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INTRODUCTION OF OPTICAL ACCESS SHOWCASE FOR G.EPON/SIEPON: ACTIVITIES FOR RELATED STANDARDIZATION AND INTEROPERABILITY

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Introduction of optical access showcase for
G.epon/SIEPON
~ Activities for related standardization
and interoperability test~

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Outline

1. **Background**
   - **Progress of optical broadband service**
   - **EPON standard and issue**
   - **System level EPON standards**
2. **G.epon/SIEPON standards**
3. **Activity for interoperability tests and optical access showcase**
4. **Formation of WG with related organization**
5. **Conclusion**

Progress of optical broadband (FTTH) service

HATS

> FTTH service based on PON system has become popular.
> Especially, EPON has been used widely in Japan.
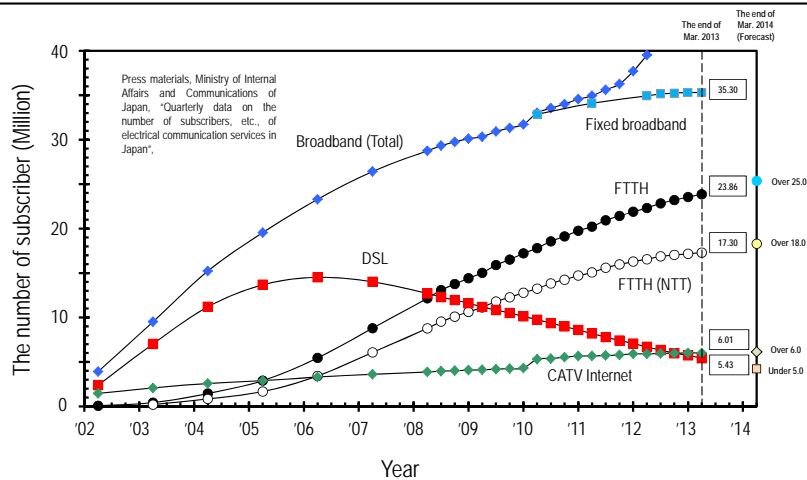
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EPON standard and issue

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> Ethernet based PON was standardized by IEEE.
>   > To realize 10Gbps high-speed access network
>   > Enabling broadband applications such as Bi-directional Super High Definition Video, Remote Education, Remote Healthcare, etc.
> However that standardization was limited in PHY and MAC layer thus preventing EPON interoperability.
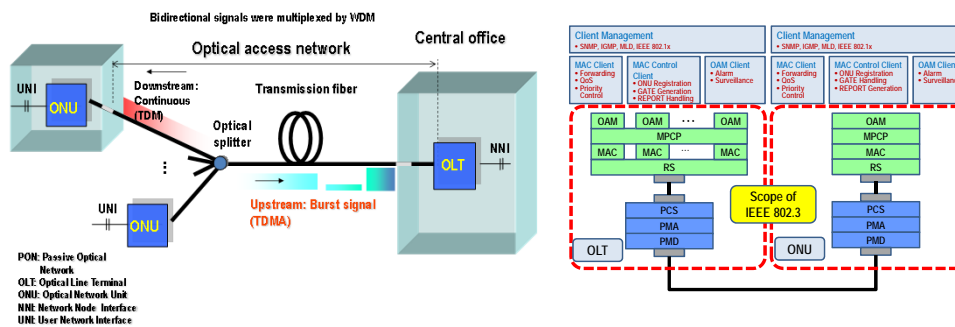
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System level EPON standard

- ✓ In order to improve EPON interoperability, a system level EPON standardization started in IEEE P1904.1 SIEPON (Service Interoperability in EPON) WG since 2010 and it was approved in June 2013.

  http://grouper.ieee.org/groups/1904/1/

- ✓ SIEPON WG plans to conduct its Conformance Test and issue Certificates (SIEPON Certificate Program).

- ✓ Moreover, SIEPON Package B, which is one of SIEPON specifications based on Japan specifications, was consented as ITU-T G.epon (G.9801) in July 2013.

- ➤ In order to promote EPON interoperability, HATS conference organized Optical Access Ad-hoc WG.

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Outline

1. **Background**
2. **G.epon/SIEPON standards**
   - **G.epon/SIEPON standards**
   - **SIEPON standard packages**
   - **Added Specifications for G.epon/SIEPON standards**
   - **Architecture model for G.epon/SIEPON**
   - **Logical connection model for G.epon/SIEPON**
   - **Related EPON standards**
3. **Activity for interoperability tests and optical access showcase**
4. **Formation of WG with related organization**
5. **Conclusion**

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G.epon/SIEPON Standards

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- SIEPON is a system level standard for EPON.
- G.epon (G.9801) is a new ITU-T Recommendation that is ITU-T version of EPON based on SIEPON Package B and adopts Generic OMCI, which is common to various ITU-T systems, instead of eOAM.

Common Ethernet services

HN management BBF TR-142 (TR-069 for PON)

Service model BBF TR-156, 200 (TR-101 for PON)

G.988（Generic OMCI）

eOAM

PON management (Ex. OAM)

System level specification

Higher layer specifications (Ex. QoS management)

G.986 (1G-P2P)

G.987 (XG-PON) G.984 (G-PON)

802.3av （10G-EPON） 802.3ah （GE-PON）

MAC layer specifications (Ex. Frame structure)

Physical layer specifications (Ex. Transmission bandwidth)

ITU-T Recommendations | G.epon | IEEE standards | SIEPON

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SIEPON standard packages

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- Packaged standardizations.
  - It is hard to realize a unified set of specifications for realizing interoperability among existing 1G-EPON devices because there are different specifications for each vendor or carrier.
- SIEPON specifies 3 specification packages
  - However SIEPON aims to realize a hardware commoditizing in order to absorb differences by modifications of their firmware.

Item	Feature	Package		
		A	B	C
RF	REPORT MPCP format	shall implement REPORT MPCPDU format per 8.3.2.1.3	shall implement REPORT MPCPDU format per 8.3.2.3.3	shall implement REPORT MPCPDU format per 8.3.2.2.3
RLC	Report Queue Length Calculation	shall implement queue length calculation per 8.3.2.1.2	shall implement queue length calculation per 8.3.2.3.2	shall implement queue length calculation per 8.3.2.2.2
DSM	Device status monitoring	shall implement device status monitoring per 9.2.3		
PLD	UNI Port Loop Detection	NA	NA	shall implement UNI Port Loop Detection per 9.2.7

Profile

Dedicated profile for each package (Different functions for packages)

Common profile for packages (Same function for each package)

Given package supports a profile

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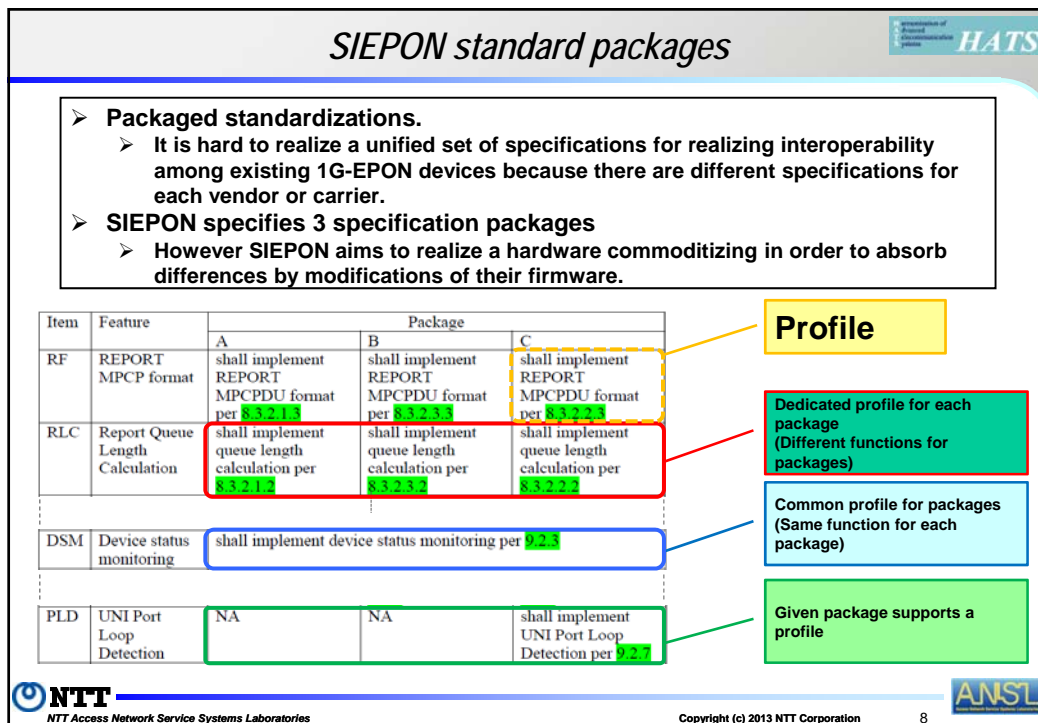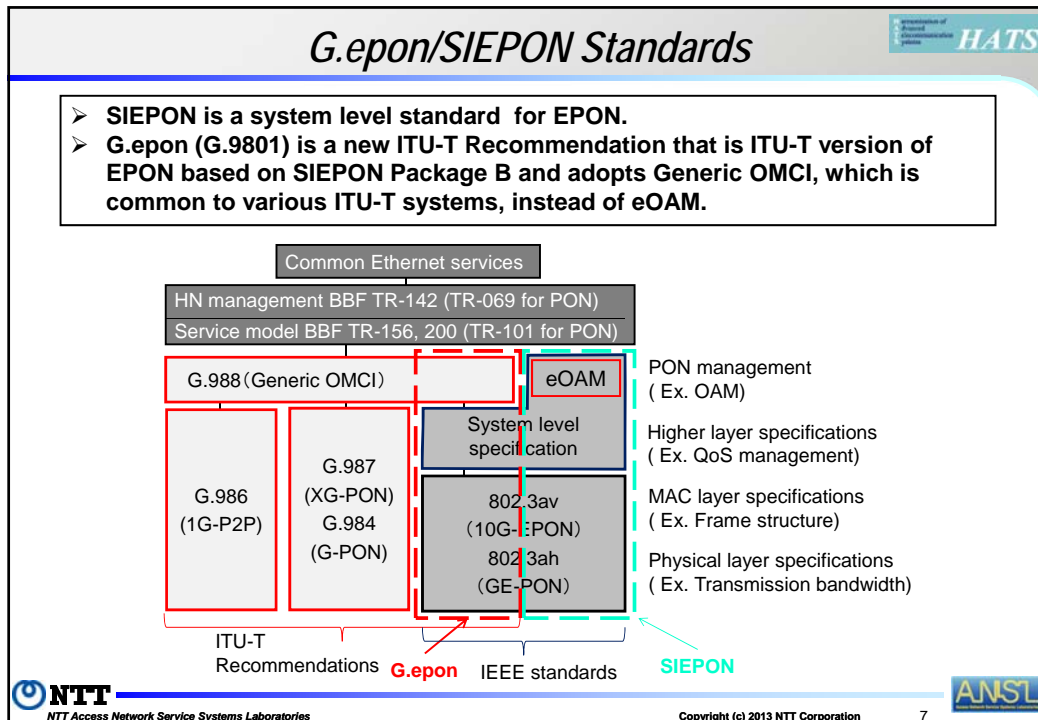NTT Access Network Service Systems Laboratories

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Added Specifications for G.epon/SIEPON standards

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Items	Main specifications	Remarks
Client Management	Encryption/Authentication, Protection, Power saving, Service management, System monitoring	
OAM client	OAM discovery, Alarm handling, Statistical information processing (Surveillance)	Surveillance and control functions
MAC client	Queue control, Priority control, Policing, etc.	Main signal control functions
MAC control client	Bandwidth control (assignment), Report generation/handling, Gate generation/handling, Discovery control	PON access control functions

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Architecture model for G.epon/SIEPON

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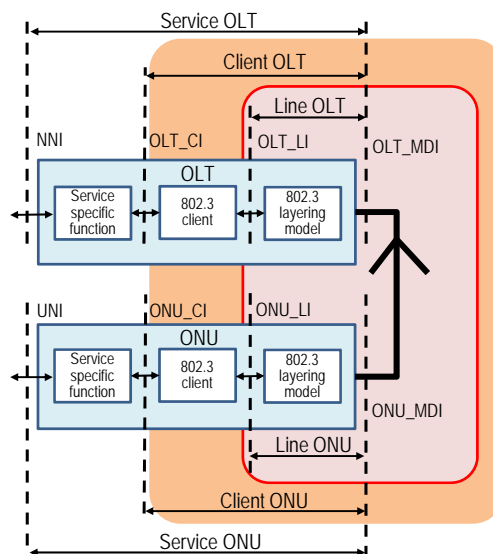
- **Line-OLT/ONU**
  - Function blocks defined by IEEE 802.3
- **Client-OLT/ONU**
  - General function blocks provided by PON ASIC chips
- **Service-OLT/ONU**
  - Products provided by system vendors

Coverage of ITU-T G.epon/ IEEE Std 1904.1

Coverage of IEEE Std 802.3

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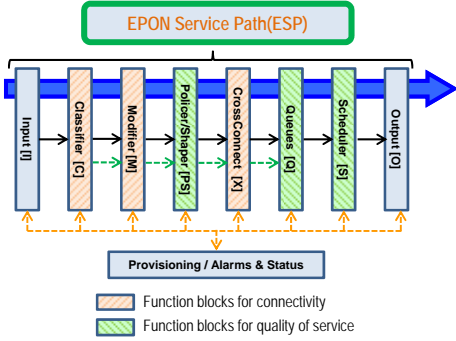*NTT Access Network Service Systems Laboratories* Copyright (c) 2013 NTT Corporation 10
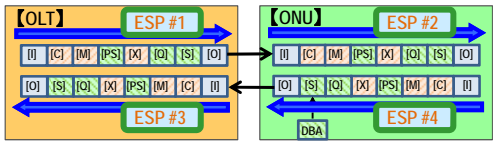
Logical connection model for G.epon/SIEPON

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- **EPON Service Path（ESP）**
  - ESP is a unidirectional virtual path providing a connection and "QoS" in a service.
  - ESP abstracts differences between implementation such as single and multiple LLID implementation in an ONU.

EPON Service Path(ESP)

Input [I] | Classifier [C] | Modifier [M] | Policer/Shaper [PS] | CrossConnect [X] | Queues [Q] | Scheduler [S] | Output [O]

Provisioning / Alarms & Status

Function blocks for connectivity
Function blocks for quality of service

- An example of ESP
  - Bidirectional unicast

【OLT】 ESP #1
[I] [C] [M] [PS] [X] [Q] [S] [O]
[O] [S] [Q] [X] [PS] [M] [C] [I]
ESP #3

【ONU】 ESP #2
[I] [C] [M] [PS] [X] [Q] [S] [O]
[O] [S] [Q] [X] [PS] [M] [C] [I]
ESP #4
DBA

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Related EPON standards

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- ➢ IEEE P1904.1 SIEPON
  - ✓ Package A: System level EPON specifications for North American MSO market
  - ✓ Package B: System level EPON specifications for Japan market
  - ✓ Package C: System level EPON specifications for China market
- ➢ IEEE P1904.1 SIEPON/Conformance
  - ✓ Conformance 01: Conformance Test case for Package A
  - ✓ Conformance 02: Conformance Test case for Package B
  - ✓ Conformance 03: Conformance Test case for Package C
- ➢ ITU-T G.epon (G.9801)
  - ✓ ITU-T EPON standards based on IEEE P1904.1 SIEPON package B and ITU-T G.988 generic OMCI for EPON
- ➢ ITU-T G.epon Implementers' guide
  - ✓ Conformance and interoperability test specification for G.epon
- ➢ IEEE 802.3ah: Ethernet First Mile, Ethernet Standards for Access System including 1G-EPON PHY and MAC layer specifications
- ➢ IEEE 802.3av: Optical Interfaces and PHY layer specifications for 10G-EPON

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Outline

1. **Background**
2. **G.epon/SIEPON standards**
3. **Activity for interoperability tests and optical access showcase**
   - **Intention of G.epon/SIEPON system interoperability**
   - **Optical access ad-hoc WG**
   - **Demonstration system for optical access showcase**
4. **Formation of WG with related organization**
5. **Conclusion**

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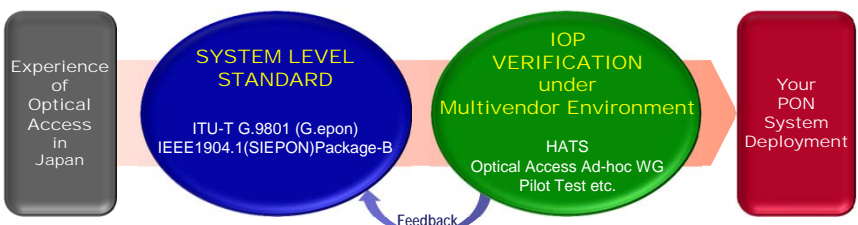

Intention of G.epon/SIEPON system interoperability

- Ensure operators to deploy G.epon/SIEPON package B compliant system under multiple vendors' environment.
  - Any countries' operators can utilize the highly matured Japanese optical access technology for their telecommunication infrastructure.

Experience of Optical Access in Japan

SYSTEM LEVEL STANDARD
ITU-T G.9801 (G.epon)
IEEE1904.1(SIEPON)Package-B

IOP VERIFICATION under Multivendor Environment
HATS
Optical Access Ad-hoc WG
Pilot Test etc.

Your PON System Deployment

Feedback

- Optical access Ad-hoc WG
  - Performs IOP verification under multiple venders' environment
    - In order to ensure interoperability of G.epon/SIEPON compliant equipment
  - Considers and extract issues for conducting conformance and interoperability tests in Japan.
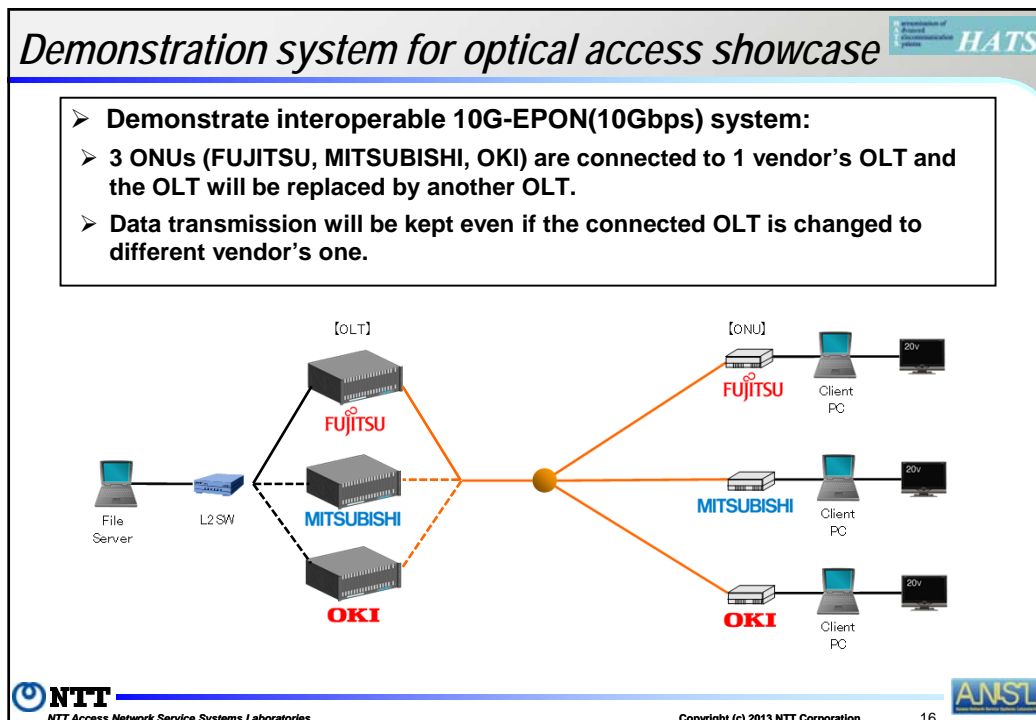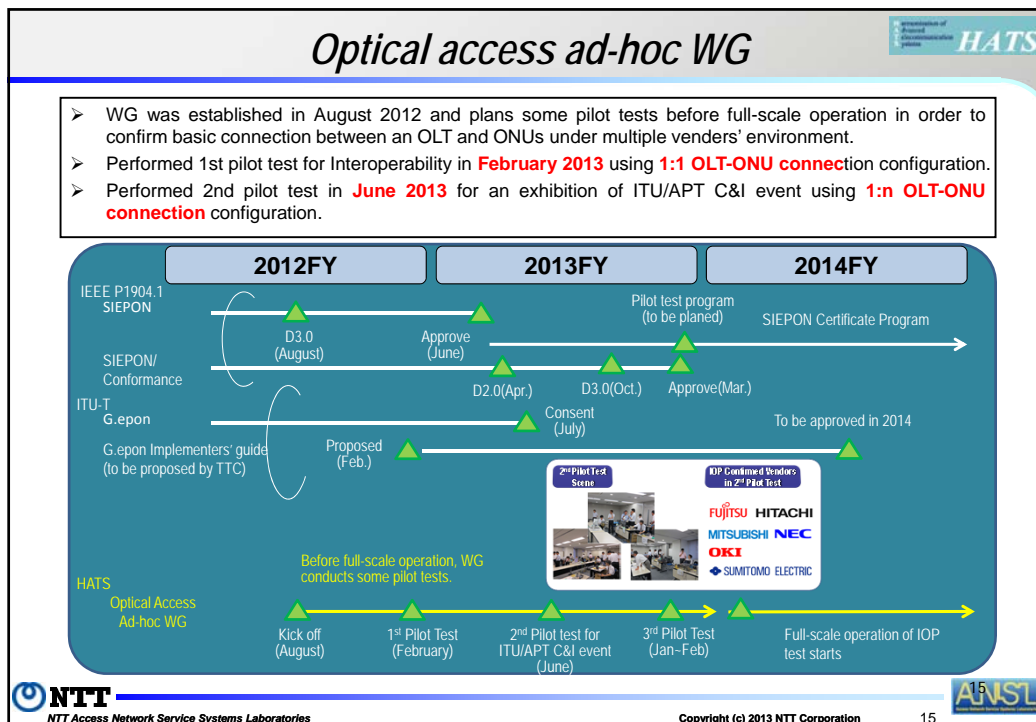 - Feedbacks WG results and achievements to related standards.

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Formation of WG with related organizations

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➢ Optical Access Ad-hoc WG conducts Conformance and Interoperability Test for G.epon/SIEPON compliant devices.
➢ WG collaborates with TTC and seeks the way to collaborate with IEEE SIEPON Certification Program in order to create some Test cases for Conformance and Interoperability Test.
➢ WG also consider the promotion of harmonization with ITU-T/ASTAP for global promotion of G.epon/SIEPON

Vendors

IEEE SIEPON Certification Program
•Conduct conformance Test and issue Certificate

SIEPON Interoperability Test

Test lab (No in Japan)

A
B
C

IOP Test Program
• Conduct IOP test for SIEPON equipment with SIPON Certificate
• Create IOP test guideline
• Global Promotion of SIEPN equipment

HATS
Conference
Optical Access Ad-hoc WG

Collaboration

TTC

Operators

A
B

•Support for IOP Test
•Provide Test machine
•Use of Test results

C

•**Conduct SIEPON Conformance Test**

Harmonization with ITU-T/ASTAP

D

G.epon Interoperability Test

G.epon Conformance and IOP test program
•Conduct Conformance and IOP tests using G.epon Implementers' guide
•Creation of IOP test guideline and global promotion G.epon equipment

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Conclusion

- **Presented**
  - **EPON standard and its issue**
  - **Demand for System level EPON standards**
- **Explained outline of G.epon/SIEPON standards**
  - **Difference between G.epon and SIEPON**
  - **Some features of G.epon/SIEPON**
- **Introduced**
  - **Our activity of interoperability tests in Japan for G.epon/SIEPON compliant equipment under multiple venders' environment.**
  - **2nd pilot test for ITU/APT C&I event using 1:n OLT-ONU connection configuration.**
  - **The demonstration system for Optical Access Showcase**
- **HATS optical access Ad-hoc WG consider**
  - **the promotion of harmonization with related organization, especially ITU-T/ASTAP in order to promote G.epon/SIEPON compliant system via some C&I event.**

Thank you