



Information Technology Infrastructure and Service Management



Information technology (IT) infrastructure refers to an enterprise's entire collection of hardware, software, networks, data centers, facilities and related equipment used to develop, test, operate, monitor, manage and/or support the delivery of computing services to the business. Operating this infrastructure to deliver appropriate service levels for minimum cost is an ongoing challenge for both business and IT management.

This Insight document reviews some of the major topics in this area including the migration to cloud computing, standardization around ITIL processes, integrated toolsets to support those processes, and the need to maintain business investment and operational discipline.

The content of this Insight document should not be construed as specific professional advice or services for your business by Technology Consulting Associates, LLC.

Before making any decision that might affect your finances or business a qualified professional advisor should be consulted.



Table of Contents

Insight Objectives 4

 Audience 4

Background 5

 The Past 5

 Today 6

Information Technology Infrastructure 7

 Framework 7

 Cloud Computing 8

Process 9

 Information Technology Infrastructure Library (ITIL) 9

 Key Performance Indicators (KPIs) 11

 Service Integration and Management (SIAM) 12

Tools 13

Financials and Business Management 14

 Migrating to the Cloud 15

Insights 16

How TCA Can Help 17

Technology Consulting Associates



Insight Objectives

This TCA *Insight* paper provides information relevant to information technology infrastructure and its management.

Audience

The following individuals should find this *Insight* useful:

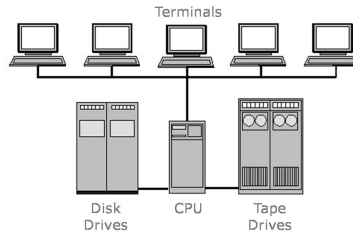
- Strategic business management
- Business financial and planning management
- Executive IT management
- IT operational management
- IT infrastructure management
- IT financial management

Technology Consulting Associates

Background

The Past

This diagram depicts typical business computing infrastructure in the early 1980's:

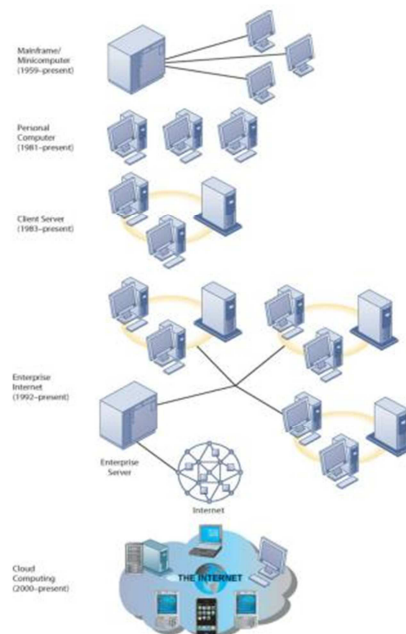


Traditional Computing Infrastructure

Computing was done on a central CPU attached to dedicated storage supporting a small number of users on limited access terminals. Computer programs were developed by *application programmers* to execute on a specific computing infrastructure which was established and maintained by *system programmers*. The infrastructure and applications were run by dedicated *computer operators* using processes that were documented in "runbooks" created and supported by the system and application programmers. The manufacturers of the computing infrastructure typically provided a set of tools to support the specific device's operation.

Computing costs, although extremely high on a unit of work basis compared to today, were fairly easy to account for since they were centralized and were typically associated with a small number of applications.

Computing infrastructure, its operation, and associated costs have changed dramatically over the last three decades. Infrastructure management, operation, and accounting have struggled to keep up with the changes in technology.



Computing Infrastructure Evolution

Today

The complexity, malleability, and scope of a modern business computing infrastructure cannot be completely represented by a diagram like the Traditional Computing Infrastructure of the early 1980's.



Today's Complex Infrastructure

- Networks - Local Area Networks (LANs), Wide Area Networks (WANs), private networks, the Internet, cellular networks, Virtual Private Networks (VPNs).....
- Physical and virtual computing platforms - mainframes, servers, PC's, smartphones.....
- Telephony and associated devices - PBX's, VOIP, virtual call centers.....
- Physical and virtual storage technologies including solid state, disc, tape, attached, portable.....
- User access devices - PC's, tablets, smart phones.....
- Computing facilities including data centers, server rooms, outsourced, cloud.....
- IT operations environments for networks, storage management, security.....
- Application development environments - .NET, Java, HTML.....
- Database management systems - relational/SQL, Teradata, Hadoop.....
- Enterprise content management systems - Alfresco, SharePoint, Documentum.....
- Security environments and devices - firewalls, IDS/IPS.....
-

Not only has computing infrastructure size and scope expanded, but remnants of earlier infrastructures add even more complexity.

IT operational processes are significantly more formal than they were, but management struggles to keep up with the dramatic changes in computing infrastructure and the rapid growth in the use of information technology by the modern enterprise.

Initially driven by the need to manage outsourcers and to report performance to business management, IT has begun to adopt Key Performance Indicators (KPIs) associated with IT operational processes to measure service levels and results.

A wide variety of IT operational tools are available in the marketplace. Most organizations have a number of these tools and struggle to integrate the data they provide into meaningful information that can be used to manage the computing infrastructure and report on IT service levels.

Costs for today's business computing infrastructure and its operation (IT I&O) are typically benchmarked at between sixty and eighty percent (60%-80%) of an overall enterprise IT budget. Based on Gartner's forecast of a worldwide IT spend of \$3.5 trillion dollars in 2017¹, it can be estimated that over \$2 trillion will be spent on IT I&O in 2017.

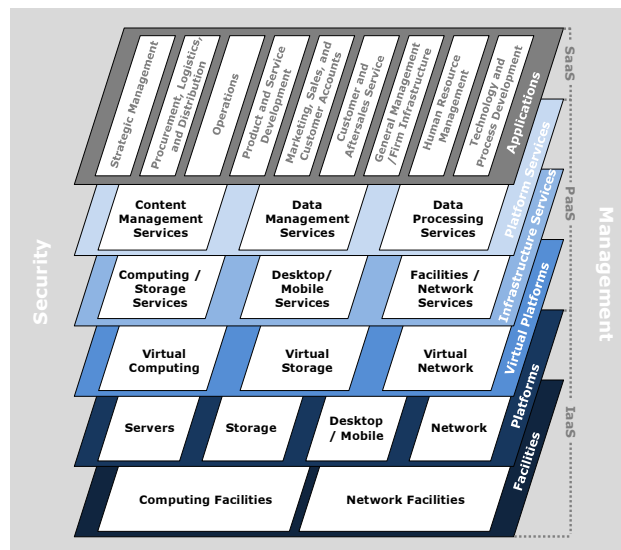
¹Gartner Worldwide IT Spending Forecast Q4 2016 (<http://www.gartner.com/technology/research/it-spending-forecast>)

Information Technology Infrastructure

Information technology infrastructure refers to an enterprise's entire collection of hardware, software, networks, data centers, facilities and related equipment used to develop, test, operate, monitor, manage and/or support IT services.

Framework

Due to the complexity of modern IT infrastructures it is useful to organize the components into a framework, like Technology Consulting Associate's Computing Infrastructure Framework² presented here.



TCA's Computing Infrastructure Framework

This framework divides IT infrastructure into eight (8) domains:

- Applications – computer programs designed to perform a specific function directly for a user (or for another application program)

Layers of software-based abstraction that can, and should, be used if possible

- Platform Services – services provided to application programs that isolate them from the underlying infrastructure
- Infrastructure Services – services provided to platform services and/or application programs that traditionally would be provided directly by physical infrastructure components
- Virtual Platforms - software-based platforms that emulate physical platforms

Physical components of the infrastructure

- Platforms – physical devices that comprise the computing infrastructure
- Facilities – spaces that house computing platforms

² For a complete description of this model see Information Technology Infrastructure Framework available on TCA's website. Application areas derived from the Bureau of Labor Statistics, Sharon P. Brown 2008

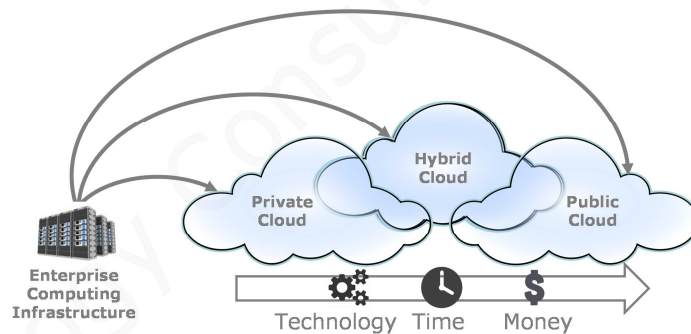
Components used to monitor and control the infrastructure

- Security – applications/services used to protect the confidentiality, integrity and availability of computer system data from those with malicious intentions
- Management – applications/services that are used to monitor and control the IT infrastructure

This framework may be collapsed into the service offerings provided by cloud vendors today: SaaS, PaaS, and IaaS. The expanded model is more useful when organizing the internal and traditional computing infrastructure components most enterprises have to deal with.

Cloud Computing

In the last decade technologies supporting “cloud computing” have provided increased flexibility and options for computing infrastructure. Commercial Off-The-Shelf (COTS) software today is often provided as a “cloud service”, eliminating a majority of the need for internal enterprise computing infrastructure. Virtualization and other technologies have reduced computing infrastructure costs and increased flexibility, providing for internal “Private” clouds and the ability to move applications to “Public” clouds. “Hybrid” architectures allow enterprises to process transactions and data across “Public” and “Private” clouds.



Computing Infrastructure Moves to the Cloud

Real concerns exist around security, management, and vendor dependencies in today’s cloud environments. However, as technology advances and management processes mature, enterprises will migrate towards Public clouds as the computing infrastructure of choice. This migration will be driven primarily by lower costs, increased flexibility, and a need to reduce the management complexity of a modern computing infrastructure.

The real question is not whether public cloud computing is the computing infrastructure of the future, but what are the dependencies, processes, management tools, costs, timing, and optimal migration paths to get there. It will take many years, perhaps even decades, for many enterprises to complete this migration.



Process

As discussed earlier, managing the day-to-day operation of a 1980's computing environment was the responsibility of the computer operator. The computer operator executed detailed "runbooks" that were created by the application and system programmers. When something did not work appropriately the system and application programmers were called to diagnose and fix the issue.

As computing infrastructure environments grew in complexity this informal IT operations management approach did not provide the levels of consistency and quality required by most businesses. Over time more formal IT operational processes were developed and entitled Information Technology Operations Management (ITOM).

Information Technology Infrastructure Library (ITIL)

In the late 1980's and through the 1990's the UK Government's Central Computer and Telecommunications Agency (CCTA) developed and published a set of standard practices covering specific areas of IT service management. This "library" was named the Information Technology Infrastructure Library (ITIL) and was built around a process model based view of controlling and managing IT services, including those that were generally referred to as ITOM.

In 2001 ITIL v2 consolidated ITSM into nine logical "sets". ITIL v3, published in 2007 and updated in 2011, further streamlined the library around a set of five core publications which together form the "ITIL Service Lifecycle":

- Service Strategy
- Service Design
- Service Transition
- Service Operation (ITOM)
- Continual Service Improvement

ITIL is the generally accepted framework for processes surrounding management of information technology infrastructure.³ ITIL provides a common framework and terminology for organizing the work required to provide IT services in a modern business computing environment.⁴

³ Other frameworks include:

- *Business Process Framework (eTOM)* is a process framework for telecommunications service providers
- *COBIT (Control Objectives for Information and Related Technologies)* is an IT Governance framework that specifies control objectives, metrics and maturity models
- *FitSM[5]* is a standard for lightweight service management and is in large parts aligned to that of ISO/IEC 20000.
- *ISO/IEC 20000* is an international standard for managing and delivering IT services which bears many similarities to that of ITIL version 2, since BS 15000 (precursor of ISO/IEC 20000) and ITIL were mutually aligned up to version 2 of ITIL
- *MOF[6] (Microsoft Operations Framework)* includes, in addition to a general framework of service management functions, guidance on managing services based on Microsoft technologies

⁴ For a more complete description of ITIL see *Information Technology Infrastructure Library Overview* available on TCA's website



There are thirty-seven ITIL processes within and across the five service lifecycle stages as depicted in this chart.



ITIL Stages and Processes

Key Performance Indicators (KPIs)

A Key Performance Indicator (KPI) is a measurable value that demonstrates how effectively a company is achieving key business objectives. Organizations use KPIs at multiple levels to evaluate their success at reaching targets. High-level KPIs may focus on the overall performance of the enterprise, while low-level KPIs may focus on processes in departments such as sales, marketing or a call center.

Each of the thirty-seven processes within ITIL’s framework can have Key Performance Indicators (KPIs) associated with them. ITIL provides suggested KPIs which can be supplemented using other sources⁵.

The breadth and depth of ITIL’s framework requires that organizations prioritize processes based on their importance to the business and that suitable KPIs are established that reflect those priorities.

| Key Performance Indicator (KPI) | Definition |
|---------------------------------|---|
| Number of repeated Incidents | Number of repeated Incidents, with known resolution methods |
| Incidents resolved Remotely | Number of Incidents resolved remotely by the Service Desk (i.e.without carrying out work at user's location) |
| Number of Escalations | Number of escalations for Incidents not resolved in the agreed resolution time |
| Number of Incidents | Number of incidents registered by the Service Desk grouped into categories |
| Average Initial Response Time | Average time taken between the time a user reports an Incident and the time that the Service Desk responds to that Incident |
| Incident Resolution Time | Average time for resolving an incident grouped into categories |
| First Time Resolution Rate | Percentage of Incidents resolved at the Service Desk during the first call grouped into categories |
| Resolution within SLA | Rate of incidents resolved during solution times agreed in SLA grouped into categories |
| Incident Resolution Effort | Average work effort for resolving Incidents grouped into categories |

Sample Potential KPIs for Incident Management

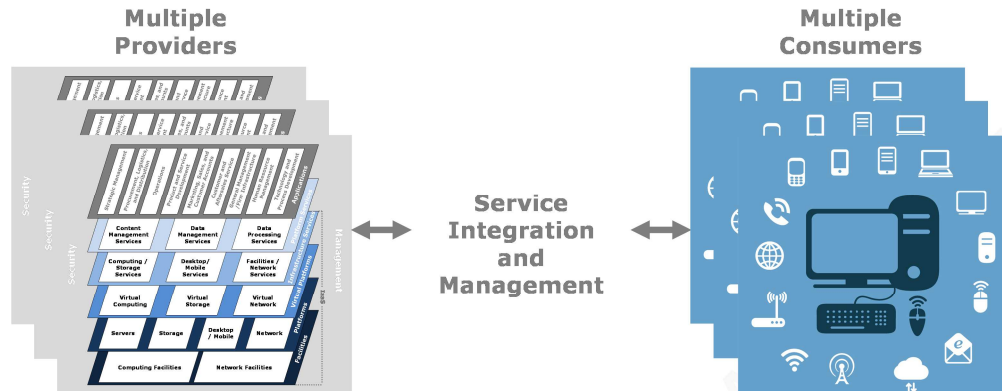
KPI’s, including financial KPIs, should be selected and organized into ITIL processes, filtered based on ability to produce, values set based on business needs and desires, and measurement / reporting / review established as an ongoing management process.

⁵See the following sources of IT-related KPIs

- ASL & BiSL | Information Technology
- VMF | Telecommunications
- COBIT | Information Technology
- GRI | Sustainability
- ITIL | Information Technology
- PMBOK | Project Portfolio
- PRINCE2 | Project Portfolio
- Risk IT | Information Technology
- SCOR | Supply Chain
- UBPR | Banking
- Value Reference Model | Value Chain

Service Integration and Management (SIAM)

Service Integration and Management (SIAM) is the coordination of people, processes, and tools/technology across multiple internal and external service providers to deliver information technology services to multiple consumer groups.⁶



Service Integration and Management (SIAM)

The concepts behind SIAM are not new. Large organizations have been managing multiple IT service providers for many years. An example from TCA’s client portfolio is an international hospitality company that integrated and centrally managed two internal U.S.-based help desks, an outsourced Asian help desk, and an outsourced European help desk via contractually mandated software interfaces and standardized processes.

What is new is the increase in number, type and complexity of IT service providers utilized by businesses of all sizes. In the early 2000’s the Information Technology Service Management (ITSM) function typically was performed by internal IT resources supplemented by a single (or very few) outsourcers. The rise of more flexible and granular service offerings for all the infrastructure domains and components⁷, and their increased use by businesses of all sizes, has resulted in a need to ensure that all of these players work together to provide IT services to the business.⁸

SIAM can be scoped to include all the ITIL functions and processes discussed earlier with the added complexity of ensuring that the processes work across multiple vendors and organizations. Efforts are ongoing to fully define SIAM as IT organizations attempt to catch up with the new ITSM delivery models.

⁶See www.AXELOS.com for more detail on SIAM. Introductory discussions include:

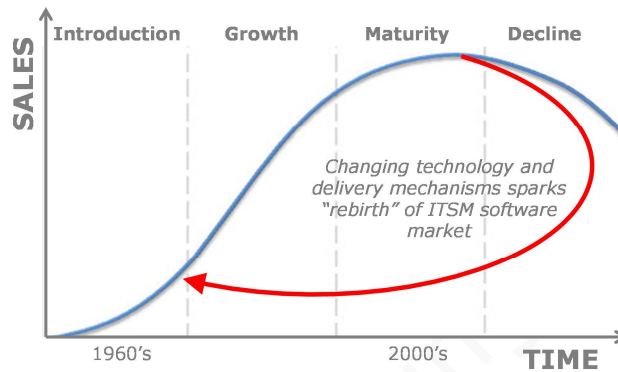
- An introduction to Service Integration and Management (January 2015)
- ITIL® and An example ITIL® -based model for effective Service Integration and Management (April 2015) both by Kevin Holland

⁷ Refer back to TCA’s Computing Infrastructure Framework which includes infrastructure components, their management (scoped by ITIL processes/functions), and business applications

⁸SIAM itself is a function that can be outsourced

Tools

The market for ITSM tools was maturing by the end of the century. As outsourced infrastructure became more common, reducing the number of independently managed large computing infrastructures, the overall market for ITSM tools was maturing. Vendors were consolidating into "large shop" and "small shop" toolsets and revenues were stagnating. The computing infrastructure transformation led by the "Cloud" movement, as well as other technologies, brought significant new requirements and sparked a new growth phase in the marketplace.



ITSM Software Market Life Cycle

Tools and services⁹ supporting the management and security of today's computing infrastructure can be as complex and sophisticated as the infrastructure itself. There are well over a thousand tools and vendors in the rapidly growing \$20B - \$30B marketplace today.

| | |
|-------------------|---------------------------|
| CA Technologies | ServiceNow |
| BMC Software | VMware |
| IBM Tivoli | SolarWinds |
| HP Software | Attachmate (NetIQ/Novell) |
| Dell | ASG |
| Microsoft | Splunk |
| Compuware | Oracle |
| Symantec | Landesk |
| EMC | Cisco |
| Riverbed | SAP |
| HEAT Software | EasyVista |
| Cherwell Software | Coud Health Technologies |

A Few of the Major ITSM Tool Vendors

This "new" ITSM software market will mature over the next decade. Integration within the ITIL functions that define IT service management, as well as the ability to integrate those functions across organizational and functional boundaries (SIAM) will be key requirements of software in this marketplace. Much like the ERP software market of the 1990's, the vendors that emphasize this integration will be the likely survivors.

⁹Vendors often offer tools as Cloud services and may provide the related function as an outsourced service



Financials and Business Management

As stated earlier, IT infrastructure and operations typically represent the majority of information technology costs for a business. Financial management of this function comes down to two major aspects:

1. Service Levels – service levels are required by the business. These service levels should be defined by measurable and reportable KPIs associated with the applications supporting the business. (e.g. available percent, number of incidents, response time)
2. Costs – costs should be minimized assuming service levels are met

Service levels and appropriate measurements should be established for all applications based on estimated costs and business management agreement. Once established, IT management should be held accountable for the results. This sounds easier than it is because most businesses have not allocated costs along business application lines, nor established appropriate service levels for individual business applications.

Investment is typically required in IT infrastructure and operations (IT I&O) when new applications are introduced, when service levels are increased, or to reduce IT infrastructure and operations costs. These investments, like any business investment, should be viewed from a business case perspective.



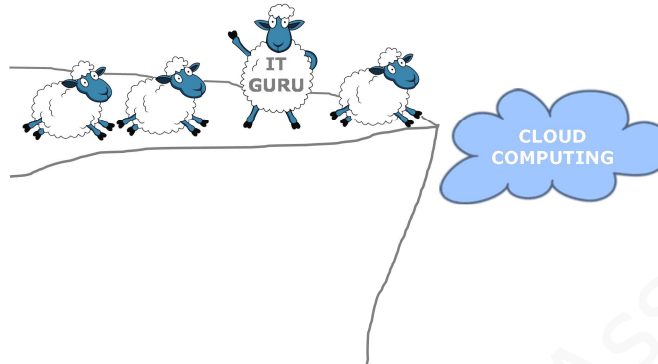
Business Case Perspective

- New applications – services levels should be established and IT I&O costs, both one-time and ongoing, included in the overall application business case
- Service level changes – increased IT I&O costs associated with increased service levels, both one-time and ongoing, should be justified by improved business performance
- IT I&O cost reductions – ongoing IT infrastructure costs have benefited over the years by declining costs (on a unit of work basis) associated with hardware and network services. These cost savings are achieved simply based on refreshing technology as it becomes fully depreciated. More significant changes in IT I&O costs have been achieved via outsourcing (e.g. cloud services) and the use of new technologies (e.g. virtualization).



Migrating to the Cloud

The economies of scale that cloud vendors enjoy will continue to grow, resulting in cost and functionality advantages that will be passed on to companies using their services. However, contrary to what some "IT visionaries" may preach, public cloud computing is not always the right answer today.



Cloud Computing Does Not Always Deliver Optimal Results

There are still security, portability, and cost issues that have not been completely eliminated by cloud vendors. Migrating to cloud services should be undertaken as an ongoing strategic program that will take many years, maybe a decade or more! Business should:

- Establish guiding principles for cloud usage based on required application service levels and IT I&O needs
- Develop a high level strategic plan, including high level target schedule, for enterprise cloud migration based on guiding principles and the company's application portfolio, infrastructure portfolio, and the IT organization
- Ensure every application development, implementation, or migration project is supported by a valid business case that considers the strategic nature of cloud services
- Ensure that every infrastructure component/service purchase or replacement/renewal is supported by a valid business case that considers the strategic nature of cloud services
- Ensure that ongoing operational costs are reviewed and justified on a periodic basis against current cloud-based offerings

Do not rush to the cloud because it is "strategic" without valid business reasons for doing so. Doing so can increase costs and reduce service levels.



Insights

- ① Cloud technologies represent a key component in the future of information technology infrastructure
- ① Economies of scale will provide business advantages to public cloud vendors that will drive businesses to migrate to them over the coming years as issues around security and portability are addressed
- ① ITIL is a universally accepted framework for IT operations and service management and should be adopted by information technology management
- ① The benefits of utilizing multiple suppliers for computing infrastructure will require the addition of SIAM to the existing ITIL framework
- ① KPIs for information technology operations and associated financials, structured around the ITIL framework, should be established and reported on
- ① Successful toolsets supporting the functions and processes around IT operations and service management, much like ERP software for general business, will focus on integration
- ① Migration to modern information technology infrastructure and its operation should be guided by a strategic program based on principles, a long term vision, and a plan for achieving the vision
- ① IT infrastructure and operations investments should always be justified by a business case
- ① Competitive advantage in information technology infrastructure and operations is achieved by minimizing costs while meeting required service levels

How TCA Can Help

TCA works with companies to define, plan, and implement changes that improve the performance of their business. We can help your company plan and implement appropriate information technology infrastructure and service management functions that minimize costs while meeting appropriate service levels.

Typical TCA Information Technology Operation and Service Management services include:

- ✓ Project business case development
- ✓ IT infrastructure guiding principles development
- ✓ IT infrastructure standards development
- ✓ IT service management KPI development
- ✓ IT infrastructure and operations strategic planning
- ✓ IT infrastructure and operations program management
- ✓ IT infrastructure and/or operations project management
- ✓ IT operations and service management tool selection
- ✓ ITIL training and development

For more information about how TCA can help your business please contact us

| | |
|-------|--------------------------------------|
| Mail | P.O. Box 420076 Atlanta, GA 30342 |
| Phone | 404.303.1795 877.842.1842 |
| Fax | 404.943.9081 |
| Email | information@tca-llc.com |

Visit us at www.tca-llc.com