

Programming with the Microsoft Graph API



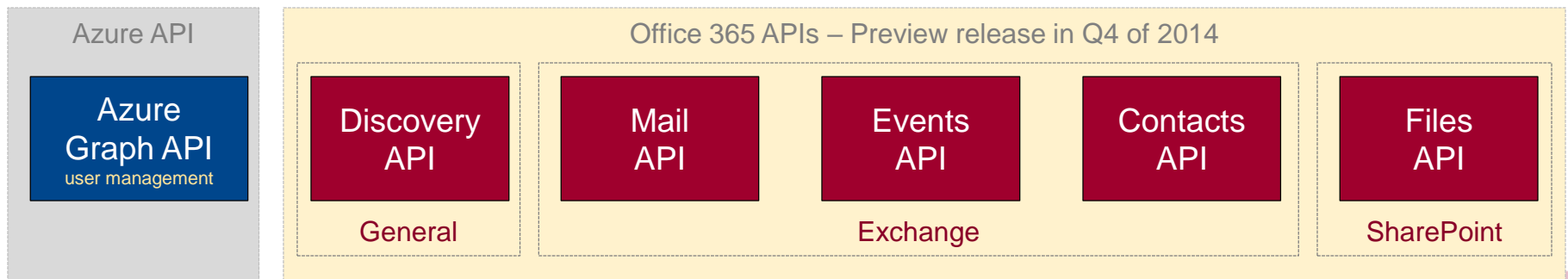
Agenda

- Overview of Microsoft Graph API
- Constructing URLs for the Microsoft Graph API
- Developing Applications with the Microsoft Graph API
- Programming SPFx Webparts using MSGraphClient
- Granting Microsoft Graph API Permissions



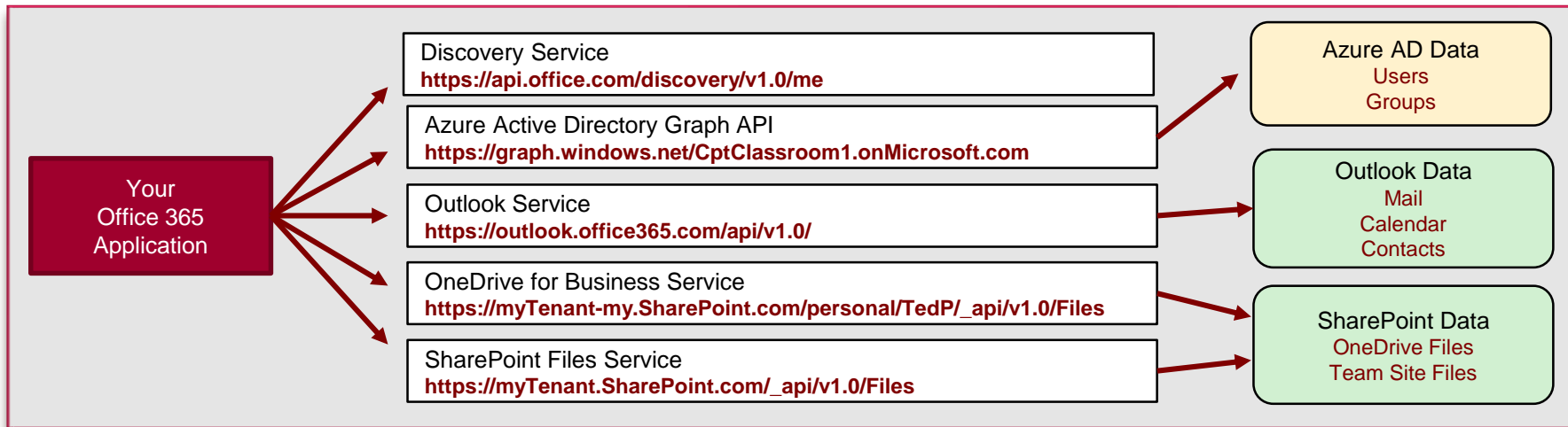
Microsoft Released Office 365 APIs in 2014

- Office 365 APIs created for accessing data in Office 365
 - Implemented as RESTful services based on ODATA version 4.0
 - Provides authentication and authorization based on OAuth 2.0
 - Provides extra authentication support for OpenID Connect
- Open standards provide wide range of accessibility
 - Many choices for tools, languages and development platforms
 - Microsoft has created Office 365 SDKs for specific platforms
- Office 365 APIs set the stage for the Microsoft Graph API
 - Microsoft Graph API created to simplify accessing Office 365



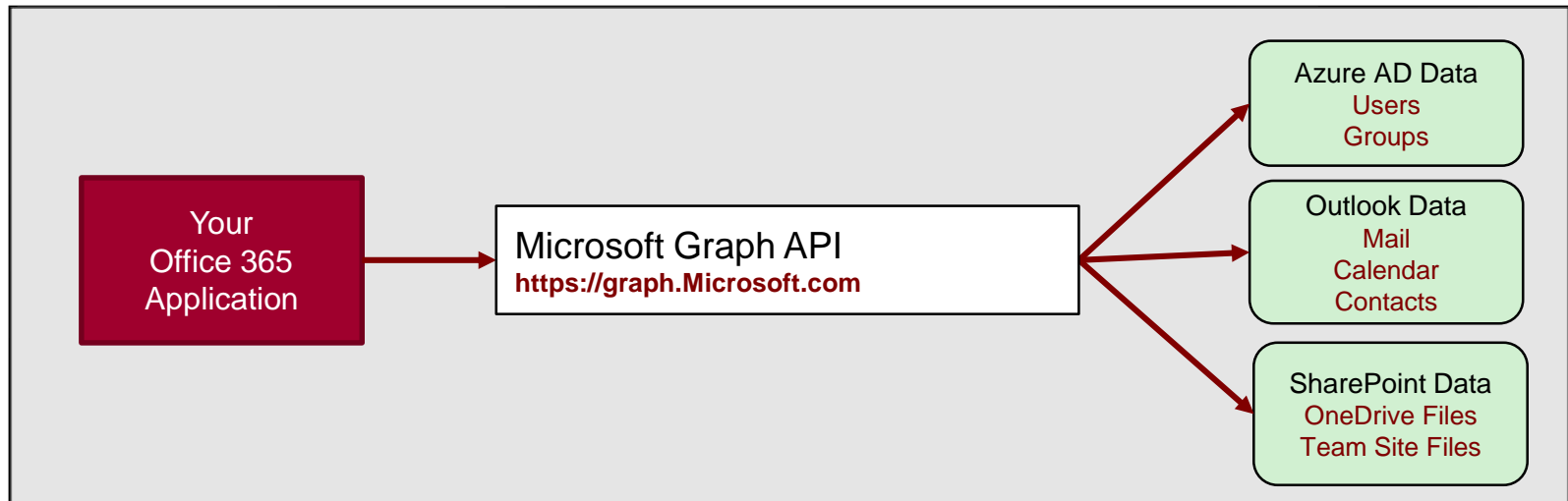
Office 365 API Endpoint in Initial Release

- Azure Endpoints
 - Azure Graph API
- Office 365 API Endpoints
 - Outlook service
 - OneDrive for Business Service
 - SharePoint Files Service
 - Discovery Services



The Microsoft Graph API

- Designed as a single, more-comprehensive service
 - Abstracts away divisions between AD, Exchange and SharePoint
 - No need to discover endpoints using the Discovery Service
 - You can acquire and cache a single access token per user



What Does It Do?

- Single resource that proxies multiple Microsoft services
- Allows for easy traversal of objects and relationships
- Simplifies token acquisition and management
- Eliminates the need to traditional discovery
 - It does this by using "me" and "myorganization"



Universal Access

- Direct REST API
 - Any platform
 - Any language
 - Any framework
- Native SDKs
 - Utilize framework & platform specific implementations
 - Abstracts the details of building & processing requests over HTTP
 - .NET, iOS, Android, PHP, Ruby, JavaScript, etc.



The Graph Explorer

- Graph Explorer used to execute calls into Microsoft Graph API
 - Great place to discover what the API can do
 - <https://developer.microsoft.com/en-us/graph/graph-explorer>

The screenshot shows the Microsoft Graph Explorer interface in a web browser. The browser's address bar displays the URL: `https://developer.microsoft.com/en-us/graph/graph-explorer#access_token=eyJ0eXAiOiJKV1QiLCJub25jZSI6IkFRQUJBQUFBQUFEWHpaM2lmc1H`. The page header includes the Microsoft logo and navigation links: Microsoft Graph, Solutions, Graph Explorer, Quick Starts, Docs, API Reference, Samples & SDKs, Blog, Support, and My Apps.

The main interface is divided into three sections:

- Left Sidebar:** Contains the 'Graph Explorer' title, 'Authentication' section with user 'Ted Pattison' (student@msd0910.onmicrosoft.com) and a 'sign out' link, and 'Sample Queries' under 'SharePoint Sites' and 'Microsoft Teams (beta)'. Each query is preceded by a 'GET' button.
- Top Bar:** Features a 'GET' dropdown menu, a version selector set to 'v1.0', and a text input field containing the endpoint `https://graph.microsoft.com/v1.0/sites/root/drives`.
- Main Content Area:** Includes tabs for 'Request Body' and 'Request Headers'. Below these, a green status bar indicates 'Success - Status Code 200' and '720ms'. At the bottom, there are tabs for 'Response Preview' and 'Response Headers'. The 'Response Preview' tab is active, displaying a JSON response for the drive endpoint.

The JSON response in the 'Response Preview' tab is as follows:

```
{
  "@odata.context": "https://graph.microsoft.com/v1.0/$metadata#drives",
  "value": [
    {
      "createdDateTime": "2018-08-31T20:01:13Z",
      "description": "",
      "id": "b!_-TPjP3rNE2wzU5_dTud11EI4Yk5H49OveTp-rjXyUuWPVHkPwDNR6nGJ_U8xa9W",
      "lastModifiedDateTime": "2018-08-31T20:01:13Z",
      "name": "Documents",
      "webUrl": "https://msd0910.sharepoint.com/Shared%20Documents",
      "driveType": "documentLibrary",
      "createdBy": {

```



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Calling the Graph API

`https://graph.microsoft.com`

`/ {version} / {resource} / {id} / {property} ? {query-parameters}`

- HTTP verbs dictate the request intent: GET | POST | PATCH | PUT | DELETE
- Version: `/v1.0` or `/beta`
- Resource: `/users`, `/groups`, `/sites`, `/drives`, `/devices`, more...
- Member from collection: `/users/AAA`
- Property: `/users/AAA/department`
- Traverse to related resources via navigations: `/users/AAA/events`
- Query parameters: `/users/AAA/events?$top=5`
 - Format results: `$select` | `$orderby`
 - Control results: `$filter` | `$expand`
 - Paging: `$top` | `$skip` | `$skiptoken`



Pagination

Graph uses server-side page size limits

When querying collections, Graph may return the results in many pages

Always expect an `@odata.nextLink` property in the response

Contains the URL to the next page



Request

```
GET https://graph.microsoft.com/v1.0/me/messages?$select=subject,from
```

Response

```
{
  "@odata.nextLink": "https://graph.microsoft.com/v1.0/me/messages?$select=subject%2cfrom&$skip=16",
  "value": [
    {
      "subject": "Your Azure AD Identity Protection Weekly Digest",
```

1.

Always handle the possibility that the responses are paged in nature

2.

Follow the `@odata.nextLink` to obtain the next page of results

3.

Final page will not contain an `@odata.nextLink` property

4.

Treat the entire URL as an opaque string



Querying data | Use filters

Choose the **records** your app really needs and no more

Don't send unnecessary data over the wire

Tip
Use **\$filter**

GET [https://graph.microsoft.com/v1.0/users?\\$filter=department eq 'Sales' & \\$select=givenName,mail](https://graph.microsoft.com/v1.0/users?$filter=department eq 'Sales' & $select=givenName,mail)



POST/PATCH/PUT | no response required

If your code doesn't need to get a response, then opt out

Don't send unnecessary data over the wire

Tip
Use HTTP
Prefer return=minimal
request header



- User, group and organizational

Data

One endpoint
One token
All users

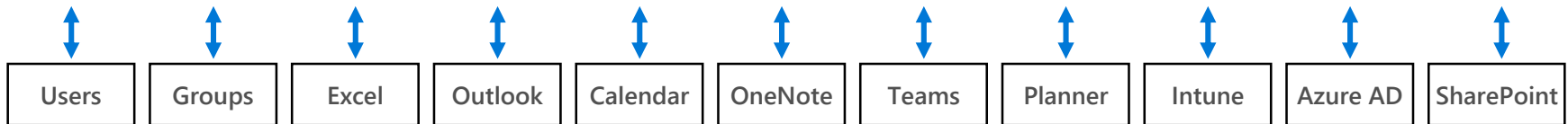


Your app



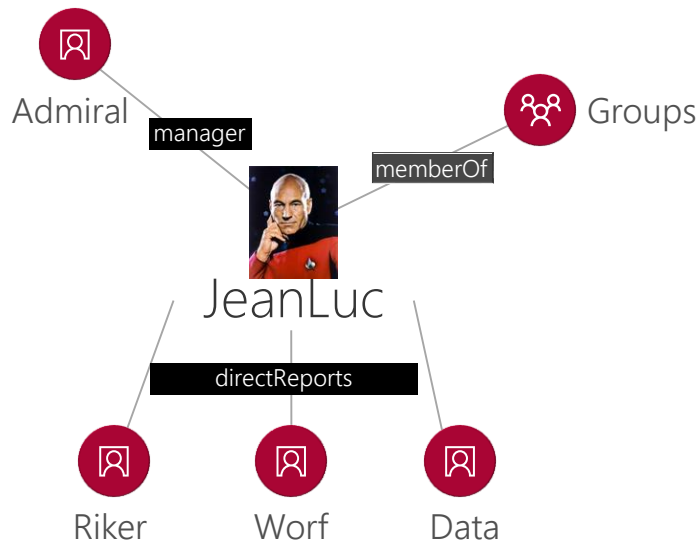
Microsoft Teams API - [preview](#)
Project Rome API - [preview](#)
SharePoint Sites API – [GA](#)
OneNote API – [GA](#)
Planner API – [GA](#)

<https://graph.microsoft.com>



With Microsoft Graph

Get the user **profile**



GET: [/users/JeanLuc](#)

```
{  
  "displayName": "JeanLuc Picard",  
  "jobTitle": "Captain",  
}
```

GET: [/users/JeanLuc/photo/...](#)

```
{}
```

GET: [/users/JeanLuc/manager](#)

```
{"displayName": "Starfleet Admiral", ...}
```

GET: [/users/JeanLuc/directReports](#)

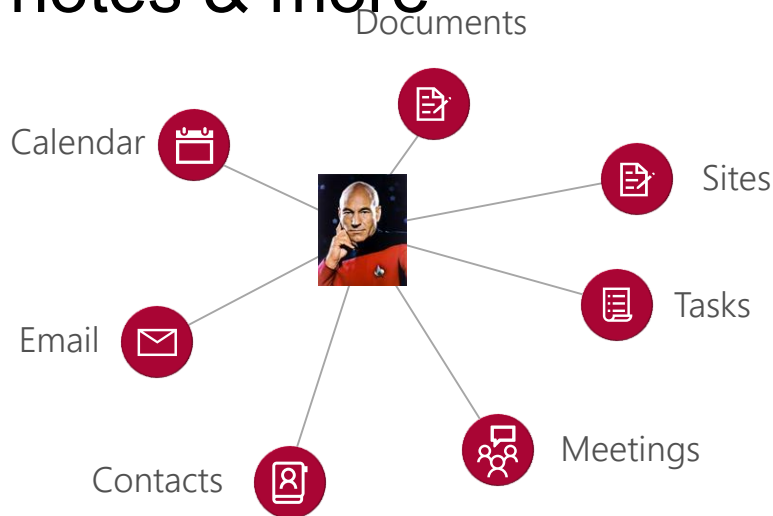
```
"value" : [  
  {"displayName": "Riker", ...},  
  {"displayName": "Worf", ...},  
]
```

GET: [/me/memberOf/...](#)

```
"value" : [  
  {"displayName": "Starfleet engineering", ...},  
  {"displayName": "Beaming", ...},  
]
```

With Microsoft Graph

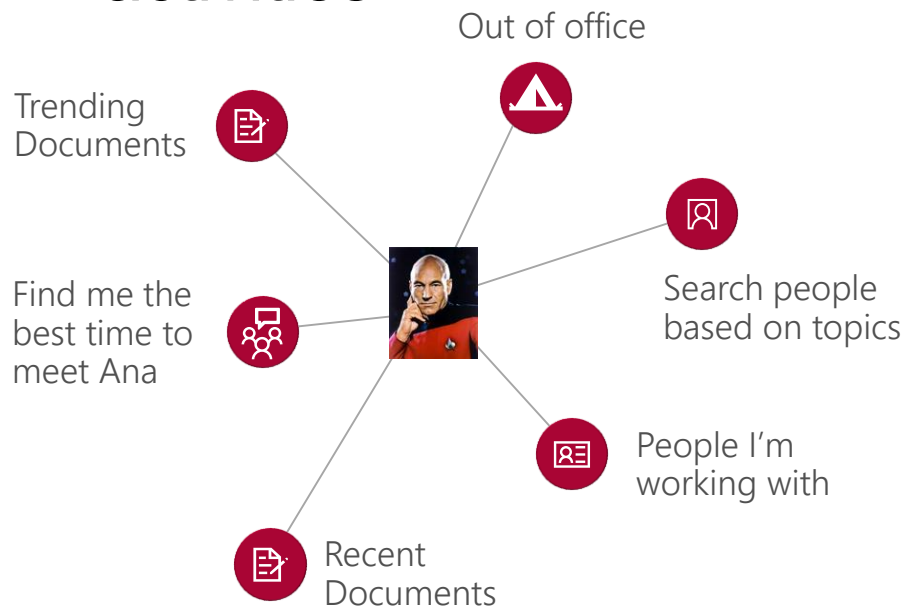
Get **content** for email, calendar, files, tasks, sites, notes & more



```
GET /me/drive/root/...  
"value" : [  
  {"name": "proposal.pptx",... },  
  {"name": "forecast.xlsx",... }  
]  
  
GET /drives/items/{id}/workbook  
  
GET /me/messages  
  
GET /me/events  
  
GET /me/contacts  
  
GET /me/onenote/notebooks  
  
GET /me/planner/tasks  
  
GET /me/devices  
  
GET /sites:/teams/opg:/  
  
GET /sites:/teams/opg:/lists  
  
GET /groups/{id}/conversations
```

With Microsoft Graph

Get **insights** based on activities



```
GET /me/insights/trending
"value" : [
  {"name": "presentation.pptx", ...},
  {"name": "forecast.xlsx", ...}
]
```

```
GET /me/drive/recent
"value" : [
  {"name": "guidelines.pptx", ...},
  {"name": "budget.xlsx", ...}
]
```

```
GET people/?$search="topic: planning"
"value" : [
  {"displayName": "Data", ...},
  {"displayName": "Worf", ...}
]
```

```
POST: /me/findMeetingTimes
{
  "attendees": [
    {
      "type": "required",
      "emailAddress": {
        "address": "riker@contoso.com"
      }
    }
  ],
  "meetingDuration": "2h"
}
```

Read data from existing SharePoint site

GET <https://graph.microsoft.com/beta/sites/{siteId}/lists/{listId}/items?expand=columnSet>

```
{ "value": [ {  
  "createdBy": { "user" : { "id": "d54e4cdd-d2ca-4c39-bfa5-35895bca12f0", "displayName": "John" } },  
  "createdDateTime": "2017-09-20T08:16:21Z",  
  "eTag": "1610ac6a-24f6-4458-9733-1e5977c63caa,1",  
  "id": "1610ac6a-24f6-4458-9733-1e5977c63caa",  
  "lastModifiedBy": { "user": { "id": "d54e4cdd-d2ca-4c39-bfa5-35895bca12f0", "displayName": "John" } },  
  "lastModifiedDateTime": "2017-09-0T08:16:21Z",  
  "webUrl": "https://site.sharepoint.com/sites/mysite/Lists/mytasks/1_.000",  
  "listItemId": 1,  
  "columnSet": {  
    "Title": "Project Upgrade: Use the Microsoft Graph",  
    "Description": "Set up group for new technologies.",  
    "id": "1",  
    ...  
  }  
} ] }
```



OneDrive + Excel Services

```
GET https://graph.microsoft.com/v1.0/me/drive/  
    root/search(q='.xlsx')?select=name,id,webUrl
```

```
GET https://graph.microsoft.com/1.0/me/drive/  
    items/<id>/workbook/worksheets
```

```
GET https://graph.microsoft.com/beta/me/drive/  
    items/{itemId}/workbook/worksheets('Time')/  
    range(address='a2:d4')
```



Update Excel Timesheet Data

```
PATCH https://graph.microsoft.com/beta/me/drive/  
      items/{itemId}/workbook/worksheets('Sheet1')/  
      range(address='a2:b2')  
  
{  
  "values": [ ["September", "200.0"] ],  
  "valueTypes": [ ["String", "Double"] ],  
}
```



New Capabilities

- Traversal of relationships
- Query parameters
- Batching - preview
- Notifications - users & groups - preview
- Track changes - GA
- Extensions - GA



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Microsoft Graph JavaScript SDK

- Microsoft Graph is accessible via REST API & various SDKs
- Client-side solutions can leverage the JavaScript SDK
 - <https://github.com/microsoftgraph/msgraph-sdk-javascript>
 - Requires initialization with an Azure AD provided OAuth2 access token to create the client



Initializing the Microsoft Graph JS SDK

```
var client = MicrosoftGraph.Client.init({  
  authProvider: (done) => {  
    done(null, access_token);  
  }  
});
```

```
client  
  .api('/me')  
  .get((err, res) => {  
    console.log(res);  
  });
```



Microsoft Graph TypeScript Type Declarations

- Use the Microsoft Graph JavaScript SDK in TypeScript applications
- TypeScript type declarations introduce strong types and documentation to client-side projects
 - <https://github.com/microsoftgraph/msgraph-typescript-typings>



Microsoft Graph TypeScript Type Declarations

```
import * as MicrosoftGraph from '@microsoft/microsoft-graph-types';

// init Microsoft Graph client

client
  .api('/me')
  .get((error: any, user: MicrosoftGraph.User, rawResponse?: any) => {
    console.log('name: ', user.displayName);
    console.log('email: ', user.displayName);
    console.log('phone: ', user.businessPhones[0]);
  });
});
```



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SharePoint Online User Already Authenticated

- Users in SharePoint Online & Office 365 are already authenticated
 - SharePoint Online has same Azure AD dependency as Microsoft Graph
 - Users login to Office 365 with their Work & School account (Azure AD)
- Calls to the Microsoft Graph are proxied through SharePoint Online
 - Eliminates the need for creation of a separate Azure AD application
 - Does not bypass any permission / scope requirements
 - Can only access business entities, not consumer entities



Calling Services from Client-side Code

- Calling a secured service requires the acquisition of token
 - Authenticate and get authorized in Azure AD application
 - Interactive login & programmatic acquisition of access token
- Client-side components cannot do the same
 - Components cannot securely do this across domains seamlessly
 - Can't store application ID's and secrets client side
 - Require an authentication prompt with a popup or redirection



SPFx Includes Microsoft Graph Client

- MSGraphClient: Microsoft Graph Client for SPFx
 - Abstracts the token acquisition from the SPFx development
 - Wraps the Microsoft Graph JavaScript SDK line

```
let graphClient: MSGraphClient =  
    this.context.serviceScope.consume(MSGraphClient.serviceKey);
```



SPFx Proxy Calls through Existing Application

- SharePoint Online already has an Azure AD application
 - Client-side solutions in SharePoint Online call the SharePoint REST API in the same domain
 - No extra authentication required
 - Provided these tenants have granted the necessary scopes, SharePoint will call the Microsoft Graph
 - Responses from the Microsoft Graph are returned back to the client-side application
- Permission requests to Azure AD applications
 - Only SharePoint Online tenant administrators can [grant|reject] permission requests
 - Approved permissions are available to all client-side solutions in a tenant



SPFx Solutions Declare Permission Requests

```
// package-solution.json
{
  "$schema": "https://developer.microsoft.com/json-schemas/spfx-build/package-solution.schema.json",
  "solution": {
    "name": "ms-graph-sp-fx-client-side-solution",
    "id": "dfb230b7-4f61-431f-9b65-a34e83922663",
    "version": "1.0.0.0",
    "includeClientSideAssets": true,
    "webApiPermissionRequests": [
      { "resource": "Microsoft Graph", "scope": "User.ReadBasic.All" },
      { "resource": "Microsoft Graph", "scope": "Calendars.Read" },
      { "resource": "Microsoft Graph", "scope": "Tasks.Read" }
    ]
  },
  "paths": {
    "zippedPackage": "solution/ms-graph-sp-fx.sppkg"
  }
}
```



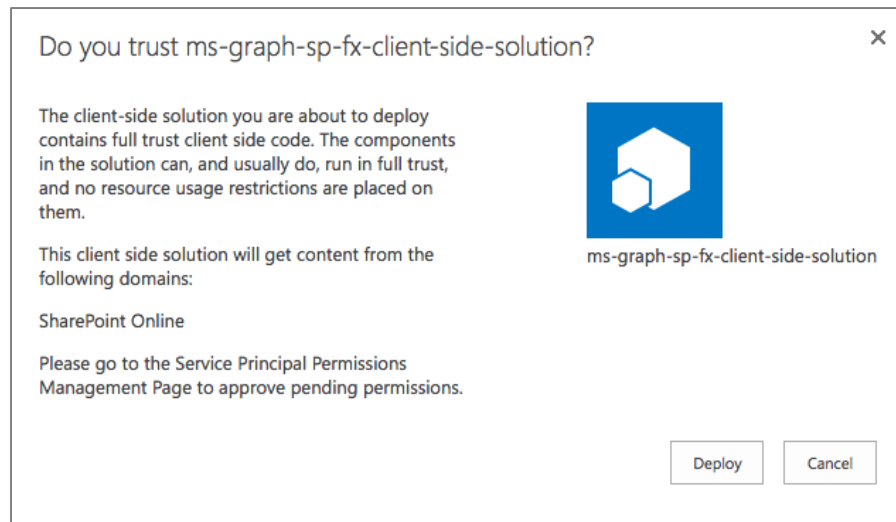
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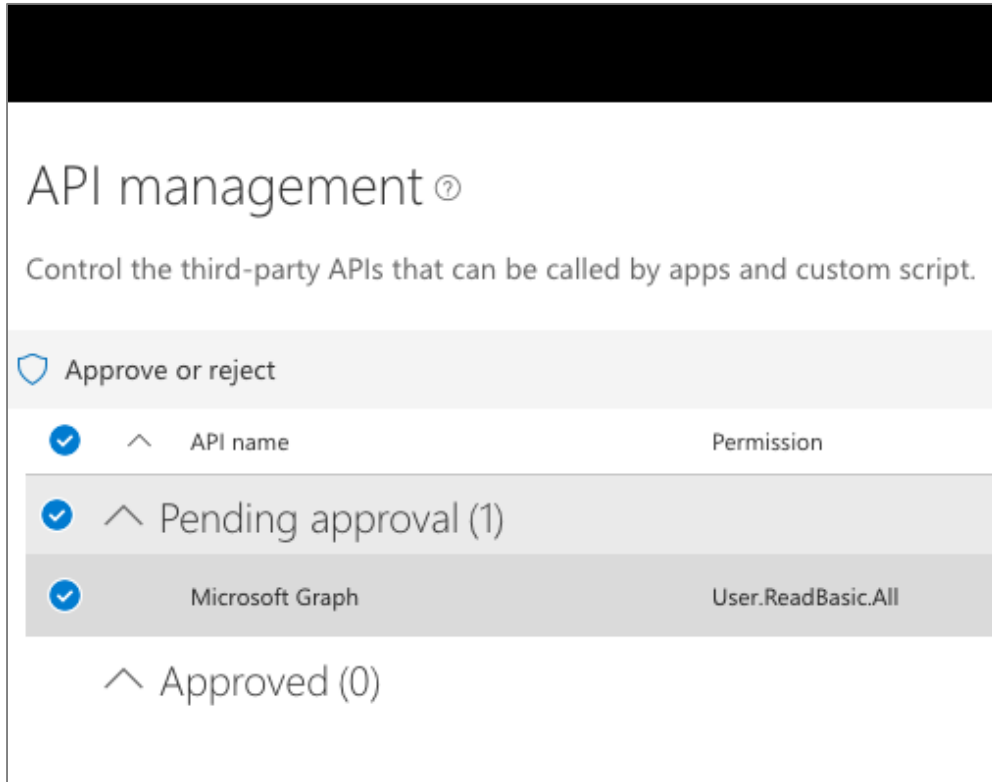


Add Package to SharePoint App Catalog

- Extra note in dialog notifies of additional step required
- While application can be installed in SharePoint sites, it does not have the permissions granted that it needs to access Azure AD protected resources



Approve / Reject with SharePoint Online API Management Page



The screenshot shows the 'API management' page in SharePoint Online. The page has a dark header bar. Below the header, the title 'API management' is followed by a help icon. A subtitle reads 'Control the third-party APIs that can be called by apps and custom script.' A section titled 'Approve or reject' with a shield icon contains a table of pending approvals. The table has two columns: 'API name' and 'Permission'. One entry is visible: 'Microsoft Graph' with the permission 'User.ReadBasic.All'. Below the table, there is a link to 'Approved (0)'.

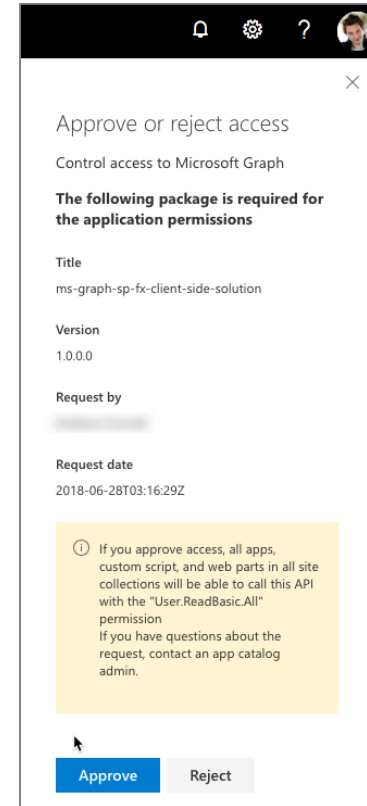
API management ?

Control the third-party APIs that can be called by apps and custom script.

Approve or reject

API name	Permission
Pending approval (1)	
Microsoft Graph	User.ReadBasic.All

Approved (0)



The screenshot shows a modal dialog box titled 'Approve or reject access'. The dialog has a close button in the top right corner. The main text reads 'Control access to Microsoft Graph'. Below this, a bold message states 'The following package is required for the application permissions'. The dialog lists the following details: Title (ms-graph-sp-fx-client-side-solution), Version (1.0.0.0), Request by (redacted), and Request date (2018-06-28T03:16:29Z). A yellow warning box contains a note: 'If you approve access, all apps, custom script, and web parts in all site collections will be able to call this API with the "User.ReadBasic.All" permission. If you have questions about the request, contact an app catalog admin.' At the bottom, there are 'Approve' and 'Reject' buttons.

Approve or reject access

Control access to Microsoft Graph

The following package is required for the application permissions

Title
ms-graph-sp-fx-client-side-solution

Version
1.0.0.0

Request by
[Redacted]

Request date
2018-06-28T03:16:29Z

① If you approve access, all apps, custom script, and web parts in all site collections will be able to call this API with the "User.ReadBasic.All" permission. If you have questions about the request, contact an app catalog admin.

Approve Reject



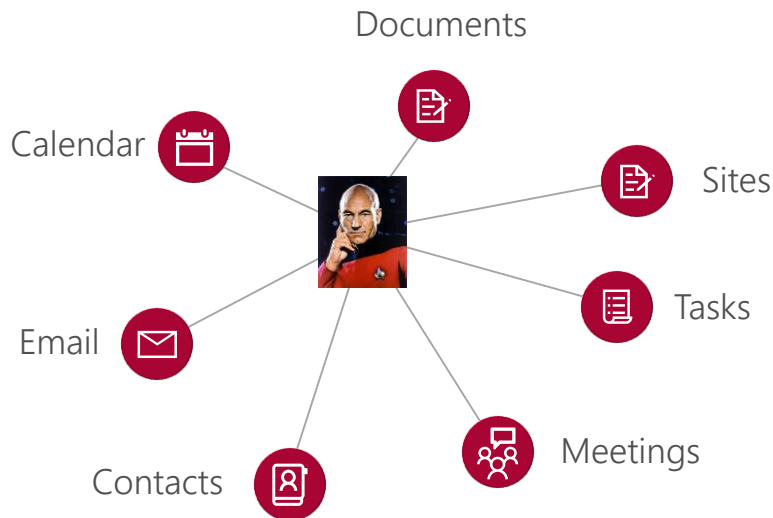
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With Microsoft Graph

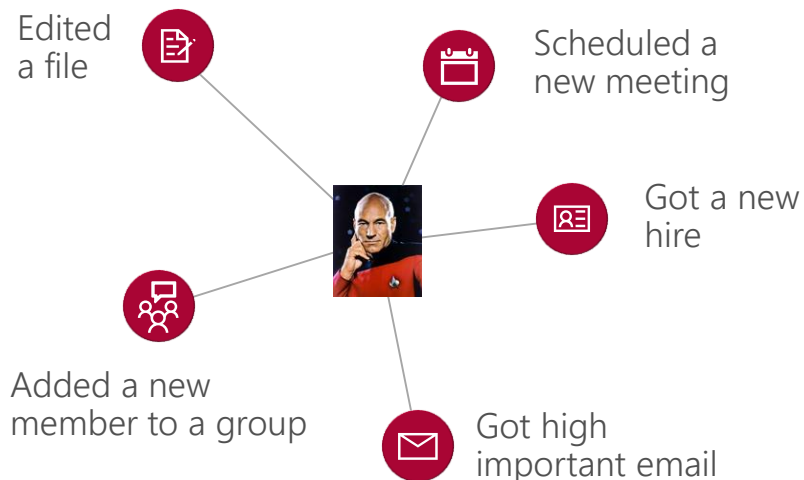
Use **\$batch** to combine multiple requests in one call



```
Batching
POST /$batch
{
  "requests": [{
    "id": "1",
    "url": "/me/drive/root/children",
    "method": "POST",
    "body": {
      "name": "folder1",
      "folder": {}
    },
    "headers": {
      "content-type": "application/json"
    }
  }, {
    "id": "2",
    "url": "/me/drive/root/children/folder1",
    "method": "GET",
    "dependsOn": ["1"]
  }, {
    "id": "3",
    "method": "GET",
    "url": "/me/planner/tasks"
  }, {
    "id": "4",
    "method": "GET",
    "url": "/groups/{id}/events"
  }
  ]
}
```

With Microsoft Graph

Get notifications & track changes



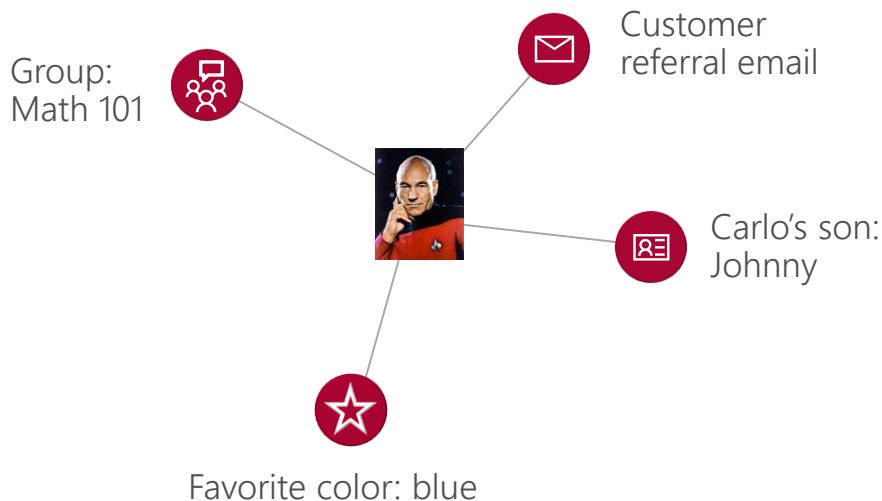
```
GET /me/mailFolders/{id}/messages/delta
"@odata.deltaLink": "me/mailFolders('AA')/messages/
delta?$deltatoken=BB",
"value" : [...]
```

```
POST /subscriptions
{
  "changeType": "created,updated",
  "notificationUrl": "https://app.net/callback",
  "resource": "/me/mailFolders('AA')/messages",
}
```

```
GET /me/mailFolders/{id}/messages/delta
?$deltatoken=BB"
"value" : [...]
```

Extending the Graph

Add **extensions** to user, group, mail & more



Open Extensions

```
GET /me/message/<id>/?$expand=extensions
{
  "displayName": "JeanLuc",
  "extensions": [
    {
      "extensionName": "Com.Contoso.Referral",
      "companyName": "atwork",
      "expirationDate": "2017-12-30T11",
      "dealValue": 10,000
    }
  ]
}
```

Schema extensions

```
POST /schemaExtensions
{
  "id": "training_courses",
  "targetTypes": [ "Group" ],
  "properties": [
    {
      "name": "courseName",
      "type": "String"
    }
  ]
}
```

```
GET /groups?$filter=courses/name eq Math101
```