# Cloud Computing Architecture based on AWS

A Story About Change In Thinking of Enterprise Architecture

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# Agenda

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# Introduction

The Open Group's notes on Cloud Computing:

* Cloud Computing is an Internet phenomenon, the latest major (r)evolution in computing.

* The great milestone following the emergence of the mainframe, the minicomputer, the microprocessor, the PC, the Internet, and the World-Wide Web.

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# Why mention Enterprise Architecture (EA)?

* As per Grady Booch: EA attends to the architecture of a business that uses technology; Technical Architecture (TA) attends to the architecture of the software-intensive systems that support that business.

* Cloud Computing is likely to impact not only TA, but also the entire EA along with its business workflow, offerings and pricing model, procurement, new cost and resources optimization processes in place.

# Pre-Cloud Mindset – in general

My thoughts on Cloud Computing from before ~3 years:

* Hype & marketing buzzword – a new marketing trick.
* The idea without a clear and unambiguous definition.
* At best a more sophisticated approach to hosting of applications.
* Glaring *aaS... (IaaS, PaaS etc.) at every turn.
* Affects only TA and not EA nor the Enterprise as a whole.

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To Rethink Cloud

# Pre-Cloud Mindset – IT Infrastructure

* IT architecture as something given up front – apps should be tuned to own IT infrastructure.

* No room to discuss – only complaining about scarce resources (memory, processor, disk volume etc.).

* Long procurement process to get approvals and purchase new servers or machines (CAPEX).

* Relatively stable deployment environment – with servers running for months, years…

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# Pre-Cloud Mindset – IT roles

Typical, mostly rigid separation of technical Roles within the Enterprise:

* Architects in dozens and dozens flavors – guys to calculate, **predict** workload and potential changes, plan IT infrastructure and all that.

* IT Administrators – kings and at times, queens of infrastructure, OSs, setups, patches and upgrades.

* Software craftsmen – Developers & Testers.
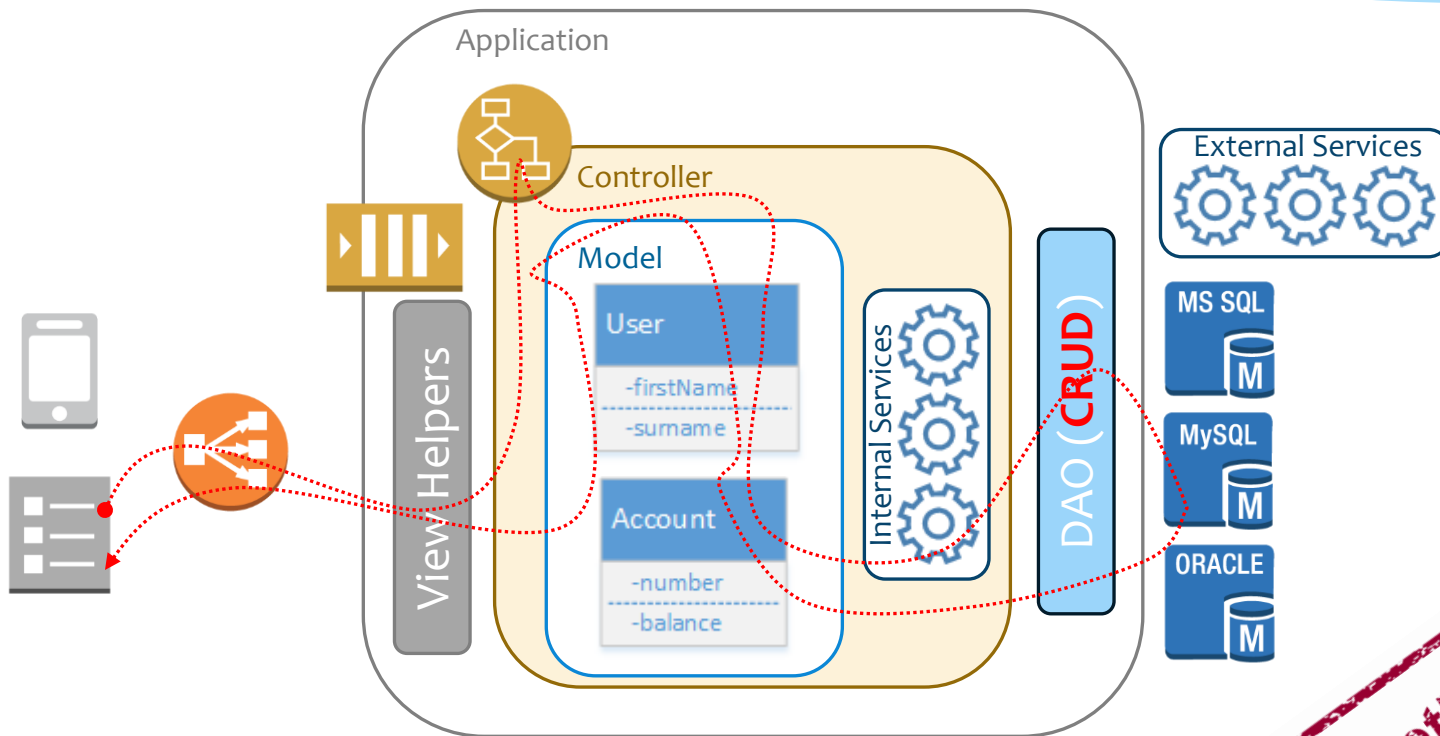
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# Pre-Cloud Mindset – Design & Impl.

* ACID – belief and pressure being put especially on C.
* Strong reliance on local and distributed transactions.
* No big issue with abrupt restart or crash of the machine: Data like logs, transaction logs, configuration files are still available on the attached disk.
* Developer's focus to squeeze performance out of code at the cost of increased complexity (e.g. with sophisticated multithreaded algorithms in use).
* MVC & CRUD patterns far and wide.

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# Pre-Cloud Mindset – MVC with CRUD

# Pre-Cloud Mindset –Impl. & Tests

* Concerns like auto-scaling, load balancing outside Programmer's interest scope.

* The same case for a deployment process, OS installation, setup of app servers and applications – just as tedious as bookkeeping. "Non-programmable" elements not included directly in business logic except scripting some stuff out.

* Established and stiff tests environments.

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# Trigger to Learn & Rethink

**Immediate Trigger**: Arriving at Kroll Ontrack and being involved in the project to build a flexible and cost-effective Service Platform with these qualities:

- Configurable rather than customizable
- Scalable, with rapid and ad hoc environment setup
- Without capital expenditure on IT infrastructure so…

…  Amazon Web Services was KO's choice for a base Cloud platform to build upon.

# Why AWS?

* …
* AWS is the overwhelming market share leader, with more than five times the compute capacity in use than the aggregate total of the other fourteen providers in this Magic Quadrant.
* It is a thought leader; it is extraordinarily innovative, exceptionally agile and very responsive to the market.
* It has the richest IaaS product portfolio, and is constantly expanding its service offerings and reducing its prices.
* …

# Why AWS?

What does a typical Web Developer and his/her crew need to deliver some business goods?

1. …
2. …
3. …
4. …

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# Why AWS?

*All fully configurable, scalable, reliable and so forth…*

| Web App needs: | With AWS: |
|---|---|
| Compute Power | Amazon EC2 |
| Configuration/Setup | Amazon Cloud Formation |
| (Blob) Storage capacity | Amazon S3 |
| Durable file system | Amazon EBS |
| Database storage | Amazon RDS/DynamoDB |
| Messaging | Amazon SQS |
| Load balancing | Amazon ELB |
| Scaling | Amazon Scaling |
| Monitoring | Amazon CloudWatch |

# Cloud Mindset – in general

True False

My perception on Cloud Computing for the time being:

* Hype – oh yeah…, as with every new technology.

* There is a quite precise definition in place.

* There is a significant difference between Cloud Computing and hosting itself.

* Fortunately, WaaS has not been found yet.

* Indeed, introducing Cloud across the Enterprise usually impacts EA as well.

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Reconsidered

# Definition of Cloud Computing
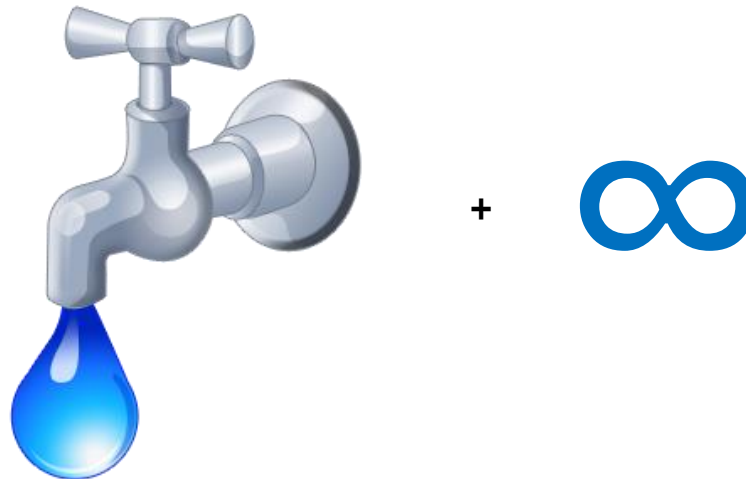by National Institute of Standards and Technology (NIST)

* Cloud Computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g. networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.

* This Cloud model is composed of five essential characteristics, three service models, and four deployment models.

Reconsidered
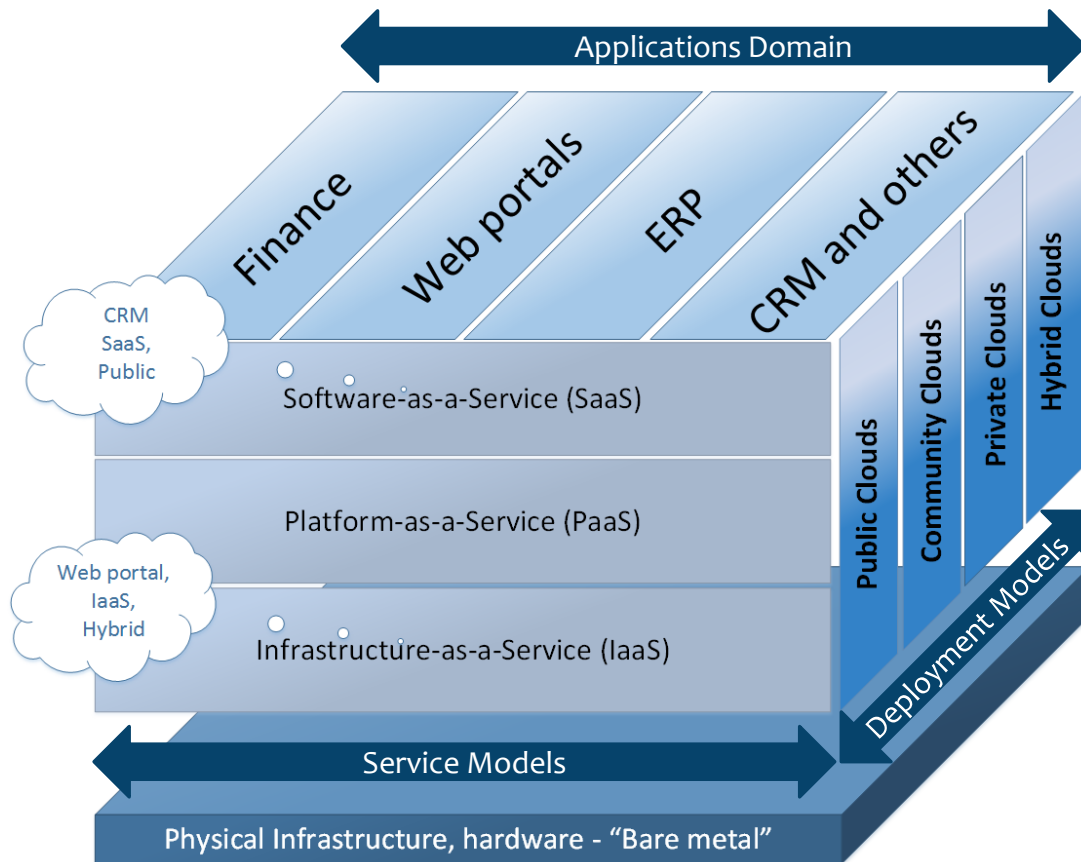
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# Why Cloud?

Even though for two reasons – a breakthrough in the mindset:

- Computing as a utility like water, gas and electricity.
- "A Sense of Infinity" – you access infinite compute resources.

# Composite and Layered Cloud Model

Applications Domain

Finance
Web portals
ERP
CRM and others

CRM SaaS, Public

Software-as-a-Service (SaaS)

Platform-as-a-Service (PaaS)

Web portal, IaaS, Hybrid

Infrastructure-as-a-Service (IaaS)

Public Clouds
Community Clouds
Private Clouds
Hybrid Clouds

Deployment Models

Service Models

Physical Infrastructure, hardware - "Bare metal"

* Each Cloud Service Model provides some level of abstraction that can help Service Consumer reduce the efforts involved in creating and deploying applications.

# Hosting vs. Cloud Computing

True    False

✔       ☐

* Hosting **is not the same thing** as Cloud Computing since it usually does not provide for all of the five Cloud's characteristics.

* Hosting is simply renting infrastructure and footprint at a hosting provider's facility – think of moving an application from site X to site Y.

* Migrating an application to the Cloud is a much more involved process (often entails reengineering or rewriting of legacy apps).

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*Reconsidered*

# Cloud Mindset – Infrastructure

True    False

* IT infrastructure becomes a virtual resource and is abstracted out.

* Enormous field for experiments to determine the most optimal IT configuration for our application.

* No procurement processes at all – by moving into **pay-as-you-go model** (OPEX).

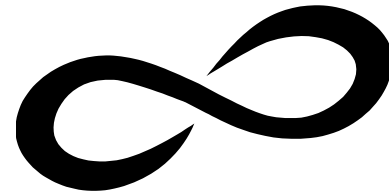* Notion of "machine" is redefined and abstracted away – as of now a volatile resource by default.

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# Cloud Mindset – IT roles
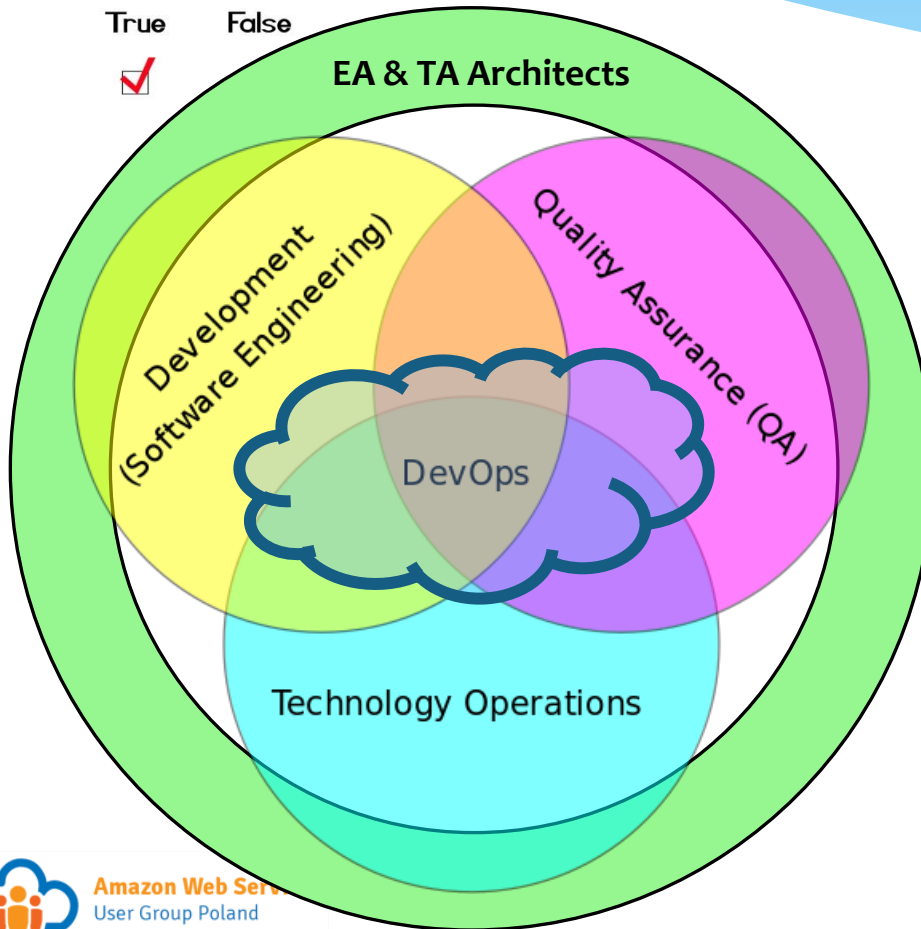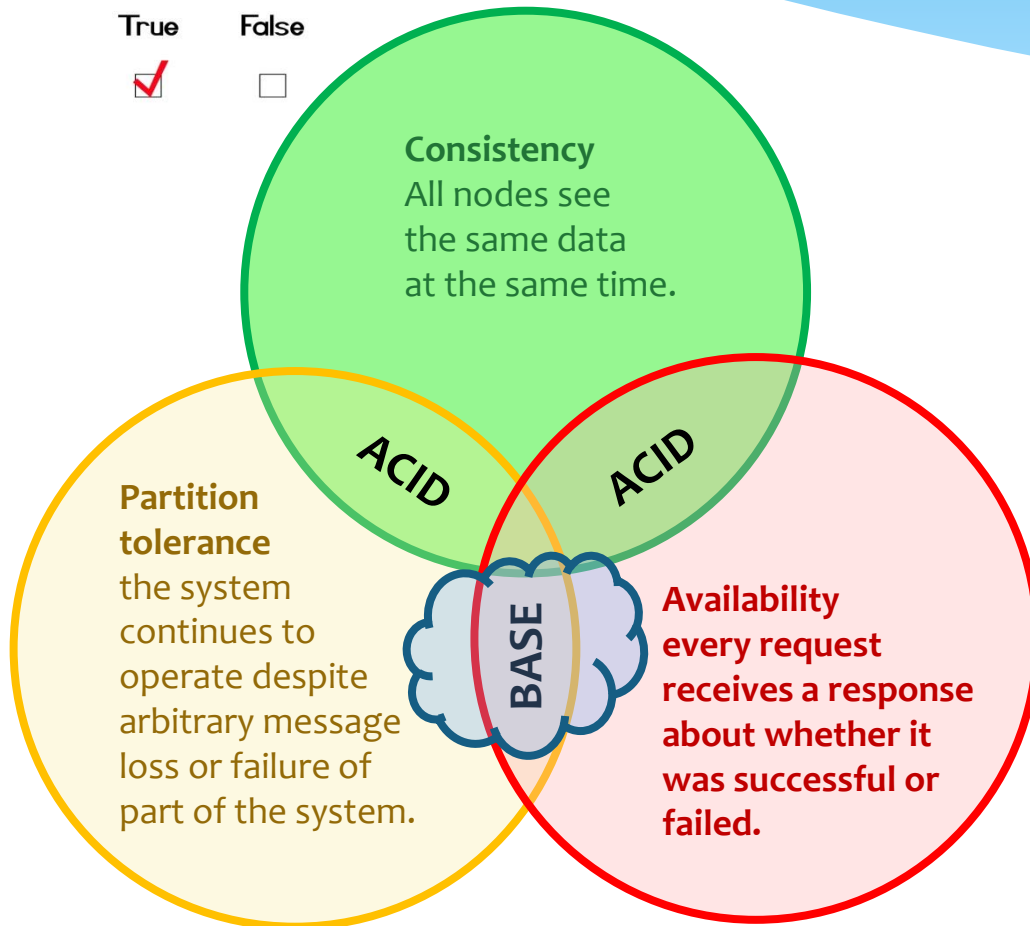


* Extremely enhanced role of the DevOps.
* Strong contribution and cooperation is a must.
* Ideally fits in the SCRUM philosophy.
* We are to be all **the Developers!** (in slightly different flavors).

# Cloud Mindset –IT roles

* No longer Architects are forced to predict future workload, plan IT infrastructure along with computing resources – they are available on-demand and to your ~~heart's~~ wallet's content!

# Cloud Mindset – Design & Impl.

True  False

Consistency
All nodes see
the same data
at the same time.

ACID

ACID

Partition
tolerance
the system
continues to
operate despite
arbitrary message
loss or failure of
part of the system.

BASE

Availability
every request
receives a response
about whether it
was successful or
failed.

* Eric Brewer's CAP theorem in place from ACID towards BASE.

* BASE = Basically Available, Soft State, Eventually Consistent.

* "Myth: Eric Brewer on Why Banks are BASE Not ACID - **Availability Is Revenue**"
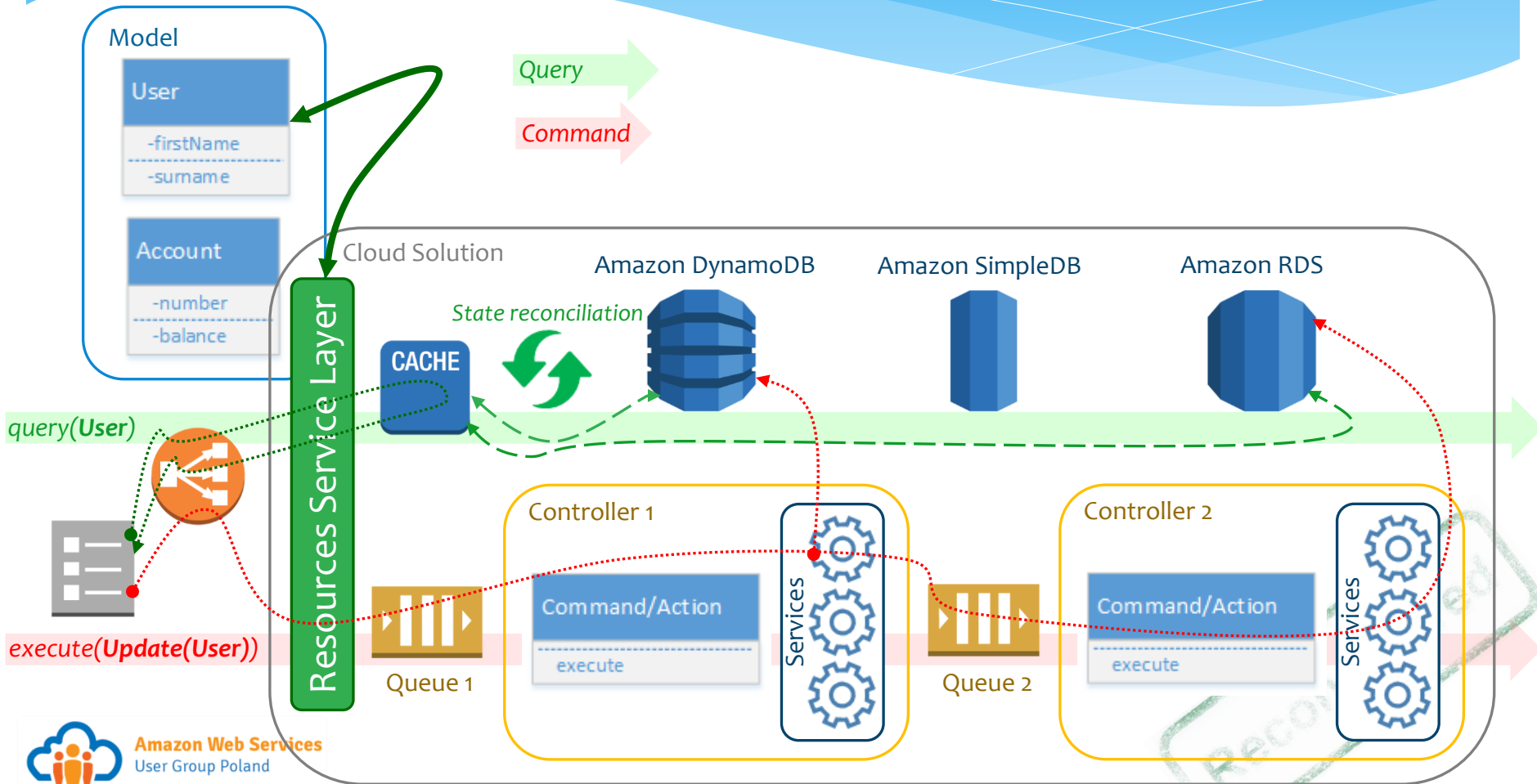
# Cloud Mindset –Impl. & Tests

True    False

☑       ☐

* Now, auto-scaling and load balancing matters are of interest to Programmers.

* A deployment process, OS & app servers setup become "programmable" entities and can be included as part of the application flow.

* CI and tests environments for any combination of versions of applications/services can be provisioned on demand and decommissioned once superfluous.

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# Cloud Mindset - Environments
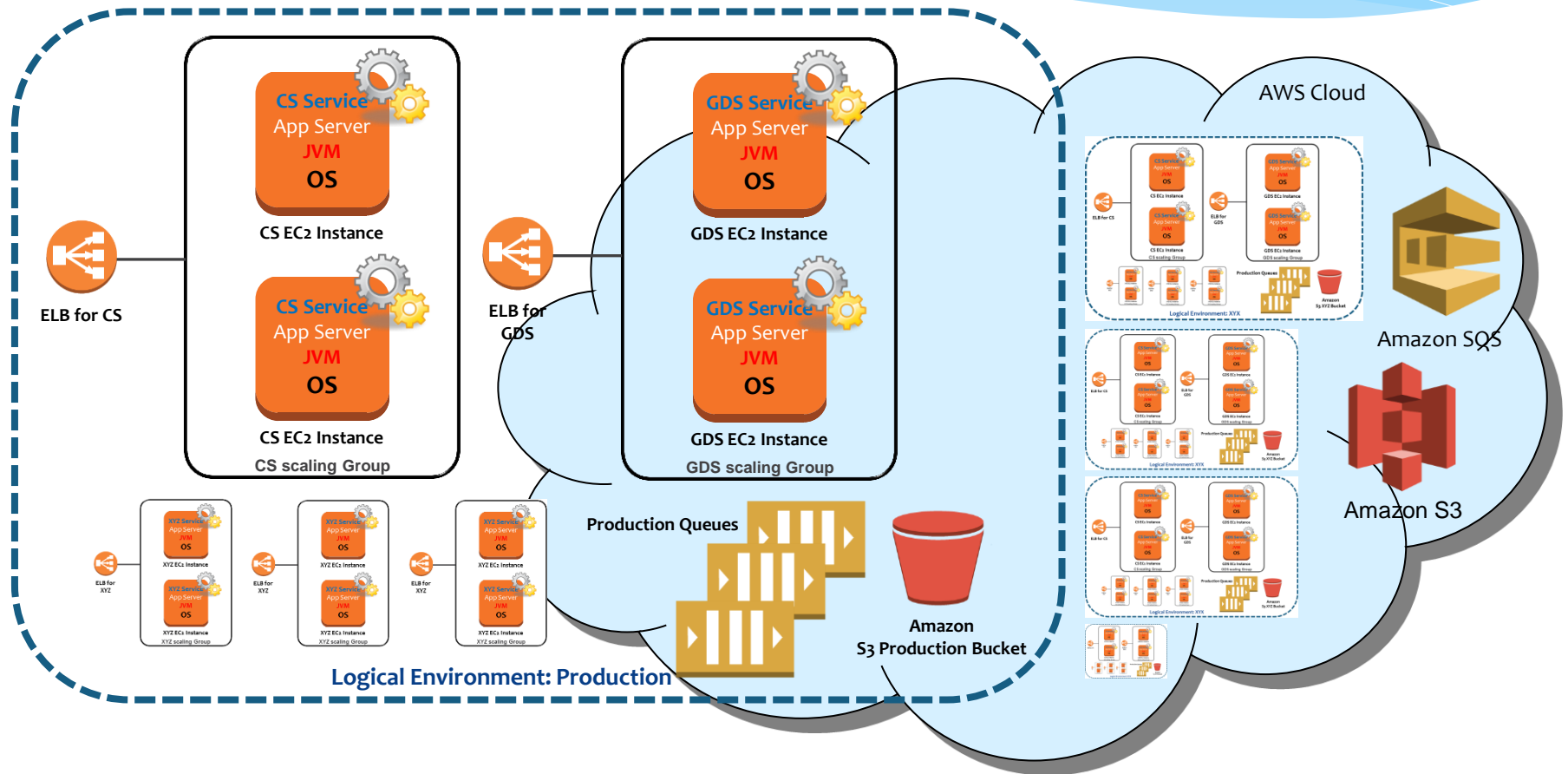
# Recommendations

*"Everything fails, all the time"*

* DFF (Design For Failure) – as of the early design stage.
* DFE (Design For Elasticity) – statelessness comes in play.
* DFA (… For Availability) – avoid single point of failure.
* Set free power of Asynch. – loose-coupling matters.
* Rethink towards Parallelism – at every tier.
* Be Inventor - experiment on variety of Arch's options.
* Optimize resource usage – turn off "the light" while not in use.
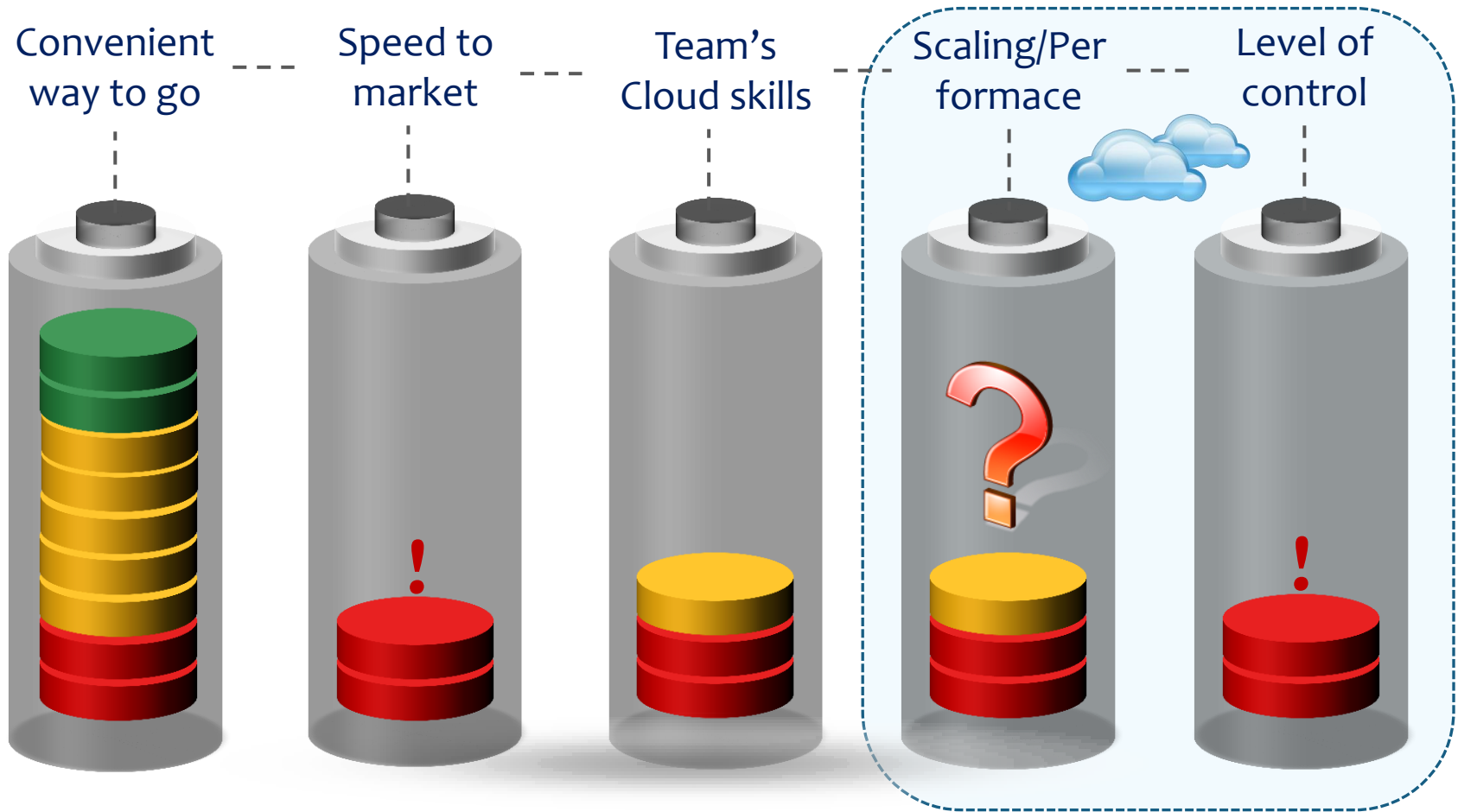
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# Common gaps

* Migrating applications to the Cloud "as is" without rethinking settings.

* Any Cloud initiative should have its origin in the real business need to satisfy.

* Reinventing the wheel – attempts to implement reliability and availability on one's own (with IaaS).

* Leaving off security concerns merely to CSP*.

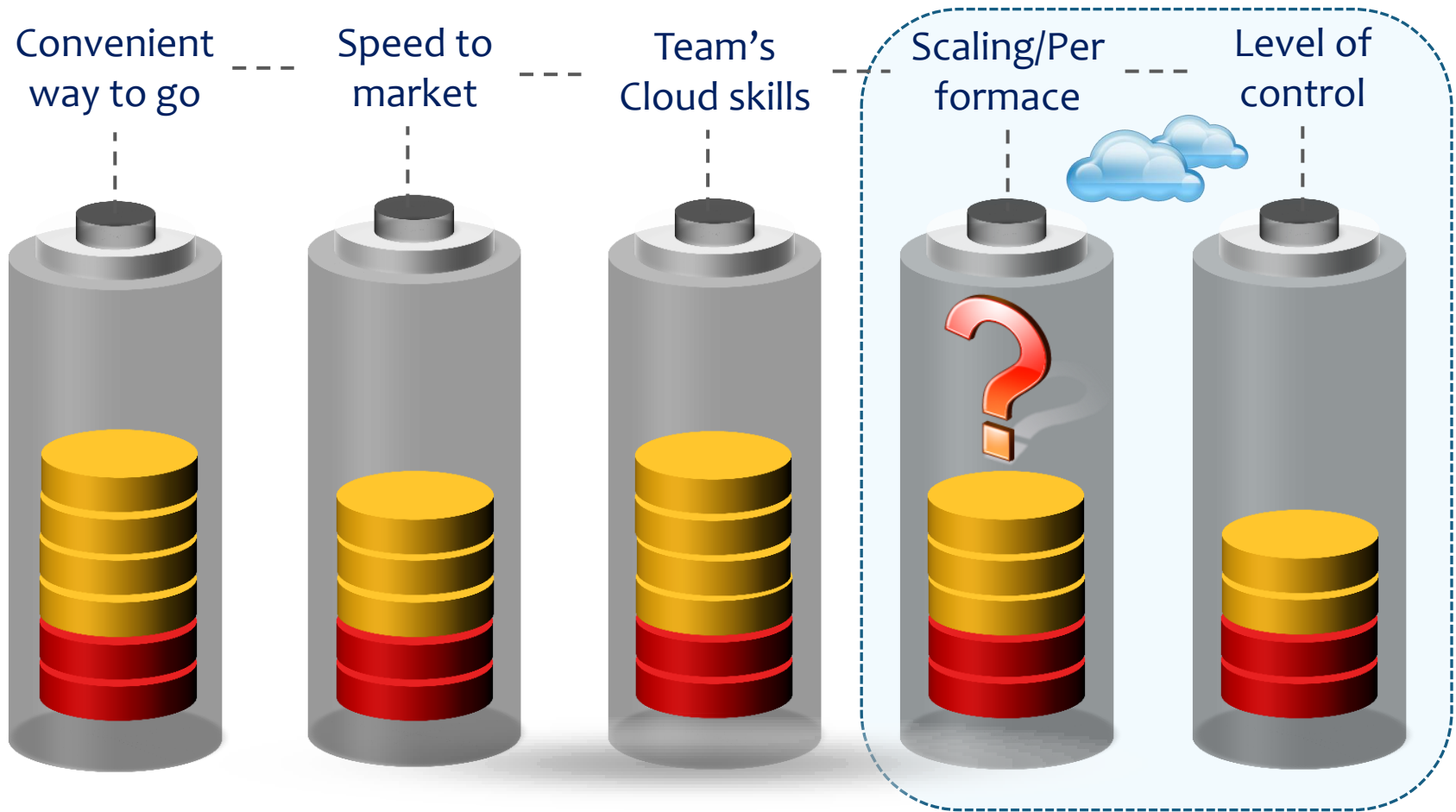*Security in the Cloud is beyond the subject of this presentation. It deserves on a separate lecture.

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# Challenges and Threats

* Increased security vulnerabilities.
  * Responsibility for customers' data is shared with the CSP.
* Limited operational governance.
* CSP lock-in and reduced portability!
  * Due to the lack of established and adopted industry Cloud specifications and standards.
* Multi-regional compliance, legal & privacy concerns.

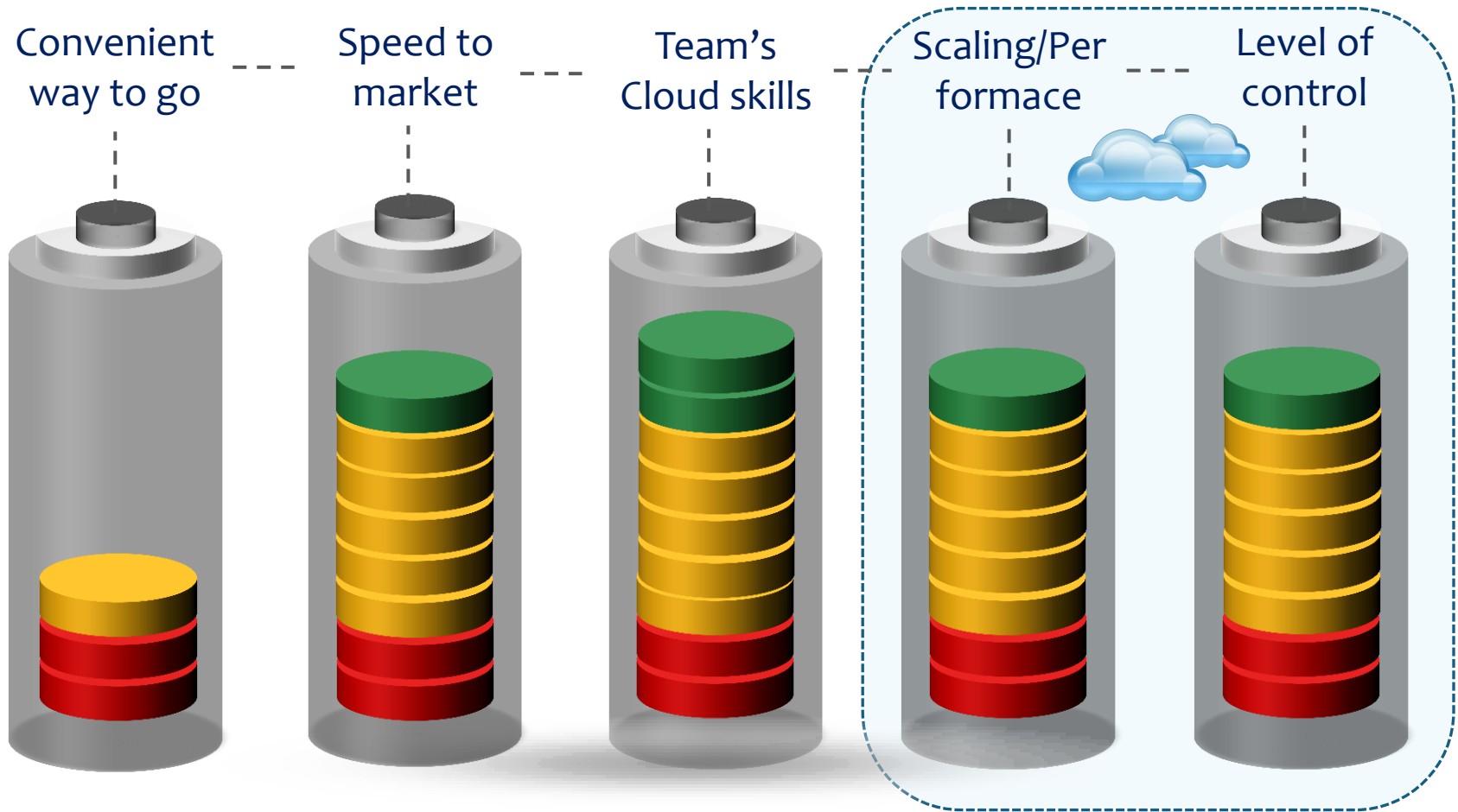**Amazon Web Services**
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# When PaaS?

Convenient way to go — Speed to market — Team's Cloud skills — Scaling/Per formace — Level of control

# For a dessert – Why AWS?

Proven and spectacular successes:

* Instagram

* Netflix

* Dozens and dozens of others…

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# For a dessert – Why AWS?

* We are enjoying it more and more over time.
* We are able to center around delivering a business value.
* Each of us finds something interesting and absorbing to specialize, develop one's skills and focus on:
  * Big data, NoSQL, Relational DBs
  * Cloud security and virtual IT administration challenges
  * Workflows, messaging, security and so on…
* Extremely interdisciplinary space to embrace – cross-domain skills wanted on board.

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