Solution Set Analyzer Update
“Kolesar_Kalculator_2012_01_17.xls”

Paul Kolesar, CommScope

IEEE 802.3

Next Generation Optics Study Group

January, 2012 Newport Beach, CA

Outline

- User's guide to solution set analyzer part 1
  - The PMD analyzer
- Cabling cost model development
- User's guide to solution set analyzer part 2
  - The cabling cost analyzer
- User's guide to solution set analyzer part 3
  - The total cost analyzer
- Test-driving the analyzer
- Future work

User's Guide to Solution Set Analyzer Part 1
- The PMD Analyzer -

History and Improvements Since November Study Group Meeting

- First suggested in kolesar_02_0911_NG100GOPTX.pdf as a way to calculate an optimal solution set
- Floated first cut as kolesar_01_1111_NG100GOPTX.xls to gather feedback
- Incorporated feedback in Kolesar_Kalculator_2011_11_14.xls
  - Added Read-me tab
  - Version tracking using date coding
  - Used color coding to facilitate usage
  - Added metric units
  - Added server-to-switch channels
  - Added interpolation capability
  - Plotted the channel length CDFs
  - Changed the CDFs from decimal to percentage
- Presented kolesar_01a_11-29-11_NG100GOPTX_MMFAdHoc, a users guide, via web conference to MMF ad hoc
  - The next section basically repeats that material for the Study Group
  - The remaining sections are new user's guide and output of Kolesar_Kalculator_2012_01_17.xls

Read Me (1 of 3)

- SolutionAnalyzer_2011_11_17 description
- This workbook permits comparison of PMD solution sets and associated cabling targeted to support data center environments.
- The worksheet "PMD Sol'n Set" allows comparison of up to four sets, each with up to four PMDs, on a variety of metrics.
- The cells in columns B, C and D in **bold** font are inputs to the analysis.
  - In column B input the description of the PMDs within the sets, in order of ascending reach (i.e. ascending supportable distance) capability.
  - In column C input relative values of the metric to be compared such as cost, power consumption, size, etc.
  - In column D input the reach capability in meters. The column E reach values in US customary units of feet are calculated, not input.
  - Note: The default input values are placeholders.

Read Me (2 of 3)

- The calculation produces Figures of Merit for each of the five data center channel length cumulative density functions (CDFs) provided in columns M thru S and plotted to the right in both metric (meters) and US customary (feet) units.
  - The originating source of the CDFs is referenced within the comments imbedded in the title cells above the CDF columns.
- Two categories of channel CDFs are provided.
  - Columns O and P are the CDFs for access channels between servers and switches in two different time periods that illustrate migration of switch placement closer to servers.
  - Columns Q, R and S are the CDFs for aggregation channels between switches for three different topology mixes detailed in the referenced source material.

Read Me (3 of 3)

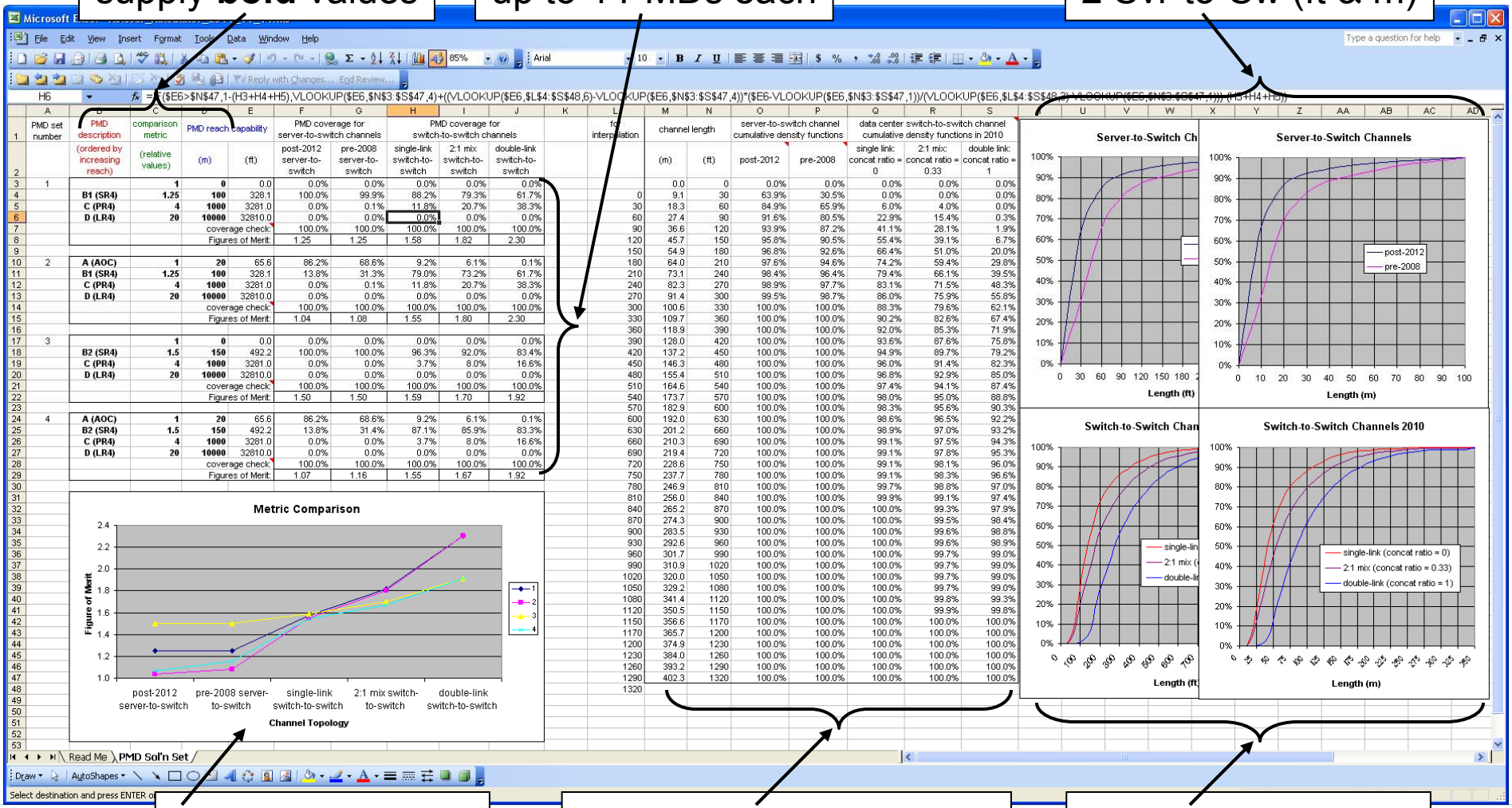
- The calculation proceeds as follows.
  - The channel coverage of each PMD is determined by comparison to the CDFs using linear interpolation starting with the first PMD listed in the set.
  - The channel coverage of the next PMD in the set is determined from where the previous PMD stopped, and so on, thus necessitating ascending reach order.
  - A coverage check is determined by summing the coverage of all the PMDs in the set for each CDF, wherein a value less than 100% indicates that a portion of that CDF is not covered.
  - The Figures of Merit are determined by summing coverage-weighted comparison metrics. These are plotted below the PMD tables in the order of channels with decreasing CDF (i.e. longer channel lengths).
  - Note: Setting reach to 0 effectively eliminates a PMD from the calculation provided that PMD is listed before others in compliance with the ascending reach ordering requirement.
  - For this reason, it is recommended to fill in the PMDs starting at the bottom row of each set.

Overall Dashboard

3 input columns:
supply **bold** values

4 solution sets:
up to 4 PMDs each

Graphical CDFs:
2 Svr-to-Sw (ft & m)



Output graph:
FoM for sol'n sets

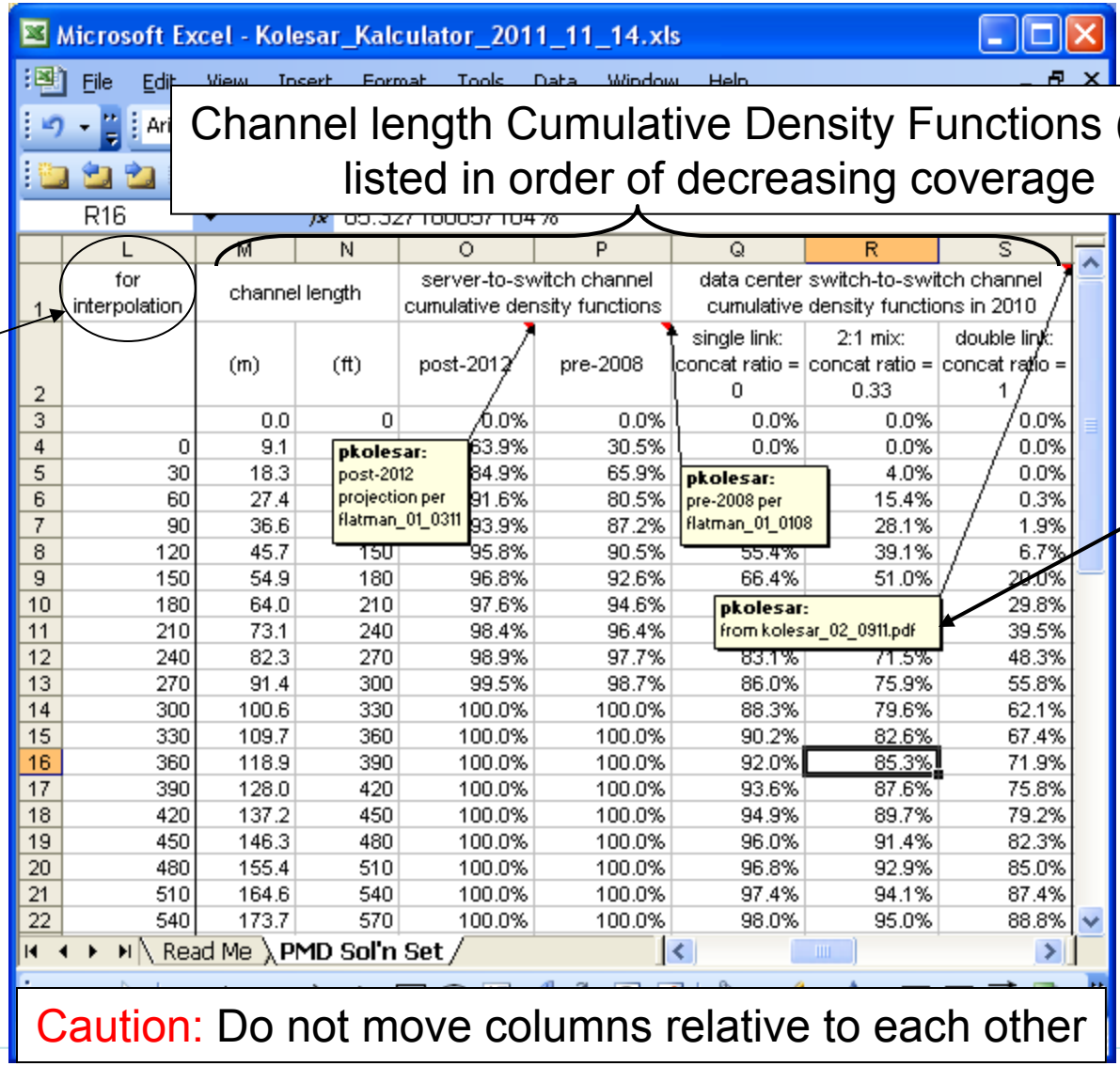
5 numerical CDFs:
2 Srv-to-Sw, 3 Sw-to-Sw

Graphical CDFs:
3 Sw-to-Sw (ft & m)

Numerical CDF Dashboard

Column L for interpolation functionality

Channel length Cumulative Density Functions (CDFs) listed in order of decreasing coverage

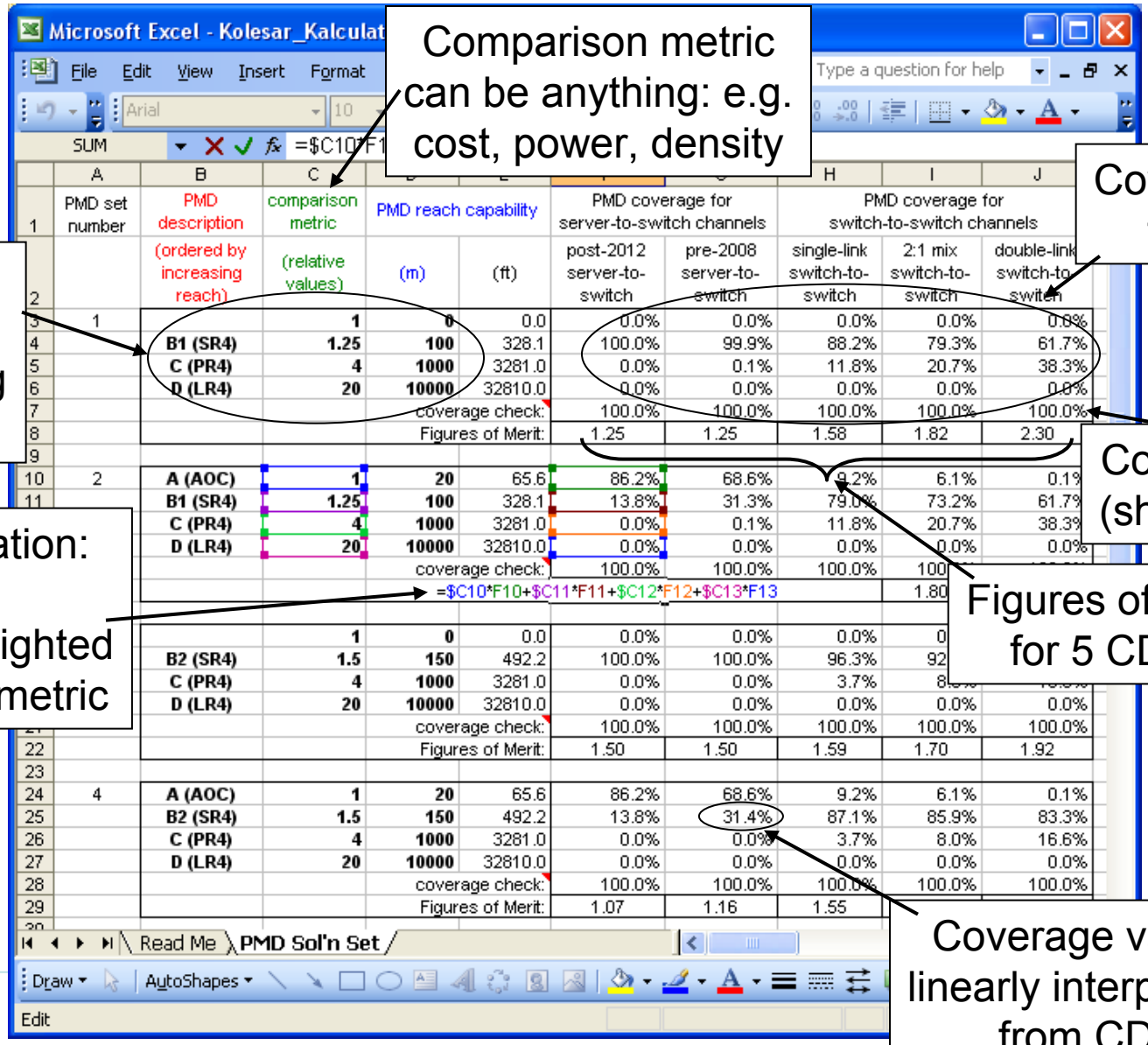


	L	M	N	O	P	Q	R	S
1	for interpolation	channel length		server-to-switch channel cumulative density functions		data center switch-to-switch channel cumulative density functions in 2010		
2		(m)	(ft)	post-2012	pre-2008	single link: concat ratio = 0	2:1 mix: concat ratio = 0.33	double link: concat ratio = 1
3		0.0	0	0.0%	0.0%	0.0%	0.0%	0.0%
4	0	9.1		63.9%	30.5%	0.0%	0.0%	0.0%
5	30	18.3		84.9%	65.9%		4.0%	0.0%
6	60	27.4		91.6%	80.5%		15.4%	0.3%
7	90	36.6		93.9%	87.2%		28.1%	1.9%
8	120	45.7	150	95.8%	90.5%	55.4%	39.1%	6.7%
9	150	54.9	180	96.8%	92.6%	66.4%	51.0%	20.0%
10	180	64.0	210	97.6%	94.6%			29.8%
11	210	73.1	240	98.4%	96.4%			39.5%
12	240	82.3	270	98.9%	97.7%	83.1%	71.5%	48.3%
13	270	91.4	300	99.5%	98.7%	86.0%	75.9%	55.8%
14	300	100.6	330	100.0%	100.0%	88.3%	79.6%	62.1%
15	330	109.7	360	100.0%	100.0%	90.2%	82.6%	67.4%
16	360	118.9	390	100.0%	100.0%	92.0%	85.3%	71.9%
17	390	128.0	420	100.0%	100.0%	93.6%	87.6%	75.8%
18	420	137.2	450	100.0%	100.0%	94.9%	89.7%	79.2%
19	450	146.3	480	100.0%	100.0%	96.0%	91.4%	82.3%
20	480	155.4	510	100.0%	100.0%	96.8%	92.9%	85.0%
21	510	164.6	540	100.0%	100.0%	97.4%	94.1%	87.4%
22	540	173.7	570	100.0%	100.0%	98.0%	95.0%	88.8%

Comments give source references

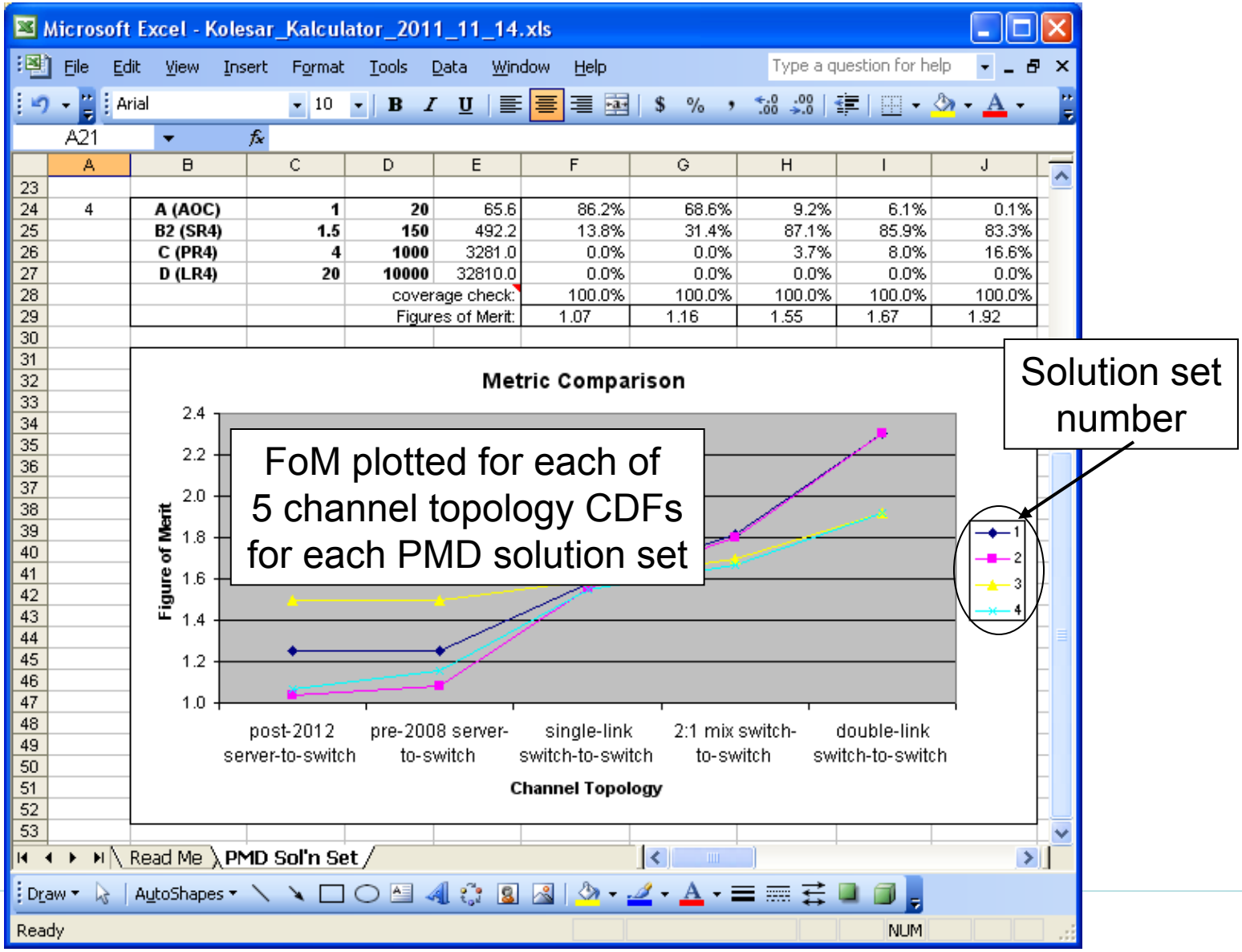
Caution: Do not move columns relative to each other

Input/Output Dashboard (1 of 2)



	A	B	C	D	E	F	G	H	I	J
1	PMD set number	PMD description	comparison metric	PMD reach capability		PMD coverage for server-to-switch channels		PMD coverage for switch-to-switch channels		
2		(ordered by increasing reach)	(relative values)	(m)	(ft)	post-2012 server-to-switch	pre-2008 server-to-switch	single-link switch-to-switch	2:1 mix switch-to-switch	double-link switch-to-switch
3	1		1	0	0.0	0.0%	0.0%	0.0%	0.0%	0.0%
4		B1 (SR4)	1.25	100	328.1	100.0%	99.9%	88.2%	79.3%	61.7%
5		C (PR4)	4	1000	3281.0	0.0%	0.1%	11.8%	20.7%	38.3%
6		D (LR4)	20	10000	32810.0	0.0%	0.0%	0.0%	0.0%	0.0%
7					coverage check:	100.0%	100.0%	100.0%	100.0%	100.0%
8					Figures of Merit:	1.25	1.25	1.58	1.82	2.30
9										
10	2	A (AOC)	1	20	65.6	86.2%	68.6%	9.2%	6.1%	0.1%
11		B1 (SR4)	1.25	100	328.1	13.8%	31.3%	79.0%	73.2%	61.7%
12		C (PR4)	4	1000	3281.0	0.0%	0.1%	11.8%	20.7%	38.3%
13		D (LR4)	20	10000	32810.0	0.0%	0.0%	0.0%	0.0%	0.0%
14					coverage check:	100.0%	100.0%	100.0%	100	
15			=$C10*F10+$C11*F11+$C12*F12+$C13*F13						1.80	
16			1	0	0.0	0.0%	0.0%	0.0%	0	
17		B2 (SR4)	1.5	150	492.2	100.0%	100.0%	96.3%	92	
18		C (PR4)	4	1000	3281.0	0.0%	0.0%	3.7%	8	
19		D (LR4)	20	10000	32810.0	0.0%	0.0%	0.0%	0.0%	0.0%
20					coverage check:	100.0%	100.0%	100.0%	100.0%	100.0%
21					Figures of Merit:	1.50	1.50	1.59	1.70	1.92
22										
23	4	A (AOC)	1	20	65.6	86.2%	68.6%	9.2%	6.1%	0.1%
24		B2 (SR4)	1.5	150	492.2	13.8%	31.4%	87.1%	85.9%	83.3%
25		C (PR4)	4	1000	3281.0	0.0%	0.0%	3.7%	8.0%	16.6%
26		D (LR4)	20	10000	32810.0	0.0%	0.0%	0.0%	0.0%	0.0%
27					coverage check:	100.0%	100.0%	100.0%	100.0%	100.0%
28					Figures of Merit:	1.07	1.16	1.55		

Input/Output Dashboard (2 of 2)



	A	B	C	D	E	F	G	H	I	J
23										
24	4	**A (AOC)**	**1**	**20**	65.6	86.2%	68.6%	9.2%	6.1%	0.1%
25		**B2 (SR4)**	**1.5**	**150**	492.2	13.8%	31.4%	87.1%	85.9%	83.3%
26		**C (PR4)**	**4**	**1000**	3281.0	0.0%	0.0%	3.7%	8.0%	16.6%
27		**D (LR4)**	**20**	**10000**	32810.0	0.0%	0.0%	0.0%	0.0%	0.0%
28				coverage check:		100.0%	100.0%	100.0%	100.0%	100.0%
29				Figures of Merit:		1.07	1.16	1.55	1.67	1.92

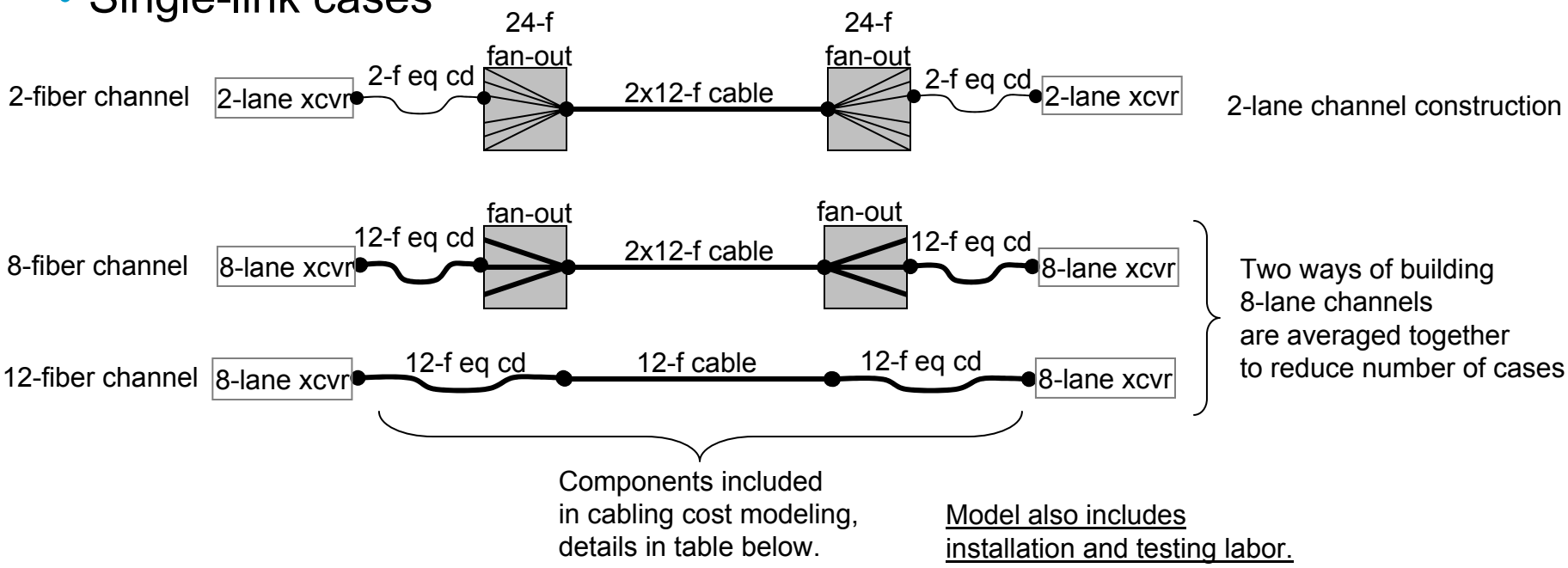
FoM plotted for each of 5 channel topology CDFs for each PMD solution set

Solution set number

Next Step:
Cabling Cost Model Development

Cabling Channel Models (1 of 2)

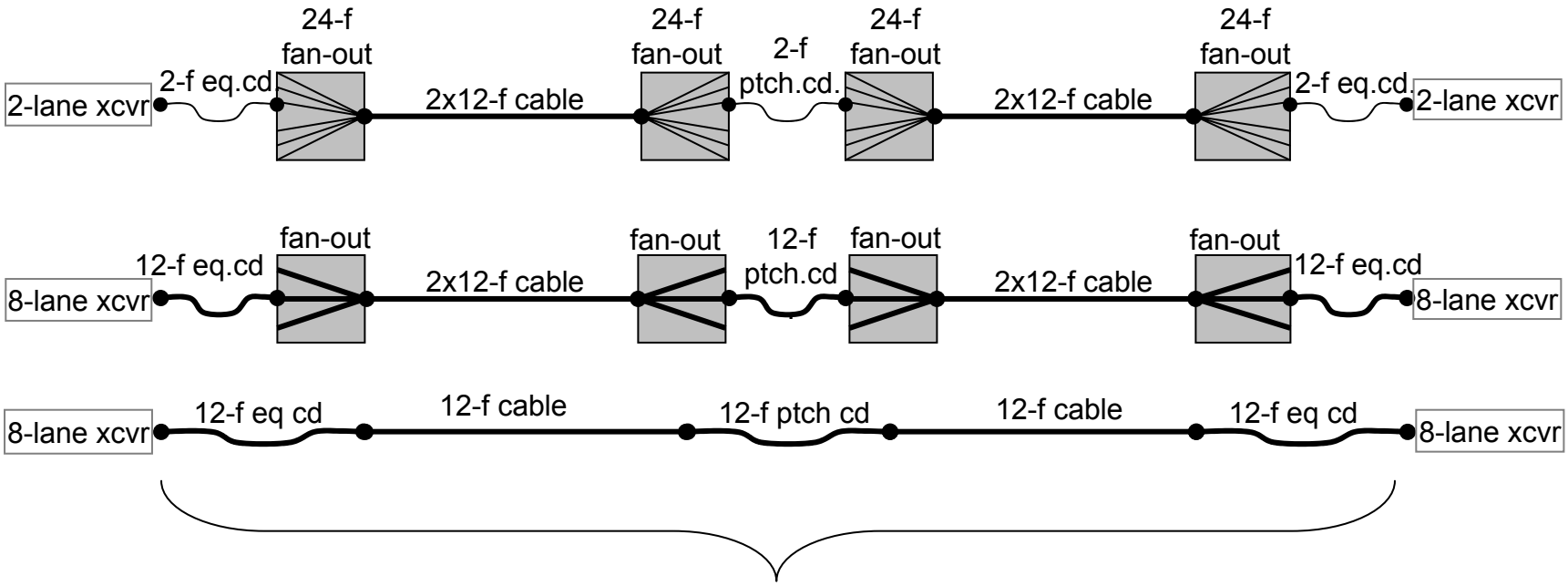
- Single-link cases



	Equip cord	length (m)	Fan-out	Trunk cable	length (m)	Fan-out	Equip cord	length (m)
2-fiber channel	(1) 2-f	2	(1/12th) 24-f	(1/12th) 2x12-f	5 - 296	(1/12th) 24-f	(1) 2-f	2
8-fiber channel	(1) 12-f	2	(1/3rd) 24-f	(1/3rd) 2x12-f	5 - 296	(1/3rd) 24-f	(1) 12-f	2
12-fiber channel	(1) 12-f	2	0	(1) 12-f	5 - 296	0	(1) 12-f	2

Cabling Channel Models (2 of 2)

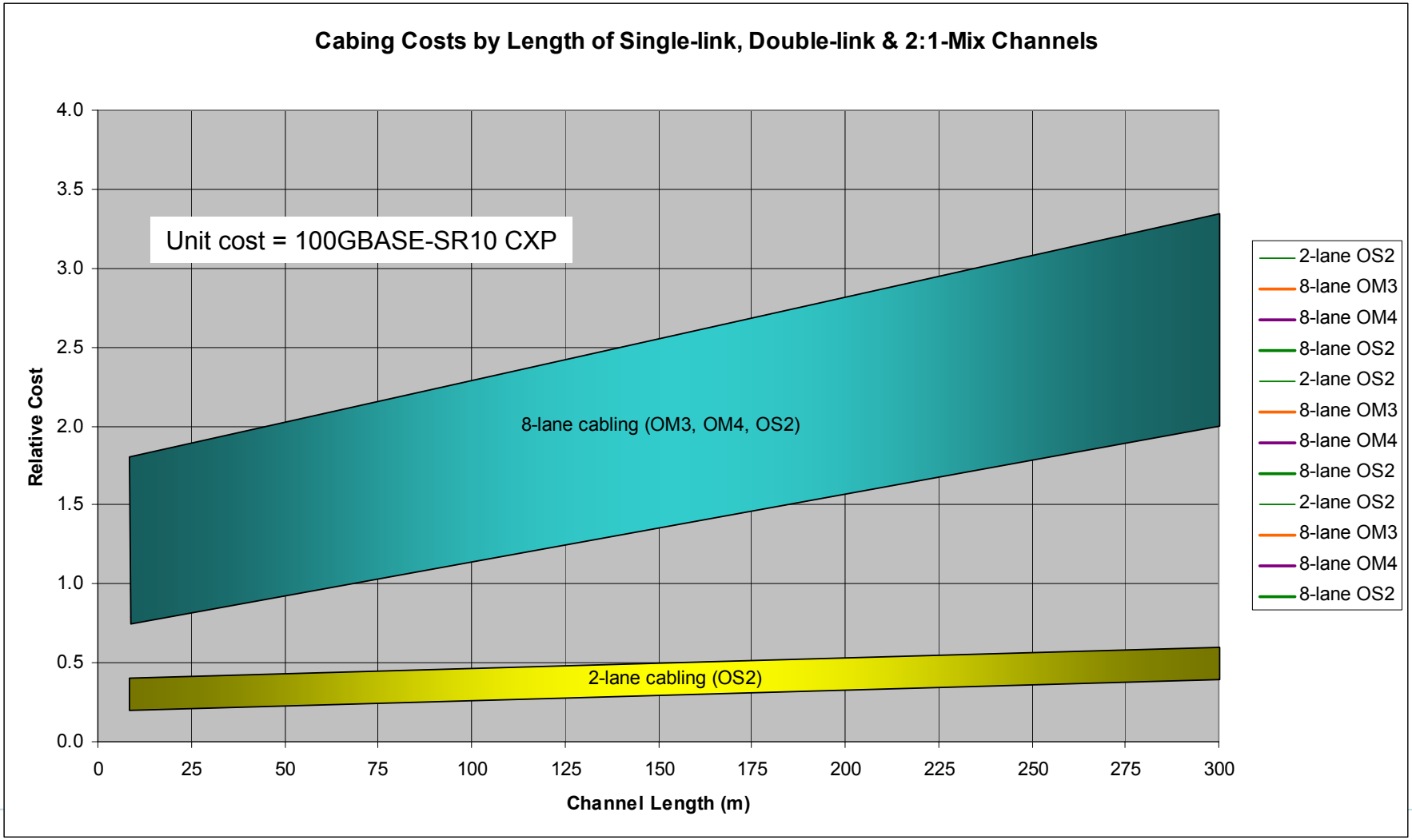
- Double-link cases



	Equip cord	length (m)	Fan-out	Trunk cable	length (m)	Fan-out	Patch cord	length (m)	Fan-out	Trunk cable	length (m)	Fan-out	Equip cord	length (m)
2-fiber channel	(1) 2-f	2	(1/12th) 24-f	(1/12th) 2x12-f	5 - 296	(1/12th) 24-f	(1) 2-f	2	(1/12th) 24-f	(1/12th) 2x12-f	5 - 296	(1/12th) 24-f	(1) 2-f	2
8-fiber channel	(1) 12-f	2	(1/3rd) 24-f	(1/3rd) 2x12-f	5 - 296	(1/3rd) 24-f	(1) 12-f	2	(1/3rd) 24-f	(1/3rd) 2x12-f	5 - 296	(1/3rd) 24-f	(1) 12-f	2
12-fiber channel	(1) 12-f	2	0	(1) 12-f	5 - 296	0	(1) 12-f	2	0	(1) 12-f	5 - 296	0	(1) 12-f	2

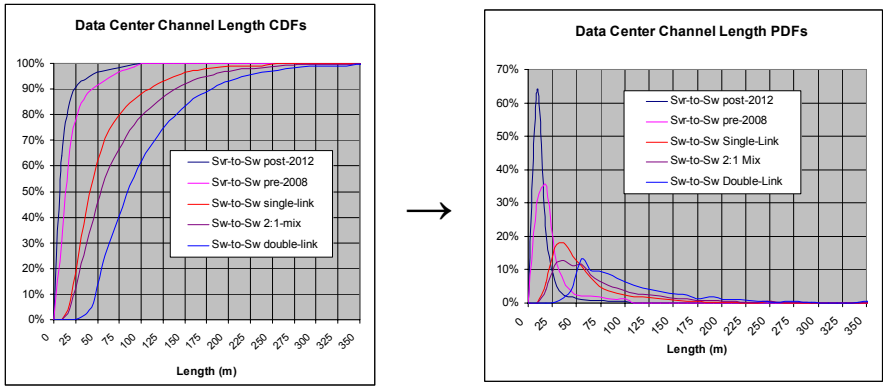
Cabling Channel Costs

- Calculated installed cabling cost for channels supporting various PMDs



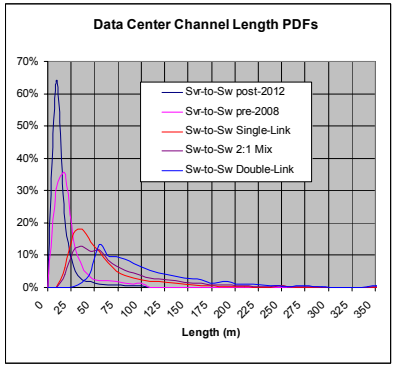
Cabling Cost Model

- Step 1: Derive channel length PDFs from CDFs

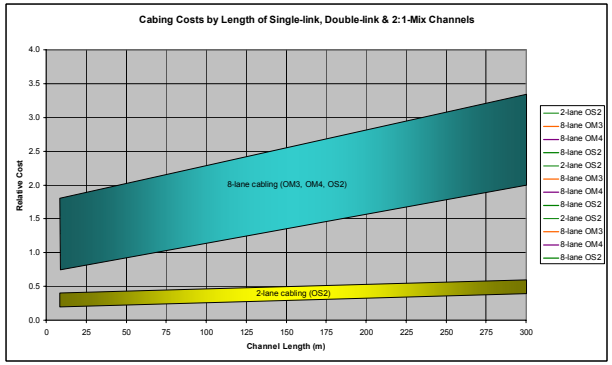


- Step 2: Weight cabling costs by channel PDF and integrate over length of interest to get costs for connectivity and fiber types

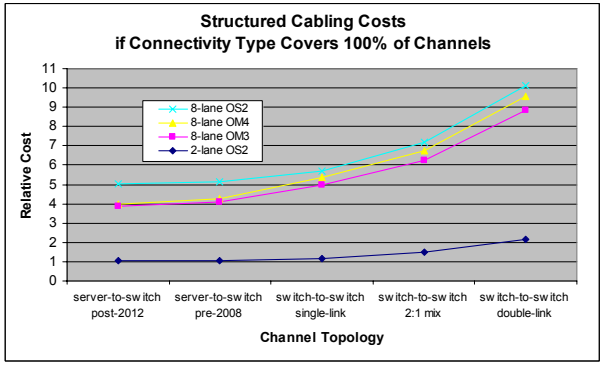
400 m
$\int$
0 m



×

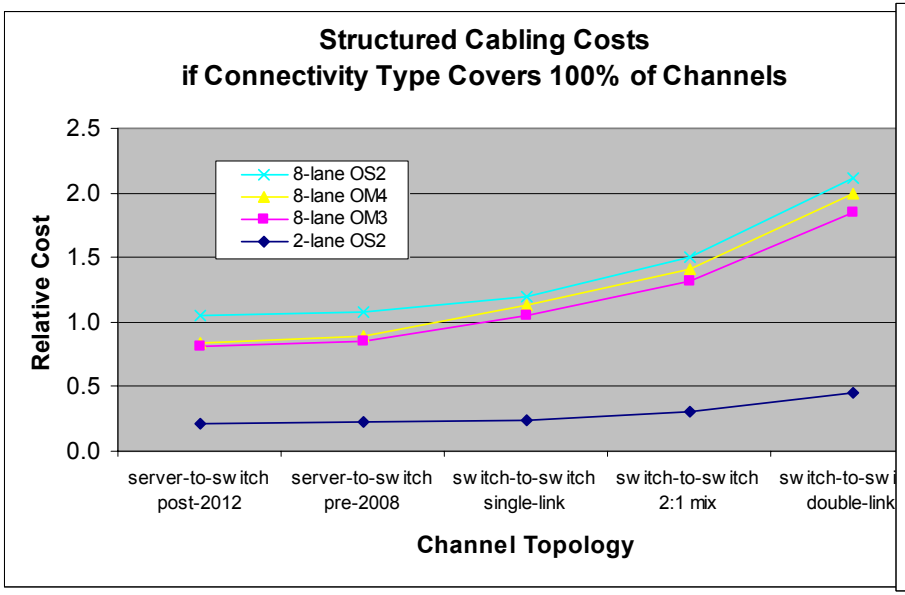


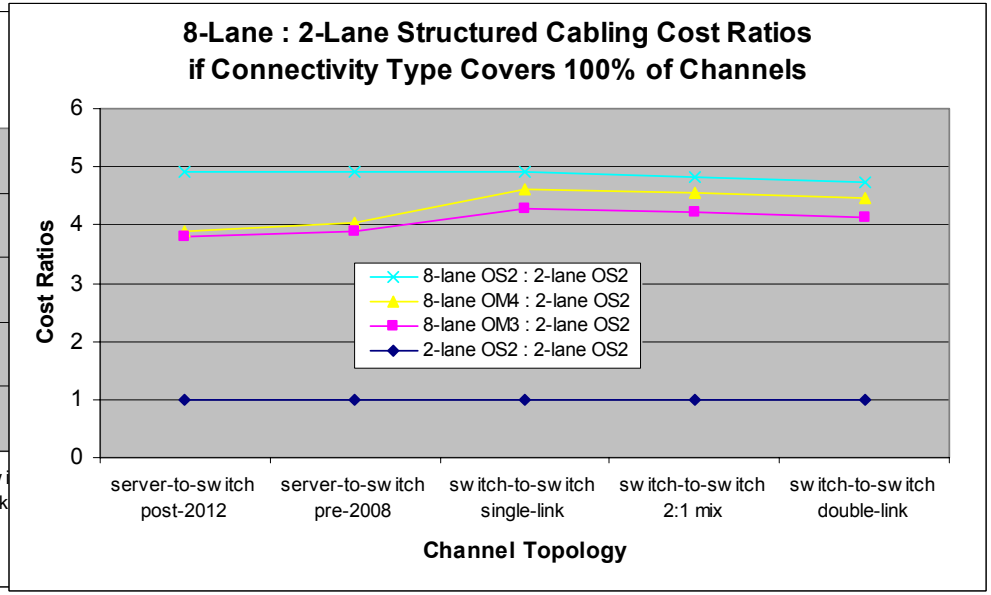
=



Cabling Cost Model

- Basic cost relationships
  - 8-lane cabling is 4x to 5x more expensive than 2-lane cabling
    - Follows expected first-order driver: the strand-count ratio
  - Second order drivers are:
    - fiber type, connector type, and number of terminations per link





User's Guide to Solution Set Analyzer Part 2
- The Cabling Cost Analyzer -

Read Me (1 of 3)

- SolutionAnalyzer_2012_01_17 description
- The worksheet "Cabling Sol'n Set" allows comparison of cabling costs for up to four PMD sets, each with up to four PMDs.
  - Five cabling connectivity types can be examined that include 2-lane OS2, 8-lane OM3, 8-lane OM4, 8-lane OS2, and no structured cabling.
  - The 2-lane and 8-lane types represent structured cabling associated with PMDs that use one fiber and four fibers in each direction, respectively.
  - The last type, "no structured cabling", is associated with of the use of Active Optical Cables (AOCs) or Direct Attach Copper (DAC) cables.
- The cells in columns B thru G in **bold** font are inputs to the analysis.
  - In column B input the description of the PMDs within the sets, in order of increasing cost.
  - In columns C thru G input the PMD's reach capability in meters for each cabling type over which it is intended to operate.
  - Note: The default input values are placeholders.

Read Me (2 of 3)

- The calculation produces relative cabling cost values for each of the five data center channel length cumulative density functions (CDFs) provided in columns AQ thru AU.
  - These are the same CDFs used in the "PMD Sol'n Set" worksheet and described previously.
  - The cost calculations are based on cabling cost CDFs in columns BA thru BT.
  - The originating source of the cabling cost CDFs is referenced within the comment imbedded in the title cell above the first set of cabling CDF columns.
- The calculation proceeds as follows:
  - The cabling cost for each PMD is determined by comparison to the cabling cost CDFs in colmns BA thru BT using linear interpolation starting with the first PMD listed in the set and moving to the right thru the five cabling types.
  - Because the cabling types are placed in ascending cost order from left to right, the cost calculation can find the lowest cost scenario by applying priority to the lowest cost PMD / cabling-type combination defined in the set.
  - The calculation then applies increasingly higher cost combinations in succession to channel lengths that may exceed the reach of the prior combinations until all PMD / cabling-type combinations are analyzed.

Read Me (3 of 3)

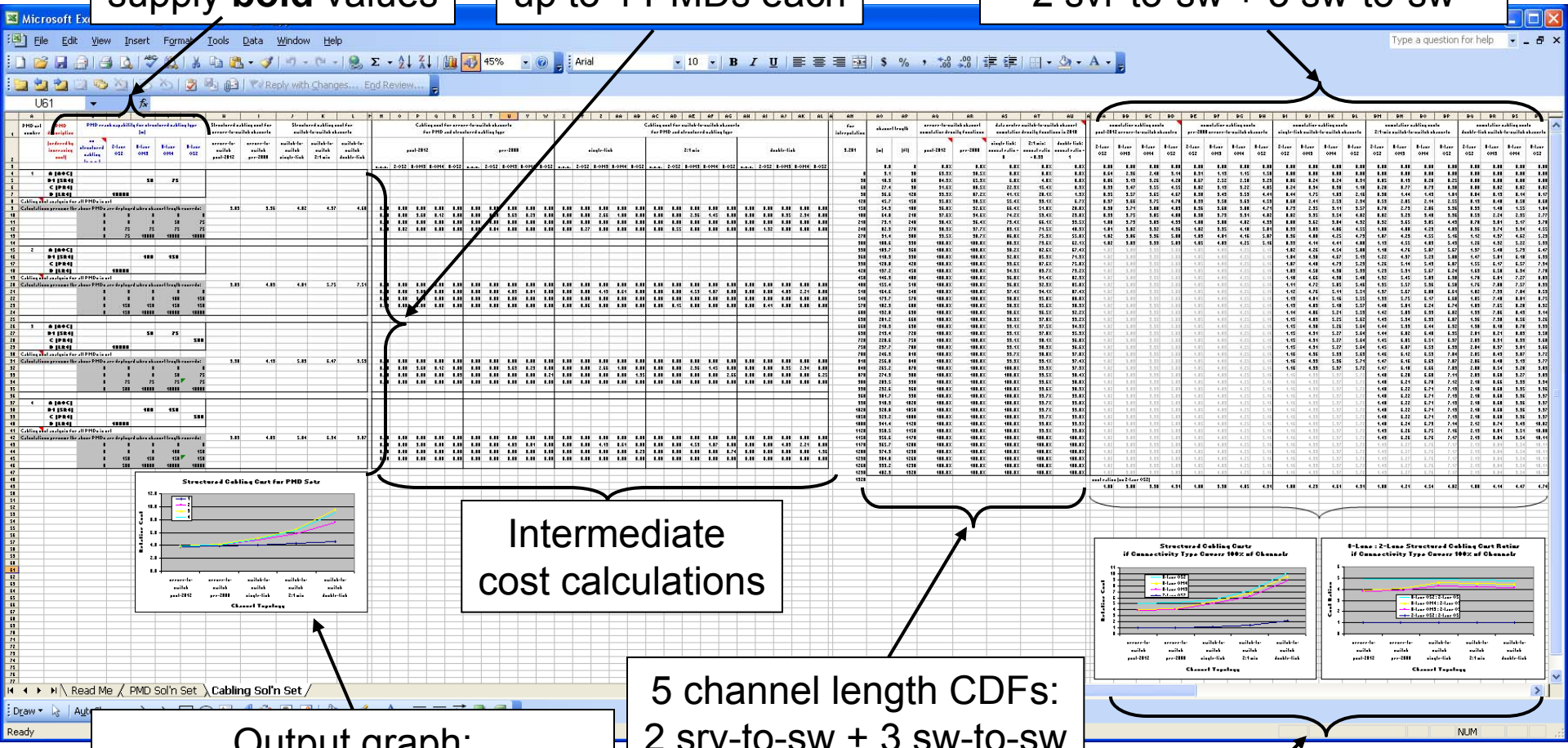
- The calculation proceeds as follows (continued):
  - The values in the grey cells below each PMD set, determined from the maximum reach of lower-cost combinations, provide the shortest channel length to which the corresponding PMD / cable-type combination is applied.
  - Cost values for individual PMD / cabling-type combinations are collected in columns N thru AL in arrays aligned with the PMD sets.
  - A zero cost value is assigned to any input cell left blank and any entry in the "no structured cabling" column.
  - A cost contribution is calculated for any PMD / cable-type combination that is required to complete coverage of the five data center channel length CDFs.
  - The cost for each of the five channel CDFs is the sum of all cost values for each PMD / cable-type combination within the set that is required to reach complete coverage.
  - However, complete cost values can only be determined for channels where the reach of the PMD set provides complete channel coverage, as determined by the "coverage check" on the "PMD Sol'n Set" worksheet.
  - The summed cost values are tabulated in columns H thru L and plotted below the PMD sets to allow a graphical comparison of all PMD sets for each channel CDF.

Overall Dashboard

6 input columns:
supply **bold** values

4 solution sets:
up to 4 PMDs each

Length-weighted cost CDFs:
2 svr-to-sw + 3 sw-to-sw



Intermediate
cost calculations

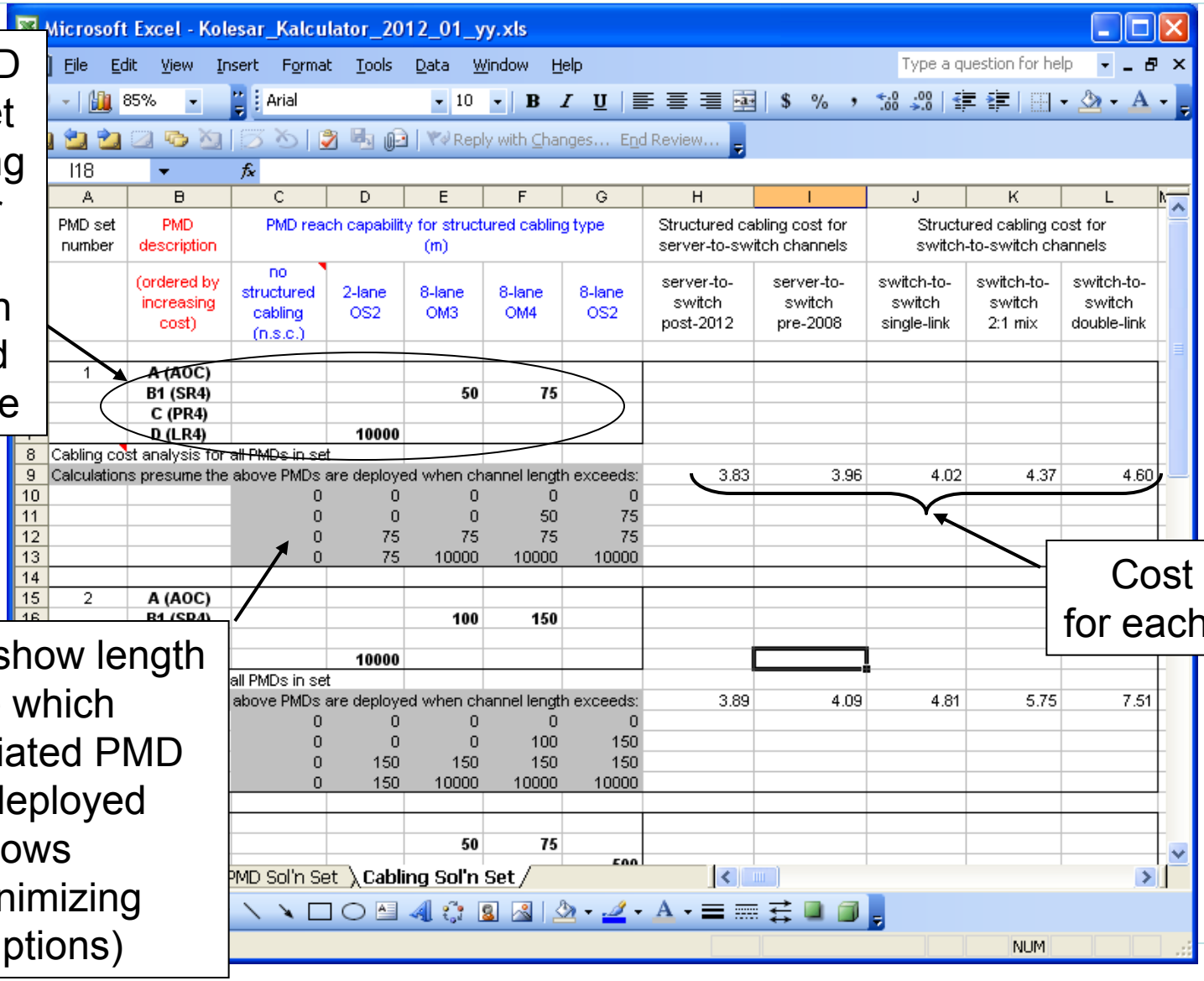
5 channel length CDFs:
2 srv-to-sw + 3 sw-to-sw

Output graph:
cabling costs for sol'n sets,
2 srv-to-sw + 3 sw-to-sw

Graphical length-weighted costs and ratios:
2 svr-to-sw + 3 sw-to-sw

Input/Output Dashboard (1 of 2)

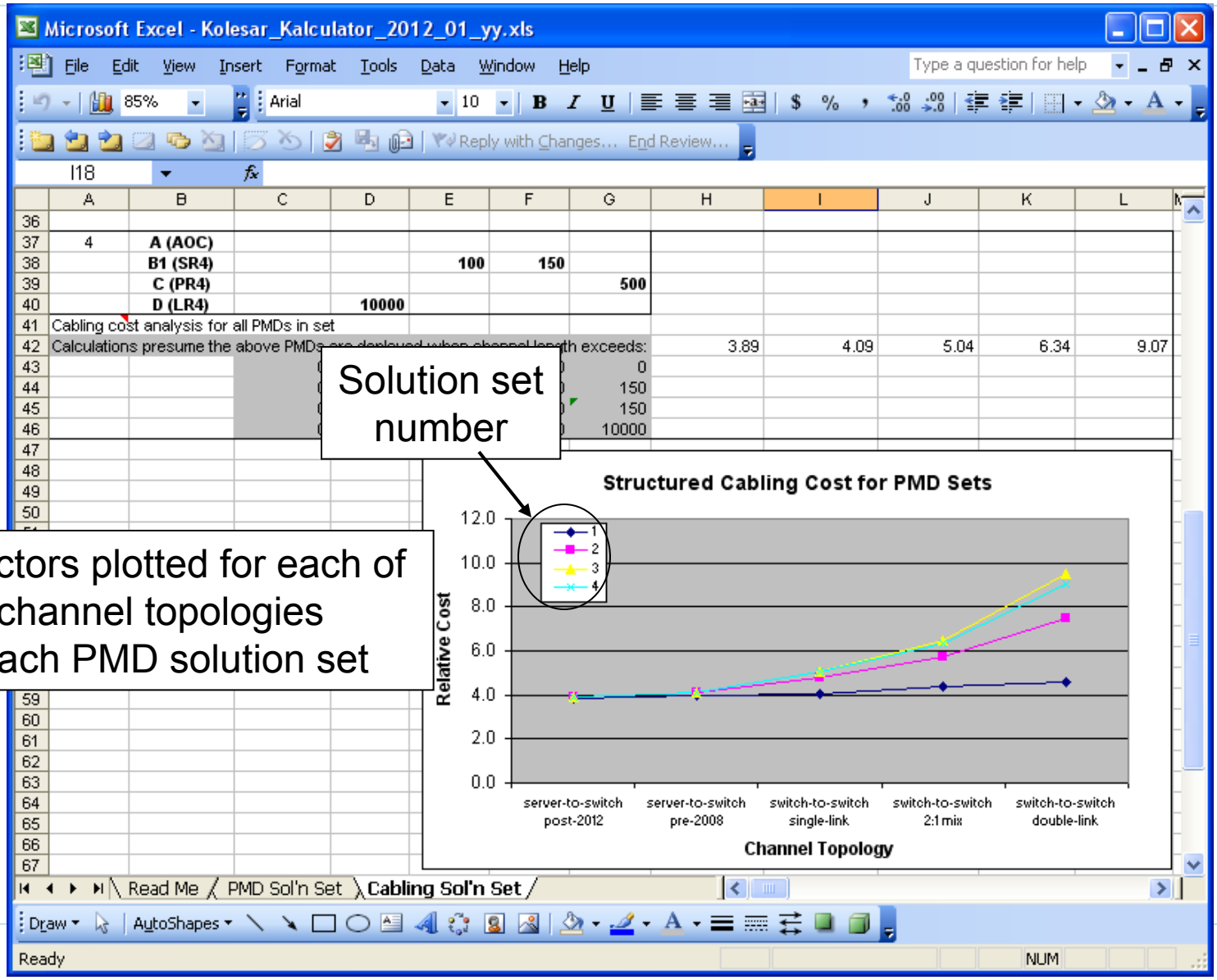
Define PMD solution set in ascending cost order and enter reaches on associated cabling type



Cost factors for each topology

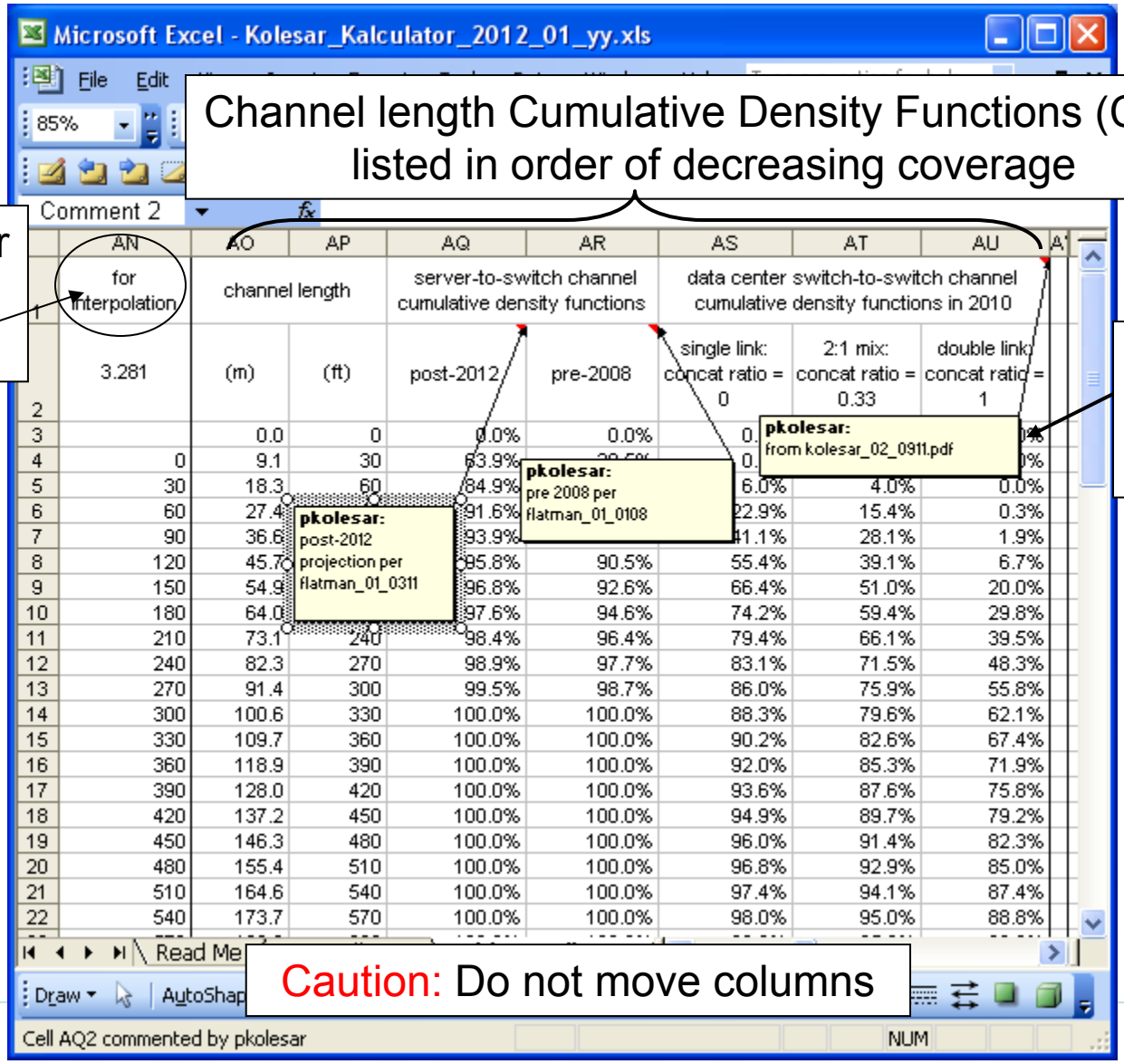
Grey cells show length above which the associated PMD will be deployed (follows cost-minimizing assumptions)

Input/Output Dashboard (2 of 2)



Cost factors plotted for each of 5 channel topologies for each PMD solution set

Numerical CDF Dashboard – Same as PMD Sol'n Set



	AN	AO	AP	AQ	AR	AS	AT	AU
1	for interpolation	channel length		server-to-switch channel cumulative density functions		data center switch-to-switch channel cumulative density functions in 2010		
2	3.281	(m)	(ft)	post-2012	pre-2008	single link: concat ratio = 0	2:1 mix: concat ratio = 0.33	double link: concat ratio = 1
3		0.0	0	0.0%	0.0%	0.		0%
4	0	9.1	30	63.9%		0.		0%
5	30	18.3	60	84.9%		6.0%	4.0%	0.0%
6	60	27.4		91.6%		22.9%	15.4%	0.3%
7	90	36.6		93.9%		41.1%	28.1%	1.9%
8	120	45.7		95.8%	90.5%	55.4%	39.1%	6.7%
9	150	54.9		96.8%	92.6%	66.4%	51.0%	20.0%
10	180	64.0		97.6%	94.6%	74.2%	59.4%	29.8%
11	210	73.1	240	98.4%	96.4%	79.4%	66.1%	39.5%
12	240	82.3	270	98.9%	97.7%	83.1%	71.5%	48.3%
13	270	91.4	300	99.5%	98.7%	86.0%	75.9%	55.8%
14	300	100.6	330	100.0%	100.0%	88.3%	79.6%	62.1%
15	330	109.7	360	100.0%	100.0%	90.2%	82.6%	67.4%
16	360	118.9	390	100.0%	100.0%	92.0%	85.3%	71.9%
17	390	128.0	420	100.0%	100.0%	93.6%	87.6%	75.8%
18	420	137.2	450	100.0%	100.0%	94.9%	89.7%	79.2%
19	450	146.3	480	100.0%	100.0%	96.0%	91.4%	82.3%
20	480	155.4	510	100.0%	100.0%	96.8%	92.9%	85.0%
21	510	164.6	540	100.0%	100.0%	97.4%	94.1%	87.4%
22	540	173.7	570	100.0%	100.0%	98.0%	95.0%	88.8%

Channel-Length-Weighted Cabling Cost CDFs Dashboard (1 of 2)

COMMSCOPE®

Microsoft Excel - Kolesar_Kalculator_2012_01_zz.xls

File Edit View Insert Format Tools

BP6 | fx 0.20497311473

CDFs for 4 cabling types over 5 channel topologies

Row	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BQ	BR	BS	BT
1	cumulative cabling costs post-2012 server-to-switch channels				cumulative cabling costs pre-2008 server-to-switch channels				cumulative cabling costs single-link switch-to-switch channels				cumulative cabling costs 2:1-mix switch-to-switch channels				cumulative cabling costs double-link switch-to-switch channels			
2	2-lane OS2	8-lane OM3	8-lane OM4	8-lane OS2	2-lane OS2	8-lane OM3	8-lane OM4	8-lane OS2	2-lane OS2	8-lane OM3	8-lane OM4	8-lane OS2	2-lane OS2	8-lane OM3	8-lane OM4	8-lane OS2	2-lane OS2	8-lane OM3	8-lane OM4	8-lane OS2
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.13	0.49	0.50	0.66	0.06	0.24	0.24	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.18	0.67	0.68	0.88	0.14	0.53	0.54	0.69	0.01	0.05	0.05	0.06	0.01	0.04	0.04	0.05	0.00	0.00	0.00	0.00
6	0.19	0.73	0.74	0.95	0.17	0.66	0.67	0.85	0.05	0.20	0.21	0.25	0.04	0.16	0.17	0.20	0.00	0.00	0.00	0.00
7	0.20	0.75	0.77	0.98	0.19	0.72	0.74	0.92	0.09	0.37	0.38	0.45	0.08	0.30	0.31	0.38	0.01	0.03	0.03	0.04
8	0.20	0.77	0.78	1.00	0.20	0.75	0.77	0.96	0.13	0.51	0.53	0.62	0.11	0.43	0.45	0.53	0.03	0.10	0.10	0.13
9	0.21	0.78	0.80	1.01	0.20	0.77	0.80	0.99	0.15	0.62	0.65	0.75	0.15	0.57	0.60	0.70	0.08	0.31	0.32	0.38
10	0.21	0.79	0.81	1.02	0.21	0.79	0.82	1.01	0.17	0.70	0.74	0.84	0.17	0.68	0.71	0.83	0.12	0.47	0.49	0.58
11	0.21	0.79	0.82	1.03	0.21	0.81	0.84	1.03	0.18	0.76	0.81	0.91	0.19	0.77	0.81	0.93	0.16	0.63	0.66	0.77
12	0.21	0.80	0.82	1.04	0.21	0.83	0.86	1.05	0.19	0.80	0.85	0.95	0.21	0.84	0.89	1.01	0.20	0.78	0.82	0.95
13	0.21	0.81	0.83	1.05	0.22	0.84	0.87	1.06	0.20	0.84	0.89	0.99	0.22	0.90	0.95	1.08	0.23	0.92	0.97	1.11
14	0.21	0.81	0.84	1.05	0.22	0.86	0.89	1.08	0.21	0.87	0.93	1.02	0.24	0.95	1.01	1.14	0.26	1.03	1.09	1.24
15	0.21	0.81	0.84	1.05	0.22	0.86	0.89	1.08	0.21	0.89	0.95	1.05	0.25	1.00	1.06	1.19	0.29	1.13	1.20	1.35
16	0.21	0.81	0.84	1.05	0.22	0.86	0.89	1.08	0.22	0.92	0.98	1.07	0.26	1.04	1.11	1.23	0.31	1.22	1.29	1.45
17	0.21	0.81	0.84	1.05	0.22	0.86	0.89	1.08	0.22	0.94	1.01	1.10	0.26	1.08	1.15	1.27	0.32	1.29	1.37	1.53
18	0.21	0.81	0.84	1.05	0.22	0.86	0.89	1.08	0.23	0.96	1.03	1.12	0.27	1.11	1.19	1.31	0.34	1.36	1.45	1.61
19	0.21	0.81	0.84	1.05	0.22	0.86	0.89	1.08	0.23	0.98	1.05	1.13	0.28	1.14	1.22	1.34	0.36	1.42	1.52	1.68
20	0.21	0.81	0.84	1.05	0.22	0.86	0.89	1.08	0.23	0.99	1.06	1.14	0.28	1.17	1.25	1.36	0.37	1.48	1.58	1.74
21	0.21	0.81	0.84	1.05	0.22	0.86	0.89	1.08	0.23	1.00	1.07	1.15	0.29	1.19	1.27	1.38	0.38	1.53	1.64	1.79
22	0.21	0.81	0.84	1.05	0.22	0.86	0.89	1.08	0.24	1.01	1.08	1.16	0.29	1.21	1.29	1.40	0.39	1.57	1.67	1.83
23	0.21	0.81	0.84	1.05	0.22	0.86	0.89	1.08	0.24	1.02	1.09	1.17	0.29	1.22	1.31	1.41	0.39	1.60	1.71	1.86
24	0.21	0.81	0.84	1.05	0.22	0.86	0.89	1.08	0.24	1.02	1.10	1.17	0.30	1.24	1.32	1.43	0.40	1.64	1.76	1.91
25	0.21	0.81	0.84	1.05	0.22	0.86	0.89	1.08	0.24	1.03	1.10	1.18	0.30	1.25	1.34	1.44	0.41	1.67	1.79	1.93
26	0.21	0.81	0.84	1.05	0.22	0.86	0.89	1.08	0.24	1.03	1.11	1.18	0.30	1.26	1.35	1.45	0.41	1.70	1.82	1.96
27	0.21	0.81	0.84	1.05	0.22	0.86	0.89	1.08	0.24	1.03	1.11	1.18	0.30	1.27	1.36	1.46	0.42	1.72	1.84	1.98
28	0.21	0.81	0.84	1.05	0.22	0.86	0.89	1.08	0.24	1.03	1.11	1.18	0.30	1.27	1.36	1.46	0.42	1.74	1.86	2.00
29	0.21	0.81	0.84	1.05	0.22	0.86	0.89	1.08	0.24	1.03	1.11	1.18	0.30	1.27	1.37	1.46	0.43	1.75	1.88	2.02
30	0.21	0.81	0.84	1.05	0.22	0.86	0.89	1.08	0.24	1.04	1.12	1.19	0.31	1.29	1.38	1.48	0.43	1.76	1.89	2.03
31	0.21	0.81	0.84	1.05	0.22	0.86	0.89	1.08	0.24	1.05	1.13	1.20	0.31	1.29	1.39	1.48	0.43	1.77	1.90	2.04
32	0.21	0.81	0.84	1.05	0.22	0.86	0.89	1.08	0.24	1.05	1.13	1.20	0.31	1.30	1.39	1.49	0.43	1.79	1.92	2.05
33	0.21	0.81	0.84	1.05	0.22	0.86	0.89	1.08	0.24	1.05	1.13	1.20	0.31	1.30	1.40	1.49	0.44	1.80	1.93	2.07
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.13	1.20	0.31	1.31	1.40	1.49	0.44	1.81	1.95	2.08
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.13	1.20	0.31	1.31	1.40	1.49	0.44	1.82	1.95	2.08
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.13	1.20	0.31	1.31	1.40	1.49	0.44	1.82	1.95	2.08
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.13	1.20	0.31	1.31	1.40	1.49	0.44	1.82	1.95	2.08
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.13	1.20	0.31	1.31	1.40	1.49	0.44	1.82	1.95	2.08
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.13	1.20	0.31	1.31	1.40	1.49	0.44	1.82	1.95	2.08
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.13	1.20	0.31	1.31	1.41	1.50	0.44	1.83	1.97	2.09
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.13	1.20	0.31	1.31	1.41	1.50	0.45	1.84	1.98	2.11
42	0.21	0.81	0.84	1.05	0.22	0.86	0.89	1.08	0.24	1.05	1.13	1.20	0.31	1.32	1.42	1.50	0.45	1.85	1.99	2.11
43	0.21	0.81	0.84	1.05	0.22	0.86	0.89	1.08	0.24	1.05	1.13	1.20	0.31	1.32	1.42	1.50	0.45	1.85	1.99	2.11
44	0.21	0.81	0.84	1.05	0.22	0.86	0.89	1.08	0.24	1.05	1.13	1.20	0.31	1.32	1.42	1.50	0.45	1.85	1.99	2.11
45	0.21	0.81	0.84	1.05	0.22	0.86	0.89	1.08	0.24	1.05	1.13	1.20	0.31	1.32	1.42	1.50	0.45	1.85	1.99	2.11
46	0.21	0.81	0.84	1.05	0.22	0.86	0.89	1.08	0.24	1.05	1.13	1.20	0.31	1.32	1.42	1.50	0.45	1.85	1.99	2.11
47	0.21	0.81	0.84	1.05	0.22	0.86	0.89	1.08	0.24	1.05	1.13	1.20	0.31	1.32	1.42	1.50	0.45	1.85	1.99	2.11
48	cost ratios (vs 2-lane OS2)																			
49	1.00	3.80	3.91	4.91	1.00	3.91	4.06	4.91	1.00	4.31	4.63	4.92	1.00	4.23	4.55	4.83	1.00	4.15	4.46	4.73

Grey values for lengths where CFDs stop increasing

PMD Sol'n Set / Cabling Sol'n Cost / Total Sol'n Cost

Caution: Do not move columns

Channel-Length Weighted Cabling Cost CDFs Dashboard (2 of 2)

COMMSCOPE®

Microsoft Excel - Kolesar_Kalculator_2012_01_zz.xls

File Edit View Insert Format Tools Data Window Help

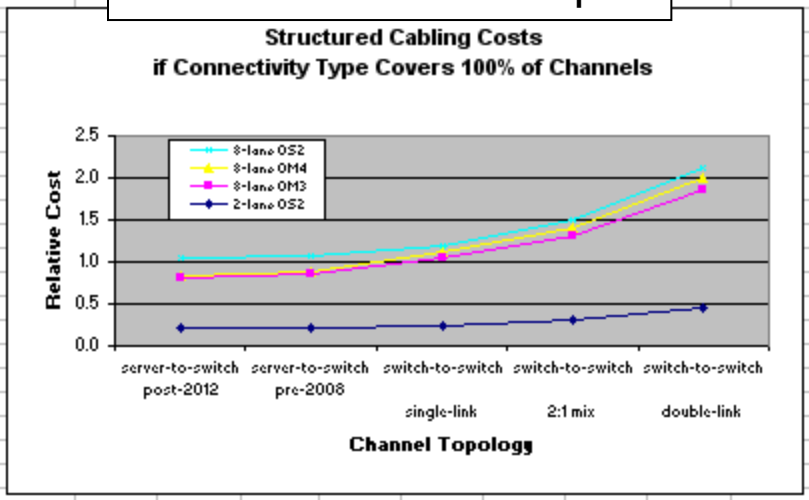
IF function

BP6 0.204973114736329

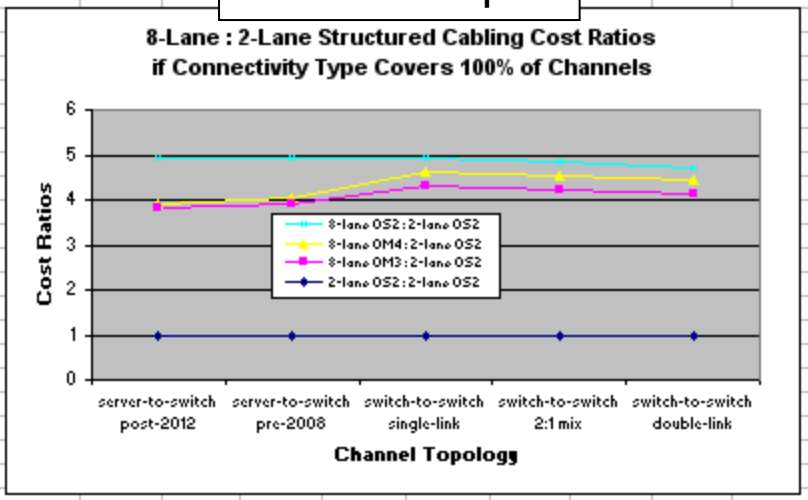
Cost ratio figures relative to 2-fiber OS2 channel

	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BQ	BR	BS	BT
46	0.21	0.81	0.84	1.05	0.22	0.86	0.89	1.08	0.24	1.05	1.13	1.20	0.31	1.32	1.42	1.50	0.45	1.85	1.99	2.11
47	0.21	0.81	0.84	1.05	0.22	0.86	0.89	1.08	0.24	1.05	1.13	1.20	0.31	1.32	1.42	1.50	0.45	1.85	1.99	2.11
48	cost ratios (vs 2-lane OS2)																			
49	1.00	3.80	3.91	4.91	1.00	3.91	4.06	4.91	1.00	4.31	4.63	4.92	1.00	4.23	4.55	4.83	1.00	4.15	4.46	4.73

Relative cost factors plot



Cost ratios plot



PMD Sol'n Set | Cabling Sol'n Cost | Total Sol'n Cost

Draw AutoShapes

Ready NUM

User's Guide to Solution Set Analyzer Part 3
- The Total Cost Analyzer -

Read Me (1 of 1)

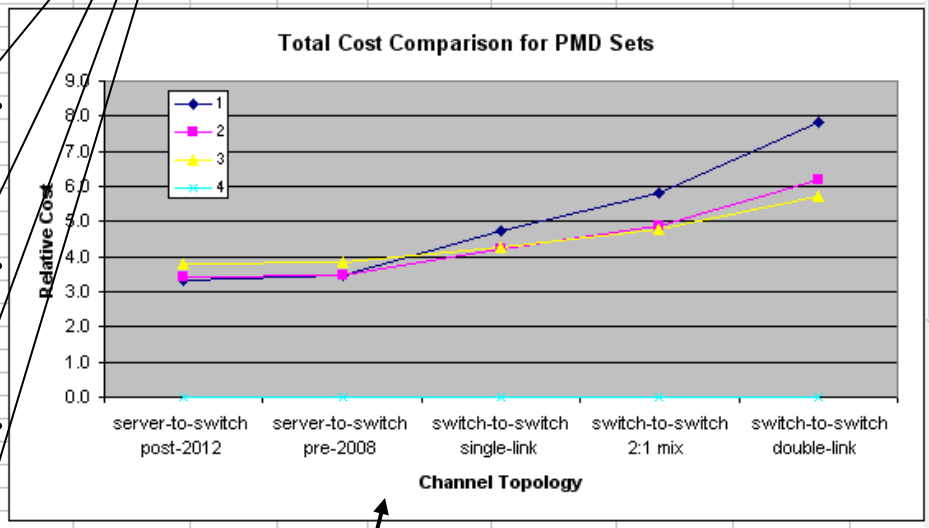
- SolutionAnalyzer_2011_11_17 description
- The worksheet "Total Sol'n Cost" produces the total cost (i.e. 2 PMDs + cabling) for each PMD set defined by cost comparison metrics on worksheet "PMD Sol'n Set".
- The calculation requires no user input on this worksheet, as the cost values come from the other worksheets and the PMD descriptions in column B are imported from the "PMD Sol'n Set" worksheet.
- The calculation of total cost is determined by multiplying the PMD cost Figure-of-Merit by two (because two PMDs are required in each channel) and adding the cost of the associated cabling for each of the five channel topologies.
  - Important: Because the cabling cost values are relative to the cost of a 100GBASE-SR10 CXP module, the PMDs in each solution set must also use this same basis in order to produce meaningful combined cost values.
  - The total cost values are graphically displayed for each PMD solution set for the five channel topologies.

Dashboard

PMD solution sets imported from “PMD Sol’n Set”

Total costs for sol’n sets for each of 5 cabling CDFs

PMD set number	PMD description (copied from PMD Sol'n Set worksheet)	Total cost for server-to-switch channels: server-to-switch post-2012	server-to-switch pre-2008	Total cost for switch-to-switch channels: switch-to-switch single-link	switch-to-switch 2:1 mix	switch-to-switch double-link
1						
	SR4					
	LR4	3.3	3.5	4.8	5.8	7.8
2						
	SR4					
	LR4	3.4	3.5	4.2	4.9	6.2
3						
	SR4					
	LR4	3.8	3.9	4.3	4.8	5.7
4						
	SR4					
	LR4	0.0	0.0	0.0	0.0	0.0



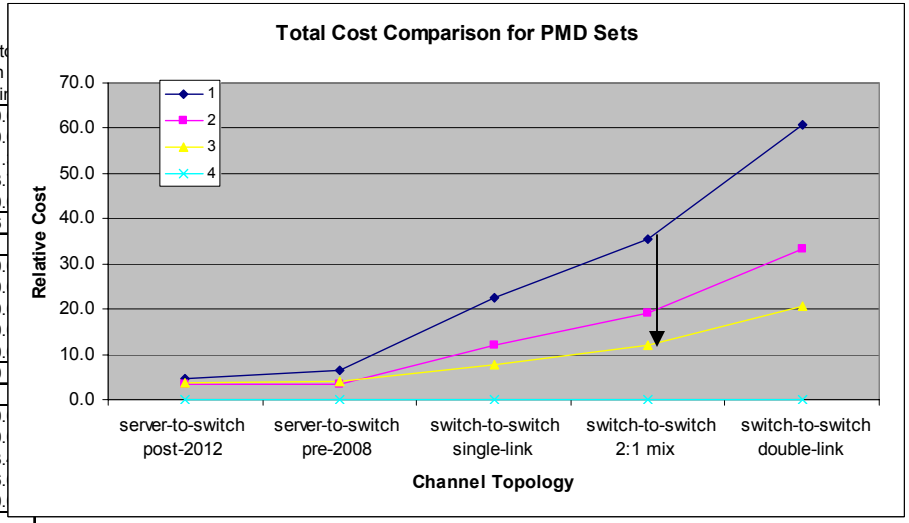
Output graph: total costs for sol’n sets

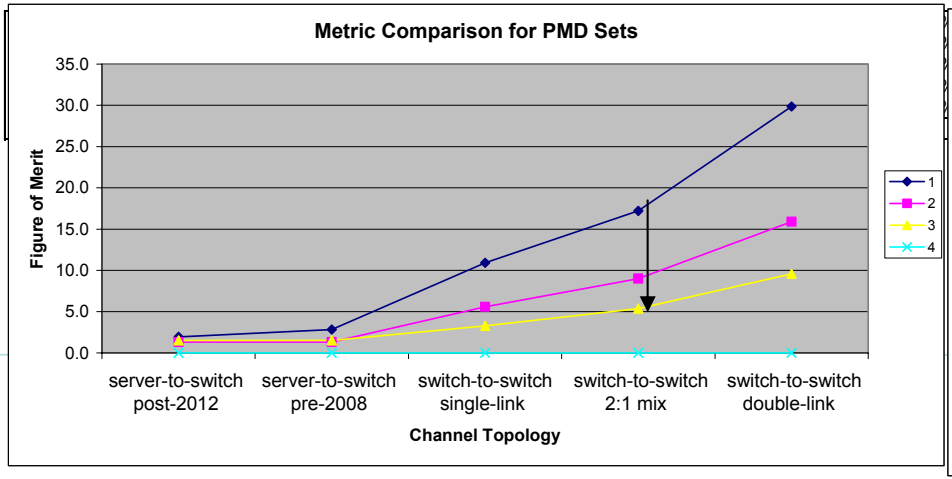
Test Driving the Analyzer

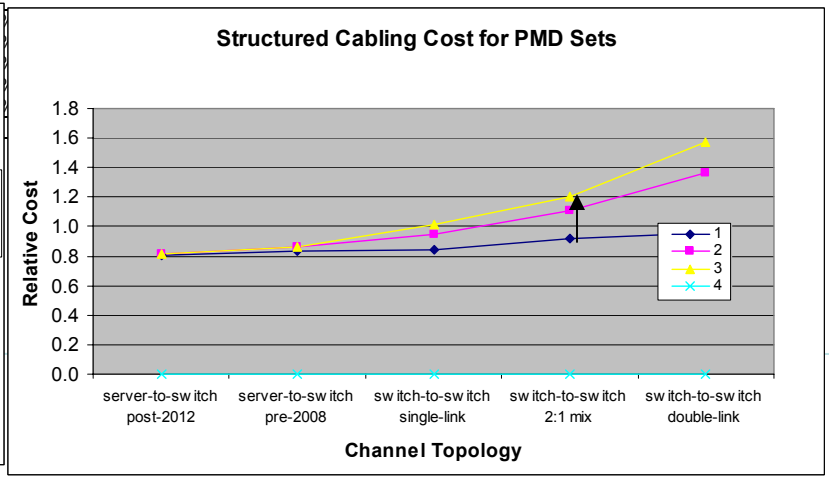
Important Example Series 1 (1 of 3)

- Using Petrilla SR4s and my estimate (i.e. Gen1 LR4 = 50x SR10 now) cost values:
  - 150 m SR4 lowers sw-to-sw PMD cost by 69% compared to 75 m SR4
  - Offsetting this, cabling costs increase 33% with 150 m SR4
  - Overall total costs decrease by 66%

PMD set number	PMD description (ordered by increasing reach)	comparison metric (relative values)	PMD reach capability (m)	(ft)	PMD coverage for server-to-switch channels: server-to-switch post-2012	server-to-switch pre-2008	PMD coverage for switch-to-switch channels: switch-to-switch single-link	switch-to-switch 2:1 mix	switch-to-switch double-lin
1				0.0	0.0%	0.0%	0.0%	0.0%	0.
				0.0	0.0%	0.0%	0.0%	0.0%	0.
	SR4	**1.2**	**75**	246.1	98.5%	96.7%	80.1%	67.2%	41.
	LR4	**50**	**10000**	32810.0	1.5%	3.3%	19.9%	32.8%	58.
			coverage check:		100.0%	100.0%	100.0%	100.0%	100.
			Figures of Merit:		1.93	2.83	10.90	17.22	29.86
2				0.0	0.0%	0.0%	0.0%	0.0%	0.
				0.0	0.0%	0.0%	0.0%	0.0%	0.
	SR4	**1.3**	**115**	377.3	100.0%	100.0%	91.3%	84.2%	70.
	LR4	**50**	**10000**	32810.0	0.0%	0.0%	8.7%	15.8%	30.
			coverage check:		100.0%	100.0%	100.0%	100.0%	100.
			Figures of Merit:		1.30	1.30	5.56	9.01	15.90
3				0.0	0.0%	0.0%	0.0%	0.0%	0.
				0.0	0.0%	0.0%	0.0%	0.0%	0.
	SR4	**1.5**	**150**	492.2	100.0%	100.0%	96.3%	92.0%	83.
	LR4	**50**	**10000**	32810.0	0.0%	0.0%	3.7%	8.0%	16.
			coverage check:		100.0%	100.0%	100.0%	100.0%	100.
			Figures of Merit:		1.50	1.50	3.29	5.38	9.57
4									



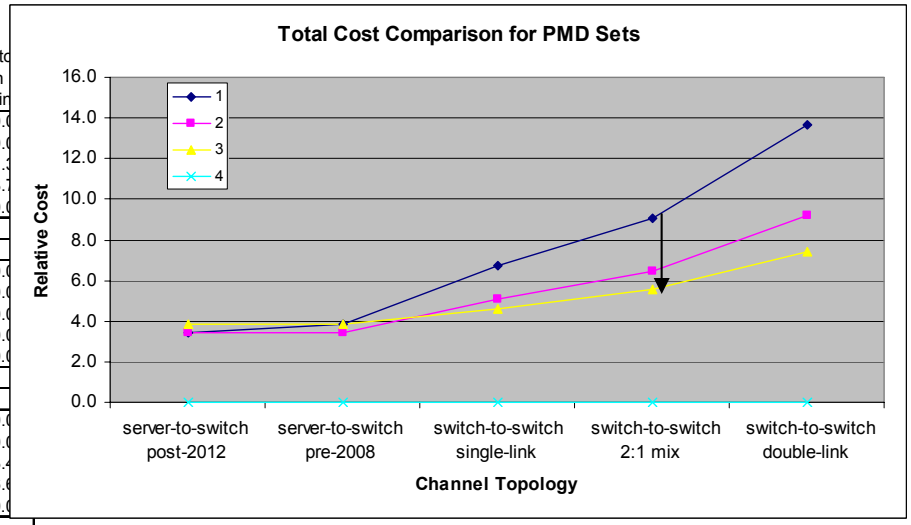


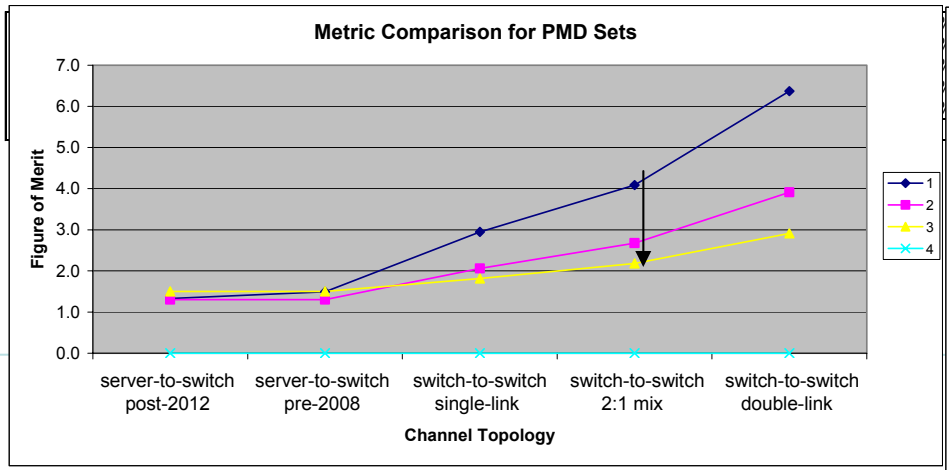


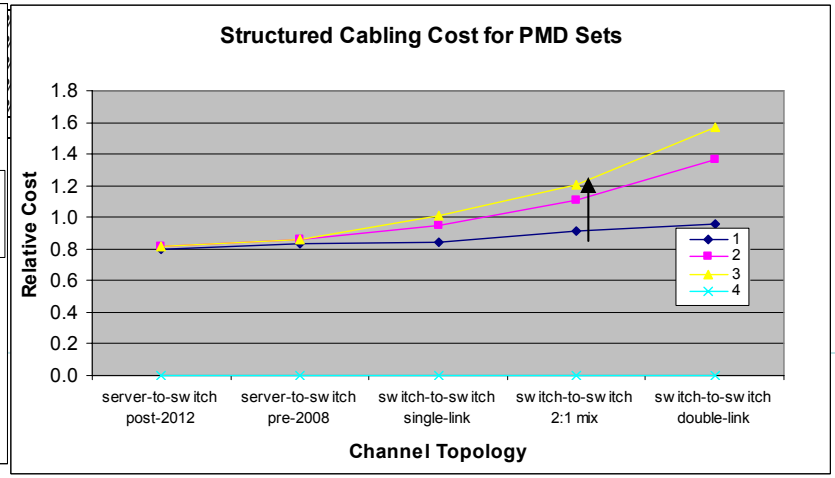
Important Example Series 1 (2 of 3)

- Using Petrilla SR4s and Cole Gen2 LR4 = 10x SR10 in 2012 cost values:
  - 150 m SR4 lowers sw-to-sw PMD cost by 47% compared to 75 m SR4
  - Offsetting this, cabling costs increase 33% with 150 m SR4 (same as before)
  - Overall total costs decrease by 38%

PMD set number	PMD description (ordered by increasing reach)	comparison metric (relative values)	PMD reach capability (m)	(ft)	PMD coverage for server-to-switch channels: server-to-switch post-2012	server-to-switch pre-2008	PMD coverage for switch-to-switch channels: switch-to-switch single-link	switch-to-switch 2:1 mix	switch-to-switch double-link
1				0.0	0.0%	0.0%	0.0%	0.0%	0.0
				0.0	0.0%	0.0%	0.0%	0.0%	0.0
	SR4	**1.2**	**75**	246.1	98.5%	96.7%	80.1%	67.2%	41.1
	LR4	**10**	**10000**	32810.0	1.5%	3.3%	19.9%	32.8%	58.7
			coverage check:		100.0%	100.0%	100.0%	100.0%	100.0
			Figures of Merit:		1.33	1.49	2.95	4.09	6.37
2				0.0	0.0%	0.0%	0.0%	0.0%	0.0
				0.0	0.0%	0.0%	0.0%	0.0%	0.0
	SR4	**1.3**	**115**	377.3	100.0%	100.0%	91.3%	84.2%	70.0
	LR4	**10**	**10000**	32810.0	0.0%	0.0%	8.7%	15.8%	30.0
			coverage check:		100.0%	100.0%	100.0%	100.0%	100.0
			Figures of Merit:		1.30	1.30	2.06	2.68	3.91
3				0.0	0.0%	0.0%	0.0%	0.0%	0.0
				0.0	0.0%	0.0%	0.0%	0.0%	0.0
	SR4	**1.5**	**150**	492.2	100.0%	100.0%	96.3%	92.0%	83.4
	LR4	**10**	**10000**	32810.0	0.0%	0.0%	3.7%	8.0%	16.6
			coverage check:		100.0%	100.0%	100.0%	100.0%	100.0
			Figures of Merit:		1.50	1.50	1.81	2.18	2.91
4									



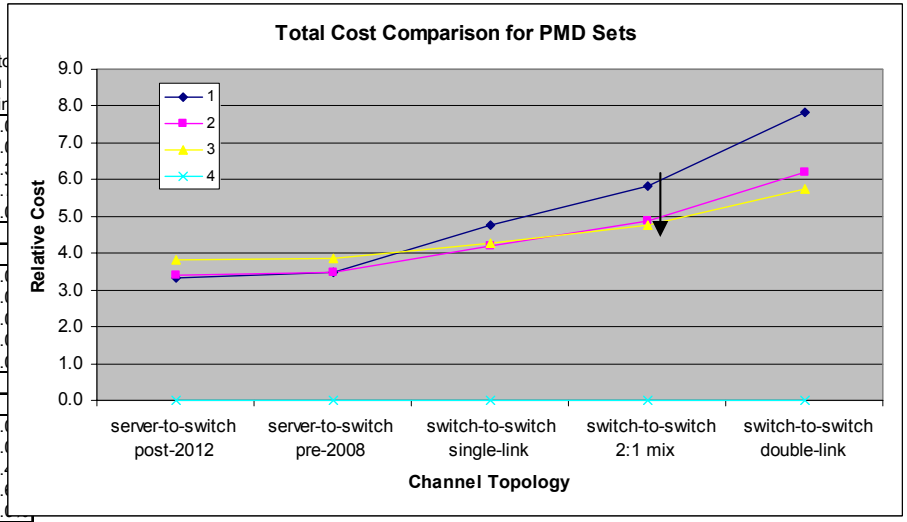


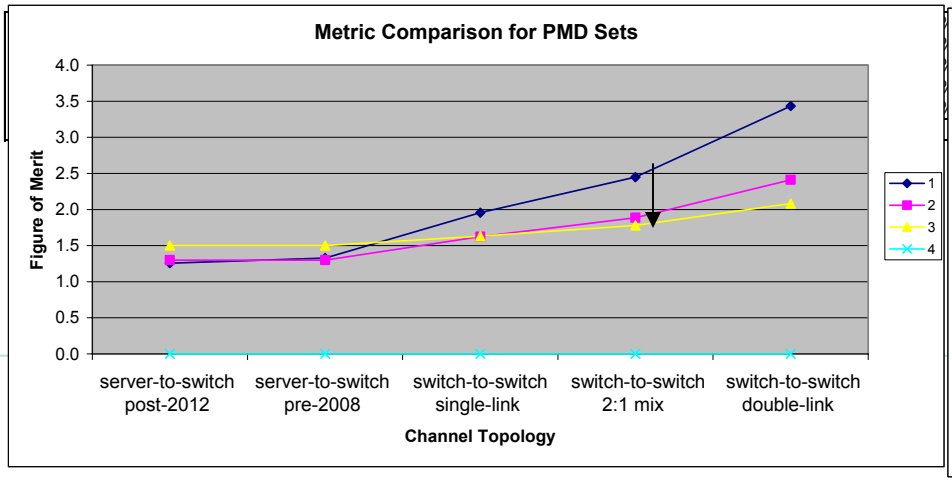


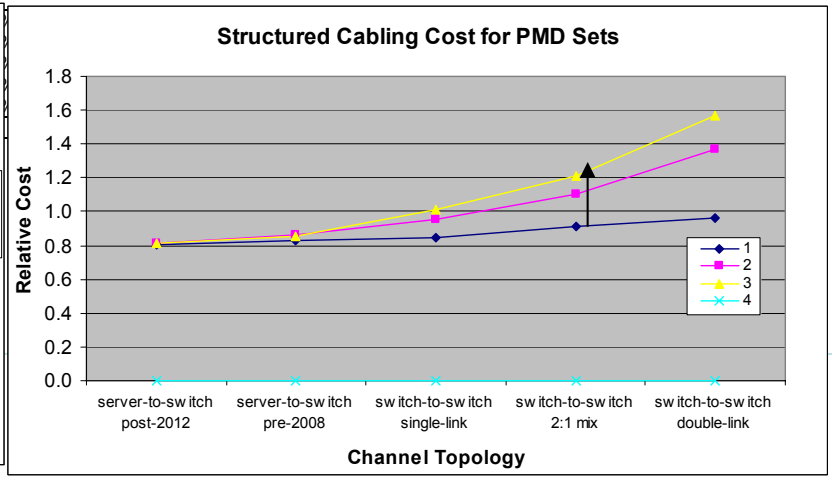
Important Example Series 1 (3 of 3)

- Using Petrilla SR4s and Cole Gen2 LR4 = 5x SR10 in ~2014 cost values:
  - 150 m SR4 lowers sw-to-sw PMD cost by 27% compared to 75 m SR4
  - Offsetting this, cabling costs increase 33% with 150 m SR4 (same as before)
  - Overall total costs decrease by 17%

PMD set number	PMD description (ordered by increasing reach)	comparison metric (relative values)	PMD reach capability (m)	(ft)	PMD coverage for server-to-switch channels: server-to-switch post-2012	server-to-switch pre-2008	PMD coverage for switch-to-switch channels: switch-to-switch single-link	switch-to-switch 2:1 mix	switch-to-switch double-lin
1				0.0	0.0%	0.0%	0.0%	0.0%	0.0
				0.0	0.0%	0.0%	0.0%	0.0%	0.0
	SR4	**1.2**	**75**	246.1	98.5%	96.7%	80.1%	67.2%	41.3
	LR4	**5**	**10000**	32810.0	1.5%	3.3%	19.9%	32.8%	58.7
				coverage check:	100.0%	100.0%	100.0%	100.0%	100.0
				Figures of Merit:	1.26	1.33	1.96	2.45	3.43
2				0.0	0.0%	0.0%	0.0%	0.0%	0.0
				0.0	0.0%	0.0%	0.0%	0.0%	0.0
	SR4	**1.3**	**115**	377.3	100.0%	100.0%	91.3%	84.2%	70.0
	LR4	**5**	**10000**	32810.0	0.0%	0.0%	8.7%	15.8%	30.0
				coverage check:	100.0%	100.0%	100.0%	100.0%	100.0
				Figures of Merit:	1.30	1.30	1.62	1.89	2.41
3				0.0	0.0%	0.0%	0.0%	0.0%	0.0
				0.0	0.0%	0.0%	0.0%	0.0%	0.0
	SR4	**1.5**	**150**	492.2	100.0%	100.0%	96.3%	92.0%	83.4
	LR4	**5**	**10000**	32810.0	0.0%	0.0%	3.7%	8.0%	16.0
				coverage check:	100.0%	100.0%	100.0%	100.0%	100.0
				Figures of Merit:	1.50	1.50	1.63	1.78	2.08
4									



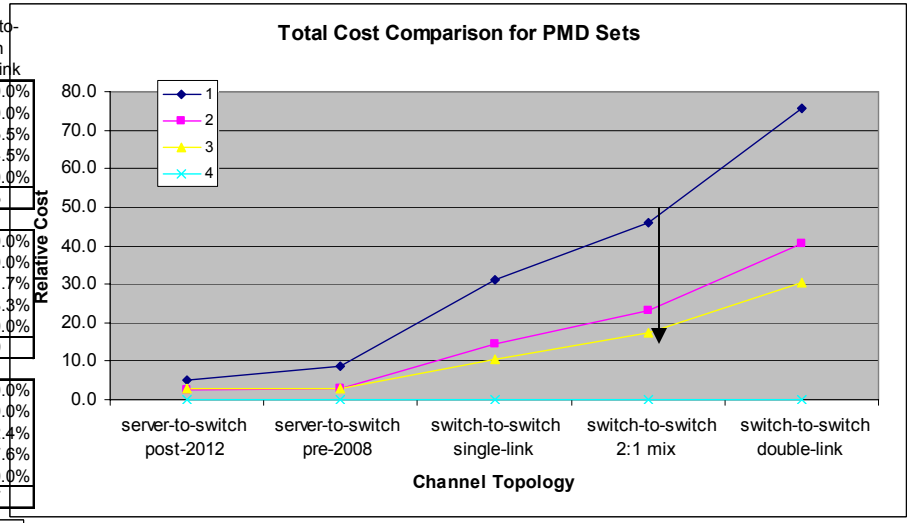


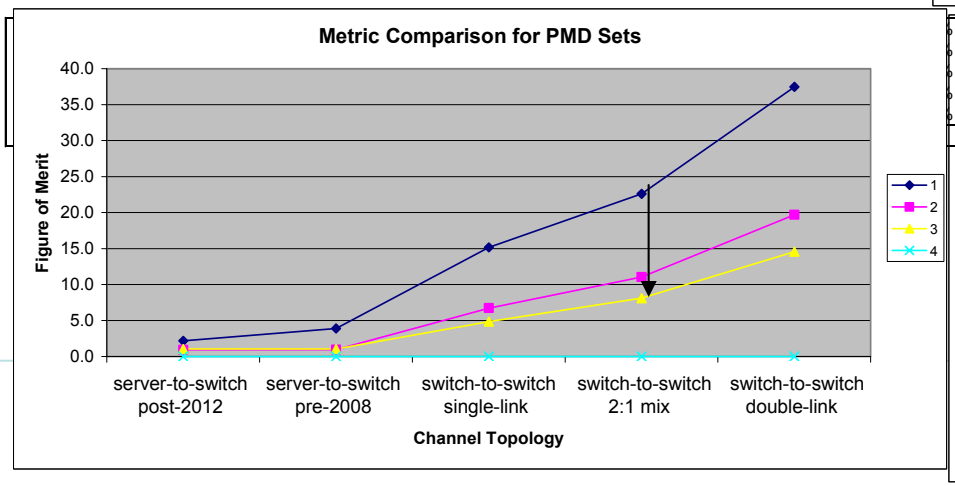


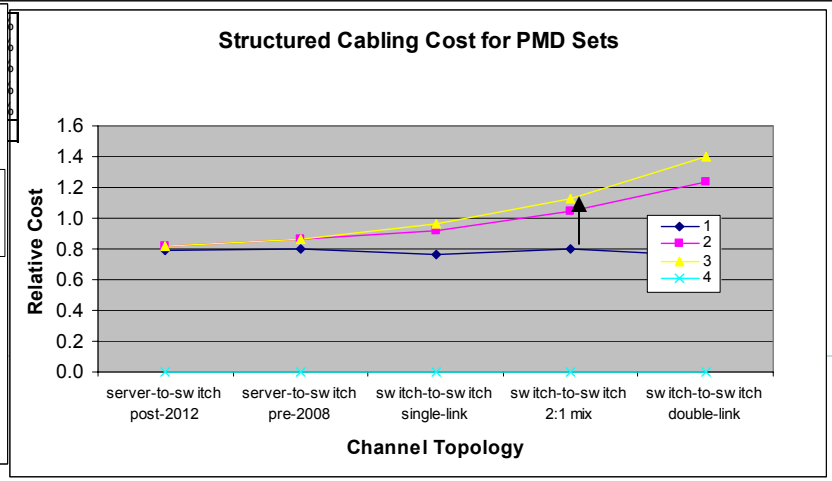
Important Example Series 2 (1 of 3)

- Using King SR4s and my estimate (i.e. Gen1 LR4 = 50x SR10 now) cost values:
  - 120 m SR4 lowers sw-to-sw PMD cost by 64% compared to 60 m SR4
  - Offsetting this, cabling costs increase 40% with 120 m SR4
  - Overall total costs decrease by 62%

PMD set number	PMD description (ordered by increasing reach)	comparison metric (relative values)	PMD reach capability (m)	(ft)	PMD coverage for server-to-switch channels: server-to-switch post-2012	server-to-switch pre-2008	PMD coverage for switch-to-switch channels: switch-to-switch single-link	switch-to-switch 2:1 mix	switch-to-switch double-link
1				0.0	0.0%	0.0%	0.0%	0.0%	0.0%
				0.0	0.0%	0.0%	0.0%	0.0%	0.0%
	KingSR4	**0.8**	**60**	196.9	97.2%	93.7%	70.8%	55.7%	25.5%
	Dist.LR4now	**50**	**10000**	32810.0	2.8%	6.3%	29.2%	44.3%	74.5%
				coverage check:	100.0%	100.0%	100.0%	100.0%	100.0%
				Figures of Merit:	2.15	3.89	15.16	22.59	37.45
2				0.0	0.0%	0.0%	0.0%	0.0%	0.0%
				0.0	0.0%	0.0%	0.0%	0.0%	0.0%
	KingSR4wRxSimEQ	**0.9**	**100**	328.1	100.0%	99.9%	88.2%	79.3%	61.7%
	Dist.LR4now	**50**	**10000**	32810.0	0.0%	0.1%	11.8%	20.7%	38.3%
				coverage check:	100.0%	100.0%	100.0%	100.0%	100.0%
				Figures of Merit:	0.92	0.94	6.72	11.04	19.69
3				0.0	0.0%	0.0%	0.0%	0.0%	0.0%
				0.0	0.0%	0.0%	0.0%	0.0%	0.0%
	KingSR4wRxActEq	**1.05**	**120**	393.7	100.0%	100.0%	92.2%	85.6%	72.4%
	Dist.LR4now	**50**	**10000**	32810.0	0.0%	0.0%	7.8%	14.4%	27.6%
				coverage check:	100.0%	100.0%	100.0%	100.0%	100.0%
				Figures of Merit:	1.05	1.05	4.86	8.09	14.57
4									



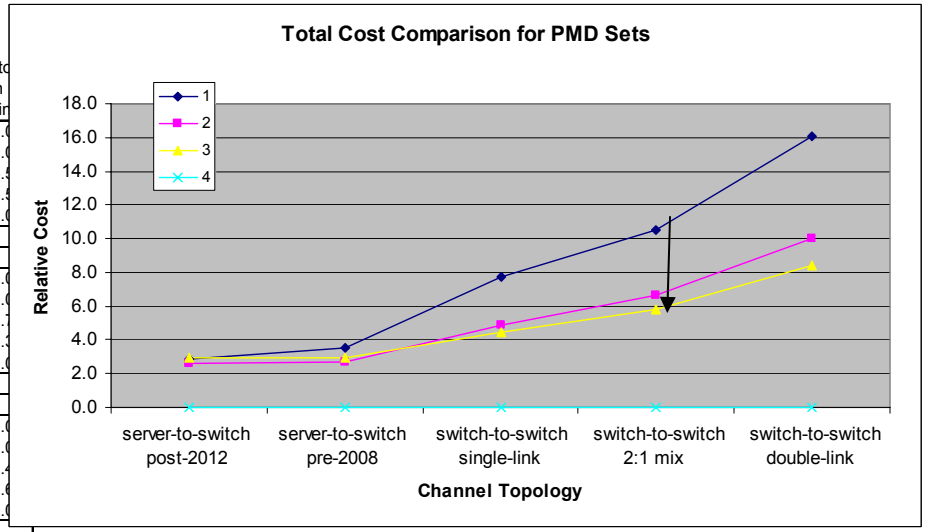


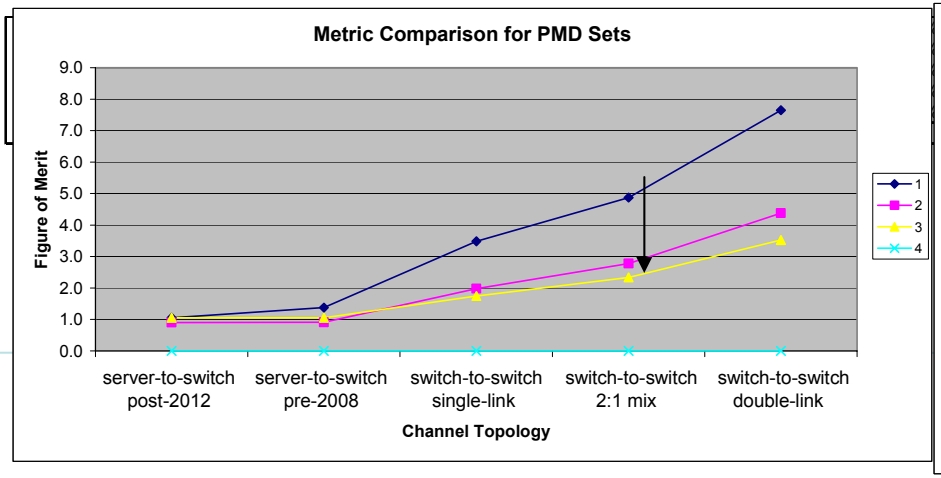


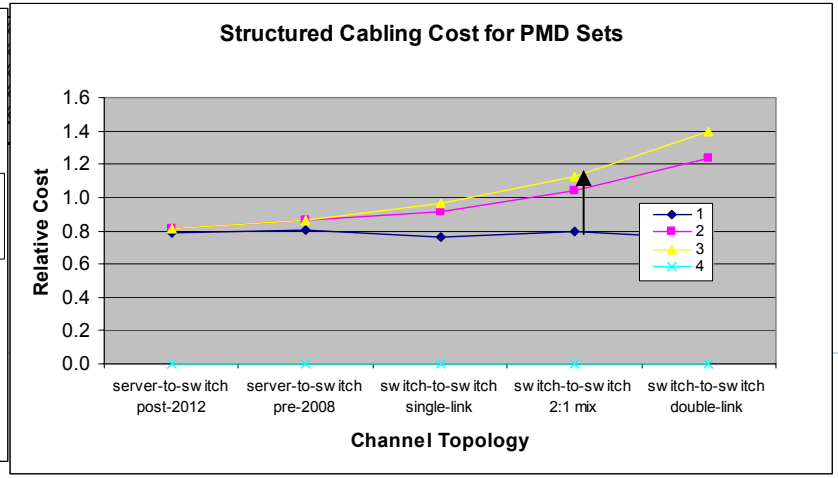
Important Example Series 2 (2 of 3)

- Using King SR4s and Cole Gen2 LR4 = 10x SR10 in 2012 cost values:
  - 120 m SR4 lowers sw-to-sw PMD cost by 52% compared to 60 m SR4
  - Offsetting this, cabling costs increase 40% with 120 m SR4 (same as before)
  - Overall total costs decrease by 45%

PMD set number	PMD description (ordered by increasing reach)	comparison metric (relative values)	PMD reach capability (m)	(ft)	PMD coverage for server-to-switch channels: server-to-switch post-2012	server-to-switch pre-2008	PMD coverage for switch-to-switch channels: switch-to-switch single-link	switch-to-switch 2:1 mix	switch-to-switch double-link
1				0.0	0.0%	0.0%	0.0%	0.0%	0.0
				0.0	0.0%	0.0%	0.0%	0.0%	0.0
	KingSR4	**0.8**	**60**	196.9	97.2%	93.7%	70.8%	55.7%	25.5
	ColeLR4.2012	**10**	**10000**	32810.0	2.8%	6.3%	29.2%	44.3%	74.5
				coverage check:	100.0%	100.0%	100.0%	100.0%	100.0
				Figures of Merit:	1.05	1.38	3.49	4.87	7.65
2				0.0	0.0%	0.0%	0.0%	0.0%	0.0
				0.0	0.0%	0.0%	0.0%	0.0%	0.0
	KingSR4wRxSimEQ	**0.9**	**100**	328.1	100.0%	99.9%	88.2%	79.3%	61.7
	ColeLR4.2012	**10**	**10000**	32810.0	0.0%	0.1%	11.8%	20.7%	38.3
				coverage check:	100.0%	100.0%	100.0%	100.0%	100.0
				Figures of Merit:	0.90	0.91	1.98	2.78	4.38
3				0.0	0.0%	0.0%	0.0%	0.0%	0.0
				0.0	0.0%	0.0%	0.0%	0.0%	0.0
	KingSR4wRxActEq	**1.05**	**120**	393.7	100.0%	100.0%	92.2%	85.6%	72.4
	ColeLR4.2012	**10**	**10000**	32810.0	0.0%	0.0%	7.8%	14.4%	27.6
				coverage check:	100.0%	100.0%	100.0%	100.0%	100.0
				Figures of Merit:	1.05	1.05	1.75	2.34	3.52
4									



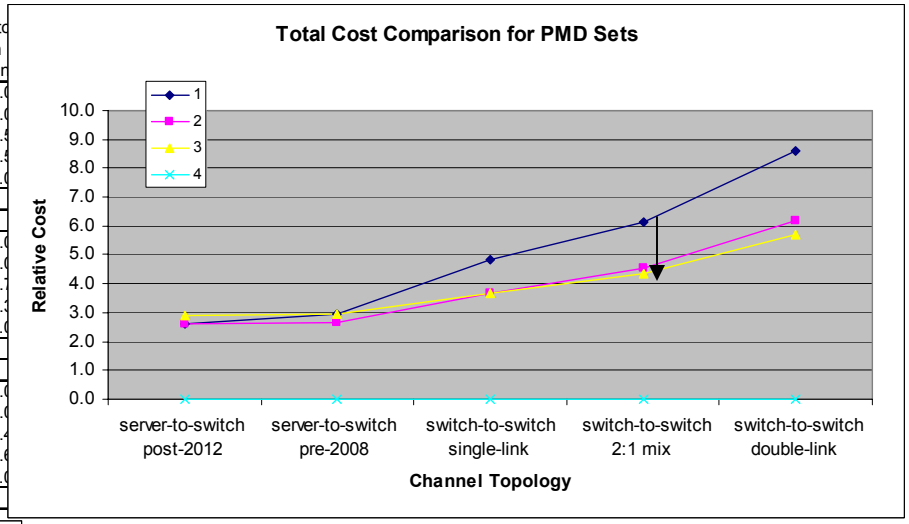


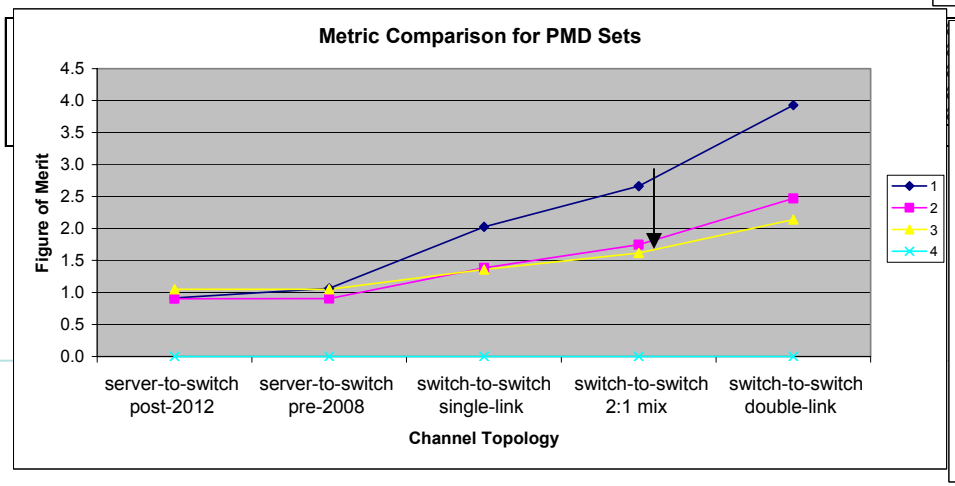


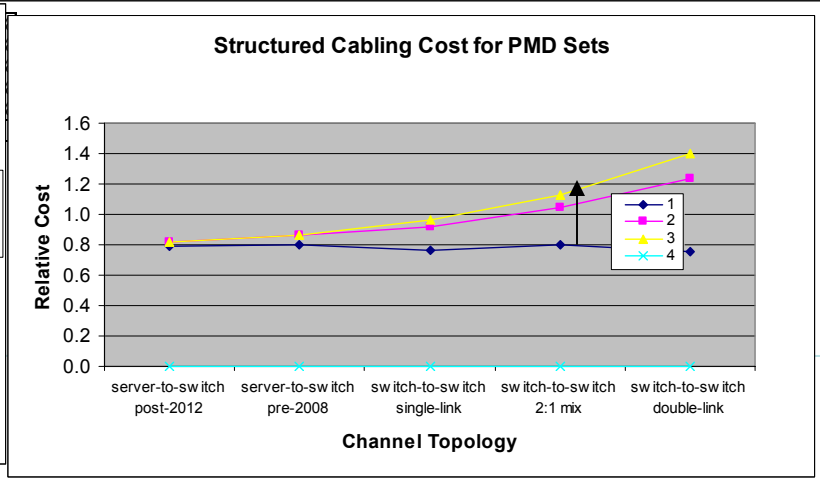
Important Example Series 2 (3 of 3)

- Using King SR4s and Cole Gen2 LR4 = 5x SR10 in ~2014 cost values:
  - 120 m SR4 lowers sw-to-sw PMD cost by 52% compared to 60 m SR4
  - Offsetting this, cabling costs increase 40% with 120 m SR4 (same as before)
  - Overall total costs decrease by 28%

PMD set number	PMD description (ordered by increasing reach)	comparison metric (relative values)	PMD reach capability (m)	(ft)	PMD coverage for server-to-switch channels: server-to-switch post-2012	server-to-switch pre-2008	PMD coverage for switch-to-switch channels: switch-to-switch single-link	switch-to-switch 2:1 mix	switch-to-switch double-link
1				0.0	0.0%	0.0%	0.0%	0.0%	0.0
				0.0	0.0%	0.0%	0.0%	0.0%	0.0
	KingSR4	**0.8**	**60**	196.9	97.2%	93.7%	70.8%	55.7%	25.5
	ColeLR4.2014	**5**	**10000**	32810.0	2.8%	6.3%	29.2%	44.3%	74.5
				coverage check:	100.0%	100.0%	100.0%	100.0%	100.0
				Figures of Merit:	0.92	1.06	2.03	2.66	3.93
2				0.0	0.0%	0.0%	0.0%	0.0%	0.0
				0.0	0.0%	0.0%	0.0%	0.0%	0.0
	KingSR4wRxSimEQ	**0.9**	**100**	328.1	100.0%	99.9%	88.2%	79.3%	61.7
	ColeLR4.2014	**5**	**10000**	32810.0	0.0%	0.1%	11.8%	20.7%	38.3
				coverage check:	100.0%	100.0%	100.0%	100.0%	100.0
				Figures of Merit:	0.90	0.90	1.39	1.75	2.47
3				0.0	0.0%	0.0%	0.0%	0.0%	0.0
				0.0	0.0%	0.0%	0.0%	0.0%	0.0
	KingSR4wRxActEq	**1.05**	**120**	393.7	100.0%	100.0%	92.2%	85.6%	72.4
	ColeLR4.2014	**5**	**10000**	32810.0	0.0%	0.0%	7.8%	14.4%	27.6
				coverage check:	100.0%	100.0%	100.0%	100.0%	100.0
				Figures of Merit:	1.05	1.05	1.36	1.62	2.14
4									



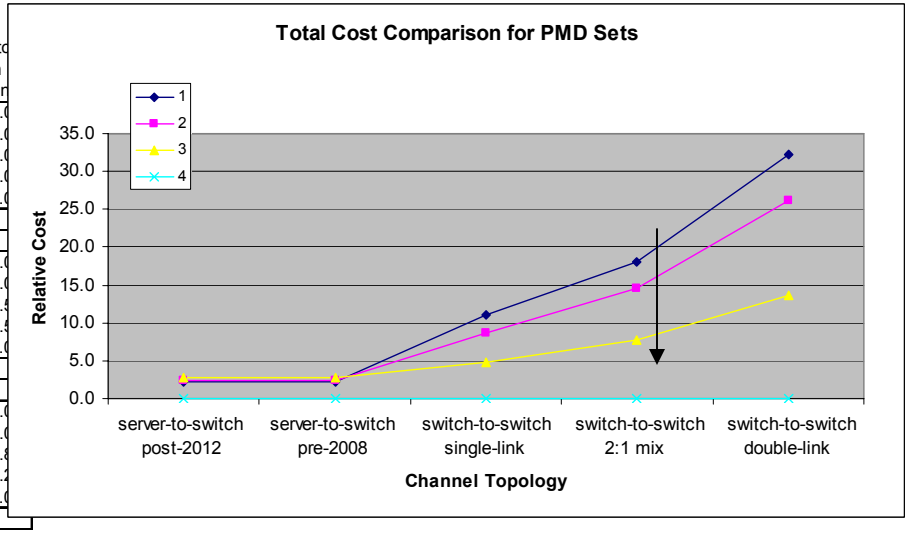


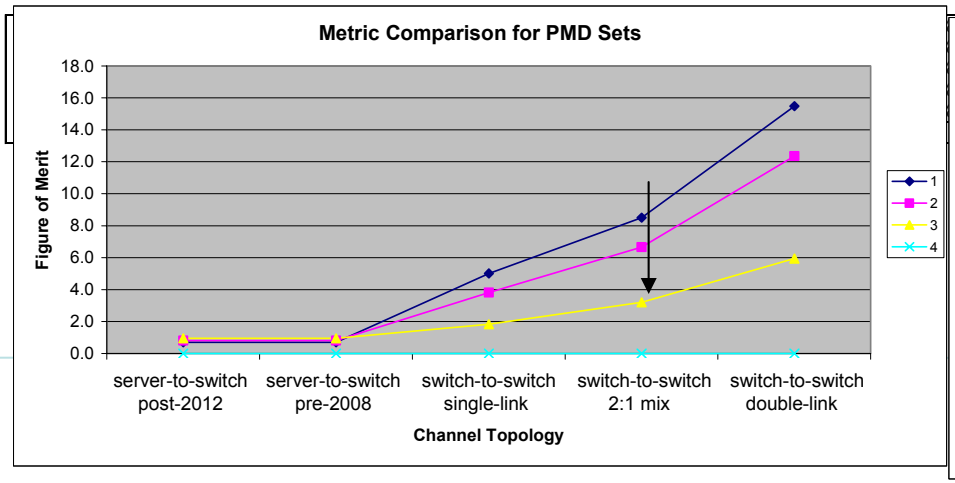


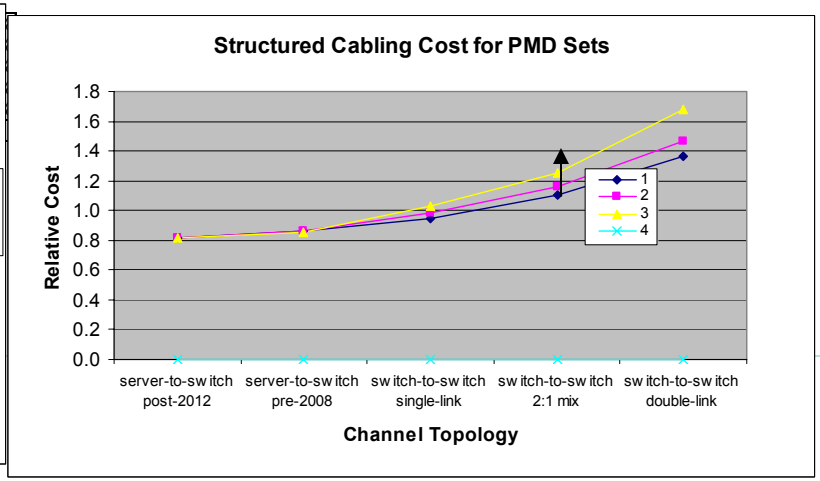
Important Example Series 3 (1 of 3)

- Using King SR4s+FEC and my estimate (i.e. Gen1 LR4 = 50x SR10 now) cost values:
  - 180 m SR4 lowers sw-to-sw PMD cost by 62% compared to 115 m SR4
  - Offsetting this, cabling costs increase 12% with 180 m SR4
  - Overall total costs decrease by 58%

PMD set number	PMD description (ordered by increasing reach)	comparison metric (relative values)	PMD reach capability (m)	PMD reach capability (ft)	PMD coverage for server-to-switch channels: server-to-switch post-2012	server-to-switch pre-2008	PMD coverage for switch-to-switch channels: switch-to-switch single-link	switch-to-switch 2:1 mix	switch-to-switch double-lin
1				0.0	0.0%	0.0%	0.0%	0.0%	0.0
				0.0	0.0%	0.0%	0.0%	0.0%	0.0
	KingSR4+FEC	**0.7**	**115**	377.3	100.0%	100.0%	91.3%	84.2%	70.0
	Dist.LR4.now	**50**	**10000**	32810.0	0.0%	0.0%	8.7%	15.8%	30.0
				coverage check:	100.0%	100.0%	100.0%	100.0%	100.0
				Figures of Merit:	0.70	0.70	5.01	8.50	15.48
2				0.0	0.0%	0.0%	0.0%	0.0%	0.0
				0.0	0.0%	0.0%	0.0%	0.0%	0.0
	KingSR4wTxEq+FEC	**0.8**	**130**	426.5	100.0%	100.0%	93.9%	88.1%	76.5
	Dist.LR4.now	**50**	**10000**	32810.0	0.0%	0.0%	6.1%	11.9%	23.5
				coverage check:	100.0%	100.0%	100.0%	100.0%	100.0
				Figures of Merit:	0.80	0.80	3.82	6.66	12.35
3				0.0	0.0%	0.0%	0.0%	0.0%	0.0
				0.0	0.0%	0.0%	0.0%	0.0%	0.0
	KingSR4wRxActEq+FEC	**0.95**	**180**	590.6	100.0%	100.0%	98.2%	95.4%	89.8
	Dist.LR4.now	**50**	**10000**	32810.0	0.0%	0.0%	1.8%	4.6%	10.2
				coverage check:	100.0%	100.0%	100.0%	100.0%	100.0
				Figures of Merit:	0.95	0.95	1.83	3.20	5.94
4									



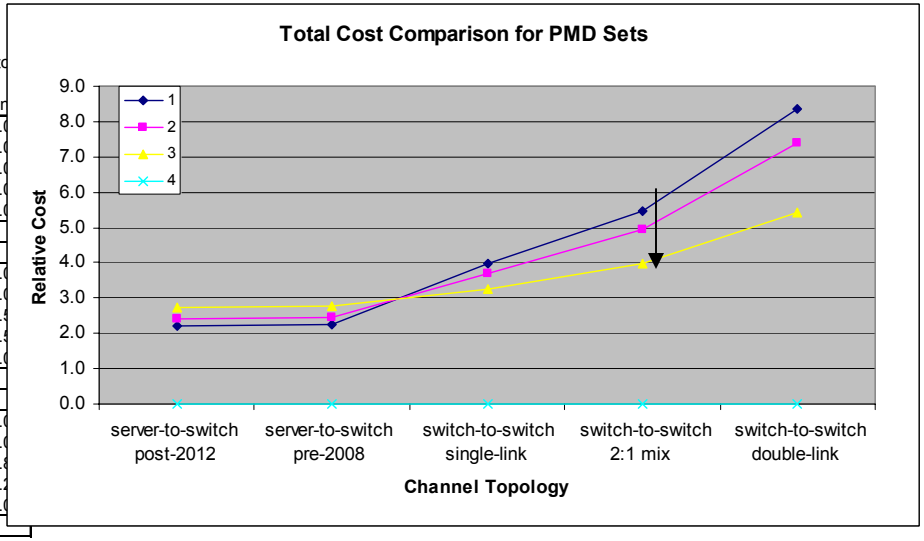


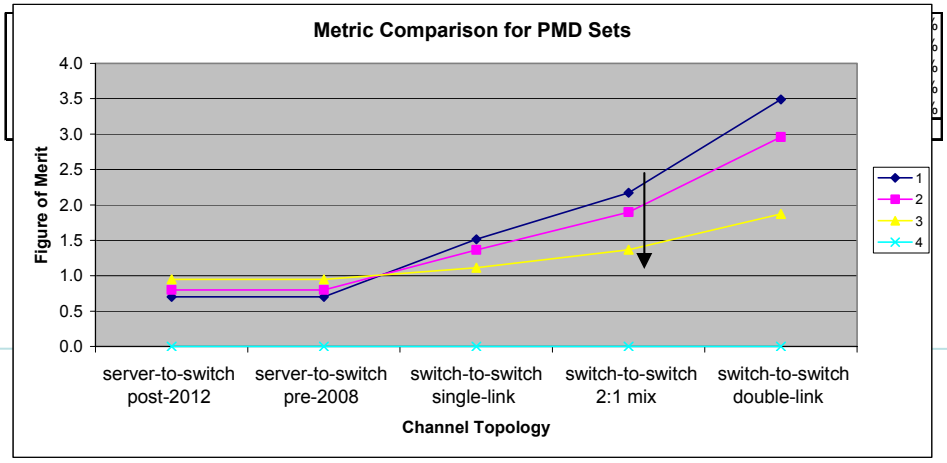


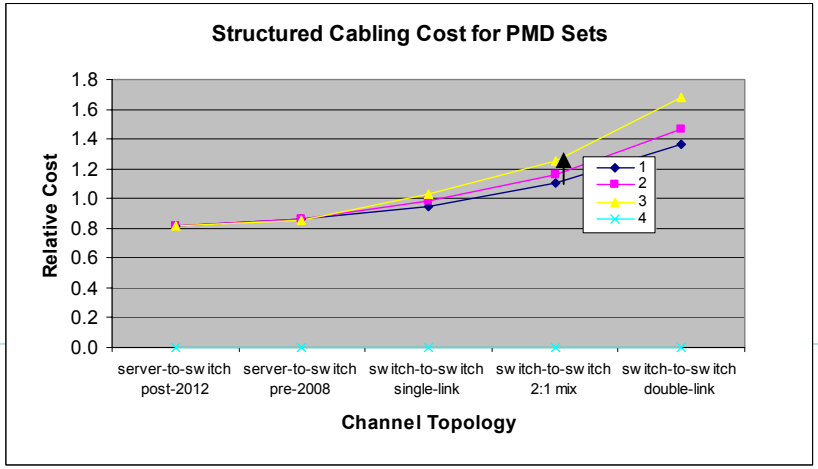
Important Example Series 3 (2 of 3)

- Using King SR4s+FEC and Cole Gen2 LR4 = 10x SR10 in 2012 cost values:
  - 180 m SR4 lowers sw-to-sw PMD cost by 37% compared to 115 m SR4
  - Offsetting this, cabling costs increase 12% with 180 m SR4 (same as before)
  - Overall total costs decrease by 27%

PMD set number	PMD description (ordered by increasing reach)	comparison metric (relative values)	PMD reach capability (m)	(ft)	PMD coverage for server-to-switch channels: server-to-switch post-2012	server-to-switch pre-2008	PMD coverage for switch-to-switch channels: switch-to-switch single-link	switch-to-switch 2:1 mix	switch-to-switch double-link
1				0.0	0.0%	0.0%	0.0%	0.0%	0.0
				0.0	0.0%	0.0%	0.0%	0.0%	0.0
	KingSR4+FEC	**0.7**	**115**	377.3	100.0%	100.0%	91.3%	84.2%	70.0
	ColeLR4.2012	**10**	**10000**	32810.0	0.0%	0.0%	8.7%	15.8%	30.0
				coverage check:	100.0%	100.0%	100.0%	100.0%	100.0
				Figures of Merit:	0.70	0.70	1.51	2.17	3.49
2				0.0	0.0%	0.0%	0.0%	0.0%	0.0
				0.0	0.0%	0.0%	0.0%	0.0%	0.0
	KingSR4wTxEq+FEC	**0.8**	**130**	426.5	100.0%	100.0%	93.9%	88.1%	76.5
	ColeLR4.2012	**10**	**10000**	32810.0	0.0%	0.0%	6.1%	11.9%	23.5
				coverage check:	100.0%	100.0%	100.0%	100.0%	100.0
				Figures of Merit:	0.80	0.80	1.36	1.90	2.96
3				0.0	0.0%	0.0%	0.0%	0.0%	0.0
				0.0	0.0%	0.0%	0.0%	0.0%	0.0
	KingSR4wRxActEq+FEC	**0.95**	**180**	590.6	100.0%	100.0%	98.2%	95.4%	89.8
	ColeLR4.2012	**10**	**10000**	32810.0	0.0%	0.0%	1.8%	4.6%	10.2
				coverage check:	100.0%	100.0%	100.0%	100.0%	100.0
				Figures of Merit:	0.95	0.95	1.11	1.37	1.87
4									



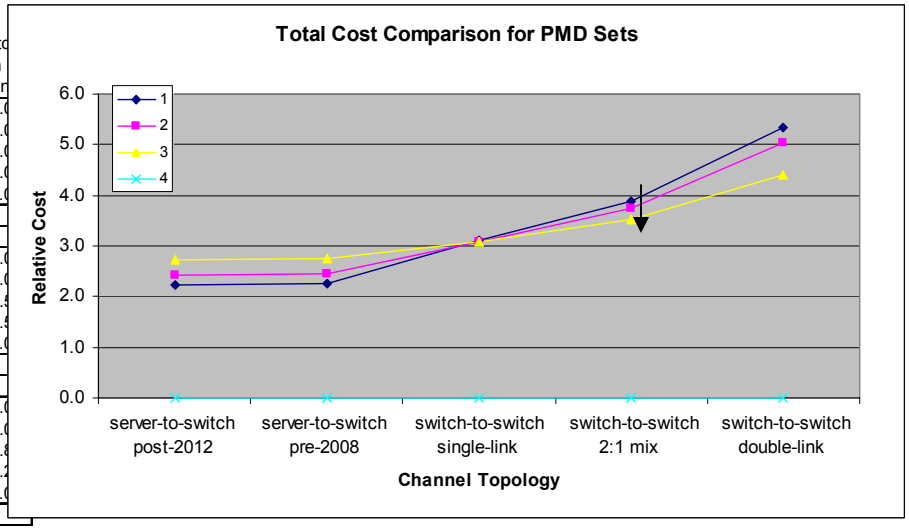


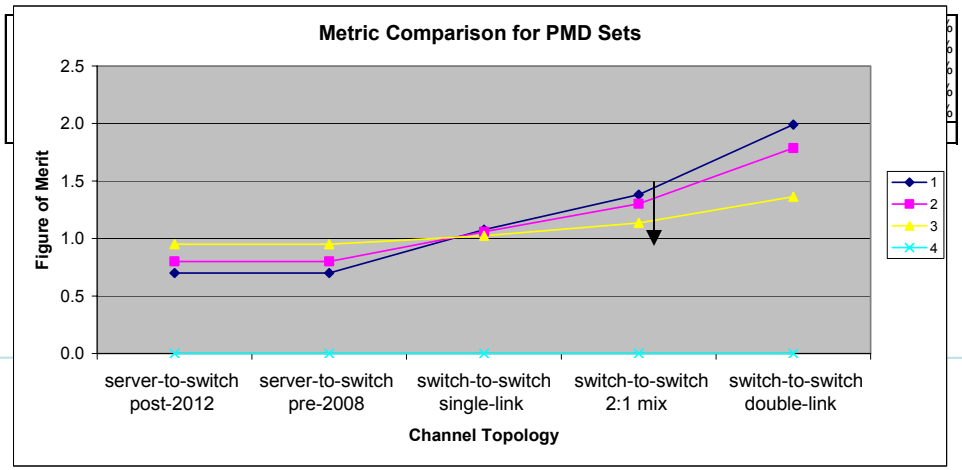


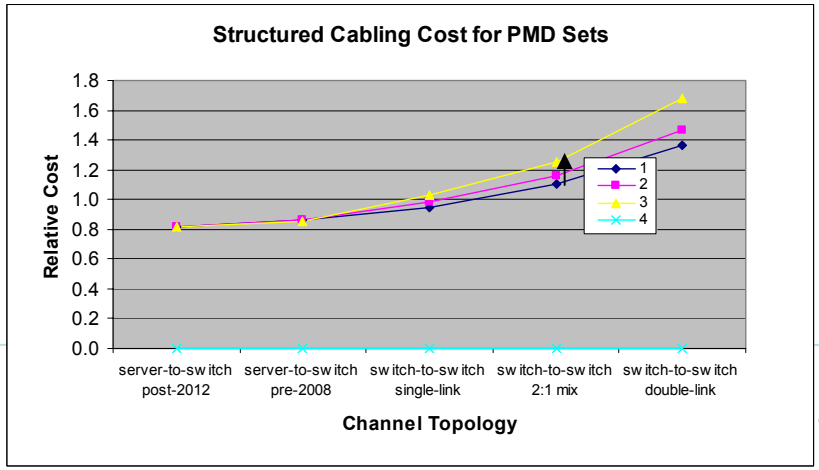
Important Example Series 3 (3 of 3)

- Using King SR4s+FEC and Cole Gen2 LR4 = 5x SR10 in ~2014 cost values:
  - 180 m SR4 lowers sw-to-sw PMD cost by 17% compared to 115 m SR4
  - Offsetting this, cabling costs increase 12% with 180 m SR4 (same as before)
  - Overall total costs decrease by 9%

PMD set number	PMD description (ordered by increasing reach)	comparison metric (relative values)	PMD reach capability (m)	(ft)	PMD coverage for server-to-switch channels: server-to-switch post-2012	server-to-switch pre-2008	PMD coverage for switch-to-switch channels: switch-to-switch single-link	switch-to-switch 2:1 mix	switch-to-switch double-link
1				0.0	0.0%	0.0%	0.0%	0.0%	0.0
				0.0	0.0%	0.0%	0.0%	0.0%	0.0
	KingSR4+FEC	**0.7**	**115**	377.3	100.0%	100.0%	91.3%	84.2%	70.0
	ColeLR4.2014	**5**	**10000**	32810.0	0.0%	0.0%	8.7%	15.8%	30.0
				coverage check:	100.0%	100.0%	100.0%	100.0%	100.0
				Figures of Merit:	0.70	0.70	1.08	1.38	1.99
2				0.0	0.0%	0.0%	0.0%	0.0%	0.0
				0.0	0.0%	0.0%	0.0%	0.0%	0.0
	KingSR4wTxEq+FEC	**0.8**	**130**	426.5	100.0%	100.0%	93.9%	88.1%	76.5
	ColeLR4.2014	**5**	**10000**	32810.0	0.0%	0.0%	6.1%	11.9%	23.5
				coverage check:	100.0%	100.0%	100.0%	100.0%	100.0
				Figures of Merit:	0.80	0.80	1.06	1.30	1.79
3				0.0	0.0%	0.0%	0.0%	0.0%	0.0
				0.0	0.0%	0.0%	0.0%	0.0%	0.0
	KingSR4wRxActEq+FEC	**0.95**	**180**	590.6	100.0%	100.0%	98.2%	95.4%	89.8
	ColeLR4.2014	**5**	**10000**	32810.0	0.0%	0.0%	1.8%	4.6%	10.2
				coverage check:	100.0%	100.0%	100.0%	100.0%	100.0
				Figures of Merit:	0.95	0.95	1.02	1.14	1.36
4									







Future Work

- Put this tool to work
  - Analyze cost projections from contributions submitted to this study group
  - Derive conditions and PMDs under which the needed costs can be met
  - Use this understanding to set objectives that can achieve that outcome

Questions / Comments?