What is Cloud

Cloud

- Cloud is an operational model
  - Subscription economy
    - Pay for what you need
  - Enabling businesses to focus on their core competencies
    - Automation of routine tasks
- Changing IT operations
  - Procurement
  - Management

Workloads are moving to Cloud

- Traditional compute workloads are decreasing
  - 52% today to 37% in 2 years
- Private cloud compute workloads are rapidly increasing
  - 35% now to 47% in 2 years
- Public cloud compute workloads are increasing
  - 12% today to 15% in 2 years

Source: Computer World & Triangle research study 2014

What is Cloud

- National Institute of Standard and Technology (NIST) defines cloud:

  - *“Cloud computing is a model for enabling ubiquitous, convenient, **on-demand** network access to a **shared pool** of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be **rapidly provisioned** and released with **minimal management effort** or service provider interaction.”*

Essential Characteristics

- On-demand Self-service
  - User can provision computing resources without human intervention
    - Server time, storage, software resources
- Broadband Network Access
  - Resources can be accessed through public network
    - Workstations, Laptops, Tablets, Mobile Phones

Essential Characteristics

- Resource Pooling
  - Services are pooled to serve multiple consumers using multi-tenant model
  - Physical and virtual resources allocation are dynamic based upon demand
- Rapid Elasticity
  - Resources can be elastically provisioned and related to enable scaling
  - Consumer gets virtually unlimited resources
- Measured Services
  - Automatically optimize and control resources
  - Resource utilization can be monitored, reported and controlled

What does all this mean

- Get resources when you want (rapidly)
- Grow or shrink resources on demand
- Keep tabs on your cost
- Easily accessible
- Retail Store during Christmas
  - Scale resources with demand and return after the season
  - No need to setup permanent resources

Cloud Service Types, Deployment, and Ownership Model

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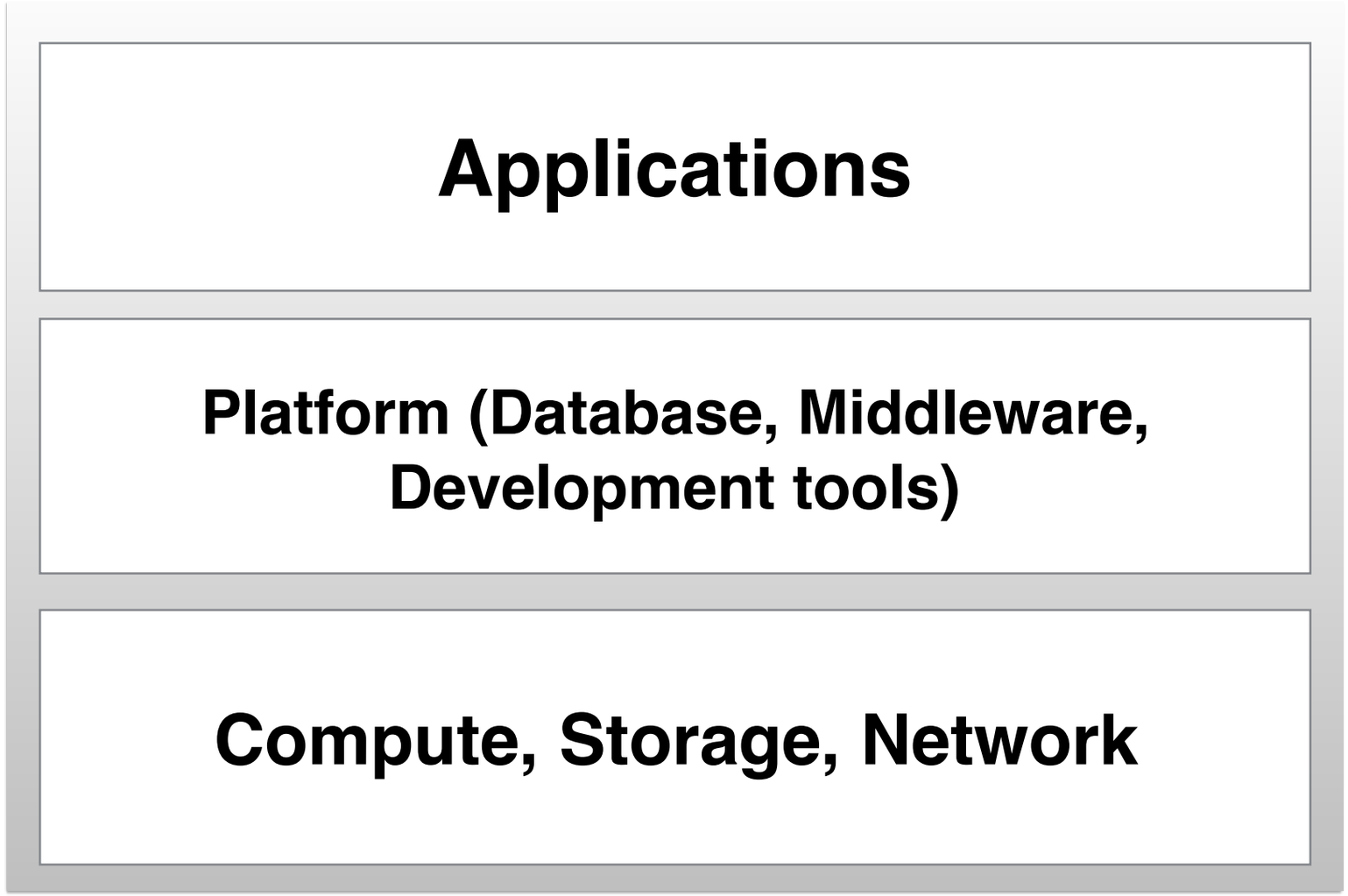
How are Cloud Services Provided?

Resources

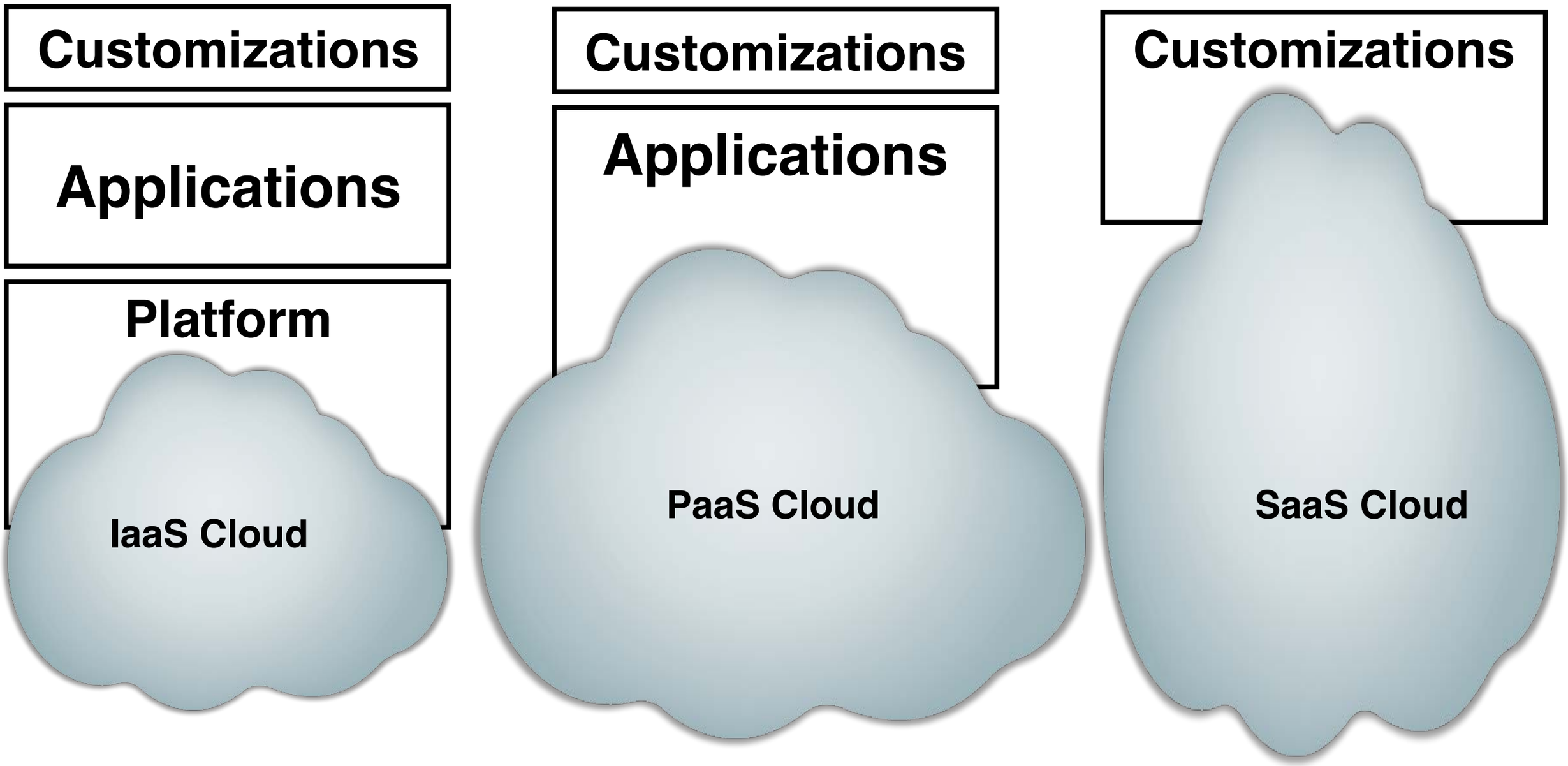
- Resources in 3 buckets



Service Models

- Cloud services are provided to users in many forms
- NIST defines at least 3 forms:

Service Models



Infrastructure as a Service (IaaS)

- Provides users functionality to provision computing and storage resources
- Resources available as Virtual images
- Cloud users have capability to manage these virtual resources
- Cloud Provider is responsible for managing underlying technology
    - Hardware, operating system, network.
- Resources are charged as “pay-per-use” basis
    - Subscription economy
- User get full visibility and control of resource usage

Platform as a Service (PaaS)

- Builds on top of the Infrastructure as a service
- Provides users:
  - Development tools, Software Libraries, Databases,
  - Middleware
- Enable users to quickly develop and deploy applications
- Cloud provider manages:
  - Hardware, OS, Network, Storage, Middleware

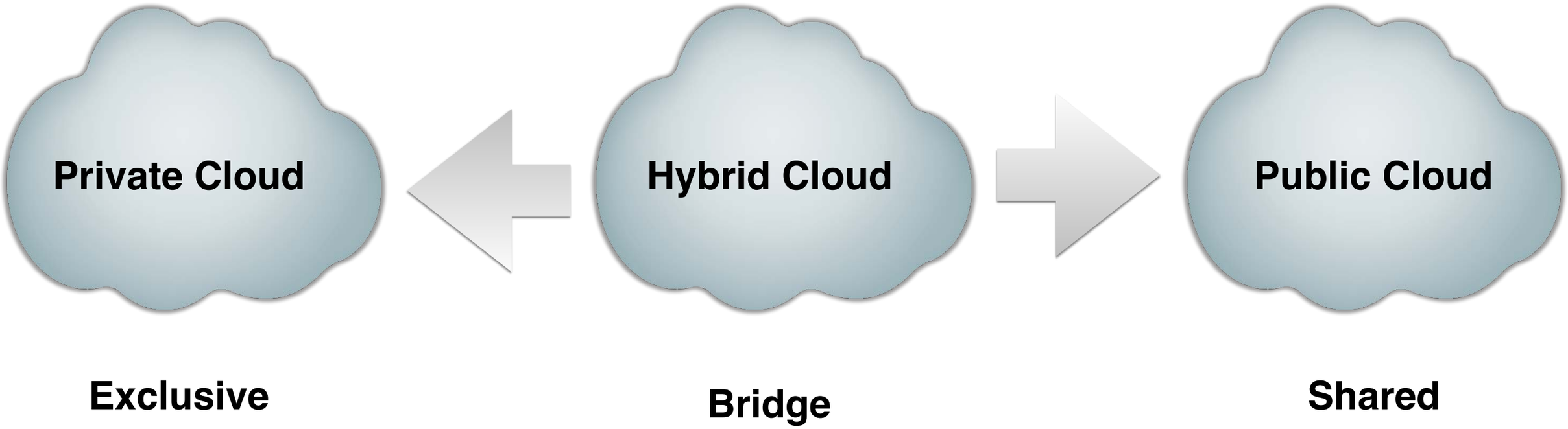
Software as a Service (SaaS)

- Builds on top of the Platform as a service
- Provides a complete software application for use
- Application is accessed from anywhere over the internet
- Cloud provider manages everything including the:
  - Application, and Data
  - User is completely unaware of details of underlying architecture

How is Cloud Deployed?

Deployment

- Private, Public, & Hybrid



Private Cloud

- Cloud infrastructure is dedicated for a single organization.
- Infrastructure can be setup on-premise or off-premise
- Internal or external cloud management
- Provides complete control

Public Cloud

- Cloud services are shared
- Cloud services are provided by 3rd party
- Operational Expense
  - Little to no upfront investment.

Hybrid Cloud

- Combines services of private and public clouds
- Take advantage of public cloud while controlling mission-critical applications
- Cloud bursting — overdraft for peak loads
- Development/Test & Production resource distributions

Compute, Storage, and Network

Corporate Infrastructure Challenges

- Isolated and Inelastic Pools of Compute, Storage, and Network within Data Centers
- Lack of Elastic Infrastructure drives Over-Provisioned Hardware with limited efficiency in utilization
- Highly Heterogeneous Hardware & Software Infrastructure
- Multiple Forms of Compute, Storage & Network Equipment with limited standardization
- Fragmented Infrastructure Automation
- Limited Virtualization of Storage and Network even if Servers are virtualized
- Result: Inefficient Infrastructure which hinders projects, is complex to use, and expensive to operate

What customers looking for?

- Software Defined Virtualized Data Center in the Cloud
- Broad range of cost effective, highly elastic Compute, Storage, and Network Resources
- Ability to migrate their existing Software without needing to re-write them
- Provide deep control of infrastructure along with security, governance, and performance

Cloud Infrastructure

- Compute
- Storage
- Networking

Compute

- Elastic Compute — Shared
- Dedicated Compute
- Bare Metal

Note: Each vendor provides different services and names and packages also vary.

Elastic Compute

- Customer gets virtual machine of selected operating system
    - Shared amongst many
- VM is configured based upon customer needs
    - Core, storage, etc.
- Shared resource that can grow on demand
    - Elasticity — Accommodate growth or short-term spikes
    - Auto-scaling
- Multiple Os — Linux, Windows, Solaris, etc.
- Self-service UI to start/stop instances
- Provided by almost all providers

Dedicated Compute

- Some may not want to share hardware resources
- Fully isolated compute service
  - Dedicated physical servers and cores
  - Dedicated network
- No noisy neighbor
- Helps with compliance requirements
  - Not sharing hardware with others
- Virtual machines work the same way as in Elastic Compute
- Elasticity is very limited

Bare Metal

- Forrester defines Bare Metal cloud service as:

“IaaS offerings that deliver dedicated physical infrastructure that does not include virtualization and is provisioned via the same type of cloud interface with the common characteristics of VM-based cloud offerings, including on-demand access, unlimited scale, and detailed resource accounting.”

- Not every cloud provider provides this service

Storage

- Different tiers of storage options available
- Block Storage
  - Persistent storage accessible by VM instances
    - High Performance
- Object Storage
  - Backup applications, Database, user files, etc.

Storage

- Archive
  - Long-Term inexpensive option for storing data
  - Usually costs more to retrieve the data
  - Eliminate the need for offsite tape backups
- Highly available — usually 99.9999% or higher
- Secure
  - Some provide data transfer using SSL
- Data redundantly stored across multiple facilities & devices

Network

- How to connect to the public cloud?
- Having resources in the cloud is good but also need good connection
- Each provide gives multiple connectivity options
  - Public Network
  - VPN
  - Direct Connection

Data, Integration, and App Development

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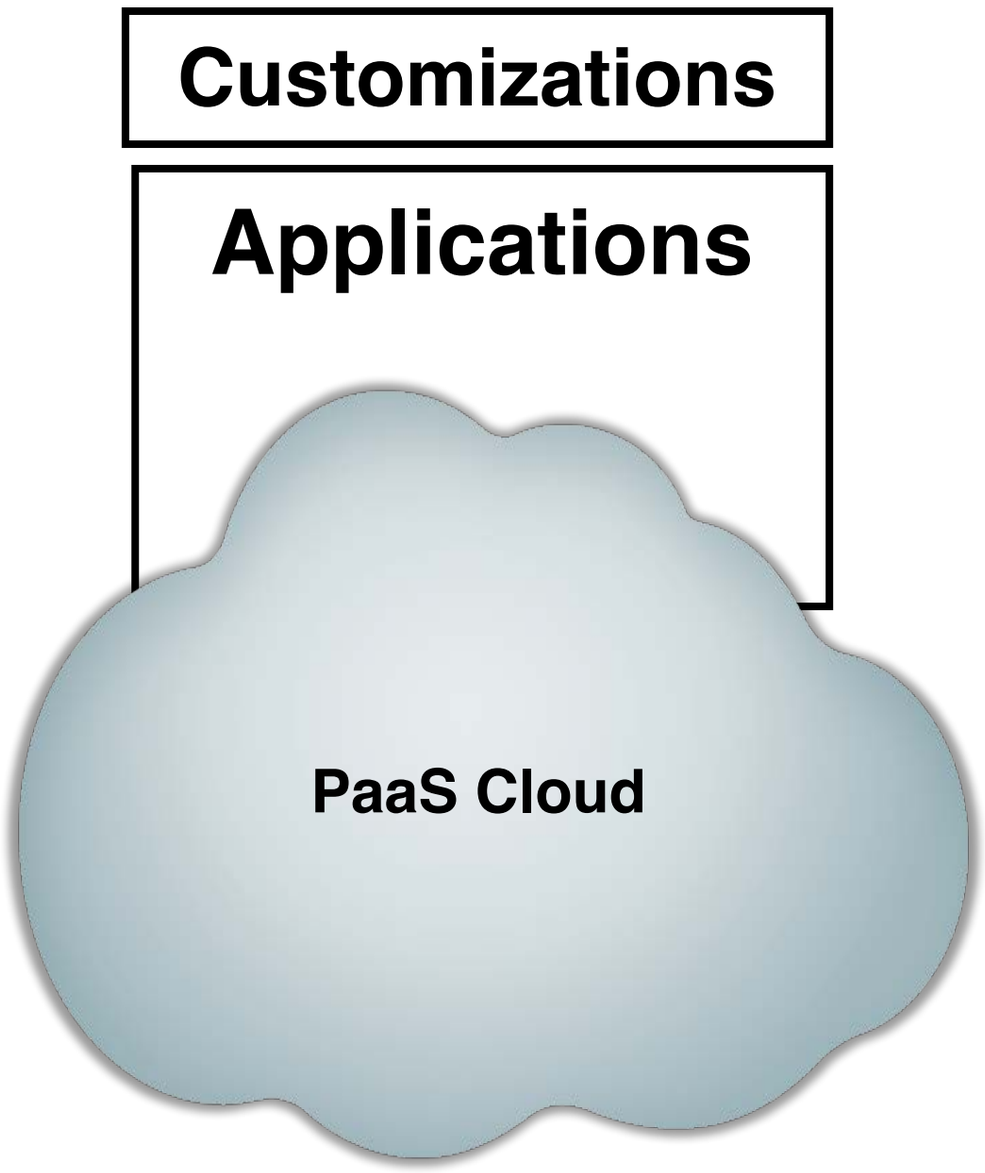
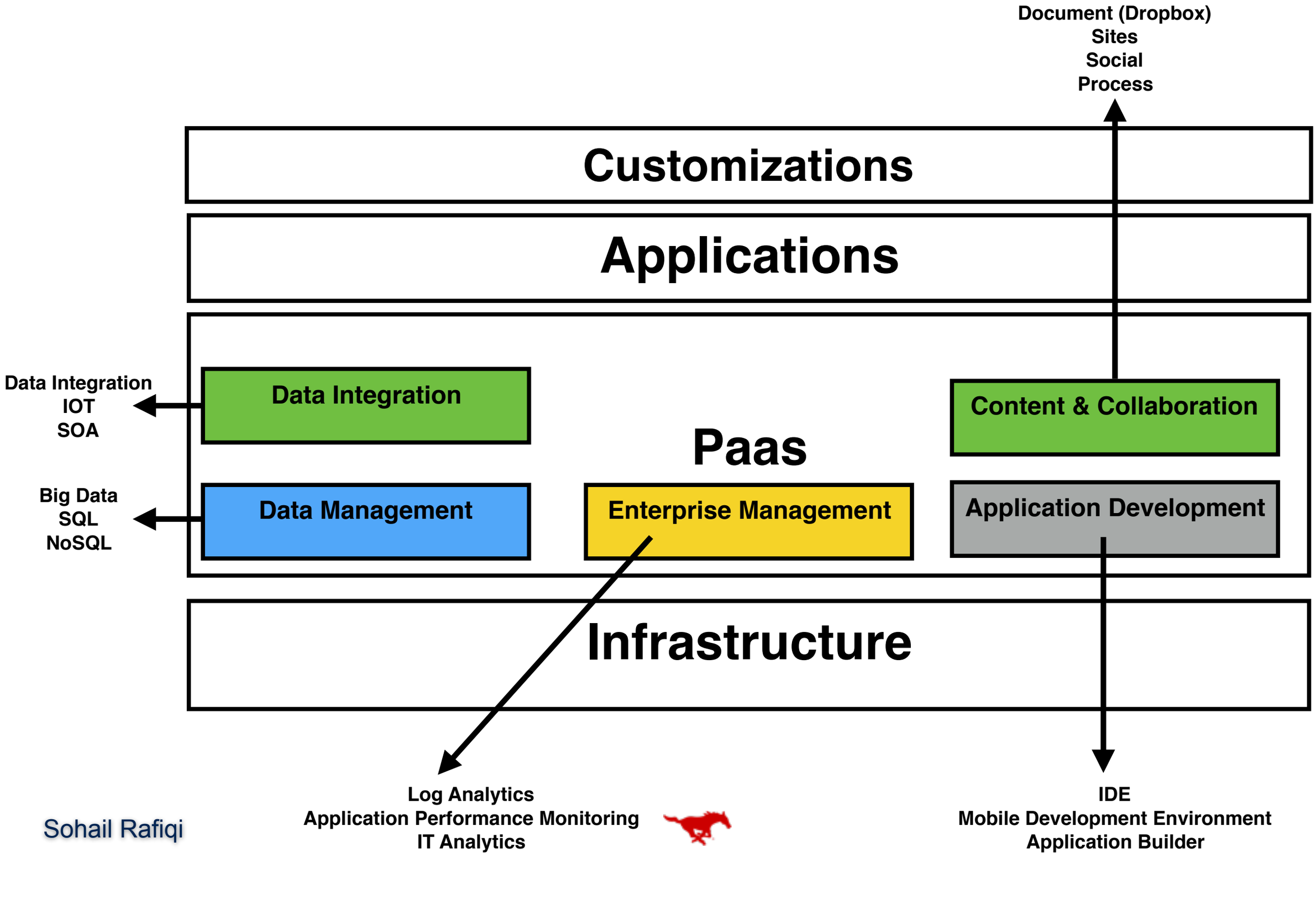
Service Models



Platform as a Service



Sohail Rafiqi

Database Services

- Cloud DB Service provides relational and NoSQL DB
- Relieves app developers of administration tasks
- Popular RDBMS:
  - SQL Server
  - MySQL
  - Oracle

Features

- Scalability
  - Provision as much compute and storage resource required for application workload
  - Provisioned capacity can be scaled-up and down
- Reliability
  - High availability is provided by Cloud providers
  - Including database backup/restore utilities

Features

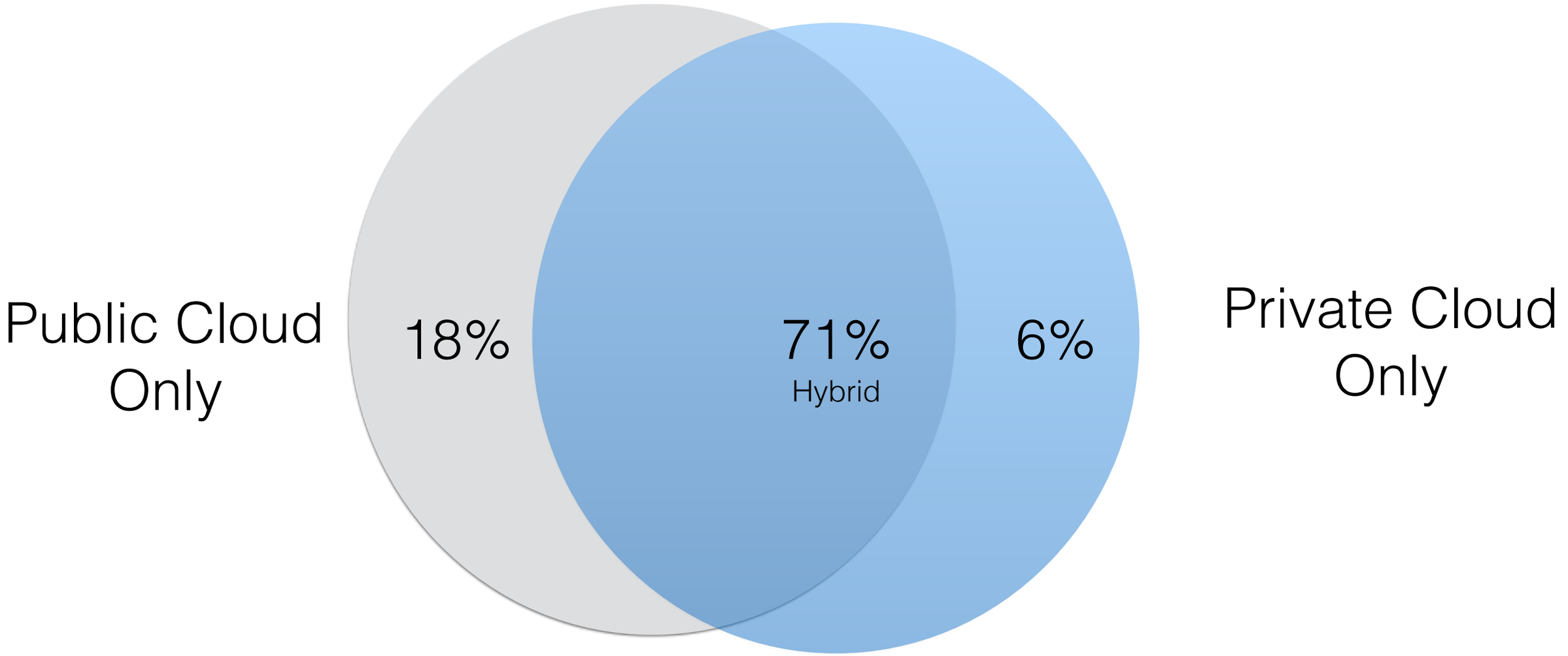
- Security
  - Cloud provider handles data access, DOS, etc.
  - Some provides encryption at rest and in-transit.
- Performance
  - User can easily monitor and manage performance

Cloud Strategy, Adoption, Needs, Challenges

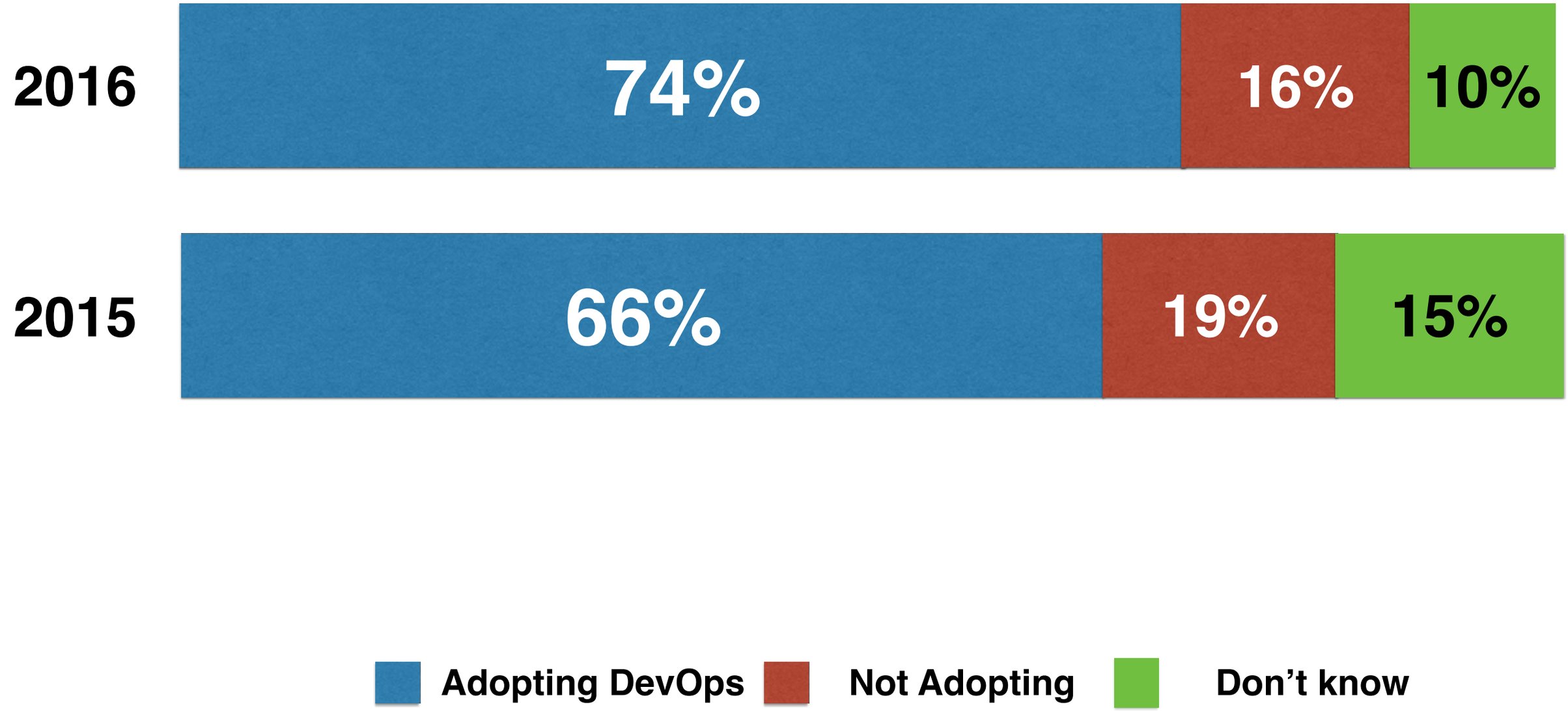
Enterprise Cloud Strategy

- Survey revealed (1000+ Employees) plans for next 3 years:
  - 3% has no plans for cloud
  - 5% — Single private cloud
  - 10% — Single public Cloud
  - 82% of enterprises are forming multi-cloud strategy
    - 14% —Multiple Private
    - 13% — Multiple Public Cloud
      - ✓ What is Multi-cloud?
        - Get the best of breed from different providers
        - Each has strength
      - ✓ Managing gets complicated
    - 55% Hybrid Cloud

Current usage of Cloud



DevOps Adoption Up in 2016



Why Cloud

- Deliver services faster, cheaper and lower risk
  - Agility — Faster deployment
  - Cost — Lower Total Cost of Ownership
  - Risk — Service Level Compliance

Why Cloud

- Trade Capital Expense for Variable Expense
    - Minimum to no cost to start
    - Pay as you go model (subscription)
- Easy to plan capacity
    - Scale on need basis
- Enable focusing on core business
    - Minimize time on keeping the lights on
- Economies of scale
    - Enhance resource utilization.