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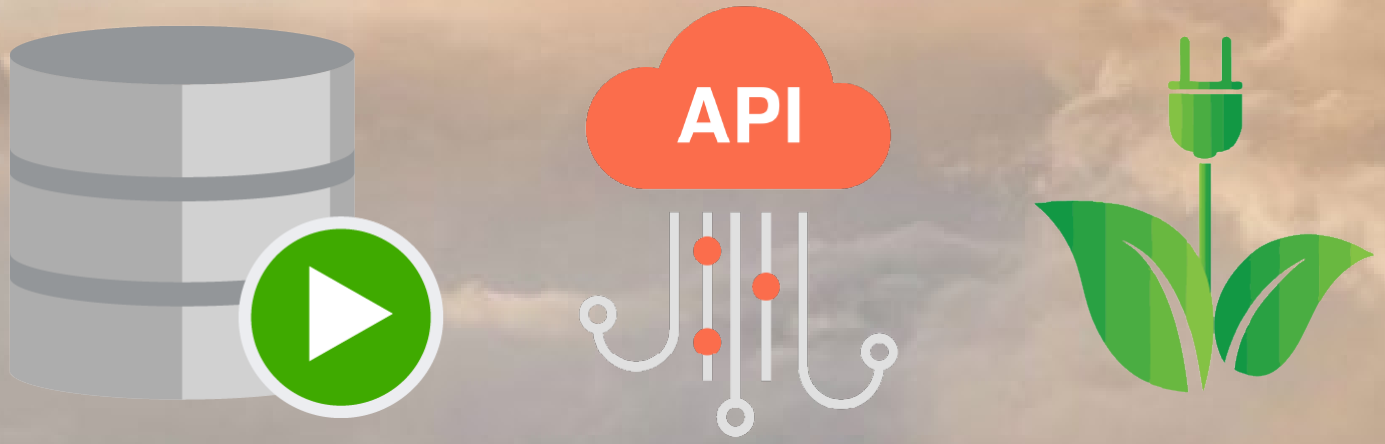
The German Oracle Database Community



ā'pěks (#orclapex) Meetup

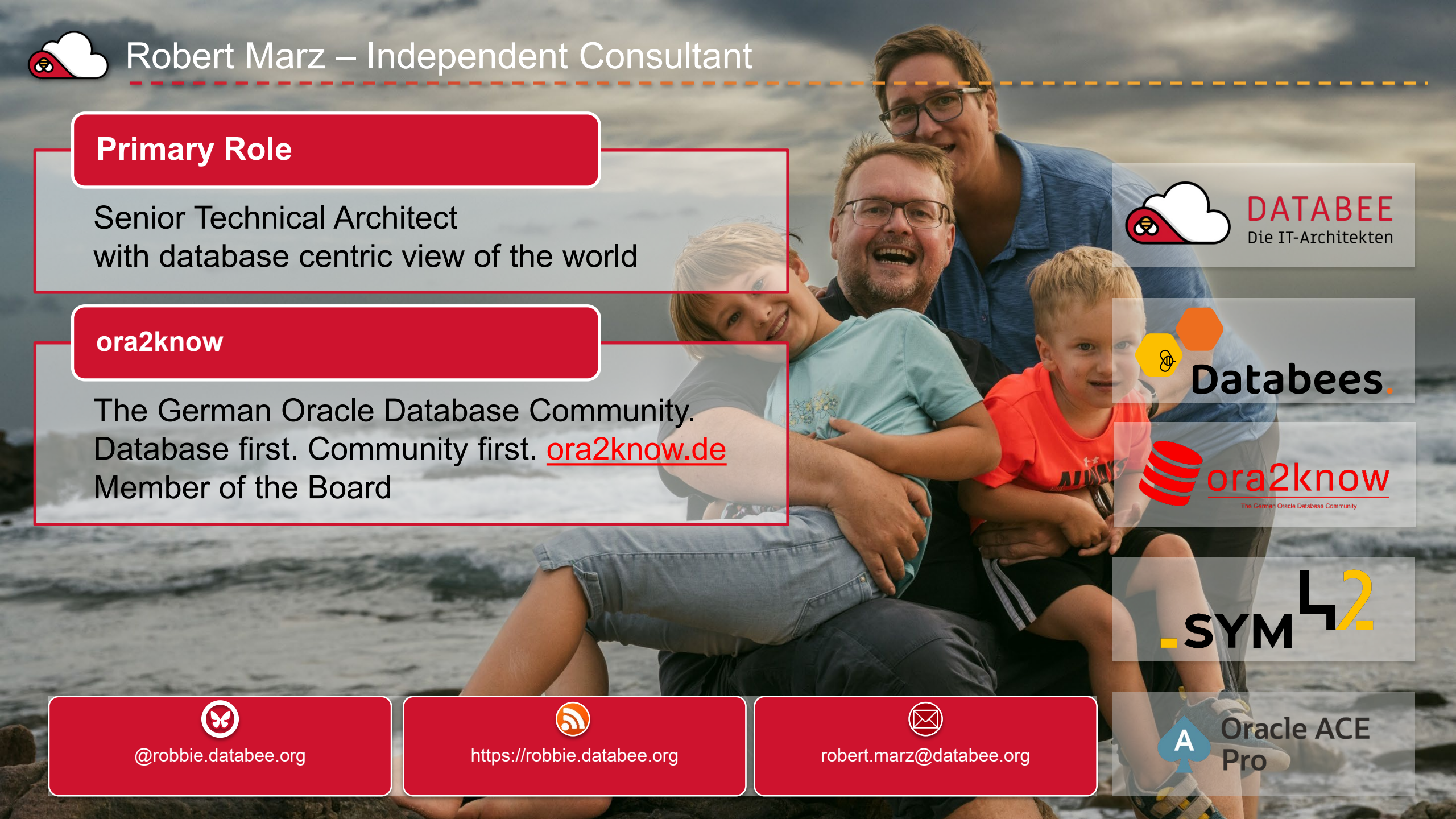
Advanced API Development with Oracle REST Data Services (ORDS)

Thursday, May 22nd, 2025 (19:00 - 19:45)

Robert Marz

DATABEE

Die IT-Architekten



Robert Marz – Independent Consultant

Primary Role

Senior Technical Architect
with database centric view of the world

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The German Oracle Database Community.
Database first. Community first. ora2know.de
Member of the Board

DATABEE
Die IT-Architekten

Databees.

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The German Oracle Database Community

SYMLINK

Oracle ACE Pro

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- Eine starke Community für Oracle Datenbank Benutzer
- Ziele: Wissensvermittlung für Entwickler und DBAs
- Angebote: MeetUps, Podcasts, Live Events
- Projekte: Veranstaltung zum Kennenlernen
- Kontakt: info@ora2know.de

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The German Oracle Database Community

Oracle ACE

The Oracle ACE Program

400+ technical experts helping peers globally

- The Oracle ACE Program recognizes and rewards community members for their technical and community contributions to the Oracle community
- 3 membership levels: Director, Pro, and Associate
- Nominate yourself or a colleague at ace.oracle.com/nominate
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.SYMPOSIUM 42

Created by the community, to support the community

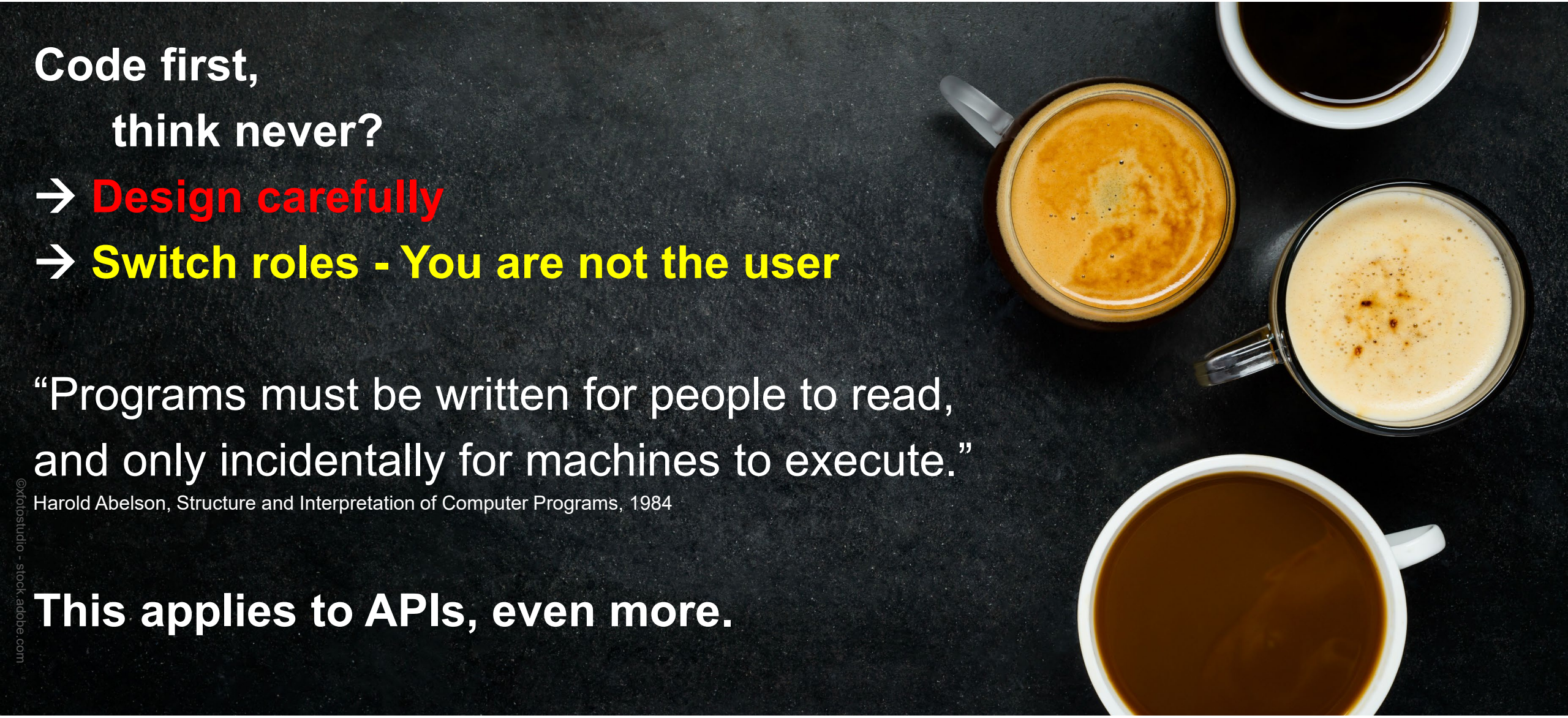
Sharing of reliable knowledge
Supporting the various user groups and individuals

@sym_42

https://sym42.org/

Designing your REST API

API Design Approaches



Code first,
think never?
→ Design carefully
→ Switch roles - You are not the user

"Programs must be written for people to read,
and only incidentally for machines to execute."
Harold Abelson, Structure and Interpretation of Computer Programs, 1984

This applies to APIs, even more.

API Grammar

Nouns / What?

Your API Objects
  e.g. contracts, cars, VirtualMachines, …
  GET /products
  GET /VirtualMachines/4711

Verbs / How?

http Methods
  e.g GET, POST, PUT, DELETE

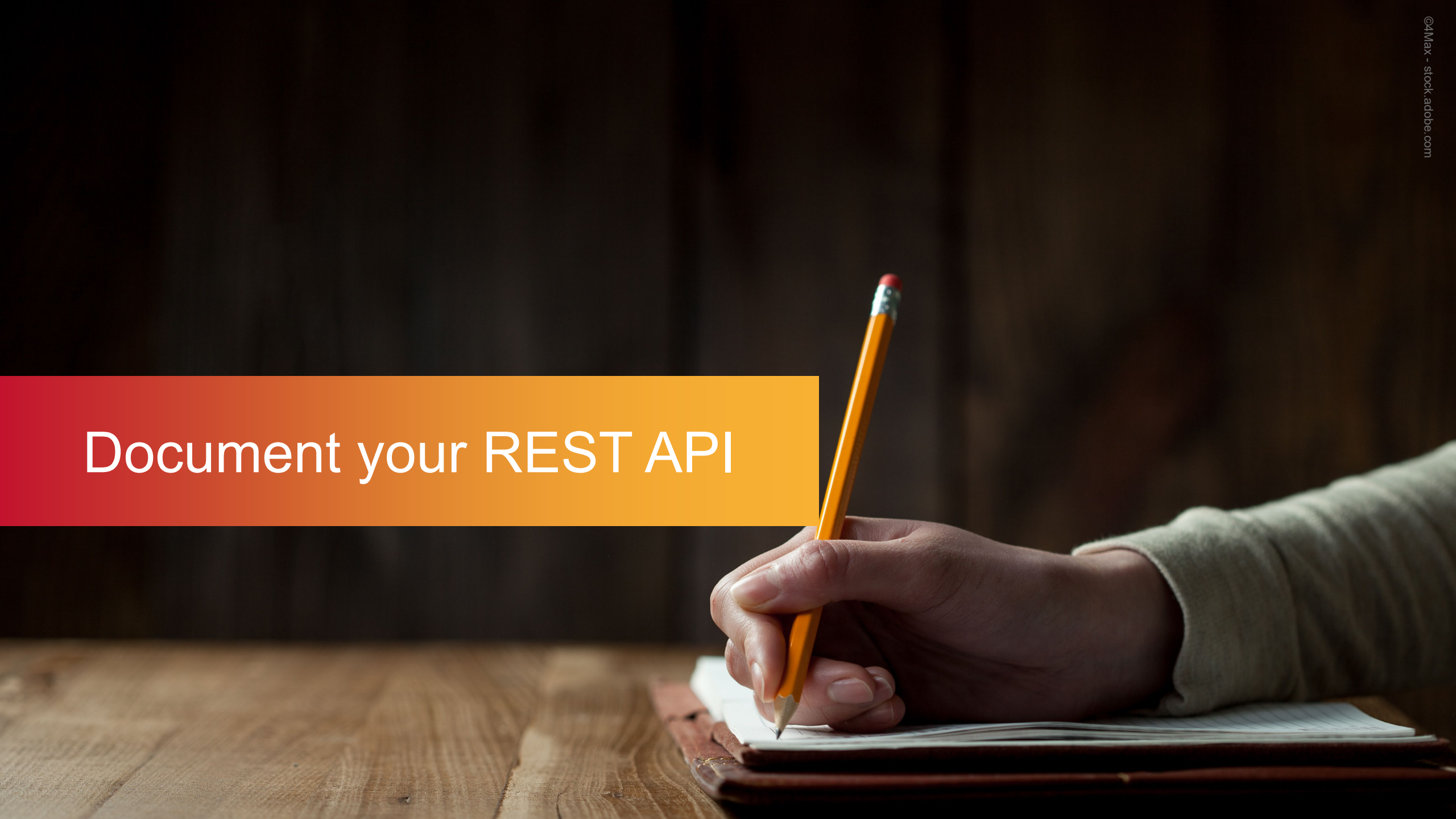
Relations

Sub-resources
  e.g DELETE /VirtualMachines/4711/VMDiskMappings/5

API Design Best Practices

- Try it, Test it, Document it
- Be redundant
- Use nouns, but no verbs, Nouns are plural
- GET method should never alter states
- Use HTTP headers
- Provide Filtering, Sorting, Field Selection & Paging
- Use ETAGs and HATEOAS

Document your REST API



Swagger vs. open API

Swagger

Cloud Platform

- Swagger Editor
- Swagger UI
- Swagger Codegen
- Swagger Hub
- Swagger Inspector

API description standard

- donated to Linux Foundation
- renamed to OpenAPI Specification
- JSON or YAML files

Swagger™
Supported by SMARTBEAR

OPENAPI INITIATIVE

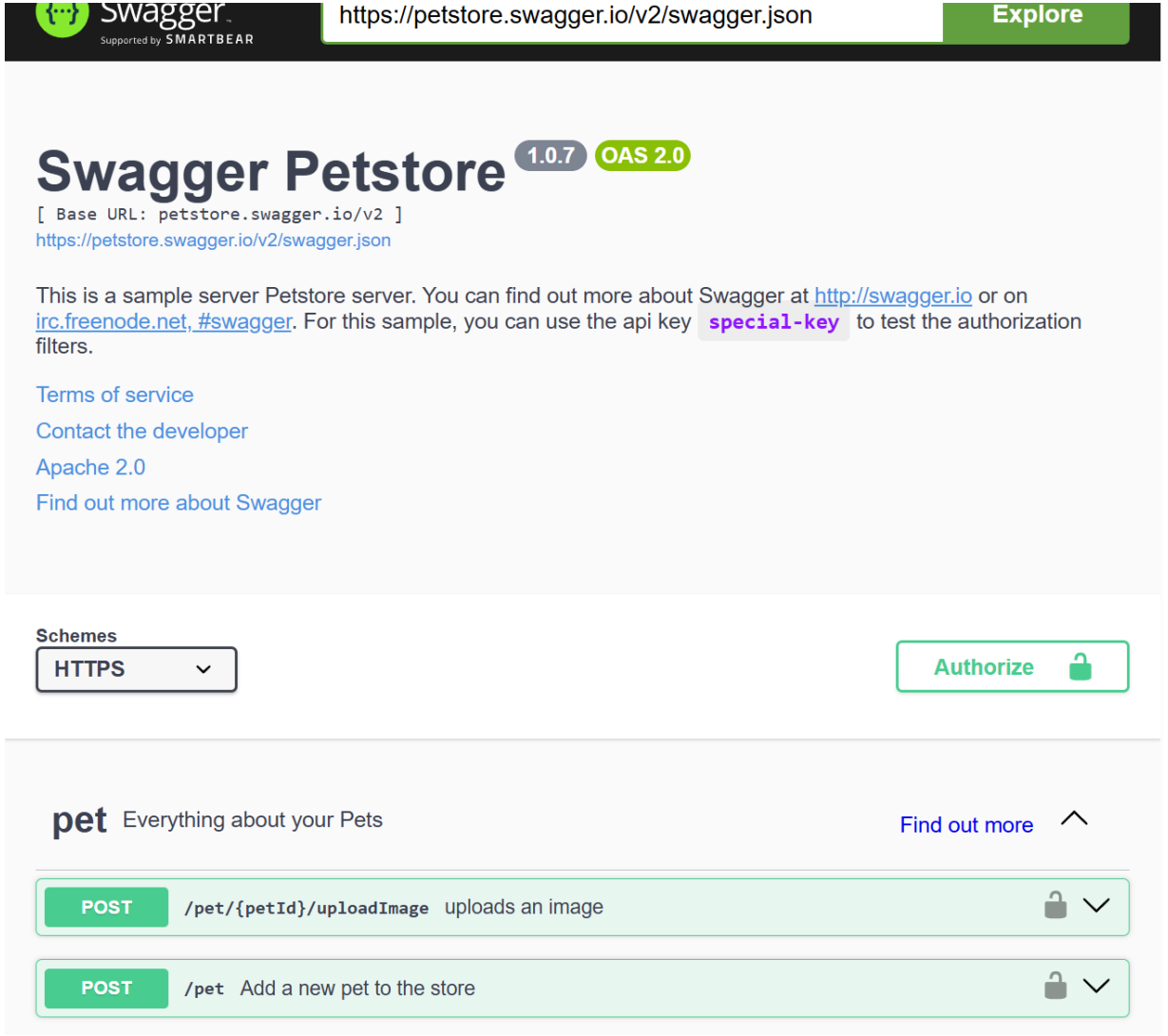
Open API Documentation

This is the only Documentation, your users will see

It builds your reputation (good or bad)

Provide a swagger endpoint/url

Keep your API consistent with the Docs



Swagger-CodeGen-CLI

Convert

openapi.yml distributed over multiple files

into a single json file

```
java -jar swagger-codegen-cli-3.0.64.jar generate -l openapi -i ${api} -o ./out
```

https://swagger.io/docs/open-source-tools/swagger-ui/usage/installation/

SwaggerUI

URL to your openapi.json

```
<!DOCTYPE html>
<html lang="en">
  <head>
    <meta charset="utf-8" />
    <meta name="viewport" content="width=device-width, initial-scale=1" />
    <meta name="description" content="SwaggerUI" />
    <title>SwaggerUI</title>
    <link rel="stylesheet" href="https://unpkg.com/swagger-ui-dist@5.11.0/swagger-ui.css" />
  </head>
  <body>
  <div id="swagger-ui"></div>
  <script src="https://unpkg.com/swagger-ui-dist@5.11.0/swagger-ui-bundle.js" crossorigin></script>
  <script src="https://unpkg.com/swagger-ui-dist@5.11.0/swagger-ui-standalone-preset.js" crossorigin></script>
  <script>
    window.onload = () => {
      window.ui = SwaggerUIBundle({
        url: 'https://petstore3.swagger.io/api/v3/openapi.json',
        dom_id: '#swagger-ui',
        presets: [
          SwaggerUIBundle.presets.apis,
          SwaggerUIStandalonePreset
        ],
        layout: "StandaloneLayout",
      });
    };
  </script>
  </body>
</html>
```

https://swagger.io/docs/open-source-tools/swagger-ui/usage/installation/

Open API – What to document

Endpoints (Modules)

- Description

Parameters

- URL / Header
- Datatypes
- Examples

Body & Response

- JSON Schemas
- Examples

Organize your Code

Custom PL/SQL oder ORDS Functionality

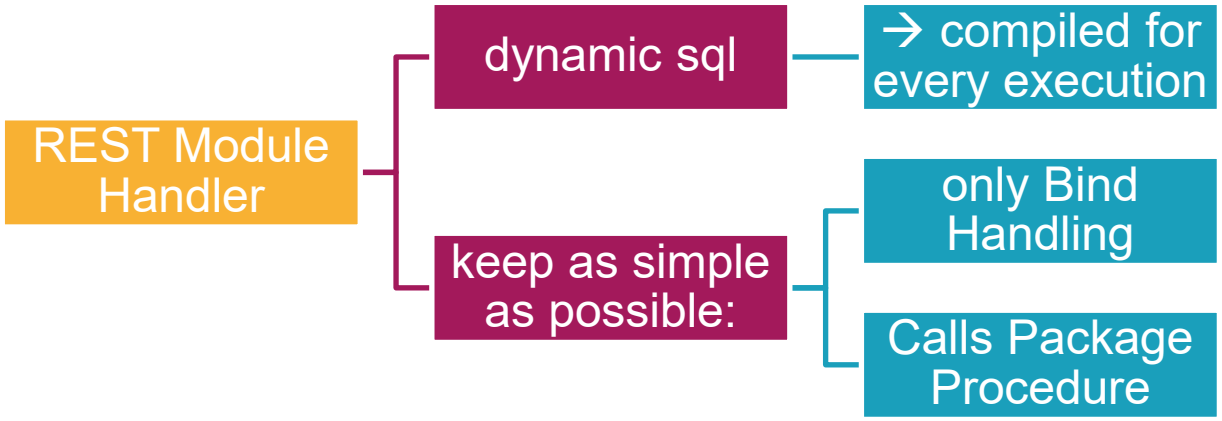
use ords source type
whenever you can

use custom pl/sql
whenever you must

Organize PL/SQL Code

RestResult	Reusable Business Logic	Per module	General REST-Helper
PL/SQL Type (Alternative: Use a JSON Doc)	PL/SQL Packages	PL/SQL Packages	PL/SQL Package
http-status Code http-status Message JSON-Result		Function for every handler (template + http-method) Calls Re-Usable Business Logic	Procedure for Output Generation Gets result from module function as Input Input and Output Validation Error Handling

REST Module Handler Defintion



REST › Module › ffacmd_v1 › execwf › **POST**

POST

execwf

Zuletzt aktualisiert: vor 9 Minute

Keine Kommentare verfügbar

Quelltyp: plsql/block | Seitengröße: 0

http://localhost:8080/ords/fsm_core/ffacmd/v1/execwf

Quelle

```
1  begin
2      :status_code := common.process_rest_result(rest_execwf.post(:body));
3  end;
```

Paging

Paging is crucial for large datasets

REST call are stateless and independent

Provide metadata in the responses:

- are there more rows
- current offset
- links to following and preceding pages

The ORDS source types provides those for free

Hypermedia **a**s **t**he **E**ngine **o**f **A**pplication **S**tate (HATEOAS)

ETags for Caching and DML Locking

ETags (Entity Tags)

- http headers
- identify specific versions of resources
- part of http/1.1 spec (RFC 7232)
- great for result caching

Optimistic Concurrency Control

- Prevention of Mid-air Collisions
- ensure client has read the latest changes before updating

ORDS source types

- bring ETags for free

JSON Schemas

Validate all JSON against schemas

- Incoming
- Outgoing
- Resting in the Database

Make sure schemas

are consistent with docs
→ re-use your openAPI spec

ORDS Auth with JWTs

JWT (JSON Web Token)

JWT (JSON Web Token)

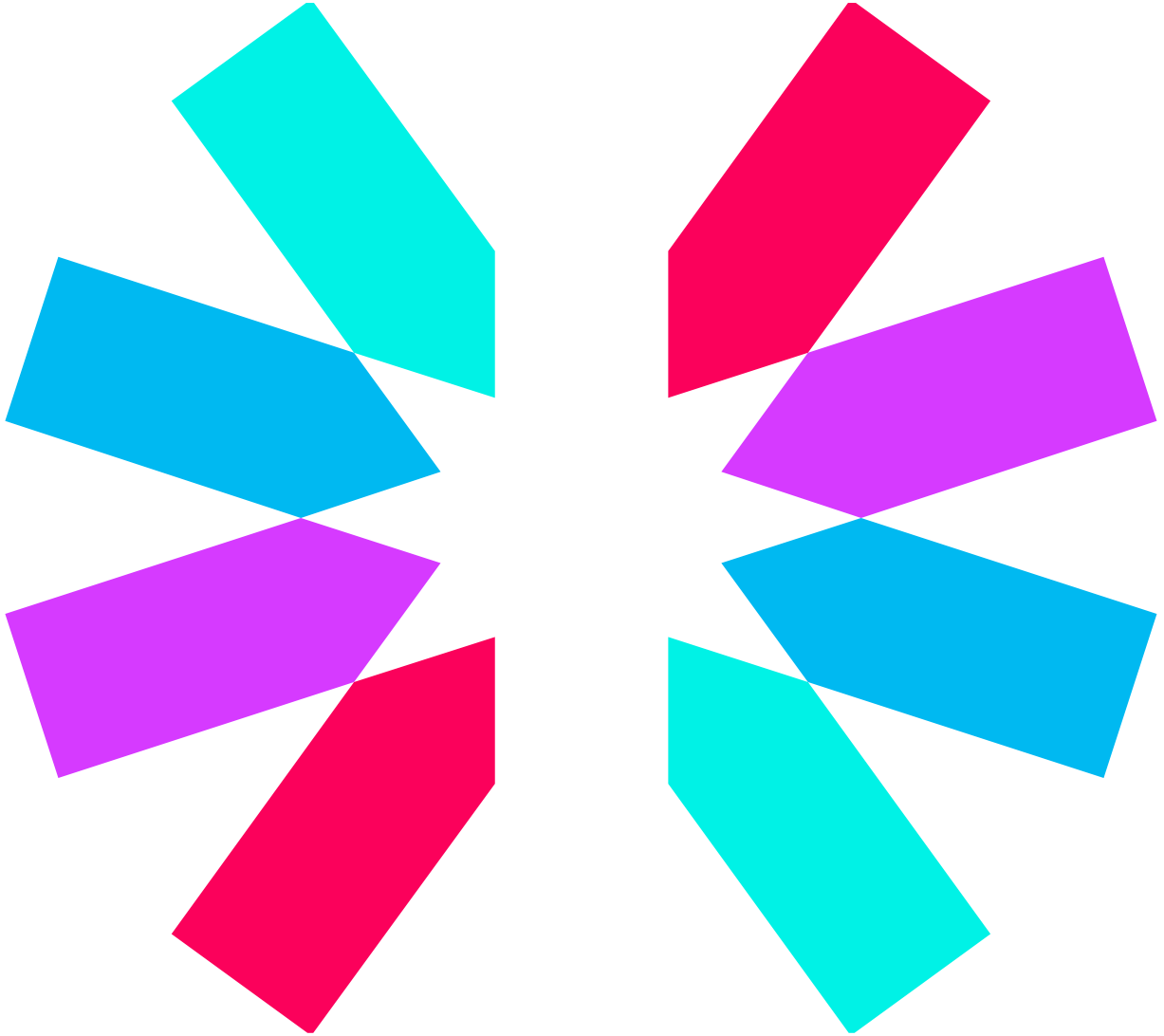
- industry standard RFC 7519
- represent claims securely between two parties

Transport

- http header field
- Authorization: Bearer {{token}}

Parts

- 3 Sections:
  - Header (JSON)
  - Payload (JSON)
  - Signature
- Base64 encoded

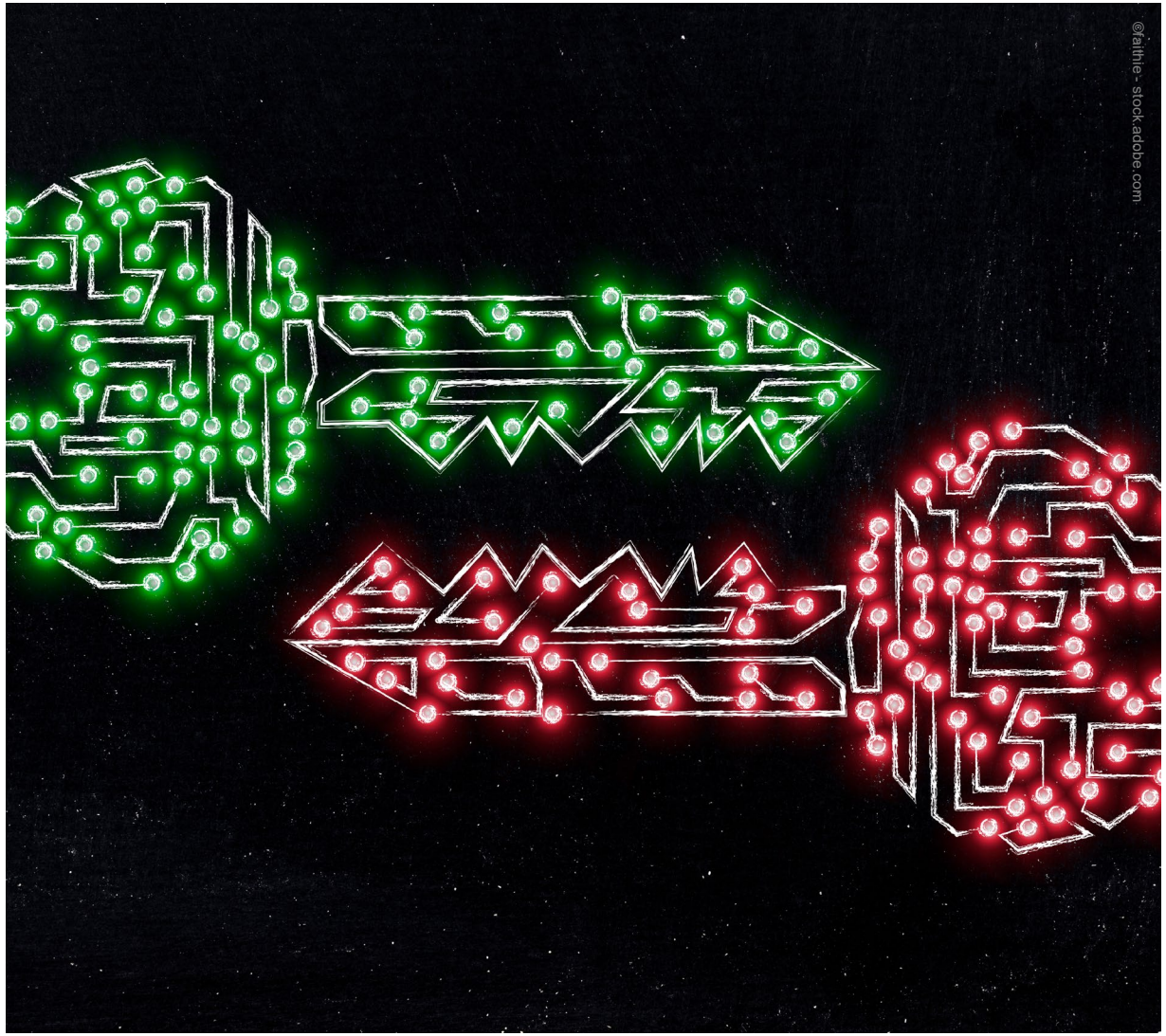


Java Web Token – How it works


```
{
  "exp": 1732104719,
  "iat": 1732102919,
  "jti": "874be9ae-b186-4684-af50-f1cfa726e581",
  "iss": "https://host.examle.com/realms/tenant1",
  "sub": "5db8e25d-21c7-4cd4-ac1e-a26832b46850",
  "typ": "Bearer",
  "azp": "Dispo",
  "session_state": "8af6a246-7277-4216-b660-4c44b95a5c20",
  "acr": "1",
  "allowed-origins": [
    "https://host.examle.com/Acceptance/dispoManager/",
    "http://localhost:5000",
    "https://host.examle.com/dispoManager/"
  ],
  "scope": "openid email profile",
  "sid": "8af6a246-7277-4216-b660-4c44b95a5c20",
  "name": "Robert Marz",
  "groups": ["/Dispatcher","/Technican"],
  "preferred_username": "postman-test-user-03",
  "given_name": "Robert",
  "family_name": "Marz",
  "email": "robert.marz@databee.org"
}
```


Client	establishes Session with ID Provider
	Receives Bearer Token with Claims
	Sends Token as http-header to Server
Server	Decodes Token
	Validate Token (online or offline)
	Extracts Information: Username; Full-Name; Groups

ORDS Auth with JWTs



ORDS

- latest release has JWT profiles
- enabled by default
- if not configured, every JWT will result in an error and Java Stacktrace

ORDS JWT profile disable

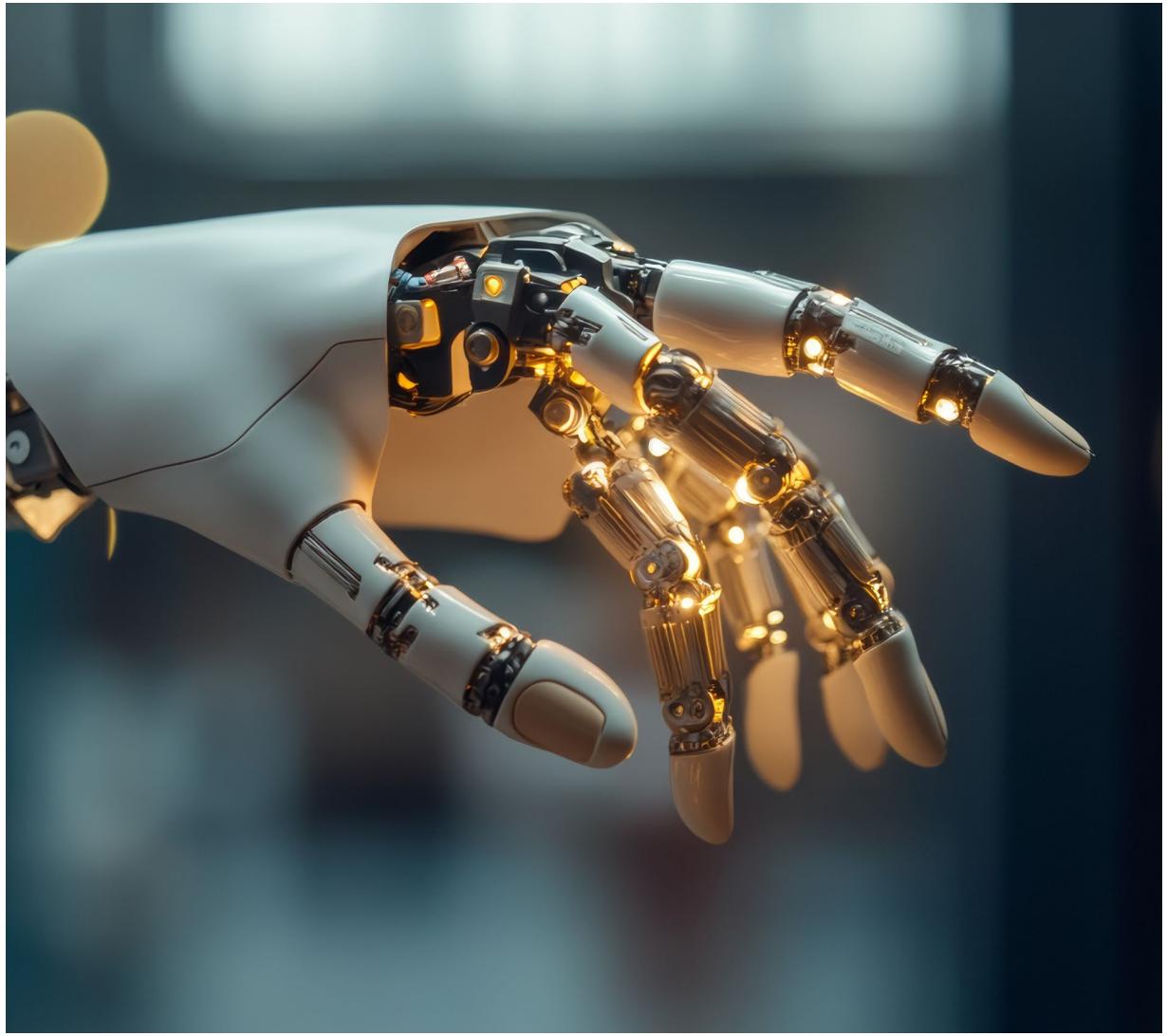
```
ords config set
  security.jwt.profile.enabled false
```

Parse JWT

- You have to parse the payload for claims like roles, groups, etc anyway

Sharing Auth between APEX and REST

JWTs and Apex



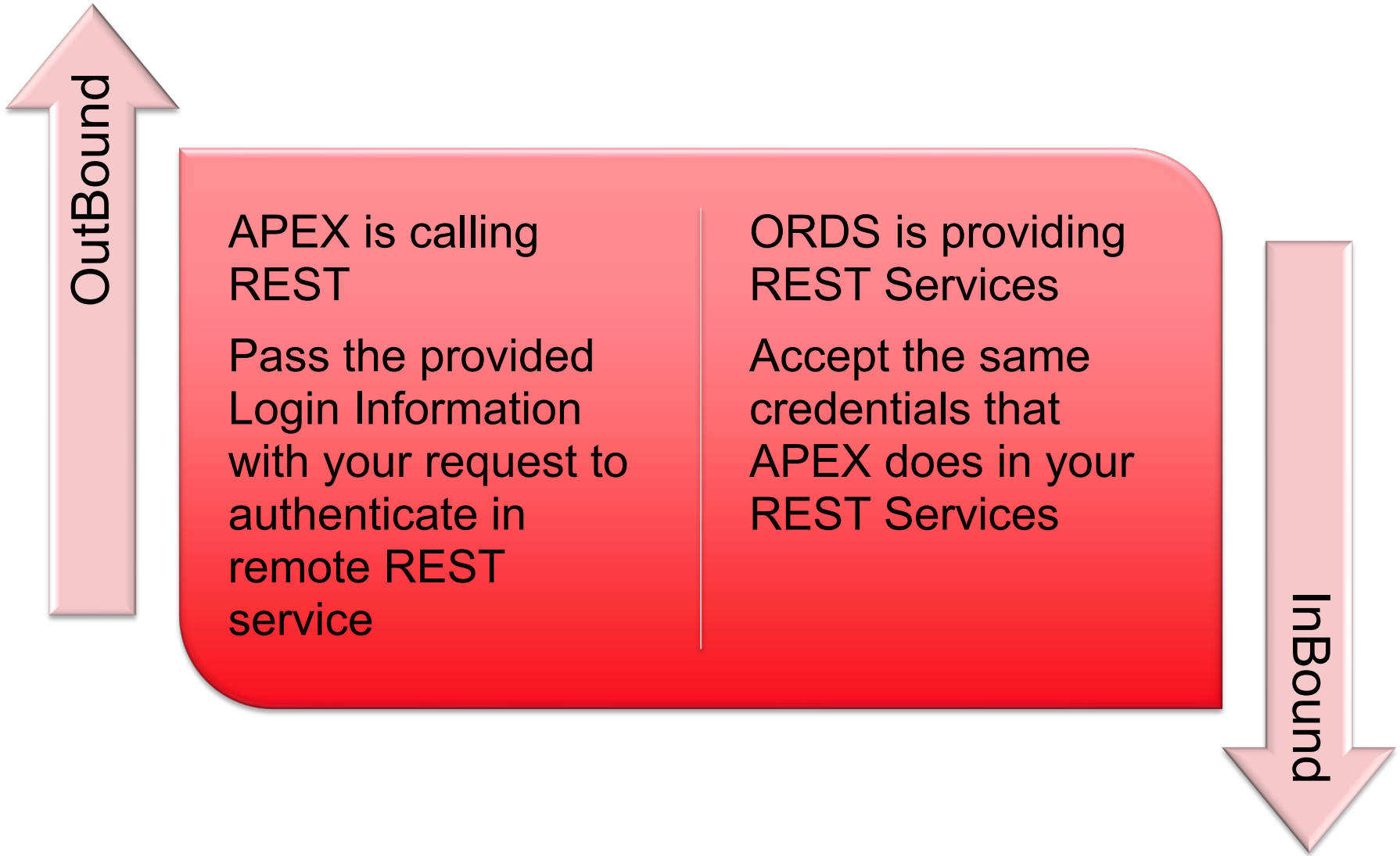
Apex

- Built-In Support

Social-Sign-In Auth Scheme

- social networks and enterprise identity providers that support OpenID Connect or OAuth2 standards
  - - MS Entra ID (ex Azure Active Directroy)
  - - KeyCloak
  - …

REST & APEX Scenarios



JWTs and REST outbound

```
/* We want to mimic this curl command in PL/SQL.
curl --request POST 'https://host.example.com/cool/service' \
--header 'Authorization: Bearer eyJhbGciOiJI ... '
*/

DECLARE
  l_response      CLOB;
  jwt_token       VARCHAR2(32000) := 'eyJhbGciOiJI ... ';
BEGIN
  -- Set the Request HTTP Headers.
  apex_web_service.set_request_headers
   (p_name_01  => 'Authorization',
    p_value_01 => 'Bearer ' || jwt_token,
    p_reset    => TRUE);

  -- Call API using Username and Password.
  l_response := apex_web_service.make_rest_request
    (p_url                  => 'https://dummyjson.com/auth/login',
     p_http_method          => 'POST');
END;
```

JWTs and REST inbound

Parse incoming JWT

Package APEX_JWT

- encode
- decode
- validate – no session verification!

Check if Session is valid

online: REST call to ID Provider

offline: check signature against public key

Make user details available

Set package Variables

set session context

ORDS Pre-Hook

ORDS Pre Hook

ORDS Pre Hook

PL/SQL function called before every ORDS Request
(that includes APEX calls)

returns boolean

- true: all good
- false: HTTP status 403 forbidden
- unavailable: HTTP status 500 internal error

Configure

per connecton pool

ords setting procedure.rest.preHook

→ Perfect place for JWT validation

ORDS PreHook best Practices

small pre_hook function

- place in schema on its own
- standalone function (no package)
- call pre_hooks function in REST-enabled-Schema
- return true if not needed

pre_hooks (in packages)

- for every REST enabled schema
- or even for every module
- do the actual job

Be careful

- defect pre_hook stops
- REST Services and Apex for your ords-pool

```
create or replace function ords_pre_hook
    return boolean
    authid current_user
  as
    l_apex_base varchar2(32767 char) := OWA_UTIL.get_cgi_env('X-APEX-BASE');
    l_path varchar2(32767 char) := OWA_UTIL.get_cgi_env('X-APEX-PATH');
    l_result boolean := true;
  begin
     if l_apex_base like '%/ords/fsm_%'
      then
         -- ignore swagger services
         if l_path like 'swagger%' then return true; end if;
         -- ignore health services
         if l_path like 'health%' then return true; end if;
         -- ignore sdw (sql dev web) services
         if l_path like 'sign-in%' then return true; end if;
         -- ignore services that start with an underscore
         if regexp_like (l_path, '(^_|^/_)') then return true; end if;
         -- ignore metadata-catalog
         if l_path like 'metadata-catalog%' then return true; end if;
         execute immediate 'begin :1 := '||user||'.common.ords_pre_hook; END;' using out l_result;
     end if;
     return l_result;
  end ords_pre_hook;
/

grant execute on fsm_core.ords_pre_hook to ORDS_PUBLIC_USER
/
```

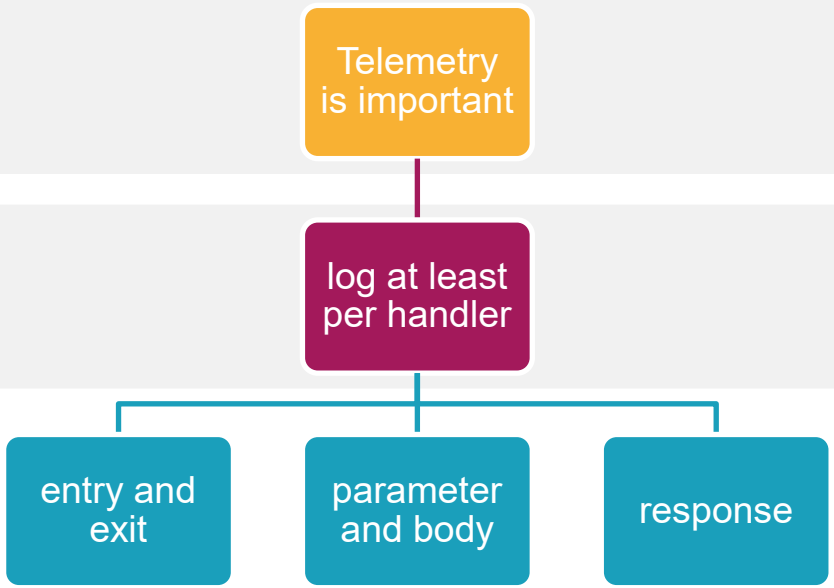
Timing and Logging

Integrate it in your Framework

- prehook
- output processor

Think about retention times

- establish a cleanup process



API Management Systems

Cloud-based

- Azure API Management
- Amazon API Gateway
- Google Cloud API Gateway
- Apigee (now part of Google Cloud)
- MuleSoft Anypoint Platform
- IBM API Connect
- Kong Enterprise
- Tyk Cloud
- Postman API Platform
- RapidAPI

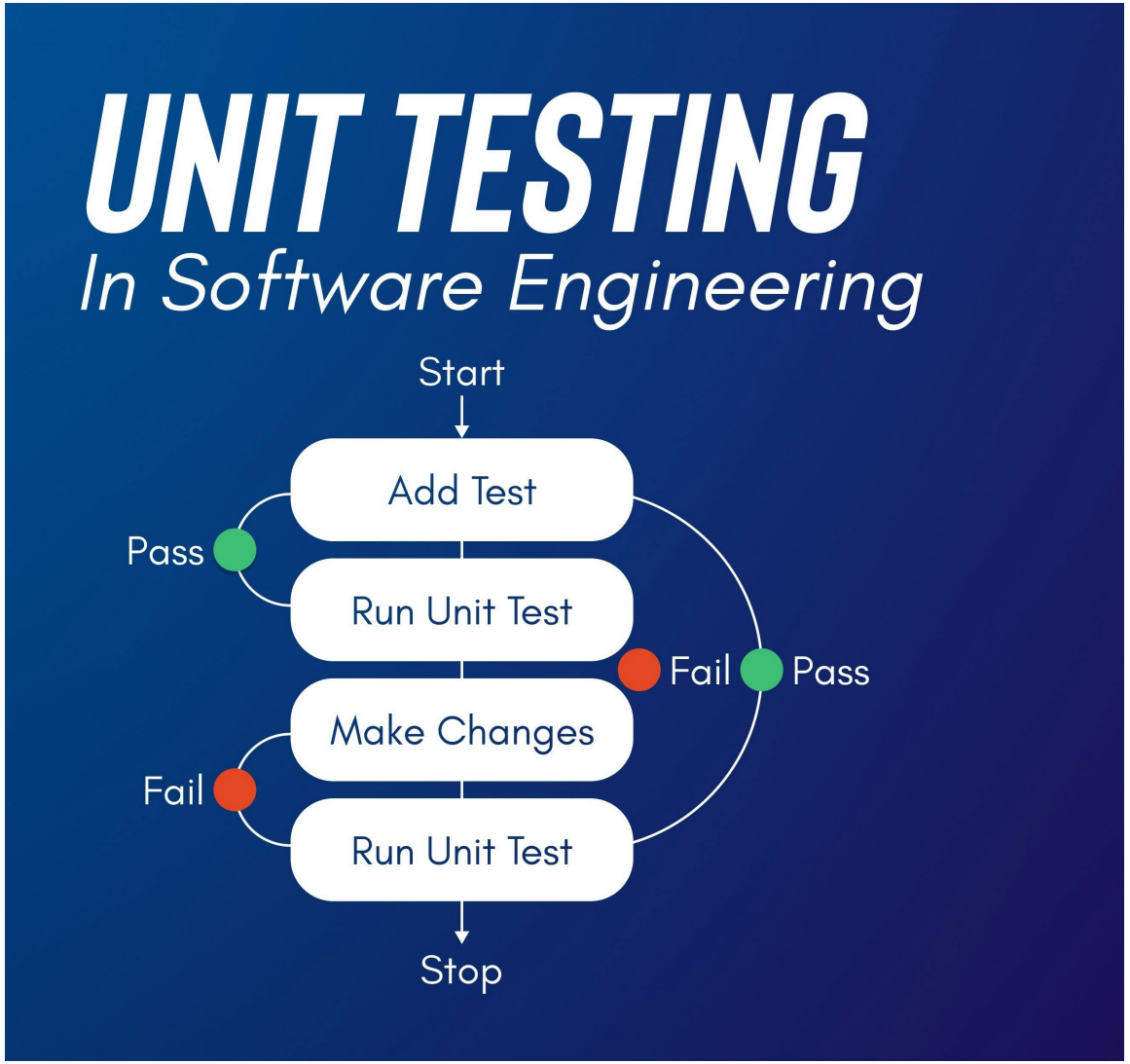
On-premises and Open Source

- Kong Gateway (open source version)
- Tyk Open Source API Gateway
- Apache APISIX
- WSO2 API Manager
- Gravitee.io
- KrakenD
- Gloo Edge
- 3scale API Management (Red Hat)

Hybrid and Multi-Cloud

- Axway API Management
- Software AG webMethods API Management
- CA API Management (Broadcom)
- Dell Boomi API Management
- Oracle API Platform Cloud Service

Unit Tests



Test your

- Business Functions
- Modules
- Endpoints

Use Tools

- utPLSQL

API Tests with REST Client

Rest Clients

- Postman
- Insomnia
- ...

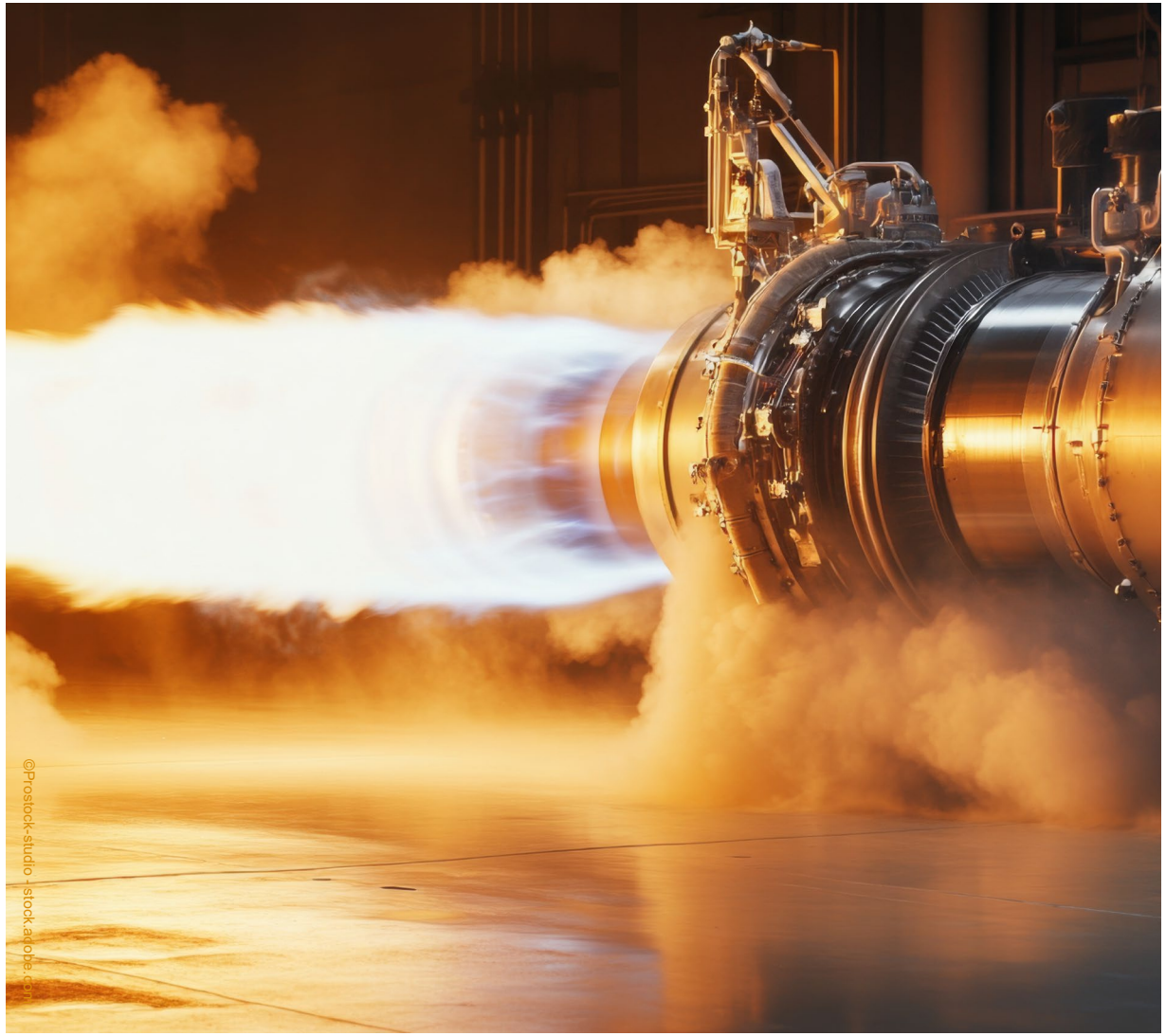
Build Collections

- contain every endpoint
- use case
- variable

Run through workflow

- generate and collect values
- Script (JS)

Stress and Load Tests



Performance

- normal usage
- peak usage
- DoS Attacks
- Mistakes on Client side

Open Source Tools

- Apache Jmeter
- k6 (now part of Grafana Labs)
- Gatling
- Locust
- …

Advanced API Development with ORDS

- Design your API carefully
- Document your API
- Keep code in ORDS Module Handler short
- Authenticate with JWTs / oAuth
- ORDS pre Hook is powerful
- Test your API