CMA
ACCELERATED PROGRAM

Information Technology
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1 Foreword

This manual is fairly broad in its covering of IT related topics but consider this as only a starting point in the study of Information Technology. Please do not think that if you know this material that is all there is to know. IT is a constantly changing, very wide reaching subject covering many disciplines, topics and areas of specialization. No single manual can cover off every possible topic and variation on how IT services are delivered to business today.

This manual is written to provide a common baseline on a variety of relevant IT related topics facing business today. More importantly, this manual also attempts to identify the linkages between business activity and IT activities. IT is a key enabler of overall business strategy, and linkages exist between the computer room and the boardroom that it is important for a CMA to recognize and use them to their advantage.

A CMA may also be called on to provide some guidance and approval on large IT investments. To be effective in this activity, it requires that a CMA be able to understand and appreciate the complexities of the undertaking being proposed. The impacts of an IT acquisition can change how decisions are made, how people do their job, and even how a company is structured. To be able to understand this fully requires detailed knowledge that can only be gathered through detailed and specific study. This study will allow the CMA to ask the appropriate questions and draw better conclusions.

2 Introduction

This course has been designed to provide participants with the insights and frameworks necessary to effectively understand current issues facing organizations rollout and management of information technology (IT).

This is not meant to be a technical course; however, out of necessity this course does include a number of technical subjects, with the intention to relate them into a business context. This course is practical knowledge that can be taken back and applied within an organization.

This course is organized along the following general themes:

- The Business of IT - Managerial theories and IT decision making
- Information Technology Fundamentals – Technical Topics
- Security, Control Frameworks and Auditing
- Finance / Accounting Specific IT Topics
- Emerging Technology Trends and Topics
3 Section 1 – The Business of IT

3.1 Defining Information Technology (IT)

Many people define IT solely as the boxes and wires necessary to support the business, providing email, desktop support, file & print management etc. Other people define IT as programming debugging or testing code. While these definitions hold true for some people in the industry in reality many people in IT never write code, rarely pick up a screw-driver and do not work on a help desk. IT in its broadest sense covers many different domains, professions and services that relate to the use of technology. Although numerous definitions exist a general one that can be used is:

*Tools, technology services, and roles used to support a business’ decision making process.*

Information Technology can generally be broken into the following two general sub-categories.

<table>
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<th>Category</th>
<th>What they do</th>
<th>Example</th>
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<tr>
<td>Infrastructure</td>
<td>These are the boxes, wires, operating systems and equipment that are used to host programs and applications. Infrastructure itself does nothing without applications that tell them what to do.</td>
<td>Networks, Servers, PC’s, Printers, Databases, Hard Disks, Operating Systems (Windows, Linux, Unix)</td>
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<td>Applications</td>
<td>These are the programs that develop and support the computer programs that users interacted with to perform business functions.</td>
<td>Internet Explorer, MS-Office, SAP, Payroll, Billing, Games (Though this one is not really for business)</td>
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The Infrastructure category can be further decomposed into multiple layers breaking out the hardware from the software, but for our purposes the two categories are sufficient.
3.2 IT Jobs & Roles

Part of the challenges of being in the (IT) Information Technology profession is that it is difficult to quantify exactly where the bounds of many IT roles begin and end. Just as there are many different types of technology there are also many different IT jobs and roles. Most IT jobs are not purely technology since many of them have significant business components as well.

The following are some of the more generic IT roles that exist in industry today.

**CIO – Chief Information Officer** – This role can go by many different names but this is the most important IT role. The CIO may or may not be an executive but this person is ultimately responsible for setting the overall IT strategy, and the direction and vision for the department. This role is the prime linkage between IT and business. The capabilities of the CIO can make a huge difference between whether IT becomes an enabler or a hindrance to the business.

A CIO needs four separate skills to be successful: CIO’s must be a Strategist, they need to be an Innovator, they must be a Business enabler and understand the business they support, and lastly they must be a Technologist.¹

A typical CIO in a midsized company would probably spend the vast majority of their time looking at the business, looking at technology and figuring out how the two can best be married to meet a number of competing priorities. The underlying goal of the job would be to drive the business forward, and optimize the business processes while pushing the technology aspects into the background. It is important that the business drive the IT decisions, not the IT driving the business.

Because there is new capacity and capabilities which are available does not mean that it is optimal or appropriate for the business to adopt a particular technology direction. The challenge for IT is to strike the appropriate balance between innovation, business need and corporate risks. These types of circumstances are common in any industry and diplomacy is required when the business is excited about some new trend or gadget. The technology may not be a fit for the overall direction, or the timing may be wrong, so often directing the enthusiasm is the key to success in the management of IT services.

**Architects** – There are many, many different ways for technology to be deployed and architects are responsible for deciding what technology is to be implemented and how this will happen. Architects develop and maintain the technology blueprints, standards and designs for both project and organizations. Architects often have the dual role of not only being responsible for current projects but actively working for the CIO to manage and maintain the strategic plan.

**Programmer** – Also known as *application developers* and *coders*. These are the people who develop the applications and write the programs that people use. Programmers use a wide variety of tools and technologies to get their work done, and programmers usually are a specialist in one or a few technologies.
**Business Analyst** – These are the people who turn business requirements into the technical specifications that programmers use for development. Business Analysts also often take a lead in testing. Business analysts are also the people who map and re-engineer business processes to fit new systems.

**QA Analysts** – These people ensure that what is designed covers off what was specified in the requirement, and what was built matches the design. QA analysts are also often responsible for capturing lessons learned and recognizing opportunities for quality improvements for future projects.

**DBA – Data Base Analysts** – These people are responsible for managing databases and technical environments. DBA’s come in two forms:

*Development DBA* usually works closely with a team of developers and gets more involved in design decisions, giving advice on performance and writing good database specific code (Structured Query Language – SQL).

*Production DBA* is responsible for maintaining Databases within an organization, so it is a very difficult and demanding job. He or she often gets involved when all the design decisions have been made, and has simply to keep things up and running.

DBA tasks include managing Security, Performance, Availability, Development and testing support for the database environments they control.

**Data modelers** – Data modelers are responsible for creating models of business functions. These models mimic business objects either into a database or a development class. Data modelers are the key to creating effective databases which underpin organizations. Data modelers are the bridge between DBA’s and Business Analysts, and are usually very experienced employees who understand both technology and the business.

**Application Configuration Specialist** – These people are functional experts in a particular application, and know how to configure it to meet a particular client’s needs. These people may have a specific business functional area that they are also knowledgeable in. (ex. SAP – HR, Oracle GL, etc)

**Project Manager** – Project Managers are responsible for managing and implementing IT projects. IT project managers can be specialists in one type of project or another and the job description can vary greatly for this role.

**Managers / Executives** – Just like every other department in an organization IT requires management, oversight, budgeting and direction. IT managers are responsible for all the day-to-day management of their departments, and may also be responsible for oversight of contractors as well.
**Network** – These are the people who are responsible for managing and supporting the needs of the network. This role may also include taking care of telephony services.

**Operations** – These are the people who are responsible for running Backups, supervising and managing production schedulers. These are the people that are often responsible for running the batch schedule and who deal with problems that happen in the middle of the night.

**Info Security** – Information Security is responsible for keeping the IT environment safe and secure. Some of the tasks Info Security may take on include physical monitoring, keeping systems patched and current, authentication of users, auditing projects and production environments for vulnerabilities that can put the business at risk.

**Storage** – Organizations use a lot of disk and backup storage. Storage specialists match the business needs for storage with particular technologies and manage the storage environment. This role may also include managing the backup environment.

**Desktop** – This group of people are responsible for managing the operating system and tools running on end users workstations.

**Auditors** – There are multiple different types of IT related auditors that organizations can deploy. This role can vary from ensuring that large projects are not misspending funds to reviewing how people interact with technology to ensure that all the basic rules of good financial management, like segregation of duties, are being followed.

**Help Desk** – These are the people who log problem tickets, try to resolve problems for end users and escalate when they cannot.

The influence of IT on an organization is far ranging, so executives outside of IT also play a role in supporting IT.ii

**CFO/ VP of Finance** – Takes the lead in identifying IT benefits, not just costs. Works closely with the CIO on the business case for strategic IT investments.

**COO** – Works with the CIO to deploy IT. Involves the CIO in all major operational changes / decisions.

**VP Sales** – Equips and trains sales personnel with technology. Uses technology to accelerate the sales cycle.

**VP Marketing** – Uses IT for visibility and data collection.

**VP HR** – Helps CEO to understand productivity benefits of IT. Considers IT training a priority.
3.3 **Link between Corporate Strategy and IT**

Any organization that wants to be successful needs to have clearly laid out strategies for all aspects of their business, marketing, sales, financial management and IT. If there is no comprehensive vision and strategy for IT then an organization will end up with a chaos of technology, services and projects.

Author and researcher Nicholas G. Carr wrote a groundbreaking article in May 2003 in Harvard Business Review entitled “IT Doesn’t Matter”iii In this article Carr argues that Information Technology has become the backbone of commerce today, however as technology becomes more readily available to all, the ability for technology alone to separate a company from its competitors diminishes. IT strategy alone is not enough to make a company ultimately successful. Extracting value from IT requires investment and innovation in other areas of the business. IT cannot stand alone, it needs to be in lockstep with the rest of the business.

Having an IT strategy that matches the business means a company avoids the common complaint that IT doesn’t understand or doesn’t respond to business needs.

The IT strategy needs to be clearly understood corporate wide and all the executives and senior management need to support the IT strategy. All IT projects that are recommended and ultimately approved need to compliment the high level strategy.

A few high level factors that need to go into the high level strategy include:

*First*, is the company going to be cutting edge, middle of the pack, or a trailer for keeping current with tools and technologies? This decision then sets the tone for all the rest of IT spend and staffing.

*Secondly*, for IT products and services will the company adopt a buy or a build mentality as the default starting position? This has implications on how projects are executed and how the team is staffed.

*Thirdly*, who is going to provide IT services? Are some or all of the management of technology going to be outsourced? If outsourcing is the model is the provider going to be working in the building, down the street, across the city, or across the world?

*Fourthly*, what is the planned overall spend on IT as a percentage of net revenues? Companies may consciously decide to under-spend or overspend on IT services as part of their corporate strategy and need to plan accordingly.

The high level decisions may change over time as the company evolves. However, once the high level decisions are made then it is possible to develop the tactical plans for running operations and executing projects.
The CIO is responsible for the tone of the IT strategy and it fitting into the overall corporate direction. Architects are responsible for understanding this vision and turning it into blueprints and ensuring compliance to the overall vision.

### 3.4 Organization of IT departments

One of the biggest factors for success for an IT department depends on the way that an organization structures the way it delivers IT services. IT departments have a dual role to support a complex, ever changing technical environment and to respond to the changing demands from the business. To respond to these needs companies have come up with various organizational models to deliver the needed services. Some organizations centralize all services into a single department, some allow for end users to manage some of their own services, and some companies outsource their IT management services to another company.

Regardless of how IT services are delivered, an IT organization that is not organized efficiently results in confusion, overlaps and gaps in who provides services, miscommunications and conflicting priorities which all translates into poor delivery of service.

A typical organizational structure for a larger company is to break the department into three distinct sub teams with a clear division of duties.

Companies that do not have this separation of duties suffer from three distinct problems:

1) **Confused priorities:** Are resources supposed to work on the projects they are assigned to, or on the problems of the day? Depending upon the leanings of management one party or the other gets the attention.
2) **Switching costs**: The increased cost associated with switching resources from one role to another. This typically manifests itself as missed deadlines on the project delivery side.

3) **Skill Set Matching**: People tend to be good at one type of task. People who are good in application support and small enhancements may be terrible at projects and vice versa. Organizations have a tough time finding resources that can fill both gaps equally.

### 3.4.1 Additional IT Human Resources Factors

Beyond the simple physical structure of an IT department, the following industry trends will impact/influence every IT department to one degree or another and will need to be dealt with either through organizational modifications or through corporate policy.

- Empowerment of employees
- De-layering
- Impacts of Outsourcing /Down Sizing / Right Sizing
- Networking
- Flattening of corporate hierarchies
- Moonlighting
- Change Management Rate

IT organizations continuously need to re-evaluate how they respond to business and environmental demands in order to provide the most efficient and flexible response to organizations they service. To do this every company needs to deal with many of the contradictions of organizational design to come up with the right mix for their company.

Companies that do not get the mix correct to match the culture and needs of the rest of the organization end up either with a rogue IT department or a non-responsive IT department. Both of these circumstances result in damage to the business.

### 3.5 Use of Consultants

At some point in every organization can be faced with constraints in skills, time and knowledge. These constraints are especially felt in IT departments where very specific knowledge is often required to be able to successfully implement new projects or to solve thorny problems. In many cases to get past these constraints companies look to consultants to fill the voids and gaps. There are many different types of IT consultants and almost as many ways to use them, but in general there are two general ways that consultants are used.

**Staff augmentation:** In this circumstance consultants are brought in to augment existing staff, and the consultant takes direction for day to day activities from the management team. The consultant essentially acts like a member of the staff while they
are working for the organization, and uses the existing processes, tools and governance to get their work done.

**Self Direction:** In this mode the consultant comes in with their own set of tools, processes and templates and takes over accountability and management for delivering a particular project or service. This is more likely to occur when teams of consultants come in to run a project.

When a company is engaging contractors it is important to understand which model they will be working under as many conflicts have occurred when consultants that believe they are working in a Self-Directed mode work with a client that believes that the consultants should be working in a staff-augmentation mode.

Consultants may work for a professional services organization like Accenture, HP, Teradata or Deloitte where every consultant has a specific services delivery framework that does not vary from project to project. After the first project they know exactly what to expect on each subsequent project regardless of whom from the company is delivering the service. Alternately consultants may be independents that bring their own flavor of services, templates and skills to each engagement. Both types of consultants have their particular niches that they fit into.

Two things to keep in mind when dealing with consultants:

1) They will only remain at an organization as long as they can keep the client happy. Consultants generally will work long and hard to ensure the organizations are satisfied with the work they provide.

2) Consultants usually want to remain at the organization in order to keep generating revenue for themselves and their company. If it appears as if many of them are constantly on the hustle for additional revenue opportunities, it is because they often are. When consultants suggest additional billable work, the organization needs to have a critical eye as to why the work is being proposed.

### 3.6 Outsourcing

When companies decide that they want to outsource IT services it is often a financially motivated decision. Companies want to shed balance sheet assets and boost their return on capital by leveraging specialist support companies.

If done correctly outsourcing potentially allows an organization to achieve the following:

- Company can focus on core strengths and competencies
- Opportunity to save money
- Better levels of IT service and overall uptime can be achieved internally
• Access to specialists on particular technology
• Increased standardization
• Ability to ramp up / ramp down IT services easily as needs dictate.

In theory outsourcing is a straightforward decision, outsource the non-core activities. (Support, non-strategic IT systems etc.) However many companies overlook the strategic link between business strategy and IT, and outsource too many of their strategic competencies. Companies that decide to outsource need to ensure that the outsourcing activities do not negatively impact the ability for the rest of the business to get information necessary to support decision making processes, and they need to ensure that what gets outsourced is not strategic for success.

There are several factors which can contribute to improving the odds of a successful outcome for an outsourcing arrangement.

• Due diligence to ensure that there is a good cultural match between the company and outsource provider. It would not be a good fit for an entrepreneurial company to work with an outsource provider that favours process over agility for change.
• A documented and agreed to understanding of what the company is hoping to achieve by outsourcing. Clear, concise and comprehensive contracts and service level agreements are fundamentals to this understanding. It must be measurable to be achievable so benchmarks must be included within the agreements.
• Candid discussions with internal staff to understand and address their concerns and issues with outsourcing. Without internal support outsourcing arrangements face a tougher startup than those where internal staff support the process.

If not done correctly there are a number of business risks that companies may face as a result of outsourcing which need to be understood and managed.

**Short-term Risks**
Higher operations costs
Increased customer complaints
Lower service quality
Operation shutdown

**Long-term Risks**
Price/contract creep
Low rate of innovation
Operational dependency
Loss of strategic assets
Process level lock-in
Adoption of disadvantageous architecture style
Loss of innovation capabilities
Loss of strategic flexibility
3.7 Augmenting the Technology Decision Making Process

A business is presented with a wide variety of choices and options for the deployment of technology. Fortunately there are a number of independent companies that can lend some critical analysis as inputs into the decision making process. These companies provide analysis of technologies, vendors and the marketplace.

*This section is not intended to be an endorsement of a particular service or company. There are many, many different companies that provide these types of services, but Gartner and Forrester are the most widely known and referenced.*

3.7.1 Technology vs. The Marketplace

One of the most highly touted tools that is referenced by companies is a hype-cycle chart. Gartner conceived the idea, and produces hype-cycle charts on a variety of topics.

The basic premise of a hype cycle chart is to plot the hype or over-excitement that accompanies the rollout of new technologies. After the initial excitement is over people become disillusioned with the problems found with the technology, then the problems get...
worked out and general adoption begins to take place. The further to the right on a hype chart a particular technology is the more mature and widely adopted the technology is.

Decision makers can look at their own internal companies and the technology being proposed and make a determination if the technology is at the right stage for adoption.

A hype cycle in Gartner's interpretation comprises 5 steps:

1. "Technology Trigger" — The first phase of a hype cycle is the "technology trigger" or breakthrough, product launch or other event that generates significant press and interest.

2. "Peak of Inflated Expectations" — In the next phase, a frenzy of publicity typically generates over-enthusiasm and unrealistic expectations. There may be some successful applications of a technology, but there are typically more failures.

3. "Trough of Disillusionment" — Technologies enter the "trough of disillusionment" because they fail to meet expectations and quickly become unfashionable. Consequently, the press usually abandons the topic and the technology.

4. "Slope of Enlightenment" — Although the press may have stopped covering the technology, some businesses continue through the "slope of enlightenment" and experiment to understand the benefits and practical application of the technology.

5. "Plateau of Productivity" — A technology reaches the "plateau of productivity" as the benefits of it become widely demonstrated and accepted. The technology becomes increasingly stable and evolves in second and third generations. The final height of the plateau varies according to whether the technology is broadly applicable or benefits only a niche market.

The term “hype-cycle” is now used more broadly in the marketing of new technologies.
3.7.2 Comparing Vendors

Once a company has determined that they want / need a particular type of technology to be deployed, they are faced with the next step of trying to determine which vendor’s tools are the best fit for their particular needs. Forrester and Gartner have also come up with tools and graphical representations that can be used as inputs into this step of the decision making process.

Gartner – Magic Quadrants

The “Magic Quadrant” from Gartner is a graphical representation of a marketplace at and for a specific time period. It depicts Gartner’s analysis of how certain vendors measure against criteria for that marketplace, as defined by Gartner. Beyond just the simple graphic Gartner includes a technical write-up that emphasizes strengths and weaknesses of each particular vendor and the criteria that was used to place vendors into the various quadrants.

Companies that are furthest to the right and highest have the most complete offerings (in Gartner’s opinion).
Gartner maps vendors upon two criteria: **completeness of vision** and **ability to execute**. Using different qualifiers per criteria for the varying industries, the Magic Quadrant then rates the participants into one of four quadrants:

**Leaders** score higher on both criteria; the ability to execute and completeness of vision. Typically larger industry developed businesses with vision and potential for expansion.

**Challengers** score higher the ability to execute and lower on the completeness of vision. Typically the larger, more settled businesses with minimal future plans for that industry.

**Visionaries** score lower on the ability to execute and higher on the completeness of vision. Typically the smaller companies are unloading their planned potential.

**Niche players** score lower on both criteria: the ability to execute and completeness of vision. Typically market fledglings.

Gartner produces over 500 different magic quadrants on a wide variety of topics, tools and criteria.

**Forrester Wave**
The Forrester Wave tool is their version of an analysis framework that also feeds into the decision making process.
The Forrester wave is driven by a user customizable excel spreadsheet that allows users to weight different decision making criteria and adjusts the wave dynamically based upon what is important to a company. The excel spreadsheet also contains detailed analysis of the items under review.

Similar to Gartner, Forrester produces hundreds of waves on a variety of topics and subjects.

**Notes / Cautions on these tools:**
1. These tools should never replace the decision making process. Just because a company is in the leader’s quadrant it does not automatically make them a fit for the company. The input from these services is an input into the decision making process.

2. There is always criticism on the criteria that is used to plot the different offerings. It is important to carefully review the accompanying write ups to determine what criteria are being used for the particular assessment. For example, a company may have a great rating on ability to execute, but not have any Canadian capability to execute.

3. The analysis from these types of companies is not cheap. The purchase of a specific report or analysis can be several thousand dollars. Some companies purchase subscriptions to these services which grants access to the whole library of analysis.

4. The analysis is valid only for a period of time. The marketplace is constantly changing with the emergence of new technologies, merging of companies etc. As a result looking at analysis that is a year or two old may no longer reflect current state.

### 3.8 Licensing Management / Piracy

The terms and conditions put into the use of software can be quite complex and difficult to get a grasp on. However companies that do not pay attention to their management of software licenses and terms of use run the risk of facing ever stiffer penalties and legal consequences. Companies that do not have a handle on the introduction and management of software also face the possible introduction of rogue software into their environment.

When people purchase a software license, they are purchasing a legal right to limited use the product, not to own the software. Software is intellectual property and is treated as such.
The terms of the licensing agreements normally cover off things such as:

- Downgrade rights. Can a new license be purchased, but install & run the old product?
- How many machines can the software be running on: Secondary Use Rights
- Does the agreement allow backup copies of the manuals and installation media?
- What is the lifespan of the agreement?

Licenses can have different life spans. They can be either perpetual or non-perpetual:

- Perpetual licenses are everlasting and valid if the software is being used in accordance with the license-agreement requirements.
- Non-perpetual licenses, or subscription licenses, are temporary and provide the right to use a particular licensed product until the end of the license-agreement term. Once the term of the agreement is up, companies either need to repurchase a new license or stop using the product.

Software licensing comes in a variety of different forms, it is important the EULA (End User License Agreement) is read to understand the restrictions that are placed on the usage of the software.

**Commercial Software:** This is the most typical way that people think of software licensing in which people purchase software in a shrink wrapped box and install it.

**Shareware:** Can be acquired from others or downloaded from the internet and tried at no cost during a specified trial period. After the copy of the software is tested or the free trial period expires, the user must purchase a license for the shareware or delete, uninstall or otherwise destroy the copy of the shareware.

**Freeware:** Can be copied as either an archival copy or for use as long as the use is not for profit. Some Freeware can be de-compiled and modified without the permission of the copyright holder, but generally any new program derived from Freeware must also be designated as Freeware and not sold for profit. It is important to understand that all software that is freely attainable for download is not necessarily Freeware. In many cases software which is packaged to appear as freeware may require purchase just after installation.

**Public Domain:** When an author designates that their software is in the open domain it can be freely used, reverse engineered, and modified as anyone sees fit.

Companies need to treat software and licenses like a mechanic treats his /her tools.

- Know where they are at all times.
- Keep them in a central location.
- Don’t lend them out.
• Do some routine checking every now and then to weed out tools that are no longer useful

On top of that a few more good practices

• Don’t allow people to bring in software from home as this may introduce both technical problems and create potential licensing issues.
• Have a process in place to manage software and utilities which are downloaded off the internet as this may also introduce unsupported and unmanaged software into the enterprise.

3.8.1 Transferring Licenses
Companies tend to move computers around from person to person, there are licensing ramifications of this practice that managers need to be aware of. Many cases where companies are found to be non-compliant because of not managing this circumstance well. Make sure that when computers or software is transferred all the original documentation and licenses accompanies the transfer.

3.8.2 Managing Original Documentation
It is very important for companies to maintain the documentation of software purchases and licenses.
Catalog and keep the following information and documents for all the software bought or used:

• All original media (diskettes, CDs, DVD’s) purchased or received along with all original manuals and reference documentation included with the software.
• The software product name, version number, and serial number.
• Proof of purchase such as sales orders, invoices, purchase receipts, packing slips that denote the product(s) and quantity purchased. This can include an invoice delivered with a computer that already had software installed.
• Software Site License Agreement and/or Software Site Licensing Program Summary of Order that shows the customer number assigned.
• A letter from the manufacturer and/or publisher denoting what comes with the computer.
• Purchase Orders that the Purchasing Department has approved and processed.
• All unexpired license documentation (for commercial software, this is usually a printed form that may have an embossed seal; for shareware and freeware, and a print out of the license agreement).
• Registration information: If the software has been registered, then print out a proof of registration as another proof of purchase.
3.8.3 Free and Open Source Software

Some companies have looked at the amount of money they are spending on procuring and managing software licensing, and have opted to utilize Open Source software as their alternative. Free and Open Source Software (FOSS) alternatives are available for almost all tools, utilities and capabilities. The capabilities of the various tools vary greatly and finding support and maintenance for FOSS is often more difficult than adopting the tools. FOSS definitely has a following and many of the tools are excellent and are finding increasing adoption within companies.

For example a Linux based identity management solution is available which can run on an obsolete PC for $200.00 compared to a commercial solution that can be priced at up to $15,000.00.

3.8.4 Grey Market

One subject that often comes up when looking at licensing is the topic of the grey market. For those not familiar with the term it is the purchase of software or hardware through a channel that is not authorized / approved to sell the products.

Products sold through the grey market are cheaper than products that are purchased through regular channels for several reasons. Grey Market equipment and software may not include support, may not include all the supporting media (Manuals etc.), and may be ineligible for trade-in, and upgrade programs.

Although grey market software and hardware may be the same as what is sold through other channels, companies may be shocked that when they go to look for support or warranty they are declined by the manufacturer.

Companies need to check that their providers are authorized resellers. If a deal seems to be too good to be true, it probably is.
4 Section 2 - Information Technology Fundamentals

4.1 What is a Computer?

This seems like a very basic question, but in reality a computer is made up of a complex combination of parts and pieces, often with foreign sounding names and a purpose that a typical lay person may only guess at. However, from a logical perspective, computer components perform one of 3 main and 2 supporting logical operations.

**Main Processes**

**Input**: How does data get conveyed from the outside world into the computer? (keyboard, mouse, stylus etc.)

**Processing**: How does the computer take the data that it is passed and deal with it? (CPU, memory)

**Output**: How does the data get conveyed out for users to consume and use? (printers, monitors, etc.)

**Supporting Processes**

**Communication**: How do computers talk to each other (modems, network cards, wireless, etc.)

**Storage**: How does the data get stored either for immediate use or future reference? (disk drives, RAM, USB flash drives, etc.)

The classification of particular components into one of the categories is not a perfect science as some components can perform multiple operations (e.g. a CD burner can arguably be an input device, a storage device and with a mental stretch a communications method). It isn’t important that the classification is not perfect, but understanding the logical operations is a fundamental.

Computers come in a wide variety of shapes, sizes and capabilities, but fortunately there is a convenient analogy that can be used to understand how all the main parts connect and function.
A big old wooden desk is a lot like a computer. The desktop is like RAM (Random Access Memory) and that is the working area. The larger the desk means more RAM which allows the user to work on things simultaneously. If the desk is not big enough there is a need to put things into drawers before pulling out new files to work with (temporarily swapping to disk). If there is not enough RAM, the user must swap a lot and the computer runs slow. Because RAM gets wiped clean when the power goes out it is called Volatile Storage.

The drawers of the desk are the permanent storage (Hard Drives). The bigger the drawers the more space the user will have to put files they are not currently using. Because Hard Drives, CD-ROM’s and thumb drives all maintain their data even when no power is present so they are called Non-Volatile storage.

The person working at the desk is the main processor (The CPU – Central Processing Unit) and can work at different speeds (Processor speed). The worker may be able to do anywhere from a few to a lot of computations concurrently in their head, this is the class of processor (Pentium, Celeron, Duo Core, Quad Core, Xeon etc.).

How quickly the user can pull stuff out of drawers and onto the desktop and then onto the worker and then back again into storage is the bus speed of the computer. The faster the bus speed the faster the computer can perform certain operations.

The fax machine sitting on the desk allows one desk to be connected to another one and to send data from one desk to another (Networking).

This is obviously a very simplified model of a computer, and does not deal with video cards, keyboards, monitors, flash memory etc. but it does get the main point across.

4.1.1 Laws that govern computing power and pricing

Most people can relate to purchasing a computer, only to discover that 6 months later the model just purchased has been replaced by a faster, cheaper model. This phenomenon is real and this rapid progression in changing technology is governed by three well documented principles:

Moore’s Law: Computing power doubles every 18 months

Gilder’s Law: Double the bandwidth capacity for the same price every 18 months

Kryder’s Law: Data and information storage is doubling every 18 months

These principles have proven true for the last 40 years. By knowing about these three principles it is possible to improve some of the business decision making processes.

1) Don’t buy technology to sit on the shelf since it depreciates rapidly.
2) Technology purchases cannot future-proof an organization. All technology has a fixed shelf life and is constantly evolving.

A car that is 20 years old, but with very low mileage is still a serviceable car (arguably). However a computer that is 20 years old is nothing more than a paperweight.

IT investments are ongoing for an organization, and standards are constantly changing and evolving. Companies need to ensure that they have factored this into their planning and considerations.

### 4.2 Networking and communications

Computers often do not do work in isolation. Computers need to exchange data between each other and other peripheral devices.

Here are a few definitions that are important to understand:

**NIC:** Network Interface Card: This is the device inside the computer that allows computers to connect to a network.

**Topology:** The geometric arrangement of devices on the network.

There are three basic topologies: bus, ring, and star. Most networks are a combination of these arrangements.

In a bus topology all of the devices are connected to a central cable or backbone.
In a ring topology the devices are connected in a closed loop so that each device is connected to two others, one on either side. This kind of topology is robust; that is, one device’s failure will probably not cause total network failure.

In a star topology the devices are all connected to a central hub, which forwards data towards its final destination. If the data's destination is within the local star segment, the hub will forward data directly to the destination device; if the data's destination is outside the local star segment, the hub forwards the data to a device which forwards the data.

**Protocols:** The language, rules and encoding used for sending data.

**Bandwidth:** The bandwidth refers to the capacity of the network to move data. Bandwidth is measured in MegaBytes per second or Giga-Bytes per second. The higher the bandwidth, the higher the price. Bandwidth can either be dedicated or shared. Shared bandwidth is cheaper but the speed varies greatly depending upon the time of day. Companies that buy dedicated bandwidth get fixed service, but are paying for unused capacity.

**Media:** How devices are connected by twisted-pair wire, coaxial cables, or fiber optic cables. There are two main classes of media in use: *Wired* (where devices are physically connected by wires) and *Wireless* (where devices communicate wirelessly) In a *Mixed* network both wireless and hardwired are deployed. From a practical point of view companies need to weigh the various pros and cons of both types of services.

**Wired Networks**

In a wired network computers are connected to the physical backbone by a wire running from a hub, router or switch. The cables that are most commonly used are rated based upon the bandwidth they can effectively carry. Category 3, 5, 6e are the typical designations that can be found. The type of cabling matters as higher demand applications and services require higher quality connections. More than a few companies have been surprised that their networks will require a very expensive upgrade to cabling to deploy new services. It is recommended that companies that are embarking on a wiring project put in the highest quality cable they can, anticipating that sometime they will need the capability.
Wired networks are quite secure, due to their physical nature - no one can use the network connectivity or monitor a company’s traffic unless they are also physically connected. Firewalls prevent intruders accessing the organization's network. Wireless networks can be made secure, but devices have to be configured to protect the network.

<table>
<thead>
<tr>
<th><strong>PROS</strong></th>
<th><strong>CONS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Faster speeds than wireless</td>
<td>Not as flexible as wireless. Users are tethered by the wires.</td>
</tr>
<tr>
<td>Physically More Secure than wireless</td>
<td>Expensive to upgrade wiring</td>
</tr>
<tr>
<td>Can support more users</td>
<td></td>
</tr>
</tbody>
</table>

**Wireless**

In a wireless network, computers utilize a wireless network card in the computer to connect to a wireless access point on the network. The access point is connected via wires into the rest of the network.

Because wireless networks can be accessed into by anyone who can get within reach of the wireless signal, security is critical. Typically for a corporation a wireless security plan deploys several layers of protection.

- Step 1 - Not broadcasting the wireless network name (SSID)
- Step 2 - Enabling Encryption (with a passphrase or token)
- Step 3 - Deploying an authentication server that has a unique account name and password for each user

Even with all these different layers it is possible that a determined person could still potentially gain access, but the company would thwart all but the most determined.

<table>
<thead>
<tr>
<th><strong>PROS</strong></th>
<th><strong>CONS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>More flexible than wired</td>
<td>Lower bandwidth</td>
</tr>
<tr>
<td>Faster rollout than wireless</td>
<td>Less secure than Wired Networks</td>
</tr>
</tbody>
</table>

Regardless of what medium computers use to connect to the network inside the network are a number of different devices that facilitate communications between computers. In some cases several functions are bundled into a single device that can perform numerous capabilities.
**Routers, Bridges, Switches and Hubs:** These devices all allow computers to talk to each other. The bandwidth of these devices dictates the speed that the overall network will run.

**Routers:** Routers are devices that connect one network to another. Routers may also change from one media to another. Some routers also enable VPN functionality (Explained later)

**Bridge:** A bridge extends a single physical LAN, often using a different medium across the bridge then the rest of the LAN. For example a wireless bridge can be setup between two buildings where inside the buildings wired LANS are in use.

**Hubs:** A hub has multiple ports and takes data in from one port and rebroadcasts it out on all the other ports.

**Switches:** A switch is a smart hub. A switch keeps track of what computers are on which ports, and only sends data out on the port where it should go, not out on every port.

Networks often contain switches and hubs working in concert.

**Firewalls:** These devices are designed to shield a network from different types of intrusion and security threats.

### 4.2.1 Network reach

Different types of networks have a different reach. The following diagram outlines the different types of networks and their respective reaches.
**PAN:** Personal Area Network - Anyone who has seen a Bluetooth headset connected to a cell phone has seen a Personal Area Network in action. There are a number of different technologies that can be used for PAN (USB, Firewire, Bluetooth, RS-232). These networks are used for personal communications, typically between a peripheral device and a computer such as a printer and a computer, headset and a phone. A PAN’s reach can be measured in feet (typically under 20 feet).

**LAN:** Local Area Network - is a high-speed communications system designed to link computers and other data processing devices together within a small geographic area, such as a workgroup, department, or building. This allows users to electronically share vital computing resources, such as hardware (e.g. printers and CD-ROM drives), application programs, and data. LANs vary greatly in size, with the smallest being two computers on a single desk up to several hundred computers within a building or two. At the edge of each LAN is typically a switch and/or router and/or firewall that all traffic entering and leaving the LAN is directed through.

A LAN may have multiple PANs enclosed within it.

If several LANs are connected together then they are combined into a WAN or a MAN.

**WAN:** Wide Area Network – A wide area network is a connection of several different LANs. A Wide Area Network can connect thousands of computers. Different WANs have different capabilities and features. Bell Canada’s Sympatico Service runs on the Bell Canada WAN.

A WAN has advantages over a public network like the Internet by having increased reliability, performance and security. However maintaining a WAN, especially on leased lines, can be very expensive and prices rise as the distance between the offices increases.

**MAN:** Metropolitan Area Network - If a WAN is found within a single metropolitan area it is a MAN. Hydro One deploys a MAN in Toronto that they use for monitoring all of their equipment. Hydro also sells some of their un-used bandwidth to other commercial users.
### 4.3 Databases

A database is an application that allows for the structured storage, retrieval and processing of data. Databases come in many shapes and sized and capabilities and they underpin most business applications and processes.

Databases provide more than a means to simply store and manage data, DataBase Management Systems (DBMS) tools provide all the necessary capabilities to manage security, data encryption, multi user system access, and processing of queries and transactions.

The most common type of database in use is called a Relational Database Management System (RDBMS). There are many different RDBMS offerings on the market today each targeted to a specific application or niche. A few examples include: SQL Server, MS-Access, Oracle, Lotus Approach.

Besides relational databases are also hierarchical and object oriented databases. Hierarchical databases are used in older systems and object oriented databases are used for specific niche uses.

This manual will be looking at relational databases only. Most of the concepts from relational databases can be applied to the other models as well.

Databases are made up of four major connected elements, Reports, Forms, Queries and Tables.
Tables are where data is stored. Each table consists of rows and columns, and data tables are often thought of as spreadsheet worksheets because they are setup in a similar looking fashion.

<table>
<thead>
<tr>
<th>Row</th>
<th>Last Name</th>
<th>First Name</th>
<th>Phone Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Brown</td>
<td>Michelle</td>
<td>(905) 563-2245</td>
</tr>
<tr>
<td>2</td>
<td>Brown</td>
<td>Tony</td>
<td>(905) 563-2245</td>
</tr>
<tr>
<td>3</td>
<td>Carmen</td>
<td>Brenda</td>
<td>(416) 345-2307</td>
</tr>
<tr>
<td>4</td>
<td>Douglas</td>
<td>Penny</td>
<td>(519) 823-4600</td>
</tr>
</tbody>
</table>

Data contained in one row is known as a **record**. Each record contains one or more **fields**, and each field in the database has its type. For example, the INTEGER (or INT) field type is used to store numeric values, while the VARCHAR field type is suited for managing text strings and the DATE field type stores dates. The BINARY or BLOB data types are designed for storing data such as images which need to be treated differently than other data because of their large size.

Many people ask the obvious question – if a database is so much like a spreadsheet, why not just use a spreadsheet? Databases are actually much more powerful than spreadsheets in the way that the user is able to manipulate data. Here are just a few of the actions that are performed on a database that would be difficult if not impossible to perform on a spreadsheet:

- Retrieve all records that match certain criteria
- Update records in bulk
- Support for transactions (Defined below)
- Cross-reference records in different tables
- Perform complex aggregate calculations
- Allow for multiple users to simultaneously access and update records in a controlled manner.

In a Database there are typically many tables which are created. One table is created for every logical entity and one for every action that happens. Tables are named after the data that is found in them. Some names for tables are things like:

- **Employees**: Contains generic information on every employee (Hire Date, Current Contact Information, Social Security # etc.)
- **Employee Payroll**: Contains information on every payroll transaction with an employee
- **Employee Salary History**: Information on an employee’s salary history. What dates did they change from one salary grade to another?
Records in one table are related to records in another table through relationships that are defined and stored in the database. Every record can be looked up through the keys that make rows unique. For example the Employees table would typically contain an Employee # which would appear in other tables like Employee Payroll. The use of the same employee # in both places would link the records in the two tables together.

Queries are used to extract, view, and manipulate data. Queries are the tools used to sort, filter, update and analyze the data in the database. Queries can be developed in a variety of tools, but an industry standard is SQL - Structured Query Language. There are two general types of queries that are built / developed.

DDL – Data Definition Language: These are queries that make changes to the structure of the database. DDL queries add columns (but not rows) to tables, add / drop tables, queries and views. When a user adds a new table named Employee Vacation Tracking this is done with a DDL query.

DQL – Data Query Language (Also called Data Manipulation Language): These are queries that CRUD (Create, Retrieve, Update, Delete) data out of the database. When a user adds a new record of an employee taking a vacation they can do this with DQL.

One very important thing to be aware of with queries is the powerful concept of transactions. The user can take updates, inserts, deletes from a group of tables and wrap them into a single transaction. For example when a person is paying for something with their interact account it is important that all the steps are wrapped into a single transaction in case something goes wrong.

Example: A single transaction could look like:

BEGIN TRANSACTION
Lookup account balance to see if there is enough money
Update purchaser’s account with a debit
Update retailers account with a credit
Issue a record for loyalty points
COMMIT TRANSACTION

Transactions follow something called the ACID rule. The ACID rule is one of the most fundamental concepts of database theory. ACID dictates four rules that every transaction must achieve to be valid: Atomicity, Consistency, Isolation and Durability. A failure of any one of these four rules makes a transaction invalid.

The following is an explanation of these fundamentals.

Atomicity: Means that all database changes within a transaction must follow an “all or nothing” rule. Each transaction is said to be “atomic.” If one part of a transaction fails, the entire transaction fails. It is critical that the DBMS maintain the atomic nature of all transactions in spite of any DBMS, operating system or hardware failure.
**Consistency**: Means that only valid data will be written into the database. If a transaction is executed that violates the database’s consistency rules, the whole transaction will be rolled back and the database will be restored to a state consistent with those rules. But, if a transaction successfully completes, it will take the database from one state that is consistent with the rules to another state that is also consistent with the rules.

**Isolation**: Means that if multiple transactions occur at the same time they do not impact each other’s execution.

Example, if Theo and Percy both issue different transactions against a database at the same time, both transactions must operate on the database in an isolated manner. The database either performs Theo’s entire transaction before executing Percy’s or vice-versa. This prevents Theo’s transaction from referencing intermediate data produced as a side effect of part of Percy’s transaction that will not eventually be committed to the database.

*The isolation property does not ensure which transaction will execute first, only that they will not interfere with each other.*

**Durability**: Means that any transaction that is committed to the database will not be lost. Durability is ensured through the use of database backups and transaction logs that allow for restoring all committed transactions if a failure of hardware or software occurs.

**Forms**: Allow the user to CRUD (Create, Retrieve, Update, Delete) the data in a table. Think of forms as the window into the database: Forms do not store data, they provide a way to view and access it. Forms are the means that allow the user to turn a collection of tables into an application where users interact with data through a friendly interface.
Reports are used to produce output from the tables in the database. If there is a database table containing employee information, the user can create a report that prints out a phone list for distribution. Reports can be driven either directly from tables or connect to queries.

4.3.1 Databases and data modeling
Relational Databases have been around for years and there are well documented accepted standards and best practices for creating data models regardless of the tool. The rules centre around something called data normalization. Data normalization strives to remove duplicity and ambiguity out of data sets. There are five progressive levels of normalization, but most databases do not strive to implement anything beyond 3rd Normal Form (the 5NF is not described below because it is generally not used).

Data normalization is only a guideline. Often the rules are bent to meet some practical business need. Having a good data modeler helps to recognize when these rules need to be broken.

Here is an example of a non-normalized table:

<table>
<thead>
<tr>
<th>Student #</th>
<th>Name</th>
<th>Sex</th>
<th>Grade</th>
<th>Course</th>
<th># of students</th>
<th>Teacher</th>
<th>Teacher Phone</th>
</tr>
</thead>
<tbody>
<tr>
<td>110106</td>
<td>R. Sabina</td>
<td>F</td>
<td>10</td>
<td>MBUS101</td>
<td>12</td>
<td>R. Kelly</td>
<td>(905) 875-5543</td>
</tr>
<tr>
<td>110106</td>
<td>R. Sabina</td>
<td>F</td>
<td>10</td>
<td>MCOM101</td>
<td>14</td>
<td>J. Johns</td>
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</tr>
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<td>(905) 875-5545</td>
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<tr>
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<td>MMAT112</td>
<td>13</td>
<td>M. Weins</td>
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<td>6</td>
<td>R. Kelly</td>
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</tr>
<tr>
<td>109737</td>
<td>U. Long</td>
<td>M</td>
<td>10</td>
<td>MBUS101</td>
<td>12</td>
<td>R. Kelly</td>
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</tr>
<tr>
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<td>(905) 875-5545</td>
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<tr>
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<td>13</td>
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<td>(905) 875-5511</td>
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<td>10</td>
<td>MGE0132</td>
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<td>R. Kelly</td>
<td>(905) 875-5543</td>
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<tr>
<td>110976</td>
<td>C. Pherson</td>
<td>F</td>
<td>10</td>
<td>MMUS111</td>
<td>22</td>
<td>B. Tern</td>
<td>(905) 875-5545</td>
</tr>
<tr>
<td>110976</td>
<td>C. Pherson</td>
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<td>10</td>
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<tr>
<td>110976</td>
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<td>10</td>
<td>MGE0132</td>
<td>6</td>
<td>R. Kelly</td>
<td>(905) 875-5543</td>
</tr>
</tbody>
</table>

A quick examination of this table shows several problems:
- There is a mix of student and teacher information in the single table.
- There is repeating data (eg. Teacher Phone # appears multiple times)
- If everyone drops out of particular class then there is no way to know what the teachers phone number is.
• If there are two teachers with the same name how do you represent it in the database?

To fix these problems the following data model would be created which splits the data up into multiple tables, creates relationships between the tables, and introduces new keys for representing teachers.

### Student Info

<table>
<thead>
<tr>
<th>Student #</th>
<th>Name</th>
<th>Sex</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>110108</td>
<td>R. Sabina</td>
<td>F</td>
<td>10</td>
</tr>
<tr>
<td>109787</td>
<td>U. Long</td>
<td>M</td>
<td>10</td>
</tr>
<tr>
<td>110976</td>
<td>C. Pherson</td>
<td>F</td>
<td>10</td>
</tr>
</tbody>
</table>

### Course Info

<table>
<thead>
<tr>
<th>Course</th>
<th>Teacher ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>MBUS101</td>
<td>1</td>
</tr>
<tr>
<td>MCOM101</td>
<td>2</td>
</tr>
<tr>
<td>MMUS111</td>
<td>3</td>
</tr>
<tr>
<td>MMAT112</td>
<td>4</td>
</tr>
<tr>
<td>MGEC132</td>
<td>1</td>
</tr>
</tbody>
</table>

### Student Course Info

<table>
<thead>
<tr>
<th>Student #</th>
<th>Course Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>110108</td>
<td>MBUS101</td>
</tr>
<tr>
<td>110106</td>
<td>MCOM101</td>
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<tr>
<td>110108</td>
<td>MMUS111</td>
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<tr>
<td>110108</td>
<td>MMAT112</td>
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<tr>
<td>110976</td>
<td>MGEC132</td>
</tr>
<tr>
<td>109787</td>
<td>MBUS101</td>
</tr>
<tr>
<td>109787</td>
<td>MCOM101</td>
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<tr>
<td>109787</td>
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<td>MMAT112</td>
</tr>
<tr>
<td>110976</td>
<td>MGEC132</td>
</tr>
</tbody>
</table>

### Teacher Info

<table>
<thead>
<tr>
<th>Teacher #</th>
<th>Teacher Name</th>
<th>Phone</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>R. Kelly</td>
<td>(905) 876-6543</td>
</tr>
<tr>
<td>2</td>
<td>J. Johns</td>
<td>(905) 876-6576</td>
</tr>
<tr>
<td>3</td>
<td>B. Torn</td>
<td>(905) 876-6645</td>
</tr>
<tr>
<td>4</td>
<td>M. Weins</td>
<td>(905) 876-6511</td>
</tr>
</tbody>
</table>

**First Normal Form (1NF):** Provides the basic rules for an organized database:
Eliminate duplicate / redundant columns from the same table. Create separate tables for each group of related data and identify each row with a unique column or set of columns (the primary key).

This means that the original non normalized table is broken into multiple tables. (Student Info, Student Course Info, Course Info and Teacher Info)

**Second Normal Form (2NF):** First, meet all the requirements of the first normal form.
Then remove subsets of data that apply to multiple rows of a table and place them into separate tables. Create relationships between these new tables and their predecessors through the use of foreign keys.

This means that the relationships between the tables are established.

**Third normal form (3NF):** First meet all the requirements of the second normal form.
Then remove columns that are not dependent upon the primary key.
This means that the "# of students" column would be removed, as the count of students per class can be calculated from other data in the database.

**Fourth Normal Form (4NF):** Meet all the requirements of the third normal form. Then for relations remove multi-valued dependencies.

Not represented in the model.

Remember, these normalization guidelines are cumulative. For a database to be in 2NF, it must first fulfill all the criteria of a 1NF database.

Having a database that is normalized is not an indication that the data model is a good model, only that it is not a poor model. Having a data model that is poorly designed or implemented can result in significant limitations that have lasting wide ranging impacts. Rules that are built into data models are very expensive to change.

There are many cases where companies have implemented poor data models only to discover that the limitations of the model prevent them from expanding their business or responding to market conditions. Fixing these types of problems can be very expensive because not only does the model need to change, but so do the programs that rely on the model. Some of these fixes can run into the multi-million dollar price tag to correct.

It has been argued that data modeling is the most critical step in information systems design.

### 4.4 Data Warehousing

Data warehouses collect historical data from multiple different front end sources, rationalize, summarize it and catalog it in large consistent, stable, and accurate data stores which allows for all types of questions to be answered which otherwise would be difficult or expensive to do. Data warehouses are optimized to provide data to answer the same question asked multiple different ways to support the decision making process.

Data warehouses provide the following benefits to an organization:

- A data warehouse provides a single version of the truth, which reduces time spent on trying to reconcile data sources.
- Simpler and faster access to corporate data to the entire user community
- Reduction in time it takes to develop and deliver new reporting
- Forces different areas of the business to standardize around definitions, metrics and common hierarchies.
People build data warehouses for different reasons, but these are often the main reasons that are cited:

- Reports and requests for important data for ad-hoc requests require IT expertise and staff to complete.
- In many mid to large sized organizations data is stored in silos and is not consistent in how it presents this data e.g. a hospital may have different systems for pediatrics, vs. outpatient services vs. Oncology. To be able to report on patient activity would be very difficult and time consuming and a lot of energy would be spent on talking about where the data comes from instead of what the data is.
- Most of the front end systems are OLTP – On line transaction processing and are not structured to support larger queries that often go into decision support type requests. OLTP systems are good at answering what is the current status of a given account, customer, shipment, A/R record, which can be looked up in fractions of a second and only look for a particular record. Data Warehouses queries may process millions or billions of records to support a query and the query may run for many hours. If a user were to attempt to run these types of queries against a production OLTP system they would most likely adversely impact performance for everyone else trying to use the system.
- A data warehouse is concerned about how things move and change over time. Typically OLTP front end systems are only concerned about current state and a limited history. For example if a customer moves from one location to another an OLTP system typically only cares about the current address, a data warehouse would keep track of both the original and the revised address.

Data warehouses alleviate these common problems and more by creating integrated, standardized views of data from the systems that are connected to them.

Data warehouses are built upon the basic premise that information that is critical for one person (or group of people) is important to others, and of interest to still others.

Data warehouses can provide data to answer questions like:

- Do they have enough customers that meet a particular criteria to launch a particular marketing campaign?
- Is there a relationship between profitability of their customers, the sales channel they use, and the geographic location in the country where the customers are from?
- Is there a relationship between pharmacy costs and whether a patient in emergency is triaged at night or during the day?

Data warehouses can be used for both reporting and analysis. There is a significant difference between the two activities and companies require solutions that can do both.

Data warehouses used to only be built to support a small group of very highly skilled analysts and would be used to support only the strategic decision making process. Recent
improvements in processing power and tools mean that increasingly data warehouse data is being pushed to front line staff to support operational activities as well. “Which customers get routed to the best customer services agents? Who gets the last available seat on the plane” can all be answered better if employees and systems have better data.

For example, a profitability calculation can be done in the data warehouse and the results dumped down to the telephone routing system. When a very profitable customer calls in for assistance they are automatically routed into a priority queue that is handled by the best customer service agents.

The customer that has been bumped 3x in the past 6 months may get the last seat on the plane.

This shift in the use of data warehousing has been named Active or Dynamic Data warehousing by a few of the vendors. With an active data warehouse, employees who interact directly with customers and suppliers are empowered with information-based decision making at their fingertips.
A data warehouse typically looks like this:

Source Systems: Systems of record that provide data to be included in the warehouse.
ETL - Extract Transform and Load: Processes that extract and transform data to load either into or out of the warehouse.
Rollups: Aggregations and summaries of data for use in reporting and queries
Output: Where does the data from the warehouse go?

Building a data warehouse presents organizations with many challenges. Ideally companies would think about the needs and requirements for data warehousing before putting in any other systems, but invariably data warehouses get added to existing environments after the fact.

4.4.1 Data Marts vs. Data Warehousing
Since investments in data warehouses can be considerable companies often opt to create data-marts instead of a full blown data warehouse. A data mart is a department or subject specific mini-data warehouse. A data mart can be created much faster than a full integrated warehouse, but if organizations create too many data marts then the costs to
manage and maintain the data marts exceed what it would cost to create a fully functional
data warehouse.

Data Marts can be fed either directly from an existing data warehouse, or can be fed
directly from source systems. Different data marts may be stored in different locations
on different platforms using different database products.

4.4.2 Data Staging (ETL)
Getting data out of source systems and into the data warehouse in reasonable and rational
format is by far the largest effort of building a data warehouse. This activity can account
for 80% of the total effort of the total project. The issues are not so much technical as
business. Understanding how different systems represent data, settling on a common
format, and determining just who owns the data consume the time.

Data staging is typically done through a process called ETL (Extract – Transform –
Load). There are many tools available on the market today to automate this process, and
the selection of a tool that meets the needs of the organization should not be undertaken
lightly. The replacement of an ETL tool can run in the millions of dollars for even a
moderately sized organization because of the need to re-engineer and extensively test the
processes that are touched by the ETL process.

4.4.3 OLAP vs. OLTP

On-Line Analytic Processing is a term that is used to highlight the different needs of
reporting and analysis systems from the needs of transaction processing systems which
are optimized to run day-to-day business operations.

OLAP is good for answering questions like: Which of my customers have done over
$50,000 worth of business with me over the last quarter and who have also not called the
customer contact centre over that same time period?

To answer this question requires access to large amounts of data most likely from several
different sources.

On Line Transaction Procession (OLTP) systems are optimized to support the needs of
business units directly. They are great at processing single transactions quickly, and
running the business efficiently. OLTP systems are typically highly normalized, usually
in a 3NF.

OLTP is good for answering questions like: Did customer 078987 pay invoice #
01086757 on time?

OLAP is very different from OLTP because it relies on highly summarized, aggregated
data which is de-normalized to speed reporting and analysis. For example a large retailer
would probably have a summary table that contained a summary of sales by product. This summary table would be referenced by many reports and would save having to go back and recalculate the same values repeatedly.

OLAP uses very different structures for storing data than operational systems. In OLAP tools data is stored and accessed from multi-dimensional structures named cubes. Cubes allow a user to look at the same data from multiple different viewpoints to assist decision making.

OLAP makes it easy to explore data sets and find patterns. OLAP cubes are different from reports that they are interactive and dynamic and users can change or adopt the views as they see fit.

A single OLAP cube can replace dozens of traditional reports.

### 4.4.4 Reporting

A Data Warehouse or BI solution is useless unless a user can get reports and data out of it. There are three typical ways of doing this.

Option 1 – Use an OLAP tool
Option 2 – Use standard reporting. There are several subtypes of reports:

- **Static Reports:** Fixed reports with no user interaction.
- **Parameterized Reports:** Some user interaction to specify data ranges to include: Date ranges, product categories, company division etc.
- **Interactive Reports:** Allow users to change the layout, structure and content

Options 3 – Adhoc Reports – Queries that are written to support a one-off exercise.

### 4.4.5 Entity Relationship Diagrams

One principle technique that is used to create database models is something called ER – Entity Relationship modeling. An accurate ER model gives a reflection of the real world that can then be easily translated into a database.

An **entity** is a person, place, concept, or thing about which the business needs data. Ultimately in the database at least one table is created for each entity that is identified. Each entity must also have an identifier which uniquely identifies one instance of an entity. In this case the identifier is marked with an asterisk.
Attributes are details about the entity. For example the entity named STUDENT would have attributes like Student #, Student Name and Grade.

A relationship is a defined connection between two entities. The relationship tells us something about how the entities are related in the real world.

On an ER Diagram the following are the notations that are typically used:

These notations are used to represent the different types of relationships that are possible.

1:1 – One to One: For every instance in entity 1 there must be a corresponding instance in another table. For example if there was an entity named SEAT, each student would fill exactly one SEAT.

1:M – One to Many: For this instance in entity 1 there may be multiple instances in Entity 2. For example a teacher may teach many classes.

M:M – Many to Many: Many instances in entity 1 may be related to many instances in Entity 2. For example many students take many classes.
There are several different conventions for ER diagramming and often a diamond is used to represent relationships on diagrams.

A single ER diagram can contain hundreds of entities and relationships. This is a sample of an ER diagram for a simple database.

4.4.6 Resources Events and Agents Modeling

Building on the concept of ER modeling above there is a specific modeling technique named REA - Resources Events and Agents. This modeling technique was created originally for accounting systems but has found to be useful in many circumstances.

The model is made up on 3 main elements:

**Resources:** Are things that have economic value to a company, such as cash and inventory.

**Events:** are the various business processes conducted in a company’s daily operations, such as sales and purchases. There are 3 classes of events:
- operating events--what happens
- information events--what is recorded
- decision/management events--what is done as a result

Only operating events are included in the model.
**Agents:** Are the people and organizations, such as customers and salespeople, who participate in business events.

REA is a radical departure from traditional double entry systems. REA gives flexibility to include both financial and non-financial data in the system, and to quickly model changes in the business.

**Using REA can lead to more efficient operations**
- helps managers identify non-value added activities that can be eliminated
- increased productivity via elimination of non-value added activities generates excess capacity
- storing both financial and nonfinancial data in the same central database reduces multiple data collection, data storage, and maintenance
- detailed financial and nonfinancial business data supports a wider range of management decisions
- increased competitive advantage by providing more relevant, timely, and accurate information to managers

REA can also be used for value chain analysis:
- Value chain analysis distinguishes between primary activities (create value) and support activities (assist performing primary activities).
- REA provides a model for identifying and differentiating between these activities.
- REA provides a means for setting a prioritizing strategy by focusing on primary activities and eliminating or outsourcing support activities.

REA’s power comes from using the same pattern for modeling many different types of events, using two rules:

Each economic event should be linked to at least one economic resource and two economic agents.
The relationship shown between the two economic events is referred to as an economic duality relationship. The causal relationship occurs as a result of a give and a take happening

The following table outlines the common economic duality relationships which exist within an organization.

<table>
<thead>
<tr>
<th>Cycle</th>
<th>Economic Event 1</th>
<th>Economic Event 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue</td>
<td>Sale</td>
<td>Cash Receipt</td>
</tr>
<tr>
<td>Expenditure Cycle</td>
<td>Purchase</td>
<td>Cash Disbursement</td>
</tr>
<tr>
<td>HR / Payroll</td>
<td>Labour Acquisition</td>
<td>Cash Disbursement</td>
</tr>
<tr>
<td>Financing Cycle</td>
<td>Cash Receipt</td>
<td>Cash Disbursement</td>
</tr>
<tr>
<td>Conversion Cycle</td>
<td>Finished Goods</td>
<td>Labour Operation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Machine Operation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Material Issuance</td>
</tr>
</tbody>
</table>
The following is the standard REA model:

This same basic template is repeated for each type of transaction that is being modeled. This is the Expenditure cycle modeled.
4.4.7 Data Governance and Metadata

The term Metadata literally means information about data. Metadata specifies how a company is going to store and interpret data. Metadata also specifies how data rolls up to become the metrics and KPI’s that organizations use to drive everyday business decisions. It is critical that the way that these items are calculated is consistent throughout an organization or wrong decisions are likely. The Metadata for an organization is often stored in a central location or central dictionary for all to use and reference.

Companies do need to make an effort to define how they are going to store, manage and interpret data, or they will create confusion within the organization. This is a fairly broad statement, but a few examples can help to illustrate this point.

When the marketing department of a large shipping company was asked for a list of customers that were eligible for a particular marketing campaign, one analyst came back with a list of 21,000 customers, and a second analyst came back with a list of only 16,000 customers. The difference was one analyst included fuel and insurance surcharges in their definition of revenue, and the other one did not.

Because in this case there was no central repository of definitions for all the business to use things were left open to interpretations. This is an example of poor data governance. Now instead of talking about the marketing campaign people have to spend a lot of time questioning the business rules that are used to create the report.

In another example for one system addresses were defined as a single memo field, but in another system at the same company all the elements were broken up into separate fields. (As pictured below)

Without a herculean effort it is impossible to have data feed from System A to System B to share data, and analytics are hampered. Even if the systems has the same number of
fields if the lengths of the data fields do not match or if the validation rules that are used to check the data are not the same then the same problems can occur.

A company may think it does not matter if the call centre data is not structured the same way as the billing system. However, if the company cannot link data within systems there are many business questions they cannot answer and in turn run the risk that there may be more than one version of the truth.

Using the example above, call centre and billing systems, if a company has two sets of contact information for a customer which one is correct and how do they keep them in synch? Having consistent data modeling and metadata allows the company to automate feeds between systems to keep them in synch.

Without looking too hard, documented cases can be found where within an organization each department set their own standards around storing and managing data. This manifests itself every time a customer calls in to change their address and it can take 48 hours to come into effect, and also requires that multiple different departments manually update their systems based on emails that were sent out from the call centres, or central address management.

These manual processes could have all been eliminated if there was good data governance up front when the systems were being developed.

Mature organizations almost always have a data governance committee that is responsible for managing and directing the process of creating and managing metadata. This is not just an IT problem as the business needs to be heavily involved in providing the business definitions for the items that are in use.

### 4.5 What is Systems Development Life Cycle (SDLC)?

An end-to-end set of processes encompassing the activities, roles, and artifacts required to develop information systems, and which cover investigation, analysis, design, construction, testing, and implementation, and transfer to maintenance. The SDLC outlines how software is designed, built and deployed. There are multiple different versions and approaches to the SDLC that are in use today.

A company may opt to use a single SDLC for every project that they run, or may deploy a different SDLC process for different types of projects they deploy.

Many professional service focused organizations have created a proprietary SDLC which is part of their overall value offering. (e.g. Accenture and Teradata have both developed SDLC’s for delivering data warehousing / Business Intelligence projects).
SDLC’s can be range from very complex and formal with many steps, formal checkpoints and extensive templates, to very simple with only a few major milestones and control mechanisms that are deployed.

It is important to understand that the SDLC is intended to support and direct the project activity, but every SDLC imposes an overhead to a project that needs to be factored into the costing of the project.

Regardless of the type of SDLC the main components of each one include:

- **Collecting Requirements**: What is it that the user wants/needs?
- **Design**: How to take the requirements and turn them into a technical blueprint
- **Code / Build**: Actually building the code
- **Testing**: Exercising the code to make sure it both functions and meets the user needs
- **Deploying**: Putting the code into production for end users to be able to use.

Different SDLC’s support various approaches to developing software.

**Waterfall Approach**: This is the traditional approach to software engineering and development. In this model formal times are set aside for planning, detailed design, coding, testing and releasing into software. The goal of this approach is to get all activities for a stage completed at one time (e.g. do all the planning before getting into designs, complete and sign off all designs before beginning coding). In this model once a stage is completed typically it is not revisited.

This is a very controlled method to software development, but takes longer before the business sees anything running in production.
RAD: Rapid application Development
In a RAD environment the focus is on getting something in front of the business users as quickly as possible in order to get their feedback and input. After a short design cycle, developers build screens and reports without all the background plumbing business rules, which then gets reviewed with the users to see if what is being developed is on the right track. The developer and user interact back and forth discussing what works, what does not and the developer discards what does not work, and enhances what does. Once the users are happy with the layout of the screens, reports etc., all the background business rules and processing steps are added.

Evolutionary Prototyping and Delivery This is the most current approach to software development and is often called flexible or agile programming.

Agile focuses on doing things in very small increments and with minimal planning, but with each iteration a full functionality set is released. This allows the project to adapt new changes and new features very quickly. Agile emphasizes the business and IT working together collaboratively on each iteration.
Different software engineering approaches require different development and management skills and capabilities. It is important when embarking on a project to ensure that all team members are trained and skilled in the type of engineering that will be employed.

4.6 Tools during the SDLC

During the execution of a typical project a number of different tools are used to capture, document and represent the business and the project. Having a basic understanding of the mechanics and purpose of these tools is necessary to be able to ask analysis based questions. Here are some of the most common tools that are in place.

Purists out there may point out that many of the examples in the next section do not follow all the standard conventions. The intention of this section of the document is ONLY to allow users to recognize the different types of tools, and where / when they can be used, not to push one particular modeling standard or another.

GANTT Chart: A GANTT chart is a visual representation of the tasks, dependencies, milestones and key dates that go into a project and the relationship between them. These tools are often used to convey a large amount of information via a relatively simply visual representation.

GANTT charts are typically created and maintained by the project managers on the project.

These charts can be generated from a variety of different tools, (Excel, MS-Project etc.)

In this first sample generated out of Excel, the vertical line through all tasks represents the current date. The bar shading shows the current progress on that task. If this project was running to plan everything to the left of the current dateline would be shaded, but they are not so this project is running behind plan already and it is only in the requirements phase. This could be a warning flag that bigger problems are to come.
Tasks 23-32 all roll-up into task #22. Tasks 46, 60, 71, 82 all have tasks that rollup into these tasks as well. (Not shown)

GANTT Charts can provide different information on the left hand side and often what exactly is being represented may need some explanation as it may not be immediately obvious what is being represented, and in some cases the math for the summary task is not a straight rollup from all the dependant tasks. Here are a few definitions from this particular example:

Working Days: Number of possible work days between the start date and end date. (Accounting for holidays and weekends)
Effort Days: How much effort is required to complete the different tasks?
Slack Days: The difference between working days and effort days
Elapsed Days: Difference between the current date and the task start date
Days Complete: Number of actual effort days that have been finished to date

In this second example, (generated out of MS-Project) the tool includes arrows that show the dependencies between the tasks. But this version lacks the dateline.

**MS-Project is a specialized tool for generating reporting, analytics and management of project and resource plans.**

**System Maps, Process Maps, Data Flow Maps:** These maps or diagrams are a visual representation of how people and systems interact to complete a particular business process. These maps show how data flows through processes, not through hardware. Typical maps show – People, Processes and Data Stores.

There are many different standards in use for these types of diagrams. Often two versions of these diagrams are created. An AS-IS version of the diagram shows how processes work today, and a TO-BE version of the diagram shows how the process will work in the future.

**Level 0 – High Level or Business Context Maps:** This shows the system and its links to the outside world with no data stores, or process details. This level of map really just
shows a 10,000 foot view of where this system or process fits in the global enterprise and its external connections to the world.

**Level 1 - Process Identification Map:** At a level 1 map the high level processes and specifics of the inputs / outputs are identified. This level is intended to facilitate discussions around modifications of business process and requirements.

**Level 2 – Process Details Map:** A Process Details Map is created for every sub-process identified in the Level 1 Map. This is a very detailed view of how a particular process works. This level of map includes initializing files, archiving, indexing etc.
**RACI:** Another common tool that is often used is a RACI chart. A RACI chart shows the expectation of how different people’s responsibilities line up against different tasks.

**R** – Responsible: This is the person(s) who are responsible for doing the work to complete the task. There can be multiple people responsible who are responsible for a given task.

**A** – Accountable: This is the single person who is ultimately responsible for the task getting completed. They are the one who gets the phone call if something is not done!

**C** – Consulted: These are the people who are involved in decisions around the task, and have an opinion, but don’t carry out the work.

**I** – Informed: These are the people who are simply notified that a task is completed.

RACI charts are used in a variety of different ways. For projects they can be used to delineate who is accountable for particular deliverables which is especially useful when multiple different companies are involved. For post projects they can be used to delineate who is responsible for which particular maintenance tasks. For circumstances where there is either business or process re-engineering AS-IS and TO-BE RACI charts can show how responsibilities are shifting around.

<table>
<thead>
<tr>
<th>ROLE &amp; RESPONSIBILITIES</th>
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<tbody>
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<td></td>
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<table>
<thead>
<tr>
<th>TASK</th>
<th>Operations</th>
<th>Tech Integration</th>
<th>Development Team</th>
<th>Project Office</th>
<th>Governance</th>
<th>Compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify business need for reporting</td>
<td>R</td>
<td>C</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>A</td>
</tr>
<tr>
<td>Prioritize reporting requests</td>
<td>R</td>
<td>C</td>
<td>R</td>
<td>I</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Document high level business requirements ensuring accuracy and clarity</td>
<td>R</td>
<td>C</td>
<td>R</td>
<td>I</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Submit request for new report / change to current report</td>
<td>R</td>
<td>C</td>
<td>R</td>
<td>C</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Contact point for reporting issues/scope changes from business</td>
<td>A</td>
<td>R</td>
<td>R</td>
<td>N/A</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Resolve outstanding issues/scope changes from business</td>
<td>C</td>
<td>C</td>
<td>A</td>
<td>I</td>
<td>I</td>
<td></td>
</tr>
<tr>
<td>Design report, translating high level business requirements into technical requirements (including any Siebel formularies etc.)</td>
<td>R</td>
<td>I</td>
<td>A</td>
<td>I</td>
<td>I</td>
<td></td>
</tr>
</tbody>
</table>

**Project Logs:** When a project gets underway there are a lot of things that need to be tracked. Typically project logs are created to keep track of Issues, Action Items, Change Requests, Current Assumptions, Financials and Risks. These logs are usually created and maintained by project managers.
Swim Lanes: A swim lane diagram is a variation on process mappings that also add the twist of showing whom is responsible for executing on a particular aspect of a process. These diagrams are helpful for business and process re-engineering exercises. Business Analysts are the typical authors of Swim Lane Diagrams.

4.6.1 Post-implementation review
A frequently overlooked but necessary step in the systems development life cycle is the *post-implementation review*, also known as *post-implementation audit*. Two general areas are reviewed at this point. The performance of the new system is evaluated in terms of objectives that were stated in the feasibility and analysis phases, and the systems development life cycle is reviewed. The budgets and schedules that were developed in the feasibility and analysis phases can be used to evaluate the performance of the systems development team.

Actual error rates and processing times can be compared with the rates in the design specifications of the system. Failure of the system to achieve the design specifications might mean that the expected benefits from the new system might never be realized. It also may mean that the system is not being operated according to specifications. User complaints can be assessed at this point as well.
Another aspect of evaluating the performance of the new system involves comparing the actual operating costs of the new system with the estimated costs. Significant deviations from the estimated costs will lower the cost-benefit ratios of the new system.

The post-implementation review is conducted once the system is stable and is being used as intended. To ensure independence, this audit should be carried out by an analyst or team not involved in the original systems project. Internal auditors are frequently involved in the post-implementation review of a large system, yet outside people are sometimes brought in to conduct the audit. Their lack of personal connections, their varied experience, and their different view of the organization all contribute to a more objective review.

The review will consider a number of areas:

- The adequacy of the systems documentation regarding manual procedures and computer programmes.
- The training of personnel involved in the use of the new system.
- The reliability of the systems output.
- A comparison of the actual costs incurred during implementation against the estimated costs, and significant variances investigated.
- Actual response times are compared with planned values.

The original purpose of the system project will be re-visited. The post-implementation audit yields an assessment report of the system, including suggestions for improvement. These suggestions may be minor and can be accommodated within the ongoing development of the project. If they are major, they will be shelved until a major overhaul or replacement of the system is due. Unless, of course, they are so severe that continued operation of the system would be detrimental to the organization.

4.7 Internet Search and Information

The collection, organization and sharing of information has now all changed with the explosive growth of the internet. Many forms of information and data that used to be either inaccessible or costly to obtain are now available for free.

As a result of this phenomenon the economics of information is now changing, and a company’s ability to respond to more frequent and more detailed information is very important.

The following are some of the shifts enabled by use of computing systems and the internet.

Information Latency: This is the amount of time it takes between when an event occurs and when information about the event is available. With the use of the internet information latency is essentially eliminated. 15 years ago, before the wide adoption of
the world wide web and digital cameras to get a picture of a newborn baby from around the world could take weeks from the time the picture was taken, developed and mailed. In today’s world this process takes seconds.

**Information Richness:** As bandwidth is faster, cheaper and readily available the content of information itself can become richer. What used to be a simple text only communication can now contain complex graphics, audio and movie clips. This allows more information to be conveyed and opens up new applications and business models that would not be available otherwise.

**Information Currency:** Information is only useful so long as it is current, with the explosion of the internet information and knowledge is continuously being replaced with newer more up to date information. Having the internet as a research tool allows for access to the latest and greatest information to contribute to decision making.

**Information Asymmetry:** This is a term taken from economic theory, where one party in a transaction is privy to better or more complete information and therefore has better information than the other party. With open access to the internet as a search tool information asymmetry can be partially overcome. People can independently research a product, service or a company they are looking to make an economic investment in. In theory this leads to better decision making, and overall lower costs as buyers can bargain shop and compare products.

**Information Reach:** Information reach is defined as how many people can be reached with a particular communications campaign.

With business before the internet there was a trade off between Information Richness and Information Reach. With the use of technology both better reach and better richness are possible with only minimal costs.

A caution about electronic information, just because information is on the internet does not make it complete, accurate or unbiased. Due diligence and second opinions are always good practice to follow.

Two recent examples affecting Airlines drive the point home:
A lawsuit has been filed in October 2008 between American Airlines and Yahoo because searches on Yahoo for AAdvantage (A registered American Airlines trademark term) instead direct consumers to competitors who pay Yahoo to do so.

In September 2008 stock prices plummet for United Airlines from $12.30 to $3.00 because a single newspaper in the U.S. (The South Florida Sentinel) published a story that UAL was filing for bankruptcy. The article was up for less than 24 hours and was picked up by major stock trading journals around the world. The problem was that the information was six years old. Even after a retraction stock prices did not go back up to their previous levels.
4.8 Internet Business Models

Because the internet is a global phenomenon and is continuously evolving it opens up global markets and business models that would otherwise be unsustainable. A company no longer needs to reside in the country where they are doing business. A person also does not need to be at work in order for their business to be working. The internet can enrich all the traditional business models.

Business to Business (B2B) – Connecting one commercial entity with another (e.g. Retail store ordering products from a supplier)
Business to Consumer (B2C) – A business interacting directly with a consumer (e.g. A online travel agency proving information about last minute vacations)

Consumer to Consumer (C2C) – End consumers doing business directly with each other. (e.g. An online auction)

Consumer to Business (C2B) – A consumer driven interaction with a business (e.g. Reverse auctions like Priceline)

In order to enable internet commerce it is necessary to package and transmit data between companies. There are several different technologies that are in use to package data for transmission but the two main choices are EDI and XML.

EDI – Electronic Data Interchange - EDI is the exchange of information in a standard format between computers without any human intermediary. EDI has standard templates that are used for packaging standard business artifacts (Invoices, Orders, supply chain inquiries etc.) EDI interfaces are intended for long-term specific company-to-company connections.

EDI can run on proprietary networks called VANS – Value Added Networks which requires that companies pay additional fees to transfer information, or can run across the internet.

EDI has been around since the early 1980’s, and is primarily used by large established organizations.

XML – eXtensible Markup Language is both a scripting language and a file format. XML was designed to represent and display database contents. XML is a newer technology than EDI and is somewhat more flexible in the data it can represent. XML is designed with the concept of describe once and use anywhere, not point to point like EDI.

When an XML file is opened is appears in a format similar to what is shown below:

```xml
<?xml version="1.0" encoding="UTF-8" standalone="no" ?>
<!DOCTYPE BLM31603 (View Source for full doctype...)>```
4.9 Types of computing systems

In order for an information system to be successful, it is important to determine the kinds of information each person needs. To do this, one must understand that there are different levels of an organization and the decision making changes at each level. These decisions require various types of information.
• **Line-level Staff/Management:** Information systems at this level support business operations, thus staff and managers at this level make *practical Operational* decisions to ensure that specific jobs are done. Activities at this level include maintaining inventory records, preparing sales invoices, determining raw material requirements, shipping orders, and assigning workers to tasks.

• **Middle-level Management:** Information systems at this level support *tactical* decision-making. The emphasis is on activities required to implement the strategies determined at the top-level. Activities include planning working capital, scheduling production, formulation of budgets, making short-term forecasts, and administering personnel.

• **Top-level Management:** Information systems at this level support the attainment of competitive advantage for the firm. Top managers are concerned with *strategic* decision-making. Activities at this level are future-oriented and involve a great deal of uncertainty, such as establishing goals and determining strategies to achieve the goals. These strategies may involve introducing new product lines, determining new markets, acquiring physical facilities, setting facilities policies, generating capital, and so forth.

There are many different types of computing systems in use which support different areas of need within organizations. The following simplified diagram outlines the key characteristics of the major different types of systems that users typically directly interact with.

*Transaction processing systems (TPS):* These are the systems that most people are familiar with. These are systems that process transactions to complete business units of work. (e.g. GL, A/R, Payment Processing, Contact Management etc.). The support of day-to-day business operating activities, or transactions, is usually the first and most important objective of an information system. A computer-based transaction processing
system, also called an operations information system or an electronic data processing system, is focused at the operating level of a business. The information produced by a TPS usually consists of detailed reports of daily transactions (such as a list of items sold or all the accounting transactions that have been recorded in various ledgers and registers) or future transactions (such as a list of items that need to be ordered).

A TPS generally is deployed to serve within one functional area of a business, such as marketing, accounting and finance, production, and research and development, all have their own TPS. Although the reports generated by a TPS are useful to lower-level managers, they are not helpful to middle managers, who need more summarized information with a wider perspective.

Management Information Systems (MIS): This can also be called management reporting systems. It provides middle managers with reports that summarize and categorize information derived primarily from data gathered by the various TPS in the organization. The purpose of these reports is to allow managers to spot trends and to get an overview of current activities, as well as to monitor and control operations. The goal of an MIS is to support tactical (rather than strategic) decision making.

Although the term MIS is used to refer to any type of information system for managers, it is also used to refer specifically to middle management information systems. The reports produced by a MIS can be periodic (such as income statements and balance sheets), on demand, or event initiated, and they can summarize information or report on exceptional events or conditions. Examples of reports generated by a MIS are sales region analysis, cost analysis, annual budgeting reports, capital investment analysis, and production schedules.

Decision Support Systems (DSS): These are sets of special computer programmes and hardware to produce information not regularly supplied by transaction processing or management information systems. This information is analyzed by the DSS and used for unstructured decision making at the top management level. (TPS and MIS do not analyze the information they produce – rather, they simply report.)

DSS are designed to handle the unstructured, what-if, type of decisions that traditional MIS were not designed to support. Moreover, DSS provide managers with tools to help them better model, analyze, and make decisions about the information presented.

Executive Information Systems (EIS): Sometimes referred to as an Executive Support System) the DSS are made especially for top managers and specifically support strategic decision-making. The EIS uses data from both internal and external sources (such as news services and market research databases). An EIS might allow senior executives to call up predefined reports such as sales figures in many forms, by region, by week, by fiscal year or by projected increases. The EIS includes capabilities for analyzing data and performing what-if scenarios. Such data are more geared towards strategy than tactics.
**Expert Systems (ES):** These are sets of computer programmes that perform a task at the level of a human expert. ES are created on the basis of knowledge collected on specific topics from human experts. Armed with this knowledge and coupled with an *inference engine* to do *machine* reasoning, their goal is to imitate *human* reasoning. ES have emerged from the field of *artificial intelligence*, which is the branch of computer science that attempts to create computer systems that simulate human cognition. Expert systems are used to solve specific problems, such as how to reduce production costs, improve worker productivity, or decrease environmental impact.

**Office Information Systems (OIS):** This is often referred to as *Office Automation Systems* or OAS) facilitate everyday information processing tasks in offices and business organizations. These systems include a wide range of tools, including spreadsheets, word processors, and presentation packages. When used for personal productivity purposes, OIS are typically applied when work is unstructured and the users can use the tools however they like.

### 4.10 Transaction processing in typical business and accounting applications

Transaction processing systems collect and store data about transactions and sometimes control decisions made as part of a transaction. This is accomplished via batch or real-time processing. Systems often use a combination of *both* batch and real-time processing to complete transactions, but having an understanding of both types of processing is important.

#### 4.10.1 Batch Processing

With batch processing, data for individual transactions are gathered and stored but are not entered into the system immediately. Later, either on a schedule or when a sufficient number of transactions have accumulated, the transactions are sorted and processed through the system ultimately to update the database, and generate reports.

Batch processing has these benefits:

- It allows sharing of computer resources among many users and programs
- It shifts the time of job processing to when the computing resources are less busy
- It avoids idling the computing resources with minute-by-minute human interaction and supervision
- By keeping high overall rate of utilization, it better amortizes the cost of a computer, especially an expensive one

Batch processing is typically used for applications like printing, bulk database updates, and bulk conversions of files from one format to another.
Batch processing can be compared to doing the dishes. The dishes (Data) collect on the counter until convenient to process them (wash, dry and put away) in a single efficient operation.

Unfortunately, time delays inherent in batch processing may cause significant disadvantages. The central database may never be completely current because of transactions received while the batch was being processed. Worse yet, the processing of batch transactions builds delays into the system, with transactions not completed until the next day in some cases. For example, weekend deposits into many ATM are not posted to the depositor's account until Monday. Even though the ATM's user interface is interactive, the system in a larger sense doesn't perform real-time processing due to built-in delays.

4.10.2 Real Time Processing

With real-time processing, each transaction is processed immediately. The person providing the data is typically available to help with error correction and will normally receive confirmation of transaction completion. Real-time processing requires immediate access to an online database. Thus issues of capacity and turnaround are important. Thus online transaction processing takes more planning, testing and managing than batch processing. This is especially true in electronic business, where customers/clients expect instant turnaround.

As mentioned above, compared to batch processing, real-time processing has more stringent requirements for computer response and computer availability. As is obvious when a travel agent says, “Sorry, the computer is down!” the job and work methods of the people in the real-time TPS are designed under the assumption that the system will be up and available all the time.

An ATM is a good example of a system that uses both Real Time and Batch processing to complete work. When a PIN is used in banking it is real-time processing that validates that the person entered it in correctly, and when they pay their bills this is handled via Batch Processing.

4.11 The Main Information Platforms
Organizations end up implementing numerous different systems together to create the information platform that their business runs on. The most critical, expensive and difficult to implement pieces of the information platform are also the most critical. The following sections outline basic information on these major platforms.

### 4.11.1 Supply chain management

Companies are not islands, companies fit somewhere in the supply chain between manufacturers, distributors, retailers and consumers. As such companies need to interact with each other to exchange information to place orders, inquire about inventory and make payments. IT and the internet play a key role in automating these types of interactions and improving response time and the ability to service customers. IT deployment can do the following (and more):

- End users can order direct from suppliers, cutting out the middle tier distributors (e.g. Dell computers)
- Consumers can quickly and easily feature and price shop online (Expedia, Hotels.com etc...)
- Companies can gain insights and possibly direct access to suppliers costs, inventory levels and production capabilities

Because of the relative simplicity and ease of companies being able to e-enable their business for the partners and customers, companies are able to reap some rewards in terms of decreased costs and improved capabilities, which are not available otherwise.

Because supply chain management is such a wide area SCM solutions can be further broken down by the following sub-categories:

Supply Chain Planning (SCP)
Transportation Management Systems (TMS)
Warehouse Management Systems (WMS)
Manufacturing Execution Systems (MES)

Top vendors in this market space include SAP, Oracle, and Infor. Other vendors include two best-of-breed suppliers, Manhattan Associates and i2 Technologies, both which are providers of supply chain planning and execution solutions.

Many companies that are focused on operational improvements look to capabilities like J.I.T. – Just In Time operations. In a JIT environment the focus is to remove all inventories throughout the supply chain and have production at all stages match the demand at the next. The logistics management of these types of enterprises requires that order placement, inventory management, advanced shipping notifications and production controls all be visible throughout the supply chain. When this is achieved this is called supply chain integration. The automotive industry is the most publicized example of JIT in action, but supply chain visibility examples can be found practically anywhere.
For example, checking on the shipping status of an order on a website only to find out that a particular item has been backordered is an example of supply chain visibility.

Companies also look beyond their shipping and logistics into their data stores to also do predictive analysis on the demand for goods to anticipate needs. Combining this analysis with knowledge of lead times on ordering and shipping can maximize a company’s chances of having the right items in stock, without having excessive inventory sitting on the floor. (See the section on Data Warehousing and Business Intelligence below for more information).

The sharing of information along the supply chain allows the whole chain to become more efficient. Smart companies have figured out that the supply chain is their lifeblood and if they can make their supply chains more profitable or efficient they can either retain the savings as profit or pass them on to consumers to garner more market share. To achieve this companies are looking beyond their immediate boundaries and into their partner and supplier networks to find efficiencies.

Companies need to be aware that with increased integration with their partners they may face higher switching costs, and they may be making their corporate strengths and weaknesses visible to not only their suppliers, but to other unintended parties as well.

### 4.11.2 ERP Systems

Companies typically deploy applications in a somewhat piecemeal fashion. Applications are purchased to meet the particular needs of a department at a point in time. Human Resources, Supply Chain Management, Customer Relations Management, Financials, Manufacturing functions and Warehouse Management functions all have their own applications, running with their own databases. At a point in time companies realize that there are benefits to integrating these applications onto a single platform. ERP Enterprise Resource Planning is this solution. There are many providers of ERP solutions, however the largest ERP providers in the marketplace today are SAP, Oracle and IBM.

An ERP system provides the promise of many benefits both to an IT department and to an overall organization.

For an IT department there are possible savings by moving off multiple different tools and technologies onto a single platform. This can allow for efficiencies for the staff, data conversions and improved utilization of hardware.

The biggest benefits to an organization are due to consistent, integrated data being available for use throughout the corporation. For example, customer service can see the same information as the warehouse staff, and both know in real time which orders are currently being held because customers have gone past their credit limits.
The business value from an ERP system comes not from the software, but really by changing how people do their jobs. To implement an ERP system requires that an organization change and modify their business practices to match how the ERP system requires it. ERP systems are really big exercises in organizational change management. Companies that cannot convince, persuade or cajole their employees into adapting to the system-driven processes are bound to fail.

Because ERP systems are so pervasive in an organization the implementation of them can take months, or even years to complete. According to CIO magazine the average implementation takes between 1-3 years to complete. Over the past couple of years Internet driven capabilities called software on demand or software as a service mean that implementations can be done in weeks. Typically, on-demand and SaaS ERP applications (such as finance or HR packages) are hosted by a third party, and customers access the shared ERP applications via a Web connection. The software does not need to be installed on desktops and this simplifies rollout.

A typical ERP system uses a single comprehensive database containing modules for most of the major back-office functions within a business. Most of the major ERP systems came out of a manufacturing or operations driven background so they have modules that cover these business functions very well. Typical ERP modules include:

**Manufacturing:** engineering, capacity, workflow management, quality control, bills of material, manufacturing process, etc.

**Financials:** Accounts payable, accounts receivable, fixed assets, general ledger and cash management, etc.

**Human Resources:** Benefits, training, payroll, time and attendance, etc.

**Supply Chain Management:** Inventory, supply chain planning, supplier scheduling, claim processing, order entry, purchasing, etc.

**Projects:** Costing, billing, activity management, time and expense, etc.

**Customer Relationship Management:** sales and marketing, service, commissions, customer contact, calls center support, etc.

**Data Warehouse:** Usually this is a module that can be accessed by an organization’s customers, suppliers and employees.

**Order to Cash:** Receipt of orders, invoicing, customer master file management

Most organizations will not be able to absorb being able to implement too many modules at one time. Most companies begin with financials, as they are the backbone to all the other modules, and then will roll out other modules as it organizationally makes sense.

A caution about ERP systems – Some of the most spectacular IT project failures can be traced to failed ERP implementations. There are many highly visible, well documented cases where companies have walked away from multi million dollar investments in these types of systems. Companies need to be willing to change their mentality around how they do things to fit into how the system requires it. If companies try to tailor an ERP system with too much customization it will fail!!
A second caution about ERP systems – Because ERP systems are so wide reaching in their scope of activities they cover, they don’t do everything really well. Chances are there are some areas in organizations where the existing legacy solutions do a better job than the generic ERP systems that are being installed. Companies need to be prepared for a productivity hit when the systems are initially installed in these areas.

4.11.3 Customer Relationship Management

Companies interact with customers, or they wouldn’t exist. Unfortunately in most organizations the recording of these interactions happens in department specific systems not into a single corporation wide tool. Additionally these department specific systems do not also record opportunities that could happen elsewhere within an organization.

Here is a simple example:

A customer calls the Accounts Receivable department to inquire about the specifics on a particular invoice they are not happy about and while on the phone the customer asks if their sales rep can call back later in the day to discuss an upcoming order. The Accounts Receivable clerk writes down the request on a Post-It note because there is no way in their accounting system to be able to record the request for the sales rep. Even if the sticky note makes it to the sales rep there is no way that the A/R clerk can know if the sales rep ever made the call, and there is no way for certain that the sales rep can know that the customer has an invoice they are not happy about.

The goal of a CRM – Customer Relationship Management system is to capture information on all customer transactions into a single corporate wide asset that can be reviewed, mined and leveraged to improve the interactions with customers. CRM systems give visibility to customer interactions and allow for automatic alerts and monitoring to be setup. For example, a CRM system can automatically notify a sales-rep to setup a face to face meeting once a certain threshold of calls is made to the claims or customer service departments.

CRM systems often get confused with sales force automation tools, or contact management solutions. Both contact management and sales force automation may be a part of CRM, but ultimately CRM is intended to connect with every system that may interact with a customer, from the warehouse to accounts receivable.

Major vendors providing CRM solutions today include: Siebel, SAP, Oracle, and Amdocs

CRM systems are often installed with ERP systems and can leverage the data that is within the ERP databases as a source for mining and reporting, but CRM is much larger than that. A good CRM implementation deals with people, technology and processes holistically. CRM is really about identifying processes that can be improved with better
customer data. If companies improve these processes they improve customer loyalty which should translate into improved sales.

4.11.4 Business intelligence

Business Intelligence solutions are built on top of the rest of the information platform to provide consolidated, reconciled information typically for management consumption. Business Intelligence is a subject often very closely tied with data warehousing (explained in detail later). Business Intelligence is focused on the exploitation of data for the benefit of business (reporting, decision support and analysis). Business Intelligence is an evolutionary activity that parallels the maturity of the organization it is supporting.

Many business intelligence tools have grown out of earlier tools that were used to build executive information systems.

When companies are first getting into BI they focus on **Query and Reporting** with a focus on improving reporting for management. Companies often realize that they can do more with their data and begin to shift their focus to analytics. These companies begin **multi-dimensional analysis**. This analysis allows them to recognize which patterns are significant to the business.

**Data mining** is the final stage and uses complex algorithms to search for relationships and patterns in data that previously no one suspected. Data mining may use rule induction techniques to learn from a sample of data. When performing data mining one of four different types of relationships are being sought:

**Classes:** Stored data is used to locate data in predetermined groups. For example, a pharmacy chain could mine customer purchase data to determine when customers visit and what they typically purchase. This information could be used to increase revenue by tailoring and directing promotions for people who actually buy specific products.

**Clusters:** Data items are grouped according to logical relationships or consumer preferences. For example, data can be mined to identify market segments or consumer affinities.

**Associations:** Data can be mined to identify unexpected associations. For example people who purchase flowers at a grocery store on Friday evenings also tend to purchase red wine. Knowing this, a grocery store can situate a wine display beside the flowers.

**Sequential patterns:** Data is mined to anticipate behavior patterns and trends. For example, a sporting goods retailer could predict the likelihood of skates being purchased based on a consumer’s purchase of hockey socks and hockey tape.

A data warehouse containing detailed historical data is needed to make the investment in data mining and multi dimensional tools worthwhile.
Different users within a company may be using different tools concurrently.

### 4.12 Accounting Information Systems (AIS)

Accounting and financial management personnel require information systems that provide them with accurate, timely, and appropriate information to carry out their functions. **Accounting Information Systems (AIS)** are designed specifically for this purpose. Like all information systems, AIS may be categorized into those that support operational, tactical and strategic decision making.

**Operational financial accounting systems** are basically **Transaction Processing Systems**. They record and report the voluminous, routine, and repetitive transactions that mirror the day-to-day operations of an organization. By computerizing these functions, organizations often eliminate the labour of manually recording endless details, usually reduce processing cost, and frequently provide faster and better service to their customers. They also develop a massive database of information that management can use to support tactical decisions and strategic planning. Organizations with operational financial accounting systems clearly have a competitive advantage over those without such systems.

**Tactical accounting systems** support management decision making by providing managers with a regular summary and exception reports, *ad hoc* reports, and other information that helps them control their areas of responsibility and allocate their resources to pursue organizational goals. **Budgeting systems, cash management systems, capital budgeting systems, and investment management systems** are common applications.

**Strategic accounting systems** support decision making that happens at the senior management levels within an organization. These systems support long term decision making and major decision making processes. These systems are based on business intelligence driven solutions. **Activity based costing, investment management systems** are two examples of these types of applications.

*Note:* Activity based costing systems can be deployed either as a tactical or strategic accounting system, depending upon how they are developed and used. For instance if the ABC system is targeted for a single department it could be considered tactical instead of strategic.

Typically, an organization’s first computerized systems are **operational-level** accounting systems. Computerized AIS for tactical decision-making and strategic planning are usually developed after basic operational (transactional) information systems are up and running.

AIS systems are not stand alone, but are part of the overall corporate information landscape.
Operational AIS produce the routine, repetitive information that are required by every organization, including paycheques, cheques to vendors, customer invoices, purchase orders, stock reports, and other regular forms and reports. Because of their task-oriented focus, operational AIS (like other information systems that emphasize routine transactions) are often called financial accounting systems.

4.12.1 Components of an Operational Accounting System

Traditionally, the accounting system includes the following components:

- Chart of Accounts
- General Ledger
- Journals and Subsidiary Journals
- Cheque book
- Accounting Procedures Manual

In a computerized system, data is ideally entered into the system only once via the subsidiary ledgers. Once the subsidiary ledger is reviewed the general ledger is batch updated. Using a computerized system for entries into subsidiary ledgers gives a division of control, allows for a division of labour and separation of duties to support internal control.

Since treatments of financial transactions vary from company to company a key part of an AIS is the accounting procedures manual which outlines the policies, procedures and governance for management of all financial transactions. The accounting procedures manual should contain information on how to extract key reports, metrics and how key items are calculated. This is especially important for organizations that have customized their accounting system to meet their particular needs.
Beyond the basic mechanisms that are used to store and record transactions, a computerized financial accounting system also has a series of software modules or subsystems used either separately or in tandem. These modules extend the capabilities of the accounting system to handle day to day operational tasks within the organization.

The system modules typically include:

1. General ledger (Discussed Above)
2. Fixed assets
3. Sales order processing
4. Accounts receivable
5. Accounts payable
6. Inventory control
7. Purchase order processing
8. Payroll

When these computerized financial accounting systems are integrated, each sub-system receives data as input from other sub-systems and provides information as output to other sub-systems.

4.12.2 Data flow in an Operational Accounting System

Each module in an accounting system is fed by source documents, which are the original records that prove that the transaction took place. Source documents include:

- Cash Receipts
- Credit Card Receipts
- Cash Register Tapes
- Cancelled Cheques
- Customer Invoices
- Supplier Invoices
- Purchase Orders
- Time Cards
- Deposit Slips
- Loan Notes
- Interest Payment Stubs

Different source documents go to different specific special journals depending upon the nature of the contents of the source documents. Source documents can be manual pieces of paper or can be electronic transactions. In an ideal electronic environment all source documents come in as electronic transactions either through web or EDI (Electronic Data Interchange) interfaces. Although this is an ideal scenario it is currently impractical to achieve for most organizations.
If companies have a high enough volume of like source documents there is an opportunity that high volume scanning and assisted computerized data entry can be used to take the manual source documents and convert them into electronic records.

Electronic records obviously have the benefit that they can be catalogued, stored and automatically retrieved to support automating other business functions. The phrase “Can you get me a copy of that invoice?” gets replaced by a user request through a website that allows a user to self service their requests.

Once information is in the Specific journals, the data then feeds into the General Ledger and into other modules of the accounting system.

Reporting is handled both from the specific modules and out of the G/L.

### 4.12.3 Accounting Cycles

Anyone who has taken a financial or managerial accounting course understands the concept of accounting cycles and how they relate to the three main business process cycles: acquisition (purchasing) cycle, conversion cycle, revenue cycle.

Data comes out of these three process cycles and feeds into an accounting cycle. Regardless of the type of business process cycle, the methods for recording the data remain the same.
Although the steps are the same for both manual and computer based accounting systems there are numerous reasons why computer based accounting systems are far superior:

**Integrated:** Computerized accounting is designed to automate and integrate all the business operations, such as sales, finance, purchase, inventory and manufacturing. The integration of the components means that people do not need to rekey data from one part of the system into another. This also means that entries into the accounting system can become an automated extract from other systems to save on manual data entry.

**Multi User:** Computerized accounting allows for multiple people to be working simultaneously. It is hard to have 2 people write in a manual journal at the same time.

**Less Error Prone:** Because users are making fewer manual calculations the possibilities for errors is greatly reduced. (But they still can happen if people misclassify transactions etc.)

**Speed:** Because of the speed and raw power of using computers it is possible to run reporting and do analysis in seconds, which would take days on manual systems.

**Improved Visibility:** Because of the factors mentioned above it is possible to run inter-period reports to see how the company is doing, lookup all transactions for a customer etc.

**Internal Controls:** One of the benefits of an AIS system is that it enables a number of Internal Controls:

- Assignment of responsibility
- Separation of responsibility for related operation
- Separation of operation and accounting
- Proofs and security measure
- Simplifies independent review

The fact that operational financial accounting systems are predominantly routine and repetitive in nature does not mean that they do not contribute to decisions that are important to the organization. For example, the *accounts receivable sub-system* may routinely process credit information about customers. This may include comparing the balance of customer accounts to customer credit limits, which is essential in making a common decision faced by the sales force: *Should the customer be allowed to make a purchase on credit?* Organizations that provide credit information to salespeople online reduce the risk of incurring bad debts, which lowers their cost of operation.
4.12.4 Types of Financial Control systems

A budgeting system permits managers to track actual revenues and expenses and to compare these amounts to expected values. It allows for comparison of current budget amounts to those of prior fiscal periods, other divisions, departments and if desired, to industry data. These comparisons allow managers to assess how they use their resources to achieve their goals.

Cash management systems support managers in ensuring that the organization has sufficient cash to meet its needs, putting excess funds from any period to use through investments, and providing borrowing power to meet the organization's cash needs during periods of insufficient cash flow. These systems are more difficult to sustain for smaller organizations that may lack the necessary resources to track cash balance on a day-to-day basis.

Capital budgeting systems provide information about the planned acquisition or disposal of major assets during a period. Managers may compare various capital-spending plans by analyzing their net present value, internal rate of return, and pay-back period. Before the asset is acquired, managers should compare and evaluate various plans for its acquisition using such basic tools as spreadsheets, which provide easy-to-use functions that return net present value, internal rate of return, pay-back period, and other asset acquisition analysis measures. With them, managers can make informed decisions on the utility of acquiring assets and how these acquisitions might best be funded.

Investment management systems support decisions regarding the organization's pension plan. Whatever the source of investment funds, most organizations invest money in securities of one kind or another. Careful management of these investments is necessary to ensure the achievement of organizational goals. They provide unique ways to manage stock and bond portfolios by using online databases that furnish immediate updates for stock and bond prices, provide information about the history of each investment, and various portfolio investment analysis tools to help managers stay on top of the organization's investments.

Tactical AIS focus on the resource allocation problems faced by managers. Tactical AIS systems are used for things like tracking inventory, payroll management and accounts receivables. These systems give managers increased control over the financial resources of their department or their organization and provide considerable support for allocating financial resources to meet organizational goals.

Strategic accounting systems typically include several types of information flows:

- Internally generated financial condition analysis data, describing the status of the organization
- Externally generated economic, demographic, and social data describing the present and future environments of the organization
- Forecasts of the organization’s future in these environments
Strategic accounting systems often involve some form of simulation for generating possible outcomes to particular scenarios. Simulation is the use of a model to approximate how a real world system would behave. In a simulation an analyst tries to create a model to mirror an economic event under study. There are multiple different tools and technologies which can be used to create and analyze the model including, regression based analysis, monte carlo simulations, exploratory simulations and expected value decision trees.

A major source of computerized information about the current and future status of the organization is the organization's own financial accounting database. When combined with online databases containing economic, social, demographic, technological, and political information on the present and future environments in which the organization must operate and powerful tool for forecasting. A major purpose of strategic decision-making is the use of such long-term forecasts to reduce the risk associated with organizational decisions.

**Financial condition analysis systems** provide management with a variety of measures of the soundness of the organization and make it possible to explore ways of improving the organization's financial condition. Financial condition analysis data on competitors, suppliers, buyers, and other organizations is also available through such systems.

### 4.13 Activity Based Costing vs. Traditional Cost Accounting

ABC has been called one of the most important management innovations the last hundred years. Because of the differences between traditional cost accounting and ABC it requires a lot of data to make ABC feasible.

For a traditional costing allocation system to work it does not require much operational data to assign costs. Costs are simply assigned based on a pre-determined allocation formula (Usually on direct labour only). Everything needed for a traditional costing exercise can be found in the chart of accounts, and the manipulation can be done in something like Excel even in the most complex organizations.

ABC systems can be implemented for a department, a division or even an entire enterprise. ABC can be based on anything from a simple to very complex model.

To get ABC working it requires collection and management of two separate types of data.

**Cost Data** – These are the costs to the organization. For ABC these are the simpler data elements to find. Simply look in the chart of accounts and pull out all cost items such as salaries, materials, equipment, facilities & overhead. Typically companies do not include financing related costs as they are not material to ABC.
Activities Data – This is information on the activities that people and equipment perform to convert inputs (raw materials etc.) into outputs (finished goods). The information on the activities needs to be detailed enough that it can be used to differentiate the different costs of separate activities. Activities are measured based upon the counts or units that are produced.

Collecting data on activities is the tougher part of data collection for ABC, and relies upon collecting operational and standards data to provide measures.

Once process maps, cost drivers, and different roll-up scenarios are all determined the discussions around ABC get interesting. An ABC model is only as good as the data upon which the activity cost is based. If the data on activities is inaccurate, too high level, or just missing then companies cannot make good decisions around those activities. IT now plays a role in identifying what operational data that supports ABC they already exist in the enterprise. If data is not currently being captured then decisions need to be made around how the model will be populated for these items:

- Engineering can provide time-study or standards results to use
- New data collection mechanisms may need to be built
- Proxies elsewhere in the business may need to be used to approximate volumes

A simple example to drive the point home…. To accurately cost activity on a shipping dock where workers move freight either by forklift (average 1.5 minutes per trip) or by handcart (average 4 minutes per trip) for fragile freight an indicator would be put the data as to which freight was handled by which means or a customer that ships predominantly fragile freight will be under allocated costs and a customer that never ships fragile freight will be over allocated costs.

The ABC data model needs to include the following components:

- **Costing Data**: Direct and indirect costs for materials, labour and overhead
- **Activity Data**: Information on activities being performed by machines and people
- **Activity Cost Drivers Data**: Information on how costs will be allocated and how costs vary based upon the activity being performed.
- **Operational Activity Data**: Information drawn from operational systems on how many units of activity work have actually been accomplished.

Outputs from an ABC system include:

- Data listings of all model input tables
- Audit, reconciliation and error-tracking reports
- Activity reports:
  - by activity and cost
  - activities selected/sorted by attributes
  - resources consumed by each activity
• where used in other activities, processes and cost objects
  • Cost object /profitability reports:
    • profitability by dimension
    • activity resources by cost object

To accurately cost requires a LOT of data, the more data collected the better the potential for costing becomes. Because of the intensive data needs to feed even a moderately complex model, a data warehouse is the typical data store behind a model. Even then tradeoffs are necessary to ensure that a model is used that can run quickly enough to provide data for management consumption.

Reporting out of an ABC model is done through the same tools as for a data warehousing and business intelligence.

Building an ABC model is not typically a one time activity, as organizations evolve the ABC models need to be updated and revisited in order to keep them current. This needs to be factored into the costs of the ABC project.
5 Section 3 - Security, Control and Auditing

Hardly a day goes by without an article in the news about a security breach or misuse of information where hundreds or thousands of people’s information erroneously falls into the wrong hands. The fallout from these types of circumstances can be extremely damaging to organizations. It is now in the best interest of organizations to ensure that they have proper plans in place to improve the odds of staying out of the limelight. How an organization treats data and information says a lot about a company. Companies that understand the value of their data take great pains to protect their information assets.

While unauthorized access from outside parties is, perhaps, the most publicized risk involving an IS, it is not considered by experts to be the most important. Outside access is actually ranked somewhere near the bottom. Research has shown that the greatest IS risk is from accidental errors made by employees. Internal concerns involve unintentional errors or omissions during the input, processing, or output of data; the theft of computers and peripheral devices; intentional damage by disgruntled or dishonest employees; and damage from fire, water, or natural disasters (such as destruction by fire, water, wind, or earthquake).

With the proliferation of methods that can be used to store and move large volumes of data quickly and easily it is more important than ever that companies are aware of the risks they are exposing themselves to. In order for a company to protect themselves it is necessary that they create an environment of controls that match the risks they face.

5.1.1 Security and Control Philosophies

A control environment consists of managerial philosophy, organizational structure, a steering committee, and management control.

Managerial philosophy includes management's attitudes and actions towards controlling risk. If management emphasizes Information System risk control, then employee attitudes on this topic should be significantly affected.

The organizational structure provides an overall framework for planning, directing, and controlling an organization and has a significant influence on the control environment. It specifies reporting, transaction processing, and decision-making relationships. The lines of authority and responsibility among individuals and groups are defined in the structure. These lines are crucial for ensuring that responsibility for IS control is clearly defined. The steering committee develops a plan and determines policies for the organization's IS.

Management control methods describe how management keeps track of the authority delegated to others and supervises organizational activities. In theory, owners and managers must be able to monitor the performance and effort of employees and departments in order to assess their compliance with managerial policies, procedures, and
objectives, often outlined in plans and budgets. These monitoring activities are a major component of what is generally known as a *feedback control system*.

### 5.1.2 Physical vs. Logical Security

There are two basic types of security: *physical* and *logical*. Physical security safeguards the hardware components of the Information System, and logical security protects the data and software elements.

Physical security for hardware requires safeguards that can protect it (including the data processing centre, terminals, PCs, output and storage devices, etc.) from unauthorized users, theft, fire, water, terrorism and other natural disasters.

Methods of physical security include locating the facility where it can be effectively protected, controlling entry to the computer facility through finger, eye, or voice prints to identify individuals who should be allowed access and, as simple as it sounds, just plain locking doors. To avoid a complete loss of data in any disaster, organizations should establish a regular policy of backing up system files and storing these backups in a physically separate facility. A backup is a second, or even a third, copy of a data file on a device other than the original storage media.

A company based in Canada was involved in a project where weeks worth of work were lost because backups were stored in the same room as the development servers. A burst pipe in the ceiling of an adjoining unit destroyed everything. It is important to have a proper system in place.

Protecting software and data is entirely different from protecting hardware. Computer hardware can almost always be replaced, but an organization's data are irreplaceable and data may be the organization’s *most important asset*. For example consider Environics Research, who’s only real asset is the information they collect. Even if it is not destroyed, data can fall into the wrong hands, a situation with disastrous implications for private companies or governments at any level. For this reason, data and software must be protected from unauthorized use.

*Is protection or ease of use and access the most important objective?* In general, the availability and ease of use objectives often override security concerns. When this movement towards easy-to-use systems is combined with recent technological and software advancements, the growing need for users to access large amounts of data, and the decentralisation of computer systems, the result can be a massive data security problem. Management controls are rising in importance.

### 5.1.3 Organizational Security

For proper control, a well planned and properly functioning support organization is critical. A key to organizational control is the segregation of functions between the IS department and the user. *Systems analysts* and *programmers* are responsible for the development and maintenance of programmes. The systems development personnel
should be separated from the operators who have access to computer processing equipment. Similarly, the documentation, data files, and programmes fall under data supervision, so that operators cannot access documentation they do not need, and only authorized users can access certain data. In large organizations, disk and tape libraries control data files when not in use by authorized personnel. Finally, a data entry group controls the actual input of data into the system. In all these cases, the objective is to keep those who may wish to perpetrate fraud from accessing the information, data, or equipment.

Control procedures are also classified as access, input, processing, output, procedural, and documentation control procedures. Each type of such procedure ensures either data security, integrity, or the ultimate delivery of needed information to the appropriate decision maker.

Access controls restrict user access to hardware, software, or data. Access control procedures include:

- Access to programme documentation should be allowed only to people who require it.
- Access to computer hardware should be limited to authorized individuals.
- Access to data and programmes should be limited to individuals authorized to process or maintain particular systems.

Accurate data input can be ensured through input controls. Input control procedures primarily provide data integrity. These procedures check that the data is authorized and correctly converted into machine readable form and that no data is lost, suppressed, duplicated, or otherwise improperly changed.

The input process subsumes five basic functions in which data are entered, checked, or changed:

- Transaction entry
- Transaction update
- File and database maintenance
- Queries
- Error correction

The systems designer must select the appropriate input method for each situation based on the organization's processing needs, the control features, and the attributes associated with each input method.

Two types of logs should be maintained on all input. A transaction log contains a list of all transactions entered into the system. Error logs, generated by the computer when an error occurs, include such details as time, date, and type of error. If corrections are subsequently made to any data found to be in error, these are also logged.
**Processing controls** ensure data integrity when processing data into information. The four types of processing controls include:

- **Processing and logic controls** primarily ensure that the IS satisfies its objectives. In other words, a well-designed and thoroughly tested system delivers useful and accurate information to decision-makers.
- **File and database controls** ensure that the correct files are processed and that files and databases are protected. A record of use is maintained for each file. File and database maintenance procedures are established for changes to records.
- **Software controls** ensure that transactions and information for reporting and decision-making needs are processed in accordance with management’s objectives. These controls restrict access to the operating and database systems and provide for backup, recovery, and restart procedures.
- **For hardware controls**, hardware manufacturers provide overflow and read/write checks to ensure that data are not lost and that input and output are accurate and free of transcription errors.

**Output control procedures** ensure the accuracy of such output as reports, data updates, or queries. With these controls, only authorized personnel receive the results of the output. This objective can be very difficult when printed reports are generated. In such cases, controls must be maintained over the storage of such output media as payroll cheques, the report generating programme, the report printing programme, the actual printing operation, the distribution of multiple copies, the emailing of reports, exporting to PDF and CSV files, the review for errors, and the storage and retention of output.

**Documentation controls** include the up-to-date maintenance of source documents including reports, audit trails, procedures, and the database controls that document data structure and job responsibilities.

**Procedural controls** are found in written manuals that provide step-by-step procedures to be followed by computer operators, data entry personnel, and end-users for the smooth flow of information and the implementation of appropriate control features.

To know how effective these controls are once they have been established, organizations must conduct comprehensive and systematic audits. Large organizations have their own internal auditing group charged with this responsibility. Most organizations will use external auditors in the monitoring of control compliance.

Operating Features of a Control Environment:xix

- all transactions must be authorized
- authorization must be documented
- there must be a record of every action
• authorization /record comparison
• segregation of functions

Internal Accounting Control Objectives:

• organizational segregation
• only valid transactions are accepted for processing
• all transactions have been properly authorized
• every valid authorized transaction is recorded
• the accounting entry correctly reflects the transaction
• the transaction is to be correctly classified
• the transaction data are to be correctly processed

5.1.4 Control Frameworks

There are a lot of factors and facets to consider when creating a control environment. Fortunately many fully documented frameworks already exist which can be adopted either as is, or with some customization.

**ITIL – Information Technology Infrastructure Library:** A set of best practices and IT management practices which can be found in 14 volumes. ITIL is a very process-centered approach to IT management. ITIL is normally only selectively implemented since it can add a significant amount of process overhead if implemented in full. Since ITIL is quite generic it also requires customization to fit an organization.

**Zachman Framework for Enterprise Architecture:** This is a 36 cell framework that focuses primarily on architecture in an application centered view. This framework looks at who, what, where, when and why of data, function, network, people time and motivation. This framework allows for identifying which business processes need to be supported by IT and how.

**ISO/IEC 20000:** Is a set of standards coming out of the International Standards Organization (ISO) ISO and ITIL do overlap, however ISO offers a certifying body behind it. ISO is really about documenting standard processes and compliance.

ISO/IEC 17799 is a specific audit standard for information security. This is not a complete framework because of its narrow focus, but it does have value as part of a control framework.

**ITSM – Information Technology Service Management:** Is a framework that is focused on the end users or customers viewpoint. ITSM has no single defining governance body or single authoritative standards, so it cannot be compared to the other standards in use. ITSM is used primarily as a means to evaluate staffing levels, priorities and budgets as it relates to the end user experience.
COSO – Committee of Sponsoring Organizations: COSO has released a framework officially named *Internal Control- Integrated Framework*, but it is in practice called the COSO report. It provides suitable frameworks for management assessment of controls. COSO is broken up into the following areas:
- Control Environments
- Risk Assessment
- Control Activities
- Monitoring
- Information and communication

COSO is the SEC’s suggested Internal Controls framework. COSO does not provide specifics on control objectives and related control activities, but instead describes the controls at a high level.

COBIT – Control Objectives for Information and Related Technology: This is a framework offered by ISACA- Information System Audit and Control Association and the ITGI – Information Technology Governance Institute. This is a comprehensive control framework containing four major areas:
- Plan & Organize
- Acquire and Implement
- Delivery and Support
- Monitor and Evaluate

These four areas are then broken down into 34 sub areas.

COBIT is an accepted standard for achieving SOX compliance, and has 3 main tenants:
- Regulatory Compliance
- Delivering value from IT
- Operating IT effectively

COBIT is one of the most comprehensive frameworks in use today and also benefits from being COSO compliant.

This diagram nicely explains the relationship between COSO and COBIT. By using COBIT to implement the five components of COSO the organization also puts in the necessary control frameworks which satisfy the needs for SOX compliance.
5.1.5 Practical Notes on the Creation of Policy

Theory is great; however policies, procedures and governance need to be short on theory and long on specifics and examples. It has been demonstrated that overly technical or theoretical governance is ineffectual in driving the correct behaviour.

Control policy needs to include:

- How access is granted, to whom, to which data and in which circumstance?
- What are appropriate data storage and transfer mechanisms for data and how they are used? (e.g. Is it okay to carry code, documents, data sets on DVD’s, Thumb Drives, Personal Laptops etc.).
- Outlining a schedule when auditors will be engaged to come in for reviews.
- How is production data is protected from exposing Personally Identifiable Information-PII?
- What does the company do to ensure security gets tightened when employees leave?
- How does the company treat passwords etc. (It is STRONGLY recommended that every person use their own username / password combination for access as a default position). What does the company do with default passwords on existing systems?
- Encryption of data. Make sure policies state that people do not leave the premises with data on unencrypted devices. (Thumb drives, PDA’s, laptops etc.). Tools are readily available that can provide sufficient levels of protection, but not if people don’t use them.
- Policies around how to access the network, such as are people allowed to connect new devices etc.

5.1.6 Disaster Recovery Policies

Unfortunately bad things happen, even to good companies. Companies need to be prepared that their business operations may be interrupted due to many different possible factors. All companies need to have plans in place for how they would deal with both service interruptions and resuming normal business should these unfortunate circumstances occur. Since IT is such a fundamental component of doing business today IT capabilities often consume a large part of Disaster Recovery Planning.

Assessing risks to the business means asking two basic questions. First, if a loss occurred, how would the organization respond? Second, what would the cost of the response be (or alternatively, what might be the irremediable loss attendant upon the event)? These questions should be addressed from a variety of dimensions: economic, technical, operational, and behavioural. Answers to these questions will provide the organization with a detailed set of scenarios that provide an assessment of risk exposure, a measurement of the probability of data and information loss, and the consequences of
such scenarios. Finally, they should also suggest the introduction of strategies to prevent, detect, and correct these scenarios.

Companies can face disasters on all levels from a single critical server failing, to destruction of operating facilities. Plans need to span all different levels of threat.

One practical thing…. Don’t store the only copy of disaster recovery plans at the main operating facility. Keep a backup copy of the procedures, governance, contact lists, etc. offsite!

Since every company is uniquely different there is no single recipe for what the appropriate disaster recovery plan should look like. However in any organization if people are not thinking about risks and exposures they are not acting on ways to close these exposures. Remind people often about these risks and why policies and plans are in place to deal with them and the need for compliance.

5.1.7 Personally Identifiable Information (PII)

Personally Identifiable Information is information that can be used to link a piece of data to a particular/specific individual. For health records this could be an OHIP number, for a bank this could be account numbers, for a retail company this could be a loyalty or customer number. For internet service providers this can be an IP (Internet Protocol) Address.

It is important that any PII data that is not running in a secured environment, masked or blocked so that no unauthorized use of the data can occur, (e.g. if an analyst at the hospital is looking for a linkage between wait times and the amount of time it takes for bills to be paid the data set that they are working with needs to be able to link the data elements, but should use masked data instead of true OHIP numbers).

PII is just one more factor that organizations need to factor into their security plans.

5.2 Security and Fraud

Computer fraud and security breaches result in billions of dollars in losses worldwide every year. There are a wide variety of techniques and schemes that are used for committing computer crimes.

Some classifications of computer crime include:

- Insider crimes / fraud
- Employee misconduct
- Hacking / cracking
- Network intrusion
- Computer viruses
- Blackmail
- Industrial espionage
Computer fraud can happen by computer manipulation at three stages:

**Input manipulation**: This is the most common computer crime, as it is easily perpetrated and difficult to detect. This type of crime does not require any sophisticated computer knowledge and can be committed by anyone having access to normal data processing functions at the input stage. Generally this type of crime involves the deliberate entry of false information. Creating a false cheque requisition would be an example of this type of fraud.

**Program or data manipulation**: This type of fraud is very difficult to discover and is frequently not recognized. This type of crime is done by people with computer-specific knowledge. This approach involves changing existing programs in the computer system or inserting new programs or routines.

**Output manipulation**: Output manipulation is done by targeting the output stages of the computer system. An obvious example is cash dispenser fraud, achieved by falsifying instructions to the computer in the input stage. There is a particular subset of fraud conducted by computer manipulation that takes advantage of the automatic repetitions of computer processes. An example of this is the salami technique, where nearly unnoticeable thin slices of financial transactions are repeatedly removed and transferred to another account.

Many types of computer fraud or computer crime involve an aspect of social engineering where people are convinced through fraudulent means to give up passwords, user names or other important information. These types of schemes are called phishing.

There are many motivations behind computer crime:

- Seeking economic/competitive advantage
- Prestige
- Revenge

Common Fraud Schemes

- Internal
  - Billing schemes
  - Inventory fraud
  - Payroll fraud
  - Skimming/salami techniques
  - Cheque tampering
  - Register schemes
- External
  - Telecommunications fraud
  - Hacking
  - Internet fraud
  - Software piracy
5.2.1 Preventing Fraud

The first step in preventing fraud is having a rigorous security policy that all employees and people who can access the computer systems follow. The policy is a fundamental into the overall control environment.

Ensure that there is appropriate segregation of duties for IT personnel. The following roles should all be segregated:

a. People who request changes
b. People who make the code changes
c. People who test systems
d. People who promote code into production
e. People who monitor production

Systems need to have access controls. The objective is to ensure that only authorized persons and applications have access to data, and to perform specifically defined functions.

To manage the environment means good change control procedures are required. The objective of the program change controls is to ensure that all changes to applications are properly authorized, tested, and approved before implementation.

Finally audit and review frequently for vulnerabilities. Different organizations are subject to different risks and every company needs to tailor their readiness for dealing with threats.

5.3 Auditing Computer Based Systems

A MIS audit identifies all the controls that govern individual information systems and assess their effectiveness. To accomplish this, the auditor must acquire a thorough understanding of operations, physical facilities, telecommunications, control systems, data security objectives, organizational structure, personnel, manual procedures, and individual applications.

Auditors should collect and analyze all the material about a specific information system, such as user and system documentation, sample inputs and outputs, and relevant documentation about integrity controls. The next step is to list and rank all control weaknesses and estimate the probability of their occurrence, with an attendant assessment of the financial and organizational impact of each threat. Management is expected to devise a plan for countering significant weaknesses in controls.

Unfortunately the term computer auditor can have a variety of different meanings and connotations. Auditors are typically deployed in the following scenarios:
1) Review new projects and systems which are under development.
   a. Provides an independent review to management that proper processes and
      governance are in place to deliver the project effectively.
   b. Confirms that new system itself has necessary controls (Input, Processing
      and Output) to limit risks and vulnerabilities.
   c. Confirms that IT Infrastructure can appropriately support the application

2) Review existing systems that are already running in production. Systems change
   incrementally over time, often without interim audit.
   a. How do changes impact security and control?
   b. Do changes in manual processes introduce additional risks?
   c. Is data still being used and stored in the same ways it was originally
      intended?

3) Review of infrastructure for security vulnerabilities
   a. Physical security
   b. Contingency planning / Disaster recovery planning
   c. Logical Access Control
   d. Program Change Control
   e. Operating Systems
   f. Telecommunications
   g. Storage
   h. Databases
   i. Operations
   j. Encryption / Cryptography

Auditing is intended to confirm that existing control structures are still in force and acting
appropriately in response to the risks that the company faces. To be truly useful auditing
must be maintained as an independent appraisal function.

5.3.1 Different types of audits
A financial audit is focused on confirming the reliability of financial and operating
information. The audit also evaluates the effectiveness of internal controls, and that all
resources within the organization are properly accounted for.

An IT audit is focused on ensuring that organizational control structures are reflected
properly in the electronic systems that support and manage the business. The IT audit
process is not just focused on financial aspects of the business, but on all areas of the
business that can be put at risk by deploying an electronic system.

Both financial and IT audits can either be done internally or by external parties.

The Institute of Internal Auditors defines internal auditing as follows:
Internal auditing is an independent objective assurance and consulting activity designed to add value and improve an organization’s operations. It helps an organization accomplish its objectives by bringing a systematic and disciplined approach to evaluate and improve the effectiveness of risk management, control and governance processes.

The results found by internal auditors are used to improve the organization, and are not typically shared outside of the organization.

The primary mission of external financial auditors is to provide an independent opinion on the organization’s financial statements, annually. External auditors approach is historical in nature, as they assess whether the statements conform to generally accepted accounting principles, whether they fairly present the financial position of the organization, whether the results of operations for a given period of time are accurately represented, and whether the financial statements have been materially affected. The results from external auditors are included in the publicly disclosed financial statements from the company.

There are many different roles that external, non-finance focused IT auditors assume. Organizations may bring in specialist IT auditing firms to look at various aspects of the electronic systems supporting the business. The results of these audits are used to improve operations and are kept within the organization.

The following table summarizes the difference between the 3 different types of auditors that can be engaged.

<table>
<thead>
<tr>
<th>Internal Auditor</th>
<th>External Financial Auditor</th>
<th>External non-Financial IT Auditor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employee</td>
<td>Independent Contractor</td>
<td>Independent Contractor</td>
</tr>
<tr>
<td>Serves Management &amp; Board</td>
<td>Serves 3rd Parties</td>
<td>Serves Management &amp; the board</td>
</tr>
<tr>
<td>Reviews all operations and controls for improvement opportunities</td>
<td>Reviews financials – balance sheets, income statement accounts etc.</td>
<td>Reviews operations and controls for improvement opportunities</td>
</tr>
<tr>
<td>Directly concerned about fraud</td>
<td>Indirectly concerned except when financial statements may be impacted</td>
<td>Directly concerned about fraud</td>
</tr>
<tr>
<td>Independent of the activities being audited</td>
<td>Independent of the organization being audited</td>
<td>Independent of the organization being audited</td>
</tr>
<tr>
<td>Reviews continually</td>
<td>Reviews Periodically</td>
<td>Reviews Periodically</td>
</tr>
</tbody>
</table>
5.3.2 Auditing Process

The following is the process that auditing follows when conducting an audit:

**Client acceptance/retention stage:** Based on a preliminary knowledge of the client's business, the auditor undertakes various activities, the primary objective of which is to determine whether to accept or reject a prospective engagement. The auditor may reject the engagement if the risks of misstatement are too high, if there is a perception that auditors will not be given full access etc.

**Audit planning stage:** In this phase, the auditor undertakes various activities, the primary purpose of which is to decide upon an appropriate audit approach for each balance on the financial statements. In this phase auditors may interview various candidates, get questionnaires completed etc.

**Control testing stage:** The purpose of this stage is to gather evidence as to the effectiveness of operation of the controls. In the cases when the controls are not as effective as was believed in the planning stage, the auditor will alter the planned audit approach.

**Substantive testing stage:** In this stage, the auditor gathers the substantive evidence (i.e. evidence as to the completeness, validity and accuracy) of individual account balances and underlying classes of transactions for the purpose of determining the extent of misstatements in the individual account balances.

**Opinion formulation stage:** In this last audit stage the auditor forms an opinion on the financial statements. This decision is based on an evaluation of the extent to which the financial statements are consistent with the auditor's knowledge of the entity, including the auditor's conclusions concerning the extent of misstatement in individual account balances.

5.3.3 Compliance vs. Substantive Testing

Compliance testing is focused on ensuring that activities comply with corporate plans, policies and documented procedures and whether the procedures are adequate. Results from compliance testing are indirect evidence.

Substantive testing is looking at direct evidence that particular activities are happening as they should. Substantive evidence is direct evidence and is always given a higher weight in decision making than the results of compliance testing.

5.3.4 Computer-Assisted Audit Techniques - CAAT

Because of the volumes of data that organizations contain in their systems it is beneficial to use electronic means to interrogate them to quickly find different types of inconsistent information.
The techniques and tools that are used for these types of investigations are called Computer Assisted Audit Techniques (CAAT). Depending upon the nature of the audit and the type of systems being reviewed different tools and techniques are available. The following are a few of the different scenarios that CAAT tools can be deployed to detect:

**Individual suspect transactions:** CAAT can sift through thousands of records, even spanning back through many years of data looking for specific patterns that are indicative of fraudulent activity. (Sales with missing invoices, searches for duplicate check #’s, vendors with multiple vendor codes etc.)

**100% verification:** Because computers can check thousands of transactions a minute they can quickly confirm that balances that are supposed to match do, and recalculate key ratios that may be an indicator of fraudulent or suspicious activity. (Spread on pricing, ratio of sales to returns etc.)

**Fraud Patterns:** There are often patterns that indicate improper or suspicious activity. Voided transactions followed by a no sale, use of a credit card for a tiny purchase followed almost immediately by a large purchase etc.

CAAT tools can be tailored for an audit at a particular organization based on the types of risks that they face. The tailoring allows for low risk or low value scenarios to be eliminated from the scans.

CAAT tools can be developed and deployed either for periodic or ongoing access and scans. For example banks and financial institutions deploy complex heuristic engines that scan all credit card transactions in real time to automatically detect multiple different types of fraud and pop up alerts to auditors to immediately review. Other organizations may only have a quarterly or annual scan done.

CAAT is not only used for detection of fraud but the same tools and techniques are also used to find cases where either manual or electronic control processes or systems have broken down.
6 Section 4 - Finance / Accounting Specific IT topics

As an accounting or finance professional you may be called upon to participate in preparation of materials to support IT decision making. The following topics will help to give a background into doing this work effectively.

6.1 Valuating IT projects

The valuation of IT projects is often one of the most difficult aspects of dealing with IT. For some IT projects it is very difficult to relate the IT expenditure to a specific hard business benefit. For example how does a company quantify a benefit from upgrading an email server to a newer release of software? This can be likened to a landlord that owns a building and fixes a roof that is getting old. This does not intrinsically increase the value of the building.

In other cases IT projects promise benefits throughout an organization that are not tied to a technology uplift but really to a business transformation. Often many IT projects are really business transformations in disguise. The technology really just supports the changes elsewhere in the business.

That being said there are several different approaches that can be used to come up with a financial valuation of an IT project e.g. IRR, Payback, and NPV. This document will not go into an in depth explanation on how to perform any of the calculation, but will help give a sense of some of the more common approaches that are used.

Payback Period: is the length of time it takes to recover the initial investment using cash flows from the project. Decision: If the payback period is less than a pre-established limit, do the project.

Discounted Payback: is the amount of time it takes for an investment to break even. Accounting for the time value of money. It is almost the same as payback except for reducing the future payments by the appropriate cost of capital. Why? Because it is money that will be actualized in the future and will therefore be less valuable than money available today. (Research Time Value of Money if not clear.) The biggest shortcoming with the discounted payback method is that there is no economic rationale for determining the correct cutoff period. An arbitrary cutoff period must be chosen, so corporations need to decide whether 2 years is acceptable, or 4 years, or 5, etc. The discounted payback period also tends to bias the user toward short term investments as it ignores cash flows beyond the cutoff. A project that takes a few years to get up to speed and then creates phenomenal returns would be rejected strictly on its cash flow profile.

Net Present Value (NPV): is a method used in evaluating investments, whereby the net present value of all cash outflows (such as the cost of the investment) and cash inflows (returns) is calculated using a given discount rate, usually required rate of return. An
investment is acceptable if the NPV is positive. In capital budgeting, the discount rate used is called the hurdle rate and is usually equal to the incremental cost of capital. Decision: If the present value of the inflows from the project exceeds the present value of the outflows, do the project.

**Internal Rate of Return (IRR):** is defined as the *discount rate* which makes the *net present value* of a project equal to zero. In mathematical terms, IRR is the projected discount rate that makes the net present value (NPV) calculation equal to zero. The IRR is the most often used alternative to NPV. With IRR we try to find a single rate or return that accompanies the project. This rate relies only on the cash flows of the project, not on external rates.

IRR is the required return that results in zero NPV when it is used as the discount rate. There is no mathematical approach to finding IRR. The only way to find an IRR is by trial and error, or by using Excel solver and goal seek Decision: if the project's IRR exceeds the required risk adjusted return, do the project.

Regardless of the valuation approach that is used there are a number of different financial elements that need to be factored into the overall valuation calculations.

**Benefits Stream:** This is the stream of benefits that are expected from the project such as reduced headcount, operational efficiencies, profits from additional revenue etc. Total benefits for a project may be more than just quantifiable financial benefits, other benefits that can be attributed to a project include:

1. Green dollar savings from current base (Reductions in current costs of technology/service)
2. Cost containment and/or cost avoidance
3. Effective spending management for incremental spending (discounts negotiated, favourable terms, bundling)
4. Non-quantifiable benefits (e.g. productivity/efficiency gains, risk mitigation)
5. Revenue Opportunities

**Special Note:** Often technology projects will have *both* one-time and ongoing costs associated with updating desktops, servers and networks to run the new tools. It is very important to understand these costs early as they can be considerable.

**One Time Costs:** These include development costs, costs for consultants, travel & living for the project team, capital costs for setup of servers and hardware, decommissioning old systems etc. Note: often travel and living expenses get missed and can be substantial.

**Change Management Costs:** These are the costs associated with communicating and training end users to use the new system and to deal with costs from features and capabilities that may have been lost as a result of introducing the new system. When a new system is introduced which is different than existing systems, some features and capabilities which users used to rely on are no longer available. It takes time energy and costs to develop alternative work methods.
**Ongoing Costs:** These include licensing, maintenance fees, leasing fees for hardware, costs for support personnel, changes in run rates, recurring or planned upgrades etc.

**Other Project Impacts:** Often when a new higher priority project begins it will draw resources from already in-flight projects. The impacts and spend to date on projects that need to be deferred, delayed or cancelled need to be factored in.

**Financing Costs:** These are the costs associated with financing the project, (interest and capitalization etc.), as well as any unusual depreciations that are required for this project.

**Treatment of Existing Equipment Assets:** What happens to existing equipment / licenses that are redundant or obsolete as a result of the project (i.e. write-offs, discount sell offs etc.).

**Cross Entity Considerations:** In some circumstances recovery treatments for projects that cross legal entities need to be factored in. These can be quite complex to setup and administer especially for ongoing support and maintenance.

**Special Note / Caution:** Periodically what starts out as a simple IT project can cascade into a much larger overall program. For example a request comes in for an upgrade to an existing engineering package.

- The new tool requires more memory than the existing tool.
- The existing servers don’t have space for more memory
- New servers come with a different operating system which requires that the corporate anti-virus product also gets updated.

It is important to be aware that this type of scenario can occur, and due diligence is always required.

### 6.2 Comparing IT Vendors

One circumstance organizations often find themselves in is a circumstance where they need to evaluate competing offers from multiple vendors to solve a particular business technology problem. What seems like a very straight forward task can prove to be extremely difficult in practice given the multiple competing priorities within a business.

For example: The sales department is sponsoring putting in a sales force management package to improve reporting and information sharing between sales reps. The Marketing VP really likes the product from company A, it has most of the features he/she wants and has a simple easy to navigate GUI, and is cheaper to buy / license. The solution from Company B is okay, but it is missing a text messaging feature which is key and is more difficult to navigate.

The IT department prefers the solution from company B, as they can host this application on servers they already own and they have support people on staff who are already
familiar with much of the underlying technology. The offering from Company A means they need to install new servers with a different toolset on them and will need to either train up some of their own internal folks on support or will need to contract support from elsewhere.

In some organizations Sales will simply go off and buy the offering from Company A and leave it up to IT to figure out how to support it, in other companies IT will simply force Option B to be purchased and end up with users that won’t use the solution.

Several different decision making methods exist to make the best imperfect decision. But regardless of the approach adopted, it is important to understand that when an IT decision is being made, all the different perspectives are reviewed, considered and understood.

Beyond the simple fit for business needs the following criteria also need to be factored into the evaluation:

Infrastructure Related Factors:

- **Performance**: What are its speed, capacity, and throughput (end-to-end transaction time)?
- **Cost**: What is its lease or purchase price? What will be its cost of operation and maintenance?
- **Reliability**: What is the risk of malfunction and its maintenance requirements? What are its error control and diagnostic features?
- **Availability**: When is its delivery date?
- **Compatibility**: Is it compatible with existing components and/or systems and business processes?
- **Modularity and Scalability**: Can it be expanded and upgraded through modules or add-ons?
- **Technology**: In what year of its product life cycle is it? Does it use new or untested technology? Does it run the risk of obsolescence?
- **Ergonomics**: Has it been engineered with users in mind? Is it user friendly, safe, comfortable, and easy to use?
- **Connectivity**: Can it be easily connected to wide area and local area networks?
- **Environmental requirements**: What are its electrical power, air-conditioning, and other environmental requirements?
- **Software**: Are operating systems and application programmes available that can best use this hardware?
- **Support**: Are the services required to support and maintain it available?

Software factors:

- **Efficiency**: Does the software require large memory capacity or CPU time?
- **Flexibility**: Can it handle its processing assignments easily without major modifications?
• Security: Does it provide control procedures for errors, malfunctions, and improper use?
• Language: Is it written in a programming language that is used by the organization's programmers and users?
• Documentation: Is the software well documented? Does it include helpful user instructions?
• Hardware: Does the existing hardware have the features required to best use this software?
• Performance: What are its speed, capacity, and throughput?
• Cost: What is its price?
• Reliability: What is the risk of malfunction? What are its error control and diagnostic features?
• Availability: When is its delivery date?
• Compatibility: Is it compatible with existing hardware, software and business processes?
• Ergonomics: Has it been engineered with users in mind? Is it user friendly, safe, comfortable and easy to use? Does it include a graphical user interface (GUI) if appropriate?
• Support: Are the services required to support and maintain it available?

6.3 Negotiating IT Contracts

When someone goes out to buy a car it is a very straightforward transaction that can take place over an afternoon. All the options, negotiations, settlements and financing arrangements can take place in a very short period of time. Unfortunately purchasing IT services, especially around large projects often takes a significant amount of time with lots of different factors that come into play.

It is important that financial managers understand the different phases that occur when looking at IT contracts and the precision that accompanies different interactions.

The following diagram outlines typical negotiations and accompanying precision that occurs.
Initially a vendor begins with a number of broad brushed assumptions that they use to present a price around their product / service offering. (Is it bigger than bread box type stuff). As negotiations proceed, the precision around the estimates improve as assumptions are converted into facts throughout the discovery phase.

By the time the commitment stage is reached the goal is to have all the high level assumptions removed. Companies may pay a vendor for the high level design phase, may complete the phase themselves internally, or sometimes may get a vendor to do the work as a free pre-sales engagement.

For large projects companies want to limit their risks, to do so they will add a series of gates within the Project Execution phase. As the project passes through each gate a review is completed and a decision is made if the project should continue onto the next phase or revise scope.

### 6.4 Service Level Agreements:

Service Level agreements are a necessary contractual addendum. Service Level Agreements should ideally be developed in consultation between the vendor, IT and the ultimate end users. This is necessary to avoid different understandings between expected performance and support arrangements. SLA information should also reflect current maintenance or support agreement with the vendor. More than a few projects have gotten
into trouble once in production when end users went looking for small enhancements or changes only to discover that they were not covered within the SLA and would be expensive to implement.

6.4.1 Specific Notes on Development Contracts

1) What is the nature of the contract: Fixed Price or Time & Material

   a. Fixed price requires that all the requirements be clearly defined before the contracts are signed. If this is not done two possible outcomes are possible.
      i. Death by CR (Change Request): every feature originally thought was part of the original scope is deemed to be a change request and is charged incrementally to the project.
      ii. Quality Cut: in order to maximize their profits the contracting company cuts out as many features as possible and pushes responsibilities for testing etc. onto the users.

   b. Time and Material – Requires that timelines and costs be very tightly managed or costs and timelines can be stretched out for long periods of time working on every possible feature, capability and contingency.

2) Veto on staffing for the project: Unfortunately in some cases personalities may not mesh between project teams and internal staff. It is important that the client explicitly has the right to request alternate staffing from vendors.

3) Management and control of data and information. Corporate information and data is both a source of competitive advantage and liability in the wrong hands. Corporations want to ensure that all contracts include expectations around the management of company data and information.

4) Ownership of customizations. It is important to understand if a company pays for a customization or new feature can it also prevent this feature from being installed at its competition. Perhaps not, but it is good to know this type of information up front.

6.4.2 Specific Notes on Maintenance Contracts

Maintenance contracts come with criteria to maintain compliance and eligibility for support.

1) Currency: Many IT contracts have clauses regarding maintenance costs and what level of currency\(^1\) is required to maintain support from vendors. If the

\(^1\) Currency in this context means – how close to the latest / newest version. E.g. Current – 2 means that all components of the solution are within 2 revisions of the latest version.
maintenance requirements are too high then the system can be in a perpetual state of having to upgrade multiple times per year just to stay compliant. It is important to review the maintenance contacts to understand what happens if the company falls out of compliance. Two standard approaches that vendors take to ensure compliance are either to cease providing support to out of compliant systems or charging a premium for support.

2) **End of Maintenance Cycle:** When the term of the maintenance contract are over maintenance fees may be automatically renewed, automatically increased, or a forced upgrade may be mandated in the terms of the contract. More than a few companies have been shocked to find out that their maintenance fees have jumped 25% or more when their existing contracts end.

3) **Fair Usage/License Transfer:** Once the contract is over, or if the company merges with another company, the terms of the agreement may state that the company is no longer allowed to use the hardware / software without a contract renegotiation. This may hold even for items that are out of support. The company may also be ineligible to resell unused license or hardware.

4) **Planned upgrade cycle:** The contract terms should specify how often updates are released and on what schedule. The upgrade schedule should also outline how often to major vs. minor updates get released.

5) **Level of support:** Contracts should specify what the hours of support are, what types of support are available, and who provides the support. The support clauses should also identify who is responsible for installing upgrades and patches.

6) **Replacement / Spare Parts:** Contracts should specify how spare parts will be provided, where they will be stored and how they will be replenished. Contracts should be clear on pricing for replacements and spares.

### 6.5 Maturity Models and Certification

How effective an IT department is can be a subject of a lot of debate. One means that an IT department can use to improve their effectiveness in an organized fashion is to pursue one of several different standard certifications. These certifications can serve as both an internal benchmark, and if high enough levels of certifications are achieved can be used as external indicators to customers, clients and suppliers of the quality of their partner. In some cases certification may be required to do business with certain customers or suppliers.

Certifications can be achieved both by individuals and at a department or organizational level. Most of the personal certifications are vendor specific or technology area specific certifications (e.g. security).

As there are many, many different certifications available, some with little or no business value, research on the certification benefits needs to be done before pursuing the certification. A simple business case on the value to the organization is often required.
A few of the different department certifications that organizations can pursue include:
ISO – International Organization for Standardization. ISO is a family of different
standards and certifications, but ISO 9000 are the standards for quality management
systems.

CMMI – Capability Maturity Model Integration. A process improvement approach for
organizations. 3 different versions of CMMI exist for different organizations.

ITIL – Information Technology Infrastructure Library. ITIL is a series of best practices
for managing Infrastructure, Operations and Development

**Vendor specific certifications (Cisco, Microsoft etc.):** Many vendors offer certifications
on their specific products and services. These certifications can mean being promoted as
partners by the vendors, and can give access to improved pricing, development tools and
technical support.

A caution about certifications: Certifications can be expensive, time consuming and a
distraction to running the business. Companies need to make sure that the reason for
chasing the certifications are valid and allow the organization to improve and benefit.
Many organizations lose this focus and chasing the certification becomes the goal, once
the certification is achieved no further activity happens until the next round of visits from
the auditors. Certifications should be pursued when there is a specific reason for the
certification to be achieved, and the business can derive a positive overall benefit.
7 Section 5. Key Emerging Trends

7.1 Remote Workers and the Internet

Given that many people are now virtual or mobile they often need access to network resources and applications which are stored on servers inside of corporate networks. To enable this capability users use VPN – Virtual Private Networking tools. These tools create a virtual network tunnel between a computer connected to the internet and a corporate network. When the tunnel is enabled it is essentially the same as if the computer was taken and plugged directly into the corporate network. VPN allows users to become disconnected from the network, yet still work wherever a broadband internet signal can be reached.

Getting A VPN functioning requires that firewalls be configured correctly, that a VPN device is installed on the corporate network, and that software is setup and configured on end users computers.

VPN is often a solution for home offices or small remote department offices.

A proper VPN enables the following business benefits:

- Extend geographic connectivity to anywhere on the globe
- Improve security
- Reduce running costs versus traditional WAN
- Reduce commuting time and transportation costs for remote users
- Improve productivity by allowing people flexibility on how they work
- Simplified network topology

Given the complexity of getting a VPN setup and the potential security risks that remote access can introduce, some companies have opted not to allow VPN access. As an alternative, companies may deploy a web portal instead which runs certain applications like email and file sharing. This approach offers many of the same benefits as VPN.

7.2 Internet Telephony

A course on IT management would certainly be lacking if it did not talk about one of the fastest growing trends affecting businesses today. Internet Telephony often goes by the name VOIP (Voice over Internet Protocol) but the services available extend well beyond just voice services. VOIP services are exploding in the marketplace today for several reasons. By routing phone calls over broadband Internet connections, VoIP bypasses traditional phone service and delivers practically free long-distance calling around the world. Some
companies that have switched over to VOIP have reported as much as a 70% savings in their overall telephony costs.

VOIP offers a lot more than just a telephone service. Because phones are IP based the user can move their phone anywhere in the world where there is a broadband internet connection and the phone number moves with the user. VOIP allows for implementation of services like IVR (Interactive Voice Recognition) voice to email integration and very complex routing rules without having to invest in a lot of infrastructure at any given location.

For example with VOIP it is possible to setup a routing rule like this:

When the phone rings if a person doesn’t pick it up within 3 rings it will route it to their secretary, unless it a pre-selected person (let those calls ring for 8 rings). If the secretary or user does not pick up then it will record the message and post them into an email inbox as attachments.

When people are leaving a voicemail and they press 7 they get an automated option to put an appointment into a calendar for a callback.

There are a number of different configurations and options which are available for VOIP users, but all share the same basic premise that they use the internet to transfer data packets containing voice information. One technical feature that is driving VoIP phone service is use of the Session Initiation Protocol, or SIP. SIP comes out of the world of instant messaging. SIP runs in the background and it is used to connect a teen to all of her/his friends when they are supposed to be doing their homework. SIP for VOIP makes connections between IP devices anywhere in the world without the need for old fashioned switching in between. It is a PBx and a phone system all in one, only without having to install or pay for either… which is making huge impacts on business.

VOIP offerings are generally targeted to two very different groups of users.

**Residential users:** These users use their existing broadband internet connection and layer on hardware and/or software to provide the service, or use services offered directly by their cable services provider. There are a number of offerings for VOIP that can vary from a software only solution (like Skype) to combination hardware / software offerings (Cogeco, Bell, Rogers). Some VOIP offerings do not require that replacement any of the phones or wiring that already exists. (There is a new box added that is a bridge between the cable and the existing phone lines)

Some of the reasons why people may wish to implement VOIP at home:

- Cheaper for long distance charges. (One flat monthly rate for everywhere in North America $14.99 per month in my case).
- Access to better services than a user could get from a traditional phone service. (Multiple phone numbers, caller ID, multiple voice mail boxes).
• When the user is out of the house they can use a virtual soft phone connected to their laptop and can get an internet connection anywhere to get calls which is ideal for frequent travelers.

Some of the reasons why people may think twice about VOIP at home include:

• Fairly technical initial setup. (Routers, potentially software etc.)
• May not be compatible with a users old fax machine, alarm system monitoring.
• Requires battery backup, or the phone doesn’t work when the power is out.
• Depending upon the quality and speed of the internet connection the voice quality can vary greatly. If there is have a fast connection things work great and a user can even have multiple phone calls going on at the same time as they surf. If they have a slow connection then voice quality will suffer greatly.
• Phone numbers not published in traditional phone books
• 911 service may not work in some areas

Business Users: Business users are the other targets of VOIP services. With business offerings almost always the Internet Service Provider is also the VOIP provider. With business offerings, packages can be scaled by providers from just a few users to thousands.

Typically in a business context the phones at people’s desks are replaced with an IP phone. For an IP phone instead of a phone cable connecting the phone to the wall a network cable comes right into the phone.

Most business IP phones have a large display, and a fair amount of computing power built right into them. Because of this convergence of phones with computing power it opens up a wide variety of possibilities that were previously unavailable.

A few of the myriad of applications that are possible include:

• Replacement of time & attendance time swipe machines with phones instead.
• Using the phones as a broadcasting mechanism to replace paging systems.
• A data entry portal for hotels to offer services that people used to call down to room service to access.
• Creation of virtual call centres. A business no longer needs to have everyone together in a big office to run a call centre. Using VOIP all that is needed is a fast internet connection and people. This allows companies to save on facility costs, to scale their operations to demand at will, and to provide a flexible work schedule for workers by removing the commute. Managers can still get all the stats they used to get out of their local Phone System, but using the VOIP service to provide the details.

Companies are not rushing out to replace their phone systems all today, as the existing systems may already be meeting the needs of a particular business. However as
companies are considering upgrades and replacements Internet Telephony definitely needs to be something that gets factored into considerations.

### 7.3 Virtualization

Companies face a lot of challenges in getting applications out into production:

- A particular application often requires a specific mix of patches, components and configuration options that make it difficult for multiple applications to co-exist on the same server.
- Before applications or enhancements are rolled out they need to be tested to ensure that they function correctly and do not have any unintended results on anything else running in production. This requires systems that are configured identically to what is running in production.

Because of this:

- Companies often have servers running with significant extra capacity
- Companies have servers that are only used periodically for testing and certification purposes

To counter these types of scenarios virtualization is used. With virtualization a single server is configured to run multiple different virtual operating systems and configurations concurrently. These virtual servers can each be administered independently and each one can be enabled or disabled very quickly.

All commercial virtualization solutions provide P2V (Physical to Virtual) migration tools. These tools take an existing physical server and make a virtual hard drive image of that server including all necessary modifications to the images so that the server will boot up and run in a virtual environment. The company does not need to rebuild their servers and manually reconfigure them as a virtual server—they simply import them in with the entire server configuration intact!

One added feature of virtualization is that a user can get a built in disaster recovery capability. The images created with the P2V tools can also be used to rebuild crashed servers.

Virtualization is still a relatively complex technology to setup and administer, so most companies will begin down this road by virtualizing their development and test environments as sort of a test before wider rollout.

A caution about virtualization: Unfortunately because virtualization is still relatively new many vendors may have terms and conditions in their licensing agreements to discourage virtualization. They may demand a license be purchased for each virtual session setup on the server, or may expressly prohibit their software from being installed on a virtualized server. Companies need to research this before any serious virtualization project gets underway.
7.4 Green Computing

Just like in many other areas of society there is also a movement for companies to become less environmentally damaging in their use of computers. For companies that are running data centres as their business, energy costs are often their 2nd or 3rd largest costs after labour. For these companies finding ways to reduce these costs obviously is more than just altruistic. However even for small companies there are savings that can be achieved in adopting a greener approach to computing.

A full Green Computing initiative encompasses: power/energy use, recycling of old/obsolete equipment, reductions in paper and often telecommuting.

The scope of a green computing initiative varies by organizational will. These initiatives can start with something as simple as implementing the built in power saving options on desktops right up to reconfiguring the data centre to improve air flow and reduce the needs for Air Conditioning.

For companies looking to improve their triple bottom line a green computing plan can fit well into this overall program.

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