40G/100G Optical Transport Network Recovery and Disruption Time Measurement

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Backbone and metro networks that support optical transport network technology (OTN as per ITUT G.709) carry many independent channels over different wavelengths on a single optical fiber. With up to 100 Gbit/s per channel, OTN-based networks can transport legacy as well as packet-based services over the same network for better bandwidth efficiency and network scalability. However, performance requirements are increasingly stringent making the testing and qualification of these transport networks more challenging.

Today, network operators require network survivability measures to ensure recovery in the event of failure. They also need proactive operational measures for network scalability or maintenance upgrades. This highlights one of the primary values enabled by OTN mesh-based networks: the rapid rerouting of traffic connections around unforeseeable network failures. Network survivability at the OTN layer has the benefit of addressing root failures with a minimum number of recovery actions and preventing failures from propagating through higher layers in the network. The result: significant time and money saved.

This application note outlines the OTN service disruption time (SDT) measurement approach housed in EXFO's FTB-85100G (40G/100G) Packet Blazer. This module addresses the lab testing and qualification of 40G/100G OTN transmission systems and field commissioning procedures for system manufacturers and network operators respectively.

The FTB/IQS-85100G SDT feature is designed to measure the duration of a disruption on a received OTU3/OTU4 signal. The function monitors the presence of a specific defect on an OTN layer to ensure that network survivability mechanisms managed by the control plane can recover the impacted optical path and its traffic within the 50 ms industry standard. Table 1 lists the supported and user-selectable network layers as well as their corresponding "defect selection" under the OTNSDT function.

Layer	Defect
OTL	LOF, OOF, LOL, LOR, OOR, Inv. marker, FAS
FEC	FEC-CORR, FEC-UNCORR
OTU	AIS, LOF, OOF, LOM, OOM, BDI, IAE, BIAE, BIP-8, BEI, FAS, MFAS
ODU	AIS, OCI, LCK, BDI, BIP-8, BEI, FSF, BSF, FSD, BSD
OTU	AIS, CSF
Pattern	Pattern loss, bit error

Table 1. OTNSDT Layers and Triggers

When the SDT function is activated, it scans for defects. The measurement is triggered when a defect is detected, as shown in Figure 1. The test period is initiated and the SDT begins to measure the time spent in the Test Period window for the duration of the disruption. When no defects are detected over a period exceeding the No Defect Time, which is user-configurable, the SDT stops measuring. The SDT measurement is then calculated as the time between the detection of the first defect and the end of the last defect. The SDT measurement does not include the No Defect Time; this is considered as a single measurement cycle. At this point, the SDT feature is automatically reset for another measurement.

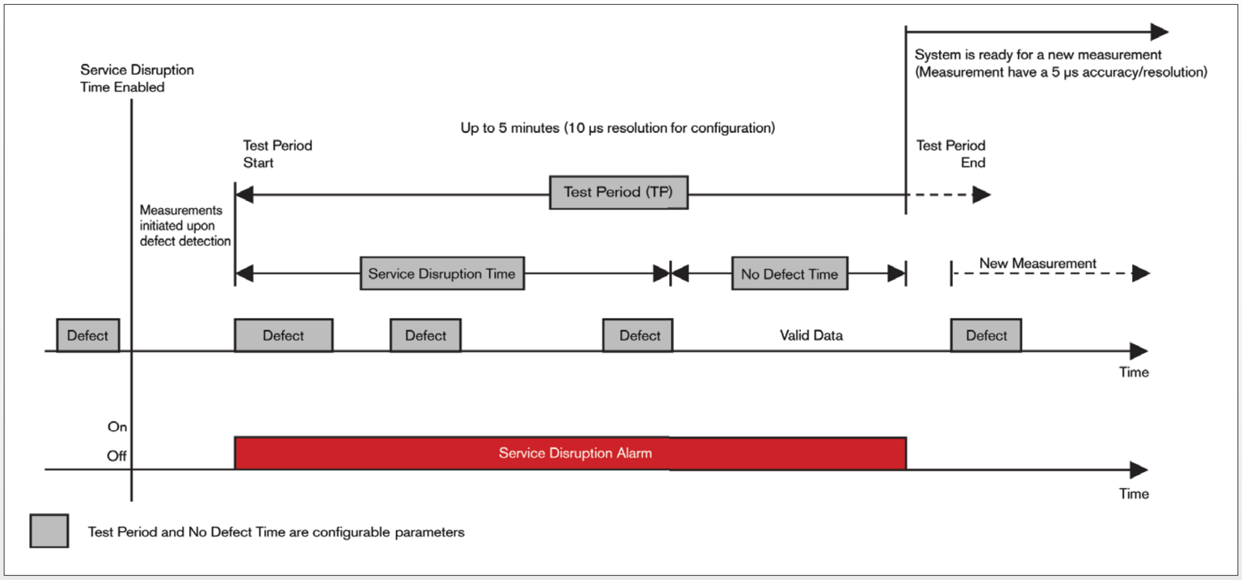

Figure 1. SDT Test Period and No Defect Time

The main advantage of EXFO's SDT feature is its precision and ability to identify multiple disruptions on a network, even when they occur within a short span of time. This is controlled via the user-configurable No Defect Time parameter, which is automatically set to 300 ms and supports values between 2 μs and 2 s.; as shown in Figure 2. The No Defect Time defines the threshold that is used to determine when it is safe to report that a defect is no longer present. When properly configured, it allows the FTB-85100G Packet Blazer to correctly terminate the Test Period window and be ready for the next defect. In a situation where multiple disruptions are present and the time between defects is less than the No Defect Time, a single disruption is reported.

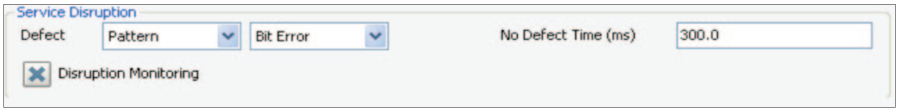

Figure 2. SDT Trigger (Defect) and No Defect Time Configurations

The FTB-85100G SDT feature also supports a parent defect approach, where the SDT measurement is triggered when other specific defects, on that layer or higher, are detected–eliminating the need for the user to manually select different defects at their corresponding layers. The SDT function supports multiple statistics, as shown in Figure 3. These statistics include the shortest, longest, last, average and total duration of all the disruptions. All SDT measurements are provided with a resolution of 1μs for all supported OTN layers.

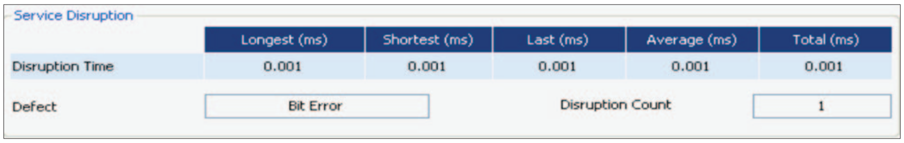

Figure 3. SDT Statistics

CONCLUSION

Optical transport networks are the most robust transport solution available. The 40G/100G transmission systems that are being deployed today will continue to be the best choice for carriers who want a stable and resilient method of delivering next-generation services. EXFO's FTB-85100G Packet Blazer SDT function provides the precise measurements required to benchmark OTN-availability in carrier labs as well as in the field, setting a new standard in 40G/100G high-speed test and measurement solutions.

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