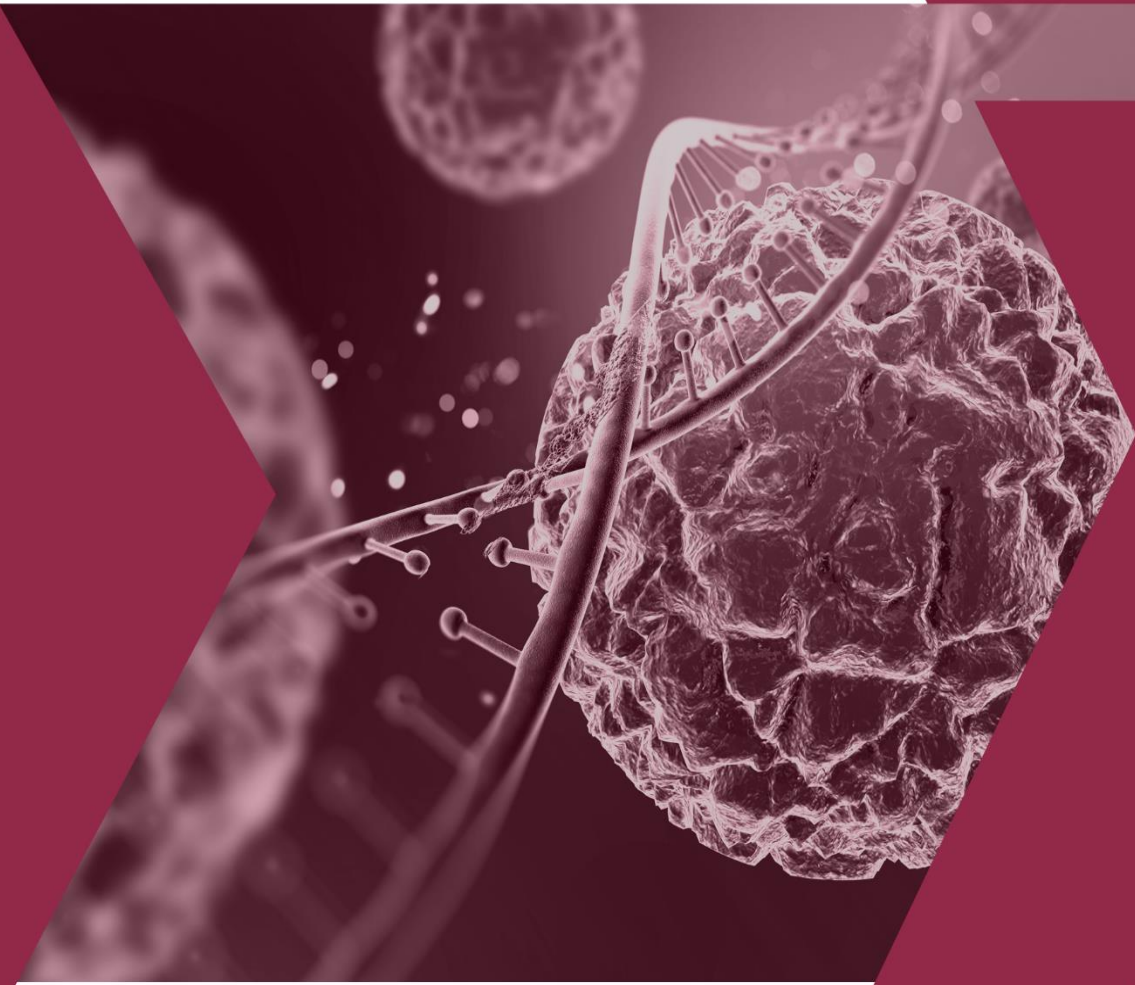


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Designing IT for Healthcare

Approaches and thoughts

2020
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About the Author



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An IT professional and a visionary who excels in drawing parallels between the business needs and digital technologies. Having presence in IT Sector since 1989, he has led many roles at operational and senior management level. Business Process Automation, IT Infrastructure, Data Centres, and service management has been his forte. Being a hands-on techie, he likes to lead by example. He has rich experience in designing multi role networks and working with stakeholders in automating business processes to achieve organisational needs. He has worked with Persistent Systems Ltd & VXL Instruments Limited – Bangalore

Wildlife photography and 4 X 4 adventure drives is his passion.

Prelude

As the healthcare industry evolves, it needs IT's agility and flexibility to deliver patient care in new and diverse ways. At the same time, providers need to tighten up the security of their infrastructures to protect patient data from the latest risks.

With the right solutions, the entire healthcare IT environment can operate transparently while delivering the agility, scalability, and unwavering reliability that today's patient care environments demand.

Is IT a real enabler for efficient healthcare services?

IT in Healthcare makes it possible for service providers to manage patient care through the secure use and sharing of health information. ...

Information Technologies (ITs) can play a critical and crucial role in improving health care for individuals and communities. By providing new and more efficient ways of accessing, communicating, and storing information, ITs can help bridge the information divides that have emerged in the health sector in developing countries—between health professionals and the communities they serve and between the producers of health research and the practitioners who need it. Through the development of databases and other applications, the ITs also provide the capacity to improve health system efficiencies and prevent medical errors. Look at some scenarios...

- A physician in a remote rural hospital is initially unable to diagnose a patient with a complex array of symptoms. However, using his computer and access to healthcare portals, searches, and access to the structured data, he can diagnose and successfully treat the patient for a tropical disease the patient picked up while traveling abroad.
- Another physician looks at her hospital's prescription trends using the newly created electronic health record system (EHR) and finds that other physicians are not using the post-surgical antibiotic that is shown to be most effective according to the current international guidelines. She speaks to the administration about advocating a switch in antibiotics that will improve patient recovery outcomes and thereby save the hospital money.
- A neonatologist, who transmits CT-scans and other medical images by e-mail to his network of personal contacts around the world to help in diagnosing and treating premature newborn, estimates that teleconsultations have helped him to save numerous lives during the past year.
- A young woman, too embarrassed to ask her physician about reproductive health issues and the risks of sexually transmitted infections, anonymously contacts physicians at a woman's health clinic, where they've set up e-mail accounts for staff to support these types of physician-patient interactions

Each of these examples demonstrates how information technologies (ITs) can play a critical role in improving health care for individuals and communities. By providing new and more efficient ways of accessing, communicating, and storing information, ITs can help bridge the information divides that have emerged in the health sector in developing countries—between health professionals and the communities they serve and between the producers of health research and the practitioners who need it. Through the development of databases and other applications, IT also provides the capacity to improve health system efficiencies and prevent medical errors.

For meeting the scenarios described above, one needs to have a fully flexible network and computing fabric with ubiquitous access and reach. This can be a great challenge and an opportunity as well. Let us look into the critical building blocks that deliver this.

Thoughts for Network design

IT Infrastructure designers many times commit “Overkill” in the specification for the networking equipment that goes into the racks. Though this adds up to the performance, at the cost of investment. A deep study is mandatory from the user perspective and some questions need to be asked and answered.

- How many people will have concurrent sessions on the proposed network?
- What are business productivity programs that the organization proposes to use?
- Will any automatic data acquisition systems pool in data to the core of the network?
- Is the data generated graphic oriented or text-based or mixed?
- What is the computing pattern or strategy? (Client-Server or Server Centric)
- Will the downloads of large files and videos be permitted from the Internet?

A judicious call will have to be taken while understanding the responses to the above questions.

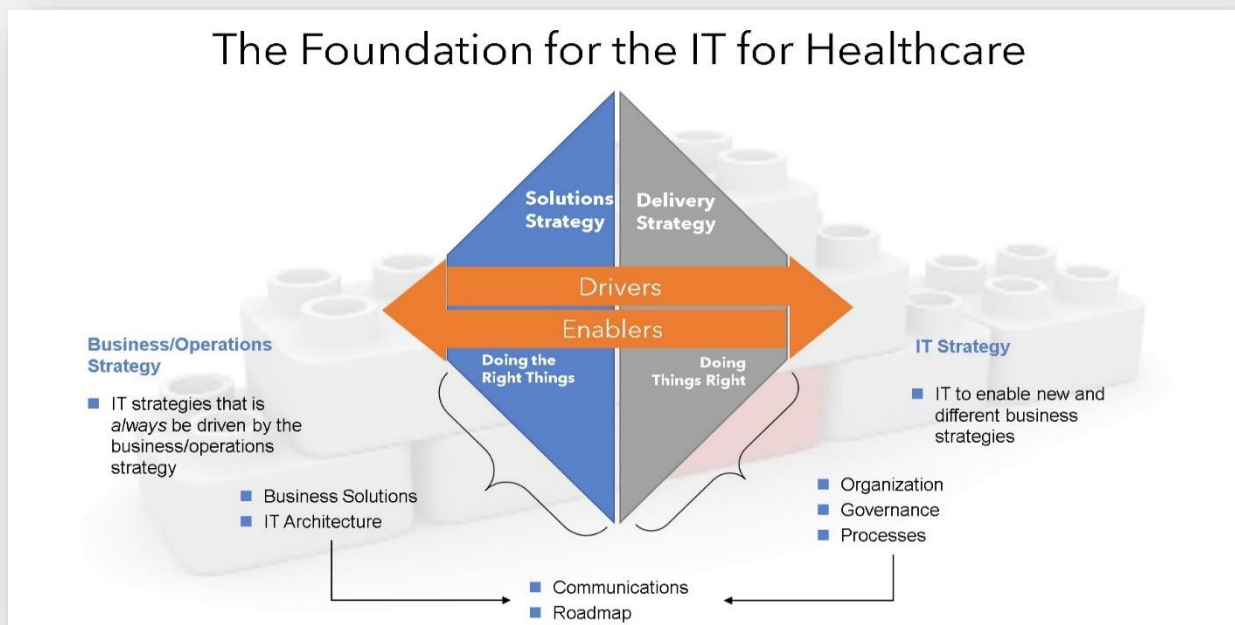
It is mandatory to have a self-healing mechanism for the backbone and the core of the network. Load balancing between Core Switches, Firewalls, IDP, IPS, WAN Optimizers may be a good idea to implement.

Aligning the hierarchy of the IT Infrastructure to Organizational hierarchy is very essential as this would govern the way the layers of the network are designed. Similar to the roles that people play in the organization, the same way computers and the nodes also perform the role play.

Designing and building a network that best suits the needs of your office is anything but trivial. It involves a host of different design and technology choices to ensure that your network is stable, lasting, and adds value to your organization.

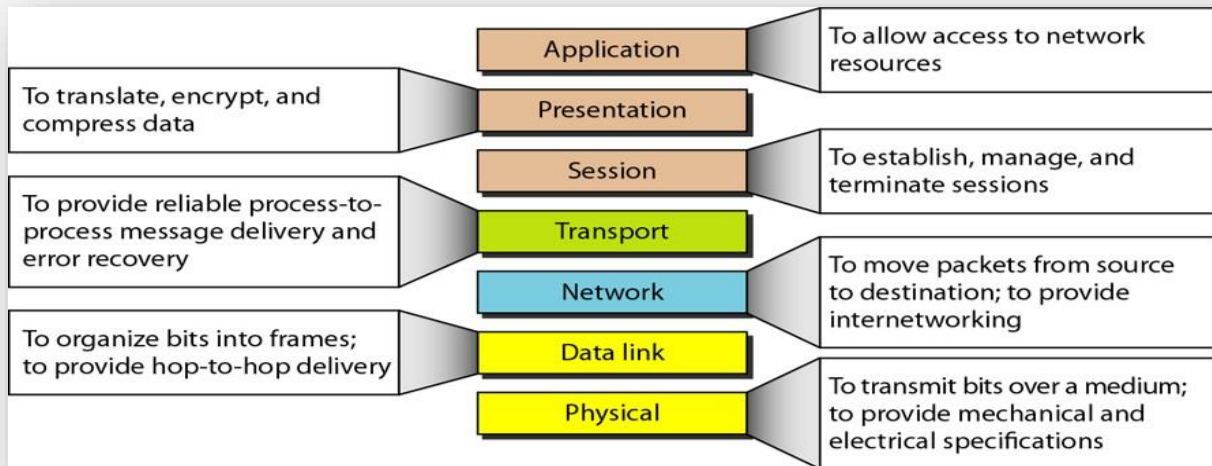
An important lesson from this experience is you have to be sure of what you are doing. Check, double-check, and triple check the requirements, and do as much research as you want on your choices. But when you get down to the actual design, be clear about what is needed.

There will be a lot of value in the adoption of “Thought Leadership” much before the much required “Technology Leadership”. The following illustration is self-explanatory to have a great beginning!



OSI model

The Open System Industry (OSI) model is the industry standard when it comes to networking and network troubleshooting. While designing any IT Infrastructure take a look back to this model. It is not only very important but also very critical to refresh the basics. Layer 1 is the king, so any disruptions in this layer can lead to outages. This is the most critical layer for a stable network.



Also, you will likely work a lot in layers 2, 3 and 4, while designing a network, so it is important to understand what happens in each of these layers, and which devices work with which layers.

Typically, layer 2 is where you will define the type of topology needed to move your traffic around. It can be your Ethernet, Token ring, ATM, DSL, or any other similar topology. Layer 3 handles the protocols like TCP/IP that you will use to route traffic from one point to another. Finally, layer 4 defines the delivery and sequencing within a network. For example, if there is a need for guaranteed delivery, then TCP is a good choice. Otherwise, UDP is good because it is lightweight and faster.

Having talked about the OSI Model, we need to make sure of the following.

- The network cabling is properly designed, and all the rules are mandatorily followed.
- All the VLANs are thoughtfully planned
- Network fabric (Switching) is adequately deployed with estimation and provisioning on MPPS for Core and access switches, Firewall capacity planning, and remote bandwidths
- HCI in the current given scenario should be a preferred option with an enterprise-class hypervisor
- Clustering of applications and databases should be on the top of the list

Internet and firewalls

Internet and firewalls are two important aspects that define your network design. For small businesses, a DSL router is enough to connect to the Internet, but for medium- and large-sized businesses, multiple redundant connections are essential to prevent failovers. Also, when you set up an Internet connection, you will have plenty of public IP addresses for different devices, so you should know how to manage them well. In general, allocate them to the right devices that need direct access to the Internet, such as your web servers.

Firewalls are another important consideration while designing a network. You have lots of different options to design and implement a firewall, but a common method is one that uses an external router to connect directly to the Internet and an internal router to connect to the organization's network. Make the right choice based on the type of firewall you want to use.

Firewall as the name suggests protects your internal resources from any cyber-attacks. So, create your access policies very judiciously. I would recommend a basic strategy of “Deny by default and Allow by exceptions.”

See the big picture

While designing a network, it is important to be able to see the larger picture, and not focus primarily on the individual aspects of a network. For example, many network designers believe routing at the edges can increase the speed of the network. Though this is true, the complexities that come with it are hard to manage. Further, it is hard to determine if the routing increased the speed of the network. In such a case, if you focus too much on routing at the edges, it may lead to security headaches for the overall network.

On the other hand, if you are able to see the larger picture, you will know why you should make a choice and how it would impact the overall network. This picture is sure to help you make better decisions.

A good rule of thumb is to keep it as simple as you can. Remember, just because you can do something, does not mean you have to. Labs and test environments are the places for experiments, not a live production enterprise system.

Constant monitoring

If you think you are done after designing and building the network, you cannot be any further from the truth. You will have to constantly monitor the network even to know if your design is right! Also, you will need more visibility into the network, especially if your organization has demanded virtualization and advanced network-intensive applications.

Documentation

Another overlooked aspect of network design is documentation. Go back to your high school days, and document every single task or change you make, as this will help to ensure you are following the established best practices. Also, such documentation would make it easy for anyone to track changes and troubleshoot effectively. Besides, documentation will grow insignificant when you add more layers and technology, as it can help with scalability and stability.

Designing a network is a complex task, as you'll have to take into account a lot of internal and external aspects, including the requirements of your organization, possible security threats, demands of virtualization, size of the organization, and more. The above-mentioned best practices can go a long way in making your life easier when you begin creating a network.

The 7 Categories of Healthcare Information Technology

The average person often does not think about healthcare software. They often do not think about how it affects the medical industry as a whole either. But its impact has revolutionized patient care on a global scale. The implementation of these systems in hospitals and practices have monumental effects. Every year more healthcare providers are taking steps to change the way their business manages their internal processes. But choosing the right one for your business can be confusing. There are several categories of healthcare information technology (HIT) and with many of these software applications sharing similar capabilities, it is not easy to distinguish one from the next. That is why we need a primer to help break down to the basics.

What is Health Information Technology?

Before we dive in too far, let us define what health information technology is. In the broadest sense, HIT is the application of information technology to healthcare. It is another way to describe the comprehensive management of information among consumers, clinicians, government, quality entities, and insurers.

The use of health information technology improves the quality and effectiveness of healthcare. It promotes individual and public health and increases the accuracy of diagnoses. The software also reduces costs and medical errors, while improving the efficiency of both administrative and clinical processes.

How Many Categories Are There?

There are three main categories of healthcare information technology and four “subcategories.” You will find these exist in both hospitals and physician offices and are beneficial for all types of providers.

Practice Management (PM)

As the name implies, practice management software (PM) helps you manage different administrative and clinical aspects of your practice. This software centralizes various systems so you can run things more efficiently. It automates almost every task that fits under the “health information management” umbrella.

PM software takes away stress and helps you optimize your time. Your overall goal is to help you provide better short- and long-term patient care, and with the correct system in place, you will exceed patient expectations.

EMR

Electronic medical record (EMR) systems are one of the most popular medical software categories. EMRs replaced paper records by digitizing medical charting, making digital versions of charts and patient histories. These systems can also alert you when patients are due for preventive procedures and screenings. Besides, EMRs help physicians treat patients by looking at their history and comparing their health data against past entries.

EHR

Electronic health record (EHR) systems function similarly to EMRs, though the former is a more robust system overall. EHRs allow you to check a patient’s history, diagnoses, treatments, medications, allergies, X-rays, test results, and more.

One major difference to note is how information is shared by each. Data from EMRs can only be viewed within one office while EHRs can share patient data with other EHRs. If a patient moves or goes to an

emergency room, they can be properly treated because different physicians will have access to their information.

Four Subcategories of Healthcare Information Technology

These systems often integrate with practice management software to provide robust functions and better patient care.

Patient Portal

Patient portals help people view everything you would find in an EMR and EHR, including patient history, treatments, and medications. They can check on records or additional notes you leave for them, even when they are not in your office. These systems have increased in popularity among hospitals and medical practices in recent years. Today's consumer expects more transparency and accessibility than ever before, so it is no wonder why portals are becoming an industry standard.

Scheduling

Scheduling software oftentimes goes hand-in-hand with a patient portal. You can direct patients to log on to their account and schedule appointments when it is convenient for them. Providing patients, the accessibility to manage their scheduling radically reduces your phone traffic.

Rather than calling every time they want to make an appointment; patients can go online via their preferred mobile device. In today's digital age, most patients choose this option to handle scheduling on their own anyway. It may be one of the biggest advantages of simplifying a small but vital process.

Medical Billing

One of the most time-consuming tasks for practices is managing all aspects of billing. It is especially true for busy hospitals and practices when there is little time to spare for most tasks in the first place.

That is where medical billing software steps in. This type of system automates patient billing and filing insurance claims. If there is an issue such as a late payment, the system alerts you so you can act accordingly.

e-Prescribing

Sending prescriptions to pharmacies can be tedious when creating orders for multiple patients. To expedite the process, physician offices began using e-Prescribing software. In just a few clicks a prescription is sent, filled, and waiting for the patient when they get to the pharmacy. Additionally, e-Prescribing systems ensure there is never a prescription mix up due to hard to decipher handwriting.

The system displays the prescription at the pharmacy, ensuring patient safety by giving them the correct one. A study by Decision Resources found that using e-Prescribing software has increased the prescribing of generic drugs. You are able to keep better track of patient records and provide more cost-effective medication.

The Health Information System Provisioning

Although HIS offers many potential benefits, individuals, and institutions have been slow to adopt the technology. In some cases, the issues are financially motivated. Even when monetary incentives are provided by the federal government, implementing HIS can be too expensive of a turn off for providers.

Other times the problems are technical. One example of this occurs when companies try to interface different proprietary systems with health information technology containing laboratory or medication data.

To choose and use HIS effectively, an organization must be diligent in researching both current and proposed requirements. Despite initial difficulties associated with implementing the program, the outcomes are worth the risk and effort.

Start Using Healthcare Information System?

Make the choice and take the decisions

Though there are many systems to choose from, we hope this list can help narrow your search. Request demos from vendors so you know what each program is capable of before making a final decision.

Think of how processes will be streamlined at your hospital or practice once you do implement a system. It could make the least favorable tasks much easier to manage for you and the rest of your staff.

Building Blocks for Enterprise Management System for Healthcare

In today's world, it has become mandatory to have a well-engineered and thought of business processes for the highest performance and efficiency. Moreover, IT has to be seamlessly interfaced with the business processes. This alignment is nothing but IT enablement of the enterprise.

Service convergence is the "mantra" for sustained and continued performance of the EMS. Being unified yields better control and predictability over how the infrastructure will perform during critical instances.



If you want to define the scope of the Enterprise Management System, you must get answers to the following questions.

1. What is required to be done by the system?
2. Type of access and reach to the system... ubiquitous access?
3. Devices and I/O those will communicate with the system
4. Areas of collaboration vs business requirement

The entire building blocks that are required to cover the end to end business model can be categorized into the following layers.

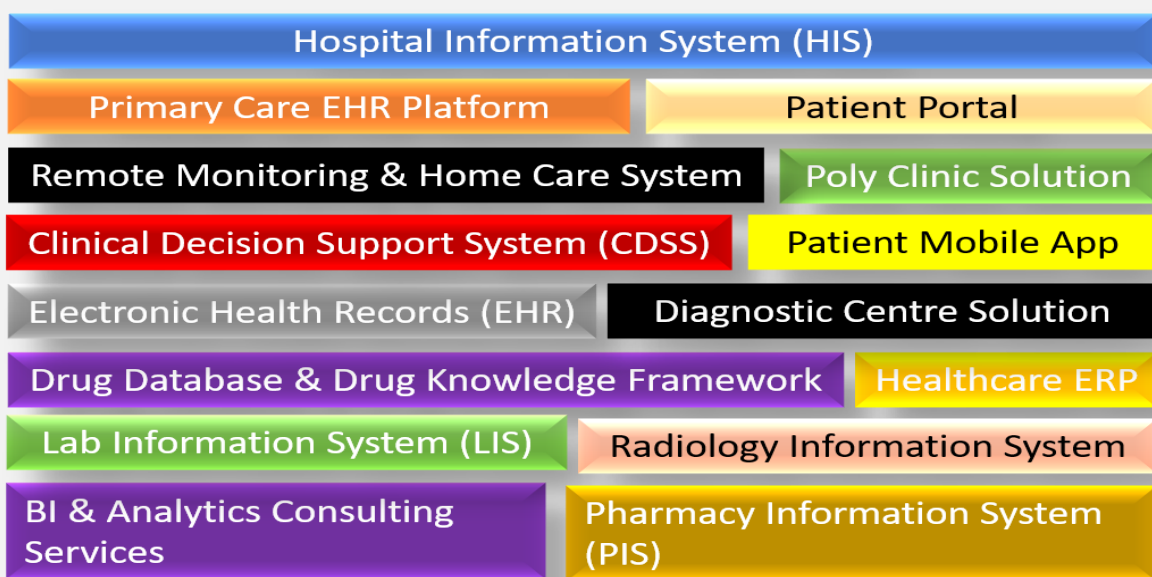


1. Collaboration Layer
 - a. Patients Portal
 - b. Remote medicine
 - c. Clinical portal and pathway
 - d. Doctor's Portal
 - e. Clinical MIS etc.
2. Analytics & Collab Management
 - a. Capex vs OPEX
 - b. Equipment Performance
 - c. TPA
 - d. Specialty P&L
 - e. Revenue mapping & management
 - f. Scheduling
 - g. Clinical Analytics
 - h. Schemes Launch & Monitoring

3. Operation Layer
 - a. OP, Org Structure, CRM, Referral, Registration, Taxation,
 - b. Casualty, HER, EMR, Lab Management, OP Clinic, Nursing & Ward, HRMS
 - c. ICU / HDU, OT & Surgery, Payments & TPA, Inventory Management, Employee cost, Payroll, Fixed Assets
 - d. Surgical Care, Blood Bank, Pharmacy, Vendor Management, Revenue and collection, Cost Allocation, Cash & Bank

4. Add On / Operational Module
 - a. Imaging
 - b. EYE Bank
 - c. Laundry & Linen
 - d. Kitchen
 - e. CSSD
 - f. EMR
5. Integration with third party Applications
 - a. Ambulance, Bedside Monitors
 - b. Barcode & Assets
 - c. Modalities & Lab Equipment
 - a. Payment Gateway and Third-Party Apps

One also needs to do a good in-depth requirement analysis into the following model



Conclusion

- All healthcare facilities are not the same. So, design the IT Infrastructure after several sessions with the business stakeholders.
- Though 100% uptime is required, do not oversubscribe the links and the backbone leading to higher CAPEX. Plan the trade-off.
- Design for the future. **Think 5 years ahead**
- Do not compete with the competition set your path of technology leadership and enjoy an uncluttered highway to success.
- Always remember that any technology solution will only sustain if its “Affordable and Appropriate”.
- Use the **‘Six Thinking Hats’** school of thoughts while investing in technology.