Cloud Computing – Challenges and Opportunities

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Overview

- Cloud Computing: higher agility and lower cost
  - *Require new application, hardware, and operational models*
- Cloud Architectural Elements
  - *Windows Azure as an example*
- Challenges
  - *Targeting apps to cloud – new and existing apps*
  - *Security and trust – in large public shared clouds*
  - *Hybrid clouds – necessary, yet introduce new cross cloud issues*
- Predictions & Conclusions
  - *One size does not fit all – spectrum of clouds*
  - *Need new cloud application model*

Why Embrace the Cloud?

- Greater agility
  - Resource and business agility
- Reduced cost
  - Increased utilization, capex -> opex
- Cloud as communication hub
  - Data sharing across devices

- *High-scale sharing is key*
  - Economies of scale
  - Elasticity
  - Increased utilization

Three Dimensions of Cloud Computing

Style of computing with dynamically scalable and virtualized resources provided as a service typically over the Internet

App Model

- Scale-out, service oriented,
- Replicated state, stored in network

Hardware Model

- Shared, scale-out, industry-standard hardware
- At cloud provider, partner, or on-premises

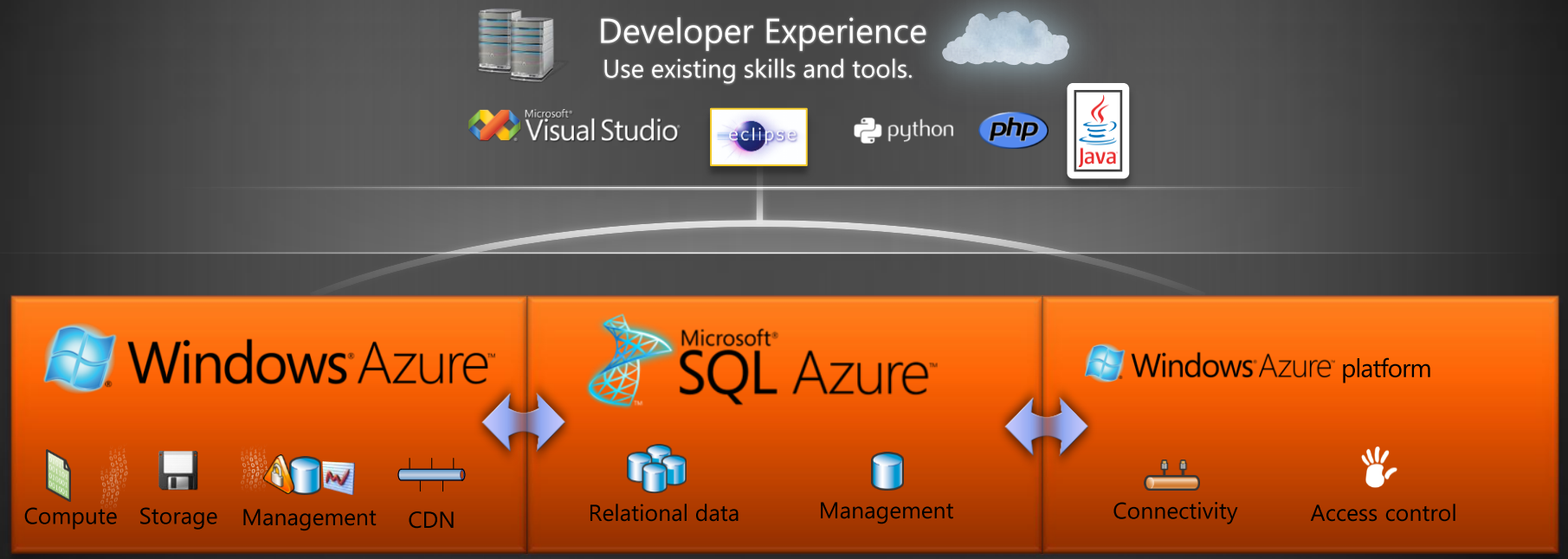
Operations Model

- Manage services not servers
- Usage tracking and chargeback

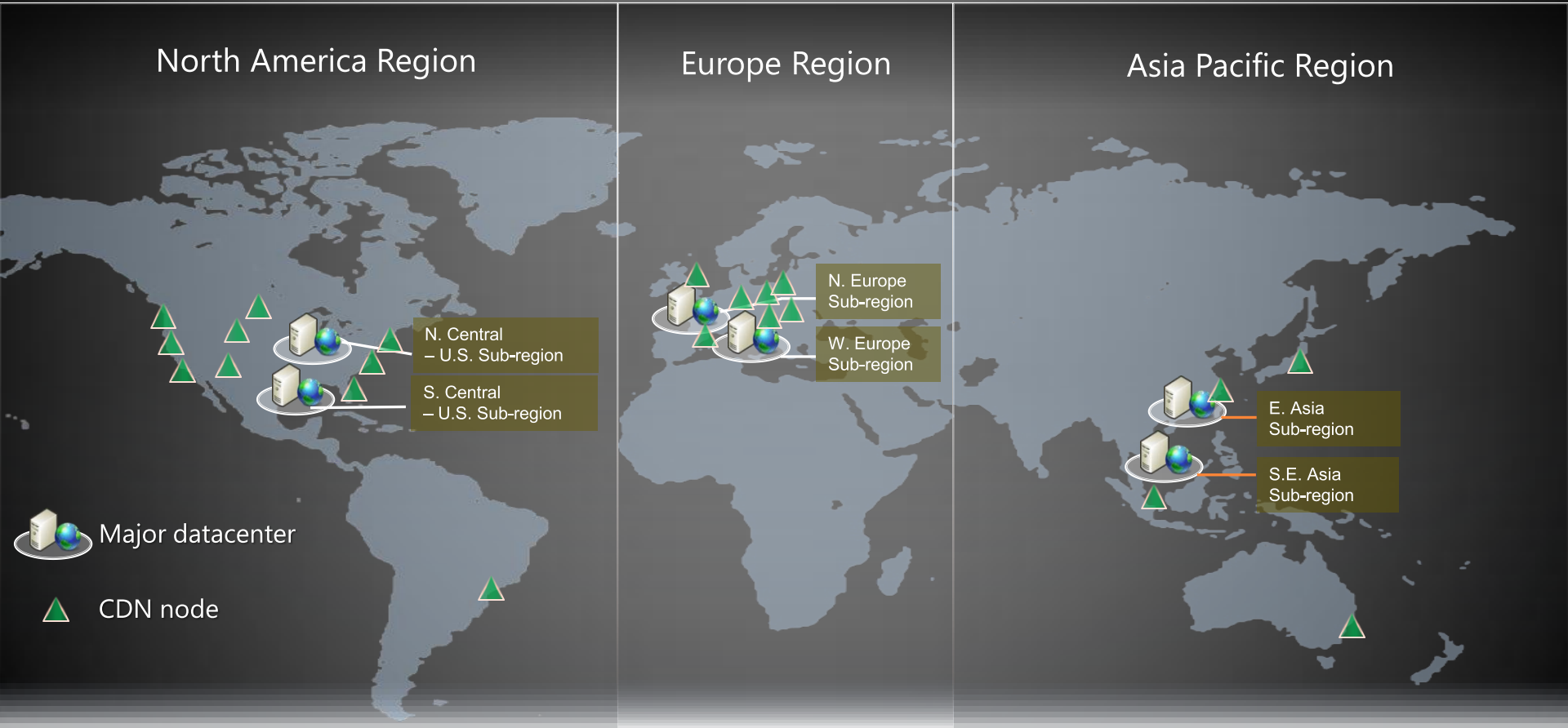
Cloud Architecture Elements

Efficient compute fabric	• Machine and network virtualization & resource management
Each node is a cache state	• Scale-out model, expect failures, reconstruct state from elsewhere
Automation	• Reduce cost, increase agility, remove human from loop
Modeling to capture intent and constraints	• Key to enabling automation
An application model	• Simplify and enable automation; geared toward scale-out services
Platform services and APIs	• Increase programmer agility, reduce duplication, enforce policies

The Windows Azure Platform



Windows Azure Growing Global Presence



Development and Operations Tools

Windows Azure SDK

- Includes a development fabric for running and debugging code locally

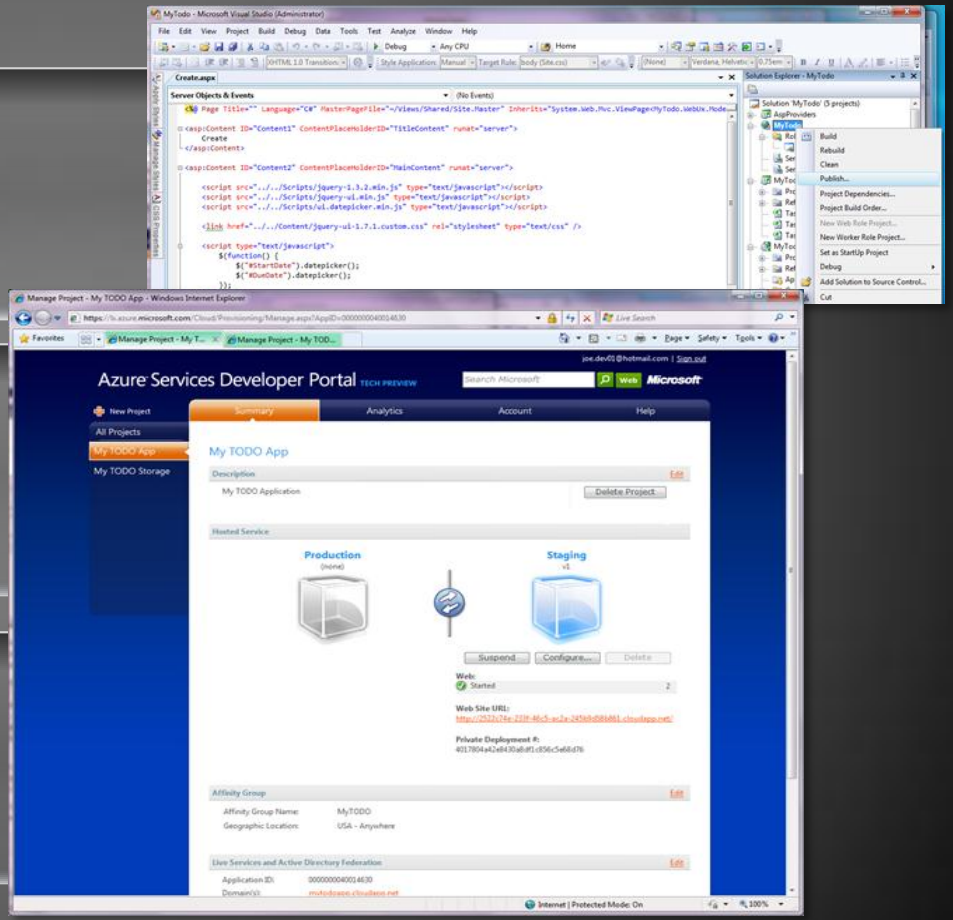
Windows Azure Tools for Microsoft Visual Studio

Windows Azure Tools for Eclipse for PHP and Java

Web portal, including billing

RESTful management APIs

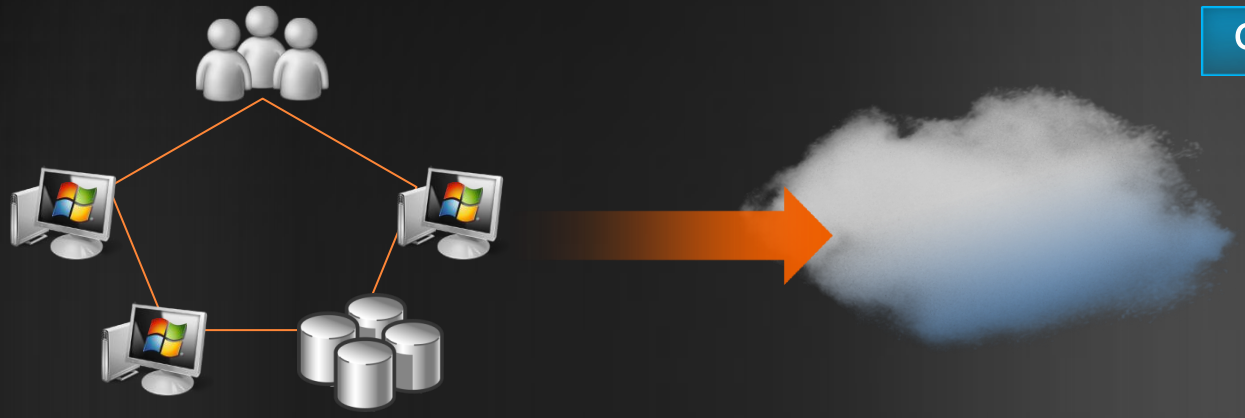
Service lifecycle management



Challenges

- Targeting applications to the cloud
  - Forklift approach does not work
- Security, trust, and regulations
  - Particularly in shared environments
- Hybrid clouds
  - Necessary, yet introduce new cross cloud issues

Targeting Apps to Cloud



Some Easy Cases — e.g., web site sharing public data

Often, Forklift Approach Will Not Work — Careful decomposition needed

Questions To Consider

- Application State
- Application Scale
- Data Sensitivity
- Connectivity Needs
- Application Portability
- Latency Between Components
- Regulation and Compliance

Targeting Apps to the Cloud

Application Data	State must be replicated, by app directly or in a replicated store
Application Configuration & Installation	Configuration state only a cache; no lengthy install step
Application Scale	App must scale horizontally (scale-out) not vertically (scale-up)
Application Dependencies	App must be able to run on cloud platform with no special hardware needs
Latency Needs	Shared cloud systems may not guarantee uniform/low latency among app components
Connectivity Needs	Intra- and inter- app connectivity needs must be clear and can provided by platform
Data Sensitivity	Public clouds may not be able to host all sensitive data
Security and Regulation	Location and type of cloud matters – see next slides

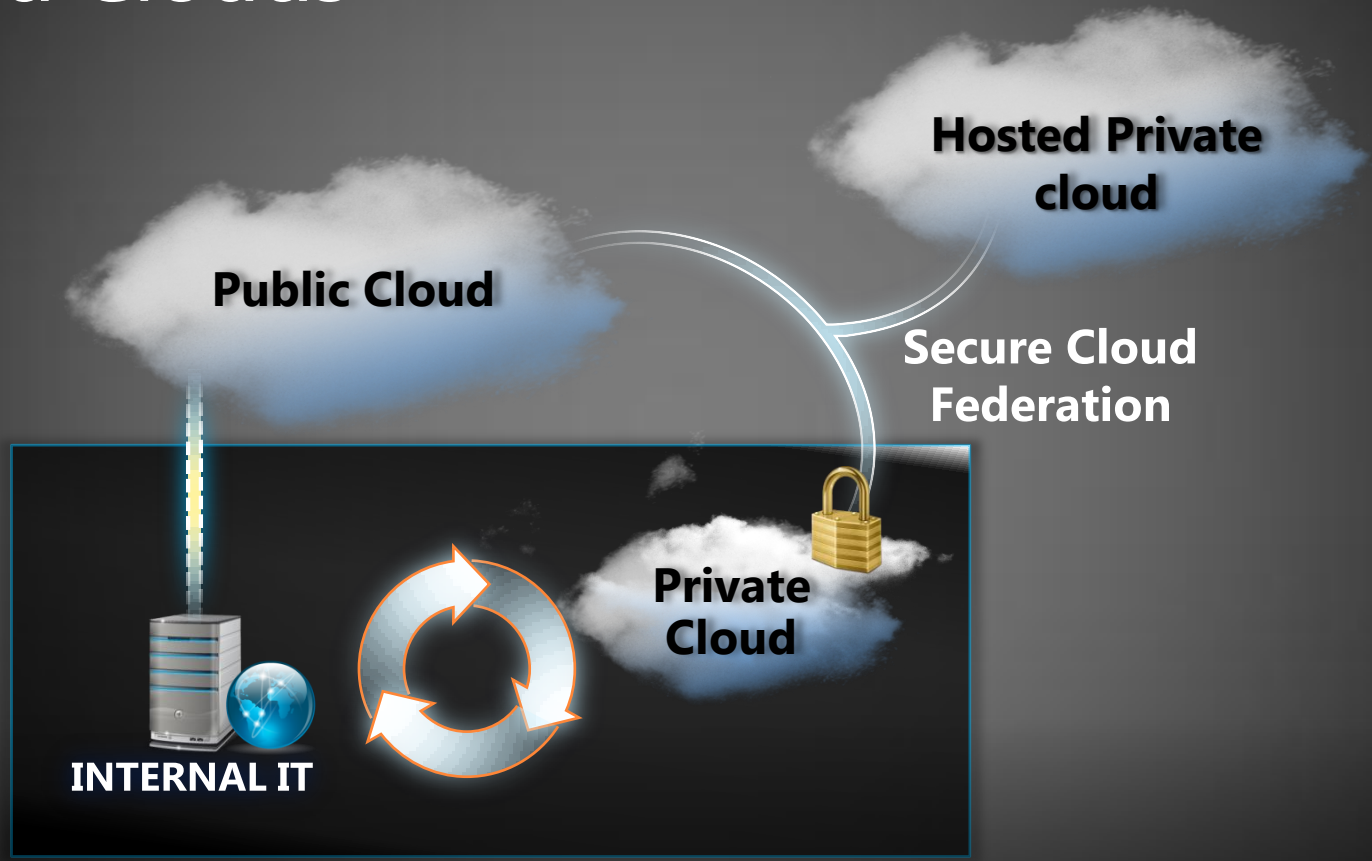
Cloud Security Considerations

- Identity and Access Management
  - Federate from on-premises to the cloud
  - Federate across organisation and country borders
- Application operational processes
  - Should be integrated into the organisation's security management
- Communication and endpoint Integrity
  - Applications and clients are no longer behind firewall
- Compliance and Risk Management
  - Cloud customers still responsible for compliance and risk management

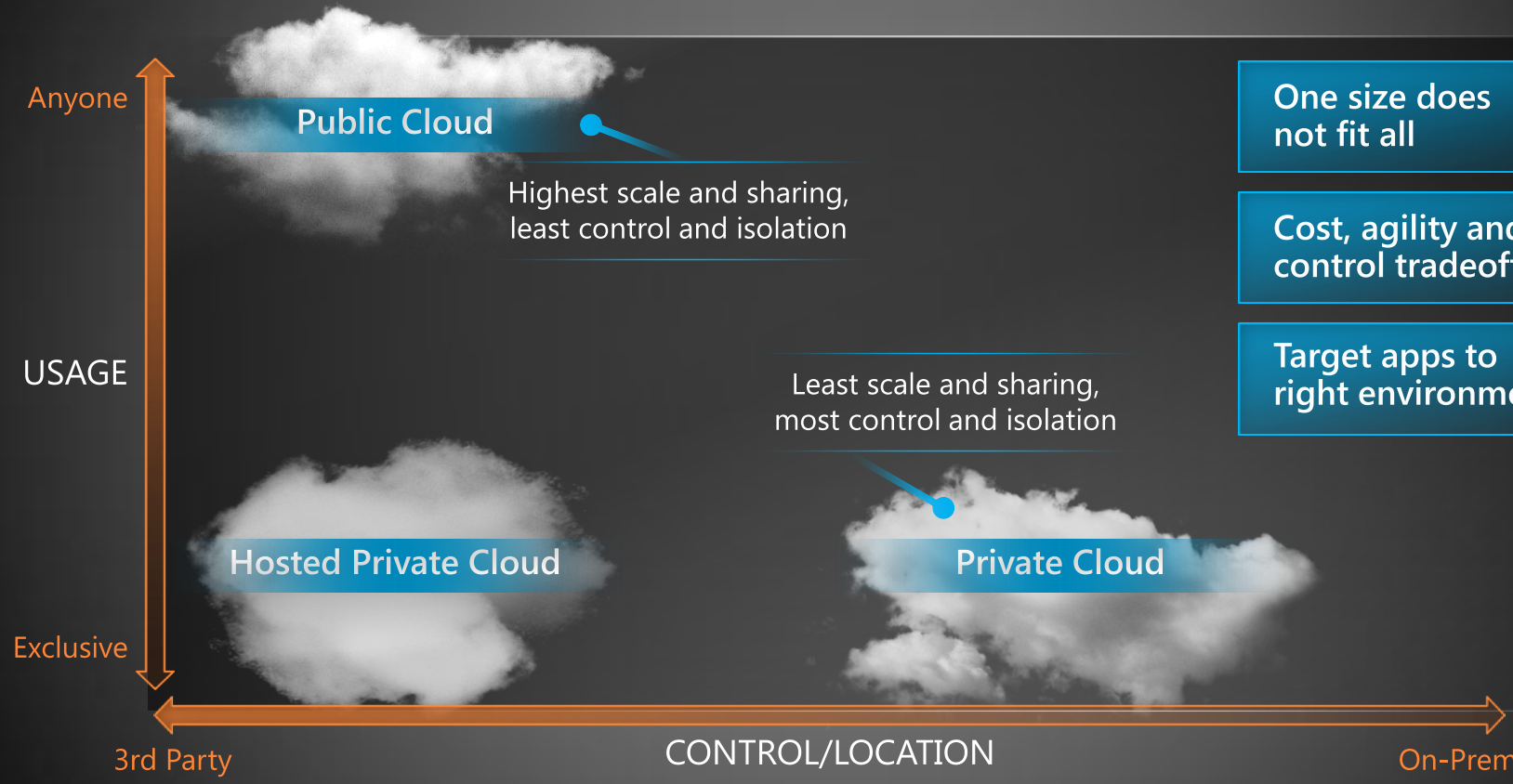
Regulations and National Boundaries

- Do you know where your data resides?
- Hybrid clouds can span national boundaries
- Many governments regulates where data can live
  - And where it cannot
- Policy controls are needed for data & applications
  - Driven by regulations and business needs

Hybrid Clouds



Cloud Spectrum and Tradeoffs



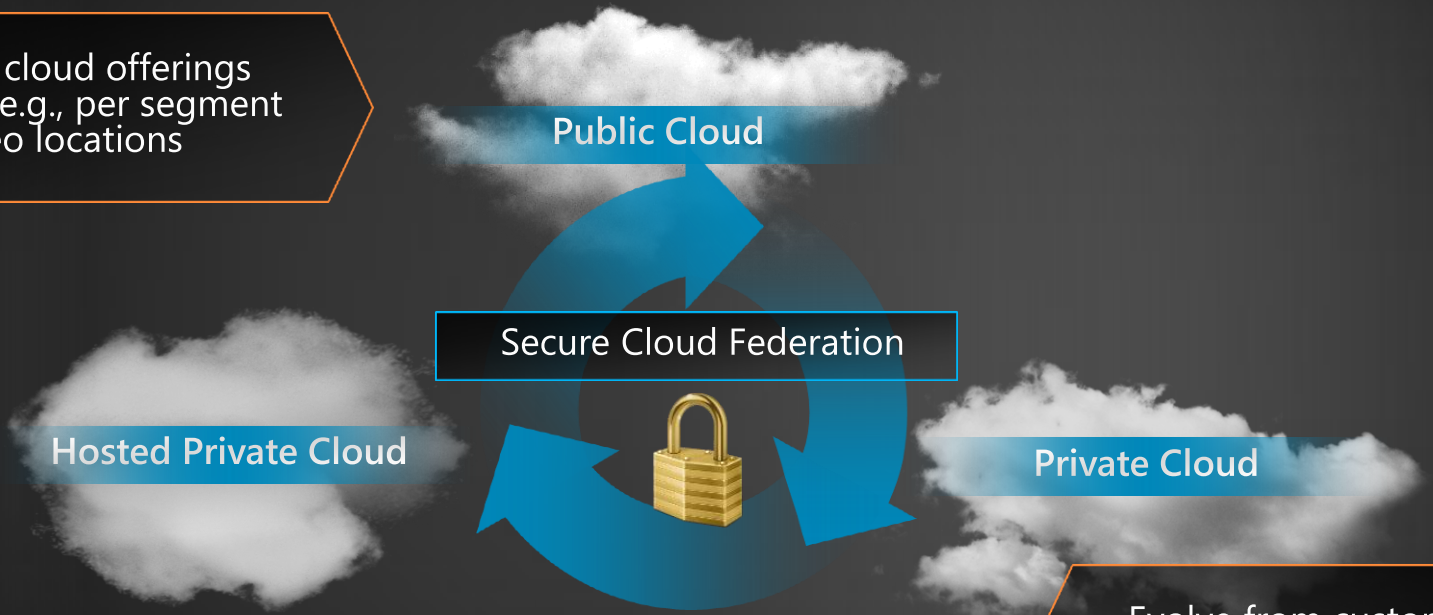
One size does not fit all

Cost, agility and control tradeoffs

Target apps to right environment

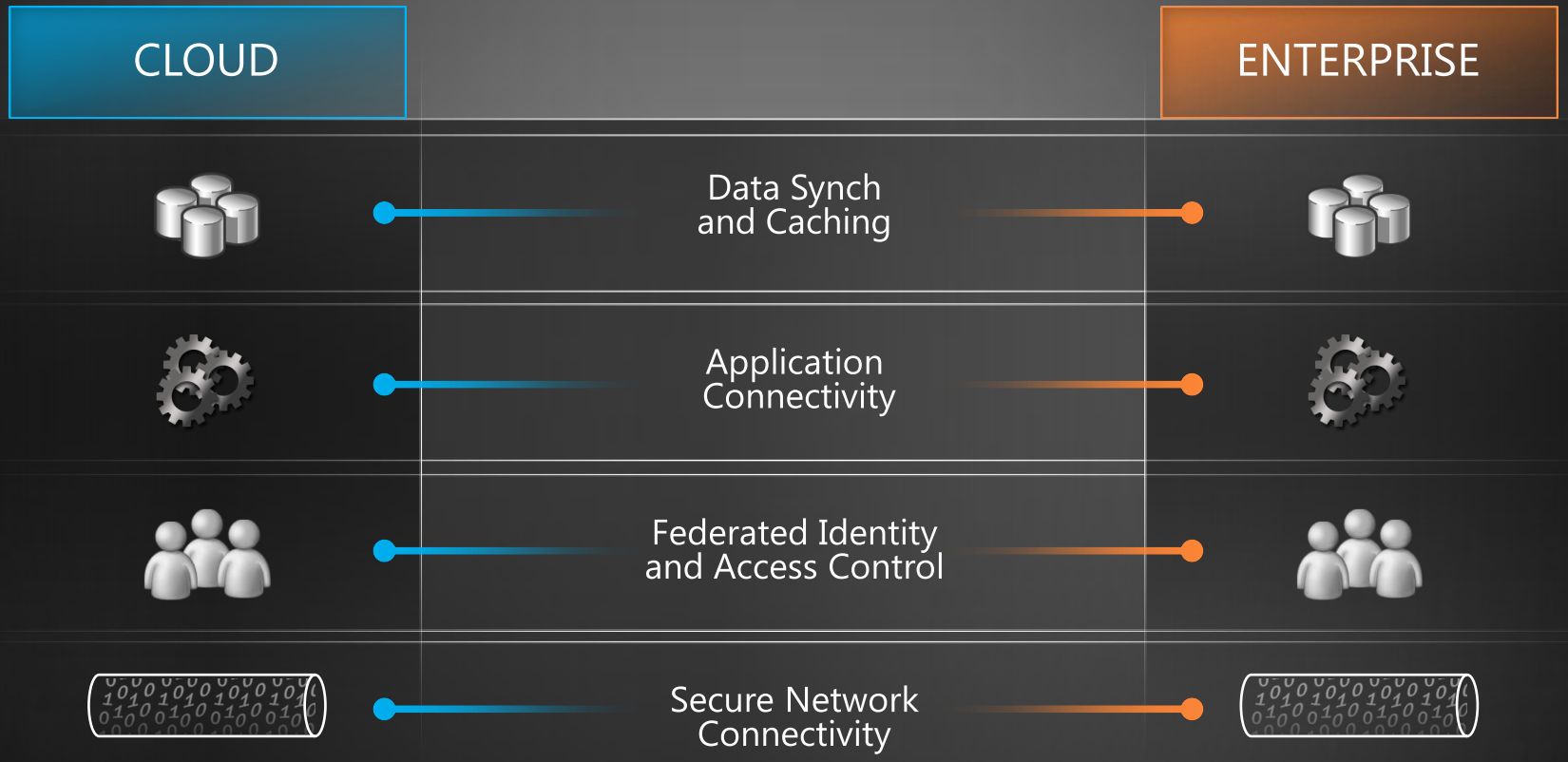
Evolving into Hybrid Clouds

Specialized cloud offerings will evolve, e.g., per segment industry, geo locations



Evolve from custom virtualized infrastructure to packaged platforms

Secure Cloud Federation



Predictions

Cloud Application Model will be the Default

Scale-out, service oriented; the rest will be “legacy”

Public Clouds will Become More Mature

But private clouds will not go away

More Specialized Clouds - Per-industry, Per-geo, …

Cloud federation and cloud brokers will be prevalent
Hybrid clouds will be the norm

Security and Management Across Cloud Boundaries

Services distributed across clouds by default
Policy-driven secure connectivity mechanisms will be needed

Summary

- Cloud computing: It's still very early
- Once size does not fit all
  - Spectrum of clouds
  - Security will span multiple clouds and locales by default
  - Must consider location, control, and level of risk tolerance
- Need new cloud application model
  - Scale-out by default, including data storage and management
  - Adjusts to available cloud hardware and network

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