

MATES ED2MIT

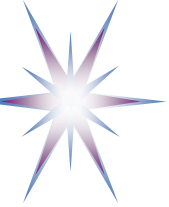
Education and Training for Data Driven Maritime Industry

Tutorial A01.02

Cloud Computing Foundation:
Reference Model and Use cases

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University of Amsterdam



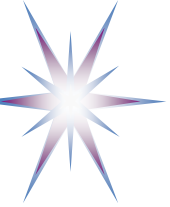


Cloud Computing Basics

- Definition Cloud Computing
- Trends to Hybrid Clouds
- Virtual Machines and Containers
- Cloud Security and Compliance
- DevOps support

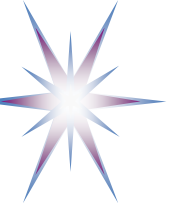


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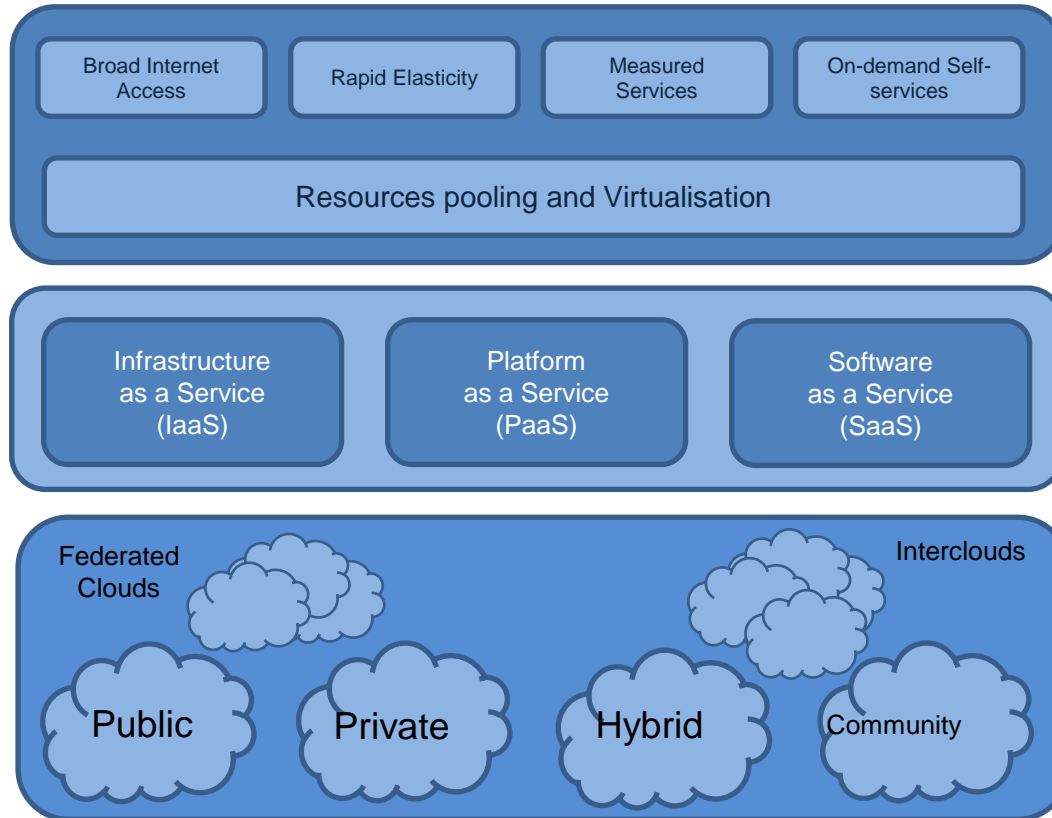
Cloud Computing as a key IT technology development factor

- Cloud Computing has entered a maturing stage and currently a commodity services
- Cloud Computing is powering modern business and powering new technologies development that require elastic computing resources on-demand
 - Mobile applications
 - Big Data and AI applications
 - Internet of Things (IoT)
 - Changes telecom market landscape
- In turn, other technologies demand accelerates Cloud Computing development
- Cloud Computing increases business agility and speeds up new services/products development to market
 - However still restrained by security concerns on business data protection



NIST Cloud Definition - Visualisation

Visual presentation of NIST Cloud Definition

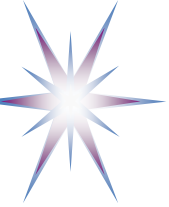


- New emerging cloud deployment and operation models
 - Intercloud/multicloud
 - Federated clouds

Essential
Characteristics

Service
Models

Deployment
Models



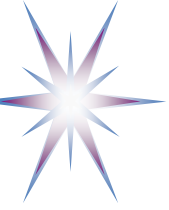
Cloud Deployment Models

Private Cloud: The cloud infrastructure is provisioned for exclusive use by a single organization comprising multiple consumers (e.g., business units). It may be owned, managed, and operated by the organization, a third party, or some combination of them, and it may exist on or off premises.

Public Cloud: The cloud infrastructure is provisioned for open use by the general public. It may be owned, managed, and operated by a business, academic, or government organization, or some combination of them. It exists on the premises of the cloud provider.

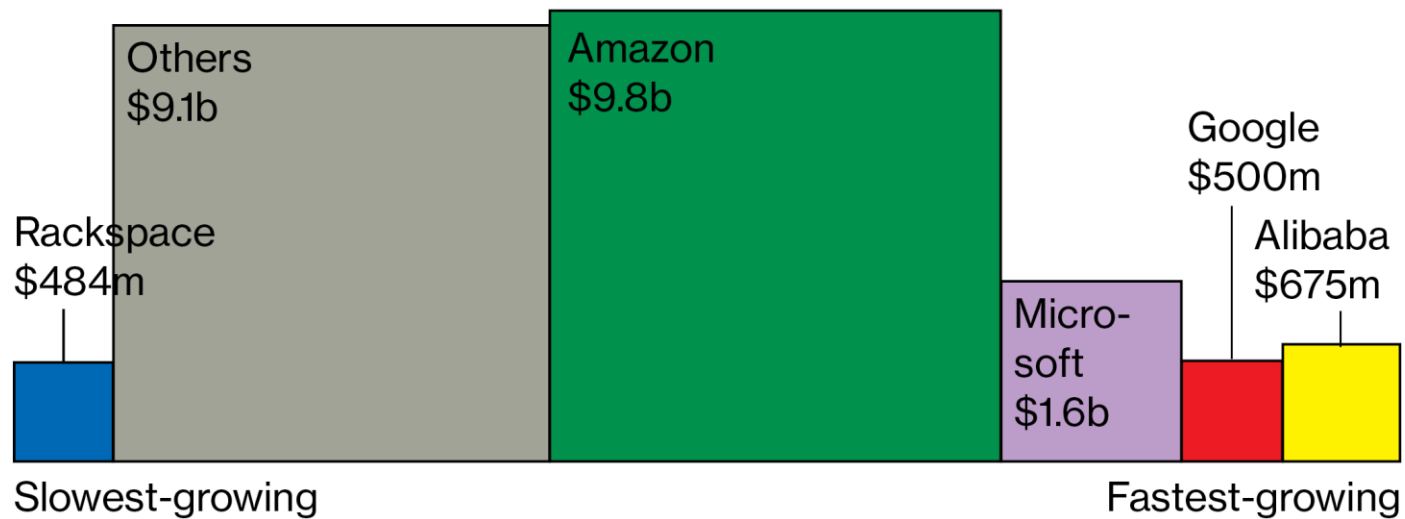
Hybrid Cloud: The cloud infrastructure is a composition of two or more distinct cloud infrastructures (private, community, or public) that remain unique entities, but are bound together by standardized or proprietary technology that enables data and application portability (e.g., cloud bursting for load balancing between clouds).

Community Cloud: The cloud infrastructure is provisioned for exclusive use by a specific community of consumers from organizations that have shared concerns (e.g., mission, security requirements, policy, and compliance considerations). It may be owned, managed, and operated by one or more of the organizations in the community, a third party, or some combination of them, and it may exist on or off premises.



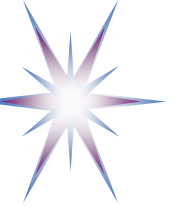
Cloud Services Market Trends

Cloud infrastructure services revenue, 2016



GRAPHIC BY BLOOMBERG BUSINESSWEEK; DATA: GARTNER

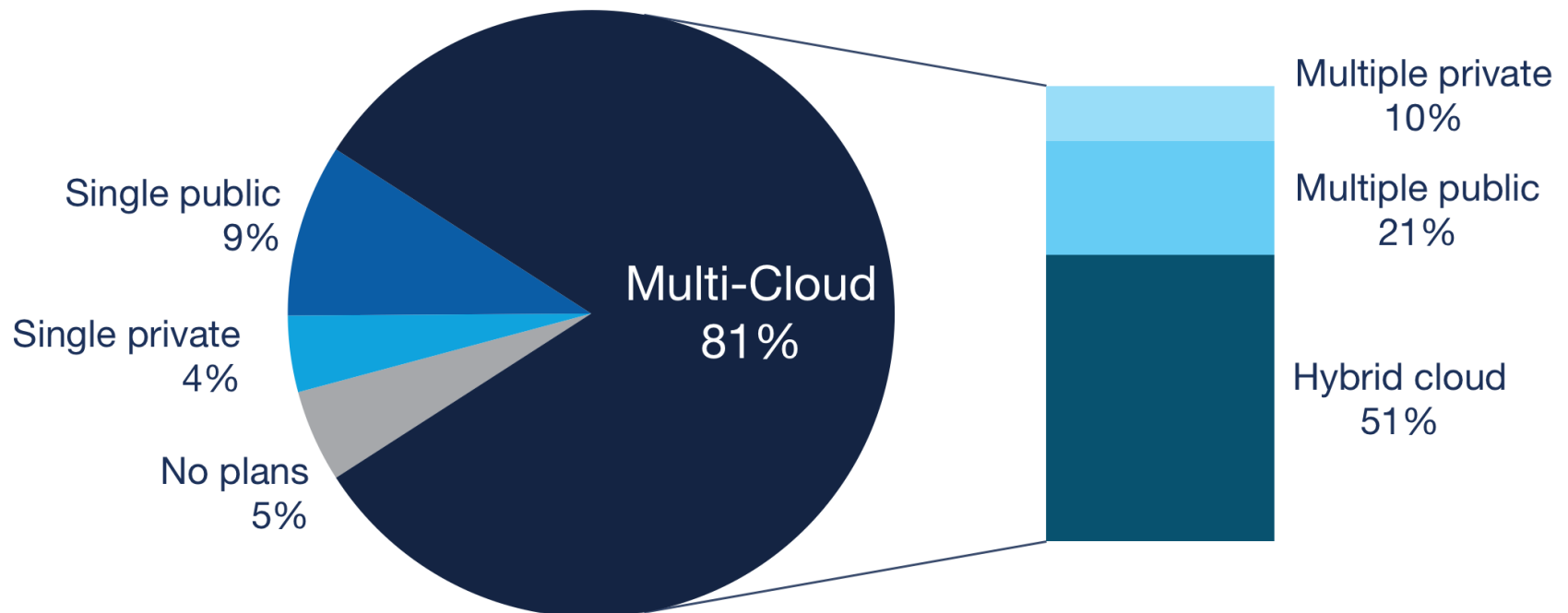
- <https://www.bloomberg.com/news/articles/2017-11-10/microsoft-and-google-turn-to-ai-to-catch-amazon-in-the-cloud>



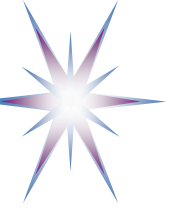
Enterprise Cloud Strategy

Enterprise Cloud Strategy

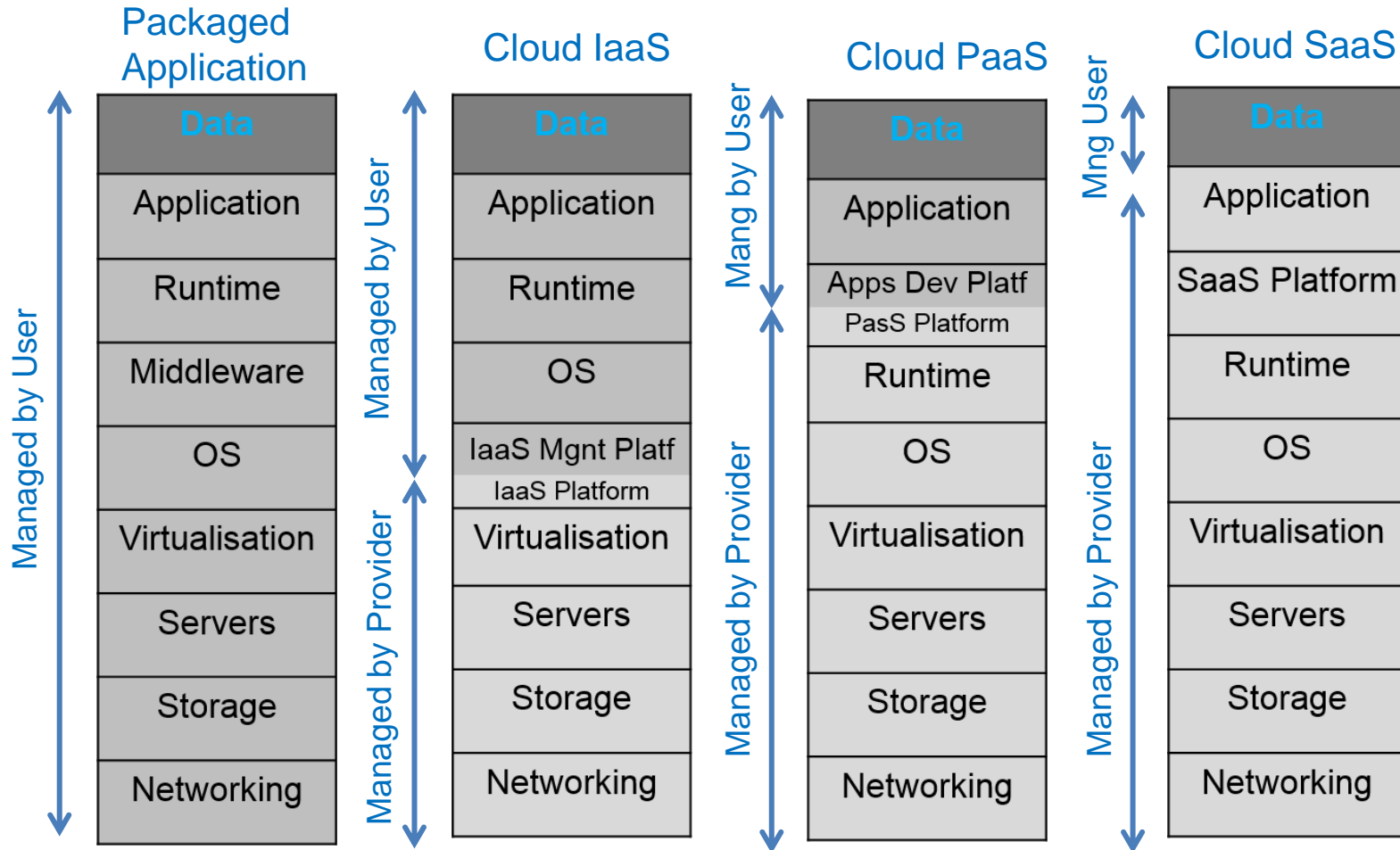
1000+ employees



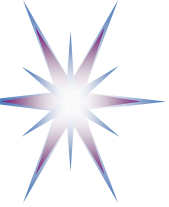
Source: RightScale 2018 State of the Cloud Report



Relation between IaaS, PaaS, SaaS



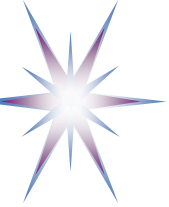
Note: Data always remain under user (cloud consumer or customer) responsibility, however it may be processed. Physically, they may be processed at each of S/P/IaaS level



Cloud Use Cases

Why do we need use cases analysis?

- Use cases analysis is an important component of the technology definition
- Use cases analysis gives examples how the technology is used and allows defining best practices
- Provide input for taxonomy
- Define requirements general and specific, functional and non-functional
- Provides a basis for architecture validation
- Help identifying the main stakeholders



General Cloud Use Cases

Use case 1:

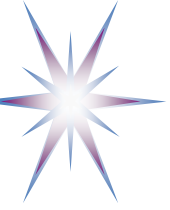
- Moving part of workload to cloud in case of abrupt demand increase: cloudburst

Use case 2:

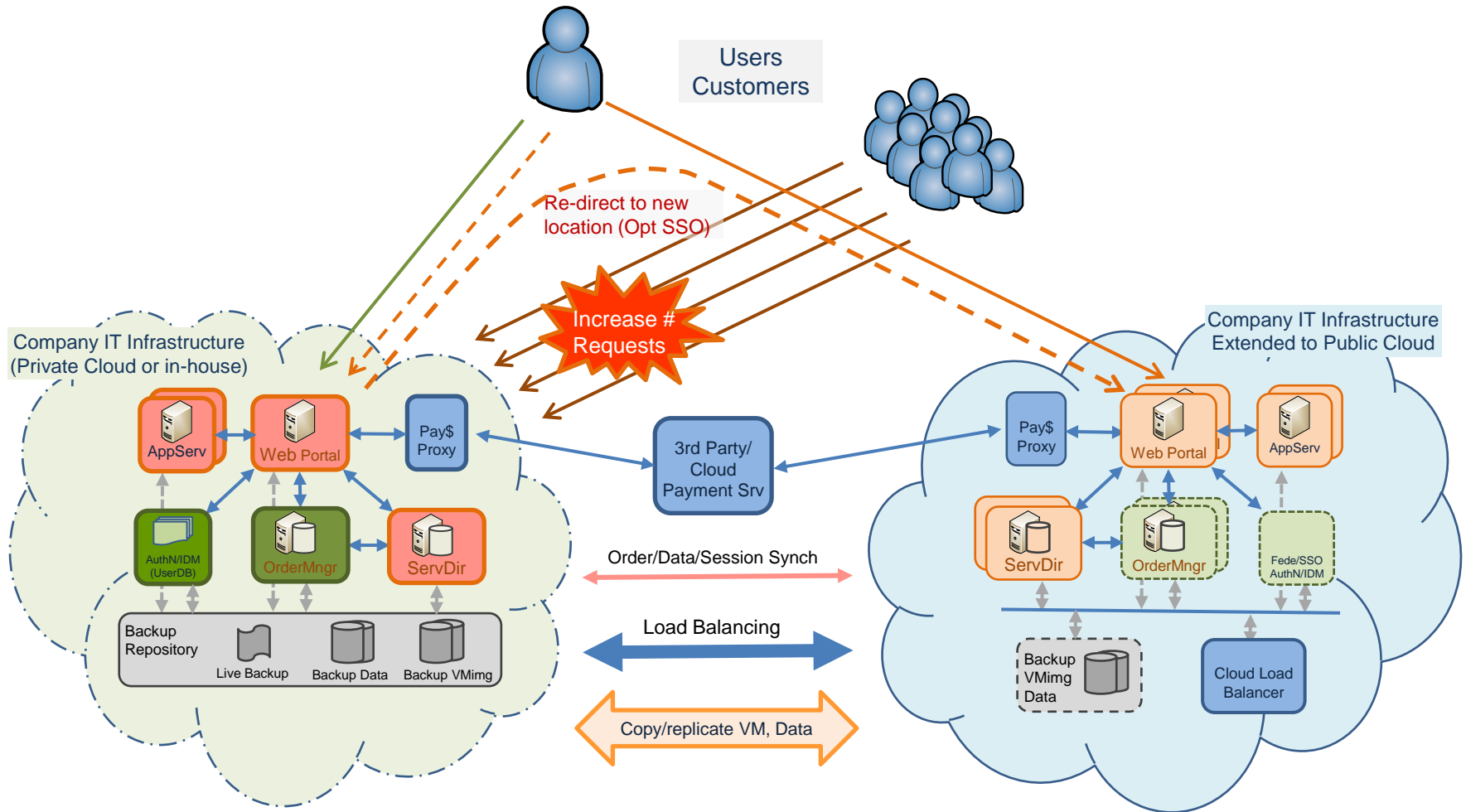
- Disaster recovery
 - Moving/restoring emergency load in a partner cloud
 - Restoring own cloud based IT infrastructure

Use case 3:

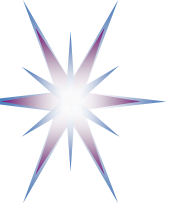
- Service continuity when changing cloud provider



Cloudburst: Rapid load increase: seasonal, cyclical



Scenario: Abrupt demand increase for company's services: holiday shopping, seasonal, gaming, mobile Apps, ads campaign.



Cloudburst: Rapid load increase: seasonal, cyclical - Details

Scenario

- Webshops/eMarkets, entertainment sites have seasonal/holidays increase of load and users
- Surviving “disaster of success” when popular application or website attracts abrupt amount of users

Preconditions

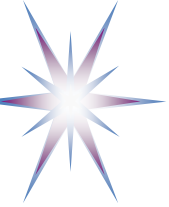
- Company’s IT infrastructure is cloud based: private cloud or hosted on cloud
- Services and applications grouped to simplify services extension to cloud
 - Some 3rd party services (like payment systems) are already hosted on cloud
- The whole or part of IT infrastructure is backed up, including VM, Data, UserDB, topology, state/session

Sequence:

- Cloudburst scenario is triggered when increased number of requests causes services delay or interruption
- VM images and up-to-date order data (optionally UserDB) are backed up/replicated and transferred to suitable cloud provider (location, compatibility, cost)
- VMs and all necessary components are deployed in new cloud/location, data and states are synchronized
- Requests (all or part) are started to be re-directed to new location benefiting from elasticity of cloud resources
 - Additional capacity are automatically added to keep required Quality of Service (QoS), e.g. request processing time, download speed, streaming quality
- Some services are typically not replicated to burst cloud, e.g. UserDB and order or payment processing
 - Initial client authentication can be done at the main site/portal and redirected using Single Sign On (SSO) to new/cloud location
 - Data and processes synchronization must be in action
- External cloud resources and infrastructure stopped and de-commissioned, VM destroyed, after demand decrease (scale-down), all business related data are transferred back to company

Challenges

- Real time migration

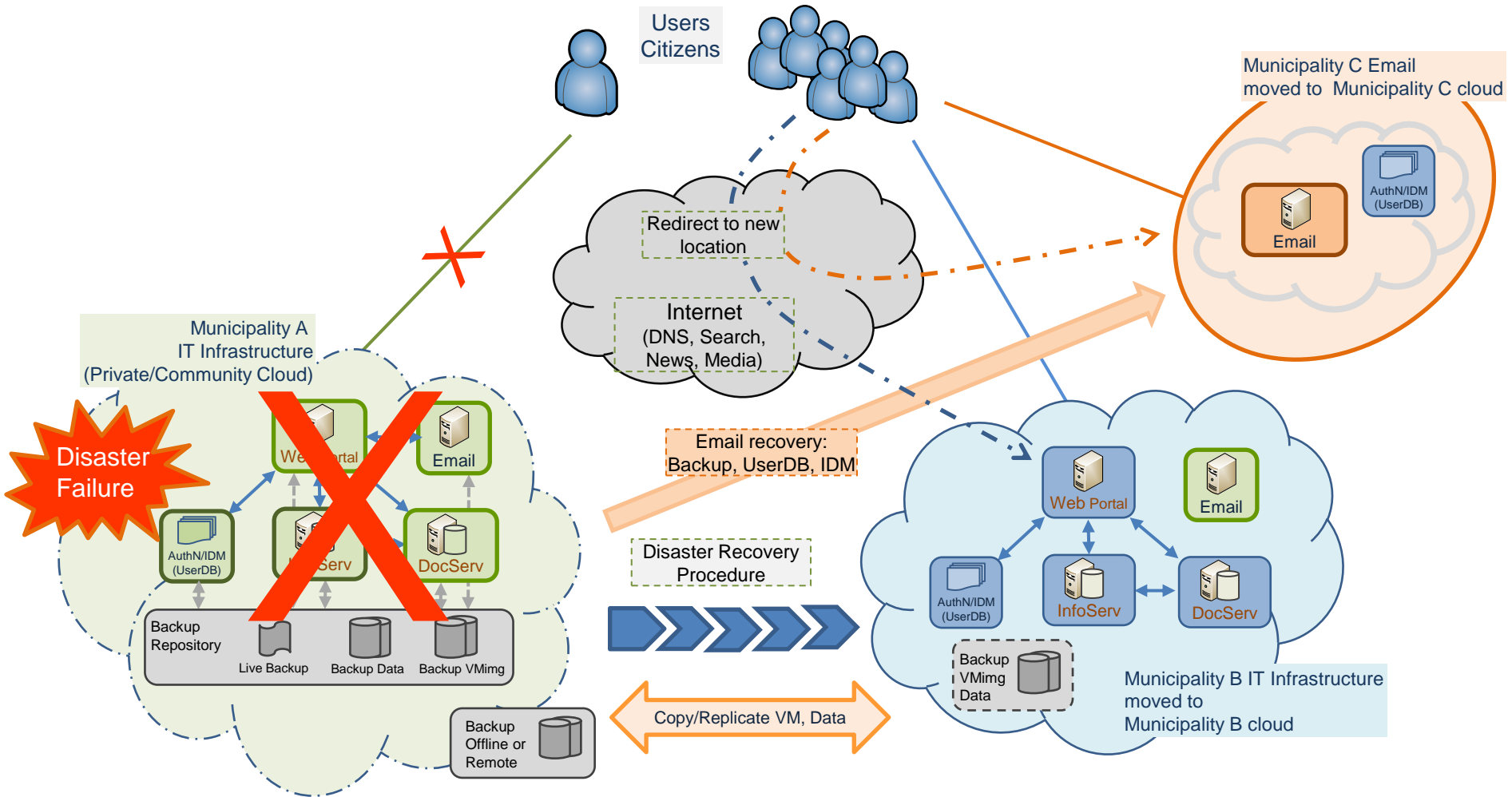


Cloudburst: Design suggestions

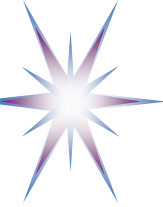
- How will you launch your workloads? From a template, from a clone or from a dormant VM/instance?
- How will you connect, and how much data do you intend to push over this network connection?
 - Is it a point-to-point network, MPLS, EVPL or VPN, and is it production data, metadata, sensitive data or management traffic?
- How automated should this solution be? Is the cloud portal you have chosen easy enough to operate to take advantage of cloud bursting?
 - An API can provide full automation, but will require coding and additional business logic in your applications.
- How will the cloud handle your security policies? Does the cloud you have chosen have the governance and maturity you would expect for your data?
 - Can you even bring your own policies into the cloud? After all, the cloud holds your data, shouldn't it be able to support your existing IT policies?
- How will you handle load balancing? Will you need local and possibly global load balancing that can be dynamically updated to include the new workloads you have bursted into the cloud?
- How will you charge back in case of services outsourcing? Does your cloud bursting solution make it easy to charge back internal and external customers and set spend limits, controlling cloud sprawl and avoiding the auto-ballooning of cloud costs?

[ref] Cloudburst: Three steps for enterprise scaling into the cloud
<http://blog.savvis.com/2012/04/cloud-burst-three-steps-for-enterprise-scaling.html> /

Disaster Recovery (massive infrastructure failure)



Scenario: Due to natural disaster IT infrastructure of Municipality A destroyed; offline backup stored remotely is available; information service restored in the municipality B, email – in municipality C



Disaster Recovery: Services restored in a new location

Scenario

- Due to natural disaster IT infrastructure of Municipality A destroyed
- Offline backup stored remotely is available but cannot be used from Municipality A
- There is vital need for information both for citizens and for rescue team
- amount of users

Preconditions

- Municipalities' IT infrastructures are cloud based: using community cloud deployment model
- The whole IT infrastructure is backed up regularly, including VMs of all applications and services, Data, UserDB, topology
- Data and backups are replicated to/stored remotely

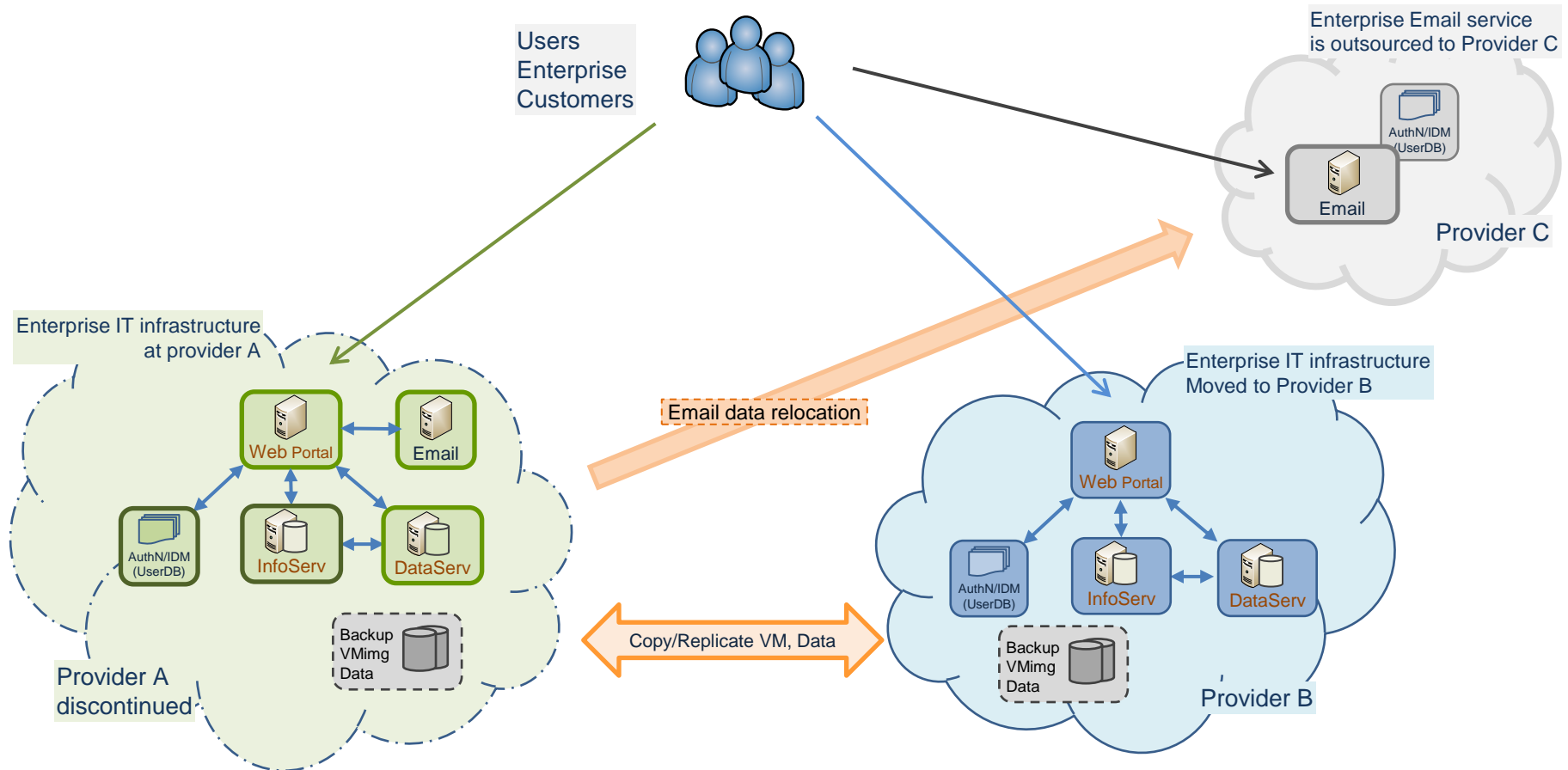
Sequence:

- Emergency Team (ET) starts working and following emergency response procedure
- ET accesses backup and transfers all files and images to previously defined location(s):
 - Information service is restored in the municipality B
 - Email service is restored in municipality C
 - Some services are provided by other municipalities
- New services location is registered in DNS and information is populated on Internet and on the web, by phone, newspapers
- Municipality A information services and email starting working on emergency mode; when original facility and datacenter are restored, services will be migrated to original location

Challenges:

- Full services backup and restoration must also include infrastructure and services topology
- Compatibility and standards for VM images, Data, service description and topology
- Compatible cloud platforms in Municipality A, B, C

Service continuity when changing Cloud provider



Scenario: Provider A discontinues its service; there is transition period; enterprise moves services to a new provider, assures services continuity, makes services optimisation



Service continuity when changing Cloud provider

Scenario

- Provider A discontinues its service; there is transition period; enterprise moves services to a new provider, assures services continuity

Preconditions

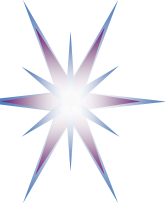
- Enterprise IT infrastructure is cloud based: private cloud or hosted on cloud
- The whole IT infrastructure is backed up, including VM, Data, UserDB, topology
- There is a transition period and a transition plan that also includes service/infrastructure optimization, some applications re-design

Sequence:

- Enterprise transfers/replicates either individual VM images or the whole infrastructure to new provider(s)
 - Main IT infrastructure is moved to provider B
 - Email service is moved to provider C
- Data are replicated to new location(s) and synchronised
- New services location is registered in DNS for correct Internet traffic forwarding; no other changes required
- Enterprise starts operating from a new location a new cloud provider as usual

Challenges:

- Full services backup and migration must also include infrastructure and services topology
- Compatibility and standards for VM images, Data, service description and topology
- Compatibility of cloud platforms at providers A, B, C

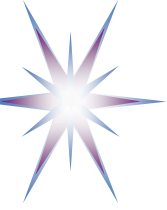


Google, AWS, Azure Big Data Stacks

The image displays three overlapping screenshots of cloud provider consoles:

- Google Cloud Platform:** Shows the 'BIG DATA' section with services like BigQuery, Pub/Sub, Dataflow, ML Engine, IoT Core, Genomics, and Dataprep.
- AWS Management Console:** Shows various service categories including Migration, Machine Learning, Networking & Content Delivery, Analytics, Developer Tools, and Security, Identity & Compliance.
- Microsoft Azure:** Shows the 'New' services menu with 'AI + Cognitive Services' highlighted. The 'Azure Marketplace' section lists various services like Machine Learning Experimentation, Machine Learning Model Management, Data Science Virtual Machine, Web App Bot, Computer Vision API, Face API, Text Analytics API, and Language Understanding.

At the bottom, a taskbar shows file names like 'training-data (1).tar.gz', 'cosmosdb.pptx', and 'P4010.pptx'.



AWS, Azure, Google Big Data Stacks

The image displays three overlapping screenshots of major cloud service providers' management consoles, illustrating their interfaces for managing Big Data stacks.

- AWS Console (Center):** Shows a dashboard with categories like Migration (AWS Migration Hub, Application Discovery Service, etc.), Machine Learning (Amazon SageMaker, Amazon Comprehend, etc.), Business Productivity (Alexa for Business, Amazon Chime, etc.), Networking & Content Delivery (VPC, CloudFront, etc.), Analytics (Athena, EMR, etc.), and Internet of Things (AWS IoT, etc.).
- Google Cloud Platform (Left):** Shows a sidebar with navigation options like Home, Pins, BigQuery, Pub/Sub, Dataproc (with a sub-menu for Clusters and Jobs), Dataflow, ML Engine, IoT Core, Genomics, and Dataprep.
- Microsoft Azure (Right):** Shows the Azure Marketplace with a search bar and a list of services including Machine Learning Experimentation, Machine Learning Model Management, Data Science Virtual Machine, Web App Bot, Computer Vision API, Face API, Text Analytics API, and Language Understanding.

A large, stylized orange watermark reading "Native and intuitive" is superimposed diagonally across the center of the three console screenshots.

AWS, Azure, Google Big Data Stacks

The image displays three overlapping screenshots of cloud management consoles, illustrating the infrastructure stacks for AWS, Azure, and Google Cloud Platform (GCP). A red handwritten text "Business oriented" is written across the Azure screenshot.

- Google Cloud Platform (GCP):** The screenshot shows the GCP console with the "Dataproc" service selected. The "Clusters" tab is active, displaying a list of clusters and their status. The "APIs" section is visible on the right, showing the "Requests (requests/sec)" graph.
- AWS Management Console:** The screenshot shows the AWS console with the "Migration" and "Networking & Content Delivery" sections visible. The "Migration" section includes services like AWS Migration Hub, Application Discovery Service, Database Migration Service, Server Migration Service, and Snowball. The "Networking & Content Delivery" section includes VPC, CloudFront, Route 53, API Gateway, and Direct Connect.
- Microsoft Azure:** The screenshot shows the Azure portal with the "New" button selected. The "Azure Marketplace" is displayed, showing various services and their status. The "Cognitive Services" section is highlighted, indicating the focus on AI and machine learning capabilities.

AWS, Azure, Google Big Data Stacks

simple and focused

Google Cloud Platform

My First Project

Home

Pins appear here

BIG DATA

- BigQuery
- Pub/Sub
- Dataproc
- Dataflow
- ML Engine
- IoT Core
- Genomics
- Dataprep

Google Cloud Platform status

All services normal

Go to Cloud status da

Billing

Estimated charges

For the billing period 1 2018

View detailed charges

Error Reporting

https://console.cloud.google.com/dataproc?project=deep-bolt-183015

training-data (1).tar.gz

cosmosdb.pptx Failed - Network error

P4010.pptx

Show all

New - Microsoft Azure

https://portal.azure.com/#create,

0-Laureate Lens

LOE - DS

Amex

MijnING

ZelfJvA

MijnSNS

UrenFNWI

Microsoft Azure

New

Search the Marketplace

Azure Marketplace

See all

Featured

See all

Get started

Recently created

Compute

Networking

Storage

Web + Mobile

Containers

Databases

Data + Analytics

Internet of Things

Enterprise Integration

Security + Identity

Developer tools

Monitoring + Management

Add-ons

Blockchain

Machine Learning Experimentation (preview) Learn more

Machine Learning Model Management (preview) Learn more

Data Science Virtual Machine - Windows 2016 Learn more

Web App Bot Learn more

Computer Vision API Learn more

Face API Learn more

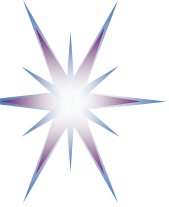
Text Analytics API Learn more

Language Understanding Learn more

AI + Cognitive Services

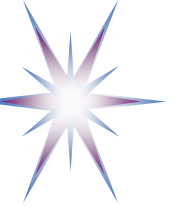
P4010.pptx

Show all



AWS Cloud – Basic Services

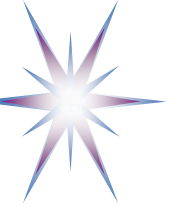
- EC2 (Elastic Cloud Computing) – VMs, Container,
- S3 (Simple Storage Service) – buckets
- Lambda (functions – serverless computing)
- Network – Virtual Private Cloud, Virtual Private Network, dedicated connectivity
- Database – SQL, NoSQL
- IoT, Edge Computing
- Identity management, Federated Access Control
- Data Analytics, Business Intelligence
- Machine Learning



AWS Cloud Big Data Services

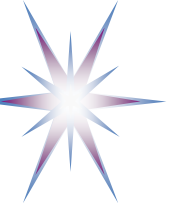
AWS Cloud offers the following services and resources for Big Data processing:

- EC2 Virtual Machine (VM) instances for HPC optimized for computing (with multiple cores) and with extended storage for large data processing.
- **Amazon Elastic MapReduce (EMR)** provides the Hadoop framework on Amazon EC2 and offers a wide range of Hadoop related tools.
- **Amazon Kinesis** is a managed service for real-time processing of streaming big data (throughput scaling from megabytes to gigabytes of data per second and from hundreds of thousands different sources).
- **Amazon DynamoDB** highly scalable NoSQL data stores with sub-millisecond response latency.
- Amazon Aurora scalable relational database
- Amazon Redshift fully-managed petabyte-scale **Data Warehouse** in cloud at cost less than \$1000 per terabyte per year.
- **Amazon Machine Learning**
- Machine Learning (Artificial Intelligence) based services (Lex, Translate, Recognition, etc.)



Selecting Cloud Service Provider

- Type of VM instance
- Compute resource: VM, Container, Function or Lambda
- Storage resources and Content Distribution Network (CDN)
- Region and availability zone
 - Local compliance and certification, e.g. GDPR for Europe
- Cost of services and billing scheme
 - Note: VM cost is calculated per core
 - Note: Database cost is calculated by transactions and I/O operations + used VM instances

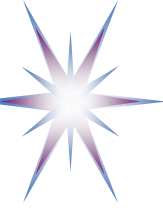


Amazon Web Services (AWS) Cloud

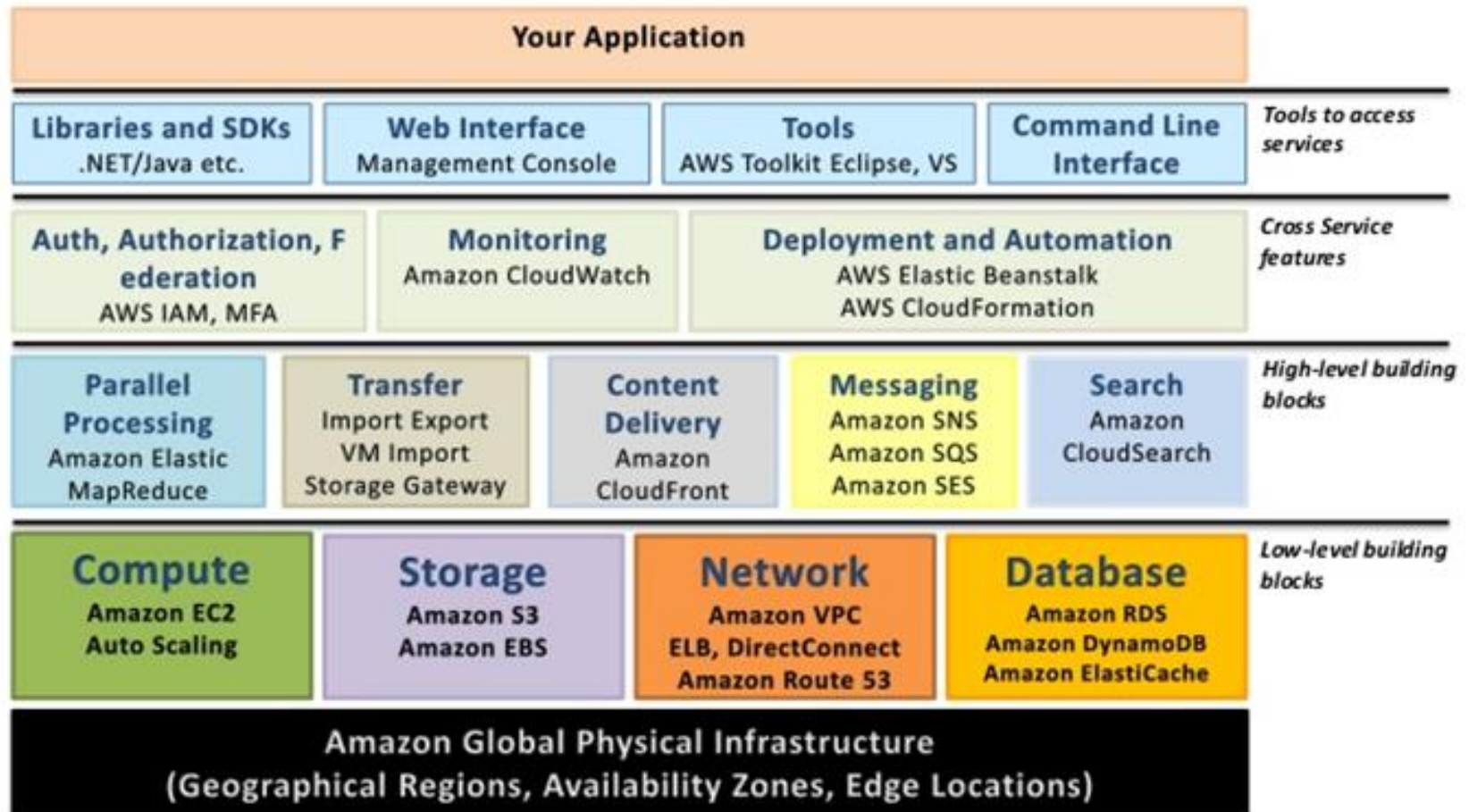
- AWS service groups
 - **Compute: Elastic Compute Cloud (EC2) and EC2 Container service**
 - Storage and Content Delivery: Simple Storage Service (S3), CloudFront, Glacier, etc.
 - **Database: RDS, Dynamo, ElastiCache, Redshift**
 - Networking: VPC, Direct Connect, Rout 53
 - Security and Identity Management: IAM (Identity and Access management), Directory, etc.
 - Developer tools
 - Management and Governance
 - **Analytics and Machine Learning**
 - Mobile Services
 - Applications Integration
 - Enterprise Applications
 - Internet of Things
- AWS has 14+ availability zones to choose from:
 - US Standard (default), US West (Oregon), US West (Northern California)
 - Europe: Ireland, Frankfurt, London, Paris
 - Asia Pacific (Singapore), Asia Pacific (Tokyo), Asia Pacific (Sydney), Asia Pacific (Mumbai)
 - South America (Sao Paulo)
 - **GovCloud (US) Regions.** The US Standard Region automatically routes requests to facilities in Northern Virginia or the Pacific Northwest using network maps

Amazon EC2 and S3 API became a standard-de-facto interfaces for accessing and managing cloud services

- Majority of existing cloud management platforms offer EC2 and S3 interfaces

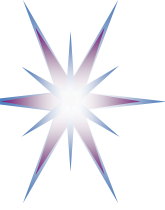


Amazon AWS Cloud Architecture (est 2011)

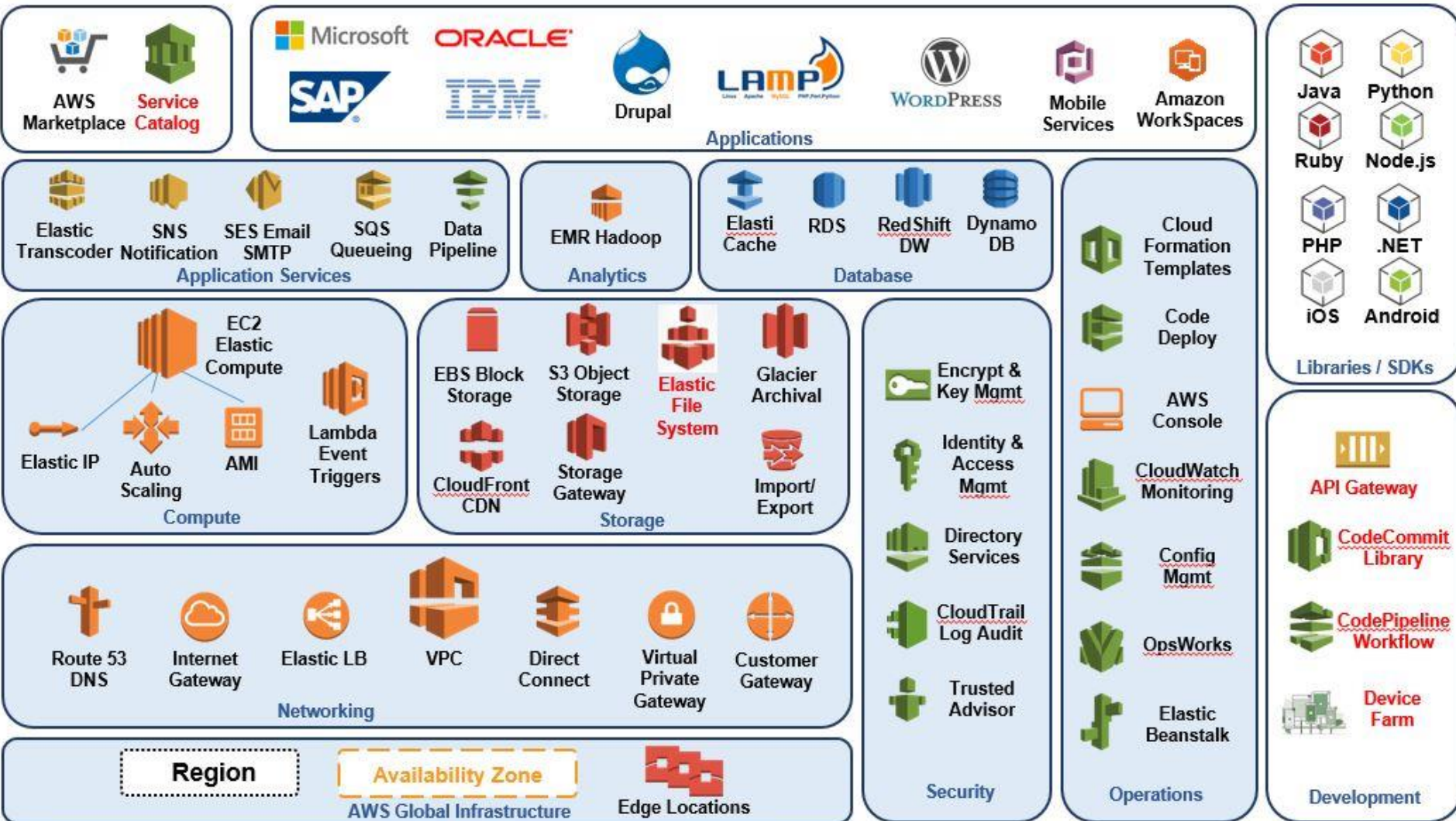


AWS Architecture Overview: Services (2018) - <https://d1.awsstatic.com/whitepapers/aws-overview.pdf>

Credits "Building Powerful Web Applications in the AWS Cloud" by Louis Columbus
<http://softwarestrategiesblog.com/2011/03/10/building-powerful-web-applications-in-the-aws-cloud/>



AWS Products (est. 2015)





Amazon AWS Console – Products (2020)

eu-west-1.console.aws.amazon.com/ec2/v2/home?region=eu-west-1#Home:

Apps BMark Search+ SNE LENS Polar EDSFwiki Google AWS Euromaidan Collect Projects Tasks Other bookmarks












aws Services Resource Groups Yuri Demchenko Ireland Support

History

- EC2
- RDS
- Console Home
- AWS Cost Explorer
- S3
- VPC

Find a service by name or feature (for example, EC2, S3 or VM, storage).

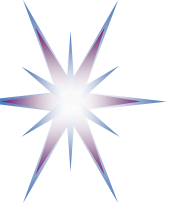
Group A-Z

 Compute <ul style="list-style-type: none">EC2LightsailECRECSEKSLambdaBatchElastic BeanstalkServerless Application RepositoryAWS OutpostsEC2 Image Builder	 Customer Enablement <ul style="list-style-type: none">AWS IQSupportManaged Services	 Machine Learning <ul style="list-style-type: none">Amazon SageMakerAmazon CodeGuruAmazon ComprehendAmazon ForecastAmazon Fraud DetectorAmazon KendraAmazon LexAmazon Machine LearningAmazon PersonalizeAmazon PollyAmazon RekognitionAmazon TextractAmazon TranscribeAmazon TranslateAWS DeepLensAWS DeepRacerAmazon Augmented AI	 Application Integration <ul style="list-style-type: none">Step FunctionsAmazon EventBridgeAmazon MQSimple Notification ServiceSimple Queue ServiceSWF
 Storage <ul style="list-style-type: none">S3EFSFSxS3 Glacier	 Blockchain <ul style="list-style-type: none">Amazon Managed Blockchain	 Satellite <ul style="list-style-type: none">Ground Station	 AWS Cost Management <ul style="list-style-type: none">AWS Cost ExplorerAWS BudgetsAWS Marketplace Subscriptions
	 Quantum Technologies <ul style="list-style-type: none">Amazon Braket	 Management & Governance	 Customer Engagement <ul style="list-style-type: none">Amazon ConnectPinpointSimple Email Service

close

Feedback English (US)

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Amazon EC2: Amazon Machine Instances (AMI)

EC2 AMIs (Amazon Machine Instances) forms the basic infrastructure on which applications can be deployed just as any other server

- **Reserved instances**, which can be purchased with a one time payment for a long term reservation and are available at considerably lower prices
- **On-Demand instances**, which are for immediate demands but with comparatively higher prices
- **Spot instances**, which is unused capacity for which users can bid for

AMI allows the following controls over the provisioned infrastructure:

- Location of the AMIs and management of static IP addresses
 - Using one of eight availability zones for a user to choose from:
- Network management and access control to the AMI configuration
- Use of a Web based management console
- For professional use, developers have an option to use **AWS command line tools** which allows them to write scripts to automate this management (e.g., Ruby, bash, python)



Amazon EC2 Machine Instances Types

VM instances are optimised for different types of applications and use cases
(Amazon EC2 Instances <http://aws.amazon.com/ec2/instance-types/>):

- M3 - General Purpose
- C3 - Compute Optimized
- R3 - Memory Optimized
- G2 - GPU
- I2 - Storage Optimized
- HS1 - High storage density
- **T1 - Low cost micro instances**

Name	vCPUs	Baseline Perf	RAM (GiB)	CPU Cred/Hrr	Price/Hr (Linux)	Price/ Month
t2.micro	1	10%	1.0	6	\$0.013	\$9.50
t2.small	1	20%	2.0	12	\$0.026	\$19.00
t2.medium	2	40%	4.0	24	\$0.052	\$38.00

Example 1: M3 instance provides a balance between compute, memory, and network resources:

- High Freq. Intel Xeon E5-2670 (Sandy Bridge) Processors
- SSD-based instance storage for fast I/O performance
- Balance of compute, memory, and network resources

M3 instances come in configurations:

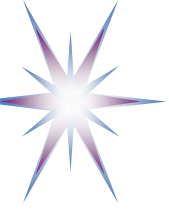
- m3.medium (1 core, 3.75 GB, SSD 1 x 4 GB)
- m3.large (2 core, 7.5 GB, SSD 1 x 32 GB)
- m3.xlarge (4 core, 15 GB, SSD 2 x 40 GB)
- m3.2xlarge (8 core, 30 GB, SSD 8 x 30 GB)

C3 instances are compute-optimized, using highest performing processors

- High Frequency Intel Xeon E5-2680 v2 (Ivy Bridge) Processors
- Support for Enhanced Networking
- Support for clustering
- SSD based instances storage

C3 instances come in configurations:

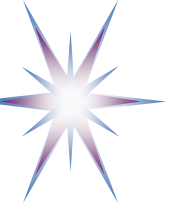
- c3.large (2 core, 3.75 GB, SSD 2 x 16 GB)
- c3.xlarge (4 core, 7.5 GB, 2 x 40 GB)
- c3.2xlarge (8 core, 15 GB, 2 x 80 GB)
- c3.4xlarge (16 core, 30 GB, 2 x 160 GB)
- c3.8xlarge (32 core, 60 GB, 2 x 320 GB)



Optimizing Cost and Billing Options

On-demand Instances	Reserved Instances	Spot Instances	Dedicated Instances
<ul style="list-style-type: none">• Pay as you go• Zero commitment	<ul style="list-style-type: none">• One time low upfront fee + discounted hourly costs• Upto 71% savings over on-demand	<ul style="list-style-type: none">• Requested Bid Price and Pay as you go• Price change every hour based on EC2 capacity	<ul style="list-style-type: none">• Standard and Reserved• Multi-tenant Single Customer• Ideal for compliance and regulatory workload

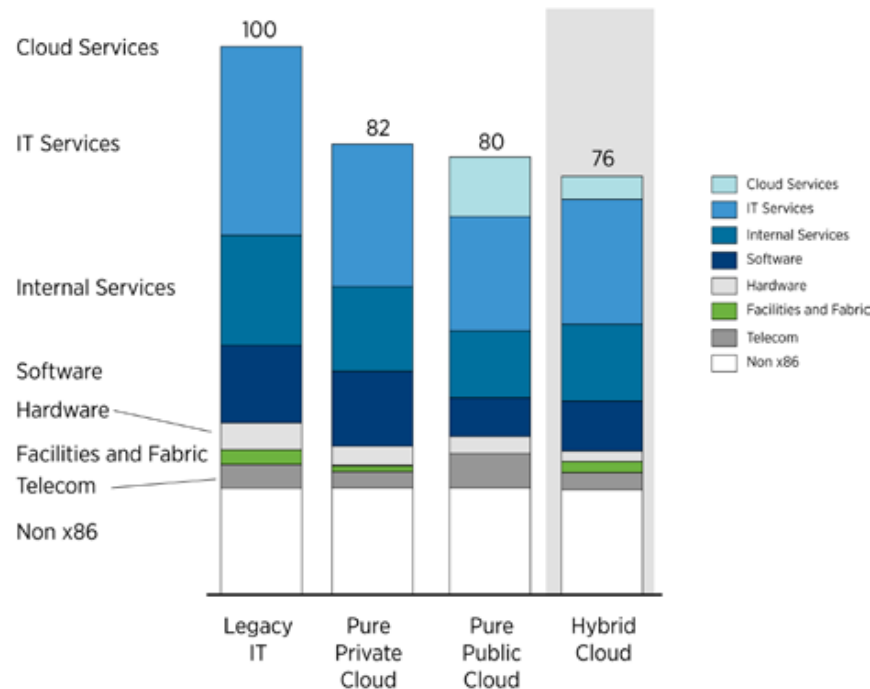
- EC2 AMIs offers the following resources provisioning and billing options
 - *Reserved* instances, which can be purchased with a one time payment for a long term reservation and are available at considerably lower prices
 - *On-Demand* instances, which are for immediate demands but with comparatively higher prices
 - *Spot* instances, which is unused capacity for which users can bid for
 - Dedicated instances (can be standard and reserved) created and deposited for special user needs



Cloud and Total IT Spending

Annual Total IT Spend

(100 = Total IT spend with all on-premise infrastructure)



[ref] Business Agility and the True Economics of Cloud Computing.
Business White Paper, VMware 2011.

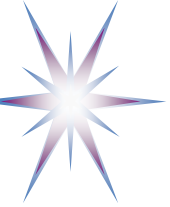
VMware and EMC research [ref]

- The hybrid cloud is more economical than pure public cloud or pure private cloud models
- Hybrid cloud deployment would reduce typical total IT spending by approximately **20 to 30 percent**
- Hybrid clouds combine benefits of public clouds elasticity and on-demand resource provisioning with the benefits of private clouds
 - Legacy applications
 - Operational control
 - Sensitive applications and data
- Hybrid clouds require **standardisation and interoperability** between private and public platforms to achieve applications portability
 - Common platform
 - Common management
 - Security
 - Compliance



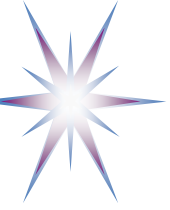
Amazon Elastic MapReduce (EMR)

- Amazon Elastic MapReduce (EMR) provides the Hadoop framework on Amazon EC2 and offers a wide range of Hadoop related tools.
- MapReduce and Spark
- Graphical user interface



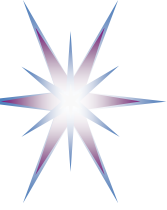
Self-check Questions

- Dropbox: What type of cloud service or application?
- You run/setup accountants company. What type of cloud service you would use?
- You are a researcher using unique (old) software for your data processing.
 - What type of cloud service you will use?
- You need to setup a summer school on (agile) programming techniques.
 - Will you use cloud? What type?
- You need to support a project group that besides writing reports needs also regular project calls (voice, video)



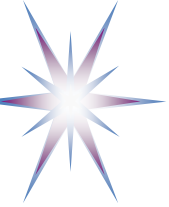
Demo: Services deployment on AWS

- AWS VM launch (deployment)
 - Important aspects
- EMR deployment
 - Cluster configuration suggestion
- Secure remote access
 - SSH client, secret key configuration



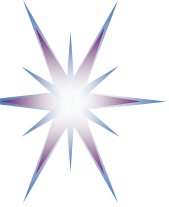
Curiously Asked Questions (CuAQ)

- What is minimum viable knowledge of cloud?
- Is cloud secure enough? What about GDPR?
- Do I need to use SSH?



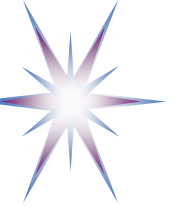
Summary: Cloud Computing

- Cloud is an ultimate technology for Big Data
 - Big Data storage and Data processing
- Cloud Computing has many benefits as a new technology and as IT infrastructure design and management transformation factor
- At the same time Cloud Computing has a number of restraining factors, main of which is security of data and services or infrastructure in clouds
 - New services based on Confidential Computing platform



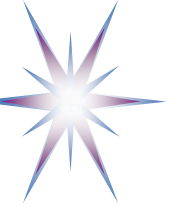
Reflection and discussion

- What would be your estimation for SME in the known to you business domain of the pros and cons factors to move to cloud?
- What form of cloud services is more economically efficient for big, medium, small company?



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Acknowledgement

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Co-funded by the
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