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FDD PCS Structure
TX Downstream

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Rev R02

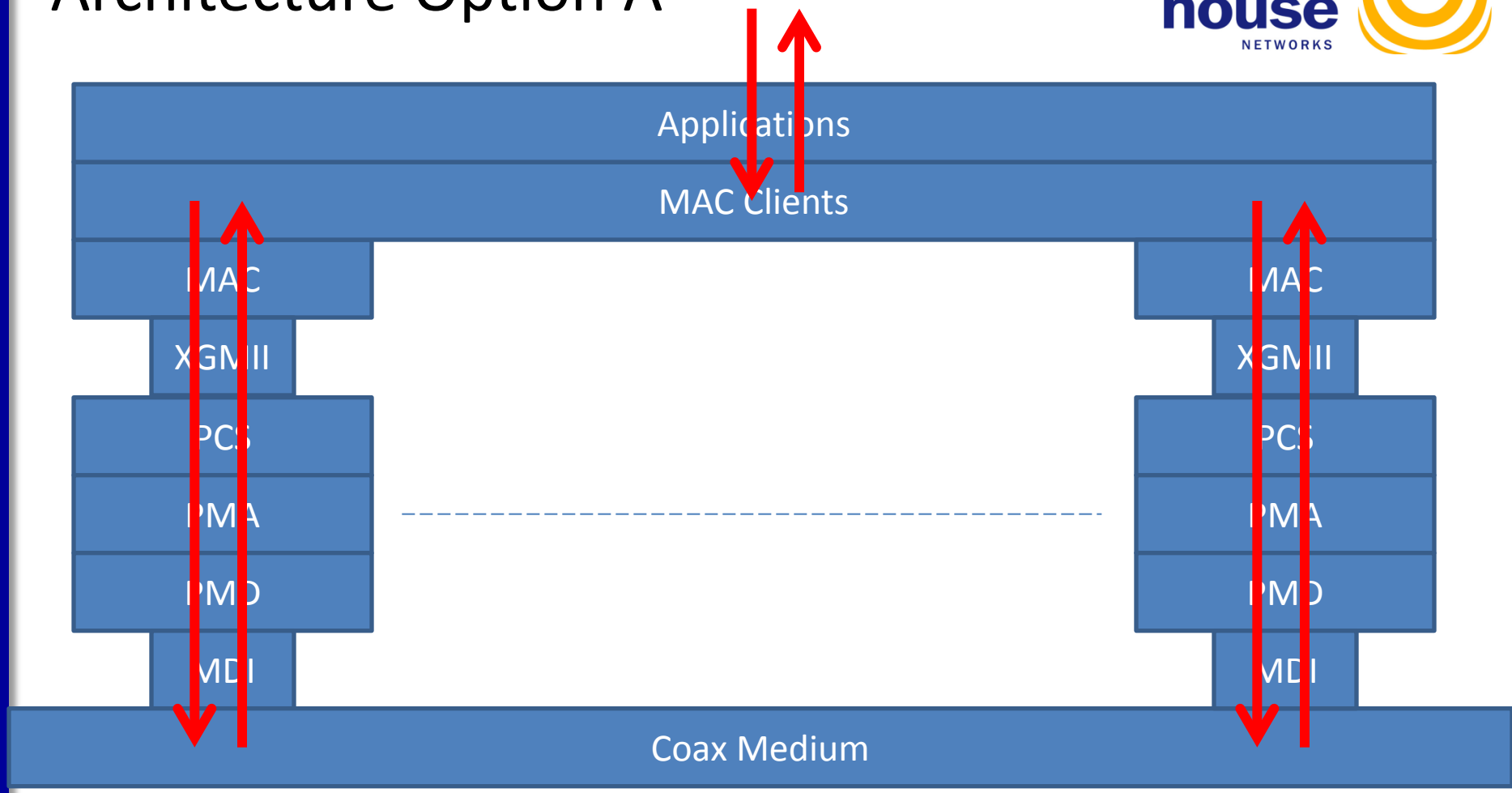
PCS & PMA

- Decision needs to be made about the division between PCS and PMA for EPoC
  - At this time (see kliger_3bn_01_1013_R01.pdf), it is not clear whether Randomizer / Symbol Mapper is to be included in PCS or be already part of PMA
- The decision is also blocking definition of individual compatibility interfaces between layers and sublayers
  - Without them, it is difficult to describe the operation of individual state diagrams
- This presentation examines two alternative approaches for PMA/PCS separation and suggests the path forward for PCS and PMA definition

EPoC Architecture options

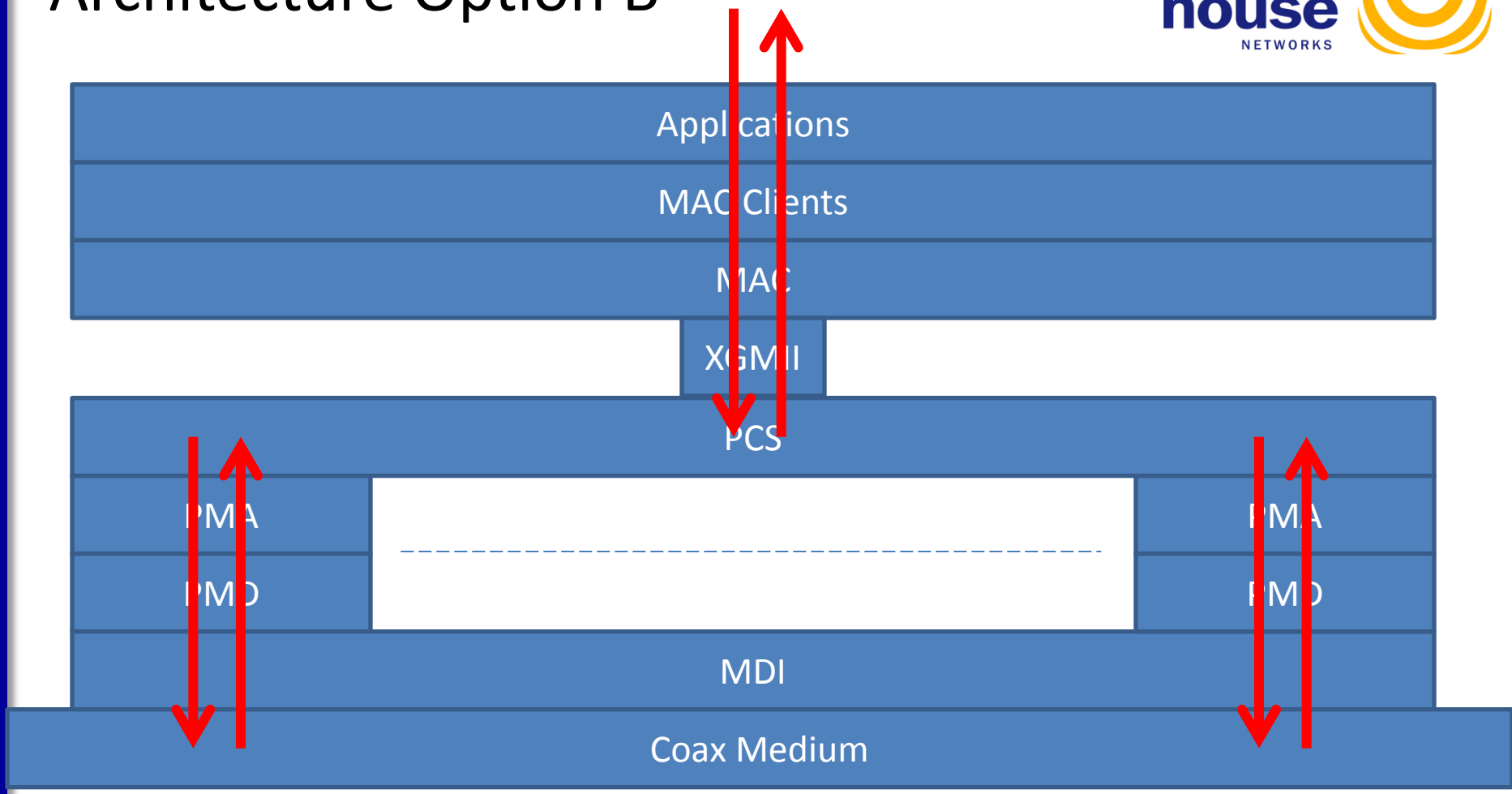
- EPoC is intended to operate with more than 1 OFDM channel in upstream and / or downstream to achieve the data rate up to 10 Gbit/s in downstream
- This means that EPoC is likely to have to support more than one data lane (lane = OFDM channel) per direction
- Two options are examined in the following slides
  - Option A resembles a LAG of multiple independent PMDs (and MACs), combined with a single MAC Client
  - Option B resembles closely approach taken in 40GE/100GE, where a single MAC data stream is striped across multiple data lanes (one data lane = one PMD).
  - Option A is not recommended for further development due to its technical challenges, flexibility constraints, and problems with multiple generations of equipment on the same coaxial plant.

Architecture Option A



- Each EPoC PMD has a dedicated MAC, XGMII, PCS, and PMA
- Each OFMD channel becomes an independent data link. Data from individual applications has to be striped across individual OFDM channels to avoid overloading some links.

Architecture Option B



- Each EPoC PMD has a dedicated PMA, but shares PCS and MAC with other EPoC PMDs.
- This approach is similar to 40GE/100GE as well as EFM 10PASS-TS

Two options to choose from?

- Option A requires complex load balancing between individual PMD instances and destination-aware decision at MAC Client as to where to send the given data stream
  - It allows support for multiple generations of devices with different channel number on the same coax port (similar to DOCSIS 3.0)
  - This requires complex MAC Client structure (not present in Clause 102 right now) and data replication at MAC Client level to make sure all stations get the required content.
- Option B is much closer to typical Ethernet (L2) approach in that a single MAC channel is created between the CLT and CNU, the capacity of which is defined by amount of allocated spectrum (OFDM channels).
  - It supports just one type of CNUs on the same coax port (with the same number of OFDM channels) but gains in implementation simplicity.
  - The number of supported OFDM channels becomes then a device implementation problem (like number of LLIDs in EPON) and not the standard definition problem.

Suggestions going forward

- Suggestion 1: adopt Option B as the target architecture for EPoC (both the CNU and the CLT)
  - Number of supported OFDM channels becomes a device problem (and vendor differentiator)
  - EPoC to support any number of OFDM channels (between 1 and 4), with MAC / MAC Control to discover the number of connected OFDM channels and configure the device for operation accordingly
- Suggestion 2: separate PCS and PMA in Tx direction as follows:
  - PCS ends at the output of FEC Encoder; the interface between PCS and PMA transfers one 65-bit block per clock cycle;
  - PMA includes Randomizer, Symbol Mapper, Time & Frequency Allocation, etc. and other functions associated with mapping and encoding the bit stream onto the specific PMD
  - The Rx direction is symmetrical
  - The separation between PMA and PMD is to be defined separately

THANKS !