Cloud Computing Fundamentals: The Next Generation Platform

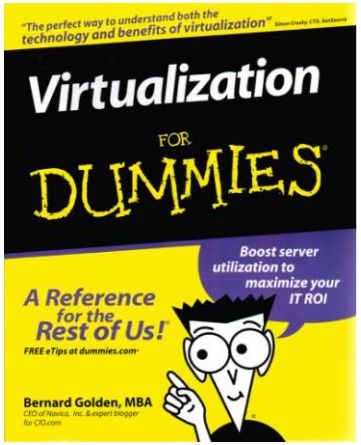
Who is Bernard Golden?

CEO: HyperStratus, enterprise cloud computing consultancy

20+ years experience in large IT shops, enterprise software, global consultancy, venture capital

Virtualization and Cloud Computing Advisor, CIO Magazine

Author, "Virtualization for Dummies," Two upcoming books on cloud computing

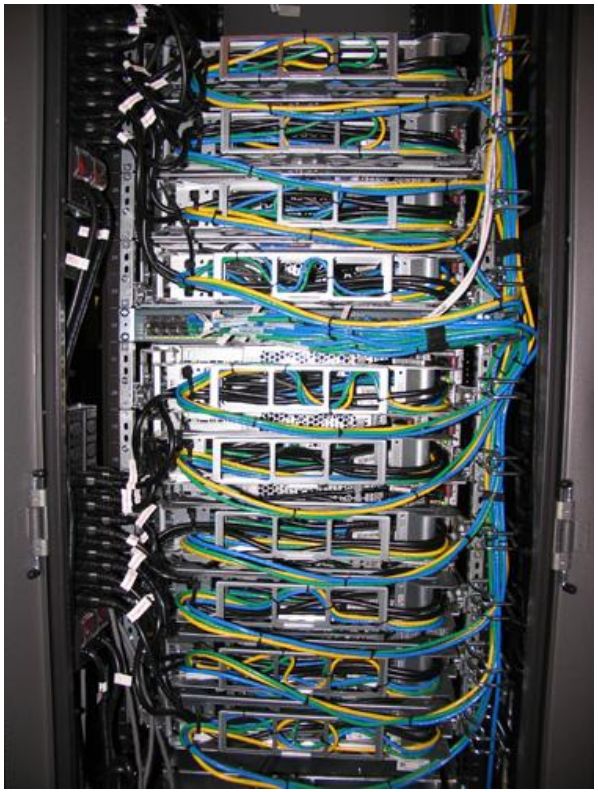


Agenda

Introduction to Cloud Computing	9:00 - 10:00
Break	10:00 - 10:15
Key Challenges to Cloud Computing	10:15 - 12:00
Break	12:00 - 12:15
Creating a Cloud Computing Action Plan	12:15 - 1:00

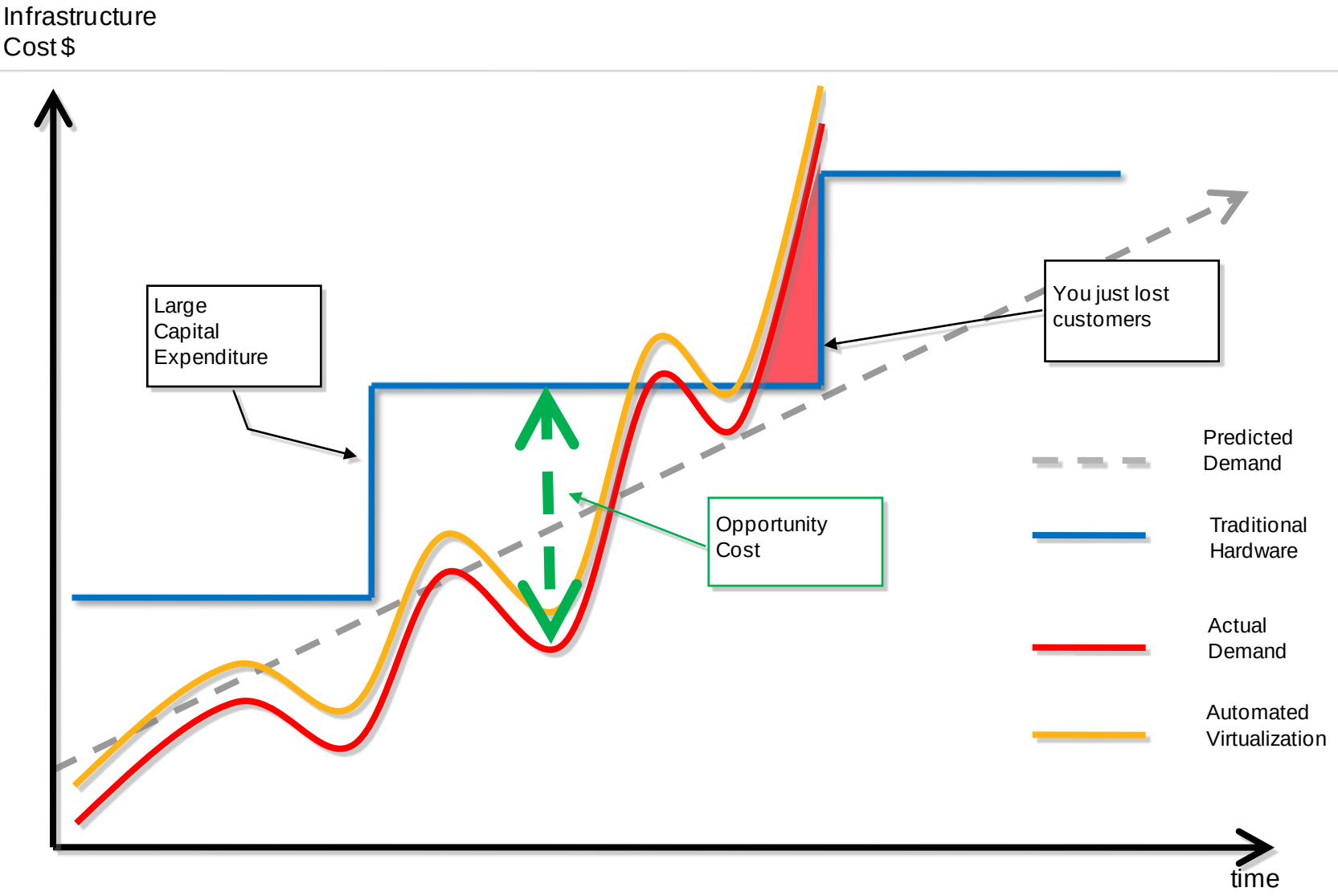
Cloud Computing Overview

- **Grows from 1MM to 100+ MM insurance claims/day in one week**
- **Traditional solution: $750K new hardware + $30K/month maintenance/hosting**
- **Cloud solution: $600/month Amazon Web Services**

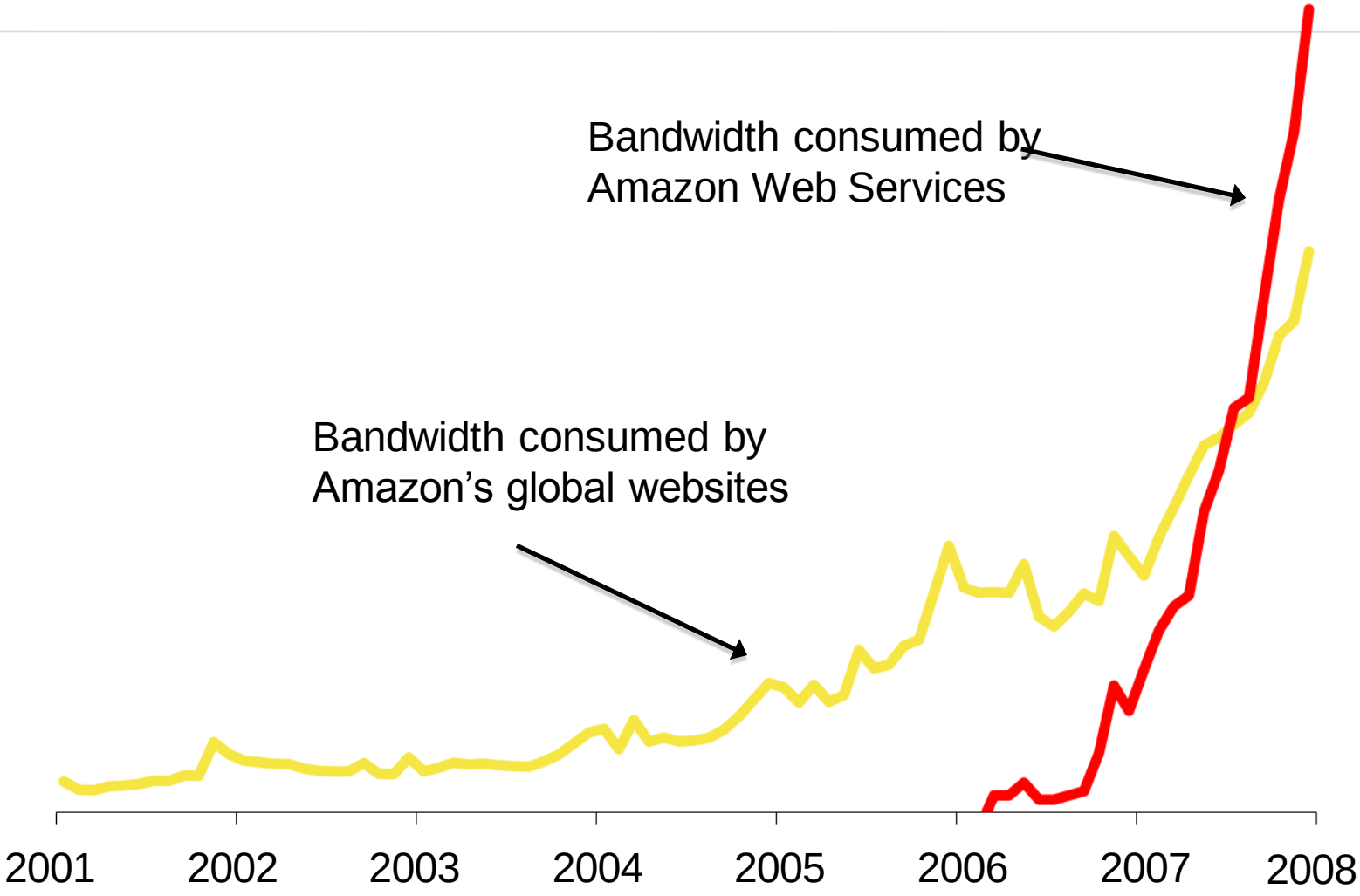


Don’t Forget Complexity!

Predictions Cost Money



Is Cloud Computing for Real?



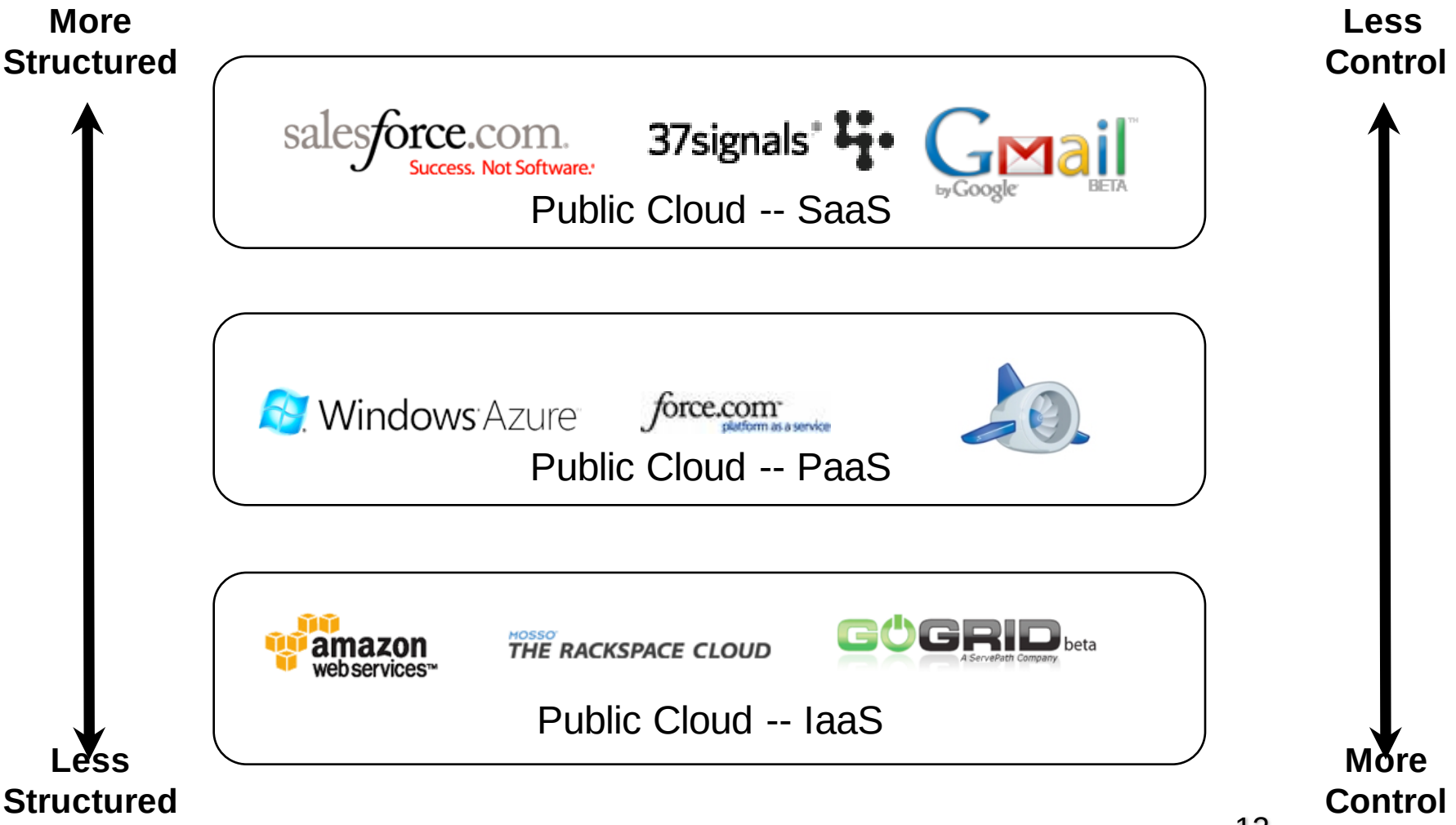
NIST Definition of Cloud Computing

On Demand Self-Service	A consumer can unilaterally provision computing capabilities, such as server time and network storage, as needed automatically
Broad Network Access	Capabilties are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms
Resource Pooling	The provider's computing resources are pooled to serve multiple consumers, with resources dynamically assigned and reassigned according to consumer demand
Rapid Elasticity	Capabilities can be rapidly and elastically provisioned, in some cases automatically, to quickly scale out and rapidly released to quickly scale in
Measured Service	Resource usage can be monitored, controlled, and reported providing transparency for both the provider and consumer of the service

Key Cloud Benefits

Huge Resources	IT agility as systems can be sized to meet demand -- as load scales, system resources are easily obtained to ensure SLAs can be met
No Commitment	No longer face the tradeoff between overprovisioning (waste of capital) and underprovisioning (waste of users)
Pay by the Drink	Move IT payments from CAPEX to OPEX. Pay only for actual resources consumed. Tie IT cost to business benefit received

How the Cloud is Delivered



Don’t forget about internal and hybrid clouds!

IaaS -- Benefits and Drawbacks

IaaS Benefits

- Maximum control
- Software selection
- Maximum flexibility
- Lowest cost

IaaS Drawbacks

- Software infrastructure is yours
- Change control
- No hardware visibility

PaaS -- Benefits and Drawbacks

PaaS Benefits

- High productivity
- Less infrastructure management
- Integration with platform services

PaaS Drawbacks

- Lock-in
- Forced upgrades
- Limits to application functionality

SaaS -- Benefits and Drawbacks

SaaS Benefits

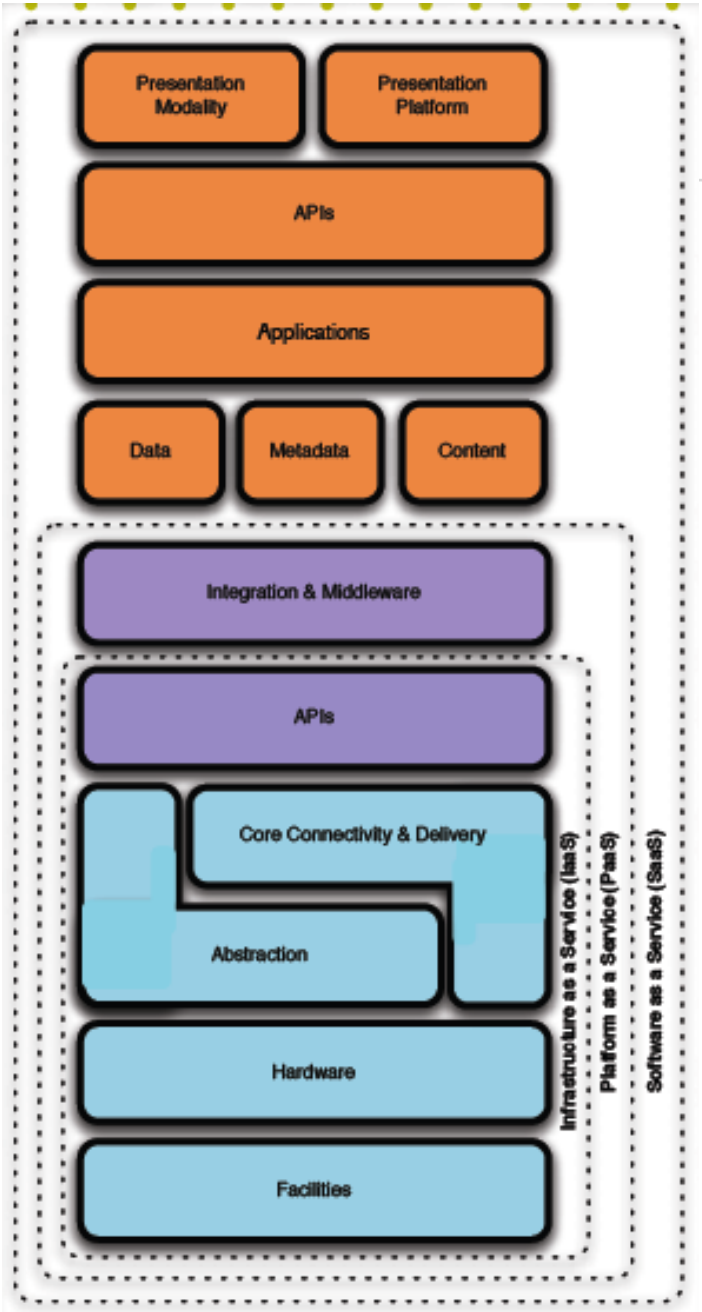
- No need for on-premise software
- Subscription payment model
- Automatic upgrades

SaaS Drawbacks

- Forced upgrades
- Lock-in
- Data integration, availability, ownership

Down One Level

Cloud Taxonomy



Source: Christofer Hoff, Cloud Security Alliance "Security Guidance for Critical Areas of Focus in Cloud Computing," Page 22

- **Foundation of cloud is virtualization (mostly)**
- **Upper cloud services are incremental to lower cloud services**
- **Lower level services are key for higher level services**

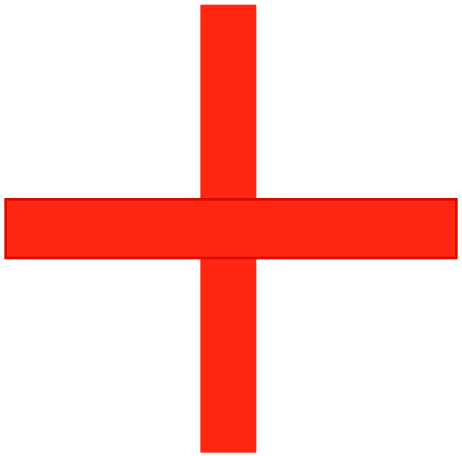
Virtualization:
The abstraction of software from physical resources

Multi-Processor
Multi-Core

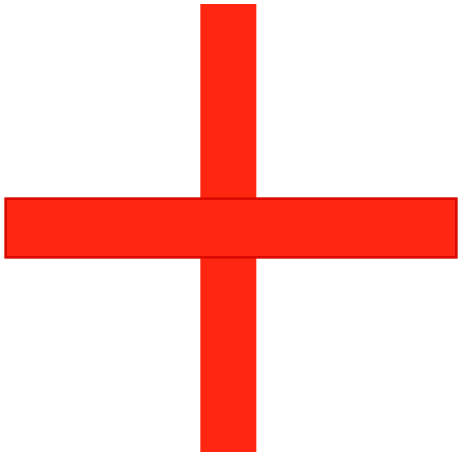
Cloud Compute

Plus

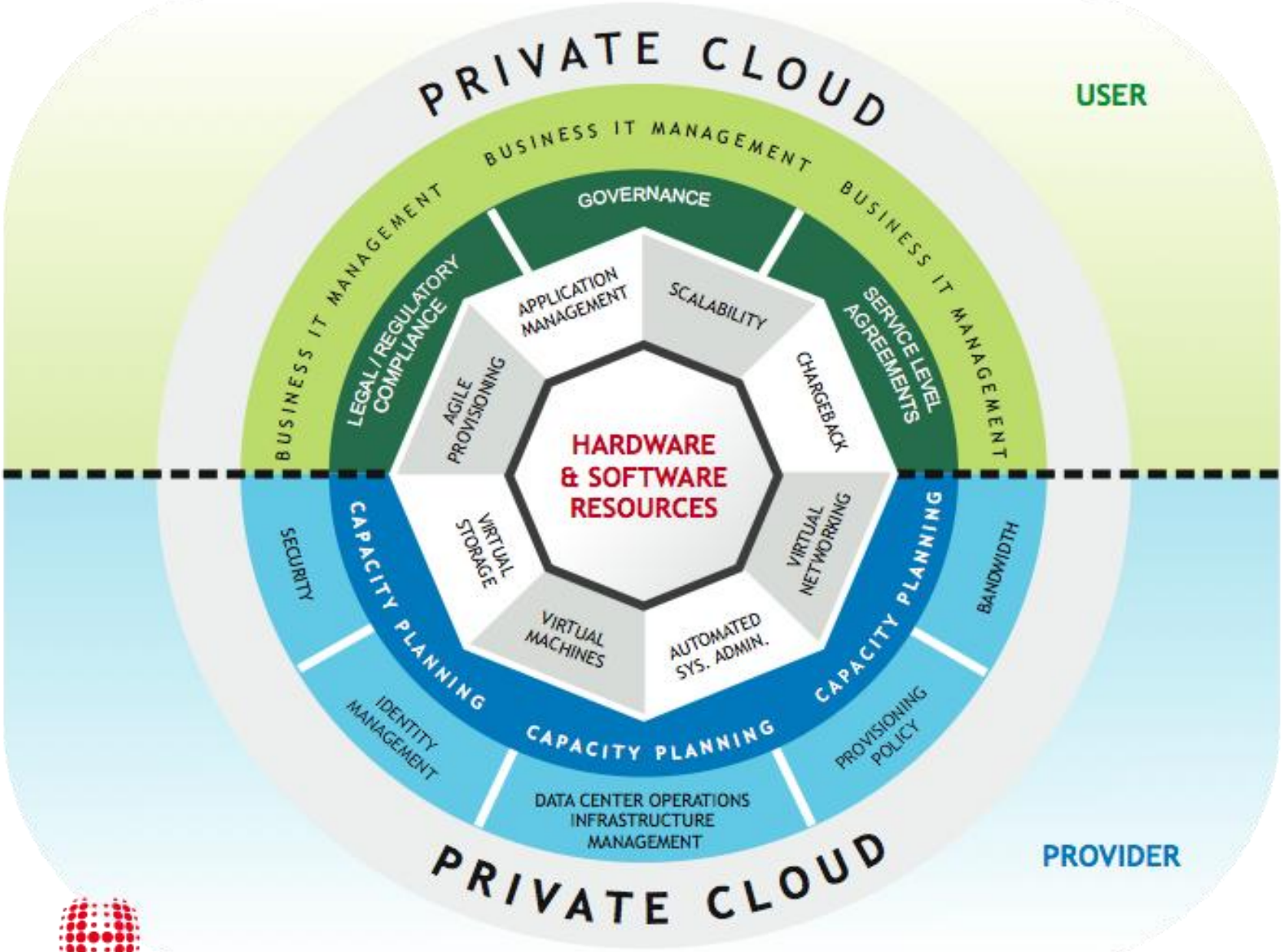
Cloud Compute



Cloud Compute



- End user self-service
- Orchestration
- Automation
- Automatic Elasticity
- Chargeback/billing
- Governance



HyperStratus
Virtualization, Cloud Computing .. and more

Cloud Example #2

Lessonopoly 2.0 BETA

Username
Password
Remember me
Login

- Forgot password?
- Create new account

CLASSROOM
- My Home
- My Planner
- My Library

LESSON PLANS
- Search
- Submit
- Browse

CONNECT
- Teachers
- Groups
- Forums
- Wiki

Sponsors

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Welcome to **Lessonopoly**, a free tool that lets you manage your classroom, find and share lesson plans, and connect with other teachers.

Manage your classroom

Find lesson plans in our Library

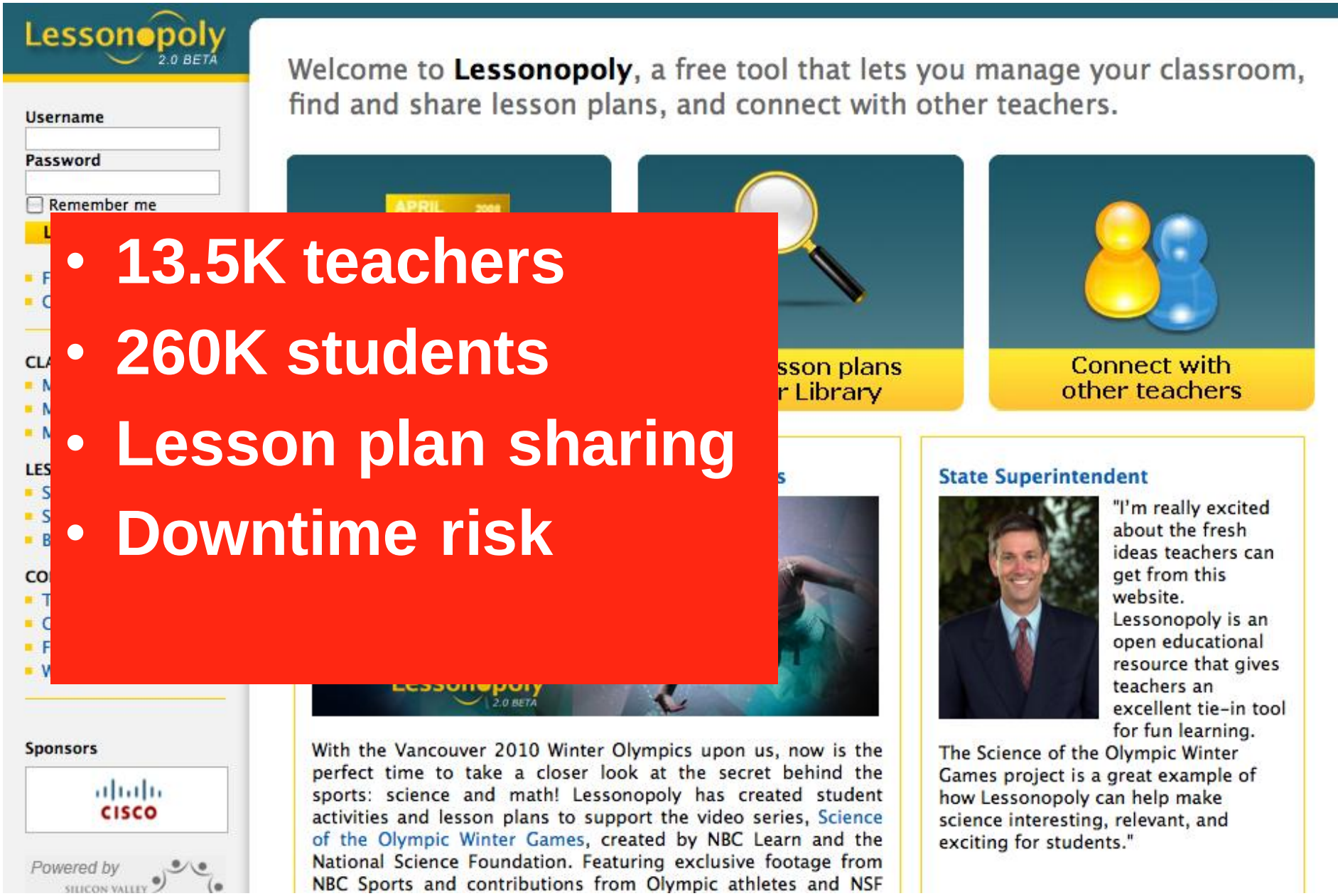
Connect with other teachers

atured Lesson Plans: Science of the Olympics

With the Vancouver 2010 Winter Olympics upon us, now is the perfect time to take a closer look at the secret behind the s: science and math! Lessonopoly has created stu activitie d lesson plans to support the video ser Science of the Olympic Learn and the National Science Foundation. Featuring exclusive footage from NBC Sports and contributions from Olympic athletes and NSF

State Superintendent

"I'm really excited about the fresh ideas teachers can get from this website. Lessonopoly is an open educational resource that gives teachers an excellent tie-in tool for fun learning. The Science of the Olympic Winter Games project is a great example of how Lessonopoly can help make science interesting, relevant, and exciting for students."



- 13.5K teachers
- 260K students
- Lesson plan sharing
- Downtime risk

Infrastructure Options

External Hosting Provider	Virtualization	Amazon Cloud
Single machine, subject to outages	Adds redundant hardware, virtual machine migration	Removes hardware from equation
Growth requires additional equipment, still subject to outages	Growth requires additional equipment, still has SPOF	Growth is accommodated by additional EC2 instances
No additional skill development required	Significant skill development required	Modest skill development required

Lessonopoly Cloud TCO Savings

Single Server	Multi-Tier	Horizontally Scaled
55%	57%	55%

Note: TCO Analysis without AWS Reserved Instances

What Helped

- **Supportive management**
- **Aligned mission**
- **Open source**
- **Appropriate Architecture**

SVEF Cloud Lessons

Pros

- Application port to AWS straightforward
- Increased robustness
- Equivalent security
- Reduced cost
- Whitepaper available

Cons

- Network traffic aggregation
- Assumption about need for additional hardware

How to Get Started

Initial Uses of Cloud Computing

- Dev/test
- Scalable website
- Sporadic/very large BI
- Periodic batch processing
- Short-duration websites
- Few privacy/security concerns

Key Challenges

Five Common Objections to Cloud Computing

- System management
- SLA
- TCO
- Security/Privacy
- Application migration

Issue #1 -- System Management

- Legacy tools do not handle cloud gracefully
- Legacy tools hardware-focused
- Native cloud tools rudimentary
- New breed cloud-oriented
- No spanning of internal and external

Issue #1 -- System Management

- Same criticism leveled at early virtualization
- Legacy products integrating cloud computing
- Best answer is mix of management tools
- If consistent system management important, examine providers with integrated cloud offering

Issue #2 -- SLA

- Many cloud providers offer no or poor SLA
- Cloud SLAs too low
- Cloud providers not trustworthy
- Inappropriate for enterprise applications

Issue #2 -- SLA

- Apples to apples: Uptime SLAs are DC-based; clouds are combined hardware and software
- Consider alternative SLA performance
- Seek SLA appropriate to use
- Recognize limitations of SLA
- Seek cloud provider with appropriate SLA

Issue #3 -- TCO

- Clouds providers build profit margins into their pricing, while IT organizations are non-profit
- Subscription costs more than purchase
- System variability affects total cost

Issue #3 -- TCO

- Real Issue is total cost, not profit motive
- Compare Loaded (Activity Based Costing --ABC), not marginal cost
- Most IT groups do not have accurate internal cost
- Cost adjusts with system load -- which is good!

Cloud Issue #4 -- Security/Privacy

- Can you trust cloud provider?
- Privacy regulations based on physical hardware
- Government access to cloud data
- General confusion about cloud privacy implications

Cloud Issue #4 -- Security/Privacy

- Can you trust internal IT?
- Evaluate privacy regulations with counsel
- Research cloud provider security/privacy practices
- Scrub data to remove privacy issues
- Encrypt cloud data
- Avoid putting truly private data in cloud

Cloud Issue #5 -- App Migration

- Hard to migrate apps to cloud environments
- Hard to migrate apps out of cloud environments
- If you can't migrate existing apps, why bother?
- Locked (in) to a cloud

Cloud Issue #5 -- App Migration

- Choose cloud service appropriate to application
- Use greenfield application approach
- Lock-in starts with first decision whether in cloud or in data center
- Architect for flexible deployment options
- Evaluate provider(s) data availability policies

Real Challenges to Cloud Computing

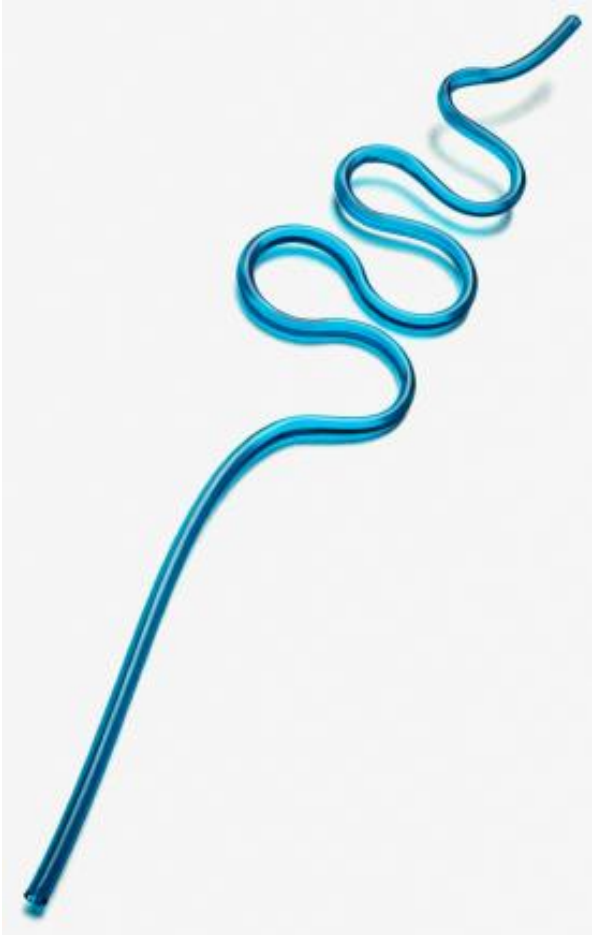
- Skinny Straw
- Application integration across boundaries
- Software licensing
- Security/Privacy

Challenge #1 -- The Skinny Straw

- Low bandwidth
- High(ish) latency
- Large datasets
- Expensive to fix

Challenge #1 -- The Skinny Straw

- Partition applications
- Characterize latency needs
- Look Application Delivery Controllers (ADC)
- Avoid massive data uploads
- Remember Amazon Sneakernet++



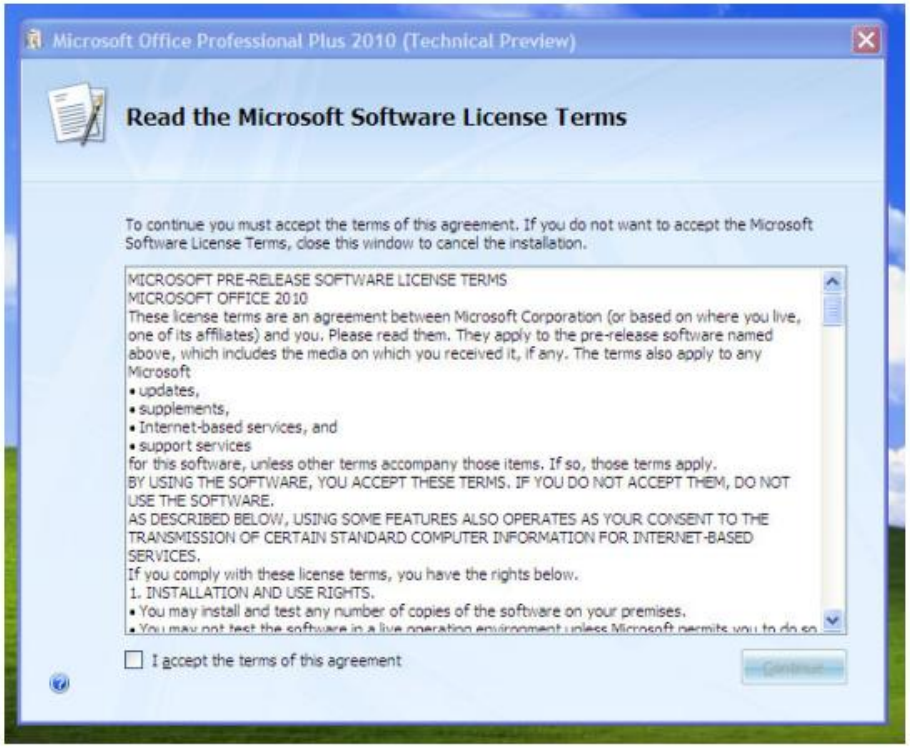
Challenge #2 -- App Integration

- Multiple integration points
- No SOA
- “Secret” integration
- Inter-cloud much slower

Challenge #2 -- App Integration

- Evaluate needs before implementation!
- Address integration architecture
- Look to Application Delivery Controllers (ADC)
- Avoid complex integration needs

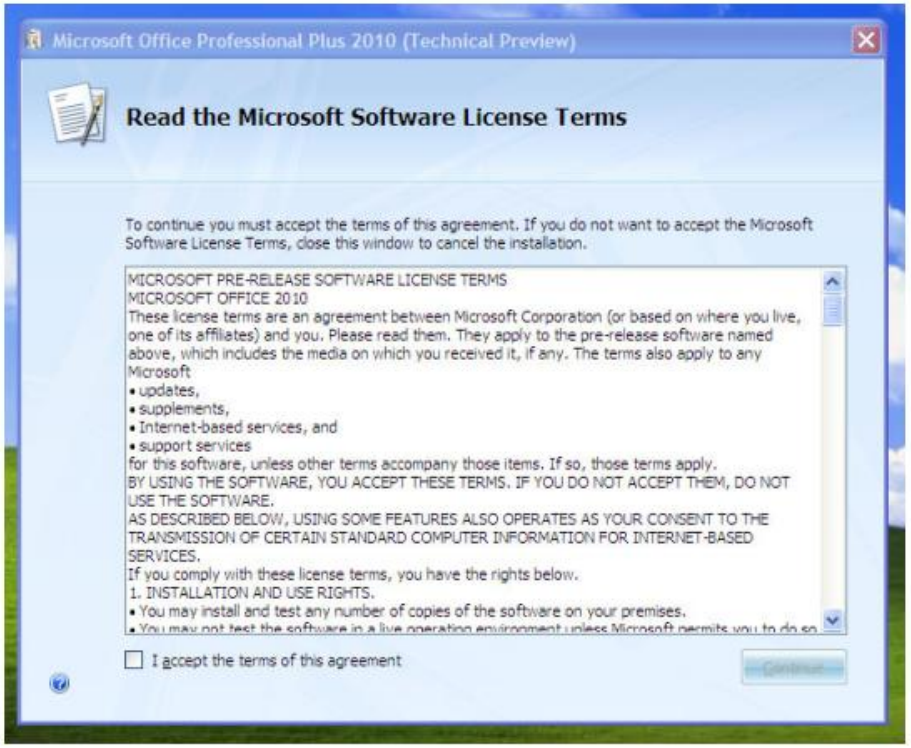
Challenge #3 -- Software Licensing



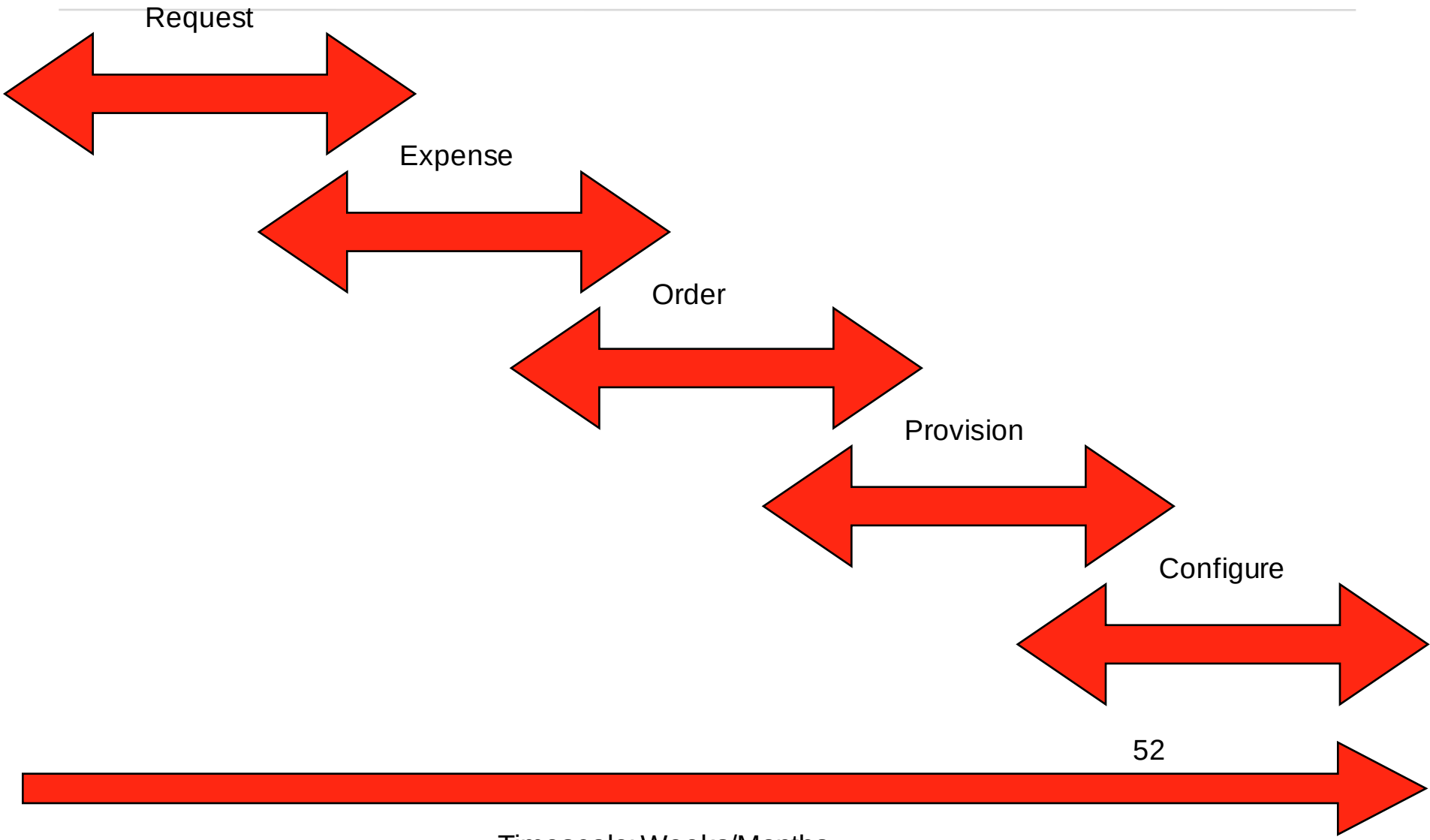
- **Physical, perpetual world**
- **Locked to MAC addresses**
- **Lack metering**
- **Unhappy vendors**

Challenge #3 -- Software Licensing

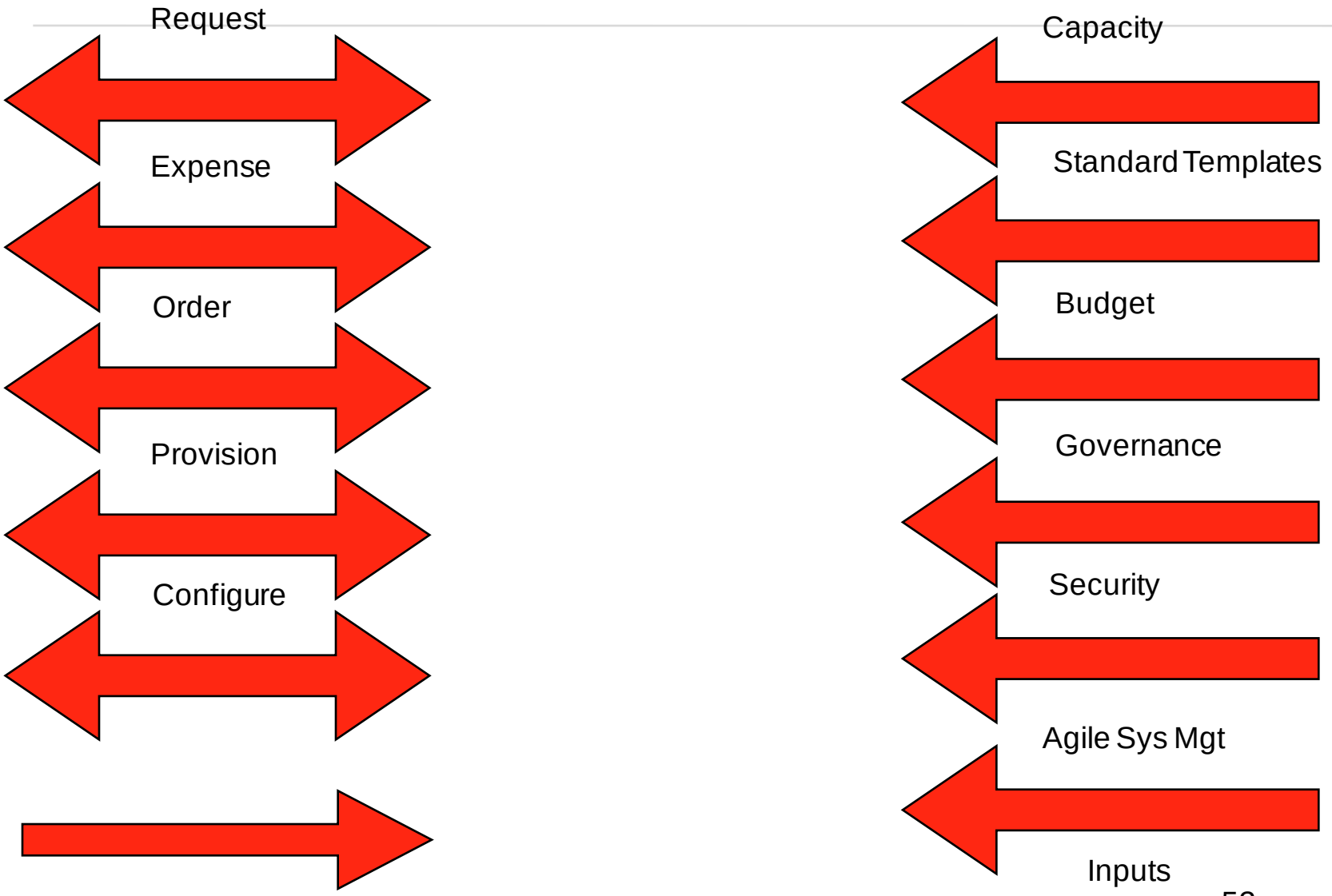
- Evaluate licenses early
- ELA may help
- Open source?
- Segregate apps by licenses



Challenge #4 -- Reengineering



Challenge #4 -- Reengineering

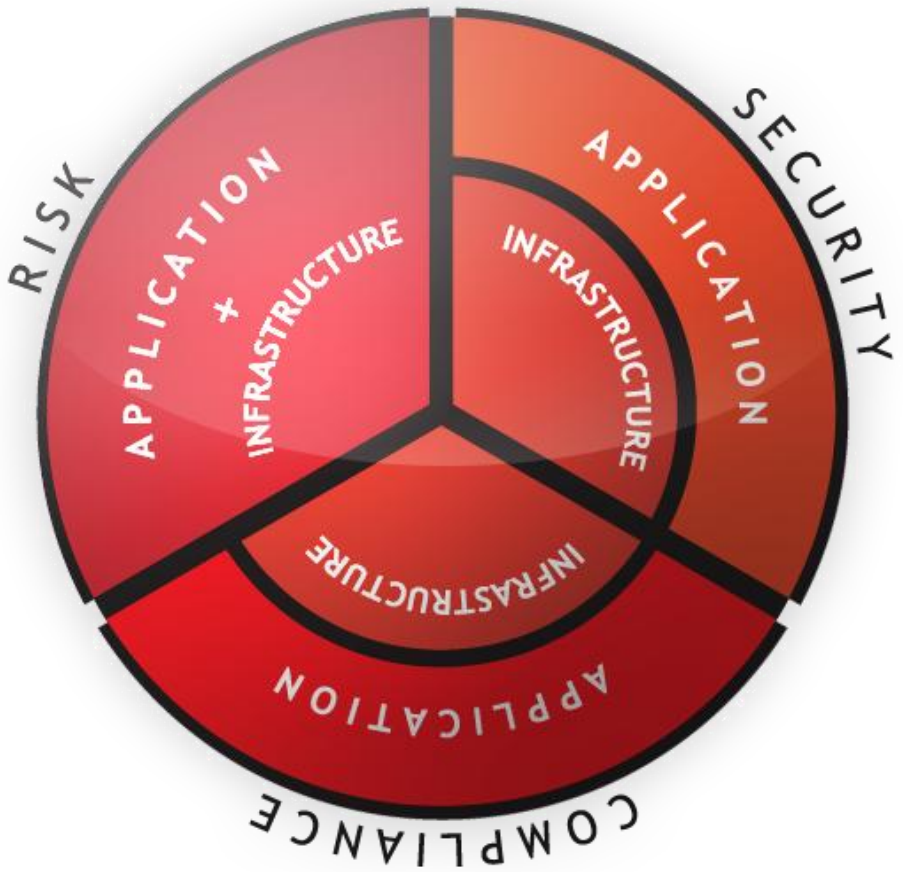


Challenge #5 -- Security

- Number one concern
- Who's responsible?
- Lack of guidance/best practices
- Unhappy vendors

Cloud Security Truths

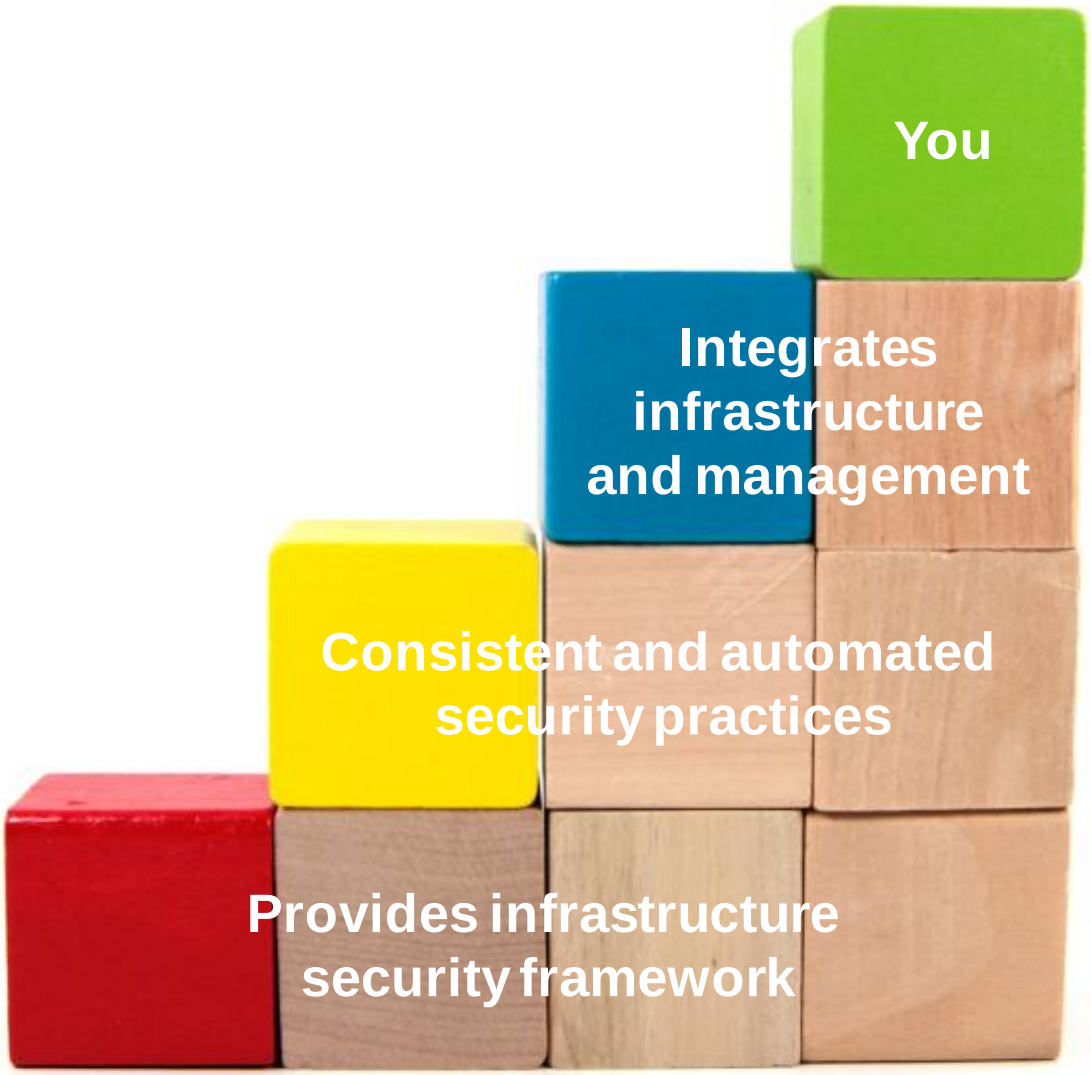
- Three elements
- Often confused
- Shared responsibility
- Asymmetric risk



New Security Paradigm

- Deperimeterized
- Current solutions don't apply
- New solutions needed
- Security at end point

Security is A Shared Responsibility



Application

Application Management

Cloud Provider

Six Crucial Areas for Complete Security

1. Security groups/firewall rules
2. Key management
3. Network security
4. Storage protection
5. Intrusion detection
6. Application code management

Security Responsibility

		IaaS	Paas	Saas
Application	Responsibility	User	User	Provider
	Action	Best practices and certification	Best practices and certification	Evaluation and certification
Middleware	Responsibility	User	Provider	Provider
	Action	Best practices and certification	Evaluation and certification	Evaluation and certification
Infra-structure	Responsibility	Provider	Provider	Provider
	Action	Evaluation and certification	Evaluation and certification	Evaluation and certification

Cloud Computing Rules to Live By

- The cloud != internal data center at another IP address
- The cloud is not outsourcing by another name
- Don't be surprised by culture shock
- Build cloud apps, not apps in cloud

Creating a Cloud Computing Action Plan

First Decision

or

Pilots

- Structured
- Deliberate
- Formal learning
- Process-focused
- Aligned with organization
- Diverse team

Skunkworks

- Unstructured
- Focused on speed
- Tacit learning
- Agile
- Sheltered from organization
- Specialized team

Cloud Pilot Project Goals

- Evaluate cloud viability for organization
- Experiment with POC
- Gain hands-on experience
- Develop organizational learning

Cloud Pilot Key Choices

- Public vs. private
- Migration vs. new application
- Core vs. Context
- Strategy and tactics

Cloud Pilot No-Nos

- Conduct extended study
- Attempt to define five year roadmap
- Boil the ocean
- Make long-term decision
- Start with critical application

Cloud Pilot Yes-Yeses

- Tactical, not skunkworks
- Align with core architecture
- Integrate TCO analysis
- Use tactical experience to inform strategy
- Don’t get locked-in by initial choice

Pilot Cloud Application Profile

- Create cross-functional team
- Web-based (obviously!)
- Ideally, highly variable load
- Open source-based
- Deployable in public cloud

Pilot Cloud Application Profile

- Few integration needs
- Important, but not critical functionality
- Small to moderate data storage
- No privacy implications

Evaluating Pilot Cloud Application

- Migration issues encountered
- Employee skill development required
- System management used and issues encountered
- Integration challenges
- Scalability experience

Evaluating Pilot Cloud Application

- **TCO**
  - **Cloud vs. established internal practice**
  - **Attempt to establish loaded cost for internal alternative**
  - **Project TCO for variable loads**
- **Apply learning to create ongoing action plan**

Moving Beyond the Pilot

- Perform application portfolio analysis
- Rank applications along criteria (1=low, 3=high)
  - Load stability
  - Need for internal integration
  - Security/privacy requirements
  - Data transfer requirements
  - Operational dependency
  - Software license issues
- Create staged migration project plan
- Rinse and repeat

Portfolio Analysis Example

	App 1	App 2	App 3	App N
Load Stability	2	3	1	1
Internal Integration Need	1	3	1	2
Security/privacy Issues	2	2	2	3
Data Transfer Requirements	1	2	2	1
Operational Dependency	1	3	2	1
Software License Issues	1	3	1	3
Total	8	16	9	11

Moving Beyond the Pilot

- Review applications against cloud profile
- Applications with significant pain points
- Create migration plan as appropriate

Class Exercise

- Identify appropriate pilot application
- Map to First Application Profile above
- Envision appropriate team members
- Create high-level project plan
- Define success

Conclusion

- Three distinct characteristics
  - "Infinite Scalability"
  - No long-term commitment
  - Pay-by-the-drink
- Think agility, flexibility, and lower costs
- Challenge to established modes of IT
- Build cloud apps, not apps in the cloud!