Cloud Computing and Big Data

Cloud overview and introduction

Oxford University
Software Engineering Programme
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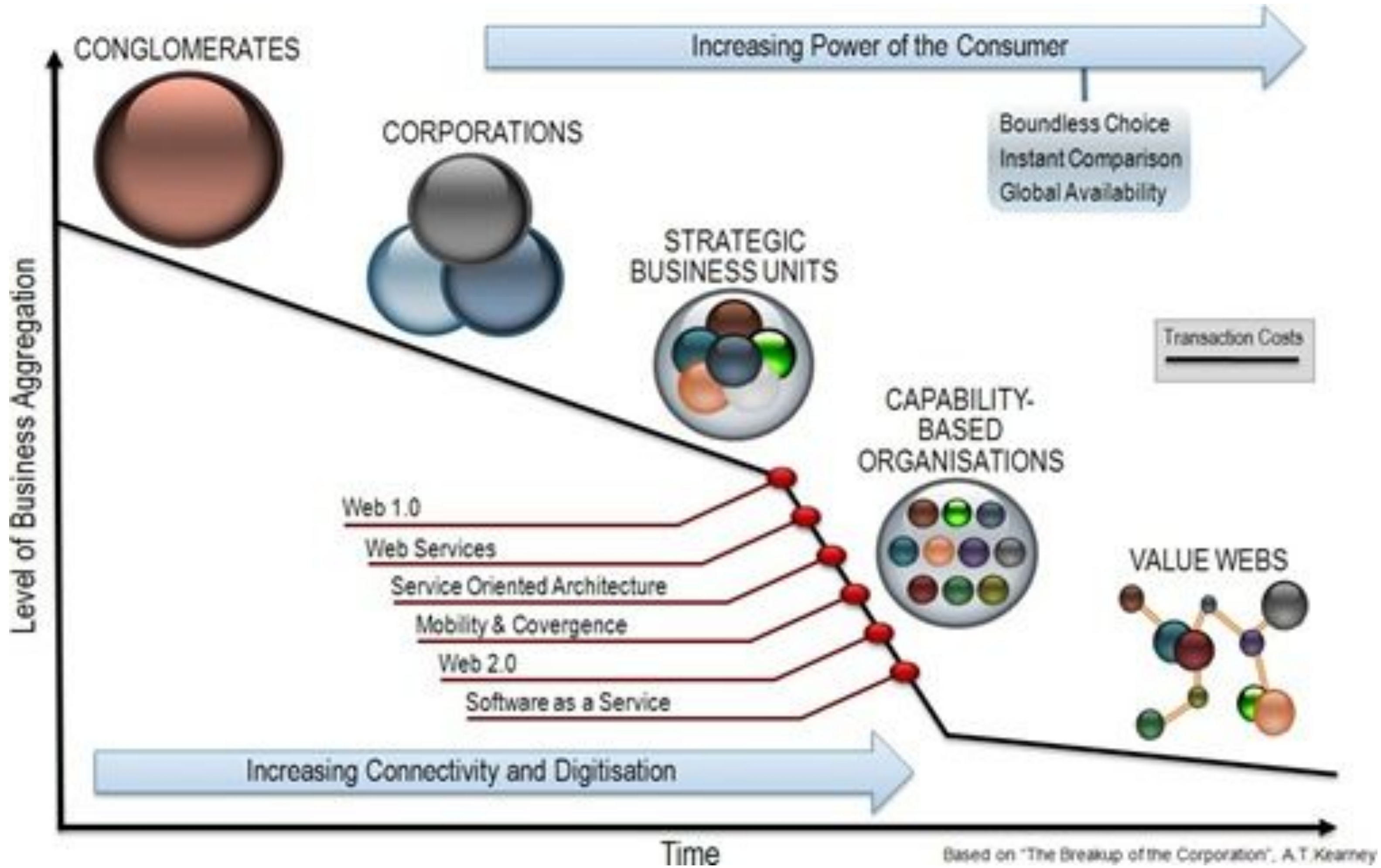
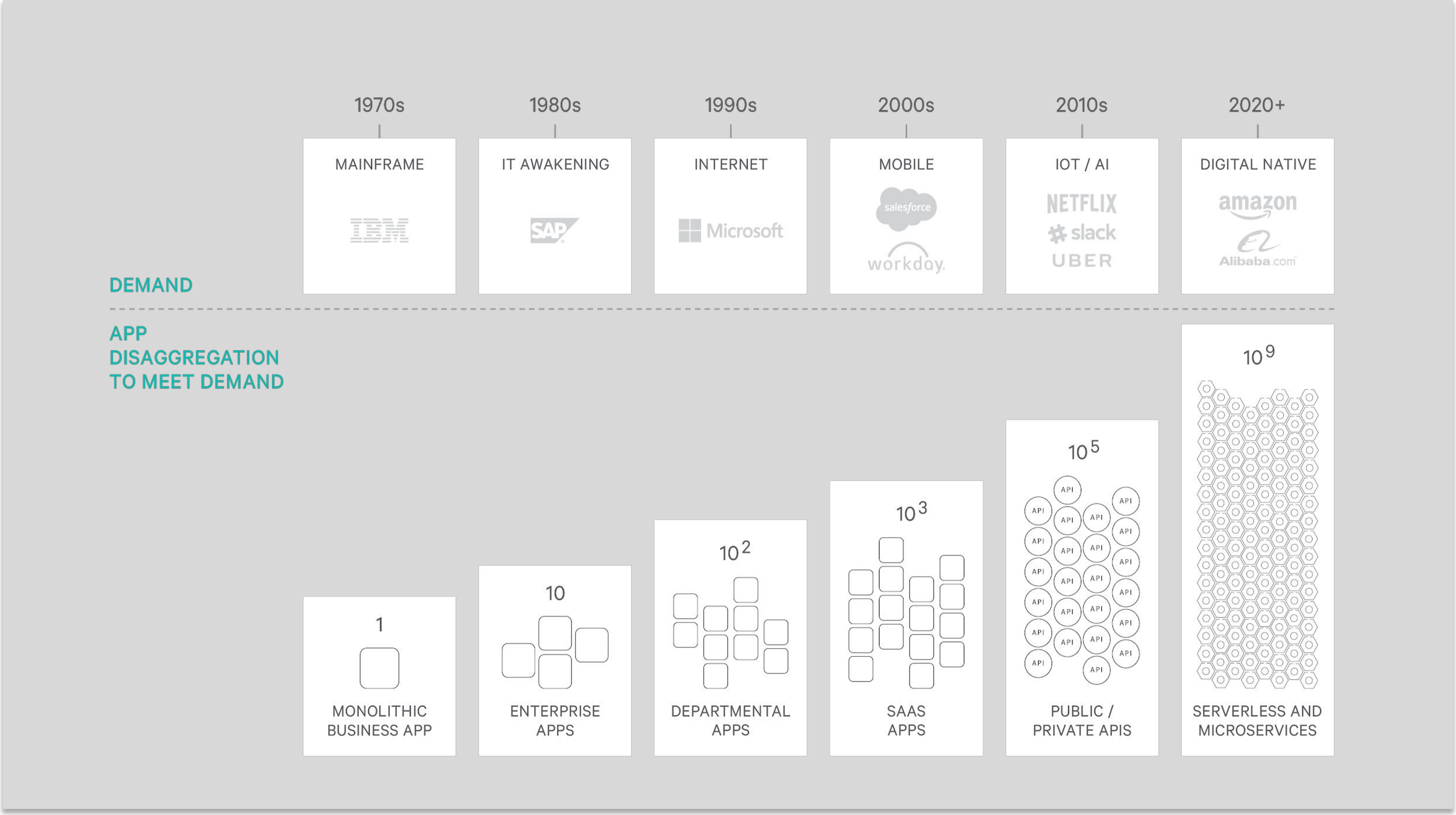
Contents

Drivers for a new IT model



Increasing disaggregation



What is Cloud?

- Depends who **you** are
  - **My daughter**: iCloud (her music in the cloud)
  - **My mum**: gmail (her email in the cloud)
  - **My VP sales**: Salesforce (his prospects in the cloud)
  - **Sysadmin**: Amazon/Rackspace/etc (his infrastructure in the cloud)
  - ***:** what *you* care about, self-provisioned, managed, metered and paid per use, in the cloud

Cloud Computing Definition (NIST)

- On-demand self-service
  - Users can provision resources without human intervention
- Broad network access
  - Heterogeneous access to resources
- Resource pooling
  - Multi-tenant shared capabilities
- Rapid elasticity
  - Services can scale up and down automatically
- Measured service
  - Resources can be metered and charged for based on real-world measures

Cloud Native

http://pzf.fremantle.org/2010/05/cloud-native.html

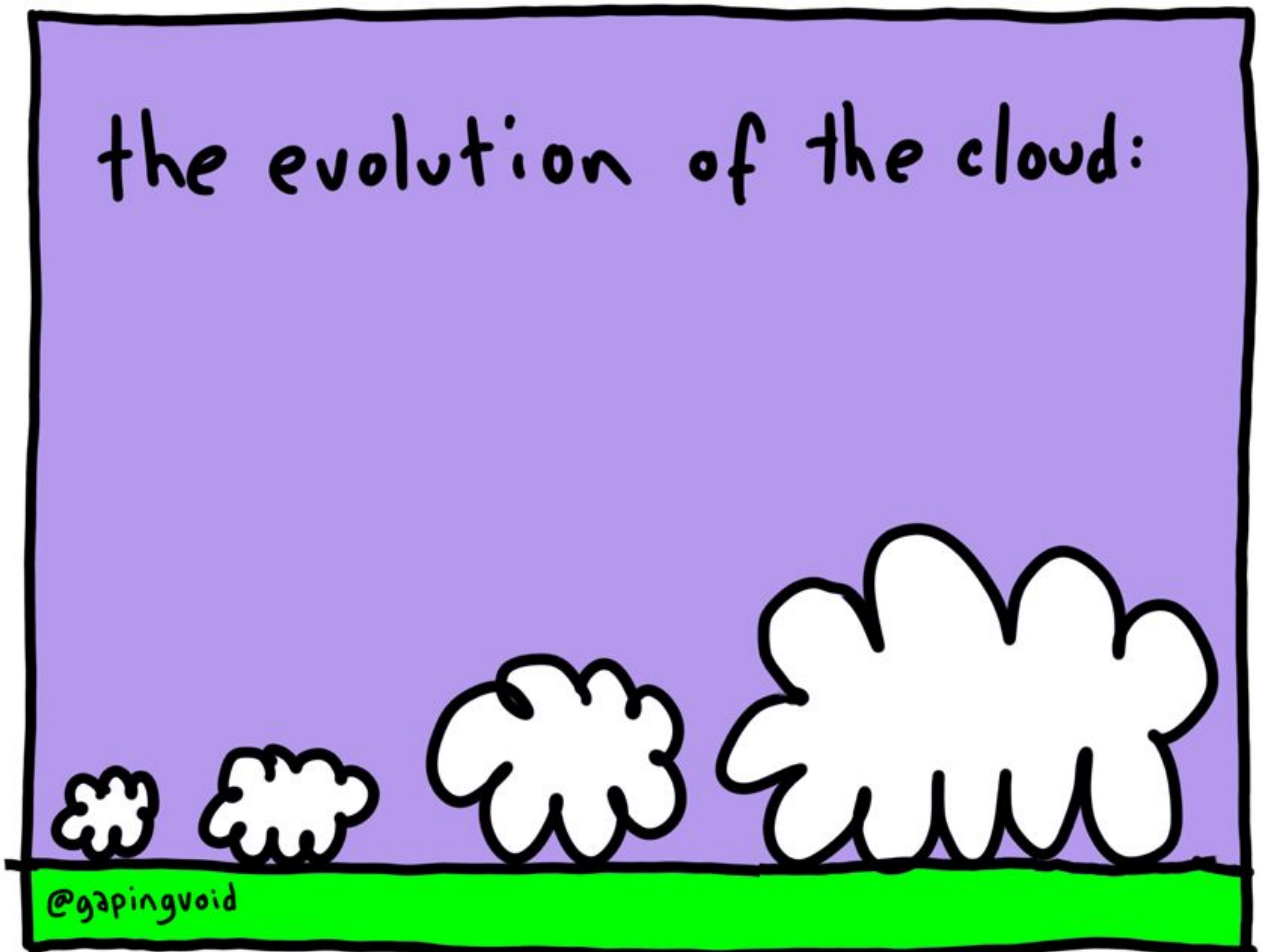
- **Distributed/Dynamically Wired** **(works properly in the cloud)**
  - Supports deploying in a dynamically sized cluster
  - Finds services across applications even when they move
- **Elastic** **(Uses the cloud efficiently)**
  - Scales up and down as needed
  - Works with the underlying IaaS
- **Multi-tenant** **(Only costs when you use it)**
  - Virtual isolated instances with near zero incremental cost
  - Implies you have a proper identity model
- **Self-service** **(in the hands of users)**
  - De-centralized creation and management of tenants
  - Automated Governance across tenants
- **Granularly Billed and Metered** **(pay for just what you use)**
  - Allocate costs to exactly who uses them
- **Incrementally Deployed and Tested** **(seamless live upgrades)**
  - Supports continuous update, side-by-side operation, in-place testing and incremental production

New definition of Cloud Native

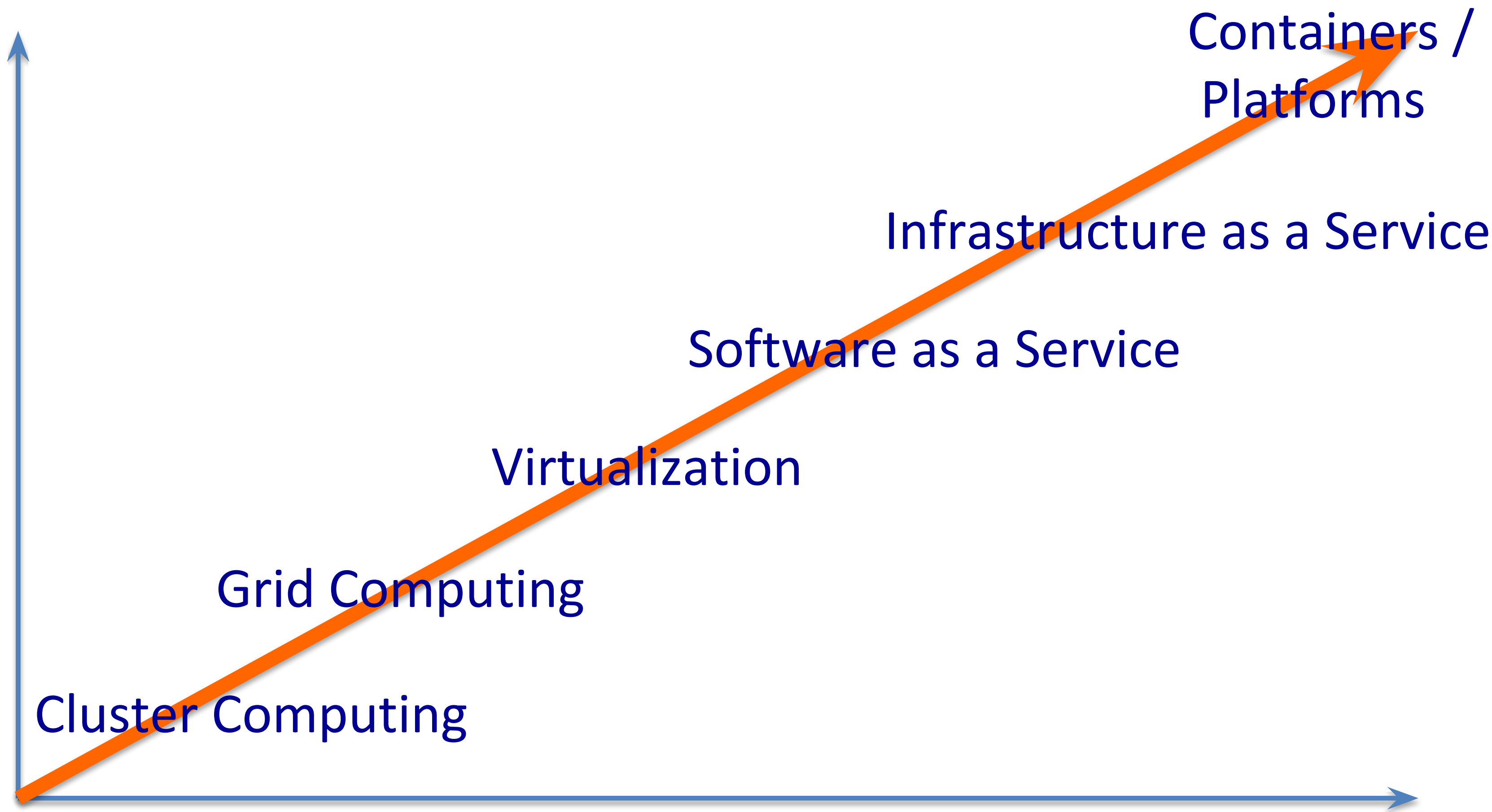
- From the Cloud Native Computing Foundation
  - Container based
  - Dynamic
  - Microservice oriented

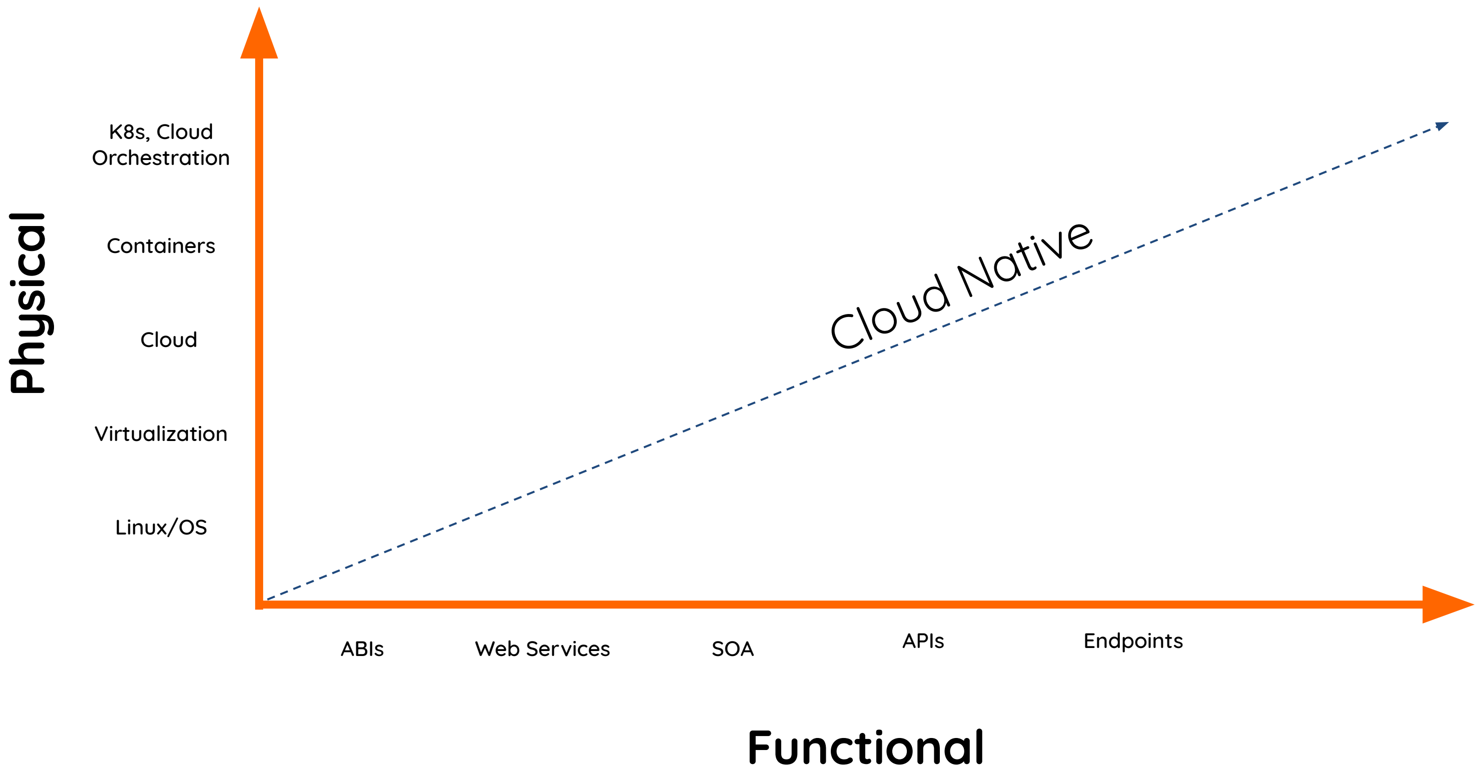
Origins of Cloud Computing

- Virtual Machines on Mainframes
  - VM/370 – 1972
- Grid Computing
  - Grid computing is the collection of computer resources from multiple locations to reach a common goal.
- Software-as-a-Service
  - Salesforce.com 1999
- Amazon AWS
  - 2002


the evolution of the cloud:
@gapingvoid

Evolution of Cloud





Physical
K8s, Cloud Orchestration
Containers
Cloud
Virtualization
Linux/OS
Cloud Native
ABIs
Web Services
SOA
APIs
Endpoints
Functional

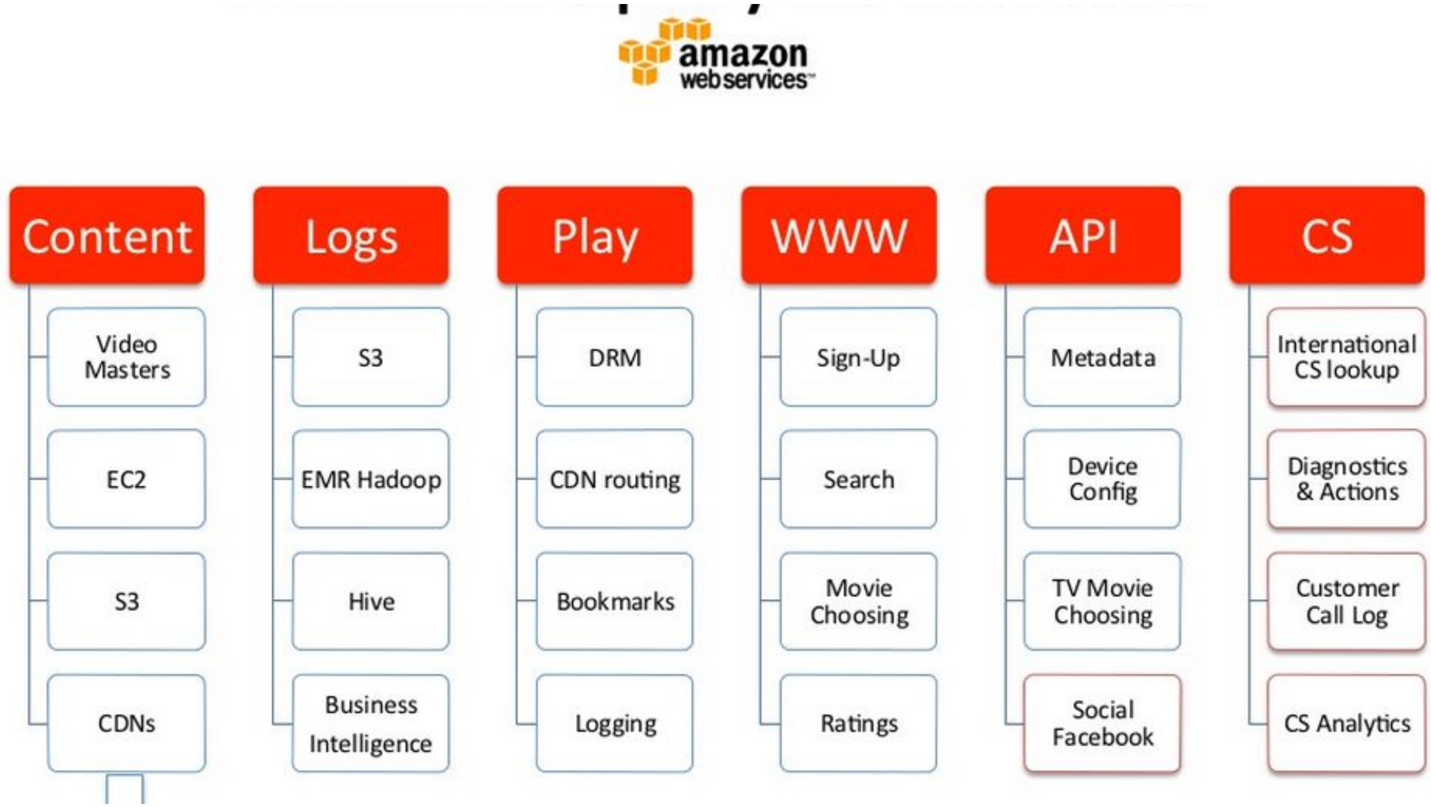
CASE STUDIES


Netflix - Watch TV Programm
https://signup.netflix.com
Offline Mail
Inbox (124,820) - p
WSO2
WSO2, Inc. - Calend
+ bitmark
Shorten with bit.ly
Gmail - Inbox (720)
NETFLIX
Questions? Call 0800 096 6379 – 24
Buy / Redeem Gift
Member
1 MONTH FREE TRIAL
Watch TV programmes & films anytime, anywhere.
Only £5.99 a month.
Start Your Free Month

Netflix

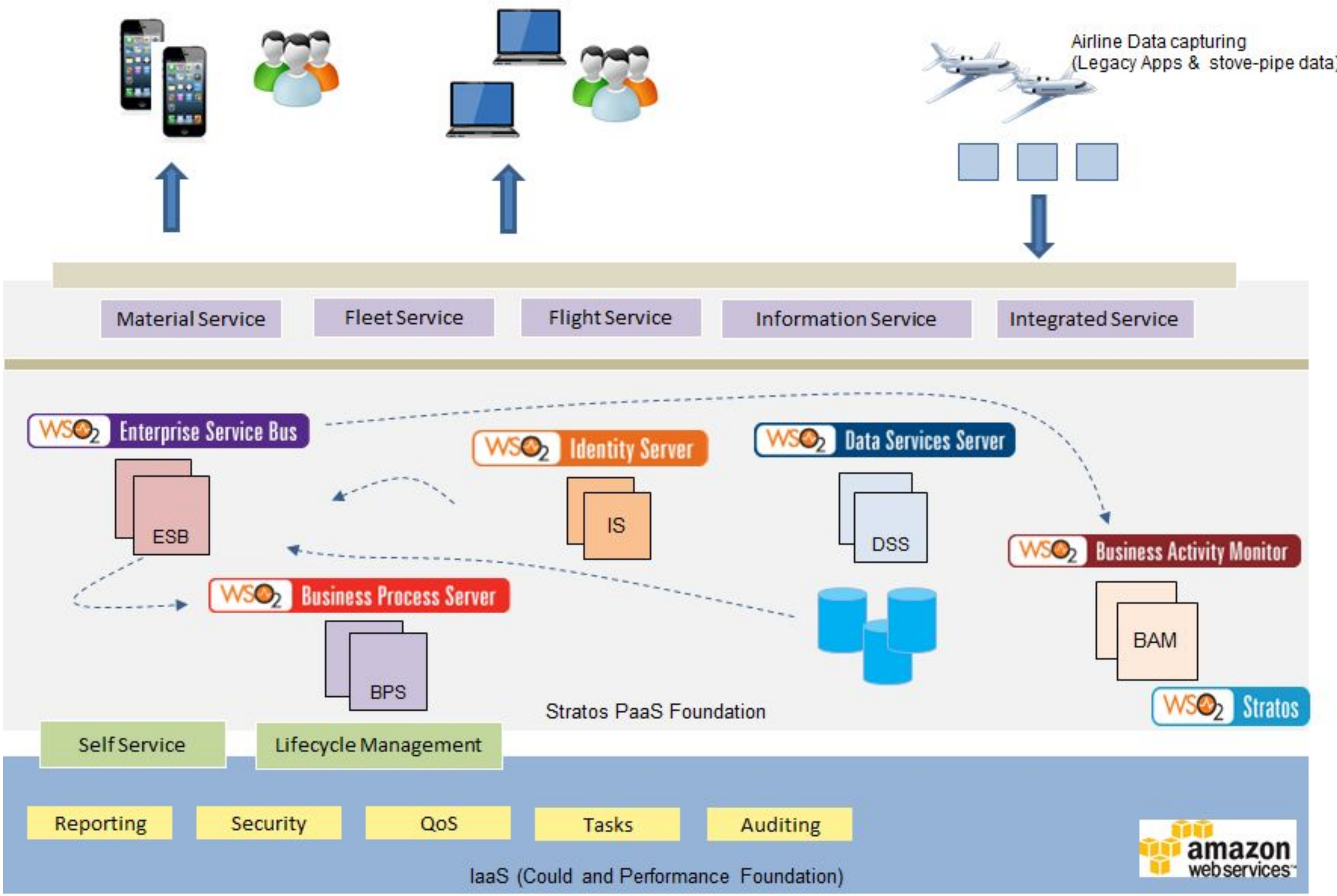
- A REST and Cloud based SOA approach
- Continuous Delivery
- 100% Based in the cloud
- See excellent presentations from Adrian Cockcroft
  - e.g. http://www.slideshare.net/adrianco/global-netflix-platform

Netflix Deployed on AWS



Boeing Digital Airline

Case Study : Boeing - A PaaS based Integration and API ecosystem



Case Study : Multi-tenanted Mobile Orchestration Gateway Platform

Customer

One of the largest global networking solutions providers required to build a mobile services orchestration gateway platform, enabling mobile providers to simplify QoS service access to their external business partners.

Challenge

- Build a mobile services orchestration gateway than can scale upto 40,000 TPS with 99.999% service availability.
- Extensible architecture capable of interfacing with multiple protocols such as XMPP, Diameter whilst maintaining pre-defined SLAs and throughput.
- Integrating with ASR5000K, Third-party PCRF systems
- Multi-tenancy support for API lifecycle management.
- Multi-geographical deployment with autoscaling and failover compensation.

Solution

- Rebuilt an 18 month project in 4 weeks
- API Governance powered by multi-tenanted API Manager cluster with enforced security and lifecycle management.
- Business logic through ESB mediators exposed as REST APIs.
- Stateful caching using Cassandra
- Analytics and monetization of API usage using BAM integrated with enterprise licensing platform.
- Partner Onboarding interfaces and authorization workflows.
- Enterprise-grade cloud deployment based on Stratos PaaS foundation with native support for multi-tenancy, resource pooling and elastic scaling.

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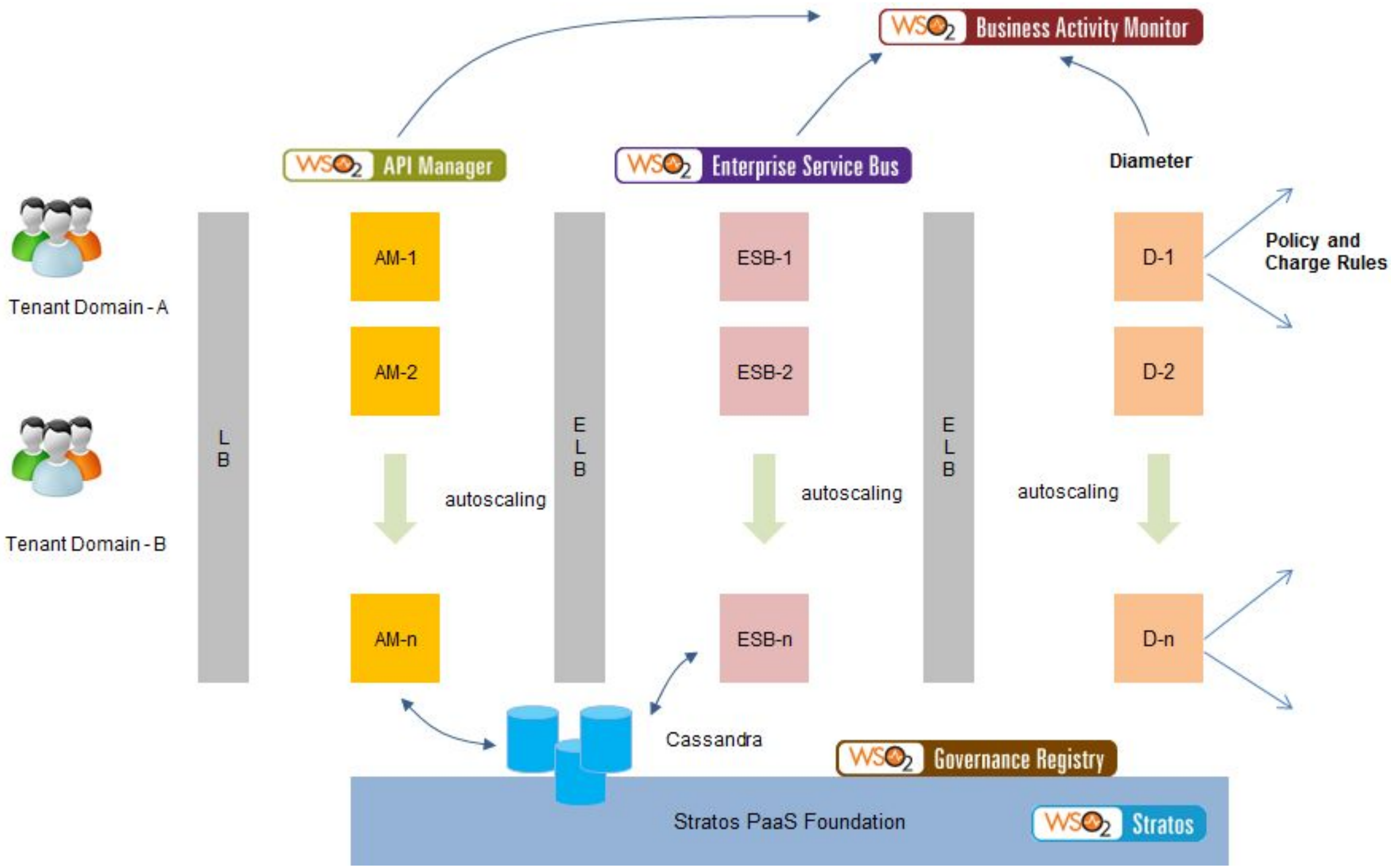
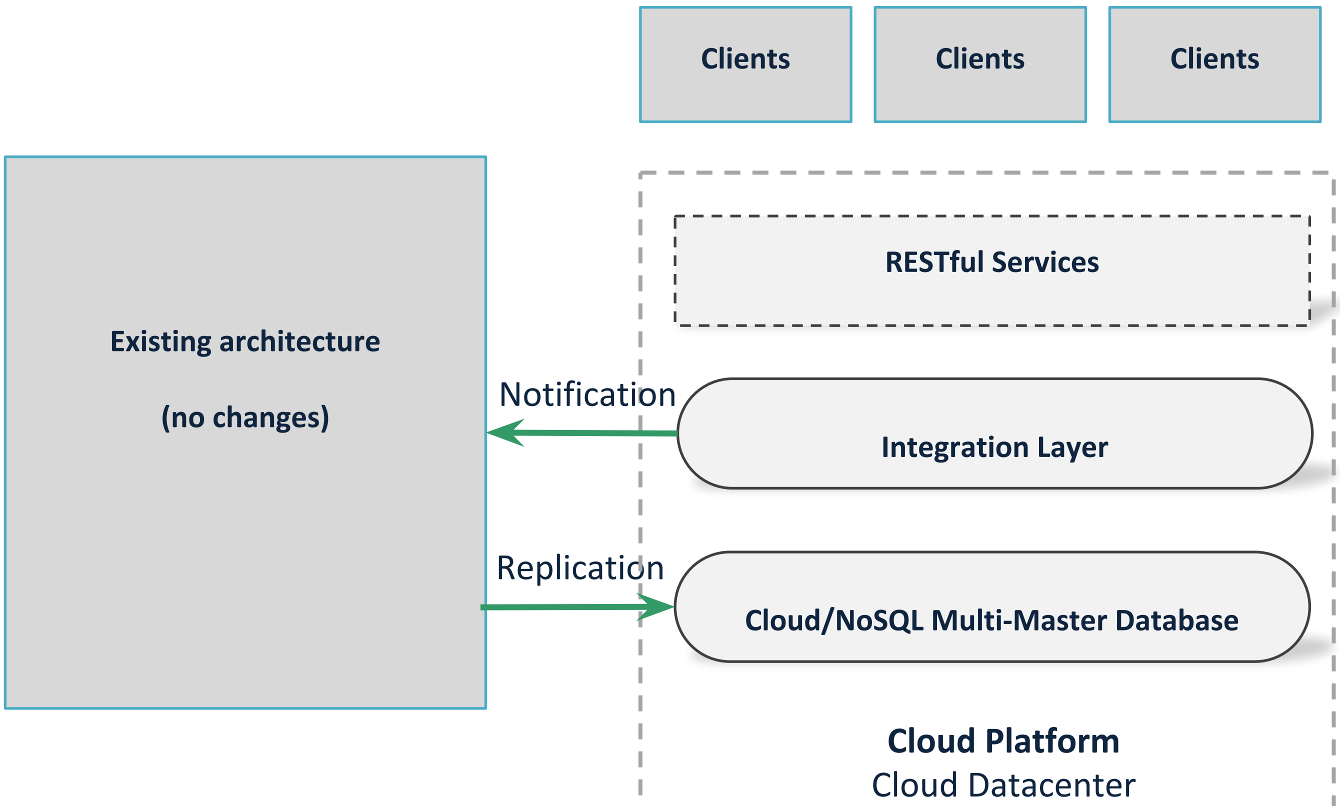


Pay TV company

- Needed to scale up to provide instant pay-as-you-go on mobile devices
- Support Disaster Recovery (DR)
- Elastic Scale e.g. during an important football match

Architecture



Large-scale cluster management at Google with Borg

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Abstract

Google's Borg system is a cluster manager that runs hundreds of thousands of jobs, from many thousands of different applications, across a number of clusters each with up to tens of thousands of machines.

It achieves high utilization by combining admission control, efficient task-packing, over-commitment, and machine sharing with process-level performance isolation. It supports high-availability applications with runtime features that minimize fault-recovery time, and scheduling policies that reduce the probability of correlated failures. Borg simplifies life for its users by offering a declarative job specification language, name service integration, real-time job monitoring, and tools to analyze and simulate system behavior.

We present a summary of the Borg system architecture and features, important design decisions, a quantitative analysis of some of its policy decisions, and a qualitative examination of lessons learned from a decade of operational experience with it.

1. Introduction

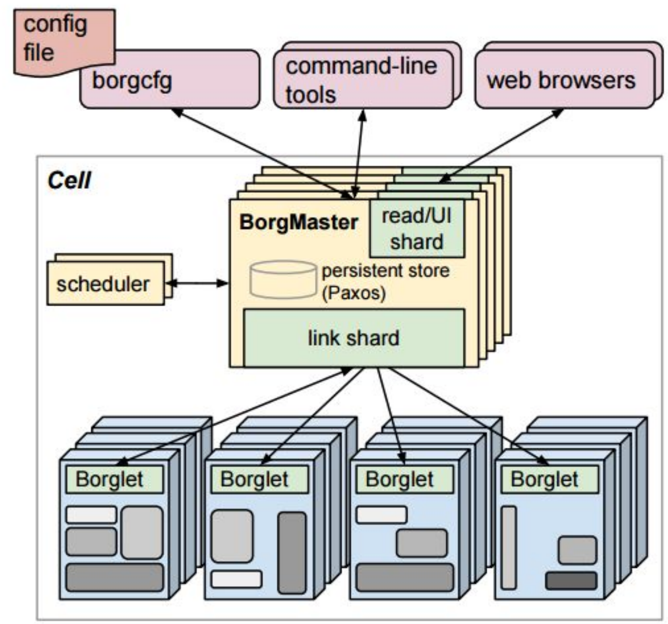

Figure 1: The high-level architecture of Borg. *Only a tiny fraction of the thousands of worker nodes are shown.*

cluding with a set of qualitative observations we have made from operating Borg in production for more than a decade.

Questions?