# Head in the Cloud, Feet on the Ground

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# Why Cloud?
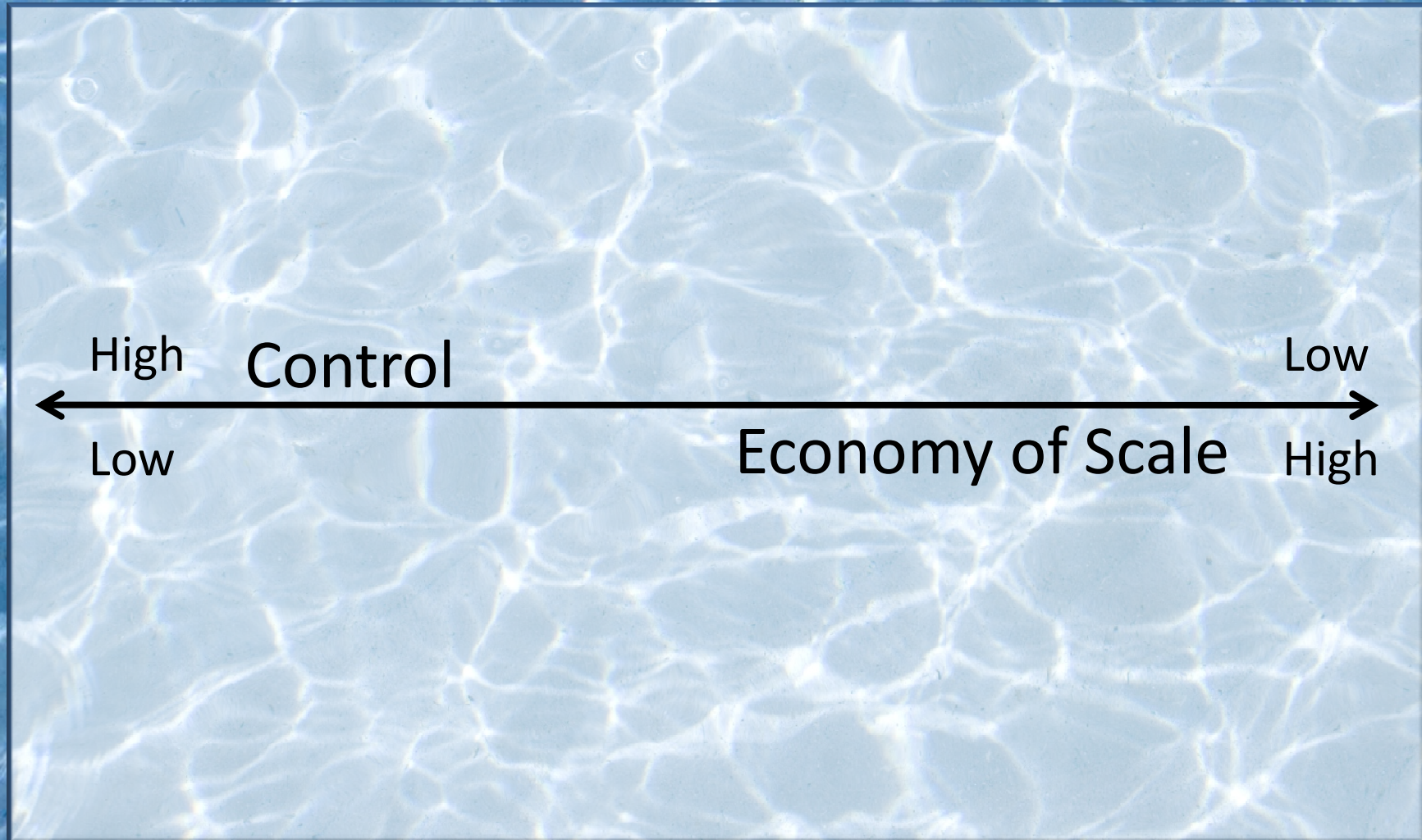
# What is it anyway?

# How can I benefit?

# Business Drivers for IT Projects

- **Increase market share and revenue**
  - Investing in product development and customer facing interaction channels
- **Increase efficiency and lower TCO**
  - Investing in technologies and processes to drive efficiency and lower cost through optimization
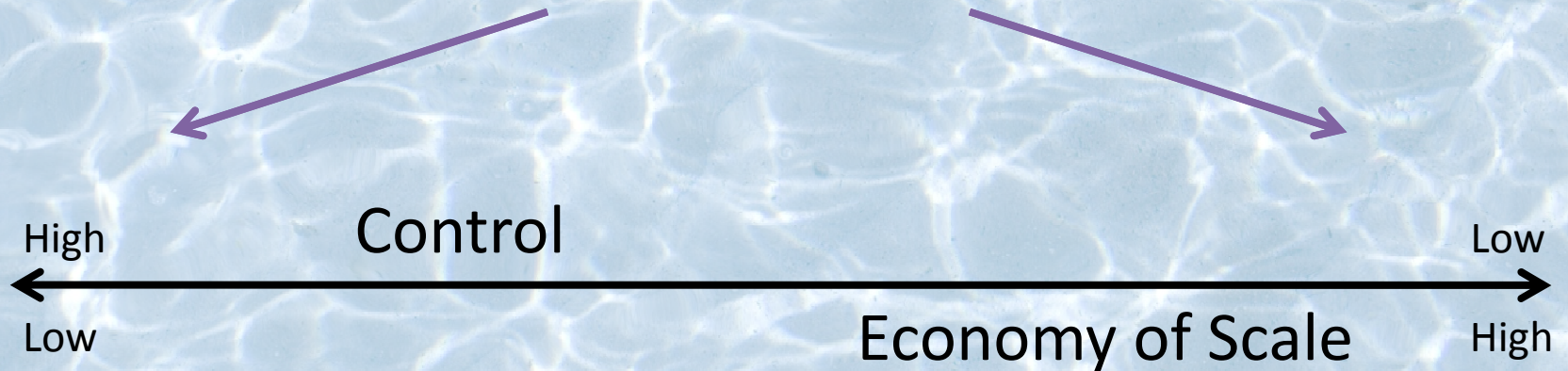
# Control vs. Economy of Scale
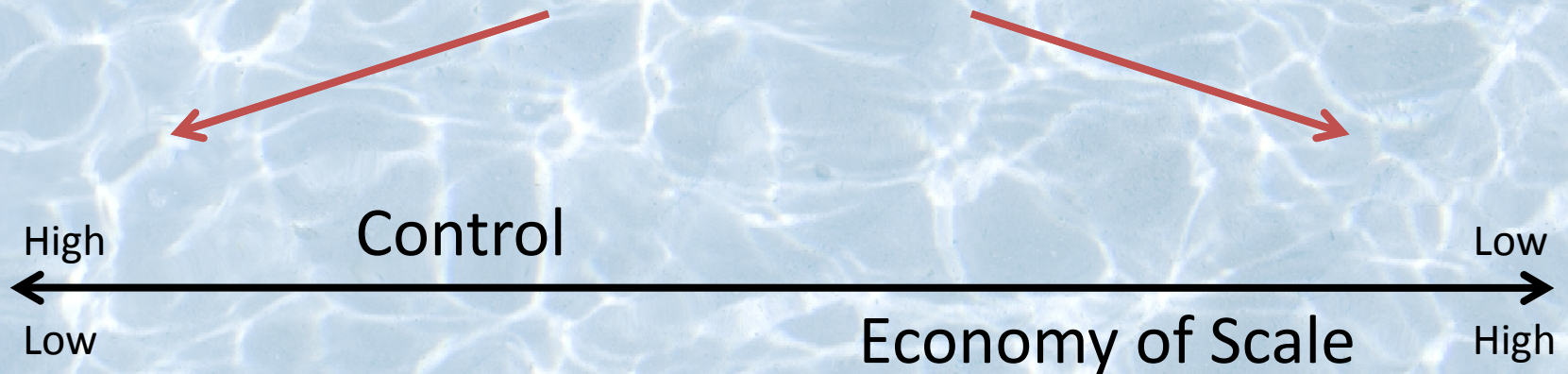
High    Control                               Low

⟵——————————————————————⟶

Low                     Economy of Scale     High

# On premises vs. in the cloud

High     Control     Low

Low     Economy of Scale     High

Large Scale Datacenters

# Leveraging Economy of Scale

Ratio between $ buckets for medium and very large DC

| Technology | Ratio |
| --- | --- |
| Network | 7.1 |
| Storage | 5.7 |
| Administration | 7.1 |

Source: Above the Clouds: A Berkeley View of Cloud Computing

# Location Matters

Short distance access to hydroelectric power

**Price per KWH**

| Price | State |
|-------|-------|
| 3.6¢ | Idaho |
| 10.0¢ | California |
| 18.8¢ | Hawaii |

Long distance transmission over the grid

Energy generation based on expensive resources

# Datacenter Options

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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## Application runs at a **hoster**

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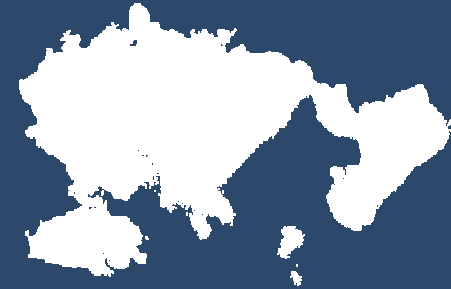
- Shared, multi-tenant environment
- Offers pool of computing resources, abstracted from infrastructure
- Pay as you go

# X as a Service

## Software as a Service

- Use applications over a network

## Platform as a Service

- Deploy customer-created applications to a cloud

## Infrastructure as a Service

- Rent processing, storage, network capacity, and other fundamental computing resources

# IaaS

- User gets access to a pool of resources through VM abstraction
- User needs to patch/maintain the system
- Scales only if stateless or if well partitioned

- E.g. Amazon EC2

# PaaS

- User gets access to a pool of resources through a programming model
- System is managed by the cloud provider
- Platform (programming model) can provide scalability

- E.g. Windows Azure, Google App Engine

# SaaS

- User gets access to applications
- System is completely managed by the cloud provider
- Cloud provider may offer customization and extensibility options

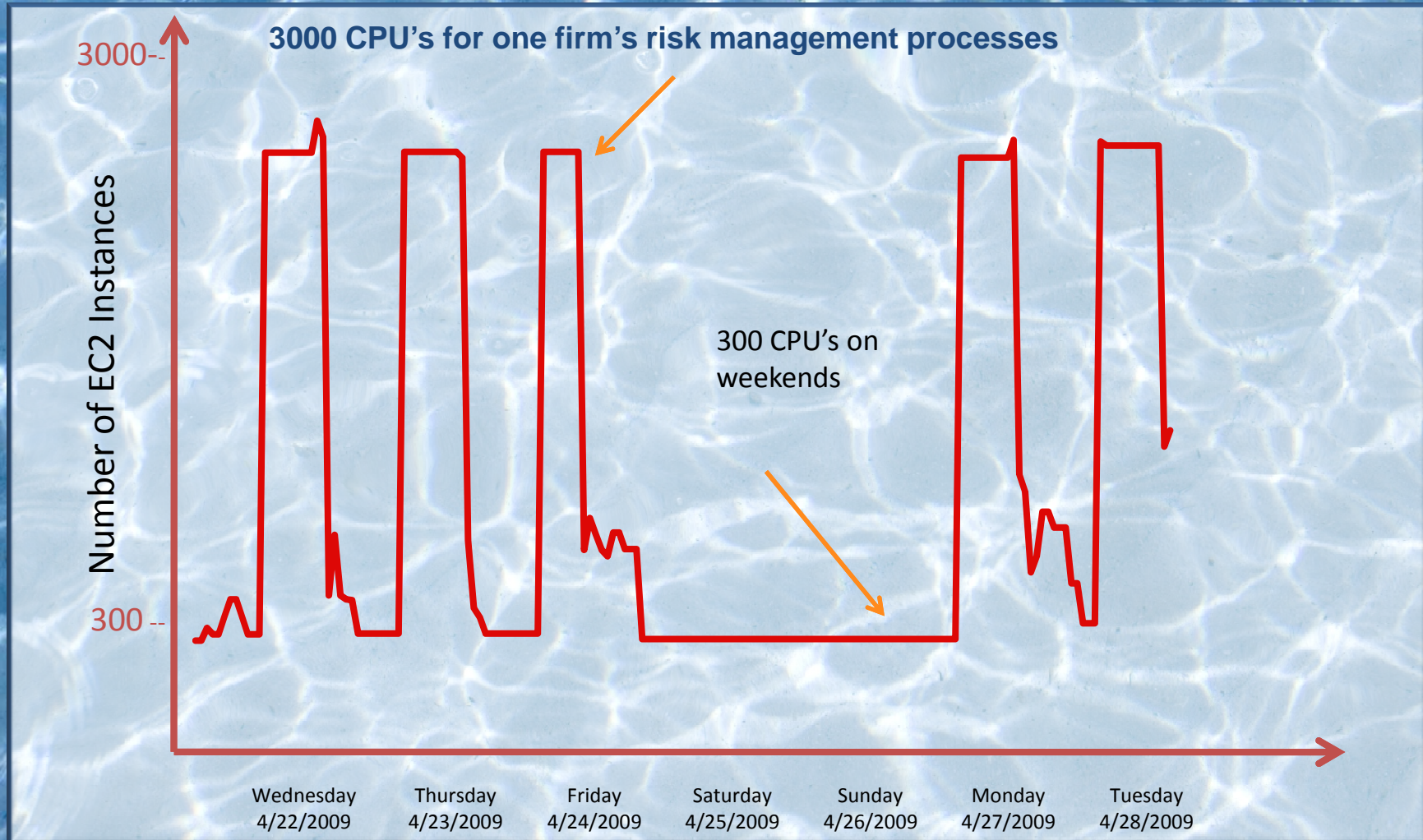- E.g. Salesforce.com, Microsoft BPOS, Google Apps

# Need for Elasticity



Daily Pageviews (percent)

facebook.com    cnn.com    yahoo.com
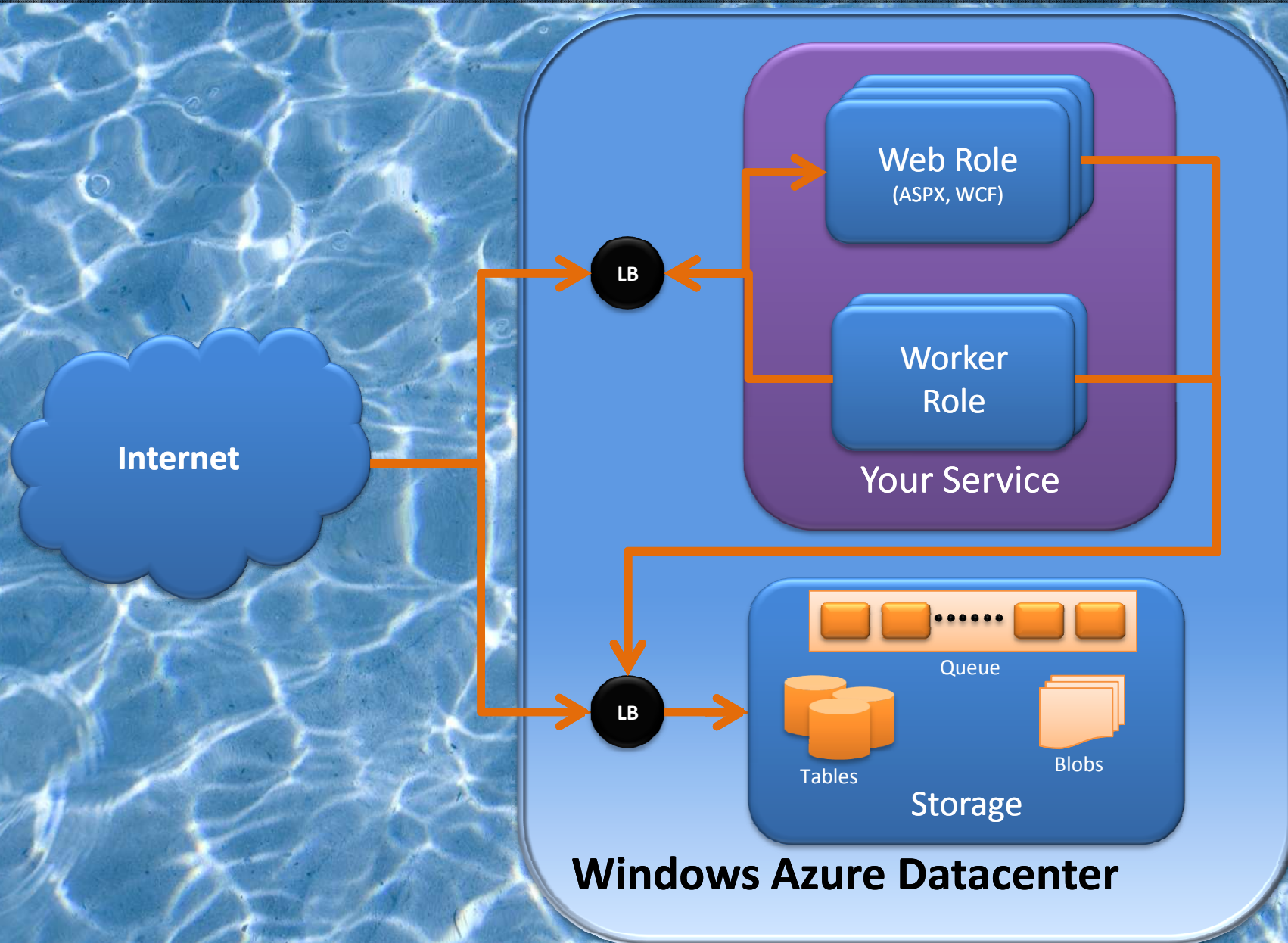
# Wall Street firm on Amazon EC2
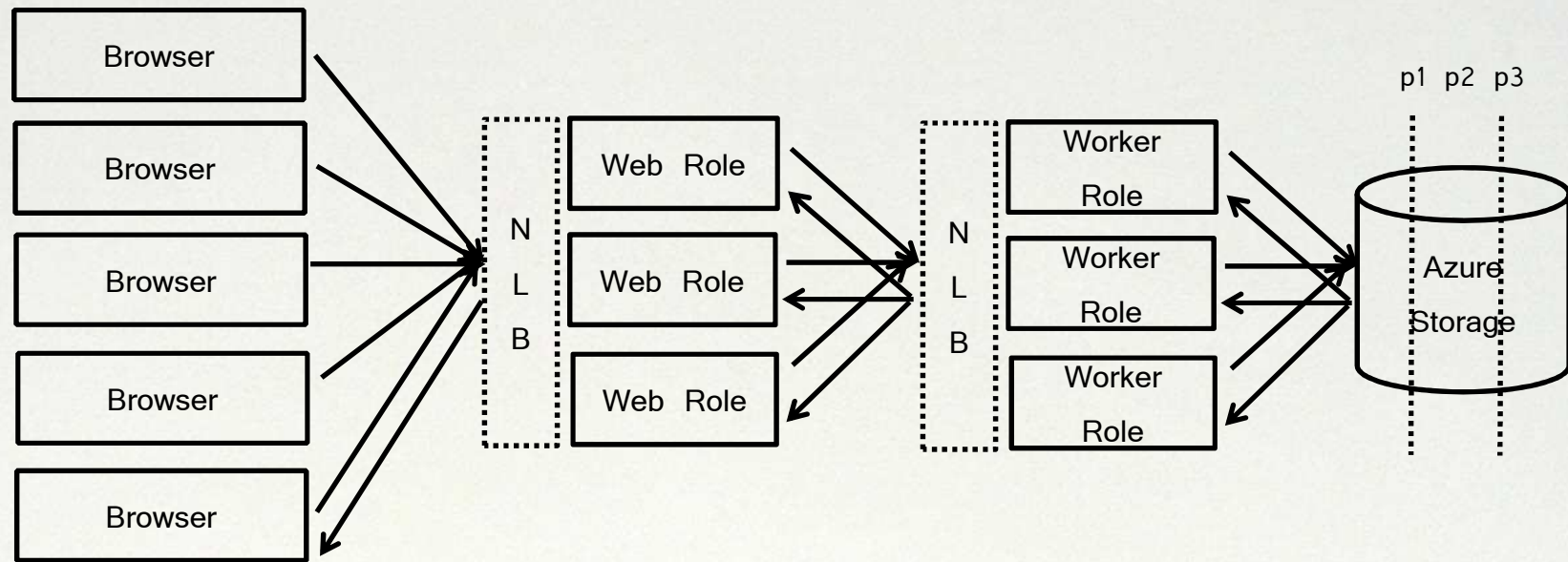
# Scale through PaaS

- The platform abstracts the physical infrastructure
- Ability to scale built into the programming model
  - Google's AppEngine
  - Microsoft's Windows Azure
  - Amazon's elastic MapReduce
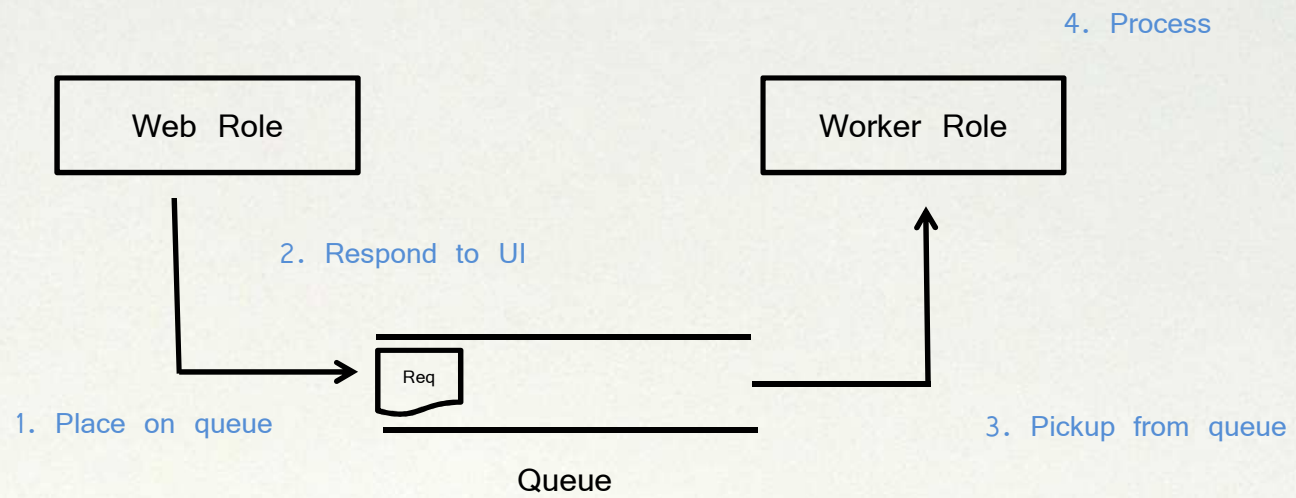  - ...

Windows Azure Building Blocks

Special thanks go to Simon Guest who let me "borrow" these whiteboard slides

Web  Role → Worker  Role

Web  Role ← Worker  Role

Tight  coupling  between  web  and  worker  role

is  an  anti-pattern

4. Process

Web Role

Worker Role

2. Respond to UI

Req

1. Place on queue

3. Pickup from queue

Queue

4. Process

Web Role

Worker Role

Req

Queue

5. Add result to table

Table

6. Query table on refresh
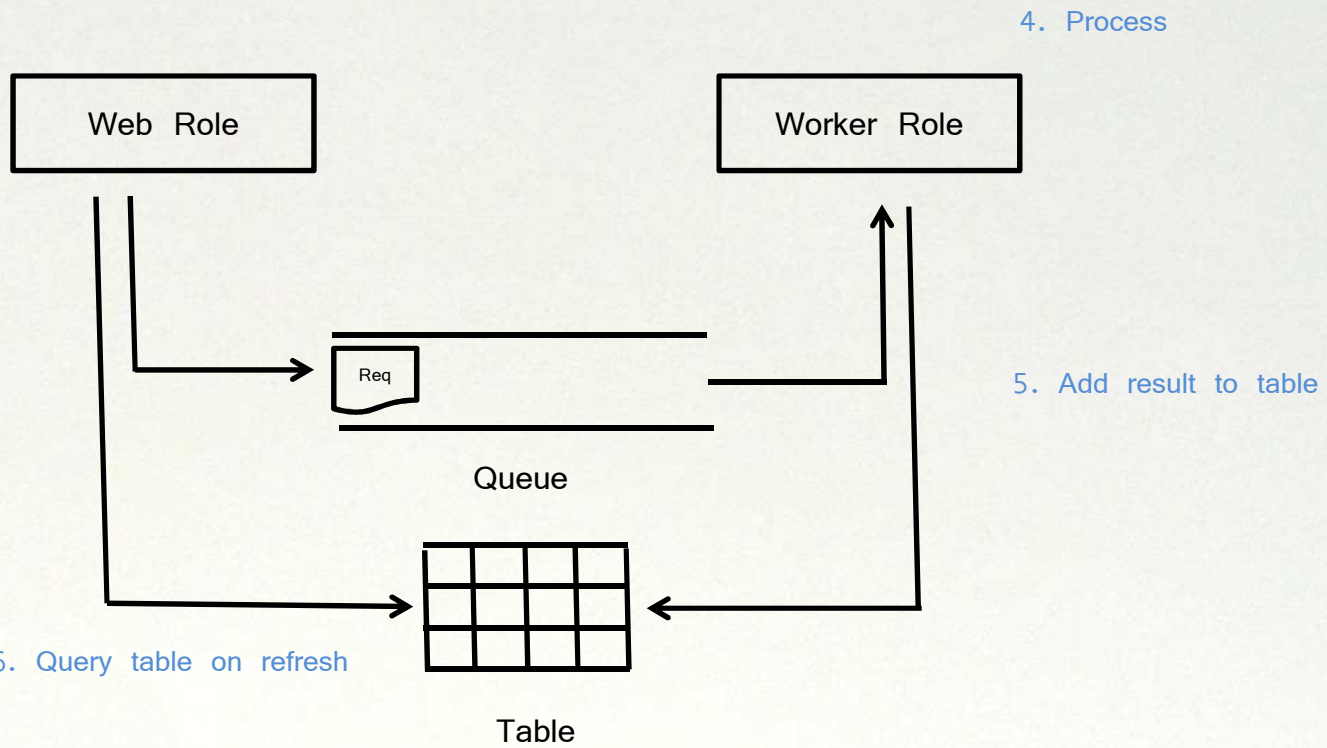
# The CxO Value Proposition

- Time to Market
  - No upfront CAPEX
  - Instant access to compute resources
- Total Cost of Ownership
  - CAPEX/OPEX
  - Economy of scale
  - Elasticity
- Productivity
  - Higher level of abstraction for compute resources
- Risk Mitigation
  - Allows for trial and error
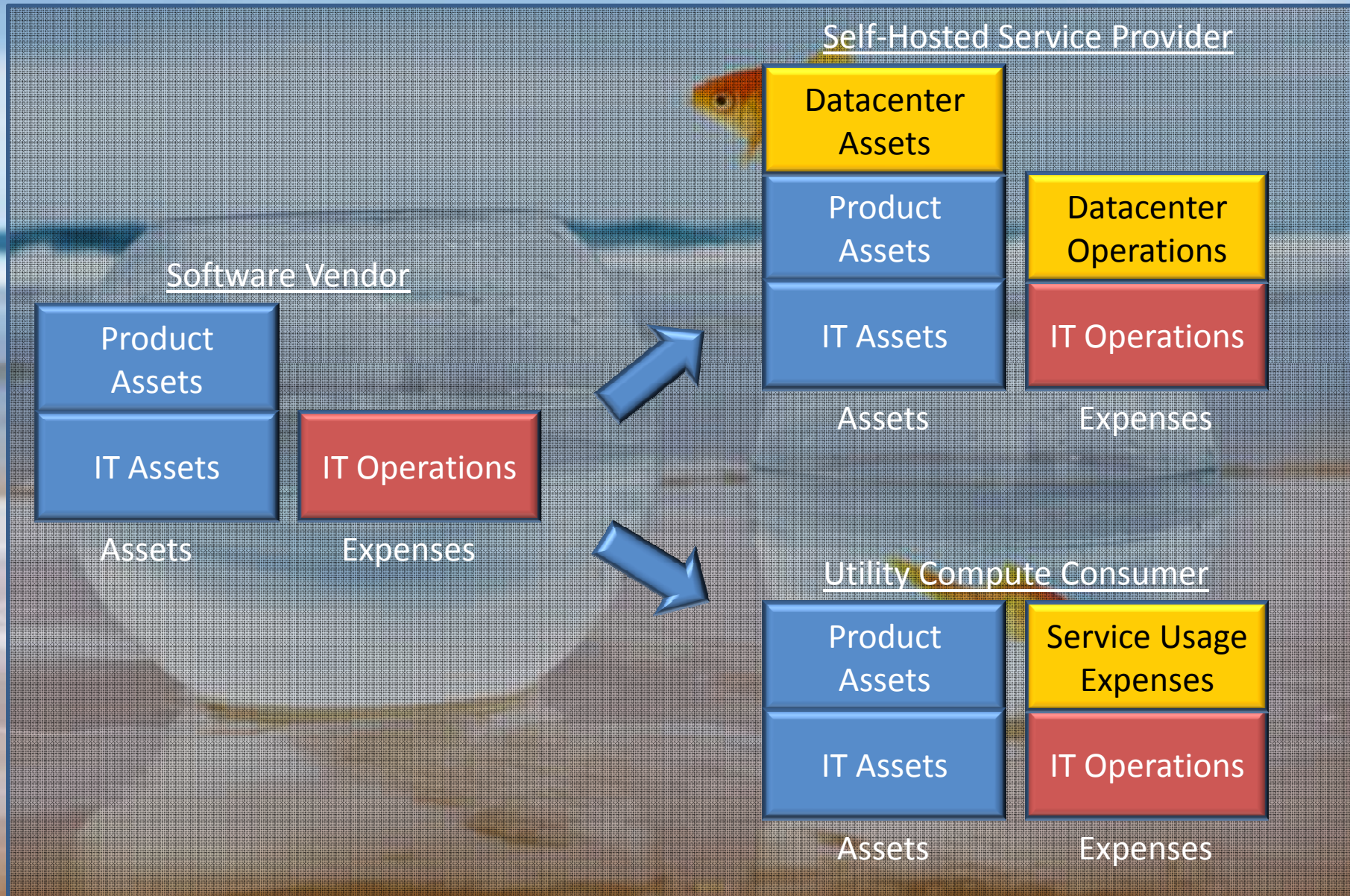  - Unpredictable utilization patterns

# CAPEX vs. OPEX

- CAPEX spending are investments to increase the capacity or efficiency for more than one accounting period
  - Create new assets on the balance sheet
  - Assets are deprecated over the following FYs
  - Debt amortization might be required
- OPEX are expenses related to the production of good and services
  - Reduce earnings and impact cash flow
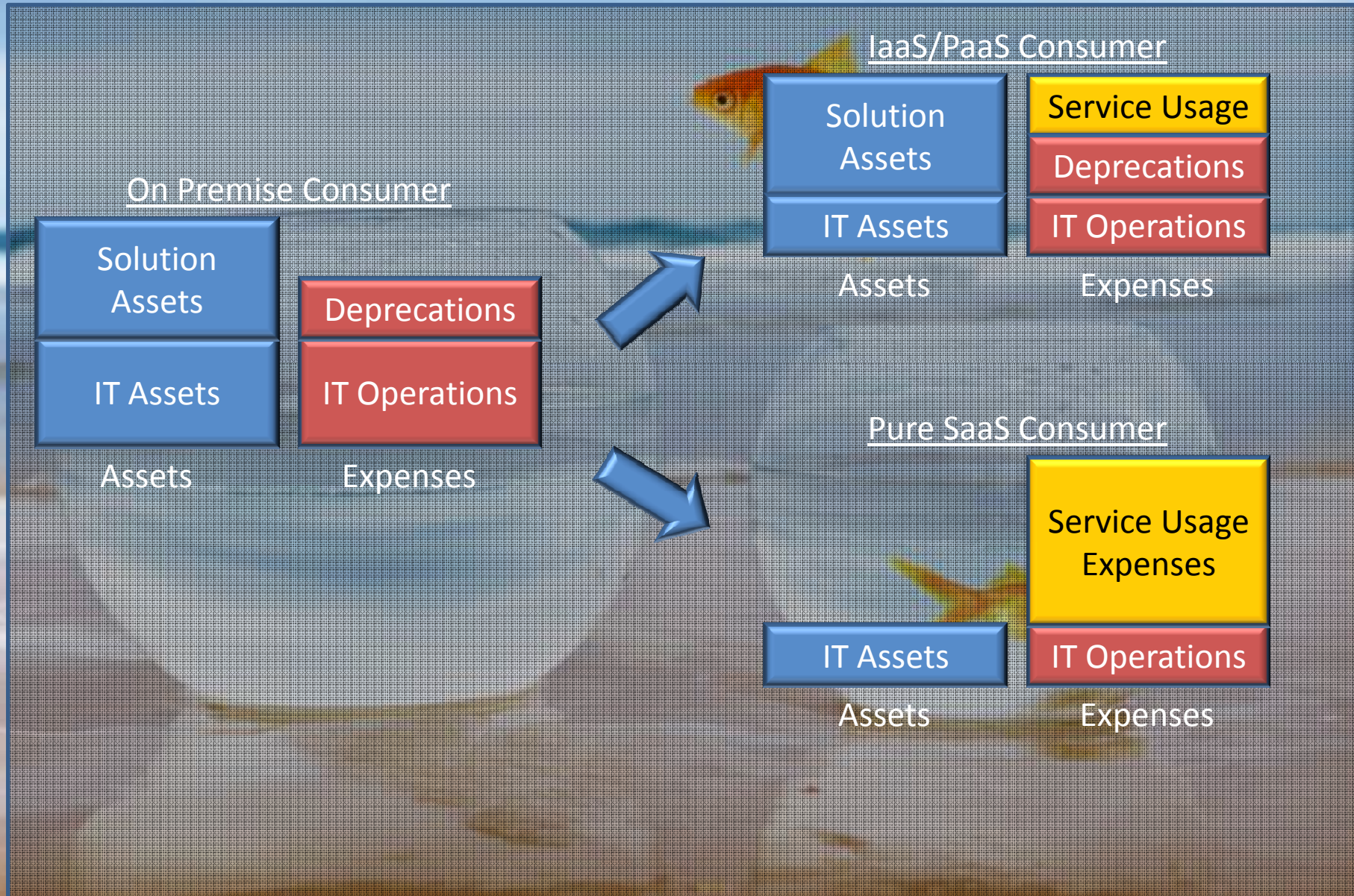  - FY boundary
  - Year-over-year budgeting

# Service Transformation - Vendor View

**Self-Hosted Service Provider**

| | |
|---|---|
| Datacenter Assets | |
| Product Assets | Datacenter Operations |
| IT Assets | IT Operations |
| Assets | Expenses |

**Software Vendor**

| | |
|---|---|
| Product Assets | |
| IT Assets | IT Operations |
| Assets | Expenses |

**Utility Compute Consumer**

| | |
|---|---|
| Product Assets | Service Usage Expenses |
| IT Assets | IT Operations |
| Assets | Expenses |

# CAPEX/OPEX Impact

**On Premise Consumer**

| Solution Assets |
|---|

| IT Assets |
|---|

Assets

| Deprecations |
|---|

| IT Operations |
|---|

Expenses

**IaaS/PaaS Consumer**

| Solution Assets |
|---|

| IT Assets |
|---|

Assets

| Service Usage |
|---|

| Deprecations |
|---|

| IT Operations |
|---|

Expenses

**Pure SaaS Consumer**

| Service Usage Expenses |
|---|

| IT Assets |
|---|

Assets

| IT Operations |
|---|

Expenses

# Cloud Pricing

- Pricing Options
  - Pay as you go – flexible but unpredictable
  - Flat fees, Quotas, Limits allow for better control
  - Decisions based on business model, predictability, IT budgeting
- Pricing Dimensions
  - Compute pricing
    - # CPUs (hours deployed vs. hours utilized)
    - Dedicated local storage & memory
  - Bandwidth (inbound, outbound, inter-DC)
    - Can become very pricy for large storages
    - Disk shipments
  - Storage
    - Average used storage capacity vs. , "fixe sized" storage
    - Storage transactions (read, write)
    - Used query time

# GoDaddy: Web Hosting Plans

**Extensive Language Support!**   See all

python  Microsoft .net  Ruby  php

perl

**Dozens of FREE Add-on Applications!**   See all

Google   Mochila   OpenX

Joomla!   Drupal   WordPress

Choose Your Operating System: ⦿ Linux (Plan Details)  ○ Windows (Plan Details)

## ECONOMY PLAN

10 GB Space | 300 GB Transfer
100 Email Accounts
10 MySQL Databases

○ 3mos: $4.99/mo
○ 12mos: $4.74/mo Save 5%‡
○ 24mos: $4.49/mo Save 10%‡
○ 36mos: $4.24/mo Save 15%‡

## DELUXE PLAN

150 GBSpace | 1,500 GB Transfer
500 Email Accounts
25 MySQL Databases

○ 1mo:   $6.99/mo
⦿ 12mos: $6.64/mo Save 5%‡
○ 24mos: $6.29/mo Save 10%‡
○ 36mos: $5.94/mo Save 15%‡

## UNLIMITED⁺ PLAN

Unlimited Space and Transfer!
1000 Email Accounts
Unlimited MySQL Databases
Includes Free†† SSL Certificate!

○ 1mo:   $14.99/mo
○ 12mos: $14.24/mo Save 5%‡
○ 24mos: $13.49/mo Save 10%‡
○ 36mos: $12.74/mo Save 15%‡

# GoDaddy: Virtual Dedicated Servers

| Ready-to-Go-Plans | Build Your Own | Assisted Service Plan |

## Economy Plan

**10 GB Disk Space**
**500 GB Bandwidth**

- ◯ 1 mo: **$29.99/mo**
- ◯ 6 mo: **$29.99/mo**
- ◯ 12 mo: **$26.99/mo** SAVE 10%!
- ◯ 24 mo: **$23.99/mo** SAVE 20%!

**Plan Features**
- 256 MB RAM Guaranteed /
  (1 GB RAM Bursted)
- Linux: CentOS or Fedora
- Simple Control Panel
- FREE! SSL Cert, $29.99/yr
  value!†††
- $75 in Ad Credits
- And MORE!

## Deluxe Plan

**20 GB Disk Space**
**1,000 GB Bandwidth**

- ◯ 1 mo: **$49.98/mo**
- ◯ 6 mo: **$49.98/mo**
- ◉ 12 mo: **$45.98/mo** SAVE 8%!
- ◯ 24 mo: **$41.98/mo** SAVE 16%!

> 🛒 **Add to Cart**

**Plan Features**
- 256 MB RAM Guaranteed /
  (1 GB RAM Bursted)
- Linux: CentOS or Fedora
- Simple Control Panel
- FREE! SSL Cert, $29.99/yr
  value!†††
- $100 in Ad Credits
- And MORE!

## Premium Plan

**50 GB disk space**
**2,000 GB Bandwidth**

- ◯ 1 mo: **$114.93/mo**
- ◯ 6 mo: **$114.93/mo**
- ◯ 12 mo: **$105.44/mo** SAVE 8%!
- ◯ 24 mo: **$95.94/mo** SAVE 16%!

**Plan Features**
- 512 MB RAM Guaranteed /
  (2 GB RAM Bursted)
- Linux: CentOS or Fedora
- cPanel unlimited control panel
- FREE! SSL Cert, $29.99/yr
  value!†††
- $125 in Ad Credits
- And MORE!

# Amazon: EC2 Pricing

| United States | Europe | |
|---|---|---|
| **Standard On-Demand Instances** | **Linux/UNIX Usage** | **Windows Usage** |
| Small (Default) | $0.10 per hour | $0.125 per hour |
| Large | $0.40 per hour | $0.50 per hour |
| Extra Large | $0.80 per hour | $1.00 per hour |
| **High CPU On-Demand Instances** | **Linux/UNIX Usage** | **Windows Usage** |
| Medium | $0.20 per hour | $0.30 per hour |
| Extra Large | $0.80 per hour | $1.20 per hour |

| United States | Europe | | |
|---|---|---|---|
| **Linux/UNIX** | **One-time Fee** | | |
| **Standard Reserved Instances** | **1 yr Term** | **3 yr Term** | **Usage** |
| Small (Default) | $227.50 | $350 | $0.03 per hour |
| Large | $910 | $1400 | $0.12 per hour |
| Extra Large | $1820 | $2800 | $0.24 per hour |
| **High CPU Reserved Instances** | **1 yr Term** | **3 yr Term** | **Usage** |
| Medium | $455 | $700 | $0.06 per hour |
| Extra Large | $1820 | $2800 | $0.24 per hour |

# IaaS versus Hosting

- 1 year unlimited hosting at GoDaddy               $171
- 1 year dedicated Server at GoDaddy            $552
- App deployed for 1 year at EC2                   >$864

- Differentiating factors
    - Guaranteed resources
        - RAM   256 MB  vs.          1.7 GB
        - Disk    20 GB    vs.          160 GB
    - Elasticity, ability to ad-hoc scale up/down
    - Low-latency access to high scalable storage
    - Cost/time to deploy

# The Azure SLA

## Compute connectivity

- Your service is connected and reachable via web

- Internet facing roleswill have external connectivity

**>99.95%**

## Database availability

- Database is connected to the internet gateway

- Availability monitoring every 5-minute interval

**>99.9%**

## Storage availability

- Storage service will be available/ reachable (connectivity)

- Your storage requests will be processed successfully

**>99.9%**

## Service availability

- .NET Service Bus endpoint will have external connectivity

- Message operation requests will be processed successfully
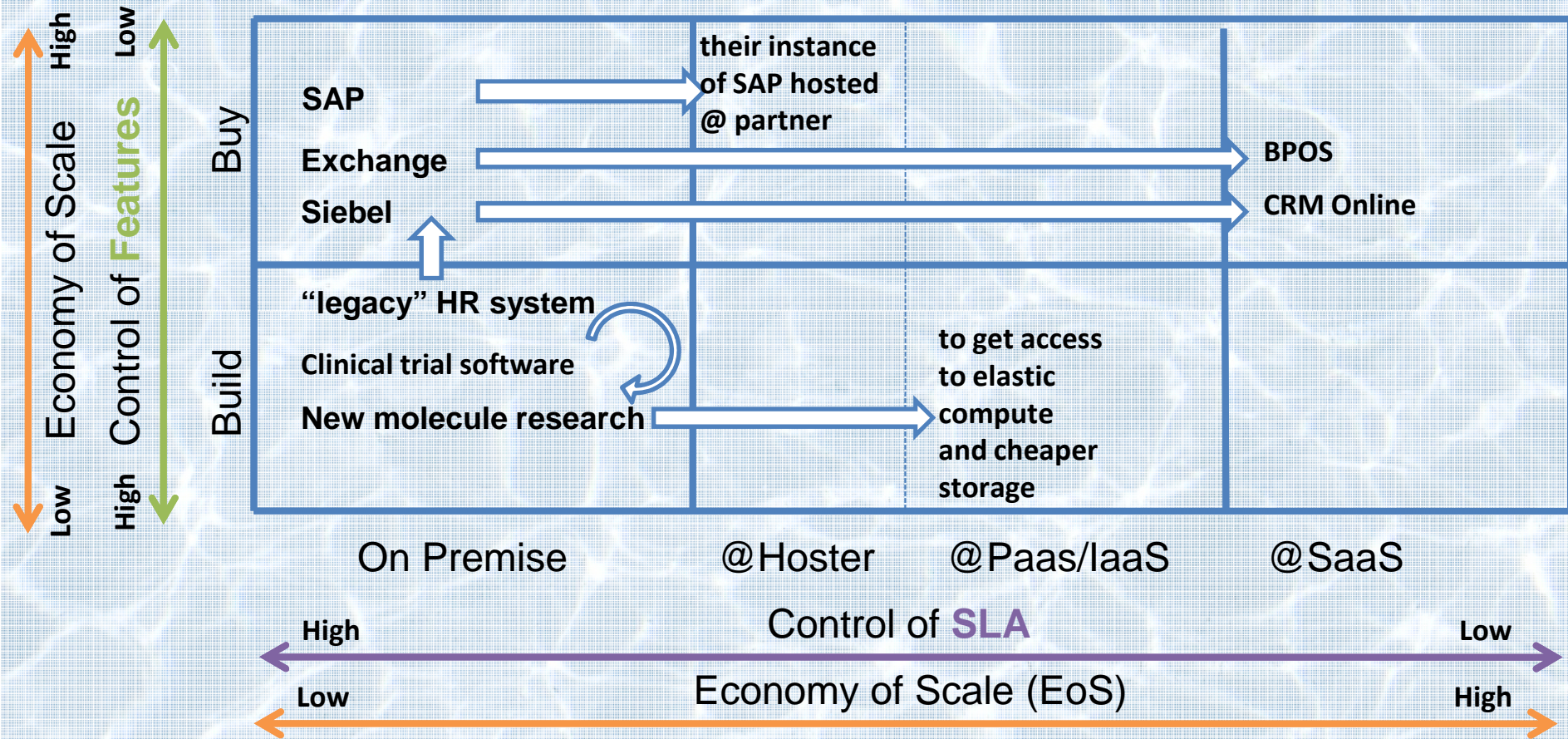
**>99.9%**

# SLAs

- Common SLAs don't share risk
  - Credit against service payments
  - No credit towards missed revenue
- Risk sharing SLAs
  - Sharing the risk on missed revenue
  - Payment based on revenue share

# The Move is on…



Economy of Scale — High / Low

Control of Features — Low / High

Buy

Build

SAP → their instance of SAP hosted @ partner

Exchange → BPOS

Siebel → CRM Online

"legacy" HR system

Clinical trial software

New molecule research → to get access to elastic compute and cheaper storage

On Premise    @Hoster    @Paas/IaaS    @SaaS

Control of SLA — High / Low

Economy of Scale (EoS) — Low / High

Big Challenge:
Crossing Corporate Boundaries
- Business Processes
- Connectivity and Messaging
- Federated Identity
- Data Access

# The Bandwidth Challenge

- Storage vs. Bandwidth
- Time and cost of transferring data
  - AWS Import/Export
- Compute and storage location matters
  - Compute where the data is stored instead of moving the data to the compute resource

# The Regulation Challenge

- Safe Harbor Act
  - Datacenter locations matter
- Patriot Act
  - Big Brother might get access to your data
- Industry Regulations
  - E.g. Payment Card Industry Data Security Standard (PCI DSS)

# Where to Start?

- Find a business case first!
- Compute Scenarios
  - Capabilities with little integration requirements
    - Input → compute → output
  - High scalability/performance requirements
  - Challenging utilization requirements
- Storage Scenarios
  - Archiving solutions
  - Cross-corporate data sharing
  - Look for capabilities with infrequent compute