1. Network types
   1. Star network
   2. Mesh network
2. Security
   1. Firewalls
   2. HIPPA compliance
   3. Access of information
3. Proposed architecture
   1. Star network
   2. Secure database
   3. LAN behind firewall

A quick search on the largest hospitals in the world will show that the United States does not rank among the top ten (Goddard, *Top 10 largest hospitals in the world*). While this may sound optimistic, that the United States does not need hospitals as large as those in more populated countries, it could also mean that modern local hospitals are not equipped for the influx of patients, due to poor IT infrastructure. Kyle Stevens Hospital faces the problem of network latency and poor connectivity as a result of adding a new “Radiology Images” department. “Infrastructural inefficiencies and protocol overheads” cause latency by “more than one, and often, by more than two orders of magnitude (Chandrasekaran, Godfrey, Maggs, Singala, *The Internet at the Speed of Light*). For this reason, Kyle Stevens Hospital’s current network architecture must be updated to accommodate the increase workload of the hospital. An exploration of current hospital network architecture reveals five areas to consider when creating a hospital network: carrier-class performance, flexibility and scalability, end-to-end security, operational simplicity, and total cost of ownership (Juniper Networks, *Five Requirements of a Healthcare Network*). Kyle Stevens Hospital will need to incorporate all of these areas to better meet patient demands. Due to the critical nature of hospitals, “redundancy is an essential element in facilitating reliable and safe operations in health care delivery processes” (Tay, *Revisiting Redundancy in Hospitals – A Case-based Research Study*). Since Kyle Stevens Hospital is a growing hospital, future scalability must be considered as well. HIPAA laws require complete end-to-end security of all patient information; thus, security will be a top priority. Since the hospital is implementing a large network, it must be simple enough to implement and scale up when the time comes. Lastly, cost is a factor since implementation will be no small feat. Through the outlook of these areas, Kyle Stevens Hospital will set itself up for success.

Even though technology enhances hospital’s services and abilities, “system outages and network downtime . . . can result in serious risk to patient safety (Juniper Networks, para. 5). A necessary component for redundancy is information backups. This can be solved through having multiple backups servers for patient records. These servers must continually be in sync. Syncing two large servers housing patient records raises two more areas to be considered: power and throughput. The issue of powering both serves can be addressed by implementing power sources, should one fail. The latter issue of throughput will need to be addressed via the network bandwidth. A proposed solution for improving bandwidth is to “utilize a forwarding identifier to indicate the compressor’s location, separating the header compression process from the packet forwarding process. In this way, context identifiers with an identical value are allowed to coexist in the same network, and flow table entries matching the compressed flows can be aggregated,” as discussed by Dong, Qin, Sun, Yan, Zhang, and Zheng (para.). The reason for this proposed forwarding identifier and proposed compression separation is because current convention has potential to limit processing capacity, as well as scalability. Since Kyle Stevens Hospital is looking ahead at future expansion, scalability is a prominent topic. By breaking down the information packets, these packets can be transferred more quickly, as well as the header packets providing an optimal route across which the information packets to be transferred. The benefits of this network design create two addresses for each network node: one to identify the node, one to locate the node. If the location of the node changes, its identity will remain unchanged, thereby transferring small packets across the network. This transfer of smaller packets means the same network can handle greater throughput. Locator/ID separation protocol (LISP) is the main protocol used for this type of network routing. LISP is especially useful for VLANs, where the network is comprised of many wireless devices. LISP allows the wireless devices to maintain the same IP address even when they’re location changes, because the endpoint identifier does not change, only the routing locator. Both duplicate servers and locator/ID separation protocol will increase the redundancy and carrier-class performance of Kyle Stevens Hospital.

Utilizing locator/ID separation protocol also promotes flexibility and scalability within Kyle Stevens Hospital. A major advantage of the LISP protocol is that it can be widely used for virtual local access networks (VLAN), where many of the connected devices are wireless. This is beneficial for scalability as it moves networks away from being Ethernet driven networks. While Ethernet networks are great for flexibility, they lack the scalability needed in growing hospital networks (Alezabi, et al., para. 3). Scalability can also happen through various routing mechanisms: routing at the source, routing implicitly, aggregate granularity, and imposing routing restrictions (Cox, et al., pt. 1). Routers aid in network scalability but can be costly, as well as necessitate complicated configuration and maintenance. However, for Kyle Stevens Hospital, routers prove a more viable option as most connected devices are wireless. This means that a relatively simple architecture and protocol should be implemented, as will be discussed later. The architecture of choice must contain the ability to either scale up or scale out. Scaling up refers to additional processing power and storage, while scaling out refers to adding more routers, switches, devices, etc. (Sundvall, p. 30). Kyle Stevens Hospital will take the approach of scaling out, adding more routers and switches when necessary. This will be the easiest and most flexible approach, as it will provide scalability for new departments when the time comes. Should Kyle Stevens Hospital choose to use a Cloud database server versus an on-premises, a network load balancer would benefit the hospital greatly for scaling out (www.aws.com). During busy hours when many EHRs are needed at the same time, a network load balancer can increase the number of database servers to handle the load (Alankar, et al., para. 2). This will allow greater flexibility and scalability withing Kyle Stevens Hospital.

With a proposed Cloud database, one might ask about the security of confidential EHR. This is a valid concern, as Kyle Stevens Hospital will not have access to the physical hardware. It provides many advantages, however, as the hospital will not have to power the large servers.