IT Systems Management
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Contents

1 Executive Support

Crucial for SysMan. Business metrics is a good argument for Ex. Supp., continuous support should be ensured.

2 Organizing for Systems Management

2.1 Factors to Consider in Designing IT Organizations

In the case of IT, restructuring is often necessary to support company growth, increased customer demand, changing business requirements, acquisitions, mergers, buyouts, or other industry changes. Three key factors by which infrastructures can be organized: departmental responsibilities, planning orientation, and systems management processes.

Org. Model Know Your Business (KYB), Locating Deparments in the Infrastructure, Identify Process Owners.

3 Staffing for System Management

Skilled professionals are needed at the outset to develop plans, design processes, and evaluate technologies; then they are needed to transform these ideas from paper into realities.

Skill Set defined as technical familiarity with a particular software product, architecture, or platform.

Skill Level defined as the length of experience and depth of technical expertise and variety of platform familiarity an individual has acquired and can apply to a given technology.

Importance of the right staff Determining required skill sets and skills levels, assessing skill levels of current onboard staff (alternative sources of staffing, recruiting infra. staff from the outside [operative/consultive]), selecting the *Most Qualified Candidate*, retaining *Key Personnel*, using *Consultants and Contractors* (benefits / drawbacks are involved, steps for developing career paths for staff memebers)

4 Ethics, Legislation, and Outsourcing

Personal Ethics Set values an individual uses to influence and guide his or her personal behavior.

Business Ethics Set values an individual uses to influence and guide his or her business behavior. Business ethics tend to focus on the behaviors of an individual as it pertains to his or her work environment. The differences between personal and business ethics may be at once both subtle and far-reaching.

NPI Stands for non-public information and pertains to the private, personal information of an individual not readily available in public records. Customers typically disclose such information to private or public companies to transact business. Examples of NPI are social security numbers, unlisted telephone numbers, and credit card account numbers.

5 Customer Service

IT evolved into a service organization.

- Identifying your key customers
- Identifying key services of key customers
- Identifying key processes that support key services
- Identifying key suppliers that support key processes

Integrating the 4 key elements of Good Customer Service.

6 Availability

Availability Process of optimizing the readiness of production systems by accurately measuring, analyzing, and reducing outages to those production systems.
The ratio of the total time a functional unit is capable of being used during a given interval to the length of the interval.
Mean Time To Failure (MTTF), Mean Time To Repair (MTTR)

Responsiveness Operational responsiveness is a quality of a business process or supporting IT solution, which indicates its ability to respond to changing conditions and customer interactions as they occur.

Uptime measure of the time that individual components within a production system are functionally operating. This contrasts to availability, which focuses on the production system as a whole.

Slow Response refers to unacceptably long periods of time for an online transaction to complete processing and return results to the user. The period of time deemed unacceptable varies depending on the type of transaction involved. For simple inquiries, a one-second response may seem slow; for complex computations, two- or three-second responses may be acceptable. Slow response is usually a performance and tuning problem requiring highly-trained personnel with specialized expertise

Downtime Downtime refers to the total inoperability of a hardware device, a software routine, or some other critical component of a system that results in the outage of a production application.

High Availability refers to the design of a production environment such that all single points of failure are removed through redundancy to eliminate production outages. This type of environment is often referred to as being fault tolerant.

SMART **S**pecific, *Targets should be straightforward and emphasize what you want to happen*. **M**easurable, *If a target cannot be measured then you cannot determine whether it has been achieved*. **A**chievable, *It must be possible to achieve the target with an acceptable investment of time and resources*. **R**elevant, *Achieving the target must contribute to the overall business mission*. **T**imely, *The target must be something that can be achieved and measured over the reporting period of the SLA*[1].

6.1 7-Rs of availability

These seven Rs of high availability all contribute in a unique way to extending uptime, minimizing downtime, and improving the overall level of service provided by online systems.

6.1.1 Redundancy

Power Supply, Multiple processors, Segmented Memory, Redundant Disks

6.1.2 Reputation

The reputation of key suppliers of servers, disk storage systems, database management systems, and network hardware and software plays a principle role in striving for high availability. It is always best to go with the best. Reputations can be verified in several ways, including the following: Percent of market share, Reports from industry analysts such as Gartner Group, Publications such Wall Street Journal and ComputerWorld, Track record of reliability and repairability, Customer references

6.1.3 Reliability

The reliability of the hardware and software can also be verified from customer references and industry analysts. Beyond that, you should consider performing what we call an empirical component reliability analysis. The following list describes the seven steps required to accomplish this.

1. Review and analyze problem management logs.
2. Review and analyze supplier logs.
3. Acquire feedback from operations personnel.
4. Acquire feedback from support personnel.
5. Acquire feedback from supplier repair personnel.
6. Compare experiences with other shops.
7. Study reports from industry analysts.

6.1.4 Repairability

This refers to is the relative ease with which service technicians can resolve or replace failing components. A common metric used to evaluate this trait is the average or mean time to repair (MTTR). MTTR is sometimes interpreted as the mean time to recover, the mean time to restore, or the mean time to resolve. It measures the average time it takes to do the actual repair. $\text{MTTR} = \frac{\text{sum of repair times}}{\text{\# of failures}}$

6.1.5 Recoverability

This refers to the ability to overcome a momentary failure in such a way that there is no impact on end-user availability. It could be as small as a portion of main memory recovering from a single-bit memory error; it can be as large as having an entire server system switch over to its standby system with no loss of data or transactions. Recoverability also includes retries of attempted reads and writes out to disk or tape, as well as the retrying of transmissions down network lines.

6.1.6 Responsiveness

This trait is the sense of urgency all people involved with high availability need to exhibit. This includes having well-trained suppliers and in-house support personnel who can respond to problems quickly and efficiently. It also pertains to how quickly the automated recovery of resources such as disks or servers can be enacted. Escalation is another aspect of responsiveness that ensures higher levels of technical expertise and management support are involved to restore availability as quickly as possible. Escalation guidelines are usually documented in service-level agreements between IT and business customers.

6.1.7 Robustness

A robust process will be able to withstand a variety of forces—both internal and external—that could easily disrupt and undermine availability in a weaker environment. Robustness puts a high premium on documentation and training to withstand the following:

Technical Changes as they relate to Platforms, Products, Services, Customers

Personnel Changes as they relate to Turnover, Expansion, Rotation

Business changes as they relate to New direction, Acquisitions, Mergers

Defining a process to measure and monitor Infrastructure's Availability: Committed Hours of Availability (A), Outage hours (B), Achieved Availability: $\frac{A-B}{A} \cdot 100\%$.

7 Performance and Tuning

Methodology to maximize throughput and minimize response times of batch jobs, online transactions, and Internet activities. The five infrastructure areas most impacted by performance and tuning are:

- Servers
- Disk storage
- Databases
- Networks
- Desktop Computers

8 Production Acceptance

Methodology used to consistently and successfully deploy application systems into a production environment regardless of platform.

Consistent methodology While the methodology is consistent, it is not necessarily identical across all platforms. This means there are essential steps of the process that need to be done for every production deployment, and then there are other steps that can be added, omitted, or modified depending on the type of platform selected for production use.

Deploying into a production environment This implies that the process is not complete until all users are fully up and running on the new system. For large applications, this could involve thousands of users phased in over several months.

Application system This refers to any group of software programs necessary for conducting a company's business—the end-users of which are primarily, but not necessarily, in departments outside of IT. This excludes software still in development, as well as software used as tools for IT support groups.

Production Acceptance Process

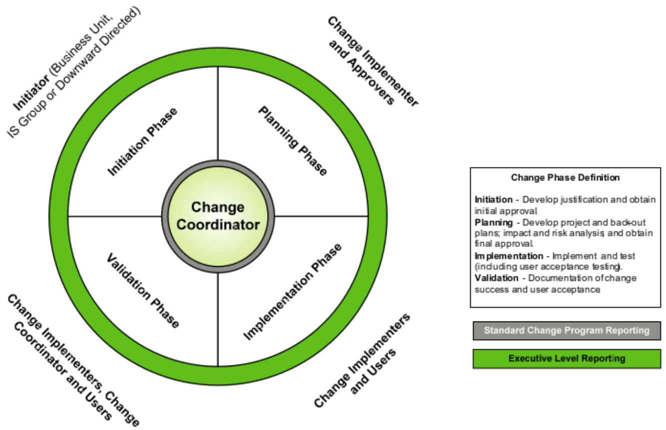
1. Identify an Executive Sponsor
2. Select a Process Owner
3. Solicit Executive Support
4. Assemble a Production Acceptance Team
5. Identify and Prioritize Requirements
6. Develop Policy Statements
7. Nominate a Pilot System
8. Design Appropriate Forms
9. Document updates, extension and new procedures
10. Run field tests and a solid pilot phase
11. Revise Policies, Procedures, and Forms
12. Define an adequate marketing strategy (if applicable)
13. Conduct a lessons-learned sessions
14. Follow-up with continuous improvements

Pay attention:

- Production Acceptance is not Change Management
- New Applications vs. New Versions of Existing Applications

9 Change Management

Change Management is the process to control and coordinate all changes to an IT production environment. Control involves requesting, prioritizing, and approving changes; coordination involves collaborating, scheduling, communicating, and implementing changes.
A change is defined as any modification that could impact the stability or responsiveness of an IT production environment.



9.1 Key Steps Required in Developing a Change Management Process

1. Identify an executive sponsor.
2. Assign a process owner.
3. Select a cross-functional process design team.
4. Arrange for meetings of the cross-functional process design team.
5. Establish roles and responsibilities for members supporting the design team.

[1] SLA is short for service level agreement and refers to a documented, negotiated agreement between a representative from an IT department and a representative from an end-user department concerning the quality of service delivered. Common SLA metrics include percent uptime availability, average response times, and escalation procedures for problems.

6. Identify the benefits of a change management process.
7. If change metrics exist, collect and analyze them; if not, set up a process to do so.
8. Identify and prioritize requirements.
9. Develop definitions of key terms.
10. Design the initial change management process.
11. Develop policy statements.
12. Develop a charter for a Change Advisory Board (CAB).
13. Use the CAB to continually refine and improve the change management process.

9.2 Scope

Because the Change Management Process deals with the management of changes in the production environment, it is imperative that both customers and the company's change organization understand the events that are considered within the scope of the process. In this section, the scope is described and includes areas which are both within and outside of the change management process scope.

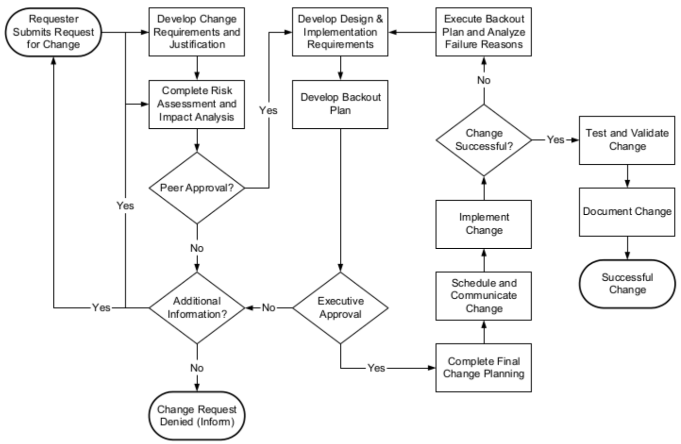
9.2.1 Tasks in the scope of CMP

- SDLC – Changes handled through the formal software development life cycle will be included within the company's change management program.
- Hardware – Installation, modification, removal or relocation of computing equipment.
- Software – Installation, patching, upgrade or removal of software products including operating systems, access methods, commercial off-the-shelf (COTS) packages, internally developed packages and utilities.
- Database – Changes to databases or files such as additions, reorganizations and major maintenance.
- Application – Application changes being promoted to production as well as the integration of new application systems and the removal of obsolete elements.
- Moves, Adds, Changes and Deletes – Changes to system configuration.
- Scheduled Changes - Requests for creation, deletion, or revision to job schedules, back-up schedules or other regularly scheduled jobs managed by the IT department.
- Telephony – Installation, modification, de-installation, or relocation of PBX/VOIP equipment and services.
- Desktop – Any modification or relocation of desktop equipment and services for users or classroom labs.
- Generic and Miscellaneous Changes – Any changes that are required to complete tasks associated with normal job requirements.

9.2.2 Tasks that aren't part of CMP

- Contingency/Disaster Recovery
- BCM related activities
- Changes to non-production elements or resources
- Changes made within the daily administrative process.
  - Password resets
  - User adds/deletes
  - User modifications
  - Adding, deleting or revising security groups
  - Rebooting machines when there is no change to the
  - configuration of the system
  - File permission changes

9.3 Workflow Tasks



Basic Change Managment Workflow

9.4 Approvals Required for Change Based on Risk Level

Change Category	Risk Level	Priority: Emergency	Urgent	Routine	Low
Production Migration	No Risk	Assignment group	Assignment group	Assignment group	Assignment group
	No Risk	Mgr of Assignment group	Mgr of Assignment group	Mgr of Assignment group	Mgr of Assignment group

Change Category	Risk Level	Priority: Emergency	Urgent	Routine	Low
Hardware	High	Assignment group based on subcategory, Peer Review, CAB	Assignment group based on subcategory, Peer Review, CAB	Assignment group based on subcategory, Peer Review, CAB	Assignment group based on subcategory, Peer Review, CAB
	Moderate	Assignment group based on subcategory, Peer Review	Assignment group based on subcategory, Peer Review	Assignment group based on subcategory, Peer Review	Assignment group based on subcategory, Peer Review
	Low	Assignment group based on subcategory, Peer Review	Assignment group based on subcategory, Peer Review	Assignment group based on subcategory, Peer Review	Assignment group based on subcategory, Peer Review
	No Risk	Assignment group based on subcategory, Peer Review	Assignment group based on subcategory, Peer Review	Assignment group based on subcategory, Peer Review	Assignment group based on subcategory, Peer Review

Change Category	Risk Level	Priority: Emergency	Urgent	Routine	Low
Software	High	Assignment group based on subcategory, Peer Review, CAB	Assignment group based on subcategory, Peer Review, CAB	Assignment group based on subcategory, Peer Review, CAB	Assignment group based on subcategory, Peer Review, CAB

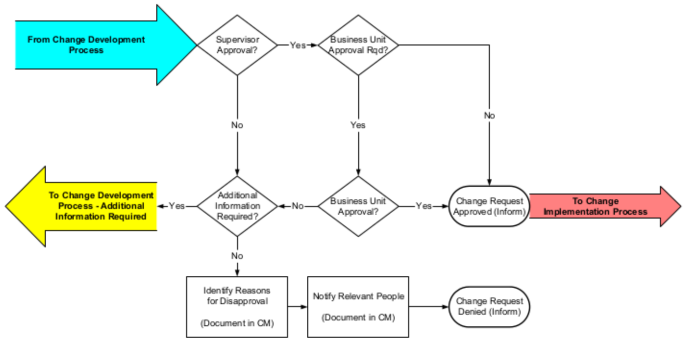
9.5 Risk Level Based Lead Times

It is essential that requests for change are submitted and approved in a timely manner. This will allow completion of accurate documentation, change processing and obtaining the approvals in sufficient time prior to the requested implementation date. Lead times are the number of days an action (Initiation or Approval) must be completed prior to the requested implementation date. The number of days will vary, depending on the priority and the risk level.

		Lead Time by Change Phase	
Priority	**Risk Level**	**Initiation**	**Approval**
Emergency	High	3	3
	Moderate	2	2
	Low	1	1
	No Risk	1	1
Urgent	High	6	3
	Moderate	4	2
	Low	2	1
	No Risk	1	1
Routine	High	20	10
	Moderate	15	7
	Low	10	5
	No Risk	5	3
Low	High	25	15
	Moderate	20	10
	Low	15	7
	No Risk	10	5

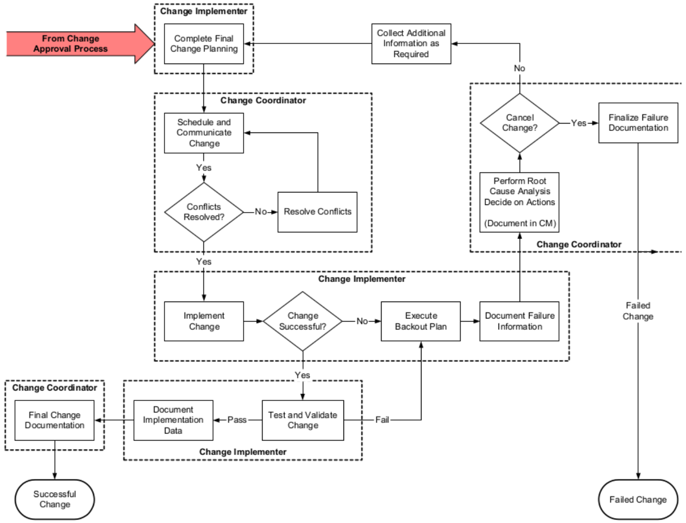
9.6 Change Approval Phase

After a minor, major or significant change has been correctly prioritized, categorized, and analyzed by the Change Coordinator and been through the Peer Review process, the change must be authorized for implementation. The diagram below identifies the workflow associated with change management approval at the company:



Change Approval Phase

9.7 Implementation and Documentation phase



Change Implementation and Documentation Phase

9.8 Key Definitions

Change Advisory Board (CAB) The CAB is a cross-functional group set up to evaluate change requests for business need, priority, cost/benefit, and potential impacts to other systems or processes. Typically the CAB will make recommendations for implementation, further analysis, deferment, or cancellation.

CAB Emergency Committee (CAB/EC) This is a subset of the CAB that deals only with emergency changes. It is established to be able to meet on short notice to authorize or reject changes with emergency priority.

Change Any new IT component deliberately introduced to the IT environment that may affect an IT service level or otherwise affect the functioning of the environment or one of its components.

Change Category The measurement of the potential impact a particular change may have on IT and the business. The change complexity and resources required, including people, money, and time, are measured to determine the category. The risk of the deployment, including potential service downtime, is also a factor.

Change Coordinator The role that is responsible for planning and implementing a change in the IT environment. The Change Coordinator role is assigned to an individual for a particular change by the Change Coordinator and assumes responsibilities upon receiving an approved RFC. The Change Coordinator is required to follow the approved change schedule.

Change Requester A person who initiates a Request for Change; this person can be a business representative or a member of the IT organization.

Change Initiator A person who receives a request for change from the Change Requester and enters the request for change in the Change Management process; this person is typically a member of the IT organization.

Change Manager The role that has the overall management responsibility for the Change Management process in the IT organization.

Change Priority A change classification that determines the speed with which a requested change is to be approved and deployed. The urgency of the need for the solution and the business risk of not implementing the change are the main criteria used to determine the priority.

Change Record The record within the company's selected technology platform that contains all of the information relative to a change. This information includes justification, risk and impact analysis, approvals, phases, and tasks associated with accomplishing the change.

Configuration Item (CI) An IT component that is under configuration management control. Each CI can be composed of other CIs. CIs may vary widely in complexity, size, and type, from an entire system (including all hardware, software, and documentation) to a single software module or a minor hardware component.

Forward Schedule of Changes (FSC) The FSC shows when all changes are to take place within the entire Customer IT infrastructure. This single glance at the change schedule makes it possible to see the available change windows. Scheduling changes against the FSC also ensures that multiple, interdependent changes are not scheduled at the same time.

Release A collection of one or more changes that includes new and / or changed Configuration Items that are tested and then introduced into the production environment.

Request for Change (RFC) This is the formal change request, including a description of the change, components affected, business need, cost estimates, risk assessment, resource requirements, and approval status.

10 Problem Management

Problem management is a process used to identify, log, track, resolve, and analyze problems impacting IT services.

10.1 Scope of Problem Management

Many infrastructures do agree that first-level problem handling, commonly referred to as tier 1, is the minimum basis for problem management.

10.2 Key Steps to Developing a Problem Management Process

1. Select an executive sponsor.
2. Assign a process owner.
3. Assemble a cross-functional team.
4. Identify and prioritize requirements.
5. Establish a priority and escalation scheme.
6. Identify alternative call-tracking tools.
7. Negotiate service levels.
8. Develop service and process metrics.
9. Design the call-handling process.
10. Evaluate, select, and implement the call-tracking tool.
11. Review metrics to continually improve the process.

11 Storage Management

Storage management is a process used to optimize the use of storage devices and to protect the integrity of data for any media on which it resides.

11.1 Storage Management Capacity

Storage management capacity consists of providing sufficient data storage to authorized users at a reasonable cost.

11.2 Storage Management Performance

The first performance consideration is the size and type of main memory.

11.3 Storage Management Reliability

Fault tolerance w/ RAID Systems

RAID Level	Explanation
0	Disk striping for performance
1	Mirroring for total redundancy
0 + 1	Combination of striping and mirroring
3	Striping and fault tolerance with parity on totally dedicated parity drives
5	Striping and fault tolerance with parity on nonassociated data drives

11.4 Storage Management Recoverability

several methods available for recovering data that has been altered, deleted, damaged, or otherwise made inaccessible. Determining the correct recovery technique depends on the manner in which the data was backed up.

12 Network Management

Process to maximize the reliability and utilization of network components in order to optimize network availability and responsiveness.

12.1 Key Decisions about Network Management

1. What will be managed by this process?
2. Who will manage it?
3. How much authority will this person be given?
4. What types of tools and support will be provided?
5. To what extent will other processes be integrated with this process?
6. What levels of service and quality will be expected?

12.2 Assessing an Infrastructure's Network Management Process

12.3 Measuring and Streamlining the Network Management Process

We can measure the effectiveness of a network management process with service metrics such as network availability, network response times, and elapsed time to logon.

13 Configuration Management

Process to ensure that the interrelationships of varying versions of infrastructure hardware and software are documented accurately and efficiently.

Configuration management refers to coordinating and documenting the different levels of hardware, firmware, and software that comprise mainframes, servers, desktops, databases, and various network devices such as routers, hubs, and switches. It does not refer to application software systems or to the verification of various levels of application software in different stages of development, testing, and deployment—these activities are commonly referred to as versioning control and are normally managed by the applications development group or by a software quality assurance group within applications development.

13.1 Pratical Tips for Improving Config. Man.

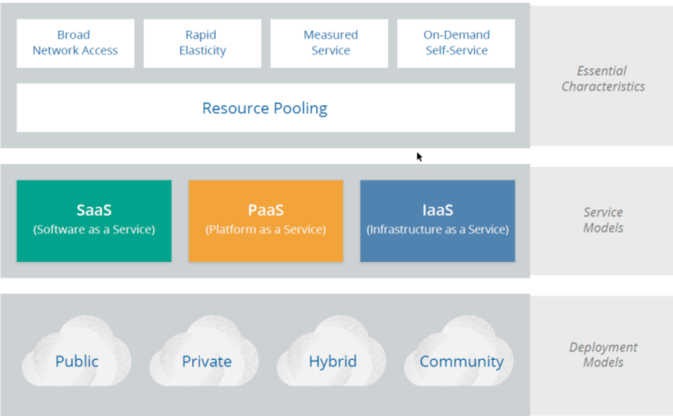
1. Select a qualified process owner.
2. Acquire the assistance of a technical writer or a documentation analyst.
3. Match the backgrounds of writers to technicians.
4. Evaluate the quality and value of existing configuration documentation.
5. Involve appropriate hardware suppliers.
6. Involve appropriate software suppliers.
7. Coordinate documentation efforts in advance of major hardware and software upgrades.
8. Involve the asset-management group for desktop equipment inventories.

13.2 Assessing an Infrastructure's Configuration Management Process

13.3 Measuring and Streamlining the Configuration Management Process

We can measure the effectiveness of a configuration management process with service metrics such as the number of times analysts, auditors, or repair technicians find out-of-date configuration documentation. Process metrics, such as the elapsed time between altering the physical or logical configuration and noting it on configuration diagrams, help us gauge the efficiency of this process. And we can streamline the configuration management process by automating certain actions—the updating of multiple pieces of documentation requiring the same update, for example.

14 Cloud Services



14.1 Characteristics of a Cloud

- Resource pooling is the most fundamental characteristic, as discussed above. The provider abstracts resources and collects them into a pool, portions of which can be allocated to different consumers (typically based on policies).
- Consumers provision the resources from the pool using on-demand self-service. They manage their resources themselves, without having to talk to a human administrator.
- Broad network access means that all resources are available over a network, without any need for direct physical access; the network is not necessarily part of the service.
- Rapid elasticity allows consumers to expand or contract the resources they use from the pool (provisioning and deprovisioning), often completely automatically. This allows them to more closely match resource consumption with demand (for example, adding virtual servers as demand increases, then shutting them down when demand drops).
- Measured service meters what is provided, to ensure that consumers only use what they are allotted, and, if necessary, to charge them for it. This is where the term utility computing comes from, since computing resources can now be consumed like water and electricity, with the client only paying for what they use.

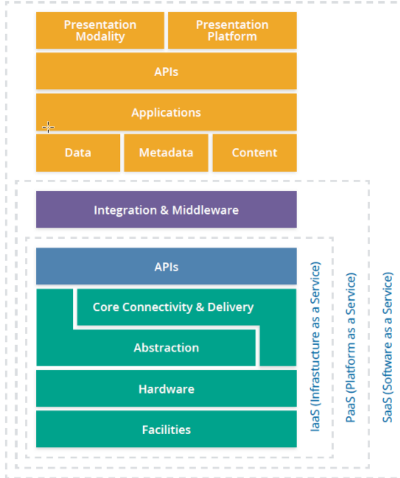
14.2 Cloud Services

- Software as a Service (SaaS) is a full application that's managed and hosted by the provider. Consumers access it with a web browser, mobile app, or a lightweight client app.
- Platform as a Service (PaaS) abstracts and provides development or application platforms, such as databases, application platforms (e.g. a place to run Python, PHP, or other code), file storage and collaboration, or even proprietary application processing (such as machine learning, big data processing, or direct Application Programming Interfaces (API) access to features of a full SaaS application). The key differentiator is that, with PaaS, you don't manage the underlying servers, networks, or other infrastructure.
- Infrastructure as a Service (IaaS) offers access to a resource pool of fundamental computing infrastructure, such as compute, network, or storage.

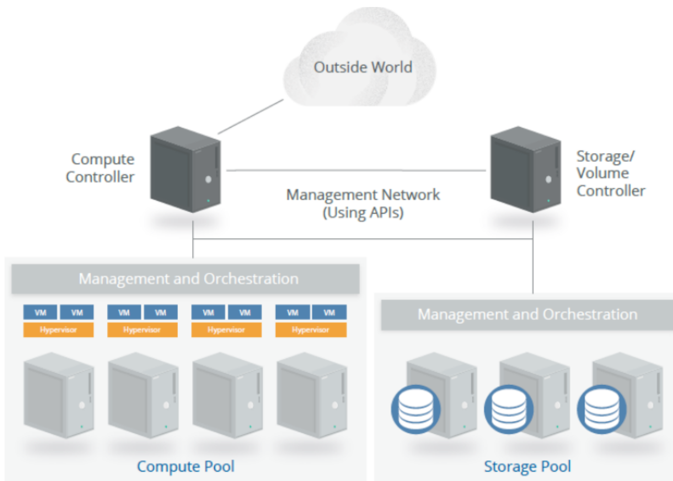
14.3 Cloud Services Security

	Infrastructure Owned By[1]	Infrastructure Owned By[2]	Infrastructure Located[3]	Accessible and Consumed By[4]
Public	Third-Party Provider	Third-Party Provider	Off-Premises	Untrusted
Private/ Community	Organization Third-Party Provider	Organization Third-Party Provider	On-Premises Off-Premises	Trusted
Hybrid	Both Organization & Third-Party Provider	Both Organization & Third-Party Provider	Both On-Premises & Off-Premises	Trusted & Untrusted

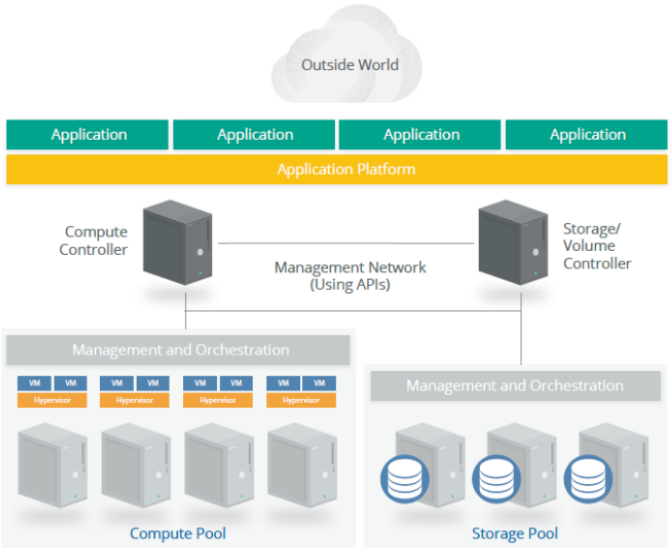
14.4 Reference Architecture



14.5 Simplified IaaS platform



14.6 Simplified SaaS on top of our IaaS



15 Capacity Planning

As its name implies, the systems management discipline of capacity planning involves the planning of various kinds of resource capacities for an infrastructure.
Capacity planning is a process to predict the types, quantities, and timing of critical resource capacities that are needed within an infrastructure to meet accurately forecasted workloads.

15.1 4 Key Elements

1. The type of resource capacities required, such as servers, disk space, or bandwidth
2. The size or quantities of the resource in question
3. The exact timing of when the additional capacity is needed
4. Decisions about capacity that are based on sound, thorough forecasts of anticipated workload demands

15.2 Why Capacity Planning Is Seldom Done Well

1. Analysts Are Too Busy with Day-To-Day Activities
2. Users Are Not Interested (or able?) in Predicting Future Workloads
3. Users Who Are Interested Cannot Forecast Accurately
4. Capacity Planners May Be Reluctant to Use Effective Measuring Tools
5. Need for updates: Corporate or IT Directions May Change over time (e.g. yearly)
6. Planning Is Typically Not Part of an Infrastructure Culture
7. Managers Sometimes Confuse Capacity Management with Capacity Planning

15.3 Steps to develop an effective capacity planning process

1. Select an Appropriate Capacity Planning Process Owner
2. Identify the Key (Critical?) Resources to be Measured
3. Monitor the Utilizations or Performance of the Resources
4. Compare Utilizations to Maximum Capacities
5. Collect Workload Forecasts from Developers and Users
6. Transform Workload Forecasts into IT Resource Requirements
7. Map Requirements onto Existing Utilizations
8. Predict When the Business/Company Will Be Out of Capacity
9. Update Forecasts and Utilizations

15.4 Additional Benefits of Capacity Planning

1. Strengthens Relationships with Developers and End-Users
2. Improves Communications with Suppliers
3. Encourages Collaboration with Other Infrastructure Groups
4. Promotes a Culture of Strategic Planning as Opposed to Tactical Firefighting

15.5 Helpful Hints for Effective Capacity Planning

1. Start Small
2. Speak the Language of Your Customers
3. Consider Future Platforms
4. Share Plans with Suppliers
5. Anticipate Nonlinear Cost Ratios
6. Plan for Occasional Workload Reductions
7. Prepare for the Turnover of Personnel
8. Strive to Continually Improve the Process
9. Evaluate the Hidden Costs of Upgrades

15.6 Uncovering the Hidden Costs of Upgrades

1. Hardware Maintenance
2. Technical Support
3. Software Maintenance
4. Memory Upgrades
5. Channel Upgrades
6. Cache Upgrades
7. Data Backup Time
8. Operations Support
9. Offsite Storage
10. Network Hardware
11. Network Support
12. Floor Space
13. Power and Air Conditioning

15.7 Assessing an Infrastructure's Capacity Planning Process

15.8 Measuring and Streamlining the Capacity Planning Process

We can measure the effectiveness of a capacity planning process with service metrics such as the number of instances of poor response due to inadequate capacity on servers, disk devices, or the network. Process metrics—such as the number of instances of poor response due to inadequate capacity on servers, disk devices, or the network—help us gauge the efficiency of this process. We can be streamline the capacity planning process by automating certain actions—the notification to analysts when utilization thresholds are exceeded, the submittal of user forecasts, and the conversion of user-workload forecasts into capacity requirements, for example.

16 Strategic Security

Strategic security is designed to safeguard the availability, integrity, and confidentiality of designated data and programs against unauthorized access, modification, or destruction.

16.1 Developing a Strategic Security Process

1. Identify an executive sponsor.
2. Select a process owner.
3. Define goals of strategic security.
4. Establish review boards.
5. Identify, categorize, and prioritize requirements.
6. Inventory current state of security.
7. Establish security organization.
8. Develop security policies.
9. Assemble planning teams.
10. Review and approve plans.
11. Evaluate technical feasibility of plans.
12. Assign and schedule the implementation of plans.

16.2 Measuring and Streamlining the Security Process

We can measure the effectiveness of a security process with service metrics such as the number of outages caused by security breaches and the amount of data altered, damaged, or deleted due to security violations. Process metrics, such as the number of password resets requested and granted and the number of multiple sign-ons processed over time, help us gauge the efficiency of this process. Finally, we can streamline the security process by automating certain actions—for example, the analysis of password resets, network violations, or virus protection invocations.

17 Business Continuity

Business continuity is a methodology to ensure the continuous operation of critical business systems in the event of widespread or localized disasters to an infrastructure environment.

17.1 Steps to Developing an Effective Business Continuity Process

1. Acquire executive support.
2. Select a process owner.
3. Assemble a cross-functional team.
4. Conduct a business impact analysis.
5. Identify and prioritize requirements.
6. Assess possible business continuity recovery strategies.
7. Develop a request for proposal (RFP) for outside services.
8. Evaluate proposals and select the best offering.
9. Choose participants and clarify their roles on the recovery team.
10. Document the business continuity plan.
11. Plan and execute regularly scheduled tests of the plan.
12. Conduct a lessons-learned postmortem after each test.
13. Continually maintain, update, and improve the plan.

18 Facilities Management

Facilities management is a process to ensure that an appropriate physical environment is consistently supplied to enable the continuous operation of all critical infrastructure equipment.

18.1 Major Elements

UPS uninterruptible power supply and is a temporary battery backup in the event of commercial power loss. UPS units are normally used to power data centers for 15-20 minutes until such time that commercial power is restored or until longer term backup generators come online. Portable UPS units are now available for servers, workstations and desktops outside of a data center.

18.2 Facilities Management Process Owner

- Determining the Scope of Responsibilities of a Facilities Management Process Owner
- Desired Traits of a Facilities Management Process Owner

The owner of the facilities management process almost always resides in the computer operations department.

18.3 Evaluating the Physical Environment

- Major Physical Exposures Common to a Data Center
- Keeping Physical Layouts Efficient and Effective

If the problem-management system includes a robust database, it should be easy to analyze trouble tickets caused by facilities issues and highlight trends, repeat incidents, and root causes.

18.4 Tips to Improve the Facilities Management Process

1. Nurture relationships with facilities department.
2. Establish relationships with local government inspecting agencies, especially if you are considering major physical upgrades to the data center.
3. Consider using video cameras to enhance physical security.
4. Analyze environmental monitoring reports to identify trends, patterns, and relationships.
5. Design adequate cooling for hot spots due to concentrated equipment.
6. Check on effectiveness of water and fire detection and suppression systems.
7. Remove all tripping hazards in the computer center.
8. Check on earthquake preparedness of data center (devices anchored down, training of personnel, and tie-in to disaster recovery).

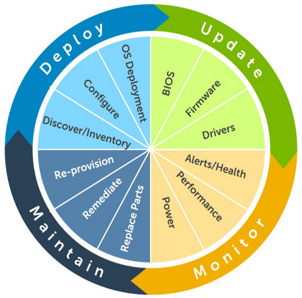
18.5 Facilities Management at Outsourcing Centers

Shops that outsource portions of their infrastructure services—colocation of servers is an example—often feel that the responsibility for the facilities management process is also outsourced and no longer of their concern. While outsourcers have direct responsibilities for providing stable physical environments, the client has an indirect responsibility to ensure this will occur. During the evaluation of bids and in contract negotiations, appropriate infrastructure personnel should ask the same types of questions about the outsourcer's physical environment that they would ask if it were their own computer center.

18.6 Measuring and Streamlining the Facilities Management Process

We can measure the effectiveness of a facilities management process with service metrics such as the number of outages due to facilities management issues and the number of employee safety issues measured over time. Process metrics—for example, the frequency of preventative maintenance and inspections of air conditioning, smoke detection, and fire suppression systems and the testing of uninterruptible power supplies and backup generators—help us gauge the efficiency of this process. And we can streamline the facilities management process by automating actions such as notifying facilities personnel when environmental monitoring thresholds are exceeded for air conditioning, smoke detection, and fire suppression.

19 IT Monitoring



19.1 Ten Priorities for Systems Management

Operating System Performance and Availability Monitoring processes should begin with the initial deployment of an OS, ensuring the installation was a success or identifying any errors. The ongoing availability of an OS must also be recorded and tracked by monitoring resources such as uptime and identifying the failover status of clustered servers. OS performance must be monitored in real-time by recording the status of system resources, including the load on CPUs, memory, and individual processes. Any system performance elements that exceed established thresholds need to be immediately reported to IT operations for prompt remediation. It is also essential to correlate OS performance with the performance of applications and other workloads. In particular, database performance issues (identified in error logs and job status reporting) can be difficult to resolve without mapping the issues to the performance of system resources (such as CPU and memory status).

Server Hardware Status All devices in a support stack must also be monitored to ensure their physical hardware components are functioning optimally. Wear-and- tear from continuous use and environmental conditions can degrade a system's performance or cause it to fail outright. Catching potential hardware problems early will enable administrators to repair systems that are failing or move workloads to new systems before the issues become business impacting. Hardware components to monitor include the CPU, memory SIMMs, USB ports, and SCSI chains. Administrators should also be aware of which physical cable ports are in use and the status of any additional direct-attached devices.

> Catching potential hardware problems early will enable administrators to repair systems that are failing or move workloads to new systems before the issues become business impacting.

Data and Storage Availability Another key pillar in systems management is ensuring the high performance and availability of storage systems. This includes monitoring disk I/O performance, disk usage, and the integrity of the file systems. Paging and swapping metrics are also important to track, especially for environments that support dynamic data management systems, such as large SQL databases. Any storage devices that include RAID technology must also be monitored and alarmed so any faulty drives can be immediately replaced to ensure uninterrupted service. Storage Area Networks (SAN) and Network- Attached Storage (NAS) also require vigilant monitoring to ensure data is being transmitted reliably between storage devices.

Directory Services Directory services (including Active Directory, LDAP, NIS, and DNS) provide centralized management and distribution capabilities for critical system, network, and user information that are commonly accessed by endpoints across the support stack. To ensure directory services are always accurate and up to date, all changes (adds, deletes and updates) must be tracked and reported. This includes monitoring for changes to both individual and group of users and systems. Details on change events should be tracked to add accountability to directory service management processes. These include the identification of who made the change and when it was made.

Patches and Updates All server software components – including operating systems, applications, drivers, and firmware – require periodic patching and updates to new editions. These are often released to resolve performance issues, security vulnerabilities, or code bugs, and are typically provisioned by IT operations. Since it is essential to ensure that all software elements are promptly updated to ensure their security and reliability, the availability of new patches and updates must be continuously tracked and then compared against the versions currently installed on all devices in the support stack. By alarming on patches and updates that need to be installed, administrators can quickly deploy the fixes, minimizing business risks. Further, the patch deployment process itself must be monitored to assure they are successfully installed. The date and time when patches were installed should also be recorded so they can later be correlated with any system performance issues that may have resulted. This allows administrators to rollback faulty patches before they become business impacting.

Virtualization Infrastructure Performance Virtualization continues to see increased adoption as a key enabler of cloud computing; however, the complexity of the resources necessary for enabling a virtualized environment has also radically increased management challenges. These difficulties can be broadly mitigated with the assistance of monitoring and analytics, which should be employed in support of all types of virtualization – including server virtualization, desktop virtualization, and application virtualization. Performance of each VM should be recorded in a similar way to how it would be recorded on a static server, and alerts should be activated if/when performance falls below established thresholds. However, VMs must also be mapped to physical infrastructures and to any software dependencies necessary for their operations. In this way, a failure or performance issue within a VM can be traced back to the physical component that is the root cause of the problem.

Problem and Incident Alarming and Reporting Despite all preventative measures, sometimes failures and performance errors will occur in any IT implementation. Incident management processes include the necessary procedures for detecting and responding to issues that have already occurred. The key to effective incident management is prompt identification of the failure – the faster it is identified, the faster it will be resolved. The entire support stack (including hardware, software, and virtual components) must be continuously monitored so administrators can be immediately alerted to failure events. Some critical areas to monitor include: system logs, application and script status reports, threshold breach alerts, process tables (e.g. to identify hung or zombie processes) and database error logs. To ensure administrators are not overwhelmed with requests, they should only be alerted to incidents that are business impacting.

> The key to effective incident management is prompt identification of the failure – the faster it is identified, the faster it will be resolved.

Change Detection and Behavioral analysis Both proactive problem management and reactive incident resolution are improved with addition of change detection. Nearly all IT failure events are caused by a change that was made to the environment (the only exception to that rule being hardware failures caused by normal wear-and-tear), so by identifying changes as they occur, failure events can be correlated to it and the root cause more rapidly identified. All configuration elements should be monitored for change – including OS kernel and system files, registry files, scripts, and applications – and records on each change event should include what was changed, when it was changed, and who implemented the change. The latter adds an element of accountability, allowing administrators to track back to who was responsible and determine why the change was made. Of course, IT operations teams do not have the time to evaluate every change event, so analytics should be in place to only alert them to changes that are impactful to the support stack.

Capacity Planning In order to ensure the continuous availability of IT services to support business requirements, IT operations must proactively predict and promptly implement expansions to the capacity of IT resources. For instance, when servers regularly exceed about 80% of their capacity – in terms of CPU utilization, memory performance, and storage availability – they should be upgraded or replaced. Storage capacity should be identified by the amount of unallocated space, the amount of unused space in each partition, and the overall I/O performance of the storage device or array. Similarly, organizations that support virtualization implementations must monitor their capacity to support the existing number of VMs and the expected number of new VMs that will be provisioned. Database capacities must also be monitored by IT operations to ensure the system resources will be continuously available to support them. This includes monitoring database and log file sizes, buffer mangers, caches, and the number of active database user connections or open sessions.

Email Server Monitoring Email is an essential method of communication for any modern enterprise, which is why ensuring the uninterrupted routing of email messages is also a top priority for IT operations. Email servers, such as Microsoft Exchange, must be monitored to ensure they are continuously online and functioning at peak performance. This includes monitoring to ensure all applicable protocols for outgoing mail (such as SMTP) and incoming mail (such as POP3 and IMAP) are properly functioning, and the performance of mail routing can be determined by tacking the round trip time of messages. Any mail routing failures or performance issues should be logged and correlated to determine if the cause is a common system error. Additionally, the messages themselves should be monitored to ensure they conform to enterprise policies. Any emails with inappropriate content should be blacklisted and any messages sent from a questionable source (identified by their IP address and domain names) should be blocked.

19.2 Top 5 priorities for network security

Identity and Access Management (IAM) Provide structure and reporting for authentication services for personnel and systems throughout the enterprise.

Vulnerability Management Identify and address vulnerabilities across all enterprise systems and applications.

Change Monitoring Identify changes, both authorized and unauthorized, to your infrastruc- ture and who performed them.

Correlated, Centralized Event Management and Analysis Maintain continuous monitoring for anomalous, unusual, noncompliant, and malicious activities with a centralized repository for collecting and displaying all recorded events with out-of-the-box and user customizable intel- ligence and reporting.

Incident Response Regularly updated and tested conglomeration of documented manual and automated response processes and procedures available to the security personnel.

19.3 Seven Priorities for Network Management

Get the Network Under Management In order to establish effective network monitoring, the first step is to figure out which devices comprise the network and what critical resources are connected to it and by it. You can't manage what you don't know is out there, and EMA has heard countless stories of surprises resulting from initial (or even ongoing) network discovery. Start by selecting a network monitoring product. Some are simple, and some are sophisticated, but they all allow the collection of network device information for bringing devices under management.
There are a number of critical connected resources that should also be incorporated as part of the initial monitoring push:

- Network-enabling resources, such as DNS (Domain Name Service) and AD (Active Directory) servers, as well as IP address management systems such as DHCP (Dynamic Host Control Protocol), should be defined or discovered and added. These services are critical to basic network functionality, and when any of them stop functioning properly, network and application health and performance suffers. For instance, if AD authentication is not occurring because the server is down, users will not be able to access their Exchange email.
- Network security elements such as firewalls and IDS/IPSs (Intrusion Detection/Prevention Systems) will commonly sit in-line as part of the network path.
- Critical connected application servers are important too. You want to know that those systems are up, and at the very least that their Network Interface Cards (NICs) are functioning properly, so they can access the network without problems.

Define Device Groupings The next step is to organize the elements to be monitored. This essential step allows network monitoring teams to designate the relative importance of each component, according to specific characteristics of the organization and the managed infrastructure. Basically, the goal of this step is to link the monitored network to the organization that it connects and supports.

There are three types of grouping approaches that EMA finds to be most common and useful across settings both large and small, and using them helps to answer the what, where, and who of problem isolation and management. Following are some key types:

- Device Type: Network managers most often start with views into the managed network that bring together devices by category, such as routers, switches, and access points. This approach to grouping facilitates inventory management, device administration, and general health assessments. This will often be the place to figure out precisely what is the source of a problem under investigation.
- Geographical: For any organization that has more than one operating location, a geographical or site-based grouping of monitored devices is perhaps the most easily understandable way of looking at the network. This answers the question of where problems have occurred. Graphical topology map views fill this need and are often used as a primary display in the NOC (Network Operations Center) as a visual guide to operations status. It is also very helpful for quickly isolating the scope and impact of any problem.
- Organizational: The most direct technique for relating network monitoring information to the connected community is to group network elements in terms of which part of the business or organization they serve. This addresses the question of who is impacted by any issue or problem. There will be a lot of overlap here, when considering core devices, but this is key to recognizing and accurately communicating with end-user and line of business communities, whether for regular status reporting or during a troubleshooting and recovery scenario.

Prioritized Availability Monitoring The next step and priority is to define which devices, groups, and/or sites are to be designated as most critical to the organization. Any time one of these switches or ports is down unexpectedly, it's likely that access to important applications has been interrupted or, at best, impaired. These will be the network components that will be assigned the highest priority for sustained monitoring – when any of these elements or locations suffers an availability incident, they will receive priority attention from the operations staff.

Add Device-level Performance Monitoring With availability monitoring in hand, network managers can turn towards the next major set of challenges – recognizing and managing the performance of the network. The objective here is to move beyond being able to answer the question "is the network up?" and onto "is the network meeting performance and throughput expectations?" The most common mechanism for this is to expand availability-oriented SNMP polling to collect a broad range of health and activity metrics from network devices on a repeating periodic basis. That data is then archived and kept in a historical database, so that trends can be identified and normal versus abnormal activity revealed. Following are a set of essential areas to focus upon for establishing device-level network performance monitoring:

- Monitoring device resources: Collecting metrics on current levels of device resources such as CPU usage, memory usage, power levels, temperature (and more) reveals a detailed view of the operational capacity and health of each device.
- Monitoring ports/interfaces: By harvesting counters such as packets, octets, discards and errors both coming into and going out of each logical and physical interface, it is possible to recognize congestion issues as well as operational viability of the many touch points that comprise the connectivity fabric.
- Setting performance thresholds: Default performance alerts/alarms should be configured to watch for extreme high values in monitored metrics across all devices, such as interface utilization or device CPU exceeding 90%, and tuned more finely for critical/essential devices and resources. This provides indications to network managers that network links may be approaching saturation, before the network begins to fail.
- Identifying trends: Your monitoring system should provide reports on performance metrics over time so that you can recognize trends

over weeks, months, or even the past year. This provides network engineering the data necessary to accurately plan capacity, and network managers the ability to recognize changes in usage patterns or quality indicators that warrant proactive mitigation.

Get Change Under Control Enemy number one, when it comes to stability and performance of the network, is unplanned change or unintended consequences of change. Consequently, an essential aspect of monitoring networks for both performance and health must include recognition of changes being made to the network or occurring within the network. For instance, a routing change can break a network path between sites, a network QoS tag could be misconfigured and starve a latency-sensitive application like VoIP of necessary priority delivery, or a firewall rule change could block access to a critical application. Having change indicators on hand can significantly accelerate both problem troubleshooting as well as remediation.

There are two techniques for integrating change awareness into network monitoring. The first involves finding and capturing change indicators, and adding them into the primary monitoring platform and process. These indicators can often be found in the form of device traps or notifications (sometimes via API). Another good source is log files, where the exact change made, the time it was made, and often who made the change is captured and recorded.
The second important approach for establishing control over change is to leverage the ability of NCCM (Network Change and Configuration Management) tools to automatically scan devices, compare their configurations to expected norms, and automatically report variances. This latter approach can help reveal potential problem sources while also providing the added value of assuring policy and regulatory compliance. NCCM tools may be available as a module that works directly with your network monitoring platform, which will be easiest to integrate into monitoring practices, or may be stand-alone in nature, in which case a bit more effort will be needed to incorporate change indicators and scan results.

Add Application Awareness With the network layer well in hand, being monitored for availability, performance, and change, network managers can turn their focus upon adding the crown jewel of monitoring – application awareness. The objective here is to understand exactly what is traveling over the network, from where to where, in what volumes, and at what times. This is the touch point between a network and the served organization, yielding direct insight into the applications and services that the network is entrusted and expected to deliver. It also represents one of the most direct opportunities for recognizing how individuals as well as groups utilize and gain value from the network.
With application-aware data incorporated into the monitoring process, measures can be taken to leverage it in a manner similar to device-based performance outlined above. Network managers will want to set thresholds so that they may be notified of unexpected spikes or high levels of activity of any individual application or any individual end-user. Unexpectedly low levels of activity may also be of interest, as it may be an indication of impaired application or transaction activity.

Integrate and Communicate The full value of network monitoring cannot be fully realized without sharing and collaborating, both across the IT infrastructure team as well as beyond. Since the network is the fabric connecting IT-empowered organizations, it represents a strategic viewpoint for understanding the ebb and flow of activity and health of the IT function in the eyes of those who rely upon IT for their daily tasks and work. That viewpoint is a powerful one that when effectively shared, and can facilitate improved planning, smoother rollouts, and a better collective understanding of operations between IT and their customers.
Following are recommended focus areas for integration and sharing of information into and from the network monitoring function:

- **Help desk and trouble ticketing**: Connecting the network monitoring system to a trouble ticketing platform, and/or directly into a help desk management system, provides a link for tracking issues as they arise, the steps that have been taken to remedy them, in the final dispensation. Time-based escalation procedures can also be automated for network issues using the features in these systems, providing a better experience for IT's customers.
- **Systems and application monitoring**: The network connects systems to end users or to other systems, to deliver application and service traffic. By aligning network monitoring with monitoring of systems and applications, IT operations teams can correlate indicators and events to recognize dependencies and accelerate identification of root causes. This may involve another layer of management technology, to serve as a central consolidation point, or may be possible within the core network management platform, if that system has been designed to incorporate data from other domains.
- **Security monitoring and management**: Many of the technologies and data sources used for network security monitoring are the same as those used for network operations monitoring. Issues recognized within the network may, at times, actually reflect security threats. Open sharing of activity and issues found by the network monitoring team with the security team can greatly accelerate incident assessment and remediation. As with systems and applications, this may involve forwarding of events or data to a central SEIM (Security Event and Information Management) platform, or may be an integral capability of the network monitoring system.
- **Line of business and end users**: Finally, we cannot forget those who the network serves. Providing a means for reporting or exposing current network health, availability, and even performance status to senior executive leadership and even down to end users can be very helpful in managing expectations and proving value delivered. Essential here is the ability to focus reporting upon that portion of the infrastructure that is relevant to a user, group of users, or line of business, so that they are not overloaded with information that is not pertinent to their needs.

19.4 80% Rule

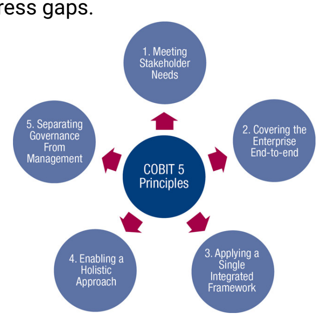
When servers regularly exceed about 80% of their capacity – in terms of CPU utilization, memory performance, and storage availability – they should be upgraded or replaced.

20 CoBIT Framework

COBIT (Control Objectives for Information and Related Technologies) is a good-practice framework created by international professional association ISACA for information technology (IT) management and IT governance. COBIT provides an implementable "set of controls over information technology and organizes them around a logical framework of IT-related processes and enablers."
The business orientation of COBIT consists of linking business goals to IT goals, providing metrics and maturity models to measure their achievement, and identifying the associated responsibilities of business and IT process owners. The process focus of COBIT is illustrated by a process model that subdivides IT into four domains (Plan and Organize; Acquire and Implement; Deliver and Support; and Monitor and Evaluate) and 34 processes inline with the responsibility areas of plan, build, run, and monitor. It is positioned at a high level and has been aligned and harmonized with other, more detailed IT standards and good practices such as COSO, ITIL, BiSL, ISO 27000, CMMI, TOGAF and PMBOK. COBIT acts as an integrator of these different guidance materials, summarizing key objectives under one umbrella framework that link the good practice models with governance and business requirements. COBIT 5 further consolidated and integrated the COBIT 4.1, Val IT 2.0 and Risk IT frameworks and drew from ISACA's IT Assurance Framework (ITAF) and the Business Model for Information Security (BMIS).
The framework and its components can, when utilized well, also contribute to ensuring regulatory compliance. It can encourage less wasteful information management, improve retention schedules, increase business agility, and lower costs while better complying with data retention and management regulations.

COBIT components include:

- **Framework**: Organizes IT governance objectives and good practices by IT domains and processes and links them to business requirements.
- **Process descriptions**: A reference process model and common language for everyone in an organization. The processes map to responsibility areas of plan, build, run, and monitor.
- **Control objectives**: Provides a complete set of high-level requirements to be considered by management for effective control of each IT process.
- **Management guidelines**: Helps assign responsibility, agree on objectives, measure performance, and illustrate interrelationship with other processes.
- **Maturity models**: Assesses maturity and capability per process and helps to address gaps.



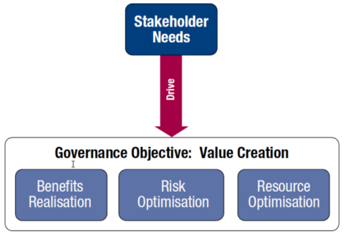
The COBIT 5 framework defines 7 categories of enablers:

- Principles, Policies and Frameworks
- Processes
- Organisational Structures
- Culture, Ethics and Behaviour
- Information
- Services, Infrastructure and Applications
- People, Skills and Competencies

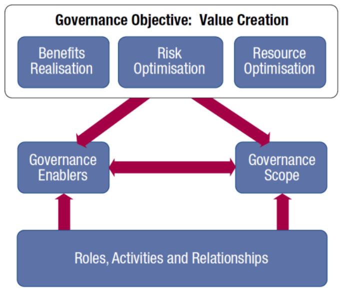
The COBIT 5 framework makes a clear distinction between governance and management. These two disciplines encompass different types of activities, require different organisational structures and serve different purposes. COBIT 5's view on this key distinction between governance and management is:

- Governance ensures that stakeholder needs, conditions and options are evaluated to determine balanced, agreed-on enterprise objectives to be achieved; setting direction through prioritisation and decision making; and monitoring performance and compliance against agreed-on direction and objectives (e.g. board of directors).
- Management plans, builds, runs and monitors activities in alignment with the direction set by the governance body to achieve the enterprise objectives (e.g. CEO).

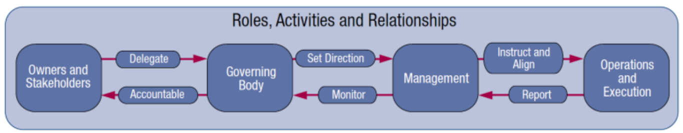
20.1 Governance Objective: the value creation



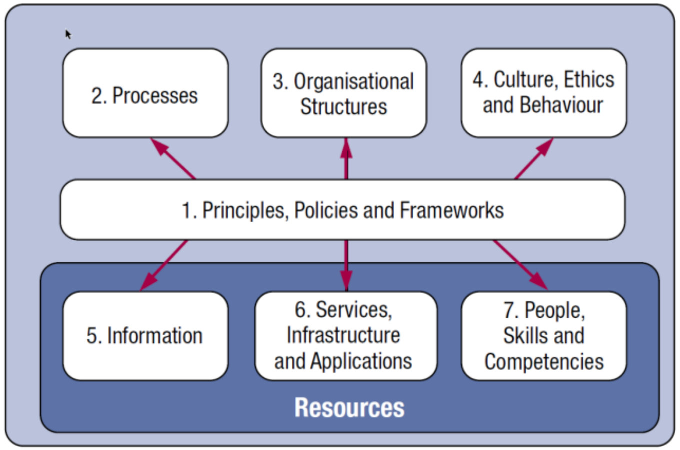
20.2 Governance and Management in COBIT5



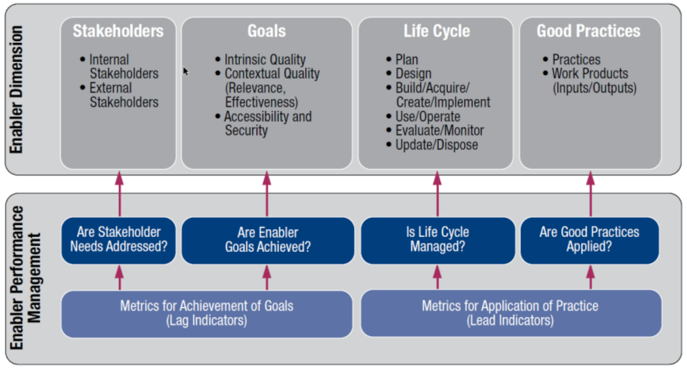
20.3 Key Roles, Activities and Relationships



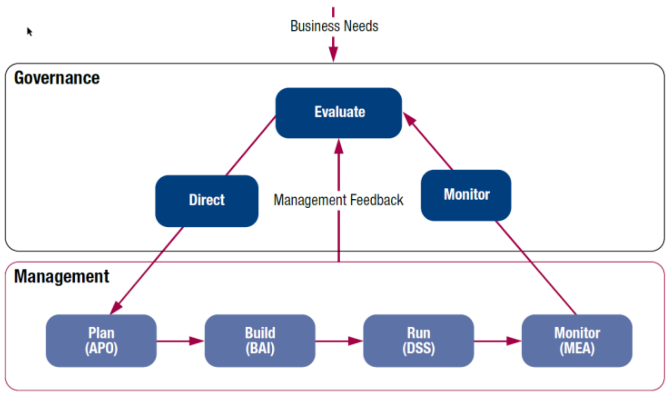
20.4 Enterprise Enablers



20.5 Enterprise Enablers (2)



20.6 Management and Governance key areas and responsibilities



20.7 Table of Maturity Levels

Figure 20—Comparison Table of Maturity Levels (COBIT 4.1) and Process Capability Levels (COBIT 5)

COBIT 4.1 Maturity Model Level	Process Capability Based on ISO/IEC 15504	Context
5 Optimised—Processes have been refined to a level of good practice, based on the results of continuous improvement and maturity modelling with other enterprises. IT is used in an integrated way to automate the workflow, providing tools to improve quality and effectiveness, making the enterprise quick to adapt.	**Level 5: Optimising process**—The level 4 predictable process is continuously improved to meet relevant current and projected business goals.	
4 Managed and measurable—Management monitors and measures compliance with procedures and takes action where processes appear not to be working effectively. Processes are under constant improvement and provide good practice. Automation and tools are used in a limited or fragmented way.	**Level 4: Predictable process**—The level 3 established process now operates within defined limits to achieve its process outcomes.	**Enterprise View—Corporate Knowledge**
3 Defined process—Procedures have been standardised and documented, and communicated through training. It is mandated that these processes should be followed; however, it is unlikely that deviations will be detected. The procedures themselves are not sophisticated, but are the formalisation of existing practices.	**Level 3: Established process**—The level 2 managed process is now implemented using a defined process that is capable of achieving its process outcomes.	
	Level 2: Managed process—The level 1 performed process is now implemented in a managed fashion (planned, monitored and adjusted) and its work products are appropriately established, controlled and maintained.	
2 Repeatable but intuitive—Processes have developed to the stage where similar procedures are followed by different people undertaking the same task. There is no formal training or communication of standard procedures, and responsibility is left to the individual. There is a high degree of reliance on the knowledge of individuals and, therefore, errors are likely.	**Level 1: Performed process**—The implemented process achieves its process purpose. **Remark: It is possible that some classified as Maturity Model 1 will be classified as 15504 0, if the process outcomes are not achieved.**	**Instance View—Individual Knowledge**
1 Initial/*Ad hoc*—There is evidence that the enterprise has recognised that the issues exist and need to be addressed. There are, however, no standardised processes; instead, there are *ad hoc* approaches that tend to be applied on an individual or case-by-case basis. The overall approach to management is disorganised.		
0 Non-existent—Complete lack of any recognisable processes. The enterprise has not even recognised that there is an issue to be addressed.	**Level 0: Incomplete process**—The process is not implemented or fails to achieve its purpose.	

20.8 Cobit 5 vs Cobit 4.1

Comparison Table of Maturity Attributes (COBIT 4.1) and Process Attributes (COBIT 5)

	COBIT 5 Process Capability Attribute								
COBIT 4.1 Maturity Attribute	Process Performance	Performance Management	Work Product Management	Process Definition	Process Deployment	Process Measurement	Process Control	Process Innovation	Process Optimisation
Awareness and communication				■	■	■			
Policies, plans and procedures							■		
Tools and automation				■					
Skills and expertise				■	■				
Responsibility and accountability				■					
Goals setting and measurement		■				■			

20.9 ISACA

Leading global provider of knowledge, certifications, community, advocacy, education on information systems (IS), assurance and security, enterprise governance and management of IT, IT-related risk and compliance.

95,000 constituents in 160 countries. ISACA attests IT skills & knowledge through recognized certifications:

- Certified Information Systems Auditor® (CISA®),
- Certified Information Security Manager® (CISM®),
- Certified in the Governance of Enterprise IT® (CGEIT®) and
- Certified in Risk and Information Systems ControlTM (CRISCTM) designations

20.10 CoBIT 5: SIEM

Security information and event management (SIEM), it is a solution enterprise security professionals both insight into and a track record of the activities within their IT environment. It provides Real time analysis of log and event data, to provide:

- threat monitoring,
- event correlation and
- incident response

Collects and aggregates log data generated throughout the organization's technology infrastructure:

- servers
- host systems
- applications
- network and
- security devices such as firewalls and antivirus filters.

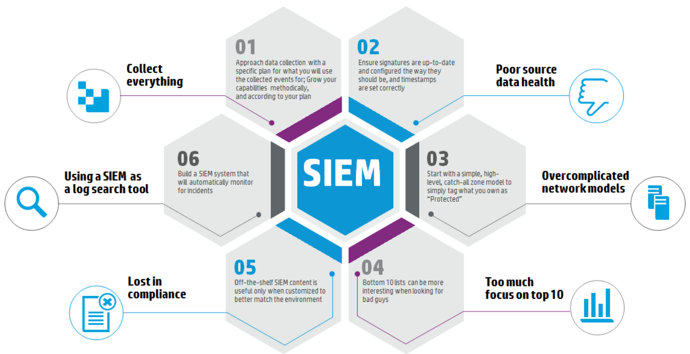
SIEM software identifies and categorizes incidents and events, as well as analyzes them.
SIEM has 2 main objectives:

- providing reports on security-related incidents and events, such as successful and failed logins, malware activity and other possible malicious activities
- sending alerts if the event analysis discovers an activity that runs against predetermined rulesets, indicating a potential security issue.

SIEM is implemented via software, systems, appliances, or some combination of these items. There are, generally speaking, six main attributes of an SIEM system:

- **Retention**: Storing data for long periods so that decisions can be made off of more complete data sets.
- **Dashboards**: Used to analyze (and visualize) data in an attempt to recognize patterns or target activity or data that does not fit into a normal pattern.
- **Correlation**: Sorts data into packets that are meaningful, similar and share common traits. The goal is to turn data into useful information.
- **Alerting**: When data is gathered or identified that trigger certain responses - such as alerts or potential security problems - SIEM tools can activate certain protocols to alert users, like notifications sent to the dashboard, an automated email or text message.
- **Data Aggregation**: Data can be gathered from any number of sites once SIEM is introduced, including servers, networks, databases, software and email systems. The aggregator also serves as a consolidating resource before data is sent to be correlated or retained.
- **Compliance**: Protocols in a SIEM can be established that automatically collect data necessary for compliance with company, organizational or government policies.

20.11 6 Ways to screw up a SIEM implementation



21 SOC

An information security operations center ("ISOC" or "SOC") is a facility where enterprise information systems (web sites, applications, databases, data centers and servers, networks, desktops and other endpoints) are monitored, assessed, and defended.

21.1 High Level View

21.2 Typical Services handled by SOC

- Security Monitoring & Incident Handling
  - Security Incident Handling
  - New Threats Management
- Operational Security Management
  - Risk Analysisy Management (Security Plans)
  - Remediation Plans
  - Operational Security
- Technical Security Analysis
  - Vulnerability Assessment
  - Security Baseline Compliance Assessment
  - Forensics Analysis Services
- Security Infrastructures Management
  - Operational Security

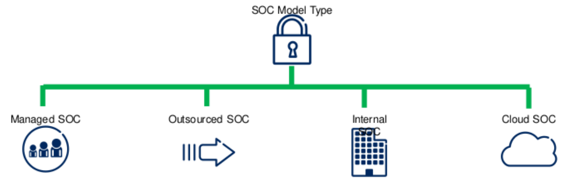
SOC's modular design enables adding/removing different services depending on organization requirements and InfoSec maturity.

21.3 SOC's Team Skills - General

Synthetically, the SOC team manages and prevents security issues and defines all security instructions/guidelines for IT teams and therefore requires a diverse and very high level of expertise grouped into 4 distinct areas of expertise. The SOC general skill-set are:

- Security Skills
- Network Skills
- Infrastructure Skills
- Governance & Compliance Skills

21.4 SOC Options



The SOC is located at Client's premises	The SOC is located at supplier premises	The SOC is located at Client's premises	The SOC is located on supplier's cloud
Client provides the tools and equipment (based on supplier's recommendations)	Supplier provides the standard SOC tools and equipment	Client provides the tools and equipment (based on supplier's recommendations)	The tools are cloud based. Equipment are part of supplier standard cloud
The skills are provided by supplier (possibly)	The skills are provided by the supplier	Client provides the skills that are trained by the supplier	The skills are provided by suppliers
The processes are collaboratively developed by Client and the supplier	The processes are collaboratively developed by Client and the supplier	The processes are collaboratively developed by Client and supplier	The processes are collaboratively developed by Client and supplier
The processes are managed by the supplier	The processes are produced/managed by supplier	Processes management is transferred to Client's SOC employees	The processes are managed by supplier

22 SysAdmin Code Of Ethics

We as professional System Administrators do hereby commit ourselves to the highest standards of ethical and professional conduct, and agree to be guided by this code of ethics, and encourage every System Administrator to do the same.

Professionalism I will maintain professional conduct in the workplace and will not allow personal feelings or beliefs to cause me to treat people unfairly or unprofessionally.

Personal Integrity I will be honest in my professional dealings and forthcoming about my competence and the impact of my mistakes. I will seek assistance from others when required. I will avoid conflicts of interest and biases whenever possible. When my advice is sought, if I have a conflict of interest or bias, I will declare it if appropriate, and recuse myself if necessary.

Privacy I will access private information on computer systems only when it is necessary in the course of my technical duties. I will maintain and protect the confidentiality of any information to which I may have access, regardless of the method by which I came into knowledge of it.

Laws and Policies I will educate myself and others on relevant laws, regulations, and policies regarding the performance of my duties.

Communication I will communicate with management, users, and colleagues about computer matters of mutual interest. I will strive to listen to and understand the needs of all parties.

System Integrity I will strive to ensure the necessary integrity, reliability, and availability of the systems for which I am responsible. I will design and maintain each system in a manner to support the purpose of the system to the organization.

Education I will continue to update and enhance my technical knowledge and other work-related skills. I will share my knowledge and experience with others.

Responsibility to Computing Community I will cooperate with the larger computing community to maintain the integrity of network and computing resources. Social Responsibility As an informed professional, I will encourage the writing and adoption of relevant policies and laws consistent with these ethical principles.

Ethical Responsibility I will strive to build and maintain a safe, healthy, and productive workplace. I will do my best to make decisions consistent with the safety, privacy, and well-being of my community and the public, and to disclose promptly factors that might pose unexamined risks or dangers. I will accept and offer honest criticism of technical work as appropriate and will credit properly the contributions of others. I will lead by example, maintaining a high ethical standard and degree of professionalism in the performance of all my duties. I will support colleagues and co-workers in following this code of ethics.