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Protocol for Carrying Authentication for Network Access (PANA) with IPv4
Unspecified Address
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Abstract

This document defines how PANA client (PaC) can perform PANA authentication prior to configuring an IP address.

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PANA with IPv4 Unspecified Address

February 2012

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[1.](#) Introduction

PANA (Protocol for carrying Authentication for Network Access) [[RFC5191](#)] as a UDP-based protocol operates with the assumption that the PANA client (PaC) is already configured with an IP address. Private IPv4, globally-routable IPv4 [[RFC1918](#)] or IPv6, IPv4 or IPv6 link-local are the types of addresses that can be configured by PaCs prior to running PANA [[RFC5193](#)].

In case the PaC and the PANA Authentication Agent (PAA) are on the same IP subnet where all hosts in the subnet can be reached in one routing hop, the PaC can run PANA with the PAA prior to configuring an IP address.

This document defines an extension of PANA to allow the PaC to use IPv4 unspecified address (0.0.0.0) until it gets authenticated/authorized; and configures an IP address afterwards (possibly using DHCP). Such a feature is already available in Mobile IPv4 [[RFC3344](#)] where MN can use unspecified IPv4 address with Mobile IP protocol until it is assigned a home address, and also DHCP [[RFC2131](#)].

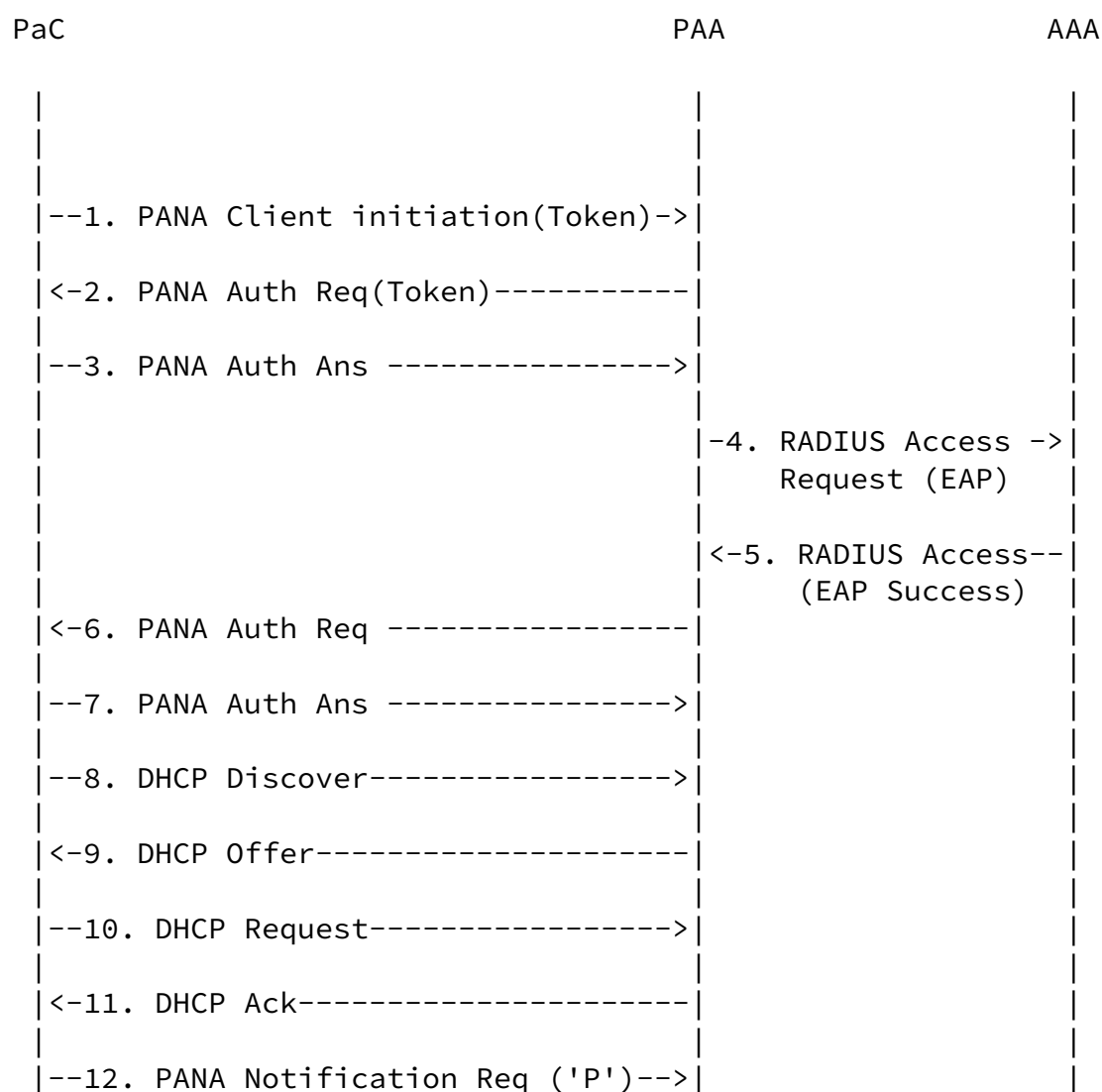
This extension is defined only as a solution for use cases in which PANA authentication is required prior to any kind of IP address allocation or configuration. It is not intended to become the default mode of operation for PANA.

[1.1.](#) Specification of Requirements

In this document, several words are used to signify the requirements of the specification. These words are often capitalized. The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [[RFC2119](#)].

[2.](#) Details

Figure 1 is an example call flow that illustrates use of unspecified IPv4 address with the PaC during PANA authentication. Note that there can be other ways for combining DHCP and PANA call flows.



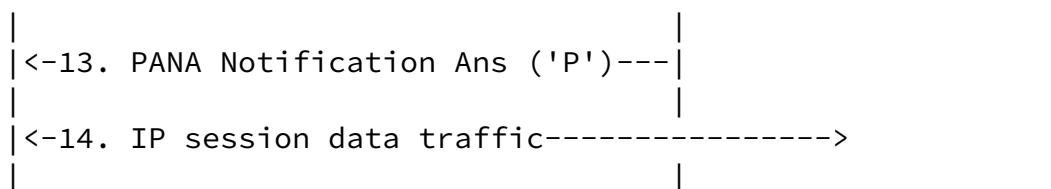


Figure 1: Example Call Flow for PANA with IPv4 Unspecified Address

Step 1: The PaC initiates PANA by sending a broadcasted PCI carrying a Token AVP that contains a random value generated by the PaC.

The source IPv4 address of the PCI is set to 0.0.0.0. The source port number is chosen by the PaC. The destination IPv4 address is set to 255.255.255.255. The destination port number is the PANA port number (716).

Step 2: The PAA responds with a PAR message that includes the token generated by the PaC. The PAR message has its source IPv4 address

set to the PAA's IP address, and the destination IPv4 address is set to 255.255.255.255. If the PAA is capable of retrieving the PaC's L2 address from incoming PCI, then the PAR is L2-unicast using that L2 address. Otherwise, the PAR message will be L2-broadcast.

The PaC discovers the PAA's IPv4 address when it receives the PAR message.

Step 3: The PaC sends the PAN message to the PAA's newly discovered IPv4 address.

Steps 4-7: PANA and RADIUS carrying out the selected EAP method.

Steps 8-11: Now that the PaC is authenticated, it proceeds to configuring service IP address using DHCPv4. In this example the PAA and DHCP server are co-located. The DHCP server responds to the DHCP Discover messages that are coming from authenticated PaCs while the ones from unauthenticated PaCs are silently dropped. Details of how the DHCP server verifies the authenticity of the PaC (e.g., via its bindings to the lower-layer security) are outside the scope of this specification. Scenarios involving separate PAA and DHCP server are also possible. Their details are outside the scope of this

specification as well. As soon as the new IPv4 address is confirmed by the DHCPACK, the PaC can stop using the unspecified address.

Steps 12 and 13: Following a change of IP address (from unspecified to a DHCP-assigned one), the PaC sends a PNR message with the 'P' (Ping) bit set. The PAA learns the new IP address of the PaC with the help of this message. The PAA responds with a PNA message with the 'P' (Ping) bit set. See [[RFC5191](#)] for detailed usage of the 'P' (Ping) bit.

Step 14: The PaC can transmit and receive IP data packets using its IP address. Step 14 can be executed in parallel with Steps 12 and 13.

A PAA implementation may not be capable of retrieving the PaC's L2 address from L2 header of the incoming PANA messages, or be able to send a L2-unicast even if it could retrieve the address. In such a case, the PAA sends PANA messages as L2-broadcast. In order to prevent other PaCs from processing the messages destined for a specific PaC, each PaC is required to supply a randomly generated token as a payload AVP to PCI and expect it to be echoed back by the PAA in the initial PAR. Token AVP is defined for this purpose.

Note that any message beyond Step 2 would include the PAA-assigned and PaC-acknowledged PANA Session Id, hence use of Token AVP is not needed for those messages.

[3.](#) PaC Behavior

A PaC SHALL use unspecified address as its source IP address until it configures another IP address. The PaC SHALL send a PCI carrying a Token AVP. The PaC SHOULD NOT include a Token AVP in any other message.

The PaC SHALL silently drop any PAR that carries a Token AVP whose token value does not match the one contained in the PCI sent by the PaC.

The PaC, before it sends the first PAN to the PAA, SHALL silently drop any PAR that is L2-broadcast and without carrying a Token AVP.

Any legacy PaC that does not implement this specification will

automatically drop the incoming PAR that carries the Token AVP as this is an unrecognized AVP. This is the standard behavior defined in [[RFC5191](#)].

[4.](#) PAA Behavior

If a PAA receives a PCI whose source IP address is unspecified but that does not carry a Token AVP, then it SHALL drop the PCI.

When the PAA needs to send a packet to a PaC that is using an unspecified IP address, then the PAA shall set the destination IP address to 255.255.255.255. The PAA SHOULD set the destination L2 address to the source L2 address retrieved from the incoming PaC packet, when possible; otherwise set to L2 broadcast address. If this is the very first PAR message sent to L2 broadcast address in response to a PCI message containing a Token AVP, then the PAA SHALL include a Token AVP copied from the PCI. The PAA SHOULD NOT include a Token AVP in any other PANA message, as an already-assigned PANA Session Id serves the need.

The PAA SHALL set the 'I' (IP Reconfiguration) bit of PAR messages in authentication and authorization phase so that the PaC proceeds to IP address configuration. See [[RFC5191](#)] for detailed usage of the 'I' (IP Reconfiguration) bit.

Any legacy PAA that does not implement this specification would automatically drop the incoming PCI that carries the Token AVP as this is an unrecognized AVP. This is the standard behavior defined in [[RFC5191](#)].

[5.](#) AVP Definition

This document defines one new AVP as described below.

[5.1.](#) Token AVP

The Token AVP (AVP Code TBD) is of type Unsigned64 containing a random value generated by the PaC.

6. Message Size Considerations

Since IP fragmentation for IP packets using unspecified address is prohibited, link-layer MTU needs to be no less than the IP packet size carrying the largest PANA message in the case where EAP message size is the same as the minimum EAP MTU size (i.e., 1020 octets [[RFC3748](#)]). Such a PANA message is the very first PANA-Auth-Request message in Authentication and Authorization phase carrying an EAP-Payload AVP. In order to limit the message size, the PAA can choose to separate the PAR carrying the Integrity-Algorithm, PRF-Algorithm, and Token AVPs from the one carrying the very first EAP-Payload AVP. The following computations are made under this assumption.

An EAP-Payload AVP that carries an EAP-Request of size being equal to the minimum EAP MTU size. The size of such an AVP is $1020 + 8 = 1028$ octets.

In this case, the PANA message size including PANA header (16 octets), UDP header (8 octets) and IPv4 header (20 octets) is $1028 + 16 + 8 + 20 = 1072$ octets. Therefore, the link-layer MTU size for IP packets MUST be no less than 1072 octets when unspecified IPv4 address is used for PANA. Note that Ethernet (MTU = 1500 octets) meets this requirement.

PANA as an EAP lower-layer reports the EAP MTU to the EAP layer, so that EAP methods can perform appropriate fragmentation [[RFC3748](#)]. The EAP MTU is calculated as follows:

$$\text{EAP_MTU} = \text{L2_MTU} - 52$$

In the above formula, the value of 52 is the PANA overhead (IP, UDP and PANA headers, and the EAP-Payload AVP header).

7. Security Considerations

When the PAA is not capable of L2-unicasting PANA messages to the target PaC, other nodes on the same subnet can receive those

messages. This may pose a risk if there is any confidential data

exposed in the messages. Typically no such exposure exists as PANA, EAP, and EAP methods are defined in a way they can also be used in wireless networks where snooping is always a possibility.

8. IANA Considerations

As described in [Section 5.1](#) and following the new IANA allocation policy on PANA message [[RFC5872](#)], a new AVP Code for Token AVP needs to be assigned by IANA.

9. Acknowledgments

The authors would like to thank Rafael Marin Lopez and Yasuyuki Tanaka for their valuable comments.

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