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TPM Main
Part 3 Commands

Specification Version 1.2
Level 2 Revision 116
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58Change History

Version	Date	Description
Rev 50	Jul 2003	Started 01 Jul 2003 by David Grawrock Breakup into parts and the merge of 1.1 commands
Rev 63	Oct 2003	Change history tied to part 1 and kept in part 1 (DP)
Rev 71	Mar 2004	Change in terms from authorization data to AuthData.
Rev 91	Sept 2005	The following modifications were made by Tasneem Brutch: ▪ Update to section 6.2 informative, for TPM_OwnerClear. ▪ Addtion of action item 15, to section 6.2, for TPM_OwnerClear. ▪ Addition of "MAY" to section 20.1, TPM_NV_DefineSpace, Action 1(a). ▪ Addition of a new Action (4) to Section 20.2, TPM_NV_WriteValue ▪ Addtion of a new Action (3) to Section 20.4, TPM_NV_ReadValue. ▪ Typo corrected in Section 21.1 ▪ Moved TPM_GetCapabilityOwner from Section the Deleted Commands (section 28.1) to section 7.3. Added information on operands, command description and actions from Rev. 67.
Rev 92	Sept 2005	Section 7.3 TPM_GetCapabilityOwner Ordinal was added to the outgoing params, which is not returned but is typically included in outParamDigest.
Rev 92	Sept 2005	Corrected a copy and paste error: Part 3 20.2 TPM_NV_WriteValue Removed the Action "3. If D1 -> TPM_NV_PER_AUTHREAD is TRUE return TPM_AUTH_CONFLICT"
Rev 93	Sept. 2005	Moved TPM_CertifySelfTest command to the deleted section.
Rev 100	May 2006	Added deferredPhysicalPresence and its use in TPM_FieldUpgrade, clarified CTR mode, added TPM_NV_INDEX_TRIAL and use in TPM_NV_DefineSpace
Rev 101	Aug 2006	Changed "set to NULL" to "set to all zeros" in many places. TPM_OwnerClear must affect disableFullDALogicInfo. Clarified that _INFO keys may be used where _SHA1 keys are used. Clarified that a global secret can be used for field upgrade confidentiality. Added TPM_CMK_CreateBlob actions for the migrationType parameter. Added TPM_CertifyKey action to check payload. Clarified that TPM_Delegate_LoadOwnerDelegation returns an error if there is no owner and owner authorization is present. Clarified that TPM_NV_DefineSpace cannot define the DIR index. Clarified that the TPM does not have to clean up the effects of a wrapped command upon failure of a transport response. Clarified that TPM_ReleaseCounter does not ignore the continueAuthSession parameter.
Rev 102	Sept 2006	Reworked TPM_GetPubkey to always check authorization data if present and allow no-authorization for TPM_AUTH_PRIV_USE_ONLY or TPM_AUTH_NEVER. Fixed TPM_LoadContext typo, Action 6.e. returns error if the HMAC does NOT match.
Rev 103	Oct 2006	Added warning notes where excluding key handle from HMAC can allow an attack. Added warning that delegating TPM_ChangeAuth allows elevation of privilege.
Rev 104	Nov 2006	Owner clear sets allowMaintenance and readSRKPub to default state. TPM_Unseal can use DSAP. TPM_CreateEndorsementKeyPair uses TPM_ES_RSAESOAEP_SHA1_MGF1.
Rev 105	Feb 2007	TPM_Seal, TPM_CreateWrapKey informative that they lack an identifier. TPM_NV_DefineSpace should check inputs before changing state. TPM_NV_DefineSpace, TPM_NV_WriteValue, TPM_NV_ReadValue ignore disabled and deactivated when nvLocked is FALSE, MAY always check HMAC. TPM_NV_WriteValue must not return error for DIR data size of 0. TPM_NV_ReadValue partial DIR reads are allowed. Informative that audit occurs twice for transport wrapped command. TPM_Reset must invalidate OSAP and DSAP sessions, must not invalidate sessions saved by TPM_SaveContext.
Rev 106	April 2007	Removed tpmProof check for non-migratable parent keys.
Rev 107	July 2007	Removed unused maxNVBufSize. Increment the auditMonotonicCounter before audit response if digest is zero. State should not change on field upgrade authorization failure. PCR values for a key are validated at use, not at load. TPM_StirRandom is not required to check for data < 256 bytes. TPM_ChangeAuth must validate usageAuth. Entity PCRs must be validated each time an OIAP session is used. TPM_ExecuteTransport MUST log public key logs.
Rev 108	Sept 2007	TPM_ForceClear succeeds even with no owner (informative). Audit only occurs when the commands executes successfully. Field upgrade should not change shielded locations. Reordered TPM_NV_DefineSpace, TPM_NV_WriteValue so the NV write cound is not incremented if there is an authorization error.
Rev 109	Oct 2007	Added PCR index check to TPM_SHA1CompleteExtend, TPM_Extend, TPM_PCRRead.
Rev 110	May 2008	Minor typo corrections.

Rev 111	July 2008	TPM_SaveState gives priority to keys where parentPCRStatus is TRUE. Informative security warning when field upgrade adds new features. TPM_MakeIdentity normative that the signing key digestAtRelease is not validated.
Rev 112	Jan 2009	Create and load storage and migrate key, ownership commands check for default exponent, TPM_CMK_CreateBlob MAY check unused restrictTicket and sigTicket, TPM_NV_WriteValue does auth checks before changing bGlobalLock
Rev 113	Jan 2009	Identity key checks for default exponent. TPM_SHA1Update actions added. TPM_NV_WriteValue, TPM_NV_ReadValue added checks for disabled, deactivated.
Rev 114	Jan 2009	No changes
Rev 116	Aug 2009	No Changes

TCG Doc Roadmap – Main Spec

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TCG Main Spec Roadmap

- Normative Reference -

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61**Table of Contents**

227End of Introduction do not delete

228**1. Scope and Audience**

229The TPM main specification is an industry specification that enables trust in computing 230platforms in general. The main specification is broken into parts to make the role of each 231document clear. A version of the specification (like 1.2) requires all parts to be a complete 232specification.

233This is Part 3, the commands that the TPM will use.

234This document is an industry specification that enables trust in computing platforms in 235general.

236**1.1** **Key words**

237The key words "MUST," "MUST NOT," "REQUIRED," "SHALL," "SHALL NOT," "SHOULD," 238"SHOULD NOT," "RECOMMENDED," "MAY," and "OPTIONAL" in the chapters 2-10 239normative statements are to be interpreted as described in [RFC-2119].

240**1.2**   **Action Order**

241   1. The order of ordinal actions is advisory.

242In particular, the order in which errors are checked is vendor specific. The TPM SHOULD
243check for error conditions as much as possible before executing actions that   alter   the
244TPM state.

245See also Part 2 "Return Codes" for a discussion of error code requirements.

246   2. After input parameter parsing errors, the state of the TPM may or may not be
247   changed. The TSS can use TPM_GetCapability to determine what state has been
248   affected.

249For example, authorized commands terminate authorization sessions on error, since the
250response cannot roll the nonce. However, if the incoming session handle parameter cannot
251be parsed, the session cannot be terminated.

252

253

254 1.3   Statement Type

255 Please note a very important distinction between different sections of text throughout this
256 document. You will encounter two distinctive kinds of text: informative comment and
257 normative statements. Because most of the text in this specification will be of the kind
258 normative statements, the authors have informally defined it as the default and, as such,
259 have specifically called out text of the kind informative comment. They have done this by
260 flagging the beginning and end of each informative comment and highlighting its text in
261 gray. This means that unless text is specifically marked as of the kind informative
262 comment, you can consider it of the kind normative statements.

263 For example:

264 **Start of informative comment:**

265 This is the first paragraph of several paragraphs containing text of the kind informative
266 comment ...

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

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

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

271 **End of informative comment.**

272 This is the first paragraph of one or more paragraphs (and/or sections) containing the text
273 of the kind normative statements ...

274 To understand the TPM specification the user MUST read the specification. (This use of
275 MUST indicates a keyword usage and requires an action).

2762. Description and TODO

277This document is to show the changes necessary to create the 1.2 version of the TCG 278specification. Some of the sections are brand new text; some are rewritten sections of the 2791.1 version. Upon approval of the 1.2 changes, there will be a merging of the 1.1 and 1.2 280versions to create a single 1.2 document.

73
74

281 3. Admin Startup and State

285 3.1   TPM_Init

294 **Definition**

295 TPM_Init();
296

297 Operation of the TPM. This is not a command that any software can execute. It is inherent
298 in the design of the TPM and the platform that the TPM resides on.

299 **Parameters**

300 None

301 **Description**

302 1. The TPM_Init signal indicates to the TPM that platform initialization is taking place. The
303   TPM SHALL set the TPM into a state such that the only legal command to receive after
304   the TPM_Init is the TPM_Startup command. The TPM_Startup will further indicate to the
305   TPM how to handle and initialize the TPM resources.

306 2. The platform design MUST be that the TPM is not the only component undergoing
307   initialization. If the TPM_Init signal forces the TPM to perform initialization then the
308   platform MUST ensure that ALL components of the platform receive an initialization
309   signal. This is to prevent an attacker from causing the TPM to initialize to a state where
310   various masquerades are allowable. For instance, on a PC causing the TPM to initialize
311   and expect measurements in PCR0 but the remainder of the platform does not initialize.

312 3. The design of the TPM MUST be such that the ONLY mechanism that signals TPM_Init
313   also signals initialization to the other platform components.

314 **Actions**

315 1. The TPM sets TPM_STANY_FLAGS -> postInitialise to TRUE.

316 3.2   TPM_Startup

336 Incoming Parameters and Sizes

| PARAM | | HMAC | | Type | Name | Description |
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal TPM_ORD_Startup
4	2	2S	2	TPM_STARTUP_TYPE	startupType	Type of startup that is occurring

337 Outgoing Parameters and Sizes

| PARAM | | HMAC | | Type | Name | Description |
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_Startup

338 Description

339TPM_Startup MUST be generated by a trusted entity (the RTM or the TPM, for example).

340   1. If the TPM is in failure mode

341   a. TPM_STANY_FLAGS -> postInitialize is still set to FALSE

342   b. The TPM returns TPM_FAILEDSELFTEST

343 Actions

344 1. If TPM_STANY_FLAGS -> postInitialise is FALSE,

345   a. Then the TPM MUST return TPM_INVALID_POSTINIT, and exit this capability

346 2. If stType = TPM_ST_CLEAR

347   a. Ensure that sessions associated with resources TPM_RT_CONTEXT, TPM_RT_AUTH,
348   TPM_RT_DAA_TPM, and TPM_RT_TRANS are invalidated

349   b. Reset TPM_STCLEAR_DATA -> PCR[] values to each correct default value

350   i. pcrReset is FALSE, set to 0x00..00

351   ii. pcrReset is TRUE, set to 0xFF..FF

352   c. Set the following TPM_STCLEAR_FLAGS to their default state

353   i. PhysicalPresence

354   ii. PhysicalPresenceLock

355   iii. disableForceClear

356   d. The TPM MAY initialize auditDigest to all zeros

357   i. If not initialized to all zeros, the TPM SHALL ensure that auditDigest contains
358   a valid value.

359   ii. If initialization fails, the TPM SHALL set auditDigest to all zeros and SHALL set
360   the internal TPM state so that the TPM returns TPM_FAILEDSELFTEST to all
361   subsequent commands.

362   e. The TPM SHALL set TPM_STCLEAR_FLAGS -> deactivated to the same state as
363   TPM_PERMANENT_FLAGS -> deactivated

364   f. The TPM MUST set the TPM_STANY_DATA fields to:

365   i. TPM_STANY_DATA->contextNonceSession is set to all zeros

366   ii. TPM_STANY_DATA->contextCount is set to 0

367   iii. TPM_STANY_DATA->contextList is set to 0

368   g. The TPM MUST set TPM_STCLEAR_DATA fields to:

369   i. Invalidate contextNonceKey

370   ii. countID to zero

371   iii. ownerReference to TPM_KH_OWNER

372   h. The TPM MUST set the following TPM_STCLEAR_FLAGS to

373   i. bGlobalLock to FALSE

374   i. Determine which keys should remain in the TPM

375   i. For each key that has a valid preserved value in the TPM

376   (1)   if parentPCRStatus is TRUE then call TPM_FlushSpecific(keyHandle)

377   (2)   if isVolatile is TRUE then call TPM_FlushSpecific(keyHandle)

378   ii.   Keys under control of the OwnerEvict flag MUST stay resident in the TPM

3793.   If stType = TPM_ST_STATE

380   a.   If the TPM has no state to restore, the TPM MUST set the internal state such that it
381   returns TPM_FAILEDSELFTEST to all subsequent commands.

382   b.   The TPM MAY determine for each session type (authorization, transport, DAA, ...) to
383   release or maintain the session information. The TPM reports how it manages sessions
384   in the TPM_GetCapability command.

385   c.   The TPM SHALL take all necessary actions to ensure that all PCRs contain valid
386   preserved values. If the TPM is unable to successfully complete these actions, it SHALL
387   enter the TPM failure mode.

388   i.   For resettable PCR the TPM MUST set the value of TPM_STCLEAR_DATA ->
389   PCR[]to the resettable PCR default value. The TPM MUST NOT restore a resettable
390   PCR to a preserved value

391   d.   The TPM MAY initialize auditDigest to all zeros.

392   i.   Otherwise, the TPM SHALL take all actions necessary to ensure that
393   auditDigest contains a valid value. If the TPM is unable to successfully complete
394   these actions, the TPM SHALL initialize auditDigest to all zeros and SHALL set the
395   internal state such that the TPM returns TPM_FAILEDSELFTEST to all
396   subsequent commands.

397   e.   The TPM MUST restore the following flags to their preserved states:

398   i.   All values in TPM_STCLEAR_FLAGS

399   ii.   All values in TPM_STCLEAR_DATA

400   f.   The TPM MUST restore all keys that have a valid preserved value.

401   g.   The TPM resumes normal operation. If the TPM is unable to resume normal
402   operation, it SHALL enter the TPM failure mode.

4034.   If stType = TPM_ST_DEACTIVATED

404   a.   Invalidate sessions

405   i.   Ensure that all resources associated with saved and active sessions are
406   invalidated

407   b.   Set the TPM_STCLEAR_FLAGS to their default state.

408   c.   Set TPM_STCLEAR_FLAGS -> deactivated to TRUE

4095.   The TPM MUST ensure that state associated with TPM_SaveState is invalidated

4106.   The TPM MUST set TPM_STANY_FLAGS -> postInitialise to FALSE

411 3.3   TPM_SaveState

430 Incoming Parameters and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_SaveState.

431 Outgoing Parameters and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_SaveState.

432 Description

433 1. Preserved values MUST be non-volatile.

434 2. If data is never stored in a volatile medium, that data MAY be used as preserved data. In
435   such cases, no explicit action may be required to preserve that data.

4363. If an explicit action is required to preserve data, it MUST be possible for the TPM to
437   determine whether preserved data is valid.

4384. If a parameter mirrored by any preserved value is altered, all preserved values MUST be
439   declared invalid.

4405. The TPM MAY declare all preserved values invalid in response to any command other
441   than TPM_Init.

442**Actions**

4431. Store TPM_STCLEAR_DATA -> PCR contents except for

444   a. If the PCR attribute pcrReset is TRUE

445   b. Any platform identified debug PCR

4462. The auditDigest MUST be handled according to the audit requirements as reported by
447   TPM_GetCapability.

448   a. If the ordinalAuditStatus is TRUE for the TPM_SaveState ordinal and the auditDigest
449   is being stored in the saved state, the saved auditDigest MUST include the
450   TPM_SaveState input parameters and MUST NOT include the output parameters.

4513. All values in TPM_STCLEAR_DATA MUST be preserved.

4524. All values in TPM_STCLEAR_FLAGS MUST be preserved.

4535. The contents of any key that is currently loaded SHOULD be preserved if the key's
454   parentPCRStatus indicator is TRUE.

4556. The contents of any key that has TPM_KEY_CONTROL_OWNER_EVICT set MUST be
456   preserved

4577. The contents of any key that is currently loaded MAY be preserved.

4588. The contents of sessions (authorization, transport, DAA, etc.) MAY be preserved as
459   reported by TPM_GetCapability.

460**4. Admin Testing**

461**4.1   TPM_SelfTestFull**

463TPM_SelfTestFull tests all of the TPM capabilities.

464Unlike TPM_ContinueSelfTest, which may optionally return immediately and then perform
465the tests, TPM_SelfTestFull always performs the tests and then returns success or failure.

467**Incoming Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_SelfTestFull

468**Outgoing Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_SelfTestFull

469**Actions**

4701. TPM_SelfTestFull SHALL cause a TPM to perform self-test of each TPM internal function.

471   a. If the self-test succeeds, return TPM_SUCCESS.

472   b. If the self-test fails, return TPM_FAILEDSELFTEST.

4732. Failure of any test results in overall failure, and the TPM goes into failure mode.

4743. If the TPM has not executed the action of TPM_ContinueSelfTest, the TPM

475   a. MAY perform the full self-test.

476   b. MAY return TPM_NEEDS_SELFTEST.

477**4.2**   **TPM_ContinueSelfTest**

478**Start of informative comment:**

479TPM_ContinueSelfTest informs the TPM that it should complete the self-test of all TPM
480functions.

481The TPM may return success immediately and then perform the self-test, or it may perform
482the self-test and then return success or failure.

483**End of informative comment.**

484**Incoming Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_ContinueSelfTest

485**Outgoing Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_ContinueSelfTest

486**Description**

4871. Prior to executing the actions of TPM_ContinueSelfTest, if the TPM receives a command
488   C1 that uses an untested TPM function, the TPM MUST take one of these actions:

489   a. The TPM MAY return TPM_NEEDS_SELFTEST

490   i. This indicates that the TPM has not tested the internal resources required to
491   execute C1.

492   ii. The TPM does not execute C1.

493   iii. The caller MUST issue TPM_ContinueSelfTest before re-issuing the command
494   C1.

495   (1) If the TPM permits TPM_SelfTestFull prior to completing the actions of
496   TPM_ContinueSelfTest, the caller MAY issue TPM_SelfTestFull rather than
497   TPM_ContinueSelfTest.

498   b. The TPM MAY return TPM_DOING_SELFTEST

499   i. This indicates that the TPM is doing the actions of TPM_ContinueSelfTest
500   implicitly, as if the TPM_ContinueSelfTest command had been issued.

501   ii. The TPM does not execute C1.

502   iii. The caller MUST wait for the actions of TPM_ContinueSelfTest to complete
503   before reissuing the command C1.

504 c. The TPM MAY return TPM_SUCCESS or an error code associated with C1.

505   i. This   indicates   that   the   TPM   has   completed   the   actions   of
506   TPM_ContinueSelfTest and has completed the command C1.

507   ii. The error code MAY be TPM_FAILEDSELFTEST.

Actions

509 1. If TPM_PERMANENT_FLAGS -> FIPS is TRUE or TPM_PERMANENT_FLAGS -> TPMpost
510   is TRUE

511 a. The TPM MUST run all self-tests

512 2. Else

513 a. The TPM MUST complete all self-tests that are outstanding

514   i. Instead of completing all outstanding self-tests the TPM MAY run all self-tests

515 3. The TPM either

516 a. MAY immediately return TPM_SUCCESS

517   i. When TPM_ContinueSelfTest finishes execution, it MUST NOT respond to the
518   caller with a return code.

519 b. MAY   complete   the   self-test   and   then   return   TPM_SUCCESS   or
520   TPM_FAILEDSELFTEST.

5214.3 TPM_GetTestResult

522Start of informative comment:

523TPM_GetTestResult provides manufacturer specific information regarding the results of the 524self-test. This command will work when the TPM is in self-test failure mode. The reason for 525allowing this command to operate in the failure mode is to allow TPM manufacturers to 526obtain diagnostic information.

527End of informative comment.

528Incoming Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_GetTestResult

529Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_GetTestResult
4	4	3S	4	UINT32	outDataSize	The size of the outData area
5	<>	4S	<>	BYTE[]	outData	The outData this is manufacturer specific

530Description

531This command will work when the TPM is in self test failure mode or limited operation 532mode.

533Actions

5341. The TPM SHALL respond to this command with a manufacturer specific block of
535   information that describes the result of the latest self-test

5362. The information MUST NOT contain any data that uniquely identifies an individual TPM.

537 5. Admin Opt-in

538 5.1 TPM_SetOwnerInstall

543 Incoming Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_SetOwnerInstall
4	1	2S	1	BOOL	state	State to which ownership flag is to be set.

544 Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_SetOwnerInstall

545 Action

546 1. If the TPM has a current owner, this command immediately returns with
547   TPM_SUCCESS.

548 2. The TPM validates the assertion of physical presence. The TPM then sets the value of
549   TPM_PERMANENT_FLAGS -> ownership to the value in state.

5505.2   TPM_OwnerSetDisable

551Start of informative comment:

552The TPM owner sets the PERMANENT disable flag to TRUE or FALSE.

553End of informative comment.

554Incoming Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_OwnerSetDisable
4	1	2S	1	BOOL	disableState	Value for disable state
5	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for owner authentication.
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
6	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
7	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
8	20			TPM_AUTHDATA	ownerAuth	The authorization session digest for inputs and owner authentication. HMAC key: ownerAuth.

555Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_OwnerSetDisable
4	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
5	1	4H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
6	20			TPM_AUTHDATA	resAuth	The authorization session digest for the returned parameters. HMAC key: ownerAuth.

556Action

5571. The TPM SHALL authenticate the command as coming from the TPM Owner. If
558 unsuccessful, the TPM SHALL return TPM_AUTHFAIL.

5592. The TPM SHALL set the TPM_PERMANENT_FLAGS -> disable flag to the value in the
560 disableState parameter.

561 5.3   TPM_PhysicalEnable

562**Start of informative comment:**

563Sets the PERMANENT disable flag to FALSE using physical presence as authorization.

564**End of informative comment.**

565**Incoming Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_PhysicalEnable

566**Outgoing Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_PhysicalEnable

567**Action**

5681. Validate that physical presence is being asserted, if not return TPM_BAD_PRESENCE

5692. The TPM SHALL set the TPM_PERMANENT_FLAGS.disable value to FALSE.

570 5.4   TPM_PhysicalDisable

571**Start of informative comment:**

572Sets the PERMANENT disable flag to TRUE using physical presence as authorization

573**End of informative comment.**

574**Incoming Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_PhysicalDisable

575**Outgoing Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_PhysicalDisable

576**Action**

5771. Validate that physical presence is being asserted, if not return TPM_BAD_PRESENCE

5782. The TPM SHALL set the TPM_PERMANENT_FLAGS.disable value to TRUE.

579 5.5 TPM_PhysicalSetDeactivated

580 Start of informative comment:

581 Changes the TPM persistant deactivated flag using physical presence as authorization.

582 This command is not available when the TPM is disabled.

583 End of informative comment.

584 Incoming Operands and Sizes

| PARAM | | HMAC | | Type | Name | Description |
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_PhysicalSetDeactivated
4	1	2S	1	BOOL	state	State to which deactivated flag is to be set.

585 Outgoing Operands and Sizes

| PARAM | | HMAC | | Type | Name | Description |
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_PhysicalSetDeactivated

586 Action

587 1. Validate that physical presence is being asserted, if not return TPM_BAD_PRESENCE

588 2. The TPM SHALL set the TPM_PERMANENT_FLAGS.deactivated flag to the value in the
589   state parameter.

590 5.6   TPM_SetTempDeactivated

591**Start of informative comment:**

592This command allows the operator of the platform to deactivate the TPM until the next boot
593of the platform.

594This command requires operator authentication. The operator can provide the
595authentication by either the assertion of physical presence or presenting the operator
596AuthData value.

597**End of informative comment.**

598**Incoming Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_SetTempDeactivated
4	4		4	TPM_AUTHHANDLE	authHandle	Auth handle for operation validation. Session type MUST be OIAP
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
5	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
6	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
7	20			TPM_AUTHDATA	operatorAuth	HMAC key: operatorAuth

599**Outgoing Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_SetTempDeactivated
4	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
5	1	4H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
6	20			TPM_AUTHDATA	resAuth	The authorization session digest for the returned parameters. HMAC key: operatorAuth.

600**Action**

6011. If tag = TPM_TAG_RQU_AUTH1_COMMAND

602   a. If TPM_PERMANENT_FLAGS -> operator is FALSE return TPM_NOOPERATOR

603   b. Validate command and parameters using operatorAuth, on error return
604   TPM_AUTHFAIL

605 2. Else

606   a. If physical presence is not asserted the TPM MUST return TPM_BAD_PRESENCE

607 3. The TPM SHALL set the TPM_STCLEAR_FLAGS.deactivated flag to the value TRUE.

608 5.7   TPM_SetOperatorAuth

616 Incoming Operands and Sizes

| PARAM | | HMAC | | Type | Name | Description |
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_SetOperatorAuth
4	20	2S	20	TPM_SECRET	operatorAuth	The operator AuthData

617 Outgoing Operands and Sizes

| PARAM | | HMAC | | Type | Name | Description |
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_SetOperatorAuth

618 Action

619 1. If physical presence is not asserted the TPM MUST return TPM_BAD_PRESENCE

620 2. The TPM SHALL set the TPM_PERMANENT_DATA -> operatorAuth

621 3. The TPM SHALL set TPM_PERMANENT_FLAGS -> operator to TRUE

622 6. Admin Ownership

623 6.1 TPM_TakeOwnership

627 Incoming Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_TakeOwnership
4	2	2S	2	TPM_PROTOCOL_ID	protocolID	The ownership protocol in use.
5	4	3S	4	UINT32	encOwnerAuthSize	The size of the encOwnerAuth field
6	<>	4S	<>	BYTE[ ]	encOwnerAuth	The owner AuthData encrypted with PUBEK
7	4	5S	4	UINT32	encSrkAuthSize	The size of the encSrkAuth field
8	<>	6S	<>	BYTE[ ]	encSrkAuth	The SRK AuthData encrypted with PUBEK
9	<>	7S	<>	TPM_KEY	srkParams	Structure containing all parameters of new SRK. pubKey.keyLength & encSize are both 0. This structure MAY be TPM_KEY12.
10	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for this command
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
11	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
12	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
13	20			TPM_AUTHDATA	ownerAuth	Authorization session digest for input params. HMAC key: the new ownerAuth value. See actions for validation operations

628

629Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_TakeOwnership
4	<>	3S	<>	TPM_KEY	srkPub	Structure containing all parameters of new SRK. srkPub.encData is set to 0. This structure MAY be TPM_KEY12.
5	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
6	1	4H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
7	20			TPM_AUTHDATA	resAuth	The authorization session digest for the returned parameters. HMAC key: the new ownerAuth value

630Description

631The type of the output srkPub MUST be the same as the type of the input srkParams, either
632both TPM_KEY or both TPM_KEY12.

633Actions

6341. If TPM_PERMANENT_DATA -> ownerAuth is valid return TPM_OWNER_SET

6352. If TPM_PERMANENT_FLAGS -> ownership is FALSE return TPM_INSTALL_DISABLED

6363. If TPM_PERMANENT_DATA -> endorsementKey is invalid return
637 TPM_NO_ENDORSEMENT

6384. Verify that authHandle is of type OIAP on error return TPM_AUTHFAIL

6395. If protocolID is not TPM_PID_OWNER, the TPM MAY return TPM_BAD_PARAMETER

6406. Create A1 a TPM_SECRET by decrypting encOwnerAuth using PRIVEK as the key

641 a. This requires that A1 was encrypted using the PUBEK

642 b. Validate that A1 is a length of 20 bytes, on error return TPM_BAD_KEY_PROPERTY

6437. Validate the command and parameters using A1 and ownerAuth, on error return
644 TPM_AUTHFAIL

6458. Validate srkParams

646 a. If srkParams -> keyUsage is not TPM_KEY_STORAGE return
647 TPM_INVALID_KEYUSAGE

648 b. If srkParams -> migratable is TRUE return TPM_INVALID_KEYUSAGE

649 c. If srkParams -> algorithmParms -> algorithmID is NOT TPM_ALG_RSA return
650 TPM_BAD_KEY_PROPERTY

651 d. If srkParams -> algorithmParms -> encScheme is NOT
652 TPM_ES_RSAESOAEP_SHA1_MGF1 return TPM_BAD_KEY_PROPERTY

653 e. If srkParams -> algorithmParms -> sigScheme is NOT TPM_SS_NONE return
654 TPM_BAD_KEY_PROPERTY

655 f. srkParams -> algorithmParms -> parms -> keyLength MUST be greater than or equal
656 to 2048, on error return TPM_BAD_KEY_PROPERTY

657 g. If srkParams -> algorithmParms -> parms -> exponentSize is not 0, return
658 TPM_BAD_KEY_PROPERTY

659 h. If TPM_PERMANENT_FLAGS -> FIPS is TRUE

660 i. If srkParams -> authDataUsage specifies TPM_AUTH_NEVER return
661 TPM_NOTFIPS

662 9. Generate K1 according to the srkParams, on error return TPM_BAD_KEY_PROPERTY

663 a. This includes copying PCRInfo from srkParams to K1

664 10. Create A2 a TPM_SECRET by decrypting encSrkAuth using the PRIVEK

665 a. This requires A2 to be encrypted using the PUBEK

666 b. Validate that A2 is a length of 20 bytes, on error return TPM_BAD_KEY_PROPERTY

667 c. Store A2 in K1 -> usageAuth

668 11. Store K1 in TPM_PERMANENT_DATA -> srk

669 12. Store A1 in TPM_PERMANENT_DATA -> ownerAuth

670 13. Create TPM_PERMANENT_DATA -> contextKey according to the rules for the algorithm
671 in use by the TPM to save context blobs

672 14. Create TPM_PERMANENT_DATA -> delegateKey according to the rules for the algorithm
673 in use by the TPM to save delegate blobs

674 15. Create TPM_PERMANENT_DATA -> tpmProof by using the TPM RNG

675 16. Export TPM_PERMANENT_DATA -> srk as srkPub

676 17. Set TPM_PERMANENT_FLAGS -> readPubek to FALSE

677 18. Calculate resAuth using the newly established TPM_PERMANENT_DATA -> ownerAuth

678**6.2**   **TPM_OwnerClear**

679**Start of informative comment:**

680The TPM_OwnerClear command performs the clear operation under Owner authentication.
681This command is available until the Owner executes the TPM_DisableOwnerClear, at which
682time any further invocation of this command returns TPM_CLEAR_DISABLED.

683**End of informative comment.**

684**Incoming Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_OwnerClear
4	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for owner authentication.
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
5	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
6	1	4H1	1	BOOL	continueAuthSession	Ignored
7	20			TPM_AUTHDATA	ownerAuth	The authorization session digest for inputs and owner authentication. HMAC key: ownerAuth.

685**Outgoing Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_OwnerClear
4	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
5	1	4H1	1	BOOL	continueAuthSession	Fixed value FALSE
6	20			TPM_AUTHDATA	resAuth	The authorization session digest for the returned parameters. HMAC key: old ownerAuth.

686**Actions**

6871. Verify that the TPM Owner authorizes the command and all of the input, on error return
688   TPM_AUTHFAIL.

6892. If   TPM_PERMANENT_FLAGS   ->   disableOwnerClear   is   TRUE   then   return
690   TPM_CLEAR_DISABLED.

6913. Unload all loaded keys.

692   a. This includes owner evict keys

693   b. If TPM_PERMANENT_FLAGS -> FIPS is TRUE, the memory locations containing
694   secret or private keys MUST be set to all zeros.

695 4. The TPM MUST NOT modify the following TPM_PERMANENT_DATA items

696   a. endorsementKey

697   b. revMajor

698   c. revMinor

699   d. manuMaintPub

700   e. auditMonotonicCounter

701   f. monotonicCounter

702   g. pcrAttrib

703   h. rngState

704   i. EKReset

705   j. lastFamilyID

706   k. tpmDAASeed

707   l. authDIR[0]

708   m. daaProof

709   n. daaBlobKey

710 5. The TPM MUST invalidate the following TPM_PERMANENT_DATA items and any internal
711   resources associated with these items

712   a. ownerAuth

713   b. srk

714   c. delegateKey

715   d. delegateTable

716   e. contextKey

717   f. tpmProof

718   g. operatorAuth

719 6. The TPM MUST reset to manufacturing defaults the following TPM_PERMANENT_DATA
720   items

721   a. noOwnerNVWrite MUST be set to 0

722   b. ordinalAuditStatus

723   c. restrictDelegate

724 7. The TPM MUST invalidate or reset all fields of TPM_STANY_DATA

725   a. Nonces SHALL be reset

726   b. Lists (e.g. contextList) SHALL be invalidated

727 8. The TPM MUST invalidate or reset all fields of TPM_STCLEAR_DATA except the PCR's

728   a. Nonces SHALL be reset

729   b. Lists (e.g. contextList) SHALL be invalidated

730   c. deferredPhysicalPresence MUST be set to 0

7319. The TPM MUST set the following TPM_PERMANENT_FLAGS to their default values

732   a. disable

733   b. deactivated

734   c. readPubek

735   d. disableOwnerClear

736   e. disableFullDALogicInfo

737   f. allowMaintenance

738   g. readSRKPub

73910.The TPM MUST set the following TPM_PERMANENT_FLAGS

740   a. ownership to TRUE

741   b. operator to FALSE

742   c. maintenanceDone to FALSE

74311.The TPM releases all TPM_PERMANENT_DATA -> monotonicCounter settings

744   a. This includes invalidating all currently allocated counters. The result will be no
745   currently allocated counters and the new owner will need to allocate counters. The
746   actual count value will continue to increase.

74712.The TPM MUST deallocate all defined NV storage areas where

748   a.   TPM_NV_PER_OWNERWRITE is TRUE if nvIndex does not have the "D" bit set

749   b.   TPM_NV_PER_OWNERREAD is TRUE if nvIndex does not have the "D" bit set

750   c. The TPM MUST NOT deallocate any other currently defined NV storage areas.

75113.The TPM MUST invalidate all familyTable entries

75214.The TPM MUST terminate all sessions, active or saved.

753 6.3   TPM_ForceClear

761 **Incoming Operands and Sizes**

| PARAM | | HMAC | | Type | Name | Description |
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_ForceClear

762 **Outgoing Operands and Sizes**

| PARAM | | HMAC | | Type | Name | Description |
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_ForceClear

763 **Actions**

764 1. The TPM SHALL check for the assertion of physical presence, if not present return
765   TPM_BAD_PRESENCE

766 2. If TPM_STCLEAR_FLAGS -> disableForceClear is TRUE return TPM_CLEAR_DISABLED

767 3. The TPM SHALL execute the actions of TPM_OwnerClear (except for the TPM Owner
768   authentication check)

769 6.4   TPM_DisableOwnerClear

770 Start of informative comment:

771 The TPM_DisableOwnerClear command disables the ability to execute the TPM_OwnerClear
772 command permanently. Once invoked the only method of clearing the TPM will require
773 physical access to the TPM.

774 After the execution of TPM_ForceClear, ownerClear is re-enabled and must be explicitly
775 disabled again by the new TPM Owner.

776 End of informative comment.

777 Incoming Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_DisableOwnerClear
4	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for owner authentication.
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
5	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
6	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
7	20			TPM_AUTHDATA	ownerAuth	The authorization session digest for inputs and owner authentication. HMAC key: ownerAuth.

778 Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_DisableOwnerClear
4	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
5	1	4H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
6	20			TPM_AUTHDATA	resAuth	The authorization session digest for the returned parameters. HMAC key: ownerAuth.

779 Actions

780 1. The TPM verifies that the authHandle properly authorizes the owner.

781 2. The TPM sets the TPM_PERMANENT_FLAGS -> disableOwnerClear flag to TRUE.

7823. When this flag is TRUE the only mechanism that can clear the TPM is the
783   TPM_ForceClear command. The TPM_ForceClear command requires physical access to
784   the TPM to execute.

785 6.5   TPM_DisableForceClear

786**Start of informative comment:**

787The TPM_DisableForceClear command disables the execution of the TPM_ForceClear
788command until the next startup cycle. Once this command is executed, the TPM_ForceClear
789is disabled until another startup cycle is run.

790**End of informative comment.**

791**Incoming Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_DisableForceClear

792**Outgoing Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_DisableForceClear

793**Actions**

7941. The TPM sets the TPM_STCLEAR_FLAGS.disableForceClear flag in the TPM that disables
795   the execution of the TPM_ForceClear command.

796 6.6 TSC_PhysicalPresence

797 **Start of informative comment:**

798 Some TPM operations require the indication of a human's physical presence at the platform.
799 The presence of the human either provides another indication of platform ownership or a
800 mechanism to ensure that the execution of the command is not the result of a remote
801 software process.

802 This command allows a process on the platform to indicate the assertion of physical
803 presence. As this command is executable by software there must be protections against the
804 improper invocation of this command.

805 The physicalPresenceHWEnable and physicalPresenceCMDEnable indicate the ability for
806 either SW or HW to indicate physical presence. These flags can be reset until the
807 physicalPresenceLifetimeLock is set. The platform manufacturer should set these flags to
808 indicate the capabilities of the platform the TPM is bound to.

809 The command provides two sets of functionality. The first is to enable, permanently, either
810 the HW or the SW ability to assert physical presence. The second is to allow SW, if enabled,
811 to assert physical presence.

812 **End of informative comment.**

813 Incoming Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TSC_ORD_PhysicalPresence.
4	2	2S	2	TPM_PHYSICAL_PRESENCE	physicalPresence	The state to set the TPM's Physical Presence flags.

814 Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TSC_ORD_PhysicalPresence.

815 Actions

816 1. For documentation ease, the bits break into two categories. The first is the lifetime
817   settings and the second is the assertion settings.

818   a. Define A1 to be the lifetime settings: TPM_PHYSICAL_PRESENCE_LIFETIME_LOCK,
819   TPM_PHYSICAL_PRESENCE_HW_ENABLE, TPM_PHYSICAL_PRESENCE_CMD_ENABLE,
820   TPM_PHYSICAL_PRESENCE_HW_DISABLE,   and
821   TPM_PHYSICAL_PRESENCE_CMD_DISABLE

822   b. Define A2 to be the assertion settings: TPM_PHYSICAL_PRESENCE_LOCK,
823   TPM_PHYSICAL_PRESENCE_PRESENT, and TPM_PHYSICAL_PRESENCE_NOTPRESENT

824Lifetime lock settings

8252. If any A1 setting is present

826   a. If TPM_PERMANENT_FLAGS -> physicalPresenceLifetimeLock is TRUE, return
827   TPM_BAD_PARAMETER

828   b. If any A2 setting is present return TPM_BAD_PARAMETER

829   c. If both physicalPresence -> TPM_PHYSICAL_PRESENCE_HW_ENABLE and
830   physicalPresence -> TPM_PHYSICAL_PRESENCE_HW_DISABLE are TRUE, return
831   TPM_BAD_PARAMETER.

832   d. If both physicalPresence -> TPM_PHYSICAL_PRESENCE_CMD_ENABLE and
833   physicalPresence -> TPM_PHYSICAL_PRESENCE_CMD_DISABLE are TRUE, return
834   TPM_BAD_PARAMETER.

835   e. If physicalPresence -> TPM_PHYSICAL_PRESENCE_HW_ENABLE is TRUE Set
836   TPM_PERMANENT_FLAGS -> physicalPresenceHWEnable to TRUE

837   f. If physicalPresence -> TPM_PHYSICAL_PRESENCE_HW_DISABLE is TRUE Set
838   TPM_PERMANENT_FLAGS -> physicalPresenceHWEnable to FALSE

839   g. If physicalPresence -> TPM_PHYSICAL_PRESENCE_CMD_ENABLE is TRUE, Set
840   TPM_PERMANENT_FLAGS -> physicalPresenceCMDEnable to TRUE.

841   h. If physicalPresence -> TPM_PHYSICAL_PRESENCE_CMD_DISABLE is TRUE, Set
842   TPM_PERMANENT_FLAGS -> physicalPresenceCMDEnable to FALSE.

843   i. If physicalPresence -> TPM_PHYSICAL_PRESENCE_LIFETIME_LOCK is TRUE

844   i. Set TPM_PERMANENT_FLAGS -> physicalPresenceLifetimeLock to TRUE

845   j. Return TPM_SUCCESS

846SW physical presence assertion

8473. If any A2 setting is present

848   a. If any A1 setting is present return TPM_BAD_PARAMETER

849   i. This check here just for consistency, the prior checks would have already
850   ensured that this was ok

851   b. If TPM_PERMANENT_FLAGS -> physicalPresenceCMDEnable is FALSE, return
852   TPM_BAD_PARAMETER

853   c. If both physicalPresence -> TPM_PHYSICAL_PRESENCE_LOCK and physicalPresence
854   -> TPM_PHYSICAL_PRESENCE_PRESENT are TRUE, return TPM_BAD_PARAMETER

855   d. If both physicalPresence -> TPM_PHYSICAL_PRESENCE_PRESENT and
856   physicalPresence -> TPM_PHYSICAL_PRESENCE_NOTPRESENT are TRUE, return
857   TPM_BAD_PARAMETER

858   e. If TPM_STCLEAR_FLAGS -> physicalPresenceLock is TRUE, return
859   TPM_BAD_PARAMETER

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860   f. If physicalPresence -> TPM_PHYSICAL_PRESENCE_LOCK is TRUE

861   i.   Set TPM_STCLEAR_FLAGS -> physicalPresence to FALSE

862   ii. Set TPM_STCLEAR_FLAGS -> physicalPresenceLock to TRUE

863   iii. Return TPM_SUCCESS

864   g. If physicalPresence -> TPM_PHYSICAL_PRESENCE_PRESENT is TRUE

865   i.   Set TPM_STCLEAR_FLAGS -> physicalPresence to TRUE

866   h. If physicalPresence -> TPM_PHYSICAL_PRESENCE_NOTPRESENT is TRUE

867   i.   Set TPM_STCLEAR_FLAGS -> physicalPresence to FALSE

868   i. Return TPM_SUCCESS

8694. Else // There were no A1 or A2 parameters set

870   a. Return TPM_BAD_PARAMETER

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871**6.7 TSC_ResetEstablishmentBit**

872**Start of informative comment:**

873The PC TPM Interface Specification (TIS) specifies setting tpmEstablished to TRUE upon
874execution of the HASH_START sequence. The setting implies the creation of a Trusted
875Operating System on the platform. Platforms will use the value of tpmEstablished to
876determine if operations necessary to maintain the security perimeter are necessary.

877The tpmEstablished bit provides a non-volatile, secure reporting that a HASH_START was
878previously run on the platform. When a platform makes use of the tpmEstablished bit, the
879platform can reset tpmEstablished as the operation is no longer necessary.

880For example, a platform could use tpmEstablished to ensure that, if HASH_START had ever
881been, executed the platform could use the value to invoke special processing. Once the
882processing is complete the platform will wish to reset tpmEstablished to avoid invoking the
883special process again.

884The TPM_PERMANENT_FLAGS -> tpmEstablished bit described in the TPM specifications
885uses positive logic. The TPM_ACCESS register uses negative logic, so that TRUE is reflected
886as a 0.

887**End of informative comment.**

888**Incoming Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TSC_ORD_ResetEstablishmentBit

889**Outgoing Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TSC_ORD_ResetEstablishmentBit

890**Actions**

8911. Validate the assertion of locality 3 or locality 4

8922. Set TPM_PERMANENT_FLAGS -> tpmEstablished to FALSE

8933. Return TPM_SUCCESS

894 7. The Capability Commands

895 **Start of informative comment:**

896 The TPM has numerous capabilities that a remote entity may wish to know about. These
897 items include support of algorithms, key sizes, protocols and vendor-specific additions. The
898 TPM_GetCapability command allows the TPM to report back to the requestor what type of
899 TPM it is dealing with.

900 The request for information requires the requestor to specify which piece of information that
901 is required. The request does not allow the "merging" of multiple requests and returns only
902 a single piece of information.

903 In failure mode, the TPM returns a limited set of information that includes the TPM
904 manufacturer and version.

905 In version 1.2 with the deletion of TPM_GetCapabilitySigned the way to obtain a signed
906 listing of the capabilities is to create a transport session, perform TPM_GetCapability
907 commands to list the information and then close the transport session using
908 TPM_ReleaseTransportSigned.

909 **End of informative comment.**

910 1. The standard information provided in TPM_GetCapability MUST NOT provide unique
911   information

912   a. The TPM has no control of information placed into areas on the TPM like the NV store
913   that is reported by the TPM. Configuration information for these areas could conceivably
914   be unique

915 7.1   TPM_GetCapability

916**Start of informative comment:**

917This command returns current information regarding the TPM.

918The limitation on what can be returned in failure mode restricts the information a
919manufacturer may return when capArea indicates TPM_CAP_MFR.

920**End of informative comment.**

921 Incoming Parameters and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_GetCapability
4	4	2S	4	TPM_CAPABILITY_AREA	capArea	Partition of capabilities to be interrogated
5	4	3S	4	UINT32	subCapSize	Size of subCap parameter
6	<>	4S	<>	BYTE[]	subCap	Further definition of information

922 Outgoing Parameters and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_GetCapability
4	4	3S	4	UINT32	respSize	The length of the returned capability response
5	<>	4S	<>	BYTE[ ]	resp	The capability response

923

924 **Actions**

925 1. The TPM validates the capArea and subCap indicators. If the information is available,
926 the TPM creates the response field and fills in the actual information.

927 2. The structure document contains the list of caparea and subCap values

928 3. If the TPM is in failure mode or limited operation mode, the TPM MUST return

929   a. TPM_CAP_VERSION

930   b. TPM_CAP_VERSION_VAL

931   c. TPM_CAP_MFR

932   d. TPM_CAP_PROPERTY -> TPM_CAP_PROP_MANUFACTURER

933   e. TPM_CAP_PROPERTY -> TPM_CAP_PROP_DURATION

934   f. TPM_CAP_PROPERTY -> TPM_CAP_PROP_TIS_TIMEOUT

935   g. The TPM MAY return any other capability.

936 7.2   TPM_SetCapability

937**Start of informative comment:**

938This command sets values in the TPM.

939A setValue that is inconsistent with the capArea and subCap is considered a bad
940parameter.

941**End of informative comment.**

942**Incoming Parameters and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	ordinal: TPM_ORD_SetCapability
4	4	2S	4	TPM_CAPABILITY_AREA	capArea	Partition of capabilities to be set
5	4	3S	4	UINT32	subCapSize	Size of subCap parameter
6	<>	4S	<>	BYTE[]	subCap	Further definition of information
7	4	5S	4	UINT32	setValueSize	The size of the value to set
8	<>	6S	<>	BYTE[]	setValue	The value to set
9	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for owner authentication.
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
10	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
11	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
12	20			TPM_AUTHDATA	ownerAuth	Authorization. HMAC key: owner.usageAuth.

943 Outgoing Parameters and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	ordinal: TPM_ORD_SetCapability
4	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
5	1	4H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
6	20			TPM_AUTHDATA	resAuth	Authorization HMAC key:owner.usageAuth.

944 Actions

945 1. If tag = TPM_TAG_RQU_AUTH1_COMMAND, validate the command and parameters
946 using ownerAuth, return TPM_AUTHFAIL on error

947 2. The TPM validates the capArea and subCap indicators, including the ability to set value
948 based on any set restrictions

949 3. If the capArea and subCap indicators conform with one of the entries in the structure
950 TPM_CAPABILITY_AREA (Values for TPM_SetCapability)

951 a. The TPM sets the relevant flag/data to the value of setValue parameter.

952 4. Else

953 a. Return the error code TPM_BAD_PARAMETER.

9547.3   TPM_GetCapabilityOwner

955**Start of informative comment:**

956TPM_GetCapabilityOwner enables the TPM Owner to retrieve all the non-volatile flags and 957the volatile flags in a single operation.

958The flags summarize many operational aspects of the TPM. The information represented by 959some flags is private to the TPM Owner. So, for simplicity, proof of ownership of the TPM 960must be presented to retrieve the set of flags. When necessary, the flags that are not private 961to the Owner can be deduced by Users via other (more specific) means.

962The normal TPM authentication mechanisms are sufficient to prove the integrity of the 963response. No additional integrity check is required.

964**End of informative comment.**

965**Incoming Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_GetCapbilityOwner
4	4			TPM_AUTHHANDLE	authHandle	The authorization handle used for Owner authorization.
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
5	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
6	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization handle
7	20			TPM_AUTHDATA	ownerAuth	The authorization digest for inputs and owner authorization. HMAC key: OwnerAuth.

966

967**Outgoing Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation. See section 4.3.
		2S	4	TPM_COMMAND_CODE	ordinal	Ordinal: TPM_ORD_GetCapabilityOwner
4	4	3S	4	TPM_VERSION	version	A properly filled out version structure.
5	4	4S	4	UINT32	non_volatile_flags	The current state of the non-volatile flags.
6	4	5S	4	UINT32	volatile_flags	The current state of the volatile flags.
7	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
8	1	4H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
9	20			TPM_AUTHDATA	resAuth	The authorization digest for the returned parameters. HMAC key: OwnerAuth.

968

969**Description**

970For 31>=N>=0

9711. Bit-N of the TPM_PERMANENT_FLAGS structure is the Nth bit after the opening bracket
972   in the definition of TPM_PERMANENT_FLAGS in the version of the specification
973   indicated by the parameter "version". The bit immediately after the opening bracket is
974   the 0th bit.

9752. Bit-N of the TPM_STCLEAR_FLAGS structure is the Nth bit after the opening bracket in
976   the definition of TPM_STCLEAR_FLAGS in the version of the specification indicated by
977   the parameter "version". The bit immediately after the opening bracket is the 0th bit.

9783. Bit-N of non_volatile_flags corresponds to the Nth bit in TPM_PERMANENT_FLAGS, and
979   the lsb of non_volatile_flags corresponds to bit0 of TPM_PERMANENT_FLAGS

9804. Bit-N of volatile_flags corresponds to the Nth bit in TPM_STCLEAR_FLAGS, and the lsb
981   of volatile_flags corresponds to bit0 of TPM_STCLEAR_FLAGS

982**Actions**

9831. The TPM validates that the TPM Owner authorizes the command.

9842. The TPM creates the parameter non_volatile_flags by setting each bit to the same state
985   as the corresponding bit in TPM_PERMANENT_FLAGS. Bits in non_volatile_flags for
986   which there is no corresponding bit in TPM_PERMANENT_FLAGS are set to zero.

9873. The TPM creates the parameter volatile_flags by setting each bit to the same state as the
988   corresponding bit in TPM_STCLEAR_FLAGS. Bits in volatile_flags for which there is no
989   corresponding bit in TPM_STCLEAR_FLAGS are set to zero.

9904. The TPM generates the parameter "version".

9915. The TPM returns non_volatile_flags, volatile_flags and version to the caller.

9928. Auditing

9938.1   Audit Generation

999Description

10001. The TPM extends the audit digest whenever the ordinalAuditStatus is TRUE for the 1001 ordinal about to be executed.

10022. The TPM extends the audit digest only when a command is successfully executed.

1003 a. If the ordinal is unknown, unimplemented, or cannot be determined, no auditing is 1004 performed.

10053. Corner cases

1006 a. TPM_SaveState: Only the input parameters are audited, and the audit occurs before 1007 the state is saved. If an error occurs while or after the state is saved, the audit still 1008 occurs.

1009   b. TPM_SetOrdinalAuditStatus: In the case where the ordinalToAudit is 1010   TPM_ORD_SetOrdinalAuditStatus, audit is based on the initial state, not the final 1011   state.

1012Actions

1013The TPM will execute the ordinal and perform auditing in the following manner:

10141. Execute command

1015   a. Execution implies the performance of the listed actions for the ordinal.

10162. If the command will return TPM_SUCCESS

1017   a. If TPM_STANY_DATA -> auditDigest is all zeros

1018   i. Increment TPM_PERMANENT_DATA -> auditMonotonicCounter by 1

1019   b. Create A1 a TPM_AUDIT_EVENT_IN structure

1020   i. Set A1 -> inputParms to the digest of the input parameters from the 1021   command

1022   1. Digest value according to the HMAC digest rules of the "above the 1023   line" parameters (i.e. the first HMAC digest calculation).

1024   ii. Set A1 -> auditCount to TPM_PERMANENT_DATA -> 1025   auditMonotonicCounter

1026　　c. Set TPM_STANY_DATA -> auditDigest to SHA-1 (TPM_STANY_DATA ->
1027　　　　auditDigest || A1)

1028　　d. Create A2 a TPM_AUDIT_EVENT_OUT structure

1029　　　　i. Set A2 -> outputParms to the digest of the output parameters from the
1030　　　　　command

1031　　　　　1. Digest value according to the HMAC digest rules of the "above the
1032　　　　　　line" parameters (i.e. the first HMAC digest calculation).

1033　　　　ii. Set A2 -> auditCount to TPM_PERMANENT_DATA ->
1034　　　　　auditMonotonicCounter

1035　　e. Set TPM_STANY_DATA -> auditDigest to SHA-1 (TPM_STANY_DATA ->
1036　　　　auditDigest || A2)

1037

1038 8.2 Effect of audit failing

1039 **Start of informative comment:**

1040 The TPM audit process could have an internal error when attempting to audit a command.
1041 To indicate the audit failure, the TPM will return TPM_AUDITFAIL_SUCCESSFUL. This new
1042 functionality changes the 1.1 TPM functionality when this condition occurs.

1043 Since no audit occurs if the command fails, The TPM_AUDITFAIL_UNSUCCESSFUL return
1044 code is no longer used.

1045 **End of informative comment.**

1046 1. When, in performing the audit process, the TPM has an internal failure (unable to write,
1047   SHA-1 failure etc.) the TPM MUST set the internal TPM state such that the TPM returns
1048   the TPM_FAILEDSELFTEST error on subsequent attempts to execute a command.

1049 2. The return code for the command uses the following rules

1050   a. Command result success, audit success -> return TPM_SUCCESS

1051   b. Command result failure, no audit -> return command result failure

1052   c. Command result success, audit failure -> return TPM_AUDITFAIL_SUCCESSFUL

1053 3. If the TPM is permanently nonrecoverable after an audit failure, then the TPM MUST
1054   always return TPM_FAILEDSELFTEST for every command other than
1055   TPM_GetTestResult. This state must persist regardless of power cycling, the execution
1056   of TPM_Init or any other actions.

1057 8.3 TPM_GetAuditDigest

1058 Start of informative comment:

1059 This returns the current audit digest. The external audit log has the responsibility to track
1060 the parameters that constitute the audit digest.

1061 This value may be unique to an individual TPM. The value however will be changing at a
1062 rate set by the TPM Owner. Those attempting to use this value may find it changing without
1063 their knowledge. This value represents a very poor source of tracking uniqueness.

1064 End of informative comment.

1065 Incoming Parameters and Sizes

| PARAM | | HMAC | | Type | Name | Description |
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4			TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_GetAuditDigest
4	4			UINT32	startOrdinal	The starting ordinal for the list of audited ordinals

1066 Outgoing Parameters and Sizes

| PARAM | | HMAC | | Type | Name | Description |
#	SZ	#	SZ			
1	2			TPM_TAG	Tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4			TPM_RESULT	returnCode	The return code of the operation.
5	10			TPM_COUNTER_VALUE	counterValue	The current value of the audit monotonic counter
4	20			TPM_DIGEST	auditDigest	Log of all audited events
5	1			BOOL	more	TRUE if the output does not contain a full list of audited ordinals
5	4			UINT32	ordSize	Size of the ordinal list in bytes
6	<>			UINT32[]	ordList	List of ordinals that are audited.

1067 Description

1068 1. This command is never audited.

1069 Actions

1070 1. The TPM sets auditDigest to TPM_STANY_DATA -> auditDigest

1071 2. The TPM sets counterValue to TPM_PERMANENT_DATA -> auditMonotonicCounter

1072 3. The TPM creates an ordered list of audited ordinals. The list starts at startOrdinal listing
1073 each ordinal that is audited.

1074 a. If startOrdinal is 0 then the first ordinal that could be audited would be TPM_OIAP
1075 (ordinal 0x0000000A)

1076   b. The next ordinal would be TPM_OSAP (ordinal 0x0000000B)

10774. If the ordered list does not fit in the output buffer the TPM sets more to TRUE

10785. Return TPM_STANY_DATA -> auditDigest as auditDigest

10798.4   TPM_GetAuditDigestSigned

1096**Incoming Parameters and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_GetAuditDigestSigned
4	4			TPM_KEY_HANDLE	keyHandle	The handle of a loaded key that can perform digital signatures.
5	1	2S	1	BOOL	closeAudit	Indication if audit session should be closed
6	20	3S	20	TPM_NONCE	antiReplay	A nonce to prevent replay attacks
7	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for key authentication.
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
8	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
9	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
10	20			TPM_AUTHDATA	keyAuth	Authorization. HMAC key: key.usageAuth.

1097Outgoing Parameters and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_GetAuditDigestSigned
4	10	3S	10	TPM_COUNTER_VALUE	counterValue	The value of the audit monotonic counter
5	20	4S	20	TPM_DIGEST	auditDigest	Log of all audited events
6	20	5S	20	TPM_DIGEST	ordinalDigest	Digest of all audited ordinals
7	4	6S	4	UINT32	sigSize	The size of the sig parameter
8	<>	7S	<>	BYTE[]	sig	The signature of the area
9	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
10	1	4H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
11	20			TPM_AUTHDATA	resAuth	Authorization HMAC key: key.usageAuth.

1098Actions

10991. Validate the AuthData and parameters using keyAuth, return TPM_AUTHFAIL on error

11002. Validate that keyHandle -> keyUsage is TPM_KEY_SIGNING, TPM_KEY_IDENTITY or
1101   TPM_KEY_LEGACY, if not return TPM_INVALID_KEYUSAGE

11023. The TPM validates that the key pointed to by keyHandle has a signature scheme of
1103   TPM_SS_RSASSAPKCS1v15_SHA1   or   TPM_SS_RSASSAPKCS1v15_INFO,   return
1104   TPM_INVALID_KEYUSAGE on error

11054. Create D1 a TPM_SIGN_INFO structure and set the structure defaults

1106   a. Set D1 -> fixed to "ADIG"

1107   b. Set D1 -> replay to antiReplay

1108   c. Create D3 a list of all audited ordinals as defined in the TPM_GetAuditDigest
1109   UINT32[] ordList outgoing parameter

1110   d. Create D4 the SHA-1 of D3

1111   e. Set auditDigest to TPM_STANY_DATA -> auditDigest

1112   f. Set counterValue to TPM_PERMANENT_DATA -> auditMonotonicCounter

1113   g. Create D2 the concatenation of auditDigest || counterValue || D4

1114   h. Set D1 -> data to D2

1115   i. Create a digital signature of the SHA-1 of D1 by using the signature scheme for
1116   keyHandle

1117   j. Set ordinalDigest to D4

11185. If closeAudit == TRUE

1119   a.   If keyHandle->keyUsage is TPM_KEY_IDENTITY

1120   i.   TPM_STANY_DATA -> auditDigest MUST be set to all zeros.

1121   b.   Else

1122   i.   Return TPM_INVALID_KEYUSAGE

1123 8.5 TPM_SetOrdinalAuditStatus

1127 Incoming Parameters and Sizes

PARAM #	PARAM SZ	HMAC #	HMAC SZ	Type	Name	Description
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_SetOrdinalAuditStatus
4	4	2S	4	TPM_COMMAND_CODE	ordinalToAudit	The ordinal whose audit flag is to be set
5	1	3S	1	BOOL	auditState	Value for audit flag
6	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for owner authentication.
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
7	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
8	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
9	20			TPM_AUTHDATA	ownerAuth	HMAC key: ownerAuth.

1128 Outgoing Parameters and Sizes

PARAM #	PARAM SZ	HMAC #	HMAC SZ	Type	Name	Description
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_SetOrdinalAuditStatus
4	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
5	1	4H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
6	20			TPM_AUTHDATA	resAuth	The authorization session digest for the returned parameters. HMAC key: ownerAuth.

1129 Actions

1130 1. Validate the AuthData to execute the command and the parameters

1131 2. Validate that the ordinal points to a valid TPM ordinal, return TPM_BADINDEX on error

1132   a. Valid TPM ordinal means an ordinal that the TPM implementation supports

1133 3. Set the non-volatile flag associated with ordinalToAudit to the value in auditState

1134 9. Administrative Functions - Management

1135 9.1 TPM_FieldUpgrade

1136 **Start of informative comment:**

1137 The TPM needs a mechanism to allow for updating the protected capabilities once a TPM is
1138 in the field. Given the varied nature of TPM implementations there will be numerous
1139 methods of performing an upgrade of the protected capabilities. This command, when
1140 implemented, provides a manufacturer specific method of performing the upgrade.

1141 The manufacturer can determine, within the listed requirements, how to implement this
1142 command. The command may be more than one command and actually a series of
1143 commands.

1144 The IDL definition is to create an ordinal for the command. However, the remaining
1145 parameters are manufacturer specific.

1146 The policy to determine when it is necessary to perform the actions of TPM_RevokeTrust is
1147 outside the TPM spec and determined by other TCG workgroups.

1148 TPM_FieldUpgrade is gated by either owner authorization or deferred assertion of Physical
1149 Presence (via the TPM_STCLEAR_DATA -> deferredPhysicalPresence ->
1150 unownedFieldUpgrade flag). This gating is acknowledgement that the entity that sets the
1151 security policy for a platform must approve field upgrade for that platform. This gating can
1152 block a global attack on TPMs when the TPME's privilege information (private key) has been
1153 compromised. For blocking to be effective in an unowned TPM, the TPM's ownership flag
1154 must be FALSE. (This prevents software from taking ownership and executing
1155 TPM_FieldUpgrade with owner authorization.)

1156 If an owner is present, field upgrade MUST be owner authorized, as the actions indicate.
1157 This prevents an attacker from using physical presence to upgrade a TPM without detection
1158 by the owner.

1159 The advantages of deferred assertion of Physical Presence are that it:

1160 • permits a TPM to be upgraded if taking ownership is undesirable or impractical.

1161 • permits a TPM to be upgraded in the OS environment (where Physical Presence
1162 typically cannot be asserted), when the TPM has no owner.

1163 If it is acceptable to take ownership of a TPM temporarily, an alternative to deferred
1164 assertion of Physical Presence is the process: (1) take ownership; (2) perform an owner
1165 authorized field upgrade; (3) clear the owner from the TPM.

1166 There is no requirement for patch confidentiality. Confidentiality may be implemented
1167 using a manufacturer specific mechanism, and may use a global secret such as a
1168 symmetric encryption key.

1169 The TPM may set the volatile deactivated flag to TRUE if a reboot is required after the field
1170 upgrade. There is no requirement to do so.

1171 The TPM must check owner authorization before changing the TPM state or beginning the
1172 upgrade. This prevents a non-owner from mounting a denial-of-service attack. It is
1173 understood that a TPM may not be able to stage the entire upgrade patch inside the TPM

1174before checking owner authorization. That TPM may be forced to move the patch outside
1175the owner authorization HMAC.

1176Ideally, if the upgrade fails (e.g., due to an authentication failure) the TPM firmware should
1177remain unchanged. It is understood that a TPM may not be able to stage the entire upgrade
1178patch inside the TPM for authentication before beginning the upgrade. On a failure, that
1179TPM may be forced to roll the firmware back to a ROMed version. It may go into an upgrade
1180failure state, where it requires a successful field upgrade before continuing.

1181If a field upgrade adds or deletes features, the security implications must be analyzed. The
1182associated state must be set to prevent attacks. See, for example, allowMaintenance in Part
11832. In addition, if a field upgrade adds maintenance commands, it must atomically install
1184the manufacturer's maintenance public key.

1185**End of informative comment.**

1186IDL Definition

```
1187TPM_RESULT TPM_FieldUpgrade(
1188    [in, out] TPM_AUTH* ownerAuth,
1189    …);
```

1190Type

1191This is an optional command and a TPM is not required to implement this command in any
1192form.

1193Parameters

Type	Name	Description
TPM_AUTH	ownerAuth	Authentication from TPM owner to execute command
...		Remaining parameters are manufacturer specific

1194Description

1195The patch integrity and authenticity verification mechanisms in the TPM MUST not require
1196the TPM to hold a global secret. The definition of global secret is a secret value shared by
1197more than one TPM.

1198The TPME is not allowed to pre-store or use unique identifiers in the TPM for the purpose of
1199field upgrade. The TPM MUST NOT use the endorsement key for identification or encryption
1200in the upgrade process. The upgrade process MAY use a TPM Identity to deliver upgrade
1201information to specific TPM's.

1202The upgrade process SHOULD only change protected capabilities. The upgrade process
1203SHOULD NOT change shielded locations.

1204The upgrade process MUST NOT change the disabled or deactivated state from TRUE to
1205FALSE.

1206The upgrade process SHOULD only access data in shielded locations where this data is
1207necessary to validate the TPM Owner, validate the TPME and manipulate the blob.

1208 The execution of a TPM_FieldUpgrade command in a TPM MUST leave the TPM in a state 1209 that conforms to a version of TCG's TPM specification and conforms to any extant TCG-1210 defined credentials (certificates) that attest to that upgraded TPM.

1211 The security target used to valuate this TPM MUST include this command in the TOE.

1212 If the owner authorization fails, the state of the TPM (volatile, nonvolatile, and firmware) 1213 MUST remain unchanged. The only exception shall be the dictionary attack mitigation 1214 state, which should process the authentication failure.

1215 Actions

1216 The TPM SHALL perform the following when executing the command:

1217 1. If TPM Owner is installed

1218   a. Validate the command and parameters using TPM owner authentication, return 1219   TPM_AUTHFAIL on error

1220 2. Else

1221   a. If TPM_STCLEAR_DATA -> deferredPhysicalPresence -> unownedFieldUpgrade is 1222   FALSE return TPM_BAD_PRESENCE.

1223 3. Validate that the upgrade information was sent by the TPME. The validation mechanism 1224   MUST use a strength of function that is at least the same strength of function as a 1225   digital signature performed using a 2048 bit RSA key.

1226 4. Validate that the upgrade target is the appropriate TPM model and version.

1227 5. Process the upgrade information and update the protected capabilities

1228 6. Set the TPM_PERMANENT_DATA -> revMajor and TPM_PERMANENT_DATA -> revMinor 1229   to the values indicated in the upgrade. The selection of the value is a manufacturer 1230   option.

1231   a. The TPM MAY validate that the upgrade major and minor revision are monotonically 1232   increasing.

1233   b. The TPM MAY allow upgrade with a major and minor revision that is less than 1234   currently installed in the TPM.

1235 7. The TPM MAY set the TPM_STCLEAR_FLAGS.deactivated to TRUE

12369.2　　　　TPM_SetRedirection

1237Start of informative comment:

1238The redirection command attaches a key to a redirection receiver.

1239When making the connection to a GPIO channel the authorization restrictions are set at
1240connection time and not for each invocation that uses the channel.

1241End of informative comment.

1242Incoming Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_SetRedirection
4	4			TPM_KEY_HANDLE	keyHandle	The keyHandle identifier of a loaded key that can implement redirection.
5	4	2S	4	TPM_REDIR_COMMAND	redirCmd	The command to execute
6	4	3S	4	UINT32	inputDataSize	The size of the input data
7	<>	4S	<>	BYTE	inputData	Manufacturer parameter
8	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for keyHandle authorization
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
9	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
10	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
11	20			TPM_AUTHDATA	ownerAuth	HMAC key ownerAuth

1243Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_SetRedirection
4	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
5	1	4H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
6	20			TPM_AUTHDATA	resAuth	The authorization session digest for the returned parameters. HMAC key: key.usageAuth

1244

1245Action

12461. If tag == TPM_TAG_RQU_AUTH1_COMMAND

1247   a. Validate the command and parameters using TPM Owner authentication, on error
1248   return TPM_AUTHFAIL

12492. if redirCmd == TPM_REDIR_GPIO

1250   a. Validate that keyHandle points to a loaded key, return TPM_INVALID_KEYHANDLE
1251   on error

1252   b. Validate the key attributes specify redirection, return TPM_BAD_TYPE on error

1253   c. Validate that inputDataSize is 4, return TPM_BAD_PARAM_SIZE on error

1254   d. Validate   that   inputData   points   to   a   valid   GPIO   channel,   return
1255   TPM_BAD_PARAMETER on error

1256   e. Map C1 to the TPM_GPIO_CONFIG_CHANNEL structure indicated by inputData

1257   f. If C1 -> attr specifies TPM_GPIO_ATTR_OWNER

1258   i.   If tag != TPM_TAG_RQU_AUTH1_COMMAND return TPM_AUTHFAIL

1259   g. If C1 -> attr specifies TPM_GPIO_ATTR_PP

1260   i. If TPM_STCLEAR_FLAGS -> physicalPresence == FALSE, then return
1261   TPM_BAD_PRESENCE

1262   h. Return TPM_SUCCESS

12633. The TPM MAY support other redirection types. These types may be specified by TCG or
1264   provided by the manufacturer.

12659.3   TPM_ResetLockValue

1267Command that resets the TPM dictionary attack mitigation values

1268This allows the TPM owner to cancel the effect of a number of successive authorization
1269failures. Dictionary attack mitigation is vendor specific, and the actions here are one
1270possible implementation. The TPM may treat an authorization failure outside the mitigation
1271time as a normal failure and not disable the command.

1272If this command itself has an authorization failure, it is blocked for the remainder of the
1273lock out period. This prevents a dictionary attack on the owner authorization using this
1274command.

1275It is understood that this command allows the TPM owner to perform a dictionary attack on
1276other authorization values by alternating a trial and this command. Similarly, delegating
1277this command allows the owner's delegate to perform a dictionary attack.

1278**End of informative comment.**

1279Incoming Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_ResetLockValue
4	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for TPM Owner authorization
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
5	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
6	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
7	20			TPM_AUTHDATA	ownerAuth	HMAC key TPM Owner auth

1280Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_ResetLockValue
4	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
5	1	4H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
6	20			TPM_AUTHDATA	resAuth	HMAC key: TPM Owner auth

1281 **Action**

1282 1. If TPM_STCLEAR_DATA -> disableResetLock is TRUE return TPM_AUTHFAIL

1283   a. The internal dictionary attack mechanism will set TPM_STCLEAR_DATA ->
1284 disableResetLock to FALSE when the timeout period expires

1285 2. If the command and parameters validation using ownerAuth fails

1286   a. Set TPM_STCLEAR_DATA -> disableResetLock to TRUE

1287   b. Restart the TPM dictionary attack lock out period

1288   c. Return TPM_AUTHFAIL

1289 3. Reset the internal TPM dictionary attack mitigation mechanism

1290   a. The mechanism is vendor specific and can include time outs, reboots, and other
1291 mitigation strategies

1292**10.   Storage functions**

1293**10.1   TPM_Seal**

1294**Start of informative comment:**

1295The SEAL operation allows software to explicitly state the future "trusted" configuration that
1296the platform must be in for the secret to be revealed. The SEAL operation also implicitly
1297includes the relevant platform configuration (PCR-values) when the SEAL operation was
1298performed. The SEAL operation uses the tpmProof value to BIND the blob to an individual
1299TPM.

1300If the UNSEAL operation succeeds, proof of the platform configuration that was in effect
1301when the SEAL operation was performed is returned to the caller, as well as the secret data.
1302This proof may, or may not, be of interest. If the SEALed secret is used to authenticate the
1303platform to a third party, a caller is normally unconcerned about the state of the platform
1304when the secret was SEALed, and the proof may be of no interest. On the other hand, if the
1305SEALed secret is used to authenticate a third party to the platform, a caller is normally
1306concerned about the state of the platform when the secret was SEALed. Then the proof is of
1307interest.

1308For example, if SEAL is used to store a secret key for a future configuration (probably to
1309prove that the platform is a particular platform that is in a particular configuration), the
1310only requirement is that that key can be used only when the platform is in that future
1311configuration. Then there is no interest in the platform configuration when the secret key
1312was SEALed. An example of this case is when SEAL is used to store a network
1313authentication key.

1314On the other hand, suppose an OS contains an encrypted database of users allowed to log
1315on to the platform. The OS uses a SEALED blob to store the encryption key for the user-
1316database. However, the nature of SEAL is that any SW stack can SEAL a blob for any other
1317software stack. Hence, the OS can be attacked by a second OS replacing both the SEALED-
1318blob encryption key, and the user database itself, allowing untrusted parties access to the
1319services of the OS. To thwart such attacks, SEALED blobs include the past SW
1320configuration. Hence, if the OS is concerned about such attacks, it may check to see
1321whether the past configuration is one that is known to be trusted.

1322TPM_Seal requires the encryption of one parameter ("Secret"). For the sake of uniformity
1323with other commands that require the encryption of more than one parameter, the string
1324used for XOR encryption is generated by concatenating a nonce (created during the OSAP
1325session) with the session shared secret and then hashing the result.

1326The sealed data blob does not have a protected identifier. On a platform that does not
1327prevent unauthorized access to data, a data blob can be exchanged by a lower layer without
1328detection. The upper layer software must take additional measures to protect the relation
1329between its identifier of the data blob and the blob itself.

1330**End of informative comment.**

1331Incoming Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_Seal.
4	4			TPM_KEY_HANDLE	keyHandle	Handle of a loaded key that can perform seal operations.
5	20	2S	20	TPM_ENCAUTH	encAuth	The encrypted AuthData for the sealed data.
6	4	3S	4	UINT32	pcrInfoSize	The size of the pcrInfo parameter. If 0 there are no PCR registers in use
7	<>	4S	<>	TPM_PCR_INFO	pcrInfo	The PCR selection information. The caller MAY use TPM_PCR_INFO_LONG.
8	4	5S	4	UINT32	inDataSize	The size of the inData parameter
9	<>	6S	<>	BYTE[ ]	inData	The data to be sealed to the platform and any specified PCRs
10	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for keyHandle authorization. Must be an OSAP session for this command.
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
11	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
12	1	4H1	1	BOOL	continueAuthSession	Ignored
13	20			TPM_AUTHDATA	pubAuth	The authorization session digest for inputs and keyHandle. HMAC key: key.usageAuth.

1332Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_Seal.
4	<>	3S	<>	TPM_STORED_DATA	sealedData	Encrypted, integrity-protected data object that is the result of the TPM_Seal operation.
5	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
6	1	4H1	1	BOOL	continueAuthSession	Continue use flag, fixed value of FALSE
7	20			TPM_AUTHDATA	resAuth	The authorization session digest for the returned parameters. HMAC key: key.usageAuth.

1333Description

1334TPM_Seal is used to encrypt private objects that can only be decrypted using TPM_Unseal.

1335Actions

13361. Validate the authorization to use the key pointed to by keyHandle

13372. If the inDataSize is 0 the TPM returns TPM_BAD_PARAMETER

13383. If the keyUsage field of the key indicated by keyHandle does not have the value
1339   TPM_KEY_STORAGE, the TPM must return the error code TPM_INVALID_KEYUSAGE.

13404. If the keyHandle points to a migratable key then the TPM MUST return the error code
1341   TPM_INVALID_KEY_USAGE.

13425. Determine the version of pcrInfo

1343   a. If pcrInfoSize is 0

1344   i.   set V1 to 1

1345   b. Else

1346   i.   Point X1 as TPM_PCR_INFO_LONG structure to pcrInfo

1347   ii. If X1 -> tag is TPM_TAG_PCR_INFO_LONG

1348   (1)   Set V1 to 2

1349   iii. Else

1350   (1)   Set V1 to 1

13516. If V1 is 1 then

1352   a. Create S1 a TPM_STORED_DATA structure

13537. else

1354   a. Create S1 a TPM_STORED_DATA12 structure

1355   b. Set S1 -> et to 0

13568. Set S1 -> encDataSize to 0

13579. Set S1 -> encData to all zeros

135810.Set S1 -> sealInfoSize to pcrInfoSize

135911.If pcrInfoSize is not 0 then

1360   a. if V1 is 1 then

1361   i.   Validate pcrInfo as a valid TPM_PCR_INFO structure, return TPM_BADINDEX
1362   on error

1363   ii. Set S1 -> sealInfo -> pcrSelection to pcrInfo -> pcrSelection

1364   iii. Create h1 the composite hash of the PCR selected by pcrInfo -> pcrSelection

1365   iv. Set S1 -> sealInfo -> digestAtCreation to h1

1366   v.   Set S1 -> sealInfo -> digestAtRelease to pcrInfo -> digestAtRelease

1367   b. else

1368   i.   Validate pcrInfo as a valid TPM_PCR_INFO_LONG structure, return
1369   TPM_BADINDEX on error

1370   ii. Set S1 -> sealInfo -> creationPCRSelection to pcrInfo -> creationPCRSelection

1371   iii. Set S1 -> sealInfo -> releasePCRSelection to pcrInfo -> releasePCRSelection

1372   iv. Set S1 -> sealInfo -> digestAtRelease to pcrInfo -> digestAtRelease

1373   v. Set S1 -> sealInfo -> localityAtRelease to pcrInfo -> localityAtRelease

1374   vi. Create h2 the composite hash of the TPM_STCLEAR_DATA -> PCR selected by
1375   pcrInfo -> creationPCRSelection

1376   vii. Set S1 -> sealInfo -> digestAtCreation to h2

1377   viii.   Set S1 -> sealInfo -> localityAtCreation to TPM_STANY_FLAGS ->
1378   localityModifier

1379 12. Create a1 by decrypting encAuth according to the ADIP indicated by authHandle.

1380 13. The TPM provides NO validation of a1. Well-known values (like all zeros) are valid and
1381   possible.

1382 14. Create S2 a TPM_SEALED_DATA structure

1383   a. Set S2 -> payload to TPM_PT_SEAL

1384   b. Set S2 -> tpmProof to TPM_PERMANENT_DATA -> tpmProof

1385   c. Create h3 the SHA-1 of S1

1386   d. Set S2 -> storedDigest to h3

1387   e. Set S2 -> authData to a1

1388   f. Set S2 -> dataSize to inDataSize

1389   g. Set S2 -> data to inData

1390 15. Validate that the size of S2 can be encrypted by the key pointed to by keyHandle, return
1391   TPM_BAD_DATASIZE on error

1392 16. Create s3 the encryption of S2 using the key pointed to by keyHandle

1393 17. Set continueAuthSession to FALSE

1394 18. Set S1 -> encDataSize to the size of s3

1395 19. Set S1 -> encData to s3

1396 20. Return S1 as sealedData

139710.2   TPM_Unseal

1398**Start of informative comment:**

1399The TPM_Unseal operation will reveal TPM_Seal'ed data only if it was encrypted on this
1400platform and the current configuration (as defined by the named PCR contents) is the one
1401named as qualified to decrypt it. Internally, TPM_Unseal accepts a data blob generated by a
1402TPM_Seal operation. TPM_Unseal decrypts the structure internally, checks the integrity of
1403the resulting data, and checks that the PCR named has the value named during TPM_Seal.
1404Additionally, the caller must supply appropriate AuthData for blob and for the key that was
1405used to seal that data.

1406If the integrity, platform configuration and authorization checks succeed, the sealed data is
1407returned to the caller; otherwise, an error is generated.

1408**End of informative comment.**

1409**Incoming Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH2_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_Unseal.
4	4			TPM_KEY_HANDLE	parentHandle	Handle of a loaded key that can unseal the data.
5	<>	2S	<>	TPM_STORED_DATA	inData	The encrypted data generated by TPM_Seal.
6	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for parentHandle.
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
7	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
8	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
9	20			TPM_AUTHDATA	parentAuth	The authorization session digest for inputs and parentHandle. HMAC key: parentKey.usageAuth.
10	4			TPM_AUTHHANDLE	dataAuthHandle	The authorization session handle used to authorize inData.
		2H2	20	TPM_NONCE	dataLastNonceEven	Even nonce previously generated by TPM
11	20	3H2	20	TPM_NONCE	datanonceOdd	Nonce generated by system associated with entityAuthHandle
12	1	4H2	1	BOOL	continueDataSession	Continue usage flag for dataAuthHandle.
13	20			TPM_AUTHDATA	dataAuth	The authorization session digest for the encrypted entity. HMAC key: entity.usageAuth.

1410 Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH2_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_Unseal.
4	4	3S	4	UINT32	secretSize	The used size of the output area for secret
5	<>	4S	<>	BYTE[ ]	secret	Decrypted data that had been sealed
6	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
7	1	4H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
8	20			TPM_AUTHDATA	resAuth	The authorization session digest for the returned parameters. HMAC key: parentKey.usageAuth.
9	20	2H2	20	TPM_NONCE	dataNonceEven	Even nonce newly generated by TPM.
		3H2	20	TPM_NONCE	datanonceOdd	Nonce generated by system associated with dataAuthHandle
10	1	4H2	1	BOOL	continueDataSession	Continue use flag, TRUE if handle is still active
11	20			TPM_AUTHDATA	dataAuth	The authorization session digest used for the dataAuth session. HMAC key: entity.usageAuth.

1411 Actions

1412 1. The TPM MUST validate that parentAuth authorizes the use of the key in parentHandle,
1413 on error return TPM_AUTHFAIL

1414 2. If the keyUsage field of the key indicated by parentHandle does not have the value
1415 TPM_KEY_STORAGE, the TPM MUST return the error code TPM_INVALID_KEYUSAGE.

1416 3. The TPM MUST check that the TPM_KEY_FLAGS -> Migratable flag has the value FALSE
1417 in the key indicated by parentHandle. If not, the TPM MUST return the error code
1418 TPM_INVALID_KEYUSAGE

1419 4. Determine the version of inData

1420   a. If inData -> tag = TPM_TAG_STORED_DATA12

1421   i. Set V1 to 2

1422   ii. Map S2 a TPM_STORED_DATA12 structure to inData

1423   b. Else If inData -> ver = 1.1

1424   i. Set V1 to 1

1425   ii. Map S2 a TPM_STORED_DATA structure to inData

1426   c. Else

1427   i. Return TPM_BAD_VERSION

1428 5. Create d1 by decrypting S2 -> encData using the key pointed to by parentHandle

1429 6. Validate d1

1430   a. d1 MUST be a TPM_SEALED_DATA structure

1431   b. d1 -> tpmProof MUST match TPM_PERMANENT_DATA -> tpmProof

1432   c. Set S2 -> encDataSize to 0

1433   d. Set S2 -> encData to all zeros

1434   e. Create h1 the SHA-1 of S2

1435   f. d1 -> storedDigest MUST match h1

1436   g. d1 -> payload MUST be TPM_PT_SEAL

1437   h. Any failure MUST return TPM_NOTSEALED_BLOB

14387. If S2 -> sealInfoSize is not 0 then

1439   a. If V1 is 1 then

1440   i.   Validate that S2 -> pcrInfo is a valid TPM_PCR_INFO structure

1441   ii. Create h2 the composite hash of the PCR selected by S2 -> pcrInfo ->
1442   pcrSelection

1443   b. If V1 is 2 then

1444   i.   Validate that S2 -> pcrInfo is a valid TPM_PCR_INFO_LONG structure

1445   ii. Create h2 the composite hash of the TPM_STCLEAR_DATA -> PCR selected by
1446   S2 -> pcrInfo -> releasePCRSelection

1447   iii. Check that S2 -> pcrInfo -> localityAtRelease for TPM_STANY_DATA ->
1448   localityModifier is TRUE

1449   (1)   For example if TPM_STANY_DATA -> localityModifier was 2 then S2 ->
1450   pcrInfo -> localityAtRelease -> TPM_LOC_TWO would have to be TRUE

1451   c. Compare h2 with S2 -> pcrInfo -> digestAtRelease, on mismatch return
1452   TPM_WRONGPCRVAL

14538. The TPM MUST validate authorization to use d1 by checking that the HMAC calculation
1454   using d1 -> authData as the shared secret matches the dataAuth. Return
1455   TPM_AUTHFAIL on mismatch.

14569. If V1 is 2 and S2 -> et specifies encryption (i.e. is not all zeros) then

1457   a. If tag is not TPM_TAG_RQU_AUTH2_COMMAND, return TPM_AUTHFAIL

1458   b. Verify that the authHandle session type is TPM_PID_OSAP or TPM_PID_DSAP, return
1459   TPM_BAD_MODE on error.

1460   c. If the MSB of S2 -> et is TPM_ET_XOR

1461   i. Use MGF1 to create string X1 of length sealedDataSize. The inputs to MGF1
1462   are; authLastnonceEven, nonceOdd, "XOR", and authHandle -> sharedSecret. The
1463   four concatenated values form the Z value that is the seed for MFG1.

1464   ii. Create o1 by XOR of d1 -> data and X1

1465   d. Else

1466   i. Create o1 by encrypting d1 -> data using the algorithm indicated by inData ->
1467   et

1468   ii. Key is from authHandle -> sharedSecret

1469   iii. IV is SHA-1 of (authLastNonceEven || nonceOdd)

1470   e. Set continueAuthSession to FALSE

1471 10. else

1472 a. Set o1 to d1 -> data

1473 11. Set the return secret as o1

1474 12. Return TPM_SUCCESS

1475**10.3 TPM_UnBind**

1477TPM_UnBind takes the data blob that is the result of a Tspi_Data_Bind command and 1478decrypts it for export to the User. The caller must authorize the use of the key that will 1479decrypt the incoming blob.

1480TPM_UnBind operates on a block-by-block basis, and has no notion of any relation between 1481one block and another.

1482**End of informative comment.**

1483**Incoming Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_UnBind.
4	4			TPM_KEY_HANDLE	keyHandle	The keyHandle identifier of a loaded key that can perform UnBind operations.
5	4	2S	4	UINT32	inDataSize	The size of the input blob
6	<>	3S	<>	BYTE[ ]	inData	Encrypted blob to be decrypted
7	4			TPM_AUTHHANDLE	authHandle	The handle used for keyHandle authorization
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
8	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
9	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
10	20			TPM_AUTHDATA	privAuth	The authorization session digest that authorizes the inputs and use of keyHandle. HMAC key: key.usageAuth.

1484 Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_UnBind
4	4	3S	4	UINT32	outDataSize	The length of the returned decrypted data
5	<>	4S	<>	BYTE[ ]	outData	The resulting decrypted data.
6	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
7	1	4H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
8	20			TPM_AUTHDATA	resAuth	The authorization session digest for the returned parameters. HMAC key: key.usageAuth.

1485 Description

1486 TPM_UnBind SHALL operate on a single block only.

1487 Actions

1488 The TPM SHALL perform the following:

1489 1. If the inDataSize is 0 the TPM returns TPM_BAD_PARAMETER

1490 2. Validate the AuthData to use the key pointed to by keyHandle

1491 3. If the keyUsage field of the key referenced by keyHandle does not have the value
1492 TPM_KEY_BIND or TPM_KEY_LEGACY, the TPM must return the error code
1493 TPM_INVALID_KEYUSAGE

1494 4. Decrypt the inData using the key pointed to by keyHandle

1495 5. if (keyHandle -> encScheme does not equal TPM_ES_RSAESOAEP_SHA1_MGF1) and
1496 (keyHandle -> keyUsage equals TPM_KEY_LEGACY),

1497 a. The payload does not have TPM specific markers to validate, so no consistency check
1498 can be performed.

1499 b. Set the output parameter outData to the value of the decrypted value of inData.
1500 (Padding associated with the encryption wrapping of inData SHALL NOT be returned.)

1501 c. Set the output parameter outDataSize to the size of outData, as deduced from the
1502 decryption process.

1503 6. else

1504 a. Interpret the decrypted data under the assumption that it is a TPM_BOUND_DATA
1505 structure, and validate that the payload type is TPM_PT_BIND

1506 b. Set the output parameter outData to the value of TPM_BOUND_DATA ->
1507 payloadData. (Other parameters of TPM_BOUND_DATA SHALL NOT be returned.
1508 Padding associated with the encryption wrapping of inData SHALL NOT be returned.)

1509   c. Set the output parameter outDataSize to the size of outData, as deduced from the
1510   decryption process and the interpretation of TPM_BOUND_DATA.

15117. Return the output parameters.

1512 10.4 TPM_CreateWrapKey

1523 Incoming Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_CreateWrapKey
4	4			TPM_KEY_HANDLE	parentHandle	Handle of a loaded key that can perform key wrapping.
5	20	2S	20	TPM_ENCAUTH	dataUsageAuth	Encrypted usage AuthData for the key.
6	20	3S	20	TPM_ENCAUTH	dataMigrationAuth	Encrypted migration AuthData for the key.
7	<>	4S	<>	TPM_KEY	keyInfo	Information about key to be created, pubkey.keyLength and keyInfo.encData elements are 0. MAY be TPM_KEY12
8	4			TPM_AUTHHANDLE	authHandle	parent key authorization. Must be an OSAP session.
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
9	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
10	1	4H1	1	BOOL	continueAuthSession	Ignored
11	20			TPM_AUTHDATA	pubAuth	Authorization HMAC key: parentKey.usageAuth.

1524 Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_CreateWrapKey
4	<>	3S	<>	TPM_KEY	wrappedKey	The TPM_KEY structure which includes the public and encrypted private key. MAY be TPM_KEY12
5	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
6	1	4H1	1	BOOL	continueAuthSession	Continue use flag, fixed at FALSE

7	20			TPM_AUTHDATA	resAuth	Authorization HMAC key: parentKey.usageAuth.

1525 **Actions**

1526 The TPM SHALL do the following:

1527 1. Validate the AuthData to use the key pointed to by parentHandle. Return
1528 TPM_AUTHFAIL on any error.

1529 2. Validate the session type for parentHandle is OSAP.

1530 3. If the TPM is not designed to create a key of the type requested in keyInfo, return the
1531 error code TPM_BAD_KEY_PROPERTY

1532 4. Verify that parentHandle->keyUsage equals TPM_KEY_STORAGE

1533 5. If parentHandle -> keyFlags -> migratable is TRUE and keyInfo -> keyFlags -> migratable
1534 is FALSE then return TPM_INVALID_KEYUSAGE

1535 6. Validate key parameters

1536 a. keyInfo -> keyUsage MUST NOT be TPM_KEY_IDENTITY or
1537 TPM_KEY_AUTHCHANGE. If it is, return TPM_INVALID_KEYUSAGE

1538 b. If keyInfo -> keyFlags -> migrateAuthority is TRUE then return
1539 TPM_INVALID_KEYUSAGE

1540 7. If TPM_PERMANENT_FLAGS -> FIPS is TRUE then

1541 a. If keyInfo -> keySize is less than 1024 return TPM_NOTFIPS

1542 b. If keyInfo -> authDataUsage specifies TPM_AUTH_NEVER return TPM_NOTFIPS

1543 c. If keyInfo -> keyUsage specifies TPM_KEY_LEGACY return TPM_NOTFIPS

1544 8. If keyInfo -> keyUsage equals TPM_KEY_STORAGE or TPM_KEY_MIGRATE

1545 i. algorithmID MUST be TPM_ALG_RSA

1546 ii. encScheme MUST be TPM_ES_RSAESOAEP_SHA1_MGF1

1547 iii. sigScheme MUST be TPM_SS_NONE

1548 iv. key size MUST be 2048

1549 v. exponentSize MUST be 0

1550 9. Determine the version of key

1551 a. If keyInfo -> ver is 1.1

1552 i. Set V1 to 1

1553 ii. Map wrappedKey to a TPM_KEY structure

1554 iii. Validate all remaining TPM_KEY structures

1555 b. Else if keyInfo -> tag is TPM_TAG_KEY12

1556 i. Set V1 to 2

1557 ii. Map wrappedKey to a TPM_KEY12 structure

1558 iii. Validate all remaining TPM_KEY12 structures

155910. Create DU1 by decrypting dataUsageAuth according to the ADIP indicated by
1560   authHandle

156111. Create DM1 by decrypting dataMigrationAuth according to the ADIP indicated by
1562   authHandle

156312. Set continueAuthSession to FALSE

156413. Generate asymmetric key according to algorithm information in keyInfo

156514. Fill in the wrappedKey structure with information from the newly generated key.

1566   a. Set wrappedKey -> encData -> usageAuth to DU1

1567   b. If the KeyFlags -> migratable bit is set to 1, the wrappedKey -> encData ->
1568   migrationAuth SHALL contain the decrypted value from dataMigrationAuth.

1569   c. If the KeyFlags -> migratable bit is set to 0, the wrappedKey -> encData ->
1570   migrationAuth SHALL be set to the value tpmProof

157115. If keyInfo->PCRInfoSize is non-zero

1572   a. If V1 is 1

1573   i. Set wrappedKey -> pcrInfo to a TPM_PCR_INFO structure using the
1574   pcrSelection to indicate the PCR's in use

1575   b. Else

1576   i. Set wrappedKey -> pcrInfo to a TPM_PCR_INFO_LONG structure

1577   c. Set wrappedKey -> pcrInfo to keyInfo -> pcrInfo

1578   d. Set wrappedKey -> digestAtCreation to the TPM_COMPOSITE_HASH indicated by
1579   creationPCRSelection

1580   e. If V1 is 2 set wrappedKey -> localityAtCreation to TPM_STANY_DATA -> locality

158116. Encrypt the private portions of the wrappedKey structure using the key in parentHandle

158217. Return the newly generated key in the wrappedKey parameter

1583 10.5   TPM_LoadKey2

1585Before the TPM can use a key to either wrap, unwrap, unbind, seal, unseal, sign or perform
1586any other action, it needs to be present in the TPM. The TPM_LoadKey2 function loads the
1587key into the TPM for further use.

1588The TPM assigns the key handle. The TPM always locates a loaded key by use of the handle.
1589The assumption is that the handle may change due to key management operations. It is the
1590responsibility of upper level software to maintain the mapping between handle and any
1591label used by external software.

1592To permit this mapping between handle and upper software labels (called key handle
1593virtualization), the key handle returned by TPM_LoadKey2 must not be included in the
1594response HMAC. This may cause problems if several keys are authorized using the same
1595authorization data. Care should be taken to assign different authorization data to each key.

1596This command has the responsibility of enforcing restrictions on the use of keys. For
1597example, when attempting to load a STORAGE key it will be checked for the restrictions on
1598a storage key (2048 size etc.).

1599The load command must maintain a record of whether any previous key in the key
1600hierarchy was bound to a PCR using parentPCRStatus.

1601The flag parentPCRStatus enables the possibility of checking that a platform passed
1602through some particular state or states before finishing in the current state. A grandparent
1603key could be linked to state-1, a parent key could linked to state-2, and a child key could be
1604linked to state-3, for example. The use of the child key then indicates that the platform
1605passed through states 1 and 2 and is currently in state 3, in this example. TPM_Startup
1606with stType == TPM_ST_CLEAR indicates that the platform has been reset, so the platform
1607has not passed through the previous states. Hence keys with parentPCRStatus==TRUE
1608must be unloaded if TPM_Startup is issued with stType == TPM_ST_CLEAR.

1609If a TPM_KEY structure has been decrypted AND the integrity test using "pubDataDigest"
1610has passed AND the key is non-migratory, the key must have been created by the TPM. So
1611there is every reason to believe that the key poses no security threat to the TPM. While there
1612is no known attack from a rogue migratory key, there is a desire to verify that a loaded
1613migratory key is a real key, arising from a general sense of unease about execution of
1614arbitrary data as a key. Ideally a consistency check would consist of an encrypt/decrypt
1615cycle, but this may be expensive. For RSA keys, it is therefore suggested that the
1616consistency test consists of dividing the supposed RSA product by the supposed RSA prime,
1617and checking that there is no remainder.

1619Incoming Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_LoadKey2.
4	4			TPM_KEY_HANDLE	parentHandle	TPM handle of parent key.
5	<>	2S	<>	TPM_KEY	inKey	Incoming key structure, both encrypted private and clear public portions. MAY be TPM_KEY12
6	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for parentHandle authorization.
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
7	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
8	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
9	20			TPM_AUTHDATA	parentAuth	The authorization session digest for inputs and parentHandle. HMAC key: parentKey.usageAuth.

1620Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_LoadKey2
4	4			TPM_KEY_HANDLE	inkeyHandle	Internal TPM handle where decrypted key was loaded.
5	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
6	1	4H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
7	20			TPM_AUTHDATA	resAuth	The authorization session digest for the returned parameters. HMAC key: parentKey.usageAuth.

1621Actions

1622The TPM SHALL perform the following steps:

16231. Validate the command and the parameters using parentAuth and parentHandle -> 1624 usageAuth

16252. If parentHandle -> keyUsage is NOT TPM_KEY_STORAGE return 1626 TPM_INVALID_KEYUSAGE

16273. If the TPM is not designed to operate on a key of the type specified by inKey, return the 1628 error code TPM_BAD_KEY_PROPERTY

16294. The TPM MUST handle both TPM_KEY and TPM_KEY12 structures

16305. Decrypt the inKey -> privkey to obtain TPM_STORE_ASYMKEY structure using the key 1631 in parentHandle

1632 6. Validate the integrity of inKey and decrypted TPM_STORE_ASYMKEY

1633 a. Reproduce inKey -> TPM_STORE_ASYMKEY -> pubDataDigest using the fields of
1634 inKey, and check that the reproduced value is the same as pubDataDigest

1635 7. Validate the consistency of the key and it's key usage.

1636 a. If inKey -> keyFlags -> migratable is TRUE, the TPM SHALL verify consistency of the
1637 public and private components of the asymmetric key pair. If inKey -> keyFlags ->
1638 migratable is FALSE, the TPM MAY verify consistency of the public and private
1639 components of the asymmetric key pair. The consistency of an RSA key pair MAY be
1640 verified by dividing the supposed (P*Q) product by a supposed prime and checking that
1641 there is no remainder.

1642 b. If inKey -> keyUsage is TPM_KEY_IDENTITY, verify that inKey->keyFlags->migratable
1643 is FALSE. If it is not, return TPM_INVALID_KEYUSAGE

1644 c. If inKey -> keyUsage is TPM_KEY_AUTHCHANGE, return TPM_INVALID_KEYUSAGE

1645 d. If inKey -> keyFlags -> migratable equals 0 then verify that TPM_STORE_ASYMKEY
1646 -> migrationAuth equals TPM_PERMANENT_DATA -> tpmProof

1647 e. Validate the mix of encryption and signature schemes

1648 f. If TPM_PERMANENT_FLAGS -> FIPS is TRUE then

1649   i. If keyInfo -> keySize is less than 1024 return TPM_NOTFIPS

1650   ii. If keyInfo -> authDataUsage specifies TPM_AUTH_NEVER return
1651   TPM_NOTFIPS

1652   iii. If keyInfo -> keyUsage specifies TPM_KEY_LEGACY return TPM_NOTFIPS

1653 g. If inKey -> keyUsage is TPM_KEY_STORAGE or TPM_KEY_MIGRATE

1654   i. algorithmID MUST be TPM_ALG_RSA

1655   ii. Key size MUST be 2048

1656   iii. exponentSize MUST be 0

1657   iv. sigScheme MUST be TPM_SS_NONE

1658 h. If inKey -> keyUsage is TPM_KEY_IDENTITY

1659   i. algorithmID MUST be TPM_ALG_RSA

1660   ii. Key size MUST be 2048

1661   iii. exponentSize MUST be 0

1662   iv. encScheme MUST be TPM_ES_NONE

1663 i. If the decrypted inKey -> pcrInfo is NULL,

1664   i. The TPM MUST set the internal indicator to indicate that the key is not using
1665   any PCR registers.

1666 j. Else

1667   i. The TPM MUST store pcrInfo in a manner that allows the TPM to calculate a
1668   composite hash whenever the key will be in use

1669   ii. The TPM MUST handle both version 1.1 TPM_PCR_INFO and 1.2
1670   TPM_PCR_INFO_LONG structures according to the type of TPM_KEY structure

1671   (1)   The TPM MUST validate the TPM_PCR_INFO or TPM_PCR_INFO_LONG
1672   structures for legal values.   However, the digestAtRelease and
1673   localityAtRelease are not validated for authorization until use time.

16748. Perform any processing necessary to make TPM_STORE_ASYMKEY key available for
1675   operations

16769. Load key and key information into internal memory of the TPM. If insufficient memory
1677   exists return error TPM_NOSPACE.

167810. Assign inKeyHandle according to internal TPM rules.

167911. Set InKeyHandle -> parentPCRStatus to parentHandle -> parentPCRStatus.

168012. If parentHandle indicates that it is using PCR registers, then set inKeyHandle ->
1681   parentPCRStatus to TRUE.

1682 10.6 TPM_GetPubKey

1688 Incoming Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_GetPubKey.
4	4			TPM_KEY_HANDLE	keyHandle	TPM handle of key.
5	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for keyHandle authorization.
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
6	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
7	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
8	20			TPM_AUTHDATA	keyAuth	Authorization HMAC key: key.usageAuth.

1689 Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_GetPubKey.
4	<>	3S	<>	TPM_PUBKEY	pubKey	Public portion of key in keyHandle.
5	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
6	1	4H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
7	20			TPM_AUTHDATA	resAuth	Authorization. HMAC key: key.usageAuth.

1690 Actions

1691 The TPM SHALL perform the following steps:

1692 1. If tag = TPM_TAG_RQU_AUTH1_COMMAND then

1693 a. Validate the command parameters using keyHandle -> usageAuth, on error return
1694 TPM_AUTHFAIL

1695 2. Else

1696   a. Verify that keyHandle -> authDataUsage is   TPM_NO_READ_PUBKEY_AUTH   or
1697   TPM_AUTH_NEVER, on error return TPM_AUTHFAIL

16983. If keyHandle == TPM_KH_SRK then

1699   a. If   TPM_PERMANENT_FLAGS   ->   readSRKPub   is   FALSE   then   return
1700   TPM_INVALID_KEYHANDLE

17014. If keyHandle -> pcrInfoSize is not 0

1702   a. If keyHandle -> keyFlags has pcrIgnoredOnRead set to FALSE

1703   i. Create a digestAtRelease according to the specified PCR registers and compare
1704   to keyHandle -> digestAtRelease and if a mismatch return TPM_WRONGPCRVAL

1705   ii. If specified validate any locality requests

17065. Create a TPM_PUBKEY structure and return

1707**10.7   TPM_Sealx**

1708**Start of informative comment:**

1709The TPM_Sealx command works exactly like the TPM_Seal command with the additional 1710requirement of encryption for the inData parameter. This command also places in the 1711sealed blob the information that the TPM_Unseal also requires encryption.

1712TPM_Sealx requires the use of 1.2 data structures. The actions are the same as TPM_Seal 1713without the checks for 1.1 data structure usage.

1714The method of incrementing the symmetric key counter value is different from that used by 1715some standard crypto libraries (e.g. openSSL, Java JCE) that increment the entire counter 1716value. TPM users should be aware of this to avoid errors when the counter wraps.

1717**End of informative comment.**

1718**Incoming Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_Sealx
4	4			TPM_KEY_HANDLE	keyHandle	Handle of a loaded key that can perform seal operations.
5	20	2S	20	TPM_ENCAUTH	encAuth	The encrypted AuthData for the sealed data.
6	4	3S	4	UINT32	pcrInfoSize	The size of the pcrInfo parameter. If 0 there are no PCR registers in use
7	<>	4S	<>	TPM_PCR_INFO	pcrInfo	MUST use TPM_PCR_INFO_LONG.
8	4	5S	4	UINT32	inDataSize	The size of the inData parameter
9	<>	6S	<>	BYTE[ ]	inData	The data to be sealed to the platform and any specified PCRs
10	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for keyHandle authorization. Must be an OSAP session for this command.
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
11	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
12	1	4H1	1	BOOL	continueAuthSession	Ignored
13	20			TPM_AUTHDATA	pubAuth	The authorization session digest for inputs and keyHandle. HMAC key: key.usageAuth.

1719 Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_Sealx
4	<>	3S	4	TPM_STORED_DATA	sealedData	Encrypted, integrity-protected data object that is the result of the TPM_Sealx operation.
5	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
6	1	4H1	1	BOOL	continueAuthSession	Continue use flag, fixed value of FALSE
7	20			TPM_AUTHDATA	resAuth	The authorization session digest for the returned parameters. HMAC key: key.usageAuth.

1720 Actions

1721 1. Validate the authorization to use the key pointed to by keyHandle

1722 2. If the inDataSize is 0 the TPM returns TPM_BAD_PARAMETER

1723 3. If the keyUsage field of the key indicated by keyHandle does not have the value
1724   TPM_KEY_STORAGE, the TPM must return the error code TPM_INVALID_KEYUSAGE.

1725 4. If the keyHandle points to a migratable key then the TPM MUST return the error code
1726   TPM_INVALID_KEY_USAGE.

1727 5. Create S1 a TPM_STORED_DATA12 structure

1728 6. Set S1 -> encDataSize to 0

1729 7. Set S1 -> encData to all zeros

1730 8. Set S1 -> sealInfoSize to pcrInfoSize

1731 9. If pcrInfoSize is not 0 then

1732   a. Validate pcrInfo as a valid TPM_PCR_INFO_LONG structure, return TPM_BADINDEX
1733   on error

1734   b. Set S1 -> sealInfo -> creationPCRSelection to pcrInfo -> creationPCRSelection

1735   c. Set S1 -> sealInfo -> releasePCRSelection to pcrInfo -> releasePCRSelection

1736   d. Set S1 -> sealInfo -> digestAtRelease to pcrInfo -> digestAtRelease

1737   e. Set S1 -> sealInfo -> localityAtRelease to pcrInfo -> localityAtRelease

1738   f. Create h2 the composite hash of the TPM_STCLEAR_DATA -> PCR selected by
1739   pcrInfo -> creationPCRSelection

1740   g. Set S1 -> sealInfo -> digestAtCreation to h2

1741   h. Set S1 -> sealInfo -> localityAtCreation to TPM_STANY_DATA -> localityModifier

1742 10. Create S2 a TPM_SEALED_DATA structure

1743 11. Create a1 by decrypting encAuth according to the ADIP indicated by authHandle.

1744   a. If authHandle indicates XOR encryption for the AuthData secrets

1745   i.   Set S1 -> et to TPM_ET_XOR || TPM_ET_KEY

1746   (1) TPM_ET_KEY is added because TPM_Unseal uses zero as a special value
1747   indicating no encryption.

1748   b. Else

1749   i.   Set S1 -> et to the algorithm indicated by authHandle

1750 12. The TPM provides NO validation of a1. Well-known values (like all zeros) are valid and
1751   possible.

1752 13. If authHandle indicates XOR encryption

1753   a. Use MGF1 to create string X2 of length inDataSize. The inputs to MGF1 are;
1754   authLastNonceEven, nonceOdd, "XOR", and authHandle -> sharedSecret. The four
1755   concatenated values form the Z value that is the seed for MFG1.

1756   b. Create o1 by XOR of inData and X2

1757 14. Else

1758   a. Create o1 by decrypting inData using the algorithm indicated by authHandle

1759   b. Key is from authHandle -> sharedSecret

1760   c. CTR is SHA-1 of (authLastNonceEven || nonceOdd)

1761 15. Create S2 a TPM_SEALED_DATA structure

1762   a. Set S2 -> payload to TPM_PT_SEAL

1763   b. Set S2 -> tpmProof to TPM_PERMANENT_DATA -> tpmProof

1764   c. Create h3 the SHA-1 of S1

1765   d. Set S2 -> storedDigest to h3

1766   e. Set S2 -> authData to a1

1767   f. Set S2 -> dataSize to inDataSize

1768   g. Set S2 -> data to o1

1769 16. Validate that the size of S2 can be encrypted by the key pointed to by keyHandle, return
1770   TPM_BAD_DATASIZE on error

1771 17. Create s3 the encryption of S2 using the key pointed to by keyHandle

1772 18. Set continueAuthSession to FALSE

1773 19. Set S1 -> encDataSize to the size of s3

1774 20. Set S1 -> encData to s3

1775 21. Return S1 as sealedData

1776 11.   Migration

1778 The migration of a key from one TPM to another is a vital aspect to many use models of the 1779 TPM. The migration commands are the commands that allow this operation to occur.

1780 There are two types of migratable keys, the version 1.1 migratable keys and the version 1.2 1781 certifiable migratable keys.

1783 11.1   TPM_CreateMigrationBlob

1785 The TPM_CreateMigrationBlob command implements the first step in the process of moving 1786 a migratable key to a new parent or platform. Execution of this command requires 1787 knowledge of the migrationAuth field of the key to be migrated.

1788 Migrate mode is generally used to migrate keys from one TPM to another for backup, 1789 upgrade or to clone a key on another platform. To do this, the TPM needs to create a data 1790 blob that another TPM can deal with. This is done by loading in a backup public key that 1791 will be used by the TPM to create a new data blob for a migratable key.

1792 The TPM Owner does the selection and authorization of migration public keys at any time 1793 prior to the execution of TPM_CreateMigrationBlob by performing the 1794 TPM_AuthorizeMigrationKey command.

1795 IReWrap mode is used directly to move the key to a new parent (on either this platform or 1796 another). The TPM simply re-encrypts the key using a new parent, and outputs a normal 1797 encrypted element that can be subsequently used by a TPM_LoadKey command.

1798 TPM_CreateMigrationBlob implicitly cannot be used to migrate a non-migratory key. No 1799 explicit check is required. Only the TPM knows tpmProof. Therefore, it is impossible for the 1800 caller to submit an AuthData value equal to tpmProof and migrate a non-migratory key.

1802Incoming Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH2_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_CreateMigrationBlob
4	4			TPM_KEY_HANDLE	parentHandle	Handle of the parent key that can decrypt encData.
5	2	2S	2	TPM_MIGRATE_SCHEME	migrationType	The migration type, either MIGRATE or REWRAP
6	<>	3S	<>	TPM_MIGRATIONKEYAUTH	migrationKeyAuth	Migration public key and its authorization session digest.
7	4	4S	4	UINT32	encDataSize	The size of the encData parameter
8	<>	5S	<>	BYTE[ ]	encData	The encrypted entity that is to be modified.
9	4			TPM_AUTHHANDLE	parentAuthHandle	The authorization session handle used for the parent key.
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
10	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with parentAuthHandle
11	1	4H1	1	BOOL	continueAuthSession	Continue use flag for parent session
12	20		20	TPM_AUTHDATA	parentAuth	Authorization HMAC key: parentKey.usageAuth.
13	4			TPM_AUTHHANDLE	entityAuthHandle	The authorization session handle used for the encrypted entity.
		2H2	20	TPM_NONCE	entitylastNonceEven	Even nonce previously generated by TPM
14	20	3H2	20	TPM_NONCE	entitynonceOdd	Nonce generated by system associated with entityAuthHandle
15	1	4H2	1	BOOL	continueEntitySession	Continue use flag for entity session
16	20			TPM_AUTHDATA	entityAuth	Authorization HMAC key: entity.migrationAuth.

1803

1804Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH2_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_CreateMigrationBlob
4	4	3S	4	UINT32	randomSize	The used size of the output area for random
5	<>	4S	<>	BYTE[ ]	random	String used for xor encryption
6	4	5S	4	UINT32	outDataSize	The used size of the output area for outData
7	<>	6S	<>	BYTE[ ]	outData	The modified, encrypted entity.
8	20	3H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		4H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with parentAuthHandle
9	1	5H1	1	BOOL	continueAuthSession	Continue use flag for parent key session
10	20		20	TPM_AUTHDATA	resAuth	Authorization. HMAC key: parentKey.usageAuth.
11	20	3H2	20	TPM_NONCE	entityNonceEven	Even nonce newly generated by TPM to cover entity
		4H2	20	TPM_NONCE	entitynonceOdd	Nonce generated by system associated with entityAuthHandle
12	1	5 H2	1	BOOL	continueEntitySession	Continue use flag for entity session
13	20			TPM_AUTHDATA	entityAuth	Authorization HMAC key: entity.migrationAuth.

1805Description

1806The TPM does not check the PCR values when migrating values locked to a PCR.

1807The second authorization session (using entityAuth) MUST be OIAP because OSAP does not 1808have a suitable entityType

1809Actions

18101. Validate that parentAuth authorizes the use of the key pointed to by parentHandle.

18112. Validate that parentHandle -> keyUsage is TPM_KEY_STORAGE, if not return 1812   TPM_INVALID_KEYUSAGE

18133. Create d1 a TPM_STORE_ASYMKEY structure by decrypting encData using the key 1814   pointed to by parentHandle.

1815   a. Verify that d1 -> payload is TPM_PT_ASYM.

18164. Validate that entityAuth authorizes the migration of d1. The validation MUST use d1 -> 1817   migrationAuth as the secret.

18185. Validate that migrationKeyAuth -> digest is the SHA-1 hash of (migrationKeyAuth -> 1819   migrationKey || migrationKeyAuth -> migrationScheme || TPM_PERMANENT_DATA -> 1820   tpmProof).

18216. If migrationType == TPM_MS_MIGRATE the TPM SHALL perform the following actions:

1822   a. Build two byte arrays, K1 and K2:

1823   i. K1 = d1.privKey[0..19] (d1.privKey.keyLength + 16 bytes of d1.privKey.key),
1824   sizeof(K1) = 20

1825   ii. K2 = d1.privKey[20..131] (position 16-127 of d1 . privKey.key), sizeof(K2) = 112

1826 b. Build M1 a TPM_MIGRATE_ASYMKEY structure

1827   i. TPM_MIGRATE_ASYMKEY.payload = TPM_PT_MIGRATE

1828   ii. TPM_MIGRATE_ASYMKEY.usageAuth = d1.usageAuth

1829   iii. TPM_MIGRATE_ASYMKEY.pubDataDigest = d1. pubDataDigest

1830   iv. TPM_MIGRATE_ASYMKEY.partPrivKeyLen = 112 – 127.

1831   v. TPM_MIGRATE_ASYMKEY.partPrivKey = K2

1832 c. Create o1 (which SHALL be 198 bytes for a 2048 bit RSA key) by performing the
1833 OAEP encoding of m using OAEP parameters of

1834   i. m = M1 the TPM_MIGRATE_ASYMKEY structure

1835   ii. pHash = d1->migrationAuth

1836   iii. seed = s1 = K1

1837 d. Create r1 a random value from the TPM RNG. The size of r1 MUST be the size of o1.
1838 Return r1 in the Random parameter.

1839 e. Create x1 by XOR of o1 with r1

1840 f. Copy r1 into the output field "random".

1841 g. Encrypt x1 with the migration public key included in migrationKeyAuth.

1842 7. If migrationType == TPM_MS_REWRAP the TPM SHALL perform the following actions:

1843 a. Rewrap the key using the public key in migrationKeyAuth, keeping the existing
1844 contents of that key.

1845 b. Set randomSize to 0 in the output parameter array

1846 8. Else

1847 a. Return TPM_BAD_PARAMETER

1848**11.2**   **TPM_ConvertMigrationBlob**

1849**Start of informative comment:**

1850This command takes a migration blob and creates a normal wrapped blob. The migrated 1851blob must be loaded into the TPM using the normal TPM_LoadKey function.

1852Note that the command migrates private keys, only. The migration of the associated public 1853keys is not specified by TPM because they are not security sensitive. Migration of the 1854associated public keys may be specified in a platform specific specification. A TPM_KEY 1855structure must be recreated before the migrated key can be used by the target TPM in a 1856TPM_LoadKey command.

1857**End of informative comment.**

1858**Incoming Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_ConvertMigrationBlob.
4	4			TPM_KEY_HANDLE	parentHandle	Handle of a loaded key that can decrypt keys.
5	4	2S	4	UINT32	inDataSize	Size of inData
6	<>	3S	<>	BYTE [ ]	inData	The XOR'd and encrypted key
7	4	4S	4	UINT32	randomSize	Size of random
8	<>	5S	<>	BYTE [ ]	random	Random value used to hide key data.
9	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for keyHandle.
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
10	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
11	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
12	20			TPM_AUTHDATA	parentAuth	The authorization session digest that authorizes the inputs and the migration of the key in parentHandle. HMAC key: parentKey.usageAuth

1859

1860 Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_ConvertMigrationBlob
4	4	3S	4	UINT32	outDataSize	The used size of the output area for outData
5	<>	4S	<>	BYTE[ ]	outData	The encrypted private key that can be loaded with TPM_LoadKey
6	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
7	1	4H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
8	20			TPM_AUTHDATA	resAuth	The authorization session digest for the returned parameters. HMAC key: parentKey.usageAuth

1861 Action

1862 The TPM SHALL perform the following:

1863 1. Validate the AuthData to use the key in parentHandle

1864 2. If the keyUsage field of the key referenced by parentHandle does not have the value
1865   TPM_KEY_STORAGE, the TPM must return the error code TPM_INVALID_KEYUSAGE

1866 3. Create d1 by decrypting the inData area using the key in parentHandle

1867 4. Create o1 by XOR d1 and random parameter

1868 5. Create m1 a TPM_MIGRATE_ASYMKEY structure, seed and pHash by OAEP decoding o1

1869 6. Create k1 by combining seed and the TPM_MIGRATE_ASYMKEY -> partPrivKey field

1870 7. Create d2 a TPM_STORE_ASYMKEY structure

1871   a.   Verify that m1 -> payload == TPM_PT_MIGRATE

1872   b.   Set d2 -> payload = TPM_PT_ASYM

1873   c.   Set d2 -> usageAuth to m1 -> usageAuth

1874   d.   Set d2 -> migrationAuth to pHash

1875   e.   Set d2 -> pubDataDigest to m1 -> pubDataDigest

1876   f.   Set d2 -> privKey field to k1

1877 8. Create outData using the key in parentHandle to perform the encryption

1878**11.3   TPM_AuthorizeMigrationKey**

1879**Start of informative comment:**

1880This command creates an authorization blob, to allow the TPM owner to specify which 1881migration facility they will use and allow users to migrate information without further 1882involvement with the TPM owner.

1883It is the responsibility of the TPM Owner to determine whether migrationKey is appropriate 1884for migration. The TPM checks just the cryptographic strength of migrationKey.

1885**End of informative comment.**

1886**Incoming Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_AuthorizeMigrationKey
4	2	2S	2	TPM_MIGRATE_SCHEME	migrationScheme	Type of migration operation that is to be permitted for this key.
4	<>	3S	<>	TPM_PUBKEY	migrationKey	The public key to be authorized.
5	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for owner authentication.
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
6	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
7	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
8	20			TPM_AUTHDATA	ownerAuth	The authorization session digest for inputs and owner authorization. HMAC key: ownerAuth.

1887**Outgoing Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_AuthorizeMigrationKey
4	<>	3S	<>	TPM_MIGRATIONKEYAUTH	outData	Returned public key and authorization session digest.
5	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
6	1	4H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
7	20			TPM_AUTHDATA	resAuth	The authorization session digest for the returned parameters. HMAC key: ownerAuth.

1888

1889**Action**

1890The TPM SHALL perform the following:

1891 1. Check that the cryptographic strength of migrationKey is at least that of a 2048 bit RSA
1892 key. If migrationKey is an RSA key, this means that migrationKey MUST be 2048 bits or
1893 greater and MUST use the default exponent.

1894 2. Validate the AuthData to use the TPM by the TPM Owner

1895 3. Create a f1 a TPM_MIGRATIONKEYAUTH structure

1896 4. Verify that migrationKey-> algorithmParms -> encScheme is
1897 TPM_ES_RSAESOAEP_SHA1_MGF1, and return the error code
1898 TPM_INAPPROPRIATE_ENC if it is not

1899 5. Set f1 -> migrationKey to the input migrationKey

1900 6. Set f1 -> migrationScheme to the input migrationScheme

1901 7. Create v1 by concatenating (migrationKey || migrationScheme ||
1902 TPM_PERMANENT_DATA -> tpmProof)

1903 8. Create h1 by performing a SHA-1 hash of v1

1904 9. Set f1 -> digest to h1

1905 10. Return f1 as outData

1906 11.4   TPM_MigrateKey

1907**Start of informative comment:**

1908The TPM_MigrateKey command performs the function of a migration authority.

1909The command is relatively simple; it just decrypts the input packet (coming from 1910TPM_CreateMigrationBlob or TPM_CMK_CreateBlob) and then re-encrypts it with the input 1911public key. The output of this command would then be sent to TPM_ConvertMigrationBlob 1912or TPM_CMK_ConvertMigration on the target TPM.

1913TPM_MigrateKey does not make ANY assumptions about the contents of the encrypted blob. 1914Since it does not have the XOR string, it cannot actually determine much about the key 1915that is being migrated.

1916This command exists to permit the TPM to be a migration authority. If used in this way, it is 1917expected that the physical security of the system containing the TPM and the AuthData 1918value for the MA key would be tightly controlled.

1919To prevent the execution of this command using any other key as a parent key, this 1920command works only if keyUsage for maKeyHandle is TPM_KEY_MIGRATE.

1921**End of informative comment.**

1922 Incoming Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_MigrateKey
4	4			TPM_KEY_HANDLE	maKeyHandle	Handle of the key to be used to migrate the key.
5	<>	2S	<>	TPM_PUBKEY	pubKey	Public key to which the blob is to be migrated
6	4	3S	4	UINT32	inDataSize	The size of inData
7	<>	4S	<>	BYTE[ ]	inData	The input blob
8	4			TPM_AUTHHANDLE	maAuthHandle	The authorization session handle used for maKeyHandle.
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
9	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with certAuthHandle
10	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
11	20			TPM_AUTHDATA	keyAuth	The authorization session digest for the inputs and key to be signed. HMAC key: maKeyHandle.usageAuth.

1923 Outgoing Operands and Sizes

Param		HMAC		Type	Name	Description
#	Sz	#	Sz			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_MigrateKey
4	4	3S	4	UINT32	outDataSize	The used size of the output area for outData
5	<>	4S	<>	BYTE[ ]	outData	The re-encrypted blob
6	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with certAuthHandle
7	1	4H1	1	BOOL	continueAuthSession	Continue use flag for cert key session
8	20			TPM_AUTHDATA	keyAuth	The authorization session digest for the target key. HMAC key: maKeyHandle.usageAuth

1924 Actions

1925 1. Validate that keyAuth authorizes the use of the key pointed to by maKeyHandle

1926 2. The TPM validates that the key pointed to by maKeyHandle has a key usage value of
1927   TPM_KEY_MIGRATE, and that the allowed encryption scheme is
1928   TPM_ES_RSAESOAEP_SHA1_MGF1.

1929 3. The TPM validates that pubKey is of a size supported by the TPM and that its size is
1930   consistent with the input blob and maKeyHandle.

1931 4. The TPM decrypts inData and re-encrypts it using pubKey.

1932**11.5**   **TPM_CMK_SetRestrictions**

1933**Start of informative comment:**

1934This command is used by the Owner to dictate the usage of a certified-migration key with
1935delegated authorization (authorization other than actual owner authorization).

1936This command is provided for privacy reasons and must not itself be delegated, because a
1937certified-migration-key may involve a contractual relationship between the Owner and an
1938external entity.

1939Since restrictions are validated at DSAP session use, there is no need to invalidate DSAP
1940sessions when the restriction value changes.

1941**End of informative comment.**

1942**Incoming Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes incl. paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Ordinal: TPM_ORD_CMK_SetRestrictions
4	4	2S	4	TPM_CMK_DELEGATE	restriction	The bit mask of how to set the restrictions on CMK keys
5	4			TPM_AUTHHANDLE	authHandle	The authorization session handle TPM Owner authentication
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
6	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
7	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
8	20			TPM_AUTHDATA	ownerAuth	The authorization session digest. HMAC key:ownerAuth

1943**Outgoing Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation
		2S	4	TPM_COMMAND_CODE	ordinal	Ordinal: TPM_ORD_CMK_SetRestrictions
4	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
5	1	4H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
6	20			TPM_AUTHDATA	resAuth	Authorization HMAC key: ownerAuth.

1944**Description**

1945TPM_PERMANENT_DATA -> restrictDelegate is used as follows

19461. If the session type is TPM_PID_DSAP and TPM_KEY -> keyFlags -> migrateAuthority is
1947   TRUE

478

479

1948   a. If

1949TPM_KEY_USAGE   is   TPM_KEY_SIGNING   and   restrictDelegate   ->
1950TPM_CMK_DELEGATE_SIGNING is TRUE, or

1951TPM_KEY_USAGE   is   TPM_KEY_STORAGE   and   restrictDelegate   ->
1952TPM_CMK_DELEGATE_STORAGE is TRUE, or

1953TPM_KEY_USAGE is TPM_KEY_BIND and restrictDelegate -> TPM_CMK_DELEGATE_BIND
1954is TRUE, or

1955TPM_KEY_USAGE   is   TPM_KEY_LEGACY   and   restrictDelegate   ->
1956TPM_CMK_DELEGATE_LEGACY is TRUE, or

1957TPM_KEY_USAGE   is   TPM_KEY_MIGRATE   and   restrictDelegate   ->
1958TPM_CMK_DELEGATE_MIGRATE is TRUE

1959then the key can be used.

1960   b. Else return TPM_INVALID_KEYUSAGE.

1961**Actions**

19621. Validate   the   ordinal   and   parameters   using   TPM   Owner   authentication,   return
1963   TPM_AUTHFAIL on error

19642. Set TPM_PERMANENT_DATA -> TPM_CMK_DELEGATE -> restrictDelegate = restriction

19653. Return TPM_SUCCESS

1966 11.6 TPM_CMK_ApproveMA

1967 **Start of informative comment:**

1968 This command creates an authorization ticket, to allow the TPM owner to specify which
1969 Migration Authorities they approve and allow users to create certified-migration-keys
1970 without further involvement with the TPM owner.

1971 It is the responsibility of the TPM Owner to determine whether a particular Migration
1972 Authority is suitable to control migration

1973 **End of informative comment.**

1974 **Incoming Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_CMK_ApproveMA
4	20	2S	20	TPM_DIGEST	migrationAuthorityDigest	A digest of a TPM_MSA_COMPOSITE structure (itself one or more digests of public keys belonging to migration authorities)
5	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for owner authentication.
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
6	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
7	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
8	20			TPM_AUTHDATA	ownerAuth	Authorization HMAC, key: ownerAuth.

1975 **Outgoing Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_CMK_ApproveMA
4	20	3S	20	TPM_HMAC	outData	HMAC of migrationAuthorityDigest
5	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
6	1	4H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
7	20			TPM_AUTHDATA	resAuth	Authorization HMAC, key: ownerAuth.

1976 **Action**

1977 The TPM SHALL perform the following:

1978 1. Validate the AuthData to use the TPM by the TPM Owner

1979 2. Create M2 a TPM_CMK_MA_APPROVAL structure

1980   a. Set M2 ->migrationAuthorityDigest to migrationAuthorityDigest

19813. Set outData = HMAC(M2) using tpmProof as the secret

19824. Return TPM_SUCCESS

1983 11.7 TPM_CMK_CreateKey

1984 **Start of informative comment:**

1985 The TPM_CMK_CreateKey command both generates and creates a secure storage bundle for 1986 asymmetric keys whose migration is controlled by a migration authority.

1987 TPM_CMK_CreateKey is very similar to TPM_CreateWrapKey, but: (1) the resultant key must 1988 be a migratable key and can be migrated only by TPM_CMK_CreateBlob; (2) the command is 1989 Owner authorized via a ticket.

1990 TPM_CMK_CreateKey creates an otherwise normal migratable key except that (1) 1991 migrationAuth is an HMAC of the migration authority and the new key's public key, signed 1992 by tpmProof (instead of being tpmProof); (2) the migrationAuthority bit is set TRUE; (3) the 1993 payload type is TPM_PT_MIGRATE_RESTRICTED.

1994 The migration-selection/migration authority is specified by passing in a public key (actually 1995 the digests of one or more public keys, so more than one migration authority can be 1996 specified).

1997 **End of informative comment.**

1998 Incoming Operands and Sizes

PARAM #	PARAM SZ	HMAC #	HMAC SZ	Type	Name	Description
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_CMK_CreateKey
4	4			TPM_KEY_HANDLE	parentHandle	Handle of a loaded key that can perform key wrapping.
5	20	2S	20	TPM_ENCAUTH	dataUsageAuth	Encrypted usage AuthData for the key.
6	<>	3S	<>	TPM_KEY12	keyInfo	Information about key to be created, pubkey.keyLength and keyInfo.encData elements are 0. MUST be TPM_KEY12
7	20	4S	20	TPM_HMAC	migrationAuthorityApproval	A ticket, created by the TPM Owner using TPM_CMK_ApproveMA, approving a TPM_MSA_COMPOSITE structure
8	20	5S	20	TPM_DIGEST	migrationAuthorityDigest	The digest of a TPM_MSA_COMPOSITE structure
9	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for parent key authorization. Must be an OSAP session.
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
10	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
11	1	4H1	1	BOOL	continueAuthSession	Ignored
12	20			TPM_AUTHDATA	pubAuth	The authorization session digest that authorizes the use of the public key in parentHandle. HMAC key: parentKey.usageAuth.

1999 Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_CMK_CreateKey
4	<>	3S	<>	TPM_KEY12	wrappedKey	The TPM_KEY structure which includes the public and encrypted private key. MUST be TPM_KEY12
5	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
6	1	4H1	1	BOOL	continueAuthSession	Continue use flag, fixed at FALSE
7	20			TPM_AUTHDATA	resAuth	The authorization session digest for the returned parameters. HMAC key: parentKey.usageAuth.

2000 Actions

2001 The TPM SHALL do the following:

2002 1. Validate the AuthData to use the key pointed to by parentHandle. Return
2003   TPM_AUTHFAIL on any error

2004 2. Validate the session type for parentHandle is OSAP

2005 3. If the TPM is not designed to create a key of the type requested in keyInfo, return the
2006   error code TPM_BAD_KEY_PROPERTY

2007 4. Verify that parentHandle->keyUsage equals TPM_KEY_STORAGE

2008 5. Verify that parentHandle-> keyFlags-> migratable == FALSE

2009 6. If keyInfo -> keyFlags -> migratable is FALSE, return TPM_INVALID_KEYUSAGE

2010 7. If keyInfo -> keyFlags -> migrateAuthority is FALSE , return TPM_INVALID_KEYUSAGE

2011 8. Verify that the migration authority is authorized

2012   a. Create M1 a TPM_CMK_MA_APPROVAL structure

2013   i. Set M1 ->migrationAuthorityDigest to migrationAuthorityDigest

2014   b. Verify that migrationAuthorityApproval == HMAC(M1) using tpmProof as the secret
2015   and return error TPM_MA_AUTHORITY on mismatch

2016 9. Validate key parameters

2017   a. keyInfo -> keyUsage MUST NOT be TPM_KEY_IDENTITY or
2018   TPM_KEY_AUTHCHANGE. If it is, return TPM_INVALID_KEYUSAGE

2019 10. If TPM_PERMANENT_FLAGS -> FIPS is TRUE then

2020   a. If keyInfo -> keySize is less than 1024 return TPM_NOTFIPS

2021   b. If keyInfo -> authDataUsage specifies TPM_AUTH_NEVER return TPM_NOTFIPS

2022   c. If keyInfo -> keyUsage specifies TPM_KEY_LEGACY return TPM_NOTFIPS

2023 11. If keyInfo -> keyUsage equals TPM_KEY_STORAGE or TPM_KEY_MIGRATE

2024   a. algorithmID MUST be TPM_ALG_RSA

2025   b. encScheme MUST be TPM_ES_RSAESOAEP_SHA1_MGF1

2026   c. sigScheme MUST be TPM_SS_NONE

2027   d. key size MUST be 2048

2028   e. exponentSize MUST be 0

2029 12. If keyInfo -> tag is NOT TPM_TAG_KEY12 return error TPM_INVALID_STRUCTURE

2030 13. Map wrappedKey to a TPM_KEY12 structure

2031 14. Create DU1 by decrypting dataUsageAuth according to the ADIP indicated by
2032   authHandle.

2033 15. Set continueAuthSession to FALSE

2034 16. Generate asymmetric key according to algorithm information in keyInfo

2035 17. Fill in the wrappedKey structure with information from the newly generated key.

2036   a. Set wrappedKey -> encData -> usageAuth to DU1

2037   b. Set wrappedKey -> encData -> payload to TPM_PT_MIGRATE_RESTRICTED

2038   c. Create thisPubKey, a TPM_PUBKEY structure containing wrappedKey's public key
2039   and algorithm parameters

2040   d. Create M2 a TPM_CMK_MIGAUTH structure

2041   i. Set M2 -> msaDigest to migrationAuthorityDigest

2042   ii. Set M2 -> pubKeyDigest to SHA-1 (thisPubKey)

2043   e. Set wrappedKey -> encData -> migrationAuth equal to HMAC(M2), using tpmProof as
2044   the shared secret

2045 18. If keyInfo->PCRInfoSize is non-zero

2046   a. Set wrappedKey -> pcrInfo to a TPM_PCR_INFO_LONG structure

2047   b. Set wrappedKey -> pcrInfo to keyInfo -> pcrInfo

2048   c. Set wrappedKey -> digestAtCreation to the TPM_COMPOSITE_HASH indicated by
2049   creationPCRSelection

2050   d. Set wrappedKey -> localityAtCreation to TPM_STANY_FLAGS -> localityModifier

2051 19. Encrypt the private portions of the wrappedKey structure using the key in parentHandle

2052 20. Return the newly generated key in the wrappedKey parameter

2053 ## 11.8 TPM_CMK_CreateTicket

2060 **Incoming Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_CMK_CreateTicket
4	<>	2S	<>	TPM_PUBKEY	verificationKey	The public key to be used to check signatureValue
5	20	3S	20	TPM_DIGEST	signedData	The data to be verified
6	4	4S	4	UINT32	signatureValueSize	The size of the signatureValue
7	<>	5S	<>	BYTE[]	signatureValue	The signatureValue to be verified
8	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for owner authentication.
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
9	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
10	1	4H1	1	BOOL	continueAuthSession	Ignored
11	20			TPM_AUTHDATA	pubAuth	The authorization session digest for inputs and owner. HMAC key: ownerAuth.

2061Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_CMK_CreateTicket
4	20	3S	20	TPM_HMAC	sigTicket	Ticket that proves digest created on this TPM
5	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
6	1	4H1	1	BOOL	continueAuthSession	Continue use flag
7	20			TPM_AUTHDATA	resAuth	Authorization. HMAC key:. ownerAuth.

2062Actions

2063The TPM SHALL do the following:

2064 1. Validate the TPM Owner authentication to use the command

2065 2. Validate that the key type and algorithm are correct

2066   a. Validate that verificationKey -> algorithmParms -> algorithmID == TPM_ALG_RSA

2067   b. Validate that verificationKey -> algorithmParms ->encScheme == TPM_ES_NONE

2068   c. Validate that verificationKey ->algorithmParms ->sigScheme is
2069   TPM_SS_RSASSAPKCS1v15_SHA1 or TPM_SS_RSASSAPKCS1v15_INFO

2070 3. Use verificationKey to verify that signatureValue is a valid signature on signedData, and
2071   return error TPM_BAD_SIGNATURE on mismatch

2072 4. Create M2 a TPM_CMK_SIGTICKET

2073   a. Set M2 -> verKeyDigest to the SHA-1 (verificationKey)

2074   b. Set M2 -> signedData to signedData

2075 5. Set sigTicket = HMAC(M2) signed by using tpmProof as the secret

2076 6. Return TPM_SUCCESS

2077 11.9 TPM_CMK_CreateBlob

2078**Start of informative comment:**

2079TPM_CMK_CreateBlob command is very similar to TPM_CreateMigrationBlob, except that it: 2080(1) uses an extra ticket (restrictedKeyAuth) instead of a migrationAuth authorization 2081session; (2) uses the migration options TPM_MS_RESTRICT_MIGRATE or 2082TPM_MS_RESTRICT_APPROVE; (3) produces a wrapped key blob whose migrationAuth is 2083independent of tpmProof.

2084If the destination (parent) public key is the MA, migration is implicitly permitted. Further 2085checks are required if the MA is not the destination (parent) public key, and merely selects 2086a migration destination: (1) sigTicket must prove that restrictTicket was signed by the MA; 2087(2) restrictTicket must vouch that the target public key is approved for migration to the 2088destination (parent) public key. (Obviously, this more complex method may also be used by 2089an MA to approve migration to that MA.) In both cases, the MA must be one of the MAs 2090implicitly listed in the migrationAuth of the target key-to-be-migrated.

2091When the migrationType is TPM_MS_RESTRICT_MIGRATE, restrictTicket and sigTicket are 2092unused. The TPM may test that the corresponding sizes are zero, so the caller should set 2093them to zero for interoperability.

2094**End of informative comment.**

2095Incoming Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_CMK_CreateBlob
4	4			TPM_KEY_HANDLE	parentHandle	Handle of the parent key that can decrypt encData.
5	2	2S	2	TPM_MIGRATE_SCHEME	migrationType	The migration type, either TPM_MS_RESTRICT_MIGRATE or TPM_MS_RESTRICT_APPROVE
6	<>	3S	<>	TPM_MIGRATIONKEYAUTH	migrationKeyAuth	Migration public key and its authorization session digest.
7	20	4S	20	TPM_DIGEST	pubSourceKeyDigest	The digest of the TPM_PUBKEY of the entity to be migrated
8	4	5S	4	UINT32	msaListSize	The size of the msaList parameter, which is a variable length TPM_MSA_COMPOSITE structure
9	<>	6S	<>	TPM_MSA_COMPOSITE	msaList	One or more digests of public keys belonging to migration authorities
10	4	7S	4	UINT32	restrictTicketSize	The size of the restrictTicket parameter
11	<>	8S	<>	BYTE[]	restrictTicket	If migrationType is TPM_MS_RESTRICT_APPROVE, a TPM_CMK_AUTH structure, containing the digests of the public keys belonging to the Migration Authority, the destination parent key and the key-to-be-migrated.
12	4	9S	4	UINT32	sigTicketSize	The size of the sigTicket parameter
13	<>	10S	<>	BYTE[]	sigTicket	If migrationType is TPM_MS_RESTRICT_APPROVE, a TPM_HMAC structure, generated by the TPM, signaling a valid signature over restrictTicket
14	4	11S	4	UINT32	encDataSize	The size of the encData parameter
15	<>	12S	<>	BYTE[]	encData	The encrypted entity that is to be modified.
16	4			TPM_AUTHHANDLE	parentAuthHandle	The authorization session handle used for the parent key.
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
17	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with parentAuthHandle
18	1	4H1	1	BOOL	continueAuthSession	Continue use flag for parent session
19	20		20	TPM_AUTHDATA	parentAuth	HMAC key: parentKey.usageAuth.

2096 Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_CMK_CreateBlob
4	4	3S	4	UINT32	randomSize	The used size of the output area for random
5	<>	4S	<>	BYTE[ ]	random	String used for xor encryption
6	4	5S	4	UINT32	outDataSize	The used size of the output area for outData
7	<>	6S	<>	BYTE[ ]	outData	The modified, encrypted entity.
8	20	3H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		4H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with parentAuthHandle
9	1	5H1	1	BOOL	continueAuthSession	Continue use flag for parent key session
10	20		20	TPM_AUTHDATA	resAuth	HMAC key: parentKey.usageAuth.

2097 Description

2098 The TPM does not check the PCR values when migrating values locked to a PCR.

2099 Actions

2100 1. Validate that parentAuth authorizes the use of the key pointed to by parentHandle.

2101 2. The TPM MAY verify that migrationType == migrationKeyAuth -> migrationScheme and
2102 return TPM_BAD_MODE on error.

2103 a. The TPM MAY ignore migrationType.

2104 3. Verify that parentHandle-> keyFlags-> migratable == FALSE

2105 4. Create d1 by decrypting encData using the key pointed to by parentHandle.

2106 5. Verify that the digest within migrationKeyAuth is legal for this TPM and public key

2107 6. Verify that d1 -> payload == TPM_PT_MIGRATE_RESTRICTED or
2108 TPM_PT_MIGRATE_EXTERNAL

2109 7. Verify that the migration authorities in msaList are authorized to migrate this key

2110 a. Create M2 a TPM_CMK_MIGAUTH structure

2111 i. Set M2 -> msaDigest to SHA-1[msaList]

2112 ii. Set M2 -> pubKeyDigest to pubSourceKeyDigest

2113 b. Verify that d1 -> migrationAuth == HMAC(M2) using tpmProof as the secret and
2114 return error TPM_MA_AUTHORITY on mismatch

2115 8. If migrationKeyAuth -> migrationScheme == TPM_MS_RESTRICT_MIGRATE

2116 a. Verify that intended migration destination is an MA:

2117   i.   For one of n=1 to n=(msaList -> MSAlist), verify that SHA-1[migrationKeyAuth
2118   -> migrationKey] == msaList -> migAuthDigest[n]

2119   b. Validate that the MA key is the correct type

2120   i.   Validate that migrationKeyAuth -> migrationKey -> algorithmParms ->
2121   algorithmID == TPM_ALG_RSA

2122   ii. Validate that migrationKeyAuth -> migrationKey -> algorithmParms ->
2123   encScheme is an encryption scheme supported by the TPM

2124   iii. Validate that migrationKeyAuth -> migrationKey ->algorithmParms ->
2125   sigScheme is TPM_SS_NONE

2126   c. The TPM MAY validate that restrictTicketSize is zero.

2127   d. The TPM MAY validate that sigTicketSize is zero.

21289. else If migrationKeyAuth -> migrationScheme == TPM_MS_RESTRICT_APPROVE

2129   a. Verify that the intended migration destination has been approved by the MSA:

2130   i.   Verify that for one of the n=1 to n=(msaList -> MSAlist) values of msaList ->
2131   migAuthDigest[n], sigTicket == HMAC (V1) using tpmProof as the secret where V1
2132   is a TPM_CMK_SIGTICKET structure such that:

2133   (1)   V1 -> verKeyDigest = msaList -> migAuthDigest[n]

2134   (2)   V1 -> signedData = SHA-1[restrictTicket]

2135   ii. If [restrictTicket -> destinationKeyDigest] != SHA-1[migrationKeyAuth ->
2136   migrationKey], return error TPM_MA_DESTINATION

2137   iii. If [restrictTicket -> sourceKeyDigest] != pubSourceKeyDigest, return error
2138   TPM_MA_SOURCE

213910.Else return with error TPM_BAD_PARAMETER.

214011.Build two bytes array, K1 and K2, using d1:

2141   a. K1   =   TPM_STORE_ASYMKEY.privKey[0..19]
2142   (TPM_STORE_ASYMKEY.privKey.keyLength   +   16   bytes   of
2143   TPM_STORE_ASYMKEY.privKey.key), sizeof(K1) = 20

2144   b. K2   =   TPM_STORE_ASYMKEY.privKey[20..131]   (position   16-127   of
2145   TPM_STORE_ASYMKEY . privKey.key), sizeof(K2) = 112

214612.Build M1 a TPM_MIGRATE_ASYMKEY structure

2147   a. TPM_MIGRATE_ASYMKEY.payload = TPM_PT_CMK_MIGRATE

2148   b. TPM_MIGRATE_ASYMKEY.usageAuth = TPM_STORE_ASYMKEY.usageAuth

2149   c. TPM_MIGRATE_ASYMKEY.pubDataDigest = TPM_STORE_ASYMKEY. pubDataDigest

2150   d. TPM_MIGRATE_ASYMKEY.partPrivKeyLen = 112 – 127.

2151   e. TPM_MIGRATE_ASYMKEY.partPrivKey = K2

215213.Create o1 (which SHALL be 198 bytes for a 2048 bit RSA key) by performing the OAEP
2153   encoding of m using OAEP parameters m, pHash, and seed

2154   a. m is the previously created M1

2155   b. pHash = SHA-1(SHA-1[msaList] || pubSourceKeyDigest)

2156   c. seed = s1 = the previously created K1

215714.Create r1 a random value from the TPM RNG. The size of r1 MUST be the size of o1.
2158   Return r1 in the random parameter

215915.Create x1 by XOR of o1 with r1

216016.Copy r1 into the output field "random"

216117.Encrypt x1 with the migrationKeyAuth-> migrationKey

2162**11.10   TPM_CMK_ConvertMigration**

2163**Start of informative comment:**

2164TPM_CMK_ConvertMigration completes the migration of certified migration blobs.

2165This command takes a certified migration blob and creates a normal wrapped blob with 2166payload type TPM_PT_MIGRATE_EXTERNAL. The migrated blob must be loaded into the 2167TPM using the normal TPM_LoadKey function.

2168Note that the command migrates private keys, only. The migration of the associated public 2169keys is not specified by TPM because they are not security sensitive. Migration of the 2170associated public keys may be specified in a platform specific specification. A TPM_KEY 2171structure must be recreated before the migrated key can be used by the target TPM in a 2172TPM_LoadKey command.

2173TPM_CMK_ConvertMigration checks that one of the MAs implicitly listed in the 2174migrationAuth of the target key has approved migration of the target key to the destination 2175(parent) key, and that the settings (flags etc.) in the target key are those of a CMK.

2176**End of informative comment.**

2177**Incoming Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_CMK_ConvertMigration
4	4			TPM_KEY_HANDLE	parentHandle	Handle of a loaded key that can decrypt keys.
5	60	2S	60	TPM_CMK_AUTH	restrictTicket	The digests of public keys belonging to the Migration Authority, the destination parent key and the key-to-be-migrated.
6	20	3S	20	TPM_HMAC	sigTicket	A signature ticket, generated by the TPM, signaling a valid signature over restrictTicket
7	<>	4S	<>	TPM_KEY12	migratedKey	The public key of the key-to-be-migrated. The private portion MUST be TPM_MIGRATE_ASYMKEY properly XOR'd
8	4	5S	4	UINT32	msaListSize	The size of the msaList parameter, which is a variable length TPM_MSA_COMPOSITE structure
9	<>	6S	<>	TPM_MSA_COMPOSITE	msaList	One or more digests of public keys belonging to migration authorities
10	4	7S	4	UINT32	randomSize	Size of random
11	<>	8S	<>	BYTE [ ]	random	Random value used to hide key data.
12	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for keyHandle.
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
13	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
14	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
15	20			TPM_AUTHDATA	parentAuth	Authorization HMAC: parentKey.usageAuth

2178 Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_CMK_ConvertMigration
4	4	3S	4	UINT32	outDataSize	The used size of the output area for outData
5	<>	4S	<>	BYTE[ ]	outData	The encrypted private key that can be loaded with TPM_LoadKey
6	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
7	1	4H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
8	20			TPM_AUTHDATA	resAuth	Authorization HMAC key .usageAuth

2179 Action

2180 1. Validate the AuthData to use the key in parentHandle

2181 2. If the keyUsage field of the key referenced by parentHandle does not have the value
2182 TPM_KEY_STORAGE, the TPM must return the error code TPM_INVALID_KEYUSAGE

2183 3. Create d1 by decrypting the migratedKey -> encData area using the key in parentHandle

2184 4. Create o1 by XOR d1 and random parameter

2185 5. Create m1 a TPM_MIGRATE_ASYMKEY, seed and pHash by OAEP decoding o1

2186 6. Create migratedPubKey a TPM_PUBKEY structure corresponding to migratedKey

2187   a. Verify that pHash == SHA-1(SHA-1[msaList] || SHA-1(migratedPubKey)

2188 7. Create k1 by combining seed and the TPM_MIGRATE_ASYMKEY -> partPrivKey field

2189 8. Create d2 a TPM_STORE_ASYMKEY structure.

2190   a. Set the TPM_STORE_ASYMKEY -> privKey field to k1

2191   b. Set d2 -> usageAuth to m1 -> usageAuth

2192   c. Set d2 -> pubDataDigest to m1 -> pubDataDigest

2193 9. Verify that parentHandle-> keyFlags -> migratable == FALSE

2194 10. Verify that m1 -> payload == TPM_PT_CMK_MIGRATE then set d2-> payload =
2195 TPM_PT_MIGRATE_EXTERNAL

2196 11. Verify that for one of the n=1 to n=(msaList -> MSAlist) values of msaList ->
2197 migAuthDigest[n] sigTicket == HMAC (V1) using tpmProof as the secret where V1 is a
2198 TPM_CMK_SIGTICKET structure such that:

2199   a. V1 -> verKeyDigest = msaList -> migAuthDigest[n]

2200   b. V1 -> signedData = SHA-1[restrictTicket]

2201 12. Create parentPubKey, a TPM_PUBKEY structure corresponding to parentHandle

220213. If [restrictTicket -> destinationKeyDigest] != SHA-1(parentPubKey), return error
2203   TPM_MA_DESTINATION

220414. Verify that migratedKey is corresponding to d2

220515. If migratedKey -> keyFlags -> migratable is FALSE, and return error
2206   TPM_INVALID_KEYUSAGE

220716. If migratedKey -> keyFlags -> migrateAuthority is FALSE, return error
2208   TPM_INVALID_KEYUSAGE

220917. If [restrictTicket -> sourceKeyDigest] != SHA-1(migratedPubKey), return error
2210   TPM_MA_SOURCE

221118. Create M2 a TPM_CMK_MIGAUTH structure

2212   a. Set M2 -> msaDigest to SHA-1[msaList]

2213   b. Set M2 -> pubKeyDigest to SHA-1[migratedPubKey]

221419. Set d2 -> migrationAuth = HMAC(M2) using tpmProof as the secret

221520. Create outData using the key in parentHandle to perform the encryption

2216 12.   Maintenance Functions (optional)

2218 When a maintenance archive is created with generateRandom FALSE, the maintenance blob
2219 is XOR encrypted with the owner authorization before encryption with the maintenance
2220 public key. This prevents the manufacturer from obtaining plaintext data. The receiving
2221 TPM must have the same owner authorization as the sending TPM in order to XOR decrypt
2222 the archive.

2223 When generateRandom is TRUE, the maintenance blob is XOR encrypted with random data,
2224 which is also returned. This permits someone trusted by the Owner to load the
2225 maintenance archive into the replacement platform in the absence of the Owner and
2226 manufacturer, without the Owner having to reveal information about his auth value. The
2227 receiving and sending TPM's may have different owner authorizations. The random data is
2228 transferred from the sending TPM owner to the receiving TPM owner out of band, so the
2229 maintenance blob remains hidden from the manufacturer.

2230 This is a typical maintenance sequence:

2231 1. Manufacturer:

2232 • generates maintenance key pair

2233 • gives public key to TPM1 owner

2234 2. TPM1: TPM_LoadManuMaintPub

2235 • load maintenance public key

2236 3. TPM1: TPM_CreateMaintenanceArchive

2237 • XOR encrypt with owner auth or random

2238 • encrypt the maintenance archive with maintenance public key

2239 4. TPM2:

2240 • Take ownership

2241 • Create and activate an AIK

2242 • Certify the SRK with the AIK, proving that the SRK came from a legitimate TPM

2243 4. Manufacturer:

2244 • decrypt maintenance archive with maintenance private key

2245 • (still XOR encrypted with owner auth or random)

2246 • validate the TPM2 SRK certification

2247 • encrypt the maintenance archive with TPM2 SRK public key

2248 5. TPM2: TPM_LoadMaintenanceArchive

2249 • decrypt the maintenance archive with SRK private key

2250 • XOR decrypt with owner auth or random

2252

2253

225412.1   TPM_CreateMaintenanceArchive

2255**Start of informative comment:**

2256This command creates the maintenance archive. It can only be executed by the owner, and 2257may be shut off with the TPM_KillMaintenanceFeature command.

2258**End of informative comment.**

2259**Incoming Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Cmd ordinal: TPM_ORD_CreateMaintenanceArchive
4	1	2S	1	BOOL	generateRandom	Use RNG or Owner auth to generate 'random'.
5	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for owner authentication.
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
6	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
7	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
8	20			TPM_AUTHDATA	ownerAuth	HMAC key: ownerAuth.

2260**Outgoing Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Cmd ordinal: TPM_ORD_CreateMaintenanceArchive
4	4	3S	4	UINT32	randomSize	Size of the returned random data. Will be 0 if generateRandom is FALSE.
5	<>	4S	<>	BYTE [ ]	random	Random data to XOR with result.
6	4	5S	4	UINT32	archiveSize	Size of the encrypted archive
7	<>	6S	<>	BYTE [ ]	archive	Encrypted key archive.
8	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
9	1	4H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
10	20			TPM_AUTHDATA	resAuth	The authorization session digest for the returned parameters. HMAC key: ownerAuth.

2261**Actions**

2262Upon authorization being confirmed this command does the following:

2263 1. Validates that the TPM_PERMANENT_FLAGS -> allowMaintenance is TRUE. If it is
2264   FALSE, the TPM SHALL return TPM_DISABLED_CMD and exit this capability.

2265 2. Validates the TPM Owner AuthData.

2266 3. If the value of TPM_PERMANENT_DATA -> manuMaintPub is zero, the TPM MUST
2267   return the error code TPM_KEYNOTFOUND

2268 4. Build a1 a TPM_KEY structure using the SRK. The encData field is not a normal
2269   TPM_STORE_ASYMKEY structure but rather a TPM_MIGRATE_ASYMKEY structure built
2270   using the following actions.

2271 5. Build a TPM_STORE_PRIVKEY structure from the SRK. This privKey element should be
2272   132 bytes long for a 2K RSA key.

2273 6. Create k1 and k2 by splitting the privKey element created in step 4 into 2 parts. k1 is
2274   the first 20 bytes of privKey, k2 contains the remainder of privKey.

2275 7. Build m1 by creating and filling in a TPM_MIGRATE_ASYMKEY structure

2276   a. m1 -> usageAuth is set to TPM_PERMANENT_DATA -> tpmProof

2277   b. m1 -> pubDataDigest is set to the digest value of the SRK fields from step 4

2278   c. m1 -> payload is set to TPM_PT_MAINT

2279   d. m1 -> partPrivKey is set to k2

2280 8. Create o1 (which SHALL be 198 bytes for a 2048 bit RSA key) by performing the OAEP
2281   encoding of m using OAEP parameters of

2282   a. m = TPM_MIGRATE_ASYMKEY structure (step 7)

2283   b. pHash = TPM_PERMANENT_DATA -> ownerAuth

2284   c. seed = s1 = k1 (step 6)

2285 9. If generateRandom = TRUE

2286   a. Create r1 by obtaining values from the TPM RNG. The size of r1 MUST be the same
2287   size as o1. Set random parameter to r1

2288 10. If generateRandom = FALSE

2289   a. Create r1 by applying MGF1 to the TPM Owner AuthData. The size of r1 MUST be the
2290   same size as o1. Set randomSize to 0.

2291 11. Create x1 by XOR of o1 with r1

2292 12. Encrypt x1 with the manuMaintPub key using the TPM_ES_RSAESOAEP_SHA1_MGF1
2293   encryption scheme.

2294 13. Set a1 -> encData to the encryption of x1

2295 14. Set TPM_PERMANENT_FLAGS -> maintenanceDone to TRUE

2296 15. Return a1 in the archive parameter

2297 12.2 TPM_LoadMaintenanceArchive

2308 Incoming Operands and Sizes

PARAM #	PARAM SZ	HMAC #	HMAC SZ	Type	Name	Description
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_LoadMaintenanceArchive
4	4	2S	4	UINT32	archiveSize	Sice of the encrypted archive
5	<>	3S	<>	BYTE[]	archive	Encrypted key archive
				…	…	Vendor specific arguments
-	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for owner authentication.
			20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
-	20		20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
-	1		1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
--	20			TPM_AUTHDATA	ownerAuth	The authorization session digest for inputs and owner authentication. HMAC key: ownerAuth.

2309

2310Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4		4	TPM_RESULT	returnCode	The return code of the operation.
			4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_LoadMaintenanceArchive
				..	..	Vendor specific arguments
-	20		20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
			20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
-	1		1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
-	20			TPM_AUTHDATA	resAuth	The authorization session digest for the returned parameters. HMAC key: ownerAuth, the original value and not the new auth value

2311Description

2312The maintenance mechanisms in the TPM MUST not require the TPM to hold a global 2313secret. The definition of global secret is a secret value shared by more than one TPM.

2314The TPME is not allowed to pre-store or use unique identifiers in the TPM for the purpose of 2315maintenance. The TPM MUST NOT use the endorsement key for identification or encryption 2316in the maintenance process. The maintenance process MAY use a TPM Identity to deliver 2317maintenance information to specific TPM's.

2318The maintenance process can only change the SRK, tpmProof and TPM Owner AuthData 2319fields.

2320The maintenance process can only access data in shielded locations where this data is 2321necessary to validate the TPM Owner, validate the TPME and manipulate the blob

2322The TPM MUST be conformant to the TPM specification, protection profiles and security 2323targets after maintenance. The maintenance MAY NOT decrease the security values from 2324the original security target.

2325The security target used to evaluate this TPM MUST include this command in the TOE.

2326Actions

2327The TPM SHALL perform the following when executing the command

23281. Validate the TPM Owner's AuthData

23292. Validate that the maintenance information was sent by the TPME. The validation 2330   mechanism MUST use a strength of function that is at least the same strength of 2331   function as a digital signature performed using a 2048 bit RSA key.

23323. The packet MUST contain m2 as defined in section 12.1.

23334. Ensure that only the target TPM can interpret the maintenance packet. The protection 2334   mechanism MUST use a strength of function that is at least the same strength of 2335   function as a digital signature performed using a 2048 bit RSA key.

2336 5. Execute the actions of TPM_OwnerClear.

2337 6. Process the maintenance information

2338   a. Update the SRK

2339   i. Set the SRK usageAuth to be the same as the source TPM owner's AuthData

2340   b. Update TPM_PERMANENT_DATA -> tpmProof

2341   c. Update TPM_PERMANENT_DATA -> ownerAuth

2342 7. Set TPM_PERMANENT_FLAGS -> maintenanceDone to TRUE

2343

2344**12.3**   **TPM_KillMaintenanceFeature**

2345**Start of informative comment:**

2346The TPM_KillMaintencanceFeature is a permanent action that prevents ANYONE from
2347creating a maintenance archive. This action, once taken, is permanent until a new TPM
2348Owner is set.

2349This action is to allow those customers who do not want the maintenance feature to not
2350allow the use of the maintenance feature.

2351At the discretion of the Owner, it should be possible to kill the maintenance feature in such
2352a way that the only way to recover maintainability of the platform would be to wipe out the
2353root keys. This feature is mandatory in any TPM that implements the maintenance feature.

2354**End of informative comment.**

2355**Incoming Operands and Sizes**

| PARAM | | HMAC | | Type | Name | Description |
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_KillMaintenanceFeature
4	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for owner authentication.
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
5	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
6	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
7	20			TPM_AUTHDATA	ownerAuth	HMAC key: ownerAuth.

2356**Outgoing Operands and Sizes**

| PARAM | | HMAC | | Type | Name | Description |
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_KillMaintenanceFeature
4	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
5	1	4H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
6	20			TPM_AUTHDATA	resAuth	HMAC key: ownerAuth.

2357**Actions**

23581. Validate the TPM Owner AuthData

23592. Set the TPM_PERMANENT_FLAGS.allowMaintenance flag to FALSE.

2360 12.4   TPM_LoadManuMaintPub

2361 **Start of informative comment:**

2362 The TPM_LoadManuMaintPub command loads the manufacturer's public key for use in the
2363 maintenance process. The command installs manuMaintPub in PERMANENT data storage
2364 inside a TPM. Maintenance enables duplication of non-migratory data in protected storage.
2365 There is therefore a security hole if a platform is shipped before the maintenance public key
2366 has been installed in a TPM.

2367 The command is expected to be used before installation of a TPM Owner or any key in TPM
2368 protected storage. It therefore does not use authorization.

2369 **End of informative comment.**

2370 Incoming Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_LoadManuMaintPub
4	20	2S	20	TPM_NONCE	antiReplay	AntiReplay and validation nonce
5	<>	3S	<>	TPM_PUBKEY	pubKey	The public key of the manufacturer to be in use for maintenance

2371 Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_LoadManuMaintPub
4	20	3S	20	TPM_DIGEST	checksum	Digest of pubKey and antiReplay

2372 Description

2373 The pubKey MUST specify an algorithm whose strength is not less than the RSA algorithm
2374 with 2048bit keys.

2375 pubKey SHOULD unambiguously identify the entity that will perform the maintenance
2376 process with the TPM Owner.

2377 TPM_PERMANENT_DATA -> manuMaintPub SHALL exist in a TPM-shielded location, only.

2378 If an entity (Platform Entity) does not support the maintenance process but issues a
2379 platform credential for a platform containing a TPM that supports the maintenance process,
2380 the value of TPM_PERMANENT_DATA -> manuMaintPub MUST be set to zero before the
2381 platform leaves the entity's control. That is, this ordinal can only be run once, and used to
2382 either load the key or load a NULL key.

2383**Actions**

2384The first valid TPM_LoadManuMaintPub command received by a TPM SHALL

23851. Store the parameter pubKey as TPM_PERMANENT_DATA -> manuMaintPub.

23862. Set checksum to SHA-1 of (pubKey || antiReplay)

23873. Export the checksum

23884. Subsequent calls to TPM_LoadManuMaintPub SHALL return code
2389   TPM_DISABLED_CMD.

2390 **12.5   TPM_ReadManuMaintPub**

2391 **Start of informative comment:**

2392 The TPM_ReadManuMaintPub command is used to check whether the manufacturer's
2393 public maintenance key in a TPM has the expected value. This may be useful during the
2394 manufacture process. The command returns a digest of the installed key, rather than the
2395 key itself. This hinders discovery of the maintenance key, which may (or may not) be useful
2396 for manufacturer privacy.

2397 The command is expected to be used before installation of a TPM Owner or any key in TPM
2398 protected storage. It therefore does not use authorization.

2399 **End of Informative Comments**

2400 **Incoming Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_ReadManuMaintPub
4	20	2S	20	TPM_NONCE	antiReplay	AntiReplay and validation nonce

2401 **Outgoing Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_ReadManuMaintPub
4	20	3S	20	TPM_DIGEST	checksum	Digest of pubKey and antiReplay

2402 **Description**

2403 This command returns the hash of the antiReplay nonce and the previously loaded
2404 manufacturer's maintenance public key.

2405 **Actions**

2406 The TPM_ReadManuMaintPub command SHALL

2407 1. Create "checksum" by concatenating data to form (TPM_PERMANENT_DATA ->
2408   manuMaintPub ||antiReplay) and passing the concatenated data through SHA-1.

2409 2. Export the checksum

2410 13.   Cryptographic Functions

2411 13.1   TPM_SHA1Start

2412**Start of informative comment:**

2413This capability starts the process of calculating a SHA-1 digest.

2414The exposure of the SHA-1 processing is a convenience to platforms in a mode that do not
2415have sufficient memory to perform SHA-1 themselves. As such, the use of SHA-1 is
2416restrictive on the TPM.

2417The TPM may not allow any other types of processing during the execution of a SHA-1
2418session. There is only one SHA-1 session active on a TPM. The exclusivity of a SHA-1
2419context is due to the relatively large volatile buffer it requires in order to hold the
2420intermediate results between the SHA-1 context commands. This buffer can be in
2421contradiction to other command needs.

2422After the execution of TPM_SHA1Start, and prior to TPM_SHA1Complete or
2423TPM_SHA1CompleteExtend, the receipt of any command other than TPM_SHA1Update will
2424cause the invalidation of the SHA-1 session.

2425**End of informative comment.**

2426**Incoming Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_SHA1Start

2427**Outgoing Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_SHA1Start
4	4	3S	4	UINT32	maxNumBytes	Maximum number of bytes that can be sent to TPM_SHA1Update. Must be a multiple of 64 bytes.

2428**Description**

24291. This capability prepares the TPM for a subsequent TPM_SHA1Update,
2430   TPM_SHA1Complete or TPM_SHA1CompleteExtend command. The capability SHALL
2431   open a thread that calculates a SHA-1 digest.

2432 2. After receipt of TPM_SHA1Start, and prior to the receipt of TPM_SHA1Complete or
2433 TPM_SHA1CompleteExtend, receipt of any command other than TPM_SHA1Update
2434 invalidates the SHA-1 session.

2435 a. If the command received is TPM_ExecuteTransport, the SHA-1 session invalidation is
2436 based on the wrapped command, not the TPM_ExecuteTransport ordinal.

2437 b. A SHA-1 thread (start, update, complete) MUST take place either completely outside
2438 a transport session or completely within a single transport session.

243913.2   TPM_SHA1Update

2440**Start of informative comment:**

2441This capability inputs complete blocks of data into a pending SHA-1 digest. At the end of
2442the process, the digest remains pending.

2443**End of informative comment.**

2444**Incoming Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_SHA1Update
4	4	2S	4	UINT32	numBytes	The number of bytes in hashData. Must be a multiple of 64 bytes.
5	<>	3S	<>	BYTE [ ]	hashData	Bytes to be hashed

2445**Outgoing Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_SHA1Update

2446**Description**

2447This command SHALL incorporate complete blocks of data into the digest of an existing
2448SHA-1 thread. Only integral numbers of complete blocks (64 bytes each) can be processed.

2449**Actions**

24501. If there is no existing SHA-1 thread, return TPM_SHA_THREAD

24512. If numBytes is not a multiple of 64

2452   a. Return TPM_SHA_ERROR

2453   b. The TPM MAY terminate the SHA-1 thread

24543. If numBytes is greater than maxNumBytes returned by TPM_SHA1Start

2455   a. Return TPM_SHA_ERROR

2456   b. The TPM MAY terminate the SHA-1 thread

24574. Incorporate hashData into the digest of the existing SHA-1 thread.

2458

2459 13.3 TPM_SHA1Complete

2460 **Start of informative comment:**

2461 This capability terminates a pending SHA-1 calculation.

2462 **End of informative comment.**

2463 Incoming Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_SHA1Complete
4	4	2S	4	UINT32	hashDataSize	Number of bytes in hashData, MUST be 64 or less
5	<>	3S	<>	BYTE [ ]	hashData	Final bytes to be hashed

2464 Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_SHA1Complete
4	20	3S	20	TPM_DIGEST	hashValue	The output of the SHA-1 hash.

2465 Description

2466 This command SHALL incorporate a partial or complete block of data into the digest of an
2467 existing SHA-1 thread, and terminate that thread. hashDataSize MAY have values in the
2468 range of 0 through 64, inclusive.

2469 If the SHA-1 thread has received no bytes the TPM SHALL calculate the SHA-1 of the empty
2470 buffer.

2471 13.4   TPM_SHA1CompleteExtend

2472**Start of informative comment:**

2473This capability terminates a pending SHA-1 calculation and EXTENDS the result into a
2474Platform Configuration Register using a SHA-1 hash process.

2475This command is designed to complete a hash sequence and extend a PCR in memory-less
2476environments.

2477**End of informative comment.**

2478**Incoming Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_SHA1CompleteExtend
4	4	2S	4	TPM_PCRINDEX	pcrNum	Index of the PCR to be modified
5	4	3S	4	UINT32	hashDataSize	Number of bytes in hashData, MUST be 64 or less
6	<>	4S	<>	BYTE [ ]	hashData	Final bytes to be hashed

2479**Outgoing Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_SHA1CompleteExtend
4	20	3S	20	TPM_DIGEST	hashValue	The output of the SHA-1 hash.
5	20	4S	20	TPM_PCRVALUE	outDigest	The PCR value after execution of the command.

2480**Description**

2481This command SHALL incorporate a partial or complete block of data into the digest of an
2482existing SHA-1 thread, EXTEND the resultant digest into a PCR, and terminate the SHA-1
2483session. hashDataSize MAY have values in the range of 0 through 64, inclusive.

2484The SHA-1 session MUST terminate even if the command returns an error, e.g.
2485TPM_BAD_LOCALITY.

2486**Actions**

24875. Validate that pcrNum represents a legal PCR number. On error, return TPM_BADINDEX.

24886. Map V1 to TPM_STANY_DATA

24897. Map L1 to V1 -> localityModifier

2490 8. If the current locality, held in L1, is not selected in TPM_PERMANENT_DATA -> pcrAttrib
2491   [pcrNum]. pcrExtendLocal, return TPM_BAD_LOCALITY

2492 9. Create H1 the TPM_DIGEST of the SHA-1 session ensuring that hashData, if any, is
2493   added to the SHA-1 session

2494 10. Perform the actions of TPM_Extend using H1 as the data and pcrNum as the PCR to
2495   extend

2496 13.5   TPM_Sign

2497 **Start of informative comment:**

2498 The Sign command signs data and returns the resulting digital signature.

2499 The TPM does not allow TPM_Sign with a TPM_KEY_IDENTITY (AIK) because TPM_Sign can
2500 sign arbitrary data and could be used to fake a quote. (This could have been relaxed to
2501 allow TPM_Sign with an AIK if the signature scheme is _INFO   For an _INFO key, the
2502 metadata prevents TPM_Sign from faking a quote.)

2503 **End of informative comment.**

2504 Incoming Operands and Sizes

| PARAM | | HMAC | | Type | Name | Description |
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_Sign.
4	4			TPM_KEY_HANDLE	keyHandle	The keyHandle identifier of a loaded key that can perform digital signatures.
5	4	2s	4	UINT32	areaToSignSize	The size of the areaToSign parameter
6	<>	3s	<>	BYTE[]	areaToSign	The value to sign
7	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for keyHandle authorization
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
8	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
9	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
10	20			TPM_AUTHDATA	privAuth	The authorization session digest that authorizes the use of keyHandle. HMAC key: key.usageAuth

2505 Outgoing Operands and Sizes

| PARAM | | HMAC | | Type | Name | Description |
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_Sign.
4	4	3S	4	UINT32	sigSize	The length of the returned digital signature
5	<>	4S	<>	BYTE[ ]	sig	The resulting digital signature.
6	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
7	1	4H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
8	20			TPM_AUTHDATA	resAuth	The authorization session digest for the returned parameters. HMAC key: key.usageAuth

2506 **Description**

2507 The TPM MUST support all values of areaToSignSize that are legal for the defined signature
2508 scheme and key size. The maximum value of areaToSignSize is determined by the defined
2509 signature scheme and key size.

2510 In the case of PKCS1v15_SHA1 the areaToSignSize MUST be TPM_DIGEST (the hash size of
2511 a SHA-1 operation - see 8.5.1 TPM_SS_RSASSAPKCS1v15_SHA1). In the case of
2512 PKCS1v15_DER the maximum size of areaToSign is k-11 octets, where k is limited by the
2513 key size (see TPM_SS_RSASSAPKCS1v15_DER).

2514 **Actions**

2515 1. The TPM validates the AuthData to use the key pointed to by keyHandle.

2516 2. If the areaToSignSize is 0 the TPM returns TPM_BAD_PARAMETER.

2517 3. Validate that keyHandle -> keyUsage is TPM_KEY_SIGNING or TPM_KEY_LEGACY, if not
2518   return the error code TPM_INVALID_KEYUSAGE

2519 4. The TPM verifies that the signature scheme and key size can properly sign the
2520   areaToSign parameter.

2521 5. If signature scheme is TPM_SS_RSASSAPKCS1v15_SHA1 then

2522   a. Validate that areaToSignSize is 20 return TPM_BAD_PARAMETER on error

2523   b. Set S1 to areaToSign

2524 6. Else if signature scheme is TPM_SS_RSASSAPKCS1v15_DER then

2525   a. Validate that areaToSignSize is at least 11 bytes less than the key size, return
2526   TPM_BAD_PARAMETER on error

2527   b. Set S1 to areaToSign

2528 7. else if signature scheme is TPM_SS_RSASSAPKCS1v15_INFO then

2529   a. Create S2 a TPM_SIGN_INFO structure

2530   b. Set S2 -> fixed to "SIGN"

2531   c. Set S2 -> replay to nonceOdd

2532   i. If nonceOdd is not present due to an unauthorized command return
2533   TPM_BAD_PARAMETER

2534   d. Set S2 -> dataLen to areaToSignSize

2535   e. Set S2 -> data to areaToSign

2536   f. Set S1 to the SHA-1(S2)

2537 8. Else return TPM_INVALID_KEYUSAGE

2538 9. The TPM computes the signature, sig, using the key referenced by keyHandle using S1
2539   as the value to sign

2540 10. Return the computed signature in Sig

2541 13.6 TPM_GetRandom

2542**Start of informative comment:**

2543TPM_GetRandom returns the next bytesRequested bytes from the random number 2544generator to the caller.

2545It is recommended that a TPM implement the RNG in a manner that would allow it to return 2546RNG bytes such that the frequency of bytesRequested being more than the number of bytes 2547available is an infrequent occurrence.

2548**End of informative comment.**

2549 Incoming Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_GetRandom.
4	4	2S	4	UINT32	bytesRequested	Number of bytes to return

2550 Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_GetRandom.
4	4	3S	4	UINT32	randomBytesSize	The number of bytes returned
5	<>	4S	<>	BYTE[ ]	randomBytes	The returned bytes

2551 Actions

25521. The TPM determines if amount bytesRequested is available from the TPM.

25532. Set randomBytesSize to the number of bytes available from the RNG. This number MAY 2554 be less than bytesRequested.

25553. Set randomBytes to the next randomBytesSize bytes from the RNG

2556 13.7 TPM_StirRandom

2557 Start of informative comment:

2558 TPM_StirRandom adds entropy to the RNG state.

2559 End of informative comment.

2560 Incoming Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_StirRandom
4	4	2S	4	UINT32	dataSize	Number of bytes of input
5	<>	3S	<>	BYTE[ ]	inData	Data to add entropy to RNG state

2561 Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_StirRandom

2562 Actions

2563 1. If dataSize is not less than 256 bytes, the TPM MAY return TPM_BAD_PARAMETER.

2564 2. The TPM updates the state of the current RNG using the appropriate mixing function.

2565 13.8 TPM_CertifyKey

2566**Start of informative comment:**

2567The TPM_CertifyKey operation allows one key to certify the public portion of another key.

2568A TPM identity key may be used to certify non-migratable keys but is not permitted to 2569certify migratory keys or certified migration keys. As such, it allows the TPM to make the 2570statement "this key is held in a TPM-shielded location, and it will never be revealed." For 2571this statement to have veracity, the Challenger must trust the policies used by the entity 2572that issued the identity and the maintenance policy of the TPM manufacturer.

2573Signing and legacy keys may be used to certify both migratable and non-migratable keys. 2574Then the usefulness of a certificate depends on the trust in the certifying key by the 2575recipient of the certificate.

2576The key to be certified must be loaded before TPM_CertifyKey is called.

2577The determination to use the TPM_CERTIFY_INFO or TPM_CERTIFY_INFO2 on the output is 2578based on which PCRs and what localities the certified key is restricted to. A key to be 2579certified that does not have locality restrictions and which uses no PCRs greater than PCR 2580#15 will cause this command to return and sign a TPM_CERTIFY_INFO structure, which 2581provides compatibility with V1.1 TPMs.

2582When this command is run to certify all other keys (those that use PCR #16 or higher, as 2583well as those limited by locality in any way), it will return and sign a TPM_CERTIFY_INFO2 2584structure.

2585TPM_CertifyKey does not support the case where (a) the certifying key requires a usage 2586authorization to be provided but (b) the key-to-be-certified does not. In such cases, 2587TPM_CertifyKey2 must be used. TPM_CertifyKey cannot be used to certify CMKs.

2588If a command tag (in the parameter array) specifies only one authorisation session, then the 2589TPM convention is that the first session listed is ignored (authDataUsage must be 2590TPM_AUTH_NEVER for this key) and the incoming session data is used for the second auth 2591session in the list. In TPM_CertifyKey, the first session is the certifying key and the second 2592session is the key-to-be-certified. In TPM_CertifyKey2, the first session is the key-to-be-2593certified and the second session is the certifying key.

2594The key handles of both the certifying key and the key to be certified are not included in the 2595HMAC protecting the command. This permits key handle virtualization (swapping of keys 2596in and out of the TPM that results in different key handles while at the same time 2597maintaining key identifiers of upper layer software). In environments where the interface to 2598the TPM is accessible by other parties, the key handles not being protected allows an 2599attacker to change the handle of the key to be certified. This can be avoided by processing 2600this command within a transport session and making sure that antiReplay indeed contains 2601a nonce.

2602**End of informative comment.**

2603Incoming Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH2_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_CertifyKey
4	4			TPM_KEY_HANDLE	certHandle	Handle of the key to be used to certify the key.
5	4			TPM_KEY_HANDLE	keyHandle	Handle of the key to be certified.
6	20	2S	20	TPM_NONCE	antiReplay	160 bits of externally supplied data (typically a nonce provided to prevent replay-attacks)
7	4			TPM_AUTHHANDLE	certAuthHandle	The authorization session handle used for certHandle.
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
8	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with certAuthHandle
9	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
10	20			TPM_AUTHDATA	certAuth	The authorization session digest for inputs and certHandle. HMAC key: certKey.auth.
11	4			TPM_AUTHHANDLE	keyAuthHandle	The authorization session handle used for the key to be signed.
		2H2	20	TPM_NONCE	keylastNonceEven	Even nonce previously generated by TPM
12	20	3H2	20	TPM_NONCE	keynonceOdd	Nonce generated by system associated with keyAuthHandle
13	1	4H2	1	BOOL	continueKeySession	The continue use flag for the authorization session handle
14	20			TPM_AUTHDATA	keyAuth	The authorization session digest for the inputs and key to be signed. HMAC key: key.usageAuth.

2604Outgoing Operands and Sizes

Param		HMAC		Type	Name	Description
#	Sz	#	Sz			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH2_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_CertifyKey
4	<>	3S	<>	TPM_CERTIFY_INFO	certifyInfo	TPM_CERTIFY_INFO or TPM_CERTIFY_INFO2 structure that provides information relative to keyhandle
5	4	4S	4	UINT32	outDataSize	The used size of the output area for outData
6	<>	5S	<>	BYTE[ ]	outData	The signature of certifyInfo
7	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with certAuthHandle
8	1	4H1	1	BOOL	continueAuthSession	Continue use flag for cert key session
9	20		20	TPM_AUTHDATA	resAuth	The authorization session digest for the returned parameters and parentHandle. HMAC key: certKey -> auth.
10	20	2H2	20	TPM_NONCE	keyNonceEven	Even nonce newly generated by TPM
		3H2	20	TPM_NONCE	keynonceOdd	Nonce generated by system associated with keyAuthHandle
11	1	4H2	1	BOOL	continueKeySession	Continue use flag for target key session
12	20			TPM_AUTHDATA	keyAuth	The authorization session digest for the target key. HMAC key: key.auth.

2605Actions

26061. The TPM validates that the key pointed to by certHandle has a signature scheme of
2607   TPM_SS_RSASSAPKCS1v15_SHA1 or TPM_SS_RSASSAPKCS1v15_INFO

26082. Verify command and key AuthData values:

2609   a. If tag is TPM_TAG_RQU_AUTH2_COMMAND

2610   i. The TPM verifies the AuthData in certAuthHandle provides authorization to
2611   use the key pointed to by certHandle, return TPM_AUTHFAIL on error

2612   ii. The TPM verifies the AuthData in keyAuthHandle provides authorization to
2613   use the key pointed to by keyHandle, return TPM_AUTH2FAIL on error

2614   b. else if tag is TPM_TAG_RQU_AUTH1_COMMAND

2615   i. Verify that authDataUsage is TPM_AUTH_NEVER for the key referenced by
2616   certHandle, return TPM_AUTHFAIL on error.

2617   ii. The TPM verifies the AuthData in keyAuthHandle provides authorization to
2618   use the key pointed to by keyHandle, return TPM_AUTHFAIL on error

2619   c. else if tag is TPM_TAG_RQU_COMMAND

2620   i. Verify that authDataUsage is TPM_AUTH_NEVER for the key referenced by
2621   certHandle, return TPM_AUTHFAIL on error.

2622   ii. Verify that authDataUsage is TPM_AUTH_NEVER or
2623   TPM_NO_READ_PUBKEY_AUTH for the key referenced by keyHandle, return
2624   TPM_AUTHFAIL on error.

2625 3. If keyHandle -> payload is not TPM_PT_ASYM, return TPM_INVALID_KEYUSAGE.

2626 4. If the key pointed to by certHandle is an identity key (certHandle -> keyUsage is
2627 TPM_KEY_IDENTITY)

2628 a. If keyHandle -> keyFlags -> migratable is TRUE return TPM_MIGRATEFAIL

2629 5. Validate that certHandle -> keyUsage is TPM_KEY_SIGN, TPM_KEY_IDENTITY or
2630 TPM_KEY_LEGACY, if not return TPM_INVALID_KEYUSAGE

2631 6. Validate that keyHandle -> keyUsage is TPM_KEY_SIGN, TPM_KEY_STORAGE,
2632 TPM_KEY_IDENTITY, TPM_KEY_BIND or TPM_KEY_LEGACY, if not return
2633 TPM_INVALID_KEYUSAGE

2634 7. If keyHandle -> digestAtRelease requires the use of PCRs 16 or higher to calculate or if
2635 keyHandle -> localityAtRelease is not 0x1F

2636 a. Set V1 to 1.2

2637 8. Else

2638 a. Set V1 to 1.1

2639 9. If keyHandle -> pcrInfoSize is not 0

2640 a. If keyHandle -> keyFlags has pcrIgnoredOnRead set to FALSE

2641   i. Create a digestAtRelease according to the specified TPM_STCLEAR_DATA ->
2642   PCR registers and compare to keyHandle -> digestAtRelease and if a mismatch
2643   return TPM_WRONGPCRVAL

2644   ii. If specified validate any locality requests on error TPM_BAD_LOCALITY

2645 b. If V1 is 1.1

2646   i. Create C1 a TPM_CERTIFY_INFO structure

2647   ii. Fill in C1 with the information from the key pointed to by keyHandle

2648   iii. The TPM MUST set c1 -> pcrInfoSize to 44.

2649   iv. The TPM MUST set c1 -> pcrInfo to a TPM_PCR_INFO structure properly filled
2650   out using the information from keyHandle.

2651   v. The TPM MUST set c1 -> digestAtCreation to 20 bytes of 0x00.

2652 c. Else

2653   i. Create C1 a TPM_CERTIFY_INFO2 structure

2654   ii. Fill in C1 with the information from the key pointed to by keyHandle

2655   iii. Set C1 -> pcrInfoSize to the size of an appropriate TPM_PCR_INFO_SHORT
2656   structure.

2657   iv. Set C1 -> pcrInfo to a properly filled out TPM_PCR_INFO_SHORT structure,
2658   using the information from keyHandle.

2659   v. Set C1 -> migrationAuthoritySize to 0

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266010. Else

2661   a. Create C1 a TPM_CERTIFY_INFO structure

2662   b. Fill in C1 with the information from the key pointed to by keyHandle

2663   c. The TPM MUST set c1 -> pcrInfoSize to 0

266411. Create TPM_DIGEST H1 which is the SHA-1 hash of keyHandle -> pubKey -> key. Note
2665   that <key> is the actual public modulus, and does not include any structure formatting.

266612. Set C1 -> pubKeyDigest to H1

266713. The TPM copies the antiReplay parameter to c1 -> data.

266814. The TPM sets certifyInfo to C1.

266915. The TPM creates m1, a message digest formed by taking the SHA-1 of c1.

2670   a. The TPM then computes a signature using certHandle -> sigScheme. The resulting
2671   signed blob is returned in outData.

2672**13.9**   **TPM_CertifyKey2**

2673**Start of informative comment:**

2674This command is based on TPM_CertifyKey, but includes the ability to certify a Certifiable
2675Migration Key (CMK), which requires extra input parameters.

2676TPM_CertifyKey2 always produces a TPM_CERTIFY_INFO2 structure.

2677TPM_CertifyKey2 does not support the case where (a) the key-to-be-certified requires a
2678usage authorization to be provided but (b) the certifying key does not.

2679If a command tag (in the parameter array) specifies only one authorisation session, then the
2680TPM convention is that the first session listed is ignored (authDataUsage must be
2681TPM_NO_READ_PUBKEY_AUTH or TPM_AUTH_NEVER for this key) and the incoming
2682session data is used for the second auth session in the list. In TPM_CertifyKey2, the first
2683session is the key to be certified and the second session is the certifying key.

2684The key handles of both the certifying key and the key to be certified are not included in the
2685HMAC protecting the command. This permits key handle virtualization (swapping of keys
2686in and out of the TPM that results in different key handles while at the same time
2687maintaining key identifiers of upper layer software). In environments where the interface to
2688the TPM is accessible by other parties, the key handles not being protected allows an
2689attacker to change the handle of the key to be certified. This can be avoided by processing
2690this command within a transport session and making sure that antiReplay indeed contains
2691a nonce.

2692**End of informative comment.**

2693**Incoming Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH2_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_CertifyKey2
4	4			TPM_KEY_HANDLE	keyHandle	Handle of the key to be certified.
5	4			TPM_KEY_HANDLE	certHandle	Handle of the key to be used to certify the key.
6	20	2S	20	TPM_DIGEST	migrationPubDigest	The digest of a TPM_MSA_COMPOSITE structure, containing at least one public key of a Migration Authority
7	20	3S	20	TPM_NONCE	antiReplay	160 bits of externally supplied data (typically a nonce provided to prevent replay-attacks)
8	4			TPM_AUTHHANDLE	keyAuthHandle	The authorization session handle used for the key to be signed.
		2H1	20	TPM_NONCE	keylastNonceEven	Even nonce previously generated by TPM
9	20	3H1	20	TPM_NONCE	keynonceOdd	Nonce generated by system associated with keyAuthHandle
10	1	4H1	1	BOOL	continueKeySession	The continue use flag for the authorization session handle
11	20			TPM_AUTHDATA	keyAuth	The authorization session digest for the inputs and key to be signed. HMAC key: key.usageAuth.
12	4			TPM_AUTHHANDLE	certAuthHandle	The authorization session handle used for certHandle.
		2H2	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs

13	20	3H2	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with certAuthHandle
14	1	4H2	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
15	20			TPM_AUTHDATA	certAuth	Authorization HMAC key: certKey.auth.

2694 Outgoing Operands and Sizes

Param		HMAC		Type	Name	Description
#	Sz	#	Sz			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH2_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_CertifyKey2
4	<>	3S	<>	TPM_CERTIFY_INFO2	certifyInfo	TPM_CERTIFY_INFO2 relative to keyHandle
5	4	4S	4	UINT32	outDataSize	The used size of the output area for outData
6	<>	5S	<>	BYTE[ ]	outData	The signed public key.
7	20	2H1	20	TPM_NONCE	keyNonceEven	Even nonce newly generated by TPM
		3H1	20	TPM_NONCE	keyNonceOdd	Nonce generated by system associated with certAuthHandle
8	1	4H1	1	BOOL	keyContinueAuthSession	Continue use flag for cert key session
9	20		20	TPM_AUTHDATA	keyResAuth	Authorization HMAC key: keyHandle -> auth.
10	20	2H2	20	TPM_NONCE	certNonceEven	Even nonce newly generated by TPM
		3H2	20	TPM_NONCE	AuthLastNonceOdd	Nonce generated by system associated with certAuthHandle
11	1	4H2	1	BOOL	CertContinueAuthSession	Continue use flag for cert key session
12	20		20	TPM_AUTHDATA	certResAuth	Authorization HMAC key: certHandle -> auth.

2695 Actions

2696 1. The TPM validates that the key pointed to by certHandle has a signature scheme of
2697   TPM_SS_RSASSAPKCS1v15_SHA1 or TPM_SS_RSASSAPKCS1v15_INFO

2698 2. Verify command and key AuthData values:

2699   a. If tag is TPM_TAG_RQU_AUTH2_COMMAND

2700   i. The TPM verifies the AuthData in keyAuthHandle provides authorization to
2701   use the key pointed to by keyHandle, return TPM_AUTHFAIL on error

2702   ii. The TPM verifies the AuthData in certAuthHandle provides authorization to
2703   use the key pointed to by certHandle, return TPM_AUTH2FAIL on error

2704   b. else if tag is TPM_TAG_RQU_AUTH1_COMMAND

2705   i. Verify that authDataUsage is TPM_AUTH_NEVER or
2706   TPM_NO_READ_PUBKEY_AUTH for the key referenced by keyHandle, return
2707   TPM_AUTHFAIL on error

2708   ii. The TPM verifies the AuthData in certAuthHandle provides authorization to
2709   use the key pointed to by certHandle, return TPM_AUTH2FAIL on error

2710   c. else if tag is TPM_TAG_RQU_COMMAND

2711   i. Verify that authDataUsage is TPM_AUTH_NEVER or
2712   TPM_NO_READ_PUBKEY_AUTH for the key referenced by keyHandle, return
2713   TPM_AUTHFAIL on error

2714   ii. Verify that authDataUsage is TPM_AUTH_NEVER for the key referenced by
2715   certHandle, return TPM_AUTHFAIL on error.

27163. If the key pointed to by certHandle is an identity key (certHandle -> keyUsage is
2717   TPM_KEY_IDENTITY)

2718   a. If keyHandle -> keyFlags -> migratable is TRUE and [keyHandle -> keyFlags->
2719   migrateAuthority is FALSE or (keyHandle -> payload != TPM_PT_MIGRATE_RESTRICTED
2720   and   keyHandle   ->   payload   !=   TPM_PT_MIGRATE_EXTERNAL)]   return
2721   TPM_MIGRATEFAIL

27224. Validate that certHandle -> keyUsage is TPM_KEY_SIGNING, TPM_KEY_IDENTITY or
2723   TPM_KEY_LEGACY, if not return TPM_INVALID_KEYUSAGE

27245. Validate that keyHandle -> keyUsage is TPM_KEY_SIGNING, TPM_KEY_STORAGE,
2725   TPM_KEY_IDENTITY,   TPM_KEY_BIND   or   TPM_KEY_LEGACY,   if   not   return
2726   TPM_INVALID_KEYUSAGE

27276. The TPM SHALL create a c1 a TPM_CERTIFY_INFO2 structure from the key pointed to
2728   by keyHandle

27297. Create TPM_DIGEST H1 which is the SHA-1 hash of keyHandle -> pubKey -> key. Note
2730   that <key> is the actual public modulus, and does not include any structure formatting.

27318. Set C1 -> pubKeyDigest to H1

27329. Copy the antiReplay parameter to c1 -> data

273310. Copy other keyHandle parameters into C1

273411. If   keyHandle   ->   payload   ==   TPM_PT_MIGRATE_RESTRICTED   or
2735   TPM_PT_MIGRATE_EXTERNAL

2736   a. create thisPubKey, a TPM_PUBKEY structure containing the public key, algorithm
2737   and parameters corresponding to keyHandle

2738   b. Verify that the migration authorization is valid for this key

2739   i.   Create M2 a TPM_CMK_MIGAUTH structure

2740   ii. Set M2 -> msaDigest to migrationPubDigest

2741   iii. Set M2 -> pubkeyDigest to SHA-1[thisPubKey]

2742   iv. Verify that [keyHandle -> migrationAuth] == HMAC(M2) signed by using
2743   tpmProof as the secret and return error TPM_MA_SOURCE on mismatch

2744   c. Set C1 -> migrationAuthority = SHA-1(migrationPubDigest || keyHandle -> payload)

2745   d. if keyHandle -> payload == TPM_PT_MIGRATE_RESTRICTED

2746   i.   Set C1 -> payloadType = TPM_PT_MIGRATE_RESTRICTED

2747   e. if keyHandle -> payload == TPM_PT_MIGRATE_EXTERNAL

2748   i.   Set C1 -> payloadType = TPM_PT_MIGRATE_EXTERNAL

274912. Else

2750   a. set C1 -> migrationAuthority = NULL

2751   b. set C1 -> migrationAuthoritySize =0

2752   c. Set C1 -> payloadType = TPM_PT_ASYM

2753 13. If keyHandle -> pcrInfoSize is not 0

2754   a. The TPM MUST set c1 -> pcrInfoSize to match the pcrInfoSize from the keyHandle
2755   key.

2756   b. The TPM MUST set c1 -> pcrInfo to match the pcrInfo from the keyHandle key

2757   c. If keyHandle -> keyFlags has pcrIgnoredOnRead set to FALSE

2758   i. Create a digestAtRelease according to the specified TPM_STCLEAR_DATA ->
2759   PCR registers and compare to keyHandle -> digestAtRelease and if a mismatch
2760   return TPM_WRONGPCRVAL

2761   ii. If specified validate any locality requests on error TPM_BAD_LOCALITY

2762 14. Else

2763   a. The TPM MUST set c1 -> pcrInfoSize to 0

2764 15. The TPM creates m1, a message digest formed by taking the SHA-1 of c1

2765   a. The TPM then computes a signature using certHandle -> sigScheme. The resulting
2766   signed blob is returned in outData

2767**14.   Endorsement Key Handling**

27771. A TPM SHALL NOT install an EK unless generated on the TPM by execution of
2778   TPM_CreateEndorsementKeyPair or TPM_CreateRevocableEK

2779 14.1 TPM_CreateEndorsementKeyPair

2780 **Start of informative comment:**

2781 This command creates the TPM endorsement key. It returns a failure code if an
2782 endorsement key already exists.

2783 **End of informative comment.**

2784 Incoming Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_CreateEndorsementKeyPair
4	20	2S	20	TPM_NONCE	antiReplay	Arbitrary data
5	<>	3S	<>	TPM_KEY_PARMS	keyInfo	Information about key to be created, this includes all algorithm parameters

2785 Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_CreateEndorsementKeyPair
4	<>	3S	<>	TPM_PUBKEY	pubEndorsementKey	The public endorsement key
5	20	4S	20	TPM_DIGEST	checksum	Hash of pubEndorsementKey and antiReplay

2786 Actions

2787 1. If an EK already exists, return TPM_DISABLED_CMD

2788 2. Validate the keyInfo parameters for the key description

2789 a. If the algorithm type is RSA the key length MUST be a minimum of 2048. For
2790 interoperability the key length SHOULD be 2048

2791 b. If the algorithm type is other than RSA the strength provided by the key MUST be
2792 comparable to RSA 2048

2793 c. The other parameters of keyInfo (encScheme, sigScheme, etc.) are ignored.

2794 3. Create a key pair called the "endorsement key pair" using a TPM-protected capability.
2795 The type and size of key are that indicated by keyInfo. Set encScheme to
2796 TPM_ES_RSAESOAEP_SHA1_MGF1.

2797 4. Create checksum by performing SHA-1 on the concatenation of (PUBEK || antiReplay)

2798 5. Store the PRIVEK

2799 6. Create TPM_PERMANENT_DATA -> tpmDAASeed from the TPM RNG

28007. Create TPM_PERMANENT_DATA -> daaProof from the TPM RNG

28018. Create TPM_PERMANENT_DATA -> daaBlobKey from the TPM RNG

28029. Set TPM_PERMANENT_FLAGS -> CEKPUsed to TRUE

280310. Set TPM_PERMANENT_FLAGS -> enableRevokeEK to FALSE

2804 14.2 TPM_CreateRevocableEK

2805 **Start of informative comment:**

2806 This command creates the TPM endorsement key. It returns a failure code if an
2807 endorsement key already exists. The TPM vendor may have a separate mechanism to create
2808 the EK and "squirt" the value into the TPM.

2809 The input parameters specify whether the EK is capable of being reset, whether the
2810 AuthData value to reset the EK will be generated by the TPM, and the new AuthData value
2811 itself if it is not to be generated by the TPM. The output parameter is the new AuthData
2812 value that must be used when resetting the EK (if it is capable of being reset).

2813 The command TPM_RevokeTrust must be used to reset an EK (if it is capable of being
2814 reset).

2815 Owner authorisation is unsuitable for authorizing resetting of an EK: someone with
2816 Physical Presence can remove a genuine Owner, install a new Owner, and revoke the EK.
2817 The genuine Owner can reinstall, but the platform will have lost its original attestation and
2818 may not be trusted by challengers. Therefore if a password is to be used to revoke an EK, it
2819 must be a separate password, given to the genuine Owner.

2820 In v1.2 an OEM has extra choices when creating EKs.

2821 a) An OEM could manufacture all of its TPMs with enableRevokeEK==TRUE.

2822 If the OEM has tracked the EKreset passwords for these TPMs, the OEM can give the
2823 passwords to customers. The customers can use the passwords as supplied, change the
2824 passwords, or clear the EKs and create new EKs with new passwords.

2825 If EKreset passwords are random values, the OEM can discard those values and not give
2826 them to customers. There is then a low probability (statistically zero) chance of a local DOS
2827 attack to reset the EK by guessing the password. The chance of a remote DOS attack is zero
2828 because Physical Presence must also be asserted to use TPM_RevokeTrust.

2829 b) An OEM could manufacture some of its TPMs with enableRevokeEK==FALSE. Then the
2830 EK can never be revoked, and the chance of even a local DOS attack on the EK is
2831 eliminated.

2832 **End of informative comment.**

2833 This is an optional command

2834Incoming Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_CreateRevocableEK
4	20	2S	20	TPM_NONCE	antiReplay	Arbitrary data
5	<>	3S	<>	TPM_KEY_PARMS	keyInfo	Information about key to be created, this includes all algorithm parameters
6	1	4S	1	BOOL	generateReset	If TRUE use TPM RNG to generate EKreset. If FALSE use the passed value inputEKreset
7	20	5S	20	TPM_NONCE	inputEKreset	The authorization value to be used with TPM_RevokeTrust if generateReset==FALSE, else the parameter is present but ignored

2835Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_CreateRevocableEK
4	<>	3S	<>	TPM_PUBKEY	pubEndorsementKey	The public endorsement key
5	20	4S	20	TPM_DIGEST	checksum	Hash of pubEndorsementKey and antiReplay
6	20	5S	20	TPM_NONCE	outputEKreset	The AuthData value to use TPM_RevokeTrust

2836Actions

28371. If an EK already exists, return TPM_DISABLED_CMD

28382. Perform the actions of TPM_CreateEndorsementKeyPair, if any errors return with error

28393. Set TPM_PERMANENT_FLAGS -> enableRevokeEK to TRUE

2840   a. If generateReset is TRUE then

2841   i. Set TPM_PERMANENT_DATA -> EKreset to the next value from the TPM RNG

2842   b. Else

2843   i. Set TPM_PERMANENT_DATA -> EKreset to inputEKreset

28444. Return PUBEK, checksum and Ekreset

28455. The outputEKreset AuthData is sent in the clear. There is no uniqueness on the TPM
2846 available to actually perform encryption or use an encrypted channel. The assumption is
2847 that this operation is occurring in a controlled environment and sending the value in the
2848 clear is acceptable.

2849 14.3 TPM_RevokeTrust

2850 **Start of informative comment:**

2851 This command clears the EK and sets the TPM back to a pure default state. The generation
2852 of the AuthData value occurs during the generation of the EK. It is the responsibility of the
2853 EK generator to properly protect and disseminate the RevokeTrust AuthData.

2854 **End of informative comment.**

2855 This is an optional command

2856 Incoming Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_RevokeTrust
4	20	2S	20	TPM_NONCE	EKReset	The value that will be matched to EK Reset

2857 Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_RevokeTrust

2858 Actions

2859 1. The TPM MUST validate that TPM_PERMANENT_FLAGS -> enableRevokeEK is TRUE,
2860 return TPM_PERMANENTEK on error

2861 2. The TPM MUST validate that the EKReset matches TPM_PERMANENT_DATA -> EKReset
2862 return TPM_AUTHFAIL on error.

2863 3. Ensure that physical presence is being asserted

2864 4. Perform the actions of TPM_OwnerClear (excepting the command authentication)

2865 a. NV items with the pubInfo -> nvIndex D value set MUST be deleted. This changes the
2866 TPM_OwnerClear handling of the same NV areas

2867 b. Set TPM_PERMANENT_FLAGS -> nvLocked to FALSE

2868 5. Invalidate TPM_PERMANENT_DATA -> tpmDAASeed

2869 6. Invalidate TPM_PERMANENT_DATA -> daaProof

2870 7. Invalidate TPM_PERMANENT_DATA -> daaBlobKey

2871 8. Invalidate the EK and any internal state associated with the EK

2872 14.4   TPM_ReadPubek

2873**Start of informative comment:**

2874Return the endorsement key public portion. This value should have controls placed upon 2875access, as it is a privacy sensitive value.

2876The readPubek flag is set to FALSE by TPM_TakeOwnership and set to TRUE by 2877TPM_OwnerClear, thus mirroring if a TPM Owner is present.

2878**End of informative comment.**

2879**Incoming Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_ReadPubek
4	20	2S	20	TPM_NONCE	antiReplay	Arbitrary data

2880**Outgoing Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_ReadPubek
4	<>	3S	<>	TPM_PUBKEY	pubEndorsementKey	The public endorsement key
5	20	4S	20	TPM_DIGEST	checksum	Hash of pubEndorsementKey and antiReplay

2881**Description**

2882This command returns the PUBEK.

2883**Actions**

2884The TPM_ReadPubek command SHALL

28851. If TPM_PERMANENT_FLAGS -> readPubek is FALSE return TPM_DISABLED_CMD

28862. If no EK is present the TPM MUST return TPM_NO_ENDORSEMENT

28873. Create checksum by performing SHA-1 on the concatenation of (pubEndorsementKey || 2888 antiReplay).

28894. Export the PUBEK and checksum.

2890 14.5 TPM_OwnerReadInternalPub

2897 Incoming Operands and Sizes

PARAM #	PARAM SZ	HMAC #	HMAC SZ	Type	Name	Description
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_OwnerReadInternalPub
4	4	2S	4	TPM_KEY_HANDLE	keyHandle	Handle for either PUBEK or SRK
5	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for owner authentication.
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
6	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
7	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
8	20			TPM_AUTHDATA	ownerAuth	The authorization session digest for inputs and owner authentication. HMAC key: ownerAuth.

2898 Outgoing Operands and Sizes

PARAM #	PARAM SZ	HMAC #	HMAC SZ	Type	Name	Description
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_OwnerReadInternalPub
4	<>	3S	<>	TPM_PUBKEY	publicPortion	The public portion of the requested key
5	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
6	1	4H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
7	20			TPM_AUTHDATA	resAuth	The authorization session digest for the returned parameters. HMAC key: ownerAuth.

2899 Actions

2900 1. Validate the parameters and TPM Owner AuthData for this command

2901 2. If keyHandle is TPM_KH_EK

2902   a. Set publicPortion to PUBEK

29033. Else If keyHandle is TPM_KH_SRK

2904   a. Set publicPortion to the TPM_PUBKEY of the SRK

29054. Else return TPM_BAD_PARAMETER

29065. Export the public key of the referenced key

2907 15.   Identity Creation and Activation

2908 15.1   TPM_MakeIdentity

2918 **Incoming Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH2_COMMAND
2	4			UINT32	paramSize	Total number of input bytes incl. paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_MakeIdentity.
4	20	2S	20	TPM_ENCAUTH	identityAuth	Encrypted usage AuthData for the new identity
5	20	3S	20	TPM_CHOSENID_HASH	labelPrivCADigest	The digest of the identity label and privacy CA chosen for the AIK
6	<>	4S	<>	TPM_KEY	idKeyParams	Structure containing all parameters of new identity key. pubKey.keyLength & idKeyParams.encData are both 0 MAY be TPM_KEY12
7	4			TPM_AUTHHANDLE	srkAuthHandle	The authorization session handle used for SRK authorization.
		2H1	20	TPM_NONCE	srkLastNonceEven	Even nonce previously generated by TPM
8	20	3H1	20	TPM_NONCE	srknonceOdd	Nonce generated by system associated with srkAuthHandle
9	1	4H1	1	BOOL	continueSrkSession	Ignored
10	20			TPM_AUTHDATA	srkAuth	The authorization session digest for the inputs and the SRK. HMAC key: srk.usageAuth.
11	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for owner authentication. Session type MUST be OSAP.
		2H2	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
12	20	3H2	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
13	1	4H2	1	BOOL	continueAuthSession	Ignored
14	20		20	TPM_AUTHDATA	ownerAuth	The authorization session digest for inputs and owner. HMAC key: ownerAuth.

2919Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH2_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal:TPM_ORD_MakeIdentity.
4	<>	3S	<>	TPM_KEY	idKey	The newly created identity key. MAY be TPM_KEY12
5	4	4S	4	UINT32	identityBindingSize	The used size of the output area for identityBinding
6	<>	5S	<>	BYTE[ ]	identityBinding	Signature of TPM_IDENTITY_CONTENTS using idKey.private.
7	20	2H2	20	TPM_NONCE	srkNonceEven	Even nonce newly generated by TPM.
		3H2	20	TPM_NONCE	srknonceOdd	Nonce generated by system associated with srkAuthHandle
8	1	4H2	1	BOOL	continueSrkSession	Continue use flag. Fixed value of FALSE
9	20			TPM_AUTHDATA	srkAuth	The authorization session digest used for the outputs and srkAuth session. HMAC key: srk.usageAuth.
10	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
11	1	4H1	1	BOOL	continueAuthSession	Continue use flag. Fixed value of FALSE
12	20		20	TPM_AUTHDATA	resAuth	The authorization session digest for the returned parameters. HMAC key: ownerAuth.

2920Description

2921The public key of the new TPM identity SHALL be identityPubKey. The private key of the 2922new TPM identity SHALL be tpm_signature_key.

2923Properties of the new identity

Type	Name	Description
TPM_PUBKEY	identityPubKey	This SHALL be the public key of a previously unused asymmetric key pair.
TPM_STORE_ASYMKEY	tpm_signature_key	This SHALL be the private key that forms a pair with identityPubKey and SHALL be extant only in a TPM-shielded location.

2924

2925This capability also generates a TPM_KEY containing the tpm_signature_key.

2926If identityPubKey is stored on a platform it SHALL exist only in storage to which access is 2927controlled and is available to authorized entities.

2928The signing of TPM_ID_CONTENTS is not an authorized use of the key. The 2929TPM_PCR_INFO_xxx "…AtRelease" values are not validated.

2930Actions

2931A Trusted Platform Module that receives a valid TPM_MakeIdentity command SHALL do the 2932following:

29331. Validate the idKeyParams parameters for the key description

739
740

2934　a.　If the algorithm type is RSA, the key length MUST be a minimum of 2048 and MUST
2935　use the default exponent. For interoperability the key length SHOULD be 2048.

2936　b.　If the algorithm type is other than RSA the strength provided by the key MUST be
2937　comparable to RSA 2048

2938　c.　If the TPM is not designed to create a key of the requested type, return the error code
2939　TPM_BAD_KEY_PROPERTY

2940　d.　If TPM_PERMANENT_FLAGS -> FIPS is TRUE then

2941　　　i.　If authDataUsage specifies TPM_AUTH_NEVER return TPM_NOTFIPS

29422.　Use authHandle to verify that the Owner authorized all TPM_MakeIdentity input
2943　parameters.

29443.　Use srkAuthHandle to verify that the SRK owner authorized all TPM_MakeIdentity input
2945　parameters.

29464.　Verify that idKeyParams -> keyUsage is TPM_KEY_IDENTITY. If it is not, return
2947　TPM_INVALID_KEYUSAGE

29485.　Verify that idKeyParams -> keyFlags -> migratable is FALSE. If it is not, return
2949　TPM_INVALID_KEYUSAGE

29506.　Create a1 by decrypting identityAuth according to the ADIP indicated by authHandle.

29517.　Set continueAuthSession and continueSRKSession to FALSE.

29528.　Determine the structure version

2953　a.　If idKeyParams -> tag is TPM_TAG_KEY12

2954　　　i.　Set V1 to 2

2955　　　ii.　Create idKey a TPM_KEY12 structure using idKeyParams as the default values
2956　　　for the structure

2957　b.　If idKeyParams -> ver is 1.1

2958　　　i.　Set V1 to 1

2959　　　ii.　Create idKey a TPM_KEY structure using idKeyParams as the default values
2960　　　for the structure

29619.　Set the digestAtCreation values for pcrInfo

2962　a.　For TPM_PCR_INFO_LONG include the locality of the current command

296310.Create an asymmetric key pair (identityPubKey and tpm_signature_key) using a TPM-
2964　protected capability, in accordance with the algorithm specified in idKeyParams

296511.Ensure that the AuthData information in A1 is properly stored in the idKey as
2966　usageAuth.

296712.Attach identityPubKey and tpm_signature_key to idKey

296813.Set idKey -> migrationAuth to TPM_PERMANENT_DATA-> tpmProof

296914.Ensure that all TPM_PAYLOAD_TYPE structures identify this key as TPM_PT_ASYM

297015.Encrypt the private portion of idKey using the SRK as the parent key

297116. Create a TPM_IDENTITY_CONTENTS structure named idContents using
2972   labelPrivCADigest and the information from idKey

297317. Sign idContents using tpm_signature_key and TPM_SS_RSASSAPKCS1v15_SHA1. Store
2974   the result in identityBinding.

2975 15.2 TPM_ActivateIdentity

2976 **Start of informative comment:**

2977 The purpose of TPM_ActivateIdentity is to twofold. The first purpose is to obtain assurance
2978 that the credential in the TPM_SYM_CA_ATTESTATION is for this TPM. The second purpose
2979 is to obtain the session key used to encrypt the TPM_IDENTITY_CREDENTIAL.

2980 This is an extension to the 1.1 functionality of TPM_ActivateIdentity. The blob sent to from
2981 the CA can be in the 1.1 format or the 1.2 format. The TPM determines the type from the
2982 size or version information in the blob.

2983 TPM_ActivateIdentity checks that the symmetric session key corresponds to a TPM-identity
2984 before releasing that session key.

2985 Only the Owner of the TPM has the privilege of activating a TPM identity. The Owner is
2986 required to authorize the TPM_ActivateIdentity command. The owner may authorize the
2987 command using either the TPM_OIAP or TPM_OSAP authorization protocols.

2988 The creator of the ActivateIdentity package can specify if any PCR values are to be checked
2989 before releasing the session key.

2990 **End of informative comment.**

2991 **Incoming Parameters and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH2_COMMAND
2	4			UINT32	paramSize	Total number of input bytes incl. paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_ActivateIdentity
4	4			TPM_KEY_HANDLE	idKeyHandle	Identity key to be activated
5	4	2S	4	UINT32	blobSize	Size of encrypted blob from CA
6	<>	3S	<>	BYTE [ ]	blob	The encrypted ASYM_CA_CONTENTS or TPM_EK_BLOB
7	4			TPM_AUTHHANDLE	idKeyAuthHandle	The authorization session handle used for ID key authorization.
		2H1	20	TPM_NONCE	idKeyLastNonceEven	Even nonce previously generated by TPM
8	20	3H1	20	TPM_NONCE	idKeynonceOdd	Nonce generated by system associated with idKeyAuthHandle
9	1	4H1	1	BOOL	continueIdKeySession	Continue usage flag for idKeyAuthHandle.
10	20			TPM_AUTHDATA	idKeyAuth	The authorization session digest for the inputs and ID key. HMAC key: idKey.usageAuth.
11	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for owner authentication.
		2H2	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
12	20	3H2	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
13	1	4H2	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
14	20		20	TPM_AUTHDATA	ownerAuth	The authorization session digest for inputs and owner. HMAC key: ownerAuth.

2992Outgoing Parameters and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH2_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal:TPM_ORD_ActivateIdentity
4	<>	3S	<>	TPM_SYMMETRIC_KEY	symmetricKey	The decrypted symmetric key.
5	20	2H1	20	TPM_NONCE	idKeyNonceEven	Even nonce newly generated by TPM.
		3H1	20	TPM_NONCE	idKeynonceOdd	Nonce generated by system associated with idKeyAuthHandle
6	1	4H1	1	BOOL	continueIdKeySession	Continue use flag, TRUE if handle is still active
7	20			TPM_AUTHDATA	idKeyAuth	The authorization session digest used for the returned parameters and idKeyAuth session. HMAC key: idKey.usageAuth.
8	20	2H2	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H2	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
9	1	4H2	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
10	20		20	TPM_AUTHDATA	resAuth	The authorization session digest for the returned parameters. HMAC key: ownerAuth.

2993Description

29941. The command TPM_ActivateIdentity activates a TPM identity created using the command
2995   TPM_MakeIdentity.

29962. The command assumes the availability of the private key associated with the identity.
2997   The command will verify the association between the keys during the process.

29983. The command will decrypt the input blob and extract the session key and verify the
2999   connection between the public and private keys. The input blob can be in 1.1 or 1.2
3000   format.

3001Actions

3002A Trusted Platform Module that receives a valid TPM_ActivateIdentity command SHALL do
3003the following:

30041. Using the authHandle field, validate the owner's AuthData to execute the command and
3005   all of the incoming parameters.

30062. Using the idKeyAuthHandle, validate the AuthData to execute command and all of the
3007   incoming parameters

30083. Validate that the idKey is the public key of a valid TPM identity by checking that
3009   idKeyHandle -> keyUsage is TPM_KEY_IDENTITY. Return TPM_BAD_PARAMETER on
3010   mismatch

30114. Create H1 the digest of a TPM_PUBKEY derived from idKey

30125. Decrypt blob creating B1 using PRIVEK as the decryption key

30136. Determine the type and version of B1

3014   a. If B1 -> tag is TPM_TAG_EK_BLOB then

3015   i. B1 is a TPM_EK_BLOB

3016   b. Else

3017   i. B1 is a TPM_ASYM_CA_CONTENTS. As there is no tag for this structure it is
3018   possible for the TPM to make a mistake here but other sections of the structure
3019   undergo validation

3020 7. If B1 is a version 1.1 TPM_ASYM_CA_CONTENTS then

3021   a. Compare H1 to B1 -> idDigest on mismatch return TPM_BAD_PARAMETER

3022   b. Set K1 to B1 -> sessionKey

3023 8. If B1 is a TPM_EK_BLOB then

3024   a. Validate that B1 -> ekType is TPM_EK_TYPE_ACTIVATE, return TPM_BAD_TYPE if
3025   not.

3026   b. Assign A1 as a TPM_EK_BLOB_ACTIVATE structure from B1 -> blob

3027   c. Compare H1 to A1 -> idDigest on mismatch return TPM_BAD_PARAMETER

3028   d. If A1 -> pcrSelection is not NULL

3029   i. Compute a composite hash C1 using the PCR selection A1 -> pcrSelection

3030   ii. Compare C1 to A1 -> pcrInfo->digestAtRelease and return
3031   TPM_WRONGPCRVAL on a mismatch

3032   e. If A1 -> pcrInfo specifies a locality ensure that the appropriate locality has
3033   been asserted, return TPM_BAD_LOCALITY on error

3034   f. Set K1 to A1 -> symmetricKey

3035 9. Return K1

3036 16.   Integrity Collection and Reporting

3037 **Start of informative comment:**

3038 This section deals with what commands have direct access to the PCR

3039 **End of informative comment.**

3040 1. The TPM SHALL only allow the following commands to alter the value of
3041   TPM_STCLEAR_DATA -> PCR

3042   a. TPM_Extend

3043   b. TPM_SHA1CompleteExtend

3044   c. TPM_Startup

3045   d. TPM_PCR_Reset

3046 16.1 TPM_Extend

3050 Incoming Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_Extend.
4	4	2S	4	TPM_PCRINDEX	pcrNum	The PCR to be updated.
5	20	3S	20	TPM_DIGEST	inDigest	The 160 bit value representing the event to be recorded.

3051 Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_Extend.
4	20	3S	20	TPM_PCRVALUE	outDigest	The PCR value after execution of the command.

3052 Description

3053Add a measurement value to a PCR

3054 Actions

30551. Validate that pcrNum represents a legal PCR number. On error, return TPM_BADINDEX.

30562. Map L1 to TPM_STANY_FLAGS -> localityModifier

30573. Map P1 to TPM_PERMANENT_DATA -> pcrAttrib [pcrNum]. pcrExtendLocal

30584. If, for the value of L1, the corresponding bit is not set in the bit map P1, return
3059   TPM_BAD_LOCALITY

30605. Create c1 by concatenating (TPM_STCLEAR_DATA -> PCR[pcrNum] || inDigest). This
3061   takes the current PCR value and concatenates the inDigest parameter.

30626. Create h1 by performing a SHA-1 digest of c1.

30637. Store h1 to TPM_STCLEAR_DATA -> PCR[pcrNum]

30648. If TPM_PERMANENT_FLAGS -> disable is TRUE or TPM_STCLEAR_FLAGS -> deactivated
3065   is TRUE

3066   a. Set outDigest to 20 bytes of 0x00

30679. Else

3068   a. Set outDigest to h1

3069 16.2 TPM_PCRRead

3071 The TPM_PCRRead operation provides non-cryptographic reporting of the contents of a
3072 named PCR.

3074 **Incoming Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_PCRRead.
4	4	2S	4	TPM_PCRINDEX	pcrIndex	Index of the PCR to be read

3075 **Outgoing Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_PCRRead.
4	20	3S	20	TPM_PCRVALUE	outDigest	The current contents of the named PCR

3076 **Description**

3077 The TPM_PCRRead operation returns the current contents of the named register to the
3078 caller.

3079 **Actions**

3080 1. Validate that pcrIndex represents a legal PCR number. On error, return
3081   TPM_BADINDEX.

3082 2. Set outDigest to TPM_STCLEAR_DATA -> PCR[pcrIndex]

3083 3. Return TPM_SUCCESS

3084

3085 16.3   TPM_Quote

3086**Start of informative comment:**

3087The TPM_Quote operation provides cryptographic reporting of PCR values. A loaded key is
3088required for operation. TPM_Quote uses a key to sign a statement that names the current
3089value of a chosen PCR and externally supplied data (which may be a nonce supplied by a
3090Challenger).

3091The term "ExternalData" is used because an important use of TPM_Quote is to provide a
3092digital signature on arbitrary data, where the signature includes the PCR values of the
3093platform at time of signing. Hence the "ExternalData" is not just for anti-replay purposes,
3094although it is (of course) used for that purpose in an integrity challenge.

3095TPM_Quote should not use a TPM_KEY_SIGNING, because there is no way for the remote
3096party to tell whether TPM_Quote or TPM_Sign created the signature. The exception is a
3097TPM_KEY_SIGNING key with the _INFO signature   scheme,   because   the   metadata
3098differentiates TPM_Sign from TPM_Quote.

3099**End of informative comment.**

3100 Incoming Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_Quote.
4	4			TPM_KEY_HANDLE	keyHandle	The keyHandle identifier of a loaded key that can sign the PCR values.
5	20	2S	20	TPM_NONCE	externalData	160 bits of externally supplied data (typically a nonce provided by a server to prevent replay-attacks)
6	<>	3S	<>	TPM_PCR_SELECTION	targetPCR	The indices of the PCRs that are to be reported.
7	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for keyHandle authorization.
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
8	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
9	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
10	20			TPM_AUTHDATA	privAuth	The authorization session digest for inputs and keyHandle. HMAC key: key -> usageAuth.

3101 Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_Quote.
4	<>	3S	<>	TPM_PCR_COMPOSITE	pcrData	A structure containing the same indices as targetPCR, plus the corresponding current PCR values.
5	4	4S	4	UINT32	sigSize	The used size of the output area for the signature
6	<>	5S	<>	BYTE[ ]	sig	The signed data blob.
7	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
8	1	4H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
9	20			TPM_AUTHDATA	resAuth	The authorization session digest for the returned parameters. HMAC key: Key -> usageAuth.

3102 Actions

3103 1. The TPM MUST validate the AuthData to use the key pointed to by keyHandle.

3104 2. Validate that keyHandle -> sigScheme is TPM_SS_RSASSAPKCS1v15_SHA1 or
3105   TPM_SS_RSASSAPKCS1v15_INFO, if not return TPM_INAPPROPRIATE_SIG.

3106 3. Validate that keyHandle -> keyUsage is TPM_KEY_SIGNING, TPM_KEY_IDENTITY, or
3107   TPM_KEY_LEGACY, if not return TPM_INVALID_KEYUSAGE

3108 4. Validate targetPCR

3109   a. targetPCR is a valid TPM_PCR_SELECTION structure

3110   b. On errors return TPM_INVALID_PCR_INFO

3111 5. Create H1 a SHA-1 hash of a TPM_PCR_COMPOSITE using the TPM_STCLEAR_DATA ->
3112   PCR indicated by targetPCR -> pcrSelect

3113 6. Create Q1 a TPM_QUOTE_INFO structure

3114   a. Set Q1 -> version to 1.1.0.0

3115   b. Set Q1 -> fixed to "QUOT"

3116   c. Set Q1 -> digestValue to H1

3117   d. Set Q1 -> externalData to externalData

3118 7. Sign SHA-1 hash of Q1 using keyHandle as the signature key

3119 8. Return the signature in sig

3120**16.4   TPM_PCR_Reset**

3121**Start of informative comment:**

3122For PCR with the pcrReset attribute set to TRUE, this command resets the PCR back to the
3123default value, this mimics the actions of TPM_Init. The PCR may have restrictions as to
3124which locality can perform the reset operation.

3125Sending a null pcrSelection results in an error is due to the requirement that the command
3126actually do something. If pcrSelection is null there are no PCR to reset and the command
3127would then do nothing.

3128For PCR that are resettable, the presence of a Trusted Operating System (TOS) can change
3129the behavior of TPM_PCR_Reset. The following pseudo code shows how the behavior
3130changes

3131At TPM_Startup

3132   If TPM_PCR_ATTRIBUTES->pcrReset is FALSE

3133   Set PCR to 0x00...00

3134   Else

3135   Set PCR to 0xFF...FF

3136At TPM_PCR_Reset

3137   If TPM_PCR_ATTRIBUTES->pcrReset is TRUE

3138   If TOSPresent

3139   Set PCR to 0x00...00

3140   Else

3141   Set PCR to 0xFF...FF

3142   Else

3143   Return error

3144The above pseudocode is for example only, for the details of a specific platform, the reader
3145must review the platform specific specification. The purpose of the above pseudocode is to
3146show that both pcrReset and the TOSPresent bit control the value in use to when the PCR
3147resets.

3148**End of informative comment.**

3149**Incoming Parameters and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_PCR_Reset
4	<>	2S	<>	TPM_PCR_SELECTION	pcrSelection	The PCR's to reset

315O**Outgoing Parameters and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_PCR_Reset

3151**Description**

3152This command resets PCR values back to the default value. The command MUST validate
3153that all PCR registers that are selected are available to be reset before resetting any PCR.
3154This command MUST either reset all selected PCR registers or none of the PCR registers.

3155**Actions**

31561. Validate that pcrSelection is valid

3157   a. is a valid TPM_PCR_SELECTION structure

3158   b. pcrSelection -> pcrSelect is non-zero

3159   c. On errors return TPM_INVALID_PCR_INFO

31602. Map L1 to TPM_STANY_FLAGS -> localityModifier

31613. For each PCR selected perform the following

3162   a. If TPM_PERMANENT_DATA -> pcrAttrib[pcrIndex].pcrReset is FALSE, return
3163   TPM_NOTRESETABLE

3164   b. If, for the value L1, the corresponding bit is clear in the bit map
3165   TPM_PERMANENT_DATA -> pcrAttrib[pcrIndex].pcrResetLocal, return TPM_NOTLOCAL

31664. For each PCR selected perform the following

3167   a. The PCR MAY only reset to 0x00...00 or 0xFF...FF

3168   b. The logic to determine which value to use MUST be described by a platform specific
3169   specification

3170 16.5   TPM_Quote2

3171 **Start of informative comment:**

3172 The TPM_Quote2 operation provides cryptographic reporting of PCR values. A loaded key is
3173 required for operation. TPM_Quote2 uses a key to sign a statement that names the current
3174 value of a chosen PCR and externally supplied data (which may be a nonce supplied by a
3175 Challenger).

3176 The term "externalData" is used because an important use of TPM_Quote2 is to provide a
3177 digital signature on arbitrary data, where the signature includes the PCR values of the
3178 platform at time of signing. Hence the "externalData" is not just for anti-replay purposes,
3179 although it is (of course) used for that purpose in an integrity challenge.

3180 TPM_Quote2 differs from TPM_Quote in that TPM_Quote2 uses TPM_PCR_INFO_SHORT to
3181 hold information relative to the PCR registers. TPM_PCR_INFO_SHORT includes locality
3182 information to provide the requestor a more complete view of the current platform
3183 configuration.

3184 **End of informative comment.**

3185 **Incoming Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_Quote2
4	4			TPM_KEY_HANDLE	keyHandle	The keyHandle identifier of a loaded key that can sign the PCR values.
5	20	2S	20	TPM_NONCE	externalData	160 bits of externally supplied data (typically a nonce provided by a server to prevent replay-attacks)
6	<>	3S	<>	TPM_PCR_SELECTION	targetPCR	The indices of the PCRs that are to be reported.
7	1	4S	1	BOOL	addVersion	When TRUE add TPM_CAP_VERSION_INFO to the output
8	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for keyHandle authorization.
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
9	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
10	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
11	20			TPM_AUTHDATA	privAuth	The authorization session digest for inputs and keyHandle. HMAC key: key -> usageAuth.

3186 Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_Quote2
4	<>	3S	<>	TPM_PCR_INFO_SHORT	pcrData	The value created and signed for the quote
5	4	4S	4	UINT32	versionInfoSize	Size of the version info
6	<>	5S	<>	TPM_CAP_VERSION_INFO	versionInfo	The version info
7	4	6S	4	UINT32	sigSize	The used size of the output area for the signature
8	<>	7S	<>	BYTE[ ]	sig	The signed data blob.
9	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
10	1	4H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
11	20			TPM_AUTHDATA	resAuth	The authorization session digest for the returned parameters. HMAC key: Key -> usageAuth.

3187 Actions

3188 1. The TPM MUST validate the AuthData to use the key pointed to by keyHandle.

3189 2. Validate that keyHandle -> sigScheme is TPM_SS_RSASSAPKCS1v15_SHA1 or
3190 TPM_SS_RSASSAPKCS1v15_INFO, if not return TPM_INAPPROPRIATE_SIG.

3191 3. Validate that keyHandle -> keyUsage is TPM_KEY_SIGNING, TPM_KEY_IDENTITY, or
3192 TPM_KEY_LEGACY, if not return TPM_INVALID_KEYUSAGE

3193 4. Validate targetPCR is a valid TPM_PCR_SELECTION structure, on errors return
3194 TPM_INVALID_PCR_INFO

3195 5. Create H1 a SHA-1 hash of a TPM_PCR_COMPOSITE using the TPM_STCLEAR_DATA ->
3196 PCR[] indicated by targetPCR -> pcrSelect

3197 6. Create S1 a TPM_PCR_INFO_SHORT

3198 a. Set S1->pcrSelection to targetPCR

3199 b. Set S1->localityAtRelease to TPM_STANY_DATA -> localityModifier

3200 c. Set S1->digestAtRelease to H1

3201 7. Create Q1 a TPM_QUOTE_INFO2 structure

3202 a. Set Q1 -> fixed to "QUT2"

3203 b. Set Q1 -> infoShort to S1

3204 c. Set Q1 -> externalData to externalData

3205 8. If addVersion is TRUE

3206 a. Concatenate to Q1 a TPM_CAP_VERSION_INFO structure

3207   b. Set the output parameters for versionInfo

32089. Else

3209   a. Set versionInfoSize to 0

3210   b. Return no bytes in versionInfo

321110.Sign a SHA-1 hash of Q1 using keyHandle as the signature key

321211.Return the signature in sig

3213 17. Changing AuthData

3214 17.1 TPM_ChangeAuth

3215 **Start of informative comment:**

3216 The TPM_ChangeAuth command allows the owner of an entity to change the AuthData for
3217 the entity.

3218 This command cannot invalidate the old entity. Therefore, the authorization change is only
3219 effective if the application can guarantee that the old entity can be securely destroyed. If
3220 not, two valid entities will exist, one with the old and one with the new authorization secret.

3221 If this command is delegated, the delegated party can expand its key use privileges. That
3222 party can create a copy of the key with known authorization, and it can then use the key
3223 without any ordinal restrictions.

3224 TPM_ChangeAuth requires the encryption of one parameter ("NewAuth"). For the sake of
3225 uniformity with other commands that require the encryption of more than one parameter,
3226 the parameters used for used encryption are generated from the authLastNonceEven
3227 (created during the OSAP session), nonceOdd, and the session shared secret.

3228 The parameter list to this command must always include two authorization sessions,
3229 regardless of the state of authDataUsage for the respective keys.

3230 **End of informative comment.**

3231

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH2_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_ChangeAuth
4	4			TPM_KEY_HANDLE	parentHandle	Handle of the parent key to the entity.
5	2	2 S	2	TPM_PROTOCOL_ID	protocolID	The protocol in use.
6	20	3 S	20	TPM_ENCAUTH	newAuth	The encrypted new AuthData for the entity
7	2	4 S	2	TPM_ENTITY_TYPE	entityType	The type of entity to be modified
8	4	5 S	4	UINT32	encDataSize	The size of the encData parameter
9	<>	6 S	<>	BYTE[ ]	encData	The encrypted entity that is to be modified.
10	4			TPM_AUTHHANDLE	parentAuthHandle	The authorization session handle used for the parent key.
		2 H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
11	20	3 H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with parentAuthHandle
12	1	4 H1	1	BOOL	continueAuthSession	Ignored, parentAuthHandle is always terminated.
13	20			TPM_AUTHDATA	parentAuth	The authorization session digest for inputs and parentHandle. HMAC key: parentKey.usageAuth.
14	4			TPM_AUTHHANDLE	entityAuthHandle	The authorization session handle used for the encrypted entity. The session type MUST be OIAP
		2 H2	20	TPM_NONCE	entitylastNonceEven	Even nonce previously generated by TPM
15	20	3 H2	20	TPM_NONCE	entitynonceOdd	Nonce generated by system associated with entityAuthHandle
16	1	4 H2	1	BOOL	continueEntitySession	Ignored, entityAuthHandle is always terminated.
17	20			TPM_AUTHDATA	entityAuth	The authorization session digest for the inputs and encrypted entity. HMAC key: entity.usageAuth.

3232 Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH2_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation. See section 4.3.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_ChangeAuth
4	4	3S	4	UINT32	outDataSize	The used size of the output area for outData
5	<>	4S	<>	BYTE[ ]	outData	The modified, encrypted entity.
6	20	2 H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3 H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with parentAuthHandle
7	1	4 H1	1	BOOL	continueAuthSession	Continue use flag, fixed value of FALSE
8	20			TPM_AUTHDATA	resAuth	The authorization session digest for the returned parameters and parentHandle. HMAC key: parentKey.usageAuth.
9	20	2 H2	20	TPM_NONCE	entityNonceEven	Even nonce newly generated by TPM to cover entity
		3 H2	20	TPM_NONCE	entitynonceOdd	Nonce generated by system associated with entityAuthHandle
10	1	4 H2	1	BOOL	continueEntitySession	Continue use flag, fixed value of FALSE
11	20			TPM_AUTHDATA	entityAuth	The authorization session digest for the returned parameters and entity. HMAC key: entity.usageAuth, the original and not the new auth value

3233 Description

3234 1. The parentAuthHandle session type MUST be TPM_PID_OSAP.

3235 2. In this capability, the SRK cannot be accessed as entityType TPM_ET_KEY, since the
3236 SRK is not wrapped by a parent key.

3237 Actions

3238 1. Verify that entityType is one of TPM_ET_DATA, TPM_ET_KEY and return the error
3239 TPM_WRONG_ENTITYTYPE if not.

3240 2. Verify that parentAuthHandle session type is TPM_PID_OSAP return TPM_BAD_MODE
3241 on error

3242 3. Verify that entityAuthHandle session type is TPM_PID_OIAP return TPM_BAD_MODE on
3243 error

3244 4. If protocolID is not TPM_PID_ADCP, the TPM MUST return TPM_BAD_PARAMETER.

3245 5. The encData parameter MUST be the encData field from either the TPM_STORED_DATA
3246 or TPM_KEY structures.

3247 6. Create decryptAuth by decrypting newAuth according to the ADIP indicated by
3248 parentHandle.

3249 7. The TPM MUST validate the command using the AuthData in the parentAuth parameter

3250 8. Validate that parentHandle -> keyUsage is TPM_KEY_STORAGE, if not return
3251 TPM_INVALID_KEYUSAGE

3252 9. After parameter validation, the TPM creates b1 by decrypting encData using the key
3253   pointed to by parentHandle.

3254 10. The TPM MUST validate that b1 is a valid TPM structure, either a
3255   TPM_STORE_ASYMKEY or a TPM_SEALED_DATA

3256   a. Check the length and payload, return TPM_INVALID_STRUCTURE on any mismatch

3257   b. The TPM must validate the command using the authorization data entityAuth
3258   parameter.   The HMAC key is TPM_STORE_ASYMKEY -> usageAuth or
3259   TPM_SEALED_DATA -> authData.

3260 11. The TPM replaces the AuthData for b1 with decryptAuth created above.

3261 12. The TPM encrypts b1 using the appropriate mechanism for the type using the
3262   parentKeyHandle to provide the key information.

3263 13. The TPM MUST enforce the destruction of both the parentAuthHandle and
3264   entityAuthHandle sessions.

3265 17.2 TPM_ChangeAuthOwner

3266 **Start of informative comment:**

3267 The TPM_ChangeAuthOwner command allows the owner of an entity to change the
3268 AuthData for the TPM Owner or the SRK.

3269 This command requires authorization from the current TPM Owner to execute.

3270 TPM's targeted for an environment (e.g. a server) with long lasting sessions should not
3271 invalidate all sessions.

3272 **End of informative comment.**

3273 Incoming Operands and Sizes

PARAM #	PARAM SZ	HMAC #	HMAC SZ	Type	Name	Description
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_ChangeAuthOwner
4	2	2S	2	TPM_PROTOCOL_ID	protocolID	The protocol in use.
5	20	3S	20	TPM_ENCAUTH	newAuth	The encrypted new AuthData for the entity
6	2	4S	2	TPM_ENTITY_TYPE	entityType	The type of entity to be modified
7	4			TPM_AUTHHANDLE	ownerAuthHandle	The authorization session handle used for the TPM Owner.
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
8	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with ownerAuthHandle
9	1	4H1	1	BOOL	continueAuthSession	Continue use flag the TPM ignores this value
10	20			TPM_AUTHDATA	ownerAuth	The authorization session digest for inputs and ownerHandle. HMAC key: ownerAuth.

3274 Outgoing Operands and Sizes

PARAM #	PARAM SZ	HMAC #	HMAC SZ	Type	Name	Description
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_ChangeAuthOwner
4	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with ownerAuthHandle
5	1	4H1	1	BOOL	continueAuthSession	Continue use flag, fixed value of FALSE
6	20			TPM_AUTHDATA	resAuth	The authorization session digest for the returned parameters and ownerHandle. HMAC key: ownerAuth, the original value and not the new auth value

3275**Actions**

32761. The TPM MUST validate the command using the AuthData in the ownerAuth parameter

32772. The ownerAuthHandle session type MUST be TPM_PID_OSAP

32783. If protocolID is not TPM_PID_ADCP, the TPM MUST return TPM_BAD_PARAMETER.

32794. Verify that entityType is either TPM_ET_OWNER or TPM_ET_SRK, and return the error
3280   TPM_WRONG_ENTITYTYPE if not.

32815. Create decryptAuth by decrypting newAuth according to the ADIP indicated by
3282   ownerAuthHandle.

32836. The TPM MUST enforce the destruction of the ownerAuthHandle session upon
3284   completion of this command (successful or unsuccessful). This includes setting
3285   continueAuthSession to FALSE

32867. Set the AuthData for the indicated entity to decryptAuth

32878. The TPM MUST invalidate all owner authorized OSAP and DSAP sessions, active or
3288   saved.

32899. The TPM MAY invalidate all sessions, active or saved

3290 18.   Authorization Sessions

3291 18.1   TPM_OIAP

3292 Incoming Operands and Sizes

| PARAM | | HMAC | | Type | Name | Description |
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_OIAP.

3293 Outgoing Operands and Sizes

| PARAM | | HMAC | | Type | Name | Description |
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_OIAP.
4	4			TPM_AUTHHANDLE	authHandle	Handle that TPM creates that points to the authorization state.
5	20			TPM_NONCE	nonceEven	Nonce generated by TPM and associated with session.

3294 Actions

3295 1. The TPM_OIAP command allows the creation of an authorization session handle and the
3296   tracking of the handle by the TPM. The TPM generates the handle and nonce.

3297 2. The TPM has an internal limit as to the number of handles that may be open at one
3298   time, so the request for a new handle may fail if there is insufficient space available.

3299 3. Internally the TPM will do the following:

3300   a. TPM allocates space to save handle, protocol identification, both nonces and any
3301   other information the TPM needs to manage the session.

3302   b. TPM generates authHandle and nonceEven, returns these to caller

3303 4. On each subsequent use of the OIAP session the TPM MUST generate a new nonceEven
3304   value.

3305 5. When TPM_OIAP is wrapped in an encrypted transport session, no input or output
3306   parameters are encrypted.

3307

3308**18.1.1   Actions to validate an OIAP session**

3315**Actions**

3316The TPM MUST perform the following operations:

33171. The TPM MUST verify that the authorization session handle (H, say) referenced in the
3318   command points to a valid session. If it does not, the TPM returns the error code
3319   TPM_INVALID_AUTHHANDLE

33202. The TPM SHALL retrieve the latest version of the caller's nonce (nonceOdd) and
3321   continueAuthSession flag from the input parameter list, and store it in internal TPM
3322   memory with the authSession 'H'.

33233. The TPM SHALL retrieve the latest version of the TPM's nonce stored with the
3324   authorization session H (authLastNonceEven) computed during the previously executed
3325   command.

33264. The TPM MUST retrieve the secret AuthData (SecretE, say) of the target entity. The entity
3327   and its secret must have been previously loaded into the TPM.

3328   a. If the command using the OIAP session requires owner authorization

3329   i. If TPM_STCLEAR_DATA -> ownerReference is TPM_KH_OWNER, the secret
3330   AuthData is TPM_PERMANENT_DATA -> ownerAuth

3331   ii. If TPM_STCLEAR_DATA -> ownerReference is pointing to a delegate row

3332   (1) Set R1 a row index to TPM_STCLEAR_DATA -> ownerReference

3333   (2) Set D1 a TPM_DELEGATE_TABLE_ROW to TPM_PERMANENT_DATA ->
3334   delegateTable -> delRow[R1]

3335   (3) Set the secret AuthData to D1 -> authValue

3336   (4) Validate the TPM_DELEGATE_PUBLIC D1 -> pub

3337   (a)   Validate D1 -> pub -> permissions based on the command ordinal

3338   (b)   Validate D1 -> pub -> pcrInfo based on the PCR values

33395. The TPM SHALL perform a HMAC calculation using the entity secret data, ordinal, input
3340   command parameters and authorization parameters per Part 1 Object-Independent
3341   Authorization Protocol.

33426. The TPM SHALL compare HM to the AuthData value received in the input parameters. If
3343   they are different, the TPM returns the error code TPM_AUTHFAIL if the authorization
3344   session is the first session of a command, or TPM_AUTH2FAIL if the authorization

3345 session is the second session of a command. Otherwise, the TPM executes the command
3346 which (for this example) produces an output that requires authentication.

3347 7. The TPM SHALL generate a nonce (nonceEven).

3348 8. The TPM creates an HMAC digest to authenticate the return code, return values and
3349 authorization parameters to the same entity secret per Part 1 Object-Independent
3350 Authorization Protocol.

3351 9. The TPM returns the return code, output parameters, authorization parameters and
3352 authorization session digest.

3353 10. If the output continueUse flag is FALSE, then the TPM SHALL terminate the session.
3354 Future references to H will return an error.

3355 11. Each time that access to an entity (e.g., key) is authorized using OIAP, the TPM MUST
3356 validate the TPM_PCR_INFO_xxx "...AtRelease" values if specified for the entity

3357 a. The TPM SHOULD validate the values before using the shared secret to validate the
3358 command parameters. This prevents a dictionary attack on the shared secret when the
3359 values are invalid for the entity.

3360 18.2 TPM_OSAP

3362 The TPM_OSAP command creates the authorization session handle, the shared secret and
3363 generates nonceEven and nonceEvenOSAP.

3364 **End of informative comment.**

3365 Incoming Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_OSAP.
4	2			TPM_ENTITY_TYPE	entityType	The type of entity in use
5	4			UINT32	entityValue	The selection value based on entityType, e.g. a keyHandle #
6	20			TPM_NONCE	nonceOddOSAP	The nonce generated by the caller associated with the shared secret.

3366 Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_OSAP.
4	4			TPM_AUTHHANDLE	authHandle	Handle that TPM creates that points to the authorization state.
5	20			TPM_NONCE	nonceEven	Nonce generated by TPM and associated with session.
6	20			TPM_NONCE	nonceEvenOSAP	Nonce generated by TPM and associated with shared secret.

3367 Description

3368 1. The TPM_OSAP command allows the creation of an authorization session handle and the
3369 tracking of the handle by the TPM. The TPM generates the handle, nonceEven and
3370 nonceEvenOSAP.

3371 2. The TPM has an internal limit on the number of handles that may be open at one time,
3372 so the request for a new handle may fail if there is insufficient space available.

3373 3. The TPM_OSAP allows the binding of an authorization to a specific entity. This allows
3374 the caller to continue to send in AuthData for each command but not have to request
3375 the information or cache the actual AuthData.

3376 4. When TPM_OSAP is wrapped in an encrypted transport session, no input or output
3377 parameters are encrypted.

3378 5. If the owner pointer is pointing to a delegate row, the TPM internally MUST treat the
3379 OSAP session as a DSAP session

3380 6. TPM_ET_SRK or TPM_ET_KEYHANDLE with a value of TPM_KH_SRK MUST specify the
3381 SRK.

3382 7. If the entity is tied to PCR values, the PCR's are not validated during the TPM_OSAP
3383 ordinal session creation. The PCR's are validated when the OSAP session is used.

3384 **Actions**

3385 1. The TPM creates S1 a storage area that keeps track of the information associated with
3386 the authorization.

3387 2. S1 MUST track the following information

3388   a. Protocol identification (i.e. TPM_PID_OSAP)

3389   b. nonceEven

3390   i.   Initialized to the next value from the TPM RNG

3391   c. shared secret

3392   d. ADIP encryption scheme from TPM_ENTITY_TYPE entityType

3393   e. Any other internal TPM state the TPM needs to manage the session

3394 3. The TPM MUST create and MAY track the following information

3395   a. nonceEvenOSAP

3396   i.   Initialized to the next value from the TPM RNG

3397 4. The TPM calculates the shared secret using an HMAC calculation. The key for the HMAC
3398 calculation is the secret AuthData assigned to the key handle identified by entityValue.
3399 The input to the HMAC calculation is the concatenation of nonces nonceEvenOSAP and
3400 nonceOddOSAP. The output of the HMAC calculation is the shared secret which is saved
3401 in the authorization area associated with authHandle

3402 5. Check if the ADIP encryption scheme specified by entityType is supported, if not return
3403 TPM_INAPPROPRIATE_ENC.

3404 6. If entityType = TPM_ET_KEYHANDLE

3405   a. The entity to authorize is a key held in the TPM. entityValue contains the keyHandle
3406 that holds the key.

3407   b. If entityValue is TPM_KH_OPERATOR return TPM_BAD_HANDLE

3408 7. else if entityType = TPM_ET_OWNER

3409   a. This value indicates that the entity is the TPM owner. entityValue is ignored

3410   b. The HMAC key is the secret pointed to by ownerReference (owner secret or delegated
3411 secret)

3412 8. else if entityType = TPM_ET_SRK

3413   a. The entity to authorize is the SRK. entityValue is ignored.

3414 9. else if entityType = TPM_ET_COUNTER

3415   a. The entity is a monotonic counter, entityValue contains the counter handle

3416 10. else if entityType = TPM_ET_NV

3417   a. The entity is a NV index, entityValue contains the NV index

341811.else return TPM_BAD_PARAMETER

341912.On each subsequent use of the OSAP session the TPM MUST generate a new nonce
3420   value.

342113.The TPM MUST ensure that OSAP shared secret is only available while the OSAP session
3422   is valid.

342314.The session MUST terminate upon any of the following conditions:

3424   a. The command that uses the session returns an error

3425   b. The resource is evicted from the TPM or otherwise invalidated

3426   c. The session is used in any command for which the shared secret is used to encrypt
3427   an input parameter (TPM_ENCAUTH)

3428   d. The TPM Owner is cleared

3429   e. TPM_ChangeAuthOwner is executed and this session is attached to the owner
3430   authorization

3431   f. The   session   explicitly   terminated   with   continueAuth,   TPM_Reset   or
3432   TPM_FlushSpecific

3433   g. All OSAP sessions associated with the delegation table MUST be invalidated when
3434   any of the following commands execute:

3435   i.   TPM_Delegate_Manage

3436   ii. TPM_Delegate_CreateOwnerDelegation with Increment==TRUE

3437   iii. TPM_Delegate_LoadOwnerDelegation

3438

3439 18.2.1   Actions to validate an OSAP session

3440 **Start of informative comment:**

3441 This section describes the authorization-related actions of a TPM when it receives a
3442 command that has been authorized with the OSAP protocol.

3443 Many commands use OSAP authorization. The following description is therefore necessarily
3444 abstract.

3445 **End of informative comment**

3446 **Actions**

3447 1. On reception of a command with ordinal C1 that uses an authorization session, the TPM
3448   SHALL perform the following actions:

3449 2. The TPM MUST have been able to retrieve the shared secret (Shared, say) of the target
3450   entity when the authorization session was established with TPM_OSAP. The entity and
3451   its secret must have been previously loaded into the TPM.

3452 3. The TPM MUST verify that the authorization session handle (H, say) referenced in the
3453   command points to a valid session. If it does not, the TPM returns the error code
3454   TPM_INVALID_AUTHHANDLE.

3455 4. The TPM MUST calculate the HMAC (HM1, say) of the command parameters according
3456   to Part 1 Object-Specific Authorization Protocol.

3457 5. The TPM SHALL compare HM1 to the AuthData value received in the command. If they
3458   are different, the TPM returns the error code TPM_AUTHFAIL if the authorization session
3459   is the first session of a command, or TPM_AUTH2FAIL if the authorization session is the
3460   second session of a command., the TPM executes command C1 which produces an
3461   output (O, say) that requires authentication and uses a particular return code (RC, say).

3462 6. The TPM SHALL generate the latest version of the even nonce (nonceEven).

3463 7. The TPM MUST calculate the HMAC (HM2) of the return parameters according to section
3464   Part 1 Object-Specific Authorization Protocol.

3465 8. The TPM returns HM2 in the parameter list.

3466 9. The TPM SHALL retrieve the continue flag from the received command. If the flag is
3467   FALSE, the TPM SHALL terminate the session and destroy the thread associated with
3468   handle H.

3469 10. If the shared secret was used to provide confidentiality for data in the received
3470   command, the TPM SHALL terminate the session and destroy the thread associated with
3471   handle H.

3472 11. Each time that access to an entity (e.g., key) is authorized using OSAP, the TPM MUST

3473   a. ensure that the OSAP shared secret is that derived from the entity using TPM_OSAP

3474   b. validate the TPM_PCR_INFO_xxx "…AtRelease" values if specified for the entity

3475   i. The TPM SHOULD validate the values before using the shared secret to
3476   validate the command parameters. This prevents a dictionary attack on the
3477   shared secret when the values are invalid for the entity.

3478 **18.3   TPM_DSAP**

3479 **Start of informative comment:**

3480 The TPM_DSAP command creates the authorization session handle using a delegated
3481 AuthData value passed into the command as an encrypted blob or from the internal
3482 delegation table. It can be used to start an authorization session for a user key or the
3483 owner.

3484 As in TPM_OSAP, it generates a shared secret and generates nonceEven and
3485 nonceEvenOSAP.

3486 **End of informative comment.**

3487 **Incoming Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_DSAP.
4	2			TPM_ENTITY_TYPE	entityType	The type of delegation information to use
5	4			TPM_KEY_HANDLE	keyHandle	Key for which delegated authority corresponds, or 0 if delegated owner activity. Only relevant if entityValue equals TPM_DELEGATE_KEY_BLOB
6	20			TPM_NONCE	nonceOddDSAP	The nonce generated by the caller associated with the shared secret.
7	4			UINT32	entityValueSize	The size of entityValue.
8	<>	2S	<>	BYTE [ ]	entityValue	TPM_DELEGATE_KEY_BLOB or TPM_DELEGATE_OWNER_BLOB or index MUST not be empty If entityType is TPM_ET_DEL_ROW then entityValue is a TPM_DELEGATE_INDEX

3488 **Outgoing Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_DSAP.
4	4			TPM_AUTHHANDLE	authHandle	Handle that TPM creates that points to the authorization state.
5	20			TPM_NONCE	nonceEven	Nonce generated by TPM and associated with session.
6	20			TPM_NONCE	nonceEvenDSAP	Nonce generated by TPM and associated with shared secret.

3489 **Description**

3490 1. The TPM_DSAP command allows the creation of an authorization session handle and the
3491   tracking of the handle by the TPM. The TPM generates the handle, nonceEven and
3492   nonceEvenOSAP.

3493 2. The TPM has an internal limit on the number of handles that may be open at one time,
3494   so the request for a new handle may fail if there is insufficient space available.

3495 3. The TPM_DSAP allows the binding of a delegated authorization to a specific entity. This
3496   allows the caller to continue to send in AuthData for each command but not have to
3497   request the information or cache the actual AuthData.

3498 4. Each ordinal that uses the DSAP session MUST validate that TPM_PERMANENT_DATA
3499   -> restrictDelegate does not restrict delegation, based on keyHandle -> keyUsage and
3500   keyHandle -> keyFlags, return TPM_INVALID_KEYUSAGE on error.

3501 5. On each subsequent use of the DSAP session the TPM MUST generate a new nonce
3502   value and check if the ordinal to be executed has delegation to execute. The TPM MUST
3503   ensure that the DSAP shared secret is only available while the DSAP session is valid.

3504 6. When TPM_DSAP is wrapped in an encrypted transport session

3505   a. For input the only parameter encrypted is entityValue

3506   b. For output no parameters are encrypted

3507 7. The DSAP session MUST terminate under any of the following conditions

3508   a. The command that uses the session returns an error

3509   b. If attached to a key, when the key is evicted from the TPM or otherwise invalidated

3510   c. The session is used in any command for which the shared secret is used to encrypt
3511   an input parameter (TPM_ENCAUTH)

3512   d. The TPM Owner is cleared

3513   e. TPM_ChangeAuthOwner is executed and this session is attached to the owner
3514   authorization

3515   f. The   session   explicitly   terminated   with   continueAuth,   TPM_Reset   or
3516   TPM_FlushSpecific

3517   g.   All DSAP sessions MUST be invalidated when any of the following commands
3518   execute:

3519   i.   TPM_Delegate_CreateOwnerDelegation

3520   ii. When Increment is TRUE

3521   iii. TPM_Delegate_LoadOwnerDelegation

3522   iv. TPM_Delegate_Manage

3523 entityType = TPM_ET_DEL_OWNER_BLOB

3524   The entityValue parameter contains an owner delegation blob structure.

3525 entityType = TPM_ET_DEL_ROW

3526   The entityValue parameter contains a row number in the nv Delegation table which
3527   should be used for the AuthData value.

3528 entityType = TPM_DEL_KEY_BLOB

3529   The entityValue parameter contains a key delegation blob structure.

3530 **Actions**

3531 1. If entityType == TPM_ET_DEL_OWNER_BLOB

3532   a. Map entityValue to B1 a TPM_DELEGATE_OWNER_BLOB

3533   b. Validate that B1 is a valid TPM_DELEGATE_OWNER_BLOB, return
3534 TPM_WRONG_ENTITYTYPE on error

3535   c. Locate B1 -> pub -> familyID in the TPM_FAMILY_TABLE and set familyRow to
3536 indicate row, return TPM_BADINDEX if not found

3537   d. Set FR to TPM_FAMILY_TABLE.famTableRow[familyRow]

3538   e. If FR -> flags TPM_FAMFLAG_ENABLED is FALSE, return TPM_DISABLED_CMD

3539   f. Verify that B1->verificationCount equals FR -> verificationCount.

3540   g. Validate the integrity of the blob

3541   i. Copy B1 -> integrityDigest to H2

3542   ii. Set B1 -> integrityDigest to all zeros

3543   iii. Create H3 the HMAC of B1 using tpmProof as the secret

3544   iv. Compare H2 to H3 return TPM_AUTHFAIL on mismatch

3545   h. Create S1 a TPM_DELEGATE_SENSITIVE by decrypting B1 -> sensitiveArea using
3546 TPM_DELEGATE_KEY

3547   i. Validate S1 values

3548   i. S1 -> tag is TPM_TAG_DELEGATE_SENSITIVE

3549   ii. Return TPM_BAD_DELEGATE on error

3550   j. Set A1 to S1 -> authValue

3551 2. Else if entityType == TPM_ET_DEL_ROW

3552   a. Verify that entityValue points to a valid row in the delegation table.

3553   b. Set D1 to the delegation information in the row.

3554   c. Set A1 to D1->authValue.

3555   d. Locate D1 -> familyID in the TPM_FAMILY_TABLE and set familyRow to indicate that
3556 row, return TPM_BADINDEX if not found

3557   e. Set FR to TPM_FAMILY_TABLE.famTableRow[familyRow]

3558   f. If FR -> flags TPM_FAMFLAG_ENABLED is FALSE, return TPM_DISABLED_CMD

3559   g. Verify that D1->verificationCount equals FR -> verificationCount.

3560 3. Else if entityType == TPM_ET_DEL_KEY_BLOB

3561   a. Map entityValue to K1 a TPM_DELEGATE_KEY_BLOB

3562   b. Validate that K1 is a valid TPM_DELEGATE_KEY_BLOB, return
3563 TPM_WRONG_ENTITYTYPE on error

3564   c. Locate K1 -> pub -> familyID in the TPM_FAMILY_TABLE and set familyRow to
3565 indicate that row, return TPM_BADINDEX if not found

3566   d. Set FR to TPM_FAMILY_TABLE.famTableRow[familyRow]

3567   e. If FR -> flags TPM_FAMFLAG_ENABLED is FALSE, return TPM_DISABLED_CMD

3568   f. Verify that K1 -> pub -> verificationCount equals FR -> verificationCount.

3569   g. Validate the integrity of the blob

3570   i. Copy K1 -> integrityDigest to H2

3571   ii. Set K1 -> integrityDigest to all zeros

3572   iii. Create H3 the HMAC of K1 using tpmProof as the secret

3573   iv. Compare H2 to H3 return TPM_AUTHFAIL on mismatch

3574   h. Validate that K1 -> pubKeyDigest identifies keyHandle, return TPM_KEYNOTFOUND
3575   on error

3576   i. Create S1 a TPM_DELEGATE_SENSITIVE by decrypting K1 -> sensitiveArea using
3577   TPM_DELEGATE_KEY

3578   j. Validate S1 values

3579   i. S1 -> tag is TPM_TAG_DELEGATE_SENSITIVE

3580   ii. Return TPM_BAD_DELEGATE on error

3581   k. Set A1 to S1 -> authValue

35824. Else return TPM_BAD_PARAMETER

35835. Generate a new authorization session handle and reserve space to save protocol
3584   identification, shared secret, pcrInfo, both nonces, ADIP encryption scheme, delegated
3585   permission bits and any other information the TPM needs to manage the session.

35866. Read two new values from the RNG to generate nonceEven and nonceEvenOSAP.

35877. The TPM calculates the shared secret using an HMAC calculation. The key for the HMAC
3588   calculation is A1. The input to the HMAC calculation is the concatenation of nonces
3589   nonceEvenOSAP and nonceOddOSAP. The output of the HMAC calculation is the shared
3590   secret which is saved in the authorization area associated with authHandle.

3591 18.4   TPM_SetOwnerPointer

3592 **Start of informative comment:**

3593 This command will set a reference to which secret the TPM will use when executing an
3594 owner secret related OIAP or OSAP session.

3595 This command should only be used to provide an owner delegation function for legacy code
3596 that does not itself support delegation. Normally, TPM_STCLEAR_DATA->ownerReference
3597 points to TPM_KH_OWNER, indicating that OIAP and OSAP sessions should use the owner
3598 authorization. This command allows ownerReference to point to an index in the delegation
3599 table, indicating that OIAP and OSAP sessions should use the delegation authorization.

3600 In use, a TSS supporting delegation would create and load the owner delegation and set the
3601 owner pointer to that delegation. From then on, a legacy TSS application would use its OIAP
3602 and OSAP sessions with the delegated owner authorization.

3603 Since this command is not authorized, the ownerReference is open to DoS attacks.
3604 Applications can attempt to recover from a failing owner authorization by resetting
3605 ownerReference to an appropriate value.

3606 This command intentionally does not clear OSAP sessions. A TPM 1.1 application gets the
3607 benefit of owner delegation, while the original owner can use a pre-existing OSAP session
3608 with the actual owner authorization.

3609 **End of informative comment.**

3610 **Incoming Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_ COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Ordinal: TPM_ORD_SetOwnerPointer
4	2	2S	2	TPM_ENTITY_TYPE	entityType	The type of entity in use
5	4	3S	4	UINT32	entityValue	The selection value based on entityType

3611 **Outgoing Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_ COMMAND
2	4			UINT32	paramSize	Total number of output bytes
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation
		2S	4	TPM_COMMAND_CODE	ordinal	Ordinal: TPM_ORD_SetOwnerPointer

3612 **Actions**

3613 1. Map TPM_STCLEAR_DATA to V1

3614 2. If entityType = TPM_ET_DEL_ROW

3615   a. This value indicates that the entity is a delegate row. entityValue is a delegate index
3616   in the delegation table.

3617   b. Validate that entityValue points to a legal row within the delegate table stored within
3618   the TPM. If not return TPM_BADINDEX

3619   i.   Set D1 to the delegation information in the row.

3620   c. Locate D1 -> familyID in the TPM_FAMILY_TABLE and set familyRow to indicate that
3621   row, return TPM_BADINDEX if not found.

3622   d. Set FR to TPM_FAMILY_TABLE.famTableRow[familyRow]

3623   e. If FR -> flags TPM_FAMFLAG_ENABLED is FALSE, return TPM_DISABLED_CMD

3624   f. Verify that B1->verificationCount equals FR -> verificationCount.

3625   g. The TPM sets V1-> ownerReference to entityValue

3626   h. Return TPM_SUCCESS

36273. else if entityType = TPM_ET_OWNER

3628   a. This value indicates that the entity is the TPM owner. entityValue is ignored.

3629   b. The TPM sets V1-> ownerReference to TPM_KH_OWNER

3630   c. Return TPM_SUCCESS

36314. Return TPM_BAD_PARAMETER

3632 19. Delegation Commands

3633 19.1 TPM_Delegate_Manage

3634 **Start of informative comment:**

3635 TPM_Delegate_Manage is the fundamental process for managing the Family tables, 3636 including enabling/disabling Delegation for a selected Family. Normally 3637 TPM_Delegate_Manage must be executed at least once (to create Family tables for a 3638 particular family) before any other type of Delegation command in that family can succeed.

3639 TPM_Delegate_Manage is authorized by the TPM Owner if an Owner is installed, because 3640 changing a table is a privileged Owner operation. If no Owner is installed, 3641 TPM_Delegate_Manage requires no privilege to execute. This does not disenfranchise an 3642 Owner, since there is no Owner, and simplifies loading of tables during platform 3643 manufacture or on first-boot. Burn-out of TPM non-volatile storage by inappropriate use is 3644 mitigated by the TPM's normal limits on NV-writes in the absence of an Owner. Tables can 3645 be locked after loading, to prevent subsequent tampering, and only unlocked by the Owner, 3646 his delegate, or the act of removing the Owner (even if there is no Owner).

3647 TPM_Delegate_Manage command is customized by opCode:

3648 (1) TPM_FAMILY_ENABLE enables/disables use of a family and all the rows of the delegate 3649 table belonging to that family,

3650 (2) TPM_FAMILY_ADMIN can be used to prevent further management of the Tables until an 3651 Owner is installed, or until the Owner is removed from the TPM. (Note that the Physical 3652 Presence command TPM_ForceClear always enables further management, even if 3653 TPM_ForceClear is used when no Owner is installed.)

3654 (3) TPM_FAMILY_CREATE creates a new family. Sessions are invalidated even in this case 3655 because the lastFamilyID could wrap.

3656 (4) TPM_FAMILY_INVALIDATE invalidates an existing family. The TPM_SELFTEST_FAILED 3657 error code is returned because the familyRow has already been validated earlier. Failure 3658 here indicates a malfunction of the TPM.

3659 The rationale for Action 19.1 is that invalidating the family ID prevents the use of 3660 associated delegate rows, whether or not those delegate rows are themselves invalidated. 3661 Omitting the delegate row invalidation avoids an NV write.

3662 **End of informative comment.**

3663Incoming Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_Delegate_Manage
4	4	2S	4	TPM_FAMILY_ID	familyID	The familyID that is to be managed
5	4	3s	4	TPM_FAMILY_OPERATION	opCode	Operation to be performed by this command.
6	4	4s	4	UINT32	opDataSize	Size in bytes of opData
7	<>	5s	<>	BYTE [ ]	opData	Data necessary to implement opCode
8	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for owner authentication.
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
9	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
10	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
11	20			TPM_AUTHDATA	ownerAuth	HMAC key: ownerAuth.

3664Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_Delegate_Manage
4	4	3S	4	UINT32	retDataSize	Size in bytes of retData
5	<>	4S	<>	BYTE [ ]	retData	Returned data
6	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
7	1	4H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
8	20			TPM_AUTHDATA	resAuth	HMAC key: ownerAuth.

3665Action

36661. If opCode != TPM_FAMILY_CREATE

3667 a. Locate familyID in the TPM_FAMILY_TABLE and set familyRow to indicate row,
3668 return TPM_BADINDEX if not found

3669 b. Set FR, a TPM_FAMILY_TABLE_ENTRY, to TPM_FAMILY_TABLE. famTableRow
3670 [familyRow]

36712. If tag = TPM_TAG_RQU_AUTH1_COMMAND

3672 a. Validate the command and parameters using ownerAuth, return TPM_AUTHFAIL on
3673 error

3674   b. If the command is delegated (authHandle session type is TPM_PID_DSAP or through
3675   ownerReference delegation)

3676   i. If opCode = TPM_FAMILY_CREATE

3677   (1)   The TPM MUST ignore familyID

3678   ii. Else

3679   (1)   Verify that the familyID associated with authHandle matches the
3680   familyID parameter, return TPM_DELEGATE_FAMILY on error

3681 3. Else

3682   a. If TPM_PERMANENT_DATA -> ownerAuth is valid, return TPM_AUTHFAIL

3683   b. If   opCode   !=   TPM_FAMILY_CREATE   and   FR   ->   flags   ->
3684   TPM_DELEGATE_ADMIN_LOCK is TRUE, return TPM_DELEGATE_LOCK

3685   c. Validate max NV writes without an owner

3686   i. Set NV1 to TPM_PERMANENT_DATA -> noOwnerNVWrite

3687   ii. Increment NV1 by 1

3688   iii. If NV1 > TPM_MAX_NV_WRITE_NOOWNER return TPM_MAXNVWRITES

3689   iv. Set TPM_PERMANENT_DATA -> noOwnerNVWrite to NV1

3690 4. The TPM invalidates sessions

3691   a. MUST invalidate all DSAP sessions

3692   b. MUST invalidate all OSAP sessions associated with the delegation table

3693   c. MUST set TPM_STCLEAR_DATA -> ownerReference to TPM_KH_OWNER

3694   d. MAY invalidate any other session

3695 5. If opCode == TPM_FAMILY_CREATE

3696   a. Validate that sufficient space exists within the TPM to store an additional family and
3697   map F2 to the newly allocated space.

3698   b. Validate that opData is a TPM_FAMILY_LABEL

3699   i. If opDataSize != sizeof(TPM_FAMILY_LABEL) return TPM_BAD_PARAM_SIZE

3700   c. Map F2 to a TPM_FAMILY_TABLE_ENTRY

3701   i. Set F2 -> tag to TPM_TAG_FAMILY_TABLE_ENTRY

3702   ii. Set F2 -> familyLabel to opData

3703   d. Increment TPM_PERMANENT_DATA -> lastFamilyID by 1

3704   e. Set F2 -> familyID = TPM_PERMANENT_DATA -> lastFamilyID

3705   f. Set F2 -> verificationCount = 1

3706   g. Set F2 -> flags -> TPM_FAMFLAG_ENABLED to FALSE

3707   h. Set F2 -> flags -> TPM_DELEGATE_ADMIN_LOCK to FALSE

3708   i. Set retDataSize = 4

3709   j.   Set retData = F2 -> familyID

3710   k.   Return TPM_SUCCESS

37116. If authHandle is of type DSAP then continueAuthSession MUST set to FALSE

37127. If opCode == TPM_FAMILY_ADMIN

3713   a.   Validate that opDataSize == 1, and that opData is a Boolean value.

3714   b.   Set (FR -> flags -> TPM_DELEGATE_ADMIN_LOCK) = opData

3715   c.   Set retDataSize = 0

3716   d.   Return TPM_SUCCESS

37178. else If opCode == TPM_FAMILY_ENABLE

3718   a.   Validate that opDataSize == 1, and that opData is a Boolean value.

3719   b.   Set FR -> flags-> TPM_FAMFLAG_ENABLED = opData

3720   c.   Set retDataSize = 0

3721   d.   Return TPM_SUCCESS

37229. else If opCode == TPM_FAMILY_INVALIDATE

3723   a.   Invalidate all data associated with familyRow

3724   i.   All data is all information pointed to by FR

3725   ii. return TPM_SELFTEST_FAILED on failure

3726   b.   The TPM MAY invalidate delegate rows that contain the same familyID.

3727   c.   Set retDataSize = 0

3728   d.   Return TPM_SUCCESS

372910. Else return TPM_BAD_PARAMETER

3730 19.2 TPM_Delegate_CreateKeyDelegation

3731 **Start of informative comment:**

3732 This command delegates privilege to use a key by creating a blob that can be used by 3733 TPM_DSAP.

3734 There is no check for appropriateness of the key's key usage against the key permission 3735 settings. If the key usage is incorrect, this command succeeds, but the delegated command 3736 will fail.

3737 These blobs CANNOT be used as input data for TPM_LoadOwnerDelegation because the 3738 internal TPM delegate table can store owner delegations only.

3739 (TPM_Delegate_CreateOwnerDelegation must be used to delegate Owner privilege.)

3740 The publicInfo -> familyID can specify a disabled family row. The family row is checked 3741 when the key delegation is used in a DSAP session, not when it is created.

3742 **End of informative comment.**

3743 Incoming Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_Delegate_CreateKeyDelegation.
4	4			TPM_KEY_HANDLE	keyHandle	The keyHandle identifier of a loaded key.
5	<>	2S	<>	TPM_DELEGATE_PUBLIC	publicInfo	The public information necessary to fill in the blob
6	20	3S	20	TPM_ENCAUTH	delAuth	The encrypted new AuthData for the blob. The encryption key is the shared secret from the authorization session protocol.
7	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for keyHandle authorization
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
8	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
9	1	4H1	1	BOOL	continueAuthSession	Ignored
10	20			TPM_AUTHDATA	privAuth	The authorization session digest that authorizes the use of keyHandle. HMAC key: key.usageAuth

3744

3745Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_Delegate_CreateKeyDelegation
4	4	3S	4	UINT32	blobSize	The length of the returned blob
5	<>	4S	<>	TPM_DELEGATE_KEY_BLOB	blob	The partially encrypted delegation information.
6	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
7	1	4H1	1	BOOL	continueAuthSession	Continue use flag. Fixed value of FALSE
8	20			TPM_AUTHDATA	resAuth	The authorization session digest for the returned parameters. HMAC key: key.usageAuth

3746Description

37471. The use restrictions that may be present on the key pointed to by keyHandle are not
3748 enforced for this command. Stated another way, TPM_CreateKeyDelegation is not a use
3749 of the key.

3750Action

37511. Verify AuthData for the command and parameters using privAuth

37522. Locate publicInfo -> familyID in the TPM_FAMILY_TABLE and set familyRow to indicate
3753 row, return TPM_BADINDEX if not found

37543. If the key authentication is in fact a delegation, then the TPM SHALL validate the
3755 command and parameters using Delegation authorisation, then

3756 a. Validate that authHandle -> familyID equals publicInfo -> familyID return
3757 TPM_DELEGATE_FAMILY on error

3758 b. If TPM_FAMILY_TABLE.famTableRow[authHandle -> familyID] -> flags ->
3759 TPM_FAMFLAG_ENABLED is FALSE, return error TPM_DISABLED_CMD.

3760 c. Verify that the delegation bits in publicInfo do not grant more permissions then
3761 currently delegated. Otherwise return error TPM_AUTHFAIL

37624. Check that publicInfo -> delegateType is TPM_DEL_KEY_BITS

37635. Verify that authHandle indicates an OSAP or DSAP session return
3764 TPM_INVALID_AUTHHANDLE on error

37656. Create a1 by decrypting delAuth according to the ADIP indicated by authHandle.

37667. Create h1 the SHA-1 of TPM_STORE_PUBKEY structure of the key pointed to by
3767 keyHandle

37688. Create M1 a TPM_DELEGATE_SENSITIVE structure

3769 a. Set M1 -> tag to TPM_TAG_DELEGATE_SENSITIVE

3770   b. Set M1 -> authValue to a1

3771   c. The TPM MAY add additional information of a sensitive nature relative to the
3772   delegation

3773 9. Create M2 the encryption of M1 using TPM_DELEGATE_KEY

3774 10. Create P1 a TPM_DELEGATE_KEY_BLOB

3775   a. Set P1 -> tag to TPM_TAG_DELG_KEY_BLOB

3776   b. Set P1 -> pubKeyDigest to H1

3777   c. Set P1 -> pub to PublicInfo

3778   d. Set P1 -> pub -> verificationCount to familyRow -> verificationCount

3779   e. Set P1 -> integrityDigest to all zeros

3780   f. The TPM sets additionalArea and additionalAreaSize appropriate for this TPM. The
3781   information MAY include symmetric IV, symmetric mode of encryption and other data
3782   that allows the TPM to process the blob in the future.

3783   g. Set P1 -> sensitiveSize to the size of M2

3784   h. Set P1 -> sensitiveArea to M2

3785 11. Calculate H2 the HMAC of P1 using tpmProof as the secret

3786 12. Set P1 -> integrityDigest to H2

3787 13. Ignore continueAuthSession on input set continueAuthSession to FALSE on output

3788 14. Return P1 as blob

378919.3 TPM_Delegate_CreateOwnerDelegation

3790**Start of informative comment:**

3791TPM_Delegate_CreateOwnerDelegation delegates the Owner's privilege to use a set of 3792command ordinals, by creating a blob. Such blobs can be used as input data for TPM_DSAP 3793or TPM_Delegate_LoadOwnerDelegation.

3794TPM_Delegate_CreateOwnerDelegation includes the ability to void all existing delegations 3795(by incrementing the verification count) before creating the new delegation. This ensures 3796that the new delegation will be the only delegation that can operate at Owner privilege in 3797this family. This new delegation could be used to enable a security monitor (a local separate 3798entity, or remote separate entity, or local host entity) to reinitialize a family and perhaps 3799perform external verification of delegation settings. Normally the ordinals for a delegated 3800security monitor would include TPM_Delegate_CreateOwnerDelegation (this command) in 3801order to permit the monitor to create further delegations, and 3802TPM_Delegate_UpdateVerification to reactivate some previously voided delegations.

3803If the verification count is incremented and the new delegation does not delegate any 3804privileges (to any ordinals) at all, or uses an authorisation value that is then discarded, this 3805family's delegations are all void and delegation must be managed using actual Owner 3806authorisation.

3807(TPM_Delegate_CreateKeyDelegation must be used to delegate privilege to use a key.)

3808**End of informative comment.**

3809Incoming Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	TPM_ORD_Delegate_CreateOwnerDelegation.
4	1	2S	1	BOOL	increment	Flag dictates whether verificationCount will be incremented
5	<>	3S	<>	TPM_DELEGATE_PUBLIC	publicInfo	The public parameters for the blob
6	20	4S	20	TPM_ENCAUTH	delAuth	The encrypted new AuthData for the blob. The encryption key is the shared secret from the OSAP protocol.
7	4			TPM_AUTHHANDLE	authHandle	The authorization session handle TPM Owner authentication
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
8	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
9	1	4H1	1	BOOL	continueAuthSession	Ignored
10	20			TPM_AUTHDATA	ownerAuth	The authorization session digest. HMAC key:ownerAuth

3810 Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	TPM_ORD_Delegate_CreateOwnerDelegation
4	4	3S	4	UINT32	blobSize	The length of the returned blob
5	<>	4S	<>	TPM_DELEGATE_OWNER_B LOB	blob	The partially encrypted delegation information.
6	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
7	1	4H1	1	BOOL	continueAuthSession	Continue use flag. Fixed value of FALSE
8	20			TPM_AUTHDATA	resAuth	The authorization session digest for the returned parameters. HMAC key: ownerAuth

3811 Action

3812 1. The TPM SHALL authenticate the command using TPM Owner authentication. Return 3813 TPM_AUTHFAIL on failure.

3814 2. Locate publicInfo -> familyID in the TPM_FAMILY_TABLE and set familyRow to indicate 3815 the row return TPM_BADINDEX if not found

3816 a. Set FR to TPM_FAMILY_TABLE.famTableRow[familyRow]

3817 3. If the TPM Owner authentication is in fact a delegation

3818 a. Validate that authHandle -> familyID equals publicInfo -> familyID return 3819 TPM_DELEGATE_FAMILY on error

3820 b. If FR -> flags -> TPM_FAMFLAG_ENABLED is FALSE, return error 3821 TPM_DISABLED_CMD.

3822 c. Verify that the delegation bits in publicInfo do not grant more permissions then 3823 currently delegated. Otherwise, return error TPM_AUTHFAIL.

3824 4. Check that publicInfo -> delegateType is TPM_DEL_OWNER_BITS

3825 5. Verify that authHandle indicates an OSAP or DSAP session return 3826 TPM_INVALID_AUTHHANDLE on error

3827 6. If increment == TRUE

3828 a. Increment FR -> verificationCount

3829 b. Set TPM_STCLEAR_DATA-> ownerReference to TPM_KH_OWNER

3830 c. The TPM invalidates sessions

3831   i. MUST invalidate all DSAP sessions

3832   ii. MUST invalidate all OSAP sessions associated with the delegation table

3833   iii. MAY invalidate any other session

3834 7.   Create a1 by decrypting delAuth according to the ADIP indicated by authHandle.

3835 8.   Create M1 a TPM_DELEGATE_SENSITIVE structure

3836   a.   Set M1 -> tag to TPM_TAG_DELEGATE_SENSITIVE

3837   b.   Set M1 -> authValue to a1

3838   c.   Set other M1 fields as determined by the TPM vendor

3839 9.   Create M2 the encryption of M1 using TPM_DELEGATE_KEY

3840 10. Create B1 a TPM_DELEGATE_OWNER_BLOB

3841   a.   Set B1 -> tag to TPM_TAG_DELG_OWNER_BLOB

3842   b.   Set B1 -> pub to publicInfo

3843   c.   Set B1 -> sensitiveSize to the size of M2

3844   d.   Set B1 -> sensitiveArea to M2

3845   e.   Set B1 -> integrityDigest to all zeros

3846   f.   Set B1 -> pub -> verificationCount to FR -> verificationCount

3847 11. The TPM sets additionalArea and additionalAreaSize appropriate for this TPM. The
3848   information MAY include symmetric IV, symmetric mode of encryption and other data
3849   that allows the TPM to process the blob in the future.

3850 12. Create H1 the HMAC of B1 using tpmProof as the secret

3851 13. Set B1 -> integrityDigest to H1

3852 14. Ignore continueAuthSession on input set continueAuthSession to FALSE on output

3853 15. Return B1 as blob

3854 19.4 TPM_Delegate_LoadOwnerDelegation

3869 Incoming Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes incl. paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Ordinal: TPM_ORD_Delegate_LoadOwnerDelegation
4	4	3S	4	TPM_DELEGATE_INDEX	index	The index of the delegate row to be written

w to be written						
5	4	4S	4	UINT32	blobSize	The size of the delegate blob
6	<>	5S	<>	TPM_DELEGATE_OWNER _BLOB	blob	Delegation information, including encrypted portions as appropriate
7	4			TPM_AUTHHANDLE	authHandle	The authorization session handle TPM Owner authentication
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
8	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
9	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
10	20			TPM_AUTHDATA	ownerAuth	The authorization session digest. HMAC key:ownerAuth

3870 **Outgoing Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation
		2S	4	TPM_COMMAND_CODE	ordinal	TPM_ORD_Delegate_LoadOwnerDelegation
5	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
6	1	4H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
7	20			TPM_AUTHDATA	resAuth	Authorization HMAC key: ownerAuth.

3871 **Actions**

3872 1. Map blob to D1 a TPM_DELEGATE_OWNER_BLOB.

3873   a. Validate that D1 -> tag == TPM_TAG_DELEGATE_OWNER_BLOB

3874 2. Locate D1 -> pub -> familyID in the TPM_FAMILY_TABLE and set familyRow to indicate
3875 row, return TPM_BADINDEX if not found

3876 3. Set FR to TPM_FAMILY_TABLE -> famTableRow[familyRow]

3877 4. If TPM Owner is installed

3878   a. Validate the command and parameters using TPM Owner authentication, return
3879 TPM_AUTHFAIL on error

3880   b. If the command is delegated (authHandle session type is TPM_PID_DSAP or through
3881 ownerReference delegation), verify that D1 -> pub -> familyID matches authHandle ->
3882 familyID, on error return TPM_DELEGATE_FAMILY

3883 5. Else

3884   a. If tag is not TPM_TAG_RQU_COMMAND, return TPM_AUTHFAIL

3885   b. If FR -> flags -> TPM_DELEGATE_ADMIN_LOCK is TRUE return
3886 TPM_DELEGATE_LOCK

3887   c. Validate max NV writes without an owner

3888   i. Set NV1 to PD -> noOwnerNVWrite

3889   ii. Increment NV1 by 1

3890   iii. If NV1 > TPM_MAX_NV_WRITE_NOOWNER return TPM_MAXNVWRITES

3891   iv. Set PD -> noOwnerNVWrite to NV1

3892 6. If FR -> flags -> TPM_FAMFLAG_ENABLED is FALSE, return TPM_DISABLED_CMD

3893 7. If TPM Owner is installed, validate the integrity of the blob

3894   a. Copy D1 -> integrityDigest to H2

3895   b. Set D1 -> integrityDigest to all zeros

3896   c. Create H3 the HMAC of D1 using tpmProof as the secret

3897   d. Compare H2 to H3, return TPM_AUTHFAIL on mismatch

38988. If TPM Owner is installed, create S1 a TPM_DELEGATE_SENSITIVE area by decrypting
3899   D1 -> sensitiveArea using TPM_DELEGATE_KEY. Otherwise set S1 = D1 -> sensitiveArea

39009. Validate S1

3901   a. Validate   that   S1   ->   tag   ==   TPM_TAG_DELEGATE_SENSITIVE,   return
3902   TPM_INVALID_STRUCTURE on error

390310. Validate that index is a valid value for delegateTable, return TPM_BADINDEX on error

390411. The TPM invalidates sessions

3905   a. MUST invalidate all DSAP sessions

3906   b. MUST invalidate all OSAP sessions associated with the delegation table

3907   c. MAY invalidate any other session

390812. Copy data to the delegate table row

3909   a. Copy the TPM_DELEGATE_PUBLIC from D1 -> pub to TPM_DELEGATE_TABLE ->
3910   delRow[index] -> pub.

3911   b. Copy the TPM_SECRET from S1 -> authValue to TPM_DELEGATE_TABLE ->
3912   delRow[index] -> authValue.

3913   c. Set TPM_STCLEAR_DATA-> ownerReference to TPM_KH_OWNER

3914   d. If authHandle is of type DSAP then continueAuthSession MUST set to FALSE

391513. Return TPM_SUCCESS

3916 19.5 TPM_Delegate_ReadTable

3925 Incoming Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_Delegate_ReadTable

3926 Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_Delegate_ReadTable
4	4	3S	4	UINT32	familyTableSize	Size in bytes of familyTable
5	<>	4S	<>	BYTE [ ]	familyTable	Array of TPM_FAMILY_TABLE_ENTRY elements
6	4	5S	4	UINT32	delegateTableSize	Size in bytes of delegateTable
7	<>	6S	<>	BYTE[]	delegateTable	Array of TPM_DELEGATE_INDEX and TPM_DELEGATE_PUBLIC elements

3927 Actions

3928 1. Set familyTableSize to the number of valid families on the TPM times
3929 sizeof(TPM_FAMILY_TABLE_ELEMENT).

3930 2. Copy the valid entries in the internal family table to the output array familyTable

3931 3. Set delegateTableSize to the number of valid delegate table entries on the TPM times
3932 (sizeof(TPM_DELEGATE_PUBLIC) + 4).

3933 4. For each valid entry

3934 a. Write the TPM_DELEGATE_INDEX to delegateTable

3935 b. Copy the TPM_DELEGATE_PUBLIC to delegateTable

3936 5. Return TPM_SUCCESS

3937 19.6 TPM_Delegate_UpdateVerification

3938 **Start of informative comment:**

3939 TPM_UpdateVerification sets the verificationCount in an entity (a blob or a delegation row)
3940 to the current family value, in order that the delegations represented by that entity will
3941 continue to be accepted by the TPM.

3942 **End of informative comment**.

3943 **Incoming Operands and Sizes**

| PARAM | | HMAC | | Type | Name | Description |
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_Delegate_UpdateVerification
4	4	2S	4	UINT32	inputSize	The size of inputData
5	<>	3S	<>	BYTE	inputData	TPM_DELEGATE_KEY_BLOB or TPM_DELEGATE_OWNER_BLOB or TPM_DELEGATE_INDEX
6	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for owner authentication.
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
7	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
8	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
9	20			TPM_AUTHDATA	ownerAuth	Authorization HMAC key: ownerAuth.

3944Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_Delegate_UpdateVerification
4	4	3S	4	UINT32	outputSize	The size of the output
5	<>	4S	<>	BYTE	outputData	TPM_DELEGATE_KEY_BLOB or TPM_DELEGATE_OWNER_BLOB
6	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
7	1	4H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
8	20			TPM_AUTHDATA	resAuth	The authorization session digest for the returned parameters. HMAC key: ownerAuth.

3945Actions

39461. Verify the TPM Owner, directly or indirectly through delegation, authorizes the command
3947 and parameters, on error return TPM_AUTHFAIL

39482. Determine the type of inputData (TPM_DELEGATE_TABLE_ROW or
3949 TPM_DELEGATE_OWNER_BLOB or TPM_DELEGATE_KEY_BLOB) and map D1 to that
3950 structure

3951 a. Mapping to TPM_DELEGATE_TABLE_ROW requires taking inputData as a tableIndex
3952 and locating the appropriate row in the table

39533. If D1 is a TPM_DELEGATE_OWNER_BLOB or TPM_DELEGATE_KEY_BLOB, validate the
3954 integrity of D1

3955 a. Copy D1 -> integrityDigest to H2

3956 b. Set D1 -> integrityDigest to all zeros

3957 c. Create H3 the HMAC of D1 using tpmProof as the secret

3958 d. Compare H2 to H3 return TPM_AUTHFAIL on mismatch

39594. Locate (D1 -> pub -> familyID) in the TPM_FAMILY_TABLE and set familyRow to indicate
3960 row, return TPM_BADINDEX if not found

39615. Set FR to TPM_FAMILY_TABLE.famTableRow[familyRow]

39626. If delegated, verify that family of the delegated Owner-auth is the same as D1:
3963 (authHandle -> familyID) == (D1 -> pub -> familyID); otherwise return error
3964 TPM_DELEGATE_FAMILY

39657. If delegated, verify that the family of the delegated Owner-auth is enabled: if (authHandle
3966 -> familyID -> flags TPM_FAMFLAG_ENABLED) is FALSE, return TPM_DISABLED_CMD

39678. Set D1 -> verificationCount to FR -> verificationCount

3968 9. If D1 is a TPM_DELEGATE_OWNER_BLOB or TPM_DELEGATE_KEY_BLOB set the
3969   integrity of D1

3970   a. Set D1 -> integrityDigest to all zeros

3971   b. Create H1 the HMAC of D1 using tpmProof as the secret

3972   c. Set D1 -> integrityDigest to H1

3973 10. If D1 is a blob recreate the blob and return it

3974 **19.7 TPM_Delegate_VerifyDelegation**

3975**Start of informative comment:**

3976TPM_VerifyDelegation interprets a delegate blob and returns success or failure, depending 3977on whether the blob is currently valid. The delegate blob is NOT loaded into the TPM.

3978**End of informative comment.**

3979**Incoming Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal, TPM_Delegate_VerifyDelegation
4	4	2S	4	UINT32	delegationSize	The length of the delegated information blob
5	<>	3S	<>	BYTE[ ]	delegation	TPM_DELEGATE_KEY_BLOB or TPM_DELEGATE_OWNER_BLOB

3980**Outgoing Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal, TPM_Delegate_VerifyDelegation

3981**Actions**

39821. Determine the type of blob, If delegation -> tag is equal to 3983 TPM_TAG_DELGATE_OWNER_BLOB then

3984 a. Map D1 a TPM_DELEGATE_OWNER_BLOB to delegation

39852. Else if delegation -> tag = TPM_TAG_DELG_KEY_BLOB

3986 a. Map D1 a TPM_DELEGATE_KEY_BLOB to delegation

39873. Else return TPM_BAD_PARAMETER

39884. Locate D1 -> familyID in the TPM_FAMILY_TABLE and set familyRow to indicate row, 3989 return TPM_BADINDEX if not found

39905. Set FR to TPM_FAMILY_TABLE.famTableRow[familyRow]

39916. If FR -> flags TPM_FAMFLAG_ENABLED is FALSE, return TPM_DISABLED_CMD

39927. Validate that D1 -> pub -> verificationCount matches FR -> verificationCount, on 3993 mismatch return TPM_FAMILYCOUNT

39948. Validate the integrity of D1

3995 a. Copy D1 -> integrityDigest to H2

3996   b. Set D1 -> integrityDigest to all zeros

3997   c. Create H3 the HMAC of D1 using tpmProof as the secret

3998   d. Compare H2 to H3 return TPM_AUTHFAIL on mismatch

3999 9. Create S1 a TPM_DELEGATE_SENSITIVE area by decrypting D1 -> sensitiveArea using
4000   TPM_DELEGATE_KEY

4001 10. Validate S1 values

4002   a. S1 -> tag is TPM_TAG_DELEGATE_SENSITIVE

4003   b. Return TPM_BAD_PARAMETER on error

4004 11. Return TPM_SUCCESS

4005 20.   Non-volatile Storage

4006**Start of informative comment:**

4007This section handles the allocation and use of the TPM non-volatile storage.

4008**End of informative comment.**

4009If nvIndex refers to the DIR, the TPM ignores actions containing access control checks that
4010have no meaning for the DIR. The TPM only checks the owner authorization.

4012 20.1   TPM_NV_DefineSpace

4013 **Start of informative comment:**

4014 This establishes the space necessary for the indicated index. The definition will include the
4015 access requirements for writing and reading the area.

4016   Previously defined space at the index and new size is non-zero (and space is available,
4017   etc.) –> redefine the index

4018   No previous space at the index and new size is non-zero (and space is available,
4019   etc.)-> define the index

4020   Previously defined space at the index and new size is 0 -> delete the index

4021   No previous space at the index and new size is 0 -> error

4022 The space definition size does not include the area needed to manage the space.

4023 Setting TPM_PERMANENT_FLAGS -> nvLocked TRUE when it is already TRUE is not an
4024 error.

4025 **End of informative comment.**

4026 Incoming Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Ordinal, TPM_ORD_NV_DefineSpace
4	<>	2S	<>	TPM_NV_DATA_PUBLIC	pubInfo	The public parameters of the NV area
5	20	3S	20	TPM_ENCAUTH	encAuth	The encrypted AuthData, only valid if the attributes require subsequent authorization
6	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for ownerAuth
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
7	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
8	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
9	20			TPM_AUTHDATA	ownerAuth	The authorization session digest HMAC key: ownerAuth

4027 Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	ordinal, TPM_ORD_NV_DefineSpace
4	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs

		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
5	1	4H1	1	BOOL	continueAuthSession	Continue use flag, fixed to FALSE
6	20			TPM_AUTHDATA	ownerAuth	The authorization session digest HMAC key: ownerAuth

4028Description

4029For the case where pubInfo -> dataSize is 0, pubInfo -> pcrInfoRead and pubInfo -> 4030pcrInfoWrite are not used. However, since the general principle is to validate parameters 4031before changing state, the TPM SHOULD parse pubInfo completely before invalidating the 4032data area.

4033Actions

40341. If pubInfo -> nvIndex == TPM_NV_INDEX_LOCK and tag = TPM_TAG_RQU_COMMAND

4035   a. If pubInfo -> dataSize is not 0, the command MAY return TPM_BADINDEX.

4036   b. Set TPM_PERMANENT_FLAGS -> nvLocked to TRUE

4037   c. Return TPM_SUCCESS

40382. If TPM_PERMANENT_FLAGS -> nvLocked is FALSE then all authorization checks except 4039   for the Max NV writes are ignored

4040   a. Ignored checks include physical presence, owner authorization, 'D' bit check, 4041   bGlobalLock, no authorization with a TPM owner present, bWriteSTClear, the check that 4042   pubInfo -> dataSize is 0 in Action 5.c. (the no-authorization case) , disabled and 4043   deactivated.

4044   i. The check that pubInfo -> dataSize is 0 is still enforced in Action 6.f. 4045   (returning after deleting a previously defined storage area) and Action 9.f. (not 4046   allowing a space of size 0 to be defined).

4047   ii. If ownerAuth is present, the TPM MAY check the authorization HMAC.

4048   b. The check for pubInfo -> nvIndex == TPM_NV_INDEX0 in Action 3. is not ignored.

40493. If pubInfo -> nvIndex has the D bit (bit 28) set to a 1 or pubInfo -> nvIndex == 4050   TPM_NV_INDEX0 then

4051   a. Return TPM_BADINDEX

4052   b. The D bit specifies an index value that is set in manufacturing and can never be 4053   deleted or added to the TPM

4054   c. Index value TPM_NV_INDEX0 is reserved and cannot be defined

40554. If tag = TPM_TAG_RQU_AUTH1_COMMAND then

4056   a. The TPM MUST validate the command and parameters using the TPM Owner 4057   authentication and ownerAuth, on error return TPM_AUTHFAIL

4058   b. authHandle session type MUST be OSAP

4059   c. Create A1 by decrypting encAuth according to the ADIP indicated by authHandle.

40605. else

4061   a. Validate the assertion of physical presence. Return TPM_BAD_PRESENCE on error.

4062   b. If TPM Owner is present then return TPM_OWNER_SET.

4063   c. If pubInfo -> dataSize is 0 then return TPM_BAD_DATASIZE. Setting the size to 0
4064   represents an attempt to delete the value without TPM Owner authentication.

4065   d. Validate max NV writes without an owner

4066   i. Set NV1 to TPM_PERMANENT_DATA -> noOwnerNVWrite

4067   ii. Increment NV1 by 1

4068   iii. If NV1 > TPM_MAX_NV_WRITE_NOOWNER return TPM_MAXNVWRITES

4069   iv. Set NV1_INCREMENTED to TRUE

4070   e. Set A1 to encAuth. There is no nonce or authorization to create the encryption string,
4071   hence the AuthData value is passed in the clear

4072 6. If pubInfo -> nvIndex points to a valid previously defined storage area then

4073   a. Map D1 a TPM_NV_DATA_SENSITIVE to the storage area

4074   b. If D1 -> attributes specifies TPM_NV_PER_GLOBALLOCK then

4075   i. If TPM_STCLEAR_FLAGS -> bGlobalLock is TRUE then return
4076   TPM_AREA_LOCKED

4077   c. If D1 -> attributes specifies TPM_NV_PER_WRITE_STCLEAR

4078   i. If D1 -> pubInfo -> bWriteSTClear is TRUE then return TPM_AREA_LOCKED

4079   d. Invalidate the data area currently pointed to by D1 and ensure that if the area is
4080   reallocated no residual information is left

4081   e. If NV1_INCREMENTED is TRUE

4082   i. Set TPM_PERMANENT_DATA -> noOwnerNVWrite to NV1

4083   f. The TPM invalidates authorization sessions

4084   i. MUST invalidate all authorization sessions associated with D1

4085   ii. MAY invalidate any other authorization session

4086   g. If pubInfo -> dataSize is 0 then return TPM_SUCCESS

4087 7. Parse pubInfo -> pcrInfoRead

4088   a. Validate pcrInfoRead structure on error return TPM_INVALID_STRUCTURE

4089   i. Validation includes proper PCR selections and locality selections

4090 8. Parse pubInfo -> pcrInfoWrite

4091   a. Validate pcrInfoWrite structure on error return TPM_INVALID_STRUCTURE

4092   i. Validation includes proper PCR selections and locality selections

4093   b. If pcrInfoWrite -> localityAtRelease disallows some localities

4094   i. Set writeLocalities to TRUE

4095   c. Else

4096   i. Set writeLocalities to FALSE

40979. Validate that the attributes are consistent

4098   a. The TPM SHALL ignore the bReadSTClear, bWriteSTClear and bWriteDefine
4099   attributes during the execution of this command

4100   b. If TPM_NV_PER_OWNERWRITE is TRUE and TPM_NV_PER_AUTHWRITE is TRUE
4101   return TPM_AUTH_CONFLICT

4102   c. If TPM_NV_PER_OWNERREAD is TRUE and TPM_NV_PER_AUTHREAD is TRUE
4103   return TPM_AUTH_CONFLICT

4104   d. If   TPM_NV_PER_OWNERWRITE   and   TPM_NV_PER_AUTHWRITE   and
4105   TPM_NV_PER_WRITEDEFINE and TPM_NV_PER_PPWRITE and writeLocalities are all
4106   FALSE

4107   i.   Return TPM_PER_NOWRITE

4108   e. Validate pubInfo -> nvIndex

4109   i.   Make sure that the index is applicable for this TPM. Return TPM_BADINDEX
4110   on error. A valid index is platform and context sensitive. That is, attempting to
4111   validate an index may be successful in one configuration and invalid in another
4112   configuration. The individual index values MUST indicate if there are any
4113   restrictions on the use of the index.

4114   ii. TPM_NV_INDEX_DIR is always an invalid defined index.

4115   f.   If dataSize is 0 return TPM_BAD_PARAM_SIZE

411610. Create D1 a TPM_NV_DATA_SENSITIVE structure

4117   a. Set D1 -> pubInfo to pubInfo

4118   b. Set D1 -> authValue to A1

4119   c. Set D1 -> pubInfo -> bReadSTClear to FALSE

4120   d. Set D1 -> pubInfo -> bWriteSTClear to FALSE

4121   e. Set D1 -> pubInfo -> bWriteDefine to FALSE

412211. Validate that sufficient NV is available to store D1 and pubInfo -> dataSize bytes of data

4123   a. Return TPM_NOSPACE if pubInfo -> dataSize is not available in the TPM

412412. If pubInfo -> nvIndex is not TPM_NV_INDEX_TRIAL

4125   a. Reserve NV space for pubInfo -> dataSize

4126   b. Set all bytes in the newly defined area to 0xFF

4127   c. If NV1_INCREMENTED is TRUE

4128   i.   Set TPM_PERMANENT_DATA -> noOwnerNVWrite to NV1

412913. Ignore continueAuthSession on input and set to FALSE on output

413014. Return TPM_SUCCESS

4131 20.2 TPM_NV_WriteValue

4132 **Start of informative comment:**

4133 This command writes the value to a defined area. The write can be TPM Owner authorized
4134 or unauthorized and protected by other attributes and will work when no TPM Owner is
4135 present.

4136 The action setting bGlobalLock to TRUE is intentionally before the action checking the
4137 owner authorization. This allows code (e.g., a BIOS) to lock NVRAM without knowing the
4138 owner authorization.

4139 The DIR (TPM_NV_INDEX_DIR) has the attributes TPM_NV_PER_OWNERWRITE and
4140 TPM_NV_WRITEALL.

4141 Certain platform manufacturers or software might require specific error handling in Action
4142 20.2.

4143 Owner authorization is not required when nvLocked is FALSE. If the host does send owner
4144 authorization, Action 20.2 indicates that it should be correct, since some TPM
4145 implementations may validate it.

4146 **End of informative comment.**

4147 Incoming Operands and Sizes

PARAM #	PARAM SZ	HMAC #	HMAC SZ	Type	Name	Description
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Ordinal, TPM_ORD_NV_WriteValue
4	4	2S	4	TPM_NV_INDEX	nvIndex	The index of the area to set
5	4	3S	4	UINT32	offset	The offset into the NV Area
6	4	4S	4	UINT32	dataSize	The size of the data parameter
7	<>	5S	<>	BYTE	data	The data to set the area to
8	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for TPM Owner
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
9	20	3H1	20	TPM_NONCE	authNonceOdd	Nonce generated by caller
10	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
11	20			TPM_AUTHDATA	ownerAuth	The authorization session digest HMAC key: ownerAuth

4148 Outgoing Operands and Sizes

PARAM #	PARAM SZ	HMAC #	HMAC SZ	Type	Name	Description
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	ordinal, TPM_ORD_NV_WriteValue

4	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	authNonceOdd	Nonce generated by caller
5	1	4H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
6	20			TPM_AUTHDATA	ownerAuth	The authorization session digest HMAC key: ownerAuth

4149 Description

4150 For TPM_NV_INDEX_DIR, the ordinal MUST NOT set an error code for the "if dataSize = 0"
4151 action. However, the flags set in this case are not applicable to the DIR.

4152 Actions

4153 1. If TPM_PERMANENT_FLAGS -> nvLocked is FALSE then all authorization checks except
4154 for the max NV writes are ignored

4155 a. Ignored checks include physical presence, owner authorization,
4156 TPM_NV_PER_OWNERWRITE, PCR, bWriteDefine, bGlobalLock, bWriteSTClear, locality,
4157 disabled and deactivated.

4158 b. TPM_NV_PER_AUTHWRITE is not ignored.

4159 c. If ownerAuth is present, the TPM MAY check the authorization HMAC.

4160 2. Locate and set D1 to the TPM_NV_DATA_AREA that corresponds to nvIndex, return
4161 TPM_BADINDEX on error

4162 a. If nvIndex = TPM_NV_INDEX_DIR, set D1 to TPM_PERMANENT_DATA -> authDir[0]

4163 3. If TPM_PERMANENT_FLAGS -> nvLocked is TRUE

4164 a. If D1 -> permission -> TPM_NV_PER_OWNERWRITE is TRUE

4165   i. If TPM_PERMANENT_FLAGS -> disable is TRUE, return TPM_DISABLED

4166   ii. If TPM_STCLEAR_FLAGS -> deactivated is TRUE, return TPM_DEACTIVATED

4167 b. If D1 -> permission -> TPM_NV_PER_OWNERWRITE is FALSE

4168   i. If TPM_PERMANENT_FLAGS -> disable is TRUE, the TPM MAY return
4169   TPM_DISABLED

4170   ii. If TPM_STCLEAR_FLAGS -> deactivated is TRUE, the TPM MAY return
4171   TPM_DEACTIVATED

4172 4. If tag = TPM_TAG_RQU_AUTH1_COMMAND then

4173 a. If D1 -> permission -> TPM_NV_PER_OWNERWRITE is FALSE return
4174 TPM_AUTH_CONFLICT

4175   i. This check is ignored if nvIndex is TPM_NV_INDEX0.

4176 b. Validate command and parameters using ownerAuth HMAC with TPM Owner
4177 authentication as the secret, return TPM_AUTHFAIL on error

4178 5. Else

4179 a. If D1 -> permission -> TPM_NV_PER_OWNERWRITE is TRUE return
4180 TPM_AUTH_CONFLICT

4181   i. This check is ignored if nvIndex is TPM_NV_INDEX0.

4182   b. If no TPM Owner validate max NV writes without an owner

4183   i.   Set NV1 to TPM_PERMANENT_DATA -> noOwnerNVWrite

4184   ii. Increment NV1 by 1

4185   iii. If NV1 > TPM_MAX_NV_WRITE_NOOWNER return TPM_MAXNVWRITES

4186   iv. Set NV1_INCREMENTED to TRUE

4187 6. If nvIndex is TPM_NV_INDEX0 then

4188   a. If dataSize is not 0, the TPM MAY return TPM_BADINDEX.

4189   b. Set TPM_STCLEAR_FLAGS -> bGlobalLock to TRUE

4190   c. Return TPM_SUCCESS

4191 7. If   D1   ->   permission   ->   TPM_NV_PER_AUTHWRITE   is   TRUE   return
4192   TPM_AUTH_CONFLICT

4193 8. Check   that   D1   ->   pcrInfoWrite   ->   localityAtRelease   for   TPM_STANY_DATA   ->
4194   localityModifier is TRUE

4195   a. For example if TPM_STANY_DATA -> localityModifier was 2 then D1 -> pcrInfo ->
4196   localityAtRelease -> TPM_LOC_TWO would have to be TRUE

4197   b. On error return TPM_BAD_LOCALITY

4198 9. If D1 -> attributes specifies TPM_NV_PER_PPWRITE then validate physical presence is
4199   asserted if not return TPM_BAD_PRESENCE

4200 10. If D1 -> attributes specifies TPM_NV_PER_WRITEDEFINE

4201   a. If D1 -> bWriteDefine is TRUE return TPM_AREA_LOCKED

4202 11. If D1 -> attributes specifies TPM_NV_PER_GLOBALLOCK

4203   a. If TPM_STCLEAR_FLAGS -> bGlobalLock is TRUE return TPM_AREA_LOCKED

4204 12. If D1 -> attributes specifies TPM_NV_PER_WRITE_STCLEAR

4205   a. If D1 ->bWriteSTClear is TRUE return TPM_AREA_LOCKED

4206 13. If D1 -> pcrInfoWrite -> pcrSelection specifies a selection of TPM_STCLEAR_DATA ->
4207   PCR[]

4208   a. Create P1 a composite hash of the TPM_STCLEAR_DATA -> PCR[] specified by D1 ->
4209   pcrInfoWrite

4210   b. Compare P1 to D1 -> pcrInfoWrite -> digestAtRelease return TPM_WRONGPCRVAL
4211   on mismatch

4212 14. If dataSize = 0 then

4213   a. Set D1 -> bWriteSTClear to TRUE

4214   b. Set D1 -> bWriteDefine to TRUE

4215 15. Else

4216   a. Set S1 to offset + dataSize

4217   b. If S1 > D1 -> dataSize return TPM_NOSPACE

4218   c. If D1 -> attributes specifies TPM_NV_PER_WRITEALL

4219   i.   If dataSize != D1 -> dataSize return TPM_NOT_FULLWRITE

4220   d. Write the new value into the NV storage area

4221   e. If NV1_INCREMENTED is TRUE

4222   i.   Set TPM_PERMANENT_DATA -> noOwnerNVWrite to NV1

422316. Set D1 -> bReadSTClear to FALSE

422417. Return TPM_SUCCESS

4225 20.3 TPM_NV_WriteValueAuth

4233 **Incoming Operands and Sizes**

PARAM #	PARAM SZ	HMAC #	HMAC SZ	Type	Name	Description
1	2			TPM_TAG	Tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Ordinal, TPM_ORD_NV_WriteValueAuth
4	4	2S	4	TPM_NV_INDEX	nvIndex	The index of the area to set
5	4	3S	4	UINT32	offset	The offset into the chunk
6	4	4S	4	UINT32	dataSize	The size of the data area
7	<>	5S	<>	BYTE	data	The data to set the area to
8	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for NV element authorization
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
9	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
10	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
11	20			TPM_AUTHDATA	authValue	HMAC key: NV element auth value

4234 **Outgoing Operands and Sizes**

PARAM #	PARAM SZ	HMAC #	HMAC SZ	Type	Name	Description
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	ordinal, TPM_ORD_NV_WriteValueAuth
4	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	NonceOdd	Nonce generated by system associated with authHandle
5	1	4H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
6	20			TPM_AUTHDATA	authValue	HMAC key: NV element auth value

4235 **Actions**

4236 1. Locate and set D1 to the TPM_NV_DATA_AREA that corresponds to nvIndex, return
4237   TPM_BADINDEX on error

42382. If D1 -> attributes does not specify TPM_NV_PER_AUTHWRITE then return
4239   TPM_AUTH_CONFLICT

42403. Validate authValue using D1 -> authValue, return TPM_AUTHFAIL on error

42414. Check that D1 -> pcrInfoWrite -> localityAtRelease for TPM_STANY_DATA ->
4242   localityModifier is TRUE

4243   a. For example if TPM_STANY_DATA -> localityModifier was 2 then D1 -> pcrInfo ->
4244   localityAtRelease -> TPM_LOC_TWO would have to be TRUE

4245   b. On error return TPM_BAD_LOCALITY

42465. If D1 -> attributes specifies TPM_NV_PER_PPWRITE then validate physical presence is
4247   asserted if not return TPM_BAD_PRESENCE

42486. If D1 -> pcrInfoWrite -> pcrSelection specifies a selection of PCR

4249   a. Create P1 a composite hash of the TPM_STCLEAR_DATA -> PCR[] specified by D1 ->
4250   pcrInfoWrite

4251   b. Compare P1 to digestAtRelease return TPM_WRONGPCRVAL on mismatch

42527. If D1 -> attributes specifies TPM_NV_PER_WRITEDEFINE

4253   a. If D1 -> bWriteDefine is TRUE return TPM_AREA_LOCKED

42548. If D1 -> attributes specifies TPM_NV_PER_GLOBALLOCK

4255   a. If TPM_STCLEAR_FLAGS -> bGlobalLock is TRUE return TPM_AREA_LOCKED

42569. If D1 -> attributes specifies TPM_NV_PER_WRITE_STCLEAR

4257   a. If D1 -> bWriteSTClear is TRUE return TPM_AREA_LOCKED

425810. If dataSize = 0 then

4259   a. Set D1 -> bWriteSTClear to TRUE

4260   b. Set D1 -> bWriteDefine to TRUE

426111. Else

4262   a. Set S1 to offset + dataSize

4263   b. If S1 > D1 -> dataSize return TPM_NOSPACE

4264   c. If D1 -> attributes specifies TPM_NV_PER_WRITEALL

4265   i. If dataSize != D1 -> dataSize return TPM_NOT_FULLWRITE

4266   d. Write the new value into the NV storage area

426712. Set D1 -> bReadSTClear to FALSE

426813. Return TPM_SUCCESS

4269 20.4   TPM_NV_ReadValue

4270 **Start of informative comment:**

4271 Read a value from the NV store. This command uses optional owner authentication.

4272 Action 1 indicates that if the NV area is not locked then reading of the NV area continues
4273 without ANY authorization. This is intentional, and allows a platform manufacturer to set
4274 the NV areas, read them back, and then lock them all without having to install a TPM
4275 owner.

4276 Certain platform manufacturers or software might require specific error handling in Action
4277 20.4.

4278 Owner authorization is not required when nvLocked is FALSE. If the host does send owner
4279 authorization, Action 20.4 indicates that it should be correct, since some TPM
4280 implementations may validate it.

4281 **End of informative comment.**

4282 Incoming Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Ordinal, TPM_ORD_NV_ReadValue
4	4	2S	4	TPM_NV_INDEX	nvIndex	The index of the area to set
5	4	3S	4	UINT32	offset	The offset into the area
6	4	4S	4	UINT32	dataSize	The size of the data area
7	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for TPM Owner authorization
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
8	20	3H1	20	TPM_NONCE	authNonceOdd	Nonce generated by caller
9	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
10	20			TPM_AUTHDATA	ownerAuth	HMAC key: ownerAuth

4283 Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S		TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	TPM_ORD_NV_ReadValue
4	4	3S	4	UINT32	dataSize	The size of the data area
5	<>	4S	<>	BYTE	data	The data to set the area to
6	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs

		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
7	1	4H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
8	20			TPM_AUTHDATA	ownerAuth	HMAC key: ownerAuth

4284 Actions

42851. If TPM_PERMANENT_FLAGS -> nvLocked is FALSE then all authorization checks are 4286 ignored.

4287 a. Ignored checks include physical presence, owner authorization, PCR, bReadSTClear, 4288 locality, TPM_NV_PER_OWNERREAD, disabled and deactivated.

4289 b. TPM_NV_PER_AUTHREAD is not ignored.

4290 c. If ownerAuth is present, the TPM MAY check the authorization HMAC.

42912. Set D1 a TPM_NV_DATA_AREA structure to the area pointed to by nvIndex, if not found 4292 return TPM_BADINDEX

4293 a. If nvIndex = TPM_NV_INDEX_DIR, set D1 to TPM_PERMANENT_DATA -> authDir[0]

42943. If TPM_PERMANENT_FLAGS -> nvLocked is TRUE

4295 a. If D1 -> permission -> TPM_NV_PER_OWNERREAD is TRUE

4296 i. If TPM_PERMANENT_FLAGS -> disable is TRUE, return TPM_DISABLED

4297 ii. If TPM_STCLEAR_FLAGS -> deactivated is TRUE, return TPM_DEACTIVATED

4298 b. If D1 -> permission -> TPM_NV_PER_OWNERREAD is FALSE

4299 i. If TPM_PERMANENT_FLAGS -> disable is TRUE, the TPM MAY return 4300 TPM_DISABLED

4301 ii. If TPM_STCLEAR_FLAGS -> deactivated is TRUE, the TPM MAY return 4302 TPM_DEACTIVATED

43034. If tag = TPM_TAG_RQU_AUTH1_COMMAND then

4304 a. If D1 -> TPM_NV_PER_OWNERREAD is FALSE return TPM_AUTH_CONFLICT

4305 b. Validate command and parameters using TPM Owners authentication on error return 4306 TPM_AUTHFAIL

43075. Else

4308 a. If D1 -> TPM_NV_PER_AUTHREAD is TRUE return TPM_AUTH_CONFLICT

4309 b. If D1 -> TPM_NV_PER_OWNERREAD is TRUE return TPM_AUTH_CONFLICT

43106. Check that D1 -> pcrInfoRead -> localityAtRelease for TPM_STANY_DATA -> 4311 localityModifier is TRUE

4312 a. For example if TPM_STANY_DATA -> localityModifier was 2 then D1 -> pcrInfo -> 4313 localityAtRelease -> TPM_LOC_TWO would have to be TRUE

4314 b. On error return TPM_BAD_LOCALITY

43157. If D1 -> attributes specifies TPM_NV_PER_PPREAD then validate physical presence is 4316 asserted if not return TPM_BAD_PRESENCE

43178. If D1 -> TPM_NV_PER_READ_STCLEAR then

4318   a. If D1 -> bReadSTClear is TRUE return TPM_DISABLED_CMD

4319 9. If D1 -> pcrInfoRead -> pcrSelection specifies a selection of PCR

4320   a. Create P1 a composite hash of the TPM_STCLEAR_DATA -> PCR[] specified by D1 ->
4321   pcrInfoRead

4322   b. Compare P1 to D1 -> pcrInfoRead -> digestAtRelease return TPM_WRONGPCRVAL on
4323   mismatch

4324 10. If dataSize is 0 then

4325   a. Set D1 -> bReadSTClear to TRUE

4326   b. Set data to NULL (output parameter dataSize to 0)

4327 11. Else

4328   a. Set S1 to offset + dataSize

4329   b. If S1 > D1 -> dataSize return TPM_NOSPACE

4330   c. Set data to area pointed to by offset

4331   i.   This includes partial reads of TPM_NV_INDEX_DIR.

4332 12. Return TPM_SUCCESS

4333 20.5 TPM_NV_ReadValueAuth

4334**Start of informative comment:**

4335This command requires that the read be authorized by a value set with the blob.

4336The Part 2 ordinal table indicates that TPM_NV_ReadValueAuth requires an owner present.
4337This is normative, although it was a mistake.

4338**End of informative comment.**

4339**Incoming Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Ordinal, TPM_ORD_NV_ReadValueAuth
4	4	2S	4	TPM_NV_INDEX	nvIndex	The index of the area to set
5	4	3S	4	UNIT32	offset	The offset from the data area
6	4	5S	4	UINT32	dataSize	The size of the data area
7	4			TPM_AUTHHANDLE	authHandle	authThe auth handle for the NV element authorization
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
8	20	3H1	20	TPM_NONCE	authNonceOdd	Nonce generated by system associated with authHandle
9	1	4H1	1	BOOL	authContinueSession	The continue use flag for the authorization session handle
10	20			TPM_AUTHDATA	authHmac	HMAC key: nv element authorization

4340**Outgoing Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	ordinal, TPM_ORD_NV_ReadValueAuth
4	4	3S	4	UINT32	dataSize	The size of the data area
5	<>	4S	<>	BYTE	data	The data
6	20	2H1	20	TPM_NONCE	authNonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	authLastNonceOdd	Nonce generated by system associated with authHandle
7	1	4H1	1	BOOL	authContinueSession	Continue use flag, TRUE if handle is still active
8	20			TPM_AUTHDATA	authHmacOut	HMAC key: nv element authorization

4341**Actions**

43421. Locate and set D1 to the TPM_NV_DATA_AREA that corresponds to nvIndex, on error
4343   return TPM_BADINDEX

4344 2. If D1 -> TPM_NV_PER_AUTHREAD is FALSE return TPM_AUTH_CONFLICT

4345 3. Validate authHmac using D1 -> authValue on error return TPM_AUTHFAIL

4346 4. If D1 -> attributes specifies TPM_NV_PER_PPREAD then validate physical presence is
4347 asserted if not return TPM_BAD_PRESENCE

4348 5. Check that D1 -> pcrInfoRead -> localityAtRelease for TPM_STANY_DATA ->
4349 localityModifier is TRUE

4350 a. For example if TPM_STANY_DATA -> localityModifier was 2 then D1 -> pcrInfo ->
4351 localityAtRelease -> TPM_LOC_TWO would have to be TRUE

4352 b. On error return TPM_BAD_LOCALITY

4353 6. If D1 -> pcrInfoRead -> pcrSelection specifies a selection of PCR

4354 a. Create P1 a composite hash of the TPM_STCLEAR_DATA -> PCR[] specified by D1 ->
4355 pcrInfoRead

4356 b. Compare P1 to D1 -> pcrInfoRead -> digestAtRelease return TPM_WRONGPCRVAL on
4357 mismatch

4358 7. If D1 specifies TPM_NV_PER_READ_STCLEAR then

4359 a. If D1 -> bReadSTClear is TRUE return TPM_DISABLED_CMD

4360 8. If dataSize is 0 then

4361 a. Set D1 -> bReadSTClear to TRUE

4362 b. Set data to all zeros

4363 9. Else

4364 a. Set S1 to offset + dataSize

4365 b. If S1 > D1 -> dataSize return TPM_NOSPACE

4366 c. Set data to area pointed to by offset

4367 10. Return TPM_SUCCESS

4368 21.   Session Management

4369**Start of informative comment:**

4370Three TPM_RT_CONTEXT session resources located in TPM_STANY_DATA work together to 4371control session save and load: contextNonceSession, contextCount, and contextList[].

4372All three MUST initialized at TPM_Startup(ST_CLEAR) and TPM_Startup(ST_DEACTIVATED) 4373and MAY be initialized at TPM_Startup(ST_STATE).   Initializing invalidates all saved 4374sessions. They MAY be restored by TPM_Startup(ST_STATE). This case would allow saved 4375sessions to be loaded.   The actual ST_STATE operation is reported by the 4376TPM_RT_CONTEXT startup effect.

4377TPM_SaveContext creates a contextBlob containing an encrypted contextNonceSession. The 4378nonce is checked by TPM_LoadContext. So initializing contextNonceSession invalidates all 4379saved contexts. The nonce is large and protected, making a replay infeasible.

4380The contextBlob also contains a public but protected contextCount. The count increments 4381for each saved contextBlob. The TPM also saves contextCount in contextList[]. The TPM 4382validates contextBlob against the contextList[] during TPM_LoadContext. Since the 4383contextList[] is finite, it limits the number of valid saved sessions. Since the contextCount 4384cannot be allowed to wrap, it limits the total number of saved sessions.

4385After a contextBlob is loaded, its contextCount entry is removed from contextList[]. This 4386releases space in the context list for future entries. It also invalidates the contextBlob. So a 4387saved contextBlob can be loaded only once.

4388TPM_FlushSpecific can also specify a contextCount to be removed from the contextList[], 4389allowing invalidation of an individual contextBlob. This is different from TPM_FlushSpecific 4390specifying a session handle, which invalidates a loaded session, not a saved contextBlob.

4391**End of informative comment.**

4392

4393 21.1   TPM_KeyControlOwner

4394**Start of informative comment:**

4395This command controls some attributes of keys that are stored within the TPM key cache.

4396OwnerEvict: If this bit is set to true, this key remains in the TPM non-volatile storage 4397through all TPM_Startup events. The only way to evict this key is for the TPM Owner to 4398execute this command again, setting the owner control bit to false and then executing 4399TPM_FlushSpecific.

4400The key handle does not reference an authorized entity and is not validated.

4401The check for two remaining key slots ensures that users can load the two keys required to 4402execute many commands. Since only the owner can flush owner evict keys, non-owner 4403commands could be blocked if this test was not performed.

4404**End of informative comment.**

4405**Incoming Parameters and Sizes**

PARAM	HMAC	Type	Name	Description

#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes incl. paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_KeyControlOwner
4	4			TPM_KEY_HANDLE	keyHandle	The handle of a loaded key.
5	<>	2S	<>	TPM_PUBKEY	pubKey	The public key associated with the loaded key
6	4	3S	4	TPM_KEY_CONTROL	bitName	The name of the bit to be modified
7	1	4S	1	BOOL	bitValue	The value to set the bit to
8	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for owner authentication.
9		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
10	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
11	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
12	20		20	TPM_AUTHDATA	ownerAuth	HMAC authorization: key ownerAuth

4406 Outgoing Parameters and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal:TPM_ORD_KeyControlOwner
4	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM.
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system
5	1	4H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
6	20			TPM_AUTHDATA	resAuth	HMAC authorization: key ownerAuth

4407 Description

4408 1. Set an internal bit within the key cache that controls some attribute of a loaded key.

4409 Actions

4410 1. Validate the AuthData using the owner authentication value, on error return
4411 TPM_AUTHFAIL

4412 2. Validate that keyHandle refers to a loaded key, return TPM_INVALID_KEYHANDLE on
4413 error.

4414 3. Validate that pubKey matches the key held by the TPM pointed to by keyHandle, return
4415 TPM_BAD_PARAMETER on mismatch

4416 a. This check is added so that virtualization of the keyHandle does not result in attacks,
4417 as the keyHandle is not associated with an authorization value

4418 4. Validate that bitName is valid, return TPM_BAD_MODE on error.

4419 5. If bitName == TPM_KEY_CONTROL_OWNER_EVICT

4420   a. If bitValue == TRUE

4421   i. Verify that after this operation at least two key slots will be present within the
4422   TPM that can store any type of key both of which do NOT have the OwnerEvict bit
4423   set, on error return TPM_NOSPACE

4424   ii. Verify that for this key handle, parentPCRStatus is FALSE and isVolatile is
4425   FALSE. Return TPM_BAD_PARAMETER on error.

4426   iii. Set ownerEvict within the internal key storage structure to TRUE.

4427   b. Else if bitValue == FALSE

4428   i. Set ownerEvict within the internal key storage structure to FALSE.

44296. Return TPM_SUCCESS

4430 21.2   TPM_SaveContext

4431 **Start of informative comment:**

4432 TPM_SaveContext saves a loaded resource outside the TPM. After successful execution of
4433 the command, the TPM automatically releases the internal memory for sessions but leaves
4434 keys in place.

4435 There is no assumption that a saved context blob is stored in a safe, protected area. Since
4436 the context blob can be loaded at any time, do not rely on TPM_SaveContext to restrict
4437 access to an entity such as a key. If use of the entity should be restricted, means such as
4438 authorization secrets or PCR's should be used.

4439 In general, TPM_SaveContext can save a transport session. However, it cannot save an
4440 exclusive transport session, because any ordinal other than TPM_ExecuteTransport
4441 terminates the exclusive transport session. This action prevents the exclusive transport
4442 session from being saved and reloaded while intervening commands are hidden from the
4443 transport log.

4444 **End of informative comment.**

4445 Incoming Parameters and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_SaveContext
4	4			TPM_HANDLE	handle	Handle of the resource being saved.
5	4	2S	4	TPM_RESOURCE_TYPE	resourceType	The type of resource that is being saved
6	16	3S	16	BYTE[16]	label	Label for identification purposes

4446 Outgoing Parameters and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_SaveContext
4	4	3S	4	UINT32	contextSize	The actual size of the outgoing context blob
5	<>	4S	<>	TPM_CONTEXT_BLOB	contextBlob	The context blob

4447 Description

4448 1. The caller of the function uses the label field to add additional sequencing, anti-replay or
4449 other items to the blob. The information does not need to be confidential but needs to be
4450 part of the blob integrity.

4451**Actions**

44521. Map V1 to TPM_STANY_DATA

44532. Validate that handle points to resource that matches resourceType, return
4454   TPM_INVALID_RESOURCE on error

44553. Validate that resourceType is a resource from the following list if not return
4456   TPM_INVALID_RESOURCE

4457   a. TPM_RT_KEY

4458   b. TPM_RT_AUTH

4459   c. TPM_RT_TRANS

4460   d. TPM_RT_DAA_TPM

44614. Locate the correct nonce

4462   a. If resourceType is TPM_RT_KEY

4463   i. If TPM_STCLEAR_DATA -> contextNonceKey is all zeros

4464   (1)   Set TPM_STCLEAR_DATA -> contextNonceKey to the next value from
4465   the TPM RNG

4466   ii. Map N1 to TPM_STCLEAR_DATA -> contextNonceKey

4467   iii. If the key has TPM_KEY_CONTROL_OWNER_EVICT set then return
4468   TPM_OWNER_CONTROL

4469   b. Else

4470   i. If V1 -> contextNonceSession is all zeros

4471   (1)   Set V1 -> contextNonceSession to the next value from the TPM RNG

4472   ii. Map N1 to V1 -> contextNonceSession

44735. Set K1 to TPM_PERMANENT_DATA -> contextKey

44746. Create R1 by putting the sensitive part of the resource pointed to by handle into a
4475   structure. The structure is a TPM manufacturer option. The TPM MUST ensure that ALL
4476   sensitive information of the resource is included in R1.

44777. Create C1 a TPM_CONTEXT_SENSITIVE structure

4478   a. C1 forms the inner encrypted wrapper for the blob. All saved context blobs MUST
4479   include a TPM_CONTEXT_SENSITIVE structure and the TPM_CONTEXT_SENSITIVE
4480   structure MUST be encrypted.

4481   b. Set C1 -> contextNonce to N1

4482   c. Set C1 -> internalData to R1

44838. Create B1 a TPM_CONTEXT_BLOB

4484   a. Set B1 -> tag to TPM_TAG_CONTEXTBLOB

4485   b. Set B1 -> resourceType to resourceType

4486   c. Set B1 -> handle to handle

4487   d. Set B1 -> integrityDigest to all zeros

4488   e. Set B1 -> label to label

4489   f.   Set B1 -> additionalData to information determined by the TPM manufacturer. This
4490   data will help the TPM to reload and reset context. This area MUST NOT hold any data
4491   that is sensitive (symmetric IV are fine, prime factors of an RSA key are not).

4492   i.   For OSAP sessions and for DSAP sessions attached to keys, the hash of the
4493   entity MUST be included in additionalData

4494   g. Set B1 -> additionalSize to the size of additionalData

4495   h. Set B1 -> sensitiveSize to the size of C1

4496   i.   Set B1 -> sensitiveData to C1

4497 9. If resourceType is TPM_RT_KEY

4498   a. Set B1 -> contextCount to 0

4499 10. Else

4500   a. If V1 -> contextCount > 2^{32}-2 then

4501   i.   Return with TPM_TOOMANYCONTEXTS

4502   b. Else

4503   i.   Validate that the TPM can still manage the new count value

4504   (1)   If the distance between the oldest saved context and the contextCount
4505   is too large return TPM_CONTEXT_GAP

4506   ii. Find contextIndex such that V1 -> contextList[contextIndex] equals 0. If not
4507   found exit with TPM_NOCONTEXTSPACE

4508   iii. Increment V1 -> contextCount by 1

4509   iv. Set V1-> contextList[contextIndex] to V1 -> contextCount

4510   v.   Set B1 -> contextCount to V1 -> contextCount

4511   c. The TPM MUST invalidate all information regarding the resource except for
4512   information needed for reloading

4513 11. Calculate B1 -> integrityDigest the HMAC of B1 using TPM_PERMANENT_DATA ->
4514   tpmProof as the secret

4515 12. Create E1 by encrypting C1 using K1 as the key

4516   a. Set B1 -> sensitiveSize to the size of E1

4517   b. Set B1 -> sensitiveData to E1

4518 13. Set contextSize to the size of B1

4519 14. Return B1 in contextBlob

4520**21.3**   **TPM_LoadContext**

4521**Start of informative comment:**

4522TPM_LoadContext loads into the TPM a previously saved context. The command returns a
4523handle.

4524**End of informative comment.**

4525**Incoming Parameters and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_LoadContext
4	4			TPM_HANDLE	entityHandle	The handle the TPM MUST use to locate the entity tied to the OSAP/DSAP session
5	1	2S	1	BOOL	keepHandle	Indication if the handle MUST be preserved
6	4	3S	4	UINT32	contextSize	The size of the following context blob.
7	<>	4S	<>	TPM_CONTEXT_BLOB	contextBlob	The context blob

4526**Outgoing Parameters and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_LoadContext
4	4			TPM_HANDLE	handle	The handle assigned to the resource after it has been successfully loaded.

4527**Actions**

45281. Map contextBlob to B1, a TPM_CONTEXT_BLOB structure

45292. Map V1 to TPM_STANY_DATA

45303. Create M1 by decrypting B1 -> sensitiveData using TPM_PERMANENT_DATA ->
4531 contextKey

45324. Create C1 and R1 by splitting M1 into a TPM_CONTEXT_SENSITIVE structure and
4533 internal resource data

45345. Check contextNonce

4535 a. If B1 -> resourceType is NOT TPM_RT_KEY

4536   i. If C1 -> contextNonce does not equal V1 -> contextNonceSession return
4537   TPM_BADCONTEXT

ii. Validate that the resource pointed to by the context is loaded (i.e. for OSAP the key referenced is loaded and DSAP connected to the key) return TPM_RESOURCEMISSING

    (1)   For OSAP sessions and for DSAP sessions attached to keys, the TPM MUST validate that the hash of the entity matches the entity held by the TPM

    (2)   For OSAP and DSAP sessions referring to a key, verify that entityHandle identifies the key linked to this OSAP/DSAP session, if not return TPM_BAD_HANDLE.

b. Else

    i. If C1 -> internalData -> parentPCRStatus is FALSE and C1 -> internalData -> isVolatile is FALSE

        (1)   Ignore C1 -> contextNonce

    ii. else

        (1)   If C1 -> contextNonce does not equal TPM_STCLEAR_DATA -> contextNonceKey return TPM_BADCONTEXT

6. Validate the structure

a. Set H1 to B1 -> integrityDigest

b. Set B1 -> integrityDigest to all zeros

c. Copy M1 to B1 -> sensitiveData

d. Create H2 the HMAC of B1 using TPM_PERMANENT_DATA -> tpmProof as the HMAC key

e. If H2 does not equal H1 return TPM_BADCONTEXT

7. If keepHandle is TRUE

a. Set handle to B1 -> handle

b. If the TPM is unable to restore the handle the TPM MUST return TPM_BAD_HANDLE

8. Else

a. The TPM SHOULD attempt to restore the handle but if not possible it MAY set the handle to any valid for B1 -> resourceType

9. If B1 -> resourceType is NOT TPM_RT_KEY

a. Find contextIndex such that V1 -> contextList[contextIndex] equals B1 -> TPM_CONTEXT_BLOB -> contextCount

b. If not found then return TPM_BADCONTEXT

c. Set V1 -> contextList[contextIndex] to 0

10. Process B1 to return the resource back into TPM use

4572 22. Eviction

4573**Start of informative comment:**

4574The TPM has numerous resources held inside of the TPM that may need eviction. The need 4575for eviction occurs when the number or resources in use by the TPM exceed the available 4576space. For resources that are hard to reload (i.e. keys tied to PCR values) the outside entity 4577should first perform a context save before evicting items.

4578In version 1.1 there were separate commands to evict separate resource types. This new 4579command set uses the resource types defined for context saving and creates a generic 4580command that will evict all resource types.

4581**End of informative comment.**

4582The TPM MUST NOT flush the EK or SRK using this command.

4583Version 1.2 deprecates the following commands:

4584● TPM_Terminate_Handle

4585● TPM_EvictKey

4586● TPM_Reset

4587 **22.1 TPM_FlushSpecific**

4591 **Incoming Parameters and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_FlushSpecific
4	4			TPM_HANDLE	handle	The handle of the item to flush
5	4	2S	4	TPM_RESOURCE_TYPE	resourceType	The type of resource that is being flushed

4592 **Outgoing Parameters and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_FlushSpecific

4593 **Description**

4594 TPM_FlushSpecific releases the resources associated with the given handle.

4595 **Actions**

4596 1. If resourceType is TPM_RT_CONTEXT

4597   a. The handle for a context is not a handle but the "context count" value. The TPM uses
4598   the "context count" value to locate the proper contextList entry and sets R1 to the
4599   contextList entry

4600 2. Else if resourceType is TPM_RT_KEY

4601   a. Set R1 to the key pointed to by handle

4602   b. If R1 -> ownerEvict is TRUE return TPM_KEY_OWNER_CONTROL

4603 3. Else if resourceType is TPM_RT_AUTH

4604   a. Set R1 to the authorization session pointed to by handle

4605 4. Else if resourceType is TPM_RT_TRANS

4606   a. Set R1 to the transport session pointed to by handle

4607 5. Else if resourceType is TPM_RT_DAA_TPM

4608   a. Set R1 to the DAA session pointed to by handle

46096. Else return TPM_INVALID_RESOURCE

46107. Validate that R1 determined by resourceType and handle points to a valid allocated
4611   resource. Return TPM_BAD_PARAMETER on error.

46128. Invalidate R1 and all internal resources allocated to R1

4613   a. Resources include authorization sessions

4614 # 23. Timing Ticks

4623 ## 23.1 TPM_GetTicks

4627 **Incoming Parameters and Sizes**

| PARAM | | HMAC | | Type | Name | Description |
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Ordinal: TPM_ORD_GetTicks

4628 **Outgoing Parameters and Sizes**

| PARAM | | HMAC | | Type | Name | Description |
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Ordinal: TPM_ORD_GetTicks
4	32	3S	32	TPM_CURRENT_TICKS	currentTime	The current time held in the TPM

4629 **Description**

4630 This command returns the current time held in the TPM. It is the responsibility of the
4631 external system to maintain any relation between this time and a UTC value or local real
4632 time value.

4633 **Actions**

4634 1. Set T1 to the internal TPM_CURRENT_TICKS structure

4635 2. Return T1 as currentTime.

463623.2   TPM_TickStampBlob

4637**Start of informative comment:**

4638This command applies a time stamp to the passed blob. The TPM makes no representation
4639regarding the blob merely that the blob was present at the TPM at the time indicated.

4640**End of informative comment.**

4641**Incoming Parameters and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Ordinal, fixed value of TPM_ORD_TickStampBlob
4	4			TPM_KEY_HANDLE	keyHandle	The keyHandle identifier of a loaded key that can perform digital signatures.
5	20	2S	20	TPM_NONCE	antiReplay	Anti replay value added to signature
6	20	3S	20	TPM_DIGEST	digestToStamp	The digest to perform the tick stamp on
7	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for keyHandle authorization
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
8	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
9	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
10	20			TPM_AUTHDATA	privAuth	The authorization session digest that authorizes the use of keyHandle. HMAC key: key.usageAuth

4642 Outgoing Parameters and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Ordinal, fixed value of TPM_ORD_TickStampBlob
4	32	3S	32	TPM_CURRENT_TICKS	currentTicks	The current time according to the TPM
5	4	4S	4	UINT32	sigSize	The length of the returned digital signature
6	<>	5S	<>	BYTE[ ]	sig	The resulting digital signature.
7	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
8	1	4H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
9	20			TPM_AUTHDATA	resAuth	The authorization session digest for the returned parameters. HMAC key: key.usageAuth

4643 Description

4644 The function performs a digital signature on the hash of digestToStamp and the current tick 4645 count.

4646 It is the responsibility of the external system to maintain any relation between tick count 4647 and a UTC value or local real time value.

4648 Actions

4649 1. The TPM validates the AuthData to use the key pointed to by keyHandle.

4650 2. Validate that keyHandle -> keyUsage is TPM_KEY_SIGNING, TPM_KEY_IDENTITY or 4651 TPM_KEY_LEGACY, if not return the error code TPM_INVALID_KEYUSAGE.

4652 3. Validate that keyHandle -> sigScheme is TPM_SS_RSASSAPKCS1v15_SHA1 or 4653 TPM_SS_RSASSAPKCS1v15_INFO, if not return TPM_INAPPROPRIATE_SIG.

4654 4. If TPM_STCLEAR_DATA -> currentTicks is not properly initialized

4655   a. Initialize the TPM_STCLEAR_DATA -> currentTicks

4656 5. Create T1, a TPM_CURRENT_TICKS structure.

4657 6. Create H1 a TPM_SIGN_INFO structure and set the structure defaults

4658   a. Set H1 -> fixed to "TSTP"

4659   b. Set H1 -> replay to antiReplay

4660   c. Create H2 the concatenation of digestToStamp || T1

4661   d. Set H1 -> dataLen to the length of H2

4662   e. Set H1 -> data to H2

46637. The TPM computes the signature, sig, using the key referenced by keyHandle, using
4664   SHA-1 of H1 as the information to be signed

46658. The TPM returns T1 as currentTicks parameter

4666 24. Transport Sessions

4667

4668 See Part 1 for rationale and security issues.

4669 24.1 TPM_EstablishTransport

4670 **Start of informative comment:**

4671 This establishes the transport session. Depending on the attributes specified for the session
4672 this may establish shared secrets, encryption keys, and session logs. The session will be in
4673 use for by the TPM_ExecuteTransport command.

4674 The only restriction on what can happen inside of a transport session is that there is no
4675 "nesting" of sessions. It is permissible to perform operations that delete internal state and
4676 make the TPM inoperable.

4677 **End of informative comment.**

4678 **Incoming Parameters and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_EstablishTransport
4	4			TPM_KEY_HANDLE	encHandle	The handle to the key that encrypted the blob
5	<>	2S	<>	TPM_TRANSPORT_PUBLIC	transPublic	The public information describing the transport session
6	4	3S	4	UINT32	secretSize	The size of the secret Area
7	<>	4S	<>	BYTE[]	secret	The encrypted secret area
8	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for keyHandle authorization
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
9	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
10	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
11	20			TPM_AUTHDATA	keyAuth	Authorization. HMAC key: encKey.usageAuth

4679

4680Outgoing Parameters and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_EstablishTransport
4	4			TPM_TRANSHANDLE	transHandle	The handle for the transport session
5	4	3S	4	TPM_MODIFIER_INDICATOR	locality	The locality that called this command
6	32	4S	32	TPM_CURRENT_TICKS	currentTicks	The current tick count
7	20	5S	20	TPM_NONCE	transNonceEven	The even nonce in use for subsequent execute transport
8	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
9	1	4H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
10	20			TPM_AUTHDATA	resAuth	Authorization. HMAC key: key.usageAuth

4681Description

4682This command establishes the transport sessions shared secret. The encryption of the
4683shared secret uses the public key of the key loaded in encKey.

4684Actions

46851. If encHandle is TPM_KH_TRANSPORT then

4686   a. If tag is NOT TPM_TAG_RQU_COMMAND return TPM_BADTAG

4687   b. If transPublic -> transAttributes specifies TPM_TRANSPORT_ENCRYPT return
4688   TPM_BAD_SCHEME

4689   c. If secretSize is not 20 return TPM_BAD_PARAM_SIZE

4690   d. Set A1 to secret

46912. Else

4692   a. encHandle -> keyUsage MUST be TPM_KEY_STORAGE or TPM_KEY_LEGACY return
4693   TPM_INVALID_KEYUSAGE on error

4694   b. If encHandle -> authDataUsage does not equal TPM_AUTH_NEVER and tag is NOT
4695   TPM_TAG_RQU_AUTH1_COMMAND return TPM_AUTHFAIL

4696   c. Using encHandle -> usageAuth validate the AuthData to use the key and the
4697   parameters to the command

4698   d. Create K1 a TPM_TRANSPORT_AUTH structure by decrypting secret using the key
4699   pointed to by encHandle

4700   e. Validate K1 for tag

4701   f. Set A1 to K1 -> authData

4702 3. If transPublic -> transAttributes has TPM_TRANSPORT_ENCRYPT

4703   a. If TPM_PERMANENT_FLAGS -> FIPS is true and transPublic -> algId is equal to
4704   TPM_ALG_MGF1 return TPM_INAPPROPRIATE_ENC

4705   b. Check if the transPublic -> algId is supported, if not return
4706   TPM_BAD_KEY_PROPERTY

4707   c. If transPublic -> algid is TPM_ALG_AESXXX, check that transPublic -> encScheme is
4708   supported, if not return TPM_INAPPROPRIATE_ENC

4709   d. Perform any initializations necessary for the algorithm

4710 4. Generate transNonceEven from the TPM RNG

4711 5. Create T1 a TPM_TRANSPORT_INTERNAL structure

4712   a. Ensure that the TPM has sufficient internal space to allocate the transport session,
4713   return TPM_RESOURCES on error

4714   b. Assign a T1 -> transHandle value. This value is assigned by the TPM

4715   c. Set T1 -> transDigest to all zeros

4716   d. Set T1 -> transPublic to transPublic

4717   e. Set T1-> transNonceEven to transNonceEven

4718   f. Set T1 -> authData to A1

4719 6. If TPM_STANY_DATA -> currentTicks is not properly initialized

4720   a. Initialize the TPM_STANY_DATA -> currentTicks

4721 7. Set currentTicks to TPM_STANY_DATA -> currentTicks

4722 8. If T1 -> transPublic -> transAttributes has TPM_TRANSPORT_LOG set then

4723   a. Create L1 a TPM_TRANSPORT_LOG_IN structure

4724   i. Set L1 -> parameters to SHA-1 (ordinal || transPublic || secretSize || secret)

4725   ii. Set L1 -> pubKeyHash to all zeros

4726   iii. Set T1 -> transDigest to SHA-1 (T1 -> transDigest || L1)

4727   b. Create L2 a TPM_TRANSPORT_LOG_OUT structure

4728   i. Set L2 -> parameters to SHA-1 (returnCode || ordinal || locality ||
4729   currentTicks || transNonceEven)

4730   ii. Set L2 -> locality to the locality of this command

4731   iii. Set L2 -> currentTicks to currentTicks, this MUST be the same value that is
4732   returned in the currentTicks parameter

4733   iv. Set T1 -> transDigest to SHA-1 (T1 -> transDigest || L2)

4734 9. If T1 -> transPublic -> transAttributes has TPM_TRANSPORT_EXCLUSIVE then set
4735   TPM_STANY_FLAGS -> transportExclusive to TRUE

4736   a. Execution of any command other than TPM_ExecuteTransport or
4737   TPM_ReleaseTransportSigned targeting this transport session will cause the abnormal
4738   invalidation of this transport session transHandle

4739   b. The TPM gives no indication, other than invalidation of transHandle, that the session
4740   is terminated

474110.Return T1 -> transHandle as transHandle

4742 24.2 TPM_ExecuteTransport

4743 **Start of informative comment:**

4744 Delivers a wrapped TPM command to the TPM where the TPM unwraps the command and
4745 then executes the command.

4746 TPM_ExecuteTransport uses the same rolling nonce paradigm as other authorized TPM
4747 commands. The even nonces start in TPM_EstablishTransport and change on each
4748 invocation of TPM_ExecuteTransport.

4749 The only restriction on what can happen inside of a transport session is that there is no
4750 "nesting" of sessions. It is permissible to perform operations that delete internal state and
4751 make the TPM inoperable.

4752 Because, in general, key handles are not logged, a digest of the corresponding public key is
4753 logged. In cases where the key handle is logged (e.g. TPM_OwnerReadInternalPub), the
4754 public key is also logged.

4755 The wrapped command is audited twice – once according to the actions of
4756 TPM_ExecuteTransport and once within the wrapped command itself according to the
4757 special rules for auditing a command wrapped in an encrypted transport session.

4758 The method of incrementing the symmetric key counter value is different from that used by
4759 some standard crypto libraries (e.g. openSSL, Java JCE) that increment the entire counter
4760 value. TPM users should be aware of this to avoid errors when the counter wraps.

4761 **End of informative comment.**

4762 **Incoming Parameters and Sizes**

PARAM #	PARAM SZ	HMAC #	HMAC SZ	Type	Name	Description
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_ExecuteTransport
4	4	2S	4	UINT32	wrappedCmdSize	Size of the wrapped command
5	<>	3S	<>	BYTE[]	wrappedCmd	The wrapped command
6	4			TPM_TRANSHANDLE	transHandle	The transport session handle
		2H1	20	TPM_NONCE	transLastNonceEven	Even nonce previously generated by TPM
7	20	3H1	20	TPM_NONCE	transNonceOdd	Nonce generated by caller
8	1	4H1	1	BOOL	continueTransSession	The continue use flag for the authorization session handle
9	20			TPM_AUTHDATA	transAuth	HMAC for transHandle key: transHandle -> authData

4763

4764**Outgoing Parameters and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the ExecuteTransport command. This does not reflect the status of wrapped command.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_ExecuteTransport
4	8	3S	8	UINT64	currentTicks	The current ticks when the command was executed
5	4	4S	4	TPM_MODIFIER_INDICATOR	locality	The locality that called this command
6	4	5S	4	UINT32	wrappedRspSize	Size of the wrapped response
7	<>	6S	<>	BYTE[]	wrappedRsp	The wrapped response
8	20	2H1	20	TPM_NONCE	transNonceEven	Even nonce newly generated by TPM
		3H1	20	TPM_NONCE	transNonceOdd	Nonce generated by caller
9	1	4H1	1	BOOL	continueTransSession	The continue use flag for the session
10	20			TPM_AUTHDATA	transAuth	HMAC for transHandle key: transHandle -> authData

4765**Description**

47661. This command executes a TPM command using the transport session.

47672. Prior to execution of the wrapped command (action 11 below) failure of the transport
4768 session MUST have no effect on the resources referenced by the wrapped command. The
4769 exception is when the TPM goes into failure mode and return FAILED_SELFTEST for all
4770 subsequent commands.

47713. After execution of the wrapped command, failure of the transport session MAY NOT
4772 affect wrapped command resources. That is, the TPM is not required to clean up the
4773 effects of the wrapped command. Sessions and keys MAY remain loaded. It is
4774 understood that the transport session will be returning an error code and not reporting
4775 any session nonces. Therefore, wrapped sessions are no longer useful to the caller. It is
4776 the responsibility of the caller to clean up the result of the wrapped command.

47774. Execution of the wrapped command (action 11) SHOULD have no effect on the transport
4778 session.

4779 a. The wrapped command SHALL use no resources of the transport session, this
4780 includes authorization sessions

4781 b. If the wrapped command execution returns an error (action 11 below) then the
4782 sessions for TPM_ExecuteTransport still operate properly.

4783 c. The exception to this is when the wrapped command causes the TPM to go into
4784 failure mode and return TPM_FAILSELFTEST for all subsequent commands

47855. Field layout

4786 a. Notation

4787i. et indicates the outer TPM_**E**xecute**T**ransport command and response

4788 ii. w indicates the inner command and response that is **w**rapped by the
4789 TPM_ExecuteTransport.

4790 iii. (o) indicates **o**ptional parameters that may or may not be present in the wrapped
4791 command.

4792 b. Command representation

4793 c. **

4794 d. TAGet | LENet | ORDet | wrappedCmdSize | wrappedCmd | AUTHet

4795 e. **

4796 f. wrappedCmd looks like the following

4797 g. ***

4798 h. TAGw | LENw | ORDw | HANDLESw(o) | DATAw | AUTH1w (o) | AUTH2w (o)

4799 i. ***

4800 j. | LEN1 |

4801 k. | E1 | (encrypted)

4802 l. | C1 | (decrypted)

4803 m. Response representation

4804 n. **

4805 o. TAGet | LENet | RCet | … | wrappedRspSize | wrappedRsp | AUTHet

4806 p. **

4807 q. wrappedRsp looks like the following

4808 r. ***

4809 s. TAGw | LENw | RCw | HANDLESw(o) | DATAw | AUTH1w (o) | AUTH2w (o)

4810 t. ***

4811 u. | LEN2 |

4812 v. | ←------------------------ C2 ---→ |

4813 w. | S2 | (decrypted)

4814 x. | E2 | (encrypted)

4815 y. The only command and response parameter that is possibly encrypted is DATAw.

4816 6. Additional DATAw comments

4817 a. For TPM_FlushSpecific and TPM_SaveContext

4818   i. The DATAw part of these commands does not include the handle.

4819 (1) It is understood that encrypting the resourceType prevents a determination of
4820 the handle type.

4821   ii. If the resourceType is TPM_RT_KEY, then the public key MUST be logged.

4822 b. For TPM_DAA_Join and TPM_DAA_Sign

4823   i. The DATAw part of these commands does not include the input handle. The
4824   output handle from stage 0 is included in DATAW.

4825   c. For TPM_LoadKey2

4826   i. The outgoing handle is not part of the outgoing DATAw and is not encrypted or
4827   logged by the outgoing transport.

4828   d. For TPM_LoadKey

4829   i. The outgoing handle is part of the outgoing DATAw and is encrypted and
4830   logged.

4831   e. For TPM_LoadContext

4832   i. The outgoing handle is not part of the outgoing DATAw and is not encrypted or
4833   logged by the outgoing transport.

4834   (1) It is understood that encrypting the contextBlob prevents a determination of
4835   the handle type.

4836   f. For TPM_OIAP and TPM_OSAP,   no input or output parameters are encrypted
4837   or logged.

4838   i. For TPM_OSAP, the public key MUST NOT be logged. During a logged
4839   transport session, when a wrapped command uses the key, the public key
4840   referenced by the key handle will be logged in the transport. Thus, the audit trail
4841   is established for any key usage at that time.

4842   g. For TPM_DSAP

4843   i. For input, only entityValue is encrypted and logged.

4844   ii. For output no parameters are encrypted or logged.

48457. TPM_ExecuteTransport returns an implementation defined result when the wrapped
4846   command would cause termination of the transport session. Implementation defined
4847   possibilities include but are not limited to: the wrapped command may execute,
4848   completely, partially, or not at all, the transport session may or may not be terminated,
4849   continueTransSession may not be processed or returned correctly, and an error may or
4850   may not be returned. The wrapped commands include:

4851   a. TPM_FlushSpecific, TPM_SaveContext targeting the transport session

4852   b. TPM_OwnerClear, TPM_ForceClear, TPM_RevokeTrust

4853**Actions**

48541. Using transHandle locate the TPM_TRANSPORT_INTERNAL structure T1

48552. Parse wrappedCmd

4856   a. Set TAGw, LENw, and ORDw to the parameters from wrappedCmd

4857   b. Set E1 to DATAw

4858   i. This pointer is ordinal dependent and requires the execute transport
4859   command to parse wrappedCmd

4860   c. Set LEN1 to the length of DATAw

4861   i. DATAw always ends at the start of AUTH1w if AUTH1w is present

4862 3. If LEN1 is less than 0, or if ORDw is unknown, unimplemented, or cannot be determined

4863   a. Return TPM_BAD_PARAMETER

4864 4. If T1 -> transPublic -> transAttributes has TPM_TRANSPORT_ENCRYPT set then

4865   a. If T1 -> transPublic -> algId is TPM_ALG_MGF1

4866   i. Using the MGF1 function, create string G1 of length LEN1. The inputs to the
4867   MGF1 are transLastNonceEven, transNonceOdd, "in", and T1 -> authData. These
4868   four values concatenated together form the Z value that is the seed for the MGF1.

4869   ii. Create C1 by performing an XOR of G1 and wrappedCmd starting at E1.

4870   b. If the encryption algorithm requires an IV or CTR, calculate the IV or CTR value

4871   i. Using the MGF1 function, create string IV1 or CTR1 with a length set by the
4872   block size of the encryption algorithm. The inputs to the MGF1 are
4873   transLastNonceEven, transNonceOdd, and "in". These three values concatenated
4874   together form the Z value that is the seed for the MGF1. Note that any
4875   terminating characters within the string "in" are ignored, so a total of 42 bytes are
4876   hashed.

4877   ii. The symmetric key is taken from the first bytes of T1 -> authData.

4878   iii. Decrypt DATAw and replace the DATAw area of E1 creating C1

4879   c. TPM_OSAP, TPM_OIAP have no parameters encrypted

4880   d. TPM_DSAP has special rules for parameter encryption

4881 5. Else

4882   a. Set C1 to the DATAw area E1 of wrappedCmd

4883 6. Create H1 the SHA-1 of (ORDw || C1).

4884   a. C1 MUST point at the decrypted DATAw area of E1

4885   b. The TPM MAY use this calculation for both execute transport authorization,
4886   authorization of the wrapped command and transport log creation

4887 7. Validate the incoming transport session authorization

4888   a. Set inParamDigest to SHA-1 (ORDet || wrappedCmdSize || H1)

4889   b. Calculate the HMAC of (inParamDigest || transLastNonceEven || transNonceOdd ||
4890   continueTransSession) using T1 -> authData as the HMAC key

4891   c. Validate transAuth, on errors return TPM_AUTHFAIL

4892 8. If TPM_ExecuteTransport requires auditing

4893   a. Create TPM_AUDIT_EVENT_IN using H1 as the input parameter digest and update
4894   auditDigest

4895   b. On any error return TPM_AUDITFAIL_UNSUCCESSFUL

4896 9. If ORDw is from the list of following commands return TPM_NO_WRAP_TRANSPORT

4897   a. TPM_EstablishTransport

4898   b. TPM_ExecuteTransport

4899   c. TPM_ReleaseTransportSigned

4900 10. If T1 -> transPublic -> transAttributes has TPM_TRANSPORT_LOG set then

4901   a. Create L2 a TPM_TRANSPORT_LOG_IN structure

4902   b. Set L2 -> parameters to H1

4903   c. If ORDw is a command with no key handles

4904   i. Set L2 -> pubKeyHash to all zeros

4905   d. If ORDw is a command with one key handle

4906   i. Create K2 the hash of the TPM_STORE_PUBKEY structure of the key pointed
4907   to by the key handle.

4908   ii. Set L2 -> pubKeyHash to SHA-1 (K2)

4909   e. If ORDw is a command with two key handles

4910   i. Create K2 the hash of the TPM_STORE_PUBKEY structure of the key pointed
4911   to by the first key handle.

4912   ii. Create K3 the hash of the TPM_STORE_PUBKEY structure of the key pointed
4913   to by the second key handle.

4914   iii. Set L2 -> pubKeyHash to SHA-1 (K2 || K3)

4915   f. Set T1 -> transDigest to the SHA-1 (T1 -> transDigest || L2)

4916   g. If ORDw is a command with key handles, and the key is not loaded, return
4917   TPM_INVALID_KEYHANDLE.

4918 11. Send the wrapped command to the normal TPM command parser, the output is C2 and
4919   the return code is RCw

4920   a. If ORDw is a command that is audited then the TPM MUST perform the input and
4921   output audit of the command as part of this action.

4922   b. The TPM MAY use H1 as the data value in the authorization and audit calculations
4923   during the execution of C1

4924 12. Set CT1 to TPM_STANY_DATA -> currentTicks -> currentTicks and return CT1 in the
4925   currentTicks output parameter

4926 13. Calculate S2 the pointer to the DATAw area of C2

4927   a. Calculate LEN2 the length of S2 according to the same rules that calculated LEN1

4928 14. Create H2 the SHA-1 of (RCw || ORDw || S2)

4929   a. The TPM MAY use this calculation for execute transport authorization and transport
4930   log out creation

4931 15. Calculate the outgoing transport session authorization

4932   a. Create the new transNonceEven for the output of the command

4933   b. Set outParamDigest to SHA-1 (RCet || ORDet || TPM_STANY_DATA -> currentTicks
4934   -> currentTicks || locality || wrappedRspSize || H2)

4935　　c. Calculate transAuth, the HMAC of (outParamDigest || transNonceEven ||
4936　　transNonceOdd || continueTransSession) using T1 -> authData as the HMAC key

4937 16. If T1 -> transPublic -> transAttributes has TPM_TRANSPORT_LOG set then

4938　　a.　Create L3 a TPM_TRANSPORT_LOG_OUT structure

4939　　b.　Set L3 -> parameters to H2

4940　　c.　Set L3 -> currentTicks to TPM_STANY_DATA -> currentTicks

4941　　d.　Set L3 -> locality to TPM_STANY_DATA -> localityModifier

4942　　e.　Set T1 -> transDigest to the SHA-1 (T1 -> transDigest || L3)

4943 17. If T1 -> transPublic -> transAttributes has TPM_TRANSPORT_ENCRYPT set then

4944　　a.　If T1 -> transPublic -> algId is TPM_ALG_MGF1

4945　　　　i.　Using the MGF1 function, create string G2 of length LEN2. The inputs to the
4946　　　　MGF1 are transNonceEven, transNonceOdd, "out", and T1 -> authData. These
4947　　　　four values concatenated together form the Z value that is the seed for the MGF1.

4948　　　　ii.　Create E2 by performing an XOR of G2 and C2 starting at S2.

4949　　b.　Else

4950　　　　i.　Create IV2 or CTR2 using the same algorithm as IV1 or CTR1 with the input
4951　　　　values transNonceEven, transNonceOdd, and "out". Note that any terminating
4952　　　　characters within the string "out" are ignored, so a total of 43 bytes are hashed.

4953　　　　ii.　The symmetric key is taken from the first bytes of T1 -> authData

4954　　　　iii.　Create E2 by encrypting C2 starting at S2

4955 18. Else

4956　　a.　Set E2 to the DATAw area S2 of wrappedRsp

4957 19. If continueTransSession is FALSE

4958　　a.　Invalidate all session data related to transHandle

4959 20. If TPM_ExecuteTranport requires auditing

4960　　a. Create TPM_AUDIT_EVENT_OUT using H2 for the parameters and update the
4961　　auditDigest

4962　　b. On　　any　　errors　　return　　TPM_AUDITFAIL_SUCCESSFUL　　or
4963　　TPM_AUDITFAIL_UNSUCCESSFUL depending on RCw

4964 21. Return C2 but with S2 replaced by E2 in the wrappedRsp parameter

496524.3   TPM_ReleaseTransportSigned

4966**Start of informative comment:**

4967This command completes the transport session. If logging for this session is turned on, then 4968this command returns a digital signature of the hash of all operations performed during the 4969session.

4970This command serves no purpose if logging is turned off, and results in an error if 4971attempted.

4972This command uses two authorization sessions, the key that will sign the log and the 4973authorization from the session. Having the session authorization proves that the requestor 4974that is signing the log is the owner of the session. If this restriction is not put in then an 4975attacker can close the log and sign using their own key.

4976The hash of the session log includes the information associated with the input phase of 4977execution of the TPM_ReleaseTransportSigned command. It cannot include the output 4978phase information.

4979**End of informative comment.**

4980**Incoming Parameters and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH2_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_ReleaseTransportSigned
4	4			TPM_KEY_HANDLE	keyHandle	Handle of a loaded key that will perform the signing
5	20	2S	20	TPM_NONCE	antiReplay	Value provided by caller for anti-replay protection
6	4			TPM_AUTHHANDLE	authHandle	The authorization session to use key
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
7	20	3H1	20	TPM_NONCE	authNonceOdd	Nonce generated by system associated with authHandle
8	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
9	20			TPM_AUTHDATA	keyAuth	The authorization session digest that authorizes the use of key. HMAC key: key -> usageAuth
10	4			TPM_TRANSHANDLE	transHandle	The transport session handle
		2H2	20	TPM_NONCE	transLastNonceEven	Even nonce in use by execute Transport
11	20	3H2	20	TPM_NONCE	transNonceOdd	Nonce supplied by caller for transport session
12	1	4H2	1	BOOL	continueTransSession	The continue use flag for the authorization session handle
13	20			TPM_AUTHDATA	transAuth	HMAC for transport session key: transHandle -> authData

4981 Outgoing Parameters and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH2_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_ReleaseTransportSigned
4	4	3S	4	TPM_MODIFIER_INDICATOR	locality	The locality that called this command
5	32	4S	32	TPM_CURRENT_TICKS	currentTicks	The current ticks when the command executed
6	4	5S	4	UINT32	signSize	The size of the signature area
7	<>	6S	<>	BYTE[]	signature	The signature of the digest
8	20	2H1	20	TPM_NONCE	authNonceEven	Even nonce newly generated by TPM
		3H1	20	TPM_NONCE	authNonceOdd	Nonce generated by caller
9	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the session
10	20			TPM_AUTHDATA	keyAuth	HMAC: key -> usageAuth
11	20	2H2	20	TPM_NONCE	transNonceEven	Even nonce newly generated by TPM
		3H2	20	TPM_NONCE	transNonceOdd	Nonce generated by caller
12	1	4H2	1	BOOL	continueTransSession	The continue use flag for the session
13	20			TPM_AUTHDATA	transAuth	HMAC: transHandle -> authData

4982 Description

4983 This command releases a transport session and signs the transport log

4984 Actions

4985 1. Using transHandle locate the TPM_TRANSPORT_INTERNAL structure T1

4986 2. Validate that keyHandle -> sigScheme is TPM_SS_RSASSAPKCS1v15_SHA1 or
4987 TPM_SS_RSASSAPKCS1v15_INFO, if not return TPM_INAPPROPRIATE_SIG.

4988 3. Validate that keyHandle -> keyUsage is TPM_KEY_SIGNING, if not return
4989 TPM_INVALID_KEYUSAGE

4990 4. Using key -> authData validate the command and parameters, on error return
4991 TPM_AUTHFAIL

4992 5. Using transHandle -> authData validate the command and parameters, on error return
4993 TPM_AUTH2FAIL

4994 6. If T1 -> transAttributes has TPM_TRANSPORT_LOG set then

4995   a. Create A1 a TPM_TRANSPORT_LOG_OUT structure

4996   b. Set A1 –> parameters to the SHA-1 (ordinal || antiReplay)

4997   c. Set A1 -> currentTicks to TPM_STANY_DATA -> currentTicks

4998   d. Set A1 -> locality to the locality modifier for this command

4999   e. Set T1 -> transDigest to SHA-1 (T1 -> transDigest || A1)

50007. Else

5001   a. Return TPM_BAD_MODE

50028. Create H1 a TPM_SIGN_INFO structure and set the structure defaults

5003   a. Set H1 -> fixed to "TRAN"

5004   b. Set H1 -> replay to antiReplay

5005   c. Set H1 -> data to T1 -> transDigest

5006   d. Sign SHA-1 hash of H1 using the key pointed to by keyHandle

50079. Invalidate all session data related to T1

500810.Set continueTransSession to FALSE

500911.Return TPM_SUCCESS

5010 # 25. Monotonic Counter

5011 ## 25.1 TPM_CreateCounter

5012 **Start of informative comment:**

5013 This command creates the counter but does not select the counter. Counter creation
5014 assigns an AuthData value to the counter and sets the counters original start value. The
5015 original start value is the current internal base value plus one. Setting the new counter to
5016 the internal base avoids attacks on the system that are attempting to use old counter
5017 values.

5018 **End of informative comment.**

5019 **Incoming Parameters and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes incl. paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_CreateCounter
4	20	2S	20	TPM_ENCAUTH	encAuth	The encrypted auth data for the new counter
5	4	3s	4	BYTE	label	Label to associate with counter
7	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for owner authentication.
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
8	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
9	1	4H1	1	BOOL	continueAuthSession	Ignored
10	20		20	TPM_AUTHDATA	ownerAuth	Authorization ownerAuth.

5020 **Outgoing Parameters and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_CreateCounter
4	4	3s	4	TPM_COUNT_ID	countID	The handle for the counter
5	10	4S	10	TPM_COUNTER_VALUE	counterValue	The starting counter value
6	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
7	1	4H1	1	BOOL	continueAuthSession	Fixed value of FALSE
8	20		20	TPM_AUTHDATA	resAuth	Authorization. HMAC key: ownerAuth.

5021 **Description**

5022This command creates a new monotonic counter. The TPM MUST support a minimum of 4 5023concurrent counters.

5024Actions

5025The TPM SHALL do the following:

50261. Using the authHandle field, validate the owner's AuthData to execute the command and 5027   all of the incoming parameters. The authorization session MUST be OSAP or DSAP

50282. Ignore continueAuthSession on input and set continueAuthSession to FALSE on output

50293. Create a1 by decrypting encAuth according to the ADIP indicated by authHandle.

50304. Validate that there is sufficient internal space in the TPM to create a new counter. If 5031   there is insufficient space, the command returns an error.

5032   a. The TPM MUST provide storage for a1, TPM_COUNTER_VALUE, countID, and any 5033   other internal data the TPM needs to associate with the counter

50345. Increment the max counter value

50356. Set the counter to the max counter value

50367. Set the counter label to label

50378. Create a countID

5038 25.2 TPM_IncrementCounter

5039 **Start of informative comment:**

5040 This authorized command increments the indicated counter by one. Once a counter has
5041 been incremented then all subsequent increments must be for the same handle until a
5042 successful TPM_Startup(ST_CLEAR) is executed.

5043 The order for checking validation of the command parameters when no counter is active,
5044 keeps an attacker from creating a denial-of-service attack.

5045 **End of informative comment.**

5046 **Incoming Parameters and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_IncrementCounter
4	4	2s	4	TPM_COUNT_ID	countID	The handle of a valid counter
5	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for counter authorization
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
6	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
7	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
8	20			TPM_AUTHDATA	counterAuth	The authorization session digest that authorizes the use of countID. HMAC key: countID -> authData

5047 **Outgoing Parameters and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_IncrementCounter
5	10	3S	10	TPM_COUNTER_VALUE	count	The counter value
6	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
7	1	4H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
8	20			TPM_AUTHDATA	resAuth	The authorization session digest for the returned parameters. HMAC key: countID -> authData

5048 **Description**

5049 This function increments the counter by 1.

5050 The TPM MAY implement increment throttling to avoid burn problems

5051 **Actions**

5052 1. If TPM_STCLEAR_DATA -> countID is 0

5053   a. Validate that countID is a valid counter, return TPM_BAD_COUNTER on mismatch

5054   b. Validate the command parameters using counterAuth

5055   c. Set TPM_STCLEAR_DATA -> countID to countID

5056 2. else

5057   a. If TPM_STCLEAR_DATA -> countID does not equal countID

5058   i. Return TPM_BAD_COUNTER

5059   b. Validate the command parameters using counterAuth

5060 3. Increments the counter by 1

5061 4. Return new count value in count

5062 **25.3 TPM_ReadCounter**

5063 **Start of informative comment:**

5064 Reading the counter provides the caller with the current number in the sequence.

5065 **End of informative comment.**

5066 **Incoming Parameters and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes incl. paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_ReadCounter
4	4	2S	4	TPM_COUNT_ID	countID	ID value of the counter

5067 **Outgoing Parameters and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_ReadCounter
4	10	3S	10	TPM_COUNTER_VALUE	count	The counter value

5068 **Description**

5069 This returns the current value for the counter indicated. The counter MAY be any valid
5070 counter.

5071 **Actions**

5072 1. Validate that countID points to a valid counter. Return TPM_BAD_COUNTER on error.

5073 2. Return count

5074 25.4   TPM_ReleaseCounter

5075**Start of informative comment:**

5076This command releases a counter such that no reads or increments of the indicated counter
5077will succeed.

5078**End of informative comment.**

5079 Incoming Parameters and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_ReleaseCounter
4	4	2s	4	TPM_COUNT_ID	countID	ID value of the counter
5	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for countID authorization
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
6	20	3H1	20	TPM_NONCE	nonceOdd	Nonce associated with countID
7	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
8	20			TPM_AUTHDATA	counterAuth	The authorization session digest that authorizes the use of countID. HMAC key: countID -> authData

5080 Outgoing Parameters and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_ReleaseCounter
4	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
5	1	4H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
6	20			TPM_AUTHDATA	resAuth	The authorization session digest for the returned parameters. HMAC key: countID -> authData

5081 Actions

5082The TPM uses countID to locate a valid counter.

50831. Authenticate the command and the parameters using the AuthData pointed to by
5084   countID. Return TPM_AUTHFAIL on error

50852. The TPM invalidates all internal information regarding the counter. This includes
5086   releasing countID such that any subsequent attempts to use countID will fail.

50873. The TPM invalidates sessions

5088   a. MUST invalidate all OSAP sessions associated with the counter

5089   b. MAY invalidate any other session

5090 4. If TPM_STCLEAR_DATA -> countID equals countID,

5091   a. Set TPM_STCLEAR_DATA -> countID to an illegal value (not the zero value)

5092 25.5   TPM_ReleaseCounterOwner

5097**Incoming Parameters and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_ReleaseCounterOwner
4	4	2s	4	TPM_COUNT_ID	countID	ID value of the counter
5	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for owner authentication
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
6	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
7	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
8	20			TPM_AUTHDATA	ownerAuth	The authorization session digest that authorizes the inputs. HMAC key: ownerAuth

5098**Outgoing Parameters and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_ReleaseCounterOwner
4	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
5	1	4H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
6	20			TPM_AUTHDATA	resAuth	The authorization session digest for the returned parameters. HMAC key: ownerAuth

5099**Description**

5100This invalidates all information regarding a counter.

5101**Actions**

51021. Validate that ownerAuth properly authorizes the command and parameters

51032. The TPM uses countID to locate a valid counter. Return TPM_BAD_COUNTER if not
5104   found.

5105 3. The TPM invalidates all internal information regarding the counter. This includes
5106   releasing countID such that any subsequent attempts to use countID will fail.

5107 4. The TPM invalidates sessions

5108   a. MUST invalidate all OSAP sessions associated with the counter

5109   b. MAY invalidate any other session

5110 5. If TPM_STCLEAR_DATA -> countID equals countID,

5111   a. Set TPM_STCLEAR_DATA -> countID to an illegal value (not the zero value)

5112**26.** **DAA commands**

5113**26.1** **TPM_DAA_Join**

5114**Start of informative comment:**

5115TPM_DAA_Join is the process that establishes the DAA parameters in the TPM for a specific
5116DAA issuing authority.

5117outputSize and outputData are always included in the outParamDigest. This includes stage
51180, where the outputData contains the DAA session handle.

5119 **End of informative comment.**

5120**Incoming Parameters and Sizes**

| PARAM | | HMAC | | Type | Name | Description |
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes incl. paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_DAA_Join.
4	4			TPM_HANDLE	handle	Session handle
5	1	2S	1	BYTE	stage	Processing stage of join
6	4	3S	4	UINT32	inputSize0	Size of inputData0 for this stage of JOIN
7	<>	4S	<>	BYTE[]	inputData0	Data to be used by this capability
8	4	5S	4	UINT32	inputSize1	Size of inputData1 for this stage of JOIN
9	<>	6S	<>	BYTE[]	inputData1	Data to be used by this capability
10	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for owner authentication
		2 H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
11	20	3 H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
12	1	4 H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
13	20		20	TPM_AUTHDATA	ownerAuth	The authorization session digest for inputs and owner. HMAC key: ownerAuth.

5121Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes incl. paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_DAA_Join.
4	4	3S	4	UINT32	outputSize	Size of outputData
5	<>	4S	<>	BYTE[]	outputData	Data produced by this capability
6	20	2 H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3 H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
7	1	4 H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
8	20		20	TPM_AUTHDATA	resAuth	Authorization HMAC key: ownerAuth.

5122**Description**

5123This table summaries the input, output and saved data that is associated with each stage of
5124processing.

Stage	Input Data0	Input Data1	Operation	Output Data	Scratchpad
0	DAA_count (used as # repetitions of stage 1)	NULL	initialise	Session Handle	NULL
1	n0	signatureValue	rekeying	NULL	n0
2	DAA_issuerSettings	signatureValue	issuer settings	NULL	NULL
3	DAA_count	NULL	DAA_join_uo, DAA_join_u1	NULL	NULL
4	DAA_generic_R0	DAA_generic_n	$P1 = R0^{f0} \bmod n$	NULL	P1
5	DAA_generic_R1	DAA_generic_n	$P2 = P1*(R1^{f1}) \bmod n$	NULL	P2
6	DAA_generic_S0	DAA_generic_n	$P3 = P2*(S0^{u0}) \bmod n$	NULL	P3
7	DAA_generic_S1	DAA_generic_n	$U = P3*(S1^{u1}) \bmod n$	U	NULL
8	NE	NULL	U2	U2	NULL
9	DAA_generic_R0	DAA_generic_n	$P1 = R0^{r0} \bmod n$	NULL	P1
10	DAA_generic_R1	DAA_generic_n	$P2 = P1*(R1^{r1}) \bmod n$	NULL	P2
11	DAA_generic_S0	DAA_generic_n	$P3 = P2*(S0^{r2}) \bmod n$	NULL	P3
12	DAA_generic_S1	DAA_generic_n	$P4 = P3*(S1^{r3}) \bmod n$	P4	NULL
13	DAA_generic_gamma	w	$w1 = w^{q} \bmod gamma$	NULL	w
14	DAA_generic_gamma	NULL	$E = w^{f} \bmod gamma$	E	w
15	DAA_generic_gamma	NULL	$r = r0 + (2^{power0})*r1 \bmod q$, $E1 = w^{r} \bmod gamma$	E1	NULL
16	c1	NULL	$c = hash(c1 \mathbin\Vert NT)$	nt	NULL
17	NULL	NULL	$s0 = r0 + c*f0$	s0	NULL
18	NULL	NULL	$s1 = r1 + c*f1$	s1	NULL
19	NULL	NULL	$s2 = r2 + c*u0 \bmod 2^{power1}$	s2	NULL
20	NULL	NULL	$s12 = r2 + c*u0 \gg power1$	c	s12
21	NULL	NULL	$s3 = r3 + c*u1 + s12$	s3	NULL
22	u2	NULL	$v0 = u2 + u0 \bmod 2^{power1}$ $v10 = u2 + u0 \gg power1$	enc(v0)	v10
23	u3	NULL	$V1 = u3 + u1 + v10$	enc(v1)	NULL
24	NULL	NULL	enc(DAA_tpmSpecific)	enc(DAA_tpmSpecific)	NULL

5125

5126 Actions

5127 A Trusted Platform Module that receives a valid TPM_DAA_Join command SHALL:

5128 1. Use ownerAuth to verify that the Owner authorized all TPM_DAA_Join input parameters.

5129 2. Any error return results in the TPM invalidating all resources associated with the join

5130 3. Constant values of 0 or 1 are 1 byte integers, stages affected are

5131   a. 4(j), 5(j), 14(f), 17(e)

5132 4. Representation of the strings "r0" to "r4" are 2-byte ASCII encodings, stages affected are

5133   a. 9(i), 10(h), 11(h), 12(h), 15(f),15(g), 17(d), 18(d), 19(d), 20(d), 21(d)

5134 **Start of informative comment:**

5135 5. Variable DAA_Count

5136 a. In stage 0, DAA_Count denotes the length of the RSA key chain, which certifies the
5137 main DAA public key and which will be loaded in stage 1. It also denotes the number of
5138 times stage 1 is executed.

5139 b. In stage 3 the variable DAA_count denotes the actual DAA counter. It allows a DAA
5140 issuer to keep track of the number of times it has issued 'different' DAA credentials to
5141 the same platform. (The counter does not need to be equal to the actual number.)

5142 **End of informative comment.**

5143 Stages

5144 0. If stage==0

5145   c. Determine that sufficient resources are available to perform a TPM_DAA_Join.

5146   i. The TPM MUST support sufficient resources to perform one (1)
5147   TPM_DAA_Join/ TPM_DAA_Sign. The TPM MAY support additional
5148   TPM_DAA_Join/ TPM_DAA_Sign sessions.

5149   ii. The TPM may share internal resources between the DAA operations and other
5150   variable resource requirements:

5151   iii.   If there are insufficient resources within the stored key pool (and one or
5152   more keys need to be removed to permit the DAA operation to execute) return
5153   TPM_NOSPACE

5154   iv.   If there are insufficient resources within the stored session pool (and
5155   one or more authorization or transport sessions need to be removed to permit
5156   the DAA operation to execute), return TPM_RESOURCES.

5157   d. Set all fields in DAA_issuerSettings = NULL

5158   e. set all fields in DAA_tpmSpecific = NULL

5159   f. set all fields in DAA_session = NULL

5160   g. Set all fields in DAA_joinSession = NULL

5161   h. Verify that sizeOf(inputData0) == sizeOf(DAA_tpmSpecific -> DAA_count) and return
5162 error TPM_DAA_INPUT_DATA0 on mismatch

5163   i.   Verify that inputData0 > 0, and return error TPM_DAA_INPUT_DATA0 on mismatch

5164   j.   Set DAA_tpmSpecific -> DAA_count = inputData0

5165   k. set   DAA_session   ->   DAA_digestContext   =   SHA-1(DAA_tpmSpecific ||
5166   DAA_joinSession)

5167   l.   set DAA_session -> DAA_stage = 1

5168   m. Assign session handle for TPM_DAA_Join

5169   n. set outputData = new session handle

5170   i.   The handle in outputData is included the output HMAC.

5171   o. return TPM_SUCCESS

51726. If stage==1

5173   a. Verify that DAA_session ->DAA_stage==1. Return TPM_DAA_STAGE and flush handle
5174   on mismatch

5175   b. Verify   that   DAA_session   ->   DAA_digestContext   ==   SHA-1(DAA_tpmSpecific ||
5176   DAA_joinSession) and return TPM_DAA_TPM_SETTINGS on mismatch

5177   c. Verify   that   sizeOf(inputData0)   ==   DAA_SIZE_issuerModulus   and   return   error
5178   TPM_DAA_INPUT_DATA0 on mismatch

5179   d. If DAA_session -> DAA_scratch == NULL:

5180   i.   Set DAA_session -> DAA_scratch = inputData0

5181   ii. set DAA_joinSession -> DAA_digest_n0 = SHA-1(DAA_session -> DAA_scratch)

5182   iii. set DAA_tpmSpecific -> DAA_rekey = SHA-1(tpmDAASeed || DAA_joinSession
5183   -> DAA_digest_n0)

5184   e. Else (If DAA_session -> DAA_scratch != NULL):

5185   i.   Set signedData = inputData0

5186   ii. Verify that sizeOf(inputData1) == DAA_SIZE_issuerModulus and return error
5187   TPM_DAA_INPUT_DATA1 on mismatch

5188   iii. Set signatureValue = inputData1

5189   iv. Use   the   RSA   key   ==   [DAA_session   ->   DAA_scratch]   to   verify   that
5190   signatureValue   is   a   signature   on   signedData   using
5191   TPM_SS_RSASSAPKCS1v15_SHA1 (RSA PKCS1.5 with SHA-1), and return error
5192   TPM_DAA_ISSUER_VALIDITY on mismatch

5193   v. Set DAA_session -> DAA_scratch = signedData

5194   f.   Decrement DAA_tpmSpecific -> DAA_count by 1 (unity)

5195   g. If DAA_tpmSpecific -> DAA_count == 0:

5196   i.   increment DAA_session -> DAA_stage by 1

5197   h. set   DAA_session   ->   DAA_digestContext   =   SHA-1(DAA_tpmSpecific ||
5198   DAA_joinSession)

5199   i.   set outputData = NULL

5200   j.   return TPM_SUCCESS

5201 7. If stage==2

5202   a.   Verify that DAA_session ->DAA_stage==2. Return TPM_DAA_STAGE and flush handle
5203   on mismatch

5204   b.   Verify that DAA_session -> DAA_digestContext == SHA-1(DAA_tpmSpecific ||
5205   DAA_joinSession) and return error TPM_DAA_TPM_SETTINGS on mismatch

5206   c.   Verify that sizeOf(inputData0) == sizeOf(TPM_DAA_ISSUER) and return error
5207   TPM_DAA_INPUT_DATA0 on mismatch

5208   d.   Set DAA_issuerSettings = inputData0. Verify that all fields in DAA_issuerSettings are
5209   present and return error TPM_DAA_INPUT_DATA0 if not.

5210   e.   Verify that sizeOf(inputData1) == DAA_SIZE_issuerModulus and return error
5211   TPM_DAA_INPUT_DATA1 on mismatch

5212   f.   Set signatureValue = inputData1

5213   g.   Set signedData = (DAA_joinSession -> DAA_digest_n0 ||DAA_issuerSettings)

5214   h.   Use the RSA key [DAA_session -> DAA_scratch] to verify that signatureValue is a
5215   signature on signedData using TPM_SS_RSASSAPKCS1v15_SHA1 (RSA PKCS1.5 with
5216   SHA-1),, and return error TPM_DAA_ISSUER_VALIDITY on mismatch

5217   i.   Set DAA_tpmSpecific -> DAA_digestIssuer == SHA-1(DAA_issuerSettings)

5218   j.   set   DAA_session   ->   DAA_digestContext   =   SHA-1(DAA_tpmSpecific ||
5219   DAA_joinSession)

5220   k.   Set DAA_session -> DAA_scratch = NULL

5221   l.   increment DAA_session -> DAA_stage by 1

5222   m. return TPM_SUCCESS

5223 8. If stage==3

5224   a.   Verify that DAA_session ->DAA_stage==3. Return TPM_DAA_STAGE and flush handle
5225   on mismatch

5226   b.   Verify that DAA_tpmSpecific -> DAA_digestIssuer == SHA-1(DAA_issuerSettings) and
5227   return error TPM_DAA_ISSUER_SETTINGS on mismatch

5228   c.   Verify that DAA_session -> DAA_digestContext == SHA-1(DAA_tpmSpecific ||
5229   DAA_joinSession) and return error TPM_DAA_TPM_SETTINGS on mismatch

5230   d.   Verify that sizeOf(inputData0) == sizeOf(DAA_tpmSpecific -> DAA_count) and return
5231   error TPM_DAA_INPUT_DATA0 on mismatch

5232   e.   Set DAA_tpmSpecific -> DAA_count = inputData0

5233   f.   Obtain random data from the RNG and store it as DAA_joinSession -> DAA_join_u0

5234   g.   Obtain random data from the RNG and store it as DAA_joinSession -> DAA_join_u1

5235   h.   set outputData = NULL

5236   i.   increment DAA_session -> DAA_stage by 1

5237   j. set   DAA_session   ->   DAA_digestContext   =   SHA-1(DAA_tpmSpecific ||
5238   DAA_joinSession)

5239   k. return TPM_SUCCESS

5240 9. If stage==4,

5241   a. Verify that DAA_session ->DAA_stage==4. Return TPM_DAA_STAGE and flush handle
5242   on mismatch

5243   b. Verify that DAA_tpmSpecific -> DAA_digestIssuer == SHA-1(DAA_issuerSettings) and
5244   return error TPM_DAA_ISSUER_SETTINGS on mismatch

5245   c. Verify that DAA_session -> DAA_digestContext == SHA-1(DAA_tpmSpecific ||
5246   DAA_joinSession) and return error TPM_DAA_TPM_SETTINGS on mismatch

5247   d. Set DAA_generic_R0 = inputData0

5248   e. Verify that SHA-1(DAA_generic_R0) == DAA_issuerSettings -> DAA_digest_R0 and
5249   return error TPM_DAA_INPUT_DATA0 on mismatch

5250   f. Set DAA_generic_n = inputData1

5251   g. Verify that SHA-1(DAA_generic_n) == DAA_issuerSettings -> DAA_digest_n and
5252   return error TPM_DAA_INPUT_DATA1 on mismatch

5253   h. Set X = DAA_generic_R0

5254   i. Set n = DAA_generic_n

5255   j. Set f = SHA-1(DAA_tpmSpecific -> DAA_rekey || DAA_tpmSpecific -> DAA_count ||
5256   0) || SHA-1(DAA_tpmSpecific -> DAA_rekey || DAA_tpmSpecific -> DAA_count || 1)
5257   mod DAA_issuerSettings -> DAA_generic_q

5258   k. Set f0 = f mod 2^{DAA_power0} (erase all but the lowest DAA_power0 bits of f)

5259   l. Set DAA_session -> DAA_scratch = (X^{f0}) mod n

5260   m. set outputData = NULL

5261   n. increment DAA_session -> DAA_stage by 1

5262   o. return TPM_SUCCESS

5263 10. If stage==5

5264   a. Verify that DAA_session ->DAA_stage==5. Return TPM_DAA_STAGE and flush handle
5265   on mismatch

5266   b. Verify that DAA_tpmSpecific -> DAA_digestIssuer == SHA-1(DAA_issuerSettings) and
5267   return error TPM_DAA_ISSUER_SETTINGS on mismatch

5268   c. Verify that DAA_session -> DAA_digestContext == SHA-1(DAA_tpmSpecific ||
5269   DAA_joinSession) and return error TPM_DAA_TPM_SETTINGS on mismatch

5270   d. Set DAA_generic_R1 = inputData0

5271   e. Verify that SHA-1(DAA_generic_R1) == DAA_issuerSettings -> DAA_digest_R1 and
5272   return error TPM_DAA_INPUT_DATA0 on mismatch

5273   f. Set DAA_generic_n = inputData1

5274   g. Verify that SHA-1(DAA_generic_n) == DAA_issuerSettings -> DAA_digest_n and
5275   return error TPM_DAA_INPUT_DATA1 on mismatch

5276   h. Set X = DAA_generic_R1

5277   i.   Set n = DAA_generic_n

5278   j. Set f = SHA-1(DAA_tpmSpecific -> DAA_rekey || DAA_tpmSpecific -> DAA_count ||
5279   0) || SHA-1(DAA_tpmSpecific -> DAA_rekey || DAA_tpmSpecific -> DAA_count || 1)
5280   mod DAA_issuerSettings -> DAA_generic_q.

5281   k. Shift f right by DAA_power0 bits (discard the lowest DAA_power0 bits) and label the
5282   result f1

5283   l.   Set Z = DAA_session -> DAA_scratch

5284   m. Set DAA_session -> DAA_scratch = $Z*(X^{f1})$ mod n

5285   n. set outputData = NULL

5286   o. increment DAA_session -> DAA_stage by 1

5287   p. return TPM_SUCCESS

5288 11. If stage==6

5289   a. Verify that DAA_session ->DAA_stage==6. Return TPM_DAA_STAGE and flush handle
5290   on mismatch

5291   b. Verify that DAA_tpmSpecific -> DAA_digestIssuer == SHA-1(DAA_issuerSettings) and
5292   return error TPM_DAA_ISSUER_SETTINGS on mismatch

5293   c. Verify that DAA_session -> DAA_digestContext == SHA-1(DAA_tpmSpecific ||
5294   DAA_joinSession) and return error TPM_DAA_TPM_SETTINGS on mismatch

5295   d. Set DAA_generic_S0 = inputData0

5296   e. Verify that SHA-1(DAA_generic_S0) == DAA_issuerSettings -> DAA_digest_S0 and
5297   return error TPM_DAA_INPUT_DATA0 on mismatch

5298   f. Set DAA_generic_n = inputData1

5299   g. Verify that SHA-1(DAA_generic_n) == DAA_issuerSettings -> DAA_digest_n and
5300   return error TPM_DAA_INPUT_DATA1 on mismatch

5301   h. Set X = DAA_generic_S0

5302   i.   Set n = DAA_generic_n

5303   j. Set Z = DAA_session -> DAA_scratch

5304   k. Set Y = DAA_joinSession -> DAA_join_u0

5305   l.   Set DAA_session -> DAA_scratch = $Z*(X^Y)$ mod n

5306   m. set outputData = NULL

5307   n. increment DAA_session -> DAA_stage by 1

5308   o. return TPM_SUCCESS

5309 12. If stage==7

5310   a. Verify that DAA_session ->DAA_stage==7. Return TPM_DAA_STAGE and flush handle
5311   on mismatch

5312   b. Verify that DAA_tpmSpecific -> DAA_digestIssuer == SHA-1(DAA_issuerSettings) and
5313   return error TPM_DAA_ISSUER_SETTINGS on mismatch

5314   c. Verify that DAA_session -> DAA_digestContext == SHA-1(DAA_tpmSpecific ||
5315   DAA_joinSession) and return error TPM_DAA_TPM_SETTINGS on mismatch

5316   d. Set DAA_generic_S1 = inputData0

5317   e. Verify that SHA-1(DAA_generic_S1) == DAA_issuerSettings -> DAA_digest_S1 and
5318   return error TPM_DAA_INPUT_DATA0 on mismatch

5319   f. Set DAA_generic_n = inputData1

5320   g. Verify that SHA-1(DAA_generic_n) == DAA_issuerSettings -> DAA_digest_n and
5321   return error TPM_DAA_INPUT_DATA1 on mismatch

5322   h. Set X = DAA_generic_S1

5323   i. Set n = DAA_generic_n

5324   j. Set Y = DAA_joinSession -> DAA_join_u1

5325   k. Set Z = DAA_session -> DAA_scratch

5326   l. Set DAA_session -> DAA_scratch = $Z*(X^Y) \bmod n$

5327   m. Set DAA_session -> DAA_digest to the SHA-1 (DAA_session -> DAA_scratch ||
5328   DAA_tpmSpecific -> DAA_count || DAA_joinSession -> DAA_digest_n0)

5329   n. set outputData = DAA_session -> DAA_scratch

5330   o. set DAA_session -> DAA_scratch = NULL

5331   p. increment DAA_session -> DAA_stage by 1

5332   q. return TPM_SUCCESS

533313.If stage==8

5334   a. Verify that DAA_session ->DAA_stage==8. Return TPM_DAA_STAGE and flush handle
5335   on mismatch

5336   b. Verify that DAA_tpmSpecific -> DAA_digestIssuer == SHA-1(DAA_issuerSettings) and
5337   return error TPM_DAA_ISSUER_SETTINGS on mismatch

5338   c. Verify that DAA_session -> DAA_digestContext == SHA-1(DAA_tpmSpecific ||
5339   DAA_joinSession) and return error TPM_DAA_TPM_SETTINGS on mismatch

5340   d. Verify inputSize0 == DAA_SIZE_NE and return error TPM_DAA_INPUT_DATA0 on
5341   mismatch

5342   e. Set NE = decrypt(inputData0, privEK)

5343   f. set outputData = SHA-1(DAA_session -> DAA_digest || NE)

5344   g. set DAA_session -> DAA_digest = NULL

5345   h. increment DAA_session -> DAA_stage by 1

5346   i. return TPM_SUCCESS

5347 14. If stage==9

5348 a. Verify that DAA_session ->DAA_stage==9. Return TPM_DAA_STAGE and flush handle
5349 on mismatch

5350 b. Verify that DAA_tpmSpecific -> DAA_digestIssuer == SHA-1(DAA_issuerSettings) and
5351 return error TPM_DAA_ISSUER_SETTINGS on mismatch

5352 c. Verify that DAA_session -> DAA_digestContext == SHA-1(DAA_tpmSpecific ||
5353 DAA_joinSession) and return error TPM_DAA_TPM_SETTINGS on mismatch

5354 d. Set DAA_generic_R0 = inputData0

5355 e. Verify that SHA-1(DAA_generic_R0) == DAA_issuerSettings -> DAA_digest_R0 and
5356 return error TPM_DAA_INPUT_DATA0 on mismatch

5357 f. Set DAA_generic_n = inputData1

5358 g. Verify that SHA-1(DAA_generic_n) == DAA_issuerSettings -> DAA_digest_n and
5359 return error TPM_DAA_INPUT_DATA1 on mismatch

5360 h. Obtain random data from the RNG and store it as DAA_session -> DAA_contextSeed

5361 i. Obtain DAA_SIZE_r0 bytes using the MGF1 function and label them Y. "r0" ||
5362 DAA_session -> DAA_contextSeed is the Z seed.

5363 j. Set X = DAA_generic_R0

5364 k. Set n = DAA_generic_n

5365 l. Set DAA_session -> DAA_scratch = (X^Y) mod n

5366 m. set outputData = NULL

5367 n. increment DAA_session -> DAA_stage by 1

5368 o. return TPM_SUCCESS

5369 15. If stage==10

5370 a. Verify that DAA_session ->DAA_stage==10. Return TPM_DAA_STAGE and flush
5371 handle on mismatch h

5372 b. Verify that DAA_tpmSpecific -> DAA_digestIssuer == SHA-1(DAA_issuerSettings) and
5373 return error TPM_DAA_ISSUER_SETTINGS on mismatch

5374 c. Verify that DAA_session -> DAA_digestContext == SHA-1(DAA_tpmSpecific ||
5375 DAA_joinSession) and return error TPM_DAA_TPM_SETTINGS on mismatch

5376 d. Set DAA_generic_R1 = inputData0

5377 e. Verify that SHA-1(DAA_generic_R1) == DAA_issuerSettings -> DAA_digest_R1 and
5378 return error TPM_DAA_INPUT_DATA0 on mismatch

5379 f. Set DAA_generic_n = inputData1

5380 g. Verify that SHA-1(DAA_generic_n) == DAA_issuerSettings -> DAA_digest_n and
5381 return error TPM_DAA_INPUT_DATA1 on mismatch

5382 h. Obtain DAA_SIZE_r1 bytes using the MGF1 function and label them Y. "r1" ||
5383 DAA_session -> DAA_contextSeed is the Z seed.

5384 i. Set X = DAA_generic_R1

5385   j.   Set n = DAA_generic_n

5386   k.   Set Z = DAA_session -> DAA_scratch

5387   l.   Set DAA_session -> DAA_scratch = Z*(X^Y) mod n

5388   m.   set outputData = NULL

5389   n.   increment DAA_session -> DAA_stage by 1

5390   o.   return TPM_SUCCESS

539116. If stage==11

5392   a.   Verify that DAA_session ->DAA_stage==11. Return TPM_DAA_STAGE and flush
5393   handle on mismatch

5394   b.   Verify that DAA_tpmSpecific -> DAA_digestIssuer == SHA-1(DAA_issuerSettings) and
5395   return error TPM_DAA_ISSUER_SETTINGS on mismatch

5396   c.   Verify that DAA_session -> DAA_digestContext == SHA-1(DAA_tpmSpecific ||
5397   DAA_joinSession) and return error TPM_DAA_TPM_SETTINGS on mismatch

5398   d.   Set DAA_generic_S0 = inputData0

5399   e.   Verify that SHA-1(DAA_generic_S0) == DAA_issuerSettings -> DAA_digest_S0 and
5400   return error TPM_DAA_INPUT_DATA0 on mismatch

5401   f.   Set DAA_generic_n = inputData1

5402   g.   Verify that SHA-1(DAA_generic_n) == DAA_issuerSettings -> DAA_digest_n and
5403   return error TPM_DAA_INPUT_DATA1 on mismatch

5404   h.   Obtain DAA_SIZE_r2 bytes using the MGF1 function and label them Y. "r2" ||
5405   DAA_session -> DAA_contextSeed is the Z seed.

5406   i.   Set X = DAA_generic_S0

5407   j.   Set n = DAA_generic_n

5408   k.   Set Z = DAA_session -> DAA_scratch

5409   l.   Set DAA_session -> DAA_scratch = Z*(X^Y) mod n

5410   m.   set outputData = NULL

5411   n.   increment DAA_session -> DAA_stage by 1

5412   o.   return TPM_SUCCESS

541317. If stage==12

5414   a.   Verify that DAA_session ->DAA_stage==12. Return TPM_DAA_STAGE and flush
5415   handle on mismatch

5416   b.   Verify that DAA_tpmSpecific -> DAA_digestIssuer == SHA-1(DAA_issuerSettings) and
5417   return error TPM_DAA_ISSUER_SETTINGS on mismatch

5418   c.   Verify that DAA_session -> DAA_digestContext == SHA-1(DAA_tpmSpecific ||
5419   DAA_joinSession) and return error TPM_DAA_TPM_SETTINGS on mismatch

5420   d.   Set DAA_generic_S1 = inputData0

5421 e. Verify that SHA-1(DAA_generic_S1) == DAA_issuerSettings -> DAA_digest_S1 and
5422 return error TPM_DAA_INPUT_DATA0 on mismatch

5423 f. Set DAA_generic_n = inputData1

5424 g. Verify that SHA-1(DAA_generic_n) == DAA_issuerSettings -> DAA_digest_n and
5425 return error TPM_DAA_INPUT_DATA1 on mismatch

5426 h. Obtain DAA_SIZE_r3 bytes using the MGF1 function and label them Y. "r3" ||
5427 DAA_session -> DAA_contextSeed is the Z seed.

5428 i. Set X = DAA_generic_S1

5429 j. Set n = DAA_generic_n

5430 k. Set Z = DAA_session -> DAA_scratch

5431 l. Set DAA_session -> DAA_scratch = $Z*(X^Y)$ mod n

5432 m. set outputData = DAA_session -> DAA_scratch

5433 n. Set DAA_session -> DAA_scratch = NULL

5434 o. increment DAA_session -> DAA_stage by 1

5435 p. return TPM_SUCCESS

5436 18. If stage==13

5437 a. Verify that DAA_session->DAA_stage==13. Return TPM_DAA_STAGE and flush
5438 handle on mismatch

5439 b. Verify that DAA_tpmSpecific -> DAA_digestIssuer == SHA-1(DAA_issuerSettings) and
5440 return error TPM_DAA_ISSUER_SETTINGS on mismatch

5441 c. Verify that DAA_session -> DAA_digestContext == SHA-1(DAA_tpmSpecific ||
5442 DAA_joinSession) and return error TPM_DAA_TPM_SETTINGS on mismatch

5443 d. Set DAA_generic_gamma = inputData0

5444 e. Verify that SHA-1(DAA_generic_gamma) == DAA_issuerSettings ->
5445 DAA_digest_gamma and return error TPM_DAA_INPUT_DATA0 on mismatch

5446 f. Verify that inputSize1 == DAA_SIZE_w and return error TPM_DAA_INPUT_DATA1 on
5447 mismatch

5448 g. Set w = inputData1

5449 h. Set w1 = $w^{(DAA\_issuerSettings -> DAA\_generic\_q)}$ mod (DAA_generic_gamma)

5450 i. If w1 != 1 (unity), return error TPM_DAA_WRONG_W

5451 j. Set DAA_session -> DAA_scratch = w

5452 k. set outputData = NULL

5453 l. increment DAA_session -> DAA_stage by 1

5454 m. return TPM_SUCCESS.

5455 19. If stage==14

5456 a. Verify that DAA_session ->DAA_stage==14. Return TPM_DAA_STAGE and flush
5457 handle on mismatch

5458   b. Verify that DAA_tpmSpecific -> DAA_digestIssuer == SHA-1(DAA_issuerSettings) and
5459   return error TPM_DAA_ISSUER_SETTINGS on mismatch

5460   c. Verify that DAA_session -> DAA_digestContext == SHA-1(DAA_tpmSpecific ||
5461   DAA_joinSession) and return error TPM_DAA_TPM_SETTINGS on mismatch

5462   d. Set DAA_generic_gamma = inputData0

5463   e. Verify   that   SHA-1(DAA_generic_gamma)   ==   DAA_issuerSettings   ->
5464   DAA_digest_gamma and return error TPM_DAA_INPUT_DATA0 on mismatch

5465   f. Set f = SHA-1(DAA_tpmSpecific -> DAA_rekey || DAA_tpmSpecific -> DAA_count ||
5466   0) || SHA-1(DAA_tpmSpecific -> DAA_rekey || DAA_tpmSpecific -> DAA_count || 1)
5467   mod DAA_issuerSettings -> DAA_generic_q.

5468   g. Set E = ((DAA_session -> DAA_scratch)^f) mod (DAA_generic_gamma).

5469   h. Set outputData = E

5470   i. increment DAA_session -> DAA_stage by 1

5471   j. return TPM_SUCCESS.

547220. If stage==15

5473   a. Verify that DAA_session ->DAA_stage==15. Return TPM_DAA_STAGE and flush
5474   handle on mismatch

5475   b. Verify that DAA_tpmSpecific -> DAA_digestIssuer == SHA-1(DAA_issuerSettings) and
5476   return error TPM_DAA_ISSUER_SETTINGS on mismatch

5477   c. Verify that DAA_session -> DAA_digestContext == SHA-1(DAA_tpmSpecific ||
5478   DAA_joinSession) and return error TPM_DAA_TPM_SETTINGS on mismatch

5479   d. Set DAA_generic_gamma = inputData0

5480   e. Verify   that   SHA-1(DAA_generic_gamma)   ==   DAA_issuerSettings   ->
5481   DAA_digest_gamma and return error TPM_DAA_INPUT_DATA0 on mismatch

5482   f. Obtain DAA_SIZE_r0 bytes using the MGF1 function and label them r0. "r0" ||
5483   DAA_session -> DAA_contextSeed is the Z seed.

5484   g. Obtain DAA_SIZE_r1 bytes using the MGF1 function and label them r1. "r1" ||
5485   DAA_session -> DAA_contextSeed is the Z seed.

5486   h. set r = r0 + 2^DAA_power0 * r1 mod (DAA_issuerSettings -> DAA_generic_q).

5487   i. set E1 = ((DAA_session -> DAA_scratch)^r) mod (DAA_generic_gamma).

5488   j. Set DAA_session -> DAA_scratch = NULL

5489   k. Set outputData = E1

5490   l. increment DAA_session -> DAA_stage by 1

5491   m. return TPM_SUCCESS.

549221. If stage==16

5493   a. Verify that DAA_session ->DAA_stage==16. Return TPM_DAA_STAGE and flush
5494   handle on mismatch

5495 b. Verify that DAA_tpmSpecific -> DAA_digestIssuer == SHA-1(DAA_issuerSettings) and
5496 return error TPM_DAA_ISSUER_SETTINGS on mismatch

5497 c. Verify that DAA_session -> DAA_digestContext == SHA-1(DAA_tpmSpecific ||
5498 DAA_joinSession) and return error TPM_DAA_TPM_SETTINGS on mismatch

5499 d. Verify that inputSize0 == sizeOf(TPM_DIGEST) and return error
5500 TPM_DAA_INPUT_DATA0 on mismatch

5501 e. Set DAA_session -> DAA_digest = inputData0

5502 f. Obtain DAA_SIZE_NT bytes from the RNG and label them NT

5503 g. Set DAA_session -> DAA_digest to the SHA-1 (DAA_session -> DAA_digest || NT)

5504 h. Set outputData = NT

5505 i. increment DAA_session -> DAA_stage by 1

5506 j. return TPM_SUCCESS.

5507 22. If stage==17

5508 a. Verify that DAA_session ->DAA_stage==17. Return TPM_DAA_STAGE and flush
5509 handle on mismatch

5510 b. Verify that DAA_tpmSpecific -> DAA_digestIssuer == SHA-1(DAA_issuerSettings) and
5511 return error TPM_DAA_ISSUER_SETTINGS on mismatch

5512 c. Verify that DAA_session -> DAA_digestContext == SHA-1(DAA_tpmSpecific ||
5513 DAA_joinSession) and return error TPM_DAA_TPM_SETTINGS on mismatch

5514 d. Obtain DAA_SIZE_r0 bytes using the MGF1 function and label them r0. "r0" ||
5515 DAA_session -> DAA_contextSeed is the Z seed.

5516 e. Set f = SHA-1(DAA_tpmSpecific -> DAA_rekey || DAA_tpmSpecific -> DAA_count ||
5517 0) || SHA-1(DAA_tpmSpecific -> DAA_rekey || DAA_tpmSpecific -> DAA_count || 1)
5518 mod DAA_issuerSettings -> DAA_generic_q.

5519 f. Set f0 = f mod 2^{DAA_power0} (erase all but the lowest DAA_power0 bits of f)

5520 g. Set s0 = r0 + (DAA_session -> DAA_digest) * f0 in **Z.** Compute over the integers. The
5521 computation is not reduced with a modulus.

5522 h. set outputData = s0

5523 i. increment DAA_session -> DAA_stage by 1

5524 j. return TPM_SUCCESS

5525 23. If stage==18

5526 a. Verify that DAA_session ->DAA_stage==18. Return TPM_DAA_STAGE and flush
5527 handle on mismatch

5528 b. Verify that DAA_tpmSpecific -> DAA_digestIssuer == SHA-1(DAA_issuerSettings) and
5529 return error TPM_DAA_ISSUER_SETTINGS on mismatch

5530 c. Verify that DAA_session -> DAA_digestContext == SHA-1(DAA_tpmSpecific ||
5531 DAA_joinSession) and return error TPM_DAA_TPM_SETTINGS on mismatch

5532   d. Obtain DAA_SIZE_r1 bytes using the MGF1 function and label them r1. "r1" ||
5533   DAA_session -> DAA_contextSeed is the Z seed.

5534   e. Set f = SHA-1(DAA_tpmSpecific -> DAA_rekey || DAA_tpmSpecific -> DAA_count ||
5535   0) || SHA-1(DAA_tpmSpecific -> DAA_rekey || DAA_tpmSpecific -> DAA_count || 1)
5536   mod DAA_issuerSettings -> DAA_generic_q.

5537   f. Shift f right by DAA_power0 bits (discard the lowest DAA_power0 bits) and label the
5538   result f1

5539   g. Set s1 = r1 + (DAA_session -> DAA_digest)* f1 in **Z.** Compute over the integers. The
5540   computation is not reduced with a modulus.

5541   h. set outputData = s1

5542   i. increment DAA_session -> DAA_stage by 1

5543   j. return TPM_SUCCESS

5544 24. If stage==19

5545   a. Verify that DAA_session ->DAA_stage==19. Return TPM_DAA_STAGE and flush
5546   handle on mismatch

5547   b. Verify that DAA_tpmSpecific -> DAA_digestIssuer == SHA-1(DAA_issuerSettings) and
5548   return error TPM_DAA_ISSUER_SETTINGS on mismatch

5549   c. Verify that DAA_session -> DAA_digestContext == SHA-1(DAA_tpmSpecific ||
5550   DAA_joinSession) and return error TPM_DAA_TPM_SETTINGS on mismatch

5551   d. Obtain DAA_SIZE_r2 bytes using the MGF1 function and label them r2. "r2" ||
5552   DAA_session -> DAA_contextSeed is the Z seed.

5553   e. Set s2 = r2 + (DAA_session -> DAA_digest)*(DAA_joinSession -> DAA_join_u0) mod
5554   2^DAA_power1 (Erase all but the lowest DAA_power1 bits of s2)

5555   f. set outputData = s2

5556   g. increment DAA_session -> DAA_stage by 1

5557   h. return TPM_SUCCESS

5558 25. If stage==20

5559   a. Verify that DAA_session ->DAA_stage==20. Return TPM_DAA_STAGE and flush
5560   handle on mismatch

5561   b. Verify that DAA_tpmSpecific -> DAA_digestIssuer == SHA-1(DAA_issuerSettings) and
5562   return error TPM_DAA_ISSUER_SETTINGS on mismatch

5563   c. Verify that DAA_session -> DAA_digestContext == SHA-1(DAA_tpmSpecific ||
5564   DAA_joinSession) and return error TPM_DAA_TPM_SETTINGS on mismatch

5565   d. Obtain DAA_SIZE_r2 bytes using the MGF1 function and label them r2. "r2" ||
5566   DAA_session -> DAA_contextSeed is the Z seed.

5567   e. Set s12 = r2 + (DAA_session -> DAA_digest)*(DAA_joinSession -> DAA_join_u0)

5568   f. Shift s12 right by DAA_power1 bit (discard the lowest DAA_power1 bits).

5569   g. Set DAA_session -> DAA_scratch = s12

5570   h. Set outputData = DAA_session -> DAA_digest

5571   i. increment DAA_session -> DAA_stage by 1

5572   j. return TPM_SUCCESS

5573 26. If stage==21

5574   a. Verify that DAA_session ->DAA_stage==21. Return TPM_DAA_STAGE and flush
5575   handle on mismatch

5576   b. Verify that DAA_tpmSpecific -> DAA_digestIssuer == SHA-1(DAA_issuerSettings) and
5577   return error TPM_DAA_ISSUER_SETTINGS on mismatch

5578   c. Verify that DAA_session -> DAA_digestContext == SHA-1(DAA_tpmSpecific ||
5579   DAA_joinSession) and return error TPM_DAA_TPM_SETTINGS on mismatch

5580   d. Obtain DAA_SIZE_r3 bytes using the MGF1 function and label them r3. "r3" ||
5581   DAA_session -> DAA_contextSeed is the Z seed.

5582   e. Set s3 = r3 + (DAA_session -> DAA_digest)*(DAA_joinSession -> DAA_join_u1) +
5583   (DAA_session -> DAA_scratch).

5584   f. Set DAA_session -> DAA_scratch = NULL

5585   g. set outputData = s3

5586   h. increment DAA_session -> DAA_stage by 1

5587   i. return TPM_SUCCESS

5588 27. If stage==22

5589   a. Verify that DAA_session ->DAA_stage==22. Return TPM_DAA_STAGE and flush
5590   handle on mismatch

5591   b. Verify that DAA_tpmSpecific -> DAA_digestIssuer == SHA-1(DAA_issuerSettings) and
5592   return error TPM_DAA_ISSUER_SETTINGS on mismatch

5593   c. Verify that DAA_session -> DAA_digestContext == SHA-1(DAA_tpmSpecific ||
5594   DAA_joinSession) and return error TPM_DAA_TPM_SETTINGS on mismatch

5595   d. Verify inputSize0 == DAA_SIZE_v0 and return error TPM_DAA_INPUT_DATA0 on
5596   mismatch

5597   e. Set u2 = inputData0

5598   f. Set v0 = u2 + (DAA_joinSession -> DAA_join_u0) mod 2^{DAA_power1} (Erase all but
5599   the lowest DAA_power1 bits of v0).

5600   g. Set DAA_tpmSpecific -> DAA_digest_v0 = SHA-1(v0)

5601   h. Set v10 = u2 + (DAA_joinSession -> DAA_join_u0) in **Z.** Compute over the integers.
5602   The computation is not reduced with a modulus.

5603   i. Shift v10 right by DAA_power1 bits (erase the lowest DAA_power1 bits).

5604   j. Set DAA_session ->DAA_scratch = v10

5605   k. Set outputData

5606   i. Fill in TPM_DAA_BLOB with a type of TPM_RT_DAA_V0 and encrypt the v0
5607   parameters using TPM_PERMANENT_DATA -> daaBlobKey

5608   ii. set outputData to the encrypted TPM_DAA_BLOB

5609   l. increment DAA_session -> DAA_stage by 1

5610   m. set DAA_session -> DAA_digestContext = SHA-1(DAA_tpmSpecific ||
5611 DAA_joinSession)

5612   n. return TPM_SUCCESS

561328.If stage==23

5614   a. Verify that DAA_session ->DAA_stage==23. Return TPM_DAA_STAGE and flush
5615 handle on mismatch

5616   b. Verify that DAA_tpmSpecific -> DAA_digestIssuer == SHA-1(DAA_issuerSettings) and
5617 return error TPM_DAA_ISSUER_SETTINGS on mismatch

5618   c. Verify that DAA_session -> DAA_digestContext == SHA-1(DAA_tpmSpecific ||
5619 DAA_joinSession) and return error TPM_DAA_TPM_SETTINGS on mismatch

5620   d. Verify inputSize0 == DAA_SIZE_v1 and return error TPM_DAA_INPUT_DATA0 on
5621 mismatch

5622   e. Set u3 = inputData0

5623   f. Set v1 = u3 + DAA_joinSession -> DAA_join_u1 + DAA_session ->DAA_scratch

5624   g. Set DAA_tpmSpecific -> DAA_digest_v1 = SHA-1(v1)

5625   h. Set outputData

5626   i. Fill in TPM_DAA_BLOB with a type of TPM_RT_DAA_V1 and encrypt the v1
5627   parameters using TPM_PERMANENT_DATA -> daaBlobKey

5628   ii. set outputData to the encrypted TPM_DAA_BLOB

5629   i. Set DAA_session ->DAA_scratch = NULL

5630   j. increment DAA_session -> DAA_stage by 1

5631   k. set DAA_session -> DAA_digestContext = SHA-1(DAA_tpmSpecific ||
5632 DAA_joinSession)

5633   l. return TPM_SUCCESS

563429.If stage==24

5635   a. Verify that DAA_session ->DAA_stage==24. Return TPM_DAA_STAGE and flush
5636 handle on mismatch

5637   b. Verify that DAA_tpmSpecific -> DAA_digestIssuer == SHA-1(DAA_issuerSettings) and
5638 return error TPM_DAA_ISSUER_SETTINGS on mismatch

5639   c. Verify that DAA_session -> DAA_digestContext == SHA-1(DAA_tpmSpecific ||
5640 DAA_joinSession) and return error TPM_DAA_TPM_SETTINGS on mismatch

5641   d. set outputData = enc(DAA_tpmSpecific) using TPM_PERMANENT_DATA ->
5642 daaBlobKey

5643   e. Terminate the DAA session and all resources associated with the DAA join session
5644 handle.

5645   f. return TPM_SUCCESS

564630. If stage > 24, return error: TPM_DAA_STAGE

5647 26.2   TPM_DAA_Sign

5648**Start of informative comment:**

5649outputSize and outputData are always included in the outParamDigest. This includes stage
56500, where the outputData contains the DAA session handle.

5651 **End of informative comment.**

5652TPM protected capability; user must provide authorizations from the TPM Owner.

5653Incoming Operands and Sizes

| PARAM | | HMAC | | Type | Name | Description |
#	SZ	#	SZ			
1	2			TPM_TAG	Tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes incl. paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	Ordinal	Command ordinal: TPM_ORD_DAA_Sign
4	4			TPM_HANDLE	handle	Handle to the sign session
5	1	2S	1	BYTE	stage	Stage of the sign process
6	4	3S	4	UINT32	inputSize0	Size of inputData0 for this stage of DAA_Sign
7	<>	4S	<>	BYTE[]	inputData0	Data to be used by this capability
8	4	5S	4	UINT32	inputSize1	Size of inputData1 for this stage of DAA_Sign
9	<>	6S	<>	BYTE[]	inputData1	Data to be used by this capability
10	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for owner authentication
		2 H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
11	20	3 H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
12	1	4 H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
13	20		20	TPM_AUTHDATA	ownerAuth	The authorization session digest for inputs and owner. HMAC key: ownerAuth.

5654Outgoing Operands and Sizes

| PARAM | | HMAC | | Type | Name | Description |
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes incl. paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal:TPM_ORD_DAA_Sign
4	4	3S	4	UINT32	outputSize	Size of outputData
5	<>	4S	<>	BYTE[]	outputData	Data produced by this capability
6	20	2 H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3 H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
7	1	4 H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
8	20		20	TPM_AUTHDATA	resAuth	The authorization session digest for the returned parameters. HMAC key: ownerAuth.

5655 **Description**

5656 This table summaries the input, output and saved data that is associated with each stage of
5657 processing.

Stage	Input Data0	Input Data1	Operation	Output Data	Scratchpad
0	DAA_issuerSettings	NULL	initialise	handle	NULL
1	enc(DAA_tpmSpecific)	NULL	initialise	NULL	NULL
2	DAA_generic_R0	DAA_generic_n	$P1=R0^{r0} \bmod n$	NULL	P1
3	DAA_generic_R1	DAA_generic_n	$P2 = P1*(R1^{r1}) \bmod n$	NULL	P2
4	DAA_generic_S0	DAA_generic_n	$P3 = P2*(S0^{r2}) \bmod n$	NULL	P3
5	DAA_generic_S1	DAA_generic_n	$T = P3*(S1^{r4}) \bmod n$	T	NULL
6	DAA_generic_gamma	w	$w1 = w^q \bmod gamma$	NULL	w
7	DAA_generic_gamma	NULL	$E = w^f \bmod gamma$	E	w
8	DAA_generic_gamma	NULL	$r = r0 + (2^{power0})*r1 \bmod q$, $E1 = w^r \bmod gamma$	E1	NULL
9	c1	NULL	$c = hash(c1 \| NT)$	NT	NULL
10	b (selector)	m or handle to AIK	$c = hash(c \| 1 \| m)$ or $c = hash(c \| 0 \| AIK\text{-}modulus)$	c	NULL
11	NULL	NULL	$s0 = r0 + c*f0$	s0	NULL
12	NULL	NULL	$s1 = r1 + c*f1$	s1	NULL
13	enc(v0)	NULL	$s2 = r2 + c*v0 \bmod 2^{power1}$	s2	NULL
14	enc(v0)	NULL	$s12 = r2 + c*v0 >> power1$	NULL	s12
15	enc(v1)	NULL	$s3 = r4 + c*v1 + s12$	s3	NULL

5658

5659 When a TPM receives an Owner authorized command to input enc(DAA_tpmSpecific) or
5660 enc(v0) or enc(v1), the TPM MUST verify that the TPM created the data and that neither the
5661 data nor the TPM's daaProof has been changed since the data was created. ==Loading one of
5662 these wrapped blobs does not require authorization, since correct blobs were created by the
5663 TPM under Owner authorization, and unwrapped blobs cannot be used without Owner
5664 authorisation.== The TPM MUST NOT restrict the number of times that the contents of
5665 enc(DAA_tpmSpecific) or enc(v0) or enc(v1) can be used by the same combination of TPM
5666 and daaProof that created them.

5667 **Actions**

5668 A Trusted Platform Module that receives a valid TPM_DAA_Sign command SHALL:

5669 1. Use ownerAuth to verify that the Owner authorized all TPM_DAA_Sign input parameters.

5670 2. Any error results in the TPM invalidating all resources associated with the command

5671 3. Constant values of 0 or 1 are 1 byte integers, stages affected are

5672   a. 7(f), 11(e), 12(e)

56734. Representation of the strings "r0" to "r4" are 2-byte ASCII encodings, stages affected are

5674   a. 2(h), 3(h), 4(h), 5(h), 12(d), 13(f), 14(f), 15(f)

5675**Stages**

56760. If stage==0

5677   b. Determine that sufficient resources are available to perform a TPM_DAA_Sign.

5678   i. The TPM MUST support sufficient resources to perform one (1)
5679   TPM_DAA_Join/ TPM_DAA_Sign. The TPM MAY support addition TPM_DAA_Join/
5680   TPM_DAA_Sign sessions.

5681   ii. The TPM may share internal resources between the DAA operations and other
5682   variable resource requirements:

5683   iii. If there are insufficient resources within the stored key pool (and one or more
5684   keys need to be removed to permit the DAA operation to execute) return
5685   TPM_NOSPACE

5686   iv. If there are insufficient resources within the stored session pool (and one or
5687   more authorization or transport sessions need to be removed to permit the DAA
5688   operation to execute), return TPM_RESOURCES.

5689   c. Set DAA_issuerSettings = inputData0

5690   d. Verify that all fields in DAA_issuerSettings are present and return error
5691   TPM_DAA_INPUT_DATA0 if not.

5692   e. set all fields in DAA_session = NULL

5693   f. Assign new handle for session

5694   g. Set outputData to new handle

5695   i. The handle in outputData is included the output HMAC.

5696   h. set DAA_session -> DAA_stage = 1

5697   i. return TPM_SUCCESS

56985. If stage==1

5699   a. Verify that DAA_session ->DAA_stage==1. Return TPM_DAA_STAGE and flush handle
5700   on mismatch

5701   b. Set DAA_tpmSpecific = unwrap(inputData0) using TPM_PERMANENT_DATA ->
5702   daaBlobKey

5703   c. Verify that DAA_tpmSpecific -> DAA_digestIssuer == SHA-1(DAA_issuerSettings) and
5704   return error TPM_DAA_ISSUER_SETTINGS on mismatch

5705   d. set DAA_session -> DAA_digestContext = SHA-1(DAA_tpmSpecific)

5706   e. set outputData = NULL

5707   f.   set DAA_session -> DAA_stage =2

5708   g. return TPM_SUCCESS

57096. If stage==2

5710 a. Verify that DAA_session ->DAA_stage==2. Return TPM_DAA_STAGE and flush handle
5711 on mismatch

5712 b. Verify that DAA_tpmSpecific -> DAA_digestIssuer == SHA-1(DAA_issuerSettings) and
5713 return error TPM_DAA_ISSUER_SETTINGS on mismatch

5714 c. Verify that DAA_session -> DAA_digestContext == SHA-1(DAA_tpmSpecific) and
5715 return error TPM_DAA_TPM_SETTINGS on mismatch

5716 d. Set DAA_generic_R0 = inputData0

5717 e. Verify that SHA-1(DAA_generic_R0) == DAA_issuerSettings -> DAA_digest_R0 and
5718 return error TPM_DAA_INPUT_DATA0 on mismatch

5719 f. Set DAA_generic_n = inputData1

5720 g. Verify that SHA-1(DAA_generic_n) == DAA_issuerSettings -> DAA_digest_n and
5721 return error TPM_DAA_INPUT_DATA1 on mismatch

5722 h. Obtain random data from the RNG and store it as DAA_session -> DAA_contextSeed

5723 i. Obtain DAA_SIZE_r0 bytes using the MGF1 function and label them Y. "r0" ||
5724 DAA_session -> DAA_contextSeed is the Z seed.

5725 j. Set X = DAA_generic_R0

5726 k. Set n = DAA_generic_n

5727 l. Set DAA_session -> DAA_scratch = (X^Y) mod n

5728 m. set outputData = NULL

5729 n. increment DAA_session -> DAA_stage by 1

5730 o. return TPM_SUCCESS

5731 7. If stage==3

5732 a. Verify that DAA_session ->DAA_stage==3. Return TPM_DAA_STAGE and flush handle
5733 on mismatch

5734 b. Verify that DAA_tpmSpecific -> DAA_digestIssuer == SHA-1(DAA_issuerSettings) and
5735 return error TPM_DAA_ISSUER_SETTINGS on mismatch

5736 c. Verify that DAA_session -> DAA_digestContext == SHA-1(DAA_tpmSpecific) and
5737 return error TPM_DAA_TPM_SETTINGS on mismatch

5738 d. Set DAA_generic_R1 = inputData0

5739 e. Verify that SHA-1(DAA_generic_R1) == DAA_issuerSettings -> DAA_digest_R1 and
5740 return error TPM_DAA_INPUT_DATA0 on mismatch

5741 f. Set DAA_generic_n = inputData1

5742 g. Verify that SHA-1(DAA_generic_n) == DAA_issuerSettings -> DAA_digest_n and
5743 return error TPM_DAA_INPUT_DATA1 on mismatch

5744 h. Obtain DAA_SIZE_r1 bytes using the MGF1 function and label them Y. "r1" ||
5745 DAA_session -> DAA_contextSeed is the Z seed.

5746 i. Set X = DAA_generic_R1

5747 j. Set n = DAA_generic_n

5748   k. Set Z = DAA_session -> DAA_scratch

5749   l. Set DAA_session -> DAA_scratch = Z*(X^Y) mod n

5750   m. set outputData = NULL

5751   n. increment DAA_session -> DAA_stage by 1

5752   o. return TPM_SUCCESS

57538. If stage==4

5754   a. Verify that DAA_session ->DAA_stage==4. Return TPM_DAA_STAGE and flush handle
5755   on mismatch

5756   b. Verify that DAA_tpmSpecific -> DAA_digestIssuer == SHA-1(DAA_issuerSettings) and
5757   return error TPM_DAA_ISSUER_SETTINGS on mismatch

5758   c. Verify that DAA_session -> DAA_digestContext = SHA-1(DAA_tpmSpecific)   and
5759   return error TPM_DAA_TPM_SETTINGS on mismatch

5760   d. Set DAA_generic_S0 = inputData0

5761   e. Verify that SHA-1(DAA_generic_S0) == DAA_issuerSettings -> DAA_digest_S0 and
5762   return error TPM_DAA_INPUT_DATA0 on mismatch

5763   f. Set DAA_generic_n = inputData1

5764   g. Verify that SHA-1(DAA_generic_n) == DAA_issuerSettings -> DAA_digest_n and
5765   return error TPM_DAA_INPUT_DATA1 on mismatch

5766   h. Obtain DAA_SIZE_r2 bytes using the MGF1 function and label them Y. "r2" ||
5767   DAA_session -> DAA_contextSeed is the Z seed.

5768   i. Set X = DAA_generic_S0

5769   j. Set n = DAA_generic_n

5770   k. Set Z = DAA_session -> DAA_scratch

5771   l. Set DAA_session -> DAA_scratch = Z*(X^Y) mod n

5772   m. set outputData = NULL

5773   n. increment DAA_session -> DAA_stage by 1

5774   o. return TPM_SUCCESS

57759. If stage==5

5776   a. Verify that DAA_session ->DAA_stage==5. Return TPM_DAA_STAGE and flush handle
5777   on mismatch

5778   b. Verify that DAA_tpmSpecific -> DAA_digestIssuer == SHA-1(DAA_issuerSettings) and
5779   return error TPM_DAA_ISSUER_SETTINGS on mismatch

5780   c. Verify that DAA_session -> DAA_digestContext == SHA-1(DAA_tpmSpecific) and
5781   return error TPM_DAA_TPM_SETTINGS on mismatch

5782   d. Set DAA_generic_S1 = inputData0

5783   e. Verify that SHA-1(DAA_generic_S1) == DAA_issuerSettings -> DAA_digest_S1 and
5784   return error TPM_DAA_INPUT_DATA0 on mismatch

5785   f.   Set DAA_generic_n = inputData1

5786   g. Verify that SHA-1(DAA_generic_n) == DAA_issuerSettings -> DAA_digest_n and
5787   return error TPM_DAA_INPUT_DATA1 on mismatch

5788   h. Obtain DAA_SIZE_r4 bytes using the MGF1 function and label them Y. "r4" ||
5789   DAA_session -> DAA_contextSeed is the Z seed.

5790   i.   Set X = DAA_generic_S1

5791   j.   Set n = DAA_generic_n

5792   k. Set Z = DAA_session -> DAA_scratch

5793   l.   Set DAA_session -> DAA_scratch = $Z*(X^Y)$ mod n

5794   m. set outputData = DAA_session -> DAA_scratch

5795   n. set DAA_session -> DAA_scratch = NULL

5796   o. increment DAA_session -> DAA_stage by 1

5797   p. return TPM_SUCCESS

5798 10. If stage==6

5799   a. Verify that DAA_session ->DAA_stage==6. Return TPM_DAA_STAGE and flush handle
5800   on mismatch

5801   b. Verify that DAA_tpmSpecific -> DAA_digestIssuer == SHA-1(DAA_issuerSettings) and
5802   return error TPM_DAA_ISSUER_SETTINGS on mismatch

5803   c. Verify that DAA_session -> DAA_digestContext == SHA-1(DAA_tpmSpecific) and
5804   return error TPM_DAA_TPM_SETTINGS on mismatch

5805   d. Set DAA_generic_gammma = inputData0

5806   e. Verify that SHA-1(DAA_generic_gamma) == DAA_issuerSettings ->
5807   DAA_digest_gamma and return error TPM_DAA_INPUT_DATA0 on mismatch

5808   f. Verify that inputSize1 == DAA_SIZE_w and return error TPM_DAA_INPUT_DATA1 on
5809   mismatch

5810   g. Set w = inputData1

5811   h. Set w1 = w^(DAA_issuerSettings -> DAA_generic_q) mod (DAA_generic_gamma)

5812   i.   If w1 != 1 (unity), return error TPM_DAA_WRONG_W

5813   j.   Set DAA_session -> DAA_scratch = w

5814   k. set outputData = NULL

5815   l.   increment DAA_session -> DAA_stage by 1

5816   m. return TPM_SUCCESS.

5817 11. If stage==7

5818   a. Verify that DAA_session ->DAA_stage==7. Return TPM_DAA_STAGE and flush handle
5819   on mismatch

5820   b. Verify that DAA_tpmSpecific -> DAA_digestIssuer == SHA-1(DAA_issuerSettings) and
5821   return error TPM_DAA_ISSUER_SETTINGS on mismatch

5822   c. Verify that DAA_session -> DAA_digestContext == SHA-1(DAA_tpmSpecific) and
5823   return error TPM_DAA_TPM_SETTINGS on mismatch

5824   d. Set DAA_generic_gamma = inputData0

5825   e. Verify   that   SHA-1(DAA_generic_gamma)   ==   DAA_issuerSettings   ->
5826   DAA_digest_gamma and return error TPM_DAA_INPUT_DATA0 on mismatch

5827   f. Set f = SHA-1(DAA_tpmSpecific -> DAA_rekey || DAA_tpmSpecific -> DAA_count ||
5828   0) || SHA-1(DAA_tpmSpecific -> DAA_rekey || DAA_tpmSpecific -> DAA_count || 1)
5829   mod DAA_issuerSettings -> DAA_generic_q.

5830   g. Set E = ((DAA_session -> DAA_scratch)^f) mod (DAA_generic_gamma).

5831   h. Set outputData = E

5832   i. increment DAA_session -> DAA_stage by 1

5833   j. return TPM_SUCCESS.

5834 12. If stage==8

5835   a. Verify that DAA_session ->DAA_stage==8. Return TPM_DAA_STAGE and flush handle
5836   on mismatch

5837   b. Verify that DAA_tpmSpecific -> DAA_digestIssuer == SHA-1(DAA_issuerSettings) and
5838   return error TPM_DAA_ISSUER_SETTINGS on mismatch

5839   c. Verify that DAA_session -> DAA_digestContext == SHA-1(DAA_tpmSpecific) and
5840   return error TPM_DAA_TPM_SETTINGS on mismatch

5841   d. Set DAA_generic_gamma = inputData0

5842   e. Verify   that   SHA-1(DAA_generic_gamma)   ==   DAA_issuerSettings   ->
5843   DAA_digest_gamma and return error TPM_DAA_INPUT_DATA0 on mismatch

5844   f. Obtain DAA_SIZE_r0 bytes using the MGF1 function and label them r0. "r0" ||
5845   DAA_session -> DAA_contextSeed is the Z seed.

5846   g. Obtain DAA_SIZE_r1 bytes using the MGF1 function and label them r1. "r1" ||
5847   DAA_session -> DAA_contextSeed is the Z seed.

5848   h. set r = r0 + 2^DAA_power0 * r1 mod (DAA_issuerSettings -> DAA_generic_q).

5849   i. Set E1 = ((DAA_session -> DAA_scratch)^r) mod (DAA_generic_gamma)

5850   j. Set DAA_session -> DAA_scratch = NULL

5851   k. Set outputData = E1

5852   l. increment DAA_session -> DAA_stage by 1

5853   m. return TPM_SUCCESS.

5854 13. If stage==9

5855   a. Verify that DAA_session ->DAA_stage==9. Return TPM_DAA_STAGE and flush handle
5856   on mismatch

5857   b. Verify that DAA_tpmSpecific -> DAA_digestIssuer == SHA-1(DAA_issuerSettings) and
5858   return error TPM_DAA_ISSUER_SETTINGS on mismatch

5859 c. Verify that DAA_session -> DAA_digestContext == SHA-1(DAA_tpmSpecific) and
5860 return error TPM_DAA_TPM_SETTINGS on mismatch

5861 d. Verify that inputSize0 == sizeOf(TPM_DIGEST) and return error
5862 TPM_DAA_INPUT_DATA0 on mismatch

5863 e. Set DAA_session -> DAA_digest = inputData0

5864 f. Obtain DAA_SIZE_NT bytes from the RNG and label them NT

5865 g. Set DAA_session -> DAA_digest to the SHA-1 (DAA_session -> DAA_digest || NT)

5866 h. Set outputData = NT

5867 i. increment DAA_session -> DAA_stage by 1

5868 j. return TPM_SUCCESS.

5869 14. If stage==10

5870 a. Verify that DAA_session ->DAA_stage==10. Return TPM_DAA_STAGE and flush
5871 handle on mismatch

5872 b. Verify that DAA_tpmSpecific -> DAA_digestIssuer == SHA-1(DAA_issuerSettings) and
5873 return error TPM_DAA_ISSUER_SETTINGS on mismatch

5874 c. Verify that DAA_session -> DAA_digestContext == SHA-1(DAA_tpmSpecific) and
5875 return error TPM_DAA_TPM_SETTINGS on mismatch

5876 d. Verify that inputSize0 == sizeOf(BYTE), and return error TPM_DAA_INPUT_DATA0 on
5877 mismatch

5878 e. Set selector = inputData0, verify that selector == 0 or 1, and return error
5879 TPM_DAA_INPUT_DATA0 on mismatch

5880 f. If selector == 1, verify that inputSize1 == sizeOf(TPM_DIGEST), and return error
5881 TPM_DAA_INPUT_DATA1 on mismatch

5882 g. Set DAA_session -> DAA_digest to SHA-1 (DAA_session -> DAA_digest || 1 ||
5883 inputData1)

5884 h. If selector == 0, verify that inputData1 is a handle to a TPM identity key (AIK), and
5885 return error TPM_DAA_INPUT_DATA1 on mismatch

5886 i. Set DAA_session -> DAA_digest to SHA-1 (DAA_session -> DAA_digest || 0 || n2)
5887 where n2 is the modulus of the AIK

5888 j. Set outputData = DAA_session -> DAA_digest

5889 k. increment DAA_session -> DAA_stage by 1

5890 l. return TPM_SUCCESS.

5891 15. If stage==11

5892 a. Verify that DAA_session ->DAA_stage==11. Return TPM_DAA_STAGE and flush
5893 handle on mismatch

5894 b. Verify that DAA_tpmSpecific -> DAA_digestIssuer == SHA-1(DAA_issuerSettings) and
5895 return error TPM_DAA_ISSUER_SETTINGS on mismatch

5896   c. Verify that DAA_session -> DAA_digestContext == SHA-1(DAA_tpmSpecific) and
5897   return error TPM_DAA_TPM_SETTINGS on mismatch

5898   d. Obtain DAA_SIZE_r0 bytes using the MGF1 function and label them r0. "r0" ||
5899   DAA_session -> DAA_contextSeed is the Z seed.

5900   e. Set f = SHA-1(DAA_tpmSpecific -> DAA_rekey || DAA_tpmSpecific -> DAA_count ||
5901   0) || SHA-1(DAA_tpmSpecific -> DAA_rekey || DAA_tpmSpecific -> DAA_count || 1)
5902   mod DAA_issuerSettings -> DAA_generic_q.

5903   f.   Set f0 = f mod 2^{DAA_power0} (erase all but the lowest DAA_power0 bits of f)

5904   g.   Set s0 = r0 + (DAA_session -> DAA_digest)*(f0)

5905   h.   set outputData = s0

5906   i.   increment DAA_session -> DAA_stage by 1

5907   j.   return TPM_SUCCESS

5908 16. If stage==12

5909   a. Verify that DAA_session ->DAA_stage==12. Return TPM_DAA_STAGE and flush
5910   handle on mismatch

5911   b. Verify that DAA_tpmSpecific -> DAA_digestIssuer == SHA-1(DAA_issuerSettings) and
5912   return error TPM_DAA_ISSUER_SETTINGS on mismatch

5913   c. Verify that DAA_session -> DAA_digestContext == SHA-1(DAA_tpmSpecific) and
5914   return error TPM_DAA_TPM_SETTINGS on mismatch

5915   d. Obtain DAA_SIZE_r1 bytes using the MGF1 function and label them r1. "r1" ||
5916   DAA_session -> DAA_contextSeed is the Z seed.

5917   e. Set f = SHA-1(DAA_tpmSpecific -> DAA_rekey || DAA_tpmSpecific -> DAA_count ||
5918   0) || SHA-1(DAA_tpmSpecific -> DAA_rekey || DAA_tpmSpecific -> DAA_count || 1)
5919   mod DAA_issuerSettings -> DAA_generic_q.

5920   f.   Shift f right by DAA_power0 bits (discard the lowest DAA_power0 bits) and label the
5921   result f1

5922   g.   Set s1 = r1 + (DAA_session -> DAA_digest)*(f1)

5923   h.   set outputData = s1

5924   i.   increment DAA_session -> DAA_stage by 1

5925   j.   return TPM_SUCCESS

5926 17. If stage==13

5927   a. Verify that DAA_session ->DAA_stage==13. Return TPM_DAA_STAGE and flush
5928   handle on mismatch

5929   b. Verify that DAA_tpmSpecific -> DAA_digestIssuer == SHA-1(DAA_issuerSettings) and
5930   return error TPM_DAA_ISSUER_SETTINGS on mismatch

5931   c. Verify that DAA_session -> DAA_digestContext == SHA-1(DAA_tpmSpecific) and
5932   return error TPM_DAA_TPM_SETTINGS on mismatch

5933   d. Set DAA_private_v0= unwrap(inputData0) using TPM_PERMANENT_DATA ->
5934   daaBlobKey

5935 e. Verify that SHA-1(DAA_private_v0) == DAA_tpmSpecific -> DAA_digest_v0 and return
5936 error TPM_DAA_INPUT_DATA0 on mismatch

5937 f. Obtain DAA_SIZE_r2 bytes from the MGF1 function and label them r2. "r2" ||
5938 DAA_session -> DAA_contextSeed is the Z seed.

5939 g. Set s2 = r2 + (DAA_session -> DAA_digest)*(DAA_private_v0) mod 2^DAA_power1
5940 (erase all but the lowest DAA_power1 bits of s2)

5941 h. set outputData = s2

5942 i. increment DAA_session -> DAA_stage by 1

5943 j. return TPM_SUCCESS

5944 18. If stage==14

5945 a. Verify that DAA_session ->DAA_stage==14. Return TPM_DAA_STAGE and flush
5946 handle on mismatch

5947 b. Verify that DAA_tpmSpecific -> DAA_digestIssuer == SHA-1(DAA_issuerSettings) and
5948 return error TPM_DAA_ISSUER_SETTINGS on mismatch

5949 c. Verify that DAA_session -> DAA_digestContext == SHA-1(DAA_tpmSpecific) and
5950 return error TPM_DAA_TPM_SETTINGS on mismatch

5951 d. Set DAA_private_v0= unwrap(inputData0) using TPM_PERMANENT_DATA ->
5952 daaBlobKey

5953 e. Verify that SHA-1(DAA_private_v0) == DAA_tpmSpecific -> DAA_digest_v0 and return
5954 error TPM_DAA_INPUT_DATA0 on mismatch

5955 f. Obtain DAA_SIZE_r2 bytes using the MGF1 function and label them r2. "r2" ||
5956 DAA_session -> DAA_contextSeed is the Z seed.

5957 g. Set s12 = r2 + (DAA_session -> DAA_digest)*(DAA_private_v0).

5958 h. Shift s12 right by DAA_power1 bits (erase the lowest DAA_power1 bits).

5959 i. Set DAA_session -> DAA_scratch = s12

5960 j. set outputData = NULL

5961 k. increment DAA_session -> DAA_stage by 1

5962 l. return TPM_SUCCESS

5963 19. If stage==15

5964 a. Verify that DAA_session ->DAA_stage==15. Return TPM_DAA_STAGE and flush
5965 handle on mismatch

5966 b. Verify that DAA_tpmSpecific -> DAA_digestIssuer == SHA-1(DAA_issuerSettings) and
5967 return error TPM_DAA_ISSUER_SETTINGS on mismatch

5968 c. Verify that DAA_session -> DAA_digestContext == SHA-1(DAA_tpmSpecific) and
5969 return error TPM_DAA_TPM_SETTINGS on mismatch

5970 d. Set DAA_private_v1 = unwrap(inputData0) using TPM_PERMANENT_DATA ->
5971 daaBlobKey

5972   e. Verify that SHA-1(DAA_private_v1) == DAA_tpmSpecific -> DAA_digest_v1 and return
5973   error TPM_DAA_INPUT_DATA0 on mismatch

5974   f. Obtain DAA_SIZE_r4 bytes using the MGF1 function and label them r4. "r4" ||
5975   DAA_session -> DAA_contextSeed is the Z seed.

5976   g. Set s3 = r4 + (DAA_session -> DAA_digest)*(DAA_private_v1) + (DAA_session ->
5977   DAA_scratch).

5978   h. Set DAA_session -> DAA_scratch = NULL

5979   i. set outputData = s3

5980   j. Terminate the DAA session and all resources associated with the DAA sign session
5981   handle.

5982   k. return TPM_SUCCESS

598320.If stage > 15, return error: TPM_DAA_STAGE

5984 27. Deprecated commands

5985 **Start of informative comment:**

5986 This section covers the commands that were in version 1.1 but now have new functionality
5987 in other functions. The deprecated commands are still available in 1.2 but all new software
5988 should use the new functionality.

5989 There is no requirement that the deprecated commands work with new structures.

5990 **End of informative comment.**

5991 1. Commands deprecated in version 1.2 MUST work with version 1.1 structures

5992 2. Commands deprecated in version 1.2 MAY work with version 1.2 structures

5993**27.1** **Key commands**

5999**27.1.1** **TPM_EvictKey**

6000**Incoming Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_EvictKey
4	4			TPM_KEY_HANDLE	evictHandle	The handle of the key to be evicted.

6001**Outgoing Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_EvictKey

6002**Actions**

6003The TPM will invalidate the key stored in the specified handle and return the space to the 6004available internal pool for subsequent query by TPM_GetCapability and usage by 6005TPM_LoadKey. If the specified key handle does not correspond to a valid key, an error will 6006be returned.

6007**New 1.2 functionality**

6008The command must check the status of the ownerEvict flag for the key and if the flag is 6009TRUE return TPM_KEY_CONTROL_OWNER

6010 27.1.2   TPM_Terminate_Handle

6011 **Start of informative comment:**

6012 This allows the TPM manager to clear out information in a session handle.

6013 6014 6015 6016 6017 The TPM may maintain the authorization session even though a key attached to it has been unloaded or the authorization session itself has been unloaded in some way. When a command is executed that requires this session, it is the responsibility of the external software to load both the entity and the authorization session information prior to command execution.

6018 **End of informative comment.**

6019 **Incoming Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_Terminate_Handle.
4	4			TPM_AUTHHANDLE	handle	The handle to terminate

6020 **Outgoing Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_Terminate_Handle.

6021 **Description**

6022 6023 The TPM SHALL terminate the session and destroy all data associated with the session indicated.

6024 **Actions**

6025 6026 A TPM SHALL unilaterally perform the actions of TPM_Terminate_Handle upon detection of the following events:

6027 1. Completion of a received command whose authorization "continueUse" flag is FALSE.

6028 6029 6030 2. Completion of a received command when a shared secret derived from the authorization session was exclusive-or'ed with data (to provide confidentiality for that data). This occurs during execution of a TPM_ChangeAuth command, for example.

6031 3. When the associated entity is destroyed (in the case of TPM Owner or SRK, for example)

6032 4. Upon execution of TPM_Init

60335. When the command returns an error. This is due to the fact that when returning an
6034   error the TPM does not send back nonceEven. There is no way to maintain the rolling
6035   nonces, hence the TPM MUST terminate the authorization session.

60366. Failure of an authorization check belonging to that authorization session.

6037 27.2 Context management

6043 27.2.1 TPM_SaveKeyContext

6049 **Incoming Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_SaveKeyContext
4	4			TPM_KEY_HANDLE	keyHandle	The key which will be kept outside the TPM

6050 **Outgoing Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_SaveKeyContext
4	4	3S	4	UINT32	keyContextSize	The actual size of the outgoing key context blob. If the command fails the value will be 0
5	<>	4S	<>	BYTE[]	keyContextBlob	The key context blob.

6051 **Description**

6052 1. This command allows saving a loaded key outside the TPM. After creation of the
6053   keyContextBlob, the TPM automatically releases the internal memory used by that key.
6054   The format of the key context blob is specific to a TPM.

6055 2. A TPM protected capability belonging to the TPM that created a key context blob MUST
6056   be the only entity that can interpret the contents of that blob. If a cryptographic
6057   technique is used for this purpose, the level of security provided by that technique
6058   SHALL be at least as secure as a 2048 bit RSA algorithm. Any secrets (such as keys)

6059   used in such a cryptographic technique MUST be generated using the TPM's random
6060   number generator. Any symmetric key MUST be used within the power-on session
6061   during which it was created, only.

6062 3. A key context blob SHALL enable verification of the integrity of the contents of the blob
6063   by a TPM protected capability.

6064 4. A key context blob SHALL enable verification of the session validity of the contents of the
6065   blob by a TPM protected capability. The method SHALL ensure that all key context blobs
6066   are rendered invalid if power to the TPM is interrupted.

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TPM Main Part 3 Commands
Specification Version 1.2

6068 27.2.2   TPM_LoadKeyContext

6069 Start of informative comment:

6070 TPM_LoadKeyContext loads a key context blob into the TPM previously retrieved by a 6071 TPM_SaveKeyContext call. After successful completion the handle returned by this 6072 command can be used to access the key.

6073 End of informative comment.

6074 Incoming Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_LoadKeyContext
4	4	2S	4	UINT32	keyContextSize	The size of the following key context blob.
5	<>	3S	<>	BYTE[]	keyContextBlob	The key context blob.

6075 Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_LoadKeyContext
4	4			TPM_KEY_HANDLE	keyHandle	The handle assigned to the key after it has been successfully loaded.

6076 Description

6077 1. This command allows loading a key context blob into the TPM previously retrieved by a 6078   TPM_SaveKeyContext call. After successful completion the handle returned by this 6079   command can be used to access the key.

6080 2. The contents of a key context blob SHALL be discarded unless the contents have passed 6081   an integrity test. This test SHALL (statistically) prove that the contents of the blob are 6082   the same as when the blob was created.

6083 3. The contents of a key context blob SHALL be discarded unless the contents have passed 6084   a session validity test. This test SHALL (statistically) prove that the blob was created by 6085   this TPM during this power-on session.

6086

608727.2.3   TPM_SaveAuthContext

6088**Start of informative comment:**

6089TPM_SaveAuthContext saves a loaded authorization session outside the TPM. After creation
6090of the authorization context blob, the TPM automatically releases the internal memory used
6091by that session. The format of the authorization context blob is specific to a TPM.

6092**End of informative comment.**

6093**Incoming Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_SaveAuthContext
4	4			TPM_AUTHHANDLE	authHandle	Authorization session which will be kept outside the TPM

6094**Outgoing Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_SaveAuthContext
4	4	3S	4	UINT32	authContextSize	The actual size of the outgoing authorization context blob. If the command fails the value will be 0.
5	<>	4S	4	BYTE[]	authContextBlob	The authorization context blob.

6095**Description**

6096This command allows saving a loaded authorization session outside the TPM. After creation
6097of the authContextBlob, the TPM automatically releases the internal memory used by that
6098session. The format of the authorization context blob is specific to a TPM.

6099A TPM protected capability belonging to the TPM that created an authorization context blob
6100MUST be the only entity that can interpret the contents of that blob. If a cryptographic
6101technique is used for this purpose, the level of security provided by that technique SHALL
6102be at least as secure as a 2048 bit RSA algorithm. Any secrets (such as keys) used in such a
6103cryptographic technique MUST be generated using the TPM's random number generator.
6104Any symmetric key MUST be used within the power-on session during which it was created,
6105only.

6106An authorization context blob SHALL enable verification of the integrity of the contents of
6107the blob by a TPM protected capability.

6108 An authorization context blob SHALL enable verification of the session validity of the
6109 contents of the blob by a TPM protected capability. The method SHALL ensure that all
6110 authorization context blobs are rendered invalid if power to the TPM is interrupted.

6111 27.2.4 TPM_LoadAuthContext

6112 **Start of informative comment:**

6113 TPM_LoadAuthContext loads an authorization context blob into the TPM previously
6114 retrieved by a TPM_SaveAuthContext call. After successful completion, the handle returned
6115 by this command can be used to access the authorization session.

6116 **End of informative comment.**

6117 **Incoming Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_LoadAuthContext
4	4	2S	4	UINT32	authContextSize	The size of the following authorization context blob.
5	<>	3S	<>	BYTE[]	authContextBlob	The authorization context blob.

6118 **Outgoing Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_LoadAuthContext
4	4			TPM_KEY_HANDLE	authHandle	The handle assigned to the authorization session after it has been successfully loaded.

6119 **Description**

6120 This command allows loading an authorization context blob into the TPM previously
6121 retrieved by a TPM_SaveAuthContext call. After successful completion, the handle returned
6122 by this command can be used to access the authorization session.

6123 The contents of an authorization context blob SHALL be discarded unless the contents have
6124 passed an integrity test. This test SHALL (statistically) prove that the contents of the blob
6125 are the same as when the blob was created.

6126 The contents of an authorization context blob SHALL be discarded unless the contents have
6127 passed a session validity test. This test SHALL (statistically) prove that the blob was created
6128 by this TPM during this power-on session.

6129 For an OSAP authorization context blob referring to a key, verify that the key linked to this
6130 session is resident in the TPM.

6131

6132 27.3   DIR commands

6141 1. A dirIndex value of 0 MUST corresponds to an NV storage nvIndex value
6142   TPM_NV_INDEX_DIR.

6143 2. The TPM vendor MAY return errors or MAY provide vendor specific mappings for DIR
6144   dirIndex values greater than 0 to NV storage locations.

6145 27.3.1 TPM_DirWriteAuth

6155 Incoming Operands and Sizes

PARAM #	PARAM SZ	HMAC #	HMAC SZ	Type	Name	Description
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_DirWriteAuth.
4	4	2S	4	TPM_DIRINDEX	dirIndex	Index of the DIR
5	20	3S	20	TPM_DIRVALUE	newContents	New value to be stored in named DIR
6	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for command.
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
7	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
8	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
9	20			TPM_AUTHDATA	ownerAuth	The authorization session digest for inputs. HMAC key: ownerAuth.

6156 Outgoing Operands and Sizes

PARAM #	PARAM SZ	HMAC #	HMAC SZ	Type	Name	Description
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_DirWriteAuth
4	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
5	1	4H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
6	20			TPM_AUTHDATA	resAuth	The authorization session digest for the returned parameters. HMAC key: ownerAuth.

6157 Actions

61581. Validate that authHandle contains a TPM Owner AuthData to execute the
6159   TPM_DirWriteAuth command

61602. Validate that dirIndex points to a valid DIR on this TPM

61613. Write newContents into the DIR pointed to by dirIndex

6162

616327.3.2   **TPM_DirRead**

6164**Start of informative comment:**

6165The TPM_DirRead operation provides read access to the DIRs. No authentication is required
6166to perform this action because typically no cryptographically useful AuthData is available
6167early in boot. TSS implementers may choose to provide other means of authorizing this
6168action. Version 1.2 requires only one DIR. If the DIR named does not exist, the
6169TPM_DirRead operation returns TPM_BADINDEX.

6170**End of informative comment.**

6171**Incoming Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_DirRead.
4	4	2S	4	TPM_DIRINDEX	dirIndex	Index of the DIR to be read

6172**Outgoing Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_DirRead.
4	20	3S	20	TPM_DIRVALUE	dirContents	The current contents of the named DIR

6173**Actions**

61741. Validate that dirIndex points to a valid DIR on this TPM

61752. Return the contents of the DIR in dirContents

6176 27.4 Change Auth

6181

6182 27.4.1   TPM_ChangeAuthAsymStart

6183**Start of informative comment:**

6184The TPM_ChangeAuthAsymStart starts the process of changing AuthData for an entity. It 6185sets up an OIAP session that must be retained for use by its twin 6186TPM_ChangeAuthAsymFinish command.

6187TPM_ChangeAuthAsymStart creates a temporary asymmetric public key "tempkey" to 6188provide confidentiality for new AuthData to be sent to the TPM. TPM_ChangeAuthAsymStart 6189certifies that tempkey was generated by a genuine TPM, by generating a certifyInfo 6190structure that is signed by a TPM identity. The owner of that TPM identity must cooperate 6191to produce this command, because TPM_ChangeAuthAsymStart requires authorization to 6192use that identity.

6193It is envisaged that tempkey and certifyInfo are given to the owner of the entity whose 6194authorization is to be changed. That owner uses certifyInfo and a 6195TPM_IDENTITY_CREDENTIAL to verify that tempkey was generated by a genuine TPM. This 6196is done by verifying the TPM_IDENTITY_CREDENTIAL using the public key of a CA, 6197verifying the signature on the certifyInfo structure with the public key of the identity in 6198TPM_IDENTITY_CREDENTIAL, and verifying tempkey by comparing its digest with the value 6199inside certifyInfo. The owner uses tempkey to encrypt the desired new AuthData and inserts 6200that encrypted data in a TPM_ChangeAuthAsymFinish command, in the knowledge that 6201only a TPM with a specific identity can interpret the new AuthData.

6202**End of informative comment.**

6203**Incoming Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_ChangeAuthAsymStart.
4	4			TPM_KEY_HANDLE	idHandle	The keyHandle identifier of a loaded identity ID key
5	20	2s	20	TPM_NONCE	antiReplay	The nonce to be inserted into the certifyInfo structure
6	<>	3S	<>	TPM_KEY_PARMS	tempKey	Structure contains all parameters of ephemeral key.
7	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for idHandle authorization.
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
8	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
9	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
10	20			TPM_AUTHDATA	idAuth	Authorization. HMAC key: idKey.usageAuth.

6204Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_ChangeAuthAsymStart
7	95	3S	95	TPM_CERTIFY_INFO	certifyInfo	The certifyInfo structure that is to be signed.
8	4	4S	4	UINT32	sigSize	The used size of the output area for the signature
9	<>	5S	<>	BYTE[ ]	sig	The signature of the certifyInfo parameter.
10	4	6s	4	TPM_KEY_HANDLE	ephHandle	The keyHandle identifier to be used by ChangeAuthAsymFinish for the ephemeral key
11	<>	7S	<>	TPM_KEY	tempKey	Structure containing all parameters and public part of ephemeral key. TPM_KEY.encSize is set to 0.
12	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
13	1	4H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
14	20			TPM_AUTHDATA	resAuth	Authorization. HMAC key: idKey.usageAuth.

6205Actions

62061. The TPM SHALL verify the AuthData to use the TPM identity key held in idHandle. The
6207   TPM MUST verify that the key is a TPM identity key.

62082. The TPM SHALL validate the algorithm parameters for the key to create from the
6209   tempKey parameter.

62103. Recommended key type is RSA

62114. Minimum RSA key size MUST is 512 bits, recommended RSA key size is 1024

62125. For other key types the minimum key size strength MUST be comparable to RSA 512

62136. If the TPM is not designed to create a key of the requested type, return the error code
6214   TPM_BAD_KEY_PROPERTY

62157. The TPM SHALL create a new key (k1) in accordance with the algorithm parameter. The
6216   newly created key is pointed to by ephHandle.

62178. The TPM SHALL fill in all fields in tempKey using k1 for the information. The TPM_KEY
6218   -> encSize MUST be 0.

62199. The TPM SHALL fill in certifyInfo using k1 for the information. The certifyInfo -> data
6220   field is supplied by the antiReplay.

622110. The TPM then signs the certifyInfo parameter using the key pointed to by idHandle. The
6222   resulting signed blob is returned in sig parameter

6223 **Field Descriptions for certifyInfo parameter**

Type	Name	Description
TPM_VERSION	Version	TPM version structure; Part 2 TPM_VERSION
keyFlags	Redirection	This SHALL be set to FALSE
	Migratable	This SHALL be set to FALSE
	Volatile	This SHALL be set to TRUE
TPM_AUTH_DATA_USAGE	authDataUsage	This SHALL be set to TPM_AUTH_NEVER
TPM_KEY_USAGE	KeyUsage	This SHALL be set to TPM_KEY_AUTHCHANGE
UINT32	PCRInfoSize	This SHALL be set to 0
TPM_DIGEST	pubDigest	This SHALL be the hash of the public key being certified.
TPM_NONCE	Data	This SHALL be set to antiReplay
TPM_KEY_PARMS	info	This specifies the type of key and its parameters.
BOOL	parentPCRStatus	This SHALL be set to FALSE.

6225 27.4.2   TPM_ChangeAuthAsymFinish

6227 The TPM_ChangeAuthAsymFinish command allows the owner of an entity to change the
6228 AuthData for the entity.

6229 The command requires the cooperation of the owner of the parent of the entity, since
6230 AuthData must be provided to use that parent entity. The command requires knowledge of
6231 the existing AuthData information and passes the new AuthData information. The
6232 newAuthLink parameter proves knowledge of existing AuthData information and new
6233 AuthData information. The new AuthData information "encNewAuth" is encrypted using the
6234 "tempKey" variable obtained via TPM_ChangeAuthAsymStart.

6235 A parent therefore retains control over a change in the AuthData of a child, but is prevented
6236 from knowing the new AuthData for that child.

6237 The changeProof parameter provides a proof that the new AuthData value was properly
6238 inserted into the entity. The inclusion of a nonce from the TPM provides an entropy source
6239 in the case where the AuthData value may be in itself be a low entropy value (hash of a
6240 password etc).

6241 **End of informative comment.**

6242 Incoming Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_ChangeAuthAsymFinish
4	4			TPM_KEY_HANDLE	parentHandle	The keyHandle of the parent key for the input data
5	4			TPM_KEY_HANDLE	ephHandle	The keyHandle identifier for the ephemeral key
6	2	3S	2	TPM_ENTITY_TYPE	entityType	The type of entity to be modified
7	20	4s	20	TPM_HMAC	newAuthLink	HMAC calculation that links the old and new AuthData values together
8	4	5S	4	UINT32	newAuthSize	Size of encNewAuth
9	<>	6S	<>	BYTE[ ]	encNewAuth	New AuthData encrypted with ephemeral key.
10	4	7S	4	UINT32	encDataSize	The size of the inData parameter
11	<>	8S	<>	BYTE[ ]	encData	The encrypted entity that is to be modified.
12	4			TPM_AUTHHANDLE	authHandle	Authorization for parent key.
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
13	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
14	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
15	20			TPM_AUTHDATA	privAuth	The authorization session digest for inputs and parentHandle. HMAC key: parentKey.usageAuth.

6243

6244Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_ChangeAuthAsymFinish
4	4	3S	4	UINT32	outDataSize	The used size of the output area for outData
5	<>	4S	<>	BYTE[ ]	outData	The modified, encrypted entity.
6	20	5s	20	TPM_NONCE	saltNonce	A nonce value from the TPM RNG to add entropy to the changeProof value
7	<>	6S	<>	TPM_DIGEST	changeProof	Proof that AuthData has changed.
8	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
9	1	4H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
10	20			TPM_AUTHDATA	resAuth	The authorization session digest for the returned parameters. HMAC key: parentKey.usageAuth.

6245Description

6246If the parentHandle points to the SRK then the HMAC key MUST be built using the TPM 6247Owner authentication.

6248Actions

62491. The TPM SHALL validate that the authHandle parameter authorizes use of the key in 6250 parentHandle.

62512. The encData field MUST be the encData field from TPM_STORED_DATA or TPM_KEY.

62523. The TPM SHALL create e1 by decrypting the entity held in the encData parameter.

62534. The TPM SHALL create a1 by decrypting encNewAuth using the ephHandle -> 6254 TPM_KEY_AUTHCHANGE private key. a1 is a structure of type 6255 TPM_CHANGEAUTH_VALIDATE.

62565. The TPM SHALL create b1 by performing the following HMAC calculation: b1 = HMAC 6257 (a1 -> newAuthSecret). The secret for this calculation is encData -> currentAuth. This 6258 means that b1 is a value built from the current AuthData value (encData -> 6259 currentAuth) and the new AuthData value (a1 -> newAuthSecret).

62606. The TPM SHALL compare b1 with newAuthLink. The TPM SHALL indicate a failure if the 6261 values do not match.

62627. The TPM SHALL replace e1 -> authData with a1 -> newAuthSecret

62638. The TPM SHALL encrypt e1 using the appropriate functions for the entity type. The key 6264 to encrypt with is parentHandle.

62659. The TPM SHALL create saltNonce by taking the next 20 bytes from the TPM RNG.

626610.The TPM SHALL create changeProof a HMAC of (saltNonce concatenated with a1 -> n1)
6267   using a1 -> newAuthSecret as the HMAC secret.

626811.The TPM MUST destroy the TPM_KEY_AUTHCHANGE key associated with the
6269   authorization session.

6270**27.5   TPM_Reset**

6271**Start of informative comment:**

6272TPM_Reset releases all resources associated with existing authorization sessions. This is
6273useful if a TSS driver has lost track of the state in the TPM.

6274**End of informative comment.**

6275Deprecated Command in 1.2

6276**Incoming Parameters and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_Reset.

6277**Outgoing Parameters and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_Reset.

6278**Description**

6279This is a deprecated command in V1.2. This command in 1.1 only referenced authorization
6280sessions and is not upgraded to affect any other TPM entity in 1.2

6281**Actions**

6282 1. The TPM invalidates all resources allocated to authorization sessions as per version 1.1
6283   extant in the TPM

6284   a. This includes structures created by TPM_SaveAuthContext and TPM_SaveKeyContext

6285   b. The TPM MUST invalidate OSAP sessions

6286   c. The TPM MAY invalidate DSAP sessions

6287   d. The TPM MUST NOT invalidate structures created by TPM_SaveContext

6288 2. The TPM does not reset any PCR or DIR values.

6289 3. The TPM does not reset any flags in the TPM_STCLEAR_FLAGS structure.

6290 4. The TPM does not reset or invalidate any keys

629127.6   TPM_OwnerReadPubek

6295Incoming Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_OwnerReadPubek
4	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for owner authentication.
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
5	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
6	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
7	20			TPM_AUTHDATA	ownerAuth	The authorization session digest for inputs and owner authentication. HMAC key: ownerAuth.

6296Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_OwnerReadPubek
4	<>	3S	<>	TPM_PUBKEY	pubEndorsementKey	The public endorsement key
5	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
6	1	4H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
7	20			TPM_AUTHDATA	resAuth	The authorization session digest for the returned parameters. HMAC key: ownerAuth.

6297Description

6298This command returns the PUBEK.

6299Actions

6300The TPM_OwnerReadPubek command SHALL

63011. Validate the TPM Owner AuthData to execute this command

63022. Export the PUBEK

630327.7 TPM_DisablePubekRead

6304**Start of informative comment:**

6305The TPM Owner may wish to prevent any entity from reading the PUBEK. This command
6306sets the non-volatile flag so that the TPM_ReadPubek command always returns
6307TPM_DISABLED_CMD.

6308This command has in essence been deprecated as TPM_TakeOwnership now sets the value
6309to false. The command remains at this time for backward compatibility.

6310**End of informative comment.**

6311**Incoming Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_DisablePubekRead
4	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for owner authentication.
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
5	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
6	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
7	20			TPM_AUTHDATA	ownerAuth	The authorization session digest for inputs and owner authorization. HMAC key: ownerAuth.

6312**Outgoing Operands and Sizes**

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_DisablePubekRead
4	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
5	1	4H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
6	20			TPM_AUTHDATA	resAuth	The authorization session digest for the returned parameters. HMAC key: ownerAuth.

6313**Actions**

63141. This capability sets the TPM_PERMANENT_FLAGS -> readPubek flag to FALSE.

6315 27.8   TPM_LoadKey

6353Incoming Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_LoadKey.
4	4			TPM_KEY_HANDLE	parentHandle	TPM handle of parent key.
5	<>	2S	<>	TPM_KEY	inKey	Incoming key structure, both encrypted private and clear public portions. MAY be TPM_KEY12
6	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for parentHandle authorization.
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
7	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
8	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
9	20			TPM_AUTHDATA	parentAuth	The authorization session digest for inputs and parentHandle. HMAC key: parentKey.usageAuth.

6354Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_LoadKey
4	4	3S	4	TPM_KEY_HANDLE	inkeyHandle	Internal TPM handle where decrypted key was loaded.
5	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
6	1	4H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
7	20			TPM_AUTHDATA	resAuth	The authorization session digest for the returned parameters. HMAC key: parentKey.usageAuth.

6355Actions

6356The TPM SHALL perform the following steps:

63571. Validate the command and the parameters using parentAuth and parentHandle ->
6358   usageAuth

63592. If   parentHandle   ->   keyUsage   is   NOT   TPM_KEY_STORAGE   return
6360   TPM_INVALID_KEYUSAGE

63613. If the TPM is not designed to operate on a key of the type specified by inKey, return the
6362   error code TPM_BAD_KEY_PROPERTY

63634. The TPM MUST handle both TPM_KEY and TPM_KEY12 structures

63645. Decrypt the inKey -> privkey to obtain TPM_STORE_ASYMKEY structure using the key
6365   in parentHandle

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6366 6. Validate the integrity of inKey and decrypted TPM_STORE_ASYMKEY

6367   a. Reproduce inKey -> TPM_STORE_ASYMKEY -> pubDataDigest using the fields of
6368   inKey, and check that the reproduced value is the same as pubDataDigest

6369 7. Validate the consistency of the key and it's key usage.

6370   a. If inKey -> keyFlags -> migratable is TRUE, the TPM SHALL verify consistency of the
6371   public and private components of the asymmetric key pair. If inKey -> keyFlags ->
6372   migratable is FALSE, the TPM MAY verify consistency of the public and private
6373   components of the asymmetric key pair. The consistency of an RSA key pair MAY be
6374   verified by dividing the supposed (P*Q) product by a supposed prime and checking that
6375   there is no remainder.

6376   b. If inKey -> keyUsage is TPM_KEY_IDENTITY, verify that inKey->keyFlags->migratable
6377   is FALSE. If it is not, return TPM_INVALID_KEYUSAGE

6378   c. If inKey -> keyUsage is TPM_KEY_AUTHCHANGE, return TPM_INVALID_KEYUSAGE

6379   d. If inKey -> keyFlags -> migratable equals 0 then verify that TPM_STORE_ASYMKEY
6380   -> migrationAuth equals TPM_PERMANENT_DATA -> tpmProof

6381   e. Validate the mix of encryption and signature schemes

6382   f. If TPM_PERMANENT_FLAGS -> FIPS is TRUE then

6383   i. If keyInfo -> keySize is less than 1024 return TPM_NOTFIPS

6384   ii. If keyInfo -> authDataUsage specifies TPM_AUTH_NEVER return
6385   TPM_NOTFIPS

6386   iii. If keyInfo -> keyUsage specifies TPM_KEY_LEGACY return TPM_NOTFIPS

6387   g. If inKey -> keyUsage is TPM_KEY_STORAGE or TPM_KEY_MIGRATE

6388   i. algorithmID MUST be TPM_ALG_RSA

6389   ii. Key size MUST be 2048

6390   iii. exponentSize MUST be 0

6391   iv. sigScheme MUST be TPM_SS_NONE

6392   h. If inKey -> keyUsage is TPM_KEY_IDENTITY

6393   i. algorithmID MUST be TPM_ALG_RSA

6394   ii. Key size MUST be 2048

6395   iii. exponentSize MUST be 0

6396   iv. encScheme MUST be TPM_ES_NONE

6397   i. If the decrypted inKey -> pcrInfo is NULL,

6398   i. The TPM MUST set the internal indicator to indicate that the key is not using
6399   any PCR registers.

6400   j. Else

6401   i. The TPM MUST store pcrInfo in a manner that allows the TPM to calculate a
6402   composite hash whenever the key will be in use

6403   ii. The TPM MUST handle both version 1.1 TPM_PCR_INFO and 1.2
6404   TPM_PCR_INFO_LONG structures according to the type of TPM_KEY structure

6405   (1) The TPM MUST validate the TPM_PCR_INFO or TPM_PCR_INFO_LONG
6406   structures for legal values. However, the digestAtRelease and
6407   localityAtRelease are not validated for authorization until use time.

64088. Perform any processing necessary to make TPM_STORE_ASYMKEY key available for
6409   operations

64109. Load key and key information into internal memory of the TPM. If insufficient memory
6411   exists, return error TPM_NOSPACE.

641210.Assign inKeyHandle according to internal TPM rules.

641311.Set InKeyHandle -> parentPCRStatus to parentHandle -> parentPCRStatus.

641412.If parentHandle indicates it is using PCR registers, then set inKeyHandle ->
6415   parentPCRStatus to TRUE.

6416 28.   Deleted Commands

6421 1. The TPM MUST return TPM_BAD_ORDINAL for any deleted command

6422 28.1 TPM_GetCapabilitySigned

6423 **Start of informative comment:**

6424 Along with TPM_GetCapabilityOwner this command allowed the possible signature of 6425 improper values.

6426 TPM_GetCapabilitySigned is almost the same as TPM_GetCapability. The differences are 6427 that the input includes a challenge (a nonce) and the response includes a digital signature 6428 to vouch for the source of the answer.

6429 If a caller itself requires proof, it is sufficient to use any signing key for which only the TPM 6430 and the caller have AuthData.

6431 If a caller requires proof for a third party, the signing key must be one whose signature is 6432 trusted by the third party. A TPM-identity key may be suitable.

6433 **End of informative comment.**

6434 **Deleted Ordinal**

6435 TPM_GetCapabilitySigned

6436 28.2   TPM_GetOrdinalAuditStatus

6438 Get the status of the audit flag for the given ordinal.

6440 Incoming Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RQU_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4			TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_GetOrdinalAuditStatus
4	4			TPM_COMMAND_CODE	ordinalToQuery	The ordinal whose audit flag is to be queried

6441 Outgoing Operands and Sizes

PARAM		HMAC		Type	Name	Description
#	SZ	#	SZ			
1	2			TPM_TAG	tag	TPM_TAG_RSP_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4			TPM_RESULT	returnCode	The return code of the operation.
4	1			BOOL	State	Value of audit flag for ordinalToQuery

6442 Actions

6443 1. The TPM returns the Boolean value for the given ordinal. The value is TRUE if the
6444   command is being audited.

644528.3   TPM_CertifySelfTest

6454**Incoming Operands and Sizes**

PARAM #	PARAM SZ	HMAC #	HMAC SZ	Type	Name	Description
1	2			TPM_TAG	tag	TPM_TAG_RQU_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of input bytes including paramSize and tag
3	4	1S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_CertifySelfTest
4	4			TPM_KEY_HANDLE	keyHandle	The keyHandle identifier of a loaded key that can perform digital signatures.
5	20	2S	20	TPM_NONCE	antiReplay	Anti Replay nonce to prevent replay of messages
6	4			TPM_AUTHHANDLE	authHandle	The authorization session handle used for keyHandle authorization
		2H1	20	TPM_NONCE	authLastNonceEven	Even nonce previously generated by TPM to cover inputs
7	20	3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
8	1	4H1	1	BOOL	continueAuthSession	The continue use flag for the authorization session handle
9	20			TPM_AUTHDATA	privAuth	The authorization session digest that authorizes the inputs and use of keyHandle. HMAC key: key.usageAuth

6455**Outgoing Operands and Sizes**

PARAM #	PARAM SZ	HMAC #	HMAC SZ	Type	Name	Description
1	2			TPM_TAG	tag	TPM_TAG_RSP_AUTH1_COMMAND
2	4			UINT32	paramSize	Total number of output bytes including paramSize and tag
3	4	1S	4	TPM_RESULT	returnCode	The return code of the operation.
		2S	4	TPM_COMMAND_CODE	ordinal	Command ordinal: TPM_ORD_CertifySelfTest
4	4	3S	4	UINT32	sigSize	The length of the returned digital signature
5	<>	4S	<>	BYTE[ ]	sig	The resulting digital signature.
6	20	2H1	20	TPM_NONCE	nonceEven	Even nonce newly generated by TPM to cover outputs
		3H1	20	TPM_NONCE	nonceOdd	Nonce generated by system associated with authHandle
7	1	4H1	1	BOOL	continueAuthSession	Continue use flag, TRUE if handle is still active
8	20			TPM_AUTHDATA	resAuth	The authorization session digest for the returned parameters. HMAC key: key.usageAuth

6456**Description**

6457The key in keyHandle MUST have a KEYUSAGE value of type TPM_KEY_SIGNING or
6458TPM_KEY_LEGACY or TPM_KEY_IDENTITY.

6459Information returned by TPM_CertifySelfTest MUST NOT aid identification of an individual
6460TPM.

6461**Actions**

64621. The TPM SHALL perform TPM_SelfTestFull. If the test fails the TPM returns the
6463   appropriate error code.

64642. After successful completion of the self-test the TPM then validates the authorization to
6465   use the key pointed to by keyHandle

6466   a. If the key pointed to by keyHandle has a signature scheme that is not
6467   TPM_SS_RSASSAPKCS1v15_SHA1, the TPM may either return TPM_BAD_SCHEME or
6468   may return TPM_SUCCESS and a vendor specific signature.

64693. Create t1 the NOT null terminated string of "Test Passed", i.e. 11 bytes.

64704. The TPM creates m2 the message to sign by concatenating t1 || AntiReplay || ordinal.

64715. The TPM signs the SHA-1 of m2 using the key identified by keyHandle, and returns the
6472   signature as sig.

6473

647428.4　　　TPM_GetAuditEvent

6475

6476Start of informative comment:

6477Deleted

6478End of informative comment.

6479Deleted Ordinal

6480TPM_GetAuditEvent

6481 28.5   TPM_GetAuditEventSigned

6482

6483 Start of informative comment:

6484 Deleted

6485 End of informative comment.

6486 Deleted Ordinal

6487 TPM_GetAuditEventSigned

6488

6489