Cloud Governance

Benefits and value from Cloud Service & Security

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Cloud Governance

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Position:  Senior Advisor & Partner
Company:  Aalborg University & Verifica
Agenda

• Benefits and value from Cloud Service
• Cloud Governance
• Maturity of Cloud Services – a study
• Security Perspectives in Cloud
About me

- CPA, CRISC, CGEIT, CISA and CIA
- ISO 9000 Lead Auditor
- Service Audit Reports (ISAE 3402)
- Extensive experience with Financial Audit, Internal Audit, Internal Controls, SOX, IT Governance, IT Security and IT Assurance
- Instructor, facilitator and speaker
- Senior Advisor & Associated Professor Aalborg University
- Member of IT Advisory Board FSR-danske revisorer
- Member of ISACA IT Assurance Task force
- ISO Subject Matter Expert
Business benefits of cloud computing

• Cloud strategies make the enterprise more efficient and agile.
• Cloud computing allows delivered services to be more innovative and more competitive.
• Cloud computing reduces overall operating costs.

• How confident can boards be that management plans will achieve these benefits?

Source: CLOUD GOVERNANCE: Questions Boards of Directors Need to Ask, 2013, ISACA
Value of Cloud Computing

• Shifting funding of IT from large capital investments (legacy IT assets) to operational expenses.
• Reallocating IT resources to core business activities.
• Easier and cheaper applications to implement, use and support.
• Increasing scalability and flexibility, enhancing the ability to respond to changing market conditions.
• Fostering innovation by shifting effort and resources from implementation projects to final product development.

Source: CLOUD GOVERNANCE: Questions Boards of Directors Need to Ask, 2013, ISACA
Governance and Change Issues With Cloud Computing

- Strategic direction of the business and of IT
- Changes to meet performance objectives
- IT is aligned with the business
- Systems are secure
- Risk is managed

Governance Questions About Cloud

1. Do management teams have a plan for cloud computing? Have they weighed value and opportunity costs?
2. How do current cloud plans support the enterprise’s mission?
3. Have executive teams systematically evaluated organizational readiness?
4. Have management teams considered what existing investments might be lost in their cloud planning?
5. Do management teams have strategies to measure and track the value of cloud return vs. risk?

Source: CLOUD GOVERNANCE: Questions Boards of Directors Need to Ask, 2013, ISACA
VAL IT "Four Ares"

The strategic question. Is the investment:
- In line with our vision
- Consistent with our business principles
- Contributing to our strategic objectives
- Providing optimal value, at affordable cost, at an acceptable level of risk

The architecture question. Is the investment:
- In line with our architecture
- Consistent with our architectural principles
- Contributing to the population of our architecture
- In line with other initiatives

Are we doing the right things?

Are we doing them the right way?

Are we getting the benefits?

Are we getting them done well?

The value question. Do we have:
- A clear and shared understanding of the expected benefits
- Clear accountability for realising the benefits
- Relevant metrics
- An effective benefits realisation process over the full economic life cycle of the investment

The delivery question. Do we have:
- Effective and disciplined management, delivery and change management processes
- Competent and available technical and business resources to deliver:
  - The required capabilities
  - The organisational changes required to leverage the capabilities

Source: ISACA, Enterprise Value: Governance of IT Investments, The Val IT Framework 2.0, 2008, ISACA
Cloud Decisions

Source: Cloud Computing Market Maturity Study Results, 2012, ISACA & CSA
Primary driver for decision to use cloud computing? (n=543)

Frequently cited responses include:

• Cost reduction
• Greater efficiency
• Greater flexibility and access to data
• To keep pace with technology

Source: IT Risk/Reward Barometer: Europe, 2012, ISACA (n=980)
# Cloud Computing Service Models

<table>
<thead>
<tr>
<th>Service Model</th>
<th>Definition</th>
<th>To Be Considered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infrastructure as a Service (IaaS)</td>
<td>Capability to provision processing, storage, networks and other fundamental computing resources, offering the customer the ability to deploy and run arbitrary software, which can include operating systems and applications. IaaS puts these IT operations into the hands of a third party.</td>
<td>Options to minimize the impact if the cloud provider has a service interruption</td>
</tr>
</tbody>
</table>
| Platform as a Service (PaaS) | Capability to deploy onto the cloud infrastructure customer-created or acquired applications created using programming languages and tools supported by the provider. | • Availability  
• Confidentiality  
• Privacy and legal liability in the event of a security breach (as databases housing sensitive information will now be hosted offsite)  
• Data ownership  
• Concerns around e-discovery |
| Software as a Service (SaaS) | Capability to use the provider’s applications running on cloud infrastructure. The applications are accessible from various client devices through a thin client interface such as a web browser (e.g., web-based e-mail). | • Who owns the applications?  
• Where do the applications reside? |

## Cloud Services Used and Satisfaction With Cloud

<table>
<thead>
<tr>
<th>Services</th>
<th>Used</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infrastructure as a Service (IaaS)</td>
<td>35.7%</td>
<td>3.39</td>
</tr>
<tr>
<td>Platform as a Service (PaaS)</td>
<td>22.6%</td>
<td>2.98</td>
</tr>
<tr>
<td>Software as a Service (SaaS)</td>
<td>62.3%</td>
<td>3.66</td>
</tr>
</tbody>
</table>

- Scale 0 (Not satisfied) 5 (Highly satisfied)

Source: Cloud Computing Market Maturity Study Results, 2012, ISACA & CSA
## Cloud Computing Deployment Models

<table>
<thead>
<tr>
<th>Deployment Model</th>
<th>Description of Cloud Infrastructure</th>
<th>To Be Considered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private cloud</td>
<td>• Operated solely for an organization&lt;br&gt;• May be managed by the organization or a third party&lt;br&gt;• May exist on-premise or off-premise</td>
<td>• Cloud services with minimum risk&lt;br&gt;• May not provide the scalability and agility of public cloud services</td>
</tr>
<tr>
<td>Community cloud</td>
<td>• Shared by several organizations&lt;br&gt;• Supports a specific community that has shared mission or interest.&lt;br&gt;• May be managed by the organizations or a third party&lt;br&gt;• May reside on-premise or off-premise</td>
<td>• Same as private cloud, plus:&lt;br&gt;• Data may be stored with the data of competitors.</td>
</tr>
<tr>
<td>Public cloud</td>
<td>• Made available to the general public or a large industry group&lt;br&gt;• Owned by an organization selling cloud services</td>
<td>• Same as community cloud, plus:&lt;br&gt;• Data may be stored in unknown locations and may not be easily retrievable.</td>
</tr>
<tr>
<td>Hybrid cloud</td>
<td>A composition of two or more clouds (private, community or public) that remain unique entities but are bound together by standardized or proprietary technology that enables data and application portability (e.g., cloud bursting for load balancing between clouds)</td>
<td>• Aggregate risk of merging different deployment models&lt;br&gt;• Classification and labeling of data will be beneficial to the security manager to ensure that data are assigned to the correct cloud type.</td>
</tr>
</tbody>
</table>

Cloud computing plan? (n=914)

<table>
<thead>
<tr>
<th></th>
<th>We do not use it for any IT services.</th>
<th>We use it for low-risk, nonmission-critical services.</th>
<th>We use it for mission-critical services</th>
<th>Unsure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public cloud</td>
<td>63%</td>
<td>22%</td>
<td>3%</td>
<td>12%</td>
</tr>
<tr>
<td>Private cloud</td>
<td>34%</td>
<td>27%</td>
<td>26%</td>
<td>13%</td>
</tr>
<tr>
<td>Hybrid cloud</td>
<td>55%</td>
<td>15%</td>
<td>4%</td>
<td>26%</td>
</tr>
</tbody>
</table>

Source: IT Risk/Reward Barometer: Europe, 2012, ISACA (n=980)
True about private cloud, public cloud and hybrid cloud (n = 904)

<table>
<thead>
<tr>
<th>Type</th>
<th>The benefit outweighs the risk.</th>
<th>The risk outweighs the benefit.</th>
<th>The risk and benefit are appropriately balanced.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public cloud</td>
<td>12%</td>
<td>68%</td>
<td>20%</td>
</tr>
<tr>
<td>Hybrid cloud</td>
<td>16%</td>
<td>40%</td>
<td>44%</td>
</tr>
<tr>
<td>Private cloud</td>
<td>57%</td>
<td>10%</td>
<td>33%</td>
</tr>
</tbody>
</table>

Source: IT Risk/Reward Barometer: Europe, 2012, ISACA (n=980)
Business Benefits of Cloud Computing

• Cost containment
• Immediacy
• Availability
• Scalability
• Efficiency
• Resiliency

**Tangible Cloud Benefits**

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tangible</strong></td>
<td></td>
</tr>
</tbody>
</table>
| Cost reduction               | Computing cost is shifted from a capital expenditure to an operational cost because the cloud provider supplies the underlying infrastructure as part of the service bundle. In addition, the cloud promises a cost reduction in the following areas:  
  • Labor—IT system administration hours/headcount  
  • Application software (SaaS only)  
  • Licensing purchase and maintenance  
  • Technical support and user support  
  • Maintenance (upgrades, updates, patches, etc.)  
  • Hosting (physical building, power, cooling, etc.) |
| Enhanced productivity        | User mobility and ubiquitous access can increase productivity. Collaborative applications increase productivity and reduce rework.                 |
| Optimized resource utilization| Enterprises use only the computing resources they need, thus reducing system idle time waste.                                              |
| Improved security/compliance | Cloud providers may offer robust security controls as a market differentiation.                                                               |
| Access to skills and capabilities | Customers benefit from top-notch skills and capabilities while avoiding employment costs (recruiting, salary, benefits, training, etc.). |
| Scalability                  | On-demand provisioning or computing resources eliminate the cost of capacity planning.                                                        |
| Agility                      | Agility contributes to cost reduction and productivity enhancement due to faster provisioning of systems:  
  • Faster application deployment (SaaS)  
  • Faster application development/testing (PaaS) |
| Customer satisfaction        | Effective utilization of cloud applications can increase collaboration between the enterprise and its customers or reduce response time to customer inquiries. |
| Reliability                  | Cloud providers have redundant sites that can address business continuity and disaster recovery in a more efficient manner.                  |
| Performance                  | Better performance and up-time can result from continuous and consistent operations monitoring by the cloud provider.                         |

# Intangible Cloud Benefits

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intangible</strong></td>
<td><strong>Description</strong></td>
</tr>
<tr>
<td>Avoidance of missed business</td>
<td>A cloud application (SaaS) may be the critical element to land a new business or expand into new markets.</td>
</tr>
<tr>
<td>opportunities</td>
<td></td>
</tr>
<tr>
<td>Focus on core business</td>
<td>IT resources can be allocated to support core business functions.</td>
</tr>
<tr>
<td>Employee satisfaction/innovation</td>
<td>Mobility and faster performance can improve employee satisfaction and boost innovation.</td>
</tr>
<tr>
<td>Collaboration</td>
<td>Real-time collaboration can increase quality and innovation.</td>
</tr>
<tr>
<td>Risk transfer</td>
<td>Some risk can be transferred to the CSP (e.g., security breaches, data loss, disaster recovery); this could represent a tangible or intangible benefit.</td>
</tr>
</tbody>
</table>

## Business Challenges to Consider

<table>
<thead>
<tr>
<th>Challenge</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incompatibility</td>
<td>Cloud services may not be compatible with the existing IT infrastructure or specific systems that must be integrated.</td>
</tr>
<tr>
<td>Uptime</td>
<td>Cloud vendors may not be able to guarantee agreed-on uptime. In addition, uptime may be impacted by other factors, including the customer’s Internet service providers.</td>
</tr>
<tr>
<td>Performance</td>
<td>Multitenant models can degrade performance over time if capacity is not properly planned. Internet speed can also negatively impact performance.</td>
</tr>
<tr>
<td>Security</td>
<td>Cloud computing represents traditional and new risk that must be accounted for and mitigated accordingly (either by the CSP or the customer).</td>
</tr>
<tr>
<td>Compliance</td>
<td>The ubiquitous and abstract nature of the cloud can cause an enterprise’s transition from compliance to noncompliance without any notice.</td>
</tr>
<tr>
<td>Pay-as-you-go</td>
<td>The enterprise must implement controls to avoid overage charges incurred when systems stay connected after a demand spike is over.</td>
</tr>
<tr>
<td>Lock-in (hardware or vendor)</td>
<td>Customers may become locked into a specific technology or a specific cloud vendor, which can prevent portability.</td>
</tr>
<tr>
<td>Cloud consumerization</td>
<td>Business units may be able to procure cloud services without involving IT. To prevent this situation, the enterprise must adapt its governance framework to control cloud services procurement.</td>
</tr>
<tr>
<td>Limited customization (Black Box)</td>
<td>Cloud applications may not be customized every time the business process changes, making the business process a “Black Box” due to costs associated with each modification or application limitations.</td>
</tr>
</tbody>
</table>
Risks and Security Concerns With Cloud Computing

• Reputation, history and sustainability of the provider
• Failure to perform to agreed-upon service levels
• Where information actually resides
• Third-party access to sensitive information
• Compliance to regulations and laws in different geographic regions (Public Clouds)
• Information may not be immediately located

Enterprise’s biggest concern about cloud computing? (n=588)

Frequently cited responses include:

• Loss of control of the data
• Data security, privacy and confidentiality concerns
• Availability concerns
• Compliance issues
• Legal issues

Source: IT Risk/Reward Barometer: Europe, 2012, ISACA (n=980)
Assurance Considerations

- Transparency
- Privacy
- Compliance
- Trans-border information flow
- Certification

# Cloud Market Maturity Model

## Table 1—Cloud Market Maturity Model

<table>
<thead>
<tr>
<th>Stage</th>
<th>Distinguishing Elements of the Cloud Market</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Infancy</strong></td>
<td>The market is small with a potential for growth and innovation that has not been realized. The definition of cloud and related roles and responsibilities is not clear. ROI is uncertain. Users and providers can be considered early adopters.</td>
</tr>
<tr>
<td><strong>Growth</strong></td>
<td>The market demonstrates significant adoption, rapid growth, and notable innovation in terms of product offerings and use. Definitions of cloud computing and how it can be leveraged are clear. Roles and responsibilities for cloud within the enterprise have evolved to address cloud’s unique aspects. Could computing is being integrated into core business activities. ROI is clear and examples of successful use are well known. Innovation leads to new product offerings not possible in earlier stages.</td>
</tr>
<tr>
<td><strong>Maturity</strong></td>
<td>Market growth has reached its peak. The level of innovation is slowing. New entrants have a difficult time distinguishing themselves from established service providers. Organizational roles and responsibilities are stable, as are relations between users and providers. Cloud computing is business as usual.</td>
</tr>
<tr>
<td><strong>Decline</strong></td>
<td>The cloud market is saturated with suppliers. Cloud computing is a commodity. Market leaders are clearly defined. There is little room for new entrants or new product offerings. Users and providers are looking for the next big opportunity.</td>
</tr>
</tbody>
</table>

Source: Cloud Computing Market Maturity Study Results, 2012, ISACA & CSA
Cloud Market Maturity

- Time to reach Maturity level

  - SaaS: 2.73 years
  - IaaS: 3.02 years
  - PaaS: 3.74 years

- 23.7-26.5% more than 5 years for maturity level

Source: Cloud Computing Market Maturity Study Results, 2012, ISACA & CSA
Groups Driving Cloud Innovation

- Public and Customers: 19.9%
- Line-of-Business Users: 13.1%
- IT Organizations: 18.7%
- Service and Product Developers: 39.0%
- Consultants and Analyst Community: 9.2%

Source: Cloud Computing Market Maturity Study Results, 2012, ISACA & CSA
Mean Scores of Business Group Influence on Cloud Innovation

- **Board and Executive Management**: 2.40
- **Business Unit Management**: 3.18
- **CIO and Senior Business Executives**: 3.36
- **IT Management and Staff**: 3.84
- **Business End Users**: 2.98

0 (no influence) to 5 (significant influence).

Source: Cloud Computing Market Maturity Study Results, 2012, ISACA & CSA
## Cloud Support for Business Goals

<table>
<thead>
<tr>
<th>Goal</th>
<th>Rank</th>
<th>Mean Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment with new technologies</td>
<td>1</td>
<td>3.58</td>
</tr>
<tr>
<td>Provide new services to enhance worker effectiveness and efficiency</td>
<td>1</td>
<td>3.58</td>
</tr>
<tr>
<td>Experiment with new ways of engaging with customers</td>
<td>2</td>
<td>3.53</td>
</tr>
<tr>
<td>Take new ideas to market</td>
<td>3</td>
<td>3.43</td>
</tr>
<tr>
<td>Provide access to best-in-class tools and capabilities</td>
<td>4</td>
<td>3.25</td>
</tr>
</tbody>
</table>

Source: Cloud Computing Market Maturity Study Results, 2012, ISACA & CSA
Positive and Negative Influences on Cloud Adoption and Innovation

<table>
<thead>
<tr>
<th>Positive Influence on Cloud Adoption/Innovation</th>
<th>Mean Score</th>
<th>Rank</th>
<th>Negative Influence on Cloud Adoption/Innovation</th>
<th>Mean Score</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost management</td>
<td>3.77</td>
<td>1</td>
<td>Information security</td>
<td>4.22</td>
<td>1</td>
</tr>
<tr>
<td>Agility</td>
<td>3.75</td>
<td>2</td>
<td>Data ownership/custodian responsibilities</td>
<td>4.12</td>
<td>2</td>
</tr>
<tr>
<td>Time to market</td>
<td>3.73</td>
<td>3</td>
<td>Legal and contractual issues</td>
<td>4.04</td>
<td>3</td>
</tr>
<tr>
<td>Efficiency</td>
<td>3.65</td>
<td>4</td>
<td>Regulatory compliance</td>
<td>4.01</td>
<td>4</td>
</tr>
<tr>
<td>Productivity</td>
<td>3.61</td>
<td>5</td>
<td>Information assurance</td>
<td>3.77</td>
<td>5</td>
</tr>
<tr>
<td>Business unit demand</td>
<td>3.55</td>
<td>6</td>
<td>Longevity of suppliers</td>
<td>3.44</td>
<td>6</td>
</tr>
<tr>
<td>Resilience</td>
<td>3.52</td>
<td>7</td>
<td>Contract lock-in</td>
<td>3.42</td>
<td>7</td>
</tr>
<tr>
<td>New technology</td>
<td>3.46</td>
<td>8</td>
<td>Performance standards</td>
<td>3.30</td>
<td>8</td>
</tr>
<tr>
<td>Customer demand</td>
<td>3.42</td>
<td>9</td>
<td>Disaster recovery/business continuity</td>
<td>3.25</td>
<td>9</td>
</tr>
<tr>
<td>Technical resources</td>
<td>3.37</td>
<td>10</td>
<td>Performance monitoring</td>
<td>3.21</td>
<td>10</td>
</tr>
<tr>
<td>New markets</td>
<td>3.33</td>
<td>11</td>
<td>Technology stability</td>
<td>3.10</td>
<td>11</td>
</tr>
<tr>
<td>Summary Mean</td>
<td>3.56</td>
<td></td>
<td>Summary Mean</td>
<td>3.62</td>
<td></td>
</tr>
</tbody>
</table>

Source: Cloud Computing Market Maturity Study Results, 2012, ISACA & CSA
## Problem Resolution Components in the Confidence Barometer

<table>
<thead>
<tr>
<th>Problem Resolution Component</th>
<th>Mean Score</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuity/availability</td>
<td>2.89</td>
<td>1</td>
</tr>
<tr>
<td>Performance</td>
<td>2.53</td>
<td>2</td>
</tr>
<tr>
<td>Problem management</td>
<td>2.42</td>
<td>3</td>
</tr>
<tr>
<td>User-supplier relationship</td>
<td>2.35</td>
<td>4</td>
</tr>
<tr>
<td>Solution integration</td>
<td>2.31</td>
<td>5</td>
</tr>
<tr>
<td>Security/assurance</td>
<td>2.25</td>
<td>6</td>
</tr>
<tr>
<td>Contracts</td>
<td>2.07</td>
<td>7</td>
</tr>
<tr>
<td>Regulation and legislation</td>
<td>2.06</td>
<td>8</td>
</tr>
<tr>
<td><strong>Overall</strong></td>
<td><strong>2.37</strong></td>
<td></td>
</tr>
</tbody>
</table>

Source: Cloud Computing Market Maturity Study Results, 2012, ISACA & CSA
## Perspectives on Security and Assurance Components

<table>
<thead>
<tr>
<th>Security and Assurance Component</th>
<th>Overall Rank</th>
<th>User Rank</th>
<th>Provider Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concerns for multi-tenancy</td>
<td>10</td>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td>Information security</td>
<td>12</td>
<td>7</td>
<td>17</td>
</tr>
<tr>
<td>Testing and assurance</td>
<td>18</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>Data ownership/custodian responsibilities</td>
<td>22</td>
<td>22</td>
<td>23</td>
</tr>
<tr>
<td>International data privacy</td>
<td>25</td>
<td>25</td>
<td>26</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Security and Assurance Component</th>
<th>Overall Rank</th>
<th>Business Rank</th>
<th>Security Rank</th>
<th>Technology Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concerns for multi-tenancy</td>
<td>10</td>
<td>13</td>
<td>15</td>
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<td>Information security</td>
<td>12</td>
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<td>23</td>
<td>19</td>
</tr>
<tr>
<td>International data privacy</td>
<td>25</td>
<td>25</td>
<td>27</td>
<td>25</td>
</tr>
</tbody>
</table>
Summary

• Ready to articulate the pros and cons.
• Where and how to add value for the business.
• Organization of any scale can go to the cloud.
• Enterprises will use some form of cloud when matured.
• BOD’s provide guidance to realize the benefits, optimize the risk and control the cost.
• Ask cloud-specific questions.
• Cloud computing are aligned to the enterprise strategy.
• Understand expected benefits and the mechanisms to track and measure them.
• Security and assurance.
Thank You

- Hans Henrik Berthing,
- Senior Advisor
- CPA, CRISC, CGEIT, CISA CIA
- Phone: +45 35 36 33 56
- Mobile: +45 22 20 28 21
- Mail: hhberthing@verifica.dk
Public Cloud

nControl has realized the following benefits from using SaaS solutions:

• A degree of cost savings (US $2,000 a year) on desktop-based software
• An ability to remain focused on its core competency
• Improved time to market for the organization, dropping to within hours for establishing new accounts, services and/or business partnerships

Other cloud delivery models as well, specifically Platform as a Service (PaaS).

• Requires more involvement from the cloud consumer;
• More flexibility and agility than the traditional software model for delivery of computational resources.

Also challenges with using the cloud,

• Costs associated with using PaaS-based databases
• A backup and/or snapshot of the data on that database cannot be ported over easily to another provider.

The firm relied upon the CSP having relevant certifications and assertions eg. (ISAE3402), (ISO 27001), and the US Department of Commerce (Safe Harbor).

Source: ISACA Journal 2012 vol 6
Community Cloud

• One’s smallest client may be its largest consumer
• A particular service (e.g., videoconferencing) may be a surprise hit
• The delivery of a blended hardware/software solution set may be appropriate in order to receive the maximum return on investment (ROI)
• A service that may have been cost-prohibitive before may be cost-effective in a cloud environment
• Collaboration (with stakeholders) is key to enhanced participation
• Community cloud consumers should not underestimate the economies of scale/cost efficiencies that can be reached by deploying a community cloud
• An organization should focus on its core competency/technical skill set, thus enabling the use of these different skill sets throughout the conglomerate
• An organization can leverage a community cloud for necessities, such as disaster recovery (DR)
• Community clouds leverage a grassroots approach for stakeholder buy-in
• Leverage security and privacy controls to mitigate risk.

Source: ISACA Journal 2012 vol 6
Hybrid Cloud

- Pfizer uses a hybrid cloud for additional computational power during worldwide research and development (WRD) efforts, such as FDA trials and human genome research.
- An external private cloud Infrastructure as a Service (IaaS) delivery model offering—Amazon Web Services’ (AWS) Elastic Compute Cloud (EC2) in addition to the Virtual Private Cloud (VPC)—for additional resources when needed.
- The benefit of an external private cloud for additional computing power is the elasticity of the cloud.
- To mitigate the risk and comply with FDA and national and/or statutory jurisdictional data privacy regulations, the organization uses encryption, virtual firewalls/networks, network and system monitoring, and identity and access management (IAM) mechanisms.
- Various controls to ensure the security and privacy of such regulated data, the organization observes a different level of cost savings than other industries.
- FDA trials ebb and flow during the course of business in the pharmaceutical industry year by year, the flexibility and the agility to provision and/or deprovision resources are of paramount importance.
- New technologies such as homomorphic encryption, which allows for computations to be executed on native ciphertext are introduced, the ability of heavily regulated industries to do faster computational processing in the cloud will increase.

Source: ISACA Journal 2012 vol 6
ROI Framework in practise

1. Determine the period of time to use (5 years is a common standard)
2. Calculate the benefits of moving to the cloud (tangible)
3. Calculate the cost of moving to the cloud
4. Identify any intangible benefits and risk and try to quantify them
5. Determine the interest rate that applies to the enterprise when it borrows money
6. Plug the numbers in the formulas

TCO = Upfront cost + Recurring cost + Termination cost

ROI = \frac{(Tangible benefits + Intangible benefits) - (Upfront cost + Recurring cost + Termination cost)}{(Upfront cost + Recurring cost + Termination cost)}