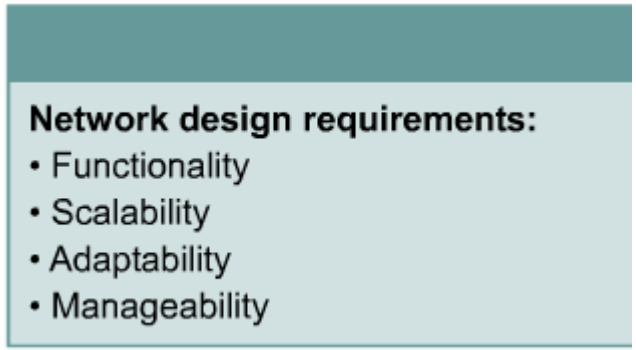
CCNA3; Module 5; LAN Dizajn

Prednáška 5

LAN Design Goals

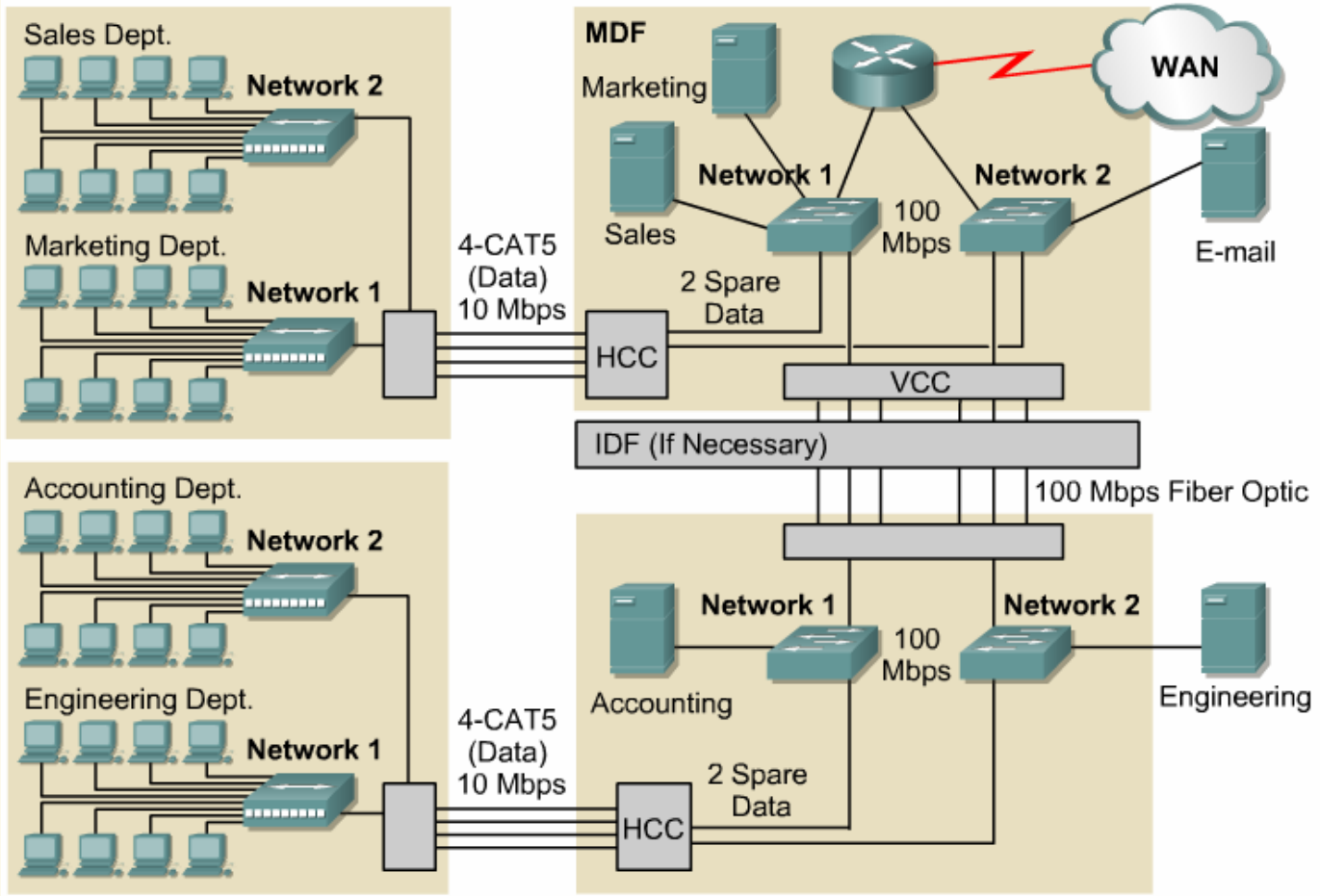


- **Functionality** – The network must work. The network must allow users to meet their job requirements. The network must provide user-to-user and user-to-application connectivity with reasonable speed and reliability.
- **Scalability** – The network must be able to grow. The initial design should grow without any major changes to the overall design.
- **Adaptability** – The network must be designed with a vision toward future technologies. The network should include no element that would limit implementation of new technologies as they become available.
- **Manageability** – The network should be designed to facilitate network monitoring and management to ensure ongoing stability of operation.

LAN Design Considerations

- The function and placement of servers
- Collision-detection issues
- Segmentation issues
- Broadcast domain issues

Server Placement



IDF - Intermediate Distribution Facilities
MDF – Main Distribution Facilities
POP – Point of Presence

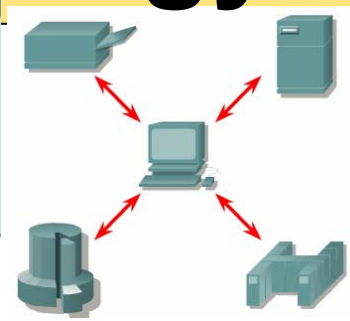
Server categorization

- Servers can be categorized into two distinct classes:
  - **Enterprise servers**
  - **Workgroup servers**
- An **enterprise server** supports all the users on the network by offering services, such as e-mail or Domain Name System (DNS) that everyone in an organization would need because it is a centralized function.
  - Should be placed to MDF
- A **workgroup server** supports a specific set of users, offering services such as word processing and file sharing.
  - Other examples might include applications that are specific to a group of users.
  - Should be placed to IDF

LAN design methodology

1

- Corporate structure
- Business information flow
- Applications in use
- Current topology
- Performance characterstics of current network



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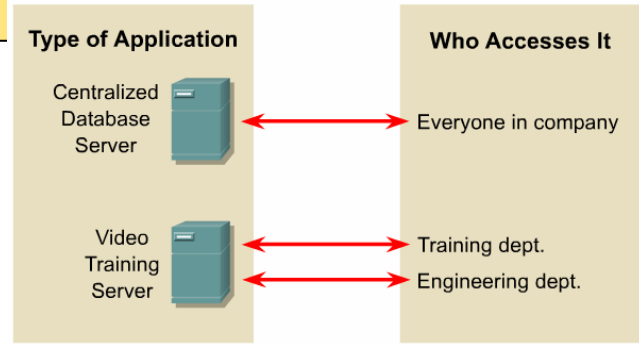

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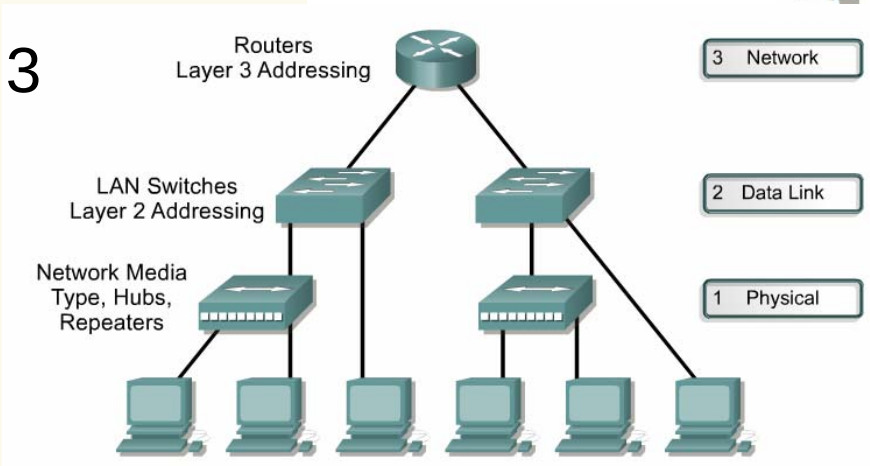

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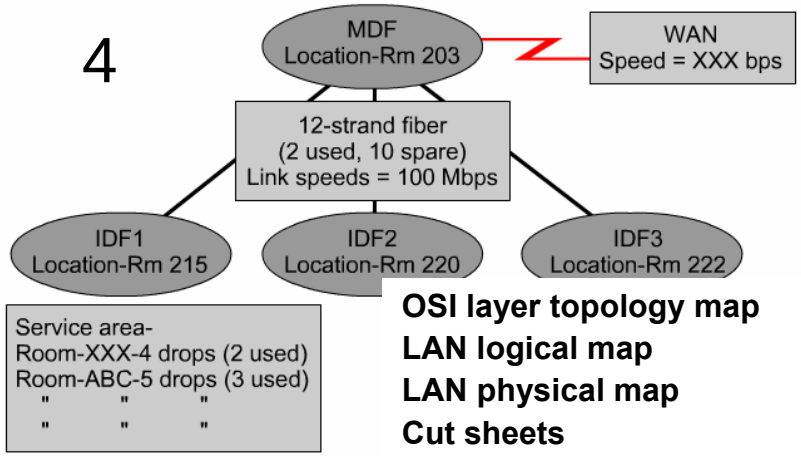
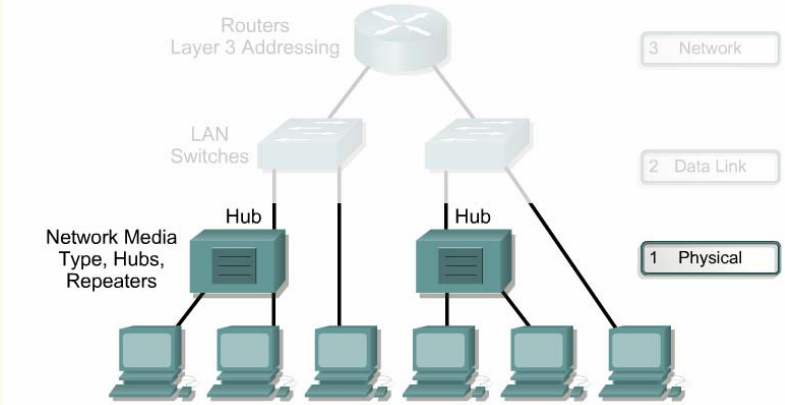


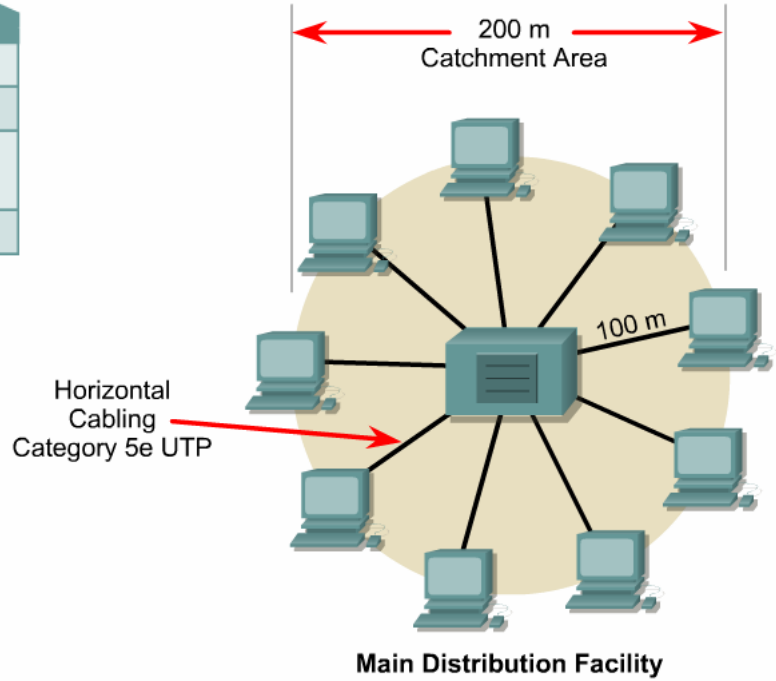
OSI layer topology map
LAN logical map
LAN physical map
Cut sheets
VLAN logical map
Layer 3 logical map
Addressing maps

1. Gather requirements and expectations
2. Analyze requirements and data
3. Design the Layer 1, 2, and 3 LAN structure, or topology
4. Document the logical and physical network implementation

Layer 1 design

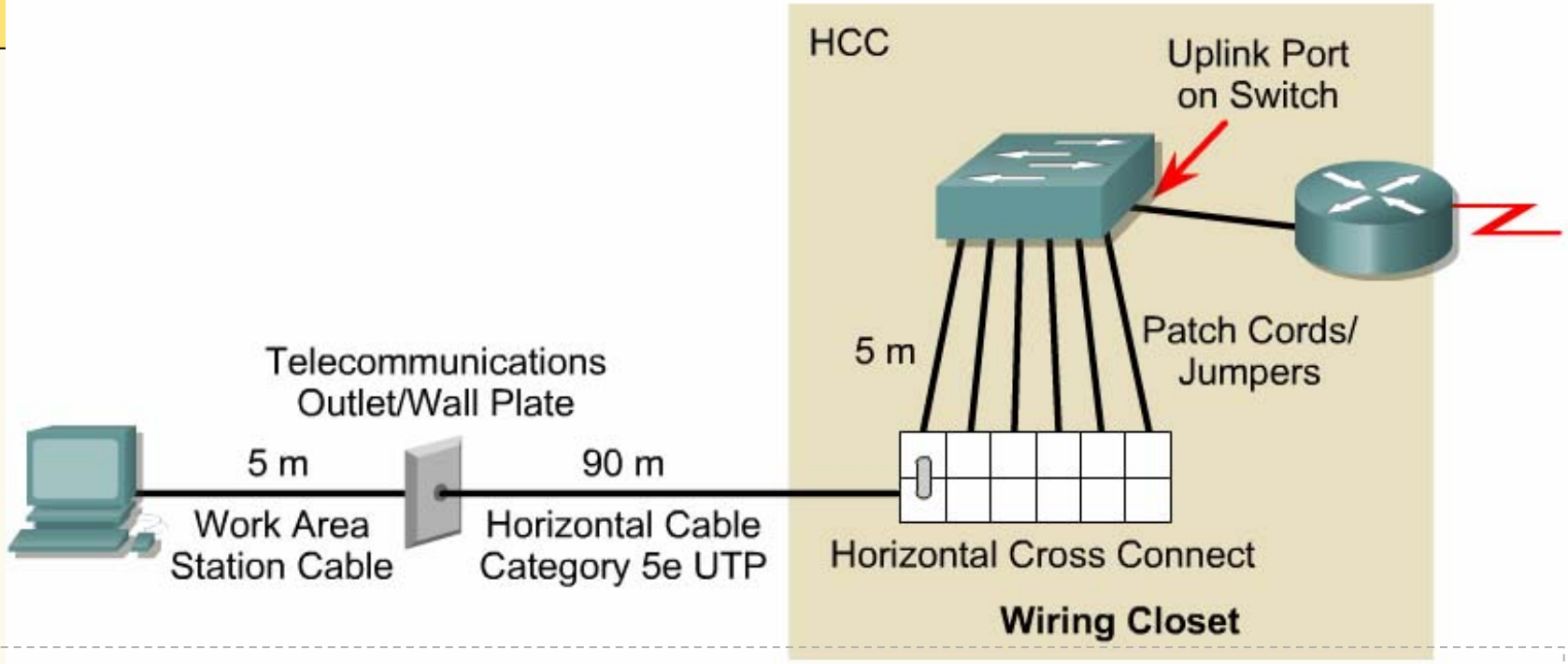
Characteristic	10BASE-T	10BASE-FL	100BASE-TX	100BASE-FX
Data rate	10 Mbps	10 Mbps	100Mbps	100 Mbps
Signaling method	Baseband	Baseband	Baseband	Baseband
Medium type	Category 5e UTP	Fiber-optic	Category 5e UTP	Multi-mode fiber (two strands)
Maximum length	100 meters	2000 meters	100 meters	2000 meters



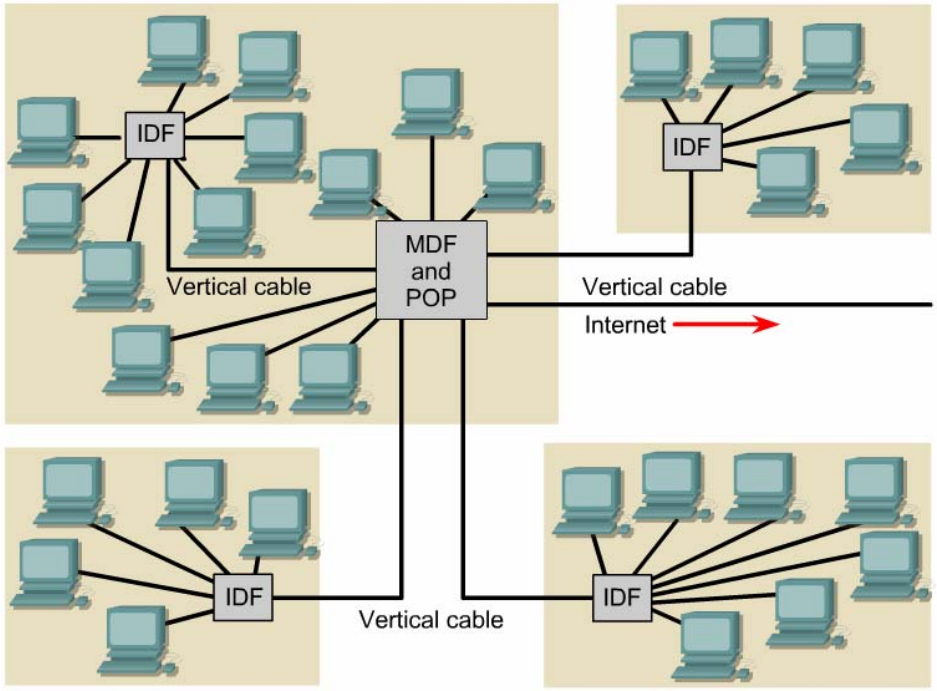


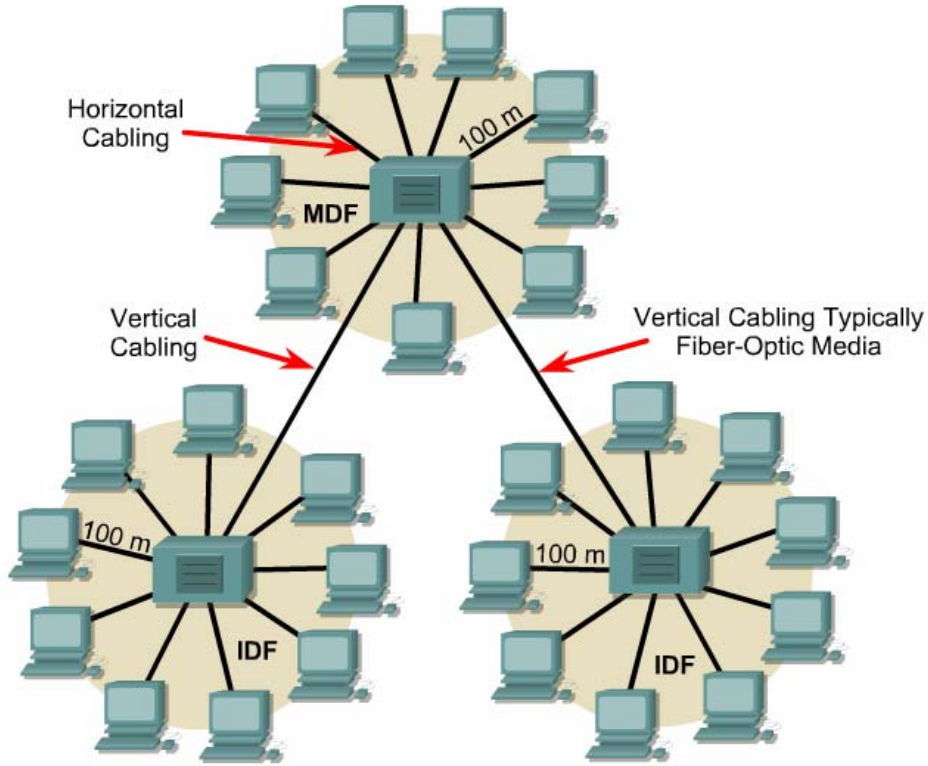
- One of the most important components to consider when designing a network is the physical cabling.
- Design issues at Layer 1 include the type of cabling to be used, typically copper or fiber-optic, and the overall structure of the cabling.

Layer 1 design



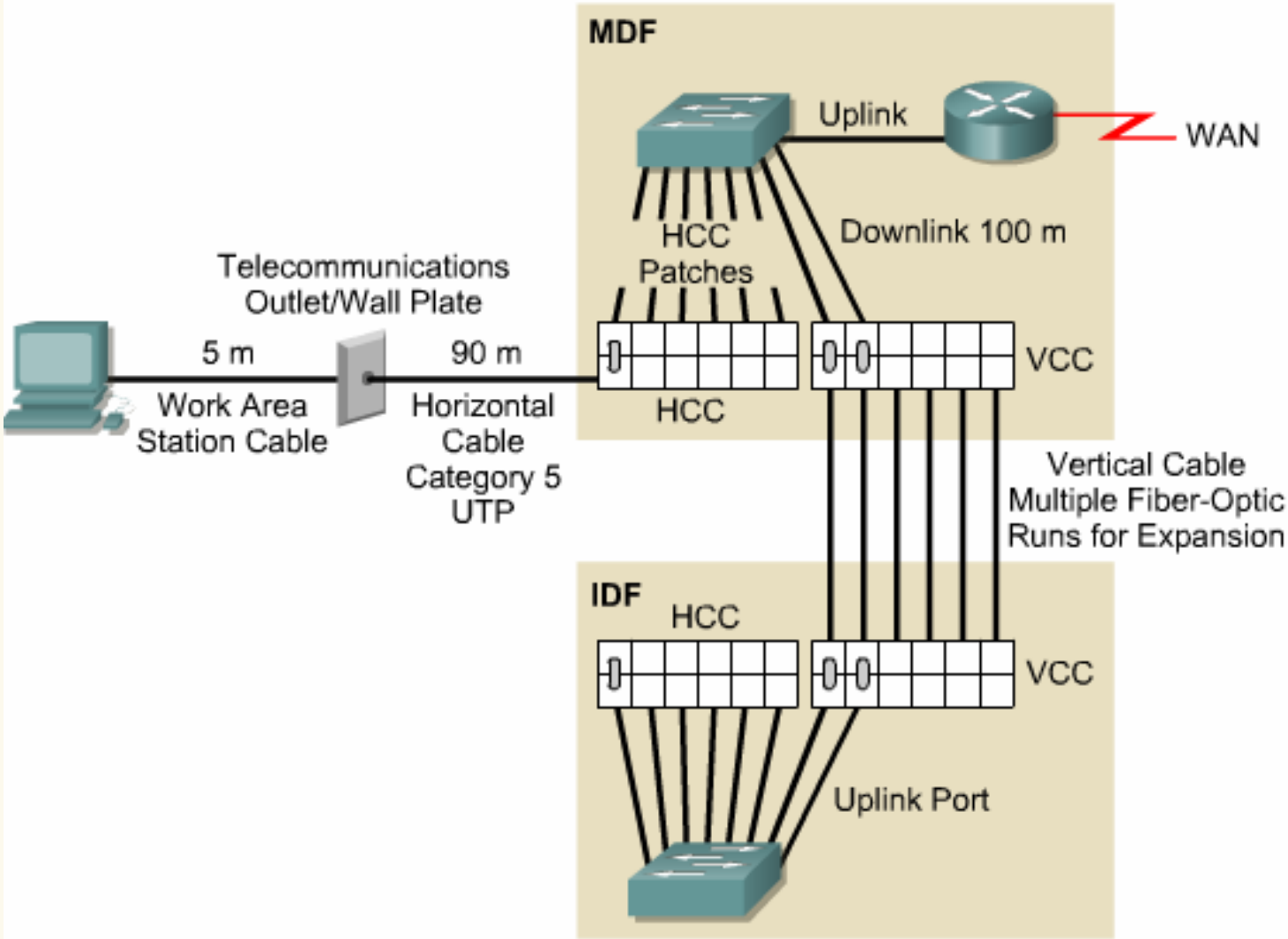
- In a simple star topology with only one wiring closet, the MDF includes one or more horizontal cross-connect (HCC) patch panels.
- HCC patch cables are used to connect the Layer 1 horizontal cabling with the Layer 2 LAN switch ports.
- The uplink port of the LAN switch, depending on the model, is connected to the Ethernet port of the Layer 3 router using a patch cable. At this point, the end host has a complete physical connection to the router port.



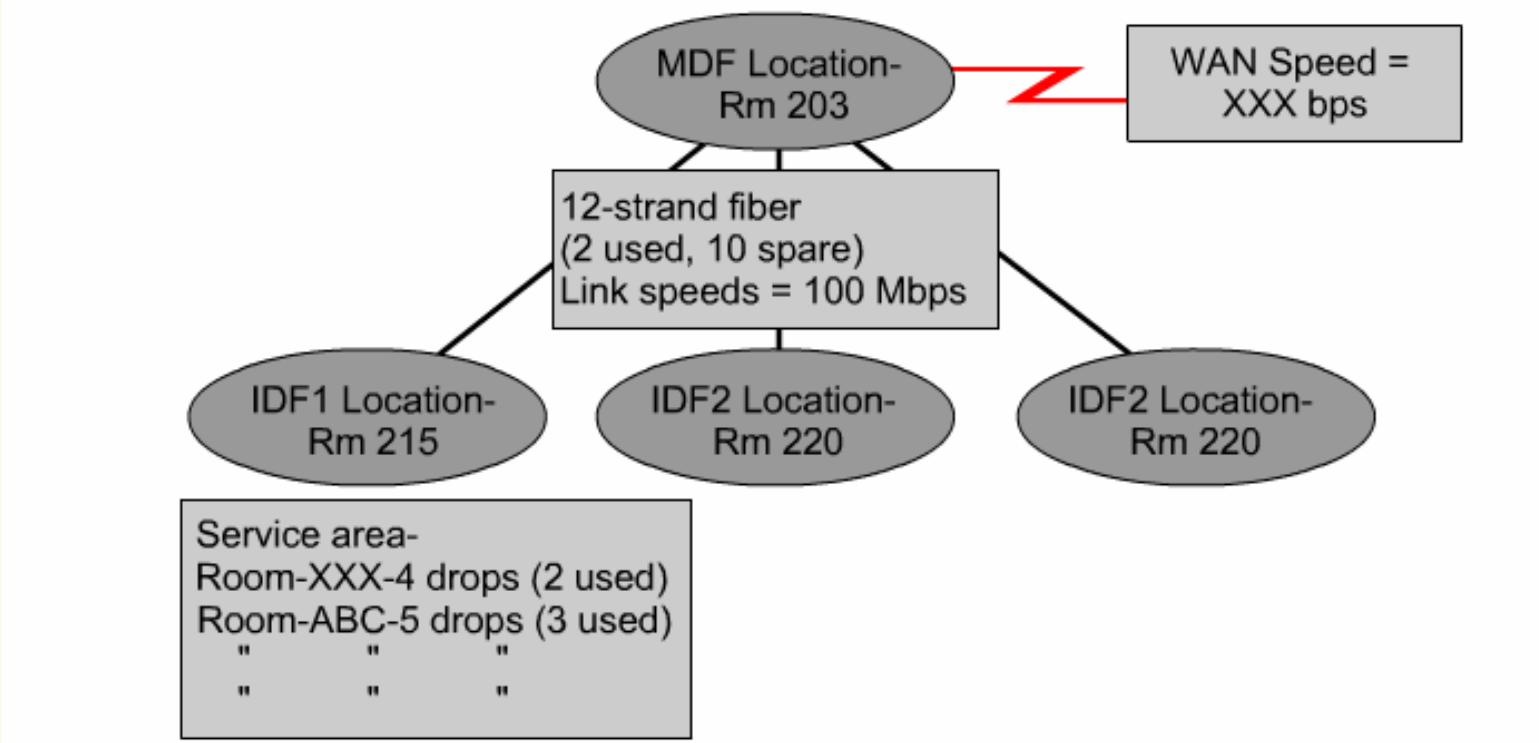


- By creating multiple wiring closets, multiple catchment areas are created.
- The secondary wiring closets are referred to as intermediate distribution facilities (IDFs).
- TIA/EIA-568-A standards specify that IDFs should be connected to the MDF by using vertical cabling, also called backbone cabling.
- A vertical cross-connect (VCC) is used to interconnect the various IDFs to the central MDF.
- Fiber-optic cabling is normally used because the vertical cable lengths are typically longer than the 100-meter limit for Category 5e UTP cable.

Extended Star Topology in a Multi-Building Campus



Documentation Logical Diagram

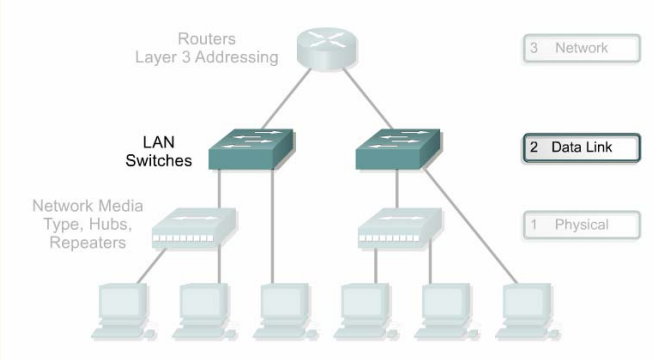


- Logical diagram is a snapshot view of all LAN implementation
- Useful in troubleshooting problems and implementing expansion in the future

Cut Sheet

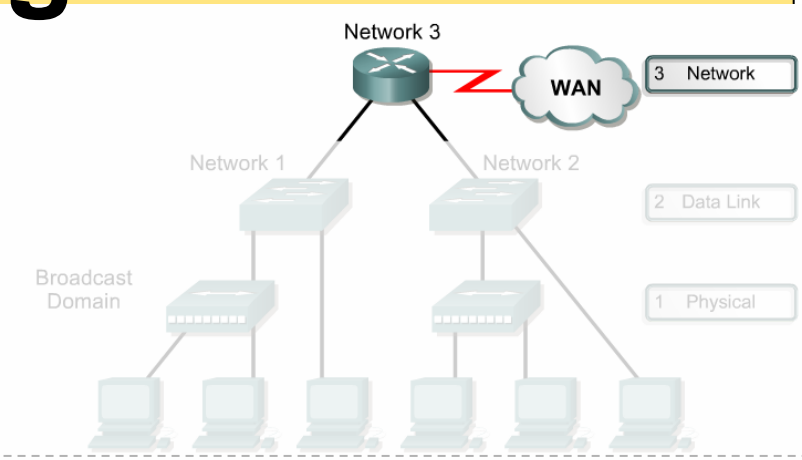
Connection	Cable ID	Cross Connection Paired#/Port#	Type of Cable	Status
IDF1 to Rm 203	203-1	HCC1/Port 13	Category 5 UTP	Used
IDF1 to Rm 203	203-2	HCC1/Port 14	Category 5 UTP	Not Used
IDF1 to Rm 203	203-3	HCC2/Port 3	Category 5 UTP	Not Used
IDF1 to MDF	IDF1-1	VCC1/Port 1	Multimode fiber	Used
IDF1 to MDF	IDF1-2	VCC1/Port 2	Multimode fiber	Used

Layer 2 design



- Collisions and collision domain size are two factors that negatively affect the performance of a network.
- Microsegmentation of the network reduces the size of collision domains and reduces collisions.
- Microsegmentation is implemented through the use of bridges and switches.
- The goal is to boost performance for a workgroup or a backbone.
- Switches can be used with hubs to provide the appropriate level of performance for different users and servers.

Layer 3 design

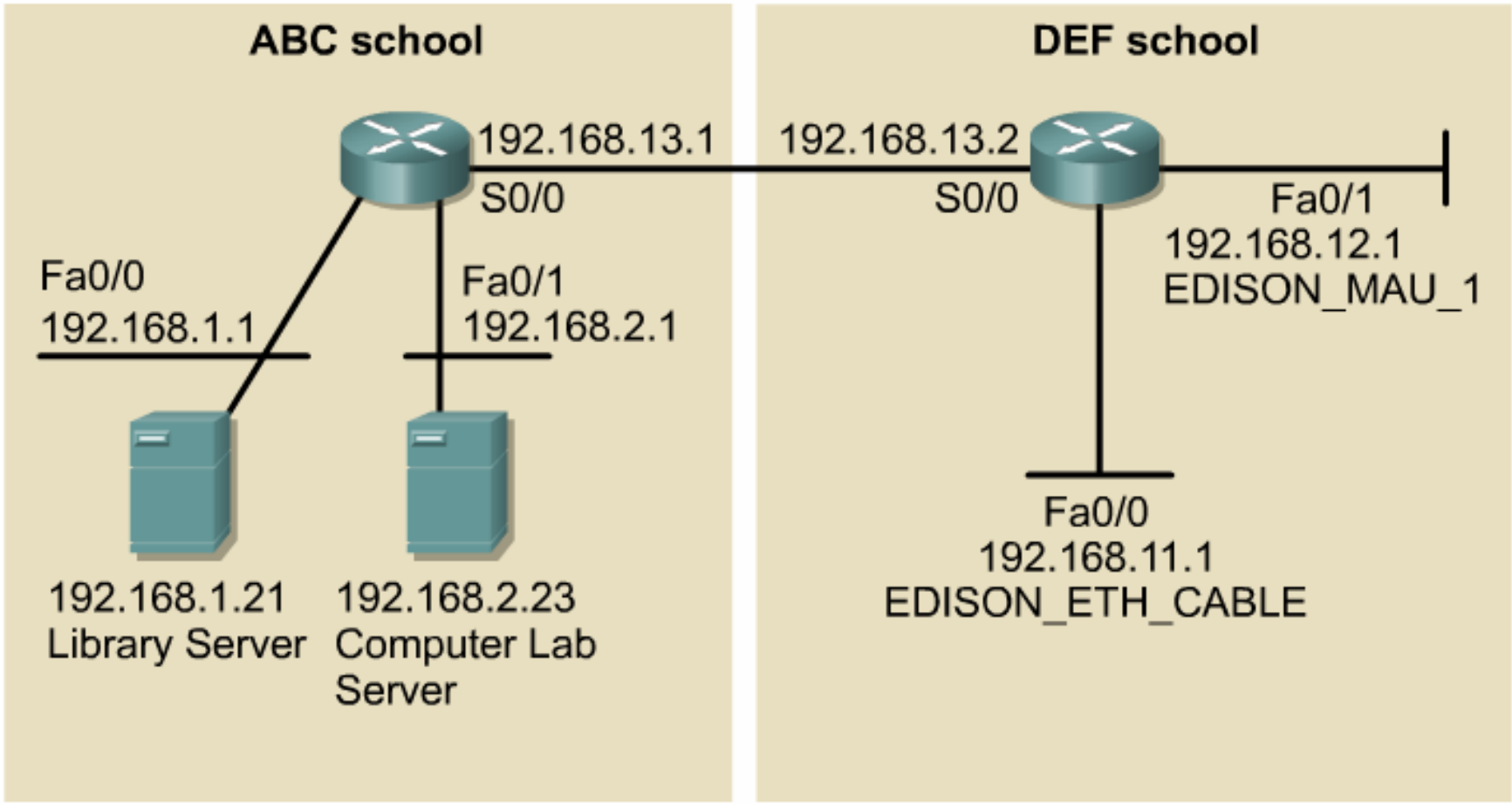


- Routers can be used to create unique LAN segments and also allow for connectivity to wide-area networks (WANs), such as the Internet.
- Layer 3 routing determines traffic flow between unique physical network segments based on Layer 3 addressing.
- Routers provide scalability because they serve as firewalls for broadcasts.
- They can also provide scalability by dividing networks into subnetworks, or subnets, based on Layer 3 addresses.
- VLAN implementation combines Layer 2 switching and Layer 3 routing technologies to limit both collision domains and broadcast domains.
- VLANs can also be used to provide security by creating the VLAN groups according to function and by using routers to communicate between VLANs.

Logical Addressing Mapped to Physical Network

Logical Address	Physical Network Devices
x.x.x.1-x.x.x.10	Router, LAN, and WAN ports
x.x.x.11-x.x.x.20	LAN switches
x.x.x.21-x.x.x.30	Enterprise servers
x.x.x.31-x.x.x.80	Workgroup servers
x.x.x.81-x.x.x.254	Hosts

Logical Addressing Maps



Logical Network Maps and Addressing Maps

IP Network 172.16.0.0

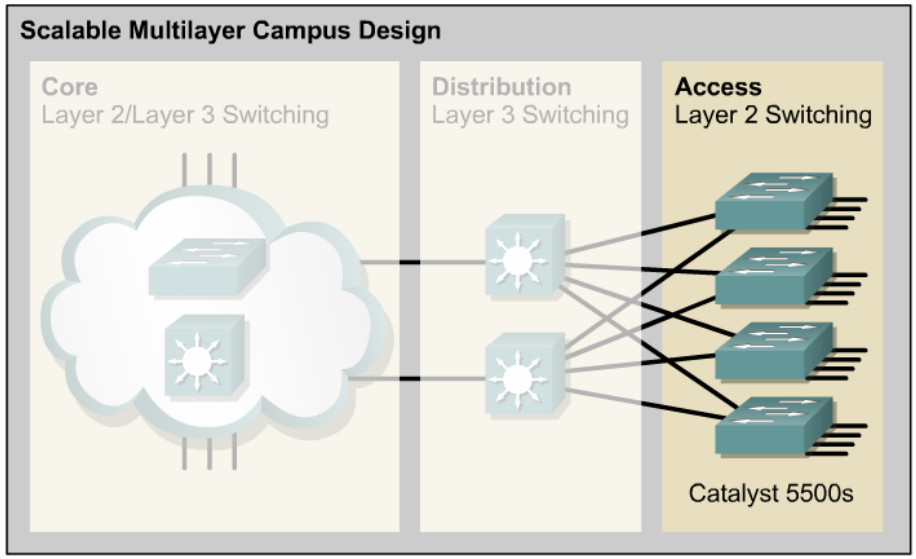
Subnet Mask = 255.255.255.0

XYZ school district

ABC school
172.16.1.0
through
172.16.10.0
Subnet mask = 255.255.255.0
Router name = ABC Router
Fa0/0 = 172.16.1.1
Fa0/1 = 172.16.2.1

DEF school
172.16.11.0
through
172.16.21.0
Subnet mask = 255.255.255.0
Router name = DEF Router
Fa0/0 = 172.16.11.1
Fa0/1 = 172.16.12.1

Switched LANs, hierarchical design overview



The hierarchical design model includes the following three layers:

- The **access layer** provides users in workgroups access to the network.
- The **distribution layer** provides policy-based connectivity.
- The **core layer** provides optimal transport between sites.
  - The core layer is often referred to as the backbone.

Access layer switches

- Access layer switches operate at Layer 2 of the OSI model and provide services such as VLAN membership.
- The main purpose of an access layer switch is to allow end users into the network.
- MAC filtering.
- Port security.
- Microsegmentation.
- An access layer switch should provide this functionality with low cost and high port density.

Features of Access Layer Switches

Catalyst	Type	Supported OSI Layers	Ethernet Ports	Fast Ethernet Ports	Gigabit Ethernet	Enterprise Size
1900 Series	Fixed configuration	Layer 2	12 or 24	2	0	Small to Medium
2820 Series	Fixed configuration with modular expansion slots	Layer 2	24	2	0	Small to Medium
2950 Series	Fixed Configuration	Layer 2	0	12 or 24 speed configurable	0 or 2	Small to Medium
4000 Series	Modular - multiple slots per chassis	Layer 2 and Layer 3	Configurable ports - up to 240	Configurable ports - up to 240	Configurable ports - up to 240	Varies with options chosen
5000 Series	Modular - multiple slots per chassis	Layer 2 and Layer 3	Configurable ports - up to 528	Configurable ports - up to 266	Configurable ports - up to 38	Varies with options chosen

Access Layer Switches

- Catalyst 1900 series
- Catalyst 2820 series
- Catalyst 2950 series
- Catalyst 4000 series
- Catalyst 5000 series

Distribution Layer

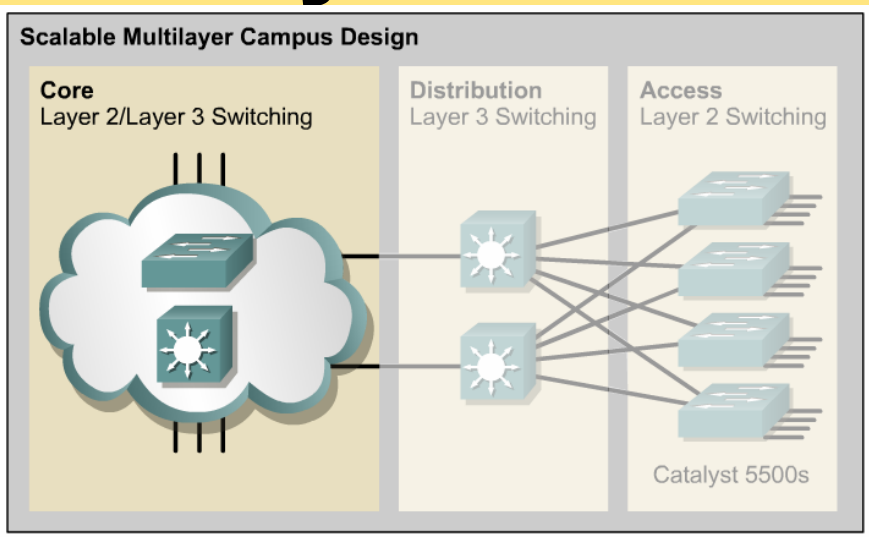
- The purpose of this layer is to provide a boundary definition in which packet manipulation can take place.
- Networks are segmented into broadcast domains by this layer.
- Policies can be applied and access control lists can filter packets.
- The distribution layer also prevents problems from affecting the core layer.
- Switches in this layer operate at Layer 2 and Layer 3.
- The distribution layer includes several functions such as the following:
  - Aggregation of the wiring closet connections
  - Broadcast/multicast domain definition
  - Virtual LAN (VLAN) routing
  - Any media transitions that need to occur
  - Security

Distribution Layer Switches

Cisco Catalyst 2926G

Cisco Catalyst 6000 Family

Core Layer



- The core layer is a high-speed switching backbone.
- If they do not have an associated router module, an external router is used for the Layer 3 function.
- This layer of the network design should not perform any packet manipulation.
  - Packet manipulation, such as access list filtering, would slow down the switching of packets.
- Providing a core infrastructure with redundant alternate paths gives stability to the network in the event of a single device failure.

Core Layer Switches

- In a network design, the core layer can be a routed, or Layer 3, core.
- Core layer switches are designed to provide efficient Layer 3 functionality when needed.
- Factors such as need, cost, and performance should be considered before a choice is made.
- The following Cisco switches are suitable for the core layer:
  - Catalyst 6500 series
  - Catalyst 8500 series
  - IGX 8400 series
  - Lightstream 1010

Core Layer Switches

IGX 8400 series

Lightstream 1010

Catalyst 8500 series

Cisco Catalyst 6500 Family