



The bridge to possible

Why API Contracts Matter

Panel: Best practices and lessons learnt on Cisco's API-First journey

Cory Guynn, Product Management Architect, Meraki

Einar Nilsen-Nygaard, Principal Engineer, ISE

Raghu Arur – Distinguished Engineer, Nexus Cloud

Stève Sfartz – Principal Architect – Cisco Developer Relations

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Webex spaces will be moderated until February 24, 2023.



/Cisco/DevNet/StèveSfartz

- API Architect in Cisco Developer Relations
- Technical Lead for API Experience and Cisco API Guidelines: prescriptive standards and best practices for APIs
- Working to deliver a great and consistent developer experience across Cisco platforms



webex: stsfartz@cisco.com
github: [ObjectIsAdvantag](#)
twitter: [@SteveSfartz](#)

“vision without
execution is
hallucination”

Cory Guynn, Product Management Architect

Cisco Meraki

- Lead architect behind the release of Dashboard API v1 and our adoption of the OpenAPI specification
- Driven by a need to simplify everything and enable new possibilities.
- Proud *Merakian* since 2011



Webex: cguynn@cisco.com
Twitter: [@eedionysus](https://twitter.com/eedionysus)

"Automate all
the things!"

Einar Nilsen-Nygaard, Principal Engineer

Cisco Identity Services Engine

- Architect for the Cisco Identity Services Engine and related services for Meraki Dashboard;
- previously architect for IOS XR, IOS XE and NX-OS open programmability interfaces
- Driven by a desire to open up the value in Cisco products to both end users and developers!



Webex: einarnn@cisco.com

Twitter: @einarnn

Github: einarnn

Raghu Arur – Distinguished Engineer Nexus Cloud

- Chief Architect for Nexus Cloud and Nexus Insights
- Driving the simplification of Day2 Ops for Cisco networking products
- Working to deliver the best observability platform for Cisco Networking

Cisco's API-First Strategy

- Treat APIs as Product
- Versioned releases
- API Changelogs
- Backwards Compatibility
- Documentation
- Support

**Backward Compatibility
announcement at Partner Summit**

**APIs are backwards compatible,
as of October 2022**

Meraki Dashboard API v1

ISE API v1

Nexus Cloud API v1

SecureX Threat Response API v1

Cloud Security Open APIs v2

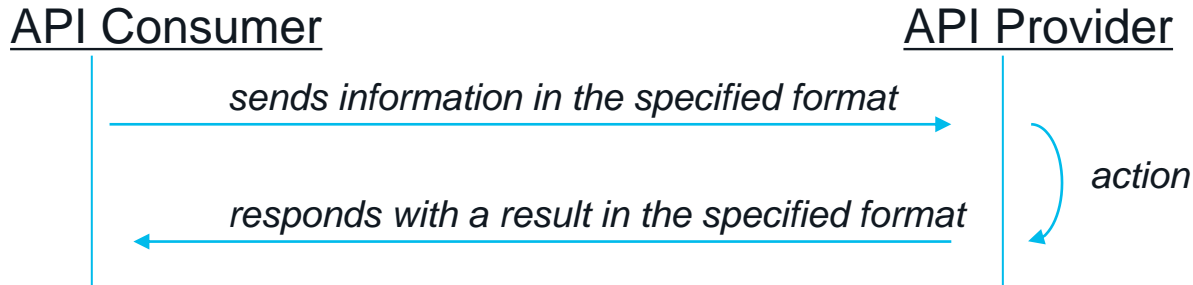
Webex API v1

pxGrid Cloud API v1


What are API Contracts?

APIs as Contracts

- An application programming interface (API) specifies how software components should interact with each other.
- As such, APIs are considered **contracts between the organization providing the API and developers consuming this API.**
- *"if you provide information in this format, I – the API - will perform a specific action and return a result in this format".*



Formalizing API Contracts

- For every [operation](#) supported by an API, its contract describes:
 - what must be provided as input
 - what will happen
 - and what, if any, data is returned
- [OpenAPI Specification](#) (OAS) is a standard to define contracts for HTTP/REST API
- Example of OpenAPI document 

```
1  openapi: 3.0.0
2  info:
3    title: Deck of Cards API
4    description: |
5      An API to simulate a deck of cards. This API can be used
6      may be created using a single deck of 52 cards, or multiple
7      of cards.
8
9      This API supports the following capabilities -
10
11      * Create a new deck, shuffled or unshuffled (order preserved)
12      * Reshuffle an existing deck
13      * Draw one or more cards from an existing deck
14      * Create piles of cards that can receive a draw
15      * Create a new deck with a specific set of cards
16
17      The API offers images of each card for easy display.
18
19  contact: {}
20  version: '1.0'
21  servers:
22    - url: http://www.deckofcardsapi.com/api/
23      variables: {}
24  paths:
25    "/deck/new/": {
26      get: {
27        summary: "Create a new deck"
28      }
29    }
30    "/deck/{deck_id}/draw/": {
31      get: {
32        summary: "Draw one or more cards from an existing deck"
33      }
34    }
35    "/deck/{deck_id}/shuffle/": {
36      get: {
37        summary: "Reshuffle an existing deck"
38      }
39    }
40  components:
41    schemas:
```

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What are API Contracts



API Reference Documentation

developer.cisco.com/meraki/api-v1/#!create-organization

- Reference documentation automatically rendered from OpenAPI documents

```
post:
  description: Create a new organization
  operationId: createOrganization
  parameters:
    - name: createOrganization
      in: body
      schema:
        type: object
        properties:
          name:
            type: string
            description: The name of the organization
        example:
          name: My organization
        required:
          - name
      required: true
  responses:
    '201':
      description: Successful operation
```



API	>
GENERAL	>
devices	>
networks	>
organizations	>
CONFIGURE	>
GET	Get Organizations
POST	Create Organization
GET	Get Organization
PUT	Update Organization
DELETE	Delete Organization
actionBatches	>
adaptivePolicy	>
admins	>
alerts	>
brandingPolicies	>
POST	Claim Into Organization
clients	>
POST	Clone Organization
configTemplates	>
devices	>

Create Organization

Operation Id: createOrganization

Description: Create a new organization

POST /organizations

Request Parameters

Body

createOrganization * | Object

Schema Definition

Example Body

```
{ "name": "My organization" }
```

Responses

Status: 201

Get Organizations

Operation Id: `getOrganizations`

Description: List the organizations that the user has privileges on

GET /organizations

Responses

Status: 200

Successful operation

Schema Definition

Example Body

-	array[]	+ -
-	id: string	Organization ID
-	name: string	Organization name
-	url: string	Organization URL
+	api: object	API related settings
+	cloud: object	Data for this organization
+	licensing: object	Licensing related settings

Parameters

Template

GET /organizations

Query Params

Headers

Run

Response: 200 OK

Data

Info

```
[
  {
    "id": "681155",
    "name": "DeLab",
    "url": "https://n392.meraki.com/o/49Gm_c/manage/orga
    "api": { "enabled": true },
    "licensing": { "model": "per-device" },
    "cloud": {
```

ISE 3.1 and above (API v1)

Introduction

Getting Started

API Reference

Configuration (Day 1)

Operation (Day 2)

ancendpoint

ancpolicy

Backup and Restore (Open API)

clearThreatsAndVulnerabilities

deploymentinfo

node

pxgridnode

Repository (OpenAPI)

sessionservicenode

supportbundle

supportbundledownload

supportbundlestatus

Monitoring

Upgrade (Day N)

Mobile Device Management

Versioning

Backup and Restore 1.0.0 OAS3

[BackupRestore.yaml](#)

Configuration Backup and Restore APIs for managing the configuration DB Backup and Restore functionality. Schedule configuration DB backup, cancel running backup and last backup status APIs are also available.

backup-restore-api-controller the backup-restore API

Backup And Restore

POST `/api/v1/backup-restore/config/backup` Take the config DB backup now by providing the name of the backup.repository name and encryption key. The API returns the task ID. Use the Task Service status API to get the status of the backup job

POST `/api/v1/backup-restore/config/cancel-backup` Cancel the running backup

GET `/api/v1/backup-restore/config/last-backup-status` Gives the last backup status

POST `/api/v1/backup-restore/config/restore` Restore a config DB backup by giving the name of the backup file, repository name and encryption key. The API returns the task ID. Use the Task Service status API to get the status of the restore job

PUT `/api/v1/backup-restore/config/schedule-config-backup` Update scheduled configuration backup

POST `/api/v1/backup-restore/config/schedule-config-backup` Schedules the configuration backup on the ISE node as per the input parameters.

Schemas

<https://developer.cisco.com/docs/identity-services-engine/v1/#!backup-and-restore-open-api>

Why API Contracts Matter

Who you are	Benefits blogs.cisco.com/developer/worldclassapis01
IT Pro or Application Developer consuming APIs	<ul style="list-style-type: none"> • OAS to discover the capabilities of an API • OAS to automatically generate client code for your preferred language • OAS as a pivot format to import/export API definitions across tools
Engineering group publishing internal or external-facing APIs BRKDEV-2249 Friday 9:15AM	<ul style="list-style-type: none"> • OAS to define the capabilities offered for your API • OAS to publish low-level SDKs • OAS to publish accurate and interactive documentation • OAS to automate raw API Changelogs • Authoring tools to initiate/edit OAS documents (Design-First) • Source code annotations to generate OAS documents (Code-First) • OAS linters to automate design reviews and adoption of REST Guidelines • Static & dynamic analysis of API Security issues including OWASP Top 10
Security and Compliance Officers overseeing every APIs	<ul style="list-style-type: none"> • OAS to maintain an inventory of an organization's APIs • Analysis of OAS documents to identify breaking changes and ensure backward compatibility of existing API Contracts • OAS to ensure compliance of new releases along CI/CD pipelines • OAS to identify zombie & shadow operations via live traffic observations

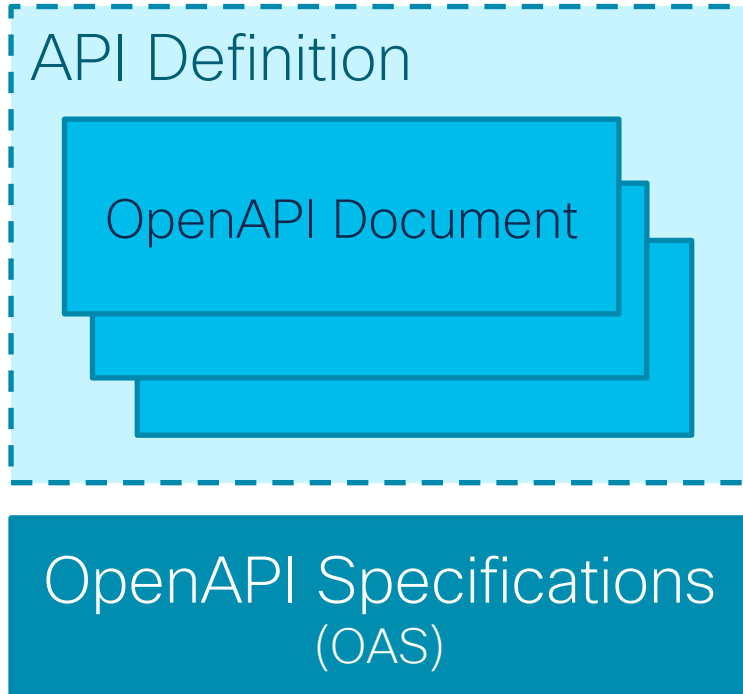
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Why API Contracts Matter



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What is an API Contract

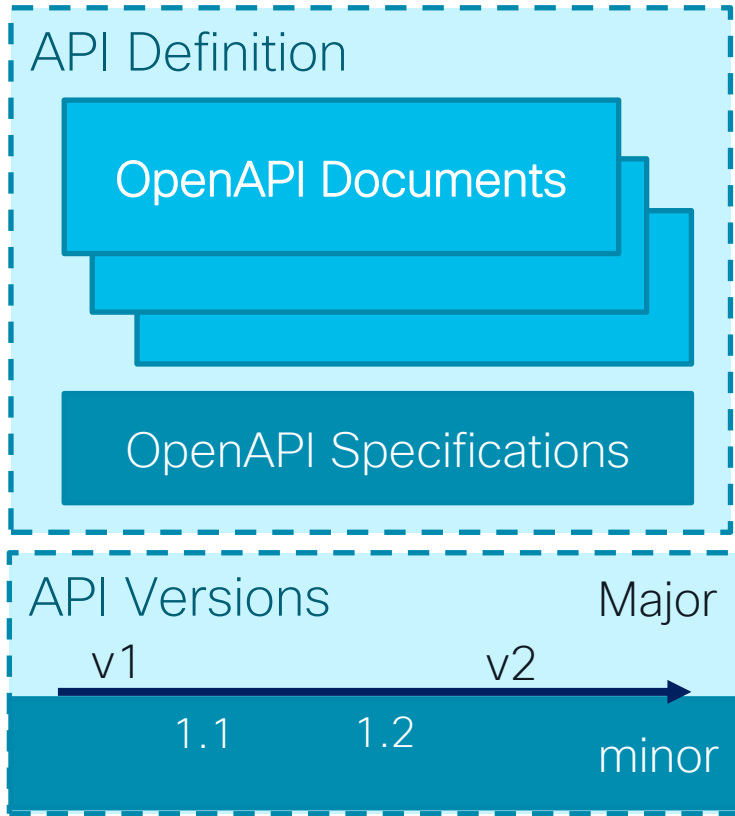


An **API Definition** describes the full contract for an API.

An **OpenAPI document** contains the description of the full set or a subset of the API features.

The **OpenAPI Specification** is a programming language-agnostic standard used to describe the contract for HTTP/REST APIs

API Contract: Definition and Lifecycle for an API



An **API Definition** describes all the operations exposed by an API including incoming/outgoing payloads.

An **OpenAPI document** contains the description of the full set or a subset of the API features.

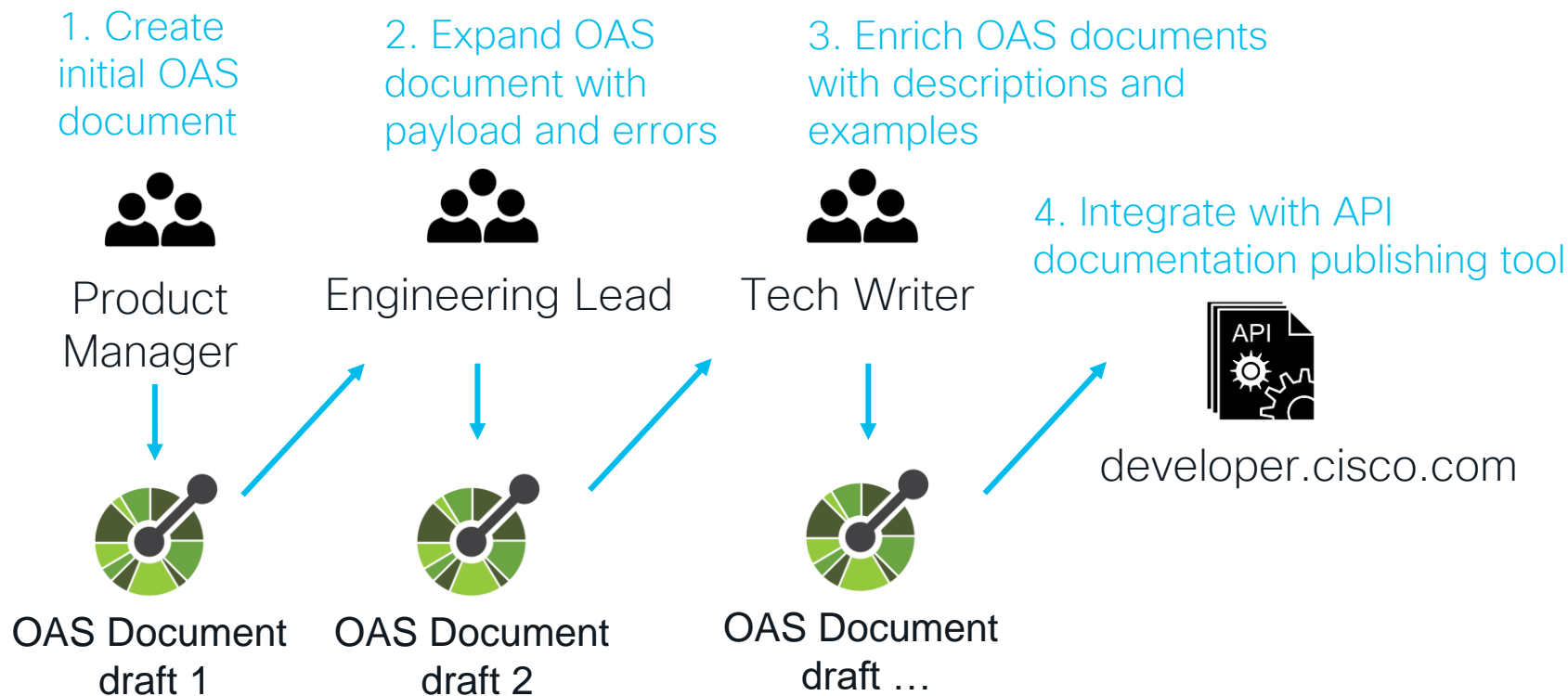
The **OpenAPI Specification** is a standard used to describe contracts for HTTP/REST APIs

API Changelog
Backward Compatibility across minor versions

API Guidelines

- An API is a **network programmatic interface that a product** – may be bare metal hardware, or virtual machine or software – AND – may be cloud or on-premises – **publishes**.
- It has **versions** – it's the API lifecycle
- **For every update, an API would publish its contract** as one or multiple OpenAPI documents for download or online browsing.
- Every API version provides a documentation which includes authentication instructions, developer guides, code samples and reference documentation... and an API changelog.

OAS Document Lifecycle



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History for openapi / openapi / spec2.json

Commits on Jan 4, 2023

API version 1.29.0

Meraki committed last month

Commits on Dec 7, 2022

API version 1.28.0

Meraki committed on Dec 7, 2022

Commits on Nov 2, 2022

API version 1.27.0

Meraki committed on Nov 2, 2022

Commits on Oct 5, 2022

API version 1.26.0

Meraki committed on Oct 5, 2022

OAS Documents Static Analysis

Detecting Quality or Security Faults

```
19
20 paths:
21   /pet:
22     post:
23
24       summary: Add a new pet to the store
25       description: ''
26       operationId: addPet
27       requestBody:
28         $ref: '#/components/requestBodies/Pet'
29       responses:
30         '405':
31           description: Invalid input
32       security:
33         - petstore_auth:
34           - write:pets
35           - read:pets
```

PROBLEMS 9 OUTPUT DEBUG CONSOLE TERMINAL JUPYTER Filter (e.g. text, **/*.ts, !**/node_modules/**)

! mini_petstore_v3.yaml 9

- ⚠ Operation "description" must be present and non-empty string. spectral(operation-description) [Ln 25, Col 20]
- ⚠ Operation must have at least one "2xx" or "3xx" response. spectral(operation-success-response) [Ln 29, Col 17]
- ⚠ Operation "description" must be present and non-empty string. spectral(operation-description) [Ln 42, Col 20]
- ⚠ Operation must have at least one "2xx" or "3xx" response. spectral(operation-success-response) [Ln 46, Col 17]

Ln 19, Col 2

Spectral, an Open Source JSON/YAML Linter



+ Added: GET /catalogue/personalize

~ Modified: GET /catalogue/{id} Breaking

Parameters:

Modified: id in path

catalogue id

Code Diff

```
1 {
2   "description": "get",
3   "operationId": "Get-an-item",
4   "parameters": [
5     {
6       "description": "catalogue id",
7       "in": "path",
8       "maxLength": 255,
9       "minLength": 1,
10      "name": "id",
11      "pattern": "[^/]*",
12      "required": true,
13      "type": "string"
14    }
15  ],
16  ...
17 }
```

API Changelog

- one operation added
- one breaking change detected

```
1 {
2   "description": "get",
3   "operationId": "Get-an-item",
4   "parameters": [
5     {
6       "description": "catalogue id",
7+      "format": "double",
8       "in": "path",
9+      "maximum": 255,
10+      "minimum": 1,
11      "name": "id",
12      "required": true,
13+      "type": "number"
14    }
15  ],
16  ...
17 }
```

API Insights

Organization Dashboard

+ Add New Service

DevRel Store

Legend



> 90 Excellent



80-89 Very Good



70-79 Good



60-69 At Risk



50-59 Warning



1-49 Alert

100

Catalogue Demo API v0.1 r2

Updated At Jun 06, 20:07



Catalogue microservice for DevRel Store demo application

87

Cart Demo API v0.0 r2

Updated At Jun 06, 02:48



Cart microservice for DevRel Store demo application

<https://developer.cisco.com/api-insights/>

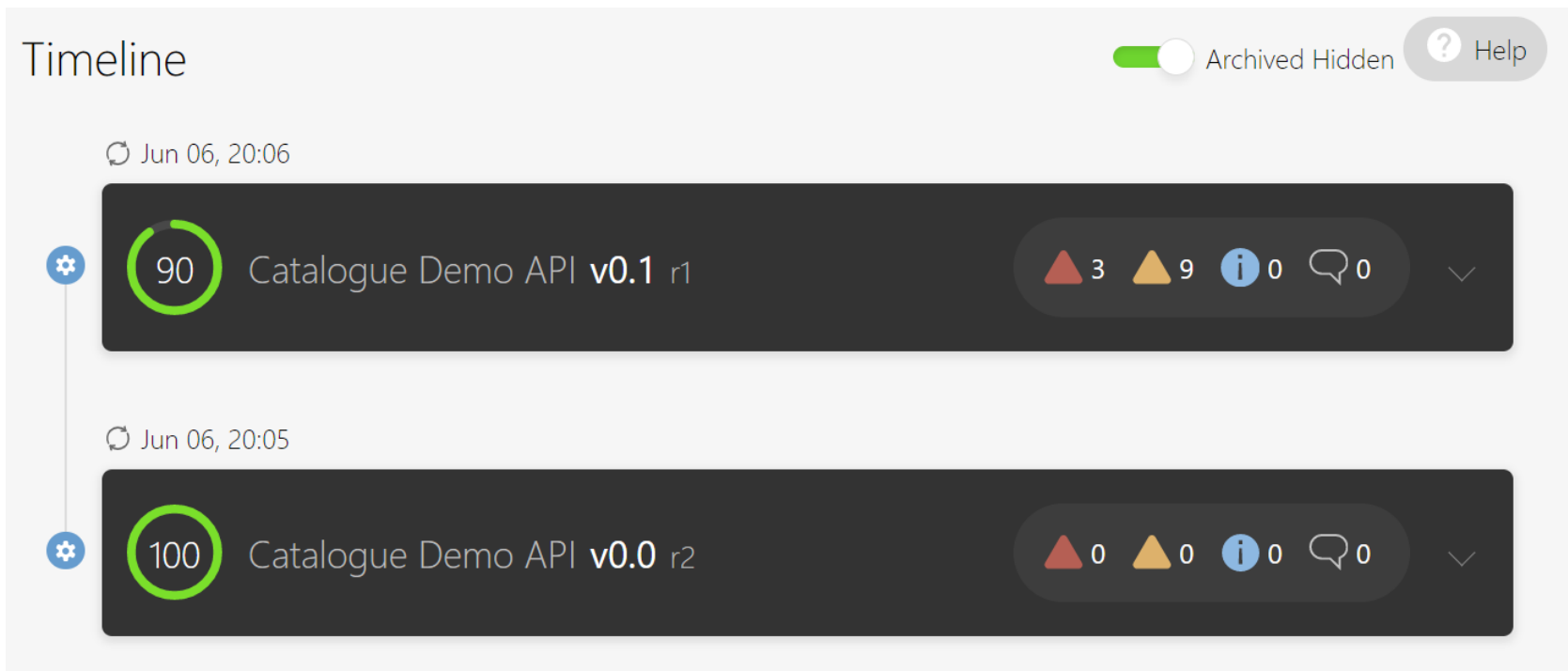
engineering@merchandiseshop.com

https://cs.co/devrel-wear-demo

engineering@merchandiseshop.com

https://cs.co/devrel-wear-demo

Lifecycle of OpenAPI Documents



🔧 Analyzing spec v0.1 r1

for compliance with ☒ Completeness ☒ REST Guidelines ☒ Security ☒ Inclusive Language

🔴 3 Error 🟡 9 Warning ⓘ 0 Info 💬 0 Hint

API Insights Demo
DevNet Zone
Meet The Developer

Analyzer	Severity▼	Findings	Recommendation
Completeness	🔴 Error	Some operations do not define errors. (Line 483)	Please add an error status code for the items identified.
REST Guidelines	🔴 Error	A 401 status code is returned when authentication fails. (Line 483)	Please add a 401 status code for the items identified.
REST Guidelines	🔴 Error	A 403 status code is returned if a consumer is not authorized to access an operation. (Line 483)	Please add a 403 status code for the items identified.
Inclusive Language	🟡 Warning	The underlying assumption of the whitelist/blacklist metaphor is that white = good and black = bad. Because colors in and of themselves have no predetermined meaning, any meaning we assign to them is cultural: for example, the color red in many Southeast Asian countries is lucky, and is often associated with events like marriages, whereas the color white carries the same connotations in many European countries. In the case of whitelist/blacklist, the terms originate in the publishing industry – one dominated by the USA and England, two countries which participated in slavery and which grapple with their racist legacies to this day. (Line 442)	'blacklist' may be insensitive, use 'denylist', 'blocklist', 'exclusion list' instead

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Evaluating the Quality of API Contracts

Trust



Highly Reliable

(Lifecycle with deprecation notices, complete & accurate definition, complete changelog)



Versioned

(API-specific lifecycle, definition published with large coverage, complete changelog)



Evolving

(Product-tied versions, changelogs and contract may not be complete, ie typically UI-led design)



Unreliable

(Breaking changes, no or partial changelog, typically unstructured or UI-led design)

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Thank you

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