A Framework for IT as a Utility

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Abstract

The IT Utility Model has created a new market for the delivery of IT, one that is not yet standardised or regulated let alone commoditised or traded. This paper takes a cross sectional look at the key players and their specific pricing policies aligned to the delivery of IT as a utility. The research seeks to explain the different pricing policies that are deployed in the market place today and the influences that affect these policies. This paper outlines the foundations in the development of an IT Utility Framework based on the underlying principles and environment in which a traditional utility functions are applied to the delivery of IT as a utility. The framework provides the underlying mechanisms in which IT services could be priced and traded on Global Exchange Market. The initial framework has been evaluated through contact with key stakeholders in the field; this forms the basis for further research that could advance the framework for delivering IT as a utility.

Key Words — IT Utility Framework, Utility Computing, Real-Time Infrastructure, Utility Pricing

1 Introduction

The IT Utility Model has been (and still is) a major topic of discussion within many IT publications [1] [2]. Within the last couple of years services have become available from the large IT Service Providers that resemble a utility delivery model [3]. Nicolas Carr in his publication "IT Doesn't Matter", talks about the vanishing advantage of IT to business and further suggests the commoditisation of IT in general. Carr's comments form the starting point for the research [4].

Commoditisation within any industry generally means lower prices to the consumer, which is mainly due to increased competition where suppliers significantly drop their profit margins in order to win business. Within the IT Industry the personal computer (PC) market space is a typical example of the effects of commoditisation. Continued literature reviews brought to light a major roadblock to the delivery of IT as a utility - a pricing framework. Much research has been conducted in the field of utility metering and billing by many of the large IT vendors (such as IBM and Sun Microsystems) [5], [6], [7], [8]. Nevertheless, pricing IT within the bounds of the current utility-style model will be difficult. This view is supported by the opinion of analysts that have investigated pricing models and frameworks for an IT Utility [9].

Such opinions and the current state of the art motivated an investigation, resulting in a dissertation that forms part of a Masters Degree, to uncover what if anything the IT Industry was doing to drive the delivery of IT as a utility. Further, findings enabled the formulation of a high-level framework in which IT resources could be standardised, commoditised and consequently traded on financial markets in a similar way to that of "true utility" resources such as electricity, gas and telecommunications. The full details are presented in Coombes [10].

2 The IT Utility Model

2.1 What is Utility Computing?

Relative to traditional utilities such as electricity and gas, IT is still in its infancy within a rapidly evolving industry. Pagden [7] defines an IT utility model as "… a combination of utility computing and utility pricing which results in minimising total IT cost expenditures and maximising IT resource usage.". Pagden goes on to say that "The two combinations can be differentiated in that utility computing is considered to be a technical solution, whilst utility pricing is considered a financial solution". Whilst these statements are true but rather simplistic to the extent that this is merely the theory behind a topic encompassing all aspects of IT, including the companies that deliver and use such services.

Pagden therefore defines utility computing as a process in which resource consumption is based on utilization rather than actual hardware ownership. Pagden suggests that utility computing solutions are implemented to:

- Collate resource utilisation data
- Aggregate and apply a pricing plan to the utilisation data
- Create eXtensible Data Records (XDRs) or XML Records

Pagden may be right in certain terms, however it is believed that utility computing should go beyond ownership of infrastructure and metering of resources utilised. Utility computing should be about the alignment of business process to IT and the way in which such services are delivered. IBM has conducted extensive work in the field of utility computing and has proposed a utility computing framework that consists of three main components [11]:

- Utility Business Service (UBS)
- Utility Resource Management Service (URMS)
- Resource Control

This utility framework aligns itself to business process by dynamically adjusting the infrastructure, i.e. allocation or removal of resources, according to pre-defined business metrics, such as contracts, subscription and SLA management and billing. Gartner [1] calls this style of computing delivery as "Real-Time

Infrastructure" that enables companies to fulfil business process, applications and infrastructure requirements from resource pools. Researchers at Gartner further predict that a quarter of Fortune 500 companies application requirements will be delivered via shared resources within the bounds of a real time infrastructure.

2.2 The Utility Computing Infrastructure

A Gartner research publication has analysed the infrastructure maturity of the proposed IT Utility Model [13]. This insightful research paper highlights key levels within the IT infrastructure that requires development in order to deliver IT as a utility. Table 1 shows Gartner's perception and prediction of the maturity cycle that the IT infrastructure needs to progress through to reach the utility utopia. Closer analysis of this table shows there are a number of key technology areas, over and above traditional infrastructure requirements, that are emerging into influential roles to the delivery of the model.

The key technology areas that have been observed to evolve from this maturity model are centralisation, virtualisation, automation, grid computing and billing. There are also trends towards rationalisation of the infrastructure in order to reduce software and staffing costs and clear progression towards a Service-Oriented Architecture (SOA) to deliver business agility. In addition there is a large focus on mechanisms/processes of licensing software, particularly within a virtualized environment.

We however believe that additional elements should be added to this maturity model: standardisation and commoditisation, and we would go further to say that in order to advance IT to a true utility an additional level, "Level 6" [10] should be added to the Gartner maturity model (see Table 2). Gartner states that "The objectives of an IT utility cannot be achieved without intense standardisation, though the exact set of standards may differ between competing providers" [14].

Gartner further states that in Level 3 of Table 1 below "providers will introduce many competitive differentiators in their offerings to control and slow the commodity trend …." [13]. We firmly believe that in order for IT to be delivered as a utility, standardisation and regulation is required amongst service providers. For example, analysing the delivery of electricity as a utility, customers in principle are able to compare providers' service offerings and price because a all delivered units are measured by the KWh.

At present we do not have such a comparator though having one would bring the market closer to commoditization – is this a situation IT service providers want to welcome or resist? If it is the latter clearly such barriers need to be overcome in order for IT to reach the utility utopia. This barrier will not be resolved by the service providers themselves, rather government or industry regulation will be required to drive the change in operation.

Level 1 **CONCENTRATED** **Centralization, standardization**	**Level 2** **CONSOLIDATED** **Rationalization, security, automation**	**Level 3** **VIRTUALIZED** **Virtualization, portability**	**Level 4** **AUTOMATED** **Business-oriented services interface**	**Level 5** **EXTENDED** **The business automation platform**
Main Objective Economies of scale (hardware and sites) **Delivery** One-to-One and one-to-many **New Developments** None	**Main Objective** Reduce software and staff costs. Improve service levels and resilience **Delivery** One-to-One and one-to-many **New Developments** Integrated security and IT management tools	**Main Objective** Optimize hardware and software use Increase efficiency **Delivery** Increasing to one-to-many (Infrastructure layer) **New Developments** Virtualization, software portability, grid, self-management, ISV certification and pricing	**Main Objective** Improve IT service delivery reactivity, reduce staff cost **Delivery** Mostly one-to-many (Infrastructure layer) **New Developments** IT policy-based management tools, service provisioning and billing, service governor, general purpose grid	**Main Objective** Business agility enablement **Delivery** One-to-many (Infrastructure and functional layer) **New Developments** BP policy-based management Application and process utilities built on IU platforms for clients' non-core processes Client focus on core business and IT processes
Financials and T&C Reduced assets and fixed cost base **Org Changes** Centralization **Transition** Relocation, impact on IS staff **Flexibility** Low (high fixed baseline)	**Financials and T&C** Reduced assets and fixed cost base **Org Changes** Rationalization, software standardization **Transition** Impact on applications and users **Flexibility** Low to medium (fixed baseline reduced)	**Financials and T&C** Cost per usage, partial **Org Changes** Application portability, IT management rules **Transition** Impact on applications and IT processes **Flexibility** Medium (fixed=variable)	**Financials and T&C** Cost per usage, flexible **Org Changes** Automated service-management processes **Transition** Impact on relationship processes **Flexibility** High (variable>fixed)	**Financials and T&C** Cost per business transaction/step **Org Changes** Automated business process, fusion **Transition** New inter-connected processes **Flexibility** High to very high (variable>>fixed)

Table 1: Gartner's Infrastructure Utility Maturity Model [13]

Level 6 INTER-CONNECTED Information and Communication Technology (ICT) Grid
Main Objective Service Provider resource pooling and provisioning **Delivery** One-to-many and many-to-one **New Developments** Alliance of Service Providers to form ICT Grid
Financials and T&C IT resources traded as a commodity on ICT Exchange **Org Changes** Customer-Service Provider; Service Provider-Service Provider **Transition** Inter-connected Grid **Flexibility** Very High (resource requirements are forecast in advance)

Table 2: Level 6 addition to Gartner's Maturity Model [10]

IT Service Providers would need to conform to industry regulation which could drive the pooling of infrastructure resources to form what we term the "Information and Communications Technology (ICT) Grid" [10].

This is where we believe an additional level "Level 6" is required in Gartner's Maturity Model. Following the structure of Gartner's model, we produced Table 2 which outlines the parameters that we think Level 6 should incorporate. The main objective for Level 6 is for IT Service Providers, whose service offering have become commoditized, to pool resources across a national and international grid infrastructure for the provisioning of services to end customers.

In effect a customer could buy a service, such as storage, from a service provider, who actually buys storage from other providers. Therefore the storage is actually dispersed across multiple providers' infrastructures, which are invisible to the end customer/user. The same principle could apply to the Application and Process utilities described in Gartner's Level 5 of the Maturity Model.

In fact Gartner has described the External Service Provider (ESP) as an extension to a company's infrastructure [15]. We would describe the ESP as a transitional infrastructure to the ICT Grid proposed later in this document.

2.3 Pricing Utility Computing

Pagden describes utility pricing as "…a method used by a supplier of a computing resource to bill a customer based on resource utilization" [7]. However, for our purposes pricing goes beyond charging for IT resource utilisation alone. Today however, even in the most complex outsourcing deals pricing is still based on the physical entities involved [16].

In his paper "IT Infrastructure Needs New Pricing Models" [13] Da Rold suggests a number of ways in which to price or chargeback for IT services, however the most consistent trend emerging is the definition of a Service Unit. This Service Unit takes into account not only infrastructure devices, such as servers or storage, but Service Level Agreements for business applications. The ideal of an IT Service Unit (ITSU) is far more complex that it appears. An ITSU in its raw form is comprised of many metrics taken from selected sources, which raises a couple of key questions that are still largely unanswered and more importantly non-standardised:

- What computing resources should be metered and charged for?
- What billing mechanisms should be implemented?

Within any IT infrastructure there are many devices and within these devices there are many components, all of which have a function in the delivery of applications to the consumer or business. Take a server for example, what should be metered and charged for? Should it be metered by the number of processor ticks, the memory used or the general I/O traffic? Today, there are no standards that define what should be metered and charged for. IT Service Providers are left to define how they meter and charge customers for IT.

Pagden describes the delivery of IT as a utility is customer specific and has not focused on the delivery and pricing of IT within a shared or virtual infrastructure, where capital costs should be shared amongst all who utilise the infrastructure. This opens up the debate even further. How, without defined standards, does a customer/business purchasing IT from an IT Service Provider know what elements of the infrastructure they should be paying for on a pay-per-use basis? Reinforcing the statement that standardisation of an IT Service Unit (ITSU) [16], which is believed, will ultimately simplify the already complex process of purchasing and subsequent billing of IT and IT services for the consumer, is essential

3 Proposal

It is without doubt that technological advancements, such as virtualisation, automation, SOA and grid computing will enable an IT infrastructure to deliver business related services. In addition we have identified that billing IT as a utility is achievable but complex. What has become obvious from the research presented is that customers want choice and under current so called IT utility offerings (including offerings from global providers) choice is not afforded to them.

Therefore having analysed the "traditional utility" market (i.e. electricity, gas and telecoms), in particular the framework within which it operates, it was observed that even within this commoditised space customers are given the ability to not only select a pricing option most suitable to them, but the freedom to compare and move between providers when necessary. The "IT Utility Model" proposed by Analysts and IT Service Providers, which is mostly proprietary, does not afford customers

ease of choice and flexibility to move from one provider to the next. It also focuses mainly on delivering IT on a pay-per-use basis, ignoring the underlying framework in which such services should be delivered. Therefore, based on investigation findings, it is suggested that an "IT Utility Framework" be proposed, providing customers the freedom of choice and "IT Utility Providers" the ability to service the diverse needs of these customers.

3.1 Framework Elements

The proposed "IT Utility Framework" depicted in Figure 1 below consists of a number of components each of which are explained and discussed in detail below:

Customers – underpin the market, IT would not exist without the technological need by commercial and retail customers. Customers need to be reassured that they have a choice of services that are scalable, secure and affordable. Technological advancements, occurring today and in the future, will address scalability and security, whilst the proposed framework will address delivery, affordability and choice.

IT Service Providers – within the proposed framework are able to supply a multitude of services to its customers. Each provider will have a core set of products or services that it maintains in-house (specialist utility – functional, resource or transactional), whilst all other services are purchased from the ICT market. From a customer perspective its nominated provider can supply all IT requirements.

Information and Communications Technology (ICT) Grid – IT Service Providers are inter-connected by the National ICT Grid. The ICT Grid's function is similar to that of the National Electric Grid (UK), in which its role is ensuring distribution and continuity of service to consumers, regardless of provider. This eliminates risk to both domestic and businesses consumers as service can be continued even in the event the incumbent provider goes in administration and can no longer service its customers. IT Service Providers can collaborate to form this new organisation; alternatively Government could fund this as a new national communications initiative under the auspices of the Next Generation Networks (NGN) Group which is a sub-committee of Ofcom [17].

ICT Exchange – is a market place in which IT resources and services will be bought and sold. As highlighted, telecom minutes are already traded between providers. Therefore on a similar principle, IT Service Providers will be able to trade excess capacity or services on a financial market. In a similar respect to traditional commodities markets it would be anticipated that two such markets would exist:

- A *Forwards Market* - in which future base load requirements would be traded on the basis of detailed IT capacity/services forecasting by Service Providers.
- A *Prompt Market* – in which fluctuating (on-demand) levels of IT capacity/service requirements of the Service Providers will be bought and sold on the market.

Market fluctuations, occurring because of capacity/service shortages (for whatever reason) will inevitably affect the price of resources which would as a consequence have a knock on effect on the cost to the consumer or affect company profit (like most commodities).

ICT Broker – has market knowledge required to trade on behalf of the Service Providers. The Brokers working on behalf of the Service Provider buy and sell excess capacity for the best possible prices, much like brokers trading of behalf of banks and energy companies. It could emerge that independent brokerage firms evolve trading on behalf of Service Providers or even large corporates.

Regulators – as within any utility framework or public service, government requires industry regulation ensuring consumer interests are protected. Although there is regulation within the telecoms market under the guise of Ofcom, investigations have shown that no regulatory outlines have been published regarding the delivery of IT as a utility service. It could however be argued that telecoms companies are in fact utilities and fall within Ofcom's regulation. That said the NGN Group is however expected to be investigating new regulatory guidelines which could address IT Service Providers delivering IT as a utility.

The buying power of Service Provider A is determined by accurate forecasting of current and future customer ICT requirements and as a consequence it is imperative that Service Provider A be able to forecast its sales strategy as well as have a good understanding of all its customer's future ICT requirements.

This information will determine the market strategy of the ICT Broker trading on behalf of Service Provider A on the ICT Exchange. The further in advance the ICT Broker can purchase infrastructure from other Service Providers trading on the ICT Exchange, the better the purchase price will be. The risk presented with this strategy is that excess ICT infrastructure could result in the event of incorrect forecasting.

Any excess infrastructure could however be put back on the market and sold on the Prompt ICT Market to Service Providers who find themselves short of infrastructure required to meet customer demands. Buying on the Prompt Market is however more costly and will affect either company profit levels of the price paid by the consumer.

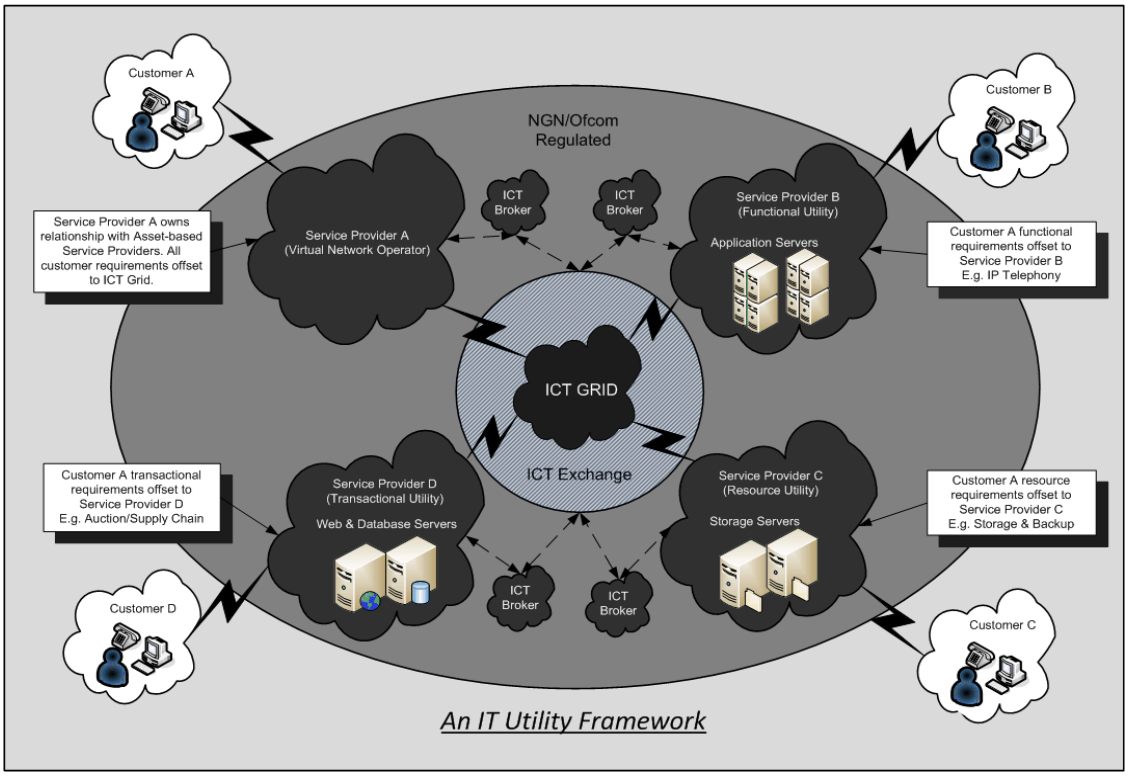

Figure 1: Proposal of an IT Utility Framework

The exchange would therefore give the Service Providers their base rate for delivering ICT services to its customers, similar to that of energy companies which operate within the bounds of a traditional utility. The Service Provider would then need to add an operational cost and its desired margin to determine the final cost to its Customer A.

The framework is flexible such that it could accommodate pay-per-use pricing structures. This is achieved in the same manner as described above with the exception that the Broker will trade based on the predetermined standards i.e. storage is priced as a gigabyte per month, whereas IP Telephony is priced on a per-user-per-month basis.

The National ICT Grid will enable Service Provider A to source services from a multitude of Service Providers. For example, Service Provider A has bought a limited amount of storage space from Service Provider C however Customer A has requested additional capacity. Service Provider A therefore purchases additional capacity from Service Provider B. Advancements in Grid and Virtualization Technology would enable Customer A's data to be securely encrypted and distributed across diverse Service Providers' infrastructures based on defined market contract agreements.

Ofcom/NGN's role would be no different from what it does today – to protect the interests of the consumer, monitoring pricing and investigating complaints relating to trading irregularities. Ofcom/NGN would work in conjunction with the ICT Grid to ensure continuity of service to consumers in the event of Provider dissolution. Ofcom/NGN's role would in fact be required to encompass the entire environment and as a consequence would also be required to interact with the Financial Standards Authority who would be responsible for monitoring financial transactions on the ICT Exchange.

3.2 Framework Evaluation

In preparation for the Masters dissertation [10] a number of established companies where consulted. Each company was selected for its specific role in the delivery of IT Infrastructure or services. For example, Nortel and Cisco being infrastructure hardware manufacturers, Microsoft for software development and licensing, Unisys as the global IT service provider, Affiniti as the UK centric IT service provider and HSBC as a consumer of IT services. The above mentioned respondents exposed a number of emerging themes which significantly contributed to the development of the proposed IT Utility Framework. In summary the respondents highlighted the following key points:

- Technology, primarily driven by business need for applications, still requires further advancements for the successful deployment of IT as a utility.
- Consumer/business perception has a large influence on Vendor and Service Provider pricing policies, although for Vendors/Service Providers to deliver IT as a utility today (albeit proprietary) requires a significant financial investment and fixed contract term from the consumer/business.
- Pricing and pricing policies need to be structured in a simple and standardized manner around tangible IT elements and business aligned services. These

policies can then be easily understood by Business Unit Managers allowing them to control cost. Therefore unpredictable cost models would not be attractive due to the complexity added to budget management.

- Standardization of IT Service Units (ITSU) is imperative to the delivery of IT as a utility. However, rather than having a single metric encompassing all elements of IT, defined (or agreed) technologies could each have their own separate mechanism of defining and quantifying the ITSU.
- Although the IT Utility market space is not yet commoditized, it is inevitable that this will/should occur. This commoditization will drive consolidation and standardization of infrastructure, where Service Providers would need to leverage economies of scale to remain competitive.
- Three core emerging IT Utilities are expected to evolve: (i) Resource Utility, (ii) Functional Utility, and (iii) Transactional Utility.
- Due to the decreasing depreciation curve (3-5 years from 7-9 years) of IT components, hardware and software IT vendors will be forced to change their business models to fulfill customer requirements. Leasing will become common place as this has a significant effect on reducing the total cost of ownership.
- It is anticipated that businesses would not outsource their core business processes, which makes it competitive, to a Service Provider. Standard processes common to the market sector will be outsourced to reduce costs. An exception to this would be found within the government sector in which the environment is non-competitive and budgets are tight. Government agencies are therefore not averse to sharing infrastructure with one another.

These points highlight that the model and framework, in which IT is delivered and priced as a utility to business and consumers today, is still a long way off that of the electricity and gas. Today IT does not find itself within the same boundaries as a traditional utility, suggesting industry resistance to commoditisation, standardisation and regulation by those within the industry. IT publications and vendors describe the delivery of IT as a utility in a commercial sense as paying for what is used. We are of the belief that Vendors and Service Providers should look beyond this definition and their own delivery capabilities. Collaboration between Service Providers, Regulators and Government will be crucial to the successful development of a framework in which IT can be delivered as a true utility.

3.3 Further Research

To add significant value to the IT community, further research needs to be conducted on the topic of IT utility pricing or the proposed IT Utility Framework, we prioritize the following three areas:

- Definition and standardization of IT Service Unit (ITSU) across multiple technology areas and how this ITSU can be integrated into the pricing policies associated with the delivery of IT as a utility.
- The effects standardization and commoditization would have on the IT industry, with particular focus on whether these elements would increase or decrease the adoption of IT as a utility by consumers.
- Validity, viability and integration of all (or individual) components of the proposed IT Utility Framework.

Therefore, focused research on how the proposed IT Utility Framework could be developed and delivered in the real world would needs to occur and it would withstand technological advancements that take place.

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