

Shelton, CT, USA January 10, 2013

**DOCUMENT SUBMITTED TO: TR-42 Meeting**

The document to which this cover statement is attached is submitted to a Formulating Group or sub-element thereof of the Telecommunications Industry Association (TIA) in accordance with the provisions of Sections 6.4.1-6.4.6 inclusive of the TIA Engineering Manual dated March 2005, all of which provisions are hereby incorporated by reference.

<b>SOURCE:</b>	Link Length Survey Task Group	
<b>CONTACT:</b>	Shadi AbuGhazaleh Hubbell Inc. 40 Waterview Drive, Shelton CT 06484 475-882-4747 Email: <a href="mailto:sabughaz@hubbell.com">sabughaz@hubbell.com</a>	
<b>TITLE:</b>	Summary of link length survey results	
<b>PROJECT NUMBER (PN):</b>	PN-568-C.2-1	
<b>DISTRIBUTION:</b>	TR-42.7	
<b>INTENDED PURPOSE OF DOCUMENT:</b>	<input type="checkbox"/>	FOR INCORPORATION INTO TIA PUBLICATION
	<input checked="" type="checkbox"/>	FOR INFORMATION
	<input type="checkbox"/>	OTHER (Please describe) _____
<b>ABSTRACT: This contribution presents highlights and analysis of the link length survey as approved by TIA TR42.7 for sharing with IEEE802.3 NGBASE-T Study Group.</b>		

**PATENT DISCLOSURE [OPTIONAL]**

The Source may have patent(s) and/or published pending patent application(s) that may be essential to the practice of all or part of this Contribution as incorporated in a TIA Publication, and the Source is willing to comply with Paragraphs 1, 2(a), or 2(b) of ANNEX H of the TIA Engineering Manual dated March 2005 as to such patent(s) and/or published pending patent application(s).

# Link Length Survey Report

TIA TR42.7

# General Description of the Survey

- Survey sent out by TIA TR42.7 to readers of “Cabling Installation and Maintenance”
- Survey open for 30 days
- 23 respondents

# Observations

Respondent Description		Number of Anticipated Links	
Owner	4	<100	2
Installer	2	<1000	4
Designer	9	<10,000	12
Integrator	6	<100,000	3
Manufacturer	2	>100,000	2

A good number are already planning for >10GBASE-T

10GBASE-T	11
40GBASE-T	5
100GBASE-T	5

Highest cabling category anticipated

Category 5e	1
Category 6	2
Category 6A	11
Higher than Category 6A	9

- Numbers represent the number of respondents that answered each question

# Observations

Link configurations utilized by respondents

	End to End Link	2 Connector Channel	3 Connector Channel	4 Connector Channel
Never	3	0	3	7
Occasionally	11	6	13	14
Often	8	13	5	0
Always	1	4	1	1

- Numbers represent the number of respondents that answered each question

responder	% < 20 m	% < 30 m	% < 40 m	% < 50 m
1	30%	40%	20%	10%
2	30%	30%	20%	20%
3	50%	60%	70%	80%
4	20%	40%	80%	100%
5	30%	40%	50%	80%
6	90%	10%		
7	80%	90%	100%	100%
8	20%	30%	30%	20%
9	90%	10%		
10	20%	40%	60%	80%
11	50%	70%	90%	100%
12	10%	50%	20%	10%
13			90%	
14	50%	50%	100%	100%
15	30%	30%	20%	20%
16	20%	20%	30%	30%
17	10%	20%	30%	40%
18	30%	40%	50%	60%
19	30%	60%	80%	90%
20	30%	50%	70%	90%
21	20%	20%	30%	50%
22	20%	30%	50%	80%
23	10%	30%	50%	10%

# Length Data

Here is the raw link length distribution data from the survey

It is apparent that some responders answered as if the four options were four separate buckets.

The following slide shows the raw data corrected for this.

responder	% < 20 m	% < 30 m	% < 40 m	% < 50 m
1	30%	70%	90%	100%
2	30%	60%	80%	100%
3	50%	60%	70%	80%
4	20%	40%	80%	100%
5	30%	40%	50%	80%
6	90%	100%	100%	100%
7	80%	90%	100%	100%
8	20%	50%	80%	100%
9	90%	100%	100%	100%
10	20%	40%	60%	80%
11	50%	70%	90%	100%
12	10%	60%	80%	90%
13			90%	
14	50%	50%	100%	100%
15	30%	60%	80%	100%
16	20%	40%	70%	100%
17	10%	30%	60%	100%
18	30%	40%	50%	60%
19	30%	60%	80%	90%
20	30%	50%	70%	90%
21	20%	20%	30%	50%
22	20%	30%	50%	80%
23	10%	40%	90%	100%

Cumulative link length distribution: highlighted data changed from “buckets” to cumulative.

The following slide shows the data converted to separate buckets, with an implied bucket for > 50 m.

responder	0-20 m	20-30 m	30-40 m	40-50 m	>50 m
1	30%	40%	20%	10%	0%
2	30%	30%	20%	20%	0%
3	50%	10%	10%	10%	20%
4	20%	20%	40%	20%	0%
5	30%	10%	10%	30%	20%
6	90%	10%			0%
7	80%	10%	10%	0%	0%
8	20%	30%	30%	20%	0%
9	90%	10%			0%
10	20%	20%	20%	20%	20%
11	50%	20%	20%	10%	0%
12	10%	50%	20%	10%	10%
13			90%		10%
14	50%	0%	50%	0%	0%
15	30%	30%	20%	20%	0%
16	20%	20%	30%	30%	0%
17	10%	20%	30%	40%	0%
18	30%	10%	10%	10%	40%
19	30%	30%	20%	10%	10%
20	30%	20%	20%	20%	10%
21	20%	0%	10%	20%	50%
22	20%	10%	20%	30%	20%
23	10%	30%	50%	10%	0%

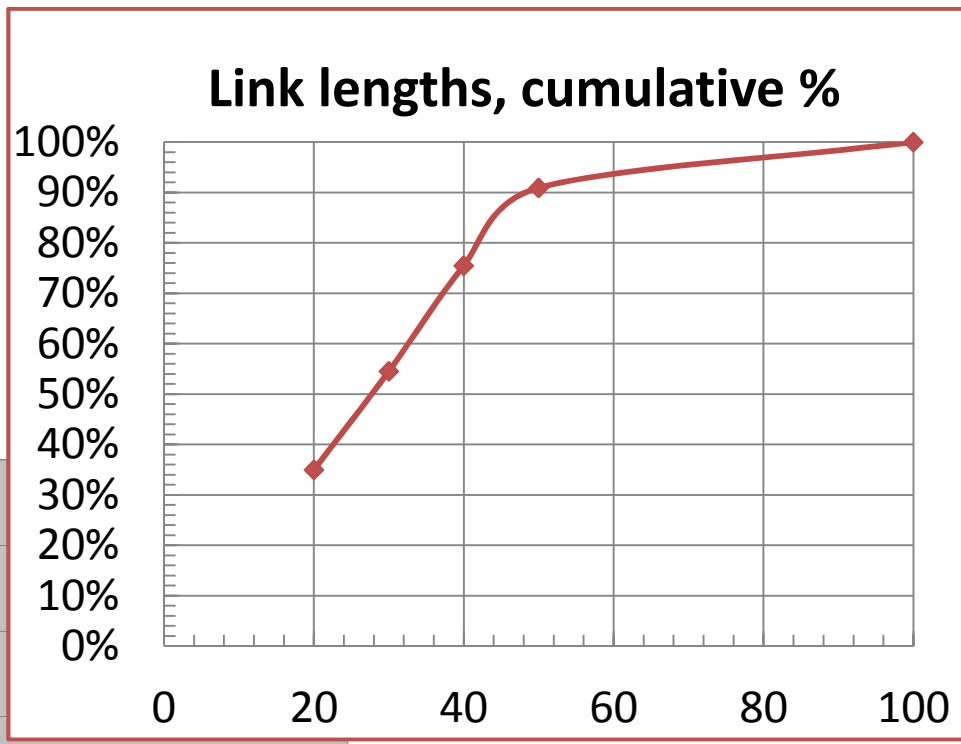
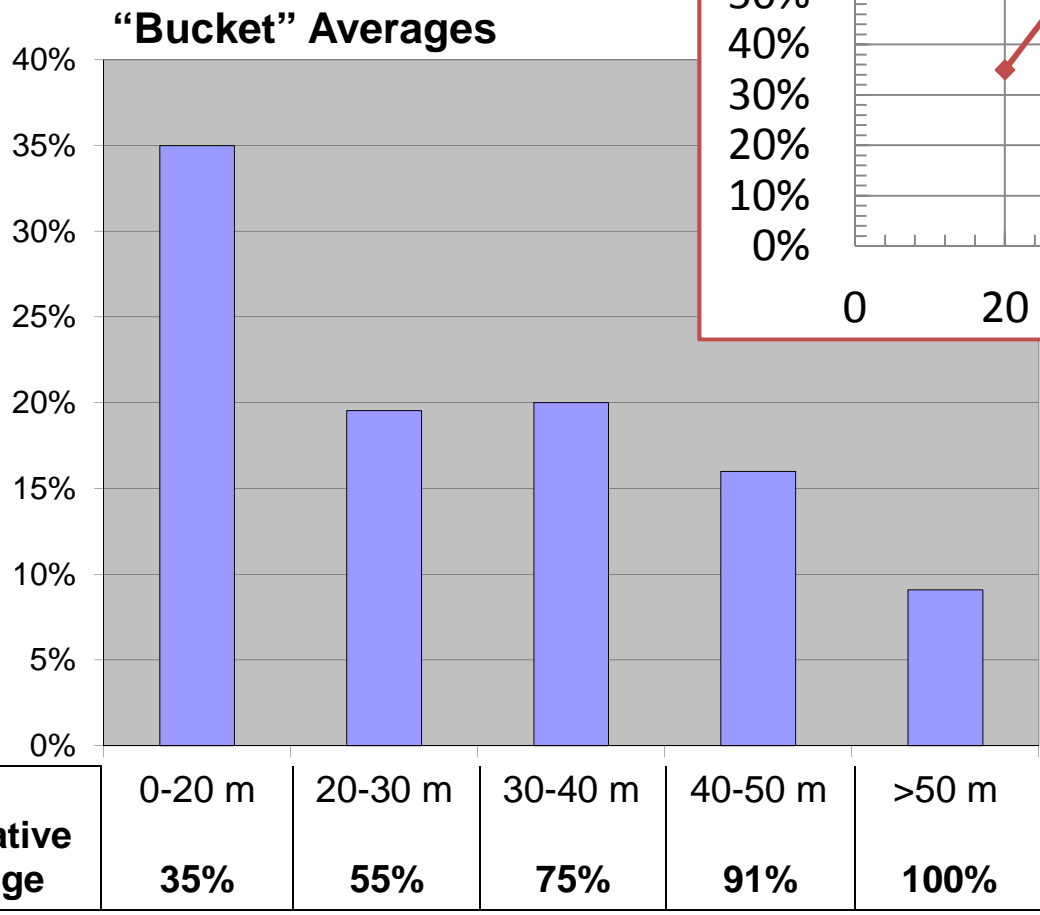
“Bucket” Length distribution:  
highlighted data changed from  
cumulative to “buckets”



# Length distributions

	0-20 m	20-30 m	30-40 m	40-50 m	>50 m
bucket average	35%	20%	20%	16%	9%
cumulative average	35%	55%	75%	91%	100%

Cumulative average distributions and the bucket averages, for the 22 responders that gave complete responses.



<b>cumulative average</b>	0-20 m	20-30 m	30-40 m	40-50 m	>50 m
	<b>35%</b>	<b>55%</b>	<b>75%</b>	<b>91%</b>	<b>100%</b>

# Results summary

- 23 respondents,
  - Cross-section of all stake-holders
  - Representing about 700K links
- Broad Market Potential –
  - 10 of the 23 respondents, design professionals, integrators, installers and owner operators, are already anticipating speeds beyond 10GBASE-T
- Data is generally in-line with previous data shown to the group –
  - Longer reach provides more coverage
  - A 20m reach would cover only 35% of responses... probably too short
  - A 30m reach would cover 55%... better
  - A 40m reach would cover 75% of responses

# Raw survey results, complete

Respondent	What is the maximum link length you anticipate needing in the data center? (Please make selections in all fields that are within your expertise)		
	Small Data Center - Maximum Link Length	Medium Data Center - Maximum Link Length	Large Data Center - Maximum Link Length
1	10 m (33 ft)	20 m (66 ft)	40 m (131 ft)
2	30 m (98 ft)	50 m (164 ft)	80 m (262 ft)
3	50 m (164 ft)	30 m (98 ft)	5 m (16 ft)
4	50 m (164 ft)	80 m (262 ft)	100 m (328 ft)
5	60 m (197 ft)	80 m (262 ft)	100 m (328 ft)
6	30 m (98 ft)	30 m (98 ft)	30 m (98 ft)
7	10 m (33 ft)	20 m (66 ft)	40 m (131 ft)
8	10 m (33 ft)	30 m (98 ft)	50 m (164 ft)
9			30 m (98 ft)
10	50 m (164 ft)	70 m (230 ft)	100 m (328 ft)
11	20 m (66 ft)	40 m (131 ft)	50 m (164 ft)
12	10 m (33 ft)	50 m (164 ft)	90 m (295 ft)
13			100 m (328 ft)
14		40 m (131 ft)	
15	20 m (66 ft)	40 m (131 ft)	80 m (262 ft)
16	40 m (131 ft)	60 m (197 ft)	90 m (295 ft)
17	30 m (98 ft)	70 m (230 ft)	100 m (328 ft)
18	30 m (98 ft)	50 m (164 ft)	70 m (230 ft)
19	30 m (98 ft)	60 m (197 ft)	100 m (328 ft)
20	10 m (33 ft)	30 m (98 ft)	60 m (197 ft)
21	5 m (16 ft)	30 m (98 ft)	60 m (197 ft)
22	50 m (164 ft)	70 m (230 ft)	90 m (295 ft)
23	90 m (295 ft)		

Respondent	Please estimate the percentage of data center connections that would be covered if the maximum allowable server link lengths were limited to 20m, 30m, 40m or 50m (66 ft, 98 ft, 131 ft or 164 ft respectively).			
	20m - Total percentage of links shorter than	30m - Total percentage of links shorter than	40m - Total percentage of links shorter than	50m - Total percentage of links shorter than
1	30%	40%	20%	10%
2	30%	30%	20%	20%
3	50%	60%	70%	80%
4	20%	40%	80%	100%
5	30%	40%	50%	80%
6	90%	10%		
7	80%	90%	100%	100%
8	20%	30%	30%	20%
9	90%	10%		
10	20%	40%	60%	80%
11	50%	70%	90%	100%
12	10%	50%	20%	10%
13			90%	
14	50%	50%	100%	100%
15	30%	30%	20%	20%
16	20%	20%	30%	30%
17	10%	20%	30%	40%
18	30%	40%	50%	60%
19	30%	60%	80%	90%
20	30%	50%	70%	90%
21	20%	20%	30%	50%
22	20%	30%	50%	80%
23	10%	30%	50%	10%

Respondent	Not counting the connections at the active equipment (e.g. switches, servers or routers), do you install (or plan to install) channels with the following number of connections in a data center?			
	End-to-End links (Direct patch cord connection) - Copper Channels	Channels with 2 Connections - Copper Channels	Channels with 3 Connections - Copper Channels	Channels with 4 Connections - Copper Channels
1	Often	Often	Occasionally	Occasionally
2	Never	Always	Never	Occasionally
3	Often	Occasionally	Occasionally	Occasionally
4	Occasionally	Often	Often	Always
5	Often	Often	Occasionally	Occasionally
6	Occasionally	Always	Never	Never
7	Never	Often	Occasionally	Occasionally
8	Never	Occasionally	Often	Occasionally
9	Often	Often	Occasionally	Occasionally
10	Occasionally	Always	Occasionally	Never
11	Occasionally	Often	Occasionally	Never
12	Often	Often	Occasionally	Never
13	Occasionally	Often		
14	Often	Often	Occasionally	Never
15	Often	Occasionally	Occasionally	Occasionally
16	Occasionally	Often	Occasionally	Occasionally
17	Occasionally	Occasionally	Often	Occasionally
18	Occasionally	Occasionally	Occasionally	Occasionally
19	Occasionally	Often	Often	Occasionally
20	Always	Occasionally	Never	Never
21	Occasionally	Always	Occasionally	Never
22	Often	Often	Often	Occasionally
23	Occasionally	Often	Always	Occasionally

Respondent	Please provide an estimate of the total number of cabling links that you anticipate installing over the next three years:	Please tell us about the cabling and applications you anticipate	
	Total number of links	Answer - Highest Cabling Category	Answer - Fastest Application
1	< 10,000 links	Higher than Category 6A	40GBASE-T
2	< 1,000 links	Category 6A	I don't know
3	< 100	Higher than Category 6A	100GBASE-T
4	< 100	Higher than Category 6A	100GBASE-T
5	< 100,000 links	Higher than Category 6A	40GBASE-T
6	< 100,000 links	Category 5e	10GBASE-T
7	More than 100,000 links	Category 6	10GBASE-T
8	< 10,000 links	Category 6A	100GBASE-T
9	< 100,000 links	Category 6A	40GBASE-T
10	< 10,000 links	Higher than Category 6A	I don't know
11	< 10,000 links	Category 6	10GBASE-T
12	< 10,000 links	Category 6A	10GBASE-T
13	< 10,000 links	Category 6A	10GBASE-T
14	< 1,000 links	Category 6A	10GBASE-T
15	< 1,000 links	Category 6A	10GBASE-T
16	< 10,000 links	Category 6A	10GBASE-T
17	More than 100,000 links	Higher than Category 6A	40GBASE-T
18	< 10,000 links	Category 6A	10GBASE-T
19	< 10,000 links	Category 6A	10GBASE-T
20	< 10,000 links	Higher than Category 6A	100GBASE-T
21	< 1,000 links	Category 6A	10GBASE-T
22	< 10,000 links	Higher than Category 6A	40GBASE-T
23	< 10,000 links	Higher than Category 6A	100GBASE-T

Respondent	What is your job function with your organization		Please provide any additional comments or information that may aid in the development of the next generation of cabling.
	Response	Other (please specify)	Open-Ended Response
1	Cabling Design Professional		
2	Cabling Design Professional		
3	Integrator or Consultant	network administrator	i feel that copper will still be popular for a while. if i desined a medium size data center. i would use copper from systems to a switch then to fiber. having 1 switch handle a cluster of servers close together probly no more than 20ft away from the switch.
4	Installer or Contractor		
5	Integrator or Consultant		
6	Cabling Manufacturer or Vendor		
7	Cabling Design Professional		the previous IEEE survey when developing 10GBaseT was 99.4% less than 55m
8	Cabling Design Professional		
9	Data Center Owner/Operator		
10	Cabling Design Professional		
11	Cabling Design Professional		
12	Installer or Contractor		
13	Data Center Owner/Operator		
14	Integrator or Consultant		
15	Data Center Owner/Operator	project managment	
16	Integrator or Consultant		
17	Cabling Design Professional		
18	Integrator or Consultant		10Gbase-T needs to be the "final" copper application - seriously, fiber is better, faster and more cost effective at high speeds and is not prone to the "every-other-year" changes advocated by copper cable companies. Do you really believe that data centers want to re-cable every time a new standard is announced? Category 8 is nothing more than than an additional burden to designers.
19	Cabling Manufacturer or Vendor		
20	Integrator or Consultant		It would be brilliantly simple if the 90m limit could be achieved at 100Gbps.
21	Cabling Design Professional		
22	Cabling Design Professional		
23	Data Center Owner/Operator		