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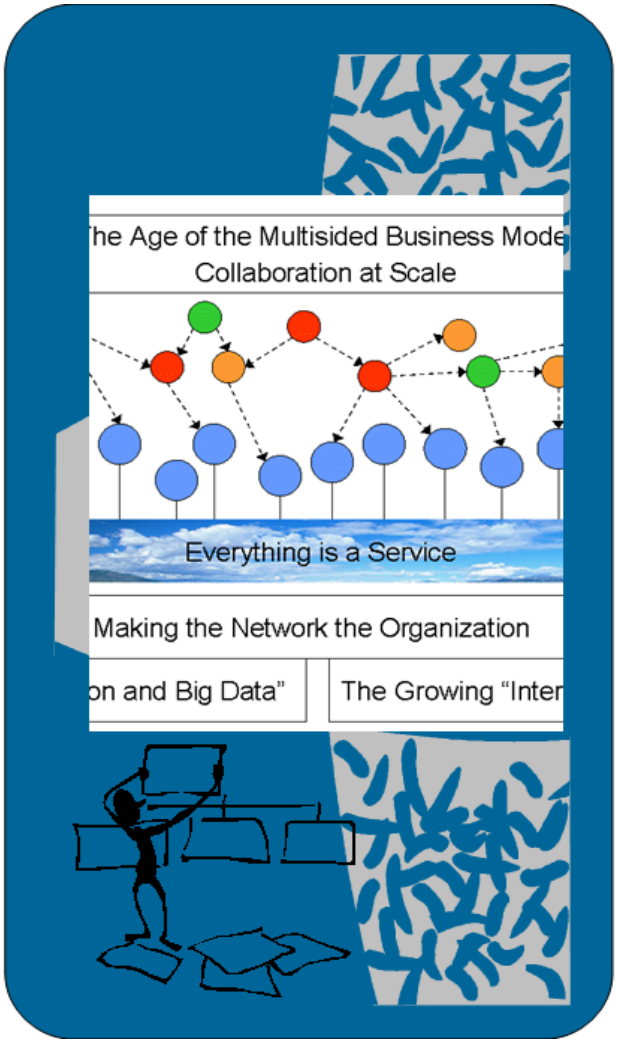

Business Driven Cloud Strategy

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By David Sprott

Originally published in the January 2011 edition of the CBDI Journal

Independent Guidance *for* Service Architecture and Engineering

Business Driven Cloud Strategy

Convergence of Cloud, SOA and BPM

Today we are in the early stages of a transformation in the way business is conducted triggered by Cloud Computing, which will have profound impacts on economics, organizations and business models. The Cloud is rapidly gaining acceptance in the provisioning of utility IT resources, but we must look beyond the purely technology considerations to understand the broader implications and opportunities for business. In this report we outline a roadmap planning approach that integrates Cloud Computing, SOA and BPM in delivering new business models.

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Introduction

In his best selling book, The Big Switch, Nicholas Carr describes how turning computing into a utility will ultimately change society as completely as the advent of cheap electricity. Carr admits that historical models and analogies have their limits, but he has convincing arguments that information technology and electricity share deep similarities.

> *We see electricity as a simple utility, a standardized current that comes safely and predictably through outlets in our walls. The innumerable applications of electric power from televisions to machine tools and assembly lines have become commonplace.*
>
> *But electricity and computing share a special trait that makes them unique . . . they can both be delivered efficiently from a great distance over a network. Because they don't have to be produced locally they can achieve the scale economies of central supply.*
>
> *In the early stages of both technologies where there are few technical standards and no broad distribution network the technology is impossible to furnish centrally. In the early days of electrification factories had to build their own generators if they wanted to use the power of electricity – just as today's companies had to set up their own information systems to use the power of computing.*
>
> *It may take decades for companies to abandon their proprietary supply operations and all the investments they represent. But in the end the savings offered by utilities become too compelling to resist, even for the largest enterprises. The grid wins.*
> *Nicholas Carr, Norton Paperback, 2009*

In the case of electricity Carr goes on to describe how society was profoundly changed as electricity powered railroads, boats, moving walkways and filled cities with a blaze of light. Tabulating machines dramatically changed the cost and timing of the 1880 census and spawned a new world of computing and commerce. But more generally the electric grid accelerated the concentration of wealth in large businesses, a trend that had been forming since the Industrial Revolution.

Cloud Computing embodies utility computing. It's more than a name change, as we discuss in a sister CBDI Journal report this month; Cloud raises the level of encapsulation, abstraction and interface. The result has the potential to have similarly profound consequences on society and business. Like electrification, the change in economics is only one outcome; we must expect widespread change in work practices, skills, business models and business organization.

Today Cloud Computing is "top of the hype curve" and whilst vendors and many enterprises are convinced this is the shape of the future, there remains considerable confusion over how the concept will eventually stabilize and mature. Whilst the economics of Cloud are compelling, any deeper comparison with simpler forms of utility are less useful because we must expect a range of solution patterns that span private, hybrid and public Clouds.

Today Cloud has two primary domains:

a) The successor to Utility Computing – rationalization and automation of technology infrastructure provisioning and operation. Prime movers include Amazon, Microsoft, IBM, HP and Oracle

b) Software as a Service (SaaS) providing multi-tenancy Web hosted applications. Prime movers include Google, Cisco, Salesforce.com but all application vendors are moving rapidly to embrace this delivery approach.

At the center of the Cloud computing universe we have the extraordinary example of Amazon – a company that has recognized the opportunity and acted to introduce a Cloud computing business model that represents a major step out from its core business, yet is highly complementary and revenue earning in an extremely short period.

The global Cloud computing market is expected to grow from $37.8 billion in 2010 to $121.1 billion in 2015 at a CAGR of 26.2% from 2010 to 2015. SaaS is the largest contributor in the Cloud computing services market, accounting for 73% of the market's revenues 2010. M&M Market Research October 11, 2010

We also note IBM, HP and Microsoft are investing massively in global Cloud utilities, which are clearly expected to be a core component of their future business models. Many software vendors are converting their application products to software as a service.

So the questions for all enterprises are:

- Is the impact of Cloud on the future business understood?
- Is there a Cloud enabled business plan in place?

If the answer is no, then it is likely that your Cloud efforts are driven by technologists and accountants, and your business is probably digging a deep hole that is the wrong size, shape and in the wrong place!

In this report we provide an outline for developing a plan and roadmap that integrates the business and technology perspectives. We show how Cloud is one dimension of a change program that needs to be coordinated with SOA and BPM and we describe maturity models that can drive roadmap development that enables business AND technology objectives and goals.

Business Value of Cloud Computing

Amazon wasn't only thinking about making it's customers' lives easier when it went in to the utility computing business. Like every sizable company today, it had been forced to purchase far more computing and storage capacity than it would ever use . . . to accommodate the burst of shopping during the week after Thanksgiving – even though that week only comes once per year. Nicholas Carr, Norton Paperback, 2009

We need to look at the technology benefits of Cloud computing and figure out what they mean to a specific enterprise. A good way to do this is to examine each of the characteristics or principles that underlie Cloud computing and relate these to the business model.

Table 1 below is provided as a start point for thinking about business strategy and models.

Characteristics and Principles	Business Values and Opportunities
Utility Pricing [1]	Reduced or avoided investment Cash flow matched to system benefits
Elastic Resource Capacity	Supports infinitely scalable business – transaction growth, new product lines and channels with minimum infrastructure investment. Enables and supports "green strategies"
Managed Operations [1]	Increased focus on core business. Non core processes outsourced to specialist providers who can provide business continuity and very high service level and quality at reduced cost. Increased componentization and reduce lock-in.
Third Party Ownership [1]	Cost motivation and opportunity to reduce investment, standardize context business processes and reduce unit and variable costs.
Self Service Provisioning and Management Automation	Reduced time to market and reduced cost of change increasing business capability to effect rapid change.
Virtualized Resources [1]	Mobile, global, location independent business. Reduced real estate costs.
Service Enabled [1]	Loose coupled business comprising highly independent capability components.
[1]Note these characteristics particularly are not by any means exclusive to Cloud. However they are intrinsic to Cloud and may be realized at lower cost and risk because of the higher level of interface abstraction in the Cloud.	

Table 1 – Cloud Business Values

Utility pricing is an intrinsic part of Cloud computing, often referred to as “pay as you go” or “pay per use”. The obvious business value is that someone else bears the investment in resources and infrastructure and for the consumer of the service cashflow is matched to system benefits.

The skeptic amongst us might say that elastic resource capacity is just a fancy term for scalability. But Amazon probably wouldn’t agree. It’s much more than simply being able to respond to variability in demand, it’s about managing massive unpredictability of demand without incurring unpredictable costs. Almost as an aside the elasticity also enables a business to minimize carbon emissions.

Managed Operations is a well understood term and larger enterprises already use managed operations as part of their outsourcing strategy to increase focus on the core business. But many enterprises are increasingly less than comfortable about outsourcing large parts of the business to third parties because the de facto contracting approach can actually reduce business agility. With Cloud computing there is real opportunity to break up the hegemony of the large service providers by componentizing finer grained capabilities with strong boundaries that facilitate switching of supplier.

Third Party Ownership of resources and software often creates a stimulus to standardize existing silos both at the infrastructure and application layers.

A very interesting aspect of Cloud computing is the automation of management and provisioning. This capability, which is relevant to all layers of the stack, can deliver dramatic reduction in cost and time to market which can be a significant competitive differentiator. For those organizations that are locked into managed service agreements based on multiple concurrent program releases that consume massive cost, resources and time, this may be the breakthrough they are looking for to reduce time and cost of the product launch cycle.

Virtualization has been a huge topic of interest in IT infrastructure for the last few years. Larry Ellison in particular has been a strident critic of Cloud computing because his company (Oracle) has established a strong business is assisting enterprises to save costs and reduce complexity by rationalizing IT infrastructure. Evidently he still maintains Cloud computing is synonymous with virtualization. But this is self serving because Cloud can deliver virtualization at a higher level of abstraction than the server - at the application and business process. In conjunction with service architecture, Cloud virtualization can deliver a mobile, global, location independent virtual business which comprises purely of service contracts. Today there are some examples of businesses formed entirely of Cloud services but these are as yet, limited sized mashups. But the writing is on the wall; tomorrow’s business models for large and small enterprises will be increasingly virtual.

Finally there is emerging understanding that the business of the future will be inherently “service oriented”. A recent report by McKinsey[1] described this trend as “Imagining anything as a service”.

Technology now enables companies to monitor, measure, customize, and bill for asset use at a much more fine-grained level than ever before. Asset owners can therefore create services around what have traditionally been sold as products. Business-to-business (B2B) customers like these service offerings because they allow companies to purchase units of a service and to account for them as a variable cost rather than undertake large capital investments. Consumers also like this "paying only for what you use" model, which helps them avoid large expenditures, as well as the hassles of buying and maintaining a product.

In the IT industry, the growth of "Cloud computing" exemplifies this shift. Consumer acceptance of Web-based Cloud services for everything from e-mail to video is of course becoming universal, and companies are following suit. *McKinsey Quarterly, August 2010*

The concept of the "service oriented enterprise" is of course at the heart of delivering business value from the Cloud. The well formed service interface is the comprehensive external view of the offered capability or product and allows the consumer to use the service in a highly automated and managed manner. SOA is therefore an essential component of all layers of the Cloud, but also, as described by McKinsey, it enables business services to be consumed directly from the Cloud.

However, contrary to this visionary service oriented Cloud of the future, there is currently considerable debate about whether Software as a Service (SaaS), particularly SaaS Web application delivery, should even be classified as Cloud, because the majority of implementations are not service oriented. They are predominantly multi-tenancy versions of ASP. Yet the SaaS sector is reported to account for some 73% of Cloud market revenue. Some might argue that means Cloud market revenues are seriously exaggerated.

Today SaaS usage is predominantly in relatively isolated, business driven functional support, particularly in the SMB sector. Many SaaS purchases are made by business domains in isolation of enterprise strategy with low integration. Larger enterprises are proceeding slowly with SaaS applications because they rarely provide a comprehensive service architecture which allows effective integration with wider enterprise service and application portfolios. We envisage that SaaS will thrive in its current form in the SMB and standalone market, but that even SMBs will soon be demanding better integration. In the enterprise market it's clear that demand will only rise if high quality service architecture support becomes an intrinsic part of the de facto offering.

Business Risks of Cloud Computing

There is widespread understanding of the potential security risks in Cloud and Utility Computing. For this reason many larger enterprises are constraining their adoption to private Cloud architectures. In 2008 the Gartner Group described Seven Cloud-computing security risks which were summarized in a Network World report[2]. See Box.

This is a reasonable list but we recommend that the security risks also need to be viewed using a business risk assessment framework. We would therefore add:

- Triage based on core or context (mission critical or not) capability – the company will not fail if a context (non mission critical) service goes off line.

- Exit clause – plan for change of provider at short notice. In today's world, planning for long term viability is nonsense. Rather planning for business agility and minimizing supplier loose coupling is essential. Well formed service architecture would be a good step towards achieving business level loosed coupling.
- Regulatory risks – it has become clear that ownership of Cloud based data, particularly consumer data, will increasingly come under regulatory scrutiny and business models should plan for this.

Recognizing the security issues large enterprises are adopting the de facto strategy of Private Cloud deployment. This makes sense as security standards and practices are very immature and private deployments allows all parties to gain experience in a low risk environment.

But in line with previous CBDI guidance[3] we recommend that security is not simply a set of technology based standards, it must be an integral part of the overall service and data architecture and associated business process designs.

1. Provider privileged user access – service providers must comply with physical, logical and personnel controls that apply to inhouse personnel
2. Regulatory compliance - service providers must be subjected to the same governance as internal functions
3. Data location – providers must make contractual commitment to obey local privacy requirements.
4. Data segregation – providers must establish water tight controls over data access
5. Recovery – have contractual commitments over replication, disaster recovery and time to restore
6. Investigative support – have contractual commitments that permit investigation and discovery
7. Long-term viability - ideally, your Cloud computing provider will never go broke or get acquired and swallowed up by a larger company. But be sure your data will remain available after such an event

Based on: Seven Cloud-computing security risks Gartner Group (Network World, 2008)

Business Strategy

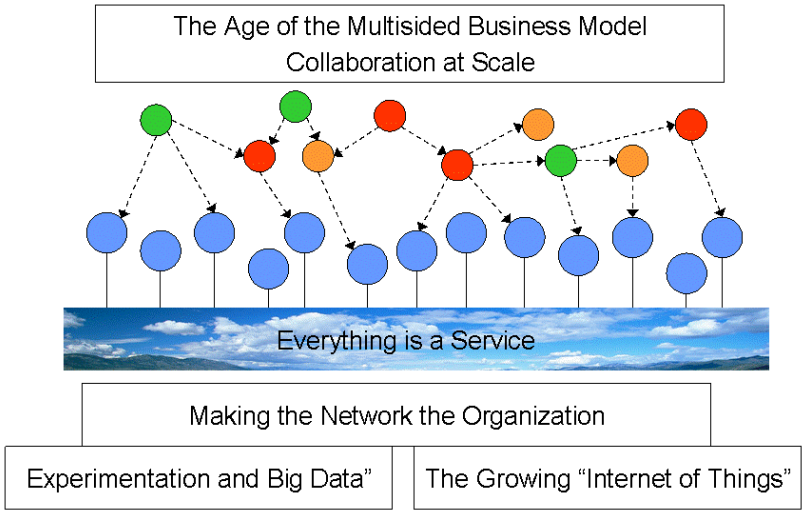

Figure 1 – Strategic Business Model

In today's and tomorrow's world business and IT strategy are inseparable. Most modern enterprises are information rich and business strategy is both enabled and driven by information technology. We must expect Cloud computing to have major impacts on business strategy. Many of the opportunities and risks discussed above will inform this discussion.

Figure 1 suggests a model for the archetypal business in the utility computing era developing some of the trends proposed by McKinsey, referred to previously. At the heart of the business model is the principle that everything is a service.

Everything is a Service?

Service! The word "service" is surely one of the most abused terms in our lexicon. In practice the term Software as a Service refers to any service delivered by a provider to a consumer. Similarly a managed service. In contrast software services as part of a Service Architecture provide an automated, software based, encapsulated capability which is offered according to a contract (interface). In the service architecture, enterprises can execute, monitor, manage and change service application assets at an optimum granularity – equivalent to business capabilities and services that have relevance to business processes. Capability owners can offer and consume services on a pay for use basis, for what have conventionally been operated as monolithic applications and sold as products. Internal divisions, themselves organized as capabilities, plus B2B and end user customers engage directly with these service offerings which allows them to automate and integrate them into their own business processes and to account for them as a variable cost rather than undertake capital investments.

As Cloud deployments evolve we can observe wide variation of service architecture compliance by layer in Table 2.

Layer	SOA Compliance	Future Direction
IaaS	High. Resources generally available as services.	More standardization will be achieved to increase loose coupling and reduce lock-in
PaaS	High. Automated, self service provisioning and use managed by Web Services.	More standardization will be achieved to increase loose coupling and reduce lock-in
SaaS	Low. Predominant architecture is conventional applications reengineered to multi-tenancy architecture. Service interfaces for B2B, not as comprehensive publication of core application functionality.	Enterprise demand will drive transition to service architecture over time.

Table 2 - Cloud Layer SOA Compliance

Business strategists should now be actively planning to transform product offerings into services. Competitors will be exploring these avenues. This is equally relevant to end user enterprises and software vendors. This represents a radical transformation of how assets are managed, in which physical and intellectual capital combine to create capability platforms for an array of service offerings that combine existing and new, differentiating products. Cloud computing enables this new model by providing an

economic service platform that is inherently service oriented and supports deep collaboration by virtue of its loose coupled, multi-tenancy architecture.

Multi-sided Business Model

A multi-sided business model involves interactions among an ecosystem or multiple parties in contrast to the conventional one on one transaction. In many cases the model arises because of data gathered from one set of users generates revenue when used in different contexts. For example:

- Credit card providers build market intelligence businesses on the back of consumer purchase information
- Amazon hosts a third party network of suppliers who offer specialist and or second hand books to Amazon customers.

Cloud computing enables the multi-sided business new model by providing an economic service platform that is inherently service oriented. Its inherent elasticity facilitates collaborations with minimum up front investment and the ability to meet unpredictable demands.

The Network is the Organization

The Internet has already had profound impacts upon the way people work, particularly in facilitating location independence and third party collaboration. Many organizations use talent on a global basis, organizing around projects or products regardless of location.

As discussed above, we should anticipate that organizations will morph to align the organization with capability services; this will potentially be a major transformation as capabilities and subsidiary components alike may be insourced, outsourced or offshored depending upon various criteria such as cost, skills and resources, time to market etc.

Cloud computing facilitates this transformation by providing the service platform that is inherently loose coupled, and allows reconfiguration with minimum cost and time.

Experimentation and Big Data; The Growing Internet of things

Once upon a time data was structured, planned and managed an integral part of transactional business processes. Today data is fluid, constantly changing in nature, structure, relationships and size. Yesterday analytical data was retrospective, manipulated into data warehouses before it was accessed by specialist tools in retrospect. Today and tomorrow data usage is in real time analyzed by heuristic business rules to trigger events and alerts, at the instance level and in aggregate. The responsive business process which alters its behavior to customize its response depending upon context and macro and micro events is already here. The data required to support the responsive business process[4] stretches way beyond conventional transactional data and the volumes generated by web sites, RFID and other devices is already immense and tomorrow will be unimaginable.

Use of data in business is no longer prescribed, but rather experimental, real time and the rules changed on a dynamic basis. Cloud computing allows us to store and manipulate these enormous volumes in an economic manner and allows us to choreograph data from many sources in a data ecosystem.

Cloud Strategy

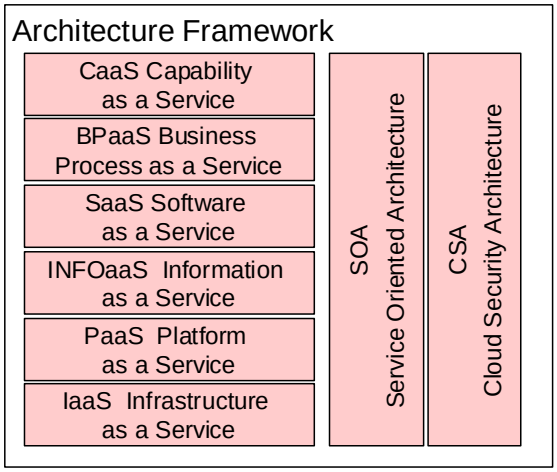

Figure 2 – Cloud Computing Reference Architecture

The Cloud is clearly a multi-dimensional capability with service delivery principles and characteristics that can be applied to a variety of purposes. To assist in developing strategy, and crucially communications, it's vital that there exists in each enterprise a reference architecture that provides useful guidance together with policy, standards and practices that ensure appropriate levels of consistency are achieved where necessary.

Figure 2 illustrates example reference architecture. We have extended the de facto NIST architecture referred to previously to include additional layers for Information and Capability as a Service. In addition we have added cross cutting layers for SOA and Cloud Security. This is intended as a template for enterprises to develop their own versions of this simple picture in a manner that reflects their own priorities.

However getting the framework in place is the simpler task. What's required is to detail the policy, standards and practices dimensions mentioned above and in parallel to understand how the layers will contribute to business strategy and create opportunities for competitive differentiation or significant improvement of business model.

Clearly the opportunities in the Cloud are potentially much more than simply better deployment. Table 3 below provides examples of business model opportunities as a starter for 10.

Layer	Description	Example Business Model Opportunities	Example Framework Implications
BPaaS	Business Process as a Service	Beyond BPO – agile outsourcing for business processes and entire stack Business process components to upgrade existing BPO and or legacy applications	BPaaS policy covering permitted behaviors in that layer, sourcing and dependencies with called services from other layers

SaaS	Software as a Service	Business process improvement Application portfolio rationalization	Permitted SaaS layer policy on behaviors. Requirements for publication of SaaS capability as services.
SOA	Service Oriented Architecture	Standard capability services for enterprise Capability service products Componentized (disaggregated) business	Policy on capability service contract requirements, behaviors, sourcing and permitted calls by dependent and depending services. Guidelines on component scoping and boundaries for both business and technology
INFOaaS	Information as a Service	Semantic consistency for business process standardization	Requirements for conformance with semantic standards for core Business Types covering both transactional and business intelligence data domains
PaaS	Platform as a Service	Faster time to market Lower license costs	Delivery technology and supply policy. Security practices, guidelines and requirements Integration and management policy
IaaS	Infrastructure as a Service	Divest non core business Business elasticity at lower cost	ITSM policies Supply policy Security policy

Table 3 –Business Model Opportunity examples by Cloud Framework Layer

From the analysis of business model opportunities we can develop clarity of business drivers that can inform Cloud Roadmap planning.

Maturity Model

Introduction to CBDI SAE Roadmap Planning

We developed the original CBDI SAE Roadmap planning approach for SOA in the period 2004 - 2006. The fundamental nature of the approach was to plan capabilities that were required to support organizational objectives and to analyze dependency and accountability in ways that the change management process could be easily communicated, managed and measured.

The central concept of CBDI Roadmap planning was based on the work of the Software Engineering Institute (SEI)[5] using the basic concept of capability. The CBDI model was however developed to be more relevant to business objectives and goals and to align with stakeholder interests.

The capabilities were initially organized as a Maturity Model with Maturity States mapped to Streams. In the SOA model the standard Maturity States track the evolving maturity of SOA measured by service architecture integration across the business and its ecosystem. This perspective is readily mapped to business objectives and goals. The Streams provide an organization neutral decomposition of capability that aligns capability areas with stakeholders such as architecture, infrastructure, governance, projects and programs and so forth.

The Maturity Model therefore provides a clear mapping of capabilities required to support business objectives over time. It's then a straightforward matter to transform the Maturity Model into an SOA Roadmap by turning the Maturity States into time periods and streams into stakeholder groups that take accountability for capability delivery. At the same time it makes sense to refine the intersecting capability plans so they form a stable base for stakeholder group activity.

Cloud Roadmap Planning

The CBDI methodology outlined above has been used by many large enterprises worldwide to plan and manage their SOA adoption. The key characteristics of the approach are the ability to clearly align change management with business objectives and goals, to coordinate, manage and monitor cross functional activity and to communicate to a wide audience. It seems self evident that these characteristics will be equally useful in planning and managing Cloud adoption. Further there is, as has been discussed, considerable overlap between SOA and Cloud and existing users of the CBDI SAE Roadmap approach will already have wide understanding, and hopefully buy in to the approach, and potentially be able to harvest, reuse and extend existing materials and plans.

Figure 3 is an example of an integrated Maturity Model for Cloud which subsumes SOA adoption considerations.

Business Goals / Streams	Cost Reduction	Services Based Products	Business Disaggregation
Management	Cost Measurement Systems	ITSM Measurement Systems	
Business Design		BPaaS for Key Capabilities	BPaaS for Ecosystem Processes
Service Architecture	Cloud Deployment Architecture & Policy	Capability Services	Ecosystem Service Architecture
Information Architecture	Semantic Standardization		Ecosystem Semantic Architecture
Security Architecture	Private Cloud Security Architecture	Hybrid Cloud Security Architecture	Hybrid/Public Cloud Security Architecture
Life Cycle Infrastructure	Integrated Cloud Tooling and PaaS Delivery	PaaS for Productized Services	
Technology Infrastructure	Private Cloud	Private/Hybrid Cloud	Hybrid/Public Cloud
Sourcing and Supply	eSCM Level 3	eSCM Level 4/5	
Organization	SOA CoE, External IT Infrastructure, Risk Mgt	Service Product CoE External BPaaS	Shared Business Process CoE
Process and Governance	Infrastructure Policies and Governance Process	Product Policies and Governance Process	Ecosystem Governance
Programs	RFP and PMO compliance	Product Design	

Figure 3 – Example of Integrated Cloud Maturity Model

In the example maturity model we have used business goals as the headline maturity model states – cost reduction driving IT rationalization, service based products driving higher abstraction capability deliveries and business disaggregation influencing componentization and partner integration.

We may expect that the maturity states in the Cloud Maturity Model will vary considerably from one enterprise to another. The model opportunities listed in Table 3 will be a good place to start. In addition it is highly likely that many enterprises will assess their current maturity state as Early Learning – a maturity model state that

is part of the base CBDI SOA Roadmap template. Table 4 shows some examples of common maturity model state combinations as scenarios or patterns.

Maturity Model States			
Early Learning	Infrastructure as a Service	Divest Non Core Business	
Early Learning	Business Process Improvement	Standardize and Rationalize Application Portfolio	
Early Learning	Semantic consistency	Standardize Business Processes	
Early Learning	Semantic consistency	Enterprise as set of Capabilities	Divest non core business

Table 4 – Example Maturity Model Scenarios

The Streams shown in the Figure 3 are also very similar to those in the template SOA Maturity Model. This shouldn't be a surprise because Streams represent a decomposition of stakeholder interests which don't necessarily change dramatically with the introduction of the Cloud. The primary change is to add a Security Architecture in view of the very high importance of this domain in Cloud deployments. In addition we have added a Provisioning Stream because in a Cloud environment external provisioning and ITSM will be of considerable importance, plus Information Architecture and Business Design. In practice we frequently add these three Streams for SOA specific models.

The intersection of Stream and Maturity Level are the capabilities. And in this very high level example the capabilities shown are naturally, very high level. Yet even at this summary level the model has some real value in communicating the overall strategy and how this relates to business goals.

In practice the high level model will be encapsulating considerable depth of capability detail that is used to coordinate, measure and manage the Cloud adoption process.

States and Streams

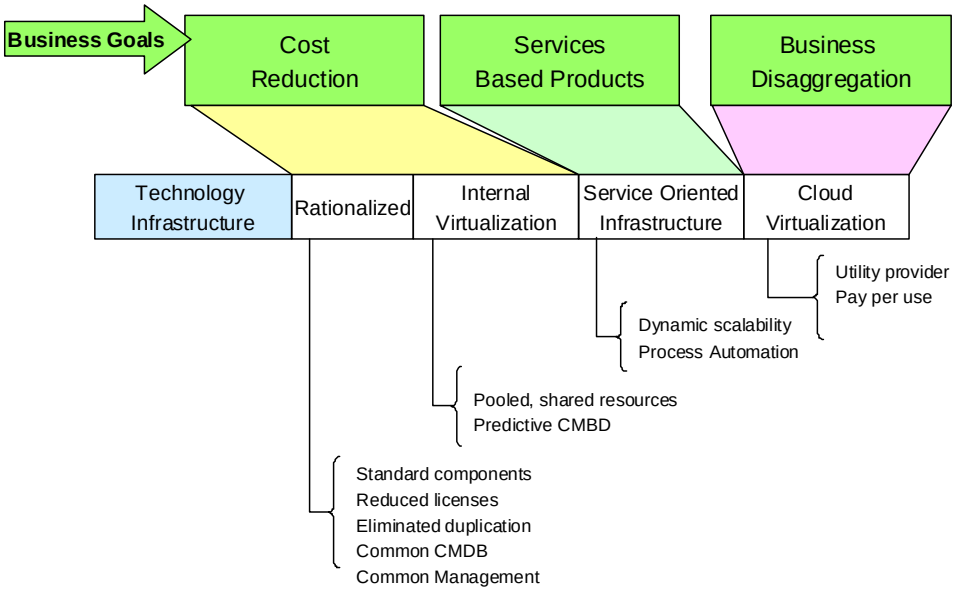

Figure 4 – Example Stream State Decomposition

The summary maturity model simply maps stream states to Business Goals. As discussed this is a high level of abstraction and the detail required for planning, managing and monitoring is considerable. At the next level it makes sense to look at each Stream individually, decompose the top level capabilities and map the dependencies to other streams.

At this next level it also makes sense to define maturity model states that are specific to each Stream. Sometimes the Stream specific states may be a repetition of the summary in the high level model, but as shown in the example Figure 4 the states will usually be Stream specific also. What's essential, as shown, is to link the Decomposed Stream states back to the business drivers in order to understand the business value and communicate the ROI.

Provider Model Variant

The example maturity models shown above are clearly for consumers of Cloud services. Not surprisingly the model for providers may vary considerably, but most models will combine provider and consumer needs. Remember that even Amazon acts in both the consumer and provider role as they offer service based products.

In Figure 3 sharp eyed readers will have spotted reference to the eSCM[6] (eSourcing Capability Model). The eSCM model developed by Carnegie Mellon and its spin-off ITSqc is a useful set of guidance and capability requirements that focus on the ITSM maturity from both provider and consumer perspective. As organizations become more and more dependent upon Cloud providers, the need to not just select, but to organize and manage the relationship becomes a major capability area for development.

Cloud Reference Framework

This report is an introductory report to Roadmap Planning for Cloud. We will return to the topic and drill down in more detail on capability requirements for each stream in further research reports. However this report wouldn't be complete without mentioning the need for a Cloud reference framework, which is a broader framework that subsumes the architecture framework discussed above and illustrated in Figure 2.

In the SOA domain the concept of reference model and reference framework are well understood as foundations for best practices that ensure consistency of approach, architecture and governance where it is appropriate. Figure 5 is a top level view of a Reference Framework for the Cloud. There are three major components to the framework.

1. **Model:** Detailed concept model together with definitions as a mechanism for clarity and consistency that can form the basis for coherent cross lifecycle deliverable templates, asset recording and management.
2. **Reference Architecture:** Defined architecture Views with relationships to policies, practices, standards, patterns and deliverables.
3. **Support Framework:** Defined practices and policies relating to IT Service Management, Governance, Organization and Roadmap and Change Management

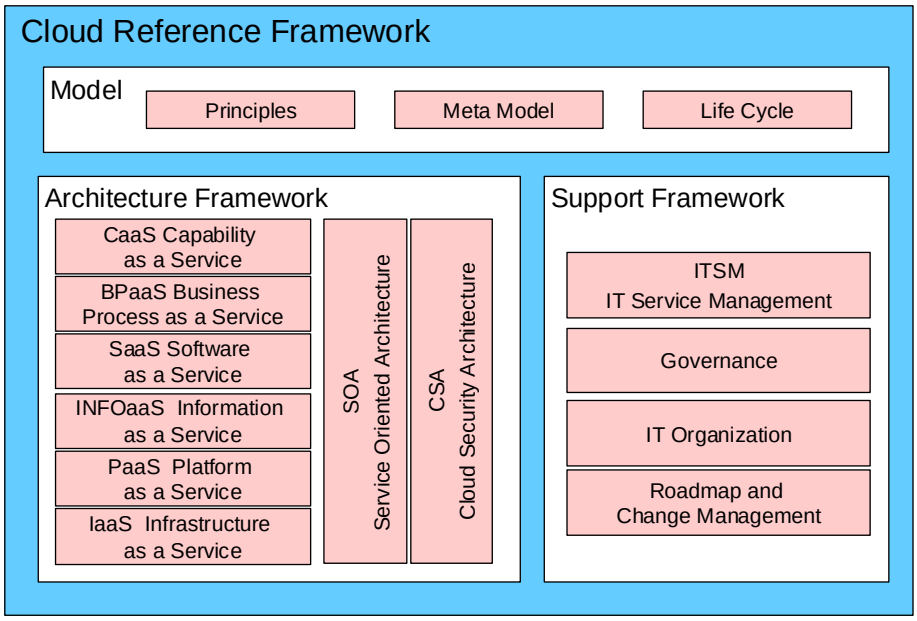

Figure 5 - Cloud Reference Framework

The Reference Framework defines and records policies and best practices that underlie all of the Roadmap Streams, and is an essential checklist for planning and managing the delivery of capabilities required within each Stream.

Conclusions

Cloud strategy is a business issue. Many Cloud initiatives are strongly technology led because there are important technology centric benefits to be realized. And in context with the Cloud Maturity Model this is important Early Learning state activity. But this early activity should be guided by a broader picture of where the enterprise needs to go. We can imagine that Amazon explored technology ideas, but very quickly realized they had a significant opportunity. Building the Amazon Web Services was clever, but creating a huge, worldwide community around them was even cleverer, creating a user base for business model extensions.

Many Cloud services are adopting well formed service architectures as a matter of course which is contributing to the level of SOA adoption because of the advantages of self service, loose coupling and encapsulation as well as opportunities for mediation, management and monitoring. At the SaaS layer (not the BPaaS layer we emphasize) the absence of service architecture indicates a level of immaturity of product offerings, which is reflected in the low adoption of application SaaS in larger enterprises. We may expect this will change as the Cloud matures, and vendors realize they will not get traction in the enterprise market without better application architecture.

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[1] Clouds, big data, and smart assets: Ten tech-enabled business trends to watch, McKinsey https://www.mckinseyquarterly.com/Clouds_big_data_and_smart_assets_Ten_tech-enabled_business_trends_to_watch_2647

[2] Gartner: Seven Cloud-computing security risks, Network World, July 2008

http://www.infoworld.com/d/security-central/gartner-seven-Cloud-computing-security-risks-853

[3] The CBDI-SAE Knowledgebase Security Portal links to a wide range of security practices including Security Architecture Within Enterprise SOA, a report originally published in the CBDI Journal, December 2006

[4] See CBDI Journal report - Information Services Architecture for Responsive Process Management, January 2011

[5] SEI http://www.sei.cmu.edu/cmmi/

[6] eSCM http://www.itsqc.org/

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