Welcome to:

Cloud and Distributed Computing in Cognitive Computing, Business Implications of Cognitive Computing

Unit objectives

After completing this unit, you should be able to:

- Understand the concepts of leveraging distributed computing for shared resources
- Learn about cloud services
- Gain knowledge on cloud computing models
- Gain an insight into virtualization and software-defined environment
- Understand the concept of security and governance
- Learn about data integration and management in the cloud
- Gain knowledge on cognitive services on cloud

Leveraging distributed computing for shared resources

- Distributed computing is a model in which components of a software system are shared among multiple computers to improve efficiency and performance.

- In the enterprise, distributed computing has often meant putting various steps in business processes at the most efficient places in a network of computers. For example, in the typical distribution using the 3-tier model, user interface processing is performed in the PC at the user's location, business processing is done in a remote computer, and database access and processing is conducted in another computer that provides centralized access for many business processes. Typically, this kind of distributed computing uses the client/server communications model.

- The Distributed Computing Environment (DCE) is a widely-used industry standard that supports this kind of distributed computing. On the Internet, third-party service providers now offer some generalized services that fit into this model.

Cloud services: Cognitive computing foundation (1 of 2)

- What is cloud computing?

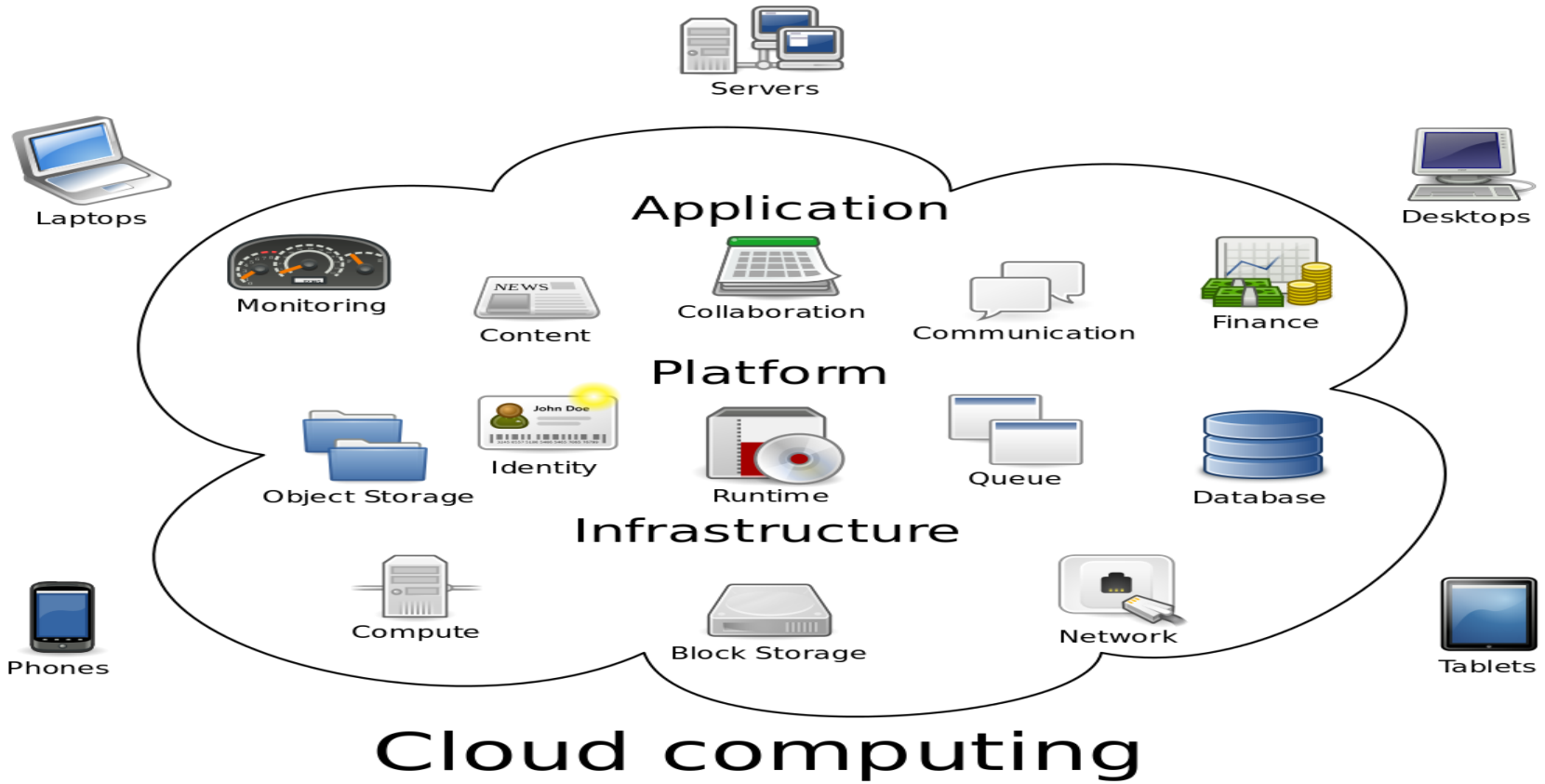

Figure: Cloud Computing framework

Source: https://images.app.goo.gl/YHneFLuNCzCo2Guq5

Cloud services: Cognitive computing foundation (2 of 3)

- Characteristics of cloud computing from NIST.

Cloud Characteristic	Description	Application
On-demand self-service	For automatically providing a consumer with provisioning capabilities as needed.	Server, Time, Network and Storage
Broad network access	For heterogeneous thin or thick client platforms.	Smartphones, tablets, PCs, wide range of locations
Resource pooling	The provider's computing resources are pooled to serve multiple consumers using a multi-tenant model.	Physical and virtual resources with dynamic provisioning
Rapid elasticity	Capabilities can be elastically provisioned and released, in some cases automatically, to scale rapidly outward and inward with demand.	Adding or removing nodes, servers, resource or instances

Figure: Cloud Computing characteristics

Source: https://images.app.goo.gl/wCaqa24LQWysbn9A8

Cloud services: Cognitive computing foundation (2 of 2)

- ISO 17788 six necessary features of cloud computing.
  - On demand self-service
  - Broad network access
  - Resource pooling
  - Rapid Elasticity
  - Measured service
  - Multi-tenancy

Cloud computing models (1 of 2)

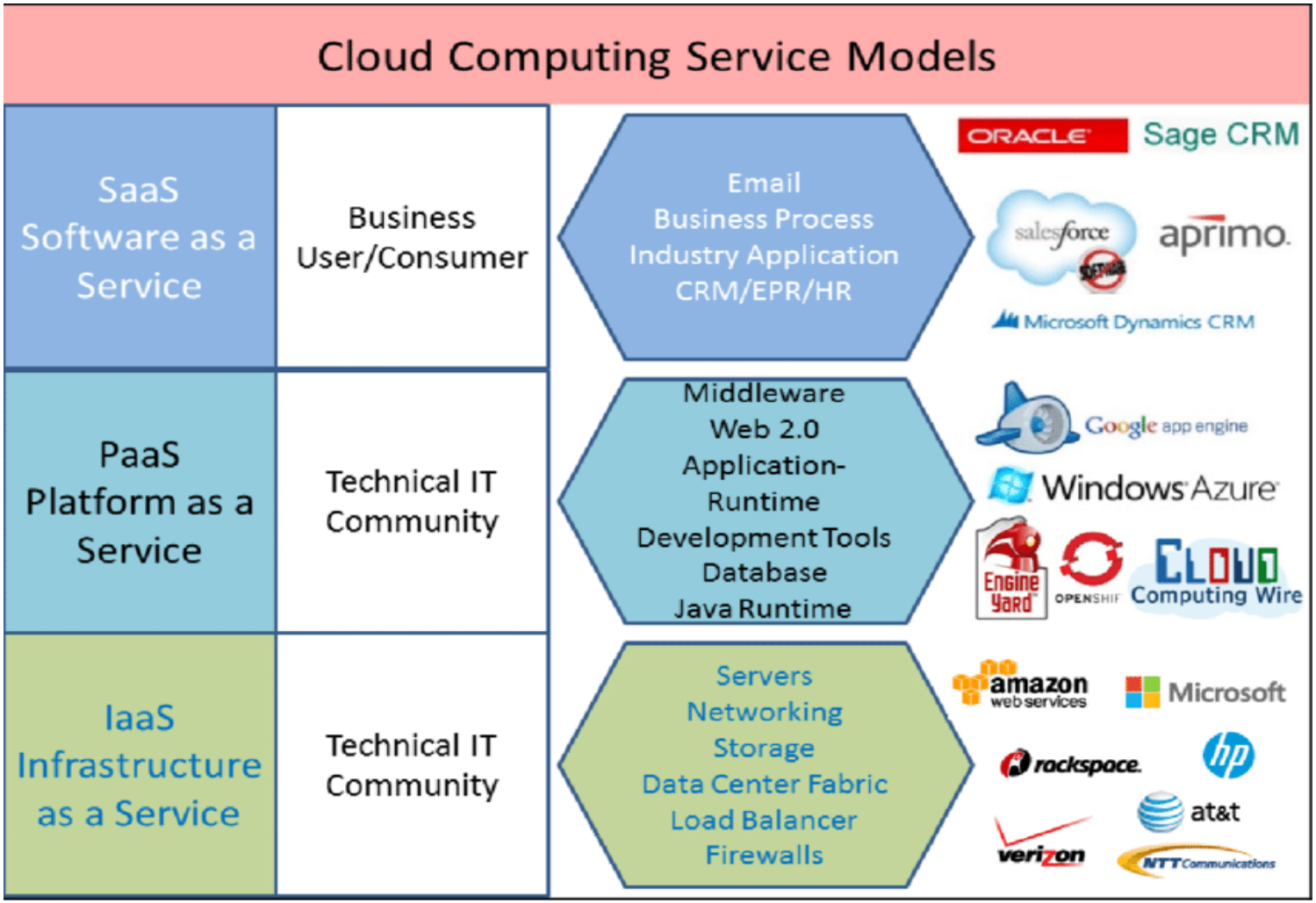

Figure: Cloud Computing Models

Source: https://images.app.goo.gl/Ve3Hwr2p5YJtk7Zq6

Cloud computing models (2 of 4)

- IaaS (Infrastructure as A Service).

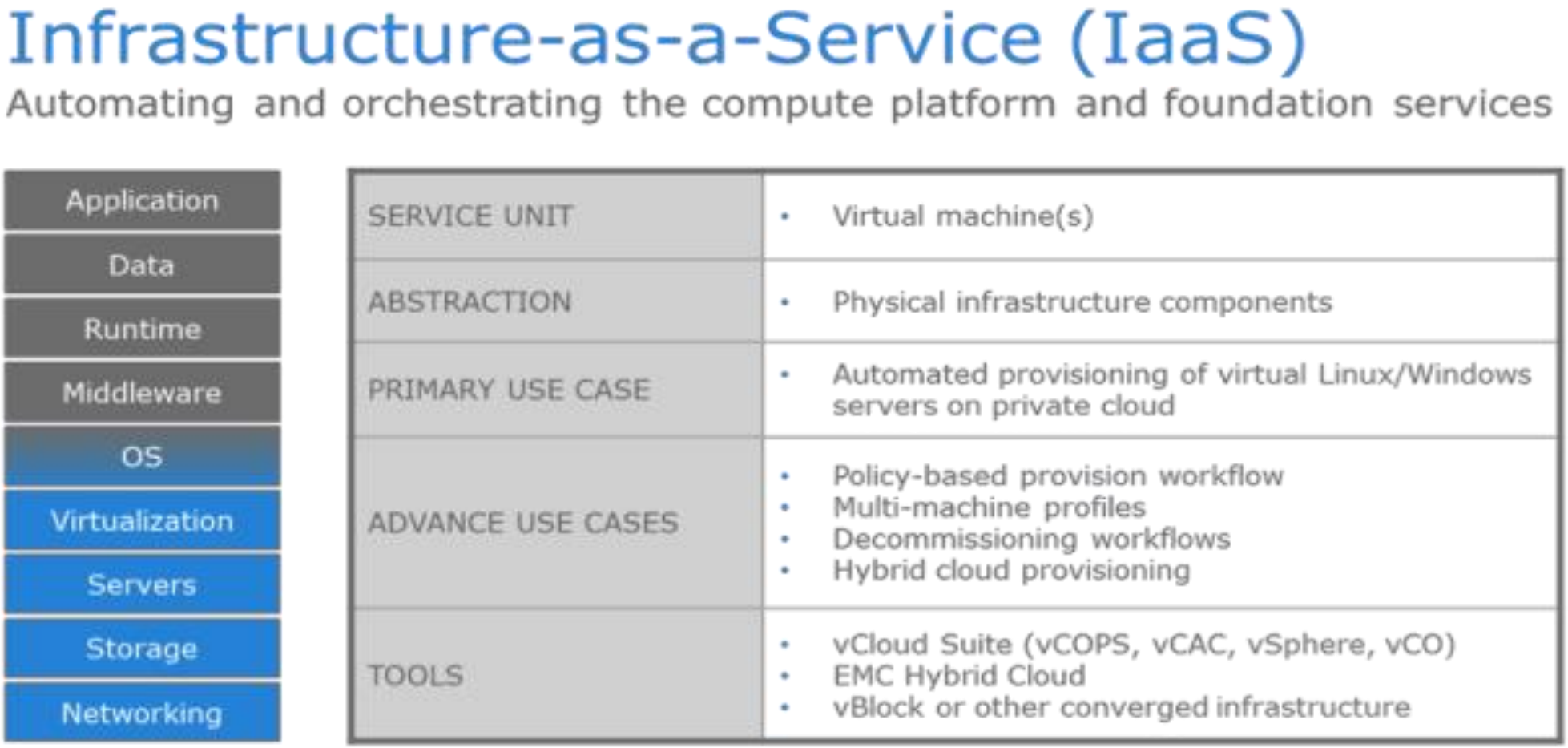

Figure: IaaS

Source: https://images.app.goo.gl/GDzqG4F9pjscen1Q6

Cloud computing models (2 of 2)

- PaaS (Platform as A Service).

Platform-as-a-Service (PaaS)

Cloud-enabled automation and orchestration of app services and containers

SERVICE UNIT	• Application services (e.g. Messaging) and containers (e.g. Redhat, tcServer, Weblogic)
ABSTRACTION	• Physical infrastructure, OS, Middleware, and Runtime are abstracted
PRIMARY USE CASE	• Provide standard application and containers to developers and testers • Dynamic management of infrastructure resources supporting horizontal scaling and bursting capabilities
ADVANCE USE CASES	• Automated testing (performance, functional, security, compliance, etc.) • Integration with continuous integration and deployment systems
TOOLS	• Cloud Foundry • vSphere

Figure: PaaS

Source: https://infocus.delltechnologies.com/wp-content/uploads/2014/09/PaaS-BD.png

Cloud computing models (4 of 4)

- SaaS (Software as A Service).

Software as a service, or SaaS, is a cloud computing solution companies can license and access via the Internet, where a third-party provider hosts and manages all hardware and software. A basic example is web-based email, like Gmail, but SaaS can range from productivity applications to customer relationship management tools to content delivery networks.

When considering a SaaS application, it's important to consider all implications – licensing fees, maintenance and upgrade timing, and options for customization to meet your business needs.

Figure: SaaS

Source: https://images.app.goo.gl/ko4GFmZHnUtkHzXZ7

Example of cloud model

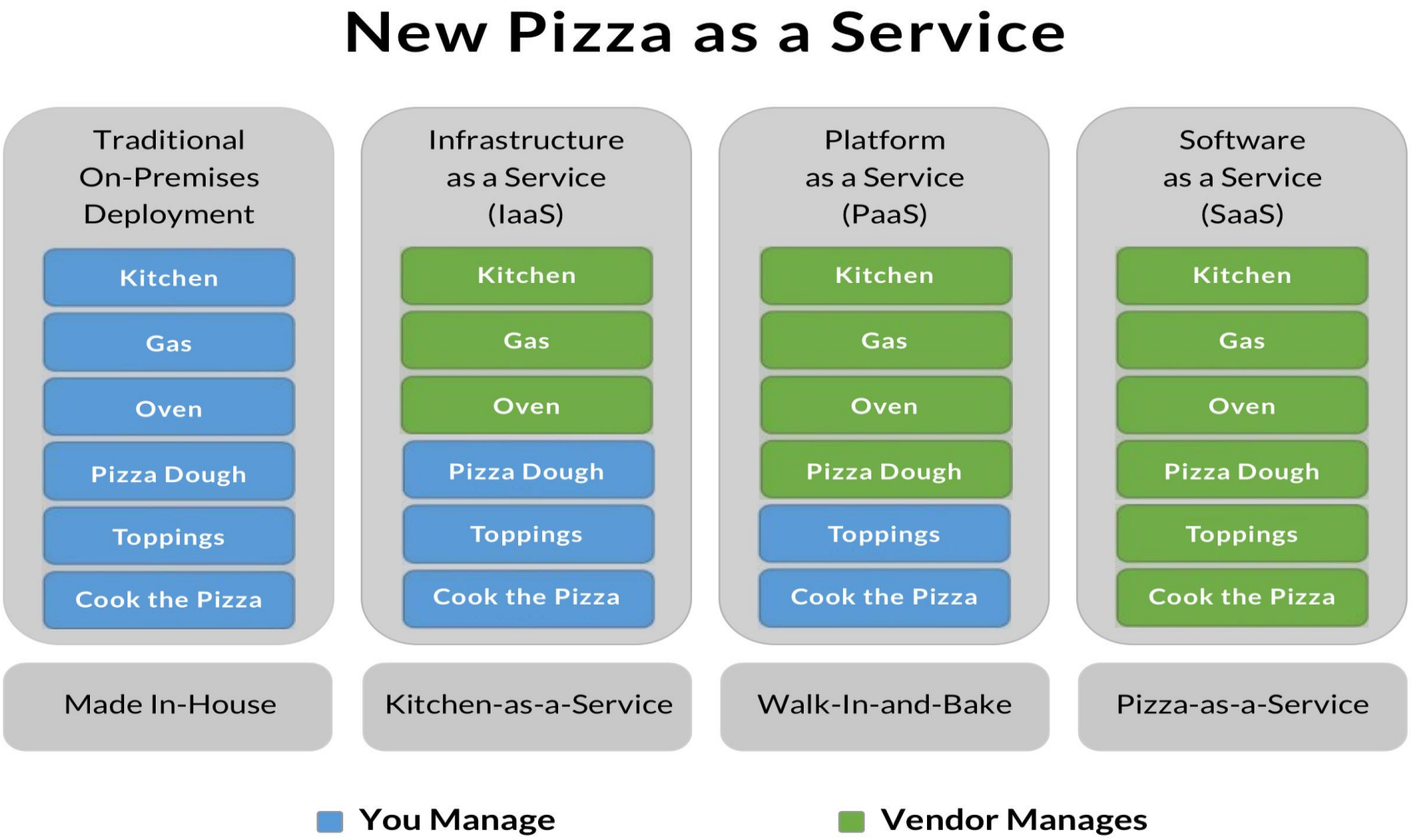

Figure: Pizza as a service overview

Source: https://images.app.goo.gl/iZo1ESkXdd8JkVUJ8

Difference between IaaS and PaaS

Type of Cloud Service	*What it Offers*	*Use This Service If:*	*Leading Service Providers*
Infrastructure as a Service (IaaS)	• Computing infrastructure, including servers, storage, platform virtualization environments, network connectivity, and operating systems • Hardware and data center maintained by service provider while resources on machine, such as memory and CPU, are left to management of user • Flexibility	• Upfront capital or space for infrastructure is unavailable • Maintaining control over resources is viable and beneficial for the project	Amazon EC2, Windows Azure, Rackspace, Google Compute Engine, Digital Ocean, Linode
Platform as a Service (PaaS)	• Services to develop, test, deploy, host, and maintain applications • CPU, memory usage, infrastructure, operating system, programming language execution environment, database, web server, and security maintained by service provider • Access for multiple concurrent users to the same development application • Support for development team collaboration • Ability to the use software components controlled by a third-party • Convenience	• Customizing hardware and software is not necessary for application development • Decreasing time-to-market is a priority	AWS Elastic Beanstalk, Windows Azure, Heroku, Salesforce1, Google App Engine, Apache Stratos, EngineYard

Figure: IaaS and PaaS comparison

Source: https://images.app.goo.gl/gP96rrt9SMxzA5Es6

Types of cloud deployment models

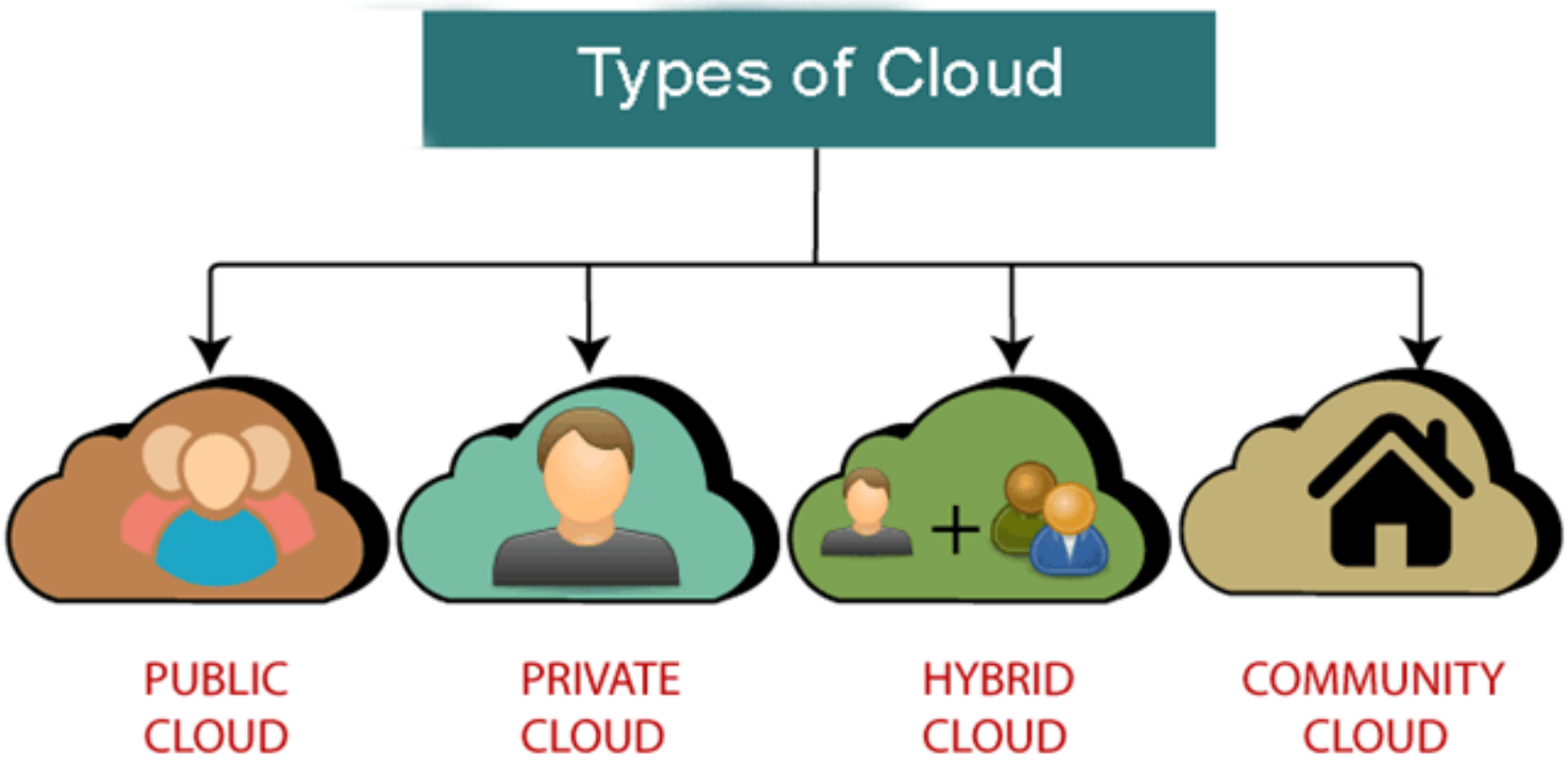

Figure: Cloud Types

Source: https://images.app.goo.gl/h39wsV9rt5pSow3W9

Types of cloud deployment models (2 of 5)

- A private cloud consists of computing resources used exclusively by one business or organization. The private cloud can be physically located at your organization's on-site datacenter or it can be hosted by a third-party service provider. But in a private cloud, the services and infrastructure are always maintained on a private network and the hardware and software are dedicated solely to your organization. In this way, a private cloud can make it easier for an organization to customize its resources to meet specific IT requirements.

- Private clouds are often used by government agencies, financial institutions, any other mid- to large-size organizations with business-critical operations seeking enhanced control over their environment.

Types of cloud deployment models (3 of 5)

Public cloud

- Public clouds are the most common way of deploying cloud computing. The cloud resources (like servers and storage) are owned and operated by a third-party cloud service provider and delivered over the Internet. Microsoft Azure , AWS ,IBM cloud are an example of a public cloud. With a public cloud, all hardware. software and other supporting infrastructure is owned and managed by the cloud provider. In a public cloud, you share the same hardware, storage and network devices with other organisations or cloud "tenants."

- You access services and manage your account using a web browser. Public cloud deployments are frequently used to provide web-based email, online office applications, storage and testing and development environments

Types of cloud deployment models (4 of 5)

Hybrid cloud

- Often called "the best of both worlds," hybrid clouds combine on-premises infrastructure, or private clouds, with public clouds so organisations can reap the advantages of both.

- In a hybrid cloud, data and applications can move between private and public clouds for greater flexibility and more deployment options. For instance, you can use the public cloud for high-volume, lower-security needs such as web-based email and the private cloud (or other on-premises infrastructure) for sensitive, business-critical operations like financial reporting.

- In a hybrid cloud, "cloud bursting" is also an option. This is when an application or resource runs in the private cloud until there is a spike in demand (such as seasonal event like online shopping or tax filing), at which point the organization can "burst through" to the public cloud to tap into additional computing resources.

Types of cloud deployment models (5 of 5)

Community cloud.

- Community cloud computing refers to a shared cloud computing service environment that is targeted to a limited set of organizations or employees (such as banks or heads of trading firms).

- The organizing principle for the community will vary, but the members of the community generally share similar security, privacy, performance and compliance requirements. Community members may wish to invoke a mechanism that is often run by themselves (not just the provider) to review those seeking entry into the community.

Difference between cloud deployment models

Difference	Private	Public	Hybrid
Tenancy	Single tenancy: there's only the data of a single organization stored in the cloud.	Multi-tenancy: the data of multiple organizations in stored in a shared environment.	The data stored in the public cloud is usually multi-tenant, which means the data from multiple organizations is stored in a shared environment. The data stored in private cloud is kept private by the organization.
Exposed to the Public	No: only the organization itself can use the private cloud services.	Yes: anyone can use the public cloud services.	The services running on a private cloud can be accessed only the organization's users, while the services running on public cloud can be accessed by anyone.
Data Center Location	Inside the organization's network.	Anywhere on the Internet where the cloud service provider's services are located.	Inside the organization's network for private cloud services as well as anywhere on the Internet for public cloud services.
Cloud Service Management	The organization must have their own administrators managing their private cloud services.	The cloud service provider manages the services, where the organization merely uses them.	The organization itself must manage the private cloud, while the public cloud is managed by the CSP.
Hardware Components	Must be provided by the organization itself, which has to buy physical servers to build the private cloud on.	The CSP provides all the hardware and ensures it's working at all times.	The organization must provide hardware for the private cloud, while the hardware of CSP is used for public cloud services.
Expenses	Can be quite expensive, since the hardware, applications and network have to be provided and managed by the organization itself.	The CSP has to provide the hardware, set-up the application and provide the network accessibility according to the SLA.	The private cloud services must be provided by the organization, including the hardware, applications and network, while the CSP manages the public cloud services.

Figure: Difference between Cloud deployment models

Source: https://blog.higcom/enterprise-collaboration/whats-difference-public-private-hybrid-cloudhq.

What is a multi-cloud model?

- Multi-cloud is the use of two or more cloud computing services from any number of different cloud vendors.

- A multi-cloud environment could be all-private, all-public or a combination of both. Companies use multi-cloud environments to distribute computing resources and minimize the risk of downtime and data loss.

- They can also increase the computing power and storage available to a business. Innovations in the cloud in recent years have resulted in a move from single-user private clouds to multi-tenant public clouds and hybrid clouds, a heterogeneous environment that leverages different infrastructure environments like the private and public cloud.

- Vendors:
  - AWS | Google Cloud Platform | IBM Cloud | Microsoft Azure | Openstack (private cloud) | Rackspace | VMware Cloud

Hybrid cloud vs multi-cloud: Which one is right?

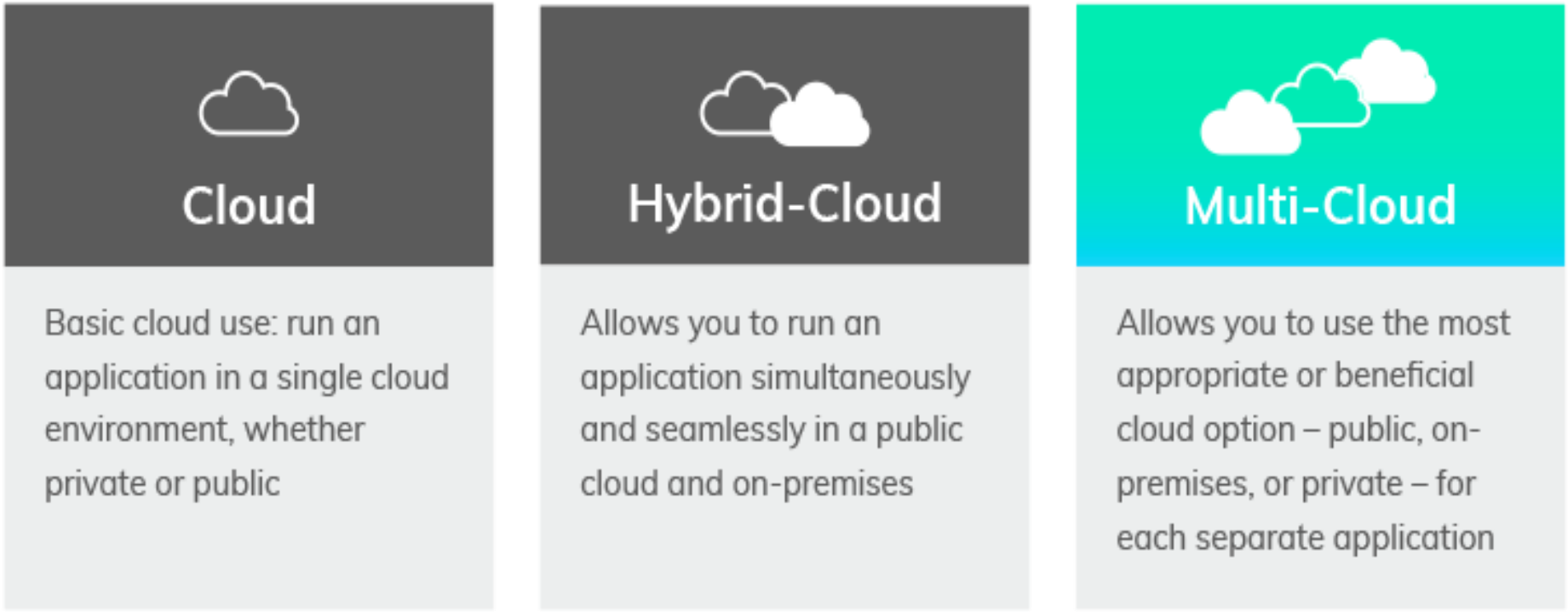

Figure: Hybrid and Multicloud model

Source: https://images.app.goo.gl/3AnqvXZVYyhnFtTs6

Applying cloud computing to clinical research

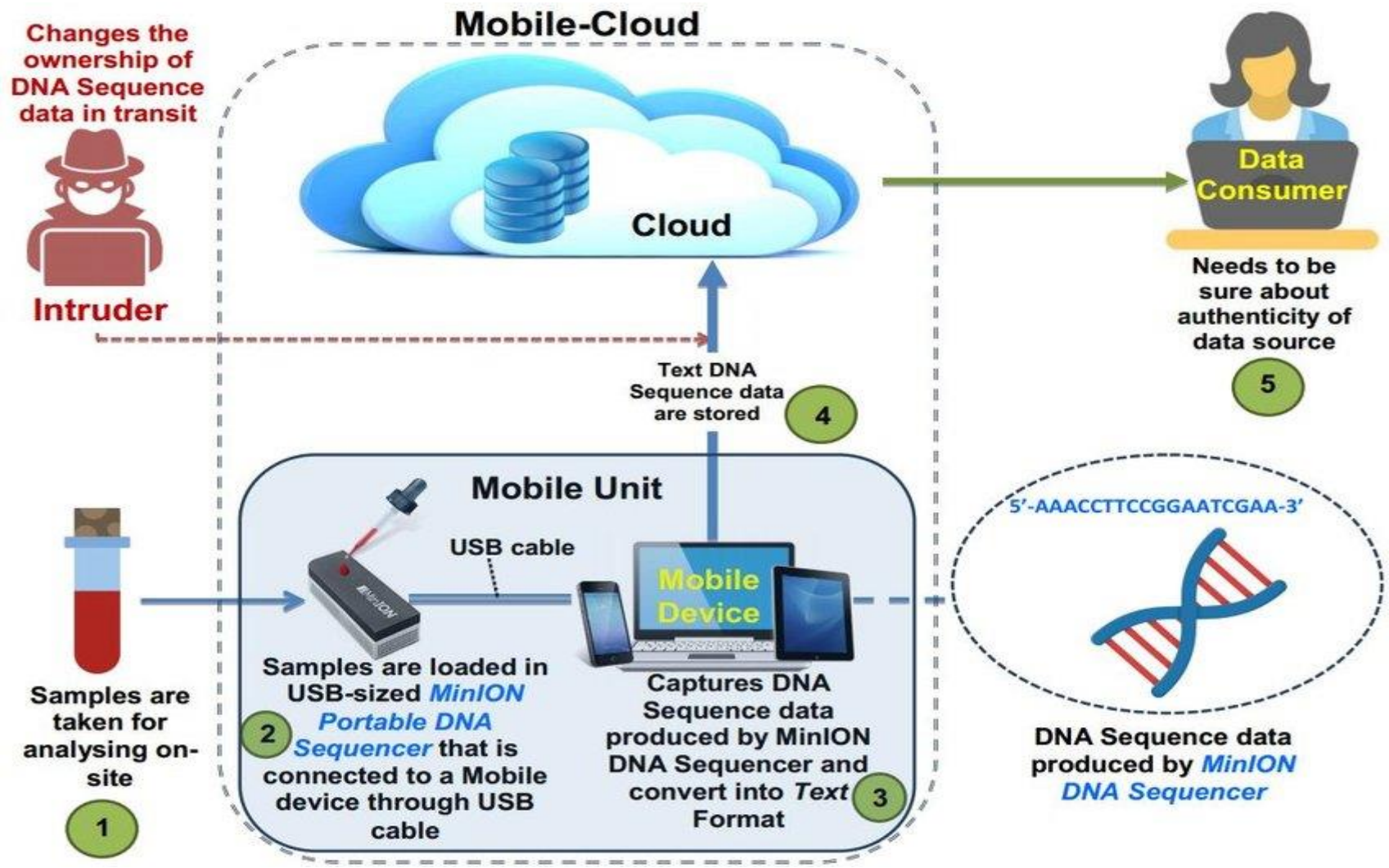

Figure: Cloud computing in Healthcare

Source: https://images.app.goo.gl/e9du9o5vdeQDw6D49

Self evaluation: Exercise 15

- To continue with the training, after learning the various steps involved in cognitive analytics and cloud operations, it is instructed to utilize the concepts of Genetic Algorithms to perform the following activity.

- You are instructed to write the following activities using Python code.

- Exercise 15: Cognitive Genetic Algorithms

Delivery models of the cloud (1 of 2)

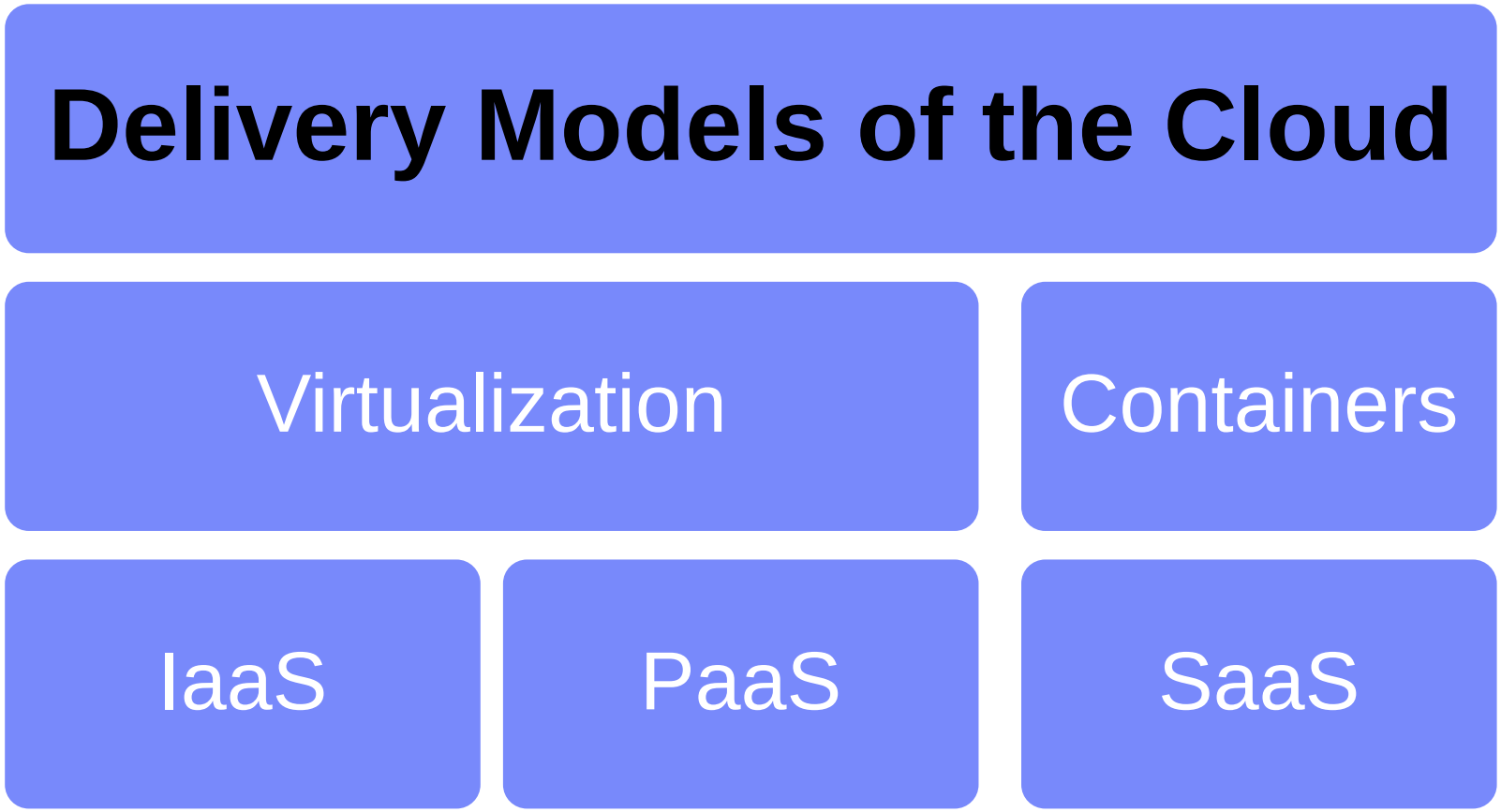

Figure: Delivery models of the cloud

Delivery models of the cloud (2 of 4)

- Virtualization.

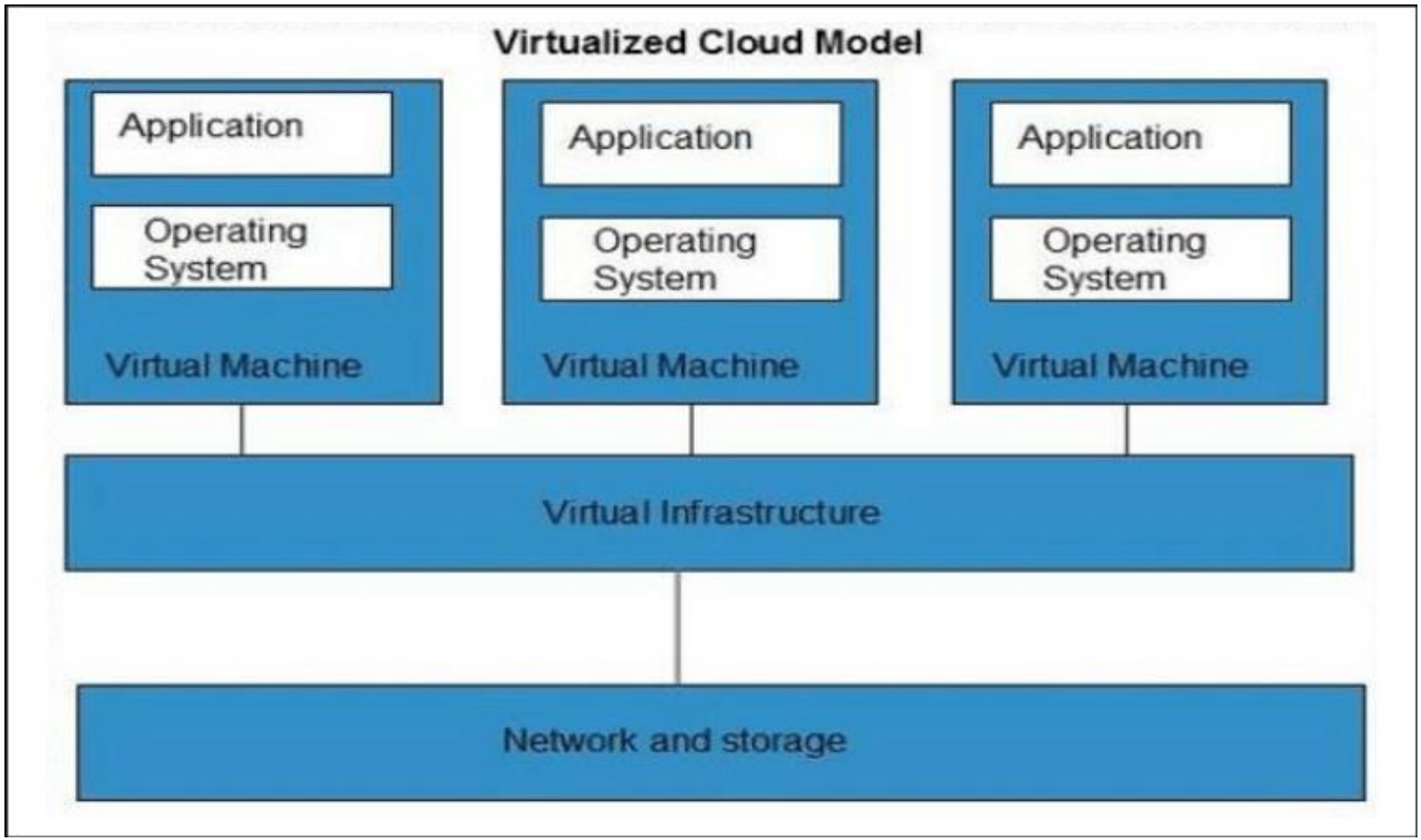

Figure: Virtualization Architecture

Source: https://images.app.goo.gl/fNkYDL8J4HScBpr19

Delivery models of the cloud (2 of 2)

- Containers.

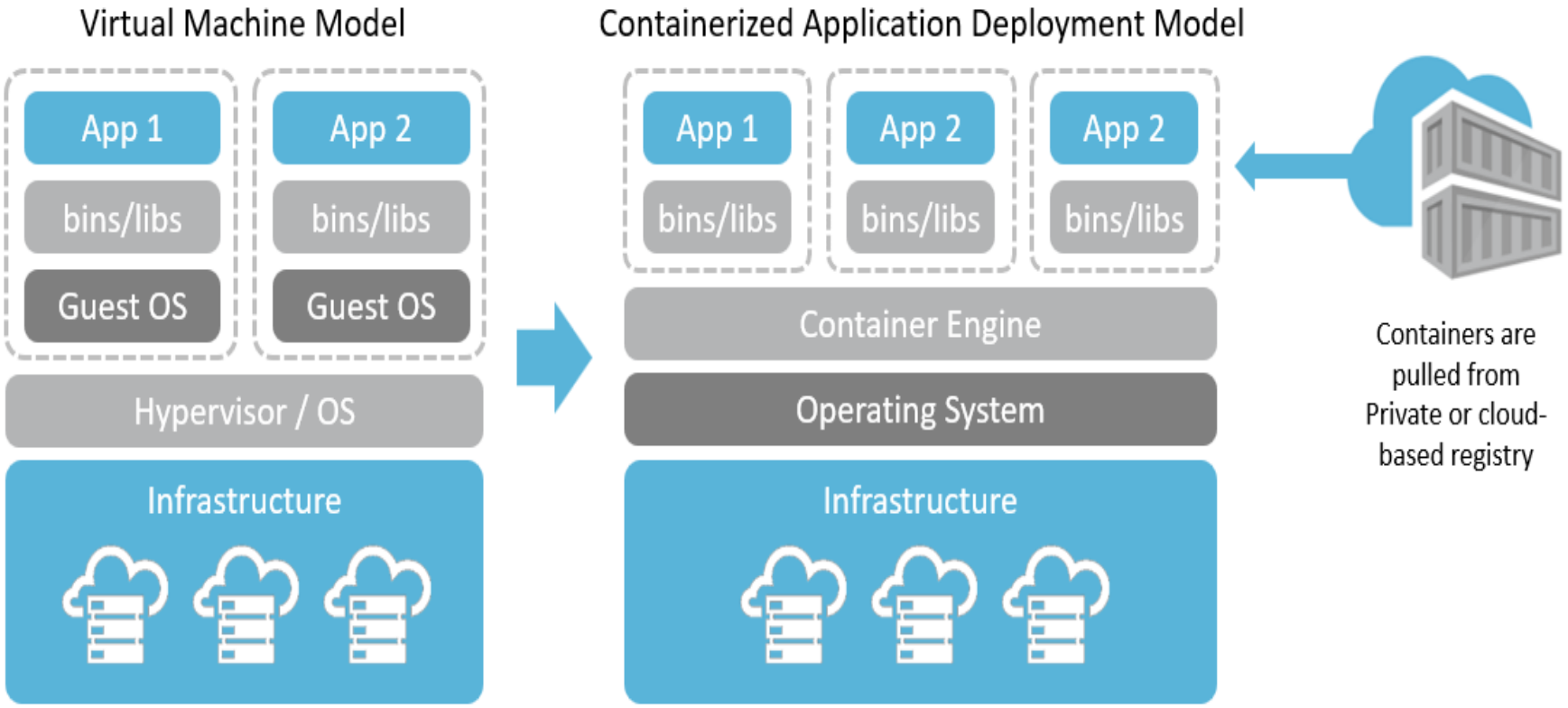

Figure: Containers in cloud

Source: https://images.app.goo.gl/pbUwkyFSB33CSdL49

Delivery models of the cloud (4 of 4)

- Why containers?

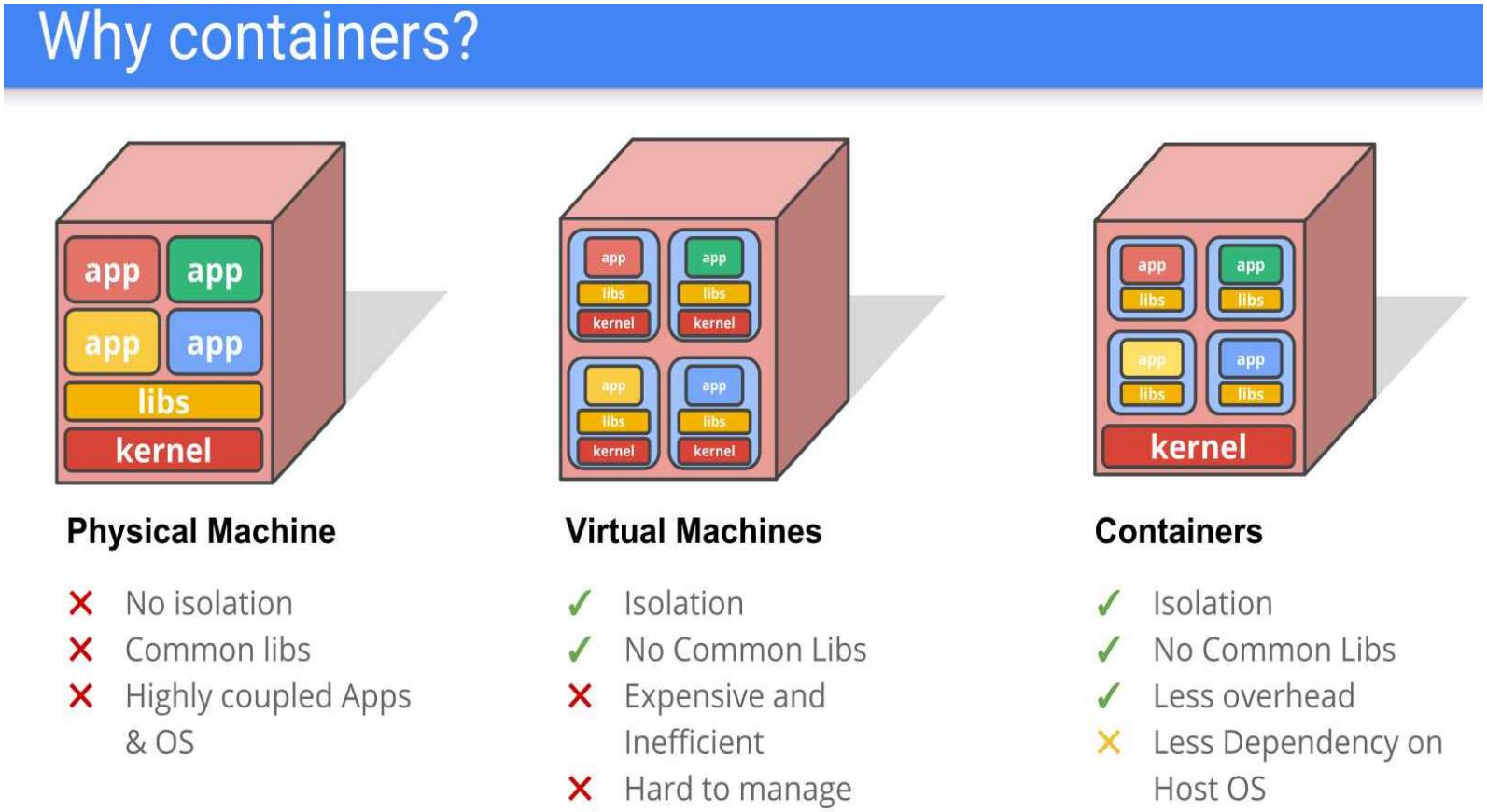

Figure: Why Containers?

Source: https://images.app.goo.gl/aiyxJmtgFtS6jd6k7

Managing workloads

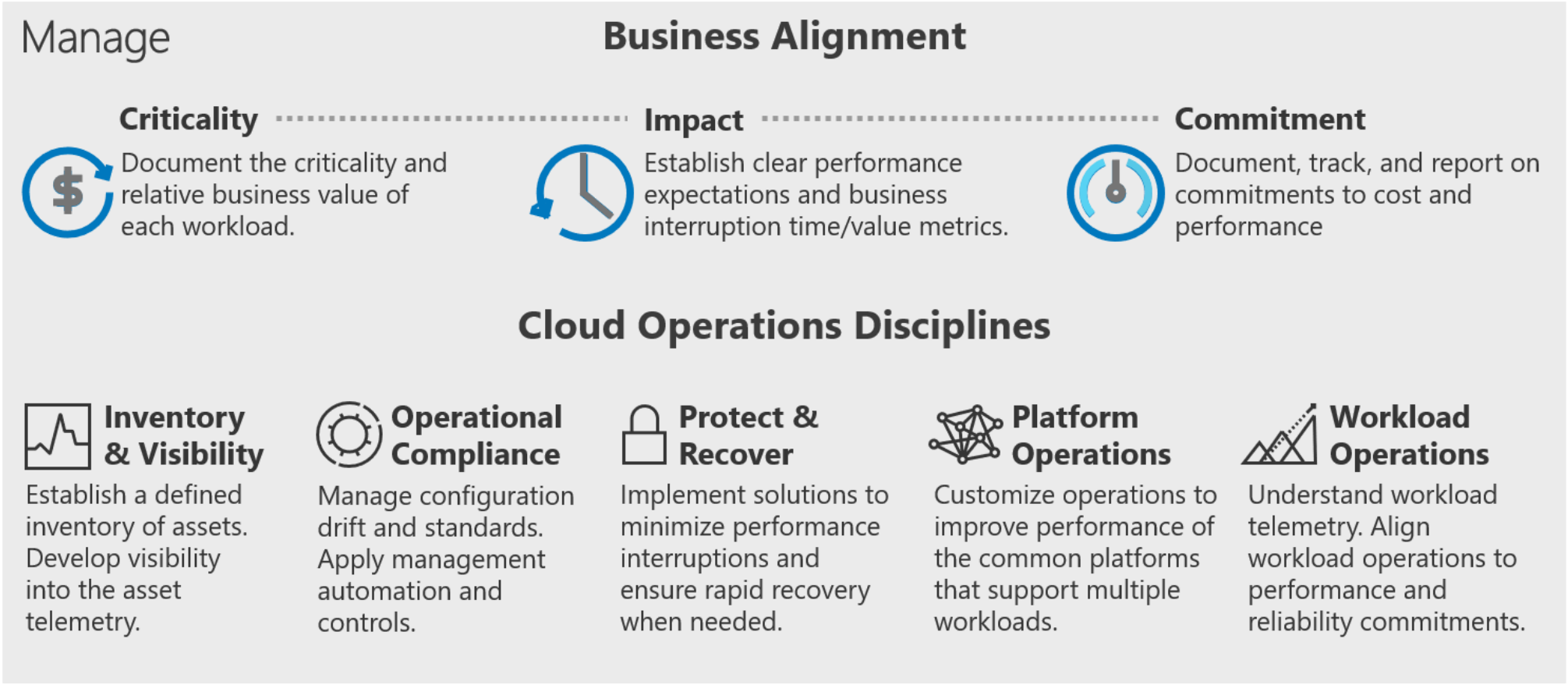

Figure: Managing workload in cloud model

Source: https://images.app.goo.gl/ZnxNKsd3Hzzt4KvY9

Security and governance

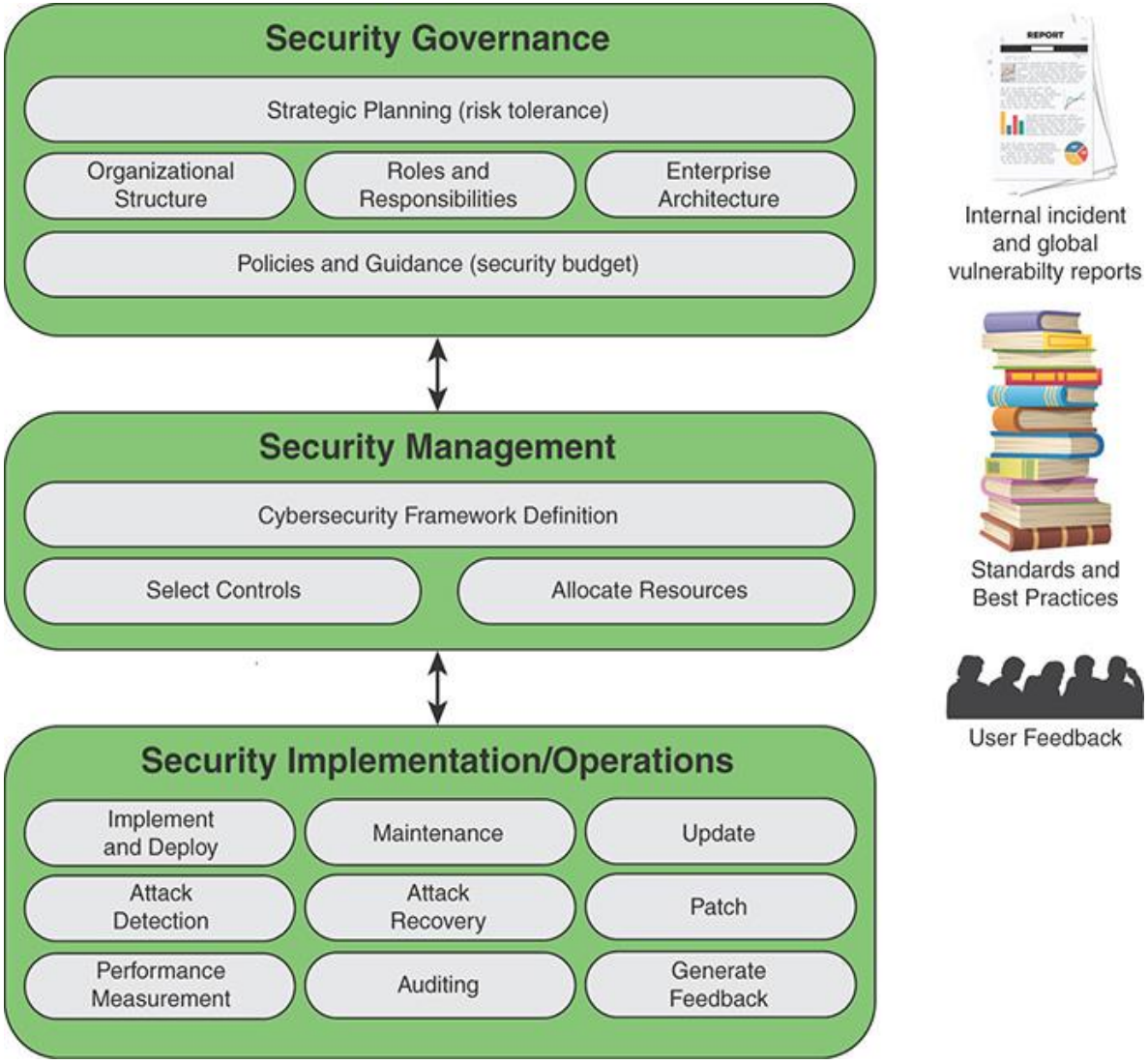

Figure: Security and governance

Source: https://images.app.goo.gl/36EeW7gSf5yXnKhYA

Data integration and management in the cloud

IBM ICE (Innovation Centre for Education)

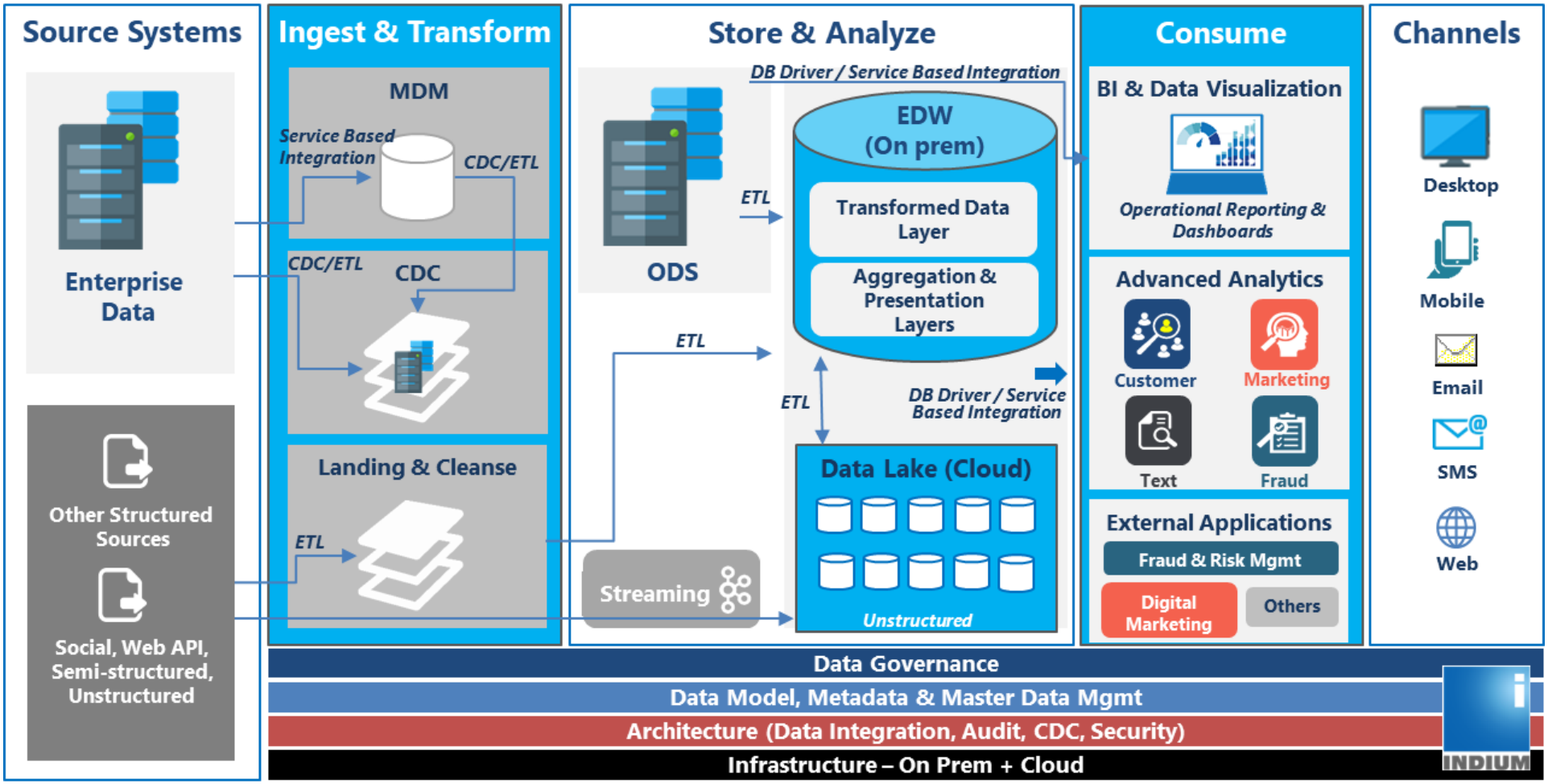

Figure: Data Integration and Management in cloud

Source: https://images.app.goo.gl/7nSrhFnMV6GRQpcq5

Cognitive computing's business implications

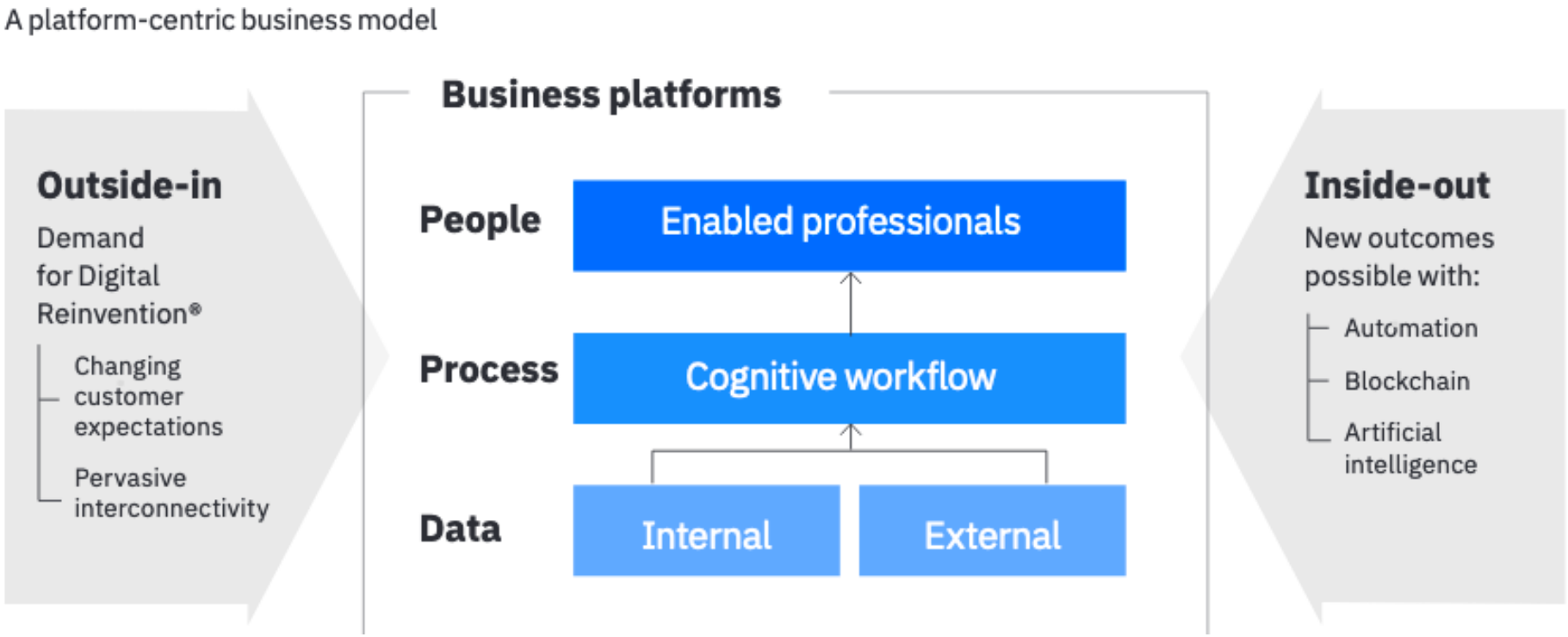

Figure: Cognitive computing's business implications

Source: https://images.app.goo.gl/AmmVZFPQWm38Z8ao7

Change preparation for business segment

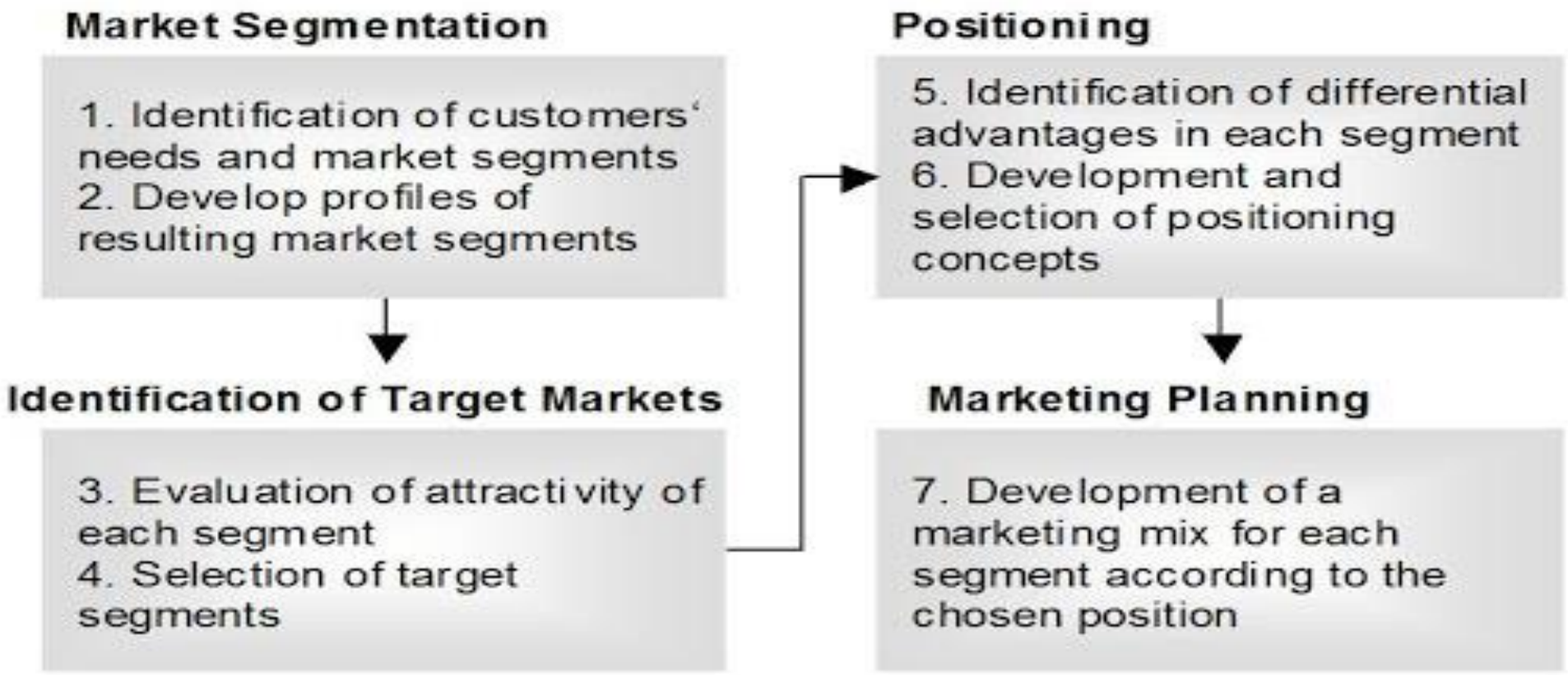

Figure: Change Preparation for business segment

Source: https://images.app.goo.gl/8Jd4o1cfPwy9CwEk9

Benefits of new disruptive models

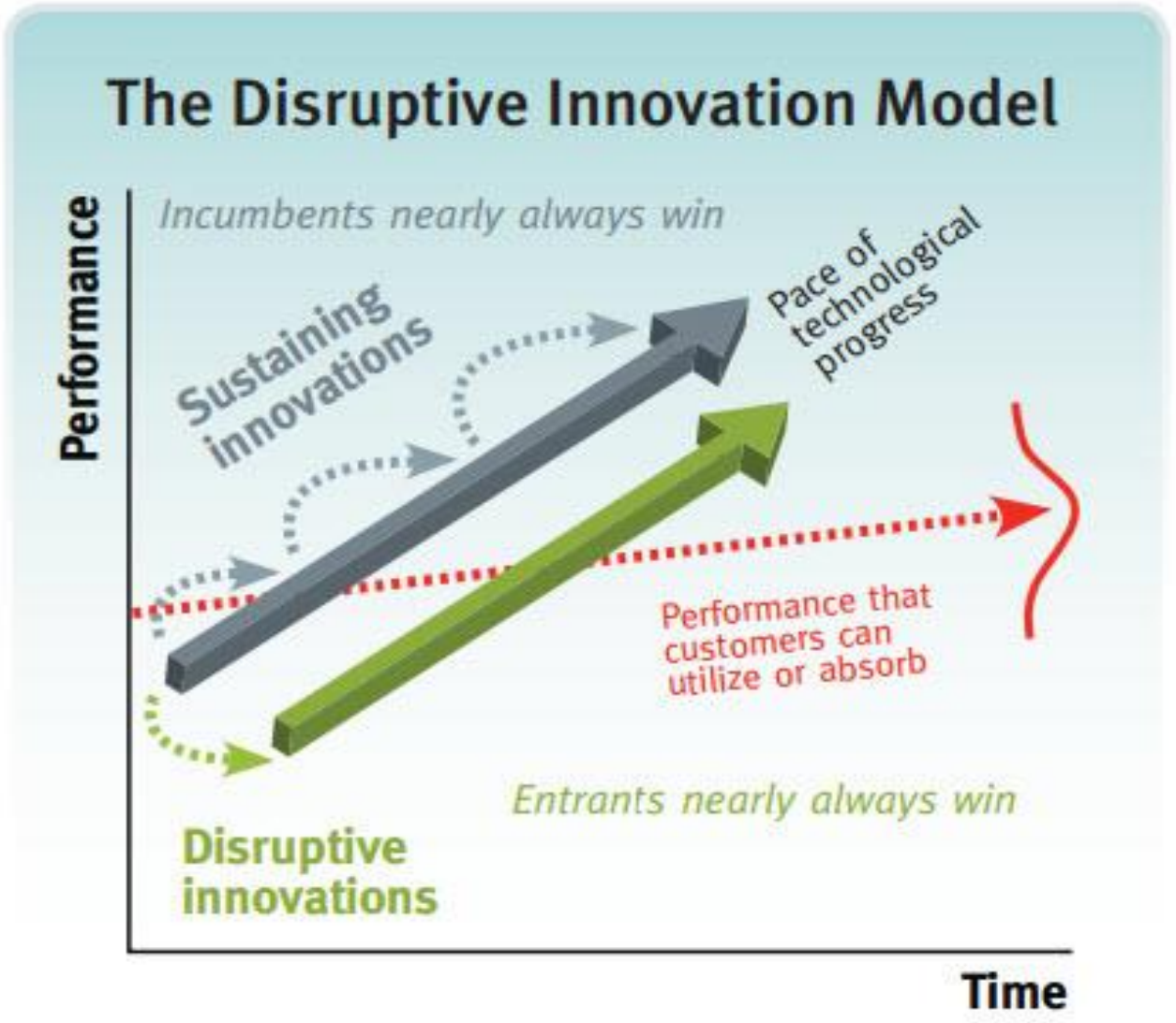

Figure: Disruptive Models

Source: https://images.app.goo.gl/kPvNYPL56xCUGfAx7

Self evaluation: Exercise 16

- To continue with the training, after learning the various steps involved in cognitive analytics and cloud operations, it is instructed to utilize the concepts of ML Algorithms to perform the following activity.

- You are instructed to write the following activities using Python code.

- Exercise 16: Fraud Detection

Knowledge means to the business

Business Intelligence	Knowledge Management
Explicit in nature	Tacit in nature
Both internal and external	Only internal
Only structured information	Both structured and unstructured information
Technology Management and operationalization of Information	Identification, acquisition, application and construction of new knowledge
Business oriented, descriptions, forecasting, analysis and decision making	Organizational processes, dynamic learning, existing knowledge to support decision making

Figure: Business and Knowledge intelligence

Source: https://images.app.goo.gl/bkWKEuBmwA7uLBdw8

The discrepancy in the approach to cognitive systems

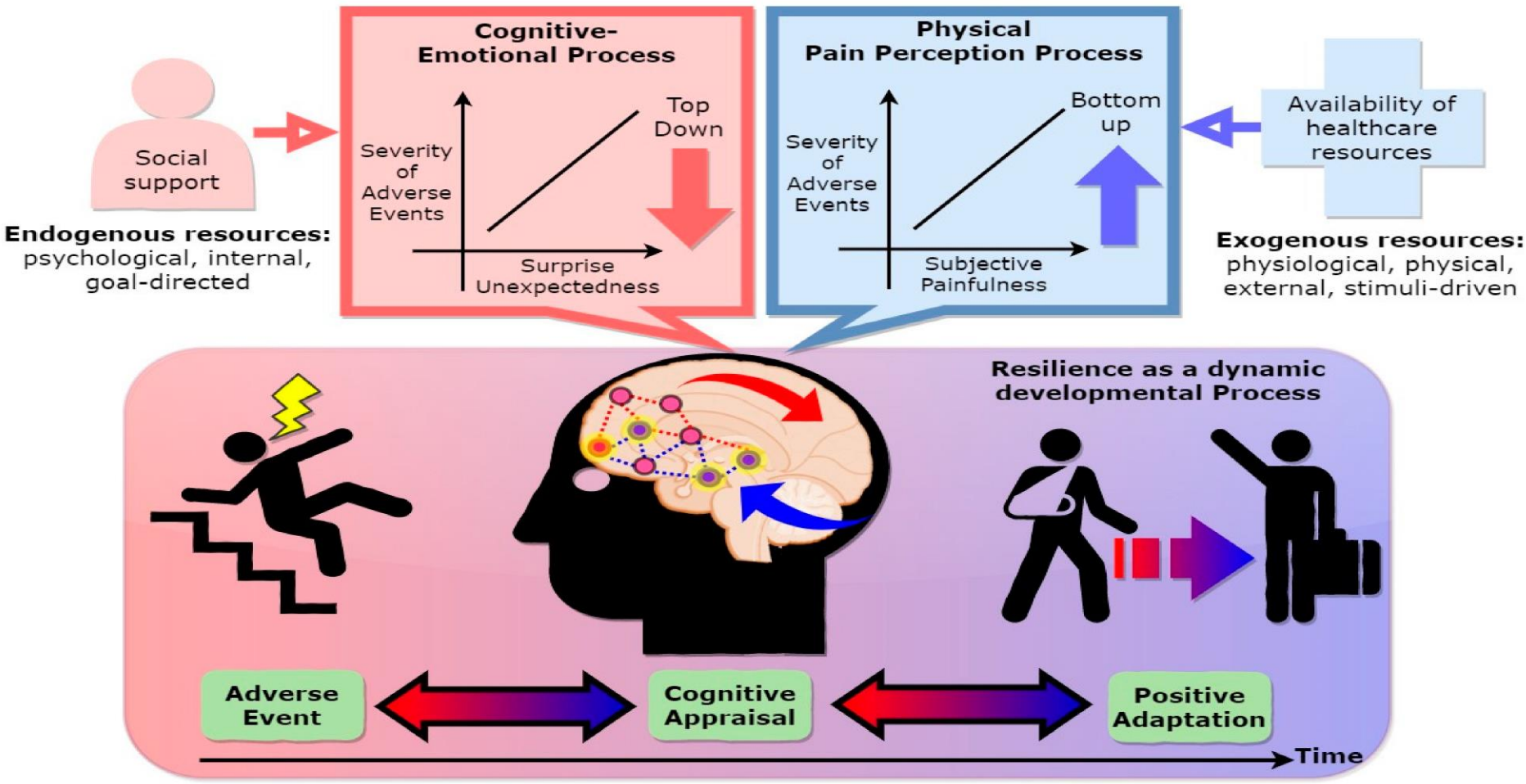

Figure: The discrepancy in the approach to cognitive systems

Source: https://images.app.goo.gl/Ey4vkUAct6RkmQ2d6

Meshing data together differently

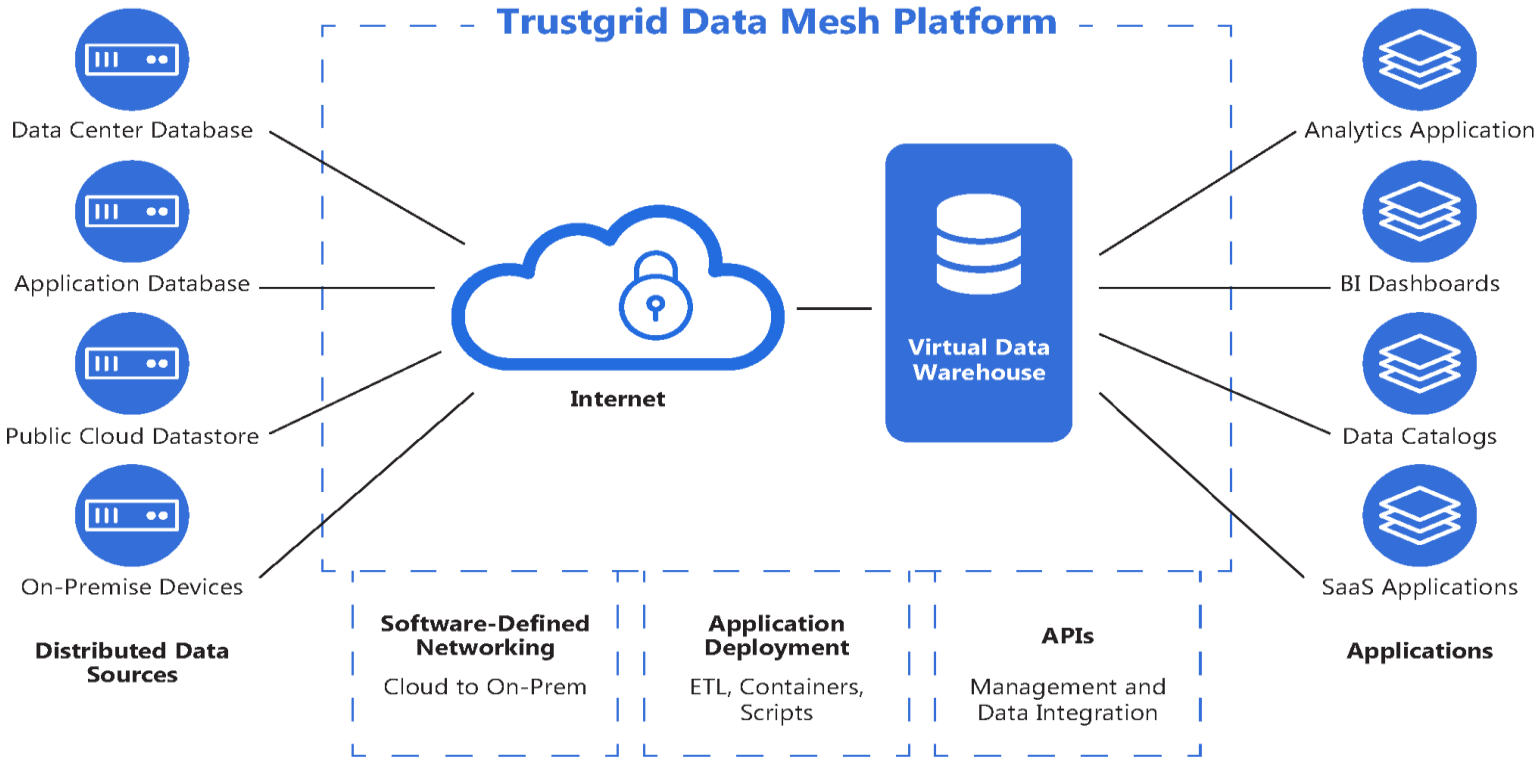

Figure: Data mesh platform

Source: https://images.app.goo.gl/NYnbx5GJYbaYRA3p6

The four stages of maturity in analytics

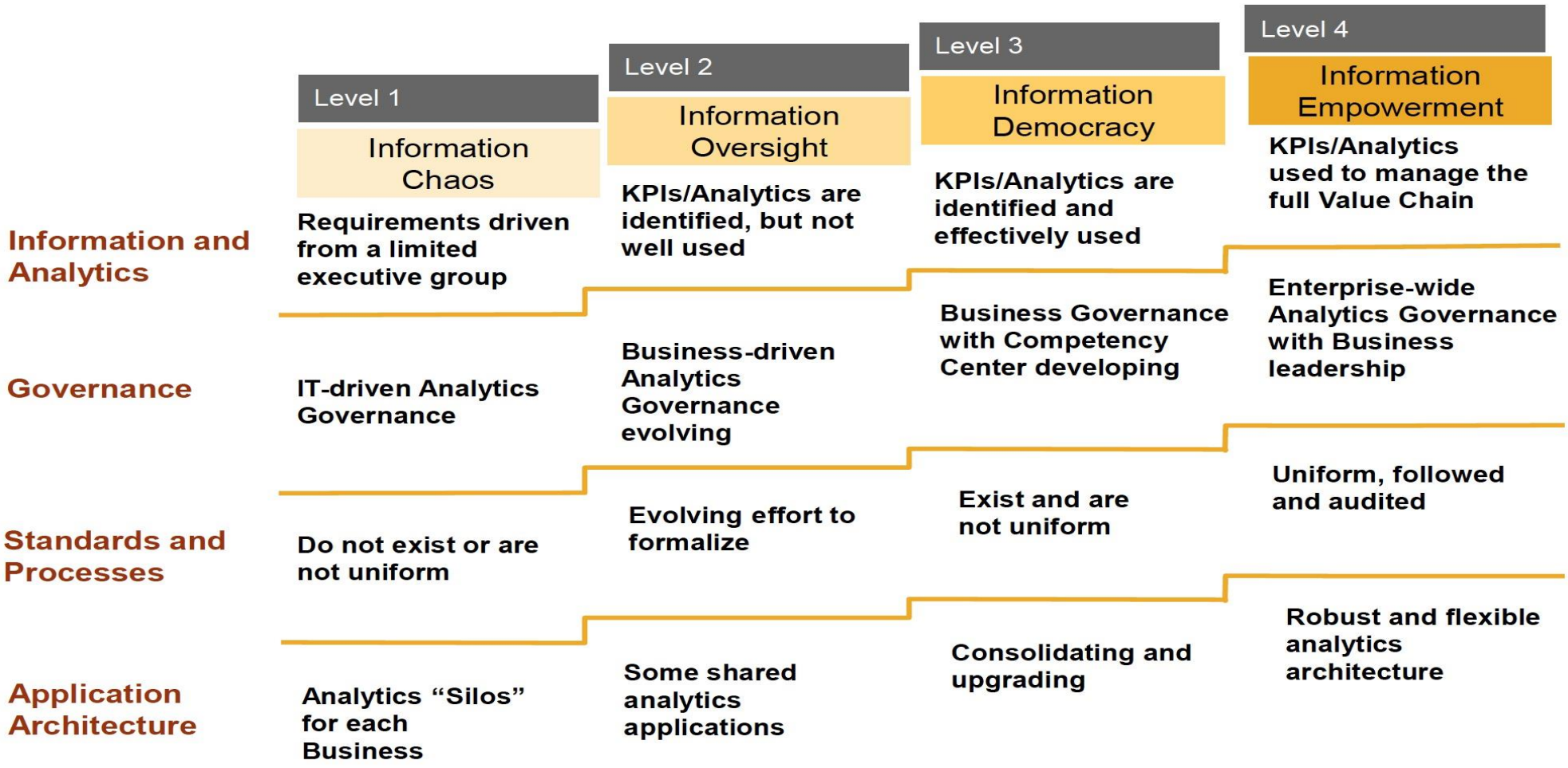

Figure: The four stages of maturity in analytics

Source: https://lh3.googleusercontent.com/x87KGOreKiKKwtTOK4KVChBVLJfET5-_477hHQwOi3ggkwsgfObQaLw189AFkJDJxvw8lg=s142

Answering business questions in new ways

Figure: Business Answer technique

Source: https://images.app.goo.gl/87oHR3BK5WerVBcKA

Building business specific solutions

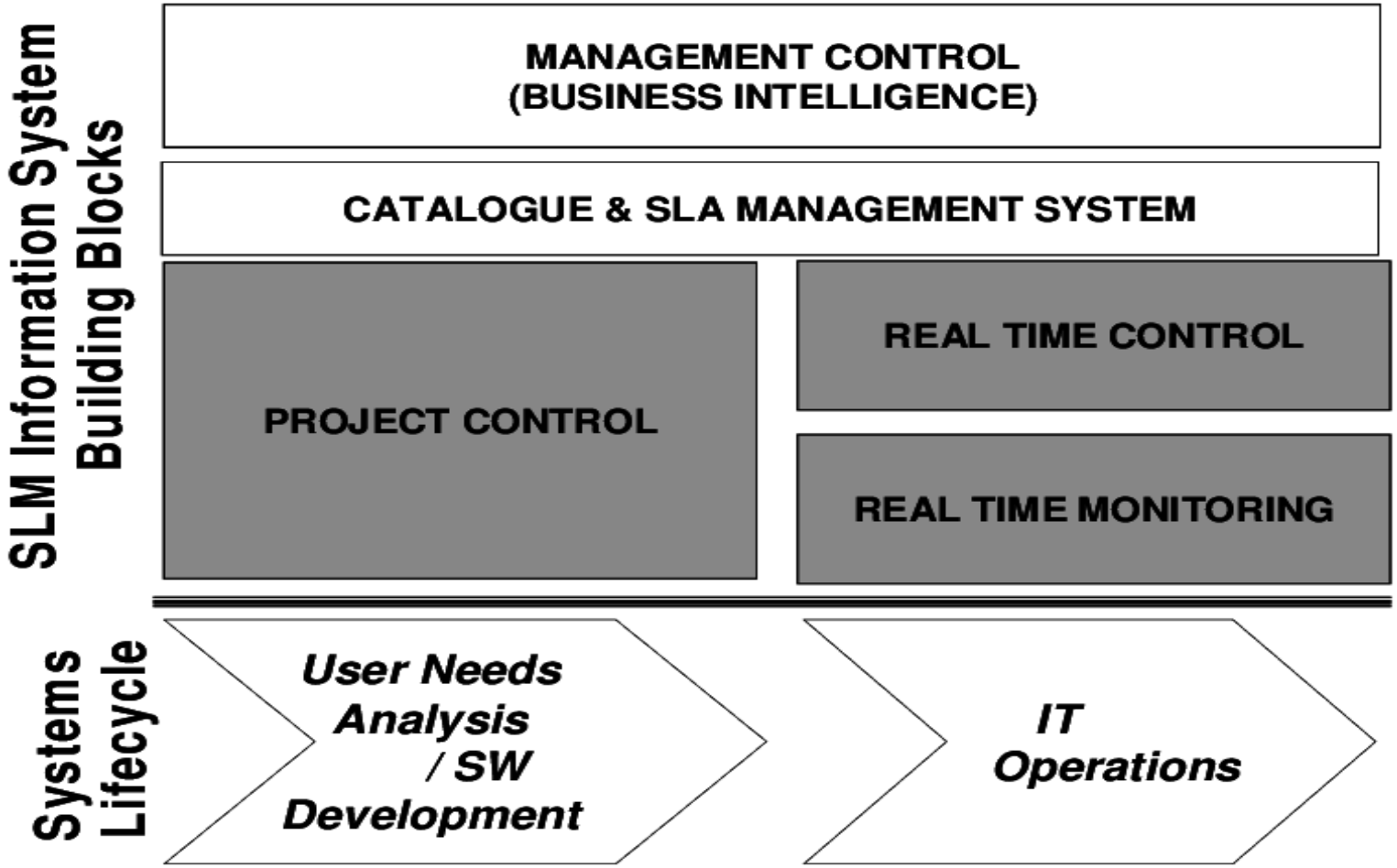

Figure: Building Business Specific Solutions

Source: https://images.app.goo.gl/R3RZKXgNrhbRdXsn9

Self evaluation: Exercise 17

- To continue with the training, after learning the various steps involved in cognitive analytics and cloud Business operations, it is instructed to utilize the concepts of ML Algorithms to perform the following activity.

- You are instructed to write the following activities using Python code.

- Exercise 17: Text Analytics

Making cognitive computing a reality

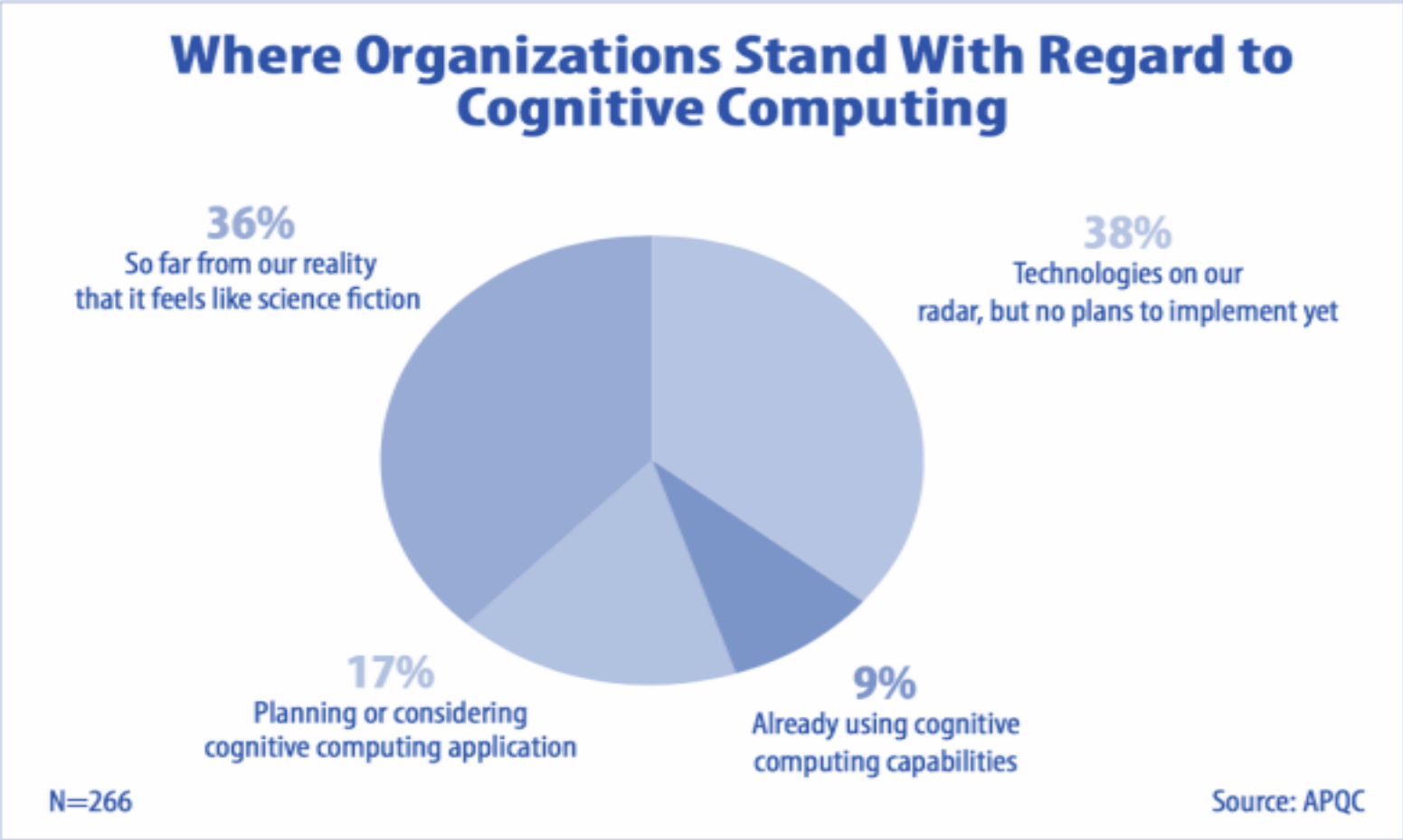

Figure: Cognitive computing a reality
Source: https://images.app.goo.gl/xJgiejrfNeBAZQ1Q8

In what way a cognitive application can bring variation in a marketplace

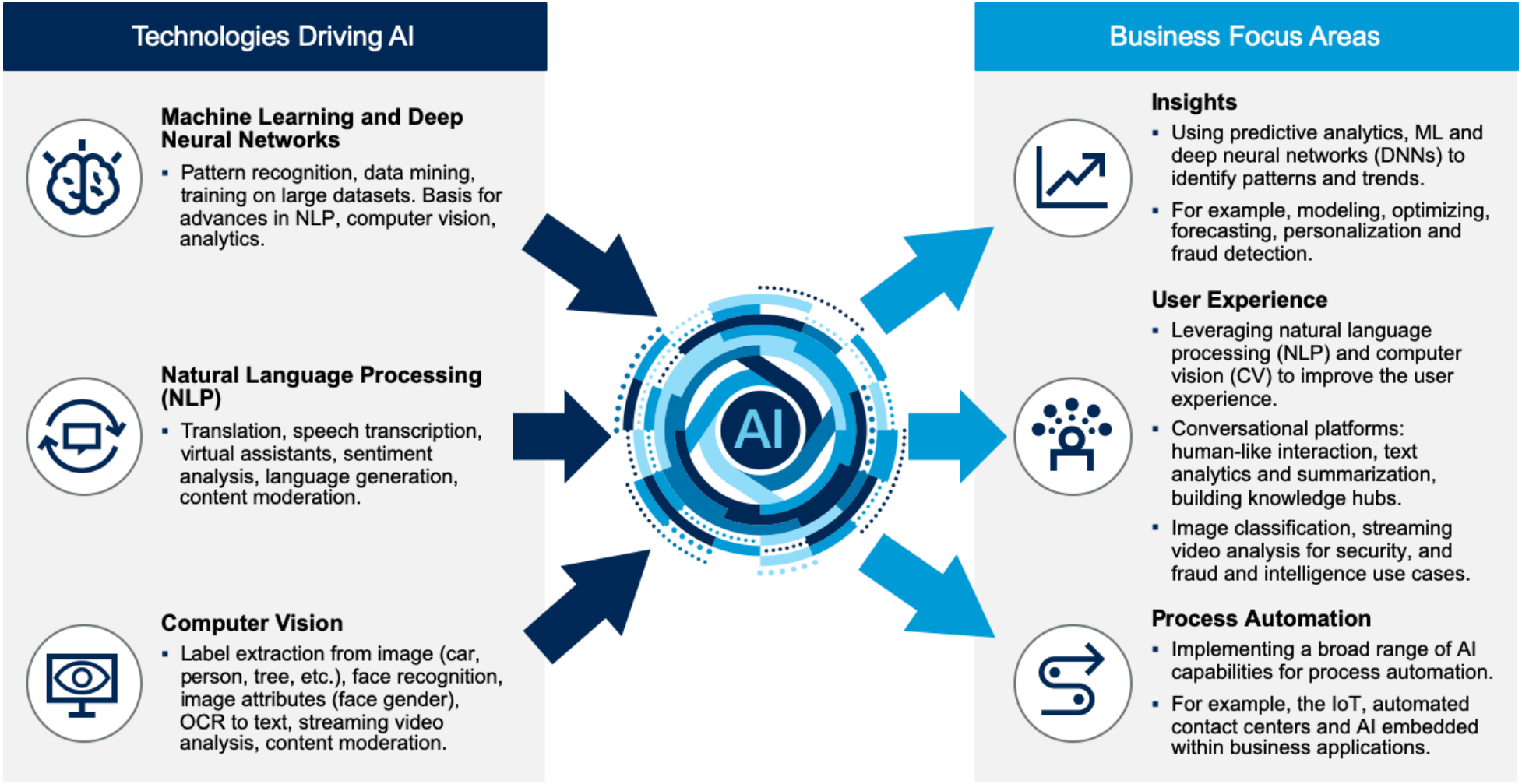

Figure: AI and Business Area

Source: https://images.app.goo.gl/BM9XosYRxAvh8Uvi9

Cognitive computing using cloud-based resources (1 of 2)

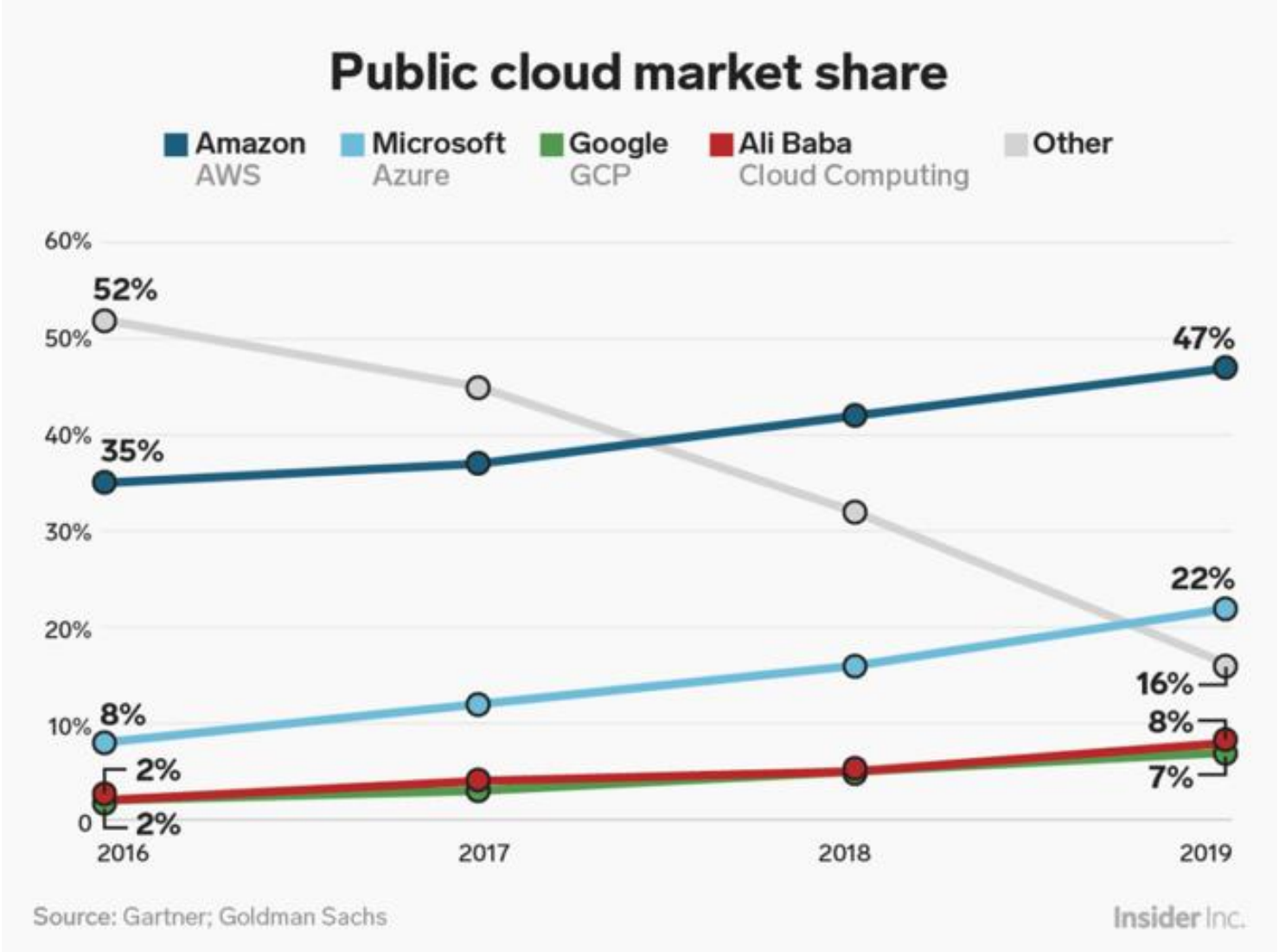

Figure: Cloud market share providers

Source: Gartner, Goldman Sachs, 2019.

Cognitive computing using cloud-based resources (2 of 4)

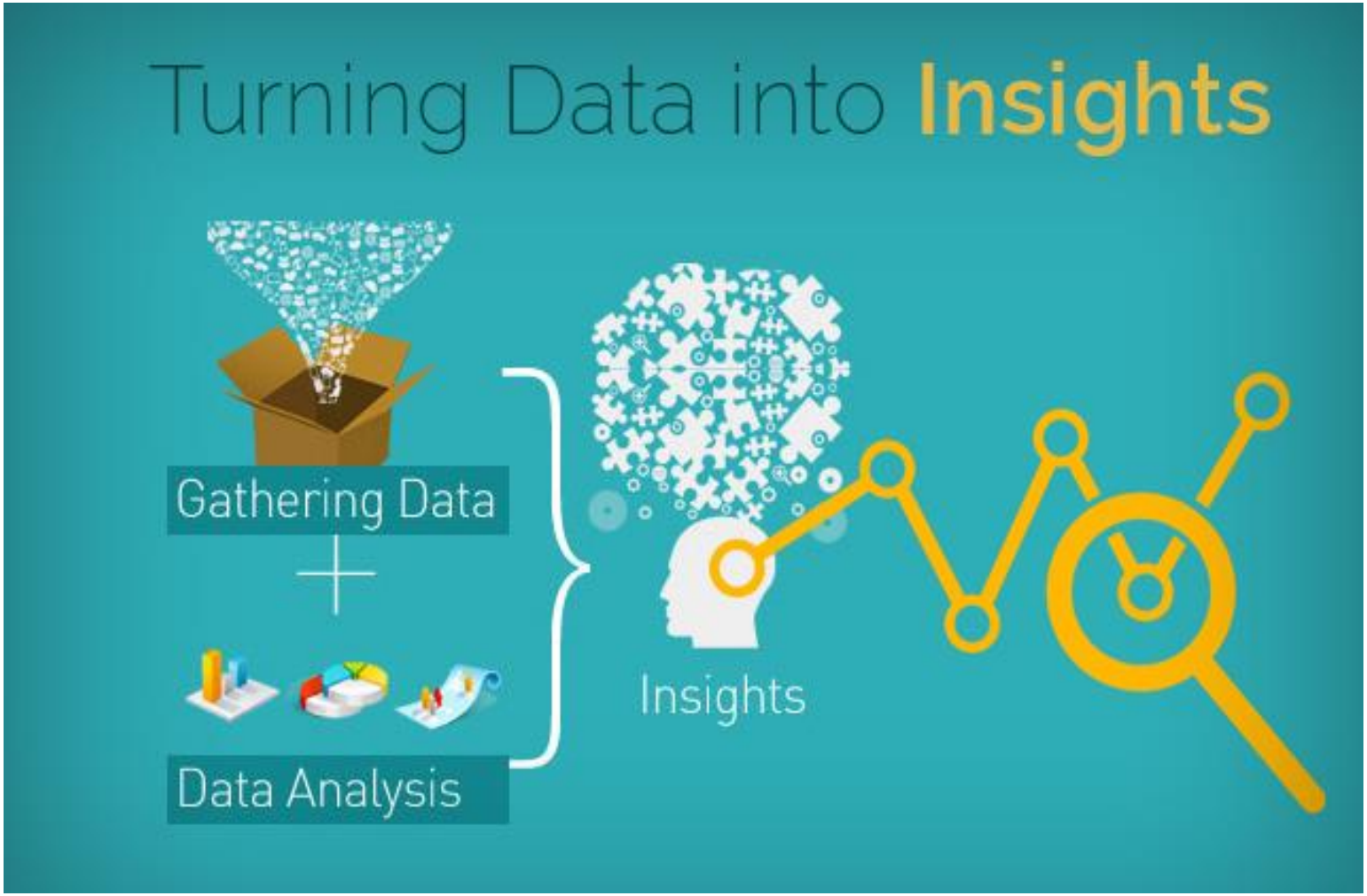

Figure: Data insights for Business

Source: https://images.app.goo.gl/YqjX41fWQxffLEpR7

Cognitive computing using cloud-based resources (2 of 2)

Figure: User experience

Source: https://images.app.goo.gl/XoVBp1DTaBh4KevF6

Cognitive computing using cloud-based resources (4 of 4)

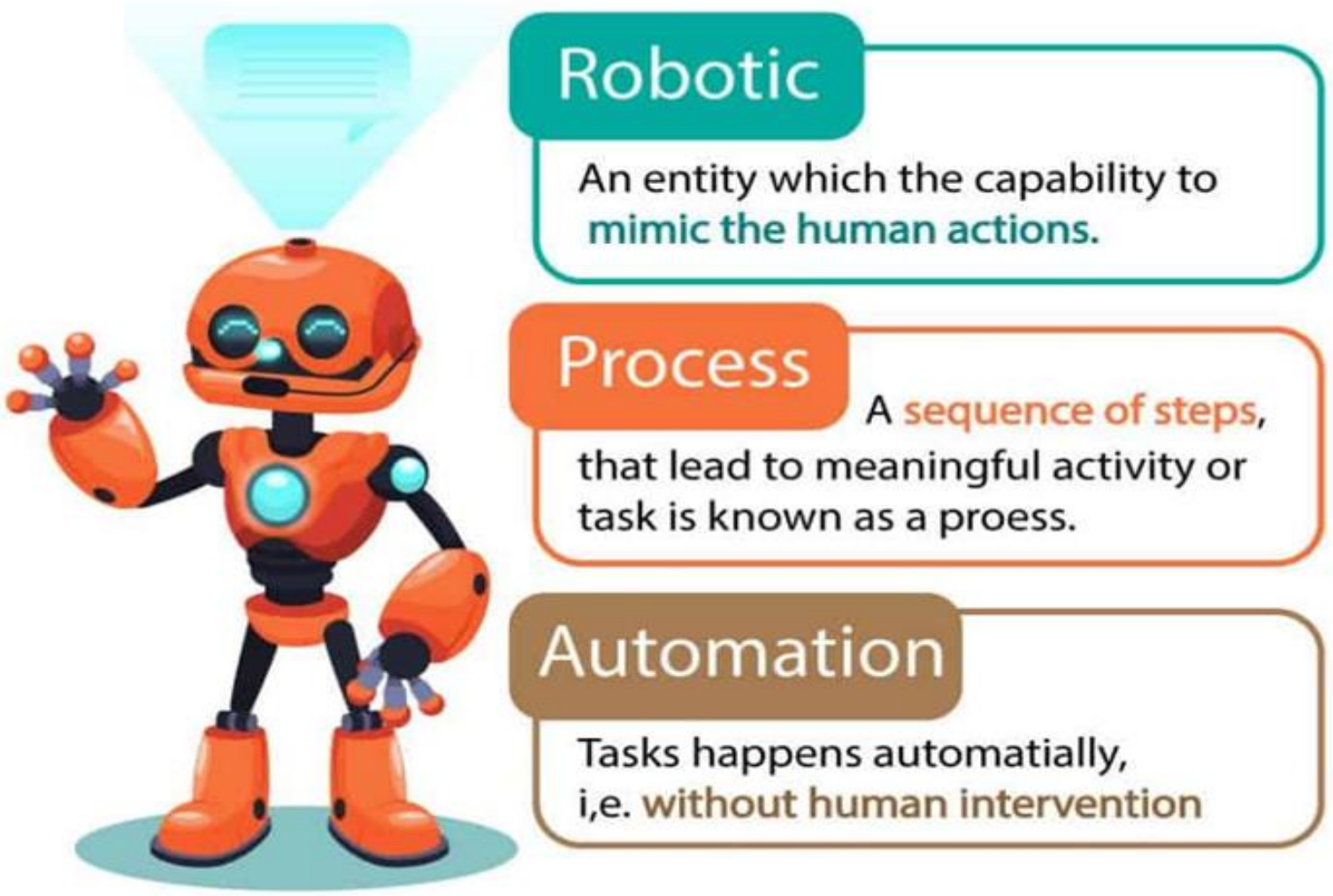

Figure: RPA

Source: https://images.app.goo.gl/GqMqfR498SerJ6KF7

Self evaluation: Exercise 18

- To continue with the training, after learning the various steps involved in cognitive analytics and cloud Business operations, it is instructed to utilize the concepts of ML Algorithms to perform the following activity.

- You are instructed to write the following activities using Python code.

- Exercise 18: Image Analytics

Checkpoint (1 of 2)

Multiple choice questions:

1. Which of the following is Cloud Platform by Amazon?
   a) Azure
   b) AWS
   c) Cloudera
   d) All the above

2. Which of the following is essential concept related to Cloud?
   a) Reliability
   b) Productivity
   c) Abstraction
   d) All the above

3. Which of the following cloud concept is related to pooling and sharing of resources?
   a) Polymorphism
   b) Abstraction
   c) Virtualization
   d) None of the above

Checkpoint solutions (1 of 2)

Multiple choice questions:

1. Which of the following is Cloud Platform by Amazon?
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   a) Reliability
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   d) All the above

3. Which of the following cloud concept is related to pooling and sharing of resources?
   a) Polymorphism
   b) Abstraction
   c) Virtualization
   d) None of the above

Checkpoint (2 of 2)

Fill in the blanks:

1. _____ computing refers to applications and services that run on a distributed network using virtualized resources.
2. _____ as a utility is a dream that dates from the beginning of the computing industry itself.
3. _____ has many of the characteristics of what is now being called cloud computing.
4. Cloud computing is an abstraction based on the notion of pooling physical resources and presenting them as a _____ resource.

True or False:

1. Scalability in the cloud allows users to expand or contract when they need to. True/False
2. High availability is a build in feature of cloud load balancers. True/False
3. In cloud computing, cloud refer to laptop. True/False

Checkpoint solutions (2 of 2)

Fill in the blanks:

1. **Cloud** computing refers to applications and services that run on a distributed network using virtualized resources.
2. **Computing** as a utility is a dream that dates from the beginning of the computing industry itself.
3. **Internet** has many of the characteristics of what is now being called cloud computing.
4. Cloud computing is an abstraction based on the notion of pooling physical resources and presenting them as a **virtual** resource.

True or False:

1. Scalability in the cloud allows users to expand or contract when they need to. **True**
2. High availability is a build in feature of cloud Load Balancers. **True**
3. In cloud computing, cloud refer to laptop. **False**

Question bank

Two mark question:

1. What is cloud computing?
2. What is the importance of cloud computing?
3. What is public cloud?
4. What is community cloud?

Four mark question:

1. Difference between Internal and external cloud.
2. Explain cloud architecture.
3. Explain business application on cloud model.
4. Describe any 3 public cloud vendors name.

Eight mark question:

1. Explain the difference between SaaS,Paas and Iaas model.
2. Explain business benefit with cloud model for cognitive applications.

Unit summary

Having completed this unit, you should be able to:

- Understand the concepts of leveraging distributed computing for shared resources
- Learn about cloud services
- Gain knowledge on cloud computing models
- Gain an insight into virtualization and software-defined environment
- Understand the concept of security and governance
- Learn about data integration and management in the cloud
- Gain knowledge on cognitive services on cloud