

EPIC 2

PON MANAGEMENT

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Introduction

As a service provider, we need an open platform that meets and exceeds the supported functionality of the current proprietary solutions. The application(s) will need to support multiple vendors' hardware and technology to provide a uniform level of functionality; the operational support interface shall be hardware and technology agnostic.

Assumptions

- Common requirements are met that are provided in EPIC_COMMON.docx
- The platform shall not be restricted to PON technologies as similar needs (e.g. software upgrades and frequency management) across multiple access technologies.
- The management tooling will integrate with the controller platform as an extension that can be added, removed, enabled or disabled.
- The management extensions should be upgradeable independently of the controller.

Acceptance Criteria

- Meet the defined test plan developed. To be delivered 4Q2016

User Story 2.1: PON Manager tool

As a Service Provider Network Administrator, we want to be able to manage our Passive Optical Network (PON) via standard management software so that we can effectively manage the Access PON network in production. .

Assumptions

- The hardware & software used in the Access PON network allows for wavelength as well as optical power adjustment control
- Common requirements are met that are provided in EPIC_COMMON.docx

Acceptance Criteria

- Provides the ability to manage the PON wavelength as well as optical power levels
- Provides diagnostics and performance management aspects of the PON
- Meet the defined test plan developed. To be delivered 4Q2016

Requirements

2.1.1 - PON Manager Tool Requirements

Requirement ID	Requirement Description 2.1.1 – PON Manager Tool Requirements	RFP Requirement ID
2.1.1.1	Shall support request and management of the OLT's measurements of upstream wavelengths transmit power level and report the power level in dBm unit and the associated wavelength as well.	N 1040
2.1.1.2	Shall support the ability to request and manage the OLT's received optical power level measurements from each ONT at their corresponding wavelength and also report their power level in dBm Unit and the associated wavelength as well.	N 1050
2.1.1.3	Shall support the ability to request and manage the ONT's power levelling capabilities which are provided to the OLT within the Serial_Number_ONU and Tuning_Response PLOAM messages.	N 1100
2.1.1.4	Shall support the ability to request the OLT to activate power levelling protocol to the ONT.	N 1120
2.1.1.5	Shall support the ability to request and store the urgent status snapshot records.	N 1950
2.1.1.6	Shall support the management of the mirroring of the Ethernet traffic received and sent to an ONT on a per subscriber basis. The Network Device shall forward the mirrored data to the virtualized OMCI (vOMCI), remote server or selected OSS for remote protocol analysis. A subscriber's Ethernet traffic stream can be identified by the following methods: VLAN ID or PON ID or ONU identification, etc. This feature shall be able to be turned on and off on demand via the SDN Controller.	M 4101
2.1.1.7	Shall support the ability to request the initiation of a loop-back / continuity test activation and deactivation command on the physical PON layer. It shall support the end-to-end loop-back and continuity test between the ONT and OLT, as specified by G.989.	M 4111
2.1.1.8	Shall support the initiation of loop-back / continuity / traceroute activation and deactivation commands at the Ethernet layer. It shall support requesting both segment and end-to-end loop-back and continuity tests, as specified by IEEE 802.1ag.	M 4121
2.1.1.9	All testing request invoked by the SDN controller shall be logged and recorded in syslog for audit trail purpose.	M 4141

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Requirement ID	Requirement Description 2.1.1 – PON Manager Tool Requirements	RFP Requirement ID
2.1.1.10	Shall provide a method for supporting and tracking the automatic discovery, registration, ranging, and activation of any ONT.	M 4201
2.1.1.11	Shall manage and track the installation and inventory information for each OLT / ONT combination which the ONT will report once it completes a power-on self-test and automatically authenticates itself with the OLT. All features must comply with ITU-T G.989.	M 4240
2.1.1.12	Shall confirm that the ONT is of a compatible type before the ONT /ONU is allowed to register and initialize. If the ONT is not allowed to register and initialize, all OLT/PON configuration information will remain unchanged.	M 4271
2.1.1.13	If the ONT model number is a compatible type but the capability of the services provisioned does not match what the ONT is capable of doing, the SDN controller shall provide the operator the following two options: (a) the compatible provisioning information could still be downloaded and the ONT would activate applicable services, such as POTS and Ethernet and ignore information that is not compatible, such as DS1. Or (b) all configuration shall remain unchanged. In another words, the ONT shall be registered and initialized but no configuration information is allowed to be downloaded. The detailed failure reason shall be logged via the SDN Controller.	M 4280
2.1.1.14	When an ONU plug-in or ONT is replaced, the SDN controller shall automatically upgrade the replacement plug-in software according to its provisioned target software version and overwrite provisioning data with then current provisioning data.	M 4290
2.1.1.15	Shall support the pre-provisioning of the ONT Registration ID and ONU_ID without an actual ONT present. The ONT registration process shall take place with the pre-provisioned Registration ID and ONU_ID, before the ONT can be fully functional with the OLT.	M 4301
2.1.1.16	For the ONTs which have completed registration, the system shall provide the capability to change the existing value of the different ONT Registration ID. Shall communicate the change to the OLT first. The ONT shall not be impacted until it re-registers again. Re-registration of an ONT is triggered when the pre-provisioned and discovered serial numbers do not match during ONT initialization and when the operator remotely invoke registration to take place from the vOLT through the SDN controller interface.	M 4321
2.1.1.17	Shall provide the capability for the operator to change the ONU_ID and communicate this change downstream to the vOLT and ONU with or without service provisioned. Shall ensure the change is communicated to the vOLT first. The ONT shall not be synchronized and operated with the new ONU ID until it re-initializes.	M 4331
2.1.1.18	Shall provide the capability to remotely invoke the ONT to re-register. The ONT shall go through activation chores such as transmission power level adjustment, serial number discovery, ONU_ID assignment, and ranging. The operator shall be able to access this functionality through the SDN controller interface.	M 4341
2.1.1.19	Shall provide the capability for the operator to reset the ONT remotely and force a re-initialization. The ONT shall go through activation process such as transmission power level adjustment, serial number discovery, ONU_ID assignment, and ranging. The operator shall be able to access this functionality through the SDN controller interface.	M 4351
2.1.1.20	Shall be capable of provisioning the time threshold that constitutes a “loss of traffic” for a multicast stream and communicate this value to the vOLT. The term “loss of traffic” is interpreted as a period where no multicast packets for the service are seen transitioning through the NE. The value shall be specified in mS.	M 5040

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Requirement ID	Requirement Description 2.1.1 – PON Manager Tool Requirements	RFP Requirement ID
2.1.1.21	Shall support monitoring and measurement collection of IGMP snooping/proxy performance including volume of joins/leaves per port, maximum concurrent joins per port, join/leave and protocol errors, join/leave latency.	M 5061
2.1.1.22	Shall utilize the vOLT NETCONF to OMCI abstraction to manage the ONT.	P 100
2.1.1.23	Support multiple operating models: in a KVM, Docker, baremetal or on the OLT.	P 110
2.1.1.24	Shall provide Wavelength management and optimization for tunable optics and will communicate these settings to the vOLT and ONT.	P 120
2.1.1.25	Shall integrate into the target orchestration platform (currently ONOS).	P 130
2.1.1.26	Allows for interoperable with BBF.247 certified ONUs.	P 140
2.1.1.27	Shall be interoperable with various OLTs from different suppliers.	P 150
2.1.1.28	Shall provide Software Management capabilities for the PON (included but not limited to the OLT and ONT).	P 170
2.1.1.29	Shall support Bridge Port Provisioning	P 180
2.1.1.30	Shall support the configuration of an Ingress QoS Profile at OLT (GEM Port)	P 190
2.1.1.31	Shall support the configuration of an Upstream Bandwidth Profile at ONT (Tcont)	P 200
2.1.1.32	Shall support the collection of Bulk Stats and General Accounting	P 210
2.1.1.33	Shall manage the PON Monitoring/Alarms, Counters, SFP Management and Housekeeping of the PON network	P 220
2.1.1.34	Shall provide subscriber based traffic management	P 280
2.1.1.35	Shall have ability to Disable, Remove or reinitialize the subscribers	P 290
2.1.1.36	The controller shall extend capabilities of the ONOS PON	P 400
2.1.1.37	Interface with the northbound interface (NBI) of the SDN controller utilizing the REST based Intent Framework.	P 410
2.1.1.38	The PON manager shall integrate with the ONOS SDN Controller	P 420
2.1.1.39	The PON Manager should log and report the Fiber Distance between OLT to each ONT. The value reported shall be made available in kilometers. The distance shall be reported on demand.	S 10
2.1.1.40	All the optical parameters (OLT Tx, ONT Tx, ONT Rx, OLT Rx) shall be monitored by the SDN Controller, continuously, in real time in order to reflect the actual quality of physical links and operational status of optical modules. Moreover, the monitoring process should not degrade the normal service transmissions.	S 40
2.1.1.41	The ONT and OLT Transceivers temperature, voltage, and laser drive current shall be reporting to the NAL and SDN Controller.	S 50
2.1.1.42	Shall report a counter value for Bit Errors received in a specific interval of time to provide quality of the optical line Downstream. This report shall be consistent with the applicable OMCI managed entity ID. Shall report these parameters; FEC PM history data, which counts corrected bytes, corrected FEC code words, uncorrectable code words, total code words, and FEC anomaly seconds. Shall allow user settable threshold triggers on the attributes of this ME.	S 70
2.1.1.43	Shall report a counter value for Bit Errors received in a specific interval of time corresponding to a specific ONT in order to quantify the performance of the optical link Upstream. Please provide your solution consistent with applicable Standards reference. Comment on your use of these parameters; FEC PM history data, which counts corrected bytes, corrected FEC code words, uncorrectable code words, total code words, and FEC anomaly seconds. The method shall allow user settable threshold triggers on the attributes of this ME.	S 80
2.1.1.44	Shall provide an on-demand report of the OLT to ONT optical loss (downstream) values and shall be measured using transmit and received power levels (loss in dB). The loss value shall be reported to the tenths degree of accuracy.	S 90
2.1.1.45	Shall track and report "transmitted optical power is too high alarm" when the ONT	S 110

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	transmitted power is > (+7dBm). The default alarm threshold shall be at +7dBm.	
2.1.1.46	Shall track and report "transmitted optical power is too low alarm" when the ONT transmitted power is < (+2dBm). The default alarm threshold shall be at +2dBm.	S 120
2.1.1.47	Shall be able to report the center wavelength of the Transmitters (which contain more than one Wavelength Plan Options) for the Access Node and the ONT. A WDM Mismatch alarm shall be raised if the ONT wavelength plan is different than the OLT system during ONT registration and operation.	S 140
2.1.1.48	The SDN controller should report the Optical Budget Class Pluggable Optics received from the Access Node for the Class of Optics Type with values conforming and associated to the emerging G.9807.1 Standards Optics Classes (N1, N2, etc.).	S 150
2.1.1.49	Shall provide a Secure interface to the managed elements.	M 1341
2.1.1.50	Shall support PON OA&M continuity and loop-back test, according to ITU-T G.989.	M 4021
2.1.1.51	Shall support Ethernet OA&M continuity and loop-back and trace route according to IEEE 802.1ag.	M 4041

User Story 2.2: Standardize Software upgrade process

As a Service Provider Administrator, we want to define & standardize the upgrade process for the SDN OLT/ONT solution, this will include firmware/software upgrades, so that we can introduce this solution into production and be able to administer updates and changes in a standard process while insuring minimal or no customer impact.

Assumptions

- Inventory database provides relevant information correlation
- Process should update inventory systems to reflect changes
- Shall not be limited to the ONT and OLT. Future support for other access technologies will be required
- Common requirements are met that are provided in EPIC_COMMON.docx

Acceptance Criteria

- Provides interface to enable upgrades
- Identify communication path/Protocols used with security in mind
- Define software Repository - (Location, size , type requirements)
- Document (test/validate) Service disruption/reliability during upgrade sequences
- Meet the defined test plan developed. To be delivered 4Q2016

Requirements

2.2.1 - Standardized Software Upgrade Process Requirements

Requirement ID	Requirement Description	RFP Requirement ID
	2.2.1 – Standardized Software Upgrade Process Requirements	
2.2.1.1	Shall be capable of requesting a backing out of an unsuccessful or failed software upgrade in a non-service affecting manner and managing the restoral of the remote system /database (Managed Element) to its previous state and software release version.	G 360, G 540. G 550
2.2.1.2	Activation of software on the Managed Element (OLT/ONT/Ethernet Switch) shall be user-initiated. This shall be supported via the local interface of the NE and via the SDN Controller GUI on demand or scheduled (Defined by user).	G 370, G 560
2.2.1.3	Shall provide notification of success or failure at key steps of all remote software upgrade processes on Managed Elements (OLT/ONT/Ethernet Switch) both during and immediately after the upgrade.	G 380, G 530
2.2.1.4	Shall support remote software downloads and activation to Managed Elements (ONT, OLT, or Ethernet Switch) such that these updates are non-service affecting on the Managed Element.	G 390, G 520, G 350, E 1160
2.2.1.5	Shall maintain up-to-date and readily available records of software releases and all fixes/changes on all Managed Elements.	G 400
2.2.1.6	Shall not accept Supplier software that is not unique, incrementing version number for each software release for Managed Elements.	G 420
2.2.1.7	SDN Controller shall have the capability to remotely upgrade multiple OLTs/ONTs/ONUx/Ethernet with software various software revisions in a serial, parallel or scheduled manner.	G 500
2.2.1.8	Shall be capable of reporting if/when the OLTs/ONTs/ONUx backs out / terminates an unsuccessful or failed software download	G 530
2.2.1.9	Shall provide the operator the option to upgrade the software during the	G 570

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Requirement ID	Requirement Description	RFP Requirement ID
	2.2.1 – Standardized Software Upgrade Process Requirements	
	activation of the managed element. Upgrade process can be either automated or operator initiated.	
2.2.1.10	Activation of software on the Managed Element shall be non-service affecting for the SDN Controller as well as not impose any requirements which would affect services on the Managed Element.	G 580
2.2.1.11	Shall be capable of identifying that a Managed Element requires a software upgrade.	G 590
2.2.1.12	The software upgrade/transfer process of a Managed Element shall be managed and monitored by the SDN Controller. The operator shall be able to identify that the software transfer has started/in progress/completed or if an error has occurred. The SDN Controller shall also indicate when an upgrade is in progress on a Managed Element and estimate the time remaining.	G 600
2.2.1.13	The SDN Controller software shall have mechanisms to prevent corruption of software for Managed Elements.	G 610
2.2.1.14	The SDN Controller should not impose any requirements on the Managed Element that require these system elements to shutdown or reboot during a software upgrade.	G 620
2.2.1.15	Pre-existing provisioning data on the SDN controller regarding any Managed Element shall not be changed as a result of software upgrades.	G 630
2.2.1.16	Shall be interoperable with one or more third party (To be identified by AT&T) OLT/ONT/ONU or Ethernet switch.	I 20
2.2.1.17	The vendor or participating vendors shall advertise their interface requirements between the SDN Controller and the OLT / ONT.	I 50
2.2.1.18	All software downloads and activations to fully loaded systems shall be capable of being completed within one 4-hour maintenance window.	E 1170
2.2.1.19	NE shall support all critical network management (NM) functionality during a software upgrade process. If this is not possible, describe impact on NM functions.	E 1190
2.2.1.20	The NE shall support the roll-back/revert of a software upgrade.	E 1200
2.2.1.21	In-service software upgrade (ISSU): Describe the ability of the platform to provide in-service software upgrades (ISSU). By ISSU we mean the platform shall have the ability to upgrade its software, either to a new release version or by applying patches to the current version, while the platform is operational without any impact to customer traffic or platform management and control functions. Software upgrades shall not require that any traffic be removed from the platform. ISSU shall work for all protocols and all hardware from day one. Please provide an estimated maximum time to complete an upgrade with ISSU.	E 1950
2.2.1.22	Ability to back out of a software installation for the platform: Describe the ability of the platform to gracefully back out of a software installation. A graceful back out shall mean that the platform shall have the ability to back out of an installation of a new software version and resume operation under the previous software version that has been reset to the previous operational configuration. This ability shall be provided prior to full operation under the new version and shall reset the new software to the previous operational configuration.	E 1960
2.2.1.23	Allow for targeted upgrades to specific groups/sub-groups of network elements. This implies an NE groups function that the application would model for users.	

User Story 2.3: Multi-vendor Instantiation Service Tool (MIST)

As a Service Provider Administrator, we want Multi-unit Instantiation Service Tool (MIST) (interface/GUI) to provide hierarchical management functions in the following areas:

- Retains software version control with more than one software version of the OLT/ONT platform
- Ability to view configuration even if managed objects are unmanageable/unreachable
- To include snapshot of current configurations (NOTE: Executed management commands must not impact service)
- Supports pushing software upgrade/downgrade to a large scale network through MIST
- Support separation of software upgrade/downgrade and software activation process through MIST
- Support both scheduled and on-demand mechanism for SW management and configuration backup/restore

Assumptions

- Common requirements are met that are provided in EPIC_COMMON.docx
- The platform shall not be restricted to PON technologies as similar needs (e.g. software upgrades and frequency management) across multiple access technologies.
- The management tooling will integrate with the controller platform as an extension that can be added, removed, enabled or disabled.
- The management extensions should be upgradeable independently of the controller.

Acceptance Criteria

- Provide administrators the ability to utilize existing SDN controller and a combination of inventory data to troubleshoot/resolve/deploy Access network software.
- Software version information to be obtained utilizing an industry standard based NETCONF interface and a well-defined YANG model (Specific standards are referenced in requirements below)
- Manage device persistence capabilities for administration in the event of connectivity loss
- Software upgrade process is in place
- Meet the defined test plan developed. To be delivered 4Q2016

Requirements

2.3.1 - OLT Requirements for SDN Control

Requirement ID	Requirement Description 2.3.1 – OLT Requirements for SDN Control	RFP Requirement ID
2.3.1.1	Shall be capable of stopping a database backup and a database restore of a managed element.	L 3710
2.3.1.2	Remote software downloads and activation shall not require any local support on site where the Network Device is located.	M 3050
2.3.1.3	Shall log and report the success / failure status of software upgrades of Managed Elements (OLT, ONT) by the status received from that element.	M 3101
2.3.1.4	Shall log and report the service state status of each of Managed Elements (OLTs, ONT) In Service/Out of Service, at the end of a software upgrade.	M 3111
2.3.1.5	Shall be capable of automatically downloading, upgrading and activating OLT / ONT	M 3131

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Requirement ID	Requirement Description 2.3.1 – OLT Requirements for SDN Control	RFP Requirement ID
	software to the provisioned OLT/ONT software version upon OLT/ONT initialization, on operator command (i.e. SSH or NETCONF interface), and/or on a scheduled basis.	
2.3.1.6	Shall support ONT software downloads through the Standard OMCI download process using the extended message set identified in G.988. (Note: These downloads can be performed during any time of day.)	M 3140
2.3.1.7	All software activations, including Network Device SW (OLT) and ONT SW, shall be capable of being complete within one 4 hour maintenance window. This also include the time required to revert back to the old running version.	M 3150
2.3.1.8	The SDN shall log and report any software activation of a Managed Element, including Network Device SW and ONT SW, that does not complete within 5 minutes.	M 3180
2.3.1.9	Permanent device configuration such as VLAN, XGEM Port Id (PON), T-CONT Traffic Container (PON), etc. shall not be changed as result of Network Device software upgrades. All pre-provisioned (not yet in service) ONT configurations shall also be maintained.	M 3210
2.3.1.10	Shall support on-request auditing of software versions (both active and passive memory) and hardware diagnostic testing (e.g., power-on self-test), and report results to the requesting client. Requests from the SSH, NETCONF interface and craft interface shall be honored.	M 3221
2.3.1.11	Shall support single software distribution that includes the software for both Network Device (OLT and ONT). The ONT shall be able to perform software synchronization with the OLT by being able to check software versions automatically and be able to download compatible software versions.	M 3231
2.3.1.12	Shall also support software image download according to ITU-T G.988. (PON)	M 3241
2.3.1.13	The discovery of any ONT software mismatch (e.g. version mismatch) shall be logged to syslog. If this is not related to a regular software maintenance upgrade as triggered by the operator, then an event notification shall be generated and sent to the operator. Any subsequent software download by the Network Device shall also be captured as an event in the log. Event notification to the operator shall be generated if the download is unsuccessful.	M 3250
2.3.1.14	If the ONT software upgrade activation fails, the ONT shall automatically rollback to the previous running software version and report the software upgrade failure	M 3591
2.3.1.15	ONT software upgrade shall not change the connections of the permanent VLAN connections, and XGEM Port Id (PON), T-CONT Traffic Container (PON) connections shall not be changed as result of ONT software upgrades.	M 3610
2.3.1.16	Shall support on-request auditing of the ONT software versions (both active and passive memory) and hardware diagnostic testing (e.g., power-on self-test), and report results to the requesting client.	M 3621
2.3.1.17	The software download shall not exceed 3 minutes from the initiation of the download to the completion for a single ONT on a single PON.	M 3640