Draft:
In Support of BMP, DI for both 4-pair and 8-pair MMF objectives at 400G

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BMP exists for both 4-pair & 8-pair solutions for 400 Gb/s Ethernet over MMF; Distinct Identity is maintained

- A 4-pair objective is needed to support end-users who have a 4-pair infrastructure and 10 years of experience designing DCs around the quad paradigm
  - Reusing large installed base of 4-pair infrastructure to migrate from 100G-SR4 to 400G-SR4.2
  - Lower relative cost for long 400G SW-SW links; better cable density
  - Implementations could be developed for 100G breakout
- An 8-pair objective is needed by end-users who wish to re-architect for the flexibility enabled by new octal paradigm
  - Supplier base for SR8 PMDs expanded beyond that of SR4.2
  - 400G SW-SW links plus maximum breakout flexibility to 50G-SR, 100G-SR2, and 200G-SR4
- Large cloud companies have endorsed each of these in SG as best-suited to their architectures. Both have high value.
  - http://ieee802.org/3/NGMMF/public/lingle_ngmmf_03_jan18.pdf
  - http://ieee802.org/3/NGMMF/public/shen_NGMMF_01_jan18.pdf
- These are not two solutions to one problem.

The same speed ratios that gave utility to 4-pair media in the past now give utility to 8-pair media

- We originally moved in factors of 10x from 100Mb to 1Gb to 10Gb
- We began producing "*speed*" in SFP+ & "*4x speed*" in QSFP starting with 40G, because serial 40G was too costly, creating a new *quad* paradigm & form factor
  - QSFP ports became standard on switches for 40 & 100GbE
  - Approximately 50% of the 40GBASE-SR4 was used for SW-SW links and 50% was used as high density 10G in breakout applications, leveraging the four pairs.
  - A 4 pair medium gave access to the SerDes (often the switch) rate for XLAUI-4, CAUI-4, 200GAUI-4
- SerDes & server speeds now growing by factors of 2x as 10G → 25G → 50G →100G, leading to a wide range of 2x Ethernet speeds
- Due to market need to move to 400G faster, we doubled up on 50Gb SerDes technology and moved to 400GAUI-8, creating a new *octal* paradigm & form factors.
  - OSFP or QSFP-DD ports will be featured on 200/400G switches
  - An 8 pair medium gives access to the SerDes rate for 400GAUI-8 and future 800GAUI-8
  - A 400G-SR8 module is a 400G SW-SW connection or a high density 200G-SR4, 100G-SR2, and 50G-SR, useful for breakout to both 50 and 100G servers and 200G multi-server NICs. This is useful since octal ports will be standard on switches. Efficient use of those ports is a valid criteria when judging 400G objectives
- The 4-pair cabling paradigm remains valid in the octal paradigm, because many end-users deployed / designed with it for past 10 years and wish to continue

It is valid to consider breakout applications when assessing BMP

- The interest in SR8 is a natural, if unintended, consequence of decisions we made three years ago to enable 400G switching with the 400GAUI-8 interface using 50G SerDes, moving to octal form factors & ports
- We create PMDs because they are good solutions for the MAC rate under consideration, not primarily for breakout to lower speeds. However, breakout applications became a fact of life after 802.3ba, impacting BMP.
- The 2x server speed cadence and the move to octal ports definitely impact the way some end-users plan to use octal modules to breakout to lower speeds, benefitting from an 8-pair medium.
- The implications for breakout were discussed extensively in when considering BMP in the original 400G Ethernet SG in 2013. An objective for supporting breakout was discussed but not adopted.
  - http://www.ieee802.org/3/400GSG/public/13_05/maki_400_01a_0513.pdf
  - http://www.ieee802.org/3/400GSG/public/13_11/dambrosia_400_01a_1113.pdf

Why is a standard needed to define SR8? Does an MSA leveraging 400GAUI-8 and 50GBASE-SR suffice?

- Specs for single-lane not always the same as for parallel lanes (see 10G-SR vs. 40G-SR4)
- The MDI and lane assignments for 16f MPO should be specified
- Some technical implementation questions have been raised that are appropriate for Task Force resolution

There is precedent in 802.3 for having two parallel solutions

- IEEE 802.3 has both 2-pair and 4-pair parallel solutions for 100 Gb/s: 100GBASE-SR2 (802.3cd) and 100GBASE-SR4 (existing), respectively

Conclusions

- The Broadest Market Potential is created by standardizing both 4-pair & 8-pair solutions for 400 Gb/s Ethernet over MMF
- The interest in 8-pair cabling is a natural outcome of industry & Ethernet choices instantiated in the 802.3bs project, while 4-pair cabling has a 10 year history in Ethernet and a large installed base.
  - End-users from the Cloud have expressed interest in both
  - Enterprise interest lies primarily with 4-pair cabling due to lower cable cost for longer SW-SW lengths
- Distinct Identity is maintained. These are not two solutions for the same problem. Precedent exists.
- The CSD responses for the NGMMF Study Group are supported by adopting objectives for 400G over both 4-pair and 8-pair MMF