# Telecommunications Infrastructure Standard for Data Centers

## ANSI/TIA-942

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# Data Center Standards

- ANSI/TIA-942 Telecommunications Infrastructure Standard for Data Centers
  - Co-chairs: Chris DiMinico & Jonathan Jew
  - Published 2005 – available through TIA at www.tiaonline.org
- ANSI/NECA/BICSI-002 Data Center Design and Implementation Best Practices
  - co-chairs: Jonathan Jew & John Kacperski
  - best practices – complements TIA-942 – 2007 target

# Who Developed TIA-942?

- Developed by the TIA TR-42.1.1 Network Distribution Nodes subcommittee as Project No. 3-0092
- Participants included:
  - Architecture & Engineering Firms
  - Consultants
  - End Users
  - Manufacturers

# Purpose of TIA-942

- Encourage early participation of telecom designers in data center design process
- Fill a void by providing standards for planning of data centers, computer rooms, server rooms, and similar spaces.
- The standard encompasses much more than just telecommunications infrastructure.
- Close to half of the technical content deals with facility specifications.

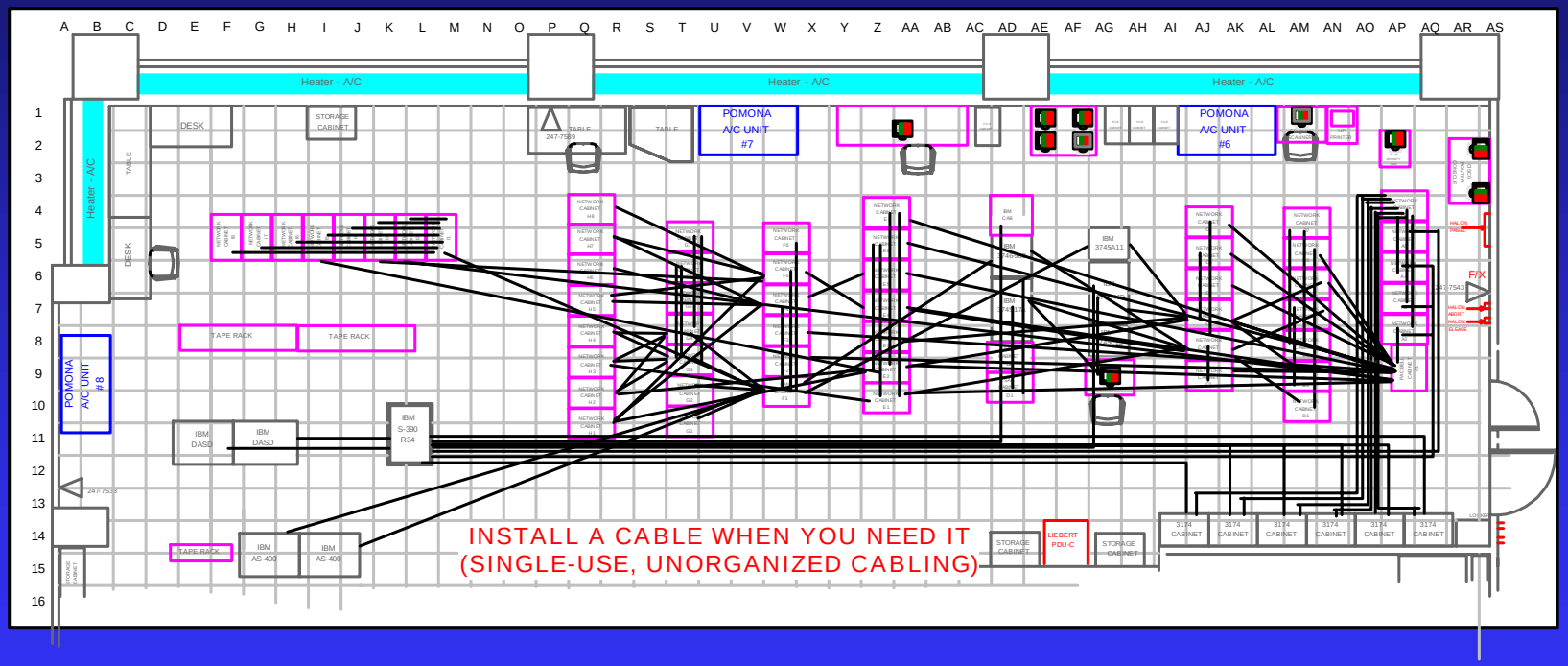
# Purpose of TIA-942

- Define a standard telecommunications infrastructure for data centers
  - Structured cabling system for data centers using standardized architecture and media
  - Accommodates a wide range of applications (LAN, WAN, SAN, channels, consoles)
  - Accommodates current and future protocols (e.g., 10+ GbE )
  - Replaces unstructured point-to-point cabling that uses different cabling for different applications

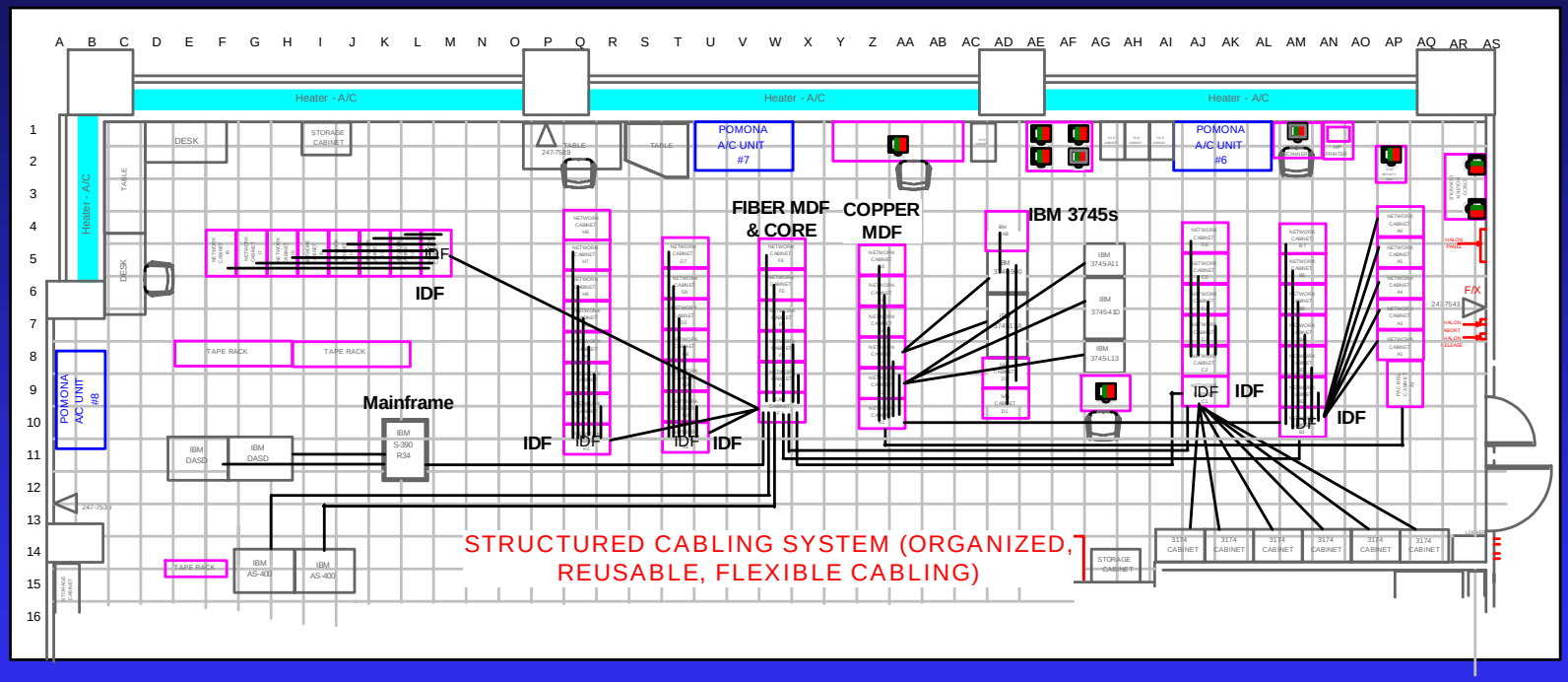
# Purpose of TIA-942

- Specifications for data center telecommunications pathways and spaces
- Recommendations on media and distance for applications over structured cabling
- Establish a standard for data center tiers to replace several proprietary standards. The TIA data center tier standard is:
  - A tool to evaluate existing data centers
  - A tool to communicate design requirements

# Unstructured Cabling



# Structured Cabling



# Design Elements

- Cabling Design
- Facility Design
- Network Design

- Informative annex's: Provide best practices
  - Annex A - Cabling Design Considerations
  - Annex B- Telecommunications infrastructure administration
  - Annex C-Access provider information
  - Annex D- Coordination of equipment plans with other engineers
  - Annex E- Data center space considerations
  - Annex F- Site selection

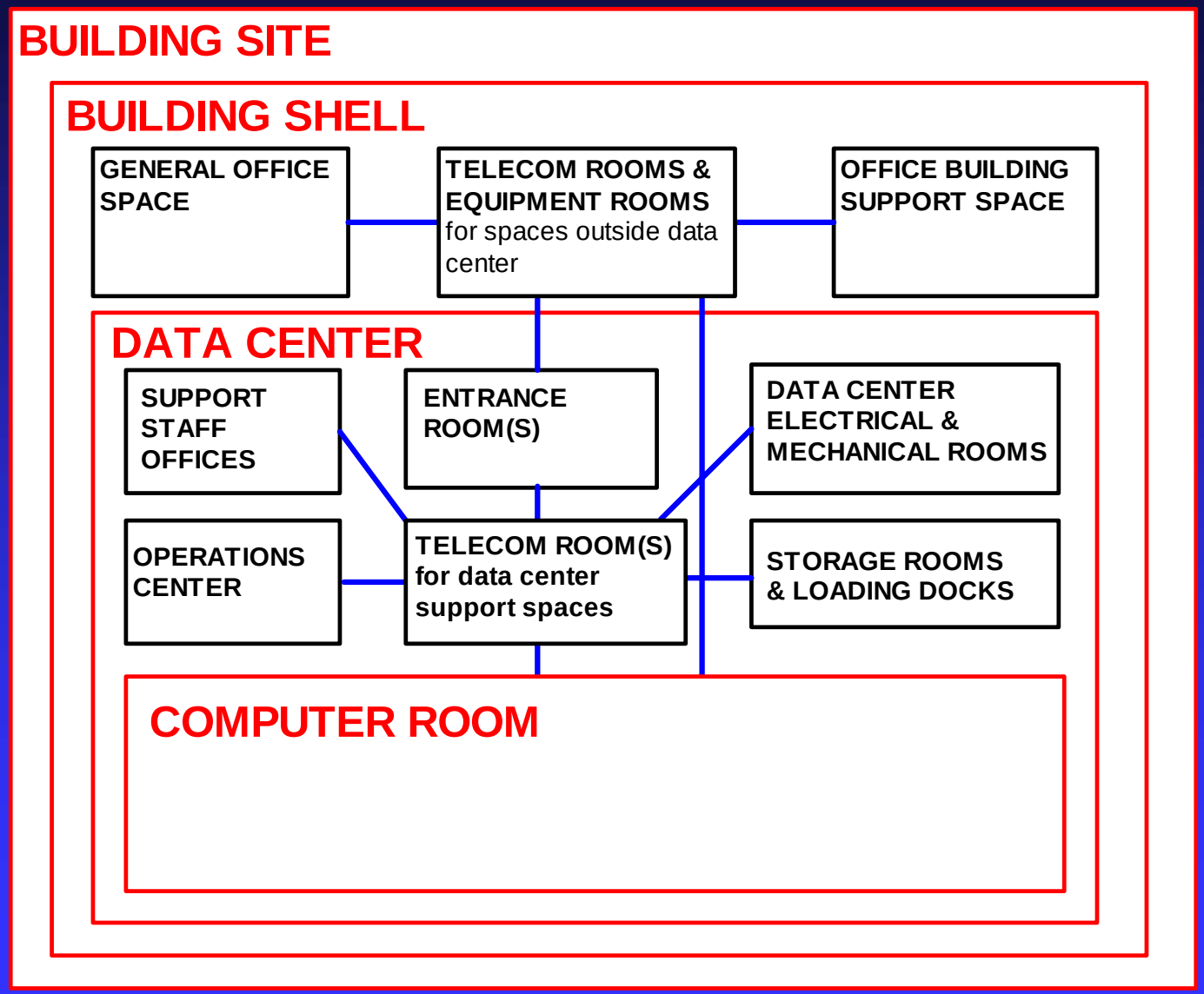
# Design Elements

- Cabling Design:
  - Copper and fiber cabling performance
  - Connectors, cables, distribution hardware
  - Cabling distances
  - Space management
- Facility Design:
  - Data center sizing
  - Power distribution methodologies
  - Pathways and spaces
  - HVAC, security, operations, and administration.
  - Flexibility, scalability, reliability and space management

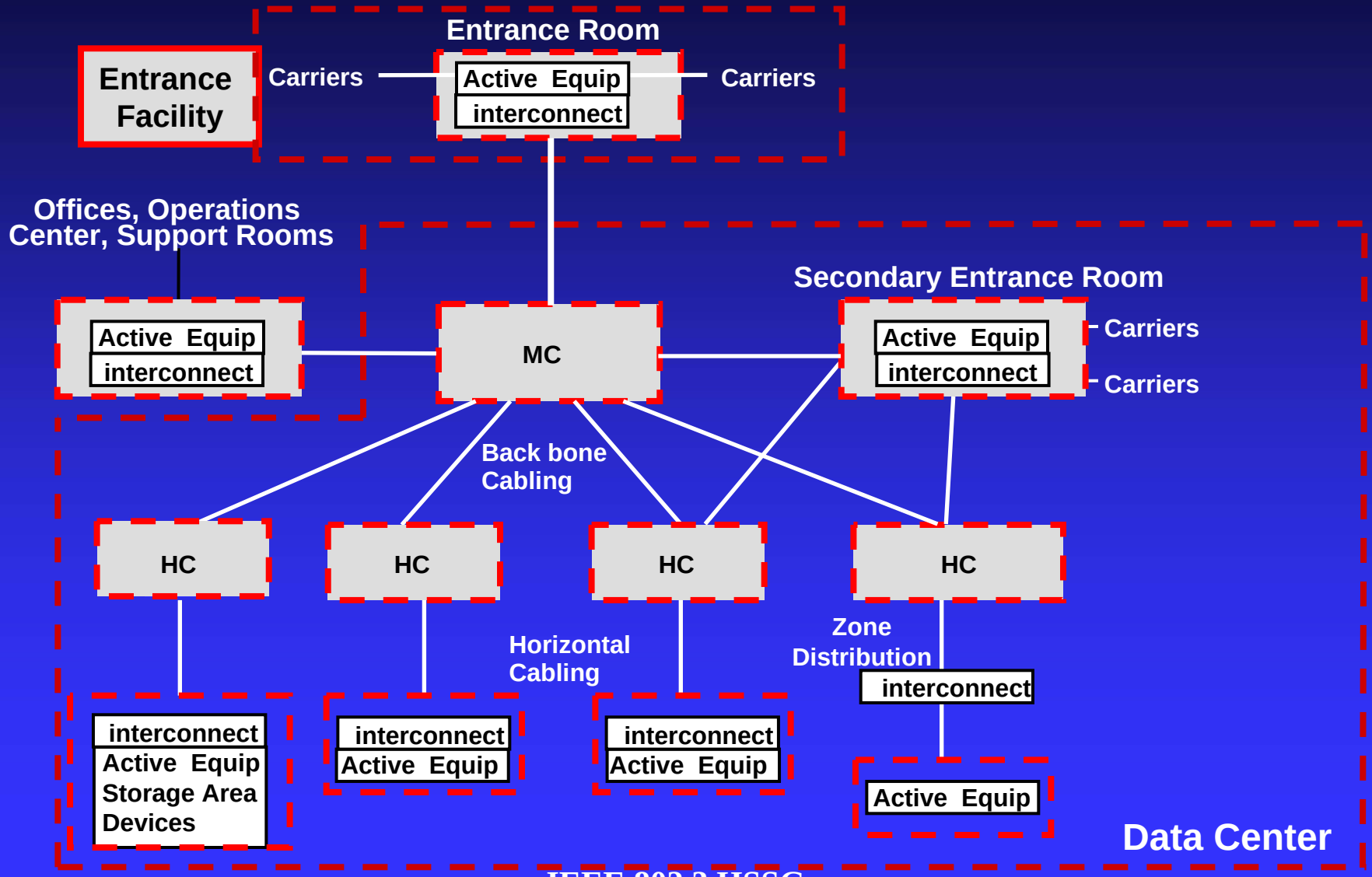
# Design Elements

- **Network Design:**
  - Support of legacy systems
  - Enable rapid deployment of new and emerging technologies such as 10 GbE and 10+ GbE copper and fiber applications.

# Relationship of Spaces



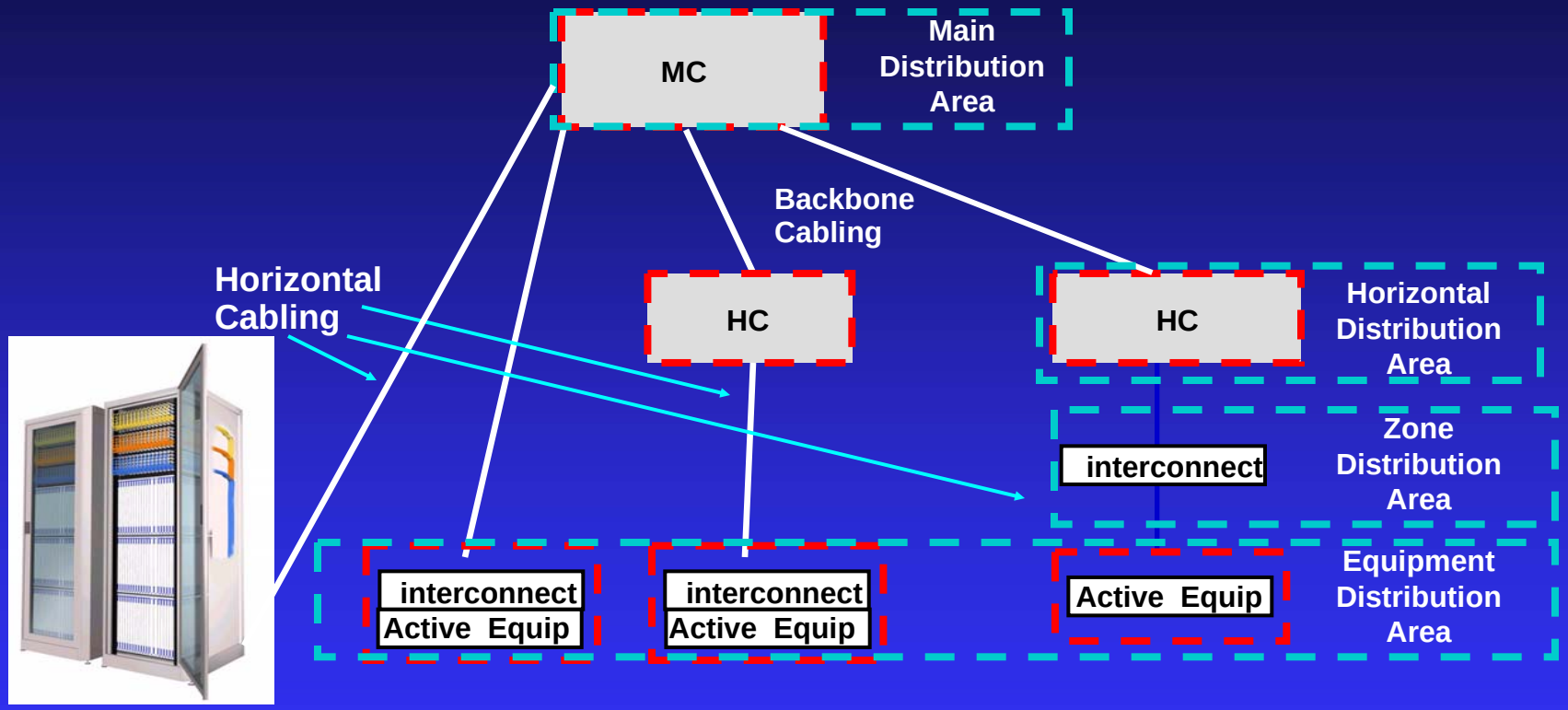
# Data Center Topology



# TIA-942 Spaces

- Entrance Room (ER) - location of interface with campus and carrier entrance facilities
- Main Distribution Area (MDA) – location of main cross-connect (MC)
- Horizontal Distribution Area (HDA) – location of horizontal cross-connect (HC)
- Zone Distribution Area (ZDA) – location of zone outlet (ZO) or consolidation point (CP)
- Equipment Distribution Area (EDA) – location of equipment cabinets and racks

# Data Center Cabling




Horizontal cabling is the cabling from the horizontal cross-connect (in the main distribution area or horizontal distribution area) to the outlet in the equipment distribution area or zone distribution area.

# Horizontal and Backbone Cabling

- Recognized Cables:
  - a) 100-ohm twisted-pair cable (ANSI/TIA/EIA-568-B.2), category 6 recommended (ANSI/TIA/EIA-568-B.2-1)
  - b) multimode optical fiber cable, either 62.5/125 micron or 50/125 micron (ANSI/TIA/EIA-568-B.3), 50/125 micron 850 nm laser optimized multimode fiber is recommended (ANSI/TIA-568-3-1)
  - c) singlemode optical fiber cable (ANSI/TIA/EIA-568-B.3)
  - d) 75-ohm (734 and 735 type) coaxial cable (Telcordia Technologies GR-139-CORE)

# Horizontal cabling distances

- The maximum horizontal distance is 90 m independent of media type.
- The maximum channel distance including equipment cords is 100 m.
- The maximum cabling distance in a data center not containing a horizontal distribution area is:
  - 300 m for an optical fiber channel including equipment cords.
  - 100 m for copper cabling including equipment cords.

# Backbone Cabling

- Includes cabling from MDA to ER, HDA
- Optional cabling between HDAs allowed
- Maximum backbone cable lengths depend on applications to be supported
- Centralized optical fiber cabling supported with interconnect, splice, or pull-through at the HDA
- Star topology with no intermediate cross-connects
- Various topologies permit redundancy and flexibility to support various data center sizes

# Computer Room & Entrance Room Requirements

- Min clear height of 2.6m/8.5 ft
- Min door size 1m/3ft wide 2.13/7ft high
- Min dist floor loading 7.2 kPA/150lbf/ft2, recommended min 12 kPA/250 lbf/ft2
- 20 degrees C to 25 degrees C
- 40% to 55% relative humidity (reduces ESD)
- Any sprinkler systems must be pre-action system
- Common bonding network (CBN) – equipotential ground reference

# Main Distribution Area

- Location of Main Cross-Connect (MC), the central point of distribution for data center structured cabling system
- Centrally located to avoid exceeding maximum distance restrictions (typically for E-1s, E-3s, T-1s and T-3s)
- Install separate racks for Fiber, UTP, and coaxial cable distribution

# Horizontal Distribution Area

- Location of Horizontal Cross-Connect (HC), the distribution point for cabling to equipment distribution area
- Distribution LAN, SAN, KVM switches and console servers located in HDA
- MDA may also include an HC for nearby equipment distribution area
- Number of HDAs depends on the density of cabling and the size of the data center

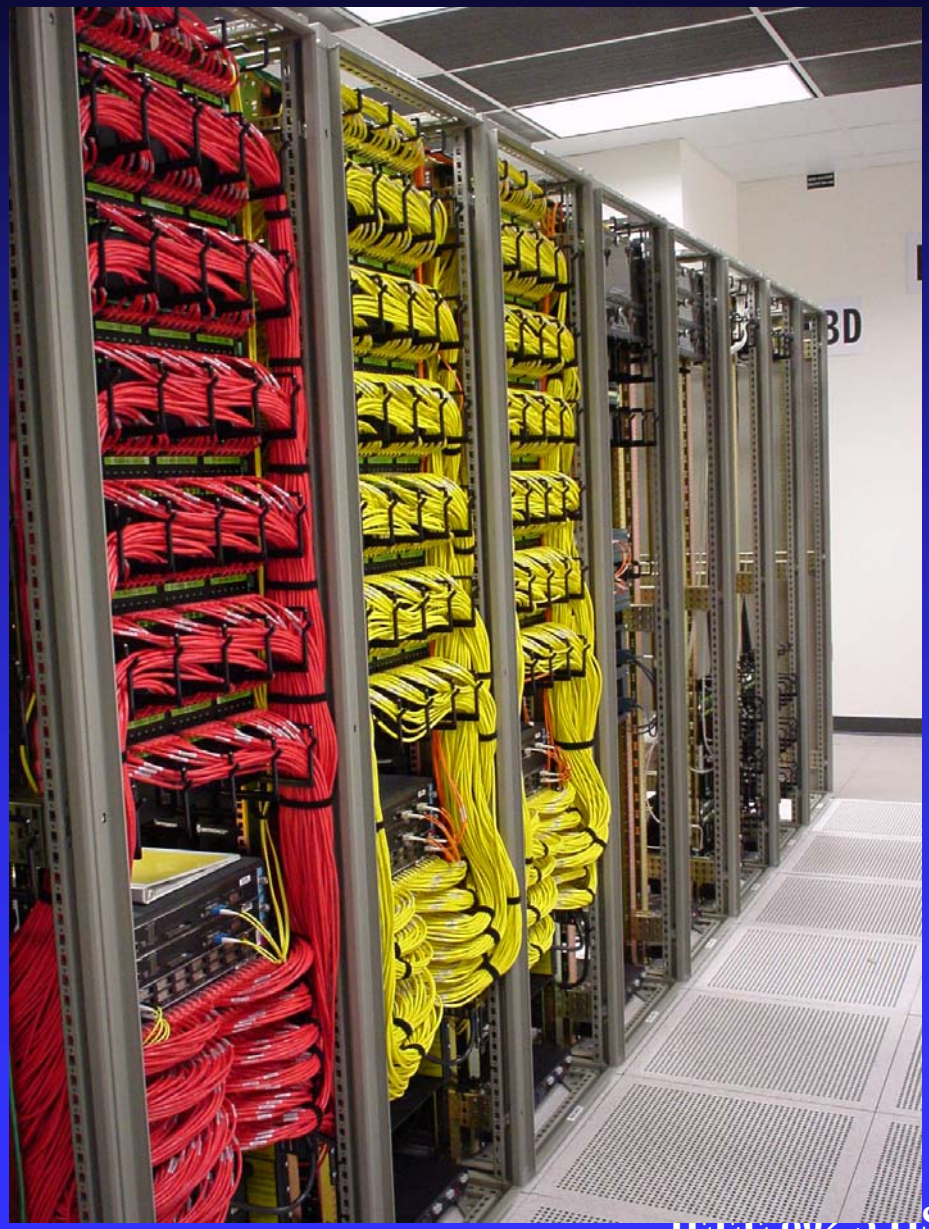
# Horizontal Distribution Area

- The capacity of the cable tray system and the size of the cross-connect creates practical limits on the size of the HC
- Guideline is maximum of 2,000 4-pair UTP or coax cable terminations per HDA
- Arrange patch bays to minimize patch cable lengths and to simplify cable management
  - Separate racks for fiber, UTP, and coax
  - Locate switches and patch panels to minimize patch cord lengths

# Zone Distribution Area

- Rack, cabinet, or under floor enclosure that houses a zone outlet (ZO) or consolidation point (CP)
- ZO - structured cabling termination for floor-standing equipment that cannot accept patch panels (e.g. mainframes and large servers).
- CP - intermediate termination point (e.g. cabling to areas where floor plan is uncertain or dynamic)
- No cross-connects within the ZDA
- No active equipment shall be located in the ZDA
- Maximum of 144 connections in a ZDA
- Maximum of one ZDA within a horizontal cable run

# Equipment Cabinets

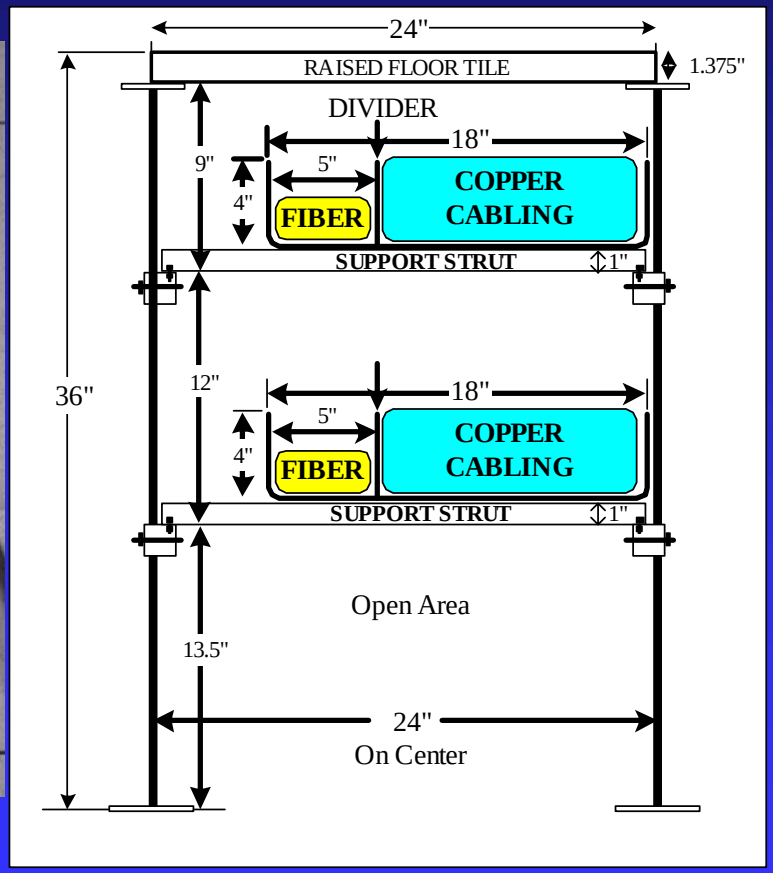


- Front rails of cabinets must be recessed to provide adequate room for patch cables and wire managers
- Recommend 1-to-1 ratio of patching to cable management
- Arrange switches and patch panels to minimize patching between cabinets & racks
- Perforated tiles at front of cabinets
- One edge of cabinets placed at edge of tile

# Raised Floor

- Better appearance than overhead cabling.
- Allows higher power densities, better control of cooling, and more flexibility in location of cooling equipment
- Most stand-alone computer systems are designed for cabling from below
- Coordinate under floor cabling with mechanical & electrical engineers
- Recommend wire basket cable trays in hot aisles for telecom cabling

# Example of Wire Basket Cable Trays For Cabling Under Raised Floor



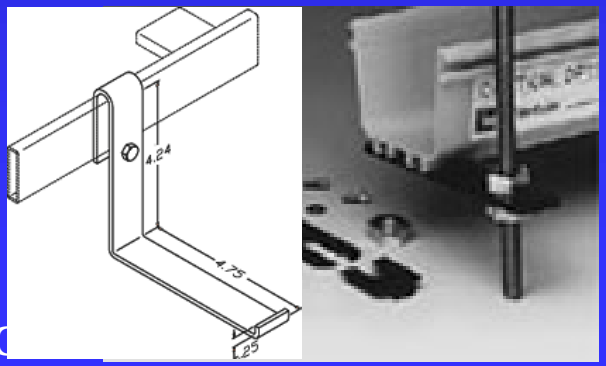
# Overhead Cable Trays

- Less expensive than raised floor systems
- Cable trays can be attached to the top of racks and cabinets (if they are uniform in height)
- Cable trays suspended from the ceiling provides more flexibility for supporting cabinets/racks of various heights and for adding and removing cabinets/racks.
- Cable trays can be installed with several layers
- Coordinate location with lighting, ducts, overhead conduits, overhead power distribution

# Overhead Cable Tray Example

3 Layer cable tray system:

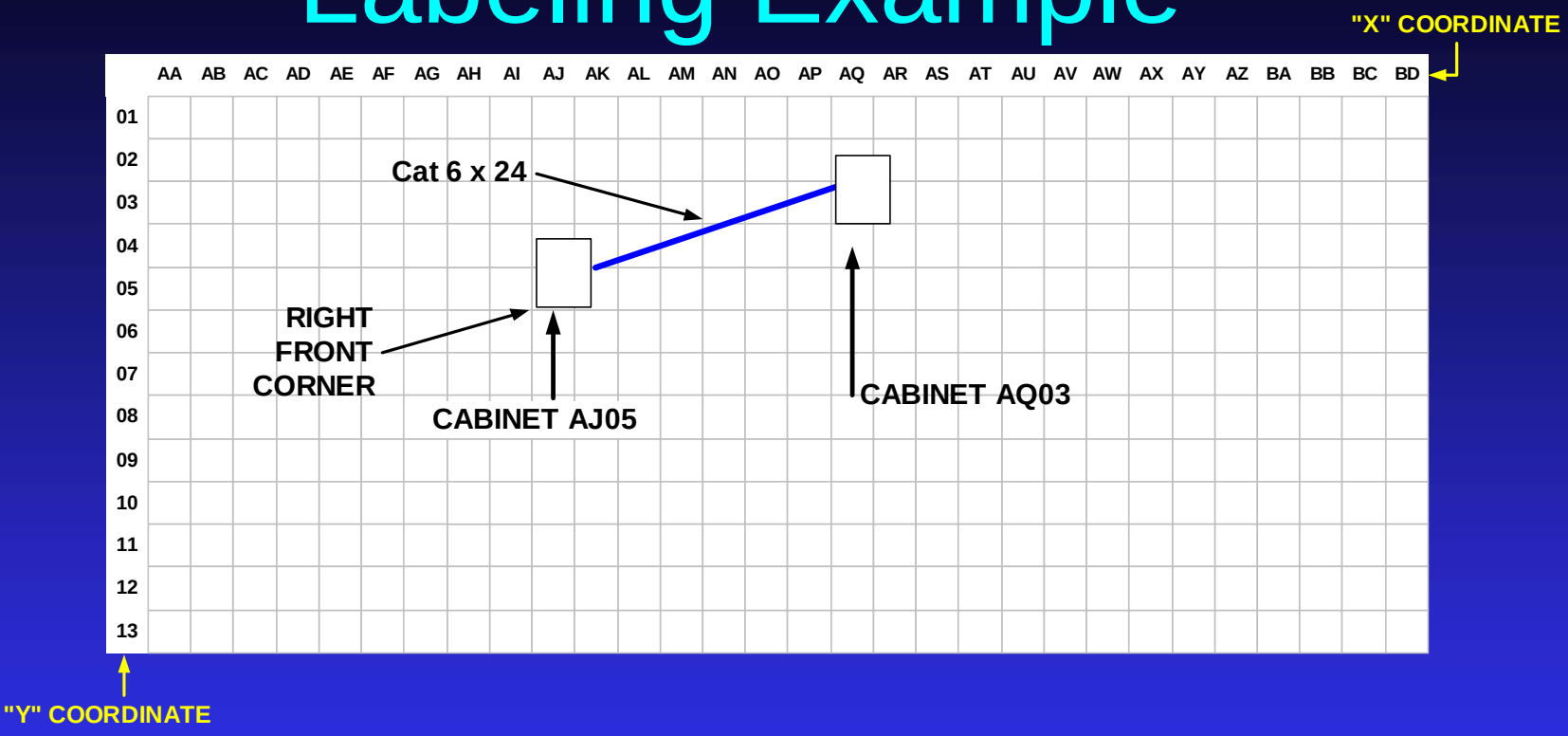
- Bottom layer – signal
- Middle layer – power
- Top layer – fiber
- Signal Reference Grid in brackets attached to lower layer of trays
- Fiber patch cables may be in fiber duct attached to threaded rods



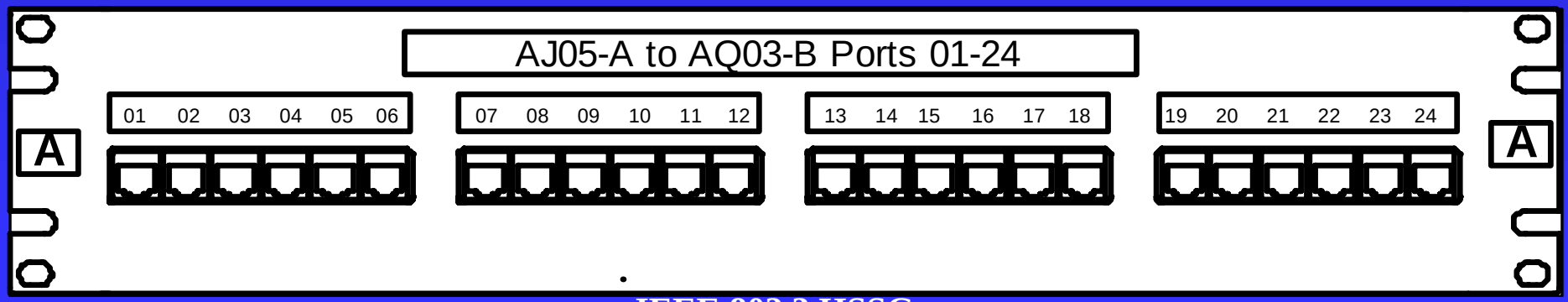
# Infrastructure Administration

- Informative annex with TIA-606-A standards compliant labeling scheme for all components.
- Labeling scheme extended for use in data centers
- Cabinets and racks labeled by location using tile grid or row/position identifiers
- All cabinets, racks, patch panels, cables, and patch cords should be labeled

# Labeling Example




Patch Panel for 24 Cat 6 from 1st Panel in Cab AJ05 to 2nd Panel in Cab AQ03



# Site Selection

- Informative annex with guidelines for selection of a site for a data center
  - Architectural
  - Electrical
  - Mechanical
  - Telecommunications
  - Security
  - Other

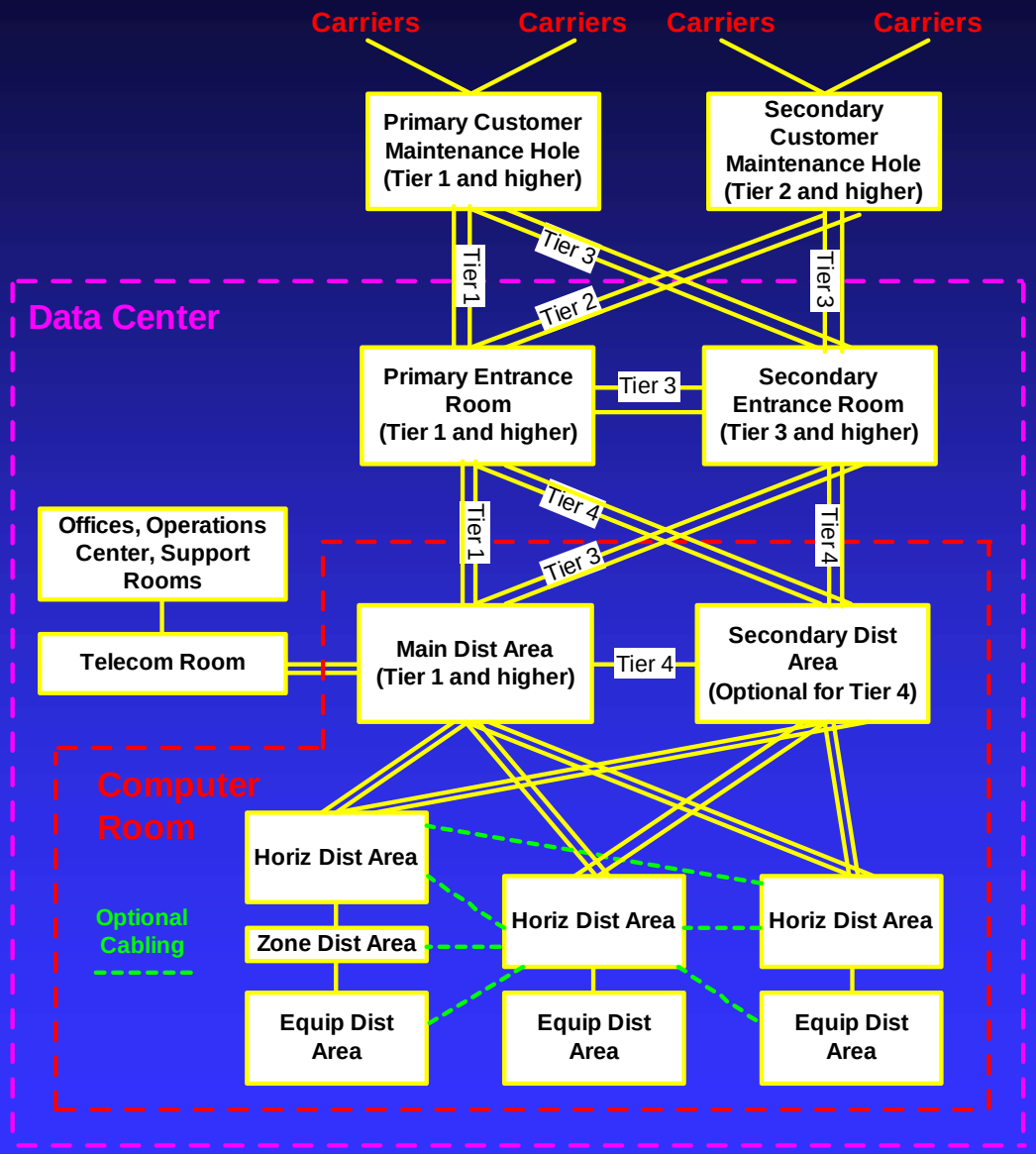
# Facilities Specifications & Tiers

- Informative annex with general architectural, structural, electrical, mechanical, and telecommunications recommendations requirements
- Annex includes detailed architectural, security, electrical, mechanical, and telecommunications recommendations for each Tier
- Recommended specifications by tier are a uniform way to rate aspects of a data center design and are a starting point for initiating design requirements with qualified architects and engineers

# Data Center Tiers

- Tier 1 – basic data center
  - no redundancy
- Tier 2 – redundant components
  - Single distribution path with redundant components
- Tier 3 – concurrently maintainable
  - Multiple distribution paths with only one active
- Tier 4 – fault tolerant
  - Multiple active distribution paths

# Redundant Topologies



# Data Center Tiers

- Higher tiers correspond to higher availability, but also have higher construction costs
- Data Center can have different tier ratings for different portions of its infrastructure (architectural, security, mechanical, electrical, telecommunications)
- The overall rating for the data center is equal to the lowest tier rating
- Capacity of systems may need to be upgraded to maintain tier rating as data center load increases
- Human error and operating procedures have a major impact on availability

# Conclusion

- TIA-942 is the first standard to specifically addresses data center infrastructure.
- Primarily a telecom infrastructure standard, but about half of the content deals with facility requirements.
- Provides a flexible and manageable structured cabling system using standard media.
- Builds on existing standards, when applicable
- Guidelines on a wide range of subjects useful to someone designing or managing a data center.
- An official tiering standard for determining the quality of a center. A way to objectively compare one center with another.