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(informative)
UMT configuration examples

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7A.2 OAM over UMT use case, UMT-aware end points

7A.2.1 Introduction

This example illustrates OAM communication between a Manager M and a Station S carried over UMT that traverses multiple L2 bridges (see Figure 7A-2). Both the Manager and the Station are UMT-aware. The UMT awarness is not required in the intermediate Bridges X and Y, as well as any possible other bridges between them.

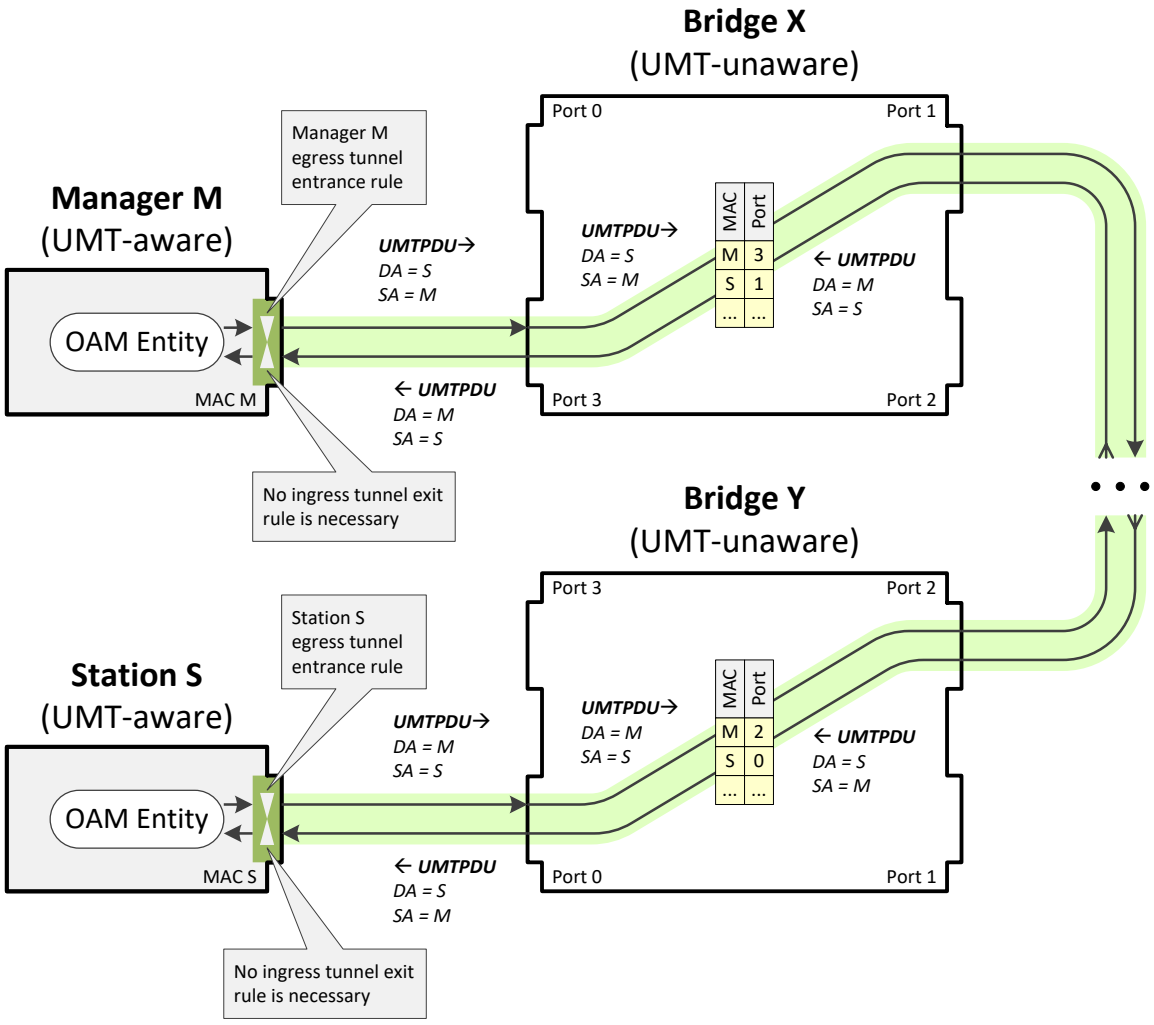

Figure 7A-2— OAM over UMT use case, UMT-aware end points

In Figure 7A-2, the Manager M, station S, Bridges X and Y have MAC addresses M, S, X, and Y respectively. For simplicity, it is assumed that all ports in a given device use the same MAC address, but this is not a requirement.

Furthermore, it is assumed that Bridges X and Y, as well as all intermediate bridges, have already populated their forwarding tables with entries for MAC addresses M and S. These entries may be created dynamically by a MAC learning function or be provisioned statically by the NMS.

7A.2.2 UMT provisioning to establish tunnels

Since the Manager M is not directly linked with the managed Station S, the OAM messages need to be carried over UMTPDUs. Therefore, before the Manager M and the Station S are able to exchange OAM messages, two UMT tunnels need to be provisioned:

— A forward UMT tunnel from Manager M to Station S.
— A reverse UMT tunnel from Station S to Manager M.

To establish a UMT tunnel from Manager M to Station S, a tunnel entrance rule is provisioned at the egress of Manager M. No tunnel exit rule is necessary at the ingress of Station S, since the UMT sublayer provides

a built-in translation of UMTPDUs with subtype `OAM_subtype` into OAMPDUs (see Receive Path Specification in 6.2).

Similarly, to establish a UMT tunnel from Station S to Manager M, a tunnel entrance rule is provisioned at the egress of Station S. No tunnel exit rule is necessary at the ingress of Manager M, since the UMT sublayer provides a built-in translation of UMTPDUs with subtype `OAM_subtype` into OAMPDUs.

Each rule is provisioned using a separate `UMT_CONFIG` message. The contents of two messages required to establish two UMT tunnles for bidirectional communication for the network segment illustrated in Figure 7A-2 are shown below.

7A.2.2.1 Addition of tunnel entrance rule at the egress of Manager M

The UMT tunnel entrance rule at the egress of Manager M is shown in Table 7A-9. This rule converts an OAMPDU into a UMTPDU in the transmit path of a given port of Manager M. The conversion replaces the destination MAC address value (`SP_DA`) with the MAC address of Station S and replaces the Slow Protocol Ethertype (`SP_TYPE`) with the UMT Ethertype (`UMT_TYPE`).

Table 7A-9 — Tunnel entrance rule at the egress of Manager M

Conditions	Actions
1. DA == SP_DA 2. ETH_TYPE_LEN == SP_TYPE 3. SUBTYPE == OAM_SUBTYPE	1.REPLACE(DA, S) 2.REPLACE(ETH_TYPE_LEN, UMT_TYPE)
NOTE: SP_TYPE – Slow Protocol Ethertype value (see IEEE Std 802.3, 57A.4) UMT_TYPE – Ethertype value identifying UMTPDUs (see 5.1) OAM_SUBTYPE – Subtype value identifying OAMPDUs (see IEEE Std 802.3, 57A.4) SP_DA – Destination MAC address associated with Slow Protocols (see IEEE Std 802.3, 57A.3) S – MAC address of Station S.	

Table 7A-10 provides the contents of a *UMT_CONFIG* UMTPDU that provisions the rule shown in Table 7A-9.

Table 7A-10 — Contents of UMT_CONFIG message

Field	Subfield	Value	Description
DestinationAddress	n/a	M	`UMT_CONFIG` UMTPDU directed to Manager M
SourceAddress	n/a	any	Source address of the device that issued the `UMT_CONFIG` UMTPDU
LengthType	n/a	0xA8-C8	Ethertype value identifying UMTPDUs (see 5.1)
Subtype	n/a	0x00	UMTPDU carrying `UMT_CONFIG` message
MsgCode	*MsgType*	0x0	This message is a Request (see Table 8-1)
	RequestCode	0x1	Request to add a rule (see Table 8-1)

Field	Subfield	Value	Description
MsgSequence	*MsgCounter*	0x00-01	This request consists of a single message
	EndOfSequence	1	
PortInstance	*PortIndex*	1	The rule is to be provisioned for port #1
	Direction	0	The rule is to be provisioned for the transmit path (i.e., an egress rule)
RuleTLV (condition)	*Type*	0xCO	This is a condition TLV (see Table 8-3)
	Length	0x0A	TLV length is 10 octets
	Operation	0x11	Comparison for equality (see Table 6-1)
	FieldCode	0x01	Compare `DST_ADDR` field (see Table 6-2)
	Value	0x01-80-C2-00-00-02	IEEE 802.3 Slow_Protocols_Multicast address (see IEEE Std 802.3, 57A.3)
RuleTLV (condition)	*Type*	0xCO	This is a condition TLV (see Table 8-3)
	Length	0x06	TLV length is 6 octets
	Operation	0x11	Comparison for equality (see Table 6-1)
	FieldCode	0x03	Compare `ETH_TYPE_LEN` field (see Table 6-2)
	Value	0x88-09	Slow Protocol Ethertype value (see IEEE Std 802.3, 57A.4)
RuleTLV (condition)	*Type*	0xCO	This is a condition TLV (see Table 8-3)
	Length	0x05	TLV length is 5 octets
	Operation	0x11	Comparison for equality (see Table 6-1)
	FieldCode	0x26	Compare `SUBTYPE` field (see Table 6-2)
	Value	0x03	Slow Protocol Subtype value for OAM (see IEEE Std 802.3, 57A.4)
RuleTLV (action)	*Type*	0xAC	This is an action TLV (see Table 8-3)
	Length	0x0A	TLV length is 10 octets
	Operation	0xCE	Change (replacement) of a field (see Table 6-3)
	FieldCode	0x01	Modify `DST_ADDR` field (see Table 6-2)
	Value	S	Set Station S MAC address as the destination for resulting UMTPDUs.
RuleTLV (action)	*Type*	0xAC	This is an action TLV (see Table 8-3)
	Length	0x06	TLV length is 6 octets
	Operation	0xCE	Change (replacement) of a field (see Table 6-3)
	FieldCode	0x03	Modify `ETH_TYPE_LEN` field (see Table 6-2)
	Value	0xA8-C8	Set Ethertype to be equal to UMT Ethertype (`UMT_TYPE`) in the resulting UMTPDUs.

Field	Subfield	Value	Description
RuleTLV (termination)	*Type*	0x00	This is a termination (end-of-rule) TLV (see Table 8-3)
	Length	0x04	TLV length is 4 octets
	Operation	0x00	Filled with zeros when not used (see Table 8-3 note)
	FieldCode	0x00	

7A.2.2.2 Addition of UMT tunnel entrance rule at the egress of Station S

The UMT tunnel entrance rule at the egress of Station S is shown in Table 7A-11. This rule converts an OAMPDU into a UMTPDU in the transmit path of port 0. The conversion replaces the destination MAC address value (SP_DA) with the MAC address of Manager M and replaces the Slow Protocol Ethertype (SP_TYPE) with the UMT Ethertype (UMT_TYPE).

Table 7A-11 — UMT tunnel entrance rule at the ingress of Station S

Conditions	Actions
4. DA == SP_DA 5. ETH_TYPE_LEN == SP_TYPE 6. SUBTYPE == OAM_SUBTYPE	3.REPLACE(DA, M) 4.CHANGE(ETH_TYPE_LEN, UMT_TYPE)
NOTE: SP_TYPE – Slow Protocol Ethertype value (see IEEE Std 802.3, 57A.4) UMT_TYPE – Ethertype value identifying UMTPDUs (see 5.1) OAM_SUBTYPE – Subtype value identifying OAMPDUs (see IEEE Std 802.3, 57A.4) SP_DA – Destination MAC address associated with Slow Protocols (see IEEE Std 802.3, 57A.3) M – MAC address of Manager M.	

Table 7A-12 provides the contents of a *UMT_CONFIG* UMTPDU that provisions the rule shown in Table 7A-11.

Table 7A-12 — Contents of UMT_CONFIG message

Field	Subfield	Value	Description
DestinationAddress	n/a	S	UMT_CONFIG UMTPDU directed to Station S
SourceAddress	n/a	any	Source address of the device that issued the UMT_CONFIG UMTPDU
LengthType	n/a	0xA8-C8	Ethertype value identifying UMTPDUs (see 5.1)
Subtype	n/a	0x00	UMTPDU carrying UMT_CONFIG message
MsgCode	*MsgType*	0x0	This message is a Request (see Table 8-1)
	RequestCode	0x1	Request to add a rule (see Table 8-1)
MsgSequence	*MsgCounter*	0x00-01	This request consists of a single message

Field	Subfield	Value	Description
	EndOfSequence	1	
PortInstance	*PortIndex*	0	The rule is to be provisioned for port #0
	Direction	0	The rule is to be provisioned for the transmit path (i.e., an egress rule)
RuleTLV (condition)	*Type*	0xCO	This is a condition TLV (see Table 8-3)
	Length	0x0A	TLV length is 10 octets
	Operation	0x11	Comparison for equality (see Table 6-1)
	FieldCode	0x01	Compare DST_ADDR field (see Table 6-2)
	Value	0x01-80-C2-00-00-02	IEEE 802.3 Slow_Protocols_Multicast address (see IEEE Std 802.3, 57A.3)
RuleTLV (condition)	*Type*	0xCO	This is a condition TLV (see Table 8-3)
	Length	0x06	TLV length is 6 octets
	Operation	0x11	Comparison for equality (see Table 6-1)
	FieldCode	0x03	Compare ETH_TYPE_LEN field (see Table 6-2)
	Value	0x88-09	Slow Protocol Ethertype value (see IEEE Std 802.3, 57A.4)
RuleTLV (condition)	*Type*	0xCO	This is a condition TLV (see Table 8-3)
	Length	0x05	TLV length is 5 octets
	Operation	0x11	Comparison for equality (see Table 6-1)
	FieldCode	0x26	Compare SUBTYPE field (see Table 6-2)
	Value	0x03	Slow Protocol Subtype value for OAM (see IEEE Std 802.3, 57A.4)
RuleTLV (action)	*Type*	0xAC	This is an action TLV (see Table 8-3)
	Length	0x0A	TLV length is 10 octets
	Operation	0xCE	Change (replacement) of a field (see Table 6-3)
	FieldCode	0x01	Modify DST_ADDR field (see Table 6-2)
	Value	M	Set Manager M MAC address as the destination for resulting UMTPDUs.
RuleTLV (action)	*Type*	0xAC	This is an action TLV (see Table 8-3)
	Length	0x06	TLV length is 6 octets
	Operation	0xCE	Change (replacement) of a field (see Table 6-3)
	FieldCode	0x03	Modify ETH_TYPE_LEN field (see Table 6-2)
	Value	0xA8-C8	Set Ethertype to be equal to UMT Ethertype (UMT_TYPE) in the resulting UMTPDUs.

Field	Subfield	Value	Description
RuleTLV (termination)	*Type*	0x00	This is a termination (end-of-rule) TLV (see Table 8-3)
	Length	0x04	TLV length is 4 octets
	Operation	0x00	Filled with zeros when not used (see Table 8-3 note)
	FieldCode	0x00	

7A.2.3 UMT provisioning to delete tunnels

The deletion of a UMT tunnel involves the deletion of a rule that controls UMT tunnel entrance. Therefore, to delete a tunnel from Manager M to Station S, the UMT tunnel entrance rule at the egress of Manager M is deleted. And to delete a UMT tunnel from Station S to Manager M, the UMT tunnel entrance rule at the egress of Station S is deleted.

Each rule deletion is provsioned using a separate `UMT_CONFIG` UMTPDU. The contents of two messages required to delete two tunnels illustrated in Figure 7A-2 are described below.

7A.2.3.1 Deletion of UMT tunnel entrance rule at the egress of Manager M

The contents of a `UMT_CONFIG` UMTPDU that deletes the UMT tunnel entrance rule at the egress of Manager M are identical to the `UMT_CONFIG` UMTPDU shown in Table 7A-10, with the exception of the value of the field `MsgCode`, subfield `RequestCode`, which in case of rule deletion has the value of 0x2 (see Table 8-1).

7A.2.3.2 Deletion of UMT tunnel entrance rule at the egress of Station S

The contents of a `UMT_CONFIG` UMTPDU that deletes the UMT tunnel entrance rule at the ingress of Bridge Y, port 0 is identical to the `UMT_CONFIG` UMTPDU shown in Table 7A-12, with the exception of the value of the field `MsgCode`, subfield `RequestCode`, which in case of rule deletion has the value of 0x2 (see Table 8-1).

7A.3 OAM over UMT use case, UMT-aware end point and UMT-unaware end point

7A.3.1 Introduction

This example illustrates OAM communication between a Manager M and a Station S carried over UMT that traverses multiple L2 bridges (see Figure 7A-3). The Manager M is UMT-aware, while the Station S is UMT-unaware. The Bridge X nearest to the Manager M may or may be not UMT-aware. The Bridge Y nearest to the Station S is UMT-aware and is responsible for converting OAMPDUs into UMTPDUs and vise versa. There can be numerous other bridges between the Bridges X and Y; those bridges may or may be not UMT-aware.

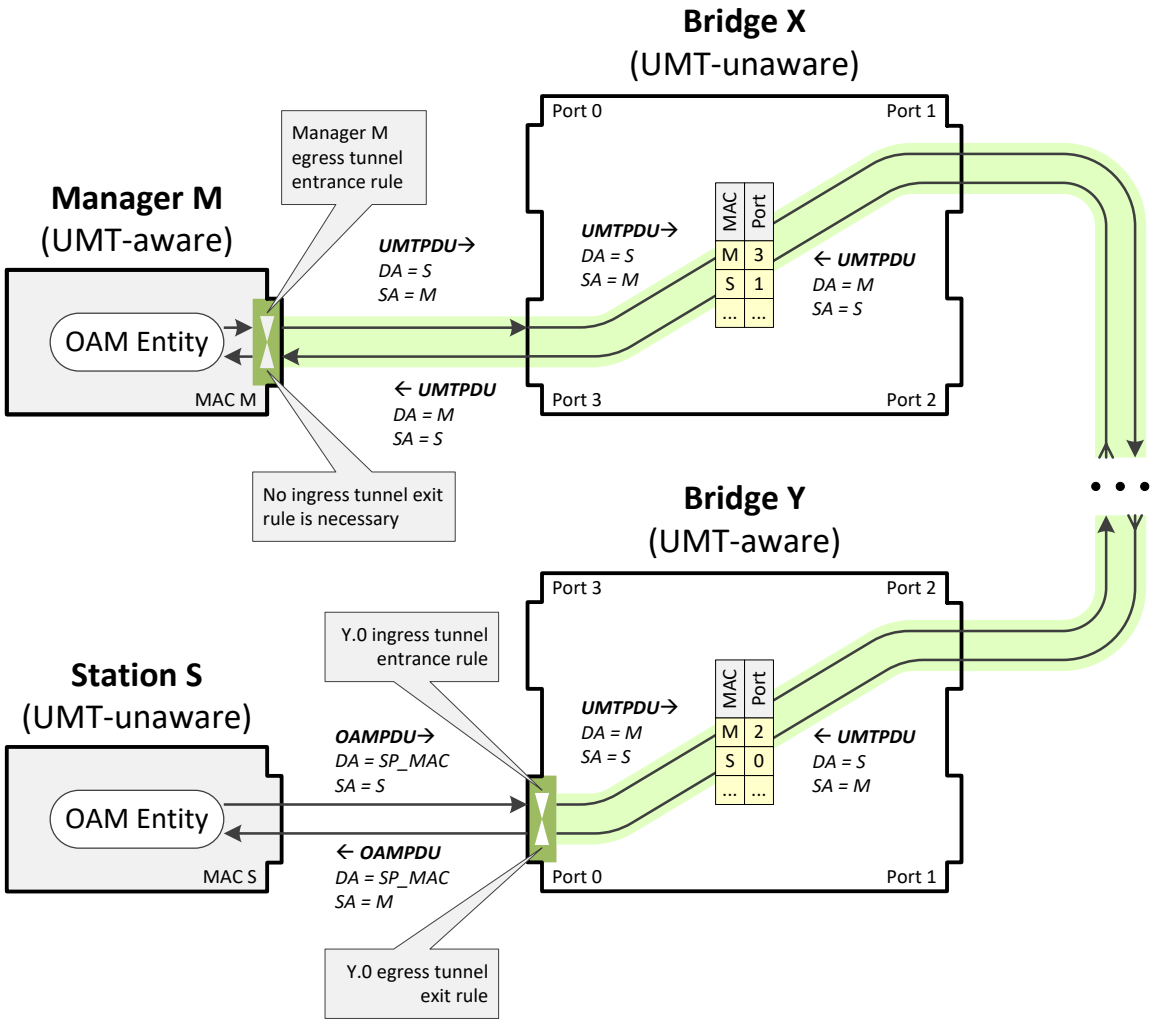

Figure 7A-3—UMTPDU format

In Figure 7A-3, the Manager M, station S, Bridges X and Y have MAC addresses M, S, X, and Y respectively. For simplicity, it is assumed that all ports in a given device use the same MAC address, but this is not a requirement.

Furthermore, it is assumed that Bridges X and Y, as well as all intermediate bridges, have already populated their forwarding tables with entries for MAC addresses M and S. These entries may be created dynamically by a MAC learning function or be provisioned statically by the NMS.

7A.3.2 UMT provisioning to establish tunnels

Since the Manager M is not directly connected to the managed Station S, the OAM messages need to be carried over UMTPDUs. Therefore, before the Manager M and the Station S are able to exchange OAM messages, two UMT tunnels need to be provisioned:

- A forward UMT tunnel from Manager M to Bridge Y, port 0.
- A reverse UMT tunnel from Bridge Y, port 0 to Manager M.

To establish a UMT tunnel from Manager M to Bridge Y, port 0, the following rules are provisioned:

- A UMT tunnel entrance rule at the egress of Manager M
- A UMT tunnel exit rule at the egress of Bridge Y, port 0

To establish a UMT tunnel from Bridge Y, port 0 to Manager M, only one rule is provisioned:

— A UMT tunnel entrance rule at the ingress of Bridge Y, port 0

No tunnel exit rule is necessary at the ingress of Manager M, since the UMT sublayer provides a built-in translation of UMTPDUs with subtype `OAM_subtype` into OAMPDUs.

Each rule is provisioned using a separate `UMT_CONFIG` message. The contents of all three messages required to establish two UMT tunnles for bidirectional communication for the network segment illustrated in Figure 7A-3 are described below.

7A.3.2.1 Addition of tunnel entrance rule at the egress of Manager M

The CTE rule and the content of the `UMT_CONFIG` UMTPDU are identical to those described in 7A.2.2.1.

7A.3.2.2 Addition of tunnel exit rule at the egress of Bridge Y, port 0

The CTE rule and the content of the `UMT_CONFIG` UMTPDU are identical to those described in 7A.1.1.2.

7A.3.2.3 Addition of UMT tunnel entrance rule at the ingress of Bridge Y, port 0

The CTE rule and the content of the `UMT_CONFIG` UMTPDU are identical to those described in 7A.1.1.3.

7A.3.3 UMT provisioning to delete tunnels

The deletion of a UMT tunnel involves the deletion of rules that control UMT tunnel entrance and UMT tunnel exit Therefore, to delete a tunnel from Manager M to Station S, the following rules are removed:

— UMT tunnel entrance rule at the egress of Manager M
— UMT tunnel exit rule at the egress of Bridge Y, port 0

To delete a UMT tunnel from Station S to Manager M, the following rule is removed:

— UMT tunnel entrance rule at the ingress of Bridge Y, port 0

Each rule deletion is provsioned using a separate `UMT_CONFIG` UMTPDU. The contents of all three messages required to delete two tunnels for bidirectional communication for the network segment illustrated in Figure 7A-3 are described below.

7A.3.3.1 Deletion of UMT tunnel entrance rule at the egress of Manager M

The contents of a `UMT_CONFIG` UMTPDU that deletes the UMT tunnel entrance rule at the egress of Manager M are identical to the `UMT_CONFIG` UMTPDU described in 7A.2.3.1.

7A.3.3.2 Deletion of UMT tunnel exit rule at the egress of Bridge Y, port 0

The contents of a `UMT_CONFIG` UMTPDU that deletes the UMT tunnel entrance rule at the egress of Bridge Y, port 0 are identical to the `UMT_CONFIG` UMTPDU described in 7A.1.2.2.

7A.3.3.3 Deletion of UMT tunnel entrance rule at the ingress of Bridge Y, port 0

The contents of a `UMT_CONFIG` UMTPDU that deletes the UMT tunnel entrance rule at the egress of Bridge Y, port 0 are identical to the `UMT_CONFIG` UMTPDU described in 7A.1.2.3.