November 2022 FSAN Technology Workshop
Call for Contributions

Oct 12, 2022

FSAN Management Committee

Logistics

- The purpose of the workshop is to study the implementation and operational complexity of the recently proposed features of the HSP PON systems, quantifying and weighing the potential benefits against the added complexity, and interoperability testing implications.
- The representatives of system and component vendor community, the research community, and the interoperability testing lab community are invited to participate.
- Execution of the FSAN consultant agreement is a prerequisite for participation.
- Each contributor is expected to give a 15 min presentation per topic allowing ample time for discussion.
- The conclusions of the workshop will be presented to the ITU-T Q2/SG15.
- For the items emphasized with blue font, the input from the SoC/FPGA and/or optical component vendors is specifically sought.

Schedule

FSAN workshop will be held over two days (with an extension to be scheduled if necessary):

Session 1: Thursday, November 10,

Session 2: Monday, November 14.

Considering that the standard time will be restored wherever the daylight savings time is in effect now, the time slot per time zone will be:

US Pacific (Seattle):	5 a.m. to 8 a.m.
US Eastern (New York):	8 a.m. to 11 a.m.
UTC (London):	13:00 to 16:00
Central European (Paris):	14:00 to 17:00
China Standard (Beijing):	21:00 to 24:00
Japan Standard (Tokyo):	22:00 to 01:00

Confirmation of the intent to present, the preferred presentation slot, and the outline of the presentation are expected by the EOB of November 3. Post-deadline changes are allowed until the final submission, which is due 24 hours before the target session.

Intellectual property policy (per FSAN Charter)

- Each Participant grants a copyright license to any materials contributed by such Participant in order to allow deliberations and, if accepted, inclusion in a submission to an SDO.
- By making a contribution to FSAN, a Participant agrees that, if a work item based on the contribution is submitted to an SDO, the Participant shall be subject to that SDO's patent policy. Alternatively, the Participant shall, prior to submission of the work item to the SDO, identify and request to withdraw the portions of the work item that it does not want to be subject to the SDO's patent policy.
- There is no obligation of confidentiality in any materials submitted or discussed in FSAN. Materials submitted with confidentiality markings may be rejected to require removal of the marking.

Workshop Agenda

1. Complexity, operational and interop implications of upstream flexible FEC
2. Complexity, operational and interop implications of downstream flexible rate
3. Intergenerational coexistence of PON systems

Note: Operators consider the upstream aspect of the flexible rate proposal to be a future work item and focus the workshop scope on the downstream aspect.

Complexity, operational and interop implications of upstream flexible FEC

- Evaluate the complexity for the OLT and ONU operating 3 FEC code variants for each supported line rate
  - This includes the OLT complexity of switching between different FEC codes on per-burst basis
- For the high margin FEC code, which is meant to compensate for out-of-spec OPL or increased optical path impairments, evaluate its benefits, considering the code applies in the upstream direction only, whereas the downstream FEC remains fixed
- Explain the mechanisms to control the switching of FEC codes
  - Explore both high margin and high throughput FEC code variants
  - Are these mechanisms exclusively OLT-based, or may/must the ONU take its share in supporting them?
  - What real-time parameters can the OLT and ONU monitor to drive the decision? Are the existing parameters, such as BER or RSSI, sufficient, or should new parameters be specified?
  - What are the implications for interoperability and testing of interoperability of those mechanisms?
  - Is switching of the FEC codes fully autonomous; or if not, what interfaces does the operator have to make the decision?
  - How can the dynamic stability of the FEC switching mechanisms be characterized?
- Fixed coding gain in the upstream is known to be difficult to measure. What kind of lab experiment can be performed to demonstrate and quantify the improvement obtained from the variable high-margin and high-throughput codes?
- Are there other important points with regard to upstream flexible FEC that you would like to bring up?

Complexity, operational and interop implications of downstream flexible rate

- Operators understand that the concept of downstream flexible rate applies to *nominal line rate* and, therefore, implies specifically flexible modulation
- Evaluate the complexity of the OLT and ONU operating two modulation formats, NRZ and PAM4, and switching between those formats multiple times per 125 us frame.
- Is it guaranteed that the legacy G.9804.2 ONUs remain fully operational in a DS flexible rate context?
  - How can a legacy ONU stay synchronized to multi-modulation PHY frame?
  - Describe the impact of the flexible rate on the TC layer specification, including the HSP frame structure (G.9804.2) and specific adjustments, such as a DS bandwidth map, FEC codeword changes, etc.
  - Are these adjustments transparent for the legacy HSP ONUs?
- Describe the impact of flexible rate on OLT PMD specifications
- Describe the possible limitations of the OPL in which DS flexible rate will be applicable
- Are there other important points with regard to downstream flexible rate that you would like to bring up?

Intergenerational coexistence of PON systems

- The intent is to include WDM as well as TDM coexistence
- With the optional-to-support OOB PSD constraints introduced into G.987.2, G.9807.1 and G.9804.3 by the September SG15 Plenary, which combinations of ITU and non-ITU PON systems can coexist on the same ODN? What are the remaining gaps in supporting feasible system coexistence combinations?
- Evaluate the complexity impact on the PON transceivers supporting the new OOB PSD constraints.
- Describe consequences of the 4 nm 3rd window (1284 – 1288nm) on the PMD of the system elements
  - Will Tx sorting be needed
  - Will temperature control be needed
    - Will coolers at the ONU be needed ?
- Elaborate on any foreseen crosstalk issues and impact on filter complexity
- Elaborate on migration paths from current WMD1r or CEx
- Elaborate on migration paths from WDM MPM to accommodate the third system
- Elaborate on triple generation hosting MPMs
  - If pure WDM
  - If mixing WDM and TDM, two DS WL sharing a common US WL

Intergenerational coexistence of PON systems

- Would it make sense to study for HSP the extension of the basic and optional wavelength sets used in the XG/XGS series?
- This requires a definition of three coexistence capable WL sets to enable triple pure WDM coexistence. This would include all DS wavelengths in the O band, together with the three upstream WL bands:
  1. 1260 – 1280 when re-using the XG/XGS basic WL set
  2. 1290 – 1330 when re-using the XG/XGS optional WL set
  3. 1284 – 1288 nm window for upstream band as the HSP third system