100 Years of Quality, Service, Innovation and Value

Presented by
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Data Center Considerations

- TIA-942
- BICSI new DC Design Manual
- Blades affect designs
  - Higher Cooling requirements
    - Under floor systems
    - Ceiling Plenum Air
    - Above Ceiling Ducted system
    - Water Cooling
- Layouts and equipment placement is more critical than ever
Standards and life spans

• ISO – generally 10 years – amended as needed
• TIA – 5 years, every 5 years they are reaffirmed, revised or rescinded
• IEEE – until a new standard replaces it or it is revised
• ALWAYS CHECK REVISIONS!
TIA-942

- Published in April 2005
- Titled “Telecommunications Infrastructure Standard for Data Centers”
  - Covers design and installation practices
  - All data center systems are addressed either specifically or by reference
- AS2834 – Computer Accommodation 1995
Main Standards/Codes for your use

- TIA 942, TIA 568-B.1, 568-B.2, 568-B.3, 569-B, 606-A, J-STD 607, 758-A
- NESC (IEEE C2) Safety Code
- Life Safety Code (NFPA 101)
- BCA (Building Code of Australia)
- ANSI T1.336 (Universal Telecommunications Frame)
- Telcordia (Gr-63-CORE and GR-139 Core) physical protection (Europe)
- BICSI
- Various others
Other Sources of Information

- Vendors – beware of false or misleading statements
  - Active Equipment
  - Infrastructure
- Equipment manufacturers – better source
  - Specifically the Techs Support Divisions
- Standards
- TechTarget www.searchdatacenters.com
- ASHRAE (HVAC Guidelines and Standards)
- www.uptimeinstitute.com (Source of the Tier Levels principal)
The ‘942’ Standard

“intended for use by designers who need a comprehensive understanding of data center design including facility planning, cabling system and network design”
Main Components – 942 Document

- Data Center Design Overview
- Cabling system Infrastructure Considerations
- Telecommunications spaces and topologies
  - Architectural
  - Environmentals
  - HVAC
  - Fire Protection
- Cabling systems
- Pathways
- Redundancy
Main Elements – DC System

- Entrance Facilities
- Office Space
- Support Staff Offices
- Operations Center
- **Computer Room**
- Telco and Equipment Rooms
- Electrical and Mechanical Rooms
  - UPS, Battery Room, Main Switch Boards and HVAC
- Storage Rooms/Loading Docks
Planning

- Estimate equipment telcom needs, space, power, cooling at full capacity
- Plan for growth over lifecycle of data center
- Coordinate preliminary designs with architectural, HVAC, structural engineers, etc.
- Create floor plan and Logical link Diagram
- Design telecommunications cabling system
  - Fiber Channel
  - Telco Demarcation Point
  - Infrastructure redundancy
- Data Centre Audit
Integrated Sub Systems to Consider

- Security Monitoring
- Access control systems
- LAN/SAN Computer systems
- Telecommunication and Network systems
- CREMS (Computer Room Environmental Monitoring)
  - Environmental Monitoring Systems
  - Power Systems
  - Cooling Systems
- Smart UPS Systems
Major Elements

- Main Distribution Area (MDA)
  - Core Equipment and MCC
- Horizontal Distribution Area (HDA)
  - Typically SAN’S, Switches
- Zone Distribution Area (ZDA)
- Equipment Distribution Area (EDA)
  - Edge Equipment, Server
- Entrance Room
  - Demarcation Points and Cable Transitions
- May have one, none or multiples of any of these
DC Elements In Detail

Main Computer Room

Main Dist Area

Computer Room Back Bone

Horizontal Distribution
AREAS
DA1 LAN
ZONE AREAS
EQUIPMENT AREAS

Horizontal Distribution
AREAS
DA2 LAN
EQUIPMENT AREAS

Horizontal Distribution
AREAS
DA3 LAN
EQUIPMENT AREAS

Horizontal Distribution
AREAS
DA4 LAN
EQUIPMENT AREAS

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Main Computer Room

- Horiz Dist Area 1
  - DA1 LAN
  - LAN/SAN
  - KVM’s

- Zone Dist Area

- Equip Dist Area
  - Racks / Processors

- Horiz Dist Area 2
  - DA2 LAN
  - LAN/SAN
  - KVM’s

- Equip Dist Area
  - Racks / Processors

- Horiz Dist Area 3
  - DA3 LAN
  - LAN/SAN
  - KVM’s

- Equip Dist Area
  - Racks / Processors

- Horiz Dist Area 4
  - DA4 LAN
  - LAN/SAN
  - KVMs

- Equip Dist Area
  - Racks / Processors
Main Distribution Area ...

Horiz Dist Area 1
DA1 LAN
LAN/SAN
KVM's

Zone Dist Area

Equip Dist Area
Racks / Processors

Main Dist Area
Core Network
DMZ, Backbones
LAN/SAN
Main Distribution Area ...

Main Dist Area
- Core Network
- DMZ, Backbones
- LAN/SAN

Horiz Dist Area 1
- DA1 LAN
- LAN/SAN
- KVM's

Zone Dist Area

Equip Dist Area
- Racks / Processors
Main Distribution Area….

- Main Cross-connect facility (MC)
- Maybe – Horizontal Cross-connect (HC)
- Core electronics (switches, routers, SAN, PBX)
- May serve multiple HC
- Potentially a Room within a Room for Added Security
Horizontal Distribution Area...

- Includes the HC if used
- LAN switches
- SAN switches
- KVM switches
- Generally there are several of these
- Minimum of one per floor
- If multiple users – secure area
Zone Distribution Area...

- Should be limited to 288 connections
- Shall NOT be a cross-connect
- No active equipment in the ZDA (except DC power)
- Must be 15m min from HAD
Equipment Distribution Area

- Contains servers
- Contains telecommunication equipment
- May feed an intermediate inter connect called a “zone distribution area”
Entrance Facilities....

- Interfaces with the MC
- May be part of the MC
- May have a redundant counterpart
  - Should be 20m away
  - Opposite side of the building
  - Separate conduits
- Handles carrier demarcations
- Should be separately secured/outside MC if possible
  - Maybe extended into the Data Centre
Support Areas

- Loading docks
  - Access to Goods Lift
- Operations center
- Security Rooms
- Personnel
- Mechanical Rooms
- Electrical Rooms
- Etc.
Points to consider

• Distance limitations due to carrier circuits
• Distance limitations due to equipment requirements
  – 10GBASE-CX4 (15m)
• Separation of power
• Hot and cold aisles (lots of Co-OP with Vendors)
• Density
  – 10G Isolation considerations
• Cooling (What are the options)
• Power requirements
Locate your Data Center away from Noise such as:

- Electrical power transformers
- X-Ray
- Generators and motors
- Radio or Radar transmitters
- Induction sealing devices
- Lift Rooms
Sizing Considerations…

• Allow 1.5m in front of cabinets (1m min)
• Allow 1m in back of cabinets (800mm min)
  – Heating may change both of these!
• 250 lb/ft^2 recommended - min .150 lb/ft^2
• Seismic considerations
• HVAC – this is a big one!
• Vibration
  – Degrades connections over time
  – Ie Locality of Plant Rooms
• Grounding/Bonding – single reference (ie Ground Loops)
Cabinet Ventilation

- Beware when adding blades – your cabinet may not be able to cool the units if the cabinet is fully populated
- Forced airflow
- Top Hat Fans not recommended
- Natural airflow
- Combination of both
- Liquid Cooling (new! Old! – New and old)
Wire Management

- 250mm Vertical recommended 150mm min
- 1:1 on horizontal
- Bend radius requirements must be met
Cabling stuff……..ed

• Plan accommodating growth so that you don’t have to add cabling
• Copper and fiber addressed
• Must be separated from power cabling
• Maximum distances for all media apply
• New maximums based on 10GBASE-T
  – 55m on Category 6 (TSB 155-for existing ONLY)
  – 100m on 10G 6 or Class F/Cat 7
  – NO Category 5e
Recognized Media

- Category 6 minimum recommended
- Some coax Security Cameras,
- Fiber optic (50 micron fiber recommended)
- Limited shared sheath media due to interference
  - Hybrid and UTP Solutions
- UTP, S/FTP or FTP
- Bus and direct connections only if needed by manufacturer
Base media selection on...

- Flexibility
- Useful Life (e.g., 10 Years)
- Size/occupant population
- Channel capacity
- Equipment vendor recommendations or specifications
  - Recommendations are only minimum
Data Center Considerations

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Hot and Cold Isles
What Does it Really Look Like?
What does it really look like?

- 2N+1 Design
Why? – Air Damming
Cooling Strategies

• Install blanks in cabinets to stop air plumes
• Install brushes/pillows in cabinets and floor openings
• Figure out your actual cooling needs
• Scale your cooling with your cabinets
• Heated air must dissipate through some means
• For every kW of power consumption you need equal thermal reduction!
Data Center Redundancy

• Redundancy
  – ‘N’ is the operational base requirement
  – N+1 Redundancy
  – N+2 Redundancy
  – 2N
  – 2N+1

• Tiers (uptime Institute –Annex)
  – Tier 1 Basic Data Center
  – Tier 2 Redundant Components
  – Tier 3 Concurrently Maintainable
  – Tier 4 Fault Tolerant
# Tiers – What do they Mean?

<table>
<thead>
<tr>
<th></th>
<th>TIER 1</th>
<th>TIER II</th>
<th>TIER III</th>
<th>TIER IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delivery Paths</td>
<td>1</td>
<td>1</td>
<td>1 Active/1 Passive</td>
<td>2 Active</td>
</tr>
<tr>
<td>Redundant Components</td>
<td>N</td>
<td>N+1</td>
<td>N+1</td>
<td>2(N+1) or S+S</td>
</tr>
<tr>
<td>Redundant Components</td>
<td>Maybe None</td>
<td>Systems</td>
<td>Systems and Power some others</td>
<td>All</td>
</tr>
<tr>
<td>Support space to floor ratio</td>
<td>20%</td>
<td>30%</td>
<td>80-90%</td>
<td>100%</td>
</tr>
<tr>
<td>Ultimate Watts/ft²-****</td>
<td>20-30</td>
<td>40-50</td>
<td>100-150</td>
<td>150+</td>
</tr>
<tr>
<td>First year deployed</td>
<td>1965</td>
<td>1970</td>
<td>1985</td>
<td>1995</td>
</tr>
<tr>
<td>Annual IT Downtime due to Site</td>
<td>28.8 hrs</td>
<td>22.0 hrs</td>
<td>1.6 hrs</td>
<td>0.4 hrs</td>
</tr>
<tr>
<td>Site availability</td>
<td>99.671%</td>
<td>99.749%</td>
<td>99.982%</td>
<td>99.995%</td>
</tr>
<tr>
<td>Power Support</td>
<td>UPS</td>
<td>UPS + Gen</td>
<td>UPS + Gen</td>
<td>UPS + Gen</td>
</tr>
<tr>
<td>Critical Path Support Requires</td>
<td>Shutdown</td>
<td>Shutdown</td>
<td>Auto</td>
<td>Auto</td>
</tr>
<tr>
<td>Cost per square foot</td>
<td>$450</td>
<td>$600</td>
<td>$900</td>
<td>$1,100+</td>
</tr>
</tbody>
</table>

Based on information from the Uptime Institute
TIA 942 – Data Center Standard

- Sets up “hot zones” for equipment
- All horizontal cables should be run and **terminated** accommodating growth so that it does not have to be revisited
- Fire, Life, Safety, Power and Lighting considerations
- Distribution areas and Telecommunications Rooms
- Equipment Placement
- Cabling Systems, Cabling Pathways and spaces
- Security and other included systems
Data Center Design Considerations

• Biometrics and other Security Access Systems
• Intelligent Patching Solutions – MapIT
  – May be compliance driven
• Business Continuity Considerations
• Fire Suppression/Detection Systems
• Supported Bandwidth over the LIFE of the data center
• Density and Power requirements
• Don’t forget Blades!
• Standards based infrastructures
Technology Grey Areas

- Standards as they are today
- Where to tomorrow
- Influences of 10 Gigabit 500 Mhz (PDAM 16)
- What happens to Category 7
Technology Grey Areas

- Moves out to 1.0 GHz
- In Alignment with TERA
Data Center Manager Poll

Data Center Decisions Conference 2005 – 300+ Data Center Managers and CIO’s Globally.

If you were to build a data center today, what cabling system would you use?

<table>
<thead>
<tr>
<th>Cabling System</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category 5e</td>
<td>6.3%</td>
</tr>
<tr>
<td>Category 6</td>
<td>9.4%</td>
</tr>
<tr>
<td>Augmented Category 6</td>
<td>31.3%</td>
</tr>
<tr>
<td>Class F/Category 7</td>
<td>50.0%</td>
</tr>
<tr>
<td>Fiber only</td>
<td>3.1%</td>
</tr>
</tbody>
</table>
Architecture Specific Design

Figure 6 IBA System Area Network
10GBASE-T

• Initially designed for data centers
• 10x the performance at 3x the price
  – Note: fiber is 10x the performance at 10x the price
• Today’s server is tomorrow’s desktop
• Mass production of chips will make this viable for desktop solutions within the next 5 years
• Heavy demand from Government and Research Facilities
• 10GBASE-CX4 is expected to dwindle after 10GBASE-T
What is ANEXT

- Alien Near End X Talk
- Out of channel noise
- Very difficult to test
- Pair to Pair noise In different cables
- Noise coupling has identical characteristics
Mitigation Techniques

• Improve Insertion Loss: 1dB insertion loss improvement provides the same effect as 1dB ANEXT mitigation
• Un-Bundle Cables
• Separate Pathways and separation at distributors
• New DSP technologies
• Port Separation in Panels and TO’s
• Screen/Shielded cables, cords and outlets
To Shield or Not to Shield

- Shielding will protect your conduit fill ratios
- ScTP (F/UTP) contains a foil around the cable
- Category 7/Class F cable includes a shield around each pair and an overall braid shield
  - Heartiest cable on the market
  - Cable sharing benefits allow 2-10/100 connections in one R45 footprint
  - New 2 pair gigabit standard ONLY for TERA
- Some companies/countries prefer shielded systems
- ANEXT is NOT an issue with shielding
Shannon Capacity of Channels

Shannon Capacity

Bandwidth in Gb/s

MHz

Cat 6 UTP - 9.39 Gb/s @ 800MHz
Cat 6 ScTP - 28.8 Gb/s @ 800MHz
Class F - 49.36 Gb/s @1000MHz
Cable Design Strategies

Aug 6 UTP
- Installation
- 40% Fill

Aug 6 UTP
- Design
- 60% Fill

Aug 6 F/UTP
- Design
- 60% Fill

Cat 7 S/FTP
- Design
- 60% Fill

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ANEXT Hot Spots

Between TO Ports

Between Patch Panel Ports

Between Patch Cords
Trends for ‘05

• Gate’s Law Revisited

• “640k ought to be enough for anybody”
  – Bill Gates, 1981

• Gate’s Law states that the speed of applications is cut in half every 18 months
  – Called application bloat

• Let’s look at Windows and Microsoft Office over the last 10 years…
# Application Growth - Bloat

<table>
<thead>
<tr>
<th>Office 95</th>
<th>Office XP</th>
<th>Windows 95</th>
<th>Windows XP</th>
</tr>
</thead>
<tbody>
<tr>
<td>386 – 486 recommended</td>
<td>PIII recommended 133MHz min</td>
<td>486 recommended</td>
<td>233MHz min 300MHz rec.</td>
</tr>
<tr>
<td>8 MB RAM</td>
<td>128 MB RAM + 8MB for each program</td>
<td>4 MB RAM, 8 recommended</td>
<td>128 MB RAM+ recommended 64MB min</td>
</tr>
<tr>
<td>40 MB min disk space 128 all features</td>
<td>245MB disk space + 115MB +50 MB</td>
<td>50-55 MB</td>
<td>1.5 GB Disk space</td>
</tr>
</tbody>
</table>
Moore’s Law

• Number of processors on a chip doubles every 18 months
• More importantly….
  – The cost to make that chip is cut in half in the same 18 month period!
• 10G chips auto-negotiate between 10/100/1000/10G
• The same chip will eventually be mass produced and used in everything
• Less expensive to do one chip than multiple
• It may be limited to speed in SOFTWARE
• That is why all machines ship with Gig today!
10G Growth

• $570 million in 2005*
• Grow to 3.3 Billion by 2009*
• Copper 10G is 1% of current market expected to be 25% of market by 2009*
  – Copper 10G ports are expected to be 3 x the cost of a 1G copper port
  – Copper 1G ports are 1/3 the price on average of a 1G fiber port
• Copper offers significant savings due to the high cost of optical electronics
• Demand from corporations, governments and research labs
• CX4 is expected to be replaced with 10GBASE-T
• 10GBASE-T is interoperable with PoE

• *Study 12/10/04 Communications Industry Researchers (CIR)
Conclusions

• 10G over copper is a reality
• Cat 5e is not a good investment
• Aug. Cat 6 (Siemon 10G 6 UTP) provides much better TCO/ROI compared to cat 6 UTP
• TERA provides the longest lifecycle and can provide even greater savings by utilizing its ability to share one 4 pair cable/outlet and will support 40G operations in the next speed iteration.
The Siemon Company’s Global Project Services (GPS℠) team works with our global network of channel partners to provide consistent, highest quality multi-site cabling project and installation coordination for key end users and system integrators.
A secure web enabled tool that will allow an instant summary of all details being coordinated through Siemon GPS including downloadable project documentation.
Siemon Training Program

Value Added Services

- BICSI Certified training covering the entire channel for both copper and fiber
- Recertification required every 2 years – either online or 2 day class
- CEC’s are a requirement assuring adherence to new standards and addendums
- Levels of Training
  - Certified Installer – Trained Designer and Installer
  - Certified Maintainer – End User certified to maintain system with warranty
  - Listed Installer – Siemon product warranty
  - Trained Installer - subcontractor to a CI
  - Consultant Architect Program – Certified Designer that can hire a CI or TI to install and provide warranty
Siemon Technical Design Assistance Program

Value Added Services

• Technical Support
• Design Assistance
• Technical Specifications
• RFIs/RFPs/RFQs
• DWG & Visio Shapes
• Siemon Product BOMs
• Quick Quote
Siemon Project Audits

Value Added Services

• Installation audits during various phases of installation
  – 33%
  – 66%
  – 99%
• Free on projects of 10,000 drops
• Provided upon request for other projects
• Catches problems before project is finished
• Provided by Siemon trainers and Program Support Services
• Checks and balances for end users
GridWork™

- Ability to audit a network infrastructure
  - Electronics and Physical Infrastructure
- Uses SNMP data, visual inspections and testing
- NO packet level snooping
- NO password snooping
- Recommended or required by all VoIP/IPT vendors prior to rollout
- Assists with moving to higher speed technologies
- Stops finger pointing between electronics and cabling specialties
- Assures solid performance PROactively
- Partnerships with various electronics manufacturers
GridWork™

Best Candidates for an Audit

• Legacy environments
• Self-mutilated environments
• Multi-site companies with central IT
• Installations greater than 5 years old
• New IPT/VoIP rollouts
GridWork™

- Audit based on customer needs
  - Physical layer only
  - Physical plus SNMP data from electronics
  - Recommend corrective measures
  - Electronics manufacturers and System integrators are using this program
  - Tailored information based on user’s needs
  - Assists with documentation requirements for compliance related issues
Siemon Data Center Assistance

- President of the BladeSystems Alliance/Data Center Solutions Alliance
- Data Center design assistance
- Codes and Standards update seminars, webinars and podcasts
- Fill in the blank business continuity plan
- Data center checklist for day one and day two services
Questions?

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