Measurement and Attestation RootS (MARS) Serialization Interface Specification

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1 SCOPE

This document is the Measurement and Attestation RootS (MARS) Serialization Interface Specification. It defines the data encoding of commands and parameters received by and responses sent from a MARS instance over a transport interface (e.g., SPI, UART, I2C, network) that requires data to be serialized. Proper serialization of data ensures that a deserializing receiver can reassemble a copy that is semantically identical to that of the sender. This specification is transport protocol agnostic. The MARS Serialized Architecture diagram is included from [1], and shown in Figure 1.

Figure 1 - MARS Serialized Architecture

1.1 Key Words

The key words “MUST,” “MUST NOT,” “REQUIRED,” “SHALL,” “SHALL NOT,” “SHOULD,” “SHOULD NOT,” “RECOMMENDED,” “MAY,” and “OPTIONAL” in this document form normative statements and are to be interpreted as described in RFC-2119, Key words for use in RFCs to Indicate Requirement Levels.

1.2 Statement Type

Please note a very important distinction between different sections of text throughout this document. There are two distinctive kinds of text: informative comment and normative statements. Because most of the text in this specification will be of the kind normative statements, the authors have informally defined it as the default and, as such, have specifically called out text of the kind informative comment. They have done this by flagging the beginning and end of each informative comment and highlighting its text in gray. This means that unless text is specifically marked as of the kind informative comment, it can be considered a kind of normative statement.
**EXAMPLE: Start of informative comment**

This is the first paragraph of 1–n paragraphs containing text of the kind *informative comment* ...

This is the second paragraph of text of the kind *informative comment* ...

This is the nth paragraph of text of the kind *informative comment* ...

To understand the TCG specification the user must read the specification. (This use of MUST does not require any action).

**End of informative comment**
2 Abbreviations, Acronyms and Terms Used

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AK</td>
<td>Attestation Key</td>
</tr>
<tr>
<td>API</td>
<td>Application Programming Interface</td>
</tr>
<tr>
<td>CBOR</td>
<td>Concise Binary Object Representation</td>
</tr>
<tr>
<td>CDDL</td>
<td>Concise Data Definition Language</td>
</tr>
<tr>
<td>I2C</td>
<td>Inter-Integrated Circuit serial communication bus</td>
</tr>
<tr>
<td>MARS</td>
<td>Measurement and Attestation RootS</td>
</tr>
<tr>
<td>PCR</td>
<td>Platform Configuration Register</td>
</tr>
<tr>
<td>PS</td>
<td>Primary Seed</td>
</tr>
<tr>
<td>SHA</td>
<td>Secure Hash Algorithm</td>
</tr>
<tr>
<td>SPI</td>
<td>Serial Peripheral Interface</td>
</tr>
<tr>
<td>TCG</td>
<td>Trusted Computing Group</td>
</tr>
<tr>
<td>TSR</td>
<td>Trusted Sensor Register</td>
</tr>
<tr>
<td>UART</td>
<td>Universal Asynchronous Receiver-Transmitter</td>
</tr>
</tbody>
</table>
3 Formatting

Serialized I/O with MARS SHALL be formatted according to RFC 8949 – Concise Binary Object Representation (CBOR). CBOR “is a data format whose design goals include the possibility of extremely small code size, fairly small message size, and extensibility without the need for version negotiation” [2]. Implementations SHALL comply with CBOR Core Deterministic Encoding Requirements, using the shortest tag possible. Note that this specification does not use tagging to extend CBOR data types.

Concise Data Definition Language (CDDL) [3] is used in Appendix A to define the formatting of MARS commands (as mars_command) and responses (as mars_response). Informative examples of CBOR-encoded MARS commands and responses are in Appendix B. Informative examples of using CDDL to verify MARS command and response formatting are in [4].

3.1 Data Type Mappings Between MARS, CBOR, and CDDL

3.1.1 Aggregation

Individual command parameters and response values are referred to as data items. A sequence of one or more data items is contained within a single CBOR array, denoted in this specification using CDDL square brackets. All serialized commands to and responses from MARS SHALL be formatted using CBOR arrays. Arrays MUST NOT have an insufficient nor excess number of data items.

3.1.2 Integers

All MARS integer data types are unsigned and denoted in this specification as CDDL uint.

3.1.3 Register Selection

A MARS regSelect 32-bit bitmask SHALL be encoded as a CDDL uint.

3.1.4 Byte Arrays

All MARS byte arrays SHALL be encoded as byte strings, denoted in this specification as CDDL bstr.

3.1.5 Boolean

The Boolean type used by MARS is denoted in this specification as CDDL bool.

3.1.6 Null Pointer

A null pointer is denoted in this specification as CDDL nil.

3.2 Commands
An array of data items in a command to MARS SHALL begin with a command code encoded as a uint. Values for command codes are defined in [1] by macros prefixed by MARS_CC_. Each command code SHALL be followed by zero or more encoded parameters required for that command.

Before beginning the actions associated with a command, a set of command format and consistency checks SHALL be performed by MARS. These checks are listed here, and SHOULD be performed in the indicated order.

1) do not start execution of command before all parameters are parsed,
2) verify that the data is a CBOR array,
3) unmarshal a command code and verify that the command is implemented,
4) verify that the number of data items in the array matches the number of parameters required by the command,
5) unmarshal parameters and verify that their types are correct
   a) verify that the bstr lengths are supported by the implementation and match constraints defined by the MARS’ profile, and return MARS_RC_VALUE otherwise,
   b) verify that ranges of values are supported, and return an appropriate response code (e.g., if PCR selection indicates an unimplemented register, return MARS_RC_REG).

### 3.3 Responses

An array of data items in a response from MARS SHALL begin with a response code encoded as a uint. Values for response codes are defined in [5] by macros prefixed by MARS_RC_. The response code SHALL be followed by zero or more encoded output values from and required by the corresponding command.
4 Bibliography


Appendix A  CDDL for MARS Commands and Responses

; Implementation specific parameters
; These parameters must be set by the implementor according to the
; relevant profile specification.
uint16 = 0..65535
; Arbitrary length binary data
binary_data = bstr .size (0..2048)
; binary data of length PT_LEN_DIGEST
digest_data = bstr .size (16..64)
; binary data of length PT_LEN_KSYM
ksym_data = bstr .size 32
; binary data of length PT_LEN_KPUB
kpub_data = bstr .size 32
; binary data of length PT_LEN_SIGN
sign_data = bstr .size (16..64)
; bit mask selecting PCRs and TSRs
reg_select_type = uint .size 4
; index of a PCR or TSR
reg_index_type = uint .size 1
; End of implementation specific parameters

; MARS Command Codes
CC_SelfTest = 0
CC_CapabilityGet = 1
CC_SequenceHash = 2
CC_SequenceUpdate = 3
CC_SequenceComplete = 4
CC_PcrExtend = 5
CC_RegRead = 6
CC_Derive = 7
CC_DpDerive = 8
CC_PublicRead = 9
CC_Quote = 10
CC_Sign = 11
CC_SignatureVerify = 12

; MARS Response Codes
rc_success = 0
rc_io = 1
rc_failure = 2
rc_buffer = 4
rc_command = 5
rc_value = 6
rc_reg = 7
rc_seq = 8
; MARS Capability Property Tags
; number of consecutive PCRs implemented on this MARS
PT_PCR = 1
; number of consecutive TSRs implemented on this MARS
PT_TSR = 2
; size of a digest that can be processed or produced
PT_LEN_DIGEST = 3
; Size of signature produced by CryptSign()
PT_LEN_SIGN = 4
; size of symmetric key produced by CryptSkdf()
PT_LEN_KSYM = 5
; size of asymmetric key returned by PublicRead()
PT_LEN_KPUB = 6
; size of private asymmetric key produced by CryptAkdf()
PT_LEN_KPRV = 7
; TCG-registered algorithm for hashing by CryptHash()
PT_ALG_HASH = 8
; TCG-registered algorithm for signing by CryptSign()
PT_ALG_SIGN = 9
; TCG-registered algorithm for symmetric key derivation by CryptSkdf()
PT_ALG_SKDF = 10
; TCG-registered algorithm for asymmetric key derivation by CryptAkdf()
PT_ALG_AKDF = 11

SelfTest = (  
    CC_SelfTest,  
    full_test: bool,  
)

SelfTest_Rsp = (  
    rc_success /  
    rc_failure  
)

CapabilityGet = (  
    CC_CapabilityGet,  
    capability: PT_PCR /  
    PT_TSR /  
    PT_LEN_DIGEST /  
    PT_LEN_SIGN /  
    PT_LEN_KSYM /  
    PT_LEN_KPUB /  
    PT_LEN_KPRV /  
    PT_ALG_HASH /  
    PT_ALG_SIGN /  
    PT_ALG_SKDF /  
    PT_ALG_AKDF,  
)
CapabilityGet_Rsp = (  
    rc_success,  
    capability_data: uint16) /  
    rc_value /  
    rc_buffer  
)

SequenceHash = (  
    code: CC_SequenceHash,  
)

SequenceHash_Rsp = (  
    rc_success /  
    rc_seq /  
    rc_command /  
    rc_failure  
)

SequenceUpdate = (  
    CC_SequenceUpdate,  
    binary_data,  
)

SequenceUpdate_Rsp = (  
    (rc_success,  
    binary_data) /  
    rc_seq /  
    rc_buffer /  
    rc_command /  
    rc_failure  
)

SequenceComplete = (  
    CC_SequenceComplete,  
)

SequenceComplete_Rsp = (  
    (rc_success,  
    binary_data) /  
    rc_seq /  
    rc_buffer /  
    rc_command /  
    rc_failure  
)

PcrExtend = (  
    CC_PcrExtend,  
)
reg_index: reg_index_type,
digest_data,
)
PcrExtend_Rsp = (  
  rc_success /
  rc_reg /
  rc_buffer /
  rc_command /
  rc_failure
)

RegRead = (  
  CC_RegRead,
  reg_index: reg_index_type,
)

RegRead_Rsp = (  
  (rc_success,  
    digest_data) /
  rc_reg /
  rc_buffer /
  rc_command /
  rc_failure
)

Derive = (  
  CC_Derive,
  reg_select: reg_select_type,
  context: binary_data
)

Derive_Rsp = (  
  (rc_success,  
    ksym_data) /
  rc_reg /
  rc_buffer /
  rc_command /
  rc_failure
)

DpDerive = (  
  CC_DpDerive,
  reg_select: reg_select_type,
  context: nil / binary_data
)

DpDerive_Rsp = (
rc_success /
rc_reg /
rc_buffer /
rc_command /
rc_failure

PublicRead = (  
    CC_PublicRead,
    restricted: bool,
    context: binary_data,
)

PublicRead_Rsp = (  
    (rc_success,
     kpub_data) /
    rc_buffer /
    rc_command /
    rc_failure
)

Quote = (  
    CC_Quote,
    reg_select: reg_select_type,
    nonce: digest_data,
    context: binary_data
)

Quote_Rsp = (  
     (rc_success,
      sign_data) /
      rc_reg /
      rc_buffer /
      rc_command /
      rc_failure
)

Sign = (  
    CC_Sign,
    context: binary_data,
    digest: digest_data,
)

Sign_Rsp = (  
    (rc_success,
     sign_data) /
     rc_buffer /
     rc_command /
rc_failure
)

SignatureVerify = (  
    CC_SignatureVerify,  
    restricted: bool,  
    context: binary_data,  
    digest: digest_data,  
    signature: sign_data,  
)

SignatureVerify_Rsp = (  
    (rc_success,  
        bool) /  
    rc_buffer /  
    rc_command /  
    rc_failure
)

; MARS Command
mars_command = [  
    SelfTest /  
    CapabilityGet /  
    SequenceHash /  
    SequenceUpdate /  
    SequenceComplete /  
    PcrExtend /  
    RegRead /  
    Derive /  
    DpDerive /  
    PublicRead /  
    Quote /  
    Sign /  
    SignatureVerify
]

; MARS Response  
; Due to pattern matching processing, the order of the response codes  
; is important. The most specific response code must be first.  
; This type is for convenience of validation. Implementation should  
; use the specific response types bound to the command.
mars_response = [  
    rc:  
        PublicRead_Rsp /  
        Quote_Rsp /  
        Sign_Rsp /  
        RegRead_Rsp /  
        SignatureVerify_Rsp /
]
Derive_Rsp /  
CapabilityGet_Rsp /  
SequenceUpdate_Rsp /  
SequenceComplete_Rsp /  
SelfTest_Rsp /  
SequenceHash_Rsp /  
PcrExtend_Rsp /  
DpDerive_Rsp
Appendix B  CBOR-encoded MARS Command and Response Examples

The tables in this appendix enumerate the hexadecimal values of examples of the MARS commands stated in the tables’ titles, and the responses to those commands. These examples are based on a MARS using SHA-256 based algorithms as implemented in hw_sha2.c [4] and with a PS provisioned as “Here are thirty two secret bytes”. The first byte in each cell of the VALUE column is defined in the CBOR Jump Table [2].

Table 1 - MARS_SelfTest

<table>
<thead>
<tr>
<th>NAME</th>
<th>VALUE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Array</td>
<td>82</td>
<td>2 data items</td>
</tr>
<tr>
<td>Command Code</td>
<td>00</td>
<td>MARS_CC_SelfTest</td>
</tr>
<tr>
<td>fullTest</td>
<td>f5</td>
<td>true</td>
</tr>
</tbody>
</table>

 RESPONSE

<table>
<thead>
<tr>
<th>NAME</th>
<th>VALUE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Array</td>
<td>81</td>
<td>1 data item</td>
</tr>
<tr>
<td>Response Code</td>
<td>00</td>
<td>MARS_RC_SUCCESS</td>
</tr>
</tbody>
</table>

Table 2 - MARS_CapabilityGet

<table>
<thead>
<tr>
<th>NAME</th>
<th>VALUE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Array</td>
<td>82</td>
<td>2 data items</td>
</tr>
<tr>
<td>Command Code</td>
<td>01</td>
<td>MARS_CC_CapabilityGet</td>
</tr>
<tr>
<td>Property Tag</td>
<td>03</td>
<td>MARS_PT_LEN_DIGEST</td>
</tr>
</tbody>
</table>

 RESPONSE

<table>
<thead>
<tr>
<th>NAME</th>
<th>VALUE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Array</td>
<td>82</td>
<td>2 data items</td>
</tr>
<tr>
<td>Response Code</td>
<td>00</td>
<td>MARS_RC_SUCCESS</td>
</tr>
<tr>
<td>Capability</td>
<td>1820</td>
<td>PROFILE_LEN_DIGEST</td>
</tr>
</tbody>
</table>

Table 3 - MARS_SequenceHash

<table>
<thead>
<tr>
<th>NAME</th>
<th>VALUE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Array</td>
<td>81</td>
<td>1 data item</td>
</tr>
<tr>
<td>Command Code</td>
<td>02</td>
<td>MARS_CC_SequenceHash</td>
</tr>
</tbody>
</table>

 RESPONSE

<table>
<thead>
<tr>
<th>NAME</th>
<th>VALUE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Array</td>
<td>81</td>
<td>1 data item</td>
</tr>
<tr>
<td>Response Code</td>
<td>00</td>
<td>MARS_RC_SUCCESS</td>
</tr>
</tbody>
</table>
### Table 4 - MARS_SequenceUpdate

<table>
<thead>
<tr>
<th>NAME</th>
<th>VALUE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Array</td>
<td>82</td>
<td>2 data items</td>
</tr>
<tr>
<td>Command Code</td>
<td>03</td>
<td>MARS_CC_SequenceUpdate</td>
</tr>
<tr>
<td>Input</td>
<td>4d</td>
<td>13-byte string</td>
</tr>
<tr>
<td></td>
<td>544347204d415253</td>
<td>“TCG MARS demo”</td>
</tr>
<tr>
<td></td>
<td>2064656d6f</td>
<td></td>
</tr>
</tbody>
</table>

**RESPONSE**

<table>
<thead>
<tr>
<th>NAME</th>
<th>VALUE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Array</td>
<td>82</td>
<td>2 data items</td>
</tr>
<tr>
<td>Response Code</td>
<td>00</td>
<td>MARS_RC_SUCCESS</td>
</tr>
<tr>
<td>Output</td>
<td>40</td>
<td>0-byte string</td>
</tr>
</tbody>
</table>

### Table 5 - MARS_SequenceComplete

<table>
<thead>
<tr>
<th>NAME</th>
<th>VALUE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Array</td>
<td>81</td>
<td>1 data item</td>
</tr>
<tr>
<td>Command Code</td>
<td>04</td>
<td>MARS_CC_SequenceComplete</td>
</tr>
</tbody>
</table>

**RESPONSE**

<table>
<thead>
<tr>
<th>NAME</th>
<th>VALUE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Array</td>
<td>82</td>
<td>2 data items</td>
</tr>
<tr>
<td>Response Code</td>
<td>00</td>
<td>MARS_RC_SUCCESS</td>
</tr>
<tr>
<td>Output</td>
<td>5820</td>
<td>32-byte string digest</td>
</tr>
<tr>
<td></td>
<td>cf5fb1917db493fd</td>
<td></td>
</tr>
<tr>
<td></td>
<td>cd89e406fd47195c</td>
<td></td>
</tr>
<tr>
<td></td>
<td>f51c82079dee5681</td>
<td></td>
</tr>
<tr>
<td></td>
<td>edd172cea2db819a</td>
<td></td>
</tr>
</tbody>
</table>

### Table 6 - MARS_PcrExtend

<table>
<thead>
<tr>
<th>NAME</th>
<th>VALUE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Array</td>
<td>83</td>
<td>3 data items</td>
</tr>
<tr>
<td>Command Code</td>
<td>05</td>
<td>MARS_CC_PcrExtend</td>
</tr>
<tr>
<td>pcrIndex</td>
<td>00</td>
<td>PCR0</td>
</tr>
<tr>
<td>digest</td>
<td>5820</td>
<td>32-byte string digest</td>
</tr>
<tr>
<td></td>
<td>cf5fb1917db493fd</td>
<td></td>
</tr>
<tr>
<td></td>
<td>cd89e406fd47195c</td>
<td></td>
</tr>
<tr>
<td></td>
<td>f51c82079dee5681</td>
<td></td>
</tr>
<tr>
<td></td>
<td>edd172cea2db819a</td>
<td></td>
</tr>
</tbody>
</table>

**RESPONSE**

<table>
<thead>
<tr>
<th>NAME</th>
<th>VALUE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Array</td>
<td>81</td>
<td>1 data item</td>
</tr>
<tr>
<td>Response Code</td>
<td>00</td>
<td>MARS_RC_SUCCESS</td>
</tr>
<tr>
<td><strong>NAME</strong></td>
<td><strong>VALUE</strong></td>
<td><strong>DESCRIPTION</strong></td>
</tr>
<tr>
<td>---------------</td>
<td>-----------</td>
<td>--------------------------------------</td>
</tr>
<tr>
<td>Array</td>
<td>82</td>
<td>2 data items</td>
</tr>
<tr>
<td>Command Code</td>
<td>06</td>
<td>MARS_CC_RegRead</td>
</tr>
<tr>
<td>pcrIndex</td>
<td>00</td>
<td>PCR0</td>
</tr>
</tbody>
</table>

**RESPONSE**

<table>
<thead>
<tr>
<th><strong>NAME</strong></th>
<th><strong>VALUE</strong></th>
<th><strong>DESCRIPTION</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Array</td>
<td>82</td>
<td>2 data items</td>
</tr>
<tr>
<td>Response Code</td>
<td>00</td>
<td>MARS_RC_SUCCESS</td>
</tr>
<tr>
<td>Output</td>
<td>5820</td>
<td>32-byte string</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>PCR0’s contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Array</td>
<td>82</td>
<td>2 data items</td>
</tr>
<tr>
<td>Output</td>
<td>5820</td>
<td>32-byte string</td>
</tr>
<tr>
<td>Response Code</td>
<td>00</td>
<td>MARS_RC_SUCCESS</td>
</tr>
<tr>
<td>Output</td>
<td>5820</td>
<td>derived value</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>NAME</strong></th>
<th><strong>VALUE</strong></th>
<th><strong>DESCRIPTION</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Array</td>
<td>83</td>
<td>3 data items</td>
</tr>
<tr>
<td>Command Code</td>
<td>07</td>
<td>MARS_CC_Derive</td>
</tr>
<tr>
<td>regSelect</td>
<td>01</td>
<td>bitmask, selects PCR0</td>
</tr>
<tr>
<td>context</td>
<td>50</td>
<td>16-byte string</td>
</tr>
</tbody>
</table>

**RESPONSE**

<table>
<thead>
<tr>
<th><strong>NAME</strong></th>
<th><strong>VALUE</strong></th>
<th><strong>DESCRIPTION</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Array</td>
<td>82</td>
<td>2 data items</td>
</tr>
<tr>
<td>Response Code</td>
<td>00</td>
<td>MARS_RC_SUCCESS</td>
</tr>
<tr>
<td>Output</td>
<td>5820</td>
<td>32-byte string</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>derived value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Array</td>
<td>83</td>
<td>3 data items</td>
</tr>
<tr>
<td>Command Code</td>
<td>08</td>
<td>MARS_CC_DpDerive</td>
</tr>
<tr>
<td>regSelect</td>
<td>01</td>
<td>bitmask, selects PCR0</td>
</tr>
<tr>
<td>context</td>
<td>45 6368696c64</td>
<td>5-byte string, “child”</td>
</tr>
</tbody>
</table>
### Table 10 - MARS_PublicRead

<table>
<thead>
<tr>
<th>NAME</th>
<th>VALUE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Array</td>
<td>83</td>
<td>3 data items</td>
</tr>
<tr>
<td>Command Code</td>
<td>09</td>
<td>MARS_CC_PublicRead</td>
</tr>
<tr>
<td>restricted</td>
<td>f5</td>
<td>true</td>
</tr>
<tr>
<td>context</td>
<td>43 414b31</td>
<td>3-byte string, “AK1”</td>
</tr>
</tbody>
</table>

### RESPONSE

<table>
<thead>
<tr>
<th>Array</th>
<th>81</th>
<th>1 data item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response Code</td>
<td>00</td>
<td>MARS_RC_SUCCESS</td>
</tr>
</tbody>
</table>

### Table 11 - MARS_Quote

<table>
<thead>
<tr>
<th>NAME</th>
<th>VALUE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Array</td>
<td>84</td>
<td>4 data items</td>
</tr>
<tr>
<td>Command Code</td>
<td>0a</td>
<td>MARS_CC_Quote</td>
</tr>
<tr>
<td>regSelect</td>
<td>01</td>
<td>bitmask, selects PCR0</td>
</tr>
<tr>
<td>nonce</td>
<td>5820</td>
<td>32-byte string, number used once</td>
</tr>
<tr>
<td>context</td>
<td>43 414b31</td>
<td>3-byte string, “AK1”</td>
</tr>
</tbody>
</table>

### RESPONSE

<table>
<thead>
<tr>
<th>Array</th>
<th>82</th>
<th>2 data items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response Code</td>
<td>00</td>
<td>MARS_RC_SUCCESS</td>
</tr>
<tr>
<td>signature</td>
<td>5820</td>
<td>32-byte string</td>
</tr>
</tbody>
</table>

### Table 12 - MARS_Sign

<table>
<thead>
<tr>
<th>NAME</th>
<th>VALUE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Array</td>
<td>83</td>
<td>3 data items</td>
</tr>
<tr>
<td>Command Code</td>
<td>0b</td>
<td>MARS_CC_Sign</td>
</tr>
</tbody>
</table>
**context** | 44 756b6579 | 4-byte string, “ukey”
---|---|---
**digest** | 5820 48984ce5d39b6e27 1e91bfaadaa15baf ccf932d8e192b9ea 5d6c6f0aa3997b20 | 32-byte string nonce

**RESPONSE**

<table>
<thead>
<tr>
<th>Array</th>
<th>82</th>
<th>2 data items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response Code</td>
<td>00</td>
<td>MARS RC SUCCESS</td>
</tr>
<tr>
<td>signature</td>
<td>5820 fd13be51c5193c3d 5fe0fad67439714e c62fb2ab9702e48 eec13123d5083c3b</td>
<td>32-byte string</td>
</tr>
</tbody>
</table>

Table 13 - MARS_SignatureVerify

<table>
<thead>
<tr>
<th>NAME</th>
<th>VALUE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Array</td>
<td>85</td>
<td>5 data items</td>
</tr>
<tr>
<td>Command Code</td>
<td>0c</td>
<td>MARS_CC_SignatureVerify</td>
</tr>
<tr>
<td>restricted</td>
<td>f5</td>
<td>true</td>
</tr>
<tr>
<td>context</td>
<td>43 414b31</td>
<td>3-byte string, “AK1”</td>
</tr>
<tr>
<td>digest</td>
<td>5820 883e3e6b7f7c00f9 d23c4d0a3aa8d890 db348f03b3fa5a6 919d2ca2b6c609f8</td>
<td>32-byte string snapshot*</td>
</tr>
<tr>
<td>signature</td>
<td>5820 630b4e485c3013ef 57c2766383f8e2b ab517e2dedb05c37 6d91cd3075635ce2</td>
<td>32-byte string</td>
</tr>
</tbody>
</table>

**RESPONSE**

<table>
<thead>
<tr>
<th>Array</th>
<th>82</th>
<th>2 data items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response Code</td>
<td>00</td>
<td>MARS RC_SUCCESS</td>
</tr>
<tr>
<td>result</td>
<td>f5</td>
<td>true</td>
</tr>
</tbody>
</table>

* Note: when verifying a MARS signature, as in this example, the snapshot is computed by duplicating the functionality of CryptSnapshot() defined in [5].

End of informative comment