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Practice Guide . . . .
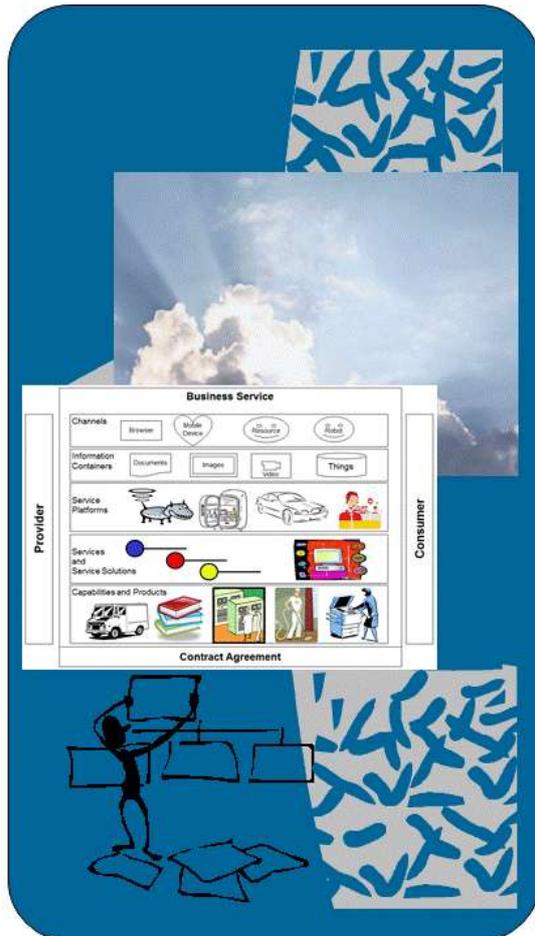## Everything is a Service?

The Cloud movement is discussing the term Everything as a Service (EaaS or XaaS). In principle this is a welcome development, encouraging business and IT participants to adopt services and service oriented concepts everywhere. However it appears that the E/XaaS initiative may be more about marketing than reality. In this article we explore how this very promising idea might be developed to clarify Cloud Service taxonomy and deliver convergence of business and IT perspectives in a Unified Service Model
By David Sprott

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Everything is a Service?

Exploring the path towards a unified service model

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Introduction

> *Cloud computing is driving discontinuity that introduces exciting opportunities and costly challenges. Organizations need to understand these changes and develop realistic cloud sourcing strategies . . .*
> *Gartner Group 2011*

We all understand Cloud Computing is driving great change in infrastructure deployment as well as IT and business systems architecture. One of the challenges is to elevate the communication of Cloud capabilities to a business level and to integrate the concepts with the emerging Service Based Economy and Enterprise.

The concept of "Everything as a Service" has been swirling around in the Cloud community for a few months. The idea is that in addition to infrastructure, platform and software as a service there's a whole range of service layers such as Backup, Communications, Desktop, Database, Hardware, Identity, Knowledge, Storage and many more. This is rather unfortunate as the additions all look like subtypes of the existing layers. More fundamentally the scope of "everything" seems to be constrained by Cloud technology.

To date the de facto Cloud standards body NIST has apparently not moved to embrace these ideas, and although HP in particular has been active in promoting them, it may be we need to encourage a broader definition of EaaS so that it can be more than Cloud marketing speak.

NIST has done a great job in defining general standards for the Cloud. However the treatment of the service concept in Cloud standards is less than clear. The core term service is heavily overloaded and used loosely in the Cloud reference architecture. Regardless of Cloud, there is overlap with SOA terminology and a requirement to clarify the service role as it relates to Software as a Service (SaaS), Service Oriented Architecture (SOA) and IT Service Management (ITSM and ITIL).

What's needed is an integrated Service model that establishes conceptual convergence between business and IT, and addresses the holistic business service comprising People, Product, Process and Technology. If we then apply these generic service concepts to Cloud and non Cloud services, we are more likely to be able to address the question of Everything as a Service.

In this article we explore the opportunity for a unified service model. We look at existing service models and suggest how these can form the basis for a common core

model that spans business service design, software service design and Cloud implementation and deployment.

The Service Story so Far

We have been moving down the services track for over a decade. It was in the year 2000 when IBM and Microsoft led an industry collaboration to deliver the Web services standards and by so doing kick started the service and SOA market. And for the past decade Web services and SOA have remained at the top of the technology toy box. It's only in the last couple of years that new technology toys have emerged to supersede SOA which has now morphed to become business as usual.

During that same period the entire business world has embraced services. Since the 1970s, authors like Alvin Toffler[1], Daniel Bell[2] and John Naisbitt[3] have predicted the post-industrial society. They forecast the end of the industrial era and the dominance of services and information. This is not a new message, the entire service provider industry has formed around this idea, and in the USA today non-manufacturing industries account for almost 90 percent of the economy. Virtually every product now has a service component to it and many products have been transformed into services.

But strangely SOA has been a highly controversial trend. The primary issue has been the fundamental tension between delivery of strategic service architecture and delivery of solutions supporting business process change. This conflict of priorities has frequently resulted in tactical, solution centered service architecture which inevitably leads to service anarchy and legacy services.

Three years ago one industry analyst went so far as to declare "SOA is dead!" Whilst this assertion was widely disputed it highlighted the issue. Since then SOA has been adopted by many enterprises, but it must be said, primarily as a technology led initiative to improve the structure of IT assets and resources. Business involvement in software services has been very low.

Perhaps as a result, genuine convergence of software services and business services has been relatively rare to date. The retailer Amazon has been a trail blazer, famously establishing the policy that all software services should be capable of being "externalized", that is directly usable by customers and suppliers as Web services. And the result is obvious to everyone, as the Amazon business model is increasingly becoming a services platform including provision of Cloud services. The epitome of the service based platform is probably the Kindle service that illustrates perfectly how Amazon has turned into a service provider – creating a tight but highly effective relationship with its customers. We can see exactly the same pattern at work with Apple and its customers.

It's not surprising that Web based enterprises should lead this integration of business and technology. The platform integration makes that straightforward. But more conventional enterprises are also seeing opportunities to follow this lead. Retailers are offering multi-channel, online and store based sales and service to retail consumers. Logistics companies are providing customer access to delivery services via software services. Airlines are providing multi-channel processes for ticketing, boarding card and other related services that help travelers reduce the stress of travel.

Cloud services are becoming a major priority for many enterprises. In many ways the Cloud is a service based environment supporting:

- virtualized, encapsulated services

- self service, on demand consumption

- multi-tenant, dynamically scaled resource pool

- managed and monitored

- pay as you go usage

Most Cloud infrastructure environments (IaaS) also adopt SOA principles. Infrastructure capabilities are provided as invokable software services under contract. The service architecture is manifestly key to the commoditization of the infrastructure layer enabling self service provisioning and automated management.

However at other levels of the Cloud reference architecture service usage is not so formal. Whilst SaaS is being widely adopted, in my own experience much of the usage is narrowly targeted at specific business problems, and acquisition of SaaS solutions is frequently undertaken by line of business managers independent of their IT organization. Whilst this may indicate failure of IT organizations to provide adequate service, the fact is SaaS solutions' core capabilities are not always SOA enabled, and the limitations of the architecture may not be apparent until the solution needs to be integrated into a wider enterprise application/service portfolio.

So whilst Cloud environments are inherently service based, and there is evidently widespread agreement that all Cloud architecture should be compliant with SOA principles, all Cloud layers are **not** necessarily SOA based. This prompts some questions:

- what is a service?

- what are the various types of service?

- is everything a service? Should it be so?

What is a Service?

Before we attempt to answer these questions, we need to take a broader view of what's happening in the service world.

Figure 1 suggests that software and business services will converge as the software components of the business service become ever more central to the customer delivery. If we reflect on the transformation of Apple's fortunes as they integrated world beating products and services, we might conclude this convergence seems highly likely to be the engine of the service based economy.

That the world is transforming to a service based economy is not in doubt. In his blog[4], Dave Gray argues eloquently that there is fundamental economic restructuring underway driven by the worldwide economic crisis and facilitated by the digital infrastructure and social networks.

The old world was an industrialized, producer economy, in which very large corporations became larger and larger by leveraging economies of scale. Products were commoditized; processes and systems were standardized and transactional in nature. In contrast, the new world is already predominantly a service based economy where companies create relationships with their customers and deliver value added services that are tailored to their customers' needs. We must plan for processes to

become adaptive and responsive, frequently using analytics to deliver customer satisfaction.
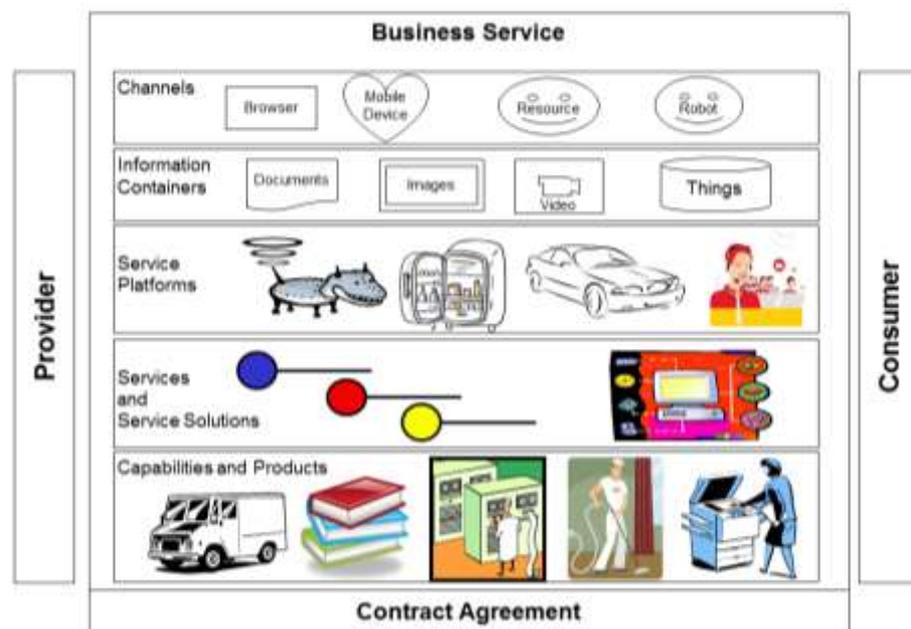

Figure 1: The New Service Framework

Dave Gray is stating the obvious when he says in the post-industrial economy there is an abundance of information, along with networks and mobile devices for moving that information around and the traditional information containers like documents and images, will be complemented with "things".

> *Your network of friends and acquaintances, the efficiency of your car's engine, the things you do, the places you go, the things you buy, what you think about them, and even your random throwaway thoughts are being captured in foursquare check-ins, tweets, status updates, photo and video uploads and other kinds of "data exhaust" that you may not even know you're generating, simply by using your phone and other devices.*
> *Dave Gray 2011*

The things become service platforms. Your smart phone, car, fridge, house, apartment or power supply meter all provide and consume services and are able to interact with other smart things to provide customized services and capabilities.

Existing Service Models

Of course services are not always software enabled services. There will always be physical services such as transport and logistics, health services, construction services, people services, maintenance services, the list is endless. However what we should anticipate is that most of these services will be complemented with, better enabled and potentially differentiated through software services. Which suggests service standards need to evolve; and business and service modeling languages need to converge.

There are sadly a wide variety of standards and languages in the service area. There have also been various attempts[5] to rationalize these disparate efforts, with minimal success. Box 1 below shows a selection of service definitions from authoritative

sources. We can see the technology centric definitions mostly align around services delivering capabilities under some form of contract (or description). In principle most technology centric service models have embraced the idea that the Service is a concept that is independent of technology. They work equally well if the service is being provided by a software service or one or more physical resources that comprise a capability. However these models are intrinsically scoped from a technology perspective and, to a greater or lesser extent, lack a business perspective. They are after all, technology models. In developing them there was no remit to address a wider audience.

CBDI – Service: A capability offered by a provider to a consumer according to a contract.

ISO 9004 - Service: is a result. This result is produced when people carry out activities that are oriented towards meeting customer needs.

ITIL – IT Service: provided to one or more Customers, by an IT Service Provider. An IT Service is based on the use of Information Technology and supports the Customer's Business Process. An IT Service is made up from a combination of people, Processes and technology and should be defined in a Service Level Agreement.

OMG – BPMN: Service: The fundamental constructs needed for modeling services and interfaces.

OMG – **and OASIS Service Reference Model.** Service: A mechanism to enable access to one or more capabilities, where the access is provided using a prescribed interface and is exercised consistent with constraints and policies as specified by the service description.

OMG – SoaML: Service: a resource that enables access to one or more capabilities.

Software Engineering Institute – CMMI for Services: Service: A product that is intangible and non-storable. A kind of product. A useful result of performing process activity. Useful intangible and non-storable results delivered through the operation of a service system, which may or may not have any automated components, encompassing everything required for service delivery, including work products, processes, tools, facilities, consumable items, and human resources.

TOGAF- Business Service: Supports business capabilities through an explicitly defined interface and is explicitly governed by an organization.

TOGAF – Platform Service: A technical capability required to provide enabling infrastructure that supports the delivery of applications.

Box 1: Some Service Definitions

Not surprisingly the business service standards focus on people, product and process. But neither the technology or business oriented service models reflect a composite perspective of the wide array of capabilities that may be assembled to form a customer facing service. Whilst they may accommodate networks of related services, or indeed hierarchies of different types of service, they do not provide the rich model that can coordinate the multiple stakeholder perspectives, nor provide the taxonomy that makes explicit the various types of service.

Changing Requirements for Service Models

There is a further question of whether the service concept embodied in both classes of model adequately represents the type of service that we will provide in future. As discussed above, there is widely held opinion that we are moving from a product based, industrial economy to a service economy in which the focus will move away from mass market transactions to individualized relationships. Existing service

models are therefore predicated on a transactional world, whereas the service of the future will need to support individualized relationships.

Products are designed to be consistent and uniform with managed differentiation, for example options on an automobile allow customization, but they will always be limited to rule based product combinations. In contrast effective services will incorporate products but be co-created with customers. A business service combines people, products, process and technology resources in a customer specific version of a generic process. In a business to business situation "customer onboarding" is industry standard terminology for the customization process. In a Web based business context, the online customer is usually able to set preferences relevant to their service and increasingly interact and receive the service through multiple, concurrent channels that can be varied on a dynamic basis.

In 2004 Chris Anderson[6] popularized the concept of the long tail in Wired Magazine. He argued that many of our assumptions about popular taste are actually artifacts of poor supply-and-demand matching - a market response to inefficient distribution which directly reduces catalog content to optimize costs. It's the physical, industrialized economy that puts dramatic limitations on our choice by focusing on commodities. But in the online, virtual world these limits disappear, and our ability to market niche products and services alters dramatically. The opportunity and challenge therefore for all businesses is to forge a personal service relationship with each consumer (bearing in mind this applies equally to all service markets, not just retail).

Customization is always a major challenge in all service deliveries. There is a natural tension between the provider who is interested in standardizing service elements and reducing onboarding costs where possible, and the consumer who wishes to minimize integration costs and integrate with existing technology and processes. Into this model we also need to throw into the mix the concept of structured and unstructured behaviors.

This is particularly relevant to physical aspects of complex service deliveries, such as requirements to substitute resources with varying SLAs, or introduce temporary rules to accommodate highly unusual circumstances for reasons outside the provider or consumer's control. Whilst we might like to think we can design highly structured online services that cover the totality of required behaviors, there is an implicit competitive challenge to respond to unstructured situations to improve the quality of the delivered service in some dimension such as security or safety. And if this topic seems a little esoteric, consider the services offered by or consumed by a robotic device[7] which operates in a hostile environment and is has delegated responsibility for its actions.

This discourse suggests a unified service model needs to articulate more than the basics of the service, provider consumer relationship. It must encompass a richer set of characteristics that reflect tomorrow's service based business.

These could include:

- a common core model that spans business and IT concerns
- separation of application services, SOA services and service management services

- facilitation of service personalization, differentiation and customization

- identification of structured and less structured behaviors and capabilities

- integration of different perspectives of multiple stakeholders

- the coordination of physical and software services

A Richer, Unified Service Model

From the foregoing it will hopefully be clear that we need more than simply a great debate about definitions of the service concept and a merge of the various service models that already exist. We need a richer set of models and an appropriate level of convergence or alignment together with a rationalized taxonomy that clarifies type of service.

A common core model that spans business and IT concerns

Separation of application services, SOA services and service management services
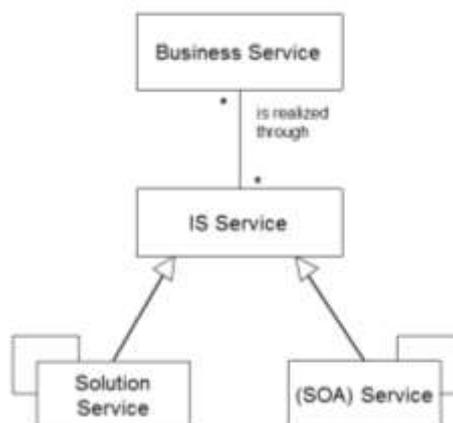
Figure 2: Proposed Core Service Model

Let's start with the core service model – the primary structure and nomenclature. Our objective is:

1. To resolve confusion over types of service and

2. To facilitate convergence between business and IT services.

Interestingly the TOGAF meta model provides a good foundation, with the relationship between the Business Service and the IS Service. The TOGAF construct separates Business Service and IS Service (Information System Service) recognizing that the delivered Business Service may vary from the aggregate of the supporting IS Services.

But what is an IS Service? In TOGAF it's too general to be helpful in understanding architecture or purpose. We recommend therefore that the IS Service is subtyped into Solution Service and SOA Service, where SOA Services are callable, fully encapsulated, loose coupled services with comprehensive behavior specification.

You may be thinking, why parenthesis around the SOA? We suggest that even now, SOA has become business as usual. Increasingly all Business Services will be supported by SOA Services, and in time a Business Service will always be

supported, if not synonymous with a callable service. In time, everything is a Service! Meantime if you wish to make yourself completely clear, then use SOA Service.

Meta Object	Definition	Origin
Business Service	Supports business capabilities through an explicitly defined interface and is explicitly governed by an organization.	TOGAF
Information System Service	The automated elements of a business service. An information system service may deliver or support part or all of one or more business services.	TOGAF
(SOA) Service	A loose coupled software capability offered by a provider to a consumer according to a contract.	CBDI-SAE
Solution Service	A Service provided to one or more Customers, by an IT Service Provider. An IT Service is based on the use of Information Technology and supports the Customer's Business Process. An IT Service is made up from a combination of people, Processes and technology and should be defined in a Service Level Agreement.	ITIL

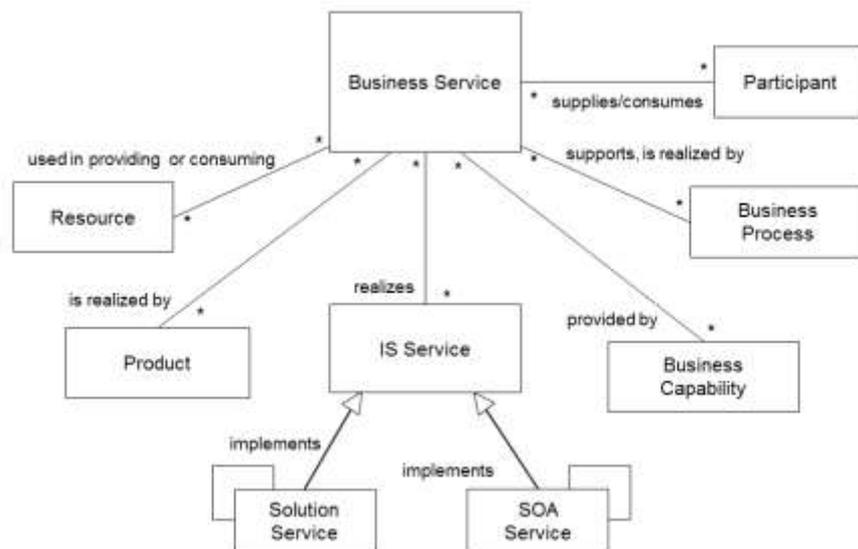**Table 1: Proposed Service Concept Definitions**

Figure 3: Core Service Context

Let's now put the Core Service Model in context. The Business Service is a composite service potentially comprising resources, capabilities, business process and product. The Business Service may be entirely virtual or it may be a physical manifestation or, frequently a combination of both.

The Core Service Model is based upon the TOGAF assertion that separation of business and software service concepts is necessary in the following situations:

- When the business has a preset definition of its services that does not align well to technical and architectural needs

- When business and IT use different language to describe similar capabilities

- Where the IS Service is misaligned with business need, particularly around the areas of quality of service, visibility of performance, and management granularity

We will suggest that the separation is always required because, even in the case of virtual services, there are always business perspectives such as product, process, pricing, capability etc that require business specific stakeholder involvement in design and operation.

Facilitation of service personalization, differentiation and customization

Service architectures are widely regarded as inherently more agile because they are loose coupled and, if compliant with well-designed reference architecture, will also enforce separation of concerns. These characteristics are intrinsic to an agile business. But, loose coupling alone is insufficient for a service based business that must tailor value added Business Services to individual customer needs. And this is where the service economy is clearly leading us.

Figure 4 below illustrates another dimension of the Core Service Model in which Business Service Offerings are defined as a set of Configurable Items which inherit Solution Service and SOA Services, chosen from the Catalog that are assembled for customer specific service deliveries as selections of Configured Items. Configurable Items may also be clustered as sub-assemblies that implement a pattern.

Configurable Items may also be delivered as Custom Items that may, according to policy, be listed in the Catalog for reuse, as part of a maturity process in which they may, dependent upon various criteria, be promoted to Standard Offerings.
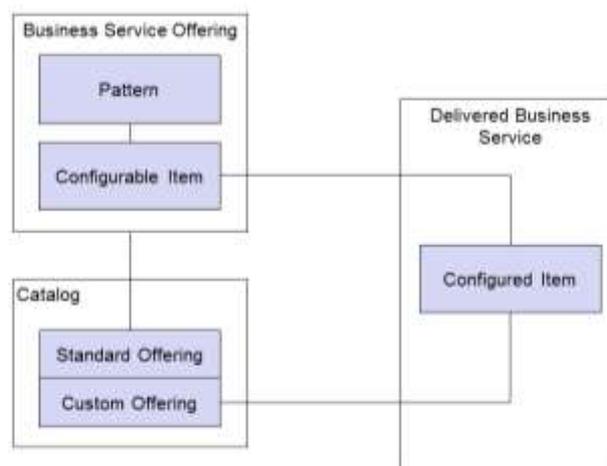

Figure 4: Personalizing the Service

For enterprises locked into legacy systems this catalog driven approach to business service assembly may impossibly futuristic. But organizations that have already traveled down the SOA path will see this as a logical progression, enabled by the formality of the service catalog, which becomes realizable when the service inventory and SOA capability maturity permit.

As an aside, this configuration approach should not be confined to SOA Services alone. Consider that Configurable Items may include the entire range of assembly components including workflow, implementation components, portal framework, portlets, platform components, differentiated services, policies and much more. We will return to that topic in a separate article.

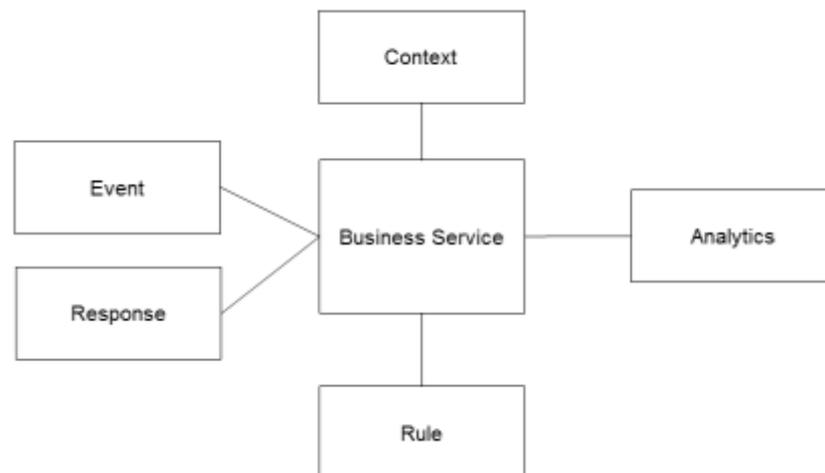**Identification of structured and less structured behaviors and capabilities**

Figure 5: Responsive Business Process

The convergence of physical and software services brings the challenge of pre-determining behaviors in a highly structured manner when some aspects of a service may be less structured, or require some level of judgment and discretion. This requirement inevitably becomes a higher priority as automated business services become integral to customized and highly differentiated customer service delivery.

The responsive business process pattern shown in Figure 5, a further dimension of the core service model, is commonly used today in high volume transaction situations such as trading where rapid response may be mission critical, for example in abnormal trading events. In this situation they are referred to as "circuit breakers". However this is a rather crude use of the pattern. In a service delivery situation where appropriate discretion needs to be exerted, for example in security checks, or service priority for resource allocation, pre-determined rules permit real time response to an event or analyzed behavior pattern. Crucially the response is in context with the business service level agreement and can be an important tool in maintaining customer satisfaction.

Where rules have not been established, thresholds may be set beyond which a sensible rule based response cannot be predetermined, then the service rules can instruct the issue of an alert to a human for further intervention.

Coordination of Business, Solutions and Services

All Business Services will increasingly have software components at the core of the service. Of course not all enterprises will have the opportunities of purely virtual and online corporations such as Amazon, but as discussed the integration of physical and virtual services is compelling and inevitable.

Service providers have typically established comprehensive service design and delivery processes based on the work of the Software Engineering Institute[8] and ITSQC[9]. Whilst all enterprises will be party to service delivery processes as consumers of outsourced services, it is less common for enterprises to implement and operate service based processes.

Similarly many enterprises have to some extent embraced separation of software service delivery and software solution delivery in a Twin Track.
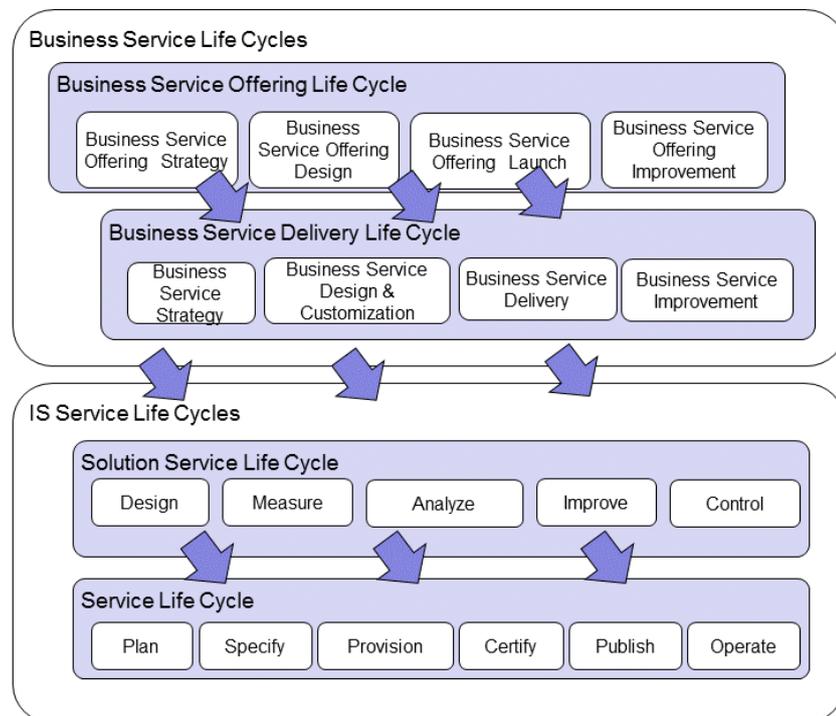

Figure 6: Multiple Service Life Cycles

In a world where everything is a Service many enterprises will embrace the service based process in its entirety. Figure 6 illustrates the four primary life cycles required:

- The Business Service Offering Life Cycle in which service based products are developed.

- The Business Service Delivery Life Cycle in which the Business Service Offering is customized for individual customers.

- The IS Solution Life Cycle which assembles software services into solutions that deliver Business Services and

- The SOA Service Life Cycle that delivers software services that are intended for reuse in multiple Business Services and Software Services.

Integration of different perspectives of multiple stakeholders

The coordination of physical and software services

Today each of the various stakeholders in the life cycle of a Business Service represent disciplines such as service sales, service design, process design, software architecture, software delivery, systems management, service delivery, business intelligence, analytics and so forth. Each of these disciplines has their own center of gravity in terms of models, practices and life cycle. See my research report[10] on this topic. Anyone involved in service delivery in a major enterprise today will be acutely aware of the amount of effort that goes into cross discipline coordination and orchestration.

A proven approach to resolving multiple dimensions of complexity is to establish Views or Aspects. Views have been routinely used in software architecture in order to create perspectives that are relevant to specific stakeholders. Each perspective

should be consistent with an integrated model, but the View is a subset created for specific stakeholder purposes.

Figure 7 illustrates how each Business Service (and its inherited SOA Services) has multiple Views which permit each discipline to manage their interest in the service in relative independence. The intersection of the Views identifies where coordination is required.
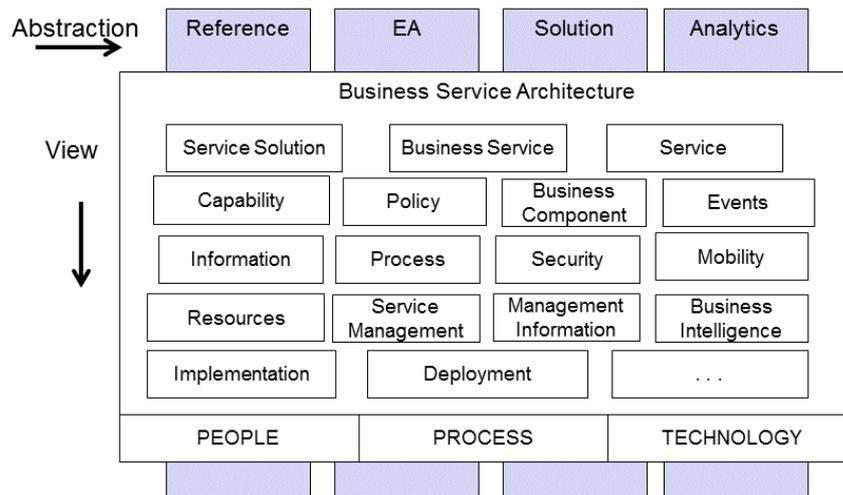

Figure 7: Business Service Stakeholder Views

In addition, the vertical dimension of Figure 7 suggests each of these perspectives exist at different levels of abstraction:

- Reference: a common conceptual model, reference architecture and process that defines standards for all capabilities.

- Enterprise Architecture (EA): the high level view of capabilities mapped to each stakeholder perspective.

- Solution Architecture: the solution architecture again mapped to each perspective

- Analytics: It would be expected that for each capability, a significant number of analytics types would span all perspective, and it would be important to capture these in a consistent manner

Conclusions

The nomenclature around the Service concept has been confused for a while as disparate disciplines have worked in relative isolation to develop discipline specific service models. The emergence and rapid adoption of the Cloud presents a stimulus and opportunity to revisit and refine our taxonomy and models, in order to clarify classification and design of services.

Embracing convergence between Business and IS Services, and particularly SOA Services is a priority for many enterprises. Establishing a sensible taxonomy and modeling language is really critical to Business Service design and delivery coordinating the many stakeholders that need to be involved.

Achieving a unified service model is not an academic issue but a significant priority for many enterprises making the transformation to the service economy.

Embracing a converged business and IT model gives all stakeholders in a Business Service the opportunity to bring consistent terminology to business requirements and design, helping providers and consumers to articulate service needs in a common manner.

Integration of models can smooth the coordination across IT and business disciplines involved in service delivery.

It would be helpful of the various standards and industry bodies came together to resolve this issue. However, as has been mentioned in this document, they have tried at least once already and failed, and standards are only useful when they deliver solutions. So whilst we must continue to encourage these organizations to address this, we envisage many enterprises will find their own practical solutions and move on. We hope this article may assist in that process and encourage de facto adoption of sensible nomenclature that facilitates "Everything as a Service" in all contexts, not just the Cloud!

Acknowledgements

[1] Future Shock, Alvin Toffler, 1970

[2] Daniel Bell, The Coming of Post-Industrial Society

[3] John Naisbitt, Megatrends 1982

[4] Dave Gray http://www.dachisgroup.com/2011/11/everything-is-a-service/

[5] Navigating the SOA Open Standards Landscape Around Architecture
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http://www.wired.com/wired/archive/12.10/tail.html?pg=1&topic=tail&topic_set=

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