432/832

Advanced Database Systems

CLOUDS, SERVICES AND BLUEMIX

Readings

1. R. Buyyaa, C. S. Yeoa, S. Venugopala, J. Broberga and I. Brandicc. Cloud computing and emerging IT platforms: Vision, hype, and reality for delivering computing as the 5th utility, *Future Generation Computer Systems*, *Volume 25*, *Issue 6*, June 2009, Pages 599–616.
2. E. Griffith. What is Cloud Computing? *Pcmag.com*, April 15, 2015.
3. *Bluemix Overview*.


Cloud
computing

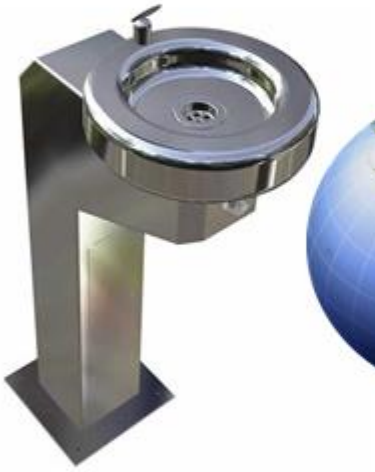
WHAT IS CLOUD COMPUTING?

Google Drive
Apple iCloud
MS OneDrive
Amazon Cloud Drive
??

***Cloud computing** is the delivery of shared computing resources, software or data — as a service and on-demand through the Internet.*

5 Essential Characteristics of Cloud Computing

Ref: The NIST Definition of Cloud Computing
http://csrc.nist.gov/publications/nistpubs/800-145/SP800-145.pdf



On-demand self-service

Ubiquitous network access

Location transparent resource pooling

Rapid elasticity

Measured service with pay per use

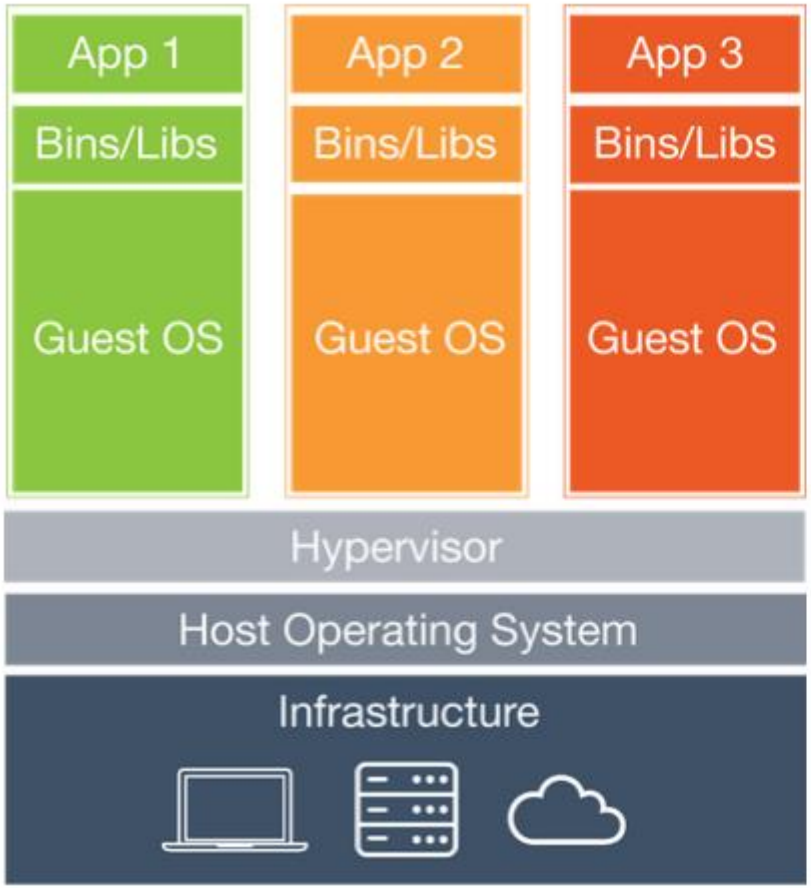
Source: http://aka.ms/532

Virtualization

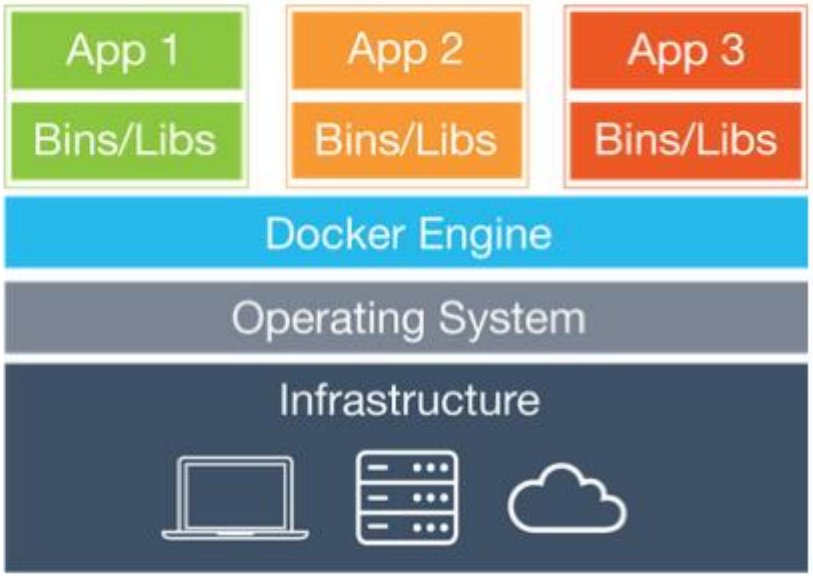
- **Virtualization** is the creation of a virtual (rather than actual) version of something, such as an operating system, a server, a storage device or network resources.
- Virtualization software (eg VMWare, Zen) is a key enabler of cloud computing

Flavours of Virtualization

Virtual Machines

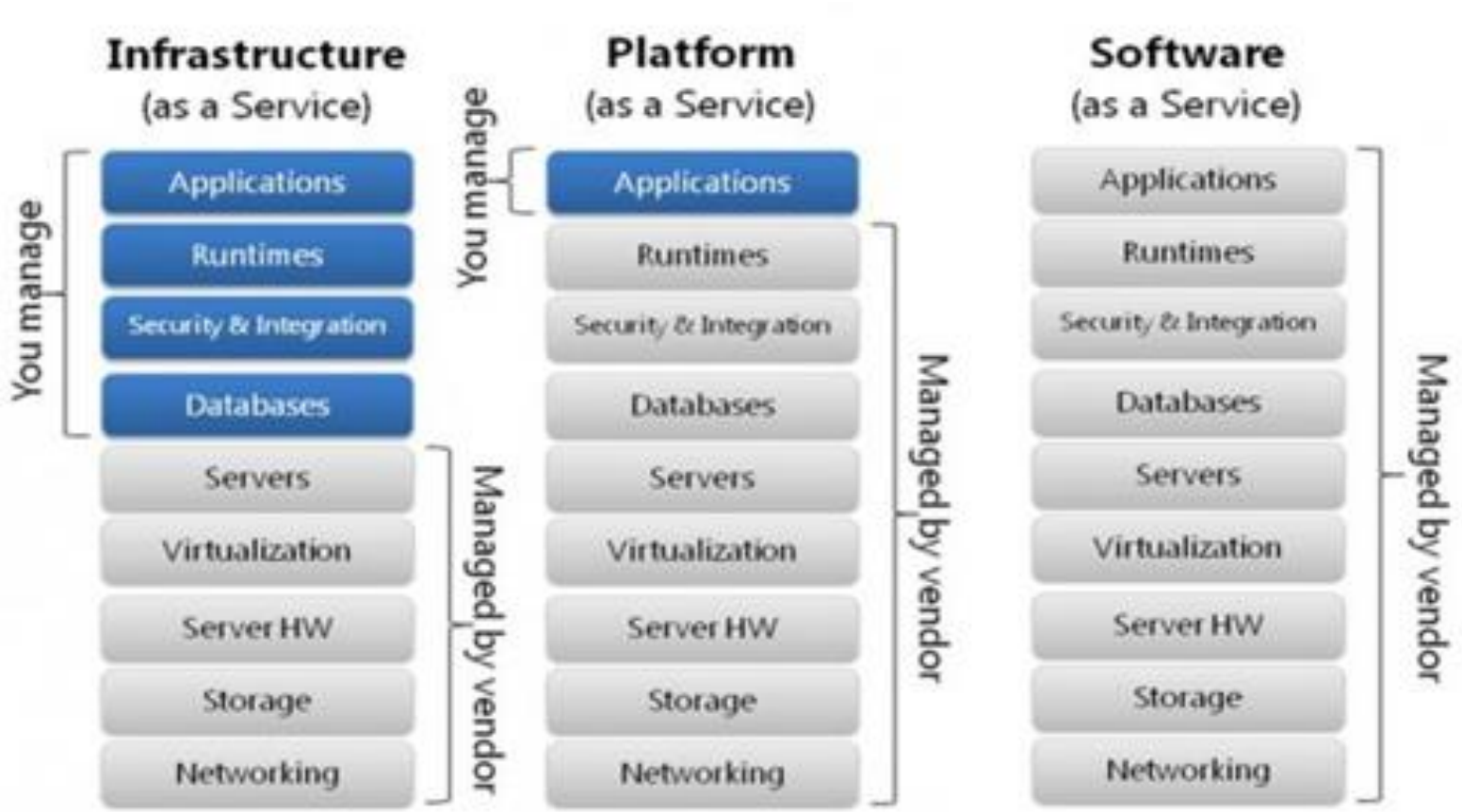


Containers



Business Models for Cloud Computing

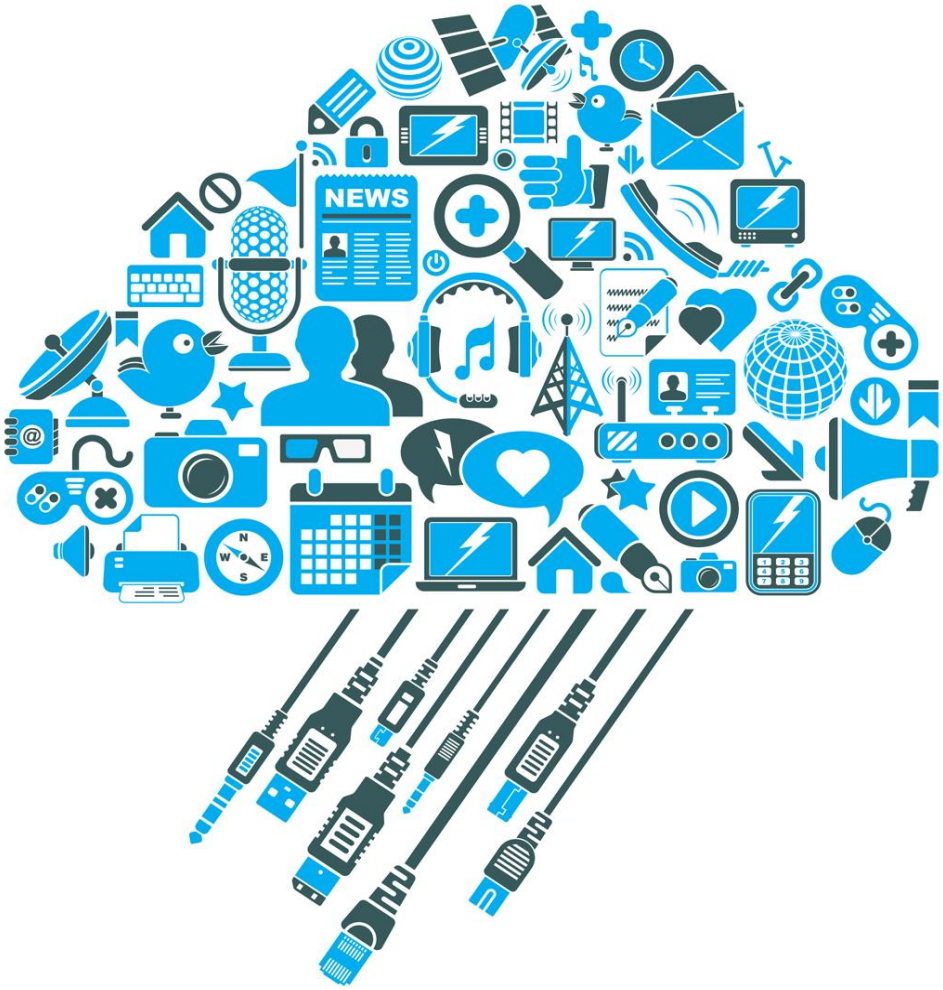
SaaS vs PaaS vs IaaS



Cloud Landscape

Created by:

CloudTimes



SERVICES COMPUTING

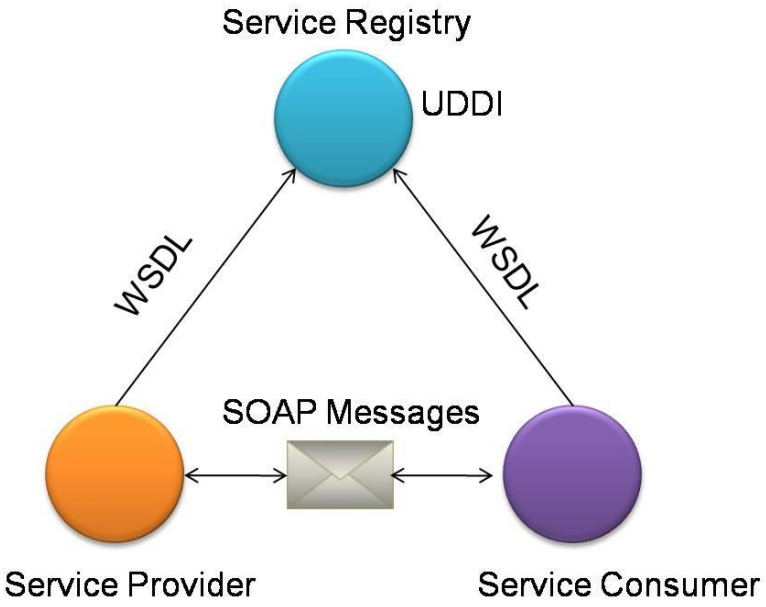
Services Computing

- Computing architecture that packages functionality as a suite of interoperable routines.
- Requires loose coupling of services with operating systems and other underlying technologies.
- Functions are separated into distinct self-describing and autonomous units, or services.
- Services are accessible via pre-defined interfaces over a network
- Services communicate by passing data in a well-defined, shared format.

Web Services

- The dominant implementation of services computing.
- Two flavours:
  - SOAP Based (WS-*) Web Services
  - REST style Web services

WS-* Web Services

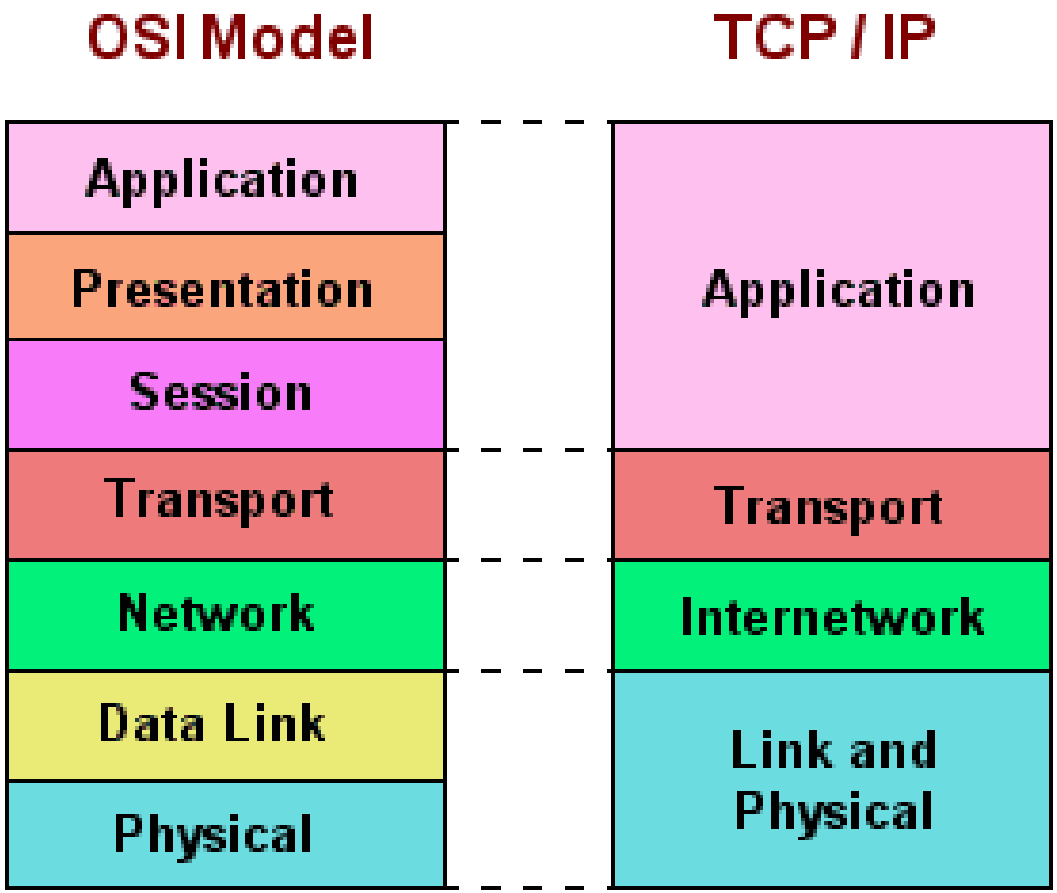


- SOAP – Simple Object Access Protocol
- WSDL – Web Service Description Language
- UDDI - Universal Description, Discovery and Integration

RESTful Web Services

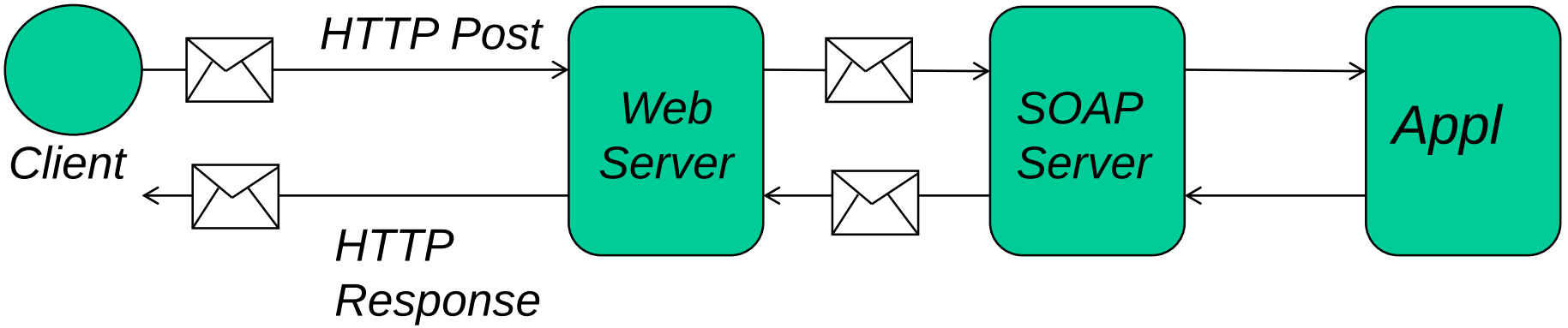
- **REpresentational State Transfer**
- The web has *addressable resources*.
  - Each resource has a Uniform Resource Identifier (URI).
  - REST is *resource-based* as opposed to action-based (like SOAP)
- The web has a *uniform and constrained interface*.
  - Eg. HTTP, has a small number of methods. Use these to manipulate resourses.
- The web is *representation oriented*
  - Can interact with a resource using different representations
- The web may be used to *communicate statelessly* – providing scalability
- *Hypermedia* is used as the engine of application state change.

Protocol Stack



Uniform Constrained Interface

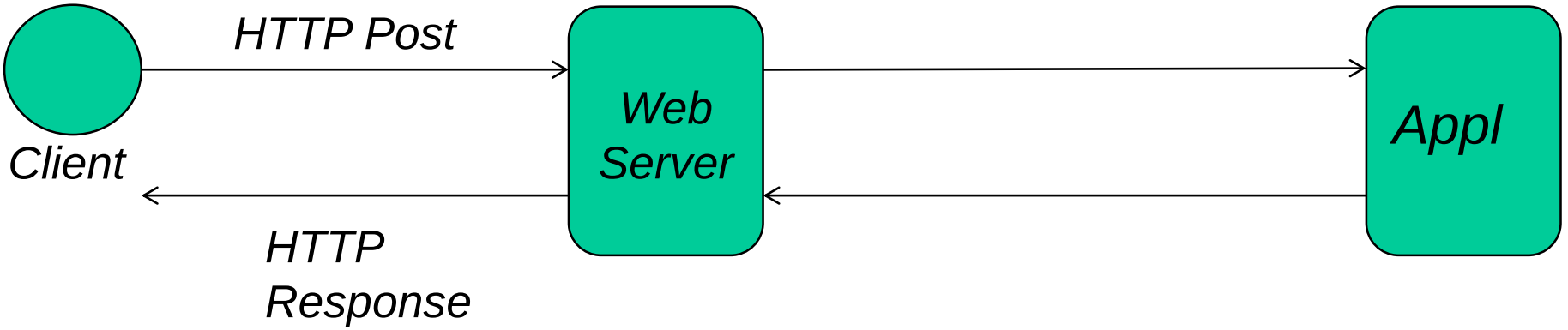
- Most commonly uses HTTP operations
  - GET - read from the resource
  - PUT – modify (insert or update) the state of the resource
  - POST – may modify the state of the resource; request and response may contain additional information
  - DELETE –modify (delete) the state of the resource.



SOAP

vs

REST Interactions



Overview of IBM Cloud Offering

BLUEMIX

What is Bluemix?

- **Bluemix** is an *open-standards*, *cloud-based PaaS* for building, running, and managing applications

What is Bluemix? (cont)

Compute

*Choose the level of **infrastructure abstraction** based on your app's architectural needs.*

CLOUD FOUNDRY

docker

openstack

Dev Tooling

*From editors to source code management to continuous delivery, you can **use Bluemix' powerful tooling** or easily **bring your own**.*

urban{code}

Location

*Deploy apps to Bluemix **Public** (in a growing number of geos), your own **dedicated cloud** Bluemix, or one that runs **within your data center (Local*)**.*

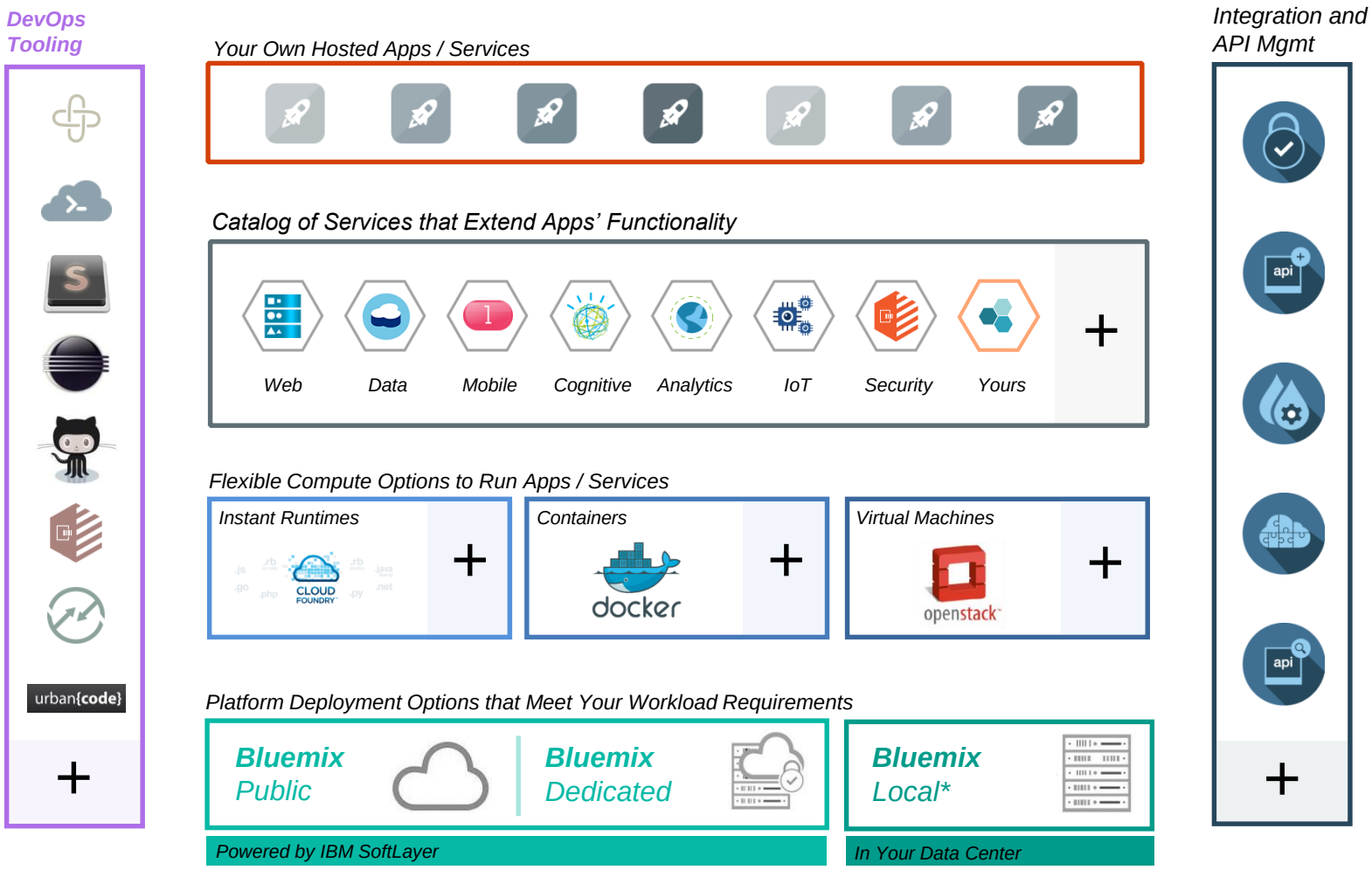
Services

*Pick from a catalog of **IBM**, **third party**, **open source**, or **your own** services to extend your apps.*

- *IBM*
- *Third Party*
- *Open Source*
- *Yours*

How does Bluemix work?

*Bluemix is underlined by three key open compute technologies: **Cloud Foundry**, **Docker**, and **OpenStack**. It extends each of these with a of **services**, robust **DevOps tooling**, and **integration** capabilities.*



Key Technologies

- ***Cloud Foundry***
  - Cloud Foundry is an open-source PaaS for developers to run their applications in the cloud
  - Developers only push their (web) applications and everything else - from the hardware up to the application servers - is provided by the platform.

Key Technologies

- ***Docker***
  - Docker is an open-source container technology to package full application stacks so that these containers can easily be run in different environments.
  - Portability is achieved by packaging the core applications along with the complete underlying stack you need to run applications including application servers, Java runtimes, configuration and other dependencies.

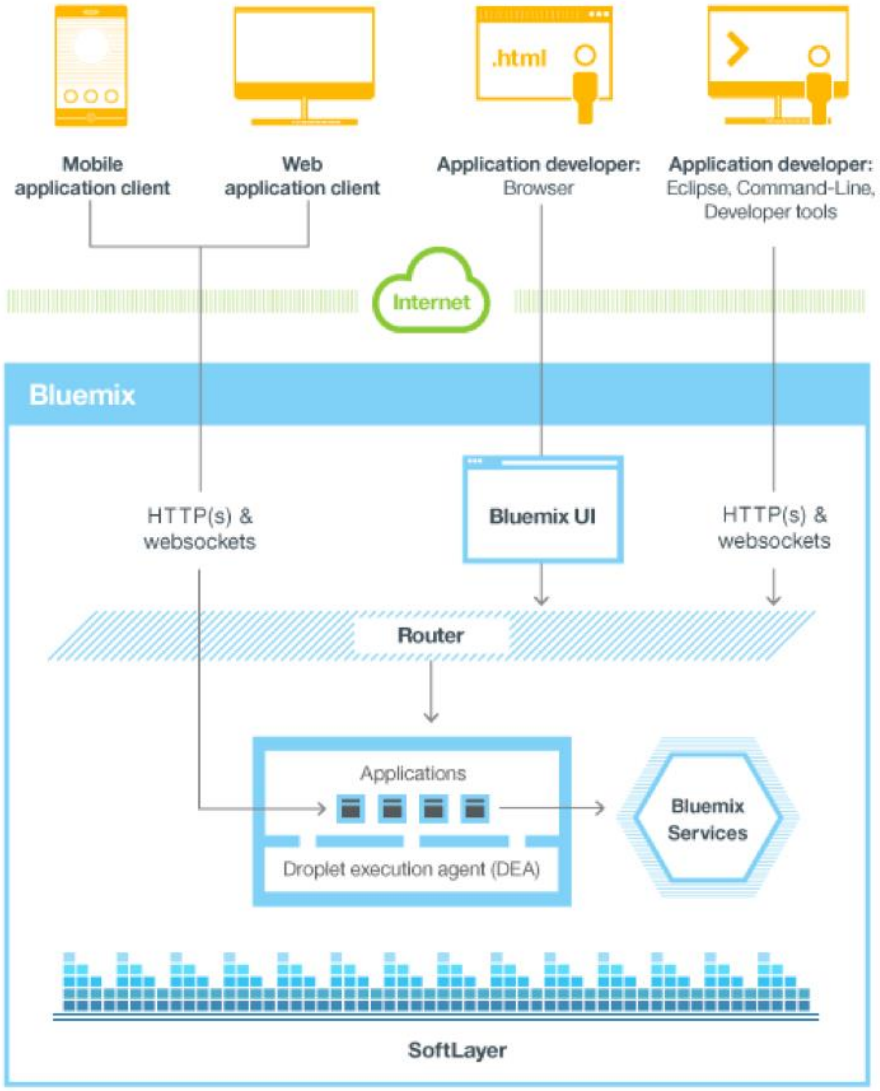
Key Technologies

- ***Openstack***
  - OpenStack is a set of open-source IaaS software tools for building and managing cloud computing platforms for public and private clouds.
  - Allows users to deploy VMs and instances on the fly and to dynamically scale running applications

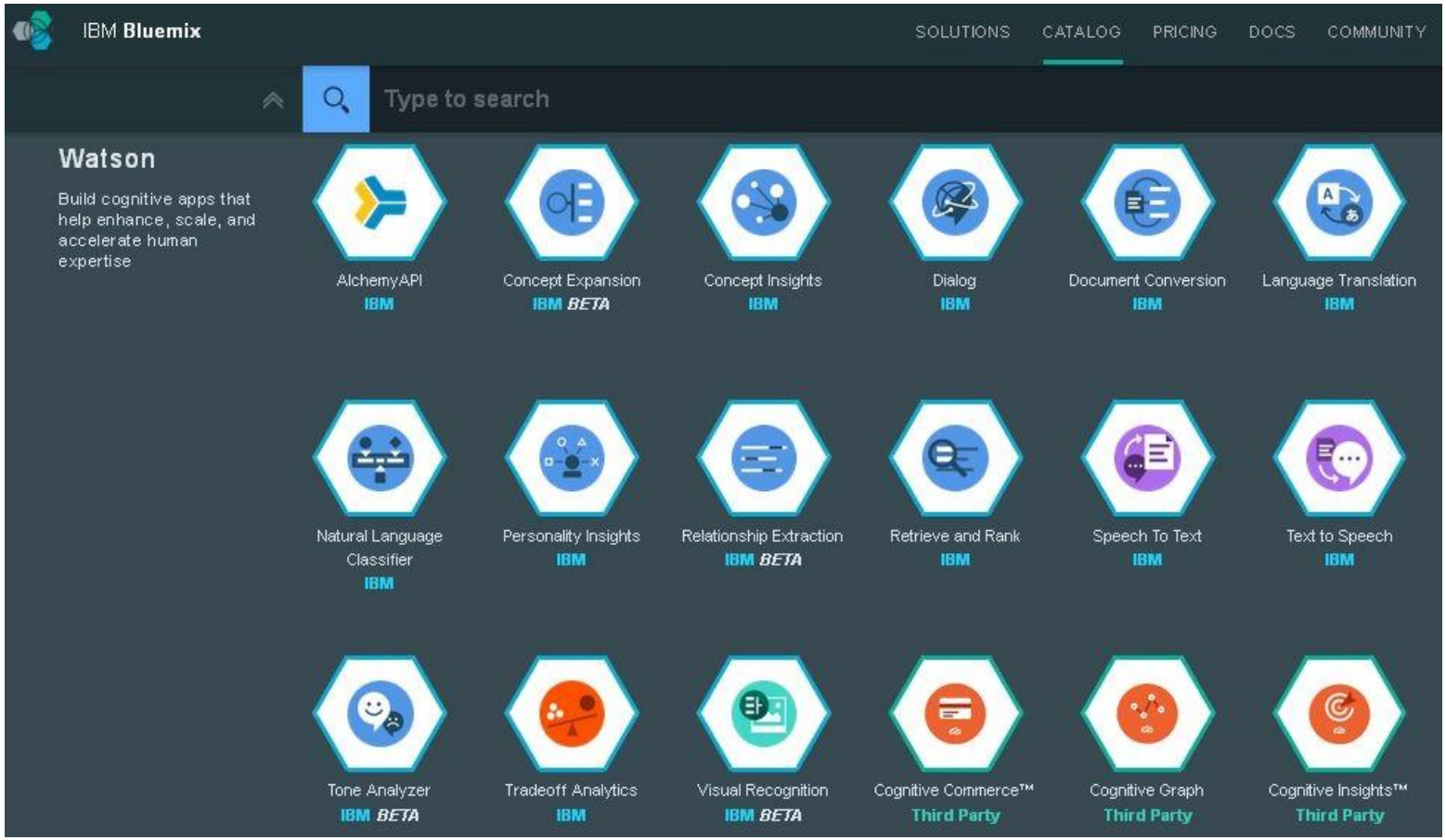
Key Technologies

- ***SoftLayer***
  - SoftLayer is an IBM-owned company
  - IaaS provider that has data centers around the world

Bluemix Architecture



Bluemix Services



WHAT'S COMING UP IN THE COURSE

- **Week 2 – Sept 19 - 23**
  - Lectures – RDBMS implementation issues
- **Week 3 – Sept 26 - 30**
  - Lectures – RDBMS implementation issues, RDBMS architectures
- **Week 4 – Oct 3 – 7**
  - Assignment 1 due Oct 4
  - Bluemix tutorial Oct 4
  - Lectures – RDBMS architectures