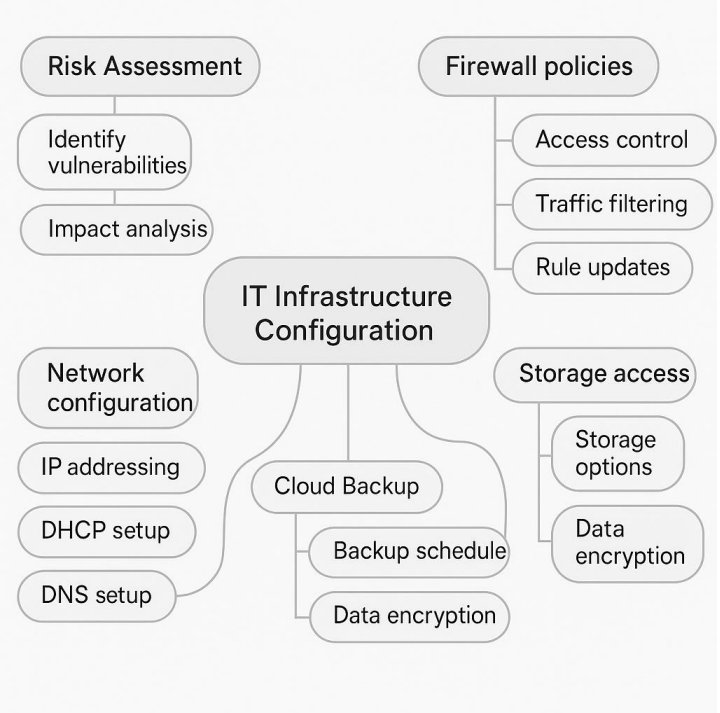

Figure 12: Minp Map IT Project (created using AI tool 2025)

Gantt charts created in Excel were used to schedule activities, monitor timelines, and track dependencies until final delivery on **September 3, 2025.**

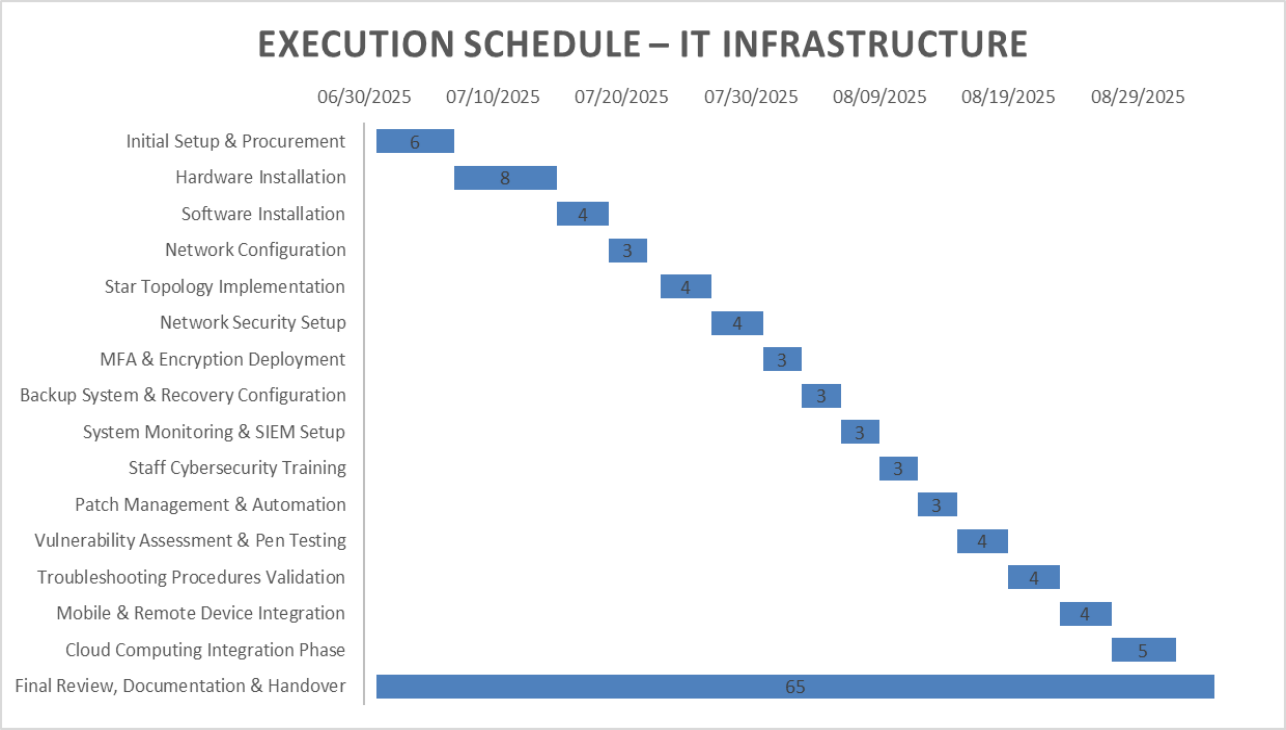

Figure 13: Gantt Chart - IT Infrastructure Project Execution

4.7.4 Conclusion

The importance of flexible and disciplined project planning was illustrated in Week 7. At NextGen, a hybrid methodology facilitates rapid and effective IT delivery by strengthening the connection between project management and corporate strategy.

4.8 Week 8 – Cybersecurity Concepts and Best Practices

4.8.1 Learned Content

Week 8 focused on cybersecurity principles such as the CIA Triad, threat mitigation, encryption, and layered defense strategies (Stallings 2017; Habash 2023).

4.8.2 Recommendations for NextGen Techworks

This matrix summarizes the key risks identified in NextGen's operating environment, along with their likelihood, impact, and prioritization. It guided the selection of mitigation strategies aligned with cybersecurity best practices.

Risk	Likelihood	Impact	Priority	Mitigation Measure
Employee error or negligence	High	Medium	High	Regular user training; enforce usage policies and secure login procedures.
Insider threat	Medium	High	High	Implement Role-Based Access Control (RBAC); enable logging and monitoring tools.
Lack of security awareness	High	High	Critical	Mandatory phishing simulations and awareness programs.
Cyber attacks (ransomware, DDoS)	Medium	High	High	Deploy FortiGate firewall; maintain updated antivirus; enable DDoS protection services.
Data breaches	Medium	High	High	Apply AES-256 encryption; restrict access via VPN and MFA.
Physical theft/damage	Low	Medium	Medium	Secure hardware physically; use device tracking and full-disk encryption.

Table 21: Risk Matrix and Mitigation Strategies

Implement multi-layered protection: FortiGate firewall, AES-256 and TLS encryption, VLAN segmentation, and multi-factor authentication. User training should reinforce threat awareness:

Figure 14: Cybersecurity Strategy Layers (created using AI tool 2025)

Below is an illustration of the suggested logical segmentation for the NextGen:

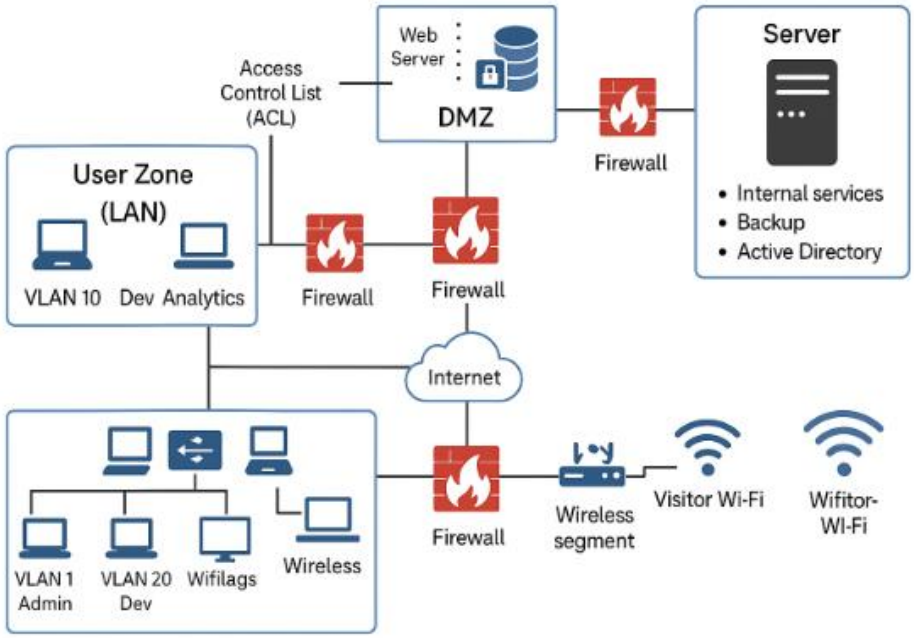

Figure 15: Network Segmentation Layout (created using AI tool 2025)

The table below shows the IT Security Costs:

Item	Quantity	Unit	Estimated Cost (GBP)	Total (GBP)	Notes
FortiGate 60F (NGFW Firewall)	1	Hardware	£520	£520	Perimeter protection, VPN, IDS/IPS
Acronis Cyber Protect Backup Suite	1	Annual license (5 devices)	£640	£640	Backup + ransomware protection
Microsoft Authenticator (MFA)	5	Free tool	£0	£0	Free MFA for Microsoft 365 accounts
Let's Encrypt TLS Certificates	-	Free service	£0	£0	Encrypts web/email traffic with TLS 1.3
Netgear Managed Switch (GS728TPP)	1	Hardware	£546	£546	VLAN segmentation and access control
OSSEC SIEM	1	Free tool	£0	£0	Centralised log monitoring & alerts
KnowBe4 Security Awareness Training	5	Annual license per user	£24	£120	Phishing simulations and user training
Nessus Professional	1	Annual license	£2,390	£2,390	Network-wide internal/external security scans
PDQ Deploy (Patch Management Tool)	1	Annual license (Enterprise)	£800	£800	Centralised update automation
Total				**£4.815**	

Table 22: IT Security Costs

4.8.3 Justification for Infrastructure Selection

Security is vital in NextGen Tech's data-driven environment. Basic tools prove inadequate, leading to a layered defense strategy. VLANs reduce lateral threats, Acronis enables rapid recovery, and user training addresses persistent risks of human error.

Tool	Primary Function	CIA Pillar Addressed
Fortinet FortiGate 60F	Perimeter protection, VPN, IPS	Confidentiality, Availability
Acronis Cyber Protect	Backup, anti-malware, disaster recovery	Integrity, Availability
Microsoft Authenticator	Multi-Factor Authentication	Confidentiality
Let's Encrypt (TLS Certificates)	Secure communications (TLS 1.3)	Confidentiality
Netgear GS728TPP Switch	VLAN segmentation, ACLs	Confidentiality, Availability
OSSEC	SIEM: log management and threat detection	Integrity, Availability
KnowBe4 Security Training	User awareness training against phishing	Confidentiality
Nessus Professional	Vulnerability scanning and reporting	Integrity, Confidentiality
PDQ Deploy	Automated patch management	Integrity

Table 23: Security Tools and CIA Triad Mapping

4.8.4 Conclusion

Week 8 emphasized proactive and structured cybersecurity. By combining technical tools with policy and training, NextGen builds a resilient defense framework aligned with compliance, business continuity, and long-term growth in digital services.

4.9 Week 9 – Troubleshooting Hardware and Software Issues

4.9.1 Learned Content

This week focused on structured troubleshooting methodologies to resolve system failures using a five-step model: identification, diagnosis, planning, resolution, and verification (Meyers 2022; CompTIA 2021).

4.9.2 Recommendations for NextGen Techworks

Recommended to standardize troubleshooting procedures using Windows tools (Event Viewer, Task Manager, Device Manager), network commands (ping, ipconfig) and a central knowledge base. Conduct regular training using platforms such as LinkedIn Learning.

Tool/Component	Type	Cost	Included in Windows	Use Case
Task Manager	Software	Free	Yes	Monitor CPU and memory usage
Event Viewer	Software	Free	Yes	Analyze system/application error logs
ipconfig / ping / tracert	Network Command	Free	Yes	Diagnose basic network issues
System Restore	Software	Free	Yes	Revert system to a previous state
Windows Defender	Security Software	Free	Yes	Antivirus and firewall protection
Device Manager	Software	Free	Yes	Detect hardware issues/conflicts
Windows Security Center	Security Interface	Free	Yes	Centralized security configuration
LinkedIn Learning	Training Platform	Paid / Educational License	No	IT troubleshooting training content

Table 24: Overview of recommended diagnostic tools and use cases

4.9.3 Justification for Infrastructure Selection

Reliable troubleshooting is crucial to service continuity and customer confidence, given NextGen's hybrid model. Small IT teams can quickly diagnose issues with minimal overhead using tools like Windows Security, Event Viewer, and Task Manager.

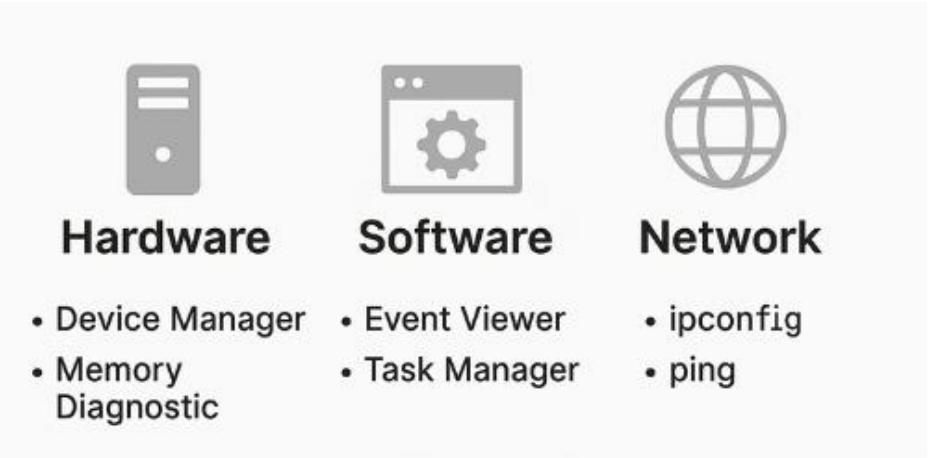

Figure 16: Troubleshooting tools by category (created using AI tool 2025)

The table below summarizes the main issues encountered during setup and the tools used to resolve them.

Issue	Likely Cause	Tool/Action Taken	Result
Printer not responding	Missing or outdated driver	Device Manager: reinstalled correct driver	Printer operational
Network latency on analyst PC	IP address conflict	ipconfig /release and /renew command	Network performance normalized
Slow boot time on admin PC	Excess startup programs	Task Manager: disabled unnecessary startup items	Boot time reduced by 40%
User cannot access shared folder	NTFS permission misconfigured	Checked folder properties, adjusted permissions	User access restored
Unexpected system restart	Overheating (poor ventilation)	Monitored via BIOS and physical inspection	Fan replaced, issue resolved

Table 25: Troubleshooting Log – Setup Phase

4.9.4 Conclusion

Week 9 emphasized structured troubleshooting as essential to system resilience and business continuity. At NextGen, where operations rely on real-time, cloud-based analytics, effective diagnostics minimize downtime and contribute to customer satisfaction. Proactive problem logging and analysis not only keeps systems up to date, but also enables safe, scalable growth.

4.10 Week 10 – Operating System

4.10.1 Learned Content

This week covered the fundamentals of Windows, Linux, and macOS, focusing on system architecture, kernel types, permissions, and process management (Stallings 2017; Meyers 2022). It also explored virtualization (Hyper-V, VirtualBox), native security tools, and patch management (Whitman & Mattord 2018).

Feature	Physical Machine	Virtual Machine (VMware/Hyper-V)	Cloud Instance (Azure/AWS)
Hardware Dependency	High	Medium	Low
Scalability	Low	Moderate	High
Deployment Speed	Slow	Moderate	Fast
Cost Efficiency (SMB Use)	Low (CapEx)	Moderate	High (OpEx-based)
Administrative Control	Full	High	Variable (based on provider)
Disaster Recovery Options	Manual	Snapshot/Backup	Built-in & Automated

Table 26: OS Setup Methods Overview

4.10.2 Recommendations for NextGen Techworks

Windows 11 Pro is recommended for administrative use due to its ease of management and enterprise compatibility. Ubuntu Server is well-suited for backend systems due to its automation capabilities and alignment with cloud-native workloads. All platforms should implement system hardening and routine updates.

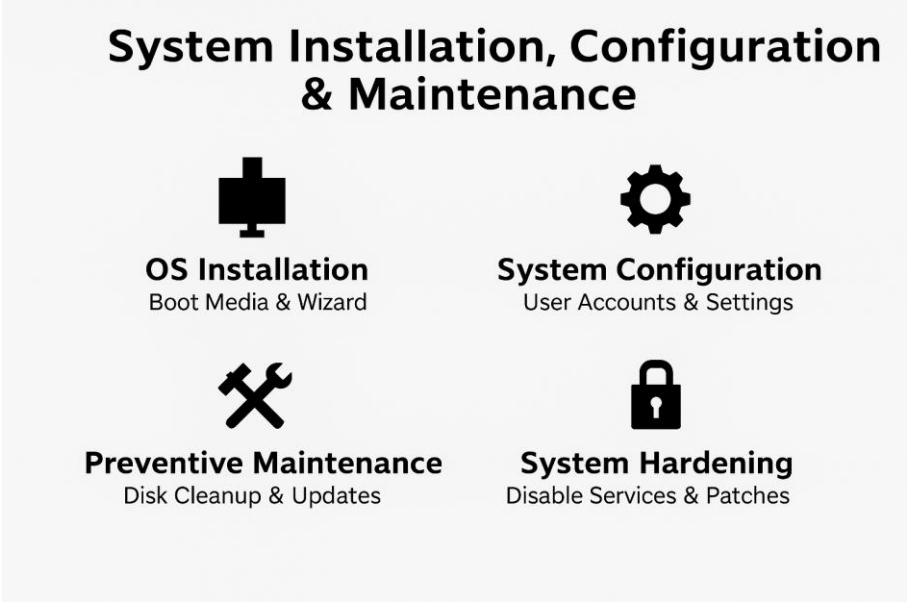

Figure 17: OS Implementation Framework (created using AI tool 2025)

To support hybrid operations and future scalability, the table below compares different OS deployment methods and their strategic use at NextGen Techworks.

Feature	Physical Machine	Virtual Machine (VMware/Hyper-V)	Cloud Instance (Azure/AWS)	Recommended Use at NextGen
Deployment Speed	Moderate	Fast	Very Fast	Physical for admin PCs; VMs for testing; Cloud for scalability
Resource Efficiency	Low to Moderate	High	Very High	Cloud for elasticity; VMs for cost-effective redundancy
Maintenance Effort	Manual	Centralized	Automated	Cloud and VMs simplify routine updates
Scalability	Limited	Moderate	High	Cloud for future growth; VMs for isolated workloads
Accessibility	Local only	Network-based	Internet-wide	Cloud for remote teams; VMs for internal simulations

Table 27: OS Deployment Methods & Recommended Use

The table illustrates the System Administration Tools Costs:

Component / Tool	Description	Cost Estimate
Microsoft Windows OS	Built-in tools like Task Manager, Event Viewer, Defender, System Restore	Included in OS license
Microsoft 365 Business Standard	Optional upgrade for more administrative control & cloud sync integration	~£10.60/user/month
KnowBe4 Training Platform	Continued use for educating on safe system practices	~£25/user/year
Optional Third-Party Antivirus	If NextGen opts for advanced antivirus (e.g., Bitdefender, Norton)	~£20–£40/year/device
Remote Monitoring and Management (RMM) tools	Tools like SolarWinds RMM, for proactive diagnostics (optional)	~£30/device/month

Table 28: System Administration Tools Costs

4.10.3 Justification for Infrastructure Selection

Windows supports general business operations, while Ubuntu meets performance and scalability goals. Diagnostic tools and system-level protections ensure a secure and resilient infrastructure for both physical and virtualized environments.

4.10.4 Conclusion

The integrity of the entire infrastructure depends on a well-configured and secure operating system. NextGen gains scalability and usability by integrating Linux and Windows in a hybrid approach, which also establishes the groundwork for safe cloud integration.

4.11 Week 11 – Mobile Devices and Printers

4.11.1 Learned Content

This week covered the deployment of operating systems, mobile devices and printers in corporate environments, with a focus on standardization, compatibility and scalability (Microsoft 2024).

Figure 18: OS Installation and Configuration Process (created using AI tool 2025)

4.11.2 Recommendations for NextGen Techworks

To ensure a consistent operating system configuration across all devices, the following tools and services are recommended to maintain compatibility, security, and scalability.

Component	Description	Device Application	Unit Cost (GBP)	Quantity	Total Cost (GBP)
Windows 11 Pro Licenses (OEM)	License per device for enterprise use	All PCs (5 units: 2 admin, 2 analysts, 1 server)	125	5	625
USB Boot Devices / External Drives	Media for OS installation and recovery	All PCs (5 units)	20	5	100
Driver Management Tool (Driver Easy Pro)	Tool for automatic driver updates	All PCs (5 units)	30	5	150
IT Technician Labor	Labor cost for installation and configurati	Estimated 8 hours for all PCs	25	8	200
Backup Image Software (Macrium Reflect Pro)	Software for pre-configured system imag	All PCs (5 units)	60	5	300
Total					**£ 1375**

Table 29: OS Setup Cost Table

The table below outlines operating system installation and configuration recommendations.

Recommendation	Objective	Application in NextGen Techworks
Use Windows 11 Pro	Ensure OS consistency and enterprise-grade features	Standardize systems for administration and data teams, improving compatibility, policy control, and integration with security tools.
Create custom installation media (MDT)	Streamline deployment and reduce manual configuration	Automate OS setup with pre-installed software, drivers, and settings—saving time and ensuring uniform security baselines across devices.
Partition drives strategically	Improve performance and simplify recovery	Separate OS from user data, enabling faster backups, cleaner recovery, and better disk organization.
Apply initial security hardening	Minimize vulnerabilities post-installation	Enable Windows Defender, firewall, and disable unnecessary admin shares to block common exploits during the setup window.
Role-based user profiles	Limit access and enhance accountability	Use LGPE to define user roles, ensuring that only key staff have admin rights—reducing insider threats and misconfigurations.
Automate update schedules	Maintain system security with minimal disruption	Schedule Windows updates for non-working hours, and use PDQ Deploy for streamlined management of third-party software patches.
Document configuration settings	Enable repeatability and future maintenance	Keep a configuration log for each device, useful for audits, scaling, and troubleshooting.
Use official driver management tools	Ensure compatibility and performance	Maintain driver updates using manufacturer tools (e.g., Dell Command Update), which enhances reliability of hardware-intensive analytics tasks.

Table 30: OS Configuration Recommendations for NextGen

For development tasks, install Visual Studio Code as the default IDE on every workstation. Its lightweight, cross-platform nature supports secure scripting and efficient coding.

4.11.3 Justification for Infrastructure Selection

A standardized Windows environment provides comprehensive enterprise support and integrated tools. Tasks such as disk partitioning and firewall configuration improve performance and security. Combined with Mobile Device Management (MDM) and uniform printer configurations, these options provide scalability and security for hybrid operations.

4.11.4 Conclusion

Week 11 Week 11 reinforced the value of standardized configurations and mobile device control. Implementing MDM, security policies, and centralized printer configurations helps NextGen scale operations efficiently and securely, laying a solid foundation for future growth and cloud integration.

4.12 Week 12 – Cloud Computing and Virtualization

4.12.1 Learned Content

This week explored cloud service models (IaaS, PaaS, SaaS), virtualization tools, and mobile cloud integration strategies tailored for small and medium-sized businesses (SMBs) like NextGen (Stallings 2017; Whitman & Mattord 2018).

The image below highlights the key benefits of cloud computing, emphasizing its role in increasing scalability, reducing hardware dependency, and supporting remote access.

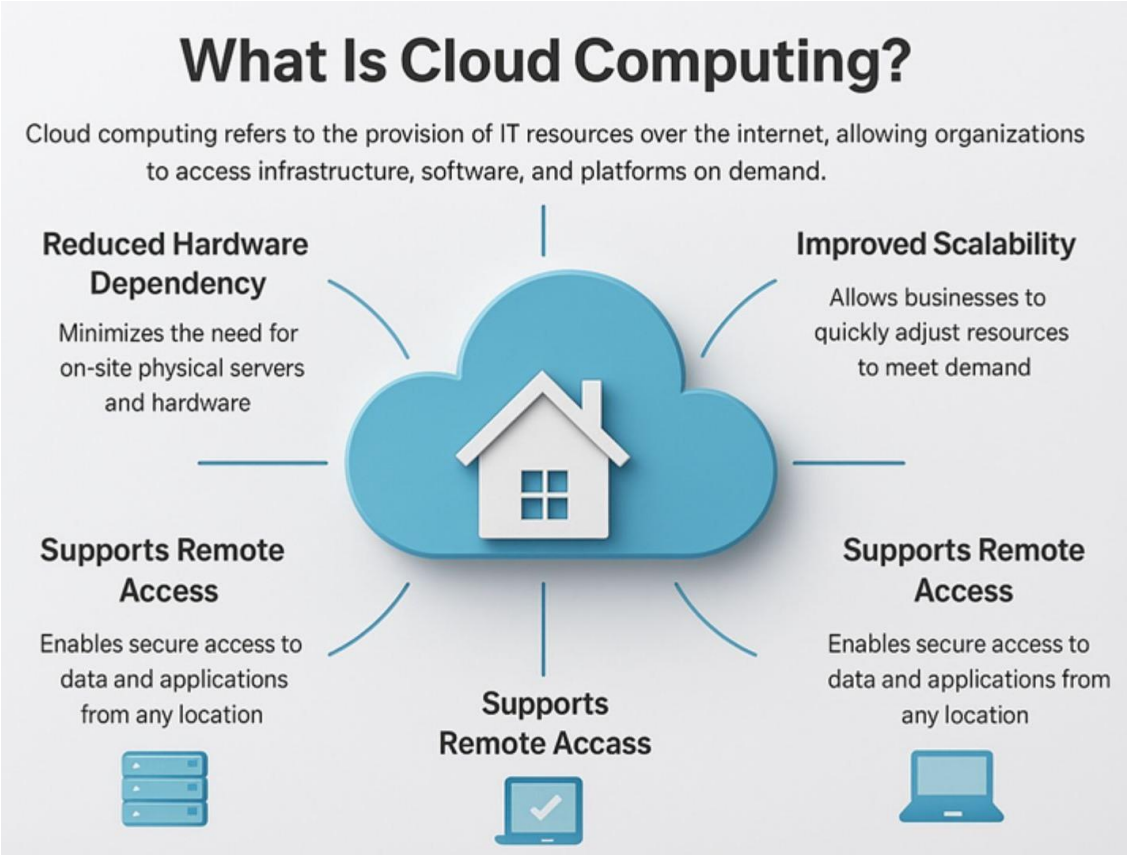

Figure 19: Key Features and Benefits of Cloud Computing (created using AI tool 2025)

4.12.2 Recommendations for NextGen Techworks

To enable a secure and scalable adoption of mobile and cloud technologies, the following recommendations are proposed:

Area	Recommendation	Description
Cloud Strategy	**Adopt a Hybrid Cloud Model**	Combine private cloud (for sensitive analytics data) and public cloud (for general services) to balance security and flexibility.
Cloud Provider	**Select a Reliable IaaS Provider**	Consider Microsoft Azure or AWS for infrastructure services with integrated compliance, scalability, and AI support.
SaaS Applications	**Use Cloud-Based Collaboration Tools**	Implement platforms like Microsoft 365 or Google Workspace for email, storage, and real-time collaboration.
MDM Implementation	**Deploy Mobile Device Management (MDM)**	Use tools like Microsoft Intune to enforce security policies on smartphones, tablets, and laptops.
BYOD Policy	**Define Clear Bring Your Own Device (BYOD) Guidelines**	Ensure personal devices accessing company data comply with security protocols, including mandatory encryption and remote wipe.
Cloud Backup	**Integrate Cloud-Based Backup Solutions**	Utilize services like Acronis Cloud Backup to ensure business continuity and fast recovery.
Access Control	**Enforce Conditional Access Policies**	Grant cloud and mobile access based on device status, location, and user identity to prevent unauthorized entry.
User Training	**Provide Staff Training on Cloud & Mobile Security**	Educate users on safe practices when using cloud services or accessing company data from personal devices.

Table 31: Mobile and Cloud Adoption Framework for NextGen

The NextGen should adopt Microsoft Azure for backups and infrastructure virtualization, and Google Workspace for productivity and communication. These platforms enhance remote collaboration, ensure secure access to data, and align with the company's hybrid work model.

To help with planning and budgeting, the table below provides monthly cost estimates:

Service	Purpose	Est. Monthly Cost (GBP)	Assigned To
Cloud VM Instance (Windows/Linux)	Hosting backup server, remote access, scalable computing	£35–£60	Server
Cloud Storage (100 GB)	Offsite secure storage for business-critical files	£2–£5	All devices (shared)
Cloud Backup Service	Redundant backup for disaster recovery	£8–£12	Server
IAM (Identity Access Management)	Central user access control	Usually included	All
Cloud Monitoring Tools	Usage analytics, alerts	Included in basic plans	Admin PC

Table 32: Cloud Services Estimated Monthly Cost

Estimated Monthly Cost for NextGen (Cloud services total): £50–£75

4.12.3 Justification for Infrastructure Selection

Azure provides seamless integration, automated backups, and scalable infrastructure, while Google Workspace enhances real-time collaboration and supports mobile access. Together, these solutions minimize reliance on on-premises servers, improve data availability, and future-proof your IT environment for digital growth and innovation.

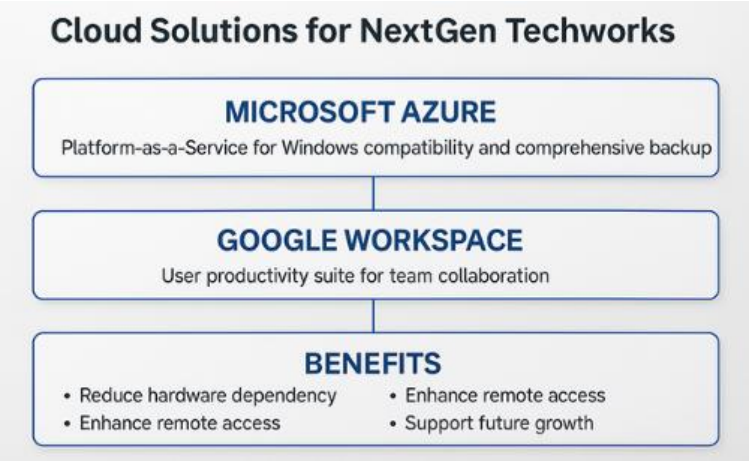

Figure 20: Cloud Solutions Implemented at NextGen Techworks (created using AI tool 2025)

4.12.4 Conclusion

Week 12 emphasized how cloud computing and virtualization are essential to building modern, resilient IT systems. For NextGen, adopting cloud platforms increases flexibility, security, and collaboration while supporting long-term goals of operational scalability, cost efficiency, and digital transformation.

4.12.5 Final Conclusion

This project provided the opportunity to combine academic knowledge with practical application in building an IT infrastructure. Crucial ideas including hardware selection, network design, operating system deployment, cybersecurity procedures, cloud integration, and endpoint management were investigated in depth and strategically utilized to meet NextGen Techworks' specific demands.

Category	Included Components	Weeks	Cost (£)
Hardware	PCs, internal components (CPU, RAM, SSD, GPU, motherboards, etc.)	Weeks 1, 2, 3	£7,610
Peripherals	Monitors, external SSDs, headsets, webcams, docking stations	Week 4	£8,730
Network Infrastructure	Switches, routers, cables, firewall (including FortiGate), LAN/WAN setup	Weeks 5, 6	£3,900
Cybersecurity	Acronis, firewall, cybersecurity training, VLAN segmentation	Week 8	£4,815
Mobile & Printing Devices	Printers, scanners, smartphones, mobile configuration tools	Week 11	£1,375
Total Project Cost:			**£26,430**

Table 33: Final Infrastructure Cost Summary

The end result is a robust infrastructure, tailored to the needs of a growing business, achieved with a one-off investment of £26,430. More than just a technical solution, this project represents a fundamental step in my development as a confident and competent IT technician.

On a personal level, this process has reinforced the need to combine practical thinking with academic understanding to deliver reliable, rapid and secure solutions.

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