



Building a Composable Enterprise with APIs

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Who am I?



- Member/Committer, Apache Software Foundation
- ~10 years at IBM
- CTO and Co-Founder, WSO2
 - Since 2005
- Open Source
- Integration, APIs, Identity
- PhD in IoT security and privacy

$$e^{i\pi} + 1 = 0$$

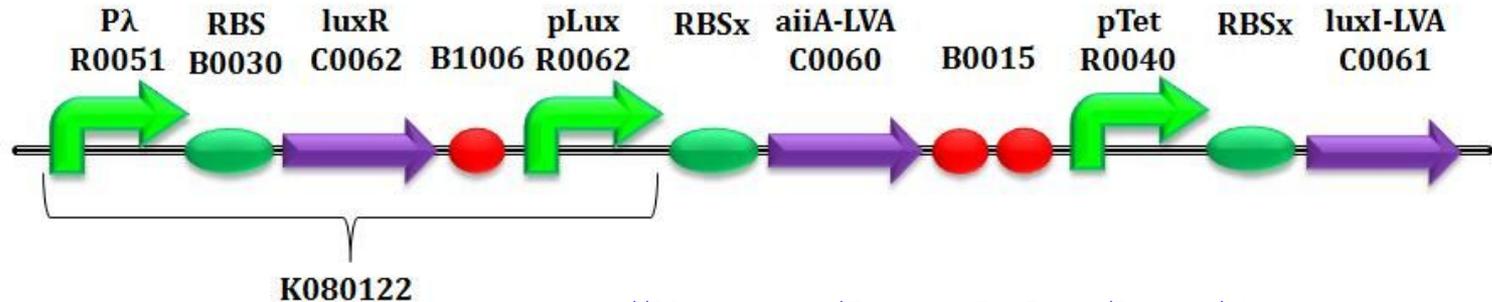
$$E = mc^2$$

$$(1) \quad \frac{d[LuxI]}{dt} = \alpha_{pTet} \cdot \left(\delta_{pTet} + \left(\frac{1 - \delta_{pTet}}{1 + \left(\frac{k_{pTet}}{aTc} \right)^{\eta_{pTet}}} \right) \right) - \left(\gamma_{LuxI} + \mu \cdot \left(\frac{N_{max} - N}{N_{max}} \right) \right) \cdot LuxI;$$

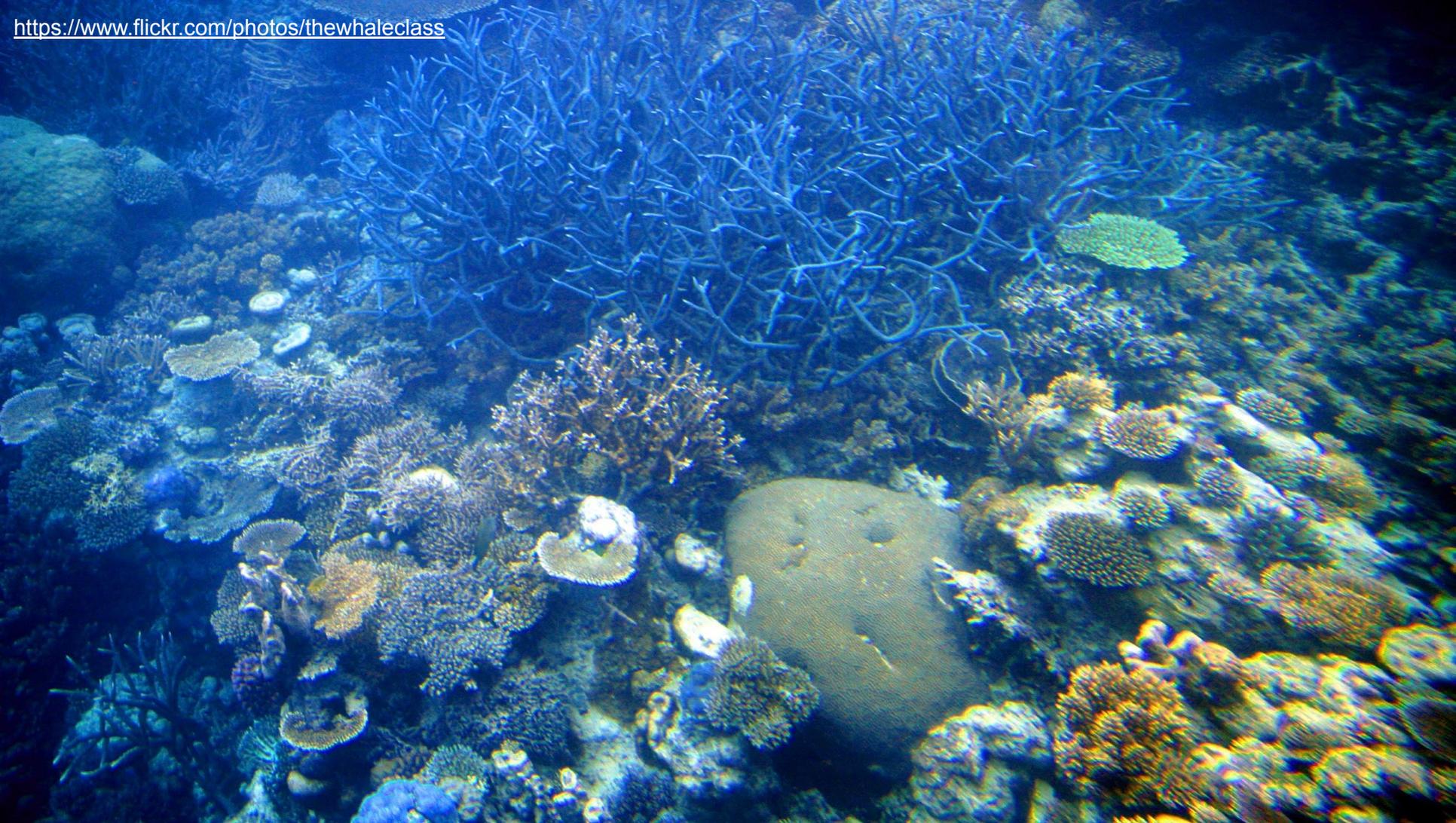
$$(2) \quad \frac{d[AiiA]}{dt} = \alpha_{pLux} \cdot \left(\delta_{pLux} + \left(\frac{1 - \delta_{pLux}}{1 + \left(\frac{k_{pLux}}{HSL} \right)^{\eta_{pLux}}} \right) \right) - \left(\gamma_{AiiA} + \mu \cdot \left(\frac{N_{max} - N}{N_{max}} \right) \right) \cdot AiiA;$$

$$(3) \quad \frac{d[HSL]}{dt} = N \cdot V_{max} \cdot \frac{1}{1 + \frac{k_{M,LuxI}}{LuxI}} - N \cdot \frac{k_{cat} \cdot AiiA \cdot HSL}{k_{M,AiiA} + AiiA} - \gamma_{HSL} \cdot HSL;$$

$$(4) \quad \frac{d[N]}{dt} = \mu \cdot N \cdot \left(\frac{N_{max} - N}{N_{max}} \right);$$



Biology is
fundamentally the
study of
complex systems





ecosystem

/ˈi:kəʊsɪstəm/

noun ECOLOGY

plural noun: **ecosystems**

a biological community of interacting organisms and their physical environment.

"the marine ecosystem of the northern Gulf had suffered irreparable damage"

- (in general use) a complex network or interconnected system.
"Silicon Valley's entrepreneurial ecosystem"

APIs are the
products of the 21st
Century

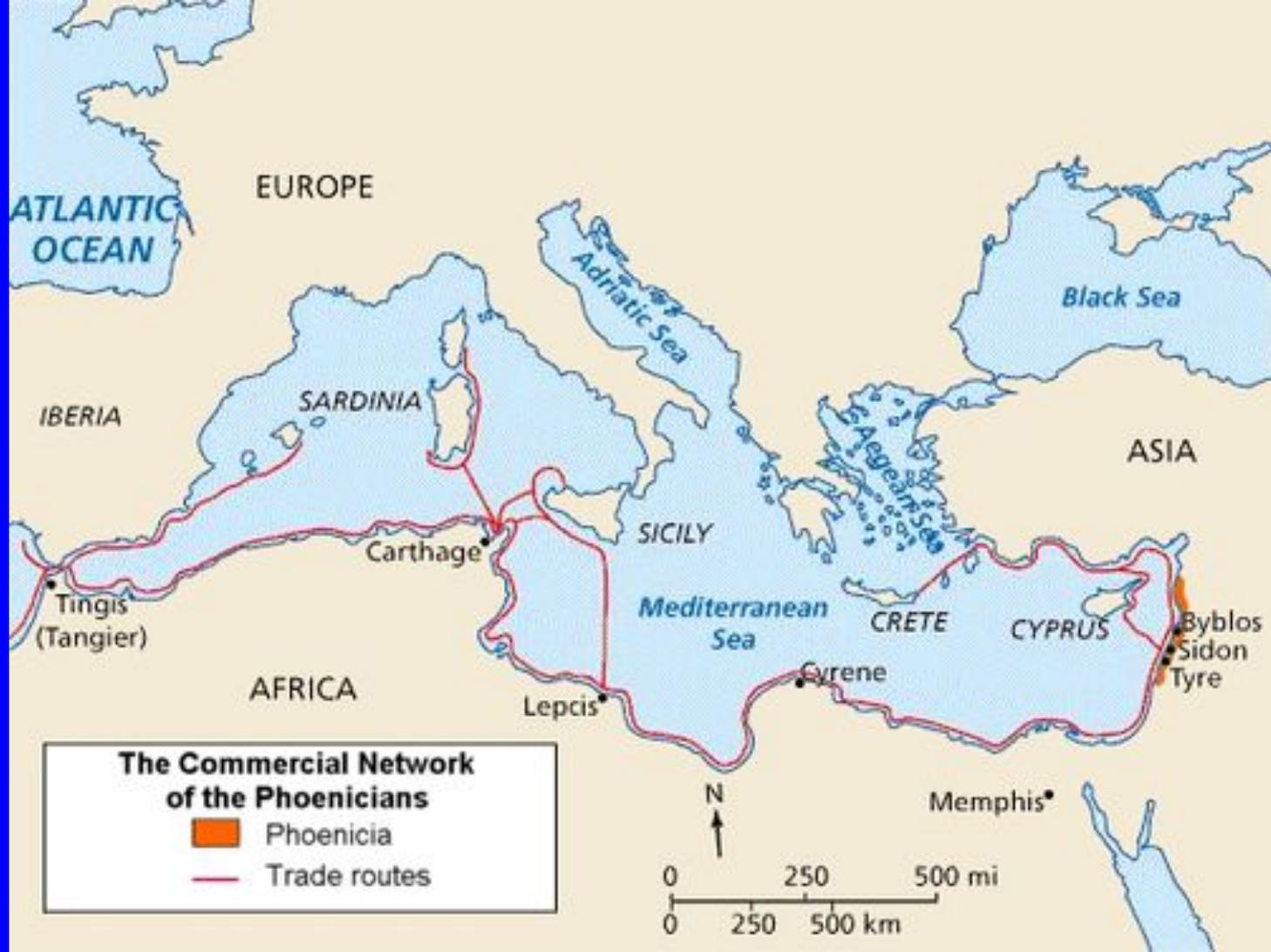






Reproducible,
Fungible,
Reliable





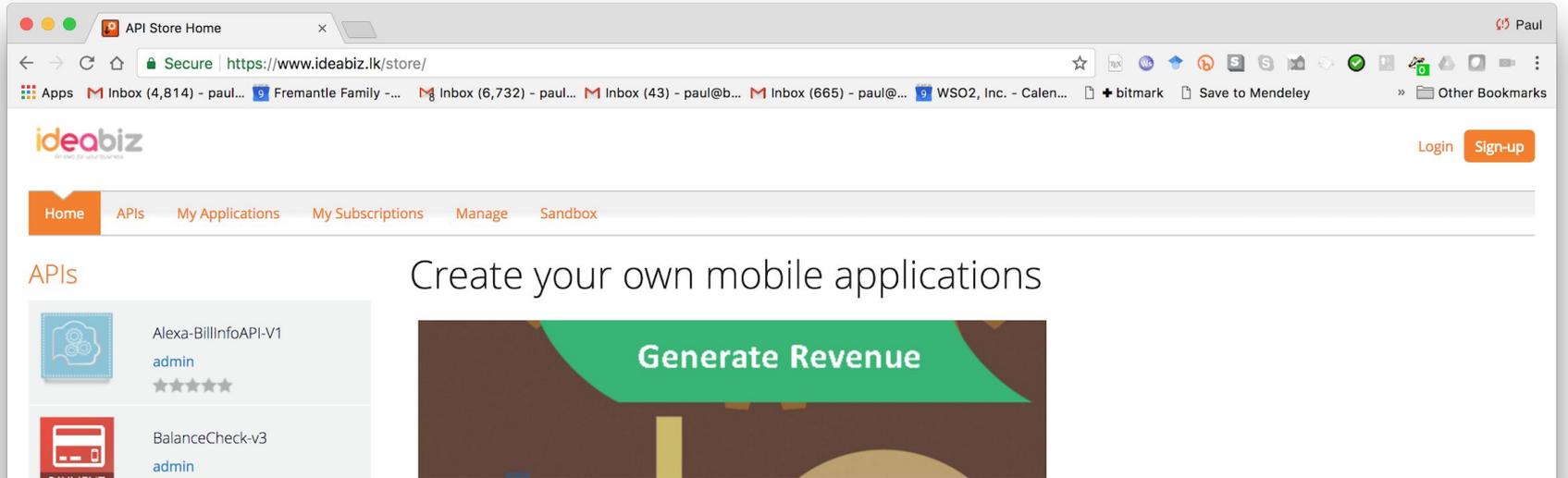


Today, most APIs are direct from producer to consumer

But **not all** APIs are direct from
producer to consumer



IdeaBiz



API Store Home

Secure <https://www.idealbiz.lk/store/>

Apps | Inboxes | Fremantle Family | Inboxes | WS02, Inc. | bitmark | Save to Mendeley | Other Bookmarks

ideabiz

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APIs

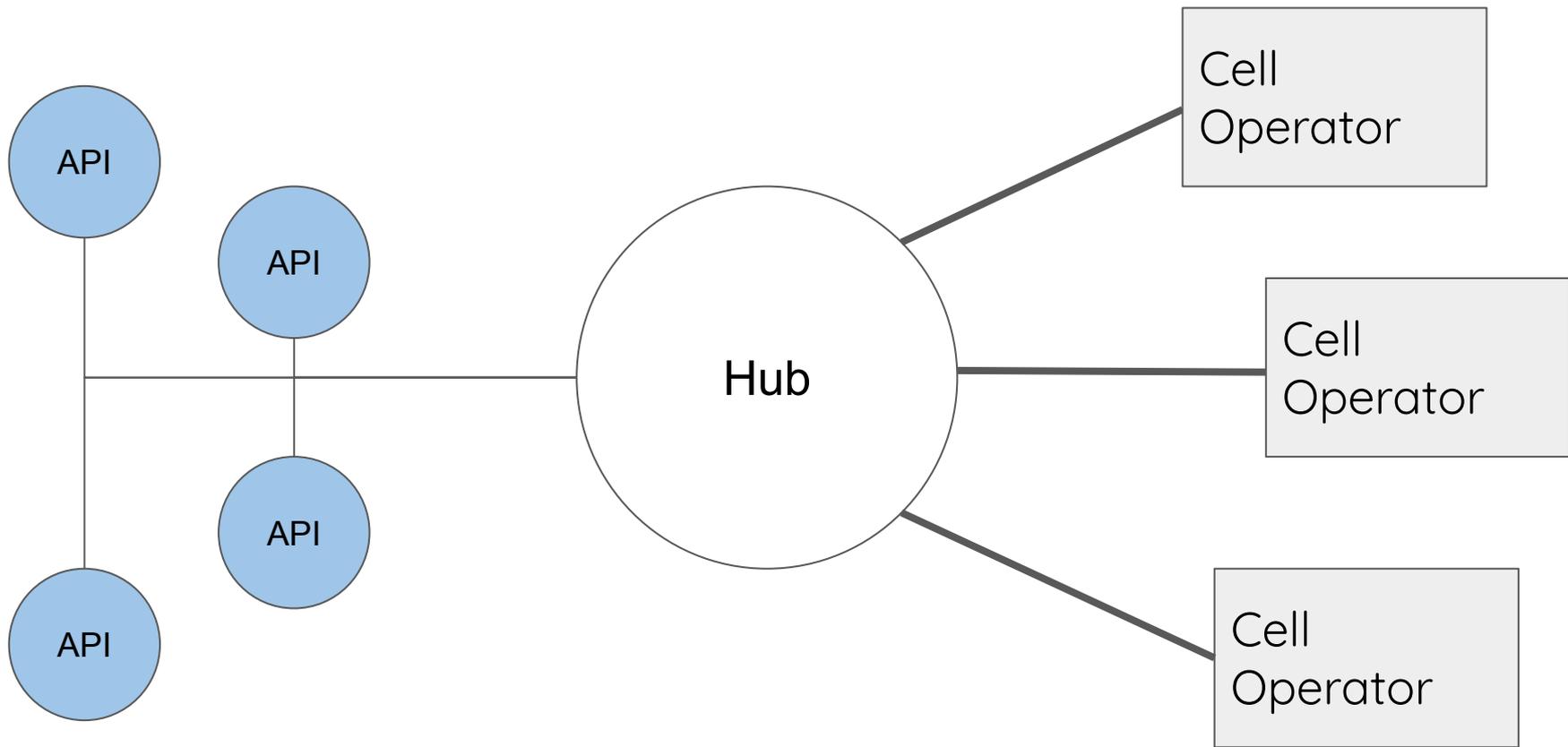
Create your own mobile applications

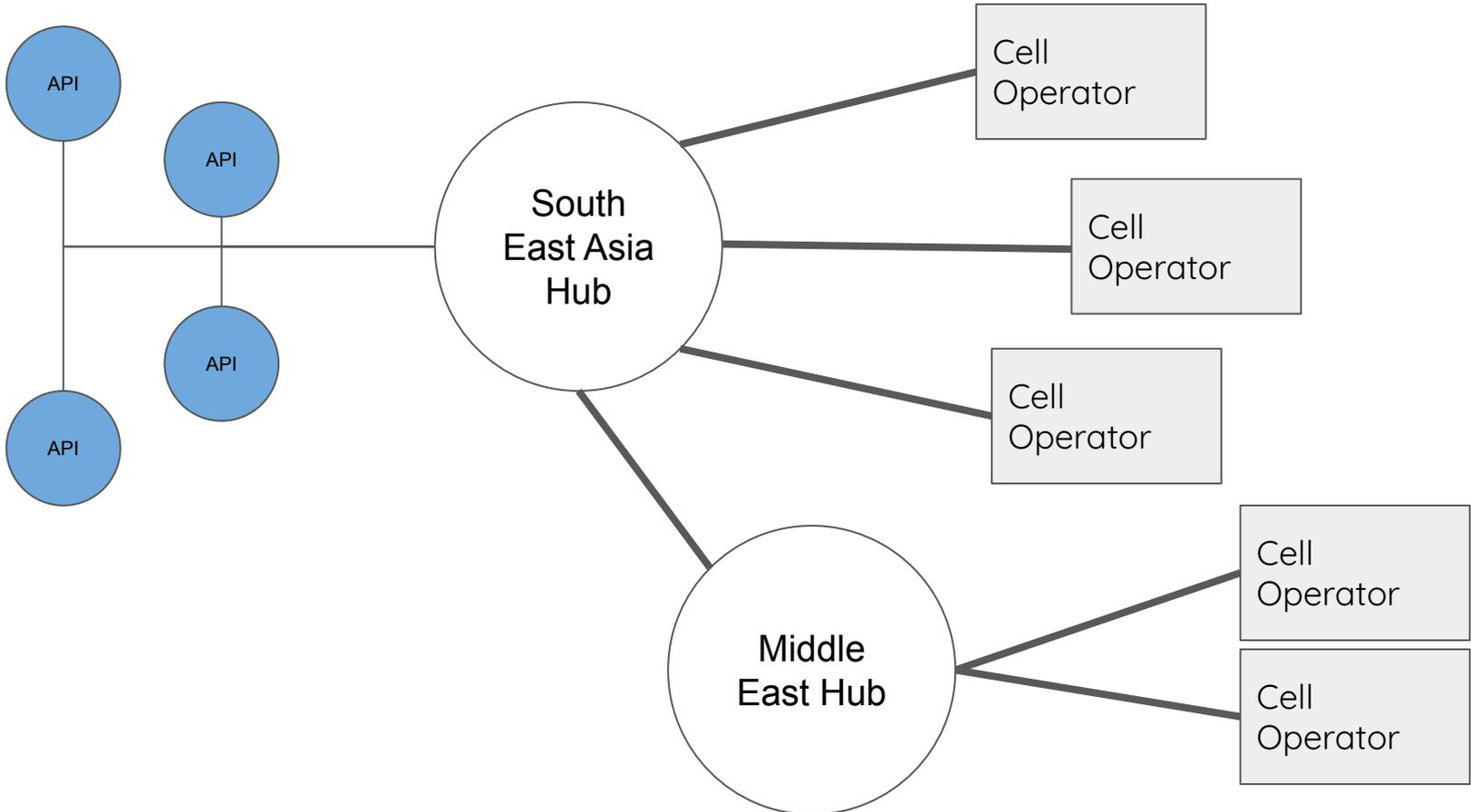
Generate Revenue

Alexa-BillInfoAPI-V1
admin
★★★★★

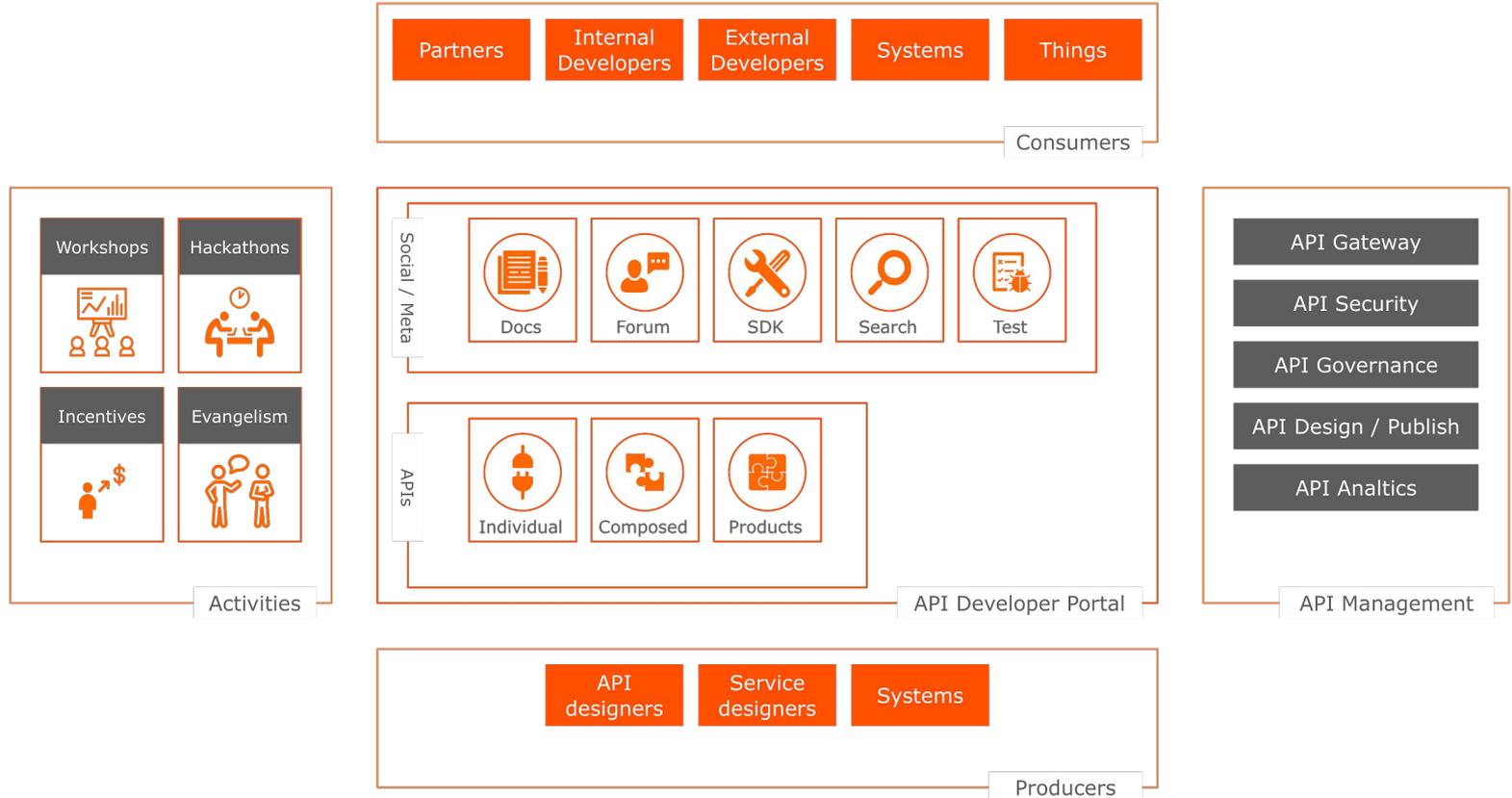
BalanceCheck-v3
admin

In the first 18 months, 2500 developers created 3300 apps





API Marketplaces



Simplified, intuitive and
power packed.
Experience the power of
NEXEN.

User ID

Password

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Our Thinking

BNY Mellon is invested in the power of big ideas. With some of the sharpest minds and most innovative thinkers in financial services, our unique perspectives can have a profound impact on investors' attitudes and actions. Our forward-thinking insights are shaping the future of finance.

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Sunday 8:00 p.m. through Friday 8:00 p.m.
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BNY Mellon

\$33,000,000,000,000

assets in custody

“We want to blur the lines
between our technology and
our customers”

Jonathan Pearl,
Director and Global Head,
NEXEN Platform Management,
BNY Mellon

A long, dimly lit tunnel with a series of lights on the ceiling, receding into the distance. The tunnel has a curved, arched ceiling and walls made of stone or concrete. The floor is dark and reflective. The lights are small and spaced out along the ceiling, creating a perspective effect as they lead the eye towards the end of the tunnel.

APIs are important
internally as well as
externally

The Agile Manifesto

“

The best architectures, requirements, and designs emerge from self-organizing teams.

“

Agile processes promote sustainable development. The sponsors, developers, and users should be able to maintain a constant pace indefinitely.

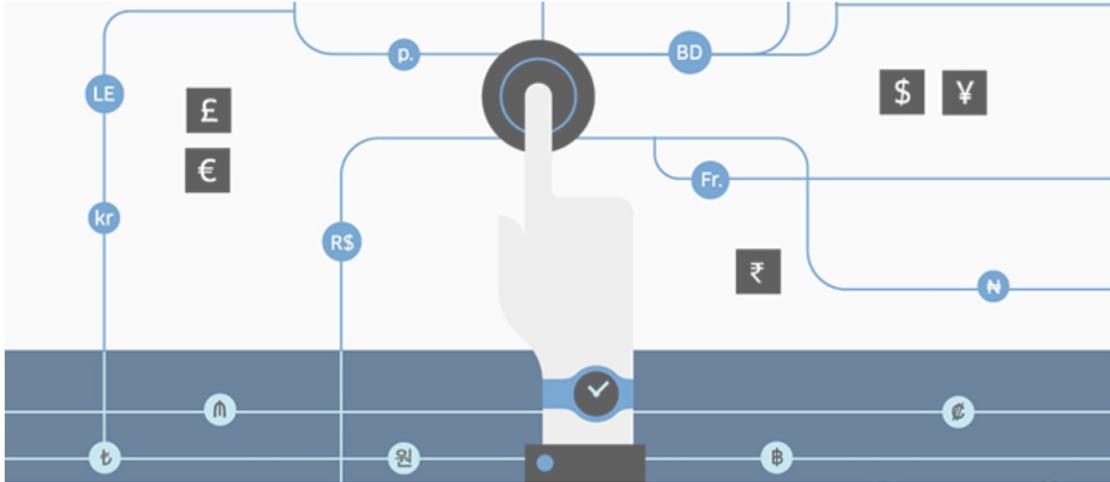
“

Deliver working software frequently with a preference to the shorter timescale.



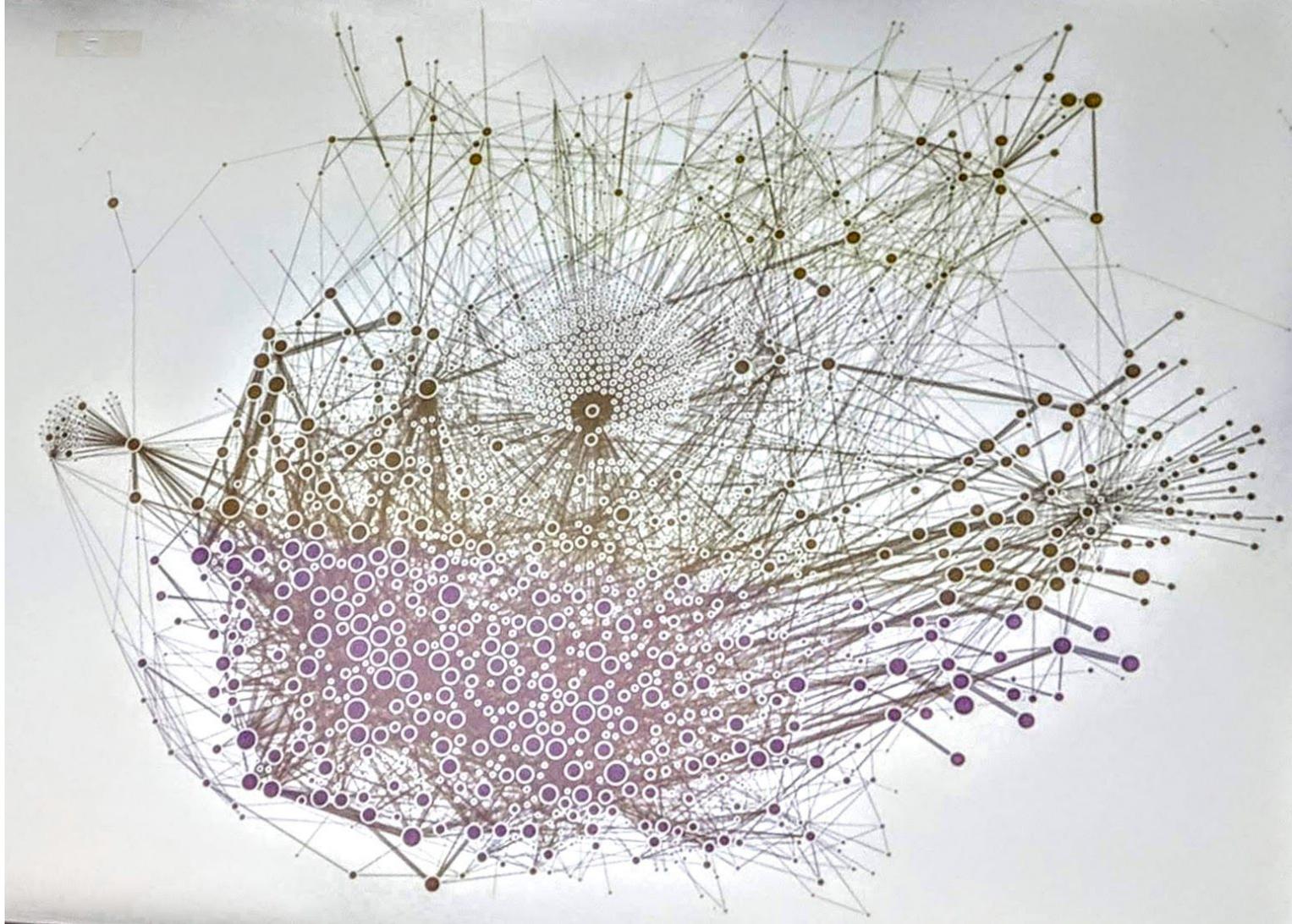
Uber in 2016

“Several hundred microservices”



A few months back, we discussed Uber's decision to [abandon its monolithic codebase in favor of a modular, flexible microservice architecture](#). Since then, we've devoted many thousands of engineering hours to expanding this ecosystem of Uber microservices (several hundred and counting), written in a variety of languages and using many different frameworks. This ongoing refactor is a huge undertaking, so we took the opportunity to adopt a new suite of technologies

Uber in
2019



Why individuals in larger teams perform worse

Jennifer S. Mueller*

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Coordination

ABSTRACT

Research shows that individuals in larger teams perform worse than individuals in smaller teams; however, very little field research examines why. The current study of 212 knowledge workers within 26 teams, ranging from 3 to 19 members in size, employs multi-level modeling to examine the underlying mechanisms. The current investigation expands upon Steiner's (1972) model of individual performance in group contexts identifying one missing element of process loss, namely relational loss. Drawing from the literature on stress and coping, relational loss, a unique form of individual level process, loss occurs when an employee perceives that support is less available in the team as team size increases. In the current study, relational loss mediated the negative relationship between team size and individual performance even when controlling for extrinsic motivation and perceived coordination losses. This suggests that larger teams diminish perceptions of available support which would otherwise buffer stressful experiences and promote performance.

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Conway's Law



Organizations which design systems are constrained to produce designs which are copies of the communication structures of these organizations.



— M. Conway, 1967

Conway's Law



Organizations which design systems are constrained to produce designs which are copies of the communication structures of these organizations.



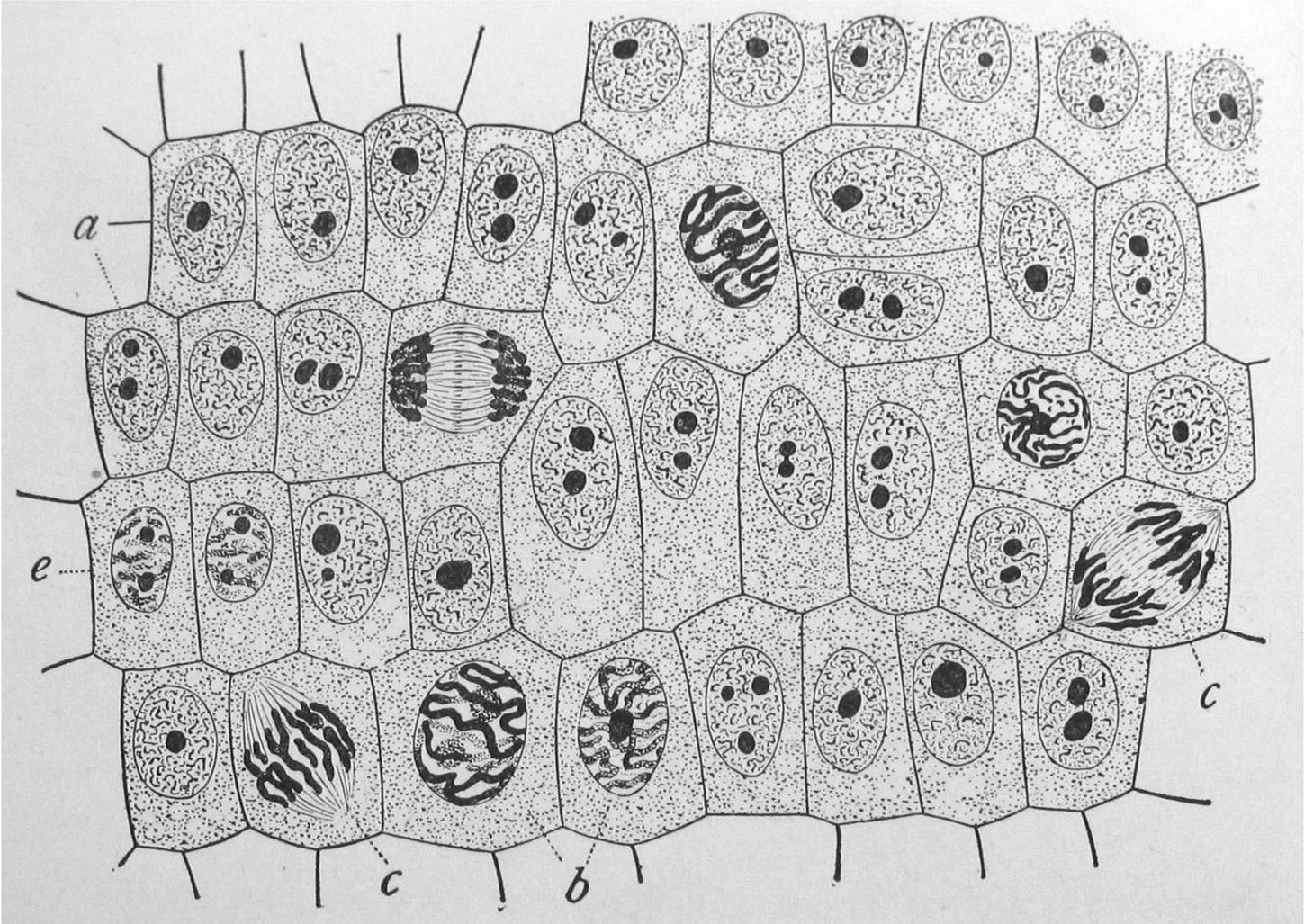
— M. Conway, 1967

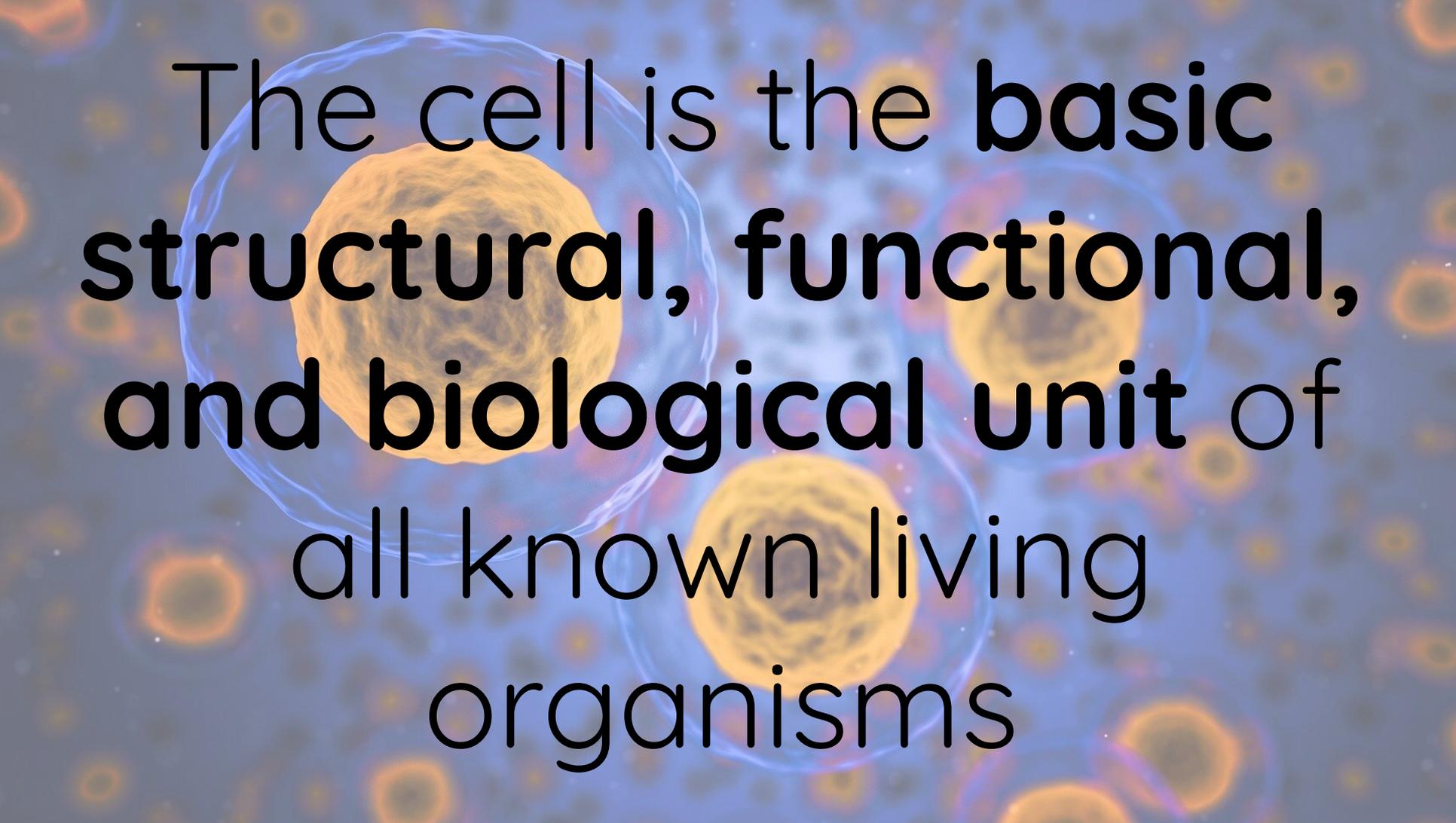
“If you have four groups working on a compiler, you'll end up with a four-pass compiler.”

Eric Raymond

A photograph of a wooden fence in a rural setting. The fence is made of three horizontal rails and vertical posts, with a grapevine growing over the top rail. The background shows a green field, trees, and a hazy horizon. The text "Self-organizing teams need boundaries" is overlaid on the left side of the image.

Self-organizing
teams need
boundaries



The background of the image shows a microscopic view of several cells. A large cell in the center-left is in sharp focus, showing a bright yellow nucleus and a blue cytoplasm. Other cells are visible in the background, some in focus and some blurred, creating a sense of depth. The overall color palette is dominated by blues and yellows.

The cell is the **basic structural, functional, and biological unit** of all known living organisms

Bounded Context and Aggregates

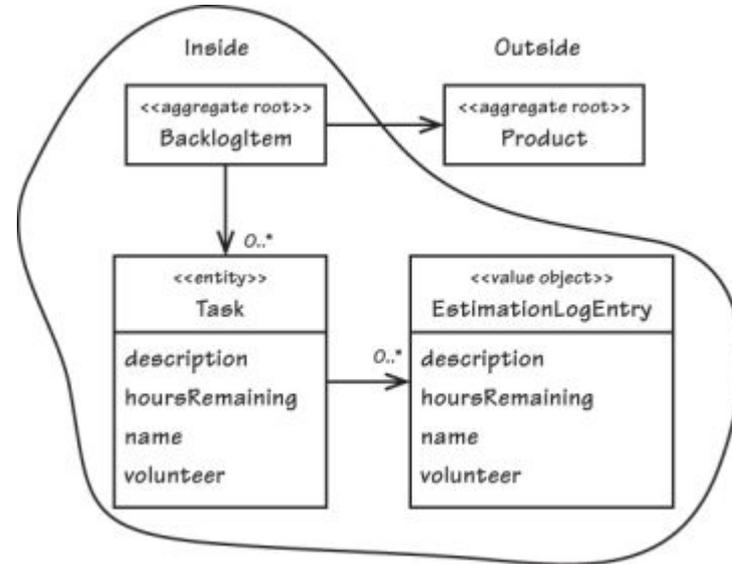
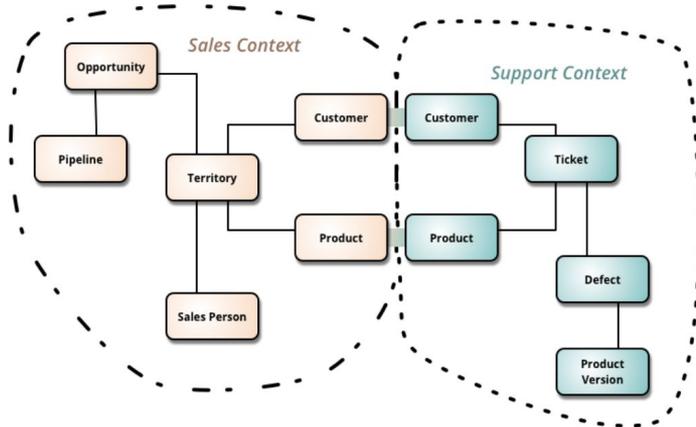
from Domain Driven Design / Eric Evans

BoundedContext



Martin Fowler
15 January 2014

Bounded Context is a central pattern in Domain-Driven Design. It is the focus of DDD's strategic design section which is all about dealing with large models and teams. DDD deals with large models by dividing them into different Bounded Contexts and being explicit about their interrelationships.



Cell-based Reference Architecture

Version Q2-2018

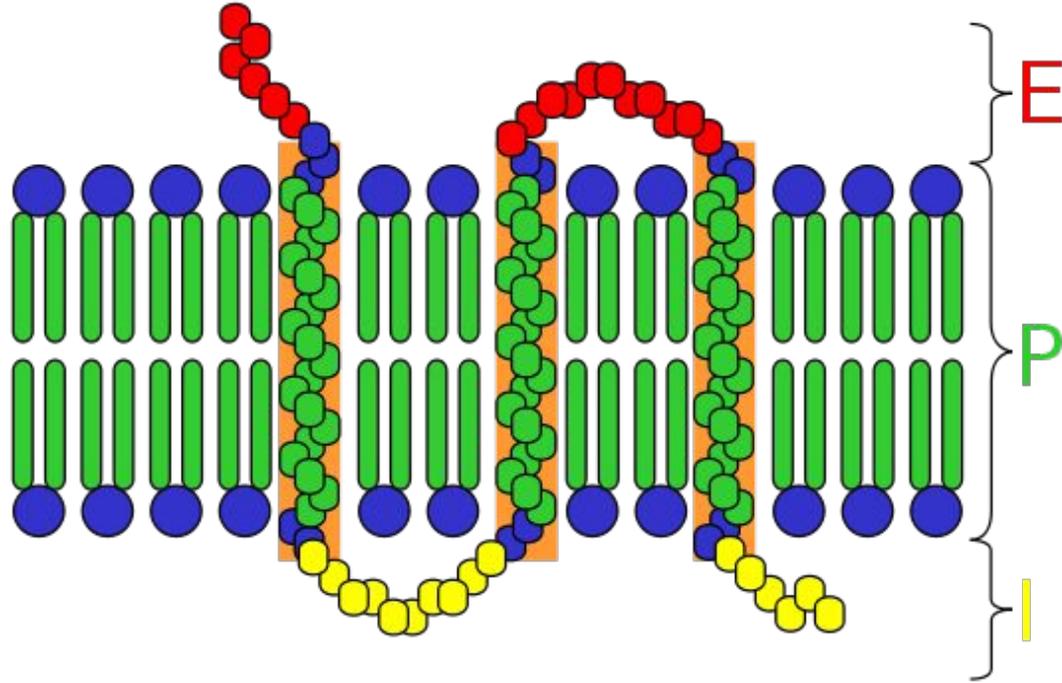
Original Authors

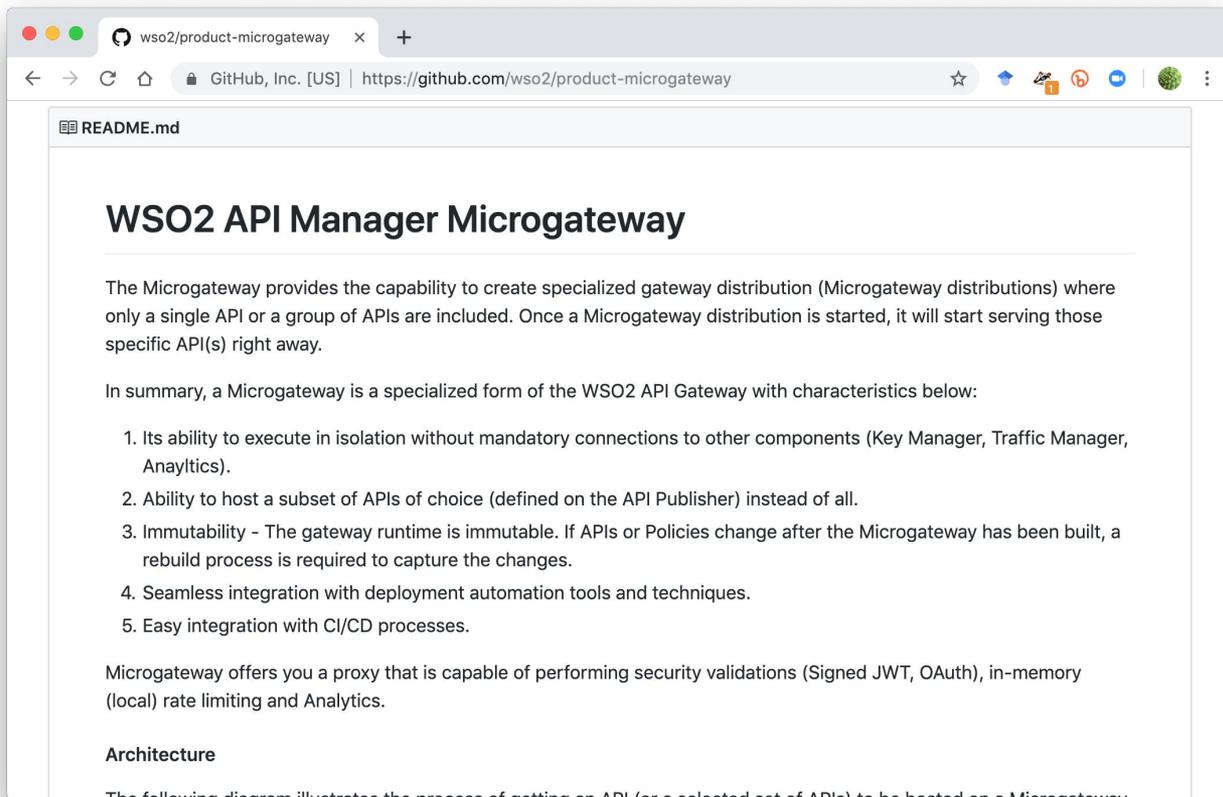
- Asanka Abeysinghe, Vice President, Architecture - CTO Office asankaa@wso2.com
- Paul Fremantle, CTO and Co-Founder paul@wso2.com

This document describes a reference architecture for modern agile digital enterprises. This reference architecture offers a logical architecture based on a disaggregated cloud-based model that can be instantiated to create an effective and agile approach for digital enterprises, deployed in private, public or hybrid cloud environments. In this paper we present the architecture, the approach to applying this architecture, and existing approaches that fit into this architecture. The architecture defined in this paper can be mapped to current architectures as well as used to define new architectures. It is designed to help move from the "as-is" towards the "to-be".

Cell boundaries

Transmembrane receptors and signalling

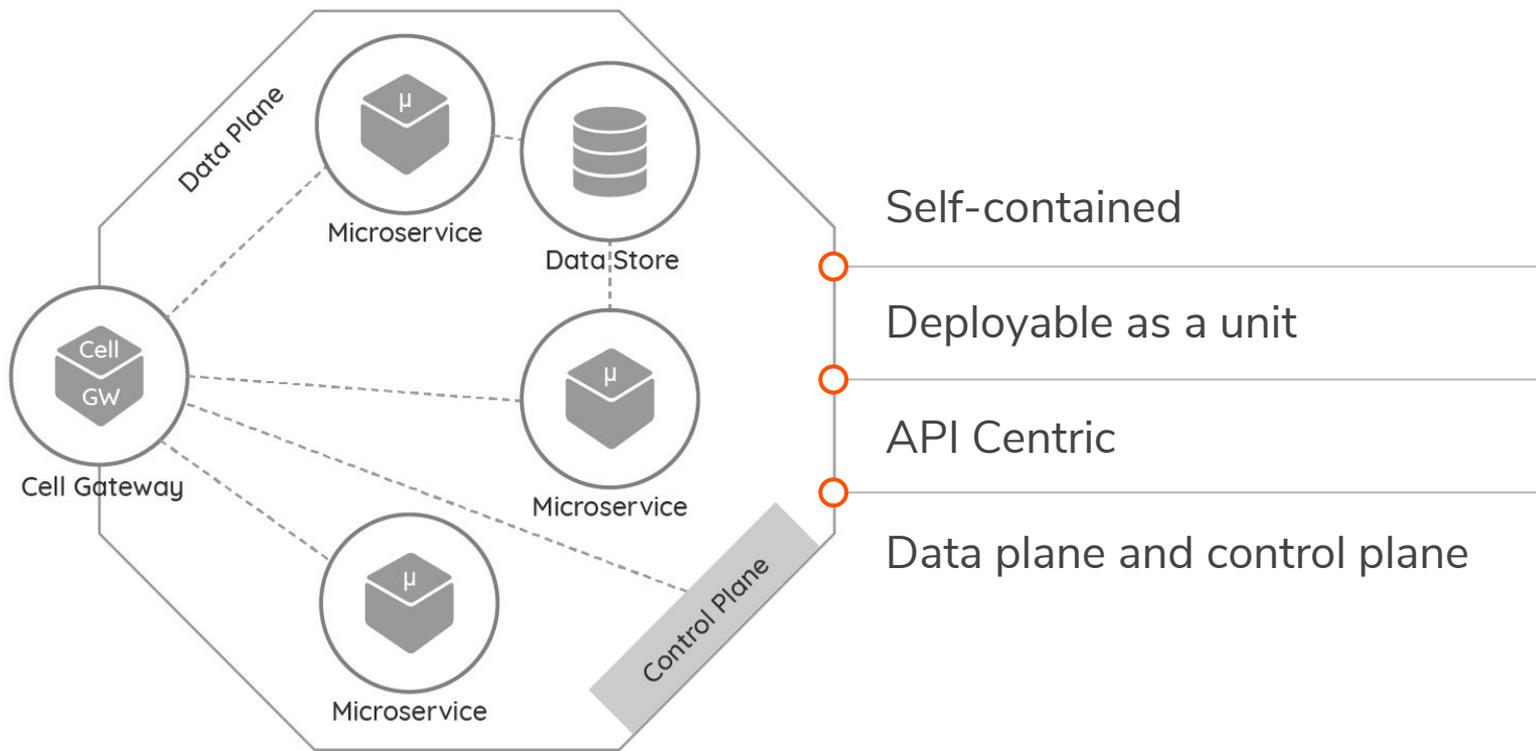




<https://github.com/wso2/product-microgateway>

<https://wso2.com/api-management/api-microgateway/>

Cells are the building blocks of a composable enterprise



<> Code

! Issues 0

🔗 Pull requests 0

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Branch: master ▾

reference-methodology / reference-methodology.md

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asankaa center h1 and added version

c48076d on 10 Dec 2018

1 contributor

259 lines (135 sloc) | 29.8 KB

Raw

Blame

History



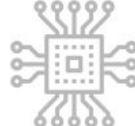
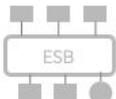
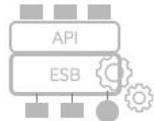
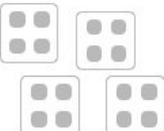
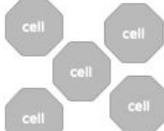
Reference Methodology for Agility

Version Q2-2018

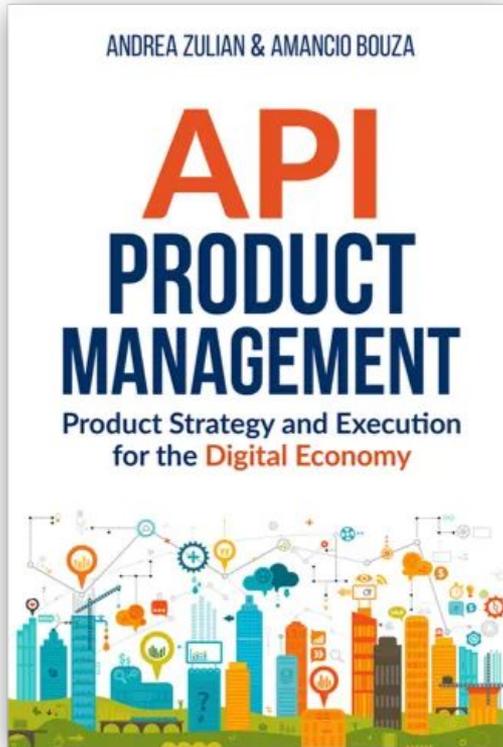
Original Authors

- Asanka Abeysinghe, Vice President - Architecture, CTO Office asankaa@wso2.com
- Paul Fremantle, CTO and Co-Founder paul@wso2.com

This document describes a reference methodology for modern agile digital enterprises. Our goal is to move organizations from the current maturity stage towards the integration agile stage. The outcome of moving higher in

	MONOLITHIC	FAST WATERFALL	API-DRIVEN	EARLY AGILITY	INTEGRATION AGILE		
PEOPLE	<p>Centralized</p> 	<p>COE</p> 	<p>API Teams</p> 	<p>Decentralized</p> 	<p>Self-Organized</p> 		
PROCESS	<p>Waterfall</p> 	<p>Fast Waterfall</p> 	<p>API Iterative</p> 	<p>Semi-Continuous</p> 	<p>Continuous</p> 		
TECHNOLOGY	<p>Silo</p> 	<p>EAI/ESB</p> 	<p>API-Driven</p> 	<p>Early Agility</p> 	<p>Continuous Agility</p> 		
		<p>Layered Architecture</p>		<p>Segmented Architecture</p>		<p>Cell-based Architecture</p>	
DIGITAL ALIGNMENT	<p>Separate</p> 	<p>Ad-hoc</p> 	<p>Early Strategic</p> 	<p>Digital-First</p> 	<p>Adaptive</p> 		

API Product Management



Product Management's Role At Every Phase of the Product Lifecycle





Solutions for health and care

Select the role below to explore Cerner solutions for all your health care needs.



Provider >



Employer >



Patient >



Health Plan >



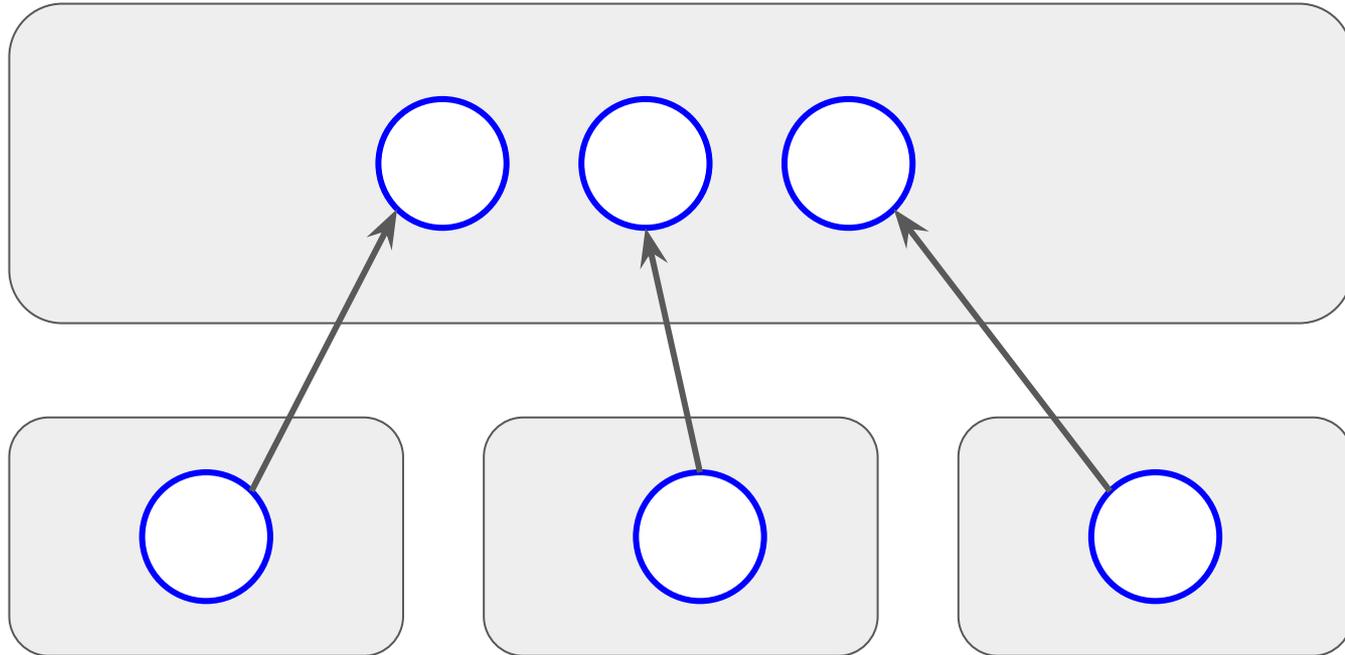
Government >



The interface to a cell needs
to be treated as a
product

5 patterns for API federation

#1. Internal API Marketplace





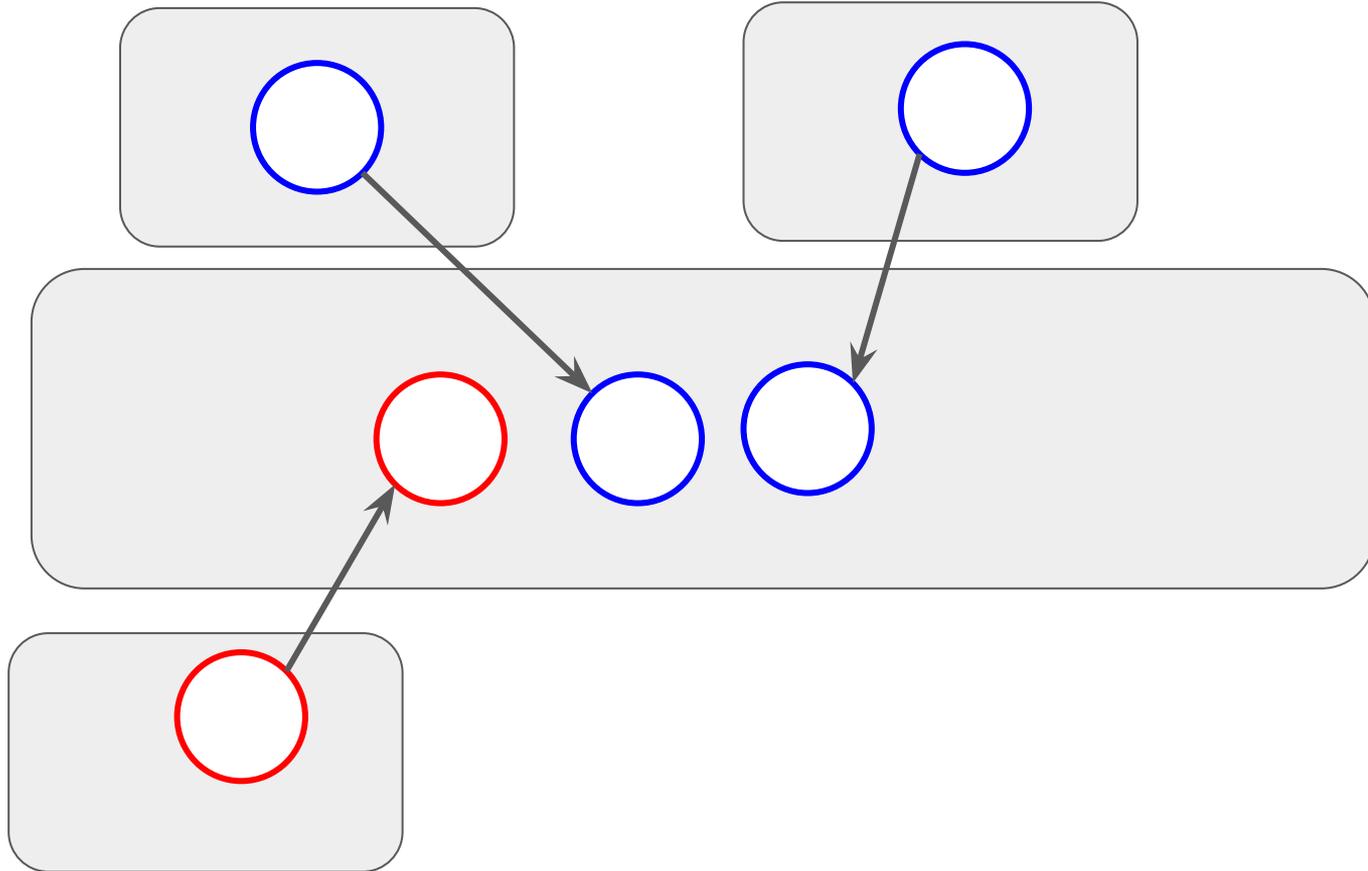
SCANIA

R500

SCANIA

R700

#2. "Partner" Marketplace



Client Access

BNY Mellon provides you with the tools you need to monitor and manage your assets. Through our innovative and intuitive technology, including investment portals, mobile trading platforms, transactional apps and more, you can access assets right at your fingertips.

Alternative Investments

Hedge Fund Clients

Manage and access portfolio and investor level data through reports and downloadable extracts.

[ACCESS HEDGE FUND](#) 

Fund of Hedge Fund Clients

Manage and access portfolio and investor level data through reports and downloadable extracts.

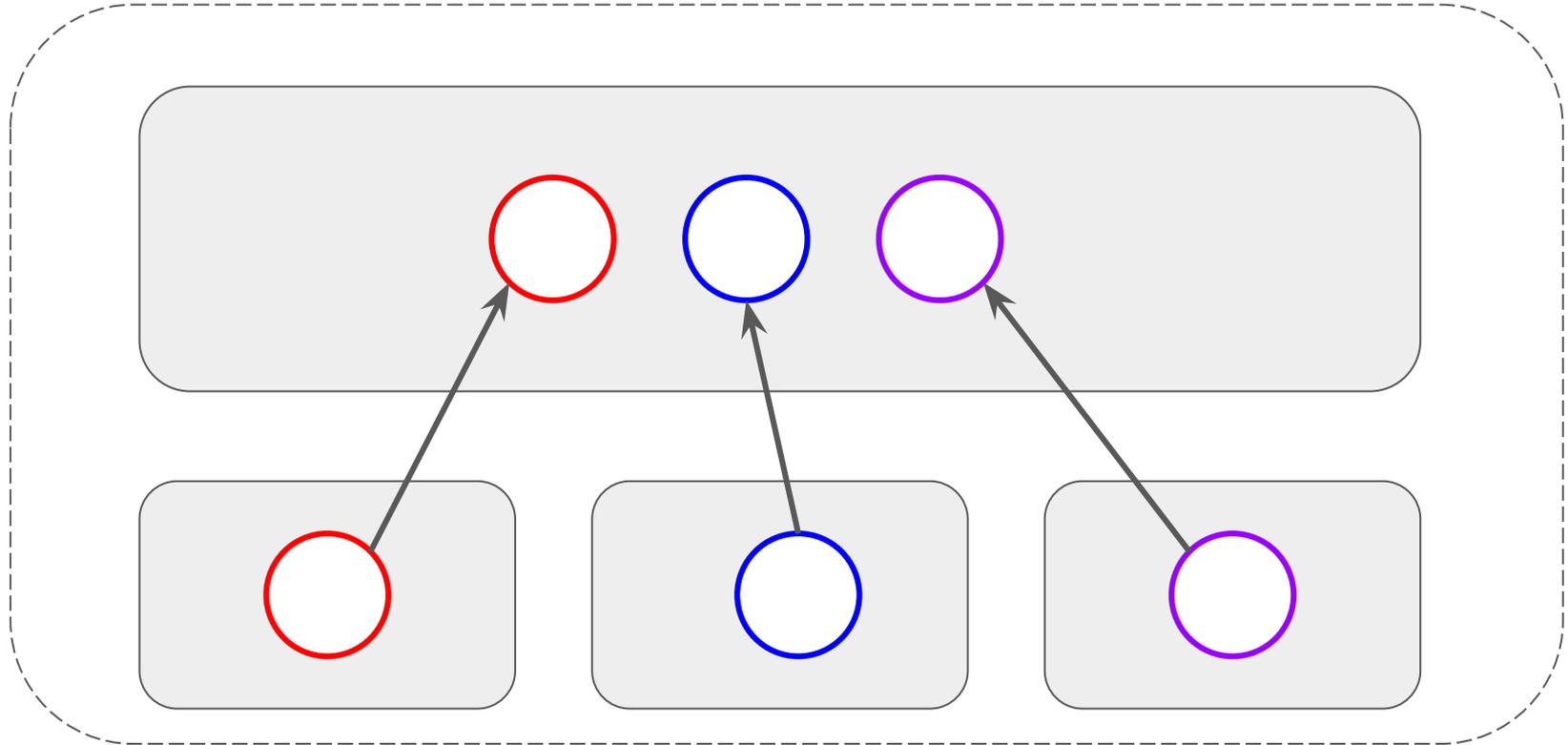
[ACCESS FUND OF HEDGE FUND](#) 

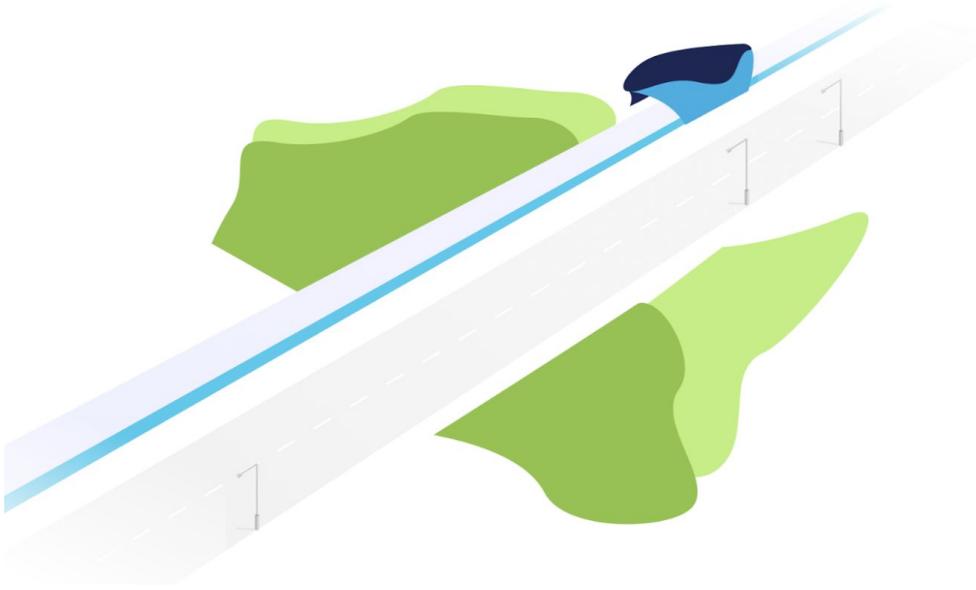
Investors

Easy access to your account information including statements, confirms, NAVs & returns, management letters and company profiles.

[ACCESS INVESTOR](#) 

#3. Closed Group API Marketplace



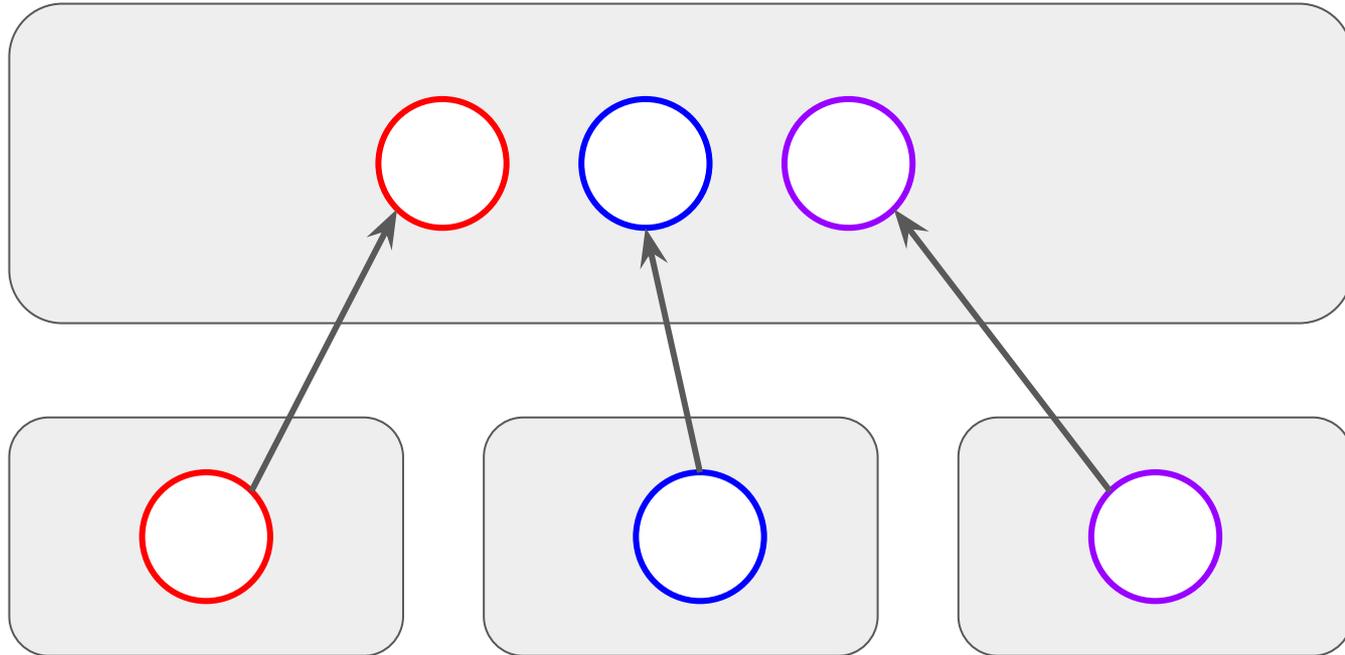


OUR VISION IS TO MAKE DUBAI THE HAPPIEST CITY ON EARTH

OVER THE PAST 40 YEARS,

Dubai's rapid development in various economic sectors meant that traditional processes needed to be continuously updated to ensure efficiency and speed. Government effectiveness became increasingly imperative especially in Government to Consumer (G2C) and Government to Government (G2G) services.

#4. Shared Revenue API Marketplace



API Store Home x Paul

Secure | <https://www.ideabiz.lk/store/>

Apps | [Inbox \(4,814\) - paul...](#) | [Fremantle Family - ...](#) | [Inbox \(6,732\) - paul...](#) | [Inbox \(43\) - paul@b...](#) | [Inbox \(665\) - paul@...](#) | [WSO2, Inc. - Calen...](#) | [bitmark](#) | [Save to Mendeley](#) | [Other Bookmarks](#)

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APIs

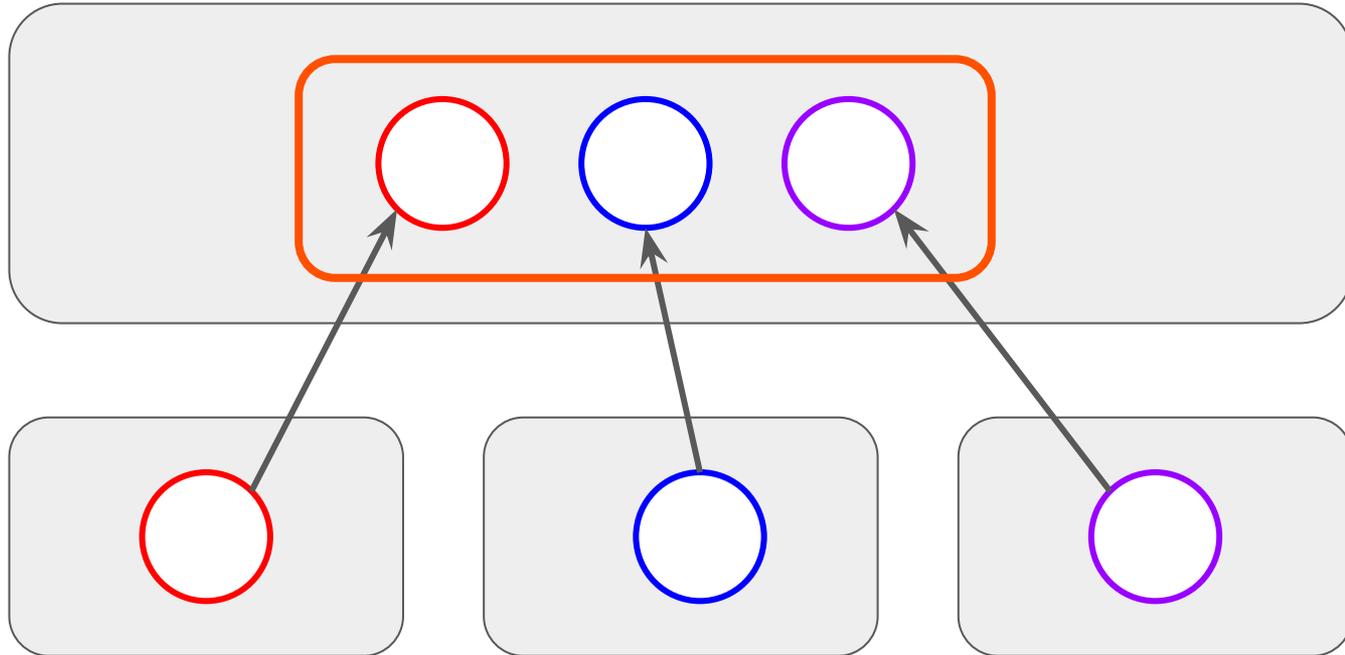
-  **Alexa-BillInfoAPI-V1**
[admin](#)
★★★★★
-  **BalanceCheck-v3**
[admin](#)

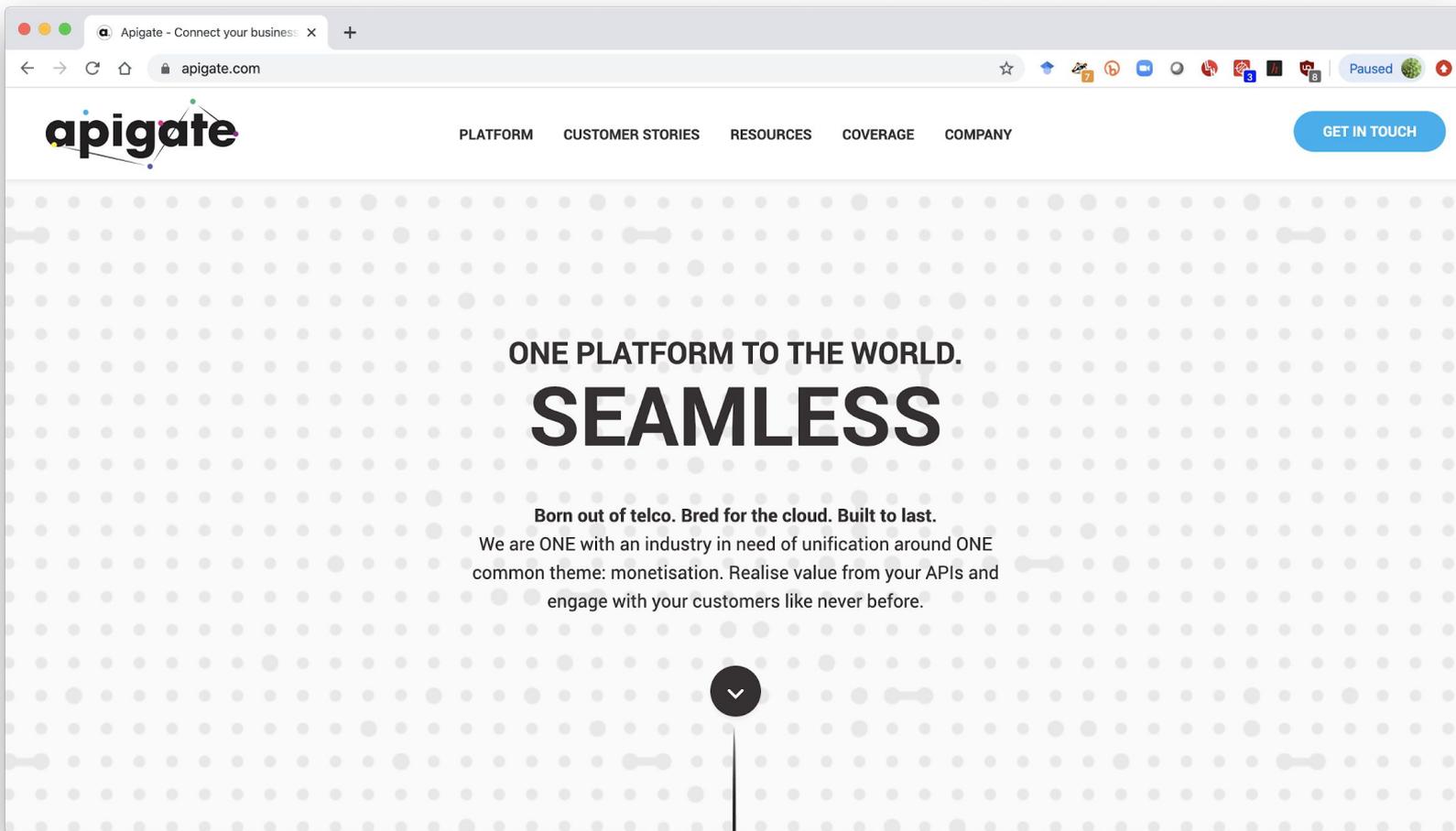
Create your own mobile applications



Generate Revenue

#5. Aggregator API Marketplace





PLATFORM CUSTOMER STORIES RESOURCES COVERAGE COMPANY

GET IN TOUCH

ONE PLATFORM TO THE WORLD.

SEAMLESS

Born out of telco. Bred for the cloud. Built to last.

We are ONE with an industry in need of unification around ONE common theme: monetisation. Realise value from your APIs and engage with your customers like never before.



wso2/product-apim: Welcome to x +

github.com/wso2/product-apim

WSO2 API Manager

build running License Apache 2.0 stackoverflow wso2am slack wso2-apim

WSO2 API Manager (WSO2 API-M) is a powerful platform for creating, managing, consuming, and monitoring web APIs. It combines tried and tested SOA best practices with modern day API management principles to solve a wide range of enterprise challenges associated with API provisioning, governance, and integration.

WSO2 API Manager consists of several loosely coupled modules.

- * API Publisher
- * API Developer Portal
- * API Gateway
- * API Key Manager
- * API Traffic Manager

The API publisher module allows API publishers to easily define APIs and manage them using a strong governance model that consists of well-established concepts such as, versioning and lifecycles. API consumers can use the API Developer Portal to discover published, production-ready APIs and access them in a secure and reliable manner using unique API keys. The built-in API Gateway module provides powerful tools to secure and control the load on individual APIs.

WSO2 API Manager is based on the revolutionary WSO2 Carbon [Middleware a' la carte] framework. All the major features have been developed as reusable Carbon components.

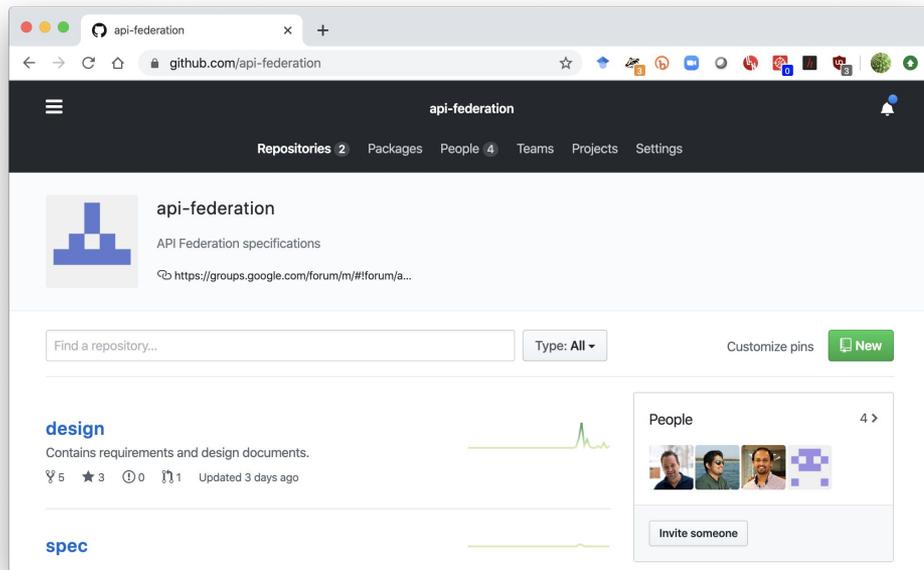
To learn more about WSO2 API Manager please visit <http://wso2.com/products/api-manager>.

Key Features

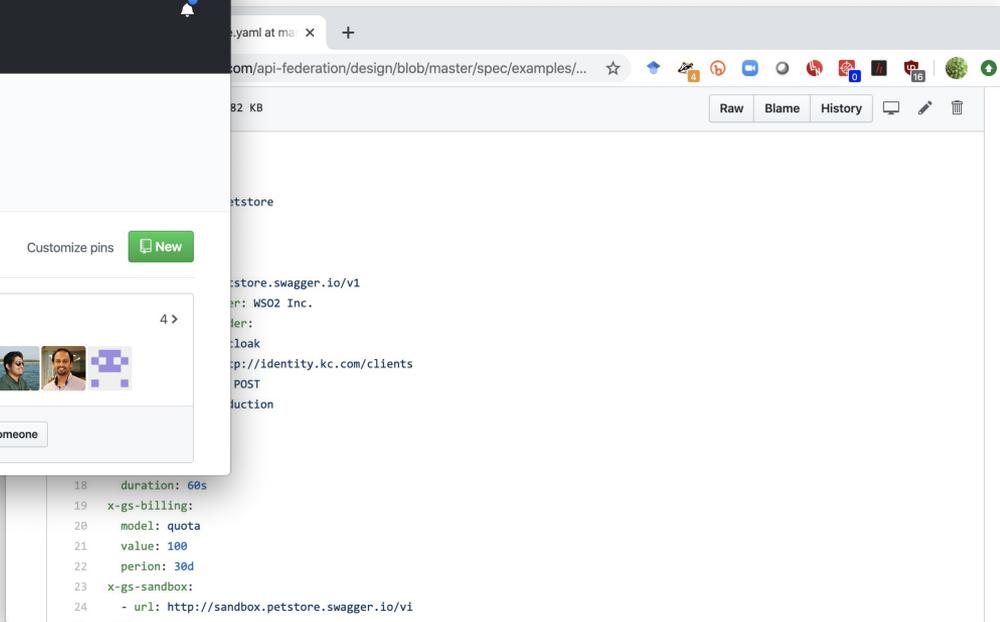
<https://github.com/wso2/product-apim>

API Federation specification group

<https://github.com/api-federation>



The screenshot shows the GitHub repository page for 'api-federation'. The page header includes navigation links for 'Repositories 2', 'Packages', 'People 4', 'Teams', 'Projects', and 'Settings'. The repository name 'api-federation' is displayed with a blue logo and the description 'API Federation specifications'. A link to a Google Group forum is provided: 'https://groups.google.com/forum/m/#forum/a...'. Below this is a search bar for repositories and a 'New' button. The 'design' repository is highlighted, with a description: 'Contains requirements and design documents.' It shows 5 forks, 3 stars, and 0 issues, and was updated 3 days ago. A 'People' section shows 4 contributors and an 'Invite someone' button.



The screenshot shows a GitHub blob page for a file named 'examples/...'. The file size is 82 KB. The page has tabs for 'Raw', 'Blame', and 'History'. The code content is an OpenAPI specification snippet:

```
18 duration: 60s
19 x-gs-billing:
20   model: quota
21   value: 100
22   period: 30d
23 x-gs-sandbox:
24   - url: http://sandbox.petstore.swagger.io/v1
```

“

A number of studies in the last decade have shown that ecosystems that have a high biodiversity - meaning **they are rich in variety of species** - are also highly productive.

”

A federated, cellular
architecture with
API-based products
creates a
Composable Enterprise

Thank you!

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<https://wso2.com>

@pzfreo