

Retrospection on Gigabit Passive Optical Network (GPON)

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Abstract- Gigabit Passive optical Network has been summarized in this paper. Gigabit Passive Optical Networks is a fiber access technology used to distribute high-speed voice, data and video services to suburban and occupational businesses. GPON mechanisms on a point-to multipoint right to use appliance through inert splitters in the grit flow link, authorizing any solitary grit suckle commencing the supplier's significant workplace to help numerous ménages and establishment.

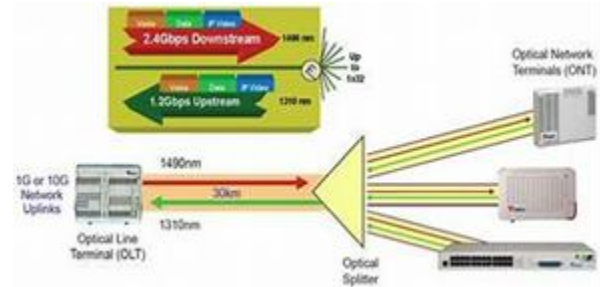
Indexed Terms- Gigabit Passive Optical Network (GPON).

I. INTRODUCTION

GPON stands for Gigabit Passive Optical Networks. GPON is precise by means of ITU-T authorization series G.984.1 over G.984.6. GPON can conveyance Ethernet, as well ATM and TDM (PSTN, ISDN, E1 and E3) circulation. GPON network comprises of chiefly two dynamic spread tools, that is to say- Optical Line Termination (OLT) and Optical Network Unit (ONU) or Optical Network Termination (ONT). GPON ropes triple-play services, high-bandwidth, long reach (upto 20km), etc.

A particular grit starting the OLT drives towards a submissive Visual Splitter (passive means, it does not need any power to function) which is situated close the operators' sites. The Optical Splitter just splits the ocular control into N distinctive streams in the direction of the hands. The Ocular streams can be at variance amid 2 to 128. Starting the Visual Splitter, single mode (SM) grit essentials trail to all users. GPON accepts two multiplexing mechanisms- a) in

downstream direction (i.e. from OLT to users), data packets are conveyed in a broadcast way, nonetheless encryption (AES) is used to avoid eavesdropping, b) in upstream direction (i.e. from users to OLT), and data packets are conveyed in a TDMA way.



II. GPON EVOLUTION

Alike to the XDSL technology which has been developing, the GPON technology is also place in recurrent community inspection. The succeeding necessities still want to be talked:

- Fresh kinds of facilities with advanced statistics taxes brand the GPON technology overstrained in terms of bandwidth.
- Fresh user-side access technologies retain growing the operator access bandwidth, version GPON as a bandwidth block.
- The splitting proportion and communication space are in quantity to the network building asset.

There are numerous predictions on the GPON development roadmap. We will chat around a usually-documented development tendency.

Next to GPON will originate the 10G PON eras which is also called NG-PON Phase 1, counting XG-PON and XGS-PON. Then, there will be the 40G

PON age containing the time wavelength division multiplexing (TWDM) PON technology, which is also called NG-PON Phase 2.

- XG-PON: 10G GPON unequal manner (downstream streak proportion: 9.953 bit/s; upstream streak proportion. 2.488 bit/s)
- XGS-PON: 10G GPON symmetric manner (downstream and upstream streak proportions: 9.953 bit/s)
- 40G TWDM PON: flowing 10G GPON wavelengths to provision bandwidth up to 4 x 9.953 bit/s

The growth tendency and supplies of advanced bandwidth networks are confronted with numerous tests. For instance, the wavelength variety of 40G TWDM PON is thin and needs severe visual connection budget. This is a crucial problematic to be solved.

Temporarily, bandwidth cannot be augmented without hardware sustenance. To effortlessly advance to advanced bandwidths, the endways (E2E) hardware on a PON network, counting the optical network unit (ONU), optical distribution network (ODN), optical line terminal (OLT), and optical units, must encounter the supplies. To defend the substructure asset in a current PON network, it is dangerous to choice a flat development manner rendering to the provision growth planning.

III. GPON ALLOCATION

3.1 ONU Identifier (ONU-ID)

ONU-ID is an 8-bit identifier that an OLT shares to an ONU in the course of ONU start through PLOAM mails. The ONU-ID is exclusive crossways the PON and remnants awaiting the ONU is powered off or immobilized by the OLT.

3.2 Allocation Identifier (ALLOC_ID)

ALLOC_ID is a 12-bit number that the OLT deals to an ONU to distinguish a traffic-bearing entity that is a receiver of upstream bandwidth distributions inside that ONU. This traffic-bearing thing is also called T-CONT.

Every ONU is allocated a defaulting ALLOC_ID which is equivalent to that ONU's ONU-ID, and can be allocated extra ALLOC_IDs as per OLT's will.

3.3 Transmission Containers (T-CONT)

A Transmission Container (T-CONT) is an ONU thing on behalf of a collection of reasonable influences that seem as a solitary unit for the drive of upstream bandwidth task on the PON. For an assumed ONU, the amount of reinforced T-CONTs is secure. The ONU separately generates all the reinforced T-CONT examples in the course of ONU beginning. The OLT determines the amount of T-CONT examples reinforced by an assumed ONU.

To stimulate a T-CONT example to transmit upstream operator circulation, the OLT has to start a charting amid T-CONT example and an ALLOC_ID, which has been before allocated to the ONU through PLOAM mails. Some ALLOC_ID allocated to the ONU, counting the evasion ALLOC_ID, can be related with solitary operator traffic T-CONT.

Here are 5 kinds of T-CONTs which can be owed to the user-

1. Type 1: This T-CONT is of secure bandwidth kind and mostly rummage-sale for facilities subtle to postponement and great importance similar to VOIP.
2. Type 2 and Type 3: Equally T-CONT is of certain bandwidth kinds and mostly rummage-sale for video facilities and data facilities of greater importance.
3. Type 4: This T-CONT is of best-effort kind and mostly rummage-sale for data facilities such as Internet and services of little importance which do not need great bandwidth.
4. Type 5: This T-CONT is of varied kind, connecting all bandwidth forms and manner all facilities.

3.4. Dynamic Bandwidth Allocation (DBA)

the OLT is blamed for handing over upstream bandwidth to the ONUs. As the entree link is shared, ONU upstream blowouts might smash if they were transported at unforeseen epochs. ONUs can be put at fluctuating places commencing the OLT, and therefore the spread interval as of every ONU is one-off. The OLT manners interim and arrays a list in every ONU from side to side PLOAM (Physical Layer Processes, Management and Maintenance) mails to tie its adjournment with approbation to very

second ONUs on the entrée linkage. This is professed Ranging.

When the halt of the whole thing ONU's has been fixed, the OLT expresses grants to unconnected ONUs. A grant is acceptance to routine a precise suspension of epoch for upstream transmission. The funding scheme is energetically re-calculated every rare milliseconds. The scheme dispenses bandwidth to every ONUs such that every ONU collects opportune bandwidth for its requirements.

DBA is a procedure that lets fast implementation of operators' bandwidth distribution centered on existing circulation supplies and it is particularly worthy for distributing with spurts upstream circulation. GPON routines TDMA for handling upstream access by ONUs, and at some point of phase, TDMA provides unshared timeslots (upstream bandwidth over phase) to every ONU for upstream transmission.

DBA certificates upstream timeslots to treaty and yield spotlighted on the dissemination of upstream transportation loads. DBA purposes on T-CONTs, which are upstream timeslots, and each is acknowledged by a specific ALLOC_ID. An ONU must have at smallest one T-CONT, but then again most have numerous T-CONTs, everyone with its personal importance or circulation period, and every one parallels to an exact upstream timeslot on the PON. Deprived of DBA provision on the OLT, upstream bandwidth is statically allocated to T-CONTs, which cannot be public, and can be altered solitary through a supervision organization. Here are dualistic duties of DBA - Status Reporting DBA (SR-DBA) and Non-Status Reporting DBA (NSR-DBA).

In NSR-DBA, an OLT intermittently dish out a petty mass of bonus bandwidth to all ONU. If the ONU has no movement to monitor, it expresses indolent structures. If the OLT become aware of that an ONU is not transporting shiftless structures, it nurtures the bandwidth dissemination to that ONU. When that ONU starts guiding idle frames, the OLT decreases its distribution consequently. NSR-DBA has the benefit that the ONUs need not be conscious of DBA, though, its drawback is it has no way to distribute bandwidth to numerous ONU's in the greatest well-organized method.

SR-DBA includes obvious T-CONT buffer position delivered by the ONUs once OLT polls them. In this technique, the OLT pleas T-CONT shield spot and the ONUs account by means of a divergent bang for each one allocated T-CONT. The report covers the statistics presently waiting in T-CONTs in the stated time slots. OLT obtains the position (DBA) report, re-calculates bandwidth distribution (BW Map) over DBA process and directs fresh BW Map to the ONUs in-band with downstream traffic. The ONU obtains the BW Map from OLT and directs the statistics in the stated time slots. Once an ONU has no evidence to direct, upon getting a grant from the OLT, it shows the way a slothful cubicle upstream to entitle that its shield is downright. This acquaints the OLT that the bequests for that T-CONT can be apportioned to superfluous T-CONTs. Doubt an ONU takes an extended line to come in its buffer, the OLT can allocate numerous T-CONTs to that ONT.

IV. TRANSMISSION CONVERGENCE (TC) LAYER

ITU-T reference G.984.3 defines GPON TC coating which is corresponding to Data Link layer of OSI model. It stipulates GPON frame format, the media access control protocol, OAM procedures and evidence encryption technique. The downstream GTC structure encloses of the physical control chunk downstream (PCBD) and the GTC payload unit. The upstream GTS frame covers numerous broadcast spurts. Every upstream spurt contains of the upstream physical layer overhead (PLOU) section and one or more bandwidth distribution intermissions related by means of an exact ALLOC_ID.

The downstream GTC structure supplies the pooled phase bearings for the PON and pooled device pointing for the upstream.

4.1 Downstream GPON Frame Format

A downstream GTC structure ingests a period of 125us as well as is 38880 bytes comprehensive, which equivalent to downstream information fraction of 2.48832 GBPS.

The OLT point in the right direction the PCBD in the transmission way, and each ONU obtains the whole PCBD. The ONUs then act upon the pertinent

evidence limited within. The Sync arena designates start of the frame to the ONUs. The indent arena covers an 8-KHz Super frame Counter field which is working by the encryption system, and might also be recycled to deliver little proportion synchronous reference signals. The PLOAM d arena grips purposes such as OAM-related apprehensions otherwise threshold-crossing cautions. BIP arena is Bit Interleaved Parity recycled to foresee bit error rate. The downstream Payload Length indicator (PLEND) bounces the remoteness of the upstream bandwidth (US BW) atlas. The PLEND is directed double for redundancy. Every item in the Upstream Bandwidth (US BW) conspiracy arena connotes introverted bandwidth dispersal to an explicit T-CONT. The amount of admissions is assumed in the PLEND arena.

The Distribution ID (ALLOC_ID) arena designates the receiver of the bandwidth allocation i.e. a specific T-CONT. The lowermost 254 distribution ID standards are used to report the ONU directly. In the course of the going procedure, the principal ALLOC_ID certain to the ONU essential are in this series. This ALLOC-ID is recognized as the evasion Distribution ID. This ALLOC_ID is similar as ONU-ID number used in PLOAM mails. If additional ALLOC_ID standards are compulsory for that ONU, they should be occupied from those above 255. ALLOC_ID 254 is the ONU Activation ALLOC_ID-used to determine unidentified ONUs. The Flag turf leases the upstream broadcast of physical layer in the air large piece for a taken ONU. The Stretch Jolt and Stopover arena calls the jolt and finale of upstream broadcast breach. The CRC arena brings culpability encounter and revision on bandwidth dissemination arena.

The GTC payload arena shelters an order of GEM (GPON Encapsulation Method) structures. The downstream GEM structure stream is making clear at the ONU centered upon the 12-bit Port ID field limited in the header of every GEM frame. Apiece ONU is prearranged to tell apart which Port-IDs adequate to it. The Port-ID remarkably is familiar with a GEM.

4.2 Upstream GPON Frame Format

The Upstream GTS frame period is also 125us in addition is 19440 Bytes stretched, which offers an upstream data level of 1.24416 GBPS. Every upstream edge conceals a size of broadcast spurts coming starting one or more ONUs. Every single upstream broadcast spurt covers an upstream physical layer overhead (PLOU) subdivision and one or more bandwidth dissemination interludes interconnected by means of dispersed ALLOC-IDs. The BW map commands the preparation of the spurts inside the frame and the distribution intermissions inside each one spurt. Apiece distribution intermission is measured by a specific distribution building of the BW map. The physical layer overhead (PLOU) at the start of the ONU upstream spurt covers the introduction which safeguards good physical layer process of the burst-mode upstream connection. The PLOU arena covers the ONU-ID arena which designates the sole ONU-ID of the ONU that is conveyance this communication. The upstream physical layer OAM (PLOAM u) turf is liable for group purposes corresponding elongating, origination of an ONT, and alarm proclamations. The upstream power even out sequence (PLS u) field covers evidence regarding the laser authority phases at the ONUs as implicit by the OLT. The dynamic bandwidth report (DBR u) arena notifies the line distance of every T-CONT at the ONT.

V. CONCLUSION

In this paper, a Gigabit Passive Optical Network is reviewed. In this paper GPON evaluation, allocation and frame format is focused. GPON is healthier than all other PON standards.

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