



# DevDays **ASIA** 2020 — online —

亞太技術年會



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## Windows Protocols and Test Suites Overview

Althea Champagnie, Senior Program Manager

Min Li, Principal Software Engineering Manager

# Agenda

- Overview of Windows Protocols
  - What do the Windows protocols cover
  - What resources are available
- Introduction to Protocols Test Suites
  - What test suites are available and how they work
  - What test cases are covered by the RDP test suites
  - Where to find the test suites and how to use them

# Overview of Windows Protocols

Althea Champagnie, Senior Program Manager

# Microsoft Interoperability Guidelines

- Our goal is to ensure that third-party developers have access to the interoperability information, tools, and resources they need to successfully develop the services, products, and platforms that apply to Microsoft
- We love our developers!



Events



Technical  
Support



Tools



Documents

# Events

- Co-sponsored industry events
  - SNIA Storage Development Conference
  - SambaXP
- RDP-focused events
  - Presentations, I/O Labs, Meetups, and more.
  - A virtual RDP event is being planned for later in the year
- Find more info at [InteropEvents.com](http://InteropEvents.com).

# What Are The Protocols Technical Specs?

- Detailed technical specifications for Microsoft protocols that are implemented and used by Windows to interoperate or communicate with other Microsoft products
- Descriptions of extensions to industry-standard and other published protocols that are used by Windows
- Essential resource for developers doing protocol implementation work
- Includes use cases
- Find them at <https://aka.ms/techspecs>

# What Are The Protocols Overview Documents?

- “... illustrate how Windows protocols that are functionally related work together, with practical examples that demonstrate common usage scenarios.”
- Good resource for new developers getting into protocol implementation work
- Good resource for seasoned developers getting into a new technology area
- Includes sequencing diagrams of the examples
- Includes Network Captures of the examples
- Find them at <https://aka.ms/ods>

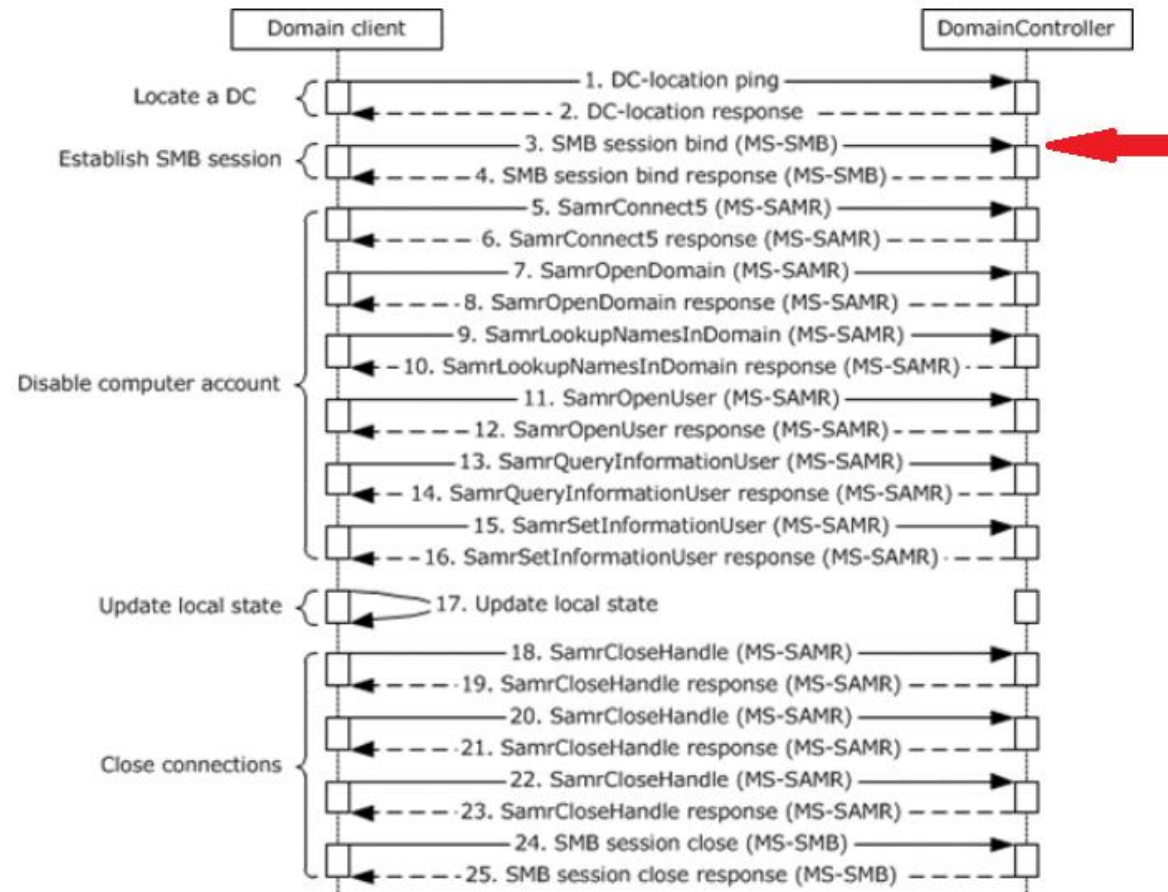


# What ODs Are Available?

Technology	Overview Document(s)
File, Fax, and Printing Services	MS-CCROD, MS-FASOD, MS-FSMOD, MS-PRSOD, MS-STOROD, MS-VSOD
Security and Identity Management	MS-AUTHSOD, MS-AZOD, MS-CERSOD, MS-RMSOD
Directory Services	MS-ADOD, MS-ADFSOD
Systems Management	MS-GPOD, MS-WMOD, MS-WSUSOD
Application Services	MS-MQOD, MS-TPSOD
Collaboration and Communications	MS-MSSOD
Networking	MS-NETOD, MS-NAPOD
Remote Connectivity	MS-RDSOD

<https://aka.ms/ods>

# What Are The Network Captures?



<https://aka.ms/odcap>

Figure 45: Message flow for unjoining from a domain

# What Are The Network Captures?

The image shows a Wireshark network capture interface. The top menu bar includes File, Edit, View, Go, Capture, Analyze, Statistics, Telephony, Wireless, Tools, and Help. The main window is titled 'pkt\_comment' and displays a list of network packets. A red arrow points to the first packet in the list, which is a Session Setup Request (SMB2) from 192.168.0.101 to 192.168.0.1. Below the packet list, the 'Packet comments' pane is expanded, showing details for the selected packet. A red arrow points to the 'Step 3' entry in the comments, which describes the SMB session bind request. The bottom pane shows the raw packet data in hexadecimal and ASCII.

No.	Time	Source	Destination	Protocol	Length	Info
45	9.638295	192.168.0.101	192.168.0.1	SMB2	3300	Session Setup Request
47	9.639900	192.168.0.1	192.168.0.101	SMB2	315	Session Setup Response
78	10.698179	192.168.0.101	192.168.0.1	SAMR	266	Connect5 request
79	10.698583	192.168.0.1	192.168.0.101	SAMR	234	Connect5 response
80	10.698675	192.168.0.101	192.168.0.1	SAMR	258	OpenDomain request
81	10.699042	192.168.0.1	192.168.0.101	SAMR	218	OpenDomain response
82	10.699123	192.168.0.101	192.168.0.1	SAMR	304	LookupNames request
83	10.699511	192.168.0.1	192.168.0.101	SAMR	258	LookupNames response
84	10.699587	192.168.0.101	192.168.0.1	SAMR	230	OpenUser request
85	10.700087	192.168.0.1	192.168.0.101	SAMR	218	OpenUser response

**Packet comments**

Title: Example 4. Figure 45. Step 3 SMB session bind  
Author: Microsoft Corporation

Step 3  
Type: Domain Client sends SMB session bind Request  
Roles: Domain Client -> Domain Controller  
Frame: 45  
Message ID: [MS-SMB2]: SMB2 SESSION\_SETUP Request

> Frame 45: 3300 bytes on wire (26400 bits), 3300 bytes captured (26400 bits) on interface \Device\NPF\_{1C0C2A9E-62B4-46B4-9C9E-C7C579F9A6B8}, id 0  
> Ethernet II, Src: Microsof\_51:a7:36 (00:15:5d:51:a7:36), Dst: Microsof\_51:a7:37 (00:15:5d:51:a7:37)  
> Internet Protocol Version 4, Src: 192.168.0.101, Dst: 192.168.0.1  
> Transmission Control Protocol, Src Port: 54341, Dst Port: 445, Seq: 290, Ack: 587, Len: 3246  
> NetBIOS Session Service  
> SMB2 (Server Message Block Protocol version 2)

```
0000 00 15 5d 51 a7 37 00 15 5d 51 a7 36 08 00 45 00  ..]Q 7.. ]Q 6..E
0010 00 00 e4 9f 40 00 80 06 00 00 c0 a8 00 65 c0 a8  ....@.....e..
0020 00 01 d4 45 01 bd fa 83 59 bf a4 d1 73 92 50 18  ..E...Y...s.P
0030 20 12 81 bd 00 00 00 00 0c aa fe 53 4d 42 40 00  ....SMB@
0040 01 00 00 00 00 00 01 00 21 00 10 00 00 00 00 00  !.....
0050 00 00 02 00 00 00 00 00 00 00 ff fe 00 00 00 00  .....
0060 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
0070 00 00 00 00 00 00 00 00 00 00 19 00 00 02 01 00  .....
0080 00 00 00 00 00 00 58 00 52 0c 00 00 00 00 00 00  ....X.R.....
0090 00 00 60 82 0c 4e 06 06 2b 06 01 05 05 02 a0 82  ..N..+.....
```

<https://aka.ms/odcap>



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# Windows 協定測試套件介紹

Min Li, Principal Software Engineering Manager

# 什麼是協定測試套件(Protocol Test Suites) ?

- 一組打包的測試範例, 用來驗證協定消息和行為
- 最初開發用於測試微軟的開放協定 (Open Specification)
  - 用來測試/驗證 Windows 行為
  - 用來測試協力廠商(industry partner)的實現
- 我們的測試套件不一定包括每個協定要求, 也不驗證具體的實現, 但可以作為測試互通性(interoperability) 的有用指示。

## 測試套件的類型:

- **單獨的測試套件:** MS-SMBD, MS-SMB, MS-ADFSP
- **家族測試套件:** AD, File Server (MS-SMB2 and related protocols), Remote Desktop, Kerberos, Branch Cache
- **概觀協定:** MS-ADOD, MS-AZOD

# 為什麼要開發協定測試套件

## 目标:

- 保證微軟開放協定(Open Specification)的品質
  - 正確性和實用性
- 幫助廠商實現協定開發
  - 簡化調試過程
    - 消息序列
    - 加密/解密消息
- 參考引用測試套件的源代碼
  - <http://aka.ms/wpts>, <http://aka.ms/wptf>

# 開發了哪些協定測試套件

## • 測試協定套件的開源進展

- 11個家族測試套件
- 44個 Windows協定
- MIT License
- 協定測試框架Protocol Test Framework
- 協定測試管理器Protocol Test Manager
- 工具集Utilities
- 2種格式: 源代碼, MSI安裝包

類別	測試套件	協定
File Sharing 文件共享	<u>File Server (SMB3)</u>	MS-SMB2, MS-FSRVP, MS-SWN, MS-DFSC, MS-RSVD, MS-SQOS, MS-FSA
	<u>MS-SMB</u>	MS-SMB
	<u>MS-SMBD</u>	MS-SMBD
	<u>BranchCache</u>	MS-PCCRC, MS-PCCRR, MS-PCCRTP, MS-PCHC, MS-CCROD
Security 安全認證	<u>Kerberos</u>	MS-KILE, MS-KKDCP, MS-PAC
	<u>MS-AZOD</u>	MS-AZOD
Active Directory 活動目錄	<u>ADFamily</u>	MS-ADTS-LDAP, MS-ADTS-PublishDC, MS-ADTS-Schema, MS-ADTS-Security, MS-APDS, MS-DRSR, MS-FRS2, MS-LSAD, MS-LSAT, MS-NRPC, MS-SAMR
	<u>MS-ADOD</u>	MS-ADOD
Remote Desktop 遠程桌面	<u>RDP Client/RDP Server</u>	MS-RDPBCGR, MS-RDPEDISP, MS-RDPEDYC, MS-RDPEGFX, MS-RDPEGT, MS-RDPEI, MS-RDPEMT, MS-RDPEUDP, MS-RDPEUSB, MS-RDPEVOR, MS-RDPRFX, MS-RDPELE
BYOD 自控電子設備	<u>MS-ADFSPiP</u>	MS-ADFSPiP

# RDP 用戶端家族測試套件

- 涵蓋11個協定,已同步至Win10 19H2 (1909)
- 被測試對象System Under Testing (SUT) 是RDP用戶端實作, mstsc.exe, FreeRDP, Thin Client ...
- 400+ 測試範例
- 測試代碼包含: RemoteFX codec, Clear Codec, Progressive Codec

# RDP 伺服器測試套件

- 涵蓋4個協定,已同步至Windows Server 19H2 (1909)
- 被測試對象System Under Testing (SUT)是RDP伺服器端實作
- 25個測試範例



# RDP 用戶端測試套件家族範圍

## MS-RDPBCGR/EDYC/EGT

- Connection
- Reactivation
- Auto-Reconnection
- Server Redirection
- Basic Client Input
- Fast-Path/Slow-Path
- Static virtual Channel
- Network Auto-Detection
- Connection health monitoring

## MS-RDPRFX

- RFX Codec (RLGR1/RLGR3)
- Image / Video Mode

## MS-RDPEUSB

- USB Device Channel Setup
- I/O

## MS-RDPEVOR

- Video Remoting

## MS-RDPEGFX

- Surface & Cache
- RemoteFX Codec
- Progressive Codec
- Clear Codec
- RDP8.0 Compression
- H264 Codec

## MS-RDPEUDP

- Reliable/Lossy Connection
- Retransmit
- Congestion Control

## MS-RDPEMT

- Build Secure Channel
- Network Auto-Detection
- Exchange DVC data

## MS-RDPEI

- Touch Input
- Touch Control

## MS-RDPEDISP

- Change display configuration

# RDP 伺服器端測試套件家族範圍

## MS-RDPBCGR/EDYC/EGT

- Connection
- Auto-Reconnection
- Fast-Path
- Slow-Path
- Static virtual Channel
- Network Auto-Detection Connection
- Health monitoring

## MS-RDPEMT

- Build Secure Channel
- Network Auto-Detection
- Exchange DVC data

## MS-RDPEDYC

- Create and close DVC
- Send compressed
- Send uncompressed data

## MS-RDPELE

- New License
- License Upgrade

# 協定測試套件在哪里

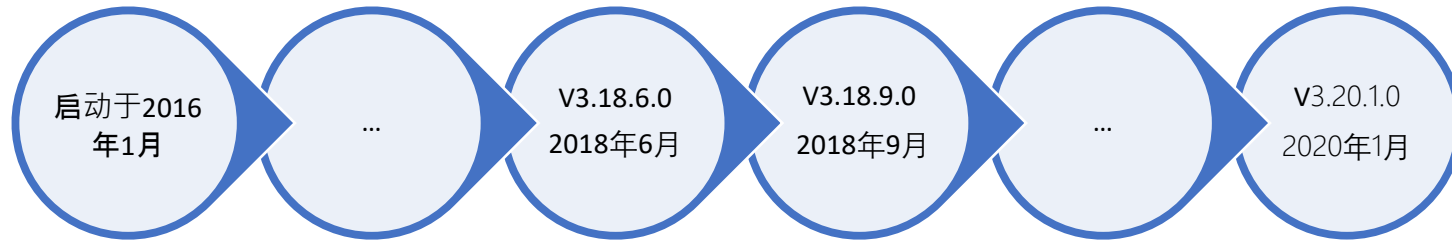
<http://aka.ms/wpts>, <http://aka.ms/wptf>

- GitHub
- 兩種格式
  - 源代碼
  - MSI安裝包

The screenshot shows the GitHub repository page for `Microsoft / WindowsProtocolTestSuites`. The repository has 75 watchers, 66 stars, and 51 forks. It contains 974 commits, 2 branches, and 6 releases. The `TestSuites` directory is highlighted in the file list, and a dropdown menu shows its contents: `ADFamily`, `BranchCache`, `FileServer`, `Kerberos`, `MS-ADFSPIP`, `MS-ADOD`, `MS-AZOD`, `MS-SMB`, `MS-SMBD`, and `RDP`. The `6 releases` link is also highlighted, and a callout box shows the details for `WindowsProtocolTestSuites 3.18.3.0`, released on Feb 2, listing various MSI assets and source code files.

Asset Name	Size
ADFamily-TestSuite-ServerEP.msi	33 MB
BranchCache.msi	1.76 MB
FileServer-TestSuite-ServerEP.msi	13.3 MB
Kerberos-TestSuite-ServerEP.msi	3.44 MB
MS-ADFSPIP-TestSuite-ClientEP.msi	820 KB
MS-ADOD-TestSuite-ODEP.msi	748 KB
MS-AZOD-TestSuite-ODEP.msi	716 KB
MS-SMB-TestSuite-ServerEP.msi	8.07 MB
MS-SMBD-TestSuite-ServerEP.msi	1.57 MB
ProtocolTestManager.msi	2.54 MB
RDP-TestSuite-ClientEP.msi	26.3 MB
RDP-TestSuite-ServerEP.msi	7.57 MB
Source code (zip)	
Source code (tar.gz)	

# 開源Windows協定測試套件



- 2 個代碼資源庫, 14 次發佈
  - GitHub <http://aka.ms/wptf>
  - GitHub <http://aka.ms/wpts>
- 3年中總下載量增長了7倍, 達到了8000+
- 持續增長的業界合作夥伴貢獻和深度合作
  - GitHub issues
  - Pull Request

A screenshot of a GitHub issues page. The top bar shows 7 Open and 225 Closed issues. The list of issues includes:

- Service principal name is wrongly determined by reverse DNS lookup (Issue #233, opened 8 days ago by slupu-infinidat)
- Visual Studio should not be a requirement (enhancement) (Issue #232, opened 14 days ago by slupu-infinidat)
- Add missing deployment items for rdpegfx test suite (RDP) (Issue #231, opened on Apr 28 by nfeder)
- Unable to run SMBD test cases for version 3.20.1.0 (MS-SMBD) (Issue #230, opened on Apr 15 by vinitagnihotri)
- [MS-RDPEFGX] RDPEFGX\_H264Codec\_PositiveTest\_AVC444v2 failure (RDP) (Issue #229, opened on Mar 5 by nfeder)
- [MSRDPEFGX]: add ExpectChannelClosed adapter method (RDP) (Issue #228, closed on Mar 5 by nfeder)
- [MS-RDPEFGX] 3.3.1.4 Bitmap Cache 0-based or 1-based indexing (RDP) (Issue #227, closed 23 days ago by nfeder)
- [MS-RDPEFGX] invalid RDPGFX\_CAPVERSION\_106 value (Issue #226, closed on Feb 26 by nfeder)
- [MS-RDPEFGX] fix invalid RDPGFX\_CAPVERSION\_106 value (Issue #225, closed on Feb 26 by nfeder)
- Update logs blob and test modification result (Issue #224, closed on Feb 21 by Xinzheng-Li)
- Add C control agent (RDP, enhancement) (Issue #223, merged on Mar 23 by ligurio)
- Fix in an RDP python control agent (RDP, bug) (Issue #222, merged on Mar 6 by ligurio)
- Building PTM and Testsuites on Linux (Linux, enhancement) (Issue #221, opened on Feb 20 by ligurio)
- [MS-RDPRFX] invalid channelId for blockType WBT\_CONTEXT (RDP, bug) (Issue #220, closed on Feb 21 by nfeder)
- [MS-RDPRFX] fix invalid channelId for blockType WBT\_CONTEXT (RDP, bug) (Issue #219, merged on Feb 21 by nfeder)
- Test case failed on Windows SMB3 share (FileServer, bug) (Issue #218, closed on Mar 30 by harshivs)
- Chocolatey packages (InstallPrerequisites, enhancement) (Issue #217, opened on Feb 3 by ligurio)
- Ptmcli.exe exits without any message (PTMCLI, question) (Issue #216, closed on Feb 3 by ligurio)
- RDP Client tests failed with same error (Documentation, bug) (Issue #215, closed on Mar 23 by ligurio)
- Is public void GetObjectFunctionality(out bool isImplemented) doing the right thing? (FileServer, bug) (Issue #214, closed on Mar 30 by zherogefluo)

# 深耕开源社群

Watch 90 Star 314 Fork 154

1 Open 5 Closed Author Label Projects

- [MSRDPEGFX]: add ExpectChannelClosed adapter method × RDP #228 by nferda was closed on Mar 5
- Add C control agent ✓ RDP #223 by ligurio was merged on Mar 23
- Fix in an RDP python control agent ✓ RDP #222 by ligurio was merged on Mar 6
- [MS-RDPRFX] fix invalid channelId for blockType WBT\_CONTEXT × RDP #219 by nferda was merged on Feb 21
- [MSRDPEGFX]: add ExpectChannelClosed adapter method × RDP #228 by nferda was closed on Mar 5
- [MS-RDPEGFX] 3.3.1.4 Bitmap Cache 0-based or 1-based indexing RDP #227 by nferda was closed 24 days ago
- Add C control agent ✓ RDP enhancement #223 by ligurio was merged on Mar 23
- Fix in an RDP python control agent ✓ RDP #222 by ligurio was merged on Mar 6
- [MS-RDPRFX] invalid channelId for blockType WBT\_CONTEXT × RDP #220 by nferda was closed on Feb 21
- [MS-RDPRFX] fix invalid channelId for blockType WBT\_CONTEXT × RDP #219 by nferda was merged on Feb 21
- Little Confusion RDP question #198 by devcoifnet was closed on Oct 29, 2019
- System.NullReferenceException in S6\_AutoDetection\_ConnectTime\_RTT RDP #195 by ligurio was closed on Aug 13, 2019
- RDP client tests failed with error "The credentials supplied to the package were not recognized" RDP question #183 by ligurio was closed on Jul 17, 2019
- Incorrect default value of VerifySUTDisplay.IQA.AssessValueThreshold in RDP default settings Documentation RDP enhancement #169 by ligurio was closed on Jun 14, 2019
- Two similar documents about SUT Remote Control Protocol in a source repository Documentation RDP enhancement question #168 by ligurio was closed on Jun 17, 2019

microsoft / WindowsProtocolTestSuites

FreeRDP / FreeRDP Watch 334 Star 4.4k Fork 1.6k

### Fixed TS\_INFO\_PACKET #5275

Merged akalabeth merged 1 commit into FreeRDP:master from jiajunw:repository on Feb 23, 2019

Conversation Commits Checks Files changed

JiajunW commented on Feb 22, 2019

Those fields exclude the length of the mandatory null terminator:

- cbDomain
- cbUserName
- cbPassword
- cbAlternateShell
- cbWorkingDir

freerdp-bot commented on Feb 22, 2019

Can one of the admins verify this patch?

JiajunW commented on Feb 22, 2019

According to MS-RDPBCGR section 2.2.1.11.1, cbDomain, cbAlternateShell, cbWorkingDir, and cbAlternateShell should exclude the length of the mandatory null terminator. And the example capture in section 4.1.10 also shows the fact:

```
00 04 09 04 -> TS_INFO_PACKET::CodePage = 0x04090409
Low word = 0x0409 = 383 = English (US)
Since the INFO_UNICODE flag is set, this is the active language identifier.

b3 43 00 00 -> TS_INFO_PACKET::Flags = 0x00004303
0x00004303
- 0x00000001 |
  0x00000002 |
  0x00000010 |
  0x00000020 |
  0x00000080 |
  0x00000100 |
  0x00000200 |
  0x00004000 |
- INFO_PACKET |
  INFO_DISABLELALTDL |
  INFO_UNICODE |
  INFO_MAXIMIZE_SHELL |
  INFO_COMPRESSION |
  INFO_ENABLE_ENCRYPTION |
  PACKET_COMPRESSION_TYPE_64 << 9 |
  INFO_FORCE_ENCRYPTED_CS_PDU
```

FreeRDP

<https://github.com/FreeRDP/FreeRDP/pull/5275>



rdesktop / rdesktop Watch 64

### Fix endianness of options field in CHANNEL\_DEF #317

Open JiajunW wants to merge 1 commit into rdesktop:master from jiajunw:CHANNEL\_DEF-endianness

Conversation Commits Checks Files changed

JiajunW commented 22 days ago

No description provided.

Fix endianness of options field in CHANNEL\_DEF

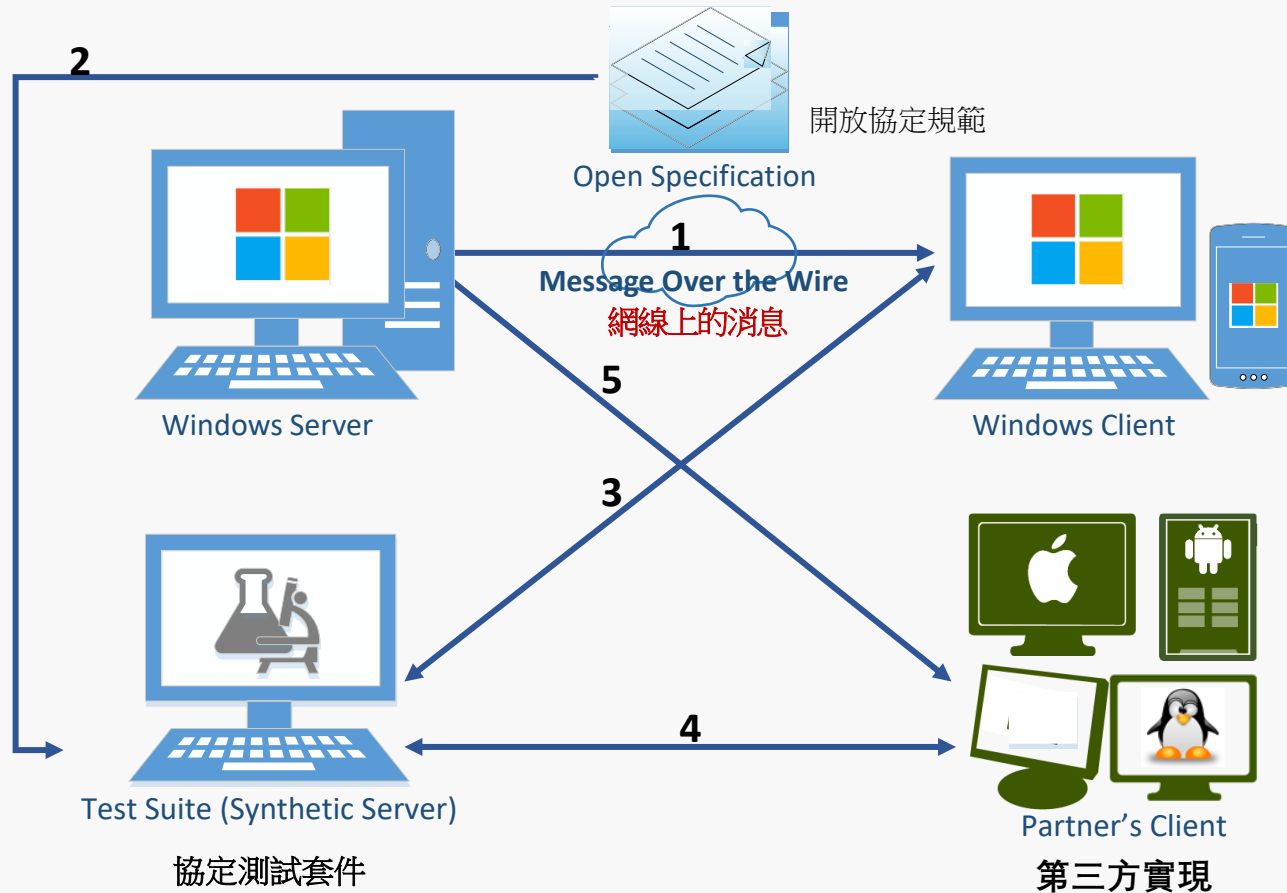
The options field should be little-endian.

The example packet is recorded in MS-RDPBCGR section 4.1.3:

```
03 00 00 00 -> TS_UD_CS_NET::channelCount = 3
72 64 70 64 72 00 00 00 -> CHANNEL_DEF::name = "rdprn"
00 00 80 80 -> CHANNEL_DEF::options = 0x00000000
0x00000000
= 0x00000000 | 0x00000000
= CHANNEL_OPTION_INITIALIZED | CHANNEL_OPTION_COMPRESS_RDP
63 6c 69 70 72 64 72 00 -> CHANNEL_DEF::name = "clipdrn"
00 00 a0 c0 -> CHANNEL_DEF::options = 0xcba00000
```

<https://github.com/rdesktop/rdesktop/pull/317>

# 如何設計協定測試套件



1. 熟悉開放協定規範：消息，消息序列，行為

2. 開發協定測試套件(Synthetic Server): 依照開放協定規範

3. 驗證文檔:與 Windows實現進行交互測試

4. 與第三方實現進行交互測試: 說明發現實現上的問題

5. 目標: 第三方實現 與Windows Server 正常交互

# 如何設計測試用例

協定規範:

#1: If RDP server receives message A from RDP Client, RDP Server should respond with message B.

#2: If message A is invalid, Test Suite should return error message C.

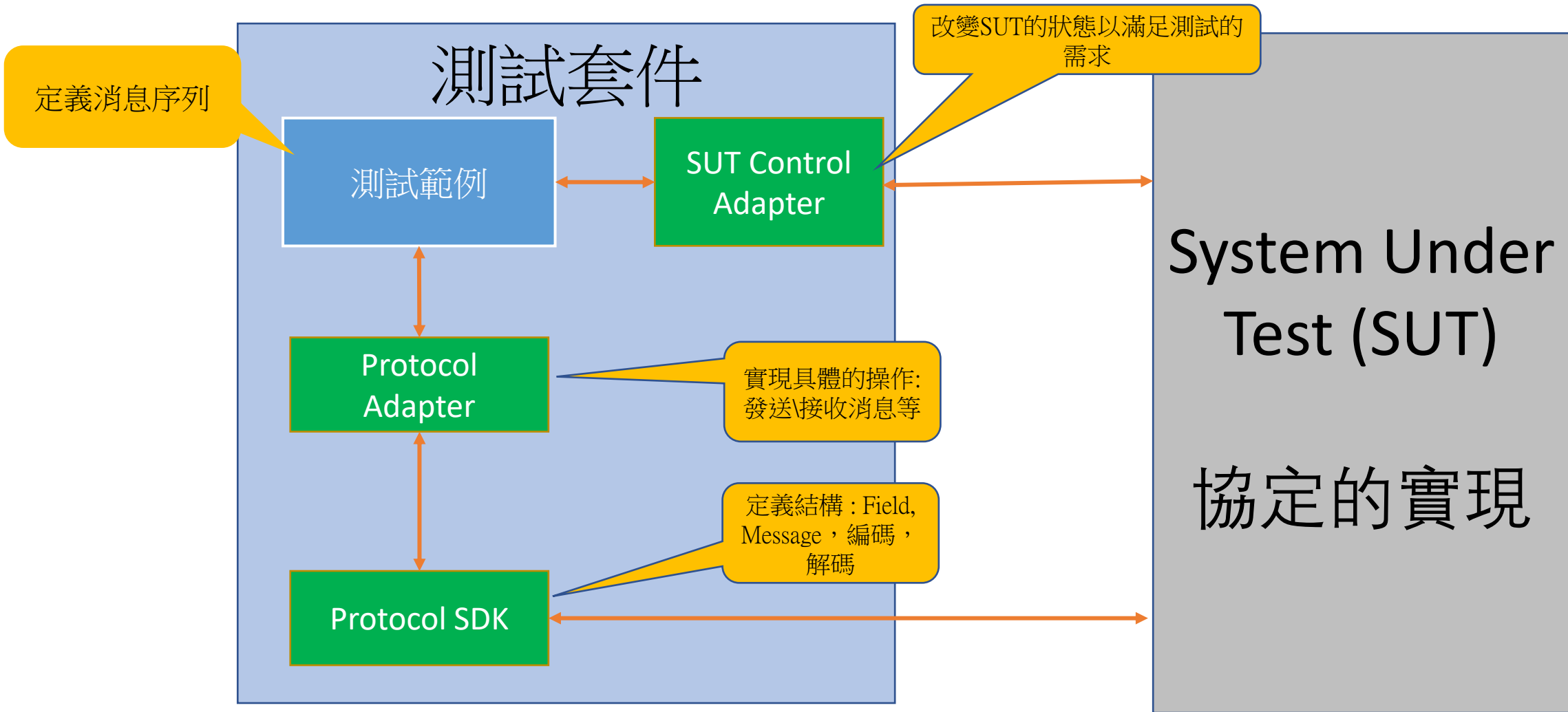
測試範例#2:

1. Establish connection;
2. TestSuite.Receive(***Invalid msgA***);
3. Expect RDP Client to send ***msgC***, and
  - ***Assert (msgC.Status == ERROR)***
4. TestSuite.Send(***Error msgC***)

測試範例#1:

1. Establish connection;
2. TestSuite.Receive(***valid msgA***);
3. Expect client to send ***msgA***, and
  - ***Assert (msgA.Field1 == valid1)***
  - ***Assert (msgA.Field2 == valid2)***
  - ...
  - ***Assert (msgB.FieldN == validN)***
4. TestSuite.Send(***valid msgB***);

# 測試套件的架構





# 協定測試框架 Protocol Test Framework (PTF)

- 基于 Visual Studio Unit Test 框架
- 集成通用的 feature
- 簡化開發測試套件
- GitHub 代碼開源：  
<http://aka.ms/wptf>

File Server  
測試套件

RDP  
測試套件

...

Protocol Test Framework

Visual Studio Unit Test

# 協定測試管理器

<http://aka.ms/wpts>

## 協定測試管理器 Protocol Test Manager (PTM)

- 嵌入了部署向導
- 自動檢測測試對象的性能和配置
- 推薦可執行的測試用例
- 簡化測試套件的配置
- 提供有好的運行界面
- 展示測試結果
- 支持命令行及重跑



# 主要特點 I

- PTF 配置文件
- XXX.deployment.ptfconfig
  - 提供測試環境的基本配置信息, 例如IP地址, 用戶名, 密碼...
- XXX.ptfconfig
  - 提供測試套件的通用信息, 例如使用的Adapter的類型, logging的類型...

```
<Adapters>
  <Adapter xsi:type="powershell" name="ISutProtocolControlAdapter" scriptdir=".\"/>
</Adapters>

<TestLog defaultprofile="Verbose">
  <Sinks>
    <File id="XMLLog" directory=".\\TestLog" file="FileServer_Log.xml" format="xml"/>
    <File id="Debug" directory=".\\TestLog" file="FileServer_DEBUG.txt" format="text"/>
    <Sink id="PipeSink" type="Microsoft.Protocols.TestTools.Logging.PipeSink"/>
  </Sinks>

  <Profiles>
    <Profile name="Verbose" extends="Error">
      <!-- Show for ETW -->
      <Rule kind="TestStep" sink="Etw" delete="false"/>
      <Rule kind="Checkpoint" sink="Etw" delete="false"/>
      <Rule kind="CheckSucceeded" sink="Etw" delete="false"/>
      <Rule kind="CheckFailed" sink="Etw" delete="false"/>
      <Rule kind="CheckInconclusive" sink="Etw" delete="false"/>
      <Rule kind="Comment" sink="Etw" delete="false"/>
      <Rule kind="Warning" sink="Etw" delete="false"/>
      <Rule kind="Debug" sink="Etw" delete="false"/>
      <Rule kind="TestFailed" sink="Etw" delete="false"/>
      <Rule kind="TestInconclusive" sink="Etw" delete="false"/>
      <Rule kind="TestPassed" sink="Etw" delete="false"/>

      <!-- Show for CommandLineConsole -->
      <Rule kind="TestStep" sink="CommandLineConsole" delete="false"/>
      <Rule kind="Checkpoint" sink="CommandLineConsole" delete="false"/>
      <Rule kind="CheckSucceeded" sink="CommandLineConsole" delete="false"/>
      <Rule kind="CheckFailed" sink="CommandLineConsole" delete="false"/>
      <Rule kind="CheckInconclusive" sink="CommandLineConsole" delete="false"/>
      <Rule kind="Comment" sink="CommandLineConsole" delete="false"/>
      <Rule kind="Warning" sink="CommandLineConsole" delete="false"/>
    </Profile>
  </Profiles>
</TestLog>
```

# 主要特點 II

## SUT Control Adapter

- 用于控制SUT (System Under Test)的狀態

- PowerShell

```
<Adapter xsi:type="powershell" name="ISutControlAdapter" scriptdir=".\"/>
```

- Interactive

```
<Adapter xsi:type="interactive" name="ISutControlAdapter"/>
```

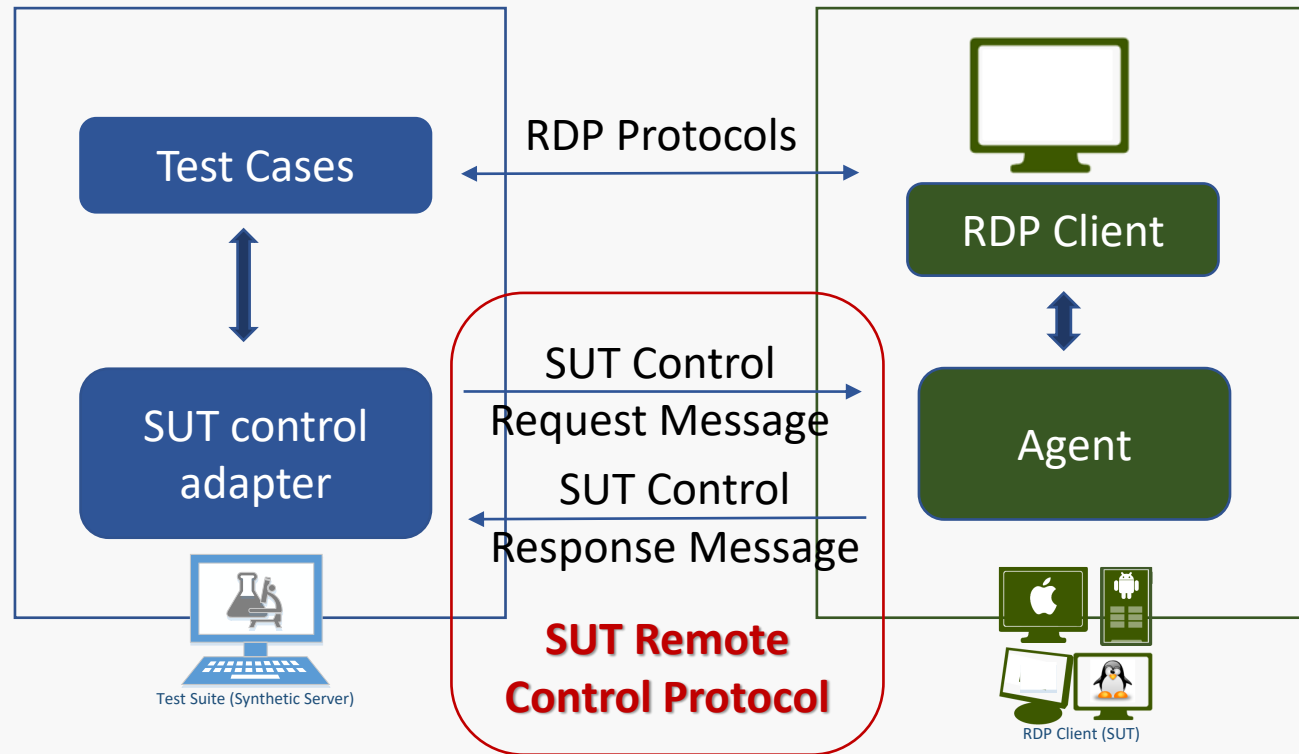
- Managed Adapter:

```
<Adapter xsi:type="managed" name="ISutControlAdapter" adaptertype="Microsoft.Protocol.TestSuites.Kerberos.Adapter.SutControlAdapter"/></Adapter>
```

- RDP Client 測試套件已支持C#, C, Python, Java的測試對象控制器 ( SUT Control Agent )
- 源代碼見[GitHub](#)

# 基於協定的測試對象控制器 SUT Control Agent

- 基於自定義的一個簡單協定 ([SUT remote control protocol](#)) 傳輸控制命令
- 用戶需要基於此協定實現一個簡單的程序作為代理器



# 資源

- 開放技術文檔: <http://aka.ms/techspecs>
- 開放技術文檔支持, 請聯繫: [dochelp@microsoft.com](mailto:dochelp@microsoft.com)
- 測試套件GitHub開源: <http://aka.ms/wpts>, <http://aka.ms/wptf>
  - 歡迎提交問題, 貢獻代碼和討論
- 技術概述文檔: <https://aka.ms/ods>
- 該書文檔網絡抓包GitHub開源: <https://aka.ms/ODCap>
- 論壇及最新消息: [https://social.msdn.microsoft.com/forums/en-us/home?forum=os\\_windowsprotocols](https://social.msdn.microsoft.com/forums/en-us/home?forum=os_windowsprotocols)



Thank you