Virtualization

- Hypervisors
- Operating system virtualization
- Application Virtualization
- Desktop virtualization

Hypervisors

- Physical hosts
- They run virtual machines
- Increase server density in the data center
- Can be clustered to provide virtual machine high availability
- Hypervisor and VMs can be backed up

Application Virtualization

- App files are not installed on the host machine but app runs on the host machine
- Allows multiple versions of the same app to run
- Allows legacy apps to run
- Machine imaging consumes less disk space
- Not the same as app containers

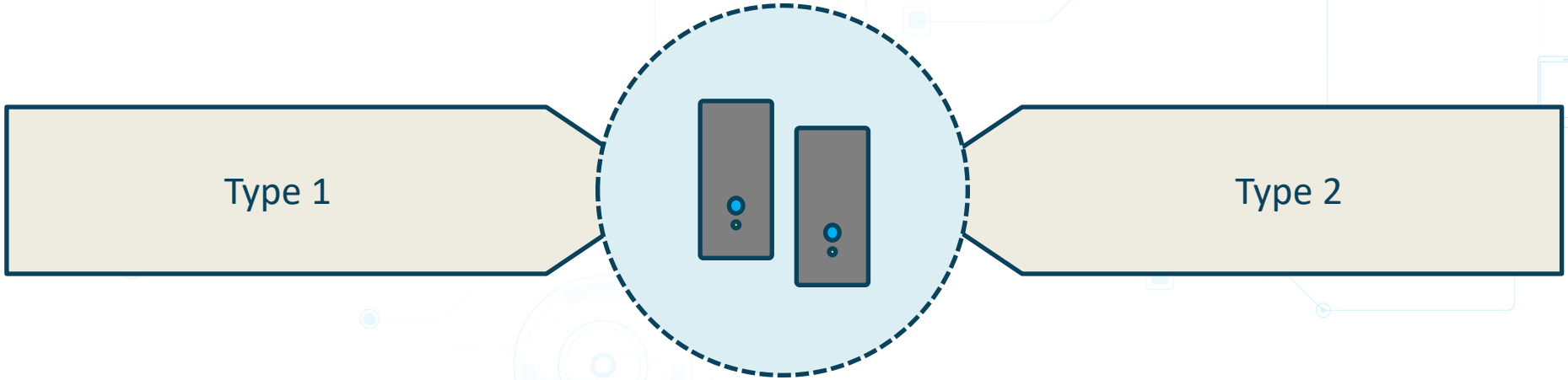
Operating System Virtualization

- Virtual machine
  - Virtual hardware
- OS runs within the VM
- Better physical hardware utilization
- Many VMs can run on a single hypervisor

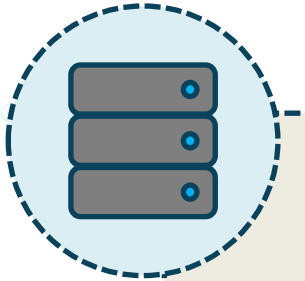
Desktop Virtualization

- Desktop environments run on a central server
- Thin clients are used to access the virtual desktop
- Centralization means more control, easier application of updates, and easier backups

Hypervisors



Type 1 Hypervisor



- Runs directly on physical hardware
- It is the OS
- Also called a *bare metal* hypervisor
- Better performance than Type 2
- Better stability than Type 2
- Enterprise use

Type 2 Hypervisor

- Runs as an app within an OS
- OS performance issues can affect VMs
- Small scale use
  - Developer station
  - IT technician stations

Hypervisor Security

- Use a Type 1 hypervisor
- Do not install any other software
- Apply updates
- Keep in a locked room
- Place on a dedicated, protected network
- Configure hypervisor clustering
- Encrypt VMs

Virtual Machine Security

- Apply updates
- Disable unnecessary items
- Firewall, malware scanner, and backups
- Consider the virtual switch(es) the VM connects to
- Set VM resource reservations

Cloud Computing Types

- Cloud characteristics
  - Metered usage
  - Resource pooling
  - Access from anywhere
  - Elasticity
  - Self-provisioned

Public Cloud

- Accessible to Internet users
- Worldwide geographic locations
- Cloud provider hardware responsibility
- Service Level Agreement (SLA)

Private Cloud

- Accessible only to a single organization
- Organization-owned hardware infrastructure
- Still adheres to cloud characteristics
- E.g. self-provisioned rapid elasticity of pooled IT resources
- Often used for departmental chargeback

Hybrid Cloud

- Best of both worlds
  - On-premises
  - Cloud
- Migration of on-premises systems and data takes time
- Examples
  - Data stored on-premises and in the cloud
  - Hardware VPN linking on-premises to cloud VPN

Community Cloud

- Same needs across multiple tenants
- Requirements
  - Sensitive data encryption
  - Regulatory compliance
  - Managed by US persons
  - FedRAMP compliant
    - Federal risk and authorization management program

Cloud Service Models

- Correlates to the type of cloud service
  - Virtual machines
  - Databases
  - Web site
  - Storage

Infrastructure as a Service (IaaS)

- Virtual machines
- Cloud storage
- Cloud virtual networks

Platform as a Service (PaaS)

- Normally applied to developers
- Databases
- Search facilities
- Cluster-based processing
- Programming components
  - APIs
  - Message queues

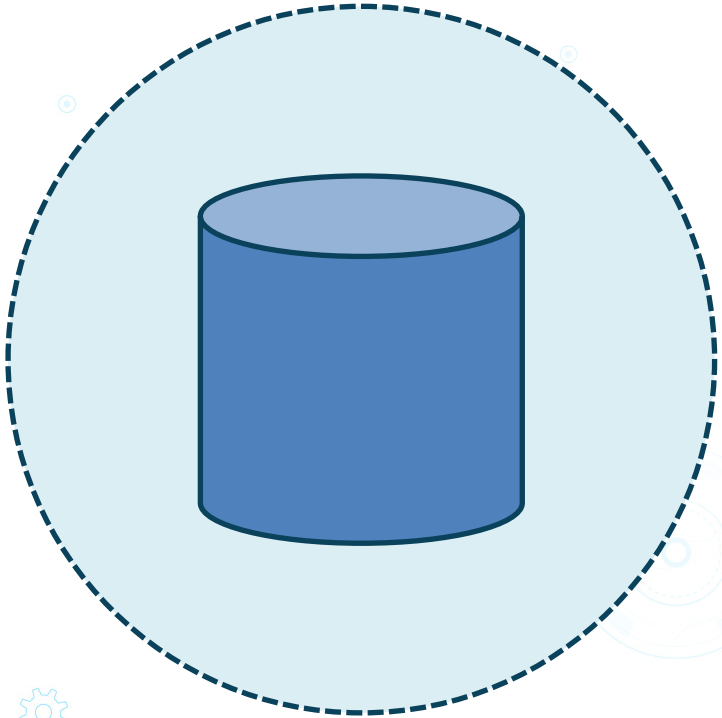
Software as a Service (SaaS)

- End-user productivity software
- Cloud storage interface tools
- Cloud e-mail
- Cloud office productivity

Common Cloud Service Offerings

- Map cloud solutions to business needs
- Your compliance with
  - Laws
  - Regulations
  - Contractual obligations
- Cloud provider compliance
  - HIPAA
  - GDPR
  - PCI DSS

Common Cloud Service Offerings



- Storage
  - Encryption of data at rest
  - Data replication to other regions
  - Content Delivery Network (CDN)
  - Data wiping techniques
  - Data backup and archiving
    - Retention policies

Common Cloud Service Offerings

- Virtual machines (VMs)
  - Image used
  - Instance type/sizing
- IP addressing
- Network placement

Common Cloud Service Offerings

- Databases
- Firewalls
- Developer - cloud APIs, function hosting, message queues, and IoT

In this exercise, you will

- Distinguish the difference between Type 1 and Type 2 hypervisors and their risks
- Explain risks introduced with cloud computing adoption
- Define the purpose of a private cloud
- Explain the benefit of using a cloud “jump box”

Hypervisors

- Type 1
  - Bare-metal
  - It is the OS and runs directly on hardware
  - Network isolation for management interfaces
- Type 2
  - Runs within an existing operating system as an app
  - OS instability can affect VMs

Cloud Computing Risks

- Vendor lock-in
- Cloud provider going out of business
- Failed Internet connection
- Shared responsibility
  - Provider due diligence with security processes and compliance

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- Accessible only to a single organization
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- Still adheres to cloud characteristics
- E.g. self-provisioned rapid elasticity of pooled IT resources
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Jump Box

- Connectivity point from the Internet
- From the jump box, access to other hosts is possible