
Car Connectivity Consortium

MirrorLink™

Internet Accessibility

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(CCC-TS-053)



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1 **VERSION HISTORY**

Version	Date	Comment
1.2.0	25 September 2013	Approved Version

3 **LIST OF CONTRIBUTORS**

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TERMS AND ABBREVIATIONS

AP	Access Point (IEEE Std 802.11-2007)
ANQP	Access Network Query Protocol (IEEE Std P802.11u)DHCP Dynamic Host Configuration Protocol
DNS	Domain Name System
GC	P2P Group Client
GO	P2P Group Owner
IE	Information Element
P2P	Peer-to-peer
STA	Non-AP Station (IEEE Std 802.11-2007)
TLV	Type-Length-Value
WLAN	Wireless Local Area Network
WSC	Wi-Fi Simple Configuration

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1 ABOUT

This document specifies MirrorLink Device Discovery on Wi-Fi Direct. The procedure is used to provide MirrorLink Server and Client's Internet configuration prior to Wi-Fi P2P group formation.

The specification lists a series of requirements, either explicitly or within the text, which are mandatory elements for a compliant solutions. Recommendations are given, to ensure optimal usage and to provide suitable performance. All recommendations are optional.

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are following the notation as described in RFC 2119 [3].

1. MUST: This word, or the terms "REQUIRED" or "SHALL", mean that the definition is an absolute requirement of the specification.
2. MUST NOT: This phrase, or the phrase "SHALL NOT", mean that the definition is an absolute prohibition of the specification.
3. SHOULD: This word, or the adjective "RECOMMENDED", mean that there may exist valid reasons in particular circumstances to ignore a particular item, but the full implications must be understood and carefully weighed before choosing a different course.
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5. MAY: This word, or the adjective "OPTIONAL", means that an item is truly optional. One vendor may choose to include the item because a particular marketplace requires it or because the vendor feels that it enhances the product while another vendor may omit the same item. An implementation which does not include a particular option MUST be prepared to interoperate with another implementation which does include the option, though perhaps with reduced functionality. In the same vein an implementation which does include a particular option MUST be prepared to interoperate with another implementation which does not include the option (except, of course, for the feature the option provides.)

2 INTERNET ACCESSIBILITY

Both MirrorLink Server and Client are able to access the Internet, if all of the following three conditions are true:

- 1) Either MirrorLink Server or Client MUST have Internet connectivity with WAN interface.
- 2) The device that has Internet access MUST be capable of sharing its connectivity to the other.
- 3) The device having Internet connectivity MUST become an Access Point

2.1 Wi-Fi P2P Connection

If a MirrorLink Server and Client want Wi-Fi P2P connection, they MUST proceed Wi-Fi connection setup as defined on the Wi-Fi P2P specification [1].

If a MirrorLink Client is setup to connect in this mode and the MirrorLink Server is set to operate in the same mode, the two devices find each other over Wi-Fi technology and negotiate the AP and client role in autonomous way by conducting Group Owner negotiation procedure defined in the Wi-Fi P2P specification.

The AP role negotiation is performed as following, as defined in [1],

- 1) The Wi-Fi interface is turned on at both MirrorLink Server and Client
- 2) If the Wi-Fi mode is set to P2P mode, it proceeds to Wi-Fi Device discovery as defined in [1]
- 3) During the device discovery, a MirrorLink device MUST include CCC IE (Information Element) which is defined in [2].
- 4) By referring the information included in the Internet Accessibility subelement in the IEEE802.11 CCC IE [2] the MirrorLink Server and the Client exchange Group Owner negotiation messages to negotiate AP role by checking GO Intent Value in the message.
- 5) A device sends higher GO Intent Value will take Group Ownership and starts AP mode.

2.1.1 MirrorLink Internet Accessibility information Exchange

To inform the configuration information of internet accessibility of both sides, an Internet Accessibility subelement MUST be included into the CCC Information Element, as defined in [2] prior to a group formation.

The Internet Accessibility entry provides the following information

- MirrorLink Type, i.e. whether the device is a Server or a Client device, and in case of a client device, whether it supports a single or multiple MirrorLink servers
- Internet Access Support, i.e. whether the device is able to provide internet access for the connected device
- Internet Access Required, i.e. whether the device requires access to the Internet
- MirrorLink Client Preference, i.e. in case there is a contradiction, the MirrorLink Clients informs about its preference to resolve it

2.1.2 Managing Wi-Fi P2P connection using MirrorLink Service Discovery

MirrorLink Server or Client wants to become Group Owner when its configuration or service needs P2P Group Owner role to operate correctly. For example, MirrorLink Client MUST become Group Owner to support more than one MirrorLink Servers, while MirrorLink Server MUST play Group Owner role to offer Internet connectivity sharing to the other. By setting its Intent Value to 15, MirrorLink Server or Client shall be the P2P Group Owner.

In the case where both the MirrorLink Server and the Client want to become Group Owner and both of them set their Intent Values to 15, the P2P connection fails. To prevent such P2P connection failure, Mir-

- 1 MirrorLink Server and Client MUST exchange Internet Accessibility information at Device Discovery procedure prior to a group formation.
- 2
- 3 Based on MirrorLink Service Configurations of the MirrorLink Server and the Client, the following Group Owner and Group Client role can be distinguished as shown in Table 2.
- 4

MirrorLink Service Configuration					Group Ownership Selection						
Internet Access ¹		Internet Access Required		Multiple ML Servers Support	ML Client Preference	GO Role Conflict	Device offering Cross Connection	P2P Role			
ML Server	ML Client	ML Server	ML Client					ML Server	ML Client		
Yes	Yes	Yes	Yes	Yes	N/A	No	ML Client	GC	GO		
				No			Both ²	Both	Both		
		Yes	No	Yes			ML Client	GC	GO		
				No			Both	Both	Both		
		No	Yes	Yes			ML Client	GC	GO		
				No			Both	Both	Both		
		No	No	Yes			N/A	GC	GO		
				No			N/A	Both	Both		
		Yes	No	Yes			Yes	Yes	Internet Access	Yes	ML Server
Multiple ML Servers	Yes				N/A (Concurrent Operation ³)	GC			GO		
No	N/A				No	ML Server		GO	GC		
Yes	No			Yes	N/A	No	N/A (Concurrent Operation ³)	GC	GO		
				No	N/A	No	N/A	GC	GO		
					ML Server	GO	GC				
No	Yes			Yes	Internet Access	Yes	ML Server	GO	GC		
					Multiple ML Servers	Yes	N/A	GC	GO		
				No	N/A	No	ML Server	GO	GC		
No	No			Yes	N/A	No	N/A	GC	GO		
				No	N/A	No	N/A	GC	GO		
					ML Server	GO	GC				
No	Yes			Yes	Yes	Yes	N/A	No	ML Client	GC	GO

¹ If P2P Device cannot provide Internet Access properties to the other, its Internet Access MUST be regarded as not available.

² Both mean that Group Owner can be decided on secondary factors. If both device can be GO, then MirrorLink Client is recommended to become GO.

³ The MirrorLink Server uses its own Internet connectivity and does not offer Cross Connection, and the MirrorLink Client cannot access the Internet.

MirrorLink Service Configuration					Group Ownership Selection				
Internet Access ¹		Internet Access Required		Multiple ML Servers Support	ML Client Preference	GO Role Conflict	Device offering Cross Connection	P2P Role	
ML Server	ML Client	ML Server	ML Client					ML Server	ML Client
				No					
				Yes					
		Yes	No	No					
				Yes					
		No	Yes	No					
				Yes					
No	No	Yes	Yes	Yes	N/A	No	N/A	GC	GO
				No				Both	Both
		Yes	No	Yes				GC	GO
				No				Both	Both
		No	Yes	Yes				GC	GO
				No				Both	Both
		No	No	Yes				GC	GO
				No				Both	Both
				Yes				GC	GO
				No				Both	Both
				Yes				GC	GO
				No				Both	Both

Table 2: MirrorLink Service Configuration for Group Owner Selection

After exchanging MirrorLink Internet Accessibility Service Configuration, MirrorLink Server and Client acknowledge which device will be the P2P Group Owner to operate MirrorLink correctly. Note that MirrorLink Server and Client MUST proceed Group Formation Procedure to form P2P group as specified in [1].

During Group Negotiation phase, both the MirrorLink Server and the Client can begin Group Owner Negotiation by sending a GO Negotiation Request frame. The device receiving a GO Negotiation Request frame shall examine the received information and respond with a GO Negotiation Response frame. If the device must be the Group Owner but its default Intent Value is lower than the Intent Value in the GO Negotiation Request, the device MUST set the value higher than the received Intent Value. If the device must be the Group Client but its default Intent Value is higher than the Intent Value in the GO Negotiation Request, the device MUST set the value lower than the received Intent Value.

The following flowchart shows Group Owner Intent Value determination process from the perspective of the P2P Device receiving a GO Negotiation Request frame.

x1 = Group Owner Intent Value of P2P Device 1 initiating the GO Negotiation Request frame

x2 = Group Owner Intent Value of P2P Device 2 receiving the GO Negotiation Request frame

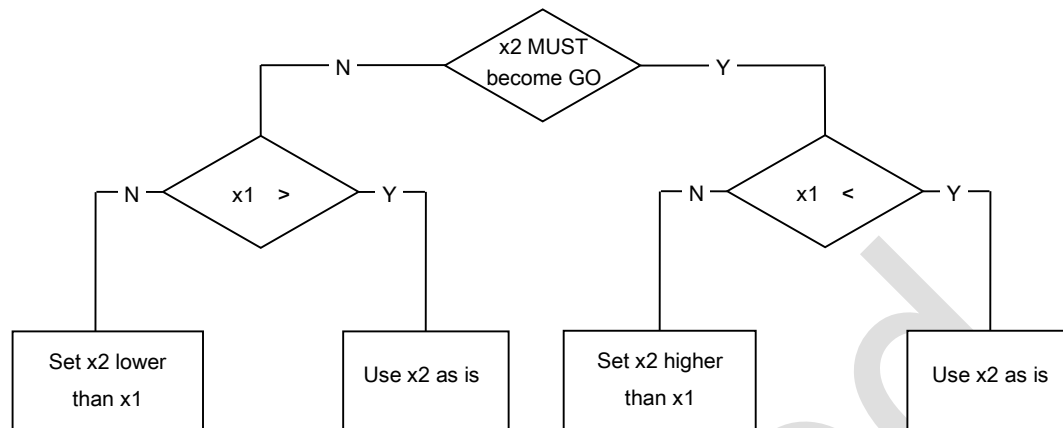


Figure 1: Group Owner Intent Value Determination Flowchart

The P2P Device initiating Group Owner Negotiation procedure MUST set its GO Intent Value less than 15, if the device is agreed to become Group Client based on MirrorLink Service Configuration exchange. If the P2P Device initiating GO Negotiation procedure is agreed to become Group Owner, the device MUST set its GO Intent Value higher than 0.

As defined in [1], The P2P Group Owner MUST act as a DHCP server to provide IP addresses to the connected P2P Clients that use IP. The DHCP server, at least, shall support Internet Protocol version 4 (IPv4) and assign IP addresses, subnet mask and default gateway. A P2P Client that uses IP shall be capable of acting as a DHCP Client. If the Group Owner shares Internet connectivity with other devices on the network, the Group Owner MUST provide at least one valid DNS address for the Internet access.

3 REFERENCES

- [1] Wi-Fi Alliance Technical Committee, P2P Task Group, “Wi-Fi Peer-to-Peer (P2P) Technical Specification”, Revision 1.1, October 4, 2010
- [2] Car Connectivity Consortium, “IEEE 802.11 CCC Information Element”, Version 1.2, CCC-TS-050
- [3] IETF, RFC 2119, “Keys words for use in RFCs to Indicate Requirement Levels”, March 1997. <http://www.ietf.org/rfc/rfc2119.txt>

Approved