Opportunities in data centers for the ITS professional

Athens, 11.10.2013
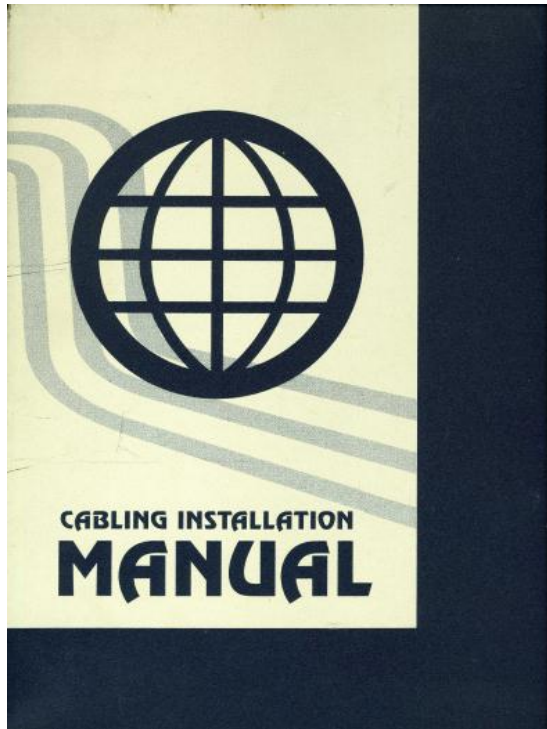
Ing. Yannis Katris, RCDD
TUI Accredited Tier Designer
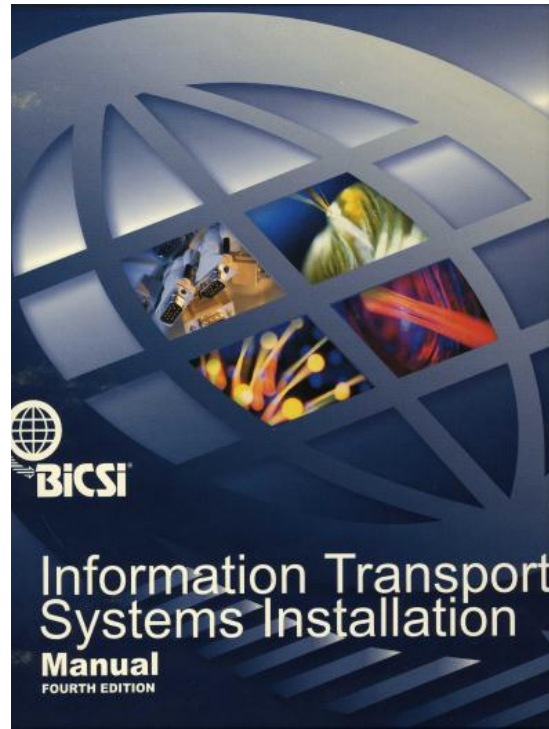CDCDP

TelecTrik
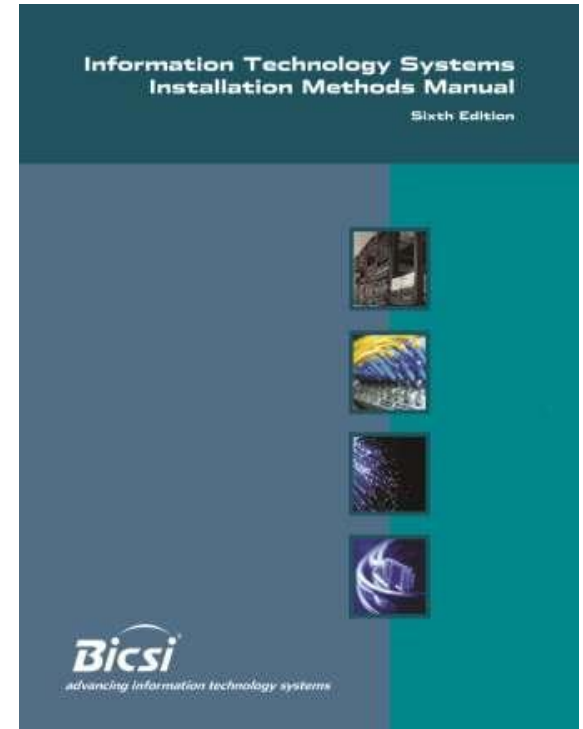
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BICSI Installation Manuals

1996

2004

2012

- **Cabling**
- **Information Transport Systems**
- **Information Technology Systems**

Structured Cabling Systems

**SCS Market Stages**
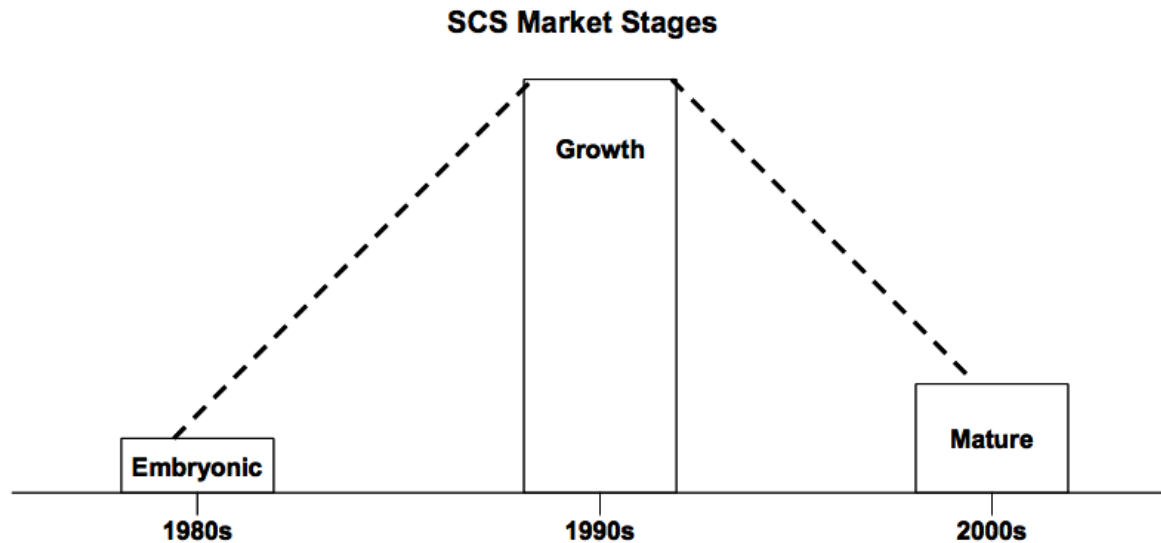
Source: FTM Consulting, Inc.

1970s: independent suppliers (not the telephone companies) provide inside wiring

1980s: PCs within the enterprise, Networks (IBM Type 1, Coaxial)

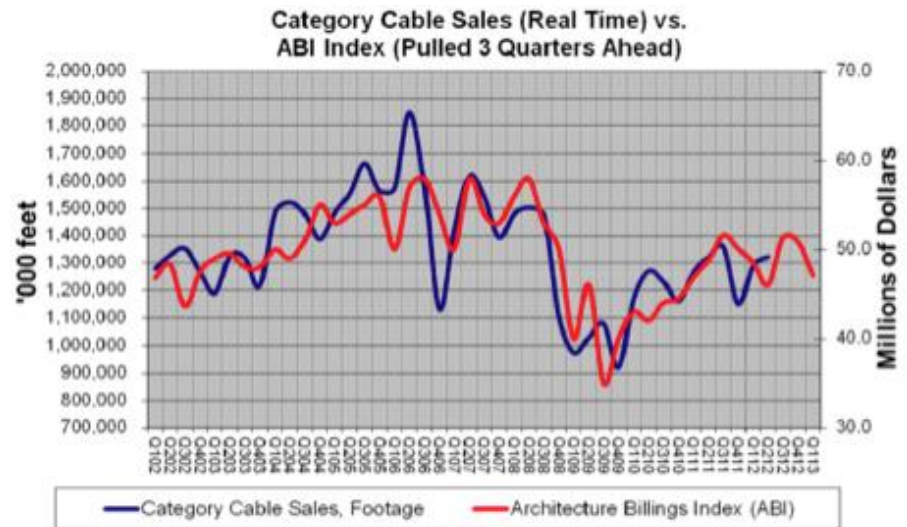1990s: 10Base-T LANs, the market is growing at phenomenal rates

2000s: new office construction declines, depressed growth, mature stage

4 pair "Category" cable footage

Footage, 4 pair "Category" Cabling

2006

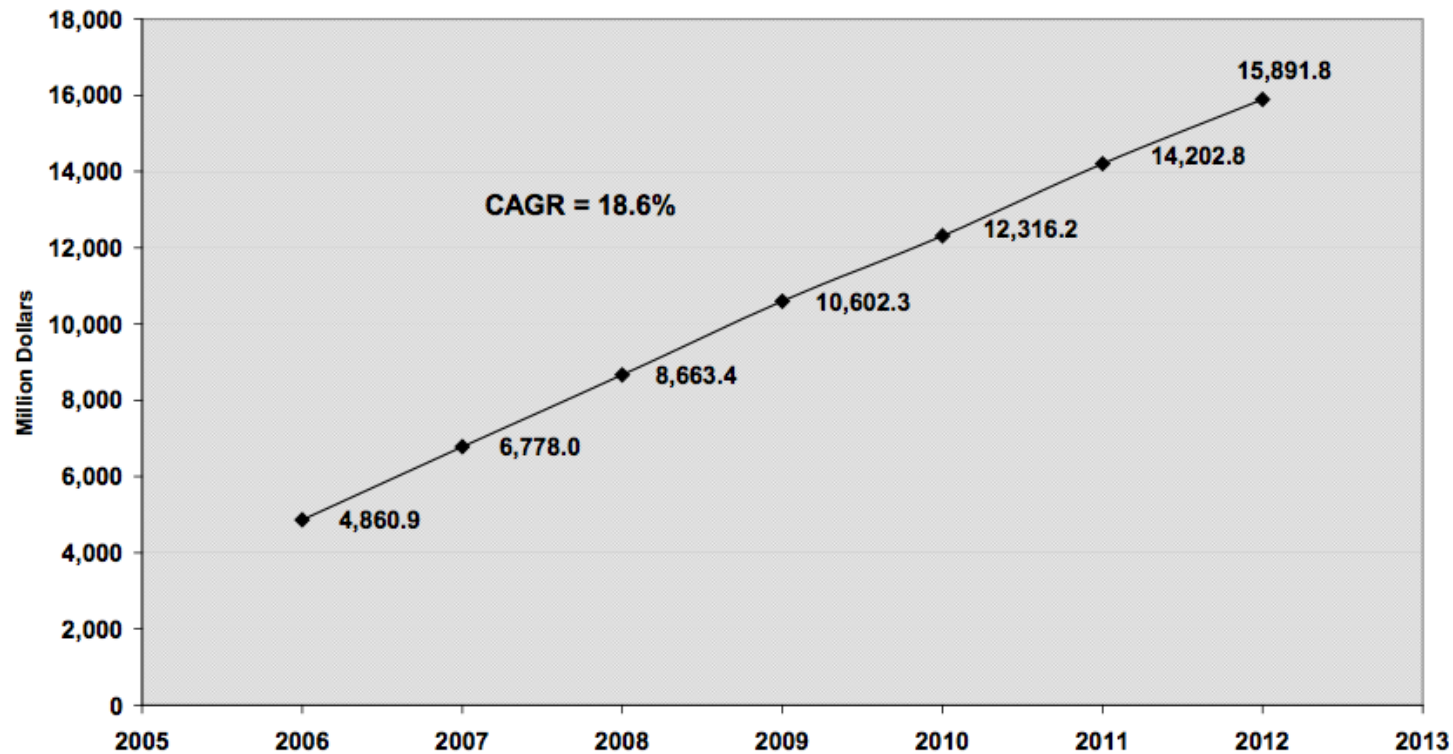Category Cable Sales (Real Time) vs. ABI Index (Pulled 3 Quarters Ahead)
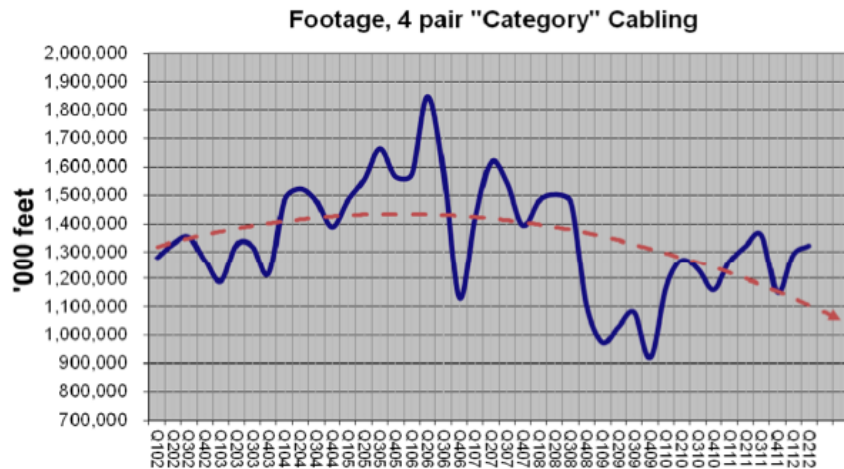
The resiliency of Cat.5e!

Source: BICSI presentation: Wireless Impact on Structured Cabling Systems, Bob Kenny (General Cable)

Total Structured Cabling Systems Market Forecast

CAGR = 18.6%

- 4,860.9 (2006)
- 6,778.0 (2007)
- 8,663.4 (2008)
- 10,602.3 (2009)
- 12,316.2 (2010)
- 14,202.8 (2011)
- 15,891.8 (2012)

Source: FTM Consulting, Inc.

A world of change

- The IT industry is one of the fastest changing in the world.
- Major changes emerging in enterprise networking – unified communications, virtualization, wireless, cloud computing, BYOD.
- Converging technologies.
- 100 million iPads sold (Oct. 2012) two and a half years after the first model came out.
- Mobile computing & Cloud computing – from a location-based PC environment to a person-based wireless environment.
- The "Post-PC Cloud-computing era". Cloud is remodeling Businesses.
- Towards a world of mobile, cloud, big data and social computing services – much faster than many realize.

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A lot of bytes!

6.6 ZB
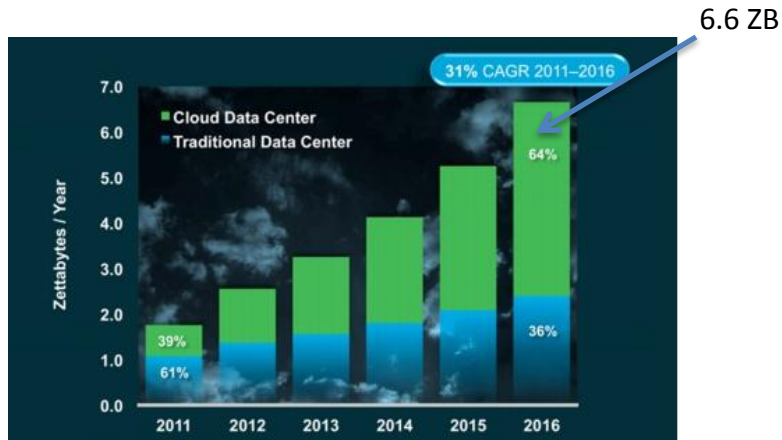
Global Data Center Traffic Growth
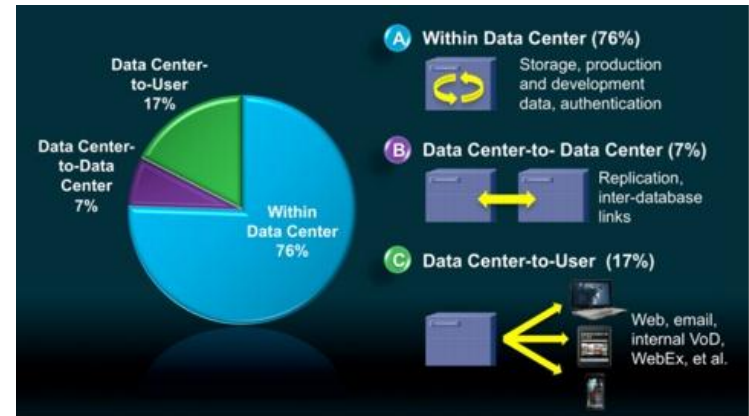
Global Data Center Traffic by Destination
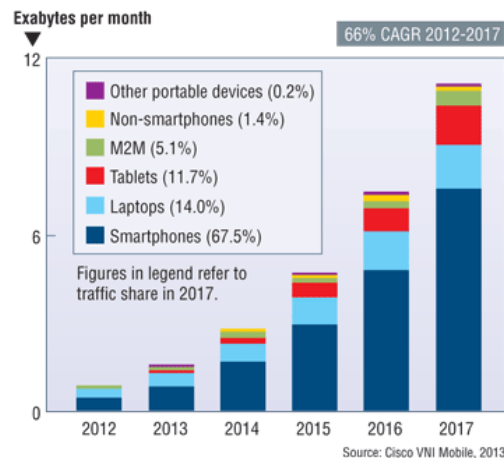
2013 Visual Networking Index

Name (Symbol)	Value
kilobyte (KB)	10^3
megabyte (MB)	10^6
gigabyte (GB)	10^9
terabyte (TB)	10^{12}
petabyte (PB)	10^{15}
exabyte (EB)	10^{18}
zettabyte (ZB)	10^{21}
yottabyte (YB)	10^{24}

Source: Cisco Global Cloud Index: Forecast and Methodology, 2011–2016

Where is the traffic?

- **Online Gaming**
- **Video Calling**
- **VoIP**
- **Web and Data**
- **File Sharing**
- **Internet-Video-to-TV**
- **Internet Video**

Data Center IP Traffic, 2011-2016

	2011	2012	2013	2014	2015	2016	CAGR 2011-2016
By Type (EB per Year)							
Data center to user	299	438	561	714	912	1,160	31%
Data center to data center	118	173	222	284	365	468	32%
Within data center	1,338	1,940	2,468	3,126	3,969	5,021	30%
By Segment (EB per Year)							
Consumer	1,404	2,107	2,700	3,439	4,418	5,672	32%
Business	351	444	551	685	828	977	23%
By Type (EB per Year)							
Cloud data center	683	1,181	1,694	2,324	3,166	4,255	44%
Traditional data center	1,072	1,370	1,557	1,800	2,080	2,394	17%
Total (EB per Year)							
Total data center traffic	1,755	2,551	3,251	4,124	5,246	6,649	31%

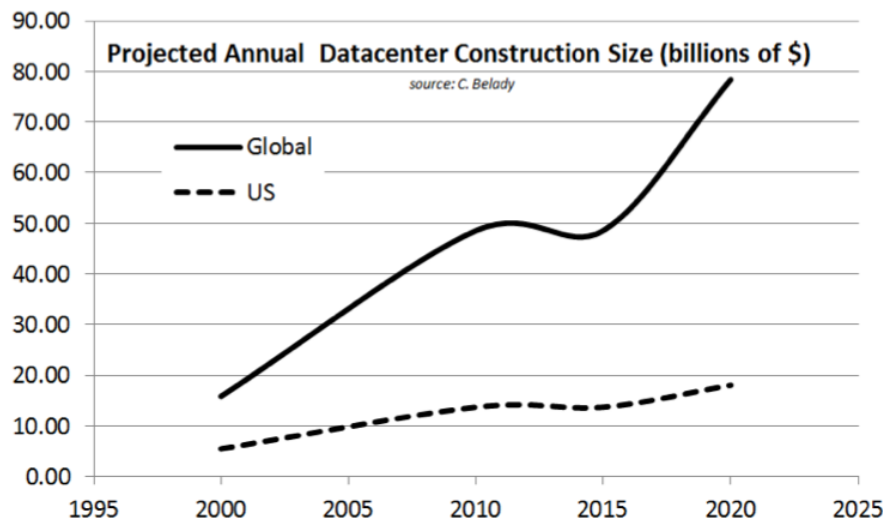Source: Cisco Global Cloud Index, 2012

Time to transfer information @ 10 Gbps

Byte 1 B = 8 b	Gigabyte 1,000,000,000 B	Terabyte 1,000 GB	Petabyte 1,000 TB	Exabyte 1,000 PB	Zettabyte 1,000 EB
sec	1				
min		15			
days			10		
years				30	
centuries					300

10 Base-* → 100 Base-* → 1000 Base-* → 10G Base-* → 40G Base-* → 100G Base-*

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Data Centers & Wireless

Source: Microsoft Martie 2011, "Projecting Annual New Datacenter Construction Market Size",
Christian L. Belady
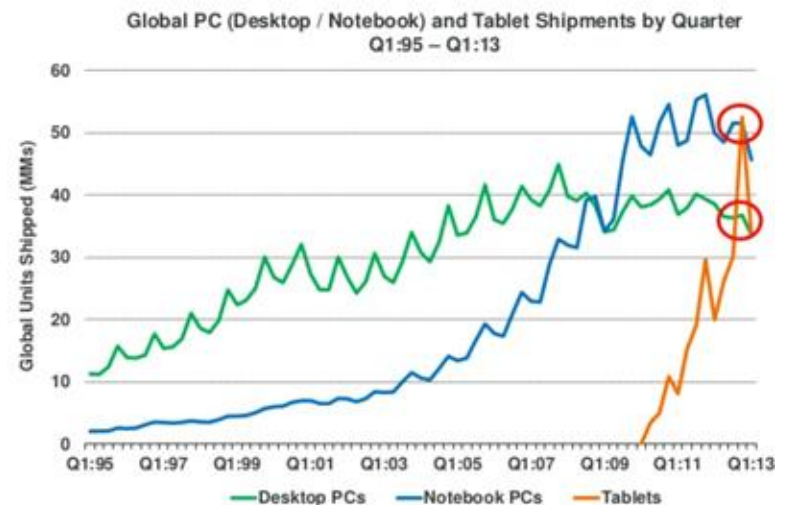
Source: Kleiner Perkins, Mary Meeker

Data Centers: New builds & modernizing existing ones
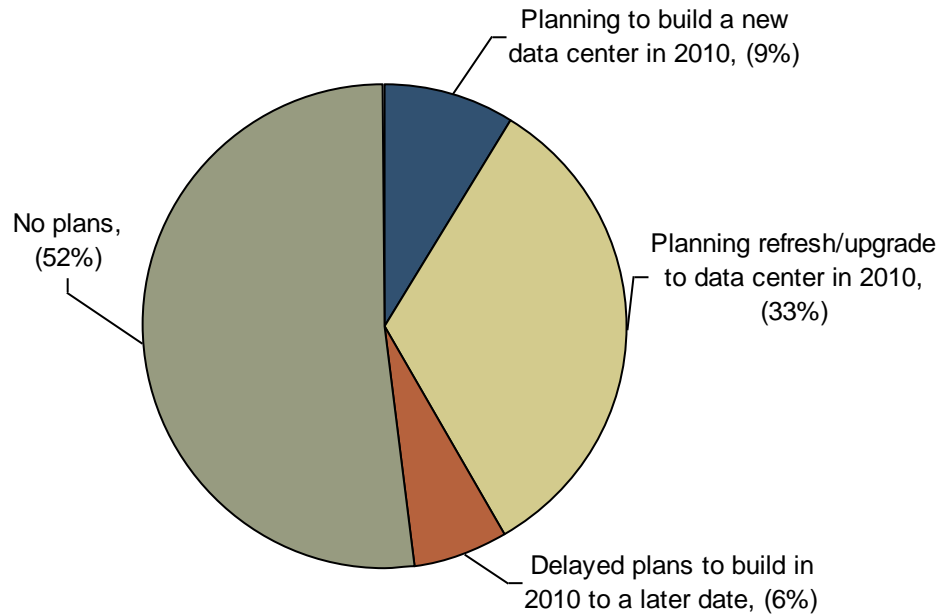
Planning to build a new data center in 2010, (9%)

No plans, (52%)

Planning refresh/upgrade to data center in 2010, (33%)

Delayed plans to build in 2010 to a later date, (6%)

Source: Info-Tech Research Group

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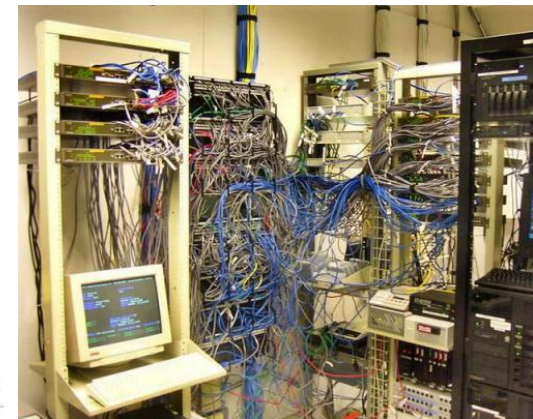
Data Center evolution

Centralized	Decentralized	The modern Data Center
Mainframe	Client-Server and Distributed Computing	Service Oriented

The modern Data Center column continues:

- Virtualized
- Consolidated
- Automated
- **Hot**

Data Center facility

Components:

- Physical space, room layout
- Raised flooring
- In-room electrical
- Standby power
- Equipment racks & cabinets
- Data Cabling & containment
- Labelling & Administration
- Grounding, bonding, the signal reference grid
- Cooling
- Fire detection, alarm & supression
- Security, access control, CCTV
- Management systems, from rack to room/building level, DCIM

Questions:

- Where should it be located?
- How big should it be?
- How much power consumption can be expected? Cooling?
- What is the uptime target?
- What are the technologies to use?
- How should be laid out?
- How long is the life span?

- (upgrading) Should we start utilizing higher grade products?
- (upgrading) Tight space, what higher density options are available?
- (upgrading) What are the new standards?

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Data Centers: New builds & modernizing existing ones – Who is involved

Role	Function
Building Architects	Familiar with local building codes (i.e. seismic requirements).
Structural Engineers	Ensure that floor and roof structure will support the weight of equipment and cooling towers.
Mechanical Engineers	Design, install, and testing all HVAC equipment required to efficiently cool the facility.
Electrical Engineers	Design, install, and test all electrical distribution and standby power systems such as generators and UPS.
Fire-Protection Engineers	Implement fire detection and gaseous fire suppression systems, water-based sprinklers, and emergency shut-offs.
Network Engineers	Design, implement, and test all structured cabling and cable terminations.
Facilities Manager	Perform oversight, ongoing maintenance, and vendor management.
General Contractor	Oversee the design of the project, and keep a tight timeline.

Different resources than those used to build office spaces

**Design strategy: Robust – Modular – Flexible - Standardized**

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A traditional three-phase **design-bid-build** process is still a viable way of doing business under many circumstances.

Design-build is better geared toward purpose-built facilities such as data centers that are constructed from the ground up and that demand more specialized expertise.

Design-build is basically a joint venture between the customer (owner) and general contractor that dictates a single contract for design, construction, and installation, and establishes costs during the preliminary design phase of the project.

- One point of contact for project questions/concerns
- Tighter communication and improved collaboration
- Faster delivery for project deployment and network cutover
- Reduced conflicts when it comes to project development
- One contract to manage

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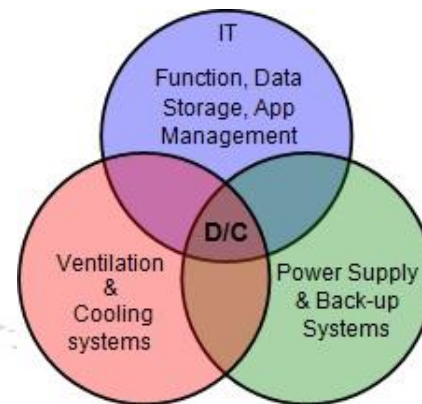
Data Center Standards
# and other useful documents
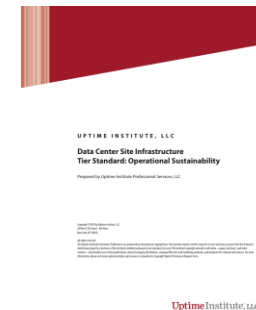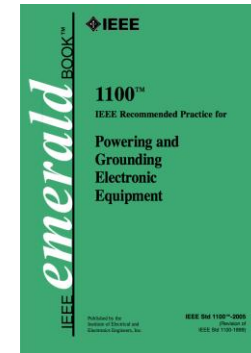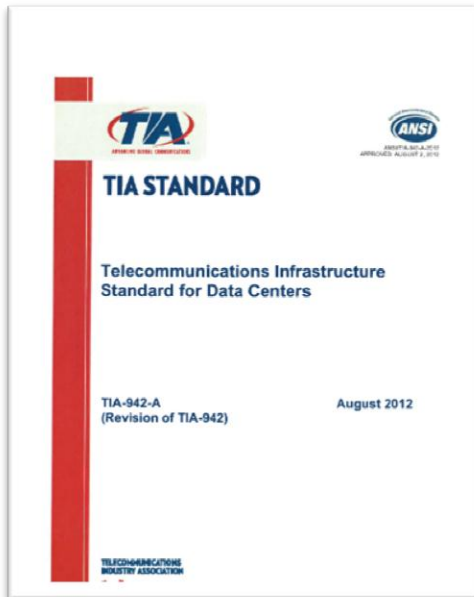
TIA-942-A: The changes

- **Incorporate Addenda to TIA-942:** Addendum 1 (Additional coaxial cabling) & Addendum 2 (General updates including revised tiering, the addition of Cat.6A, 3-level lighting protocol, revised temperature and humidity limits)
- **Restructuring standards** – a) Integrate into the TIA-568-C series (Reference generic cabling topology, terms), b) Move bonding and grounding content to TIA-568-B, c) move administration content to TIA-606-B, d) move racks and cabinets, power and telecom separation, environmental requirements to TIA-569-C, e) move outside plant pathways to TIA-758-B
- **Harmonize with international standards** (adopts terms – e.g. EO, ENI – **standardize on LC and MPO**, remove distance limitations for horizontal cabling of optical fiber)
- **Higher bandwidth applications** (remove support for Cat.3 & Cat.5e for horizontal cabling, Cat.6 minimum **Cat.6A or higher recommended**, remove support for OM1 and OM2, **OM3 minimum, OM4 recommended**, retain Single-mode fiber and 734/735 coax.
- **Energy efficiency**: new section, wider range of temperature and humidity based on new ASHRAE TC 9.9 guidelines, use of enclosures or enclosure systems to improve energy efficiency – containment/chimney, 3-level lighting protocol, LED recommendation
- **Larger and modular data centers:** New space – **IDA Intermediate Distribution Area** (IDA also being adopted in ISO/IEC 24764 in new addendum but will be called ID – Intermediate distributor), elimination of requirement that centralized optical fiber technologies be limited to one building to accommodate modular data centers using outdoor containers/modules)
- **Coaxial cabling specs:** additional requirements for connectors to be used for 75-ohm coaxial cabling in data centers, it specifies testing requirements for 75-ohm coaxial cabling in data centers, etc.

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The ITS professional in the Data Center industry

Data Center Components:

- **Physical space, room layout**
- **Raised flooring**
- **In-room electrical**
- **Standby power**
- **Equipment racks & cabinets**
- **Data Cabling & containment**
- **Labeling & Administration**
- **Grounding, bonding, the signal reference grid**
- **Cooling**
- **Fire detection, alarm & suppression**
- **Security, access control, CCTV**
- **Management systems, from rack to room/building level, DCIM**

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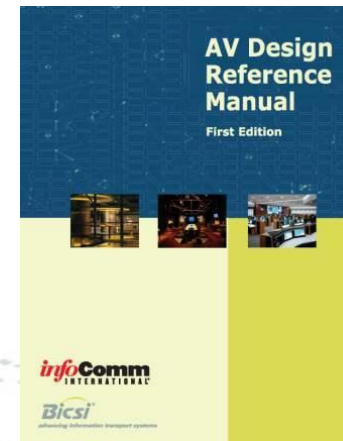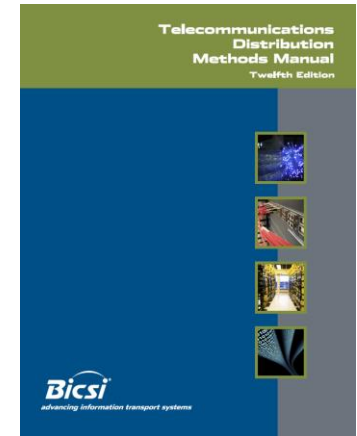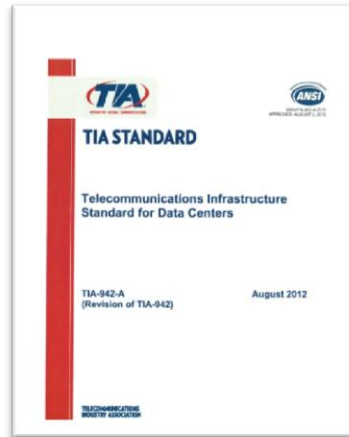
The ITS professional as a Consultant
(in the Data Center industry)

Every time you give advice to someone who is faced with a choice, you are consulting.

A consultant is a person in a position to have some influence over an individual, group, or organization but who has *no* direct power to make changes or implement programs or decisions.

In general, consultation describes any action where you give 'specialist' advice to an individual or organization *whether or not you are a part of that organization.*

Data Center Components:

- **Physical space, room layout**
- **Raised flooring**
- **In-room electrical**
- **Standby power**
- Equipment racks & cabinets
- Data Cabling & containment
- Labeling & Administration
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(Direct) opportunities (in the Data Center Industry) for the ITS professional

Data Center Components:

- Physical space, room layout
- Raised flooring
- **In-room electrical**
- Standby power
- **Equipment racks & cabinets**
- **Data Cabling & containment**
- **Labeling & Administration**
- **Grounding, bonding, the signal reference grid**
- Cooling
- Fire detection, alarm & suppression
- **Security, access control, CCTV**
- **Management systems, from rack to room/building level, DCIM**

✓ We have to understand the differences between commercial buildings and data center cabling environments.

✓ High-density copper and fiber solutions designed specifically for the data center deployment.

✓ The global data center environment is dynamic and challenging for those designing and installing the cabling network.

✓ Cabling systems design and topology choices have a significant impact on server and port utilization, operating efficiencies and even energy consumption.
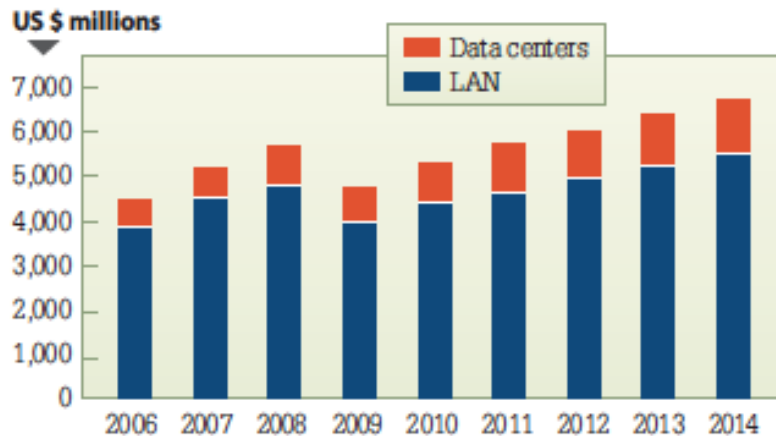
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Opportunities & challenges on Racking

Black reflects as little as 5 percent of the ambient light while gray-white reflects up to 80 percent of the light.

Opportunities & challenges on Cabling

Global cabling market, segmented by LAN and data center applications

US $ millions

- Data centers
- LAN

| | | | | | | | | |
|7,000|
|6,000|
|5,000|
|4,000|
|3,000|
|2,000|
|1,000|
|0|
|2006|2007|2008|2009|2010|2011|2012|2013|2014|

Source: BSRIA worldwide study April 2012

Copper and fiber products installed in data centers, 2011 – by value

Fi connectivity 41%

Copper cable 17%

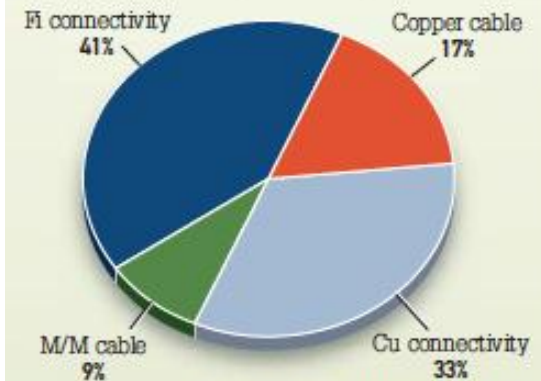M/M cable 9%

Cu connectivity 33%

Source: BSRIA worldwide study April 2012

The cabling installed in data centers accounts for 18% of the combined LAN/data center market and is continued to account for 18 to 19 percent of the total cabling sold over the next three years.
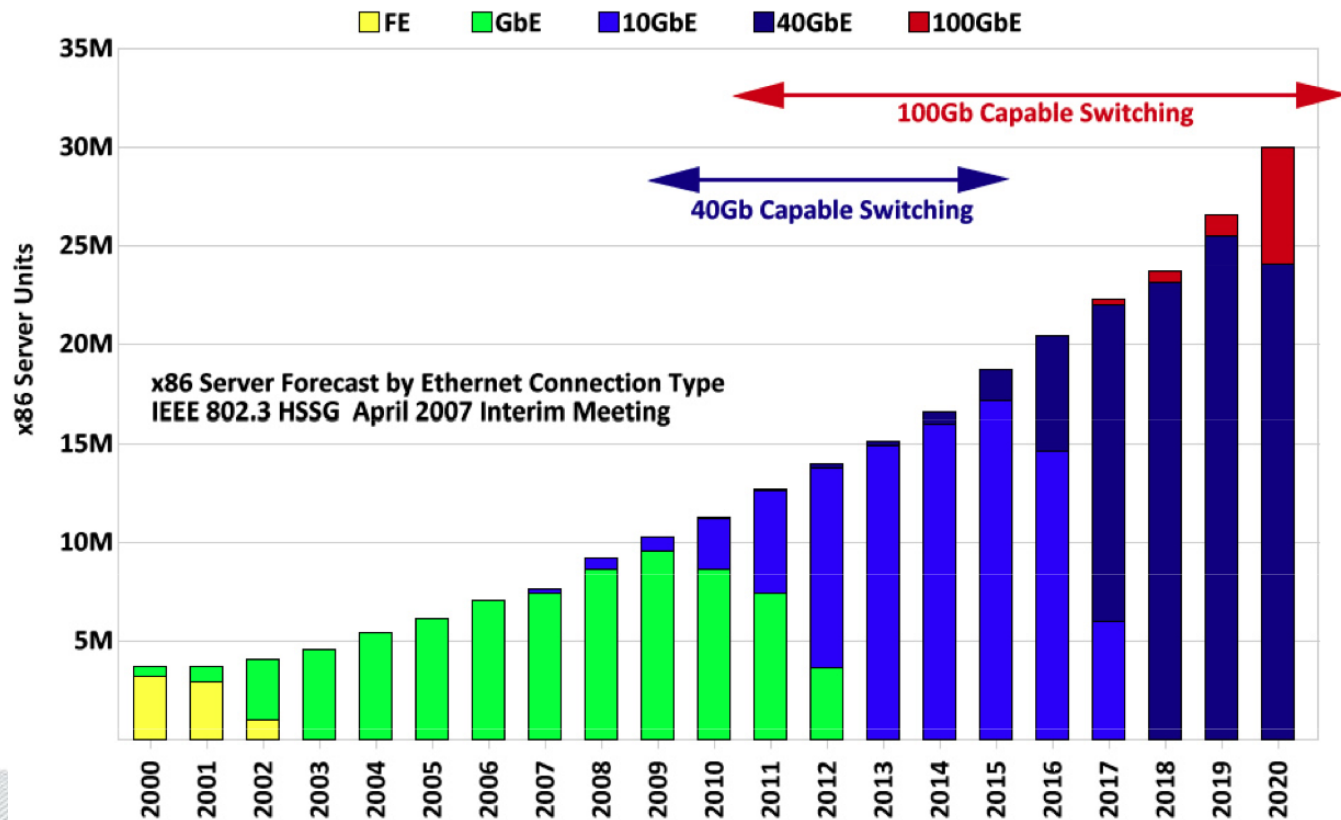
Data center customers generally buy higher-value products, such as MPOs, OM4 fiber and Cat.6A copper.

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Opportunities & challenges on Cabling

Opportunities & challenges on Cabling

✓ Cabling a Data Center is different from cabling a building. Cable lengths are shorter, performance demands are higher and instead of the two terminations common to most offices, a single cabinet can require 24, 48, 96 or even more connections in copper and fiber.

✓ Structured cabling vs. Point-to-Point

Basic principles of data center cabling: **Space savings, reliability, Manageability**

✓ ENI, MDA, IDA, HAD, ZDA, EDA, EO

✓ EoR, MoR, ToR, SAN, FCoE.

✓ Plug-and-play preterminated cabling, parallel optic technology.

✓ Virtualized environments require data rates that call for robust cabling and management systems.
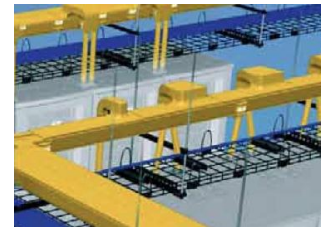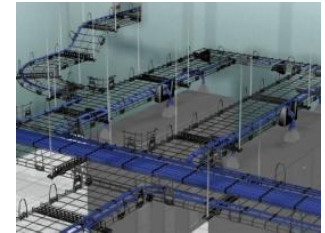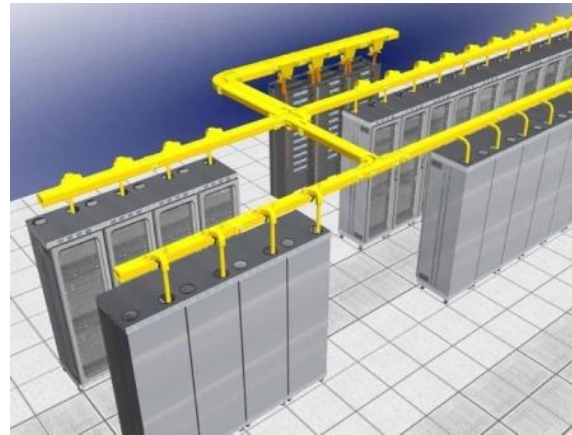
✓ High-performance computing (InfiniBand)

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Opportunities & challenges on Cabling Containment

Common Standards	Premises Standards	Component Standards
ANSI/TIA-568-C.0 (Generic)	ANSI/TIA-568-C.1 (Commercial)	ANSI/TIA-568-C.2 (Balanced twisted-pair)
ANSI/TIA-569-C (Pathways and spaces)	ANSI/TIA-570-C (Residential)	ANSI/TIA-568-C.3 (Optical fiber)
ANSI/TIA-606-B (Administration)	ANSI/TIA-942-A (Data centers)	ANSI/TIA-568-C.4 (Broadband coaxial)
ANSI/TIA-607-B (Bonding and grounding [earthing])	ANSI/TIA-1005 (Industrial)	
ANSI/TIA-758-B (Outside plant)	ANSI/TIA-1179 (Healthcare)	
ANSI/TIA-862-A (Building automation systems)	ANSI/TIA-4496 (Educational) — Future	
	Not Assigned (Large Buildings) — Future	

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Opportunities & challenges on Labelling & Administration

Common Standards	Premises Standards	Component Standards
ANSI/TIA-568-C.0 (Generic)	ANSI/TIA-568-C.1 (Commercial)	ANSI/TIA-568-C.2 (Balanced twisted-pair)
ANSI/TIA-569-C (Pathways and spaces)	ANSI/TIA-570-C (Residential)	ANSI/TIA-568-C.3 (Optical fiber)
ANSI/TIA-606-B (Administration)	ANSI/TIA-942-A (Data centers)	ANSI/TIA-568-C.4 (Broadband coaxial)
ANSI/TIA-607-B (Bonding and grounding [earthing])	ANSI/TIA-1005 (Industrial)	
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ANSI/TIA-862-A (Building automation systems)	ANSI/TIA-4496 (Educational) — Future	
	Not Assigned (Large Buildings) — Future	

Opportunities & challenges on Grounding & Bonding
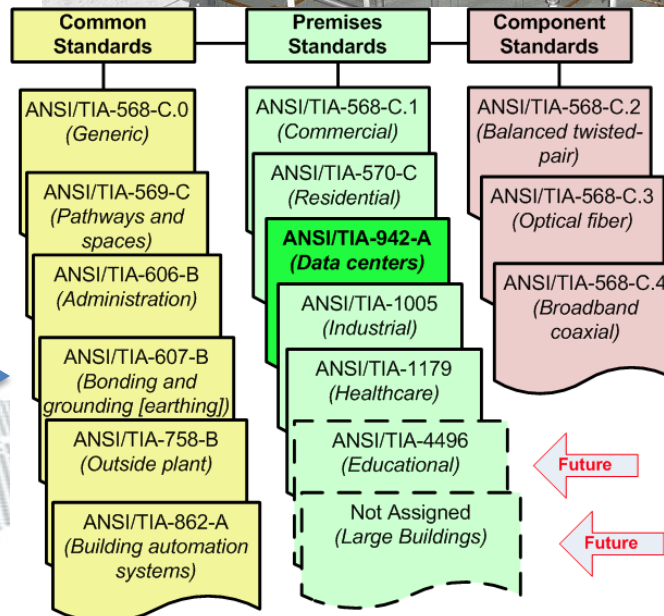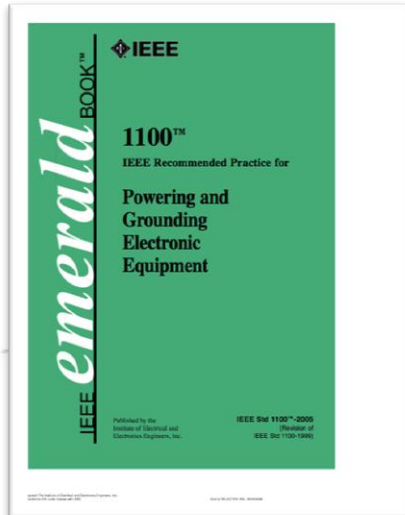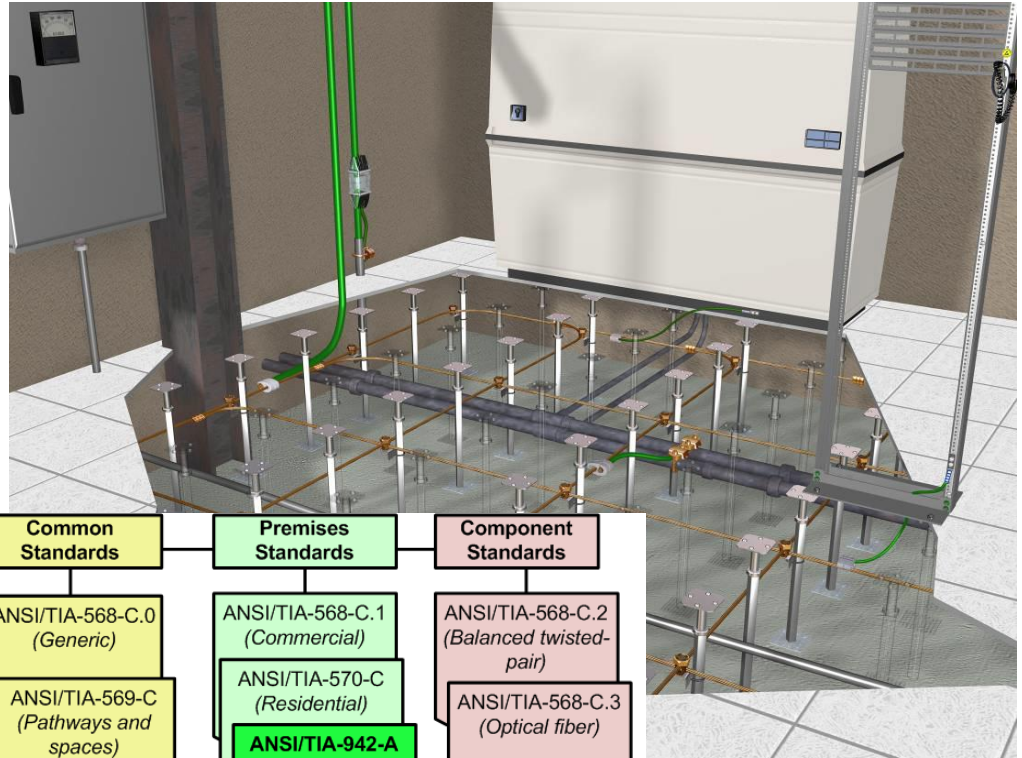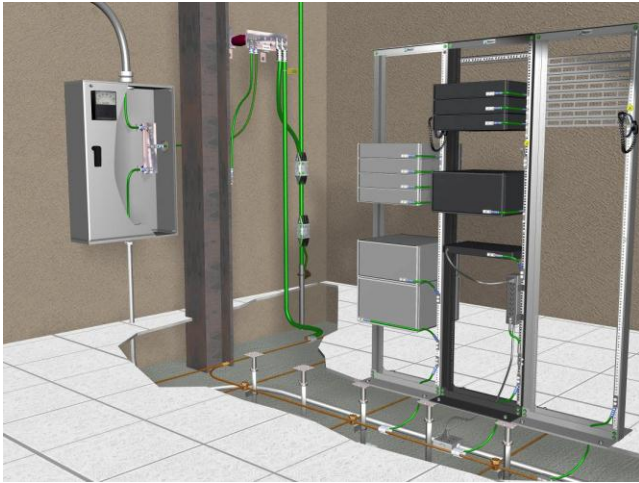
Opportunities Beyond Data Centers

✓ **Low-voltage lighting (LEDs)**

   Patch panels, category cable, racks

✓ **Health Facilities**

   TIA-1179 "Healthcare Facility telecommunications Infrastructure Standard"; ANSI/BICSI 004-2012 Standard "Information Technology Systems Design and Implementation Best Practices for Healthcare Institutions and Facilities" "

✓ **Distributed Antenna Systems (DAS)**

   DAS are similar to Wi-Fi design. – Between 2013 and 2018 more than 16 million DAS nodes will be deployed worldwide

✓ **Passive Optical LAN Technology (PONs)**

   PONs use wave division multiplexing to transmit upstream and downstream data on different wavelengths; a possible alternative to traditional active Ethernet copper-based LAN architectures

✓ **Industrial Ethernet (wired & wireless)**

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Ερωτήσεις ;

Ευχαριστώ!

yannis.katris@telectrik.ro