Loop aggregation:

Improving efficiency of the loop aggregation technique for copper EFM

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Goal

Increasing efficiency of EFM systems using loop aggregation

- **This presentation relates only to the schemes where loop aggregation is performed prior to the HDLC encoding.**

Background

- **All the considered techniques of loop aggregation segment the transmit Ethernet packets into several fragments, and add a specific "aggregation overhead" of several bytes to each them in the aim to identify the sequential number of the fragment at the receive site for proper reconstruction.**

- **Since loop aggregation is agreed to be an option, and is expected to appear only in rather specific deployment scenarios, it would be convenient to avoid aggregation overhead if no loop aggregation is applied.**

Proposed solution

- **Attach aggregation overhead only in the cases when loop aggregation takes place**
- **Convey a specific indicator to the CPE when loop aggregation takes place, informing that aggregation overhead is attached to the transmitted fragment**

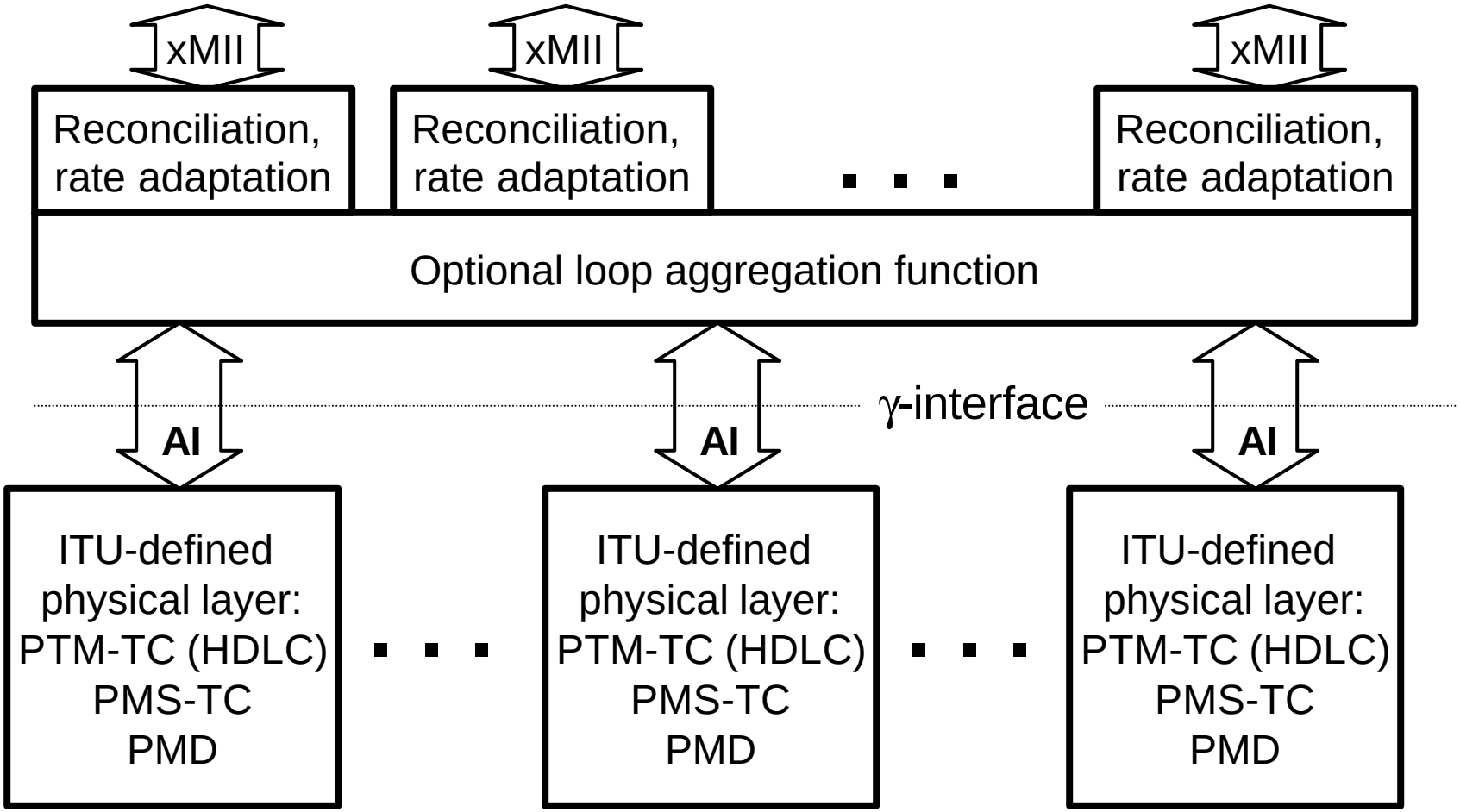
Possible techniques

- **By an OAM message from the upper layers - requires a two-step link activation: first to activate a single loop to convey the message and then a multi-loop, or vise versa.**

- **By an OAM message from the physical layer - confusing for the OAM layering, since loop aggregation function is on the layer above the PL OAM system**

- **By introducing an Aggregation Indicator (AI) into the HDLC header - seems to be simple and convenient**

More details: system architecture



Possible implementation

- **Introduce a AI bit into the HDLC Control field to indicate that the particular loop is a part of a loop aggregation scheme.**
- **If AI is received, the first N data octets delivered by the HDLC frame are interpreted at the receive site as the aggregation header and discarded upon reconstruction of the original Ethernet frame**
- **If AI is not received (no loop aggregation involved), all data octets delivered by the HDLC frame are read as the transported Ethernet frame**

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Current status

- **Currently, ITU-T doesn't specify any particular use for Address and Control HDLC fields:**

  ITU-T G.993.1:
  "The Address and Control octets are intended for auxiliary information. They shall be set to their default values of hexadecimal FF and 03 respectively if not used.
  NOTE: The address and Control fields may be used for different auxiliary OAM functions. The usage of these fields is for further study."

- **EFM SG may request the ITU-T SG15/Q4 to assign a specific bit of the Control byte to carry the AI (Q4 recently opened *G.bond* project to support loop aggregation)**

Conclusion

- A specific header supporting loop aggregation reduces the throughput of the Ethernet transport and brings implementation overhead, which is not justified for single loop deployments (happens to be the most popular)

- Introducing an Aggregation Indicator (AI) bit into the HDLC header can avoid this inefficiency. The AI is assigned by the Loop Aggregation function to the HDLC encoder of each aggregated loop via g-interface. If no aggregation takes place, the HDLC header will be set to its default value (FF,03)

- Introduction of AI bit may be adopted by ITU-T because currently no use for HDLC Address and Control fields is specified

Proposed motion

- **Introduce an Aggregation Indicator (AI) into the HDLC header to indicate that the particular loop is a part of the transmission scheme utilizing loop aggregation**