**[MS-RDPESC]:**

**Remote Desktop Protocol: Smart Card Virtual Channel Extension**

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**Revision Summary**

| Date | Revision History | Revision Class | Comments |
| --- | --- | --- | --- |
| 6/1/2007 | 1.0 | Major | Updated and revised the technical content. |
| 7/3/2007 | 1.0.1 | Editorial | Changed language and formatting in the technical content. |
| 7/20/2007 | 1.0.2 | Editorial | Changed language and formatting in the technical content. |
| 8/10/2007 | 1.0.3 | Editorial | Changed language and formatting in the technical content. |
| 9/28/2007 | 1.0.4 | Editorial | Changed language and formatting in the technical content. |
| 10/23/2007 | 1.0.5 | Editorial | Changed language and formatting in the technical content. |
| 11/30/2007 | 2.0 | Major | Normative reference. |
| 1/25/2008 | 2.0.1 | Editorial | Changed language and formatting in the technical content. |
| 3/14/2008 | 2.0.2 | Editorial | Changed language and formatting in the technical content. |
| 5/16/2008 | 2.0.3 | Editorial | Changed language and formatting in the technical content. |
| 6/20/2008 | 2.0.4 | Editorial | Changed language and formatting in the technical content. |
| 7/25/2008 | 2.0.5 | Editorial | Changed language and formatting in the technical content. |
| 8/29/2008 | 2.0.6 | Editorial | Changed language and formatting in the technical content. |
| 10/24/2008 | 2.0.7 | Editorial | Changed language and formatting in the technical content. |
| 12/5/2008 | 3.0 | Major | Updated and revised the technical content. |
| 1/16/2009 | 3.0.1 | Editorial | Changed language and formatting in the technical content. |
| 2/27/2009 | 3.0.2 | Editorial | Changed language and formatting in the technical content. |
| 4/10/2009 | 3.0.3 | Editorial | Changed language and formatting in the technical content. |
| 5/22/2009 | 4.0 | Major | Updated and revised the technical content. |
| 7/2/2009 | 4.0.1 | Editorial | Changed language and formatting in the technical content. |
| 8/14/2009 | 4.0.2 | Editorial | Changed language and formatting in the technical content. |
| 9/25/2009 | 4.1 | Minor | Clarified the meaning of the technical content. |
| 11/6/2009 | 4.1.1 | Editorial | Changed language and formatting in the technical content. |
| 12/18/2009 | 5.0 | Major | Updated and revised the technical content. |
| 1/29/2010 | 5.1 | Minor | Clarified the meaning of the technical content. |
| 3/12/2010 | 6.0 | Major | Updated and revised the technical content. |
| 4/23/2010 | 7.0 | Major | Updated and revised the technical content. |
| 6/4/2010 | 8.0 | Major | Updated and revised the technical content. |
| 7/16/2010 | 8.0 | None | No changes to the meaning, language, or formatting of the technical content. |
| 8/27/2010 | 8.0 | None | No changes to the meaning, language, or formatting of the technical content. |
| 10/8/2010 | 8.0 | None | No changes to the meaning, language, or formatting of the technical content. |
| 11/19/2010 | 8.0 | None | No changes to the meaning, language, or formatting of the technical content. |
| 1/7/2011 | 8.0 | None | No changes to the meaning, language, or formatting of the technical content. |
| 2/11/2011 | 8.0 | None | No changes to the meaning, language, or formatting of the technical content. |
| 3/25/2011 | 8.0 | None | No changes to the meaning, language, or formatting of the technical content. |
| 5/6/2011 | 8.0 | None | No changes to the meaning, language, or formatting of the technical content. |
| 6/17/2011 | 8.1 | Minor | Clarified the meaning of the technical content. |
| 9/23/2011 | 8.1 | None | No changes to the meaning, language, or formatting of the technical content. |
| 12/16/2011 | 9.0 | Major | Updated and revised the technical content. |
| 3/30/2012 | 9.0 | None | No changes to the meaning, language, or formatting of the technical content. |
| 7/12/2012 | 9.0 | None | No changes to the meaning, language, or formatting of the technical content. |
| 10/25/2012 | 9.0 | None | No changes to the meaning, language, or formatting of the technical content. |
| 1/31/2013 | 9.0 | None | No changes to the meaning, language, or formatting of the technical content. |
| 8/8/2013 | 10.0 | Major | Updated and revised the technical content. |
| 11/14/2013 | 10.0 | None | No changes to the meaning, language, or formatting of the technical content. |
| 2/13/2014 | 10.0 | None | No changes to the meaning, language, or formatting of the technical content. |
| 5/15/2014 | 10.0 | None | No changes to the meaning, language, or formatting of the technical content. |
| 6/30/2015 | 11.0 | Major | Significantly changed the technical content. |
| 10/16/2015 | 11.0 | None | No changes to the meaning, language, or formatting of the technical content. |
| 7/14/2016 | 11.0.1 | Editorial | Changed language and formatting in the technical content. |
| 6/1/2017 | 12.0 | Major | Significantly changed the technical content. |
| 9/15/2017 | 13.0 | Major | Significantly changed the technical content. |
| 12/1/2017 | 13.0 | None | No changes to the meaning, language, or formatting of the technical content. |
| 9/12/2018 | 14.0 | Major | Significantly changed the technical content. |

Table of Contents

[1 Introduction 10](#_Toc523396743)

[1.1 Glossary 10](#_Toc523396744)

[1.2 References 12](#_Toc523396745)

[1.2.1 Normative References 12](#_Toc523396746)

[1.2.2 Informative References 13](#_Toc523396747)

[1.3 Overview 13](#_Toc523396748)

[1.4 Relationship to Other Protocols 15](#_Toc523396749)

[1.5 Prerequisites/Preconditions 15](#_Toc523396750)

[1.6 Applicability Statement 16](#_Toc523396751)

[1.7 Versioning and Capability Negotiation 16](#_Toc523396752)

[1.8 Vendor-Extensible Fields 16](#_Toc523396753)

[1.9 Standards Assignments 16](#_Toc523396754)

[2 Messages 18](#_Toc523396755)

[2.1 Transport 18](#_Toc523396756)

[2.2 Common Data Types 18](#_Toc523396757)

[2.2.1 Common Structures 18](#_Toc523396758)

[2.2.1.1 REDIR\_SCARDCONTEXT 18](#_Toc523396759)

[2.2.1.2 REDIR\_SCARDHANDLE 18](#_Toc523396760)

[2.2.1.3 Connect\_Common 19](#_Toc523396761)

[2.2.1.4 LocateCards\_ATRMask 19](#_Toc523396762)

[2.2.1.5 ReaderState\_Common\_Call 19](#_Toc523396763)

[2.2.1.6 ReaderStateA 20](#_Toc523396764)

[2.2.1.7 ReaderStateW 20](#_Toc523396765)

[2.2.1.8 SCardIO\_Request 20](#_Toc523396766)

[2.2.1.9 ReadCache\_Common 21](#_Toc523396767)

[2.2.1.10 WriteCache\_Common 21](#_Toc523396768)

[2.2.1.11 ReaderState\_Return 21](#_Toc523396769)

[2.2.2 TS Server-Generated Structures 22](#_Toc523396770)

[2.2.2.1 EstablishContext\_Call 22](#_Toc523396771)

[2.2.2.2 Context\_Call 22](#_Toc523396772)

[2.2.2.3 ListReaderGroups\_Call 23](#_Toc523396773)

[2.2.2.4 ListReaders\_Call 23](#_Toc523396774)

[2.2.2.5 ContextAndStringA\_Call 24](#_Toc523396775)

[2.2.2.6 ContextAndStringW\_Call 24](#_Toc523396776)

[2.2.2.7 ContextAndTwoStringA\_Call 25](#_Toc523396777)

[2.2.2.8 ContextAndTwoStringW\_Call 26](#_Toc523396778)

[2.2.2.9 LocateCardsA\_Call 26](#_Toc523396779)

[2.2.2.10 LocateCardsW\_Call 27](#_Toc523396780)

[2.2.2.11 GetStatusChangeA\_Call 27](#_Toc523396781)

[2.2.2.12 GetStatusChangeW\_Call 28](#_Toc523396782)

[2.2.2.13 ConnectA\_Call 28](#_Toc523396783)

[2.2.2.14 ConnectW\_Call 28](#_Toc523396784)

[2.2.2.15 Reconnect\_Call 28](#_Toc523396785)

[2.2.2.16 HCardAndDisposition\_Call 29](#_Toc523396786)

[2.2.2.17 State\_Call 30](#_Toc523396787)

[2.2.2.18 Status\_Call 30](#_Toc523396788)

[2.2.2.19 Transmit\_Call 31](#_Toc523396789)

[2.2.2.20 Control\_Call 32](#_Toc523396790)

[2.2.2.21 GetAttrib\_Call 32](#_Toc523396791)

[2.2.2.22 SetAttrib\_Call 33](#_Toc523396792)

[2.2.2.23 LocateCardsByATRA\_Call 33](#_Toc523396793)

[2.2.2.24 LocateCardsByATRW\_Call 34](#_Toc523396794)

[2.2.2.25 ReadCacheA\_Call 34](#_Toc523396795)

[2.2.2.26 ReadCacheW\_Call 34](#_Toc523396796)

[2.2.2.27 WriteCacheA\_Call 35](#_Toc523396797)

[2.2.2.28 WriteCacheW\_Call 35](#_Toc523396798)

[2.2.2.29 GetTransmitCount\_Call 35](#_Toc523396799)

[2.2.2.30 ScardAccessStartedEvent\_Call 35](#_Toc523396800)

[2.2.2.31 GetReaderIcon\_Call 36](#_Toc523396801)

[2.2.2.32 GetDeviceTypeId\_Call 36](#_Toc523396802)

[2.2.3 TS Client-Generated Structures 36](#_Toc523396803)

[2.2.3.1 ReadCache\_Return 36](#_Toc523396804)

[2.2.3.2 EstablishContext\_Return 37](#_Toc523396805)

[2.2.3.3 Long\_Return 37](#_Toc523396806)

[2.2.3.4 ListReaderGroups\_Return and ListReaders\_Return 37](#_Toc523396807)

[2.2.3.5 LocateCards\_Return and GetStatusChange\_Return 38](#_Toc523396808)

[2.2.3.6 Control\_Return 38](#_Toc523396809)

[2.2.3.7 Reconnect\_Return 38](#_Toc523396810)

[2.2.3.8 Connect\_Return 39](#_Toc523396811)

[2.2.3.9 State\_Return 39](#_Toc523396812)

[2.2.3.10 Status\_Return 39](#_Toc523396813)

[2.2.3.11 Transmit\_Return 40](#_Toc523396814)

[2.2.3.12 GetAttrib\_Return 41](#_Toc523396815)

[2.2.3.13 GetTransmitCount\_Return 41](#_Toc523396816)

[2.2.3.14 GetReaderIcon\_Return 41](#_Toc523396817)

[2.2.3.15 GetDeviceTypeId\_Return 42](#_Toc523396818)

[2.2.4 Card/Reader State 42](#_Toc523396819)

[2.2.5 Protocol Identifier 42](#_Toc523396820)

[2.2.6 Access Mode Flags 43](#_Toc523396821)

[2.2.7 Reader State 44](#_Toc523396822)

[2.2.8 Return Code 45](#_Toc523396823)

[3 Protocol Details 50](#_Toc523396824)

[3.1 Protocol Server Details 50](#_Toc523396825)

[3.1.1 Abstract Data Model 50](#_Toc523396826)

[3.1.2 Timers 50](#_Toc523396827)

[3.1.3 Initialization 50](#_Toc523396828)

[3.1.4 Message Processing Events and Sequencing Rules 50](#_Toc523396829)

[3.1.4.1 SCARD\_IOCTL\_ESTABLISHCONTEXT (IOCTL 0x00090014) 54](#_Toc523396830)

[3.1.4.2 SCARD\_IOCTL\_RELEASECONTEXT (IOCTL 0x00090018) 54](#_Toc523396831)

[3.1.4.3 SCARD\_IOCTL\_ISVALIDCONTEXT (IOCTL 0x0009001C) 54](#_Toc523396832)

[3.1.4.4 SCARD\_IOCTL\_ACCESSSTARTEDEVENT (IOCTL 0x000900E0) 54](#_Toc523396833)

[3.1.4.5 SCARD\_IOCTL\_LISTREADERGROUPSA (IOCTL 0x00090020) 55](#_Toc523396834)

[3.1.4.6 SCARD\_IOCTL\_LISTREADERGROUPSW (IOCTL 0x00090024) 55](#_Toc523396835)

[3.1.4.7 SCARD\_IOCTL\_LISTREADERSA (IOCTL 0x00090028) 55](#_Toc523396836)

[3.1.4.8 SCARD\_IOCTL\_LISTREADERSW (IOCTL 0x0009002C) 55](#_Toc523396837)

[3.1.4.9 SCARD\_IOCTL\_INTRODUCEREADERGROUPA (IOCTL 0x00090050) 55](#_Toc523396838)

[3.1.4.10 SCARD\_IOCTL\_INTRODUCEREADERGROUPW (IOCTL 0x00090054) 56](#_Toc523396839)

[3.1.4.11 SCARD\_IOCTL\_FORGETREADERGROUPA (IOCTL 0x00090058) 56](#_Toc523396840)

[3.1.4.12 SCARD\_IOCTL\_FORGETREADERGROUPW (IOCTL 0x0009005C) 56](#_Toc523396841)

[3.1.4.13 SCARD\_IOCTL\_INTRODUCEREADERA (IOCTL 0x00090060) 56](#_Toc523396842)

[3.1.4.14 SCARD\_IOCTL\_INTRODUCEREADERW (IOCTL 0x00090064) 56](#_Toc523396843)

[3.1.4.15 SCARD\_IOCTL\_FORGETREADERA (IOCTL 0x00090068) 56](#_Toc523396844)

[3.1.4.16 SCARD\_IOCTL\_FORGETREADERW (IOCTL 0x0009006C) 57](#_Toc523396845)

[3.1.4.17 SCARD\_IOCTL\_ADDREADERTOGROUPA (IOCTL 0x00090070) 57](#_Toc523396846)

[3.1.4.18 SCARD\_IOCTL\_ADDREADERTOGROUPW (IOCTL 0x00090074) 57](#_Toc523396847)

[3.1.4.19 SCARD\_IOCTL\_REMOVEREADERFROMGROUPA (IOCTL 0x00090078) 57](#_Toc523396848)

[3.1.4.20 SCARD\_IOCTL\_REMOVEREADERFROMGROUPW (IOCTL 0x0009007C) 57](#_Toc523396849)

[3.1.4.21 SCARD\_IOCTL\_LOCATECARDSA (IOCTL 0x00090098) 57](#_Toc523396850)

[3.1.4.22 SCARD\_IOCTL\_LOCATECARDSW (IOCTL 0x0009009C) 58](#_Toc523396851)

[3.1.4.23 SCARD\_IOCTL\_GETSTATUSCHANGEA (IOCTL 0x000900A0) 58](#_Toc523396852)

[3.1.4.24 SCARD\_IOCTL\_GETSTATUSCHANGEW (IOCTL 0x000900A4) 58](#_Toc523396853)

[3.1.4.25 SCARD\_IOCTL\_LOCATECARDSBYATRA (IOCTL 0x000900E8) 58](#_Toc523396854)

[3.1.4.26 SCARD\_IOCTL\_LOCATECARDSBYATRW (IOCTL 0x000900EC) 58](#_Toc523396855)

[3.1.4.27 SCARD\_IOCTL\_CANCEL (IOCTL 0x000900A8) 59](#_Toc523396856)

[3.1.4.28 SCARD\_IOCTL\_CONNECTA (IOCTL 0x000900AC) 59](#_Toc523396857)

[3.1.4.29 SCARD\_IOCTL\_CONNECTW (IOCTL 0x000900B0) 59](#_Toc523396858)

[3.1.4.30 SCARD\_IOCTL\_DISCONNECT (IOCTL 0x000900B8) 59](#_Toc523396859)

[3.1.4.31 SCARD\_IOCTL\_BEGINTRANSACTION (IOCTL 0x000900BC) 59](#_Toc523396860)

[3.1.4.32 SCARD\_IOCTL\_ENDTRANSACTION (IOCTL 0x000900C0) 59](#_Toc523396861)

[3.1.4.33 SCARD\_IOCTL\_STATUSA (IOCTL 0x000900C8) 60](#_Toc523396862)

[3.1.4.34 SCARD\_IOCTL\_STATUSW (IOCTL 0x000900CC) 60](#_Toc523396863)

[3.1.4.35 SCARD\_IOCTL\_TRANSMIT (IOCTL 0x000900D0) 60](#_Toc523396864)

[3.1.4.36 SCARD\_IOCTL\_RECONNECT (IOCTL 0x000900B4) 60](#_Toc523396865)

[3.1.4.37 SCARD\_IOCTL\_CONTROL (IOCTL 0x000900D4) 60](#_Toc523396866)

[3.1.4.38 SCARD\_IOCTL\_GETATTRIB (IOCTL 0x000900D8) 60](#_Toc523396867)

[3.1.4.39 SCARD\_IOCTL\_SETATTRIB (IOCTL 0x000900DC) 61](#_Toc523396868)

[3.1.4.40 SCARD\_IOCTL\_STATE (IOCTL 0x000900C4) 61](#_Toc523396869)

[3.1.4.41 SCARD\_IOCTL\_GETTRANSMITCOUNT (IOCTL 0x00090100) 61](#_Toc523396870)

[3.1.4.42 SCARD\_IOCTL\_READCACHEA (IOCTL 0x000900F0) 61](#_Toc523396871)

[3.1.4.43 SCARD\_IOCTL\_READCACHEW (IOCTL 0x000900F4) 61](#_Toc523396872)

[3.1.4.44 SCARD\_IOCTL\_WRITECACHEA (IOCTL 0x000900F8) 62](#_Toc523396873)

[3.1.4.45 SCARD\_IOCTL\_WRITECACHEW (IOCTL 0x000900FC) 62](#_Toc523396874)

[3.1.4.46 SCARD\_IOCTL\_RELEASETARTEDEVENT 62](#_Toc523396875)

[3.1.4.47 SCARD\_IOCTL\_GETREADERICON (IOCTL 0x00090104) 62](#_Toc523396876)

[3.1.4.48 SCARD\_IOCTL\_GETDEVICETYPEID (IOCTL 0x00090108) 62](#_Toc523396877)

[3.1.5 Timer Events 62](#_Toc523396878)

[3.1.6 Other Local Events 62](#_Toc523396879)

[3.2 Protocol Client Details 63](#_Toc523396880)

[3.2.1 Abstract Data Model 63](#_Toc523396881)

[3.2.2 Timers 63](#_Toc523396882)

[3.2.3 Initialization 63](#_Toc523396883)

[3.2.4 Higher-Layer Triggered Events 63](#_Toc523396884)

[3.2.5 Message Processing Events and Sequencing Rules 63](#_Toc523396885)

[3.2.5.1 Sending Outgoing Messages 63](#_Toc523396886)

[3.2.5.2 Processing Incoming Replies 63](#_Toc523396887)

[3.2.5.3 Messages 64](#_Toc523396888)

[3.2.5.3.1 Sending EstablishContext Message 64](#_Toc523396889)

[3.2.5.3.2 Processing EstablishContext Reply 64](#_Toc523396890)

[3.2.5.3.3 Sending ReleaseContext Message 64](#_Toc523396891)

[3.2.5.3.4 Processing ReleaseContext Reply 64](#_Toc523396892)

[3.2.5.3.5 Sending IntroduceReader (ASCII) Message 64](#_Toc523396893)

[3.2.5.3.6 Processing IntroduceReader (ASCII) Reply 64](#_Toc523396894)

[3.2.5.3.7 Sending IntroduceReader (Unicode) Message 64](#_Toc523396895)

[3.2.5.3.8 Processing IntroduceReader (Unicode) Reply 64](#_Toc523396896)

[3.2.5.3.9 Sending ForgetReader (ASCII) Message 64](#_Toc523396897)

[3.2.5.3.10 Processing ForgetReader (ASCII) Reply 64](#_Toc523396898)

[3.2.5.3.11 Sending ForgetReader (Unicode) Message 65](#_Toc523396899)

[3.2.5.3.12 Processing ForgetReader (Unicode) Reply 65](#_Toc523396900)

[3.2.5.3.13 Sending IntroduceReaderGroup (ASCII) Message 65](#_Toc523396901)

[3.2.5.3.14 Processing IntroduceReaderGroup (ASCII) Reply 65](#_Toc523396902)

[3.2.5.3.15 Sending IntroduceReaderGroup (Unicode) Message 65](#_Toc523396903)

[3.2.5.3.16 Processing IntroduceReaderGroup (Unicode) Reply 65](#_Toc523396904)

[3.2.5.3.17 Sending ForgetReaderGroup (ASCII) Message 1 65](#_Toc523396905)

[3.2.5.3.18 Processing ForgetReaderGroup (ASCII) Reply 65](#_Toc523396906)

[3.2.5.3.19 Sending ForgetReaderGroup (ASCII) Message 2 65](#_Toc523396907)

[3.2.5.3.20 Processing ForgetReaderGroup (Unicode) Reply 65](#_Toc523396908)

[3.2.5.3.21 Sending AddReaderToGroup (ASCII) Message 65](#_Toc523396909)

[3.2.5.3.22 Processing AddReaderToGroup (ASCII) Reply 66](#_Toc523396910)

[3.2.5.3.23 Sending AddReaderToGroup (Unicode) Message 66](#_Toc523396911)

[3.2.5.3.24 Processing AddReaderToGroup (Unicode) Reply 66](#_Toc523396912)

[3.2.5.3.25 Sending RemoveReaderFromGroup (ASCII) Message 66](#_Toc523396913)

[3.2.5.3.26 Processing RemoveReaderFromGroup (ASCII) Reply 66](#_Toc523396914)

[3.2.5.3.27 Sending RemoveReaderFromGroup (Unicode) Message 66](#_Toc523396915)

[3.2.5.3.28 Processing RemoveReaderFromGroup (Unicode) Reply 66](#_Toc523396916)

[3.2.5.3.29 Sending ListReaderGroups (ASCII) Message 66](#_Toc523396917)

[3.2.5.3.30 Processing ListReaderGroups (ASCII) Reply 66](#_Toc523396918)

[3.2.5.3.31 Sending ListReaderGroups (Unicode) Message 66](#_Toc523396919)

[3.2.5.3.32 Processing ListReaderGroups (Unicode) Reply 66](#_Toc523396920)

[3.2.5.3.33 Sending ListReaders (ASCII) Message 67](#_Toc523396921)

[3.2.5.3.34 Processing ListReadersReply (ASCII) Reply 67](#_Toc523396922)

[3.2.5.3.35 Sending ListReaders (Unicode) Message 67](#_Toc523396923)

[3.2.5.3.36 Processing ListReadersReply (Unicode) Reply 67](#_Toc523396924)

[3.2.5.3.37 Sending LocateCards (ASCII) Message 67](#_Toc523396925)

[3.2.5.3.38 Processing LocateCards (ASCII) Reply 67](#_Toc523396926)

[3.2.5.3.39 Sending LocateCards (Unicode) Message 67](#_Toc523396927)

[3.2.5.3.40 Processing LocateCards (Unicode) Reply 67](#_Toc523396928)

[3.2.5.3.41 Sending GetStatusChange (ASCII) Message 67](#_Toc523396929)

[3.2.5.3.42 Processing GetStatusChange (ASCII) Reply 67](#_Toc523396930)

[3.2.5.3.43 Sending GetStatusChange (Unicode) Message 67](#_Toc523396931)

[3.2.5.3.44 Processing GetStatusChange (Unicode) Reply 68](#_Toc523396932)

[3.2.5.3.45 Sending Cancel Message 68](#_Toc523396933)

[3.2.5.3.46 Processing Cancel Reply 68](#_Toc523396934)

[3.2.5.3.47 Sending Connect (ASCII) Message 68](#_Toc523396935)

[3.2.5.3.48 Processing Connect (ASCII) Reply 68](#_Toc523396936)

[3.2.5.3.49 Sending Connect (Unicode) Message 68](#_Toc523396937)

[3.2.5.3.50 Processing Connect (Unicode) Reply 68](#_Toc523396938)

[3.2.5.3.51 Sending Reconnect Message 68](#_Toc523396939)

[3.2.5.3.52 Processing Reconnect Reply 68](#_Toc523396940)

[3.2.5.3.53 Sending Disconnect Message 68](#_Toc523396941)

[3.2.5.3.54 Processing Disconnect Reply 68](#_Toc523396942)

[3.2.5.3.55 Sending Status (ASCII) Message 69](#_Toc523396943)

[3.2.5.3.56 Processing Status (ASCII) Reply 69](#_Toc523396944)

[3.2.5.3.57 Sending Status (Unicode) Message 69](#_Toc523396945)

[3.2.5.3.58 Processing Status (Unicode) Reply 69](#_Toc523396946)

[3.2.5.3.59 Sending State Message 69](#_Toc523396947)

[3.2.5.3.60 Processing State Message Reply 69](#_Toc523396948)

[3.2.5.3.61 Sending BeginTransaction Message 69](#_Toc523396949)

[3.2.5.3.62 Processing BeginTransaction Reply 69](#_Toc523396950)

[3.2.5.3.63 Sending EndTransaction Message 69](#_Toc523396951)

[3.2.5.3.64 Processing EndTransaction Reply 69](#_Toc523396952)

[3.2.5.3.65 Sending Transmit Message 69](#_Toc523396953)

[3.2.5.3.66 Processing Transmit Reply 70](#_Toc523396954)

[3.2.5.3.67 Sending Control Message 70](#_Toc523396955)

[3.2.5.3.68 Processing Control Reply 70](#_Toc523396956)

[3.2.5.3.69 Sending GetReaderCapabilities Message 70](#_Toc523396957)

[3.2.5.3.70 Processing GetReaderCapabilities Reply 70](#_Toc523396958)

[3.2.5.3.71 Sending SetReaderCapabilities Message 70](#_Toc523396959)

[3.2.5.3.72 Processing SetReaderCapabilities Reply 70](#_Toc523396960)

[3.2.5.3.73 Sending WaitForResourceManager Message 70](#_Toc523396961)

[3.2.5.3.74 Processing WaitForResourceManager Reply 70](#_Toc523396962)

[3.2.5.3.75 Sending LocateCardsByATR (ASCII) Message 70](#_Toc523396963)

[3.2.5.3.76 Processing LocateCardsByATR (Unicode) Reply 70](#_Toc523396964)

[3.2.5.3.77 Processing LocateCardsByATR (ASCII) Reply 70](#_Toc523396965)

[3.2.5.3.78 Sending LocateCardsByATR (Unicode) Message 71](#_Toc523396966)

[3.2.5.3.79 Sending ReadCache (ASCII) Message 71](#_Toc523396967)

[3.2.5.3.80 Processing ReadCache (ASCII) Reply 71](#_Toc523396968)

[3.2.5.3.81 Sending ReadCache (Unicode) Message 71](#_Toc523396969)

[3.2.5.3.82 Processing ReadCache (Unicode) Reply 71](#_Toc523396970)

[3.2.5.3.83 Sending WriteCache (ASCII) Message 71](#_Toc523396971)

[3.2.5.3.84 Processing WriteCache (ASCII) Reply 71](#_Toc523396972)

[3.2.5.3.85 Sending WriteCache (Unicode) Message 71](#_Toc523396973)

[3.2.5.3.86 Processing WriteCache (Unicode) Reply 71](#_Toc523396974)

[3.2.5.3.87 Sending GetTransmitCount Message 71](#_Toc523396975)

[3.2.5.3.88 Processing GetTransmitCount Reply 71](#_Toc523396976)

[3.2.5.3.89 Sending GetReaderIcon Message 72](#_Toc523396977)

[3.2.5.3.90 Processing GetReaderIcon Reply 72](#_Toc523396978)

[3.2.5.3.91 Sending GetDeviceTypeId Message 72](#_Toc523396979)

[3.2.5.3.92 Processing GetDeviceTypeId Reply 72](#_Toc523396980)

[3.2.6 Timer Events 72](#_Toc523396981)

[3.2.7 Other Local Events 72](#_Toc523396982)

[4 Protocol Examples 73](#_Toc523396983)

[4.1 Establish Context Call 74](#_Toc523396984)

[4.2 Establish Context Return 74](#_Toc523396985)

[4.3 List Readers Call 74](#_Toc523396986)

[4.4 List Readers Return 74](#_Toc523396987)

[4.5 Get Status Change Call 74](#_Toc523396988)

[4.6 Get Status Change Return 75](#_Toc523396989)

[4.7 Connect Call 75](#_Toc523396990)

[4.8 Connect Return 75](#_Toc523396991)

[4.9 Begin Transaction Call 75](#_Toc523396992)

[4.10 Begin Transaction Return 76](#_Toc523396993)

[4.11 Status Call 76](#_Toc523396994)

[4.12 Status Return 76](#_Toc523396995)

[4.13 End Transaction Call 76](#_Toc523396996)

[4.14 End Transaction Return 76](#_Toc523396997)

[4.15 Disconnect Call 77](#_Toc523396998)

[4.16 Disconnect Return 77](#_Toc523396999)

[4.17 Release Context Call 77](#_Toc523397000)

[4.18 Release Context Return 77](#_Toc523397001)

[5 Security 78](#_Toc523397002)

[5.1 Security Considerations for Implementers 78](#_Toc523397003)

[5.2 Index of Security Parameters 78](#_Toc523397004)

[6 Appendix A: Full IDL 79](#_Toc523397005)

[7 Appendix B: Product Behavior 86](#_Toc523397006)

[8 Change Tracking 87](#_Toc523397007)

[9 Index 88](#_Toc523397008)

# Introduction

This document specifies an extension (including [**virtual channels**](#gt_13d22ba5-5d8e-4815-9728-0629e8422ceb)) to the Remote Desktop Protocol: File System Virtual Channel Extension for supporting [**smart card**](#gt_7c0fcc4a-476a-4d3a-87c0-7a503c14ef05) reader-like devices.

Sections 1.5, 1.8, 1.9, 2, and 3 of this specification are normative. All other sections and examples in this specification are informative.

## Glossary

This document uses the following terms:

**Answer To Reset (ATR)**: The transmission sent by an ISO-7816–compliant Integrated Circuit Card (as specified in [[ISO/IEC-7816-3]](https://go.microsoft.com/fwlink/?LinkId=89918) section 8) to a [**smart card reader**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0) in response to an ISO-7816-3–based RESET condition.

**ASCII**: The American Standard Code for Information Interchange (ASCII) is an 8-bit character-encoding scheme based on the English alphabet. ASCII codes represent text in computers, communications equipment, and other devices that work with text. ASCII refers to a single 8-bit ASCII character or an array of 8-bit ASCII characters with the high bit of each character set to zero.

**build number**: A part of a sequential numbering system that is used to differentiate one version of a software product from another.

**call packet**: A combination of [**I/O control (IOCTL)**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) and a data structure request from a [**protocol client**](#gt_a0d58e1e-3fb3-49a0-84b8-9b9eb7e86c65) that corresponds to that [**IOCTL**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462).

**card type**: A string that specifies a specific type of smart card that is recognized by [**Smart Cards for Windows**](#gt_c6f0d1a4-ae75-40b9-beef-baa419cb33b9).

**device**: Any peripheral or part of a computer system that can send or receive data.

**device I/O**: [**Device**](#gt_4712ded2-d927-4930-9450-29499f98cef4) input/output.

**device name**: The friendly, human-readable name of a [**device**](#gt_4712ded2-d927-4930-9450-29499f98cef4).

**HRESULT**: An integer value that indicates the result or status of an operation. A particular HRESULT can have different meanings depending on the protocol using it. See [[MS-ERREF]](%5BMS-ERREF%5D.pdf#Section_1bc92ddfb79e413cbbaa99a5281a6c90) section 2.1 and specific protocol documents for further details.

**I/O control (IOCTL)**: A command that is issued to a target file system or target device in order to query or alter the behavior of the target; or to query or alter the data and attributes that are associated with the target or the objects that are exposed by the target.

**Interface Definition Language (IDL)**: The International Standards Organization (ISO) standard language for specifying the interface for remote procedure calls. For more information, see [[C706]](https://go.microsoft.com/fwlink/?LinkId=89824) section 4.

**Microsoft Terminal Services (TS)**: A component that allows a user to access applications or data stored on a remote computer over a network connection.

**Multistring**: A series of null-terminated character strings terminated by a final null character stored in a contiguous block of memory.

**operating system version**: A uniquely identifiable numbered string that is used to identify a particular operating system.

**protocol client**: An endpoint that initiates a protocol.

**protocol server**: An endpoint that processes the [**call packet**](#gt_0a68cff0-1e07-4a15-a4ee-e08fb398ed49) from a [**protocol client**](#gt_a0d58e1e-3fb3-49a0-84b8-9b9eb7e86c65).

**reader group name**: The friendly, human-readable name for a reader group.

**Remote Desktop Protocol (RDP)**: A multi-channel protocol that allows a user to connect to a computer running [**Microsoft Terminal Services (TS)**](#gt_a954a9c7-ef37-4aca-ae9b-fade6a905eae). RDP enables the exchange of client and server settings and also enables negotiation of common settings to use for the duration of the connection, so that input, graphics, and other data can be exchanged and processed between client and server.

**remote procedure call (RPC)**: A communication protocol used primarily between client and server. The term has three definitions that are often used interchangeably: a runtime environment providing for communication facilities between computers (the RPC runtime); a set of request-and-response message exchanges between computers (the RPC exchange); and the single message from an RPC exchange (the RPC message). For more information, see [C706].

**return packet**: An encoded structure containing the result of a [**call packet**](#gt_0a68cff0-1e07-4a15-a4ee-e08fb398ed49) operation executed on the [**protocol client**](#gt_a0d58e1e-3fb3-49a0-84b8-9b9eb7e86c65).

**smart card**: A portable device that is shaped like a business card and is embedded with a memory chip and either a microprocessor or some non-programmable logic. [**Smart cards**](#gt_7c0fcc4a-476a-4d3a-87c0-7a503c14ef05) are often used as authentication tokens and for secure key storage. [**Smart cards**](#gt_7c0fcc4a-476a-4d3a-87c0-7a503c14ef05) used for secure key storage have the ability to perform cryptographic operations with the stored key without allowing the key itself to be read or otherwise extracted from the card.

**smart card reader**: A [**device**](#gt_4712ded2-d927-4930-9450-29499f98cef4) used as a communication medium between the smart card and a Host; for example, a computer. Also referred to as a Reader.

**smart card reader name**: The friendly, human-readable name of the [**smart card reader**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0). Also referred to as a Reader Name.

**Smart Cards for Windows**: An implementation of the ICC Resource Manager according to [[PCSC5]](https://go.microsoft.com/fwlink/?LinkId=90245).

**static virtual channel**: A static transport used for lossless communication between a client component and a server component over a main data connection, as specified in [MS-RDPBCGR].

**TS client**: A Microsoft Terminal Services program that initiates a connection.

**TS server**: A Microsoft Terminal Services program that responds to a request from a [**TS client**](#gt_b9854a6a-0613-4b7a-95e4-c2b359b6021a).

**Unicode**: A character encoding standard developed by the Unicode Consortium that represents almost all of the written languages of the world. The [**Unicode**](#gt_c305d0ab-8b94-461a-bd76-13b40cb8c4d8) standard [[UNICODE5.0.0/2007]](https://go.microsoft.com/fwlink/?LinkId=154659) provides three forms (UTF-8, UTF-16, and UTF-32) and seven schemes (UTF-8, UTF-16, UTF-16 BE, UTF-16 LE, UTF-32, UTF-32 LE, and UTF-32 BE).

**Unicode string**: A [**Unicode**](#gt_c305d0ab-8b94-461a-bd76-13b40cb8c4d8) 8-bit string is an ordered sequence of 8-bit units, a [**Unicode**](#gt_c305d0ab-8b94-461a-bd76-13b40cb8c4d8) 16-bit string is an ordered sequence of 16-bit code units, and a [**Unicode**](#gt_c305d0ab-8b94-461a-bd76-13b40cb8c4d8) 32-bit string is an ordered sequence of 32-bit code units. In some cases, it could be acceptable not to terminate with a terminating null character. Unless otherwise specified, all [**Unicode strings**](#gt_b069acb4-e364-453e-ac83-42d469bb339e) follow the UTF-16LE encoding scheme with no Byte Order Mark (BOM).

**universally unique identifier (UUID)**: A 128-bit value. UUIDs can be used for multiple purposes, from tagging objects with an extremely short lifetime, to reliably identifying very persistent objects in cross-process communication such as client and server interfaces, manager entry-point vectors, and [**RPC**](#gt_8a7f6700-8311-45bc-af10-82e10accd331) objects. UUIDs are highly likely to be unique. UUIDs are also known as globally unique identifiers (GUIDs) and these terms are used interchangeably in the Microsoft protocol technical documents (TDs). Interchanging the usage of these terms does not imply or require a specific algorithm or mechanism to generate the UUID. Specifically, the use of this term does not imply or require that the algorithms described in [[RFC4122]](https://go.microsoft.com/fwlink/?LinkId=90460) or [C706] must be used for generating the UUID.

**virtual channel**: A communication channel available in a TS server session between applications running at the server and applications running on the TS client.

**MAY, SHOULD, MUST, SHOULD NOT, MUST NOT:** These terms (in all caps) are used as defined in [[RFC2119]](https://go.microsoft.com/fwlink/?LinkId=90317). All statements of optional behavior use either MAY, SHOULD, or SHOULD NOT.

## References

Links to a document in the Microsoft Open Specifications library point to the correct section in the most recently published version of the referenced document. However, because individual documents in the library are not updated at the same time, the section numbers in the documents may not match. You can confirm the correct section numbering by checking the [Errata](https://go.microsoft.com/fwlink/?linkid=850906).

### Normative References

We conduct frequent surveys of the normative references to assure their continued availability. If you have any issue with finding a normative reference, please contact dochelp@microsoft.com. We will assist you in finding the relevant information.

[C706] The Open Group, "DCE 1.1: Remote Procedure Call", C706, August 1997, [https://www2.opengroup.org/ogsys/catalog/c706](https://go.microsoft.com/fwlink/?LinkId=89824)

[ISO/IEC-7816-3] International Organization for Standardization, "Identification Cards -- Integrated Circuit Cards -- Part 3: Cards with Contacts -- Electrical Interface and Transmission Protocols", ISO/IEC 7816-3, October 2006, [http://www.iso.org/iso/home/store/catalogue\_tc/catalogue\_detail.htm?csnumber=38770](https://go.microsoft.com/fwlink/?LinkId=89918)

**Note** There is a charge to download the specification.

[ISO/IEC-7816-4] International Organization for Standardization, "Identification Cards -- Integrated Circuit Cards -- Part 4: Organization, Security, and Commands for Interchange", ISO/IEC 7816-4, January 2005, [http://www.iso.org/iso/home/store/catalogue\_tc/catalogue\_detail.htm?csnumber=36134](https://go.microsoft.com/fwlink/?LinkId=89919)

**Note** There is a charge to download the specification.

[MS-DCOM] Microsoft Corporation, "[Distributed Component Object Model (DCOM) Remote Protocol](%5BMS-DCOM%5D.pdf#Section_4a893f3dbd2948cd9f43d9777a4415b0)".

[MS-DTYP] Microsoft Corporation, "[Windows Data Types](%5BMS-DTYP%5D.pdf#Section_cca2742956894a16b2b49325d93e4ba2)".

[MS-ERREF] Microsoft Corporation, "[Windows Error Codes](%5BMS-ERREF%5D.pdf#Section_1bc92ddfb79e413cbbaa99a5281a6c90)".

[MS-RDPBCGR] Microsoft Corporation, "[Remote Desktop Protocol: Basic Connectivity and Graphics Remoting](%5BMS-RDPBCGR%5D.pdf#Section_5073f4ed1e9345e1b0396e30c385867c)".

[MS-RDPEFS] Microsoft Corporation, "[Remote Desktop Protocol: File System Virtual Channel Extension](%5BMS-RDPEFS%5D.pdf#Section_34d9de58b2b540b6b970f82d4603bdb5)".

[MS-RPCE] Microsoft Corporation, "[Remote Procedure Call Protocol Extensions](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15)".

[PCSC3] PC/SC Workgroup, "Interoperability Specification for ICCs and Personal Computer Systems - Part 3: Requirements for PC-Connected Interface Devices", June 2007, [http://pcscworkgroup.com/Download/Specifications/pcsc3\_v2.01.09.pdf](https://go.microsoft.com/fwlink/?LinkId=90244)

[PCSC5] PC/SC Workgroup, "Interoperability Specification for ICCs and Personal Computer Systems - Part 5: ICC Resource Manager Definition", September 2005, [http://pcscworkgroup.com/Download/Specifications/pcsc5\_v2.01.01.pdf](https://go.microsoft.com/fwlink/?LinkId=90245)

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997, [http://www.rfc-editor.org/rfc/rfc2119.txt](https://go.microsoft.com/fwlink/?LinkId=90317)

### Informative References

None.

## Overview

The following figure illustrates a baseline for terminology related to clients and servers.



Figure 1: TS and protocol client-server definition

[**Remote Desktop Protocol (RDP)**](#gt_17c795a6-68bf-46bf-8ea8-467c8df1a0b3) Device Redirection enables client [**devices**](#gt_4712ded2-d927-4930-9450-29499f98cef4) (for example, printers, [**smart card readers**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0), drives, audio, serial ports, and parallel ports) to be available to server-side applications, within the context of a single RDP session. This protocol is specified in [[MS-RDPEFS]](%5BMS-RDPEFS%5D.pdf#Section_34d9de58b2b540b6b970f82d4603bdb5).

Smart Card Redirection is an asynchronous client/server protocol, an extension (specified in [MS-RDPEFS]) that is designed to remotely execute requests on a client's [**Smart Cards for Windows**](#gt_c6f0d1a4-ae75-40b9-beef-baa419cb33b9). These requests would have otherwise been executed on the server. Each request is composed of two packets: a [**call packet**](#gt_0a68cff0-1e07-4a15-a4ee-e08fb398ed49) and [**return packet**](#gt_9034c963-c719-4e13-86be-c597ea184431). The [**protocol client**](#gt_a0d58e1e-3fb3-49a0-84b8-9b9eb7e86c65) ([**Microsoft Terminal Services (TS)**](#gt_a954a9c7-ef37-4aca-ae9b-fade6a905eae) server) sends a call packet after an initial announcement by the [**protocol server**](#gt_6b91e507-0e17-41de-897c-356606d07088) ([**TS client**](#gt_b9854a6a-0613-4b7a-95e4-c2b359b6021a)), and will receive a return packet after the request has been completed or an error has occurred. Remote Desktop Protocol (RDP) Device Redirection uses a [**static virtual channel**](#gt_bce830ab-d09f-4dbd-b7c2-d7c7df1ea60c) as its transport.

Smart Card Redirection redirects the TS client–side Smart Cards for Windows. When Smart Card Redirection is in effect, [**TS server**](#gt_37eb268d-1dd2-4413-9fa6-3af2cab291d3) application [**smart card**](#gt_7c0fcc4a-476a-4d3a-87c0-7a503c14ef05) subsystem calls (for example, EstablishContext) are automatically remapped to the TS client–side Smart Cards for Windows, which will then receive the corresponding request. Smart Card Redirection devices are only required to understand one type of [**device I/O**](#gt_4cf701bf-ddc3-4554-b9a0-281cb5cc7b08) request.

The following figure shows a high-level sequence diagram of the protocol for redirected calls. Device Announce and Device Disconnect are handled via the lower-layer protocols.



Figure 2: High-level protocol sequence

The following figure specifies how the messages are encoded and routed from a TS client to a TS server. The following numbered list details corresponding actions related to the pictured protocol flow.



Figure 3: Protocol flow

The input for this protocol (call packet) is a combination of an [**I/O control (IOCTL)**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) and the corresponding structure as specified in section [3.2.5](#Section_4a5909f48ac241b2abe08b833c831b6f).

1. The call packet structure is encoded as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2.2.6.
2. The packet, as specified in [MS-RPCE], is returned as a response to 1.
3. The encoded value from 2 is combined with the IOCTL and transported over RDP Device Redirection, as specified in [MS-RDPEFS] section 2.
4. On the TS client, Remote Desktop Protocol: File System Virtual Channel Extension will route the packet from 3 to protocol server for the Smart Card Redirection, as specified in [MS-RDPEFS] section 2.
5. After Smart Card Redirection receives the message, the encoded structure is decoded, as specified in [MS-RPCE] section 2.2.6.
6. The packet, decoded as specified in [MS-RPCE], is a response to 5.
7. Based on the IOCTL, the structure members are used as input parameters to the Smart Cards for Windows, as specified in [[PCSC5]](https://go.microsoft.com/fwlink/?LinkId=90245) section 3.
8. The output parameters including the return code are packaged into the return packet structure for this IOCTL.
9. The return packet structure is encoded as specified in [MS-RPCE] section 2.2.6.
10. Return data, encoded as specified in [MS-RPCE], is a response to 9.
11. The encoded value from 10 is sent to RDP Device Redirection (as specified in [MS-RDPEFS]) as a reply to the call packet from 4.
12. RDP Device Redirection (as specified in [MS-RDPEFS]) routes the reply back to the protocol client.
13. On receipt of packet from 12, the encoded structure is decoded as specified by to [MS-RPCE] section 2.2.6.
14. In response to 13, return data is decoded as specified by [MS-RPCE].

The output from the Smart Card Redirection is the return packet. This data will then be processed by higher layers.

## Relationship to Other Protocols

This protocol extension expands Remote Desktop Protocol: File System Virtual Channel Extension [[MS-RDPEFS]](%5BMS-RDPEFS%5D.pdf#Section_34d9de58b2b540b6b970f82d4603bdb5) functionality to provide support for [**Smart Cards for Windows**](#gt_c6f0d1a4-ae75-40b9-beef-baa419cb33b9).

This protocol relies on the Distributed Component Object Model (DCOM) Remote Protocol [[MS-DCOM]](%5BMS-DCOM%5D.pdf#Section_4a893f3dbd2948cd9f43d9777a4415b0), which uses [**remote procedure call (RPC)**](#gt_8a7f6700-8311-45bc-af10-82e10accd331) as its transport.

This protocol uses the Remote Procedure Call Protocol Extensions ([[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2) to encode packet structures carried within an RDP session.

## Prerequisites/Preconditions

RDP Device Redirection transport (as specified in [[MS-RDPEFS]](%5BMS-RDPEFS%5D.pdf#Section_34d9de58b2b540b6b970f82d4603bdb5) section 2.2.2.7.5) must be configured to redirect [**smart card**](#gt_7c0fcc4a-476a-4d3a-87c0-7a503c14ef05) [**devices**](#gt_4712ded2-d927-4930-9450-29499f98cef4).

## Applicability Statement

This specification applies to redirecting [**Smart Cards for Windows**](#gt_c6f0d1a4-ae75-40b9-beef-baa419cb33b9) API-based calls for a Terminal Services client, as specified in [[PCSC5]](https://go.microsoft.com/fwlink/?LinkId=90245) section 3.

## Versioning and Capability Negotiation

This document covers versioning issues in the following areas:

* Protocol Versions: Smart Card Redirection supports the dialects SCREDIR\_VERSION\_XP (1), SCREDIR\_VERSION\_LONGHORN (2), and SCREDIR\_VERSION\_WINDOWS\_8 (3).
* Capability Negotiation: The Smart Card Redirection protocol does not support negotiation of the dialect to use. Instead, an implementation is configured with the dialect to use.

The [**TS server**](#gt_37eb268d-1dd2-4413-9fa6-3af2cab291d3) determines the dialect to use by analyzing the client [**build number**](#gt_560a30e4-7009-48da-b1e8-68db9c458e95) on [**device**](#gt_4712ded2-d927-4930-9450-29499f98cef4) announce as specified in [[MS-RDPBCGR]](%5BMS-RDPBCGR%5D.pdf#Section_5073f4ed1e9345e1b0396e30c385867c) section 2.2.1.3.2 using the following mapping.[<1>](#Appendix_A_1" \o "Product behavior note 1)

| **Build Number** | **Dialect** |
| --- | --- |
| >= 7865 | SCREDIR\_VERSION\_WINDOWS\_8 (3) |
| >= 4034 and < 7865 | SCREDIR\_VERSION\_LONGHORN (2) |
| < 4034 | SCREDIR\_VERSION\_XP (1) |

## Vendor-Extensible Fields

This protocol uses [**HRESULTs**](#gt_799103ab-b3cb-4eab-8c55-322821b2b235) as defined in [[MS-ERREF]](%5BMS-ERREF%5D.pdf#Section_1bc92ddfb79e413cbbaa99a5281a6c90) section 2.1. Vendors can define their own HRESULT values, provided that they set the C bit (0x20000000) for each vendor-defined value, indicating that the value is a customer code.

This protocol uses Win32 error codes. These values are taken from the Windows error number space, as specified in [MS-ERREF] section 2.2. Vendors SHOULD reuse those values with their indicated meaning. Choosing any other value runs the risk of a collision in the future.

This protocol uses NTSTATUS values as specified in [MS-ERREF] section 2.3. Vendors are free to choose their own values for this field, provided that they set the C bit (0x20000000) for each vendor-defined value, indicating it is a that customer code.

[**IOCTL**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) fields used in this specification are extensible. Vendors MUST implement the corresponding functions.

## Standards Assignments

This protocol uses the following RPC UUID for the type\_scard\_pack interface.

|  Parameter  |  Value  |  Reference  |
| --- | --- | --- |
| Remote procedure call (RPC) interface universally unique identifier (UUID) | A35AF600-9CF4-11CD-A076-08002B2BD711 | [[C706]](https://go.microsoft.com/fwlink/?LinkId=89824) Appendix A 2.5 |

# Messages

The following sections specify how Remote Desktop Protocol: Smart Card Virtual Channel Extension messages are transported, and common data types.

## Transport

All messages MUST be transported over established RDP Device Extensions (as specified in [[MS-RDPEFS]](%5BMS-RDPEFS%5D.pdf#Section_34d9de58b2b540b6b970f82d4603bdb5) section 2.1). This protocol uses the [**device**](#gt_4712ded2-d927-4930-9450-29499f98cef4) enumerate and announcement messages, as specified in [MS-RDPEFS] section 3.

Remote Desktop Protocol: File System Virtual Channel Extension is responsible for providing a unique Device ID as defined in [MS-RDPEFS] section 3.1.1.

## Common Data Types

All structures in this section MUST be encoded as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2. Unless otherwise stated, the structure MUST be initialized to zero before use.

### Common Structures

The structures defined in the following sections are common among both TS server-generated structures (for more information, see section [2.2.2](#Section_f4ca3b61b49c463c89322cf82fb7ec7a)) and TS client-generated structures (for more information, see section [2.2.3](#Section_4a383ba74ee8418593de6ddb3d6f3d1d)).

#### REDIR\_SCARDCONTEXT

REDIR\_SCARDCONTEXT represents a context to [**Smart Cards for Windows**](#gt_c6f0d1a4-ae75-40b9-beef-baa419cb33b9) on the [**TS client**](#gt_b9854a6a-0613-4b7a-95e4-c2b359b6021a).

1. typedef struct \_REDIR\_SCARDCONTEXT {
2. [range(0,16)] unsigned long cbContext;
3. [unique] [size\_is(cbContext)] byte \*pbContext;
4. } REDIR\_SCARDCONTEXT;

**cbContext:**  The number of bytes in the **pbContext** field.

**pbContext:**  An array of **cbContext** bytes that contains Smart Cards for Windows context. The data is implementation-specific and MUST NOT be interpreted or changed on the [**Protocol server**](#gt_6b91e507-0e17-41de-897c-356606d07088).

#### REDIR\_SCARDHANDLE

REDIR\_SCARDHANDLE represents a [**smart card reader**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0) handle associated with [**Smart Cards for Windows**](#gt_c6f0d1a4-ae75-40b9-beef-baa419cb33b9) context.

1. typedef struct \_REDIR\_SCARDHANDLE {
2. REDIR\_SCARDCONTEXT Context;
3. [range(0,16)] unsigned long cbHandle;
4. [size\_is(cbHandle)] byte \*pbHandle;
5. } REDIR\_SCARDHANDLE;

**Context:**  A valid context, as specified in [REDIR\_SCARDCONTEXT](#Section_060abee1e52041499ef7ce79eb500a59).

**cbHandle:**  The number of bytes in the **pbHandle** field.

**pbHandle:**  An array of **cbHandle** bytes that corresponds to a smart card reader handle on the [**TS client**](#gt_b9854a6a-0613-4b7a-95e4-c2b359b6021a). The data is implementation-specific and MUST NOT be interpreted or changed on the [**Protocol server**](#gt_6b91e507-0e17-41de-897c-356606d07088).

#### Connect\_Common

The Connect\_Common structure contains information common to both versions of the Connect function (for more information, see sections [2.2.2.13](#Section_5201b332299b4b6a973394e873ffe8cc) and [2.2.2.14](#Section_fd06f6a0a9ea478c9b5e470fd9cde5a6)).

1. typedef struct \_Connect\_Common {
2. REDIR\_SCARDCONTEXT Context;
3. unsigned long dwShareMode;
4. unsigned long dwPreferredProtocols;
5. } Connect\_Common;

**Context:**  A valid context, as specified in section [2.2.1.1](#Section_060abee1e52041499ef7ce79eb500a59).

**dwShareMode:**  A flag that indicates whether other applications are allowed to form connections to the card. Possible values of this field are specified in section [2.2.6](#Section_d81ce1d2e9584cb48e32c007133f8f23).

**dwPreferredProtocols:**  A bitmask of acceptable protocols for the connection, as specified in section [2.2.5](#Section_4167356727104e86be877b6f46fe10af).

#### LocateCards\_ATRMask

The LocateCards\_ATRMask structure contains the information to identify a [**card type**](#gt_51da9457-65ce-4157-a704-d2d6232037d2).

1. typedef struct \_LocateCards\_ATRMask {
2. [range(0,36)] unsigned long cbAtr;
3. byte rgbAtr[36];
4. byte rgbMask[36];
5. } LocateCards\_ATRMask;

**cbAtr:**  The number of bytes used in the **rgbAtr** and **rgbMask** fields.

**rgbAtr:**  Values for the card's [**Answer To Reset (ATR)**](#gt_2a8fc201-65aa-4040-980c-f4843467e6bf) string. This value MUST be formatted as specified in [[ISO/IEC-7816-3]](https://go.microsoft.com/fwlink/?LinkId=89918) section 8. Unused bytes MUST be set to 0 and MUST be ignored.

**rgbMask:**  Values for the mask for the card's ATR string. Each bit that cannot vary between cards of the same type MUST be set to 1. Unused bytes MUST be set to 0 and MUST be ignored.

#### ReaderState\_Common\_Call

The ReaderState\_Common\_Call structure contains the state of the reader at the time of the call as seen by the caller.

1. typedef struct \_ReaderState\_Common\_Call {
2. unsigned long dwCurrentState;
3. unsigned long dwEventState;
4. [range(0,36)] unsigned long cbAtr;
5. byte rgbAtr[36];
6. } ReaderState\_Common\_Call;

**dwCurrentState:**  A bitmap that specifies the current reader state according to the [**TS client**](#gt_b9854a6a-0613-4b7a-95e4-c2b359b6021a). Possible values are specified in section [2.2.7](#Section_3a2359602fec446b8ed150bcc70e3c5f).

**dwEventState:**  A bitmap that defines the state of the reader after a state change. Possible values are specified in section 2.2.7.

**cbAtr:**  The number of bytes used in the [**ATR**](#gt_2a8fc201-65aa-4040-980c-f4843467e6bf) string.

**rgbAtr:**  The value for the card's ATR string. If **cbAtr** is NOT zero, this value MUST be formatted in accordance to [[ISO/IEC-7816-3]](https://go.microsoft.com/fwlink/?LinkId=89918) section 8. Unused bytes MUST be set to 0 and MUST be ignored.

#### ReaderStateA

The ReaderStateA structure contains information used in calls that only require [**Smart Cards for Windows**](#gt_c6f0d1a4-ae75-40b9-beef-baa419cb33b9) context and an [**ASCII**](#gt_79fa85ca-ac61-467c-b819-e97dc1a7a599) string.

1. typedef struct \_ReaderStateA {
2. [string] const char\* szReader;
3. ReaderState\_Common\_Call Common;
4. } ReaderStateA;

**szReader:**  An ASCII string specifying the [**reader name**](#gt_8b790ccb-84c6-49fa-b1ed-4fc7c4e1841f).

**Common:**  A packet that specifies the state of the reader at the time of the call. For information about this packet, see section [2.2.1.5](#Section_a71e63bae58f487ca5d25a3e48856594).

#### ReaderStateW

The ReaderStateW structure is a [**Unicode**](#gt_c305d0ab-8b94-461a-bd76-13b40cb8c4d8) representation of the state of a [**smart card reader**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0).

1. typedef struct \_ReaderStateW {
2. [string] const wchar\_t\* szReader;
3. ReaderState\_Common\_Call Common;
4. } ReaderStateW;

**szReader:**  A [**Unicode string**](#gt_b069acb4-e364-453e-ac83-42d469bb339e) specifying the [**reader name**](#gt_8b790ccb-84c6-49fa-b1ed-4fc7c4e1841f).

**Common:**  A packet that specifies the state of the reader at the time of the call. For information about this packet, see section [2.2.1.5](#Section_a71e63bae58f487ca5d25a3e48856594).

#### SCardIO\_Request

The SCardIO\_Request structure represents the data to be prepended to a Transmit command (for more information, see section [3.1.4.35](#Section_0b24a330795048f8ade9fb90d51d0546)).

1. typedef struct \_SCardIO\_Request {
2. unsigned long dwProtocol;
3. [range(0,1024)] unsigned long cbExtraBytes;
4. [unique] [size\_is(cbExtraBytes)] byte \*pbExtraBytes;
5. } SCardIO\_Request;

**dwProtocol:**  The protocol in use. Possible values are specified in section [2.2.5](#Section_4167356727104e86be877b6f46fe10af).

**cbExtraBytes:**  The number of bytes in the **pbExtraBytes** field.

**pbExtraBytes:**  Request data.

#### ReadCache\_Common

The ReadCache\_Common structure contains information common to both the [ReadCacheA\_Call](#Section_ba203dbad5464e9db8cfafa22cf88c3d) and [ReadCacheW\_Call](#Section_f45705cf92994802b408685f02025e6a) structures.

1. typedef struct \_ReadCache\_Common {
2. REDIR\_SCARDCONTEXT Context;
3. UUID\* CardIdentifier;
4. unsigned long FreshnessCounter;
5. long fPbDataIsNULL;
6. unsigned long cbDataLen;
7. } ReadCache\_Common;

**Context:**  A valid context, as specified in section [2.2.1.1](#Section_060abee1e52041499ef7ce79eb500a59).

**CardIdentifier:**  A [**UUID**](#gt_c4813fc3-b2e5-4aa3-bde7-421d950d68d3) that specifies the name of the [**smart card**](#gt_7c0fcc4a-476a-4d3a-87c0-7a503c14ef05) with which the name-value pair is associated.

**FreshnessCounter:**  A value specifying the current revision of the data.

**fPbDataIsNULL:**  A Boolean value specifying whether the caller wants to retrieve the length of the data. It MUST be set to TRUE (0x00000001) if the caller wants only to retrieve the length of the data; otherwise, it MUST be set to FALSE (0x00000000).

**cbDataLen:**  The length of the buffer specified on the server side. If **cbDataLen** is set to SCARD\_AUTOALLOCATE with a value of 0xFFFFFFFF, a buffer of any length can be returned. Otherwise, the returned buffer MUST NOT exceed **cbDataLen** bytes. This field MUST be ignored if **fPbDataIsNULL** is set to TRUE (0x00000001).

#### WriteCache\_Common

The WriteCache\_Common structure contains information common between the [WriteCacheA\_Call](#Section_31ce1b620c504441b3e08661635849fb) and [WriteCacheW\_Call](#Section_3969bdcdecf342db8bc62d6f970f9c67) structures.

1. typedef struct \_WriteCache\_Common {
2. REDIR\_SCARDCONTEXT Context;
3. UUID \*CardIdentifier;
4. unsigned long FreshnessCounter;
5. [range(0,65536)] unsigned long cbDataLen;
6. [unique] [size\_is(cbDataLen)] byte \*pbData;
7. } WriteCache\_Common;

**Context:**  A valid context, as specified in section [2.2.1.1](#Section_060abee1e52041499ef7ce79eb500a59).

**CardIdentifier:**  A [**UUID**](#gt_c4813fc3-b2e5-4aa3-bde7-421d950d68d3) that identifies the [**smart card**](#gt_7c0fcc4a-476a-4d3a-87c0-7a503c14ef05) with which the data SHOULD be stored. CardIdentifier MUST be a unique value per the smart card.

**FreshnessCounter:**  A value specifying the current revision of the data.

**cbDataLen:**  The number of bytes in the **pbData** field.

**pbData:**  **cbDataLen** bytes of data to be stored.

#### ReaderState\_Return

The ReaderState\_Return structure specifies state information returned from [**Smart Cards for Windows**](#gt_c6f0d1a4-ae75-40b9-beef-baa419cb33b9).

1. typedef struct \_ReaderState\_Return {
2. unsigned long dwCurrentState;
3. unsigned long dwEventState;
4. [range(0,36)] unsigned long cbAtr;
5. byte rgbAtr[36];
6. } ReaderState\_Return;

**dwCurrentState:**  A bitmap that defines the current state of the reader at the time of the call. Possible values are specified in section [2.2.7](#Section_3a2359602fec446b8ed150bcc70e3c5f).

**dwEventState:**  A bitmap that defines the state of the reader after a state change as seen by Smart Cards for Windows. Possible values are specified in section 2.2.7.

**cbAtr:**  The number of used bytes in **rgbAtr**.

**rgbAtr:**  The values for the card's [**ATR**](#gt_2a8fc201-65aa-4040-980c-f4843467e6bf) string. Unused bytes MUST be set to zero and MUST be ignored on receipt.

### TS Server-Generated Structures

All structures in this section are sent from the [**TS server**](#gt_37eb268d-1dd2-4413-9fa6-3af2cab291d3) to the [**TS client**](#gt_b9854a6a-0613-4b7a-95e4-c2b359b6021a).

#### EstablishContext\_Call

The EstablishContext\_Call structure is used to specify the scope of [**Smart Cards for Windows**](#gt_c6f0d1a4-ae75-40b9-beef-baa419cb33b9) context to be created (for more information, see section [3.1.4.1](#Section_ea15ee619fac40ac96ebd9d63deee760)).

1. typedef struct \_EstablishContext\_Call {
2. unsigned long dwScope;
3. } EstablishContext\_Call;

**dwScope:**  The scope of the context that will be established. The following table shows valid values of this field.

| Value | Meaning |
| --- | --- |
| SCARD\_SCOPE\_USER0x00000000 | The context is a user context; any database operations MUST be performed with the domain of the user. |
| SCARD\_SCOPE\_TERMINAL0x00000001 | The context is a terminal context; any database operations MUST be performed with the domain of the terminal. This flag is currently unused; it is here for compatibility with [[PCSC5]](https://go.microsoft.com/fwlink/?LinkId=90245) section 3.1.3. |
| SCARD\_SCOPE\_SYSTEM0x00000002 | The context is the system context; any database operations MUST be performed within the domain of the system. |

#### Context\_Call

The Context\_Call structure contains [**Smart Cards for Windows**](#gt_c6f0d1a4-ae75-40b9-beef-baa419cb33b9) context.

1. typedef struct \_Context\_Call {
2. REDIR\_SCARDCONTEXT Context;
3. } Context\_Call;

**Context:**  A valid context, as specified in section [2.2.1.1](#Section_060abee1e52041499ef7ce79eb500a59).

#### ListReaderGroups\_Call

The ListReaderGroups\_Call structure contains the parameters for the List Readers Groups call (for more information, see sections [3.1.4.5](#Section_0fb9044801e24da19d60cfa1cc5e31a8) and [3.1.4.6](#Section_b9b6341ec52c4f02af0925e2121f0382)).

1. typedef struct \_ListReaderGroups\_Call {
2. REDIR\_SCARDCONTEXT Context;
3. long fmszGroupsIsNULL;
4. unsigned long cchGroups;
5. } ListReaderGroups\_Call;

**Context:**  A valid context, as specified in section [2.2.1.1](#Section_060abee1e52041499ef7ce79eb500a59).

**fmszGroupsIsNULL:**  A Boolean value specifying whether the caller wants to retrieve just the length of the data. Set to FALSE (0x00000000) in order to allow the data to be returned. Set to TRUE (0x00000001) and only the length of the data will be returned.

**cchGroups:**  The length of the string buffer specified by the caller. If **cchGroups** is set to SCARD\_AUTOALLOCATE with a value of 0xFFFFFFFF, a string of any length can be returned. Otherwise, the returned string MUST NOT exceed **cchGroups** characters in length, including any null characters. When the string to be returned exceeds **cchGroups** characters in length, including any null characters, [ListReaderGroups\_Return](#Section_6630bb5bfc0e41418b53263225c7628d).**ReturnCode** MUST be set to SCARD\_E\_INSUFFICIENT\_BUFFER (0x80100008). The **cchGroups** field MUST be ignored if **fmszGroupsIsNULL** is set to TRUE (0x00000001). Also, if **fmszGroupsIsNULL** is set to FALSE (0x00000000) but **cchGroups** is set to 0x00000000, then the call MUST succeed, ListReaderGroups\_Return.**cBytes** MUST be set to the length of the data, in bytes, and ListReaderGroups\_Return.**msz** MUST be set to NULL.

#### ListReaders\_Call

The ListReaders\_Call structure contains the parameters for the List Readers call (for more information, see sections [3.1.4.7](#Section_609b752adcc74e4fafb79c7ce3ef2b3d) and [3.1.4.8](#Section_45a76e7403014259965d39c739201b6a)).

1. typedef struct \_ListReaders\_Call {
2. REDIR\_SCARDCONTEXT Context;
3. [range(0, 65536)] unsigned long cBytes;
4. [unique] [size\_is(cBytes)] const byte \*mszGroups;
5. long fmszReadersIsNULL;
6. unsigned long cchReaders;
7. } ListReaders\_Call;

**Context:**  A valid context, as specified in section [2.2.1.1](#Section_060abee1e52041499ef7ce79eb500a59).

**cBytes:**  The length, in bytes, of reader groups specified in **mszGroups**.

**mszGroups:**  The names of the reader groups defined in the system. Reader groups not present on the [**protocol server**](#gt_6b91e507-0e17-41de-897c-356606d07088) MUST be ignored. The value of this is dependent on the context ([**IOCTL**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462)) that it is used.

| Value | Meaning |
| --- | --- |
| SCARD\_IOCTL\_LISTREADERSA0x00090028 | ASCII multistring |
| SCARD\_IOCTL\_LISTREADERSW0x0009002C | Unicode multistring |

**fmszReadersIsNULL:**  A Boolean value specifying whether the caller wants to retrieve the length of the data. Set to FALSE (0x00000000) to allow the data to be returned. Set to TRUE (0x00000001), and only the length of the data will be returned.

**cchReaders:**  The length of the string buffer specified by the caller. If **cchReaders** is set to SCARD\_AUTOALLOCATE with a value of 0xFFFFFFFF, a string of any length can be returned. Otherwise, the returned string MUST NOT exceed **cchReaders** characters in length, including any NULL characters. When the string to be returned exceeds **cchReaders** characters in length, including any null characters, [ListReaders\_Return](#Section_6630bb5bfc0e41418b53263225c7628d).**ReturnCode** MUST be set to SCARD\_E\_INSUFFICIENT\_BUFFER (0x80100008). The **cchReaders** field MUST be ignored if **fmszReadersIsNULL** is set to TRUE (0x00000001). Also, if **fmszReadersIsNULL** is set to FALSE (0x00000000) but **cchReaders** is set to 0x00000000, then the call MUST succeed, ListReaders\_Return.**cBytes** MUST be set to the length of the data in bytes, and ListReaders\_Return.**msz** MUST be set to NULL.

#### ContextAndStringA\_Call

The ContextAndStringA\_Call structure contains information used in calls that only require a [**Smart Cards for Windows**](#gt_c6f0d1a4-ae75-40b9-beef-baa419cb33b9) context and an [**ASCII**](#gt_79fa85ca-ac61-467c-b819-e97dc1a7a599) string.

1. typedef struct \_ContextAndStringA\_Call {
2. REDIR\_SCARDCONTEXT Context;
3. [string] const char\* sz;
4. } ContextAndStringA\_Call;

**Context:**  A valid context, as specified in section [2.2.1.1](#Section_060abee1e52041499ef7ce79eb500a59).

**sz:**  The value of this string depends on the context (based on [**IOCTL**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462)) in which this structure is used.

| Value | Meaning |
| --- | --- |
| SCARD\_IOCTL\_INTRODUCEREADERGROUPA0x00090050 | [**Reader group name**](#gt_2b7a4524-dca9-4024-bc7b-11e3e42d2e3b) |
| SCARD\_IOCTL\_FORGETREADERGROUPA0x00090058 | Reader group name |
| SCARD\_IOCTL\_FORGETREADERA0x00090068 | Reader name |

#### ContextAndStringW\_Call

The ContextAndStringW\_Call structure contains information used in calls that only require a [**Smart Cards for Windows**](#gt_c6f0d1a4-ae75-40b9-beef-baa419cb33b9) context and a [**Unicode string**](#gt_b069acb4-e364-453e-ac83-42d469bb339e).

1. typedef struct \_ContextAndStringW\_Call {
2. REDIR\_SCARDCONTEXT Context;
3. [string] const wchar\_t\* sz;
4. } ContextAndStringW\_Call;

**Context:**  A valid context, as specified in section [2.2.1.1](#Section_060abee1e52041499ef7ce79eb500a59).

**sz:**  The value of this Unicode string depends on the context (based on [**IOCTL**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462)) in which this structure is used.

| Value | Meaning |
| --- | --- |
| SCARD\_IOCTL\_INTRODUCEREADERGROUPW0x00090054 | [**Reader group name**](#gt_2b7a4524-dca9-4024-bc7b-11e3e42d2e3b) |
| SCARD\_IOCTL\_FORGETREADERGROUPW0x0009005C | Reader group name |
| SCARD\_IOCTL\_FORGETREADERW0x0009006C | Reader name |

#### ContextAndTwoStringA\_Call

The contents of the ContextAndTwoStringA\_Call structure are used in those calls that require a valid [**Smart Cards for Windows**](#gt_c6f0d1a4-ae75-40b9-beef-baa419cb33b9) context (as specified in section [3.2.5](#Section_4a5909f48ac241b2abe08b833c831b6f)) and two strings (friendly names).

1. typedef struct \_ContextAndTwoStringA\_Call {
2. REDIR\_SCARDCONTEXT Context;
3. [string] const char\* sz1;
4. [string] const char\* sz2;
5. } ContextAndTwoStringA\_Call;

**Context:**  A valid context, as specified in section [2.2.1.1](#Section_060abee1e52041499ef7ce79eb500a59).

**sz1:**  The value of this [**ASCII**](#gt_79fa85ca-ac61-467c-b819-e97dc1a7a599) string depends on the context (based on [**IOCTL**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462)) in which it is used.

| Value | Meaning |
| --- | --- |
| SCARD\_IOCTL\_INTRODUCEREADERA0x00090060 | Reader name |
| SCARD\_IOCTL\_ADDREADERTOGROUPA0x00090070 | Reader name |
| SCARD\_IOCTL\_REMOVEREADERFROMGROUPA0x00090078 | Reader name |

**sz2:**  The value of this ASCII string depends on the context (based on IOCTL) in which it is used.

| Value | Meaning |
| --- | --- |
| SCARD\_IOCTL\_INTRODUCEREADERA0x00090060 | Device name |
| SCARD\_IOCTL\_ADDREADERTOGROUPA0x00090070 | [**Reader group name**](#gt_2b7a4524-dca9-4024-bc7b-11e3e42d2e3b) |
| SCARD\_IOCTL\_REMOVEREADERFROMGROUPA0x00090078 | Reader group name |

#### ContextAndTwoStringW\_Call

The contents of the ContextAndTwoStringW\_Call structure is used in those calls that require a valid [**Smart Cards for Windows**](#gt_c6f0d1a4-ae75-40b9-beef-baa419cb33b9) context (as specified in section [3.2.5](#Section_4a5909f48ac241b2abe08b833c831b6f)) and two strings (friendly names).

1. typedef struct \_ContextAndTwoStringW\_Call {
2. REDIR\_SCARDCONTEXT Context;
3. [string] const wchar\_t\* sz1;
4. [string] const wchar\_t\* sz2;
5. } ContextAndTwoStringW\_Call;

**Context:**  A valid context, as specified in section [2.2.1.1](#Section_060abee1e52041499ef7ce79eb500a59).

**sz1:**  The value of this [**Unicode string**](#gt_b069acb4-e364-453e-ac83-42d469bb339e) depends on the context (based on [**IOCTL**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462)) in which it is used.

| Value | Meaning |
| --- | --- |
| SCARD\_IOCTL\_INTRODUCEREADERW0x00090064 | Reader name |
| SCARD\_IOCTL\_ADDREADERTOGROUPW0x00090074 | Reader name |
| SCARD\_IOCTL\_REMOVEREADERFROMGROUPW0x0009007C | Reader name |

**sz2:**  The value of this Unicode string depends on the context (based on IOCTL) in which it is used.

| Value | Meaning |
| --- | --- |
| SCARD\_IOCTL\_INTRODUCEREADERW0x00090064 | Device name |
| SCARD\_IOCTL\_ADDREADERTOGROUPW0x00090074 | [**Reader group name**](#gt_2b7a4524-dca9-4024-bc7b-11e3e42d2e3b) |
| SCARD\_IOCTL\_REMOVEREADERFROMGROUPW0x0009007C | Reader group name |

#### LocateCardsA\_Call

The parameters of the LocateCardsA\_Call structure specify the list of [**smart card readers**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0) to search for the specified [**card types**](#gt_51da9457-65ce-4157-a704-d2d6232037d2). For call information, see section [3.1.4.21](#Section_2f20fd13963948958a431a3d6f0ded67).

1. typedef struct \_LocateCardsA\_Call {
2. REDIR\_SCARDCONTEXT Context;
3. [range(0, 65536)] unsigned long cBytes;
4. [size\_is(cBytes)] const byte\* mszCards;
5. [range(0,10)] unsigned long cReaders;
6. [size\_is(cReaders)] ReaderStateA\* rgReaderStates;
7. } LocateCardsA\_Call;

**Context:**  A valid context, as specified in section [2.2.1.1](#Section_060abee1e52041499ef7ce79eb500a59).

**cBytes:**  The number of bytes in the **mszCards** field.

**mszCards:**  An [**ASCII**](#gt_79fa85ca-ac61-467c-b819-e97dc1a7a599) [**multistring**](#gt_63ae0a08-6a05-4269-99d0-3d3b7633949b) of card names to locate. Card names MUST be registered in [**Smart Cards for Windows**](#gt_c6f0d1a4-ae75-40b9-beef-baa419cb33b9). Unknown card types MUST be ignored.

**cReaders:**  The number of reader state structures.

**rgReaderStates:**  The reader state information specifying which readers are searched for the cards listed in **mszCards**.

#### LocateCardsW\_Call

The parameters of the LocateCardsW\_Call structure specify the list of [**smart card readers**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0) to search for the specified [**card types**](#gt_51da9457-65ce-4157-a704-d2d6232037d2). For more information, see section [3.1.4.22](#Section_52122b22b11e4014acef87de2008db77).

1. typedef struct \_LocateCardsW\_Call {
2. REDIR\_SCARDCONTEXT Context;
3. [range(0,65536)] unsigned long cBytes;
4. [size\_is(cBytes)] const byte\* mszCards;
5. [range(0,10)] unsigned long cReaders;
6. [size\_is(cReaders)] ReaderStateW\* rgReaderStates;
7. } LocateCardsW\_Call;

**Context:**  A valid context, as specified in section [2.2.1.1](#Section_060abee1e52041499ef7ce79eb500a59).

**cBytes:**  The number of bytes in the **mszCards** field.

**mszCards:**  A [**Unicode**](#gt_c305d0ab-8b94-461a-bd76-13b40cb8c4d8) [**multistring**](#gt_63ae0a08-6a05-4269-99d0-3d3b7633949b) of card names to locate. Card names MUST be registered in [**Smart Cards for Windows**](#gt_c6f0d1a4-ae75-40b9-beef-baa419cb33b9). Unknown card types MUST be ignored.

**cReaders:**  The number of reader state structures.

**rgReaderStates:**  The reader state information used to locate the cards listed in *mszCards*.

#### GetStatusChangeA\_Call

The GetStatusChangeA\_Call structure provides the state change in the reader as specified in section [3.1.4.23](#Section_e5ea2e6c9b124fd6b45d800213dd96a1).

1. typedef struct \_GetStatusChangeA\_Call {
2. REDIR\_SCARDCONTEXT Context;
3. unsigned long dwTimeOut;
4. [range(0,11)] unsigned long cReaders;
5. [size\_is(cReaders)] ReaderStateA\* rgReaderStates;
6. } GetStatusChangeA\_Call;

**Context:**  A valid context, as specified in section [2.2.1.1](#Section_060abee1e52041499ef7ce79eb500a59).

**dwTimeOut:**  The maximum amount of time, in milliseconds, to wait for an action. If this member is set to 0xFFFFFFFF (INFINITE), the caller MUST wait until an action occurs.

**cReaders:**  The number of ReaderStates to track.

**rgReaderStates:**  [**Smart card readers**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0) that the caller is tracking.

#### GetStatusChangeW\_Call

The GetStatusChangeW\_Call structure provides the state change in the Reader as specified in section [3.1.4.24](#Section_98cc1029420f4088b9b966ff7efe866d).

1. typedef struct \_GetStatusChangeW\_Call {
2. REDIR\_SCARDCONTEXT Context;
3. unsigned long dwTimeOut;
4. [range(0,11)] unsigned long cReaders;
5. [size\_is(cReaders)] ReaderStateW\* rgReaderStates;
6. } GetStatusChangeW\_Call;

**Context:**  A valid context, as specified in section [2.2.1.1](#Section_060abee1e52041499ef7ce79eb500a59).

**dwTimeOut:**  Maximum amount of time, in milliseconds, to wait for an action. If set to 0xFFFFFFFF (INFINITE), the caller MUST wait until an action occurs.

**cReaders:**  The number of ReaderStates to track.

**rgReaderStates:**  [**Smart card readers**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0) that the caller is tracking.

#### ConnectA\_Call

ConnectA\_Call opens a connection to the [**smart card**](#gt_7c0fcc4a-476a-4d3a-87c0-7a503c14ef05) located in the reader identified by a reader name.

1. typedef struct \_ConnectA\_Call {
2. [string] const char\* szReader;
3. Connect\_Common Common;
4. } ConnectA\_Call;

**szReader:**  An [**ASCII**](#gt_79fa85ca-ac61-467c-b819-e97dc1a7a599) string specifying the [**reader name**](#gt_8b790ccb-84c6-49fa-b1ed-4fc7c4e1841f) to connect to.

**Common:**  Additional parameters that are required for the Connect call are specified in section [3.1.4.28](#Section_99f88bbcfb8b4b59a5dfb5ea565d7b56). For more information, see section [2.2.1.3](#Section_32752f3244104682b9fc9096674b52de).

#### ConnectW\_Call

The ConnectW\_Call structure is used to open a connection to the [**smart card**](#gt_7c0fcc4a-476a-4d3a-87c0-7a503c14ef05) located in the reader identified by a [**reader name**](#gt_8b790ccb-84c6-49fa-b1ed-4fc7c4e1841f).

1. typedef struct \_ConnectW\_Call {
2. [string] const wchar\_t\* szReader;
3. Connect\_Common Common;
4. } ConnectW\_Call;

**szReader:**  A [**Unicode string**](#gt_b069acb4-e364-453e-ac83-42d469bb339e) specifying the reader name to connect to.

**Common:**  Additional parameters that are required for the Connect call. For more information, see sections [3.1.4.29](#Section_07f337627d81479581ab351c674e5282) and [2.2.1.3](#Section_32752f3244104682b9fc9096674b52de).

#### Reconnect\_Call

The Reconnect\_Call structure is used to reopen a connection to the [**smart card**](#gt_7c0fcc4a-476a-4d3a-87c0-7a503c14ef05) associated with a valid context. For more information, see section [3.1.4.36](#Section_e827930769e0480ba1e6ac9afe88f6b0).

1. typedef struct \_Reconnect\_Call {
2. REDIR\_SCARDHANDLE hCard;
3. unsigned long dwShareMode;
4. unsigned long dwPreferredProtocols;
5. unsigned long dwInitialization;
6. } Reconnect\_Call;

**hCard:**  A handle, as specified in section [2.2.1.2](#Section_b62763567c5f4d3ebe92a6c85e58d008).

**dwShareMode:**  A flag that indicates whether other applications can form connections to this card. For acceptable values of this field, see section [2.2.6](#Section_d81ce1d2e9584cb48e32c007133f8f23).

**dwPreferredProtocols:**  A bit mask of acceptable protocols for this connection. For specifics on possible values, see section [2.2.5](#Section_4167356727104e86be877b6f46fe10af).

**dwInitialization:**  A type of initialization that SHOULD be performed on the card.

| Value | Meaning |
| --- | --- |
| SCARD\_LEAVE\_CARD 0x00000000 | Do not do anything. |
| SCARD\_RESET\_CARD 0x00000001 | Reset the smart card.  |
| SCARD\_UNPOWER\_CARD 0x00000002 | Turn off and reset the smart card. |

#### HCardAndDisposition\_Call

The HCardAndDisposition\_Call structure defines the action taken on the disposition of a [**smart card**](#gt_7c0fcc4a-476a-4d3a-87c0-7a503c14ef05) associated with a valid context when a connection is terminated.

1. typedef struct \_HCardAndDisposition\_Call {
2. REDIR\_SCARDHANDLE hCard;
3. unsigned long dwDisposition;
4. } HCardAndDisposition\_Call;

**hCard:**  A handle, as specified in section [2.2.1.2](#Section_b62763567c5f4d3ebe92a6c85e58d008).

**dwDisposition:**  The action to take on the card in the connected reader upon close. This value is ignored on a BeginTransaction message call, as specified in section [3.2.5.3.61](#Section_5b433f97d57a439f8020f3d10493c790).

| Value | Meaning |
| --- | --- |
| SCARD\_LEAVE\_CARD 0x00000000 | Do not do anything. |
| SCARD\_RESET\_CARD 0x00000001 | Reset the smart card.  |
| SCARD\_UNPOWER\_CARD 0x00000002 | Turn off and reset the smart card. |
| SCARD\_EJECT\_CARD 0x00000003 | Eject the smart card. |

#### State\_Call

The State\_Call structure defines parameters to the State call (as specified in section [3.1.4.40](#Section_16756fb5fd8f494982f8b480f59d8d13)) for querying the contents of a [**smart card reader**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0).

1. typedef struct \_State\_Call {
2. REDIR\_SCARDHANDLE hCard;
3. long fpbAtrIsNULL;
4. unsigned long cbAtrLen;
5. } State\_Call;

**hCard:**  A handle, as specified in section [2.2.1.2](#Section_b62763567c5f4d3ebe92a6c85e58d008).

**fpbAtrIsNULL:**  A Boolean value specifying whether the caller wants to retrieve the length of the data. Set to FALSE (0x00000000) to allow the data to be returned. Set to TRUE (0x00000001), and only the length of the data will be returned. SHOULD be set to TRUE if **cbAtrLen** is set to SCARD\_AUTOALLOCATE (0xFFFFFFFF).

| Name | Value |
| --- | --- |
| FALSE | 0x00000000 |
| TRUE | 0x00000001 |

**cbAtrLen:**  The length of the buffer specified on the [**TS server**](#gt_37eb268d-1dd2-4413-9fa6-3af2cab291d3) side. If **cbAtrLen** is set to SCARD\_AUTOALLOCATE with a value of 0xFFFFFFFF, an array of any length can be returned. Otherwise, the returned array MUST NOT exceed **cbAtrLen** bytes in length. When the array to be returned exceeds **cbAtrLen** bytes in length, [State\_Return](#Section_574e5ec596ba4b11bfa952eb34307356).**ReturnCode** MUST be set to SCARD\_E\_INSUFFICIENT\_BUFFER (0x80100008). Also, **cbAtrLen** is ignored if **fpbAtrIsNULL** is set to TRUE (0x00000001). If **fpbAtrIsNULL** is set to FALSE (0x00000000) but **cbAtrLen** is set to 0x00000000, then the call MUST succeed, State\_Return.**cbAtrLen** MUST be set to the length of the data in bytes, and State\_Return.**rgAtr** MUST be set to NULL.

#### Status\_Call

Status\_Call obtains the status of a connection for a valid [**smart card reader**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0) handle.

1. typedef struct \_Status\_Call {
2. REDIR\_SCARDHANDLE hCard;
3. long fmszReaderNamesIsNULL;
4. unsigned long cchReaderLen;
5. unsigned long cbAtrLen;
6. } Status\_Call;

**hCard:**  A handle, as specified in section [2.2.1.2](#Section_b62763567c5f4d3ebe92a6c85e58d008).

**fmszReaderNamesIsNULL:**  A Boolean value specifying whether the caller wants to retrieve the length of the data. Set to FALSE (0x00000000) to allow the data to be returned. Set to TRUE (0x00000001), and only the length of the data will be returned. Also, **cchReaderLen** is ignored if this value is TRUE (0x00000001).

| Name | Value |
| --- | --- |
| FALSE | 0x00000000 |
| TRUE | 0x00000001 |

**cchReaderLen:**  The length of the string buffer specified on the [**TS server**](#gt_37eb268d-1dd2-4413-9fa6-3af2cab291d3) side. If cchReaderLen is set to SCARD\_AUTOALLOCATE with a value of 0xFFFFFFFF, a string of any length can be returned. Otherwise, the returned string MUST NOT exceed **cchReaderLen** characters in length, including any null characters. When the string to be returned exceeds **cchReaderLen** characters in length, including any null characters, [Status\_Return](#Section_987c1358ad6b4c8e88e106210c28a66f).**ReturnCode** MUST be set to SCARD\_E\_INSUFFICIENT\_BUFFER (0x80100008). The **cchReaderLen** field MUST be ignored if **fmszReaderNamesIsNULL** is TRUE (0x00000001). Also, if **fmszReaderNamesIsNULL** is set to FALSE (0x00000000) but **cchReaderLen** is set to 0x00000000, then the call MUST succeed, Status\_Return.**cbAtrLen** MUST be set to the length of the data in bytes, and Status\_Return.**pbAtr** MUST be set to NULL.

**cbAtrLen:**  Unused. MUST be ignored upon receipt.

#### Transmit\_Call

The Transmit\_Call structure is used to send data to the [**smart card**](#gt_7c0fcc4a-476a-4d3a-87c0-7a503c14ef05) associated with a valid context.

1. typedef struct \_Transmit\_Call {
2. REDIR\_SCARDHANDLE hCard;
3. SCardIO\_Request ioSendPci;
4. [range(0,66560)] unsigned long cbSendLength;
5. [size\_is(cbSendLength)] const byte\* pbSendBuffer;
6. [unique] SCardIO\_Request\* pioRecvPci;
7. long fpbRecvBufferIsNULL;
8. unsigned long cbRecvLength;
9. } Transmit\_Call;

**hCard:**  A handle, as specified in section [2.2.1.2](#Section_b62763567c5f4d3ebe92a6c85e58d008).

**ioSendPci:**  A packet specifying input header information as specified in section [2.2.1.8](#Section_f6e15da85bc04ef6b28ace88e8415621).

**cbSendLength:**  The length, in bytes, of the **pbSendBuffer** field.

**pbSendBuffer:**  The data to be written to the card. The format of the data is specific to an individual card. For more information about data formats, see [[ISO/IEC-7816-4]](https://go.microsoft.com/fwlink/?LinkId=89919) sections 5 through 7.

**pioRecvPci:**  If non-NULL, this field is an **SCardIO\_Request** packet that is set up in the same way as the **ioSendPci** field and passed as the *pioRecvPci* parameter of the Transmit call. If the value of this is NULL, the caller is not requesting the **pioRecvPci** value to be returned.

**fpbRecvBufferIsNULL:**  A Boolean value specifying whether the caller wants to retrieve the length of the data. MUST be set to TRUE (0x00000001) if the caller wants only to retrieve the length of the data; otherwise, it MUST be set to FALSE (0x00000000).

| Name | Value |
| --- | --- |
| FALSE | 0x00000000 |
| TRUE | 0x00000001 |

**cbRecvLength:**  The maximum size of the buffer to be returned. MUST be ignored if **fpbRecvBufferIsNULL** is set to TRUE (0x00000001).

#### Control\_Call

Normally, communication is to the [**smart card**](#gt_7c0fcc4a-476a-4d3a-87c0-7a503c14ef05) via the reader. However, in some cases, the ability to communicate directly with the [**smart card reader**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0) is requested. The Control\_Call structure provides the ability to talk to the reader.

1. typedef struct \_Control\_Call {
2. REDIR\_SCARDHANDLE hCard;
3. unsigned long dwControlCode;
4. [range(0,66560)] unsigned long cbInBufferSize;
5. [unique] [size\_is(cbInBufferSize)] const byte \*pvInBuffer;
6. long fpvOutBufferIsNULL;
7. unsigned long cbOutBufferSize;
8. } Control\_Call;

**hCard:**  A handle, as specified in section [2.2.1.2](#Section_b62763567c5f4d3ebe92a6c85e58d008).

**dwControlCode:**  The control code for the operation. These values are specific to the hardware [**device**](#gt_4712ded2-d927-4930-9450-29499f98cef4). This protocol MUST NOT restrict or define any values for this control codes.

**cbInBufferSize:**  The size in bytes of the **pvInBuffer** field.

**pvInBuffer:**  A buffer that contains the data required to perform the operation. This field SHOULD be NULL if the **dwControlCode** field specifies an operation that does not require input data. Otherwise, this data is specific to the function being performed.

**fpvOutBufferIsNULL:**  A Boolean value specifying whether the caller wants to retrieve the length of the data. MUST be set to TRUE (0x00000001) if the caller wants only to retrieve the length of the data; otherwise, it MUST be set to FALSE (0x00000000).

| Name | Value |
| --- | --- |
| FALSE | 0x00000000 |
| TRUE | 0x00000001 |

**cbOutBufferSize:**  The maximum size of the buffer to be returned. This field MUST be ignored if fpvOutBufferIsNULL is set to TRUE (0x00000001).

#### GetAttrib\_Call

The GetAttrib\_Call structure is used to read [**smart card reader**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0) attributes.

1. typedef struct \_GetAttrib\_Call {
2. REDIR\_SCARDHANDLE hCard;
3. unsigned long dwAttrId;
4. long fpbAttrIsNULL;
5. unsigned long cbAttrLen;
6. } GetAttrib\_Call;

**hCard:**  A handle, as specified in section [2.2.1.2](#Section_b62763567c5f4d3ebe92a6c85e58d008).

**dwAttrId:**  An identifier for the attribute to get. For more information on defined attributes, see [[PCSC3]](https://go.microsoft.com/fwlink/?LinkId=90244) section 3.1.2.

**fpbAttrIsNULL:**  A Boolean value specifying whether the caller wants to retrieve the length of the data. Set to FALSE (0x00000000) in order to allow the data to be returned. Set to TRUE (0x00000001) and only the length of the data will be returned.

| Name | Value |
| --- | --- |
| FALSE | 0x00000000 |
| TRUE | 0x00000001 |

**cbAttrLen:**  The length of the buffer specified on the [**TS Server**](#gt_37eb268d-1dd2-4413-9fa6-3af2cab291d3) side. If **cbAttrLen** is set to SCARD\_AUTOALLOCATE with a value of 0xFFFFFFFF then any buffer length can be returned. Otherwise, the returned buffer MUST NOT exceed **cbAttrLen** bytes in length. When the buffer to be returned exceeds **cbAttrLen** bytes in length, [GetAttrib\_Return](#Section_ab3ac0713fc544e69b94c1eee1168266).**ReturnCode** MUST be set to SCARD\_E\_INSUFFICIENT\_BUFFER (0x80100008). The **cbAttrLen** field MUST be ignored if **fpbAttrIsNULL** is set to TRUE (0x00000001). Also, if **fpbAttrIsNULL** is set to FALSE (0x00000000) but **cbAttrLen** is set to 0x00000000, then the call MUST succeed, GetAttrib\_Return.**cbAttrLen** MUST be set to the length of the data, in bytes, and GetAttrib\_Return.**pbAttr** MUST be set to NULL.

#### SetAttrib\_Call

The SetAttrib\_Call structure allows users to set [**smart card reader**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0) attributes.

1. typedef struct \_SetAttrib\_Call {
2. REDIR\_SCARDHANDLE hCard;
3. unsigned long dwAttrId;
4. [range(0,65536)] unsigned long cbAttrLen;
5. [size\_is(cbAttrLen)] const byte\* pbAttr;
6. } SetAttrib\_Call;

**hCard:**  A handle, as specified in section [2.2.1.2](#Section_b62763567c5f4d3ebe92a6c85e58d008).

**dwAttrId:**  The identifier of the attribute to set. The values are write-only. For more information on possible values, see [[PCSC3]](https://go.microsoft.com/fwlink/?LinkId=90244) section 3.1.2.

**cbAttrLen:**  The size, in bytes, of the data corresponding to the **pbAttr** field.

**pbAttr:**  A buffer that contains the attribute whose identifier is supplied in the **dwAttrId** field. The format is specific to the value being set.

#### LocateCardsByATRA\_Call

The LocateCardsByATRA\_Call structure returns information concerning the status of the [**smart card**](#gt_7c0fcc4a-476a-4d3a-87c0-7a503c14ef05) of interest ([**ATR**](#gt_2a8fc201-65aa-4040-980c-f4843467e6bf)).

1. typedef struct \_LocateCardsByATRA\_Call {
2. REDIR\_SCARDCONTEXT Context;
3. [range(0,1000)] unsigned long cAtrs;
4. [size\_is(cAtrs)] LocateCards\_ATRMask\* rgAtrMasks;
5. [range(0,10)] unsigned long cReaders;
6. [size\_is(cReaders)] ReaderStateA\* rgReaderStates;
7. } LocateCardsByATRA\_Call;

**Context:**  A valid context, as specified in section [2.2.2.13](#Section_5201b332299b4b6a973394e873ffe8cc).

**cAtrs:**  The number of bytes in the **rgAtrMasks** field.

**rgAtrMasks:**  An array of ATRs to match against currently inserted cards.

**cReaders:**  The number of elements in the **rgReaderStates** field.

**rgReaderStates:**  The states of the readers that the application is monitoring. The states reflect what the application determines to be the current states of the readers and that might differ from the actual states.

#### LocateCardsByATRW\_Call

The LocateCardsByATRW\_Call structure returns information concerning the status of the [**smart card**](#gt_7c0fcc4a-476a-4d3a-87c0-7a503c14ef05) of interest ([**ATR**](#gt_2a8fc201-65aa-4040-980c-f4843467e6bf)).

1. typedef struct \_LocateCardsByATRW\_Call {
2. REDIR\_SCARDCONTEXT Context;
3. [range(0, 1000)] unsigned long cAtrs;
4. [size\_is(cAtrs)] LocateCards\_ATRMask\* rgAtrMasks;
5. [range(0,10)] unsigned long cReaders;
6. [size\_is(cReaders)] ReaderStateW\* rgReaderStates;
7. } LocateCardsByATRW\_Call;

**Context:**  A valid context, as specified in section [2.2.2.14](#Section_fd06f6a0a9ea478c9b5e470fd9cde5a6).

**cAtrs:**  The number of bytes in the **rgAtrMasks** field.

**rgAtrMasks:**  An array of ATRs to match against currently inserted cards.

**cReaders:**  The number of elements in the **rgReaderStates** field.

**rgReaderStates:**  The states of the readers that the application is monitoring. The states reflects what the application believes is the current states of the readers and might differ from the actual states.

#### ReadCacheA\_Call

The ReadCacheA\_Call structure is used to obtain the card and reader information from the cache.

1. typedef struct \_ReadCacheA\_Call {
2. [string] char\* szLookupName;
3. ReadCache\_Common Common;
4. } ReadCacheA\_Call;

**szLookupName:**  An [**ASCII**](#gt_79fa85ca-ac61-467c-b819-e97dc1a7a599) string containing the lookup name.

**Common:**  Additional parameters for the Read Cache call (for additional information, see section [3.1.4.42](#Section_e333945776994cfba3ef6eed3e849350)), as specified in section [2.2.1.9](#Section_3f9e07fa66e2498b920c39531709116b).

#### ReadCacheW\_Call

The ReadCacheW\_Call structure is used to obtain the card and reader information from the cache.

1. typedef struct \_ReadCacheW\_Call {
2. [string] wchar\_t\* szLookupName;
3. ReadCache\_Common Common;
4. } ReadCacheW\_Call;

**szLookupName:**  A [**Unicode string**](#gt_b069acb4-e364-453e-ac83-42d469bb339e) containing the lookup name.

**Common:**  Additional parameters for the Read Cache call (for additional information, see section [3.1.4.43](#Section_8436548aa41f4759a7ee2d0341fa1d5d)), as specified in section [2.2.1.9](#Section_3f9e07fa66e2498b920c39531709116b).

#### WriteCacheA\_Call

The WriteCacheA\_Call structure is used to write the card and reader information to the cache.

1. typedef struct \_WriteCacheA\_Call {
2. [string] char\* szLookupName;
3. WriteCache\_Common Common;
4. } WriteCacheA\_Call;

**szLookupName:**  An [**ASCII**](#gt_79fa85ca-ac61-467c-b819-e97dc1a7a599) string containing the lookup name.

**Common:**  Additional parameters for the Write Cache call (for more information, see section [3.1.4.44](#Section_9b195b8efd734b578d9a7c4eb0b385cd)), as specified in section [2.2.1.10](#Section_5604251b9173457c947657863df9010e).

#### WriteCacheW\_Call

The WriteCacheW\_Call structure is used to write the card and reader information to the cache.

1. typedef struct \_WriteCacheW\_Call {
2. [string] wchar\_t\* szLookupName;
3. WriteCache\_Common Common;
4. } WriteCacheW\_Call;

**szLookupName:**  An [**Unicode string**](#gt_b069acb4-e364-453e-ac83-42d469bb339e) containing the lookup name.

**Common:**  Additional parameters for the Write Cache call (for more information, see section [2.2.1.10](#Section_5604251b9173457c947657863df9010e).

#### GetTransmitCount\_Call

The GetTransmitCount\_Call structure is used to obtain the number of transmit calls sent to the card since the reader was introduced.

1. typedef struct \_GetTransmitCount\_Call {
2. REDIR\_SCARDHANDLE hCard;
3. } GetTransmitCount\_Call;

**hCard:**  A handle, as specified in section [2.2.1.2](#Section_b62763567c5f4d3ebe92a6c85e58d008).

#### ScardAccessStartedEvent\_Call

ScardAccessStartedEvent\_Call is just an uninitialized 4-byte buffer that is sent as the [**IOCTL**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) requires a payload. There is no corresponding serialized structure for this call.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 20 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 30 | 1 |
| Unused |

**Unused (4 bytes):** The field is uninitialized. It SHOULD contain random data and MUST be ignored on receipt.

#### GetReaderIcon\_Call

The GetReaderIcon\_Call structure is used to obtain the reader icon from the smart card reader's INF file.

1. typedef struct \_GetReaderIcon\_Call {
2. REDIR\_SCARDCONTEXT Context;
3. [string] wchar\_t\* szReaderName;
4. } GetReaderIcon\_Call;

**Context:**  A valid context, as specified in section [2.2.1.1](#Section_060abee1e52041499ef7ce79eb500a59).

**szReaderName:**  A [**Unicode string**](#gt_b069acb4-e364-453e-ac83-42d469bb339e) containing the reader name.

#### GetDeviceTypeId\_Call

The GetDeviceTypeId\_Call structure is used to obtain the reader's device ID from the smart card reader's INF file.

1. typedef struct \_GetDeviceTypeId\_Call {
2. REDIR\_SCARDCONTEXT Context;
3. [string] wchar\_t\* szReaderName;
4. } GetDeviceTypeId\_Call;

**Context:**  A valid context, as specified in section [2.2.1.1](#Section_060abee1e52041499ef7ce79eb500a59).

**szReaderName:**  A [**Unicode string**](#gt_b069acb4-e364-453e-ac83-42d469bb339e) containing the lookup name.

### TS Client-Generated Structures

These structures originate from the client process and compose part of the [**return packet**](#gt_9034c963-c719-4e13-86be-c597ea184431). If the **ReturnCode** field of the structure is nonzero, all other fields MUST be set to zero and MUST be ignored on receipt.

#### ReadCache\_Return

The ReadCache\_Return structure is used to obtain the data that corresponds to the lookup item requested in ReadCacheA\_Call as specified in section [2.2.2.25](#Section_ba203dbad5464e9db8cfafa22cf88c3d), or ReadCacheW\_Call as specified in section [2.2.2.26](#Section_f45705cf92994802b408685f02025e6a). For more call information, see sections [3.1.4.42](#Section_e333945776994cfba3ef6eed3e849350) and [3.1.4.43](#Section_8436548aa41f4759a7ee2d0341fa1d5d).

1. typedef struct \_ReadCache\_Return {
2. long ReturnCode;
3. [range(0,65536)] unsigned long cbDataLen;
4. [unique] [size\_is(cbDataLen)] byte \*pbData;
5. } ReadCache\_Return;

**ReturnCode:**  [**HRESULT**](#gt_799103ab-b3cb-4eab-8c55-322821b2b235) or Win32 Error codes. Zero indicates success; any other value indicates failure.

**cbDataLen:**  The number of bytes in the **pbData** field.

**pbData:**  The value of the look up item.

#### EstablishContext\_Return

The EstablishContext\_Return structure is used to provide a response to an Establish Context call (for more information, see section [3.1.4.1](#Section_ea15ee619fac40ac96ebd9d63deee760).)

1. typedef struct \_EstablishContext\_Return {
2. long ReturnCode;
3. REDIR\_SCARDCONTEXT Context;
4. } EstablishContext\_Return;

**ReturnCode:**  [**HRESULT**](#gt_799103ab-b3cb-4eab-8c55-322821b2b235) or Win32 Error code. Zero indicates success; any other value indicates failure.

**Context:**  A valid context, as specified in section [2.2.1.1](#Section_060abee1e52041499ef7ce79eb500a59).

#### Long\_Return

The Long\_Return structure is used for return codes for calls that return only a long value.

1. typedef struct \_long\_Return {
2. long ReturnCode;
3. } long\_Return;

**ReturnCode:**  [**HRESULT**](#gt_799103ab-b3cb-4eab-8c55-322821b2b235) or Win32 Error code. Zero indicates success; any other value indicates failure.

#### ListReaderGroups\_Return and ListReaders\_Return

The ListReaderGroups\_Return and ListReaders\_Return structures are used to obtain results for those calls that return a [**multistring**](#gt_63ae0a08-6a05-4269-99d0-3d3b7633949b), in addition to a long return value. For more information, see sections [3.1.4.5](#Section_0fb9044801e24da19d60cfa1cc5e31a8), [3.1.4.6](#Section_b9b6341ec52c4f02af0925e2121f0382), [3.1.4.7](#Section_609b752adcc74e4fafb79c7ce3ef2b3d), and [3.1.4.8](#Section_45a76e7403014259965d39c739201b6a).

1. typedef struct \_longAndMultiString\_Return {
2. long ReturnCode;
3. [range(0,65536)] unsigned long cBytes;
4. [unique] [size\_is(cBytes)] byte \*msz;
5. } ListReaderGroups\_Return, ListReaders\_Return;

**ReturnCode:**  [**HRESULT**](#gt_799103ab-b3cb-4eab-8c55-322821b2b235) or Win32 Error code. The value returned from the [**Smart Card**](#gt_7c0fcc4a-476a-4d3a-87c0-7a503c14ef05) Redirection call.

**cBytes:**  The number of bytes in the **msz** array field.

**msz:**  The meaning of this field is specific to the context ([**IOCTL**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462)) in which it is used.

| Value | Meaning |
| --- | --- |
| SCARD\_IOCTL\_LISTREADERSA0x00090028 | ASCII multistring of readers on the system. |
| SCARD\_IOCTL\_LISTREADERSW0x0009002C | Unicode multistring of readers on the system. |
| SCARD\_IOCTL\_LISTREADERGROUPSA0x00090020 | ASCII multistring of reader groups on the system. |
| SCARD\_IOCTL\_LISTREADERGROUPSW0x00090024 | Unicode multistring of reader groups on the system. |

#### LocateCards\_Return and GetStatusChange\_Return

The LocateCards\_Return and GetStatusChange\_Return structures are used to obtain the results on those calls that return updated reader state information. (for more information, see sections [3.1.4.21](#Section_2f20fd13963948958a431a3d6f0ded67), [3.1.4.22](#Section_52122b22b11e4014acef87de2008db77), [3.1.4.23](#Section_e5ea2e6c9b124fd6b45d800213dd96a1), [3.1.4.24](#Section_98cc1029420f4088b9b966ff7efe866d), [3.1.4.25](#Section_201f92dcb12e43fb9daa9cfdf3b1bc0f), and [3.1.4.26](#Section_9f604d08756d4d789b4ec45a629dc639)).

1. typedef struct \_LocateCards\_Return {
2. long ReturnCode;
3. [range(0, 10)] unsigned long cReaders;
4. [size\_is(cReaders)] ReaderState\_Return \*rgReaderStates;
5. } LocateCards\_Return,
6. GetStatusChange\_Return;

**ReturnCode:**  [**HRESULT**](#gt_799103ab-b3cb-4eab-8c55-322821b2b235) or Win32 Error code. Zero indicates success; any other value indicates failure.

**cReaders:**  The number of elements in the **rgReaderStates** field.

**rgReaderStates:**  The current states of the readers being watched.

#### Control\_Return

The Control\_Return structure is used to obtain information from a [Control\_Call](#Section_002fc3a32ca2492e8463aba8f3923e48) (for more information, see section [3.1.4.37](#Section_032c12bb7aaa4e6f9d4c1f79cf26f45c)).

1. typedef struct \_Control\_Return {
2. long ReturnCode;
3. [range(0,66560)] unsigned long cbOutBufferSize;
4. [unique] [size\_is(cbOutBufferSize)] byte \*pvOutBuffer;
5. } Control\_Return;

**ReturnCode:**  [**HRESULT**](#gt_799103ab-b3cb-4eab-8c55-322821b2b235) or Win32 Error code. Zero indicates success; any other value indicates failure.

**cbOutBufferSize:**  The number of bytes in the **pvOutBuffer** field.

**pvOutBuffer:**  Contains the return data specific to the value of the Control\_Call structure.

#### Reconnect\_Return

The Reconnect\_Return structure is used to obtain return information from a Reconnect call (for more information, see section [3.1.4.36](#Section_e827930769e0480ba1e6ac9afe88f6b0)).

1. typedef struct Reconnect\_Return {
2. long ReturnCode;
3. unsigned long dwActiveProtocol;
4. } Reconnect\_Return;

**ReturnCode:**  [**HRESULT**](#gt_799103ab-b3cb-4eab-8c55-322821b2b235) or Win32 Error code. Zero indicates success; any other value indicates failure.

**dwActiveProtocol:**  A flag that indicates the established active protocol. For more information on acceptable values, see section [2.2.5](#Section_4167356727104e86be877b6f46fe10af) .

#### Connect\_Return

The Connect\_Return structure is used to obtain return information from a Connect call (for more information, see sections [3.1.4.28](#Section_99f88bbcfb8b4b59a5dfb5ea565d7b56) and [3.1.4.29](#Section_07f337627d81479581ab351c674e5282)).

1. typedef struct \_Connect\_Return {
2. long ReturnCode;
3. REDIR\_SCARDHANDLE hCard;
4. unsigned long dwActiveProtocol;
5. } Connect\_Return;

**ReturnCode:**  [**HRESULT**](#gt_799103ab-b3cb-4eab-8c55-322821b2b235) or Win32 Error code. Zero indicates success; any other value indicates failure.

**hCard:**  A handle, as specified in section [2.2.1.2](#Section_b62763567c5f4d3ebe92a6c85e58d008).

**dwActiveProtocol:**  A value that indicates the active [**smart card**](#gt_7c0fcc4a-476a-4d3a-87c0-7a503c14ef05) transmission protocol. Possible values are specified in section [2.2.5](#Section_4167356727104e86be877b6f46fe10af).

#### State\_Return

The State\_Return structure defines return information about the state of the [**smart card reader**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0) (for more information, see section [3.1.4.40](#Section_16756fb5fd8f494982f8b480f59d8d13)).

1. typedef struct \_State\_Return {
2. long ReturnCode;
3. unsigned long dwState;
4. unsigned long dwProtocol;
5. [range(0,36)] unsigned long cbAtrLen;
6. [unique] [size\_is(cbAtrLen)] byte \*rgAtr;
7. } State\_Return;

**ReturnCode:**  [**HRESULT**](#gt_799103ab-b3cb-4eab-8c55-322821b2b235) or Win32 Error code. Zero indicates success; any other value indicates failure.

**dwState:**  The current state of the [**smart card**](#gt_7c0fcc4a-476a-4d3a-87c0-7a503c14ef05) in the Reader. Possible values are specified in section [2.2.4](#Section_264bc504119543ffa0573d86a02c5d9c).

**dwProtocol:**  The current protocol, if any. Possible values are specified in section [2.2.5](#Section_4167356727104e86be877b6f46fe10af).

**cbAtrLen:**  The number of bytes in the **rgAtr** field.

**rgAtr:**  A pointer to a buffer that receives the [**ATR**](#gt_2a8fc201-65aa-4040-980c-f4843467e6bf) string from the currently inserted card, if available.

#### Status\_Return

The Status\_Return structure defines return information about the status of the [**smart card reader**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0) (for more information, see sections [3.1.4.33](#Section_c6812fcafa3e4771a3887d24ac535c94) and [3.1.4.34](#Section_e3781ea63ac24c7aa6d7804411b858dc)).

1. typedef struct \_Status\_Return {
2. long ReturnCode;
3. [range(0,65536)] unsigned long cBytes;
4. [unique] [size\_is(cBytes)] byte \*mszReaderNames;
5. unsigned long dwState;
6. unsigned long dwProtocol;
7. byte pbAtr[32];
8. [range(0,32)] unsigned long cbAtrLen;
9. } Status\_Return;

**ReturnCode:**  [**HRESULT**](#gt_799103ab-b3cb-4eab-8c55-322821b2b235) or Win32 Error code. Zero indicates success; any other value indicates failure.

**cBytes:**  The number of bytes in the **mszReaderNames** field.

**mszReaderNames:**  A [**multistring**](#gt_63ae0a08-6a05-4269-99d0-3d3b7633949b) containing the names that the reader is known by. The value of this is dependent on the context ([**IOCTL**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462)) that it is used.

| Value | Meaning |
| --- | --- |
| SCARD\_IOCTL\_STATUSA0x000900C8 | ASCII multistring |
| SCARD\_IOCTL\_STATUSW0x000900CC | Unicode multistring |

**dwState:**  The current state of the [**smart card**](#gt_7c0fcc4a-476a-4d3a-87c0-7a503c14ef05) in the reader. Possible values are specified in section [2.2.4](#Section_264bc504119543ffa0573d86a02c5d9c).

**dwProtocol:**  The current protocol, if any. Possible values are specified in section [2.2.5](#Section_4167356727104e86be877b6f46fe10af).

**pbAtr:**  A pointer to a buffer that receives the [**ATR**](#gt_2a8fc201-65aa-4040-980c-f4843467e6bf) string from the currently inserted card, if available.

**cbAtrLen:**  The number of bytes in the ATR string.

#### Transmit\_Return

The Transmit\_Return structure defines return information from a [**smart card**](#gt_7c0fcc4a-476a-4d3a-87c0-7a503c14ef05) after a Transmit call (for more information, see section [3.1.4.35](#Section_0b24a330795048f8ade9fb90d51d0546)).

1. typedef struct \_Transmit\_Return {
2. long ReturnCode;
3. [unique] SCardIO\_Request \*pioRecvPci;
4. [range(0, 66560)] unsigned long cbRecvLength;
5. [unique] [size\_is(cbRecvLength)] byte \*pbRecvBuffer;
6. } Transmit\_Return;

**ReturnCode:**  [**HRESULT**](#gt_799103ab-b3cb-4eab-8c55-322821b2b235) or Win32 Error code. Zero indicates success; any other value indicates failure.

**pioRecvPci:**  The protocol header structure for the instruction, followed by a buffer in which to receive any returned protocol control information (PCI) that is specific to the protocol in use. If this field is NULL, a protocol header MUST NOT be returned.

**cbRecvLength:**  The size, in bytes, of the **pbRecvBuffer** field.

**pbRecvBuffer:**  The data returned from the card.

#### GetAttrib\_Return

The GetAttrib\_Return structure defines attribute information from a [**smart card reader**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0) (for more information, see section [3.1.4.38](#Section_ef68db95671a417994e9412f741041c3)).

1. typedef struct \_GetAttrib\_Return {
2. long ReturnCode;
3. [range(0,65536)] unsigned long cbAttrLen;
4. [unique] [size\_is(cbAttrLen)] byte \*pbAttr;
5. } GetAttrib\_Return;

**ReturnCode:**  [**HRESULT**](#gt_799103ab-b3cb-4eab-8c55-322821b2b235) or Win32 Error code. Zero indicates success; any other value indicates failure.

**cbAttrLen:**  The number of bytes in the **pbAttr** field.

**pbAttr:**  A pointer to an array that contains any values returned from the corresponding call.

#### GetTransmitCount\_Return

The GetTransmitCount\_Return structure defines the number of transmit calls that were performed on the [**smart card reader**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0) (for more information, see section [3.1.4.41](#Section_ba32fda376164521a3aa6029b6a6e562)).

1. typedef struct \_GetTransmitCount\_Return {
2. long ReturnCode;
3. unsigned long cTransmitCount;
4. } GetTransmitCount\_Return;

**ReturnCode:**  [**HRESULT**](#gt_799103ab-b3cb-4eab-8c55-322821b2b235) or Win32 Error code. Zero indicates success; any other value indicates failure.

**cTransmitCount:**  The field specifies the number of successful Transmit calls (for more information, see section [3.1.4.35](#Section_0b24a330795048f8ade9fb90d51d0546)) performed on the reader since it was introduced to the system.

#### GetReaderIcon\_Return

The GetReaderIcon\_Return structure is used to obtain the data that corresponds to the lookup item requested in the **GetReaderIcon\_Call** as specified in section [2.2.2.31](#Section_e6a68d90697f4b988ad6f74853d27ccb). For more information, see section [3.1.4.48](#Section_3c9ee4055d684a6d80a0b053ea88d987).

1. typedef struct \_GetReaderIcon\_Return {
2. long ReturnCode;
3. [range(0, 4194304)] unsigned long cbDataLen;
4. [unique, size\_is(cbDataLen)] byte\* pbData;
5. } GetReaderIcon\_Return;

**ReturnCode:**  HRESULT or Win32 error code. Zero indicates success; any other value indicates failure.

**cbDataLen:**  The number of bytes in the **pbData** field.

**pbData:**  The value of the lookup item.

#### GetDeviceTypeId\_Return

The GetDeviceTypeId\_Return structure is used to obtain the data that corresponds to the lookup item requested in **GetDeviceTypeId\_Call** as specified in section [2.2.2.32](#Section_b5e18874c42d42eab1b13fd86a8a95f1). For more information, see section [3.1.4.47](#Section_a7cecc063bcb48ca90eaa9d542cffafc).

1. typedef struct \_GetDeviceTypeId\_Return {
2. long ReturnCode;
3. unsigned long dwDeviceId;
4. } GetDeviceTypeId\_Return;

**ReturnCode:**  HRESULT or Win32 error code. Zero indicates success; any other value indicates failure.

**dwDeviceId:**  The value of the lookup item.

### Card/Reader State

The following represents the current state of the smart card reader according to [**Smart Cards for Windows**](#gt_c6f0d1a4-ae75-40b9-beef-baa419cb33b9).

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 20 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 30 | 1 |
| CardReaderState |

**CardReaderState (4 bytes):** One of the following values.

| Value | Meaning |
| --- | --- |
| SCARD\_UNKNOWN 0x00000000 | The current state of the reader is unknown. |
| SCARD\_ABSENT 0x00000001 | There is no card in the reader. |
| SCARD\_PRESENT 0x00000002 | There is a card in the reader but it has not been moved into position for use. |
| SCARD\_SWALLOWED 0x00000003 | There is a card in the reader in position for use. The card is not powered. |
| SCARD\_POWERED 0x00000004 | There is power being applied to the card but the mode of the card is unknown. |
| SCARD\_NEGOTIABLE 0x00000005 | The card has been reset and is awaiting PTS negotiation. |
| SCARD\_SPECIFICMODE 0x00000006 | The card has been reset and specific communication protocols have been established. |

### Protocol Identifier

A Protocol Identifier.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 20 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 30 | 1 |
| ProtocolIdentifier |

**ProtocolIdentifier (4 bytes):** This field MUST have a value from Table A which is logically OR'ed with a value from Table B.

**Table A**

| Value | Meaning |
| --- | --- |
| SCARD\_PROTOCOL\_UNDEFINED0x00000000 | No transmission protocol is active. |
| SCARD\_PROTOCOL\_T00x00000001 | Transmission protocol 0 (T=0) is active. It is the asynchronous half-duplex character transmission protocol. |
| SCARD\_PROTOCOL\_T10x00000002 | Transmission protocol 1 (T=1) is active. It is the asynchronous half-duplex block transmission protocol. |
| SCARD\_PROTOCOL\_Tx0x00000003 | Bitwise OR combination of both of the two International Standards Organization (IS0) transmission protocols SCARD\_PROTOCOL\_T0 and SCARD\_PROTOCOL\_T1. This value can be used as a bitmask. |
| SCARD\_PROTOCOL\_RAW0x00010000 | Transmission protocol raw is active. The data from the smart card is raw and does not conform to any transmission protocol. |

**Table B**

| Value | Meaning |
| --- | --- |
| SCARD\_PROTOCOL\_DEFAULT0x80000000 | A bitwise OR with this value forces the use of the default transmission parameters and card clock frequency. |
| SCARD\_PROTOCOL\_OPTIMAL0x00000000 | Optimal transmission parameters and card clock frequency MUST be used. This flag is considered the default. No actual value is defined for this flag; it is there for compatibility with [[PCSC5]](https://go.microsoft.com/fwlink/?LinkId=90245) section 3.1.3. |

### Access Mode Flags

Access mode flags provide possible values for applications to connect to the [**smart card**](#gt_7c0fcc4a-476a-4d3a-87c0-7a503c14ef05).

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 20 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 30 | 1 |
| AccessModeFlag |

**AccessModeFlag (4 bytes):** One of the following possible values:

| Value | Meaning |
| --- | --- |
| SCARD\_SHARE\_EXCLUSIVE0x00000001 | This application is not willing to share this smart card with other applications. |
| SCARD\_SHARE\_SHARED0x00000002 | This application is willing to share this smart card with other applications. |
| SCARD\_SHARE\_DIRECT0x00000003 | This application demands direct control of the smart card reader; therefore, it is not available to other applications. |

### Reader State

The Reader State packet has a sub-structure as shown in the following table.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 20 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 30 | 1 |
| Reader State |

**Reader State (4 bytes):** Both the **dwCurrentState** field and the **dwEventState** field, found in the [ReaderState\_Common\_Call (section 2.2.1.5)](#Section_a71e63bae58f487ca5d25a3e48856594) and [ReaderState\_Return (section 2.2.1.11)](#Section_e9d1ebf847d24f64880bd1b87479aadd) structures, consist of the following two subfields.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 20 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 30 | 1 |
| Count | State |

**Count (2 bytes):** The contents of this field depend on the value of the associated [**reader name**](#gt_8b790ccb-84c6-49fa-b1ed-4fc7c4e1841f). If the reader name (for more information, see sections [2.2.1.6](#Section_a55f95e87a124ad3919d57d1414f81aa) and [2.2.1.7](#Section_0ba03cd2bed0495badbe3d2cde61980c) for the **szReader** field) is \\?PnP?\Notification, then **Count** is a count of the number of readers installed on the system and all bits except SCARD\_STATE\_CHANGED in **State** MUST be zero. Otherwise, **Count** is a count of the number of times a card has been inserted and/or removed from the [**smart card reader**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0) being monitored.

**State (2 bytes):** The state of a reader. The value MUST be according to the following table.

| Value | Meaning |
| --- | --- |
| SCARD\_STATE\_UNAWARE0x0000 | The application requires the current state but does not know it. The use of this value results in an immediate return from state transition monitoring services. |
| SCARD\_STATE\_IGNORE0x0001 | The application requested that this reader be ignored. If this bit is set in the **dwCurrentState** field of a ReaderState\_Common\_Call structure, other bits MUST NOT be set in the **dwEventState** field of the corresponding ReaderState\_Return structure. |
| SCARD\_STATE\_CHANGED 0x0002 | There is a difference between the state believed by the application, and the state known by Smart Cards for Windows. |
| SCARD\_STATE\_UNKNOWN0x0004 | The reader name is not recognized by Smart Cards for Windows. If this bit is set in the **dwEventState** field of the ReaderState\_Return structure, both SCARD\_STATE\_IGNORE and SCARD\_STATE\_CHANGED values MUST be set. This bit SHOULD NOT be set in the **dwCurrentState** field of a ReaderState\_Common\_Call structure. |
| SCARD\_STATE\_UNAVAILABLE0x0008 | The actual state of this reader is not available. If this bit is set, all of the following bits MUST be clear. |
| SCARD\_STATE\_EMPTY0x0010 | There is no card in the reader. If this bit is set, all of the following bits MUST be clear. |
| SCARD\_STATE\_PRESENT0x0020 | There is a card in the reader. |
| SCARD\_STATE\_ATRMATCH0x0040 | There is a card in the reader with an ATR that matches one of the target cards. If this bit is set, SCARD\_STATE\_PRESENT MUST be set. |
| SCARD\_STATE\_EXCLUSIVE0x0080 | The card in the reader is allocated for exclusive use by another application. If this bit is set, SCARD\_STATE\_PRESENT MUST be set. |
| SCARD\_STATE\_INUSE0x0100 | The card in the reader is in use by one or more other applications, but it can be connected to in shared mode. If this bit is set, SCARD\_STATE\_PRESENT MUST be set. |
| SCARD\_STATE\_MUTE0x0200 | The card in the reader is unresponsive or is not supported by the reader or software. |
| SCARD\_STATE\_UNPOWERED0x0400 | This implies that the card in the reader has not been turned on. |

### Return Code

The following Smart Card Facility Codes for Windows-specific return codes MAY be returned by the [**protocol server**](#gt_6b91e507-0e17-41de-897c-356606d07088) to the [**protocol client**](#gt_a0d58e1e-3fb3-49a0-84b8-9b9eb7e86c65) and are of the data type NTSTATUS, with the **sev** field set to STATUS\_SEVERITY\_WARNING (0x2) and the reserved bit (**N**) set to 0.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 20 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 30 | 1 |
| ReturnCode |

**ReturnCode (4 bytes):** One of the following return codes:

| Value | Meaning |
| --- | --- |
| SCARD\_S\_SUCCESS0x00000000 | No error has occurred. |
| SCARD\_F\_INTERNAL\_ERROR0x80100001 | An internal consistency check failed. |
| SCARD\_E\_CANCELLED0x80100002 | The action was canceled by a Cancel request. |
| SCARD\_E\_INVALID\_HANDLE0x80100003 | The supplied handle was invalid. |
| SCARD\_E\_INVALID\_PARAMETER0x80100004 | One or more of the supplied parameters could not be properly interpreted. |
| SCARD\_E\_INVALID\_TARGET0x80100005 | Registry startup information is missing or invalid. |
| SCARD\_E\_NO\_MEMORY0x80100006 | Not enough memory available to complete this command. |
| SCARD\_F\_WAITED\_TOO\_LONG0x80100007 | An internal consistency timer has expired. |
| SCARD\_E\_INSUFFICIENT\_BUFFER0x80100008 | The data buffer to receive returned data is too small for the returned data. |
| SCARD\_E\_UNKNOWN\_READER0x80100009 | The specified reader name is not recognized. |
| SCARD\_E\_TIMEOUT0x8010000A | The user-specified time-out value has expired. |
| SCARD\_E\_SHARING\_VIOLATION0x8010000B | The smart card cannot be accessed because of other connections outstanding. |
| SCARD\_E\_NO\_SMARTCARD0x8010000C | The operation requires a smart card, but no smart card is currently in the device. |
| SCARD\_E\_UNKNOWN\_CARD0x8010000D | The specified smart card name is not recognized. |
| SCARD\_E\_CANT\_DISPOSE0x8010000E | The system could not dispose of the media in the requested manner. |
| SCARD\_E\_PROTO\_MISMATCH0x8010000F | The requested protocols are incompatible with the protocol currently in use with the smart card. |
| SCARD\_E\_NOT\_READY0x80100010 | The reader or smart card is not ready to accept commands. |
| SCARD\_E\_INVALID\_VALUE0x80100011 | One or more of the supplied parameters values could not be properly interpreted. |
| SCARD\_E\_SYSTEM\_CANCELLED0x80100012 | The action was canceled by the system, presumably to log off or shut down. |
| SCARD\_F\_COMM\_ERROR0x80100013 | An internal communications error has been detected. |
| SCARD\_F\_UNKNOWN\_ERROR0x80100014 | An internal error has been detected, but the source is unknown. |
| SCARD\_E\_INVALID\_ATR0x80100015 | An ATR obtained from the registry is not a valid ATR string. |
| SCARD\_E\_NOT\_TRANSACTED0x80100016 | An attempt was made to end a non-existent transaction. |
| SCARD\_E\_READER\_UNAVAILABLE0x80100017 | The specified reader is not currently available for use. |
| SCARD\_P\_SHUTDOWN0x80100018 | The operation has been stopped to allow the server application to exit. |
| SCARD\_E\_PCI\_TOO\_SMALL0x80100019 | The PCI Receive buffer was too small. |
| SCARD\_E\_ICC\_INSTALLATION0x80100020 | No primary provider can be found for the smart card. |
| SCARD\_E\_ICC\_CREATEORDER0x80100021 | The requested order of object creation is not supported. |
| SCARD\_E\_UNSUPPORTED\_FEATURE0x80100022 | This smart card does not support the requested feature. |
| SCARD\_E\_DIR\_NOT\_FOUND0x80100023 | The specified directory does not exist in the smart card. |
| SCARD\_E\_FILE\_NOT\_FOUND0x80100024 | The specified file does not exist in the smart card. |
| SCARD\_E\_NO\_DIR0x80100025 | The supplied path does not represent a smart card directory. |
| SCARD\_E\_READER\_UNSUPPORTED0x8010001A | The reader device driver does not meet minimal requirements for support. |
| SCARD\_E\_DUPLICATE\_READER0x8010001B | The reader device driver did not produce a unique reader name. |
| SCARD\_E\_CARD\_UNSUPPORTED0x8010001C | The smart card does not meet minimal requirements for support. |
| SCARD\_E\_NO\_SERVICE0x8010001D | Smart Cards for Windows is not running. |
| SCARD\_E\_SERVICE\_STOPPED0x8010001E | Smart Cards for Windows has shut down. |
| SCARD\_E\_UNEXPECTED0x8010001F | An unexpected card error has occurred. |
| SCARD\_E\_NO\_FILE0x80100026 | The supplied path does not represent a smart card file. |
| SCARD\_E\_NO\_ACCESS0x80100027 | Access is denied to this file. |
| SCARD\_E\_WRITE\_TOO\_MANY0x80100028 | The smart card does not have enough memory to store the information. |
| SCARD\_E\_BAD\_SEEK0x80100029 | There was an error trying to set the smart card file object pointer. |
| SCARD\_E\_INVALID\_CHV0x8010002A | The supplied PIN is incorrect. |
| SCARD\_E\_UNKNOWN\_RES\_MSG0x8010002B | An unrecognized error code was returned from a layered component. |
| SCARD\_E\_NO\_SUCH\_CERTIFICATE0x8010002C | The requested certificate does not exist. |
| SCARD\_E\_CERTIFICATE\_UNAVAILABLE0x8010002D | The requested certificate could not be obtained. |
| SCARD\_E\_NO\_READERS\_AVAILABLE0x8010002E | Cannot find a smart card reader. |
| SCARD\_E\_COMM\_DATA\_LOST0x8010002F | A communications error with the smart card has been detected. Retry the operation. |
| SCARD\_E\_NO\_KEY\_CONTAINER0x80100030 | The requested key container does not exist. |
| SCARD\_E\_SERVER\_TOO\_BUSY0x80100031 | Smart Cards for Windows is too busy to complete this operation. |
| SCARD\_E\_PIN\_CACHE\_EXPIRED0x80100032 | The smart card PIN cache has expired. |
| SCARD\_E\_NO\_PIN\_CACHE0x80100033 | The smart card PIN cannot be cached. |
| SCARD\_E\_READ\_ONLY\_CARD0x80100034 | The smart card is read-only and cannot be written to. |
| SCARD\_W\_UNSUPPORTED\_CARD0x80100065 | The reader cannot communicate with the smart card due to ATR configuration conflicts. |
| SCARD\_W\_UNRESPONSIVE\_CARD0x80100066 | The smart card is not responding to a reset. |
| SCARD\_W\_UNPOWERED\_CARD0x80100067 | Power has been removed from the smart card, so that further communication is impossible. |
| SCARD\_W\_RESET\_CARD0x80100068 | The smart card has been reset, so any shared state information is invalid. |
| SCARD\_W\_REMOVED\_CARD0x80100069 | The smart card has been removed, so that further communication is impossible. |
| SCARD\_W\_SECURITY\_VIOLATION0x8010006A | Access was denied because of a security violation. |
| SCARD\_W\_WRONG\_CHV0x8010006B | The card cannot be accessed because the wrong PIN was presented. |
| SCARD\_W\_CHV\_BLOCKED0x8010006C | The card cannot be accessed because the maximum number of PIN entry attempts has been reached. |
| SCARD\_W\_EOF0x8010006D | The end of the smart card file has been reached. |
| SCARD\_W\_CANCELLED\_BY\_USER0x8010006E | The action was canceled by the user. |
| SCARD\_W\_CARD\_NOT\_AUTHENTICATED0x8010006F | No PIN was presented to the smart card. |
| SCARD\_W\_CACHE\_ITEM\_NOT\_FOUND0x80100070 | The requested item could not be found in the cache. |
| SCARD\_W\_CACHE\_ITEM\_STALE0x80100071 | The requested cache item is too old and was deleted from the cache. |
| SCARD\_W\_CACHE\_ITEM\_TOO\_BIG0x80100072 | The new cache item exceeds the maximum per-item size defined for the cache. |

# Protocol Details

The following sections specify details of the Remote Desktop Protocol: Smart Card Virtual Channel Extension, including abstract data models, interface method syntax, and message processing rules.

## Protocol Server Details

### Abstract Data Model

This section describes a conceptual model of a possible data organization that an implementation maintains to participate in this protocol. The described organization is provided to facilitate the explanation of how the protocol behaves. This document does not mandate that implementations adhere to this model provided that their external behavior is consistent with that described in this document.

The [**protocol server**](#gt_6b91e507-0e17-41de-897c-356606d07088) relies on an implementation of [**Smart Cards for Windows**](#gt_c6f0d1a4-ae75-40b9-beef-baa419cb33b9).

The following state MUST be kept by this protocol:

**dwDeviceId**: The [**device**](#gt_4712ded2-d927-4930-9450-29499f98cef4) id assigned by Remote Desktop Protocol: File System Virtual Channel Extension that identifies this protocol.

**rgSCardContextList**: List of contexts opened by the protocol server.

### Timers

None.

### Initialization

Initialization is triggered by the Remote Desktop Protocol: File System Virtual Channel Extension when it enumerates all pre-logon devices. At this time, [**TS client**](#gt_b9854a6a-0613-4b7a-95e4-c2b359b6021a) initialization is performed.

If the [**TS server**](#gt_37eb268d-1dd2-4413-9fa6-3af2cab291d3) [**operating system version**](#gt_91d2294e-258f-45c8-b246-5e1683ac4354) is earlier than 5.1, the device is not announced to the TS server

The **dwDeviceId** field MUST be set to the device Id selected by Remote Desktop Protocol: File System Virtual Channel Extension, and **rgSCardContextList** MUST be set to the empty list.

### Message Processing Events and Sequencing Rules

Only messages of type DR\_CONTROL\_REQ and DR\_CONTROL\_RSP (as specified in [[MS-RDPEFS]](%5BMS-RDPEFS%5D.pdf#Section_34d9de58b2b540b6b970f82d4603bdb5) sections 2.2.1.4.5 and 2.2.1.5.5, respectively) are valid for this protocol. All other messages MUST be processed according to the Remote Desktop Protocol: File System Virtual Channel Extension.

Only the control codes specified in the [**IOCTL**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) Processing Rules in the following table are valid. Invalid packets MUST be dropped without a reply.

|  Function number  |  Value for IoControlCode  |  IRP\_MJ\_DEVICE\_CONTROL request  |  Input packet, Output packet  |
| --- | --- | --- | --- |
| 5 | 0x00090014 | SCARD\_IOCTL\_ESTABLISHCONTEXT | [EstablishContext\_Call (section 2.2.2.1)](#Section_b990635a7637464a8923361ed3e3d67a), [EstablishContext\_Return (section 2.2.3.2)](#Section_9135d95f3740411bbdca34ac7571fddc) |
| 6 | 0x00090018 | SCARD\_IOCTL\_RELEASECONTEXT | [Context\_Call (section 2.2.2.2)](#Section_b11d26d9c3d54e968d9faba35cded852), [Long\_Return (section 2.2.3.3)](#Section_e77a13652379403799c4d30d14ba10fc) |
| 7 | 0x0009001C | SCARD\_IOCTL\_ISVALIDCONTEXT | Context\_Call (section 2.2.2.2), Long\_Return (section 2.2.3.3) |
| 8 | 0x00090020 | SCARD\_IOCTL\_LISTREADERGROUPSA | [ListReaderGroups\_Call (section 2.2.2.3)](#Section_dde8c811c258444f802898311a9e0082), [ListReaderGroups\_Return (section 2.2.3.4)](#Section_6630bb5bfc0e41418b53263225c7628d) |
| 9 | 0x00090024 | SCARD\_IOCTL\_LISTREADERGROUPSW | ListReaderGroups\_Call (section 2.2.2.3), ListReaderGroups\_Return (section 2.2.3.4) |
| 10 | 0x00090028 | SCARD\_IOCTL\_LISTREADERSA | [ListReaders\_Call (section 2.2.2.4)](#Section_be2f46a577fb40bf839caed45f0a26d7), ListReaders\_Return (section 2.2.3.4) |
| 11 | 0x0009002C | SCARD\_IOCTL\_LISTREADERSW | ListReaders\_Call (section 2.2.2.4), ListReaders\_Return (section 2.2.3.4) |
| 20 | 0x00090050 | SCARD\_IOCTL\_INTRODUCEREADERGROUPA | [ContextAndStringA\_Call (section 2.2.2.5)](#Section_a130c3df016c4ca1b85ead450fa4fe6d), Long\_Return (section 2.2.3.3) |
| 21 | 0x00090054 | SCARD\_IOCTL\_INTRODUCEREADERGROUPW | [ContextAndStringW\_Call (section 2.2.2.6)](#Section_a42d07ccb37b4fe49df92ba6320d72fa), Long\_Return (section 2.2.3.3) |
| 22 | 0x00090058 | SCARD\_IOCTL\_FORGETREADERGROUPA | ContextAndStringA\_Call (section 2.2.2.5), Long\_Return (section 2.2.3.3) |
| 23 | 0x0009005C | SCARD\_IOCTL\_FORGETREADERGROUPW | ContextAndStringW\_Call (section 2.2.2.6), Long\_Return (section 2.2.3.3) |
| 24 | 0x00090060 | SCARD\_IOCTL\_INTRODUCEREADERA | [ContextAndTwoStringA\_Call (section 2.2.2.7)](#Section_9ce7270caad546f78a10941cb94b57f5), Long\_Return (section 2.2.3.3) |
| 25 | 0x00090064 | SCARD\_IOCTL\_INTRODUCEREADERW | [ContextAndTwoStringW\_Call (section 2.2.2.8)](#Section_34bec62bb75c4729adb2f6033484fe6b), Long\_Return (section 2.2.3.3) |
| 26 | 0x00090068 | SCARD\_IOCTL\_FORGETREADERA | ContextAndStringA\_Call (section 2.2.2.5), Long\_Return (section 2.2.3.3) |
| 27 | 0x0009006C | SCARD\_IOCTL\_FORGETREADERW | ContextAndStringW\_Call (section 2.2.2.6), Long\_Return (section 2.2.3.3) |
| 28 | 0x00090070 | SCARD\_IOCTL\_ADDREADERTOGROUPA | ContextAndTwoStringA\_Call (section 2.2.2.7), Long\_Return (section 2.2.3.3) |
| 29 | 0x00090074 | SCARD\_IOCTL\_ADDREADERTOGROUPW | ContextAndTwoStringW\_Call (section 2.2.2.8), Long\_Return (section 2.2.3.3) |
| 30 | 0x00090078 | SCARD\_IOCTL\_REMOVEREADERFROMGROUPA | ContextAndTwoStringA\_Call (section 2.2.2.7), Long\_Return (section 2.2.3.3) |
| 31 | 0x0009007C | SCARD\_IOCTL\_REMOVEREADERFROMGROUPW | ContextAndTwoStringW\_Call (section 2.2.2.8), Long\_Return (section 2.2.3.3) |
| 38 | 0x00090098 | SCARD\_IOCTL\_LOCATECARDSA | [LocateCardsA\_Call (section 2.2.2.9)](#Section_c6b49a9899e643c0af6356e4918814f3), [LocateCards\_Return (section 2.2.3.5)](#Section_7b73e0c2e0fc46b19b0350684ad2beba) |
| 39 | 0x0009009C | SCARD\_IOCTL\_LOCATECARDSW | [LocateCardsW\_Call (section 2.2.2.10)](#Section_c40fb6716a504ae1b75df44b25612eb2), LocateCards\_Return (section 2.2.3.5) |
| 40 | 0x000900A0 | SCARD\_IOCTL\_GETSTATUSCHANGEA | [GetStatusChangeA\_Call (section 2.2.2.11)](#Section_3b559cd22c1949878163e22e974cdcdf), GetStatusChange\_Return (section 2.2.3.5) |
| 41 | 0x000900A4 | SCARD\_IOCTL\_GETSTATUSCHANGEW | [GetStatusChangeW\_Call (section 2.2.2.12)](#Section_af357ce863ee4577b6bfc6f5ca68d754), GetStatusChange\_Return (section 2.2.3.5) |
| 42 | 0x000900A8 | SCARD\_IOCTL\_CANCEL | Context\_Call (section 2.2.2.2), Long\_Return (section 2.2.3.3) |
| 43 | 0x000900AC | SCARD\_IOCTL\_CONNECTA | [ConnectA\_Call (section 2.2.2.13)](#Section_5201b332299b4b6a973394e873ffe8cc), [Connect\_Return (section 2.2.3.8)](#Section_ad9fbc8e096344ac8d7138021685790c) |
| 44 | 0x000900B0 | SCARD\_IOCTL\_CONNECTW | [ConnectW\_Call (section 2.2.2.14)](#Section_fd06f6a0a9ea478c9b5e470fd9cde5a6), Connect\_Return (section 2.2.3.8) |
| 45 | 0x000900B4 | SCARD\_IOCTL\_RECONNECT | [Reconnect\_Call (section 2.2.2.15)](#Section_9c1eca523a99403c8ac86437f246a154), [Reconnect\_Return (section 2.2.3.7)](#Section_e25a583fab824ba3bebfaf656c58e6d8) |
| 46 | 0x000900B8 | SCARD\_IOCTL\_DISCONNECT | [HCardAndDisposition\_Call (section 2.2.2.16)](#Section_f15ae8659e994c5bbb4315a6b4885bd0), Long\_Return (section 2.2.3.3) |
| 47 | 0x000900BC | SCARD\_IOCTL\_BEGINTRANSACTION | HCardAndDisposition\_Call (section 2.2.2.16), Long\_Return (section 2.2.3.3) |
| 48 | 0x000900C0 | SCARD\_IOCTL\_ENDTRANSACTION | HCardAndDisposition\_Call (section 2.2.2.16), Long\_Return (section 2.2.3.3) |
| 49 | 0x000900C4 | SCARD\_IOCTL\_STATE | [State\_Call (section 2.2.2.17)](#Section_ba3b909702fe4f6b951c05439a7d9da7), [State\_Return (section 2.2.3.9)](#Section_574e5ec596ba4b11bfa952eb34307356) |
| 50 | 0x000900C8 | SCARD\_IOCTL\_STATUSA | [Status\_Call (section 2.2.2.18)](#Section_f1139aede57847f3a800f36b56c80500), [Status\_Return (section 2.2.3.10)](#Section_987c1358ad6b4c8e88e106210c28a66f) |
| 51 | 0x000900CC | SCARD\_IOCTL\_STATUSW | Status\_Call (section 2.2.2.18), Status\_Return (section 2.2.3.10) |
| 52 | 0x000900D0 | SCARD\_IOCTL\_TRANSMIT | [Transmit\_Call (section 2.2.2.19)](#Section_e3861cfae61b4d64b19df6b31e076beb), [Transmit\_Return (section 2.2.3.11)](#Section_252cffd058b8434d9e1b0d547544fb0f) |
| 53 | 0x000900D4 | SCARD\_IOCTL\_CONTROL | [Control\_Call (section 2.2.2.20)](#Section_002fc3a32ca2492e8463aba8f3923e48), [Control\_Return (section 2.2.3.6)](#Section_e7e854f80c5a4814bfddb72cb8aefe3e) |
| 54 | 0x000900D8 | SCARD\_IOCTL\_GETATTRIB | [GetAttrib\_Call (section 2.2.2.21)](#Section_f4e36ff1e7b34046bddbcd192a76c7ab), [GetAttrib\_Return (section 2.2.3.12)](#Section_ab3ac0713fc544e69b94c1eee1168266) |
| 55 | 0x000900DC | SCARD\_IOCTL\_SETATTRIB | [SetAttrib\_Call (section 2.2.2.22)](#Section_28f8dd6035b745fbab7515bbf81f5d11), Long\_Return (section 2.2.3.3) |
| 56 | 0x000900E0 | SCARD\_IOCTL\_ACCESSSTARTEDEVENT | [ScardAccessStartedEvent\_Call (section 2.2.2.30)](#Section_c5ab8dd049144355960c0a527971ea69), Long\_Return (section 2.2.3.3) |
| 57 | 0x000900E4 | SCARD\_IOCTL\_RELEASETARTEDEVENT | Not used. |
| 58 | 0x000900E8 | SCARD\_IOCTL\_LOCATECARDSBYATRA | [LocateCardsByATRA\_Call (section 2.2.2.23)](#Section_100a5cc6cb6a4f90b0e4659b872c26d5), LocateCards\_Return (section 2.2.3.5) |
| 59 | 0x000900EC | SCARD\_IOCTL\_LOCATECARDSBYATRW | [LocateCardsByATRW\_Call (section 2.2.2.24)](#Section_c934cc70c1c941938b1b038d8055c000), LocateCards\_Return (section 2.2.3.5) |
| 60 | 0x000900F0 | SCARD\_IOCTL\_READCACHEA | [ReadCacheA\_Call (section 2.2.2.25)](#Section_ba203dbad5464e9db8cfafa22cf88c3d), [ReadCache\_Return (section 2.2.3.1)](#Section_da342355e37f485ea4903222a97fa356) |
| 61 | 0x000900F4 | SCARD\_IOCTL\_READCACHEW | [ReadCacheW\_Call (section 2.2.2.26)](#Section_f45705cf92994802b408685f02025e6a), ReadCache\_Return (section 2.2.3.1) |
| 62 | 0x000900F8 | SCARD\_IOCTL\_WRITECACHEA | [WriteCacheA\_Call (section 2.2.2.27)](#Section_31ce1b620c504441b3e08661635849fb), Long\_Return (section 2.2.3.3) |
| 63 | 0x000900FC | SCARD\_IOCTL\_WRITECACHEW | [WriteCacheW\_Call (section 2.2.2.28)](#Section_3969bdcdecf342db8bc62d6f970f9c67), Long\_Return (section 2.2.3.3) |
| 64 | 0x00090100 | SCARD\_IOCTL\_GETTRANSMITCOUNT | [GetTransmitCount\_Call (section 2.2.2.29)](#Section_f453f1b412914c698e97f781b2d8e66f), [GetTransmitCount\_Return (section 2.2.3.13)](#Section_32aea1d70edb4807bbd1a6ee1fbb0087) |
| 65 | 0x00090104 | SCARD\_IOCTL\_GETREADERICON | [GetReaderIcon\_Call (section 2.2.2.31)](#Section_e6a68d90697f4b988ad6f74853d27ccb), [GetReaderIcon\_Return (section 2.2.3.14)](#Section_f011f3d9e2a44c43a3364c89ecaa8360) |
| 66 | 0x00090108 | SCARD\_IOCTL\_GETDEVICETYPEID | [GetDeviceTypeId\_Call (section 2.2.2.32)](#Section_b5e18874c42d42eab1b13fd86a8a95f1), [GetDeviceTypeId\_Return (section 2.2.3.15)](#Section_fed90d29c41f490a86e97e88e42656b2) |

The [**TS client**](#gt_b9854a6a-0613-4b7a-95e4-c2b359b6021a) MUST be able to process multiple requests simultaneously within the limits of its resources.

Any errors from the [**Smart Cards for Windows**](#gt_c6f0d1a4-ae75-40b9-beef-baa419cb33b9) layer MUST be transferred to the [**TS server**](#gt_37eb268d-1dd2-4413-9fa6-3af2cab291d3) and MUST NOT be modified by the TS client. No exceptions are thrown in this protocol.

The following steps MUST be performed on each [**call packet**](#gt_0a68cff0-1e07-4a15-a4ee-e08fb398ed49) received:

1. The IoControlCode MUST be present, as specified in the preceding IOCTL Processing Rules table, for the specific protocol version implemented.[<2>](#Appendix_A_2" \o "Product behavior note 2)
2. The input data type is interpreted according to the IOCTL Processing Rules table. The data MUST be decoded as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2.2.6.
3. Processing MUST be performed according to the corresponding section that follows. On success, it MUST return a structure as specified in the preceding IOCTL Processing Rules table.
4. If the protocol encounters problems decoding the input or encoding the results, then DR\_DEVICE\_IOCOMPLETION.IOStatus (as specified in [MS-RDPEFS] section 2.2.1.5) MUST be set to an NTSTATUS code (as specified in [[MS-ERREF]](%5BMS-ERREF%5D.pdf#Section_1bc92ddfb79e413cbbaa99a5281a6c90) section 2.3), the most common of which appear in the following table.

|  Return value/code  |  Description  |
| --- | --- |
| STATUS\_NO\_MEMORY0xC0000017 | Not enough virtual memory or paging file quota is available to complete the specified operation. |
| STATUS\_UNSUCCESSFUL0xC0000001 | The requested operation was unsuccessful. |
| STATUS\_BUFFER\_TOO\_SMALL0xC0000023 | The buffer is too small to contain the entry. No information has been written to the buffer. |

1. On error, DR\_DEVICE\_IOCOMPLETION.Parameters.DeviceIOControl.OutputBufferLength MUST be set to zero and DR\_DEVICE\_IOCOMPLETION.Parameters.DeviceIOControl.OutputBuffer MUST set to NULL.
2. Otherwise, DR\_DEVICE\_IOCOMPLETION.IOStatus MUST be set to 0 (STATUS\_SUCCESS) and DR\_DEVICE\_IOCOMPLETION.Parameters.DeviceIOControl.OutputBuffer MUST contain an encoding of the structure (as specified in the preceding Message Processing Events and Sequencing Rules IOCTL Table) as specified in [MS-RPCE] section 2.2.6. DR\_DEVICE\_IOCOMPLETION.Parameters.DeviceIOControl.OutputBufferLength is the length of the data.
3. The return packet is then sent according to Remote Desktop Protocol: File System Virtual Channel Extension.

#### SCARD\_IOCTL\_ESTABLISHCONTEXT (IOCTL 0x00090014)

Establish Context creates a new [**Smart Cards for Windows**](#gt_c6f0d1a4-ae75-40b9-beef-baa419cb33b9) context specified for use in subsequent communication with Smart Cards for Windows.

Return Values: This method sets [EstablishContext\_Return](#Section_9135d95f3740411bbdca34ac7571fddc).ReturnCode to SCARD\_S\_SUCCESS on success; otherwise, it sets one of the smart card-specific errors or one of the return codes from Winerror.h. No specialized error codes are associated with this method.

If the call is successful, EstablishContext\_Return.Context MUST be added to the rgSCardContextList list maintained by this client.

#### SCARD\_IOCTL\_RELEASECONTEXT (IOCTL 0x00090018)

Release Context releases a previously established [**Smart Cards for Windows**](#gt_c6f0d1a4-ae75-40b9-beef-baa419cb33b9) context as specified in section [3.1.4.1](#Section_ea15ee619fac40ac96ebd9d63deee760). The context MUST exist in **rgSCardContextList**.

Return Values: This method sets Long\_Return.ReturnCode (for more information, see section [2.2.3.3](#Section_e77a13652379403799c4d30d14ba10fc)) to SCARD\_S\_SUCCESS on success; otherwise, it sets one of the smart card-specific errors or one of the return codes from Winerror.h. No specialized error codes are associated with this method.

If the call is successful, Context\_Call.Context (for more information, see section [2.2.2.2](#Section_b11d26d9c3d54e968d9faba35cded852)) is removed from rgSCardContextList.

#### SCARD\_IOCTL\_ISVALIDCONTEXT (IOCTL 0x0009001C)

Is Valid Context checks if a previously established [**Smart Cards for Windows**](#gt_c6f0d1a4-ae75-40b9-beef-baa419cb33b9) context from [SCARD\_IOCTL\_ESTABLISHCONTEXT](#Section_ea15ee619fac40ac96ebd9d63deee760) is still valid. For this call to succeed, Context\_Call.Context (for more information, see section [2.2.2.2](#Section_b11d26d9c3d54e968d9faba35cded852)) MUST exist in rgSCardContextList and the Smart Cards for Windows communication channel MUST still be present.

Return Values: This method sets Long\_Return.ReturnCode (for more information, see section [2.2.3.3](#Section_e77a13652379403799c4d30d14ba10fc)) to SCARD\_S\_SUCCESS on success; otherwise, it sets one of the smart card-specific errors or one of the return codes from Winerror.h. No specialized error codes are associated with this method.

#### SCARD\_IOCTL\_ACCESSSTARTEDEVENT (IOCTL 0x000900E0)

Access Started Event waits until [**Smart Cards for Windows**](#gt_c6f0d1a4-ae75-40b9-beef-baa419cb33b9) is running.

Return Values: This method sets Long\_Return.ReturnCode (for more information, see section [2.2.3.3](#Section_e77a13652379403799c4d30d14ba10fc)) to SCARD\_S\_SUCCESS if Smart Cards for Windows is running; otherwise, it sets one of the smart card-specific errors or one of the return codes from Winerror.h. No specialized error codes are associated with this method.

#### SCARD\_IOCTL\_LISTREADERGROUPSA (IOCTL 0x00090020)

The [**ASCII**](#gt_79fa85ca-ac61-467c-b819-e97dc1a7a599) version List Reader Groups returns the reader groups known to [**Smart Cards for Windows**](#gt_c6f0d1a4-ae75-40b9-beef-baa419cb33b9). [ListReaderGroups\_Return](#Section_6630bb5bfc0e41418b53263225c7628d) is constructed according to ListReaderGroups\_Return and ListReaders\_Return and the information in [ListReaderGroups\_Call](#Section_dde8c811c258444f802898311a9e0082).

Return Values: This method sets ListReaderGroups\_Return.ReturnCode (for more information, see section 2.2.3.4) to SCARD\_S\_SUCCESS on success; otherwise, it sets one of the smart card-specific errors or one of the return codes from Winerror.h. No specialized error codes are associated with this method.

#### SCARD\_IOCTL\_LISTREADERGROUPSW (IOCTL 0x00090024)

The [**Unicode**](#gt_c305d0ab-8b94-461a-bd76-13b40cb8c4d8) version List Reader Groups returns the reader groups known to [**Smart Cards for Windows**](#gt_c6f0d1a4-ae75-40b9-beef-baa419cb33b9). [ListReaderGroups\_Return](#Section_6630bb5bfc0e41418b53263225c7628d) is constructed according to ListReaderGroups\_Return and ListReaders\_Return and the information in [ListReaderGroups\_Call](#Section_dde8c811c258444f802898311a9e0082).

Return Values: This method sets ListReaderGroups\_Return.ReturnCode (for more information, see section 2.2.3.4) to SCARD\_S\_SUCCESS on success; otherwise, it sets one of the smart card-specific errors or one of the return codes from Winerror.h. No specialized error codes are associated with this method.

#### SCARD\_IOCTL\_LISTREADERSA (IOCTL 0x00090028)

The [**ASCII**](#gt_79fa85ca-ac61-467c-b819-e97dc1a7a599) version of List Readers returns the [**smart card readers**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0) known to [**Smart Cards for Windows**](#gt_c6f0d1a4-ae75-40b9-beef-baa419cb33b9). [ListReaders\_Return](#Section_6630bb5bfc0e41418b53263225c7628d) is constructed according to ListReaderGroups\_Return and ListReaders\_Return and [ListReaders\_Call](#Section_be2f46a577fb40bf839caed45f0a26d7).

Return Values: The method sets ListReaders\_Return.ReturnCode (for more information, see section 2.2.3.4) to SCARD\_S\_SUCCESS on success; otherwise, it sets one of the smart card-specific errors or one of the return codes from Winerror.h. No specialized error codes are associated with this method.

#### SCARD\_IOCTL\_LISTREADERSW (IOCTL 0x0009002C)

The [**Unicode**](#gt_c305d0ab-8b94-461a-bd76-13b40cb8c4d8) version of List Readers returns the [**smart card readers**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0) known to [**Smart Cards for Windows**](#gt_c6f0d1a4-ae75-40b9-beef-baa419cb33b9). [ListReaders\_Return](#Section_6630bb5bfc0e41418b53263225c7628d) is constructed according to ListReaderGroups\_Return and ListReaders\_Return and [ListReaders\_Call](#Section_be2f46a577fb40bf839caed45f0a26d7).

Return Values: The method sets ListReaders\_Return.ReturnCode (for more information, see section 2.2.3.4) to SCARD\_S\_SUCCESS on success; otherwise, it sets one of the smart card-specific errors or one of the return codes from Winerror.h. No specialized error codes are associated with this method.

#### SCARD\_IOCTL\_INTRODUCEREADERGROUPA (IOCTL 0x00090050)

The [**ASCII**](#gt_79fa85ca-ac61-467c-b819-e97dc1a7a599) version of Introduce Reader Group adds the reader group specified in ContextAndStringA\_Call.sz (for more information, see section [2.2.2.5](#Section_a130c3df016c4ca1b85ead450fa4fe6d)) to the list of reader groups known to [**Smart Cards for Windows**](#gt_c6f0d1a4-ae75-40b9-beef-baa419cb33b9).

Return Values: The method sets Long\_Return.ReturnCode (for more information, see section [2.2.3.3](#Section_e77a13652379403799c4d30d14ba10fc)) to SCARD\_S\_SUCCESS on success; otherwise, it sets one of the smart card-specific errors or one of the return codes from Winerror.h. No specialized error codes are associated with this method.

#### SCARD\_IOCTL\_INTRODUCEREADERGROUPW (IOCTL 0x00090054)

The [**Unicode**](#gt_c305d0ab-8b94-461a-bd76-13b40cb8c4d8) version of Introduce Reader Group adds the reader group specified in ContextAndStringW\_Call.sz (for more information, see section [2.2.2.6](#Section_a42d07ccb37b4fe49df92ba6320d72fa)) to the list of reader groups known to [**Smart Cards for Windows**](#gt_c6f0d1a4-ae75-40b9-beef-baa419cb33b9).

Return Values: The method sets Long\_Return.ReturnCode (for more information, see section [2.2.3.3](#Section_e77a13652379403799c4d30d14ba10fc)) to SCARD\_S\_SUCCESS on success; otherwise, it sets one of the smart card-specific errors or one of the return codes from Winerror.h. No specialized error codes are associated with this method.

#### SCARD\_IOCTL\_FORGETREADERGROUPA (IOCTL 0x00090058)

The [**ASCII**](#gt_79fa85ca-ac61-467c-b819-e97dc1a7a599) version of Forget Reader Group removes the reader group specified in ContextAndStringA\_Call.sz (for more information, see section [2.2.2.5](#Section_a130c3df016c4ca1b85ead450fa4fe6d)) from the list of reader groups known to the [**Smart Cards for Windows**](#gt_c6f0d1a4-ae75-40b9-beef-baa419cb33b9).

Return Values: The method sets Long\_Return.ReturnCode (for more information, see section [2.2.3.3](#Section_e77a13652379403799c4d30d14ba10fc)) to SCARD\_S\_SUCCESS on success; otherwise, it sets one of the smart card-specific errors or one of the return codes from Winerror.h. No specialized error codes are associated with this method.

#### SCARD\_IOCTL\_FORGETREADERGROUPW (IOCTL 0x0009005C)

The [**Unicode**](#gt_c305d0ab-8b94-461a-bd76-13b40cb8c4d8) version of Forget Reader Group removes the reader group specified in ContextAndStringW\_Call.sz (for more information, see section [2.2.2.6](#Section_a42d07ccb37b4fe49df92ba6320d72fa)) from the list of reader groups known to [**Smart Cards for Windows**](#gt_c6f0d1a4-ae75-40b9-beef-baa419cb33b9).

Return Values: The method sets Long\_Return.ReturnCode (for more information, see section [2.2.3.3](#Section_e77a13652379403799c4d30d14ba10fc)) to SCARD\_S\_SUCCESS on success; otherwise, it sets one of the smart card-specific errors or one of the return codes from Winerror.h. No specialized error codes are associated with this method.

#### SCARD\_IOCTL\_INTRODUCEREADERA (IOCTL 0x00090060)

The [**ASCII**](#gt_79fa85ca-ac61-467c-b819-e97dc1a7a599) version of Introduce Reader adds the [**device name**](#gt_7e3a529b-9f51-4783-a851-1ee34517bbb9) specified in ContextAndTwoStringA\_Call.sz2 (for more information, see section [2.2.2.7](#Section_9ce7270caad546f78a10941cb94b57f5)) to the [**smart card reader**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0) specified in ContextAndTwoStringA\_Call.sz1.

Return Values: The method sets Long\_Return.ReturnCode (for more information, see section [2.2.3.3](#Section_e77a13652379403799c4d30d14ba10fc)) to SCARD\_S\_SUCCESS on success; otherwise, it sets one of the smart card-specific errors or one of the return codes from Winerror.h. No specialized error codes are associated with this method.

#### SCARD\_IOCTL\_INTRODUCEREADERW (IOCTL 0x00090064)

The [**Unicode**](#gt_c305d0ab-8b94-461a-bd76-13b40cb8c4d8) version of Introduce Reader adds the [**device name**](#gt_7e3a529b-9f51-4783-a851-1ee34517bbb9) specified in ContextAndTwoStringW\_Call.sz2 (for more information, see section [2.2.2.8](#Section_34bec62bb75c4729adb2f6033484fe6b)) to the [**smart card reader**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0) specified in ContextAndTwoStringW\_Call.sz1.

Return Values: The method sets Long\_Return.ReturnCode (for more information, see section [2.2.3.3](#Section_e77a13652379403799c4d30d14ba10fc)) to SCARD\_S\_SUCCESS on success; otherwise, it sets one of the smart card-specific errors or one of the return codes from Winerror.h. No specialized error codes are associated with this method.

#### SCARD\_IOCTL\_FORGETREADERA (IOCTL 0x00090068)

The [**ASCII**](#gt_79fa85ca-ac61-467c-b819-e97dc1a7a599) version of Forget Reader removes the [**smart card reader**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0) specified in ContextAndStringA\_Call.sz (for more information, see section [2.2.2.5](#Section_a130c3df016c4ca1b85ead450fa4fe6d)) from the list of smart card readers known to [**Smart Cards for Windows**](#gt_c6f0d1a4-ae75-40b9-beef-baa419cb33b9).

Return Values: The method sets Long\_Return.ReturnCode (for more information, see section [2.2.3.3](#Section_e77a13652379403799c4d30d14ba10fc)) to SCARD\_S\_SUCCESS on success; otherwise, it sets one of the smart card-specific errors or one of the return codes from Winerror.h. No specialized error codes are associated with this method.

#### SCARD\_IOCTL\_FORGETREADERW (IOCTL 0x0009006C)

The [**Unicode**](#gt_c305d0ab-8b94-461a-bd76-13b40cb8c4d8) version of Forget Reader removes the [**smart card reader**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0) specified in ContextAndStringW\_Call.sz (for more information, see section [2.2.2.6](#Section_a42d07ccb37b4fe49df92ba6320d72fa)) from the list of smart card readers known to [**Smart Cards for Windows**](#gt_c6f0d1a4-ae75-40b9-beef-baa419cb33b9).

Return Values: The method sets Long\_Return.ReturnCode (for more information, see section [2.2.3.3](#Section_e77a13652379403799c4d30d14ba10fc)) to SCARD\_S\_SUCCESS on success; otherwise, it sets one of the smart card-specific errors or one of the return codes from Winerror.h. No specialized error codes are associated with this method.

#### SCARD\_IOCTL\_ADDREADERTOGROUPA (IOCTL 0x00090070)

The [**ASCII**](#gt_79fa85ca-ac61-467c-b819-e97dc1a7a599) version of Add Reader to Group adds the [**smart card reader**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0) specified in ContextAndTwoStringA\_Call.sz2 (for more information, see section [2.2.2.7](#Section_9ce7270caad546f78a10941cb94b57f5)).

Return Values: The method sets Long\_Return.ReturnCode (for more information, see section [2.2.3.3](#Section_e77a13652379403799c4d30d14ba10fc)) to SCARD\_S\_SUCCESS on success; otherwise, it sets one of the smart card-specific errors or one of the return codes from Winerror.h. No specialized error codes are associated with this method.

#### SCARD\_IOCTL\_ADDREADERTOGROUPW (IOCTL 0x00090074)

The [**Unicode**](#gt_c305d0ab-8b94-461a-bd76-13b40cb8c4d8) version of Add Reader to Group adds the [**smart card reader**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0) specified in ContextAndTwoStringW\_Call.sz2 (for more information, see section [2.2.2.8](#Section_34bec62bb75c4729adb2f6033484fe6b)).

Return Values: The method sets Long\_Return.ReturnCode (for more information, see section [2.2.3.3](#Section_e77a13652379403799c4d30d14ba10fc)) to SCARD\_S\_SUCCESS on success; otherwise, it sets one of the smart card-specific errors or one of the return codes from Winerror.h. No specialized error codes are associated with this method.

#### SCARD\_IOCTL\_REMOVEREADERFROMGROUPA (IOCTL 0x00090078)

The [**ASCII**](#gt_79fa85ca-ac61-467c-b819-e97dc1a7a599) version of Remove Reader From Group removes the [**smart card reader**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0) specified in ContextAndTwoStringA\_Call.sz2 (for more information, see section [2.2.2.7](#Section_9ce7270caad546f78a10941cb94b57f5)).

Return Values: The method sets Long\_Return.ReturnCode (for more information, see section [2.2.3.3](#Section_e77a13652379403799c4d30d14ba10fc)) to SCARD\_S\_SUCCESS on success; otherwise, it sets one of the smart card-specific errors or one of the return codes from Winerror.h. No specialized error codes are associated with this method.

#### SCARD\_IOCTL\_REMOVEREADERFROMGROUPW (IOCTL 0x0009007C)

The [**Unicode**](#gt_c305d0ab-8b94-461a-bd76-13b40cb8c4d8) version of Remove Reader From Group removes the [**smart card reader**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0) specified in ContextAndTwoStringW\_Call.sz2 (for more information, see section [2.2.2.8](#Section_34bec62bb75c4729adb2f6033484fe6b)).

Return Values: The method sets Long\_Return.ReturnCode (for more information, see section [2.2.3.3](#Section_e77a13652379403799c4d30d14ba10fc)) to SCARD\_S\_SUCCESS on success; otherwise, it sets one of the smart card-specific errors or one of the return codes from Winerror.h. No specialized error codes are associated with this method.

#### SCARD\_IOCTL\_LOCATECARDSA (IOCTL 0x00090098)

The [**ASCII**](#gt_79fa85ca-ac61-467c-b819-e97dc1a7a599) version of Locate Cards searches the readers specified in LocateCardsA\_Call.mszCards (for more information, see section [2.2.2.9](#Section_c6b49a9899e643c0af6356e4918814f3)). Unknown [**Card Types**](#gt_51da9457-65ce-4157-a704-d2d6232037d2) MUST be ignored. [LocateCards\_Return](#Section_7b73e0c2e0fc46b19b0350684ad2beba) is constructed according to LocateCards\_Return and GetStatusChange\_Return by using the information in LocateCardsA\_Call.

Return Values: The method sets LocateCards\_Return.ReturnCode (for more information, see section 2.2.3.5) to SCARD\_S\_SUCCESS on success; otherwise, it sets one of the smart card-specific errors or one of the return codes from Winerror.h. No specialized error codes are associated with this method.

#### SCARD\_IOCTL\_LOCATECARDSW (IOCTL 0x0009009C)

The [**Unicode**](#gt_c305d0ab-8b94-461a-bd76-13b40cb8c4d8) version of Locate Cards searches the readers specified in LocateCardsW\_Call.mszCards (for more information, see section [2.2.2.10](#Section_c40fb6716a504ae1b75df44b25612eb2)). Unknown [**Card Types**](#gt_51da9457-65ce-4157-a704-d2d6232037d2) MUST be ignored. [LocateCards\_Return](#Section_7b73e0c2e0fc46b19b0350684ad2beba) is constructed according to LocateCards\_Return and GetStatusChange\_Return by using the information in LocateCardsW\_Call.

Return Values: The method sets LocateCards\_Return.ReturnCode to SCARD\_S\_SUCCESS on success; otherwise it sets one of the smart card-specific errors or one of the return codes from Winerror.h. No specialized error codes are associated with this method.

#### SCARD\_IOCTL\_GETSTATUSCHANGEA (IOCTL 0x000900A0)

The [**ASCII**](#gt_79fa85ca-ac61-467c-b819-e97dc1a7a599) version of Get Status Change monitors the [**smart card readers**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0) specified in GetStatusChangeA\_Call.rgReaderStates (for more information, see section [2.2.2.11](#Section_3b559cd22c1949878163e22e974cdcdf)) MUST correctly represent the state of the Readers as known by [**Smart Cards for Windows**](#gt_c6f0d1a4-ae75-40b9-beef-baa419cb33b9).

Return Values: The method sets [GetStatusChange\_Return](#Section_7b73e0c2e0fc46b19b0350684ad2beba).ReturnCode to SCARD\_S\_SUCCESS on success; otherwise, it sets one of the smart card-specific errors or one of the return codes from Winerror.h. No specialized error codes are associated with this method.

#### SCARD\_IOCTL\_GETSTATUSCHANGEW (IOCTL 0x000900A4)

The [**Unicode**](#gt_c305d0ab-8b94-461a-bd76-13b40cb8c4d8) version of Get Status Change monitors the [**smart card readers**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0) specified in GetStatusChangeW\_Call.rgReaderStates (for more information, see section [2.2.2.12](#Section_af357ce863ee4577b6bfc6f5ca68d754)) MUST correctly represent the state of the readers as known by [**Smart Cards for Windows**](#gt_c6f0d1a4-ae75-40b9-beef-baa419cb33b9).

Return Values: The method sets [GetStatusChange\_Return](#Section_7b73e0c2e0fc46b19b0350684ad2beba).ReturnCode to SCARD\_S\_SUCCESS on success; otherwise, it sets one of the smart card-specific errors or one of the return codes from Winerror.h. No specialized error codes are associated with this method.

#### SCARD\_IOCTL\_LOCATECARDSBYATRA (IOCTL 0x000900E8)

The [**ASCII**](#gt_79fa85ca-ac61-467c-b819-e97dc1a7a599) version of Locate Cards By ATR searches the Readers specified in LocateCardsByATRA\_Call.rgAtrMasks (for more information, see section [2.2.2.23](#Section_100a5cc6cb6a4f90b0e4659b872c26d5)). Unknown [**card types**](#gt_51da9457-65ce-4157-a704-d2d6232037d2) MUST be ignored. [LocateCards\_Return](#Section_7b73e0c2e0fc46b19b0350684ad2beba) is constructed according to LocateCards\_Return and GetStatusChange\_Return by using the information in LocateCardsByATRA\_Call.

Return Values: The method sets LocateCards\_Return.ReturnCode (for more information, see section 2.2.3.5) to SCARD\_S\_SUCCESS on success; otherwise, it sets one of the smart card-specific errors or one of the return codes from Winerror.h. No specialized error codes are associated with this method.

#### SCARD\_IOCTL\_LOCATECARDSBYATRW (IOCTL 0x000900EC)

The [**Unicode**](#gt_c305d0ab-8b94-461a-bd76-13b40cb8c4d8) version of Locate Cards By ATR searches the readers specified in LocateCardsByATRW\_Call.rgAtrMasks ([LocateCardsByATRW\_Call](#Section_c934cc70c1c941938b1b038d8055c000)). Unknown [**Card Types**](#gt_51da9457-65ce-4157-a704-d2d6232037d2) MUST be ignored. [LocateCards\_Return](#Section_7b73e0c2e0fc46b19b0350684ad2beba) is constructed according to LocateCards\_Return and GetStatusChange\_Return by using the information in LocateCardsByATRW\_Call.

Return Values: The method sets LocateCards\_Return.ReturnCode (for more information, see section 2.2.3.5) to SCARD\_S\_SUCCESS on success; otherwise, it sets one of the smart card-specific errors or one of the return codes from Winerror.h. No specialized error codes are associated with this method.

#### SCARD\_IOCTL\_CANCEL (IOCTL 0x000900A8)

The Cancel method MUST instruct [**Smart Cards for Windows**](#gt_c6f0d1a4-ae75-40b9-beef-baa419cb33b9) to cancel any outstanding calls by using the context specified by Context\_Call.Context (for more information, see section [2.2.2.2](#Section_b11d26d9c3d54e968d9faba35cded852)).

Return Values: The method sets Long\_Return.ReturnCode (for more information, see section [2.2.3.3](#Section_e77a13652379403799c4d30d14ba10fc)) to SCARD\_S\_SUCCESS on success; otherwise, it sets one of the smart card-specific errors or one of the return codes from Winerror.h. No specialized error codes are associated with this method.

#### SCARD\_IOCTL\_CONNECTA (IOCTL 0x000900AC)

The [**ASCII**](#gt_79fa85ca-ac61-467c-b819-e97dc1a7a599) version of Connect establishes a handle to a [**smart card reader**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0). On success, [Connect\_Return](#Section_ad9fbc8e096344ac8d7138021685790c) is initialized according to [Control\_Return](#Section_e7e854f80c5a4814bfddb72cb8aefe3e).

Return Values: The method sets the Connect\_Return.ReturnCode (for more information, see section 2.2.3.8) to SCARD\_S\_SUCCESS on success; otherwise, it sets one of the smart card-specific errors or one of the return codes from Winerror.h. No specialized error codes are associated with this method.

#### SCARD\_IOCTL\_CONNECTW (IOCTL 0x000900B0)

The [**Unicode**](#gt_c305d0ab-8b94-461a-bd76-13b40cb8c4d8) version of Connect establishes a [**smart card reader**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0) handle. On success, [Connect\_Return](#Section_ad9fbc8e096344ac8d7138021685790c) is initialized according to [Control\_Return](#Section_e7e854f80c5a4814bfddb72cb8aefe3e) and the caller is given a handle to execute additional methods on the reader.

Return Values: The method sets the Connect\_Return.ReturnCode (for more information, see section 2.2.3.8) to SCARD\_S\_SUCCESS on success; otherwise, it sets one of the smart card-specific errors or one of the return codes from Winerror.h. No specialized error codes are associated with this method.

#### SCARD\_IOCTL\_DISCONNECT (IOCTL 0x000900B8)

The disconnect method releases a [**smart card reader**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0) handle that was acquired in [ConnectA\_Call](#Section_5201b332299b4b6a973394e873ffe8cc) or [ConnectW\_Call](#Section_fd06f6a0a9ea478c9b5e470fd9cde5a6),using [HCardAndDisposition\_Call](#Section_f15ae8659e994c5bbb4315a6b4885bd0).dwDisposition. After a successful call, The smart card reader handle is released and MUST be made available to the system.

Return Values: The method sets [Long\_Return](#Section_e77a13652379403799c4d30d14ba10fc).ReturnCode to SCARD\_S\_SUCCESS on success; otherwise, it sets one of the smart card-specific errors or one of the return codes from Winerror.h. No specialized error codes are associated with this method.

#### SCARD\_IOCTL\_BEGINTRANSACTION (IOCTL 0x000900BC)

The Begin Transaction method locks a [**smart card reader**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0) for exclusive access for the specified smart card reader handle. If the caller is unable to receive exclusive access, this call MUST block until the request can be met.

Return Values: The method sets Long\_Return.ReturnCode (for more information, see section [2.2.3.3](#Section_e77a13652379403799c4d30d14ba10fc)) to SCARD\_S\_SUCCESS on success; otherwise, it sets one of the smart card-specific errors or one of the return codes from Winerror.h. No specialized error codes are associated with this method.

#### SCARD\_IOCTL\_ENDTRANSACTION (IOCTL 0x000900C0)

The End Transaction method releases a [**smart card reader**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0) after being locked by a previously successful call to Begin Transaction (for more information, see section [3.1.4.31](#Section_9961866a6d4944bd8c83fcd63e23e7e9)).

Return Values: The method sets Long\_Return.ReturnCode (for more information, see section [2.2.3.3](#Section_e77a13652379403799c4d30d14ba10fc)) to SCARD\_S\_SUCCESS on success; otherwise, it sets one of the smart card-specific errors or one of the return codes from Winerror.h. No specialized error codes are associated with this method.

#### SCARD\_IOCTL\_STATUSA (IOCTL 0x000900C8)

The [**ASCII**](#gt_79fa85ca-ac61-467c-b819-e97dc1a7a599) version of the Status call returns the current state of the [**smart card reader**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0) and any [**smart card**](#gt_7c0fcc4a-476a-4d3a-87c0-7a503c14ef05) inserted. On success, Status\_Return MUST be initialized according to [Status\_Return](#Section_987c1358ad6b4c8e88e106210c28a66f).

Return Values: The method sets Status\_Return.ReturnCode (for more information, see section 2.2.3.10) to SCARD\_S\_SUCCESS on success; otherwise, it sets one of the smart card-specific errors or one of the return codes from Winerror.h. No specialized error codes are associated with this method.

#### SCARD\_IOCTL\_STATUSW (IOCTL 0x000900CC)

The [**Unicode**](#gt_c305d0ab-8b94-461a-bd76-13b40cb8c4d8) version of the Status call returns the current state of the [**smart card reader**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0) and any [**smart card**](#gt_7c0fcc4a-476a-4d3a-87c0-7a503c14ef05) inserted. On success, Status\_Return MUST be initialized according to [Status\_Return](#Section_987c1358ad6b4c8e88e106210c28a66f).

Return Values: The method sets Status\_Return.ReturnCode (for more information, see section 2.2.3.10) to SCARD\_S\_SUCCESS on success; otherwise, it sets one of the smart card-specific errors or one of the return codes from Winerror.h. No specialized error codes are associated with this method.

#### SCARD\_IOCTL\_TRANSMIT (IOCTL 0x000900D0)

The Transmit function sends a command to a [**smart card**](#gt_7c0fcc4a-476a-4d3a-87c0-7a503c14ef05) inserted to the [**smart card reader**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0) associated with the smart card reader handle. On success, the command has been successfully sent to the card and the response has been placed in [Transmit\_Return](#Section_252cffd058b8434d9e1b0d547544fb0f).

Return Values: The method sets Transmit\_Return.ReturnCode (for more information, see section 2.2.3.11) to SCARD\_S\_SUCCESS on success; otherwise, it sets one of the smart card-specific errors or one of the return codes from Winerror.h. No specialized error codes are associated with this method.

#### SCARD\_IOCTL\_RECONNECT (IOCTL 0x000900B4)

The reconnect method re-establishes a [**smart card reader**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0) handle. On success, the handle is valid once again.

Return Values: The method sets Reconnect\_Return.ReturnCode (for more information, see section [2.2.3.7](#Section_e25a583fab824ba3bebfaf656c58e6d8)) to SCARD\_S\_SUCCESS on success; otherwise, it sets one of the smart card-specific errors or one of the return codes from Winerror.h. No specialized error codes are associated with this method.

#### SCARD\_IOCTL\_CONTROL (IOCTL 0x000900D4)

The Control function sends a command to a [**smart card reader**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0) associated with the smart card reader handle. On success, the command has been successfully sent to the smart card reader and the response has been placed in [Control\_Return](#Section_e7e854f80c5a4814bfddb72cb8aefe3e).

Return Values: The method sets Control\_Return.ReturnCode (for more information, see section 2.2.3.6) to SCARD\_S\_SUCCESS on success; otherwise, it sets one of the smart card-specific errors or one of the return codes from Winerror.h. No specialized error codes are associated with this method.

#### SCARD\_IOCTL\_GETATTRIB (IOCTL 0x000900D8)

The Get Attribute function requests an attribute of the [**smart card reader**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0) associated with the smart card reader handle. On success, the attribute is copied to [GetAttrib\_Return](#Section_ab3ac0713fc544e69b94c1eee1168266).

Return Values: The method sets GetAttrib\_Return.ReturnCode (for more information, see section 2.2.3.12) to SCARD\_S\_SUCCESS on success; otherwise, it sets one of the smart card-specific errors or one of the return codes from Winerror.h. No specialized error codes are associated with this method.

#### SCARD\_IOCTL\_SETATTRIB (IOCTL 0x000900DC)

The Set Attribute function changes the value of an attribute of the [**smart card reader**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0) associated with the smart card reader handle.

Return Values: The method sets Long\_Return.ReturnCode (for more information, see section [2.2.3.3](#Section_e77a13652379403799c4d30d14ba10fc)) to SCARD\_S\_SUCCESS on success; otherwise, it sets one of the smart card-specific errors or one of the return codes from Winerror.h. No specialized error codes are associated with this method.

#### SCARD\_IOCTL\_STATE (IOCTL 0x000900C4)

The State method returns the current state of the [**smart card reader**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0) and any [**smart card**](#gt_7c0fcc4a-476a-4d3a-87c0-7a503c14ef05) inserted. On success, [Status\_Return](#Section_987c1358ad6b4c8e88e106210c28a66f) MUST be initialized as specified in section 2.2.3.10.

Return Values: The method sets State\_Return.ReturnCode (for more information, see section [2.2.3.9](#Section_574e5ec596ba4b11bfa952eb34307356)) to SCARD\_S\_SUCCESS on success; otherwise, it sets one of the smart card-specific errors or one of the return codes from Winerror.h. No specialized error codes are associated with this method.

#### SCARD\_IOCTL\_GETTRANSMITCOUNT (IOCTL 0x00090100)

The Get Transmit Count retrieves the number of times a successful Transmit method (for more information, see section [3.1.4.35](#Section_0b24a330795048f8ade9fb90d51d0546)) has been performed on the [**smart card reader**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0). On success, [GetTrasmitCount\_Return](#Section_32aea1d70edb4807bbd1a6ee1fbb0087) MUST be initialized as specified in section 2.2.3.13.

Return Values: The method sets State\_Return.ReturnCode (for more information, see section [2.2.3.9](#Section_574e5ec596ba4b11bfa952eb34307356)) to SCARD\_S\_SUCCESS on success; otherwise, it sets one of the smart card-specific errors or one of the return codes from Winerror.h. No specialized error codes are associated with this method.

#### SCARD\_IOCTL\_READCACHEA (IOCTL 0x000900F0)

The [**ASCII**](#gt_79fa85ca-ac61-467c-b819-e97dc1a7a599) version of Read Cache retrieves cached data for a specific [**smart card**](#gt_7c0fcc4a-476a-4d3a-87c0-7a503c14ef05). Data is cached according to the smart card [**UUID**](#gt_c4813fc3-b2e5-4aa3-bde7-421d950d68d3) (ReadCacheA\_Call.Common.CardIdentifier; for more information, see section [2.2.1.9](#Section_3f9e07fa66e2498b920c39531709116b)), the Card Lookup Name (ReadCacheA\_Call.szLookupName; for more information, see section [2.2.2.25](#Section_ba203dbad5464e9db8cfafa22cf88c3d)), and the freshness of the data (ReadCacheA\_Call.Common.FreshnessCounter; for more information, see section 2.2.1.9). All three MUST match in order for this call to be successful. On success, ReadCache\_Return MUST be initialized as specified in section [2.2.3.1](#Section_da342355e37f485ea4903222a97fa356).

Return Values: The method sets ReadCache\_Return.ReturnCode (for more information, see section 2.2.3.1) to SCARD\_S\_SUCCESS on success; otherwise, it sets one of the smart card-specific errors or one of the return codes from Winerror.h. No specialized error codes are associated with this method.

#### SCARD\_IOCTL\_READCACHEW (IOCTL 0x000900F4)

The [**Unicode**](#gt_c305d0ab-8b94-461a-bd76-13b40cb8c4d8) version of Read Cache retrieves cached data for a specific [**smart card**](#gt_7c0fcc4a-476a-4d3a-87c0-7a503c14ef05) in a [**Smart Cards for Windows**](#gt_c6f0d1a4-ae75-40b9-beef-baa419cb33b9) cache. Data is cached according to the smart card [**UUID**](#gt_c4813fc3-b2e5-4aa3-bde7-421d950d68d3) (ReadCacheA\_Call.Common.CardIdentifier; for more information, see section [2.2.1.9](#Section_3f9e07fa66e2498b920c39531709116b)), the Card Lookup Name (ReadCacheW\_Call.szLookupName; for more information, see section [2.2.2.26](#Section_f45705cf92994802b408685f02025e6a)), and the freshness of the data (ReadCacheW\_Call.Common.FreshnessCounter; for more information, see section 2.2.1.9). All three MUST match in order for this call to be successful. On success, ReadCache\_Return MUST be initialized as specified in section [2.2.3.1](#Section_da342355e37f485ea4903222a97fa356).

Return Values: The method sets ReadCache\_Return.ReturnCode (for more information, see section 2.2.3.1) to SCARD\_S\_SUCCESS on success; otherwise, it sets one of the smart card-specific errors or one of the return codes from Winerror.h. No specialized error codes are associated with this method.

#### SCARD\_IOCTL\_WRITECACHEA (IOCTL 0x000900F8)

The [**ASCII**](#gt_79fa85ca-ac61-467c-b819-e97dc1a7a599) version of Write Cache stores data for a specific [**smart card**](#gt_7c0fcc4a-476a-4d3a-87c0-7a503c14ef05) in a [**Smart Cards for Windows**](#gt_c6f0d1a4-ae75-40b9-beef-baa419cb33b9) cache. Data is cached according to the smart card [**UUID**](#gt_c4813fc3-b2e5-4aa3-bde7-421d950d68d3) (ReadCacheA\_Call.szLookupName; for more information, see section [2.2.2.25](#Section_ba203dbad5464e9db8cfafa22cf88c3d)), and the freshness of the data (ReadCacheA\_Call.Common.FreshnessCounter).

Return Values: The method sets Long\_Return.ReturnCode (for more information, see section [2.2.3.3](#Section_e77a13652379403799c4d30d14ba10fc)) to SCARD\_S\_SUCCESS on success; otherwise, it sets one of the smart card-specific errors or one of the return codes from Winerror.h. No specialized error codes are associated with this method

#### SCARD\_IOCTL\_WRITECACHEW (IOCTL 0x000900FC)

The [**Unicode**](#gt_c305d0ab-8b94-461a-bd76-13b40cb8c4d8) version of Write Cache stores data for a specific [**smart card**](#gt_7c0fcc4a-476a-4d3a-87c0-7a503c14ef05) in a [**Smart Cards for Windows**](#gt_c6f0d1a4-ae75-40b9-beef-baa419cb33b9) cache. Data is cached according to the smart card [**UUID**](#gt_c4813fc3-b2e5-4aa3-bde7-421d950d68d3) (ReadCacheA\_Call.szLookupName; for more information, see section [2.2.2.25](#Section_ba203dbad5464e9db8cfafa22cf88c3d)), and the freshness of the data (ReadCacheA\_Call.Common.FreshnessCounter).

Return Values: The method sets Long\_Return.ReturnCode (for more information, see section [2.2.3.3](#Section_e77a13652379403799c4d30d14ba10fc)) to SCARD\_S\_SUCCESS on success; otherwise, it sets one of the smart card-specific errors or one of the return codes from Winerror.h. No specialized error codes are associated with this method

#### SCARD\_IOCTL\_RELEASETARTEDEVENT

The SCARD\_IOCTL\_RELEASETARTEDEVENT IOCTL value is not used.

#### SCARD\_IOCTL\_GETREADERICON (IOCTL 0x00090104)

Get Reader Icon retrieves the icon from the INF file for a specific smart card reader name (for more information, see **GetReaderIcon\_Call.szReaderName**, section [2.2.2.31](#Section_e6a68d90697f4b988ad6f74853d27ccb)). On success, **GetReaderIcon\_Return.pbData** contains the icon; for more information, see section [2.2.3.14](#Section_f011f3d9e2a44c43a3364c89ecaa8360).

Return Values: This method sets **GetReaderIcon\_Return.ReturnCode** (for more information, see section 2.2.3.14) to SCARD\_S\_SUCCESS on success; otherwise, it sets one of the smart card–specific errors or another error code. No specialized error codes are associated with this method.

#### SCARD\_IOCTL\_GETDEVICETYPEID (IOCTL 0x00090108)

Get Device Type ID retrieves the device type from the INF file for a specific smart card reader name (**GetDeviceTypeId\_Call.szReaderName**; for more information, see section [2.2.2.32](#Section_b5e18874c42d42eab1b13fd86a8a95f1)). On success, **GetDeviceTypeId\_Return.dwDeviceId** contains the device type ID; for more information, see section [2.2.3.15](#Section_fed90d29c41f490a86e97e88e42656b2).

Return Values: This method sets **GetDeviceTypeId\_Return.ReturnCode** (for more information, see section 2.2.3.15) to SCARD\_S\_SUCCESS on success; otherwise, it sets one of the smart card–specific errors or another error code. No specialized error codes are associated with this method.

### Timer Events

None.

### Other Local Events

On protocol termination, the following actions are performed.

For each context in rgSCardContextList, [Cancel](#Section_195c8f3aa32341419ae833944fd50459) is called causing all outstanding messages to be processed. After there are no more outstanding messages, [Release Context](#Section_6d93ff3daabd402f8d6ce8c126a8e6f3) is called on each context and the context MUST be removed from rgSCardContextList.

## Protocol Client Details

### Abstract Data Model

This section describes a conceptual model of possible data organization that an implementation maintains to participate in this protocol. The described organization is provided to facilitate the explanation of how the protocol behaves. This document does not mandate that implementations adhere to this model provided that their external behavior is consistent with that described in this document.

The following state MUST be kept by this protocol:

**dwDeviceId**: device ID of [**smart card**](#gt_7c0fcc4a-476a-4d3a-87c0-7a503c14ef05) redirection [**device**](#gt_4712ded2-d927-4930-9450-29499f98cef4).

**rgOutstandingMessages**: Outstanding [**call packets**](#gt_0a68cff0-1e07-4a15-a4ee-e08fb398ed49) have not received a [**return packet**](#gt_9034c963-c719-4e13-86be-c597ea184431).

### Timers

No timers are required.

### Initialization

Initialization occurs when the [**protocol server**](#gt_6b91e507-0e17-41de-897c-356606d07088) sends a device-announce message according to Remote Desktop Protocol: File System Virtual Channel Extension. At that time, **dwDeviceId** MUST receive the unique device ID announced. The **rgOutstandingMessage** field MUST be set to the empty list.

### Higher-Layer Triggered Events

None.

### Message Processing Events and Sequencing Rules

#### Sending Outgoing Messages

Messages are constructed according to Remote Desktop Protocol: File System Virtual Channel Extension as a [**device**](#gt_4712ded2-d927-4930-9450-29499f98cef4) [**I/O control**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) message on the redirected device **dwDeviceId**. The [**call packet**](#gt_0a68cff0-1e07-4a15-a4ee-e08fb398ed49) MUST follow the format specified in IOCTL Processing Rules. The structure MUST be encoded as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2. The output buffer length SHOULD be set to 2,048 bytes.

The message is sent to the [**protocol server**](#gt_6b91e507-0e17-41de-897c-356606d07088) by using a transport as specified in [[MS-RDPEFS]](%5BMS-RDPEFS%5D.pdf#Section_34d9de58b2b540b6b970f82d4603bdb5) section 2.1.

#### Processing Incoming Replies

The following steps MUST be applied to each message when they are received.

If IOStatus is STATUS\_BUFFER\_TOO\_SMALL, then the message SHOULD be retransmitted according to [Sending Outgoing Messages](#Section_1be3db42a359491b91b14479e5f4c4b2), doubling the previously requested buffer length.

If IOStatus is zero, the corresponding IoControlCode-specific reply processing MUST be performed.

Otherwise, the call is considered a failure and the error MUST be propagated to the higher layer.

#### Messages

##### Sending EstablishContext Message

[**IoControlCode**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) MUST be set to [SCARD\_IOCTL\_ESTABLISHCONTEXT](#Section_ea15ee619fac40ac96ebd9d63deee760).

[EstablishContext\_Call](#Section_b990635a7637464a8923361ed3e3d67a) MUST be initialized as specified in section 2.2.2.1.

##### Processing EstablishContext Reply

The OutputBuffer MUST be decoded as [EstablishContext\_Return](#Section_9135d95f3740411bbdca34ac7571fddc), as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2.2.6.

##### Sending ReleaseContext Message

[**IoControlCode**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) MUST be set to [SCARD\_IOCTL\_RELEASECONTEXT](#Section_6d93ff3daabd402f8d6ce8c126a8e6f3).

[Context\_Call](#Section_b11d26d9c3d54e968d9faba35cded852) MUST be initialized, as specified in section 2.2.2.2.

##### Processing ReleaseContext Reply

The response message MUST be decoded as [Long\_Return](#Section_e77a13652379403799c4d30d14ba10fc), as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2.2.6.

##### Sending IntroduceReader (ASCII) Message

[**IoControlCode**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) MUST be set to [SCARD\_IOCTL\_INTRODUCEREADERA](#Section_02ea4de9860d496b95187b63c6beadb3).

[ContextAndTwoStringA\_Call](#Section_9ce7270caad546f78a10941cb94b57f5) MUST be initialized as specified in section 2.2.2.7 for a SCARD\_IOCTL\_INTRODUCEREADERA call.

##### Processing IntroduceReader (ASCII) Reply

The OutputBuffer MUST be decoded as a [Long\_Return](#Section_e77a13652379403799c4d30d14ba10fc).

##### Sending IntroduceReader (Unicode) Message

[**IoControlCode**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) MUST be set to [SCARD\_IOCTL\_INTRODUCEREADERW](#Section_960310d475914839b00197f28924062d).

[ContextAndTwoStringW\_Call](#Section_34bec62bb75c4729adb2f6033484fe6b) MUST be initialized, as specified in section 2.2.2.8, for a SCARD\_IOCTL\_INTRODUCEREADERW call.

##### Processing IntroduceReader (Unicode) Reply

The OutputBuffer MUST be decoded as [Long\_Return](#Section_e77a13652379403799c4d30d14ba10fc), as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2.2.6.

##### Sending ForgetReader (ASCII) Message

[**IoControlCode**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) MUST be set to [SCARD\_IOCTL\_FORGETREADERA](#Section_d7cbe0846f60491a9b534073c83e576f).

[ContextAndStringA\_Call](#Section_a130c3df016c4ca1b85ead450fa4fe6d) MUST be initialized, as specified in section 2.2.2.5, for a SCARD\_IOCTL\_FORGETREADERA call.

##### Processing ForgetReader (ASCII) Reply

The OutputBuffer MUST be decoded as [Long\_Return](#Section_e77a13652379403799c4d30d14ba10fc), as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2.2.6.

##### Sending ForgetReader (Unicode) Message

[**IoControlCode**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) MUST be set to [SCARD\_IOCTL\_FORGETREADERW](#Section_637aa753382c41dc9cc7b2a8e8acdd16).

[ContextAndStringW\_Call](#Section_a42d07ccb37b4fe49df92ba6320d72fa) MUST be initialized, as specified in section 2.2.2.6, for a SCARD\_IOCTL\_FORGETREADERW call.

##### Processing ForgetReader (Unicode) Reply

The OutputBuffer MUST be decoded as [Long\_Return](#Section_e77a13652379403799c4d30d14ba10fc), as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2.2.6.

##### Sending IntroduceReaderGroup (ASCII) Message

[**IoControlCode**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) MUST be set to [SCARD\_IOCTL\_INTRODUCEREADERGROUPA](#Section_a1587edcfe53443d93ecbde3178084f3).

[ContextAndStringA\_Call](#Section_a130c3df016c4ca1b85ead450fa4fe6d) MUST be initialized, as specified in section 2.2.2.5, for a SCARD\_IOCTL\_INTRODUCEREADERGROUPA call.

##### Processing IntroduceReaderGroup (ASCII) Reply

The OutputBuffer MUST be decoded as [Long\_Return](#Section_e77a13652379403799c4d30d14ba10fc), as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2.2.6.

##### Sending IntroduceReaderGroup (Unicode) Message

[**IoControlCode**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) MUST be set to [SCARD\_IOCTL\_INTRODUCEREADERGROUPW](#Section_438ba1054dfb45639615b8f84172fd82).

[ContextAndStringW\_Call](#Section_a42d07ccb37b4fe49df92ba6320d72fa) MUST be initialized, as specified in section 2.2.2.6, for a SCARD\_IOCTL\_INTRODUCEREADERGROUPW call.

##### Processing IntroduceReaderGroup (Unicode) Reply

The OutputBuffer MUST be decoded as [Long\_Return](#Section_e77a13652379403799c4d30d14ba10fc), as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2.2.6.

##### Sending ForgetReaderGroup (ASCII) Message 1

[**IoControlCode**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) MUST be set to [SCARD\_IOCTL\_FORGETREADERGROUPA](#Section_97ffdddd46334c16a7a870927e4d08a6).

[ContextAndStringA\_Call](#Section_a130c3df016c4ca1b85ead450fa4fe6d) MUST be initialized, as specified in section 2.2.2.5, for a SCARD\_IOCTL\_FORGETREADERGROUPA call.

##### Processing ForgetReaderGroup (ASCII) Reply

The OutputBuffer MUST be decoded as [Long\_Return](#Section_e77a13652379403799c4d30d14ba10fc), as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2.2.6.

##### Sending ForgetReaderGroup (ASCII) Message 2

[**IoControlCode**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) MUST be set to [SCARD\_IOCTL\_FORGETREADERGROUPW](#Section_708b04f2c9ea49ec9921f91c95c5c5b4).

[ContextAndStringW\_Call](#Section_a42d07ccb37b4fe49df92ba6320d72fa) MUST be initialized, as specified in section 2.2.2.6, for a SCARD\_IOCTL\_FORGETREADERGROUPW call.

##### Processing ForgetReaderGroup (Unicode) Reply

The OutputBuffer MUST be decoded as [Long\_Return](#Section_e77a13652379403799c4d30d14ba10fc), as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2.2.6.

##### Sending AddReaderToGroup (ASCII) Message

[**IoControlCode**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) MUST be set to [SCARD\_IOCTL\_ADDREADERTOGROUPA](#Section_a65818b57a5246ea975f81e1f9988b7e).

[ContextAndTwoStringA\_Call](#Section_9ce7270caad546f78a10941cb94b57f5) MUST be initialized, as specified in section 2.2.2.7, for a SCARD\_IOCTL\_ADDREADERTOGROUPA call.

##### Processing AddReaderToGroup (ASCII) Reply

The OutputBuffer MUST be decoded as [Long\_Return](#Section_e77a13652379403799c4d30d14ba10fc), as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2.2.6.

##### Sending AddReaderToGroup (Unicode) Message

[**IoControlCode**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) MUST be set to [SCARD\_IOCTL\_ADDREADERTOGROUPW](#Section_26ba40cb931c44b9876ccc43ef35fc19).

[ContextAndTwoStringW\_Call](#Section_34bec62bb75c4729adb2f6033484fe6b) MUST be initialized, as specified in section 2.2.2.8, for a SCARD\_IOCTL\_ADDREADERTOGROUPW call.

##### Processing AddReaderToGroup (Unicode) Reply

The OutputBuffer MUST be decoded as [Long\_Return](#Section_e77a13652379403799c4d30d14ba10fc), as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2.2.6.

##### Sending RemoveReaderFromGroup (ASCII) Message

[**IoControlCode**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) MUST be set to [SCARD\_IOCTL\_REMOVEREADERFROMGROUPA](#Section_e8fbbefc5256496fbfca387c8b37a601).

[ContextAndTwoStringA\_Call](#Section_9ce7270caad546f78a10941cb94b57f5) MUST be initialized, as specified in section 2.2.2.7, for a SCARD\_IOCTL\_REMOVEREADERFROMGROUPA call.

##### Processing RemoveReaderFromGroup (ASCII) Reply

The OutputBuffer MUST be decoded as [Long\_Return](#Section_e77a13652379403799c4d30d14ba10fc), as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2.2.6.

##### Sending RemoveReaderFromGroup (Unicode) Message

[**IoControlCode**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) MUST be set to [SCARD\_IOCTL\_REMOVEREADERFROMGROUPW](#Section_856ed35241a84c829d70de272546fb05).

[ContextAndTwoStringW\_Call](#Section_34bec62bb75c4729adb2f6033484fe6b) MUST be initialized, as specified in section 2.2.2.8, for a SCARD\_IOCTL\_REMOVEREADERFROMGROUPW call.

##### Processing RemoveReaderFromGroup (Unicode) Reply

The OutputBuffer MUST be decoded as [Long\_Return](#Section_e77a13652379403799c4d30d14ba10fc), as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2.2.6.

##### Sending ListReaderGroups (ASCII) Message

[**IoControlCode**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) MUST be set to [SCARD\_IOCTL\_LISTREADERGROUPSA](#Section_0fb9044801e24da19d60cfa1cc5e31a8).

[ListReaderGroups\_Call](#Section_dde8c811c258444f802898311a9e0082) MUST be initialized, as specified in section 2.2.2.3.

##### Processing ListReaderGroups (ASCII) Reply

The OutputBuffer MUST be decoded as [ListReaderGroups\_Return](#Section_6630bb5bfc0e41418b53263225c7628d), as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2.2.6.

##### Sending ListReaderGroups (Unicode) Message

[**IoControlCode**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) MUST be set to [SCARD\_IOCTL\_LISTREADERGROUPSW](#Section_b9b6341ec52c4f02af0925e2121f0382).

[ListReaderGroups\_Call](#Section_dde8c811c258444f802898311a9e0082) MUST be initialized, as specified in section 2.2.2.3.

##### Processing ListReaderGroups (Unicode) Reply

The OutputBuffer MUST be decoded as [ListReaderGroups\_Return](#Section_6630bb5bfc0e41418b53263225c7628d), as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2.2.6.

##### Sending ListReaders (ASCII) Message

[**IoControlCode**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) MUST be set to [SCARD\_IOCTL\_LISTREADERSA](#Section_609b752adcc74e4fafb79c7ce3ef2b3d).

[ListReaders\_Call](#Section_be2f46a577fb40bf839caed45f0a26d7) MUST be initialized, as specified in section 2.2.2.4, for an [**ASCII**](#gt_79fa85ca-ac61-467c-b819-e97dc1a7a599) call.

##### Processing ListReadersReply (ASCII) Reply

The OutputBuffer MUST be decoded as [ListReaders\_Return](#Section_6630bb5bfc0e41418b53263225c7628d), as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2.2.6.

##### Sending ListReaders (Unicode) Message

[**IoControlCode**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) MUST be set to [SCARD\_IOCTL\_LISTREADERSW](#Section_45a76e7403014259965d39c739201b6a).

[ListReaders\_Call](#Section_be2f46a577fb40bf839caed45f0a26d7) MUST be initialized, as specified in section 2.2.2.4, for an [**Unicode**](#gt_c305d0ab-8b94-461a-bd76-13b40cb8c4d8) call.

##### Processing ListReadersReply (Unicode) Reply

The OutputBuffer MUST be decoded as [ListReaders\_Return](#Section_6630bb5bfc0e41418b53263225c7628d), as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2.2.6.

##### Sending LocateCards (ASCII) Message

[**IoControlCode**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) MUST be set to [SCARD\_IOCTL\_LOCATECARDSA](#Section_2f20fd13963948958a431a3d6f0ded67).

[LocateCardsA\_Call](#Section_c6b49a9899e643c0af6356e4918814f3) MUST be initialized as specified in section 2.2.2.9.

##### Processing LocateCards (ASCII) Reply

The OutputBuffer MUST be decoded as [LocateCards\_Return](#Section_7b73e0c2e0fc46b19b0350684ad2beba), as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2.2.6.

##### Sending LocateCards (Unicode) Message

[**IoControlCode**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) MUST be set to [SCARD\_IOCTL\_LOCATECARDSW](#Section_52122b22b11e4014acef87de2008db77).

[LocateCardsW\_Call](#Section_c40fb6716a504ae1b75df44b25612eb2) MUST be initialized, as specified in section 2.2.2.10.

##### Processing LocateCards (Unicode) Reply

The OutputBuffer MUST be decoded as [LocateCards\_Return](#Section_7b73e0c2e0fc46b19b0350684ad2beba), as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2.2.6.

##### Sending GetStatusChange (ASCII) Message

[**IoControlCode**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) MUST be set to [SCARD\_IOCTL\_GETSTATUSCHANGEA](#Section_e5ea2e6c9b124fd6b45d800213dd96a1).

[GetStatusChangeA\_Call](#Section_3b559cd22c1949878163e22e974cdcdf) MUST be initialized, as specified in section 2.2.2.11.

##### Processing GetStatusChange (ASCII) Reply

The OutputBuffer MUST be decoded as [GetStatusChange\_Return](#Section_7b73e0c2e0fc46b19b0350684ad2beba), as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2.2.6.

##### Sending GetStatusChange (Unicode) Message

[**IoControlCode**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) MUST be set to [SCARD\_IOCTL\_GETSTATUSCHANGEW](#Section_98cc1029420f4088b9b966ff7efe866d).

[GetStatusChangeW\_Call](#Section_af357ce863ee4577b6bfc6f5ca68d754) MUST be initialized, as specified in section 2.2.2.12.

##### Processing GetStatusChange (Unicode) Reply

The OutputBuffer MUST be decoded as [GetStatusChange\_Return](#Section_7b73e0c2e0fc46b19b0350684ad2beba), as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2.2.6.

##### Sending Cancel Message

[**IoControlCode**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) MUST be set to [SCARD\_IOCTL\_CANCEL](#Section_195c8f3aa32341419ae833944fd50459).

Context\_Call.Context MUST be initialized, as specified in section [2.2.2.2](#Section_b11d26d9c3d54e968d9faba35cded852).

##### Processing Cancel Reply

The OutputBuffer MUST be decoded as [Long\_Return](#Section_e77a13652379403799c4d30d14ba10fc), as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2.2.6.

##### Sending Connect (ASCII) Message

[**IoControlCode**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) MUST be set to [SCARD\_IOCTL\_CONNECTA](#Section_99f88bbcfb8b4b59a5dfb5ea565d7b56).

[ConnectA\_Call](#Section_5201b332299b4b6a973394e873ffe8cc) MUST be initialized, as specified in section 2.2.2.13.

##### Processing Connect (ASCII) Reply

The OutputBuffer MUST be decoded as [Connect\_Return](#Section_ad9fbc8e096344ac8d7138021685790c), as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2.2.6.

##### Sending Connect (Unicode) Message

[**IoControlCode**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) MUST be set to [SCARD\_IOCTL\_CONNECTW](#Section_07f337627d81479581ab351c674e5282).

[ConnectW\_Call](#Section_fd06f6a0a9ea478c9b5e470fd9cde5a6) MUST be initialized, as specified in section 2.2.2.14.

##### Processing Connect (Unicode) Reply

The OutputBuffer MUST be decoded as [Connect\_Return](#Section_ad9fbc8e096344ac8d7138021685790c), as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2.2.6.

##### Sending Reconnect Message

[**IoControlCode**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) MUST be set to [SCARD\_IOCTL\_RECONNECT](#Section_e827930769e0480ba1e6ac9afe88f6b0).

[Reconnect\_Call](#Section_9c1eca523a99403c8ac86437f246a154) MUST be initialized, as specified in section 2.2.2.15.

##### Processing Reconnect Reply

The OutputBuffer MUST be decoded as [Reconnect\_Return](#Section_e25a583fab824ba3bebfaf656c58e6d8), as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2.2.6.

##### Sending Disconnect Message

[**IoControlCode**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) MUST be set to [SCARD\_IOCTL\_DISCONNECT](#Section_98c887aa6d82422fb0b1b183d241be8d).

[HCardAndDisposition\_Call](#Section_f15ae8659e994c5bbb4315a6b4885bd0) MUST be initialized, as specified in section 2.2.2.16, for a SCARD\_IOCTL\_DISCONNECT call.

##### Processing Disconnect Reply

The OutputBuffer MUST be decoded as [Long\_Return](#Section_e77a13652379403799c4d30d14ba10fc), as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2.2.6.

##### Sending Status (ASCII) Message

[**IoControlCode**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) MUST be set to [SCARD\_IOCTL\_STATUSA](#Section_c6812fcafa3e4771a3887d24ac535c94).

[Status\_Call](#Section_f1139aede57847f3a800f36b56c80500) MUST be initialized, as specified in section 2.2.2.18.

##### Processing Status (ASCII) Reply

The OutputBuffer MUST be decoded as [Status\_Return](#Section_987c1358ad6b4c8e88e106210c28a66f), as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2.2.6, and interpreted as a [SCARD\_IOCTL\_STATUSA](#Section_c6812fcafa3e4771a3887d24ac535c94) return.

##### Sending Status (Unicode) Message

[**IoControlCode**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) MUST be set to [SCARD\_IOCTL\_STATUSW](#Section_e3781ea63ac24c7aa6d7804411b858dc).

[Status\_Call](#Section_f1139aede57847f3a800f36b56c80500) MUST be initialized, as specified in section 2.2.2.18 .

##### Processing Status (Unicode) Reply

The OutputBuffer MUST be decoded as [Status\_Return](#Section_987c1358ad6b4c8e88e106210c28a66f), as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2.2.6, and interpreted as a [SCARD\_IOCTL\_STATUSW](#Section_e3781ea63ac24c7aa6d7804411b858dc) return.

##### Sending State Message

[**IoControlCode**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) MUST be set to [SCARD\_IOCTL\_STATE](#Section_16756fb5fd8f494982f8b480f59d8d13).

[State\_Call](#Section_ba3b909702fe4f6b951c05439a7d9da7) MUST be initialized, as specified in section 2.2.2.17, for a SCARD\_IOCTL\_STATE call.

##### Processing State Message Reply

The OutputBuffer MUST be decoded as [State\_Return](#Section_574e5ec596ba4b11bfa952eb34307356), as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2.2.6, and interpreted as a [SCARD\_IOCTL\_STATE](#Section_16756fb5fd8f494982f8b480f59d8d13) return.

##### Sending BeginTransaction Message

[**IoControlCode**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) MUST be set to [SCARD\_IOCTL\_BEGINTRANSACTION](#Section_9961866a6d4944bd8c83fcd63e23e7e9).

[HCardAndDisposition\_Call](#Section_f15ae8659e994c5bbb4315a6b4885bd0) MUST be initialized, as specified in section 2.2.2.16, for a SCARD\_IOCTL\_BEGINTRANSACTION call.

##### Processing BeginTransaction Reply

The OutputBuffer MUST be decoded as [Long\_Return](#Section_e77a13652379403799c4d30d14ba10fc), as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2.2.6.

##### Sending EndTransaction Message

[**IoControlCode**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) MUST be set to [SCARD\_IOCTL\_ENDTRANSACTION](#Section_857bd7fab97a4f6f806bc23873a6a864).

[HCardAndDisposition\_Call](#Section_f15ae8659e994c5bbb4315a6b4885bd0) MUST be initialized, as specified in section 2.2.2.16, for a SCARD\_IOCTL\_ENDTRANSACTION call.

##### Processing EndTransaction Reply

The OutputBuffer MUST be decoded as [Long\_Return](#Section_e77a13652379403799c4d30d14ba10fc), as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2.2.6.

##### Sending Transmit Message

[**IoControlCode**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) MUST be set to [SCARD\_IOCTL\_TRANSMIT](#Section_0b24a330795048f8ade9fb90d51d0546).

[Transmit\_Call](#Section_e3861cfae61b4d64b19df6b31e076beb) MUST be initialized as specified in section 2.2.2.19.

##### Processing Transmit Reply

The OutputBuffer MUST be decoded as [Transmit\_Return](#Section_252cffd058b8434d9e1b0d547544fb0f), as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2.2.6.

##### Sending Control Message

[**IoControlCode**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) MUST be set to [SCARD\_IOCTL\_CONTROL](#Section_032c12bb7aaa4e6f9d4c1f79cf26f45c).

[Control\_Call](#Section_002fc3a32ca2492e8463aba8f3923e48) MUST be initialized as specified in section 2.2.2.20.

##### Processing Control Reply

The OutputBuffer MUST be decoded as [Control\_Return](#Section_e7e854f80c5a4814bfddb72cb8aefe3e), as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2.2.6.

##### Sending GetReaderCapabilities Message

[**IoControlCode**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) MUST be set to [SCARD\_IOCTL\_GETATTRIB](#Section_ef68db95671a417994e9412f741041c3).

[GetAttrib\_Call](#Section_f4e36ff1e7b34046bddbcd192a76c7ab) MUST be initialized as specified in section 2.2.2.21.

##### Processing GetReaderCapabilities Reply

The OutputBuffer MUST be decoded as [GetAttrib\_Return](#Section_ab3ac0713fc544e69b94c1eee1168266), as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2.2.6.

##### Sending SetReaderCapabilities Message

[**IoControlCode**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) MUST be set to [SCARD\_IOCTL\_SETATTRIB](#Section_535f6974925e42559dbadaaad8a86651).

[SetAttrib\_Call](#Section_28f8dd6035b745fbab7515bbf81f5d11) MUST be initialized as specified in section 2.2.2.22.

##### Processing SetReaderCapabilities Reply

The OutputBuffer MUST be decoded as [Long\_Return](#Section_e77a13652379403799c4d30d14ba10fc), as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2.2.6.

##### Sending WaitForResourceManager Message

[**IoControlCode**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) MUST be set to [SCARD\_IOCTL\_ACCESSSTARTEDEVENT](#Section_47cae8f7ad7c4a568f40052fe51c0742).

[ScardAccessStartedEvent\_Call](#Section_c5ab8dd049144355960c0a527971ea69) MUST be initialized as specified in section 2.2.2.30. This structure MUST NOT be encoded and MUST be sent as is.

##### Processing WaitForResourceManager Reply

The OutputBuffer MUST be decoded as [Long\_Return](#Section_e77a13652379403799c4d30d14ba10fc), as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2.2.6.

##### Sending LocateCardsByATR (ASCII) Message

[**IoControlCode**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) MUST be set to [SCARD\_IOCTL\_LOCATECARDSBYATRA](#Section_201f92dcb12e43fb9daa9cfdf3b1bc0f).

[LocateCardsByATRA\_Call](#Section_100a5cc6cb6a4f90b0e4659b872c26d5) MUST be initialized as specified in section 2.2.2.23.

##### Processing LocateCardsByATR (Unicode) Reply

The OutputBuffer MUST be decoded as [LocateCards\_Return](#Section_7b73e0c2e0fc46b19b0350684ad2beba), as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2.2.6.

##### Processing LocateCardsByATR (ASCII) Reply

The OutputBuffer MUST be decoded as [LocateCards\_Return](#Section_7b73e0c2e0fc46b19b0350684ad2beba), as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2.2.6.

##### Sending LocateCardsByATR (Unicode) Message

[**IoControlCode**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) MUST be set to [SCARD\_IOCTL\_LOCATECARDSBYATRW](#Section_9f604d08756d4d789b4ec45a629dc639).

[LocateCardsByATRW\_Call](#Section_c934cc70c1c941938b1b038d8055c000) MUST be initialized as specified in section 2.2.2.24.

##### Sending ReadCache (ASCII) Message

[**IoControlCode**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) MUST be set to [SCARD\_IOCTL\_READCACHEA](#Section_e333945776994cfba3ef6eed3e849350).

[ReadCacheA\_Call](#Section_ba203dbad5464e9db8cfafa22cf88c3d) MUST be initialized as specified in section 2.2.2.25.

##### Processing ReadCache (ASCII) Reply

The OutputBuffer MUST be decoded as [ReadCache\_Return](#Section_da342355e37f485ea4903222a97fa356), as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2.2.6.

##### Sending ReadCache (Unicode) Message

[**IoControlCode**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) MUST be set to [SCARD\_IOCTL\_READCACHEW](#Section_8436548aa41f4759a7ee2d0341fa1d5d).

[ReadCacheW\_Call](#Section_f45705cf92994802b408685f02025e6a) MUST be initialized as specified in section 2.2.2.26.

##### Processing ReadCache (Unicode) Reply

The OutputBuffer MUST be decoded as [ReadCache\_Return](#Section_da342355e37f485ea4903222a97fa356), as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2.2.6.

##### Sending WriteCache (ASCII) Message

[**IoControlCode**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) MUST be set to [SCARD\_IOCTL\_WRITECACHEA](#Section_9b195b8efd734b578d9a7c4eb0b385cd).

[WriteCacheA\_Call](#Section_31ce1b620c504441b3e08661635849fb) MUST be initialized as specified in section 2.2.2.27.

##### Processing WriteCache (ASCII) Reply

The OutputBuffer MUST be decoded as [Long\_Return](#Section_e77a13652379403799c4d30d14ba10fc), as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2.2.6.

##### Sending WriteCache (Unicode) Message

[**IoControlCode**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) MUST be set to [SCARD\_IOCTL\_WRITECACHEW](#Section_e72096ea9db6438c81257cb563dc7ffc).

[WriteCacheW\_Call](#Section_3969bdcdecf342db8bc62d6f970f9c67) MUST be initialized as specified in section 2.2.2.28.

##### Processing WriteCache (Unicode) Reply

The OutputBuffer MUST be decoded as [Long\_Return](#Section_e77a13652379403799c4d30d14ba10fc), as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2.2.6.

##### Sending GetTransmitCount Message

[**IoControlCode**](#gt_09d6bc87-34ed-48e8-b4d4-962e90543462) MUST be set to [SCARD\_IOCTL\_GETTRANSMITCOUNT](#Section_ba32fda376164521a3aa6029b6a6e562).

[GetTransmitCount\_Call](#Section_f453f1b412914c698e97f781b2d8e66f) MUST be initialized as specified in section 2.2.2.29.

##### Processing GetTransmitCount Reply

The OutputBuffer MUST be decoded as [GetTransmitCount\_Return](#Section_32aea1d70edb4807bbd1a6ee1fbb0087), as specified in [[MS-RPCE]](%5BMS-RPCE%5D.pdf#Section_290c38b192fe422991e64fc376610c15) section 2.2.6.

##### Sending GetReaderIcon Message

IoControlCode MUST be set to SCARD\_IOCTL\_GETREADERICON.

**GetReaderIcon\_Call** MUST be initialized as specified in section [2.2.2.31](#Section_e6a68d90697f4b988ad6f74853d27ccb).

##### Processing GetReaderIcon Reply

The **OutputBuffer** MUST be decoded as **GetReaderIcon\_Return**, as specified in section [2.2.3.14](#Section_f011f3d9e2a44c43a3364c89ecaa8360).

##### Sending GetDeviceTypeId Message

IoControlCode MUST be set to SCARD\_IOCTL\_GETDEVICETYPEID.

**GetDeviceTypeId\_Call** MUST be initialized as specified in section [2.2.2.32](#Section_b5e18874c42d42eab1b13fd86a8a95f1).

##### Processing GetDeviceTypeId Reply

The **OutputBuffer** MUST be decoded as **GetDeviceTypeId\_Return**, as specified in section [2.2.3.15](#Section_fed90d29c41f490a86e97e88e42656b2).

### Timer Events

None.

### Other Local Events

None.

# Protocol Examples

This example shows the messages sent to perform a simple querying of a card in the [**TS client**](#gt_b9854a6a-0613-4b7a-95e4-c2b359b6021a) machine. It assumes that a channel has already been set up on the between the TS client and the [**TS server**](#gt_37eb268d-1dd2-4413-9fa6-3af2cab291d3). In addition, a PC/SC-compatible resource manager is running on the TS client and there exists a [**smart card reader**](#gt_5cddf14c-b925-4494-9b55-d2c8259f9ad0) with a [**smart card**](#gt_7c0fcc4a-476a-4d3a-87c0-7a503c14ef05) inserted. The following figure represents the program flow.



Figure 4: Protocol flow

This representation of the protocol flow is simplified in that there is only one application sending data over this protocol. In an actual implementation there could be multiple outstanding calls at any time.

All packets are constructed as specified in sections [3.2.5](#Section_4a5909f48ac241b2abe08b833c831b6f) and [3.2.5.3](#Section_7bf3d253ff8b4ce48f5246de86332287). The Status field refers to the **IoStatus** field as specified in [[MS-RDPEFS]](%5BMS-RDPEFS%5D.pdf#Section_34d9de58b2b540b6b970f82d4603bdb5) section 2.2.1.5. The **CompletionId** field is also specified in [MS-RDPEFS] section 2.2.1.5.

## Establish Context Call

1. IoControlCode= SCARD\_IOCTL\_ESTABLISHCONTEXT
2. CompletionId = 0
3. EstablishContext\_Call {
4. dwScope = SCARD\_SCOPE\_SYSTEM
5. }

The **CompletionId** field is specified in [[MS-RDPEFS]](%5BMS-RDPEFS%5D.pdf#Section_34d9de58b2b540b6b970f82d4603bdb5) section 2.2.1.4.

## Establish Context Return

1. CompletionId = 0
2. Status = 0
3. EstablishContext\_Return {
4. ReturnCode = 0
5. Context = {cbContext = 4, pbContext = {0x00,0x00,0x01,0xcd} }
6. }

The **Status** field is specified as the **IoStatus** field in [[MS-RDPEFS]](%5BMS-RDPEFS%5D.pdf#Section_34d9de58b2b540b6b970f82d4603bdb5) section 2.2.1.5.

## List Readers Call

1. IoControlCode = SCARD\_IOCTL\_LISTREADERSW
2. CompletionId = 0
3. ListReaders\_Call {
4. Context = {cbContext = 4, pbContext = {0x00,0x00,0x01,0xcd} }
5. cBytes = 44
6. mszGroups = L"SCard$DefaultReaders\0\0"
7. fmszReadersIsNULL = 0
8. cchReaders = 0xFFFFFFFF
9. }

## List Readers Return

1. CompletionId = 0
2. Status = 0
3. ListReaders\_Return {
4. ReturnCode = 0
5. cReaders =66
6. msz = L"Gemplus USB Smart Card Reader 0\0\0"
7. }

## Get Status Change Call

1. IoControlCode = SCARD\_IOCTL\_GETSTATUSCHANGEW
2. CompletionId = 0
3. GetStatusChangeW\_Call {
4. Context = {cbContext = 4, pbContext = {0x00,0x00,0x01,0xcd} }
5. dwTimeOut = 0
6. cReaders =1
7. rgReaderStates = {
8. { szReader = L"Gemplus USB Smart Card Reader 0"
9. Common = {
10. dwCurrentState = SCARD\_STATE\_UNAWARE
11. dwEventState = 0
12. cbAtr = 0
13. pbAtr = {0} }
14. }
15. }
16. }

## Get Status Change Return

1. Status = 0
2. CompletionId = 0
3. GetStatusChange\_Return = {
4. ReturnCode = 0
5. cReaders =1
6. rgReaderStates = {
7. dwCurrentState = SCARD\_STATE\_UNAWARE
8. dwEventState = SCARD\_STATE\_CHANGED |
9. SCARD\_STATE\_PRESENT | SCARD\_STATE\_INUSE
10. cbAtr = 9
11. rgbAtr = {0x3b, 0x16, 0x94,0x41, 0x73, 0x74,0x72,0x69,
12. 0x64}
13. }
14. }

## Connect Call

1. IoControlCode = SCARD\_IOCTL\_CONNECTW
2. CompletionId = 0
3. ConnectW\_Call = {
4. szReader = L"Gemplus USB Smart Card Reader 0"
5. Common = {
6. Context = { cbContext = 4, pbContext = {0x00,0x00,0x01,0xcd} }
7. dwShareMode = SCARD\_SHARE\_SHARED
8. dwPreferredProtocols = SCARD\_PROTOCOL\_T0 | SCARD\_PROTOCOL\_T1
9. }
10. }

## Connect Return

1. CompletionId = 0
2. Status = 0
3. Connect\_Return = {
4. ReturnCode = 0
5. hCard = {
6. Context = { cbContext = 4, pbContext = {0x00,0x00,0x01,0xcd} }
7. cbHandle = 4
8. pbHandle = {0x00,0x00,0x01,0xea}{0x00,0x00,0x01,0xea}}
9. dwActiveProtocol = SCARD\_PROTOCOL\_T0
10. }

## Begin Transaction Call

1. IoControlCode = SCARD\_IOCTL\_BEGINTRANSACTION
2. CompletionId = 0
3. HCardAndDisposition\_Call = {
4. hCard = {
5. Context = { cbContext = 4, pbContext = {0x00,0x00,0x01,0xcd} }
6. cbHandle = 4
7. pbHandle = {0x00,0x00,0x01,0xea}}
8. dwDisposition = 0
9. }

## Begin Transaction Return

1. CompletionId = 0
2. Status = 0
3. Long\_Return = {
4. ReturnCode = 0
5. }

## Status Call

1. IoControlCode = SCARD\_IOCTL\_STATUSW
2. CompletionId = 0
3. Status\_Call = {
4. hCard = {
5. Context = { cbContext = 4, pbContext = {0x00,0x00,0x01,0xcd} }
6. cbHandle = 4
7. pbHandle = {0x00,0x00,0x01,0xea} }
8. fmszReaderNamesIsNULL = 0
9. cchReaderLen = 0xFFFFFFFF
10. cbAtrLen = 36
11. }

## Status Return

1. CompletionId = 0
2. IoStatus = 0
3. Status\_Return = {
4. ReturnCode = 0
5. cBytes = 66
6. mszReaderNames = L"Gemplus USB Smart Card Reader 0\0\0"
7. dwState = SCARD\_SPECIFICMODE
8. dwProtocol = SCARD\_PROTOCOL\_T0
9. pbAtr = {0x3b, 0x16, 0x94,0x41, 0x73, 0x74,0x72,0x69,0x64}
10. cbAtr = 9
11. }

## End Transaction Call

1. IoControlCode = SCARD\_IOCTL\_ENDTRANSACTION
2. CompletionId = 0
3. HCardAndDisposition\_Call = {
4. hCard = {
5. Context = { cbContext = 4, pbContext = {0x00,0x00,0x01,0xcd} }
6. cbHandle = 4
7. pbHandle = {0x00,0x00,0x01,0xea}}
8. dwDisposition = SCARD\_LEAVE\_CARD
9. }

## End Transaction Return

1. CompletionId = 0
2. Status = 0
3. Long\_Return = {
4. ReturnCode = 0
5. }

## Disconnect Call

1. IoControlCode = SCARD\_IOCTL\_DISCONNECT
2. CompletionId = 0
3. HCardAndDisposition\_Call = {
4. hCard = {
5. Context = { cbContext = 4, pbContext = {0x00,0x00,0x01,0xcd} }
6. cbHandle = 4
7. pbHandle = {0x00,0x00,0x01,0xea}}
8. dwDisposition = SCARD\_RESET\_CARD
9. }

## Disconnect Return

1. CompletionId = 0
2. Status = 0
3. Long\_Return = {
4. ReturnCode = 0
5. }

## Release Context Call

1. IoControlCode = SCARD\_IOCTL\_RELEASECONTEXT
2. CompletionId = 0
3. Context\_Call = {
4. Context = {cbContext = 4, pbContext = {0x00,0x00,0x01,0xcd} }
5. }

## Release Context Return

1. CompletionId = 0
2. Status = 0
3. Long\_Return = {
4. ReturnCode = 0
5. }

# Security

This protocol has no security aspects and relies on the underlying transport for any security.

## Security Considerations for Implementers

None.

## Index of Security Parameters

None.

# Appendix A: Full IDL

For ease of implementation, the full [**Interface Definition Language (IDL)**](#gt_73177eec-4092-420f-92c5-60b2478df824) is provided below where ms-dtyp.idl is the IDL as specified in [[MS-DTYP]](%5BMS-DTYP%5D.pdf#Section_cca2742956894a16b2b49325d93e4ba2) section 5 and ms-dcom.idl is the IDL as specified in [[MS-DCOM]](%5BMS-DCOM%5D.pdf#Section_4a893f3dbd2948cd9f43d9777a4415b0) section 6.

1. import "ms-dtyp.idl";
2. import "ms-dcom.idl";
3. [
4. uuid(A35AF600-9CF4-11CD-A076-08002B2BD711),
5. version(1.0),
6. pointer\_default(unique)
7. ]
8. interface type\_scard\_pack
9. {
10. //
11. // Packing for calls that use the same params
12. //
13. typedef struct \_REDIR\_SCARDCONTEXT
14. {
15. [range(0, 16)] unsigned long cbContext;
16. [unique] [size\_is(cbContext)] byte \*pbContext;
17. } REDIR\_SCARDCONTEXT;
18. typedef struct \_REDIR\_SCARDHANDLE
19. {
20. REDIR\_SCARDCONTEXT Context;
21. [range(0, 16)] unsigned long cbHandle;
22. [size\_is(cbHandle)] byte \*pbHandle;
23. } REDIR\_SCARDHANDLE;
24. typedef struct \_long\_Return
25. {
26. long ReturnCode;
27. } long\_Return;
28. typedef struct \_longAndMultiString\_Return
29. {
30. long ReturnCode;
31. [range(0, 65536)] unsigned long cBytes;
32. [unique] [size\_is(cBytes)] byte \*msz;
33. } ListReaderGroups\_Return, ListReaders\_Return;
34. typedef struct \_Context\_Call
35. {
36. REDIR\_SCARDCONTEXT Context;
37. } Context\_Call;
38. typedef struct \_ContextAndStringA\_Call
39. {
40. REDIR\_SCARDCONTEXT Context;
41. [string] const char \* sz;
42. } ContextAndStringA\_Call;
43. typedef struct \_ContextAndStringW\_Call
44. {
45. REDIR\_SCARDCONTEXT Context;
46. [string] const wchar\_t \* sz;
47. } ContextAndStringW\_Call;
48. typedef struct \_ContextAndTwoStringA\_Call
49. {
50. REDIR\_SCARDCONTEXT Context;
51. [string] const char \* sz1;
52. [string] const char \* sz2;
53. } ContextAndTwoStringA\_Call;
54. typedef struct \_ContextAndTwoStringW\_Call
55. {
56. REDIR\_SCARDCONTEXT Context;
57. [string] const wchar\_t \* sz1;
58. [string] const wchar\_t \* sz2;
59. } ContextAndTwoStringW\_Call;
60. //
61. // Call specific packing
62. //
63. typedef struct \_EstablishContext\_Call
64. {
65. unsigned long dwScope;
66. } EstablishContext\_Call;
67. typedef struct \_EstablishContext\_Return
68. {
69. long ReturnCode;
70. REDIR\_SCARDCONTEXT Context;
71. } EstablishContext\_Return;
72. typedef struct \_ListReaderGroups\_Call
73. {
74. REDIR\_SCARDCONTEXT Context;
75. long fmszGroupsIsNULL;
76. unsigned long cchGroups;
77. } ListReaderGroups\_Call;
78. typedef struct \_ListReaders\_Call
79. {
80. REDIR\_SCARDCONTEXT Context;
81. [range(0, 65536)] unsigned long cBytes;
82. [unique] [size\_is(cBytes)] const byte \*mszGroups;
83. long fmszReadersIsNULL;
84. unsigned long cchReaders;
85. } ListReaders\_Call;
86. typedef struct \_ReaderState\_Common\_Call
87. {
88. unsigned long dwCurrentState;
89. unsigned long dwEventState;
90. [range(0, 36)] unsigned long cbAtr;
91. byte rgbAtr[36];
92. } ReaderState\_Common\_Call;
93. typedef struct \_ReaderStateA
94. {
95. [string] const char \* szReader;
96. ReaderState\_Common\_Call Common;
97. } ReaderStateA;
98. typedef struct \_ReaderStateW
99. {
100. [string] const wchar\_t \* szReader;
101. ReaderState\_Common\_Call Common;
102. } ReaderStateW;
103. typedef struct \_ReaderState\_Return
104. {
105. unsigned long dwCurrentState;
106. unsigned long dwEventState;
107. [range(0, 36)] unsigned long cbAtr;
108. byte rgbAtr[36];
109. } ReaderState\_Return;
110. typedef struct \_GetStatusChangeA\_Call
111. {
112. REDIR\_SCARDCONTEXT Context;
113. unsigned long dwTimeOut;
114. [range(0, 11)] unsigned long cReaders;
115. [size\_is(cReaders)] ReaderStateA \*rgReaderStates;

} GetStatusChangeA\_Call;

1. typedef struct \_LocateCardsA\_Call {
2. REDIR\_SCARDCONTEXT Context;
3. [range(0, 65536)] unsigned long cBytes;
4. [size\_is(cBytes)] const byte \* mszCards;
5. [range(0, 10)] unsigned long cReaders;
6. [size\_is(cReaders)] ReaderStateA \* rgReaderStates;
7. } LocateCardsA\_Call;
8. typedef struct \_LocateCardsW\_Call
9. {
10. REDIR\_SCARDCONTEXT Context;
11. [range(0, 65536)] unsigned long cBytes;
12. [size\_is(cBytes)] const byte \*mszCards;
13. [range(0, 10)] unsigned long cReaders;
14. [size\_is(cReaders)] ReaderStateW \*rgReaderStates;
15. } LocateCardsW\_Call;
16. typedef struct \_LocateCards\_ATRMask
17. {
18. [range(0, 36)] unsigned long cbAtr;
19. byte rgbAtr[36];
20. byte rgbMask[36];
21. } LocateCards\_ATRMask;
22. typedef struct \_LocateCardsByATRA\_Call
23. {
24. REDIR\_SCARDCONTEXT Context;
25. [range(0, 1000)] unsigned long cAtrs;
26. [size\_is(cAtrs)] LocateCards\_ATRMask \*rgAtrMasks;
27. [range(0, 10)] unsigned long cReaders;
28. [size\_is(cReaders)] ReaderStateA \*rgReaderStates;
29. } LocateCardsByATRA\_Call;
30. typedef struct \_LocateCardsByATRW\_Call
31. {
32. REDIR\_SCARDCONTEXT Context;
33. [range(0, 1000)] unsigned long cAtrs;
34. [size\_is(cAtrs)] LocateCards\_ATRMask \*rgAtrMasks;
35. [range(0, 10)] unsigned long cReaders;
36. [size\_is(cReaders)] ReaderStateW \*rgReaderStates;
37. } LocateCardsByATRW\_Call;
38. typedef struct \_GetStatusChange\_Return
39. {
40. long ReturnCode;
41. [range(0, 10)] unsigned long cReaders;
42. [size\_is(cReaders)] ReaderState\_Return \*rgReaderStates;
43. } LocateCards\_Return, GetStatusChange\_Return;
44. typedef struct \_GetStatusChangeW\_Call
45. {
46. REDIR\_SCARDCONTEXT Context;
47. unsigned long dwTimeOut;
48. [range(0, 11)] unsigned long cReaders;
49. [size\_is(cReaders)] ReaderStateW \*rgReaderStates;
50. } GetStatusChangeW\_Call;
51. typedef struct \_Connect\_Common
52. {
53. REDIR\_SCARDCONTEXT Context;
54. unsigned long dwShareMode;
55. unsigned long dwPreferredProtocols;
56. } Connect\_Common;
57. typedef struct \_ConnectA\_Call
58. {
59. [string] const char \* szReader;
60. Connect\_Common Common;
61. } ConnectA\_Call;
62. typedef struct \_ConnectW\_Call
63. {
64. [string] const wchar\_t \* szReader;
65. Connect\_Common Common;
66. } ConnectW\_Call;
67. typedef struct \_Connect\_Return
68. {
69. long ReturnCode;
70. REDIR\_SCARDHANDLE hCard;
71. unsigned long dwActiveProtocol;
72. } Connect\_Return;
73. typedef struct \_Reconnect\_Call
74. {
75. REDIR\_SCARDHANDLE hCard;
76. unsigned long dwShareMode;
77. unsigned long dwPreferredProtocols;
78. unsigned long dwInitialization;
79. } Reconnect\_Call;
80. typedef struct Reconnect\_Return
81. {
82. long ReturnCode;
83. unsigned long dwActiveProtocol;
84. } Reconnect\_Return;
85. typedef struct \_HCardAndDisposition\_Call
86. {
87. REDIR\_SCARDHANDLE hCard;
88. unsigned long dwDisposition;
89. } HCardAndDisposition\_Call;
90. typedef struct \_State\_Call
91. {
92. REDIR\_SCARDHANDLE hCard;
93. long fpbAtrIsNULL;
94. unsigned long cbAtrLen;
95. // EDITOR'S NOTE: Can be 0xFFFFFFFF
96. } State\_Call;
97. typedef struct \_State\_Return
98. {
99. long ReturnCode;
100. unsigned long dwState;
101. unsigned long dwProtocol;
102. [range(0, 36)] unsigned long cbAtrLen;
103. [unique] [size\_is(cbAtrLen)] byte \*rgAtr;
104. } State\_Return;
105. typedef struct \_Status\_Call
106. {
107. REDIR\_SCARDHANDLE hCard;
108. long fmszReaderNamesIsNULL;
109. unsigned long cchReaderLen;
110. unsigned long cbAtrLen;
111. } Status\_Call;
112. typedef struct \_Status\_Return
113. {
114. long ReturnCode;
115. [range(0, 65536)] unsigned long cBytes;
116. [unique] [size\_is(cBytes)] byte \*mszReaderNames;
117. unsigned long dwState;
118. unsigned long dwProtocol;
119. byte pbAtr[32];
120. [range(0, 32)] unsigned long cbAtrLen;
121. } Status\_Return;
122. typedef struct \_SCardIO\_Request
123. {
124. unsigned long dwProtocol;
125. [range(0, 1024)] unsigned long cbExtraBytes;
126. [unique] [size\_is(cbExtraBytes)] byte \*pbExtraBytes;
127. } SCardIO\_Request;
128. typedef struct \_Transmit\_Call
129. {
130. REDIR\_SCARDHANDLE hCard;
131. SCardIO\_Request ioSendPci;
132. [range(0, 66560)] unsigned long cbSendLength;
133. [size\_is(cbSendLength)] const byte \*pbSendBuffer;
134. [unique] SCardIO\_Request \*pioRecvPci;
135. long fpbRecvBufferIsNULL;
136. unsigned long cbRecvLength;
137. } Transmit\_Call;
138. typedef struct \_Transmit\_Return
139. {
140. long ReturnCode;
141. [unique] SCardIO\_Request \*pioRecvPci;
142. [range(0, 66560)] unsigned long cbRecvLength;
143. [unique] [size\_is(cbRecvLength)] byte \*pbRecvBuffer;
144. } Transmit\_Return;
145. typedef struct \_GetTransmitCount\_Call
146. {
147. REDIR\_SCARDHANDLE hCard;
148. } GetTransmitCount\_Call;
149. typedef struct \_GetTransmitCount\_Return
150. {
151. long ReturnCode;
152. unsigned long cTransmitCount;
153. } GetTransmitCount\_Return;
154. typedef struct \_Control\_Call
155. {
156. REDIR\_SCARDHANDLE hCard;
157. unsigned long dwControlCode;
158. [range(0, 66560)] unsigned long cbInBufferSize;
159. [unique] [size\_is(cbInBufferSize)] const byte \*pvInBuffer;
160. long fpvOutBufferIsNULL;
161. unsigned long cbOutBufferSize;
162. } Control\_Call;
163. typedef struct \_Control\_Return
164. {
165. long ReturnCode;
166. [range(0, 66560)] unsigned long cbOutBufferSize;
167. [unique] [size\_is(cbOutBufferSize)] byte \*pvOutBuffer;
168. } Control\_Return;
169. typedef struct \_GetAttrib\_Call
170. {
171. REDIR\_SCARDHANDLE hCard;
172. unsigned long dwAttrId;
173. long fpbAttrIsNULL;
174. unsigned long cbAttrLen;
175. } GetAttrib\_Call;
176. typedef struct \_GetAttrib\_Return
177. {
178. long ReturnCode;
179. [range(0, 65536)] unsigned long cbAttrLen;
180. [unique] [size\_is(cbAttrLen)] byte \*pbAttr;
181. } GetAttrib\_Return;
182. typedef struct \_SetAttrib\_Call
183. {
184. REDIR\_SCARDHANDLE hCard;
185. unsigned long dwAttrId;
186. [range(0, 65536)] unsigned long cbAttrLen;
187. [size\_is(cbAttrLen)] const byte \*pbAttr;
188. } SetAttrib\_Call;
189. typedef struct \_ReadCache\_Common
190. {
191. REDIR\_SCARDCONTEXT Context;
192. UUID \*CardIdentifier;
193. unsigned long FreshnessCounter;
194. long fPbDataIsNULL;
195. unsigned long cbDataLen;
196. } ReadCache\_Common;
197. typedef struct \_ReadCacheA\_Call
198. {
199. [string] char \* szLookupName;
200. ReadCache\_Common Common;
201. } ReadCacheA\_Call;
202. typedef struct \_ReadCacheW\_Call
203. {
204. [string] wchar\_t \* szLookupName;
205. ReadCache\_Common Common;
206. } ReadCacheW\_Call;
207. typedef struct \_ReadCache\_Return
208. {
209. long ReturnCode;
210. [range(0, 65536)] unsigned long cbDataLen;
211. [unique] [size\_is(cbDataLen)] byte \*pbData;
212. } ReadCache\_Return;
213. typedef struct \_WriteCache\_Common
214. {
215. REDIR\_SCARDCONTEXT Context;
216. UUID \*CardIdentifier;
217. unsigned long FreshnessCounter;
218. [range(0, 65536)] unsigned long cbDataLen;
219. [unique] [size\_is(cbDataLen)] byte \*pbData;
220. } WriteCache\_Common;
221. typedef struct \_WriteCacheA\_Call
222. {
223. [string] char \* szLookupName;
224. WriteCache\_Common Common;
225. } WriteCacheA\_Call;
226. typedef struct \_WriteCacheW\_Call
227. {
228. [string] wchar\_t \* szLookupName;
229. WriteCache\_Common Common;
230. } WriteCacheW\_Call;
231. }

# Appendix B: Product Behavior

The information in this specification is applicable to the following Microsoft products or supplemental software. References to product versions include updates to those products.

* Windows XP operating system
* Windows Server 2003 operating system
* Windows Vista operating system
* Windows Server 2008 operating system
* Windows 7 operating system
* Windows Server 2008 R2 operating system
* Windows 8 operating system
* Windows Server 2012 operating system
* Windows 8.1 operating system
* Windows Server 2012 R2 operating system
* Windows 10 operating system
* Windows Server 2016 operating system
* Windows Server operating system
* Windows Server 2019 operating system

Exceptions, if any, are noted in this section. If an update version, service pack or Knowledge Base (KB) number appears with a product name, the behavior changed in that update. The new behavior also applies to subsequent updates unless otherwise specified. If a product edition appears with the product version, behavior is different in that product edition.

Unless otherwise specified, any statement of optional behavior in this specification that is prescribed using the terms "SHOULD" or "SHOULD NOT" implies product behavior in accordance with the SHOULD or SHOULD NOT prescription. Unless otherwise specified, the term "MAY" implies that the product does not follow the prescription.

[<1> Section 1.7](#Appendix_A_Target_1): The Windows XP and Windows Server 2003 versions always use SCREDIR\_VERSION\_XP. Windows Vista and Windows Server 2008 are always SCREDIR\_VERSION\_LONGHORN. All other versions use SCREDIR\_VERSION\_WINDOWS\_8.

[<2> Section 3.1.4](#Appendix_A_Target_2): Windows XP and Windows Server 2003 implement function numbers 5 through 58. Windows Vista, Windows Server 2008, Windows 7, and Windows Server 2008 R2 implement function numbers 5 through 64. All other versions implement 5 through 66.

# Change Tracking

This section identifies changes that were made to this document since the last release. Changes are classified as Major, Minor, or None.

The revision class **Major** means that the technical content in the document was significantly revised. Major changes affect protocol interoperability or implementation. Examples of major changes are:

* A document revision that incorporates changes to interoperability requirements.
* A document revision that captures changes to protocol functionality.

The revision class **Minor** means that the meaning of the technical content was clarified. Minor changes do not affect protocol interoperability or implementation. Examples of minor changes are updates to clarify ambiguity at the sentence, paragraph, or table level.

The revision class **None** means that no new technical changes were introduced. Minor editorial and formatting changes may have been made, but the relevant technical content is identical to the last released version.

The changes made to this document are listed in the following table. For more information, please contact dochelp@microsoft.com.

| Section | Description | Revision class |
| --- | --- | --- |
| [7](#Section_1ccc8dbe15ac4785a7184f0f82b2f18a) Appendix B: Product Behavior | Added Windows Server 2019 to the list of applicable products. | Major |

# Index

A

Abstract data model

 [client](#section_359124f66bb1472bbaf9128b689b573b) 63

 [server](#section_3fddc9c237bd4fbea2d94edd4d5bb38b) 50

[Access\_Mode\_Flags packet](#section_d81ce1d2e9584cb48e32c007133f8f23) 43

[Applicability](#section_d20dfa7e1e1d402ea253cd1e982b2819) 16

B

[Begin transaction call example](#section_442c95cbd39543a7be37bd0b6434da1c) 75

[Begin transaction return example](#section_e478ac1a80394d0d80f41bf9c1c0262b) 76

C

[Capability negotiation](#section_568e22eec9ee4e8780c554795f667062) 16

[Card\_Reader\_State packet](#section_264bc504119543ffa0573d86a02c5d9c) 42

[Change tracking](#section_5fcb0635bb9a4bcd8ee942fac5068dd9) 87

Client

 [abstract data model](#section_359124f66bb1472bbaf9128b689b573b) 63

 [higher-layer triggered events](#section_07fe041ff74d422aadfe818dfa7c1d75) 63

 [initialization](#section_5e0b057c45e048b1ad0101ed21cfa6ad) 63

 [local events](#section_bb76f1af978247c1bb1ff2b658e9a7a5) 72

 [message processing](#section_4a5909f48ac241b2abe08b833c831b6f) 63

 [Processing Incoming Replies method](#section_55f0933b27cf414d804d466811b2c1da) 63

 [Sending Outgoing Messages method](#section_1be3db42a359491b91b14479e5f4c4b2) 63

 [sequencing rules](#section_4a5909f48ac241b2abe08b833c831b6f) 63

 structures ([section 2.2.1](#section_a1c72bb1106f45c08b9333d69ee22b39) 18, [section 2.2.3](#section_4a383ba74ee8418593de6ddb3d6f3d1d) 36)

 [timer events](#section_cbb351e820dc4b27a7a7819c6f92c130) 72

 [timers](#section_8133f96e4e50432e99d194e7fdb3b0bc) 63

[Common data types](#section_663f6b06fbab4d8c879f6a03278bf8d6) 18

[Connect call example](#section_2c2bfc4486fc4e49bce5a74d7a3323ab) 75

[Connect return example](#section_ed3a9d9b5d4142de82423a3bc1ada1a8) 75

[Connect\_Common structure](#section_32752f3244104682b9fc9096674b52de) 19

[Connect\_Return structure](#section_ad9fbc8e096344ac8d7138021685790c) 39

[ConnectA\_Call structure](#section_5201b332299b4b6a973394e873ffe8cc) 28

[ConnectW\_Call structure](#section_fd06f6a0a9ea478c9b5e470fd9cde5a6) 28

[Context\_Call structure](#section_b11d26d9c3d54e968d9faba35cded852) 22

[ContextAndStringA\_Call structure](#section_a130c3df016c4ca1b85ead450fa4fe6d) 24

[ContextAndStringW\_Call structure](#section_a42d07ccb37b4fe49df92ba6320d72fa) 24

[ContextAndTwoStringA\_Call structure](#section_9ce7270caad546f78a10941cb94b57f5) 25

[ContextAndTwoStringW\_Call structure](#section_34bec62bb75c4729adb2f6033484fe6b) 26

[Control\_Call structure](#section_002fc3a32ca2492e8463aba8f3923e48) 32

[Control\_Return structure](#section_e7e854f80c5a4814bfddb72cb8aefe3e) 38

D

Data model - abstract

 [client](#section_359124f66bb1472bbaf9128b689b573b) 63

 [server](#section_3fddc9c237bd4fbea2d94edd4d5bb38b) 50

[Data types](#section_663f6b06fbab4d8c879f6a03278bf8d6) 18

 [common - overview](#section_663f6b06fbab4d8c879f6a03278bf8d6) 18

[Disconnect call example](#section_f66d7a6de3dd4ae9831eba74d3919e62) 77

[Disconnect return example](#section_3216fc2c6f9d47bf9877e9547017a33f) 77

E

[End transaction call example](#section_50c6065f47c54a959e571254c692b098) 76

[End transaction return example](#section_08ce05a7bcf143139d1ac5f68289962f) 76

[Establish context call example](#section_1b55041fd1cc438e80eea693815991a0) 74

[Establish context return example](#section_126c8fe0918740e6a90fa4a9259dfdd3) 74

[EstablishContext\_Call structure](#section_b990635a7637464a8923361ed3e3d67a) 22

[EstablishContext\_Return structure](#section_9135d95f3740411bbdca34ac7571fddc) 37

Events

 [local - client](#section_bb76f1af978247c1bb1ff2b658e9a7a5) 72

 [local - server](#section_2bfe273f981944a380bea3aab08e59a1) 62

 [timer - client](#section_cbb351e820dc4b27a7a7819c6f92c130) 72

 [timer - server](#section_349f0d4e9bd74af2a0f6e3e5e66e853e) 62

Examples

 [begin transaction call](#section_442c95cbd39543a7be37bd0b6434da1c) 75

 [begin transaction call example](#section_442c95cbd39543a7be37bd0b6434da1c) 75

 [begin transaction return](#section_e478ac1a80394d0d80f41bf9c1c0262b) 76

 [begin transaction return example](#section_e478ac1a80394d0d80f41bf9c1c0262b) 76

 [connect call](#section_2c2bfc4486fc4e49bce5a74d7a3323ab) 75

 [connect call example](#section_2c2bfc4486fc4e49bce5a74d7a3323ab) 75

 [connect return](#section_ed3a9d9b5d4142de82423a3bc1ada1a8) 75

 [connect return example](#section_ed3a9d9b5d4142de82423a3bc1ada1a8) 75

 [disconnect call](#section_f66d7a6de3dd4ae9831eba74d3919e62) 77

 [disconnect call example](#section_f66d7a6de3dd4ae9831eba74d3919e62) 77

 [disconnect return](#section_3216fc2c6f9d47bf9877e9547017a33f) 77

 [disconnect return example](#section_3216fc2c6f9d47bf9877e9547017a33f) 77

 [end transaction call](#section_50c6065f47c54a959e571254c692b098) 76

 [end transaction call example](#section_50c6065f47c54a959e571254c692b098) 76

 [end transaction return](#section_08ce05a7bcf143139d1ac5f68289962f) 76

 [end transaction return example](#section_08ce05a7bcf143139d1ac5f68289962f) 76

 [establish context call](#section_1b55041fd1cc438e80eea693815991a0) 74

 [establish context call example](#section_1b55041fd1cc438e80eea693815991a0) 74

 [establish context return](#section_126c8fe0918740e6a90fa4a9259dfdd3) 74

 [establish context return example](#section_126c8fe0918740e6a90fa4a9259dfdd3) 74

 [get status change call](#section_542342b9545f4813b886f7b740447acf) 74

 [get status change call example](#section_542342b9545f4813b886f7b740447acf) 74

 [get status change return](#section_87e58fb9470b4615a50e7908a3976c7c) 75

 [get status change return example](#section_87e58fb9470b4615a50e7908a3976c7c) 75

 [list reader call example](#section_a7969e5b1ee4405c9f439abe46a1a457) 74

 [list reader return example](#section_0b6ae990c9b346448f6d795c5f9525cb) 74

 [list readers call](#section_a7969e5b1ee4405c9f439abe46a1a457) 74

 [list readers return](#section_0b6ae990c9b346448f6d795c5f9525cb) 74

 [overview](#section_4052c7c7467c4903914cc40dd4a241a5) 73

 [release context call](#section_53f368712f51443f92451fa6149ac8e0) 77

 [release context call example](#section_53f368712f51443f92451fa6149ac8e0) 77

 [release context return](#section_f020e4c207e642959254d588f92157f6) 77

 [release context return example](#section_f020e4c207e642959254d588f92157f6) 77

 [status call](#section_816e7281ada64b4ea700f77fab2115c1) 76

 [status call example](#section_816e7281ada64b4ea700f77fab2115c1) 76

 [status return](#section_746cc3b931dc45dba533d7bb47b71928) 76

 [status return example](#section_746cc3b931dc45dba533d7bb47b71928) 76

F

[Fields - vendor-extensible](#section_ff53bd2ef42a45018877e8f344755e23) 16

[Full IDL](#section_65c30c99e81648b692938d467b10cc39) 79

G

[Get status change call example](#section_542342b9545f4813b886f7b740447acf) 74

[Get status change return example](#section_87e58fb9470b4615a50e7908a3976c7c) 75

[GetAttrib\_Call structure](#section_f4e36ff1e7b34046bddbcd192a76c7ab) 32

[GetAttrib\_Return structure](#section_ab3ac0713fc544e69b94c1eee1168266) 41

[GetDeviceTypeId\_Call structure](#section_b5e18874c42d42eab1b13fd86a8a95f1) 36

[GetDeviceTypeId\_Return structure](#section_fed90d29c41f490a86e97e88e42656b2) 42

[GetReaderIcon\_Call structure](#section_e6a68d90697f4b988ad6f74853d27ccb) 36

[GetReaderIcon\_Return structure](#section_f011f3d9e2a44c43a3364c89ecaa8360) 41

[GetStatusChange\_Return](#section_7b73e0c2e0fc46b19b0350684ad2beba) 38

[GetStatusChangeA\_Call structure](#section_3b559cd22c1949878163e22e974cdcdf) 27

[GetStatusChangeW\_Call structure](#section_af357ce863ee4577b6bfc6f5ca68d754) 28

[GetTransmitCount\_Call structure](#section_f453f1b412914c698e97f781b2d8e66f) 35

[GetTransmitCount\_Return structure](#section_32aea1d70edb4807bbd1a6ee1fbb0087) 41

[Glossary](#section_d361b24c611e46c59ac693cb6490a472) 10

H

[HCardAndDisposition\_Call structure](#section_f15ae8659e994c5bbb4315a6b4885bd0) 29

[Higher-layer triggered events - client](#section_07fe041ff74d422aadfe818dfa7c1d75) 63

I

[IDL](#section_65c30c99e81648b692938d467b10cc39) 79

[Implementer - security considerations](#section_f37f45e306a04eec8032e56193912a71) 78

[Implementers - security considerations](#section_f37f45e306a04eec8032e56193912a71) 78

[Index of security parameters](#section_851a0c83618f4c4dbe39f63a4ddc8329) 78

[Informative references](#section_3c2309d5e2a74d1dba47f71ac322c42a) 13

Initialization

 [client](#section_5e0b057c45e048b1ad0101ed21cfa6ad) 63

 [server](#section_c587f68aac8f4787b69ef98c692101b6) 50

[Introduction](#section_81d158a244fc4347a63d43a38f350d43) 10

L

[List reader call example](#section_a7969e5b1ee4405c9f439abe46a1a457) 74

[List reader return example](#section_0b6ae990c9b346448f6d795c5f9525cb) 74

[List readers call example](#section_a7969e5b1ee4405c9f439abe46a1a457) 74

[List readers return example](#section_0b6ae990c9b346448f6d795c5f9525cb) 74

[ListReaderGroups\_Call structure](#section_dde8c811c258444f802898311a9e0082) 23

[ListReaderGroups\_Return structure](#section_6630bb5bfc0e41418b53263225c7628d) 37

[ListReaders\_Call structure](#section_be2f46a577fb40bf839caed45f0a26d7) 23

[ListReaders\_Return](#section_6630bb5bfc0e41418b53263225c7628d) 37

Local events

 [client](#section_bb76f1af978247c1bb1ff2b658e9a7a5) 72

 [server](#section_2bfe273f981944a380bea3aab08e59a1) 62

[LocateCards\_ATRMask structure](#section_479fe1cfeaf04d518964d4195a61f573) 19

[LocateCards\_Return structure](#section_7b73e0c2e0fc46b19b0350684ad2beba) 38

[LocateCardsA\_Call structure](#section_c6b49a9899e643c0af6356e4918814f3) 26

[LocateCardsByATRA\_Call structure](#section_100a5cc6cb6a4f90b0e4659b872c26d5) 33

[LocateCardsByATRW\_Call structure](#section_c934cc70c1c941938b1b038d8055c000) 34

[LocateCardsW\_Call structure](#section_c40fb6716a504ae1b75df44b25612eb2) 27

[Long\_Return structure](#section_e77a13652379403799c4d30d14ba10fc) 37

M

Message processing

 [client](#section_4a5909f48ac241b2abe08b833c831b6f) 63

 [server](#section_60d5977d00174c90ab0cf34bf44a74a5) 50

Messages

 [common data types](#section_663f6b06fbab4d8c879f6a03278bf8d6) 18

 [names](#section_7bf3d253ff8b4ce48f5246de86332287) 64

 [overview](#section_82bea74106994feb95c771791de91eb1) 18

 [processing incoming replies](#section_55f0933b27cf414d804d466811b2c1da) 63

 [sending outgoing messages](#section_1be3db42a359491b91b14479e5f4c4b2) 63

 [transport](#section_0273ee6a2b1b421bbf395c964f67220c) 18

Methods

 [Processing Incoming Replies](#section_55f0933b27cf414d804d466811b2c1da) 63

 [SCARD\_IOCTL\_ACCESSSTARTEDEVENT (IOCTL 0x000900E0)](#section_47cae8f7ad7c4a568f40052fe51c0742) 54

 [SCARD\_IOCTL\_ADDREADERTOGROUPA (IOCTL 0x00090070)](#section_a65818b57a5246ea975f81e1f9988b7e) 57

 [SCARD\_IOCTL\_ADDREADERTOGROUPW (IOCTL 0x00090074)](#section_26ba40cb931c44b9876ccc43ef35fc19) 57

 [SCARD\_IOCTL\_BEGINTRANSACTION (IOCTL 0x000900BC)](#section_9961866a6d4944bd8c83fcd63e23e7e9) 59

 [SCARD\_IOCTL\_CANCEL (IOCTL 0x000900A8)](#section_195c8f3aa32341419ae833944fd50459) 59

 [SCARD\_IOCTL\_CONNECTA (IOCTL 0x000900AC)](#section_99f88bbcfb8b4b59a5dfb5ea565d7b56) 59

 [SCARD\_IOCTL\_CONNECTW (IOCTL 0x000900B0)](#section_07f337627d81479581ab351c674e5282) 59

 [SCARD\_IOCTL\_CONTROL (IOCTL 0x000900D4)](#section_032c12bb7aaa4e6f9d4c1f79cf26f45c) 60

 [SCARD\_IOCTL\_DISCONNECT (IOCTL 0x000900B8)](#section_98c887aa6d82422fb0b1b183d241be8d) 59

 [SCARD\_IOCTL\_ENDTRANSACTION (IOCTL 0x000900C0)](#section_857bd7fab97a4f6f806bc23873a6a864) 59

 [SCARD\_IOCTL\_ESTABLISHCONTEXT (IOCTL 0x00090014)](#section_ea15ee619fac40ac96ebd9d63deee760) 54

 [SCARD\_IOCTL\_FORGETREADERA (IOCTL 0x00090068)](#section_d7cbe0846f60491a9b534073c83e576f) 56

 [SCARD\_IOCTL\_FORGETREADERGROUPA (IOCTL 0x00090058)](#section_97ffdddd46334c16a7a870927e4d08a6) 56

 [SCARD\_IOCTL\_FORGETREADERGROUPW (IOCTL 0x0009005C)](#section_708b04f2c9ea49ec9921f91c95c5c5b4) 56

 [SCARD\_IOCTL\_FORGETREADERW (IOCTL 0x0009006C)](#section_637aa753382c41dc9cc7b2a8e8acdd16) 57

 [SCARD\_IOCTL\_GETATTRIB (IOCTL 0x000900D8)](#section_ef68db95671a417994e9412f741041c3) 60

 [SCARD\_IOCTL\_GETDEVICETYPEID (IOCTL 0x00090108)](#section_3c9ee4055d684a6d80a0b053ea88d987) 62

 [SCARD\_IOCTL\_GETREADERICON (IOCTL 0x00090104)](#section_a7cecc063bcb48ca90eaa9d542cffafc) 62

 [SCARD\_IOCTL\_GETSTATUSCHANGEA (IOCTL 0x000900A0)](#section_e5ea2e6c9b124fd6b45d800213dd96a1) 58

 [SCARD\_IOCTL\_GETSTATUSCHANGEW (IOCTL 0x000900A4)](#section_98cc1029420f4088b9b966ff7efe866d) 58

 [SCARD\_IOCTL\_GETTRANSMITCOUNT (IOCTL 0x00090100)](#section_ba32fda376164521a3aa6029b6a6e562) 61

 [SCARD\_IOCTL\_INTRODUCEREADERA (IOCTL 0x00090060)](#section_02ea4de9860d496b95187b63c6beadb3) 56

 [SCARD\_IOCTL\_INTRODUCEREADERGROUPA (IOCTL 0x00090050)](#section_a1587edcfe53443d93ecbde3178084f3) 55

 [SCARD\_IOCTL\_INTRODUCEREADERGROUPW (IOCTL 0x00090054)](#section_438ba1054dfb45639615b8f84172fd82) 56

 [SCARD\_IOCTL\_INTRODUCEREADERW (IOCTL 0x00090064)](#section_960310d475914839b00197f28924062d) 56

 [SCARD\_IOCTL\_ISVALIDCONTEXT (IOCTL 0x0009001C)](#section_e1a093e08d8143fb8ef5039041827633) 54

 [SCARD\_IOCTL\_LISTREADERGROUPSA (IOCTL 0x00090020)](#section_0fb9044801e24da19d60cfa1cc5e31a8) 55

 [SCARD\_IOCTL\_LISTREADERGROUPSW (IOCTL 0x00090024)](#section_b9b6341ec52c4f02af0925e2121f0382) 55

 [SCARD\_IOCTL\_LISTREADERSA (IOCTL 0x00090028)](#section_609b752adcc74e4fafb79c7ce3ef2b3d) 55

 [SCARD\_IOCTL\_LISTREADERSW (IOCTL 0x0009002C)](#section_45a76e7403014259965d39c739201b6a) 55

 [SCARD\_IOCTL\_LOCATECARDSA (IOCTL 0x00090098)](#section_2f20fd13963948958a431a3d6f0ded67) 57

 [SCARD\_IOCTL\_LOCATECARDSBYATRA (IOCTL 0x000900E8)](#section_201f92dcb12e43fb9daa9cfdf3b1bc0f) 58

 [SCARD\_IOCTL\_LOCATECARDSBYATRW (IOCTL 0x000900EC)](#section_9f604d08756d4d789b4ec45a629dc639) 58

 [SCARD\_IOCTL\_LOCATECARDSW (IOCTL 0x0009009C)](#section_52122b22b11e4014acef87de2008db77) 58

 [SCARD\_IOCTL\_READCACHEA (IOCTL 0x000900F0)](#section_e333945776994cfba3ef6eed3e849350) 61

 [SCARD\_IOCTL\_READCACHEW (IOCTL 0x000900F4)](#section_8436548aa41f4759a7ee2d0341fa1d5d) 61

 [SCARD\_IOCTL\_RECONNECT (IOCTL 0x000900B4)](#section_e827930769e0480ba1e6ac9afe88f6b0) 60

 [SCARD\_IOCTL\_RELEASECONTEXT (IOCTL 0x00090018)](#section_6d93ff3daabd402f8d6ce8c126a8e6f3) 54

 [SCARD\_IOCTL\_RELEASETARTEDEVENT](#section_5ba01684e60d4350888835e2d99e0fa9) 62

 [SCARD\_IOCTL\_REMOVEREADERFROMGROUPA (IOCTL 0x00090078)](#section_e8fbbefc5256496fbfca387c8b37a601) 57

 [SCARD\_IOCTL\_REMOVEREADERFROMGROUPW (IOCTL 0x0009007C)](#section_856ed35241a84c829d70de272546fb05) 57

 [SCARD\_IOCTL\_SETATTRIB (IOCTL 0x000900DC)](#section_535f6974925e42559dbadaaad8a86651) 61

 [SCARD\_IOCTL\_STATE (IOCTL 0x000900C4)](#section_16756fb5fd8f494982f8b480f59d8d13) 61

 [SCARD\_IOCTL\_STATUSA (IOCTL 0x000900C8)](#section_c6812fcafa3e4771a3887d24ac535c94) 60

 [SCARD\_IOCTL\_STATUSW (IOCTL 0x000900CC)](#section_e3781ea63ac24c7aa6d7804411b858dc) 60

 [SCARD\_IOCTL\_TRANSMIT (IOCTL 0x000900D0)](#section_0b24a330795048f8ade9fb90d51d0546) 60

 [SCARD\_IOCTL\_WRITECACHEA (IOCTL 0x000900F8)](#section_9b195b8efd734b578d9a7c4eb0b385cd) 62

 [SCARD\_IOCTL\_WRITECACHEW (IOCTL 0x000900FC)](#section_e72096ea9db6438c81257cb563dc7ffc) 62

 [Sending Outgoing Messages](#section_1be3db42a359491b91b14479e5f4c4b2) 63

N

[Normative references](#section_e9b8128d19ec42a18c69c03e22c59c5a) 12

O

[Outgoing messages - sending](#section_1be3db42a359491b91b14479e5f4c4b2) 63

[Overview (synopsis)](#section_bfb1c36b891147e0be031c3bfc76d41b) 13

P

[Parameters - security](#section_851a0c83618f4c4dbe39f63a4ddc8329) 78

[Parameters - security index](#section_851a0c83618f4c4dbe39f63a4ddc8329) 78

[Preconditions](#section_7df5d3a0eed44255b3f3147a16f56dfe) 15

[Prerequisites](#section_7df5d3a0eed44255b3f3147a16f56dfe) 15

[Processing Incoming Replies method](#section_55f0933b27cf414d804d466811b2c1da) 63

[Product behavior](#section_1ccc8dbe15ac4785a7184f0f82b2f18a) 86

Protocol Details

 [overview](#section_d6e154dabdca4316bee931e6a6f1d28c) 50

[Protocol\_Identifier packet](#section_4167356727104e86be877b6f46fe10af) 42

R

[ReadCache\_Common structure](#section_3f9e07fa66e2498b920c39531709116b) 21

[ReadCache\_Return structure](#section_da342355e37f485ea4903222a97fa356) 36

[ReadCacheA\_Call structure](#section_ba203dbad5464e9db8cfafa22cf88c3d) 34

[ReadCacheW\_Call structure](#section_f45705cf92994802b408685f02025e6a) 34

[Reader\_State packet](#section_3a2359602fec446b8ed150bcc70e3c5f) 44

[ReaderState\_Common\_Call structure](#section_a71e63bae58f487ca5d25a3e48856594) 19

[ReaderState\_Return structure](#section_e9d1ebf847d24f64880bd1b87479aadd) 21

[ReaderStateA structure](#section_a55f95e87a124ad3919d57d1414f81aa) 20

[ReaderStateW structure](#section_0ba03cd2bed0495badbe3d2cde61980c) 20

[Reconnect\_Call structure](#section_9c1eca523a99403c8ac86437f246a154) 28

[Reconnect\_Return structure](#section_e25a583fab824ba3bebfaf656c58e6d8) 38

[REDIR\_SCARDCONTEXT structure](#section_060abee1e52041499ef7ce79eb500a59) 18

[REDIR\_SCARDHANDLE structure](#section_b62763567c5f4d3ebe92a6c85e58d008) 18

[References](#section_433cbd062707418eaacf05691f7053e3) 12

 [informative](#section_3c2309d5e2a74d1dba47f71ac322c42a) 13

 [normative](#section_e9b8128d19ec42a18c69c03e22c59c5a) 12

[Relationship to other protocols](#section_ede43767277c4cf3ba9bf89b8f5745c1) 15

[Release context call example](#section_53f368712f51443f92451fa6149ac8e0) 77

[Release context return example](#section_f020e4c207e642959254d588f92157f6) 77

[Replies - processing](#section_55f0933b27cf414d804d466811b2c1da) 63

[Return\_Code packet](#section_9861f8da76fe41e6847e40c9aa35df8d) 45

S

[SCARD\_IOCTL\_ACCESSSTARTEDEVENT (IOCTL 0x000900E0) method](#section_47cae8f7ad7c4a568f40052fe51c0742) 54

[SCARD\_IOCTL\_ADDREADERTOGROUPA (IOCTL 0x00090070) method](#section_a65818b57a5246ea975f81e1f9988b7e) 57

[SCARD\_IOCTL\_ADDREADERTOGROUPW (IOCTL 0x00090074) method](#section_26ba40cb931c44b9876ccc43ef35fc19) 57

[SCARD\_IOCTL\_BEGINTRANSACTION (IOCTL 0x000900BC) method](#section_9961866a6d4944bd8c83fcd63e23e7e9) 59

[SCARD\_IOCTL\_CANCEL (IOCTL 0x000900A8) method](#section_195c8f3aa32341419ae833944fd50459) 59

[SCARD\_IOCTL\_CONNECTA (IOCTL 0x000900AC) method](#section_99f88bbcfb8b4b59a5dfb5ea565d7b56) 59

[SCARD\_IOCTL\_CONNECTW (IOCTL 0x000900B0) method](#section_07f337627d81479581ab351c674e5282) 59

[SCARD\_IOCTL\_CONTROL (IOCTL 0x000900D4) method](#section_032c12bb7aaa4e6f9d4c1f79cf26f45c) 60

[SCARD\_IOCTL\_DISCONNECT (IOCTL 0x000900B8) method](#section_98c887aa6d82422fb0b1b183d241be8d) 59

[SCARD\_IOCTL\_ENDTRANSACTION (IOCTL 0x000900C0) method](#section_857bd7fab97a4f6f806bc23873a6a864) 59

[SCARD\_IOCTL\_ESTABLISHCONTEXT (IOCTL 0x00090014) method](#section_ea15ee619fac40ac96ebd9d63deee760) 54

[SCARD\_IOCTL\_FORGETREADERA (IOCTL 0x00090068) method](#section_d7cbe0846f60491a9b534073c83e576f) 56

[SCARD\_IOCTL\_FORGETREADERGROUPA (IOCTL 0x00090058) method](#section_97ffdddd46334c16a7a870927e4d08a6) 56

[SCARD\_IOCTL\_FORGETREADERGROUPW (IOCTL 0x0009005C) method](#section_708b04f2c9ea49ec9921f91c95c5c5b4) 56

[SCARD\_IOCTL\_FORGETREADERW (IOCTL 0x0009006C) method](#section_637aa753382c41dc9cc7b2a8e8acdd16) 57

[SCARD\_IOCTL\_GETATTRIB (IOCTL 0x000900D8) method](#section_ef68db95671a417994e9412f741041c3) 60

[SCARD\_IOCTL\_GETDEVICETYPEID (IOCTL 0x00090108) method](#section_3c9ee4055d684a6d80a0b053ea88d987) 62

[SCARD\_IOCTL\_GETREADERICON (IOCTL 0x00090104) method](#section_a7cecc063bcb48ca90eaa9d542cffafc) 62

[SCARD\_IOCTL\_GETSTATUSCHANGEA (IOCTL 0x000900A0) method](#section_e5ea2e6c9b124fd6b45d800213dd96a1) 58

[SCARD\_IOCTL\_GETSTATUSCHANGEW (IOCTL 0x000900A4) method](#section_98cc1029420f4088b9b966ff7efe866d) 58

[SCARD\_IOCTL\_GETTRANSMITCOUNT (IOCTL 0x00090100) method](#section_ba32fda376164521a3aa6029b6a6e562) 61

[SCARD\_IOCTL\_INTRODUCEREADERA (IOCTL 0x00090060) method](#section_02ea4de9860d496b95187b63c6beadb3) 56

[SCARD\_IOCTL\_INTRODUCEREADERGROUPA (IOCTL 0x00090050) method](#section_a1587edcfe53443d93ecbde3178084f3) 55

[SCARD\_IOCTL\_INTRODUCEREADERGROUPW (IOCTL 0x00090054) method](#section_438ba1054dfb45639615b8f84172fd82) 56

[SCARD\_IOCTL\_INTRODUCEREADERW (IOCTL 0x00090064) method](#section_960310d475914839b00197f28924062d) 56

[SCARD\_IOCTL\_ISVALIDCONTEXT (IOCTL 0x0009001C) method](#section_e1a093e08d8143fb8ef5039041827633) 54

[SCARD\_IOCTL\_LISTREADERGROUPSA (IOCTL 0x00090020) method](#section_0fb9044801e24da19d60cfa1cc5e31a8) 55

[SCARD\_IOCTL\_LISTREADERGROUPSW (IOCTL 0x00090024) method](#section_b9b6341ec52c4f02af0925e2121f0382) 55

[SCARD\_IOCTL\_LISTREADERSA (IOCTL 0x00090028) method](#section_609b752adcc74e4fafb79c7ce3ef2b3d) 55

[SCARD\_IOCTL\_LISTREADERSW (IOCTL 0x0009002C) method](#section_45a76e7403014259965d39c739201b6a) 55

[SCARD\_IOCTL\_LOCATECARDSA (IOCTL 0x00090098) method](#section_2f20fd13963948958a431a3d6f0ded67) 57

[SCARD\_IOCTL\_LOCATECARDSBYATRA (IOCTL 0x000900E8) method](#section_201f92dcb12e43fb9daa9cfdf3b1bc0f) 58

[SCARD\_IOCTL\_LOCATECARDSBYATRW (IOCTL 0x000900EC) method](#section_9f604d08756d4d789b4ec45a629dc639) 58

[SCARD\_IOCTL\_LOCATECARDSW (IOCTL 0x0009009C) method](#section_52122b22b11e4014acef87de2008db77) 58

[SCARD\_IOCTL\_READCACHEA (IOCTL 0x000900F0) method](#section_e333945776994cfba3ef6eed3e849350) 61

[SCARD\_IOCTL\_READCACHEW (IOCTL 0x000900F4) method](#section_8436548aa41f4759a7ee2d0341fa1d5d) 61

[SCARD\_IOCTL\_RECONNECT (IOCTL 0x000900B4) method](#section_e827930769e0480ba1e6ac9afe88f6b0) 60

[SCARD\_IOCTL\_RELEASECONTEXT (IOCTL 0x00090018) method](#section_6d93ff3daabd402f8d6ce8c126a8e6f3) 54

[SCARD\_IOCTL\_RELEASETARTEDEVENT method](#section_5ba01684e60d4350888835e2d99e0fa9) 62

[SCARD\_IOCTL\_REMOVEREADERFROMGROUPA (IOCTL 0x00090078) method](#section_e8fbbefc5256496fbfca387c8b37a601) 57

[SCARD\_IOCTL\_REMOVEREADERFROMGROUPW (IOCTL 0x0009007C) method](#section_856ed35241a84c829d70de272546fb05) 57

[SCARD\_IOCTL\_SETATTRIB (IOCTL 0x000900DC) method](#section_535f6974925e42559dbadaaad8a86651) 61

[SCARD\_IOCTL\_STATE (IOCTL 0x000900C4) method](#section_16756fb5fd8f494982f8b480f59d8d13) 61

[SCARD\_IOCTL\_STATUSA (IOCTL 0x000900C8) method](#section_c6812fcafa3e4771a3887d24ac535c94) 60

[SCARD\_IOCTL\_STATUSW (IOCTL 0x000900CC) method](#section_e3781ea63ac24c7aa6d7804411b858dc) 60

[SCARD\_IOCTL\_TRANSMIT (IOCTL 0x000900D0) method](#section_0b24a330795048f8ade9fb90d51d0546) 60

[SCARD\_IOCTL\_WRITECACHEA (IOCTL 0x000900F8) method](#section_9b195b8efd734b578d9a7c4eb0b385cd) 62

[SCARD\_IOCTL\_WRITECACHEW (IOCTL 0x000900FC) method](#section_e72096ea9db6438c81257cb563dc7ffc) 62

[ScardAccessStartedEvent\_Call packet](#section_c5ab8dd049144355960c0a527971ea69) 35

[SCardIO\_Request structure](#section_f6e15da85bc04ef6b28ace88e8415621) 20

[Security](#section_93063dbfca414f0294f61922fa6ae1df) 78

 [implementer considerations](#section_f37f45e306a04eec8032e56193912a71) 78

 [parameter index](#section_851a0c83618f4c4dbe39f63a4ddc8329) 78

[Sending Outgoing Messages method](#section_1be3db42a359491b91b14479e5f4c4b2) 63

Sequencing rules

 [client](#section_4a5909f48ac241b2abe08b833c831b6f) 63

 [server](#section_60d5977d00174c90ab0cf34bf44a74a5) 50

Server

 [abstract data model](#section_3fddc9c237bd4fbea2d94edd4d5bb38b) 50

 [initialization](#section_c587f68aac8f4787b69ef98c692101b6) 50

 [local events](#section_2bfe273f981944a380bea3aab08e59a1) 62

 [message processing](#section_60d5977d00174c90ab0cf34bf44a74a5) 50

 [SCARD\_IOCTL\_ACCESSSTARTEDEVENT (IOCTL 0x000900E0) method](#section_47cae8f7ad7c4a568f40052fe51c0742) 54

 [SCARD\_IOCTL\_ADDREADERTOGROUPA (IOCTL 0x00090070) method](#section_a65818b57a5246ea975f81e1f9988b7e) 57

 [SCARD\_IOCTL\_ADDREADERTOGROUPW (IOCTL 0x00090074) method](#section_26ba40cb931c44b9876ccc43ef35fc19) 57

 [SCARD\_IOCTL\_BEGINTRANSACTION (IOCTL 0x000900BC) method](#section_9961866a6d4944bd8c83fcd63e23e7e9) 59

 [SCARD\_IOCTL\_CANCEL (IOCTL 0x000900A8) method](#section_195c8f3aa32341419ae833944fd50459) 59

 [SCARD\_IOCTL\_CONNECTA (IOCTL 0x000900AC) method](#section_99f88bbcfb8b4b59a5dfb5ea565d7b56) 59

 [SCARD\_IOCTL\_CONNECTW (IOCTL 0x000900B0) method](#section_07f337627d81479581ab351c674e5282) 59

 [SCARD\_IOCTL\_CONTROL (IOCTL 0x000900D4) method](#section_032c12bb7aaa4e6f9d4c1f79cf26f45c) 60

 [SCARD\_IOCTL\_DISCONNECT (IOCTL 0x000900B8) method](#section_98c887aa6d82422fb0b1b183d241be8d) 59

 [SCARD\_IOCTL\_ENDTRANSACTION (IOCTL 0x000900C0) method](#section_857bd7fab97a4f6f806bc23873a6a864) 59

 [SCARD\_IOCTL\_ESTABLISHCONTEXT (IOCTL 0x00090014) method](#section_ea15ee619fac40ac96ebd9d63deee760) 54

 [SCARD\_IOCTL\_FORGETREADERA (IOCTL 0x00090068) method](#section_d7cbe0846f60491a9b534073c83e576f) 56

 [SCARD\_IOCTL\_FORGETREADERGROUPA (IOCTL 0x00090058) method](#section_97ffdddd46334c16a7a870927e4d08a6) 56

 [SCARD\_IOCTL\_FORGETREADERGROUPW (IOCTL 0x0009005C) method](#section_708b04f2c9ea49ec9921f91c95c5c5b4) 56

 [SCARD\_IOCTL\_FORGETREADERW (IOCTL 0x0009006C) method](#section_637aa753382c41dc9cc7b2a8e8acdd16) 57

 [SCARD\_IOCTL\_GETATTRIB (IOCTL 0x000900D8) method](#section_ef68db95671a417994e9412f741041c3) 60

 [SCARD\_IOCTL\_GETDEVICETYPEID (IOCTL 0x00090108) method](#section_3c9ee4055d684a6d80a0b053ea88d987) 62

 [SCARD\_IOCTL\_GETREADERICON (IOCTL 0x00090104) method](#section_a7cecc063bcb48ca90eaa9d542cffafc) 62

 [SCARD\_IOCTL\_GETSTATUSCHANGEA (IOCTL 0x000900A0) method](#section_e5ea2e6c9b124fd6b45d800213dd96a1) 58

 [SCARD\_IOCTL\_GETSTATUSCHANGEW (IOCTL 0x000900A4) method](#section_98cc1029420f4088b9b966ff7efe866d) 58

 [SCARD\_IOCTL\_GETTRANSMITCOUNT (IOCTL 0x00090100) method](#section_ba32fda376164521a3aa6029b6a6e562) 61

 [SCARD\_IOCTL\_INTRODUCEREADERA (IOCTL 0x00090060) method](#section_02ea4de9860d496b95187b63c6beadb3) 56

 [SCARD\_IOCTL\_INTRODUCEREADERGROUPA (IOCTL 0x00090050) method](#section_a1587edcfe53443d93ecbde3178084f3) 55

 [SCARD\_IOCTL\_INTRODUCEREADERGROUPW (IOCTL 0x00090054) method](#section_438ba1054dfb45639615b8f84172fd82) 56

 [SCARD\_IOCTL\_INTRODUCEREADERW (IOCTL 0x00090064) method](#section_960310d475914839b00197f28924062d) 56

 [SCARD\_IOCTL\_ISVALIDCONTEXT (IOCTL 0x0009001C) method](#section_e1a093e08d8143fb8ef5039041827633) 54

 [SCARD\_IOCTL\_LISTREADERGROUPSA (IOCTL 0x00090020) method](#section_0fb9044801e24da19d60cfa1cc5e31a8) 55

 [SCARD\_IOCTL\_LISTREADERGROUPSW (IOCTL 0x00090024) method](#section_b9b6341ec52c4f02af0925e2121f0382) 55

 [SCARD\_IOCTL\_LISTREADERSA (IOCTL 0x00090028) method](#section_609b752adcc74e4fafb79c7ce3ef2b3d) 55

 [SCARD\_IOCTL\_LISTREADERSW (IOCTL 0x0009002C) method](#section_45a76e7403014259965d39c739201b6a) 55

 [SCARD\_IOCTL\_LOCATECARDSA (IOCTL 0x00090098) method](#section_2f20fd13963948958a431a3d6f0ded67) 57

 [SCARD\_IOCTL\_LOCATECARDSBYATRA (IOCTL 0x000900E8) method](#section_201f92dcb12e43fb9daa9cfdf3b1bc0f) 58

 [SCARD\_IOCTL\_LOCATECARDSBYATRW (IOCTL 0x000900EC) method](#section_9f604d08756d4d789b4ec45a629dc639) 58

 [SCARD\_IOCTL\_LOCATECARDSW (IOCTL 0x0009009C) method](#section_52122b22b11e4014acef87de2008db77) 58

 [SCARD\_IOCTL\_READCACHEA (IOCTL 0x000900F0) method](#section_e333945776994cfba3ef6eed3e849350) 61

 [SCARD\_IOCTL\_READCACHEW (IOCTL 0x000900F4) method](#section_8436548aa41f4759a7ee2d0341fa1d5d) 61

 [SCARD\_IOCTL\_RECONNECT (IOCTL 0x000900B4) method](#section_e827930769e0480ba1e6ac9afe88f6b0) 60

 [SCARD\_IOCTL\_RELEASECONTEXT (IOCTL 0x00090018) method](#section_6d93ff3daabd402f8d6ce8c126a8e6f3) 54

 [SCARD\_IOCTL\_RELEASETARTEDEVENT method](#section_5ba01684e60d4350888835e2d99e0fa9) 62

 [SCARD\_IOCTL\_REMOVEREADERFROMGROUPA (IOCTL 0x00090078) method](#section_e8fbbefc5256496fbfca387c8b37a601) 57

 [SCARD\_IOCTL\_REMOVEREADERFROMGROUPW (IOCTL 0x0009007C) method](#section_856ed35241a84c829d70de272546fb05) 57

 [SCARD\_IOCTL\_SETATTRIB (IOCTL 0x000900DC) method](#section_535f6974925e42559dbadaaad8a86651) 61

 [SCARD\_IOCTL\_STATE (IOCTL 0x000900C4) method](#section_16756fb5fd8f494982f8b480f59d8d13) 61

 [SCARD\_IOCTL\_STATUSA (IOCTL 0x000900C8) method](#section_c6812fcafa3e4771a3887d24ac535c94) 60

 [SCARD\_IOCTL\_STATUSW (IOCTL 0x000900CC) method](#section_e3781ea63ac24c7aa6d7804411b858dc) 60

 [SCARD\_IOCTL\_TRANSMIT (IOCTL 0x000900D0) method](#section_0b24a330795048f8ade9fb90d51d0546) 60

 [SCARD\_IOCTL\_WRITECACHEA (IOCTL 0x000900F8) method](#section_9b195b8efd734b578d9a7c4eb0b385cd) 62

 [SCARD\_IOCTL\_WRITECACHEW (IOCTL 0x000900FC) method](#section_e72096ea9db6438c81257cb563dc7ffc) 62

 [sequencing rules](#section_60d5977d00174c90ab0cf34bf44a74a5) 50

 structures ([section 2.2.1](#section_a1c72bb1106f45c08b9333d69ee22b39) 18, [section 2.2.2](#section_f4ca3b61b49c463c89322cf82fb7ec7a) 22)

 [timer events](#section_349f0d4e9bd74af2a0f6e3e5e66e853e) 62

 [timers](#section_56153512c344416d85bd29190304e38c) 50

[SetAttrib\_Call structure](#section_28f8dd6035b745fbab7515bbf81f5d11) 33

[Standards assignments](#section_35c36a8458e84261a80df92badb21006) 16

[State\_Call structure](#section_ba3b909702fe4f6b951c05439a7d9da7) 30

[State\_Return structure](#section_574e5ec596ba4b11bfa952eb34307356) 39

[Status call example](#section_816e7281ada64b4ea700f77fab2115c1) 76

[Status return example](#section_746cc3b931dc45dba533d7bb47b71928) 76

[Status\_Call structure](#section_f1139aede57847f3a800f36b56c80500) 30

[Status\_Return structure](#section_987c1358ad6b4c8e88e106210c28a66f) 39

Structures

 client ([section 2.2.1](#section_a1c72bb1106f45c08b9333d69ee22b39) 18, [section 2.2.3](#section_4a383ba74ee8418593de6ddb3d6f3d1d) 36)

 server ([section 2.2.1](#section_a1c72bb1106f45c08b9333d69ee22b39) 18, [section 2.2.2](#section_f4ca3b61b49c463c89322cf82fb7ec7a) 22)

T

Timer events

 [client](#section_cbb351e820dc4b27a7a7819c6f92c130) 72

 [server](#section_349f0d4e9bd74af2a0f6e3e5e66e853e) 62

Timers

 [client](#section_8133f96e4e50432e99d194e7fdb3b0bc) 63

 [server](#section_56153512c344416d85bd29190304e38c) 50

[Tracking changes](#section_5fcb0635bb9a4bcd8ee942fac5068dd9) 87

[Transmit\_Call structure](#section_e3861cfae61b4d64b19df6b31e076beb) 31

[Transmit\_Return structure](#section_252cffd058b8434d9e1b0d547544fb0f) 40

[Transport](#section_0273ee6a2b1b421bbf395c964f67220c) 18

[Transport - message](#section_0273ee6a2b1b421bbf395c964f67220c) 18

[Triggered events - higher-layer - client](#section_07fe041ff74d422aadfe818dfa7c1d75) 63

V

[Vendor-extensible fields](#section_ff53bd2ef42a45018877e8f344755e23) 16

[Versioning](#section_568e22eec9ee4e8780c554795f667062) 16

W

[WriteCache\_Common structure](#section_5604251b9173457c947657863df9010e) 21

[WriteCacheA\_Call structure](#section_31ce1b620c504441b3e08661635849fb) 35

[WriteCacheW\_Call structure](#section_3969bdcdecf342db8bc62d6f970f9c67) 35