

Capstone System Design Document

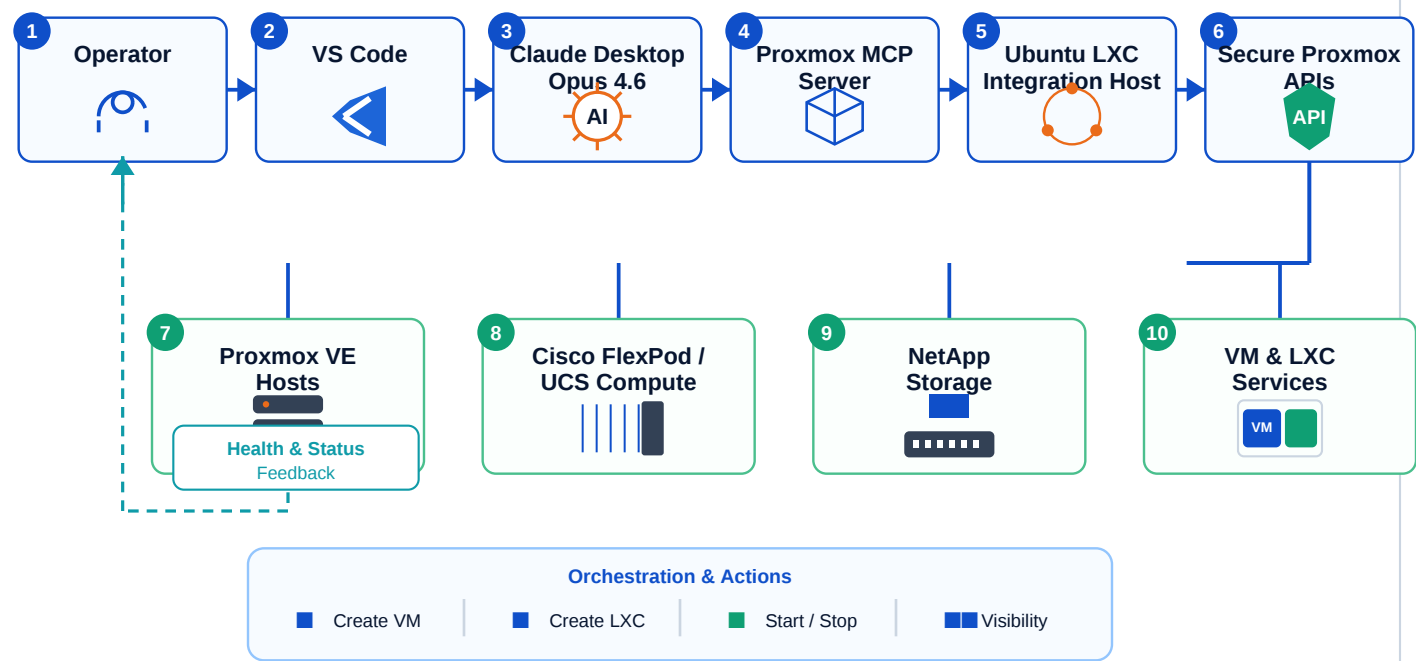
AI-Driven Proxmox Automation in a Converged Data Center Lab

i Executive Summary

This capstone system design demonstrates an AI-assisted infrastructure operations model built for Wake Tech's CTI-260 data center lab. The solution uses VS Code as the engineering workspace and Claude Desktop with the Opus 4.6 model as the AI operations interface. Both connect to a dedicated Proxmox MCP server hosted in an Ubuntu LXC integration container, creating a governed control plane between natural-language requests and Proxmox infrastructure actions.

The MCP layer translates operator intent into secured Proxmox API calls for health checks, VM/LXC inventory, service-state review, and controlled provisioning. The target platform is Proxmox VE on Cisco UCS/FlexPod compute with NetApp-backed storage, linking virtualization, APIs, AIOps concepts, and troubleshooting into one public system-design artifact.

Architecture Overview



★ Core Capabilities



AI-assisted monitoring and status checks



Natural-language infrastructure operations



API-driven VM and container lifecycle automation



Hands-on cloud and data center integration skills

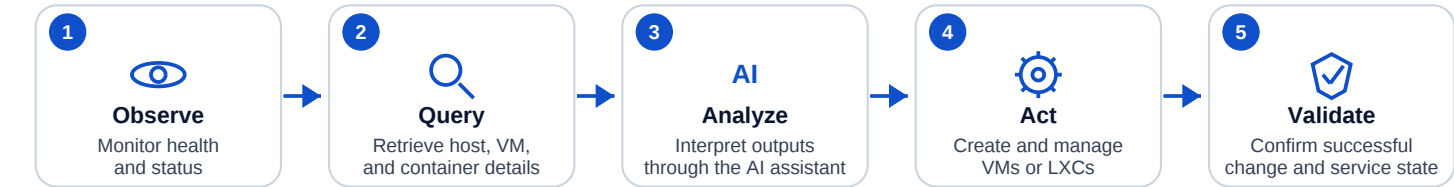
Technical Design, Controls, and Outcomes

This capstone demonstrates practical cloud and infrastructure engineering by combining AI clients, Proxmox MCP, and secured APIs to support monitoring, visibility, and provisioning in the Wake Tech lab. The design prioritizes security, automation, and measurable outcomes aligned with industry operational practices.

Solution Components

Layer	Technology	Role
1 AI Client Layer	Claude Desktop (Opus 4.6)	Natural-language interaction and operational prompting
2 Development Layer	VS Code	Prompting, experimentation, and workflow control
3 Integration Layer	Proxmox MCP on Ubuntu LXC	Translates agent requests into executable infrastructure actions
4 API Layer	Secured Proxmox APIs	Authenticates and exposes management functions
5 Virtualization Layer	Proxmox VE	Hosts and manages virtual machines and containers
6 Compute Platform	Cisco FlexPod / UCS	Provides converged compute infrastructure
7 Storage Platform	NetApp Storage	Provides resilient shared storage services
8 Service Output	VMs and LXC	Provisioned lab workloads and test environments

Operational Workflow



Security & Governance

Scoped API Access Limits automation to approved functions	Service Account Separation Supports cleaner privilege boundaries	Logging & Traceability Improves auditability and troubleshooting	Operational Safeguards Encourages validated changes	No Secret Exposure Omits passwords, tokens, and confidential values
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Skills Demonstrated

 Virtualization and container operations	 API-based infrastructure management	AI AI-assisted operations and AIOps concepts	 Converged infrastructure awareness	 Technical documentation and solution design	 Capstone communication and presentation
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LinkedIn Featured Artifact Summary



This capstone artifact represents my final cloud degree achievement and demonstrates how AI-assisted tooling can enhance infrastructure operations. It integrates Claude Desktop, VS Code, Proxmox MCP, and Proxmox APIs to support health monitoring, operational visibility, and automated VM/LXC provisioning on Cisco FlexPod and NetApp-backed infrastructure.