

Channel Bonding for Next Generation Passive Optical Network Stage 2 (NG-PON2)

Liang Zhang⁽¹⁾, Yuanqiu Luo⁽²⁾, and Nirwan Ansari⁽¹⁾

(1) Department of Electrical and Computer Engineering, New Jersey Institute of Technology, Newark, NJ, 07102, USA

(2) Futurewei (Huawei) Technologies, 400 Crossing Blvd, Bridgewater, NJ, 08807, USA

Email: lz284@njit.edu; yuanqiu.luo@huawei.com; nirwan.ansari@njit.edu



Why NG-PON2?

- Higher bandwidth requirement due to the emerging applications: Edge network cannot support emerging applications such as HD video, mobile front-haul/backhaul and high speed Ethernet [1].



Fig. 1: Emerging applications are driving for flexible high-capacity broadband access.

Why channel bonding?

- Channel bonding advantages: *i)* high capacity, *ii)* flexible bandwidth allocation, and *iii)* low CAPEX.

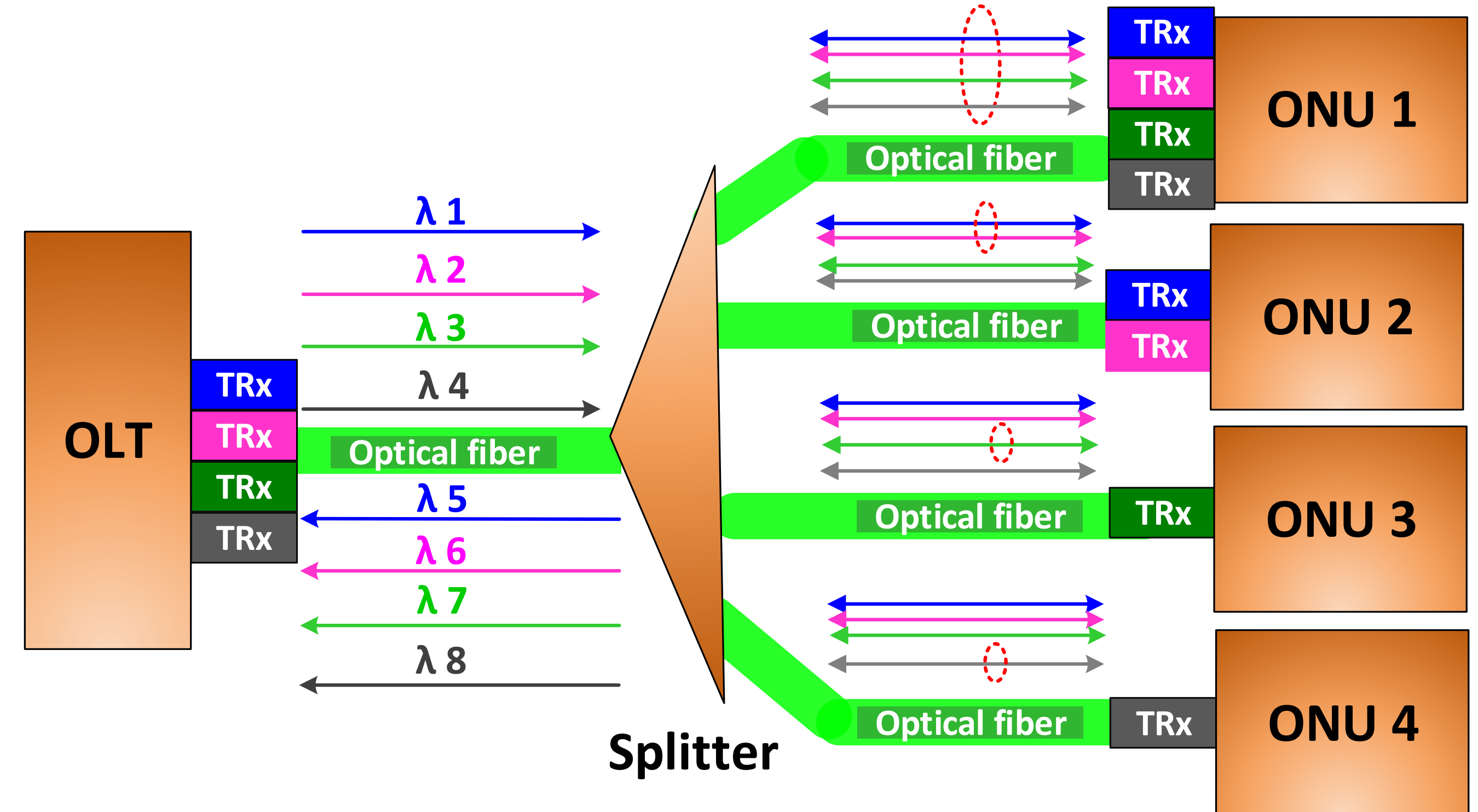


Fig. 2: An example of channel bonding for NG-PON2.

TWDM TC layer structure of current NG-PON2

- TWDM TC layer of GPON is “equivalent” to Data Link layer of OSI model.
- TWDM TC layer is composed of three sublayers: *i)* TWDM TC service adaptation sublayer, *ii)* TWDM TC framing sublayer, and *iii)* TWDM TC PHY adaptation sublayer [1].
- Channel bonding at service adaptation layer provisions the highest flexibility.

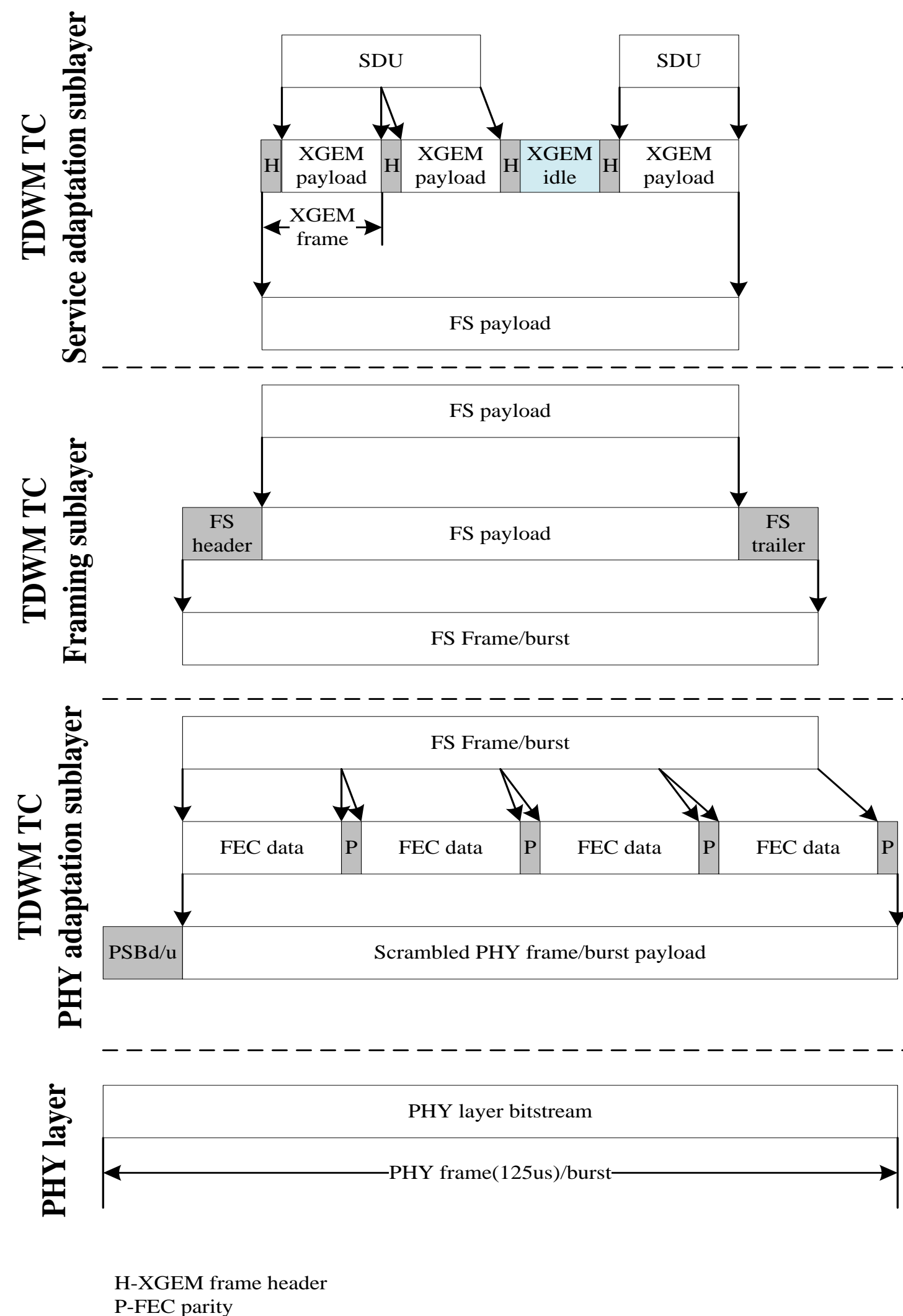


Fig. 3: TWDM TC Layer Structure [1].

Inter-leaving scheduling technique

- Traffic is distributed to the available channels via an interleaving scheduling technique.

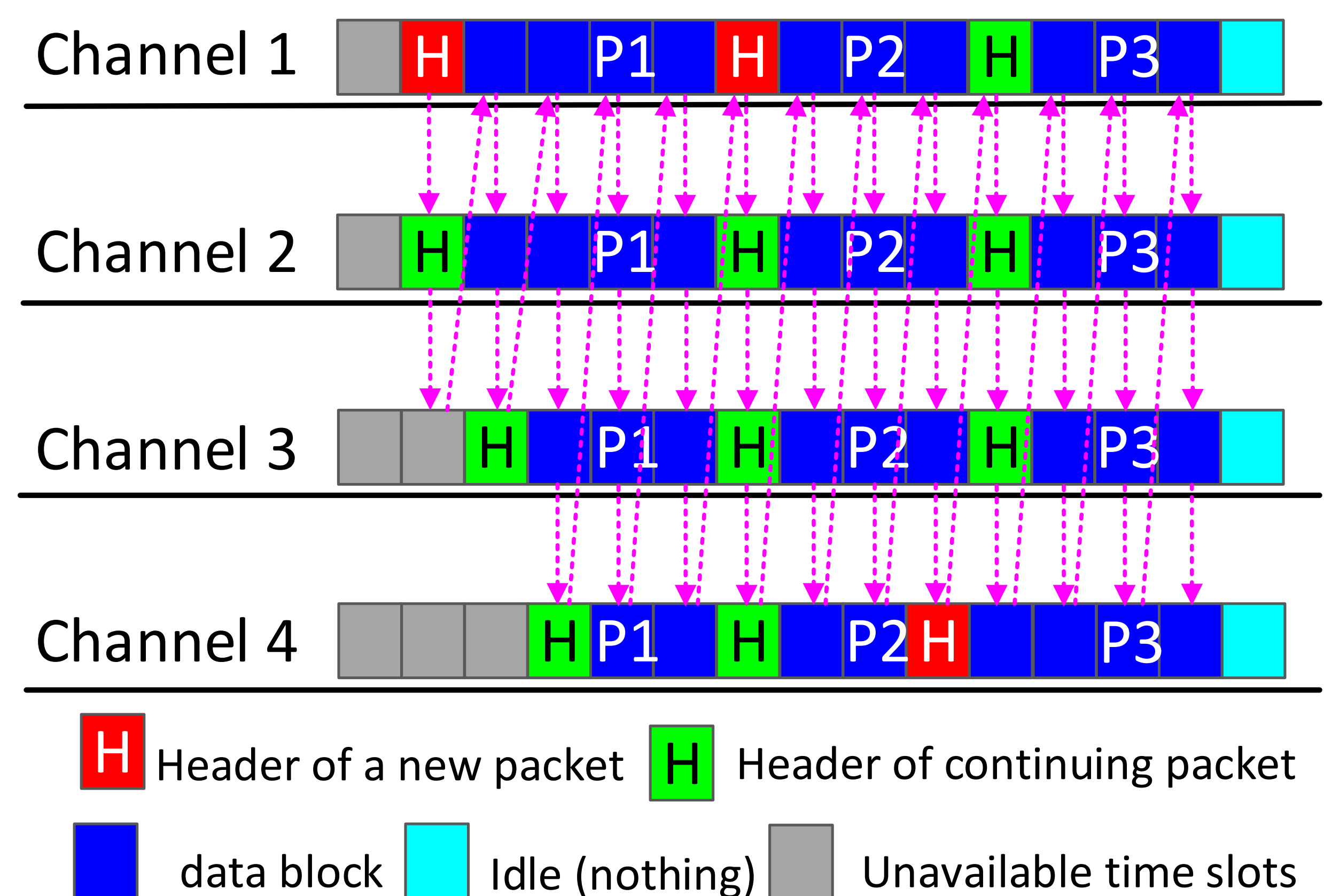
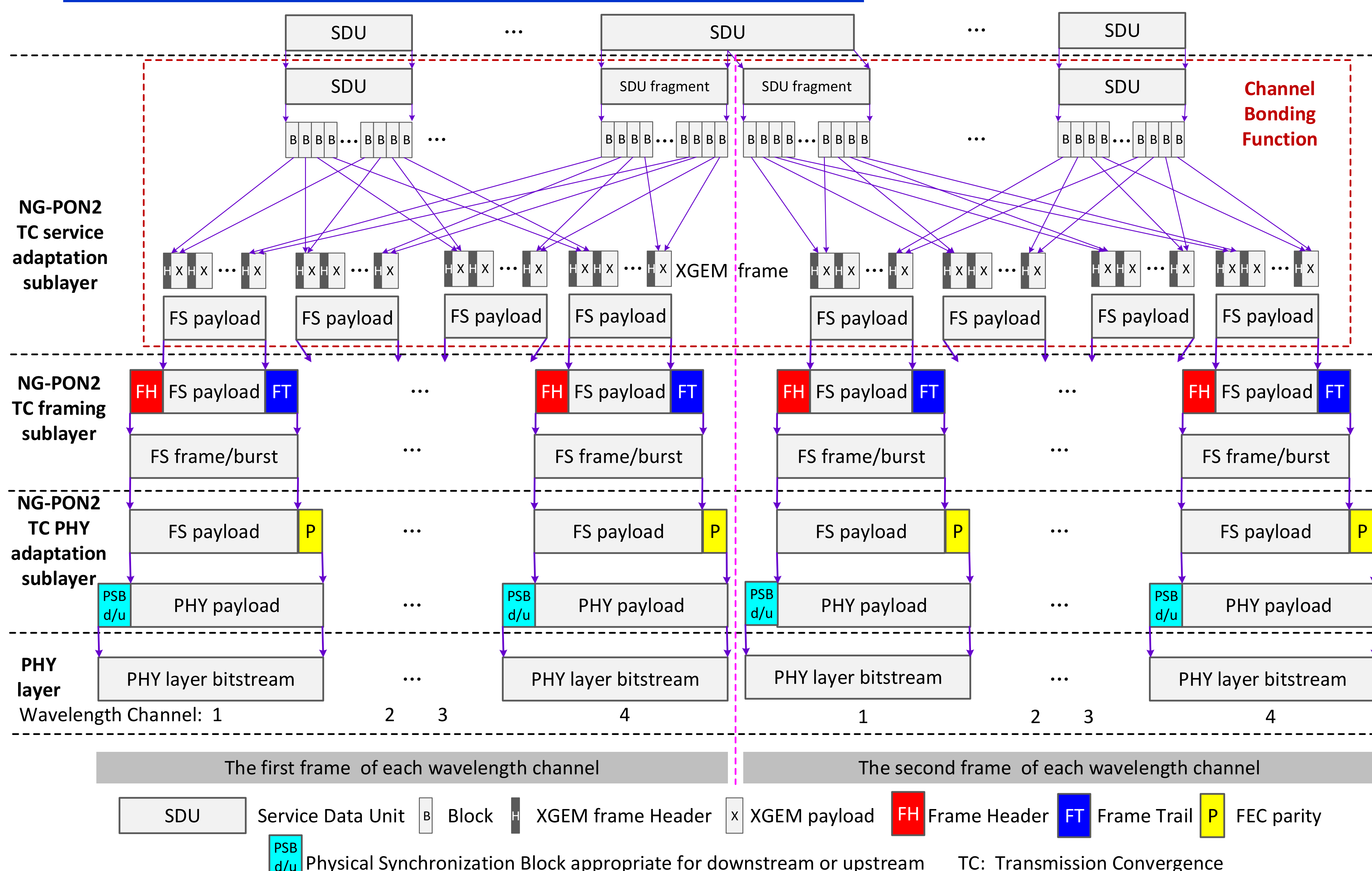


Fig. 4: An example of inter-leaving scheduling for NG-PON2.

Our channel bonding proposal for NG-PON2

- The channel bonding engine operates at the service adaptation sublayer to fulfill several functions [2]:

- 1) dividing Ethernet packets into 8-byte blocks,
- 2) implementing a channel bonding algorithm,
- 3) distributing bonded blocks to the associated channels based on the channel bonding algorithm,
- 4) forming XGEM frames, and
- 5) forming FS super-frames.



[1] “40-Gigabit-capable passive optical networks (NG-PON2): General requirements,” in *ITU-T Recommendation G.989.1*, Mar. 2013.

[2] L. Zhang, Y. Luo, N. Anwari, B. Gao, X. Liu and F. Effenberger, “Enhancing Next Generation Passive Optical Network Stage 2 (NG-PON2) with Channel Bonding,” *2017 International Conference on Networking, Architecture, and Storage (NAS)*, pp. 1-6, Aug. 2017.