Exchange Server Protocols Overview

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Agenda

- Exchange Protocols scope

- Exchange Protocols details

- Choice of protocols to use

- Resources

Exchange Protocols: Scope

Glossary

- **MAPI** - Mail API, since 1990th. Originally library used by Outlook for Windows Desktop.
- **RPC** - Remote Procedure Call
- **On-Prem Exchange Server** - Physical Exchange Server in your own server topology
- **Exchange Online** - Exchange Servers in the Cloud (Microsoft 365)
- **Hybrid Exchange** - Configuration where on-prem topology and Exchange Online tenant are connected
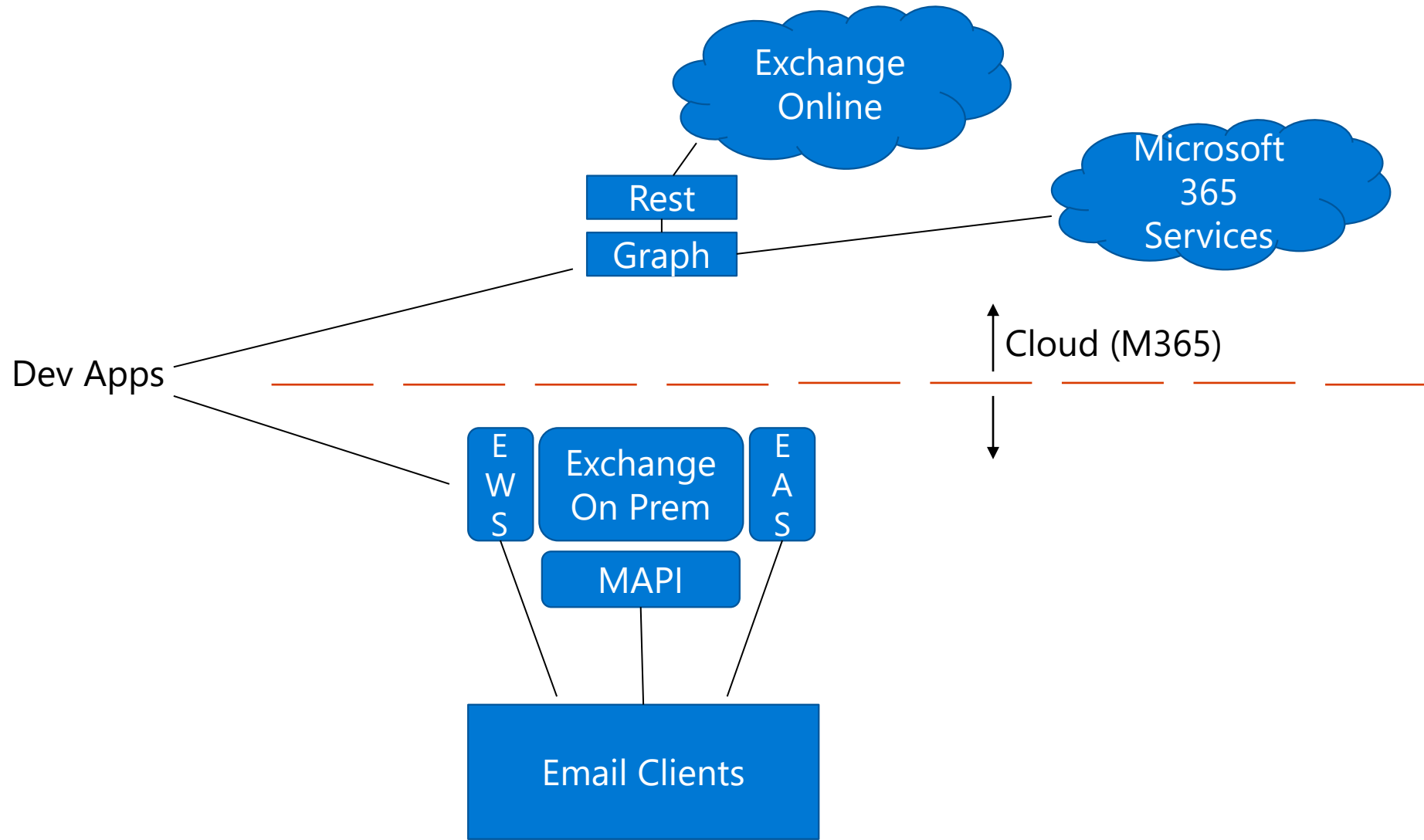
Client communication with Exchange Server
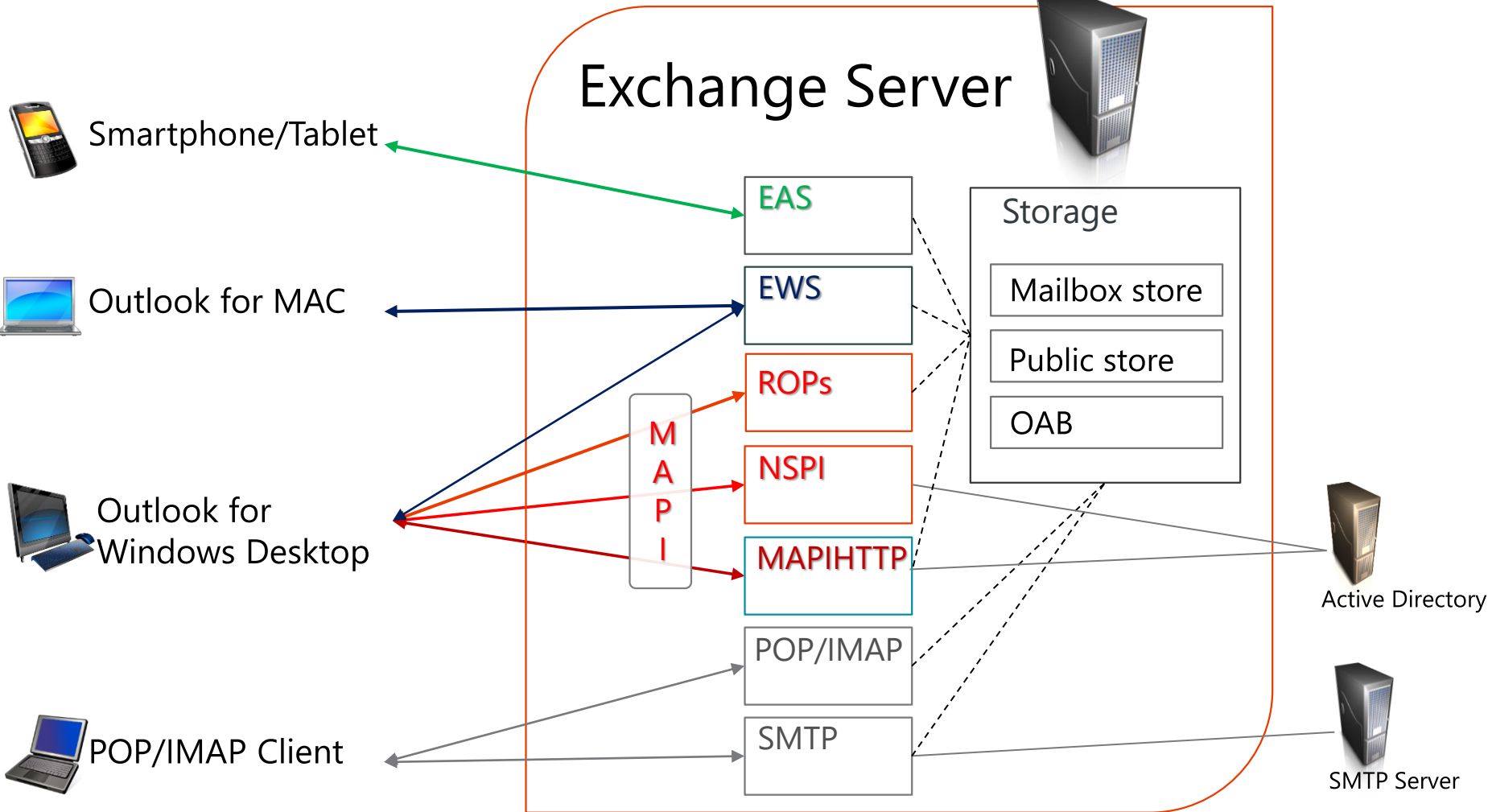
There is more to Exchange than email

Calendars	Recurring meetings, cross time zone scheduling
	Availability – both attendees and conference rooms
Tasks	One-time or recurring
	Tracking Due Date and Assignment
Contacts	Multiple Contacts Folders, Suggested Contacts
	Address book for mobile devices
Reminders	For Calendars, Tasks, Emails
Notifications	Server notifies Client that mailbox changed (new mail, etc.)
	Push or Pull

There is even more to Exchange than email

Rules	Server Side and Client Side
	Applied on messages on arrival, even when client is not connected
Out of Office	Internal and External recipients can get different OOF messages
	Time restrictions
Mail Tips	Show user that recipient is Out of Office
	Warning that mail includes very large DL, etc.
Compliance	Legal Search (eDiscovery)
	Legal Hold
Archiving	Separate Archive for old emails, accessible by client
	Retention policies set per folder
And so on...	

Exchange Protocols: Details

Overview Document: MS-OXPROTO

- Defines protocol families

- Scenario-Based
  - How protocols work together

- Walkthroughs and examples
  - Display an e-mail
  - Send an attachment
  - Create an appointment
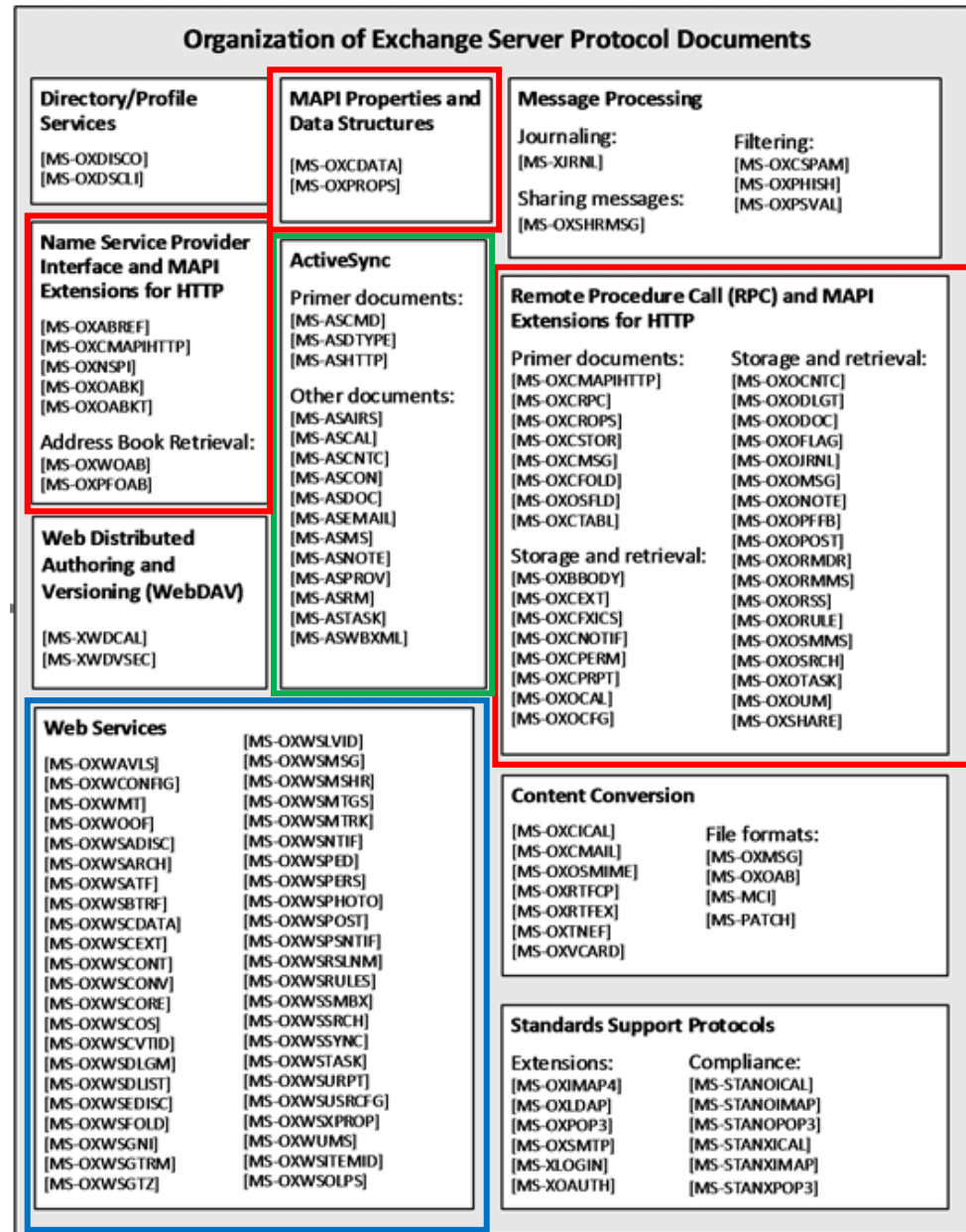 - ... and other scenarios

Protocol Families

- ROP Protocols
  - Originally RPC transport
  - HTTPS transport introduced in Exchange 2013
  - NSPI is used for Address Book access
- Exchange Web Services (EWS)
- ActiveSync (EAS)
- Other protocol groups
  - Autodiscover
  - Content Conversion
  - Standards Support

Organization of Exchange Server Protocol Documents

Directory/Profile Services
[MS-OXDISCO]
[MS-OXDSCLI]

MAPI Properties and Data Structures
[MS-OXCDATA]
[MS-OXPROPS]

Message Processing
Journaling:
[MS-XJRNL]

Sharing messages:
[MS-OXSHRMSG]

Filtering:
[MS-OXCSPAM]
[MS-OXPHISH]
[MS-OXPSVAL]

Name Service Provider Interface and MAPI Extensions for HTTP
[MS-OXABREF]
[MS-OXCMAPIHTTP]
[MS-OXNSPI]
[MS-OXOABK]
[MS-OXOABKT]

Address Book Retrieval:
[MS-OXWOAB]
[MS-OXPFOAB]

ActiveSync
Primer documents:
[MS-ASCMD]
[MS-ASDTYPE]
[MS-ASHTTP]

Other documents:
[MS-ASAIRS]
[MS-ASCAL]
[MS-ASCNTC]
[MS-ASCON]
[MS-ASDOC]
[MS-ASEMAIL]
[MS-ASMS]
[MS-ASNOTE]
[MS-ASPROV]
[MS-ASRM]
[MS-ASTASK]
[MS-ASWBXML]

Remote Procedure Call (RPC) and MAPI Extensions for HTTP
Primer documents:
[MS-OXCMAPIHTTP]
[MS-OXCRPC]
[MS-OXCROPS]
[MS-OXCSTOR]
[MS-OXCMSG]
[MS-OXCFOLD]
[MS-OXOSFLD]
[MS-OXCTABL]

Storage and retrieval:
[MS-OXBBODY]
[MS-OXCEXT]
[MS-OXCFXICS]
[MS-OXCNOTIF]
[MS-OXCPERM]
[MS-OXCPRPT]
[MS-OXOCAL]
[MS-OXOCFG]

Storage and retrieval:
[MS-OXOCNTC]
[MS-OXODLGT]
[MS-OXODOC]
[MS-OXOFLAG]
[MS-OXOJRNL]
[MS-OXOMSG]
[MS-OXONOTE]
[MS-OXOPFFB]
[MS-OXOPOST]
[MS-OXORMDR]
[MS-OXORMMS]
[MS-OXORSS]
[MS-OXORULE]
[MS-OXOSMMS]
[MS-OXOSRCH]
[MS-OXOTASK]
[MS-OXOUM]
[MS-OXSHARE]

Web Distributed Authoring and Versioning (WebDAV)
[MS-XWDCAL]
[MS-XWDVSEC]

Web Services
[MS-OXWAVLS]
[MS-OXWCONFIG]
[MS-OXWMT]
[MS-OXWOOF]
[MS-OXWSADISC]
[MS-OXWSARCH]
[MS-OXWSATF]
[MS-OXWSBTRF]
[MS-OXWSCDATA]
[MS-OXWSCEXT]
[MS-OXWSCONT]
[MS-OXWSCONV]
[MS-OXWSCORE]
[MS-OXWSCOS]
[MS-OXWSCVTID]
[MS-OXWSDLGM]
[MS-OXWSDLIST]
[MS-OXWSEDISC]
[MS-OXWSFOLD]
[MS-OXWSGNI]
[MS-OXWSGTRM]
[MS-OXWSGTZ]
[MS-OXWSLVID]
[MS-OXWSMSG]
[MS-OXWSMSHR]
[MS-OXWSMTGS]
[MS-OXWSMTRK]
[MS-OXWSNTIF]
[MS-OXWSPED]
[MS-OXWSPERS]
[MS-OXWSPHOTO]
[MS-OXWSPOST]
[MS-OXWSPSNTIF]
[MS-OXWSRSLNM]
[MS-OXWSRULES]
[MS-OXWSSMBX]
[MS-OXWSSRCH]
[MS-OXWSSYNC]
[MS-OXWSTASK]
[MS-OXWSURPT]
[MS-OXWSUSRCFG]
[MS-OXWSXPROP]
[MS-OXWUMS]
[MS-OXWSITEMID]
[MS-OXWSOLPS]

Content Conversion
[MS-OXCICAL]
[MS-OXCMAIL]
[MS-OXOSMIME]
[MS-OXRTFCP]
[MS-OXRTFEX]
[MS-OXTNEF]
[MS-OXVCARD]

File formats:
[MS-OXMSG]
[MS-OXOAB]
[MS-MCI]
[MS-PATCH]

Standards Support Protocols
Extensions:
[MS-OXIMAP4]
[MS-OXLDAP]
[MS-OXPOP3]
[MS-OXSMTP]
[MS-XLOGIN]
[MS-XOAUTH]

Compliance:
[MS-STANOICAL]
[MS-STANOIMAP]
[MS-STANOPOP3]
[MS-STANXICAL]
[MS-STANXIMAP]
[MS-STANXPOP3]

Exchange Protocols: Details
ROP Protocols

History of terminology – what is "ROP"?

- Initial name: RPC protocols
  - Remote Operations (ROPs) over RPC connection
  - RPC is just a channel to exchange binary blobs between client and server
  - This binary blob can be transmitted by other underlying protocols
    - RPC over TCP or RPC over HTTPS (MS-OXCRPC)
    - Pure HTTPS (MS-OXCMAPIHTTP)
- MAPIHTTP is RPC replacement (Exchange Server 2013)
  - The same binary blob is now transmitted over HTTP, bypassing RPC
- Since it's not RPC anymore, we now call them ROP Protocols
  - In many places it is still called "Exchange RPC protocols", sometimes MAPI

ROP Protocols Details

- Transport layers: RPC/TCP, RPC/HTTPS or pure HTTPS

- Low-level access to Exchange Server Storage
  - Optimized to minimize traffic on the wire
  - Very complex parsing

- Used by MAPI
  - Major channel for *Outlook for Windows Desktop* communication with *Exchange Server*

- Originally implemented in Exchange 4.0 (first release of Exchange)
  - Extended and re-architected several times

ROP Protocols Documentation

- ROPs protocols define both Server and Client behaviors

- Client behaviors are very complex

  - Wrapped in MAPI implementation on Outlook for Windows Desktop

  - Client performs logic to maintain complex items: Messages, Folders, Calendar, Contacts, Tasks, etc…

- Document Naming: [MS-OXO*] and [MS-OXC*]

  - Over 40 Protocols, ~3000 pages

Example of complexity in ROP Protocols

RPC/HTTPS:
EcDoRpcExt2

Header	Binary Blob

RopSize	ROP1	ROP2	...	HSOT Table

RopID	ROP Data
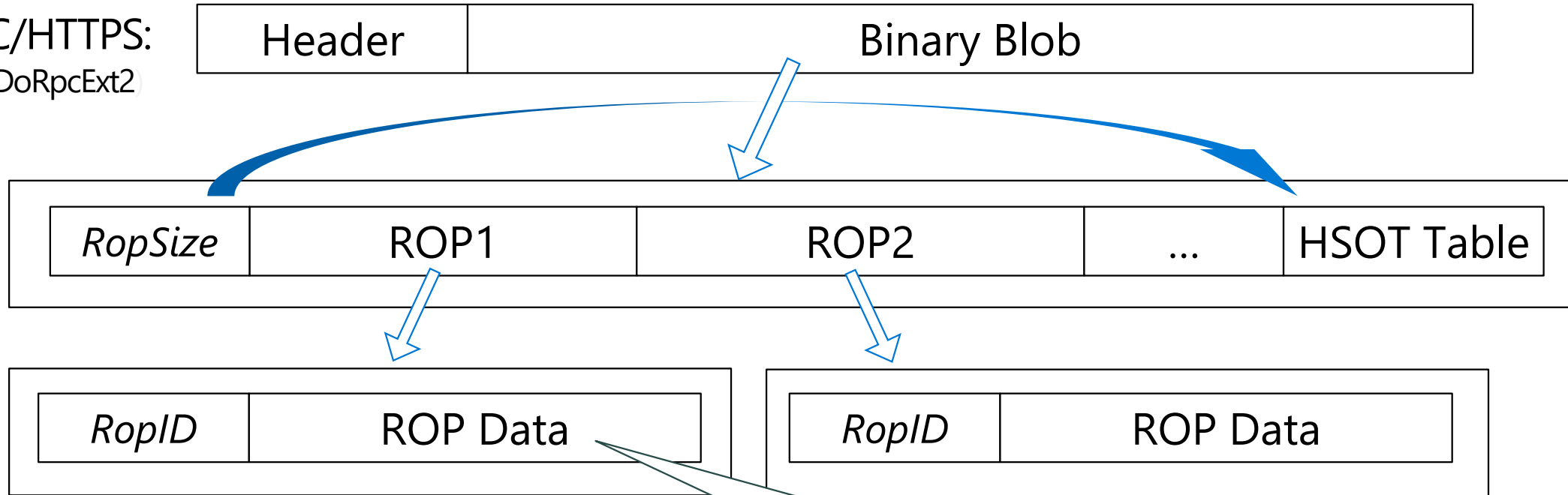
RopID	ROP Data

Note: No ROP Data size or end marker.
Every ROP Data in the blob must be parsed.
Every RopID has different ROP Data structure.
Number of documented RopIDs: 130+

Where to start: ROP Protocols
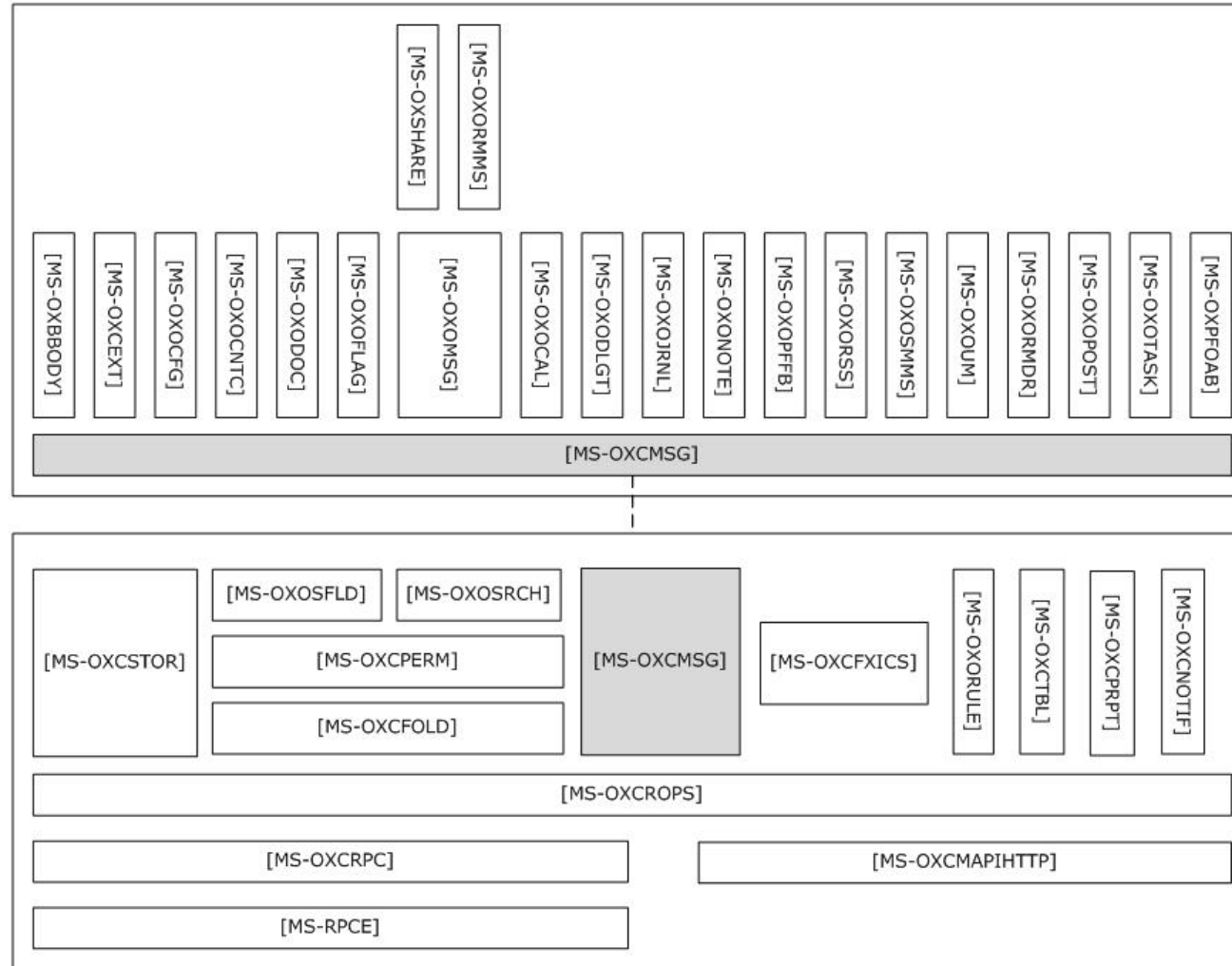
ROP Protocols Summary

- Not recommended for new applications due to complexity

- Modern Exchange Server has good alternatives

  - Exchange Web Services for On-Prem Server

  - Microsoft Graph for Exchange Online

Exchange Protocols: Details
Exchange Web Services (EWS)
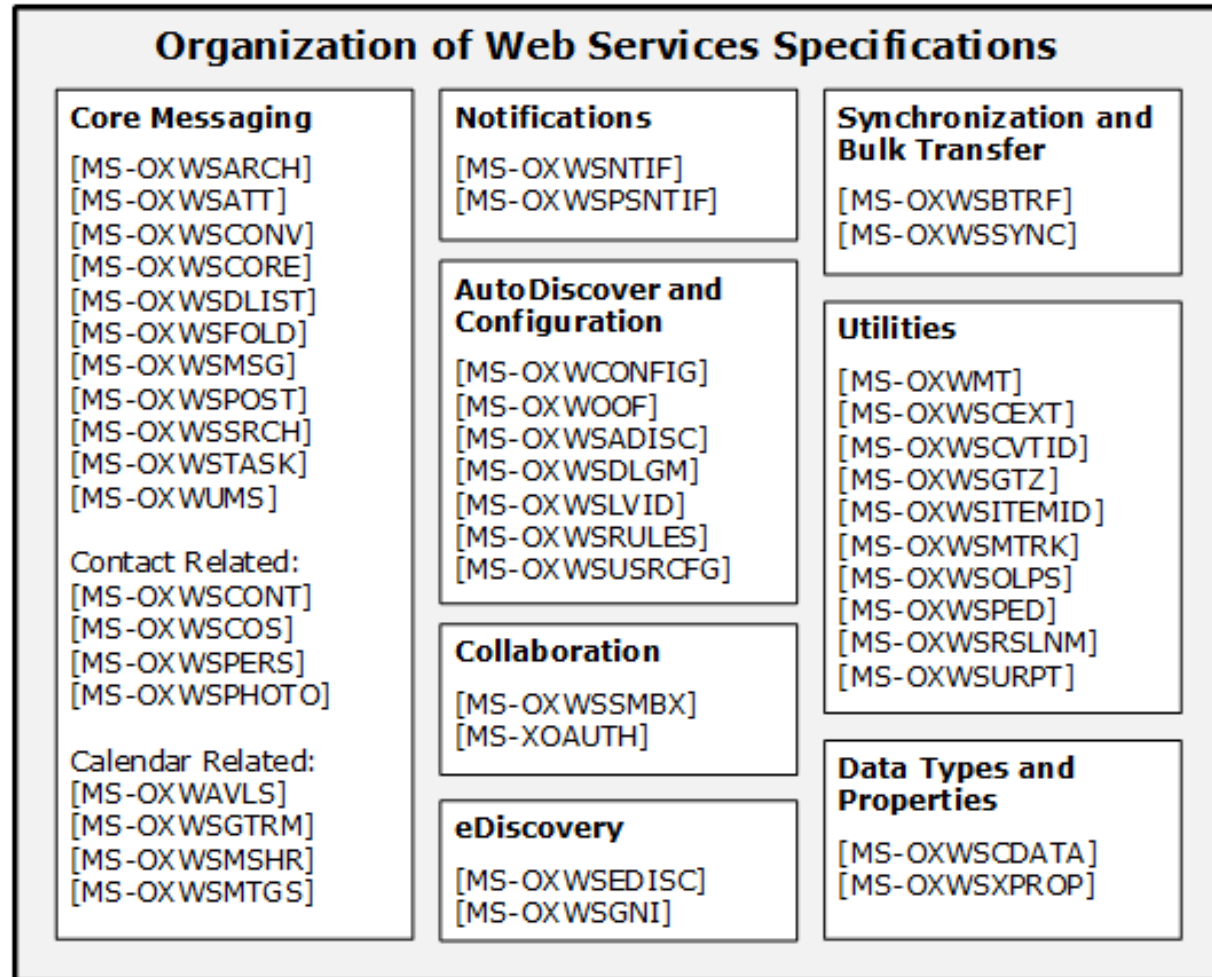
EWS Protocols: Details

- Alternative to ROP protocols

- Higher level of abstraction compared with ROP protocols
  - EWS implements messages, attachments, calendar events, contacts on server side
  - Outlook for Windows Desktop uses subset of EWS protocols
    - Unified Messaging, MailTips, Availability, OOF, Office Apps, Room List, Archive, Mailbox Policies, Calendar Sharing, Site Mailboxes, etc.
  - Intuitive/readable XML (easier troubleshooting)

- Transport: SOAP over HTTP(S)

EWS Protocols: Documentation

- Code in any language/platform that supports HTTP/SOAP calls
  - SDKs are available as well
- Document Naming: [MS-OXW*]
  - 43 Protocols, ~2000 pages
- First implementation: Exchange Server 2007
- New on-prem features tend to be implemented in EWS

Where to start: EWS

- Not hierarchical
- Start with MS-OXWSCORE

Organization of Web Services Specifications

Core Messaging

[MS-OXWSARCH]
[MS-OXWSATT]
[MS-OXWSCONV]
[MS-OXWSCORE]
[MS-OXWSDLIST]
[MS-OXWSFOLD]
[MS-OXWSMSG]
[MS-OXWSPOST]
[MS-OXWSSRCH]
[MS-OXWSTASK]
[MS-OXWUMS]

Contact Related:
[MS-OXWSCONT]
[MS-OXWSCOS]
[MS-OXWSPERS]
[MS-OXWSPHOTO]

Calendar Related:
[MS-OXWAVLS]
[MS-OXWSGTRM]
[MS-OXWSMSHR]
[MS-OXWSMTGS]

Notifications

[MS-OXWSNTIF]
[MS-OXWSPSNTIF]

AutoDiscover and Configuration

[MS-OXWCONFIG]
[MS-OXWOOF]
[MS-OXWSADISC]
[MS-OXWSDLGM]
[MS-OXWSLVID]
[MS-OXWSRULES]
[MS-OXWSUSRCFG]

Collaboration

[MS-OXWSSMBX]
[MS-XOAUTH]

eDiscovery

[MS-OXWSEDISC]
[MS-OXWSGNI]

Synchronization and Bulk Transfer

[MS-OXWSBTRF]
[MS-OXWSSYNC]

Utilities

[MS-OXWMT]
[MS-OXWSCEXT]
[MS-OXWSCVTID]
[MS-OXWSGTZ]
[MS-OXWSITEMID]
[MS-OXWSMTRK]
[MS-OXWSOLPS]
[MS-OXWSPED]
[MS-OXWSRSLNM]
[MS-OXWSURPT]

Data Types and Properties

[MS-OXWSCDATA]
[MS-OXWSXPROP]

EWS SDKs

- Exchange Web Services (EWS) Managed API
  - https://www.nuget.org/packages/Microsoft.Exchange.WebServices/

  - https://github.com/OfficeDev/ews-managed-api

  - https://docs.microsoft.com/en-us/exchange/client-developer/exchange-web-services/explore-the-ews-managed-api-ews-and-web-services-in-exchange

EWS Summary

- Recommended protocol for on-prem Exchange Server applications

- Legacy authentication only

  - No OAUTH

- GRAPH/REST APIs is better alternative for Exchange Online and Hybrid Exchange Server

  - Modern authentication

  - Seamless integration with other services (SharePoint, OneDrive, Azure Active Directory, etc.)

  - Future updates will happen in Microsoft Graph APIs

Exchange Protocols: Details
Exchange Active Sync (EAS)

Exchange ActiveSync: Protocols Details

- Lightweight synchronization protocol for Exchange Server
  - Optimized to work on high-latency and low-bandwidth networks
  - Designed to minimize device power usage
- High level of abstraction, similar to EWS in complexity
  - Provides access to email, calendar, contacts, tasks, documents, etc...
- Transport Layer: WBXML over HTTPS
- Industry standard
  - Several non-Exchange Server implementations
  - Wide range of clients – iOS, Android, Windows, etc.

Exchange ActiveSync: Protocols Documentation

- Document Naming: [MS-AS*]
  - 15 Protocols; ~900 pages
- First Implementation: Exchange Server 2003

Where to start: Exchange ActiveSync
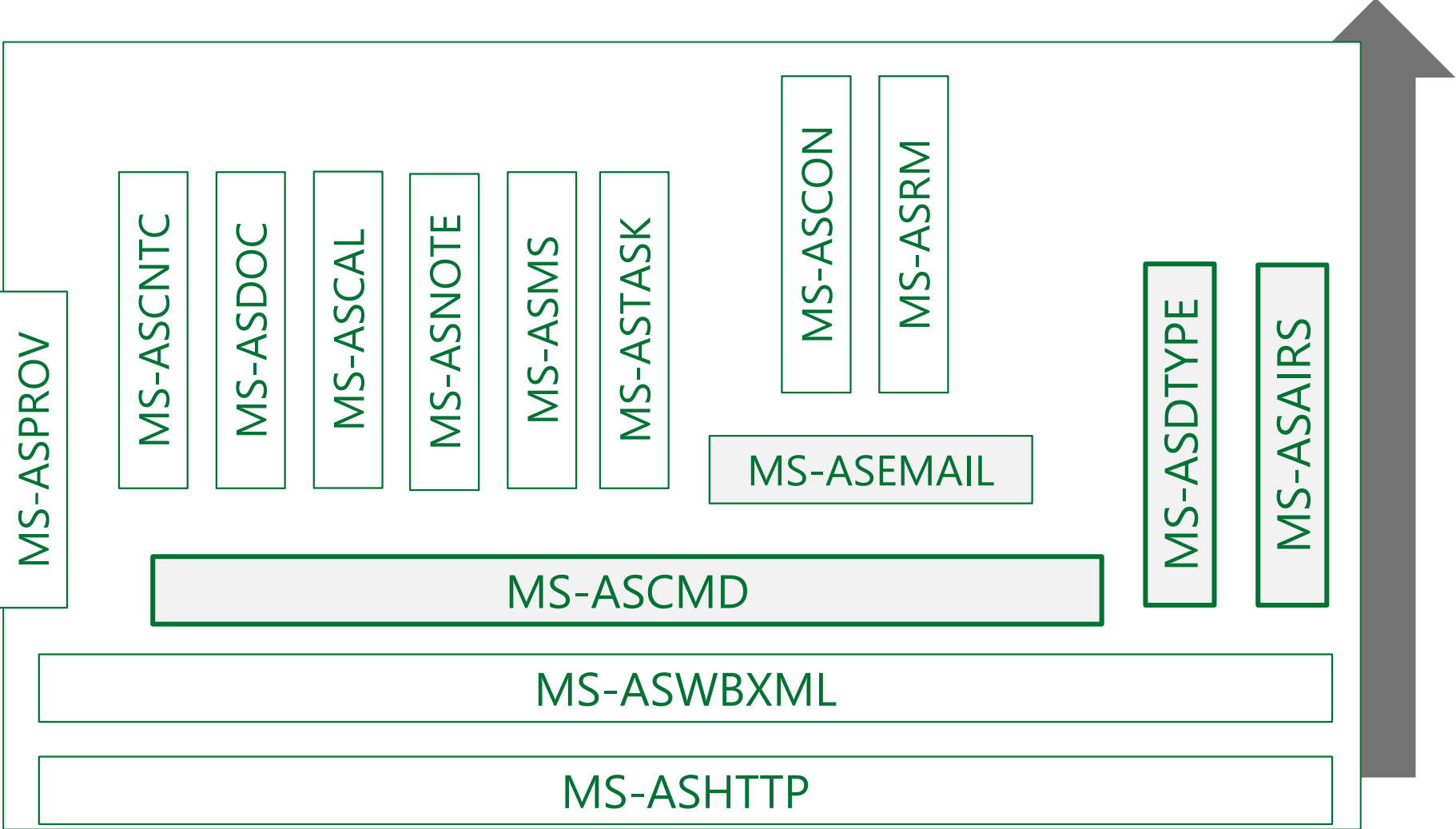
Typical Usage of Exchange ActiveSync

- Mobile Applications

- Tablets and lightweight desktop applications

  - Allows for low-bandwidth and high-latency data (Internet) connections while scaling reasonably on high-speed connections.

- Additional considerations

  - Not feature parity with Exchange ROPs and Web Service (EWS) protocols

  - Licensing requirements

- *Microsoft Graph APIs should be considered as better alternative for Exchange online*

Choice of Protocols to Use

On-Premises choice

- EWS is recommended for new applications
- ROPs protocols are very complex
- EAS has special purpose
- Hybrid mode brings on-line richness to on-prem implementations

Exchange Online has more…

- If you develop for Exchange Online, consider Microsoft Graph APIs
  - https://developer.microsoft.com/en-us/graph/
  - https://aka.ms/30DaysMSGraph

Throughout the month of November 2018, we are publishing daily articles (30 total) that aim to introduce developers to Microsoft Graph. We'll have content that covers 0-level to 200-level topics. Each post should take you 5-15 mins to read and try out the sample exercises. No prior knowledge of Microsoft Graph is required. We hope that beginners will quickly pick up the content and that experts will also learn a few new things.
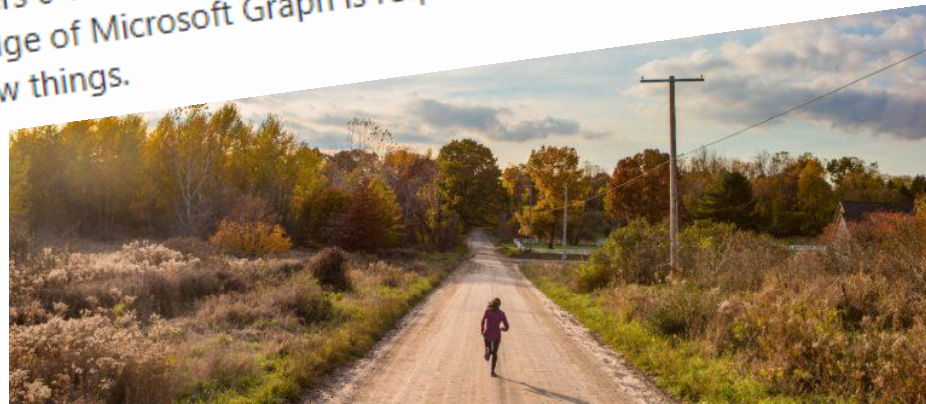
Resources

Exchange Protocol Test Tools

- ## Protocol Test Suites

    - Protocol families: EAS, EWS, and ROPs (RPC/MAPIHTTP)

- ## Fiddler Inspectors:

    - Protocol families: ROPs (MAPIHTTP)

    - Additional associated protocols

Exchange Protocol Resources

All Exchange protocol documents

https://docs.microsoft.com/en-us/openspecs/exchange_server_protocols

Fiddler inspectors for Office and Exchange protocols

https://github.com/OfficeDev/Office-Inspectors-for-Fiddler

Protocol Test Suites

https://github.com/OfficeDev/Interop-TestSuites

Office Interoperability blog:

https://docs.microsoft.com/en-us/openspecs/blog/ms-offintblogIp/61fc0f77-b3e6-4b4f-aea9-ce472fa98835

Help with Open Specifications:

mailto:dochelp@microsoft.com