Building and generating a .NET client for Space

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JET BRAINS

Agenda

JetBrains Space

JetBrains Space HTTP API

Building a .NET SDK for the Space HTTP API

Code generation

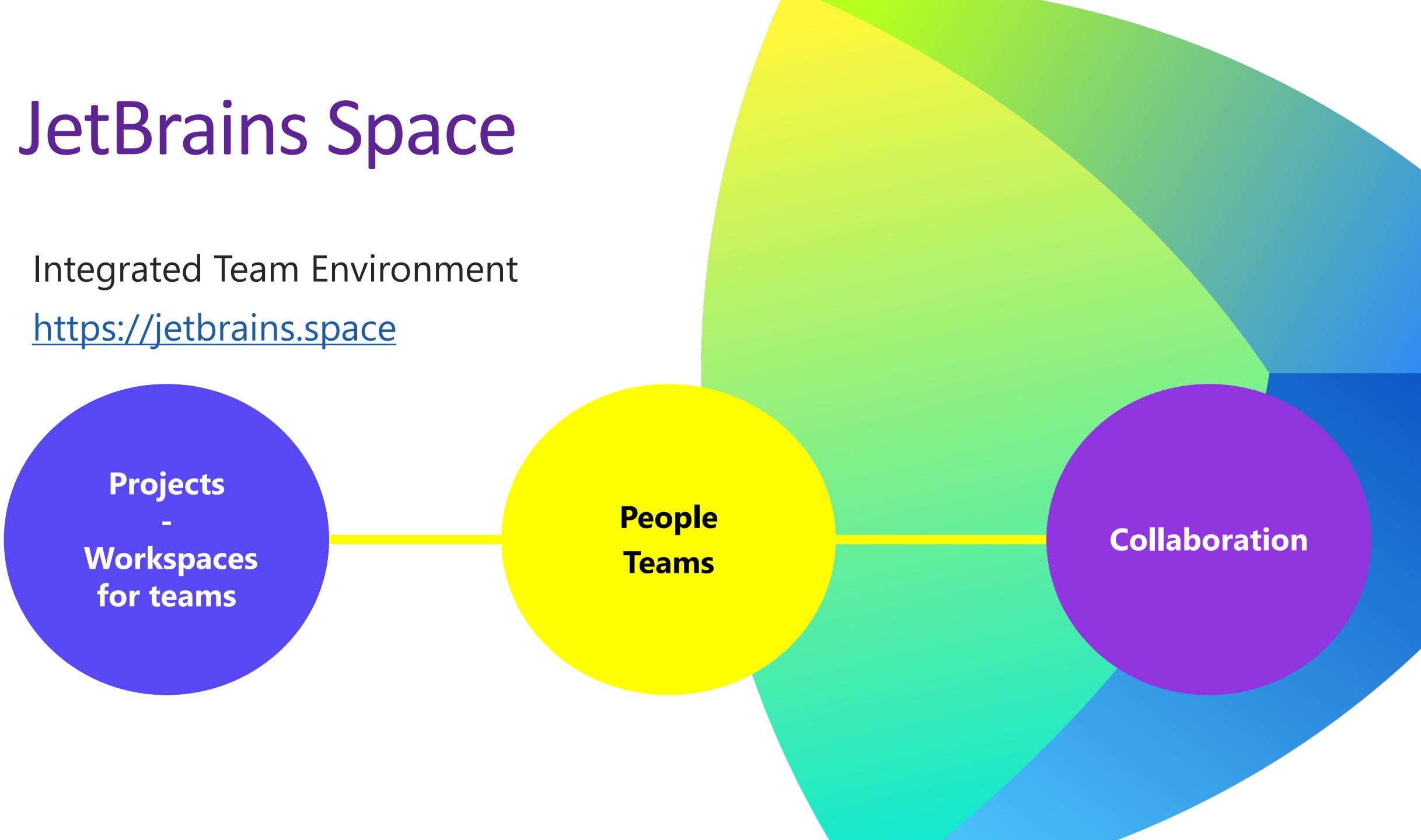
Developer experience


JetBrains Space

JetBrains Space

Integrated Team Environment

https://jetbrains.space



JetBrains Space

demo


The Space HTTP API

Integrated Team Environment

More information in Space == more value from Space

Internal integrations out of the box

- Vacation shown in profile
- Blog post targeted to team/location
- Calendar integration in blog post
- Everything can be a ToDo item
- ...

What with external integrations? Extensibility?

Everything as an HTTP API!

What do you want to build? Which integration do you need?

- Import data
- Post to chat
- Manage users, teams, and locations programatically
- Build dashboards

No good answer, so opening up everything

- Large HTTP API surface…
- HTTP API Playground to explore!

HTTP API Playground

demo

$fields

Top-level fields returned by default

Unless $fields query parameter used

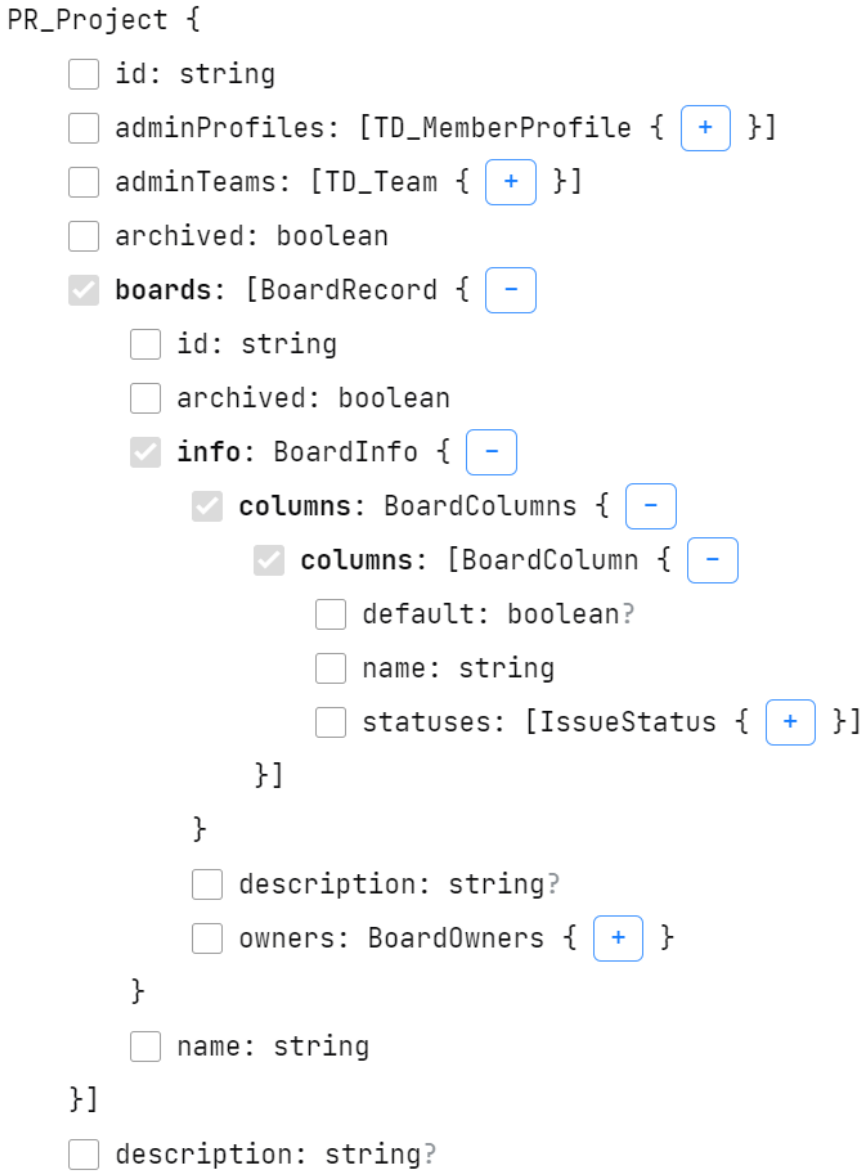
Use $fields to be specific, or get nested fields

$fields=id,icon,name

$fields=id,name,boards(id,description)

$fields=id,name,boards(id,info(columns))

$fields=*,boards(id,description)




Building a .NET SDK
for the Space HTTP API

Hello, .NET! 👋

Goal: make our users succesful at using Space in their team/organization

- Provide a ready-to-use SDK
- Minimal configuration needed
- Discoverability
- Use latest C# language features (where they make sense)

TL;DR: Lead integration developers on the shortest path to success

How? Handcrafted

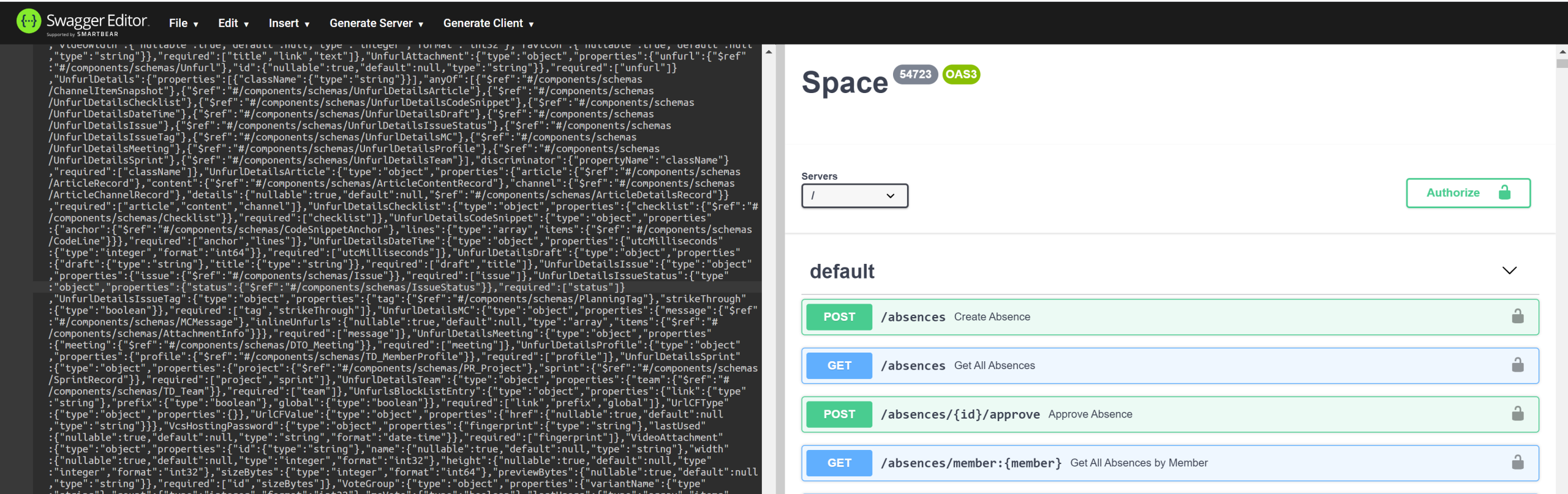
No.

- Over 150 API endpoints
- Over 700 object types
- Space EAP / Space Beta means churn!

How? OpenAPI?

Use NSwag, generate based on OpenAPI / Swagger document

Some incompatible object types needed custom code generation



How? OpenAPI?

Not very developer friendly...

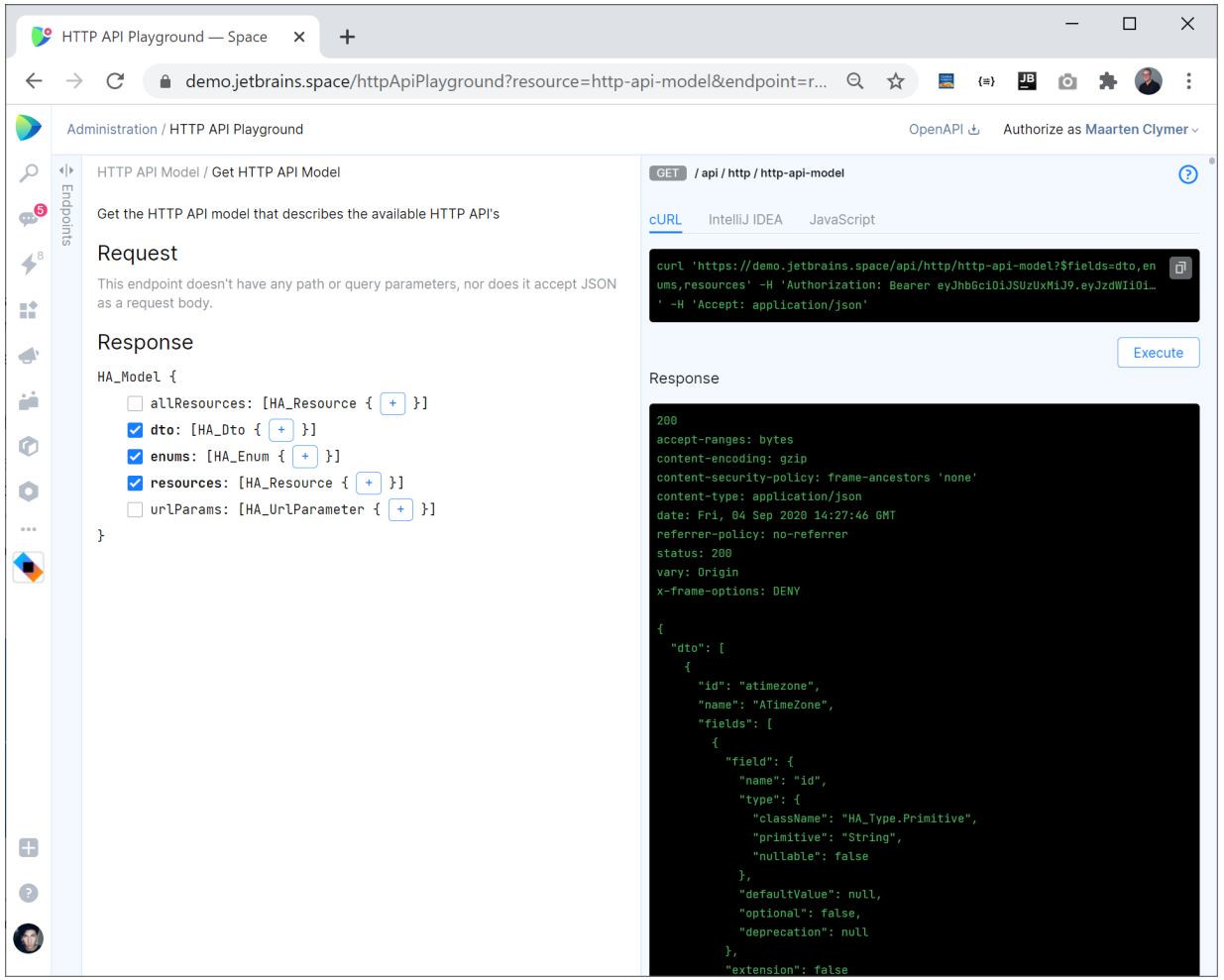
```
public class Body
{
    public string Member { get; set; }
    public string Reason { get; set; }
    public string Description { get; set; }
    public string Location { get; set; }
    public string Since { get; set; }
    public string Till { get; set; }
    public bool Available { get; set; } = false;
    public string Icon { get; set; }
}


public async Task<AbsenceRecord> GetAbsencesAsync(
    string fields, Body body, CancellationToken cancellationToken)
{

}
```

How? Custom code generation

https://your.jetbrains.space/api/http/http-api-model?$fields=dto,enums,urlParams,resources(*,nestedResources!)

Space exposes HTTP API Model

- Enumerations
- DTOs (objects passed around)
- Resources
- + data types, nullability, default values, ...

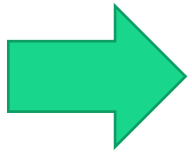


Enumeration model

```
public class ApiEnum
{
    public string Id { get; set; }

    public ApiDeprecation? Deprecation { get; set; }

    public string Name { get; set; }

    public List<string> Values { get; set; }
}

public class ApiDeprecation
{
    public string? Message { get; set; }

    public string? Since { get; set; }

    public bool ForRemoval { get; set; }
}
```

Enumeration code generator

```
public class EnumerationVisitor
{
    public string Visit(ApiEnum apiEnum)
    {
        var builder = new StringBuilder();

        if (apiEnum.Deprecation != null)
            builder.AppendLine(Visit(apiEnum.Deprecation));

        builder.AppendLine("public enum " + apiEnum.Name);
        builder.AppendLine("{");

        foreach (var apiEnumValue in apiEnum.Values)
        {
            builder.AppendLine($"    {apiEnumValue},");
        }

        builder.AppendLine("}");
        return builder.ToString();
    }

    public string Visit(ApiDeprecation apiDeprecation)
        => $"[Obsolete(\"{apiDeprecation.Message}\")]";
}
```



```
public enum AbsenceListMode
{
    All,
    WithAccessibleReasonUnapproved,
    WithAccessibleReasonAll,
}
```

DTO model

```
public class ApiDto
{
    public string Id { get; set; }
    public ApiDeprecation? Deprecation { get; set; }
    public string Name { get; set; } = default!;
    public List<ApiDtoField> Fields { get; set; }
    public Reference<ApiDto>? Extends { get; set; }
    public List<Reference<ApiDto>> Implements { get; set; }
    public List<Reference<ApiDto>> Inheritors { get; set; }
    public HierarchyRole HierarchyRole { get; set; }
    public bool Record { get; set; }
}

public class ApiField
{
    public string Name { get; set; }
    public ApiFieldType Type { get; set; }
    public bool Optional { get; set; }
    public ApiDefaultValue? DefaultValue { get; set; }
}
```

Endpoints model

Endpoint id, name, base path

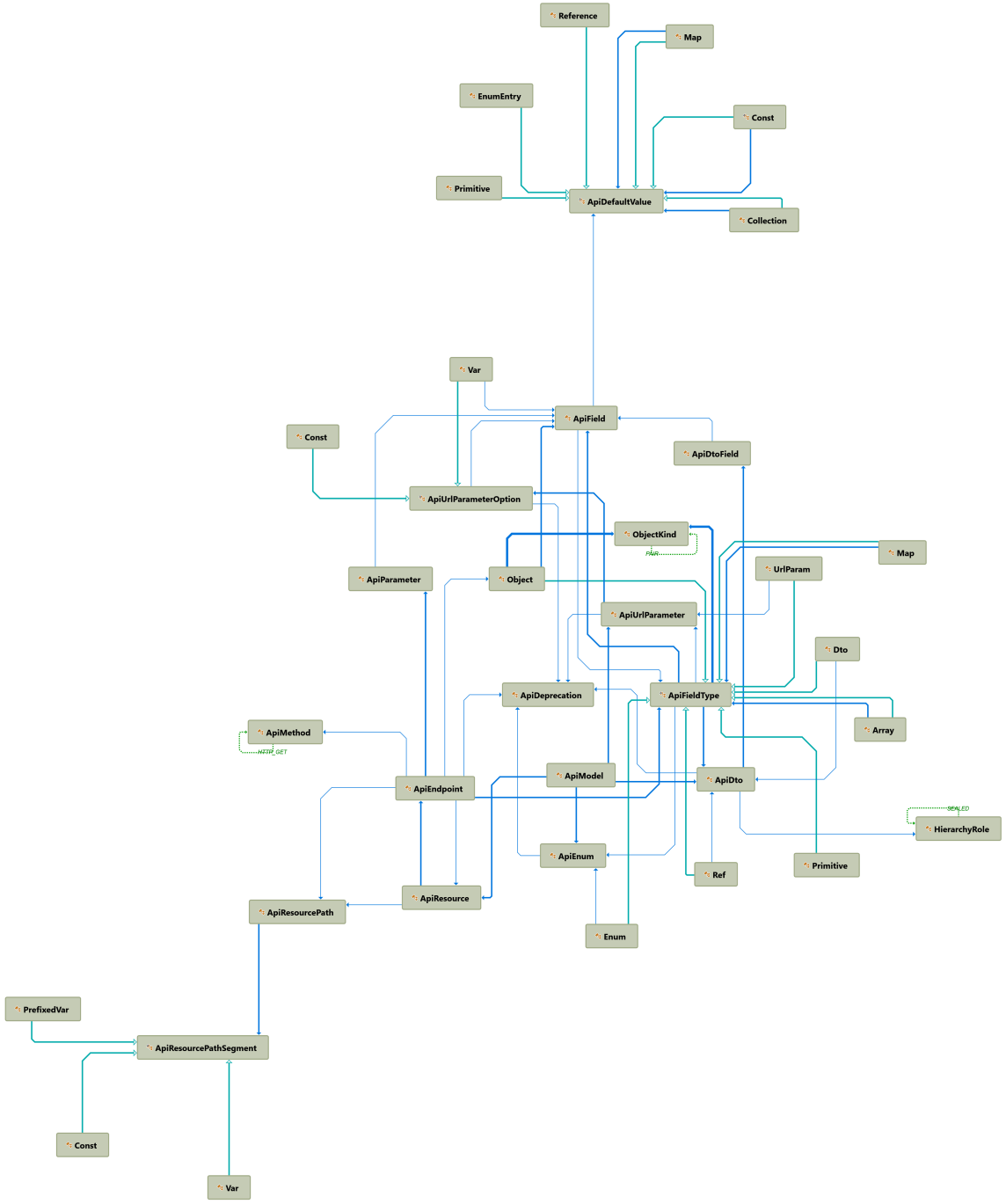
Resource id, name, path, parameters

Resource id, name, path, parameters

Resource id, name, path, parameters

...

+ parameter types
+ return types
+ default values (const, variable)



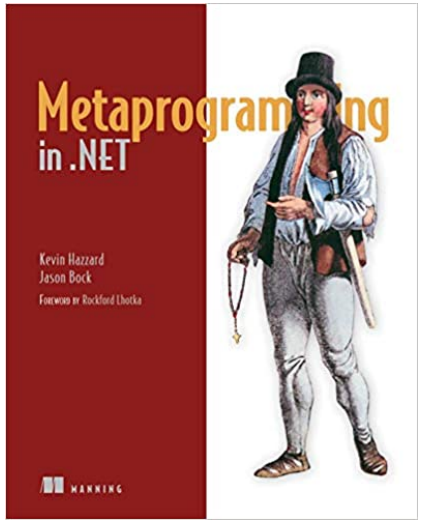
Custom code generation

demo

Roslyn/StringBuilder/...?

Generally, a few ways to generate code:

- IL-based
  - *IL Generation (Reflection.Emit)*
- Model-based
  - *CodeDOM*
  - *Expression trees*
  - *Roslyn syntax generation*
- Template-based (T4, Razor, ...)
- Strings all the way



https://amzn.to/2EWsA44

Strings all the way!

See string, recognize the output easily

- IL-based – Too complex
- Model-based – Less readable (very verbose)
- Template-based – Less readable (many small files to include)

```
builder.AppendLine(
   $"public {subject.Type.ToCSharpType()} {subject.ToCSharpPropertyName()} {{ get; set; }}");
```

```
var propertyDeclaration = SyntaxFactory.PropertyDeclaration(
   SyntaxFactory.ParseTypeName(subject.Type.ToCSharpType()), subject.ToCSharpPropertyName())
   .AddModifiers(SyntaxFactory.Token(SyntaxKind.PublicKeyword))
   .AddAccessorListAccessors(
      SyntaxFactory.AccessorDeclaration(SyntaxKind.GetAccessorDeclaration)
         .WithSemicolonToken(SyntaxFactory.Token(SyntaxKind.SemicolonToken)),
      SyntaxFactory.AccessorDeclaration(SyntaxKind.SetAccessorDeclaration)
         .WithSemicolonToken(SyntaxFactory.Token(SyntaxKind.SemicolonToken)));
```

Extension methods everywhere

Many places where we need:

- C# class name
- C# variable name
- C# type from Space model type
- …

```
public static class ApiDocumentationExtensions
{
    public static string ToCSharpDocumentationComment(
        this string subject)
    {
        var builder = new StringBuilder();
        builder.AppendLine("/// <summary>");
        builder.AppendLine("/// " + subject);
        builder.AppendLine("/// </summary>");
        return builder.ToString();
    }
}

public static class ApiDtoExtensions
{
    public static string ToCSharpClassName(this ApiDto subject)
        => CSharpIdentifier.ForClassOrNamespace(subject.Name);
}
```

System.Text.Json

"System.Text.Json is a built-in (de)serializer for .NET Core 3 and beyond."

Developer experience!

- No extra dependencies needed
- No dependency on a Newtonsoft.Json that you are not using

System.Text.Json

Not a 100% replacement for Newtonsoft.Json...

https://docs.microsoft.com/en-us/dotnet/standard/serialization/system-text-json-migrate-from-newtonsoft-how-to

Polymorphic serialization	⚠ Not supported, workaround, sample
Polymorphic deserialization	⚠ Not supported, workaround, sample
Deserialize JSON `null` literal to non-nullable value types	⚠ Not supported, workaround, sample
Deserialize to immutable classes and structs	⚠ Not supported, workaround, sample

System.Text.Json is extensible enough

Custom JsonConverter<T>

JsonConverter<T>

demo

https://blog.maartenballiauw.be/post/2020/01/29/deserializing-json-into-polymorphic-classes-with-systemtextjson.html


Code generation & developer experience

The ideal “Getting started”

1. Register application in Space
2. Install SpaceDotNet.Client package

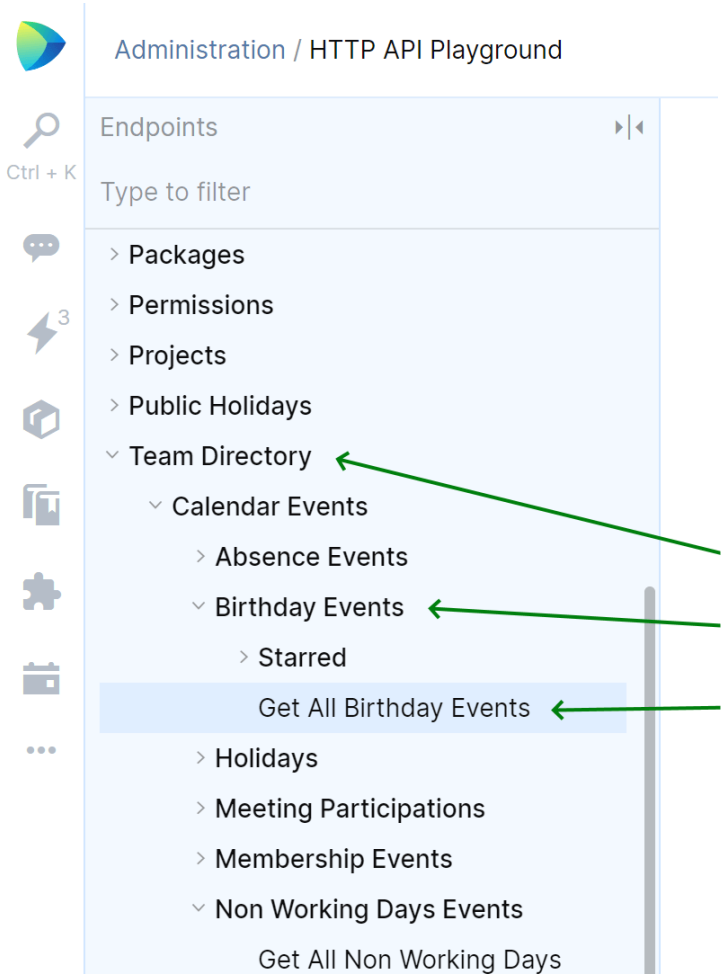
```
dotnet add package SpaceDotNet.Client
```

3. Create connection instance

```
var connection = new ClientCredentialsConnection(
    "https://your.jetbrains.space/",
    "client-id",
    "client-secret",
    new HttpClient());
```

4. Profit!

Large API surface




```
var teamDirectoryClient = new TeamDirectoryClient(connection);
var birthdays = await teamDirectoryClient
    .CalendarEvents
        .BirthdayEvents
            .GetAllBirthdayEventsAsync(...);
```

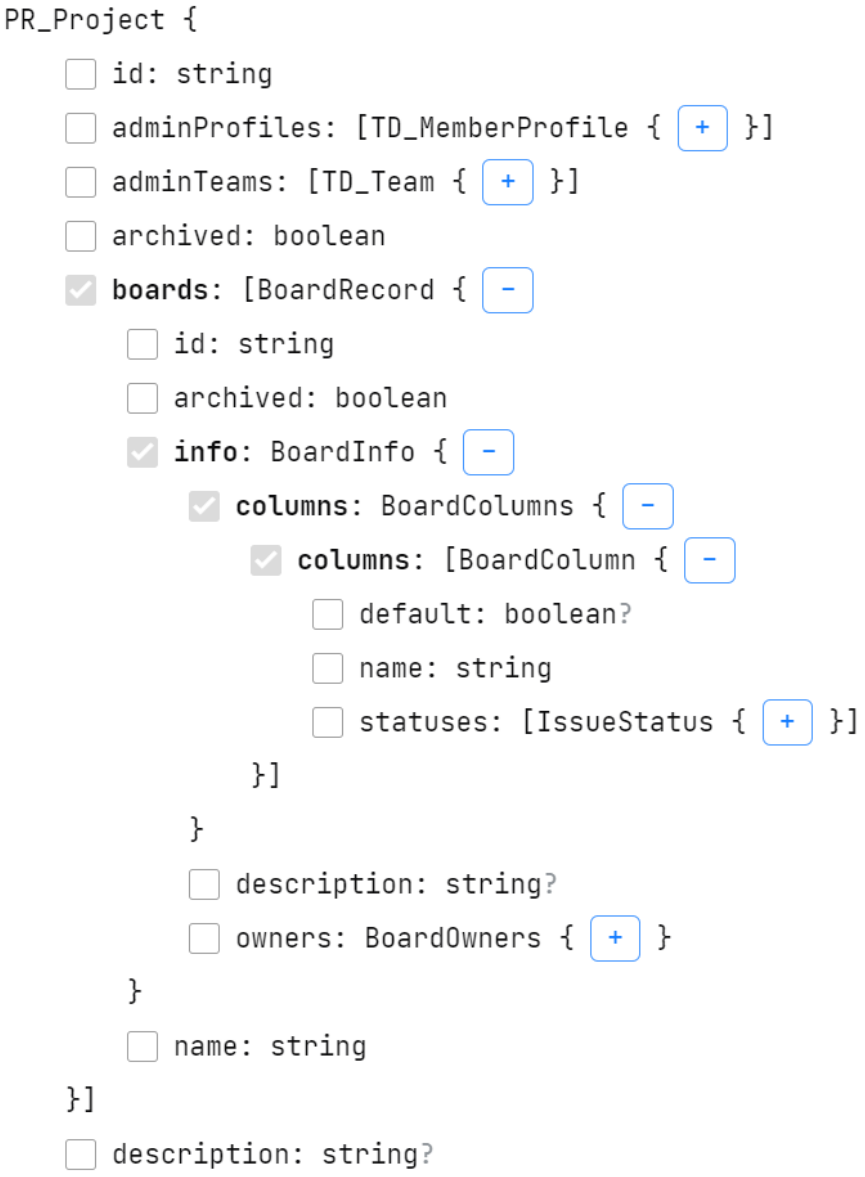
```
Top level - <...>Client

Property on service client

Method on service client
```

Remember $fields ?

Top-level fields returned by default

Unless $fields query parameter used

Use $fields to be specific, or get nested fields



$fields

Top-level fields returned by default

Use partial to be specific, or get nested fields

```
var memberProfile = await teamDirectoryClient.Profiles
    .GetProfileAsync(ProfileIdentifier.Username("Heather.Stewart"));

var memberProfile = await teamDirectoryClient.Profiles
    .GetProfileAsync(ProfileIdentifier.Username("Heather.Stewart"), _ => _
        .WithAllFieldsWildcard()          // with all top level fields
        .WithManagers(managers => managers  // include managers
            .WithId()                   //   with their Id
            .WithUsername()               //   and their Username
            .WithName(name => name        //   and their Name
                .WithFirstName()          //    with FirstName
                .WithLastName())));       //    and LastName
```

Developer experience

demo

Batches (e.g. Get all ToDo items)

```
public class Batch<T>
{
    List<T>? Data { get; }
    string? Next { get; }
    int? TotalCount { get; }

    bool HasNext();
}
```

```
var batch = await _todoClient.GetAllToDoItemsAsync(
    from: weekStart.AsSpaceDate(),
    partial: _ => _
        .WithData(data => data
            // ...
        .WithTotalCount()
        .WithNext());

do
{
    foreach (var todo in batch.Data)
    {
        // ...
    }

    batch = await _todoClient.GetAllToDoItemsAsync(
        from: weekStart.AsSpaceDate(),
        skip: batch.Next,
        partial: _ => _ /* ... */);
}
while (batch.HasNext());
```

IAsyncEnumerable to the rescue!

```
await foreach (var todo in _todoClient
    .GetAllToDoItemsAsyncEnumerable(from: weekStart.AsSpaceDate(), partial: _ => _
        .WithId()
        .WithContent(content => content
            .ForInherited<TodoItemContentMdText>(md => md
                .WithAllFieldsWildcard()))
        .WithStatus()))
{
    // ...
}
```

⚠️ Don’t use it for .Count()

```
var batch = await _todoClient.GetAllToDoItemsAsync(
    from: weekStart.AsSpaceDate(), partial: _ => _.WithTotalCount());
var numberOfResults = batch.TotalCount;
```

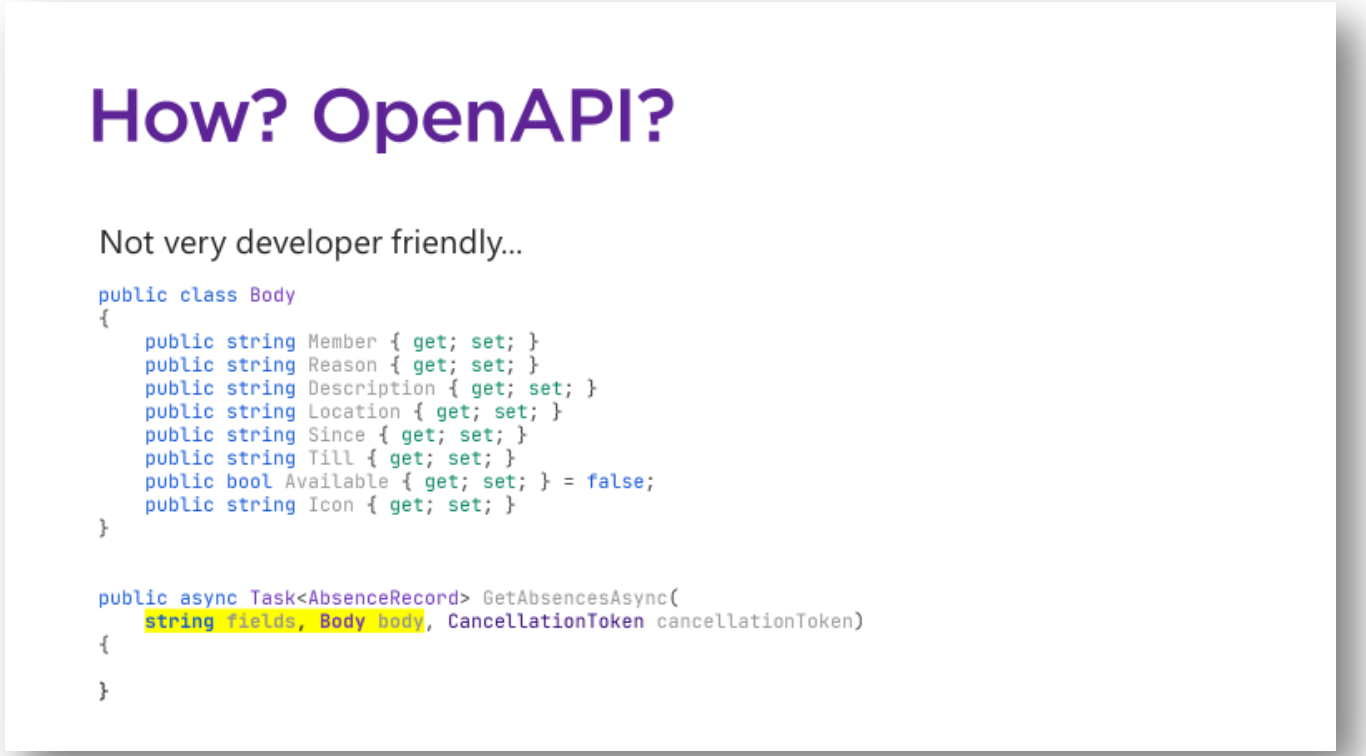
Batches and IAsyncEnumerable

demo

Request bodies are flattened

~~GetAbsences(AbsencesRequest request)~~

GetAbsences(string member, string reason, ...)



Factory methods for inheritors

Which option would you prefer?

```
await chatClient.Messages.SendMessageAsync(
    recipient: new MessageRecipientChannel()
    {
        Channel = new ChatChannelFromName()
        {
            Name = chatChannelName
        }
    },
```

```
await chatClient.Messages.SendMessageAsync(
    recipient: MessageRecipient.Channel(ChatChannel.FromName(chatChannelName)),
```

Default values

Unfortunatey not possible in C#...

```
public async IAsyncEnumerable<AbsenceRecord> GetAllAbsencesAsyncEnumerable(
   AbsenceListMode viewMode = AbsenceListMode.All, string? member = null)
```

Workaround:

```
public IAsyncEnumerable<AbsenceRecord> GetAllAbsencesAsyncEnumerable(
   AbsenceListMode? viewMode = null, string? member = null)
   => BatchEnumerator.AllItems(
      () => GetAllAbsencesAsync(viewMode: viewMode ?? AbsenceListMode.All, member: member);
```

Unfortunately not obvious what the default is when not specified.

Should we add XMLdoc instead?

Code generation

demo

Developer experience (extras)

Use SpaceDotNet in web apps

```
public void ConfigureServices(IServiceCollection services)
{
    // ...

    // Space authentication
    services.AddAuthentication(options =>
        {
            options.DefaultAuthenticateScheme = CookieAuthenticationDefaults.AuthenticationScheme;
            options.DefaultSignInScheme = CookieAuthenticationDefaults.AuthenticationScheme;
            options.DefaultChallengeScheme = SpaceDefaults.AuthenticationScheme;
        })
        .AddCookie()
        .AddSpace(options => Configuration.Bind("Space", options))
        .AddSpaceTokenManagement(); // auto-refreshes tokens in the background and provides a Space connection

    // Space client API
    services.AddSpaceClientApi();

    // Space webhook receiver
    services.AddSpaceWebHookHandler<CateringWebHookHandler>(options => Configuration.Bind("Space", options));
```

Use SpaceDotNet in web apps

.AddSpace()
- Use Space for authN

.AddSpaceClientApi()
- Register …Client with service collection

.AddSpaceTokenManagement() (experimental)
- Auto-refreshes tokens in the background
- Space client always auth'ed as currently logged in user

.AddSpaceWebHookHandler<T>() (experimental)
- Webhook support

Use SpaceDotNet in web apps

demo


Conclusion

Conclusion

JetBrains Space is an Integrated Team Environment

JetBrains Space HTTP API exposes *everything*

Building a .NET SDK for the Space HTTP API

- Goal: make our users succesful at using Space
- Provide a ready-to-use SDK
- Minimal configuration needed
- Discoverability

Code generation

Focus on developer experience

Thank you!

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