SAS/SATA II Multi-lane Connector/cabling

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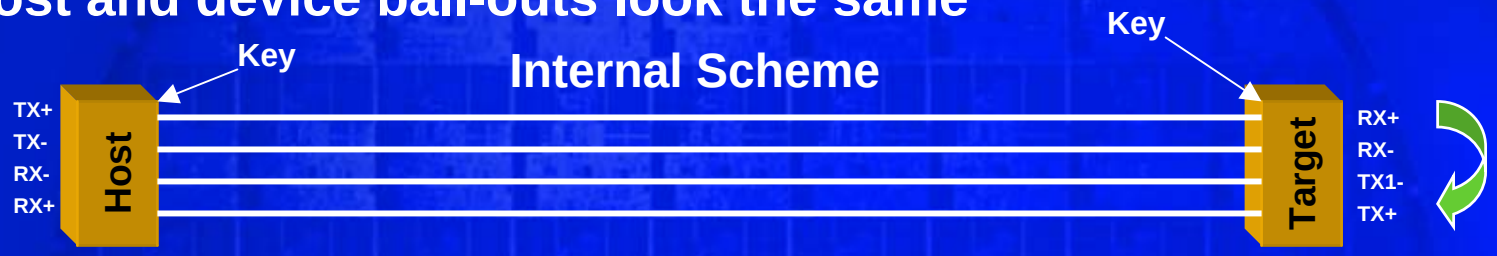
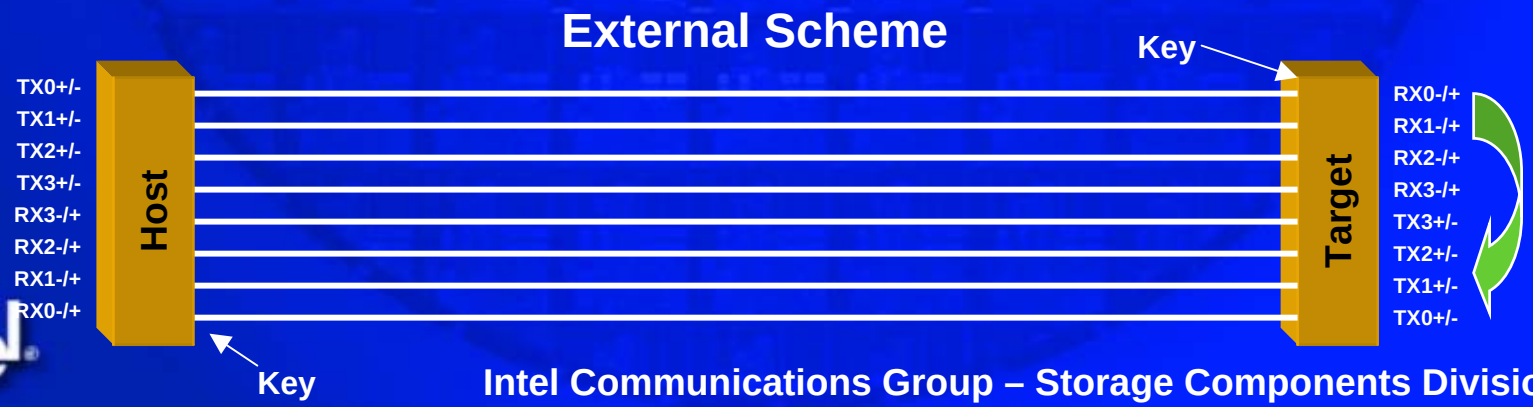
External vs. Internal Cabling Schemes

- Internal TX to RX matching is accomplished with different pinouts (same ball-out) on host vs. target
- Host and device ball-outs look the same



- External TX-RX matching accomplished with cable keying
  - Connector pin-outs & Si ball-outs are identical on both ends
  - Multilane cable has flipped keying for correct connection
- Host and device ball-outs look the same



Heritage of SATA Multi-lane

- SATA adopted SAS multi-lane for compatibility
  - Intent of SAS is to be interoperable w/ SATA
- SAS adopted FC for simplicity
  - Cables already exist – Why invent another one?
- FC adopted Infiniband scheme
  - Proven technology, cables exist
  - Eliminate TX-TX connection, but SAS/SATA II AC coupled
- Infiniband scheme for easy cable construction
  - But, no multi-lane vs. single lane pinout conundrum

Ball-out/Routing Requirements

- **FR4 is very lossy, thus:**
  - **Minimal (zero at 3Gb/s) vias and no 'cross-over' routing**
  - **Vias add about 0.7pF depending on ground plane clearance**
  - **ICH5 allows 2 vias for 1.5Gb/s channels (SATA I)**

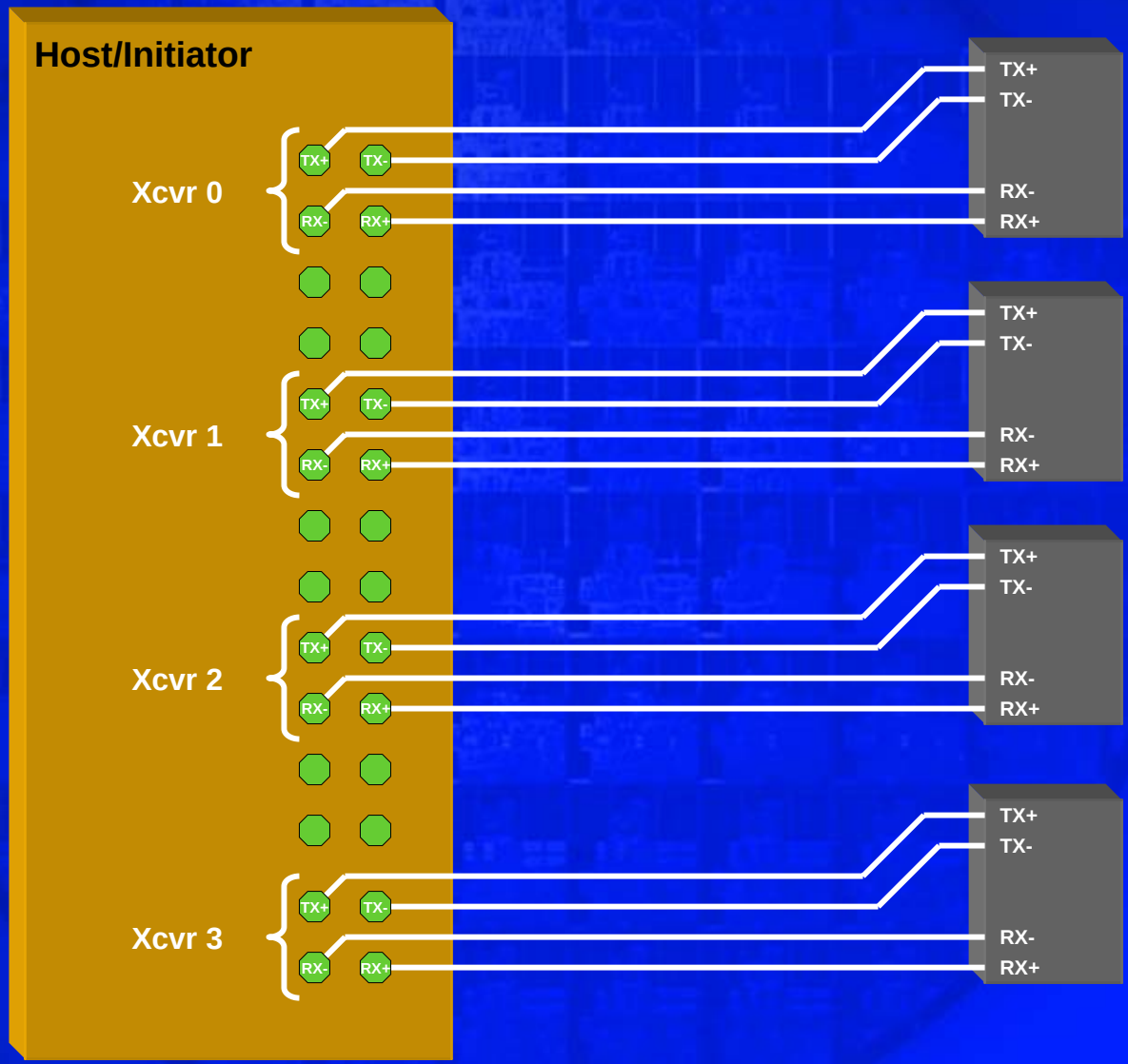
- **Ball-out & routing should be similar for multiple single lane and multilane usage models**

- **External connector scheme should allow simple (cheap) cables**
  - **No high-cost assembly requirements**
  - **Ideally would re-use current IB/FC/SAS cable constituants**

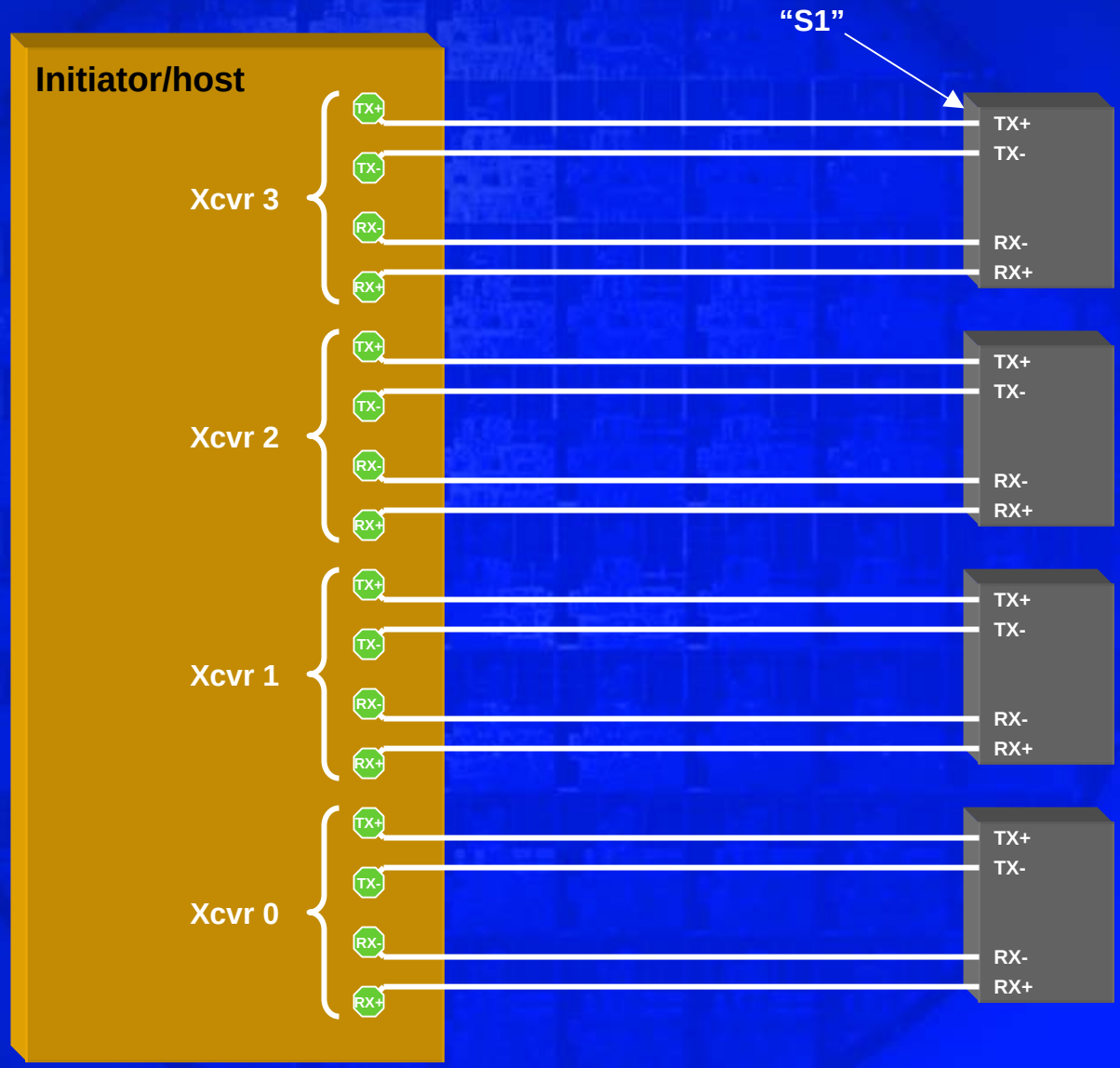
Cable and Connector Construction (External)

- **“Twin-AX” – 8 discrete differential pairs**
- **No lane ordering enforced in cable construction**

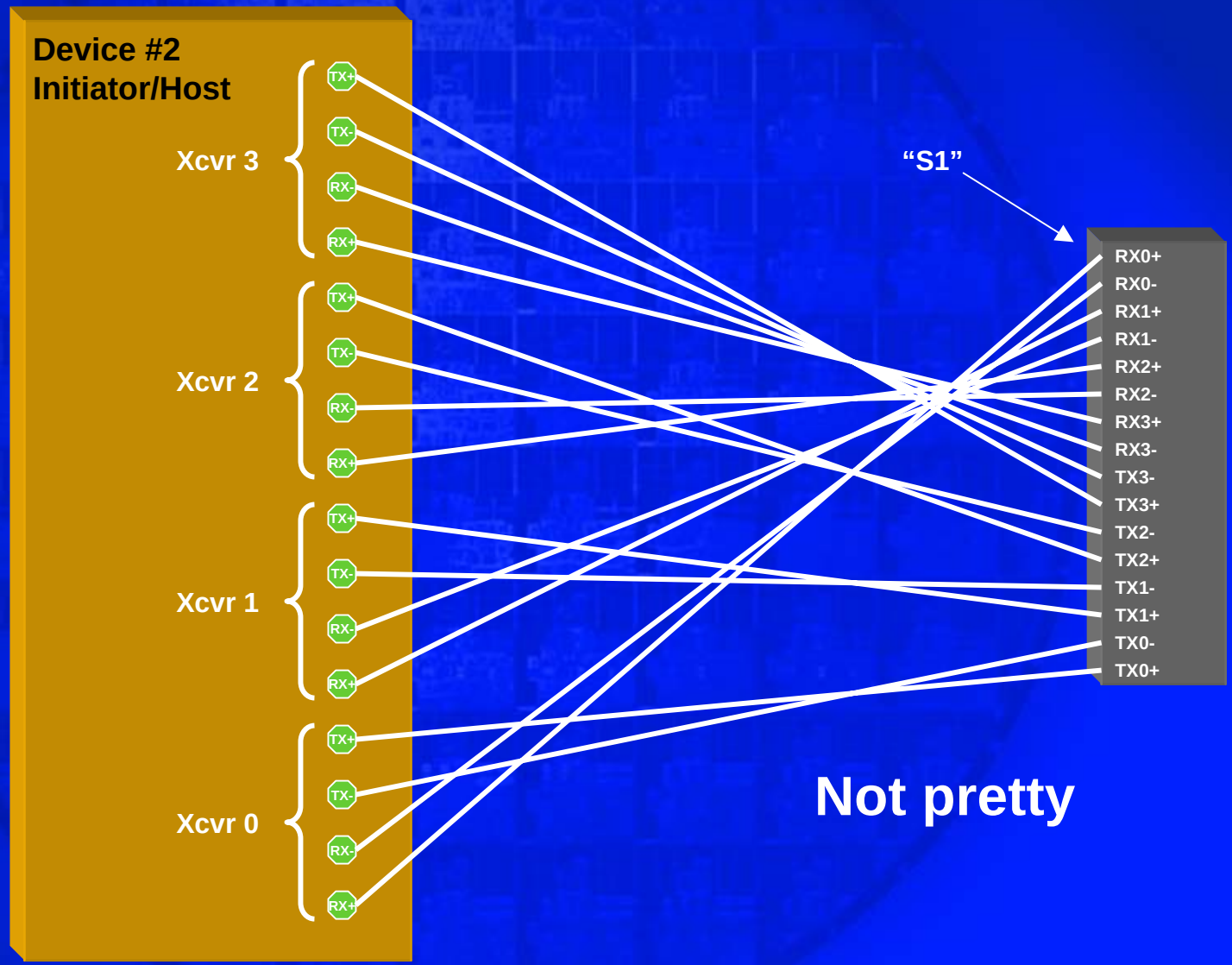
Device #1 Single Channel Routing



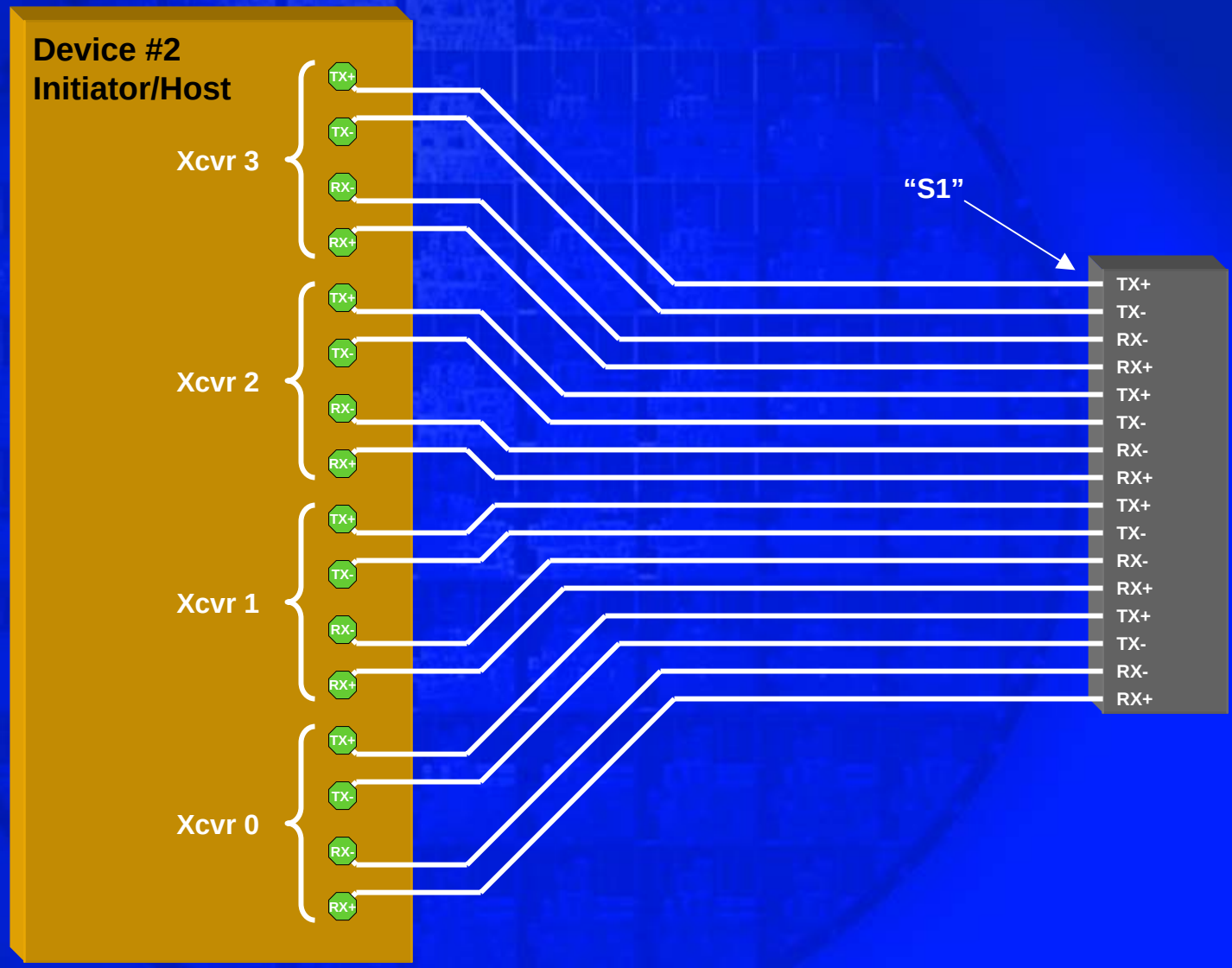
Device #2 Single Channel Routing



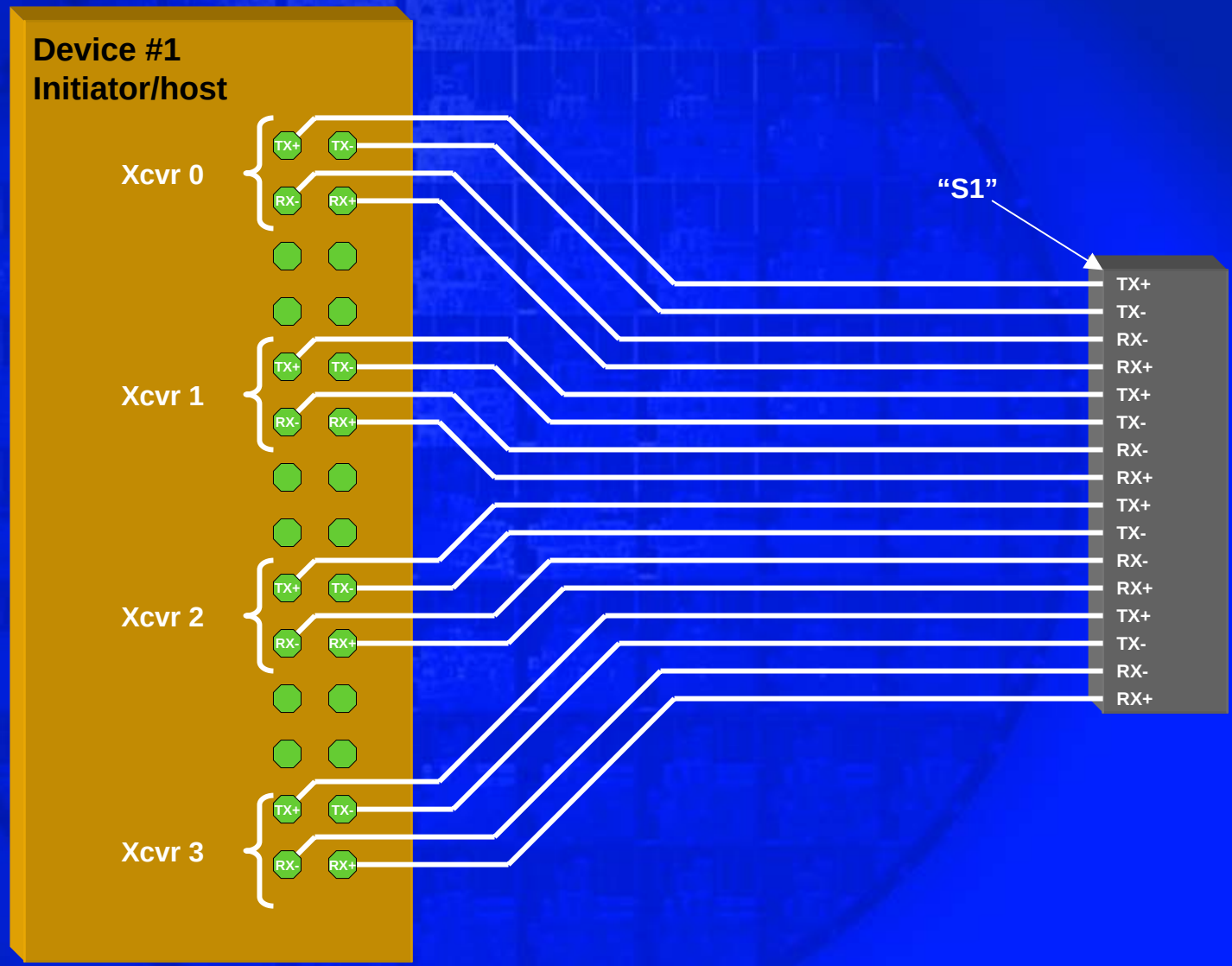
Routing to Current 8470 Scheme



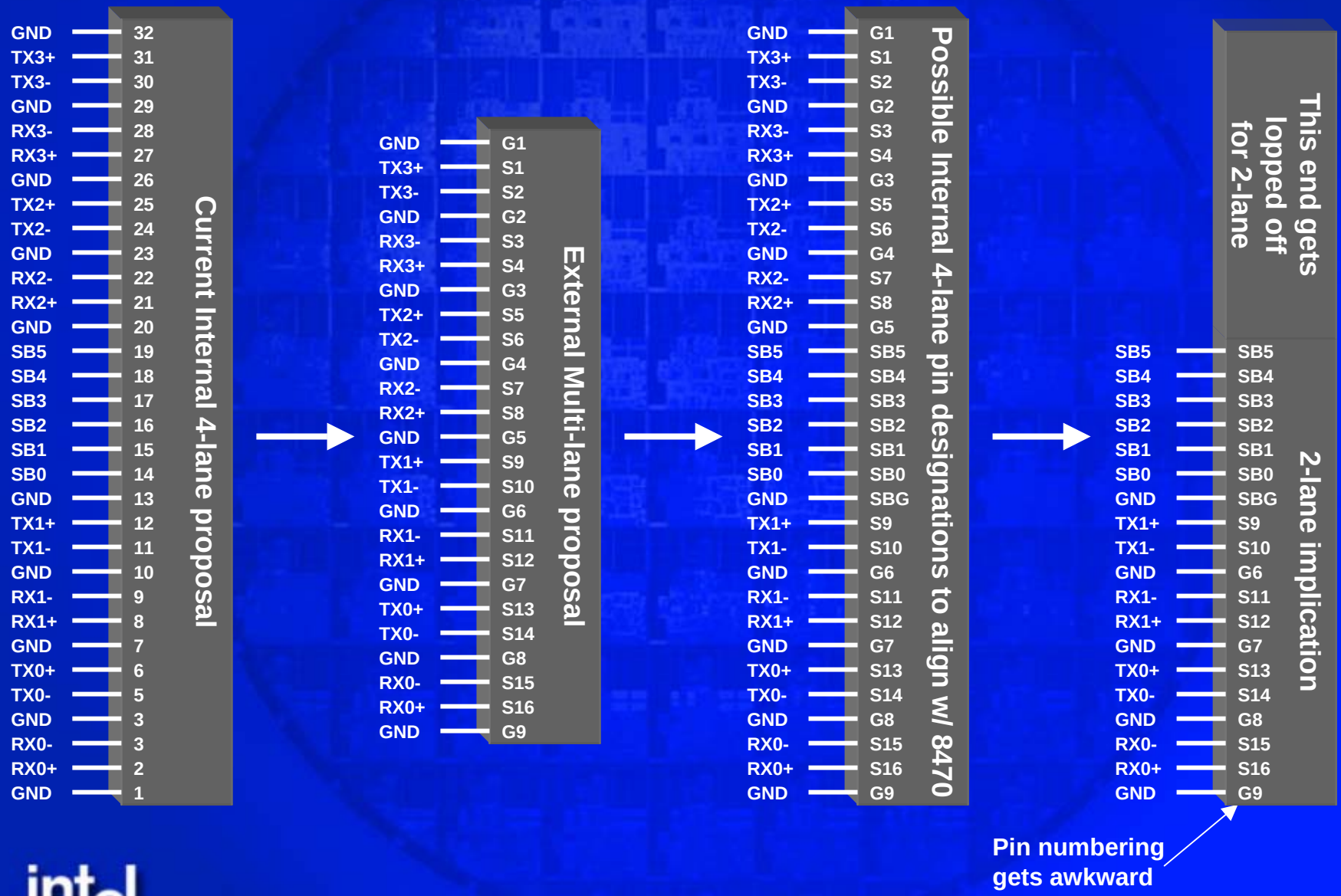
Preferred Multi-lane Pinout



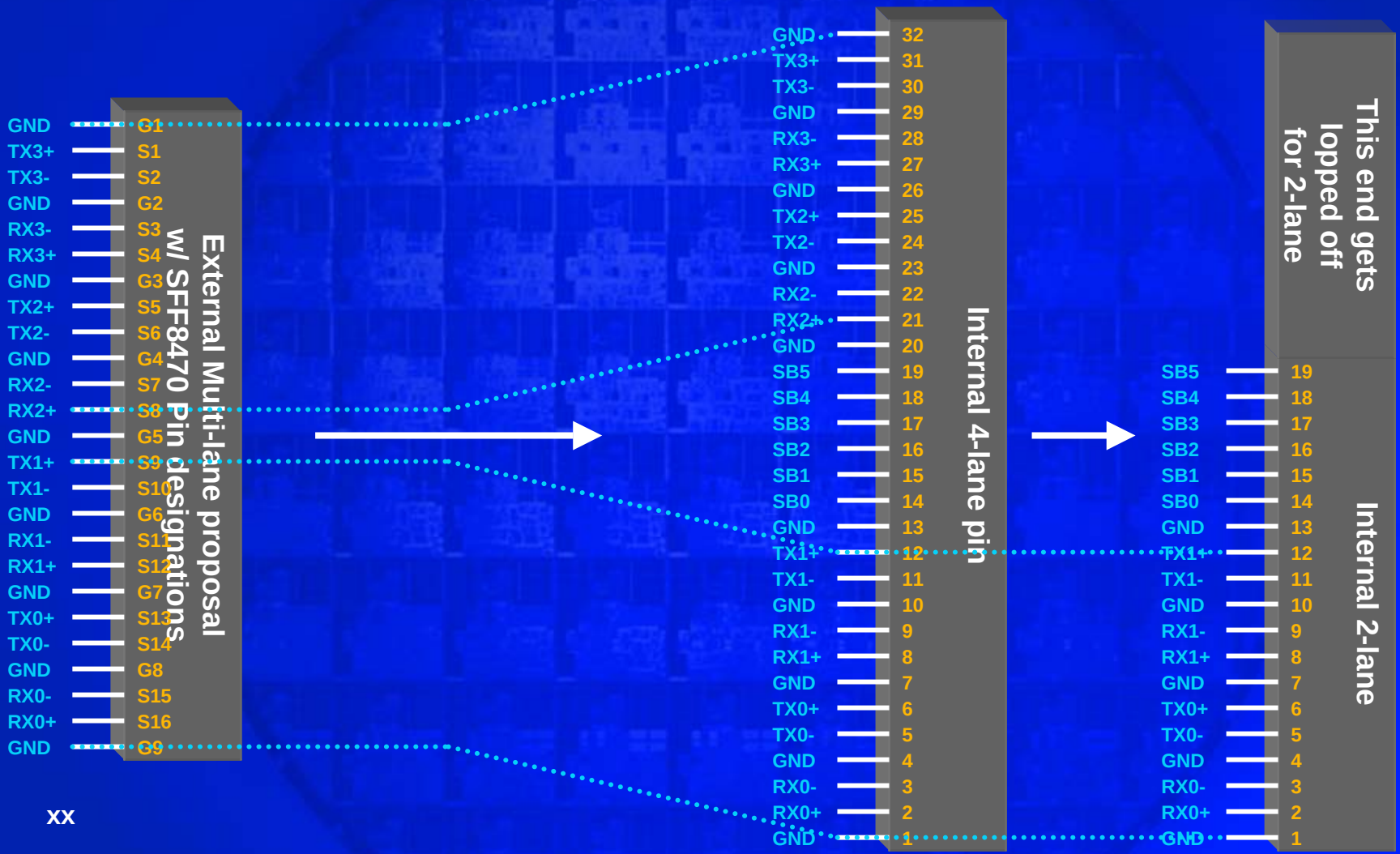
Device #1 Multi-lane Routing



Alignment w/ Internal Multi-lane



Proposed Pinouts



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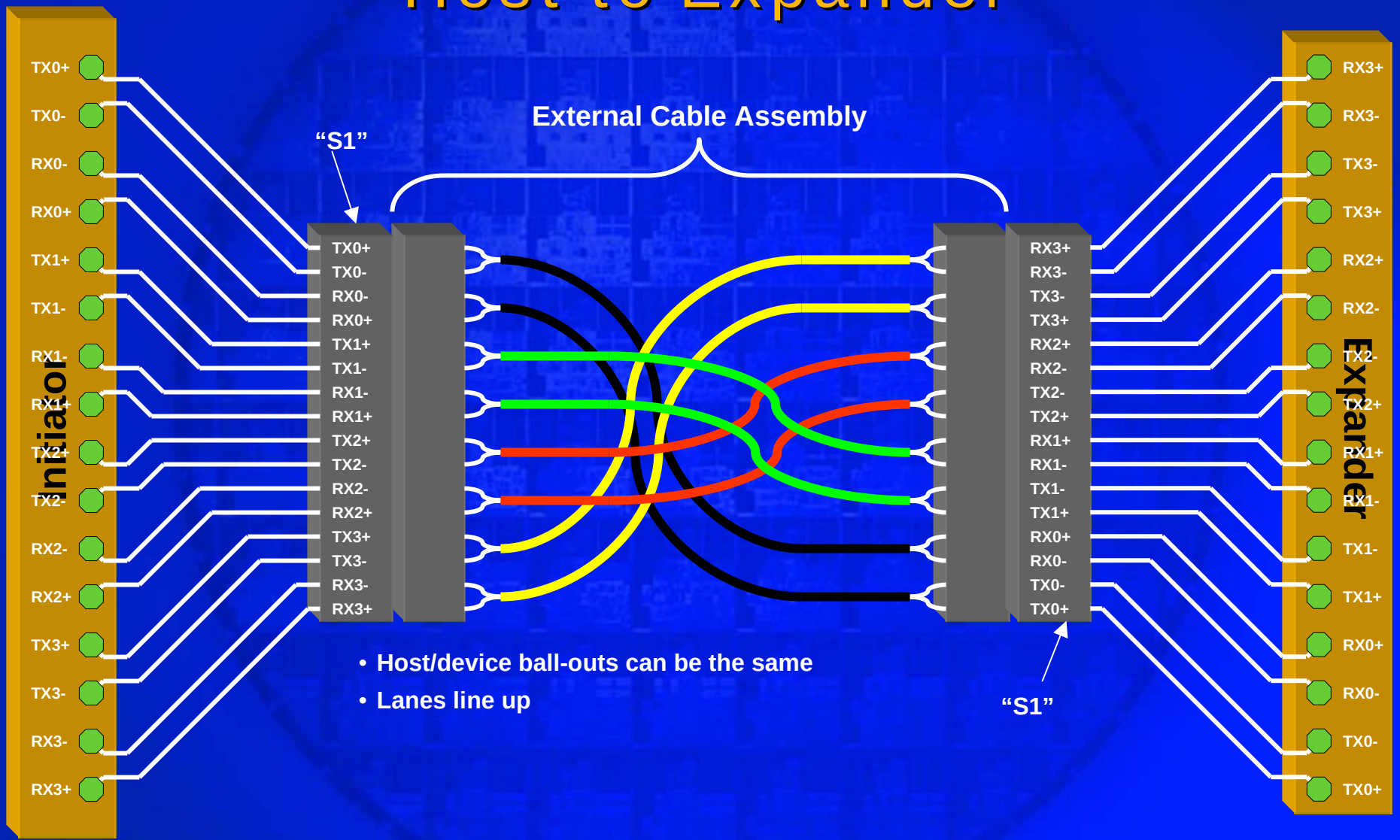
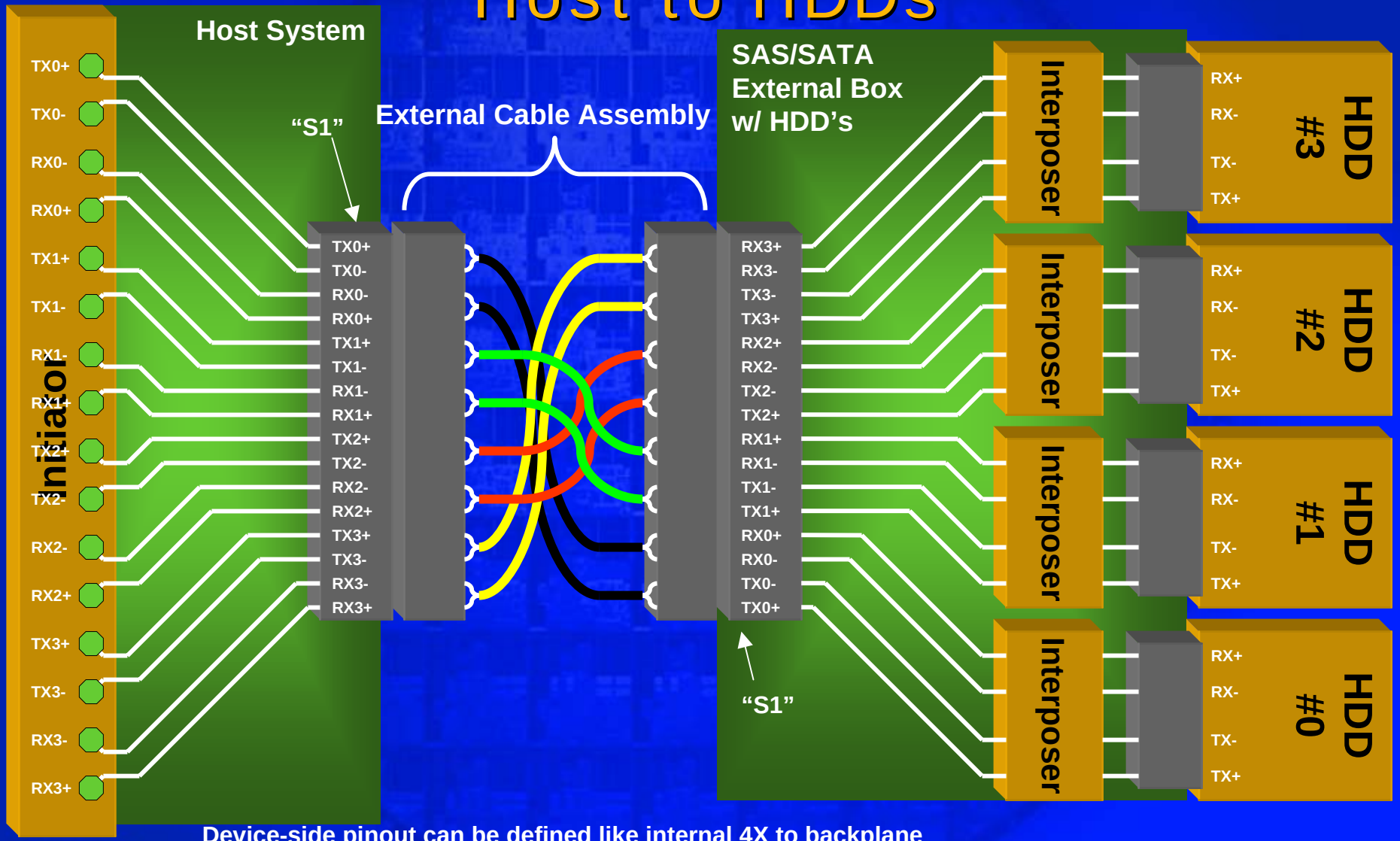
External X4 Scheme
Host to Expander

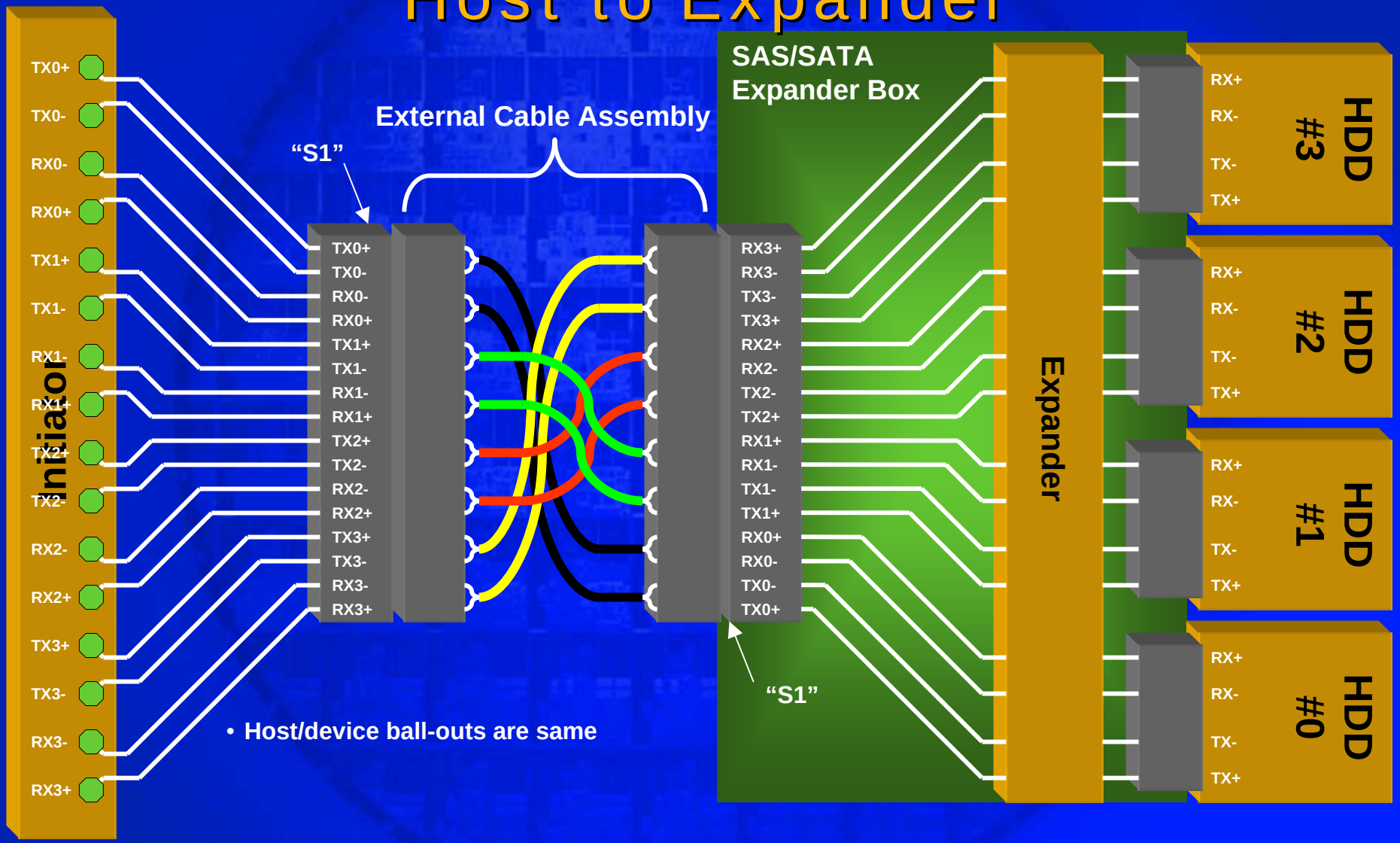


External 4X Scheme
Host to HDDs



Device-side pinout can be defined like internal 4X to backplane

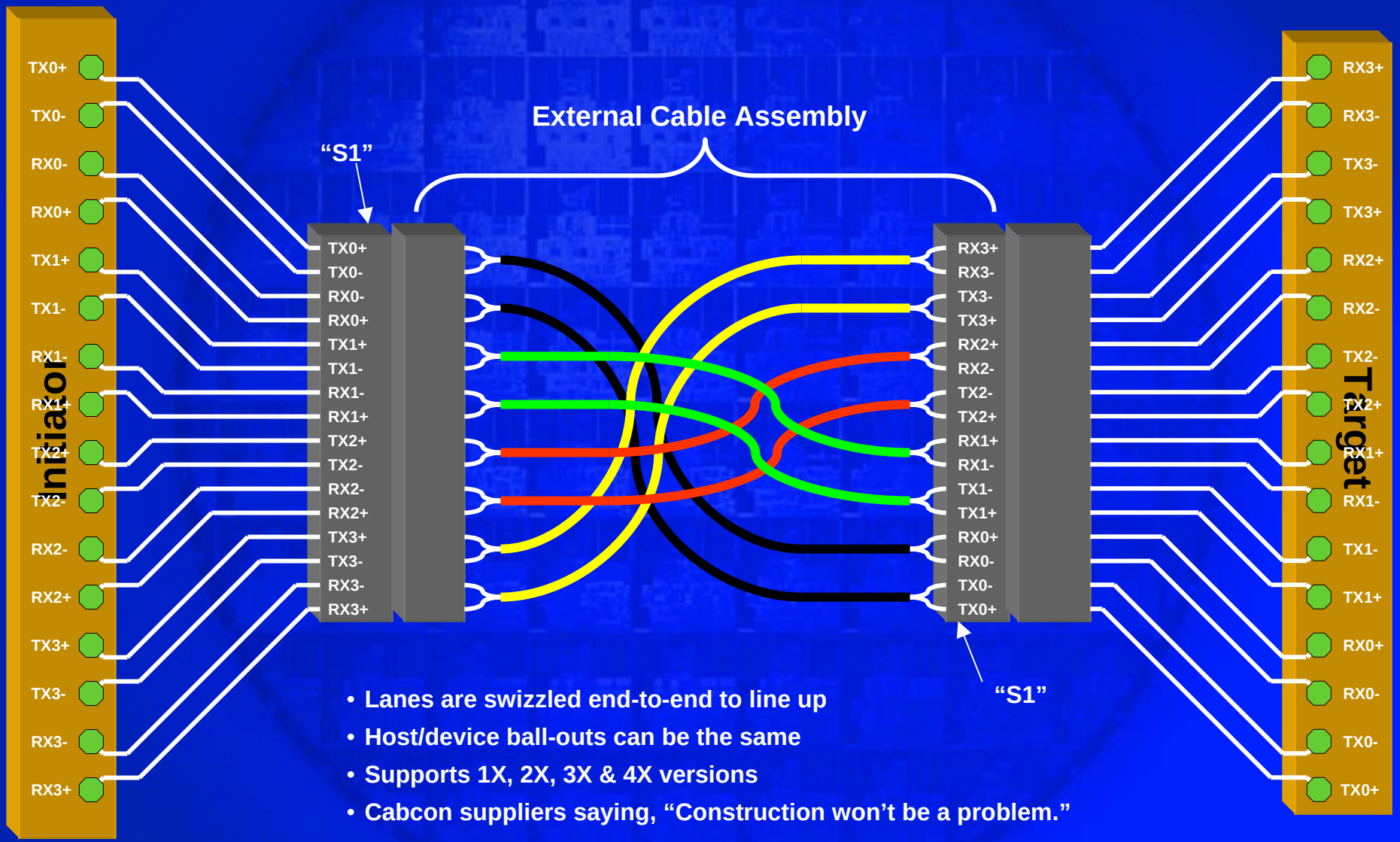
External 4X Scheme
Host to Expander



- Host/device ball-outs are same

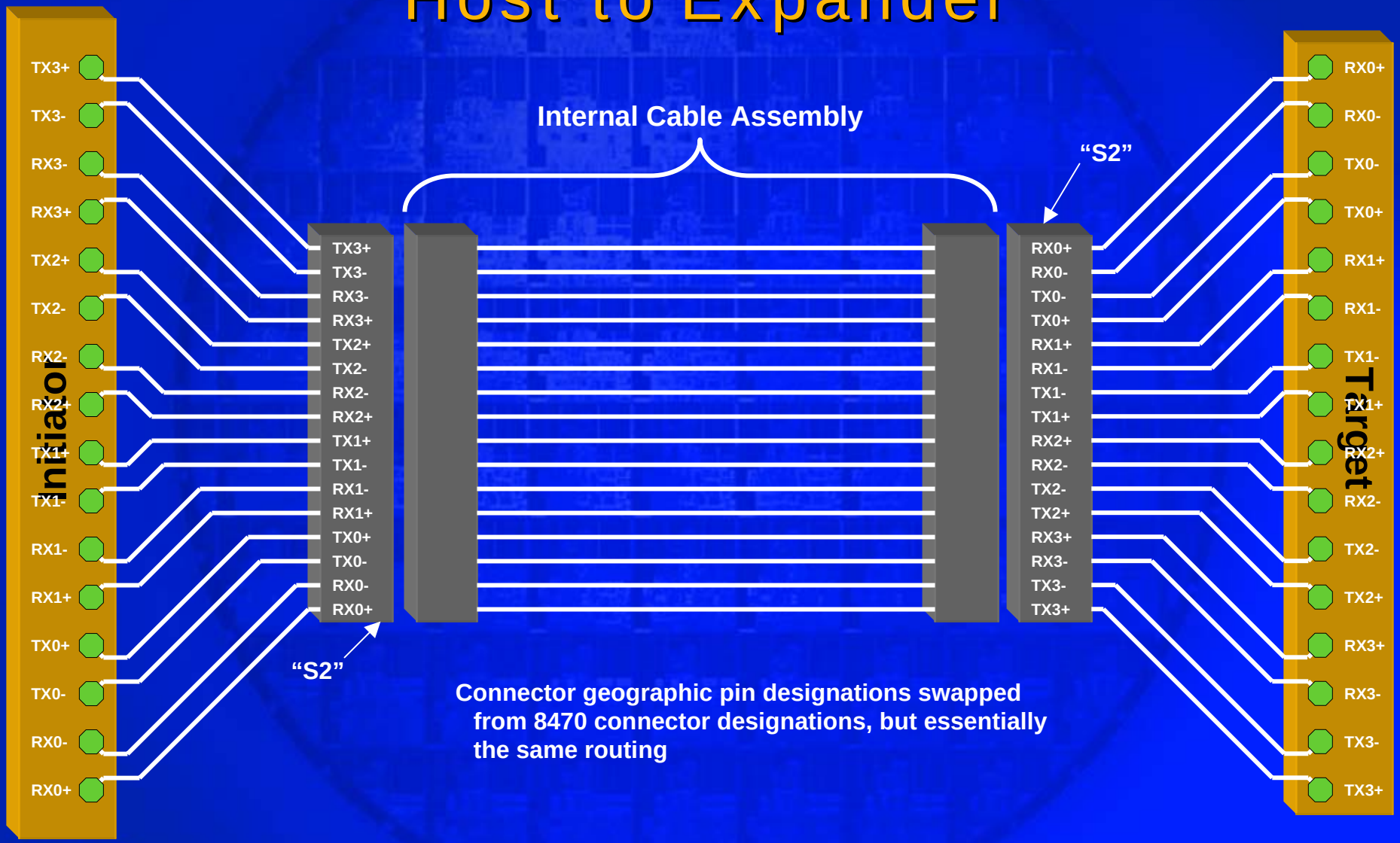
Backup

Lane Swizzle



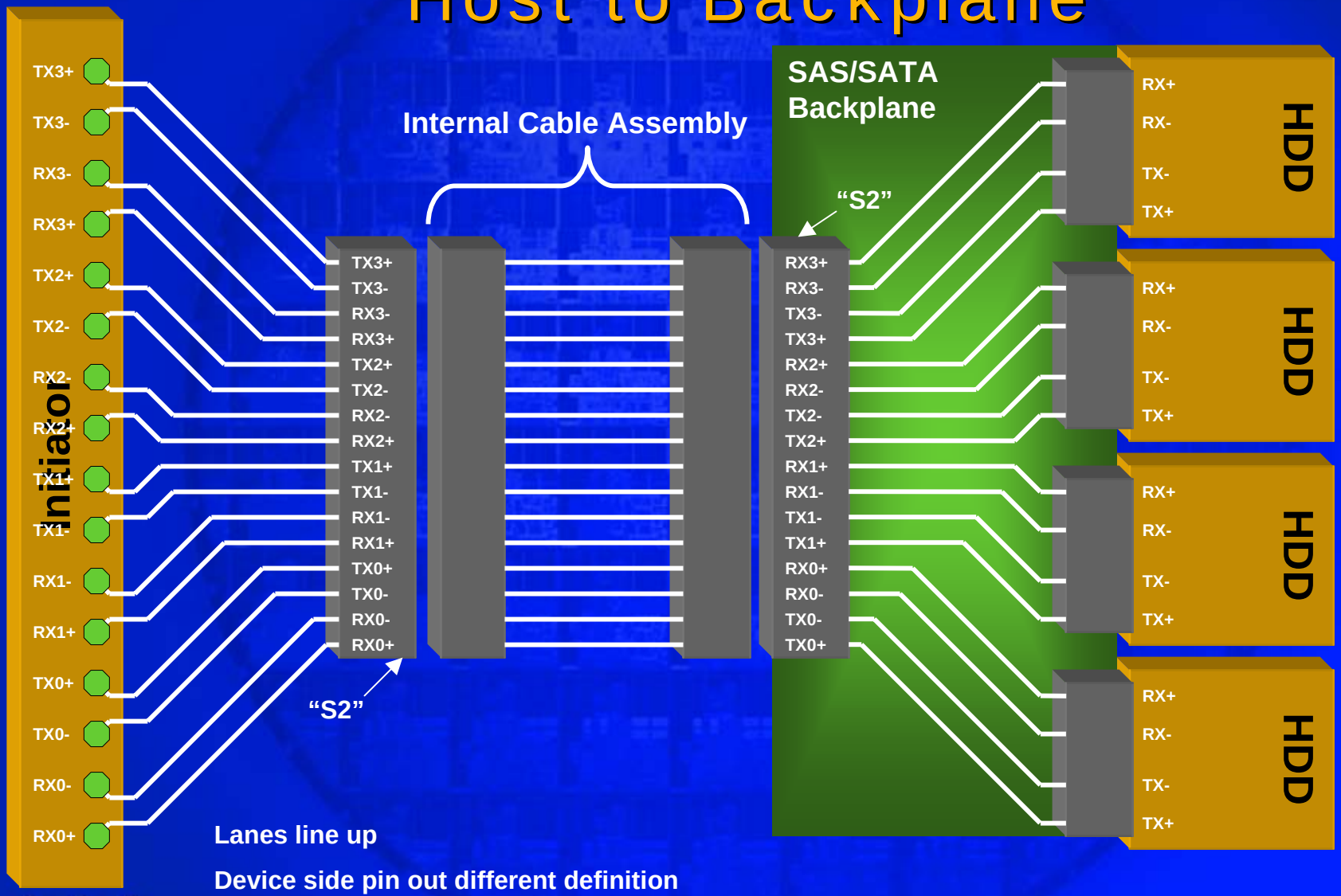
- Lanes are swizzled end-to-end to line up
- Host/device ball-outs can be the same
- Supports 1X, 2X, 3X & 4X versions
- Cabcon suppliers saying, "Construction won't be a problem."

Reference: Internal multi-lane Host to Expander

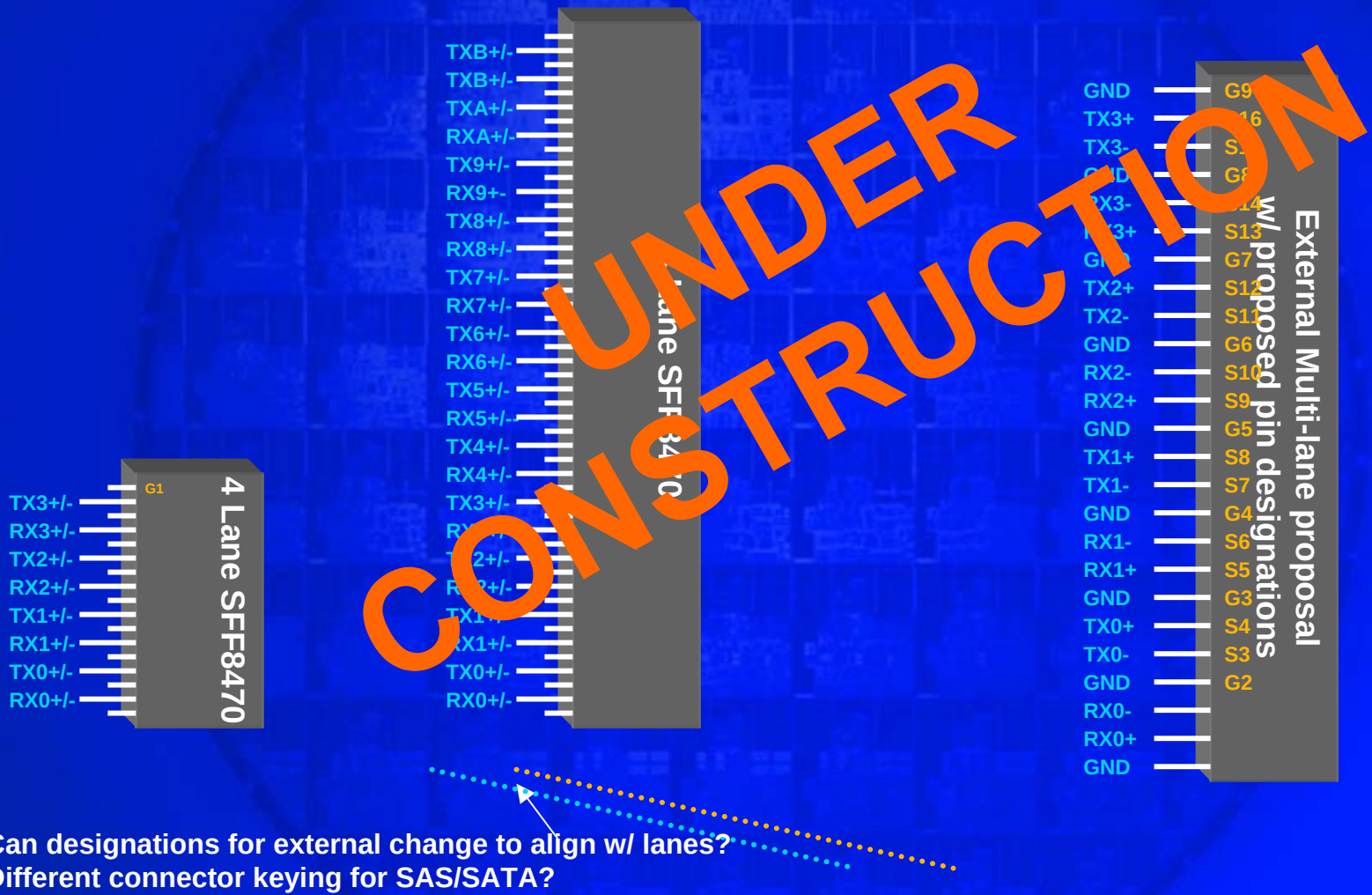


Connector geographic pin designations swapped from 8470 connector designations, but essentially the same routing

Reference: Internal 4X Scheme Host to Backplane



Extension to 12 Lane External



- Can designations for external change to align w/ lanes?
- Different connector keying for SAS/SATA?
  - SATA device to SAS host
  - No SATA host to SAS device