



Infrastructure- as-a-Service

Fulfilling the Promise of Cloud Computing

A Tata Communications White Paper



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Executive Summary

- Infrastructure-as-a-Service (IaaS) represents a new consumption model for the use of IT resources. An IaaS provider offers customers bandwidth, storage and compute power on an elastic, on-demand basis, over the Internet.
- Companies' reasons for choosing an IaaS environment differ, depending on the size of the organization and the nature of the business. Cost is often the primary reason. For Small and Medium Businesses (SMBs) with a limited capital budget, IaaS shifts the capital requirement to an operational expense that tracks with the growth of the business. Even among large enterprises, infrastructure costs are a driving force for considering IaaS.
- IaaS' other key benefits include improved cashflow, accommodation of widely inaccurate provision planning, and exceptional transparency in utilization and costs.
- Tata Communications has demonstrated its commitment to IaaS with the introduction of InstaCompute. Joining our suite of managed services that also includes colocation and managed hosting, InstaCompute adds a key component to the company's IT services road map.

Introduction



Evolution to Infrastructure-as-a-Service (IaaS)

Traditionally, companies met their growing IT needs by investing in more capital equipment. Today, competitive pressures continue to demand improvements in quality of service despite growing numbers of users and applications. At the same time, the challenging economic environment has increased pressure on IT departments to keep costs down.

The convergence of those trends, with other advances of the last several years, has made it possible to take infrastructure outsourcing to a new level. Building on the foundation of managed services such as colocation, hosting, and virtualization services, Infrastructure-as-a-Service (IaaS) has emerged as an easily deployed service that enables companies to flexibly and cost-effectively anticipate and evolve with their customers' rapidly changing business requirements.



IaaS Defined

IaaS provides simple provisioning of processing, storage, networks, and other fundamental computing resources over a network.

With IaaS, IT services can be delivered as a subscription service, eliminating up-front costs and driving down ongoing support costs (enabling companies to make a strategic shift from a CAPEX to OPEX-based business model). As with managed hosting, IaaS providers keep costs low by pooling resources and giving customers access to a shared facility. But a major difference is that IaaS resources are elastic and available on a self-service, on-demand basis.

While IaaS providers often differ in their specific offerings, key features of all IaaS models include:

- Instant deployment
- Ability to rapidly scale
- Lower TCO
- Predictable uptime

Advantages of IaaS versus other service options

Table 1 - Comparing IT Sourcing Features

	IaaS	Managed Services	Conventional Data Center
Provisioning	On-demand, instant	On-demand, days to weeks	Weeks to months
Scaling	Instantly up or down	Weeks to months, up or down	Months, up only
Charges	No upfront, "pay as you consume"	Upfront fees, minimum term commitment, fixed monthly fees	Capital-equipment purchase or lease, maintenance charges, plus bandwidth utilization fees
Self-service?	Yes, via desktop console	No	Not automated

Cloud Computing: A Closer Look

Cloud computing, at least conceptually, has been gaining rapid popularity as an easily accessible, strategic IT model. The downside of this widespread attention is that vendors have begun to provide their own definition for what comprises a cloud-based model, often based on the benefits that their specific service offering provides. To cut through the confusion, the U.S. National Institute for Standards and Technology (NIST) has come up with five essential characteristics that must be present for an offering to be considered “cloud”.

1. On-demand self-service - Customers can unilaterally provision computing capabilities, such as server time and network storage, without requiring human interaction with the service provider. This is possibly the most important cloud computing criterion.
2. Broad network access - Capabilities and control of a cloud computing service must be available over the Internet (or other networks) using standard protocols, via a wide variety of platforms, including mobile devices.
3. Resource pooling - Physical and virtual resources are dynamically assigned and reassigned according to demand, resulting in cost savings to the customer.
4. Rapid elasticity - Near-immediate provisioning of capabilities, to quickly scale up, or down, according to demand.
5. Measured Service - Customers’ use of the capabilities is monitored, controlled, reported, and charged with complete transparency, enabling a “pay-as-you-consume” metering arrangement.

One generally

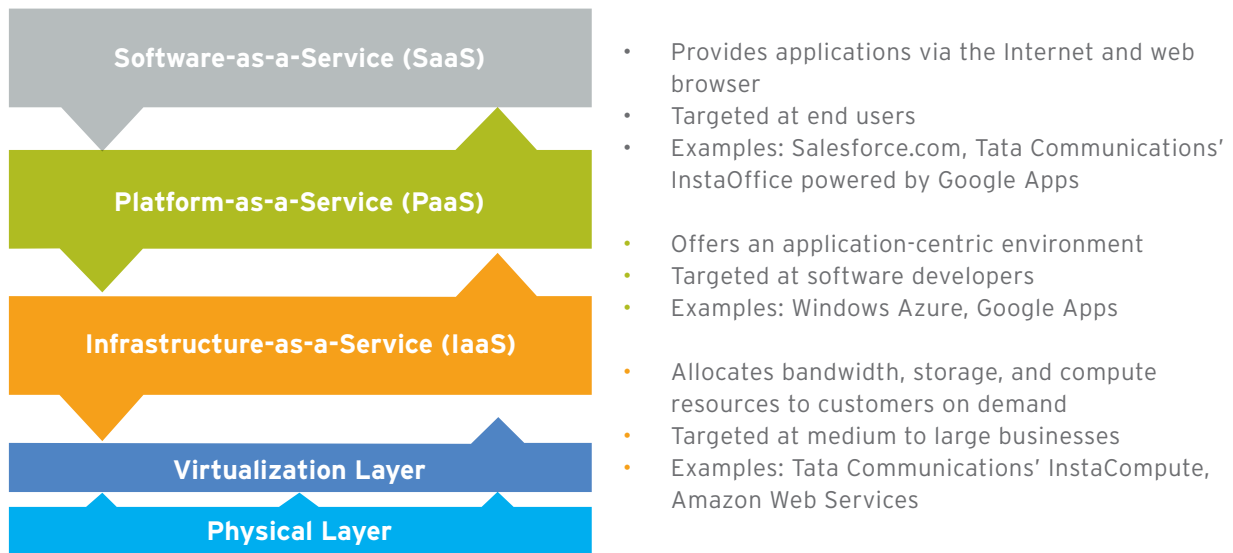
Other Cloud Computing Service Models

One generally agreed-upon area in the industry is that there are three service models of cloud computing: Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS) and Software-as-a-Service (SaaS).

PaaS is similar to IaaS, except that the service includes a specific set of programming languages and tools (the platform). Generally aimed at the developer community, PaaS is analogous to an on-premises application server, only with elasticity and other cloud-computing features. Since platform software is fixed with the service, PaaS places restrictions on the applications that can be built.

SaaS is essentially the delivery of conventional IT applications to end users over the Internet. SaaS is analogous to a client/server model, except that the server is replaced by the SaaS provider's data center, the clients are simply web browsers on desktops (or mobile devices), and the service offers cloud-computing benefits such as elasticity and pay-as-you-consume metering. SaaS gained a foothold with universal applications such as email and Customer Relationship Management (CRM) applications like Salesforce.com.

The three cloud computing service models can be viewed as a stack, with each layer increasing in specificity, while decreasing control of the underlying resources (see figure). The three layers sit above a virtualization layer, which itself sits above the physical servers, storages, and network hardware.



Virtualization refers to the abstracting of a form of technology away from its original environment. The benefit derives from being able to redeliver it in a virtual (or "logical") form capable of the same functionality as the original, but with greater flexibility.

Virtualization can also be of great benefit when supplemental data center services are needed, or consolidation of physical resources is desired to reduce power consumption and costs.

However, virtualization services should not be confused with IaaS, as they lack three of the key features of a cloud computing model – on-demand provisioning, self-service capabilities, and metered usage.

Economies of Scale

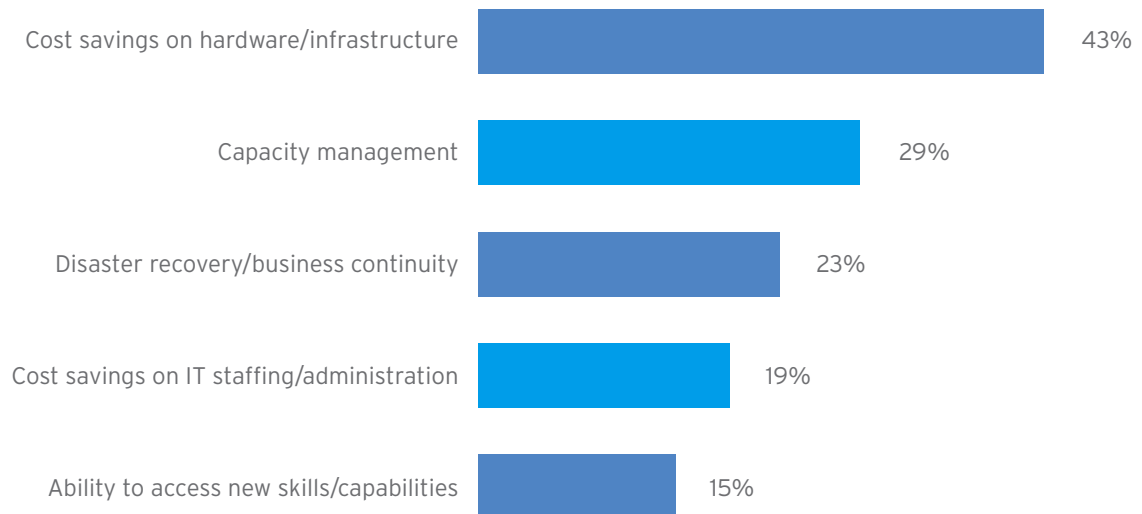
The economies of scale inherent in the IaaS model offer several advantages for customers. Primary ones include:

- **Lower overall costs**
 - IaaS providers often have greater purchasing power than single companies and business units
 - Bandwidth with redistribution (and more efficient utilization) of pooled resources
- **Avoiding technology obsolescence**
 - With high-performance IT services as their core business, IaaS providers are very likely to tap into the latest technologies
- **Unparalleled expertise**
 - IaaS providers' scale enables them to recruit top talent (and the sheer number of personnel resources) which may be unavailable to SMBs

Why IaaS?

While companies' reasons for considering IaaS differ, among SMBs and Enterprises alike, cost savings remains a key objective. A recent Yankee Group survey, focusing on cost savings, illustrates the top five motivations specified by respondents as reasons to use IaaS (see figure on the next page).

Top Five Motivations to Use Infrastructure-as-a-Service (IaaS)



Source: Yankee Group Webinar Q&A: "Pinning Down Cloud Computing"

Key Benefits of IaaS

- Improved cash flow**
 With no up-front commitments and a pay-per-use consumption model, IaaS offers an improved start-up cash flow in comparison to conventional data center and IT service models.
- Support of uncertain provision planning**
 The elasticity of IaaS enables customers to rapidly scale up resources as needed—even automatically—avoiding the undesirable consequences resulting from over- and under-provisioning.
- Transparent metering and self-service management**
 The visibility and control IaaS offers over resources, activity and costs, represent a new level of IT management efficiency.

Other benefits of IaaS include, for both SMBs and Enterprises, speed of deployment and increased functionality (such as easier backup and disaster recovery). For Enterprises specifically, IaaS brings particular advantages from both a tactical and strategic planning perspective.

Key Considerations

With IaaS, as with any new development, there are concerns about risks, readiness, and managing the transition.

Frequently asked questions center on costs, the transition process from a data center to IaaS, minimizing risk, ensuring performance, and managing the new environment.

Total Cost of Ownership (TCO)

To determine if transitioning to IaaS really is a strategic move from a cost perspective, calculating TCO is a must. This determination must include costs such as upkeep, salaries of IT personnel and the time commitment of senior management when planning, building, and managing a data center.

With static, continuous loads, an IaaS environment will generally bring cost savings, and with bursty and dynamic loads, those savings will be significant.

Migrating to IaaS

The prospect of migrating existing applications from a data center to IaaS is a primary concern of enterprise IT managers. IaaS offers encouragement in that it offers a great deal of flexibility—anything that can be virtualized can be run on IaaS. In the end, the question is whether the benefits of IaaS outweigh the investment in learning new APIs and web interfaces, and the risks of migration.

Managing Risk

In industries such as healthcare, where privacy of data is a key concern, IT administrators are often apprehensive that using cloud computing services versus on-premises data management may risk higher exposure of confidential information. IaaS providers are addressing these risks with features such as federation capabilities, which address multiple clouds and offering enterprise versions of the service.



Ensuring Performance

Service Level Agreements (SLAs) accompany voice, bandwidth, and a number of IT services. However, an SLA does not necessarily affect the actual operations; its terms and conditions are only recited when things go awry, and it typically does not protect a business from loss of system uptime. The same holds true with SLAs and IaaS providers. In the end, the quality of the uptime is directly related to the sophistication of the IT department, not the strength of the SLA. Choosing an IaaS provider that employs best practices in design and operations and promotes transparency offers the greatest assurance of performance.

Managing the Cloud

The system management tools available from IaaS providers represent an additional concern, since, like any other service (e.g., virtualization), they will require a learning curve. Just as the move to virtualization added tools for VMware, Xen, and alternatives, IaaS will require learning new tools. Many companies will find, however, that the time sacrifice is worthwhile, especially when using IaaS in situations where it is particularly advantageous (i.e., transient projects), over other services.

IaaS Deployment Models

Thus far, the basic and most widely used cloud offering among IaaS providers are public clouds (IaaS), which involve sharing compute resources among any number of customers (“multitenant”), without physically segregating them.

IaaS providers have also started to develop alternative deployment models to address the concerns of Enterprises, which often center on security and the public cloud.

These models include:

- Virtual Private IaaS
- Dedicated IaaS
- Private Community IaaS
- Hybrid IaaS

Making the Move to IaaS

Because they generally lack the resources and expertise required to deploy internal IT infrastructures, the early adopters of IaaS and other cloud-computing models have mostly been Web 2.0 start-ups, small Independent Software Vendors (ISVs), and SMBs. Enterprises, with a different set of criteria and priorities, have followed more slowly, though many are undertaking low-risk approaches to trial IaaS.

For the Enterprise

The transition to IaaS for some enterprises merely represents an evolutionary step following virtualization. For others, it will entail a dramatic change in the way they do business. However, it is important to note that the adoption of IaaS (or any cloud-computing model) is not an all-or-nothing endeavor. From bringing in a new application to migrating to an existing one, there are many strategies of evaluating how, if, and in what ways, an IaaS solution can best benefit an organization.



Choosing an IaaS Provider



As with any service a business evaluates, the features and benefits of IaaS, the price, and the provider must all be taken into consideration. The stakes are particularly high when moving IT resources from an in-house (or other arrangement) to an IaaS provider. For this reason, an IaaS service provider must be chosen carefully. From service-related questions such as: what is the minimum charge unit (i.e., hours versus minutes), to service-provider-related questions, such as: if the chosen provider has the expertise, scale and geographic coverage to meet a company's unique needs, there are many different concerns that need to be evaluated.

The overall objective for choosing an IaaS provider should be a long-term relationship. Turning over part, or all, of a business's IT to an outside organization will have challenges, not the least of which will be a perceived loss of control. The right IaaS partner will provide an elevated sense of control, bringing to bear its expertise, comprehensive tool set for management, monitoring, and reporting, and responsive customer service.

InstaCompute

InstaCompute is a flexible, cost-effective hosted IT infrastructure solution that instantly provides the variable computing power required to meet changing business needs, exactly when needed. Managed through a self-service web portal that offers business-class controls and features, InstaCompute allows dynamic addition and removal of virtual servers, storage capacity and metered Internet connectivity. With pay-per-use pricing, security and guaranteed service levels, InstaCompute is the ideal solution for businesses seeking quick time-to-market, faster revenue generation and increased competitiveness.

Already available in India, Tata Communications will be expanding the InstaCompute offering geographically, with upcoming launches in Singapore and Rest of World (RoW). Backed by 24x7x365 local and global support, the world's farthest reaching network and the global strength and 150-year reputation of the Tata Group, Tata Communications is committed to becoming the IaaS service provider and partner of choice.

Tata Communications' Solutions-at-a-Glance

Cloud Services

- Infrastructure-as-a-Service (IaaS)
 - InstaCompute
- Software-as-a-Service (SaaS)
 - InstaCRM
 - InstaECM
 - InstaOffice powered by Google Apps

Colocation Services

- Cage, cabinet, power, cooling
- Network services
- On-net services (IP, Ethernet, MPLS) and carrier diversity
- Value-added services
 - Remote hand services
 - Storage and backup services

Managed Hosting Services

- Managed servers
- Managed load balancing
- Database management
- Virtualization services
- Managed storage and backup services

Value-added Services

- Managed security services
- Network and connectivity services
- Content delivery network service

Backbone Services

- Tier-1 Internet
- IP-VPN
- MPLS Services

Conclusion

The promise of cloud computing has long been a new height of convenience—easily and rapidly provisioned pay-per-use computing resources, scaling automatically and instantly to meet changing demands. Emerging at the convergence of major computing trends such as virtualization, service-oriented architectures, and standardization of the Internet, IaaS comes closer than ever before to fulfilling that vision.

IaaS is being deployed by world-class organizations as well as aggressive SMBs. The next several years will see IaaS embraced by companies of all sizes, using all manner of deployment models, as the overwhelming economic benefits and flexibility of its elastic metered services prevail over other IT solutions.

As with disruptive business models from the past, certain technical, legal, and personnel challenges must be overcome before IaaS will enter the mainstream. Nonetheless, organizations would do well to begin the evaluation process by:

- Amassing available literature on IaaS
- Contacting IaaS providers for a consultation and audit of current practices
- Developing an accurate TCO of current IT solutions
- Working with an IaaS provider to develop a migration plan
- Testing IaaS with a new application launch or nonbusiness-critical application
- Benchmarking costs and performance of current solutions vs. IaaS candidate applications

Companies that effectively leverage the benefits of an IaaS environment may be able to gain an edge in a rapidly evolving economy.

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Notes



Infrastructure-as-a-Service

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About Tata Communications

Tata Communications, a member of the \$72.5 billion Tata Group, is a leading global provider of a new world of communications. The emerging markets communications leader leverages advanced solutions capabilities and domain expertise across its global and pan-India network to deliver managed solutions to multinational and Indian enterprises, service providers, and Indian consumers.

Tata Communications' range of services include transmission, IP, converged voice, mobility, managed network connectivity, hosting and storage, managed security, managed collaboration, and business transformation for global enterprises and service providers, as well as Internet, retail broadband, and content services for Indian consumers.