



# CCNA Discovery 4.0 Designing and Supporting Computer Networks



## Characterizing Existing Network— Chapter 3

Cisco | Networking Academy®  
Mind Wide Open™

# Objectives

- Characterize an existing network to identify strengths and weaknesses present in the design.
- Choose the appropriate hardware and software upgrades to prepare the network for the integration of new technologies.
- Upgrade the Cisco IOS software on a router or switch.
- Describe the process to perform a wireless site survey.
- Create a detailed network Design Requirements document.

# Creating a Network Diagram

- Typically, the first step in installing a new network is to take a detailed look at the existing network. The NetworkingCompany designer examines the existing network to:
  - Determine if the design goals are realistic and feasible
  - Determine if the existing network meets the expectations for scalability, availability, security, and manageability
  - Identify where new equipment, infrastructure upgrades, and new services can be integrated
  - Ensure that old and new network devices, media, and functions can work together

# Creating a Network Diagram

- Upgrading the Stadium Network
- Like most organizations, the stadium has a pre-existing network. The management wants to install a new network to:
  - Better manage its existing voice, video, and data networks
  - Improve customer service
  - Reduce costs



# Creating a Network Diagram

- The NetworkingCompany designer reviews the existing network documentation. The stadium IT department network documentation contains most of the information that the designer needs concerning network organization and services.
- **The network documentation should include:**
  - Logical and physical diagrams of the network
  - Floor plans showing the location of wiring closets and wiring runs
  - Inventory lists of installed network equipment
  - Current network configuration files
  - Inventory lists of network applications

# Creating a Network Diagram

- Producing a Network Topology Map
- As is the case with many businesses, the StadiumCompany's network documentation is not up-to-date. A new diagram will need to be created of the network as a whole, as well as the different segments that comprise it.
- Network management programs collect information and produce a diagram of the current network. Cisco Network Assistant and CiscoWorks are two examples of network management programs.

# Creating a Network Diagram

- The network designer uses standard Cisco IOS commands to obtain information about the devices and the routes that data takes through the network.
- The Cisco IOS software offers useful commands to gain information from a router to create a network diagram. Some of these commands are:
  - show version
  - show running-config
  - show ip route
  - show cdp neighbors detail
  - show controllers
  - show tech-support

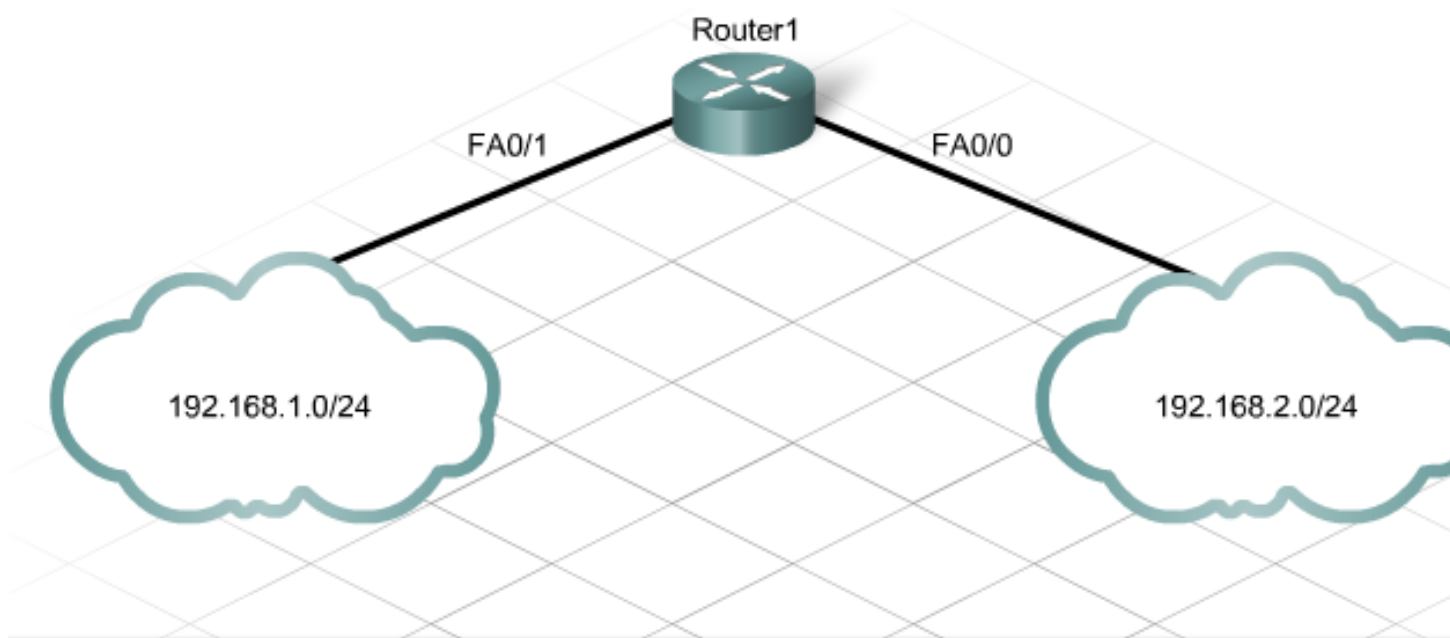


# Creating a Network Diagram

- The show tech-support command can collect a large amount of information about a router. The output from this command varies depending on the router or switch platform and configuration.
- Many of these same commands are used to gain information on a Cisco switch. Other useful switch commands include:
  - show vlan
  - show vtp
  - show spanning-tree



# Creating a Network Diagram



```
Router1#show ip route
```

```
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
```

```
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
```

```
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
```

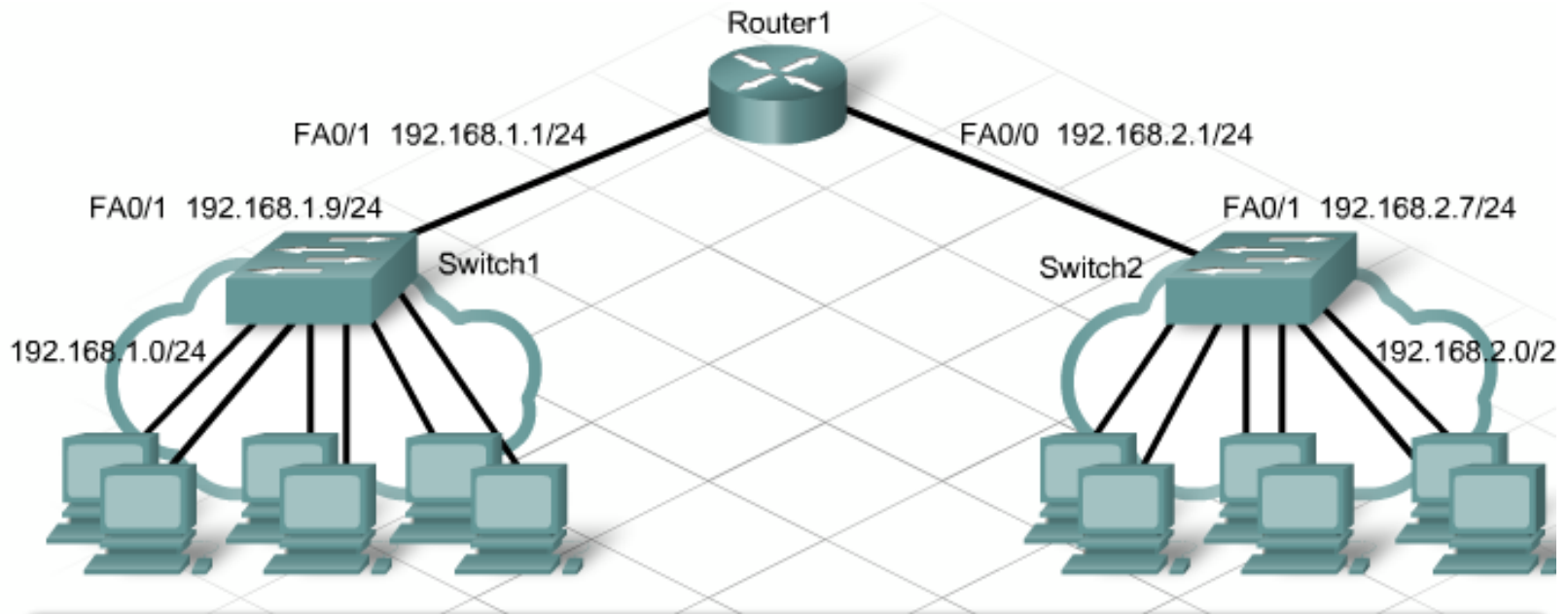
```
E1 - OSPF external type 1, E2 - OSPF external type 2
```

```
i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
```

```
ia - IS-IS inter area, * - candidate default, U - per-user static route
```

```
o - ODR, P - periodic downloaded static route
```

# Creating a Network Diagram



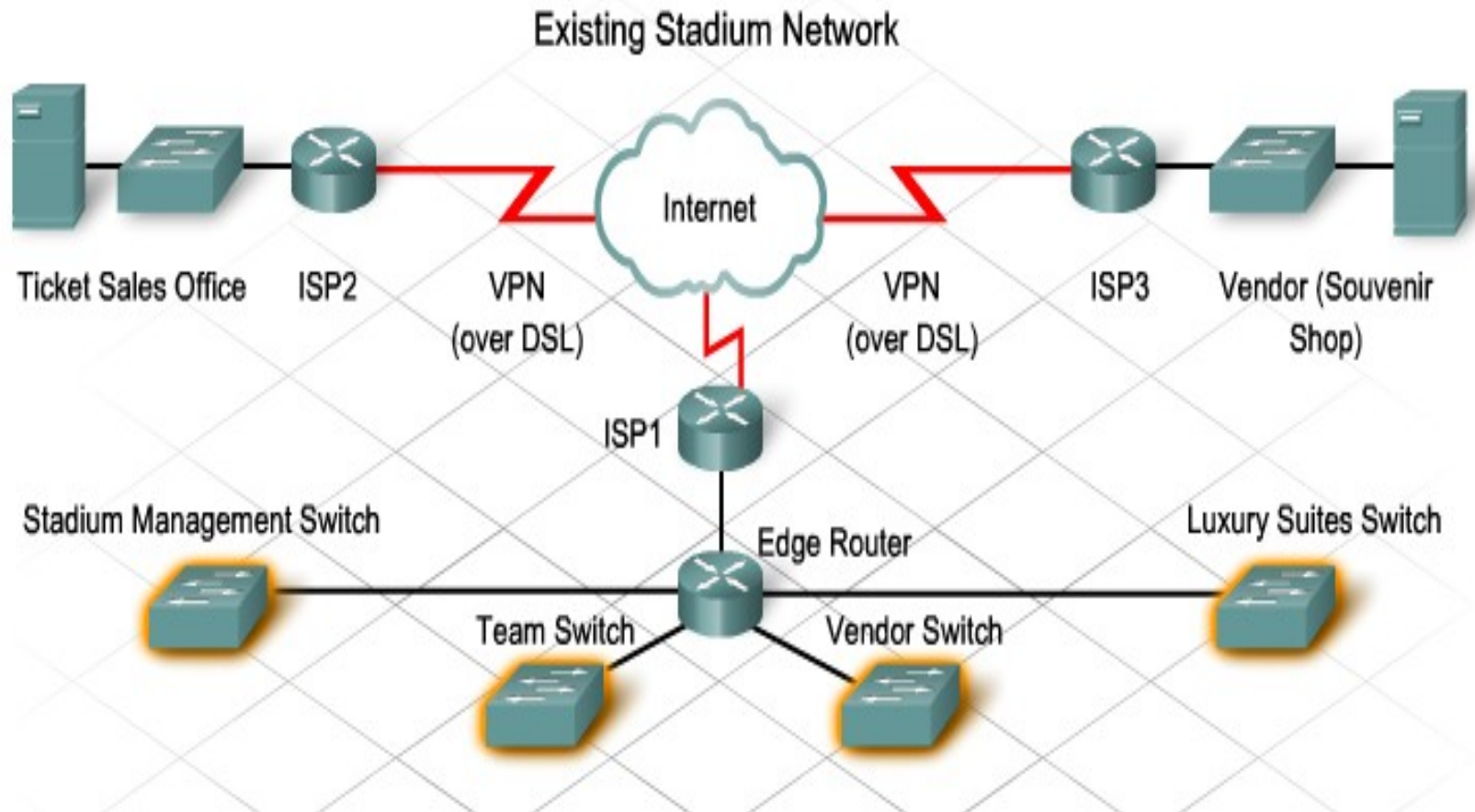
```

Router1#show cdp neighbors detail
-----
Device ID: Switch2
Entry address(es):
  IP address: 192.168.2.7
Platform: cisco WS-C2960-24TT-L, Capabilities: Switch IGMP
Interface: FastEthernet0/0, Port ID (outgoing port):
FastEthernet0/1
    
```

# Diagramming the logical architecture

- Creating an Existing Network Overview Diagram
- On the stadium network project, the first diagram that the network designer creates is a high-level view of all of the stadium network sites. The diagram shows:
  - The main stadium network
  - The souvenir shop
  - The ticket outlet locations
  - Connectivity to remote sites
  - Connectivity to business partners

# Diagramming the logical architecture



# Diagramming the logical architecture

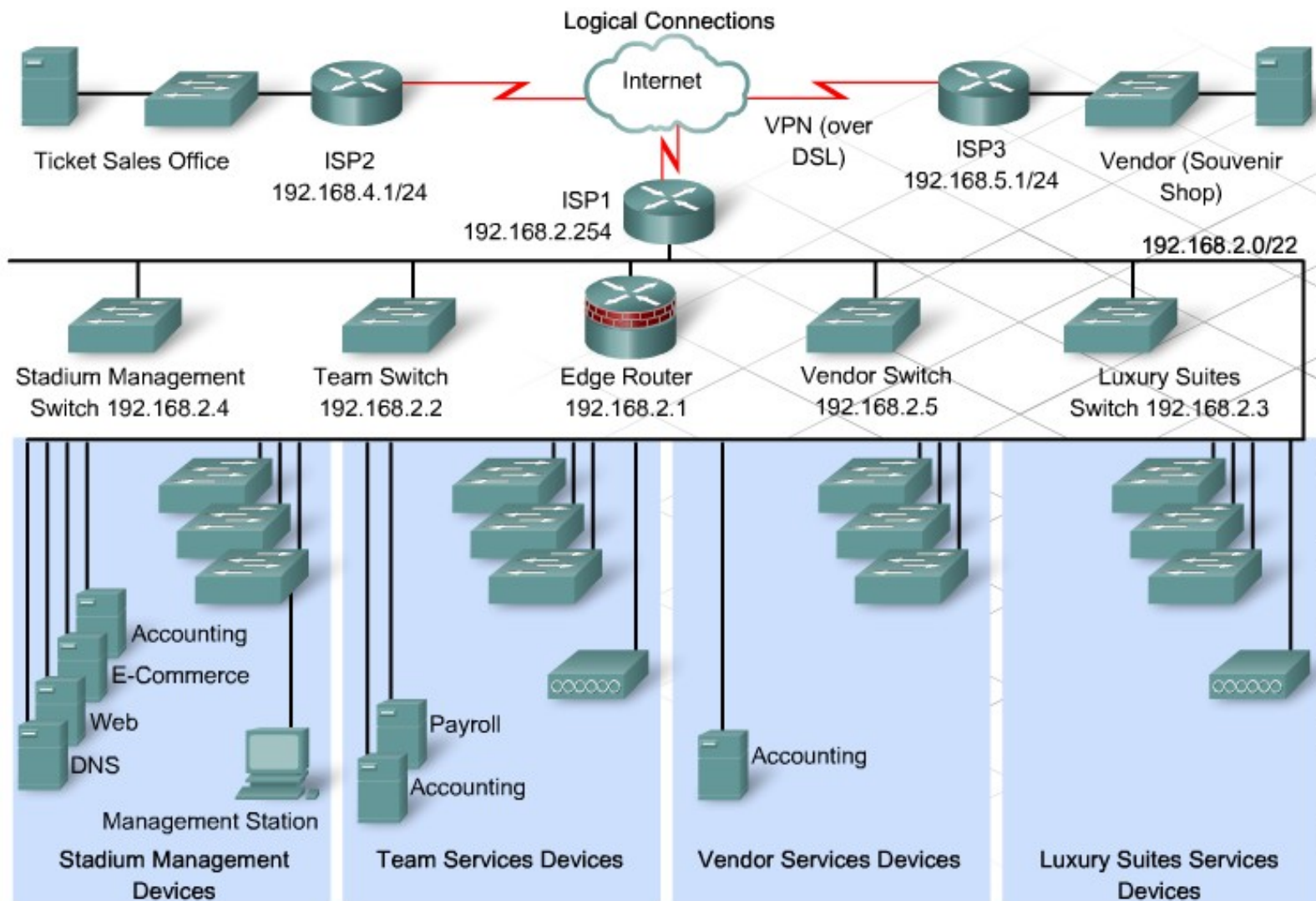
- Creating Network Segment Diagrams
- Next, the designer creates diagrams for the logical and physical layouts of the networks installed at each of the various sites.
- Each diagram shows:
  - The location of the network equipment and wiring closets
  - The logical addressing information
  - The naming information

# Diagramming the logical architecture

- Creating a Logical Diagram of the Main Stadium LAN
- The designer creates a logical network diagram that shows the major pieces of networking equipment and how they interconnect. This diagram includes:
  - Routers and switches
  - Wireless Access Points
  - Critical telecommunications equipment (CSU/DSU, modems, etc.)
  - Firewalls and intrusion detection devices (IDS)
  - Management stations
  - Servers and server farms



# Diagramming the logical architecture





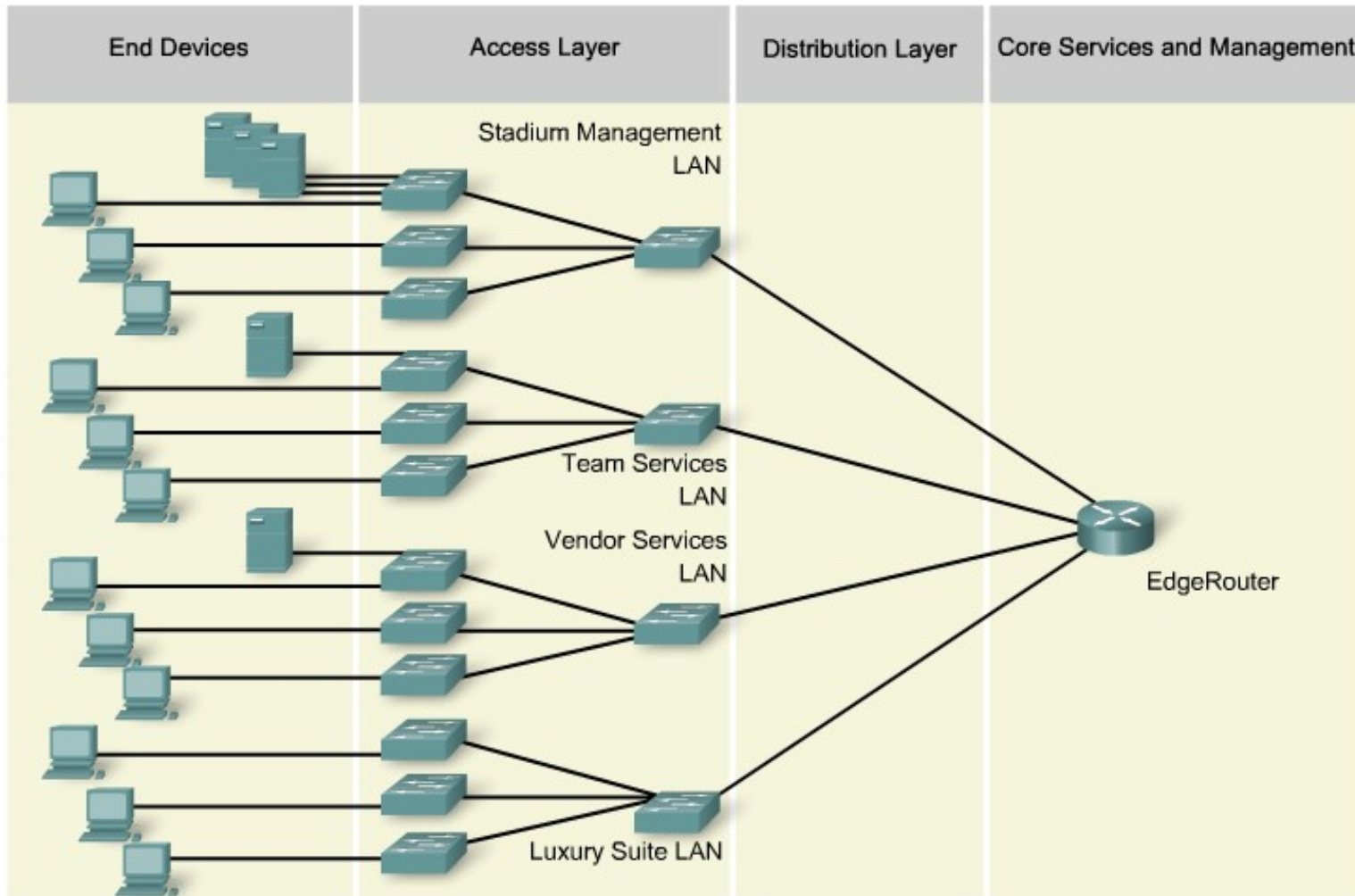
# Developing a Modular Diagram

- The stadium network has grown significantly from its initial design. The NetworkingCompany designer takes the logical diagram and organizes the network into a modular block diagram.
- A modular block diagram is a simplified version of the network. The diagram shows the major functions in modular form. It helps the designer to determine the underlying architecture on which the network is built.

# Developing a Modular Diagram

- The designer compares the block diagram to the ideal network design represented by the Cisco Enterprise Network Architectures. The designer identifies areas that must be redesigned or upgraded.
- The initial architecture of the stadium network is a large flat network. It has only two physical layers of switches. Some of the switches provide end device connectivity to the network and some interconnect other switches. Both layers are built using Layer 2 switches, which are not segmented by VLANs.

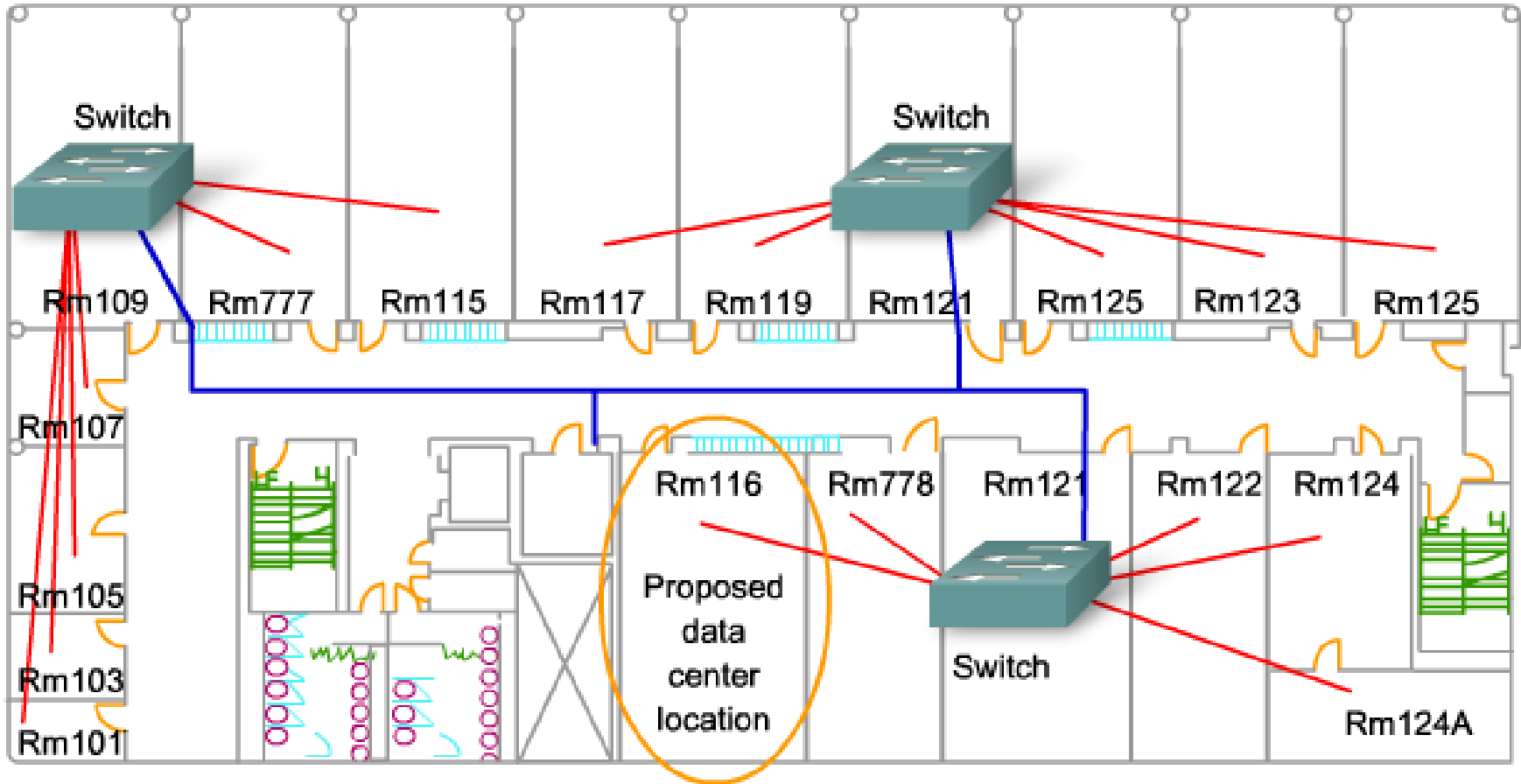
# Developing a Modular Diagram



# Strengths of Weaknesses of the Existing Network

- Strengths of the Existing Stadium Network
- The designer reviews the current voice and video network documentation to determine the locations of equipment and the various groups who use the services.
- New Category 5e wiring was recently installed throughout the stadium complex. In addition, new single-mode fiber connects the wiring closets to the main telecommunications room. The available throughput provided by the existing cabling reduces the need for changes to the infrastructure of the stadium network. Additional wiring will only be done if it is required to install the new Access Points.

# Strengths and Weaknesses of the Existing Network



# Strengths of Weaknesses of the Existing Network

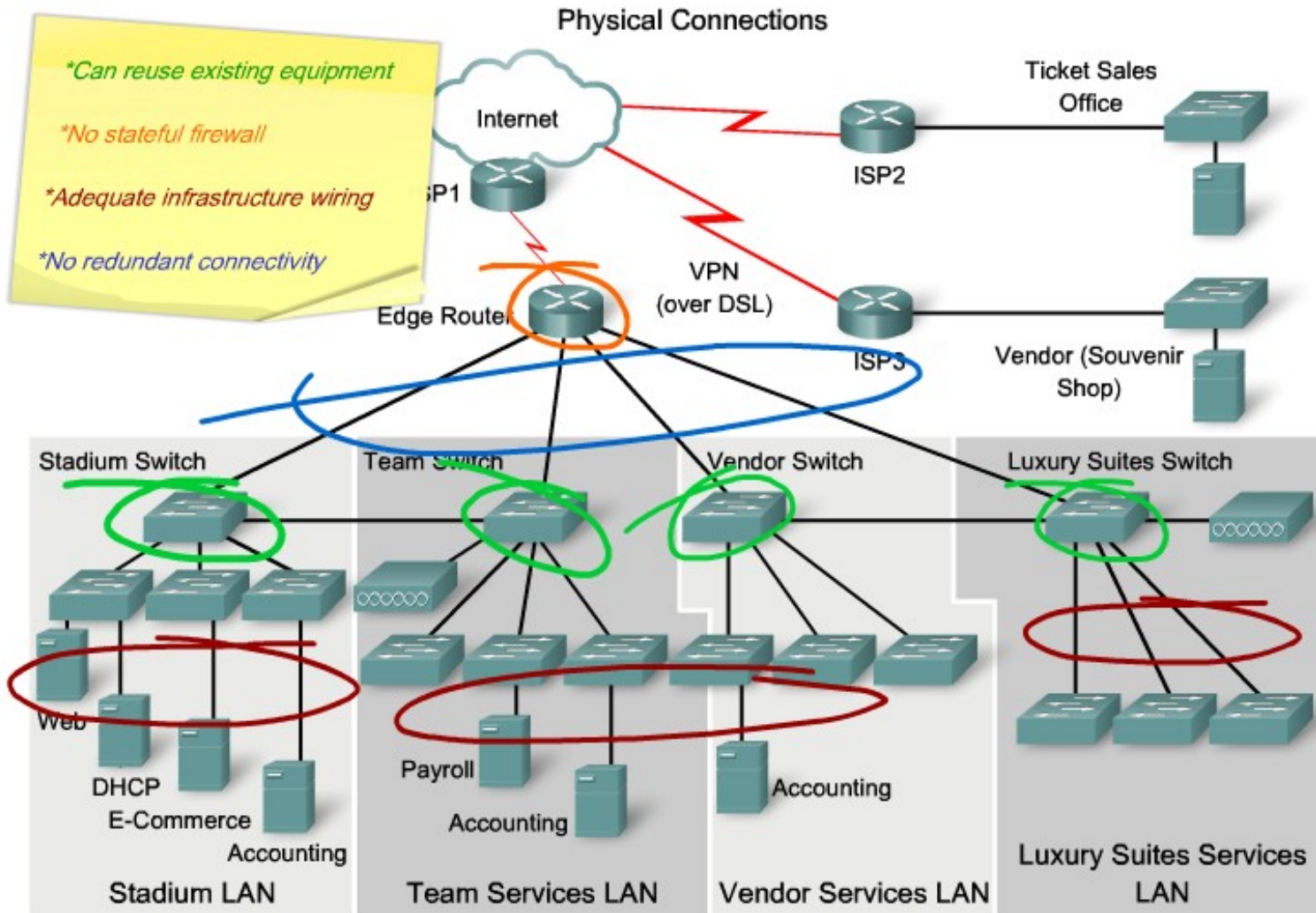
- After reviewing the diagrams and the existing equipment inventories, the network designer lists the strengths and weaknesses of the current stadium network:
- **Strengths:**
  - New wiring and adequate wiring closets
  - Adequate space for a new data center
  - Servers and PCs are current models and will not need to be replaced
  - Some existing network switches and routers can be used in the new design

# Strengths of Weaknesses of the Existing Network

- **Weaknesses:**
- Flat network design
- No Distribution Layer
- No true Core Layer
- Servers poorly located
- Multiple networks that can be difficult to maintain
- Inadequate IP addressing structure
- No dedicated bandwidth for WAN connectivity
- Poorly-implemented wireless
- Limited security implementations



# Strengths of Weaknesses of the Existing Network



# Cisco CCO features and Navigation

- Documentation - Hardware and software configuration and verification, as well as troubleshooting Cisco products and technologies
- Tools - Troubleshooting, installation, assessment, and service requests
- Downloads - Software, specific file releases, and technical support applications
- Communities and Training - Information on the Networking Professionals Connection, attending Technical Support Seminars, and other training opportunities
- News - Current topics reported in the Cisco Technical Support Newsletter

# Investigating the installed Cisco IOS Software

- Before using the tools at Cisco.com, the NetworkingCompany staff requires the following information from the equipment inventory list:
  - Model and type of device
  - Installed memory
  - Interfaces and slots
  - Optional installed modules
  - Current IOS software version and file name
- The NetworkingCompany staff uses this information to determine which Cisco IOS software version is appropriate and which hardware options can be installed.

# Investigating the installed Cisco IOS Software

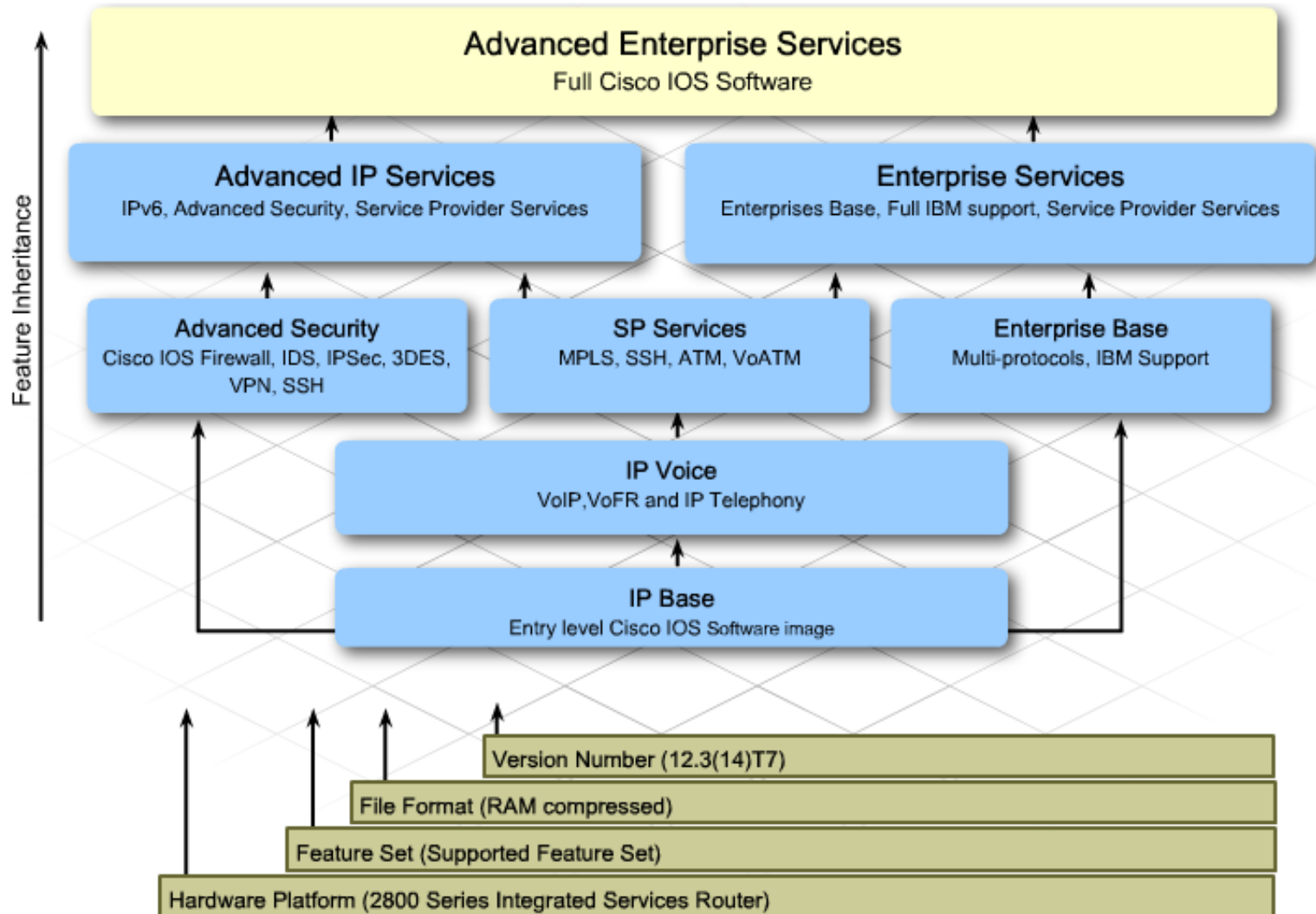
<p>IOS Version ←</p>	<pre>Router#show version Cisco Internetwork Operating System Software IOS(tm)2500 Software (C2500-I-L),Version 12.0(17a),RELEASE SOFTWARE (fcl) Copyright (c)1986-2002 by cisco Systems,Inc. Compiled Mon 11-Feb-02 05:55 by kellythw image text-base:0x00001000</pre>
<p>Bootstrap Version ←</p>	<pre>ROM:system Bootstrap,Version 11.0(10c),SOFTWARE BOOTFLASH :3000 Bootstrap Software (IGS-BOOT-R),Version 11.0(10c),RELEASE SOFTWARE(fcl) System image file is "flash:c2500-i-l.120-17a.bin"</pre>
<p>Model and CPU ←</p>	<pre>cisco 2500 (68030 processor(revision N) With 2048K/2048K bytes of memory.</pre>
<p>Amount of RAM ←</p>	<pre>processor bord ID 08860060,with hardware revision 00000000 Bridging software. X.25 software,version 3.0.0.</pre>
<p>Number and type of interfaces ←</p>	<pre>1 Ethernet/IEEE 802.3 interface(s) 2 Serial network interface(s)</pre>
<p>Amount of NVRAM ←</p>	<pre>32K bytes of non-volatile Configuration memory.</pre>
<p>Amount of flash ←</p>	<pre>8192K bytes of processor board system flash (Read ONLY)  Configuration register is 0x2102 Router#</pre>

# Investigating the installed Cisco IOS Software

- In the stadium network, three types of network devices will be included in the new design:
  - 16 Cisco 2960 switches
  - 1 Cisco 1841 router
  - 3 non-Cisco routers
- **IOS Software File Naming Conventions**
- IOS files need to be kept up-to-date to prevent security risks and to implement bug fixes. Some of the installed devices on the stadium network have outdated IOS versions.
- IOS file naming conventions provide the version number and feature set of the IOS.



# Investigating the installed Cisco IOS Software

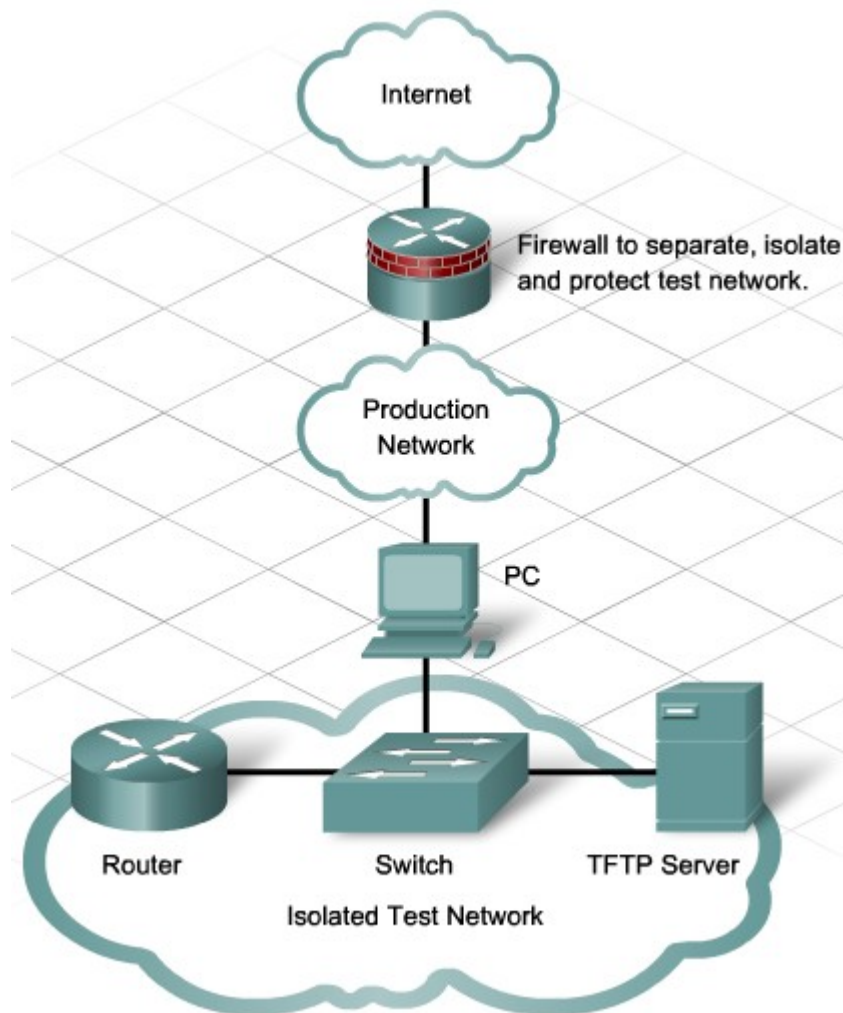


# Investigating the installed Cisco IOS Software

- Testing the Upgrade Process
- To avoid as many problems as possible, the NetworkingCompany obtains a 2960 switch and an 1841 router. They use these devices to test the upgrade process before they attempt to upgrade the stadium equipment. Testing is a good practice, because there can be significant differences from one IOS version or hardware component to another.



# Investigating the installed Cisco IOS Software



# Choosing an appropriate Cisco IOS image

Selecting the Correct Cisco IOS Software Using the CCO Feature Navigator.

**NOTE:** This page changes frequently. If you cannot find Feature Navigator using these directions, please use the Search Function to find the Feature Navigator.

1. From the Cisco.com Homepage select Tools & Resources.

2. Select Tool by Category.

3. NOTE: Software downloads are available only to registered Cisco.com users with a Cisco service contract.

Links with a lock symbol (🔒) are available only to registered Cisco.com users with a [Cisco service contract](#).  
Registered users, [log in](#) to access additional support tools and documentation.

# Choosing an appropriate Cisco IOS image

Selecting the Correct Cisco IOS Software Using the CCO Feature Navigator.







# Choosing an appropriate Cisco IOS image

```
Router1#copy tftp flash
Address or name of remote host []? 172.17.1.1
Source filename []? c1841-ipbase-mz-124-4.T7.bin
Destination filename [c1841-ipbase-mz-124-4.T7.bin]?
%Warning:There is a file already existing with this name
Do you want to over write? [confirm]
Accessing tftp://172.17.1.1/c1841-ipbase-mz-124-4.T7.bin...
Loading c1841-ipbase-mz-124-4.T7.bin from 172.17.1.1 (via FastEthernet0/0):
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
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```

# Download and Install Cisco IOS Software

- Step 1: Select a IOS Software Image
- The following factors need to be considered when selecting an IOS version:
  - Memory Requirement - Ensure that the router has enough disk or flash memory to store the IOS. The router also needs sufficient memory (DRAM) to run the IOS. If the router does not have enough memory, the router may have problems when it boots under the new IOS.
  - Interface and Module Support - Ensure that the new IOS supports all the current and new interfaces and modules to be installed in the router.
  - Software Feature Support - Compare the new IOS features with those used with the old IOS. Any new features required for the network upgrade need to be included.

# Download and Install Cisco IOS Software

**Cisco Feature Navigator**

Search by Feature | Search by Software | Compare Images

**Objective:** Define a specific software image in order to view its supported features.

Select from the pull down menus to find releases which support particular platform and feature set combinations. View your results in the table below and necessary to define a specific software image.

**Your Selections:**

Software: **IOS**  
 Major Release: **12.4T**  
 Release: 12.4(5)T  
 Platform: 1841  
 Feature Set: IP BASE

[New Search](#)

**Search Results**

Image Info	
Image Name	c1841-ipbasek9-mz.124-6.T.bin
DRAM / Min Flash	128 / 32
Enterprise Product Number	

This image has software advisories associated with it. [Click here](#) for details.

[Compare Images](#) |
 [View MIBs](#) |
 [Release Notes](#) |
 [Image Download Information](#)

**Features**

- [AAA Broadcast Accounting](#)
- [AAA CLI Stop Record Enhancement](#)
- [AAA DNIS Map for Authorization](#)
- [AAA Double Authentication Secured by Absolute Timeout](#)
- [AAA Server Group](#)



# Download and Install Cisco IOS Software

- Step 2: Identify the Device File System to Copy the Image
- The NetworkingCompany staff uses the show file systems command output to locate the Cisco IOS files or images. Either this command or the dir [file\_system] command can be used to find the free space available to store the new IOS images. If the devices do not have enough flash memory, memory upgrades should be implemented before the new IOS can be installed.

# Download and Install Cisco IOS Software

- Step 3: Verify that the TFTP Server Has IP Connectivity to the Device
- The TFTP server must have a network connection to the device. It must be able to ping the IP address of the device targeted for a TFTP software upgrade. To achieve this connection, the device interface and the TFTP server must have either an IP address in the same range or a default gateway configured.

```

Press RETURN to get started.

Router>enable
Router#show file systems
File Systems:

      Size (b)      Free (b)      Type      Flags      Prefixes
      -          -          opaque    rw         archive:
      -          -          opaque    rw         system:
      -          -          network   rw         snmp:
      -          -          opaque    rw         null:
      -          -          network   rw         tftp:
      196600      194617      nvram     rw         nvram:
* 326071680      7380992      disk      rw         flash:#
      -          -          opaque    rw         xmodem:
      -          -          opaque    rw         ymodem:
      -          -          network   rw         rcp:
      -          -          network   rw         ftp:
      -          -          network   rw         http:
      -          -          opaque    ro         tar:
      -          -          opaque    ro         cns:

Router#_
  
```

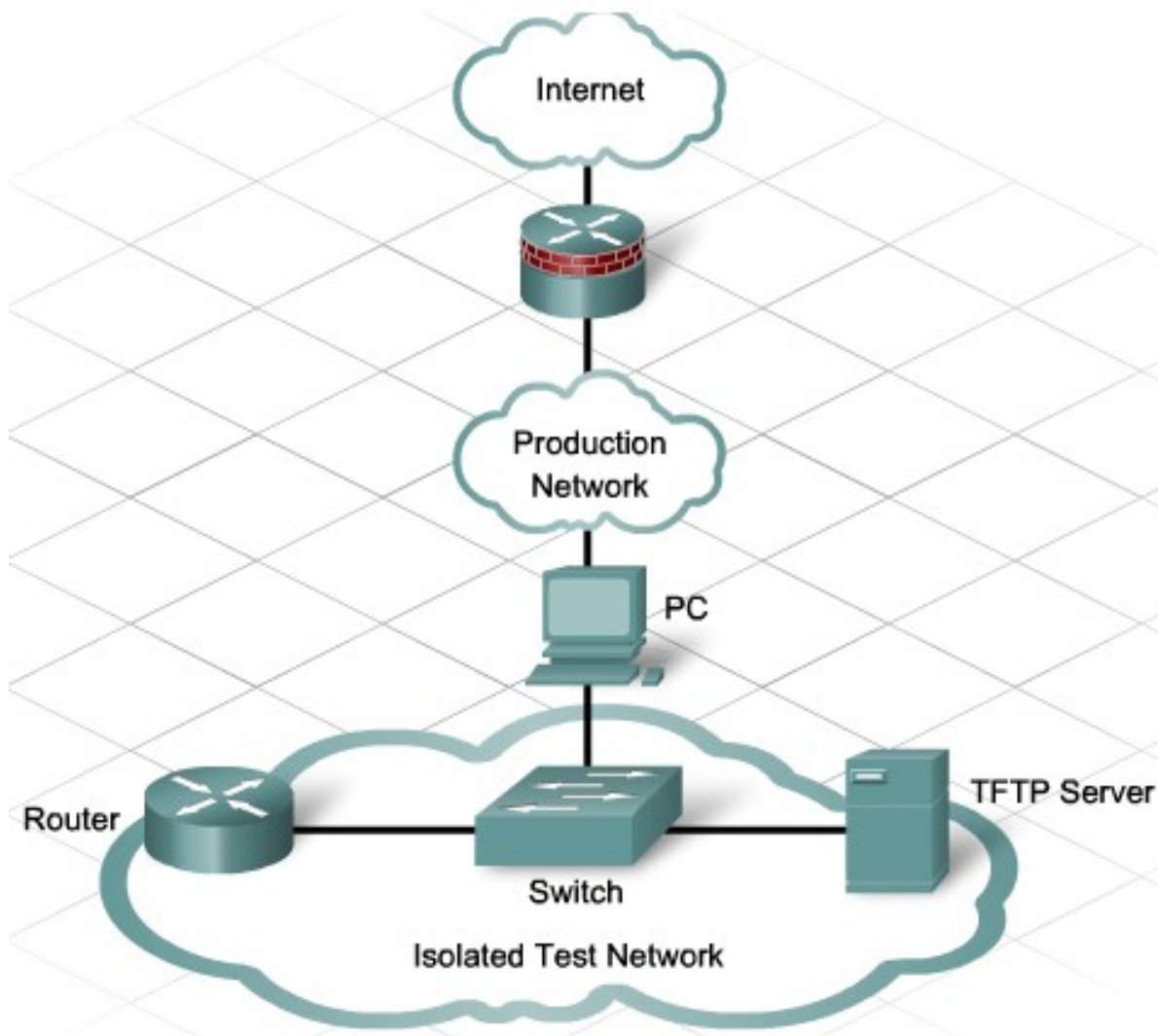
# Download and Install Cisco IOS Software

- Step 4: Back Up the Current Configurations to Prepare for the Upgrade
- The configuration files and current IOS from the router should be backed up before upgrading the Cisco IOS. The running configuration should be copied to the startup configuration. The startup configuration and the current IOS image should be backed up to a TFTP server. Some of the IOS releases add default configurations. These new configuration items may conflict with the current configuration.

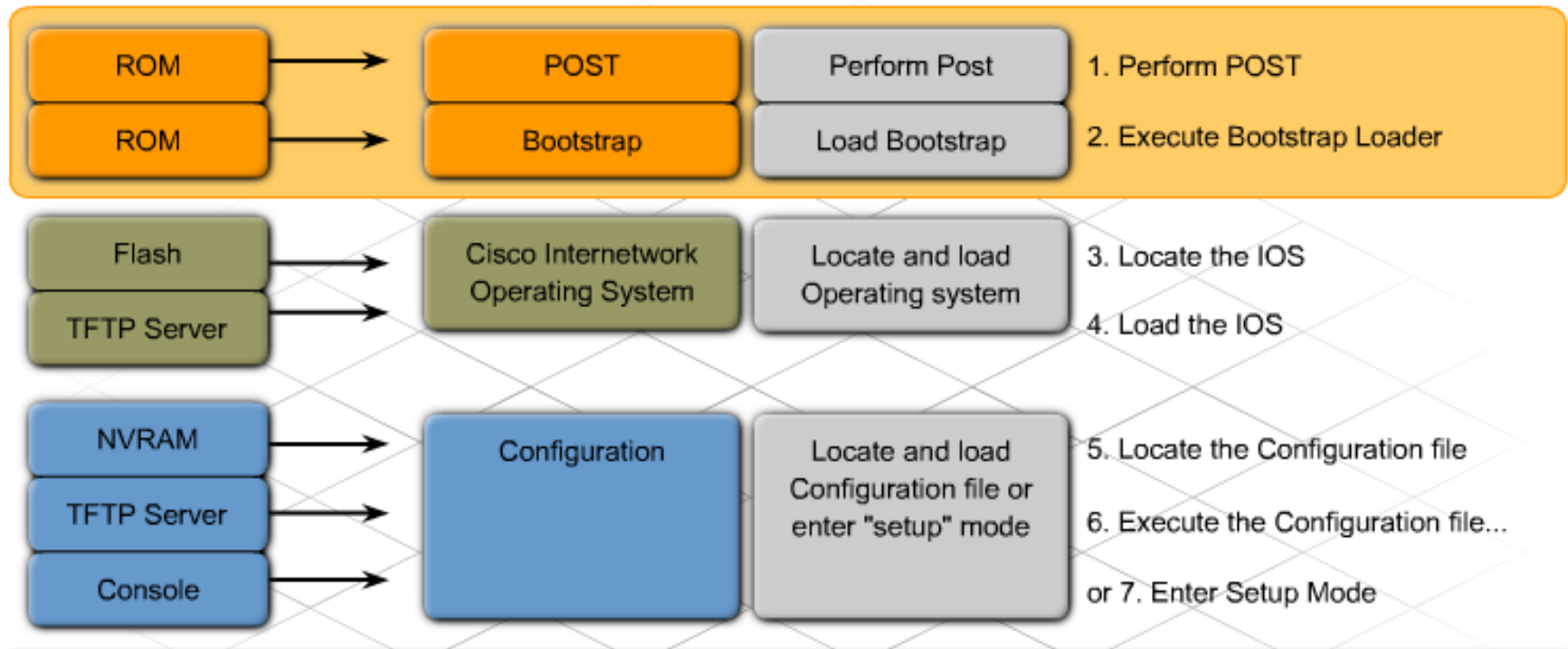
# Download and Install Cisco IOS Software

- Step 5: Copy the IOS Image to the Device
- After the NetworkingCompany staff pings between the TFTP server and the device, they are ready to copy the IOS software image into flash memory. Before copying the image, the staff ensures that the TFTP server software is running. They confirm that the IOS image is in the appropriate TFTP server directory.
- To upgrade the IOS from a TFTP server, the staff uses the copy tftp flash command.

# Download and Install Cisco IOS Software



# The Router Startup Process



```
System Bootstrap, Version 12.3(8r)T8, RELEASE SOFTWARE (fc1)
Cisco 1841 (revision 5.0) with 114688K/16384K bytes of memory.
```



# Investigating Appropriate Hardware Options

- The staff uses the 1841 router datasheet to see what modules and interfaces are available for that model. A number of different types of modules fit the two option slots on the 1841, including:
  - WAN interface cards (WICs)
  - High-speed WAN interface cards (HWICs)
  - Voice/WAN interface cards (VWICs)
  - Wireless WICs that can function as Access Points
  - Gigabit Ethernet HWICs to provide fiber connectivity



# Inside and Rear Router view



# Investigating Appropriate Hardware Options

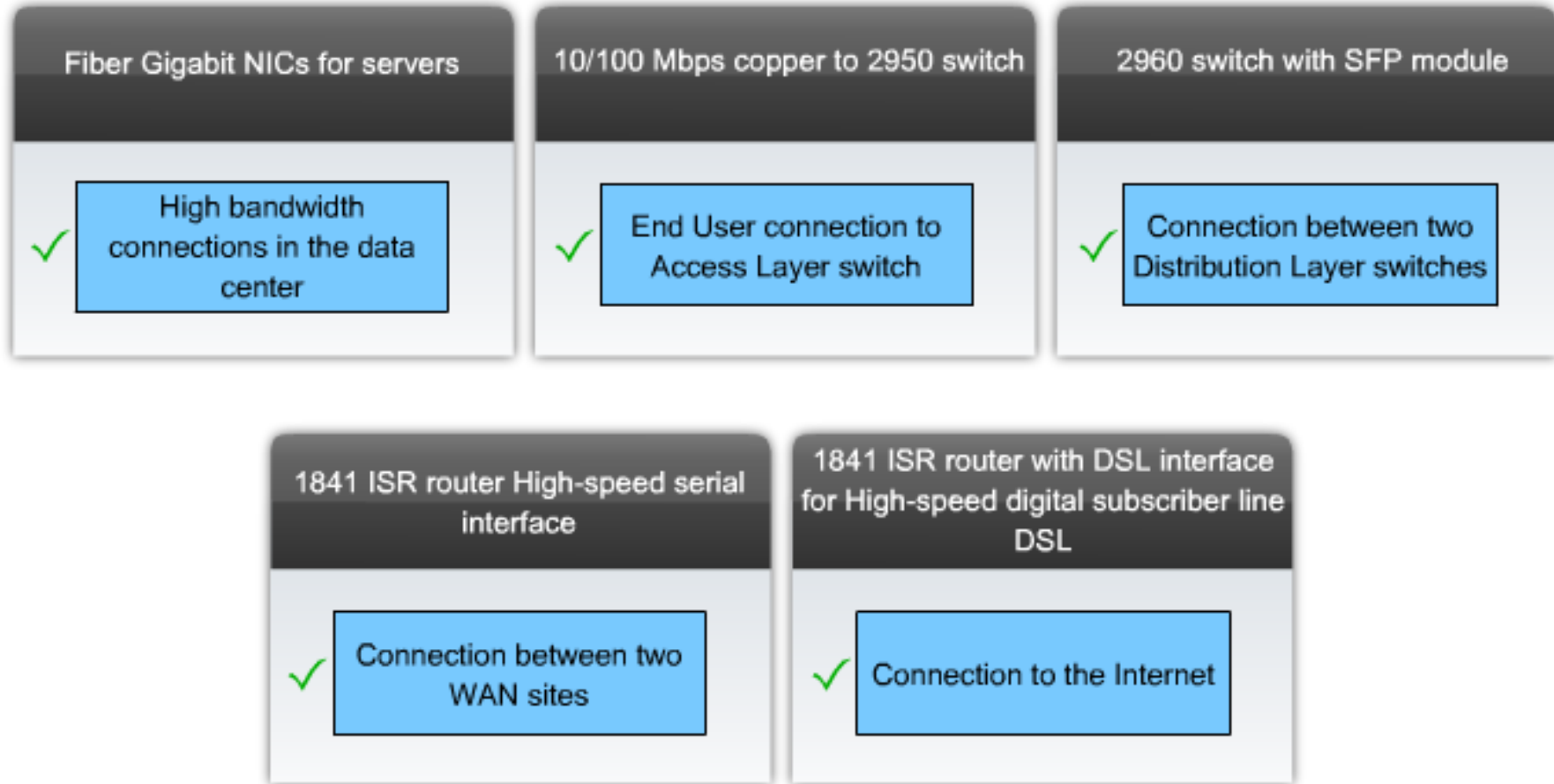
- To support the voice, video, and data traffic on the new network, the designer makes the following list of technologies and media:
- Gigabit Ethernet using fiber at the Core and Distribution Layers
- 100 Mbps connectivity using copper wire at the Access Layer
- Gigabit Ethernet using either copper or fiber in the data center
- High-speed serial connections to the two WAN sites
- High-speed digital subscriber line (DSL) to connect to the Internet

# Investigating Appropriate Hardware Options

**Table 1 WAN and LAN Connections**

Port or Connection	Port Type, Color <sup>1</sup>	Connected to:	Cable
Fast Ethernet (FE)	RJ-45, yellow	Ethernet hub.	Crossover to connect to a router Straight-through to connect to a switch
T1/E1 WAN	RJ-48C	T1 or E1 network or CSU/DSU.	RJ-48 T1/E1 straight-through (Crossover to connect of a PBX or any other equipment)
Cisco serial (1T)	60-pin D-sub, blue	CSU/DSU and serial network or equipment.	Cisco serial transition cable that matches the signaling protocol (EIA/TIA-232, EIA/TIA-449, V.35, X.21, or EIA/TIA-530) and the serial port operating mode (DTE or DCE). Refer to the <i>Cisco Modular Access Router Cable Specifications</i> document for information about selecting these cables.
Cisco Smart serial (2T)	Cisco Smart compact connector, blue	CSU/DSU and serial network or equipment. For WIC-2T and WIC-2A/S only.	
DSL	RJ-11C/RJ-14C	Network demarcation device for service provider's DSL interface.	RJ-11 straight-through for 2-wire RJ-14 straight-through for 4-wire

# Investigating Appropriate Hardware Options



# Investigating Appropriate Hardware Options

- Installing Option Interface Cards in an 1841 Router
- The procedure to install these cards is as follows:
  - Step 1: Turn Off Power to the Router
  - The 1841 router option slots do not support hot-swappable option interface cards, which can be changed with the power on.
  - Step 2: Remove the Blank Faceplate from the Slot
  - Step 3: Install the Option Module
  - Step 4: Turn on Power to the Router and Check the New Configuration



# Visiting the Customer site

- The next step in characterizing the existing network is to evaluate the wireless LAN (WLAN) deployment in the stadium. Because of differences in the configurations, Access Point (AP) placement, and the physical environment, every WLAN is a unique installation.
- Before the wireless network design is finalized, the NetworkingCompany staff performs a site survey to determine the best use and placement of the wireless networking components.



# Visiting the Customer site

- When preparing for a wireless site survey, the NetworkingCompany staff should follow the NetworkingCompany guidelines.
- These guidelines were prepared for the sports stadium site survey:
- **Preparation**
- Schedule the site survey with the customer.
- Dress appropriately for the task.
- Wear or carry company credentials.
- Bring the proper equipment (create a standard checklist to ensure that all necessary materials are included).
- Notify stadium personnel when the staff will arrive and how long the site survey should take.

# Visiting the Customer site

- **Site Survey**
- Check in with the proper staff upon entry into the stadium.
- Work quickly and professionally to instill a sense of confidence in the customer.
- Answer questions politely and as completely as possible.
- Write down any questions that must be answered by other staff members.
- Inform the customer of the survey procedures.
- Report back to the customer staff before leaving the premises to inform them of the successful completion of the survey.

# Visiting the Customer site

- **Security**
  - Many companies have their own uniformed security guards who need to be aware of any visit. Businesses typically require a visitor to check in at the main office before accessing other areas. In high-security areas, it is extremely important to gain security clearance and be escorted if needed. High-security areas include government, aviation, and military locations.
- **Safety Guidelines**
  - Follow the recommended safety guidelines to ensure proper operation and safe use of the wireless devices.
  - Obtain customer approval before touching or attaching devices to any existing networking equipment.

# Visiting the Customer site

- Some site visit requirements may include:
  - Access restrictions
  - Clothing
  - Safety equipment
  - Identification Badges
  - Hours of operation
  - Security
  - Prohibited items
- Customer requirements may vary from site to site. NetworkingCompany staff must comply with customer requirements when preparing for a site visit.

# Physical Network Consideration

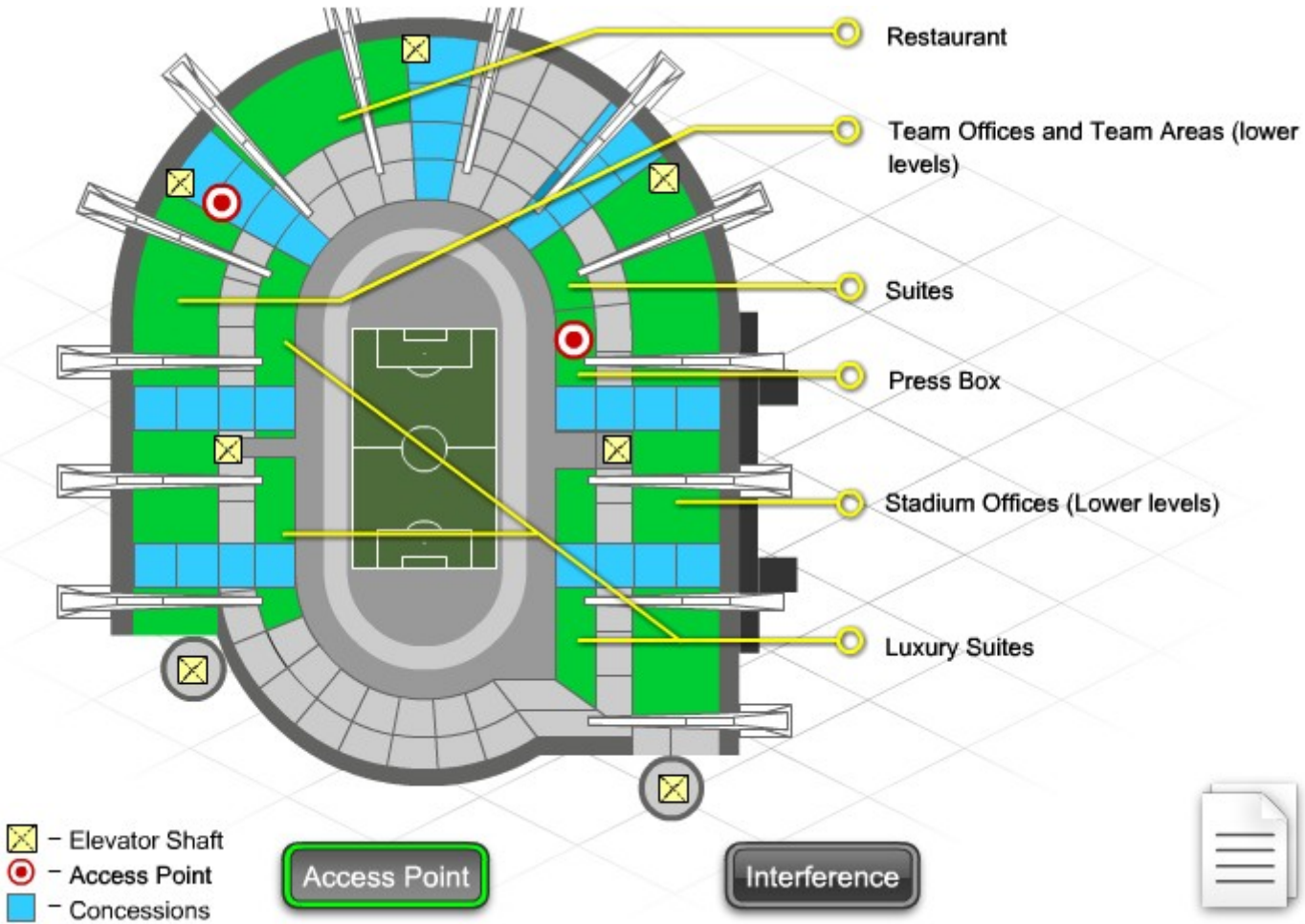
- The stadium network is currently providing limited wireless access through two Access Points (APs). One AP is in the team office area. This AP is actually a small wireless router that was purchased by the team management. The other AP, an inexpensive older Cisco Aironet AP, is located in the stadium press box.
- In the proposed network design, the stadium network requires additional wireless hotspots in the stadium restaurant and luxury suites. In both locations, the stadium management plans to offer unsecured wireless access to the Internet.

# Physical Network Consideration

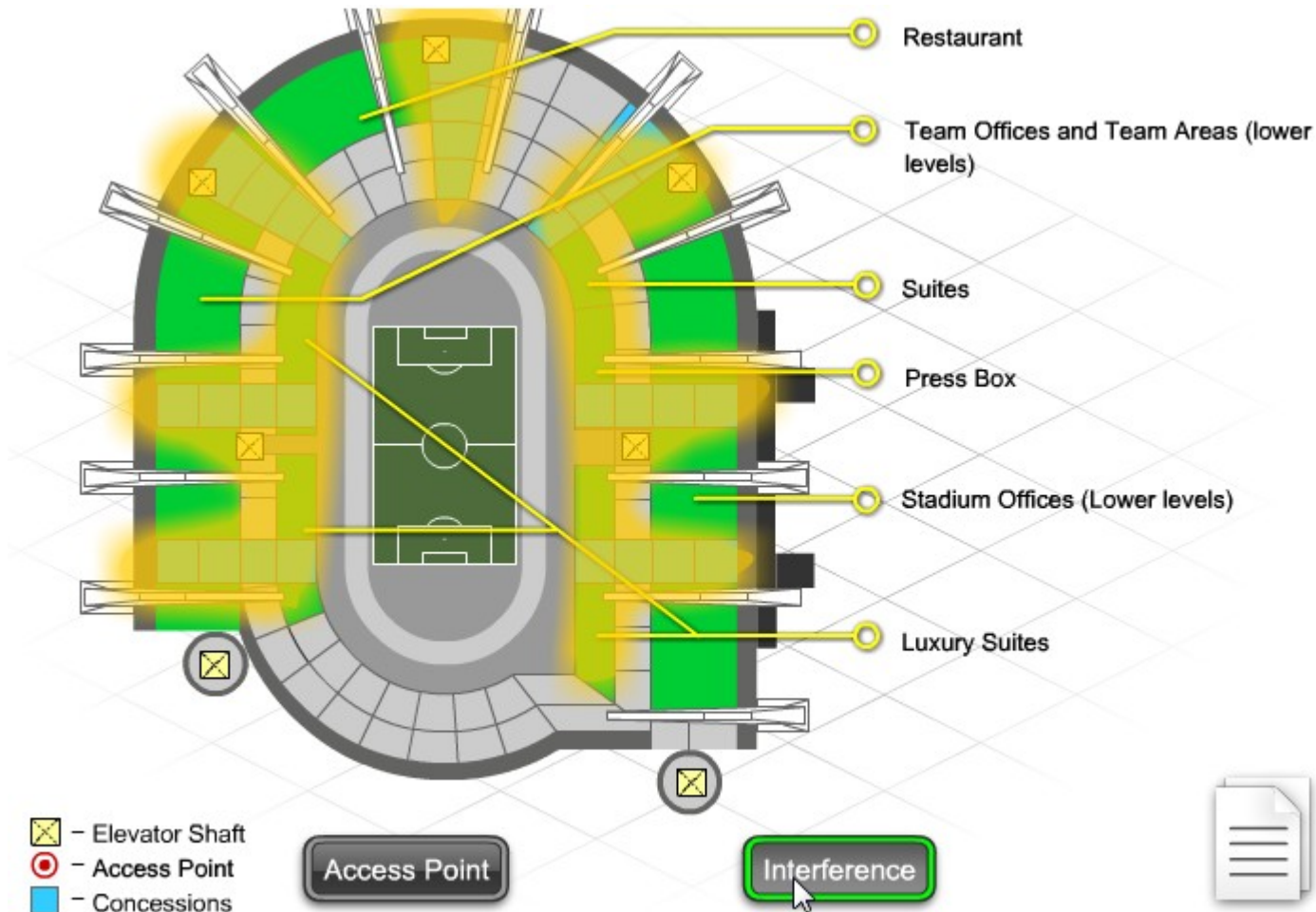
- The network designer has identified a list of possible sources of interference and some physical stadium infrastructure issues that might affect the RF coverage areas.
- Areas of concern to the designer include:
  - The many microwave ovens that are located in the concession areas and the luxury boxes
  - Wireless telephones and headsets that are used by the reporters and newsmen
  - Elevator shafts that are located near the outer areas of the restaurant and the luxury suites
  - Thick concrete pillars and walls between the luxury suites



# Physical Network Consideration



# Physical Network Consideration



Click the buttons to view AP locations and possible areas of interference in the stadium.

# Physical Network Consideration

	Can Reduce	Cannot Reduce
Thick concrete pillars and walls between the luxury suites	✓	
Microwave ovens in the concession areas and luxury boxes	✓	
Rapidly changing video and digital advertising billboards		✓
Spectators using the messaging features on their cellular mobile phones		✓
Sports and news journalists using wireless telephones and headsets	✓	
Elevator machinery in shafts near the stadium restaurant and the luxury suites	✓	
A large number of people simultaneously using their magnetic swipe cards to enter the stadium turnstiles		✓

# Wireless Site Survey and Planning

- Performing a site survey consists of the following steps:
- Step 1: Define Customer Requirements
- The stadium may want to advertise the availability of wireless hotspots. The NetworkingCompany staff needs to determine the service level expectations. They also need to determine whether the stadium wants to support advanced wireless technologies, such as wireless IP phones.

# Wireless Site Survey and Planning

- Step 2: Identify Coverage Areas
  - The NetworkingCompany staff estimates the number of potential users in each coverage area. More importantly, the staff determines the expected peak usage during major events.
- Step 3: Determine Preliminary AP Locations
  - The staff reviews the stadium plans and suggests possible AP locations. Then they determine how coverage can be provided, which areas need power, and how the APs will connect to the wired network.



# Wireless Site Survey and Planning



Laptop



Floor plan



Access Point



Tape measure



Antennas and power cord



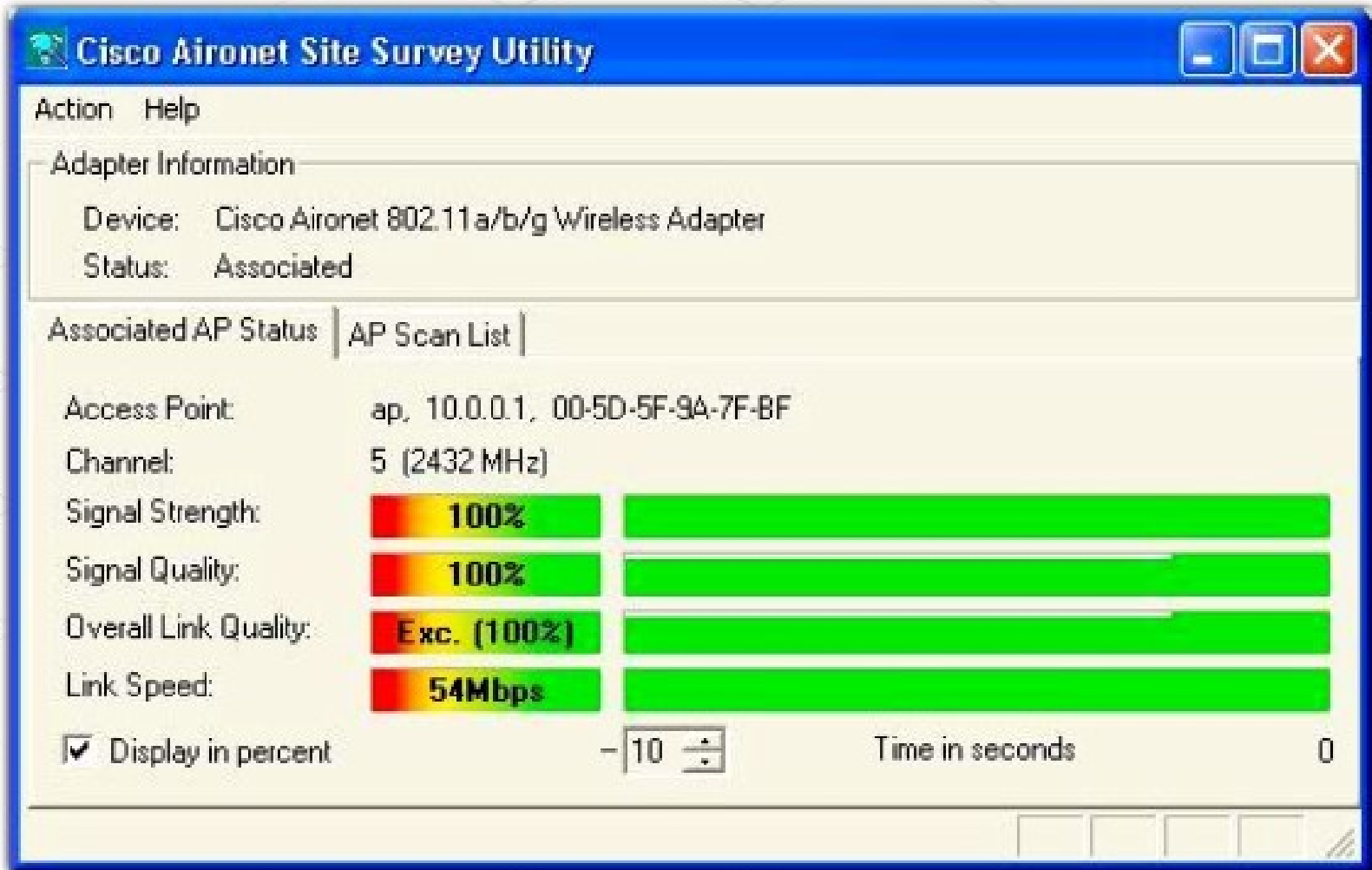
Wireless interface card for the laptop, with software



# Wireless Site Survey and Planning

- The NetworkingCompany staff performs the following steps:
- Step 1: Measure the signal strength and speed of a link as they walk away from the AP.
- Step 2: Record the readings and measure the distances to the AP when the quality or link speed changes.
- Step 3: Mark the areas where signals are acceptable on a floor plan.
- The network designer uses the marked floor plan to determine the location of the APs and the wired network jacks that connect them to the network.

# Wireless Site Survey and Planning





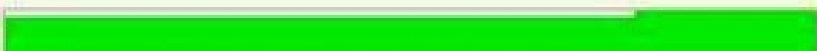

**Cisco Aironet Site Survey Utility**

Action Help

Adapter Information

Device: Cisco Aironet 802.11 a/b/g Wireless Adapter  
 Status: Associated

Associated AP Status | AP Scan List

Access Point:	ap. 10.0.0.1, 00-5D-5F-9A-7F-BF	
Channel:	5 (2432 MHz)	
Signal Strength:	100%	
Signal Quality:	100%	
Overall Link Quality:	Exc. (100%)	
Link Speed:	54Mbps	

Display in percent      - 10 ÷      Time in seconds      0

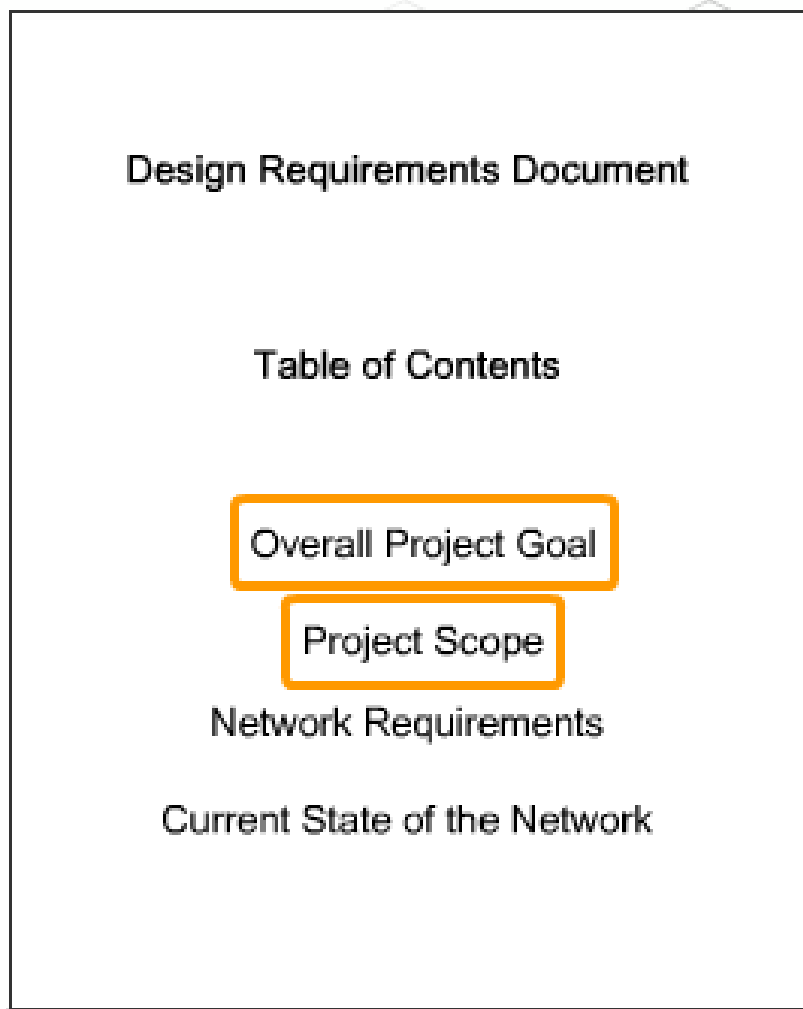
## Creating a Network Design Requirement Document

- The NetworkingCompany staff has now completed the Prepare and Plan phases of the network upgrade lifecycle. They are ready to create a Design Requirements document and begin the design of the new stadium network.
- A Design Requirements document is a summary of all the major business and technical requirements for the new network design.

# Creating a Network Design Requirement Document

- The first two sections of the Design Requirements document are the Overall Project Goal and the Project Scope.
- Overall Project Goal
- This section states the overall goals of the upgrade. It also specifies how this upgrade will help the stadium management company become more successful.
- Project Scope
- This section outlines the physical areas, applications, and user groups affected by the network upgrade. It may list components of the network that are beyond the scope of the network upgrade, such as server or application updates.

# Creating a Network Design Requirement Document



**Overall Project Goal** [X]

- Desired project outcomes
- Benefits of these outcomes to the customer

**Project Scope** [X]

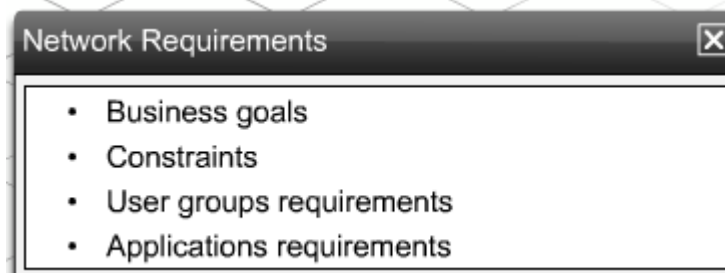
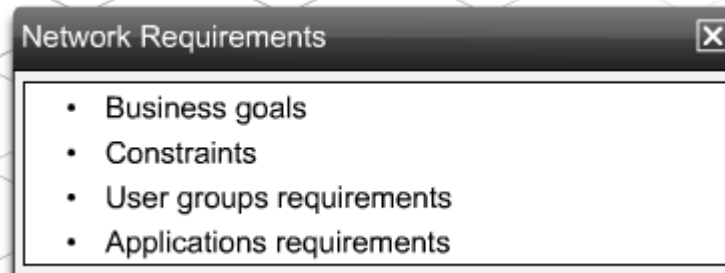
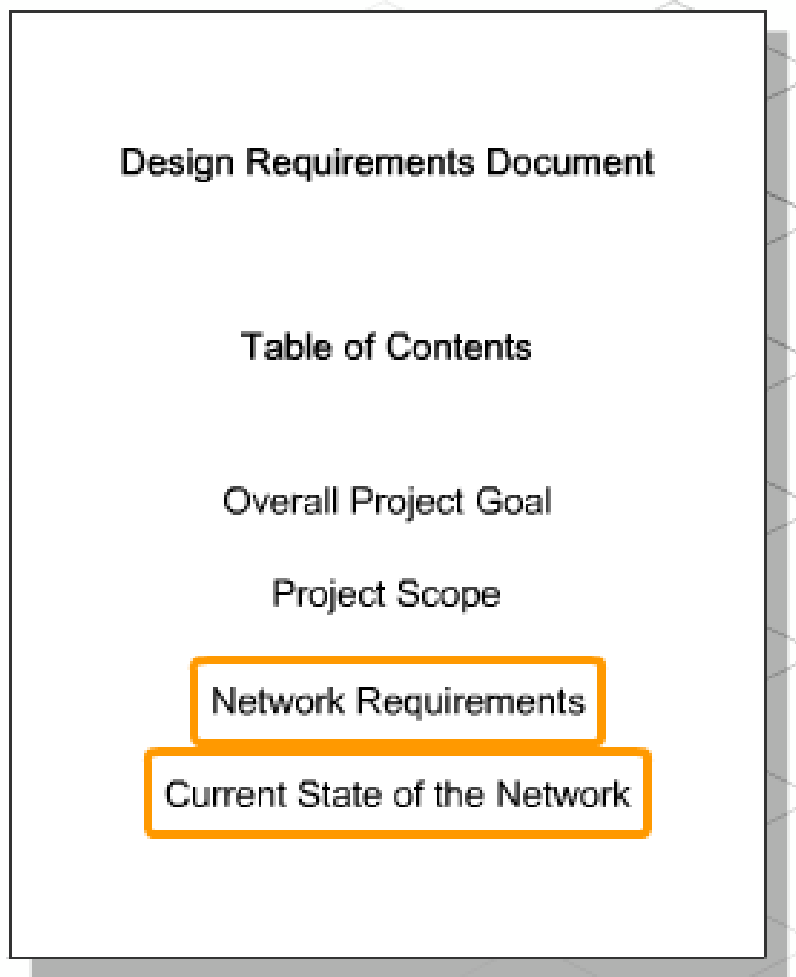
- Affected resources and user groups
- List out-of-scope resources and user groups

# Creating a Network Design Requirement Document

- Two other important sections of the Design Requirements document are Network Requirements and Current State of the Network.
- **Network Requirements**
- This section details all of the business goals and technical requirements, constraints, user groups, and applications that influence the design of the proposed stadium network.
- **State of the Network**
- This section details the existing network
- Logical and physical diagrams
- Equipment lists
- Applications
- Strengths and weaknesses



# Creating a Network Design Requirement Document



# Project Scope

- The second section of the Design Requirements document outlines the project scope. It details how much of the network is affected or changed as a result of the project.
- It also defines the parts of the existing network that are not within the areas covered by the project. These out-of-scope areas are defined so that there is no misunderstanding between the NetworkingCompany and the StadiumCompany management.

# Project Scope

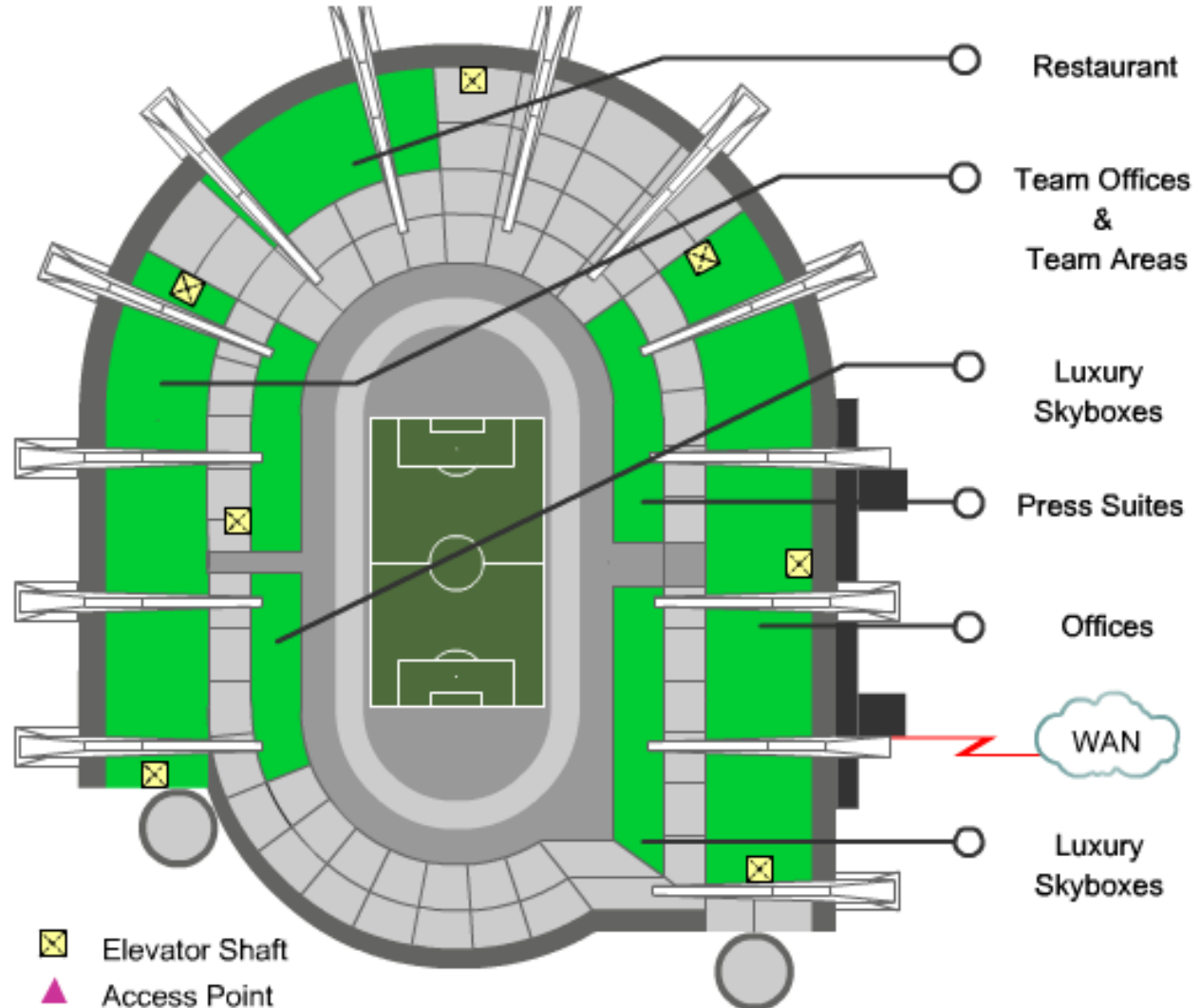
## Project Scope

The scope of this project is to upgrade the existing LAN connections in the main stadium network.

- Add wireless coverage
- Relocate servers to data center server farm
- Upgrade bandwidth to remote sites
- Implement new security measures

## Out of Scope:

- Installing an IP telephony system
- Replacing any infrastructure wiring



# Business goals and technical requirements

- The first two sections of the Design Requirements document are usually short and do not contain much detail. In contrast, the Network Requirements section is very detailed. This section helps drive the network design and implementation of new technologies.
- The Network Requirements section has the following four subsections:
  - Business Goals
  - Technical Requirements
  - Users
  - Applications

# Business goals and technical requirements

The business goals that have been identified for this project are as follows:

- Reduce costs by consolidating the separate voice, video, and data networks.
- Improve server security and control access to network resources.
- Streamline the online ticket purchasing and customer entry processes.
- Add additional wireless coverage to meet customer demand.
- Support the growth of the stadium company as it adds new types of entertainment, new partners, and new vendors.
- Provide additional services, such as voice and video, to the remote sites.

# Business goals and technical requirements

- Technical Requirements
- The NetworkingCompany designer evaluates each of the business goals. The designer then determines the technical requirements to meet the goals. These requirements are outlined in the Technical Requirements section under the properties of scalability, availability, security, and manageability.



# Business goals and technical requirements

- Scalability- A business goal is to add new services, new users, and voice and video capability to the network. The network must be able to scale easily without a major redesign or disruption to services.
- Availability-The addition of voice, security, video, and online ticketing requires the network to be available to users at all times. New applications need to be accessible to the remote sites and the main stadium location. The new ticketing and entry applications require very short transaction times.

# Business goals and technical requirements

## Technical Requirements Section

### Scalability:

- Support 50% growth of the proposed network in number of users and sites within the next two years.
- Support 75% growth of the proposed network in wireless coverage area.
- Support 75% growth of the proposed network in e-commerce traffic.

### Availability:

- Support 24 x 7 network availability for web-enabled applications.
- Support 24 x 7 network availability for security applications.
- Support 24 x 7 network availability for the telephone system.
- Improve transaction-processing time to less than 3 seconds.
- Provide high-quality voice and streaming video.
- Guarantee Quality of Service.

# Business goals and technical requirements

- **Security**-A primary goal of all network upgrades is to improve security. The proposed stadium network will include firewalls, filtering, and an intrusion detection system (IDS) to protect it from access by unauthorized users. The services will be protected using a data center server farm.
- **Manageability**-The stadium management company does not want to increase the number of IT personnel to support the new network. Therefore, the network must be easy to manage and maintain. A network is easier to manage when networking standards are used during the design and installation.

# Business goals and technical requirements

- Users
- In this section of the Design Requirements document, the different user groups and their access requirements are listed. The stadium management company plans for customers, vendors, team personnel, and remote workers to access the network. It makes similar provisions for the on-site management company personnel. Each of these groups may have specific requirements for network services. It is important to document these requirements so that they are considered in the network design.

# Business goals and technical requirements

- Applications
- The network traffic characteristics and requirements of various applications affect the design of the network. This section of the document describes the types of applications the network must support. Any specific network traffic requirements are listed as well.

## Technical Requirements Section

### Security:

- Improve security with the addition of filtering, firewalls, and IDS.
- Centralize servers and management.
- Provide wireless security.

### Manageability:

- Maintain the new network with existing personnel.
- Provide reporting and management tools.
- Train the stadium IT staff.

# Existing Network Characteristic

- State of the Existing Network
- The final section of the Design Requirements document includes the following information:
  - All of the network diagrams that the NetworkingCompany creates to illustrate the existing network
  - The names and IP addresses of servers and important networking components
  - The existing network strengths and weaknesses and how they impact the business goals



# Existing Network Characteristic

Weakness	Impact	Possible Fix
Flat Network Design	No scalability - network cannot grow without impacting performance	Create routed hierarchy
Flat Network Design	No network segmentation - cannot filter or isolate traffic creating security risks	Create segmentation with VLANs Apply traffic filters
No Redundancy	Large failure domains - link and device failures affect large areas of the network	<ul style="list-style-type: none"> <li>• Create smaller failure domains</li> <li>• Use redundancy where possible</li> </ul>
Distributed Servers	Servers at risk - no controlled environment, power backup or redundant connectivity	Move servers to data center server farm
Distributed Servers	Servers not available - no high speed links to servers	Install gigabit links to servers, centrally locate
Limited Fiber Availability	Limits the possible redundancy in the network	Stack switches and add high speed uplinks
No Stateful Firewall	Filtering only, does not prevent all unauthorized or unwanted traffic	Use IOS stateful firewall features
Firewall Only at the Edge of Network	Internal devices vulnerable - no protection from internal attacks	<ul style="list-style-type: none"> <li>• Create layered firewall and filtering mechanisms</li> <li>• Add IDS at data center</li> </ul>