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W. Kumari
Google
E. Kline
Loon

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# Captive-Portal Identification in DHCP / RA
# draft-ietf-capport-rfc7710bis-01

Abstract

In many environments offering short-term or temporary Internet access (such as coffee shops), it is common to start new connections in a captive portal mode. This highly restricts what the customer can do until the customer has authenticated.

This document describes a DHCP option (and a Router Advertisement (RA) extension) to inform clients that they are behind some sort of captive-portal device, and that they will need to authenticate to get Internet access. It is not a full solution to address all of the issues that clients may have with captive portals; it is designed to be used in larger solutions. The method of authenticating to, and interacting with the captive portal is out of scope of this document.

[ This document is being collaborated on in Github at: https://github.com/wkumari/draft-ekwk-capport-rfc7710bis. The most recent version of the document, open issues, etc should all be available here. The authors (gratefully) accept pull requests. Text in square brackets will be removed before publication. ]

Table of Contents



## 1. Introduction

In many environments, users need to connect to a captive-portal device and agree to an Acceptable Use Policy (AUP) and / or provide billing information before they can access the Internet. It is anticipated that the IETF will work on a more fully featured protocol at some point, to ease interaction with Captive Portals. Regardless of how that protocol operates, it is expected that this document will provide needed functionality because the client will need to know when it is behind a captive portal and how to contact it.

In order to present users with the payment or AUP pages, the captive-portal device has to intercept the user's connections and redirect the user to the captive portal, using methods that are very similar to man-in-the-middle (MITM) attacks. As increasing focus is placed on security, and end nodes adopt a more secure stance, these interception techniques will become less effective and/or more intrusive.

This document describes a DHCP ([RFC2131]) option (Captive-Portal) and an IPv6 Router Advertisement (RA) ([RFC4861]) extension that informs clients that they are behind a captive-portal device and how to contact it.

### 1.1. Requirements Notation

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. The Captive-Portal Option

The Captive Portal DHCP / RA Option informs the client that it may be behind a captive portal and provides the URI to access an API as defined by [draft-ietf-capport-api]. This is primarily intended to improve the user experience by getting them to the captive portal faster and more reliably. Note that, for the foreseeable future, captive portals will still need to implement the interception techniques to serve legacy clients, and clients will need to perform probing to detect captive portals.

Clients that support the Captive Portal DHCP option SHOULD include the option in the Parameter Request List in DHCPREQUEST messages. DHCP servers MAY send the Captive Portal option without any explicit request.

In order to support multiple "classes" of clients (e.g. IPv4 only, IPv6 only with DHCPv6 ([RFC3315]), IPv6 only with RA) the captive portal can provide the URI via multiple methods (IPv4 DHCP, IPv6 DHCP, IPv6 RA). The captive portal operator SHOULD ensure that the URIs handed out are equivalent to reduce the chance of operational problems. The maximum length of the URI that can be carried in IPv4 DHCP is 255 bytes, so URIs longer than 255 bytes should not be used in IPv6 DHCP or IPv6 RA.

In all variants of this option, the URI MUST be that of the captive portal API endpoint, conforming to the recommendations for such URIs [draft-ietf-capport-api] (i.e. the URI SHOULD contain a DNS name and SHOULD reference a secure transport, e.g. https).

A captive portal MAY redirect requests that do not have an Accept header field ([RFC7231] Section 5.3) containing a field item whose content-type is "application/capport+json" to the URL conveyed in the "user-portal-url" API key. When performing such content negotiation ([RFC7231] Section 3.4), captive portals need to keep in mind that such responses might be cached, and therefore SHOULD include an appropriate Vary header field ([RFC7231] Section 7.1.4) or mark them explicitly uncacheable (for example, using Cache-Control: no-store [RFC7234] Section 5.2.2.3).

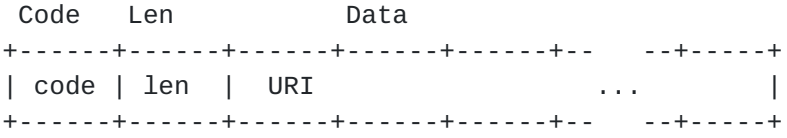
A captive portal MAY do content negotiation ([RFC7231] section 3.4) and attempt to redirect clients querying without an explicit indication of support for the captive portal API content type (i.e. without application/capport+json listed explicitly anywhere within an Accept header vis. [RFC7231] section 5.3). In so doing, the captive portal SHOULD redirect the client to the value associated with the "user-portal-url" API key.

The URI SHOULD NOT contain an IP address literal. The URI parameter is not null terminated.

Networks with no captive portals MAY explicitly indicate this condition by using this option with the IANA-assigned URI for this purpose (see Section 4.1.1). Clients observing the URI value "urn:ietf:params:capport-unrestricted" MAY forego time-consuming forms of captive portal detection.

## 2.1. IPv4 DHCP Option

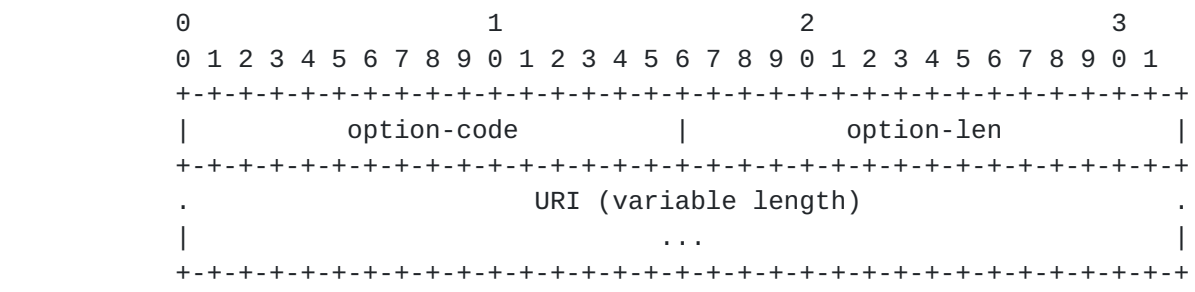
The format of the IPv4 Captive-Portal DHCP option is shown below.




- Code: The Captive-Portal DHCPv4 Option (160) (one octet)
- Len: The length, in octets of the URI.
- URI: The URI for the captive portal API endpoint to which the user should connect (encoded following the rules in [RFC3986]).

## 2.2. IPv6 DHCP Option

The format of the IPv6 Captive-Portal DHCP option is shown below.




o option-code: The Captive-Portal DHCPv6Option (103) (two octets)

o option-len: The length, in octets of the URI.

o URI: The URI for the captive portal API endpoint to which the user should connect (encoded following the rules in [RFC3986]).

See [RFC7227], Section 5.7 for more examples of DHCP Options with URIs.

## 2.3. The Captive-Portal IPv6 RA Option

This section describes the Captive-Portal Router Advertisement option.

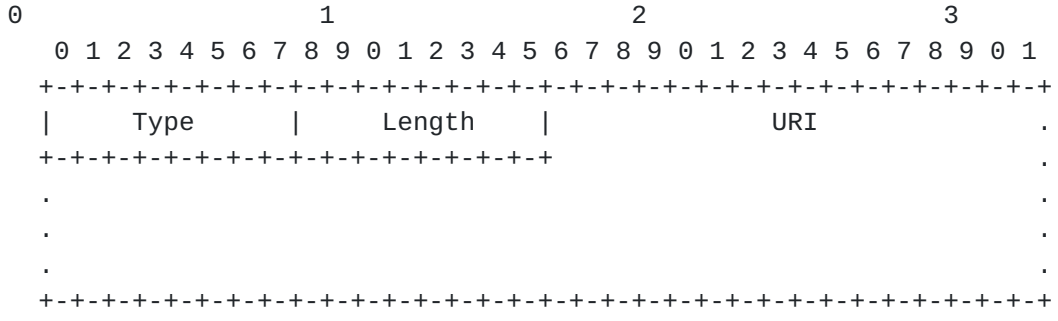



Figure 2: Captive-Portal RA Option Format

Type 37

Length 8-bit unsigned integer. The length of the option (including the Type and Length fields) in units of 8 bytes.

URI The URI for the captive portal API endpoint to which the user should connect. This MUST be padded with NULL (0x00) to make the total option length (including the Type and Length fields) a multiple of 8 bytes.

## 3. Precedence of API URIs

A device may learn about Captive Portal API URIs through more than one of (or indeed all of) the above options. It is a network configuration error if the learned URIs are not all identical.

However, if the URIs learned are not in fact all identical the captive device MUST prioritize URIs learned from network provisioning or configuration mechanisms before all other URIs. Specifically, URIs learned via any of the options in Section 2 should take precedence over any URI learned via some other mechanism, such as a redirect.

If the URIs learned via more than one option described in Section 2 are not all identical, this condition should be logged for the device owner or administrator. URI precedence in this situation is not specified by this document.

## 4. IANA Considerations

This document requests two new IETF URN protocol parameter ([RFC3553]) entries. This document also requests a reallocation of DHCPv4 option codes (see Appendix C for background).

Thanks IANA!

### 4.1. IETF params Registration

#### 4.1.1. Registry name: Captive Portal Unrestricted Identifier

Registry name: Captive Portal Unrestricted Identifier

URN: urn:ietf:params:capport-unrestricted

Specification: RFC TBD (this document)

Repository: RFC TBD (this document)

Index value: Only one value is defined (see URN above). No hierarchy is defined and therefore no sub-namespace registrations are possible.

### 4.2. BOOTP Vendor Extensions and DHCP Options Code Change

[ RFC Ed: Please remove before publication: RFC7710 uses DHCP Code 160 -- unfortunately, it was discovered that this option code is already widely used by Polycom (see appendix). Option 114 (URL) is currently assigned to Apple (RFC3679, Section 3.2.3 - Contact: Dieter Siegmund, dieter@apple.com - Reason to recover: Never published in an

RFC) Tommy Pauly (Apple) and Dieter Siegmund confirm that this codepoint hasn't been used, and Apple is willing to relinquish it for use in CAPPORT. Please see thread: https://mailarchive.ietf.org/arch/msg/captive-portals/TmqQz6Ma_fznD3XbhwkH9m2dB28 for more background. ]

The IANA is requested to update the "BOOTP Vendor Extensions and DHCP Options" registry (https://www.iana.org/assignments/bootp-dhcp-parameters/bootp-dhcp-parameters.xhtml) as follows.

Tag: 114
Name: DHCP Captive-Portal
Data Length: N
Meaning: DHCP Captive-Portal
Reference: [THIS-RFC]

Tag: 160
Name: REMOVED/Unassigned
Data Length:
Meaning:
Reference: [RFC7710][Deprecated]

## 5. Security Considerations

An attacker with the ability to inject DHCP messages or RAs could include an option from this document to force users to contact an address of his choosing. As an attacker with this capability could simply list himself as the default gateway (and so intercept all the victim's traffic); this does not provide them with significantly more capabilities, but because this document removes the need for interception, the attacker may have an easier time performing the attack. As the operating systems and application that make use of this information know that they are connecting to a captive-portal device (as opposed to intercepted connections) they can render the page in a sandboxed environment and take other precautions, such as clearly labeling the page as untrusted. The means of sandboxing and user interface presenting this information is not covered in this document - by its nature it is implementation specific and best left to the application and user interface designers.

Devices and systems that automatically connect to an open network could potentially be tracked using the techniques described in this document (forcing the user to continually authenticate, or exposing their browser fingerprint). However, similar tracking can already be performed with the standard captive portal mechanisms, so this technique does not give the attackers more capabilities.

Captive portals are increasingly hijacking TLS connections to force browsers to talk to the portal. Providing the portal's URI via a DHCP or RA option is a cleaner technique, and reduces user expectations of being hijacked - this may improve security by making users more reluctant to accept TLS hijacking, which can be performed from beyond the network associated with the captive portal.

By simplifying the interaction with the captive portal systems, and doing away with the need for interception, we think that users will be less likely to disable useful security safeguards like DNSSEC validation, VPNs, etc. In addition, because the system knows that it is behind a captive portal, it can know not to send cookies, credentials, etc. By handing out a URI using which is protected with TLS, the captive portal operator can attempt to reassure the user that the captive portal is not malicious.

Operating systems should conduct all interactions with the API in a sand-boxed environment and with a configuration that minimizes tracking risks.

## 6. Acknowledgements

This document is a -bis of RFC7710. Thanks to all of the original authors (Warren Kumari, Olafur Gudmundsson, Paul Ebersman, Steve Sheng), and original contributors.

Also thanks to the CAPPORT WG for all of the discussion and improvements including contributions and review from Lorenzo Colitti, Remi Nguyen Van, and Tommy Pauly.

## 7. References

### 7.1. Normative References

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, DOI 10.17487/RFC2119, March 1997, <https://www.rfc-editor.org/info/rfc2119>.

[RFC2131] Droms, R., "Dynamic Host Configuration Protocol", RFC 2131, DOI 10.17487/RFC2131, March 1997, <https://www.rfc-editor.org/info/rfc2131>.

[RFC3315] Droms, R., Ed., Bound, J., Volz, B., Lemon, T., Perkins, C., and M. Carney, "Dynamic Host Configuration Protocol for IPv6 (DHCPv6)", RFC 3315, DOI 10.17487/RFC3315, July 2003, <https://www.rfc-editor.org/info/rfc3315>.

[RFC3553] Mealling, M., Masinter, L., Hardie, T., and G. Klyne, "An IETF URN Sub-namespace for Registered Protocol Parameters", BCP 73, RFC 3553, DOI 10.17487/RFC3553, June 2003, <https://www.rfc-editor.org/info/rfc3553>.

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[RFC4861] Narten, T., Nordmark, E., Simpson, W., and H. Soliman, "Neighbor Discovery for IP version 6 (IPv6)", RFC 4861, DOI 10.17487/RFC4861, September 2007, <https://www.rfc-editor.org/info/rfc4861>.

[RFC7227] Hankins, D., Mrugalski, T., Siodelski, M., Jiang, S., and S. Krishnan, "Guidelines for Creating New DHCPv6 Options", BCP 187, RFC 7227, DOI 10.17487/RFC7227, May 2014, <https://www.rfc-editor.org/info/rfc7227>.

[RFC7231] Fielding, R., Ed. and J. Reschke, Ed., "Hypertext Transfer Protocol (HTTP/1.1): Semantics and Content", RFC 7231, DOI 10.17487/RFC7231, June 2014, <https://www.rfc-editor.org/info/rfc7231>.

[RFC7234] Fielding, R., Ed., Nottingham, M., Ed., and J. Reschke, Ed., "Hypertext Transfer Protocol (HTTP/1.1): Caching", RFC 7234, DOI 10.17487/RFC7234, June 2014, <https://www.rfc-editor.org/info/rfc7234>.

[RFC7710] Kumari, W., Gudmundsson, O., Ebersman, P., and S. Sheng, "Captive-Portal Identification Using DHCP or Router Advertisements (RAs)", RFC 7710, DOI 10.17487/RFC7710, December 2015, <https://www.rfc-editor.org/info/rfc7710>.

## 7.2. URIs

[1] https://tickets.meeting.ietf.org/wiki/IETF106network#Experiments

[2] https://tickets.meeting.ietf.org/wiki/CAPPORT

[3] https://community.polycom.com/t5/VoIP-SIP-Phones/DHCP-Standardization-160-vs-66/td-p/72577

## Appendix A. Changes / Author Notes.

[RFC Editor: Please remove this section before publication ]

From initial to -00.

- Import of RFC7710.

From -00 to -01.

- Remove link-relation text.
- Clarify option should be in DHCPREQUEST parameter list.
- Uppercase some SHOULDs.

## Appendix B. Changes from RFC 7710

This document incorporates the following changes from [RFC7710].

1. Clarify that IP string literals are NOT RECOMMENDED.
2. Clarify that the option URI SHOULD be that of the captive portal API endpoint.
3. Clarify that captive portals MAY do content negotiation.
4. Added text about Captive Portal API URI precedence in the event of a network configuration error.
5. Added urn:ietf:params:capport-unrestricted URN.

## Appendix C. Observations From IETF 106 Network Experiment

During IETF 106 in Singapore an experiment [1] enabling Captive Portal API compatible clients to discover a venue-info-url (see experiment description [2] for more detail) revealed that some Polycom devices on the same network made use of DHCPv4 option code 160 for other purposes [3].

The presence of DHCPv4 Option code 160 holding a value indicating the Captive Portal API URL caused these devices to not function as desired. For this reason, this document requests IANA deprecate option code 160 and reallocate different value to be used for the Captive Portal API URL.

## Authors' Addresses

Warren Kumari
Google
1600 Amphitheatre Parkway
Mountain View, CA 94043
US

Email: warren@kumari.net

Erik Kline
Loon
1600 Amphitheatre Parkway
Mountain View, CA 94043
US

Email: ek@loon.com