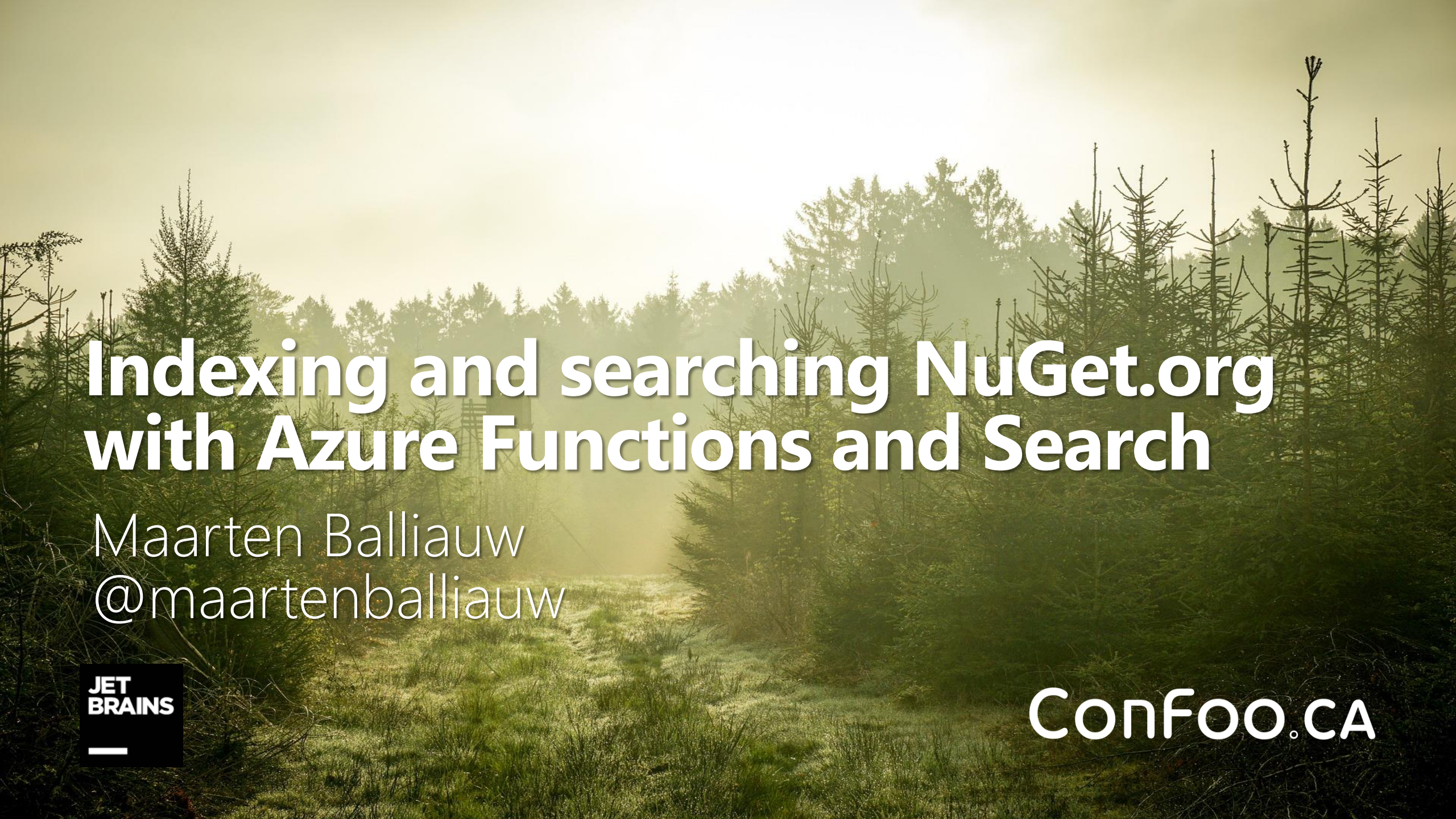
Indexing and searching NuGet.org with Azure Functions and Search
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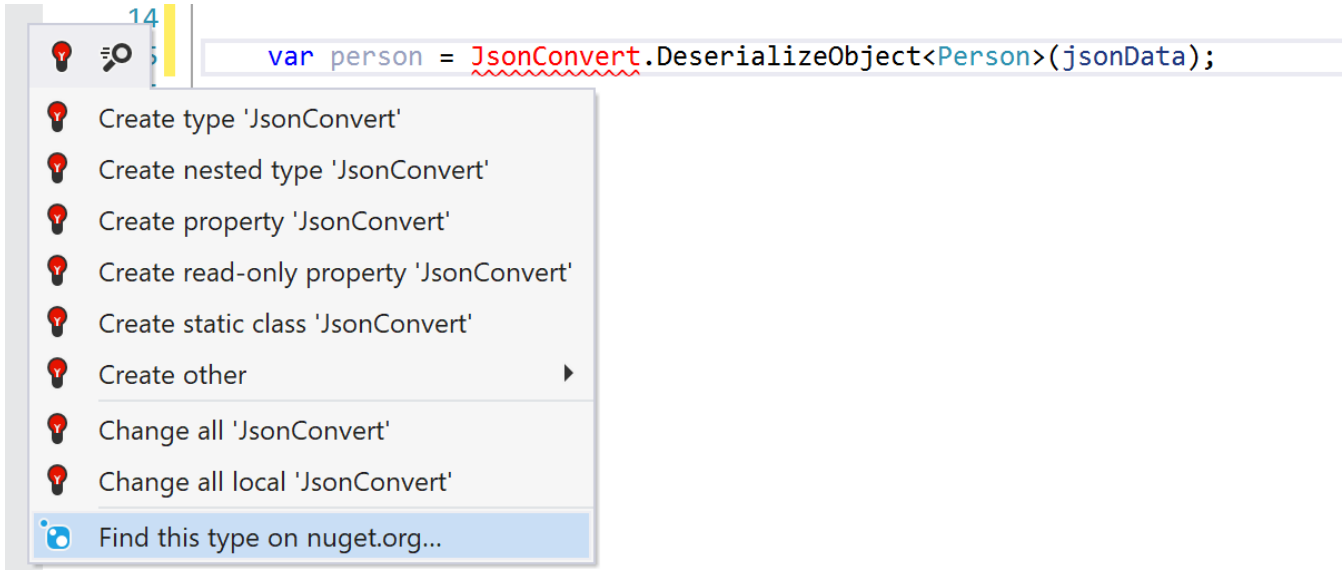
JET BRAINS
ConFoo.ca


“Find this type on NuGet.org”

“Find this type on NuGet.org”

In ReSharper and Rider

Search for namespaces
& types that are not yet referenced



“Find this type on NuGet.org”

Idea in 2013, introduced in ReSharper 9

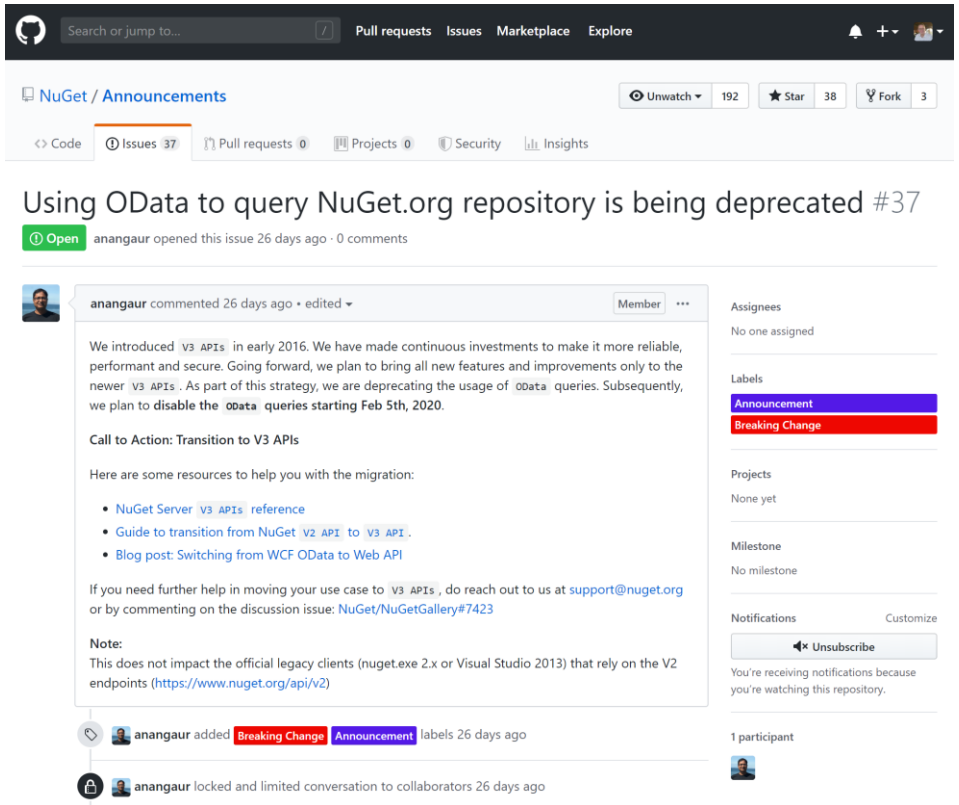
(2015 - https://www.jetbrains.com/resharper/whatsnew/whatsnew_9.html)

Consists of

- ReSharper functionality
- A service that indexes packages and powers search
  - *Azure Cloud Service (Web and Worker role)*
  - *Indexer uses NuGet OData feed*
    - https://www.nuget.org/api/v2/Packages?$select=Id,Version,NormalizedVersion,LastEdited,Published&$orderby=LastEdited%20desc&$filter=LastEdited%20gt%20datetime%272012-01-01%27

NuGet over time...

https://twitter.com/controlflow/status/1067724815958777856



https://github.com/NuGet/Announcements/issues/37


NuGet server-side API

V3 Protocol

JSON based

A "resource provider" of various endpoints per purpose

- **Catalog** (NuGet.org only) – append-only event log
- **Registrations** – materialization of newest state of a package
- **Flat container** – .NET Core package restore (and VS autocompletion)
- Report abuse URL template
- Statistics
- …

https://api.nuget.org/v3/index.json (code in https://github.com/NuGet/NuGet.Services.Metadata)

Catalog seems interesting!

- Append-only stream of mutations on NuGet.org
  - Updates (add/update) and Deletes
- Chronological
  - Can continue where left off (uses a timestamp cursor)
  - Can restore NuGet.org to a given point in time
- Structure
  - Root https://api.nuget.org/v3/catalog0/index.json
  - + Page https://api.nuget.org/v3/catalog0/page0.json
    - + Leaf https://api.nuget.org/v3/catalog0/data/2015.02.01.06.22.45/adam.jsgenerator.1.1.0.json

NuGet.org catalog

demo

“Find this type on NuGet.org”

Refactor from using OData to using V3?

- Mostly done, one thing missing: download counts (using search now)
- https://github.com/NuGet/NuGetGallery/issues/3532

Build a new version?

- Welcome to this talk ☺


Building a new version

What do we need?

Watch the NuGet.org catalog for package changes

For every package change

- Scan all assemblies
- Store relation between package id+version and namespace+type

API compatible with all ReSharper and Rider versions

What do we need?

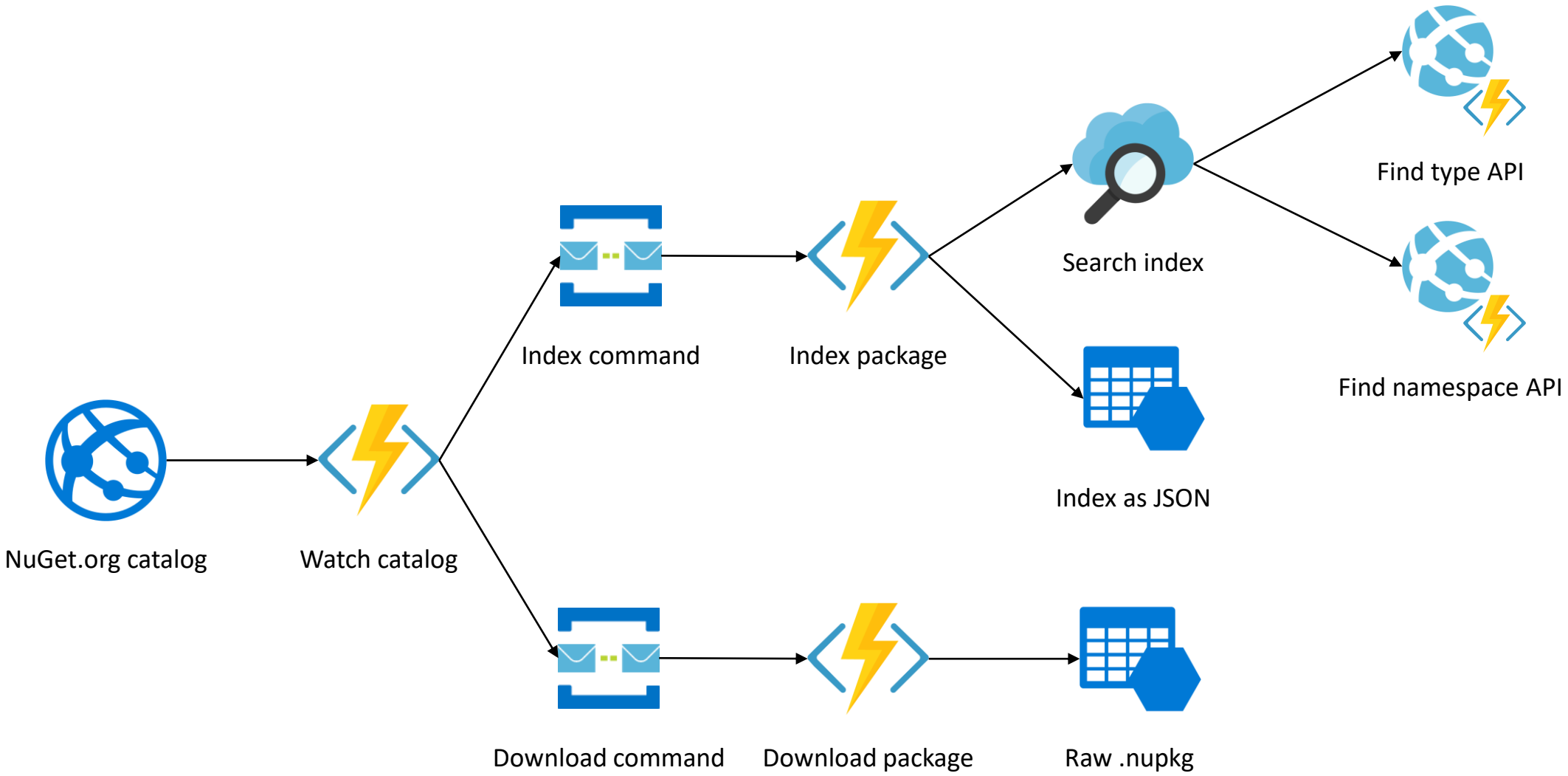
Watch the NuGet.org catalog for package changes periodic check

For every package change based on a queue

- Scan all assemblies
- Store relation between package id+version and namespace+type

API compatible with all ReSharper and Rider versions always up, flexible scale

Sounds like functions!



Collecting from catalog

demo

Functions best practices

@PaulDJohnston https://medium.com/@PaulDJohnston/serverless-best-practices-b3c97d551535

Each function should do only one thing

- Easier error handling & scaling

Learn to use messages and queues

- Asynchronous means of communicating, helps scale and avoid direct coupling

…

Bindings

	Trigger	Input	Output
Timer	✔		
HTTP	✔		✔
Blob	✔	✔	✔
Queue	✔		✔
Table		✔	✔
Service Bus	✔		✔
EventHub	✔		✔
EventGrid	✔		
CosmosDB	✔	✔	✔
IoT Hub	✔		
SendGrid, Twilio			✔
…			✔

Help a function do only one thing

- Trigger, provide input/output
- Function code bridges those

Build your own!*

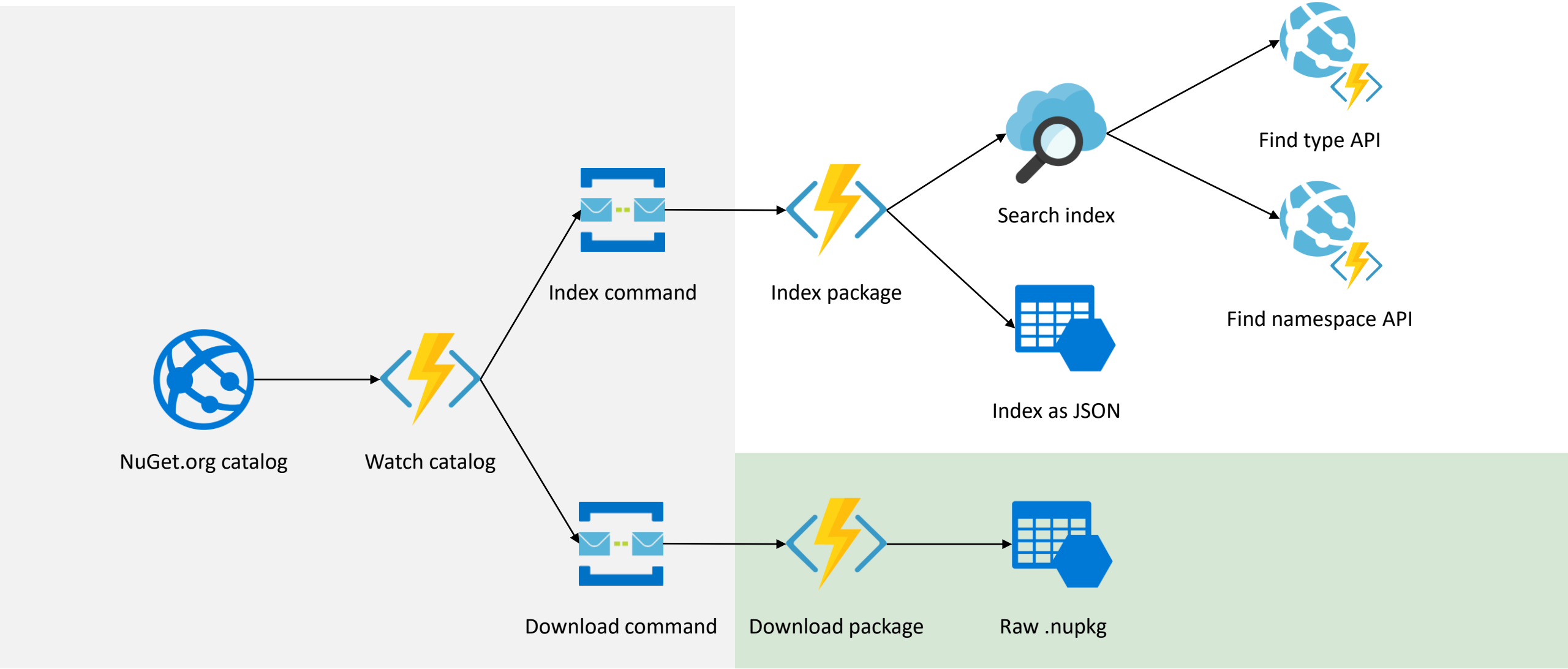
- SQL Server binding
- Dropbox binding
- …
- NuGet Catalog

*Custom *triggers* not officially supported (yet?)

Creating a trigger binding

demo

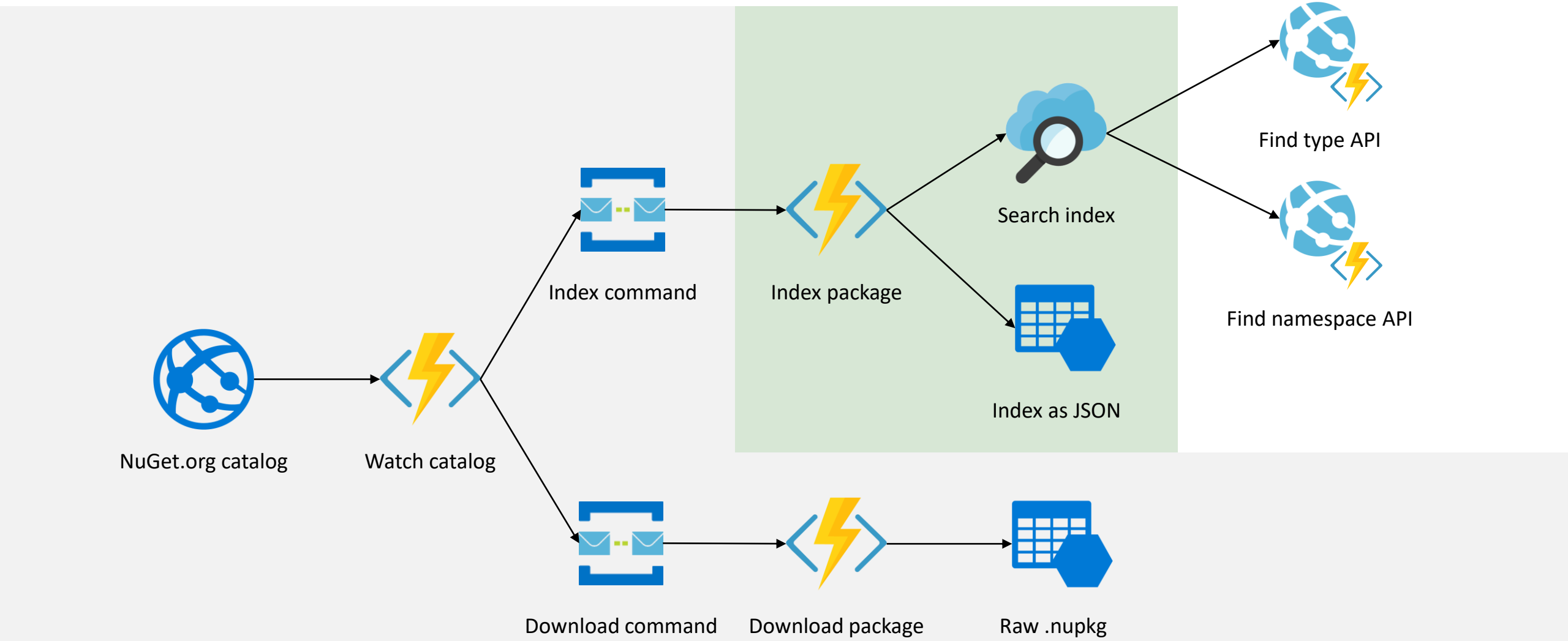
We're making progress!



Downloading packages

demo

Next up: indexing



Indexing

- Opening up the .nupkg and reflecting on assemblies
  - `System.Reflection.Metadata`
  - Does not load the assembly being reflected into application process
  - Provides access to Portable Executable (PE) metadata in assembly
- Store relation between package id+version and namespace+type
  - Azure Search? A database? Redis? Other?

Indexing packages

demo

“Do one thing well”

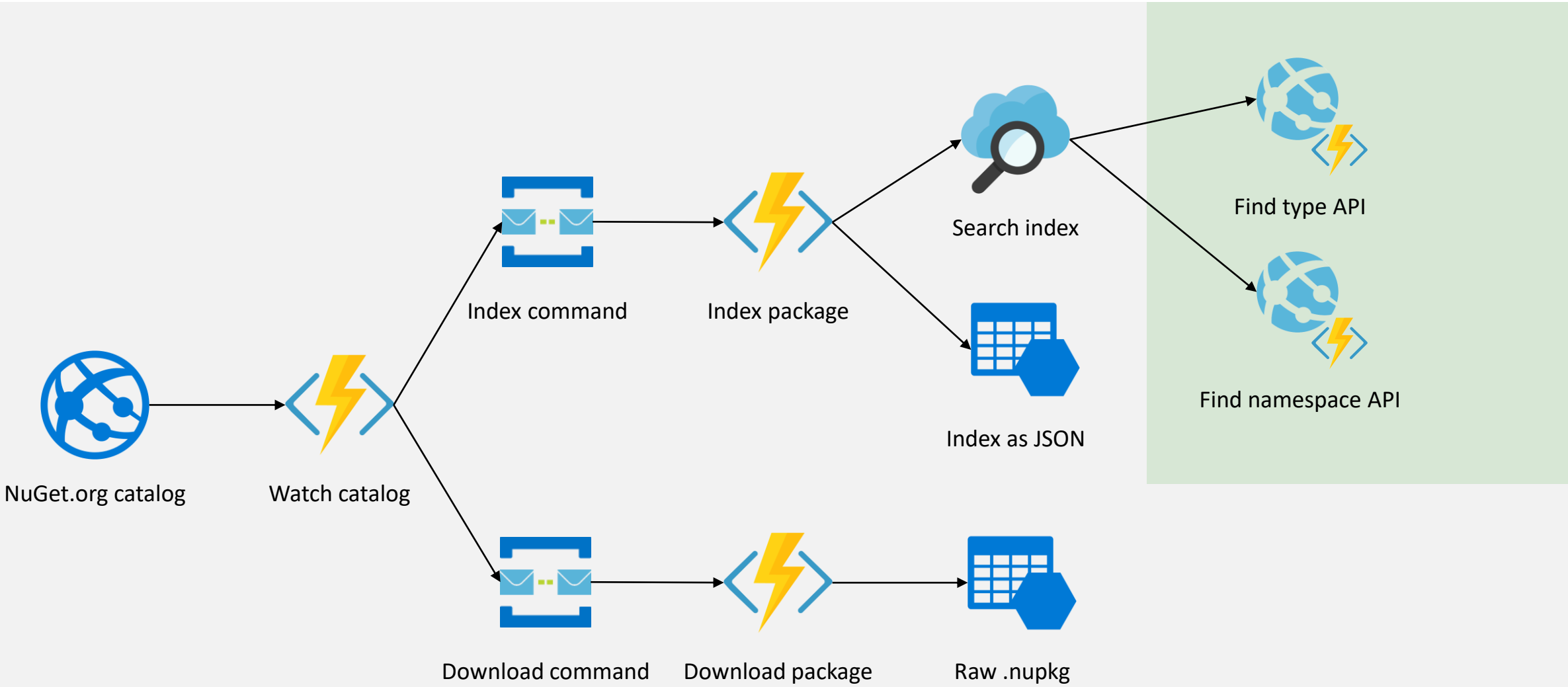
Our function shouldn’t care about creating a search index.

Better: return index operations, have something else handle those

Custom output binding?

Blog post with full story and implementation
https://bit.ly/2lzba32

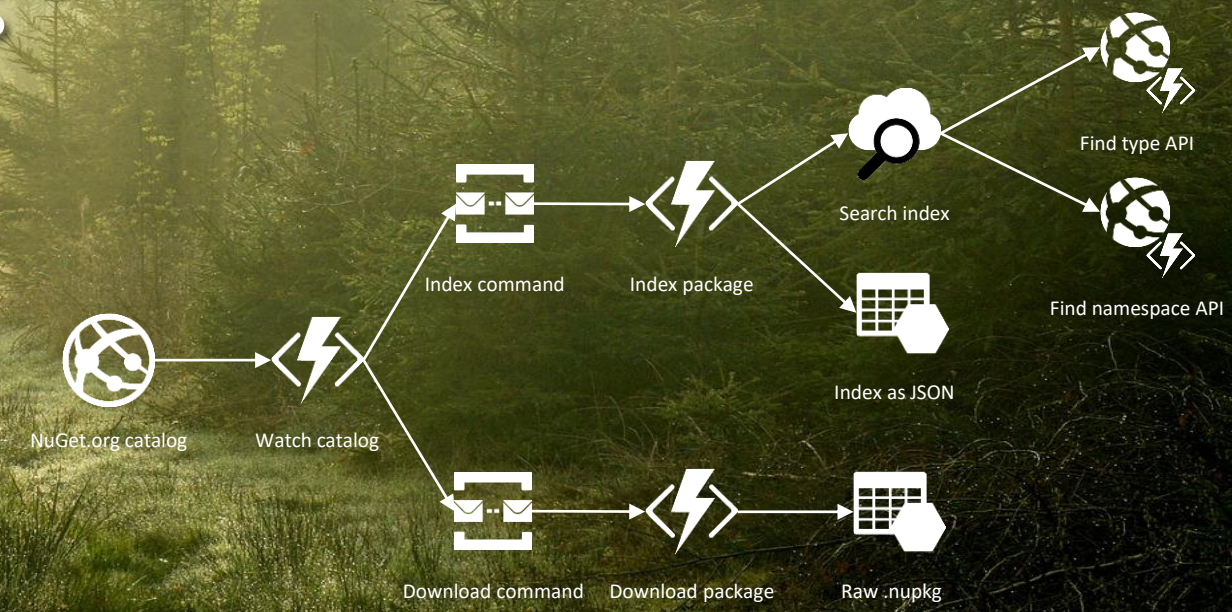
Almost there…



Making search work with ReSharper and Rider

demo

We're done!


NuGet.org catalog
Watch catalog
Index command
Index package
Search index
Find type API
Find namespace API
Index as JSON
Download command
Download package
Raw .nupkg

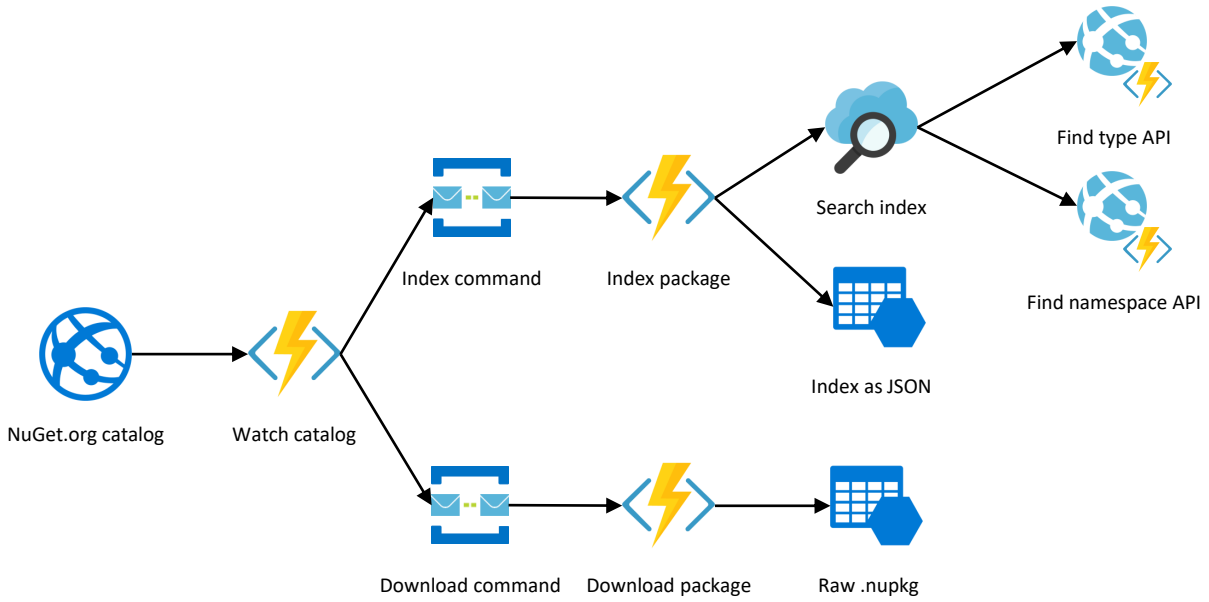
We're done!

Functions

- Collect changes from NuGet catalog
- Download binaries
- Index binaries using PE Header
- Make search index available in API

Trigger, input and output bindings

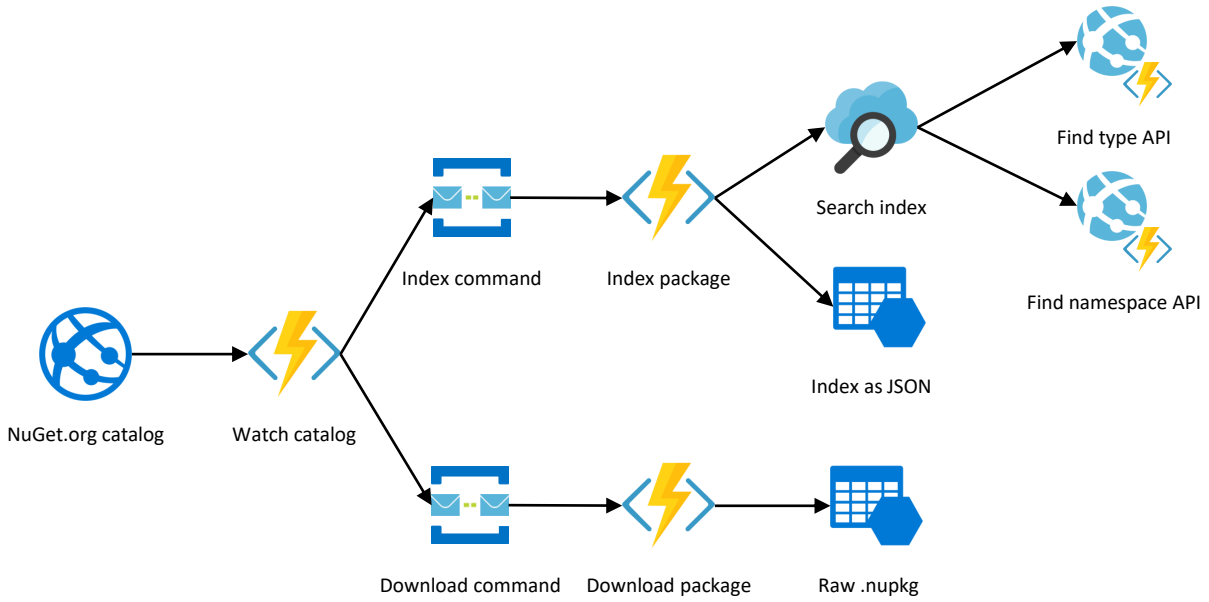
- Each function should do only one thing



We're done!

All our functions can scale (and fail) independently

- Full index in May 2019 took ~12h on 2 B1 instances
  - ~ 1.7mio packages (NuGet.org homepage says)
  - ~ 2.1mio packages (the catalog says ☺)
  - ~ 8 400 catalog pages
    - with ~ 4 200 000 catalog leaves (hint: repo signing)
- January 2020: ~ 2.6 mio packages / 3.5 TB



Closing thoughts…

Would deploy in separate function apps for cost
- Trigger binding collects all the time so needs dedicated capacity (and thus, cost)
- Others can scale within bounds/consumption (think of $$$)

Would deploy in separate function apps for failure boundaries
- Trigger, indexing, downloading should not affect health of API

Are bindings portable…?
- Avoid them if (framework) lock-in matters to you
- They are nice in terms of programming model…

Blog post with full story and implementation
https://bit.ly/2lzba32

Thank you!

https://blog.maartenballiauw.be
@maartenballiauw

JET BRAINS