STORAGE DEVELOPER CONFERENCE

SDC 23

BY Developers FOR Developers

Windows Protocol Test Suites

Architecture, design, and usage for testing protocol implementations

Presented by

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Senior Software Engineer
Microsoft

Agenda

- Background
- Test Suites Architecture
  - Application Design & Architecture
  - Test Case Design
  - SUT Control
- Usage
  - PTM Service
  - PTM Cli
  - Docker Image

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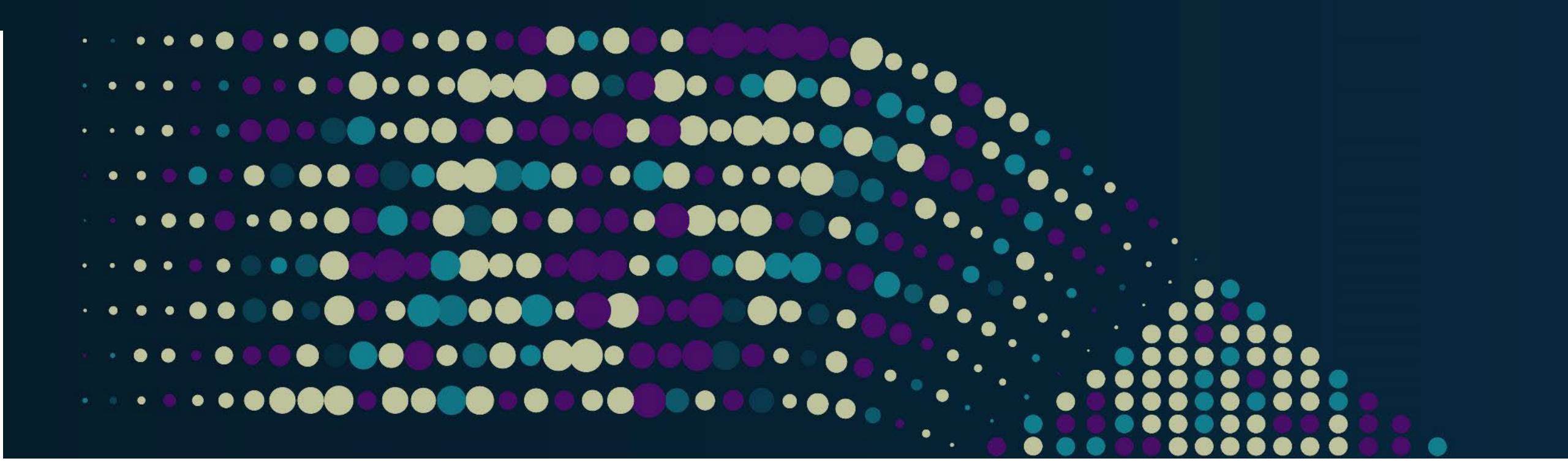

Background

Windows Protocol Test Suites

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Background – Interoperability

- Open connections to Microsoft products
  - Open protocols
  - Open APIs
  - Open Access
  - Open Source Compatibility
- Support for standards
- Data portability
- Open engagement

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Background – Windows Protocols

Evaluates whether a protocol implementation meets certain interoperability requirements.

- Originally developed for in-house testing of Microsoft Open Specifications.
- Used to test/verify Windows behavior.
- Also used to test 3rd-party implementations.

Do not cover every protocol requirement, and do not certify an implementation, but can be a useful indication of interoperability.

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Background – Test Suite Goals

- Open Source – https://github.com/microsoft/WindowsProtocolTestSuites
- Cross platform
- Protocol features as tests
- Open spec docs – https://docs.microsoft.com/en-us/openspecs/windows_protocols
- Multiple protocols – RDP, SMB2, ADFamily, etc

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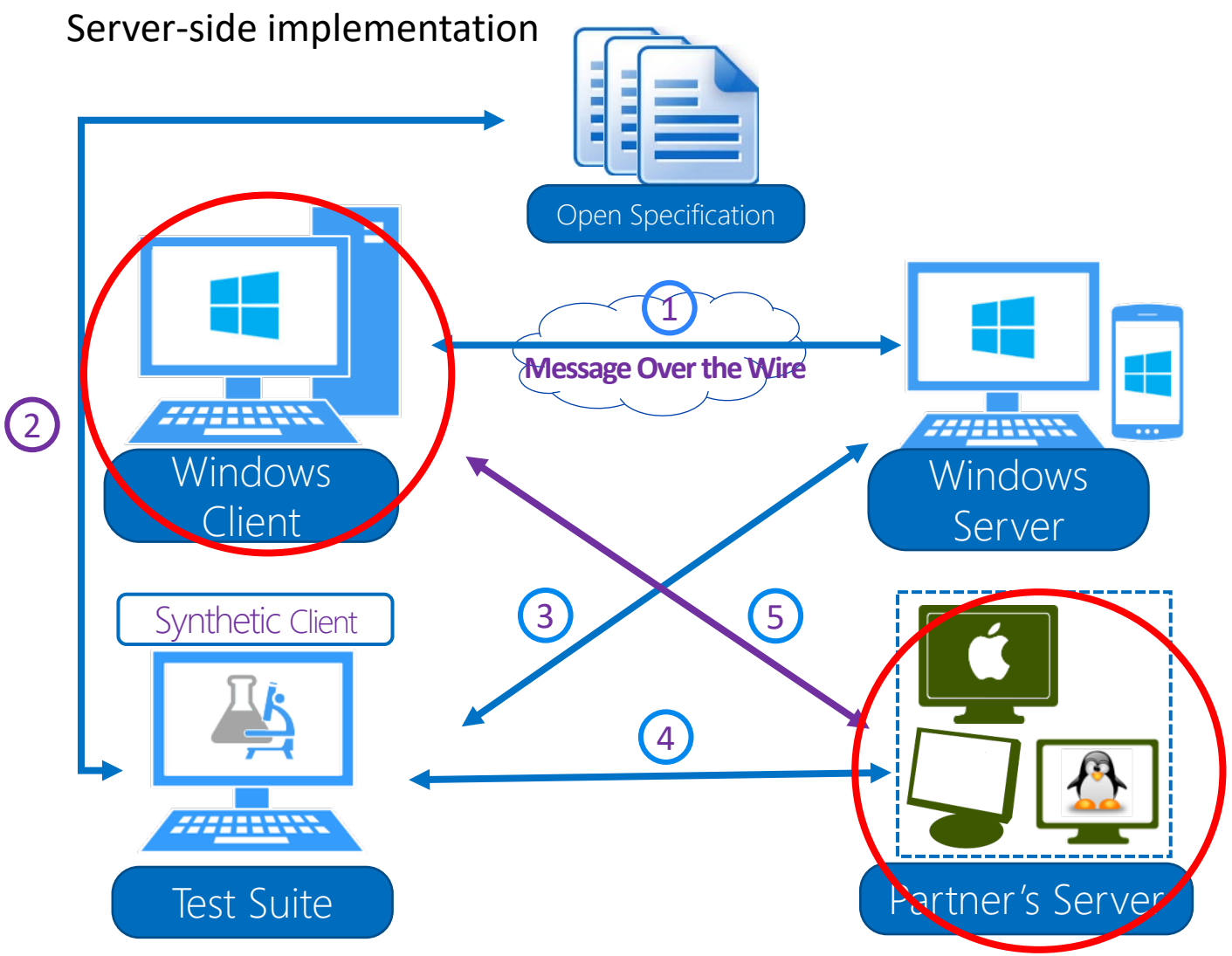
Background – Protocol Test Methodology



1. Open Specification defines messages, sequences, behaviors

2. Develop protocol test suite (synthetic client) according to Open Specification

3. Run against Windows to verify Open Specification

4. Run against 3rd-party implementation to help identify & debug issues

5. Interoperability between partner's server and Windows client

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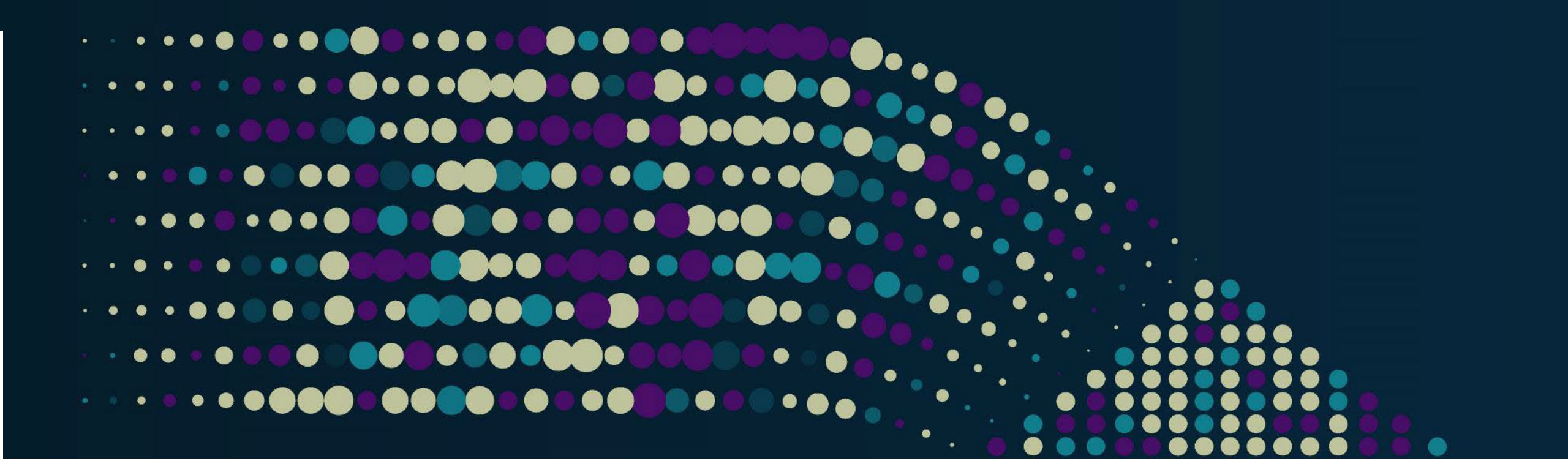

Architecture

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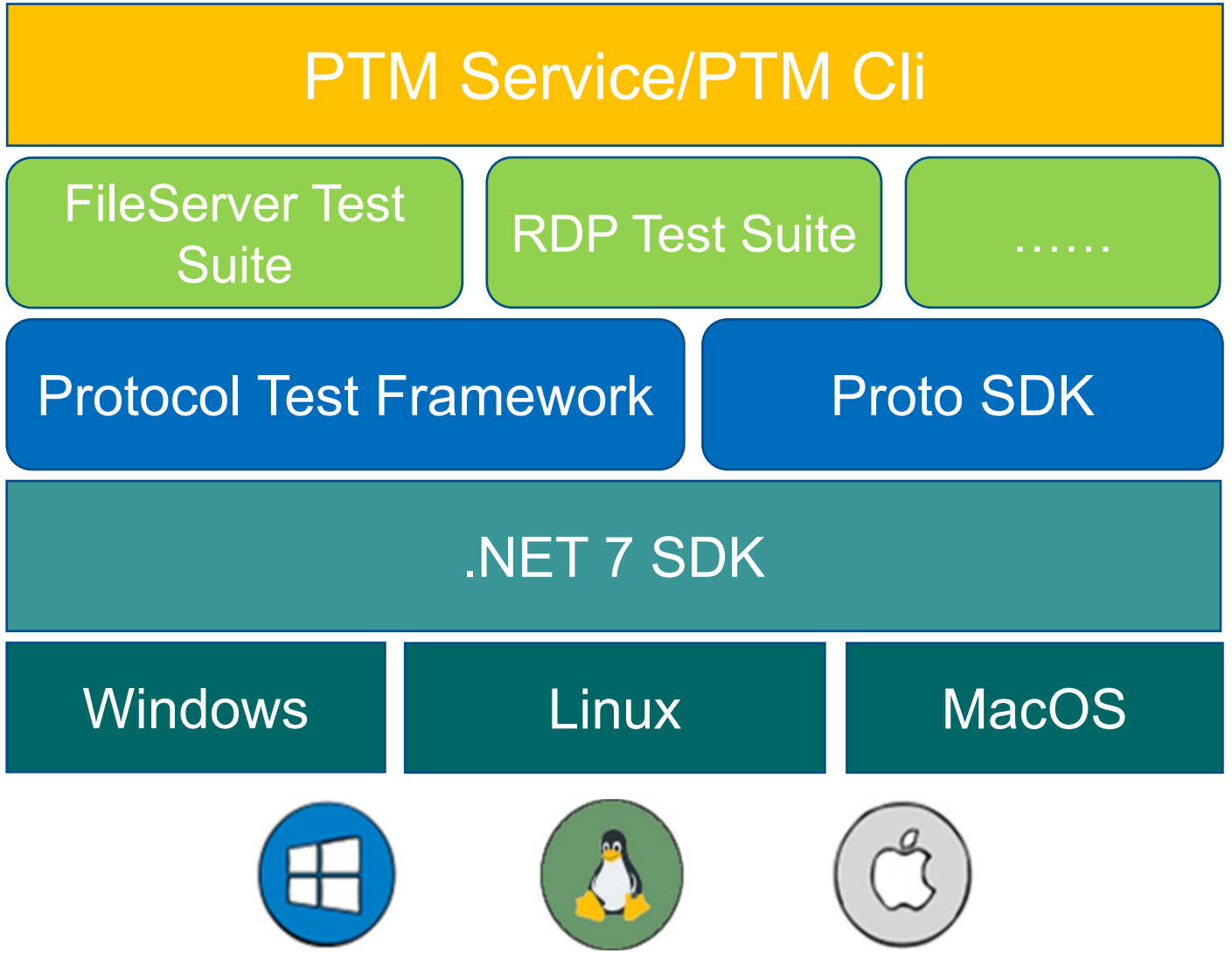
Architecture – Design



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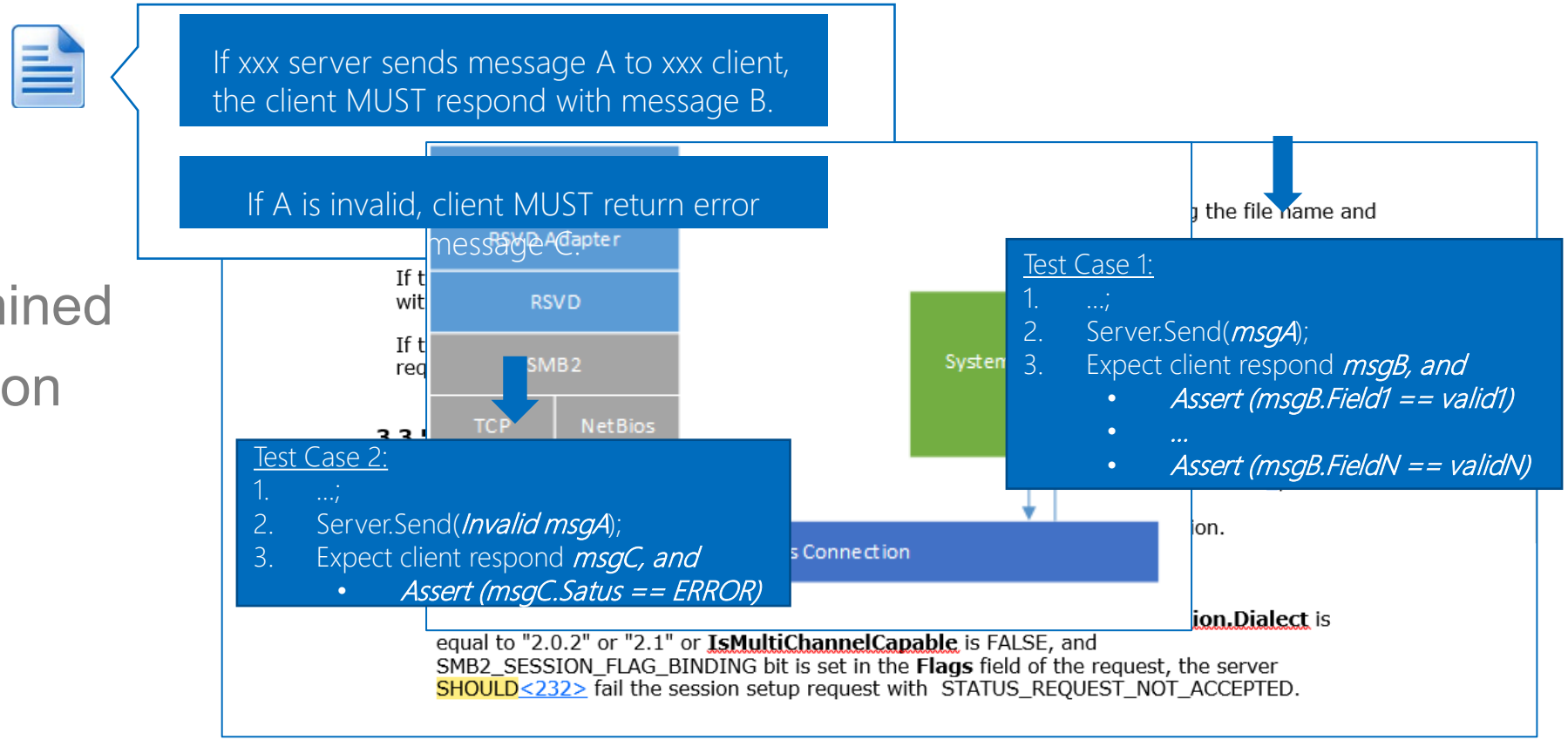
Architecture – Test Case Design

- Design
  - Test cases
  - Architecture
  - Interfaces
  - Consider undetermined partner implementation
- Implementation
  - SDK
  - Test cases



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Architecture – SUT Control

- SUT Remote Control Protocol
- Abstract control operations to SUT
  - PowerShell
  - Shell
  - Interactive
  - Managed
- SUT Control Agent (Managed) runs on SUT
  - C#
  - Java
  - C
  - Python

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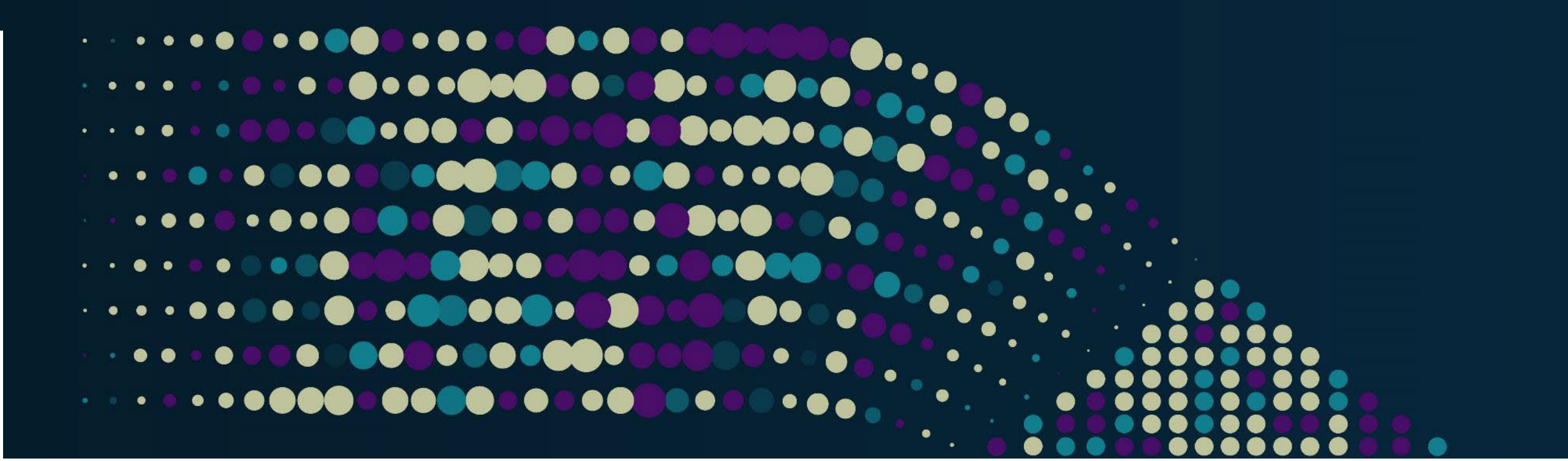

Usage

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Usage – Direct execution

- dotnet test
- Cross platform
- PowerShell & Shell batch scripts
  - RunAllTestCases
  - RunTestCasesByFilter
- Supports filtering
  - FullyQualifiedName
  - Name
  - TestCategory

```
IOLab@FSA13-CLI:~$ cd FileServer-TestSuite-ServerEP/Batch/
IOLab@FSA13-CLI:~/FileServer-TestSuite-ServerEP/Batch$ ./RunTestCasesByFilter.sh "Name~Timestamp_Zero"
Microsoft (R) Test Execution Command Line Tool Version 17.7.0-preview-23364-03+bc17bb9693cfc4778ded51aa0ab7
f1065433f989 (x64)
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Starting test execution, please wait...
A total of 9 test files matched the specified pattern.
No test matches the given testcase filter `Name~Timestamp_Zero` in /home/IOLab/FileServer-TestSuite-ServerE
P/Batch/./../Bin/Auth_ServerTestSuite.dll
No test matches the given testcase filter `Name~Timestamp_Zero` in /home/IOLab/FileServer-TestSuite-ServerE
P/Batch/./../Bin/MS-DFSC_ServerTestSuite.dll
No test matches the given testcase filter `Name~Timestamp_Zero` in /home/IOLab/FileServer-TestSuite-ServerE
P/Batch/./../Bin/MS-FSAModel_ServerTestSuite.dll
2023-09-12 10:11:44.9192023-09-12 10:11:44.919 [Comment] Expected execution time of the test suite (in seco
nds) is:
2023-09-12 10:11:44.976 [CheckSucceeded] Assume.IsTrue succeeded. SutIPAddress should be a valid IP address
 or a resolvable host name!2023-09-12 10:11:44.990 [Comment] Adapter Microsoft.Protocols.TestSuites.FileSha
ring.Common.Adapter.SutProtocolControlAdapter implements Microsoft.Protocols.TestSuites.FileSharing.Common.
Adapter.ISutProtocolControlAdapter
2023-09-12 10:11:44.993 [Comment] Set file basic information on directory and check if file system supports
 0 timestamp for ChangeTime2023-09-12 10:11:44.994 [Comment] Test environment:
2023-09-12 10:11:44.994 [Comment]        1. File System: NTFS
2023-09-12 10:11:44.995 [Comment]        2. Transport: SMB3
2023-09-12 10:11:44.995 [Comment]        3. Share Path: \\FSA13-SRV.SNIA2023-NA.org\FileShare
2023-09-12 10:11:44.996 [Comment]        4. Platform: NonWindows
2023-09-12 10:11:45.006 [Debug] Connect to server 192.168.120.89 over TCP.
2023-09-12 10:11:45.136 [CheckSucceeded] Assert.AreEqual succeeded. The response's SMB2_PREAUTH_INTEGRITY_C
APABILITIES.HashAlgorithmCount MUST be set to 1
2023-09-12 10:11:45.137 [CheckSucceeded] Assert.AreEqual succeeded. The response's SMB2_PREAUTH_INTEGRITY_C
APABILITIES Salt buffer length must same as SaltLength
2023-09-12 10:11:45.137 [CheckSucceeded] Assert.AreEqual succeeded. The response's SMB2_ENCRYPTION_CAPABILI
TIES.CipherCount MUST be set to 1
```

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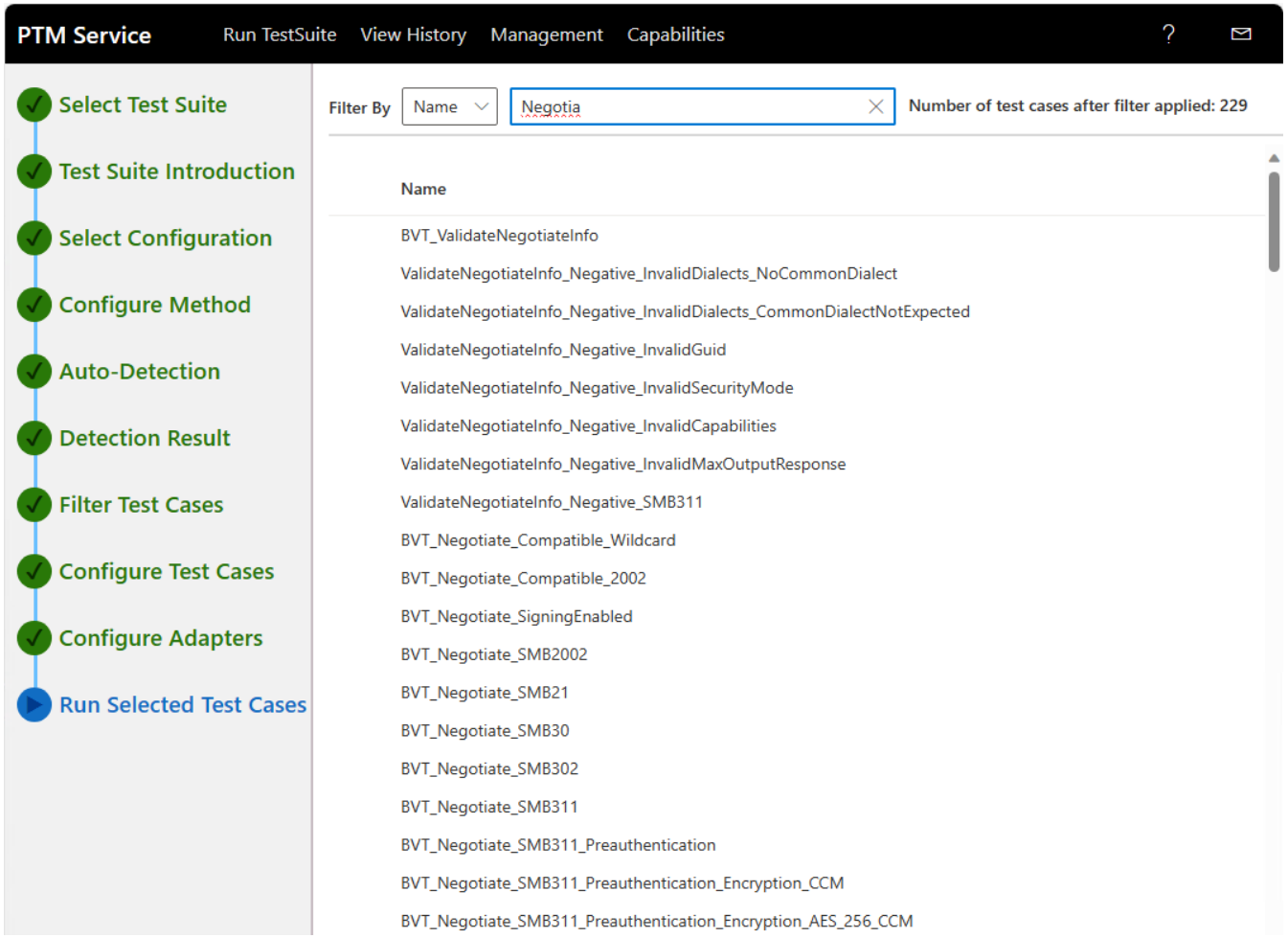
Usage – PTM Service

https://github.com/microsoft/WindowsProtocolTestSuites/releases/tag/ptmservice@1.1.0

- User Friendly
  - Auto detection
  - GUI
- Web service
- Cross platform
- Supports multiple Test Suite versions
- Create custom filter rules
- Export configuration



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Usage – PTM Cli

- Integrates with CI/CD
- Imports configuration
- Can be used with custom filter rules
- Automation friendly
- Cross platform

```
IOLab@FSA13-CLI:~/PTMCli$ dotnet PTMCli.dll -p ../Downloads/ProfileExported16943630990372.ptm -t ../FileSer
ver-TestSuite-ServerEP
0% \ (2/3496) Executing ReplayCreateNormalHandleTestCaseS743                                          2
023-09-12 10:23:58.090 [Debug] C SESSION_SETUP, Alternative Channel, SecurityMode=NEGOTIATE_SIGNING_ENABLED
, Capabilities=GLOBAL_CAP_DFSg] The selected dialect is Smb2WildcardA2023-NA.org\SMBBasic|Name=ValidateNego
2023-09-12 10:23:58.096 [Debug] R SESSION_SETUP, SessionFlags=NONE, SessionId=30817464090729FS, GLOBAL_CAP_
2023-09-12 10:23:58.144 [Debug] Global encryption disabled30}, Capabilities=GLOBAL_CAP_DFS, GLOBAL_CAP_LEAS
2023-09-12 10:23:58.144 [Debug] C CREATE, File=ReplayCreateNormalHandleTestCaseS735_65944a31-314c-4934-a4b4
-0fffedd9a2ad, DesiredAccess=DELETE, GENERIC_WRITE, GENERIC_READ, ShareAccess=(RWD)_65944a31-314c-4934-a4b4
2023-09-12 10:23:58.152 [Debug] R CREATE, FileId={ Persistent: 0x00000007000072a6, Volatile: 0x000000070000
0005 }AL_CAP_LARGE_MTU, GLOBAL_CAP_MULTI_CHANNEL, GLOBAL_CAP_PERSISTENT_HANDLES, GLOBAL_CAP_DIRECTORY_LEASI
2023-09-12 10:23:58.152 [Debug] Complete invoke target method CreateRequest.072a3, Volatile: 0x000000070000
2023-09-12 10:23:58.153 [Comment] reaching state 'S503'succeeded. The server SHOULD<168> grant the client a
2023-09-12 10:23:58.153 [Comment] checking step 'return CreateRequest', within administratively configured
2023-09-12 10:23:58.153 [Comment] reaching state 'S504'dit when responding to SMB2 NEGOTIATE, actually serv
2023-09-12 10:23:58.154 [Comment] checking step 'event CreateResponse(STATUS_SUCCESS,durableHandleResponse,
c)'3-09-12 10:23:57.188 [CheckSucceeded] Assert.AreEqual succeeded. NEGOTIATE should succeedon : !(c == nul
2023-09-12 10:23:58.154 [CheckSucceeded] Assert.IsTrue succeeded. expected 'STATUS_SUCCESS', actual 'STATUS
_SUCCESS' (status of CreateResponse, state S504) 'call CreateRequest(Smb30,NonCAShare,ClientSupportPersiste
2023-09-12 10:23:58.154 [CheckSucceeded] Assert.IsTrue succeeded. expected 'MaxSmbVersionSupported: Smb302a
IsPersistentHandleSupported: TrueaultCreateGuid,DefaultFileAttributes,DefaultCreateDisposition,DefaultLease
TreeConnect_Share_Type_Include_STYPE_CLUSTER_SOFS: Falseucceeded. Fail to check preconstraint : !((ushort)c
IsLeasingSupported: True[Debug] Start to invoke target method CreateRequest, timeout: 30
IsDirectoryLeasingSupported: Trueceeded] Assume.IsNull succeeded. Expect smb2ClientAlternativeChannel is NU
Platform: NonWindowse_STYPE_CLUSTER_SOFS == 0me.IsNull succeeded. Expect smb2ClientAlternativeChannel is NU
', actual 'MaxSmbVersionSupported: Smb302Assert.IsTrue succeeded. serverIp should not be empty when transpo
IsPersistentHandleSupported: True executing step 'call PrepareCreate(Smb30,ClientNotSupportPersistent,Norma
TreeConnect_Share_Type_Include_STYPE_CLUSTER_SOFS: False8.120.89 over TCP
IsLeasingSupported: True[Debug] Start to invoke target method PrepareCreate, timeout: 30
IsDirectoryLeasingSupported: Trueceeded] Assume.IsNull succeeded. Expect smb2ClientMainChannel is NULL.ateR
Platform: NonWindows826 [CheckSucceeded] Assume.IsTrue succeeded. SutIPAddress should be a valid IP address
' (c of CreateResponse, state S504; expected value originates from previous binding)AL_CAP_DFS, GLOBAL_CAP_
2023-09-12 10:23:58.156 [CheckSucceeded] Assert.IsTrue succeeded. Fail to check the assumption : !((1 | ((d
```

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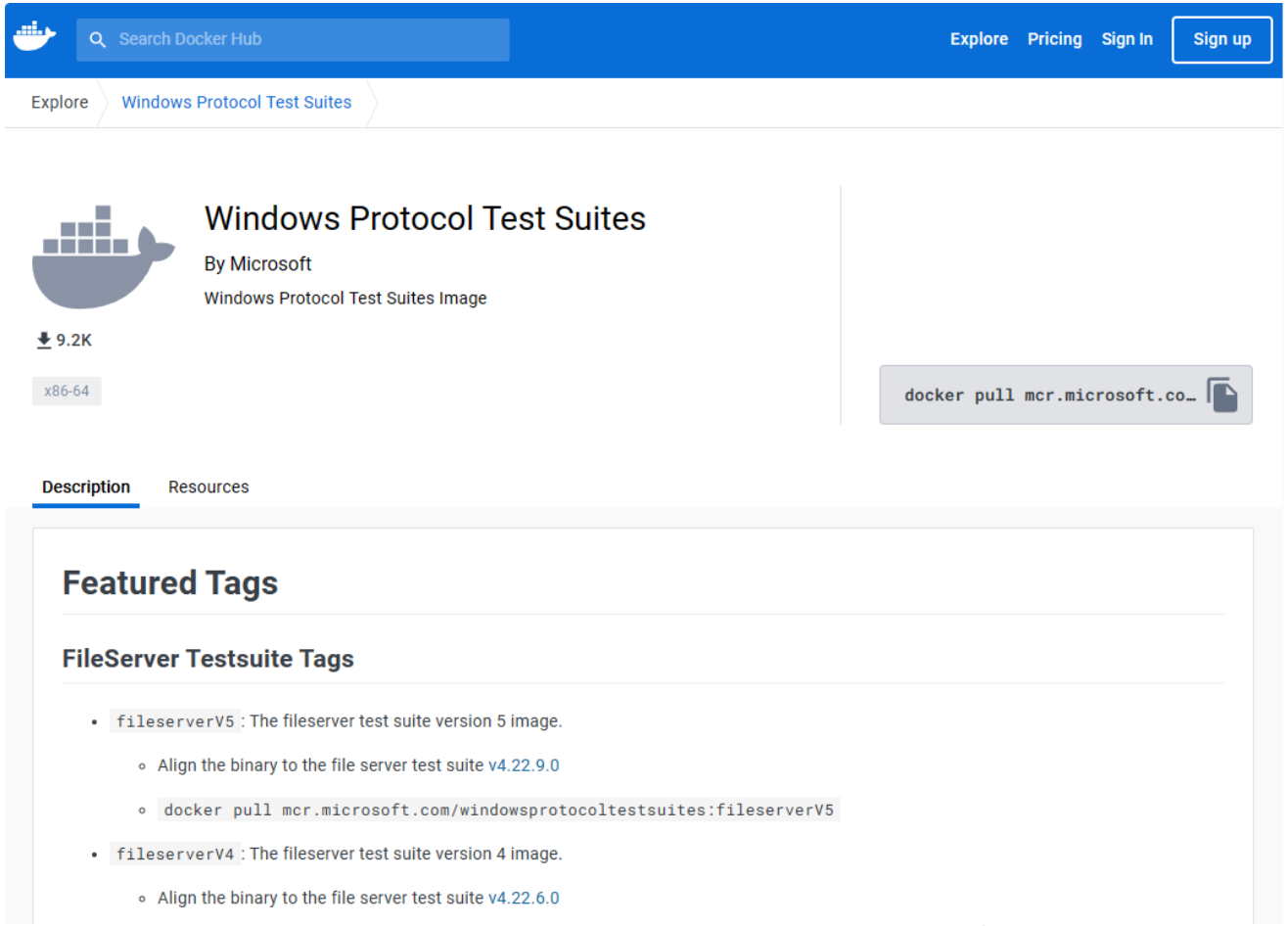
Usage – Docker Image

https://hub.docker.com/_/microsoft-windowsprotocoltestsuites

- Debian 11 base
- Supports PTM Service
- Supports Direct execution
- Supported Test Suites
  - File Server
  - RDP Server
  - RDP Client



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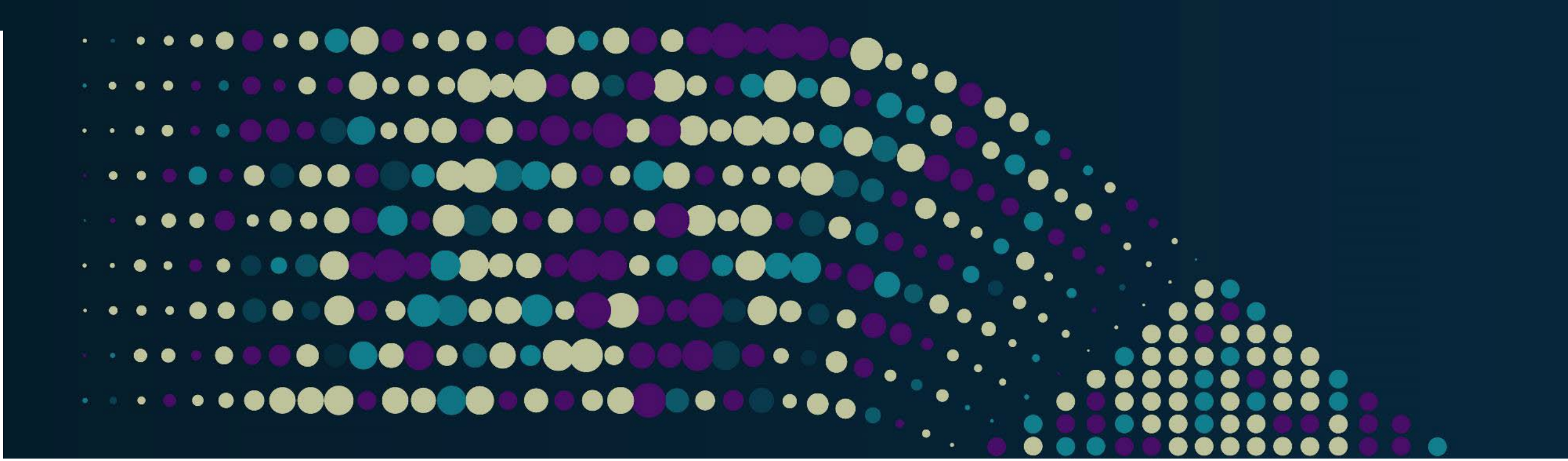

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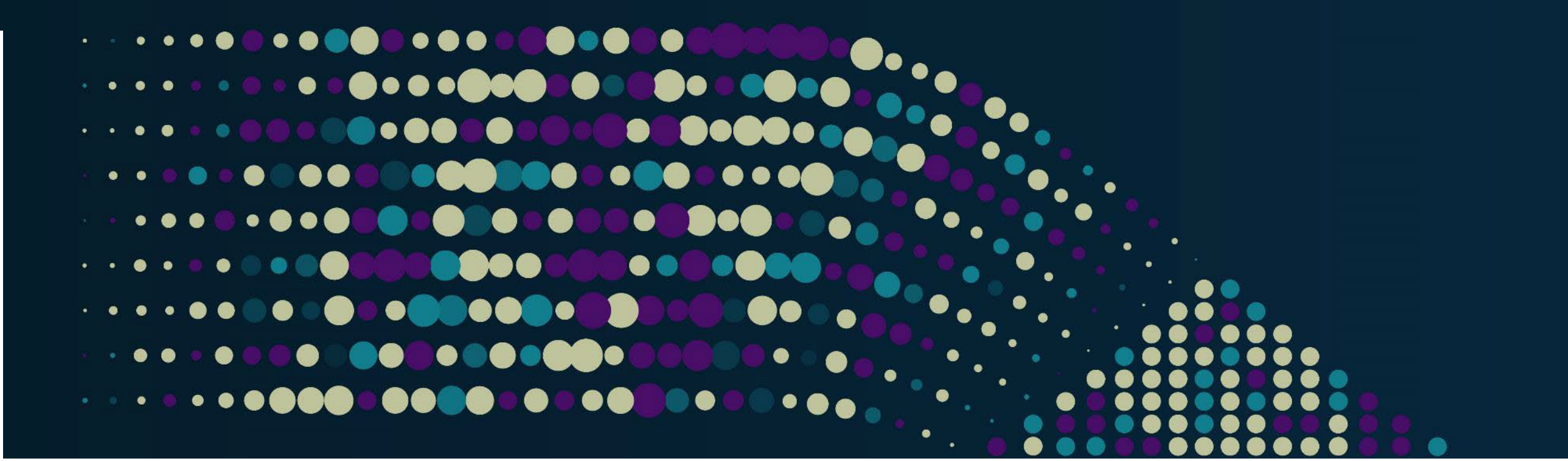

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