Purpose

- The following slides summarize rules and issues for the new mixed-mode format as sketched in recent on-line discussions

- The summary "bullet points" here will be edited in real time during IBIS-Interconnect meetings

- Once the summary rules are agreed by consensus, formal text implementing them will be written

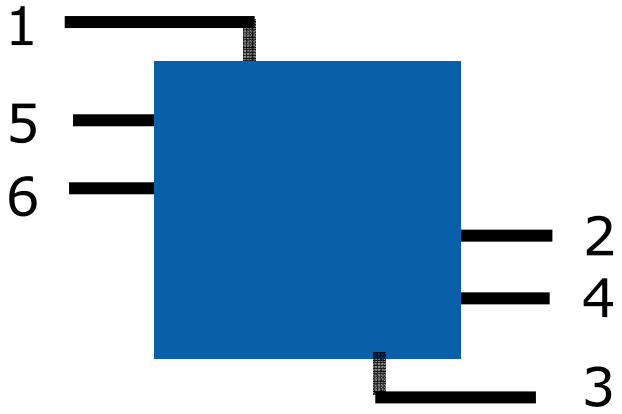
An Example…

- From Bob Ross
- For a 6-port example:
  - D2,4
  - D5,6
  - C2,4
  - C5,6
  - X1
  - X3
- The generalized matrix is:
  - Xd2d4,d2d4 Xd2d4,d5_6 . Xd2_4,c2_4 Xd2d4,c5c6 . Xd2d4,1 Xd2d4,3
  - Xd5d6,d2d4 Xd5d6,d5_6 . Xd5_6,c2_4 Xd5d6,c5c6 . Xd5d6,1 Xd5d6,3
  - Xc2c4,d2d4 Xc2c4,d5_6 . Xc2_4,c2_4 Xc2c4,c5c6 . Xc2c4,1 Xc2c4,3
  - Xc5c6,d2d4 Xc5c6,d5d6 . Xc5_6,c2_4 Xc5c6,c5c6 . Xc5c6,1 Xc5c6,3
  - X1,d2d4 X1,d5d6 . X1,c2c4 X1,c5c6 . X1,1 X1,3
  - X3,d2d4 X3,d5d6 . X3,c2c4 X3,c5c6 . X3,1 X3,3

Clarifying the Example

This drawing is arbitrary, as no specific "sides" or arrangements are implied by the example.

Multiple drawings are possible, as topologies are non-unique



- Mixed-mode only of interest for ports (2,4) and (5,6)
  - Ports 1 and 3 are expressed only in terms of single-ended data
- Stimulus, response ordering appears identical to existing definitions
  - E.g., SCD12: differential port 2 stimulus, common mode port 1 observed
- Not all relationships are defined!
  - This is unique to this proposal (contra other proposals)
  - Pro: flexible ordering; compact, particularly for larger systems
  - Con: SE data critical when key MM relationships are missing

Rules and Questions

- Single-ended data not required
- MM: Each SE data relationship appears only once
- MM: Each C/D data relationship appears only once
- Each port may "participate" in only one MM pair
  - Of each type: C, D
- SE port *numbers* used across entire file
- Mixed mode pair ordering is always +,-
- How are the positions of the data pairs defined?
  - Earlier drafts used row, column ordering of *ports*
  - This is not defined *a priori* by the specification
  - A table of ports will be made explicit in each file
- Ports may not "participate" in both SE and MM pairs

New Syntax

- [Mixed-mode Order]
  - A vector of ports and/or port relationships of interest
  - The vector determines the content and row and column order to be used in [Mixed-mode Data] (see below)
  - Single-ended port numbers are used throughout the file
  - Single-ended ports are indicated by "S" followed by an integer
  - Common-mode MM port relationships are indicated by "SC" and two integers, separated by a comma
  - Differential-mode MM port relationships are indicated by SD and two integers, separated by a comma
  - Relationships are separated by semicolons (whitespace optional)
    - *For example, S5; SD3,2; SC3,2*
  - Ports may not appear in more than one D or one C relationship
  - Only S-parameter data is defined today
    - *Other relationships may be added freely in future revisions*
  - Not every port need be included under [Mixed-mode Order]

New Syntax (2)

- [Mixed-mode Data]
  - Network data describing the electrical relationships between ports, in single-ended and/or mixed-mode terms
  - Only ports and port relationships mentioned explicitly under [Mixed-mode Order] may appear in [Mixed-mode Data]
  - The order of ports/port relationships in [Mixed-mode Order] determines the arrangement of the matrix in [Mixed-mode Data]
    - *[… Order] row vector multiplied by [… Order] column vector*
    - *See example*
  - Frequency information, spacing and other formatting identical to Touchstone 1.0 single-ended matrices