



**Logic Finder**  
Consulting, Development and Training

# **Network and Systems Infrastructure Upgrade**

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## 1- EXECUTIVE SUMMARY

This project aims at uplifting the California Library System and Network for their 50 locations. The library system is expanding and the current network no longer fully supports the evolving needs. While a complete overhaul is no easy feat, the benefits are often worth the investment, increasing both efficiencies and capabilities within the Network.

The primary goal of this project is to upgrade the existing network of California Library system. The network redesign involves redesigning library LAN and the upgrade of the WAN links. WAN helps ensure that an organization maintains its connection, while increasing efficiency, eliminating redundancies and prioritizing data. We will highlight several best practices that should be used for any network upgrade project. Whether it is upgrading network switches at a remote office, replacing an aging wireless network or implementing the latest network infrastructure technologies in the data center, each upgrade should follow same tried and true best practices i.e. Upgrading to network solution that best meets organizational requirements, determining user impact during the upgrade process & after the upgrade is complete, performing the upgrade with as little business impact as possible and ensuring that the upgrade can be properly supported once in production.

## 2- INTRODUCTION

When a small company grows rapidly, the original network that supported the company often cannot keep pace with the expansion. Employees at the company may not realize how important it is to properly plan for network upgrades. In many cases, the business may just add various network hardware devices, of varying quality, from different manufacturers, and different network connection technologies, to connect new users. Often this causes degradation in the quality of the network as each new user or device is added. If this continues, at some point the network is unable to properly support the types and level of network traffic that the users generate. Only when the network starts to fail do most small businesses look for help to redesign the network. An ISP or managed service provider may be called in to provide advice and to install and maintain the network upgrade. With the help of LogicFinder, the complicated process of upgrading the infrastructure is put into the hands of a team of talented experts who can make system better than ever.

Older infrastructure can experience performance issues when encountering a higher volume of use than they are capable of handling. This can cause a severe slow down or even a complete halt in operations, something that no growing business can afford to let happen. With an outdated infrastructure also comes an increased security risk. Older applications and operating systems tend to have more vulnerability that hackers can target, putting the information of company and customers at risk. An upgraded infrastructure leads to increased efficiency and productivity and stronger security. While an infrastructure upgrade clearly has huge advantages for business growth and security, it is no simple feat to implement the necessary changes to truly bring an outdated system up to par. Organization may need a complete overhaul of hardware for upgradation of network infrastructure and depends on the specific needs of organization.

### 3- PROJECT SCOPE:

The main goal is to upgrade the network for better performance in terms of speed. To overcome the existing issue of speed, there is a need to upgrade or replace the entire network equipments or devices.

The major objective of this project is to upgrade the network of California Library system Hospital in order to:

- Provide more than adequate bandwidth between the remote locations.
- Improve and consolidate network performance at California Library system.
- Provide increased network capacity.
- Provide future expansion capability.
- Improve the network's fault tolerance, security, and high speed connection, which will increase the efficiency of day-to-day operations in the hospital by making access time quicker.
- Identify the critical points of failure in the existing network and propose on how to eliminate them.
- Recommend which points of failure should be addressed to increase availability and how to increase this goal

#### 3.1- PROJECT REQUIREMENTS

As the businesses grow, the outdated networks no longer support their needs, necessitating an upgrade. Problems with the current network or its related technologies often create the need for an infrastructure upgrade. While an infrastructure upgrade will certainly require an investment, they can actually help one cut costs by granting the ability to implement newer technologies such as virtualization, which enables one to consolidate space and resources.

### 4- NETWORK UPGRADE PROCESS

The planning of a network upgrade begins after the initial site survey and requirements of specific business networks are gathered. It consists of five distinct phases:

- Phase 1: Requirements gathering
- Phase 2: Selection and design
- Phase 3: Implementation
- Phase 4: Operation
- Phase 5: Review and evaluation

The next sections describe each phase in detail.

## PHASE 1: REQUIREMENTS GATHERING

After all the information has been gathered from the customer and the site visit, the design team analyzes the information to determine network requirements and then generates an analysis report. If insufficient information is available to properly determine the best network upgrade path to follow, this team may request additional information.

## PHASE 2: SELECTION AND DESIGN

When the analysis report is complete, devices and cabling are selected. The design team creates multiple designs and shares them with other members on the project. This allows team members to view the LAN from a documentation perspective and evaluate trade-offs in performance and cost. It is during this step that any weaknesses of the design can be identified and addressed. Also during this phase, prototypes are created and tested. A successful prototype is a good indicator of how the new network will operate.

## PHASE 3: IMPLEMENTATION

If the first two steps are done correctly, the implementation phase may be performed without incident. If tasks were overlooked in the earlier phases, they must be corrected during implementation. A good implementation schedule must allow time for unexpected events and also schedules events to keep disruption of the customer's business to a minimum. Staying in constant communication with the customer during the installation is critical to the project's success.

## PHASE 4: OPERATION

When the network implementation phase is complete, the network moves into a production environment. In this environment, the network is considered live and performs all the tasks it has been designed to accomplish. If all steps up to this point have been properly completed, very few unexpected incidents should occur when the network moves into the operation phase.

## PHASE 5: REVIEW AND EVALUATION

After the network is operational, the design and implementation must be reviewed and evaluated against the original design objectives. This is usually done by members of the design team with assistance from the network staff. This evaluation includes costs, performance, and appropriateness for the environment. For this process, the following items are recommended:

- Compare the user experience with the goals in the documentation, and evaluate whether the design is right for the job.
- Compare the projected designs and costs with the actual deployment. This ensures that future projects will benefit from the lessons learned on this project.
- Monitor the operation, and record changes. This ensures that the system is always fully documented and accountable.

It is important that, at each phase, careful planning and review occur to ensure that the project goes smoothly and the installation is successful. Onsite technicians are often included in all phases of the upgrade, including planning. This allows them to gain a better understanding of the expectations and limitations of the network upgrade and to give the end users a much-improved level of service.

A network that is a patchwork of devices strung together using a mixture of technologies and protocols usually indicates poor or no initial planning. These types of networks are susceptible to downtime and are extremely difficult to maintain and troubleshoot. Unfortunately, this type of network is often encountered as small businesses experience rapid, unexpected growth. Even larger organizations often experience unplanned growth in their networks when they acquire or merge with other organizations. Organizations that experience a controlled rate of growth can properly plan their network to avoid problems and give their users an acceptable level of service.

## 5- NETWORK DESIGN OVERVIEW

The figure shows the top overview of the network. This is just sample design of the network and we assume this is the top network view of California Library system and we can upgrade this network by replacing the switches, routers and servers with new advanced intelligent devices that means removing old ones and implementing new smart devices to achieve better security and high speed.

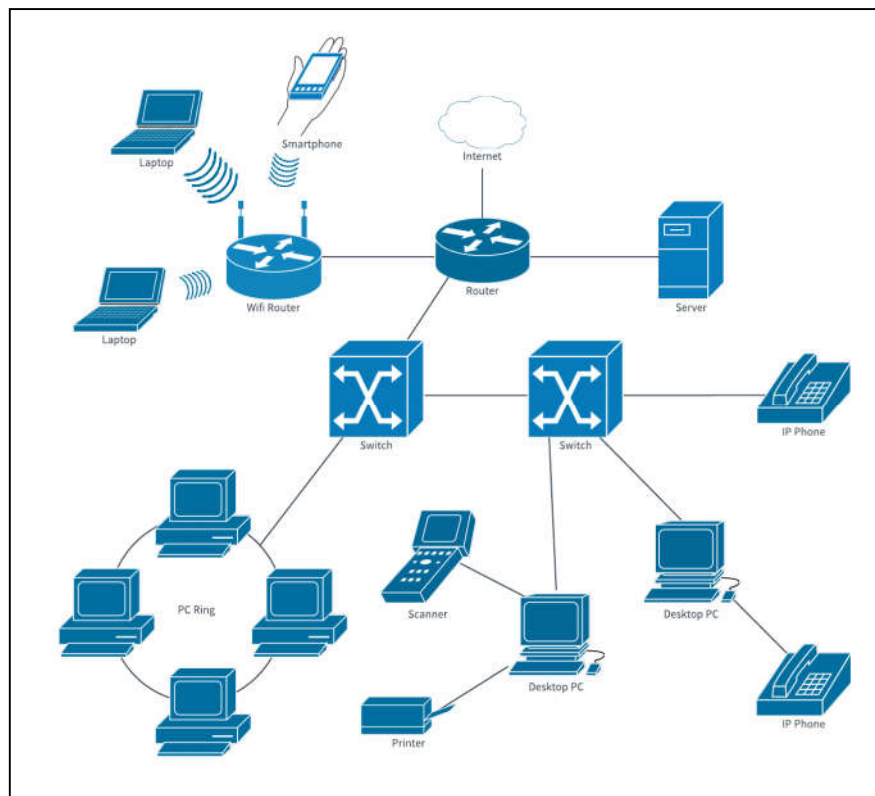


Figure 1 Top Network Overview

## 6- DATA CENTER DESIGN OVERVIEW

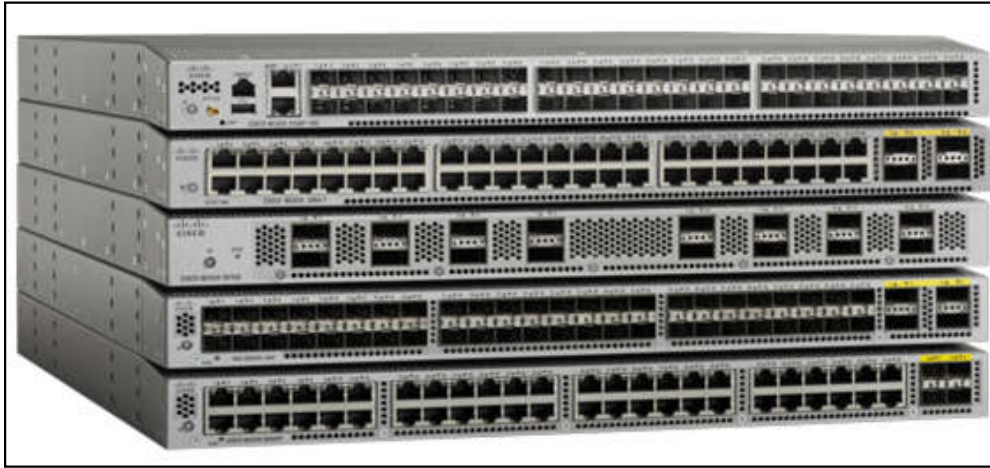
With the increasing need for computing power and space in data centers, server rack is often used to achieve high density. The server rack is a framework used for accommodating data center IT equipments such as servers, storage, HUB and network switches. It is designed to improve efficiency of data center network management and operation.

Network switches, router and server are placed in the server rack so the size of rack is look like this:



Figure 2 Rack Layouts

## 6.1- CISCO NEXUS 3000 SERIES



The 3000 Series offers low-latency, highly programmable, high-density switches. They are excellent for general-purpose deployments, high-performance computing, high-frequency trading, massively scalable data center, and cloud networks.

## 7- HARDWARE LIST

To upgrade the entire network for California library system need to change the network devices .i.e. switches, HUBs, router etc because of better performance.



Figure 3 Cisco 2960 Switch



Figure 4 Cisco 1841 ISR



Network cables are also required. You have many different types of network cables to choose from; some are more common than others. Each type of cable is best suited to specific applications and environments. The most common type of LAN cable is unshielded twisted-pair (UTP). This cable is easy to install, is fairly inexpensive, and has a high bandwidth capability. For long backbone runs or runs between buildings, fiber-optic cable normally is installed.

## 8- IP NETWORK ADDRESS TABLE

Planning for the network installation must include planning the logical addressing. Changing the Layer 3 IP addressing is a major issue when upgrading a network. If the network's structure is changed in the upgrade, the IP address scheme and network information may need to be altered to reflect the new structure.

When developing the addressing scheme, one must consider every device that requires an IP address, now and in the future. Some devices require addresses to carry out their functionality, and others only require an IP address to allow them to be accessed and configured across the network. Hosts and network devices that require an IP address include

- User computers
- Administrator computers
- Servers
- other end devices such as printers, IP phones, and IP cameras
- Router LAN interfaces
- Router WAN (serial) interfaces
- Standalone switches
- Wireless access points

For example, if a new router is introduced to the network, new local networks, or subnets, are created. These new subnets need to have the proper IP address and subnet mask calculated. Sometimes, this means having to assign a totally new addressing scheme to the entire network.

After all the planning and design phases are complete, the upgrade proceeds to the implementation phase, in which the actual network installation begins.

## 9- ONFIGURATIONS

- a. Tool Leaf Configuration
- b. Network Leaf Configuration
- c. Load Balance Configuration
- d. Firewall Configuration
- e. Switches configuration
- f. Router configuration
- g. Core Switch
- h. Router-1
- i. 20pc + Server (3)

## 10- UPGRADED INFRASTRUCTURE TOPOLOGY DIAGRAM

Figure-5 shows the data center network topology. Which provide details on each layer of this recommended infrastructure.

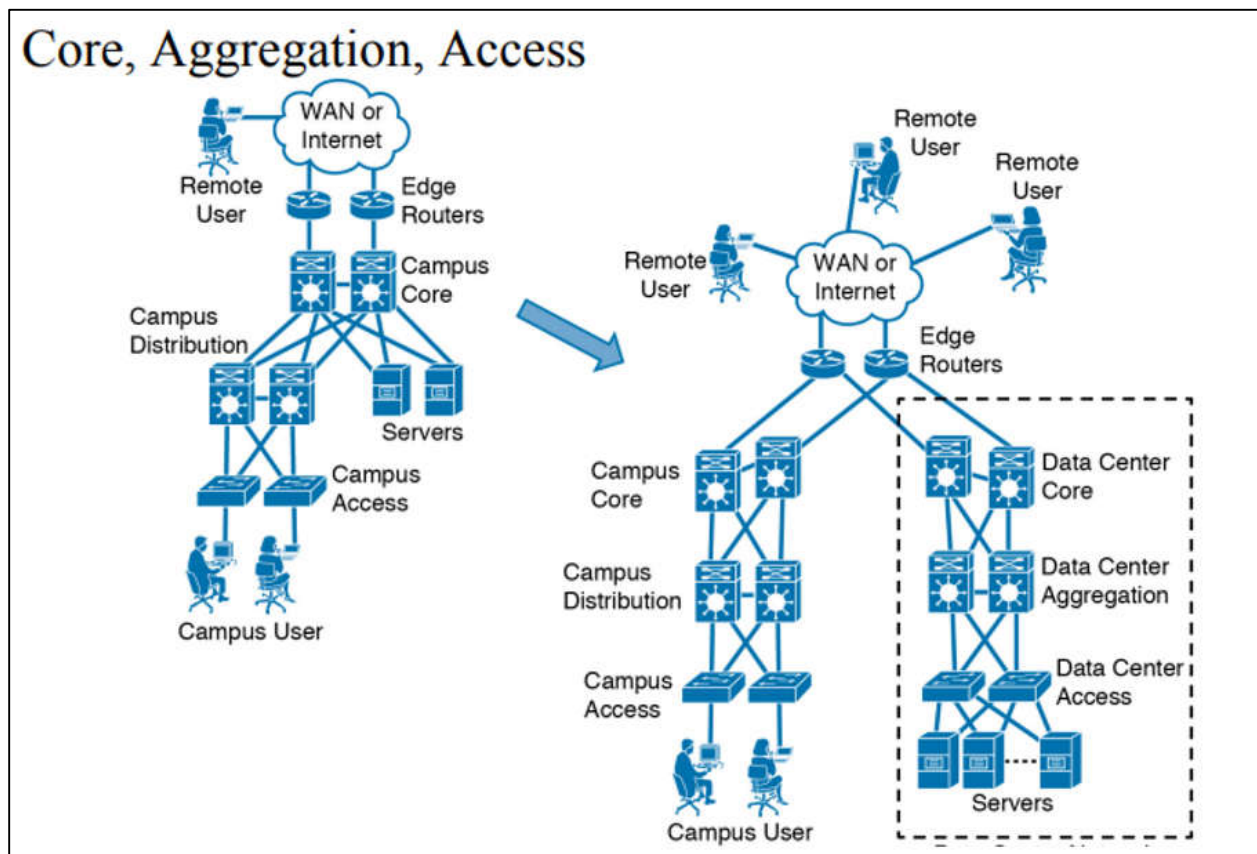


Figure 5 Data Center Network Topologies

## 10.1- DATA CENTER NETWORKS

- 20-40 servers per rack
- Each server connected to 2 access switches with 1 Gbps (10 Gbps becoming common)
- Access switches connect to 2 aggregation switches
- Aggregation switches connect to 2 core routers
- Core routers connect to edge routers
- Aggregation layer is the transition point between L2-switched access layer and I3-routed core layer
- Low Latency: In high-frequency trading market, a few microseconds make a big difference. ⇒ Cut-through switching and low-latency specifications.
- Core routers manage traffic between aggregation routers and in/out of data center
- All switches below each pair of aggregation switches form a single layer-2 domain
- Each Layer 2 domain typically limited to a few hundred servers to limit broadcast
- Most traffic is internal to the data center.
- Network is the bottleneck. Uplinks utilization of 80% is common.
- Most of the flows are small. Mode = 100 MB. DFS uses 100 MB chunks. [1]

## 11- CONCLUSION

Networks often experience unexpected growth and develop in a disorganized manner. When this happens, network performance degrades slowly with each new device added. At some point, the network no longer can support the traffic being generated by the users, so a network upgrade is required. Upgrading networks could be tricky due to the fact that a network touches every aspect of IT infrastructure of a business and impacts a wide range of users. From the end user to the server admin, and all the way to the application developer, everyone is affected by a network upgrade for better or worse. That is why it is absolutely critical that an upgrade plan be put in place that uses best practices.

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