Overview of Cloud Computing and the

Windows Azure Platform

Krishna Kumar
krishna.kumar@microsoft.com
http://azurepilot.com
Twitter: KrishnaOnAzure

Microsoft

http://AzurePilot.com

Evolution of computing paradigms

+

Highly Centralized Very Powerful

–

Programmer Productivity

1960s

Mainframes ruled the earth.

sw

Low level & Sequential (Assembly, COBOL, ForTran)

dx

None

+

Programmer Productivity

–

Less Powerful
More Administration

1970s

The rise of the **Minis**

sw

Structured
(Pascal, C)

dx

None

+

Programmer Productivity
Surge in Demand

−

Even Lesser Power
Increased Administration

1980s

Proliferation of the PCs

sw

Object Oriented
Programming
(Smalltalk, C++)

dx

Network (Socket)
Programming

+

More Centralized
More Powerful

−

Administration Explosion

1990s

Network the Servers

sw

Component Oriented
Programming
(COM)

dx

Homogeneous Client-Server,
3-Tier, RPC Based
(DCOM, CORBA, RMI)

+

Centralized Applications
Lower Administration Rise
of Mobile platform

–

Lack of Customization
Lack of Multi-Tenancy

2000s

The **Internet** comes of age

sw

Component Oriented
Programming
(.NET)

dx

Heterogeneous 3/n-Tier,
Message Passing based Web
Computing
(Web Services, SaaS)

Platform Evolution

+ −

2010s

Welcome to the Cloud

sw

Service Oriented Architecture (.NET, WCF)

dx

Web Computing, Cloud Computing (Web Services – WS*, SOAP, REST)

Platform Continuum

On-Premises Servers

- Bring your own machines, connectivity, software, etc.
- Complete control
- Complete responsibility
- Static capabilities
- Upfront capital costs for the infrastructure

Hosted Servers

- Renting machines, connectivity, software
- Less control
- Fewer responsibilities
- Lower capital costs
- More flexible
- Pay for fixed capacity, even if idle

Cloud Platform

- Shared, multi-tenant infrastructure
- Virtualized & dynamic
- Scalable & available
- Abstracted from the infrastructure
- Higher-level services
- Pay as you go

On-Premise

% of
Capital Equipment Budget
spent on IT in 2000?

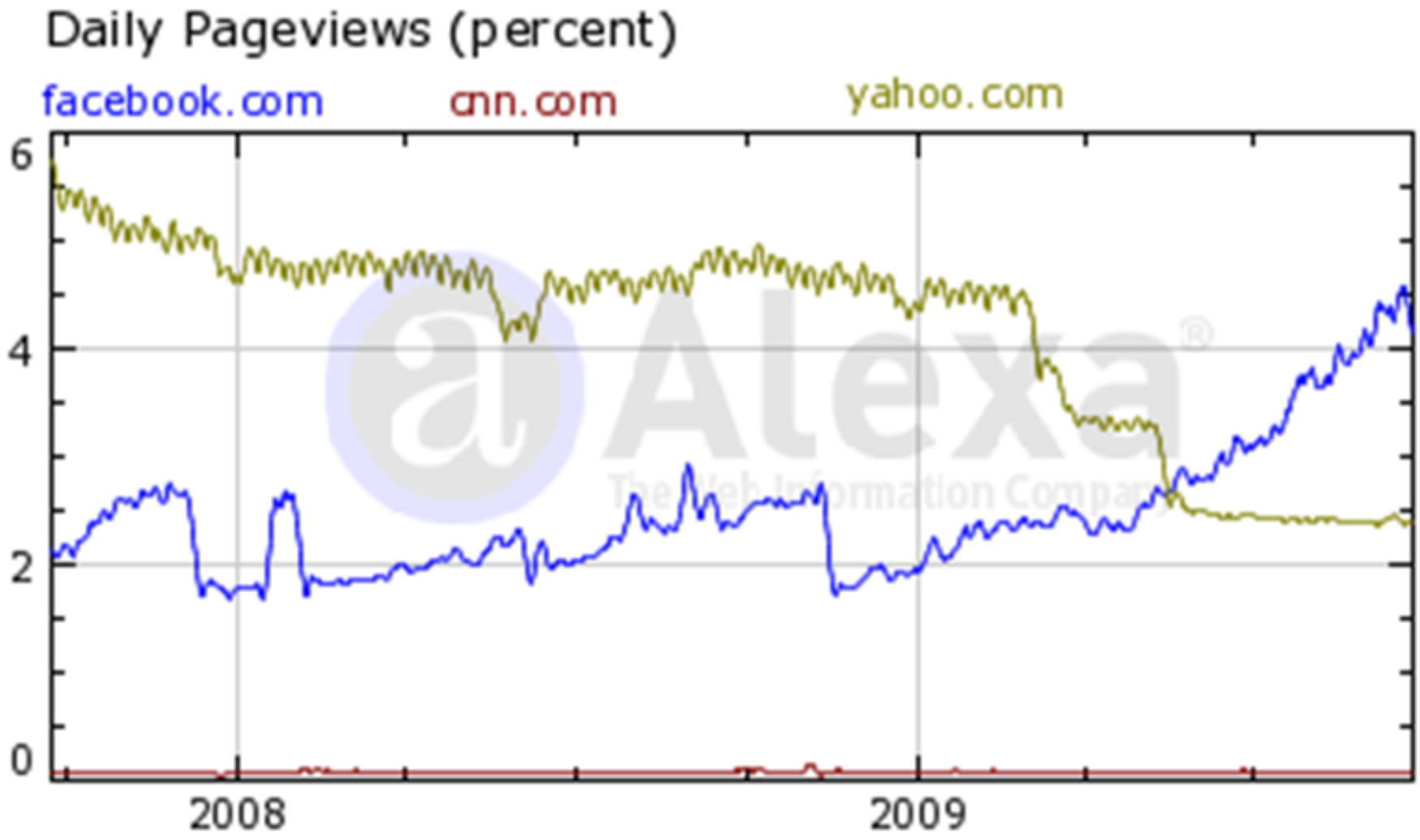
45%

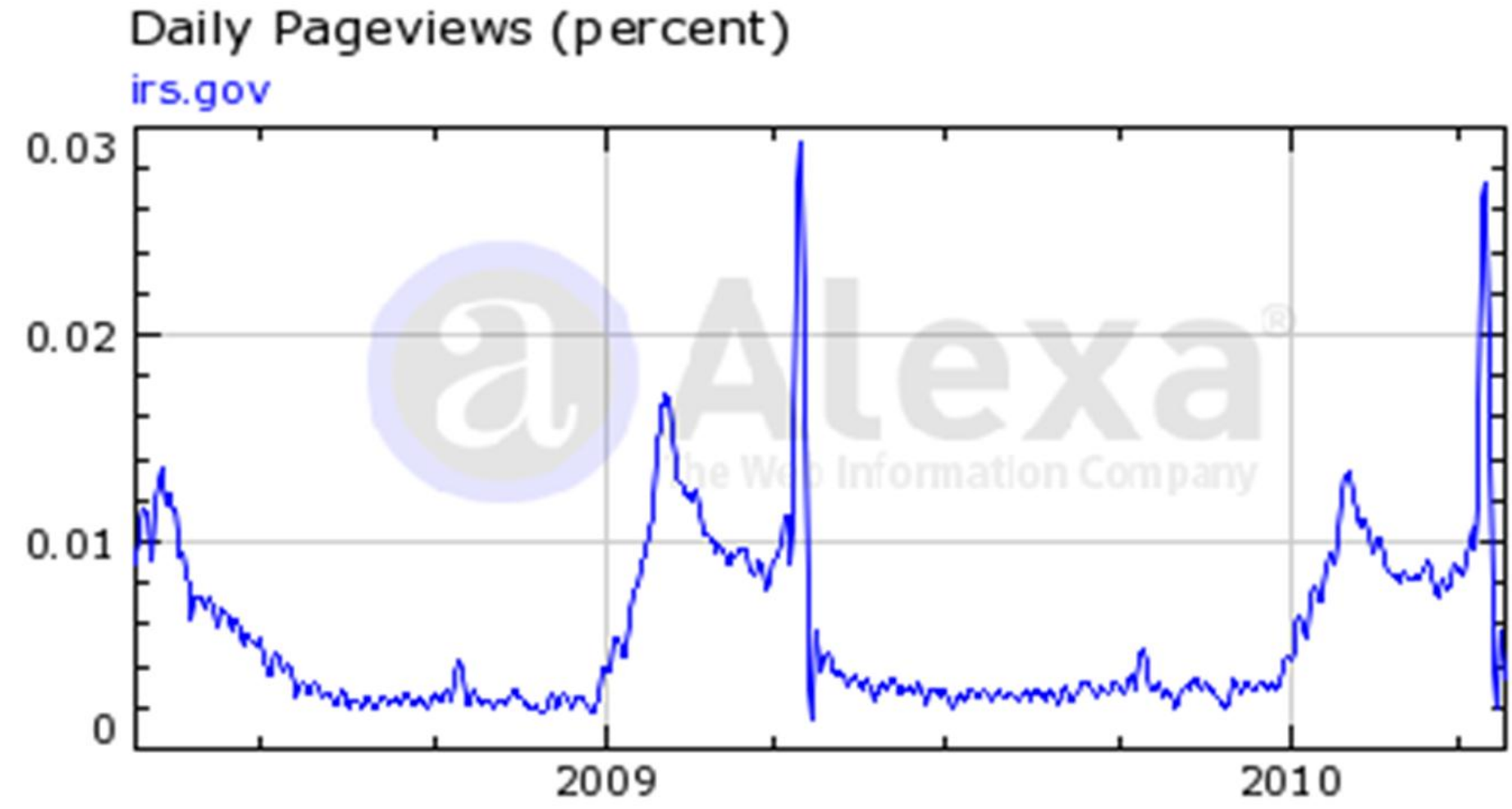
Commerce Department Statistics

% of Utilized Server Capacity on Average?

6%

Economist Survey on IT, 2008

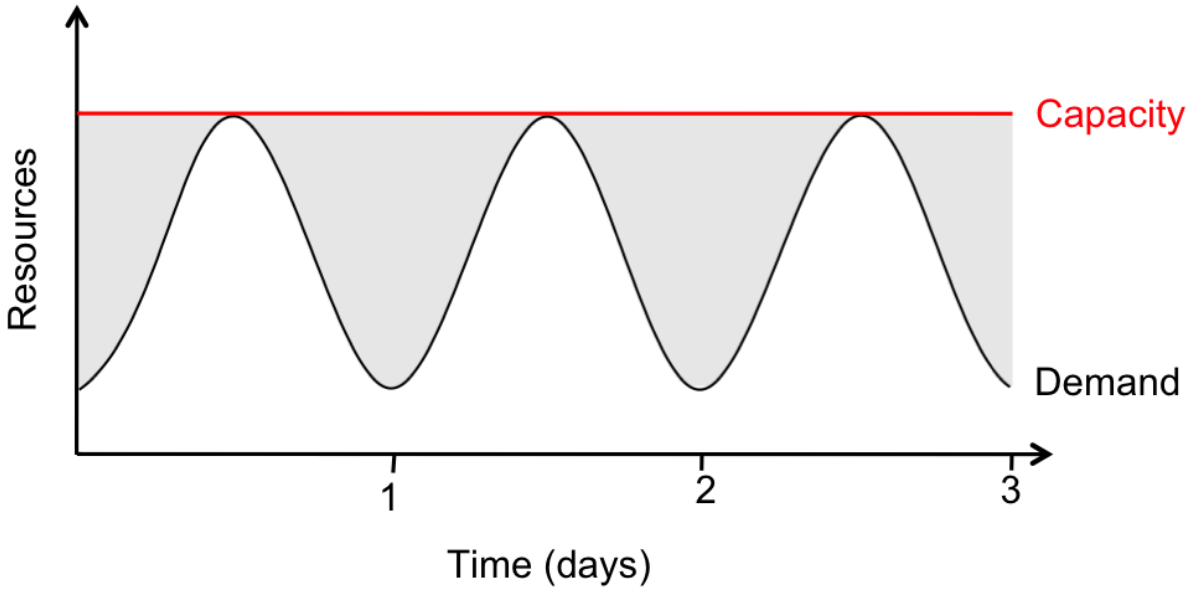

Daily Pageviews (percent)
facebook.com
cnn.com
yahoo.com
6
4
2
0
2008
2009
Alexa
The Web Information Company


Daily Pageviews (percent)
irs.gov
0.03
0.02
0.01
0
2009
2010
Alexa
the Web Information Company

Elasticity – Provisioning for Peak

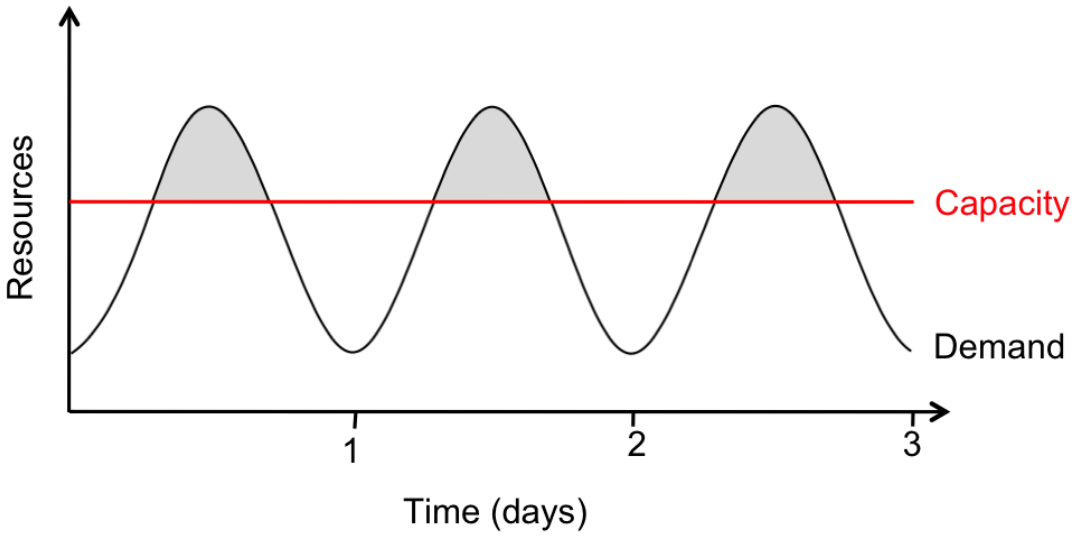
Real World Server Utilization Is 5% to 20%

- Many Services Peak Exceeds Average by a Factor of 2 to 10
- Most Provision for Peak
- Painful to Under-Provision (Lost Customers)



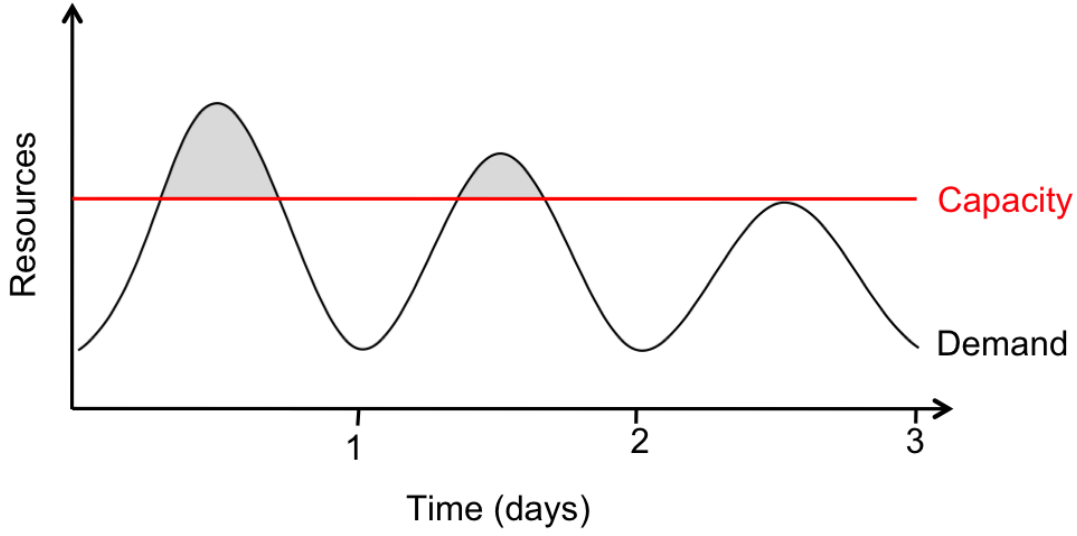
Provisioning for Peak
Without Elasticity,
We Waste Resources
(Shaded Areas)
During Non-Peak Times

Elasticity: Risks of Under-Provisioning



Under-Provisioning #1

Potential Revenue (Shaded Area) Is Sacrificed



Under-Provisioning #2

Some Users Respond to Under-Provisioning by Permanently Deserting the Site...
Bad for Revenue!

Fallback: Hosted

WebHosting Contract Boilerplate

Agreement Provisions Included

- Scope of Services
- Price and Payment
- Term and Termination
- Customer Service
- User's Warranties and Obligations
- Ownership of Intellectual Property
- Warranty and Disclaimer
- Limitation of Liability
- Indemnification of Host
- Confidential Information
- Relation of Parties
- Employee Solicitation/Hiring
- Non-assignment
- Arbitration
- Attorneys' Fees
- Severability
- Force Majeure
- No Waiver
- Entire Agreement

Exhibit A: Statement of Work

- Preamble
- Project Background
- Scope
- Key Tasks and Milestones
- Project Deliverables
- Time and Cost Estimates
- Price and Payment
- Invoices
- Payment
- Project Organization and Personnel Requirements
- Supporting Documentation
- Expenses

Exhibit B: Service Level Agreement

- Downtime
- Technical Support

Exhibit C: Web Hosting Acceptable Use Policy

- Acceptable Use
- Reporting of Violations of This Acceptable Use Policy
- Revisions to This Acceptable Use Policy

Wouldn’t it be Groovy if:

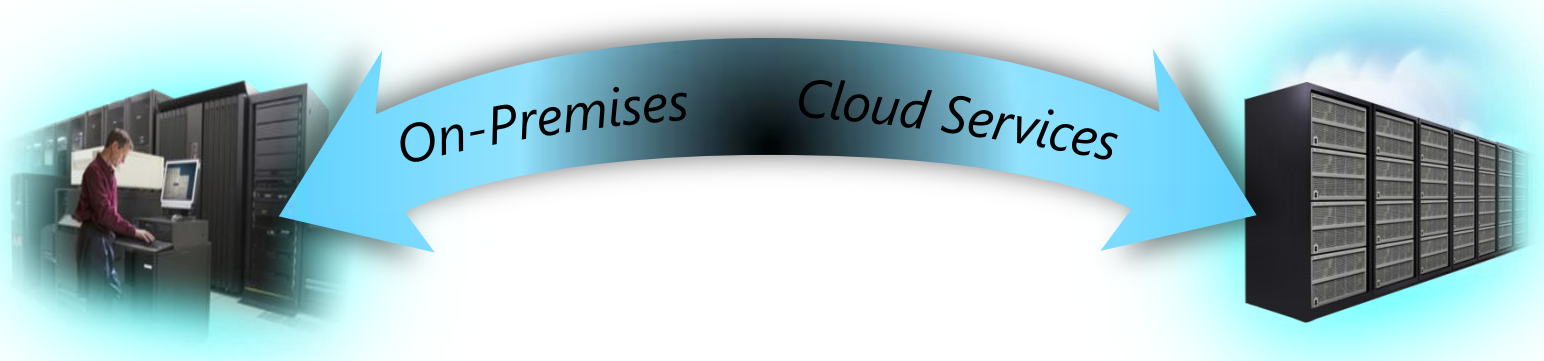
1. I pay ONLY for what I use
2. ONLY when I use it
3. With the ability to SCALE capacity up and down on-demand

We just defined the

CLOUD MANIFESTO

What is Cloud Computing?

Cloud Computing



- Store Data
- Run Applications
  - Combined with:
    - Utility model
    - Elastic Nature

What Is Cloud Computing?

Cloud Computing: App and Infrastructure over Internet

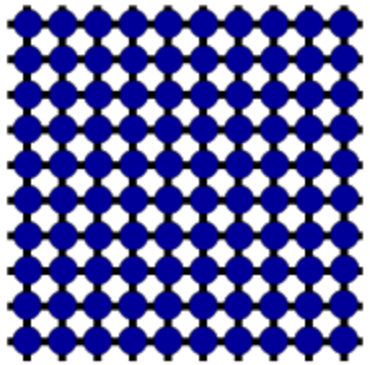
- Compute as a Service: Applications over the Internet
- Utility Computing: *"Pay-as-You-Go"* Datacenter Hardware and Software

Three New Aspects to Cloud Computing

- The Illusion of Infinite Computing Resources Available on Demand
- The Elimination of an Upfront Commitment by Cloud Users
- The Ability to Pay for Use of Computing Resources on a Short-Term Basis as Needed

How does it differ from:

- Fabric Computing
- Cluster Computing
- Grid Computing



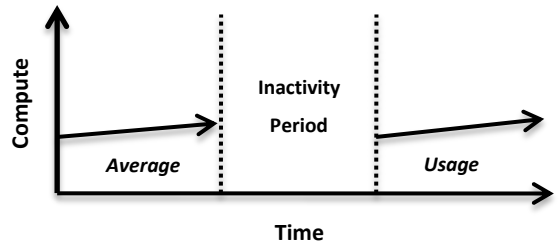
Benefits

- Agility
- Cost
- Device & Location Independence
- Multi-Tenancy
- Reliability
- Scalability
- Security
- Sustainability

Cloud Workload Patterns

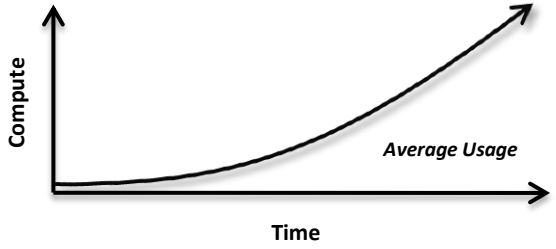
Workload Patterns Optimal For Cloud

"On and Off "



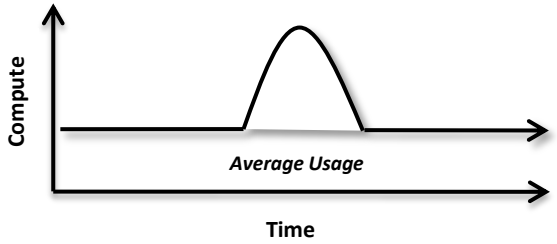
- On & off workloads (e.g. batch job)
- Over provisioned capacity is wasted
- Time to market can be cumbersome

"Growing Fast"



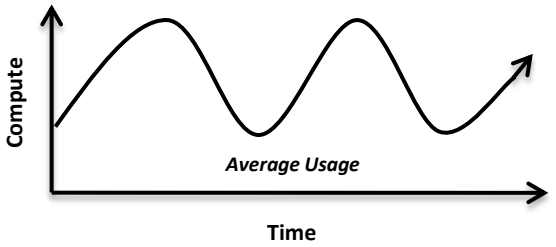
- Successful services needs to grow/scale
- Keeping up w/ growth is big IT challenge
- Complex lead time for deployment

"Unpredictable Bursting"



- Unexpected/unplanned peak in demand
- Sudden spike impacts performance
- Can't over provision for extreme cases

"Predictable Bursting"



- Services with micro seasonality trends
- Peaks due to periodic increased demand
- IT complexity and wasted capacity

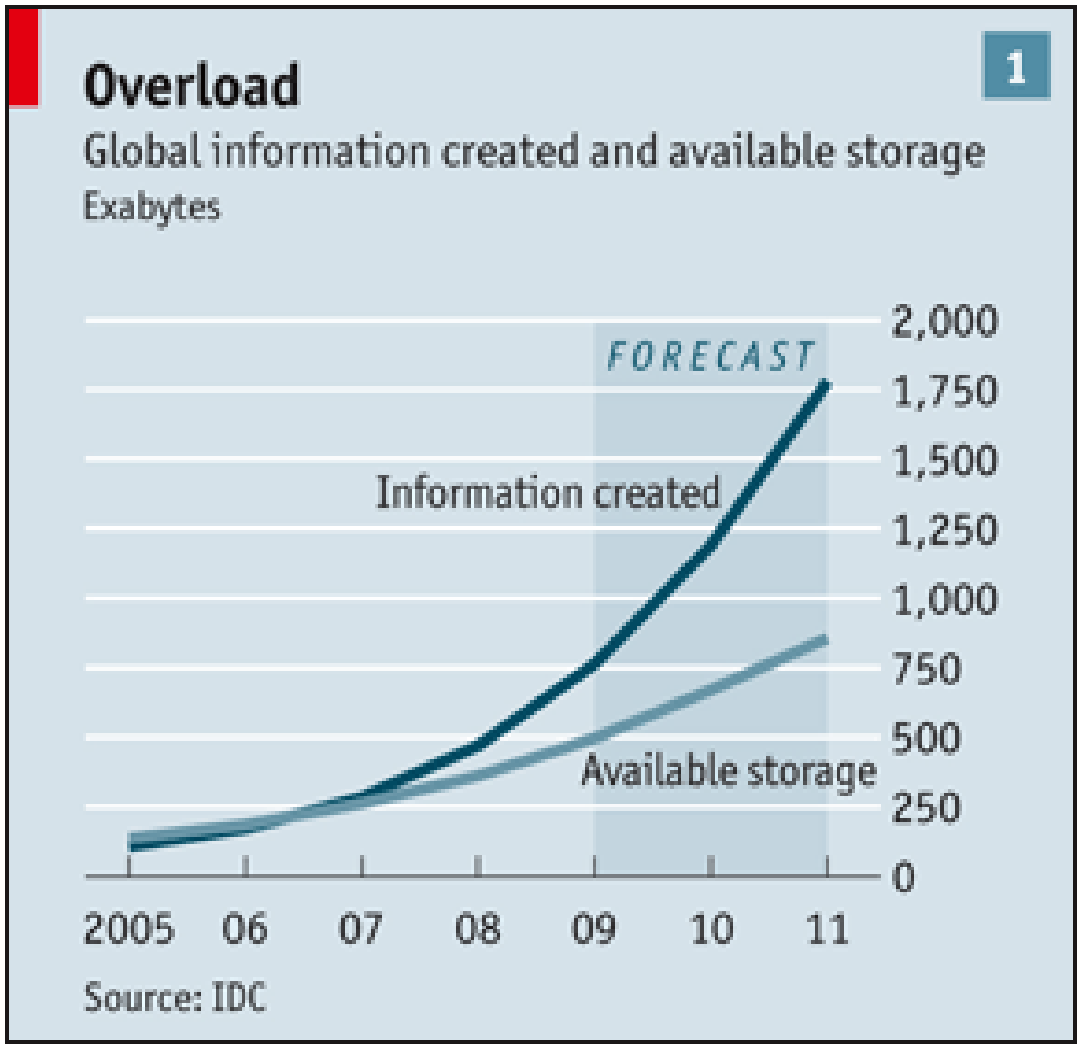
And, what about:

Business / Commerce

Consider these statistics:

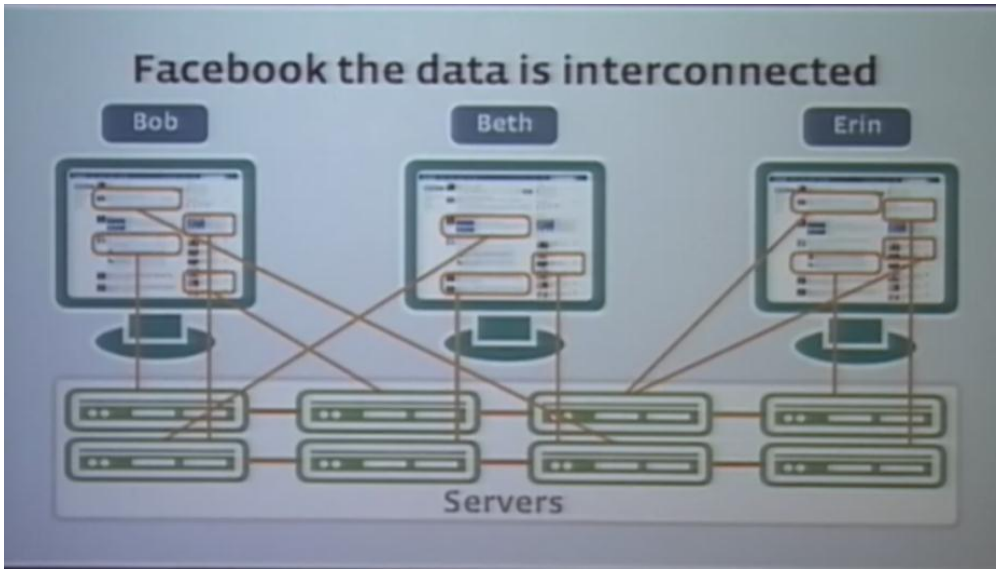
- Eighteen months ago, at Li & Fung, 100GB of information flow through its network each day. Now the amount has increased tenfold
- During 2009, American drone aircraft flying over Iraq and Afghanistan sent back around 24 years' worth of video footage
- Wal-Mart, a retail giant, handles more than 1m customer transactions every hour, feeding databases estimated at more than 2.5PB — the equivalent of 167 times the books in America's Library of Congress
- Mankind created 150 exabytes (billion gigabytes) of data in 2005. This year, it will create 1,200 exabytes.

Information Creation vs. Storage Capacity



Internet-Scale Application

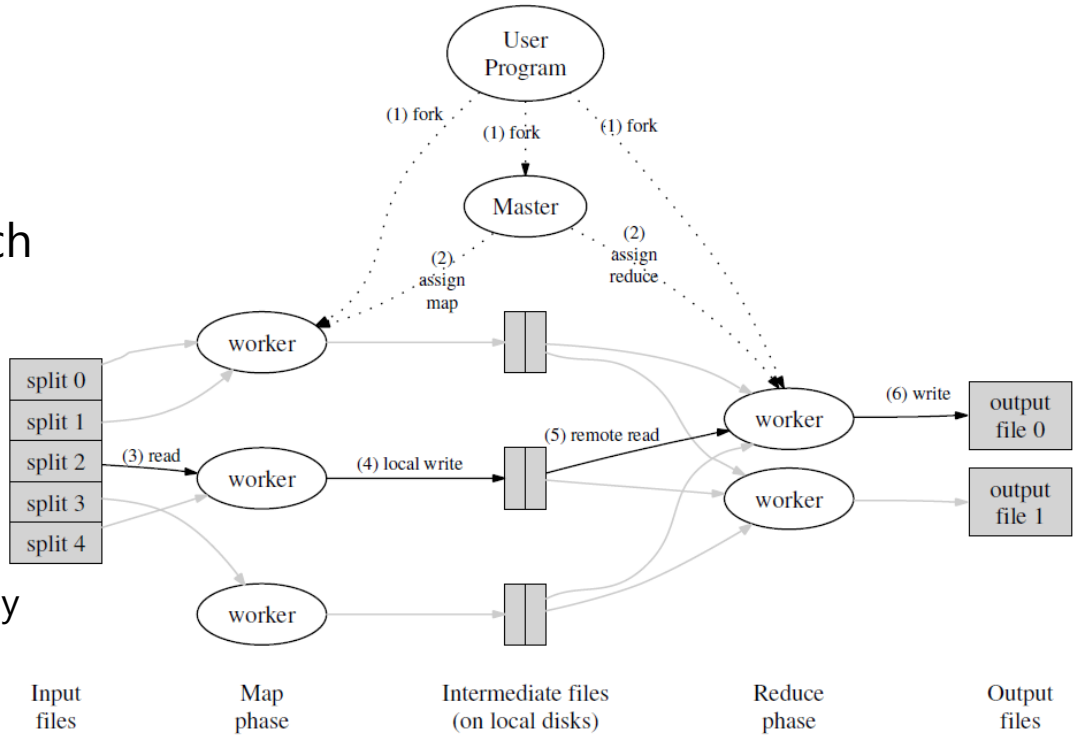
- 2009 stats:
  - +200B pageviews/month
  - >3.9T feed actions/day
  - +300M active users
  - >1B chat mesgs/day
  - 100M search queries/day
  - >6B minutes spent/day (ranked #2 on Internet)
  - +20B photos, +2B/month growth
  - 600,000 photos served / sec
  - 25TB log data / day processed thru Scribe
  - 120M queries /sec on memcache
- Scaling the "relational" data:
  - Keeps data normalized, randomly distributed, accessed at high volumes
  - Uses "shared nothing" architecture



Internet-Scale Application

- 2007 stats:
  - +20 petabytes of data processed / day by +100K MapReduce jobs
  - 1 petabyte sort took ~6 hours on ~4K servers replicated onto ~48K disks
  - +200 GFS clusters, each at 1-5K nodes, handling +5 petabytes of storage

- ~40 GB/sec aggregate read/write throughput across the cluster
- +500 servers for each search query < 500ms
- Scaling the process:
  - **MapReduce**: parallel processing framework
  - **BigTable**: structured hash database
  - **Google File System**: massively scalable distributed storage



Application Models

Web Hosting

- Massive scale infrastructure
- Burst & overflow capacity
- Temporary, ad-hoc sites

Application Hosting

- Hybrid applications
- Composite applications
- Automated agents / jobs

Media Hosting & Processing

- CGI rendering
- Content transcoding
- Media streaming

Distributed Storage

- External backup and storage

High Performance Computing

- Parallel & distributed processing
- Massive modeling & simulation
- Advanced analytics

Information Sharing

- Reference data
- Common data repositories
- Knowledge discovery & mgmt

Collaborative Processes

- Multi-enterprise integration
- B2B & e-commerce
- Supply chain management
- Health & life sciences
- Domain-specific services

Cloud Services

"IaaS"

Infrastructure-as-a-Service

host

"PaaS"

Platform-as-a-Service

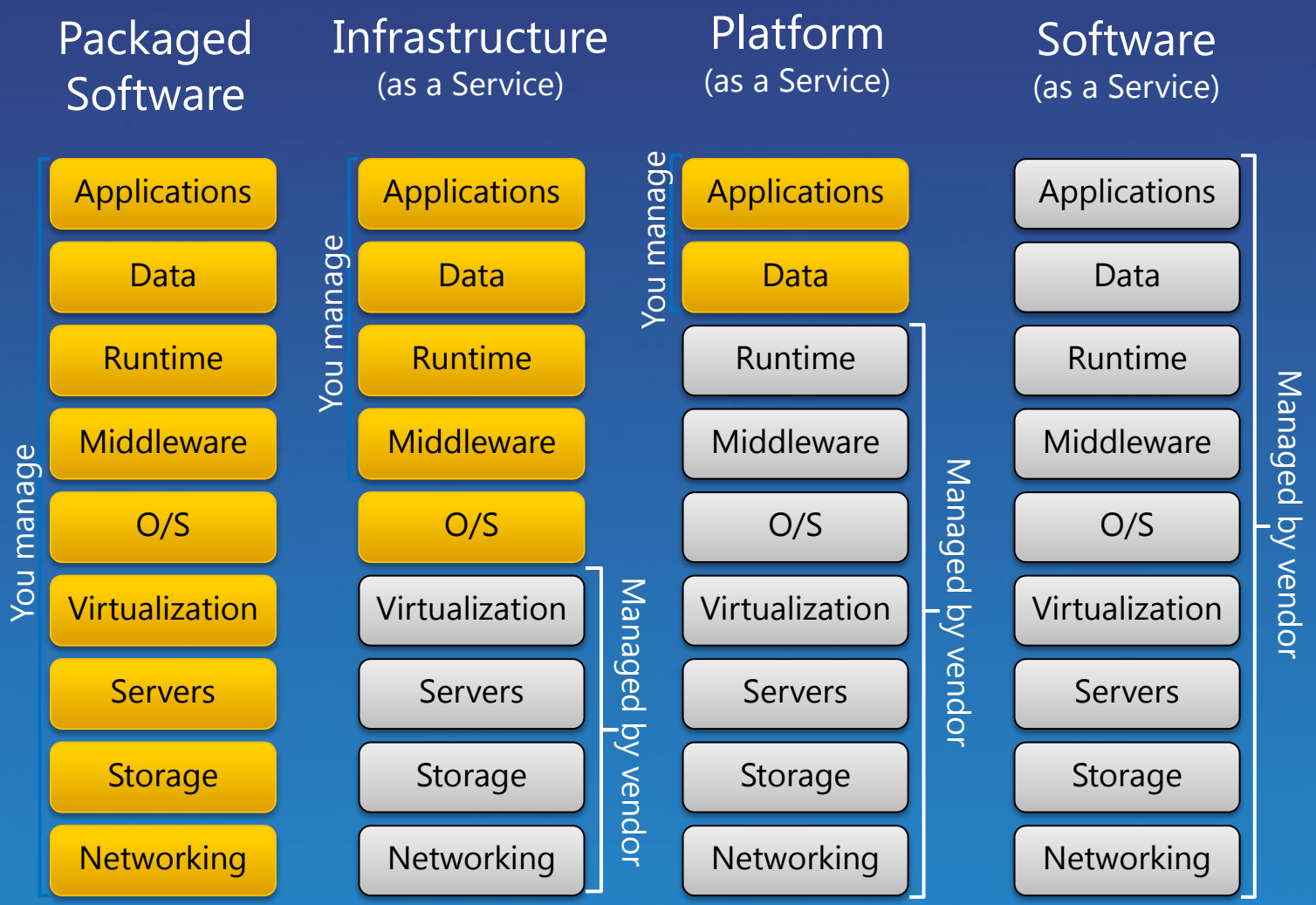
build

"SaaS"

Software-as-a-Service

consume

Cloud Services



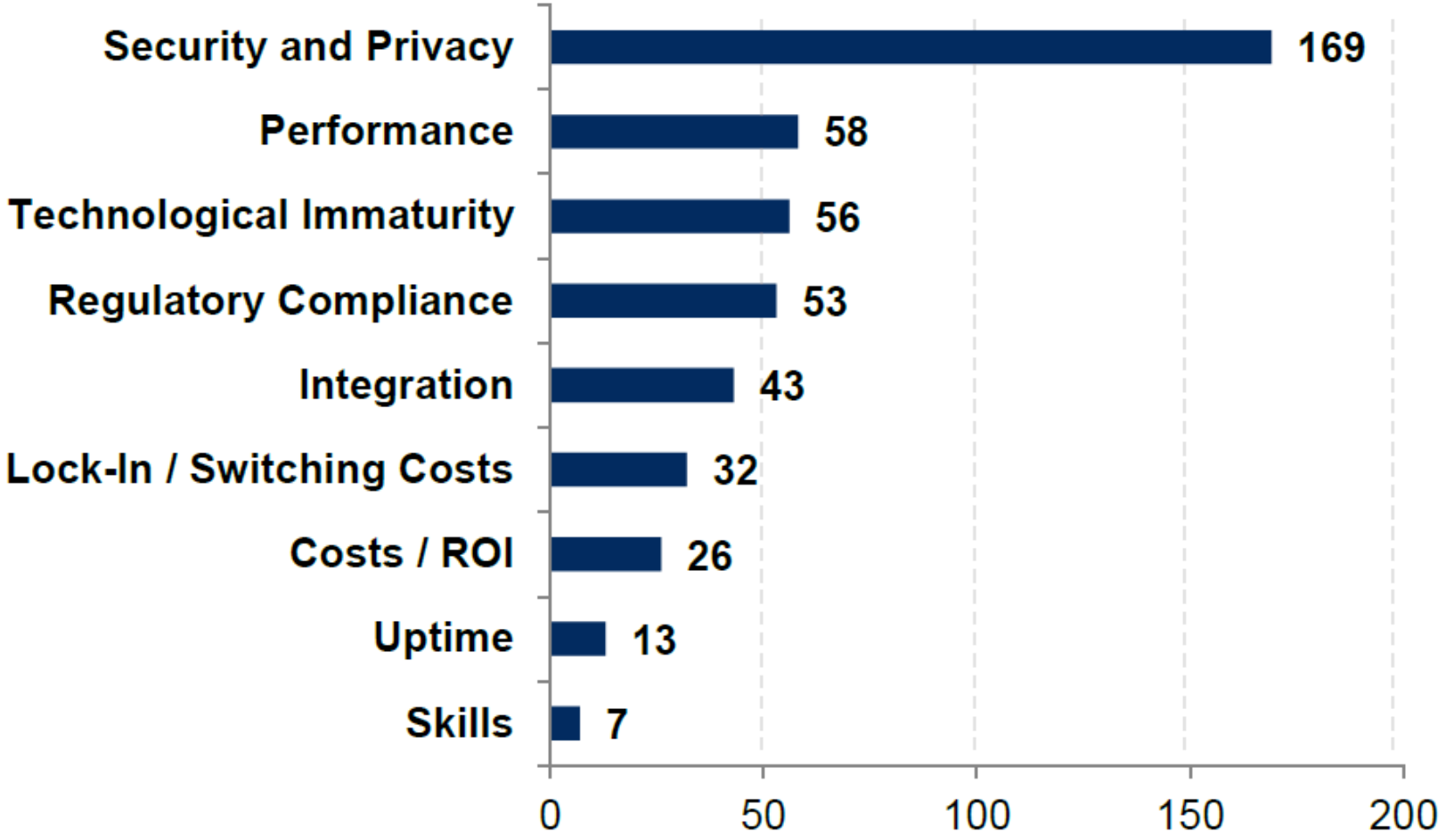
State of Cloud Computing

- Perceptions
  - "The end of software"
  - On-demand infrastructure
  - Cheaper and better
- Reality
  - Hybrid world; not "all-or-nothing"
  - Leverage existing IT skills and investments
  - Seamless user experiences
  - Evolutionary; not revolutionary
- Drivers
  - Ease-of-use, convenience
  - Product effectiveness
  - Simplify IT, reduce costs

> Types
- Public
- Private
- Internal
- External
- Hybrid

> Categories
- SaaS
- PaaS
- IaaS

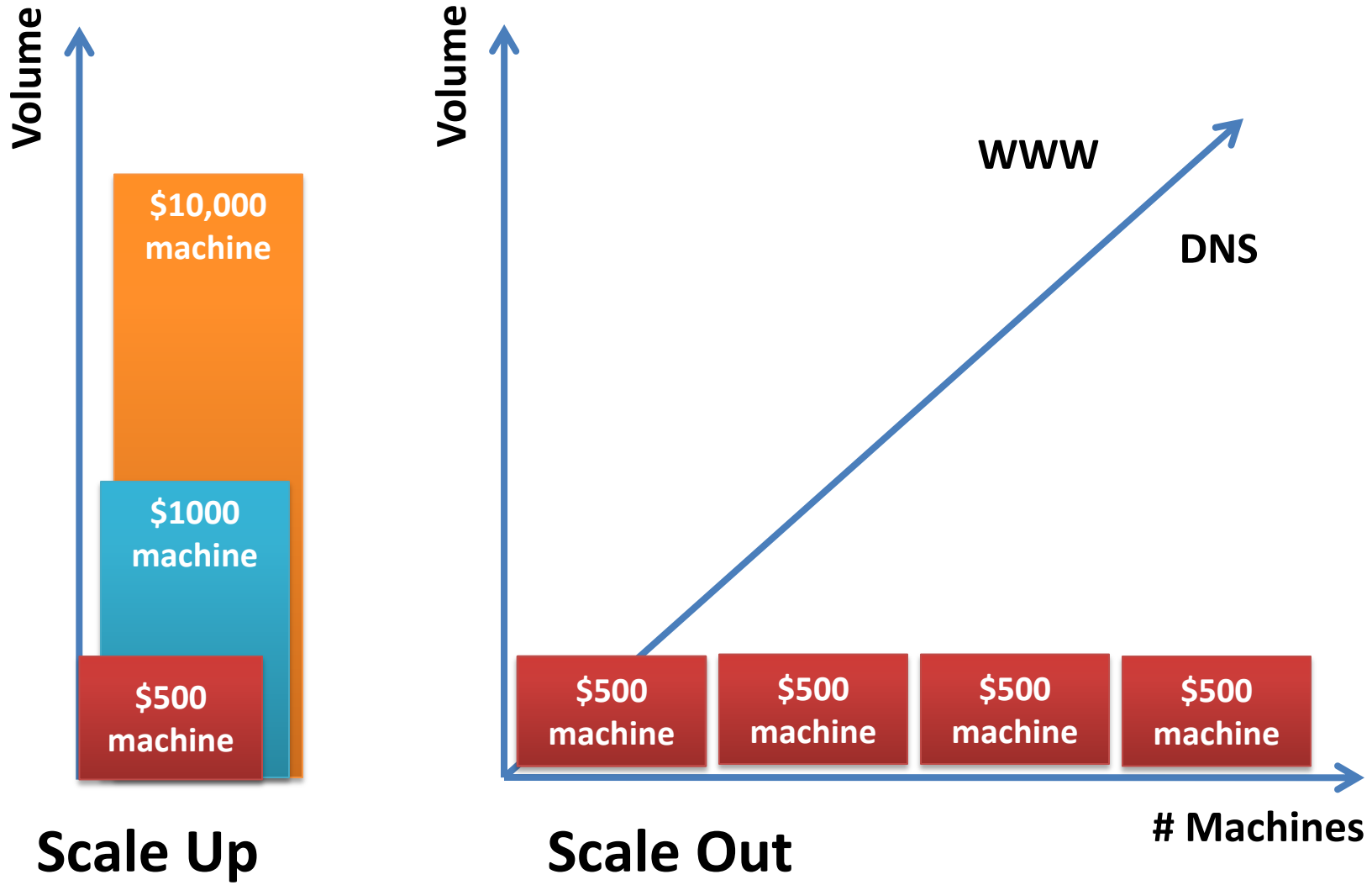
Public cloud concerns



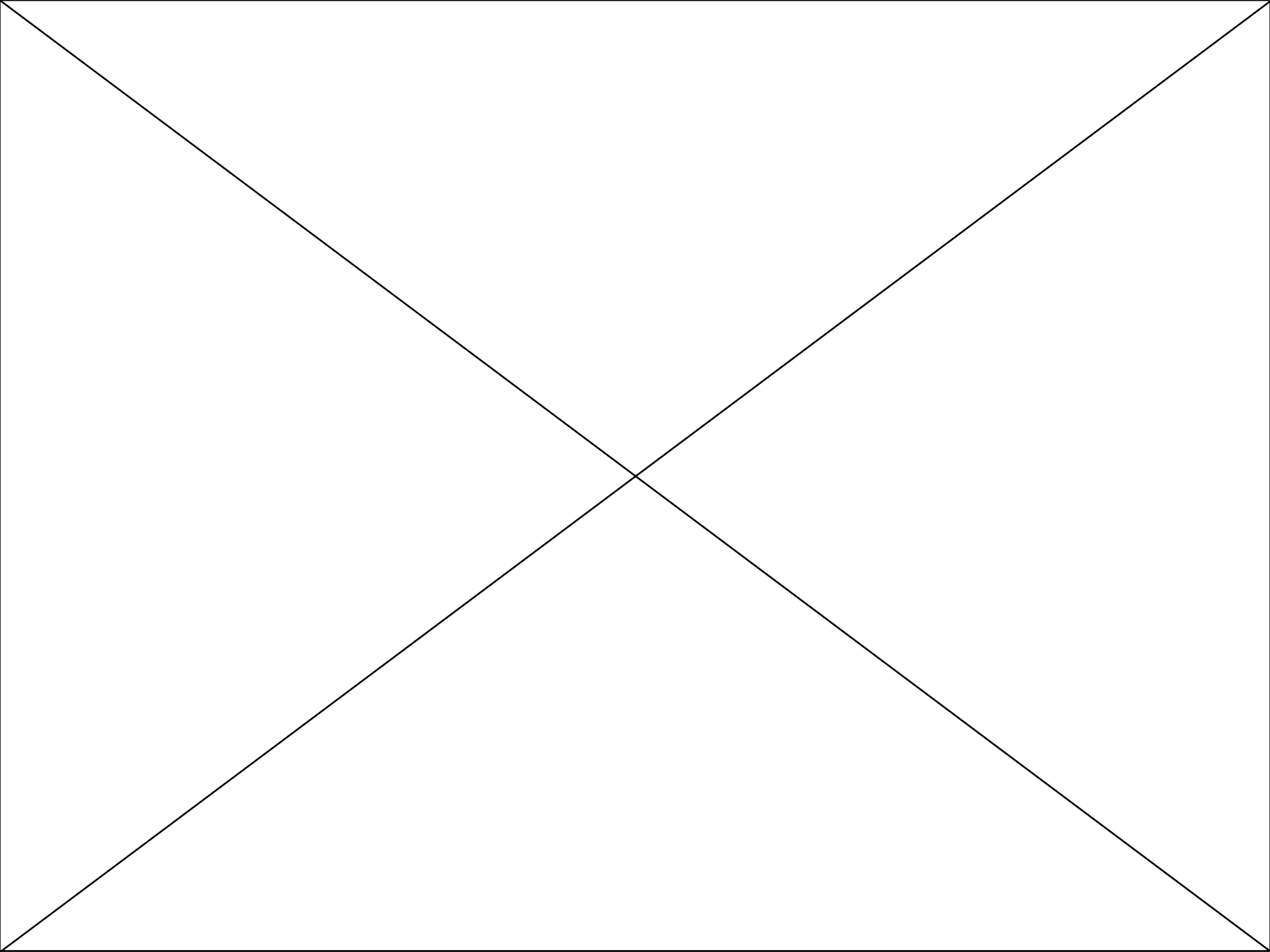
Source: Gartner CIO survey

But, How does it work?

Scale-up And Scale-out



The Cloud is typically a large data-center



Internet-Scale Application Architecture

Design

- Horizontal scaling
- Service-oriented composition
- Eventual consistency
- Fault tolerant (expect failures)

Security

- Claims-based authentication & access control
- Federated identity
- Data encryption & key mgmt.

Management

- Policy-driven automation
- Aware of application lifecycles
- Handle dynamic data schema and configuration changes

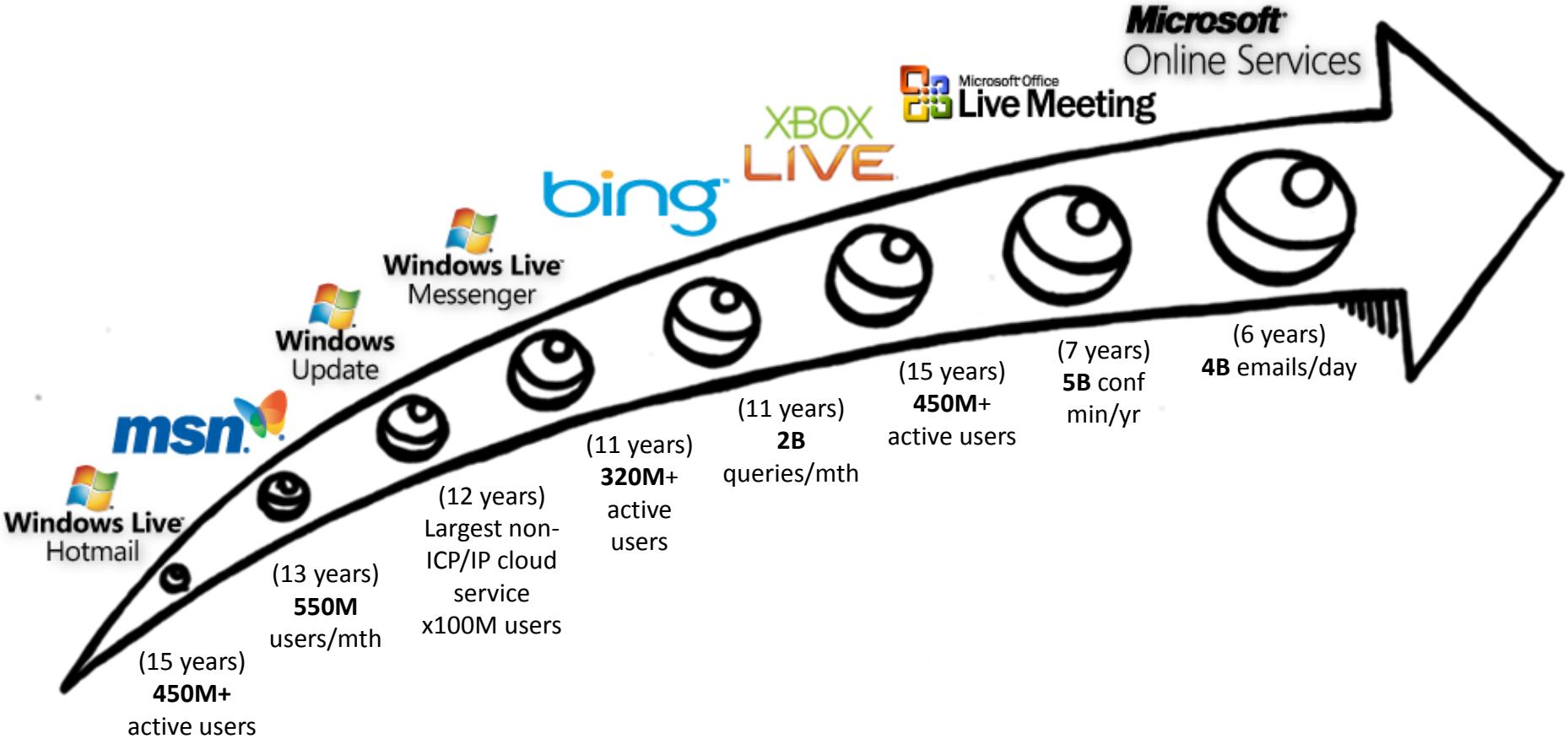
Data & Content

- De-normalization
- Logical partitioning
- Distributed in-memory cache
- Diverse data storage options (persistent & transient, relational & unstructured, text & binary, read & write, etc.)

Processes

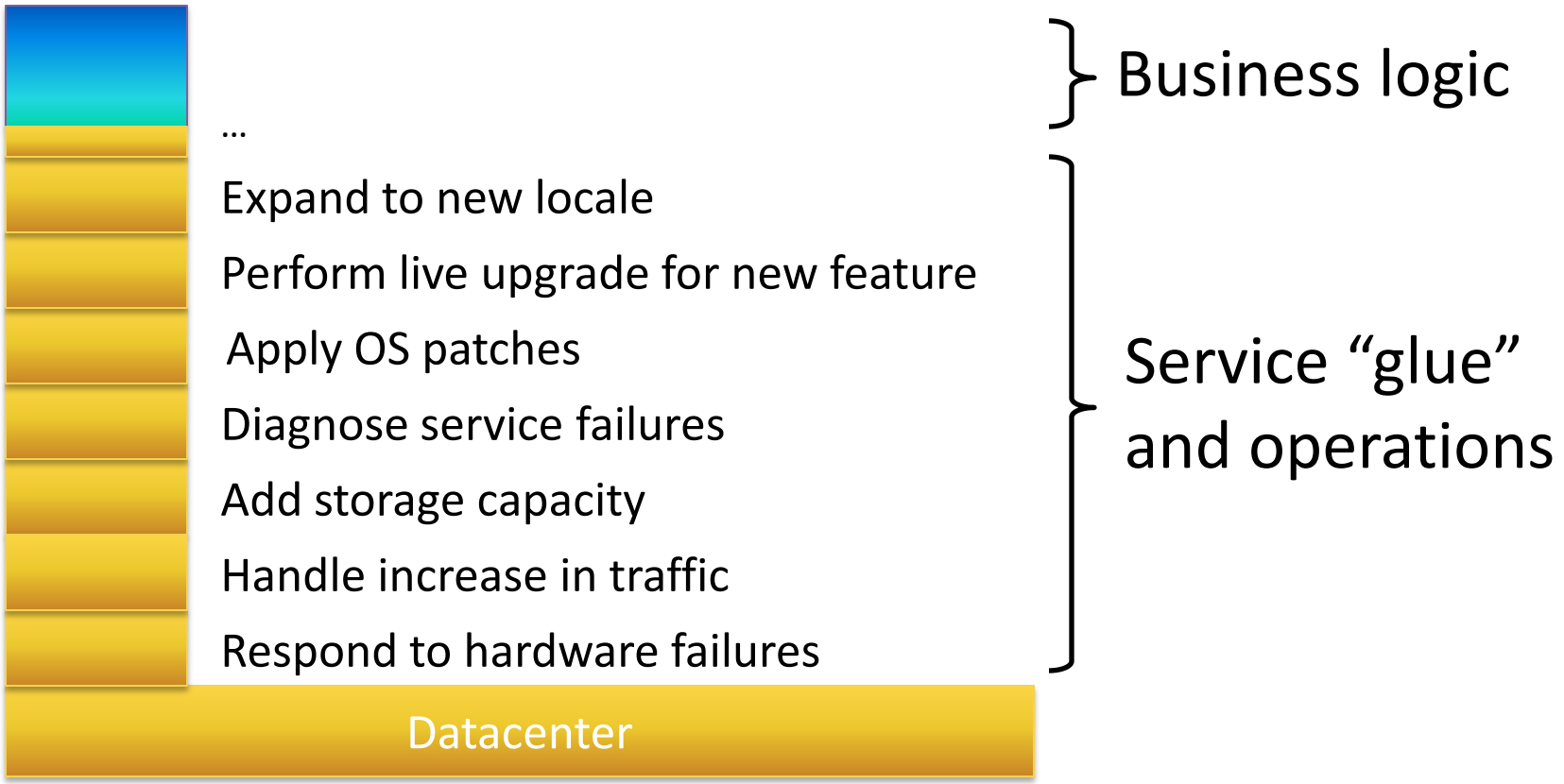
- Loosely coupled components
- Parallel & distributed processing
- Asynchronous distributed communication
- Idempotent (handle duplicity)
- Isolation (separation of concerns)

Microsoft in the Cloud



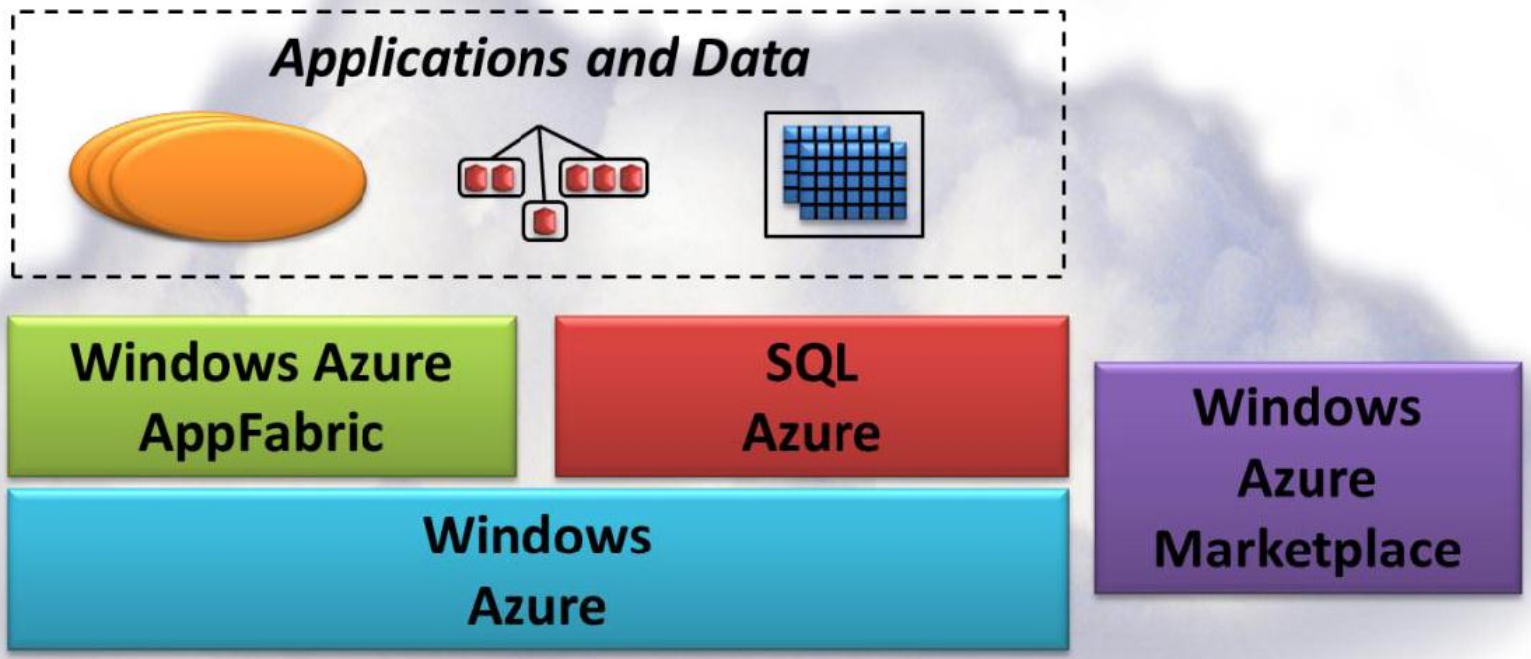
Software + Services

The Reality of Life In The Cloud

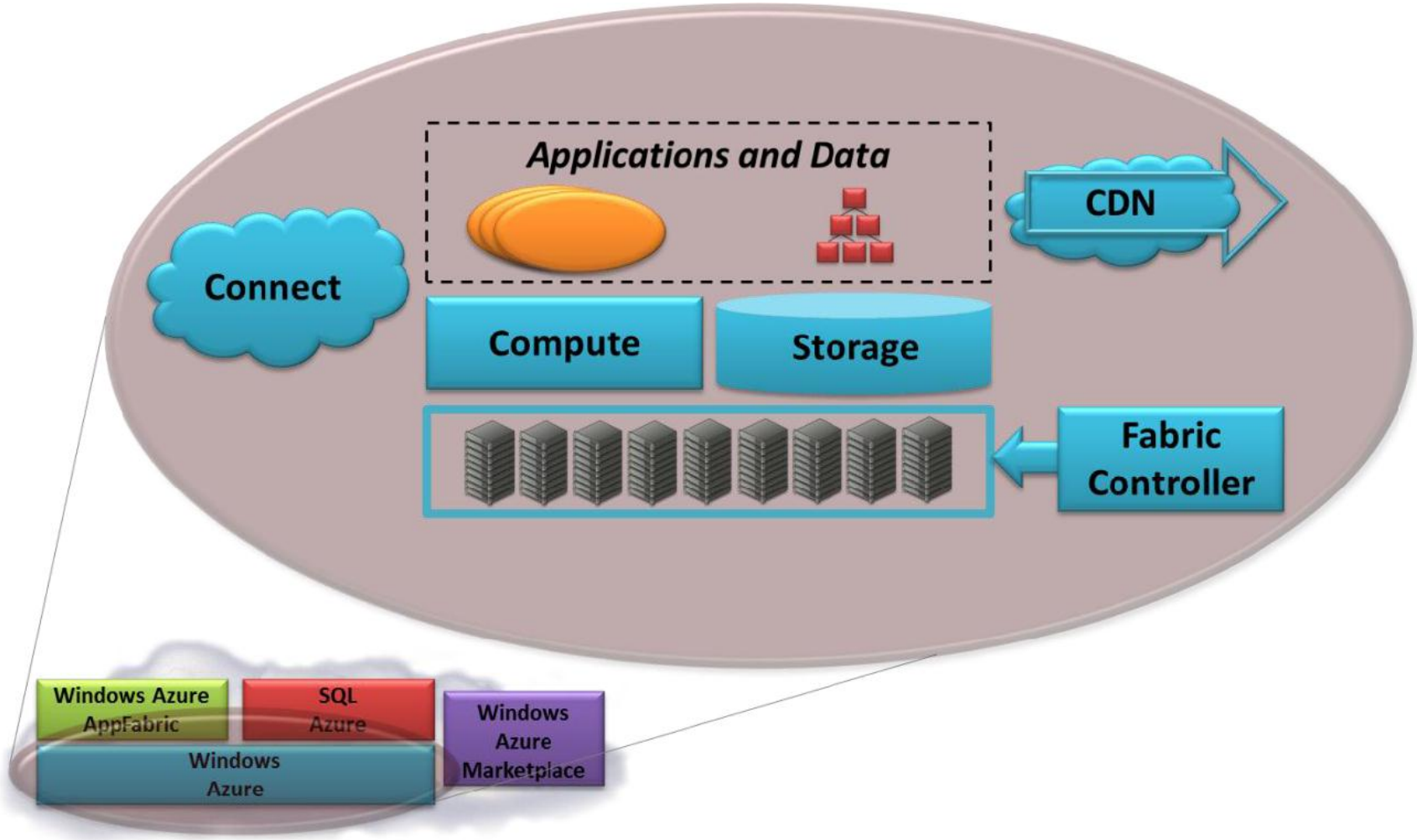


Windows Azure
An operating System for the Cloud

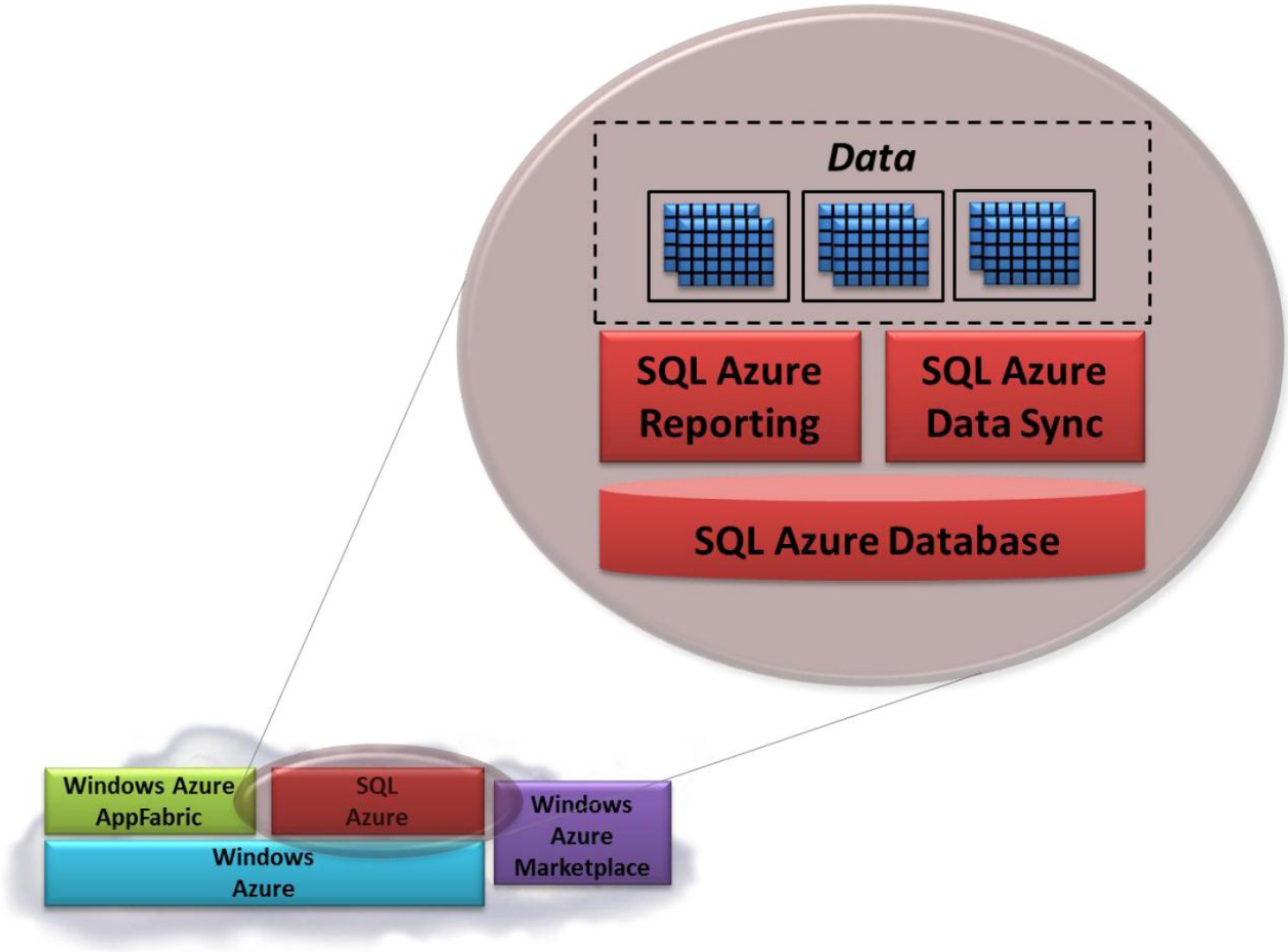
Windows Azure Platform



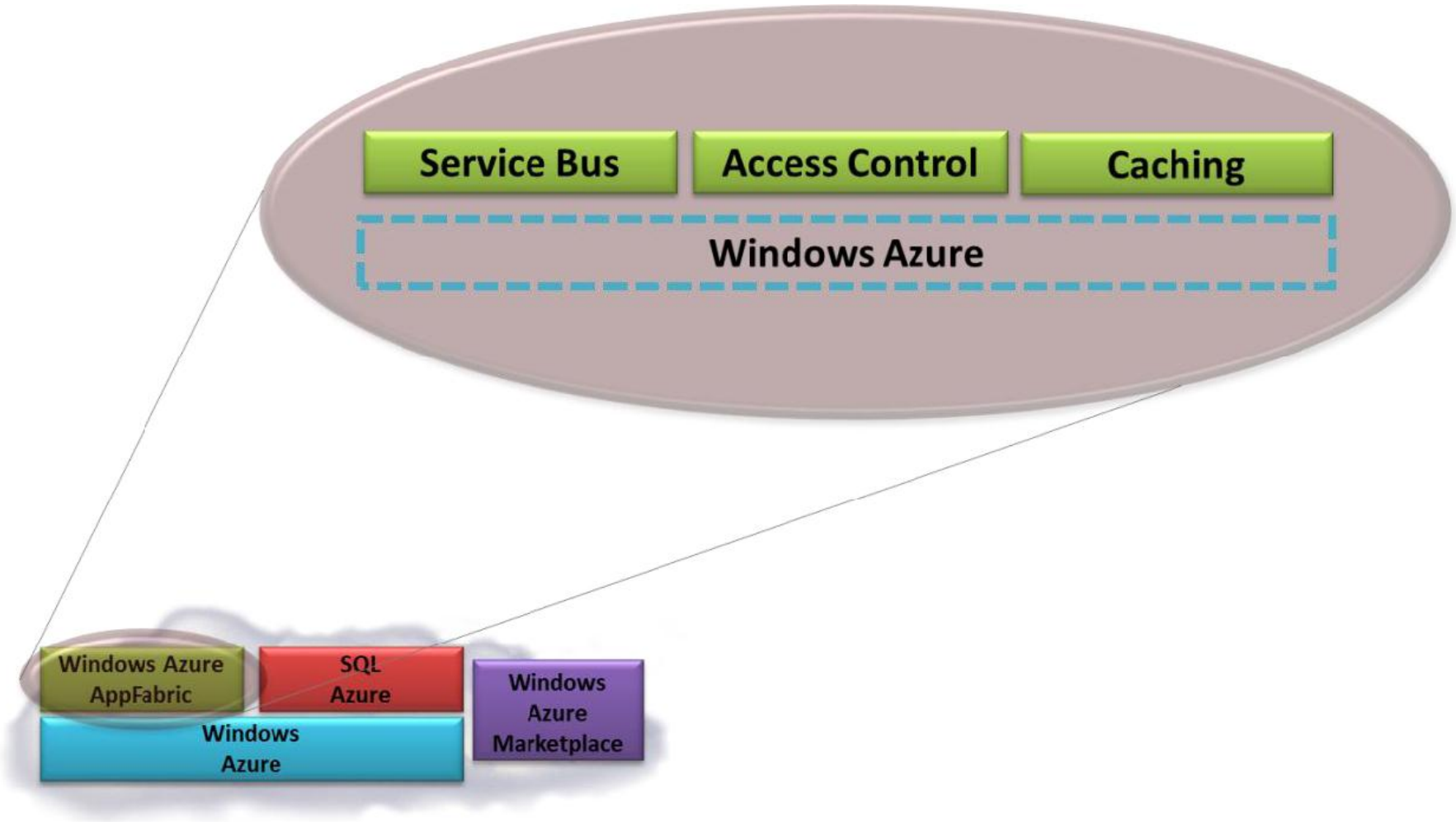
Windows Azure



SQL Azure


Data
SQL Azure Reporting
SQL Azure Data Sync
SQL Azure Database
Windows Azure AppFabric
SQL Azure
Windows Azure
Windows Azure Marketplace

Azure AppFabric



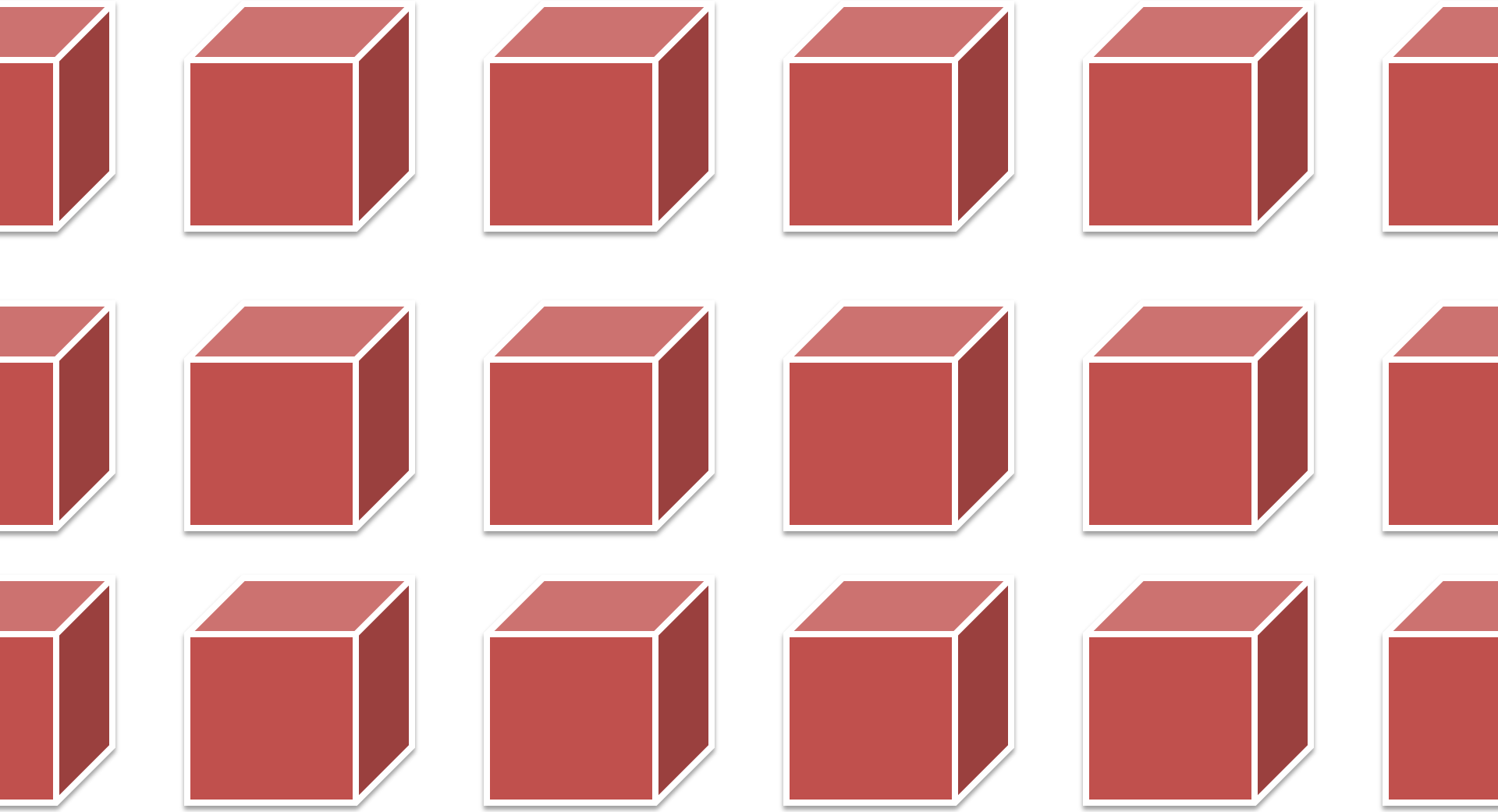
What is Windows Azure?

Windows Azure is
a place to run your applications.

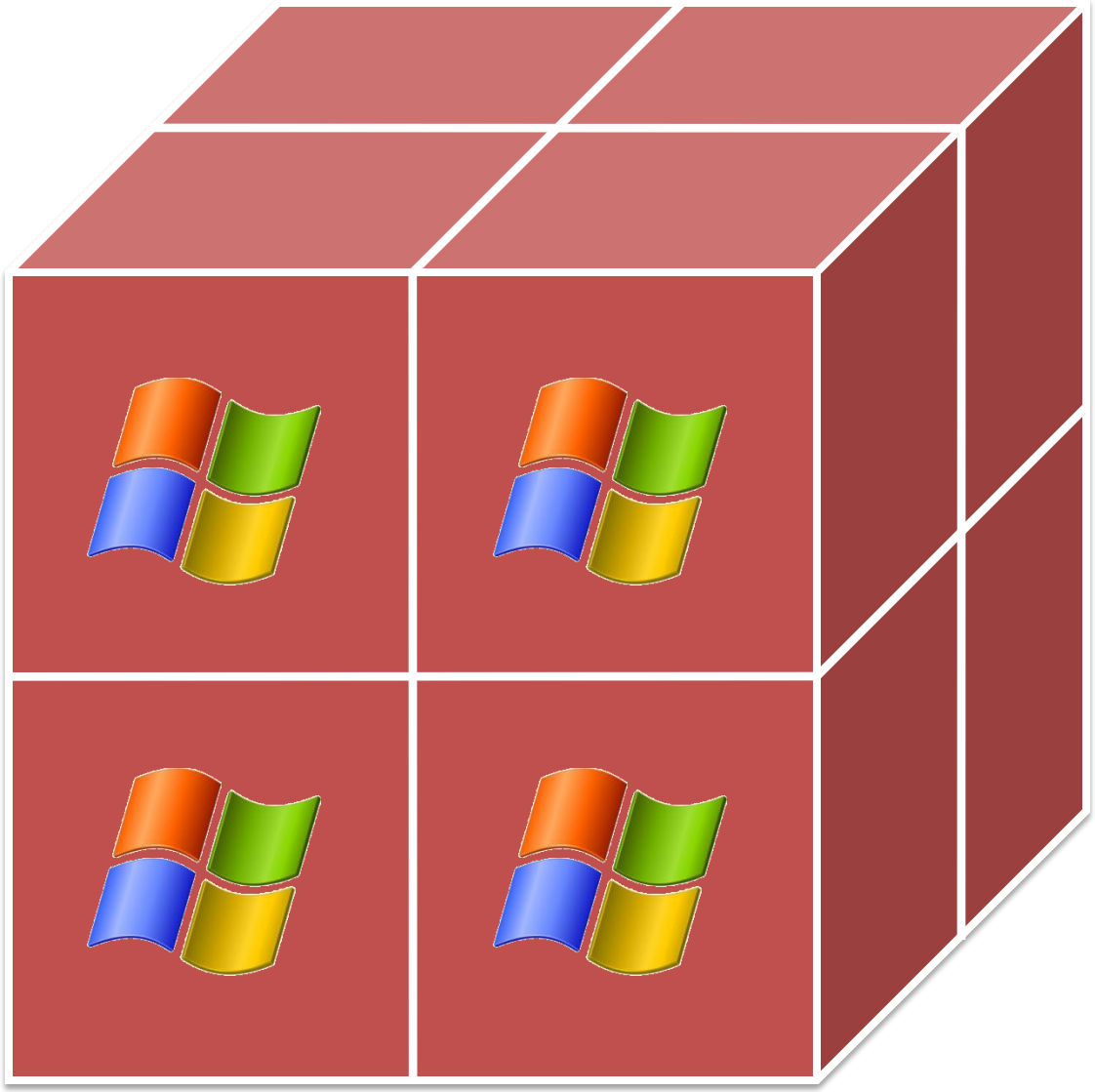
Windows Azure is
a **cloud** computing platform,
so it’s designed to scale.

Windows Azure is
a **utility** computing platform,
so you pay for what you use.

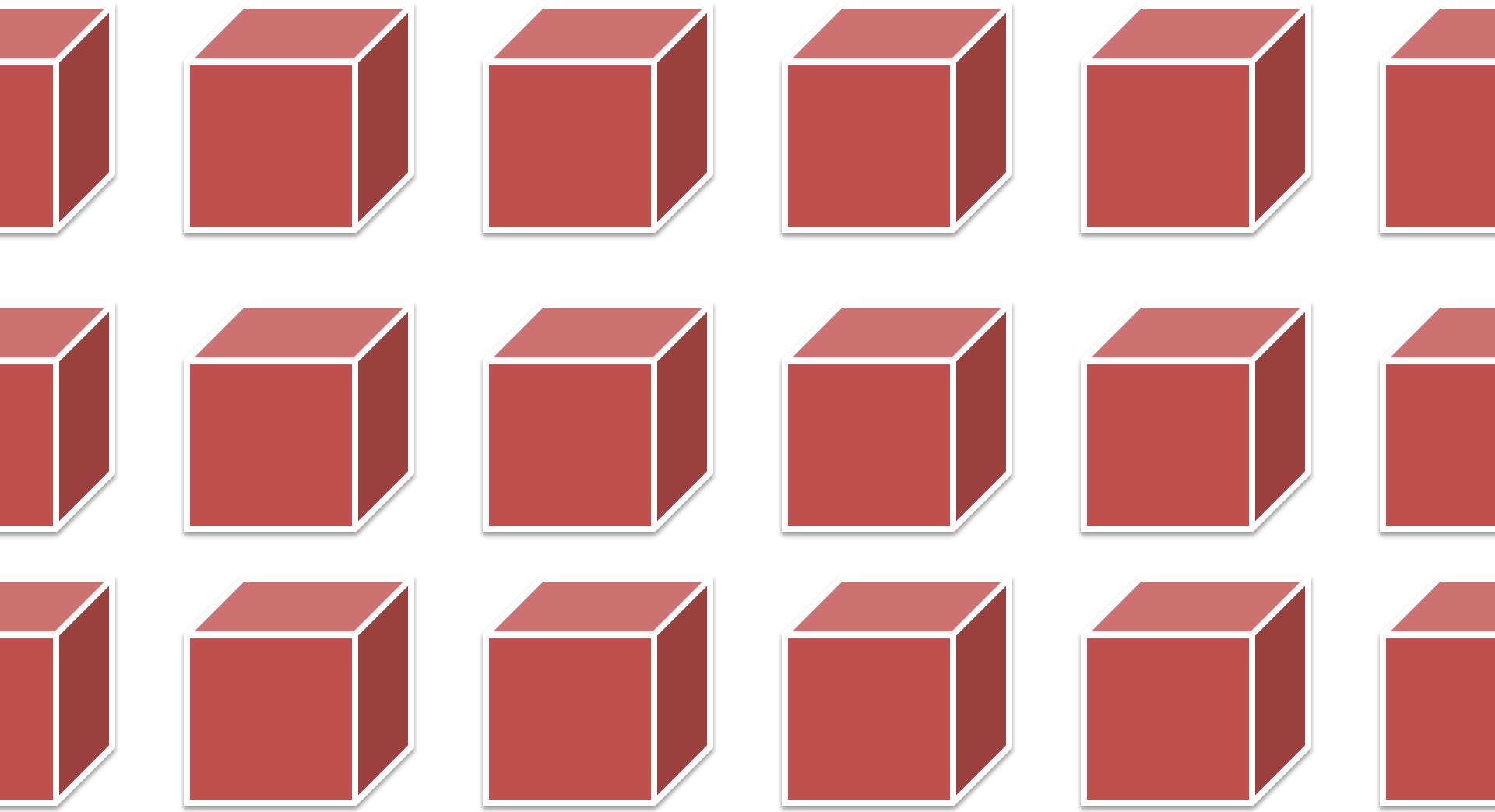
Inside are many servers.



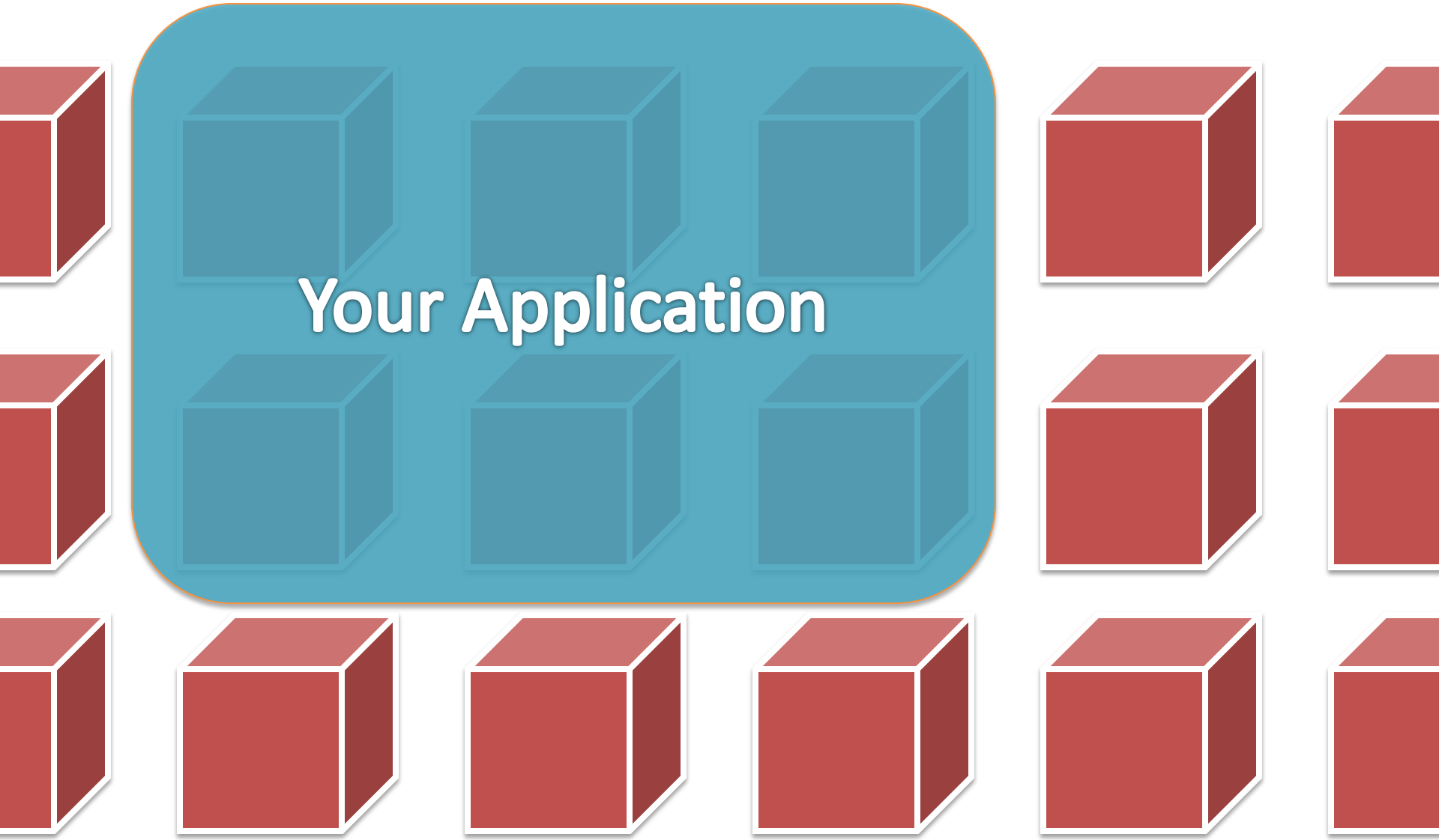
with VMs running Windows.



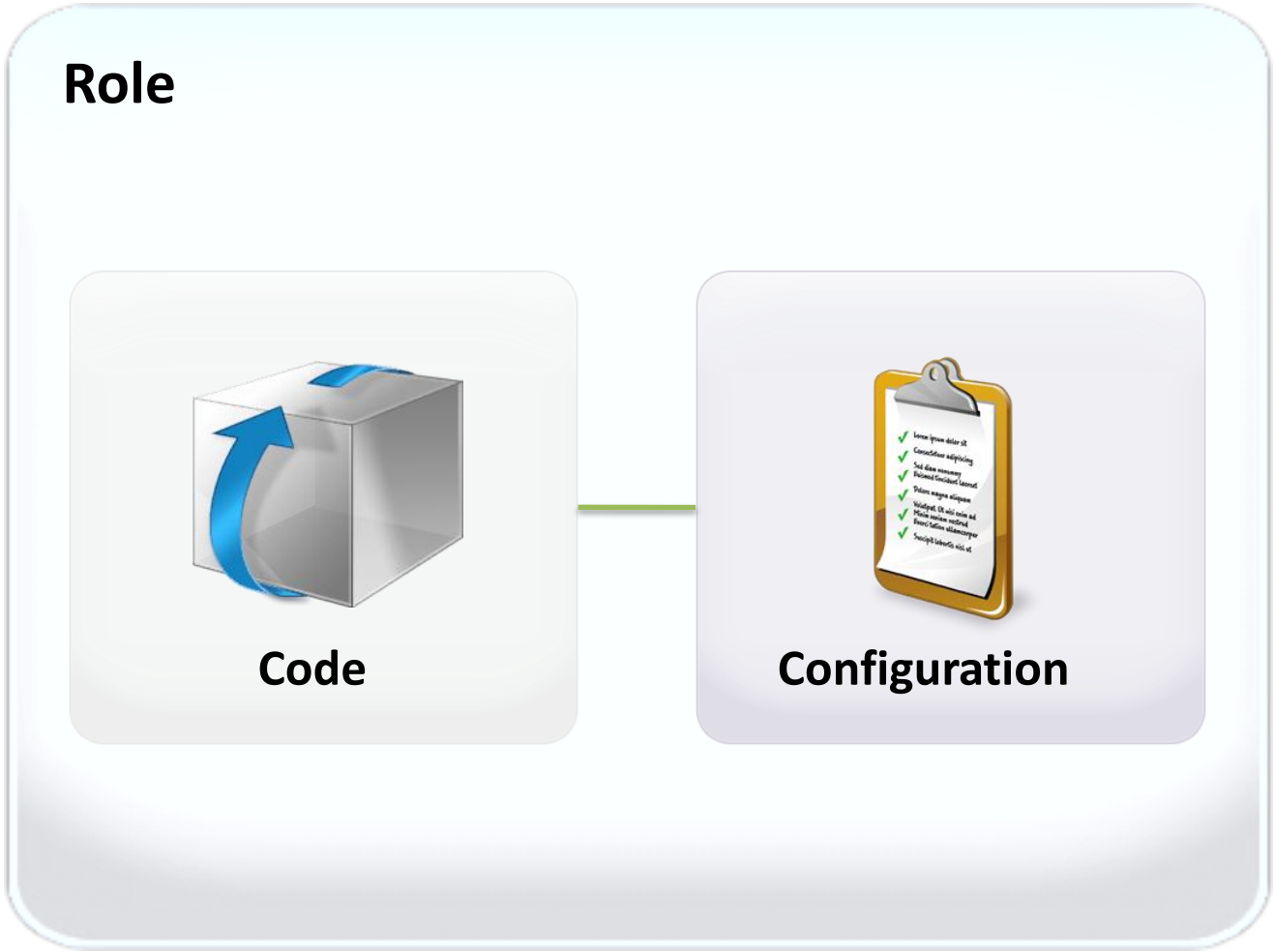
We call this the Fabric,



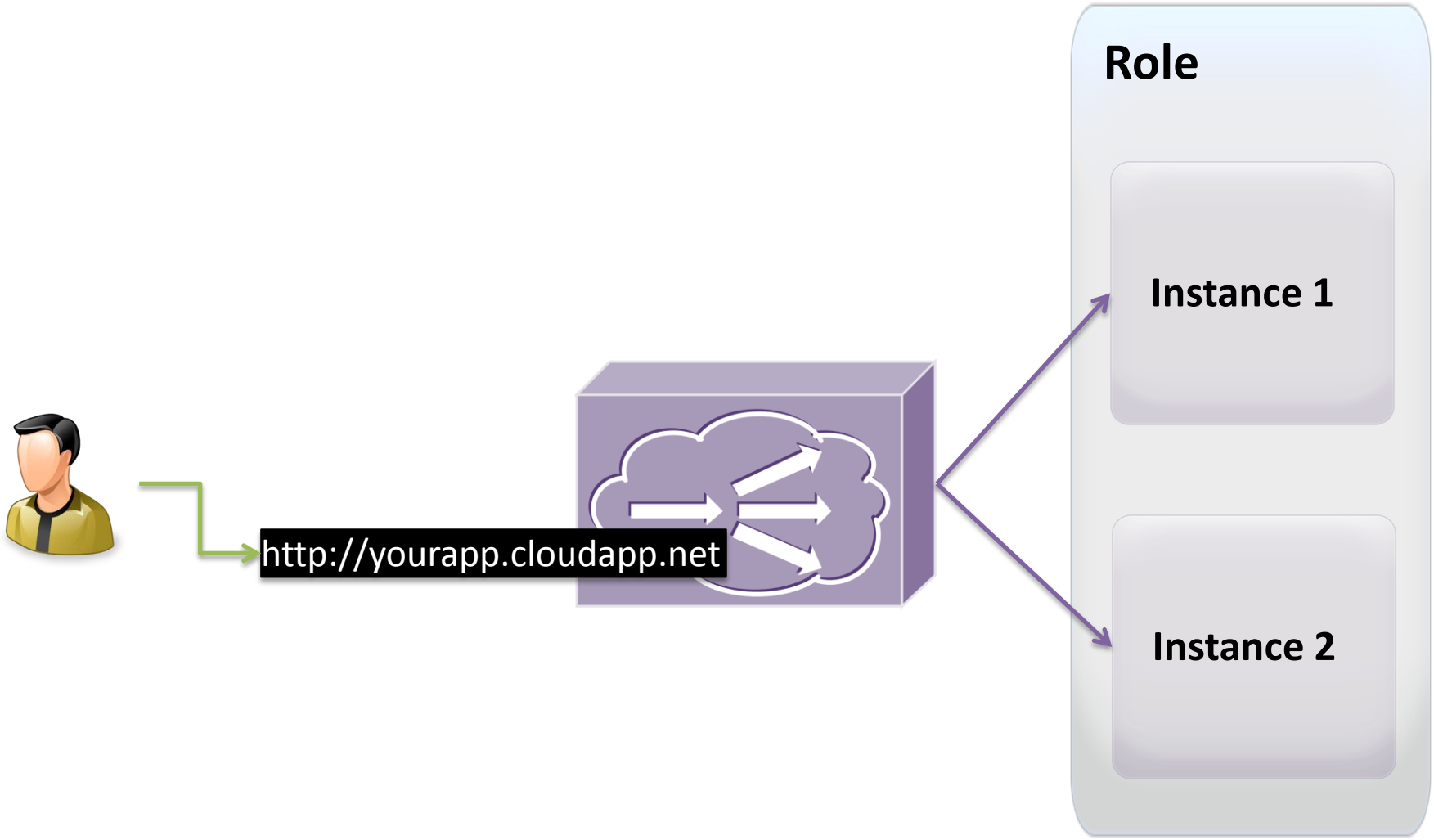
and it’s where your app runs.



Roles



Load Balanced Instances



Web vs Worker Role

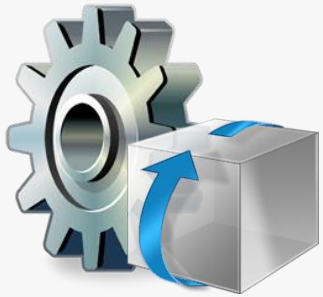
Web Role

IIS Host

Your Code

Worker Role

System Host



Your Code

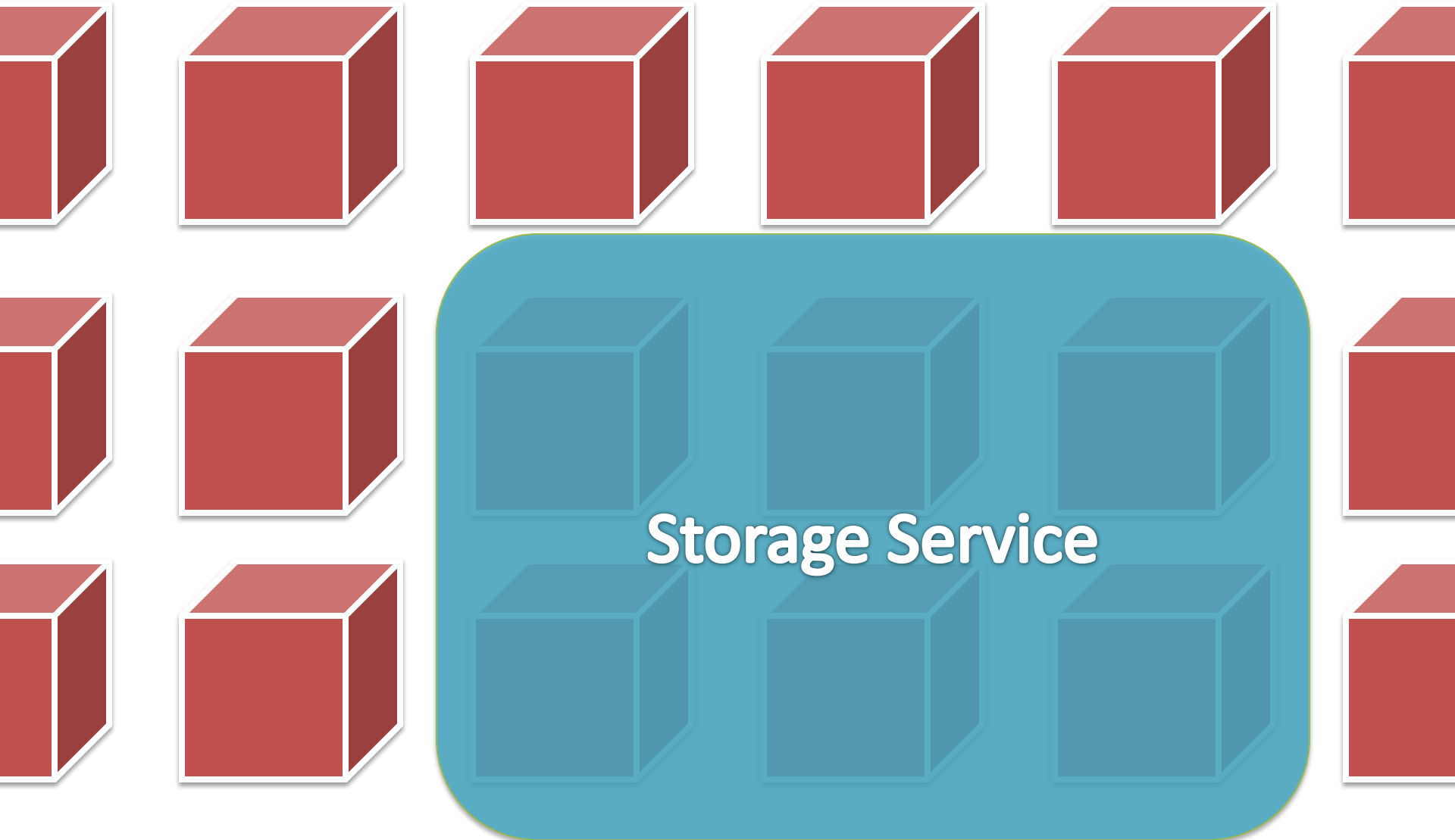
Windows Azure does **scale out**.

Stateless compute

+ Durable storage

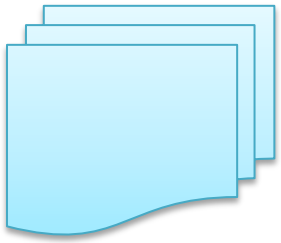
= Scalable application

Storage is just another app.



Durable Storage

Blobs

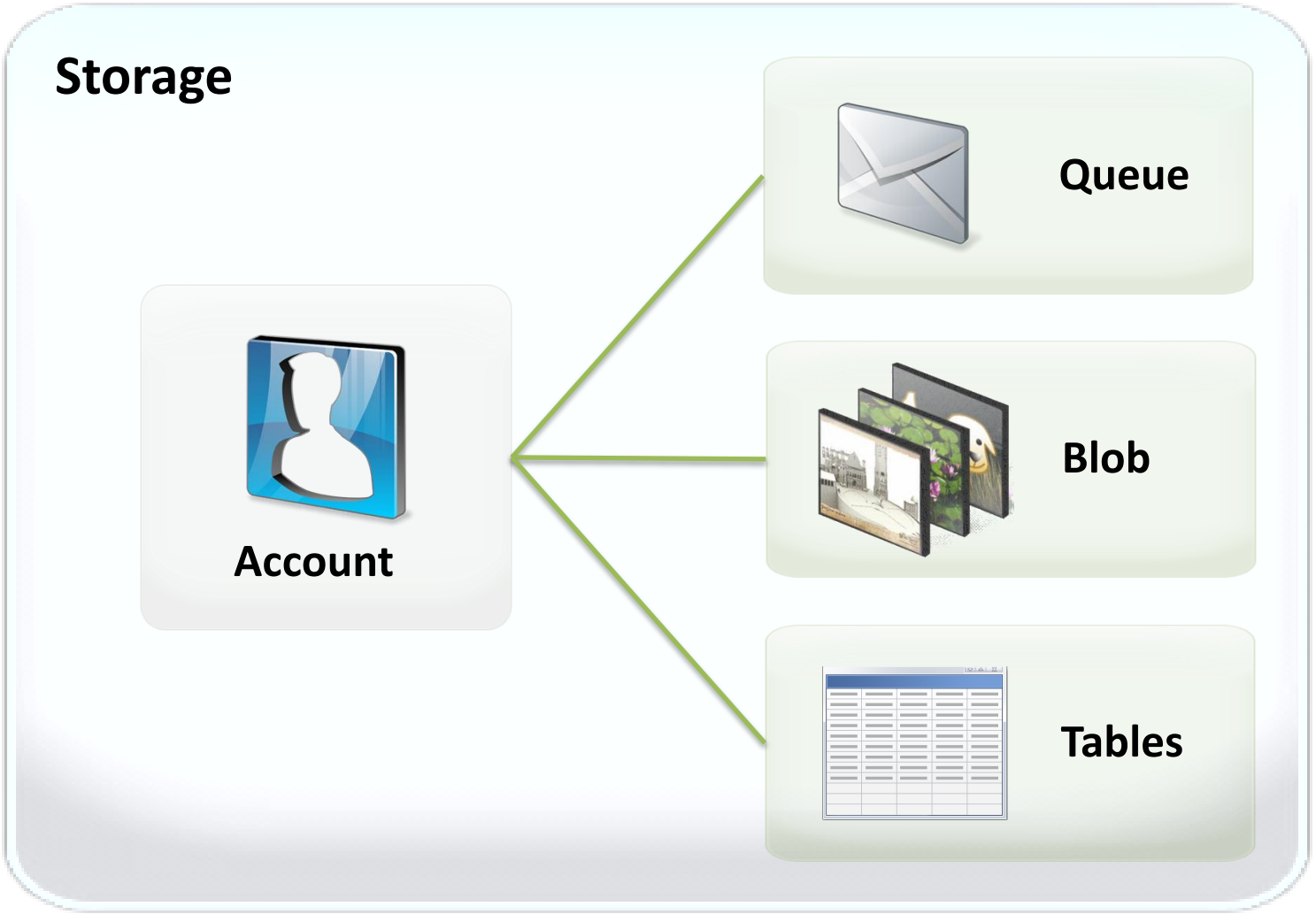


Tables

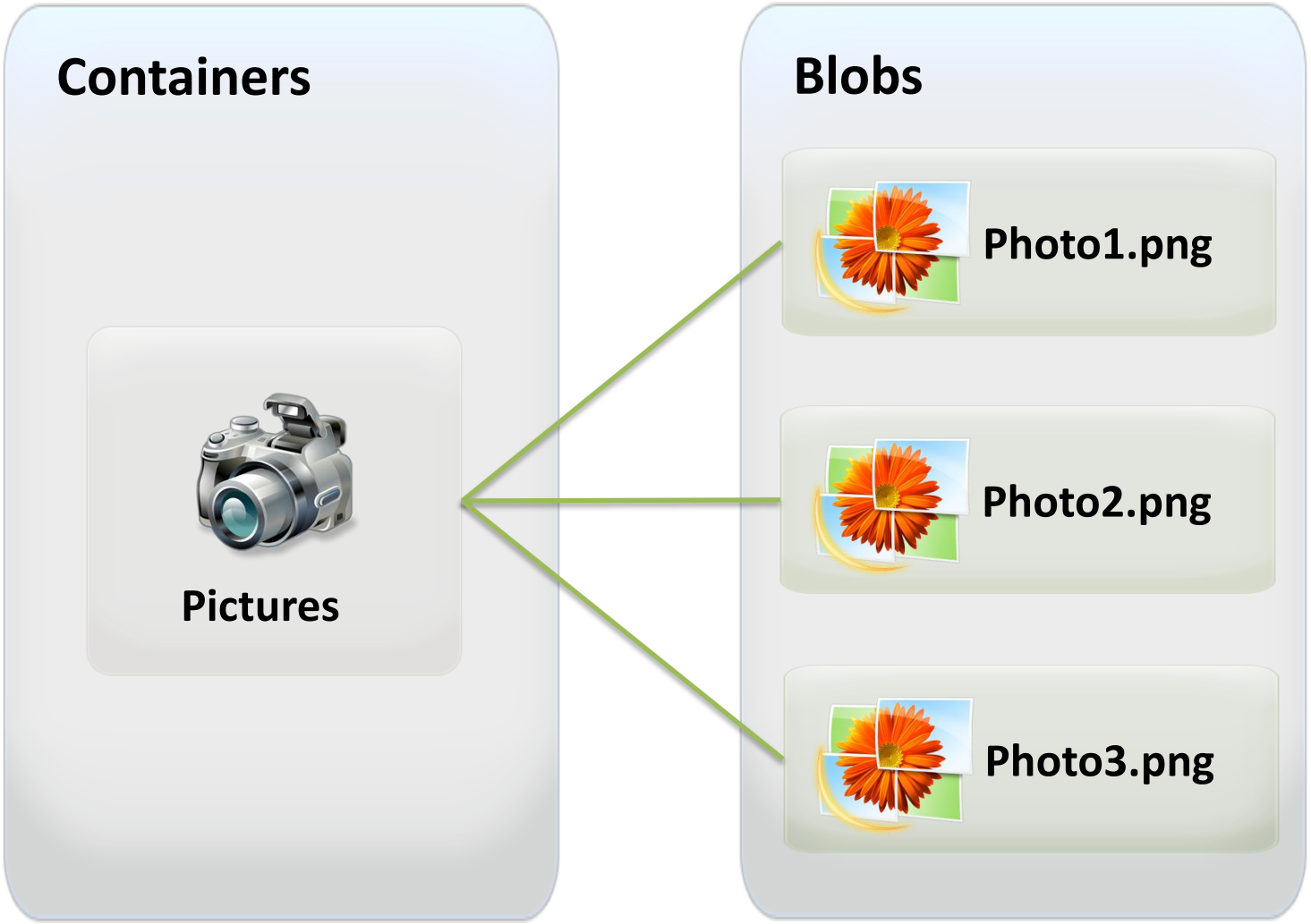
Queues

- Three replicas of everything
- REST API

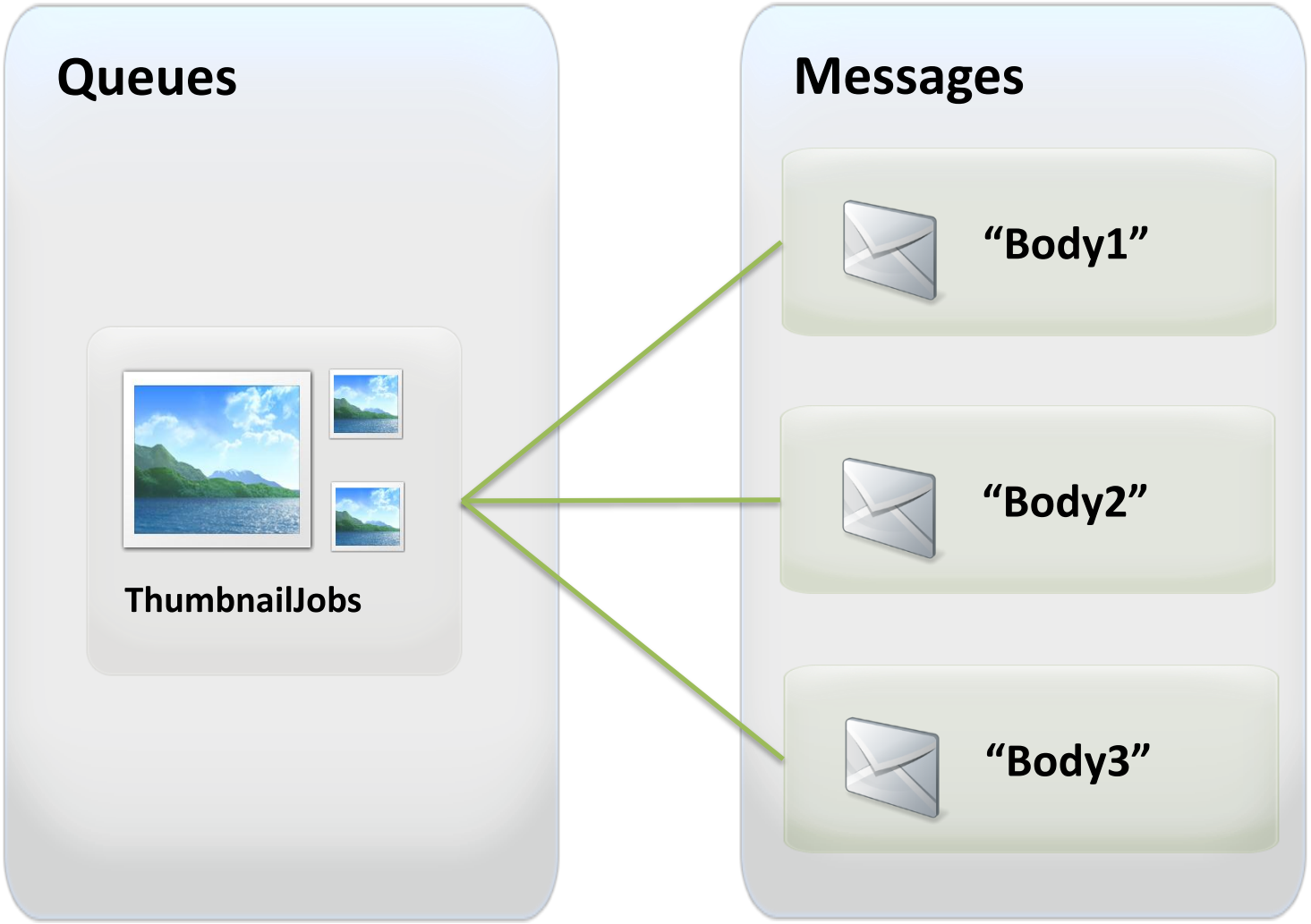
Storage



Blobs


Containers
Pictures
Blobs
Photo1.png
Photo2.png
Photo3.png

Queues



Storage
Scalable & Available

- Simple, essential storage abstractions:
  - Large items of data: Blobs, file streams, …
  - Service state: Simple tables, caches, …
  - Service communication: Queues, locks, …
- With an emphasis on:
  - Massive scale, availability and durability
  - Geo-location and geo-replication
- This is not a relational database in the cloud

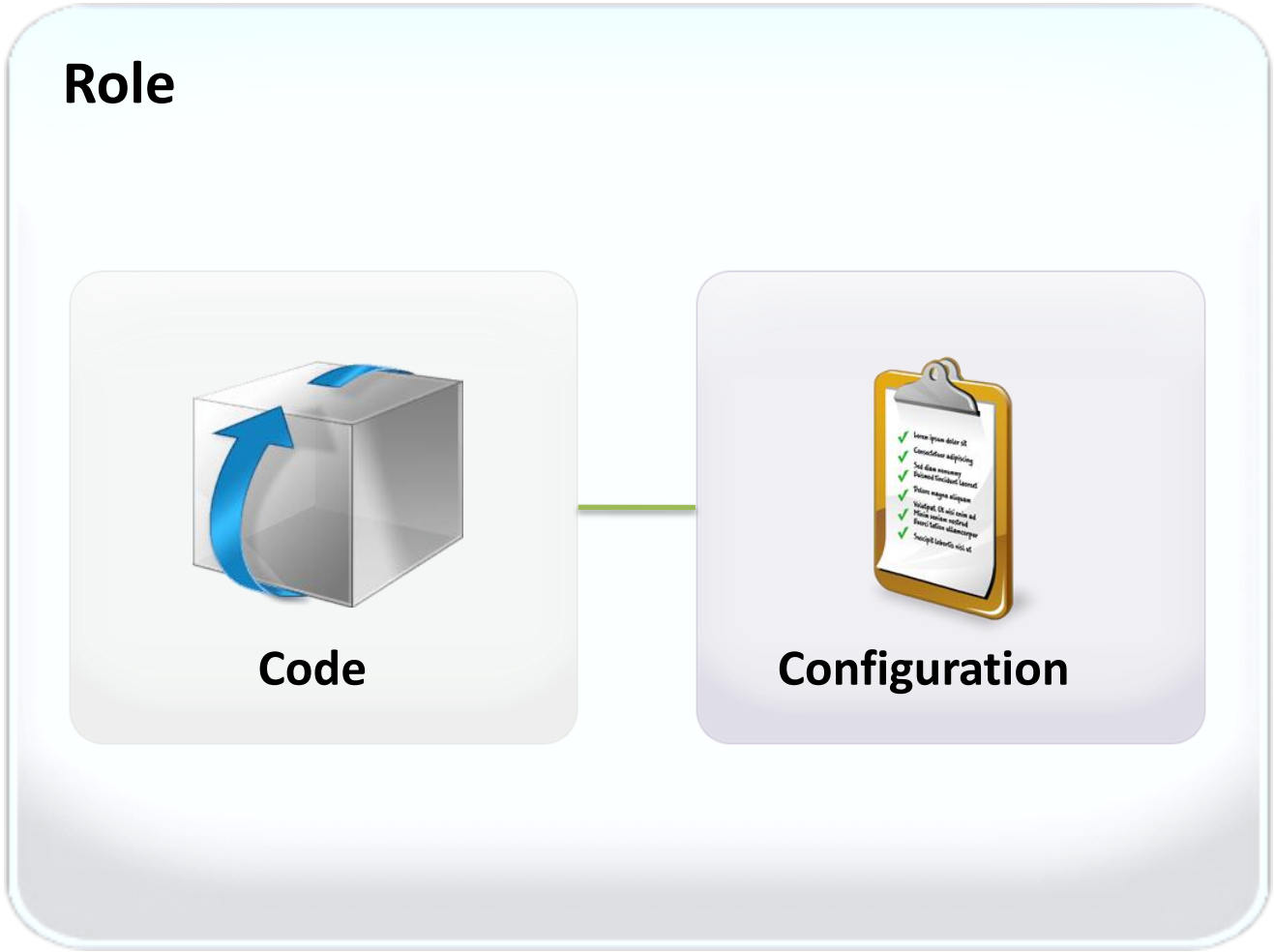
Management tasks are automated by the

Fabric Controller.

You tell the Fabric Controller **what** to do,
and it figures out **how** to do it.

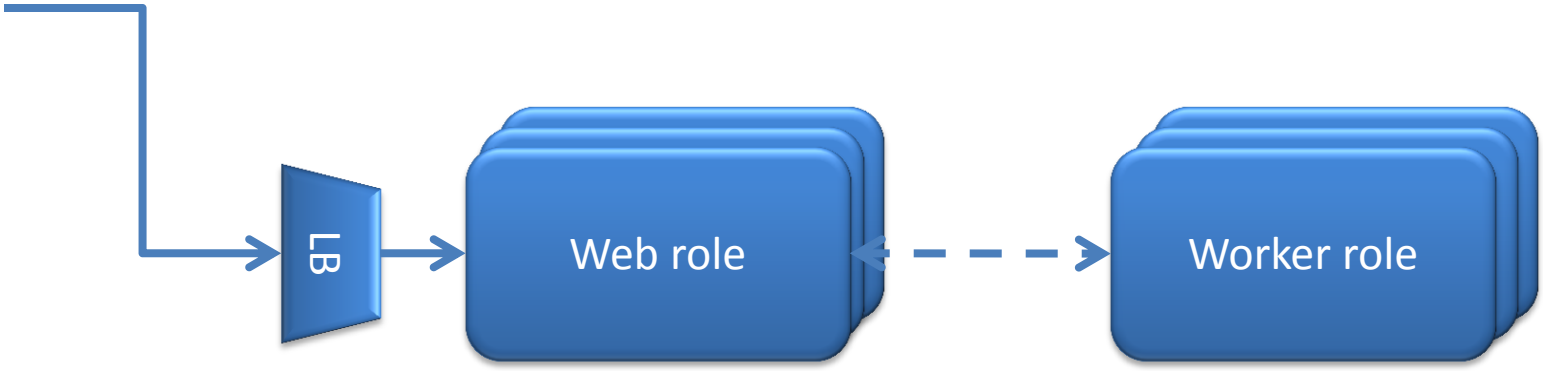
For this to work, you need to tell us about your application.

Configuration

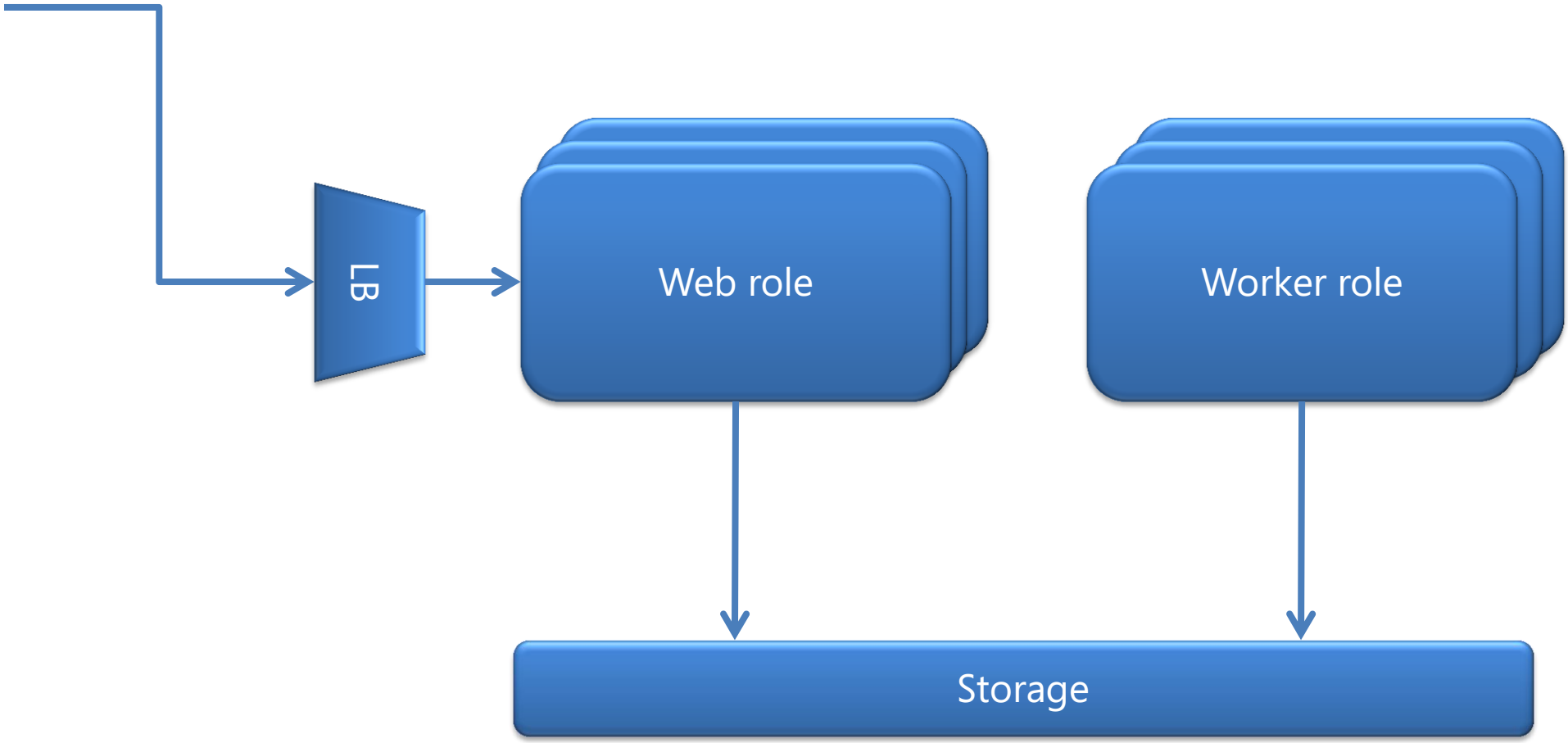


Defining Your Service

- What are the components (**roles**)?
- How do they interact?
- At what scale?



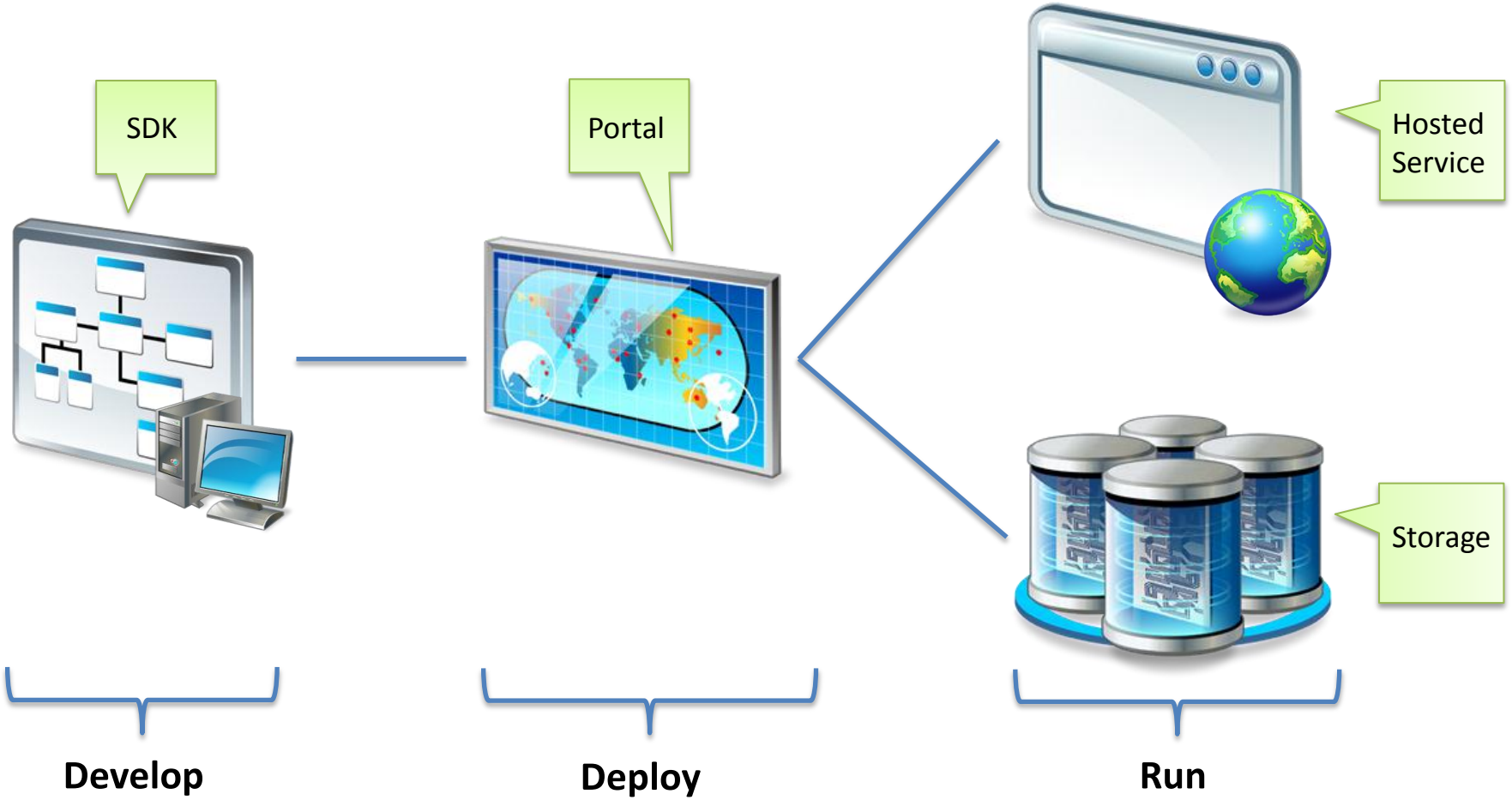
Putting It All Together



Developer Experience is Key

- Development
  - Offline cloud simulation
  - Visual Studio integration
- Maintenance
  - Local debugging
  - APIs for logging
- Management
  - APIs for configuration management
  - Web portal

Windows Azure for Application Developers



Development Fabric and Storage

Local Machine

Windows Azure Simulation Environment

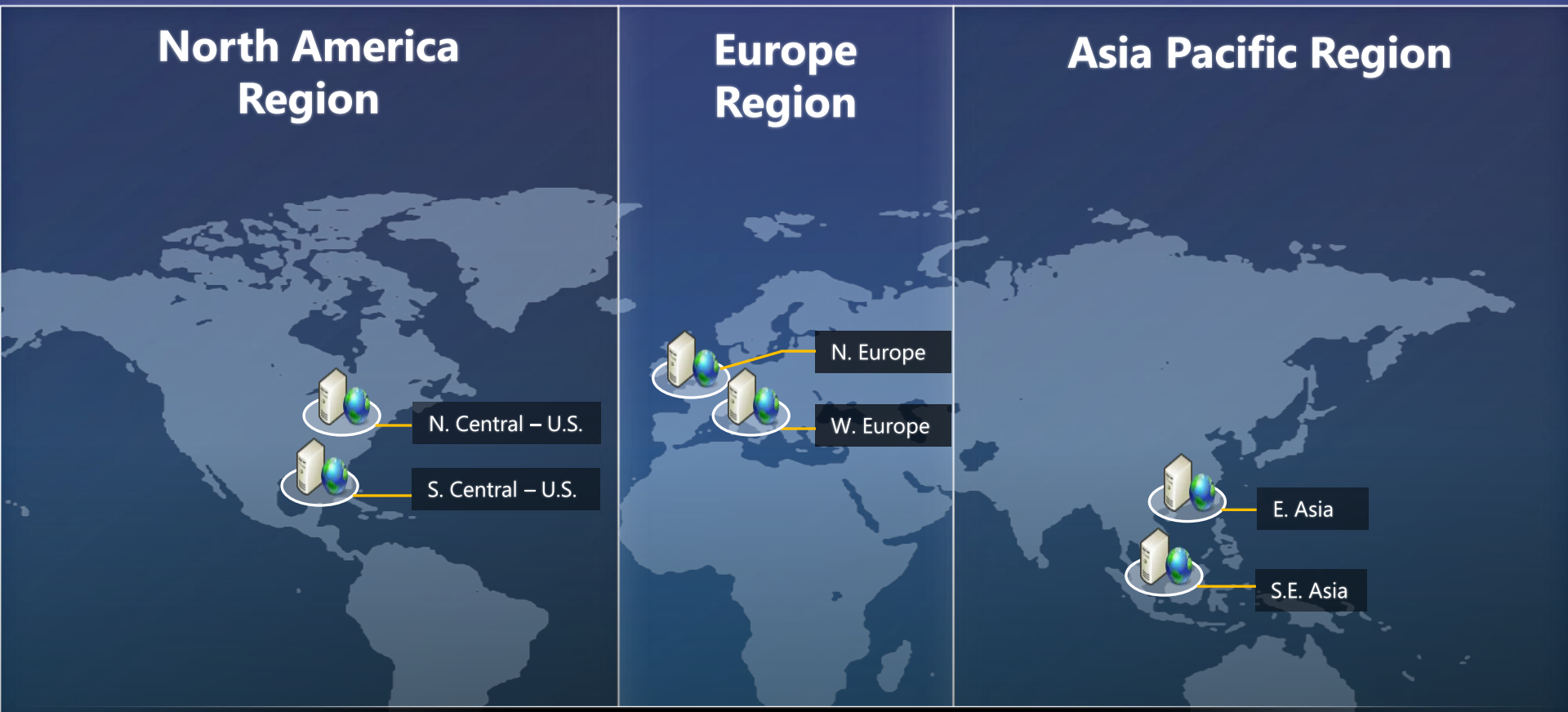
Development Fabric

Development Storage

Geo-location

- Windows Azure is in multiple “locales”
- You can:
  - Choose a locale for any of your applications
  - Create an “affinity group” to co-locate a set of applications from your cloud project
- Available through the developer portal

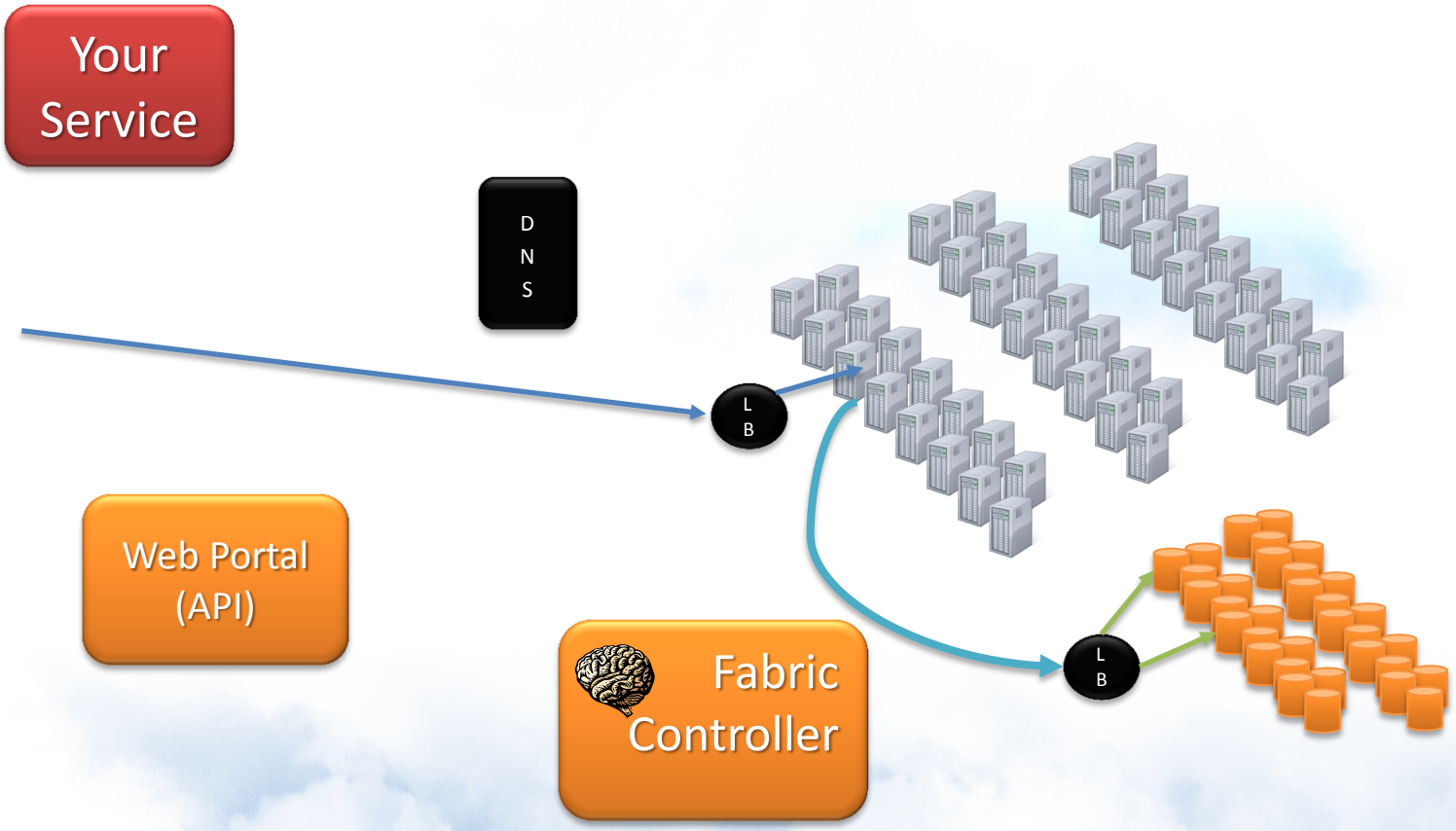
Windows Azure Platform Data Centers



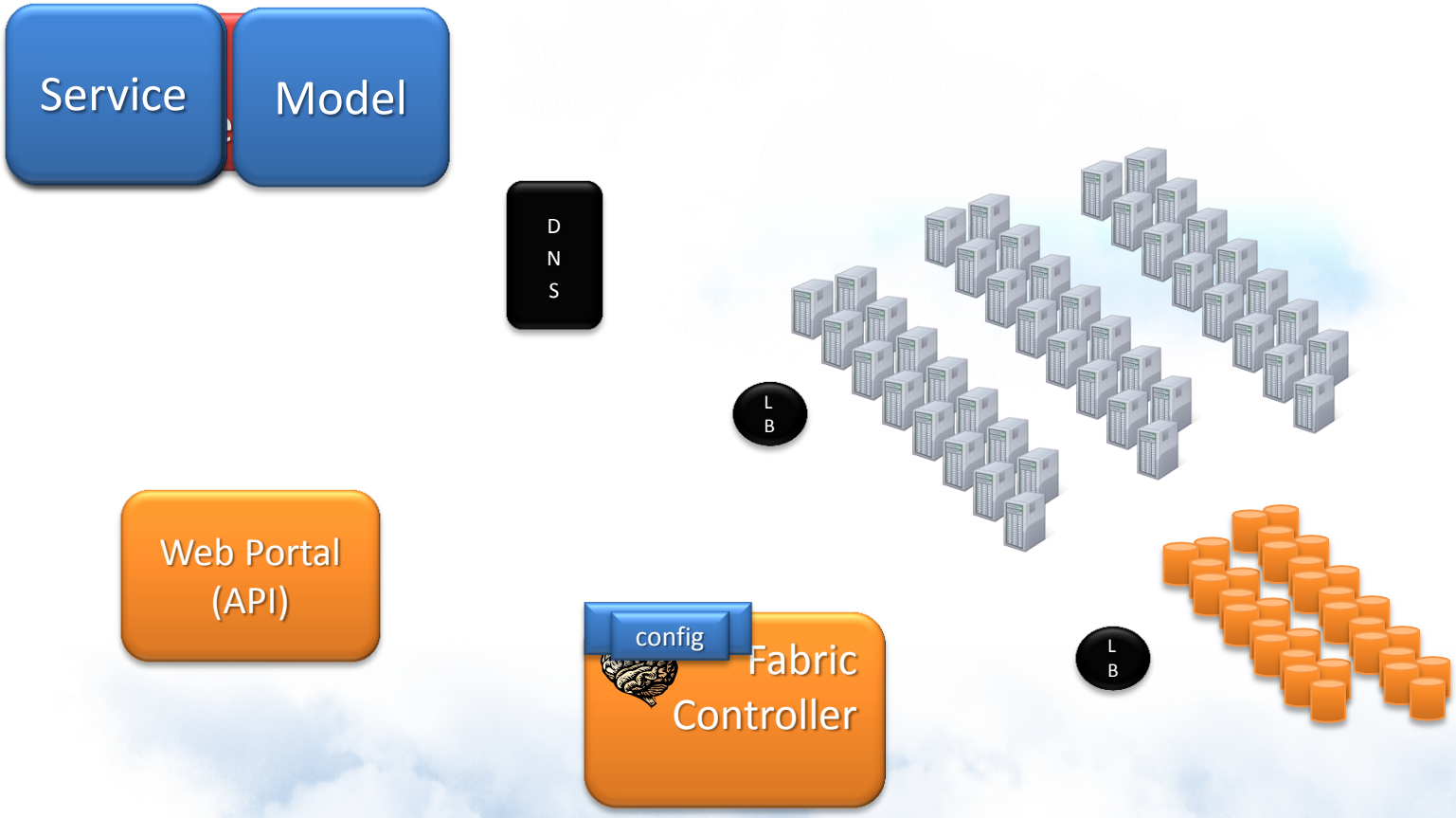
6 datacenters across 3 continents

Simply select your data center of choice when deploying an application

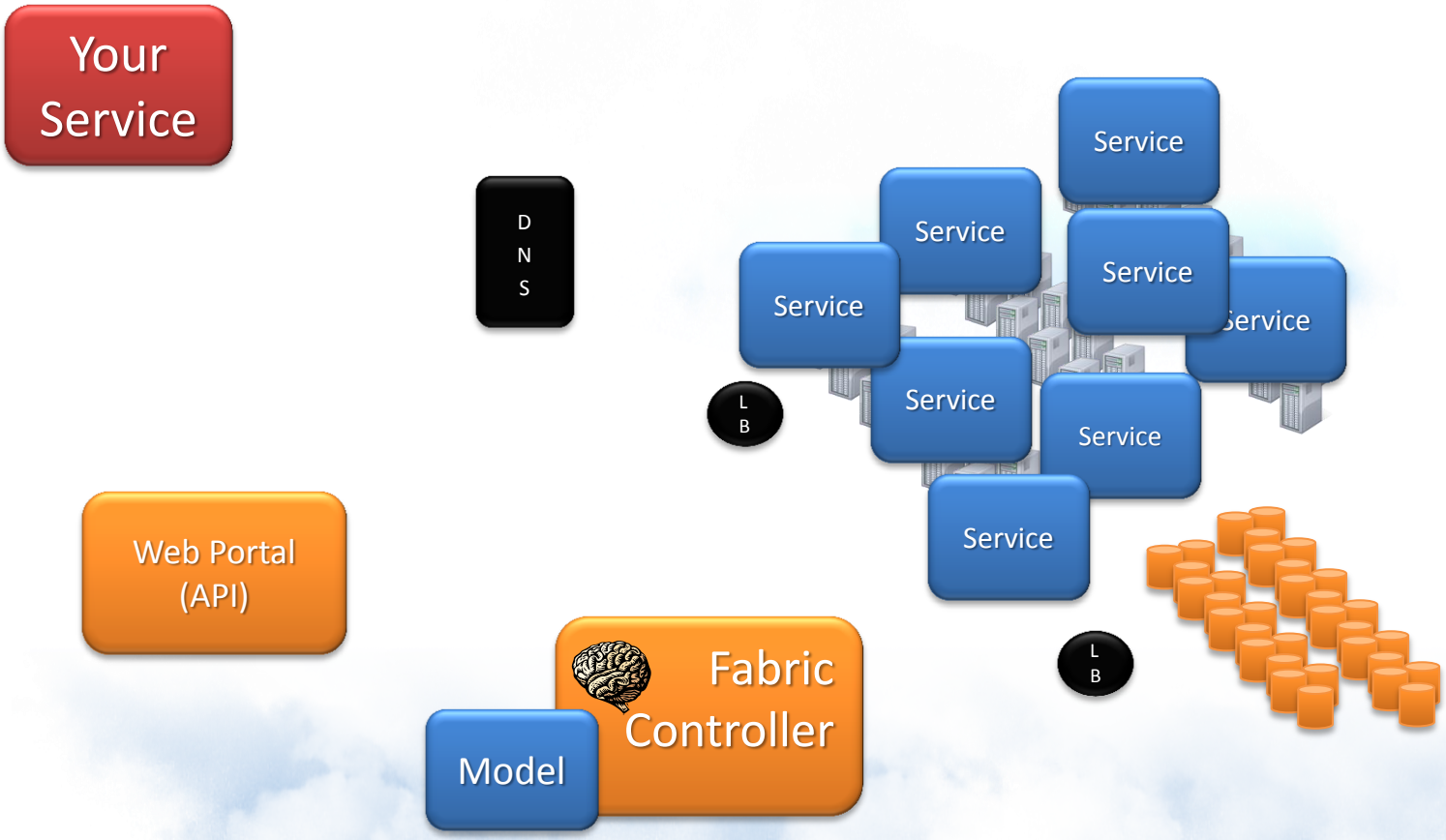
Windows Azure



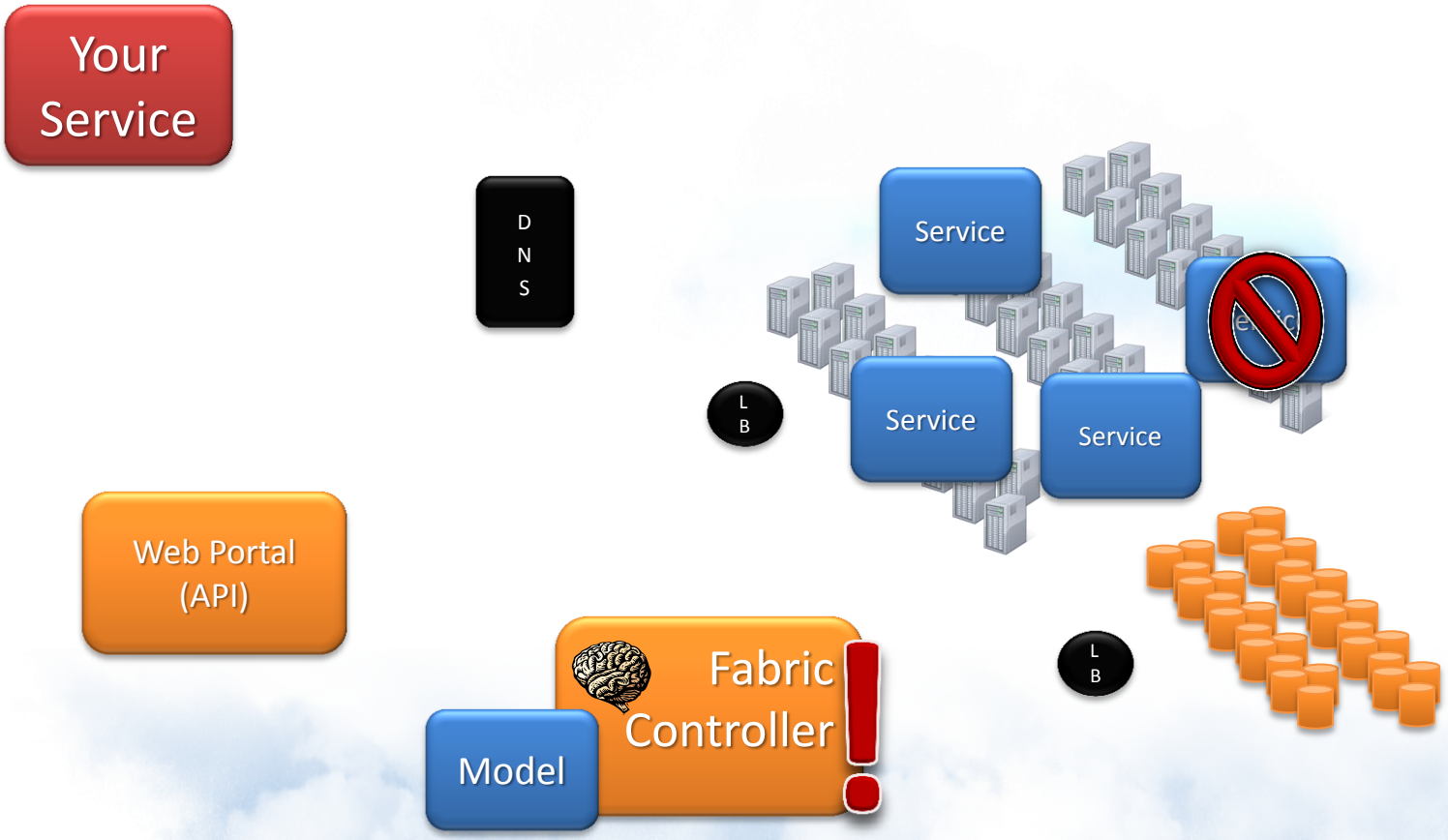
Service Deployment



Service Scaling



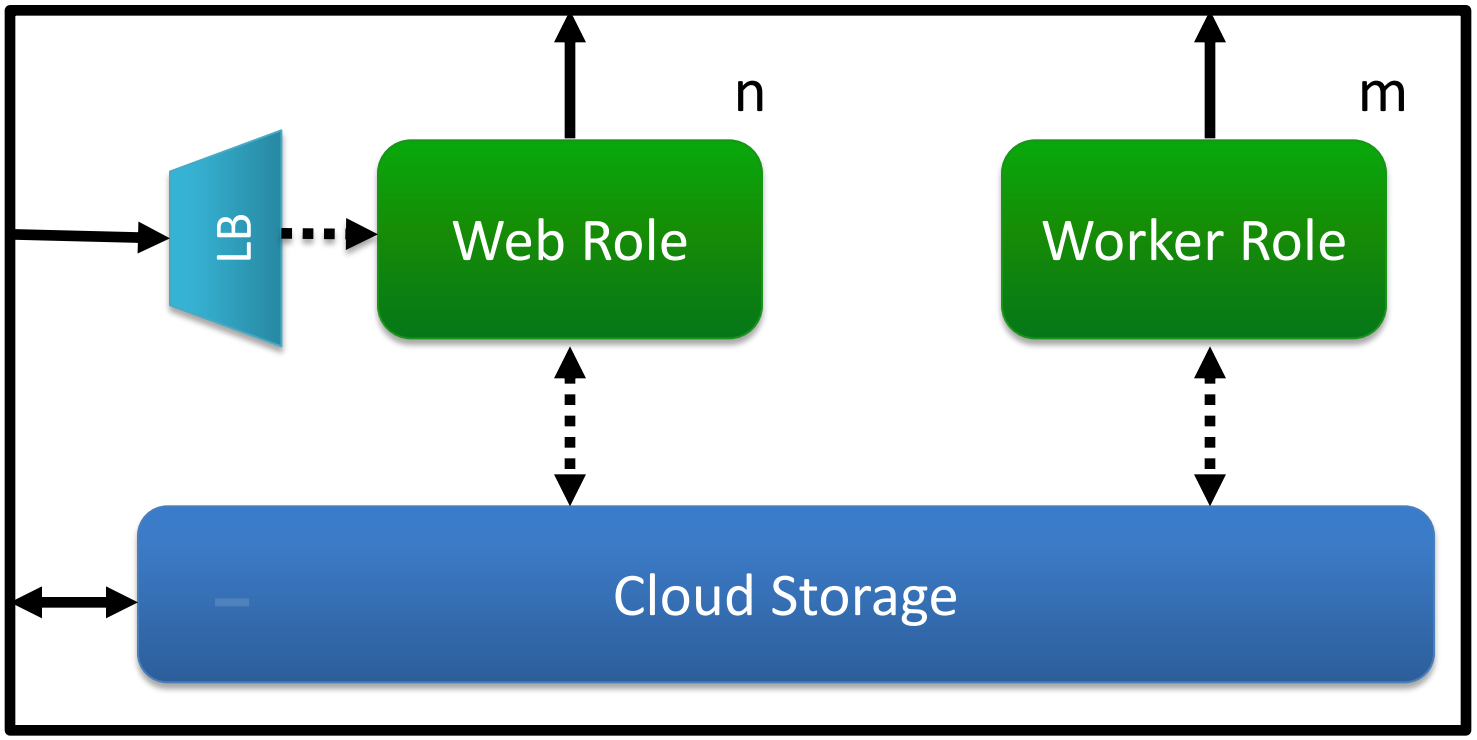
Service Monitoring & Recovery



Putting It All Together

Architectures for scalable, reliable services

Example:

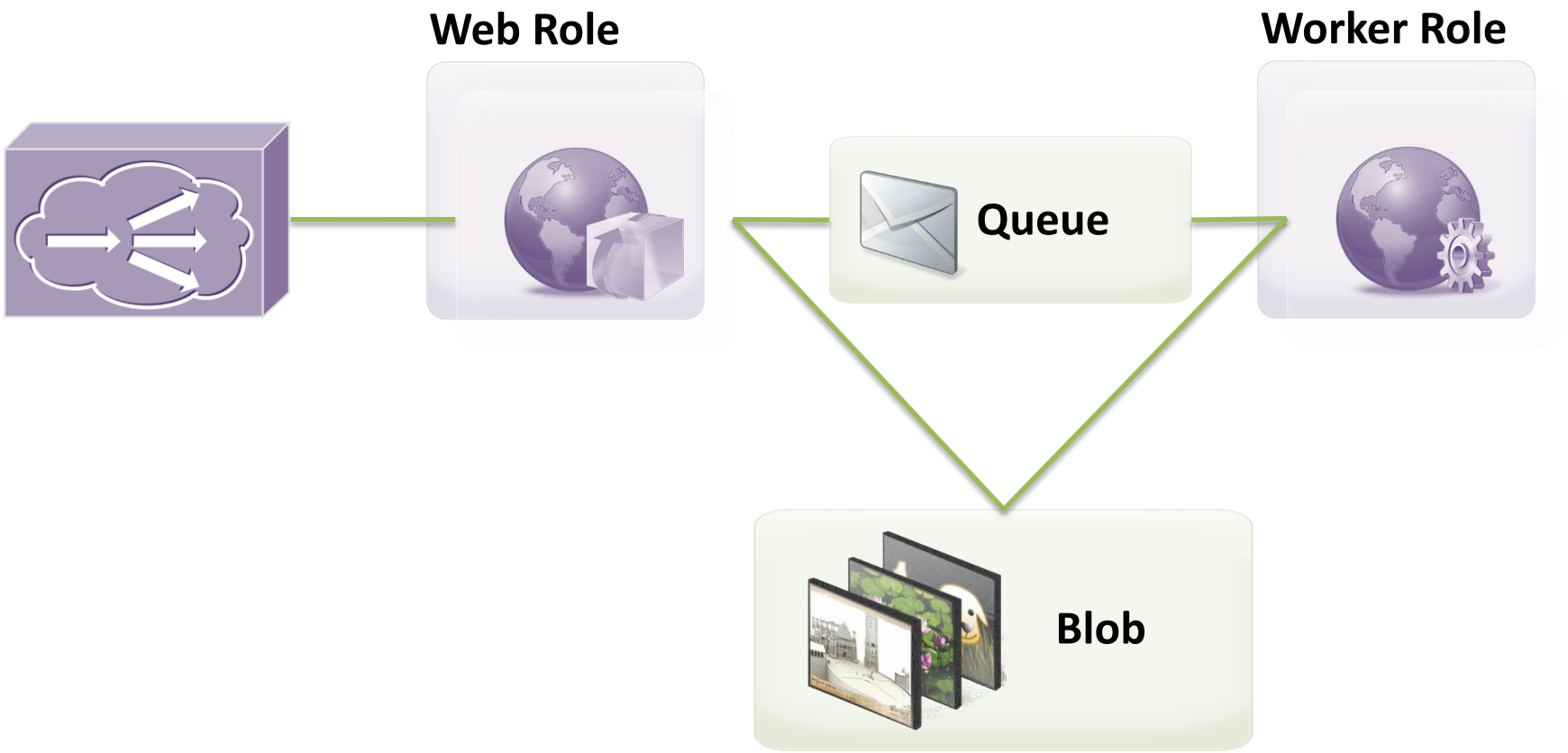


New Windows Azure Features

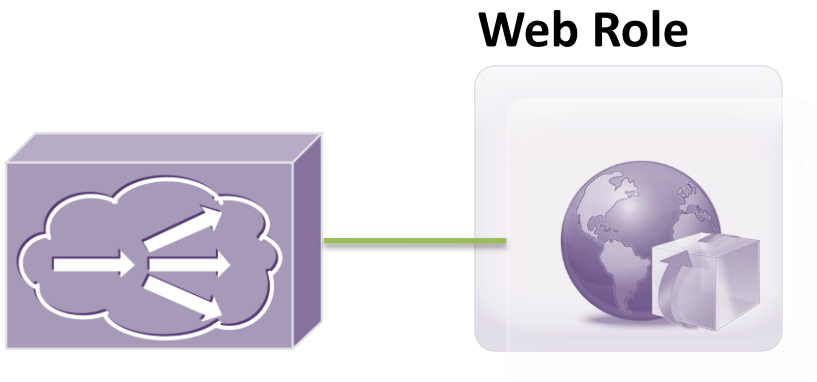
- Windows Azure Virtual Machine Role
- Windows Azure Virtual Network (formerly “Sydney”)
- Extra Small Virtual Machines
- New Windows Azure Platform Management Portal
- Multiple users & roles for management
- Windows Server 2008 R2 & IIS 7.5
- Elevated Privileges (Admin mode)
- Full IIS
- Remote Desktop

Let’s get Hands-On!

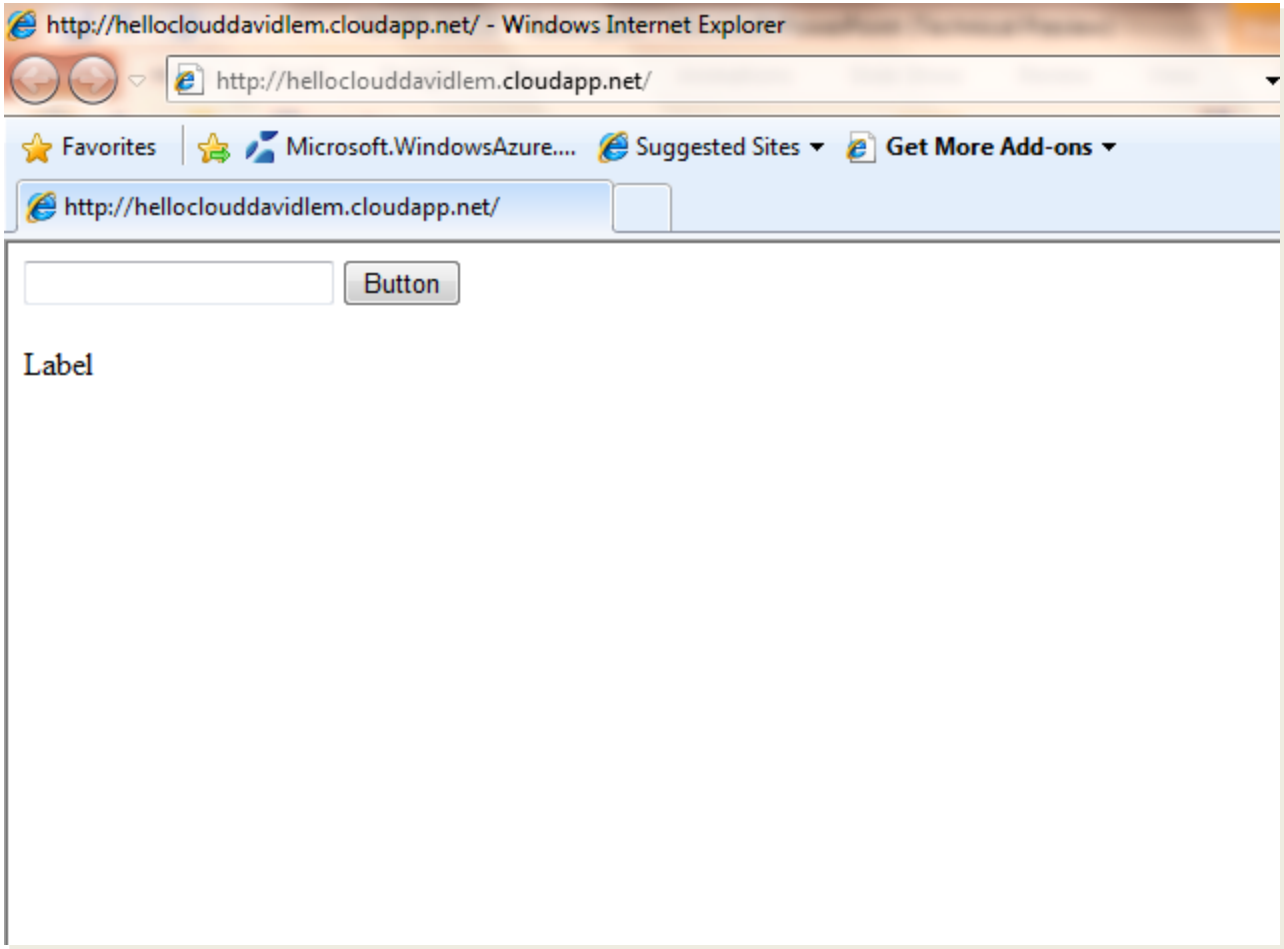
Hello Cloud



Hello Cloud – Web Role



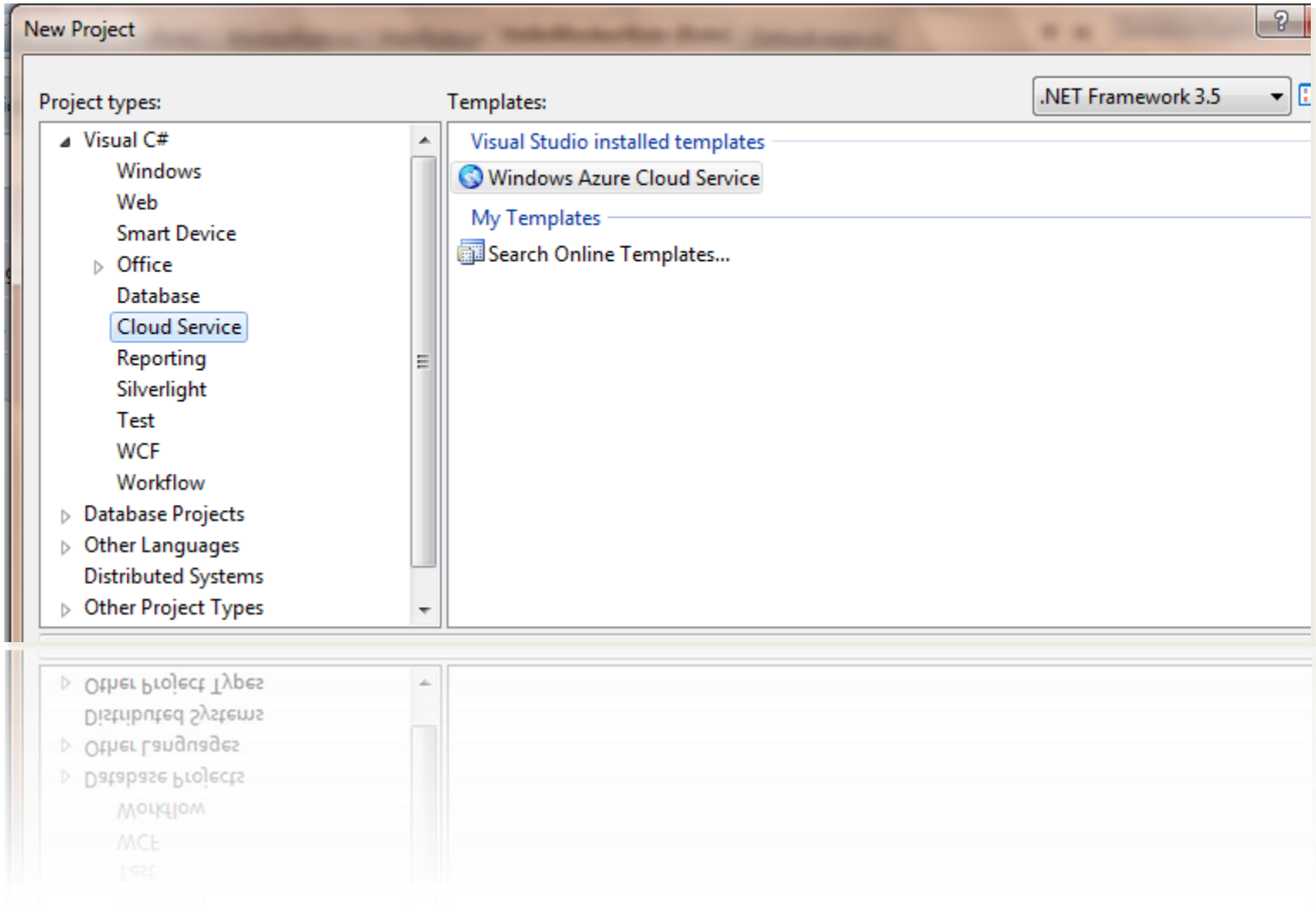
What We're Going To Code



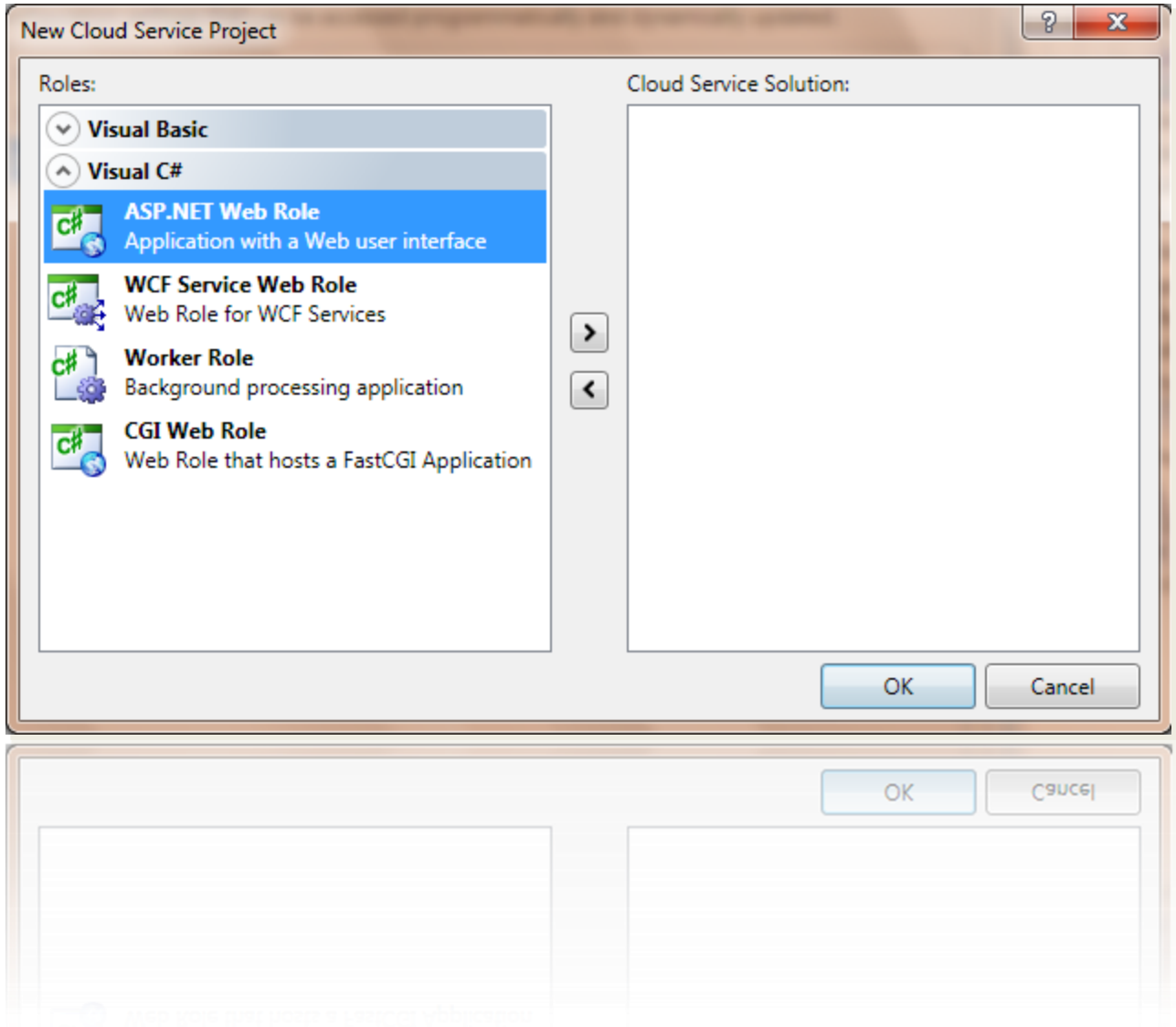
What We're Going To Code

- Step 1 - Create a Cloud Service project with a Web Role
- Step 2 - Write our code and test it locally
- Step 3 – Deploy to the Cloud

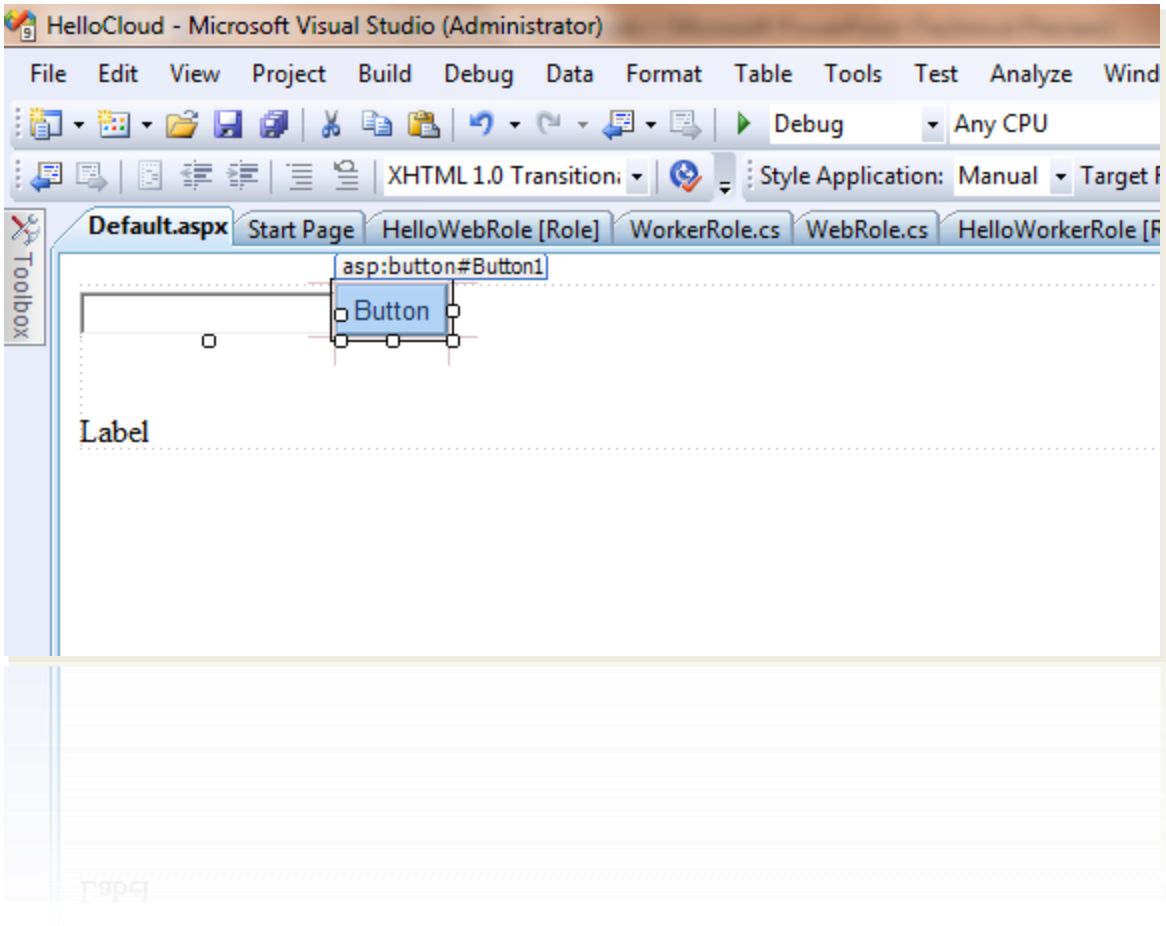
New Project


New Project
Project types:
Templates:
.NET Framework 3.5
Visual C#
Windows
Web
Smart Device
Office
Database
Cloud Service
Reporting
Silverlight
Test
WCF
Workflow
Database Projects
Other Languages
Distributed Systems
Other Project Types
Visual Studio installed templates
Windows Azure Cloud Service
My Templates
Search Online Templates...

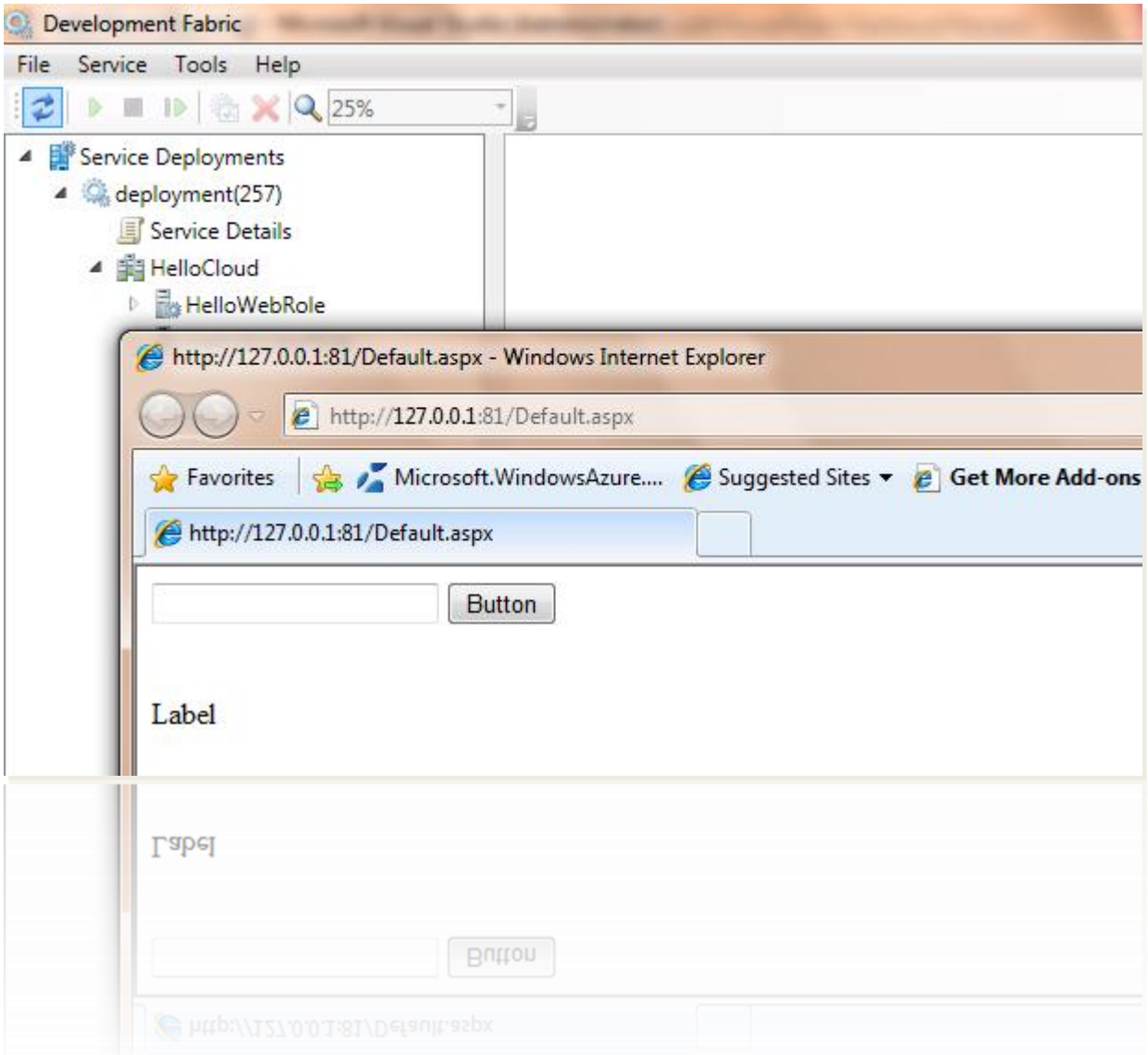
Add a Role


New Cloud Service Project
Roles:
Visual Basic
Visual C#
ASP.NET Web Role
Application with a Web user interface
WCF Service Web Role
Web Role for WCF Services
Worker Role
Background processing application
CGI Web Role
Web Role that hosts a FastCGI Application
Cloud Service Solution:
OK
Cancel

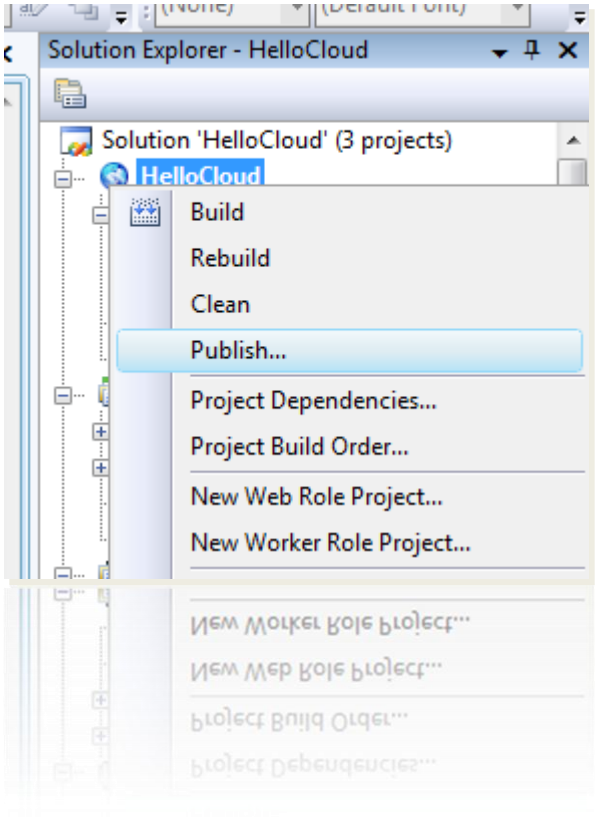
Write Some Code

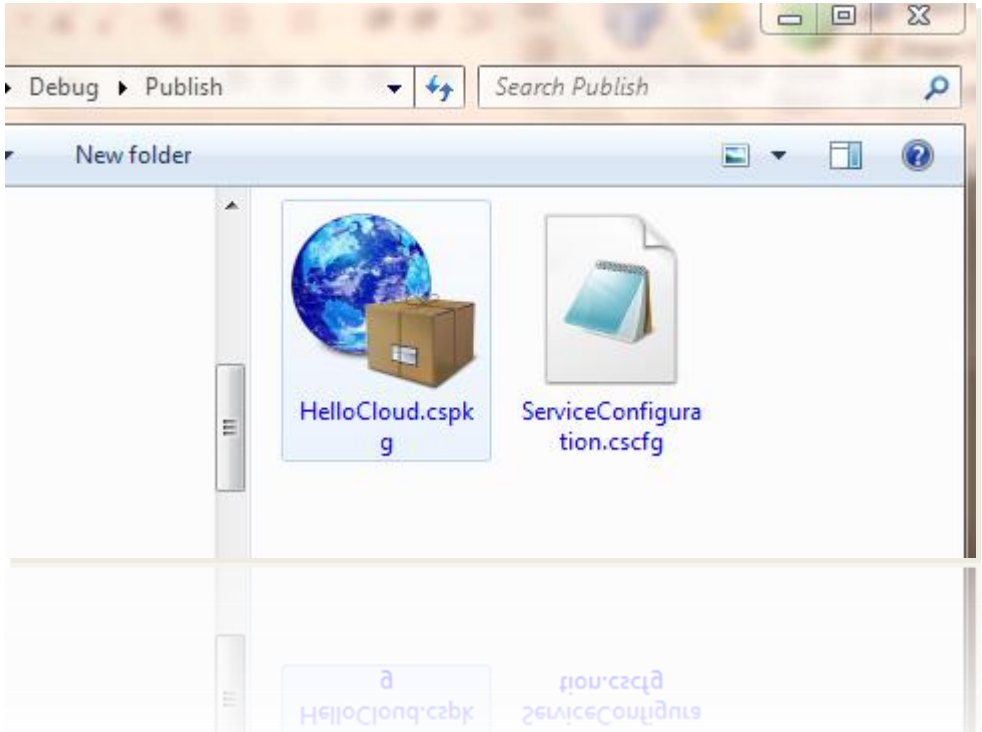


Run and Debug Locally (Hit F5)

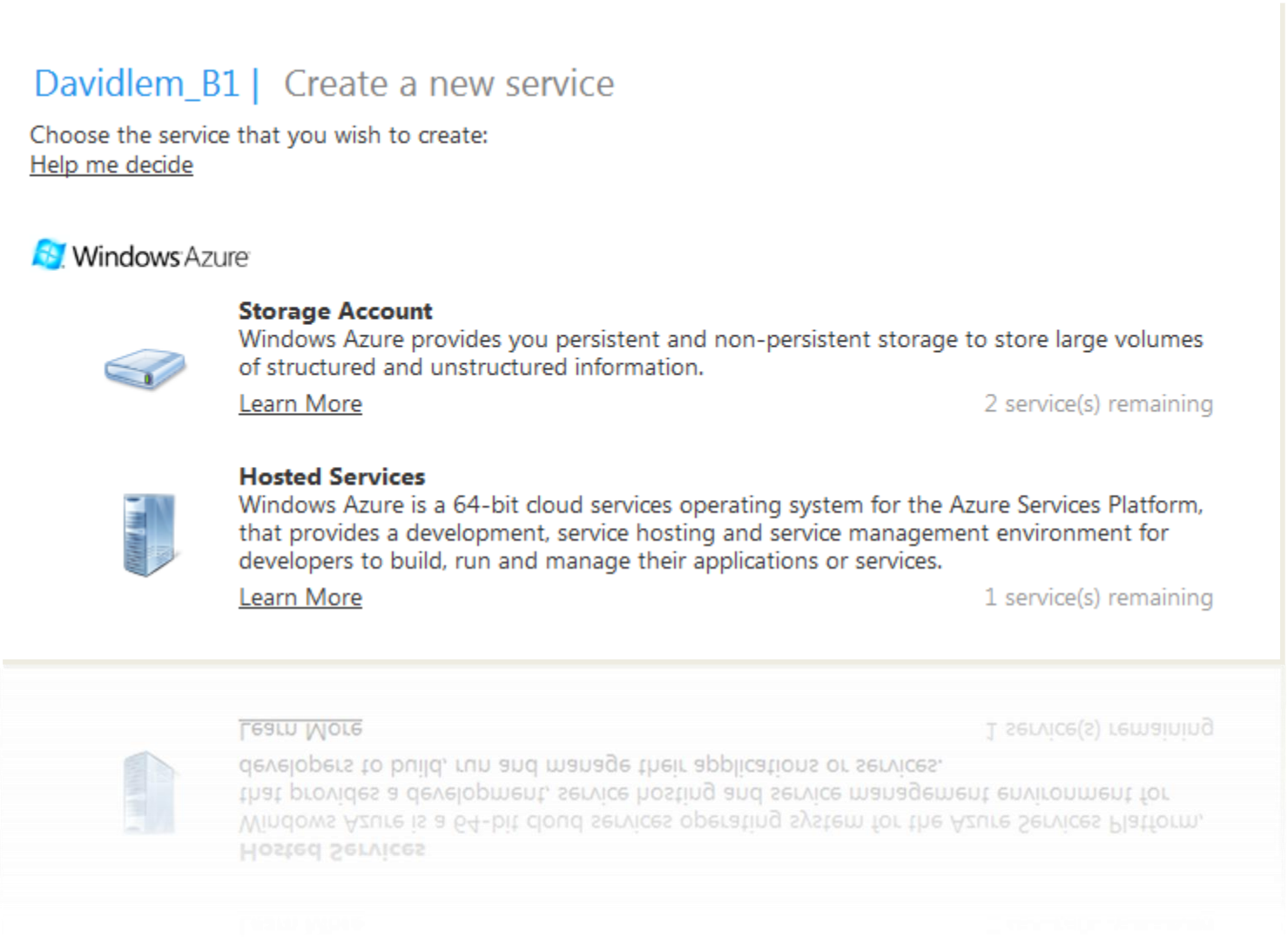


Deploy to the Cloud

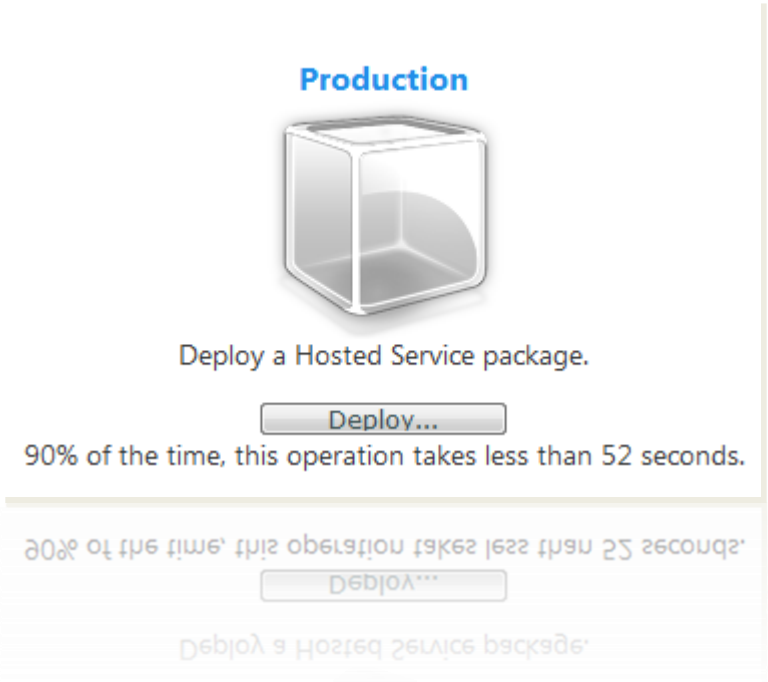


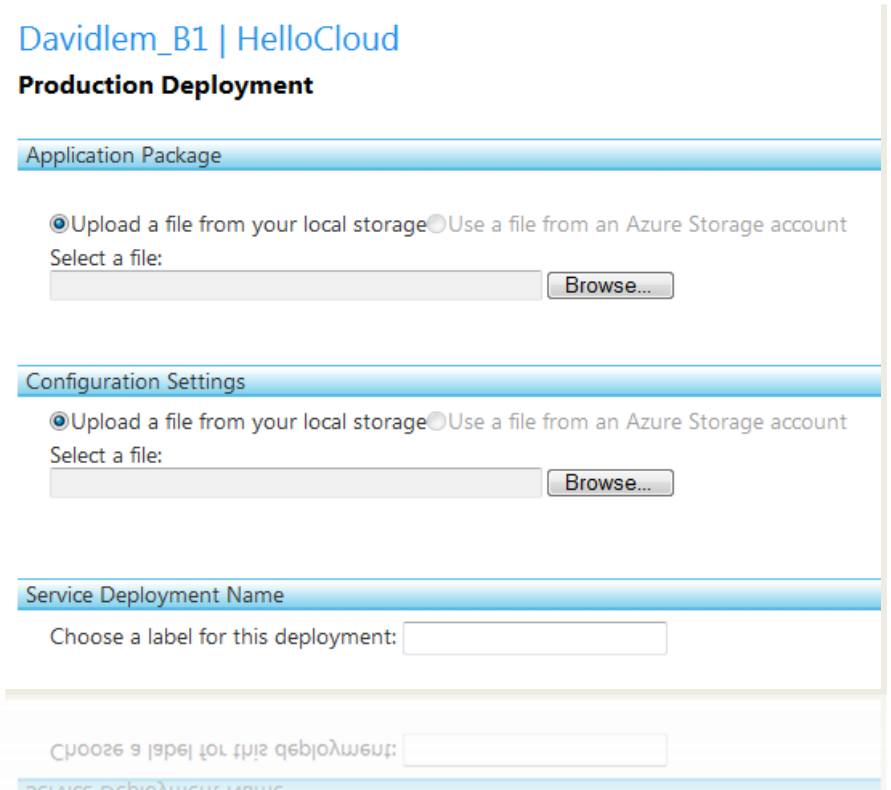


Create Your Accounts

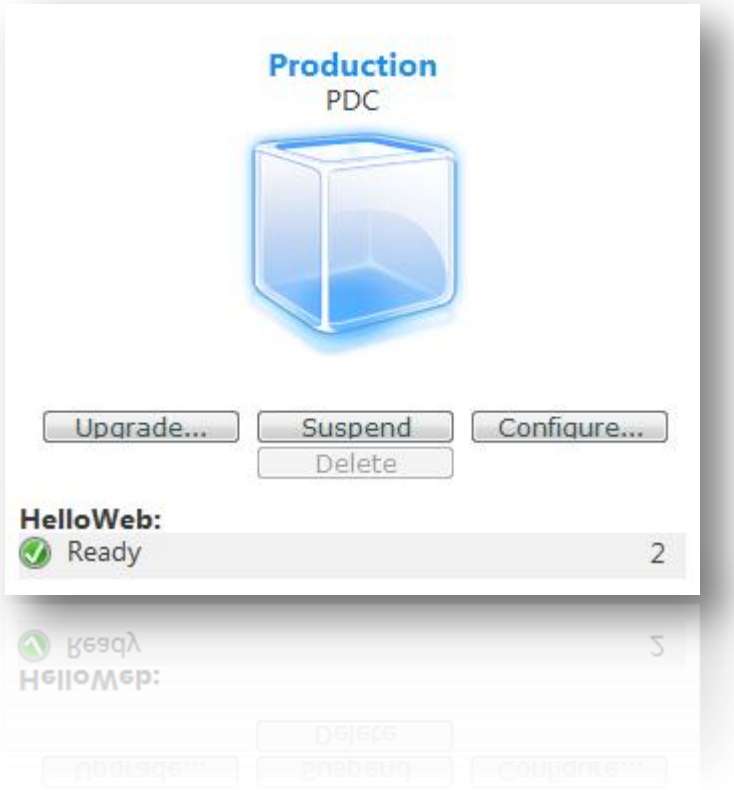


Deploy Your Service

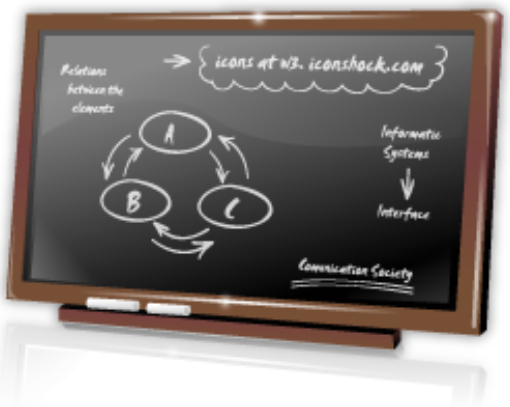




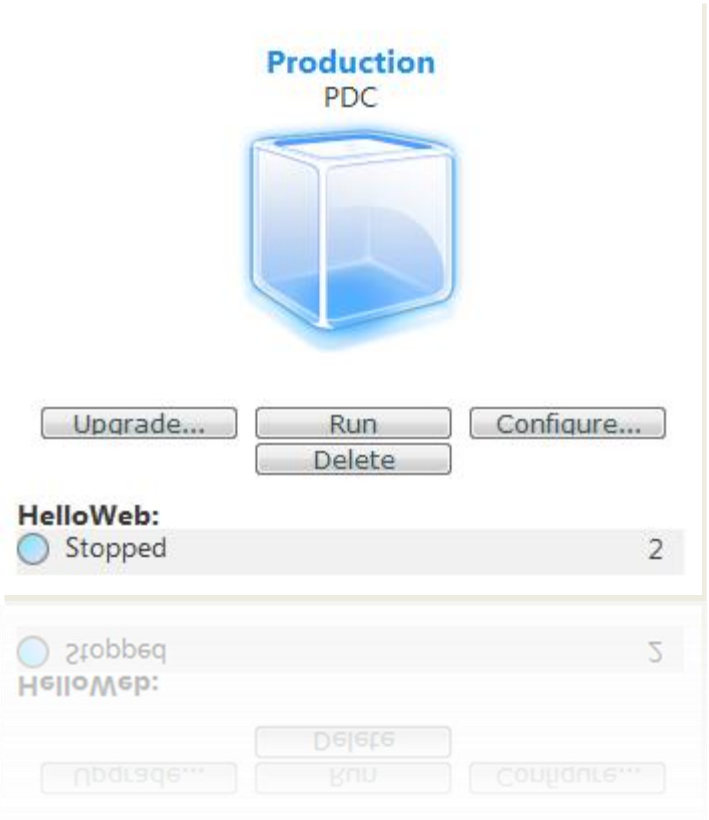
And You’re Running



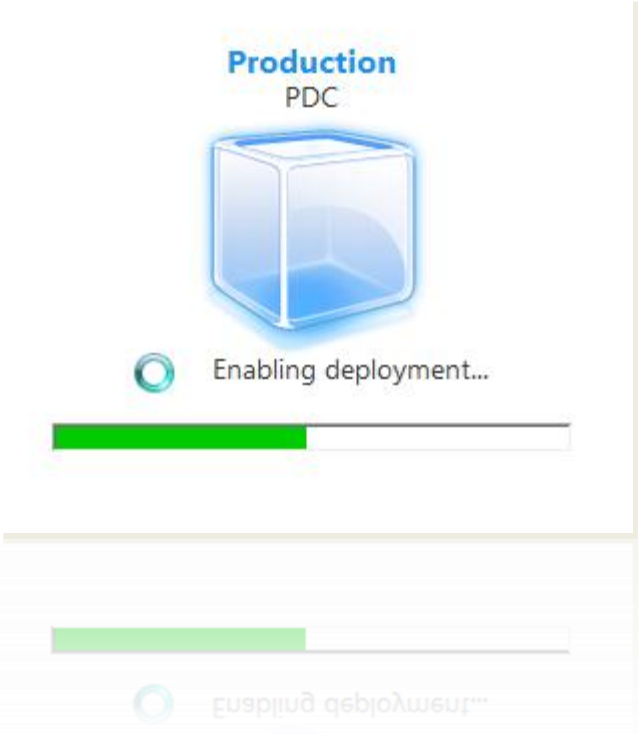
Demo:
Web Role



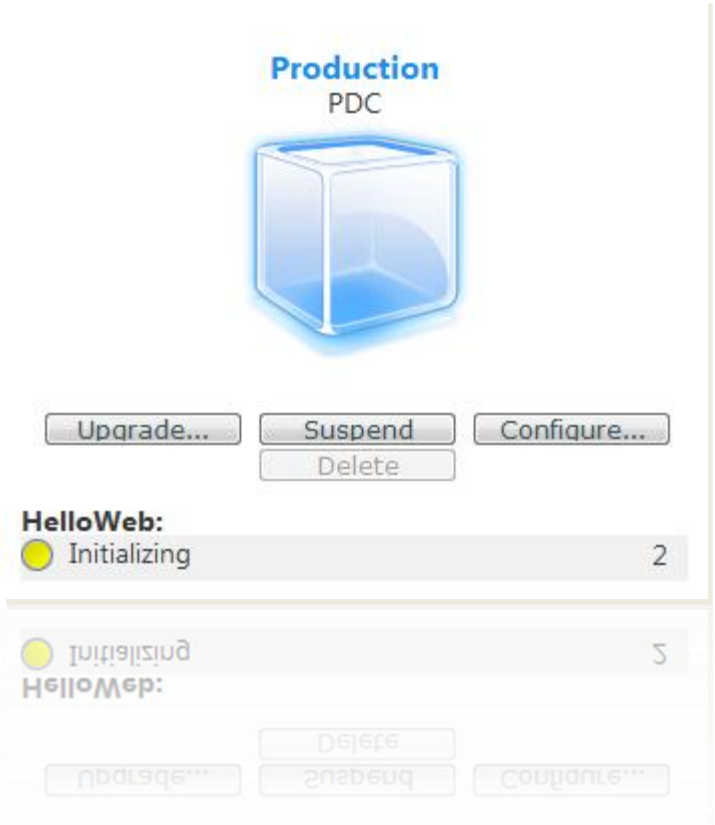
Portal – Allocated



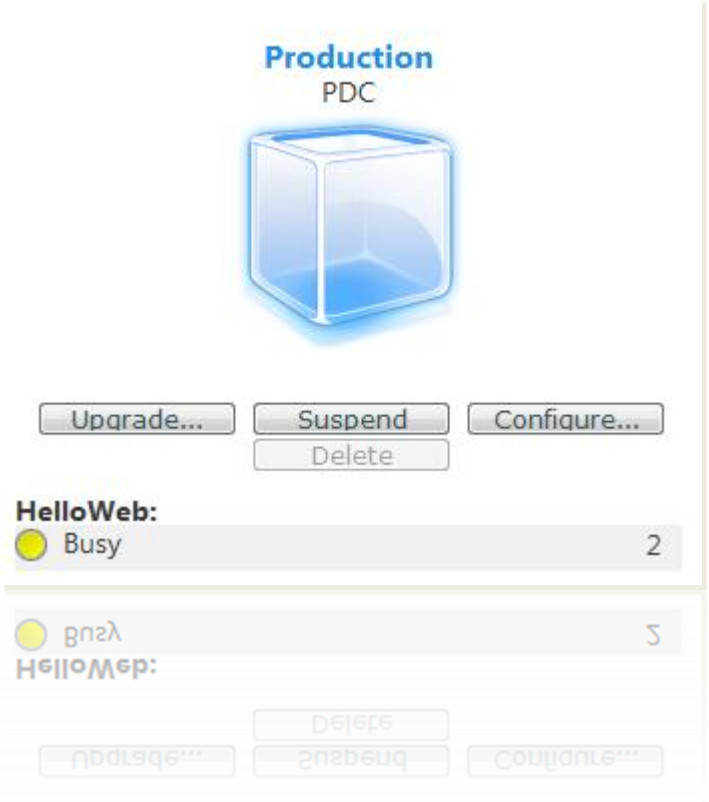
Portal - Run



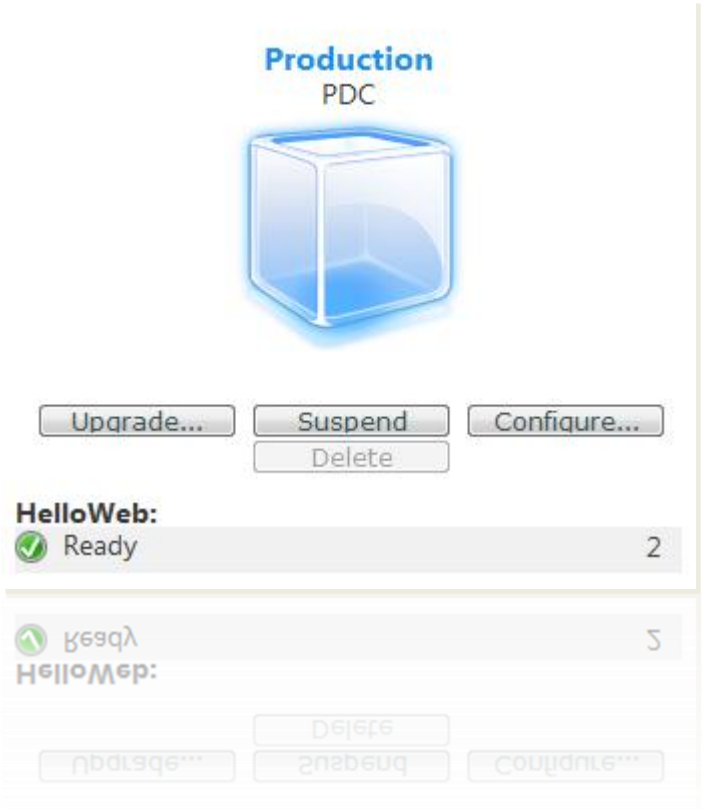
Portal - Initializing



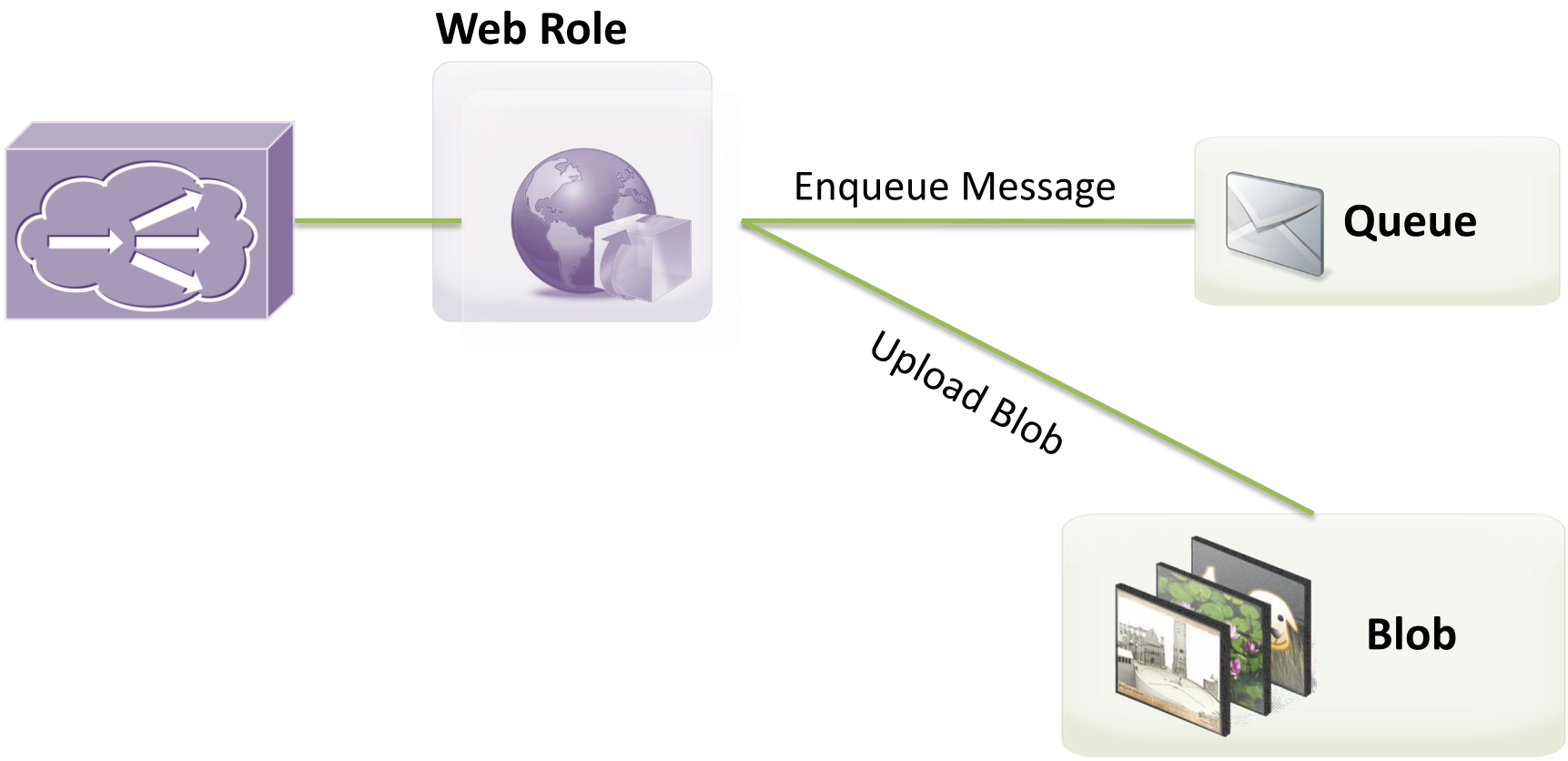
Portal - Busy


Production
PDC
Upgrade...
Suspend
Configure...
Delete
HelloWeb:
Busy
2

Portal - Ready



Hello Cloud – Blobs and Queues

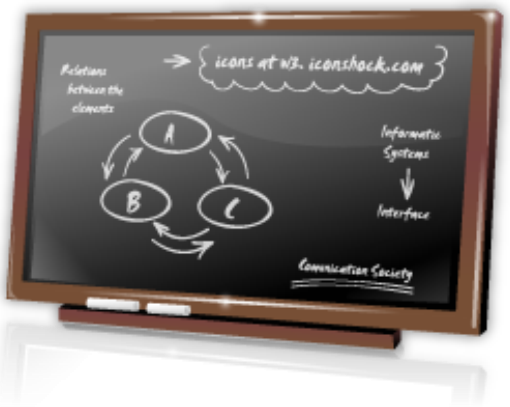


What We're Going To Code

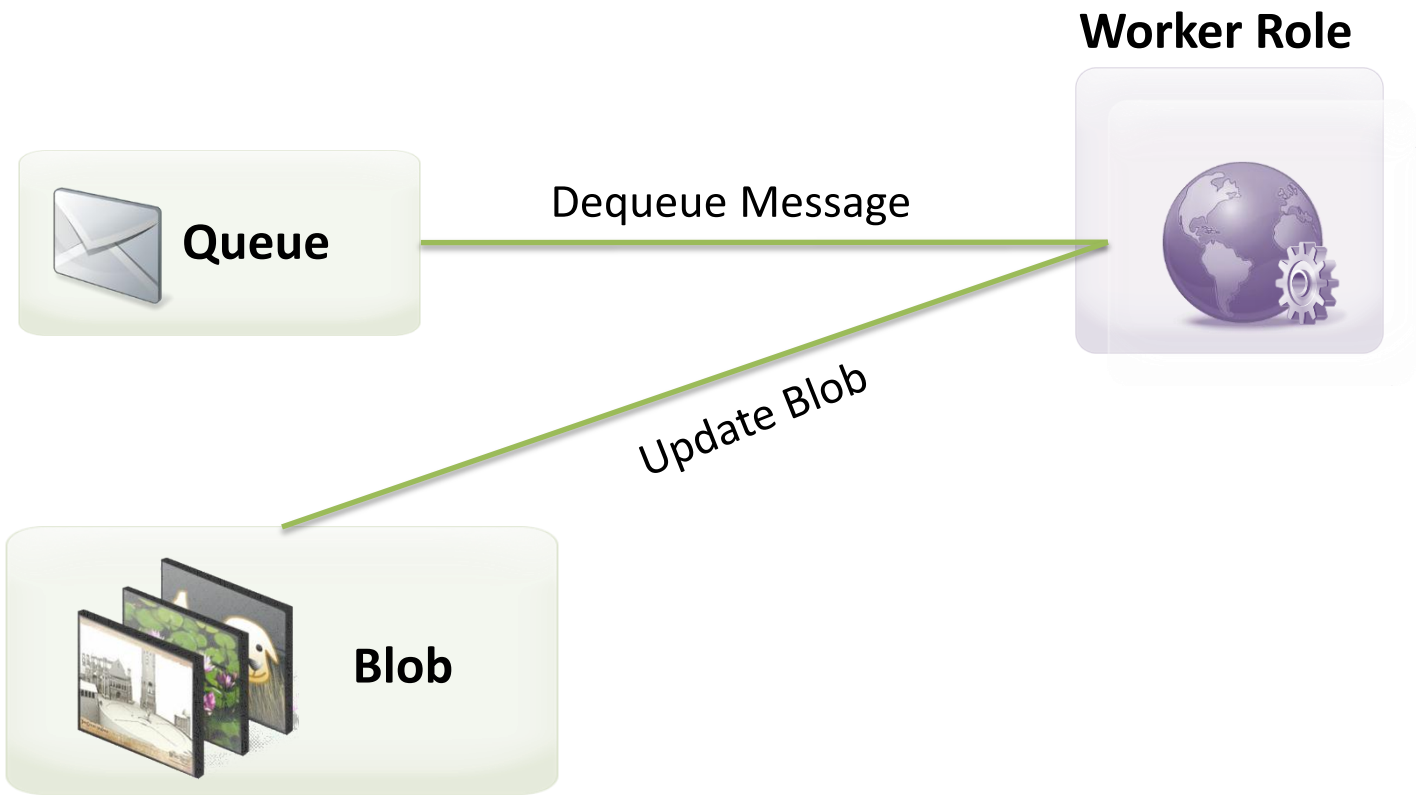
- Step 1 – Configure a Storage Account
- Step 2 – Upload a Blob
- Step 3 – Enqueue a Message

Demo:

Blob + Queue



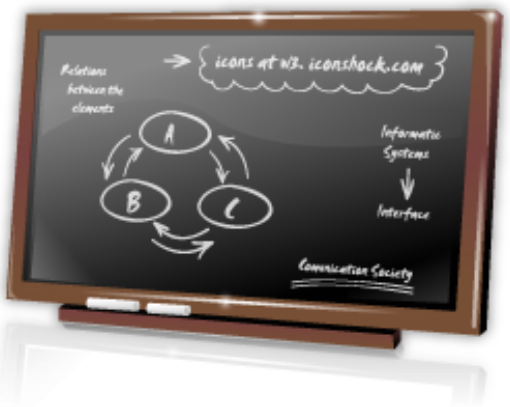
Hello Cloud – Worker Role



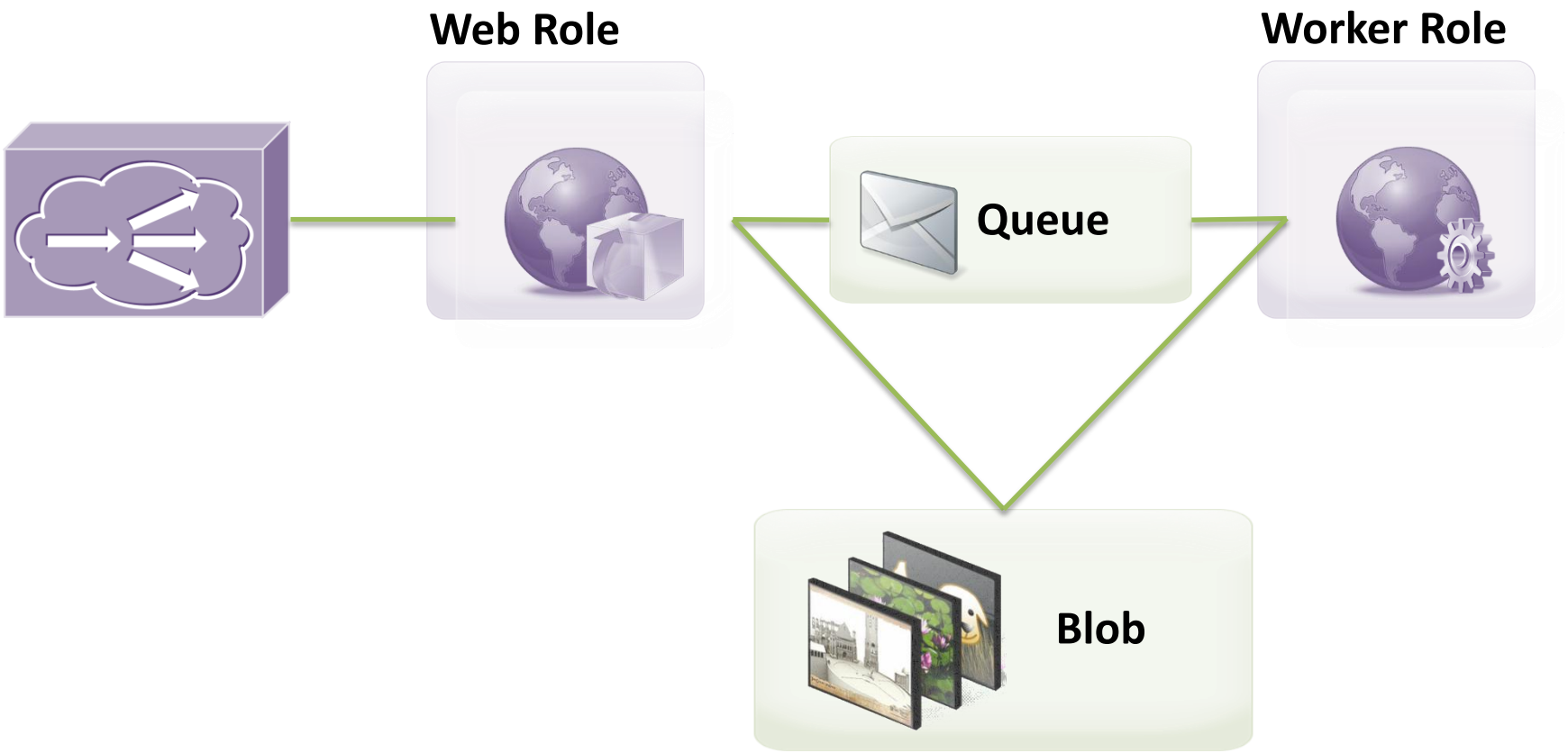
What We're Going To Code

- Step 1 – Add a Worker Role
- Step 2 – Dequeue Next Message
- Step 3 – Update the Blob referenced in the message
- Step 4 – Delete Message from Queue

Demo:
Worker Role



Hello Cloud



Demo Summary

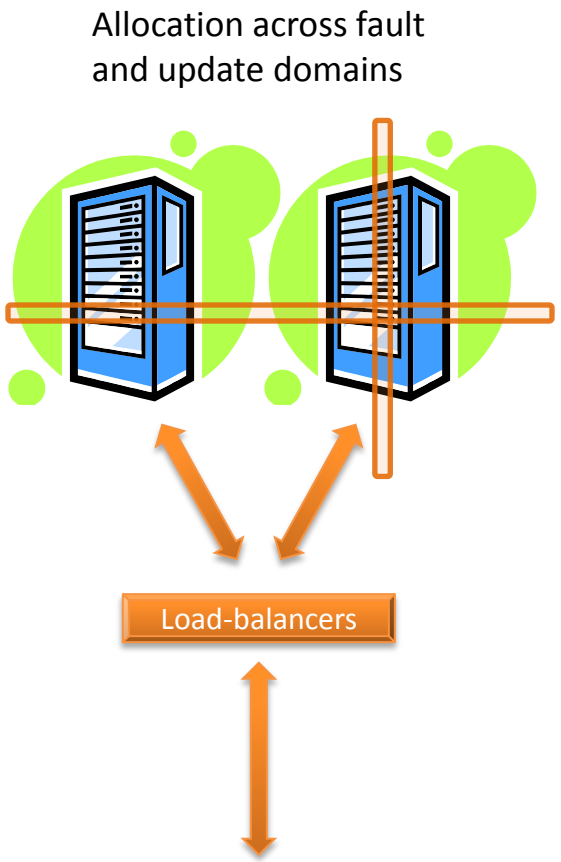
- Same Development Tools and Experience
- Local and Cloud Based Environments
- Rapid Cloud Development, Deployment and Maintenance

Under the hood:

Windows Azure ‘Compute’

Windows Azure Push-button Deployment

- Step 1: Allocate nodes
  - Across fault domains
  - Across update domains
- Step 2: Place OS and role images on nodes
- Step 3: Configure settings
- Step 4: Start Roles
- Step 5: Configure load-balancers
- Step 6: Maintain desired number of roles
  - Failed roles automatically restarted
  - Node failure results in new nodes automatically allocated



High-Level Architecture

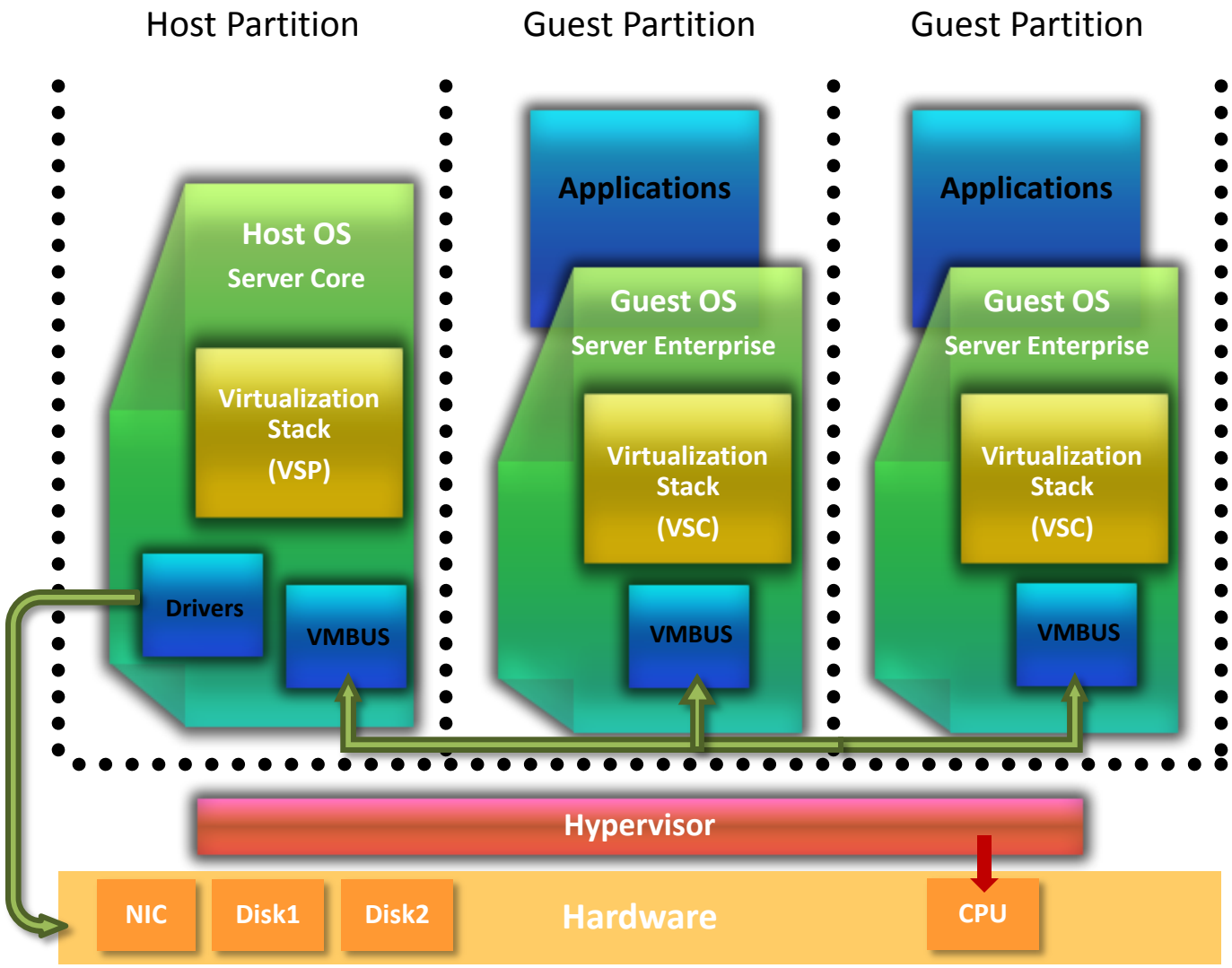
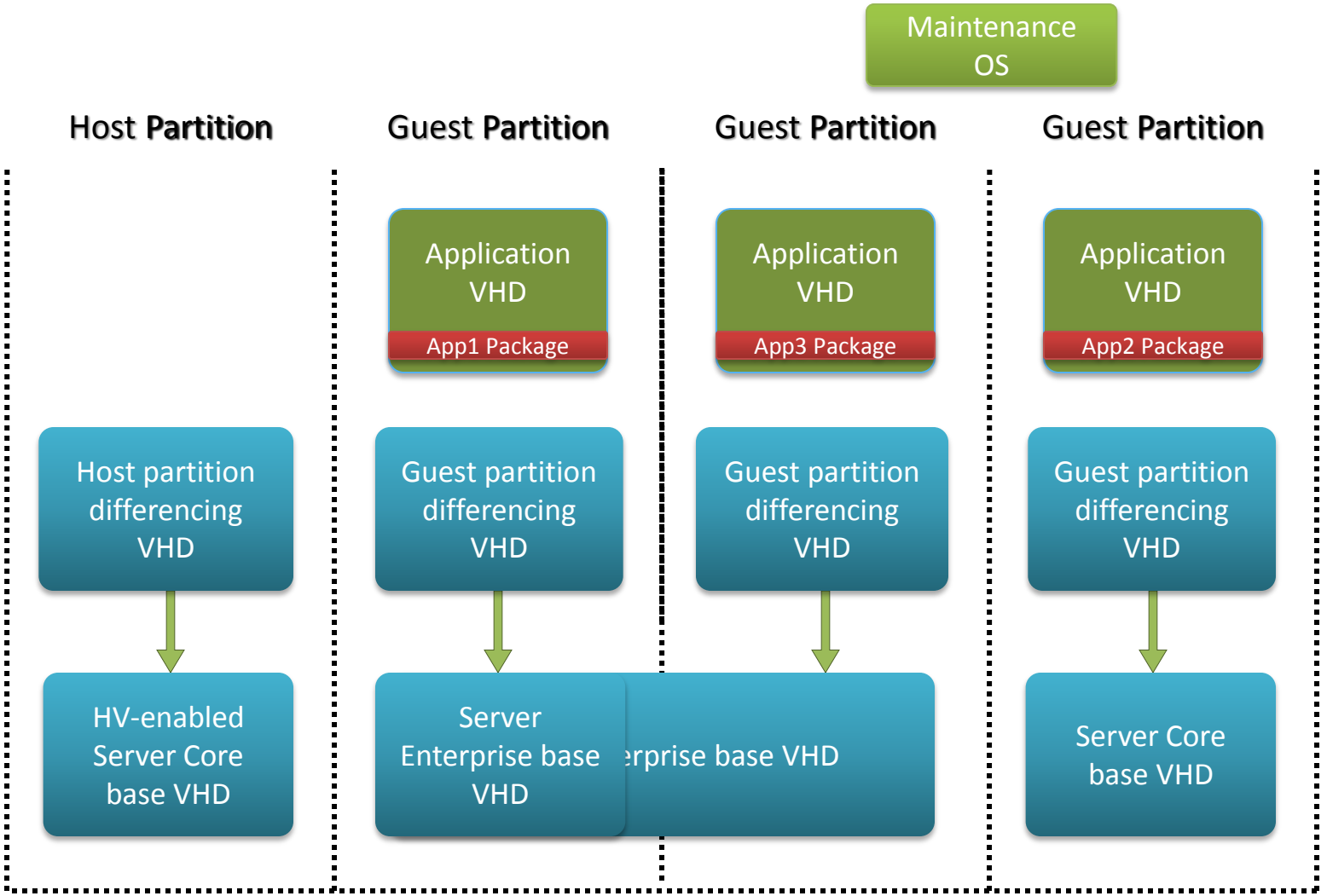
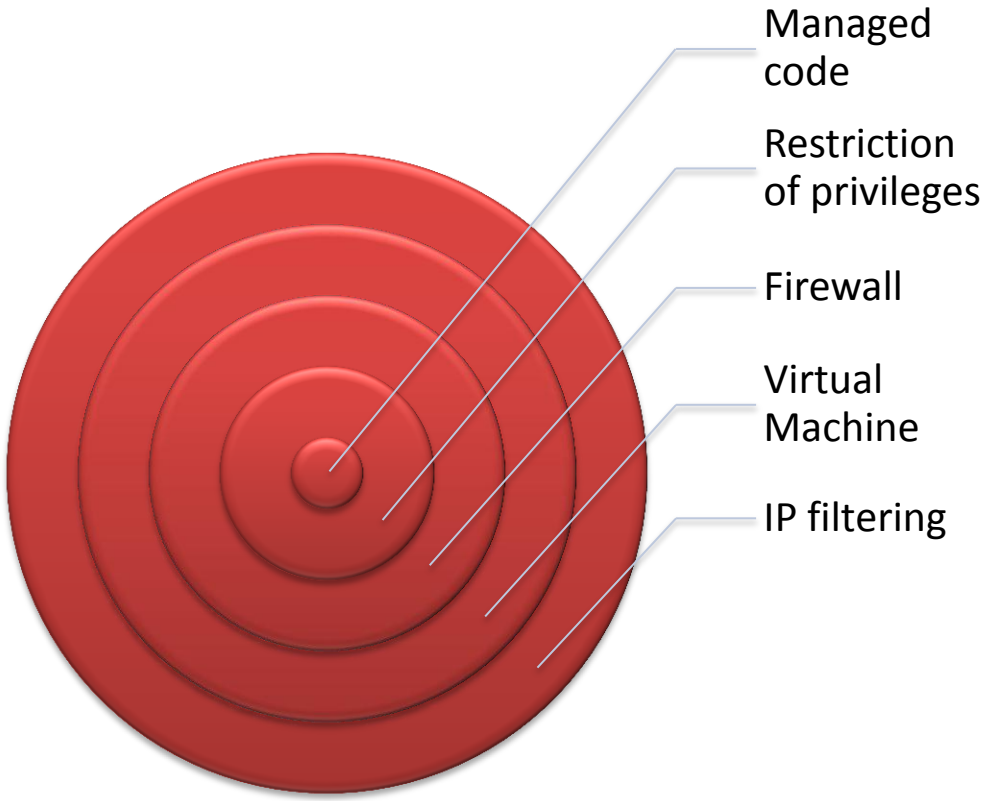


Image-Based Deployment



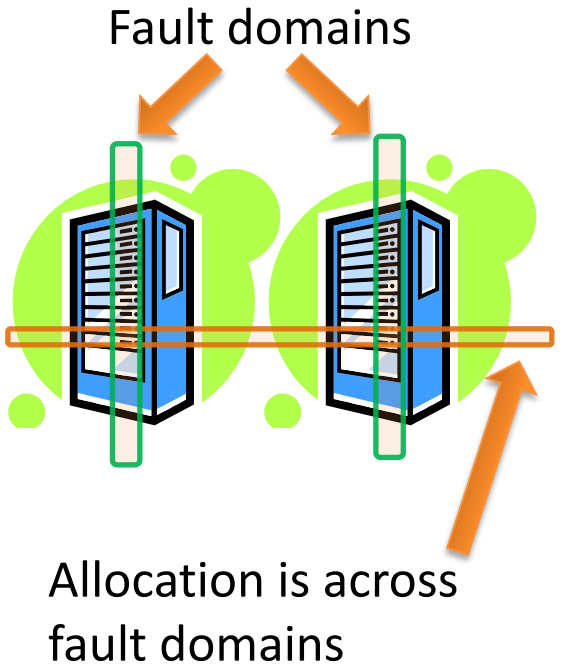
Service Isolation And Security

- Your services are isolated from other services
  - Can access resources declared in model only
  - Local node resources – temp storage
  - Network end-points
- Isolation using multiple mechanisms
- Automatic application of Windows security patches
  - Rolling OS image upgrades



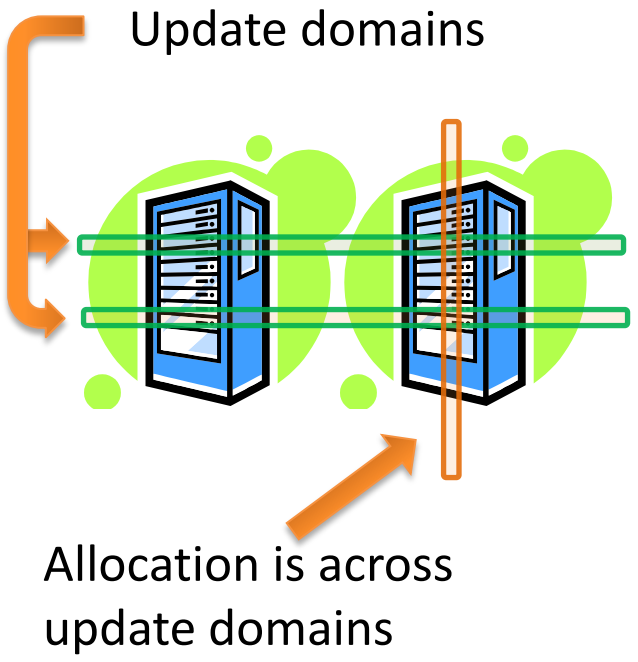
Fault Domains

- Purpose: Avoid single points of failures
- Unit of a failure
  - Examples: Compute node, a rack of machines
- System considers fault domains when allocating service roles
  - Example: Don't put all roles in same rack
- Service owner assigns number required by each role
  - Example: 10 front-ends, across 2 fault domains



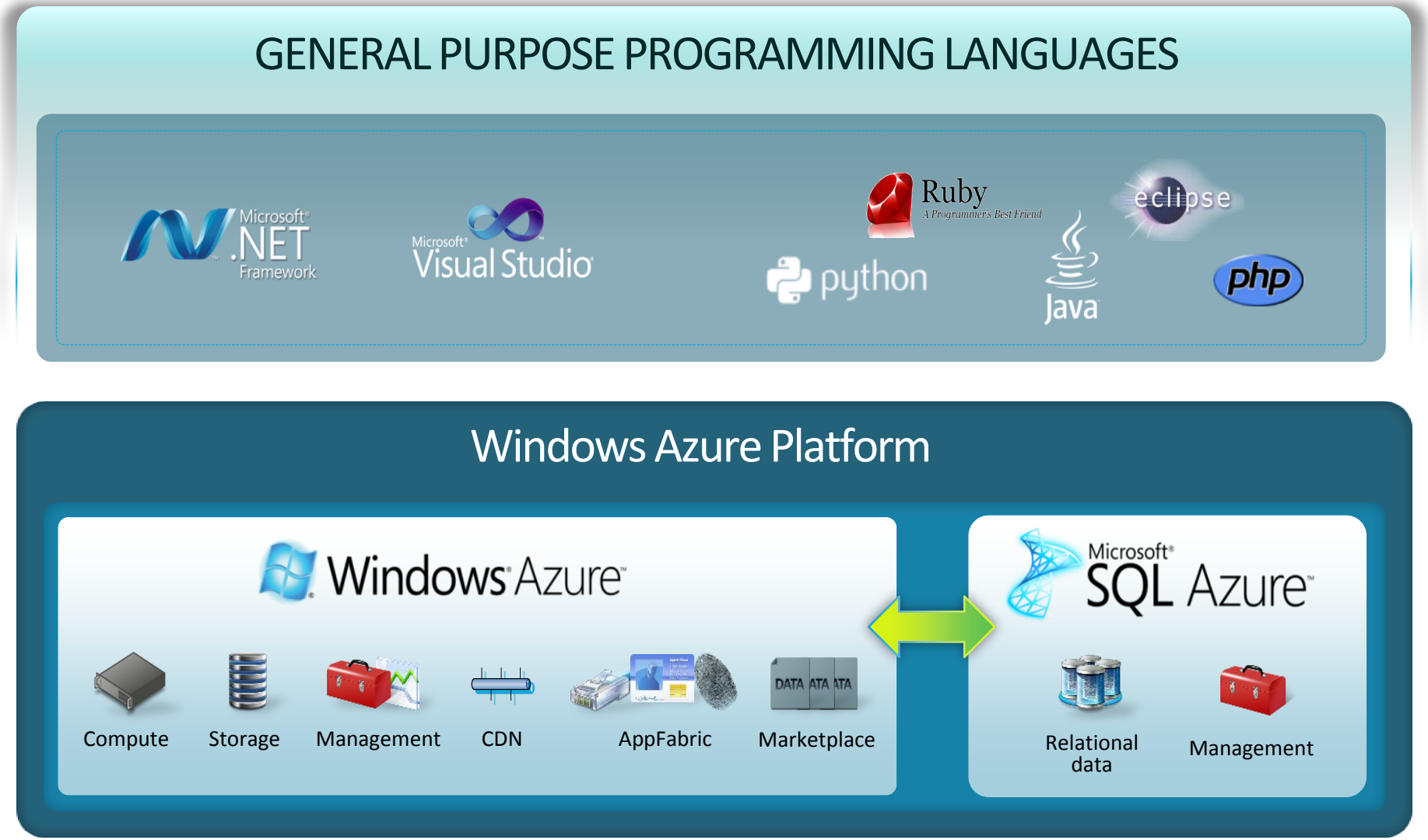
Update Domains

- Purpose: ensure service stays up while updating
- Unit of software/configuration update
  - Example: set of nodes to update
- Used when rolling forward or backward
- Developer assigns number required by each role
  - Example: 10 front-ends, across 5 update domains

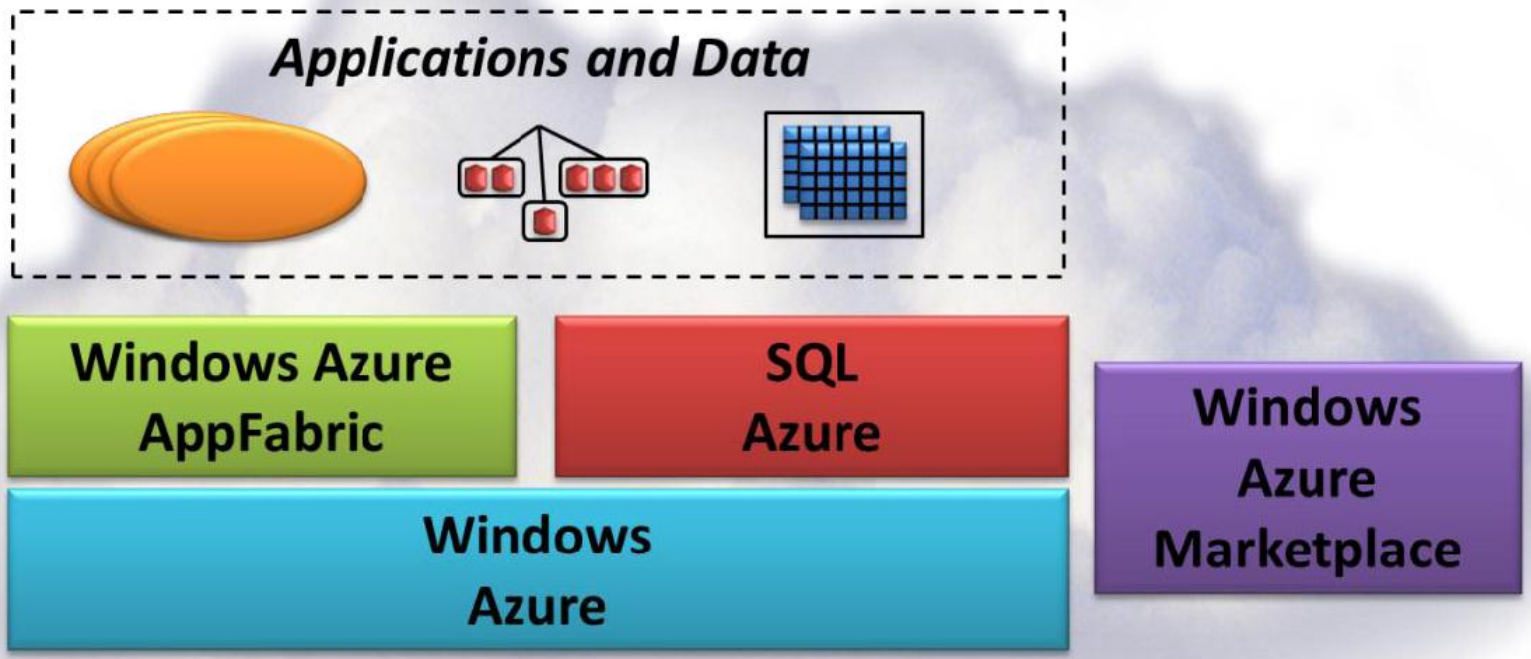


What else is in the Windows Azure Platform

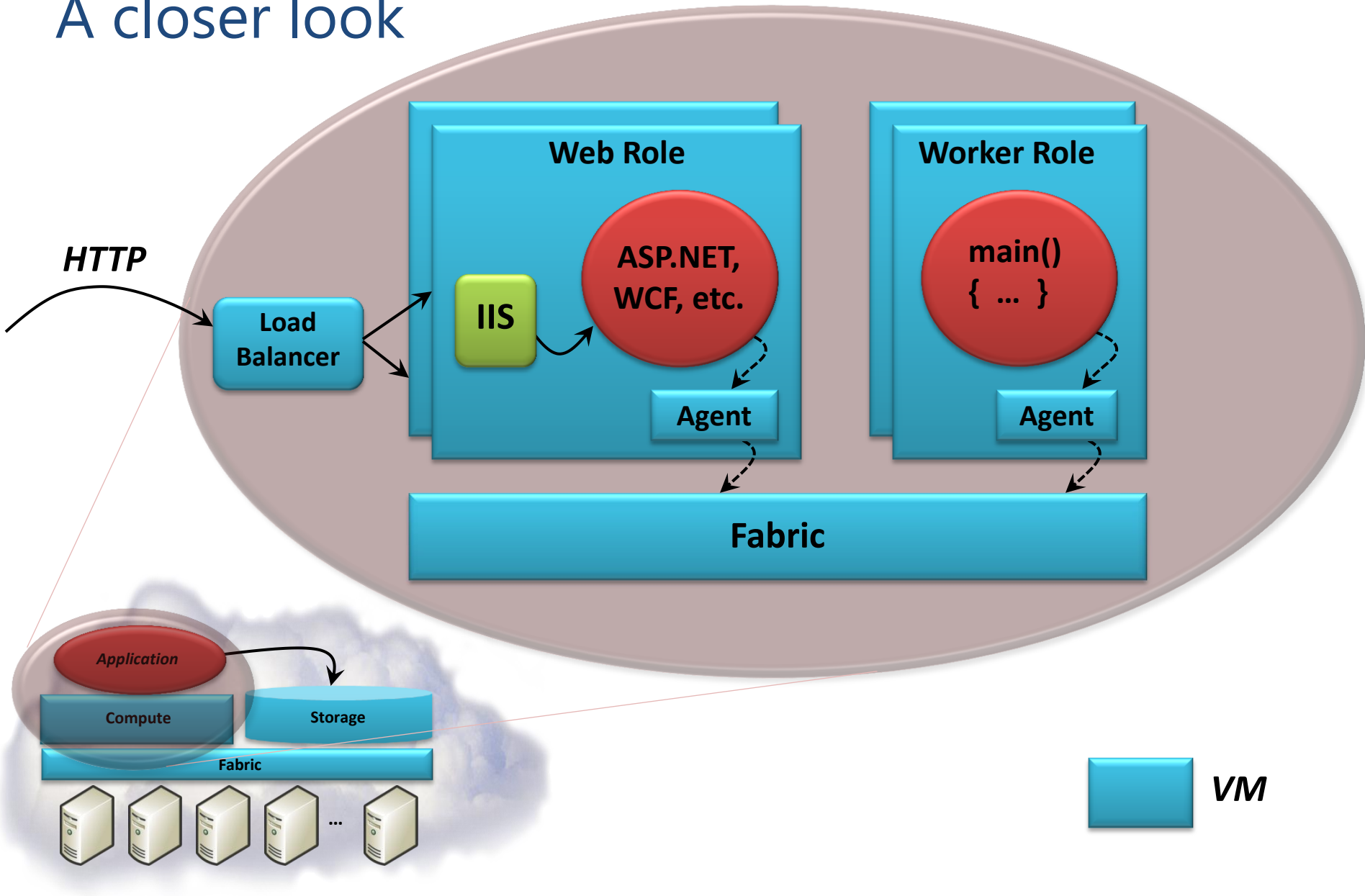
The Windows Azure Platform



Windows Azure Platform



Windows Azure Compute Service
A closer look

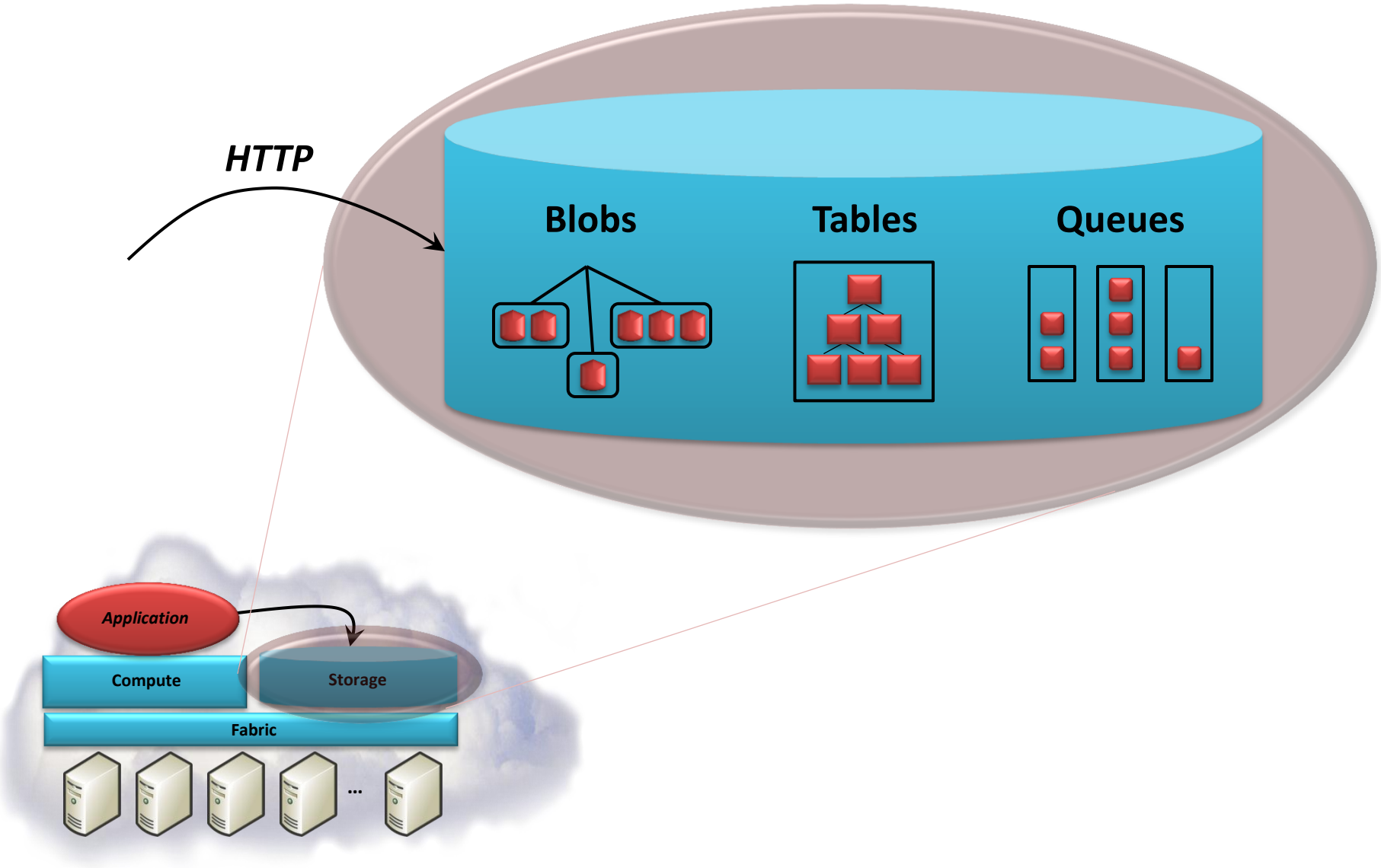


Windows Azure Compute Service
Points of interest

- The VMs are provided by a cloud-optimized hypervisor

- For developers:
  - Applications see a 64-bit Windows Server 2008 interface
    - A few things require accessing the Windows Azure Agent, e.g., logging
  - A desktop replica of Windows Azure is provided for development
    - Called the *Development Fabric*

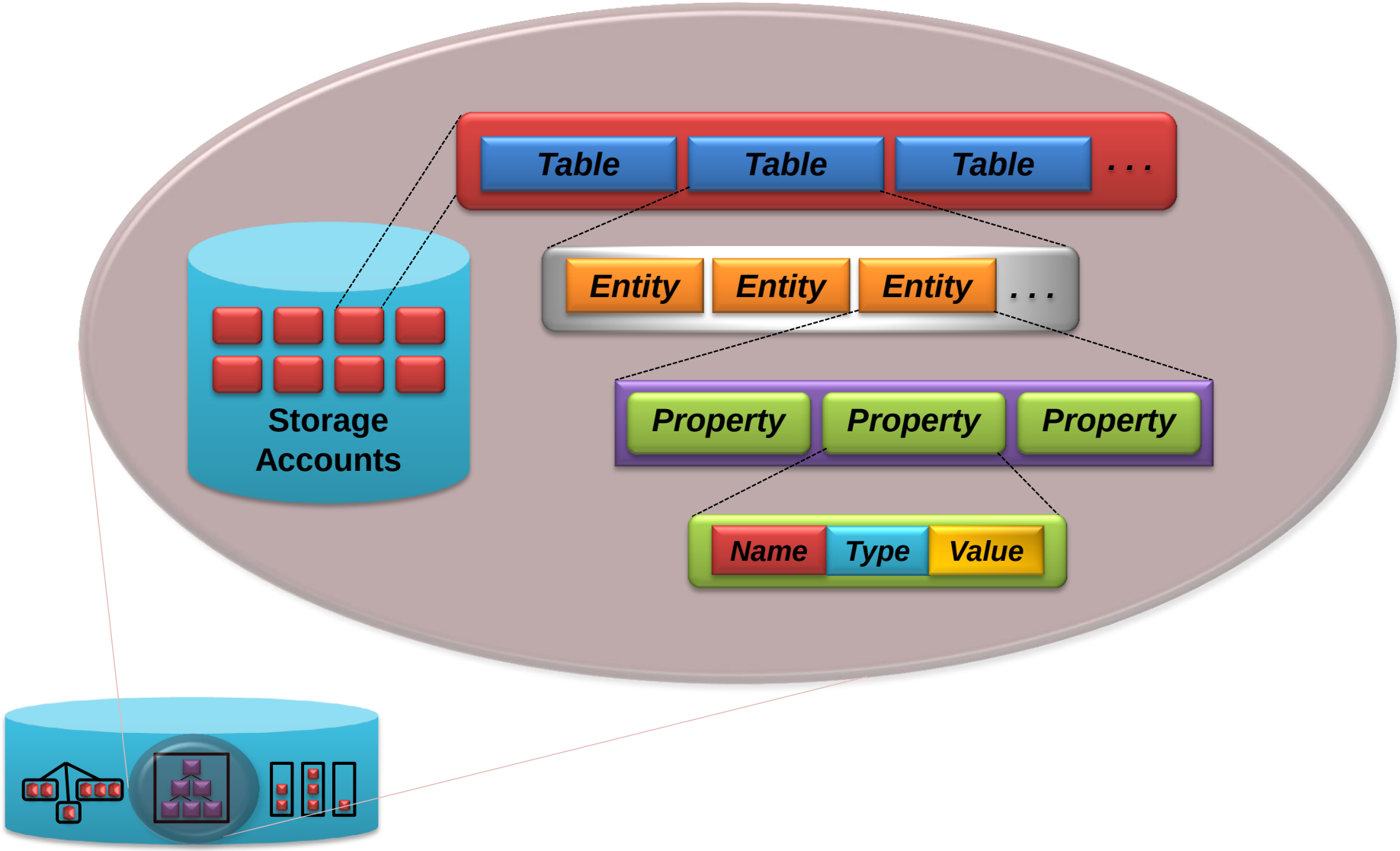
Windows Azure Storage Service
A closer look



Windows Azure Storage
Points of interest

- Storage types:
  - Blobs: a simple hierarchy of binary data
  - Tables: entity-based storage
    - Not relational tables
  - Queues: allow message-based communication
- Access:
  - Data is exposed via a RESTful interface
  - Data can be accessed by:
    - Windows Azure apps
    - Other on-premises or cloud apps

Windows Azure Storage
A closer look at tables



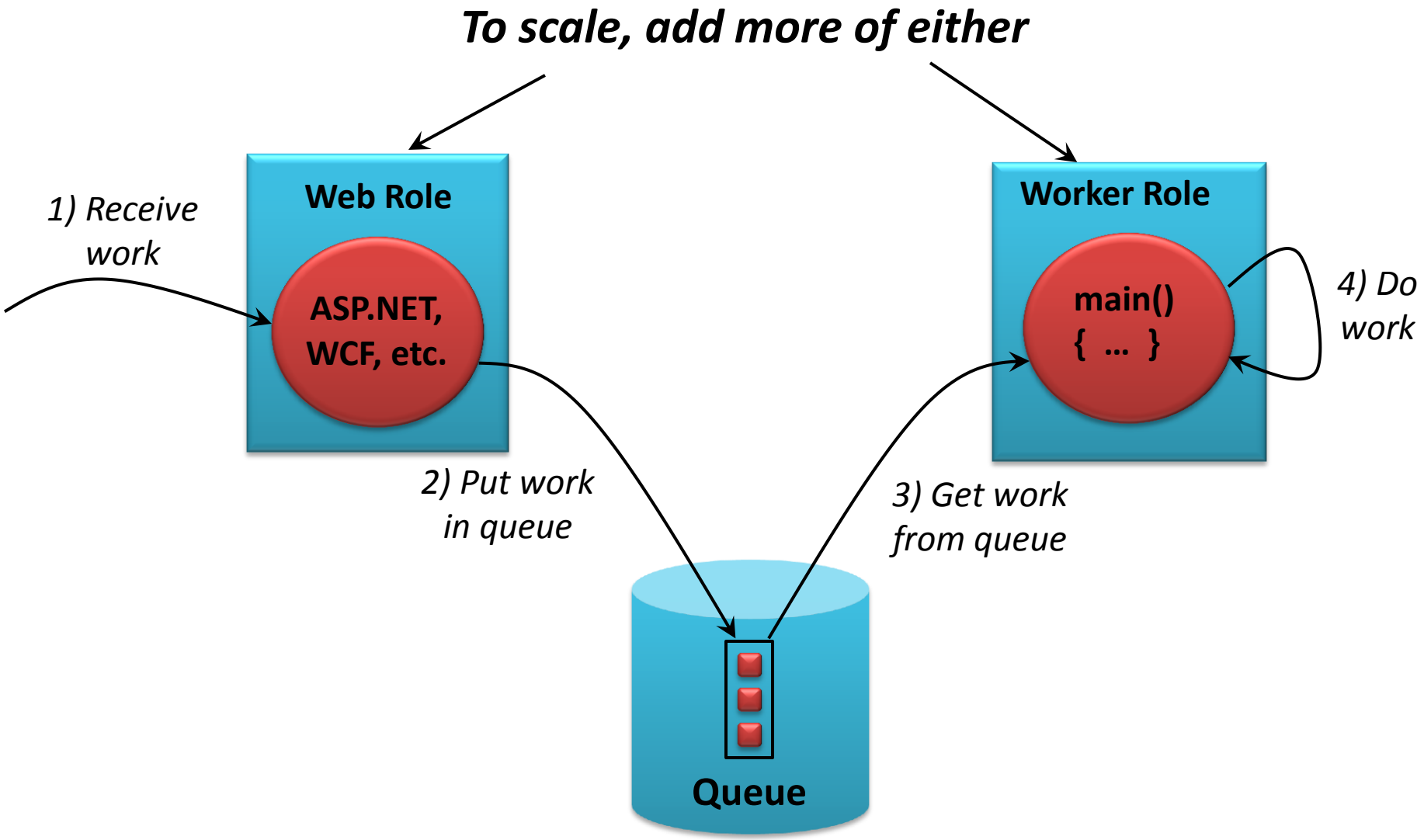
Windows Azure Storage
Tables: Challenges

- Access via REST
  - You can't use ordinary ADO.NET
- No SQL
  - A new approach for developers to learn
  - No aggregates
- An unfamiliar structure for data
  - You can't easily move relational data to or from it
  - Supporting services are scarce, e.g., reporting
- No schema
  - And no views

Windows Azure Storage
Tables: Strengths

- Massive scalability
  - By effectively allowing *scale-out* data
- Perspective:
  - Applied to the right problem, Windows Azure Tables are a beautiful thing
    - But they're not the optimal solution for a majority of data storage scenarios
  - Amazon, Google, and others provide similar storage mechanisms
    - It appears to be the state of the art for scale-out data

Using Queues
The suggested application model



SQL Azure

Extending SQL Server to the Cloud

SQL Azure Database

- Familiar SQL Server relational database model delivered as a service
  - Support for existing APIs & tools
  - Built for the cloud with high availability & fault tolerance
  - Easily provision and manage databases across multiple datacenters
- SQL Azure provides logical server
  - Gateway server that understands TDS protocol
  - Looks like SQL Server to TDS Client
  - Actual data stored on multiple backend data nodes
- Logical optimizations supported
  - Indexes, Query plans etc..
- Physical optimizations not supported
  - File Groups, Partitions etc…
- Transparently manages physical storage

Cloud Data Services

Current Capabilities

Database Service	• TSQL support • Tooling Support (SSMS, VS) • High Availability • Self-Management • Elastic Scale-out	• 50GB • Spatial Data • Local copy, backup/restore • QoS Enhancements • Developer & management experience improvements • Integrated developer portal • Database Manager	
Data Sync Service		**Data Sync Service (CTP)** • On premises/cloud spanning • Cloud-to-cloud sync	
BI Service		**Reporting as a Service (CTP)** • Reporting service CTP	
DataMarket	Microsoft® Codename "Dallas" "Dallas" CTP	**DataMarket General Availability** • New partners, new content • OData and VS support • Improved Marketplace	

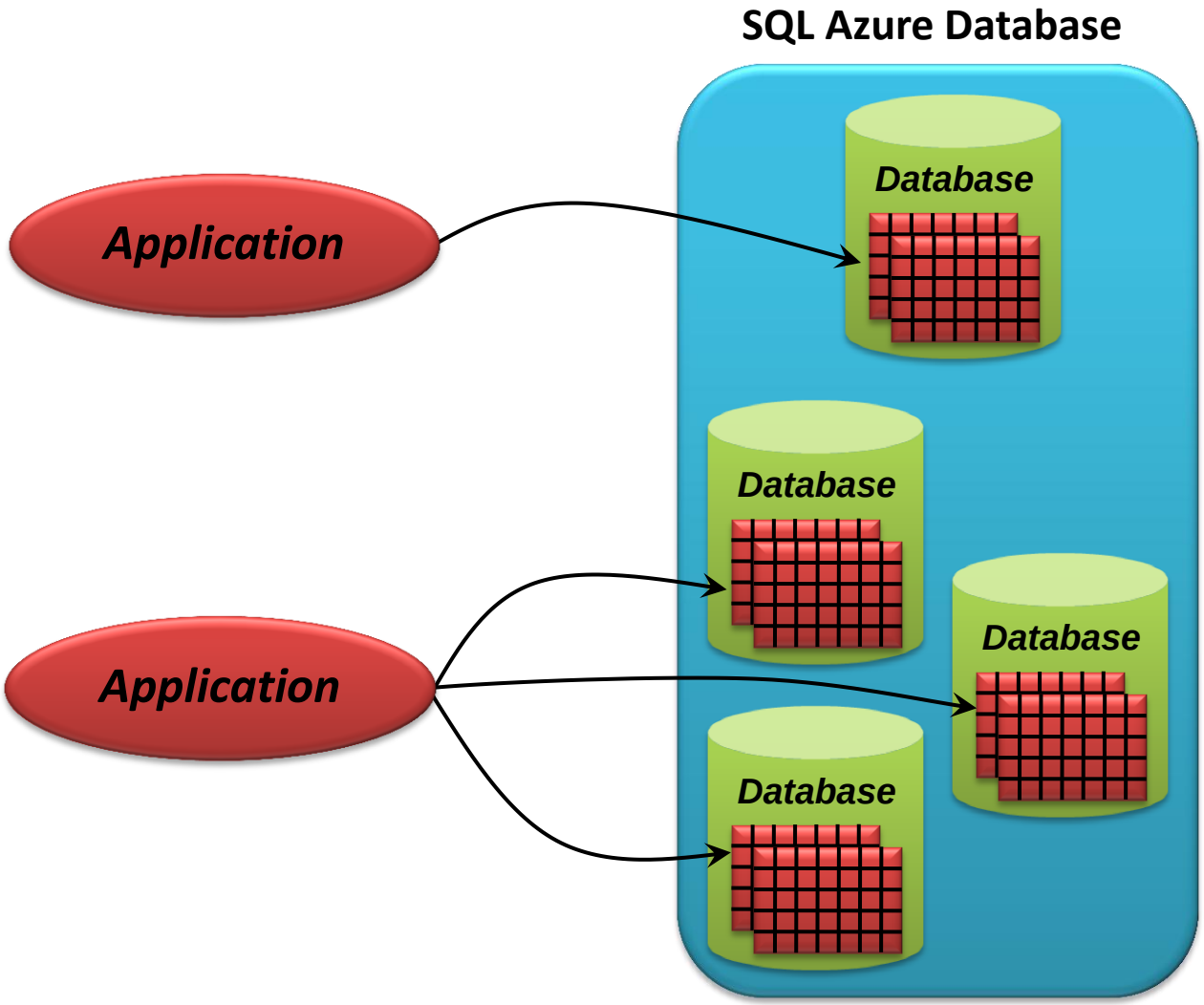
Launch-PDC09 **2010**

Reporting & Data Sync

- SQL Azure Reporting
  - SQL Server Reporting provided as a service
  - Reports authored using existing tools (BIDS) and uploaded to the cloud
  - Reports can have rich Data Visualizations (Maps, Charts, Tablix) and be exported to variety of rendering formats (Excel, Word, PDF)
  - Reports can be rendered as part of an app using the Report Viewer control
  - Directly view the reports in the browser
  - Web Service interface to render and manage reports

- SQL Azure Data Sync
  - CTP1 available now provides geo-replication
  - CTP2 available by the end of the year adds sync between SQL Server and
    SQL Azure
  - Builds on Sync Framework

SQL Azure Database
Using one or multiple databases



What we have heard..

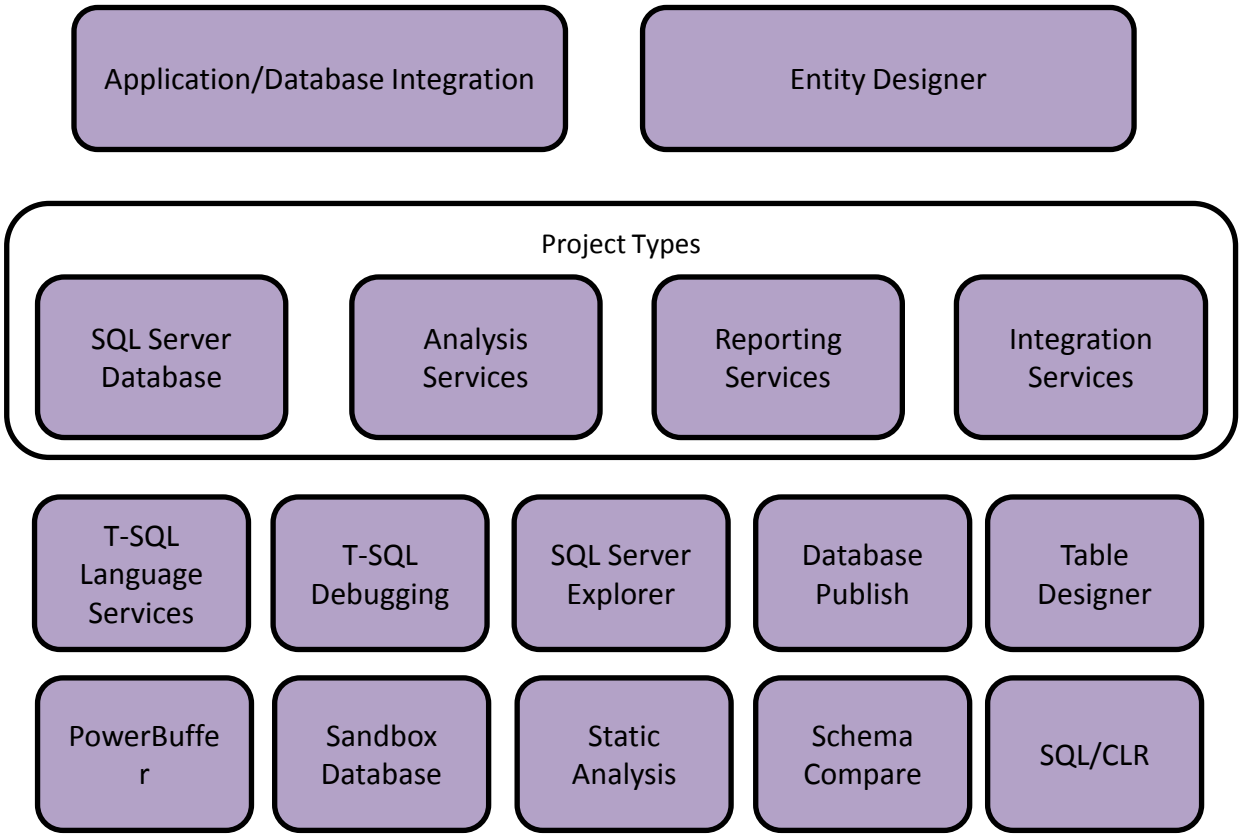
- “I want a local development environment for SQL Azure”
- “How can I be sure my database isn’t using features not yet supported?”
- “I want designer support!!!”

Introducing Code-Name “Juneau”

Codename “Juneau”

- High productivity development environment for SQL Azure, SQL Server and Business Intelligence
- Connected and offline database development
- Edition-aware development environment
- Integrated application/database development

Codename “Juneau”



Code-Name “Juneau”

- Tight integration of language services & engine
- Editor-driven debugging
- New table designer
- “Power Buffer”
- Visual control over schema changes
- Workflow-appropriate publication/deployment
- Cross-project dependencies and language services
- Deep EDM/Entity Framework integration
- Cross-language debugging

What we have heard…

- “I want Reporting Services in the cloud!!!”

Introducing SQL Azure Reporting

Extends Reporting to the Cloud

Microsoft SQL Azure

- Increased Developer Agility & Choice
- Extended Reach & Accessibility
- Elastic Scale & Reliability

Organizations can gain greater insight on their line of business data without having to worry about installing or maintaining a reporting infrastructure.

SQL Azure Reporting

Developer Agility & Choice

- Build reports using familiar design tools
- Publish reports to the cloud or embed directly within applications
- Use consistent API's to view, execute and manage reports

Extended Reach & Accessibility

- Secure and reliable access to reports
- Access reports within an application or via a web browser
- Render and export to the format desired

Elastic Scale & Reliability

- Off-premises reporting infrastructure lowers TCO
- Highly available Windows Azure environment
- Scales to meet the demands of the business as needed

SQL Azure Reporting Scenarios

- **Operational reports over SQL Azure data**
  Customers can report over their SQL Azure data, not necessarily with the intent to embed them into an application.

- **Embedding reports into my Windows or Azure application**
  Developers can use same patterns and tools they use today to embed reports into their applications in connected mode against Azure RS service.

What we have heard….

- “How do I store more than 50gb in a single database?”
- “How to I architect my application for high scale?”
- “How do I scale-out my database?”

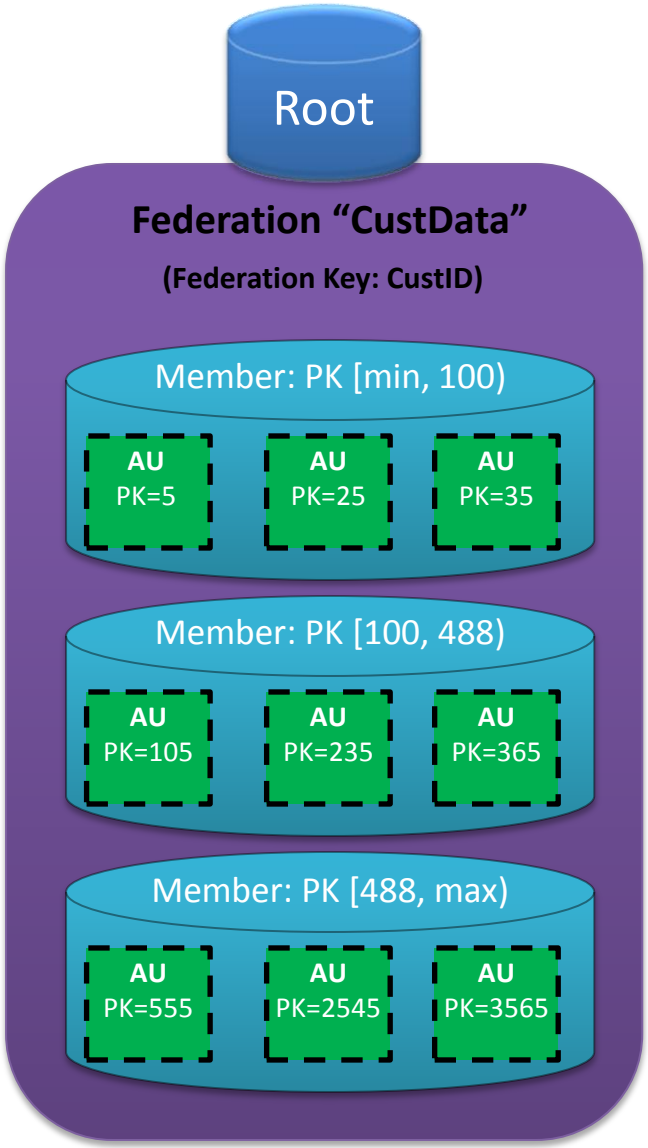
Introducing SQL Azure Federation Support

SQL Azure Federation

- Provides Scale-Out Support in SQL Azure
  - Partition data and load across **many** servers
  - Bring computational resources of **many** to bear
- Take advantage of elastic provisioning of databases
- Pay as you go benefits
- Zero physical administration
- Federation includes
  - Robust Connection Management
  - Online repartition operations
  - Split & Merge Databases

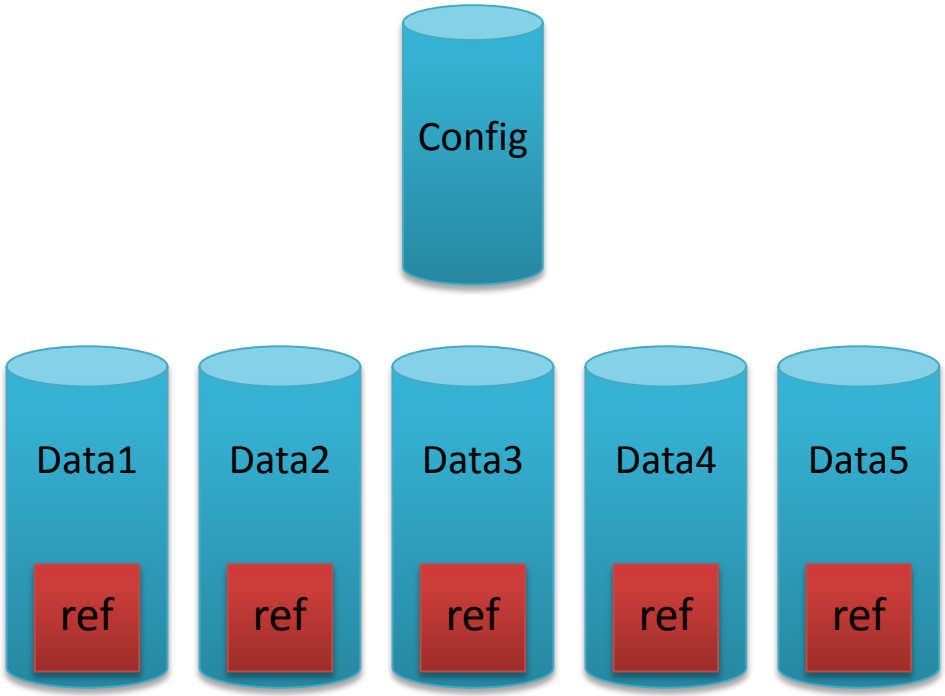
SQL Azure Federations: Concepts

- **Federation**
  - Represents the data being partitioned
- **Federation Key**
  - The value that determines the routing of a piece of data
- **Atomic Unit**
  - All rows with the same federation key value: always together!
- **Federation Member (aka Shard)**
  - A physical container for a range of atomic units
- **Federation Root**
  - The database that houses federation directory



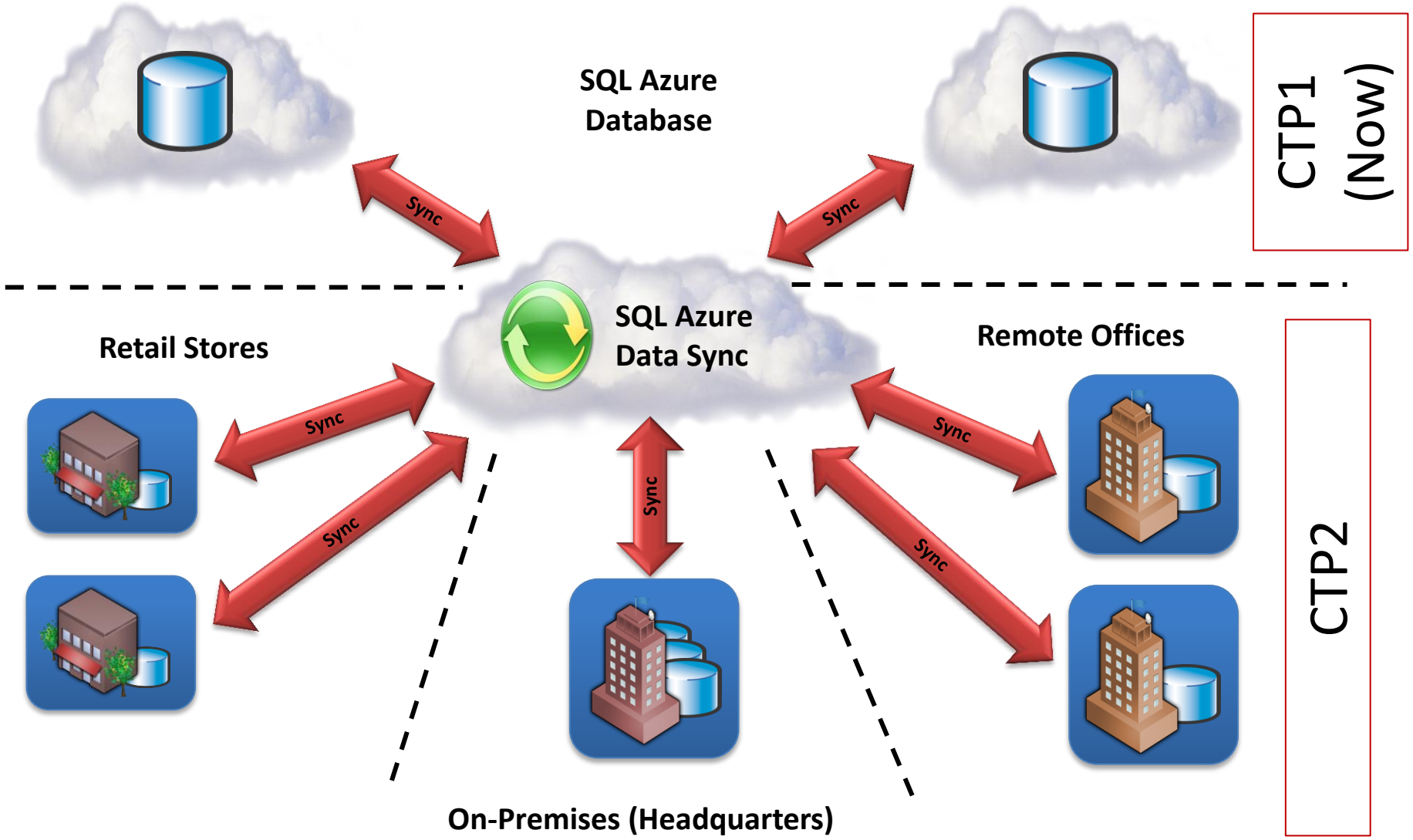
Distribution of Data: Concepts

- **Partitioned**
  - Spread across member machines
  - Each piece is on one machine (+HA)
  - Most of the data!
- **Centralized**
  - Only available in one place
  - Read and write, but not too much
- **Reference**
  - Copied to all member machines
  - Can be read anywhere (reference)
  - Should not be written to often



Introducing SQL Azure Data Sync

"Synchronization of SQL Server and SQL Azure Databases"



SQL Azure Data Sync – Key Features

- Elastic Scale
  - Service scales as resources requirements grow
- No-Code Sync Configuration
  - Easily define data to be synchronized
- Schedule Sync
  - Choose how often data is synchronized
- Conflict Handling
  - Handle issues where same data is changed in multiple locations
- Logging and Monitoring
  - Administration capabilities for tracking data and monitoring potential issues

Cloud Data Services

Current Capabilities & Future Investments

	Launch-PDC09	2010	Beyond
Database Service	• TSQL support • Tooling Support (SSMS, VS) • High Availability • Self-Management • Elastic Scale-out	• **50GB** • **Spatial Data** • Local copy, backup/restore • QoS Enhancements • Developer & management experience improvements • VS designers • Integrated developer portal • **Database Manager**	• Database Import/Export • Enhanced Backup/Restore Support • Scale Out & Elasticity Support via Federations • Enhanced multi-tenant support • Standards compliance • Resource reservation • Multi-tier SLA • JDBC Support
Data Sync Service		**Data Sync Service (CTP)** • On premises/cloud spanning • Cloud-to-cloud sync	**Data Sync Service** • On premises/cloud spanning, Cloud-to-cloud sync
BI Service		**Reporting as a Service (CTP)** • Reporting services CTP	**BI as a Service** • Reporting service • Analysis service
DataMarket	Microsoft® Codename "Dallas" "Dallas" CTP	**DataMarket General Availability** • New partners, new content • OData and VS support • Improved Marketplace	**DataMarket Futures** • World-wide Billing • Native integration in MS Products • Self Service Publication Experience

Windows Azure AppFabric

Building Block Services for connected applications

AppFabric Caching

Distributed, in-memory application cache for Windows Azure apps

Primary use cases

- Session state provider for Windows Azure applications
- Cache layer for Windows Azure applications that leverage storage in SQL Azure Databases or Windows Azure storage

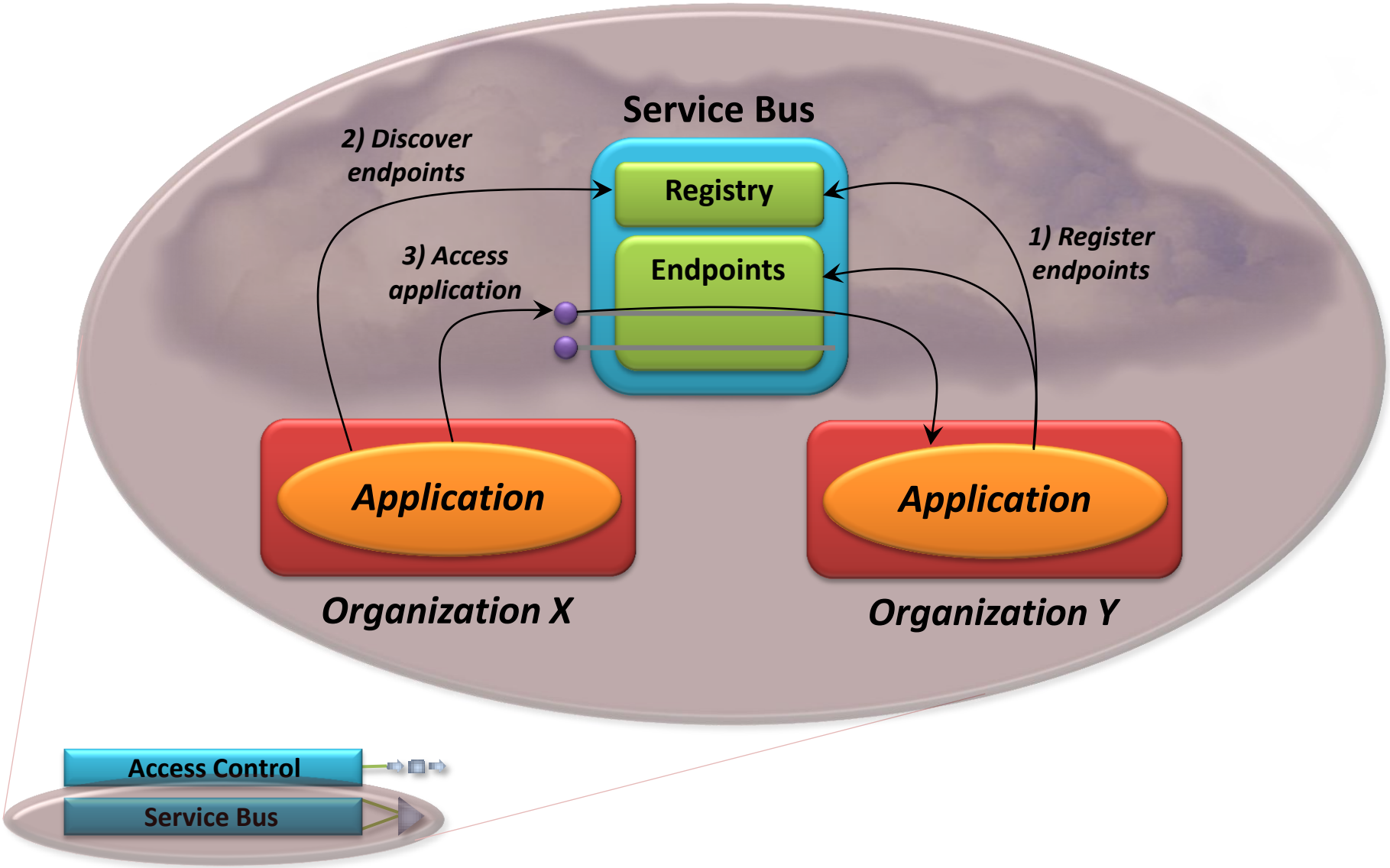
Provided as a service

- Provision, configure, and use
- No installation or management of machines/instances
- Dynamically increase and decrease cache size as needed
- Same programming model for both cloud and on-premises

Service Bus

- The problem: Exposing internal applications on the Internet isn't easy
  - Network address translation (NAT) and firewalls get in the way
- The solution:
  - Service Bus provides a cloud-based intermediary between clients and internal applications
    - Direct or queued
  - It also provides a service registry that clients can use to find the services they need

Illustrating Service Bus



AppFabric Composition Model

- .NET-based declarative model for composing applications for the Windows Azure platform
- Will enable you to define, deploy, and manage a cloud application as a single logical entity
- Rich designer experience in Visual Studio
- Runtime services in the cloud provide deployment & management of the application
- Layers on the Windows Azure Service Model

DistributedCloudApp1 - Microsoft Visual Studio (Administrator)

File Edit View Project Build Debug Team Data Tools Architecture Test Analyze Window Help

Debug | expertname

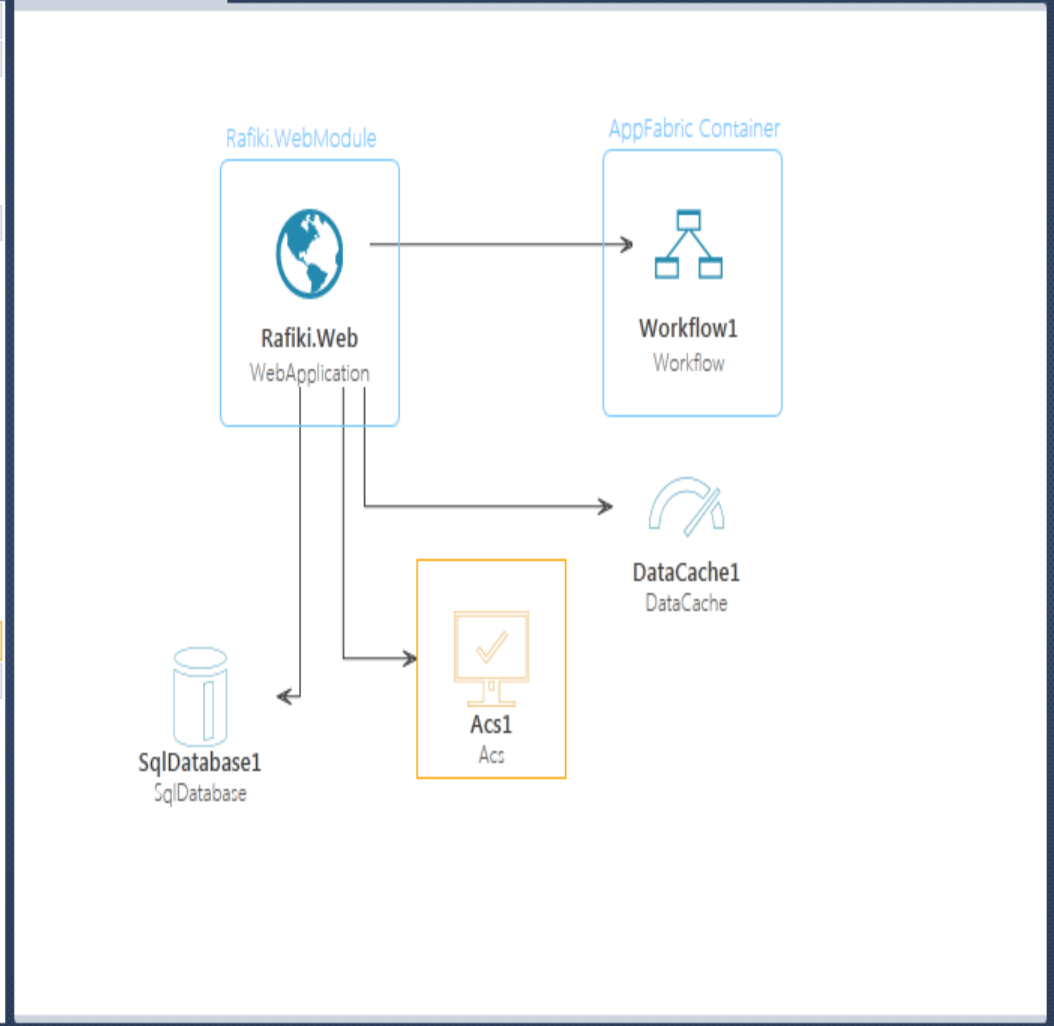
Publish: Rafiki Azure

Toolbox

- Composite Application Patterns
- Modules
  - Pointer
  - Web
  - AppFabric Container
- Services
  - Pointer
  - Database
  - Reporting
  - Data Sync
  - Access Control
  - Caching
  - Service Bus
  - WCF Service
  - ASP .NET Application
  - Workflow
- General

There are no usable controls in this group. Drag an item onto this text to add it to the toolbox.

application.manifest* | Start Page



Solution Explorer

- Rafiki.Web
  - Properties
  - References
  - Service References
  - Content
  - Controllers
  - Infrastructure
  - Models
  - Repositories
  - Views
  - Global.asax
  - Web.config
- Rafiki.WebModule
- SqlDatabase1
  - Properties
  - References
  - Data Generation Plans
  - Schema Comparisons
  - Schema Objects
  - Scripts
- Workflow1
  - Properties
  - References
  - Activity1.xaml

Schem... Solutio... Team E... Test Vi...

Properties

Error List | Output | Test Results | Find Results 1

Ready

12:23 PM
10/28/2010

http://compapp.appfabriclabs.com/#Applications/YAGXYMZHQP2UVOKQRWGLHXQWNI

Rafiki | AppFabric - Rafiki

Windows Azure Platform

Contoso | Sign Out

Location AppFabric › Rafiki ›

Actions

Summary

State	Started
Errors (24 hrs)	0

Application

Started	2
Stopped	0
Degraded	0
New	0

Services Consumed

Monitoring

Admin Log

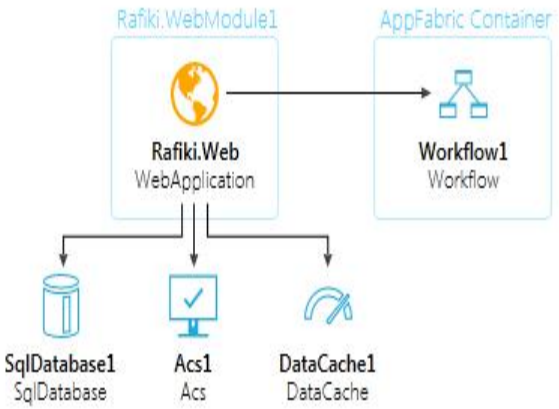
Application

This page gives you visibility into the composition of your application. It shows which components make up the application, what external functionality the application is using, and what functionality the application is exposing to the outside world.

Common Tasks

Stop Application

view **diagram** list



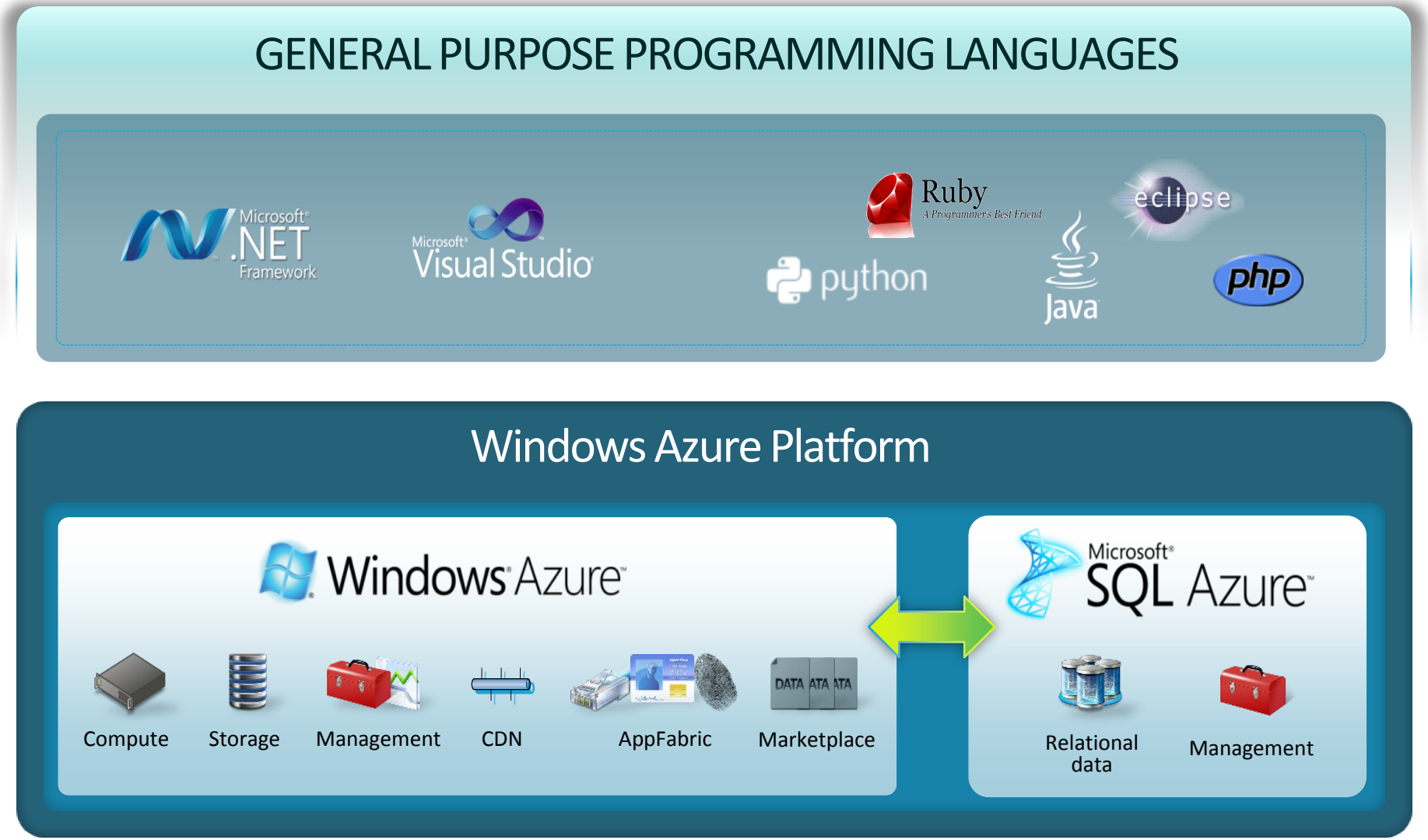
view last week day hour **5 minutes**

Metric Name Threshold Unit

Last Sync 10/28/2010 12:25:56 PM

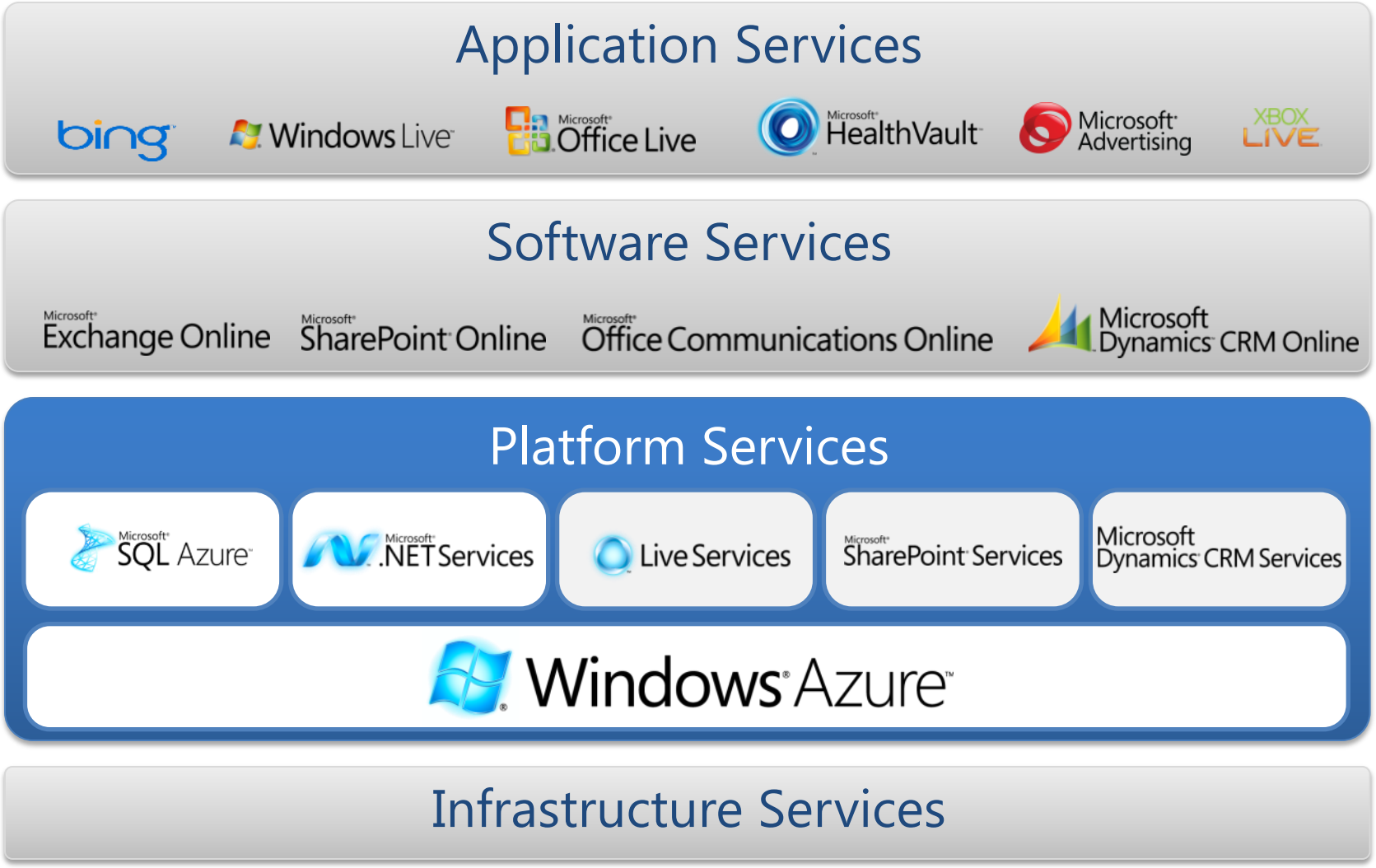
12:26 PM
10/28/2010

The Windows Azure Platform



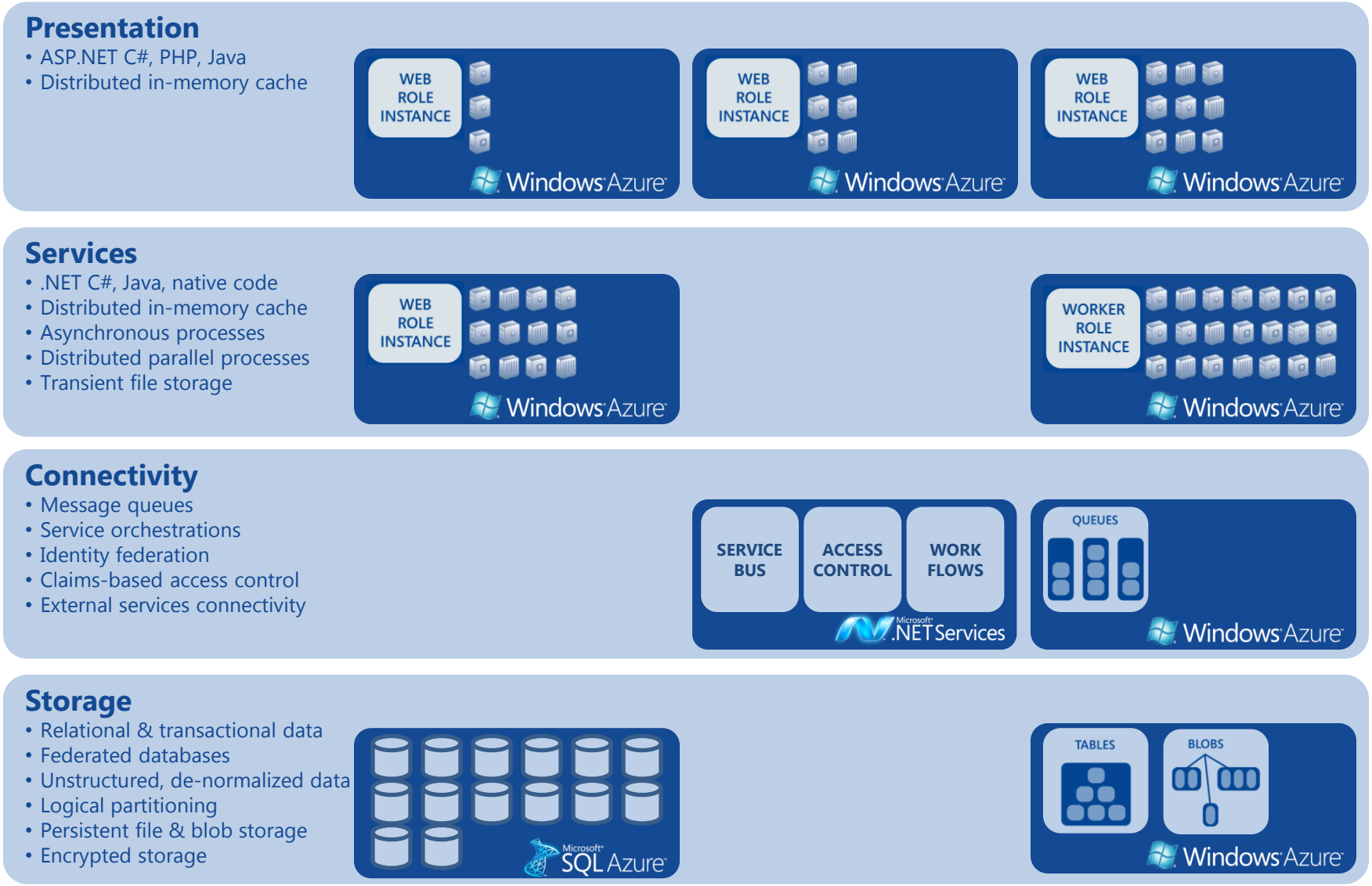
The Microsoft Cloud

Categories of Services



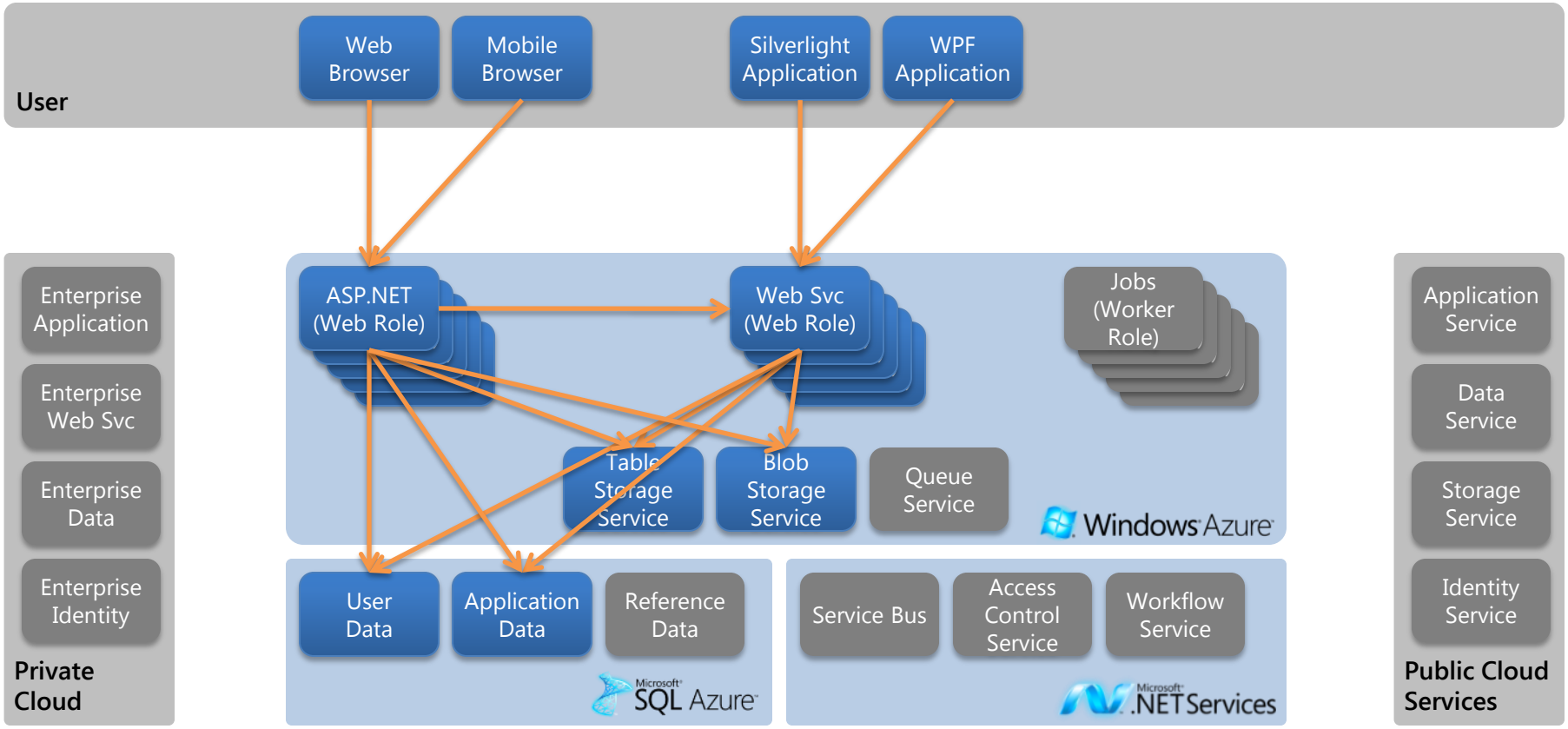
Application Patterns & Architecture

Internet-Scale Application Architecture



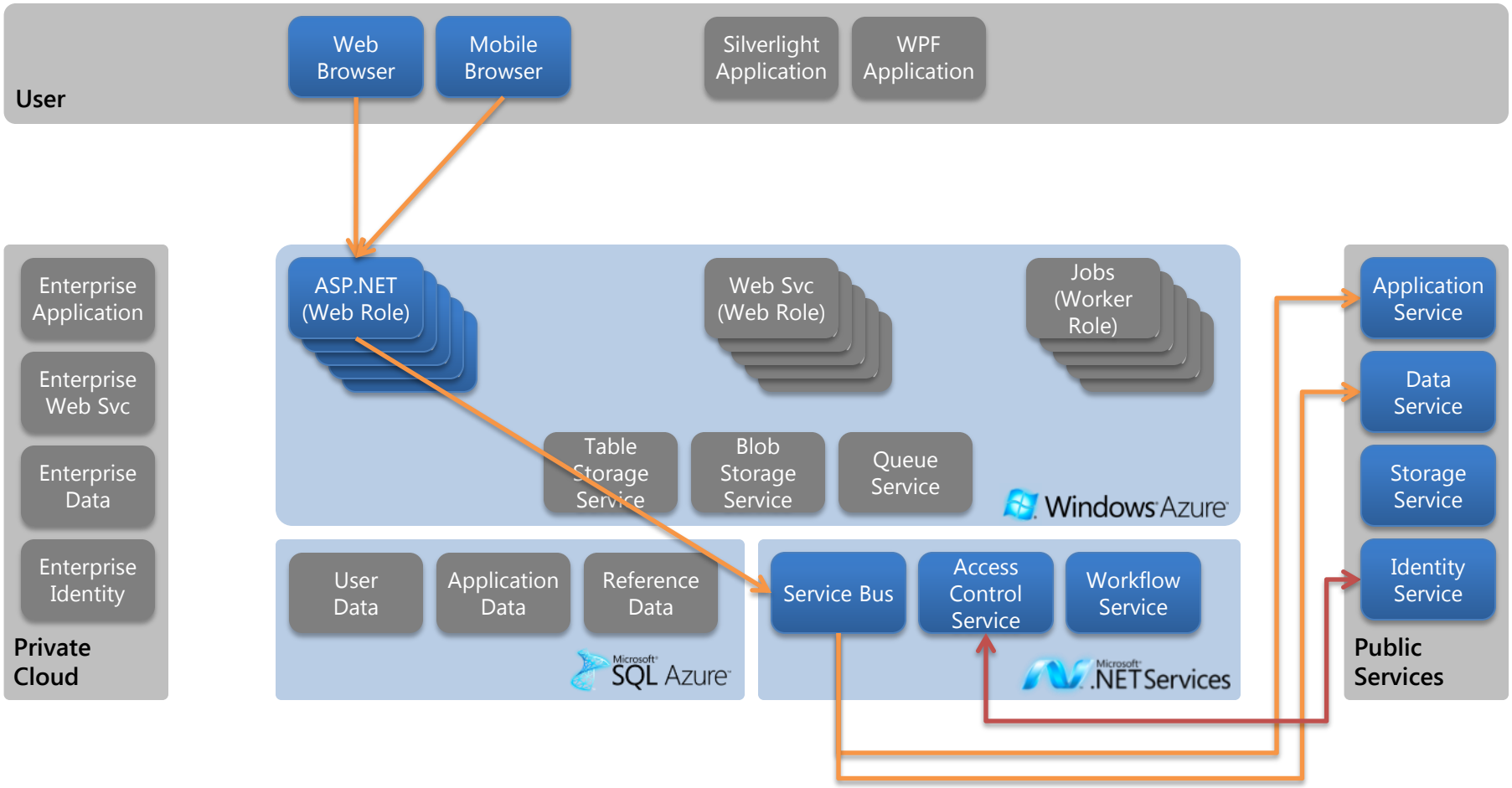
Application Patterns

Cloud Web Application



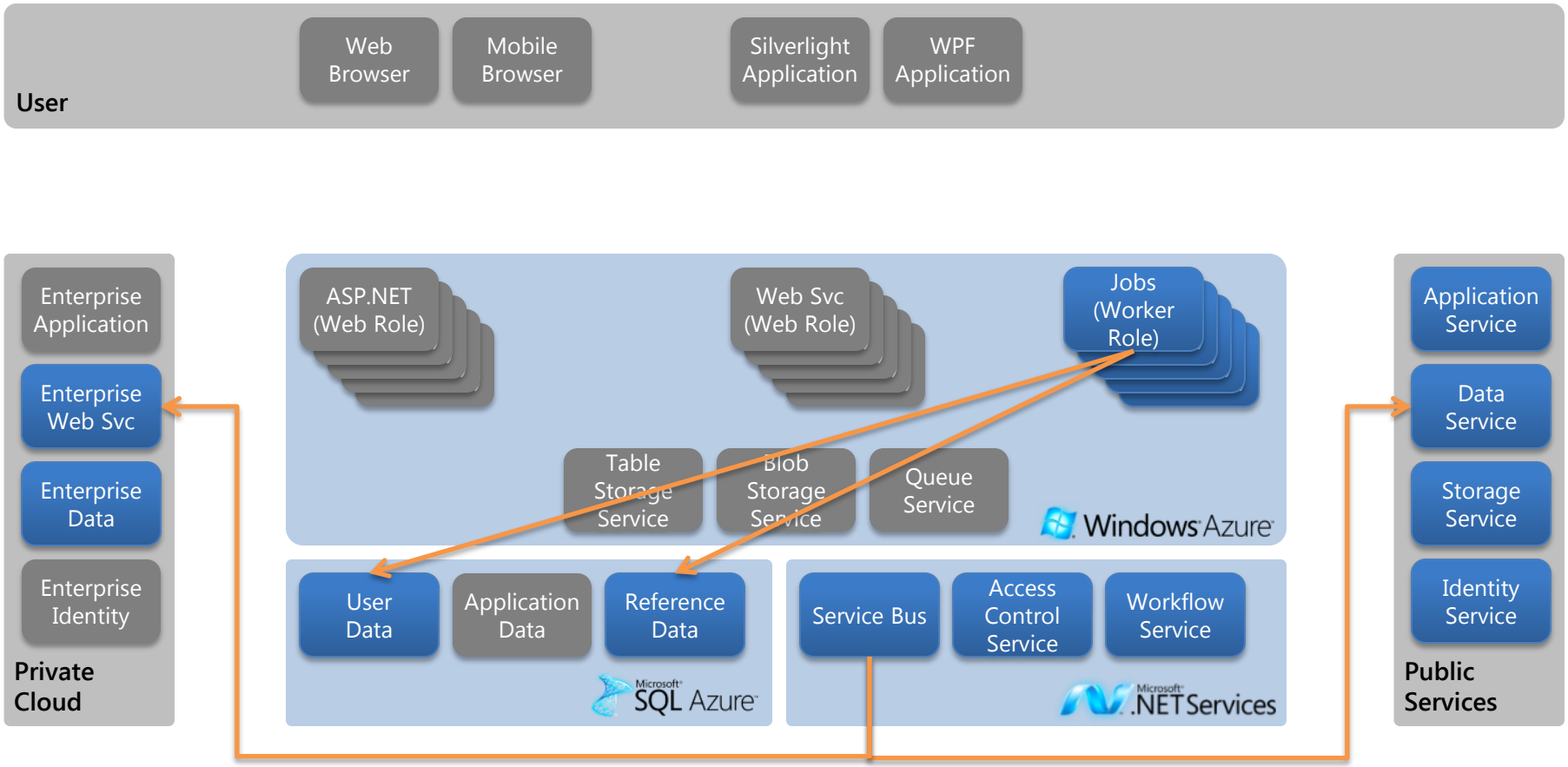
Application Patterns

Composite Services Application



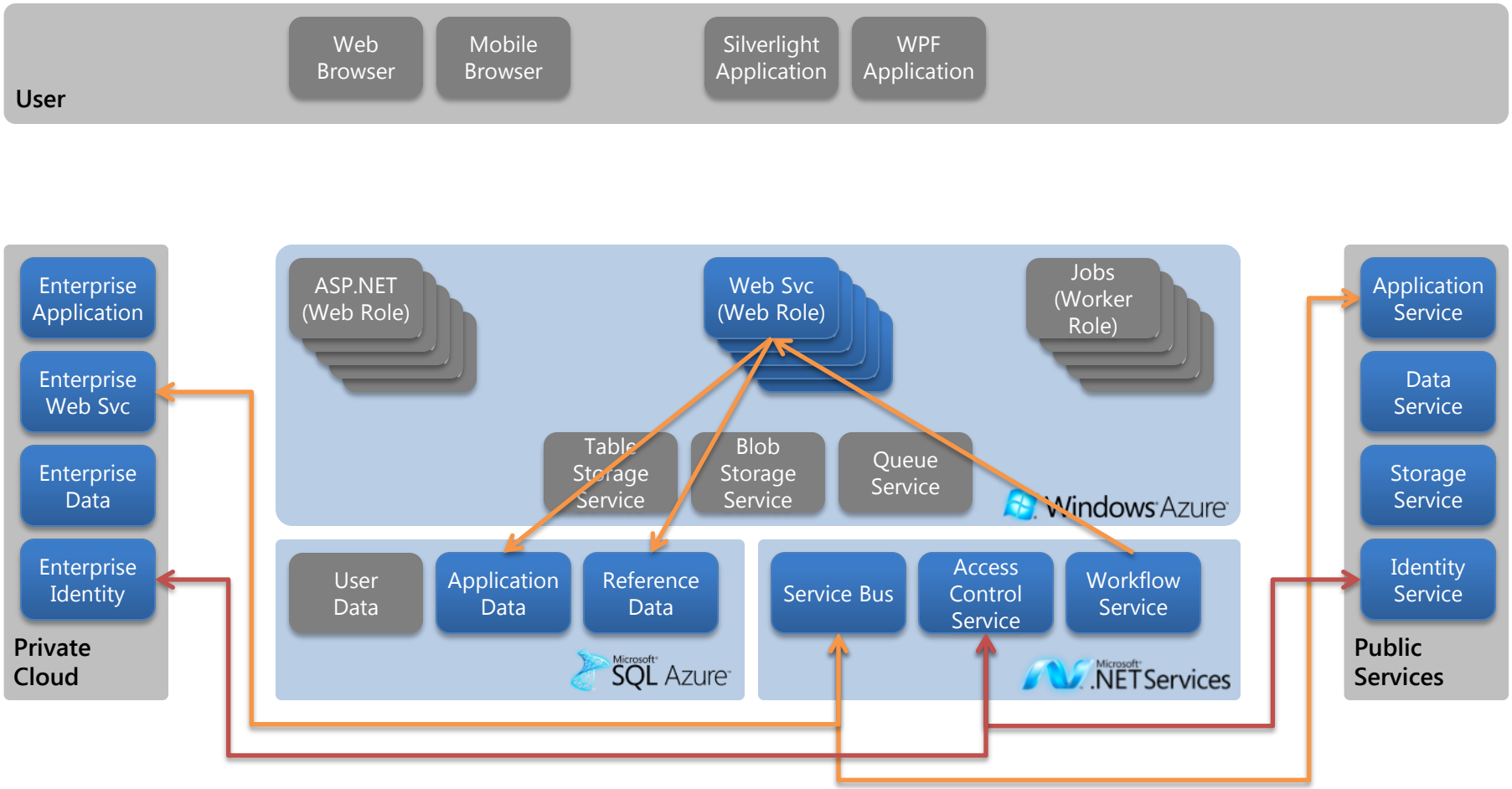
Application Patterns

Cloud Agent Application



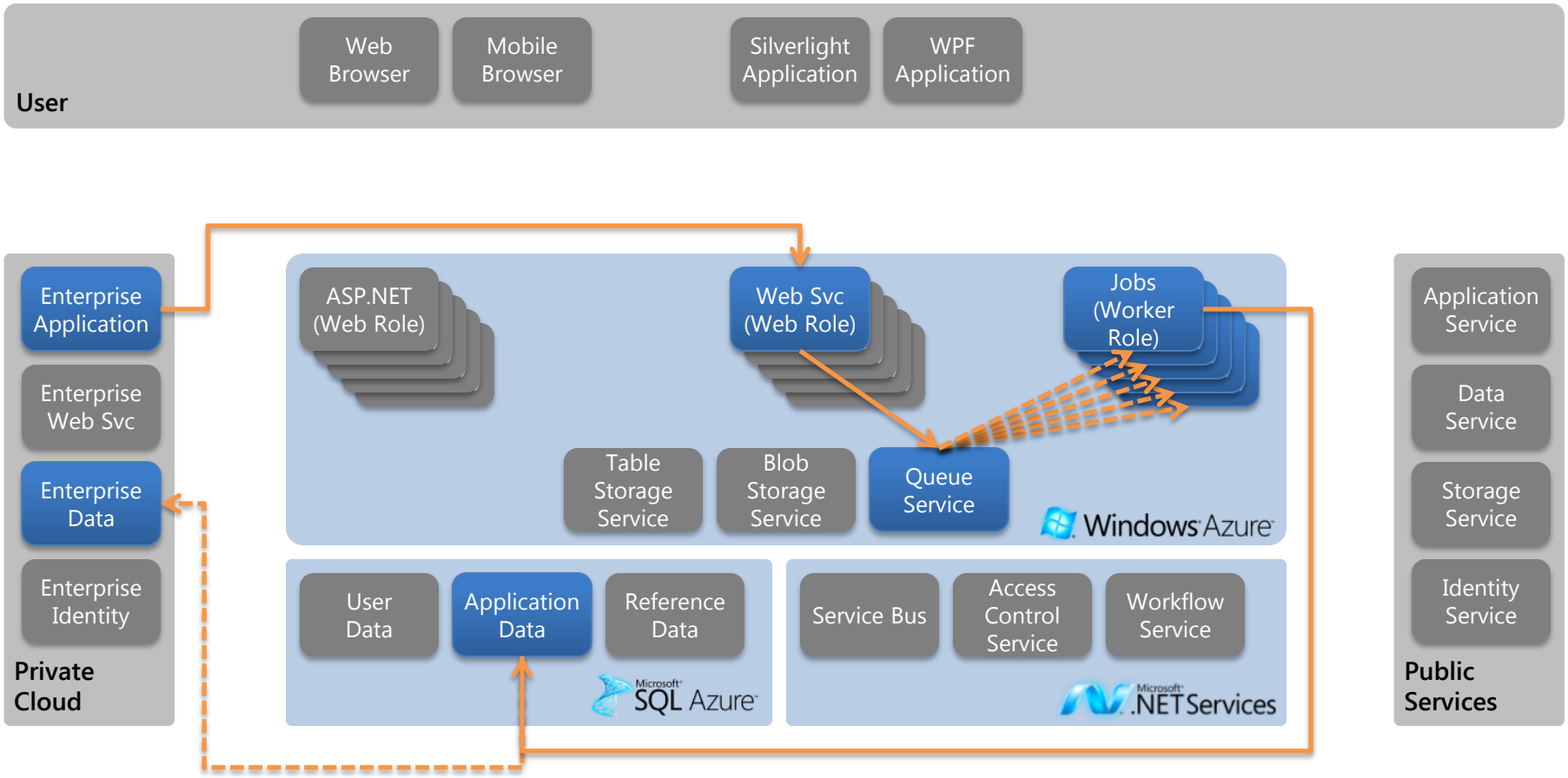
Application Patterns

B2B Integration Application



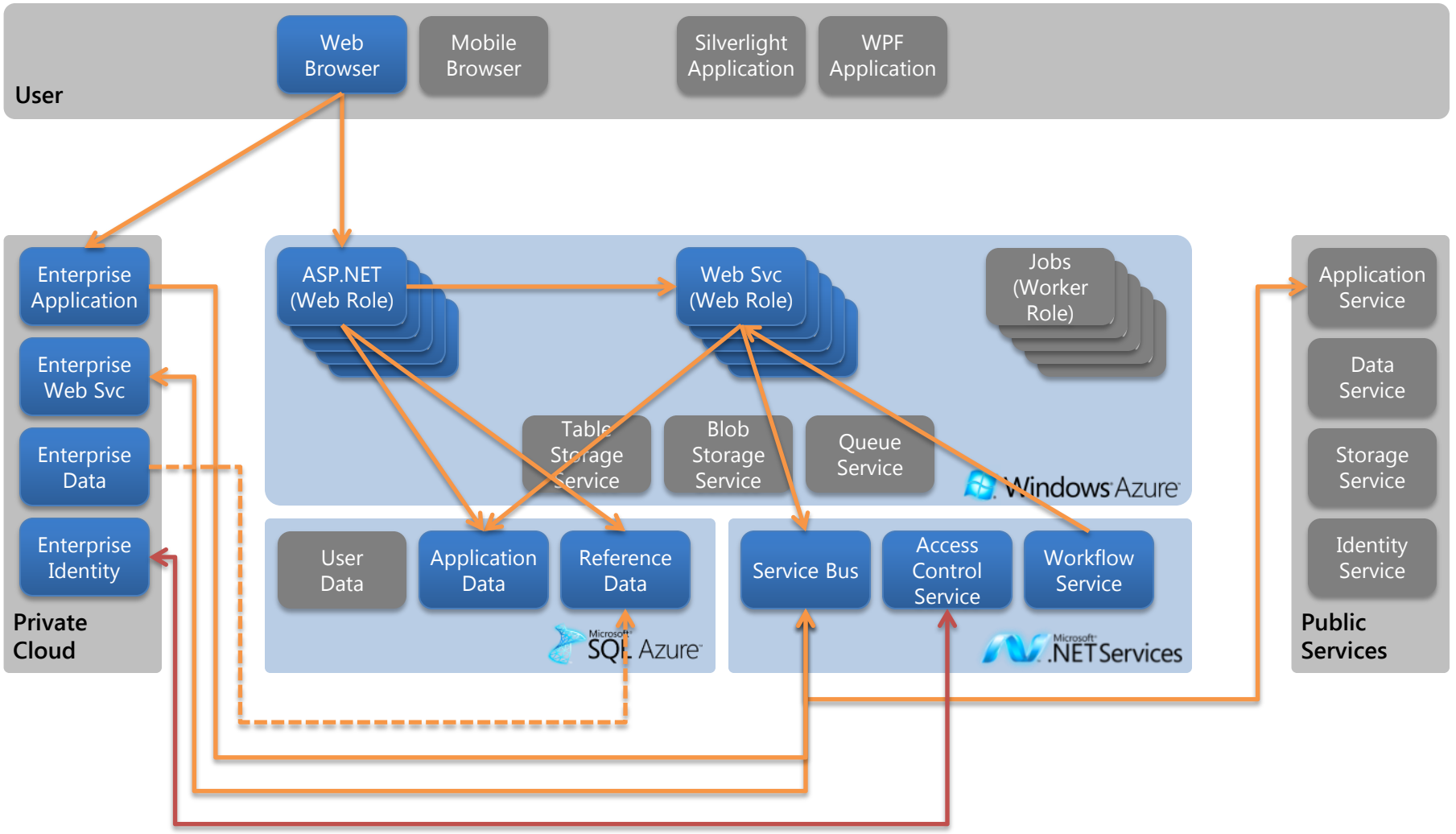
Application Patterns

Grid / Parallel Computing Application



Application Patterns

Hybrid Enterprise Application



Windows Azure Marketplace

Apps

- Find and publish applications and building block services for Windows Azure
- Directory available by the end of the year. Commerce capabilities coming in the future.

Data

- Information marketplace for discovering, purchasing, & selling data
- Data can be hosted in Windows Azure or by the data provider
- Data exposed as OData services
  - SDKs available for .NET, Silverlight, Javascript, iOS, Java, PHP, Ruby, etc.
  - Enables self-service BI within Excel
- Data providers include:
  - Data.gov, Navteq, Greg London, etc.
- Directory & Commerce available today

Windows Azure Platform International Availability

1. Australia
2. Austria
3. Belgium
4. Brazil
5. Canada
6. Chile
7. Colombia
8. Costa Rica
9. Czech Republic
10. Cyprus
11. Denmark
12. Finland
13. France
14. Germany
15. Greece
16. Hong Kong
17. Hungary
18. Ireland
19. Israel
20. India
21. Italy
22. Japan
23. Luxembourg
24. Malaysia
25. Mexico
26. Netherlands
27. New Zealand
28. Norway
29. Peru
30. Philippines
31. Poland
32. Portugal
33. Puerto Rico
34. Romania
35. Singapore
36. Spain
37. Sweden
38. Switzerland
39. Trinidad & Tobago
40. UK
41. USA

Windows Azure Platform Consumption Prices

Pay as you go and grow for only what you use when you use it

Windows Azure

Elastic, scalable, secure, and highly available automated service platform

Compute

Per service hour

$0.05-0.96/hour
+ Variable Instance Sizes

Storage

Per GB stored and transactions
$0.15 GB/month
$0.01/10k transactions

Microsoft SQL Azure

Highly available, scalable, and self managed distributed database service

Web Edition

Per database/month

$9.99/month
(up to 1 GB DB/month)

Business Edition

Per database/month

Starting at $99.99/month
(10-50 GB DB/month)

Windows Azure AppFabric Service Bus and Access Control Service

Scalable, automated, highly available services for secure connectivity

Access Control

Per Message Operation

$1.99/10k transactions

Service Bus

Per Message Operation

$3.99/month per connection

Prices shown in USD only

International prices are available

Windows Azure Instance Sizes

Variable instance sizes to handle complex workloads of any size

Extra Small	Small	Medium	Large	X-Large
$0.05	**$0.12**	**$0.24**	**$0.48**	**$0.96**
Per service hour	**Per service hour**	**Per service hour**	**Per service hour**	**Per service hour**

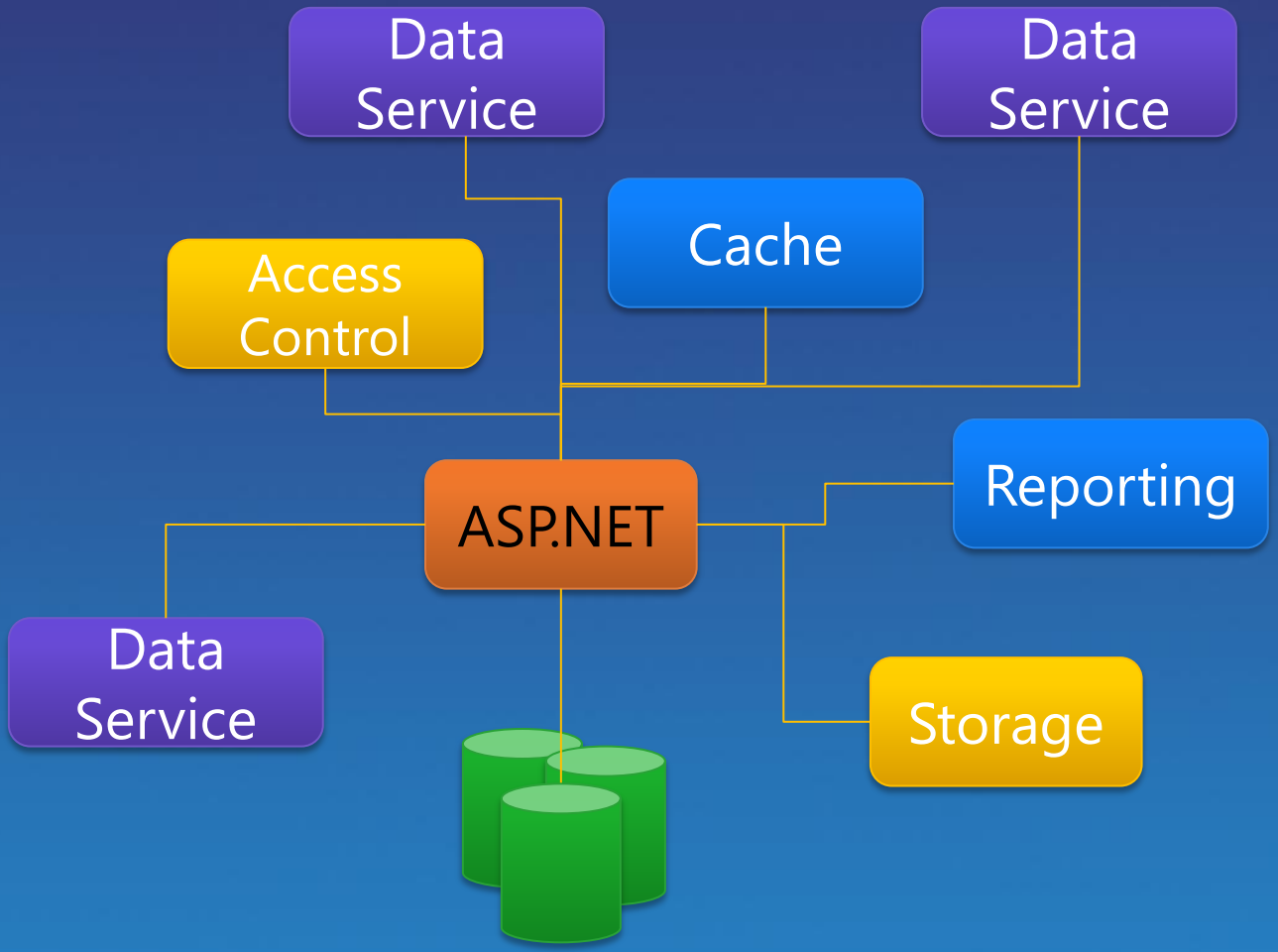
Unit of Compute Defined

Extra Small	Small	Medium	Large	X-Large
1 x 1.0Ghz	**1 x 1.6Ghz**	**2 x 1.6Ghz**	**4 x 1.6Ghz**	**8 x 1.6Ghz**
(low IO)	**(moderate IO)**	**(high IO)**	**(high IO)**	**(high IO)**
768 MB memory	**1.75 GB memory**	**3.5 GB memory**	**7.0 GB memory**	**14 GB memory**
20 GB storage (instance storage)	**250 GB storage** (instance storage)	**500 GB storage** (instance storage)	**1000 GB storage** (instance storage)	**2000 GB** (instance storage)

Windows Azure Platform Appliance

- Windows Azure Platform in your datacenter
  - Designed for unlimited scale & multi-tenancy
  - Identical to the hardware in Microsoft's datacenters
  - Delivered by a choice of hardware partners
- Benefits
  - Platform as a Service
  - Physical Control
  - Geographic Proximity
  - Regulatory Compliance
  - Data Sovereignty
- Currently in development with several partners
  - Fujitsu, Dell, HP, and eBay

New Applications - New Challenges



Roadmap

Q4 2010

- Windows Azure
  - Elevated Privileges
  - Extra Small Instance Beta
  - Marketplace (App Beta; DataMarket GA)
  - Virtual Network CTP
  - VM Role Beta
- Windows Azure AppFabric
  - Caching CTP
  - Service Bus CTP
- Server Application Virtualization CTP
- SQL Azure
  - Database Manager GA
  - Data Sync CTP
  - Reporting CTP

H1 2011

- Windows Azure VM Role GA
- Windows Azure AppFabric
  - Access Control Enhancements GA
  - Caching GA
  - Composition Model & Comp App Service CTP
  - Service Bus Enhancements GA
- SQL Azure
  - Data Sync GA
  - Reporting GA

H2 2011

- Server Application Virtualization GA
- Windows Azure
  - CDN Enhancements
  - VM Role Enhancements

Case Studies

Case Study

Background

- Web-based ERP and accounting software to help mid-sized businesses automate customized business processes
- Business needs:
  - Launch a SaaS offering which includes on demand infrastructure and billing
  - Maintain a 24/7 production environment
  - Minimize development efforts for both on-premise and SaaS offerings
- Technical implementation
  - Web – IIS 7, ASP.NET 3.5
  - Server – SQL Server 2005/2008, Windows Server 2003/2008
  - Tools – Visual Studio 2008, .NET Framework 3.5

Solution

- Cloud-based SaaS deployment
- Windows Azure
- SQL Azure

Benefits

- Application migration completed in 3 weeks with 2 developers
- Customers can implement solution without investing in on-premise infrastructure; can save ~$8,000 for startup costs
- Lowered capital expenditures
- Improved time-to-market and agility in meeting customer needs
- More strategic use of IT resources

Case Study

eduify | write faster BETA

Background

- Online service providing productivity tools to help students conduct research, write better papers, and get help on-demand
- Technical implementation
  - Client – Windows Mobile 6
  - Web – IIS 6, ASP.NET 3.5
  - Server – Windows Server 2003, SQL Server 2005
  - Services – Bing Search, Windows Live Messenger Web Toolkit
  - Tools – Visual Studio 2008, .NET Framework 3.5, .NET Compact Framework 3.5

Solution

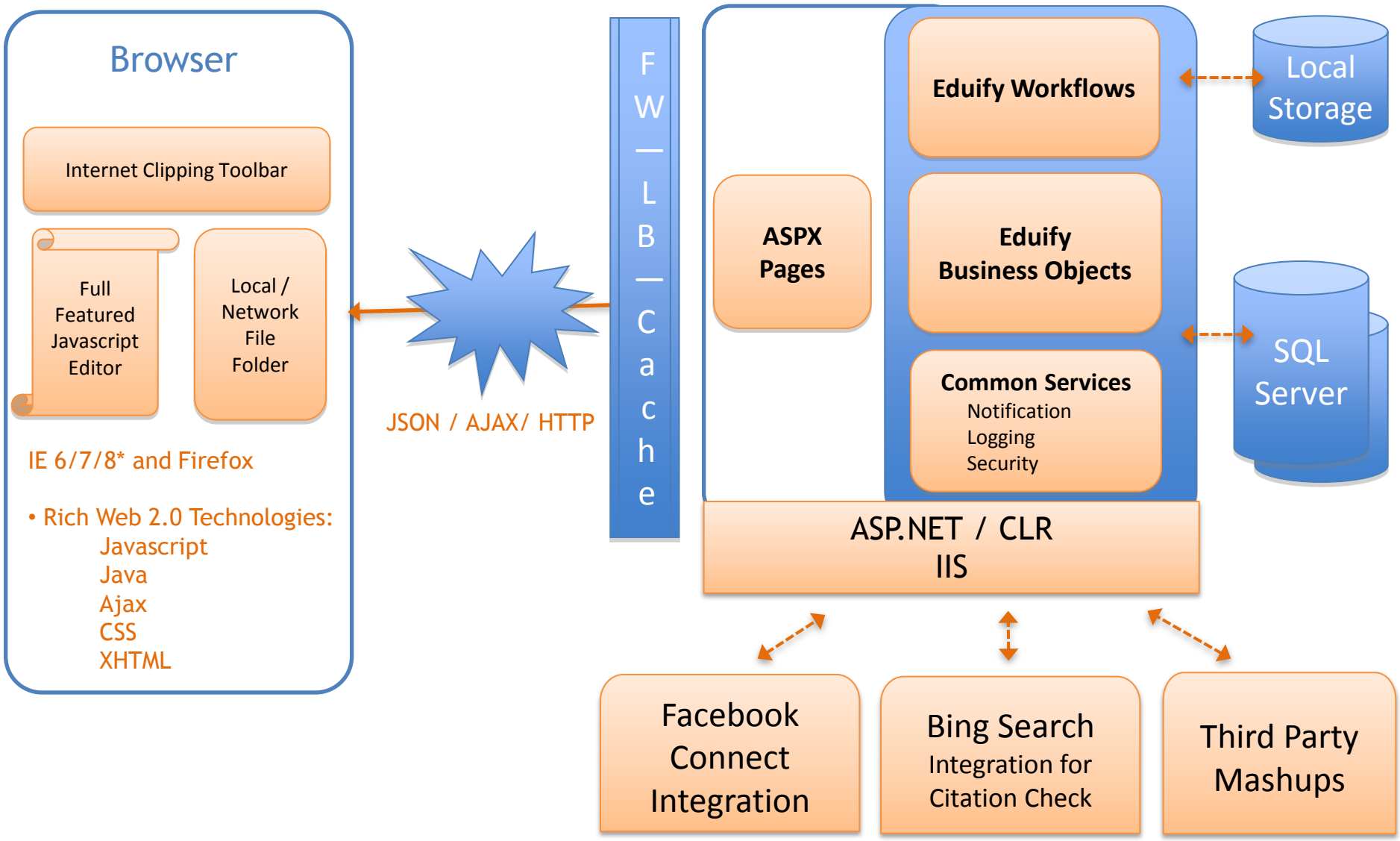
- Hybrid cloud application
- Cloud-based extensions and services mash-ups with on-premise implementation
- Windows Azure application
- .NET Services service bus, access control, & workflows

Benefits

- $500,000 savings in dev. costs
- 40% faster time-to-market
- More effective development
- Cost-effective scalability and enhanced availability

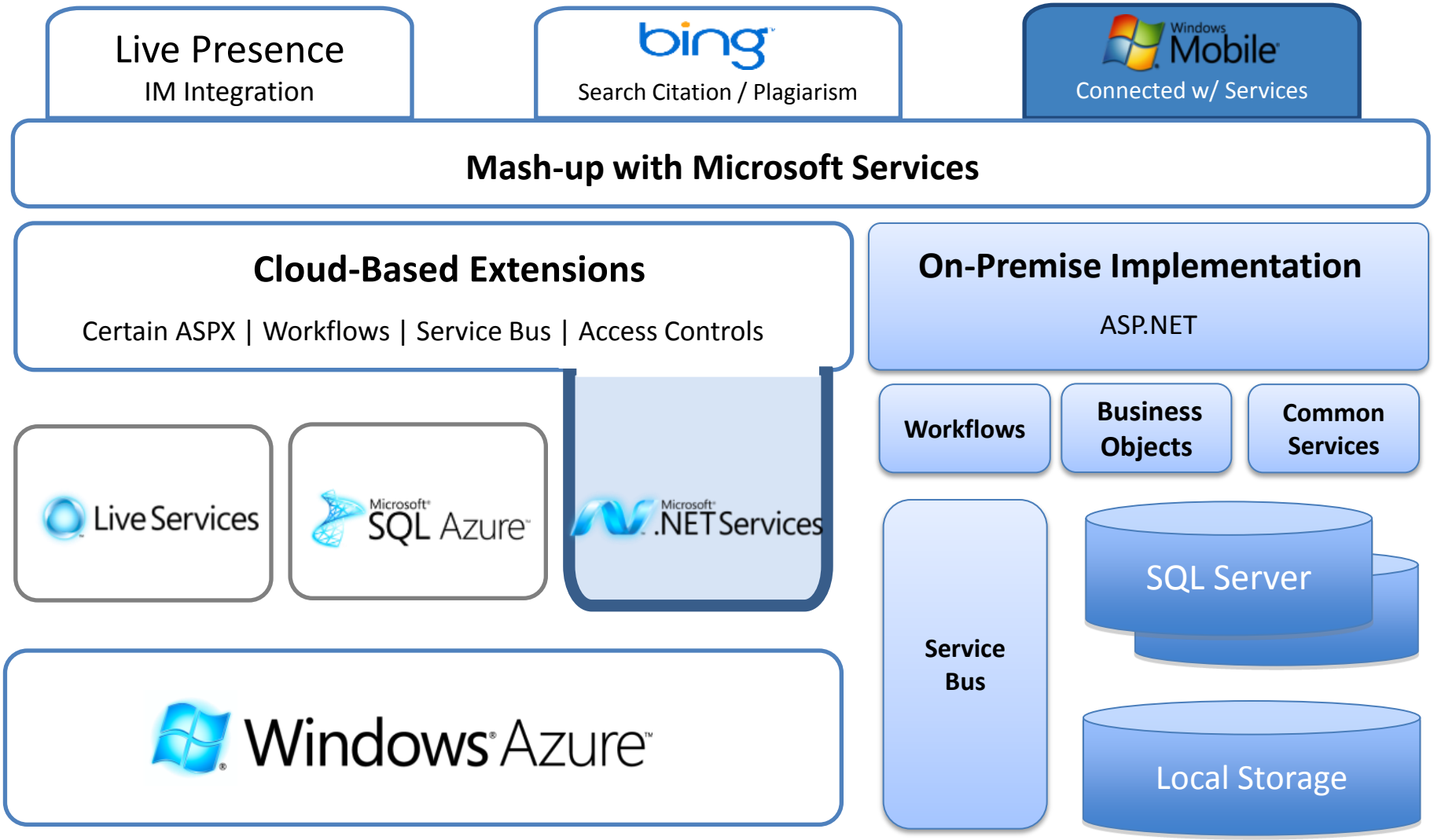
Case Study

eduify | write faster BETA



Case Study

eduify | write faster BETA

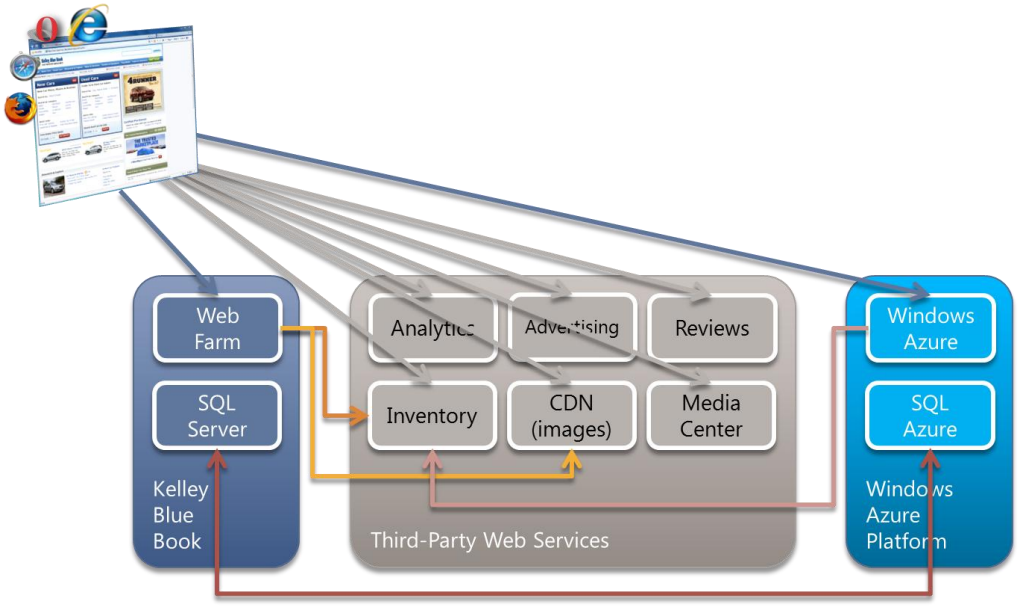


Case Study

Kelley Blue Book
THE TRUSTED RESOURCE

About

- kbb.com, established 1995; vehicle data aggregation and publication service provider
- 14M UU/month
- Multiple physical data centers



Solution

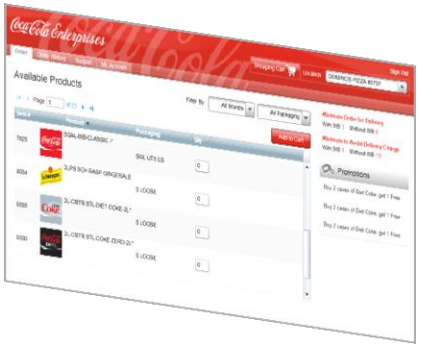
- Cloud-based overflow capacity
- Windows Azure Web Role
- SQL Azure database

Benefits

- ~$100,000 savings / year in hosting costs alone
- Retire failover data center (27 Web servers & 9 SQL Servers)
- <1% code changes needed for application compatibility
- 6 weeks down to 6 minutes to add server capacity

Case Study

Coca-Cola Enterprises Inc.

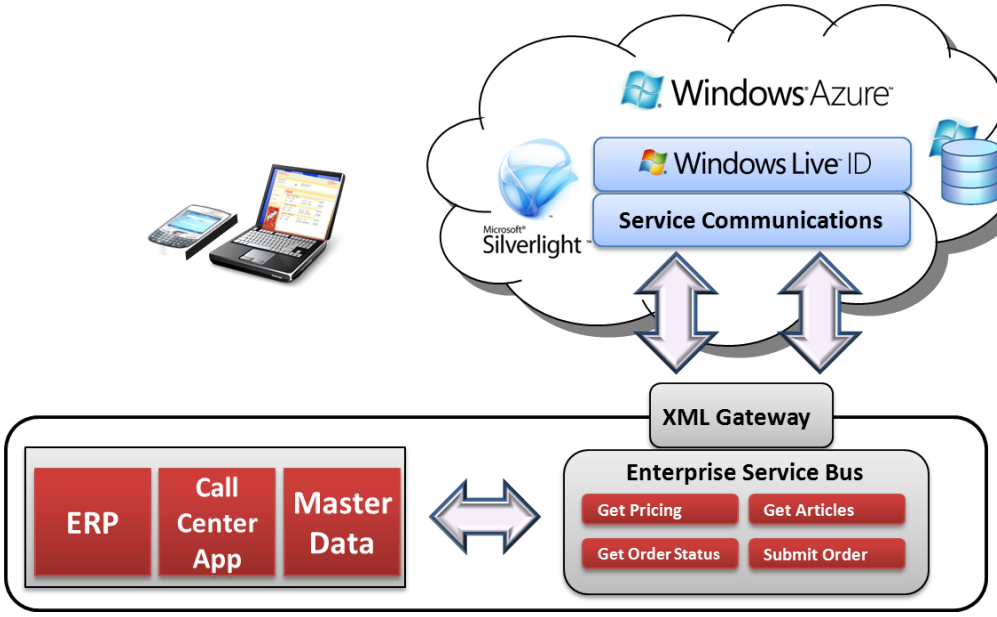


About

- Legacy call-center application for order processing and fulfillment
- On-premise systems integration with ERP and master data management

Solution

- Cloud-based Web-enablement of on-premise assets
- Windows Azure Web Role
- Web services integration via on-premise ESB endpoints



Benefits

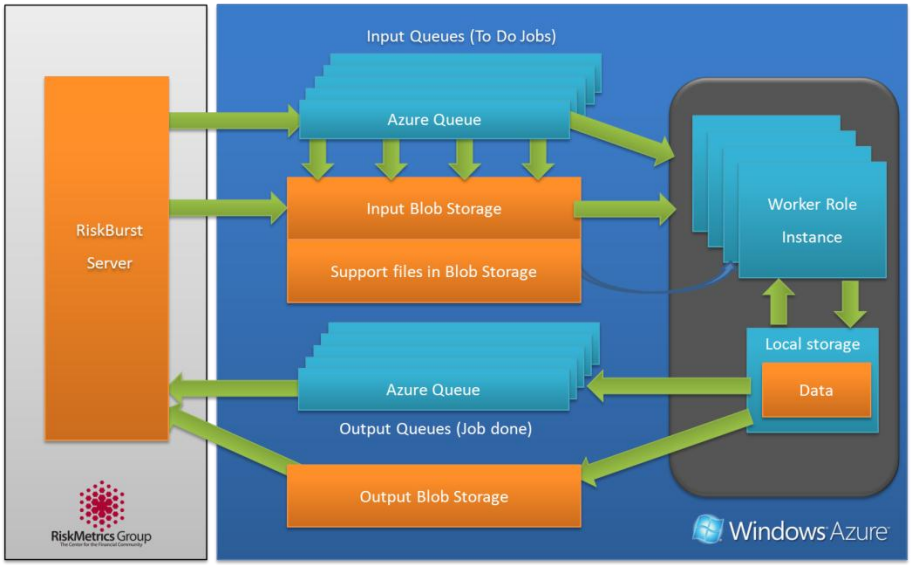
- "In a matter of weeks, we were able to see the fruits of our efforts very rapidly." – Kevin Flowers, Dir. Enabling Technologies
- "The resilience and reliability of this platform is some of the benefits that we are seeing." – Esat Sezer, SVP & CIO

Case Study

RiskMetrics Group

About

- Complex Monte Carlo simulations to calculate financial risks
- Daily risk analysis load equivalent to processing 4 trillion US Stocks
- Existing on-premise HPC implementation



Solution

- Massively scalable compute leveraging cloud capacity
- Deployed on 2K Windows Azure instances; 10K+ in 2010
- Windows Azure Worker Role
- Windows Azure Blob and Queue
- AppFabric Service Bus

Benefits

- Elastic scaling to effectively meet customer demands
- Turning elements of its peak load infrastructure from a fixed cost to a variable cost

Platform of Choice

bing
Microsoft Tag
Windows Live
Microsoft Exchange Hosted Services
Microsoft HealthVault
Microsoft Office Live
Microsoft Exchange Online
Microsoft Advertising
Microsoft SharePoint Online
Microsoft adCenter
Microsoft Dynamics CRM Online
XBOX LIVE
XBOX 360
Microsoft Mediaroom
Microsoft Silverlight
Windows
Office Microsoft
Windows phone
Windows Azure
Microsoft SQL Azure
Microsoft .NET Services
Live Services
Microsoft SharePoint Services
Microsoft Dynamics CRM Services
Live Mesh
Microsoft Surface
zune
Microsoft Dynamics
Windows Server
Microsoft Exchange Server
Microsoft SharePoint Server
Microsoft SharePoint Foundation
Microsoft SQL Server
Microsoft Groove Server
fast
Microsoft BizTalk Server
Microsoft Forefront
Microsoft Speech Server
Microsoft System Center
Microsoft Host Integration Server
Microsoft Robotics Developer Studio
xna
Microsoft Visual Studio
Microsoft Expression Studio
Microsoft .NET

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krishna.kumar@microsoft.com
http://azurepilot.com