Cloud Service models

- *Open Data Management & the Cloud*
- (Data Science & Scientific Computing / UniTS – DMG)

Cloud basic definition: again
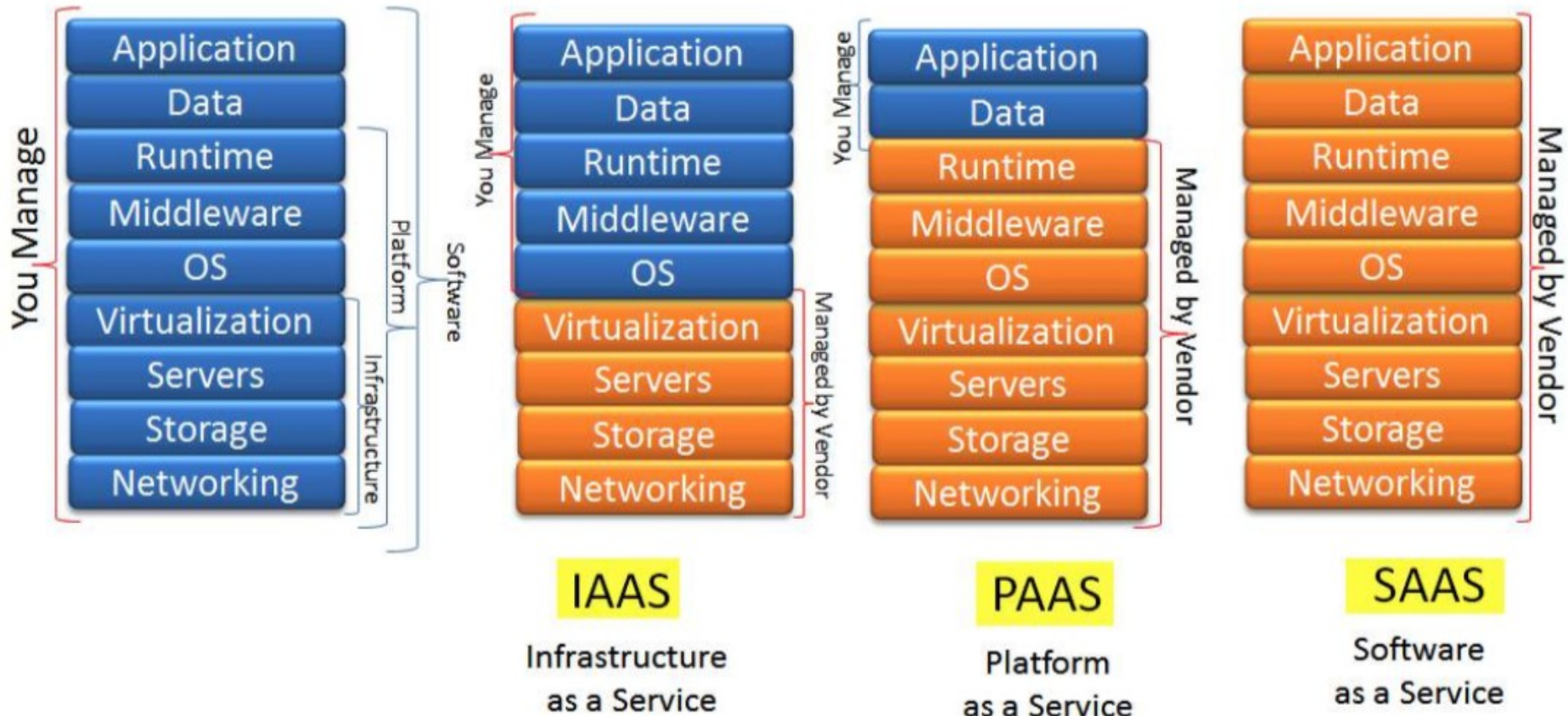
- A model of computation and data storage based on "pay as you go", access to "unlimited" remote data center capabilities

- A cloud infrastructure provides a framework to manage scalable, reliable, on-demand access to applications

- Cloud services provide the "invisible" backend to many of our mobile applications

- High level of elasticity in consumption

- Historical roots in today's Internet apps

  - Search, email, social networks

  - File storage (Live Mesh, Mobile Me, Flicker, …)
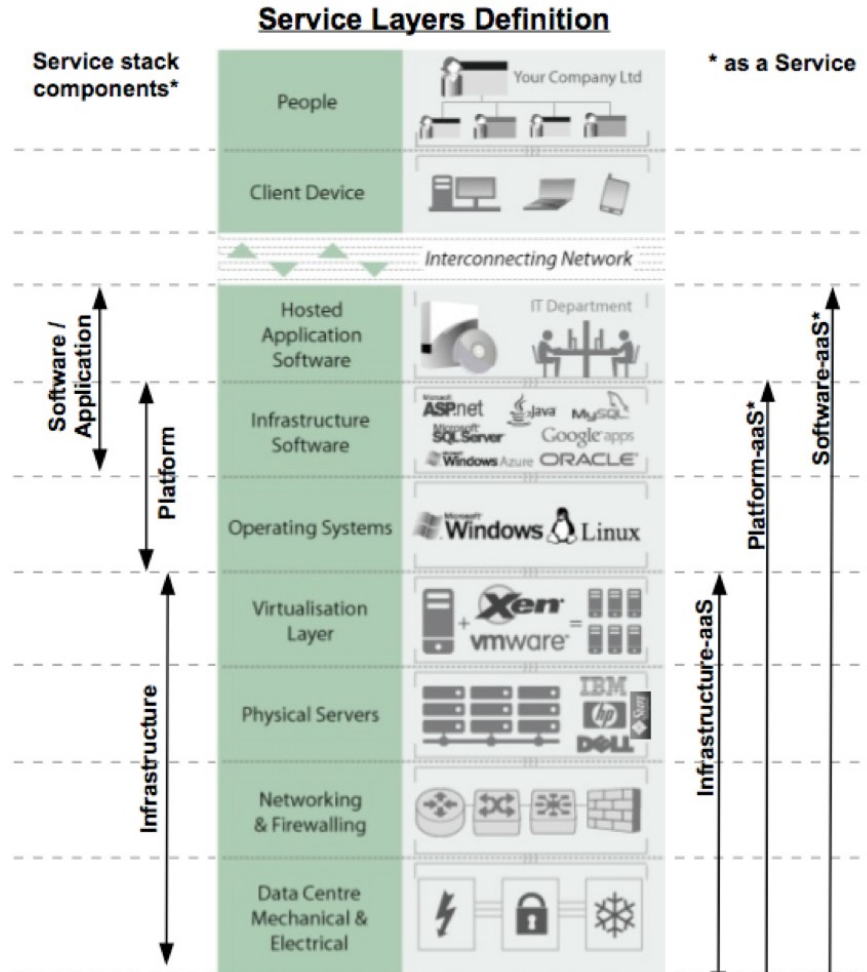
When I want pizza...

Made at home — Take & Bake — Pizza Delivered — Dined Out

You Manage / **Vendor Manages**

Stack (top to bottom): Dining Table, Soda, Electric/Gas, Oven, Fire, Pizza Dough, Tomato Sauce, Toppings, Cheese

When I manage IT stuff...

IAAS — Infrastructure as a Service

PAAS — Platform as a Service

SAAS — Software as a Service

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https://cloudcelebrity.wordpress.com/2011/11/22/introduction-to-cloud-services-iaas-paas-saas/

Service Layers

What is cloud?

A cloud infrastructure is:

*An infrastructure to provide users with the most **flexible** way to allocate computational power and storage space (and any other IT services)*

To quickly provide a customized IT infrastructure

...and you must integrate infrastructure provisioning in your data-analysis.

Python API example

```python
>>> from keystoneauth1 import loading
>>> from keystoneauth1 import session
>>> from novaclient import client
>>> loader = loading.get_plugin_loader('password')
>>> auth = loader.load_from_options(auth_url=AUTH_URL,
...                                  username=USERNAME,
...                                  password=PASSWORD,
...                                  project_id=PROJECT_ID)
>>> sess = session.Session(auth=auth)
>>> nova = client.Client(VERSION, session=sess)
```

Infrastructure as a Service

"Infrastructure as a service (IaaS) refers to online services that provide **high-level APIs** used to dereference various **low-level details** of underlying network infrastructure like physical computing resources, location, data partitioning, scaling, security, backup etc. A **hypervisor**, such as Xen, Oracle VirtualBox, Oracle VM, KVM, VMware ESX/ESXi, or Hyper-V, LXD, runs the virtual machines as guests. Pools of hypervisors within the **cloud operational system** can support large numbers of virtual machines and the ability to **scale services up and down** according to customers' varying requirements."

Wikipedia

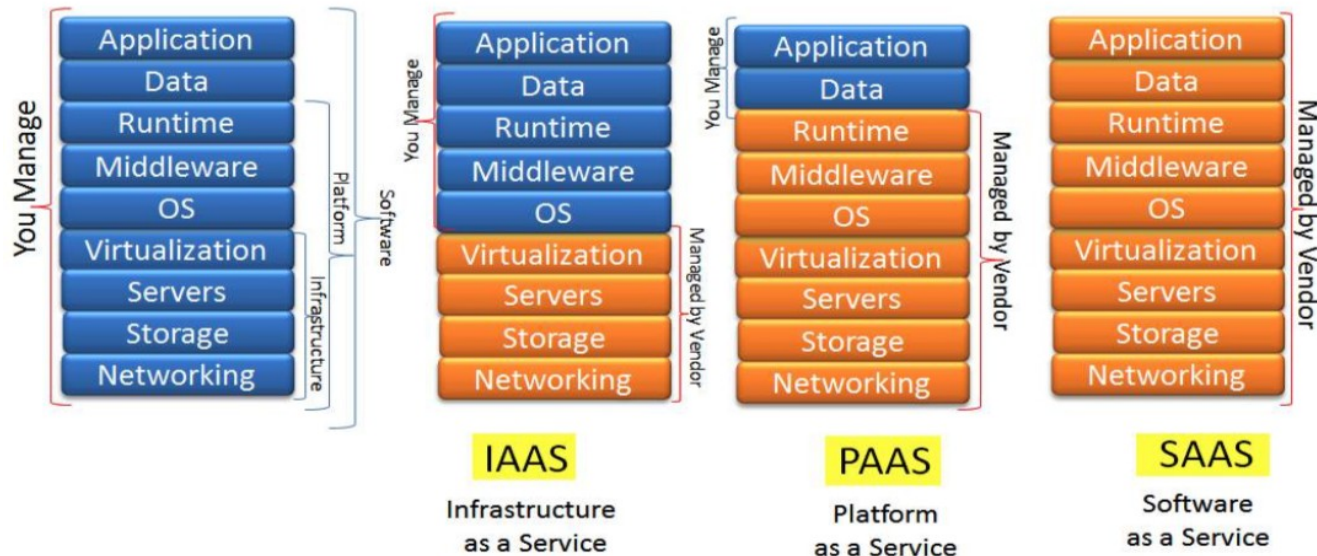# Infrastructure as a Service
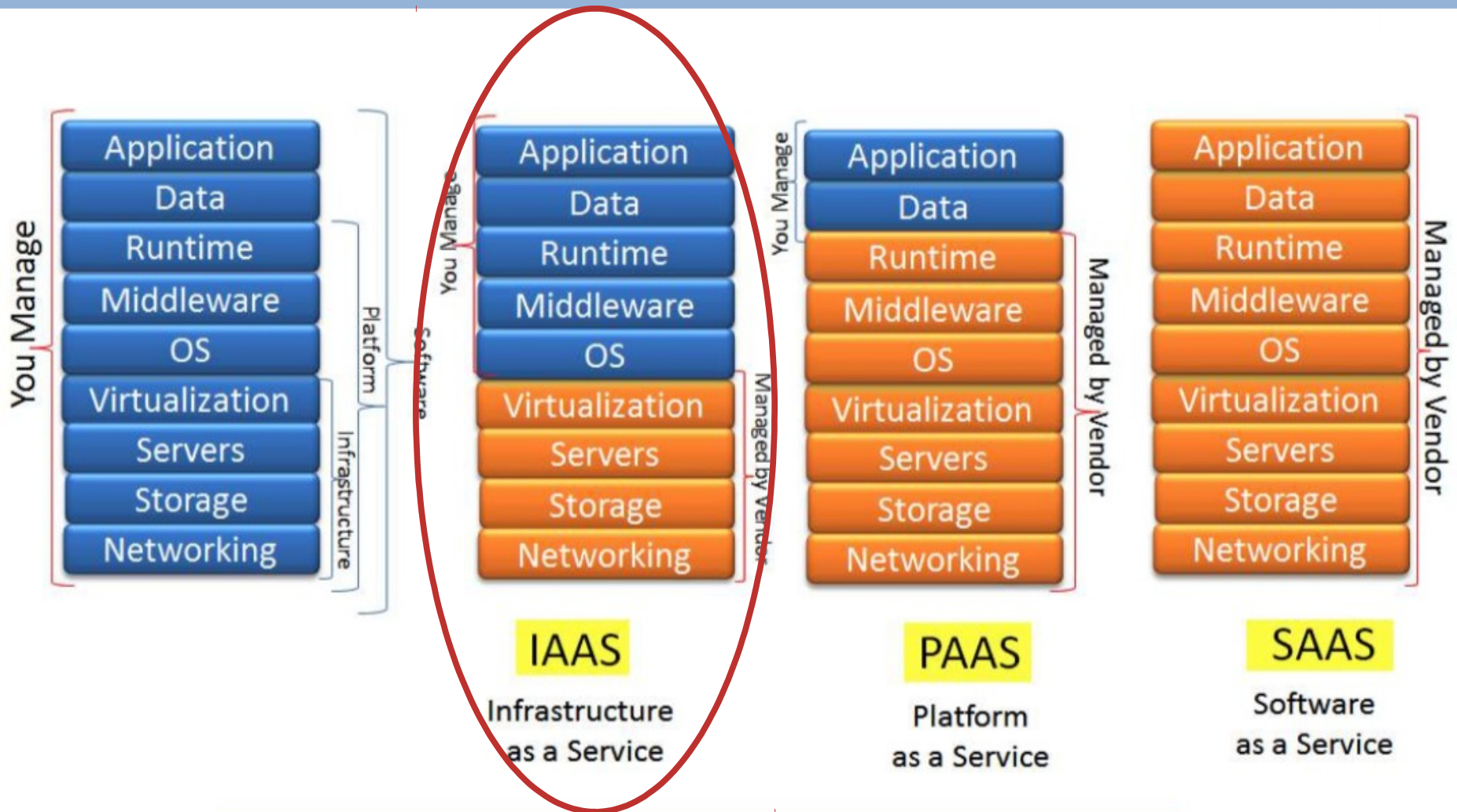
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Infrastructure as a Service

Infrastructure as a Service is a cloud computing service model in which hardware is virtualized in the cloud.

Separation of Responsibilities

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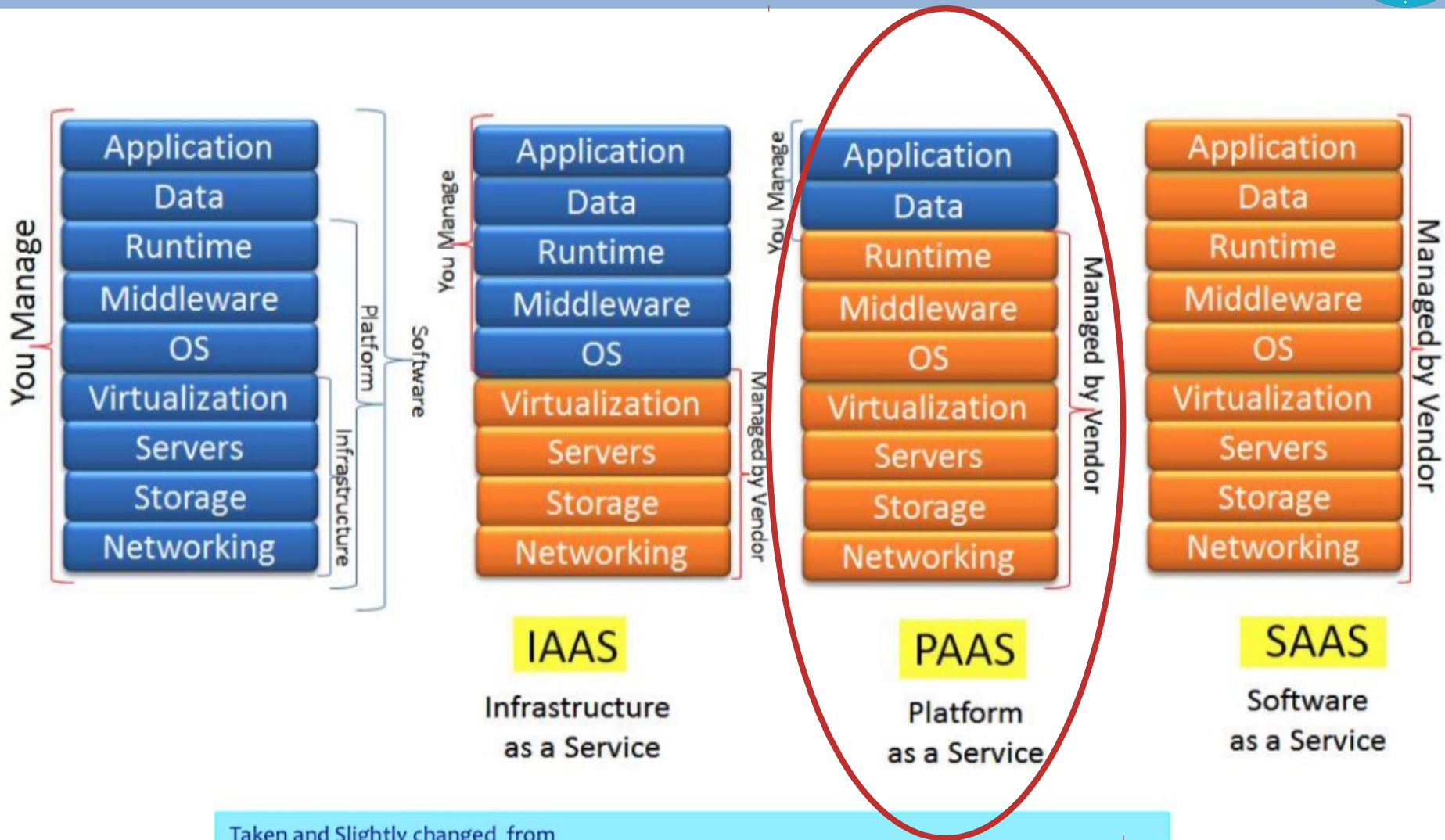
IaaS by examples

There are many IaaS (public/private, opensource, etc.)

- European Open Science Cloud (Openstack)
- Google Cloud
- Amazon Cloud (AWS)
- Microsoft Azure

Platform as a Service

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PaaS main concepts

- A platform is anything you can leverage to accomplish something in a simpler, faster, or otherwise better way than you could without.

- As a programmer, you leverage pre-existing code rather than starting from scratch and writing everything.

- The most well-known software platforms for desktop software are Windows and Mac OS
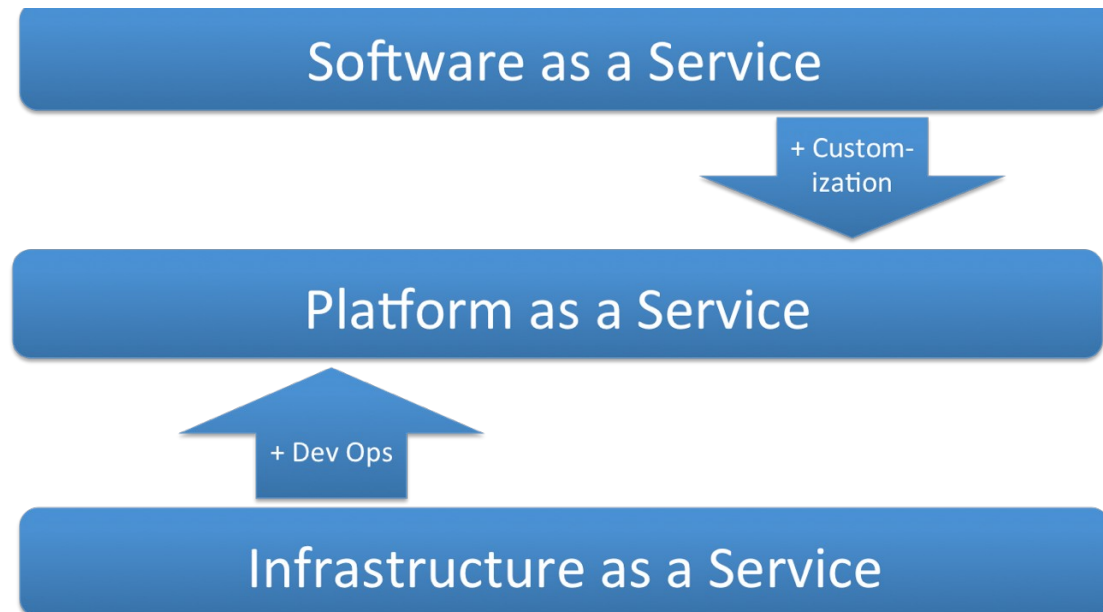
PaaS framework

PaaS provides a framework for:

- **Application development**: A PaaS platform either provides the means to use programs you create in a supported language or offers a visual development environment that writes the code for you.

- **Collaboration**: Many PaaS systems are set up to allow multiple individuals to work on the same projects.

- **Data management**: Tools are provided for accessing and using data in a data store. I Instrumentation, performance, and testing: Tools are available for measuring your applications and optimizing their performance.

- **Storage**: Data can be stored in either the PaaS vendor's service or accessed from a third- party storage service.

- **Transaction management**: Many PaaS systems provide services such as transaction managers or brokerage service for maintaining transaction integrity.

PaaS systems exist to allow you to create software that can be hosted as SaaS systems

PaaS attributes

PaaS cloud are designed to allow in developing robust, scalable, and hopefully portable applications.

On this list would be the following attributes:

- **Separate** of data management from the user interface I Reliance on cloud computing standards
- An integrated development environment (**IDE**)
- **Lifecycle** management tools
- **Multi-tenant** architecture support, security, and scalability
- Performance **monitoring**, testing, and optimization tools

A PaaS provides the tools needed to construct different types of applications that can work together in the same environment (e.g. mashup of multiple data sources).

In practice the goal of PaaS is...

- To make it easier for you to run your website or web application no matter how much traffic it gets.
- You just deploy your application and the service figures out what to do with it.
- A platform as a service should handle scaling seamlessly for you so you can just focus on your website and the code running it.

PaaS examples: OpenShift

- The open source PaaS from RedHat
- OpenShift runs on top of OpenStack
- Companies can deploy OpenShift on top of their infrastructure
- OpenStack is the infrastructure and OpenShift is the platform that run on top of it
- This analogous to Apache and MySQL that run on top of a Linux machine
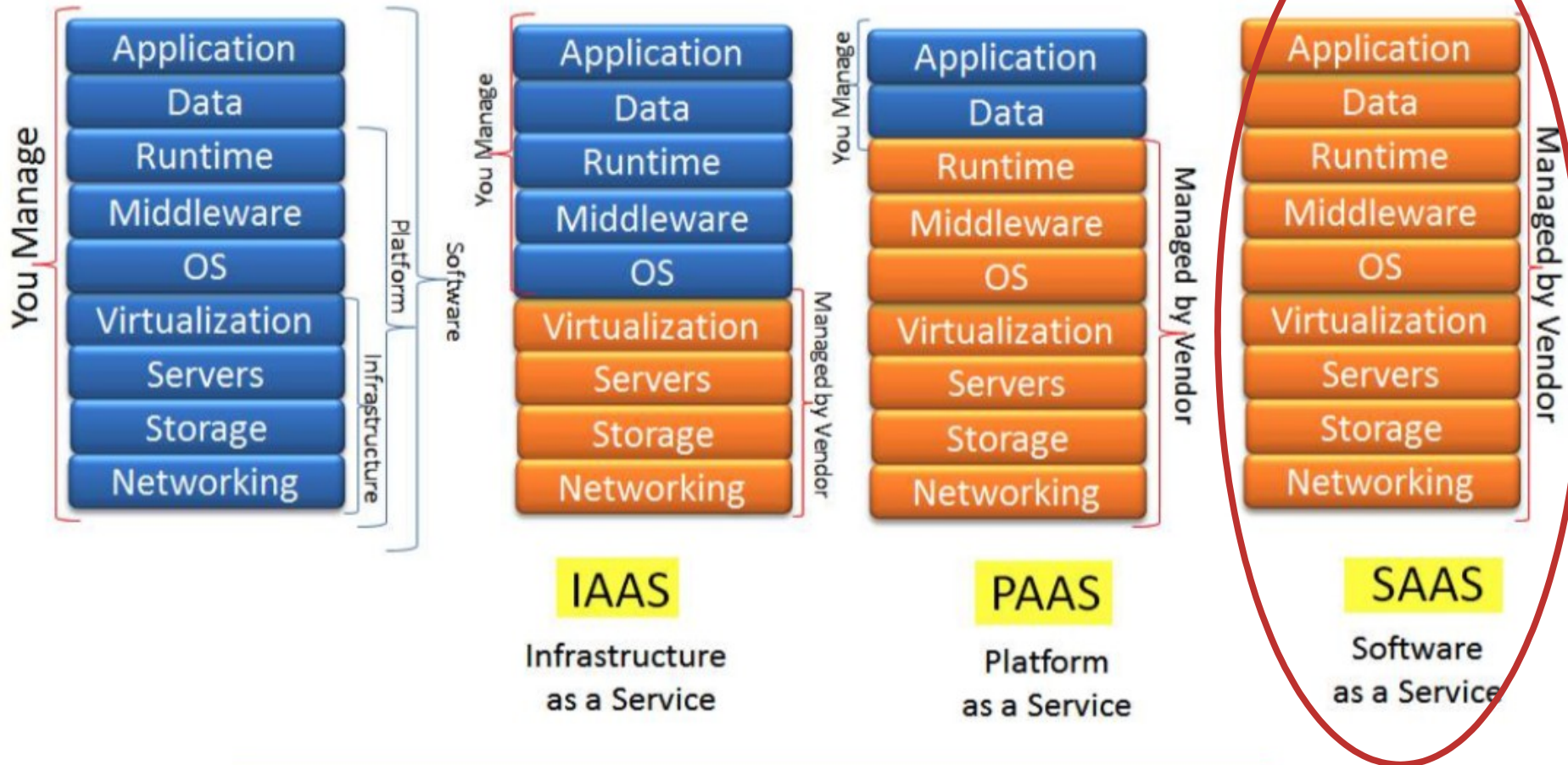
Software as a Service

Software as a service (SaaS) is a software distribution model in which a third-party provider hosts applications and makes them available to customers over the Internet.

The provider gives customers network-based access to a single copy of an application that the provider created specifically for SaaS distribution.

The application's source code is the same for all customers and when new features or functionalities are rolled out, they are rolled out to all customers.

Depending upon the service level agreement (SLA), the customer's data for each model may be stored locally, in the cloud or both locally and in the cloud.

Software as a Service

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SaaS advantages

SaaS removes the need for organizations to install and run applications on their own computers or in their own data centers. This eliminates the expense of hardware acquisition, provisioning and maintenance, as well as software licensing, installation and support.

Flexible payments: Rather than purchasing software to install, or additional hardware to support it, customers subscribe to a SaaS offering.

More predictable budgeting.

Users can also terminate SaaS offerings at any time to stop those recurring costs.

SaaS advantages

Scalable usage: Cloud services like SaaS offer high vertical scalability, which gives customers the option to access more, or fewer, services or features on-demand.

Automatic updates: Rather than purchasing new software, customers can rely on a SaaS provider to automatically perform updates and patch management. This further reduces the burden on in-house IT staff.

Accessibility and persistence: Since SaaS applications are delivered over the Internet, users can access them from any Internet-enabled device and location.

SaaS disadvantages

Businesses must rely on outside vendors

- to provide the software,

- keep that software up and running,

- track and report accurate billing,

- facilitate a secure environment for the business' data.

Providers that experience service disruptions, impose unwanted changes to service offerings,

a security breach or any other issue can have a profound effect on the customers' ability to use those SaaS offerings.

==> SaaS provider's service-level agreement (SLA) is fundamental.