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## Interworking issues between 10GBE WAN and existing transmission network

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## introduction

- The problem of mapping 100 ppm 10GBE WAN in OTN G.709 frames has been discussed during the last IEEE plenary meeting in March.
- The purpose of this presentation is to show that this 100 ppm specification will impact interworking with other type of equipment that are already deployed in transmission networks.

## Network considerations

- 10GBE specifies a WAN application with an OC192 frame in order to provide interconnection between distant equipments such as routers.
- The existing transmission network is now based on 2 layers, SONET/SDH and DWDM.
- In a near future, OTN and all optical networks will be introduced

## Expected problems with 100 ppm 10GBE WAN

- In March, it has been shown the impossibility to map 100 ppm 10GBE WAN inside the new G.709 frame.
- The SONET/SDH physical layer has been specified more than 10 years ago with an accuracy of 20 ppm. All existing SONET/SDH interfaces have been specified to accept signals within 20 ppm but not 100 ppm

## Expected problems with 100 ppm 10GBE WAN

- This impacts the following equipments:
  - SONET/SDH equipments
  - DWDM with their SONET/SDH interfaces
  - OTN G.709 equipments
- Many problems can be expected when OC192 10GBE WAN customers discover they cannot transport this signal through existing transmission network.

# Solutions

- 2 solutions
  - adapt 10GBE WAN to SONET/SDH
  - adapt SONET/SDH to 10GBE WAN
- note: ELTE if they exist at OC192 level cannot be considered as a good solution since this would require insertion of a new equipment in the network: this raises questions on management, spacing and redundancy issues.
  - And since this equipment would have a 20ppm oscillator, why not put it directly in the OC192 source?

## Solution 1: adaptation of 10GBE WAN

- Insert a 20 ppm option to the WAN application of 10GBE
  - logical, new equipments take care of existing ones
  - easy and inexpensive to implement, as discussed in March: the oscillator generating the 10GBE WAN frame is the only required modification; all other functions impacted by the frequency accuracy, clock recovery, FIFO, etc work within 20ppm since specified to work within 100 ppm

## Solution 2: adapt SONET interface to 100 ppm

- Clock recovery of input OC192 interfaces need to be redesigned to accept 100 ppm
  - this means replacement of equipments already in the fields
- input signal must be adapted to SONET/SDH frequency. The SDH frame allows 1 pointer event each 4 frames: pointer processors could accept 100 ppm deviation, but this has never been requested nor tested. Test equipments are not even qualified for that.

## Solution 2:adapt SONET interface to 100 ppm

- Once passed through a pointer processor, the new frame is within 4.6 ppm with 100 pointer rate and can be transported through SONET/SDH .
- Only the equipment extracting the payload from the 10GBE may present unexpected rate of pointers and high level of wander but this is to the terminal equipment to take care of the client requirement.

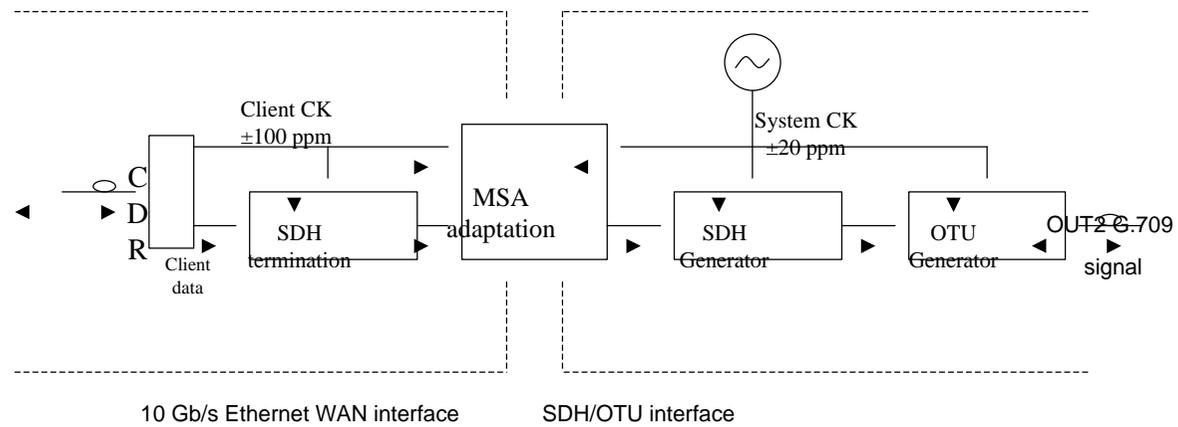
## Solution 2: adapt DWDM equipments

- OC192 clock recovery should also be modified to accept 100 ppm.
- This implies redesign and update in the fields.

## Solution 2: adapt G.709 OTN

- OC192 clock recovery should also be modified to accept 100 ppm
- The SDH layer is not accessed in an OTN equipment: it is only mapped in the OTN frame. Adaptation means(see figure on next page):
  - terminate (sink) of an OC192
  - process the SONET/SDH pointer
  - terminate (source) of a new OC192 frame

# Required modifications in OTN NE



## Complexity of adapting an OTN NE

- Implementation of such modification is estimated to be about 400K gates.
- The total complexity of the adaptation is
  - redesign new clock recovery
  - design a new 400K gates ASIC
  - management of a new layer in OTN NEs, adding complexity to the network manager

## conclusion

- These slides have shown how complex , expensive and time consuming it will be to use the current 10GBE WAN interface in existing transmission networks.
- These interworking problems will severely impact the use of 10GBE WAN when customers discover it is not compatible with OC 192 interfaces.

## Conclusion and proposal

- Replacement of a 100 ppm oscillator by a 20 ppm one is not a large modification.
- Adaptation of SONET based NEs to 100 ppm has been shown to be very complex
- It is requested that 10GBE WAN application has a 20 ppm option so that customers and operators will not face interworking problems in their existing networks.