Assessing The ROI Of Cloud
An Executive Decision Framework

Weighing the initial advantages of cloud computing is simple. The ability to eliminate upfront infrastructure investment and “pay per use” for applications in the cloud offers enterprises significant start-up cost benefits and significantly reduces time to market. The amount of supporting data in technology and business media regarding these benefits is overwhelming.

But how can IT executives calculate long term ROI of Cloud? How can they calculate ROI of Cloud for legacy applications that are more complex than email and CRM? It is difficult to quantitatively measure the cloud advantages and risks in ROI terms. This paper provides IT executives a concrete methodology for how to calculate the ROI of Cloud for their organizations. It also describes the type of internal assessment that needs to be done in order to develop an accurate estimate of future ROI of Cloud.
Introduction

CIO budgets drive the tech spending cycle and directly influence the progression of business into the Cloud. It is no surprise that the recent economic recession has pressured corporate profits to cut technology spending and limited further investment in cloud. Cloud computing will soon be a business imperative. IDC calls cloud computing “one of the most potentially transformative developments in the information technology world in the last 20 years.”

Many companies have already chosen virtualization – generating a straightforward and easily measurable ROI through the deployment of basic applications such as email and collaboration. Assessing the ROI of further investments in private cloud and PaaS, for example, is more complex and the ROI is often unclear. This can raise a roadblock for further corporate investment in cloud.

Decision makers need an overall framework that guides the set of cloud choices and associated ROI. In addition, they need a holistic view of the risks associated with moving to the cloud to understand overall economic impact of cloud migration.

The purpose of this white paper is to provide a detailed framework with which CIOs and CFOs can assess and gauge the ROI of Cloud investments. We look at the overall aspect of cost reduction, and the benefits associated with productivity and agility. In addition, we explore the additional benefits created from using a cloud based architecture; many of which impact revenue. We also look at the cost of cloud and the risk associated with cloud migration which need to be factored into the respective cost and benefit analysis.

The ROI Decision Framework

The ROI assessment framework presented in this paper is a major part of Persistent Systems Cloud Assessment Tool, which evaluates the suitability (usage and business drivers and/or constraints) of an application for cloud. Before one can calculate the ROI of moving to the cloud, it is imperative to perform an assessment of an enterprise’s applications suitability for the cloud. We walk through this piece of the analysis in the next section, before the ROI: The Cloud Assessment.

At the highest level, Cloud ROI is composed of 3 major benefit areas: Cost Reduction, Productivity Enhancement, and Revenue Transformation. The cost piece is comprised of mainly 3 different areas: Ongoing Direct Costs, One-time Migration Costs, and Risk. We discuss these in detail in following sections. The below diagram depicts the overall ROI framework for Cloud.

Figure 1: Cloud ROI Framework

An IDC study on the value of PaaS involving 10 companies and 1,190 users found that companies developing and implementing custom applications on Force.com realized a total benefit of $8.21 for every $1 invested, and a 3-year ROI of 721%.

In the pages that follow we outline the key metrics that should be part of your ROI of Cloud calculation and offer examples of the kinds of ROI that other organizations have found from the cloud.

**Before the ROI: The Cloud Assessment**

As discussed in the above section, before actually calculating the ROI, companies must baseline the cost of their existing applications and determine suitability of current applications for cloud migration. This can be done in a variety of ways. At Persistent, we have developed a Cloud Assessment Tool which takes customers through the entire assessment and ROI process.

*Figure 2: Persistent Cloud Assessment Framework*

In order to calculate ROI, one must:
- Identify Deployed Applications in the Enterprise
- Analyze Workloads and Business Heuristics for Each Application and
- Develop a Recommended Cloud Strategy (On-premise vs. Cloud)

In order to illustrate the above steps, we will use an example of a company considering moving to a private cloud. Private cloud is touted as a stepping stone towards eventual public cloud adoption, at the same time creating a private cloud entails spending more capital upfront. Therefore it is important to understand how the overall ROI can be achieved even when spending more upfront. This will help to establish a common reference point of what is a private cloud.

*Private cloud is deployment of additional set of tools and resources that enable infrastructure to be constituted with all the features of public cloud except elasticity, at the same time leveraging existing investment in physical resources. True elasticity is only enabled by bringing in public cloud resources to augment in house resources.*
In this case, Persistent’s Cloud Assessment Tool would classify the workloads and applications as follows:

Table 1: Application Workload Categorization

<table>
<thead>
<tr>
<th>Workload Type/Requirement</th>
<th>Tier 1</th>
<th>Tier 2</th>
<th>Tier 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Security</td>
<td>Critical</td>
<td>Critical to Average</td>
<td>Average</td>
</tr>
<tr>
<td>Performance/Availability</td>
<td>Critical</td>
<td>Average</td>
<td>Average</td>
</tr>
<tr>
<td>Infrastructure Nature</td>
<td>High end compute, network and storage</td>
<td>Can use generic infrastructure</td>
<td>Can use generic infrastructure</td>
</tr>
</tbody>
</table>

We then would benchmark the overall usage of the applications in terms of underlying resources. While this may be already done while doing a physical to virtual conversion, ongoing benchmarking establishes the current scaling requirements for the application.

Figure 3: Persistent Cloud Assessment Tool: Workload Analysis

During this assessment, we assume that there is a separate pool of resources for each tier of workloads since each workload category by definition does need a different tier of resources.

Next we develop a cost basis for running each of these workloads in the private cloud using industry techniques. The table on the next page from Forrester Research is a good example.²

Table 2: Forrester Research: Cost Basis of Applications

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
<th>Unit</th>
<th>Calculated total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Annual physical server TCO</td>
<td>$1,000</td>
<td>$1,000</td>
</tr>
<tr>
<td>2</td>
<td>Annual cost of standard virtual infrastructure per server</td>
<td>$1,000</td>
<td>$2,000</td>
</tr>
<tr>
<td>3</td>
<td>Size of VM to be priced</td>
<td>Small: 1xCPU, 2 GB RAM, 80 GB HDD</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Number of VMs per physical host</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Divide number of VMs by calculated annual cost per physical server</td>
<td>$100</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Determine billing period</td>
<td>Monthly</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Optics on cost for: production — assumes persistent deployment and consumption</td>
<td>Monthly</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Optics on cost for: test &amp; dev — assumes transient consumption</td>
<td>Hourly</td>
<td></td>
</tr>
</tbody>
</table>

This cost basis is computed for different infrastructure tiers, with the Tier 1 cost base being higher than other tiers. Also the cost basis is calculated assuming best capacity utilization per tier and not 100% utilization.

The figure below illustrates comparative costs for a select application for various public and internal private cloud environments. The comparison takes into account a recommended sizing of the application in terms of resource usage for both cloud options. Pricing is based on available list pricing from each cloud provider. When assessing internal costs, a set of benchmark parameters are utilized based on available metrics published by leading analyst firms.

In order to estimate the real cost of Cloud a detailed assessment of workloads per application is necessary.

The cost basis for each class of workloads is driven by the total usage of the resources. Therefore, the cost basis will increase for the remaining tier of applications. Enterprise applications within a particular enterprise typically have similar usage patterns, as the same set of associated users is using the portfolio of applications.

Finally the provisioning, configuration and migration of the applications can be automated using tools such as Chef and Puppet. In combination with the Persistent Migration Tool enterprises find reduced labor costs for managing the overall cloud setup. The typical person to server ratio can be improved from 1:5 to 1:10-15 as a result.
Cost Savings from Cloud

After categorizing an enterprise’s applications and base-lining its costs, companies can estimate their potential cost savings by utilizing the following framework:

Figure 5: Cost Savings Potential

Using this methodology, it is possible to generate a ROI of 50% for a Tier 1 workload and a ROI of 70% for a Tier 3 workload. For example, the following are the results for a recent ERP migration to a public/private cloud performed by Persistent Systems.

- Reduce number of servers from 82 to 11
- Reduce number of racks from 11 to 1
- Generate 50% CAPEX savings
- Generate 80% OPEX savings

Labor

Labor costs offer the best direct savings for every dollar of IT budget shifted into the cloud. A typical global enterprise spends 67% of its IT budget on labor, including 40% on application development and maintenance, 25% on hosting, and 2% on end user labor.

In the cloud, labor assigned to manage infrastructure can be significantly reduced if not eliminated altogether as applications in the cloud run on an automated platform. The typical person to server ratio in an enterprise can be improved from 1:5 to 1:10 or even 1:15 as a result.

Software

Software expenditures make up 16%, the next largest piece of a global enterprise IT budget; including application licensing and maintenance fees at 12% and infrastructure software at 4%. In the cloud, software can be accessed at any station, by any user, independent of individual licenses, and is charged on a per-image basis. This reduces overall software licensing and maintenance costs as companies pay only for what they use, turning a previously fixed cost into a variable cost that can be targeted for optimization.
In addition, optimization and integration eliminates redundant or excess enterprise infrastructure software, such as databases, email servers, and network and security management systems. Developer accessibility improves with the elimination of local software runtimes, virtually eliminating shelfware. The need for infrastructure management disappears as service providers deliver software enhancements and provisioning.

**Hosting**

The typical global enterprise spends 8% of its IT budget on hosting, including 4% on application servers, 3% on facilities, and 1% on storage. That spending increases as the business becomes more complex and requires more powerful hosting infrastructure. Compared to the on-premises model, hosting in the cloud can produce returns in 3 areas: transition from upfront capital expenditures to pay-as-you-go operational expenditures, improved asset utilization, and power and cooling reduction.

**CAPEX vs. OPEX**

The biggest difficulty as well as cost savings associated with hosting on premises is that all of the organization’s hosting costs are upfront capital expenditures (CAPEX). Here the cloud return potential is clear: in the cloud, costs are completely operational (OPEX) and pay-as-you-go.

Certainly organizations should utilize their capacity to the extent that it is already paid for. However, when it comes to extending capacity on premises or in the cloud, most organizations find getting IaaS on a variable basis from a cloud provider (OPEX) to be more profitable that procuring additional infrastructure.

When hosting in the cloud transforms capital expenditures into operating expenditures, cash flow is freed and can be shifted to higher-return investments. In addition, an OPEX-based model is more flexible than a CAPEX-based model, allowing your organization to easily scale up or down as business conditions dictate.

**Asset Utilization**

Transitioning from an on-premises model to a cloud-based model allows enterprises to more efficiently utilize the IT infrastructure available on-site. When an organization is approaching full utilization capacity with its existing hardware, the decision to move to the cloud can mean millions of dollars in cost savings.

**Power and Cooling**

In allowing the organization to use its existing infrastructure more efficiently, and in reducing the need for new capacity, the cloud model can significantly reduce the costs associated with powering and cooling an enterprise’s data center. As the hosting costs associated with physical infrastructure make up about half of the total cost, the cost saving potential associated with reducing power and cooling costs is significant.

- Persistent generated 75% CAPEX and OPEX savings through virtualization of 1300 test machines.
- During an ERP deployment, Persistent produced 50% CAPEX and 80% OPEX savings by dramatically reducing number of physical machine.

“*The most efficient data center is the one that you don’t have to build. Cloud can delay or eliminate the need to build a new data center, or expand an existing one.*”

- Mazen Rawashdeh, VP of Technology Operations, eBay

VMware reports that its users reduced their energy costs and consumption by up to 80% through virtualization.
Productivity Enhancement

Productivity enhancements are more subjective in nature than direct cost savings; they are dependent on the type of business and the current organizational set up. Persistent has defined these productivity metrics by benchmarking specific set of patterns across a set of known platforms.

**Application Development**

The notion of Platform as a Service (PaaS) is to extract the common set of services as a platform and enable the cloud developer to become more productive and agile. The set of services provided by the platform can be categorized as follows:

- Middleware – Identity, authentication, workflow, mashup
- Computation – Logic execution, messaging, transactions
- Data layer – Relational data, large data

In addition there are other services that tie into the previous section relating to provisioning and packaging.

Persistent has worked on several classes of applications from the ground up. Our experience indicates that potentially 25-50% less effort is required if the application were to be developed using one of the available PaaS platforms. This assumes that the UI required from an enterprise point of view is fairly standardized, and the relevant tools for data modeling are used from the PaaS toolkit.

**Maintenance**

In a legacy scenario, there are several applications that need to scale over time, however they have an inherent overhead of having to rewrite the whole code base in order to do so. The other alternative is to make use of additional infrastructure; however this is not cost effective. Persistent provides tools that work with the existing code base and make use of caching, protocol tuning and dynamic routing. This enables the application to make use of dynamic set of cloud resources. In this case, the cost of the application scaling becomes nonlinear to the amount of resources used.

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McKinsey reports an average labor productivity savings of 25-50% in a cloud-based vs. on-premises model, as well as shorter resolution time, fewer incidents, and increased worker satisfaction.³

There are several categories of previous generation or legacy applications that are maintained as part of the overall enterprise application portfolio:

- Mainframe
- Oracle Forms
- Lotus Notes
- Powerbuilder
- VB, Access
- Delphi
- COBOL

While the maintenance costs on the legacy setup increases with time, it is possible to modernize these sets of applications towards a more standard PaaS set of applications. This can reduce the maintenance and time/labor costs because of normalization of the setup post migration.

There is room to simplify the application stack for Java applications as well. Referring to Forrester Analyst, Mike Gualtieri’s blog⁴, the reason to use a full-fledged application server is limited to certain application requirements such as:

- Two phase commit operations
- Clustering and state management

**Infrastructure**

Standard stacks imply that one can optimize deployment and ongoing administration of resources. For example, if the stack is in Open Source, then utilities from companies such as Groundworks Open Source could help. Often, web applications follow a standard pattern in terms of deployment. If these can be standardized, standard admin utility scripts and automation would provide benefits.

Several companies who were pure hosting companies like RackSpace, Peak10, etc. are focused on optimizing their Infrastructure as a Service (IaaS) layers. The entire OpenStax community is another example of industry wide collaboration, from systems and hardware vendors trying to get a platform that can be better managed.

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Revenue Transformation

Revenue transformation is the third and potentially largest benefit of moving to the cloud. Revenue transformation can be achieved in 2 ways:

- Savings from cost reduction and productivity enhancement yield can be reinvested into revenue generating activities
- Cloud infrastructure itself allows generation of additional revenue at a lower cost

The following are some examples of revenue generating opportunities that can be leveraged in a cloud based model.

Data Sharing

Application siloes can trap important business data and make it inaccessible without the application shell. Protocols like OData allow for key information to be shared with associated contextual metadata. Implementing support for such data sharing mechanisms will allow applications to integrate more elegantly without the additional cost of legacy approaches of ETL and data integration. PaaS based messaging can enable this seamlessly.

Organizations can then leverage this shared data as a service to improve their top line and business efficiency by better coordinating views of their businesses. For example, better coordination with their partners, can improve the latency in the supply chain or improve turnover in inventory. Better customer targeting could also be achieved by analyzing transactions, buying patterns, etc.

Mobility

With mobile becoming the main channel of interaction with the end users, availability of a mobile interface is extremely crucial to expanding revenue opportunities. Leveraging a PaaS based mobile enablement framework can:

- Create a cross mobile platform application without additional recoding per device category
- Increase user productivity in operations support, sales, etc.
- Utilize data sharing mechanisms above to enable key data to reach the end mile on the mobile

Social Enterprise

Enterprises need to manage interactions with their customers as well as be aware of how their customers are interacting with one another. This requires several set of applications that have following characteristics:

- Bursty usage nature related to new product activity or sudden burst of customer feedback
- Ability to share specific enterprise data in context of customers
- Mobile interface

Leveraging PaaS extensions allows applications that enable the social enterprise to be built easily. Increased collaboration amongst the enterprise can have a 30-40% productivity benefit. Integrating social networking can cut down on customer feedback cycle by approximately 40%.
Capability Store

Instead of an Application Store, the Capability Store provides several enterprise capabilities and services that are candidates to be shared in the context of partner or community ecosystem. The ready existence of PaaS and enterprise cloud allows sharing in a flexible manner thereby enabling a completely new revenue stream for enterprises.

The Cost of Cloud

Clearly, there is a great return potential associated with Cloud-based model. However, a transition to Cloud-based model from an on-premise model is not without cost. The below graphic outlines the major cost components of moving to the Cloud.

**Figure 3: Cloud-based Costs**

- **Direct Ongoing Cloud Costs**
  - Cloud Platform Subscription Costs
  - Transaction/Database Costs

- **One-time Migration Costs**
  - Cloud Migration
  - Rewriting Code
  - Porting of Applications
  - Integration
  - Change Management
  - Business Continuity

- **Risk**
  - Downtime
  - Compliance Issues
  - Security

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**One time migration costs are the most variable of all of the cloud costs and therefore are critical to assessing whether there will be a positive ROI from moving an application to the cloud.**

Direct Ongoing Cloud Costs

While the cost savings associated with a cloud-based model over an on-premises model are clearly substantial, there are two areas where an IT organization will face new costs associated with Cloud: those associated with the Cloud platform (~5%) and those associated with Cloud databases (~4%). However, these are operational expenditures pay-as-you-go costs, that depend entirely on the business’ demand.

On-time Migration Costs

In addition to direct costs associated with transitioning to the cloud, migration to the cloud represents a considerable change to the way IT operates in both infrastructure and staff. In the short run, enterprises may experience disruption to business continuity and costs related to change management, integration, and incompatibilities among solutions.

From a technical standpoint, it would involve evolving the current set of applications, their infrastructure, architecture and third party components. As these applications are analyzed for vectors of complexity as well as criticality to the business, one would need to bucket these applications into certain patterns (i.e. common infrastructure needs, common middleware/third party components, common run time environment needs) and then go through a refactoring to determine if license costs can be optimized, virtualization can better leverage infrastructure, etc. All this is not trivial; hence the need to recognize that there will be some amount of investment initially. If this is done with care, then better savings are obtained in the ensuing years.
Risk

Risk management can be a source of savings through Cloud; automation and standardization can reduce human error and additional layers of security can be more easily added in the Cloud. However there are risks associated with Cloud that an enterprise doesn’t face with the on-premise model.

Incompatibility/Uptime issues

Legacy infrastructure may not be compatible with current IaaS or PaaS solutions, creating roadblocks to the complete adoption of cloud. For the most part, cloud applications are not highly standardized, thus users cannot easily extract their data and programs from one site to use on a different site. While uptime likely improves in the cloud over an on-premise model, cloud services cannot guarantee 100% uptime. However, just as internet service providers use multiple network providers to ensure consistent uptime, so can enterprises use different cloud computing providers to mitigate their risk.

Security/Compliance

We hear it often in the C-suite: “My sensitive corporate data will never be in the Cloud.” Regulations such as Sarbanes-Oxley, and Health Human Services Health Insurance Portability and Accountability Act (HIPAA) mandate auditability requirements before regulated data can be moved to the cloud. These regulations make putting sensitive data on the cloud burdensome for many enterprises. Where the cost savings opportunities are compelling enough, there are really no technological barriers to securing sensitive data on the cloud.

Quantifying Risk

A PMO office or IT department can use similar risk assessment techniques to determine the risk associated with migrating to the cloud as they would with any other major IT project. The below are two examples of how Persistent quantifies the risk associated with moving to the cloud.

Risk Associated with Cost Savings

There are various risk factors associated achieving the cost savings of cloud. Minimally, cost savings will be impacted by inadequacies of measured data. For example, some cost data is generated using a very broad window to account for seasonal variations. Incorrect sampling windows will skew the results.

This can be factored as:

\[
\text{Overall Impact} = \text{Risk (costs of on premise implementation)} - \text{Risk (Costs of cloud based implementation)}
\]

For example, a complex and business critical legacy application would have high risk weight factors on both counts, as keeping a legacy stack alive is not trivial as it requires extra hardware, special maintenance contracts and skills. Migrating the same to a cloud would also not be trivial because of lack of domain expertise in some cases, or complexity of the legacy code or architecture. In some situations it would be better to let these types of applications live on premise and look for a next generation product that is already on the Cloud and customize it for the organization’s needs.
**Risk Associated with Productivity**

The quantified benefits in this section tend to be very application specific. Productivity is really a function of how well designed the PaaS environment is. Therefore the risk to productivity can be quantified and factored as follows:

\[
\text{Overall Impact} = \text{Risk (Process Agility)} + \text{Risk (Existence of Modular/Reusable Components)} + \text{Risk (Degree of Layered Services & Scalable Architecture)} + \text{Risk (Integration)}
\]

For example, simple to use business applications that involve workflow, some collaboration and content/data would have relatively low risks and are benefited by a solid PaaS with development and deployment tools support. Companies can implement these very quickly.

However, if you are trying to implement a complex legacy application from scratch on a PaaS, then you will run into limitations as the PaaS may not have all underlying features required for the degree of complexity of the application. For example, the need to hydrate and dehydrate long running transactions may take a few days to complete.

**Conclusion**

Organizations have traditionally seen the potential return from cloud investment as generated by cost savings: labor efficiencies, cost avoidance on the software side, and the savings that come from turning capital expenditures on hosting and hardware into pay-as-you-go operational expenditures. However, benefits from productivity improvements and revenue transformation opportunities are why the cloud is viewed as truly transformational.

In order for IT executives to ensure that they achieve ROI of Cloud in their organization, a thorough assessment of internal applications suitability for the cloud must be done. In addition, it is essential that the IT department works with the business side closely to determine what potential revenue opportunities are possible from moving to the cloud. It is only then that the true long term benefit of cloud can be realized.
About Persistent Systems

Persistent Systems (BSE & NSE: PERSISTENT) builds software that drives our customers’ business; enterprises and software product companies with software at the core of their digital transformation. For more information, please visit: www.persistent.com

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