Data Centre Link Survey

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Contribution to IEEE 802.3ba Higher Speed Ethernet Task Force 23-25 Jan 2008, Portland, OR
Survey Objectives

1. establish length distribution requirements for Higher Speed Ethernet links
2. establish link speed & connectivity requirements
3. focus on recent data centre designs/installations
4. provide greater granularity for the first 30m of horizontal/client links than existing studies
5. assess level of standards compliance for cabling
6. examine differences to existing cabling studies
Flatman Cabling Surveys for IEEE 802.3

- July 1999: In-premises Optical Fibre Deployment to 2000
- Jan 2003: Installed Copper Cabling Forecast to end 2005
- July 2003: Installed Horizontal Cabling Length Distribution (office & medium-sized data centre)
- Mar 2004: In-premises Optical Fibre Installed Base to 2007
Data Centre Network Infrastructure

Clients

Access
- LAN/NAS/SAN switches

Distribution
- Routers/L3 switches

Core
- Gateways/Firewalls

Servers

Storage

Servers

Storage

Clients
Data Centre Cabling Standards

- **EIA/TIA-942:** Data Centre Cabling
  » published in 2005

- **CENELEC EN 50173-5:** Data Centre Cabling
  » approved early 2007

- **ISO/IEC 24764:** Data Centre Cabling
  » based on CENELEC EN 50173-5
  » approval anticipated in 2008
ENI = Equipment Network Interface
MD = Main Distributor
ZD = Zone Distributor
LDP = Local Distribution Point
EO = Equipment Outlet

ISO/IEC 24764: Data Centre Cabling
Example of MD to ZD to EO implementation showing equipment interfaces

°C = optional connection
Standard Data Centre Cabling Models

- Equipment
- Patch cord
- Patch Panel Cross-connect
- Permanent Link
- Channel
- Equipment cord
IDC \(_{(2006)}\) identifies 4 different types, distinguished by size:

- **Small Data Centre**
  - \(~15,000 \text{ ft}^2\) raised floor
  - 350-500 volume servers
  - 1-3 high end servers

- **Medium Data Centre**
  - \(~20,000 \text{ ft}^2\) raised floor
  - 1,500-1,700 volume servers
  - 4-5 high end servers

- **Large Data Centre**
  - \(~35,000 \text{ ft}^2\) raised floor
  - 2,000-2,500 volume servers
  - 6-7 high end servers

- **Very Large Data Centre**
  - \(>100,000 \text{ ft}^2\) raised floor
  - <25,000 volume servers
  - >8 high end servers
Oct 2007 Data Centre Cabling Survey
Summary

- 9 enterprise data centres from US, UK, Germany
- Total data centre floor space was 715,000 sq. feet
- 56k servers, 250k switch ports, 920k patch ports
- Small, medium, large, v. large sizes (IDC classes)
  - V. large had 74% links
  - Large had 20% links
  - Medium had 5% links
  - Small had 1% links
- Data centre cabling mostly standards compliant
  - Some servers had direct connections to top of rack switches (i.e. no patch cords/patch panels involved)
### Data Centre Link Speed – the next 5 years

<table>
<thead>
<tr>
<th>Year</th>
<th>100M</th>
<th>1G</th>
<th>10G</th>
<th>40G</th>
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<td>11%</td>
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<td>0%</td>
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<td>Access-to-Distribution Links</td>
<td>20%</td>
<td>80%</td>
<td>60%</td>
<td>0%</td>
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<tr>
<td>Distribution-to-Core Links</td>
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<td>80%</td>
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<td>80%</td>
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</tbody>
</table>
Enterprise Data Centre Cabling Lengths
Client-to-Access Permanent Links

Total of 250,000 links
Enterprise Data Centre Cabling Lengths
Client-to-Access Permanent Links

Total of 250,000 links

good correlation for first 30m

% Links

0-30m  31-40m  41-50m  51-60m  61-70m  71-80m  81-90m  91-100m

V.Large  Large  Medium  Small  All
Prior Data Centre Cabling Survey  
(IEEE 802.3an DiMinico_01_1103)

- Data centers recently built by (M&A) type and size
  - 83% of data center horizontal cables are <= 45m
  - 94% of data center horizontal cables are <= 55m

<table>
<thead>
<tr>
<th>Data Center Type</th>
<th>Data Center Size (sq ft)</th>
<th>0-30 m</th>
<th>31-45 m</th>
<th>46-55m</th>
<th>56-75m</th>
<th>76-100m</th>
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<td>58.1%</td>
<td>24.4%</td>
<td>11.4%</td>
<td>5.6%</td>
<td>0.4%</td>
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</table>

7 Data Centres  Total = 325,000 sq. feet

Source: Phil Isaak, Associate, Senior Communications Engineer, Mazzetti & Associates (Engineering Firm)
Prior Data Centre Cabling Survey
(IEEE 802.3an DiMinico_01_1103)

- Data centers recently built by (J&M) type and size
  - 93% of data center horizontal cables are <= 45m
  - 99% of data center horizontal cables are <= 55m

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<td><strong>Average</strong></td>
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<td>67.7%</td>
<td>25.2%</td>
<td>6.2%</td>
<td>0.5%</td>
<td>0.5%</td>
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</table>

Note: This is Permanent Link data

11 Data Centres  Total = 448,000 sq. feet

Source: Jonathan Jew, J&M Consultants, Co-chair TR42.1.1- Data Center Standard
Enterprise Data Centre Cabling Lengths
Client-to-Access Permanent Links

- Flatman All
- DiMinico J+M average
- DiMinico M+A average

% Links

0-30m
31-40m
41-50m
51-60m
61-70m
71-80m
81-90m
91-100m
Shorter length distribution for Flatman survey may be due to shift from pedestal to rack servers over 5 years (period between 2 surveys).
Enterprise Data Centre Cabling Lengths
Client-to-Access Permanent Links

Cumulative % Links

Length (m)
Enterprise Data Centre Cabling Lengths
Client-to-Access Permanent Links & Channels

- Average Perm Link = 15.8m
- Average Cordage = 4.4m
- Minimum Cordage = 3.0m
- Maximum Cordage = 9.0m
- Average Channel = 20.2m
- Min # Cords/Channel = 1.0
- Max # Cords/Channel = 4.0
- Avg # Cords/Channel = 1.6

% Links

- 0-10m
- 11-20m
- 21-30m
- 31-40m
- 41-50m
- 51-60m
- 61-70m
- 71-80m
- 81-90m
- 91-100m

used to calculate channel lengths
Enterprise Data Centre Cabling Lengths
Client-to-Access Channels

Cumulative % Links

- 33.3%
- 82.8%

Length (m)

Total of 250,000 links
Prior Data Centre Cabling Study
(IEEE 802.3 HSSG Kolesar_01_0906)

Array cable length distribution

- Many thousands of 12-fiber units

Distance between fiber panels in data centers

Kolesar, September 2006, IEEE 802.3 HSSG
Prior Data Centre Cabling Study
(IEEE 802.3 HSSG Kolesar_01_0906)

Permanent link length distribution

- Longer tail emerges

Distance of Permanent Link (i.e. w/o cords)
assuming ~1/2 are concatenated thru central cross connect

![Graph showing the distribution of permanent link lengths.](image-url)

Kolesar, September 2006, IEEE 802.3 HSSG
Prior Data Centre Cabling Study
(IEEE 802.3 HSSG Kolesar_01_0906)

Optical Fibre Permanent Links; assumed to be switch-to-switch. Derived from cumulative length distribution & converted into m.
Prior Data Centre Cabling Study
(IEEE 802.3 HSSG Swanson_01_1106)

Note: Data based on several 1000’s Corning trunk cable shipments, simulation designed to represent actual data centre deployments (using concatenated trunks)

50% links have 2 trunks
20% links have 3 trunks
30% links are point-point
Optical Fibre Permanent Links; assumed to be switch-to-switch. Derived from cumulative length distribution.
Enterprise Data Centre Cabling Lengths
Access-to-Distribution Permanent Links

Cumulative % Links vs. Length (m)

- Flatman All
- Kolesar
- Swanson
Enterprise Data Centre Cabling Lengths
Access-to-Distribution Permanent Links

Cumulative % Links vs Length (m)

- Flatman All
- Flatman V.Large
- Flatman Large
- Flatman Medium
- Flatman Small
- Kolesar
- Swanson

99% links
1% links
Enterprise Data Centre Cabling Lengths
Access-to-Distribution Permanent Links & Channels

- Flatman All Permanent Links
- Flatman All Channels

Average Perm Link = 46.1m
Average Cordage = 10.4m
Minimum Cordage = 3.0m
Maximum Cordage = 24.0m
Average Channel = 56.5m
Min # Cords/Channel = 2.0
Max # Cords/Channel = 4.0
Avg # Cords/Channel = 2.7

% Links
used to calculate channel lengths

0-25m, 26-50m, 51-75m, 76-100m, 101-125m, 126-150m, 151-175m, 176-200m, 201-225m, 226-250m, 251-275m, 276-300m
Enterprise Data Centre Cabling Lengths
Access-to-Distribution Channels

Total of 16,000 links

Cumulative % Links

Length (m)

Flatman All

89.0%
Enterprise Data Centre Cabling Lengths
Distribution-to-Core Permanent Links

Total of 3,000 links

% Links

0-25m, 26-50m, 51-75m, 76-100m, 101-125m, 126-150m, 151-175m, 176-200m, 201-225m, 226-250m, 251-275m, 276-300m

All, V.Large, Large, Medium, Small
Enterprise Data Centre Cabling Lengths
Distribution-to-Core Permanent Links & Channels

- Average Perm Link = 37.6m
- Average Cordage = 11.1m
- Minimum Cordage = 4.0m
- Maximum Cordage = 12.0m
- Average Channel = 48.7m
- Min # Cords/Channel = 2.0
- Max # Cords/Channel = 4.0
- Avg # Cords/Channel = 2.1

% Links

used to calculate channel lengths
Enterprise Data Centre Cabling Lengths
Distribution-to-Core Channels

Cumulative % Links

Length (m)

Total of 3,000 links

84.8%

Flatman All

0 25 50 75 100 125 150 175 200 225 250 275 300

0 10 20 30 40 50 60 70 80 90 100

0 25 50 75 100 125 150 175 200 225 250 275 300

Flatman All

Total of 3,000 links

0 25 50 75 100 125 150 175 200 225 250 275 300

Cumulative % Links

Length (m)
Data Centre Cabling Market Research

- detailed data centre cabling analysis by BSRIA
- research conducted in the USA during fall 2007
- report planned to be published 31 January 2008
- see Alan Flatman for prospectus & other details