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Building Return on Investment from Cloud Computing

Cloud Business Artifacts Project,
Cloud Computing Work Group,
The Open Group

A White Paper by:

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This White Paper embodies a consensus view of members of The Open Group. It does not necessarily represent the view of any particular member of The Open Group.

Building Return on Investment from Cloud Computing

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Executive Summary

This White Paper presents the initial conclusions from The Open Group on how to build and measure Return on Investment (ROI) from Cloud Computing. It was produced by the Cloud Business Artifacts (CBA) project of The Open Group Cloud Computing Work Group.

Cloud Computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction [1]. This enables users to avoid over-provisioning and under-provisioning, to improve cost, revenue, and margin, and to provide new business services based on new ways of operating.

This White Paper:

- Introduces the main factors affecting ROI from Cloud Computing, and compares the business development of Cloud Computing with that of other innovative technologies
- Describes the main approaches to building ROI by taking advantage of the benefits that Cloud Computing provides
- Describes approaches to measuring this ROI, absolutely and in comparison with traditional approaches to IT, by giving an overview of Cloud Key Performance Indicators (KPIs) and metrics

The result is an analysis of how to build and measure ROI that will help businesses to reap the benefits of Cloud Computing, and take advantage of its potential for incremental improvement and disruptive transformation of business processes.

Introduction

Cloud Computing has been described as a technological change brought about by the convergence of a number of new and existing technologies.

The promise of Cloud Computing is primarily the following key technical characteristics (see Above the Clouds [4]):

- The ability to create the illusion of infinite capacity; the performance is the same if scaled for one, to a hundred, or a thousand users with consistent service-level characteristics.
- Abstraction of the infrastructure so applications are not locked into devices or locations.
- Pay-as-you-go usage of the IT service; you only pay for what you use and with no or minimal up-front investment costs. You typically just use the service through a connection and device.
- The service is on-demand; able to scale up and scale down with near instant availability. Typically, no forward planning forecast is required.
- Access to applications and information from any access point.

But this is only half the story. These technical characteristics can also be found in non-disruptive technology solutions. The rate of change and magnitude of cost reduction and specific technical performance impact of Cloud Computing are not just incremental, but can give a five to ten times order of magnitude improvement.

The Capacity-Utilization Curve

The famous graph used by Amazon Web Services illustrating the capacity *versus* utilization curve has become an icon in Cloud Computing. The model illustrates the central idea around Cloud-based services enabled through an on-demand business provisioning model to meet actual usage.

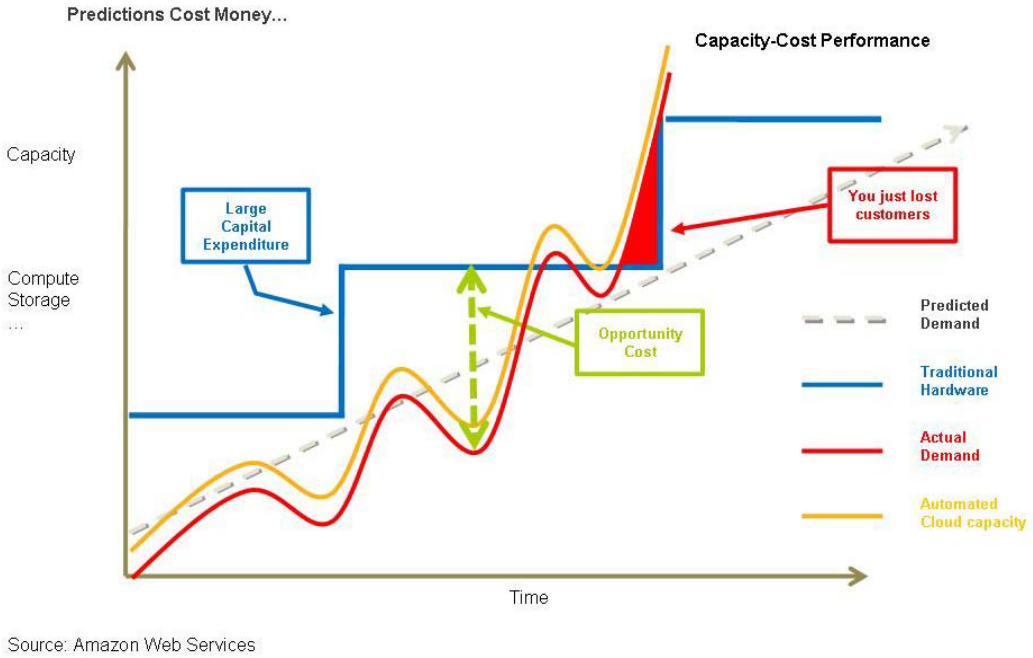

Figure 1: The Capacity *versus* Utilization Curve

Why this matters to business is that one of the core precepts of Cloud Computing is to avoid the cost impact of over-provisioning and under-provisioning. This is in addition to the opportunity for cost, revenue, and margin advantages of business services enabled by rapid deployment of Cloud services with low entry cost, and the potential to enter and exploit new markets.

We contend that in years from now, when Cloud Computing is seen in a historical context, the capacity *versus* utilization curve will be seen as an iconic model that had the same effect as previous well known business models.

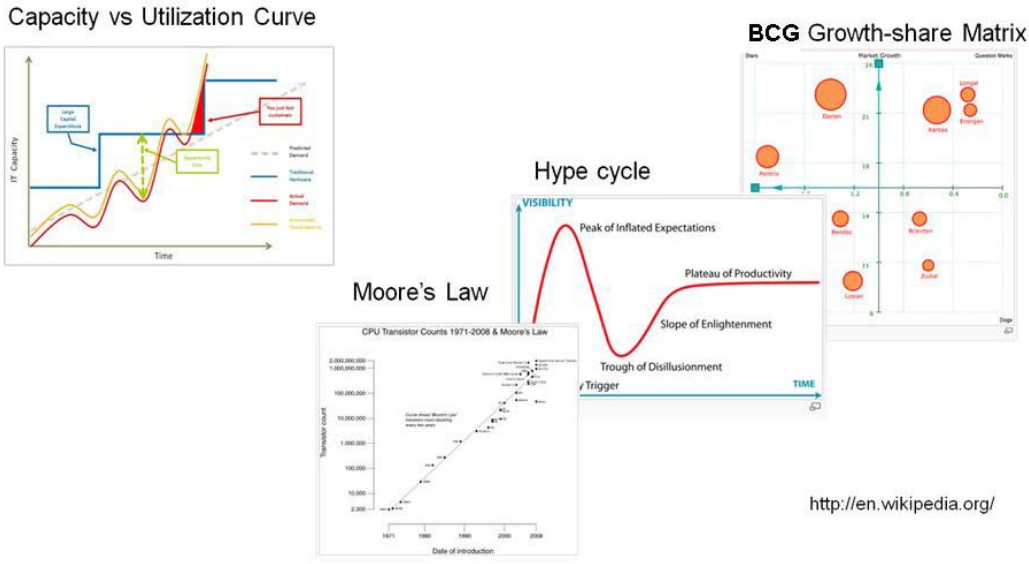

Figure 2: Iconic Business Models

Examples of these include:

- The Moore's Law model that establishes the concept of exponential growth in computational power but has subsequently been seen in other technology areas, including storage and network
- The technology hype cycle that established the emergence of innovation lifecycles, and is developed in publications by Charles H. Fine [2] and Clayton M. Christensen [3]
- The Boston Consulting Group Growth-Share Matrix that can be used to show how key industrial markets and products and services undergo transitions as the maturity lifecycles emerge, grow, and recede

But what does this potential icon mean for business? Matching capacity and actual utilization on demand improves operational efficiency, but is that all there is to it? Capacity and utilization are Key Performance Indicators (KPIs). They measure how much or how little something is being used. But is this aligned and being used to generate Return on Investment (ROI)?

Race to the Bottom versus Quality of Service (QoS)

The positioning of Cloud Computing, while initially seen as a disruptive technology influence on both buyer and seller prospects, is now evolving into a trade-off between low-cost arbitrage and added value Quality of Service (QoS).

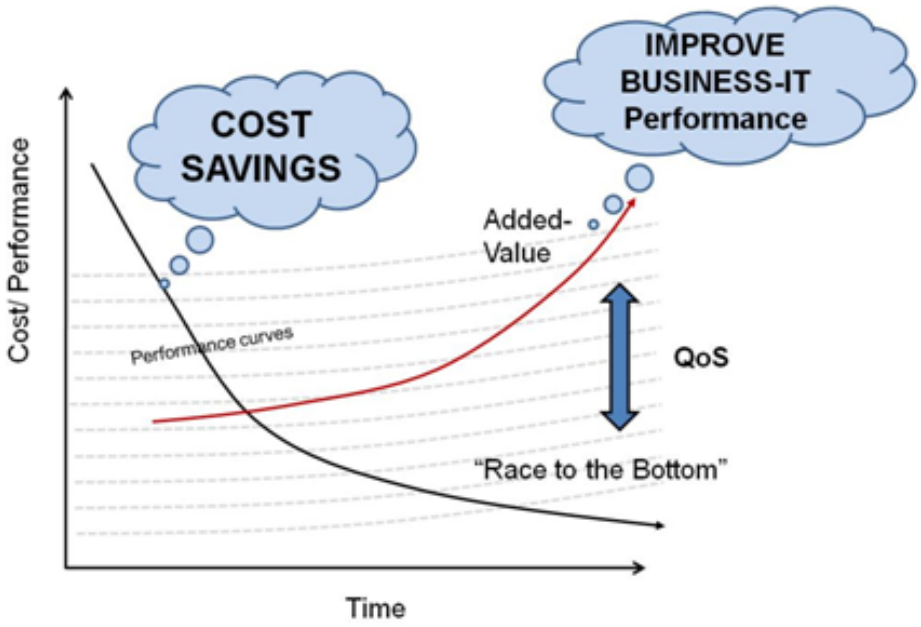

Figure 3: Race to the Bottom

The terms "race to the bottom" or similarly the "prisoner's dilemma" refer to the competing drive between participants in a market driven by the need to make the greatest cost savings. The term is often seen in a negative context, as the lower costs and margins are seen as a detriment to the participants. Massively scalable services from Cloud Computing providers have the effect of driving down costs and prices, as the dynamics of competition are shifted by the presence of potentially rapid cost reductions and huge data center investments.

The counter-balance to this is the Quality of Service (QoS), and the associated Cost of that Service (CoS) that characterizes the value of the cost per unit of performance provisioned (see the discussion on the Financial Value Perspective of Moving from CAPEX to OPEX and Pay-as-you-go).

The differentiator of Cloud Computing is not just the utility infrastructure computing services, but includes all the higher-level services that enhance and build business service value. We see this as the influence and scope of the movement from IT-centric to business-centric services across a wider services continuum, with utility services for infrastructure at one end, and with business-centric software and business processes delivered as a service from the Cloud at the other.

In addition, the need to provide adequate security should be considered. People are willing to pay a little more for a service if they are assured that there will be good security measures in placed.

This issue is highlighted in this White Paper as it has a direct bearing on the Cloud Computing ROI debate and how it is measured:

- Pricing and costing of Cloud services
- Funding approaches to Cloud services
- Return on Investment (ROI)
- Key Performance Indicators (KPIs)
- Total cost of ownership (TCO)

- Risk management
- Decisions and choices evaluation processes for Cloud services

The discussion of the market dynamics of Cloud Computing is not developed further in this White Paper, but is a recommended area of research going forward as more products and services become Cloud-enabled.

Traditional IT Compared to Cloud Computing

The iconic capacity *versus* utilization curve of Figure 1 provides a yardstick of current thinking in Cloud Computing provisioning. It is shown here for increasing demand, but the same model can be applied to both growth and decline of capacity demand in a periodic pattern typical of many businesses.

The following table shows some of the characteristics of traditional IT compared to Cloud-Computing.

Traditional IT	Cloud Computing
• Hardware is hosted on the premises of the organization and/or manage hosted. • Hardware and software is provisioned for peak demand. • Service management monitoring is used to generate forecasts of demand usage and current SLA performance. • Chargebacks and compensations are used to adjust usage and payments. • Under-provisioning and over-provisioning of capacity can result from unforeseen demand changes. • Business invests in ownership of assets that can be enhanced and extended through IT programs and development. • Changes to IT involve migration and divestment/investment issues and programs.	• Hardware and/or software is hosted off-premise (public or hybrid) or on-premise as a private Cloud service. • Services are provisioned and used based on actual demand, providing this elasticity as a managed service. • Services are typically focused on short-term "burst" demand to gain cost savings over provisioning and owning the assets. • Statistical automated scaling is used to optimize the shared virtual assets. • Risk is transferred from the buyer to the seller/provider of the Cloud service. • Cloud sellers and providers seek to grow amortized economies of scale through increasing the numbers of users of the shared resources. • The IT infrastructure and operation is masked from the service user. Cloud is more than just SaaS.

New Technology Adoption Lessons from Other Industries

Understanding the characteristics of Cloud Computing can be assisted by observations from other industries that are in the process of transformation. Lessons from alternative power sources such as solar energy and wind power contain examples of issues that resonate with familiarity in the Cloud Computing context.

When comparing Cloud Computing to solar and wind energy there are similar adoption issues:

- Potential unlimited energy resource
- Challenges to distributing efficiently
- Demonstrating its value over traditional/other alternatives

Figure 4: Solar Energy and Wind Power

Just taking a look at the solar energy and wind power characteristics:

- Global current human demand in 2009 is 16 terawatts; this is predicted to rise to 20 terawatts by 2020 (refer to Wikipedia: World Energy Resources and Consumption).
- Sunshine on earth area 120,000 terawatts (174 petawatts – 30% reflected back); that is, 60,000 times more than demand (refer to Wikipedia: Solar Energy).
- 100 square miles of solar farms with today's technology could collect enough power for the whole of the USA (refer to US Department of Energy on solar energy).
- Germany is a leader in solar power – a country with average to poor locality for sunshine but demonstrating leadership (refer to Wikipedia: Solar Energy).
- 10/15 solar farms can generate 1.3 Gigwatts = medium size coal power station (refer to Wikipedia: Solar Farm).
- California law states 20% power from renewables by 2010 (refer to the California Energy Commission on renewable energy programs).
- President Barack Obama Federal Renewables Policy requires 25% from renewables by 2025 (refer to the US Environmental Policy).
- 25% of UK electrical power could be sourced from 6000 220m tall wind turbines positioned 100 miles off-shore in the North Sea (refer to the UK Government Carbon Trust).

New Technology Adoption from a Buyer's and Seller's Perspective

Examining the issues of effective wind power or solar energy compared to contemporary energy sources draws parallels with the challenges we also see in defining new technology adoption.

Sellers of resources and services characteristically focus on their operation and technical development, and how they can enable effective business models for existing and potential new customers and markets.

Buyers are typically not concerned about how the sources of energy, resources, or services were generated and delivered. They seek to understand whether their businesses can be supported by the products or services, and whether these can be reliable and cost-effective. Buyers want to know the choices on offer and how they may be able to enhance or swap resources and services for improved business performance.

The following table shows some of the concerns of buyers and sellers of new technology.

Buyers	Sellers
• Don't care where the service comes from or what medium was used to generate it. • Does the service address the business requirement? • Is the QoS reliable? • What are the switching costs from one energy provider to another? • Is the service cost effective? • There are advocates and dissenters. • Can I use the service when and where I need it?	• Efficiencies of production compared to existing alternatives. • Storage of the service and use in service to meet on–demand needs at point of use. • The cost of (architecture) to deploy and distribute the service. • Purchasing incentives and direct governance investment. • There are advocates and dissenters. • Location, security, and access?

In Cloud Computing the common themes in engaging sellers and buyers in the new technology provisioning model includes three key questions:

- How does Cloud Computing compare to traditional IT? This principally relates to the comparison of service-level performance and license costs.
- What can I not put in the Cloud? Answers typically include UNIX systems, mainframes, and very high I/O applications, but pretty much anything can be co-located or hosted in an elastic virtual container environment. Beyond the technical definitions there are the business processes and provisioning models that set Cloud Computing apart from its predecessors of utility computing and virtualization.
- How does Cloud Computing impact revenue and budget lines? This issue involves the cost/performance enabled by virtualization and economies of scale, and the lowered need for up-front investment. Movement of revenue to Cloud providers may need to be balanced by sale of added-value services.

Above and Beyond the Clouds

There are many definitions and viewpoints provided by the sellers of what is now termed "Cloud Computing". Much of the vocabulary used is defined from the perspective of IT performance and capacity, and the impact of cost savings of asset ownership and variable seller service costs. Yet all these have direct cost-benefit impact on the business consumers of the end services and how they compete and deliver products and services in their industry.

Many business IT departments have addressed emerging trends through actions to drive cost reduction and leverage IT service providers' adoption of Cloud style services. Many industry organizations and leading IT suppliers of software, hardware, and services, seeking to address their customer needs, have vigorously evaluated and followed a Cloud-style strategy. The challenges and issues are in the transition from the current traditional IT to the new potential capabilities of Cloud Computing. They must be expressed in a

language that business end users can understand, and relate to investment, cost improvements, or business performance.

Closer to home in understanding the issues of Cloud Computing, we can draw upon the University of California, Berkeley RAD Lab. White Paper Above the Clouds [4]. This highly informative paper identifies the technical issues for Cloud adoption, and its potential for business benefits and technical challenges. The paper also sheds light on the value that these technical scenarios can provide to business:

- Avoid missed business opportunities from under-provisioning and over-provisioning (Page 1)
- Responsive Service to variable demand (Page 2)
- Pursue emergent and explorative new business market opportunities hitherto unforecast or predicted (Page 2)
- Perform cost associative tasks fast and lower cost (Page 2)
- Decouple utility services and brokering from business front end (the "fab-less" chip foundries example) (Page 3)
- Make more money from amortizing economies of scale (Page 4)
- Leverage existing investments through hybrid means (Page 4)
- "Anywhere" services, "border-less" delivery (Page 4)

This interpretation of the Above the Clouds White Paper in a business-issue context illustrates some interesting aspects of Cloud Computing potential.

The decoupling of resources and provisioning (what can be termed "back end") from the "front end" business use through intermediation follows much the same argument as Why Buy the Cow [5] from Ivar Subrah on how on-demand powers the economy and The Big Switch [6] by Nicolas Carr that takes the analogy even further with distributed industrial IT services.

The business of IT becomes that of leveraging the products and services through competing platforms and channels to defend, attack, and build customers and market share (see the discussion on the Importance of a Business Perspective of the Cloud).

However, a secondary issue from this, described as a "race to the bottom" by many industry observers, arises where commodity charging lowers the cost, removing margin benefits. The counter-balance to this is the Cost of Service (CoS) and Quality of Service (QoS) charges and added value on top of the products and services. We explore this in the next section.

Even after the passing of time from the date of publication of Above the Clouds [4], the technical challenges are still evident, but they are becoming less so with the evolution Cloud services and technology.

The Above the Clouds paper famously asserts that Private Cloud is not Cloud Computing (Page1) as it is not open to the general public, which is part of the original definition. This illustrates that definitions of Cloud are still evolving, and perhaps the definition commonly assumed in the marketplace today does not necessarily require openness, though it still retains the central concepts of elastic capacity and provisioning.

Building Return on Investment from the Cloud

The central theme of this White Paper is how to go beyond the initial capacity and utilization benefits described in Cloud Computing.

The view of capacity and utilization is a technology provider/seller viewpoint which is essentially based on key performance indicators (KPIs) rather than business benefit metrics.

- **IT capacity**, as measured by storage, CPU cycles, network bandwidth, or workload memory capacity is an indicator of performance.
- **IT utilization**, as measured by uptime availability and volume of usage is an indicator of activity and usability.

But effective cost/performance ratios and levels of usage activity do not necessarily imply proportional business benefits. They are just indicators of business activity that are not in themselves more valuable than lower operating cost. There are, however, business metrics that translate the indicators of the capacity-utilization curve to direct and indirect benefits to the business, as illustrated in Figure 5.

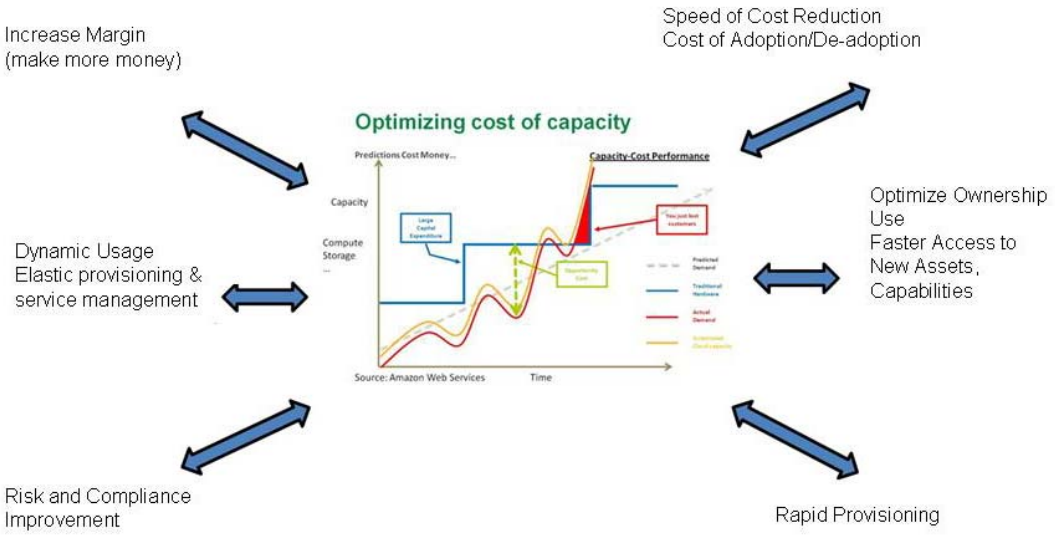

Figure 5: Business Metrics Derived From Capacity/Utilization

These metrics are described in the following sections.

Speed of Cost Reduction – Cost of Adoption/De-Adoption

The introduction of Cloud Computing as an option transforms cost of ownership and changes the dynamics of the provisioning cycle in a number of fundamental ways.

The speed and rate of change of cost reduction can be much faster using Cloud Computing than traditional investment and divestment of IT assets. In Cloud Computing the buyer can move from a CAPEX to an OPEX model through purchasing the use of the service rather than having to own and manage the assets of that service. This responsibility is transferred to the service provider.

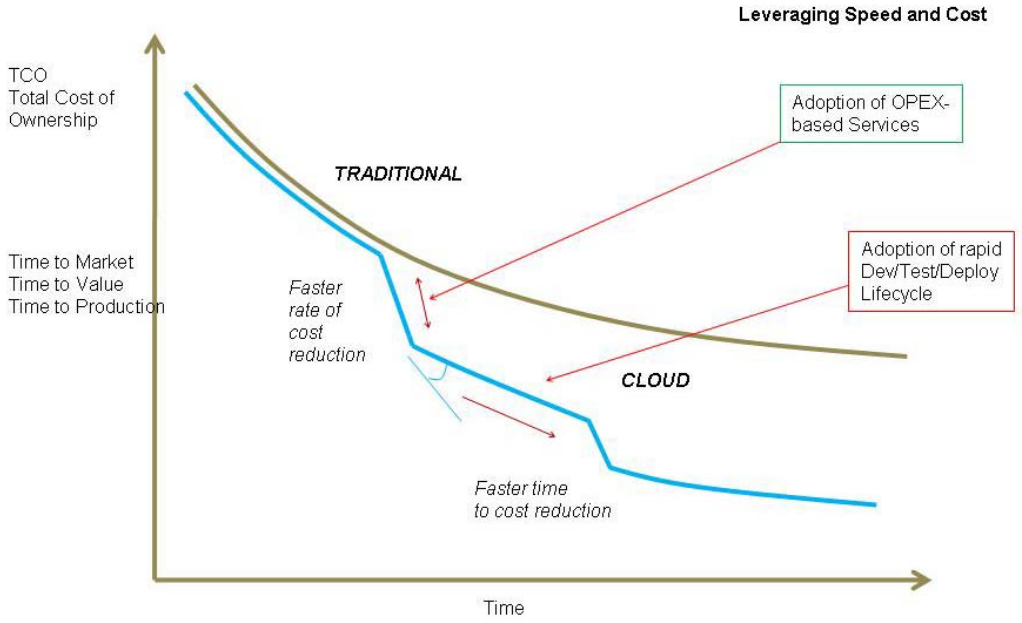

Figure 6: Speed of Cost Reduction, Cost of Change

The use of Cloud Computing to the user also potentially means a movement to a pay-as-you-go style billing model which can have different tariffs and contractual obligations compared to traditional IT ownership. These can include minimum usage periods and flexible pricing per usage profiling (see the discussion on the Financial Value Perspective of Moving from CAPEX to OPEX and Pay-as-you-go).

The key issue is the ability to adopt and remove the service either at the point of use (to scale up and down) or to make choices to use new services or change service provider.

Migration between Cloud services is still a challenge. There are portability and interoperability issues.. And hosting corporate and personal data and knowledge on the Cloud can make customers of Cloud services dependent on the providers.

There is a trade-off between the benefits of speed, cost, and Quality of Service (QoS) from a particular Cloud service provider and their ecosystem of services *versus* the flexibility and choice of alternative services and Cloud solutions.

The cost of change in an ROI business case is less in Cloud Computing as the choice of selected Cloud services is more stable and more cost-effective than traditional ownership.

Optimizing Ownership Use

The use of IT has become an enduring feature in all organizations today. The investment in data, knowledge, and infrastructure assets and software code now represent many lifeblood operations for businesses.

But many of the issues of cost of ownership are often decoupled from choices made during selection of new IT, and the impact on the long-term running and maintaining of these IT services and subsequent business usage is not properly considered:

- Technology design choices and purchasing are often done by strategic or tactical contractual purchasing based on project requirements, with little consideration for optimizing running and maintainance over the

whole system lifecycle, but

- The cost of maintenance and modifications often represent a significant part of the asset lifecycle beyond initial provisioning.

The ability to "design and provision for run", so that the choices of IT procurement are aligned with the best options and performance for long-term operation, has long been an ideal goal of business and IT. But, while technical trends such as OO, SOA, and Web 2.0 have brought functional improvements, the improvements in runtime infrastructure support have always been illusive.

A key aspect of moving to Cloud Computing is the ability to select hardware, software, and services from defined design configurations to run in production. Cloud Computing in effect seeks to bridge the design-time and run-time divide and optimize service performance. Patches and upgrades or new technology are in theory invisible to the end user of the service as they are included as part of the automatic asset management features.

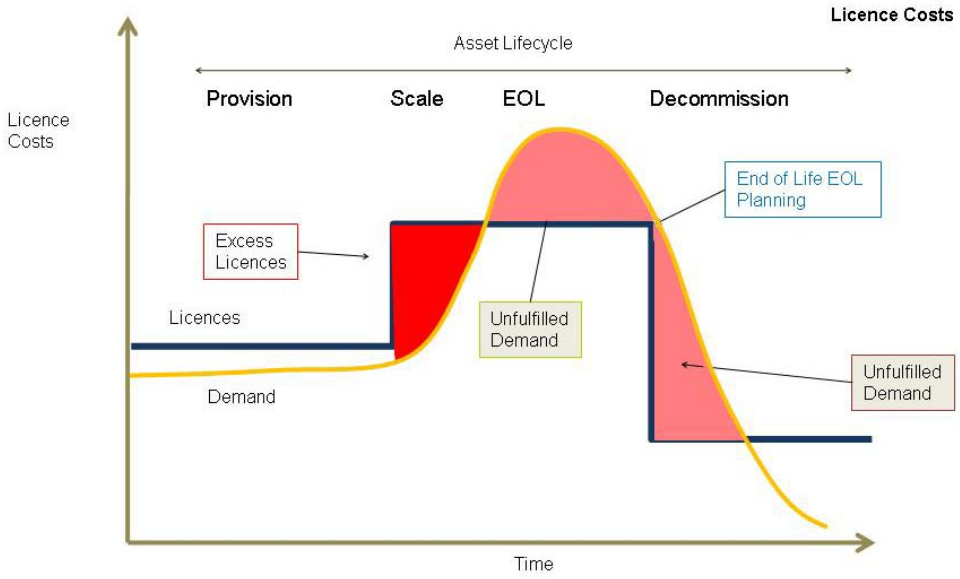

Figure 7: Optimizing Ownership Use

Cloud Computing can help an enterprise achieve the goal of a more cost-effective asset–management lifecycle process for the IT portfolio, to optimize both design and run-time performance.

While the capacity-utilization curve can reflect overall usage, this can be broken down to identify *which* assets need to be supported in this way and to rationalize, consolidate, and optimize the assets that need to perform for business goals.

The key benefits to Cloud Computing ROI from a business case perspective are in the optimization of the total asset portfolio.

Rapid Provisioning

Elastic provisioning to scale up and down to actual demand creates a new way for enterprises to scale their IT to enable business to expand.

The provisioning time compression from a week to hours, for example, demonstrated by Cloud Computing sellers/providers is a means to rapid provisioning that is not just about saving time but is also defining a new business operating model.

Organizations can review and develop business plans and then deploy infrastructure and services in a more rapid and proactive way.

Customization and development, testing, and support can also been seen in a new light with the provision of IT services in a dynamic fashion targeted at business needs.

Buyers and sellers can view rapid provisioning as a marketplace of services. Sellers can offer rapid provisioning services that sustain buyer needs for existing IT services, offer choices for innovation, and enable rapid introduction of new technology.

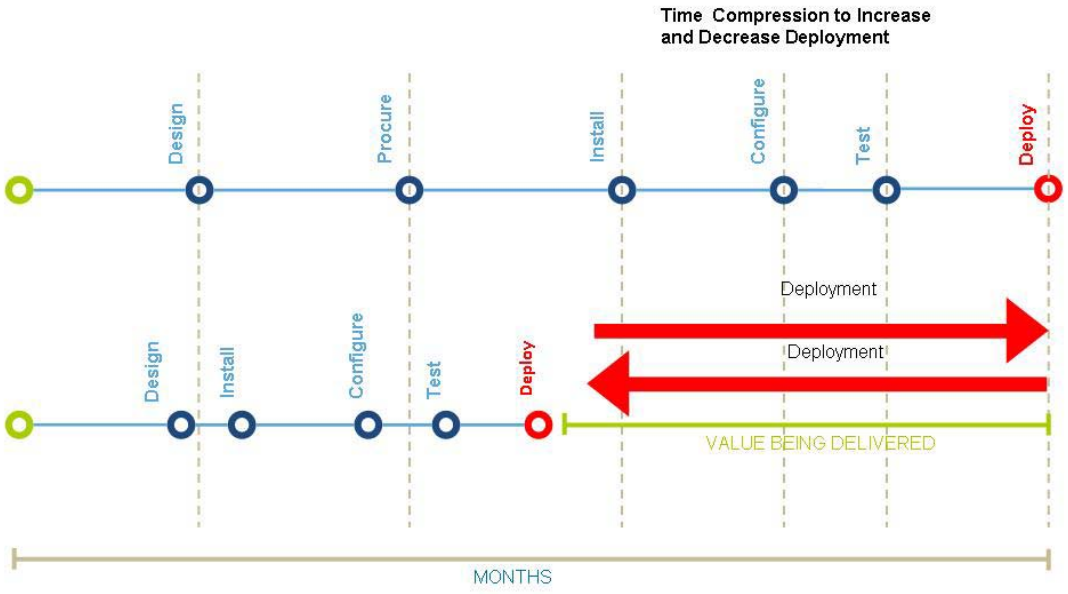

Figure 8: Optimizing Time to Deliver/Execution

The impact of rapid provisioning on ROI business cases can be profound. Examples in the government/federal sector as well as financial services and consumer goods are already evident and pointing the way to the emergence of online Cloud-based marketplaces as *de facto* standards for current and future trading between suppliers and buyers of services.

Increase Margin (Make More Money)

One of the core precepts of Cloud Computing is to avoid over-provisioning and under-provisioning. This is in addition to the opportunity for cost, revenue, and margin advantages of business services enabled by rapid deployment of Cloud services with low entry cost, and the potential to enter and exploit new markets.

What makes Cloud Computing exciting is that the potential for business is not just the incremental change improvement but the disruptive transformational effect Cloud Computing can have from the possibilities of new business operating models.

Cloud Computing enables business to pursue new and existing markets by rapid entry and exit of the products and services. It enables enterprises to "land and expand" in markets with an infrastructure and service capacity that can grow with the business.

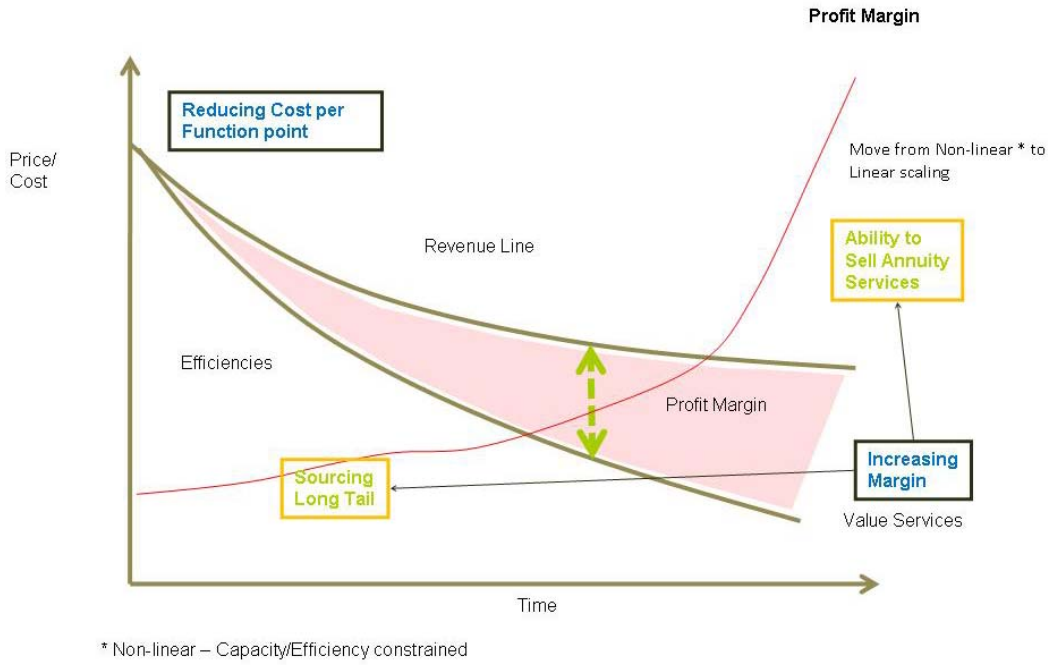

Figure 9: Optimizing Margin

Cloud Computing removes the need for additional infrastructure to test and enter markets for business (a key benefit feature particularly for small to medium size organizations).

Cloud Computing has an impact on the margin through cost reduction and through economies of scale to make more use of the same resources.

The impact on a ROI business case is that an enterprise can make more money or better use of existing investments through Cloud Computing.

There are many cases of companies large and small that can enter and develop service offerings through a "long tail" (refer to the publication by Chris Anderson [7]) approach enabled by Cloud Computing infrastructure. Existing and new markets can be attacked and entered through speculative and well-timed interventions to exploit and grow business performance.

Dynamic Usage – Elastic Provisioning and Service Management

The focus on capacity and utilization can be taken further through arrangements with Cloud Computing service providers/sellers that enable dynamic usage provisioning.

Traditional licensing associated with ownership, number of users, support, and maintenance costs and services are being challenged by the pay-as-you-go model found in on-demand Cloud Computing.

Cloud Computing is more than restructuring software and hardware and support licenses into a kind of periodic rented or lease license. It is targeting the end usage of the services at the point of real business need

of the number and scope of users of the IT service (see the discussion on the Importance of a Business Perspective of the Cloud).

With either fixed usages volumes or variable functional usage, new innovative consumption models enabled by Cloud Computing allow businesses to consider using IT in a flexible and agile way.

This can range from the "freemium", "contractless" service that you use or pay by credit card and advertizing revenues or specific pre-allocated bands of services and software functionality over a defined period of use (see the discussion on the Financial Value Perspective of Moving from CAPEX to OPEX and Pay-as-you-go).

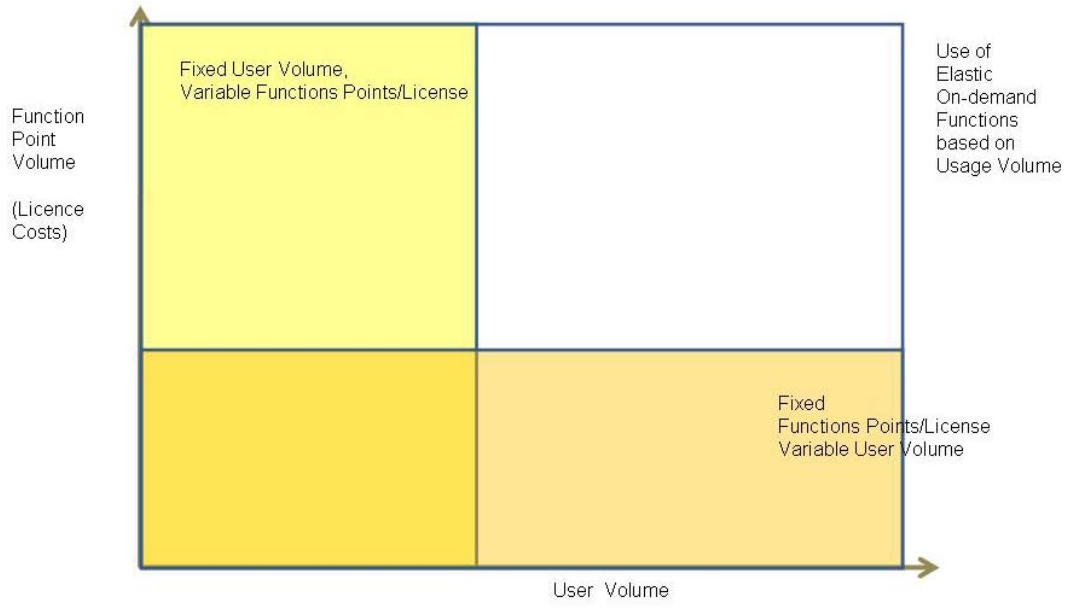

Figure 10: Elastic Provisioning

Cloud Computing can change the ownership process from buyer to seller in the sense that IT becomes a commodity purchase, and buyers focus on outcome-based performance and choices.

The impact of dynamic provisioning on the Cloud Computing ROI business case is that the façade of service management becomes more "digital". With the emergence of Internet services, it is now commonplace in residential markets for services and products to be viewed and provisioned online.

This expectation is now translated via Cloud Computing into the business world, where online service catalogs, self service, and automated services are increasingly part of the consumer experience.

Risk and Compliance Improvement

The green sustainability issue is equally valid in Cloud Computing and seen by a number of industry observers as an argument that moving into a Cloud environment will help organizations improve their carbon footprint.

This perhaps shifts the problem to the Cloud service providers as their industry potentially becomes a huge sink for electrical emissions from massive scale computing data center services.

It is expected that this challenge will be met as technological and design improvements address the energy consumption growth patterns. The benefit to the economic and emission footprint from the use of shared services is expected to have an improved impact compared to leverage of existing assets.

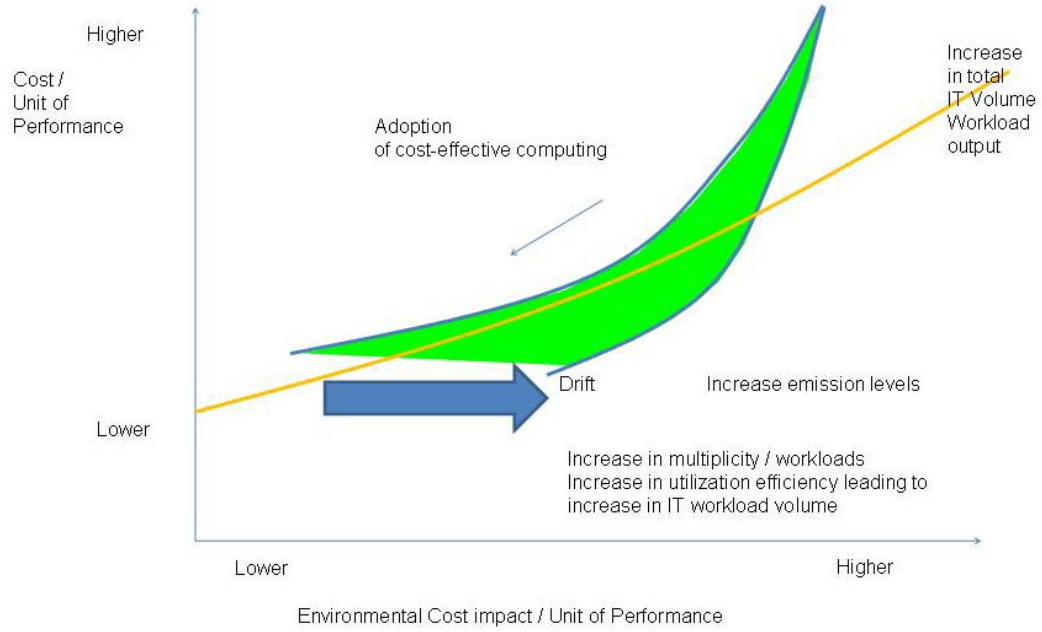

Figure 11: Green Costs of Cloud – Sustainability

A secondary effect, however, is the growth of more Cloud service users as the Cloud Computing paradigm takes off. As the cost and emission footprint per Cloud service falls, more services per cost can be consumed. As more advanced services emerge (the term "multiplicity" – see [8] – is now starting to emerge as large workload and cost-sensitive processing is moved to the Cloud and multiple processing made possible) then so can "usage creep" occur as the consumption rates further increase the usage of Cloud Computing services.

The alignment of compliance is a wider issue that includes green and legislative issues facing organizations and specific industry sector policies.

The impact on the ROI business case from using Cloud Computing services is directly relevant to sovereignty, security, and management of services risk containment. Cloud Computing domains cut across these complex issues and are directly affected by decision processes to adoption off-premise services.

Discussion: Financial Value Perspective of Moving from CAPEX to OPEX and Pay-as-you-go

Software as a Service (SaaS), utility computing, and Cloud Computing are recent themes in IT that seek to change the provisioning and utilization of IT.

Key to this is the change in cash flow and cost of capital investment.

Cash Flow

Moving to a pay-as-you-go model means the cashflow of your business is changing. Sources of revenue and outgoing cash expenditure are on a usage basis based on a unit such as time, volume, or component. Cash flow – Cash Flow after Taxes (CFAT) – is a financial measure of a business ability to generate cash flow through its operations. Moving from a CAPEX to an OPEX model develops the use of operational expenses rather than capital assets and the treatment of operating statements rather than balance sheet management. Cash flow describes revenue, cash, and working capital changes that flow within part of the operating expenses liquidity and available usage of funds. Adopting the Cloud Computing paradigm seeks to make more money (increase revenues) while driving capital costs down through greater efficiencies of working capital and OPEX changes. Calculations of Net Present Value (NPV) of investments often need to consider the discounted cash flows of the cost of capital (WACC) to assess the value of the investment return. Cloud Computing seeks to minimize or zero upfront investment and to drive improved asset usage ratios, Average Revenue Per Unit (ARPU), Average Margin Per User (AMPU), and cost of asset recovery.

Cost of Capital

Moving from CAPEX to OPEX is a change in the basis of capital investment usage as upfront and ongoing costs are changed by the Cloud Computing business model. The focus is on the ability to maximize the leverage of that capital to acquire IT and business services while minimizing the risk to the business in capital used for initial investment and ongoing maintenance charges. While moving away from investments in long-term assets may be seen as context of Cloud Computing, this implies a move towards long-term OPEX-style service where QoS and costs are still equally relevant regardless of asset ownership. The common factor is the business performance and SLA requirements.

A company with a high cost of capital (WACC) and which would benefit from bringing in their tax shield (high CFAT), is a candidate for shifting CAPEX to OPEX – but other aspects of the business context may contradict that candidacy such as availability of appropriate solutions and security constraints on using shared services. If CAPEX to OPEX is desired, then the company should be considering and evaluating outsourcing solutions, including public Cloud solutions, hybrid Cloud, and Private Cloud solutions.

Cash flow can be an important indicator if CAPEX to OPEX is the focus. Pay-as-you-go can be seen as easier on cash flow than pay-upfront. But both cash flow considerations may not necessarily exist in the same business scenario. For example, a business may want to improve cash flow through moving to a direct usage model but still retain investment in CAPEX for differentiated private business processes.

OPEX

Using an OPEX model can potentially remove and release capital that would otherwise be used for initial investment and ownership of IT assets. Alternatively, investment in a Cloud Computing platform may

require capital investment and changes to the payment and funding of the service as it is amortized over a wider shared service model for economies of scale.

The cost of capital from sources of equity and cost of debt point of view can change for private and public/federal industries that have stock market/shareholders or government sources of funding.

If the overall goal is to maximize the use of capital by best use of the debt and equity funds, in Cloud Computing the use of OPEX moves the funding towards optimizing capital investment leverage and risk management of those sources of funds.

Pay-as-you-go and Pay-by-the-drink

There are other ways of getting the equivalent to pay-as-you-go besides outsourcing/public Cloud. Financing and leasing are both forms of pay-as-you-go, as is a monthly software "rental fee" – or any other form of software licensing which shifts payments into the future. A close cousin to "pay-as-you-go" is "pay-by-the-drink" – usage-based billing. This type of billing can be construed to help with cash flow, but arguably, usage-based billing is only beneficial (to the subscriber) if bill amounts are predictable and controllable. If not, then neither the subscriber or the provider can budget effectively, and consequently the subscriber pays a premium for bursting capacity, and/or the provider (and thus the subscriber) oversubscribes the resources and runs the risk of a capacity shortage ("brownout").

If the billing basis is not tied to business activity or business outcome metrics, then most commercial utility service buyers typically opt for a monthly or annual baseline fixed rate. In other words, of the billing is tied to metrics which the business can predict and control (business metrics) then the preference is for usage-based billing: but if the billing is based on IT infrastructure and/or application metrics which the business cannot readily correlate to the business activity enabled, then fixed rate billing is preferred. Likewise, residential buyers of utility services such as cell phone service are being offered fixed rate monthly billing to ease budgeting.

The following section examines some of the metrics and performance indicators that drive business towards the Cloud Computing value model.

Cloud Computing Key Performance Indicators and Metrics

Cloud Computing introduces an expanded context for service-oriented business and IT.

Developing ROI models that show how Cloud Computing adoption can benefit both business and IT consumers and providers involves examining the key technology features and business operating model changes.

This section gives an overview of ROI models to support Cloud Computing assessments and business cases in two aspects:

- Key Performance Indicator (KPI) ratios that target Cloud Computing adoption, comparing specific metrics of traditional IT with Cloud Computing solutions. These have been classified as cost, time, quality, and profitability indicators relating to Cloud Computing characteristics.
- Key Return on Investment (ROI) savings models that demonstrate cost, time, quality, compliance, revenue, and profitability improvement by comparing traditional IT with Cloud Computing solutions.

The overview of Cloud Computing ROI models considers both indicators and ROI viewpoints.

Figure 12 shows an overview of Cloud Computing ROI models and KPIs.

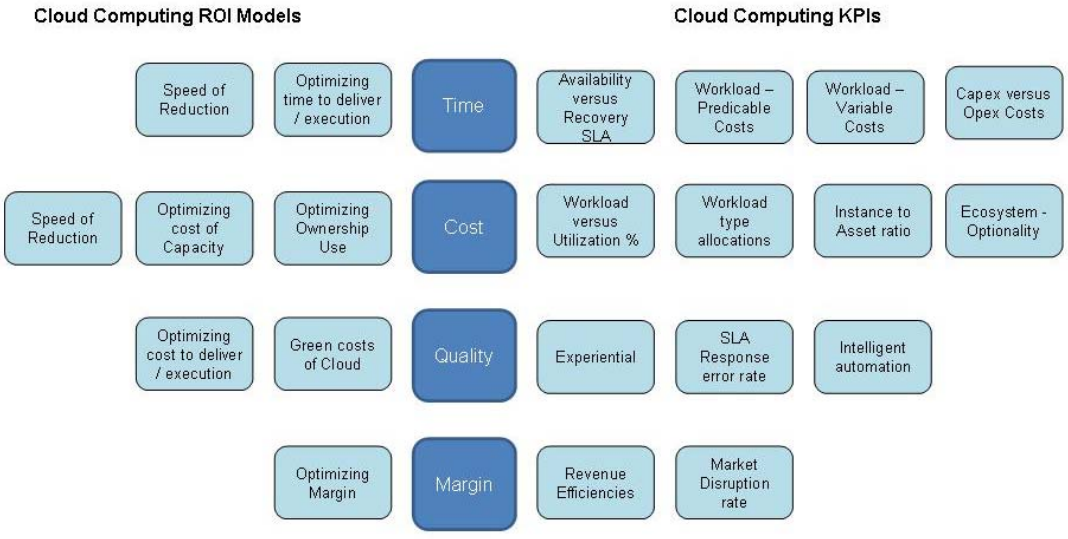

Figure 12: Cloud Computing ROI Models and KPIs

Cloud ROI Cost Indicator Ratios

Figure 13 shows the cost indicator ratios, and outline explanations are given below.

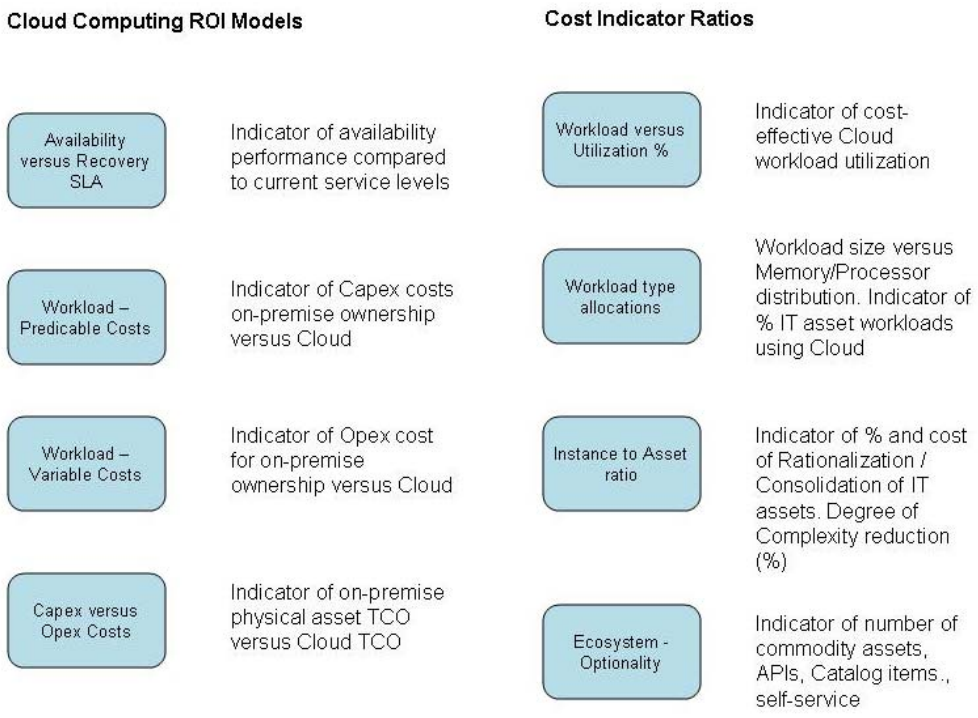

Figure 13: Cloud Computing ROI Models – Cost Indicator Ratios

Availability *versus* recovery SLA:

- Indicator of availability performance compared to current service levels

Workload – predictable costs:

- Indicator of CAPEX cost on-premise ownership *versus* Cloud

Workload – variable costs:

- Indicator of OPEX cost for on-premise ownership *versus* Cloud; indicator of burst cost

CAPEX *versus* OPEX costs:

- Indicator of on-premise physical asset TCO *versus* Cloud TCO

Workload *versus* utilization %:

- Indicator of cost-effective Cloud workload utilization

Workload type allocations:

- Workload size *versus* memory/processor distribution; indicator of % IT asset workloads using Cloud

Instance to asset ratio:

- Indicator of % and cost of rationalization/consolidation of IT assets; degree of complexity reduction

Ecosystem – optionality:

- Indicator of number of commodity assets, APIs, catalog items, self service

Cloud ROI Time Indicator Ratios

Figure 14 shows the time indicator ratios, and outline explanations are given below.

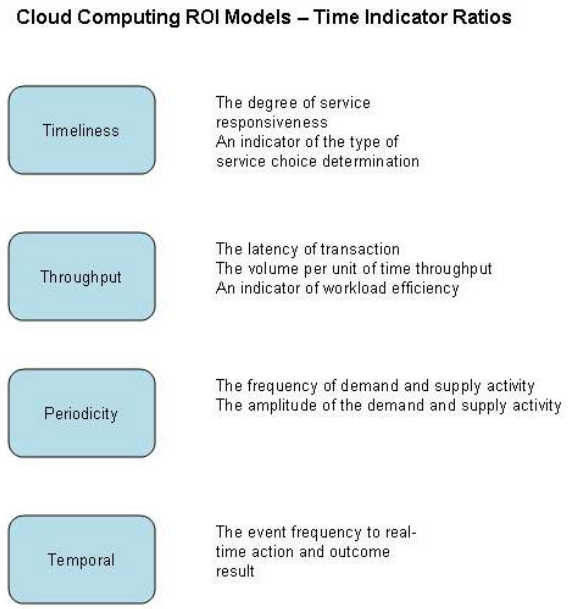

Figure 14: Cloud Computing ROI Models – Time Indicator Ratios

Timeliness:

- The degree of service responsiveness
- An indicator of the type of service choice determination

Throughput:

- The latency of transactions
- The volume per unit of time throughput
- An indicator of the workload efficiency

Periodicity:

- The frequency of demand and supply activity
- The amplitude of the demand and supply activity

Temporal:

- The event frequency to real-time action and outcome result

Cloud ROI Quality Indicator Ratios

Figure 15 shows the quality indicator ratios, and outline explanations are given below.

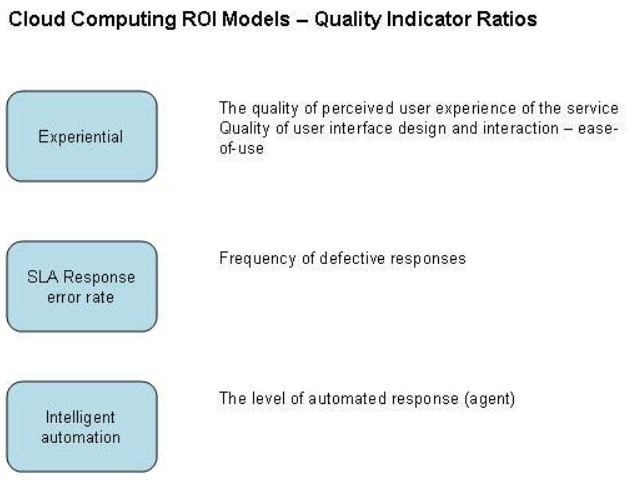

Figure 15: Cloud ROI Quality Indicator Ratios

Experiential:

- The quality of perceived user experience
- The quality of User Interface (UI) design and interaction – ease-of-use

SLA response error rate:

- Frequency of defective responses

Intelligent automation:

- The level of automation response (agent)

Cloud ROI Profitability Indicator Ratios

Figure 16 shows the profitability indicator ratios, and outline explanations are given below.

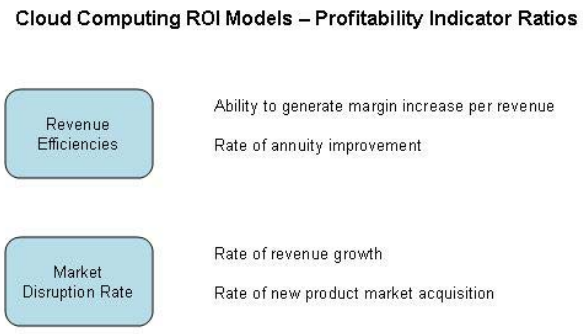

Figure 16: Cloud ROI Profitability Indicator Ratios

Revenue efficiencies:

- Ability to generate margin increase/budget efficiency per margin

- Rate of annuity revenue

Market disruption rate:

- Rate of revenue growth
- Rate of new market acquisition

Cloud ROI Savings Models

Figure 17 shows the savings models, and outline explanations are given below.

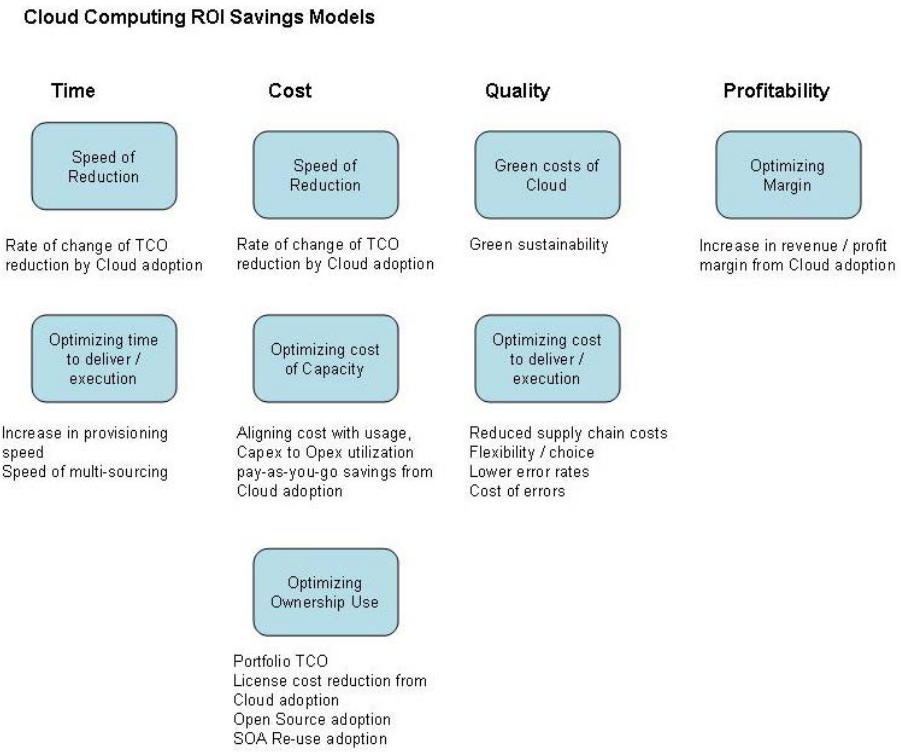

Figure 17: Cloud Computing ROI Savings Models

Speed of time reduction:

- Compression of time reduction by Cloud adoption
- Rate of change of TCO reduction by Cloud adoption

Optimizing time to deliver/execution:

- Increase in provisioning speed
- Speed of multi-sourcing

Speed of cost reduction:

- Compression of cost reduction by Cloud adoption
- Rate of change of TCO reduction by Cloud adoption

Optimizing cost of capacity:

- Aligning cost with usage, CAPEX to OPEX utilization pay-as-you-go savings from Cloud adoption
- Elastic scaling cost improvements

Optimizing ownership use:

- Portfolio TCO , license cost reduction from Cloud adoption
- Open Source adoption
- SOA re-use adoption

Green costs of Cloud:

- Green sustainability

Optimizing time to deliver/execution:

- Increase in provisioning speed
- Reduced supplycchain costs
- Speed of multi-sourcing
- Flexibility/choice

Optimizing margin:

- Increase in revenue/profit margin from Cloud adoption

Discussion: The Importance of a Business Perspective of the Cloud

From a business perspective, the way an organization operates differentiating business processes and their Quality of Service (QoS) is key to business operating success. Identifying competitive business processes as well as standard commodity operations will improve the focus of innovative market growth and cost of service optimization activities made possible by business models based on Cloud Computing opportunities.

Just focusing on infrastructure improvements may result in cost rationalization but may miss the impact and value of applications and business processes to the end customer. QoS is an essential ingredient in evaluating the business effectiveness. The elements of QoS are made up of infrastructure, resources, activities, and services spanning the whole lifecycle of business.

Amortization of Economies of Scale

In Cloud Computing the operating challenges experienced from one customer can be proactively fixed for all the other customers of the Cloud service by using a shared platform. Amortization of problems is just one example of how a Cloud solution can achieve more favorable QoS levels. So, value can be leveraged from amortizing economic economies of scale across the collective membership potential of a service ecosystem created by the Cloud.

Business Portfolio Focus

Just looking at Cloud Computing from a technical infrastructure point of view is potentially missing the wider picture of the impact of technology on the business.

Overall, what matters is defining the value to business. Value can be defined in many ways. It does not just mean the financial values of Total Cost of Ownership (TCO) and Return on Investment (ROI), but can also mean customer value, seller provider value, broker value, market brand value, corporate value, as well as technical value of the investment.

Your business is a portfolio of business processes. Using portfolio management techniques, group your business processes into three domains where the processes in each domain have common IT enablement solution selection criteria (for example, differentiating based on IT, differentiating not based on IT, and not differentiating), and apply the solution selection criteria.

The business perspective also includes consideration of whether using Cloud services can help facilitate interactions with business partners or partner organizations – for example, by using SOA or EDI through the Cloud – and whether using Cloud services may endanger any existing interactions, where suppliers of data impose particular conditions for handling confidential data.

The work of the Cloud Business Artifacts (CBA) Project in The Open Group Cloud Computing Work Group is seeking to identify the key Cloud buyer questions and in a language business can understand and use to target solutions to meet real business requirements.

Conclusions

Cloud Computing is an important stage in the development of IT systems, comparable with the emergence of the mainframe, the minicomputer, the microprocessor, and the Internet.

Cloud Computing can provide many advantages over conventional approaches to IT provisioning, which can translate into significant improvements in ROI. But what makes it particularly exciting is that its potential effect on business is not just incremental improvement, but disruptive transformation through new operating models.

This White Paper provides an analysis of how to build and measure ROI that will help businesses to reap the benefits of Cloud Computing, and take advantage of its potential for incremental improvement and disruptive transformation of business processes.

Our understanding of Cloud Computing is currently at an early stage. This is an initial analysis. ROI models will evolve as the technology matures. This evolution will be reflected, and key indicator ratios will be described in more detail, in future deliverables of The Open Group Cloud Computing Work Group and its Cloud Business Artifacts and Cloud Business Use-Cases projects.

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