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Designing a resource model for a Public API

O'Reilly Software Architecture Conference

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Tom Höfte, IT Architect, Xebia

Marco van der Linden, IT Architect, Xebia

Agenda – 3.5 hours

Introduction & API Domain discovery

~ 20 minutes

API Domain discovery

~ 45 minutes

REST Resource modeling

~ 20 minutes

Coffee Break

~ 30 minutes (3pm)

REST Resource modeling

~ 60 minutes

Other Topics & Conclusion

~ 20 minutes (5pm)

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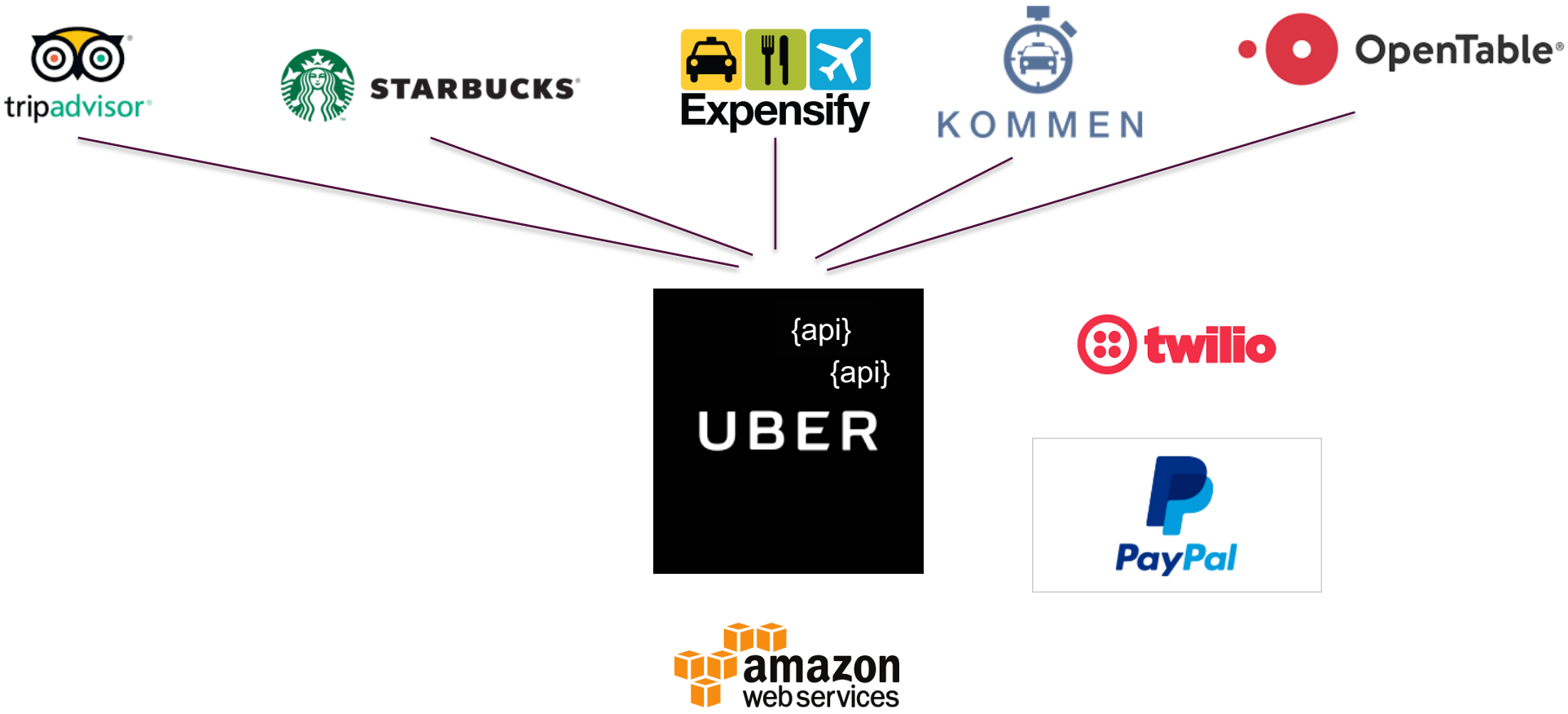
Part 0 – Introduction

The API Economy



APIs allow companies to grow and extend businesses at unprecedented rates by sharing services with third parties – *source: Harvard Business Review (https://hbr.org/2015/01/the-strategic-value-of-apis)*

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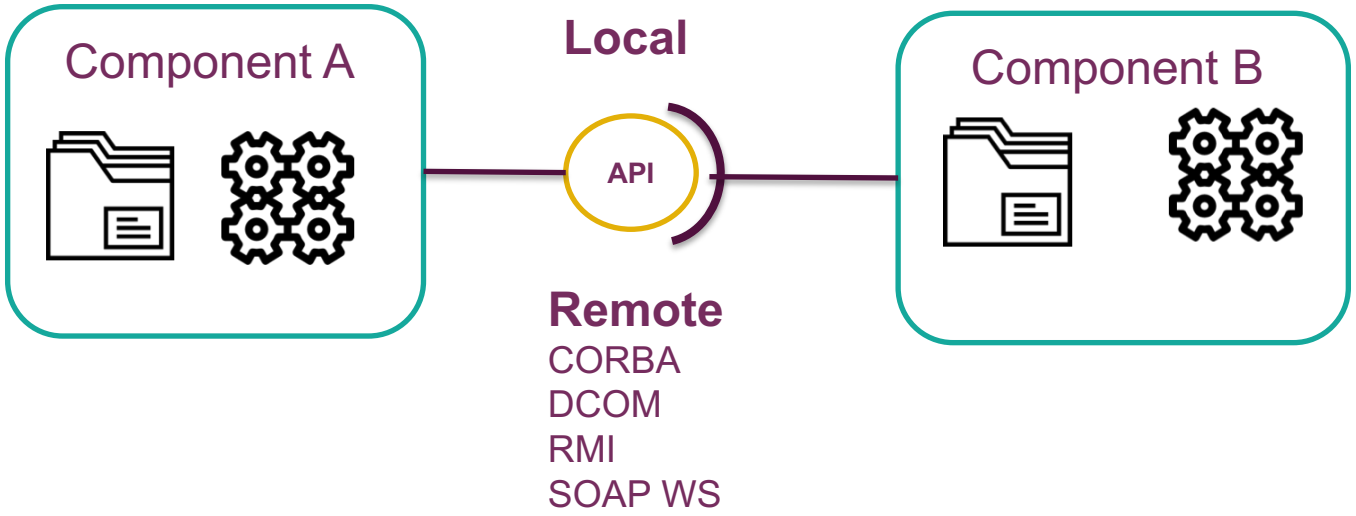
Note: Slide picture inspired by an idea of Willem van Schieveen, Bol.com

What we, ***techies***, used to think an API is



With the rise of web technologies, the **term API** is now in general use and a ***unique selling point*** on the **web**

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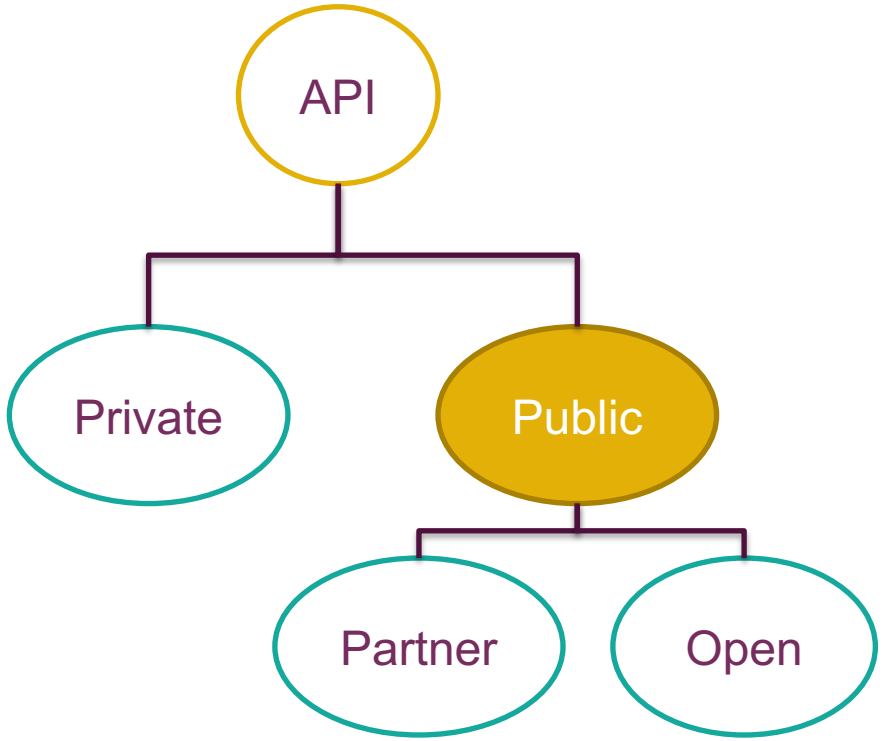
A public API is a business service with a web access point that is managed as a product



We think a **public API**

- is a open or partner **service**
- that exposes **business capabilities**
- through **consumer-friendly operations**
- that are used to built **new applications**
- accessible from a **web access point**
- and follows a **product life cycle**

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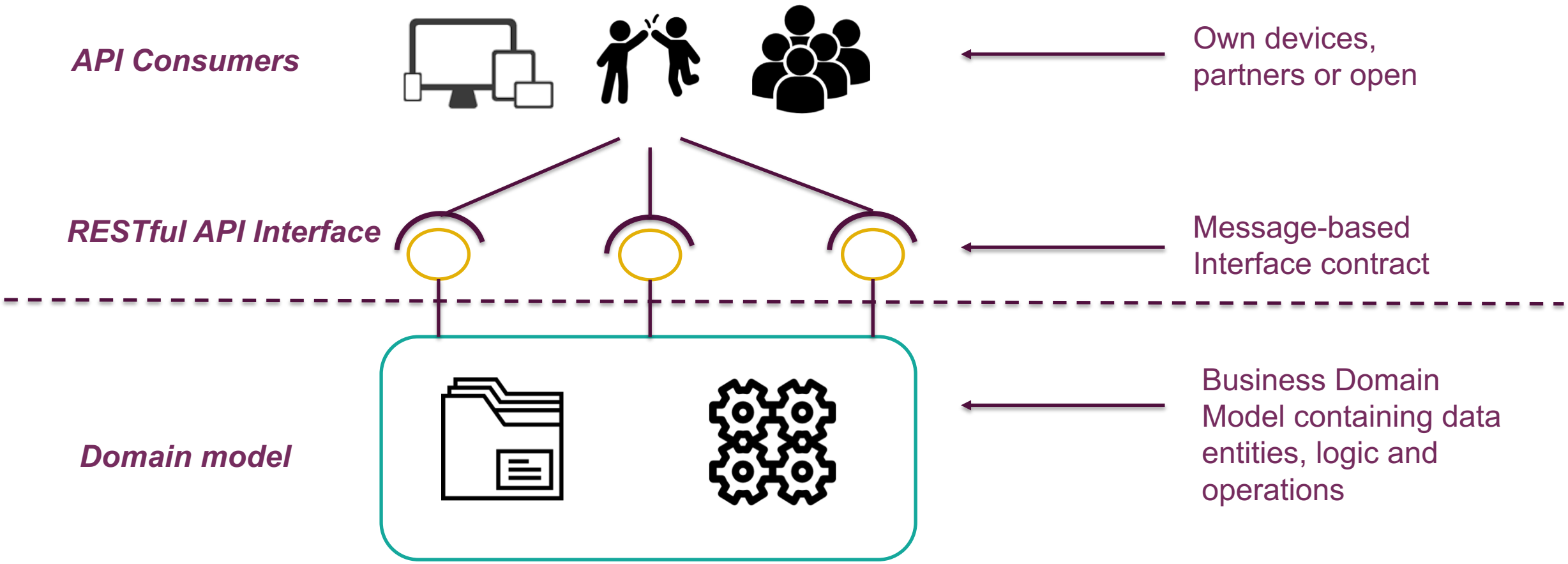
A typical API architecture: A RESTful API as the channel to your domain



But why REST?

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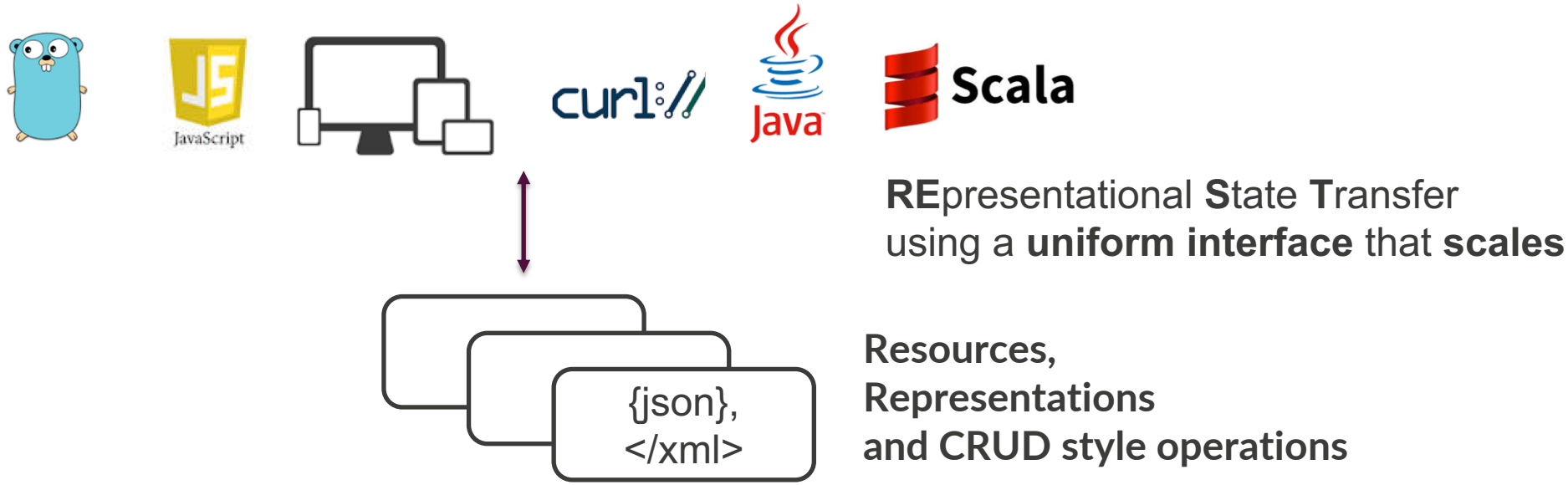
An API **needs** a **uniform interface, client-server decoupling** and **scalability. REST provides** that



REpresentational **S**tate **T**ransfer
using a **uniform interface** that **scales**

Resources,
Representations
and CRUD style operations

HTTP

- URI Format
- Request Message Format
- Scalability
- Caching
- HTTP Methods
- Response Message Format

But…

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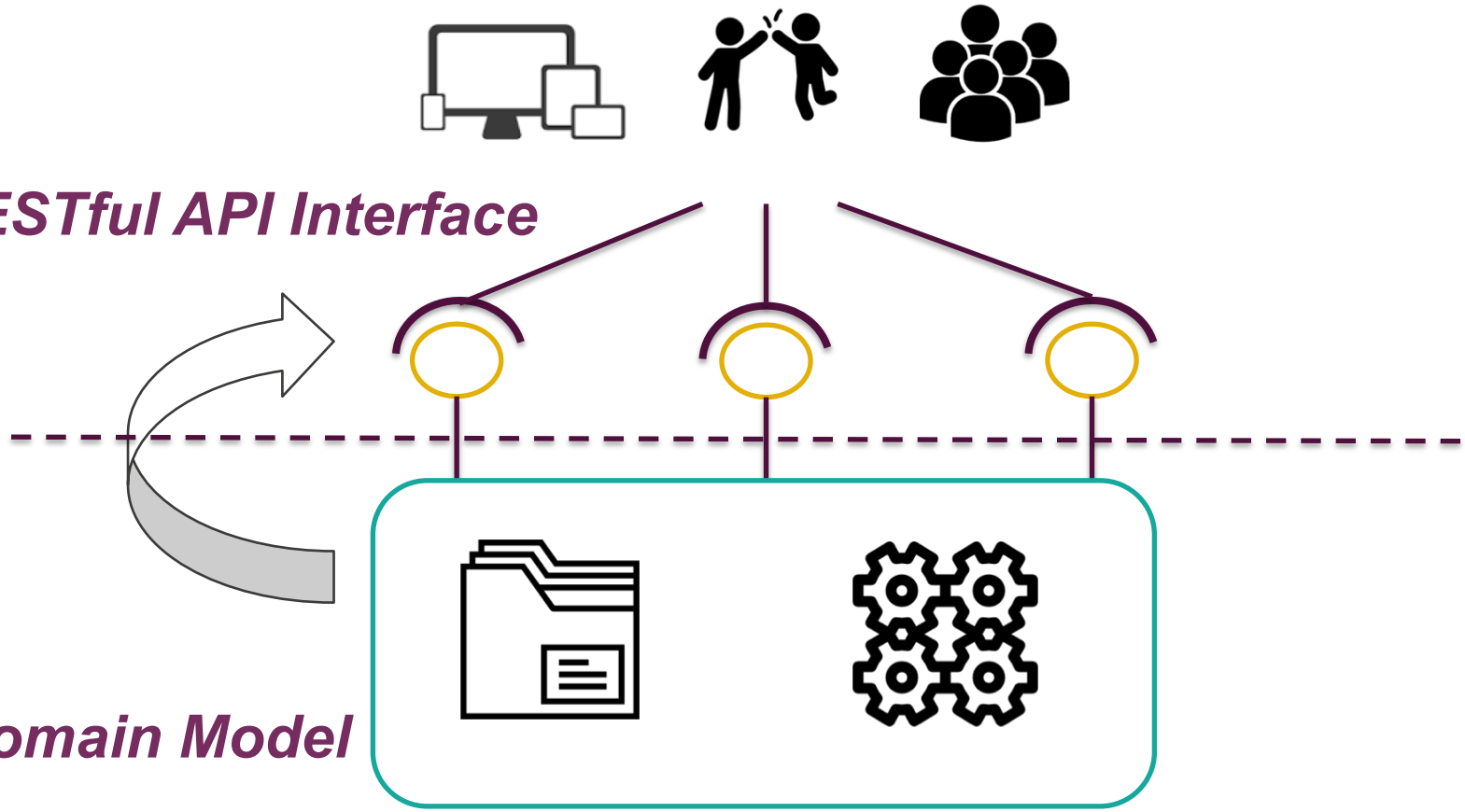
… how do you create a REST API contract for your domain?

*Describing **complex** **domain behavior** in a **simple REST manner** is **not straightforward***



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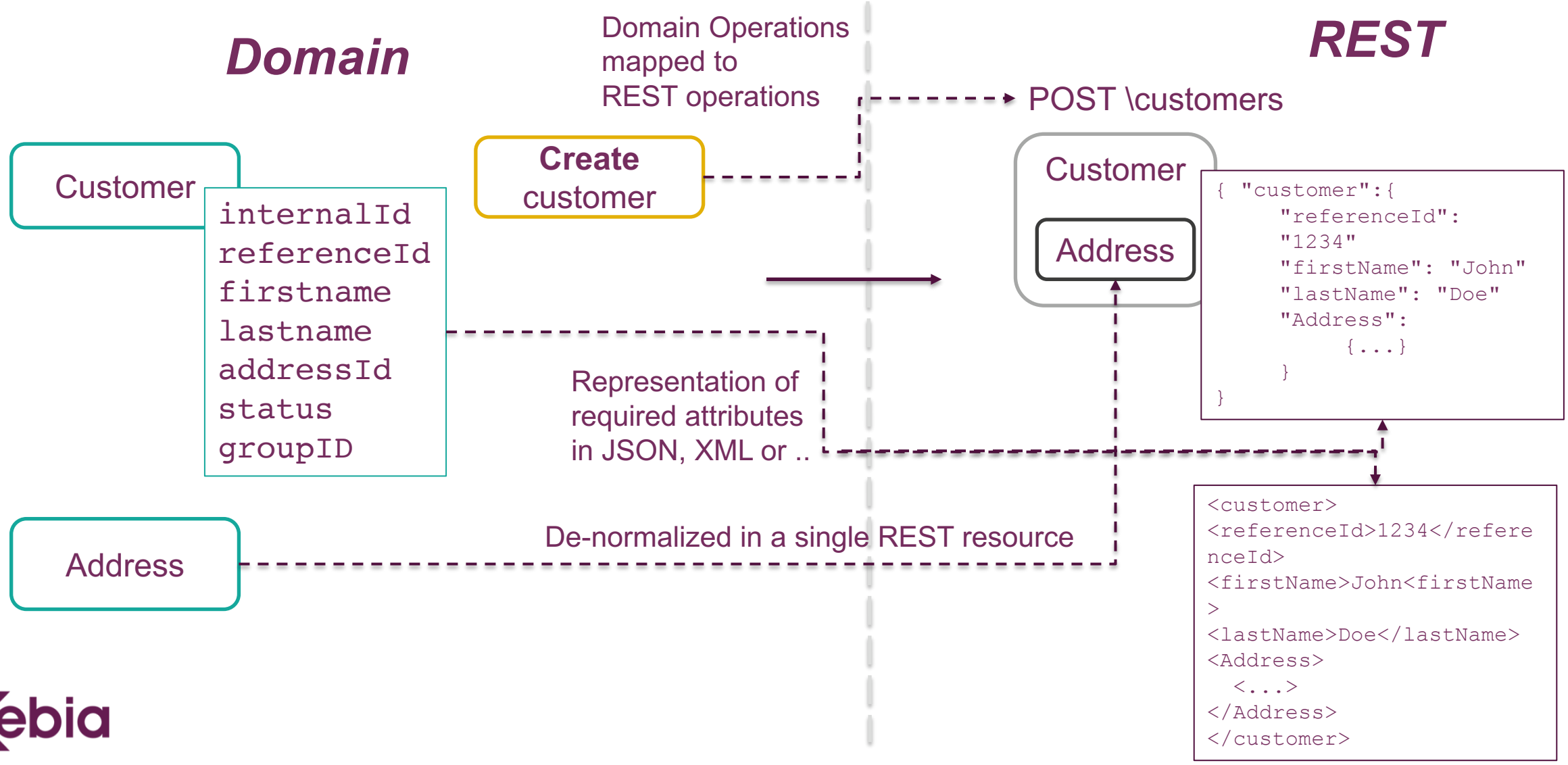
Example: Webshop



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So, resources are the *core* of a RESTful API…

Resource modeling is therefore a **key activity** to…

- Map your domain **operations** to REST operations
- Map your domain **data entities** to REST resource representations

…in order create an API that is user-friendly, extensible and maintainable

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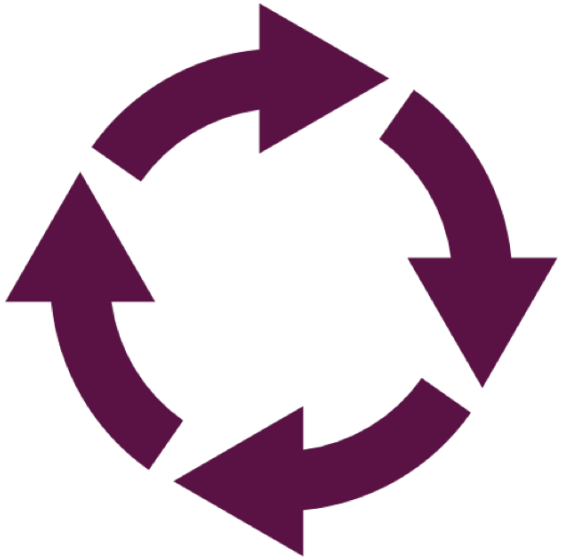
Resource Modeling Process

Discover the API domain

Discover the REST resources & operations

Define the API interface



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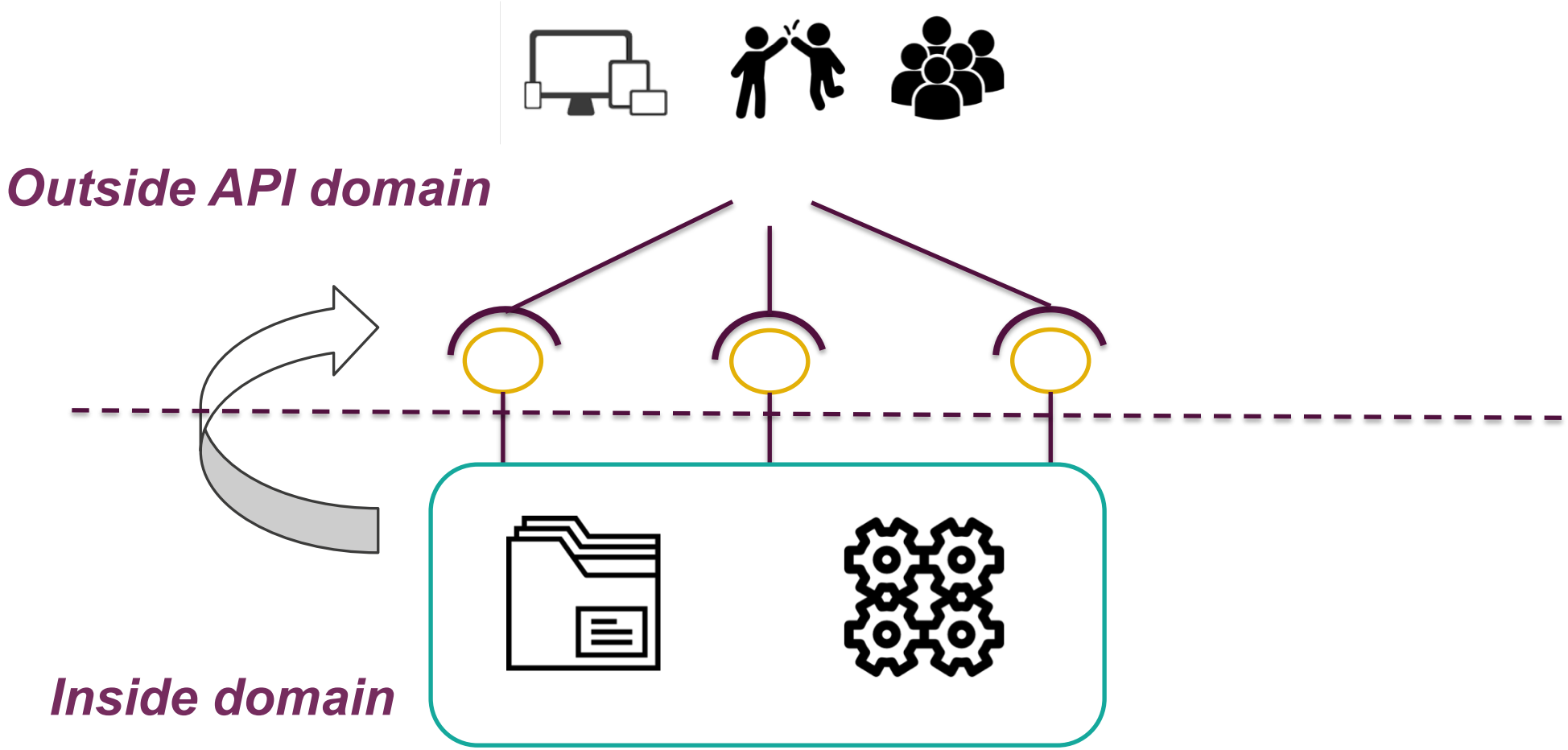
Part 1 – Discover the API domain

Goal

- Practice how to discover API domain entities, relations and operations that *you need in your API*

Discover the API functionality



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Outside API Model ⊂ Inside Business Model

Use a Ubiquitous Language

Protest against any form of:

- Ambiguity
- Inconsistencies

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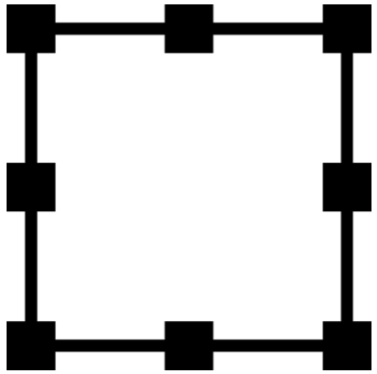
Create bounded context

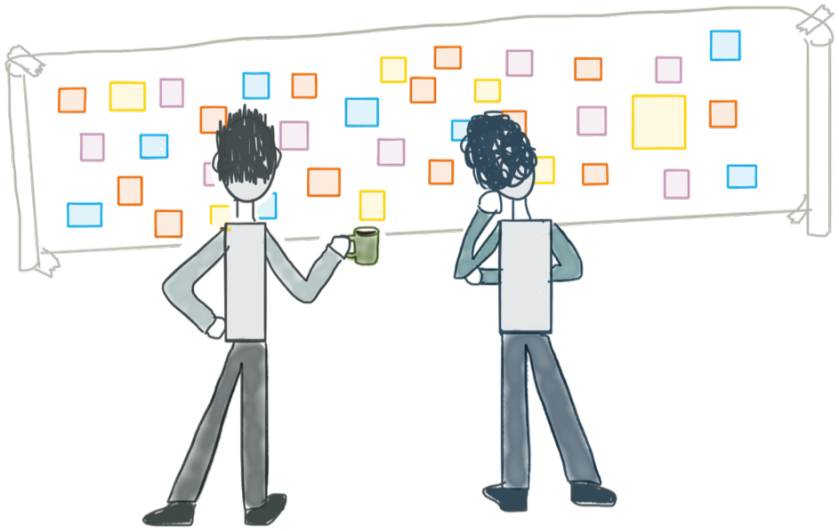
Bounded context helps:

- To logically group API behavior and form an API outline
- To structure the later implementation



Different methods

- Input:
  - Use case descriptions
  - Domain experts, external and internal
- Methods:
  - Event storming or other work shops
  - Text and domain analysis (verbs and nouns)
- Output
  - A logical domain model depicting
    - Set of nouns (entities) and verbs (operations) grouped in bounded contexts
    - Entity relations



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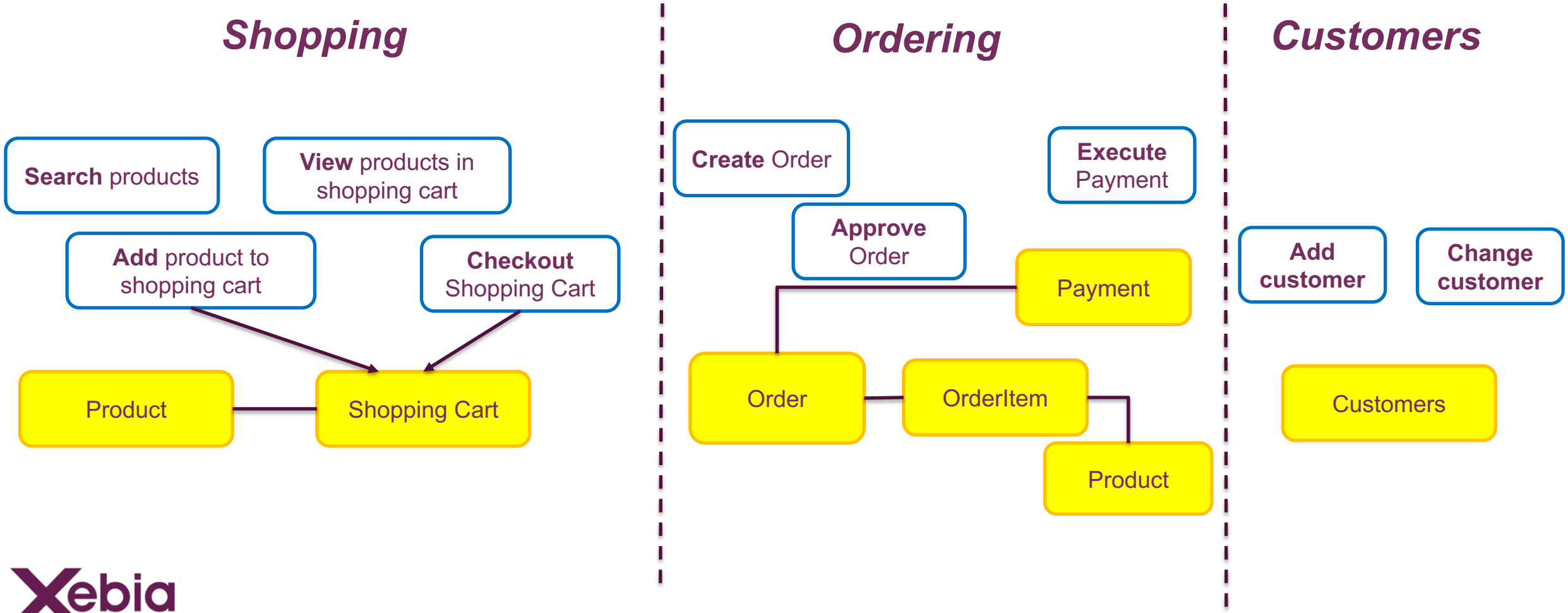
Discover your API model

Example: Partial Event–Storming output Webshop



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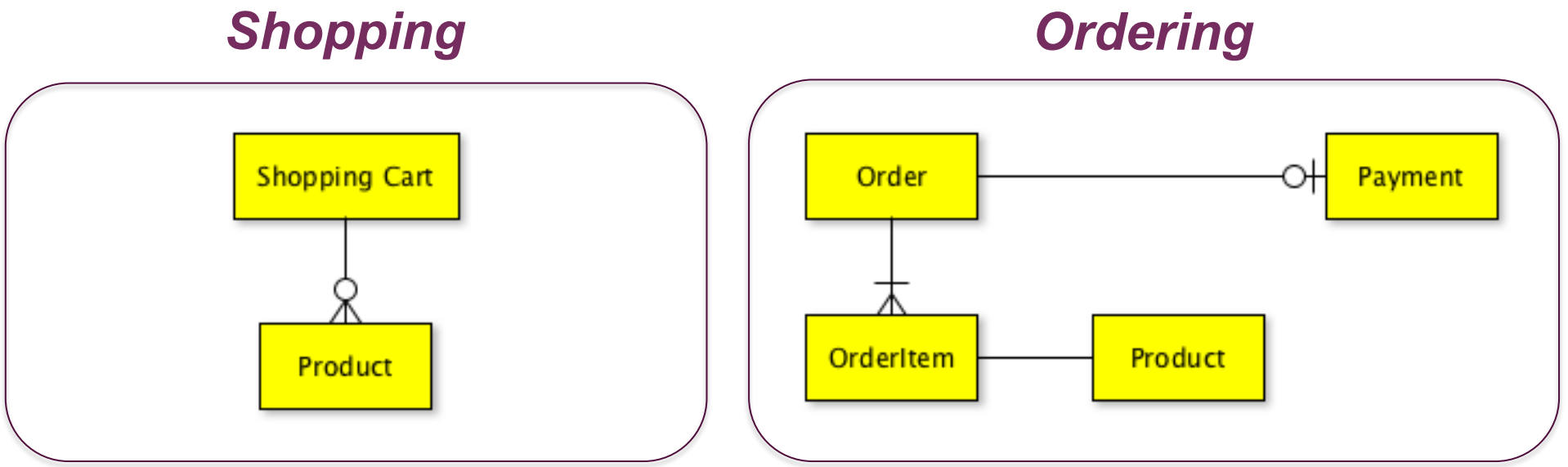
Discover your API model

Example: Partial Webshop domain model



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Exercise 1: Discover the API Domain

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Exercise Input - Case Description: FlyWithMe airline

FlyWithMe is an airline that wants to increase sales by extending its current business model towards third parties. They plan to do this by providing a Public API.

You are an architect at FlyWithMe, responsible for designing the API.
You and your team decide to start with discovering the domain entities and operations

...more input is provided in the hand-outs

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Exercise outcome

- List of domain entities
- List of domain operations
- Grouped by bounded context
- Time left? Try to define the entity relations

Tips

- Don’t try to over-complicate the business domain; the goal is not to get a complete understanding of the domain.
- Make assumptions about the business domain where needed
- Focus on API consumer functionality
- Do not focus on the attributes of an entity, solely focus on the *nouns* and *verbs*

And now to work!

- Organize yourselves in groups of 3-4
- Work on exercise till 14:45
- *Make use of whiteboard, paper, flip overs (easel pad) etc. to visualize your answer.*

Case material: http://bit.ly/restfulapidesign

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Retro time

- What went well?
- What was difficult?

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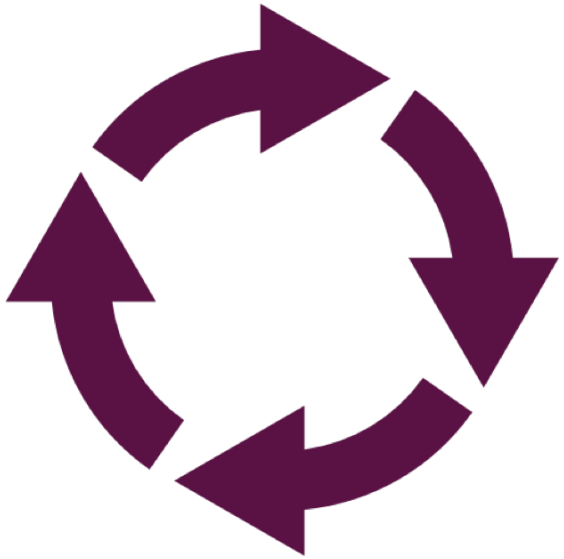
Part 2 – REST resource modeling

Goal

- Learn how to map domain entities and operations to REST resources and operations
- Learn about API documentation options
- Practice by modelling basic use cases from the case study

REST API Resource Modeling Process



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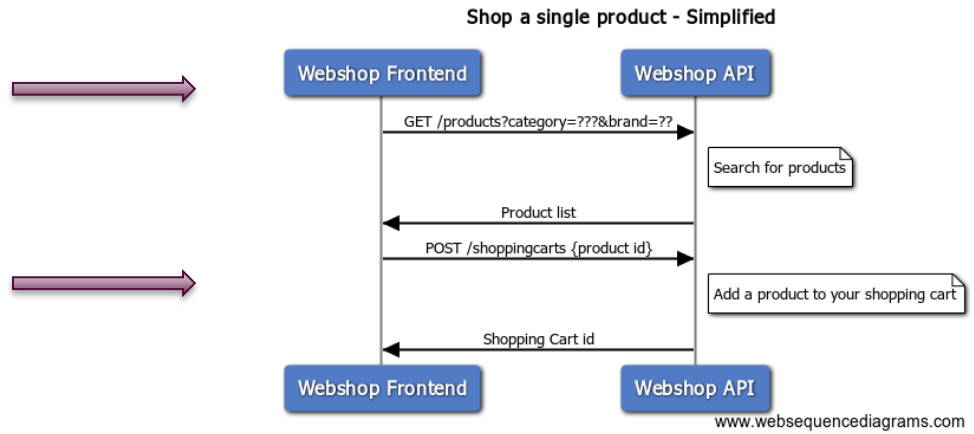
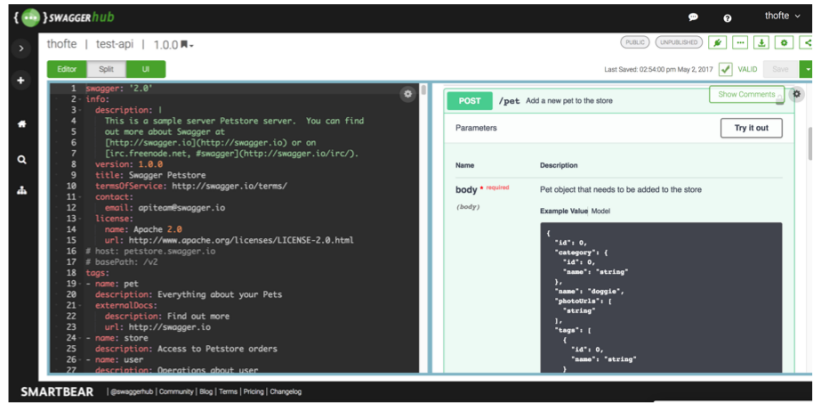
From a domain model to a REST contract
A typical flow

Domain operations

Domain Entities





Step 1 – Define sequence diagrams

- Group related domain operations in user stories
- Map domain operations and entities to REST resources and operations

Step 2 – Define the API in a specification language

- *Determine the resource representations*
- *Operation granularity*

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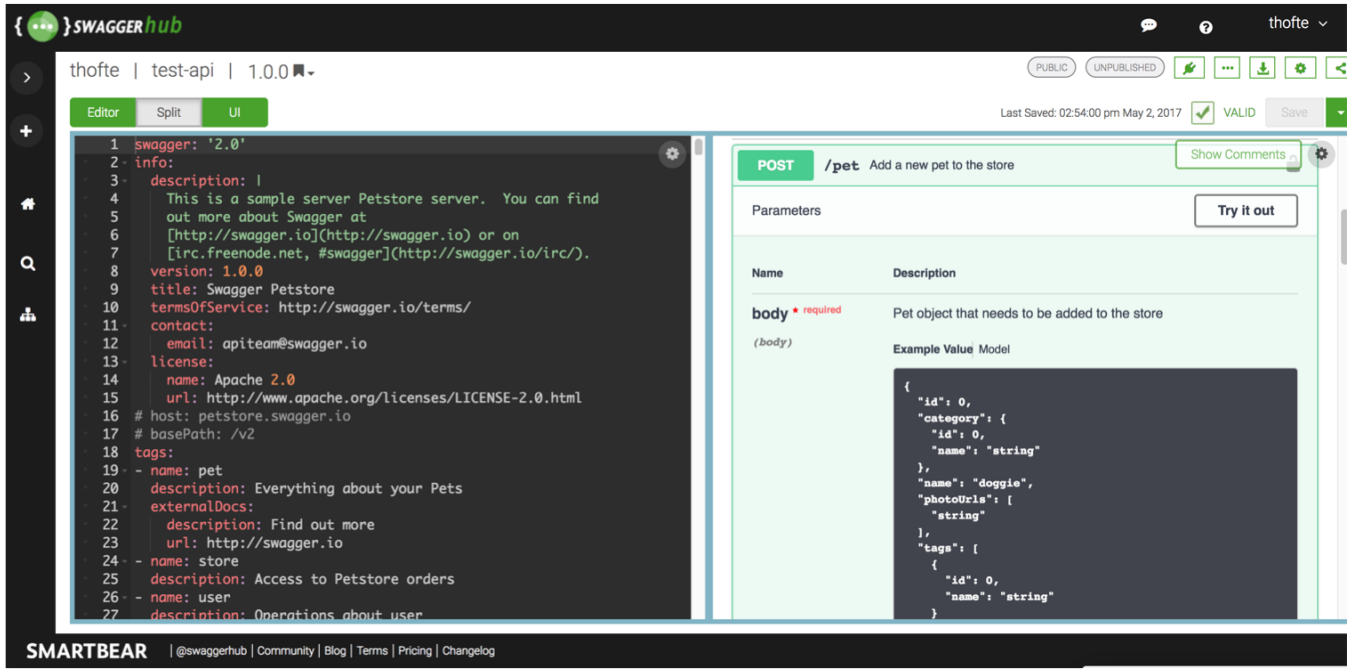
REST API specification language

- Start defining the API using a API description languages:
  - **Open API (fka Swagger)**
  - RAML
  - API Blueprint
- Kickstart your development with an API design tool
  - SwaggerHub
  - Apiary for API blueprint
  - Confluence + swagger.io plugin



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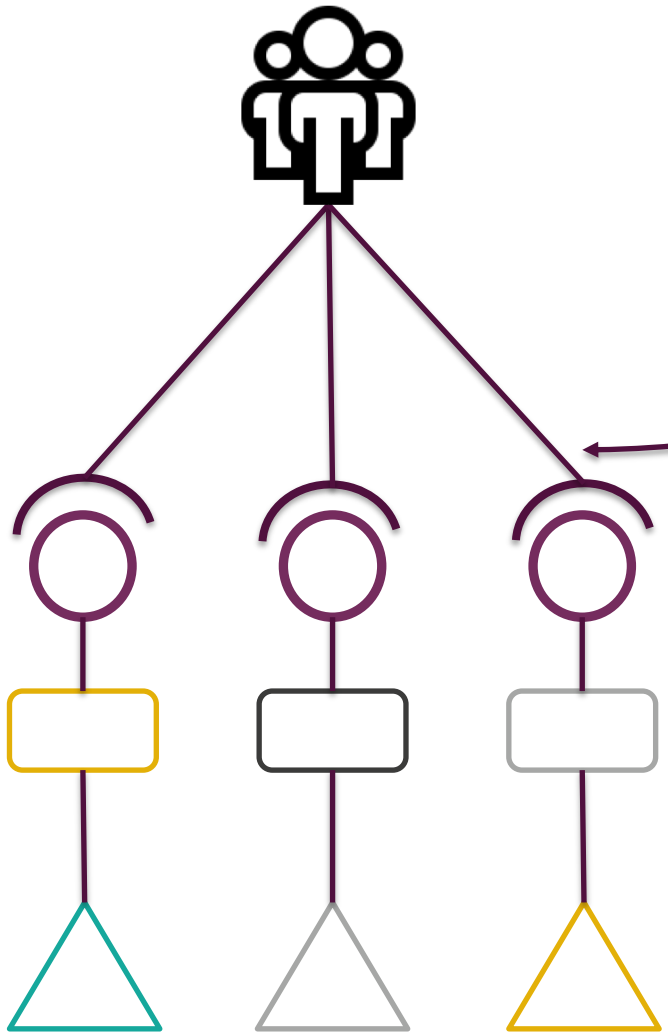
Anatomy of a RESTful API *REST= Representational State Transfer*



Resource location = URL

Resource Operations = VERBS = GET | POST | PUT | DELETE

Resources representations = NOUNS representations = Media Types (JSON, XML)

resources = NOUNS

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REST resource types

- **Document**: A single document with optional subresources
  - `https://api.flywithme.com/flightoffers/{id}`
- **Collection**: A server managed collection: a plural noun
  - `https://api.flywithme.com/airports`

REST Operations - Standard HTTP operations

Retrieve resources

```
GET https://api.flywithme.com/airports/{airportid}
```

Create a new resource

```
POST https://api.flywithme.com/bookings body: trip
```

Update an existing resource

```
PUT https://api.flywithme.com/bookings/{bookingid} body: updated trip
```

Delete an existing resource

```
DELETE https://api.flywithme.com/bookings/{bookingid}
```

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REST Operations – non-CRUD operations

- Sometimes it can be *difficult* to model a business capability spanning multiple resources with fine-grained HTTP CRUD operations.

  - **A business capability is a *long-running* process**
  - **A business capability is a synchronous function**

- Add non-CRUD verbs or noun-ified verbs to your API

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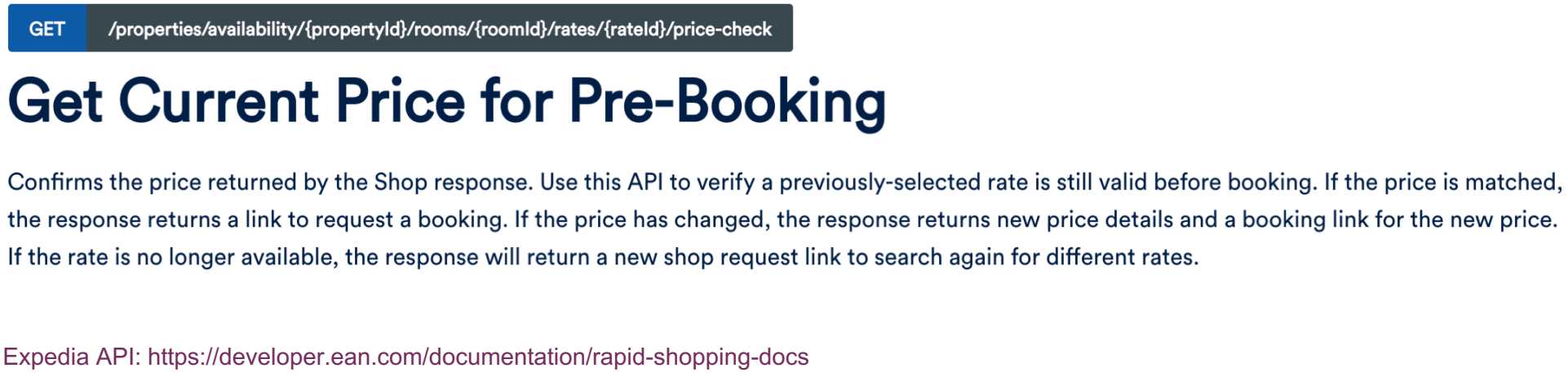
REST Operations – non-CRUD Verbs

- A verb in your URL representing a synchronous action or function
  - Typically modelled with GET



Expedia API: https://developer.ean.com/documentation/rapid-shopping-docs

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REST Operations – Noun-ified verbs

- **A noun representing an asynchronous action**
  - Long running
  - Action can be monitored
  - Typically modelled with HTTP POST
    - REST without PUT / CQRS

Create a fork

Create a fork for the authenticated user.

```
POST /repos/:owner/:repo/forks
```

Parameters

Name	Type	Description
`organization`	`string`	Optional parameter to specify the organization name if forking into an organization.

Response

Forking a Repository happens asynchronously. Therefore, you may have to wait a short period before accessing the git objects. If this takes longer than 5 minutes, be sure to contact GitHub support.

Source: GitHub API

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REST Operations – *Fine-grained HTTP CRUD operations or course-grained non-CRUD operations?*

It depends:

- ***CRUD** should be your first option*
- *Use **Non-CRUD verbs** for **synchronous operations** for which non-CRUD becomes clumsy*
- *Use **noun-ified verbs** for **long running actions** or events that must be monitored*

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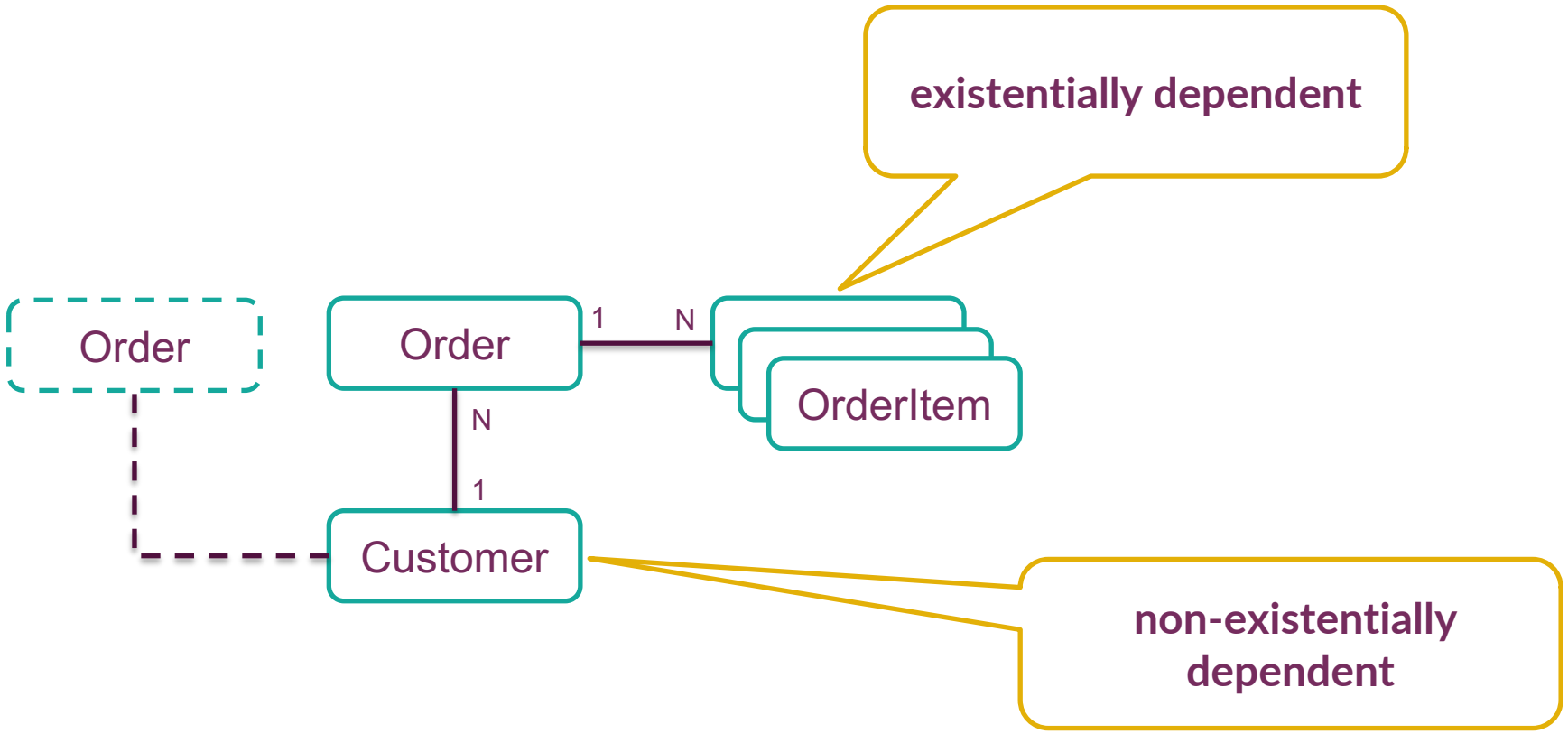
REST Resource Relations



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REST Resource Relations - Modeling

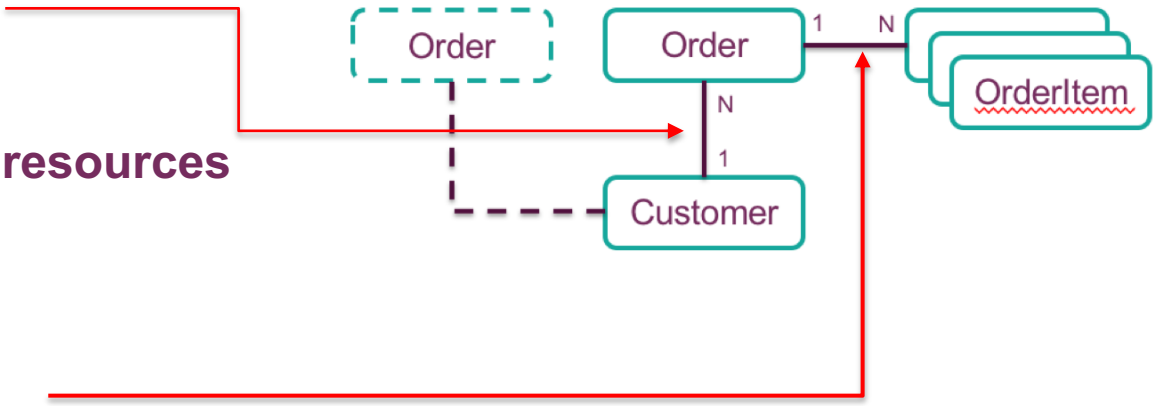
Resource modeling *options*:

- **Linked Resources**

```
{
   orderId: 1
    ...
   customerId: 1
    ...
}
```

- **Embedded resources**

```
{
   id: 1
   ...
   orderItems:
   [
     {
       id: 1
       product: "X"
       ..    }
    ]
}
```



Path modeling *rules*:

- **existentially dependent**

```
\orders\{orderid}\orderitems\{orderitemid}
```

- **non-existentially dependent**

```
\customers\{customerid}
```

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REST Resource Representations – *Media Types*

- Mime-types used most often in the Content-Type header:
  - application/json
  - application/xml
- But binary content is also possible:
  - Content-Type: application/pdf
- Or create your own custom type:
  - Content-Type: application/vnd.amazon.ebook

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REST operation response codes

Reuse HTTP response code semantics

- **Range 2xx** – Client message has been received, understood and processed succesfully
  - E.g. Use HTTP 201 when a resource is created
- **Range 3xx** – Location redirection
- **Range 4xx** – Request could not be processed due to *an error caused by the client*
- **Range 5xx** – Request could not be processed due *to an error caused by the server*

Exercise 2: Discover REST resources and operations

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Exercise input

- Take the output of exercise 1 and …
  - Take your team result
  - Or take our example result
- Look at the 2 user stories (*) and define a RESTful API by
  - Creating a sequence flow diagram
  - A Swagger file specification

(*) User stories will be provided in the exercise

Exercise outcome

For each of the 2 user stories:

- Sequence flow diagrams highlighting the REST operations and resources
- An initial swagger file specifying the REST operations and resources needed to implemented the user stories

And now to work!

- Work on the exercise till 16:30
- *Make use of*
  - *https://www.websequencediagrams.com*
  - *https://editor.swagger.io*
  - *https://swagger.io/specification/*

Case material: http://bit.ly/restfulapidesign

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Coffee Break

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Running out of material, but not out of time ?

You can add the following features:

- Notify partner websites with flight updates
- Update bookings

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Retro time

- What went well?
- What was difficult?

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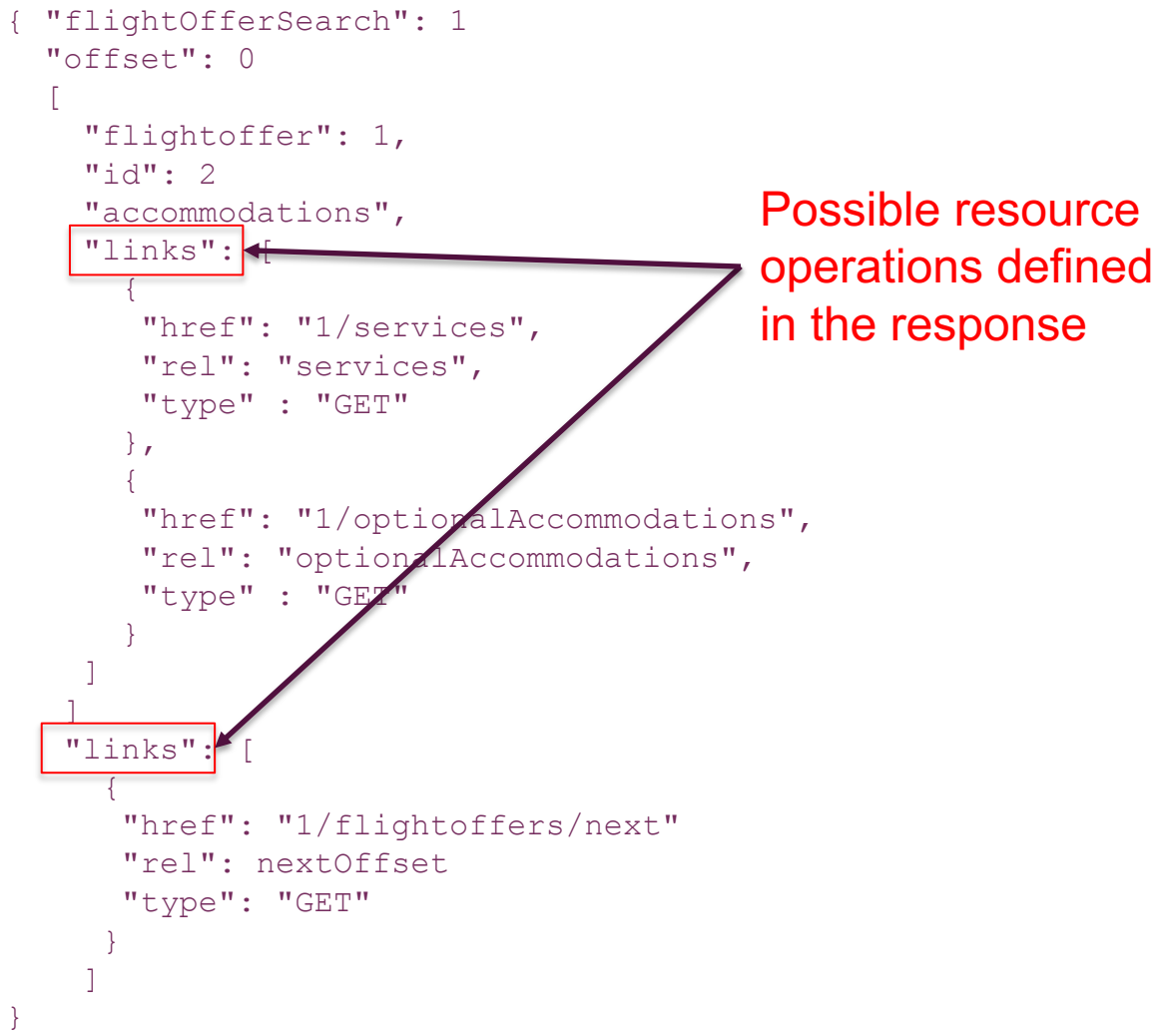
Part 3 – Other *Important* Topics

Hypermedia

- **HATEOAS** (Hypermedia as the Engine of Application State) – Richardson Maturity Model – Level 3
- Self describing, discoverable API
- Changes do not break the contract

- Some frameworks / standardisation efforts:
  - Hypertext Application Language – HAL
  - Structured Interface for Representing Entities – SIREN
  - JSON-LD and Hydra
  - JSON-API



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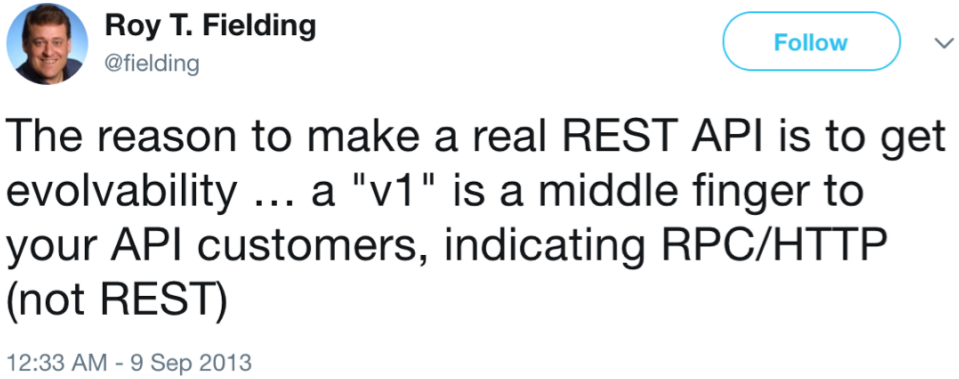
Evolving the API

Changes will happen, *so design for them.*



- **By using hypermedia or …**
- **Support versioning, but only on MAJOR versions**
  - **Make** backwards compatible changes and **avoid** breaking changes
  - **Deprecate** but leave in old functionality

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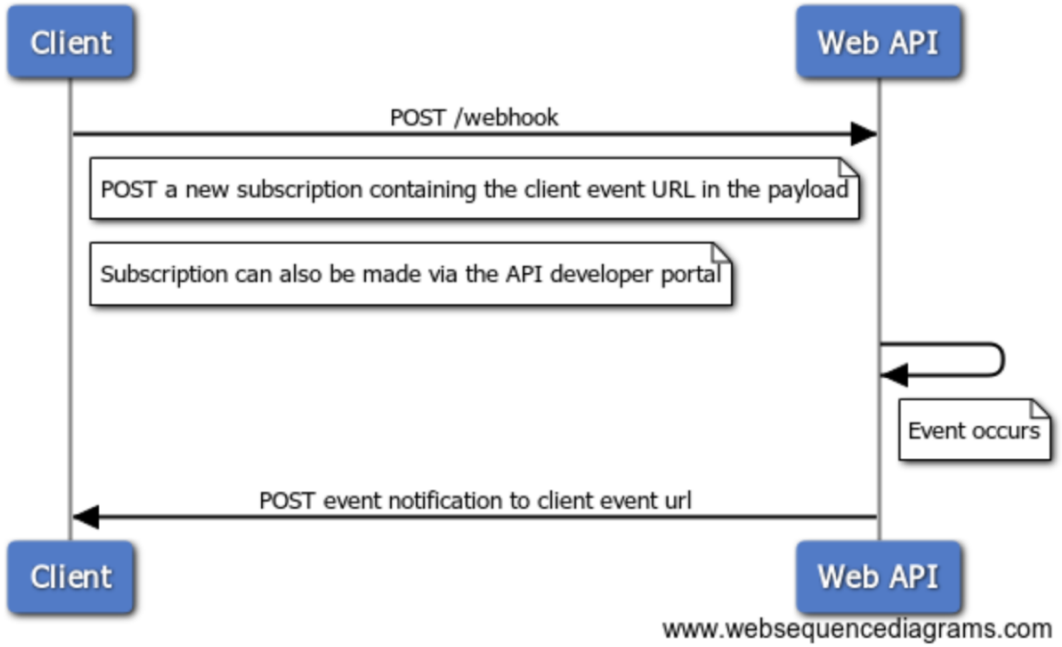
Webhook pattern

- Event-driven integration via server callbacks
  - Flight updates
  - Price changes
- Polling is bad for everyone
  - ~95% of polling requests are useless
  - Reduce load on server



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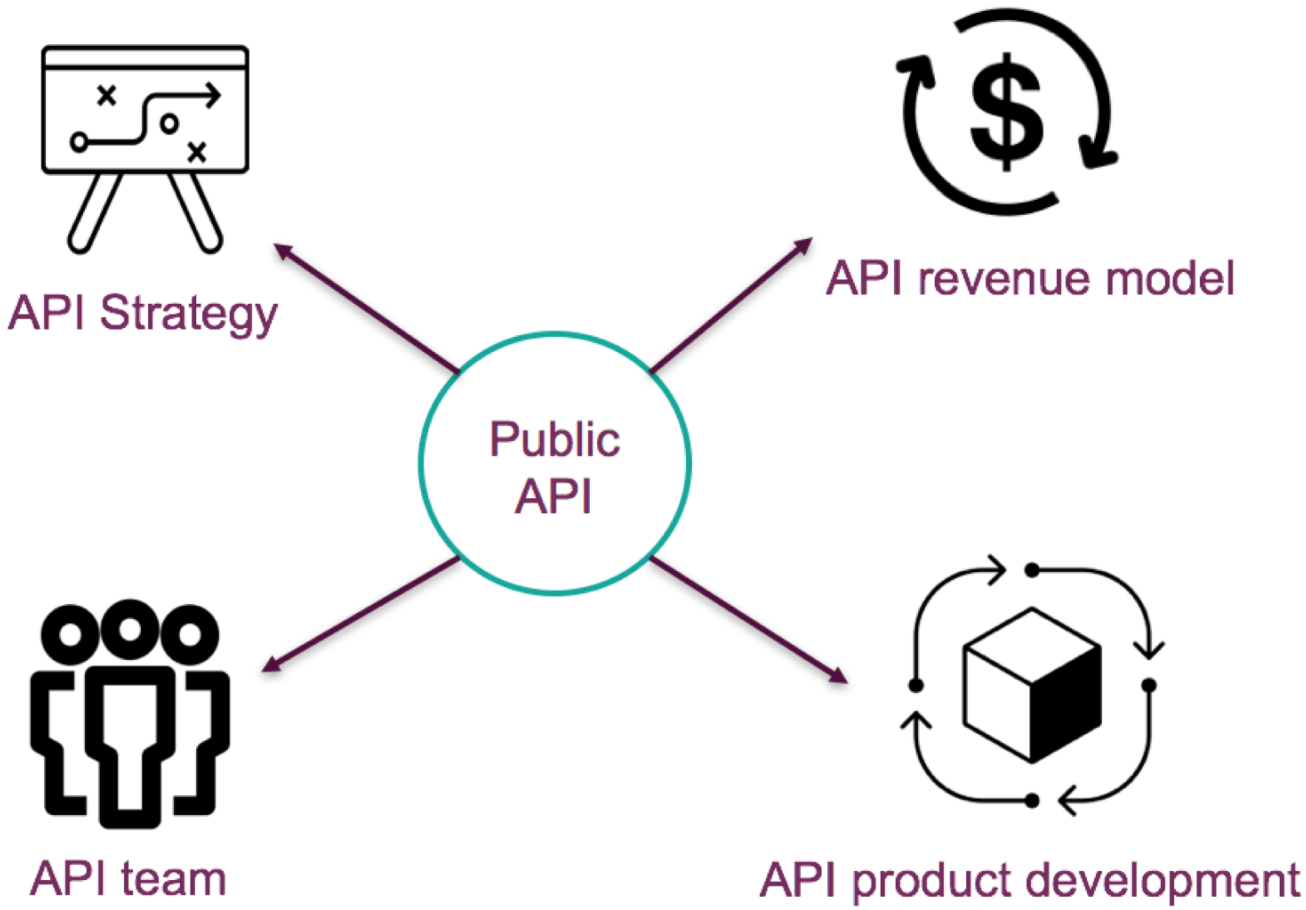
Process & People



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What have we learned?

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Learning points

- A RESTful API **interface <>** your domain **model**
- **Embrace non-CRUD** operations
- Don’t be **afraid** of changes, but **facilitate** them in your API **design** and in **communication** to your API consumers
- Be pragmatic and work iteratively
- Don’t forget about the **people** and the **process**

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Thank you for attending!

Tom Höfte, IT Architect, Xebia, *thofte@xebia.com*

Marco van der Linden, IT Architect, Xebia, *mvanderlinden@xebia.com*