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Exercises in PMMC

Exercise 4

Hand out date: Wednesday Oct 19, 2016
Submission until and discussion: Oct 26, 2016 9:45

1) SDH, SONET

1.1) Explain the structure of a STS-1 Frame (in particular, with respect to size, payload, and overhead)

1.2) Calculate the effective bandwidth (bandwidth that can actually be used to transmit user data) of a STS-3, STS3c, STS-12 and STS-12c channel. The slide on this matter presented in the lecture of October 14th can be found as a seperate download on the exercise page.

1.3) Which data fields in a STS-1 frame are used to point to the position of the payload. Why is it implemented that way? In which overhead type are these fields located?

1.4) What is the difference between OC-N, STM-M, and STS-X?

1.5) What means “protection” in SDH/SONET? Use a concrete network topology to explain how it works.

2) WDM

2.1) What is the difference between an optical add/drop multiplexer (OADM) and an optical cross-connect (OXC)?

2.2) Sketch a WDM topology with five locations, where three of these are redundantly connected. Each link must carry the same two wavelengths and every two locations may only be connected by at most one link. Where does an OCX have to be placed, in order to ensure end-to-end commections between any two locations.

3) Payload

3.1) A digital picture with a resolution of 1400x1050 pixels and a pixel depth of 24 bit has to be transmitted via UDP over a 100Mbit/s ethernet channel. Assume optimal conditions for the transmission (no collisions, no propagation delay), a MTU of 1500 Byte, no IP-options chosen, and preclude fragmentation. Calculate the transmission delay while taking into the account the overhead caused by the protocols.