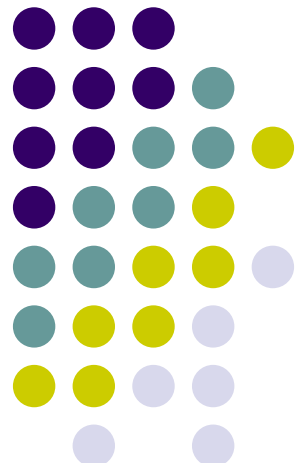
ITU-T Rec. G.984.3

Sec.5 ~ Sec.8

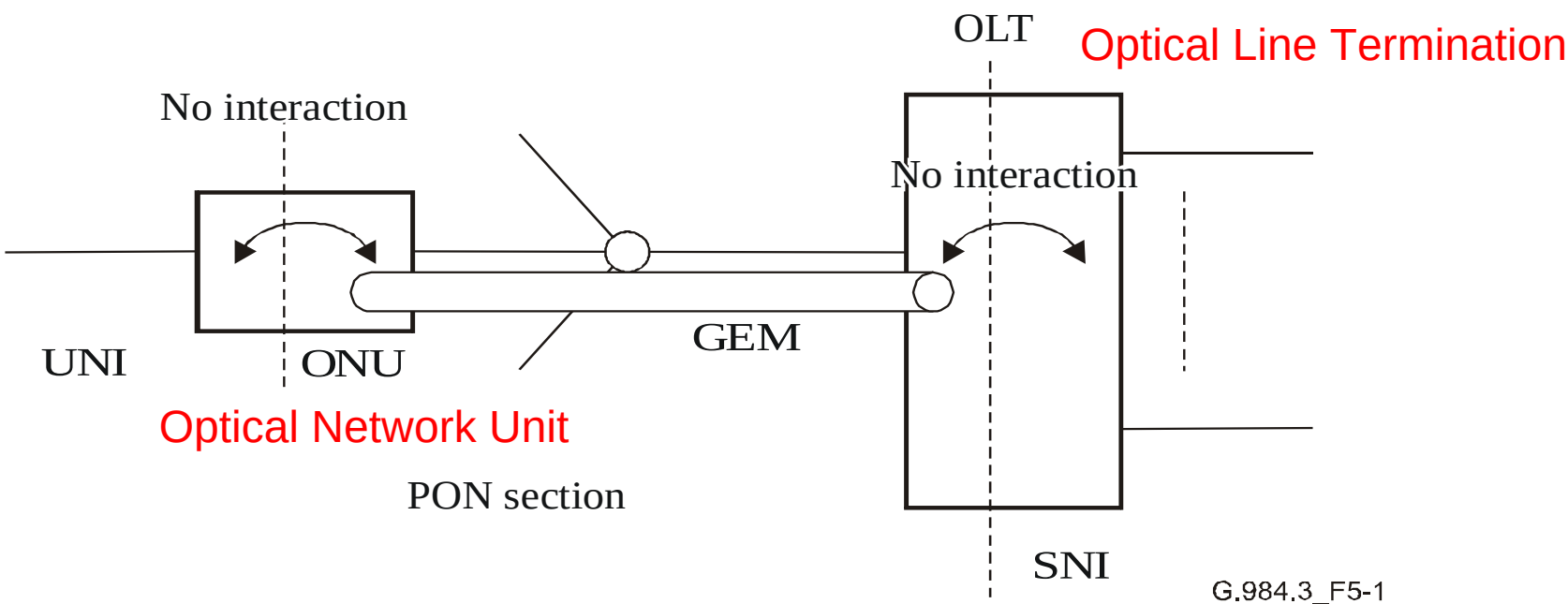
2005.10.27

丹青



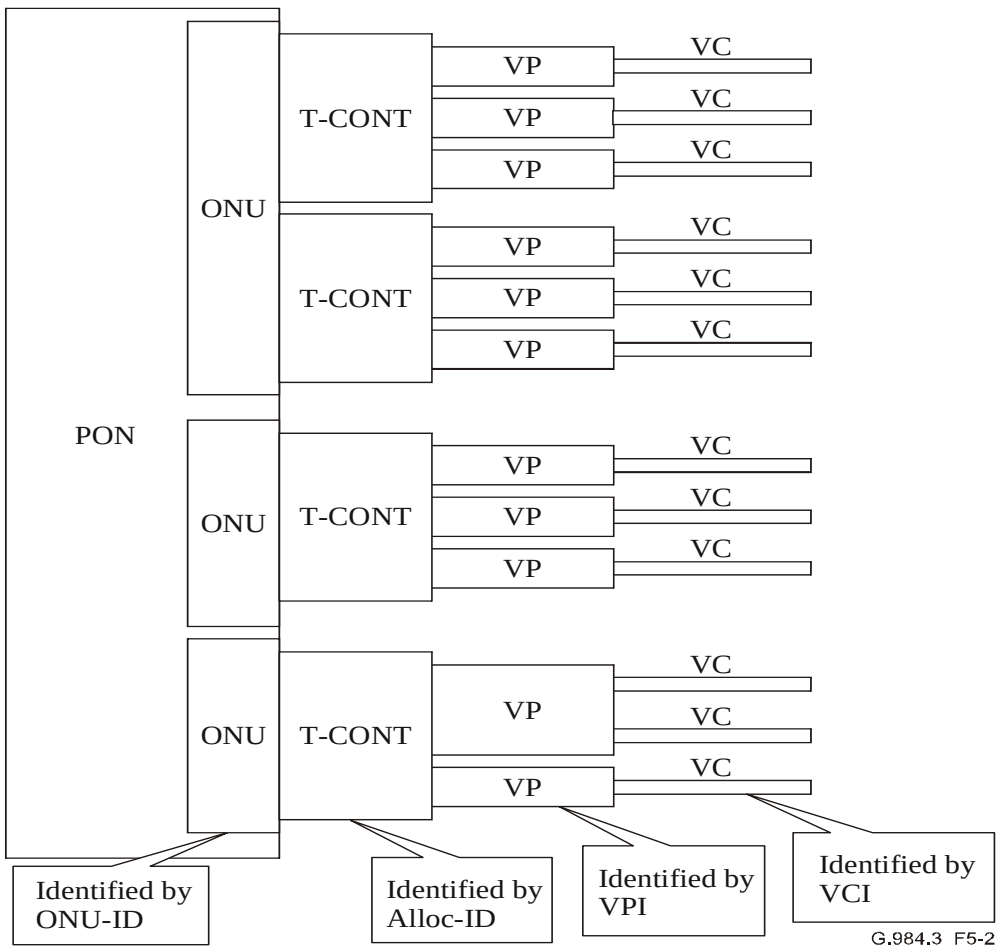
Sec 5 - Conventions

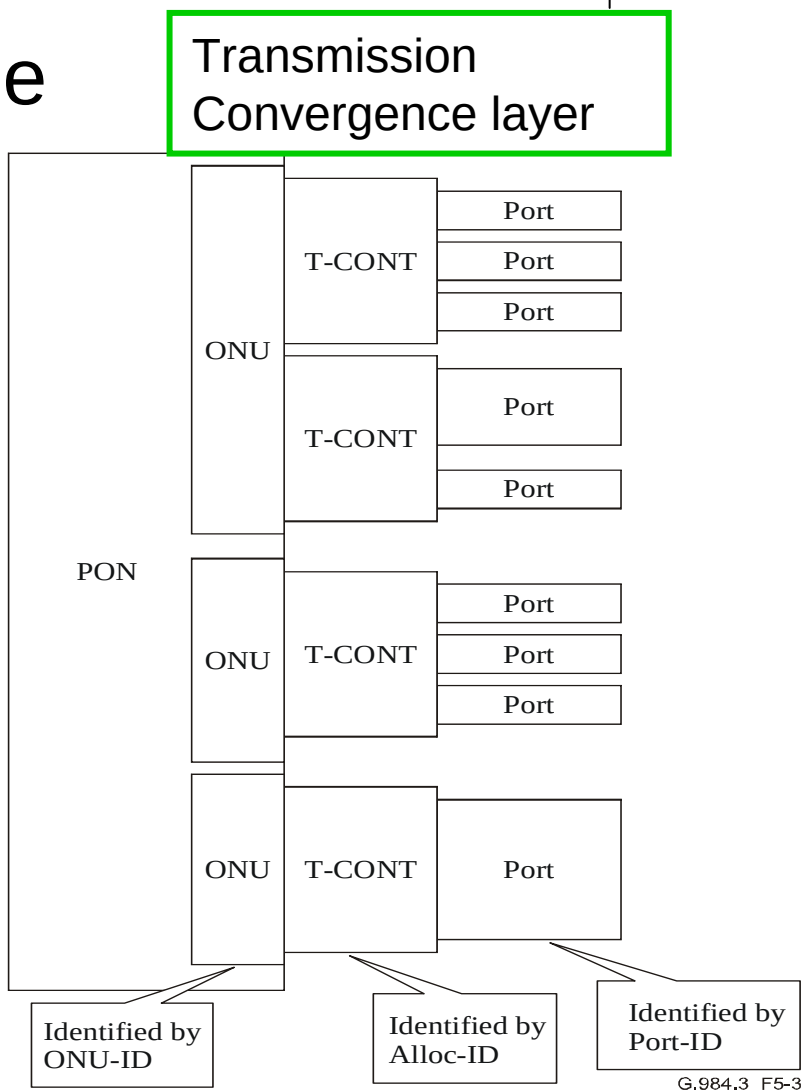
- GEM (G-PON Encapsulation Method)
  - Embedded into the PON section
  - Independent of the type of SNI and UNI



Multiplexing architecture

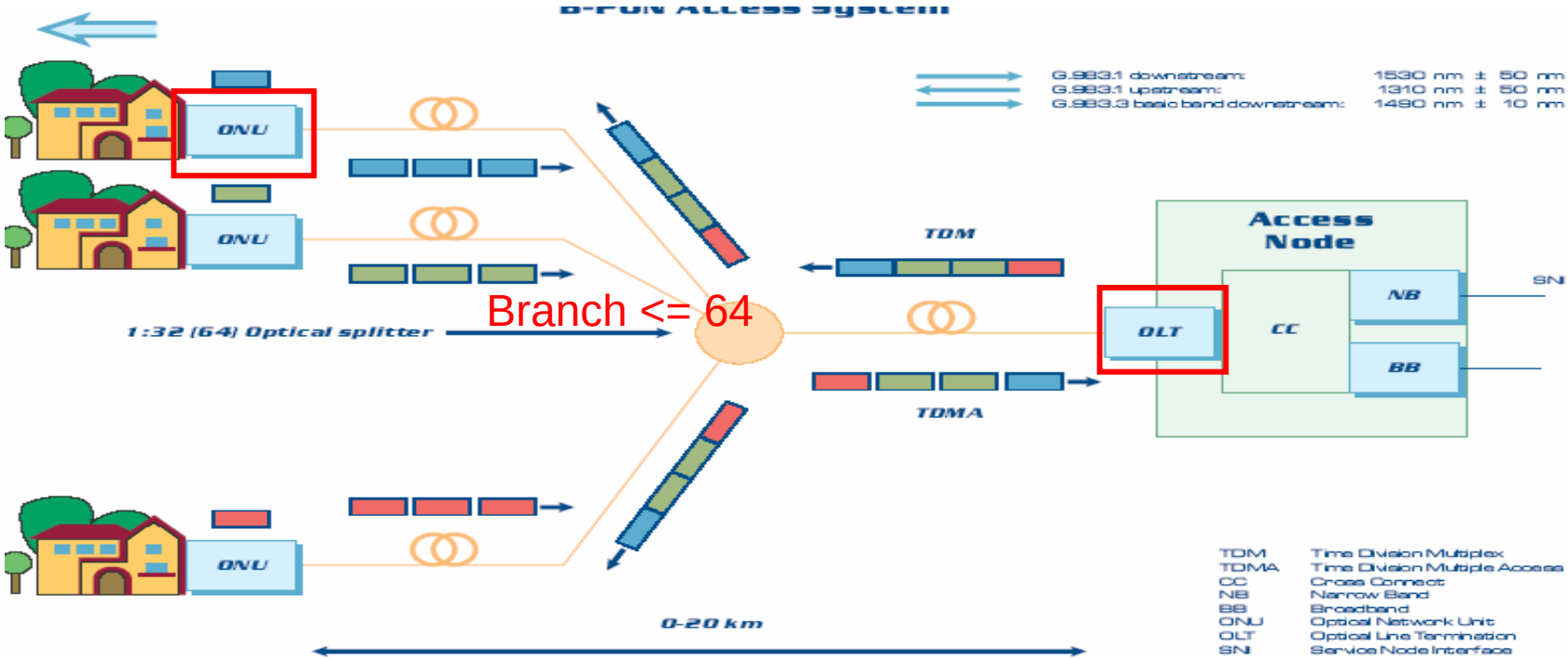
- ATM base and GEM base





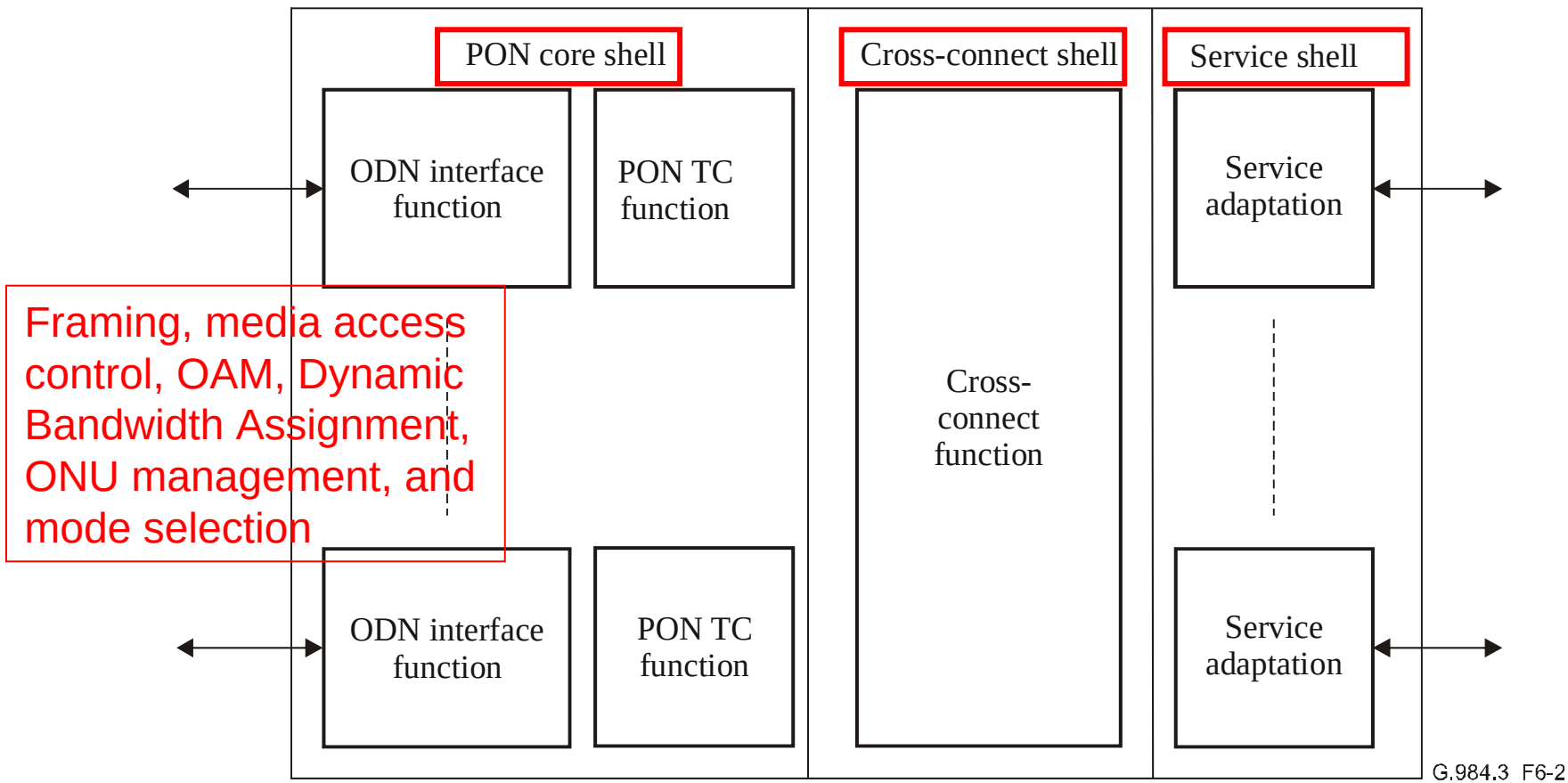
Sec 6 - G-PON system architecture

- Same as B-PON specified in G.983.1
- Logical reach = 60km, max differential = 20km



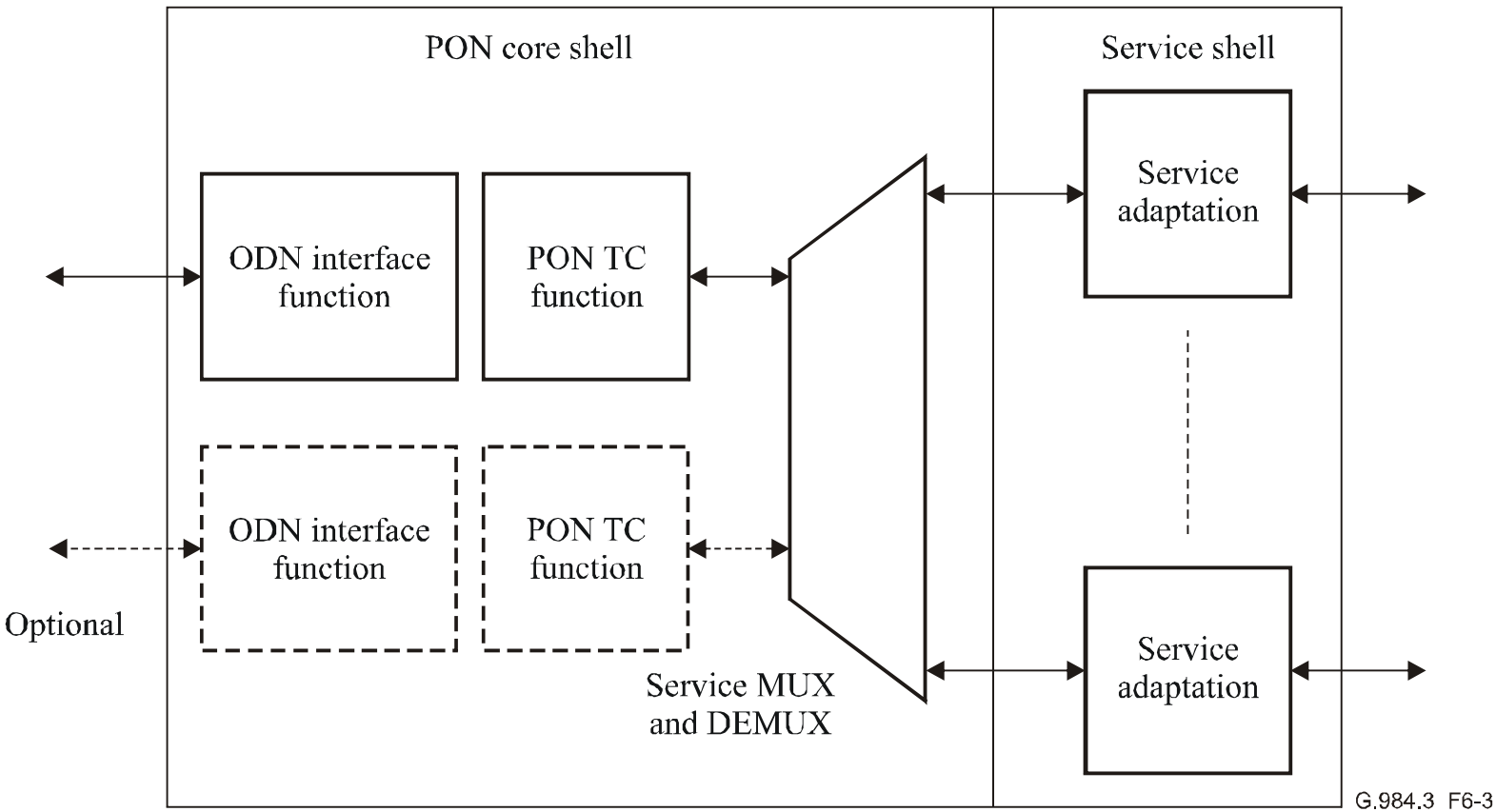
Functional blocks

- OLT (Optical Line Termination)



Functional blocks

- ONU (Optical Network Unit)

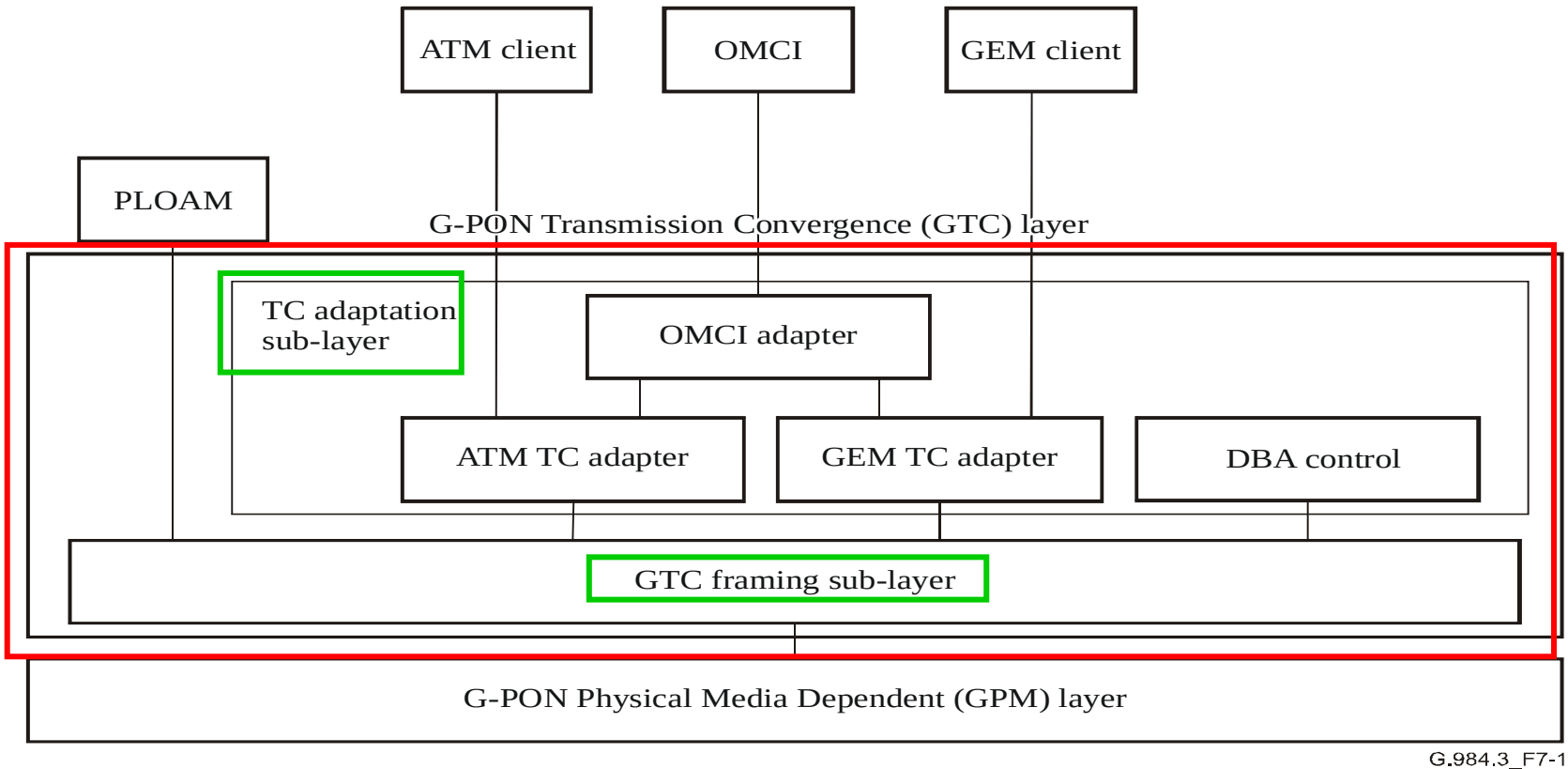


Functional blocks

- ODN (Optical Distribution Network)
  - Connects between an OLT and one or more ONUs using passive optical device
- G-PON system cannot provide inter operability with B-PON system and others

Sec 7 – GTC overview

- GTC (G-PON Transmission Convergence) layer between physical media and G-PON clients

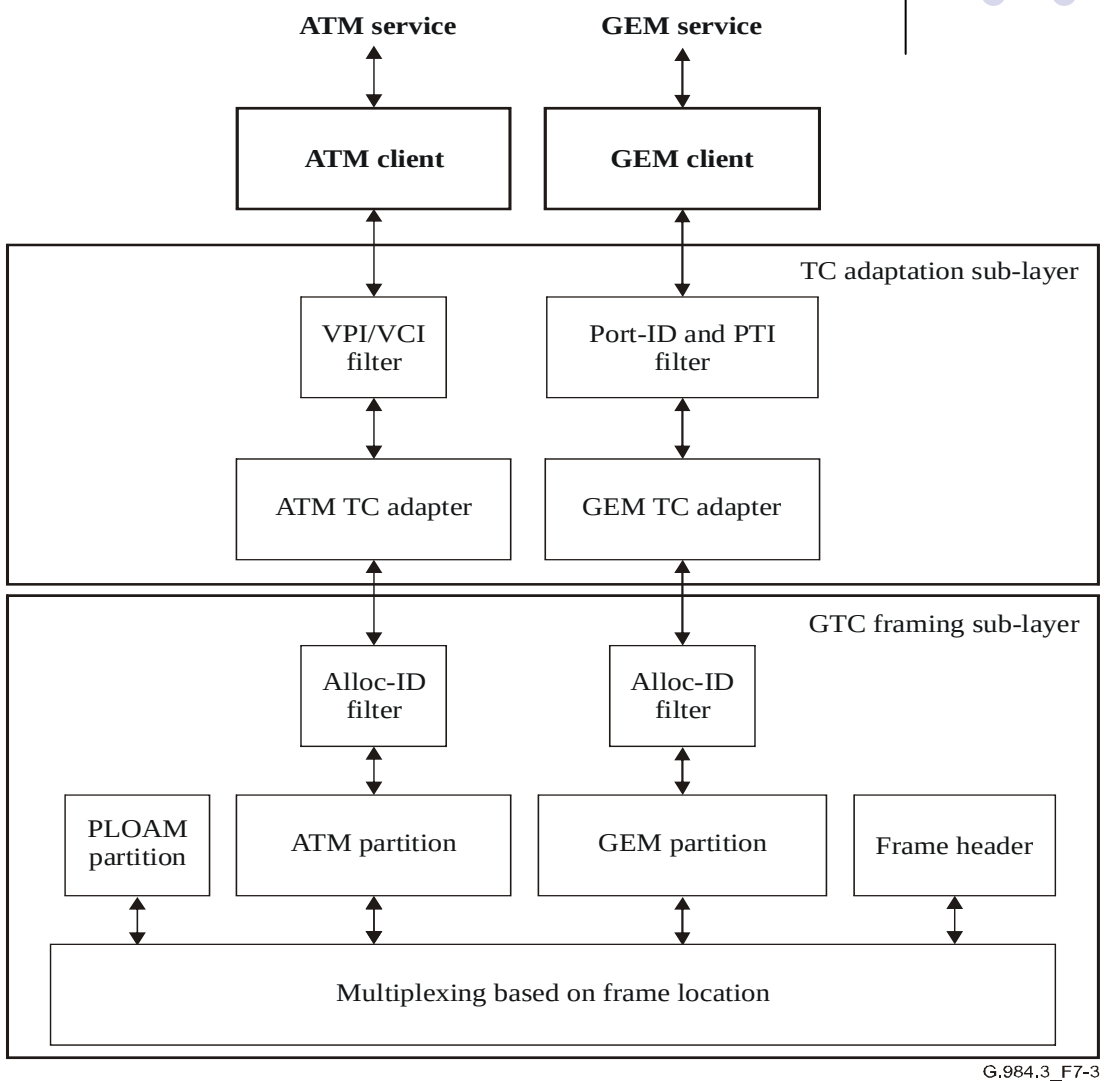


C/M planes

- Control and management planes
  - Embedded OAM
    - A low latency path for time urgent control information, because each information piece is definitely mapped into specific field in the header of the GTC frame
  - PLOAM (Physical Layer OAM)
    - A message-formatted system carried in a dedicated space of the GTC frame
  - OMCI (ONU Management and Control Interface)
    - Manage the service defining layers that lay above the GTC
    - The GTC must provide a transport interface for the traffic in ATM or GEM

U plane

- Traffic flows in the U plane are identified by their traffic type (ATM or GEM)
- The traffic type is implicitly indicated by which downstream partition or upstream allocation ID carries the data

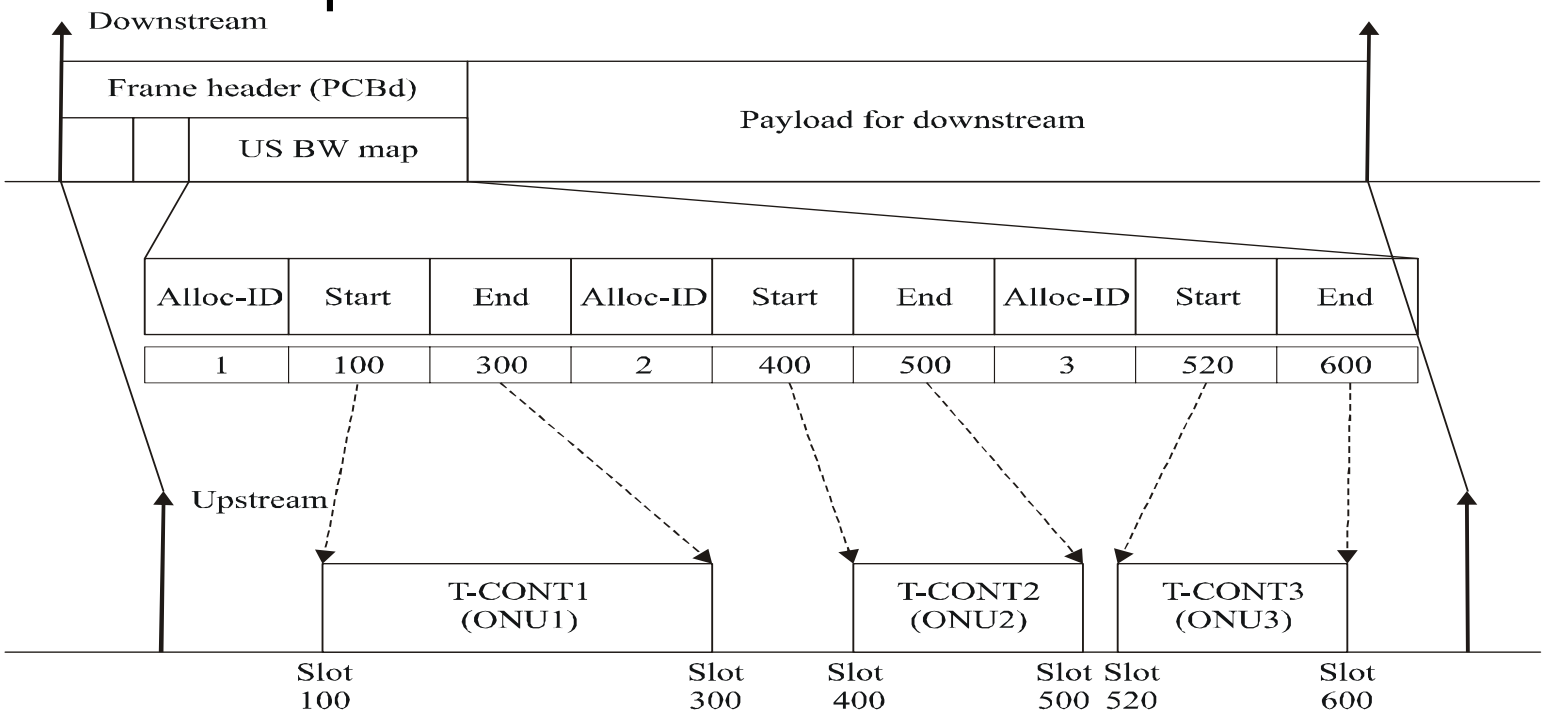


U plane

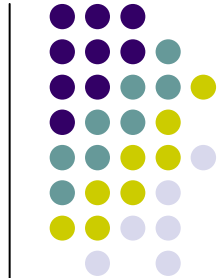
- ATM
  - Downstream – cells are carried in the ATM partition, the ONU framing sub-layer extracts the cells, and ATM TC adapter filters the cells
  - Upstream – the ATM traffic is carried over one or more T-CONTs, the OLT receives the transmission associated with the T-CONT identified by Alloc-ID, and the cells are forwarded to the ATM TC adapter, and then the ATM client
- GEM

GTC key functions

- GTC system provides media access control for upstream traffic
- OLT sends pointers in the PCBd, and these pointers indicate the time at which each ONU may begin and end its upstream transmission



Functions of sub-layers in GTC



- GTC framing sub-layer
  - Multiplexing and demultiplexing
  - Header creation and decode
  - Internal routing function based on Alloc-ID
- GTC adaptation sub-layer, and the adapters provide the ATM/GEM interfaces for upper layer entities
  - ATM TC adapter
  - GEM TC adapter
  - OMCI adapter

Traffic flow and QoS

- The GTC system considers the traffic management of T-CONTs, and each T-CONT is identified by an Alloc-ID
- OLT monitors traffic loading on each T-CONT, and makes adjustments to the bandwidth allocations to appropriately distribute the PON resources

Traffic flow and QoS

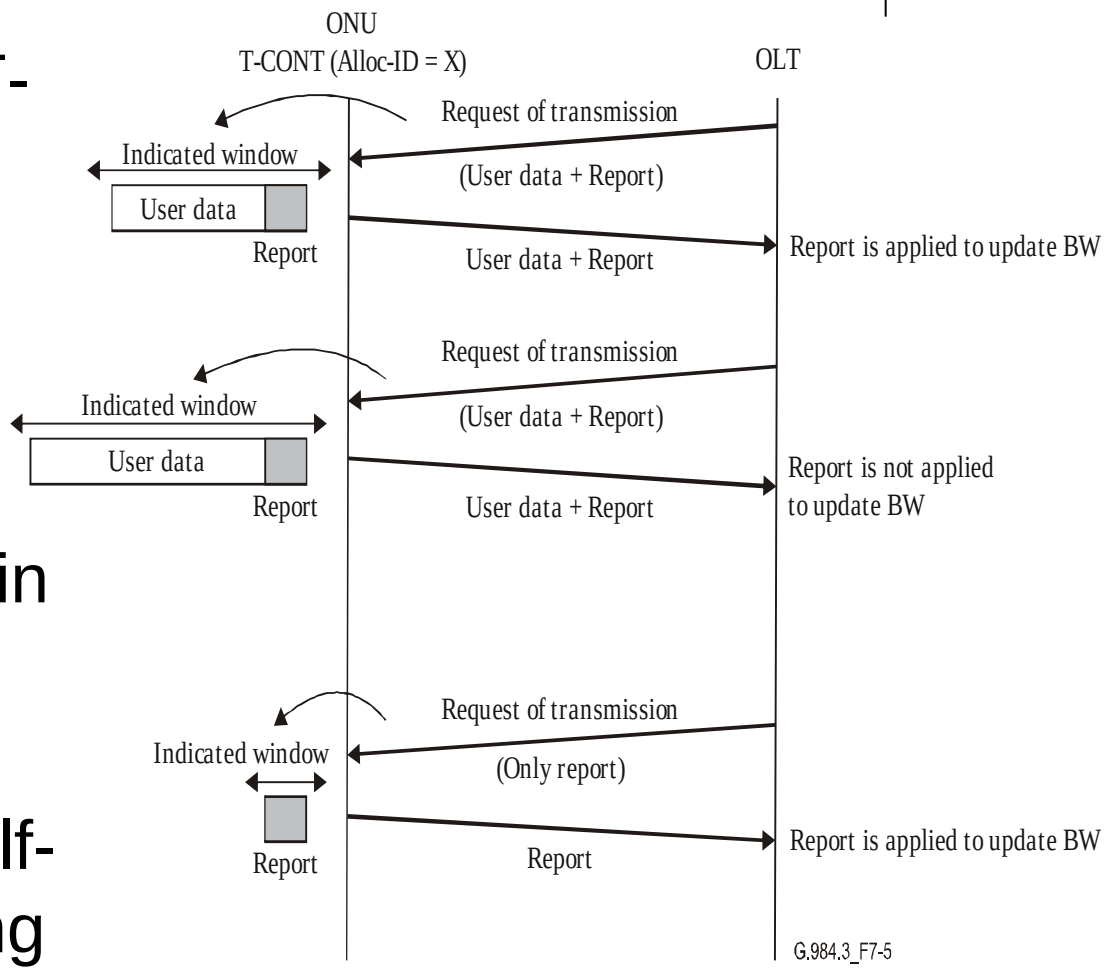
- SR-DBA (Status Reporting Dynamic Bandwidth Assignment) provides bandwidth assignment according to report from ONU
- NSR-DBA (Non-Status) invokes bandwidth assignment which does not need report from ONU. However, it provides dynamic assignment by using traffic monitoring by OLT itself

DBA specifications

- DBA functionalities are categorized into 5 parts
  - Detection of congestion status by OLT and/or ONU
  - Report of congestion status to OLT
  - Update of assigned bandwidth by OLT
  - Issues of grants by OLT according to updated bandwidth and T-CONT types
  - Management issues for DBA operations

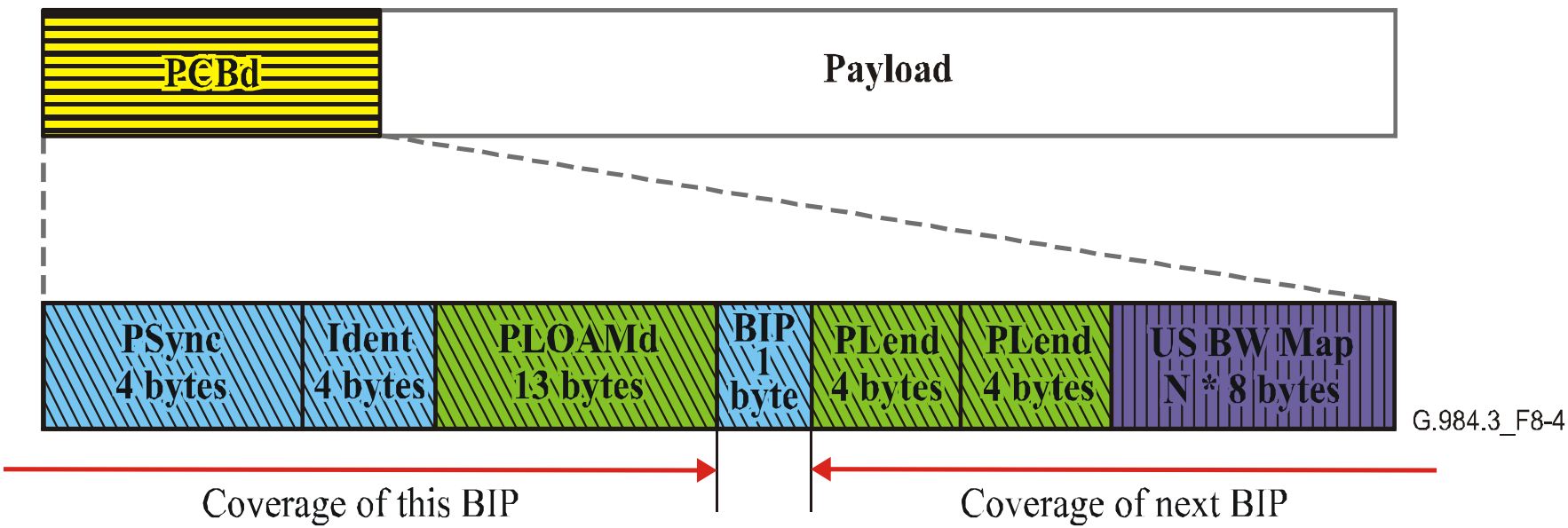
DBA specifications

- SR-DBA : when a T-CONT sends upstream data from ONU to OLT, the number of cells or blocks in the T-CONT buffer is set in the DBA field of DBRu
- NSR-DBA : OLT self-monitor the incoming traffic flows



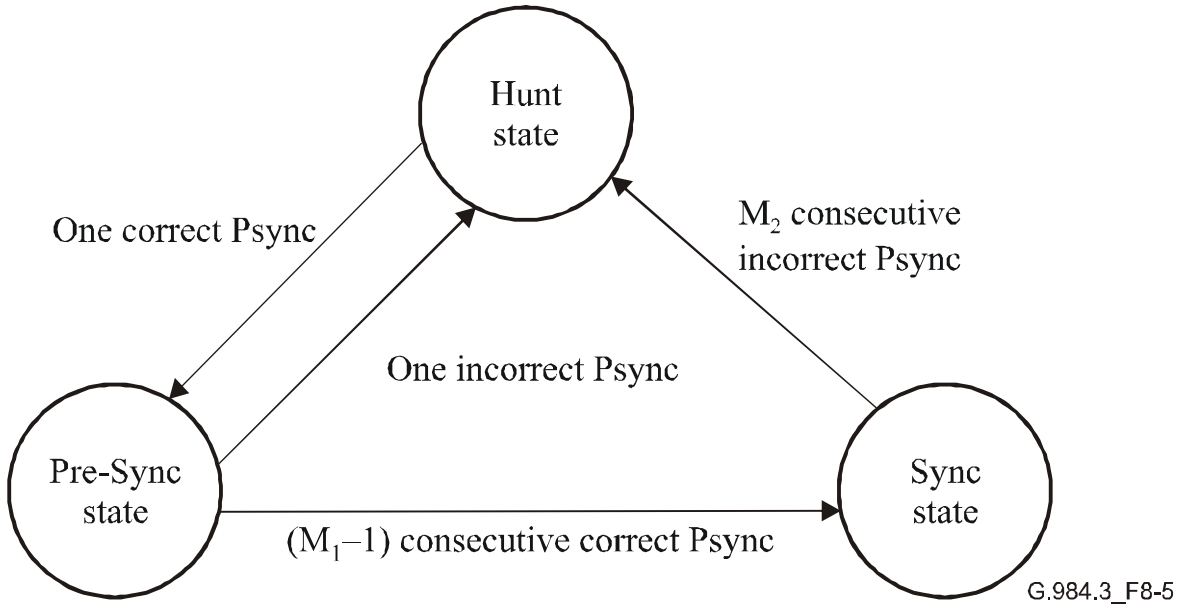
Sec 8 – GTC TC frame

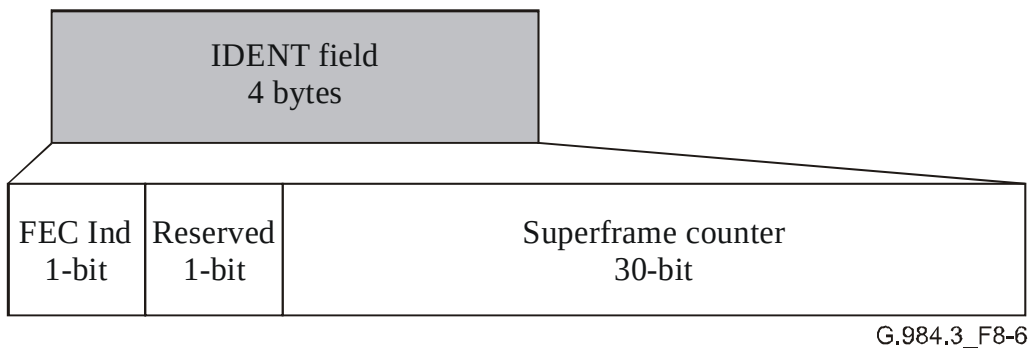
- Downstream frame (OLT to ONUs)
- PCBd (physical control block downstream)



Downstream frame

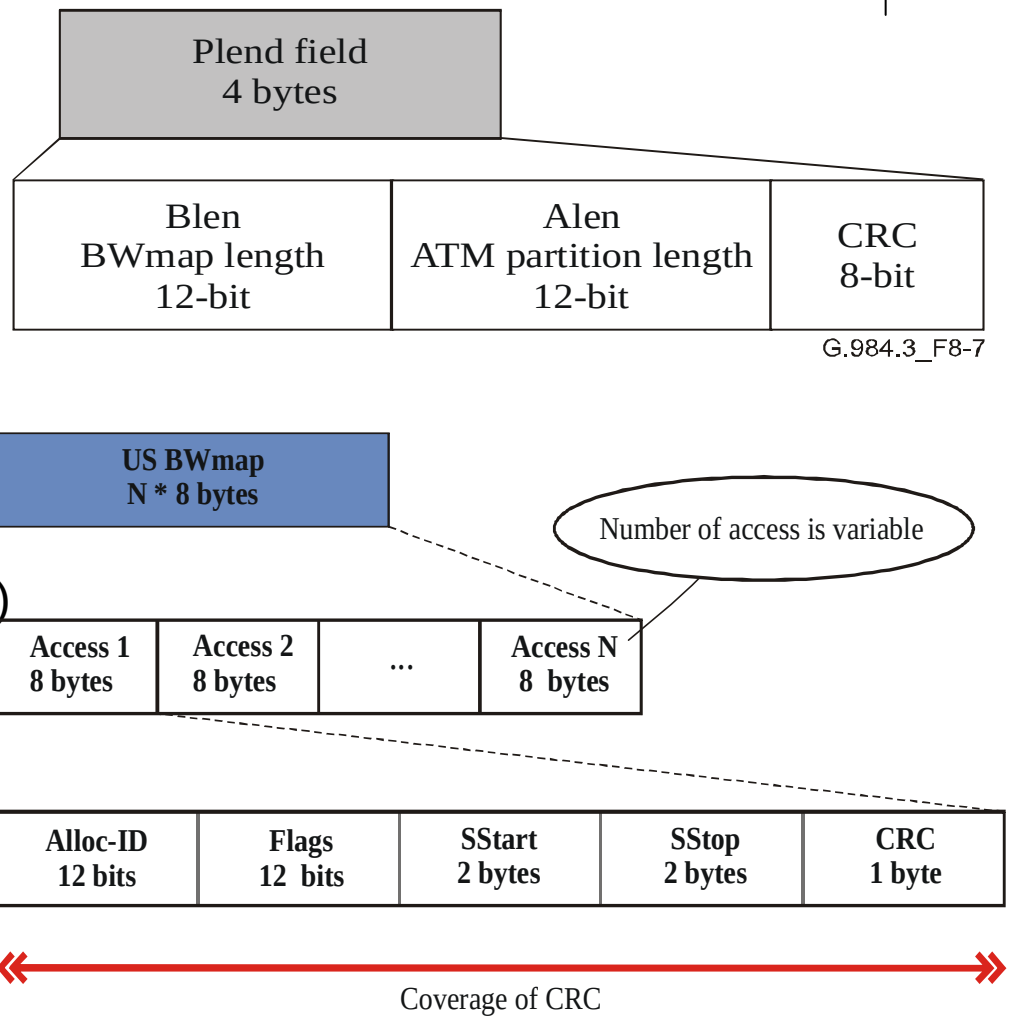
- PSync (physical synchronization)
- Ident
- PLOAMd
- BIP - Bit interleaved parity of all bytes transmitted since the last BIP



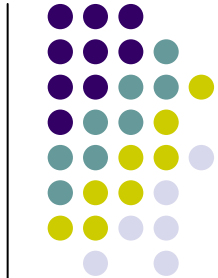


Downstream frame

- Plend (payload length downstream)
- BWmap (bandwidth map)
  - Alloc-ID
  - Flags – 4 separate indications
    - PLSu (power levelling sequence)
    - PLOAMu
    - FEC
    - DBRu
  - SSart
  - SStop
  - CRC



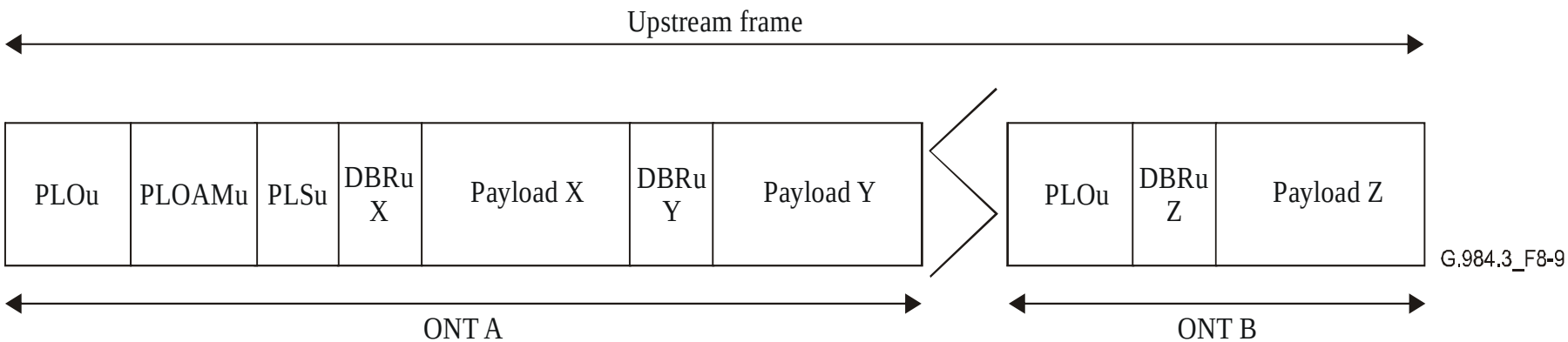
Downstream frame



- Payload
  - ATM partition
    - always an integer multiple of 53 bytes long
    - Downstream cell stream is filtered at the ONU based upon the VPI contained in each cell
  - GEM partition
    - The length of the GEM partition is whatever remains after the PCBd and ATM partitions are subtracted from the entire frame lentgh
    - Downstream frame stream is filtered at the ONU based upon the Port-ID contained in each frame fragment

Upstream frame

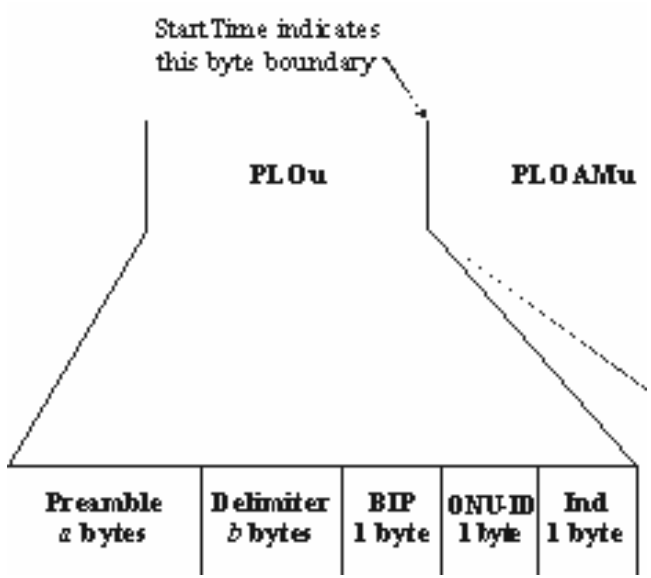
- Each frame contains a number of transmissions from one or more ONUs
- Every time an ONU takes over the PON medium from another ONU, it must send a new copy of the PLOu (physical layer overhead upstream) data



back

Upstream frame

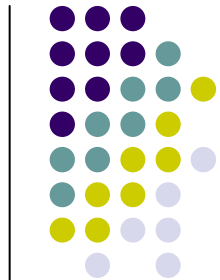
- PLOu data includes the physical layer overhead and three fields of data
  - Preamble and delimiter
  - BIP (bit interleaved parity)
  - ONU-ID
  - Ind – real time ONU status report to OLT



Bit position	Function
7 (MSB)	Urgent PLOAMu waiting (1 = PLOAM waiting, 0 = no PLOAMs waiting)
6	FEC status (1 = FEC ON, 0 = FEC OFF)
5	RDI status (1 = Defect, 0 = OK)
4	Traffic waiting in type 2 T-CONTs
3	Traffic waiting in type 3 T-CONTs
2	Traffic waiting in type 4 T-CONTs
1	Traffic waiting in type 5 T-CONTs
0 (LSB)	Reserved

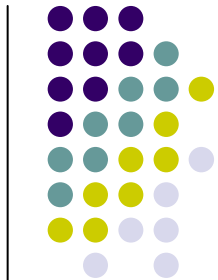
back

Upstream frame



- PLOAMu
- PLSu is used for power control measurements by the ONU. This function assists in the adjustment of ONU power levels to reduce the optical dynamic range as seen by the OLT
- DBRu (dynamic bandwidth report upstream)
  - DBA field – contains the traffic status of the T-CONT in question
  - CRC
- Payload
  - ATM cell
  - GEM header and frame fragment
  - DBA report and CRC

Mapping of traffic into GTC payloads



- ATM traffic
  - Downstream : cells are transmitted from the OLT to the ONUs using the ATM payload partition
  - Upstream : The ONU buffers ATM cells as they arrive, and then sends them in bursts when allocated time to do so by the OLT
- GEM traffic
  - The same as ATM
  - Delineation of the user data frames
  - Port identification for multiplexing

Mapping of traffic into GTC payloads

- GEM header

Indicate the content type of the fragment payload and its appropriate treatment

PLI 12 bits	Port ID 12 bits	PTI 3 bits	HEC 13 bits	Fragment payload **L** Bytes

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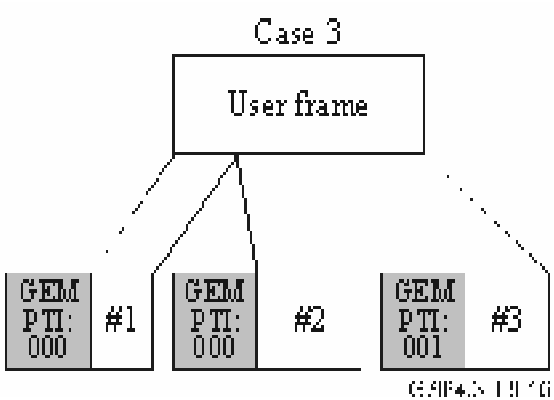
Payload Length Indicator

Payload Type Indicator

Header error control

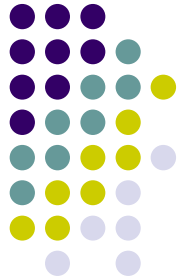


PTI code	Meaning
000	User data fragment, Congestion has Not occurred, Not the end of a frame
001	User data fragment, Congestion has Not occurred, End of a frame
010	User data fragment, Congestion Has occurred, Not the end of a frame
011	User data fragment, Congestion Has occurred, End of a frame
100	GEM OAM
101	Reserved
110	Reserved
111	Reserved

Dynamic bandwidth allocation signaling and configuration

- All OLTs provide traffic monitoring DBA, so that ONUs that do not report status can obtain some basic DBA functionality
- Status reporting DBA
  - Status indication DBA - The Status indication DBA consists of 4 bits in the PLOu Ind field. It is set on every upstream transmission from an ONU. If the bit is set to one for T-CONT type X, then the OLT can assume that there is some data waiting in at least one of the T-CONT buffers of type X

Dynamic bandwidth allocation signaling and configuration



- Piggy-back DBRu DBA reports – the piggy-back DBA report consists of a message that specifies the amount of data waiting in the T-CONT buffer corresponding to the Alloc-ID that triggered the DBRu transmission
  - The report message uses the number of ATM cells or GEM blocks waiting in the T-CONT buffer as its basic unit

Dynamic bandwidth allocation signaling and configuration

- Whole ONU report DBA – gives the ONU the freedom to select which T-CONTs it wishes to report
  - Three modes
  - OLT has no knowledge of the report format, there needs to be an extra error tolerance on the DBRu mode indication
    - Mode Indication * 2
    - Alloc-ID

Mode 0:

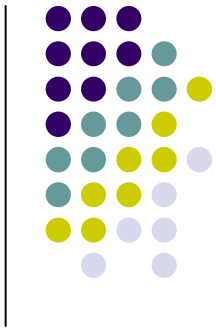
Alloc-ID 12 bits	MI 2b	MI 2b	Field1 8 bits	CRC-8 8 bits

Mode 1:

Alloc-ID 12 bits	MI 2b	MI 2b	Field1 8 bits	Field 2 8 bits	CRC-8 8 bits

Mode 2:

Alloc-ID 12 bits	MI 2b	MI 2b	Field1 8 bits	Field 2 8 bits	Field3 8 bits	Field4 8 bits	CRC-8 8 bits



Thanks!