Final Project: Server Infrastructure Design Proposal

Jatin Sharma

Course: CSET 4150 Web Server Administration

Instructor: Merl Creps

November 2025

Contents

1 Executive Summary

This project describes how the University of Toledo System (UTS) can build a better and more modern server infrastructure. UTS consists of about 1,800–2,000 employees and is a fictional version of The University of Toledo. The main objective of this report is to design an environment that can support the daily work of all UTS employees in a more secure, stable, and organized way.

The University depends on many systems such as LMS, SIS, email, payroll, research systems, and shared file storage. At the moment, the assumed setup consists of several issues such as old servers, inconsistent backups, and different hardware across buildings. This report explains how these problems can be fixed by moving to a hybrid approach, where important systems stay on-campus, but cloud services are also used for better backups and email.

This proposal includes current problems, recommended improvements, architecture diagrams, resource allocations, redundancy planning, disaster recovery strategy, estimated costs, staffing needs, and licensing requirements. The goal is to keep everything simple but also detailed enough to show understanding of how real IT environments work.

2 Company Profile

The University of Toledo System (UTS) used in this project includes several campuses and departments. Even though this is a simplified version, it still represents what a real university might look like.

Campuses and Departments

- Main Campus with classrooms, administrative offices, and student services.

- Health Science Campus for nursing, pharmacy, and medical programs.

- Engineering and Technology buildings with labs and computer classrooms.

- Research labs where faculty conduct scientific and technical projects.

- Online learning division that supports hybrid and fully online classes.

- A few smaller learning centers across Northwest Ohio.

Systems Used by UTS

UTS uses many important IT systems every day:

- SIS (Student Information System) for admissions, registration, grades.

- LMS (Learning Management System) for assignments, course materials, and online exams.

- Email and communication tools for staff and students.

- HR, payroll, and finance systems.

- Library systems and databases.

- Research computing systems for scientific work.

- Shared file storage for documents, reports, and student data.

Since UTS runs almost the entire year, having a reliable IT environment is essential. Even small downtime can cause problems for student registration, exams, or online learning.

3 Server Structure Improvements

3.1 Current State

The current assumed system at UTS has many problems that make it unreliable and hard to manage. These problems are common in older setups:

- Many physical servers are over 7–8 years old and slow.

- The systems are not virtualized, so the hardware is wasted.

- Each department has its own server, which creates confusion.

- Storage is scattered in different buildings and is not centralized.

- Backups are not consistent and are stored only on-site.

- There is no official disaster recovery (DR) plan.

- Network devices are mixed and not standardized.

Because of this, UTS employees have to deal with slow systems, higher chances of crashes, and more work for IT staff.

3.2 Future State

The improved design solves these problems by using better technology and a more organized structure:

- Three powerful virtualization servers to host several virtual machines.

- Central SAN storage for important applications.

- NAS storage for department files.

- Better firewalls and switches for stronger security.

- Cloud services such as Microsoft Azure and AWS for backups and DR.

- Microsoft 365 for email and collaboration.

This design makes the system easier to maintain and gives UTS room to grow.

4   Deployment Architecture (Hybrid / On-Prem / Cloud)

UTS will use a **hybrid infrastructure**. This means that some systems stay on campus and others move to the cloud.

On-Premises Systems

- Student Information System (SIS)

- LMS core components

- Active Directory (login/authentication)

- Research servers that need high performance

- File servers for daily storage

Cloud Systems

- Microsoft 365 for email

- Azure Blob Storage for backups

- AWS S3 for disaster recovery storage

- Some administrative and public web applications

Why Hybrid?

Hybrid is the best because:

- Important systems stay close for better performance.

- Cloud reduces the hardware cost for email and backups.

- Backups and DR become easier with Azure/AWS.

- The university gets more flexibility and scalability.
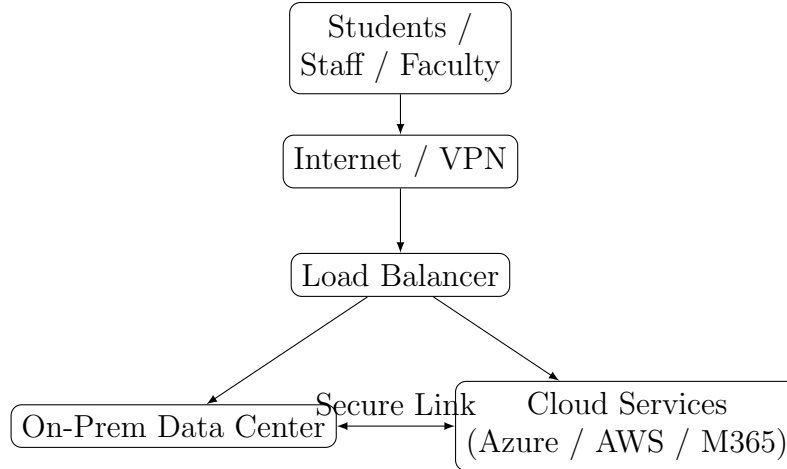
Architecture Diagram

Figure 1: Hybrid UTS architecture

5 Resource Procurement and Allocation

This section describes the compute, storage, and network resources needed for the new design. Values are simple estimates.

Compute Resources

Table 1: Compute Resources

Server	CPU	RAM	Use
Virtual Host 1	32 cores	256 GB	Main VMs
Virtual Host 2	32 cores	256 GB	Failover
Virtual Host 3	24 cores	128 GB	Databases
DMZ Server 1	16 cores	64 GB	Public apps
DMZ Server 2	16 cores	64 GB	Backup app host

Storage Resources

Table 2: Storage Resources

Storage	Size	RAID	Use
SAN Storage	120 TB	RAID 10	SIS, LMS, critical data
NAS Storage	60 TB	RAID 6	File storage
Azure Storage	Scalable	Cloud	Daily backups
AWS S3	Scalable	Cloud	DR copies

Network Resources

Device	Qty	Use
Firewalls	2	Security
Core Switches	4	Backbone
Access Switches	20	Buildings
Load Balancer	1	Web traffic
VPN Gateways	2	Remote access

Table 3: Network Resources

6   Mail Server Design

UTS will use **Microsoft 365 Exchange Online**.

Reasons

- No hardware needed on campus.

- Easy for staff and students to use.

- Strong security and spam filtering.

- Works well with Teams and OneDrive.

- Scales easily for thousands of users.

Microsoft 365 already has strong redundancy. Additional backups can also be added.

7 Redundancy Plan

Redundancy reduces downtime if something breaks.

Server Redundancy

- Three-node virtualization cluster

- Two domain controllers

Storage Redundancy

- SAN using RAID 10

- NAS using RAID 6

- Cloud snapshots

Network Redundancy

- Two firewalls

- Two VPN gateways

- Backup switches

- Two internet providers

8 Disaster Recovery Strategy

RTO and RPO

- **Critical Systems:** RTO = 2 hours, RPO = 15 minutes

- **Non-Critical Systems:** RTO = 12–24 hours, RPO = 4 hours

Backup Process

- Daily backups to Azure

- Hourly database backups

- Monthly DR copies in AWS S3

Disaster Steps

1. Identify the issue

2. Inform IT leadership

3. Switch to cloud DR environment

4. Restore services

5. Allow users to connect to DR systems

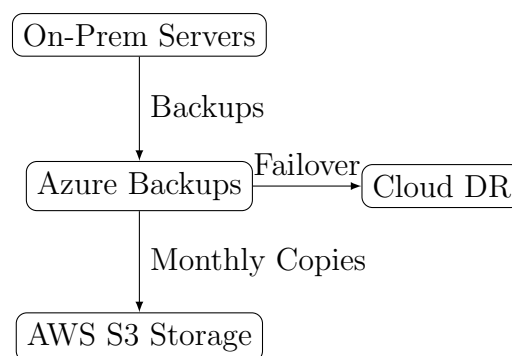6. Move back to on-prem after repair

DR Diagram

On-Prem Servers

Backups

Azure Backups —Failover→ Cloud DR

Monthly Copies

AWS S3 Storage

Figure 2: Disaster recovery flow

9 Cost Estimate

Table 4: Estimated Costs

Category	Cost
Servers	$150,000
SAN/NAS	$110,000
Network Gear	$70,000
Microsoft 365 (yearly)	$58,000
Azure + AWS (yearly)	$40,000
Backup Tools	$15,000
Support (yearly)	$35,000

These are rough values based on average university IT pricing.

10   Licensing and Staffing Requirements

Licenses Needed

- Windows Server

- SQL Server

- VMware or Hyper-V

- Microsoft 365

- Firewall subscriptions

- Backup software licenses

IT Staff Needed

- 2 System Administrators

- 1 Network Engineer

- 1 Database Administrator

- 2 Helpdesk Technicians

- 1 Security Analyst

11   Conclusion

This project gives a realistic and simple server infrastructure plan for the University of Toledo System. The hybrid model helps UTS keep important systems on-campus while using cloud services to improve backups, security, and disaster recovery.

The design is more secure, easier to manage, and supports academic and administrative needs. With proper redundancy and staffing, UTS can run its IT systems in a stable and future-ready way.

References

- Microsoft Learn – Hybrid cloud basics and when to use it. `https://learn.microsoft.com/en-us/azure/architecture/guide/technology-choices/hybrid-considerations`

- Azure Backup documentation (used for backup and DR design). `https://learn.microsoft.com/en-us/azure/backup/`

- AWS Disaster Recovery white-paper. `https://docs.aws.amazon.com/whitepapers/latest/disaster-recovery-workloads-on-aws/introduction.html`

- Exchange Online info from Microsoft 365 docs. `https://learn.microsoft.com/en-us/exchange/exchange-online`

- Active Directory Domain Services overview. `https://learn.microsoft.com/en-us/windows-server/identity/ad-ds/get-started/virtual-dc/active-directory-domain-services-overview`

- Dell Support article explaining RAID levels `https://www.dell.com/support/kbdoc/en-in/000128635/dell-servers-what-are-the-raid-levels-and-their-specifications`