Financial services technology journal

The cost management issue

Professional IT managers know that controlling costs and aligning expenditures with overall business goals and spending are critical to organizational health. But it's a classic case of "easier said than done." With continuing overcast skies forecast for the global economy, every step you take to infuse your IT organization with fiscal agility now should be appreciated—at the bottom line and in every line of business.

Letter from the executive editor

Optimizing IT spending for cyclical financial markets

The fluctuations of financial services firms' business volumes reflect the cyclical nature of the overall financial markets. These dynamics are often caused by specific crises—such as the most recent subprime mortgage problems—or a slowdown in the economy. These fluctuations require that executives and technology leaders have the ability to restrict spending levels in market downturns and quickly scale up when business volumes rise again.

During previous periods of market turbulence, executives have demanded budget cutbacks and cost savings from their IT organizations. However, because many IT costs are fixed, IT executives have limited options for reducing expenditures. Typical cost-saving initiatives entail rationalizing IT assets and resources and renegotiating vendor contracts.

Fixed IT costs cannot be scaled back easily to react quickly and appropriately to market downturns. Optimization of the "operating leverage," which is defined as the percentage of fixed costs relative to overall operating costs, increases a company's ability to lower its IT operating expenses quickly during an economic slowdown.

This issue of the Financial Services Technology Journal discusses approaches to optimizing operating leverage. We begin by defining fixed costs and discussing key areas or "levers" that often transition well from a fixed- to a variable-cost basis. Subsequent articles relate to these levers and provide key considerations for defining and assessing how to better manage IT costs.

Fixed vs. variable costs

Every technology spending category can combine fixed and variable costs. Figure 1 illustrates the breakdown of costs that are typically fixed or variable in an IT operating budget.

Fixed costs do not depend on business activity. Variable costs are proportional to business activity.

Evaluating the risk by understanding the cost structure

By understanding the cost structure and demand drivers of IT spending, we can model their effects on operating leverage. A simple modeling approach consists of four steps:

1 Estimate demand variation (i.e., maximum, minimum, average) for any given IT service

2 Document the current IT expense structure (e.g., fixed and variable expenses) and assess costs related to IT services delivery

3 Evaluate these cost variances as demand fluctuates within the range from step 1

4 Identify service alternatives and create scenarios with built-in demand variations— where related expenditures are mostly variable—and estimate the new costs derived from these scenarios

Figure 1
Fixed vs. variable IT operating costs

	Mostly fixed	Mostly variable
Employee compensation	X	
Employee other expense	X	
Contractor/professional services		X
Facilities Rent/lease Utilities Maintenance Facilities depreciation	 X X X	X
Hardware Hardware depreciation Hardware leasing Hardware maintenance	 X X X	
Software Software amortization Software nonamortization Software maintenance	 X X X	
Communication		X
Outsourcing		X

The difference between the costs calculated in steps 3 and 4 provides some visibility into the mix of fixed and variable IT budget items:

- The cost difference between steps 3 and 4 with the lowest demand represents the effect that fixed IT costs have on profit margins and earnings during a downturn. This amount also represents a potential margin for action to convert fixed to variable costs.
- The cost difference between steps 3 and 4 with the highest demand estimates the cost scalability of the current asset mix. A positive figure might reflect adequate or excess resources for this level of demand.

Large financial services firms may find it difficult to track all their assets and obligations and, thus, experience significant variances in expenditures vs. forecasts when demand fluctuates. Therefore, it is difficult and complex to precisely and accurately evaluate the current mix of resources and variations because of demand shifts. In addition, the past, limited focus on operating leverage resulted in few tools to track fixed and variable costs, making it more difficult.

Fixed investments to reduce unit costs

During past profitable cycles, business users expected IT organizations to provide high-quality services at optimal costs based on business projections—from conservative to optimistic. Their IT organizations made large investments (e.g., large purchases of dedicated servers, hiring large application development teams, building large data centers to host equipment) to provide these services at the lowest unit costs. These investments resulted in fixed operating expenses that became part of IT's budget and, later, subject to the scrutiny of company executives. Due to heavy capital investments, one of IT's major fixed-cost budget categories is depreciation.

IT capital investments that result in a greater proportion of fixed operating costs seemingly allow IT to provide services for a lower cost per unit compared to other solutions (e.g., outsourcing, leveraging virtualization to reduce capital requirements) in the short term. Because IT organizations face pressure to pursue the lowest-cost solutions, those with high fixed-cost percentages are implemented the most to comply with cost-savings guidelines and because of their perceived simplicity. While the high fixed-cost IT model meets short-term cost-savings goals, it does not optimize operating leverage. And it might lead to future constraints when additional cost savings become necessary. Furthermore, fixed operating costs cannot be eliminated easily when corresponding IT services demands drop.

IT executive challenges

Each business has its own specifications and requirements when it comes to fixed vs. variable costs. In most cases, IT executives have to tackle the following challenges to protect company margins during economic downturns:

- Dealing with the past IT executives have to cope with fixed costs from past investments and find innovative and economical ways to reduce them.
- Planning for the future IT executives need to make the right decisions on future investments with limited market visibility.

- Changing expectations and behaviors IT executives typically face resistance to change because this requires a paradigm shift, although solutions are now available to change the current IT operating environment and add capacity or new functionalities while increasing operating leverage (e.g., utility computing, software as a service).

To improve IT operating leverage, IT executives need to address the following requirements:

- Managing change People and process changes are often the most difficult to implement; new behaviors must be promoted/enforced to support new measures to improve operating leverage.
- Implementing new metrics New ways of tracking will be required with the adoption of any new standards and their positive effects on:
  – Operating leverage
  – Skillfully dealing with vendors – Agilely handling growth
- Providing transparency IT must deliver transparency in its services and cost and price structures; when making investments in new products and services, IT should provide the needed insight on how that improves operating leverage over time.

Preparation is the best defense

Professional IT managers know that controlling costs and aligning expenditures with overall business goals and spending are critical to organizational health. But it's a classic case of "easier said than done." When dealing with long-term amortization costs and new technology uses—where return on investment can be difficult to calculate—there's a need for information that takes effective IT cost management leadership to a new level.

That's exactly what you get in this issue of Financial Services Technology Journal. We've painstakingly planned this issue to offer effective, up-to-date thought leadership on IT cost planning. From the critical right-now technologies (e.g., service-oriented architecture, cloud computing) to practices that involve outsourcing and out-tasking (i.e., outsourcing simple tasks) to new paradigms in service models, you should find this to be an invaluable resource in your efforts to improve your organizational operating leverage. With continuing overcast skies forecast for the global economy, every step you take to infuse your IT organization with fiscal agility now should be appreciated—at the bottom line and in every line of business.

But in the end, leadership determines the opportunity for and success of IT operating leverage. So we have strived to support IT leaders by arming you with the strategic and operational insights that our consultants have acquired while tackling some of the most complex problems facing IT organizations.

Good reading!

Julien Courbe
Managing Director, PricewaterhouseCoopers

This issue at a glance

Now, a major IT question is, "How do we transform fixed costs into variable costs?" In this issue of the Financial Services Technology Journal, we survey multiple levers for improving operating leverage, which involve changes to operating models and technology implementations.
As in past issues, we have organized our articles along four dimensions:

- The business of technology section explores how IT organizations can meet enterprise requirements and demands by providing businesses with visibility and cost transparency to support better operating leverage. In our first article, "Using IT business management and cost transparency practices to improve operating leverage," we focus on the importance of IT business management and how it can help bridge the gap between business and technology. Our second article, "Becoming a cost-agile IT organization," explains how adopting a consumer-oriented approach can better position IT to scale back during times of economic turbulence.
- Our second section, How it (should) all start, begins by examining the new software as a service (SaaS) model for deploying applications such as Web-based services hosted by service providers, as described in the "Taking the first step toward software as a service" article. We learn about the advantages of SaaS, its cost-reduction benefits and which techniques a company can utilize to assess its readiness. Our second article, "Controlling IT costs with selective sourcing," focuses on how selective sourcing can help reduce IT costs during turbulent times.
- We look at the Data for decisions dimension in the article "Creating financial flexibility through service-oriented architecture," which focuses on service-oriented architecture (SOA) as a more dynamic and agile service-based business model than was represented by its past static incarnations. In this article, we explore the benefits, strengths, weaknesses and strategic approaches necessary for adopting SOA.
- In the Below the code section, we bring you the leading practices for converging new technologies and processes for improving desktop management and computing technology costs while keeping users satisfied. In our first article, "Easing desktop management costs with innovative new technologies," we examine current desktop practices and provide strategic recommendations for achieving all your organization's goals. The second article, "Supporting next-generation consumption-based hosting services with cloud computing," focuses on the technologies behind cloud computing, the current industry service model, its limitations, the disruptive nature of cloud computing and the potential effects of cloud computing on the cost structures of IT organizations and enterprise data centers.

The business of technology

Using IT business management and cost transparency practices to improve operating leverage

One of the objectives of IT business management is to provide businesses with visibility into and appreciation of the costs of supplying IT solutions. Business management also helps IT better plan and design for IT services, anticipate business demand and bridge the gap between business and technology. The net effect is to transform traditional enterprise IT organizations into true IT service providers that are managed like businesses. Business-aligned IT organizations are in sync with the overall goals of the enterprise and can react proactively to changes in the businesses that they serve.

Becoming a cost-agile IT organization

Historically, IT organizations have focused on supply-side economics in the management of their business and operational costs. By focusing on service provisioning rather than service consumption, IT organizations often lost sight of how their services aligned with business requirements and demand. This article discusses how adopting a consumer-oriented approach to both understanding demand and developing solutions consistent with that demand can better position IT to scale back volumes and costs during times of economic turbulence.

How it (should) all start

Taking the first step toward software as a service

Software as a service (SaaS) is a new model for deploying applications as Web-based services hosted by service providers. The SaaS model proposes that companies can significantly reduce costs by shifting their IT costs from a fixed- to a variable-cost model. SaaS could replace traditional hosted applications with outsourced services priced by actual usage. In the current economic climate, such a variable-cost model is attractive enough that corporations are investing in it. This article discusses the merits of SaaS, its strengths and weaknesses and a systematic evaluation technique that enterprises may consider to assess their readiness for SaaS.

Controlling IT costs with selective sourcing
By leveraging selective outsourcing and out-tasking opportunities, financial services managers can benefit by moving from a largely fixed-cost IT model toward a partial variable-cost strategy. The objective of this article is to review how selectively sourcing one or more subsets of a financial services company's IT resources may provide new levels of flexibility. In this way, managers can incrementally reduce their companies' computing capacities and costs during a business downturn.

Data for decisions

Creating financial flexibility through service-oriented architecture
Service-oriented architecture (SOA) implementations are showing companies that the traditional corporate IT model needs a makeover. Today, many corporate IT models simply cannot address the financial requirements of an SOA-supported enterprise. Not surprisingly, IT organizations are eagerly embracing the opportunities offered by SOA. The evolution of SOA transforms it from being a static function into a more agile, service-based business function. That is an important competitive differentiator. However, it means tweaking the corporate IT model to realize the benefits of SOA.

SOA-supported enterprises are based on eco-systems of business functions that represent the interests and needs of multiple lines of business (LOB). However, many responsibilities must be determined before implementing SOA. For example, who should pay for certain services? How are fees broken down if services are reused across an enterprise? How should SOA projects be financed? The current financial model in many companies is appropriate only in budgeting vertical LOB applications. SOA requires a different vision and execution. Success in SOA initiatives means organizations will have to adopt a strategic approach that better realizes the associated financial benefits.

Below the code

Easing desktop management costs with innovative new technologies
As demands from technology-savvy employees increase, companies are finding it more difficult to cut desktop management costs while keeping users satisfied. Now, the convergence of new technologies and associated management processes is helping transform desktop costs into variable costs. The benefits of this approach include meeting user expectations while leveraging data center and IT investments. This article examines current desktop support practices and the factors transforming them into an on-demand, variable-cost model service. It also provides strategic recommendations on achieving these goals.

Supporting next-generation, consumption-based hosting services with cloud computing
Cloud computing is a key enabler of the software-as-a-service model that supports the deployment of applications as Web-based services hosted in "clouds" of technology assets (e.g., servers, storage, network devices). The open secret of cloud computing is its ability to split application workloads across shared resources, which can be geographically dispersed, while supporting application performance and reliability as computing demand fluctuates. Cloud computing also eliminates the need to invest in hardware, software or facilities necessary to run applications and supports billing for services on a pay-as-you-go basis.

This article reviews the technologies behind cloud computing, the current industry service model and its limitations. Then it discusses current trends and capabilities in cloud computing. Today's risks and benefits are also detailed. Finally, it discusses the disruptive nature of cloud computing and its potential effects on the cost structures of IT organizations and enterprise data centers.

The business of technology

Using IT business management and cost transparency practices to improve operating leverage

Abstract
One of the objectives of IT business management is to provide businesses with visibility into and appreciation of the costs of supplying IT solutions. Business management also helps IT better plan and design for IT services, anticipate business demand and bridge the gap between business and technology. The net effect is to transform traditional enterprise IT organizations into true IT service providers that are managed like businesses. Business-aligned IT organizations are in sync with the overall goals of the enterprise and can react proactively to changes in the businesses that they serve.

Despite multimillion-dollar investments, many information technology (IT) organizations today cannot quickly respond to evolving business needs and adapt to large-scale shifts like mergers, sudden drops in sales or new product introductions. Moreover, visibility into true IT costs, usage and chargebacks is frequently poor while vulnerability to costly downtime increases.

In today's tough economic climate, those situations are unacceptable. IT organizations need better control of their cost structures and operating leverage. They need to be more agile. One solution is IT business management (ITBM).

Effectively meeting business demands requires IT to be run like a business. ITBM pushes costs out of cost centers into profit centers where demand originates, so those who require services pay for them. When implemented properly, ITBM can reduce IT's percentage of organizational fixed operating costs. ITBM internalizes management disciplines, including process, organization, technology and facilities within IT operations. As a result, IT becomes a value center rather than a cost center.

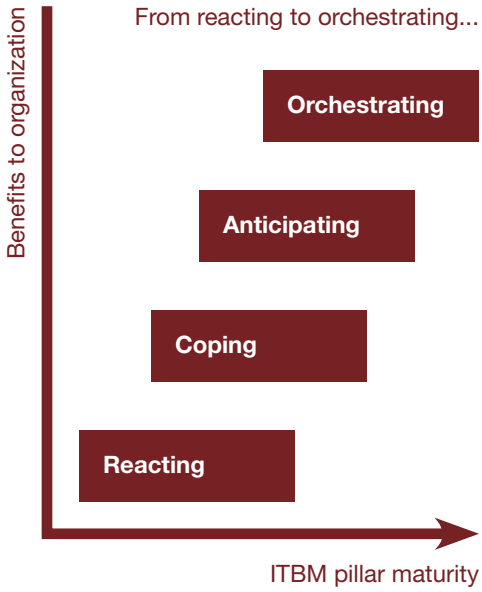
ITBM also can help shift an IT organizational cost structure and reduce its operating leverage in two ways. First, it gives end users visibility into actual IT services costs and business decision-making abilities, based on anticipated IT services costs. With ITBM, the full cost of IT services is factored into business decisions at the corporate and business-unit levels. For example, if a business unit decides to offer a new revenue- generating service for its customers, an effective ITBM program shows the IT-related costs of developing and maintaining this service. Then, the business unit can decide whether to pursue this business opportunity.

Second, ITBM provides users both the ability and responsibility to adjust IT service levels based on true demand and associated costs. Just as consumption will differ at an all-you¬can-eat buffet vs. a restaurant where the same dishes are served a la carte, the same is true of consumption of IT services. It is easy to understand why a business that does not pay for its IT services has the potential to use more than it needs, knowingly or unknowingly. Factoring these costs into profit center operating budgets is a solid method for promoting reasonable IT usage.

At the core of these concepts lie the challenges of IT cost transparency.

[1] The following framework, as described, is part of PricewaterhouseCoopers' proprietary Technology Cost Transparency solution.

Figure 1.
ITBM pillar maturity level vs. organizational benefits



ITBM and cost transparency tools and practices can transform an IT organization's operating leverage. These tools and practices provide critical information and transparency to those who are demanding IT services and shift demand toward services more conducive to a variable cost base.

Six pillars of IT cost transparency

Six major pillars that any effective IT cost transparency framework[1] must address include:

1 Costing — determining the actual cost of IT services

2 Chargeback— accurately and equitably charging back for services

3 Data/infrastructure—the data, assets and application mapping tools supporting IT services delivery and management

4 Service catalog—establishing a menu of services and a bridge between costing and chargeback

5 Management reporting—providing essential regular and ad hoc reporting capabilities, predictive modeling and visibility into the organization

6 Governance—including the communications plan, program management and leadership buy-in supporting the IT cost transparency framework

The maturity level of each pillar (Figure 1) can vary from reacting to orchestrating. In a reacting state, ad hoc actions are taken without proper planning or visibility. This often results in fixed-cost investments that may not realize their potential over time. In an orchestrating state, IT spending decisions are based on increased visibility into their effect on operating leverage.

Supporting an ITBM strategy that emphasizes variable costs or promotes services that can take advantage of fixed-cost investments means examining each pillar with an eye toward improving the current maturity level (Figure 2). It also means identifying the required people, tools and processes to progress from reacting mode to orchestrating mode when using an ITBM strategy to control fixed costs.

Understanding your environment

When addressing your IT cost structure, an adequate system of demand monitoring and modeling is required. The inability to distinguish between a blip and a sustained rise in required service levels often causes investments in excess capacity. Experience shows that proper high-level management of IT services growth includes dashboard functionality such as trend modeling and providing quick snapshots for executives.

When modeling trends in which IT services are in demand, a dashboard should allow for intuitive estimates of sustainable service levels. It also should include reliable estimates of future investments and should effectively relate this information to specific business units and demand drivers.

Also, a dashboard must be easily understood by non-IT executives and business managers in order to create awareness that some business uses of IT services are not financially justifiable. It should disclose upcoming investment plans, including spending levels and whether costs are fixed or variable. This information helps business managers under- stand and better appreciate IT organization attempts to decrease operating leverage. It also creates more-informed decision makers willing to work with IT in critically evaluating the business logic of IT service demands.

Once an understanding is established about your environment, IT can leverage data to design an ITBM strategy that can drive organizational change toward lower fixed costs. The result is a more agile cost base.

Figure 2.
Information technology business management maturity levels vs. six pillars of IT cost transparency

ITBM pillar	Reacting	Coping	Anticipating	Orchestrating
Costing	• Ad-hoc reports are developed manually to address business-unit inquiries • IT cost elements are not fully identified	• Limited availability of IT cost information • Inconsistent compute methodology across IT domains • No activity-based costing model	• Consistent IT costing framework and methodology • Activity-based costing methodology that provides some transparency and drill-down capabilities	• IT costing framework and methodology that provide chargeback information to business units on a business transaction basis • IT costing methodology that drives demand management of IT resources and allows for accurate forecasting and predictive modeling to better forecast for incremental investments requirements
Chargeback	• No chargeback mechanism in place to recoup IT costs from business units • IT costs remain in IT department/budget • No visibility between IT organizations (e.g., between application development and infrastructure)	• High-level chargeback methodology allocating costs across business units using estimated drivers • Business units have difficulty understanding IT charges • Variances are unexplained based upon shifts in business volumes • Mix of rate x volume and fixed charges	• Some visibility into upcoming demand, allowing IT organizations to adjust chargeback rates and avoid one-time adjustments • Mostly rate x volume based chargeback • Chargeback information is posted to general ledger and used in financial reporting	• IT chargeback methodology that provides transparency into IT costs and linkages with changes in strategic direction or business volume (e.g., opening or closing a new branch) • Visibility into chargeback can help organizations promote IT behaviors, improving operating leverage
Data/ infrastructure	• Driver data is not readily available, extracts not defined • Lack of IT resource-consumption measurement tools • Mapping of applications across shared servers is manual and inconsistent	• Driver data is not readily available, extracts not defined • Lack of IT resource consumption measurement tools • Mapping of applications across shared servers is manual and inconsistent	• Cost-driver data is stored in multiple mediums (e.g., Microsoft Excel spreadsheets and source systems) and aggregated manually • Some IT resource consumption measurement tools are in place	• Cost-driver data, IT asset data, IT resource-consumption data is collected and stored in a central repository (or virtual repository) • Actual usage of infrastructure assets by shared applications is measured and metered
Service catalog	• No service catalog in place • Business units have no common point of reference for IT services	• No service catalog in place • Business units have no common point of reference for IT services	• A paper-based IT service catalog is in place • List of revised IT services is updated annually • IT service costs are not well understood	• An online IT service catalog is in place with real-time updates • IT service costs structure and variation are understood by management and users
Management reporting	• Limited management reporting • No predictive modeling or forecasting based on business trends	• Limited management reporting • No predictive modeling or forecasting based on business trends	• Management reporting performed manually in Microsoft Excel or Access • Limited forecasting and predictive modeling, mostly done manually	• Costing/chargeback system provides robust operational and financial reporting to support transparency goals, highlighting fixed vs. variable components • Predictive modeling and forecasting is in place
Governance	• Components in place do not have formalized written documentation • Some components may occur on an ad-hoc basis	• Formalized governance program is documented, however, no mechanisms are in place to track or measure the governance program's effects	• Formalized written governance, however, results of changes implemented are not measured • Program is comprehensive, but no continuous improvement plan is in place	• Governance program structure is in place and measures the effectiveness of the components in improving operating leverage • Continuous improvements are planned to further control fixed costs

Key strategic initiatives

The specific initiatives that help transform the ratio of fixed to variable costs for an IT organization represent each of the six pillars:

Costing

Initiatives focus—auditing/overhauling accounting data attributes and identifying fixed vs. variable costs based on historical trends

Benefits—costs categorized in terms of activities, allowing for unpooling and itemization of fixed and variable components

Chargeback

Initiatives focus—enhancing transparency of internal invoicing with IT service consumers

Benefits—line-of-business (LOB) visibility into breakdown of charges (i.e., direct/indirect, fixed/variable); socialization and widespread ownership of operating leverage/risk reduction regarding IT expenditures

Service catalog

Initiatives focus—establishing consistent service catalog technology and implementing it in request centers; creating cost models based on cost objects that identify fixed vs. variable costs

Benefits—provisioning up-to-date, readily available service prices, influencing current demand for IT services; informing requests for future service designs, positively affecting operating leverage

Management reporting

Initiatives focus—defining key performance indicators; forecasting baseline demand necessary to determine acceptable levels of fixed investment; setting up a program management office to manage business requirements, tools and technologies; managing business intelligence

Benefits—top-down control of an acceptable threshold of fixed investment, based on management assessment of sustainable demand; defending against overly optimistic LOB leads

Data/infrastructure

Initiatives focus—auditing/consolidating IT asset use data; device and application mapping; virtualization and metering

Benefits—hardware costs, fixed by their nature, helping to prevent usage increases, effectively avoiding unnecessary investments; collecting essential data for validating costs charging back to LOBs for services, since estimating not immune to variance or error

Governance

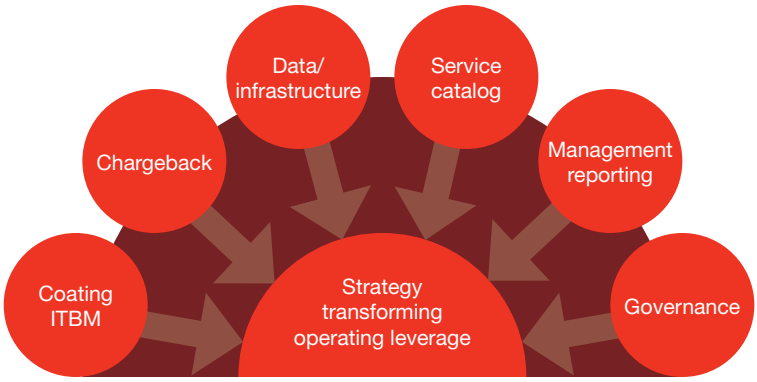
Initiatives focus—articulating roles, authorities and communications protocols for IT managers and service consumers; implementing reports training; publishing common metrics

Benefits—sophisticated, well-designed management controls wasted when there is unclear ownership and responsibility; overly engineered processes, delaying sensible investment unnecessarily; training current and future decision makers on content and interpretation of service catalogs and management reports for effective IT service execution, including appropriate investment decisions

Conclusion

ITBM and cost transparency tools and practices can transform an IT organization's operating leverage. These tools and practices provide critical information and transparency to those who are demanding IT services and shift demand toward services more conducive to a variable cost base. An effective ITBM strategy must address each of the six pillars of IT cost transparency at a sufficient level of maturity in order to change behavior and raise awareness among business IT services users.

Figure 3
Addressing all six pillars to effectively change organizational operating leverage



Becoming a cost-agile IT organization

Abstract
Historically, IT organizations have focused on supply-side economics in the management of their business and operational costs. By focusing on service provisioning rather than service consumption, IT organizations often lost sight of how their services aligned with business requirements and demand. This article discusses how adopting a consumer-oriented approach to both understanding demand and developing solutions consistent with that demand can better position IT to scale back volumes and costs during times of economic turbulence.

A new approach to managing IT costs

Worried about turbulent market conditions and a possible recession, financial services organizations are searching for opportunities to reduce IT costs. Traditionally, these organizations focused on reducing discretionary spending, tightening IT budgets and reprioritizing or deferring IT projects. However, these bottom-line approaches to cost reduction rarely factor in the effect such steps have on the quality of IT services provided to their businesses. Initiatives to reduce IT costs can have profound effects on the availability, performance and improvement opportunities of IT services.

An emerging approach to managing costs in IT organizations that operate as true service providers is to manage the demand for business services. Forward-thinking financial services organizations are implementing demand management models based on service catalogs that define and capture the economics of the IT services provided (i.e., which services, at what service levels, at what costs). This approach increases organizational control of IT operational costs. The challenge for business-oriented IT organizations is to closely align their goals, processes, IT supply chains and cost structures with changes in the businesses they serve. The current economic crisis has led financial services companies to reevaluate short-term business goals and requirements and accelerate their move toward a demand management model based on IT service consumption.

Managing service consumption

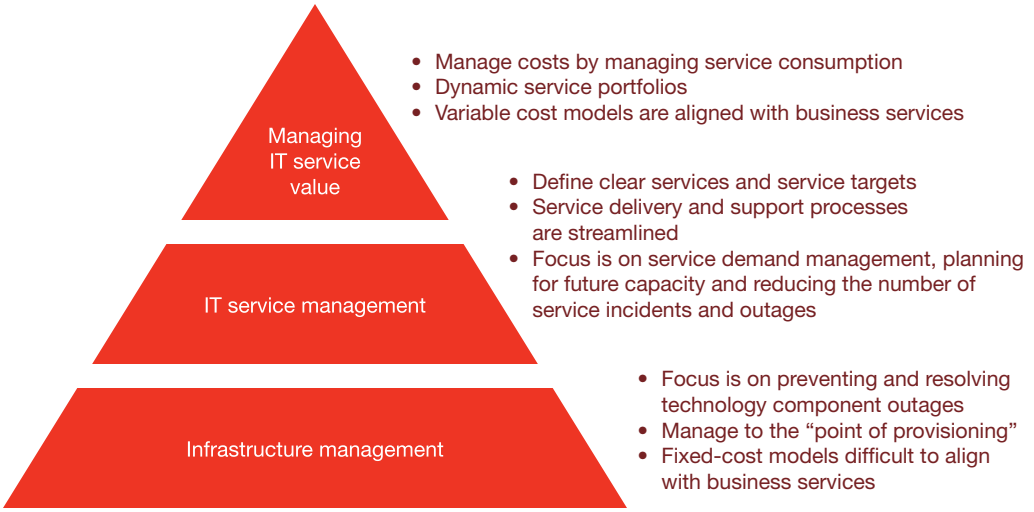
Traditionally, IT organizations have relied on supply-side economics to manage their business and operational costs, focusing on managing service provisioning rather than service consumption. These organizations are so intent on how they create services and make them available—by developing IT solutions—that they often forget why they do this—to align services to business drivers. Service portfolio management practices are often not well ingrained in such organizations, resulting in decisions that cannot be rationalized through rigorous cost-benefit analysis. As a result, IT organizations that rely on a service provisioning management model often incur large fixed costs that cannot be attributed to specific services or lines of business. Because they are so focused on provisioning services, these organizations have little incentive to analyze and respond to marginal variable costs that can be attributed to specific services and service levels.

On the other hand, IT organizations that operate under an IT service consumption management model perform tasks related to:

- Managing service levels
- Managing the supply chain
- Managing delivery costs

Managing service levels

Figure 1
Evolution of business-oriented IT organizations



IT departments driven by service provisioning used performance metrics such as mean time between failures or mean time to repair to measure their technology components. Although this model helped IT departments offer technology support, manage IT vendor supply chains and support personnel, it did not provide decision makers with transparent information on how their business systems were affected by changes in IT resources and performance levels.

Service-oriented IT organizations began measuring the performance of the services they provide using critical success factors and key performance indicators. These metrics provide business units visibility into the effect IT resource-level adjustments have on the services provided by IT departments. However, services were still being managed at the point of provisioning rather than at the point of consumption, with metrics being tracked for IT services but not for business drivers and goals. As a result, organizations could not easily determine the implications of their business goals or the potential loss of productivity and/or revenue due to changes in IT resources.

Business-oriented, process-mature IT organizations leverage service management tools and methodologies to align business goals with IT services and components (Figure 1) by mapping business processes to them and measuring the near real-time financial, business and operational effects of technology outages. New products from leading vendors have had success in developing these concepts into dashboards with metrics at the component, service and business-process levels.

Managing the supply chain

Generally, IT organizations that manage service provisioning are concerned with the back end of IT services supply chains (i.e., developing and/or purchasing IT solutions from vendors). Although this model has led to comparatively mature development of vendor and service-level management processes, they are not always aligned with business requirements on the demand side. IT organizations that do not systematically focus on demand and service portfolio management

cannot correlate changes in business demands and adjustments to IT operational processes and resources.

The emerging approach to IT service portfolio management offers "a dynamic method for governing investments in service management across the enterprise and managing them for value."[1] Service portfolio management helps companies:

- Define inventory services and business cases
- Analyze the value of their service portfolio
- Align supply and demand
- Approve services, resource allocations and chartering decisions
- Communicate service definitions and/or modifications

Organizations with well-defined portfolio management functions (i.e., front-end supply chain management for IT services) influence demand by introducing return-on¬investment concepts and infusing IT decision making with business-driven goals.

One step in IT services supply chain management is to define and manage service catalogs, subsets of the services offered in IT services portfolios. These end-user services are implemented with several different "views" to meet the functional requirements of their target audiences at each link of the service supply chain. For example, the buy view represents functions to select, customize and request IT services. The sell view reflects product/service manager views and organizes IT services into services families, such as hosting, storage, communications and middle- ware. Each services family reflects logical technology groupings used for reporting and billing. The sell view also includes mappings to IT functions that support specific services. The operate view maps IT services to the units that support them in terms of people, technologies, vendors and/or financials. Tight integration between these three views creates a well-managed IT services supply chain that is responsive to changes in business requirements.

Managing delivery costs

The service provisioning approach to IT services has resulted in IT budgets with large fixed costs and IT organizations that cannot adjust services and costs to meet changing business demands at specific performance levels. On the other hand, managing service consumption incorporates more granular costs into IT budgets and aligns IT organizations with specific services/performance levels demanded by the business. Financial services organizations that want to implement service-aligned cost structures should use activity-based costing methods or other top-down models suitable for cost allocation based on usage and/or performance tiers.

Once organizations establish cost-allocation methodologies, they can begin to manage the cost of delivering IT services through service consumption management. However, to make these initiatives successful, companies must significantly redefine the relationship between their IT and business organizations. The dialogue between IT organizations and business units must change from an annual budget review to an economic negotiation about providing specific business services at specific performance levels.

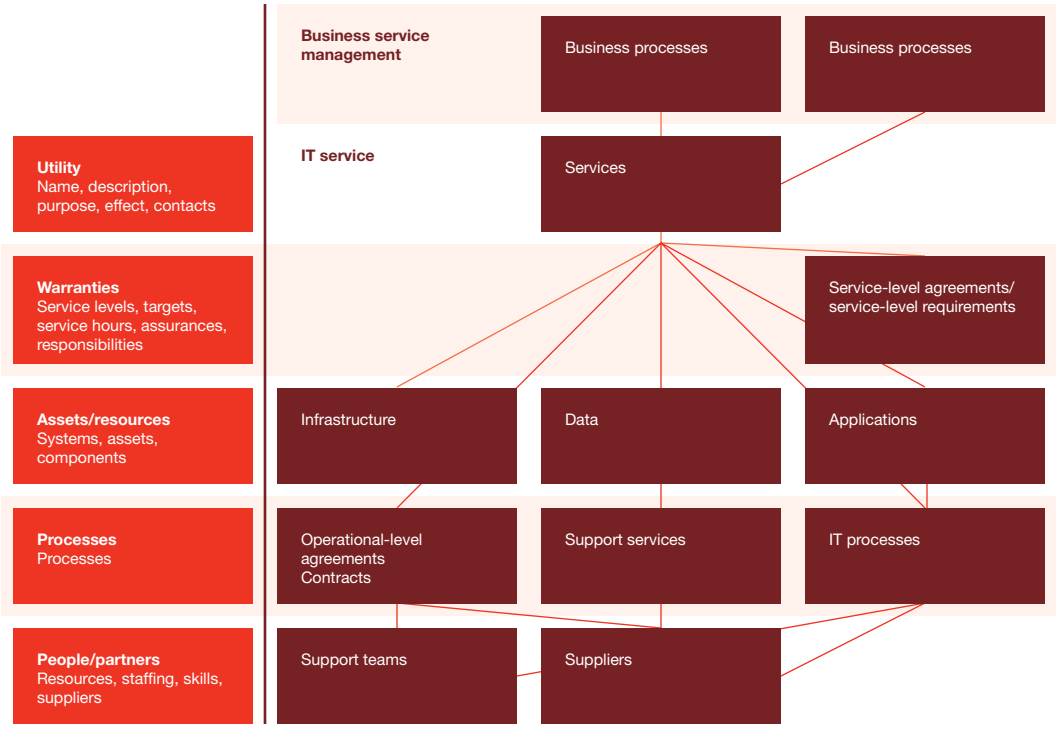
[1] Information Technology Infrastructure Library v3.0, United Kingdom Office of Government Commerce, May 2007.

Information Technology Infrastructure Library v3.0 and cost-agile organizations

Information Technology Infrastructure Library® (ITIL®) v3.0 provides a path for IT organizations to migrate from process-oriented service pro- visioning management to business-services driven service consumption management. ITIL 3.0 was introduced when IT organizations were attempting to augment their IT operational processes with industry-leading practices to become more cost agile in response to changing business demands. With ITIL 3.0, IT organizations have a more viable and focused framework to manage service consumption in line with their overall business cost structures. This framework provides cost agility by:

- **Aligning IT goals with business direction**—whereas ITIL 2.0 advises how to improve what IT does already, ITIL 3.0 tells IT organizations what they should be doing, saying that "for services to provide true value to the business, they must be designed with business objectives in mind. Service design is the stage in the life cycle that turns service strategy into the blue- print for delivering business objectives."[2]
- **Focusing on service life cycle management**—the service strategy, design, transition, operations and continuous improvement life cycle stages all provide key activities and metrics for managing the portfolio of IT services, managing the service supply chain through business consumption of IT services and measuring and demonstrating business value.

Figure 2
Required configuration management database service consumption mappings



Resurgence of the configuration management database

The configuration management database (CMDB) has been around at least since ITIL 2.0. However, CMDB has taken on strategic importance for organizations that want to manage IT service consumption. The introduction of new technologies by leading vendors in IT service management has also made CMDB much more feasible to build and maintain.

Usually, CMDB has contained all the configuration items/technology components in an IT environment as well as their interdependency mappings. In the new service consumption model, CMDB has grown into a representation of business processes mapped to business services and technology services/applications, which are mapped to supporting technology components, as required (Figure 2). IT organizations that are successful in establishing these mappings can begin to manage service levels, service supply chains and delivery costs in conjunction with changing business demands.

Conclusion: becoming more responsive to changing business demands

Operating IT departments as businesses is an ambitious initiative for most organizations. Managing service consumption rather than service provisioning allows IT organizations to align business goals with IT goals and provides the cost agility they need to run their departments as businesses. Financial services companies that are weathering current industry storms can leverage new business services management technologies and CMDB tools to develop IT organizations that are more responsive to their needs and can more easily adjust to changing business demands.

Operating IT departments as businesses is an ambitious initiative for most organizations. Managing service consumption rather than service provisioning allows IT organizations to align business goals with IT goals and provides the cost agility they need to run their departments as businesses.

How it (should) all start

Taking the first step toward software as a service

Abstract
Software as a service (SaaS) is a new model for deploying applications as Web-based services hosted by service providers. The SaaS model proposes that companies can significantly reduce costs by shifting their IT costs from a fixed- to a variable-cost model. SaaS could replace traditional hosted applications with outsourced services priced by actual usage. In the current economic climate, such a variable-cost model is attractive enough that corporations are investing in it. This article discusses the merits of SaaS, its strengths and weaknesses and a systematic evaluation technique that enterprises may consider to assess their readiness for SaaS.

Introduction

The current economic slowdown—fueled by difficulties encountered in 2007 and 2008 in financial services—is pushing companies to venture into often-uncharted territory to control costs. That's why more businesses are intrigued with the prospect of reducing costs associated with commoditized applications by purchasing them as a service. Because companies only pay for their actual usage, software as a service (SaaS) is cost-effective, particularly since it allows IT to scale up and down with business conditions and transaction volumes. But the first major challenges of SaaS lie in determining which methods reduce costs appropriately. SaaS differs from other commoditized applications based on quality, maturity, features and the set of traditional software it is supposed to replace. There is not a one-size-fits-all methodology for assessing SaaS. Those with experience in leading SaaS assessments—a critical function—are scarce because SaaS only recently gained increased attention from chief information officers (CIOs) and application owners.

Companies that believe SaaS remains immature will wait for it to gel. But forward thinkers are building experience so they can better evaluate SaaS offers and cherry-pick those that are appropriate for their companies before integrating them. By creating advisory groups, companies can better guide application owners and business managers as they evaluate whether moving to SaaS makes sense and how it could be implemented. PricewaterhouseCoopers refers to this advisory group concept as the SaaS Technology Experience Pool (STEP).

IT applications as a training ground

An effective way of implementing the first phase of SaaS is having IT become an early adopter. That gives IT an opportunity to provide the skeleton framework for other STEP advisers to be able to hone their skills on migrating IT applications to a SaaS model. Identifying the business applications that are potentially good for SaaS comes in phase two. Later, discussions with business users will help ascertain which applications on their side of the operation fit the SaaS model. STEP should include both dedicated members and part-time subject-matter experts. Together, they can identify which IT application domains to investigate when seeking SaaS cost efficiency:

Commoditized or standard application areas—it makes sense to look at network monitoring, help desk, IT asset management and messaging because they are examples of commoditized or standard application areas, which are typically nonbusiness-specific and often designed to comply with technical standards or industry-leading practices. Many SaaS vendors offer standardized functionality for services in these domains. A STEP team should also look at whether other IT teams are using different commoditized tools or practices that might be better if they were standardized.

Practices that require IT skills or specialization exceeding those of the IT organization—antivirus, spam filtering, and search and security suites are some areas that require extensive experience, which may be difficult to achieve for many IT organizations. For example, having dedicated IT staff designing spam filtering rules or searching algorithms is usually not a good use of personnel, especially when IT is producing results that could more easily be provided by a company that specializes in these areas. When examining IT practices, the STEP team should look for those that consume many company resources for little visible gain, areas where keeping skills up to date is becoming increasingly difficult because there are no structured training road maps or tasks that require research and development beyond the capabilities of the IT organization.

In-house applications that do not provide an advantage—but that require dedicated development, test and maintenance teams. Good examples are in-house-developed applications such as configuration management databases, software deployment tools, inventory and procurement applications, and time and expense reporting tools intended for consultants and other third parties. Typically, these applications were developed to satisfy a need the market could not fulfill with off-the-shelf tools. Today, it is likely vendors have software that performs the same functions as the homegrown applications. STEP teams should look at SaaS offerings and find replacements for these applications, reducing costs and freeing developers for more business-critical applications.

When IT leads the charge toward SaaS by showing examples of the improvement and cost efficiency it provides, business units are easier to bring onboard, extending SaaS benefits to more of the corporation.

In the first phase of a SaaS implementation, CIOs and their IT staffs identify applications that could create cost efficiency if they were replaced by SaaS. They will evaluate SaaS providers and the feasibility of SaaS, in general, which helps move projects from theory to reality while working in a controlled environment. Assessing select IT applications early has the benefits of:

By performing a SaaS assessment, strategy, design and implementation, CIOs and their organizations can handle potential problems in an environment they know and control, as opposed to the business environment in which applications belong to their clients.

Experience acquisition—by performing a SaaS assessment, strategy, design and implementation, CIOs and their organizations can handle potential problems in an environment they know and control, as opposed to the business environment in which applications belong to their clients. And they can evaluate SaaS without adding in the complexity of dealing with requirements from business users. In this environment, errors become learning opportunities rather than finger pointing exercises.

Believability acquisition—CIOs who have overseen their own SaaS implementations have an easier time convincing business units to assess and move their applications to SaaS. Even unwilling business units can be reassured through real-life case studies and by making key SaaS skills available.

Skills development—as the IT organization performs the application assessment, strategy design and replacement by SaaS, the skills acquired by IT staffers help increase the probability of success when applying SaaS to business applications. Other benefits include reducing implementation times for subsequent initiatives and understanding the practice of including business professionals in the process to get their buy-in early on for these transformational efforts.

Assessment

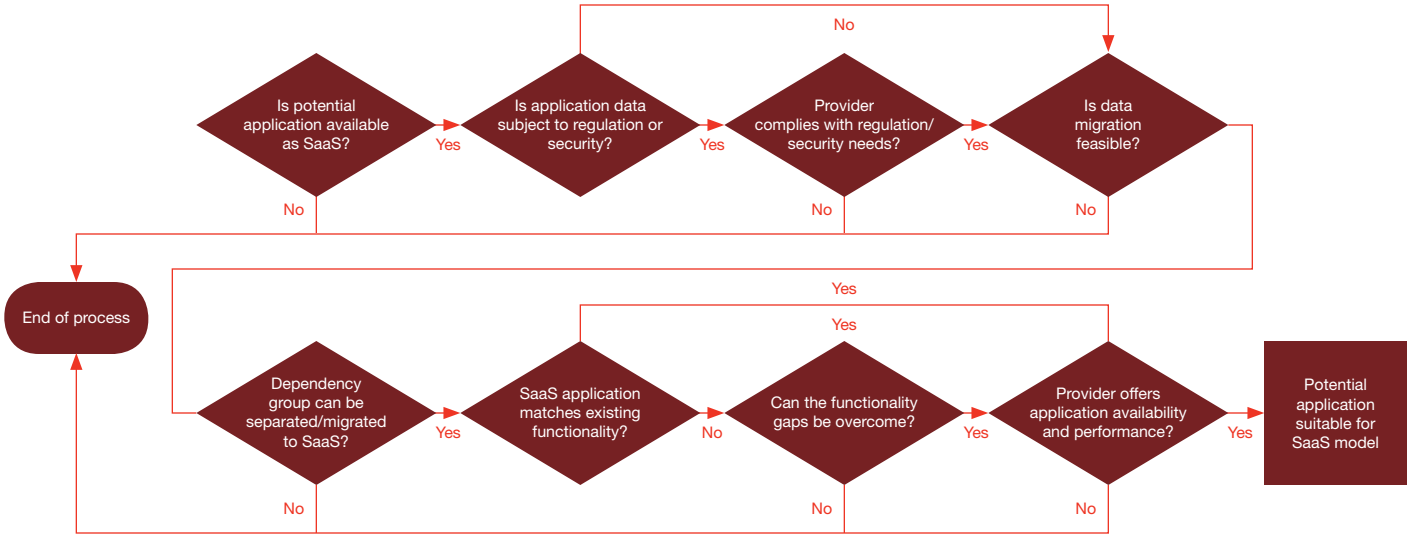
The table (Figure 1) and workflow (Figure 2) on page 16 detail critical aspects for analyzing potential applications for their fit with the SaaS model. The workflow also details PricewaterhouseCoopers' recommended decision sequence.

Each item in Figure 1 requires an initial discovery and data collection phase. IT should keep the assessment coordinated with its other SaaS activities. For example, a discovery phase for data security in the assessment should be coordinated with the selection of SaaS providers that offer security and regulatory certifications. It also should be phased in over time to define the requirements for a SaaS provider. The need for coordination will likely exceed available IT resources, making it a good idea to connect with the company's project management office (PMO) for help in planning and conducting project management activities when needed.

Figure 1
Critical assessment areas for potential software as a service (SaaS) applications

Area	Description	Importance
Application available as SaaS	If the application is not available as SaaS, there is no need to continue the analysis.	"Go/no go"
Data security	The data processed by the application is subject to regulation (e.g., e-mails) or special security measures (e.g., customer private data).	High; could become a no go if the SaaS service provider cannot comply with regulations or risks are deemed too high
Data migration	This offers ease of extracting data from the current application and migrating it to the SaaS application.	High; could become a no go if there is no cost-sensible way to extract and export data or if the SaaS service provider does not allow initial data loads
Application dependencies	Numbers and types of dependencies between potential applications and other applications. These dependencies create the following constraints: • Data constraints: other dependencies receive or send data to the potential application; the operations are not feasible in a SaaS model for technical, cost or security reasons • Time constraints: other applications interact with the potential application in a time-sensitive manner; the SaaS model would exceed the current tolerance for latency and transaction completion times • Technology constraints: the SaaS model cannot accommodate interfaces with other business applications cost efficiently due to incompatibilities among application technologies	High; could become a no go if the identified dependency group of applications cannot be separated or migrated completely to a SaaS model
Application functionality	Available functionality in the SaaS application must match existing functionality. If applications being evaluated for migration to a SaaS model belong to areas performing standard operations, the biggest challenge is talking business units through perceived gaps.	Medium/high
Business-critical status	How critical is the effect on the business if the SaaS service provider cannot offer the same application availability or performance as the current IT organization?	Medium/high

Figure 2
Sequence of main decisions for assessing potential SaaS applications



Because assessing potential applications crosses organizational boundaries, it requires a cross-functional approach. CIOs and their organizations must also be ready to cross borders to seize opportunities that send a message to corporate leadership: Assessments provide opportunities for IT to lead SaaS transformation by priorities—predominantly cost efficiency—that align with business needs.

In addition to experience acquisition, believability acquisition and skills development, IT organizations also develop abilities that ease future migrations of business applications to SaaS:

- **Conducting assessments**—IT organizations gain experience through contact with subject-matter experts and stakeholders and incorporate their input into the assessment. Workflows and activity sequences improve with experience. The benefit comes when implementing SaaS for business applications, as the IT organization will understand the majority of its tasks.
- **Estimating costs and risks**—IT applications do not necessarily have the same cost and risk profiles as business applications, but assessments of IT applications still require risk and cost models as bench¬marks for comparison of future models.
- **Defining changes to support processes and the user experience effect**—switching to a SaaS model requires a review of IT support processes around potential applications. The review allows the IT organization to reevaluate its support practices and lessen their effect on business users. This will alleviate user concerns about their support and service levels if applications are replaced by SaaS.

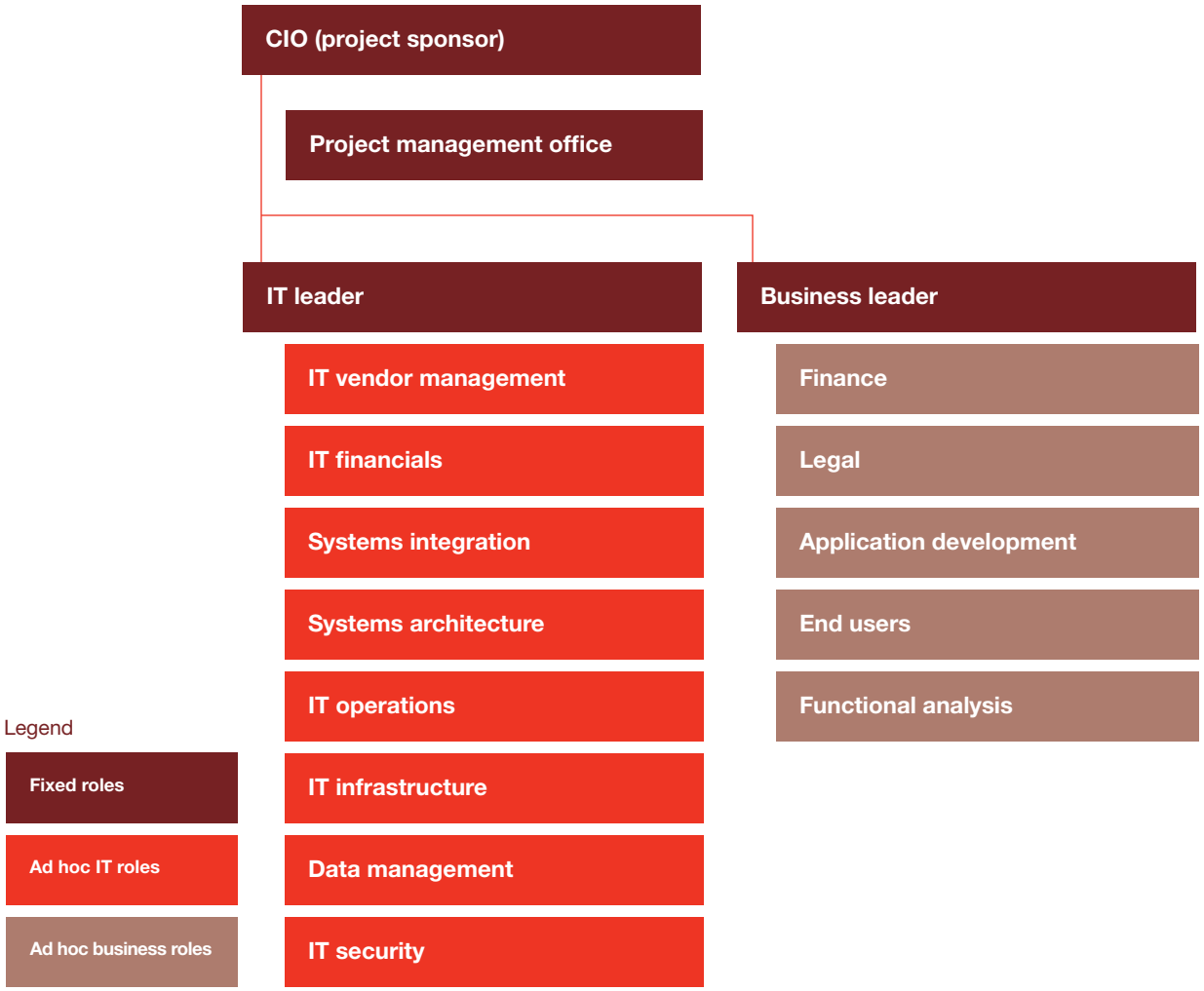
Evolving the organization toward STEP

The organizational setup for assessing SaaS for IT applications becomes the blueprint for STEP. It should reflect the need for cross- pollination of ideas and a commitment to having the appropriate members. Because IT and business personnel are likely in short supply, their time must be used carefully. That means a STEP group has to be agile. PricewaterhouseCoopers proposes such an organization (Figure 3) with few fixed roles and a majority of ad hoc functions whose input can be called upon when needed.

The definitive design of STEP will likely incorporate IT leader, ad hoc IT, business leader and ad hoc business functions. As the assessment progresses, knowledge is distributed among ad hoc functions. STEP leaders perform coordination and process improvement functions. Organizing this way makes staff availability more resilient to change, but close supervision by the leaders and the PMO is required. Otherwise, a loose structure like this could dilute accountability and command chains.

It is the role of CIOs to sponsor projects and provide vision and guidance. CIOs articulate STEP team findings and success, helping to extend SaaS initiatives to business applications and achieving buy-in from executive management.

Figure 3
The assessment organization and basis for a Software as a service Technology Experience Pool



Conclusion

SaaS promises meaningful opportunities for CIOs to lead cost-reduction initiatives within their organizations. By supporting more manageable and scalable applications—and shifting from fixed-cost to variable-cost models for the underlying IT organizations—CIOs can better model future technology services. Cost-efficient SaaS is realized by thoroughly identifying potential applications and assessing their characteristics and suitability for SaaS. PricewaterhouseCoopers recognizes the need for quick results and suggests CIOs blaze the trail to SaaS with IT applications. In doing so, they enjoy a sandboxed environment while building critical skills within their teams. They also gain valuable experience that can then be applied to other areas of the business. And they have the opportunity to share their SaaS success with corporate management, helping gain buy-in for business SaaS implementations.

Controlling IT costs with selective sourcing

Abstract
By leveraging selective outsourcing and out-tasking opportunities, financial services managers can benefit by moving from a largely fixed-cost IT model toward a partial variable-cost strategy. The objective of this article is to review how selectively sourcing one or more subsets of a financial services company's IT resources may provide new levels of flexibility. In this way, managers can incrementally reduce their companies' computing capacities and costs during a business downturn.

By moving partially to a variable-cost model, managers can lower their IT expenses incrementally. Five variable sourcing options offer innovative choices in today's challenging economy.

In today's difficult economy, financial services managers—whether at banks or other organizations—face new and unprecedented challenges. These managers must struggle with fewer new checking accounts, fewer trades and transactions, reduced savings and reduced customer activity in other areas, as well. Ideally, to control expenses, IT costs for these managers should drop, too. But at many institutions, that's simply not the case. Instead, the fixed costs of many IT resources deliver a double blow: Business is down, yet IT costs remain high.

Many financial services firms accept the idea that business expansion requires a large increase in IT investment; however, for these same organizations, business contraction does not yet translate into reduced IT costs. IT assets—including servers, networks, software and associated real estate and staff—remain fixed costs. Increases and decreases tend to come in massive step movements rather than incremental changes. As a result, these IT assets require large upfront investments that remain on the financial books even during business contractions. In essence, many financial services firms simply are not geared toward incrementally increasing or decreasing IT capacity, and related costs, to keep synchronized with the economy.

IT models: fixed costs vs. variable costs

A different, innovative approach is needed. Financial services managers can benefit by moving away from the industry's largely fixed-cost IT model and moving toward a partially variable-cost strategy. The primary objective of this article is to review how selectively sourcing one or more subsets of a financial services company's IT resources can provide new levels of flexibility. In this way, managers can incrementally reduce their corporate computing capacities and costs during a business downturn.

For example, imagine that an investment bank handles four million trade-execution orders in the first quarter of a year but only two million such orders in the second quarter. Ideally, as the number of trades is halved, the investment bank's IT expenses over these two quarters would be cut by half, too. But since many banks use a largely fixed-cost IT model, they would be unable to enjoy these savings.

Five sourcing opportunities for variable costs

For financial services managers looking to shift their IT costs from a fixed-cost to a variable-cost structure, PricewaterhouseCoopers has identified five alternative sourcing strategies. Because each company is different, one size will not fit all. Instead, managers will need to decide which of the five options are appropriate for their own situations. Managers also will need to assess the degree to which these options can be applied to gain the greatest flexibility and savings. Finally, because these strategies involve maintaining at least some IT operations on a fixed-cost basis, managers will need to decide what the ideal proportion is.

Real estate

Data centers represent a major fixed cost for many financial services providers. Companies typically purchase buildings or land on which to build; during a downturn, these fixed costs cannot be adjusted. Instead, managers may want to convert a portion of their real estate to leased property, with an option to increase or decrease space on a quarterly or semi-annual basis.

However, this may not be an ideal strategy during financial booms. When businesses are growing, a partial-lease strategy could cause real estate costs to escalate rapidly. So maintaining the ability to switch between fixed and variable costs—depending on the market climate—is an important aspect of this model. A financial services firm might secure an option in its leasing agreement to buy space, thus converting the data center to a fixed-cost basis. Also, a company considering this model should maintain a base (e.g., 50 percent of its real estate holdings) that the company owns no matter what. Then the remaining portion of real estate holdings can fluctuate between fixed and variable costs, depending on market conditions.

Another option involves working with companies that provide “data center in a box” services. Essentially, managers subscribe to these services rather than buy or lease a data center. The services not only contain the data center space but also the utility and facility infrastructure, including power, cooling and racks. Managers can use these services in a flexible manner by contracting their subscriptions, for example, or allowing them to expire during business downturns.

Enterprise license agreements

Commonly, financial services firms sign enterprise license agreements (ELAs) with their large software vendors. Essentially, these agreements require companies to pay a fixed license fee for software. If the number of users changes, the fee remains the same. That’s beneficial during an upturn: As a company expands dramatically, it still pays the same software-licensing fee. But this arrangement is unfavorable when financial services firms downsize due to reduced business. In these cases, companies are unable to reduce their software costs, although they have lowered the number of users through staff reductions.

For such times, a hierarchical approach may be better. Under this plan, companies would sign an ELA for a fixed base amount of their software licensing needs. They would also agree to a variable-cost model, in which the number of software licenses in use would be recalculated quarterly. In this way, financial services companies can reduce software-licensing fees when downsizing.

Staff and contractors

Staff represents a large cost component for any financial services IT department. During an economic downturn, many companies rely on layoffs, attrition and other forms of downsizing to lower staff costs.

Maintaining a baseline staff, plus a proportion of independent contractors, provides variability in the staffing model that can be leveraged during business downturns. The baseline might represent the staffing needed to keep IT systems operating. Then, as business demand requires, contractors can be brought on or let go without the need for severance packages and other benefits.

Outsourcing

Many financial services companies outsource some IT functions, such as networking, desktop support or application development. However, contracts for these traditional outsourcing arrangements tend to be inflexible. Changes can involve a good deal of renegotiation, additional fees or a combination of both renegotiation and extra fees. Yet, during a business downturn, change may be exactly what smart managers need.

As an alternative, managers may want to consider outsourcing IT complexity rather than outsourcing IT functions. Companies would continue to provide the median technology setup needed by most employees, but they also would outsource more complex technologies required only by a comparatively small number of employees. This strategy can save money during a business downturn, as demand for these more complex applications tends to drop during such times. Limited demand is precisely what makes these more complex applications so expensive to run. Because complex applications are provided on a limited basis, financial services companies find it difficult to reach economies of scale.

As an example of outsourcing complexity, managers at investment banks might outsource low latency trading such as index arbitrage. These applications essentially trade futures contracts during the fractions of a second—or hundredths of a second— when the market changes but the underlying stock prices don't. Applications able to take advantage of these short-lived trading opportunities require a good deal of IT infrastructure, and they must be appropriately tuned at all times. During a business downturn, a financial services firm's appetite for operating complex financial products usually diminishes, so this just becomes a matter of exiting the outsourcing arrangement.

Ideally, such outsourcing arrangements will be made before a vendor is selected and a contract is signed. According to a 2008 survey conducted by Brown-Wilson Group, more than 90 percent of outsourcing IT managers said that it's vital to have a global outsourcing strategy in place before searching for a vendor. Amending a contract based on IT complexity is far easier than amending multiple, function-based contracts. It also allows a company to focus on its competitive advantage—provisioning financial products. When possible, astute financial services managers will let others—those with core competency in technology—provide these complex applications.

Making the transition

Clearly, there is no prescribed path between fixed-cost and variable-cost models. Therefore, financial services firms that want to move to selective sourcing may consider turning to consultants or other trusted third-party advisers to help them pick an effective strategy. For example, as a leading technology consulting company, PricewaterhouseCoopers conducts workshops that help financial services managers identify an appropriate path for moving to one or more of the five variable-cost models.

Creating financial flexibility through service-oriented architecture

Abstract
Service-oriented architecture (SOA) implementations are showing companies that the traditional corporate IT model needs a makeover. Today, many corporate IT models simply cannot address the financial requirements of an SOA- supported enterprise. Not surprisingly, IT organizations are eagerly embracing the opportunities offered by SOA. The evolution of SOA transforms it from being a static function into a more agile, service-based business function. That is an important competitive differentiator. However, it means tweaking the corporate IT model to realize the benefits of SOA.

Overview

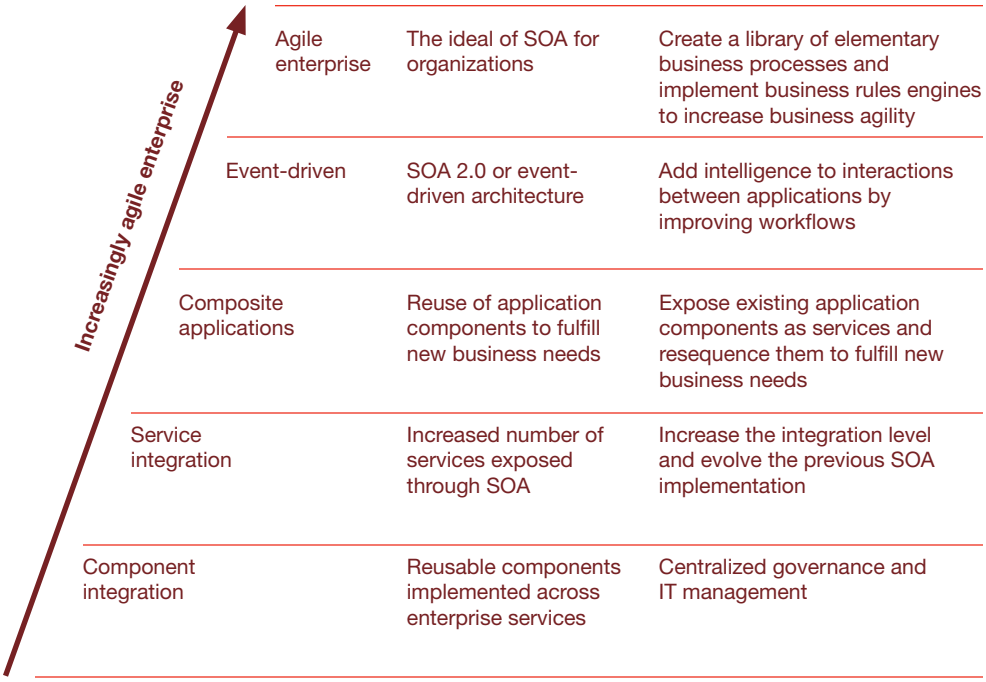
Service-oriented architecture (SOA)-supported enterprises are based on ecosystems of business functions that represent the interests and needs of multiple lines of business (LOB). However, many responsibilities must be determined before implementing SOA. For example, who should pay for certain services? Or how are fees broken down if services are reused across an enterprise? How should SOA projects be financed? The current financial model in many companies is appropriate only in budgeting for vertical LOB applications. SOA requires a different vision and execution plan. To achieve success in SOA initiatives, organizations will have to adopt a strategic approach that better realizes the associated financial benefits.

SOA and agility

Understanding why financing SOA initiatives is different from the traditional IT finance model requires a look at what actually encompasses an SOA-supported enterprise. There are five basic types of "encounters" with SOA (Figure 1):

- **SOA encounter of the first kind.** At this maturity level—which is where many large organizations reside today—the corporate IT group simply implements reusable components across its enterprise services. This level is essentially an iteration of enterprise application integration (EAI), making it easy to build a business case and secure financing for its implementation. At this stage, the investment into new licenses and skills is relatively small, and IT can provide the business with the ability to reuse functionality in real time. Business users receive information and execute functionality only when required—limiting the reuse of functionality between multiple applications. A key benefit of the SOA encounter of the first kind is that it drives down the costs of IT support. The real-time or near-real-time integration allows for spreading the processing loads over extended periods, which improves infrastructure utilization. The benefit is particularly marked when compared with the batch processes traditionally used for EAI that require intensive use of infrastructure during the batch processes. In many cases, the batch processes leave resources under utilized during normal work hours. Consequently, IT must over- procure infrastructure and computing hardware for those few hours of batch processing. The rest of the time, those resources sit idle.
- **SOA encounter of the second kind.** Companies successful with the previous encounter often find themselves at this next level. With encouraging results, organizations attempt to expose more services to SOA processes. However, these services might have little enterprise reuse if IT does not spend enough time under- standing the business operations of the enterprise. The corporation might then decide to halt its SOA efforts because it lacks a clear view of business needs and budgetary requirements.
- **SOA encounter of the third kind.** This level is an attempt to increase the agility of existing business applications. To support changing business processes, existing application components are exposed as services and are resequenced to fulfill new business needs (e.g., composite applications). This level supports reusing what already exists and reducing investments in new solutions.

Figure 1
Maturity scale for service-oriented architecture (SOA)



Unfortunately, traditional applications are created with hard coded component interactions. Simply exposing these components as services does not make them ready for SOA. SOA lies on loosely coupled components—so components should exist and work independently. Resequencing outside the application's core requires complete reverse engineering and redesign, which can be as expensive as coding a new application. While it's a good idea to have composite applications, trying to create composite applications on top of existing applications is questionable. The more resequencing needed, the more expensive the exercise becomes. Chief information officers and architecture teams will have a tough time building a sound business case for this level of SOA.

- **SOA encounter of the fourth kind.** This level, also known as SOA 2.0, brings EAI to the next level. It adds intelligence in the way applications interact with each other. Because event-driven architecture[1] (EDA) improves the workflow of value chains, the enterprise gains a reliable and agile integration framework that provides incremental value to processes that span multiple departments, such as sales or fulfillment. When executing a customer order involves multiple organizations, EAI is not enough. The entire fulfillment process must be monitored and pushed for optimal completion. With many companies organized into value chains, few have a single group responsible for the overall value chain. But EDA can be used to enforce proper execution flow for horizontal processes. EDA can also be used to monitor—and in some cases enforce—broad and asynchronous processes, raising alarms if something goes wrong and providing executive managers with information on overall performance. Companies can achieve the same results without using a workflow, but that means IT must hard code the

[1] This approach is called event-driven architecture because a particular business event starts a value chain. For example, a customer request for a loan starts a fulfillment process.

business logic, which limits the organization's ability to implement changes at the speed required to keep up with dynamic market conditions.

- **SOA encounter of the fifth kind.** This level represents what organizations should strive to achieve with SOA. This case extends resequencing, which hypothesizes that any business can be decomposed into smaller business processes. Steps in business flows located between decision points are called elementary business processes (EBPs). In many cases, the difference between how business works today and how it will work tomorrow lies in the order in which EBPs are sequenced rather than in the internal workings of each EBP. A library of EBPs and a business rules engine (workflow) allows the implementation of sequencing and provides business agility. Agility is supported for vertical organizations (business units) and for horizontal processes (integration within value chains). While this concept is not new, what has been missing until the year 2000 is enterprise-class business rules engines. Adopting this approach promises changes in how applications are designed and created and in the governance of corporate IT organizations. But IT will be challenged to build reusable agile business frameworks. Only extensively reusable frameworks can provide the ability to react swiftly to changing market needs.

The introduction of the business process execution language for process design and rules engine environments provides business users with a human¬like language for designing applications from end-to-end. As the level of abstraction increases significantly, productivity increases as well—up to six times when compared with the traditional model used today.

Financial effects of SOA

At high levels of maturity, changes required by business units are largely concentrated around changing the order of execution of elementary business processes rather than the processes themselves. This concept transforms the roles of IT and the business units in the software development cycle and significantly affects finances. Typically, traditional software development follows a recurring pattern:

1. **Business requirements** are developed by the business community and then translated into
2. **Technical architecture** for this particular business domain, which is translated into
3. **Unified Modeling Language design**, which is translated into
4. **Detailed code design**, which is translated into
5. **Code**

Too many translations significantly increase the probability of coding errors. Improving the process requires direct translation of the business architecture into executable code artifacts, which increases the level of modeling abstraction. The concept is simple: the higher the level of abstraction, the closer we are to the real human language of business design. That means spending less time developing applications. Higher levels of abstraction provide these benefits:

- Greater developer productivity
- Fewer moving parts, which reduces the possibility of coding errors and concomitant quality assurance efforts
- Fewer coding errors resulting from multiple levels of business architecture translations
- Increased precision for future development efforts
- Shortened development times and reduced emergency business changes on ongoing projects

Enterprise-class business rules engines provide a high-generation language used for resequencing EBPs, supporting the benefits of the appropriate level of modeling abstraction. In this new environment, IT focuses on the following:

- Providing and supporting a computing infrastructure (i.e., databases, servers, networks) independent of application functionality
- Managing the business rules engine
- Creating a library of EBPs and maintaining underlying application services

The new roles of the business will include:

- Defining business products, business process flows and business rules
- Identifying gaps in the library of EBPs and issuing the corresponding requirements to IT
- Using the business rules engine to configure designed functionality
- Running simulations and publishing the configuration into production

These changes drive significant financial benefits, making software development costs variable based on the level of business activity and more predictable:

- Over time, IT will amass EBPs, causing a decline in the demand for new ones
- Slow business cycles translate into slackened demand for new EBPs, reducing software development efforts
- More accurate estimates of the development efforts for new EBPs
- IT can calculate the number of CPU cycles required by each EBP and its other attributes, making chargebacks easier
- Available information on how much an EBP is used and by whom allows IT to attach a dollar value to it and issue chargebacks for its use
- EBPs are simple components, helping increase quality and reducing time and efforts for testing and fixing coding errors
- The overall enterprise architecture is simplified because EBPs (and their related application domains) are independent from the integration framework, reducing complexity and associated costs

Conclusion

The introduction of the business process execution language for process design and rules engine environments provides business users with a human-like language for designing applications from end-to-end. As the level of abstraction increases significantly, productivity increases as well—up to six times when compared with the traditional model used today. Over time, as EBPs increase, users will rely less on IT for this work-product. The result will be a well- performing SOA organization where IT more closely resembles assembly-line management.

Easing desktop management costs with innovative new technologies

Abstract
As demands from technology-savvy employees increase, companies are finding it more difficult to cut desktop management costs while keeping users satisfied. Now, the convergence of new technologies and associated management processes is helping transform desktop costs into variable costs. The benefits of this approach include meeting user expectations while leveraging data center and IT investments. This article examines current desktop support practices and the factors transforming them into an on-demand, variable-cost model service. It also provides strategic recommendations on achieving these goals.

The need to transform the desktop cost model

Delivering desktop environments to large, distributed user bases is challenging and costly. But delivery is just one of today's many desktop management cost drivers. Others include maintenance, support and depreciation of desktop personal computers (PCs); testing and deployment of new application releases; patches and upgrades to operating systems (OSes); and desktop repairs. With more workers demanding higher-quality support services, coupled with growing security and privacy concerns, it is not surprising desktop expenses keep increasing.

However, combinations of existing and breakthrough technologies are transforming the desktop cost model (Figure 1). New solutions—such as desktop virtualization, application streaming and blade PCs— promise significant change in the way IT organizations deliver and support desktops. They also help transform the desktop cost model by:

- Lowering hardware and software expenses through better resource utilization
- Increasing operational efficiency in day-to-day desktop management
- Delivering more choices in technologies that can offer hardware, OSes and applications separately, leading to more options for greater flexibility and cost efficiency
- Reducing the risk of data loss
- Decreasing the risk of privacy and security breaches

The evolution of desktops and users

Today, desktop computers are the primary interfaces between IT organizations and end users. The experiences office workers— who spend so much time at their workstations—have using PCs strongly influences how they perceive their IT organizations. As employees' working habits change, their expectations of IT and desktop requirements change, too:

- They covet mobility options, even if they travel infrequently
- They want always-on connectivity or at least the ability to access applications and data when offline
- They desire access to personalized desktop environments from anywhere, including their homes

While users lead the major shifts in desktop requirements, rapidly changing business drivers also are producing:

- More reliance on outsourced labor that requires cost-effective ways to deliver standardized, secure desktops and applications to remote, third-party users.
- Workforce reductions that require rapid provisioning and decommissioning of desktop computers.
- Mergers and acquisitions that require integration of different desktop standards, vendors and support models.

Figure 1
Information Technology Infrastructure Library-based desktop cost model

Desktop technologies				
Hardware	Software	Staffing	Accommodation	Transfer
• Servers • Storage • Network • Workstations	• Operating systems • Applications • Connection brokers • Management tools	• Service desk • Deskside support • L2/L3 support	• Warehouse/ storage of inventory	• Outsourced desktop support • Vendor support and maintenance

Cost elements		
Direct costs	Indirect costs absorbed by service	Unabsorbed indirect costs
• Workstation hardware • Desktop software licenses • Back-end license costs (physical and virtual)	• Deskside support • Service desk • L2/L3 support	• Data center power/cooling • Network • Facilities

- Major OS upgrades and application releases with stringent hardware requirements, which pose complex problems for IT organizations. Decoupling hardware, OSes and applications is a creative way of tackling these major undertakings without having to redesign the entire desktop stack.

These challenges and demands are pulling IT organizations in two directions. First, they must manage the need for mobile, distributed desktops that access applications and data from the Internet or network cloud. Second, they must centralize control and security by confining computing and data resources within a secure data center.

Approaches to transforming the desktop cost model

New technology enablers and low-cost solutions can help IT organizations address changing business drivers and cut costs from their desktop operations. First, look for cost takeouts. Later, consider reaching for more ambitious savings and disruptive cost models.

There are many way to transform the desktop cost model:

Reducing capital costs and depreciation. Reducing the company's overall desktop inventory, extending the life of equipment or both helps reduce capital costs and depreciation.

As we near the reality of U.S.$300 laptops, replacing expensive laptops with these less-costly—but also less-powerful—variations is increasingly attractive. Low-cost units will not suit all users and workloads, but they provide a novel approach to shifting capital costs.

Reducing operational costs. IT organizations strive to standardize desktop OS images, automate software patching and streamline desktop management. Today, though, technologies provide innovative ways to deploy a standard OS by cloning virtual images or other options. Technologies also provide ways to develop, test,

package and distribute software. One example is through application streaming over the network.

These approaches create operational efficiency and affect software license costs. Previously, licensing options included installing the application and paying for licenses for each desktop or installing it only as users requested it. Now, a third option is available: as-needed application streaming. This new approach makes better use of license fees and allows IT organizations to negotiate licenses. Rising license and support costs also can be mitigated with open source software. Enterprise-level open source soft- ware has been anticipated for years, but as adoption rates have gone up among consumers, a phased-in introduction of alternatives like open source office productivity suites or operating systems is no longer far-fetched.

Moving to variable-cost models. Desktop virtualization and application streaming technologies support many capabilities. One is the pooling of desktop images, in which users share limited numbers of images. Once a user logs off, the image is put back in the pool, optionally scrubbed clean and made available for the next user. In companies where users have varying work hours, it is possible to create less than one image per user. That translates into reductions in storage and possibly software licenses through:

- On-demand creation of new desktop OS images from a template—also referred to as cloning—which means desktop pool costs can shrink or expand based on user needs
- Legacy technologies, such as terminal servers, that allow multiple user sessions to share computing resources on a single server

With these capabilities, the desktop is becoming a good pay-as-you-go candidate, where users are charged—symbolically or literally—based on actual computer use. When a user needs a desktop, it can be provided on demand and priced accordingly, without the need for heavy upfront capital costs. This makes company desktop costs more predictable.

Also, the desktop-as-a-service model is emerging. Hosting companies are entering the space and building on the pervasiveness of the on-demand infrastructure to provide desktops on demand.

Reducing exposure to risk. Moving to a centrally managed desktop model reduces security and privacy risks associated with large distributed pools of workstations containing business and customer data.

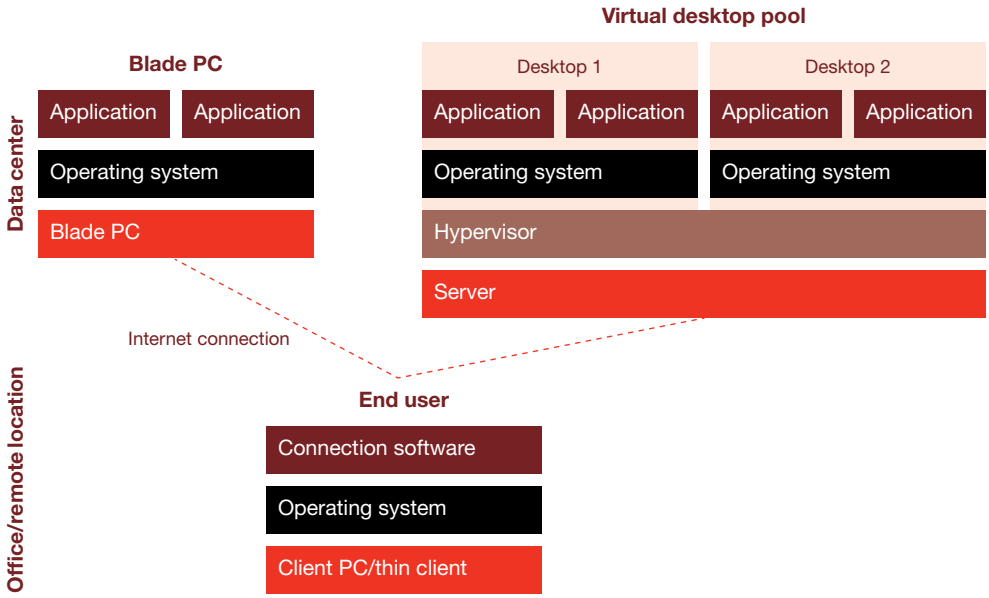
By moving data, OSes and applications back into a corporate data center, companies can better leverage standard security policies, backup mechanisms and even disaster recovery plans. Financially, a centrally managed desktop model might mitigate the risk of multimillion-dollar fines for loss of sensitive data. It also can increase employee productivity through improved data and desktop availability.

The next-generation desktop

In the past, concepts like diskless workstations and network terminals promised radical new ways of addressing desktop challenges. But they relied heavily on IT elements like network bandwidth and servers. They also had short- comings in processing power, limiting their applicability to narrow, specific uses.

Today, however, a next-generation desktop (Figure 2) can help deliver the right desktop experience to the right user in a cost-efficient manner. Virtualization

Figure 2
Examples of next-generation desktop technology solutions



technologies, development of streaming technologies that reduce bandwidth requirements and the emergence of new challenges to desktop support organizations all play important roles. The mission is accomplished using a combination of technologies, tools and cost modeling:

- **Technologies** that deliver OSes, applications, user data and settings to users provide the means for aligning user experiences with current expectations in areas like personalization.
- Streamlined **management tools and processes** deliver and support next.

While many are already in place—at various levels of maturity—the heavy reliance on data center and network services to deliver the next-generation desktop means the desktop support model will have to cross an IT organization's functional boundaries.

- **A costing model** looks at sourcing options, chargeback models and technology solutions, favorably shifting the balance of fixed vs. variable costs.

Technology framework

The technology framework for a next-generation desktop (Figure 3) must include an end-user-facing access device. There are many from which to choose:

Physical workstations are composed of traditional laptops and desktops running OSes and applications that meet company policies and standards. Endpoint virtualization applies traditional virtualization techniques to run multiple isolated OSes on a single workstation. This can either replace multiple workstations for users who need more than one or provide added security.

Thin clients are simplified workstations with limited computing power. They can display remote sessions of OSes running on a central server and transmit user

mouse or keyboard inputs back to the server. Typically, thin clients feature a minimalistic hardware configuration.

Unmanaged or light endpoints can be inexpensive or ultraportable laptops used for providing a full desktop experience for mobile users with limited computing needs. They also can act as mobile thin clients. This category includes noncorporate assets such as PCs owned by employees or firms contracted by the organization.

Unmanaged endpoints can be used in combination with **portable media**, such as standard or virtualized OSes stored on CD-ROMs or USB devices, which deliver the desktop on inexpensive media and require less workstation management.

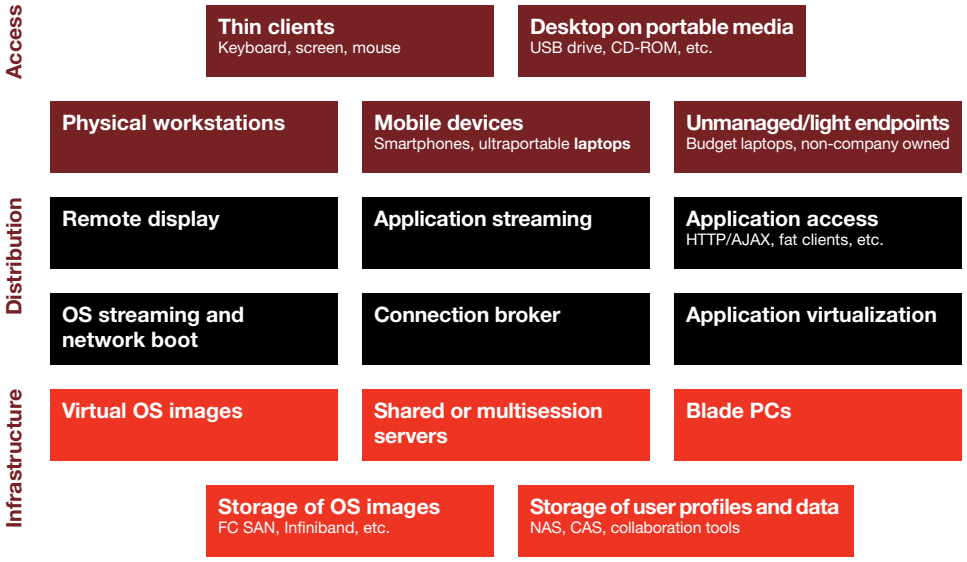
Mobile devices are typically personal digital assistants or smartphones. They often lack the processing power to run resource-heavyOSes and applications but can be used as remote clients to software components running on a central server.

Various techniques can help deliver OSes and applications to any of these access devices:

- **Remote display and application virtualization**—OSes or applications run on a central server and are remotely displayed on the user's access device
- **Streaming**—OSes or applications are delivered over the network but run locally on the access device as soon as it has received enough data to start them
- **Traditional application access methods**—these include web front-ends, such as AJAX and other Web 2.0 technologies, and legacy fat clients

Connection brokers are important middleware components that help connect users to remote desktops. Typical uses include user session management, entitlements and access rules, and handling virtual desktop pools, which use existing data center technologies to store OSes and applications in a secure, central facility. Technologies that can be used include physical servers, often through **blade PCs** (designed to provide workstation-grade computing power in a single, easy-to-provision blade), **virtual machines** hosted on physical servers,

Figure 3
Next-generation desktop technology framework



Many benefits are rising up through next-generation desktop technologies. As organizations struggle to become more agile while controlling costs, they need technologies that can trans¬form desktop delivery and user experiences. But no single technology is a one-size-fits-all solution.

and multi-session servers such as terminal servers that support the delivery of applications to multiple concurrent users.

Storage challenges in these various delivery methods include the location for user profiles (standard or roaming) and user data (e.g., using network-attached storage) but focus largely on the storage required for handling hundreds or thousands of OS images. Back-end storage deduplication or software solutions are often prerequisites to large-scale virtual desktop deployments.

Desktop management

Desktop management remains a source of both challenge and prohibitive cost. But by introducing technologies like those described earlier, companies can get closer to achieving operational efficiency and related savings, including:

- Inventory reduction and improved inventory management through discovery or management tools used in the data center today (e.g., the IT organization now can use its chosen virtual machine management tool to track virtual desktop OSes).
- Provisioning and decommissioning through data center automation and simplified end-user devices that can be installed by nontechnical staff.
- Software distribution, through application virtualization and streaming, that helps companies deploy software. It also helps push software updates transparently, with the new version being deployed as users access it.
- Asset management, through better use of software licenses, increased sharing of infrastructure—such as higher utilization of storage and computing via virtualization—and leveraging existing tracking tools to facilitate metrics.
- Break/fix can now be rolled into existing data center support processes (e.g., with virtual server provisioning, users can reimage a failed desktop OS). Moving to simpler end-user devices also can help mitigate hardware failures.

Conclusion

Many benefits are rising up through next-generation desktop technologies. As organizations struggle to become more agile while controlling costs, they need technologies that can transform desktop delivery and user experiences. But no single technology is a one-size-fits-all solution. Virtual desktops running on thin clients may be a good fit for an outsourced call center, but road-warrior executives might require a different solution. As with any technology introduction, the key lies in a phased-in approach. In this case, the approach includes three important steps:

- Understanding end-user behaviors, computing needs and service expectations
- Defining a strategy and associated technology support for delivering a desktop service that meets end-user requirements
- Mapping client requirements, support needs and cost objectives for each desktop service to an appropriate mix of technology solutions

Successfully executed, this phased-in approach to next-generation desktop technology can significantly change how workstation functionality is delivered while increasing its cost-effectiveness for your organization.

Supporting next-generation, consumption-based hosting services with cloud computing

Abstract
Cloud computing is a key enabler of the software-as-a-service model that supports the deployment of applications as Web-based services hosted in "clouds" of technology assets (e.g., servers, storage, network devices). The open secret of cloud computing is its ability to split application workloads across shared resources, which can be geographically dispersed, while supporting application performance and reliability as computing demand fluctuates. Cloud computing also eliminates the need to invest in hardware, software or facilities necessary to run applications and supports billing for services on a pay-as-you-go basis.
This article reviews the technologies behind cloud computing, the current industry service model and its limitations. Then it discusses current trends and capabilities in cloud computing. Today's risks and benefits are also detailed. Finally, it discusses the disruptive nature of cloud computing and its potential effects on the cost structures of IT organizations and enterprise data centers.

The secret to cloud computing is its ability to split application workloads across shared pools of geographically dispersed resources while maintaining application performance and reliability as demand for computing resources fluctuates.

Cloud computing: an emerging technology

In today's economic slowdown, financial services firms are reducing costs to improve their bottom lines. These measures include IT budget cuts at a time when IT departments face increasing demands for improved reliability and performance, quicker deployments and more transparent financial reporting.

Before the current economic rough patch, the trend for media-rich applications and analytics engines resulted in a proliferation of different server and storage platforms in enterprise data centers. On average, large companies are experiencing a twofold increase in their server, network and storage resources every one to five years to meet rising demands. Consequently, IT organizations, particularly those that resulted from mergers or acquisitions, manage varied and complex technology portfolios that are riddled with operational inefficiency, platform fragmentations and a lack of process and tool integration across the IT infrastructure. This complexity increases application failure rates[1] and does not support rapid deployment times or cost transparency. Companies with complex, fragmented environments face monumental challenges to improve application performance and reliability during periods of varying demand and adopt a chargeback structure based on resource consumption.

On the other hand, mature IT organizations regularly assess emerging technologies and their abilities to address these challenges. In larger companies, architecture groups typically monitor and experiment with new technologies, usually on a no-cost basis negotiated with product vendors. Other companies maintain a watch list of technologies and monitor the market through analyst reports and other pertinent data. They use a filtering function that analyzes market information and weighs their company's readiness to adopt technologies based on several criteria.

Although they are still maturing, cloud computing and the software as a service (SaaS) business model are currently grabbing the industry's attention and setting off alarms throughout corporate filtering functions.

SaaS is a new business model for deploying applications as Web-based services hosted by a service provider. A critical support of SaaS is cloud computing, which is characterized by its ability to split application workloads across shared pools of resources, support fast provisioning, provide on-demand application scaling and offer billing based on resource consumption. Companies that leverage SaaS and cloud computing don't have to invest in in-house applications hosting. These may help them significantly reduce costs and shift their IT cost structures from a fixed-cost model to a variable-cost model. IT organizations should consider this innovative approach to their IT challenges and help meet increasing user demands.

[1] Industry figures suggest that 80 percent of infrastructure failures are caused by human error, often due to fragmented and siloed change management processes (e.g., one isolated process for each technology domain that does not take into account dependencies on other domains) and an overall lack of standardized operating environments.

Utility computing: the technology behind cloud computing

The infrastructure behind cloud computing is managed through utility computing technologies. Utility computing supports dynamic provisioning and repurposing of server, network, storage and desktop resources. Configuration files for applications, operating systems (OSes) and servers are packaged into images or instances and maintained in data stores. The images can be dynamically loaded or unloaded based on predefined policies for demand, time, events, priorities or other criteria. Policies also define boundary values for the operating environment (i.e., maximum RAM in use, maximum CPU in use). In addition, utility computing can be used to manage physical and virtual servers.

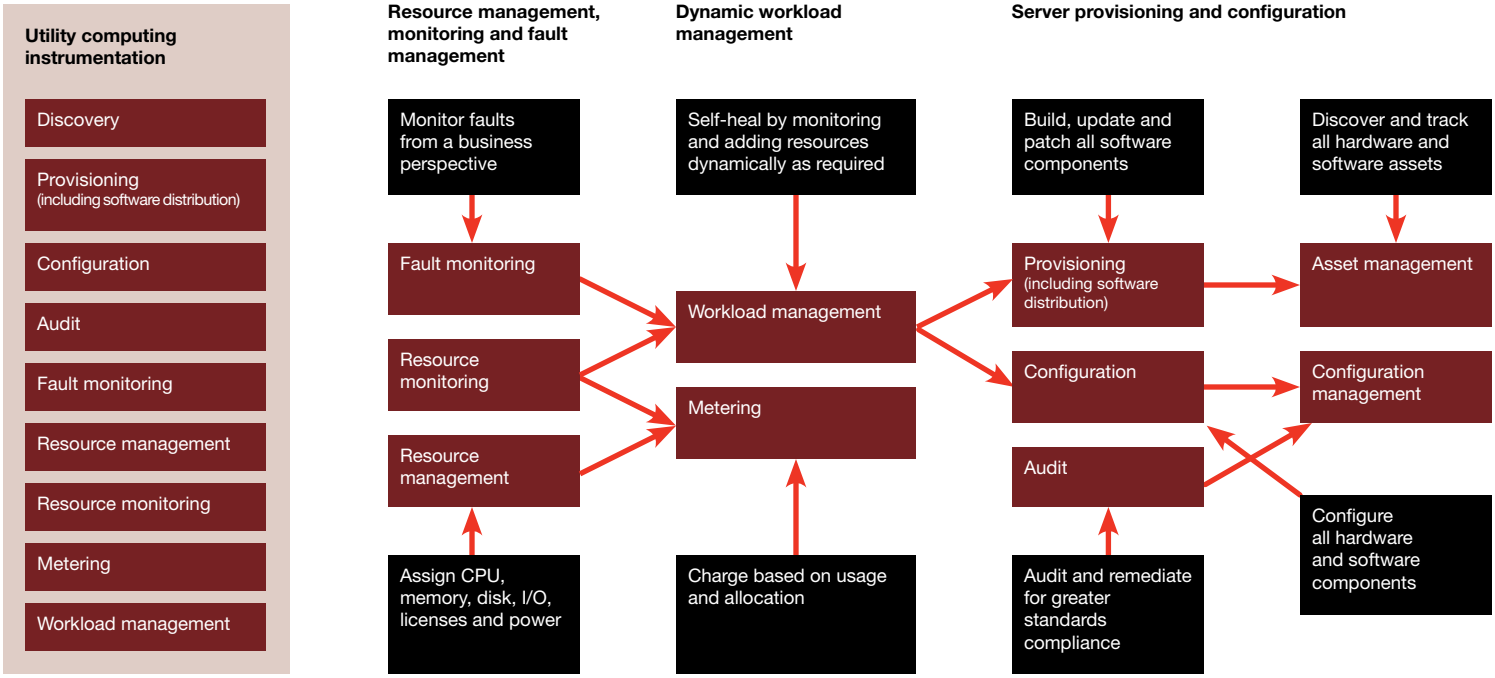
Utility computing dynamically scales applications, on demand, across shared infrastructures. This eliminates the need to over-provision resources to keep up with processing needs during peak use. It also allows idle servers to be used for other purposes or powered off to reduce overall data center energy usage. For example, utility computing lets companies use servers dedicated to disaster recovery for development or testing during normal operations. Because applications are dynamically resized and varying levels of resources are allocated at different times, utility computing allows computing and storage resources to be billed based on consumption. In addition, utility computing can help companies:

- **Reduce costs** through efficient use of resources, greater control over hardware inventory growth, lower staffing needs and reduced complexity due to lower power consumption and improved process automation, with the added benefit of fewer opportunities for human error
- **Improve quality of service** through infrastructure provisioning automation, driven by business policies and simplified capacity allocation, based on demand, to meet varying computing loads
- **Increase agility** by standardizing operations and infrastructures to allow rapid service provisioning and scaling to meet demand

The goal of utility computing is to rearrange infrastructure resources currently locked in silos across business lines and environments (e.g., development, testing, disaster recovery) into a pool of resources that are automatically allocated and deployed based on business policies and service requirements.

Implementing utility computing can be challenging because of the requirements for integrated real-time operations and appropriate instrumentation. Figure 1 identifies the key instrumentation functions required to support utility computing.

Figure 1
Key instrumentation functions required for utility computing



Instrumentation tools related to resource management, monitoring and fault management support a standardized framework for real-time monitoring and management. Key features include:

- Integrated infrastructure discovery capabilities and configuration management database linked to asset management and service-level management tools
- Management and monitoring of resources (e.g., CPU, memory, input/ output, storage, licenses, power)
- Fault and change detection and reporting in real time
- Application health and resource utilization monitoring

Instrumentation tools for server provisioning and configuration are primarily used to create images that combine baseline application and server configuration files and deploy those applications in appropriate computing environments. Some vendors refer to baseline images as distributions. These tools include a highly standardized suite of processes around configuration and change management that allows applications to be provisioned within minutes. Key benefits of server provisioning and configuration include:

- Automated change management and control, including configuration management, patch management, application packaging and rollbacks, promotion and deployments
- Configuration compliance through enforcement of policy-based audits of infrastructure resources and application configurations
- Bare metal server provisioning
- Software distribution, patching and updates
- Automated deployment and configuration of OSes
- Application release management, including application discovery, configuration and certification of software, creation and packaging of images, application promotion, and deployment
- Job scheduling
- Physical and virtual server management

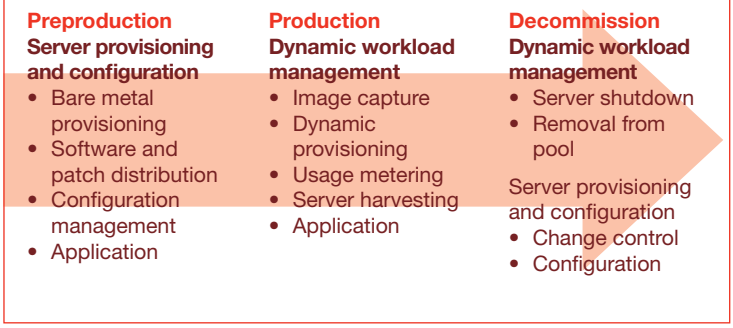
Instrumentation tools for dynamic workload management allow rapid provisioning of applications across shared servers in response to load conditions, failovers and business policies. Key characteristics include:

- Horizontal scaling, adding or subtracting an entirely new server image based on demand to meet service levels
- Capturing and hosting application images
- Delivering high-availability capabilities through rapid reconfiguration of available resources
- Starting and stopping applications
- Monitoring and measuring resource usage of applications and services and performance metrics against business policies and service levels
- Harvesting of servers (dynamically turning off lower-priority applications and repurposing servers for higher-priority applications) when no more capacity is available
- Powering servers up and down based on power management policies (i.e., time, event, capacity, demand)
- Bare metal provisioning
- Physical and virtual server management

Depending on the solutions selected, functionality overlaps may exist between tools for server provisioning and dynamic workload management, particularly in application packaging, bare metal provisioning and physical and virtual server management.

Figure 2 illustrates the roles of server pro- visioning and dynamic workload management tools throughout an application's life cycle.

Figure 2
Functional roles of server provisioning and workload management tools

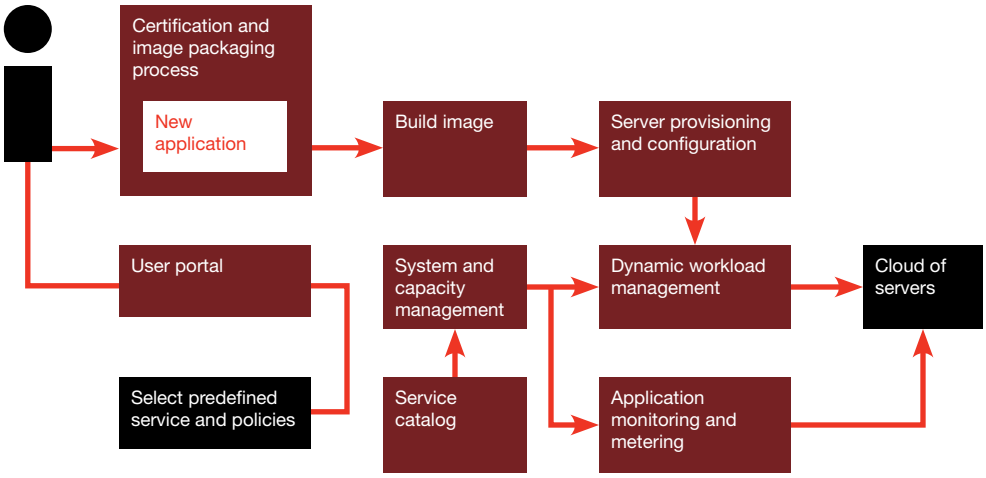


Cloud computing service models

From a service delivery perspective, cloud computing service models (Figure 3) consist of the following elements:

1. **A service catalog** is presented to users when they access a cloud computing provider's portal. Users can request predefined services, such as enterprise e-mail, and select business policies and service tiers.
2. **System and capacity management tools** interpret user requests and confirm available resources.
3. **Capacity management tools** invoke dynamic server workload tools to provision and activate predefined packaged images within identified server resources.

Figure 3
Cloud computing service architecture



4. **Dynamic workload management tools** reconfigure infrastructures to meet varying demands and business policies.
5. **Monitoring tools** verify that services perform according to committed service levels and track usage.

Candidate applications for cloud computing

Applications best suited for cloud computing are not dependent on OSes or hardware. Examples include Web-based applications that can scale horizontally by relying on web farms that have front-end load balancers. Additional servers help meet increased service demands. When demand decreases, infrastructures can scale down by turning off servers.

Current cloud computing services

Key attributes of current services offered by cloud computing providers include:

- Pay based on resource consumption (i.e., CPU hours, amount of bandwidth used) rather than a fixed cost for servers
- No long-term contracts—some vendors require only one hour of commitment

Cloud computing is compelling because costs related to computing resources are no longer fixed but vary according to consumption.

Pricing models are still evolving, and many different types may emerge. For example, pricing for e-mail appears to be moving toward a fixed charge per user with discounts available based on volume.

However, the pricing model for Web-based business applications, which will likely become the most popular services of cloud computing providers, may have fixed-price components and variable-cost elements similar to the access charges and traditional minutes used in cell phone rate plans. According to research, prices for Web-based applications are just a fraction—typically 25 percent—of what it would cost to run those applications in an enterprise data center.

Application hosting services have been available commercially since the advent of the Internet; cloud computing is simply the most recent incarnation. Historically,

Application hosting services have been available commercially since the advent of the Internet; cloud computing is simply the most recent incarnation.

Internet service providers branched into collocation or application service provider services and launched cloud computing services. New players in the cloud computing market include Google, Microsoft and Yahoo.

Today's market offerings do not yet align with cloud computing's vision. In fact, current cloud computing service offerings present significant risks:

- Service-level agreements (SLAs) are not yet in line with enterprise-class SLAs for many cloud computing providers.
- Most cloud computing providers do not offer consistent support to help companies design application architectures, define sizing requirements or configure business policies.
- To keep costs down, most cloud computing providers leverage open source software. Linux applications are the only ones that work well in this environment, while Windows- and UNIX-based applications have limited support.
- Licensing in a virtualized and dynamic workload management environment has not been adequately addressed.
- Most companies are not yet confident with the level of privacy and security offered for their data.
- Some European countries require financial data to be hosted in-country, a difficult compliance requirement for cloud computing because it is essentially geography independent. However, some providers are deploying services with built-in geographic constraints.
- Most cloud computing providers do not allow security monitoring.
- Most cloud computing providers are not compliant with the Payment Card Industry standards and cannot process credit card payments.
- Porting existing enterprise applications is difficult due to their dependencies on middleware, hardware and software residing within corporate data centers. Currently, most major business applications would not qualify as candidates to be hosted with cloud computing providers unless their architectures and dependencies could be simplified.

Cloud computing providers

There are five types of cloud computing providers:

- Traditional application service providers (e.g., Akamai, Amazon, Salesforce.com)
- Hosting providers (e.g., Layered Technologies, Terremark, XCalibre)
- Large integrated companies (e.g., IBM, Sun Microsystems)
- Web giants (e.g., Google, Microsoft, Yahoo)
- New entrants (e.g., iCloud, Mosso, Zimdesk)

A representative example of today's cloud computing service model is illustrated by Amazon.[2] It offers two key services—Elastic Compute Cloud (EC^2) and Simple Storage Service. Amazon's customers can create from scratch or select from a virtual server template which images to deploy. The company uses a third party, RightScale,[3] to help customers port or create web applications to run on EC^2.

[2] Amazon.com, Amazon Elastic Compute Cloud (Amazon EC2), beta available at http://www.amazon.com/gp/browse.html?node=201590011, retrieved August 14, 2008.
[3] RightScale, Cloud Management Platform and Support, retrieved from http://www.rightscale.com, Oct. 27, 2008.

Although the industry is still in its infancy, Google, Microsoft and Yahoo—which have vast data center infrastructures that they can leverage into grid computing—as well as other players plan to enter the market soon. This could change the data center computing paradigm dramatically.

For example, today Google offers e-mail and collaboration services as part of its Google Apps service.[4] It includes Web-based e-mail (with 25 gigabytes of storage per account), calendaring, document management and other collaborative services for U.S.$50 per user per year, with 24/7 support. These costs are significantly lower than the costs of an enterprise mailbox. In addition, Google has previewed its Google App Engine,[5] which allows developers to develop and test new applications hosted with Google's cloud computing infrastructure, offering a development sandbox and publishing functions to deploy newly developed web applications onto Google's servers.

Conclusion: creating a paradigm shift for IT and financial services companies

Today, cloud computing services and their infrastructure technologies are still maturing and considered too risky for major business applications. However, financial services companies can benefit from an increasing array of cloud computing services, including enterprise services like e-mail and Web- based collaborative and hosting services for nonmission-critical applications—such as instant messaging and Linux-based J2EE applications—at a fraction of the cost of enterprise data centers. The more commoditized and standardized the applications, the more appropriate it is to use cloud computing to host them instead of a corporate data center. In addition, cloud computing is better suited for:

- Low-priority business applications for data mining and/or that have few if any hardware or software dependencies
- Hosting facilities for development and testing, leveraged during times of increased demand such as marketing campaigns, or when enterprise computing resources are unavailable
- Running product pilot projects without committing to purchase servers until the tested products or applications prove viable

Until cloud computing matures, it will continue to be a disruptive force and can change computing and enterprise data center paradigms in significant ways. In the future, companies may require little or no infrastructure to run corporate applications, reaping the benefits of a variable-cost structure for IT and increased levels of responsiveness to fluctuating computing demands.

This paradigm shift began when web conferencing applications such as Webex were introduced. Because applications no longer have to be hosted behind enterprise firewalls, companies are reluctantly accepting the fact that an increasing number of managed applications can run outside their corporate infrastructures. As cost advantages increase to favor cloud computing, the relevancy of enterprise data centers[6] may come into question. Finally, the consumption- based cost approach inherent in cloud computing will support cost transparencies demanded by business users. These transparencies and the significant cost benefits of using cloud computing will help build support among organizations.

[4] Google, Welcome to Google Apps: choose the edition that fits your needs, retrieved from http://www.google.com/a/help/intl/en/admins/editions.html, August 14, 2008.
[5] Google, What is Google App Engine?, retrieved from http://code.google.com/appengine/docs/whatisgoogleappengine.html, August 14, 2008.
[6] A twist to the impending vanishing physical data center paradigm is the potential for companies to run their virtual data centers in a cloud.

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