Patterns for Cloud Computing

Simon Guest
Senior Director, Technical Strategy
Microsoft Corporation

Patterns for Cloud Computing

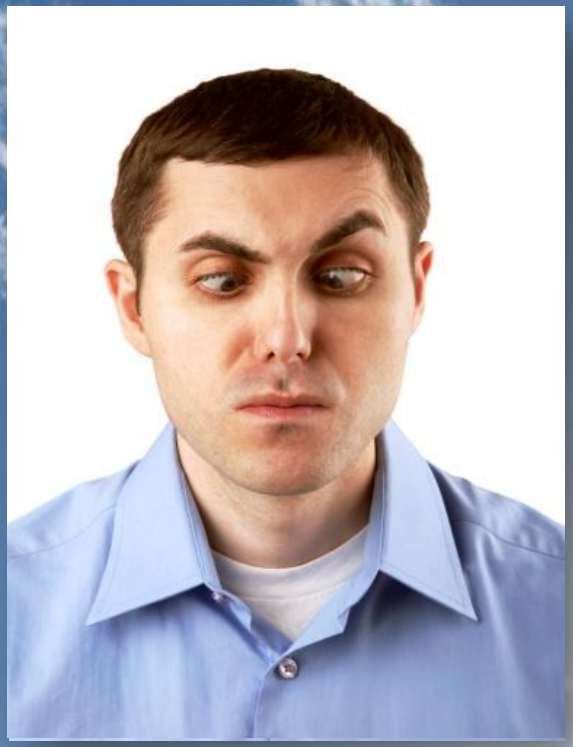
Patterns for Cloud Computing

This is Jim

Patterns for Cloud Computing

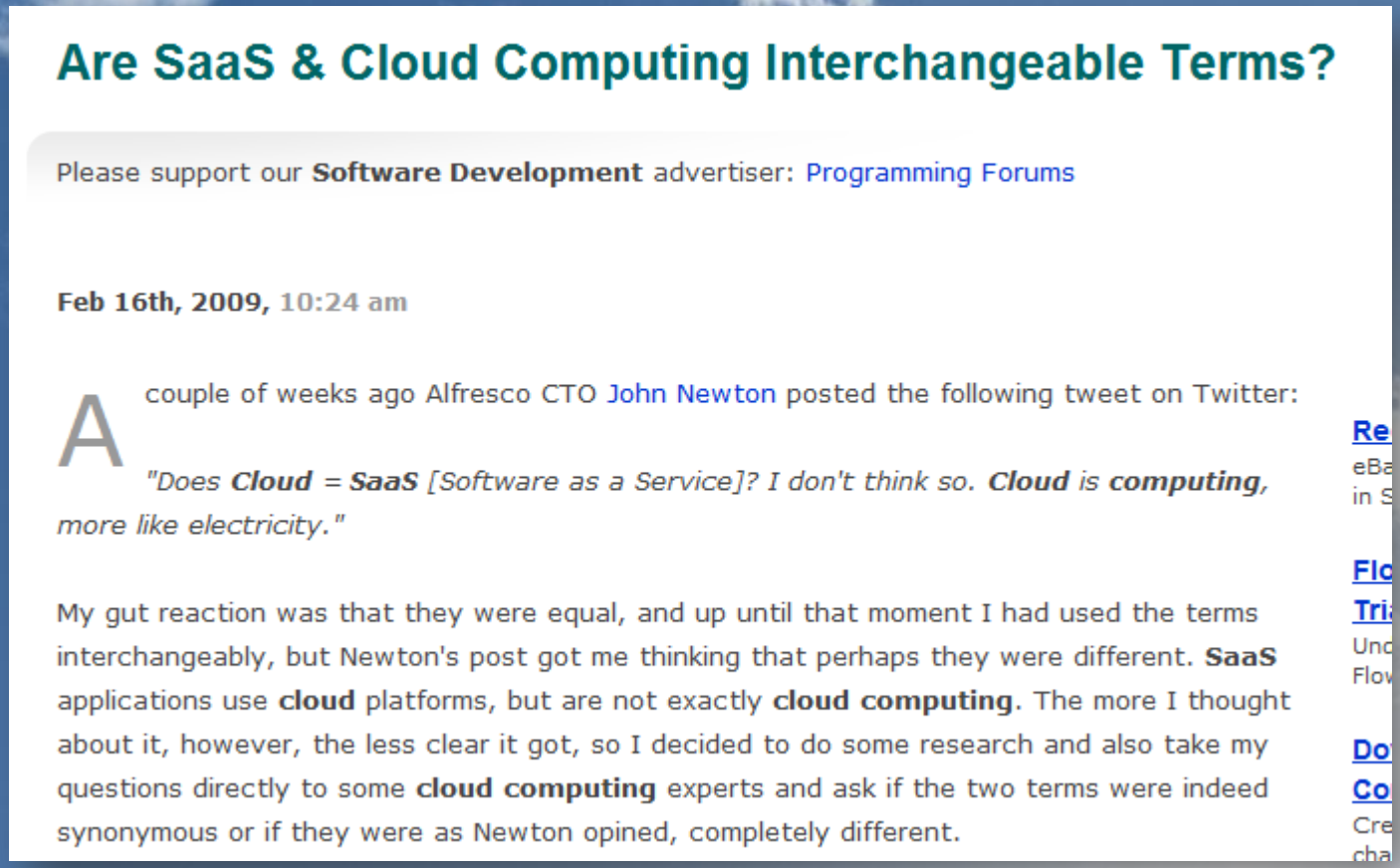
Jim has many questions about cloud computing

Patterns for Cloud Computing



The more he reads, the more confused he gets

Patterns for Cloud Computing



Are SaaS & Cloud Computing Interchangeable Terms?

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Feb 16th, 2009, 10:24 am

A couple of weeks ago Alfresco CTO John Newton posted the following tweet on Twitter:

*"Does **Cloud** = **SaaS** [Software as a Service]? I don't think so. **Cloud** is **computing**, more like electricity."*

My gut reaction was that they were equal, and up until that moment I had used the terms interchangeably, but Newton's post got me thinking that perhaps they were different. **SaaS** applications use **cloud** platforms, but are not exactly **cloud computing**. The more I thought about it, however, the less clear it got, so I decided to do some research and also take my questions directly to some **cloud computing** experts and ask if the two terms were indeed synonymous or if they were as Newton opined, completely different.

"What is cloud computing?"

Patterns for Cloud Computing

August 19th, 2008

Piecing together Microsoft's cloud-computing vision

Posted by Mary Jo Foley @ 6:37 am

Categories: .Net Framework, Code names, Corporate strategy, Database, Development tools...

Tags: Zurich, Operating System, Vision, Microsoft Corp., Service...

5 TalkBacks ADD YOUR OPINION | SHARE | PRINT | E-MAIL | WORTHWHILE? +3 7 VOTES

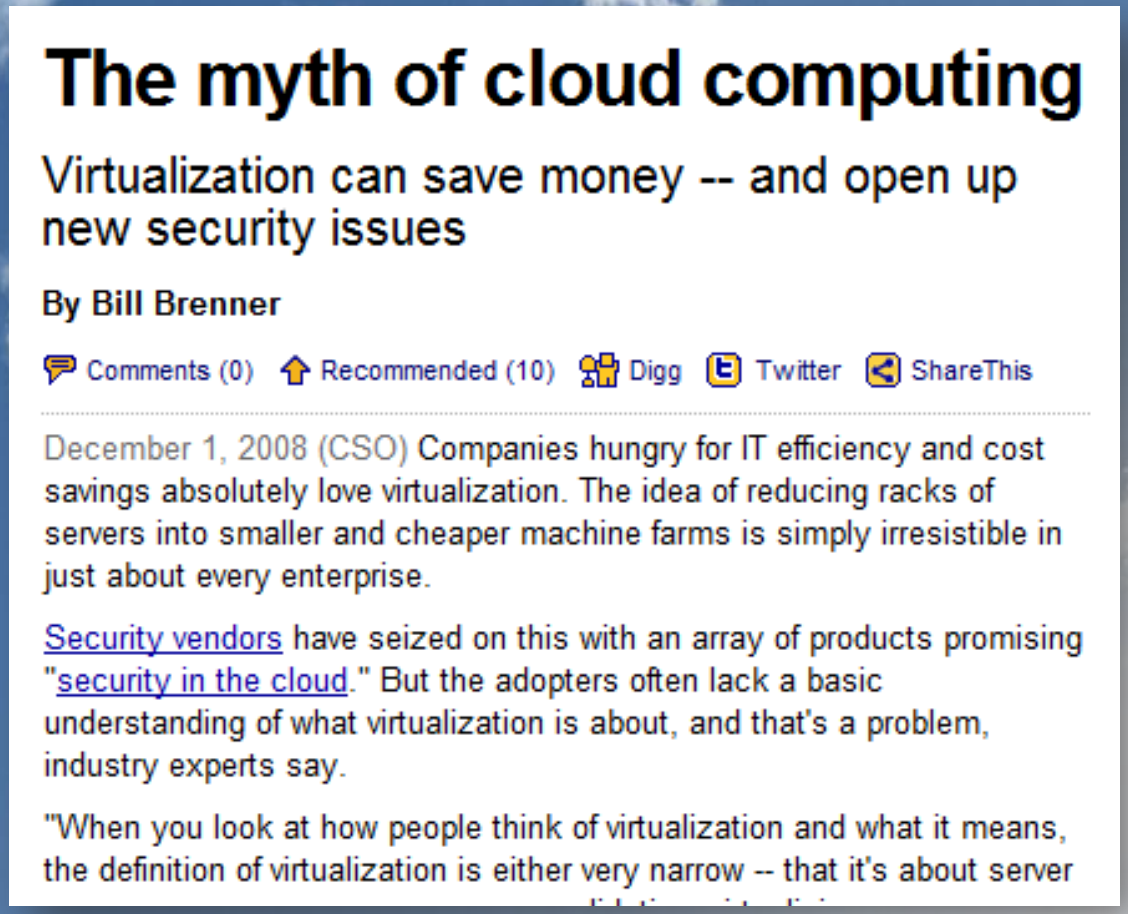
The term "cloud computing" has become almost meaningless — being used synonymously for everything from software-as-a-service (SaaS), to platform -as-a-service (PaaS).

But a new white paper, sponsored by Microsoft and written by the always entertaining consultant David Chappell, provides more clues aboutwhat the Softies are planning to unveil at this October's Professional Developers Conference. For anyone looking to understand how and where Red Dog, Zurich, BizTalk Services and SQL Server Data Services (SSDS) all fit together, the 13-pager is worth a read.

Chappell, who provided an insightful talk at TechEd in June on Microsoft's "Oslo" initiative (while managing to tread safely through a minefield of non-

"What are vendors doing in this space?"

Patterns for Cloud Computing



The myth of cloud computing

Virtualization can save money -- and open up new security issues

By Bill Brenner

Comments (0) Recommended (10) Digg Twitter ShareThis

December 1, 2008 (CSO) Companies hungry for IT efficiency and cost savings absolutely love virtualization. The idea of reducing racks of servers into smaller and cheaper machine farms is simply irresistible in just about every enterprise.

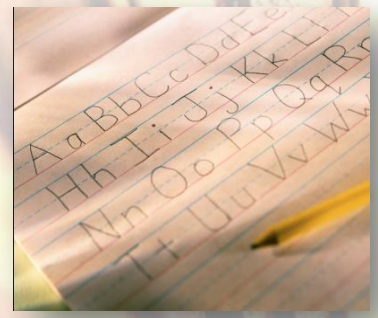
Security vendors have seized on this with an array of products promising "security in the cloud." But the adopters often lack a basic understanding of what virtualization is about, and that's a problem, industry experts say.

"When you look at how people think of virtualization and what it means, the definition of virtualization is either very narrow -- that it's about server

*"What **applications make sense** in the cloud?"*

Session Objectives

Session Objectives



Build on Stefan's introduction of of cloud computing

Provide you with 5 patterns for cloud-based applications

Show implementations of these patterns

Defining Cloud Computing

Defining Cloud Computing

Application runs
on-premises

- Bring my own machines, connectivity, software, etc.
- Complete control and responsibility
- Upfront capital costs for the infrastructure

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- Rent machines, connectivity, software
- Less control, but fewer responsibilities
- Lower capital costs, but pay for fixed capacity, even if idle

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Application runs using **cloud** platform

- Shared, multi-tenant environment
- Offers pool of computing resources, abstracted from infrastructure
- Pay as you go

Cloud "Variants"

Public Cloud

Defining Cloud Computing

Pool of computing resources offered by a vendor, typically using a "pay as you go" model

Private Cloud

Defining Cloud Computing

Pool of computing resources that lives within a **self managed datacenter**

Defining Cloud Computing

Pool of computing resources that lives within **a datacenter with no sharing**

Defining Cloud Computing

Compute: Virtualized compute based on Windows Server

Storage: Durable, scalable, & available storage

Management: Automated, management of the service

Database: Relational processing for structured/ unstructured data

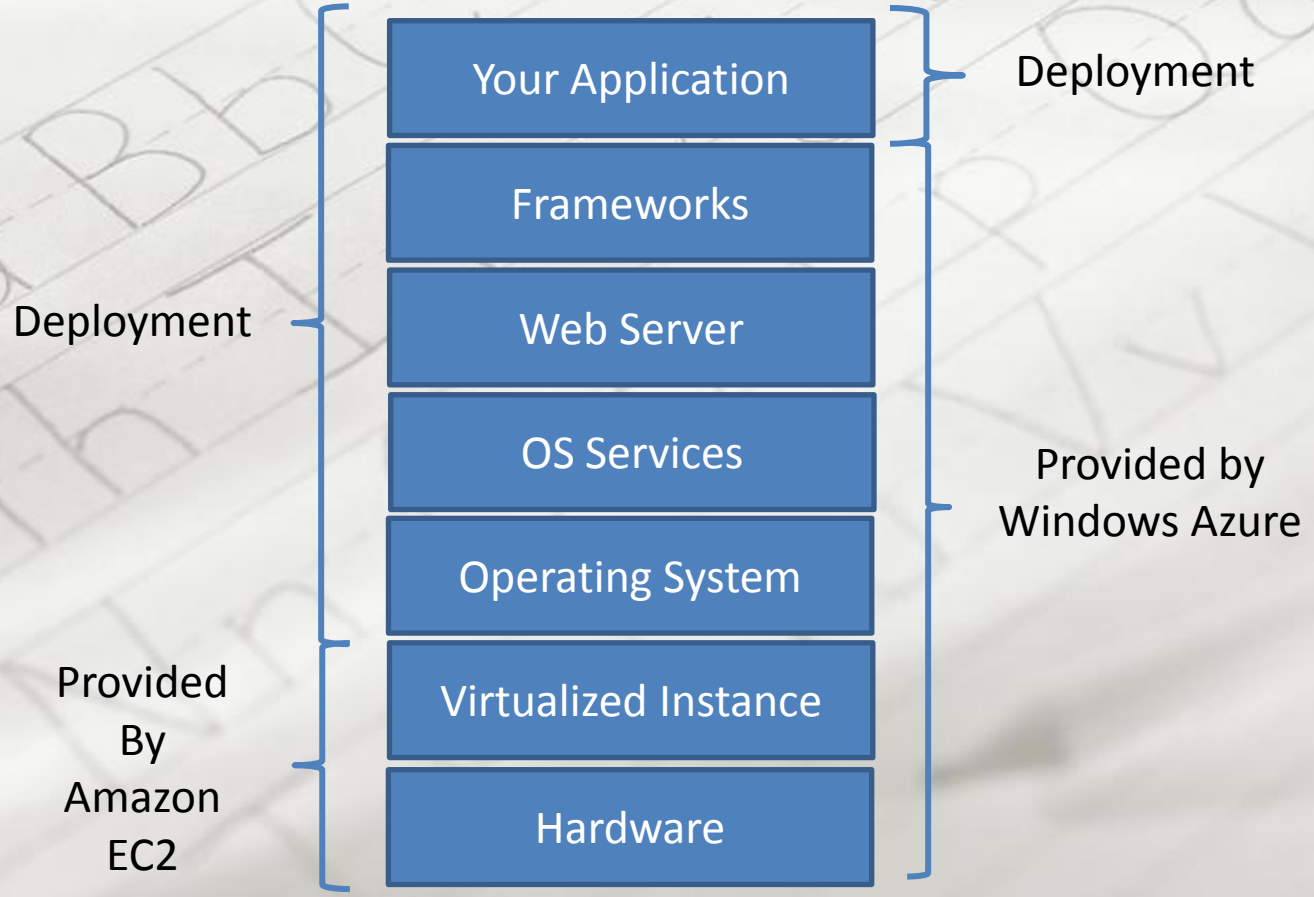
Service Bus: General purpose application bus

Access Control: Rules-driven, claims-based access control

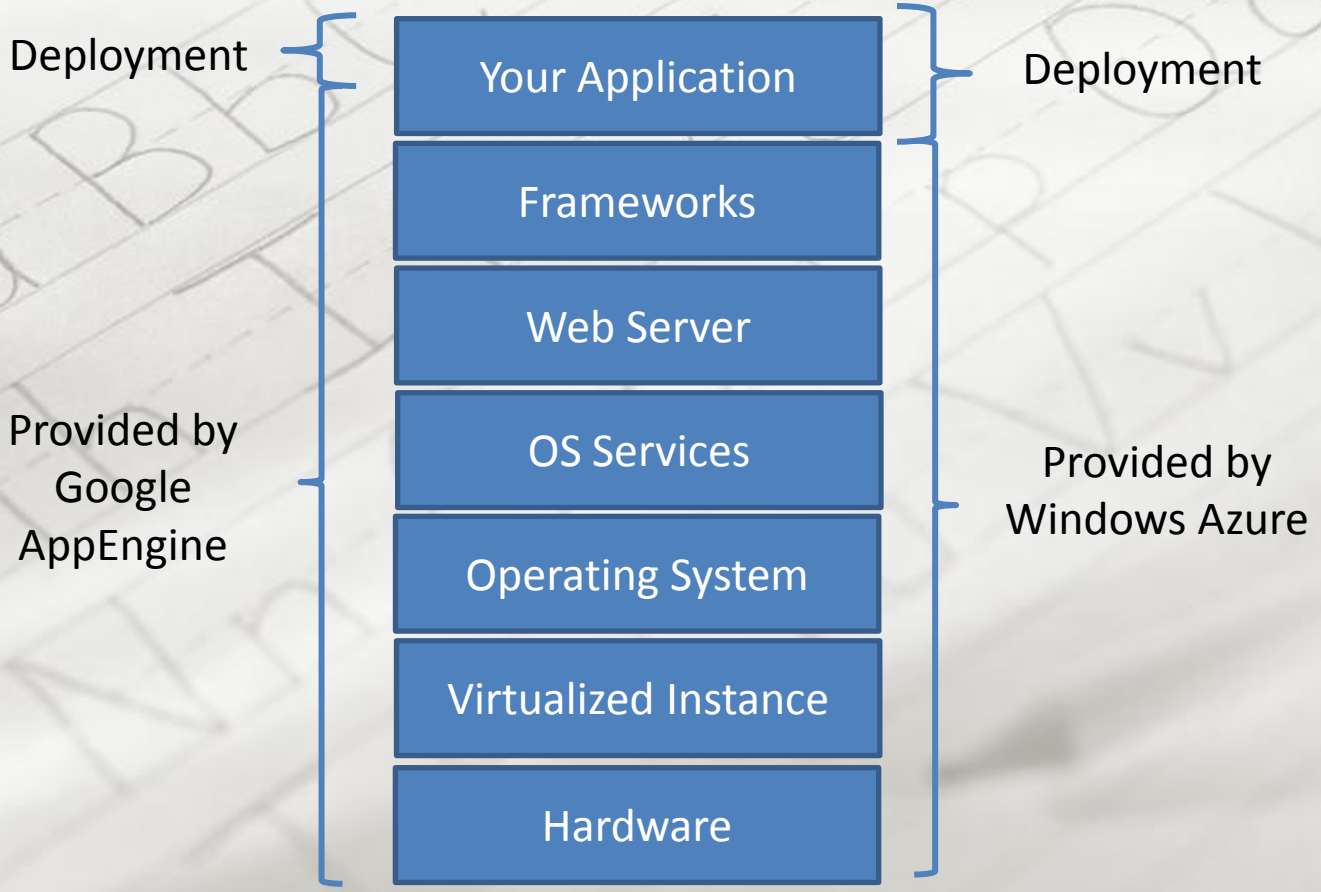
Different Models

Infrastructure as a Service (IaaS)
vs.
Platform as a Service (PaaS)

Defining Cloud Computing



Defining Cloud Computing



#1 - Using the Cloud for **Scale**

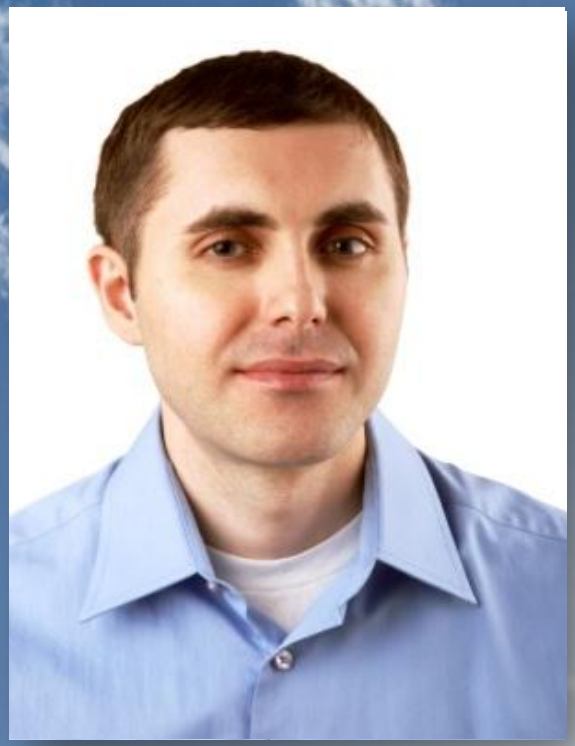
Patterns for Cloud Computing

"Isn't the cloud good for applications that need to scale dynamically?"

Patterns for Cloud Computing

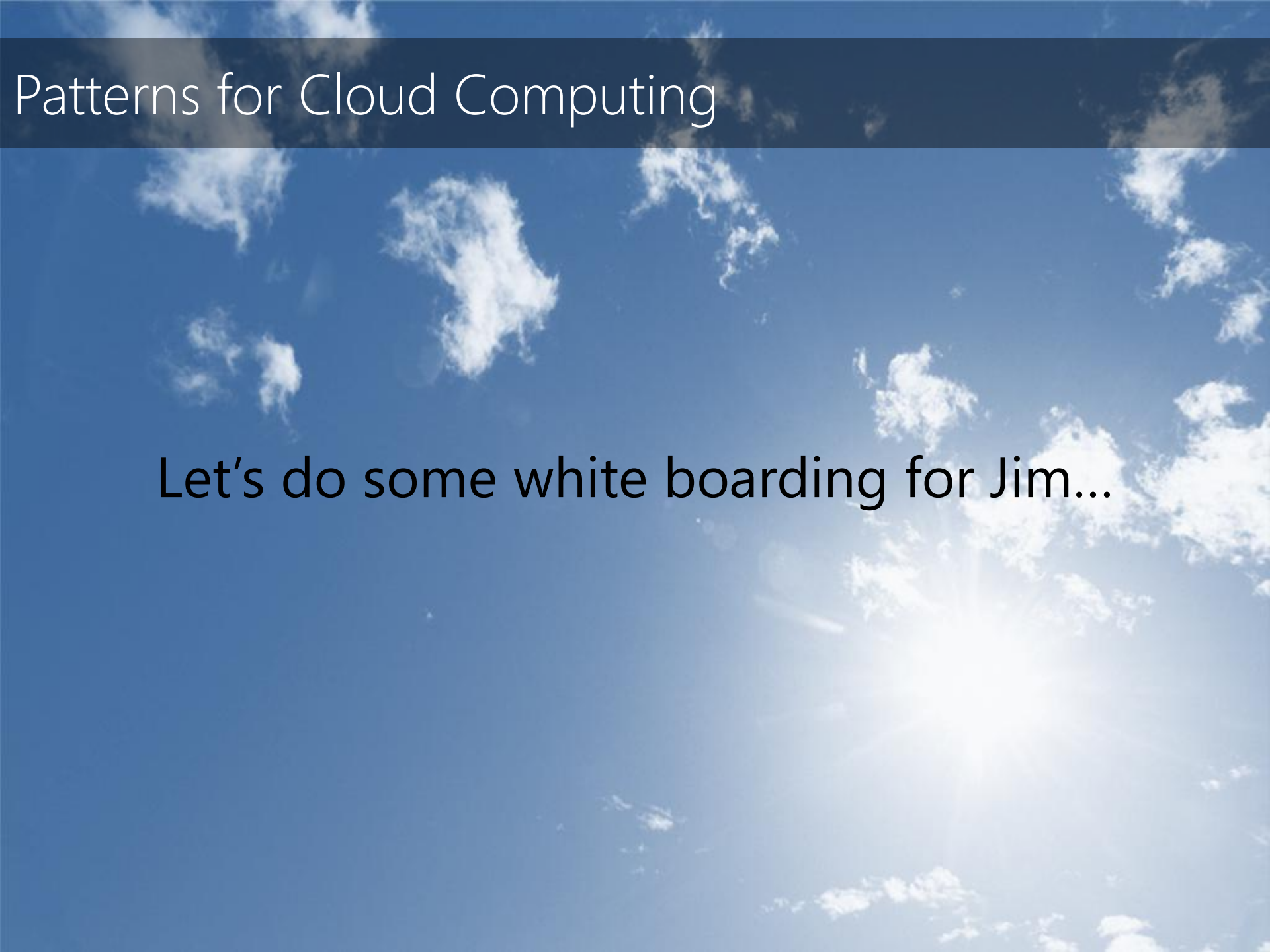
"For example, applications that have spikes or peak loads"

Patterns for Cloud Computing



"How does this work?"

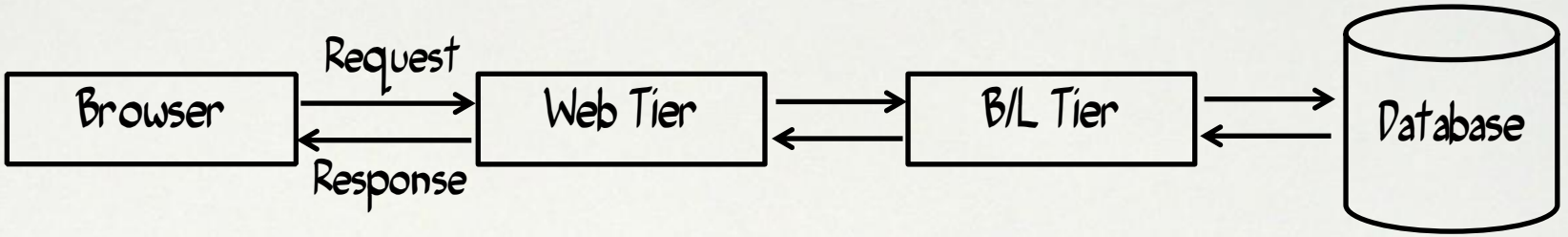
Patterns for Cloud Computing



. . .and when I say white boarding, I really mean it

#1 - Using the Cloud for Scale

"Wow! What a great site!"



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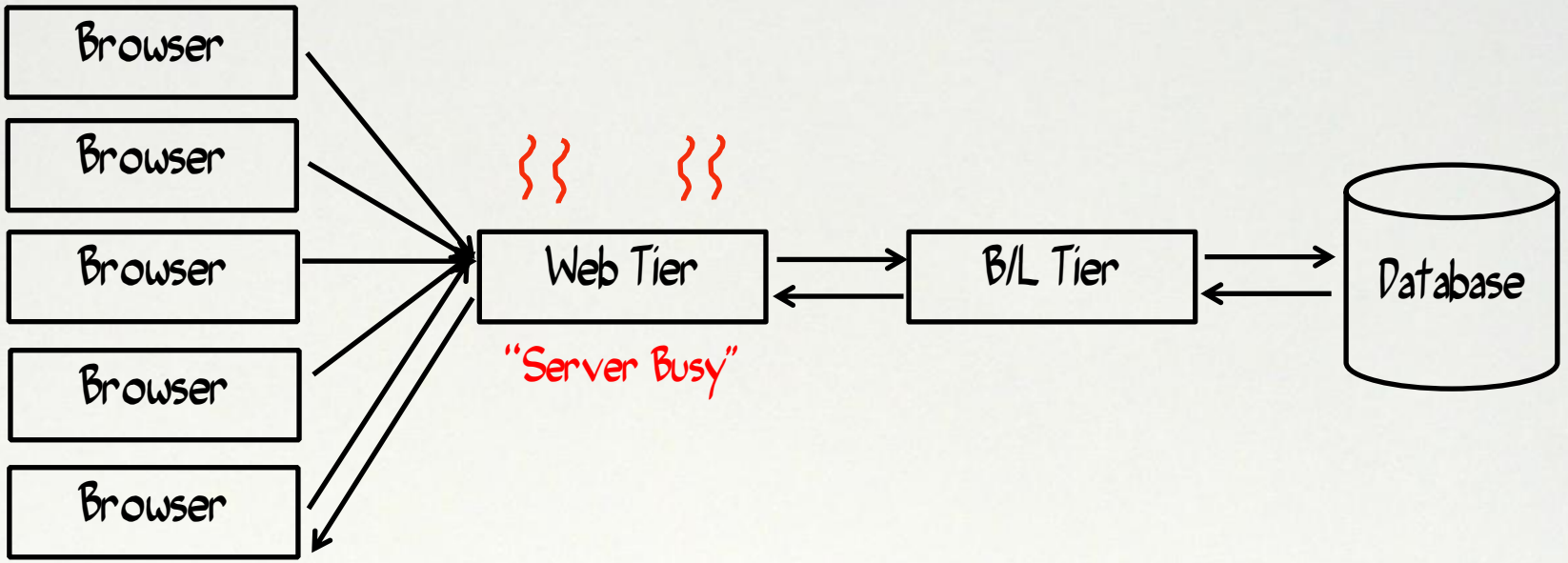

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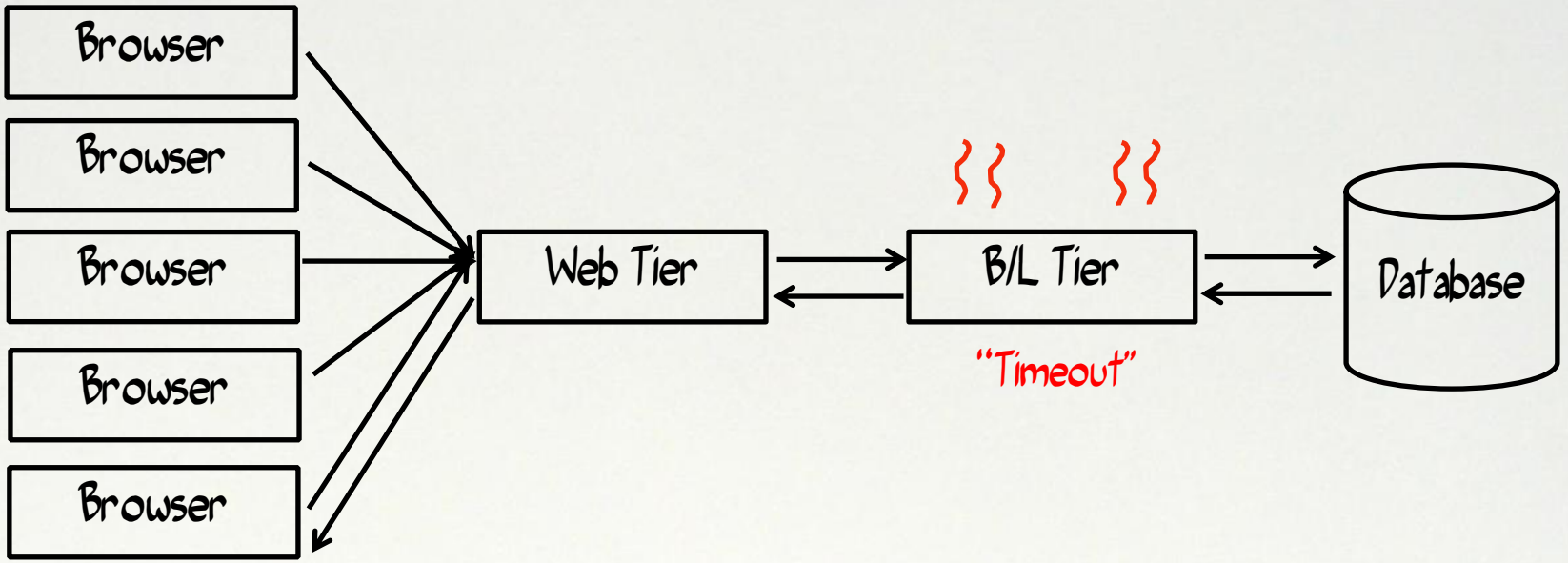

How would Jim do this today on premises?

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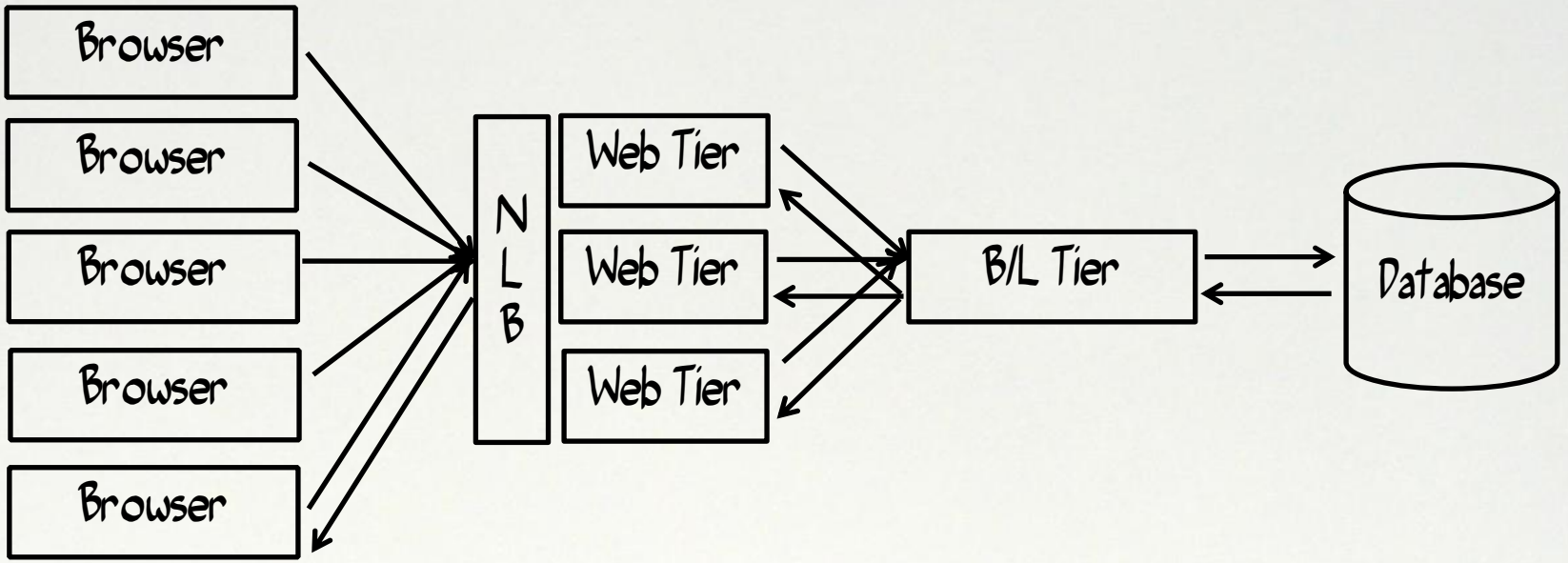

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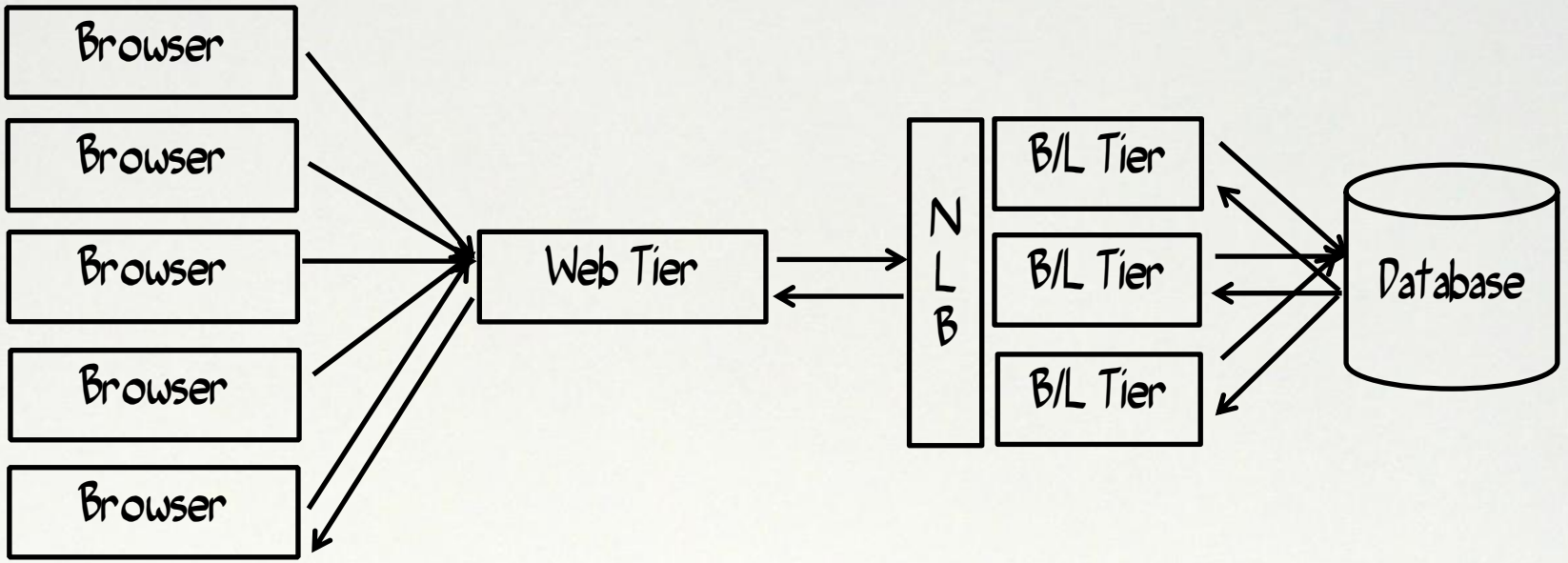

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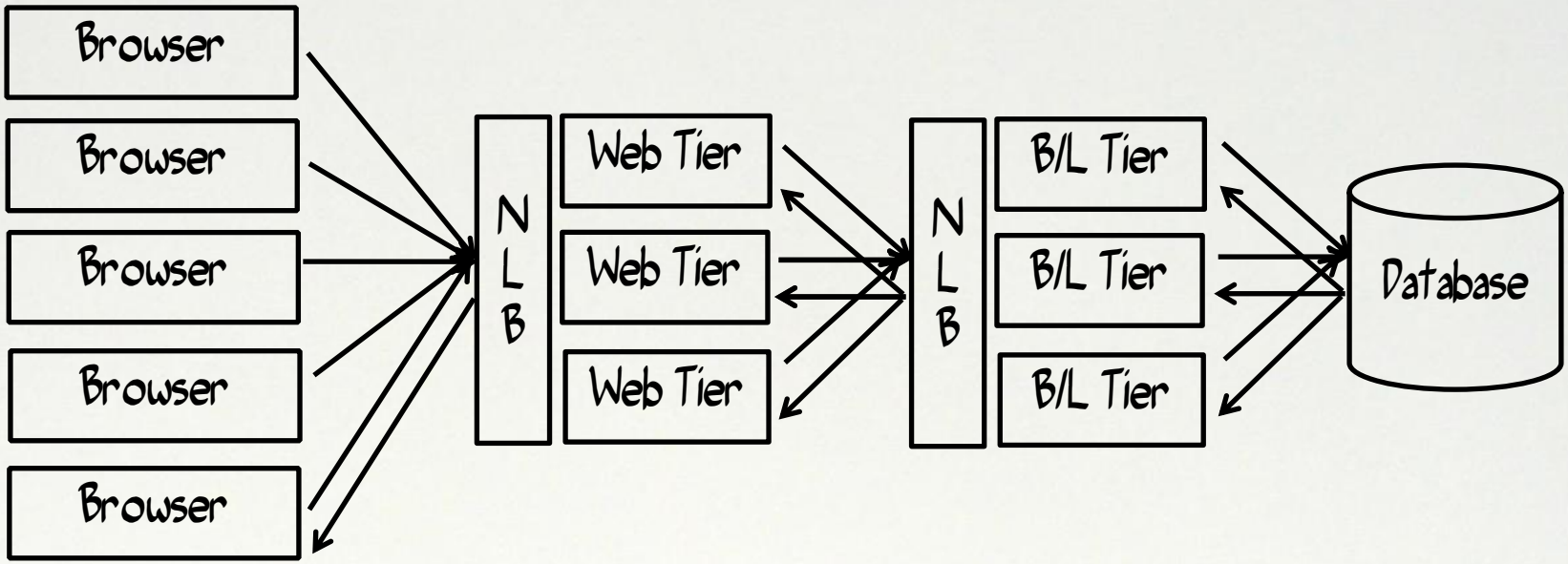

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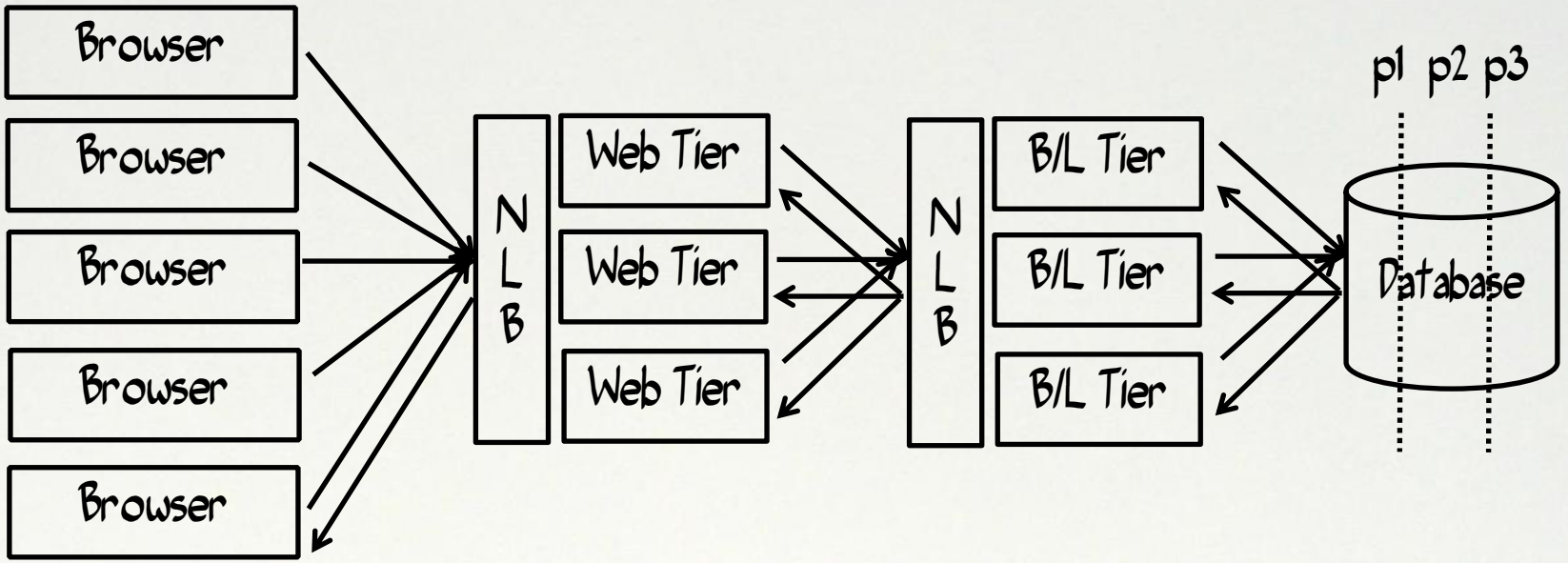

Not without consequences...

#1 - Using the Cloud for Scale

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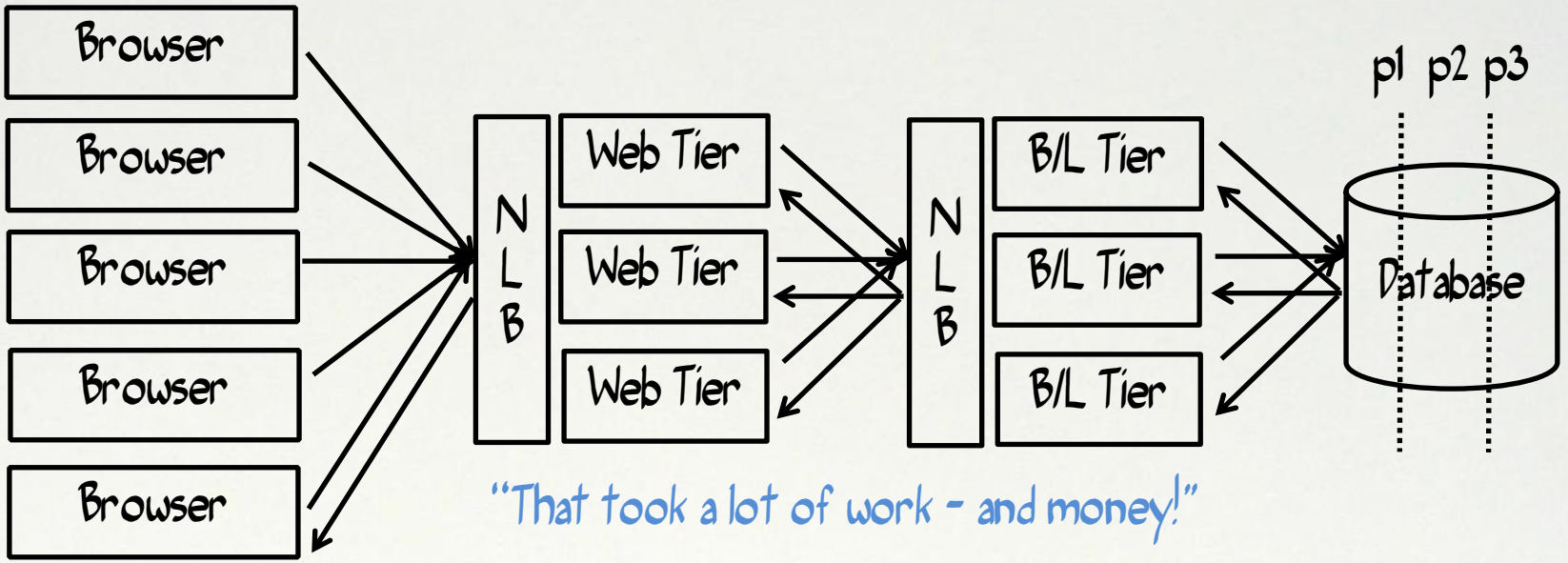
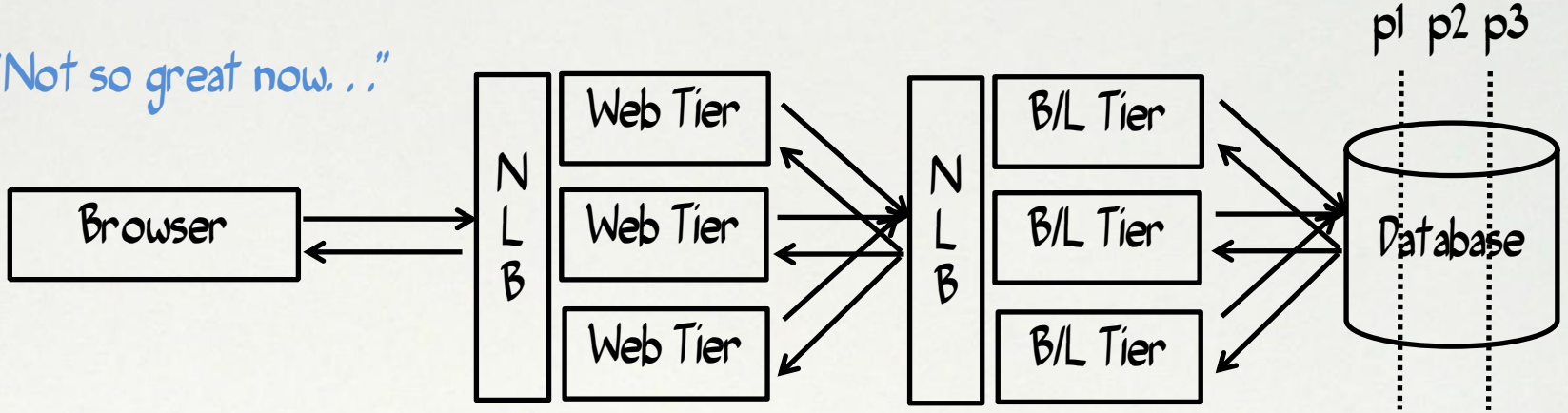


"That took a lot of work - and money!"

#1 - Using the Cloud for Scale

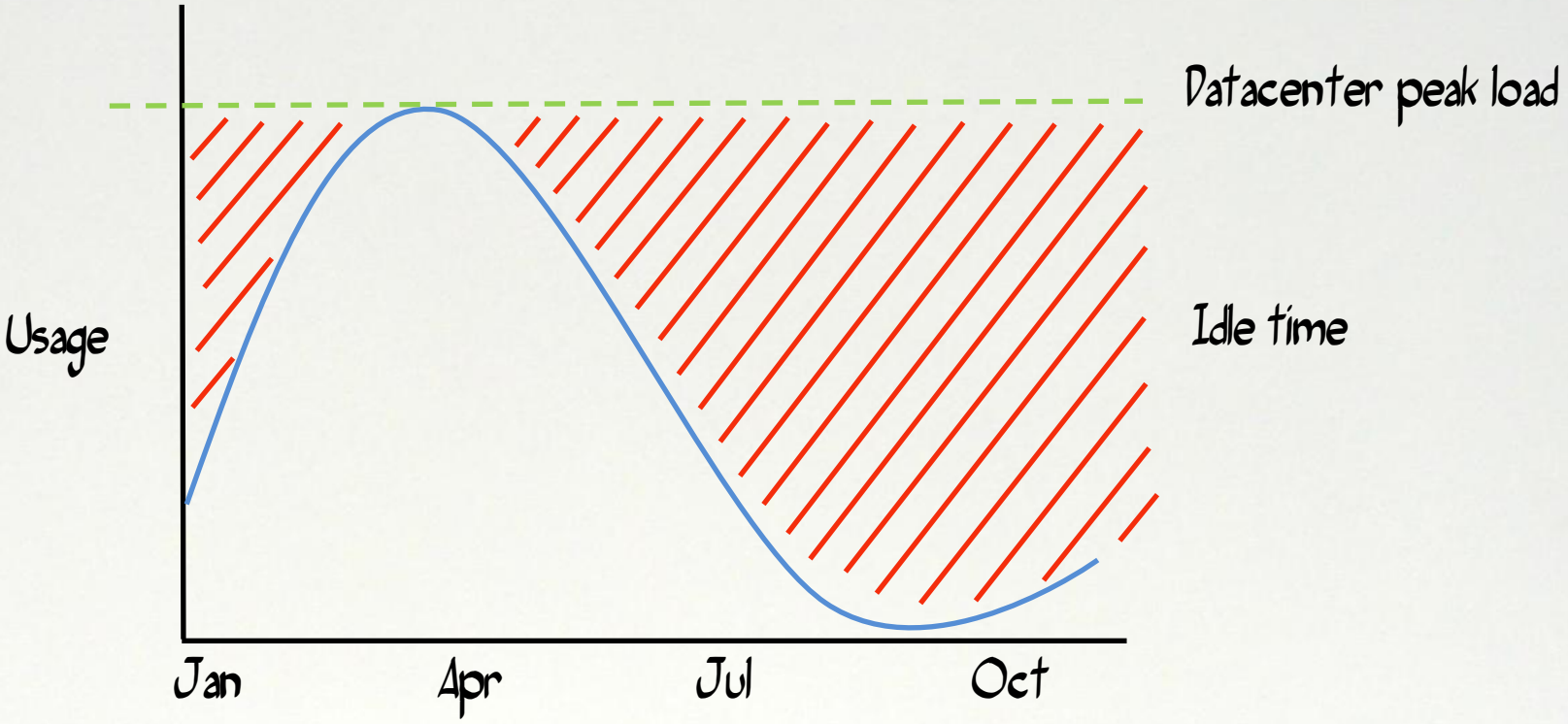
How would Jim do this today on premises?



"That took a lot of work - and money!"

"Hmmm... Most of this stuff is sitting idle..."

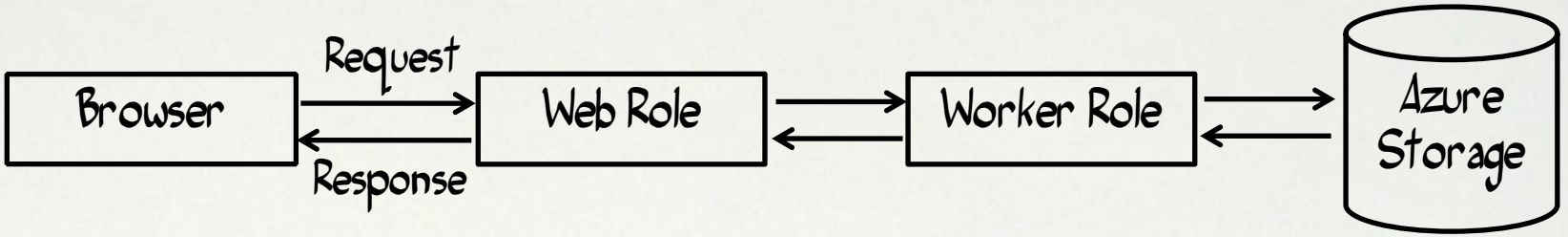
#1 - Using the Cloud for Scale



How can cloud computing help?

#1 - Using the Cloud for Scale

"Wow! What a great site!"



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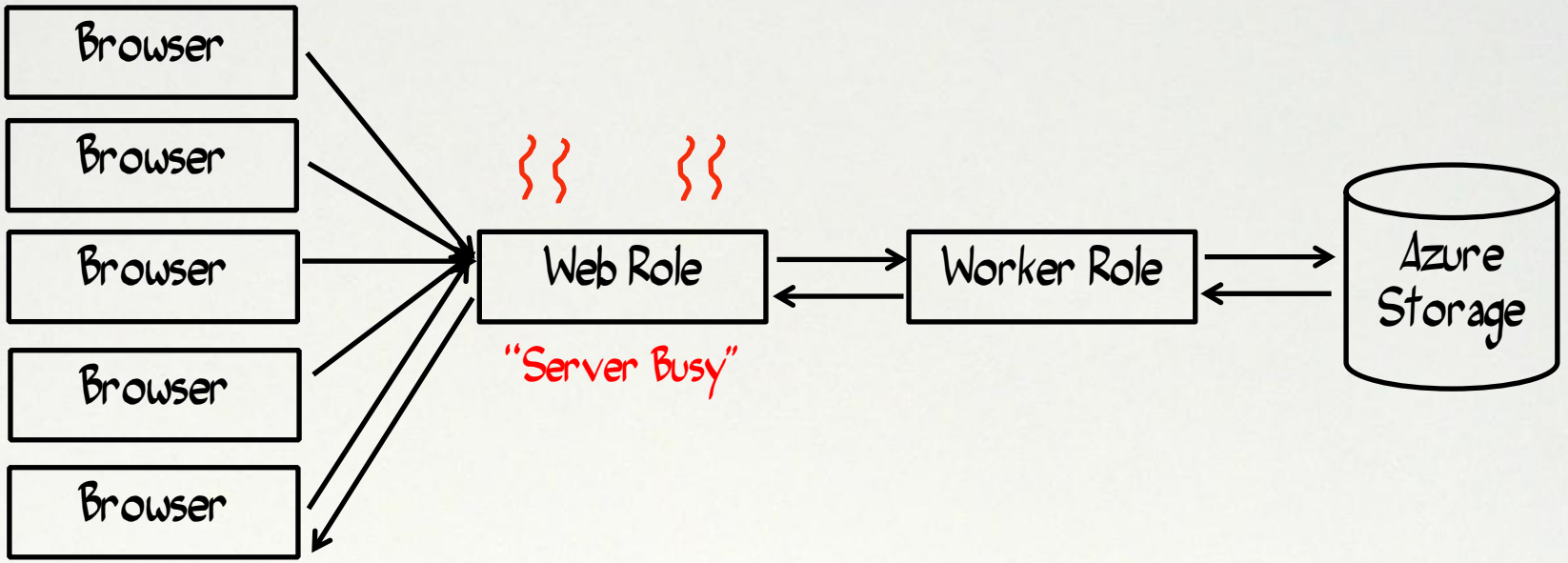


Service Tuning

Event Logs

Copy the event logs for this deployment to a storage account:

Copy Logs

Storage Account: pilotappdata

Container Name: pilotapp-staging

Configuration Settings

Edit the configuration:

```
<?xml version="1.0" encoding="utf-16"?>
<ServiceConfiguration xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance" xmlns:xsd="http://www.w3.org/2001/XMLSchema" serviceName=""
xmlns="http://schemas.microsoft.com/ServiceHosting/2008/10/ServiceConfigura
tion">
  <Role name="WebRole1">
    <ConfigurationSettings />
    <Instances count="1" />
  </Role>
  <Role name="WorkerRole1">
    <ConfigurationSettings />
    <Instances count="1" />
  </Role>
</ServiceConfiguration>
```

Upload a new configuration file:

Browse... Upload

Hosted Service

Production
v1.8

Upgrade... | Suspend | Configure... | Delete

WebRole:
Ready 10

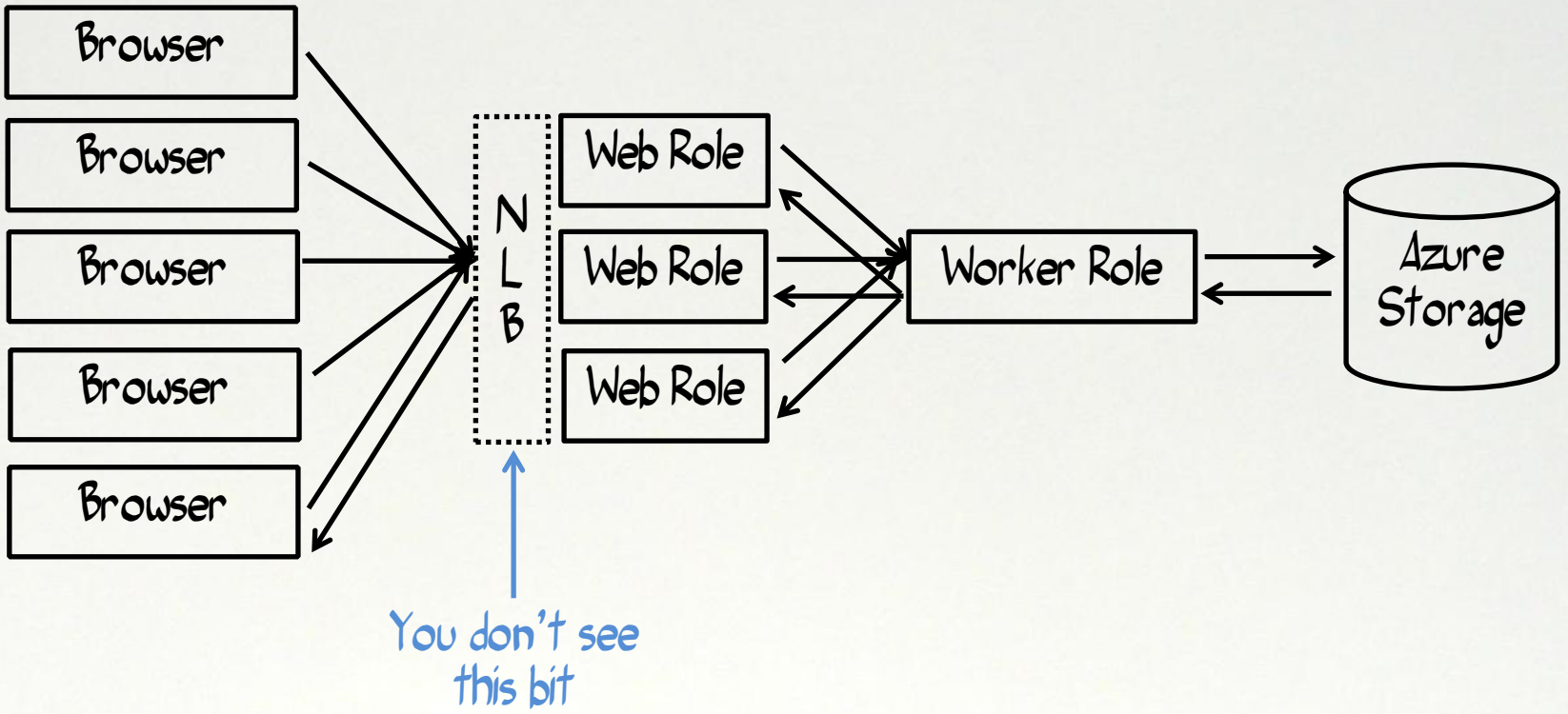
Web Site URL:
http://primephp.cloudapp.net/

Deployment ID:
52d2a2a9133d4b2ea5d72ae8b563683a

Affinity Group

Affinity Group Name: Unaffinitized
Geographic Location: Anywhere US

#1 - Using the Cloud for Scale



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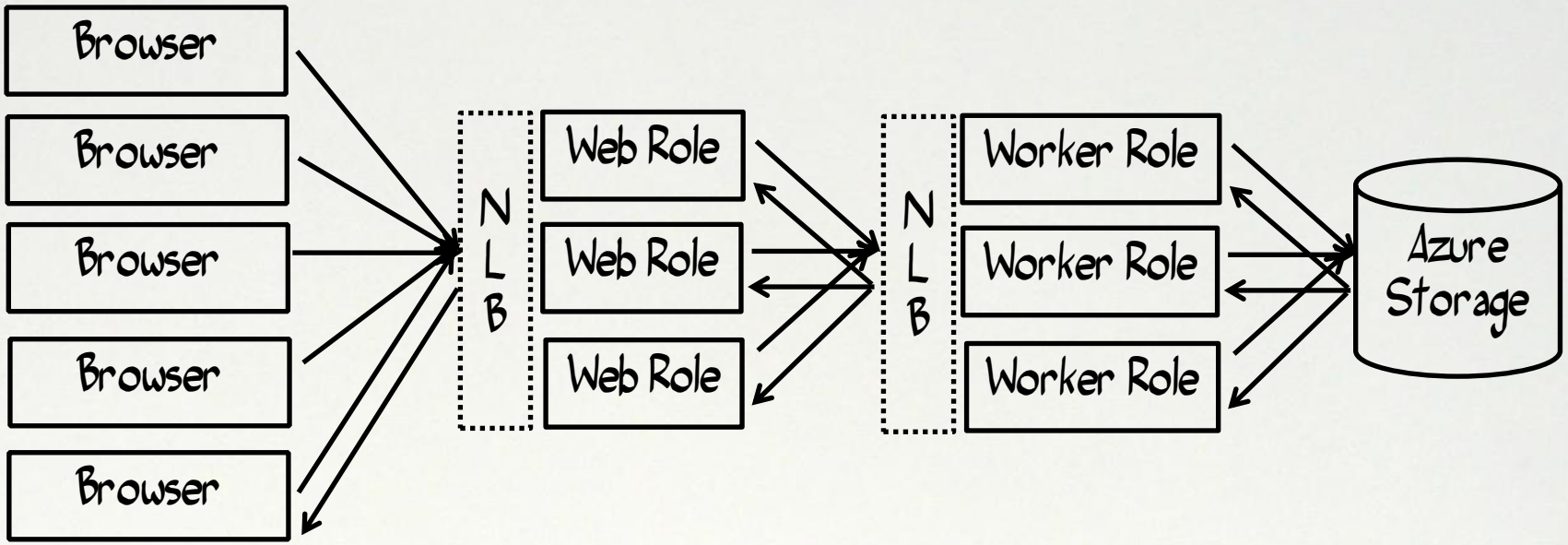
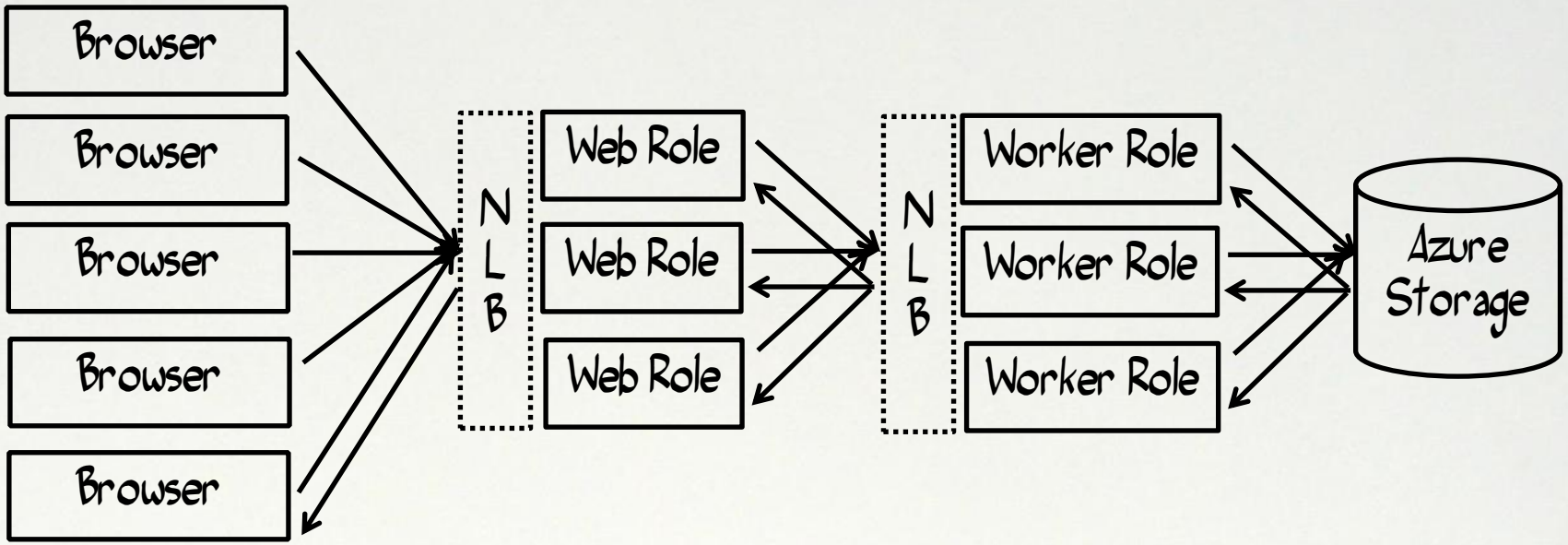


OK, so changing config is easy...

. . .but what else do I need to know?

#1 - Using the Cloud for Scale



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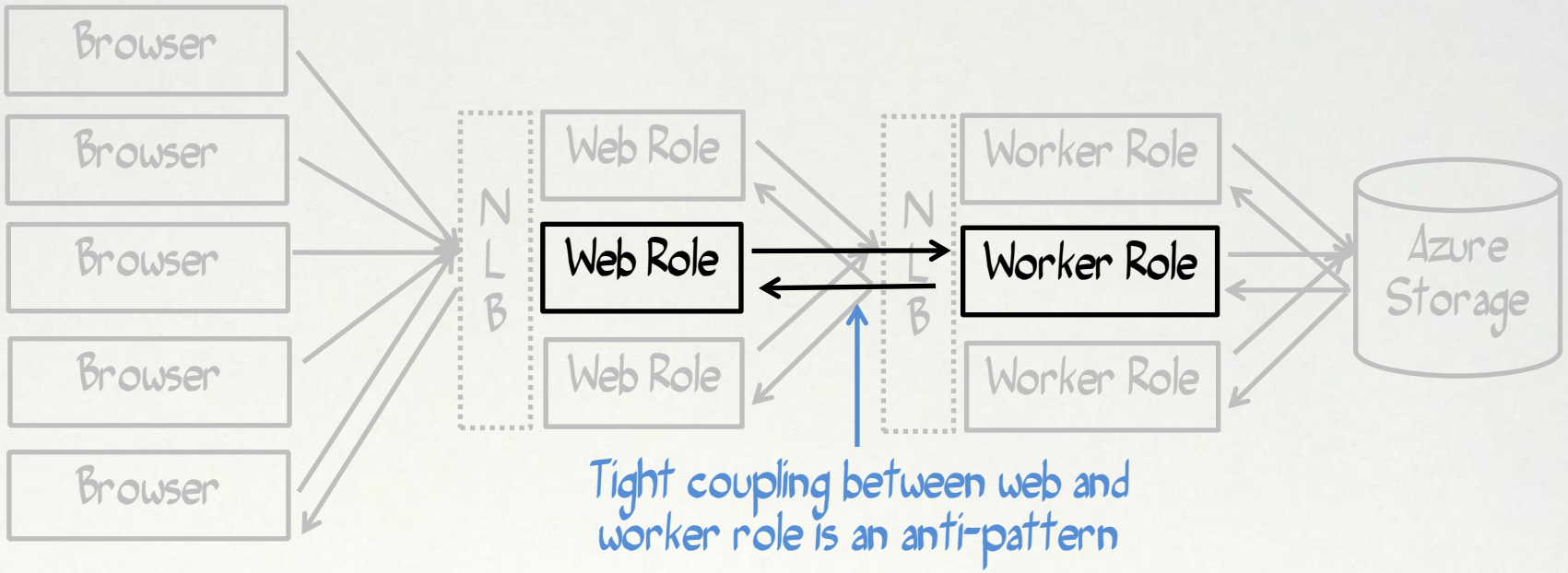

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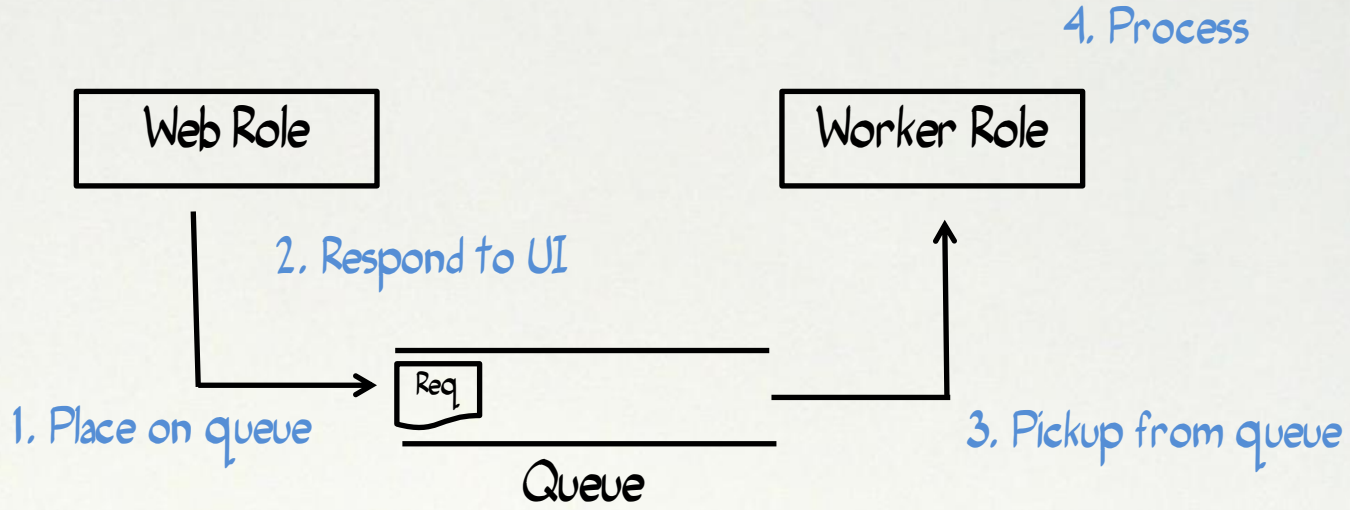

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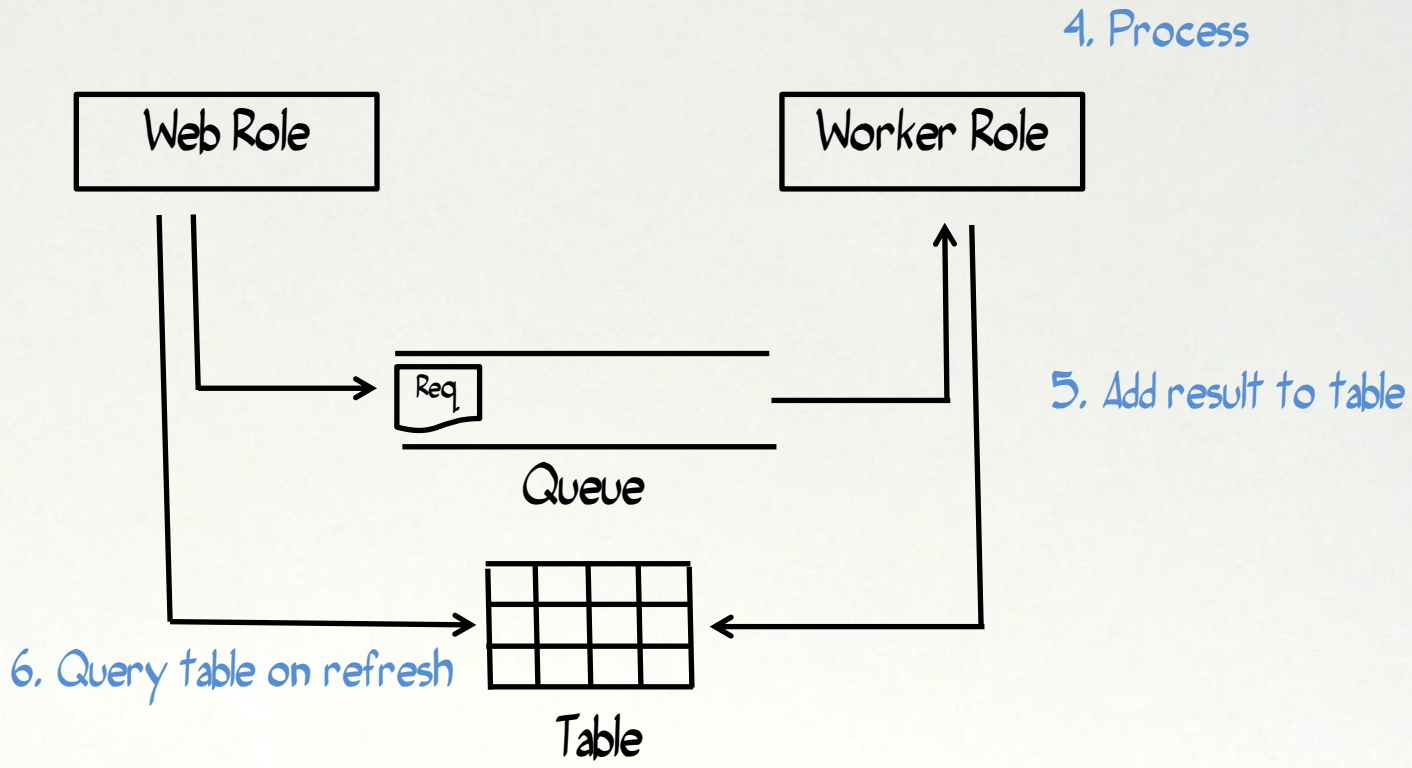
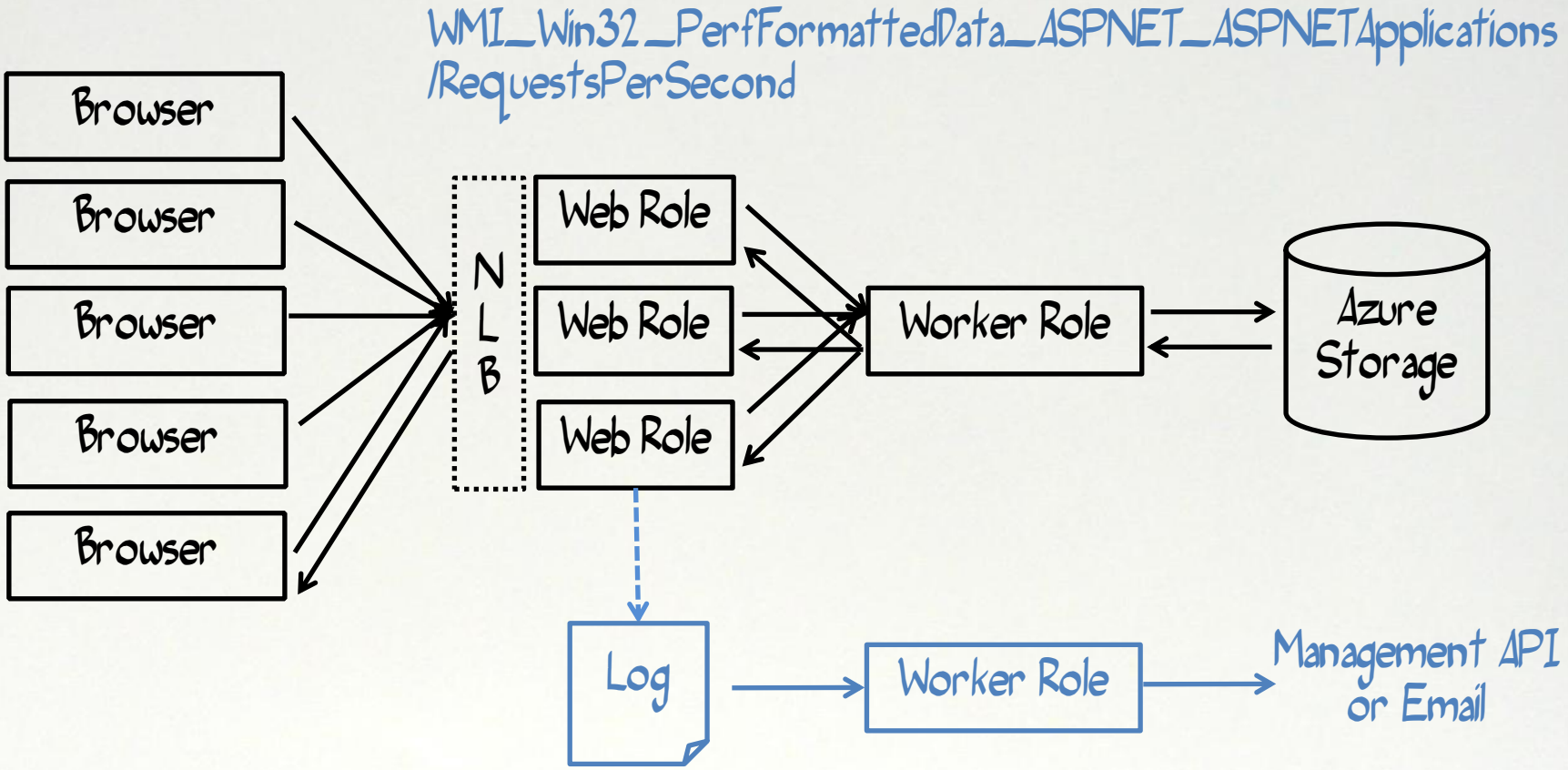


Demo: Prime Solver

How many web and worker roles do you need?

How many web and worker roles do you need?

#1 - Using the Cloud for Scale



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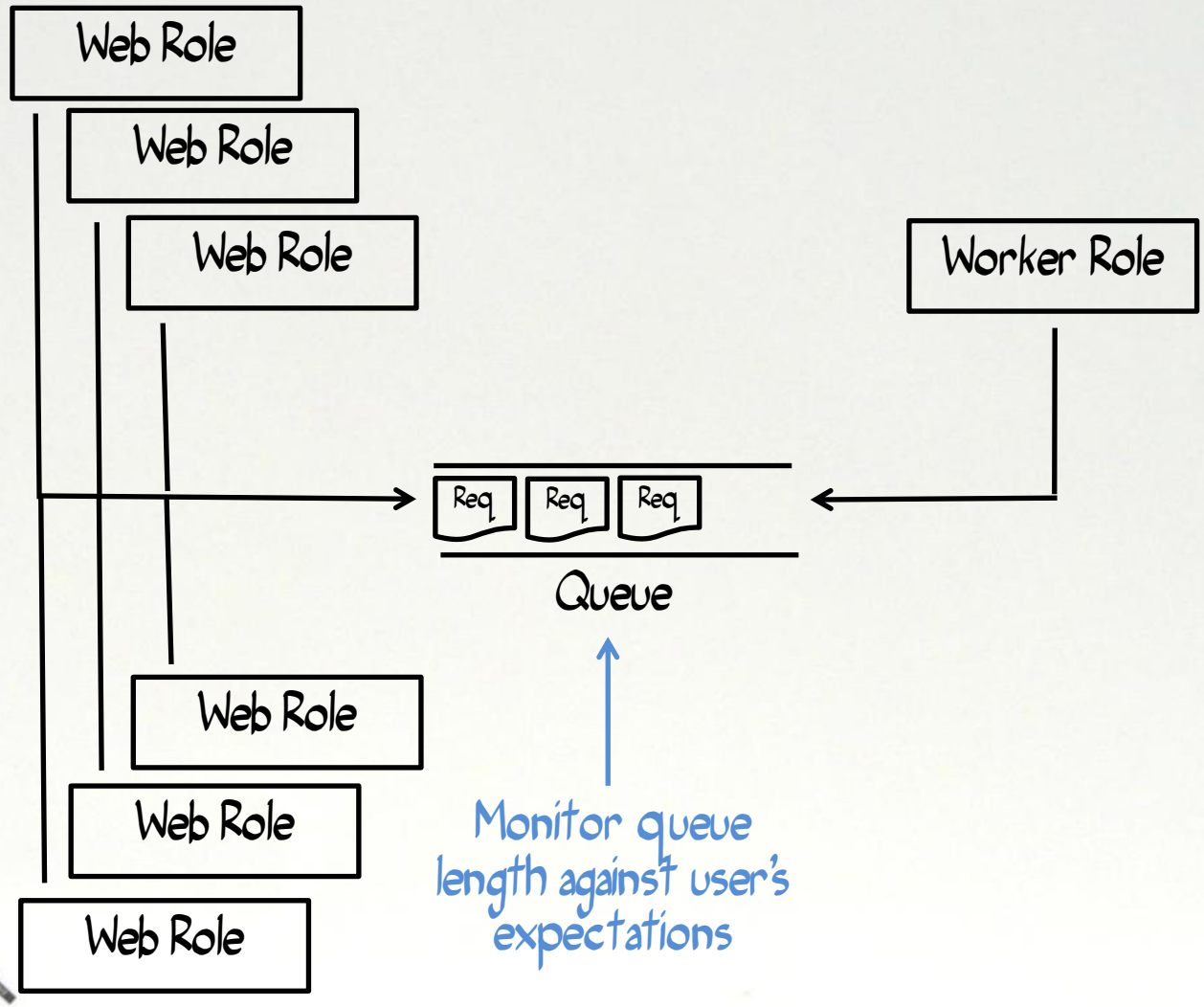

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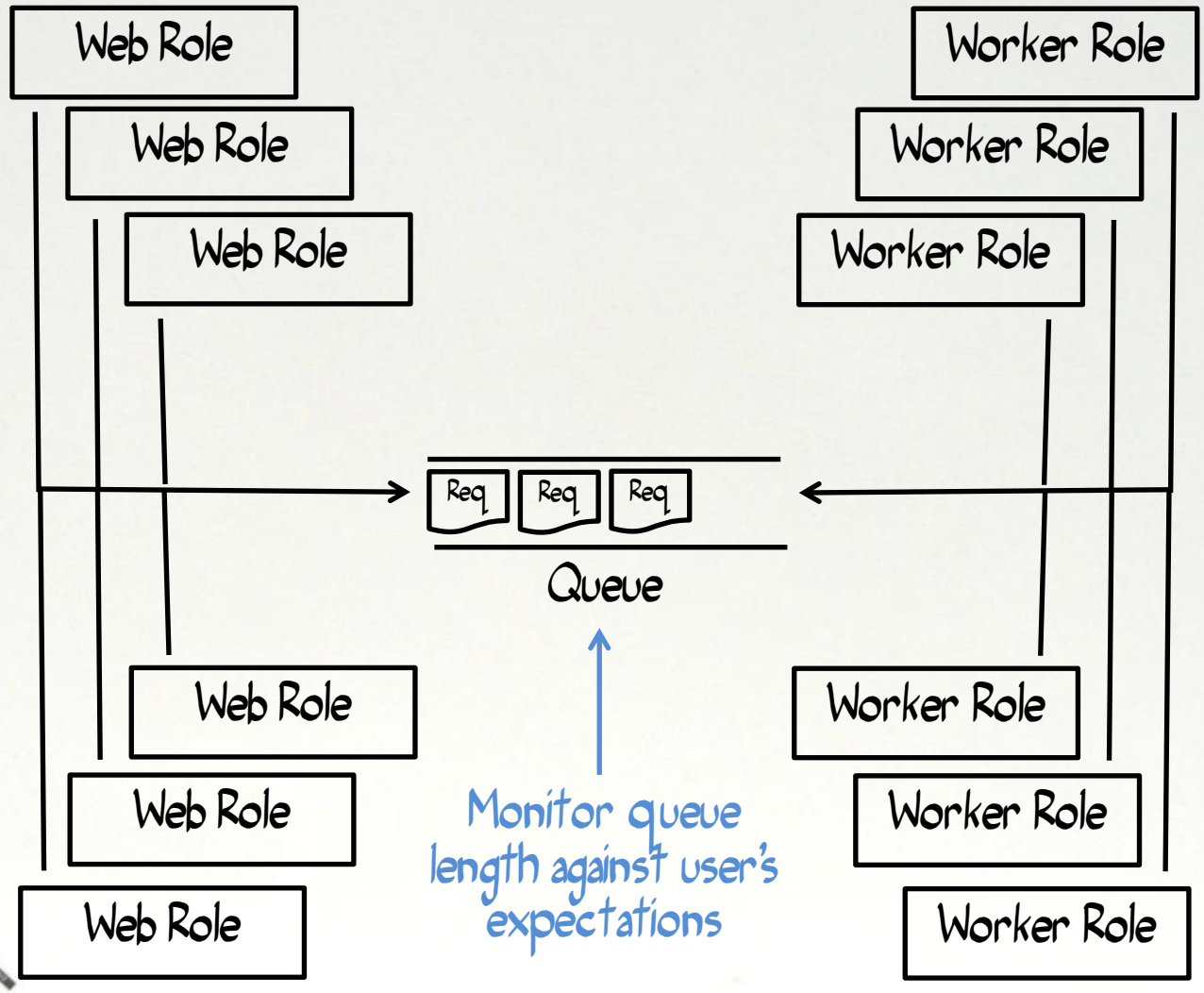


Takeaways

A core tenet of cloud computing is the ability to scale up/down

Understand how to communicate between roles and nodes

Strategy on when to scale up/down roles in production

#2 - Using the Cloud for **Multi Tenancy**

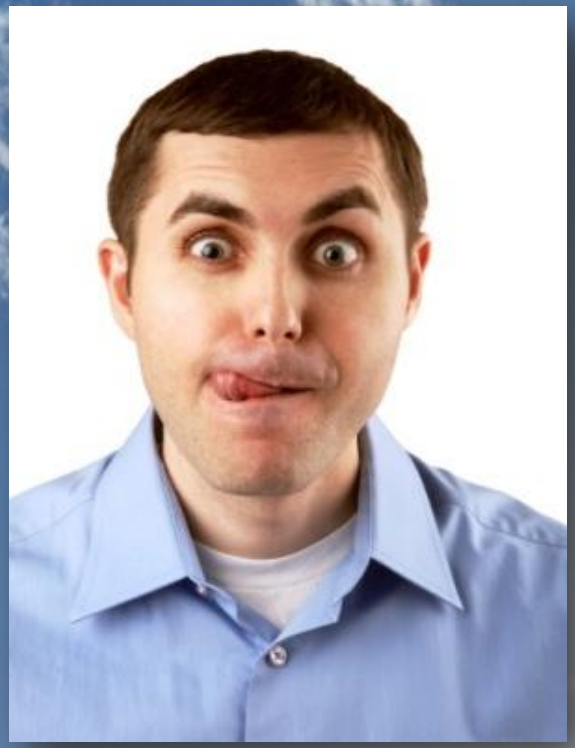
Patterns for Cloud Computing

"I like the idea of scaling Web roles…"

Patterns for Cloud Computing

"…but need to serve multiple customers"

Patterns for Cloud Computing



"Without creating separate codebases!"

How would Jim do this today on premises?

#2 - Using the Cloud for Multi Tenancy

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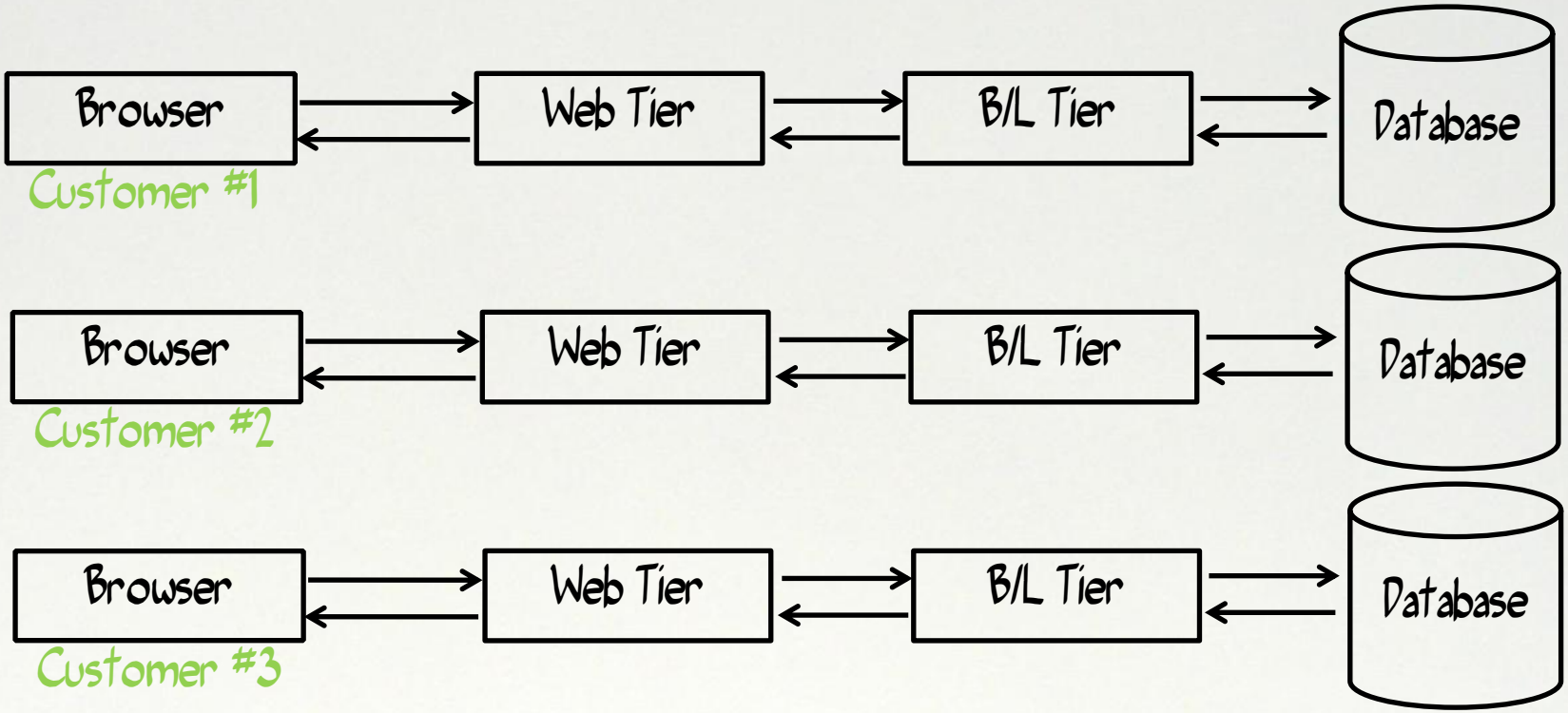
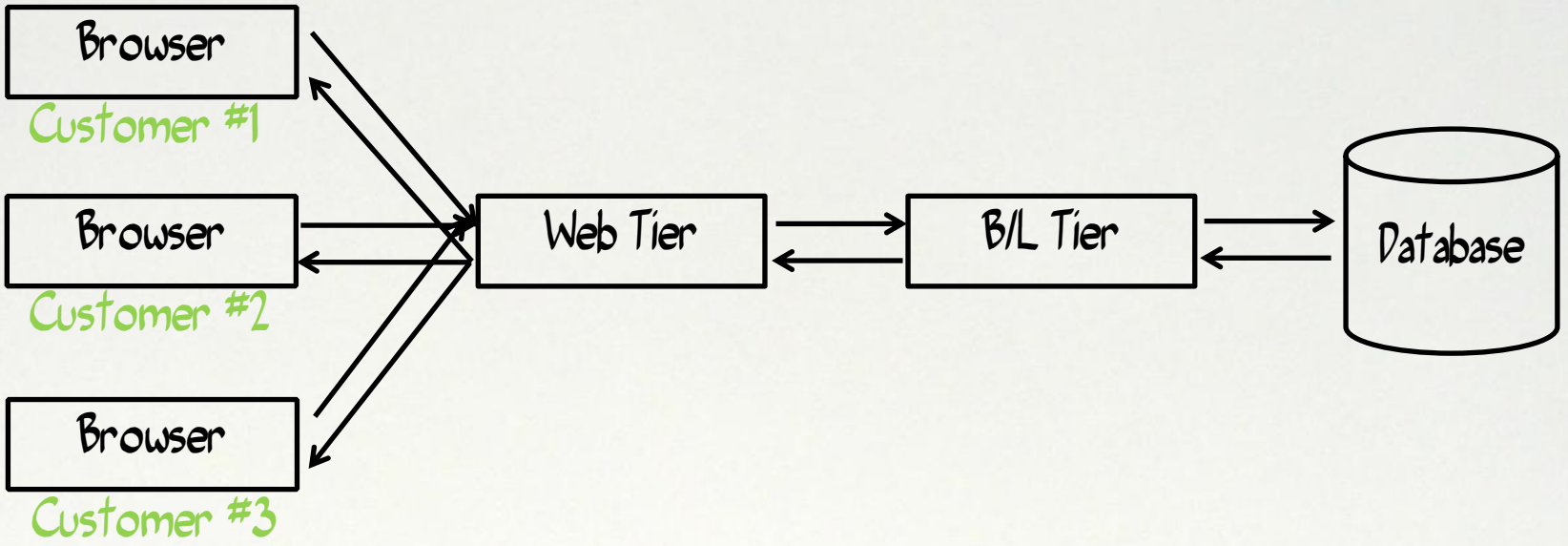


Gets expensive pretty quickly

#2 - Using the Cloud for Multi Tenancy



Schema Customizations

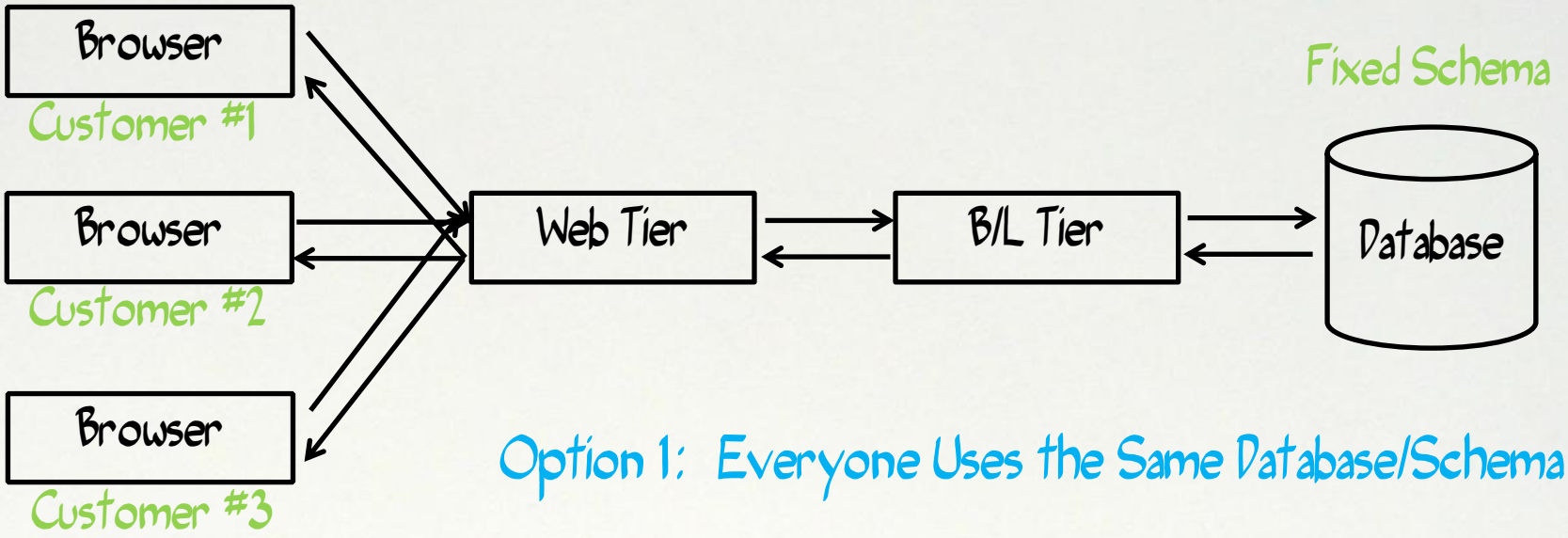
UI Customizations

Schema Customizations

UI Customizations

3 options for data in multi tenant environment

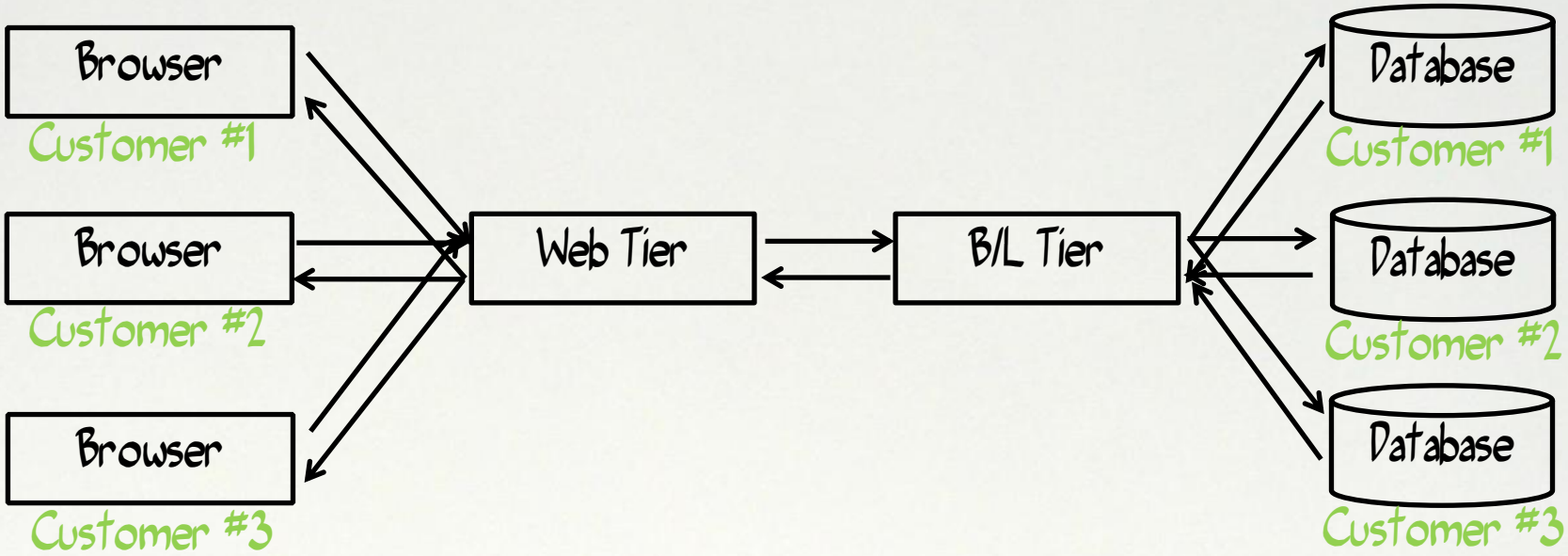
#2 - Using the Cloud for Multi Tenancy



Option 1: Everyone Uses the Same Database/Schema

Pros: Simplest approach, easy to maintain/upgrade.
Cons: No customizations. Restoring of tenant data.

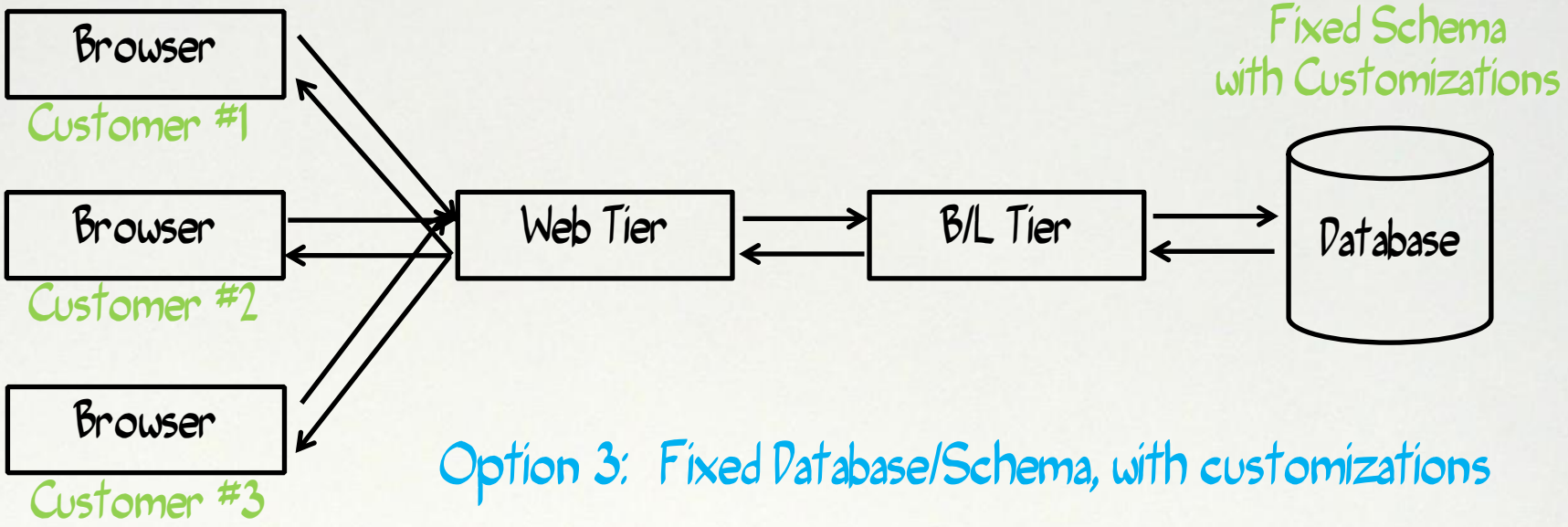
#2 - Using the Cloud for Multi Tenancy



Option 2: Give Each Customer Their Own Database/Schema

Pros: Flexible. Tenant restore is easier. High Isolation.
Cons: Can be costly. Difficult to upgrade db schemas.

#2 - Using the Cloud for Multi Tenancy

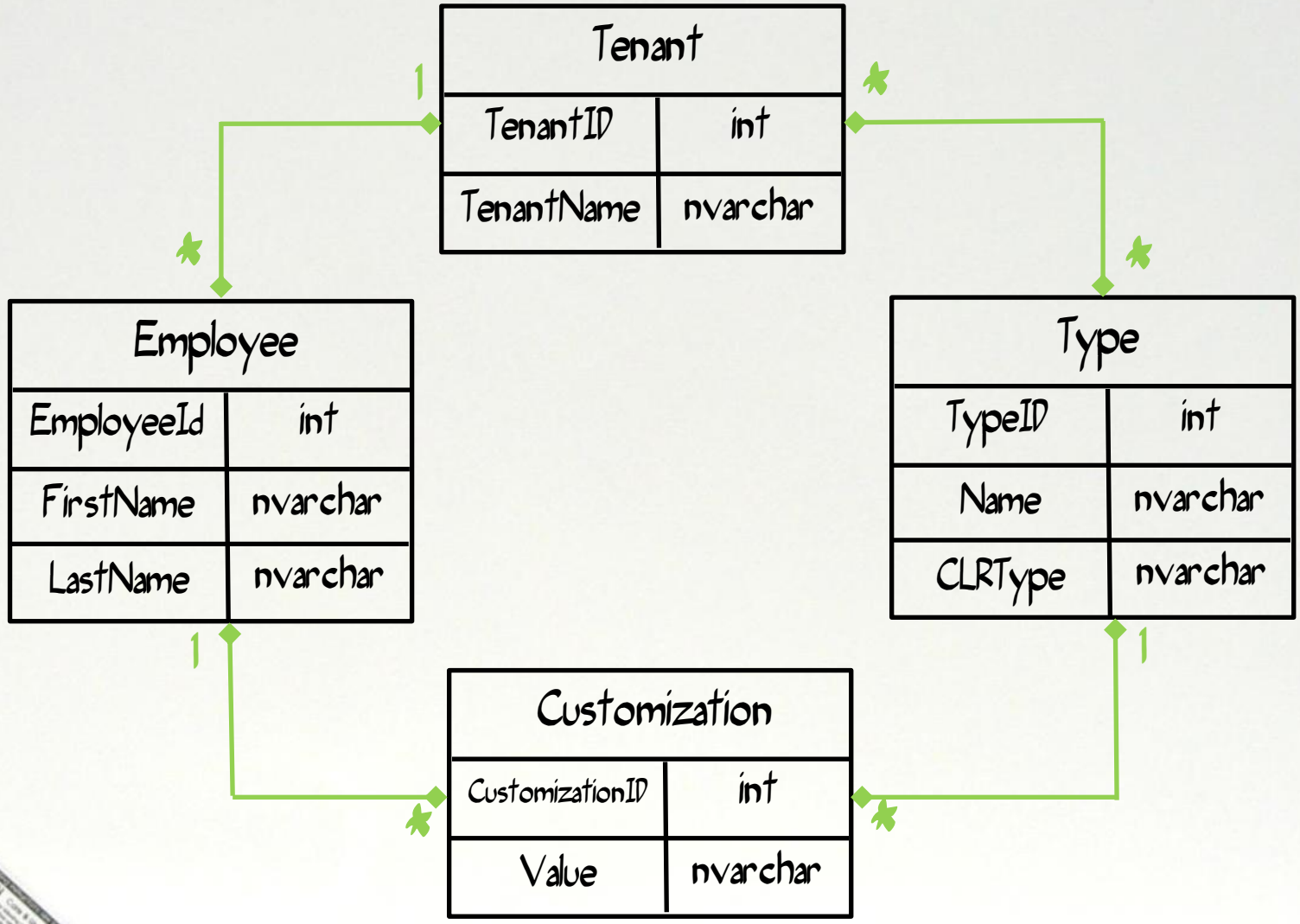


Option 3: Fixed Database/Schema, with customizations

Pros: Customers can add their own custom fields

Cons: Non standard way of customizing the schema.
Tenant restore is difficult.

#2 - Using the Cloud for Multi Tenancy



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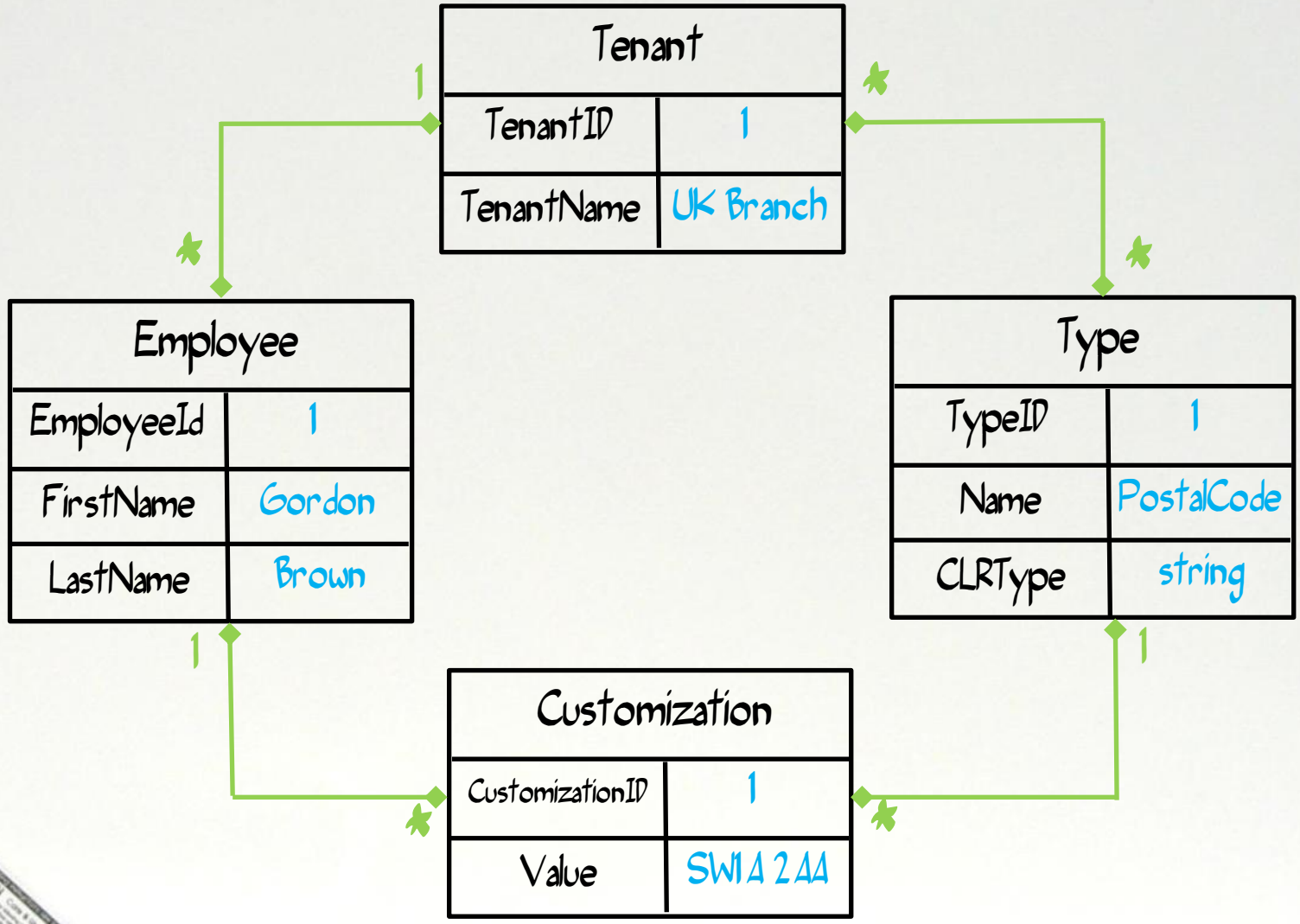

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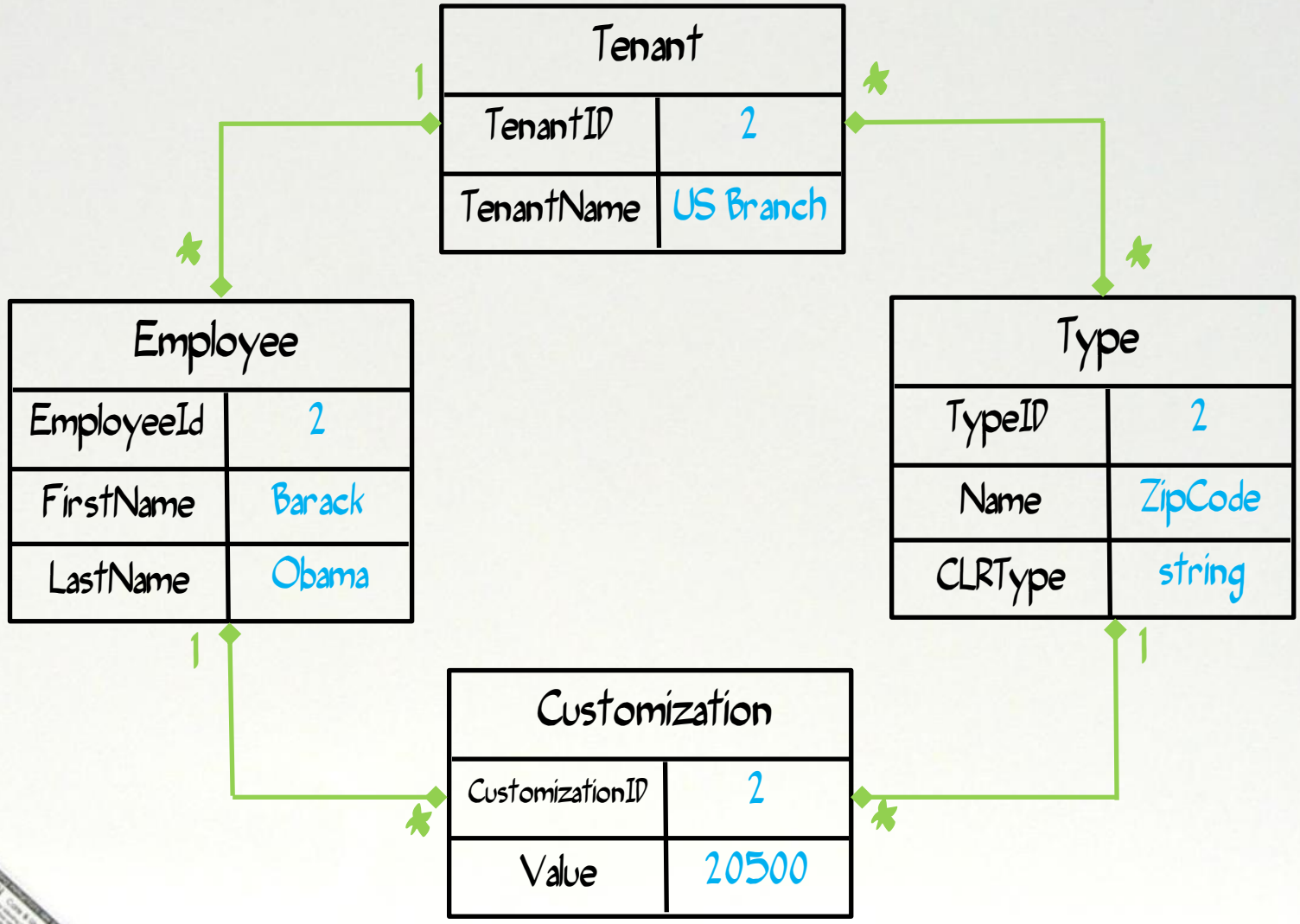

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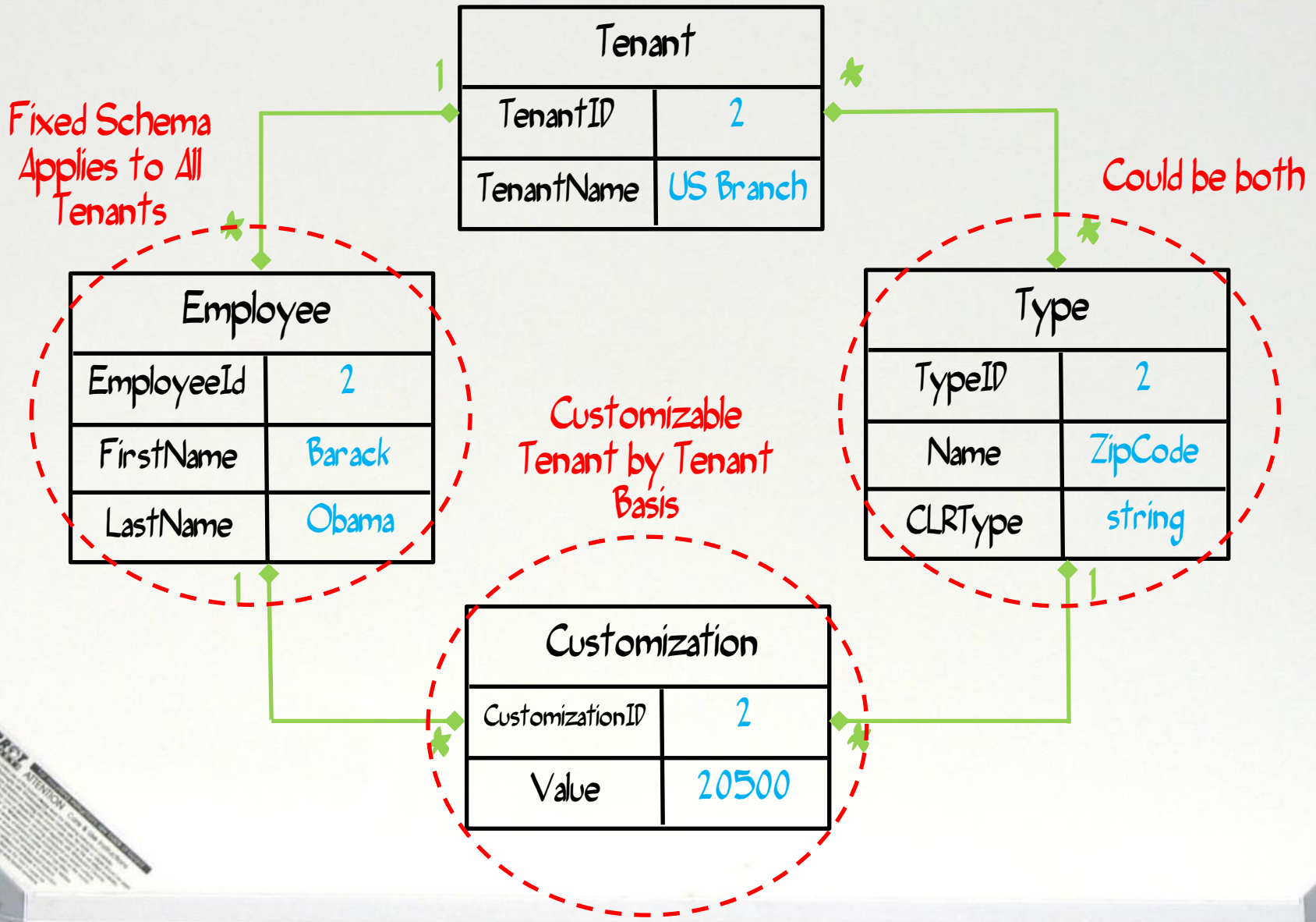
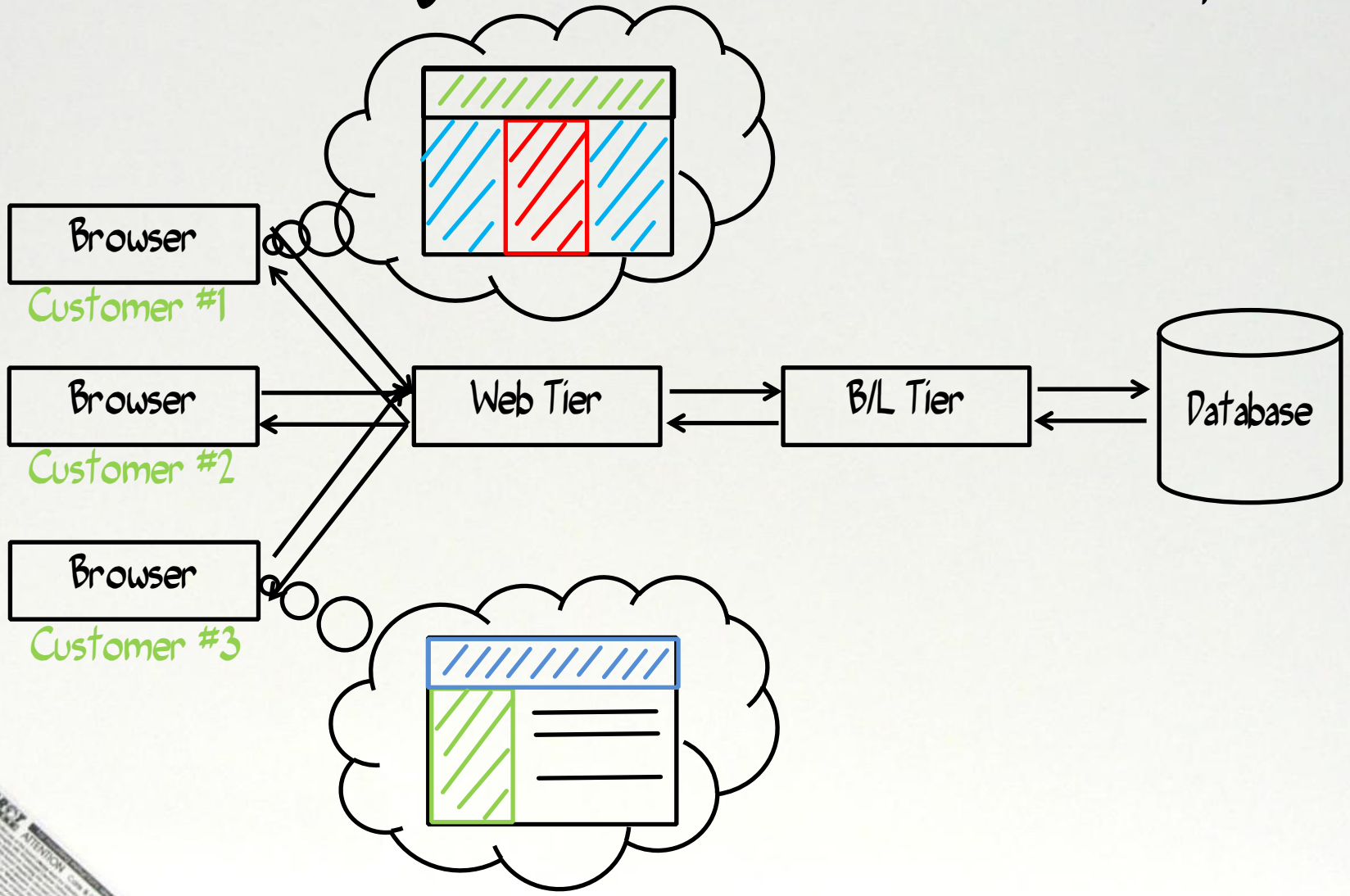


Schema Customizations

UI Customizations

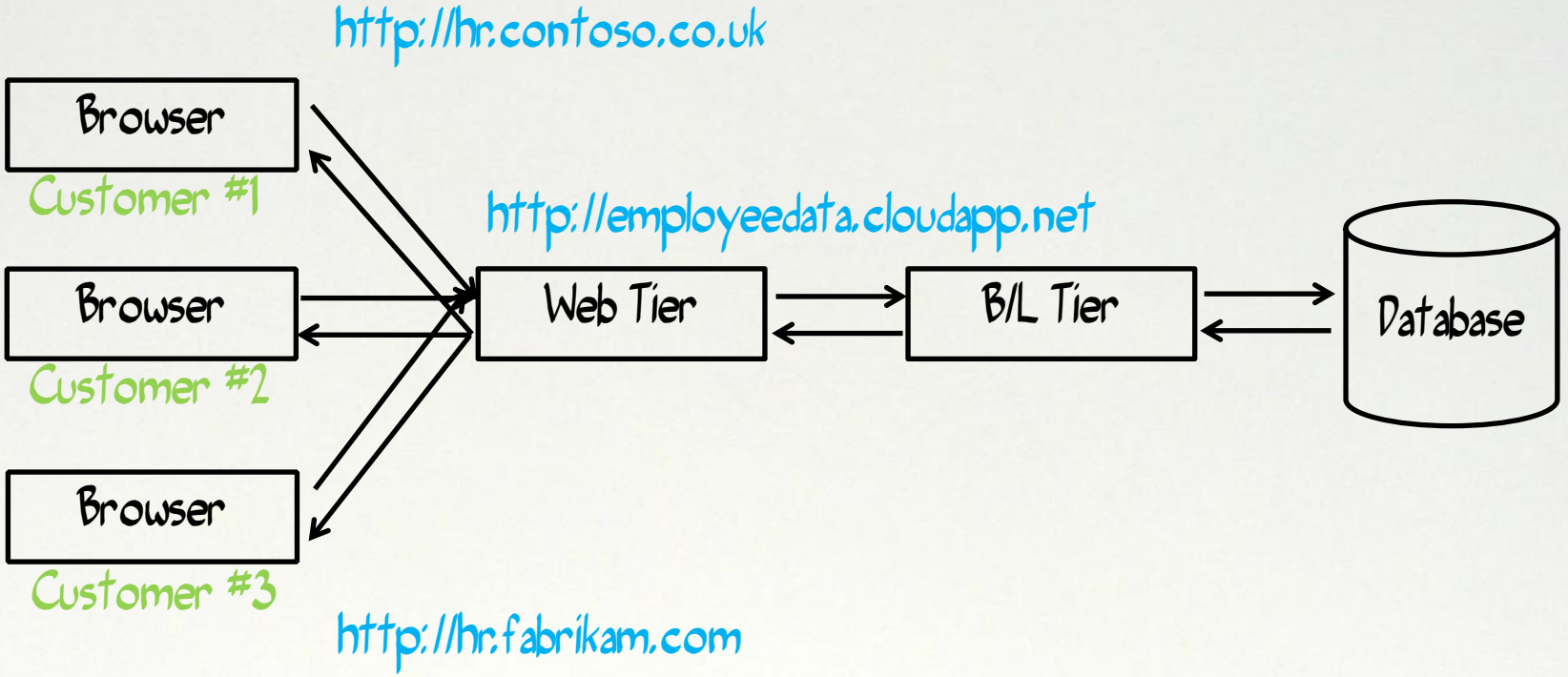
#2 - Using the Cloud for Multi Tenancy



URL Handing

Routing using MVC approach

#2 - Using the Cloud for Multi Tenancy



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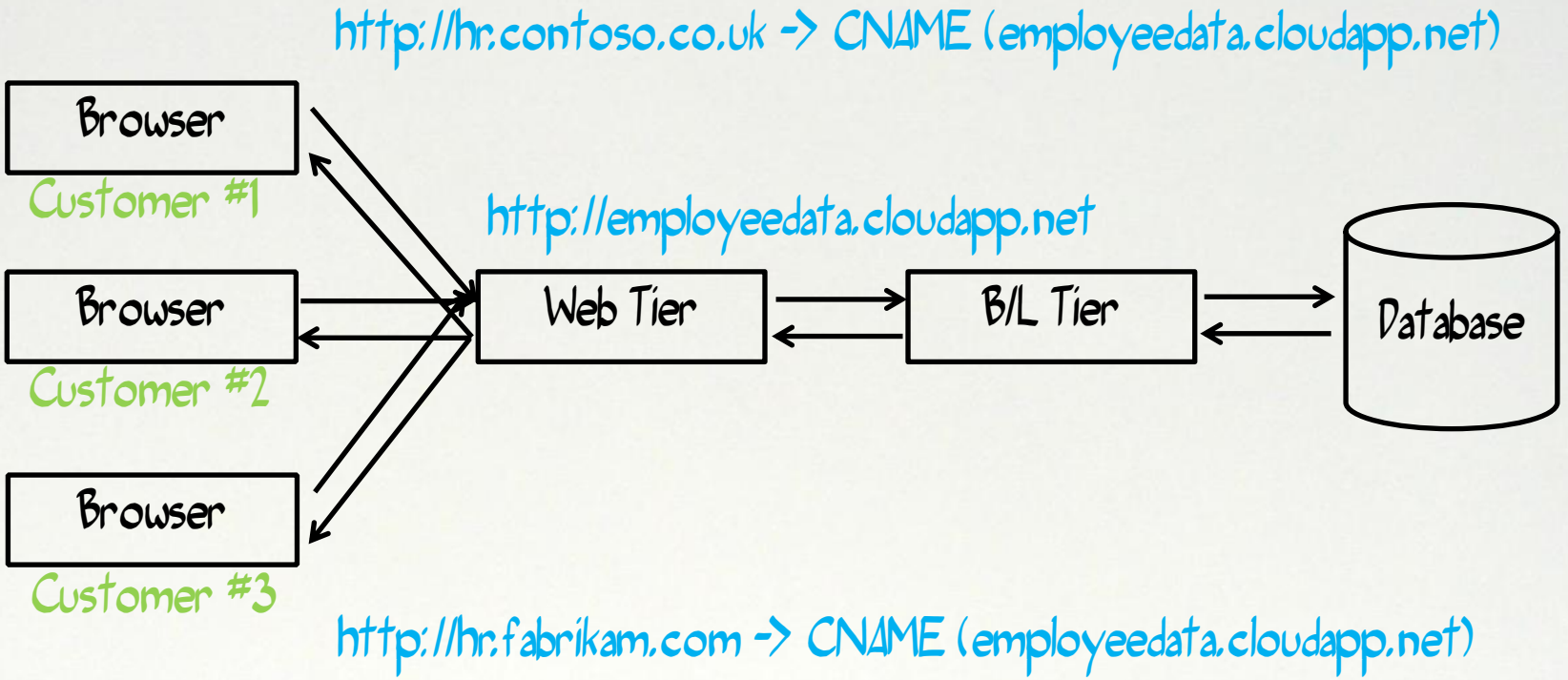

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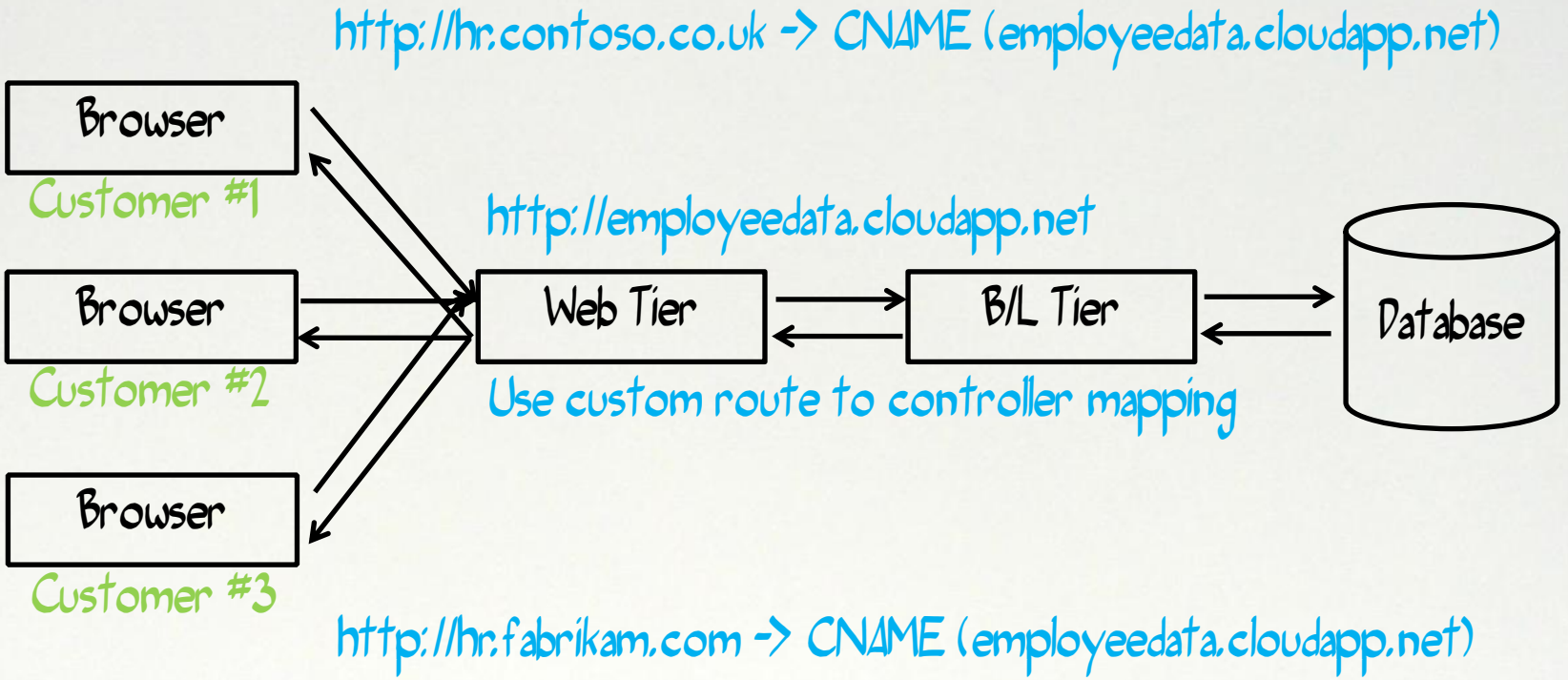


Demo: Multi Tenant Schema and UI

Takeaways

Always consider Multi Tenancy first, even if only one customer

Design considerations must include both data and UI

Many other considerations, such as identity – p&p guidance

#3 - Using the Cloud for **Compute**

Patterns for Cloud Computing

Jim sees how cloud computing supports scaling up/down nodes

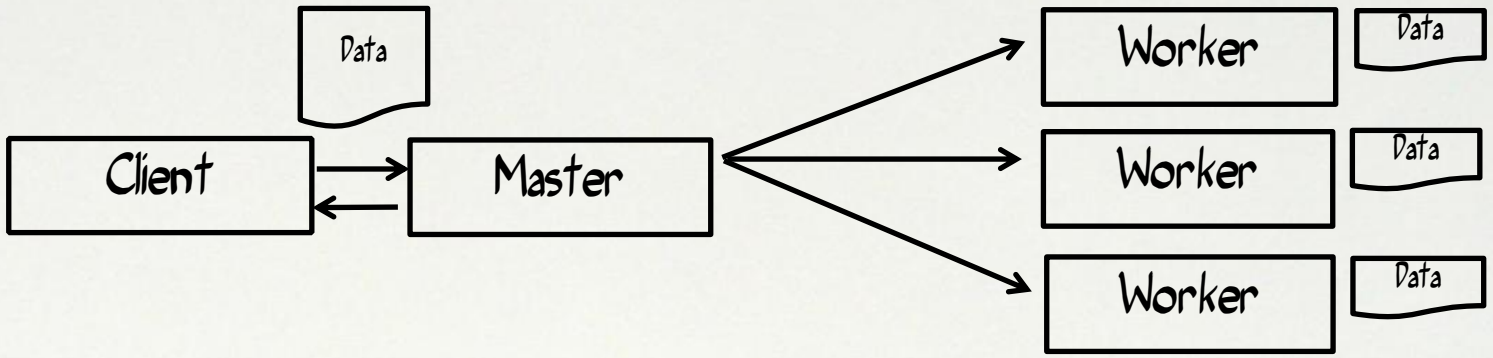
Patterns for Cloud Computing

"Can I use all of these nodes in parallel?"

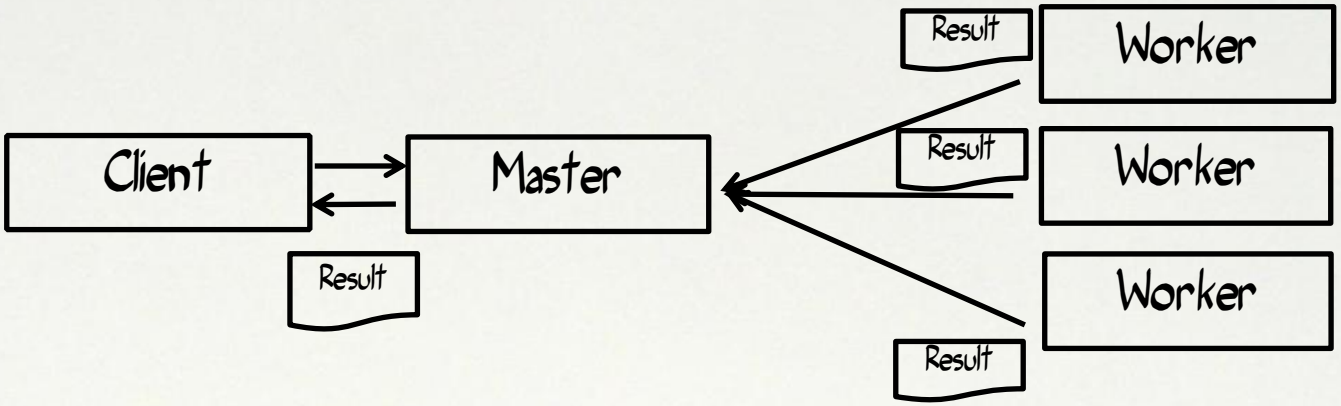
Patterns for Cloud Computing

"I've got this complex calculation I would like to share across these multiple nodes…"

#3 - Using the Cloud for Compute



#3 - Using the Cloud for Compute

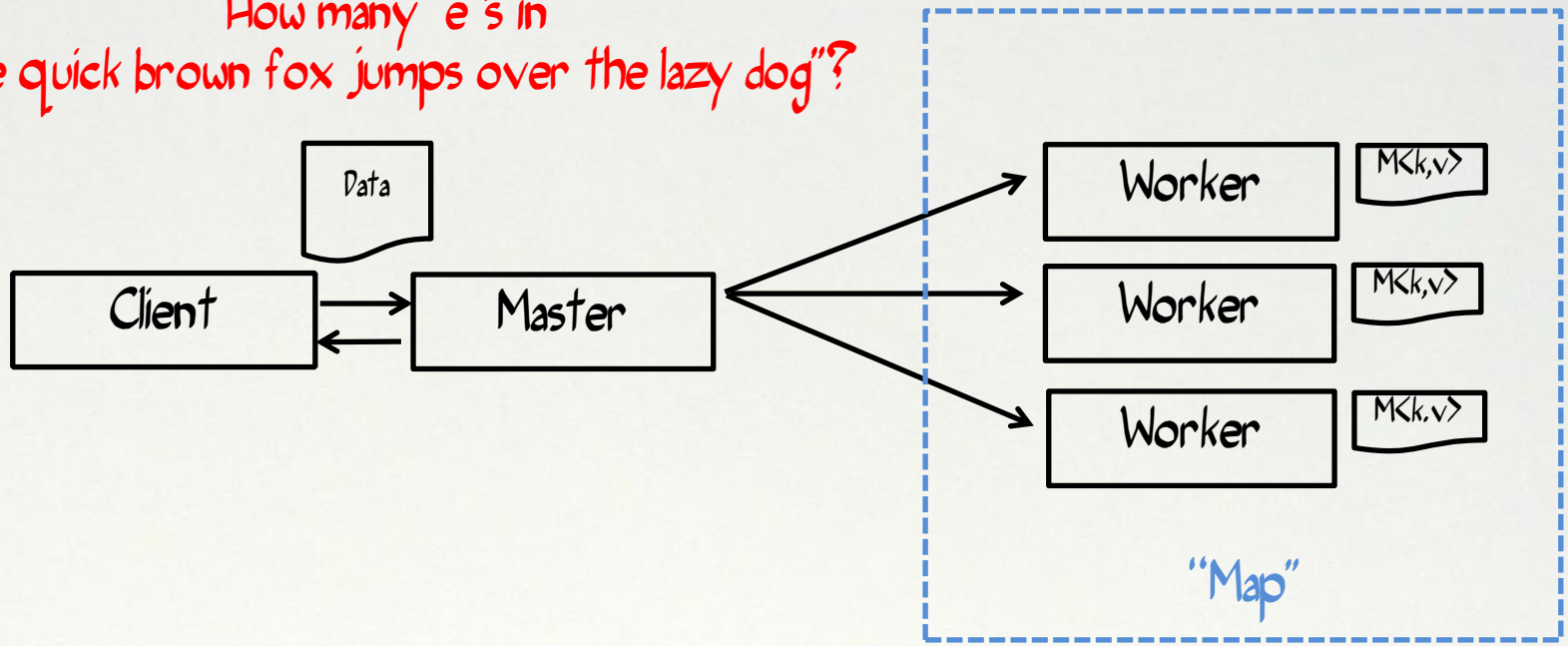


Popularized by the term "MapReduce"*

* 2004 OSDI paper by Jeff Dean and Sanjay Ghemawat (Google)

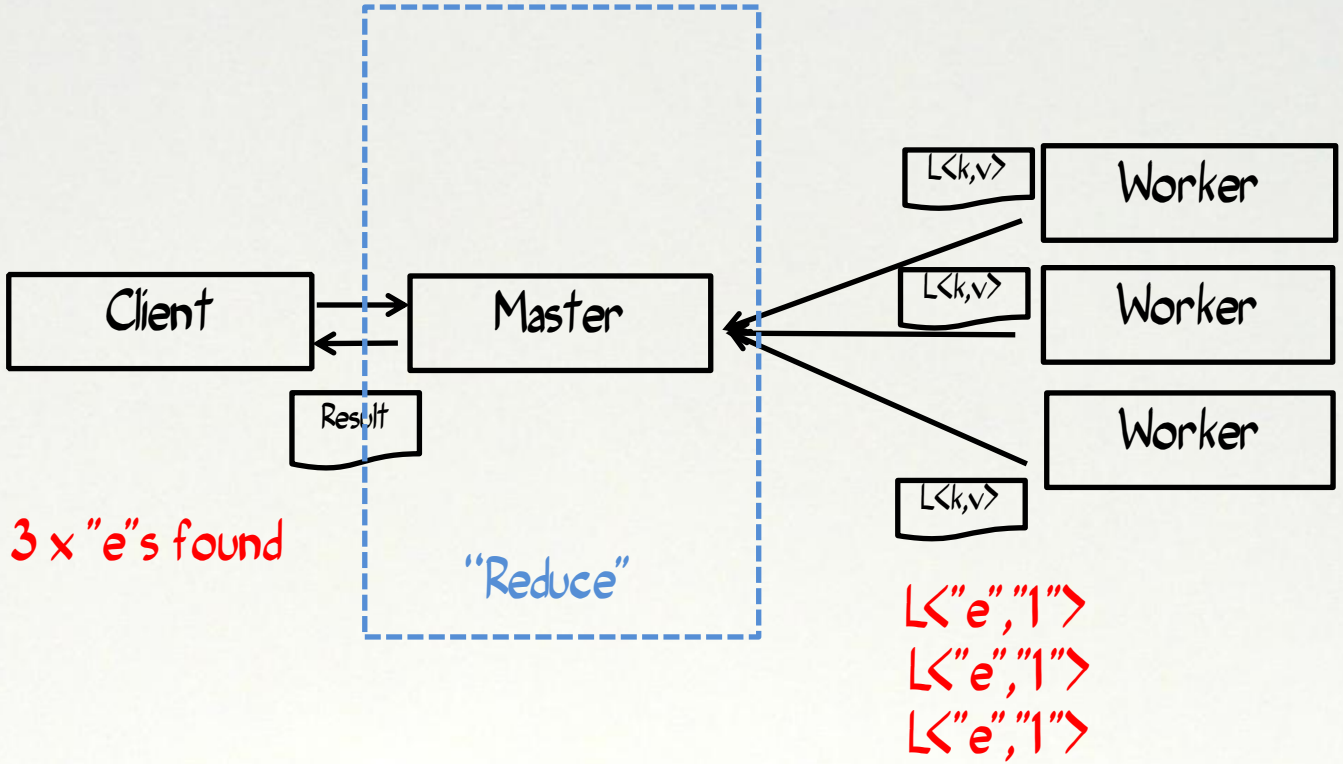
#3 - Using the Cloud for Compute

How many "e"'s in
"The quick brown fox jumps over the lazy dog"?



M<"the quick brown","e">
M<"fox jumps over","e">
M<"the lazy dog","e">

#3 - Using the Cloud for Compute



And it's definitely popular...

#3 - Using the Cloud for Compute

Google

20pb of data analyzed every day using MapReduce

Yahoo!

10k+ cores, 4pb of data using MapReduce

Facebook

2500+ cores, 1pb of data using MapReduce

Frameworks

#3 - Using the Cloud for Compute

Apache Hadoop

Open Source Java "Inspired by MapReduce"
(Core, HDFS, many more)

Cloudera

Consulting, training, distribution of Hadoop

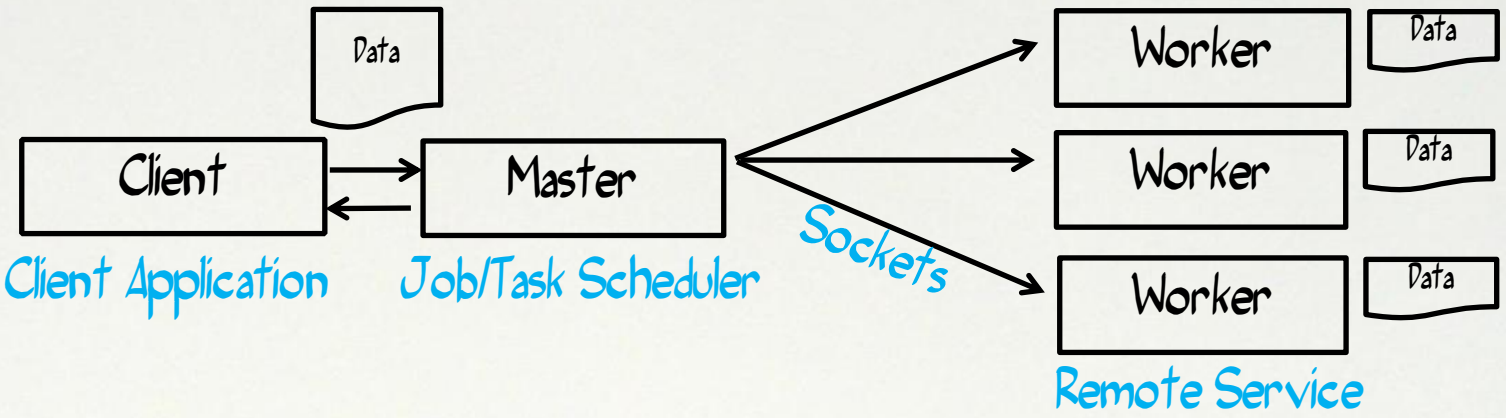
Amazon Elastic MapReduce

Hadoop implementation on EC2

How would Jim do this today on premises?

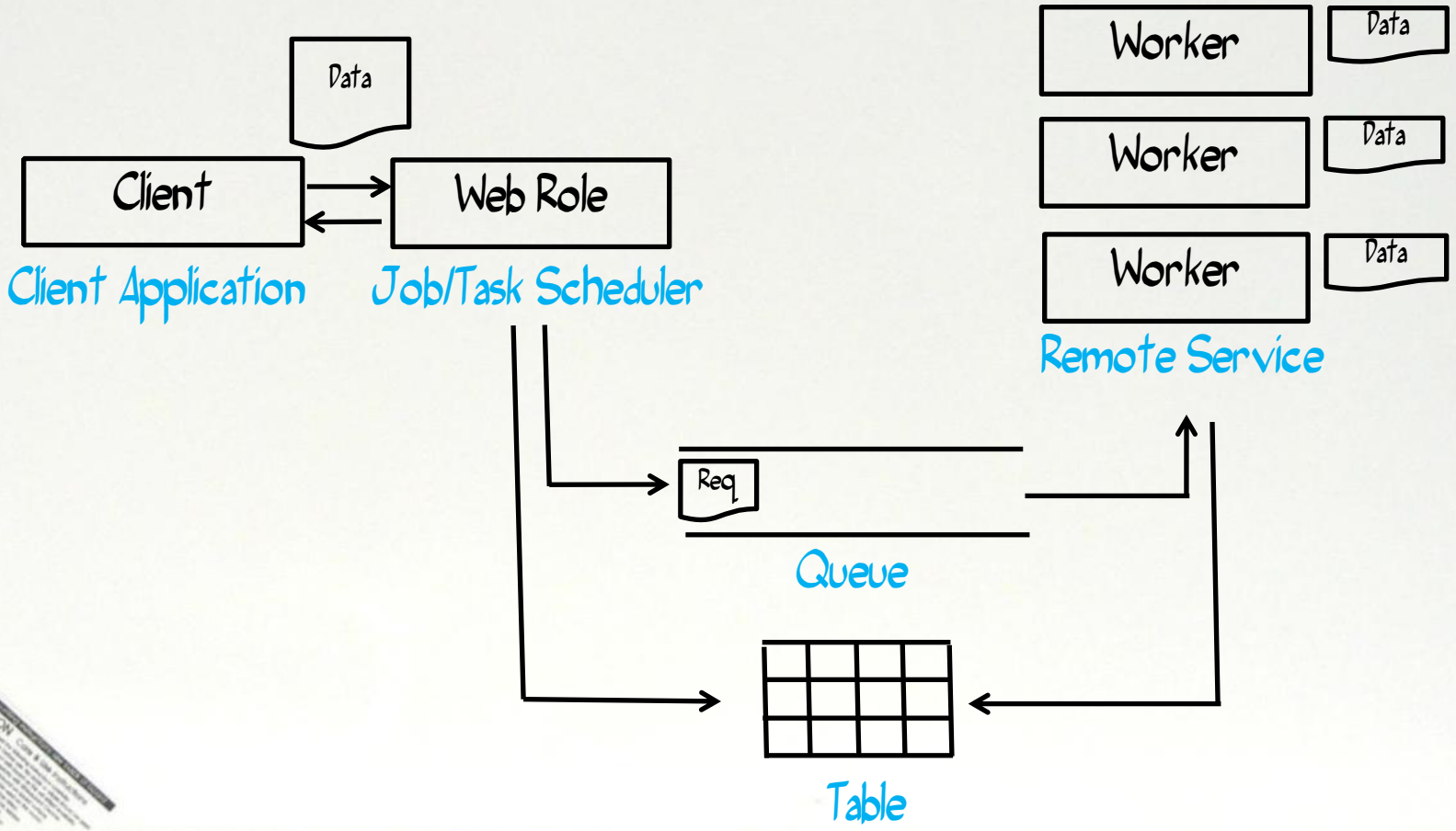
#3 - Using the Cloud for Compute

How would Jim do this today on premises?



How about implementing this on Windows Azure?

#3 - Using the Cloud for Compute



Demo: Windows Azure Demo "Inspired by MapReduce"

Takeaways

MapReduce very visible, although can be difficult to initially grasp

Learn about existing frameworks, especially Apache Hadoop

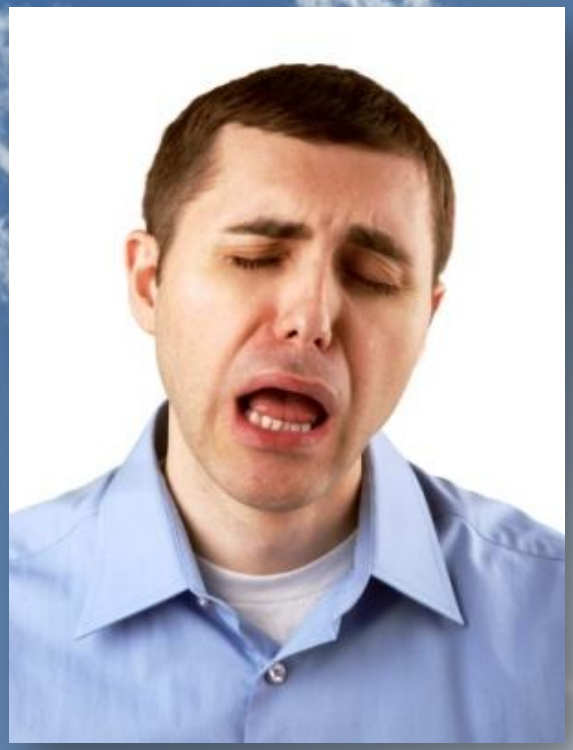
Read up on Dryad (DryadLINQ) for future direction

#4 - Using the Cloud for **Storage**

Patterns for Cloud Computing

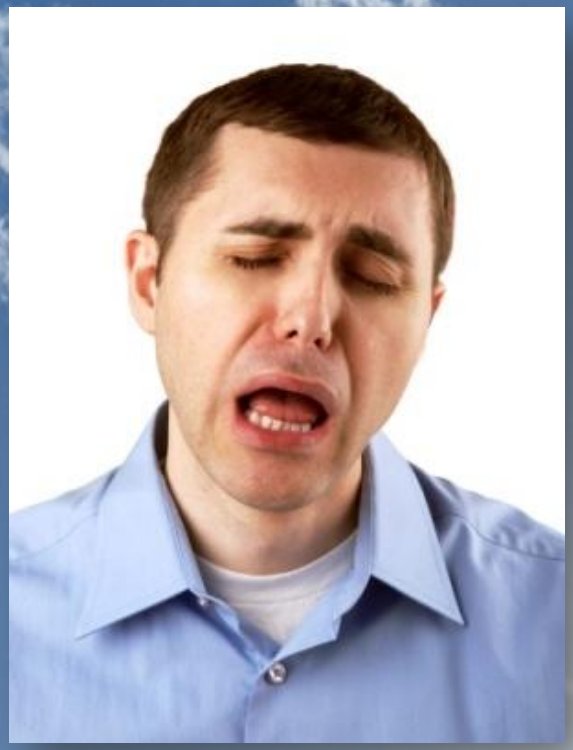
"The cloud lets me store *infinite* data, right?"

Patterns for Cloud Computing



Lots of headaches with data management today

Patterns for Cloud Computing



"It sounds too good to be true…"

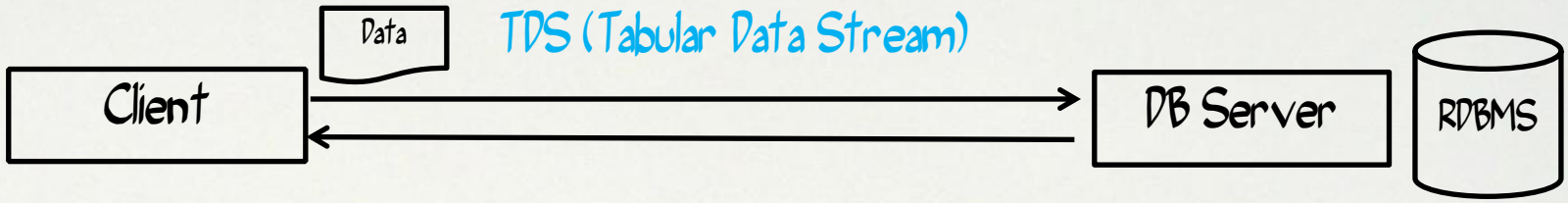
How does Jim do this today on premises?

#4 - Using the Cloud for Storage

How would Jim do this today on premises?

#4 - Using the Cloud for Storage

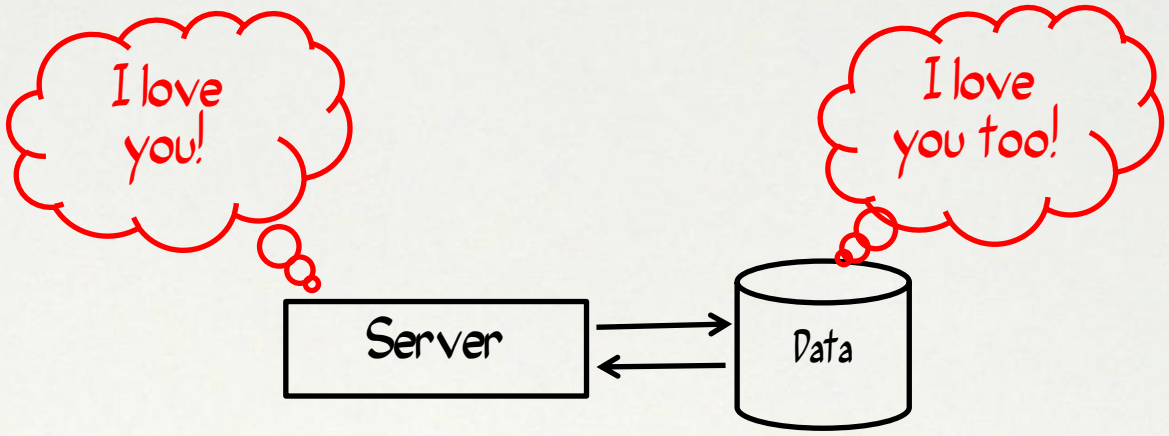
How would Jim do this today on premises?



#4 - Using the Cloud for Storage

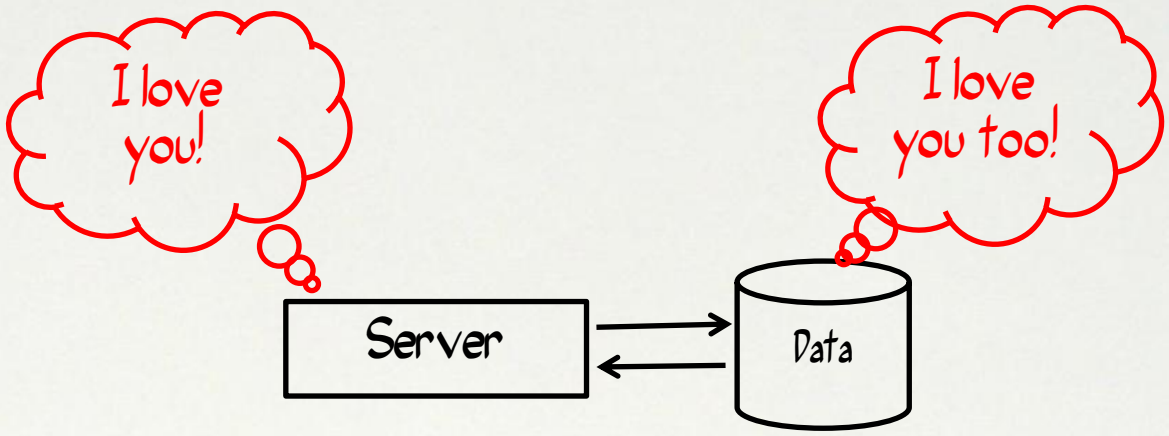
How would Jim do this today on premises?

#4 - Using the Cloud for Storage



Affinity between your data and physical hardware that serves it

#4 - Using the Cloud for Storage



Symptoms:

Which RAID number was that again?

Tedious to backup exponentially growing data

Crap! I'm at 95% capacity - got to move to a bigger disk

How does the cloud help?

Breaks the affinity between your data and hardware

Blobs, Tables, Relational

Blobs, Tables, Relational

#4 - Using the Cloud for Storage

PutBlob
PUT http://account.blob.core.windows.net/containername/blobname

http://account.blob.core.windows.net/containername/blobname

PutBlob = 64Mb MAX
MetaData = 8Kb per Blob

#4 - Using the Cloud for Storage

http://account.blob.core.windows.net/containername/blobname

#4 - Using the Cloud for Storage

GetBlob
GET http://account.blob.core.windows.net/containername/blobname
Range: bytes=329300 - 730000

http://account.blob.core.windows.net/containername/blobname

#4 - Using the Cloud for Storage

PutBlock(blobname, blockid, data)

PutBlockList(blobname, blockid1, . . ., blockidN)

http://account.blob.core.windows.net/containername/blobname

PutBlock = 4Mb MAX to a maximum of 50Gb
BlockId = 64 bytes

Blobs, Tables, Relational

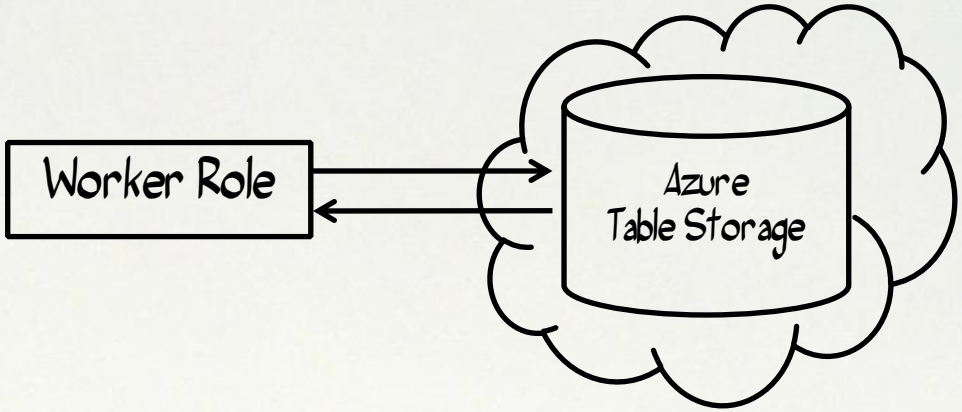
#4 - Using the Cloud for Storage

REST:

GET http://account.table.core.windows.net/Customer?$filter=%20PartitionKey%20eq%20value

LINQ:

```
var customers = from o in context.CreateQuery<customer>("Customer") where o.PartitionKey
== value select o;
```



http://account.table.core.windows.net

Each Table:

PartitionKey (e.g. DocumentName) to ensure scalability
RowKey (e.g. version number)
[fields] for data

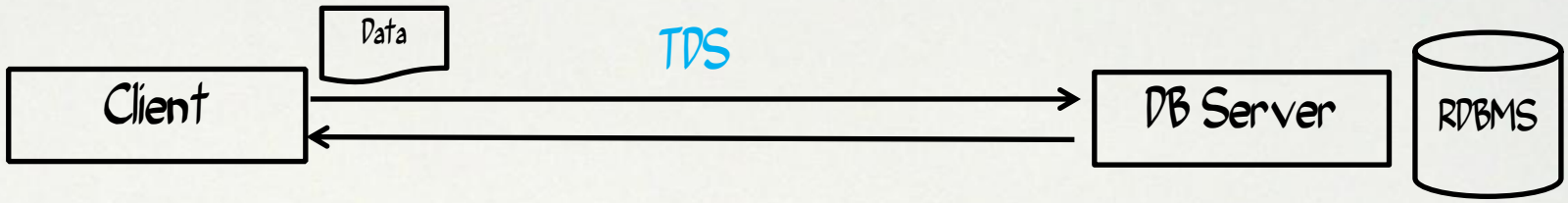
Blobs, Tables, Relational

Codename Sitka (early 2008)

SQL Server Data Services (MIX08)

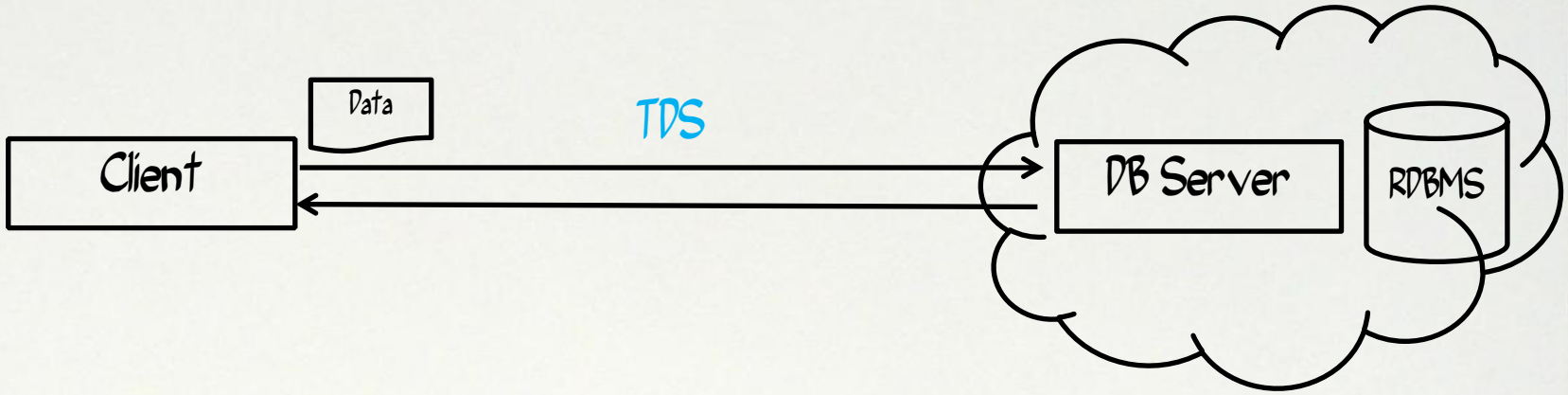
#4 - Using the Cloud for Storage

This is what I'm doing on premises...



#4 - Using the Cloud for Storage

So, this is what I would like to do in the cloud...

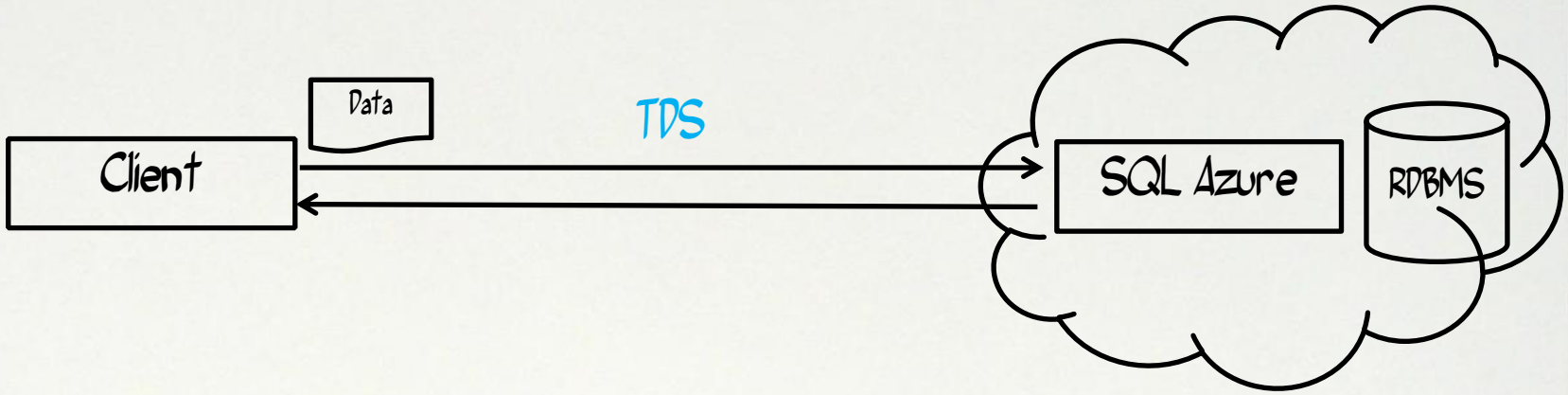


SQL Data Services (MIX09)

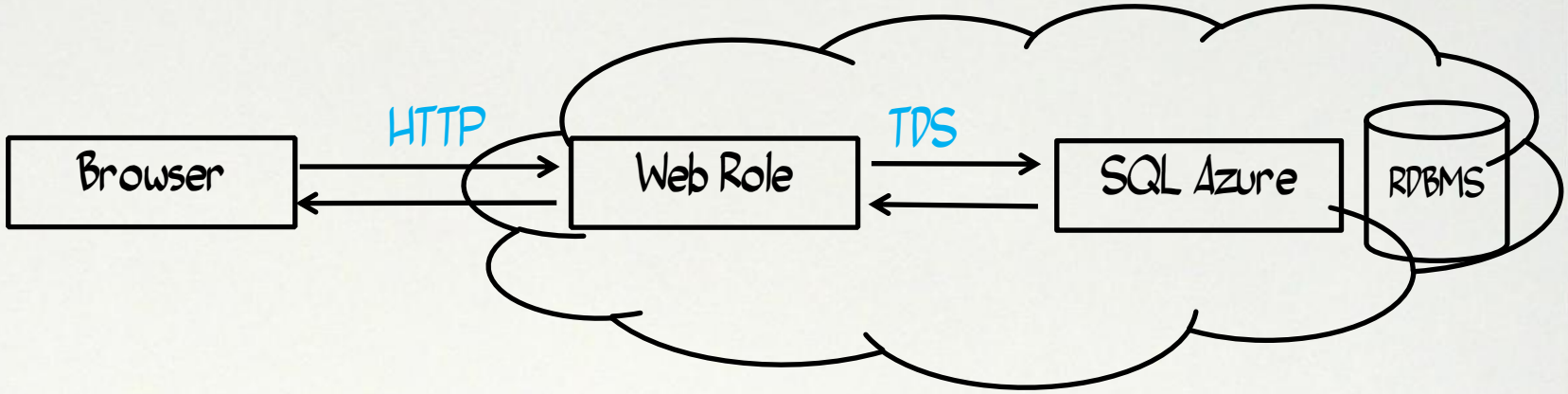
SQL Azure (July 2009)

#4 - Using the Cloud for Storage

So, this is what I would like to do...



#4 - Using the Cloud for Storage



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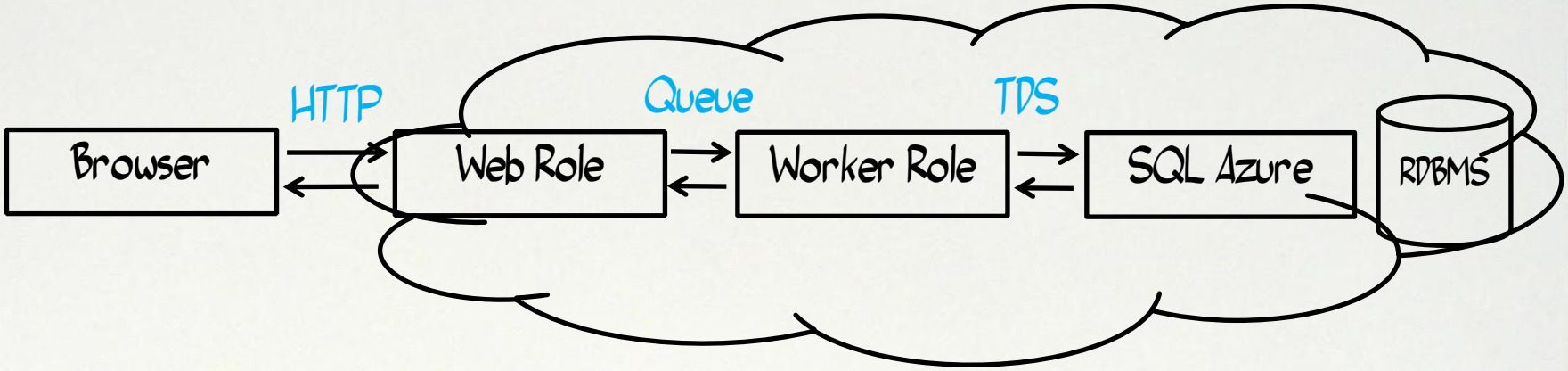
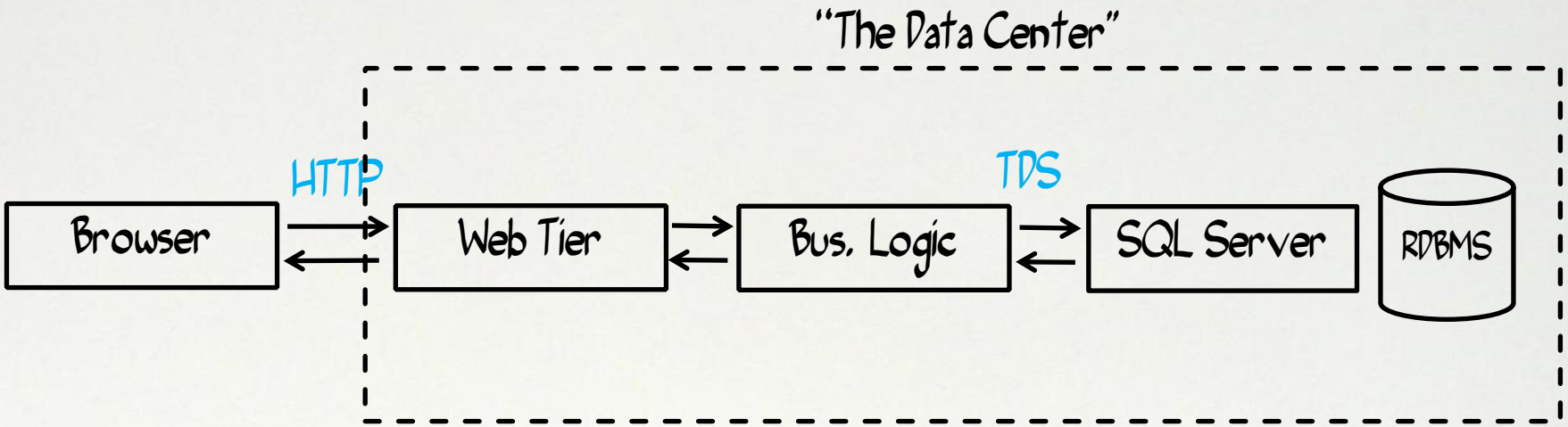
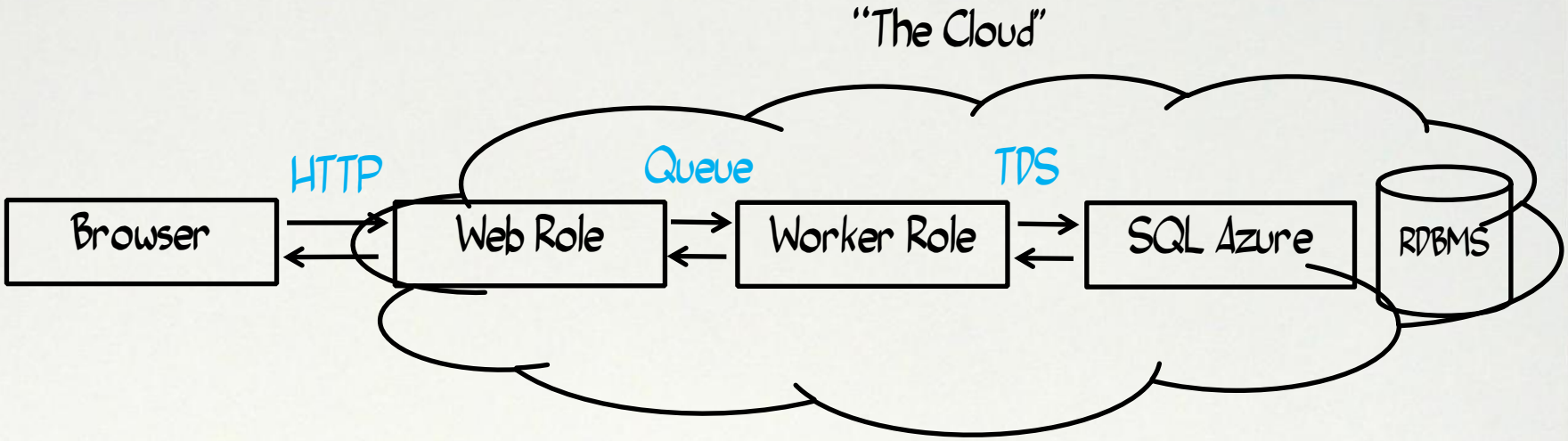


Migration!

#4 - Using the Cloud for Storage



#4 - Using the Cloud for Storage



Demo: SQL Azure CTP

Takeaways

Storage in the cloud may look the same, but breaks the affinity issue

Understand the pricing model for storage on-premises vs. cloud

SQL Azure as a factor for migration/move from on premises

#5 - Using the Cloud for **Communications**

Patterns for Cloud Computing

Jim's organization needs to communicate with other organizations

Patterns for Cloud Computing

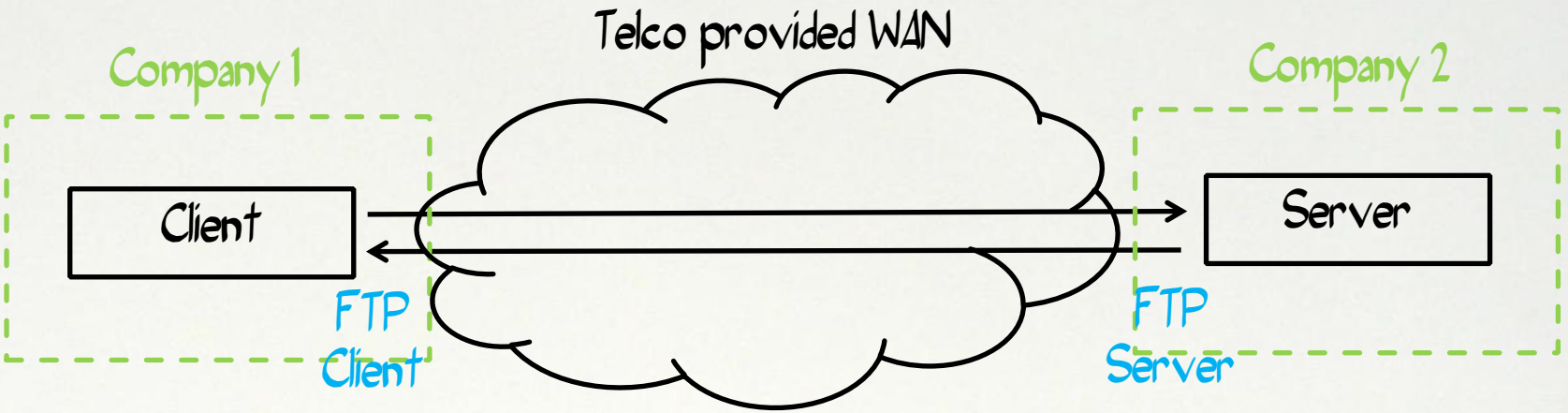
"This has always been a very tricky and expensive process to get working"

Patterns for Cloud Computing

"Does the cloud offer anything to help?"

How would Jim have done this before?

#5 - Using the Cloud for Communications



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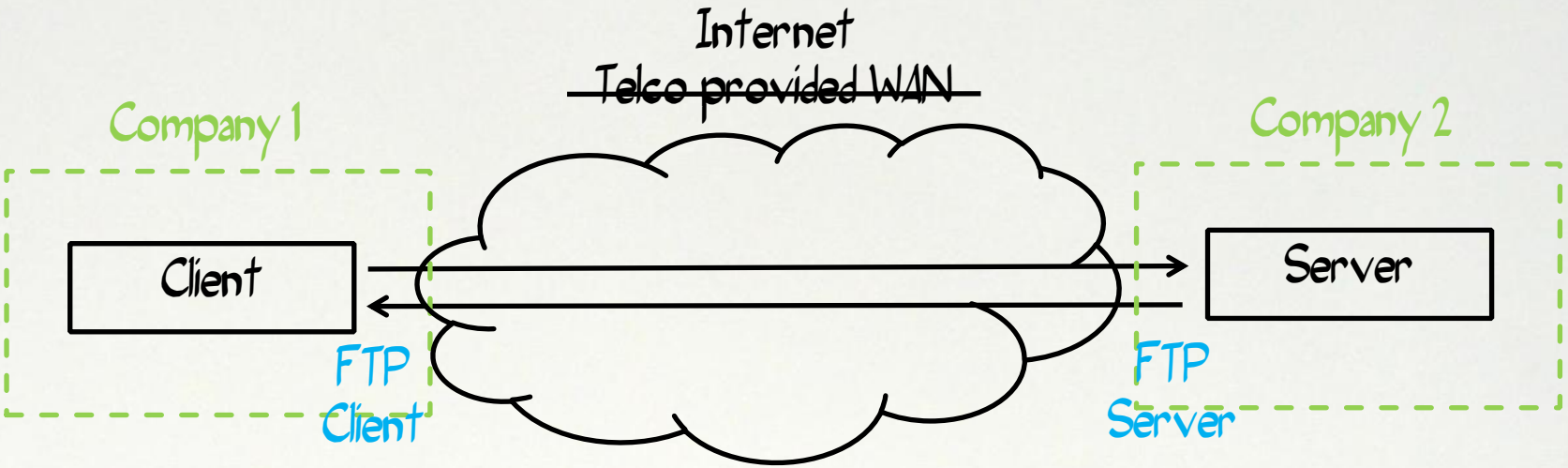

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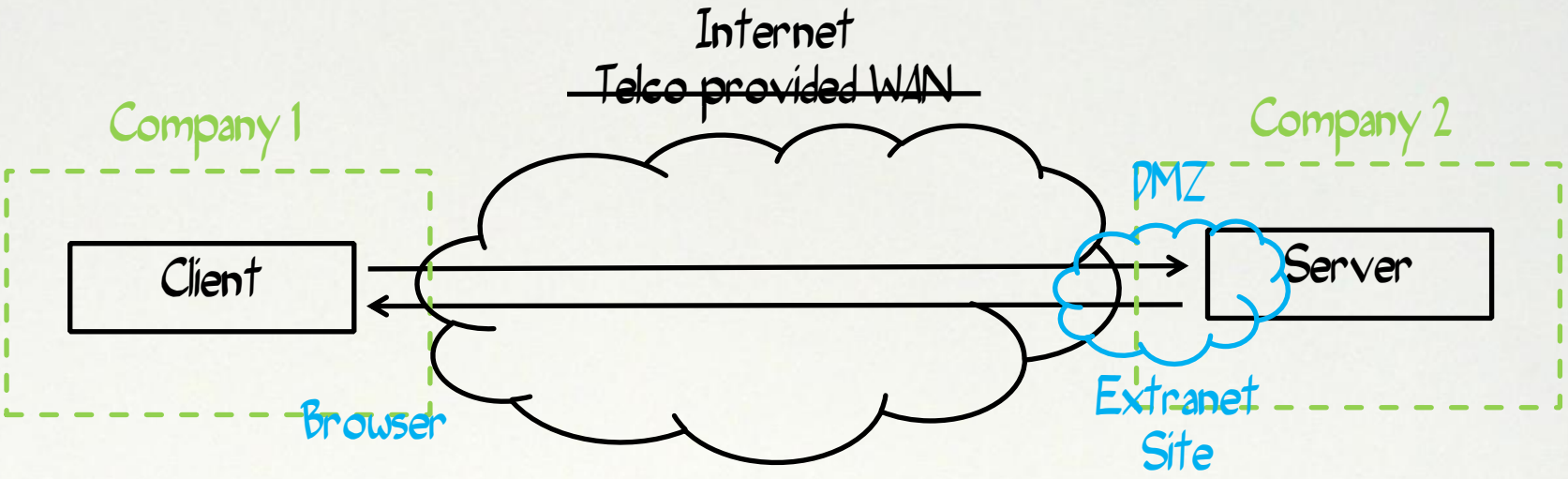
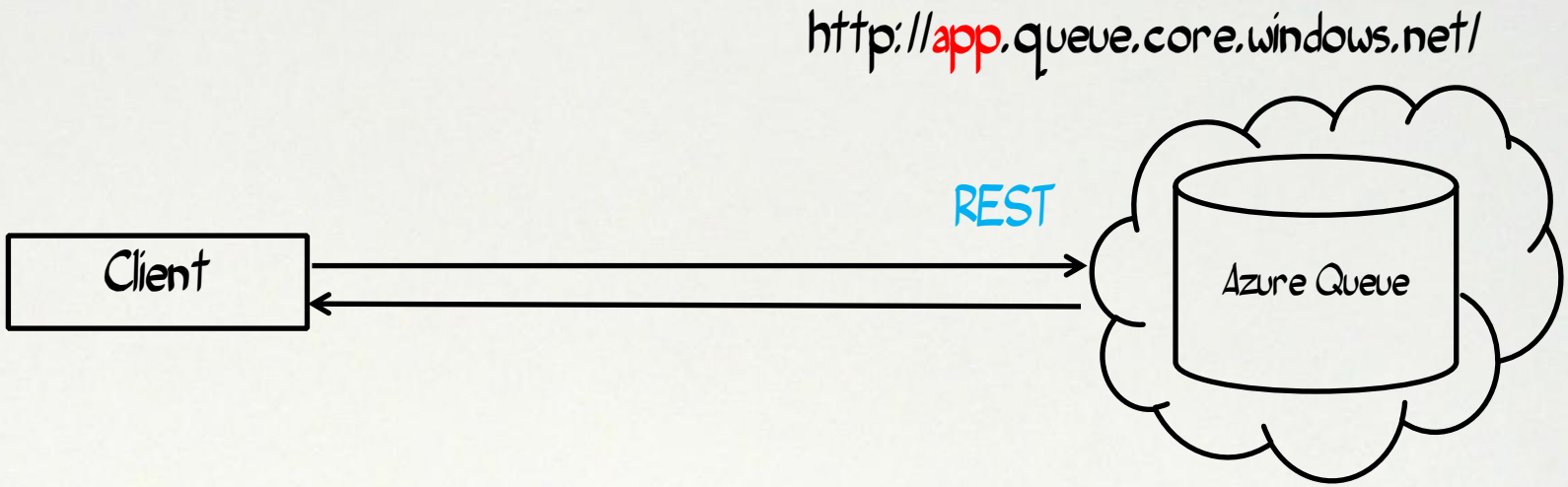


What does the cloud provide?

#5 - Using the Cloud for Communications



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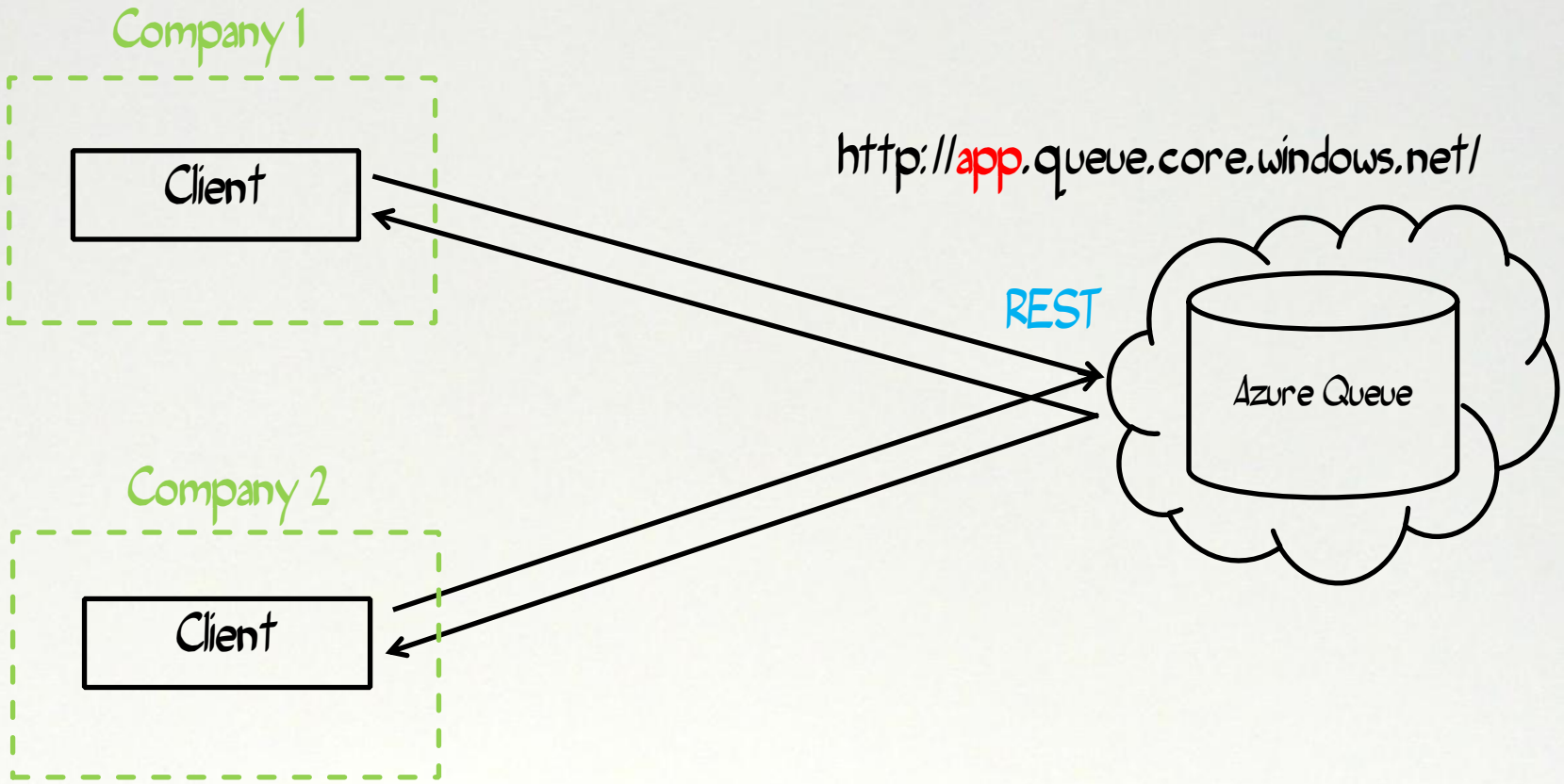

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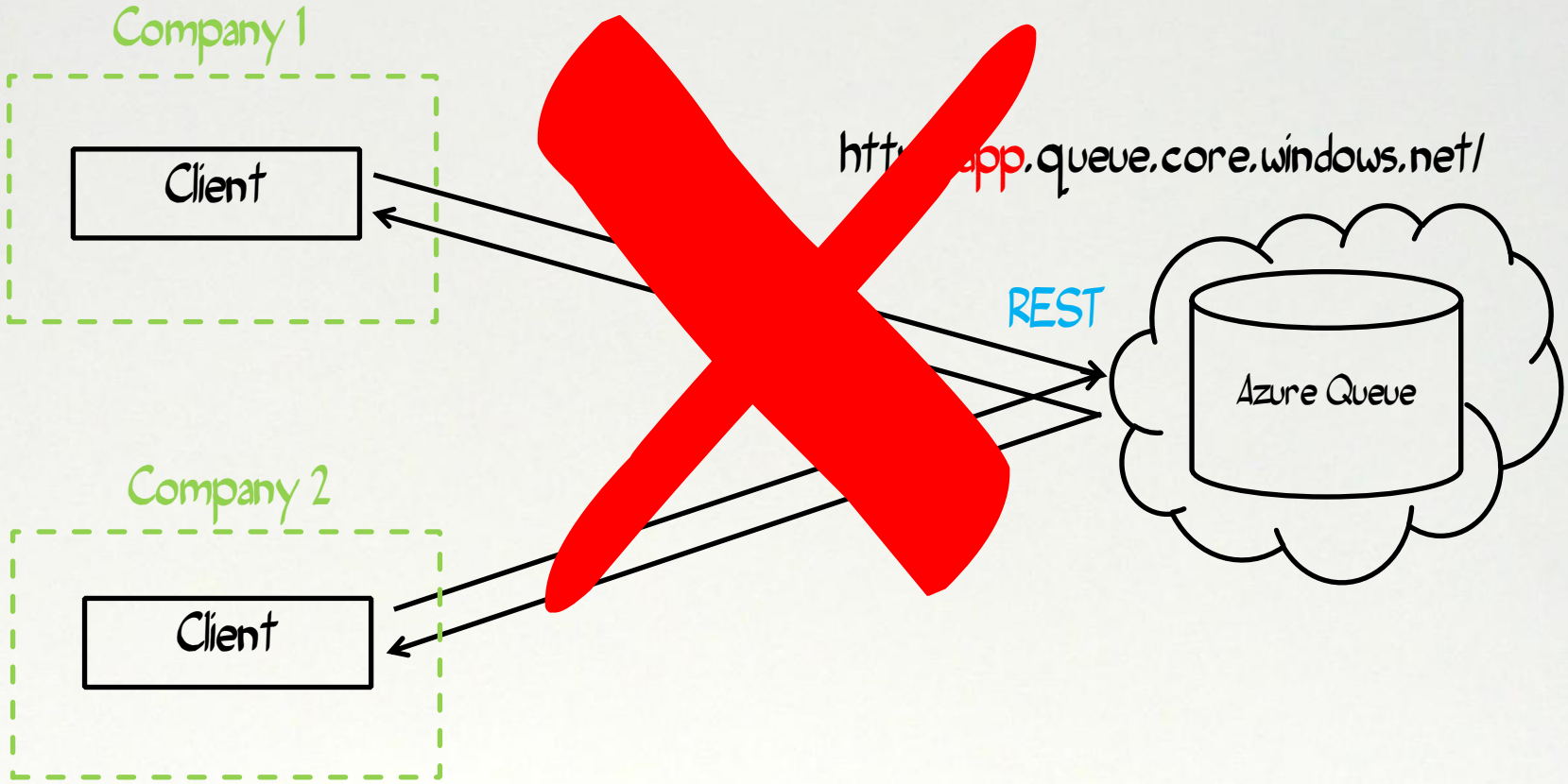

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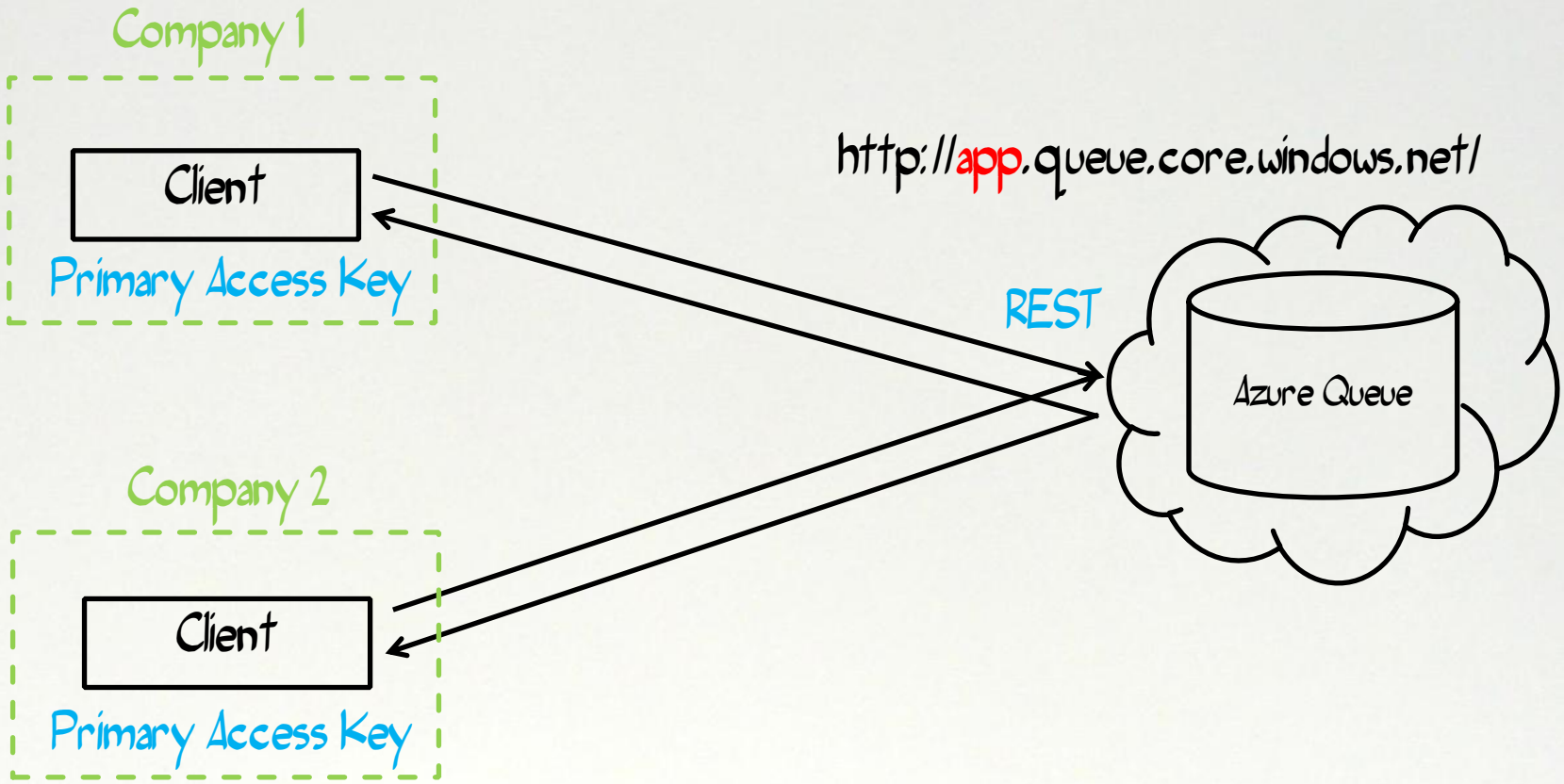

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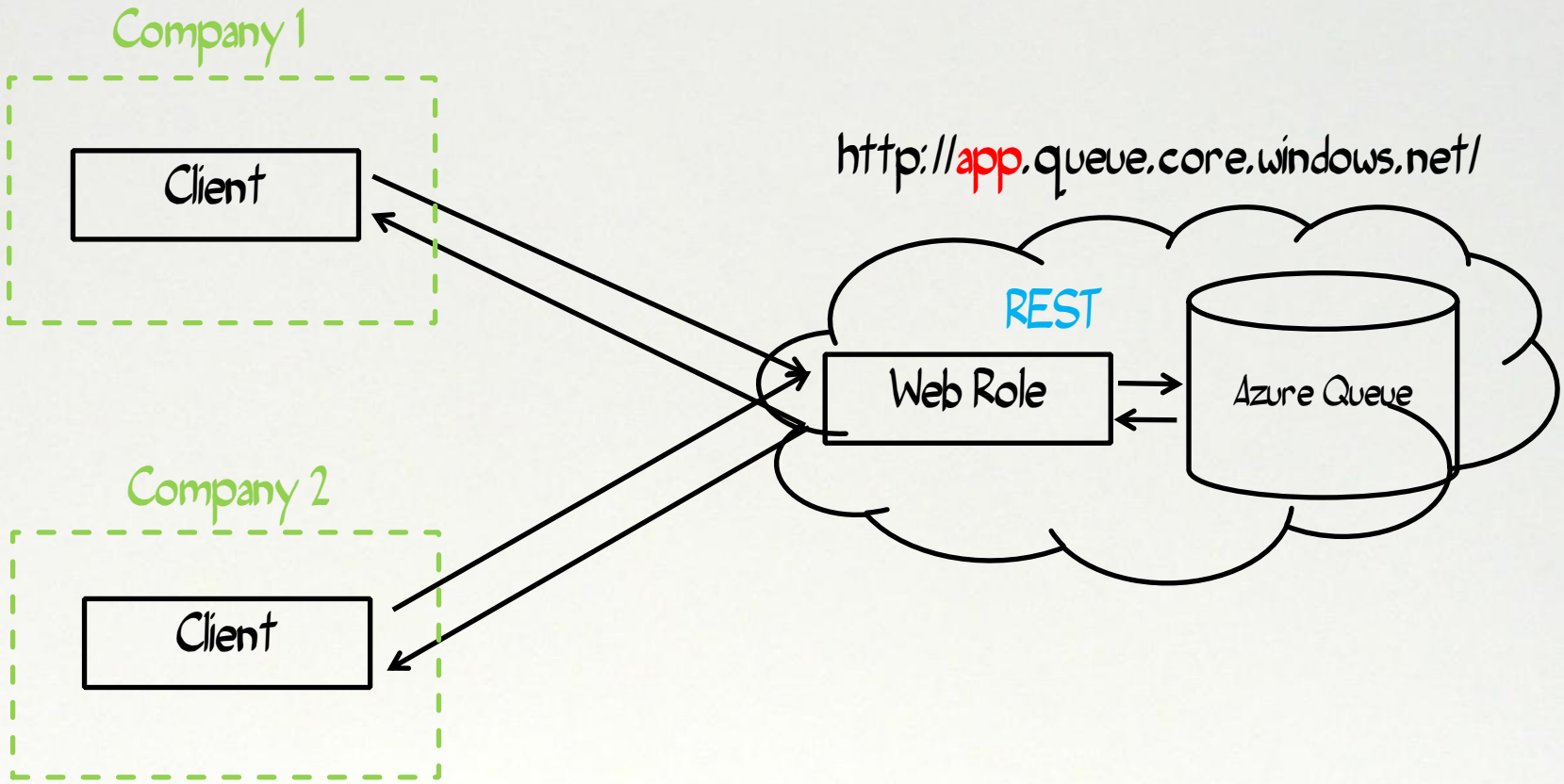

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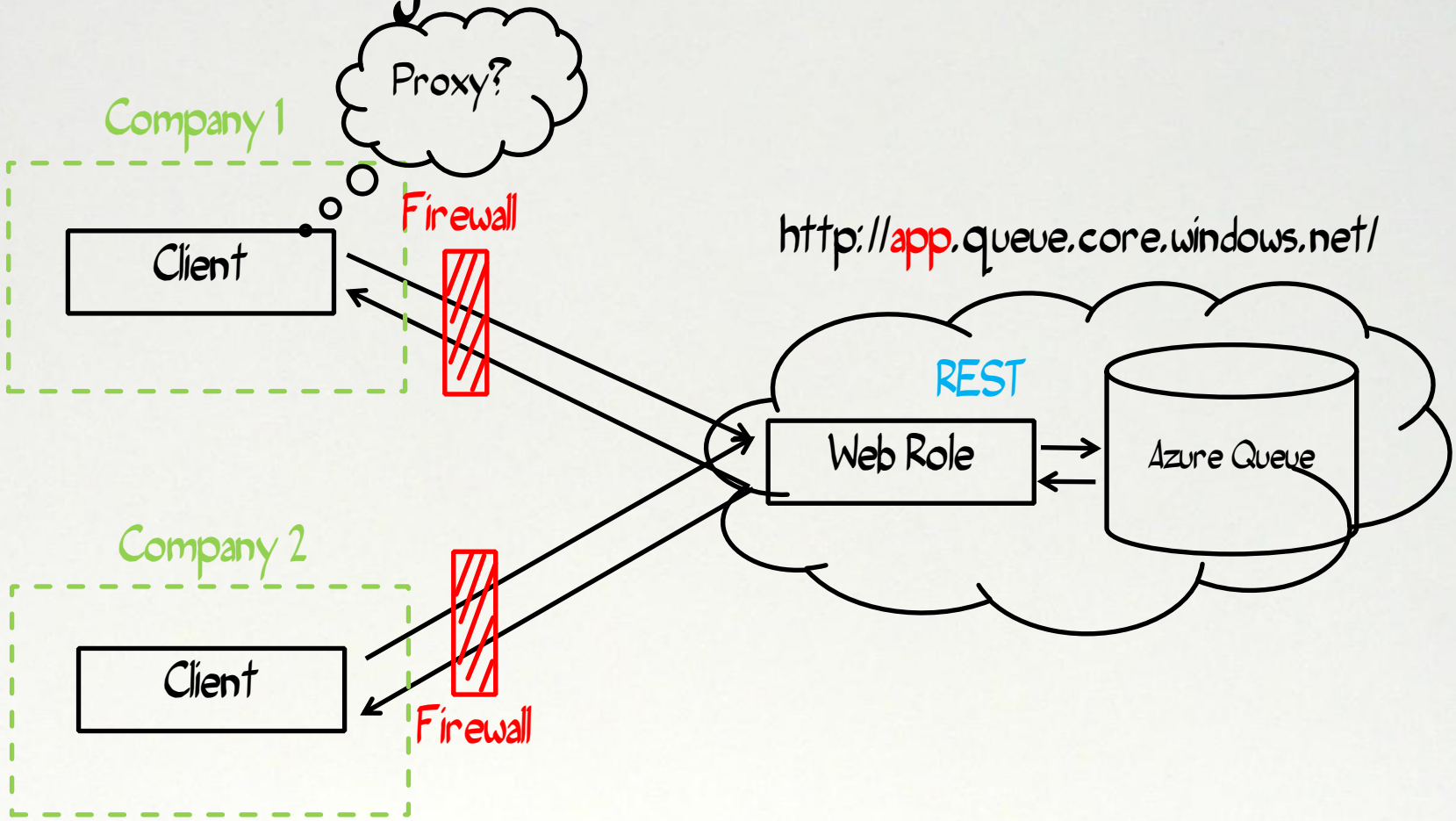

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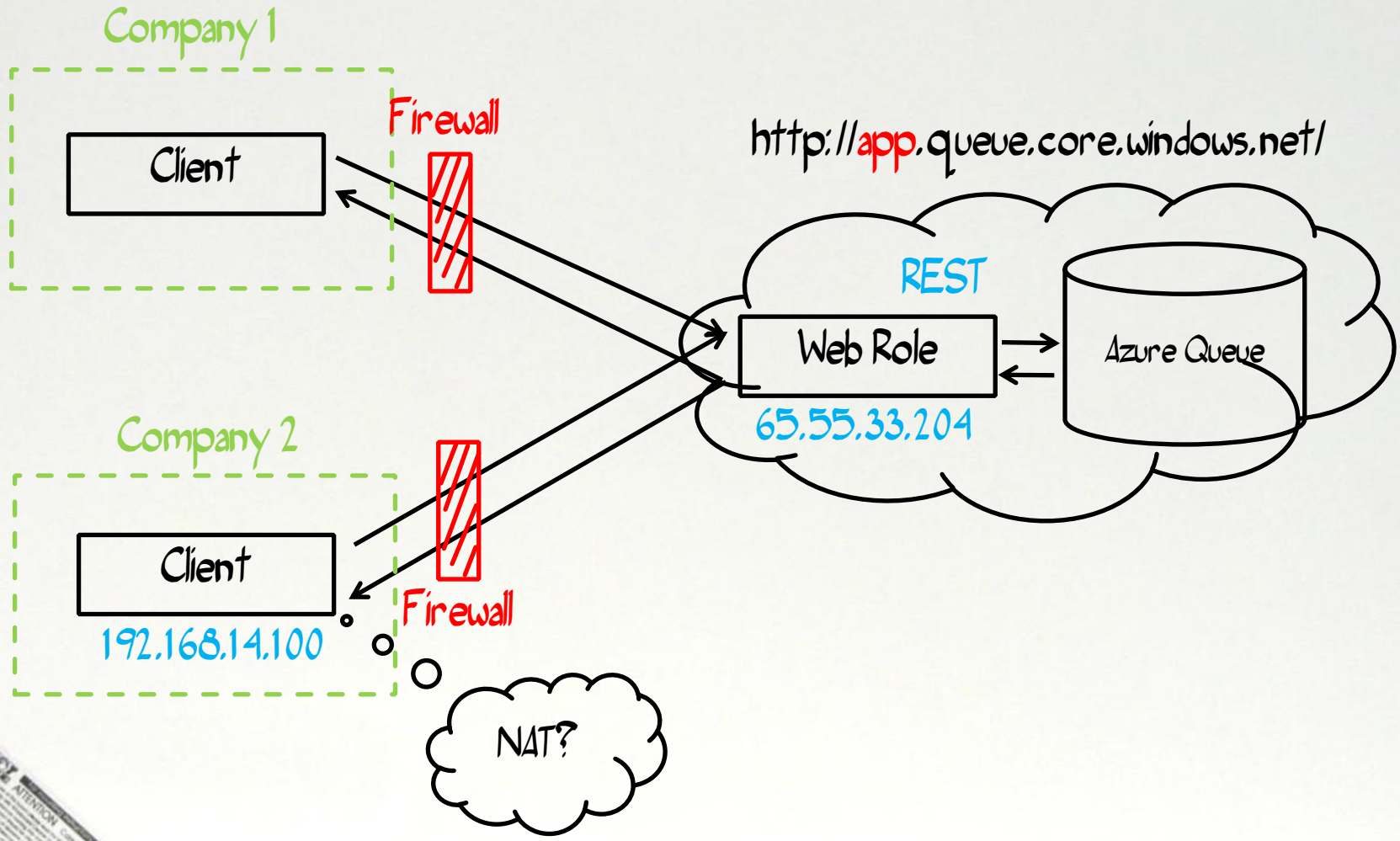

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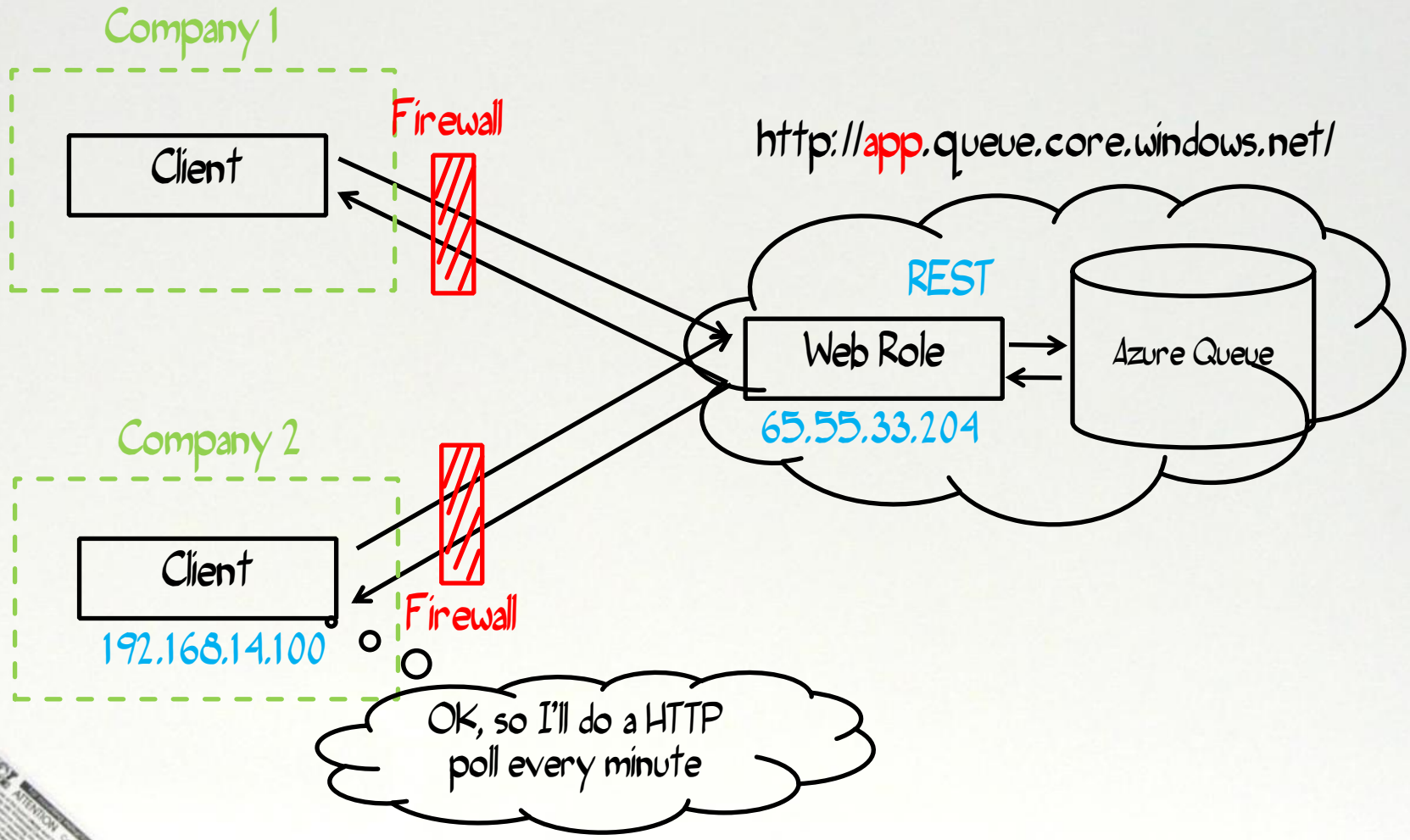

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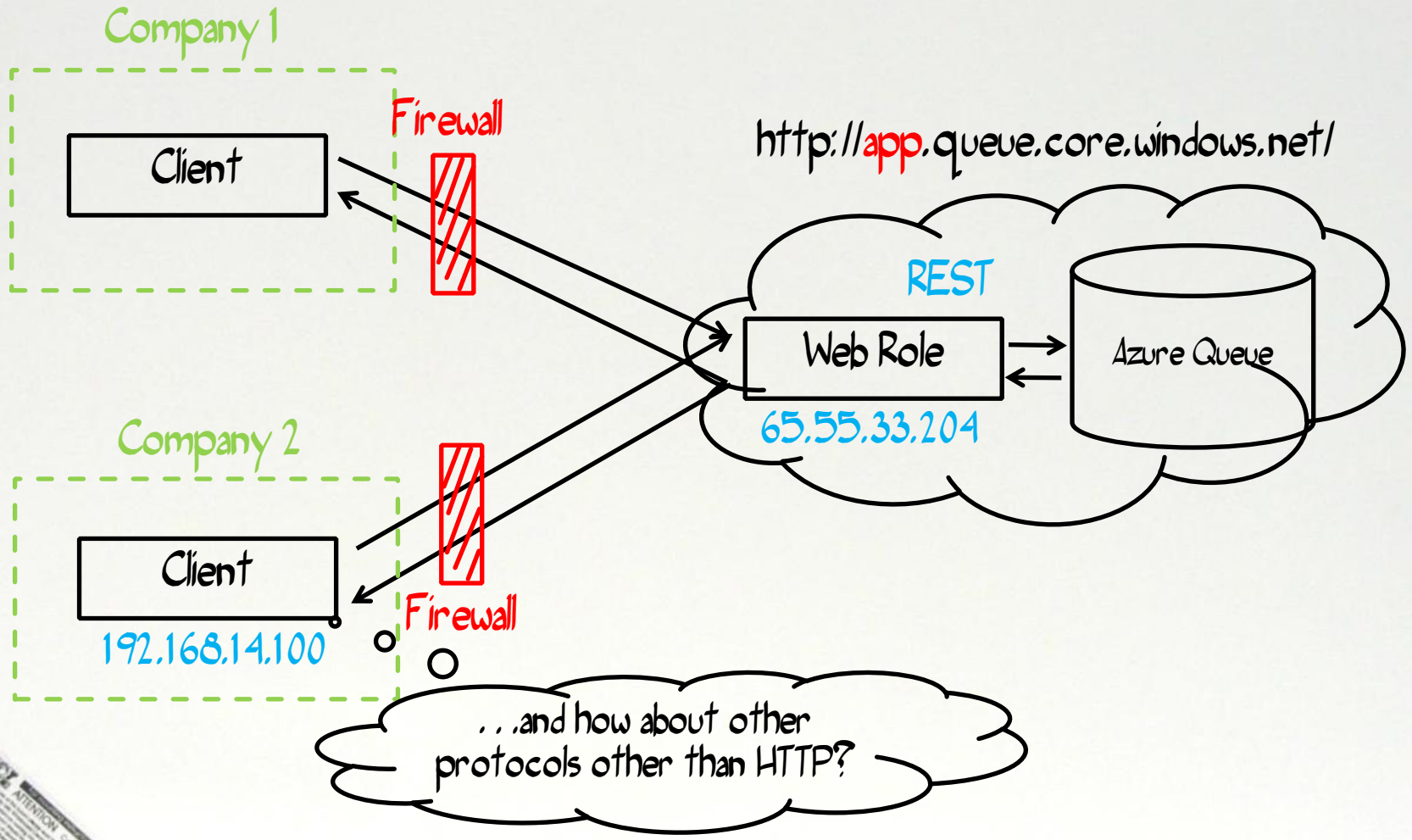


How does the .NET Service Bus help?

#5 - Using the Cloud for Communications

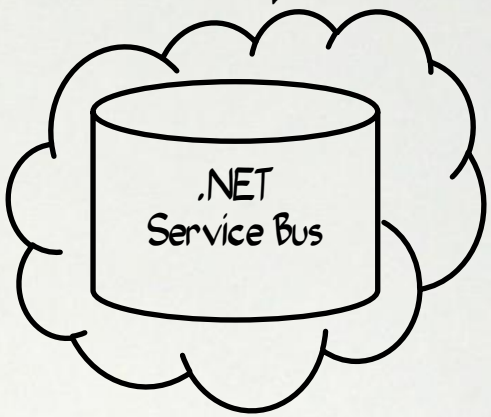
Company 1

Client

Company 2

Client

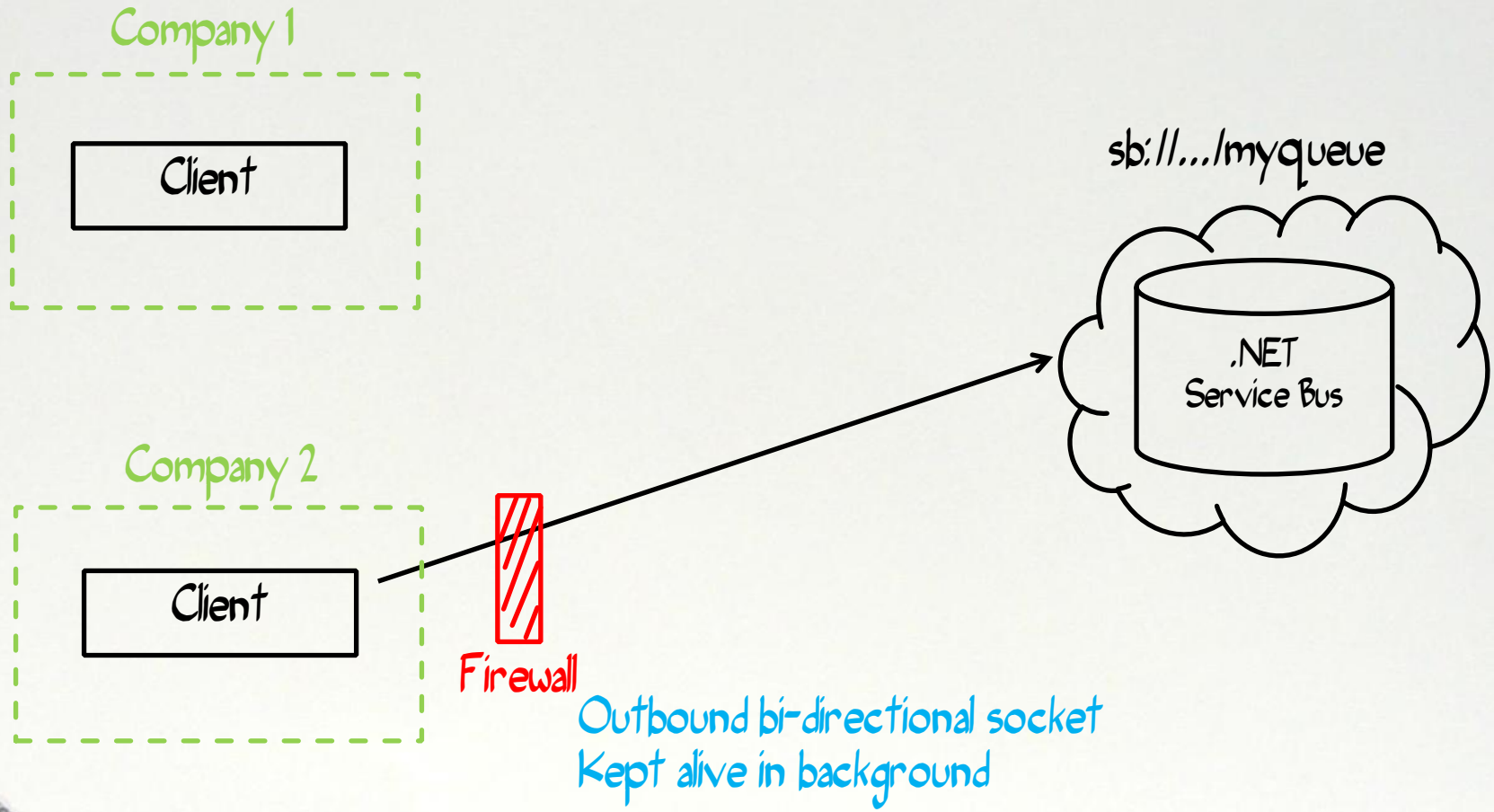
sb://.../myqueue



Two modes: TCP Relay and Message Buffer

Two modes: TCP Relay and Message Buffer

#5 - Using the Cloud for Communications



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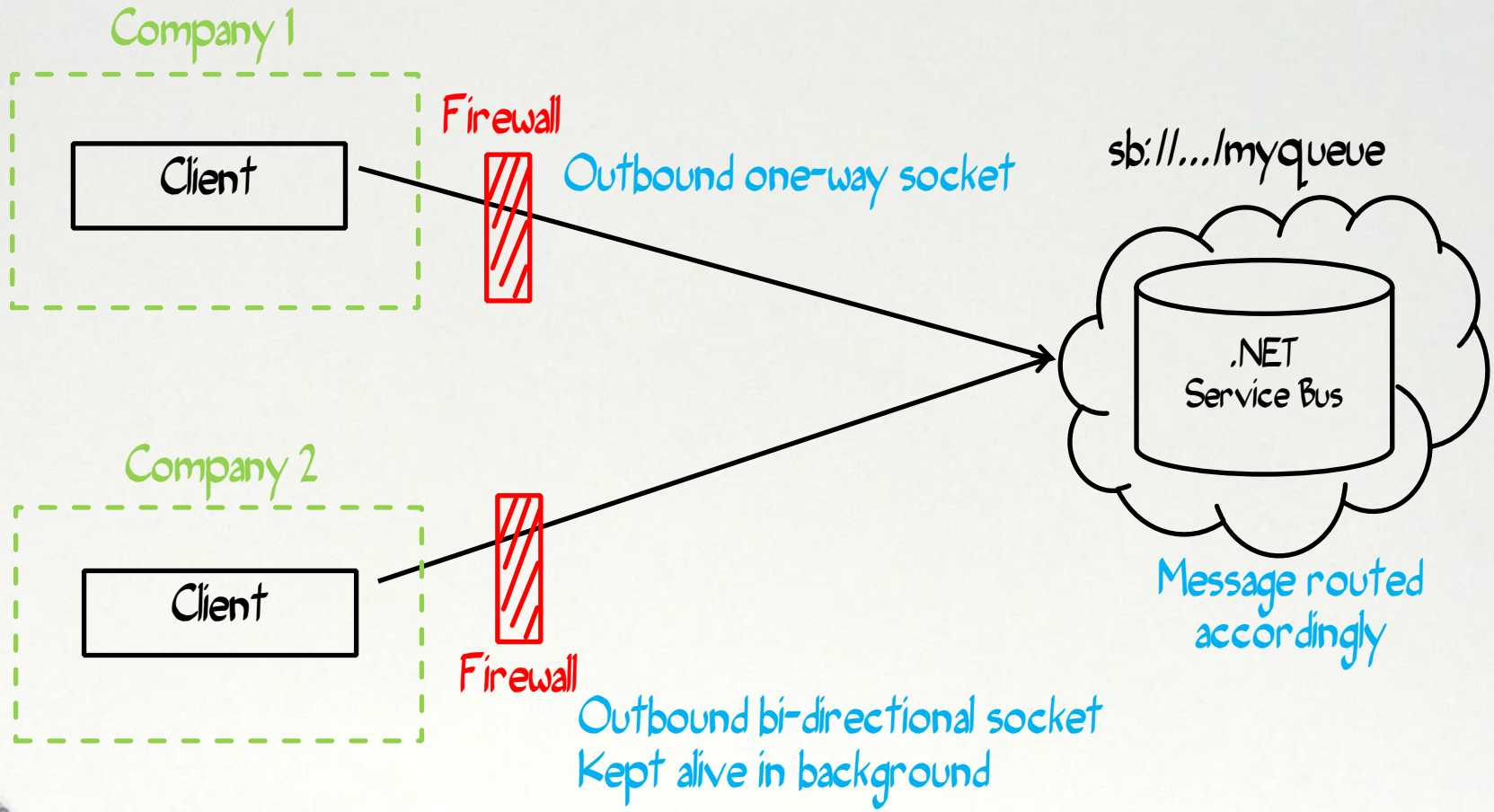

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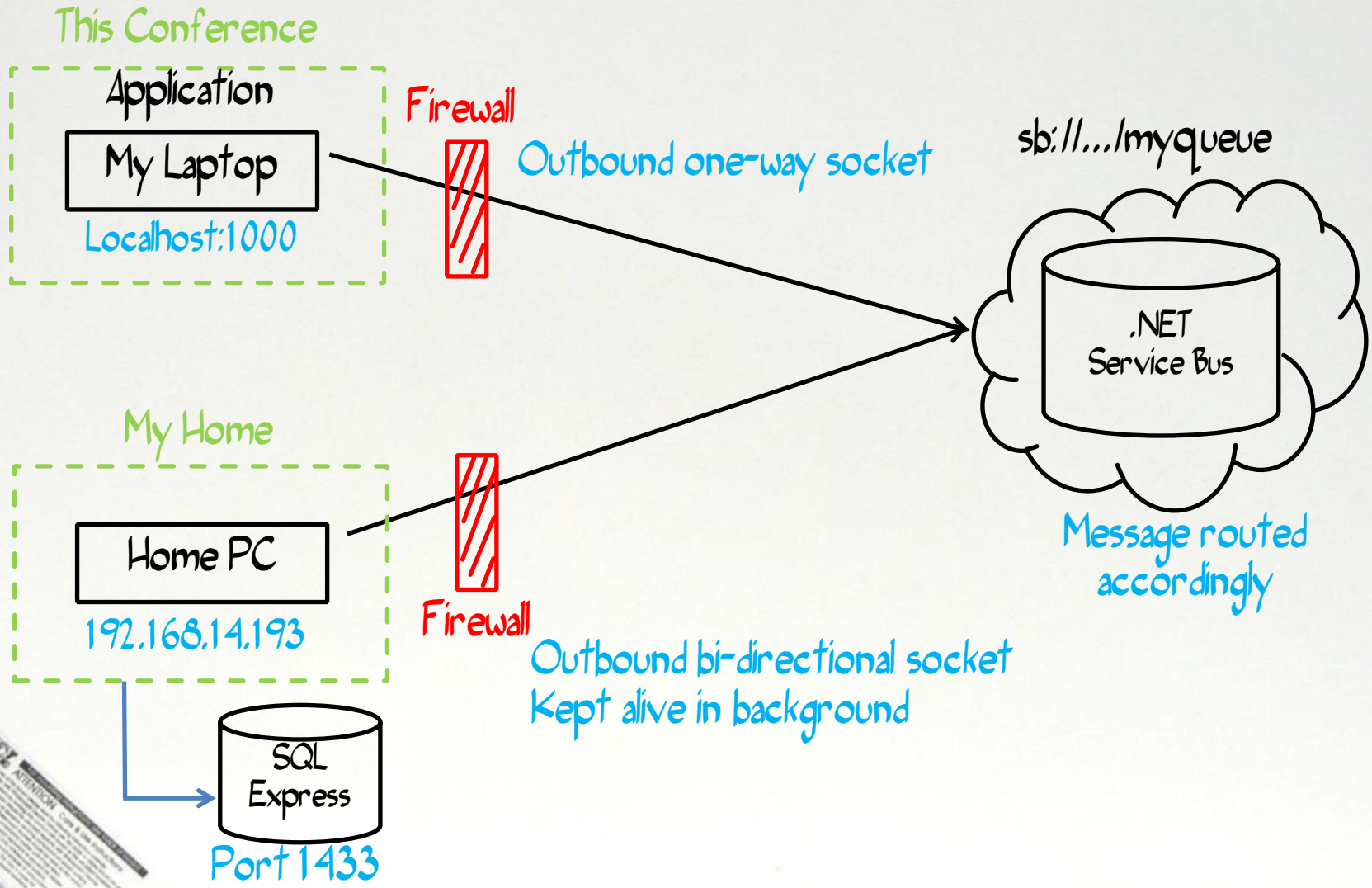
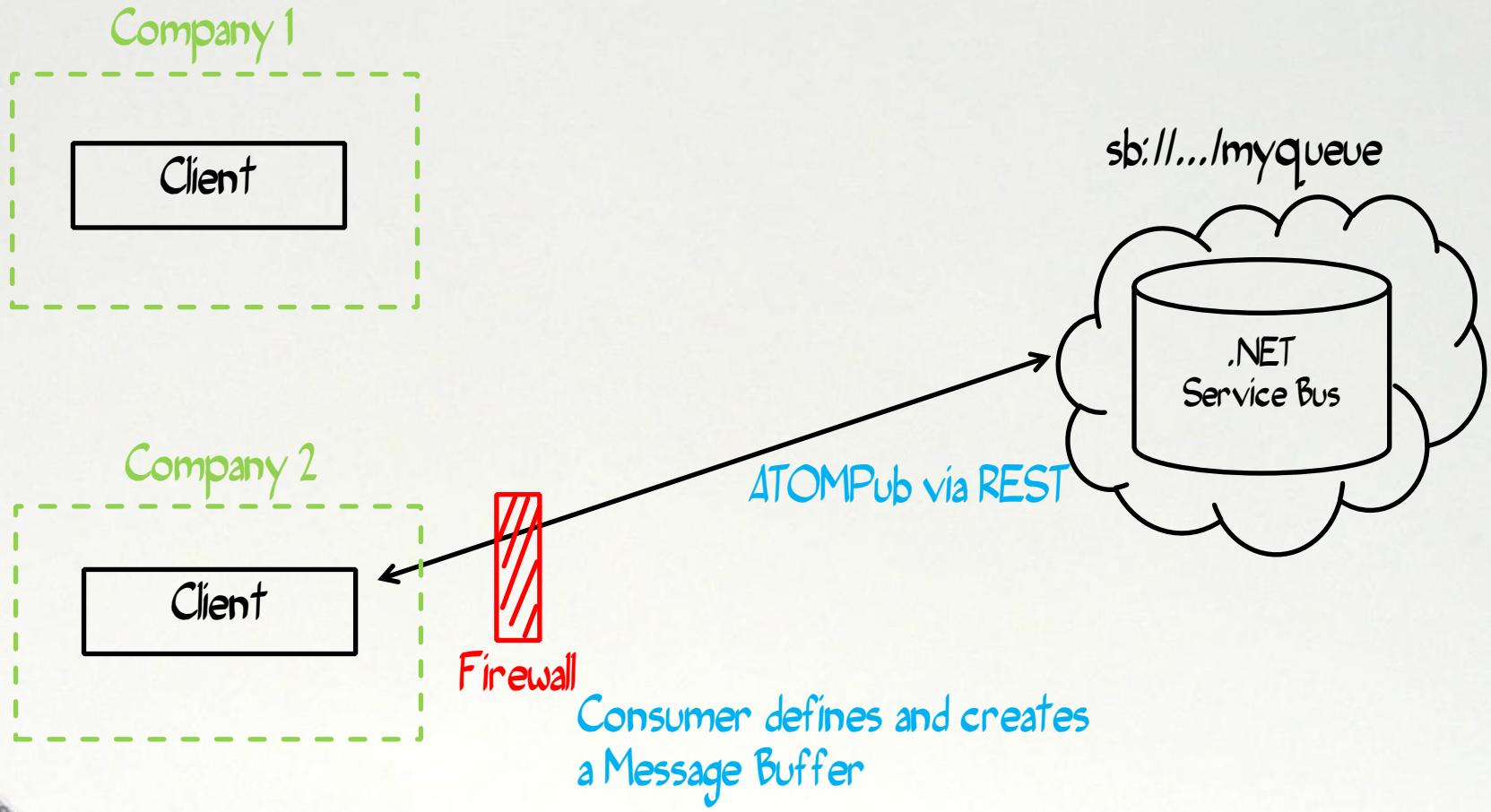


Two modes: TCP Relay and Message Buffer

#5 - Using the Cloud for Communications



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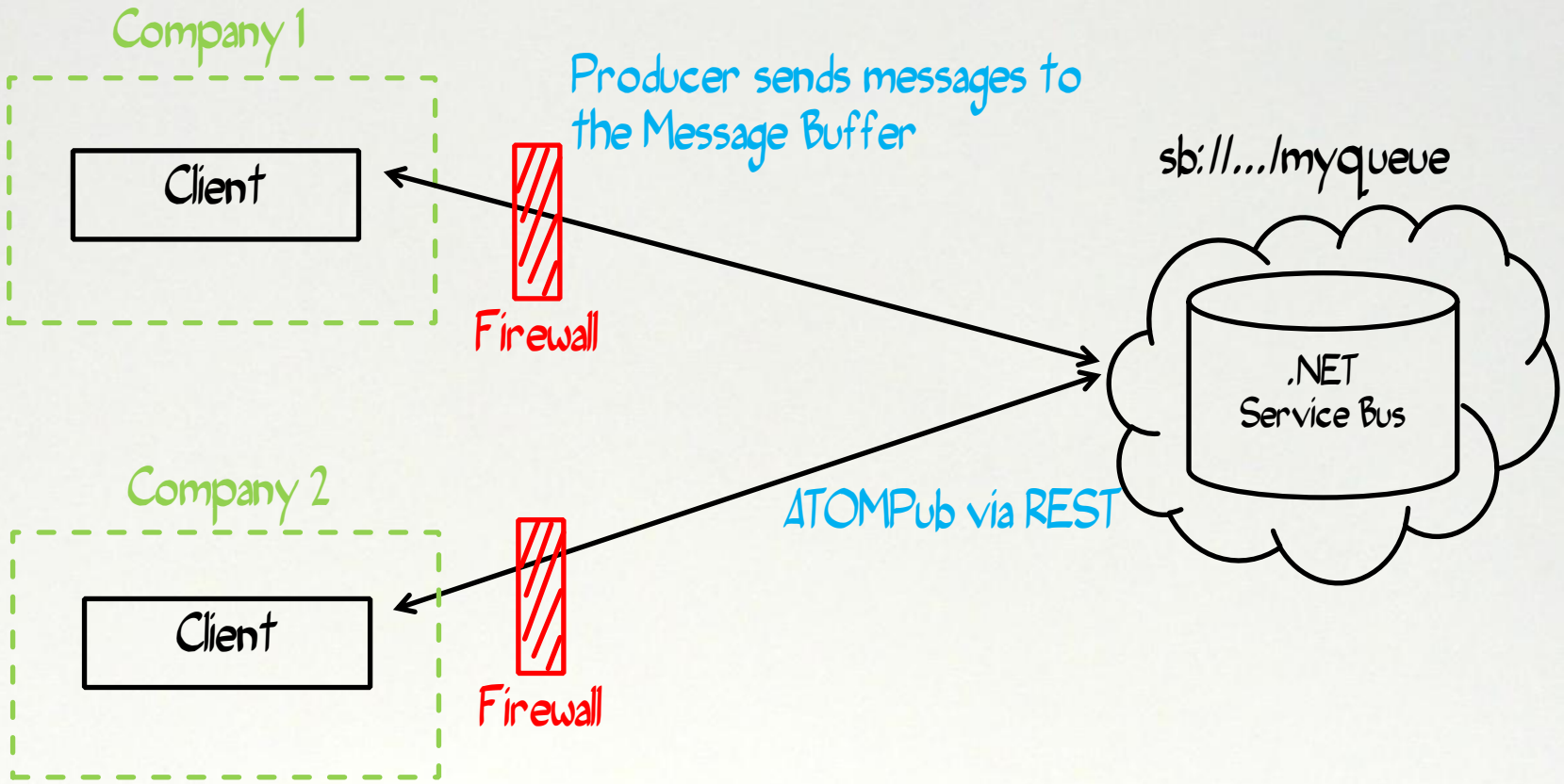

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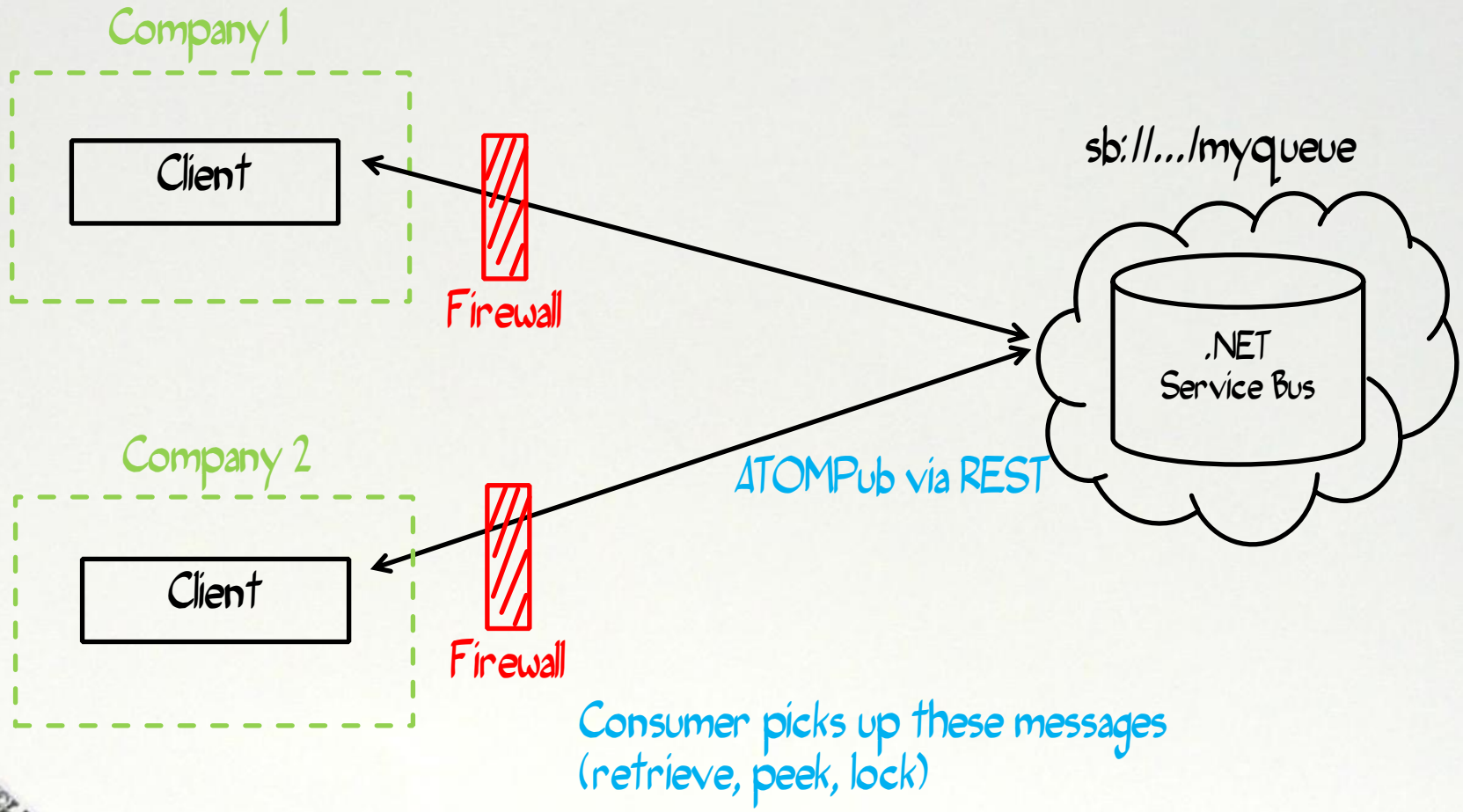


Takeaways

Be careful consuming REST based queues using shared secret

Firewalls/NATs can add additional trouble (especially non-HTTP)

Learn how .NET Service Bus traverses in these scenarios

Putting the Patterns **Together**

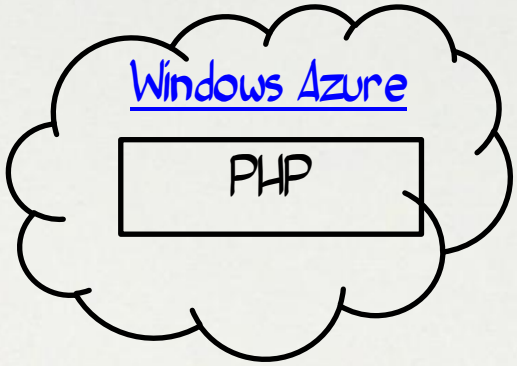
Patterns for Cloud Computing

We've covered 5 patterns, but Jim has one last question…

Patterns for Cloud Computing

Are there cases where these patterns work together?

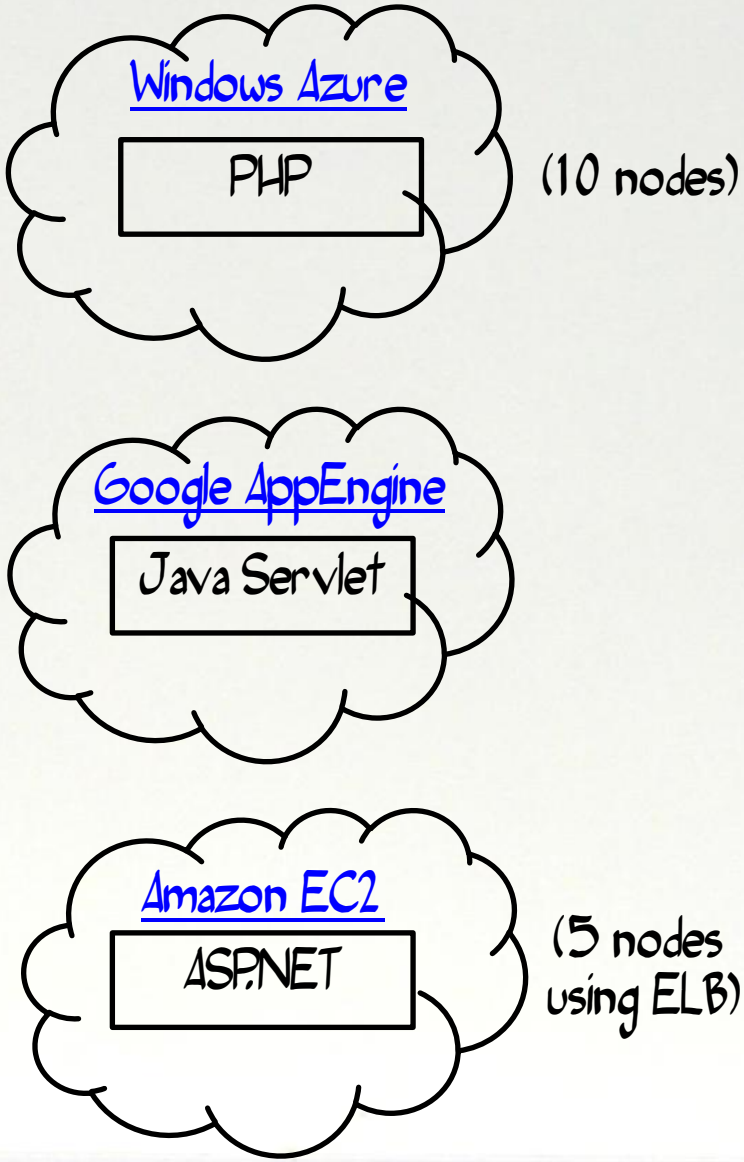
Putting the Patterns Together



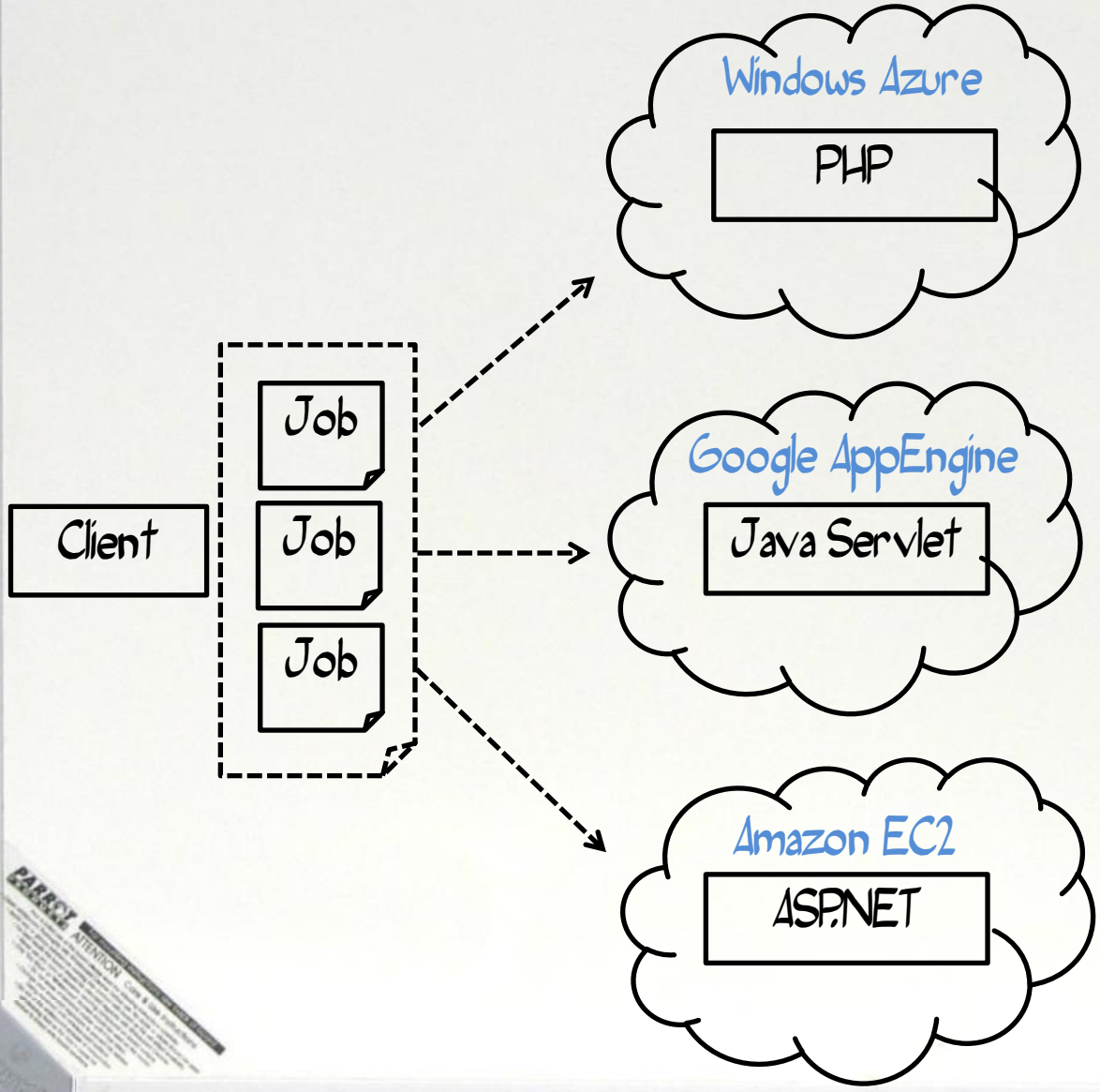
Let's build an application in PHP that scales to many nodes...

Putting the Patterns Together

Use the principles of multi tenancy to create a version of the application across multiple vendors



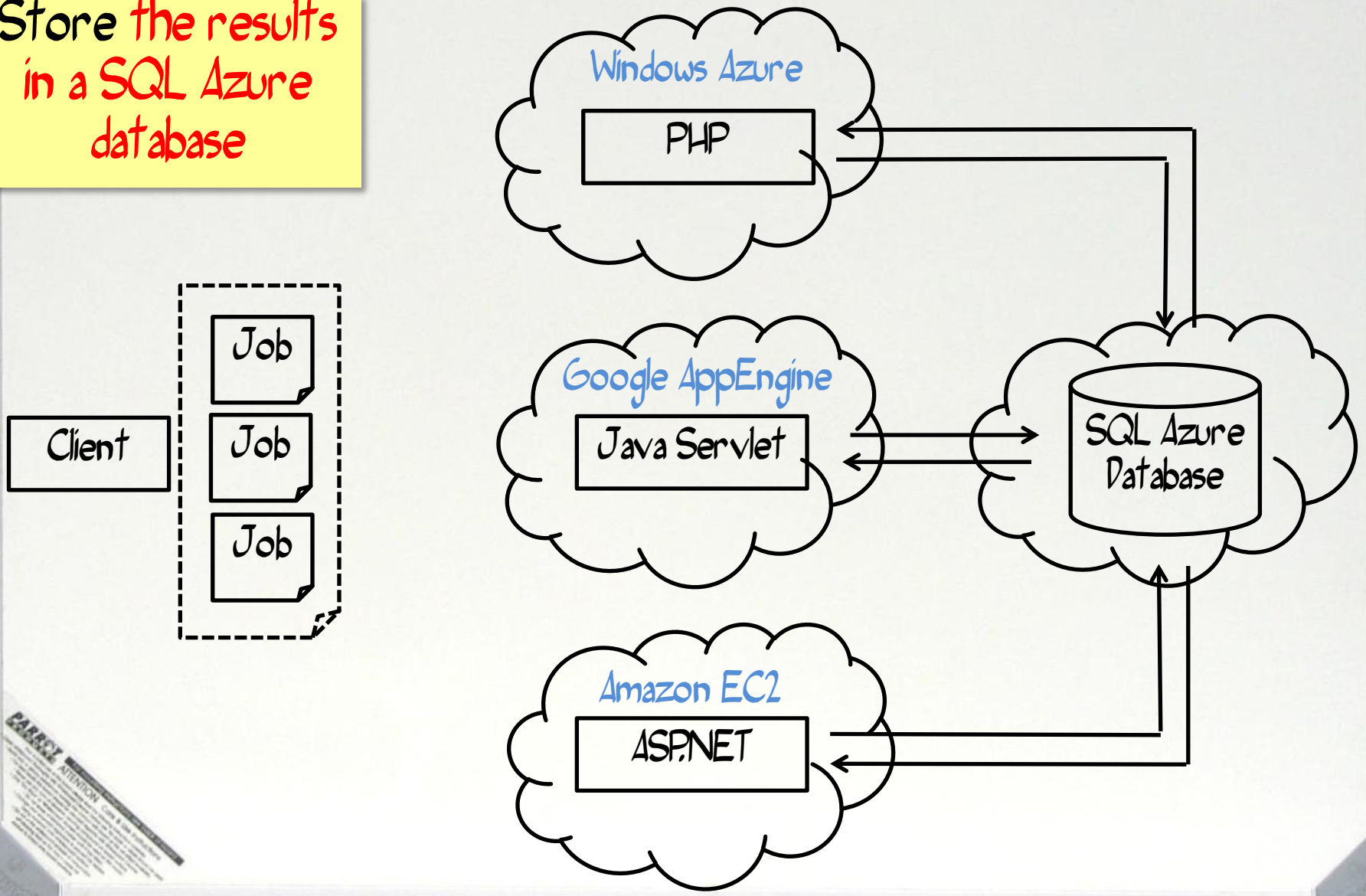
Putting the Patterns Together



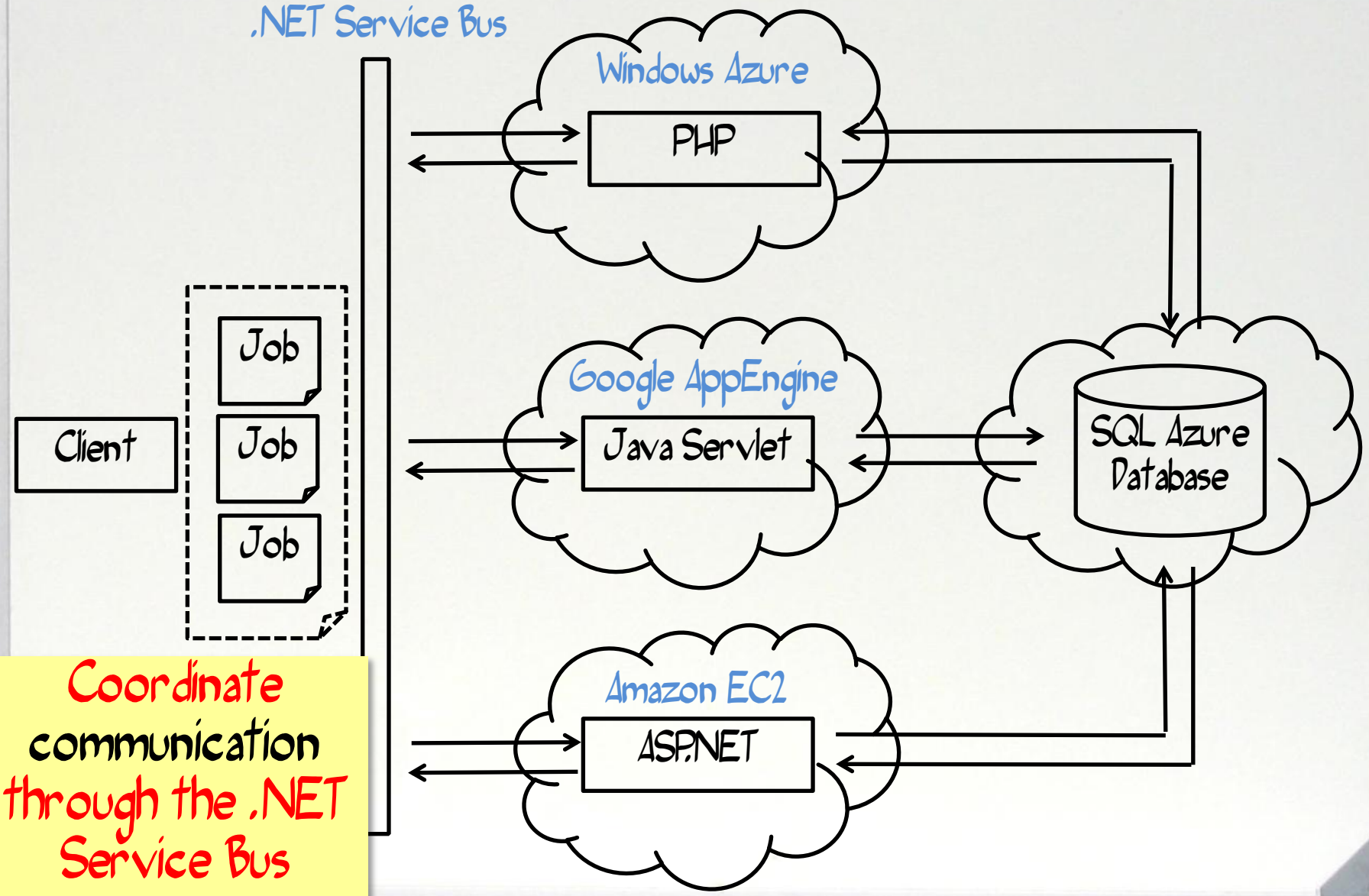
Compute results with a MapReduce-like way of distributing work across all of these applications

Putting the Patterns Together

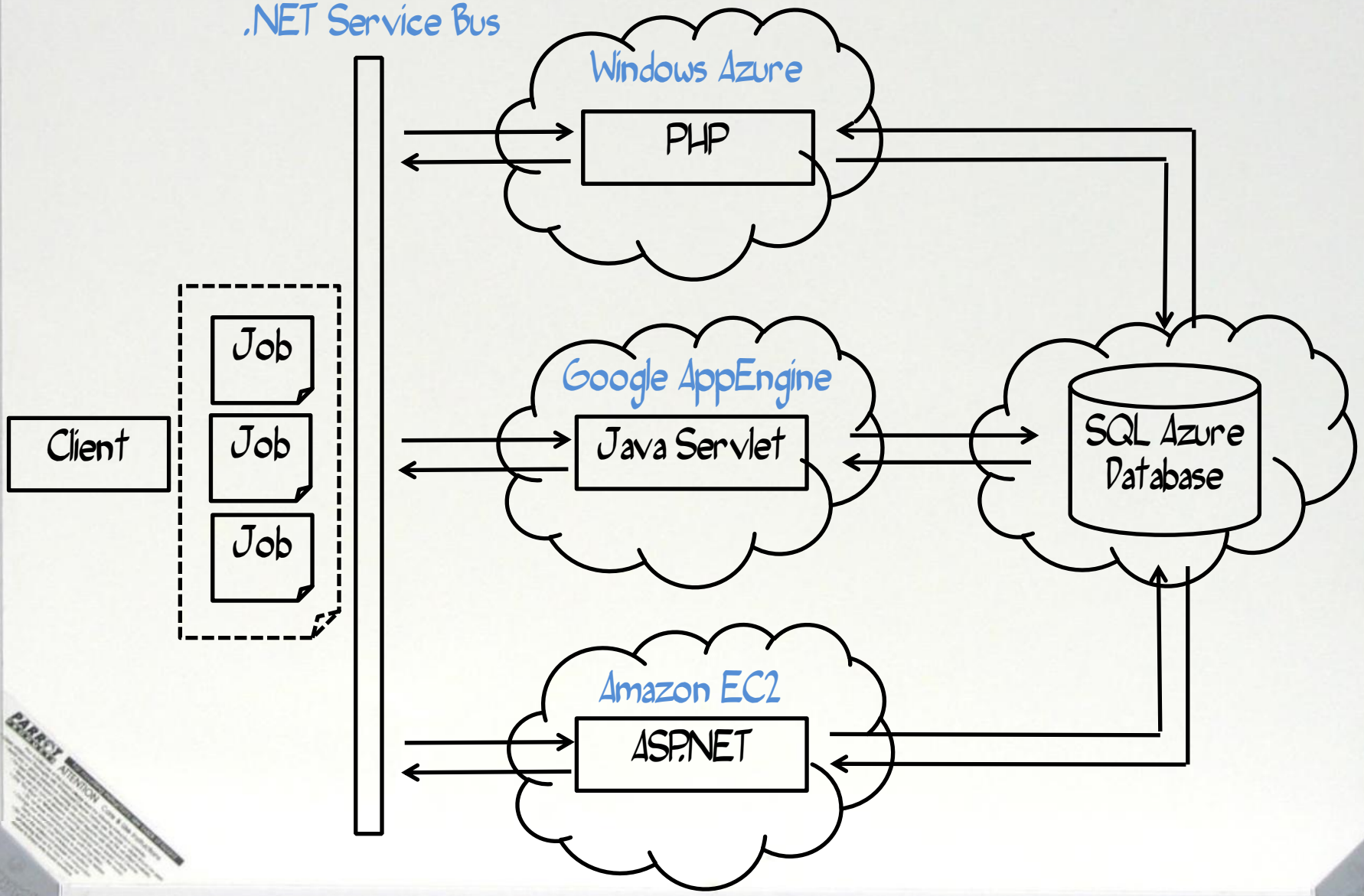
Store the results in a SQL Azure database



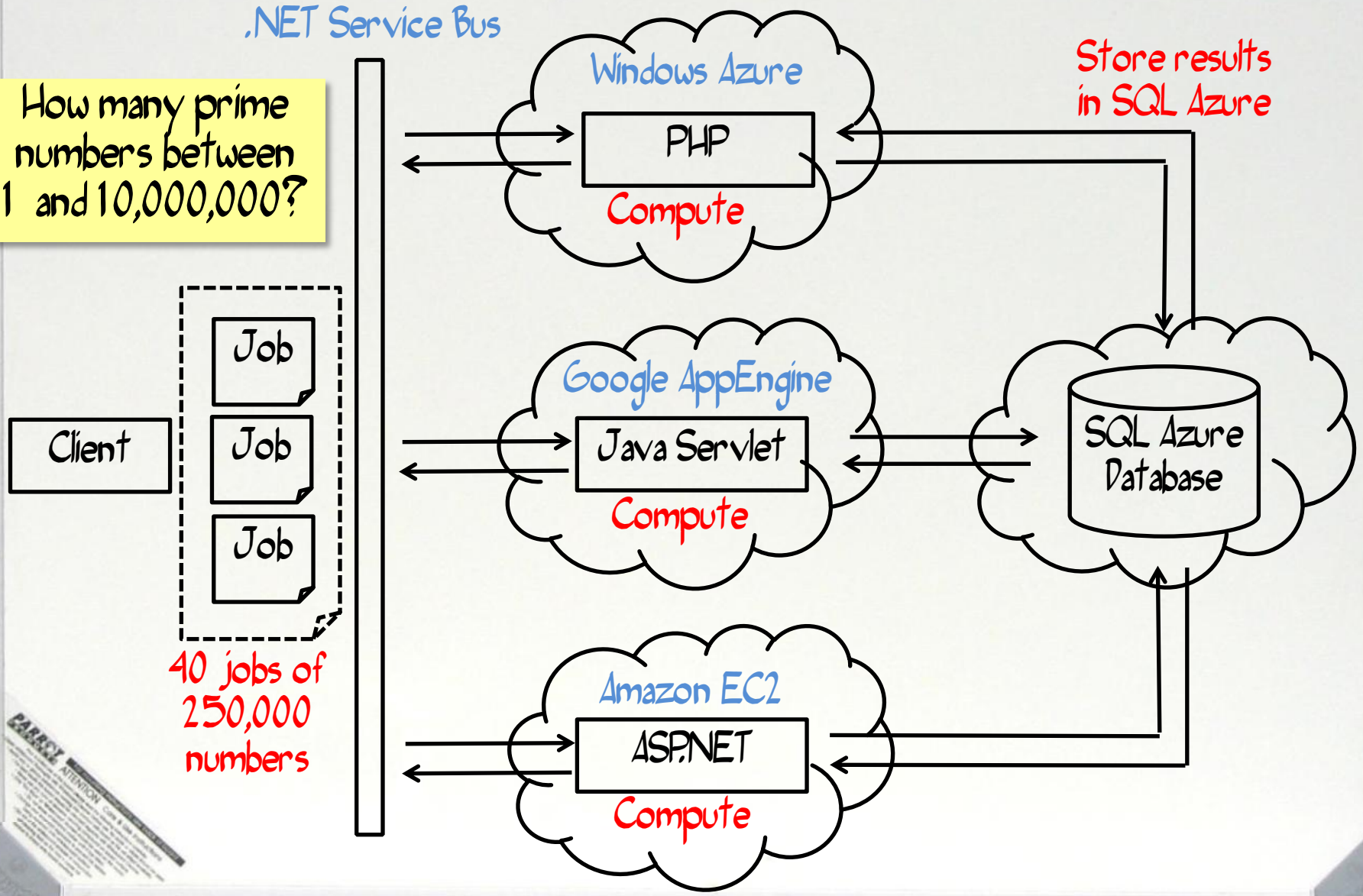
Putting the Patterns Together



Putting the Patterns Together

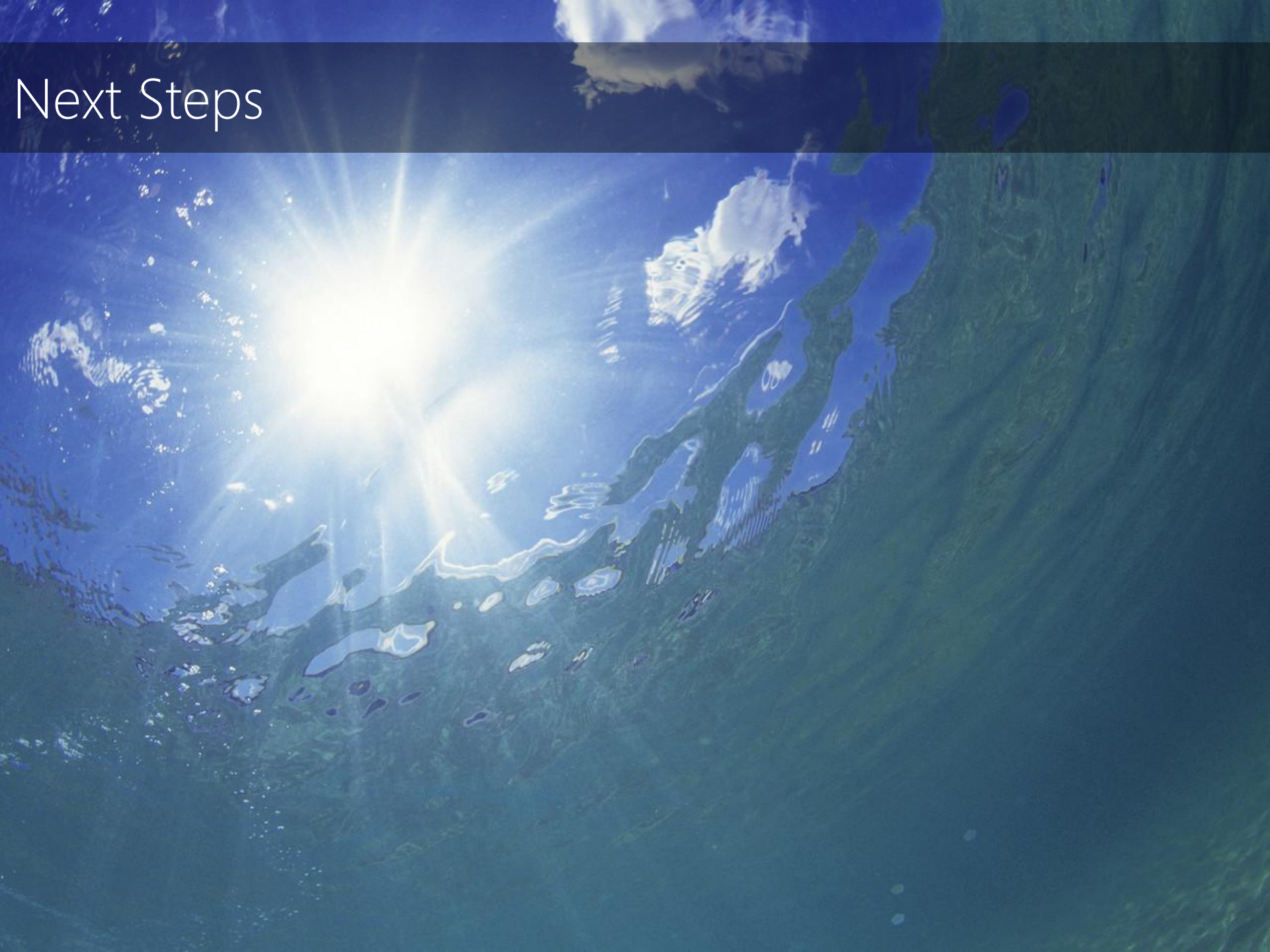


Putting the Patterns Together



Demo: Prime Solver v2.0

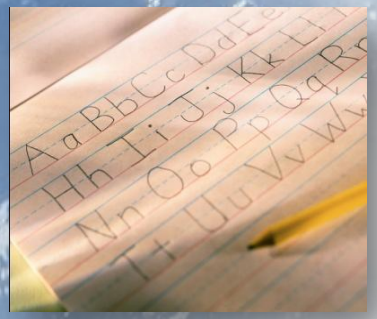
Next Steps



Next Steps

Obviously, our friend Jim, is **fake**…

Next Steps



Make sure you have a clear definition of Cloud Computing

Explore the 5 usage patterns for your scenarios today

Think about the next steps for implementation and migration

Microsoft®

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http://simonguest.com