Bridge Functions Consortium

GARP/GMRP Frame Format Test Suite
Version 0.95

Technical Document

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MODIFICATION RECORD

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INTRODUCTION

Overview
The University of New Hampshire's InterOperability Laboratory (IOL) is an institution designed to improve the interoperability of standards based products by providing an environment where a product can be tested against other implementations of a standard. This suite of tests has been developed to help implementers evaluate the functionality of their GMRP capable products. GMRP is a GARP application and thus uses the generic GARP frame format for its PDUs. This frame format is defined in sub-clause 12.11 of the IEEE 802.1D 1998 standard. The attribute types and values used in these GMRP PDUs are defined in sub-clause 10.3 of the IEEE 802.1D 1998 standard. This test suite focuses on testing whether or not the device under test (DUT) will behave properly despite the fact that illegal values may be received in the fields of the GMRP PDUs.

The tests do not determine if a product conforms to the IEEE 802.1D 1998 standard and they are not designed as interoperability tests. Rather, they provide one method to isolate problems within the GMRP capable device that will affect the interoperability performance. Successful completion of all tests contained in this suite does not guarantee that the tested device will operate with other GMRP capable devices. However, combined with satisfactory operation in the IOL's interoperability test bed, these tests provide a reasonable level of confidence that the DUT will function well in most GMRP capable environments.

Organization of Tests
The tests contained in this document are organized to simplify the identification of information related to a test and to facilitate in the actual testing process. Each test contains an identification section that describes the test and provides cross-reference information. The discussion section covers background information and specifies why the test is to be performed. Tests are grouped in order to reduce setup time in the lab environment. Each test contains the following information:

Test Number
The Test Number associated with each test follows a simple grouping structure. Listed first is a number signifying the clause of the 802.1D standard that the test suite is based on. Next comes a suite number signifying the number of this test suite relative to all other GMRP test suites. Next is a test group number to separate the tests into logical groups. Finally is the test's number within the group. This allows for the addition of future tests to the appropriate groups of the test suite without requiring the renumbering of the subsequent tests.

Purpose
This section gives a brief statement outlining what the test is attempting to achieve.

References
This section lists cross-references to the IEEE 802.1D standard and other documentation that might be helpful in understanding and evaluating the test and results.

Resource Requirements
This section specifies the hardware and test equipment that will be needed to perform the test. The items contained in this section are special test devices or other facilities, which may not be available on all devices.

Last Modification
This section gives the date of the last modification to this test.

Discussion
This section covers the assumptions made in the design or implementation of the test as well as known limitations. Other items specific to the test are covered here.

Test Setup
This section describes the configuration of the test environment. Small changes in the configuration should be included in the test procedure.

Procedure
This section of the test description contains the step-by-step instructions for carrying out the test. It provides a cookbook approach to testing, and may be interspersed with observable results.

Observable Results
This section lists observable results that can be examined by the tester to verify that the DUT is operating properly. When multiple observable results are possible, this section provides a short discussion on how to interpret them. The determination of a pass or fail for a certain test is often based on the successful (or unsuccessful) detection of a certain observable result.

Possible Problems
This section contains a description of known issues with the test procedure, which may effect test results in certain situations.

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Test 10.3.1.1 – Attribute Type Verification

Purpose: To verify that the device under test (DUT) does not accept GMRP PDUs with an Attribute Type other than 0x01 or 0x02.

References:

- IEEE 802.1D 1998: sub-clauses 10.3.1.3, 12.10.1, 12.11.1.2, 12.11.2.2, 12.11.3.3
- IEEE 802.1D 1998: Figure 12-6
- IEEE 802.1D 1998: Tables 12-3, 12-4

Resource Requirements:

- Testing Stations capable of transmitting and receiving arbitrary MAC frames.

Last Modification: April 21, 2000

Discussion: The Attribute Type is encoded as a single octet, representing an unsigned binary number. The Attribute Type identifies the type of Attribute to which the Message applies. The range of values for a given Attribute Type, and the meanings of those values, are defined by the specific GARP Application. The valid range of Attribute Type values is 1 to 255. The value of zero is reserved and may not be used by any GARP Application.

GMRP uses two Attribute Types. Attribute Type 0x01 signifies the Group Attribute Type. Attribute Type 0x02 signifies the Service Requirement Attribute Type.

Test Setup: Connect the Testing Stations to the DUT as shown in Figure 1. Enable GMRP on the DUT and allow time for it to configure.

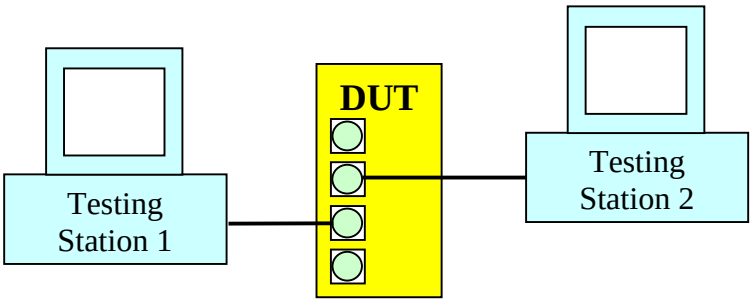

Figure 1

Procedure:

Part a: Valid Attribute Type – Group Attribute Type

1. Set Testing Station 2 to capture arbitrary MAC frames.
2. Transmit a properly formatted GMRP PDU containing a LeaveAll event from Testing Station 1 and 2.
3. Transmit a properly formatted GMRP PDU containing an Attribute Type of 0x01 from Testing Station 1. The transmitted PDUs should contain a JoinIn event for a group MAC address.
4. Transmit a properly formatted GMRP PDU containing an Empty event for the same group MAC address used in Step 3 from Testing Station 2.

Part b: Valid Attribute Type – Service Requirement Attribute Type

5. Set Testing Station 2 to capture arbitrary MAC frames.
6. Transmit a properly formatted GMRP PDU containing a LeaveAll event from Testing Station 1 and 2.
7. Transmit a properly formatted GMRP PDU containing an Attribute Type of 0x02 from Testing Station 1. The transmitted PDUs should contain a JoinIn event for a valid GMRP Attribute Value.

8. Transmit a properly formatted GMRP PDU containing an Empty event for the same Attribute Value used in Step 7 from Testing Station 2.

Part c: Invalid Attribute Types

9. Set Testing Station 2 to capture arbitrary MAC frames.
10. Transmit a properly formatted GMRP PDU containing a LeaveAll event from Testing Station 1 and 2.
11. Transmit a properly formatted GMRP PDU containing an Attribute Type of 0x00 from Testing Station 1. The transmitted PDUs should contain a JoinIn event for a group MAC address.
12. Transmit a properly formatted GMRP PDU containing an Empty event for the same group MAC address used in Step 11 from Testing Station 2.
13. Repeat steps 9-12 using Attribute Types of 0x03, 0x04, and 0xFF.

Observable results:

- In part a, the DUT should register the group MAC address specified in Step 3 on the Port to which Testing Station 1 is connected. Testing Station 2 should capture at least 2 GMRP PDUs containing a JoinEmpty event for the specified group MAC address.
- In part b, the DUT should register the Attribute Value specified in Step 7 on the Port to which Testing Station 1 is connected. Testing Station 2 should capture at least 2 GMRP PDUs containing a JoinEmpty event for the specified Attribute Type.
- In part c, the DUT should discard the GMRP PDUs being transmitted by Testing Station 1. Testing Station 2 should receive no traffic.

Possible Problems:

- None.

Test 10.3.1.2 – Attribute Length Verification

Purpose: To verify that the device under test (DUT) discards all GMRP PDUs containing an invalid Attribute Length.

References:

- IEEE 802.1D 1998: sub-clauses 12.10.1, 12.11.2.3
- IEEE 802.1D 1998: Figure 12-6
- IEEE 802.1D 1998: Tables 12-3, 12-4

Resource Requirements:

- Testing Stations capable of transmitting and receiving arbitrary MAC frames.

Last Modification: April 21, 2000

Discussion: The Attribute Length value is encoded as a single octet, representing an unsigned binary number. The Attribute Length identifies the number of octets that comprise the Attribute, including the Attribute Length field. The range of allowable values used by the Attribute Length is 0x02 to 0xFF.

Test Setup: Connect the Testing Stations to the DUT as shown in Figure 1. Enable GMRP on the DUT and allow time for it to configure.

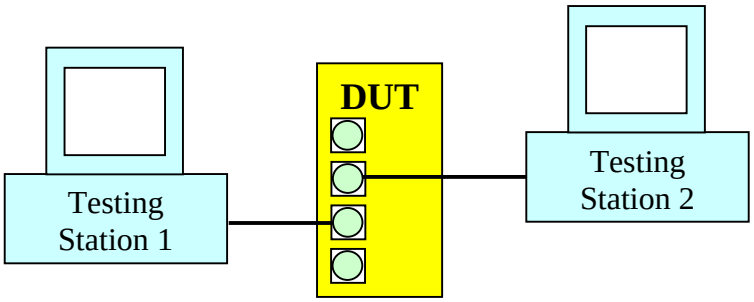

Figure 1

Procedure:

Part a: Valid Attribute Length – Group Attribute Type

1. Set Testing Station 2 to capture arbitrary MAC frames.
2. Transmit a properly formatted GMRP PDU containing a LeaveAll event from Testing Station 1 and 2.
3. Transmit a properly formatted GMRP PDU containing an Attribute Length of 0x08 from Testing Station 1. The transmitted PDUs should contain a JoinIn event for a group MAC address.
4. Transmit a properly formatted GMRP PDU containing an Empty event for the same group MAC address used in Step 3 from Testing Station 2.

Part b: Valid Attribute Length – Service Requirement Attribute Type

5. Set Testing Station 2 to capture arbitrary MAC frames.
6. Transmit a properly formatted GMRP PDU containing a LeaveAll event from Testing Station 1 and 2.
7. Transmit a properly formatted GMRP PDU containing an Attribute Length of 0x03 from Testing Station 1. The transmitted PDUs should contain a JoinIn event for a Service Requirement Attribute Type.
8. Transmit a properly formatted GMRP PDU containing an Empty event for the same Service Requirement Attribute Type used in Step 7 from Testing Station 2.

Part c: Valid Attribute Length – LeaveAll Event

9. Set Testing Station 2 to capture arbitrary MAC frames.

10. Transmit a properly formatted GMRP PDU containing a JoinIn event for a group MAC address from Testing Station 1.
11. Transmit a properly formatted GMRP PDU containing an Attribute Length of 0x02 from Testing Station 2.
12. Repeat Steps 9-11 using a Service Requirement Attribute Type.

Part d: Invalid Attribute Length

13. Set Testing Station 2 to capture arbitrary MAC frames.
14. Transmit a properly formatted GMRP PDU containing a LeaveAll event from Testing Station 1 and 2.
15. Transmit a properly formatted GMRP PDU with an Attribute Length of 0x00 containing a JoinIn event for a group MAC address from Testing Station 1.
16. Transmit a properly formatted GMRP PDU containing an Empty event for the same group MAC address used in Step 15 from Testing Station 2.
17. Repeat steps 13-16 using Attribute Lengths of 0x01, 0x07, and 0xFF.

Observable results:

- In part a, the DUT should register the group MAC address specified in Step 3 on the Port to which Testing Station 1 is connected. Testing Station 2 should capture at least 2 GMRP PDUs containing a JoinEmpty event for the specified group MAC address.
- In part b, the DUT should register the Service Requirement Attribute Type specified in Step 7 on the Port to which Testing Station 1 is connected. Testing Station 2 should capture at least 2 GMRP PDUs containing a JoinEmpty event for the specified group MAC address.
- In part c, the DUT should register the Attribute Values transmitted to it by Testing Station 1 in Step 10. Testing Station 2 should capture 2 JoinEmpty's for the Attribute Value registered in Step 10.
- In part d, the DUT should discard the GMRP PDUs transmitted by Testing Station 1. Testing Station 2 should receive no traffic.

Possible Problems:

- None.

Test 10.3.1.3 – Attribute Event Verification

Purpose: To verify that the device under test (DUT) discards all GMRP PDUs containing an invalid Attribute Event.

References:

- IEEE 802.1D 1998: sub-clauses 12.10.1, 12.11.2.5, 12.11.3.3
- IEEE 802.1D 1998: Figure 12-6
- IEEE 802.1D 1998: Tables 12-3, 12-4

Resource Requirements:

- Testing Stations capable of transmitting and receiving arbitrary MAC frames.

Last Modification: April 21, 2000

Discussion: The Attribute Event value is encoded as a single octet, representing an unsigned binary number. There is a set of operators defined in the standard that are encoded in the Attribute Event field of a PDU. The range of allowable values used by the Attribute Event is 0x00 to 0x05. The meanings for each of these values are as follows:

0x00: LeaveAll operator
0x01: JoinEmpty operator
0x02: JoinIn operator
0x03: LeaveEmpty operator
0x04: LeaveIn operator
0x05: Empty operator

Any other value for the Attribute Event field is reserved.

Test Setup: Connect the Testing Stations to the DUT as shown in Figure 1. Enable GMRP on the DUT and allow time for it to configure.

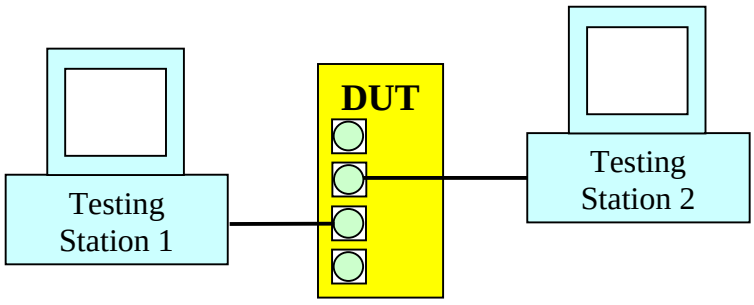

Figure 1

Procedure:

Part a: Valid Attribute Event: LeaveAll

1. Set Testing Station 2 to capture arbitrary MAC frames.
2. Transmit properly formatted GMRP PDUs with an Attribute Event value of 0x00 from Testing Station 1.

Part b: Valid Attribute Event: JoinEmpty

3. Set Testing Station 2 to capture arbitrary MAC frames.
4. Transmit a properly formatted GMRP PDU containing a LeaveAll event from Testing Station 1 and 2.

5. Transmit a properly formatted GMRP PDU with an Attribute Event value of 0x01 for a group MAC address from Testing Station 1.
6. Transmit a properly formatted GMRP PDU containing an Empty event for the same group MAC address used in Step 5 from Testing Station 2.

Part c: Valid Attribute Event: JoinIn

7. Set Testing Station 2 to capture arbitrary MAC frames.
8. Transmit a properly formatted GMRP PDU containing a LeaveAll event from Testing Station 1 and 2.
9. Transmit a properly formatted GMRP PDU with an Attribute Event value of 0x02 for a group MAC address from Testing Station 1.
10. Transmit a properly formatted GMRP PDU containing an Empty event for the same group MAC address used in Step 9 from Testing Station 2.

Part d: Valid Attribute Event: LeaveEmpty

11. Set Testing Station 2 to capture arbitrary MAC frames.
12. Transmit a properly formatted GMRP PDU containing a LeaveAll event from Testing Station 1 and 2.
13. Transmit a properly formatted GMRP PDU containing a JoinIn event for a group MAC address from Testing Station 1.
14. Transmit a properly formatted GMRP PDU containing an Empty event for the same group MAC address used in Step 13 from Testing Station 2.
15. Transmit a properly formatted GMRP PDU with an Attribute Event value of 0x03 for the group MAC address specified in Step 13 from Testing Station 1.

Part e: Valid Attribute Event: LeaveIn

16. Set Testing Station 2 to capture arbitrary MAC frames.
17. Transmit a properly formatted GMRP PDU containing a LeaveAll event from Testing Station 1 and 2.
18. Transmit a properly formatted GMRP PDU containing a JoinIn event for a group MAC address from Testing Station 1.
19. Transmit a properly formatted GMRP PDU containing an Empty event for the same group MAC address used in Step 18 from Testing Station 2.
20. Transmit a properly formatted GMRP PDU with an Attribute Event value of 0x04 for the group MAC address specified in Step 18 from Testing Station 1.

Part f: Valid Attribute Event: Empty

21. Set Testing Station 2 to capture arbitrary MAC frames.
22. Transmit a properly formatted GMRP PDU containing an Empty event for group MAC address 1 from Testing Station 1.

Part g: Invalid Attribute Event

23. Configure the Port to which Testing Station 1 is connected to be a member of the tagged set for some group MAC address.
24. Set Testing Station 2 to capture arbitrary MAC frames.
25. Transmit GMRP PDUs with an Attribute Event value of 0x06 for the group MAC address specified in Step 23 from Testing Station 1.
26. Repeat steps 15-16 using an Attribute Event of 0xFF.

Observable results:

- In part a, the DUT should transmit 2 JoinEmpty events for the default group MAC address.
- In part b, the DUT should register the group MAC address specified in Step 5 on the Port to which Testing Station 1 is connected. Testing Station 2 should receive at least 2 GMRP PDUs containing a JoinEmpty event for the group MAC address specified in Step 5.
- In part c, the DUT should register the group MAC address specified in Step 9 on the Port to which Testing Station 1 is connected. Testing Station 2 should receive at least 2 GMRP PDUs containing a JoinEmpty event for the group MAC address specified in Step 9.
- In part d, during Step 13, the DUT should register the group MAC address specified on the Port to which Testing Station 1 is connected. During Step 15, the DUT should de-register the group MAC address specified in Step 13 on the Port to which Testing Station 1 is connected. Testing Station 2 should receive a GMRP PDU containing a LeaveEmpty event for the group MAC address specified in Step 13.
- In part e, during Step 17, the DUT should register the group MAC address specified on the Port to which the Testing Station 1 is connected. During Step 19, the DUT should de-register the group MAC address specified

in Step 17 on the Port to which Testing Station 1 is connected. Testing Station 2 should receive a GMRP PDU containing a LeaveEmpty event for the group MAC address specified in Step 17.

- In part f, the DUT should transmit 2 GMRP PDUs containing a JoinEmpty event for group MAC address 1.
- In part g, the DUT should discard the GMRP PDUs transmitted by Testing Station 1. Testing Station 2 should receive no traffic.

Possible Problems:

- None.

Test 10.3.1.4 – Attribute Value Verification

Purpose: To verify that the device under test (DUT) discards all GMRP PDUs containing an invalid Attribute Value.

References:

- IEEE 802.1D 1998: sub-clauses 10.3.1.4, 12.10.1, 12.11.2.6
- IEEE 802.1D 1998: Figure 12-6
- IEEE 802.1D 1998: Tables 12-3, 12-4

Resource Requirements:

- Testing Stations capable of transmitting and receiving arbitrary MAC frames.

Last Modification: April 21, 2000

Discussion: GMRP defines two Attribute Types to be used during its operation. The first Attribute Type defined is the Group Attribute Type. Its Attribute Values are encoded in six octets that represent a Group MAC address. The valid Attribute Values for the Group Attribute Type is any Group MAC address. Any individual MAC addresses shall not be used for this Attribute Type.

The second Attribute Type defined is the Service Requirement Attribute Type. Its Attribute Values are encoded as a single octet that represents the Default Filtering Behavior to be used for the Port on which the GMRP message is received. There are two defined values of this Type are defined. The All Groups Attribute Value is encoded as 0x00. The All Unregistered Groups Attribute Value is encoded as 0x01.

Test Setup: Connect the Testing Stations to the DUT as shown in Figure 1. Enable GMRP on the DUT and allow time for it to configure.

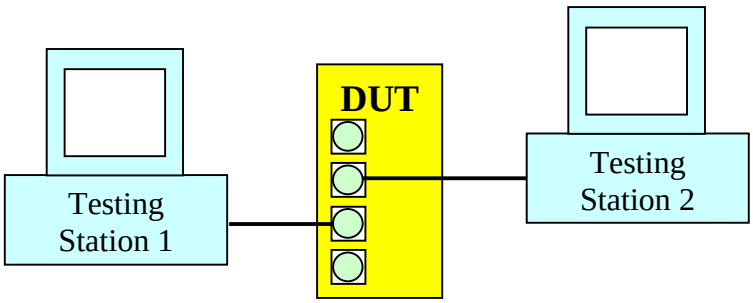

Figure 1

Procedure:

Part a: Valid Attribute Values – Group Attribute Type

1. Set Testing Station 2 to capture arbitrary MAC frames.
2. Transmit a properly formatted GMRP PDU containing a LeaveAll event from Testing Station 1 and 2.
3. Transmit a properly formatted GMRP PDU containing an Attribute Value of 0x012222222222 from Testing Station 1. The transmitted PDUs should contain a JoinIn event.
4. Transmit a properly formatted GMRP PDU containing an Empty event for the same group MAC address used in Step 3 from Testing Station 2.
5. Repeat steps 1-4 using Attribute Values of 0x032222222222 and 0x0F2222222222.

Part b: Valid Attribute Values – Service Requirement Attribute Type

6. Set Testing Station 2 to capture arbitrary MAC frames.
7. Transmit a properly formatted GMRP PDU containing a LeaveAll event from Testing Station 1 and 2.

8. Transmit a properly formatted GMRP PDU containing an Attribute Value of 0x00 from Testing Station 1. The transmitted PDUs should contain a JoinIn event.
9. Transmit a properly formatted GMRP PDU containing an Empty event for the same group MAC address used in Step 8 from Testing Station 2.
10. Repeat steps 1-4 using the Attribute Value of 0x01.

Part c: Invalid Attribute Values

11. Set Testing Station 2 to capture arbitrary MAC frames.
12. Transmit a properly formatted GMRP PDU containing a LeaveAll event from Testing Station 1 and 2.
13. Transmit a properly formatted GMRP PDU containing an Attribute Value of 0x222222222222 from Testing Station 1. The transmitted PDUs should contain a JoinIn event.
14. Transmit a properly formatted GMRP PDU containing an Empty event for the same group MAC address used in Step 8 from Testing Station 2.
15. Repeat steps 6-9 using Attribute Values of 0x444444444444, 0x888888888888, and all reserved group MAC addresses.

Observable results:

- In part a, the DUT should register the group MAC address specified in Step 1 on the Port to which Testing Station 1 is connected. Testing Station 2 should capture at least 2 GMRP PDUs containing a JoinEmpty event for the specified group MAC address.
- In part b, the DUT should register the Service Requirement Attribute Value specified in Step 1 on the Port to which Testing Station 1 is connected. Testing Station 2 should capture at least 2 GMRP PDUs containing a JoinEmpty event for the specified Service Requirement Attribute Value.
- In part c, the DUT should discard the GMRP PDUs transmitted by Testing Station 1. Testing Station 2 should receive no traffic.

Possible Problems:

- None.