

RDP Test Suite Updates & Tools

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Windows Protocol Test Suites

RDP Test Suites

RDP Test Suites Updates

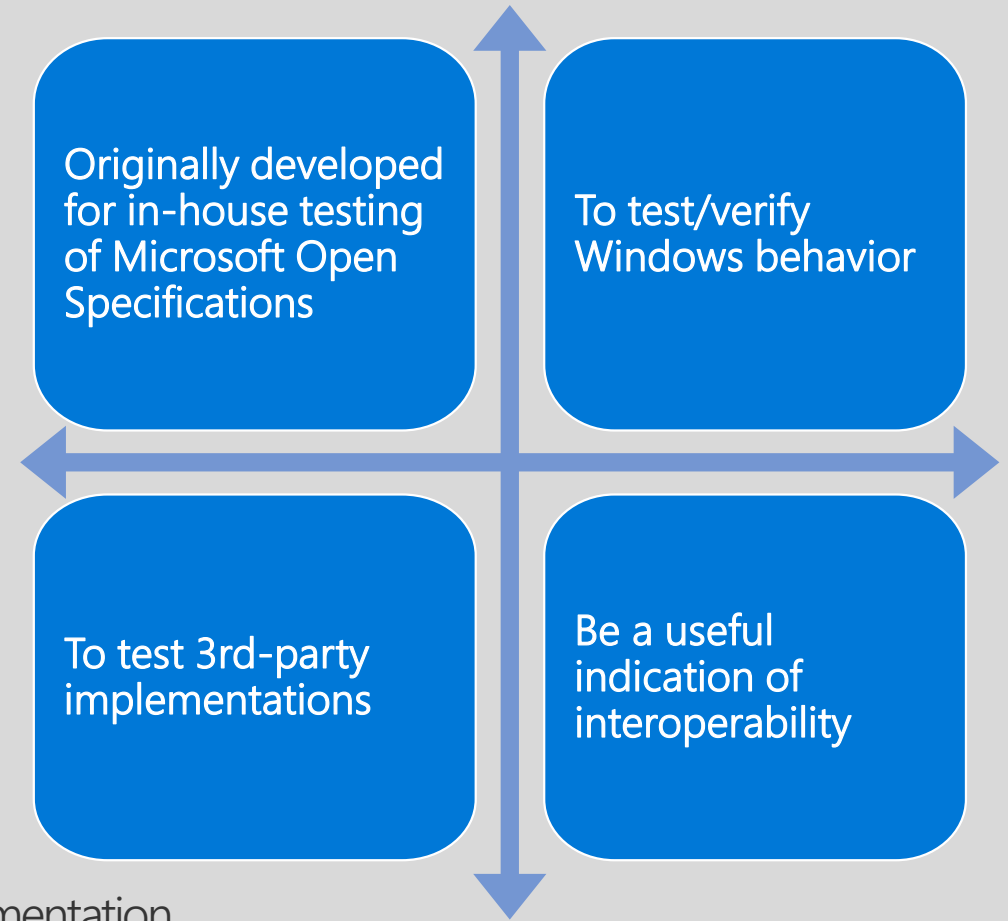
RDP Tools

Demo & QA

Agenda

What is a Windows Protocol Test Suite

- A Package of Windows Protocol Test Cases
- Evaluates whether a protocol implementation meets certain interoperability requirements.



* Do not cover every protocol requirement, and do not certify an implementation

Why We Develop Protocol Test suites



Ensure quality of Microsoft Open Specifications

1. Accuracy
2. Usability



Help to identify protocol implementation issues

1. Simplify debugging
2. Test mainstream scenarios

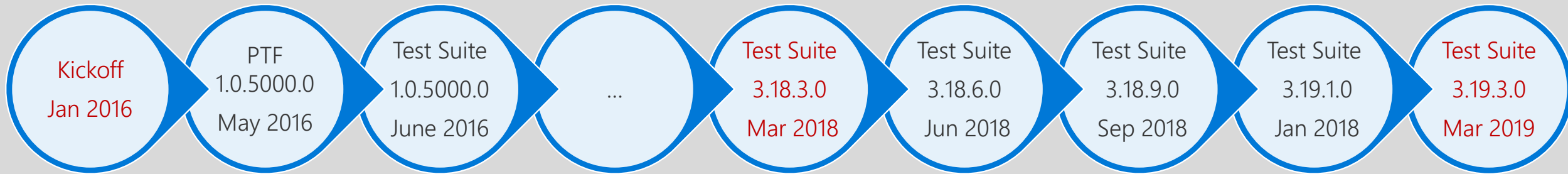


Provide test suite source code as useful reference

Windows Protocol Test Suites

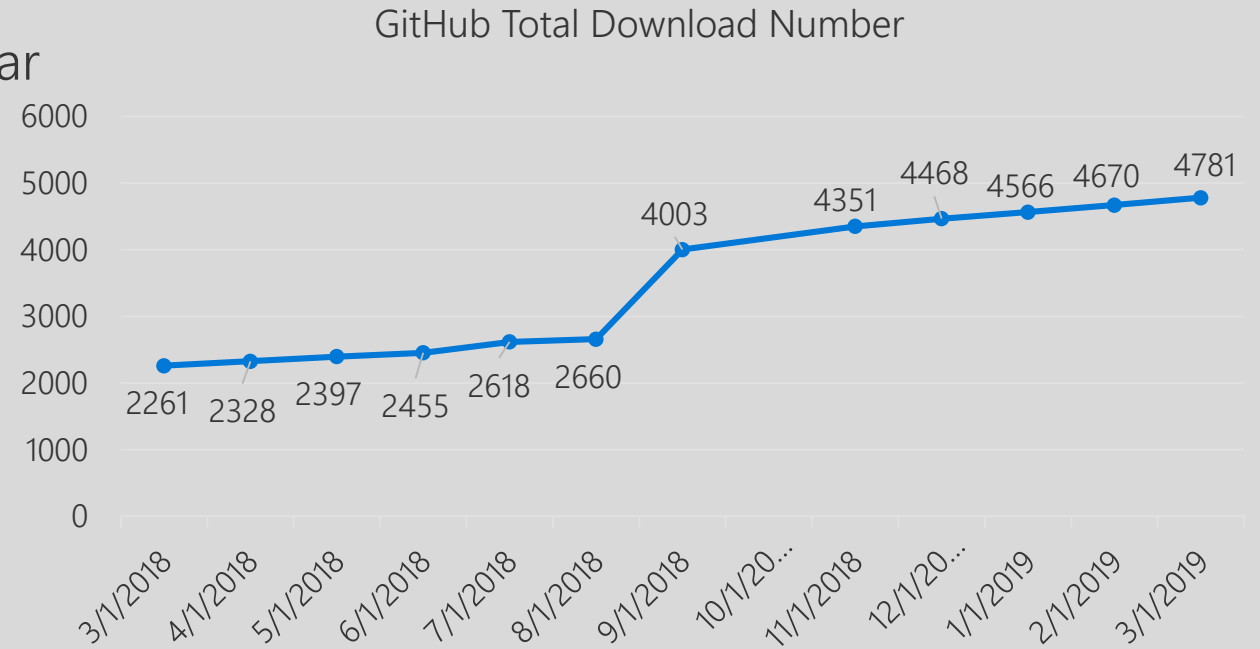
Type	Test Suite Name	Protocols
Test Suite Family	FileServer	MS-SMB2, MS-FSRVP, MS-SWN, MS-DFSC, MS-RSVD, MS-SQOS, MS-FSA, MS-HVRS
	Kerberos	MS-KILE, MS-KKDCP, MS-PAC
	RDP (Client & Server)	RDP Client Test Suite: MS-RDPBCGR, MS-RDPEDISP, MS-RDPEDYC, MS-RDPEGFX, MS-RDPEGT, MS-RDPEI, MS-RDPEMT, MS-RDPEUDP, MS-RDPEUSB, MS-RDPEVOR, MS-RDPRFX RDP Server Test Suite: MS-RDPBCGR, MS-RDPEMT, MS-RDPEDYC
	BranchCache	MS-PCCRC, MS-PCCRR, MS-PCCRTP, MS-PCHC, MS-CCROD
	ADFamily	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
OD Testing	MS-ADOD	MS-ADOD
	MS-AZOD	MS-AZOD
Test suite	MS-ADFSPiP	MS-ADFSPiP
	MS-SMB	MS-SMB
	MS-SMBD	MS-SMBD

Windows Protocol Test Suites



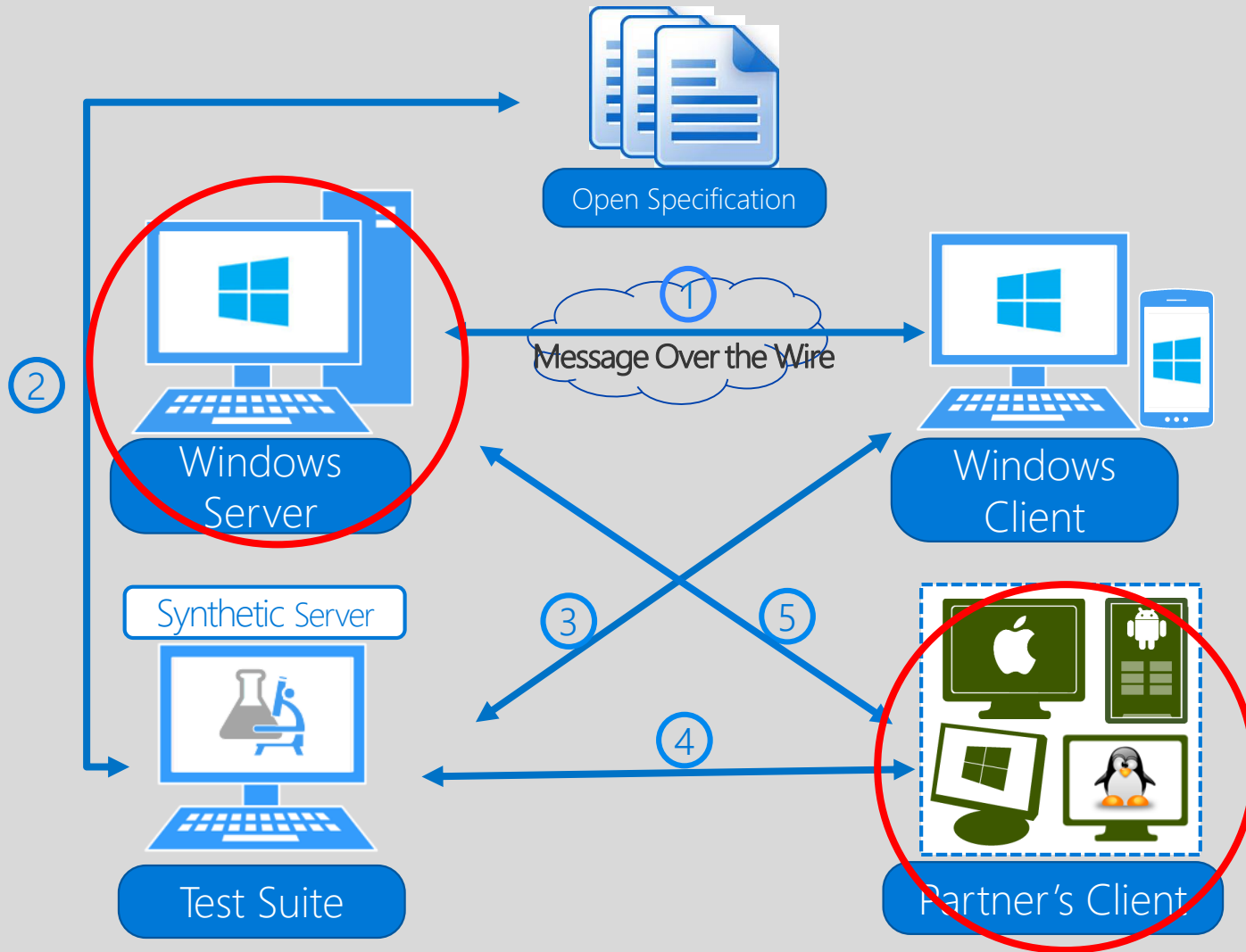
New release before every event

- 10 releases since 2016
- Total download number increased by 111% last year
- 48/48 issues closed
- 5 pull requests from external partners
- GitHub <http://aka.ms/wptf>
- GitHub <http://aka.ms/wpts>



RDP Test Suites Overview

*RDP Client Test Suite As an Example



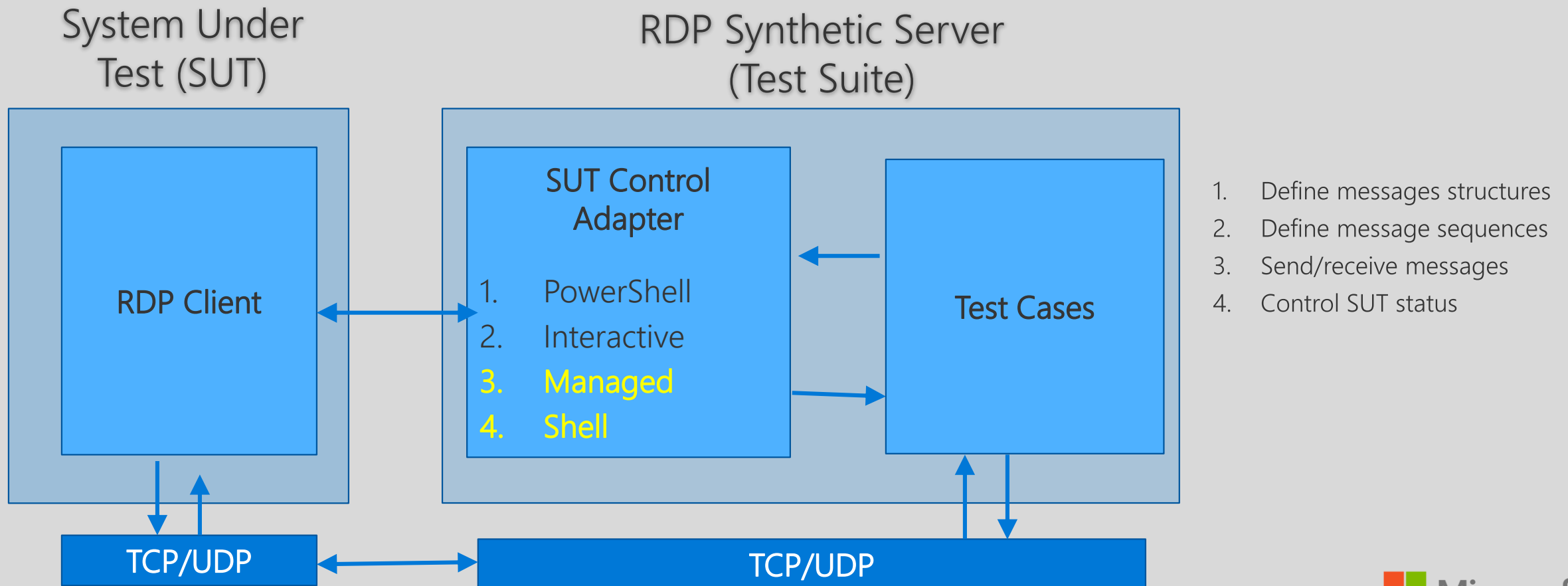
Test Methodology

1. Open Specification defines messages, sequence, behavior
2. Develop protocol test suite (synthetic server) according to Open Specification
3. Run against Windows to verify Open Specification
4. Run against partner's Client Implementation to help identify & debug issues
5. Interop between partner's Client and Windows Server

RDP Test Suites Overview

Test Suite Architecture

*RDP Client Test Suite As an Example



RDP Client Test Suite Family Scope

- 11 RDP protocols
- System Under Testing (SUT) is RDP client implementation: mstsc.exe, FreeRDP, thin Client ...
- 400+ test cases
- Test Code: RemoteFX codec, Clear Codec, Progressive Codec
- Tool: H264 Codec Tool

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-RDPEI

- Touch Input
- Touch Control

MS-RDPEMT

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

MS-RDPEDISP

- Change display configuration

RDP Client Test Suite Environment

System Under Test



Name RDP-Client
IP Add 192.168.0.1
Subnet Mask 255.255.255.0

Network Switch

Driver Computer



Name RDP-Server
IP Add 192.168.0.2
Subnet Mask 255.255.255.0

RDP Client Test Suite

Machine role

Software/service

System Under Test (SUT)

- RDP **Client** Implementation

Driver Computer
(**Synthetic RDP Server**)

- Visual Studio 2017 Community
- Protocol Test Framework
- Spec Explorer
- RDP Client Test Suite
- Protocol Test Manager

Common Testing Steps:

1. Access Driver Computer through RDP(**4488**)
2. Access SUT through RDP(3389)
3. Use Protocol Test Manger to run tests

RDP Server Test Suite Family Scope

- MS-RDPBCGR, MS-RDPEDYC, MS-RDPEMT
- System Under Testing (SUT): RDP Server Implementation
- 23 Test Cases

MS-RDPBCGR/EDYC/EGT

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

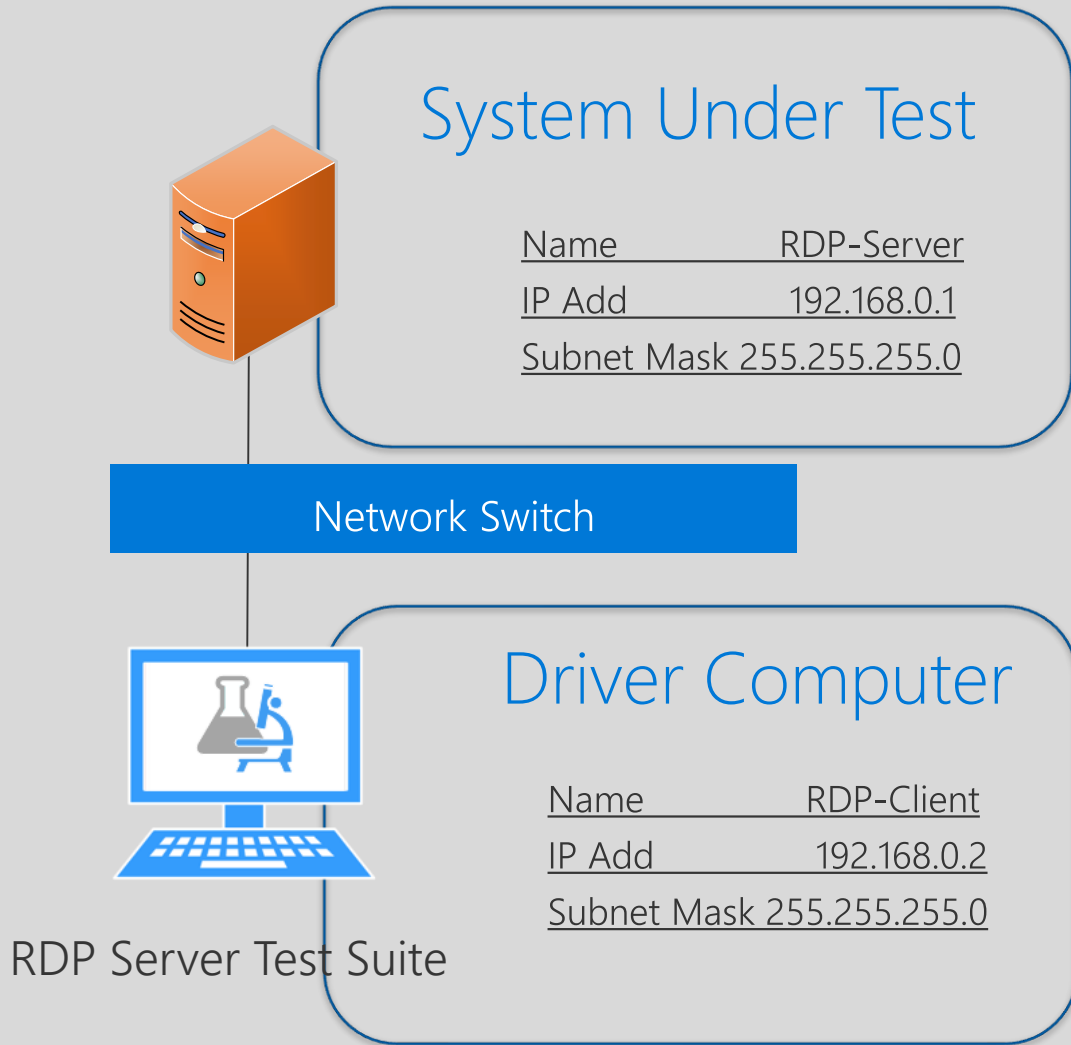
MS-RDPEMT

MultiTransport connection initiation sequences

MS-RDPEDYC

Create and close DVC
Send compressed
Send uncompressed data

RDP Server Test Suite Environment



Machine role	Software/service
System Under Test (SUT)	<ul style="list-style-type: none">RDP Server Implementation
Driver Computer (Synthetic RDP Client)	<ul style="list-style-type: none">Visual Studio 2017 CommunityProtocol Test FrameworkSpec ExplorerRDP Server Test SuiteProtocol Test Manager

Common Testing Steps:

1. Access Driver Computer and SUT thru RDP(3389)
2. Use Protocol Test Manger to run tests

How to Run Test Suite

Config Test Suite



Protocol Test Manager

Run Test Suite



Protocol Test Manager



Visual Studio



Batch File

Analysis Result



.trx File



.html File



.txt File

Updates to RDP Test Suites



RDP Test Suites Updates

Windows Protocol Test Suites v3.19.3.0 Release

<https://github.com/Microsoft/WindowsProtocolTestSuites/releases/tag/3.19.3.0>

Align with RDP protocol documents v20180912:

ProtoSDK	Support RDP version 10.6 <ul style="list-style-type: none">• Capability• PDUs
RDP Client Test Suite	Newly support 2 test scenarios: <ul style="list-style-type: none">• RDSTLS Authentication Request PDU with Auto-Reconnect Cookie• RDPGFX_MAP_SURFACE_TO_SCALED_OUTPUT_PDU
RDP Server Test Suite	Newly support 2 protocols: <ul style="list-style-type: none">• MS-RDPEDYC• MS-RDPEMT
Protocol Test Manager	<ul style="list-style-type: none">• Improve the auto-detection experience for RDP plugin• Support new protocols and tests
RDP SUT Control Agent	<ul style="list-style-type: none">• Add tutorial and example for Java version• Add more environment-specific configurations

Updates to RDP Client Test Suite

[MS-RDPBCGR]: RDSTLS authentication auto-reconnect scenario

Test whether SUT can handle auto-reconnect through RDSTLS authentication according to [MS-RDPBCGR]:

- 2.2.17.3 RDSTLS Authentication Request PDU with Auto-Reconnect Cookie
- 5.4.5.3 RDSTLS Security
- 5.5 Automatic Reconnection

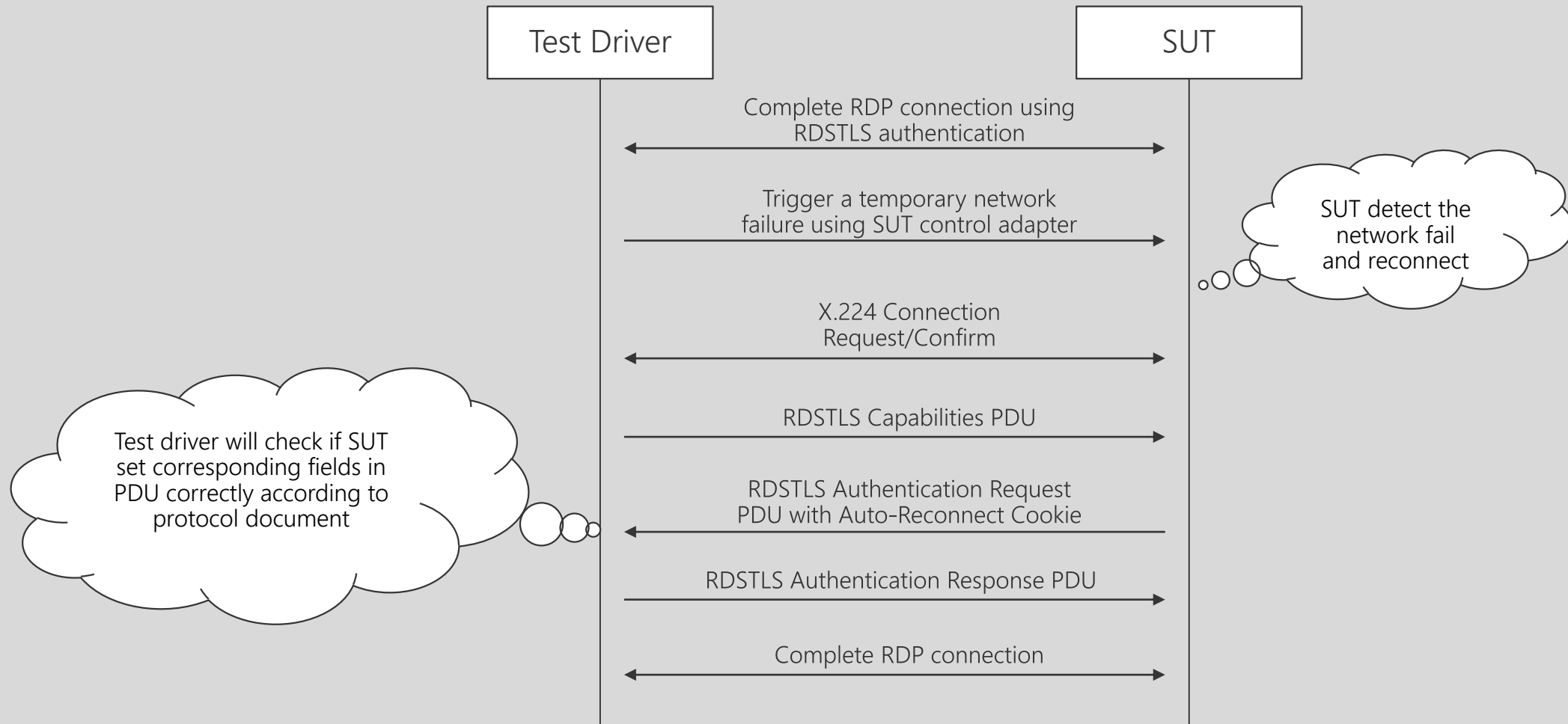
2.2.17.3 RDSTLS Authentication Request PDU with Auto-Reconnect Cookie

The RDSTLS Authentication Request PDU is sent by the client to the server and is used to request user authentication using an auto-reconnect cookie that was generated as specified in section 5.5.

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Version										PduType																					
DataType										SessionID																					
...										AutoReconnectCookieLength																					
AutoReconnectCookie (variable)																															
...																															

Updates to RDP Client Test Suite

[MS-RDPBCGR]: RDSTLS authentication auto-reconnect scenario



Updates to RDP Client Test Suite

MS-RDPEFGFX: Scaled Output Scenario

- Support by RDP 10.6
- Extend the RDPGFX_MAP_SURFACE_TO_OUTPUT_PDU with the capability to specify target width and height
- Test whether SUT can process the RDPGFX_MAP_SURFACE_TO_SCALED_OUTPUT_PDU and map the scaled surface to output

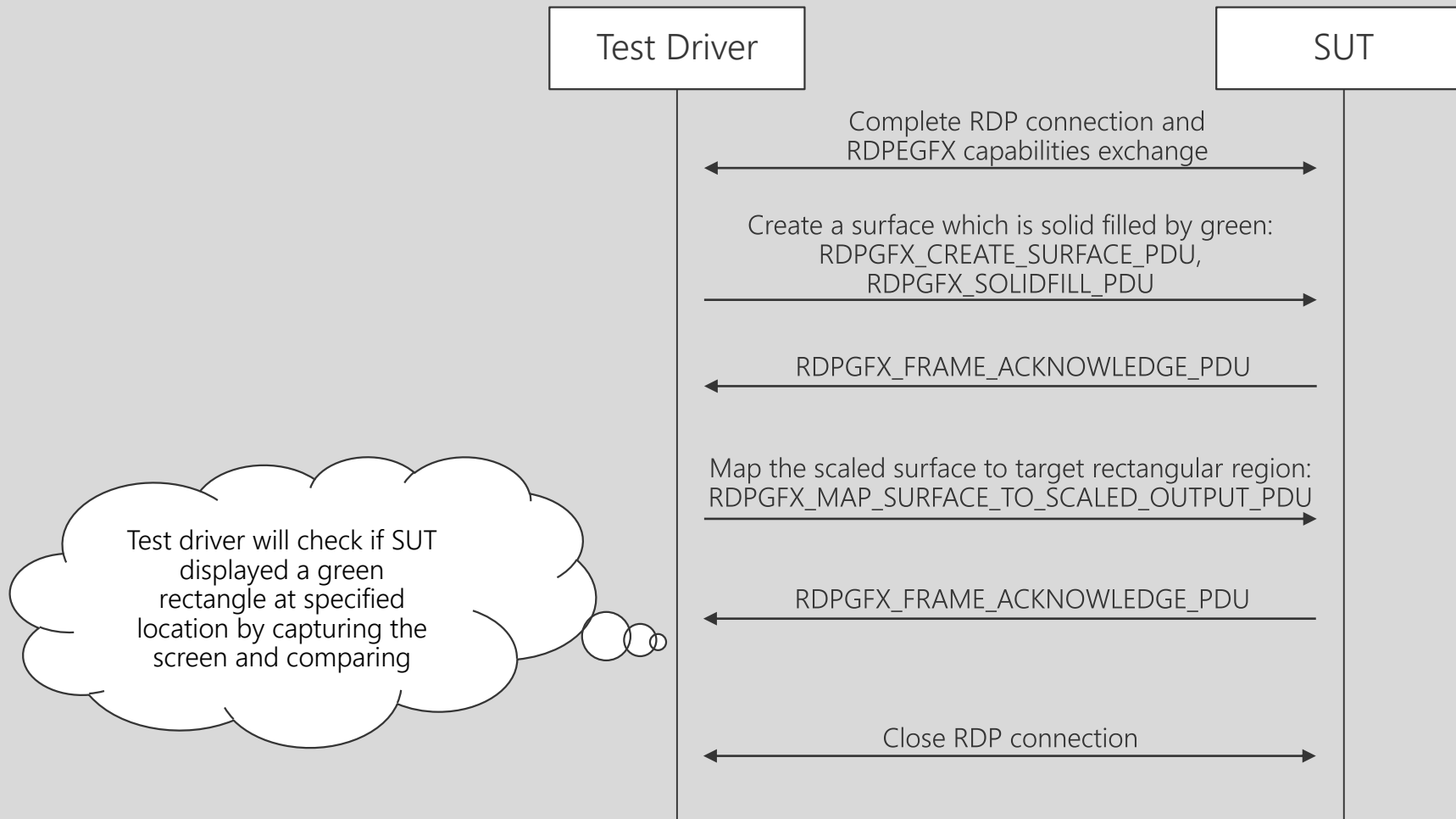
2.2.2.22 RDPGFX_MAP_SURFACE_TO_SCALED_OUTPUT_PDU

The **RDPGFX_MAP_SURFACE_TO_SCALED_OUTPUT_PDU** message is sent by the server to instruct the client to map a surface to a rectangular area of the **Graphics Output Buffer** (section [3.3.1.7](#)) ADM element, including a target width and height to which the surface MUST be scaled.



Updates to RDP Client Test Suite

MS-RDPEGFX: Scaled Output Scenario



Updates to RDP Server Test Suite

Newly support 2 protocols:

- [MS-RDPEDYC]
- [MS-RDPEMT]

Protocol	Scenarios	Test Cases
[MS-RDPEDYC]	<ul style="list-style-type: none">• Dynamic virtual channel initialization• Data sending• Compression	<ul style="list-style-type: none">• S1_EDYC_CreateAndCloseChannel• S1_EDYC_SendUncompressedData• S1_EDYC_SendCompressedDataSequence
[MS-RDPEMT]	<ul style="list-style-type: none">• Multi-transport connection initiation• Negative input	<ul style="list-style-type: none">• S1_MultitransportConnectionInitiation_PositiveTest• S1_MultitransportConnectionInitiation_NegativeTest_InvalidRequestID• S1_MultitransportConnectionInitiation_NegativeTest_InvalidSecurityCookie• S1_MultitransportConnectionInitiation_NegativeTest_InvalidRequestIDAndSecurityCookie

RDP Tools




RDP Tools


Two RDP tools are open-sourced under path TestSuites/RDP/Tools


Branch: **staging** ▼

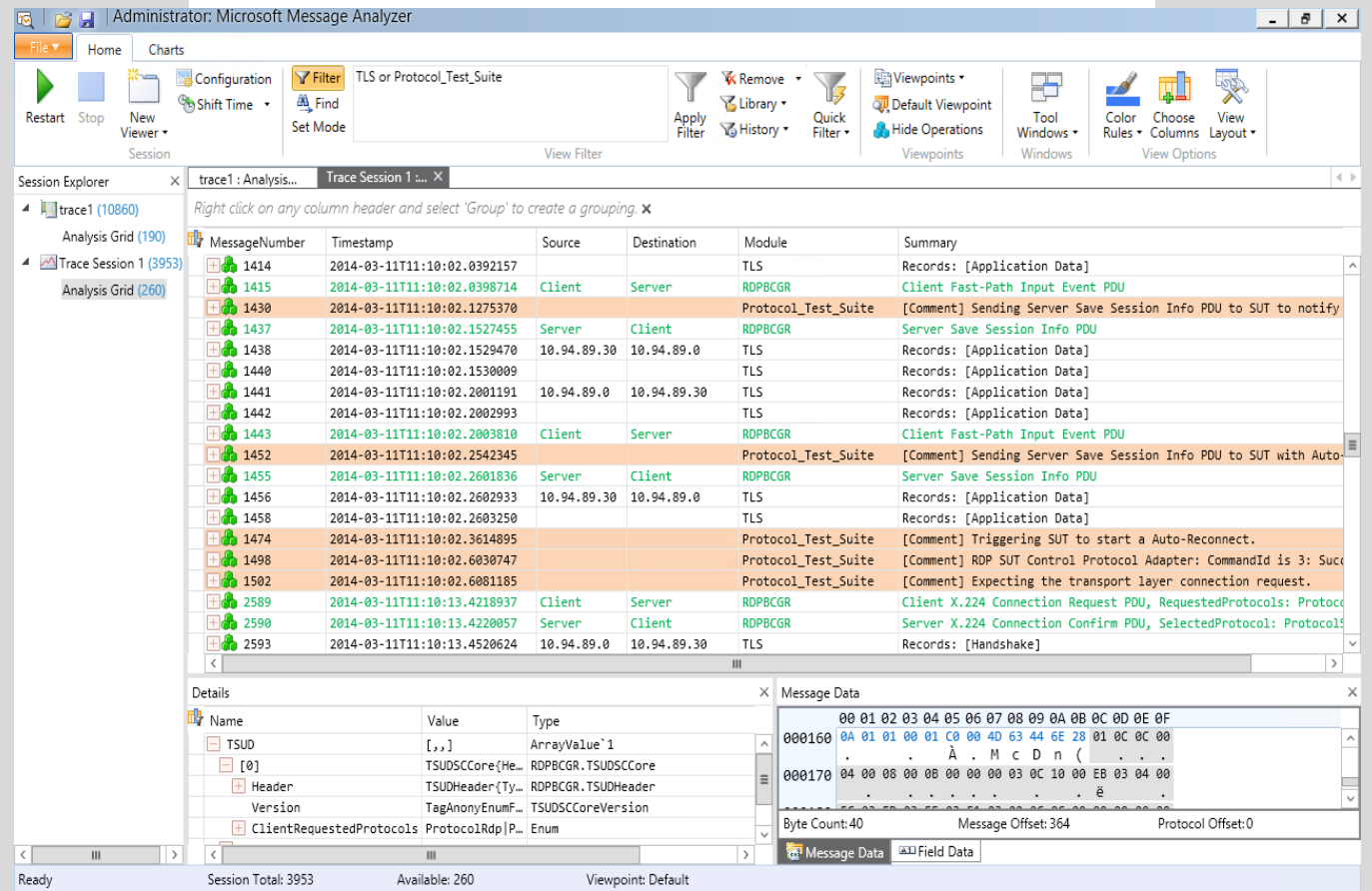
[WindowsProtocolTestSuites](#) / [TestSuites](#) / [RDP](#) / [Tools](#) /

 **yazeng** Merged PR 938: Update version of reference to make the tool work

..

 [RDPToolSet](#) Merged PR 938: Update version of reference to make the tool work

 [SuperLogViewer](#) Submit the RDP tools to VSO

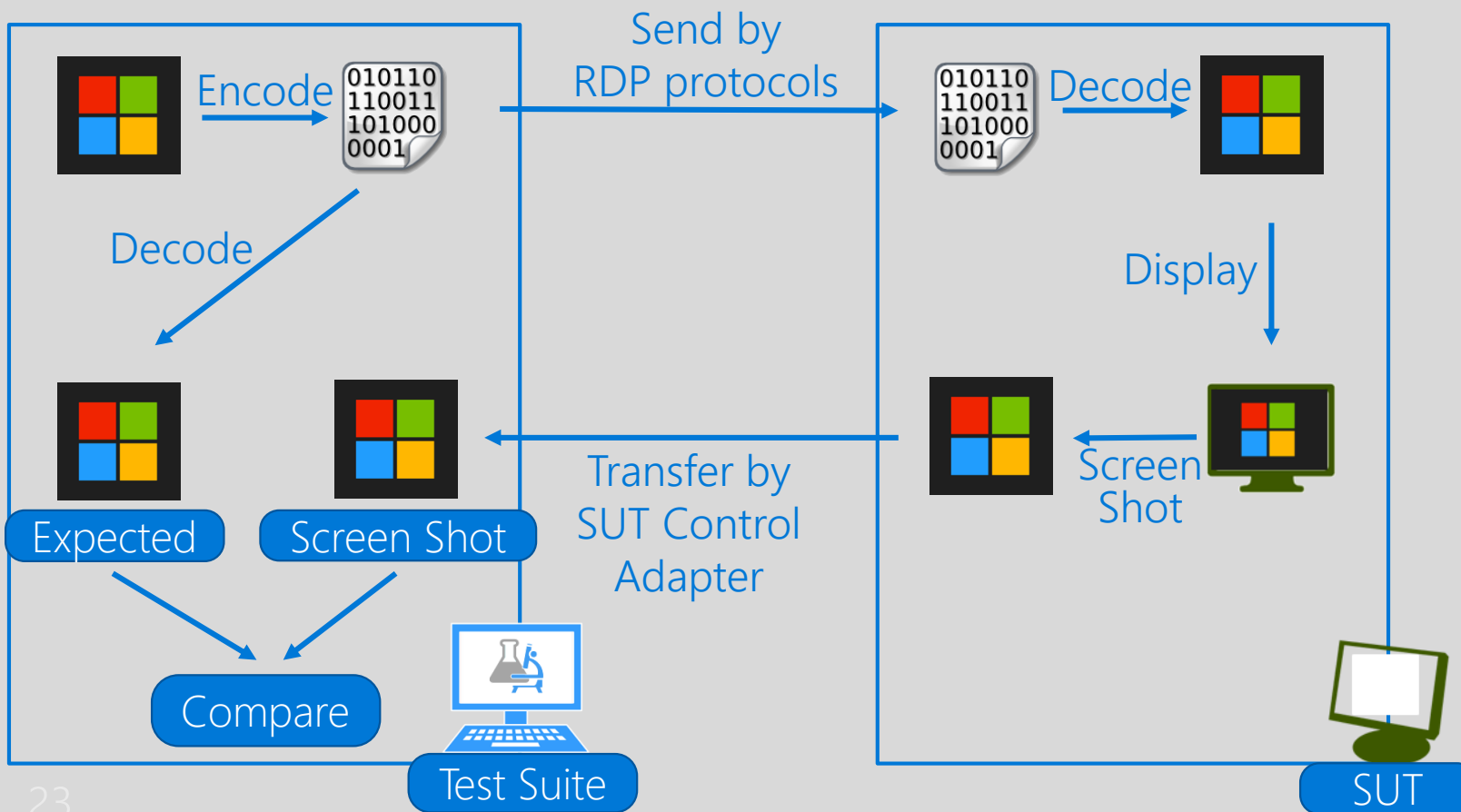


MessageNumber	Timestamp	Source	Destination	Module	Summary
1414	2014-03-11T11:10:02.0392157			TLS	Records: [Application Data]
1415	2014-03-11T11:10:02.0398714	Client	Server	RDPBCGR	Client Fast-Path Input Event PDU
1430	2014-03-11T11:10:02.1275370			Protocol_Test_Suite	[Comment] Sending Server Save Session Info PDU to SUT to notify
1437	2014-03-11T11:10:02.1527455	Server	Client	RDPBCGR	Server Save Session Info PDU
1438	2014-03-11T11:10:02.1529470	10.94.89.30	10.94.89.0	TLS	Records: [Application Data]
1440	2014-03-11T11:10:02.1530009			TLS	Records: [Application Data]
1441	2014-03-11T11:10:02.2001191	10.94.89.0	10.94.89.30	TLS	Records: [Application Data]
1442	2014-03-11T11:10:02.2002993			TLS	Records: [Application Data]
1443	2014-03-11T11:10:02.2003810	Client	Server	RDPBCGR	Client Fast-Path Input Event PDU
1452	2014-03-11T11:10:02.2542345			Protocol_Test_Suite	[Comment] Sending Server Save Session Info PDU to SUT with Auto-
1455	2014-03-11T11:10:02.2601836	Server	Client	RDPBCGR	Server Save Session Info PDU
1456	2014-03-11T11:10:02.2602933	10.94.89.30	10.94.89.0	TLS	Records: [Application Data]
1458	2014-03-11T11:10:02.2603250			TLS	Records: [Application Data]
1474	2014-03-11T11:10:02.3614895			Protocol_Test_Suite	[Comment] Triggering SUT to start a Auto-Reconnect.
1498	2014-03-11T11:10:02.6030747			Protocol_Test_Suite	[Comment] RDP SUT Control Protocol Adapter: CommandId is 3: Succ
1502	2014-03-11T11:10:02.6081185			Protocol_Test_Suite	[Comment] Expecting the transport layer connection request.
2589	2014-03-11T11:10:13.4218937	Client	Server	RDPBCGR	Client X.224 Connection Request PDU, RequestedProtocols: Protoc
2590	2014-03-11T11:10:13.4220057	Server	Client	RDPBCGR	Server X.224 Connection Confirm PDU, SelectedProtocol: Protoc
2593	2014-03-11T11:10:13.4520624	10.94.89.0	10.94.89.30	TLS	Records: [Handshake]

RDP SuperLog Viewer

RDP Codec Toolset

Graphic output verification



Problem

- In most cases, codec issues cannot be observed on the wire

How

- Exactly the same, clear codec
- Look Similar, lossy codec
 - Image quality assessment(IQA) algorithm: MS-SSIM

RDP Codec Toolset

An ASP .NET web project which could

- Visualize the encode/decode process of different codec
 - ClearCodec
 - RemoteFX
- Compare the similarity of two image using different algorithm
 - [MS-SSIM]
 - MSE
 - PSNR

Super Log Viewer

A set of Message Analyzer parsers and color rulesets

- Analyze and highlight logs from RDP test suites
- Show the payload after decryption/decompression

Reference:

https://github.com/Microsoft/WindowsProtocolTestSuites/blob/staging/TestSuites/RDP/Client/docs/RDP_ClientUserGuide.md#using-super-log-viewer

Demo

1. Run RDP Test Suites with PTM
2. Super Log Viewer
3. Protocol-Based SUT Control Agent
4. RDP Codec Toolset

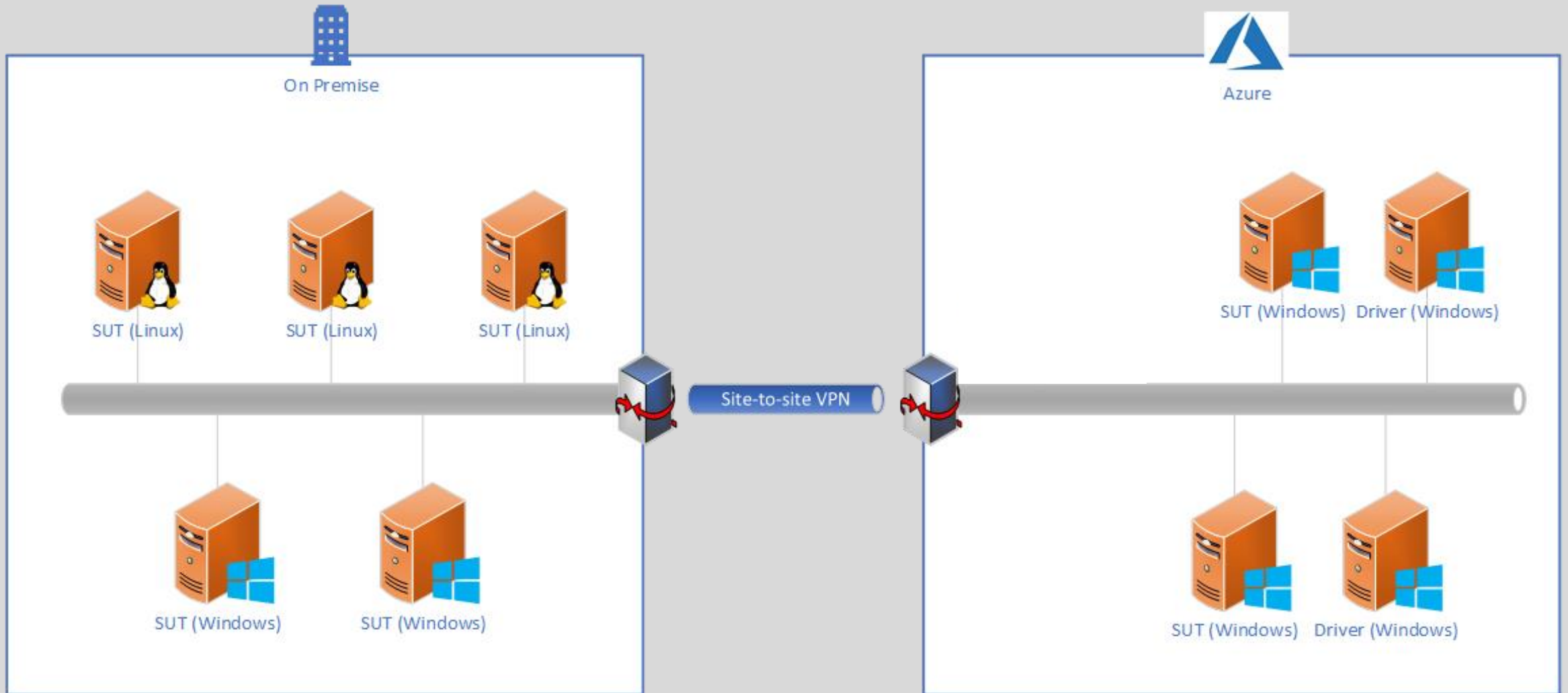


Test Environment



Network Topology

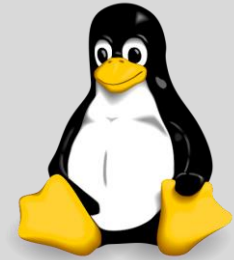
IP	Subnet	Gateway	DNS
10.10.0.0/22	255.255.252.0	10.10.0.1	10.10.0.1





Protocol Test Suite Open Source Community Meetup

- RDP Test Suites & Linux integration
- GitHub & Open Source
- RDP Tools



Time:

2:00 - 3:00 PM

Location:

Mar 27th, Wednesday
Rehearsal Room 1367



Q&A



Vivian Tian



Yan Zeng



Feng Han



Hui ren Jiang

Reference: Resources

- Windows protocol Test Suite Open Source
 - <https://github.com/Microsoft/WindowsProtocolTestSuites>
- Protocol Test Framework Open Source
 - <https://github.com/Microsoft/protocoltestframework>
- PTM and Plugin Open Source
 - <https://github.com/Microsoft/WindowsProtocolTestSuites/tree/4bdee2811d6e7e1d90b329d88ff2fc7646301cfd/ProtocolTestManager>
- Windows Protocol documents for the RTM release on MSDN
 - <https://msdn.microsoft.com/en-us/library/cc216517.aspx>