

Figure 1 illustrates the functional model of a network element, which includes four virtual concatenated (VC-3, VC-4) ports. These virtual concatenated ports support Ethernet MAC (ETM) links, with a bandwidth as small as 50 [150] Mbit/s and as large as 1050 Mbit/s (with granularity of 50 [150] Mbit/s). At initiation of a virt conc group all member SQ (sequence) numbers are set to the highest value (SQ=255) and all member CTRL (control) fields are set to IDLE.

Two of these ports are VC-4-Xv (X=1..7) ports and two are VC-3-Xv (X=1..21) ports. The VC-4-Xv ports are identified in this example as port groups A and B, each containing 7 ports. The VC-3-Xv ports are identified as port groups C and D, each containing 21 ports.

When there is a VC-4-Xv trail to be set up, a VC-4-Xv call is generated for e.g. port group A in this NE to a port group K in the far end NE. Call parameters include X=2 and diverse routing over two routes.

The Call Controller will forward this call request as two connection requests to the VC-4 Connection Controller:

- *connection request 1* is for a VC-4 virt conc connection set up, with endpoints port group A and port group K and just one VC-4 connection (traffic par.: ST=6, RCC=0, NCC=0, NVC=1, MT=1, T=0, P=0)
- *connection request 2* is for a VC-4 virt conc connection set up, with endpoints port group A and port group K and just one VC-4 connection (traffic par.: ST=6, RCC=0, NCC=0, NVC=1, MT=1, T=0, P=0); additional requirement is to have this virt conc connection diverse from the other one.

This latter requirement implies that ConReq1 and ConReq2 are routed over different STM-N ports. E.g. ConReq1 via the HOVC link supported by the left STM-16 port and ConReq2 via the HOVC link supported by the second STM-16 port. Refer to Figure 2.

Assume that ConReq1 is assigned port A1, and ConReq2 is assigned port A2 (but any other port would also be acceptable).

If e.g. ConReq2 arrives first at the far end NE (Figure 3), then it could get assigned port K1 within port group K (any other port would also be acceptable). When ConReq1 arrives it could get assigned port K2 within port group K.

Now two VC-4 trails are set up: A2-K1 and A1-K2.

A2-K1 is ready first, and will indicate this to the LCAS process in the S4/S4-X_A function in both port groups A and K by clearing their S4_TSF signal. LCAS will assign SQ=0 to the signal transported via port A2 and port K1 and will forward payload over this port... an Ethernet MAC link with 150 Mbit/s capacity is now available.

Then A1-K2 becomes available. The A2 and K1 ports will indicate this by clearing their S4_TSF signals. LCAS will assign SQ=1 to the signal transported via port A1 and port K2 and will add the new member... the Ethernet MAC link capacity is now increased to 300 Mbit/s.

The Ethernet MAC link capacity can be further increased by setting up one or more VC-4 trails between port group A and port group K. E.g. when the link capacity must be increased to 450 Mbit/s, the Call Controller receiving this INCREASE request, will e.g. decide to modify the bandwidth requested by ConReq1 (1 VC-4 → 2 VC-4); traffic par.: ST=6, RCC=0, NCC=0, NVC=2, MT=1, T=0, P=0.

Assume that port A3 and K3 are selected as endpoints for this VC-4 trail. After the A3-K3 trail is set up, the A3 and K3 ports will clear their S4_TSF signals and their LCAS processes will add the third VC-4 as member and forward payload over this port. The A3 and K3 ports will then transport a signal which includes SQ=2. Refer to Figures 4 and 5.

When the connection A1-K2 would be interrupted, A1 (and K2) will activate their S4_TSF signal and the LCAS processes co-ordinate the blocking of those ports for Ethernet traffic forwarding. During this period of signal fail it will be sending CTRL=DNU (instead of CTRL=NORM). See Figure 8.

When there is less capacity required (DECREASE request) it could be decided to remove the A2-K1 trail. As part of this removal action, the SQ numbers get adapted... A3-K3 would get SQ=1 (was: SQ=2). When the A1-K2 trail is not longer used (CTRL=IDLE), ASON/GMPLS [or NMS] can release it.

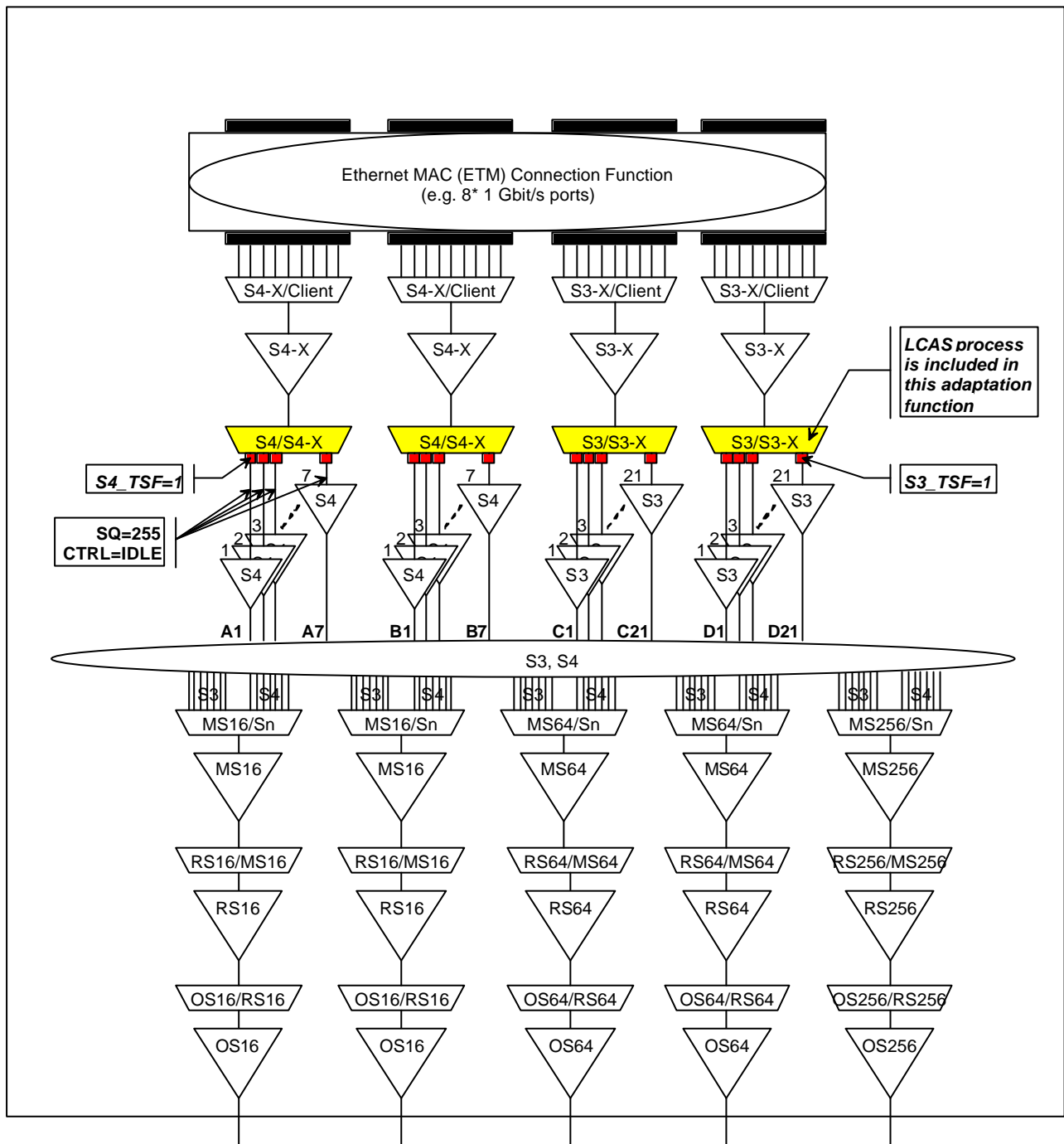


Figure 1 - Functional model fragment of network element with virtual concatenated HOVC ports

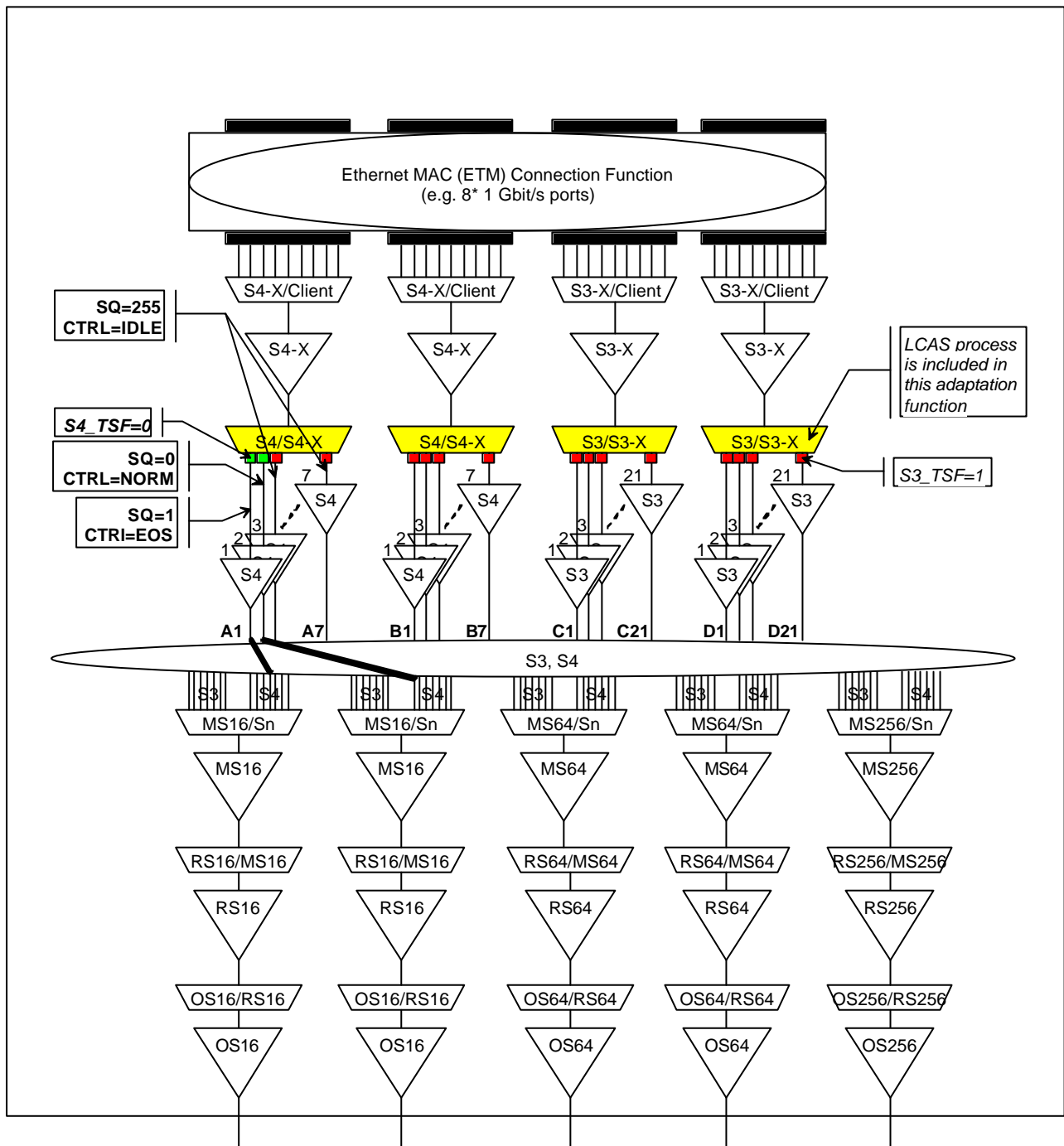


Figure 2 - VC-4-Xv (X=2) via diverse routes

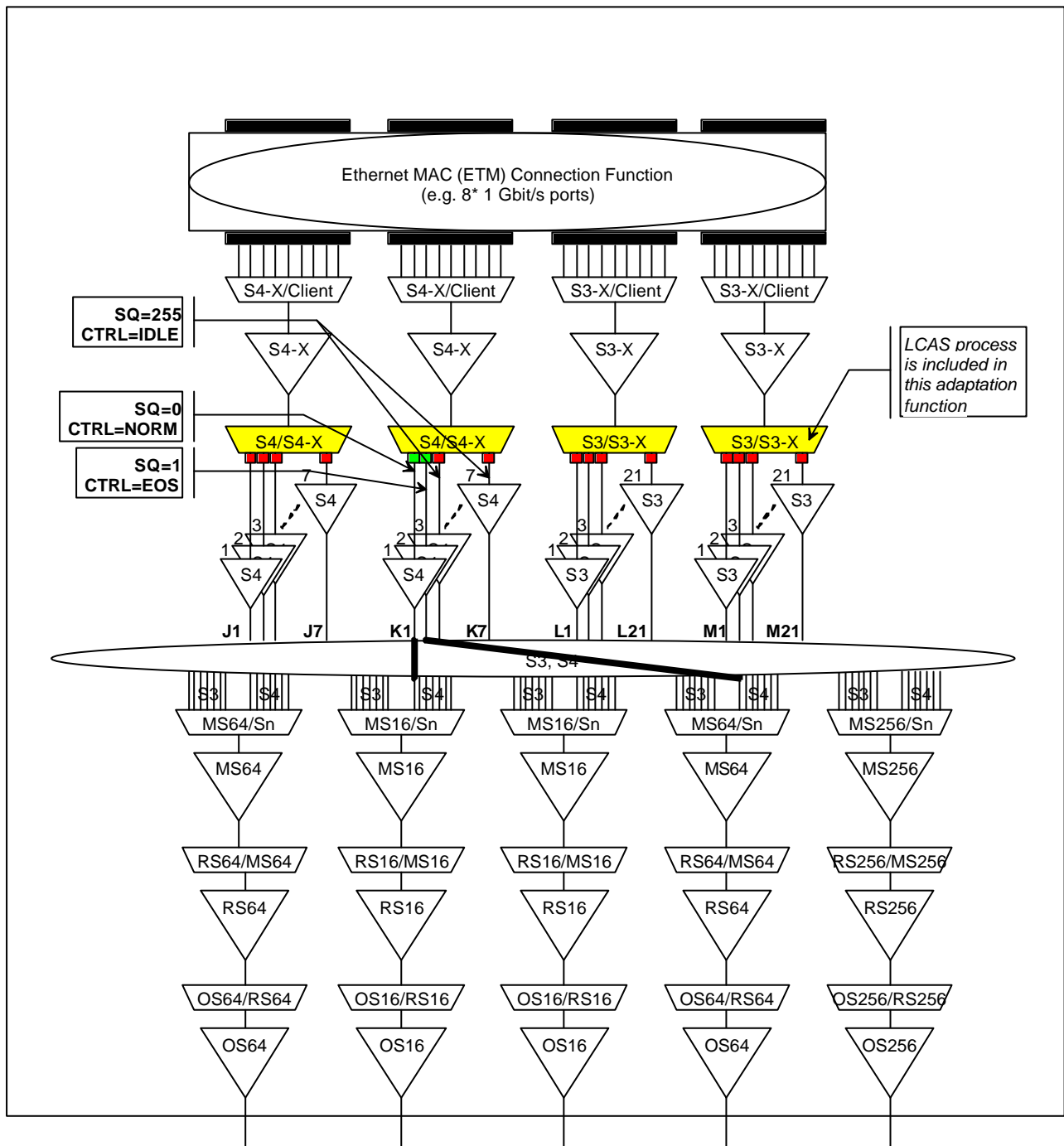


Figure 3 - Far end NE with port group K

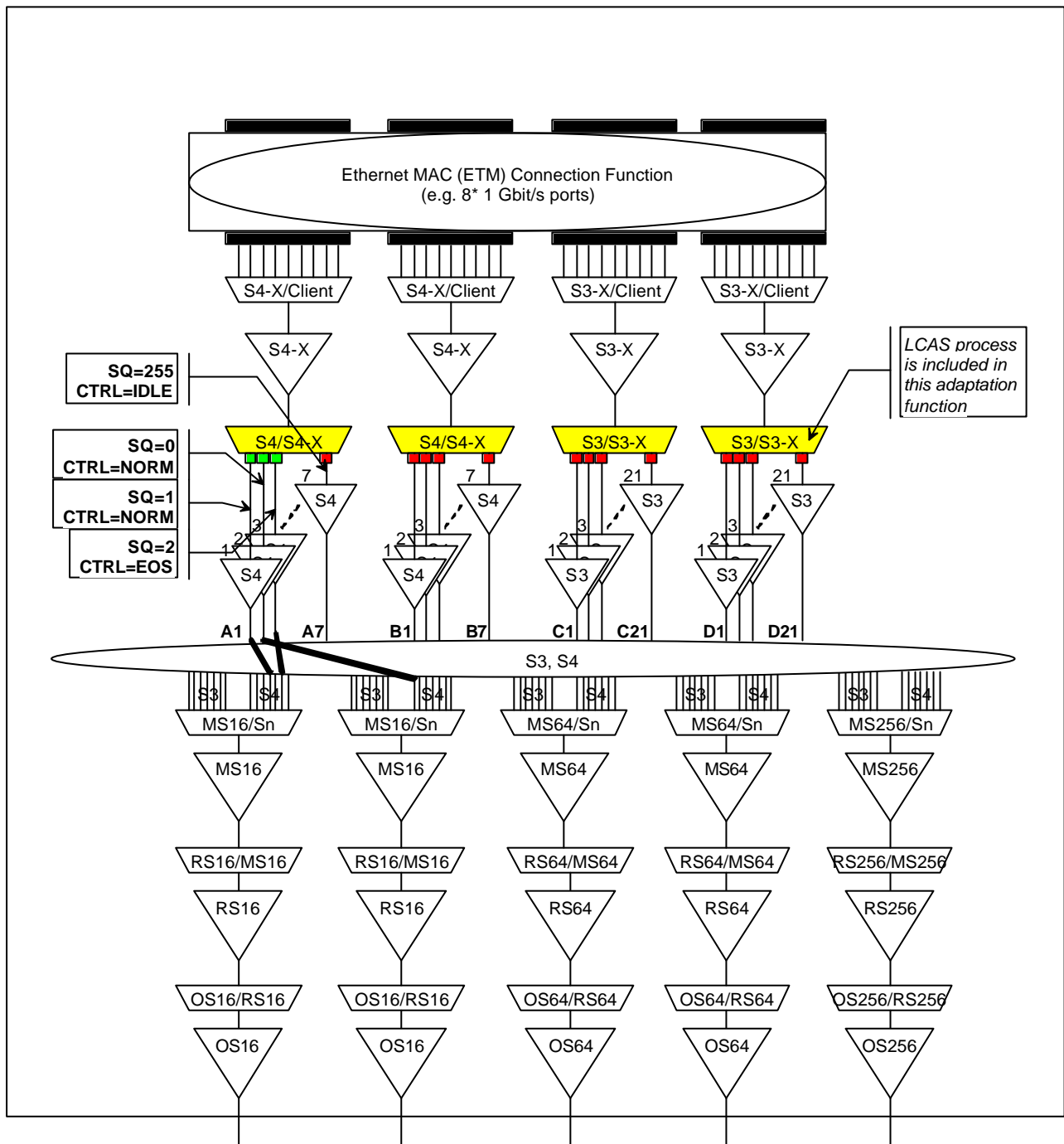


Figure 4 - VC-4-Xv (X=3) via diverse routes

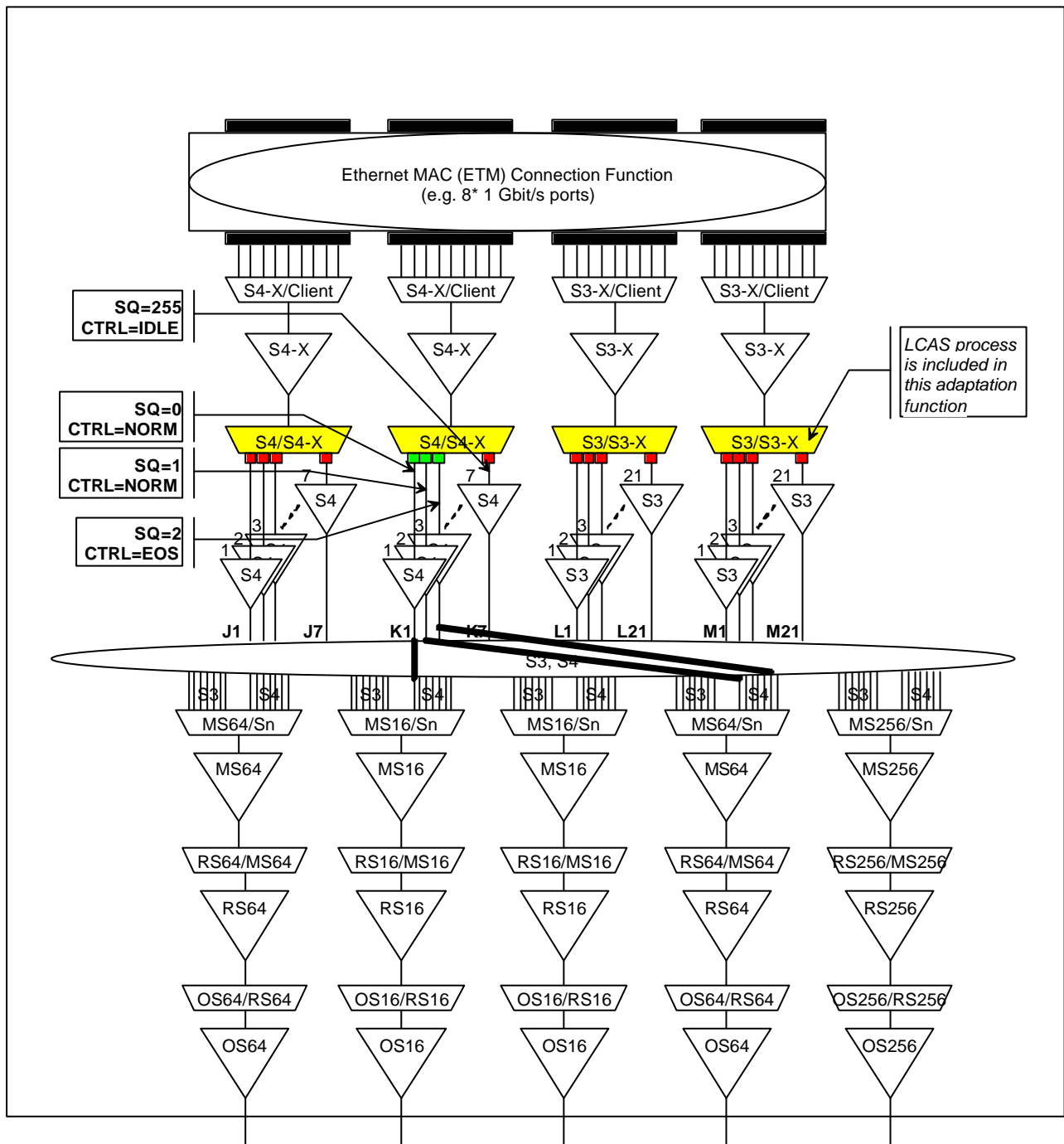


Figure 5 - Far end NE with port group K and VC-4-Xv (X=3)

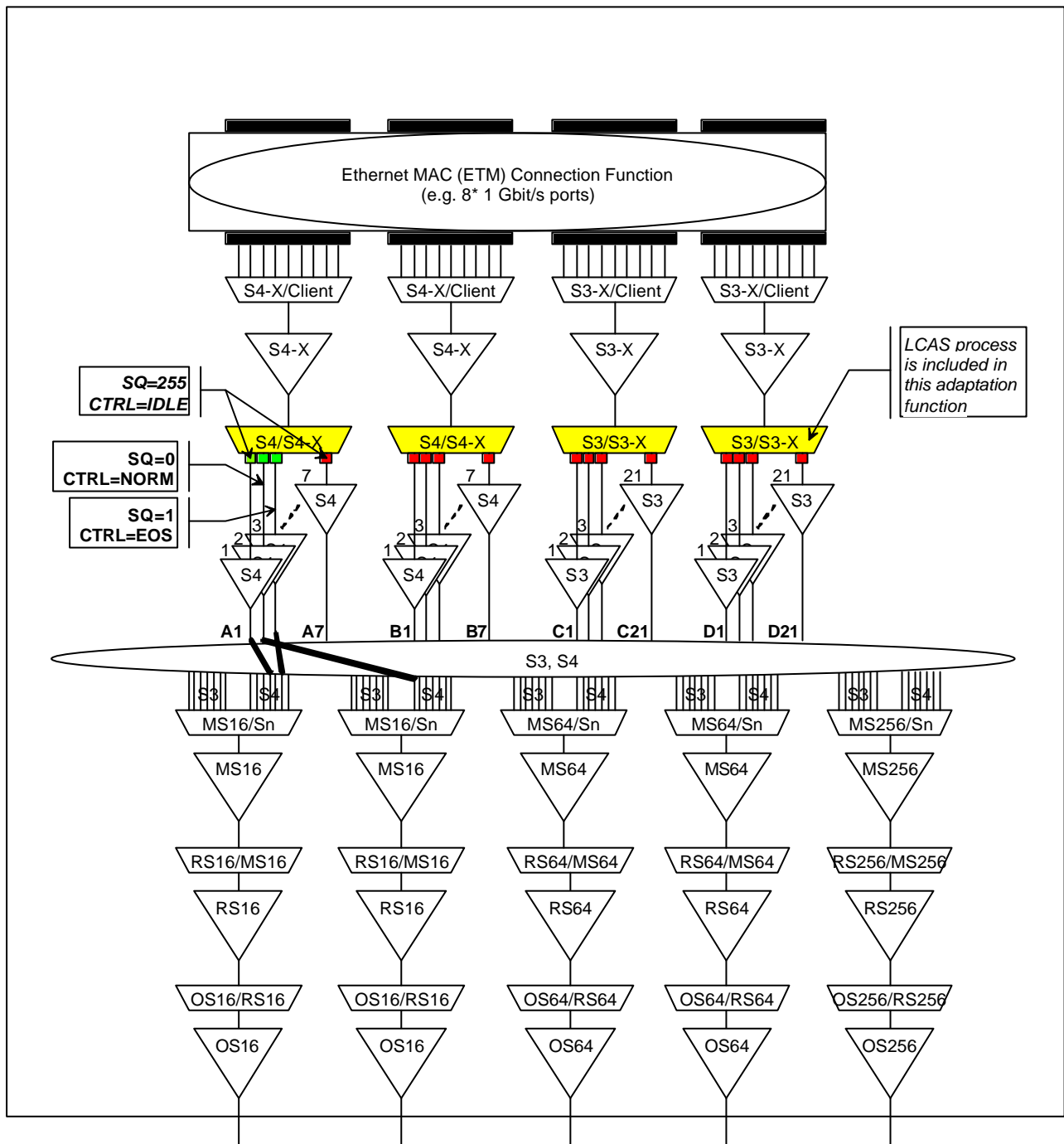


Figure 6 - Near end NE with port group A and VC-4-Xv before A1-K2 trail is released and after LCAS has decreased the bandwidth

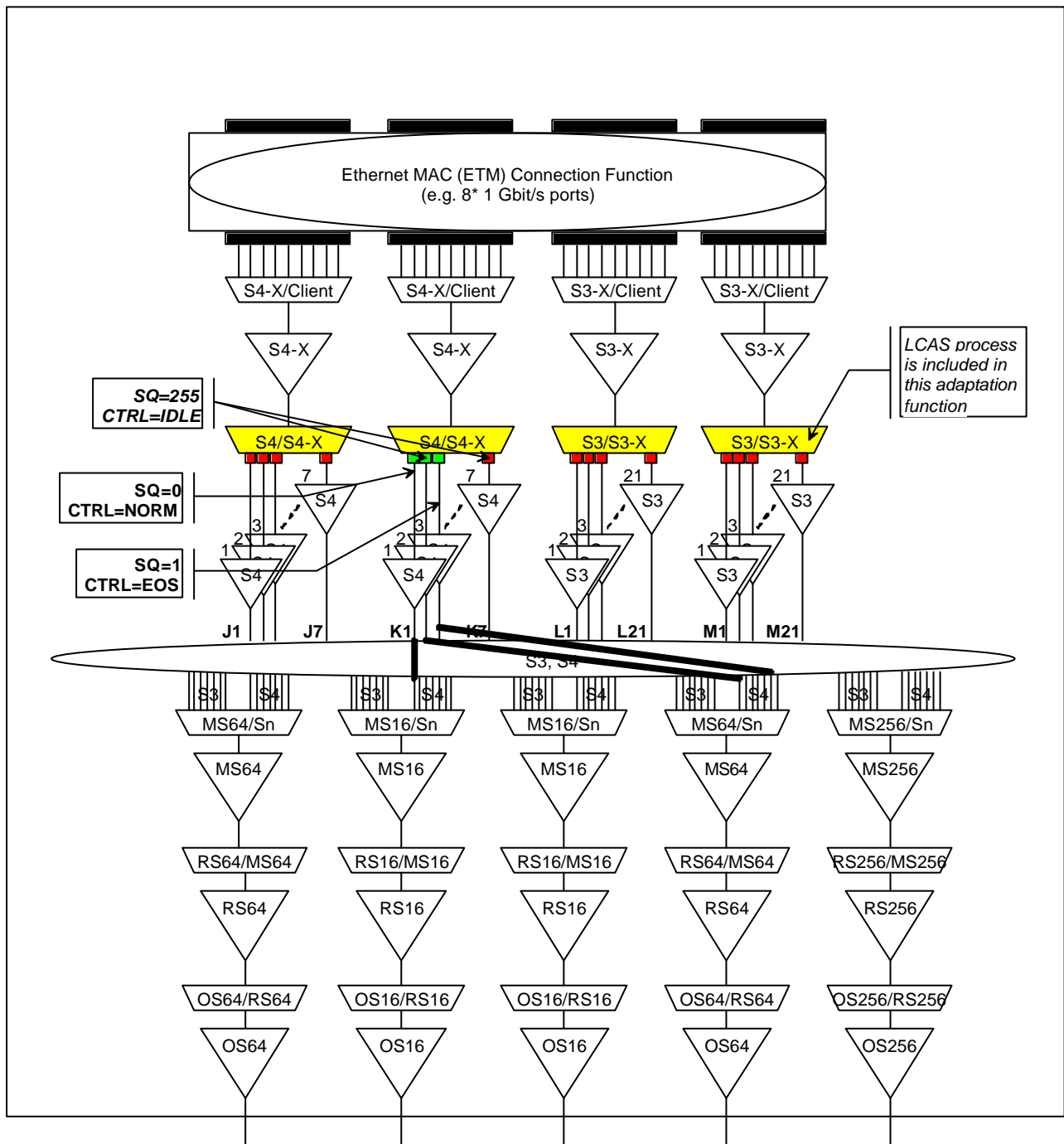


Figure 7 - Far end NE with port group K and VC-4-Xv before A1-K2 trail is released and after LCAS has decreased the bandwidth

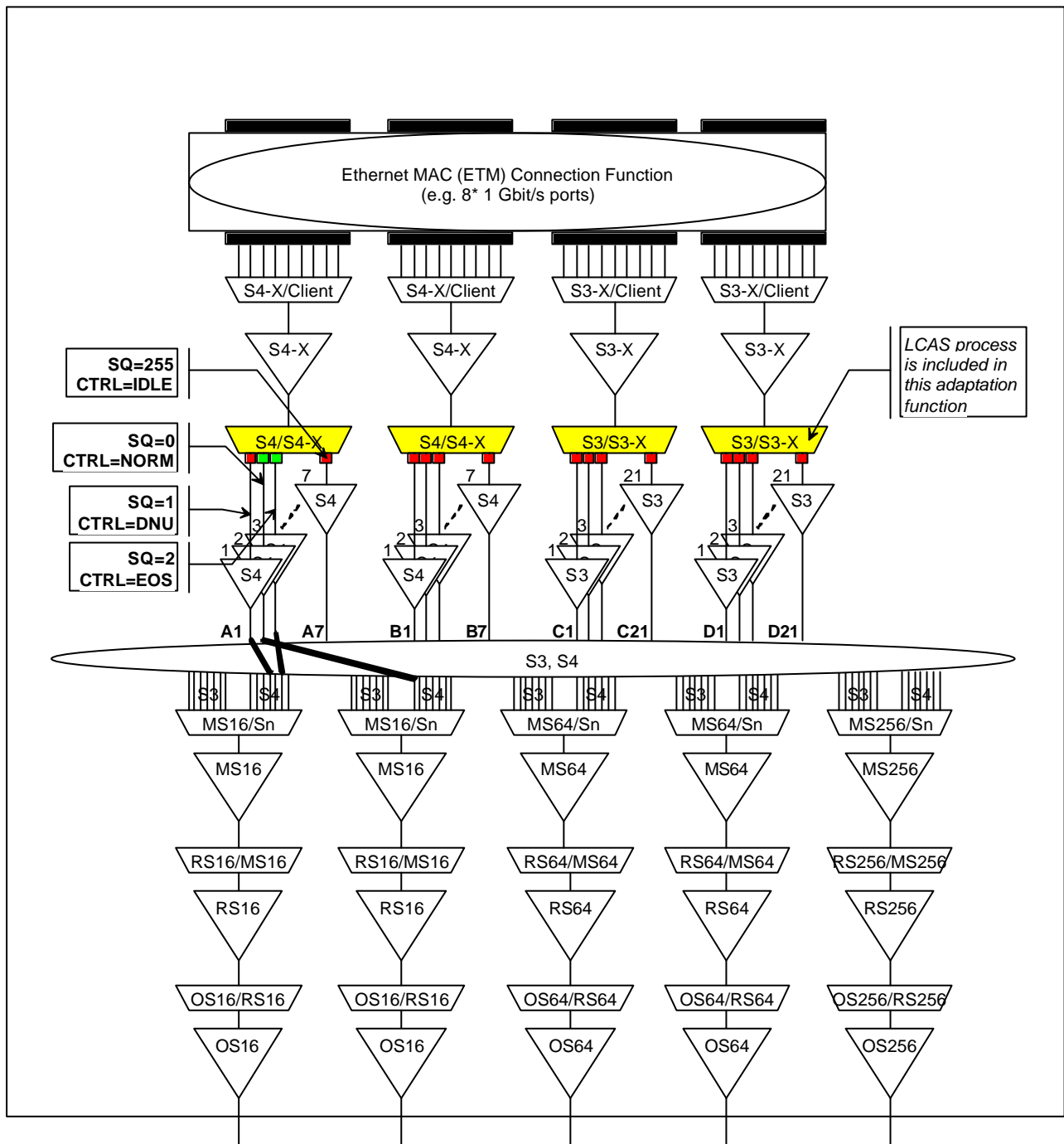


Figure 8 - VC-4-Xv (X=3) with route A1-K2 failed