SNS COLLEGE OF TECHNOLOGY

An Autonomous Institution

Coimbatore-35

Department of Computer Science and Engineering

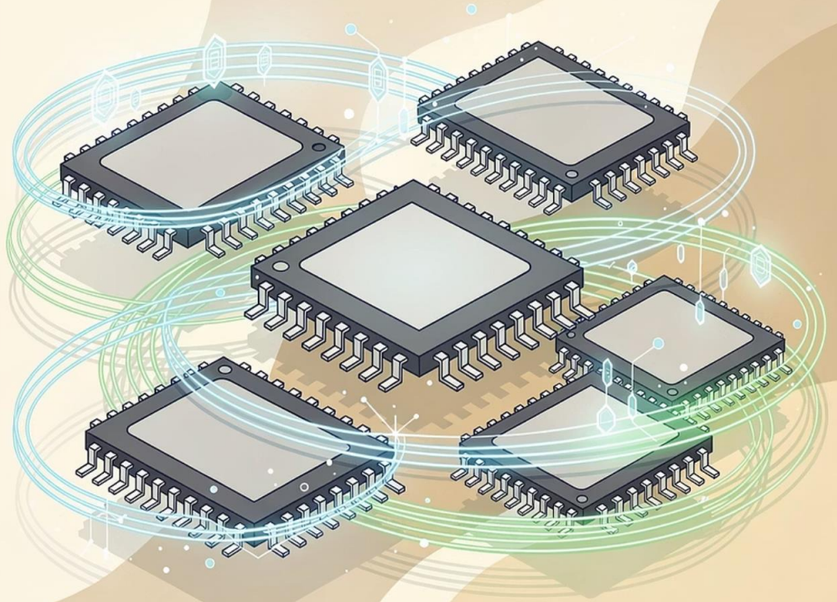
23CST206–OPERATING SYSTEMS AND VIRTUALIZATION

B.E- CSE /IV SEMESTER

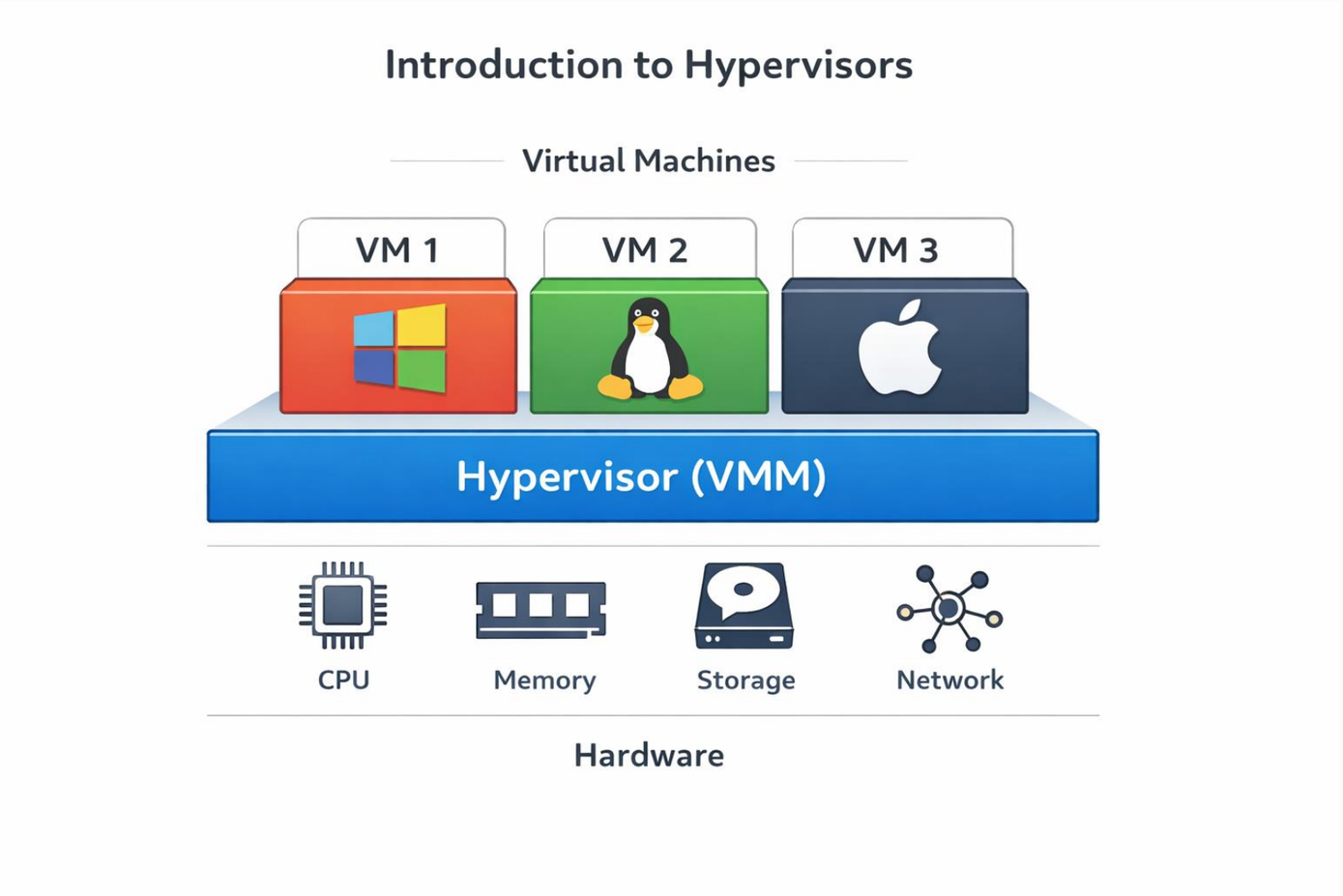
UNIT – V HYPERVISOR

Topic 1:Hypervisor -Type 1

HYPERVISOR TYPE 1



Introduction to Hypervisors



The Multifaceted Role of Hypervisors

Performance Monitoring

Tracks VM performance for optimization

VM Creation

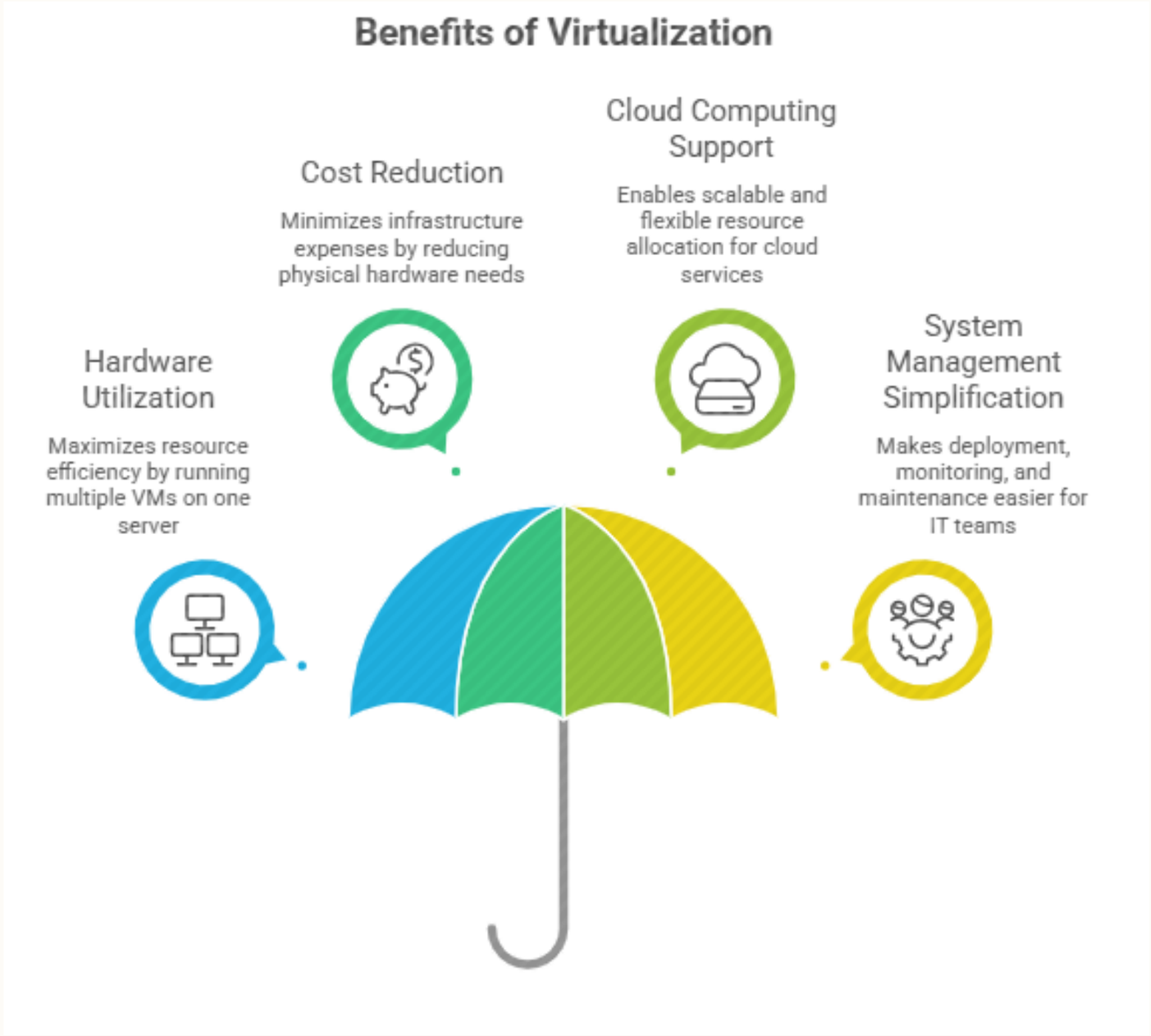
Enables the establishment of multiple virtual machines

Isolation & Security

Protects VMs from each other and external threats

Resource Allocation

Distributes hardware resources efficiently among VMs


Benefits of Virtualization
Cloud Computing Support
Enables scalable and flexible resource allocation for cloud services
Cost Reduction
Minimizes infrastructure expenses by reducing physical hardware needs
Hardware Utilization
Maximizes resource efficiency by running multiple VMs on one server
System Management Simplification
Makes deployment, monitoring, and maintenance easier for IT teams

Overview of Hypervisors

KVM

Open-source hypervisor leveraging the Linux kernel

VMware ESXi

Enterprise-grade hypervisor with robust features

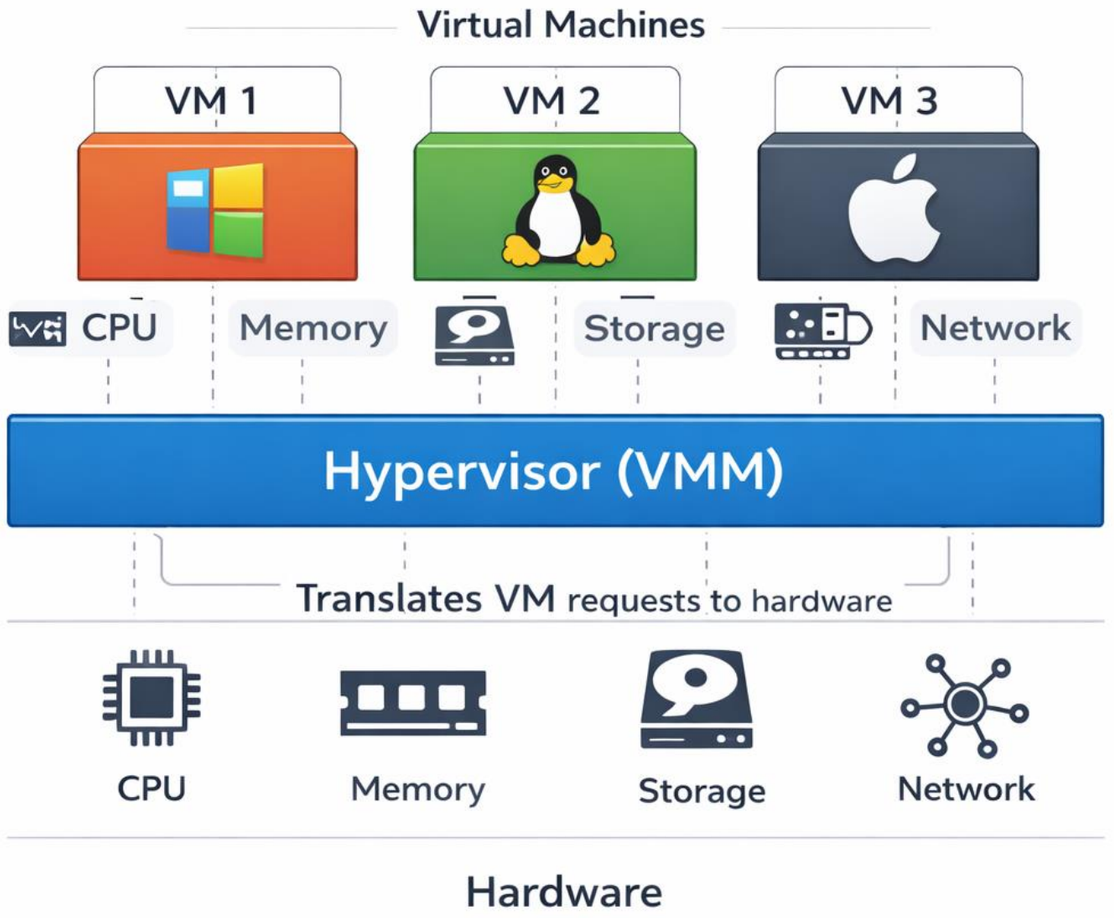
Microsoft Hyper-V

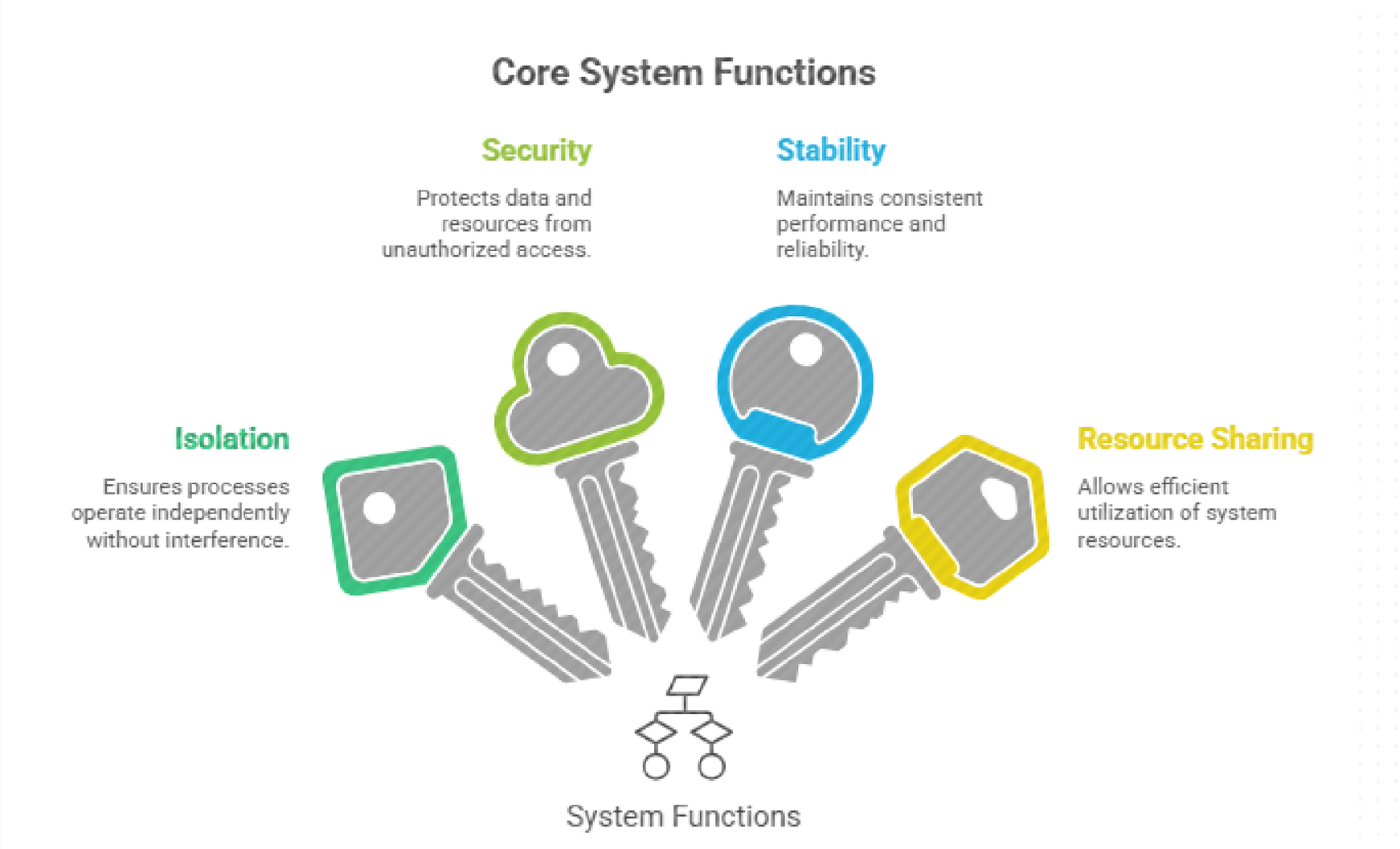
Seamless integration with Windows environments

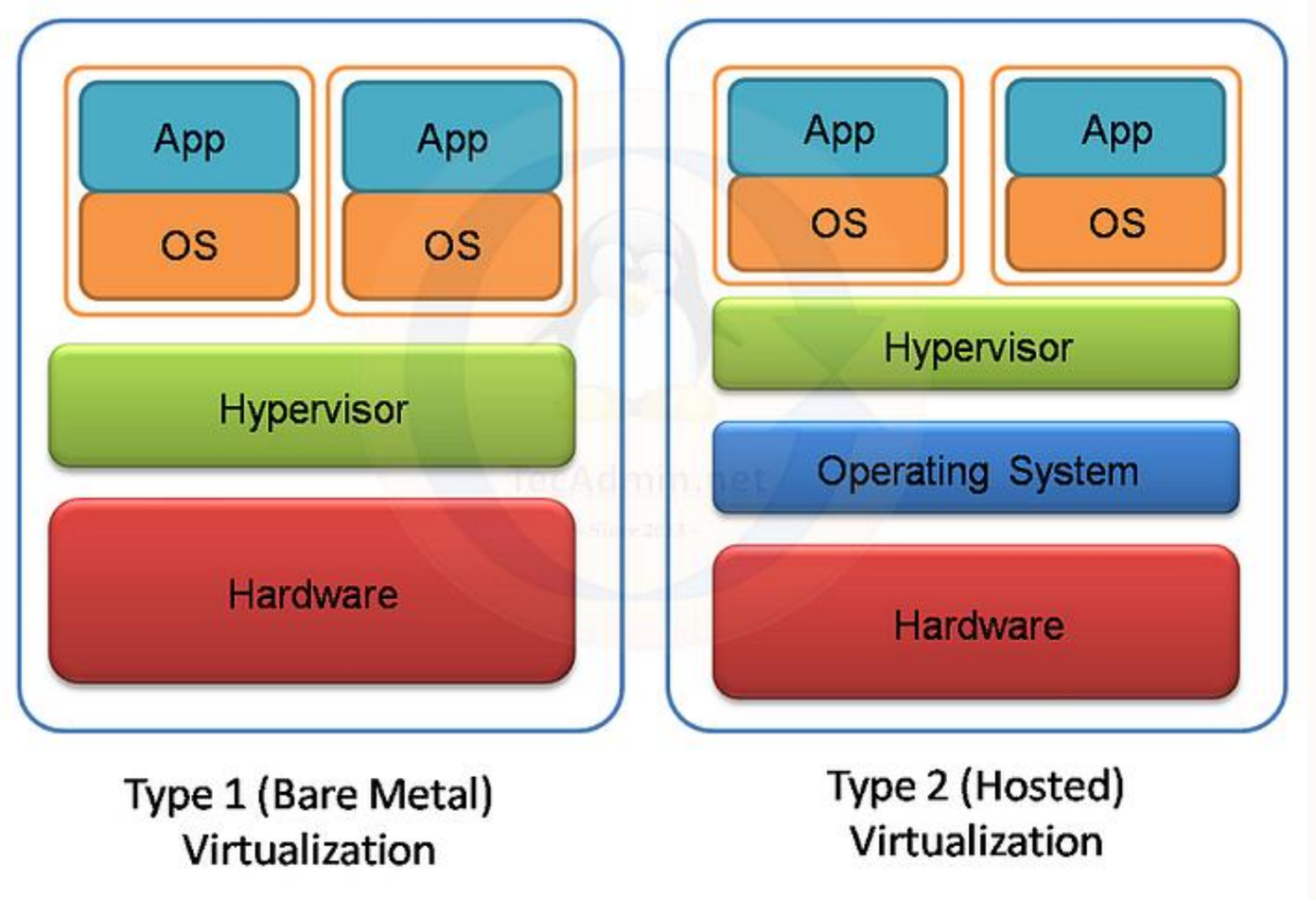
Oracle VM VirtualBox

User-friendly hypervisor for developers and testers

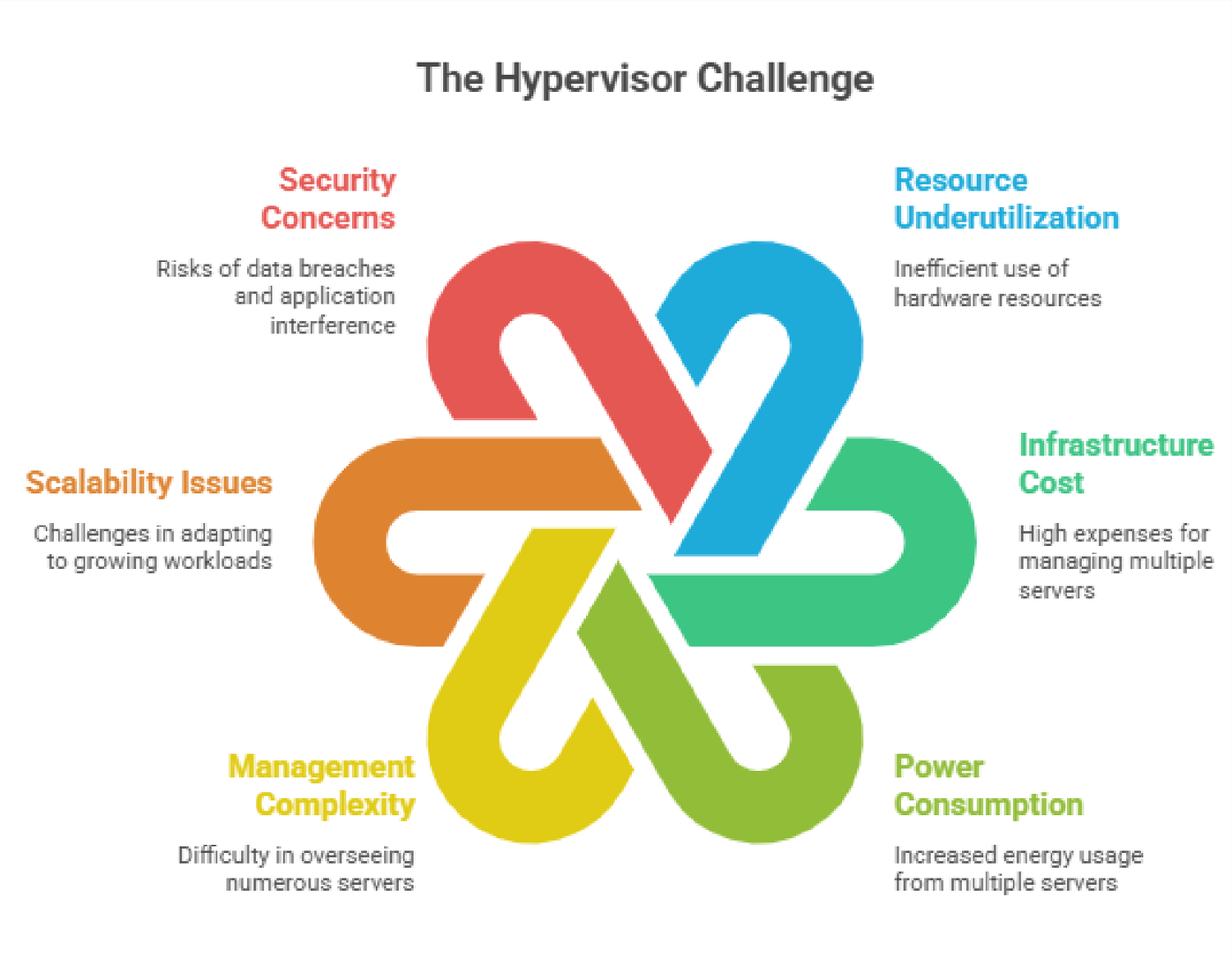
How Hypervisor Works

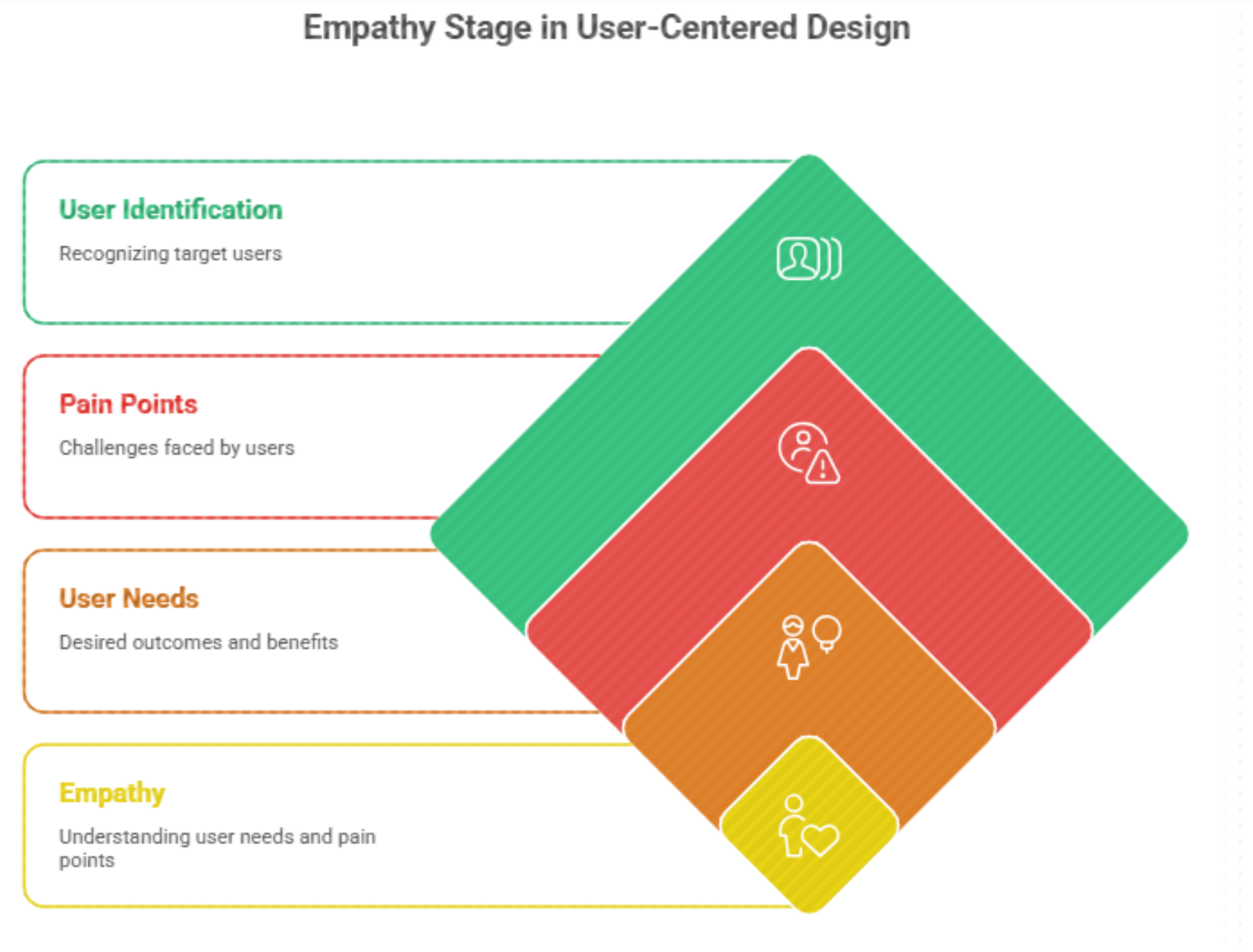


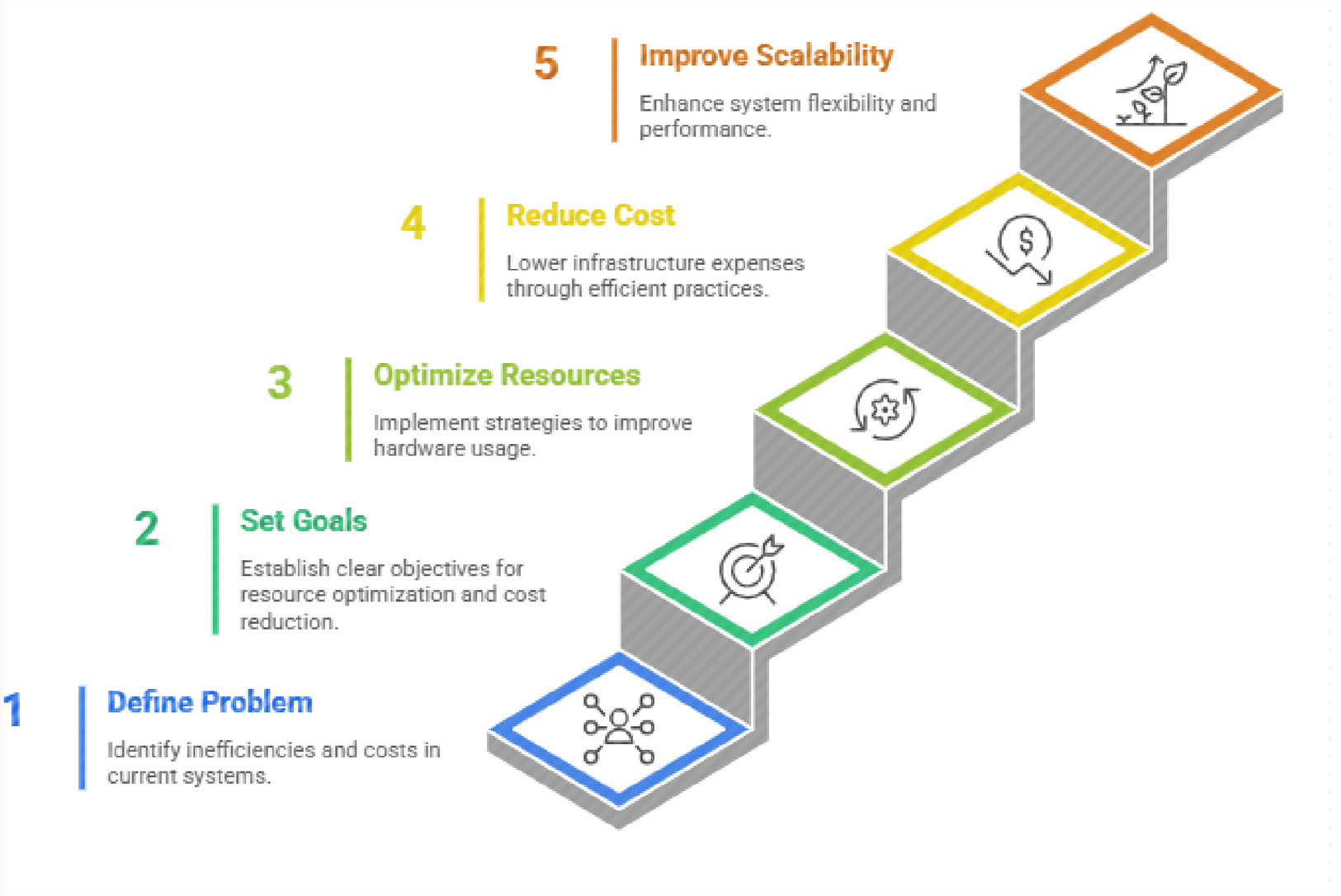

Core System Functions
Security
Protects data and resources from unauthorized access.
Stability
Maintains consistent performance and reliability.
Isolation
Ensures processes operate independently without interference.
Resource Sharing
Allows efficient utilization of system resources.
System Functions


App
App
OS
OS
Hypervisor
Hardware
Type 1 (Bare Metal) Virtualization
App
App
OS
OS
Hypervisor
Operating System
Hardware
Type 2 (Hosted) Virtualization

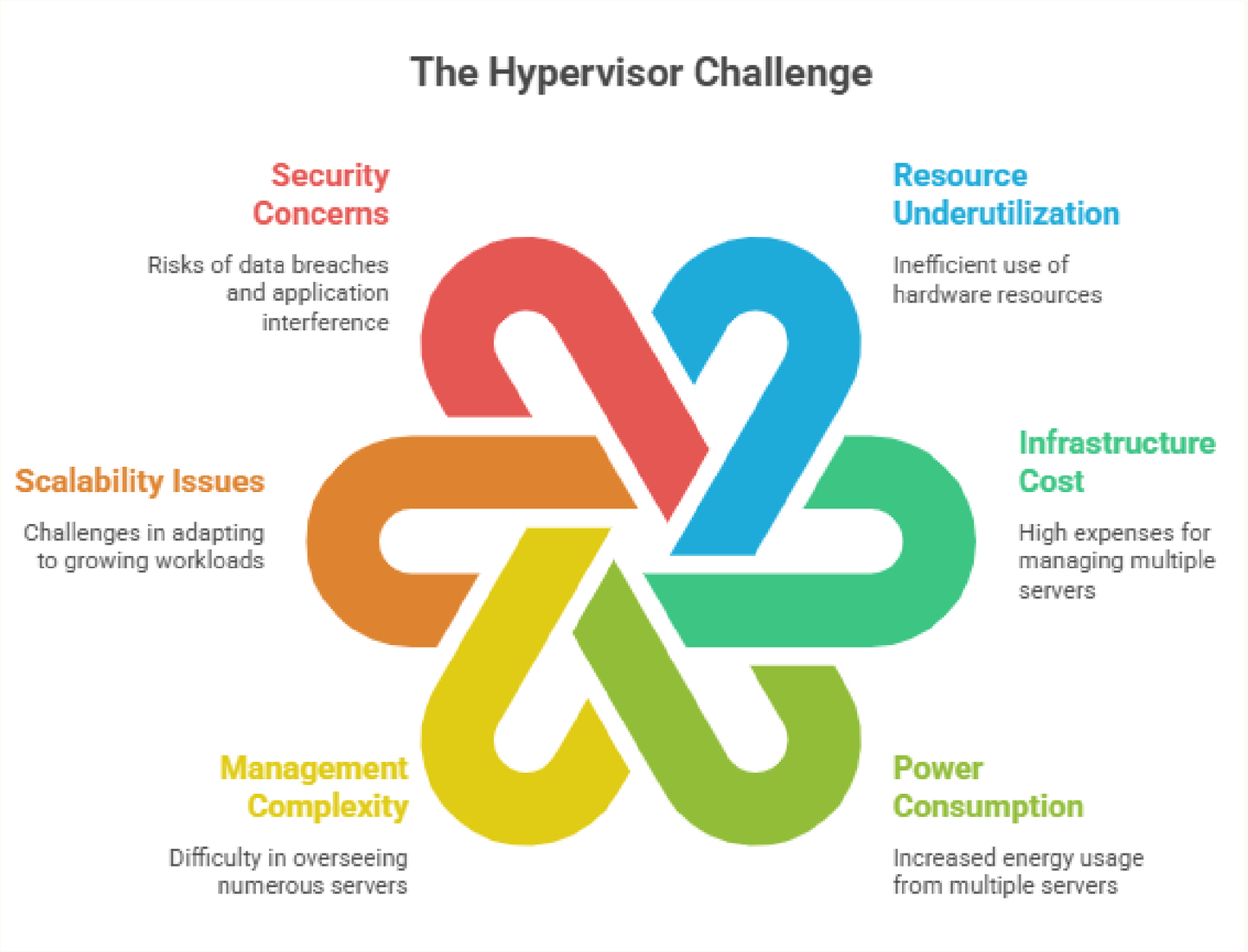
Problem Statement




Empathy Stage in User-Centered Design
User Identification
Recognizing target users
Pain Points
Challenges faced by users
User Needs
Desired outcomes and benefits
Empathy
Understanding user needs and pain points


5
Improve Scalability
Enhance system flexibility and performance.
4
Reduce Cost
Lower infrastructure expenses through efficient practices.
3
Optimize Resources
Implement strategies to improve hardware usage.
2
Set Goals
Establish clear objectives for resource optimization and cost reduction.
1
Define Problem
Identify inefficiencies and costs in current systems.

Which solution should be implemented for multi-boot systems?


The Hypervisor Challenge
Security Concerns
Risks of data breaches and application interference
Resource Underutilization
Inefficient use of hardware resources
Scalability Issues
Challenges in adapting to growing workloads
Infrastructure Cost
High expenses for managing multiple servers
Management Complexity
Difficulty in overseeing numerous servers
Power Consumption
Increased energy usage from multiple servers

Test Stage Cycle

Improve Resource Allocation

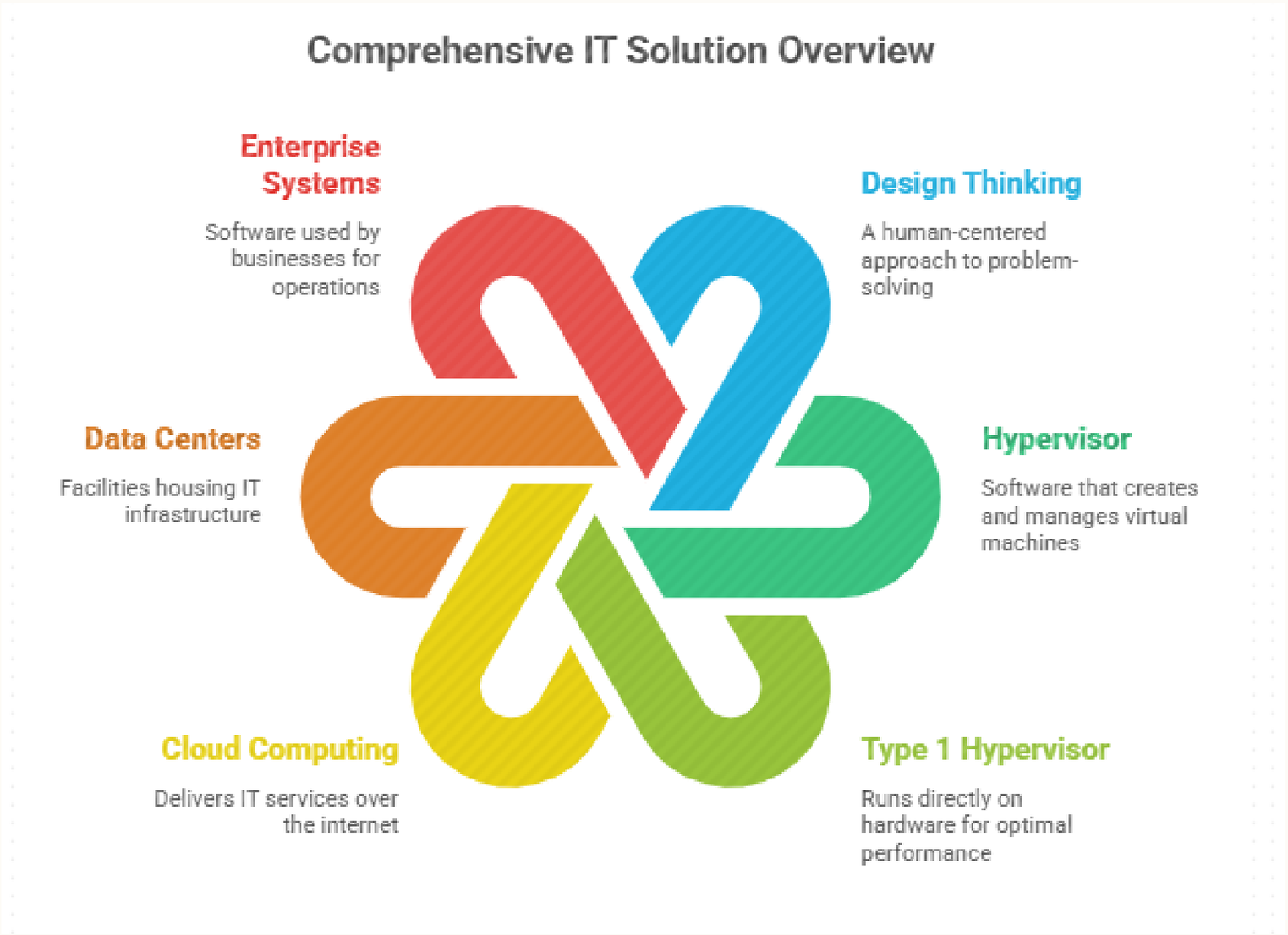
Optimize resource allocation and scheduling.

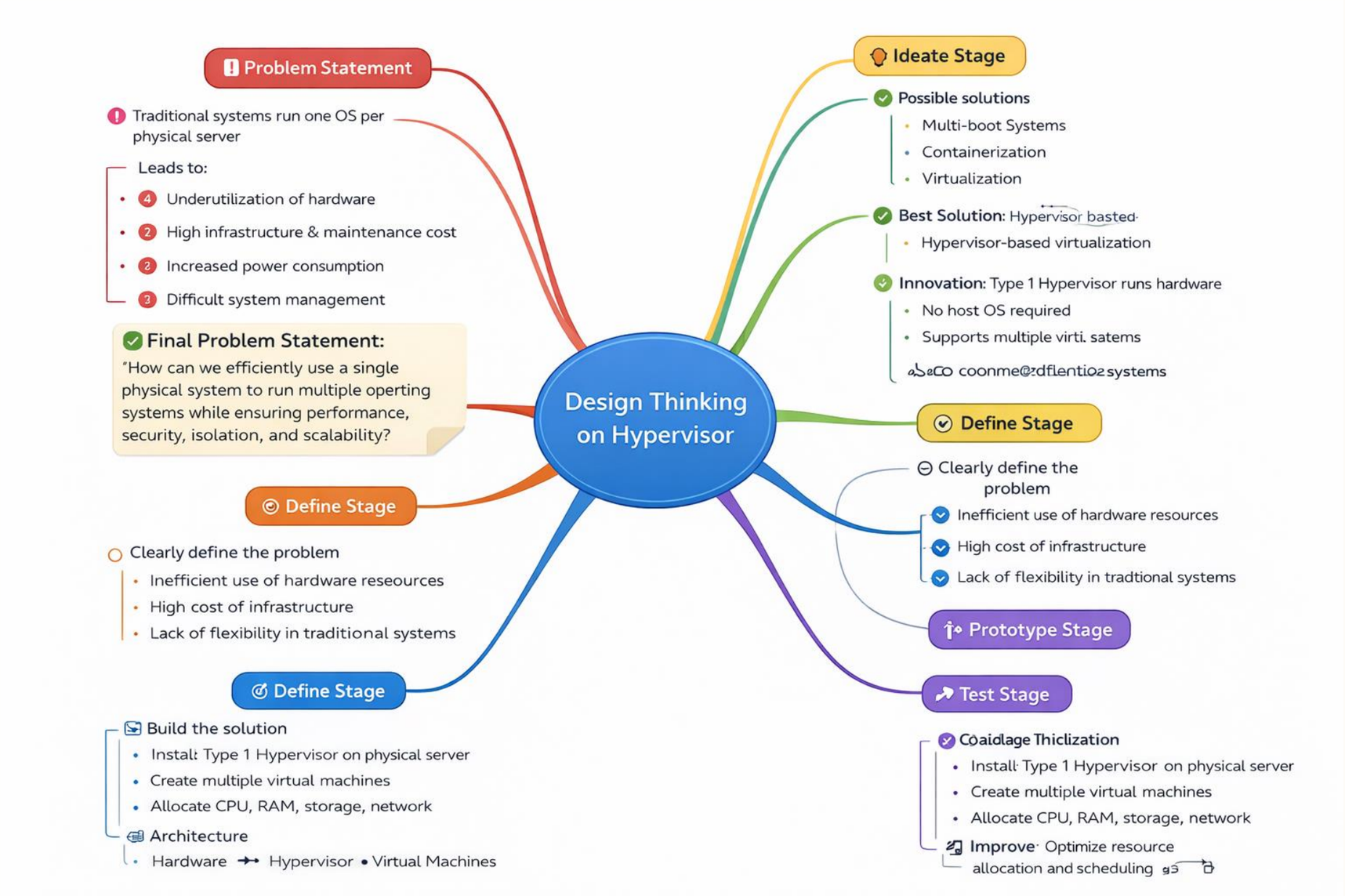
Test System Performance

Evaluate resource utilization, speed, and efficiency.

Validate Scalability

Assess system stability under heavy load.


Comprehensive IT Solution Overview
Enterprise Systems
Software used by businesses for operations
Design Thinking
A human-centered approach to problem-solving
Data Centers
Facilities housing IT infrastructure
Hypervisor
Software that creates and manages virtual machines
Cloud Computing
Delivers IT services over the internet
Type 1 Hypervisor
Runs directly on hardware for optimal performance


Design Thinking on Hypervisor
Problem Statement
Traditional systems run one OS per physical server
Leads to:
Underutilization of hardware
High infrastructure & maintenance cost
Increased power consumption
Difficult system management
Final Problem Statement:
"How can we efficiently use a single physical system to run multiple operting systems while ensuring performance, security, isolation, and scalability?
Define Stage
Clearly define the problem
Inefficient use of hardware reseources
High cost of infrastructure
Lack of flexibility in traditional systems
Define Stage
Build the solution
Install Type 1 Hypervisor on physical server
Create multiple virtual machines
Allocate CPU, RAM, storage, network
Architecture
Hardware → Hypervisor • Virtual Machines
Ideate Stage
Possible solutions
Multi-boot Systems
Containerization
Virtualization
Best Solution: Hypervisor basted
Hypervisor-based virtualization
Innovation: Type 1 Hypervisor runs hardware
No host OS required
Supports multiple virti. satems
Define Stage
Clearly define the problem
Inefficient use of hardware resources
High cost of infrastructure
Lack of flexibility in tradtional systems
Prototype Stage
Test Stage
Install Type 1 Hypervisor on physical server
Create multiple virtual machines
Allocate CPU, RAM, storage, network
Improve Optimize resource allocation and scheduling