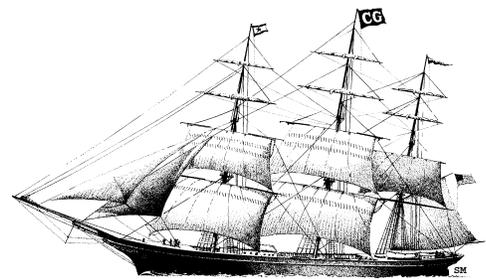


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## HP's Adaptive Enterprise Strategy and Utility Data Center Solution

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### Management Summary

That enterprise server utilization is low should come as no surprise. Enterprises upgraded their environments to address Y2K issues, and added more capacity in anticipation of endless growth. Supporting alternative approaches was seen as a way to hedge bets in a time of rapidly evolving enterprise technology. This added more equipment. Then the economy plummeted. Of course, these seemingly prudent excesses became an obvious source of waste in an era of constraint and outright shrinkage. Enterprises stopped buying, but unless they abandoned an application or closed a web site, they usually did not dispose of any of their IT assets early. **Instead, most enterprises have turned their attention to getting more use out of existing hardware and software assets – to the point of sharing what was traditionally owned.**

So how do you convert the mansions of yesteryear into the efficiency of multi-tenancy? You architect a robust system of halls and doors, redesign rooms for multi-use and – oh yes – add more sound insulation. You do the same in IT environments. In the past few years, networks (halls) have become more pervasive, and switches (doors) have grown more intelligent (soundproof and secure). IT devices have become more reliable and self-healing. Partitioning and virtual machines have made server assets divisible. Encryption, precipitated security schemes, policy-based automation, and a myriad of point products have evolved to support a consolidated structure of servers and applications. **Enterprises' new integration challenge is to be able to ensure not just that it will work, but that the consolidated environment will support guaranteed qualities of service. All of this just to maintain the *status quo*.**

**An additional data center challenge is to speed up the pace of change to match the accelerating tempo of initiatives of a competitive enterprise. Also, as the downturn drags on, a new tradition has developed of funding new IT initiatives by wringing costs out of existing IT operations.** Such frugality makes the computing infrastructure sustainable in bad times, but it also means that consolidation is not a one-time diet but a lifestyle change. You are not building house additions, you are consolidating tenants to free up space for renovation. This is a larger scale architectural challenge than merely adding more, and many things can go wrong. You may benefit from help from someone who has been through the process.

**HP has documented the best practices derived during its reorganization, and stands ready to help enterprises manage change.** Recently, HP introduced its *Adaptive Enterprise* strategy to help enterprises to more easily match business processes and the technology they require. Their *Utility Data Center*, launched in November of 2001, is a proof point of this approach. Depending on your enterprise's need for flexibility, HP's Adaptive Enterprise strategy, implemented through HP's consulting services, HP outsourcing, or perhaps the HP *Utility Data Center* may be just what you need to bring new rationality to your enterprise IT evolution. For more details, read on.

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## HP's Adaptive Enterprise Strategy

The scope of enterprise IT has grown beyond back-end processes line-of-business applications to address the broader challenges of information (not just data center) security, and corporate-wide use of data. The demands of government regulations and the need for a fully integrated value chain of suppliers, strategic allies and channel partners add more scope to existing challenges. As a result, **the action items on enterprise IT agendas often surpass the department and line-of-business silos that had previously served the enterprise (and served it well) as units of optimization.**

Silos were essential when humans were the primary processing vehicle. They were tolerable while businesses were growing and budgets were flush and broad-scale changes could be postponed. **Now, information systems are the primary processing vehicle for business, budgets are constrained, and enterprises have a growing need for a structure optimized for IT capabilities, not organizational ownership.** They need the management to go beyond infrastructure to a service-centric orientation. They need access to certain resources at an acceptable tempo of response time, but the identity and location of those resources is less important than the cost.

HP's Adaptive Enterprise strategy seeks to address these needs, providing a way to do more with existing IT assets. In this strategy, HP defines three phases of IT environment evolution. The **first phase** is the traditional data center – reactive, focused on costs, efficiencies and the integration of elements. RAS is a central concern.

With more resilient components, virtualization and automation, enterprise IT may move to a **second phase** – the service-focused data center. This is the environment of service level agreements and predictive management delivered as a metered and billable service by enterprise data centers and by service providers.

And there is more. HP has now designated a **third phase** of still more fully adaptive management. This involves not just a response to the demands of business processes, or the trending to anticipate the

demands before they are made. Phase three involves a feedback loop which advertises to the business processes and their architects what resources are available – idle capacity and new software resources. This allows the architects of tactical changes (new product offerings, etc.) to see all the resources available to them across the enterprise.

In time, once familiarity and trust are established, HP sees this feedback and availability of assets extending across the enterprise value chain. Advertising assets is not a new idea. Back when the breadth of enterprise assets was humanly knowable, enterprises leveraged assets daily. HP introduced *e-speak* some years ago for this purpose, which evolved into *UDDI* for online marketplaces. Grid initiatives use the same tactic of capacity advertisement to systematically get higher utilization of assets.

### *HP Adaptive Management*

This third phase cannot be reached without going through the second phase first, Jon Raphaelson of HP warns. The expertise gained in a service-oriented environment is crucial to the ability to offer service opportunities more freely.

To support the services-oriented environment of phase two, HP offers its *Adaptive Management* paradigm. The cornerstone of adaptive management is the ability to amass comprehensive knowledge of metrics, events and relationships<sup>1</sup> in an integrated context in which intelligent, increasingly automated responses can be used to control and direct and plan IT operations in a business context. A daisy chain of unintegrated management capabilities at physical, operational, application service management and business operations level risks incompatibility and latency. HP has added its *TeMIP* telecommunications management to its broad *OpenView* management framework to provide converged management of IT environments and the application services they provide, covering the entire service lifecycle of fulfillment (delivery) assurance (SLA management and fault management) and usage

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<sup>1</sup> On physical, logical, application, *and* business process levels

(billing). Web Services management<sup>2</sup>, and modules like Internet Usage Manager (a multi-platform mediation and business intelligence product) extend the management to meet the scope of the enterprise environment.

HP's Adaptive Enterprise strategy takes advantage of several deconstruction trends in IT<sup>3</sup>, the potent intelligence of devices and bandwidth to rethink how IT can be done less wastefully.

### ***Prerequisites***

There are a variety of ways to begin the journey of becoming an adaptive enterprise. An outsourcing engagement, the invocation of on-demand pricing on devices, or a service or consulting engagement aimed at getting more use out of enterprise resources may start the process of looking at things from a different perspective. And while HP feels its products and services support the Adaptive Enterprise well, it recognizes the variety of assets in most IT environments, and the need to use what is in place. There are some functionalities that are key to developing the *Adaptive Enterprise*.

- A pool of servers and/or storage must be networked and managed as abstract pools, or virtualized. This allows the capacities to be deployed flexibly as needed, without regard to ownership and location<sup>4</sup>. An enterprise-wide appraisal and regularization of application assets allows them to be delivered as services with similar disregard of the IT infrastructure. How large the pool should be and what assets are contained depends on the enterprise's need for flexibility. (See the *Role of HP Services*, below.) Over time, familiarity with pooled assets and trust in the directory and security services that make such pools enterprise-worthy will probably lead to more assets being swept into the pools.
- **HP advocates that the enterprise plan call for the reuse of standard assets and**

**resources**, unless there is a clear business need for a proprietary approach.

- **HP also recommends that an enterprise standardize common data center processes and policies.** HP has developed an *IT Service Reference Model* as a guide. In addition the development and reuse of process templates (either generically or as specifically enabled in HP's Utility Data Center), like the use of client profiles, can speed the response of IT to process needs. A consideration of data structures and the procedures needed to access data through different applications can also be a focus of standardization if it is relevant.

In short, **the focus of the IT environment must shift from speeds and feeds to the quality of service that a business process requires** - from racehorse performance to workhorse effectiveness.

### ***The HP Darwin Reference Architecture***

HP's *Darwin Reference Architecture* provides a standards-based framework with which to develop a service-based computing environment. It is functional, not just a framework for classifying products. It can help the enterprise align its IT infrastructure more closely with their business model and processes. Like a *Leatherman* multi-purpose tool, the Darwin Reference Architecture benefits from careful consideration of how its elements can be used.

The HP Darwin Reference Architecture specifies the traditional layers of data center infrastructure, and adds a top line of business process. **The function of the architecture, however, is not to lay out the sum of all parts, but to serve as a vehicle to map between business processes and IT elements in a way that can illustrate the effect of any change (in business process or in IT infrastructure) on all the elements.**

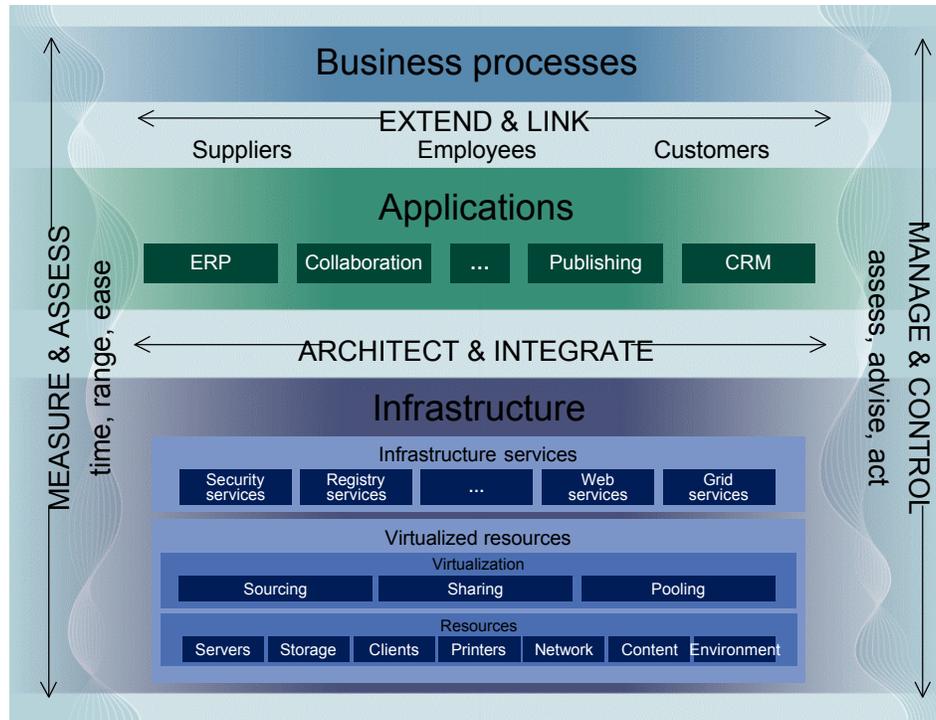
The layers of the Darwin Reference Architecture are not unusual. (See exhibit at the top of next page.)

- **Elements** (hardware and infrastructure services),

<sup>2</sup> HP's Web Services management framework has been submitted to OASIS for acceptance as a standard.

<sup>3</sup> Components vs. large integrations, distributed processes, parallel processing, automation, virtualization, more atomic approaches to security, and more pervasive approaches to file systems and directory services

<sup>4</sup> Latency issues aside.



Darwin Reference Architecture (Source: HP)

- **Application services and business processes,**
- **Separated by adaptation zones of architect and integrate and extend and link** to provide flexible use of components.

The verticals on the side are:

- The traditional, pervasive **data center management** (in upper case letters) and
- **Administrative functions** (in lower case), which will be slower to be automated than the former.

**The Adaptive Enterprise journey follows the square formed by these verticals and the two adaptability layers, giving a methodology that follow the classic evaluate-act-measure-extend litany of process evolution. What is different is that business processes are calling the tune.**

- **Measure and assess**, in the Darwin Reference Architecture context, is a measure not of performance or utilization, but of the agility an enterprise needs to remain profitable. This usually involves *faster* – as in faster product development, faster partner

qualification, and faster design of distribution strategies. It may also involve optimizing value-chain networks to gain the leverage to negotiate more beneficial contracts with partners. HP's *Agility Assessment Services* can help accelerate the process of determining where an enterprise could use agility and whether it has enough.

**The key metrics of any change are how long it will take, how widely it must be implemented, and how easy this will be. By quantifying these risk factors, an enterprise can take steps to mitigate the most drastic exposures.** An overly long transition can be split into stages that position the rewards to encourage momentum. Very broad changes can be tactically piloted. Culturally difficult change can be addressed by a variety of approaches, any of which is usually better than doing nothing.

- **Architecting and Integrating**, the next step, is easier with standardized components (applications and platforms). Again, the ability to map the widespread tradeoffs of application and hardware standardization will allow decisions to be stripped of partisan sentiments, rationally made, and clearly justified.

- As environments become more consolidated and adaptable, the role of policy-based automation in the **manage and control function** becomes larger. It is important that the prioritization rules reflect the needs of the business process, and not necessarily the topology of the enterprise. The departmental structure is still important to the enterprise, but it should not mandate how IT is done.
- After management and control systems have been tested, it is time to **link and connect** the enterprise internally and externally in ways that will allow the enterprise to be more responsive.

The range of the Darwin Reference Architecture comprises traditional data center operations, but goes well beyond them. Mapping the business process to the underlying technology permits a more systemic approach to sourcing – not just of purchasing alternatives but of multiple kinds of outsourcing opportunities. **It is not until you can model how outsourcing will affect the overall business infrastructure that you can rationalize what is often an emotional decision based on frustration or on economic duress.**

The Darwin Reference Architecture also allows the enterprise to factor in a time component. This can range from the optimized response time needed by high availability applications, to the timing and priority of business processes, to the longer range timing of business strategic initiatives. With tight budgets and constrained assets, all of these elements must be modeled in an enterprise context. Here, too, the Darwin Reference Architecture provides the mapping between business process and IT to provide hard numbers for various alternatives.

### ***The Role of HP Services***

Almost every medium or large enterprise has redundant processes instituted in days past by different departments or lines of business. A chance to regularize processes is a great opportunity to save money and should not be avoided. It is, however, politically sensitive, and may benefit from services provided by a less-entangled third party. **A dose of HP pragmatism may what many enterprises need to get past the sticking points of**

**enterprise evolution.** HP's services are collaborative in approach and pragmatically focused at short-term savings, as well as long-term cost reduction. They are structured, when possible, to generate enough savings in the short term to fund subsequent services. HP offers an Agility Assessment service, to determine what portions of an environment will benefit most from a more flexible services orientation.. It also offers a broad range of professional services, from the traditional High Availability, Migration and Business Recovery/Continuity services to IT consolidation, and enterprise Microsoft services to on-demand and Web Services Solutions. They do not offer Business Transformation solutions, leaving that to partners for whom it is a full-time expertise. Instead their services focus on crafting technology to meet business needs.

### **The HP Utility Data Center**

The key to more easily modifying the services provided by IT infrastructure is the decoupling of the application from the physical infrastructure. This can be done using web services to link applications, by using grid services to create a service-based environment, or by using a controller to parcel out workloads. These tools may be combined to match the patterns of application use of a particular enterprise.

**It is very useful to have a working example of how this might be done.** HP's *Utility Data Center (UDC)* offering, launched a year and a half ago, has the installed base (including HP itself) to provide a variety of examples of how such an environment can work. UDC is an enterprise-level environment that is policy-driven, wire-once, self-adapting, and self-healing. Not every enterprise will wish to deploy their assets in this sophisticated setting, but it shows what is possible today.

First, some history - Compaq's *Zero Latency Enterprise (ZLE)* and HP's *50,000 Node Data Center* were both multi-year initiatives. *ZLE* analyzed latencies in enterprise systems and established practices for fault isolation and clustering and other architectural remedies. The *50,000 Node Data Center* explored the problems of very large IT implementations – the power requirements,

the cooling strategies, and the ways to solve device dysfunction with automated failover and shut down, rather than immediate service.

Both initiatives produced practices that make HP's UDC more than a set of products or even an architectural approach. **Rather, UDC is a way of using computing as a tool of business - a way that comprises architecture, process, and, most importantly, extensibility.** This includes the ability to adapt existing assets, even *Superdomes* and IBM mainframes; the ability to connect to grids to broker additional capacity; and the ability to facilitate easier IT change, application change, and even organizational change.

**Utility comes from the same root as useful, and has nothing to do with a uniformity of assets.** HP's Utility Data Center does not require a set of clone devices, though the need for commonly-usable functionalities dictates that they be answerable to standard open protocols. Of course, there is a lightened administrative burden with fewer varieties of automated procedures to maintain.

### ***The Physical Infrastructure***

HP's UDC architecture is a multi-tier architecture that is programmable at several levels. Physically, the UDC comprises up to 1000 square feet of 19-inch racks, filled with servers, storage, and switches, with a central set of management racks to provide the brains of this operation. HP offers optional HP Smart Cooling services, which allow the data center to be kept warmer<sup>5</sup>, cutting down on cooling costs and making it more pleasant for humans to share. The racks are pre-wired for power and communications. Each UDC can support up to 10 resource racks of servers or other components. These resource racks can attach to up to 40 storage racks. This comes to about 41 TB of storage per UDC, varying with the mix and density of components. Connectivity is provided by switched fabric, which provides the connection and isolation of any asset to any other necessary to have a measurable quality and quantity of service for a given workload.

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<sup>5</sup> By delivering targeted cooling to warm spots through floor louvers.

### ***The Logical Virtual Farm***

**The key functional concept of HP's Utility Data Center is the *virtual farm*, a conceptual, dynamic, tunable, sub-network of aggregated IT assets that is created and dissolved by software, in response to the needs of the enterprise.** There have been server farms before, but they tended to be rigid monocultures, either in terms of the hardware they ran on, or the applications they ran, or both. Such a farm acts like one, large, partitioned server, and they were an advance in scaling, but not necessarily in agility. **HP's Utility Data Center is something different. In this case all the assets – servers, storage and network connectivity – are virtualized.**

### ***The Utility Controller***

**Each workload is defined as a service via a template which is customized at the Utility Controller portal<sup>6</sup>.** While defining the service, an administrator can model availability versus cost trade-offs, and can localize firewalls and load-balancers to provide more atomic (and affordable) high availability<sup>7</sup> for those sub-processes that require it. These templates can be saved and cloned. The efficiencies that client-side profiles have brought to end-user provisioning and support are small potatoes compared to what these templates, in conjunction with standardized applications and procedures, can do for the data center.

Additional scripts can be added at this level, if desired. **Then the Utility Controller evaluates available assets and “creates” a virtual farm to deliver the service, allocating and configuring the resources automatically. Finally, the Utility Controller loads the applications and launches the service.**

The Controller handles the monitoring and metering of the virtual farms, and also handles device failure. It handles device failure either by invoking pre-programmed fail-over, or by causing the load balancer to redirect traffic to other servers, or both, whichever is most appropriate for the quality of service that the

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<sup>6</sup> Administrators can access this portal locally or remotely, and can use it create virtual farms at multiple sites.

<sup>7</sup> This allows premium price products (example: for automated server failover) to be tactically deployed.

particular application workload warrants (and for which the enterprise is willing to pay).

### ***Integrated Service Management: The Next Tier of Management***

HP's Utility Data Center, which may contain multiple federated Utility Controllers, is managed by *Integrated Service Management* software. This software, in turn, can interface with a variety of third-party *Operation Support System (OSS)* and *Business Support System (BSS)* software that manages enterprise technical and business operations. This allows the administrator to tune workflow across applications and optimize the business process. The juggling abilities of the Utility Controller are prodigious, but it is the addition of the Integrated Service Management layer, replete with a process manager and a database, that allows the data center to configure and reconfigure the infrastructure to closely support evolving business processes, and to hook in SLA management, business intelligence, trouble ticketing, and other multi-tier functionalities.

### ***UDC Extensibility***

The UDC supports *HP-UX*, Microsoft *Windows* operating systems, *Linux*, and *Solaris* operating systems, and HP, Hitachi, and EMC storage. In addition, **any operating system supported by *OpenView's* operations agents can be part of the data center – that is, can be accessed as a networked and callable asset.** This includes large servers<sup>8</sup> like SuperDome and even IBM mainframes, and allows enterprises to leverage most if not all of their existing assets to provide a rich mix of capabilities as needed. This flexibility also allows enterprises to evolve at the pace that works with their situation in an environment that will support their long-term computing goals. **The importance of extensibility goes beyond letting you use what you have. It lets you use IT assets not yet on the drawing board, as long as they comply with the needed open standards. This makes the UDC a forward-looking tool, not just a valuable (but quickly-depreciating) asset.**

Utility Data Centers can be grid nodes.

### **HP's Utility Data Center Measurable Cost Reductions**

#### Provisioning Costs

- Deployment savings - 30% to 80%
- Capacity planning - 5% to 10%

#### Operational Costs

- Management Costs - 80%-100%
- Security - 20%-30%

Metering Costs - 5%-30%

Upgrading and migration costs - 20%-40%

Source: HP

HP can envision a scenario where value chain partners can barter surplus capacity between UDCs, comfortable with the security each UDC affords.

So, what is the bottom line? The savings are not chump change. (See box above.) In addition, there are the data center intangible values of ease of integration and process change, and the ability to more locally invoke expensive security and high availability capabilities. **But most important is the larger enterprise-wide benefits of a less constrained way to address future challenges.**

### **Is This Right for Your Enterprise?**

**Broad virtualization of the physical infrastructure, more pervasive use of automation, and consolidating one's application inventory can save money for any enterprise.** With virtualization and automation, you will get much better utilization of your physical assets, particularly if you have an adequate leavening of low priority workloads, which can, to some extent, be worked in as opportunity permits. However, the savings an enterprise can derive also depends on how much application redundancy can be found and on the licensing terms involved.

Like a modern freight train, the more units that have the flatbed car's ability to take on any load and the more standardized the loads, the more this flexibility can be leveraged. Boxcars (constrained by aperture size) and refrigerator cars are less broadly useful. But –

<sup>8</sup> As yet, the UDC does not utilize server partitions.

and this is important - if you need refrigerator cars, you will still need them. **If your environment is replete with specialized platforms and applications that you have bought prudently, the benefits of the HP approach may come more from resiliency and operations management than from consolidating on fewer servers.** These savings still can be considerable.

**Both the Utility Data Center and the Adaptive Enterprise methodology are not something to initiate at the departmental level, for the economies gained vary directly with size.** Larger, virtualized pools of resources are more efficient in terms of asset utilization and higher availability, and in terms of amortizing the costs of administration and management. A simplified applications structure also gives reduced operations management costs. This is not a tweak, but a major philosophical step towards consolidation. **If you have become frustrated by the ineffectiveness of the tweaks that point products can afford, this may be a welcome alternative.**

## Conclusion

**HP's Adaptive Enterprise methodology and their Utility Data Center illustrate ways to change a data center environment from an aggregation of often mismatched and eclectic assets into a business tool that can be rationally grown or shrunk to suit the business need.** HP presents the large enterprise with methodologies for both physical and application environments, which will allow the enterprise to align its infrastructure more closely with its business processes. Such a transformation is always difficult.

“The existence of utility architectures for IT will allow the *solutions* concept to focus on business processes, problems and metrics, rather than on physical or logical level IT processes,” Jon Raphaelson of HP believes. Tailoring a business process, with technology will become a more direct operation. Much of this will take time. Applications must be weaned from a need for statefulness. Messaging protocols, such as SOAP, must become 2-way, asynchronous processes. Devices must become able to recognize security breach as well as health problems,

and to triage the situation.

**HP's incentive of proven cost savings, a fully detailed, modeling-based methodology and risk/reward-based services, together with a forward-facing vision, all from a company that has *been there, done that* is an alluring combination that will be a comfortable fit for many enterprises.** Think about what HP might do for you.



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