Abstract

The FIDO U2F framework was designed to be able to support multiple authenticator form factors. This document describes the communication protocol with authenticators over Near Field Communication (NFC).

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1. Notation

Type names, attribute names and element names are written as code.

String literals are enclosed in “”, e.g. “UAF-TLV”.

In formulas we use “|” to denote byte wise concatenation operations.

DOM APIs are described using the ECMAScript [ECMA-262] bindings for WebIDL [WebIDL].

UAF specific terminology used in this document is defined in [FIDO glossary].

1.1 Key Words
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. Protocol

The general protocol between a FIDO client and authenticator over NFC is as follows:

1. Client sends an applet selection command
2. Authenticator replies with success
3. Client sends a command for an operation (register / authenticate)
4. Authenticator replies with response data or error

3. Framing

The NFC protocol SHALL NOT use any additional framing (unlike the USB HID protocol, for example). Instead, messages sent to an NFC authenticator SHALL follow the U2F raw message format as defined in [U2FRAWMESSAGES] in the bibliography.

4. APDU Length

Some responses may not fit into a short APDU, for this reason U2F authenticators MUST respond in the following way:

- If the request was of extended length (i.e., had 3 length bytes), the authenticator MUST respond using the extended length APDU format.
- If the request was not of extended length (i.e., had 1 length byte), the authenticator MUST respond using ISO 7816-4 APDU chaining (see Section A.4).

See below for an example:
5. Applet selection

A FIDO client **shall** always send an applet selection command to begin interaction with a FIDO authenticator via NFC. The structure of the applet selection command **shall** follow the same APDU structure as in the raw message format mentioned above.

The FIDO U2F AID consists of the following fields:

<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>RID</td>
<td>0xA000000647</td>
</tr>
<tr>
<td>AC</td>
<td>0x2F</td>
</tr>
<tr>
<td>AX</td>
<td>0x0001</td>
</tr>
</tbody>
</table>

As a result, the command for selecting the applet using the FIDO U2F AID is:

<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLA</td>
<td>0x00</td>
</tr>
<tr>
<td>INS</td>
<td>0xA4</td>
</tr>
<tr>
<td>P1</td>
<td>0x04</td>
</tr>
<tr>
<td>P2</td>
<td>0x00</td>
</tr>
<tr>
<td>LEN</td>
<td>0x08</td>
</tr>
<tr>
<td>DATA</td>
<td>0xA0000006472F0001</td>
</tr>
</tbody>
</table>

In response to the applet selection command, the FIDO authenticator **shall** reply with its version string in the successful response. In this writing, the version string is "U2F_V2", hence a successful response to the applet selection command would consist of the following bytes:

```
0x5532465F56329000
```

6. Implementation Considerations

Some NFC authenticators may be passively powered -- drawing all of their power from the NFC field. If the authenticator does not power up quick enough or has insufficient power, a poor user experience is likely to occur.

7. Bibliography

A. References

A.1 Normative references

[ECMA-262]  
*ECMAScript Language Specification, Edition 5.1.* June 2011. URL:  
http://www.ecma-international.org/publications/standards/Ecma-262.htm

[FIDO Glossary]  
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[RFC2119]  
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[WebIDL]  
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Recommendation. URL: http://www.w3.org/TR/WebIDL/