

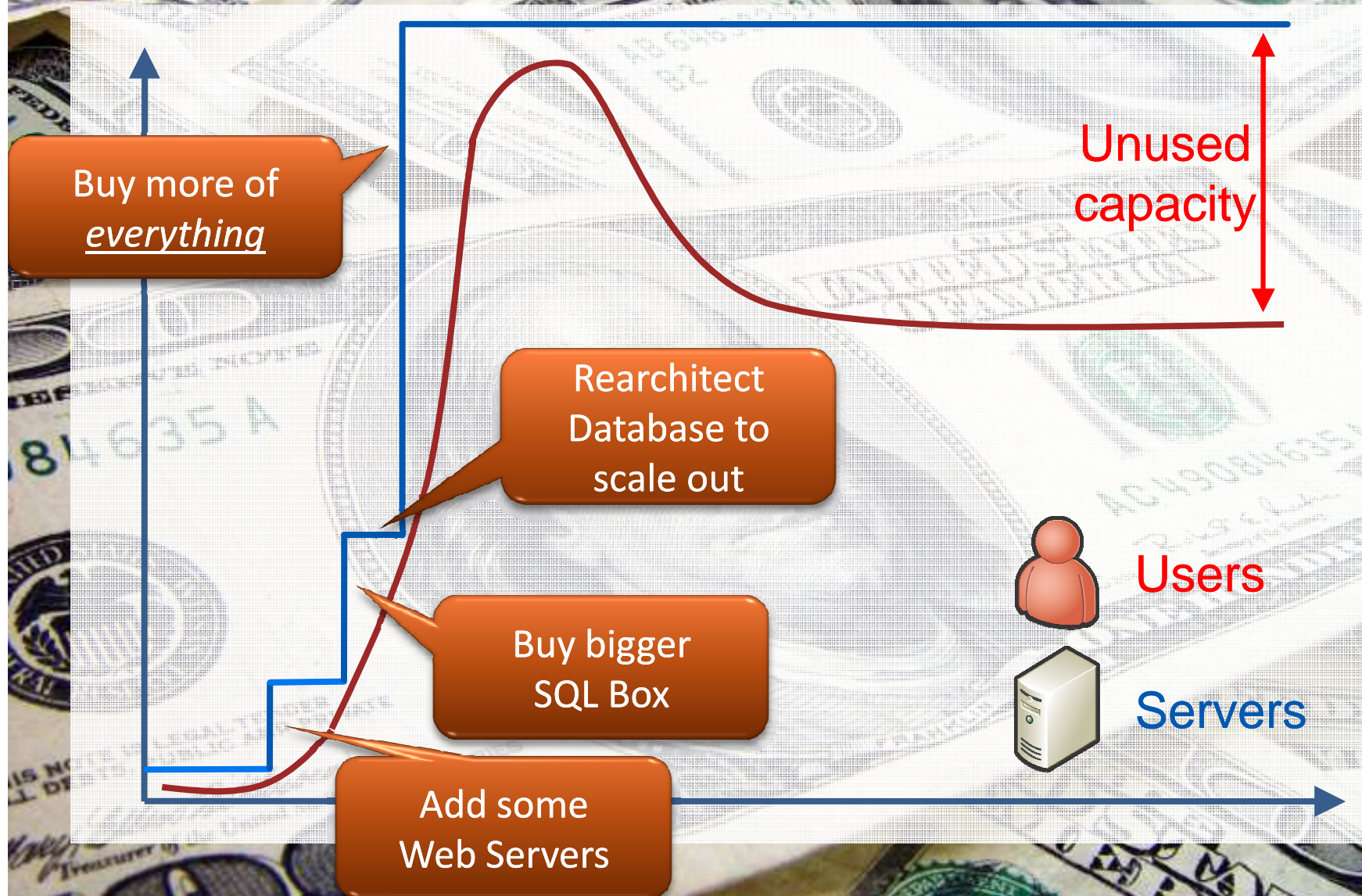
Introduction to Windows Azure

Beat Schwegler

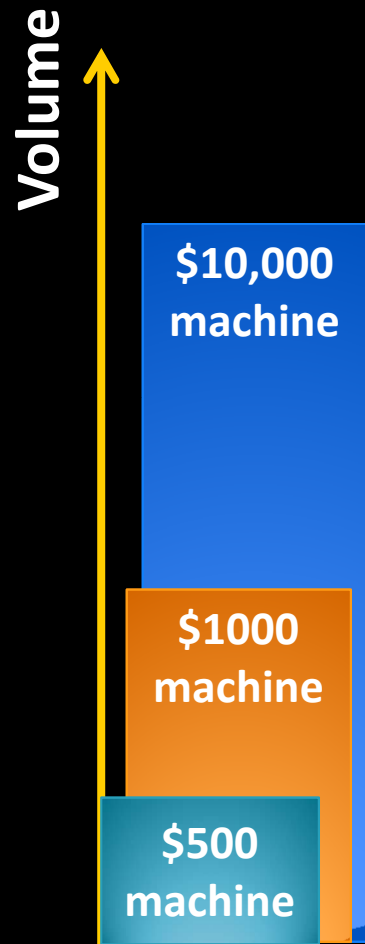
beatsch@microsoft.com

Microsoft Western Europe

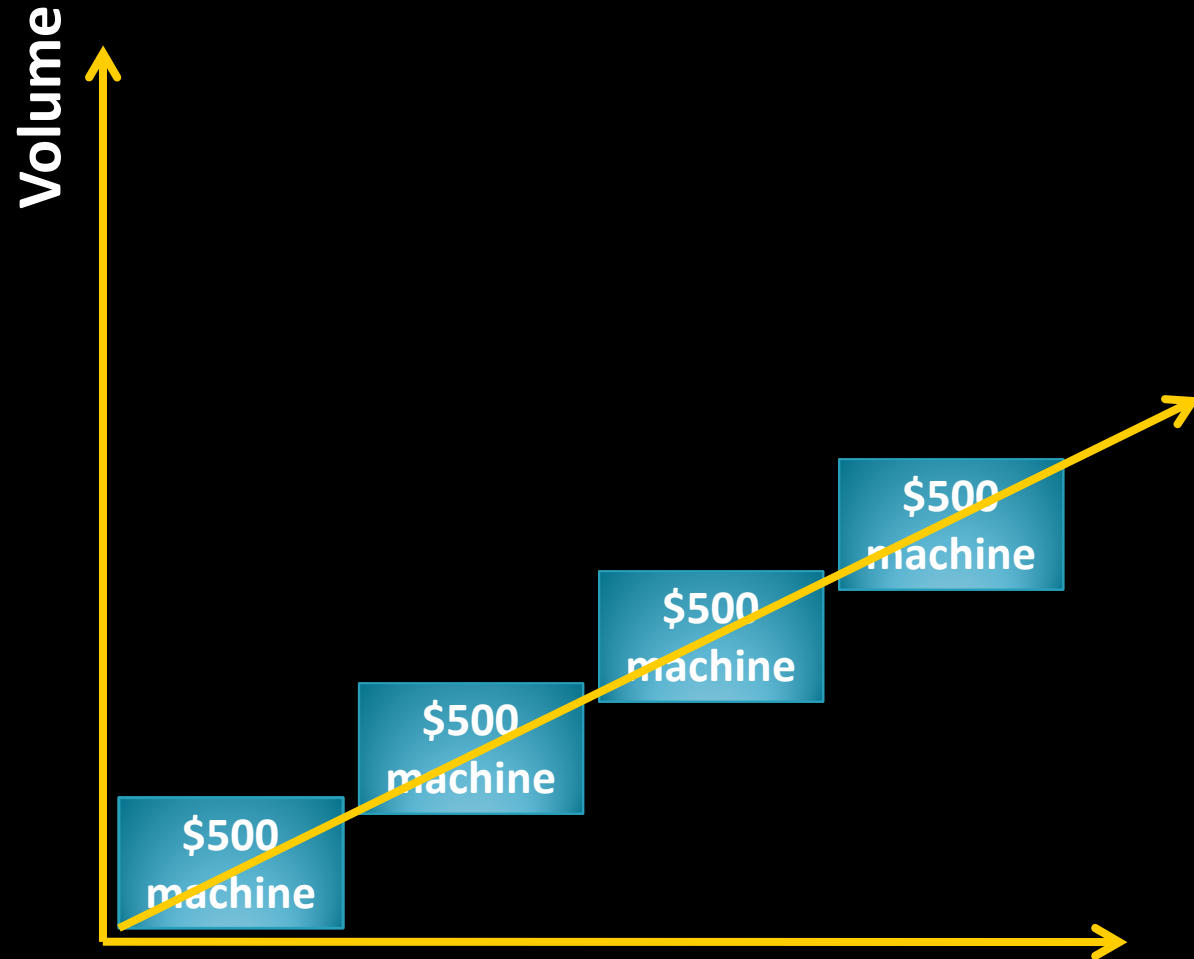
What does Success 2.0 look like?



Scale-up and Scale-out



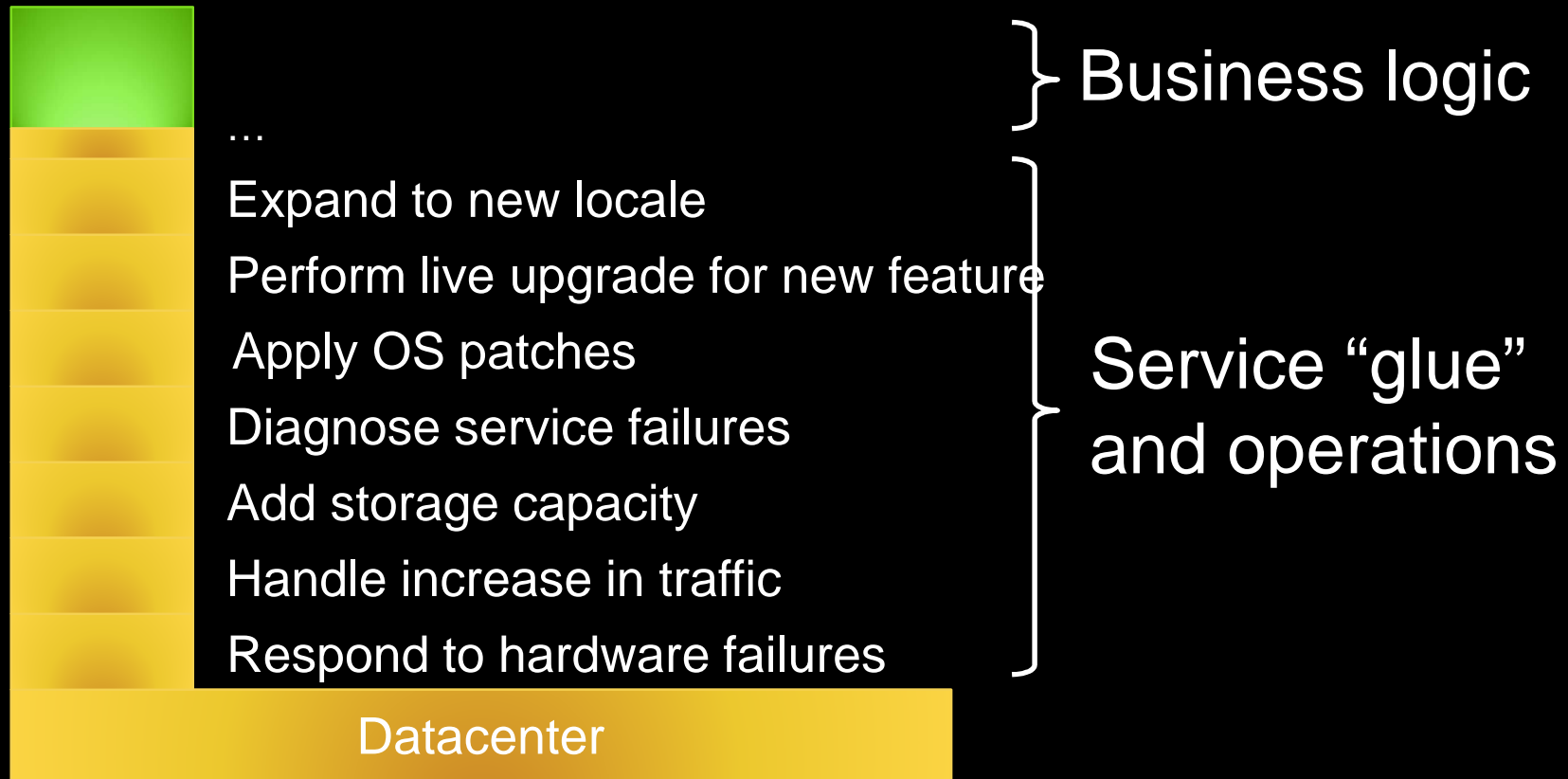
Scale Up



Scale Out

Machines

But this doesn't come for Free...



What about a Cloud OS?

- The same facilities as a desktop OS, but on a **set of connected servers**:
 - Abstract execution environment
 - Shared file system
 - Resource allocation
 - Programming environments
- And more: **Utility computing**
 - 24/7 operation
 - Pay for what you use
 - Simpler, transparent administration

Implications



- Impacts CAPEX/OPEX spending
- New Business Model Emerge
- Introduces new Programming Models

Programming Models for the Cloud

- Eric Brewer's **CAP** Theorem
 - **C**onsistency
 - **A**vailability
 - Tolerance to network **P**artitions

One can only achieve a combination of two
- This leads to **BASE** semantic (vs. ACID)
 - **B**asically **A**vailable
 - **S**oft-state
 - **E**ventual consistency

Cloud Computing Capabilities

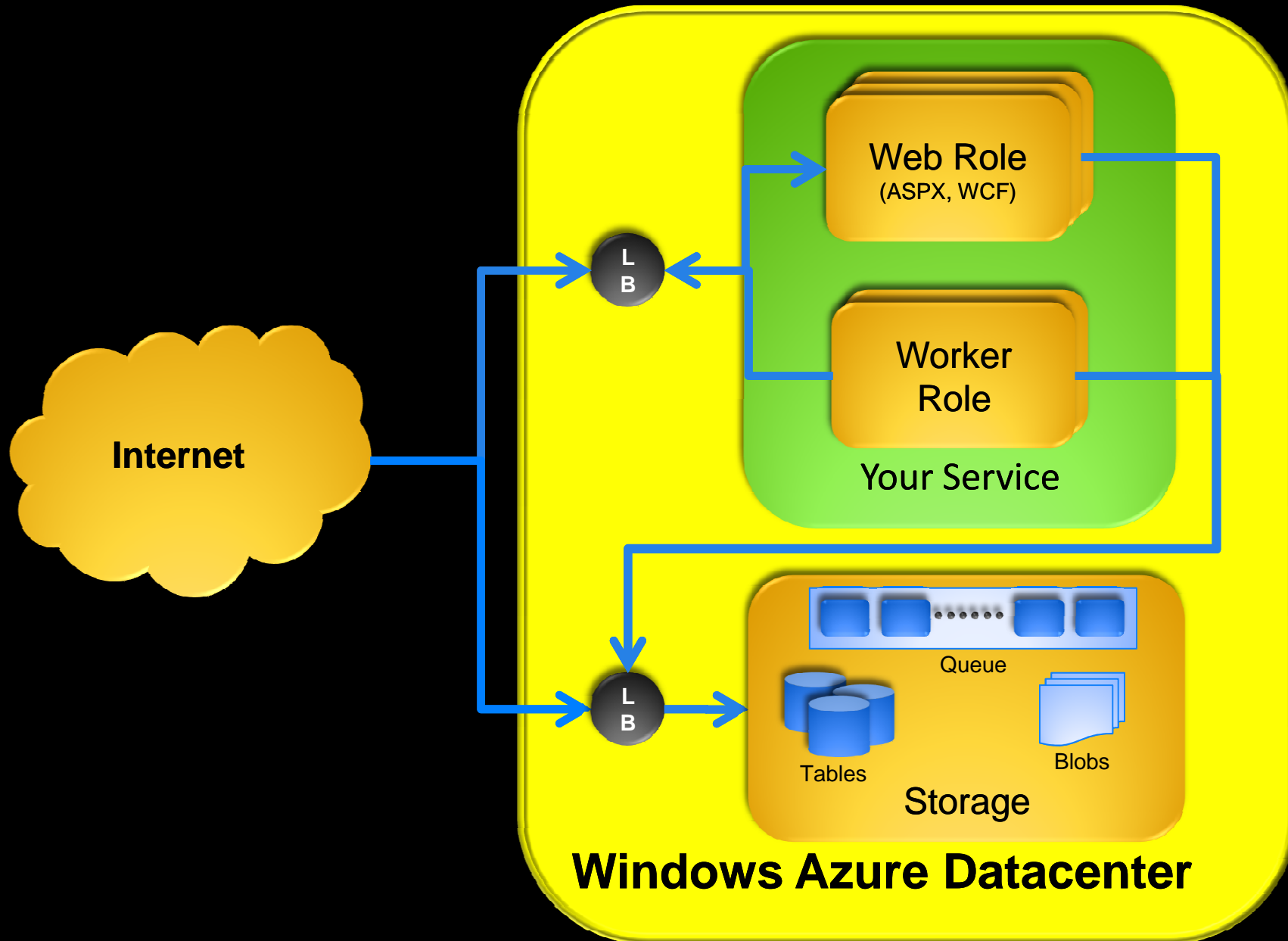
- Elastic Compute
 - How to adjust resources according to demand?
- Scalable Storage
 - How to provide cheap and durable storage?
- Network Topology
 - How to manage scale-out scenarios?

The Windows Azure Platform

An internet-scale cloud services platform hosted in Microsoft data centers, which provides an operating system and a set of developer services that can be used individually or together.



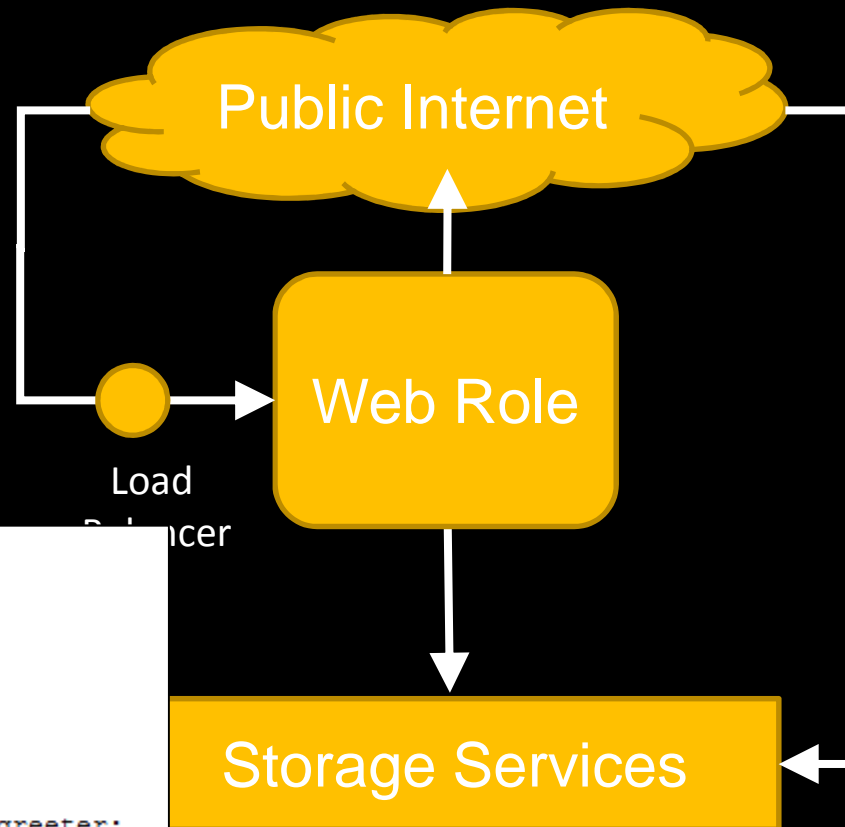
Windows Azure Building Blocks



Web Role

- Web farm that handles request from the Internet
- IIS7 hosted web core
 - Hosts ASP.NET
 - Supports SSL
 - .NET Full Trust
 - P/Invoke
 - FastCGI (PHP)

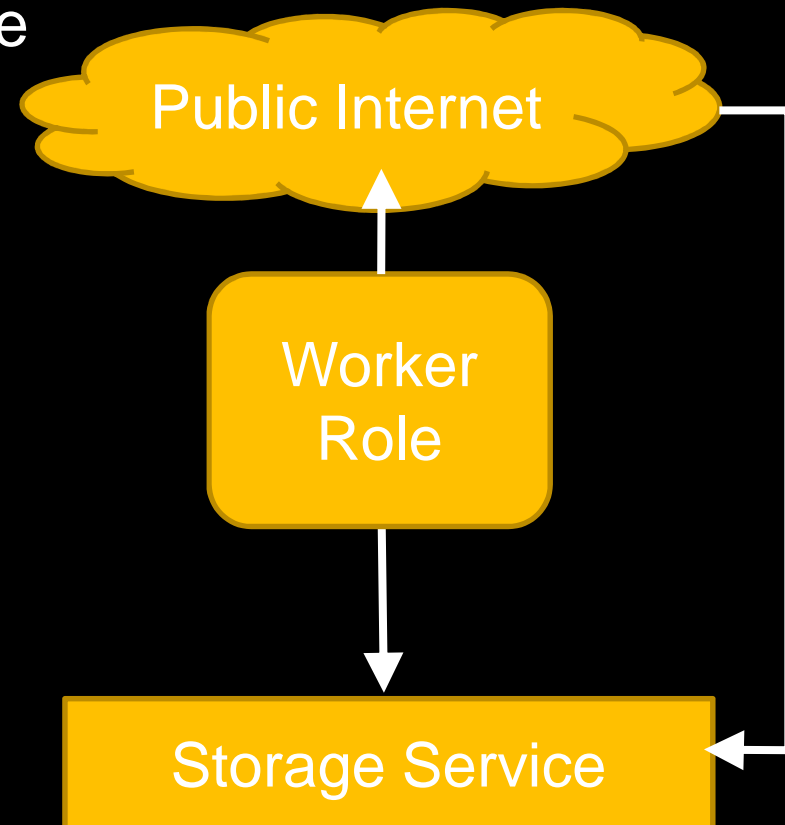
```
namespace HelloWorld_WebRole
{
    public partial class Default : System.Web.UI.Page
    {
        namespace TestService_WebRole
        {
            [XmlSerializerFormat]
            public class HelloService : ISayHello
            {
                public string SayHello(string toWhom)
                {
                    string greeter = DoDBStuff(toWhom);
                    return "Hello " + toWhom + " from " + greeter;
                }
            }
        }
    }
}
```



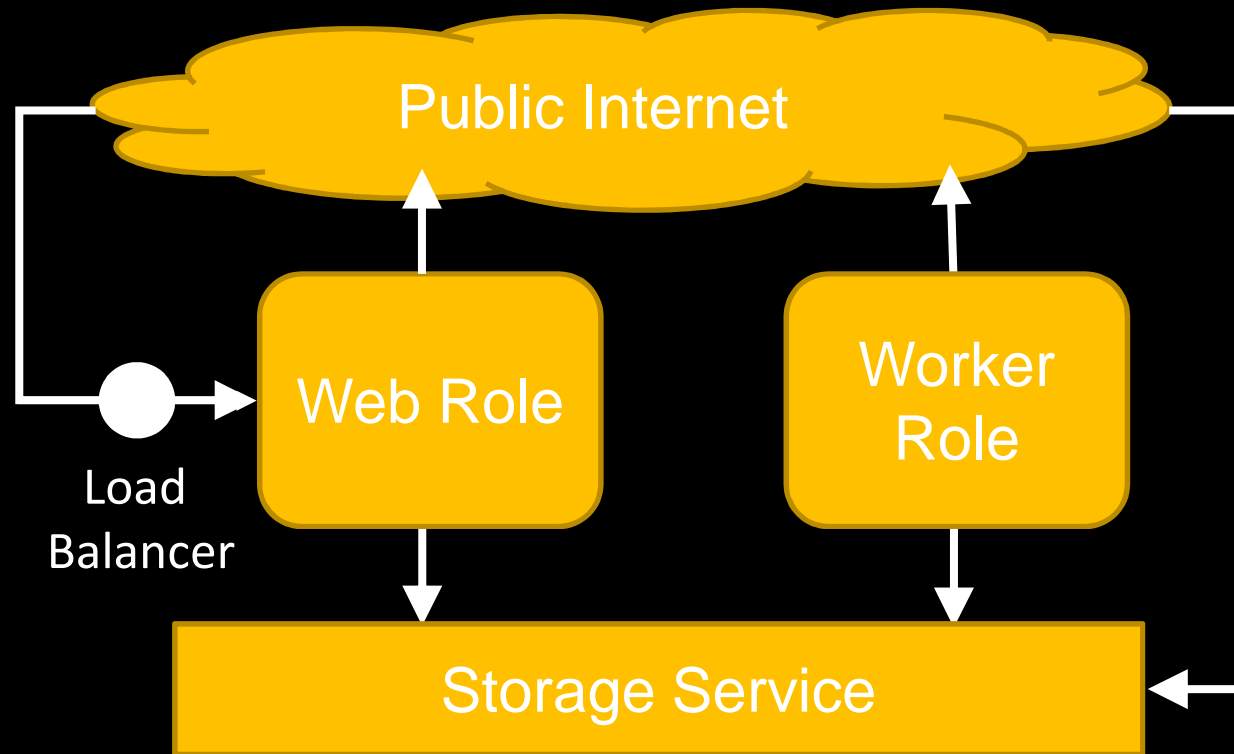
Worker Role

- No inbound network connections
- Can read requests from queue in storage
- - .NET Full Trust
 - P/Invoke

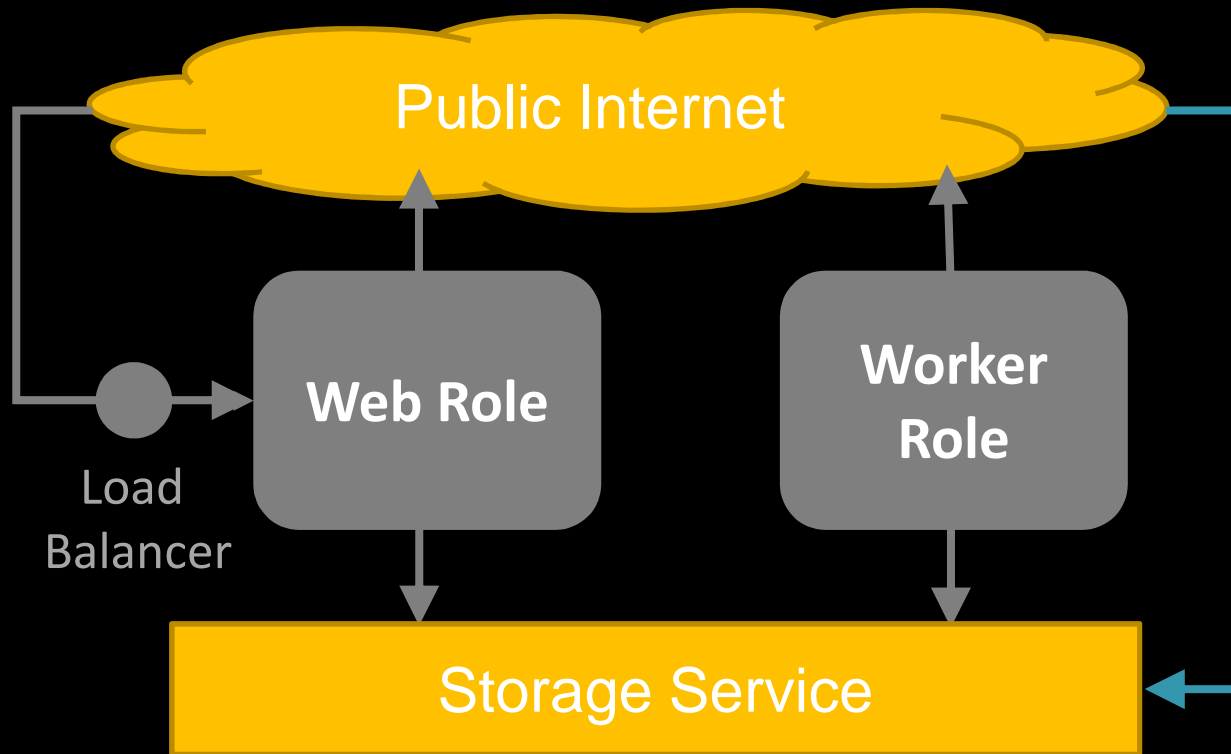
```
public class WorkerRole : RoleEntryPoint
{
    public override void Start()
    {
        RoleManager.WriteToLog("Information", "Worker Role Started");
        while (true)
        {
            Thread.Sleep(10000);
            RoleManager.WriteToLog("Information", "Worker Role Running");
        }
    }
}
```



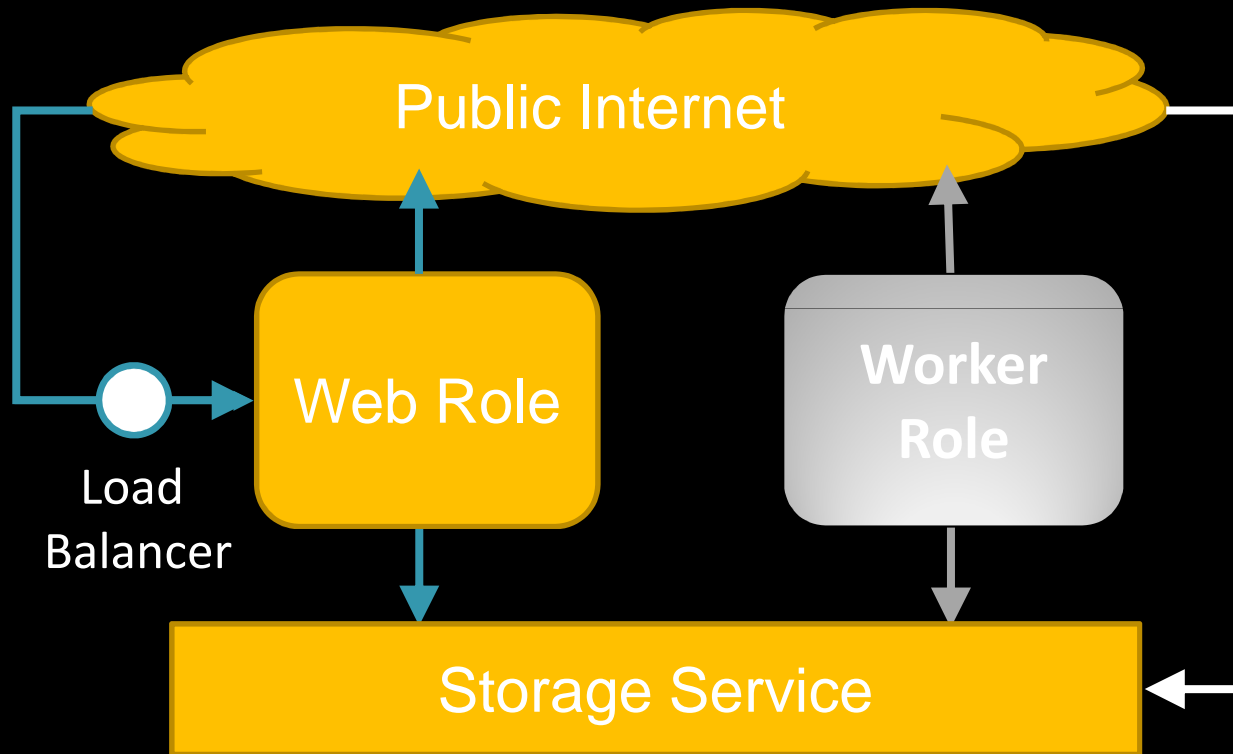
Example Service Architecture



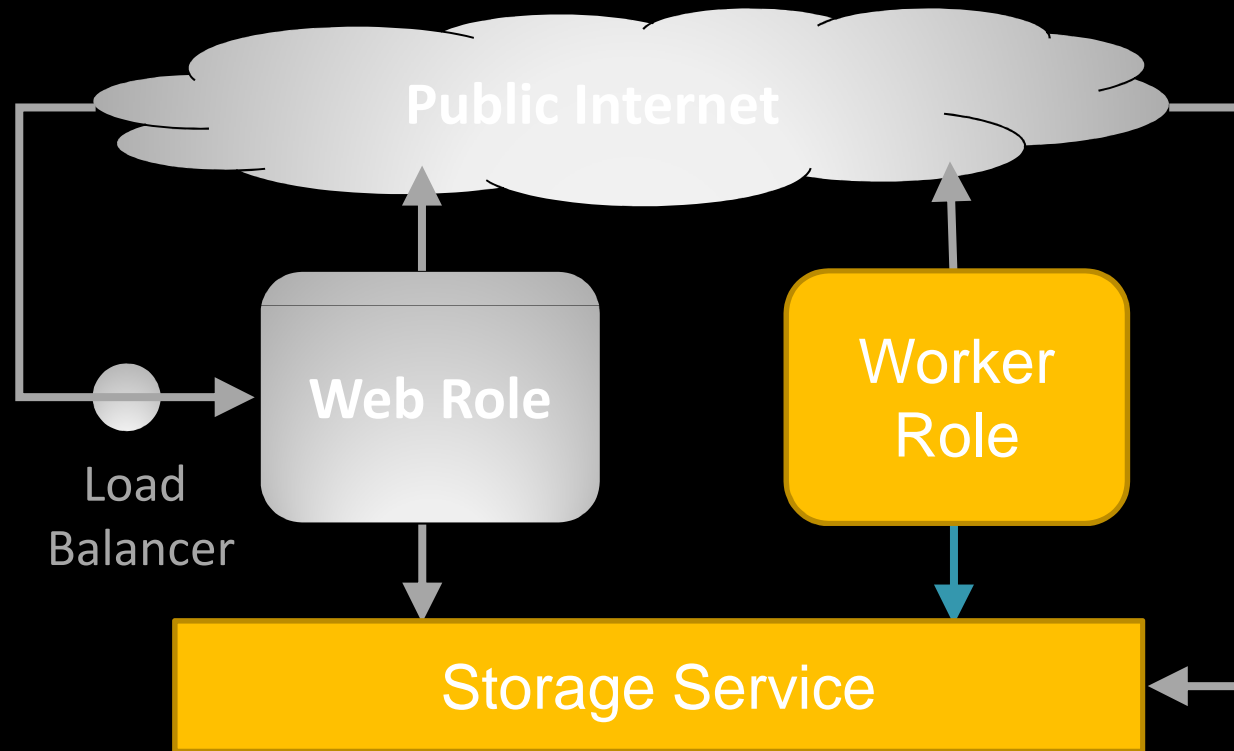
Uploading Static Content



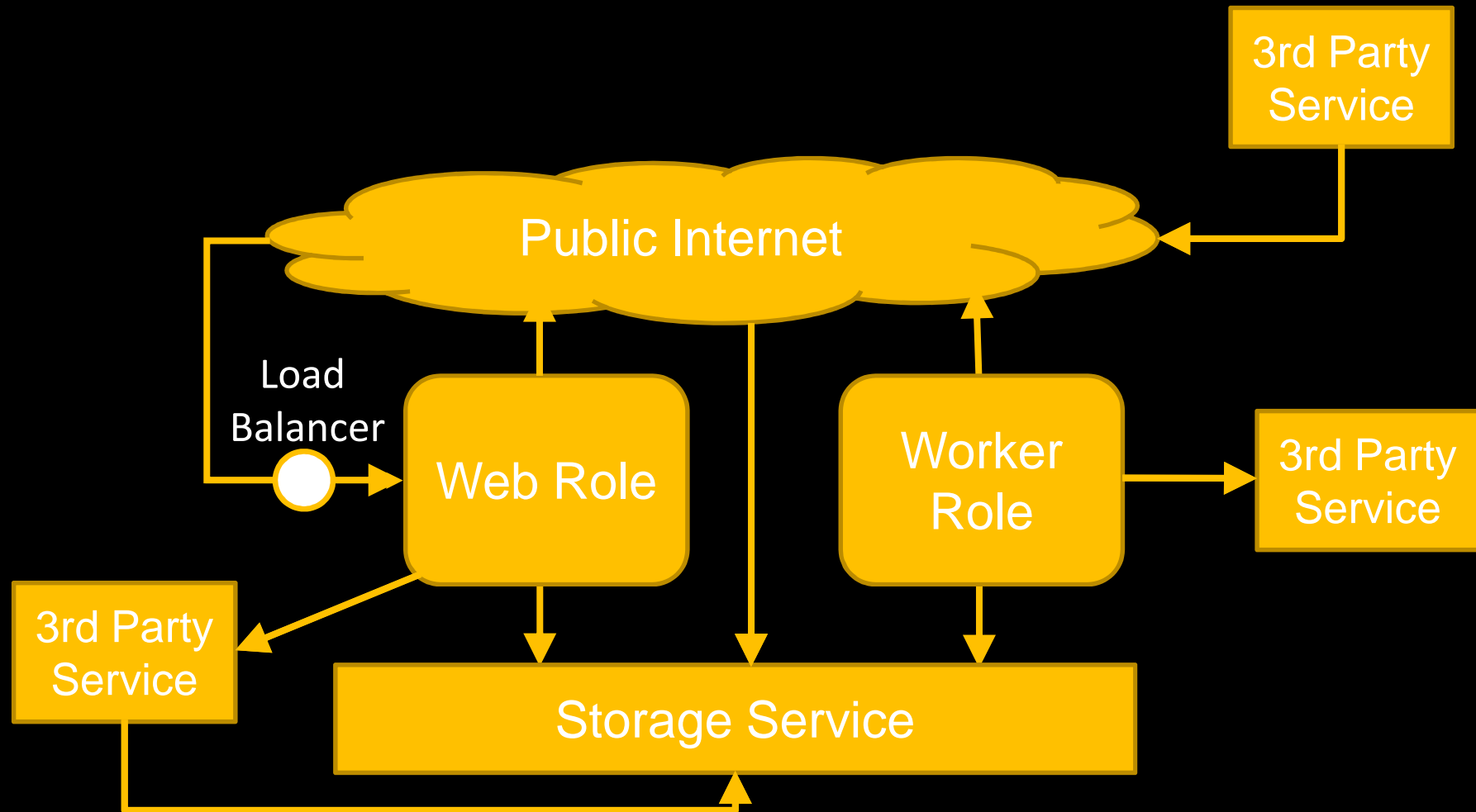
Serving Dynamic Content



Background Tasks



Architecture with additional Services



Fundamental Data Abstractions

- **Blobs** – Provide a simple interface for storing named files along with metadata for the file
- **Tables** – Provide structured storage. A Table is a set of entities, which contain a set of properties
- **Queues** – Provide reliable storage and delivery of messages for an application

Azure Queues

Get RemoveMessage

```
HTTP/1.1 200 OK
Transfer-Encoding: chunked
Content-Type: application/xml
```

DELETE

```
http://myaccount.queue.core.windows.net/myqueue/messages/messageid
?popreceipt=YzQ4Yzg1MDIGM0MDFiZDAwYzEw
```

```
<MessageId>5974b586-0df3-4e2d-ad0c-18e3892bfca2</MessageId>
<InsertionTime>Mon, 22 Sep 2008 23:29:20 GMT</InsertionTime>
<ExpirationTime>Mon, 29 Sep 2008 23:29:20 GMT</ExpirationTime>
  <PopReceipt>YzQ4Yzg1MDIGM0MDFiZDAwYzEw</PopReceipt>
<TimeNextVisible>Tue, 23 Sep 2008 05:29:20GMT</TimeNextVisible>
<MessageText>PHR1c3Q+dG...dGVzdD4=</MessageText>
</QueueMessage>
</QueueMessagesList>
```

Tables - Capabilities

What tables don't do



Not relational



No Referential Integrity

If these are important to you,
use:



No Aggregations



No x-partition transactions

What tables can do



Cheap



Very Scalable



Flexible



Durable

Data Model

- Data stored in Tables
 - A Table is a set of Entities (rows)
 - An Entity is a set of Properties (columns)
- Entity has:
 - PartitionKey – enables scalability
 - RowKey – unique id within the partition
the only indexed property
 - Timestamp – for optimistic concurrency
 - 255 properties for your data
 - Max size of 1MB

Working with Tables

Vessel Position Reporting System – SQL Server

VesselId	Time	Latitude	Longitude	Speed
xxx-xx1	10:15 14 Nov	01.23	53.24	0
xxx-xx1	10:05 14 Nov	04.45	54.32	5
xxx-xx1	09:55 14 Nov	02.32	52.34	4
xxx-xx2	10:15 14 Nov	01.23	51.23	10

To find last pos report for vessel in SQL:

```
select TOP(1) * from PosRpts  
order by [Time] DESC  
where VesselId = ???
```

Working with Tables

Solving this the Azure way

PartitionKey				
VesselId	Time	Latitude	Longitude	Speed
xxx-xx1	10:15 14 Nov	01.23	53.24	0
xxx-xx1	10:05 14 Nov	04.45	54.32	5
xxx-xx1	09:55 14 Nov	02.32	52.34	4
xxx-xx2	10:15 14 Nov	01.23	51.23	10

PartitionKey

With Tables

Stored in-order:
Just need to do a
top on the
partition

RowKey needs to
be a string

RowKey	Latitude	Longitude	Speed
2521756430999999999	01.23	53.24	0
2521756436999999999	04.45	54.32	5
2521756439999999999	02.32		

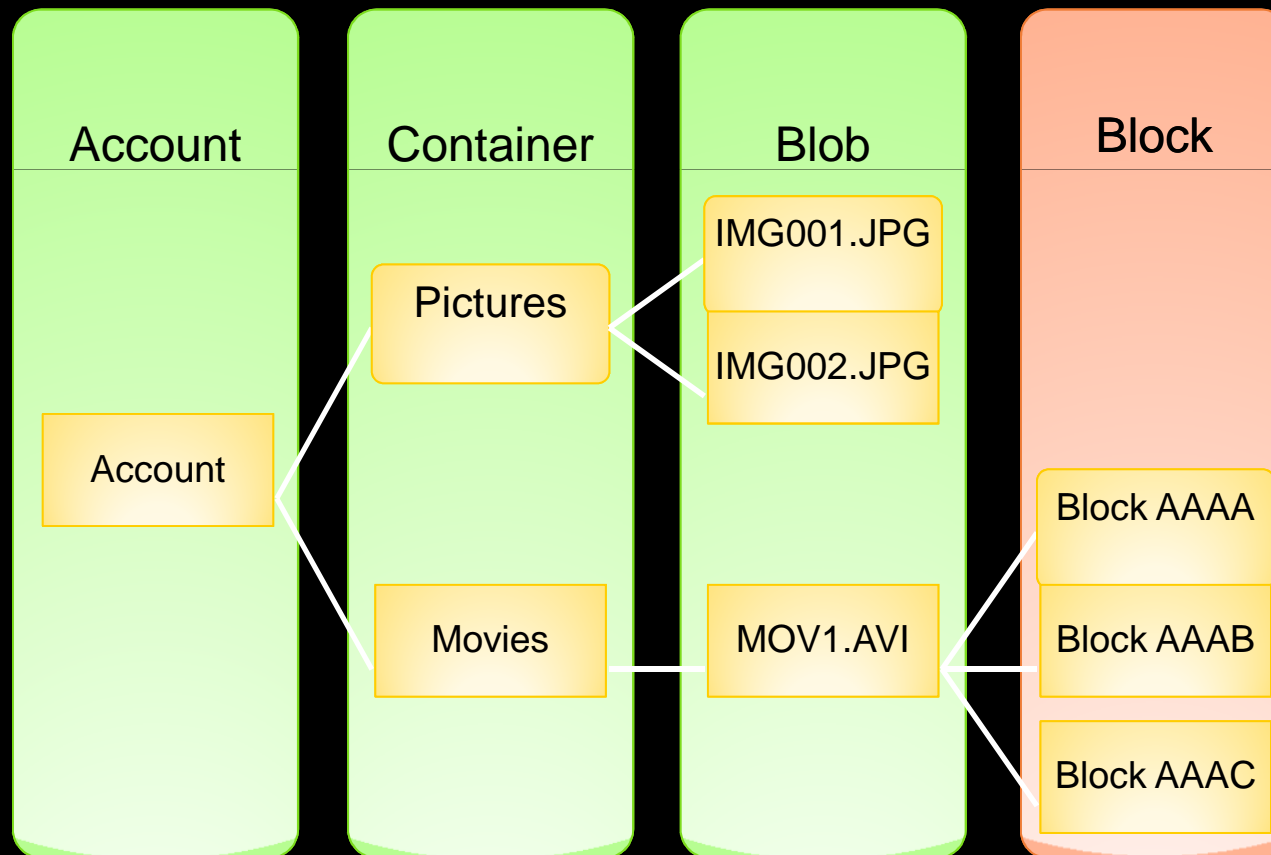
Makes it
descending

100 nanoseconds!

```
time.Ticks.ToString ()
```


Blobs

- Store Large Objects (up to 50 GB each)
- Standard REST PUT/GET/DELETE Interface
<http://<Account>.blob.core.windows.net/<Container>/<BlobName>>





The background features a dark blue to black gradient with several bright, glowing blue light streaks that curve and flow across the frame, creating a sense of motion and energy.

Hello World on Azure

New Project

Project types: Visual C#
Windows
Web
Smart Device
Office
Database
Cloud Service
Roles
Reporting
Test
WCF
Workflow

Templates: .NET Framework 3.5

Visual Studio installed templates
Blank Cloud Service
Web Cloud Service
Web And Worker Cloud Service
Worker Cloud Service

My Templates
Search Online Templates...

Web Cloud Service

Name: HelloWorld

Location: C:\Demos Browse...

Solution: Create new Solution Create directory for solution

Solution Name: HelloWorld Add to Source Control

OK Cancel

Toolbox

- Standard
- Pointer
- Label
- TextBox
- Button**
- LinkButton
- ImageButton
- HyperLink
- DropDownList
- ListBox
- CheckBox
- CheckBoxList
- RadioButton
- RadioButtonList
- Image
- ImageMap
- Table
- BulletedList

Default.aspx*

Client Objects & Events (No Events)

```
<%@ Page Language="C#" AutoEventWireup="true" CodeB...
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transi
<html xmlns="http://www.w3.org/1999/xhtml" >
<head runat="server">
  <title>Untitled Page</title>
</head>
<body>
  <form id="form1" runat="server">
    <div>
      <h1>Hello World</h1>
    </div>
  </form>
</body>
</html>
```

Solution Explorer - HelloWorld_WebR...

- Solution 'HelloWorld' (2 projects)
- HelloWorld
 - Roles
 - HelloWorld_WebRole
 - ServiceConfiguration.cscfg
 - ServiceDefinition.csdef
 - HelloWorld_WebRole
 - Properties
 - References
 - App_Data
 - Default.aspx
 - Web.config

Error List

0 Errors 0 Warnings 0 Messages

Description	File	Line	Column	Project

Team Expl... Popfly Ex... Solution E...

Properties

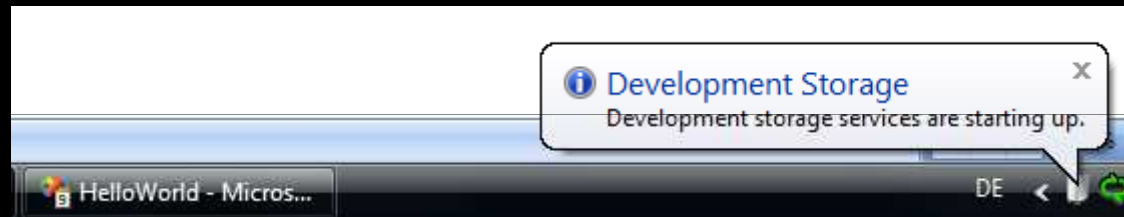
<H1>

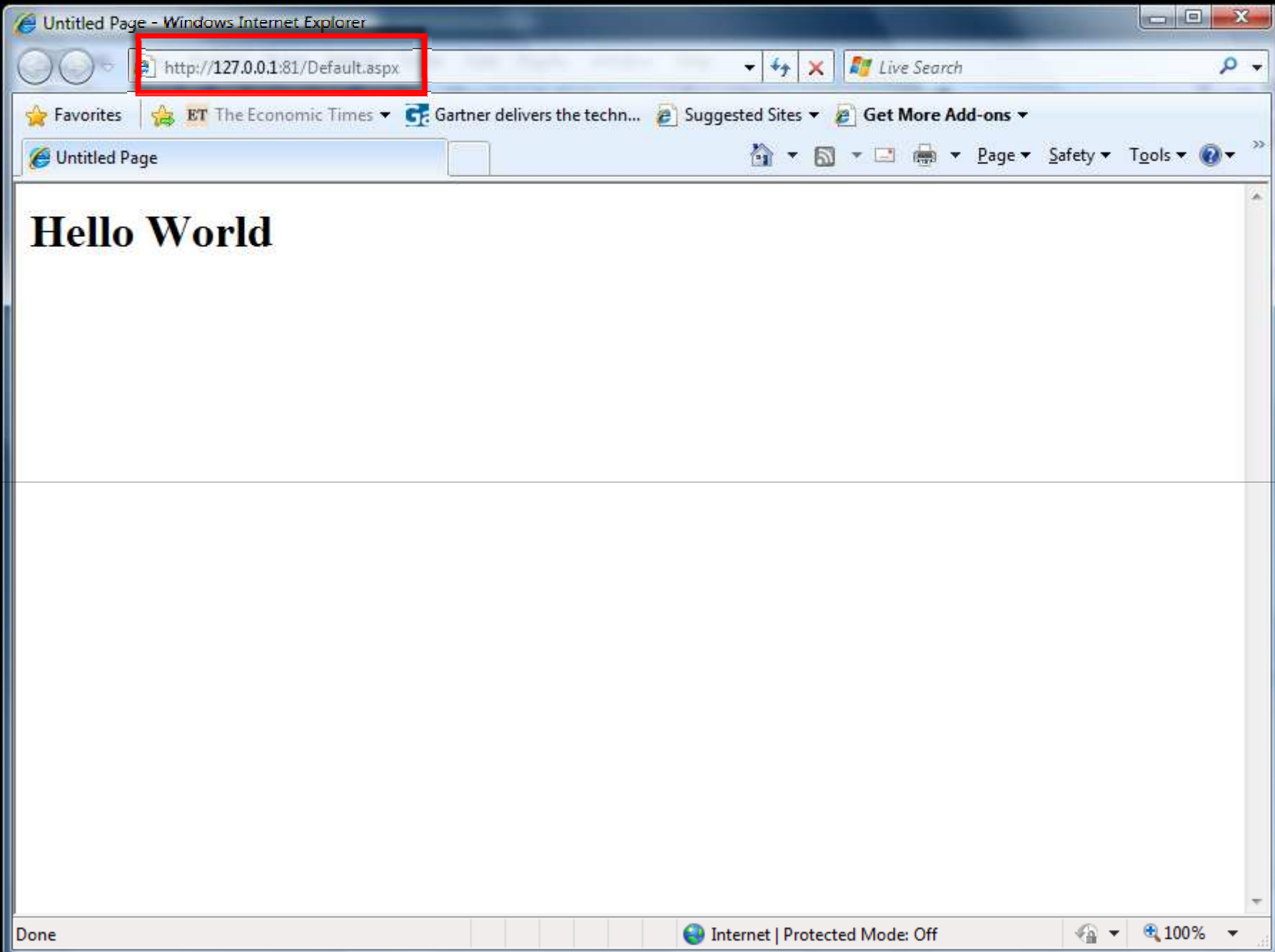
(Id)

Align left

(Id)

Error List Output Find Results 1





Hello World

Toolbox

- asmxWCF
- General

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

```
<?xml version="1.0"?>
<ServiceConfiguration serviceName="HelloWorld" xmlns="http://schemas.microsoft.com/.NetConfiguration/2006/01" >
  <Role name="WebRole">
    <Instances count="1"/>
    <ConfigurationSettings>
    </ConfigurationSettings>
  </Role>
</ServiceConfiguration>
```



Solution Explorer

- Solution 'HelloWorld' (2 projects)
- HelloWorld
 - Roles
 - HelloWorld_WebRole
 - ServiceConfiguration.cscfg
 - ServiceDefinition.csdef
- HelloWorld_WebRole
 - Properties
 - References
 - App_Data
 - Default.aspx
 - Web.config

Error List

0 Errors 0 Warnings 0 Messages

Description	File	Line	Column	Project

Properties

XML Document

Encoding: Unicode (UTF-8)

Output

Encoding: Character encoding of the document.

Development Fabric

File Service Tools Help

50%

Service Deployments

- deployment(46)
 - Service Details
 - HelloWorld
 - WebRole

deployment(46).HelloWorld.WebRole.0 (Started) ⓘ

```
role instance: deployment(46).helloworld.webrole.0
role state: Started
02.16.2009 14:00:30:021,svcs--information,srvl-info,threadid-7934,-mb role
initialised
02.16.2009 14:00:30:022,svcs--information,srvl-info,threadid-7934,-mb role
Started
```

<multiple paths selected>

Toolbox

- asmxWCF
- General

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

```
<?xml version="1.0"?>  
<ServiceConfiguration serviceName="HelloWorld" xmlns="http://schemas.microsoft.com/configuration/core/>  
  <Role name="WebRole">  
    <Instances count="5"/>  
    <ConfigurationSettings>  
    </ConfigurationSettings>  
  </Role>  
</ServiceConfiguration>
```



Solution Explorer - Solution 'HelloWo...'

- Solution 'HelloWorld' (2 projects)
- HelloWorld
 - Roles
 - HelloWorld_WebRole
 - ServiceConfiguration.cscfg
 - ServiceDefinition.csdef
- HelloWorld_WebRole
 - Properties
 - References
 - App_Data
 - Default.aspx
 - Web.config

Error List

0 Errors 0 Warnings 0 Messages

Description	File	Line	Column	Project

Properties

XML Document

Encoding: Unicode (UTF-8)

Output

Encoding: Character encoding of the document.

Development Fabric

File Service Tools Help

50%

Service Deployments

- deployment(45)
 - Service Details
 - HelloWorld
 - WebRole
 - 0
 - 1
 - 2
 - 3
 - 4

deployment(45).HelloWorld.WebRole.0 (Started)

```
sole instance: deployment(45).helloworld.webrole.0
sole state Suspended
sole state Started
02.16.2009 16:07:16:949, event=information, level=info, threadid=7076, -web
sole
initialised
02.16.2009 16:07:16:949, event=information, level=info, threadid=7076, -web
sole
Started
```

deployment(45).HelloWorld.WebRole.1 (Started)

```
sole instance: deployment(45).helloworld.webrole.1
sole state Suspended
sole state Started
02.16.2009 16:07:17:036, event=information, level=info, threadid=6364, -web
sole
initialised
02.16.2009 16:07:17:036, event=information, level=info, threadid=6364, -web
sole
Started
```

deployment(45).HelloWorld.WebRole.2 (Started)

```
sole instance: deployment(45).helloworld.webrole.2
sole state Suspended
sole state Started
02.16.2009 16:07:16:909, event=information, level=info, threadid=8356, -web
sole
initialised
02.16.2009 16:07:16:910, event=information, level=info, threadid=8356, -web
sole
Started
```

deployment(45).HelloWorld.WebRole.3 (Started)

```
sole instance: deployment(45).helloworld.webrole.3
sole state Suspended
sole state Started
02.16.2009 16:07:17:050, event=information, level=info, threadid=6300, -web
sole
initialised
02.16.2009 16:07:17:051, event=information, level=info, threadid=6300, -web
sole
Started
```

deployment(45).HelloWorld.WebRole.4 (Started)

```
sole instance: deployment(45).helloworld.webrole.4
sole state Suspended
sole state Started
02.16.2009 16:07:16:975, event=information, level=info, threadid=4420, -web
sole
initialised
02.16.2009 16:07:16:976, event=information, level=info, threadid=4420, -web
sole
Started
```

<multiple paths selected>

New Project

Summary

Analytics

Account

Help

All Projects

Live ID Lab

SayHello

Test

[New Project](#)

My Projects



Live ID Lab



SayHello
beatsch



Test

Need Help Getting Started?



Learn more about [Windows Azure](#) Hosted Services and Storage.



Learn more about the [Azure Services Platform](#) and the [Live Framework CTP](#).



Check out the [forums](#). See what others in the community are building.

Test

Description

[Edit](#)

Test Project

Delete Project

Hosted Service

Production test



Suspend

Configure...

Delete

WorkerRole:

✓ Started

WebRole:

1 ✓ Started

1

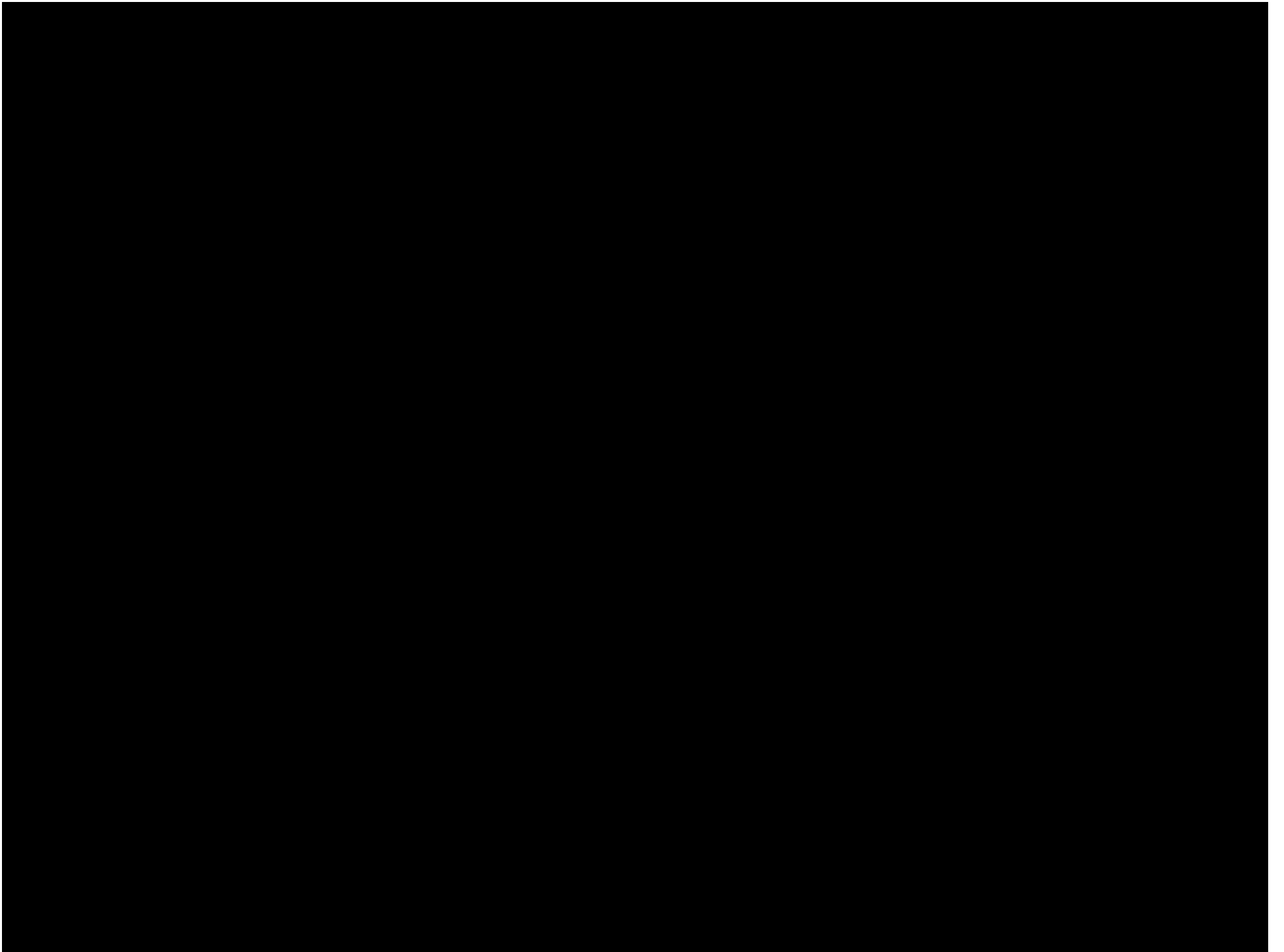
Staging (none)



Deploy a Hosted Service package.

Deploy...

DEMO: HELLO WORLD



The Windows Azure Platform

An internet-scale cloud services platform hosted in Microsoft data centers, which provides an operating system and a set of developer services that can be used individually or together.



.NET Services

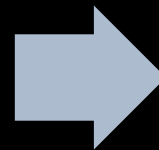


Service Bus

Access Control



Connect endpoints



Control & secure access

Service Bus

Access Control

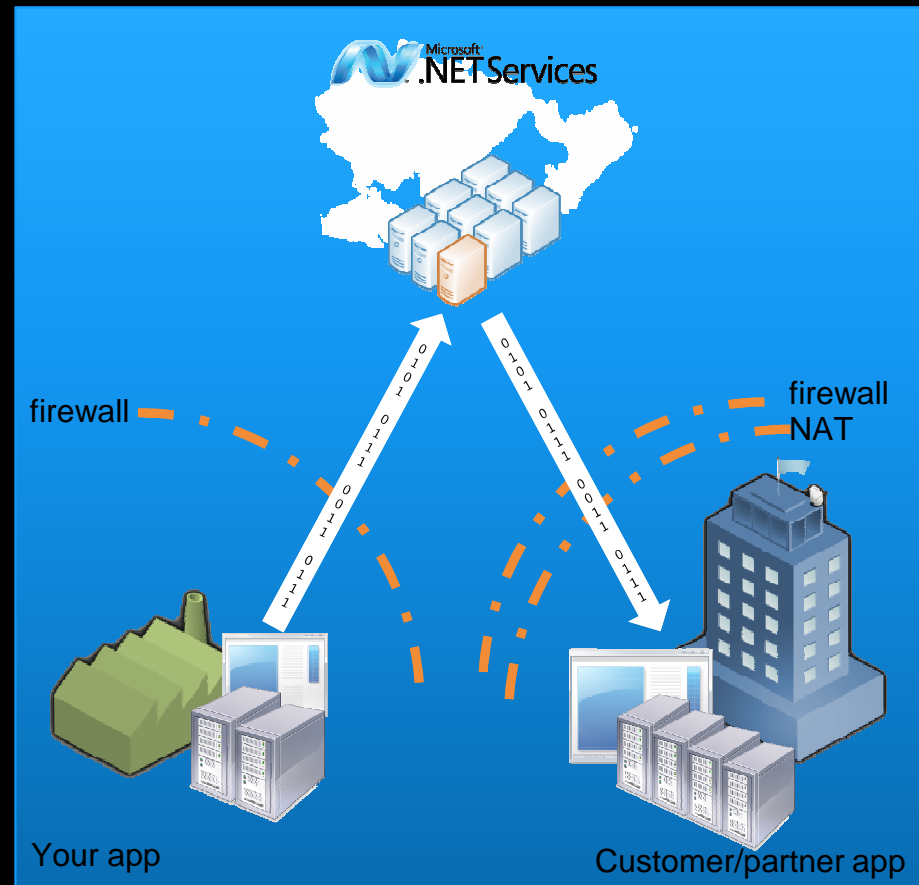
Service Bus



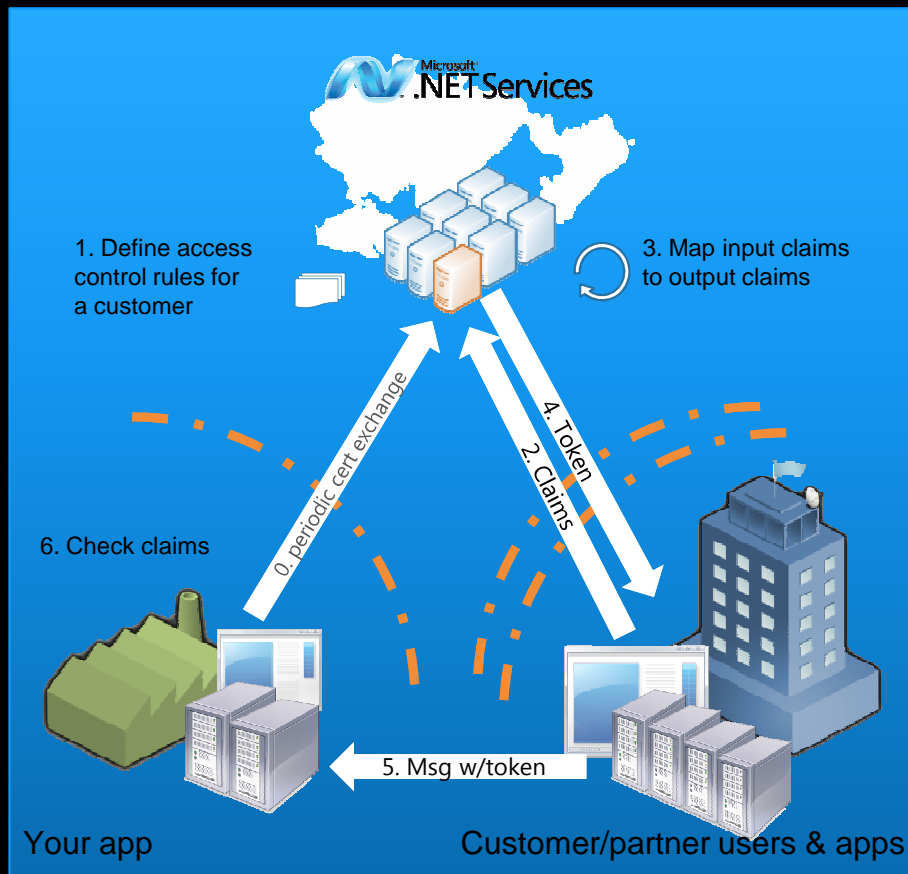
Connect Endpoints

Service Bus

- Expose RESTful or SOAP services over the internet through firewall and NAT boundaries
- Communicate bi-directionally between apps and services in an interoperable manner
- Choose relays, queues, routers, and other message patterns and types
- Scale out naturally and reliably as apps and services grow



Access Control Services



Control Access



Access Control Service

- Integrate authorization into apps to control "what users are allowed to do"
- Federate with multiple identity systems across organizations and ID providers
- Easily apply fine-grained access control rules
- Secure Service Bus communications
- Scale out naturally and reliably as apps and services grow

SQL Azure



WEB Edition

- 1 GB Database
- \$9.99 / month
- Bandwidth
 - \$0.10 inbound
 - \$0.15 outbound

Business Edition

- 10GB Database
- \$99.99 / month
- Bandwidth
 - \$0.10 inbound
 - \$0.15 outbound

Windows Azure Platform Roadmap



Simple Service Templates

One Geo
ASP.NET
Medium Trust
Automated Service Management
Service Bus, Access Control

CTP

Rich Service Templates

Multiple Geo Locations
Multiple Languages
Full Trust
Active Directory and Web ID
Relational & Virtualized Database
Auto DB Management

Commercial release

Admin Mode/VM Deployment

Geo Replication & On Premises
Systems Center Integration
Enterprise ID Federation
Distributed Queries & CLR
Analytics & reporting
Data Synch (DataHub)

Future



Web 2.0

Partners

Enterprise

Closing Thoughts

- Instant Access to compute and storage resources
- Dealing with data requires special thoughts
- The Azure Service Platform provides building blocks as cloud services

