IT Design Science Technical Paper

Why does IT infrastructure cost so much? How come, despite the enormous amounts of money we spend, IT consistently fails to meet expectations? I can download a thousand different apps to my iPhone and it works in two clicks…why does it have to be so difficult?

If you've never had to answer any of those questions in one form or another, then you can stop reading and we wish you the best of luck as you continue your charmed life. However, if you've found yourself stammering through a long-winded explanation of the complexities of different platforms and trying to explain why consumer-oriented businesses have different delivery models – well, you may find the rest of this paper very interesting.

Of course there isn't a single 30-second answer to these questions that you can rattle off to your CEO the next time you happen to ride the elevator together. The cold hard truth is that IT infrastructure is exceedingly complex, and often band-aid solutions like virtualization or adopting Cloud delivery models only adds additional complexity. The fact is most IT problems can be traced back to poor infrastructure design choices, and rather than fix the root cause organizations spend the vast majority of their time trying to remediate the run-time environment. This leads to perpetual troubleshooting and recurring optimization activities akin to a dog chasing its tail.

Not convinced yet? Let's look at the different approaches organizations use to perform infrastructure design today.

The first process is one that we affectionately call the "work of art". It's a beautiful, highly customized solution that perfectly matches the new application's business requirements to a best-of-breed set of infrastructure components. On paper it's perfect; come run-time it's an operational nightmare. How can such an idyllic solution go astray? Unfortunately there are many reasons, ranging from poor articulation of the requirements, a lack of skills and experience of the infrastructure architect designing the solution, and the complexity of building and operating a completely custom solution. And, even when the production launch goes off without a hitch, what happens when the forecasted volume is a fraction of the expectation (underutilized resources= waste); or what if the application is wildly successful and suddenly needs to scale 5x? You rush additional servers into production and hope that you have room someplace in the data center and that it fixes the problem. Often it doesn't, and systems that need to collaborate end up on different ends of the data center. Worst of all, what happens when the Operations team can't figure something out? The expensive, scarce, and overworked top-notch infrastructure architects and engineers that built the solution in the first place are pulled in to figure it out. They aren't working on building new solutions, and sometimes they've left the organization leaving you with few palatable options. Sound painfully familiar?

The second approach is one we call 'one size fits all', and unfortunately it's the latest rage in the rush to embrace server virtualization and/or Cloud Computing delivery models. To be clear, server virtualization and Cloud are excellent options for building and running IT environments … it's the binary approach to leveraging them in the design process that causes the problem. What do we mean by 'one size fits all'? It's a design approach whereby a single, standard infrastructure solution is defined to meet all application requirements. Of course it gets slightly more complicated than that, as most organizations adopt several variations on the standard solution to accommodate the world from the view of infrastructure: small, medium, large, and high-availability. On the plus side it absolutely helps simplify the complexity of building and running the environment, reduces the time to provision new infrastructure requirements, and leads to better resource utilization—but at what cost? In this design paradigm, can you be confident that you are meeting the needs of the business? Inevitably this approach will not be successful for some portion of your business environment, and you'll only find out when it becomes a production problem.

In reality most enterprises have adopted both approaches over the years, and it isn't a coincidence that a shifts toward one or the other mirror economic cycles. When the business is healthy and profitable, adherence to strict infrastructure governance rigor takes a back seat to time-to-market or other revenue/growth business mandates.

However, when times are tough and budgets get tight the pendulum swings back to the 'one size fits all' approach in the name of cost cutting and IT optimization. But because this approach fails to meet the needs of the business, you begin to see architecture exceptions increase as business starts to improve—or worse, application development teams go around the enterprise infrastructure group entirely. This accelerates as economic conditions improve, until you find yourself back in the same situation…underutilized resources and out-of-control operational costs. Then, for whatever reason, business results decline, budgets get cut, and the pendulum swings back—starting the cycle of optimization all over again.

Isn't it time to stop this unproductive cycle? If you've been around IT long enough to recognize this pattern, you've undoubtedly thought more than once "there has to be a better way". At Adaptivity, we've found there is, and we call it The Science of IT Infrastructure Design.

That terminology may feel uncomfortable – you're probably thinking, "I have an engineering degree and I work in IT infrastructure – how can you imply that it's not a science?" Or perhaps "you can't tell me Cisco/IBM/HP/etc don't have top-notch engineers building their products"; to which our response is to ask the question, "When was the last time a single product delivered a complete infrastructure solution?" The best proof we can offer is a contrasting example, the science of architecting and engineering a physical building. With physical structures there are building codes, there are zoning requirements and standards for everything from board widths to stress ratings for bolts. Think about it – a skilled English-speaking architect could hand-off a blueprint to an engineering and construction firm that speaks a completely different language and they would know how to build it. Can you do that with an IT infrastructure design today?

Let's take a look at something closer to home: application development. Think back 15 years at the explosion of development activity as organizations rushed to migrate to client/server and to the Internet. The success (or disastrous failure, in many cases) was directly linked to the skill of your developers, who all sat in close proximity and the prevailing management strategy was to leave them alone, give them whatever they wanted, and hope they finished within six months of the date that was promised. Now fast forward to current times and think about your development teams: highly distributed (different continents), 30-day release cycles, much lower cost, much higher productivity, and generally much better quality. What happened? Did developers mysteriously evolve at an accelerated rate from the rest of humanity? Of course not … what happened was the financial pain became so great that we finally applied the cold, hard logic of engineering science to the discipline of application development. In a very short time period that fundamentally changed the language, the process, and the resulting quality of the output.

Hopefully by now we've convinced you that the science of infrastructure design does not exist…or at least if you're still reading you have some doubts. So now let's explore what that science should be.
At the heart of this mismatch between business expectations and IT delivery is a disconnect between supply and demand. The business does whatever it does to make money and mitigate risk, and those activities generate demand for IT services (supply). However, IT does not behave like a free market economy—as supply increases (in excess of demand) it doesn't get cheaper and gradually come into balance, it continues to become more expensive. This is because of a fundamental disconnect, a lack of communication and understanding, between what the business wants and needs and what IT typically builds from the bottom up. So to fix this problem we (IT) need to be able to speak the same language.

Business Value Chain

Let's face it, unless you happen to work for a firm whose business is providing IT, the business folks are not going to learn how to speak the language of IT. That puts the burden of learning how to speak to business people in their native tongue on the IT organization. Fortunately you don't need to run off and enroll in an MBA program, as there is already a widely accepted cross-industry language courtesy of Michael Porter. Porter coined a term called the Business Value Chain (BVC) to describe the chain of activities for a firm operating in a specific industry. While firms always have some elements that make them unique, when viewed at the BVC level all firms in the same industry have the same basic set of activities.

The BVC alone does not go to sufficient detail for a meaningful conversation between business and IT, so the next step to decomposing the business focuses on the Business Function. At this level you are identifying the various departments that roll up to the top-level BVC, and as an IT person you need not know anything more than the name of the executive that runs it. However, to get to the level of granularity necessary for a meaningful IT conversation we go still further, down to the level we refer to as a Business Activity. At this level you are dealing with a part of the business process, and typically at a level of granularity where a specific application can be identified that supports or fulfills that activity. To visualize the taxonomy we just discussed, please refer to Figure 1 – Business Value Chain Modeling.

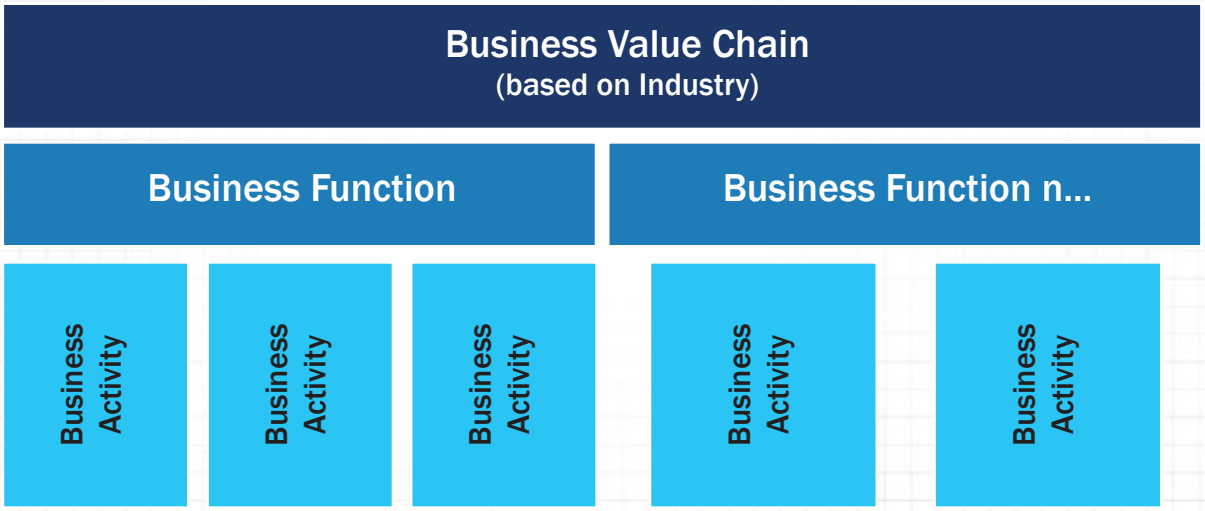

Figure 1: Business Value Chain Modeling

Now that we've provided a common vocabulary to describe the business, have we solved anything? Not really, but we've certainly improved communication. Now when referring to a Business Function or a Business Activity the IT organization should have a sense of the key performance indicators (KPIs) for that area (i.e., extremely high availability, or time to market, or low cost). Consider the impact of your helpdesk having a better sense of importance when the business calls with a problem and IT quickly recognizes it as affecting a critical revenue generating Business Activity. But to begin to apply engineering discipline we must go further still.

Application Patterns

As previously mentioned, when you decompose the business down to the Business Activity level you can typically correlate a specific application to that function. But what does that do for us—a large business likely has hundreds, if not thousands, of Business Activities and applications that support them? The answer lies in patterns. Just as we took the universe of unique business activities and abstracted them to a handful of BVCs, so too must we now do the same thing for all of those applications. In Adaptivity's experience there are perhaps 50 discrete application patterns that represent the spectrum; from Business Intelligence to Content Collaboration to Transactional Rich Internet Applications. In categorizing the hundreds or thousands of applications into their respective patterns, it suddenly becomes much easier to comprehend and consider changes to the pattern rather than individual applications. But that only scratches the surface—an experienced architect can look at an abstract pattern and immediately understand the typical qualities (i.e., the operational requirements that must be met to run acceptably) for that particular application pattern. That is to say, the architect would know that for a Business Intelligence pattern that high throughput of disk-bound data and intensive numerical processing are, among other things, critical for that application pattern to function well.

At this point we've decomposed the business and gained an understanding of the business KPIs, correlated applications and grouped them into their respective patterns, and identified some of the qualities that must be designed for. Hopefully it's starting to sound a bit more scientific, because now the fun really begins. As the business uses these applications it generates Demand for IT resources, and all of the people, process, and technology that this demand entails.

Ensembles

In our experience those 50 or so application patterns can be optimally executed—the demand is fulfilled by IT supply—on six infrastructure patterns, which we refer to as Ensembles to avoid any confusion with application patterns. These Ensembles are not simply a standard server build; they are the complete set of infrastructure resources, runtime execution tools, along with the monitoring & management technologies to facilitate high-quality low-cost operational excellence. Rather than the 'work of art' approach with thousands of solutions for every application, or the singular 'one size fits all' that fails to meet business requirements, we've distilled all of those business drivers and application qualities down and come up with a standard set of infrastructure solutions (Ensembles) that provide the ideal balance of business performance and IT efficiency to deliver IT supply in balance with business demand.

Processing Execution Destinations

The last step in our IT Infrastructure Design Science journey is taking these logical concepts and turning them into physical solutions that can be built in your data center or even in the Cloud. To do this we need to go back up to the top layers and think about the business again. When looking across the BVC, it's generally a safe assumption to consider that all of the Business Activities under a common Business Function have an affinity that manifests in considerable interaction. In a similar fashion, the Business Functions under a segment of the BVC have an affinity that creates more intense collaboration. Given those affinities—the need to interact with one another, share data, etc.—wouldn't it make sense to group them together in a physically proximate location to one another and their requisite data sources? Of course it does, and in our vernacular we call that grouping a Processing Execution Destination (PED). By leveraging the PED concept you gain several significant advantages:

- Applications run faster, because there are fewer network hops to traverse.
- Applications are more highly available, because there are fewer resources involved in delivery (and thus to fail).
- Cost of IT delivery is reduced, because there are fewer resources and fewer failures.
- Disaster Recovery is greatly simplified.

That last point probably has you scratching your head, so let's explore that idea for a minute. In most IT environments there are application-specific disaster recovery plans, resource level (i.e. SAN storage) disaster recovery plans, and data center disaster recovery plans. The challenge is which one of those options gets the business back up and running quickly? None of them—the application plan only recovers a Business Activity, the resource plan only recovers the resource, and the entire data center can take days to weeks to be fully functional. However, if you construct your data center leveraging the PED approach you have top-to-bottom transparency; that is, you know exactly what business function executes where in your data center and exactly the resources necessary to recover it.

Operational Delivery Models

We would be remiss if we attempted to publish a paper in 2010 without giving appropriate mention to Cloud Computing. Needless to say, many blogs, whitepapers, and books have been written in an attempt to codify and classify what is and isn't a Cloud. Rather than add fuel to those fires, let's simply agree on what it is: an IT delivery model.

When viewed from that lens instead of arguing about a particular technology that may or may not be used in a Cloud, it becomes far easier to think rationally about alternatives. At the risk of oversimplifying, a CIO/CTO can choose to run their IT environment themselves or outsource all or some of the responsibility to an external provider. Internally one can run things by line of business or by technology silo's (not recommended) or as a private cloud (highly recommended). Externally one can engage a full-service traditional outsourcing solution provider, a traditional hosting provider, or perhaps one of the newer Cloud providers. The time-tested approach of evaluating the benefits (cost, efficiency, time to market) against the risks (security, poor application performance and/or operational support) holds true regardless of the delivery model being evaluated. The point of this section is to reinforce the separation of the IT infrastructure design from the delivery model. The Adaptivity Design Science approach works equally well for either model, and in fact helps clarify the business implications of selecting an outsourced delivery model by virtue of the BVC decomposition. But the design, the Ensemble, can be realized physically in your own data center or logically in the Cloud.

Adaptivity's Blueprint^{4IT} Design Suite

Have you ever heard the expression "a fool with a tool is still a fool"? Our goal is to disprove that adage, to show that with the proper tools a journeyman architect can produce results similar to that of a 20 year veteran. But before we go there, let's revisit the examples we discussed earlier. How many building architects sit at a drafting table and start with a blank sheet of paper? Not many – the de facto standard tool of the trade is AutoCAD, and it's use enables faster, higher quality blueprints by both junior and seasoned architects. Similarly, Rational Rose software revolutionized the discipline of software development by providing a set of tools that enforced a consistent process, leading to faster and higher quality development activities. But do we really need a tool for IT Infrastructure Design? Over the past few pages I've superficially described the scientific method that should be followed to achieve high quality designs that meet business performance and IT efficiency expectations. As you read along, we hope that you nodded your head in agreement that this makes sense, and perhaps thought to yourself "I already do much of this". Now let's shed some light on the complexity that has managed to keep infrastructure design a 'dark art' for the past 20+ years while we highlight some of the benefits of our Blueprint 4IT Design Suite.

BVC modeling seems like a simple concept, but when you look across the spectrum of industries (17 or so, depending on how fine-grained you want to slice it) it can become a daunting effort to start with a blank sheet of paper to map your BVC, your Business Functions, and your Business Activities. In addition, do you know which of the dozen or so KPIs are most important to each Business Function/Activity? Wouldn't it be easier if you could start with a pre-populated BVC where you can edit the generic names with those of your firm, and review the default KPIs to ensure they match your priorities?

There are many excellent sources of information on Application Patterns available, but what can be more challenging is identifying the correct pattern that best represents your particular application. In our design suite we've already done the work for you: we know that based on where you are in the BVC (the Business Activity) there is a particular pattern set that will most likely to be employed to fulfill the requirements of that activity. This is not magic: people with the experience in that BA built those patterns over time either consciously top-down or they emerged bottom-up over time. More importantly, we've also pre-populated the values for the 60 or so Qualities that tell us how that pattern needs to be built. But we didn't stop there; we wanted to provide a journeyman with a veteran's experience, so we also built out a comprehensive database with all of the Known Problems (KPs) and a corresponding list of Known Remediations (KRs) for every one of those application patterns. Those KRs translate nicely into a set of IT capabilities, each with a three phase maturity level that's incorporated into output of the IT Infrastructure Design Engineering Blueprint. As you execute our standard design process, you confirm or override the default KPIs, Qualities, KPs, and you can even rate the level of maturity for the requisite IT capabilities. By the time you've worked through the process, you've created a custom blueprint for that Business Activity/Function as well as incorporated the nuances of your particular operational delivery environment.

This complex modeling and reasoning process is made possible by Adaptivity's patent-pending Blueprint4IT Analysis Engine (see Figure 2). The engine takes the factual inputs from the application patterns (Qualities, Known Problems)

associated with the Business Value Chain, and leverages Bayesian probabilities to correctly match the Ensemble, IT capabilities (for Known Remediations), and system interactions for placement into the proper Processing Execution Destination. For those unfamiliar with Bayesian math, it is an interpretation of probability that can be seen as an extension of logic that enables reasoning with uncertain statements. Translated to plain English, this means that it allows you to make calculations without having all of the data. Better yet, as more data becomes available over time the algorithms refine themselves, thus producing more accurate outputs. The Blueprint4IT Design Suite makes junior users more capable and experienced users more productive...a far cry from the blank Visio template that most start with today.

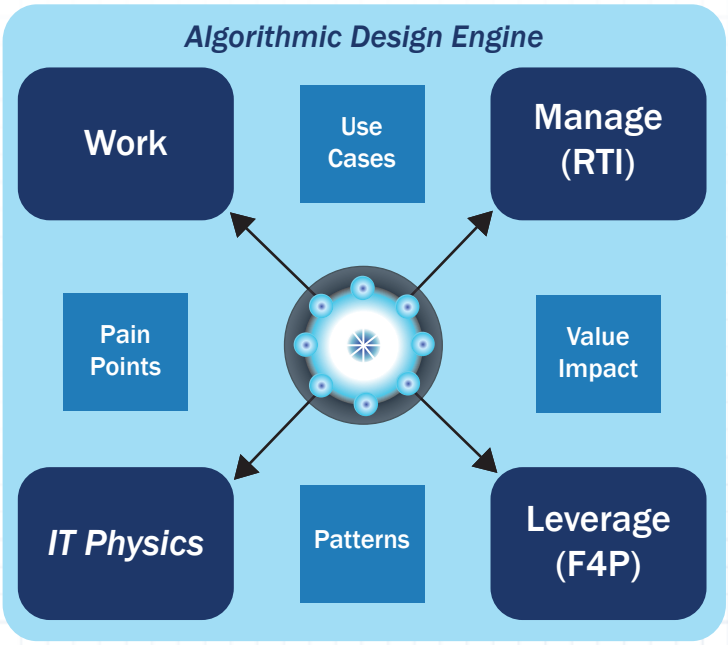

Figure 2: Blueprint4IT Algorithmic Design Engine

Use Cases

While the Blueprint4IT Design Suite can be leveraged in just about any IT Infrastructure activity, there are a number of scenarios that can dramatically benefit from its use.

Data Center Rationalization

Many organizations today are faced with the challenge of data center rationalization and consolidation. This is an expensive, complex, and risk-laden effort as potentially thousands of applications are moved over the course of many months with minimal permissible downtime. The Blueprint 4IT Design Suite helps accelerate the process and mitigate the risk by:

1. Automating the analysis of physical resources and application consumption data,
2. Providing a standard workflow for collecting and analyzing business input, and
3. Designing the optimal move schedule and target state environment.

The resulting IT Blueprints detail the recommended target state for individual applications, as well as recommending the correct placement of applications into PEDs and the necessary IT capabilities to maintain the environment. By accelerating the program and minimizing business risk the Blueprint4IT Design Suite proves an invaluable tool for execution of a data center rationalization program.

New Application Development

Not many organizations are happy with the time it takes to design, specify, quote, approve, order, and install infrastructure resources to support new application development initiatives or the resulting quality of the environment when it goes live. Much of the time is due to handoffs between groups for each of the steps, and the previous pages of this paper speak to the quality issues. However, imagine the increased satisfaction if an infrastructure architect can spend 4 hours with the application development team and generate the preliminary IT Blueprint; complete with your organization's standard IT vendors with pricing options for several configurations based on scale or availability needs. The application team could make decisions on the spot based on their budget, and an approved Blueprint sent to both Procurement and Engineering/Facilities so they can begin their work. If your organization spends a significant amount on new development every year there will be tremendous ROI in leveraging the Adaptivity Blueprint4IT platform.

Business Platform Transformation

Over the past three years many enterprises have underinvested in IT for critical business platforms – in many cases for systems that were already past end-of-life. As a result, the operating cost for those systems has increased dramatically while at the same time the business is missing opportunities due to outdated functionality. These factors quickly lead business leaders to the conclusion that it's time to invest in rebuilding these platforms, both to mitigate the risk of the outmoded environment as well as position for growth in the years to come. This type of scenario is an ideal use case for the Adaptivity Blueprint4IT Design Suite. The integration of the business architecture (BVC, BF, BA) with the know problems in the current environment, current technical inventory and IT resource consumption, as well as maturity ratings for existing IT capabilities provide the inputs necessary for the Blueprint4IT Design Suite to analyze and recommend a future state infrastructure environment for the business platform that creates the perfect match of business performance and IT efficiency.

Alternate IT Delivery Models

As previously mentioned, IT executives today face a myriad of choices for the delivery of IT services, but at the core they distill down to a decision to provide that service in-house or outsource it. The Adaptivity BluePrint4IT Design Suite can help business owners, IT executives, and architects think through the interaction of business activities and the application workloads that support them. It provides insight into the necessary business KPI's as well as operational qualities, which can then be used to rate your organization's ability to deliver those IT capabilities internally as well as those same capabilities from an external provider. From there an objective decision can be made as to the most appropriate delivery model for that service and that whatever option selected will have IT capabilities necessary to deliver the appropriate business performance.

Mergers & Acquisitions

The due diligence process surrounding merger and acquisition activities typically has insufficient representation from the IT Infrastructure organization, and with good reason – historically how much value-add can they provide in the frenetic environment leading up to a deal? But with the Adaptivity BluePrint4IT that equation changes – now a talented architect can quickly model the BVC for both organizations and identify both the business and technology overlap. The subsequent evaluation of the overlap in the technology portfolio and downstream analysis of the IT capabilities for both platforms helps business and IT executives make informed decisions about the cost of migration and/or rationalization activities. This work can be done in a fraction of the time it historically takes to perform manually, thus leading to a clearer picture of the true costs associated with a transaction.

Summary

The Adaptivity Blueprint^{4IT} Design Suite is a dramatic leap forward. It is the application of sound engineering science to tame a heretofore chaotic, expensive, and unreliable process. When you're ready to change how you design, build, and run give Adaptivity a call or visit us at www.blueprint4it.com.

About Adaptivity

Vision

Adaptivity is the IT Design Company.

Founded in late 2007 by veteran IT practioners who have dedicated their careers to changing the way IT is delivered. Our efforts have resulted in numerous industry awards for leveraging real time infrastructure, virtual datacenters and cloud utility models to deliver business impact.

Adaptivity was created to address the design challenges facing enterprise IT. We are leveraging our proven experience, industry partnerships and lessons learned to create a codified intelligent design platform. This platform enables enterprise IT to optimize, re-design and create new systems in a dynamical, virtual and agile manner.

IT Design Challenges

Our experiences helped us realize there is a gap in the technology industry not being addressed:

the "root cause" of IT delivery limitations is directly linked to how systems are designed, built and run. There are four dimensions of enterprise IT system design that cause IT delivery limitations and misalignment to business expectations.

Design Dimension #1 - "Silo-based" Systems Design

Vendors and Enterprise IT have classically focused their efforts and solutions on solving instrumentation and automation of the runtime instead of the design time.

The problem with this approach is automation of a system design built in vertical and horizontal silos. Vertical in terms of the application and data store supporting only a specific business function. Horizontal in terms of systems components built independent of each other (server, storage, network) in a deployment topology not considering business process or data flow. The net result is performance bottlenecks and missed expectations.

Design Dimension #2 - "Trees in the Forest" Monitoring & Operations

Moreover, if systems are instrumented, they typically only monitor and manage for a single KPI of uptime instead of the qualities of experience the business demand and expects (ie. Response time, priority demand sequencing, business calendar, exception events, peak loads, unit cost, security requirements, etc...). A monitoring and management system design such as this makes it nearly impossible to understand where adjustments can be made to accommodate the business.

Design Dimension #3 - "One-Size-Fits-All" Performance Engineering

Amplifying the system design problem further is the current Enterprise IT strategy to accommodate business demand of higher performance for less cost. The performance strategy is to implement a design of over-provisioned capacity in an attempt to meet peak periods therefore creating waste, inefficiency and no service guarantee. Alternatively, strategies to contain or reduce cost result in a consolidation and/or infrastructure virtualization to achieve efficiency but are typically at the expense of business performance. Neither of these design strategies enable business and IT alignment.

Design Dimension #4 - Consumerization of Enterprise IT

Compounding the system design problem for enterprise IT, is the evolving trend of "consumerization of IT". Users are experiencing a new IT delivery model via the web that is setting their expectations of transparent, flexible and on-demand access to IT services via multiple channels and paid in a variable consumption manner. This directly contradicts existing economic allocation & delivery provisioning models of enterprise IT today.