IEEE P802.11
Wireless LANs

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| TGaq Solicited PAD Resolution |
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Abstract

This document describes further changes needed to support Solicited PAD using the approved text in 136r2.

**3.4 Abbreviations and acronyms**

*Delete ANQP-SD definition D3.1 page 2 line 54:*

**8.4.2.26 Extended Capabilities element**

*Modify Table 8-132 (D3.1 page 11 lines 37-49) as shown:*

**Table 8-132—Capabilities field**

|  |  |  |
| --- | --- | --- |
| **Bit**  | **Information**  | **Notes**  |
| <ANA>  | Solicited PAD  | Indicates support for Solicited PAD procedure (10.26.3). |
| <ANA> | PAD ANQP | Indicates support for PAD ANQP procedure (10.26.4). |

**8.4.2.92 Advertisement Protocol element**

*Delete all changes to 8.4.2.92; D3.1 page 11 line 52 through page 12 line 9:*

|  |  |
| --- | --- |
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**8.4.5.24 Service Information Request ANQP-element**

*Replace the final paragraph of 8.4.5.24 (D3.1 page 16 line 54):*

The use of this element is described in clause 10.26.4 (PAD ANQP procedures).

**8.4.5.25 Service Information Response ANQP-element**

*Replace the final paragraph of 8.4.5.25 (D3.1 page 17 line 53):*

The use of this element is described in clause 10.26.4 (PAD ANQP procedures).

**10.25.3.2.1 General**

*Delete all changes to the paragraph in 10.25.3.2.1 (D3.1 page 19 line 17-23); this removes the following text from P802.11aq (the editing instructions in D3.1 do not look correct here, so not trying to show the exact changes in redline):*

A STA may use ANQP to retrieve information as defined in Table 8-257 (ANQP-element definitions) from a peer STA. A non-AP STA shall not transmit an ANQP Query to an AP or PCP for any ANQP-element unless the Advertisement Protocol ID ~~is~~ included in the Advertisement Protocol element is equal to the value for ANQP or ANQP-SD~~in a Beacon or Probe Response frame from that AP or PCP.~~

*Remove the added new “Advertisement Protocol ID” column from Table 10-16 (ANQP usage); D3.1 page 19 line 33*

*Modify 10.25.3.2.13 and its subclauses (D3.1 page 21 line 44 through page 22 line 14) as shown:*

**10.25.3.2.13 ANQP service information procedure**

When dot11UnsolicitedPADActivated is true, an AP or PCP shall include a Service Hint element or Service Hash element or both, in the same Beacon frame. Each service shall be advertised using either Service Hash element or Service Hint element, but not both, in the same Beacon frame. A Service Hint element is used to advertise the presence of one or more services with a probability of false positive as indicated in False Positive Probability Range field of the Service Hint element. A Service Hash element is used to advertise the presence of one or more services with a negligible probability of false positive. The selection of Service Hash or Service Hint element to advertise a particular service is beyond the scope of this standard.

The Service Information Request ANQP-element is used to discover available services within the BSS. A Service Name may be placed within the request. The Service Name is used within the BSS to assist with discovering services, as described in Annex AA ().

The Service Information Response ANQP-element is returned in response to a Service Information Request ANQP-element. It contains a list of service information descriptors from the Advertisement Server.

**10.26.2 Unsolicited PAD procedure**

*Modify the last paragraph of 10.26.2 (D3.1 page 22 lines 50-59) as shown:*

When dot11UnsolicitedPADActivated is true, an AP or PCP shall include a Service Hint element or Service Hash element or both, in the same Beacon frame. Each service shall be advertised using either Service Hash element or Service Hint element, but not both, in the same Beacon frame. A Service Hint element is used to advertise the presence of one or more services with a probability of false positive as indicated in False Positive Probability Range field of the Service Hint element. A Service Hash element is used to advertise the presence of one or more services with a negligible probability of false positive. The selection of Service Hash or Service Hint element to advertise a particular service is beyond the scope of this standard.

*Modify the last paragraph of 10.26.2 (D3.1 page 23 lines 15-21) as shown:*

If the non-AP STA determines that there is a matching service, the non-AP STA may decide to proceed with the solicited PAD procedure (10.26.3 (Solicited PAD procedure)), PAD ANQP procedure (10.26.4 (PAD ANQP procedure), or authentication and association procedure (10.3 (STA authentication and association)) based on the perceived false positive probability and the nature of the service (see the examples in AA.1 (Pre-association discovery usage scenarios)). The details of this decision are outside the scope of this standard.

**10.26.3 Solicited PAD procedure**

*Modify the last paragraph of 10.26.3 (D3.1 page 23 lines 55-65) as shown:*

An AP or PCP may advertise support for the Solicited PAD procedure by setting the Solicited PAD field of the Extended Capabilities element to 1 in its Beacon and Probe Response frames.

When dot11SolicitedPADActivated is true, a non-AP STA sends Probe Request frames with a Service Hash element, which includes one or more service hashes generated from the service name(s) of the service(s) that the non-AP STA is requesting, to an AP or PCP. The Probe Request frames shall have address 1 field sets to PAD Multicast Address and address 3 field set to PAD BSSID.

When dot11SolicitedPADActivated is true, an AP or PCP that receives Probe Request frames shall respond with a Probe Response that includes Service Hint element or Service Advertisment element, if the address 1 and address 3 in the Probe Request are the PAD Multicast Address and PAD BSSID address of the STA.

If Service Advertisement element is included in the Probe Response frame, the AP or PCP shall verify if there are any services matching those in the received Probe Request frame. The matching of service is based on the service hash value in the Service Hash field of the Service Hash element matches to the corresponding service hash value of the service in which the AP or PCP is offering. If the AP or PCP determines there is one or more matched services, the AP or PCP shall respond with a Probe Response frame with the Service Advertisement element containing a Basic Service Information Descriptor field for each matching service. The requesting non-AP STA shall process the Service Advertisement element in the received Probe Response frame to determine if any received service name matches with a service name that the non-AP STA is requesting and the corresponding instance names.

If there is a matched service name, the non-AP STA may decide to proceed with the PAD ANQP procedure (10.26.4 (PAD ANQP procedure) or authentication and association procedure (10.3 (STA authentication and association)) based on the nature of the service (see examples illustrated in Annex AA.1 (Pre-association discovery usage scenarios)), the details of which are out of the scope of this standard.

If Service Hint element is included in the Probe Response frame, the AP or PCP is not required to perform service matching with those services in the received Probe Request frame. The requesting non-AP STA shall determine the bit positions of the Bloom Filter Bit Array field in which the non-AP STA is searching, and verify if there are any matched services based on the matching of the corresponding bit positions of the of the Bloom Filter Bit Array field of the Service Hint element. If there is a matched service, the non-AP STA may determine to proceed with PAD ANQP procedure ( [10.26.4](#_bookmark81) [(PAD ANQP procedure),](#_bookmark81) or authentication and association procedure (10.3 (STA authentication and association)) based on the perceived false positive probability and the nature of the service (see examples illustrated in [AA.1 (Preassociation discovery usage scenarios)),](#_bookmark90) the details of which are out of the scope of this standard.

*Modify 10.26.4 (D3.1 page 23 line 52 through page 24 line 15) as shown:*

**10.26.4 PAD ANQP procedure**

An AP or PCP may advertise support for the PAD ANQP procedure by setting the PAD ANQP field of Extended Capabilities element to 1 in its Beacon and Probe Response frames.

When dot11UnsolicitedPADActivated or dot11SolicitedPADActivated is true, a non-AP STA may retrieve more information about a matched service by sending an ANQP request with a Service Information Request ANQP-element (see 8.4.5.24 (Service Information Request ANQP-element)). The Service Information Request ANQP-element shall include one or more Service Information Request Tuple subfields and each Service Information Request Tuple subfield shall include the Service Name subfield, the Instance Name subfield if applicable, and may include a Service Information Query Request subfield that is service-specific. When dot11UnsolicitedPADActivated or dot11SolicitedPADActivated is true, a responding STA shall respond to an ANQP request with an ANQP response that contains a Service Information Response ANQP-element (see 8.4.5.25 (Service Information Response ANQP-element)). The Service Information Response ANQP-element shall include zero or more Service Information Response Tuple subfields. When the Service Information Response ANQP-element contains non-zero Service Information Response Tuple subfields, each Service Information Response Tuple subfield shall include the Service Name subfield, the Instance Name subfield, and may include the corresponding Service Information Query Response subfield that is service-specific. The responding STA shall not include a Service Information Response Tuple subfield in the Service Information Response ANQP-element for a requested service that is not offered.

Based on the Service Information Response ANQP-element in the received ANQP response, the non-AP STA may decide to proceed with the authentication and association procedure (10.3 (STA authentication and association)) (see examples illustrated in Annex AA.1 (Pre-association discovery usage scenarios)). The details of this decision are outside the scope of this standard.

**B.3.3 IUT configuration**

*Modify B.3.3 (D3.1 page 28 lines 7-12) as shown:*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Item**  | **IUT configuration**  | **References**  | **Status**  | **Support**  |
| \* CF33  | Pre-association discovery procedure  | 10.26 (Pre-association discovery (PAD) procedures)  | O  | YesNoN/A |

**AA.1.1 Background Search**

*Modify AA.1.1 (D3.1 page 31 lines 51-65) as shown:*

If the probability of false positives as indicated in the False Positive Probability Range field of the Service Hint element is considered relatively high by the non-AP STA (see Figure AA-1- (Example of a message exchange for background search with high probability of false positive)), the non-AP STA may send a Probe Request with the Service Hash element to confirm the service is indeed offered through the AP or PCP. The AP or PCP then responds with a Probe Response with a Service Advertisement element that contains the corresponding Service Name and Instance Name.

The non-AP STA may then send an ANQP request with a Service Information Request ANQP-element containing the Service Name, Instance Name and specific Service Information Query Request to obtain more information about the service from the AP or PCP. The responding STA responds to the ANQP request with the ANQP response with Service Information Response ANQP-element containing the Service Name, Instance Name and specific Service Information Query Response. After the ANQP request and ANQP response exchange, the non-AP STA should be able to make an informed decision about choosing to associate to the AP or PCP.

*Modify AA.1.1 (D3.1 page 32 lines 29-35) as shown:*

If the probability of false positive is as indicated in False Positive Probability Range field of the Service Hint element is considered relatively low by the non-AP STA (see Figure AA-2 (Example of a frame exchange for background search with low probability of false positive)), the non-AP STA may directly send an ANQP request with Service Information Request ANQP-element containing the Service Name and specific Service Information Query Request to obtain more information about the service from the AP or PCP.

*Modify AA.1.1 (D3.1 page 32 lines 61-65) as shown:*

The responding STA responds to the ANQP request with the ANQP response with Service Information Response ANQP-element containing the Service Name, Instance Name and specific Service Information Query Response. After the ANQP request and ANQP response exchange, the non-AP STA should be able to make an informed decision about associating with the AP or PCP.

*Modify AA.1.1 (D3.1 page 33 lines 1-11) as shown:*

In a scenario where there is a matching Service Hash element, the non-AP STA may directly send an ANQP request with Service Information Request ANQP-element containing the Service Name and specific Service Information Query Request to obtain more information about the service from the responding STA as shown in Figure AA-3 (Example of frame exchange for background search with matching Hash element).

The responding STA responds to the ANQP request with the ANQP response with Service Information Response ANQP-element containing the Service Name, Instance Name and specific Service Information Query Response. After the ANQP request and ANQP response exchange, the non-AP STA should be able to make an informed decision about choosing to associate to the AP or PCP.

**AA.1.2 Immediate Search**

*Modify AA.1.2 (D3.1 page 33 line 42 through page 34 line 2) as shown:*

Applications that are initiated by users (e.g., a user is looking for a fast movie download service) require immediate discovery results to be presented to the user. In this scenario, a non-AP STA should perform a Solicited PAD procedure, whereby the non-AP STA sends Probe Request frames to query specific services immediately after user initiation of the service/application and the AP or PCP responds with a Probe Response frame accordingly if there is a matched service (Figure AA-4 (Example of frame exchange for immediate search)). The Probe Request frame contains the Service Hash element of the search service. The AP or PCP responds with a Probe Response frame with a Service Advertisement element containing the corresponding Service Name and Instance Name. The non-AP STA then may perform an ANQP request and ANQP response exchange with the responding STA, as shown in Figure AA-4 (Example of frame exchange for immediate search), to obtain more information about the service. After the ANQP request and ANQP response exchange, the non-AP STA should be able to make an informed decision about choosing to associate to the AP or PCP.