

# Building a Composable Enterprise with APIs

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Dr Paul Fremantle

CTO & Co-Founder, WSO2

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# Who am I?



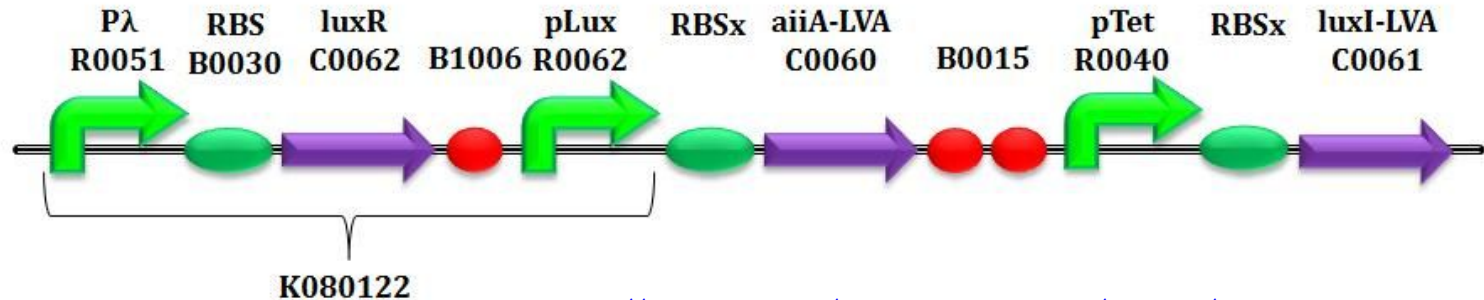
- Member/Committer, Apache Software Foundation
- ~10 years at IBM
- CTO and Co-Founder, WSO2
  - Since 2005
- Open Source
- Integration, APIs, Identity
- PhD in IoT security and privacy

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

$$E = mc^2$$

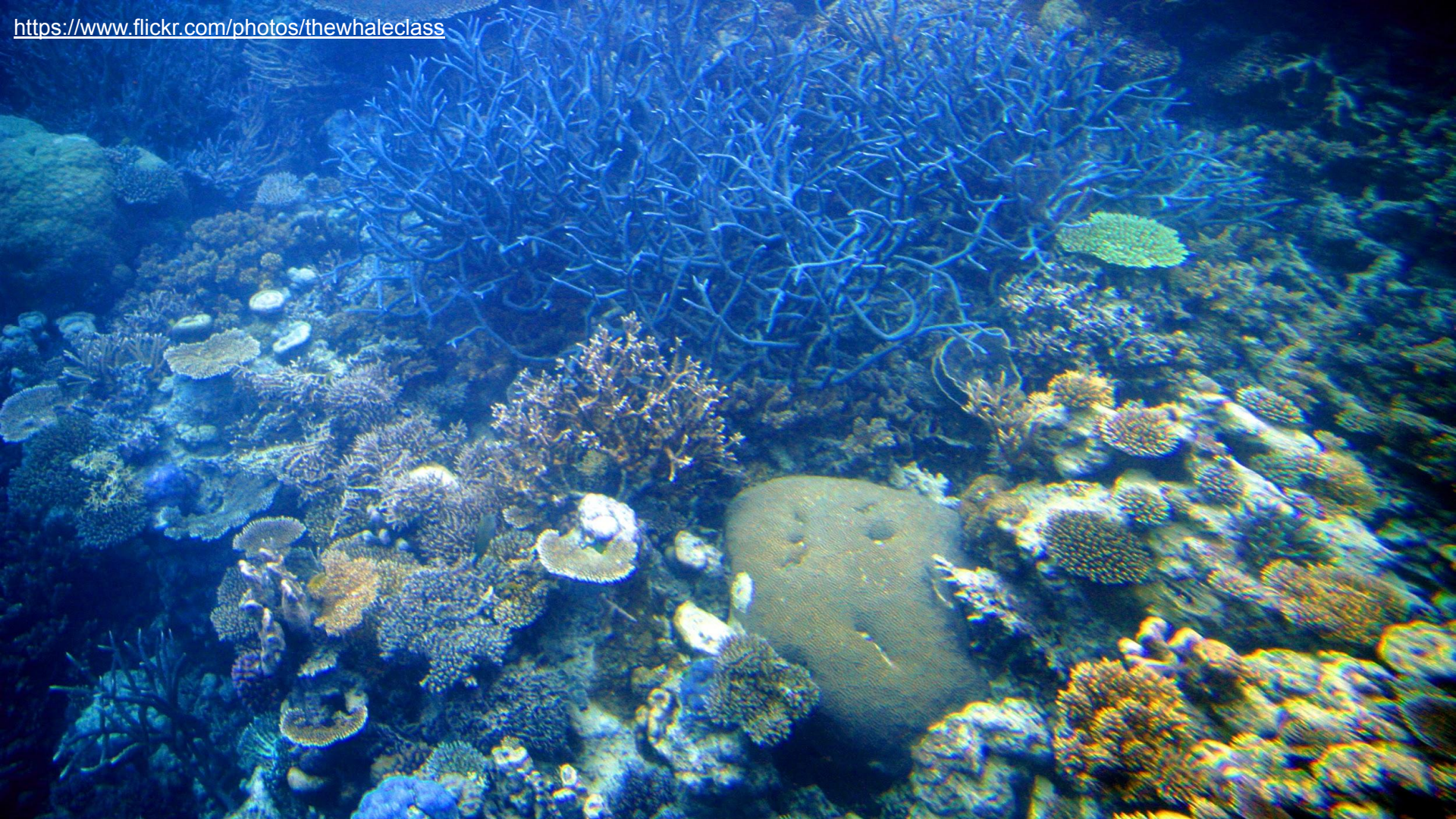


$$\begin{aligned}
 (1) \quad \frac{d[LuxI]}{dt} &= \alpha_{pTet} \cdot \left( \delta_{pTet} + \left( \frac{1 - \delta_{pTet}}{1 + \left( \frac{k_{pTet}}{aTc} \right)^{\eta_{pTet}}} \right) \right) - \left( \gamma_{LuxI} + \mu \cdot \left( \frac{N_{max} - N}{N_{max}} \right) \right) \cdot LuxI; \\
 (2) \quad \frac{d[AiiA]}{dt} &= \alpha_{pLux} \cdot \left( \delta_{pLux} + \left( \frac{1 - \delta_{pLux}}{1 + \left( \frac{k_{pLux}}{HSL} \right)^{\eta_{pLux}}} \right) \right) - \left( \gamma_{AiiA} + \mu \cdot \left( \frac{N_{max} - N}{N_{max}} \right) \right) \cdot AiiA; \\
 (3) \quad \frac{d[HSL]}{dt} &= N \cdot V_{max} \cdot \frac{1}{1 + \frac{k_{M,LuxI}}{LuxI}} - N \cdot \frac{k_{cat} \cdot AiiA \cdot HSL}{k_{M,AiiA} + AiiA} - \gamma_{HSL} \cdot HSL; \\
 (4) \quad \frac{d[N]}{dt} &= \mu \cdot N \cdot \left( \frac{N_{max} - N}{N_{max}} \right);
 \end{aligned}$$



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









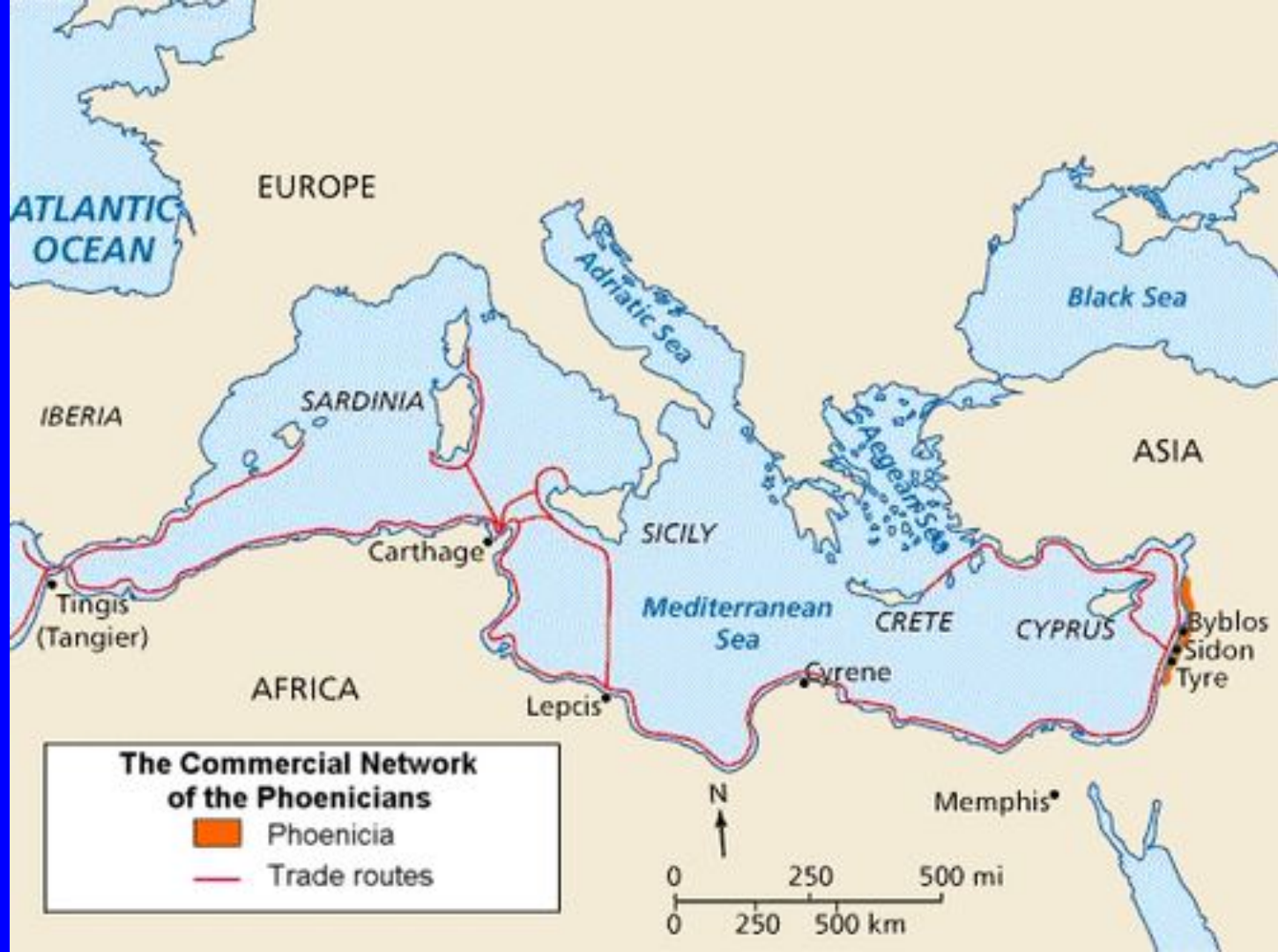


Reproducible,  
Fungible,  
Reliable











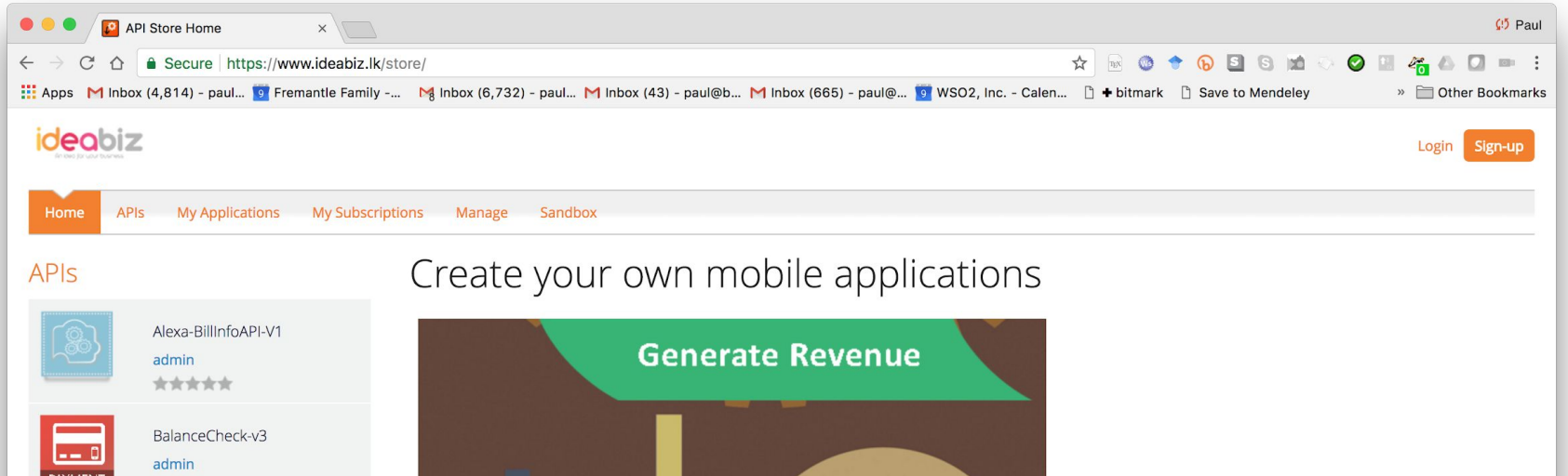
Today, most  
APIs are direct  
from producer  
to consumer



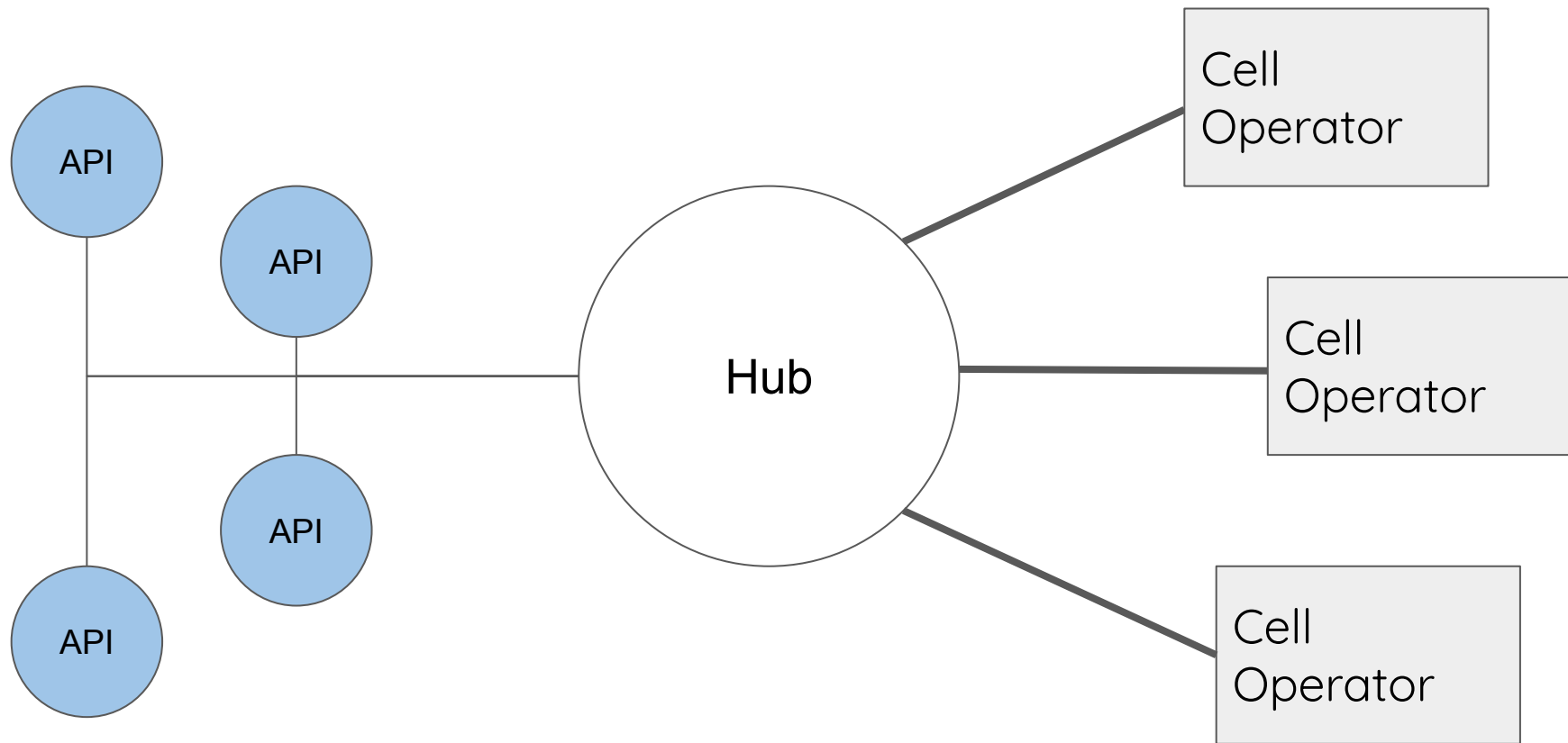
But **not all** APIs are direct from  
producer to consumer

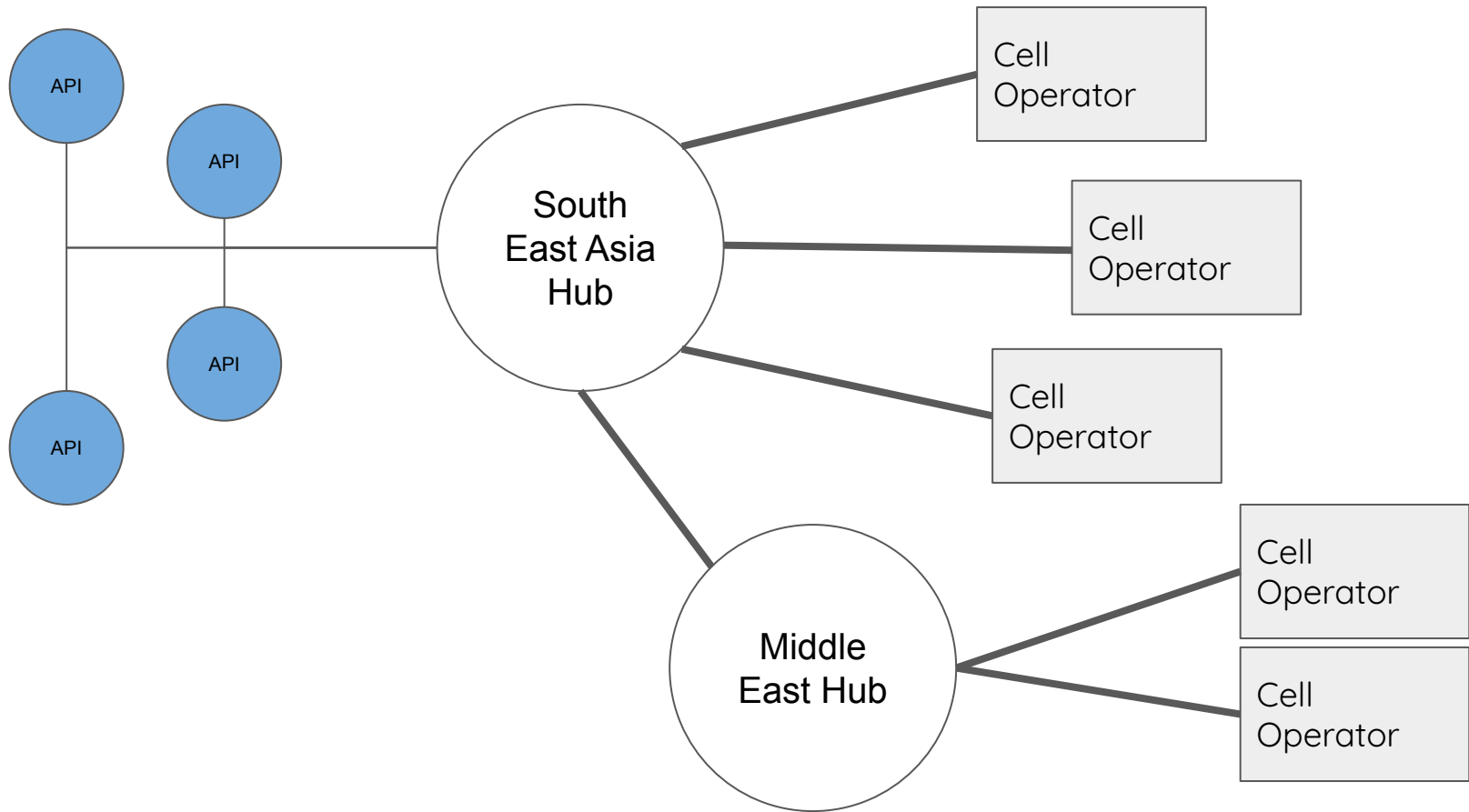


# IdeaBiz

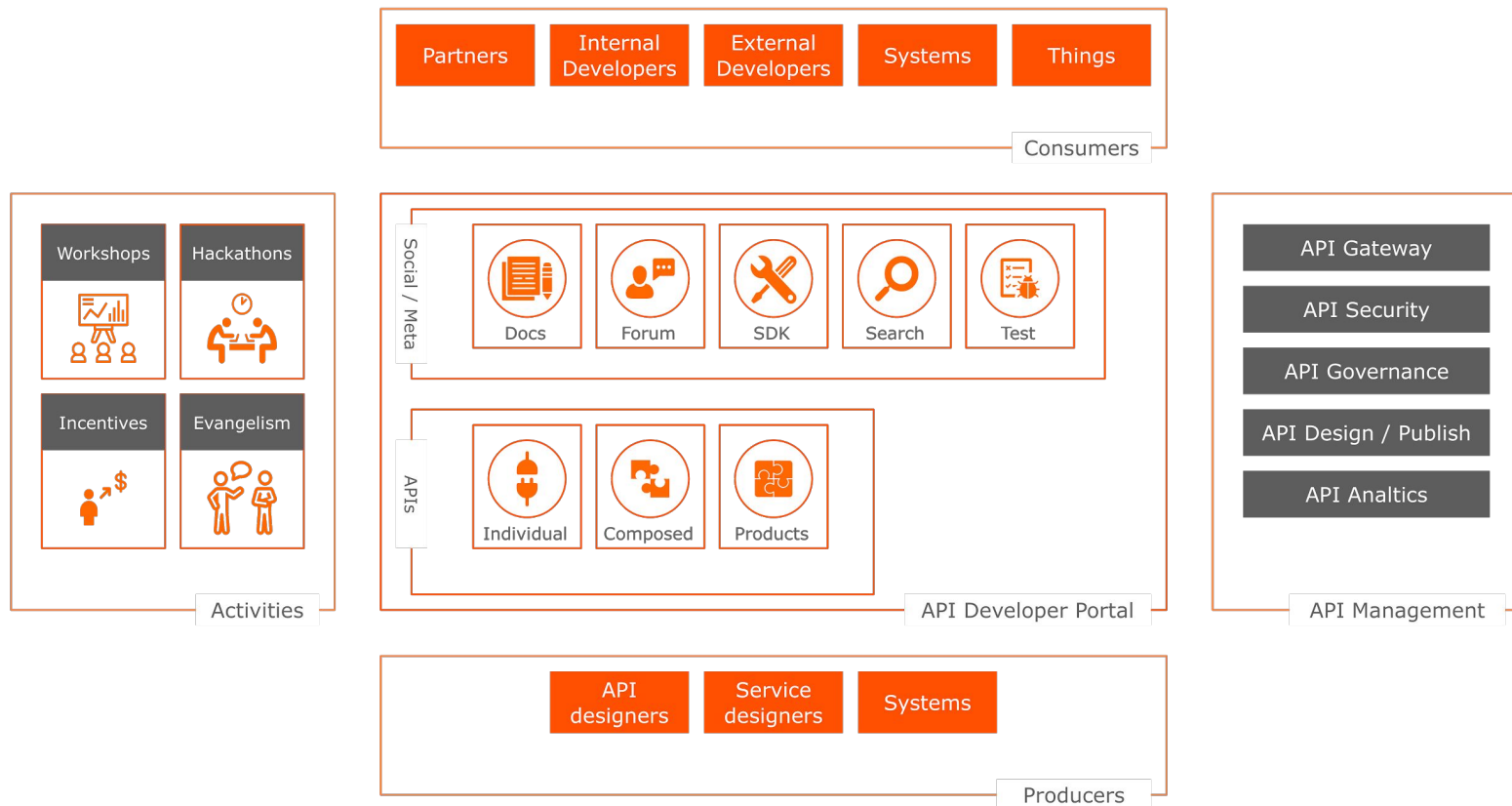


In the first 18 months, 2500 developers created 3300 apps





# API Marketplaces







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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



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.

“

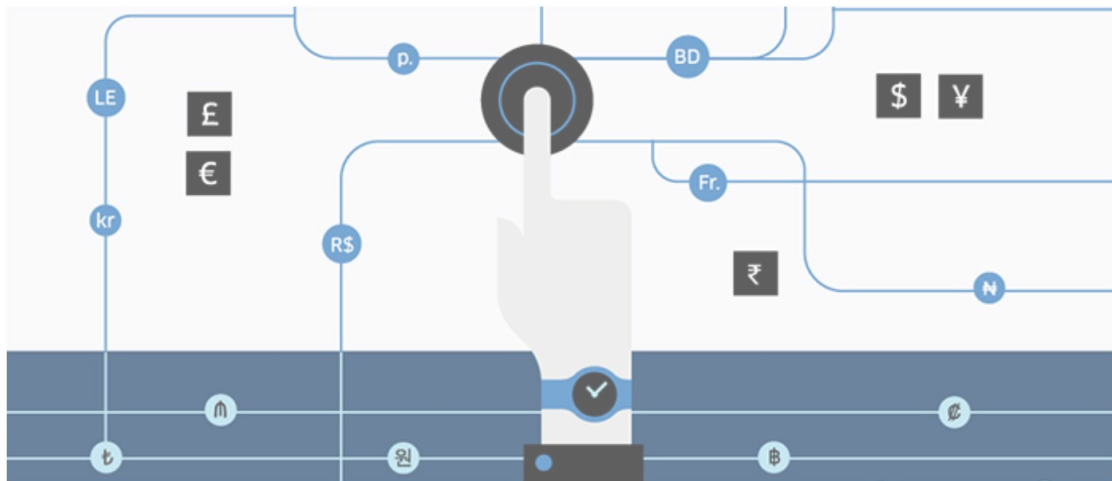
Deliver working software frequently with a preference to the shorter timescale.





# Uber in 2016

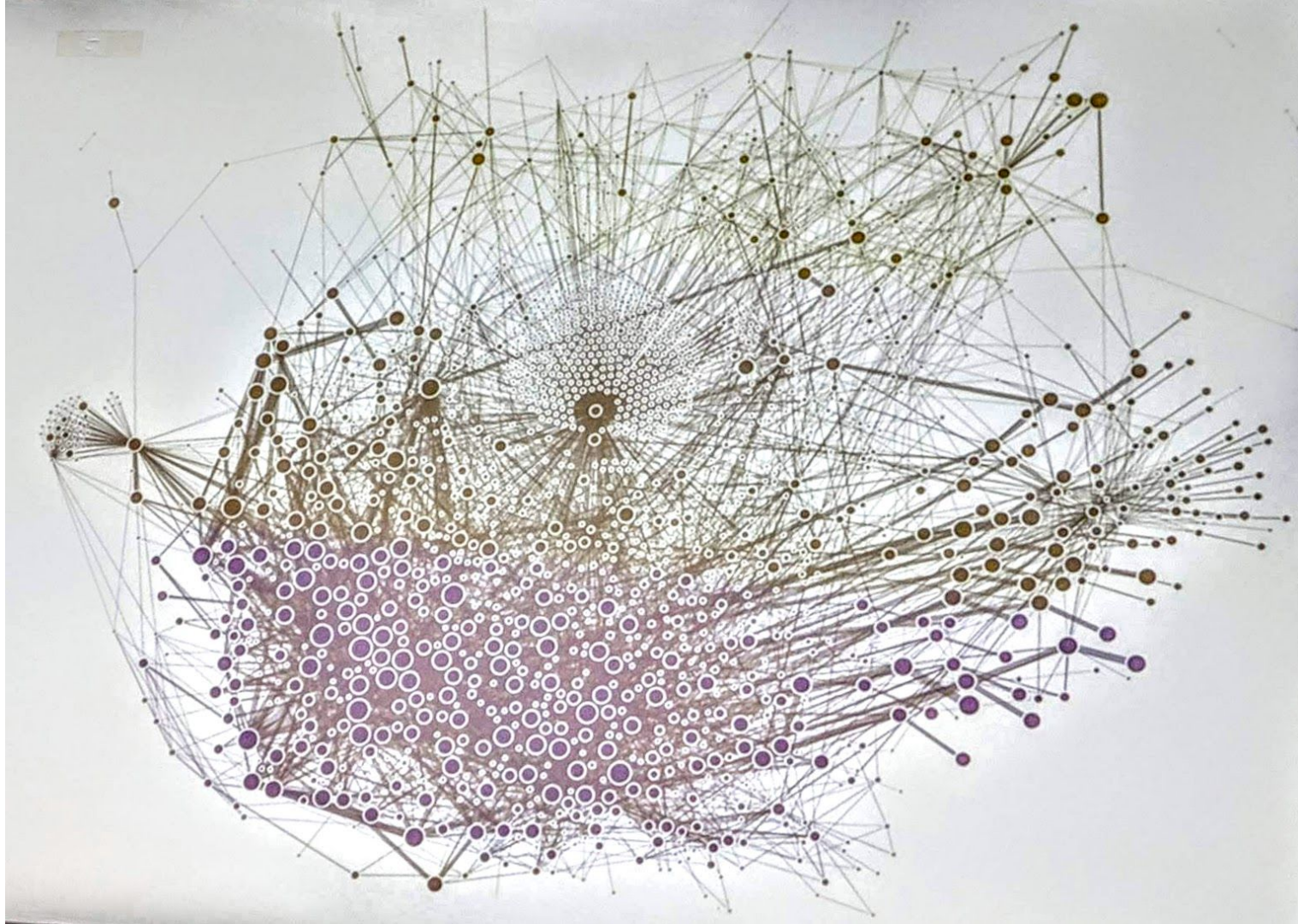
## “Several hundred microservices”



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\*

University of Pennsylvania, The Wharton School, Management Department, 3620 Locust Walk, Suite 3014 SHDH, Philadelphia, PA 19104, United States

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Individual performance

Perceived social support

Appraisal theory

Multi-level theory

Process loss

Coordination

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## 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.”*

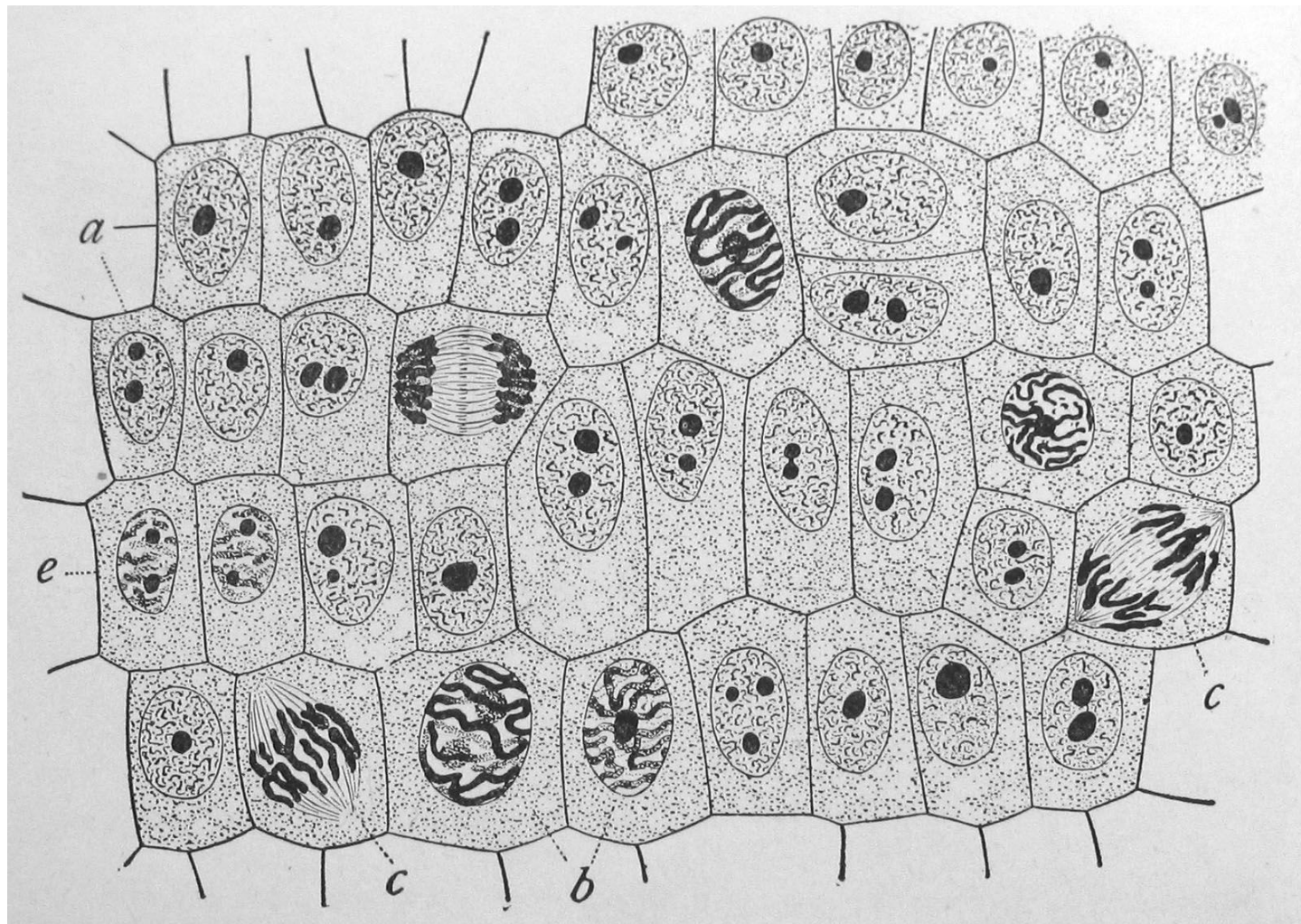
Eric Raymond

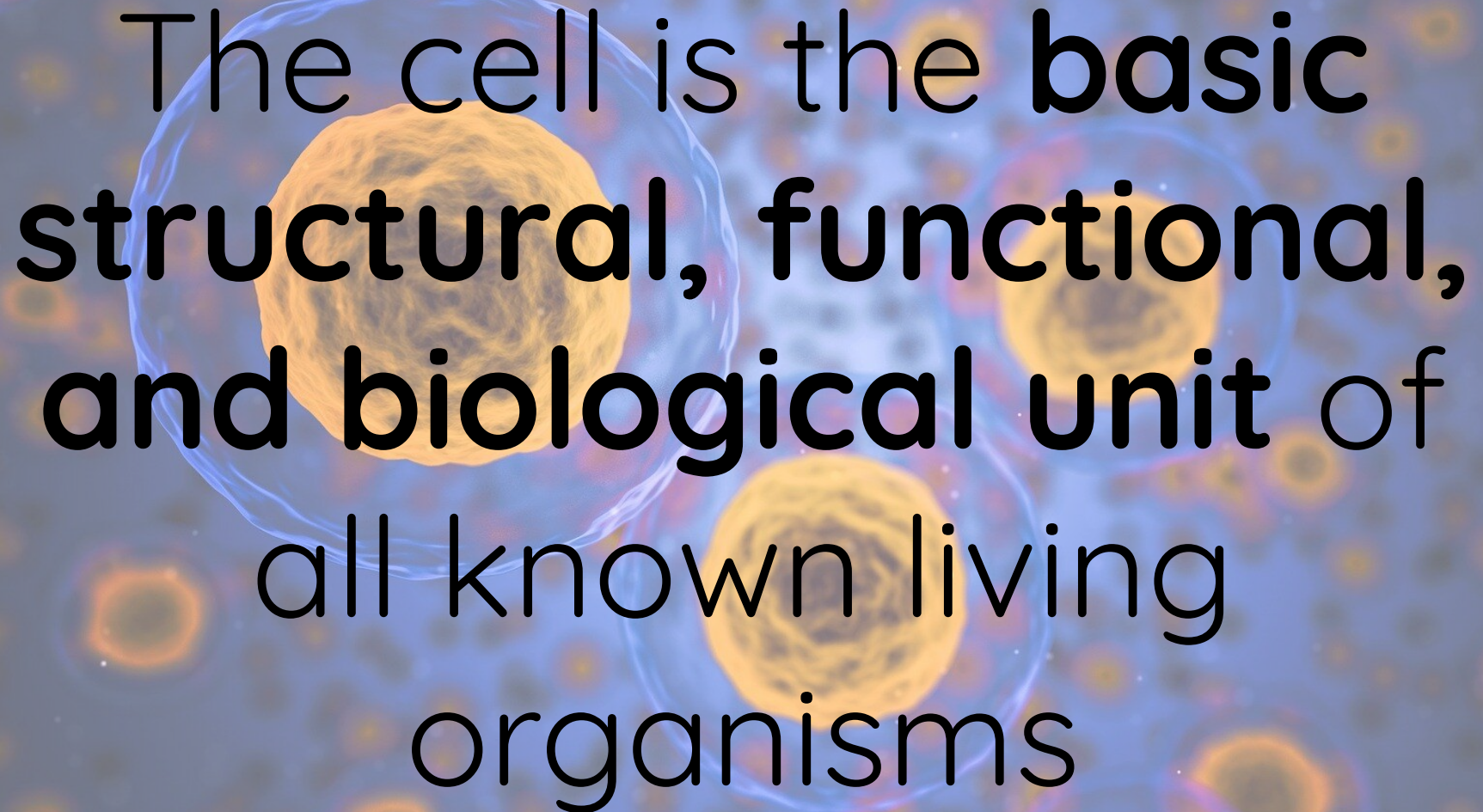


A photograph of a wooden fence in a rural setting. The fence is made of light-colored wood and has several horizontal rails. It is covered with green vines and leaves. In the background, there are trees and a field. The text "Self-organizing teams need boundaries" is overlaid on the image in white, bold, sans-serif font.

Self-organizing  
teams need  
boundaries





A microscopic view of several cells. One cell in the foreground is in sharp focus, showing a large, textured, orange-yellow nucleus and a thin, translucent blue cell membrane. Other cells are visible in the background, slightly out of focus, with similar orange-yellow nuclei and blue membranes. The overall background is a dark, grainy blue.

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

# Bounded Context and Aggregates

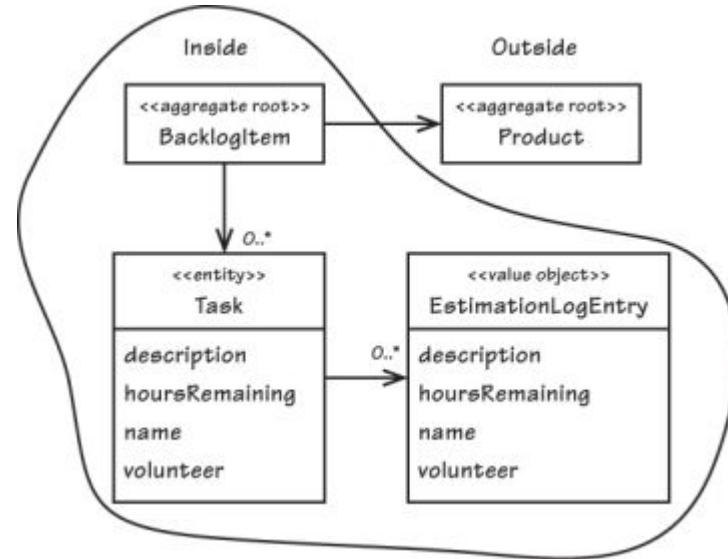
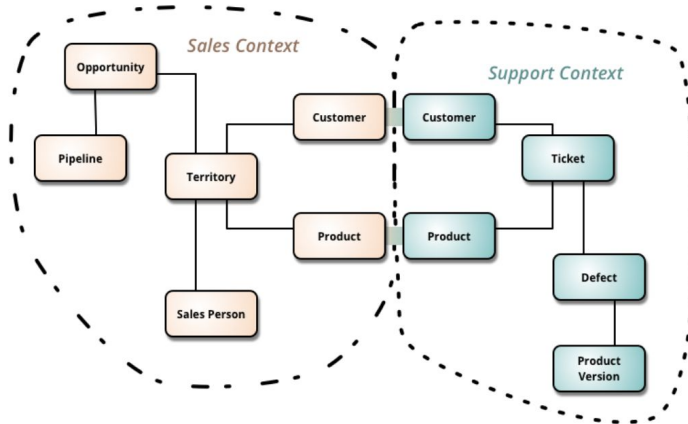
from Domain Driven Design / Eric Evans

## 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

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Version Q2-2018

## Original Authors

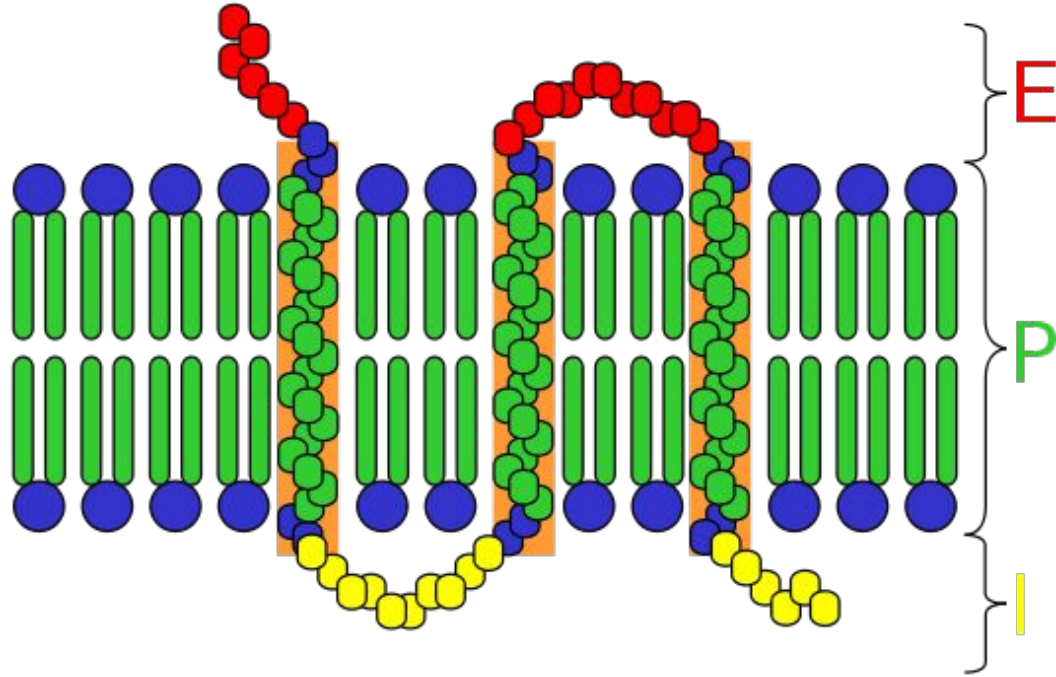
- Asanka Abeysinghe, Vice President, Architecture - CTO Office [asankaa@wso2.com](mailto:asankaa@wso2.com)
- Paul Fremantle, CTO and Co-Founder [paul@wso2.com](mailto:paul@wso2.com)

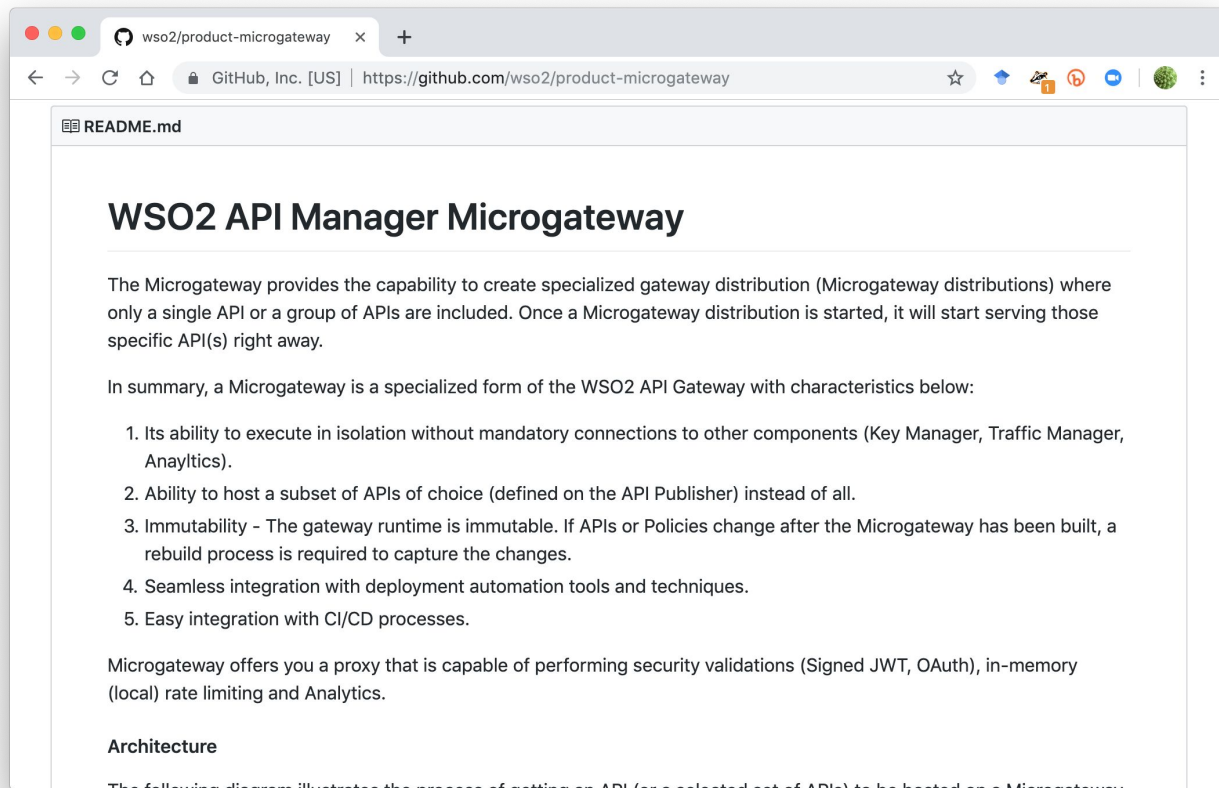
*This document describes a reference architecture for modern agile digital enterprises. This reference architecture offers a logical architecture based on a disaggregated cloud-based model that can be instantiated to create an effective and agile approach for digital enterprises, deployed in private, 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

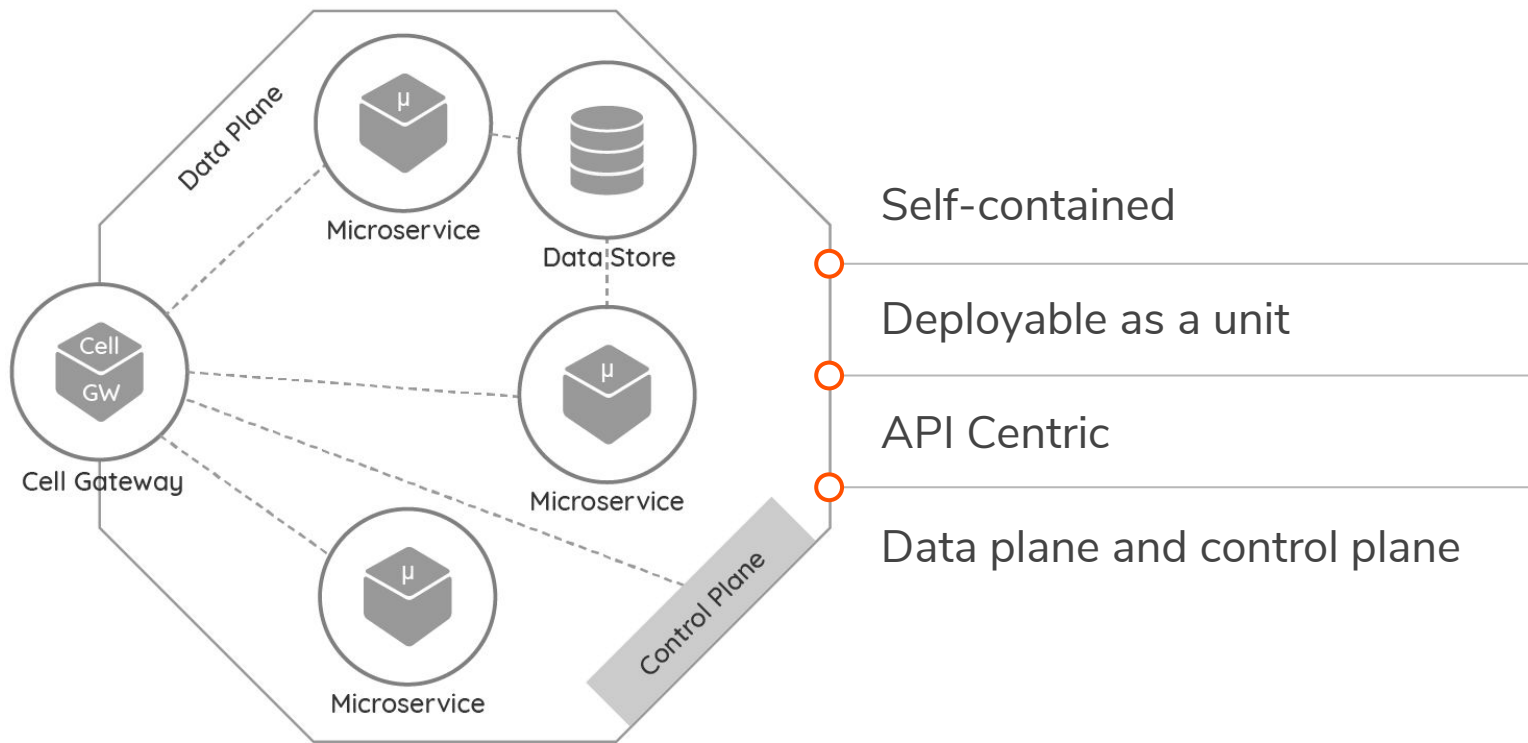




<https://github.com/wso2/product-microgateway>

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

# Cells are the building blocks of a composable enterprise





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

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History














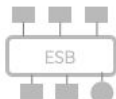
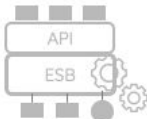
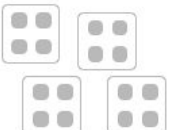
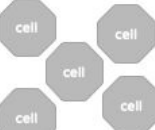





# Reference Methodology for Agility

*Version Q2-2018*

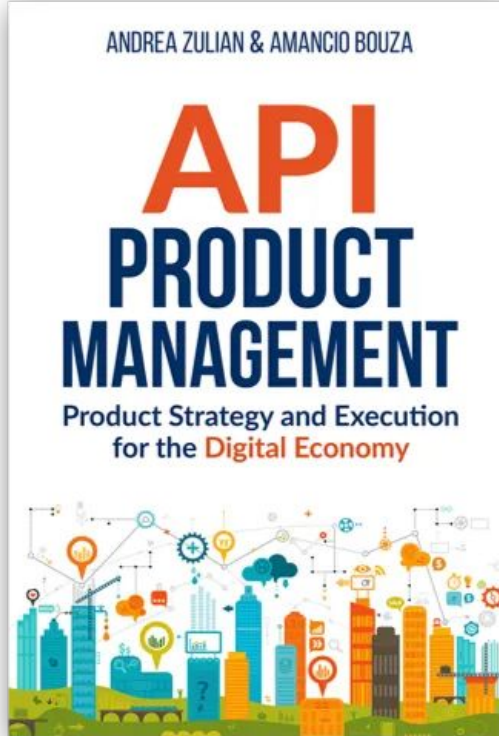
## Original Authors

- Asanka Abeysinghe, Vice President - Architecture, CTO Office [asankaa@wso2.com](mailto:asankaa@wso2.com)
- Paul Fremantle, CTO and Co-Founder [paul@wso2.com](mailto:paul@wso2.com)

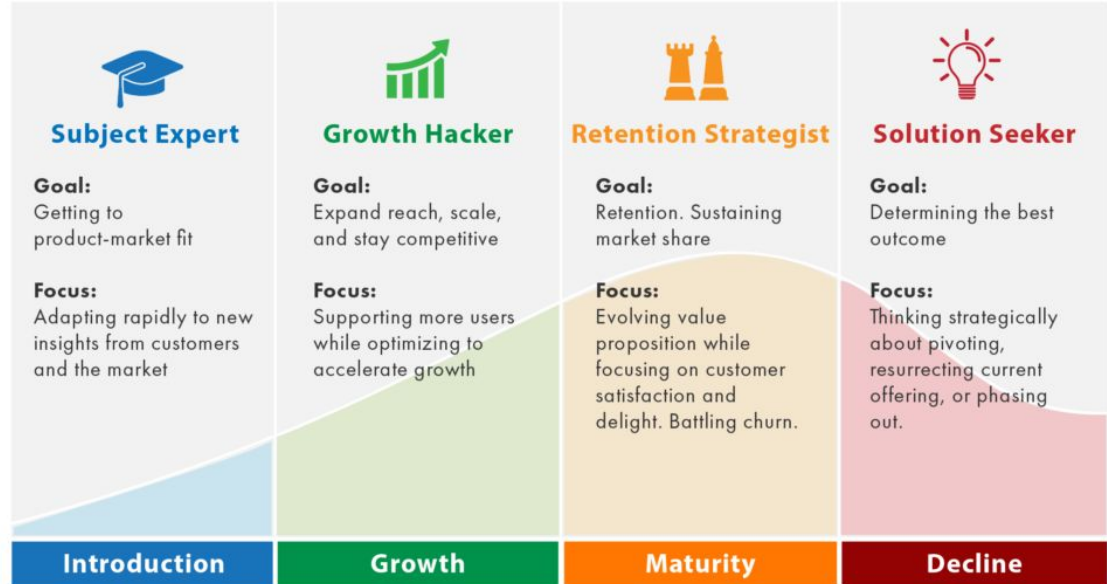
This document describes a reference methodology for modern agile digital enterprises. Our goal is to move organizations from the current maturity stage towards the integration agile stage. The outcome of moving higher in

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

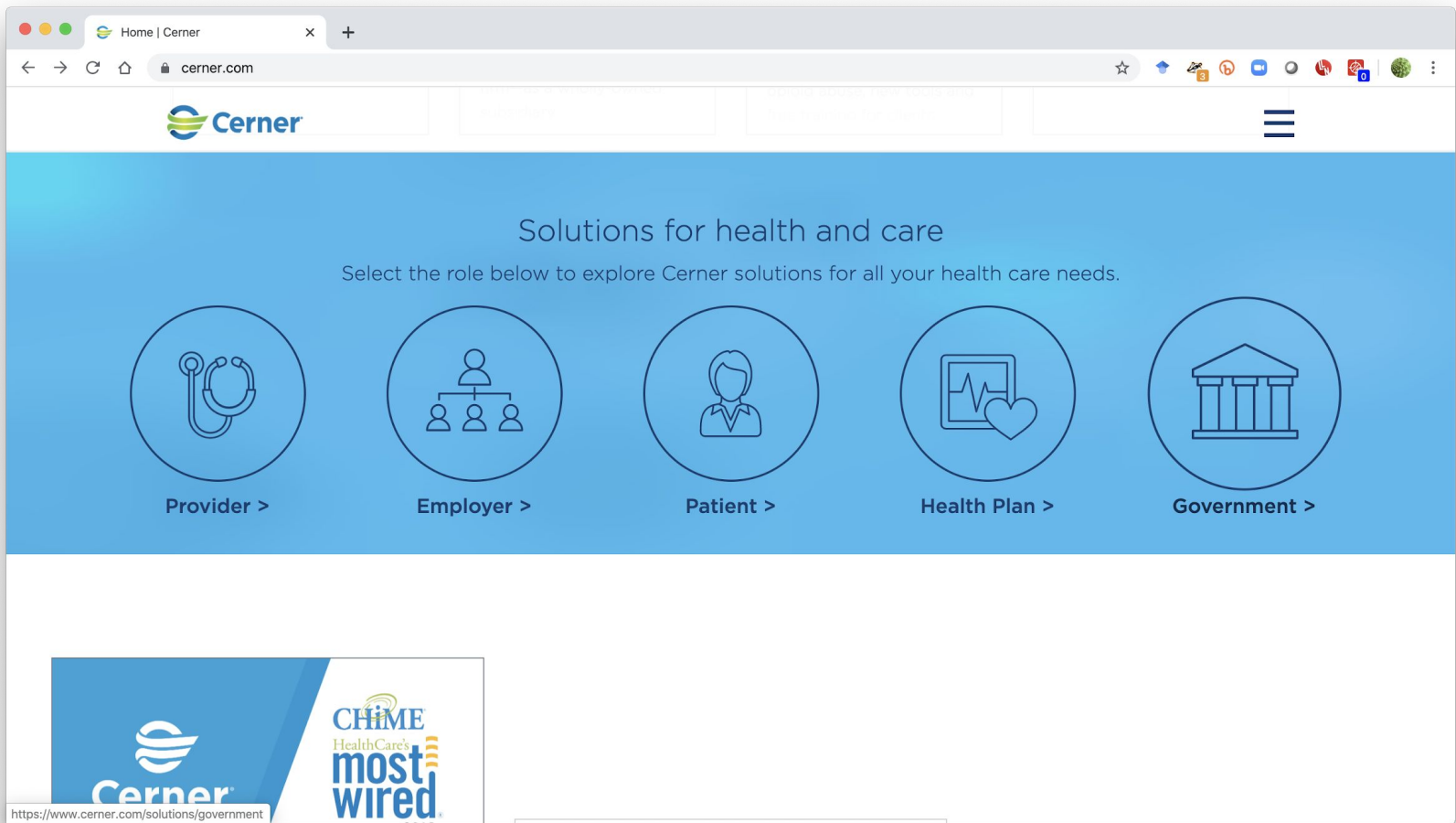
# API Product Management



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





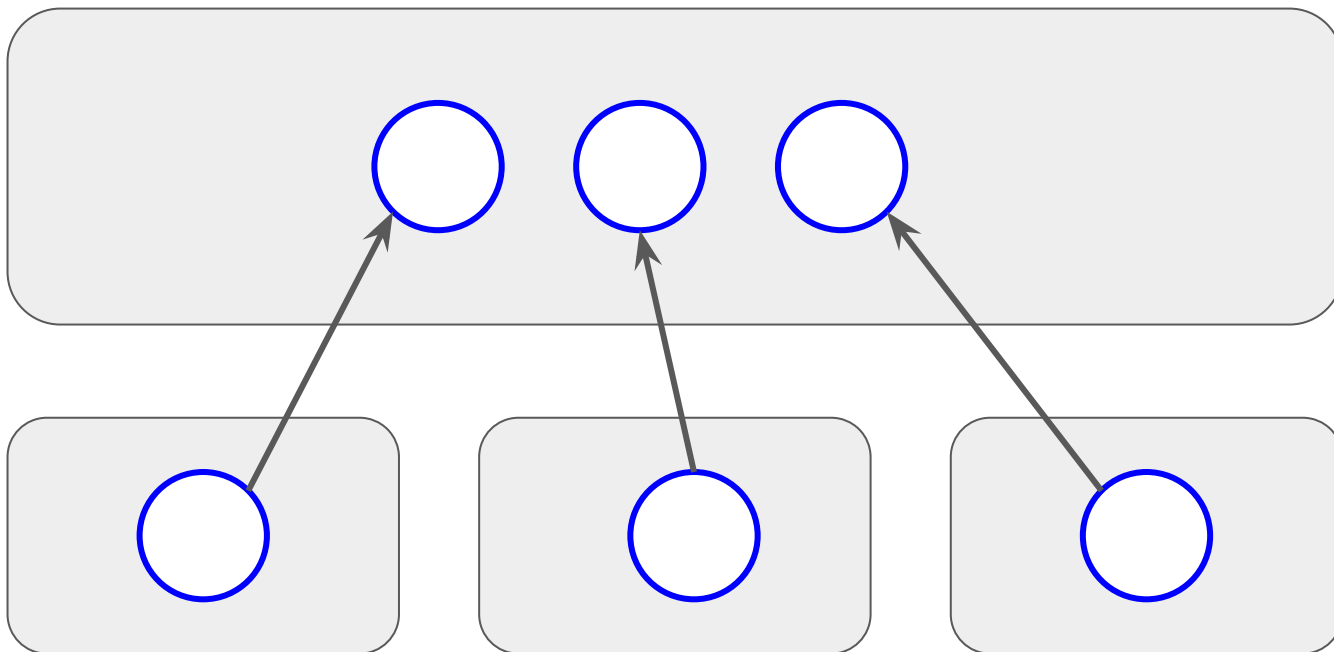


**The interface to a cell needs  
to be treated as a  
product**

5 patterns for API federation

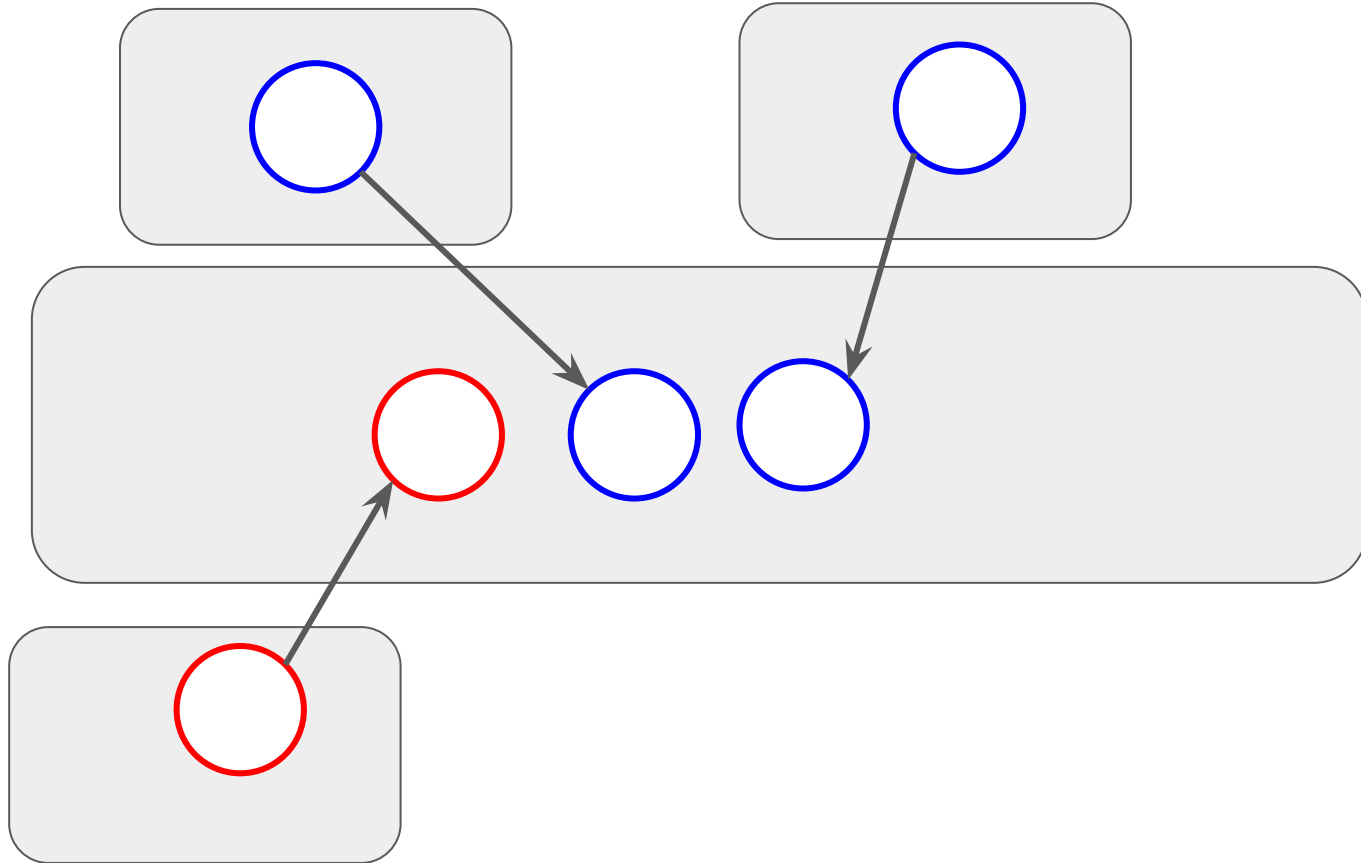


# #1. Internal API Marketplace





## #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.

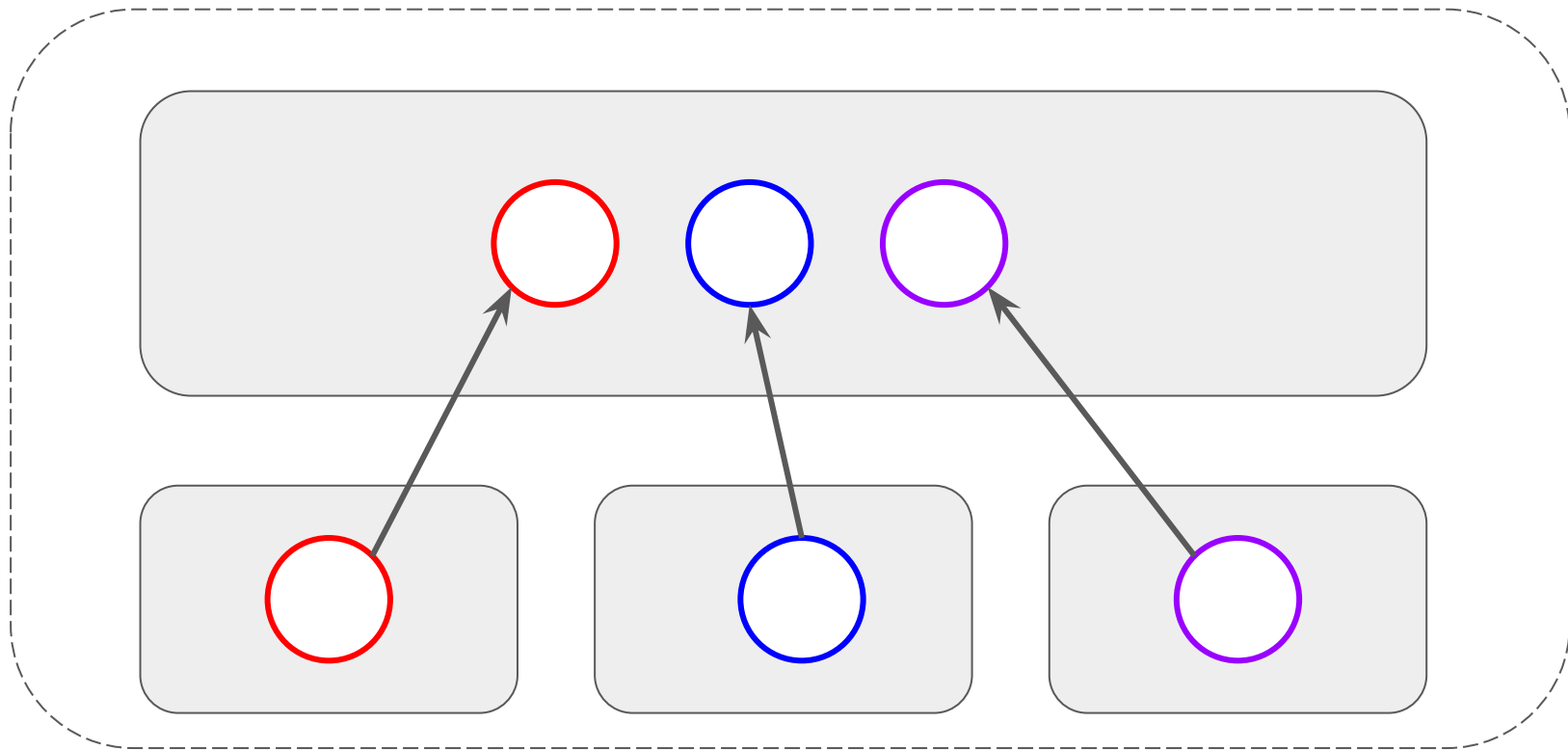
ACCESS FUND OF HEDGE FUND 

### Investors

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

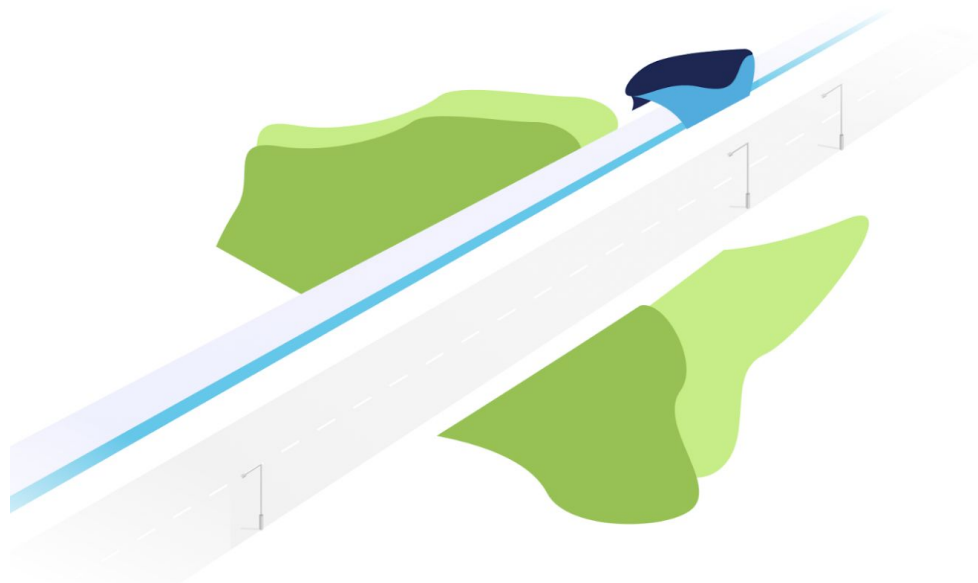
ACCESS INVESTOR 

### #3. Closed Group API Marketplace

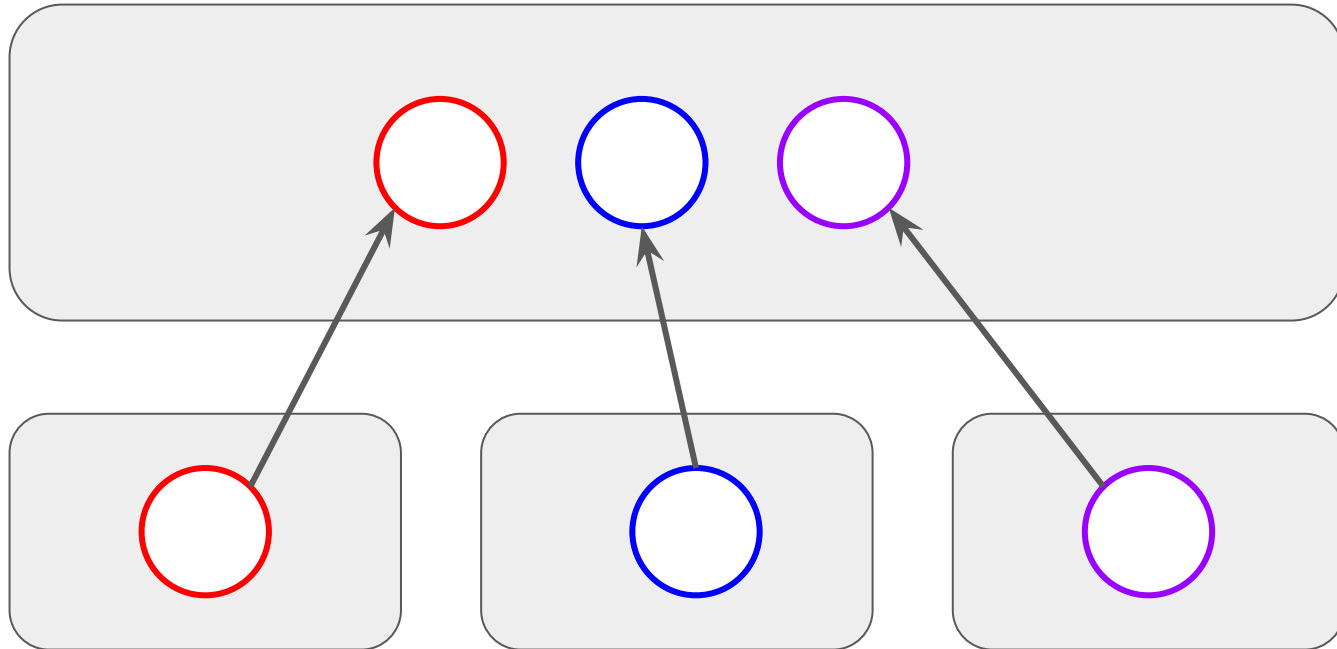


## OUR VISION IS TO MAKE DUBAI THE HAPPIEST CITY ON EARTH OVER THE PAST 40 YEARS,

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

Paul

Secure | https://www.idealbiz.lk/store/


Apps | Inboxes | Frementle Family | Inboxes | Inboxes | Inboxes | WSO2, Inc. | bitmark | Save to Mendeley | Other Bookmarks

idealbiz


Login | Sign-up

Home | APIs | My Applications | My Subscriptions | Manage | Sandbox

APIs



Alexa-BillInfoAPI-V1  
admin  
★★★★★

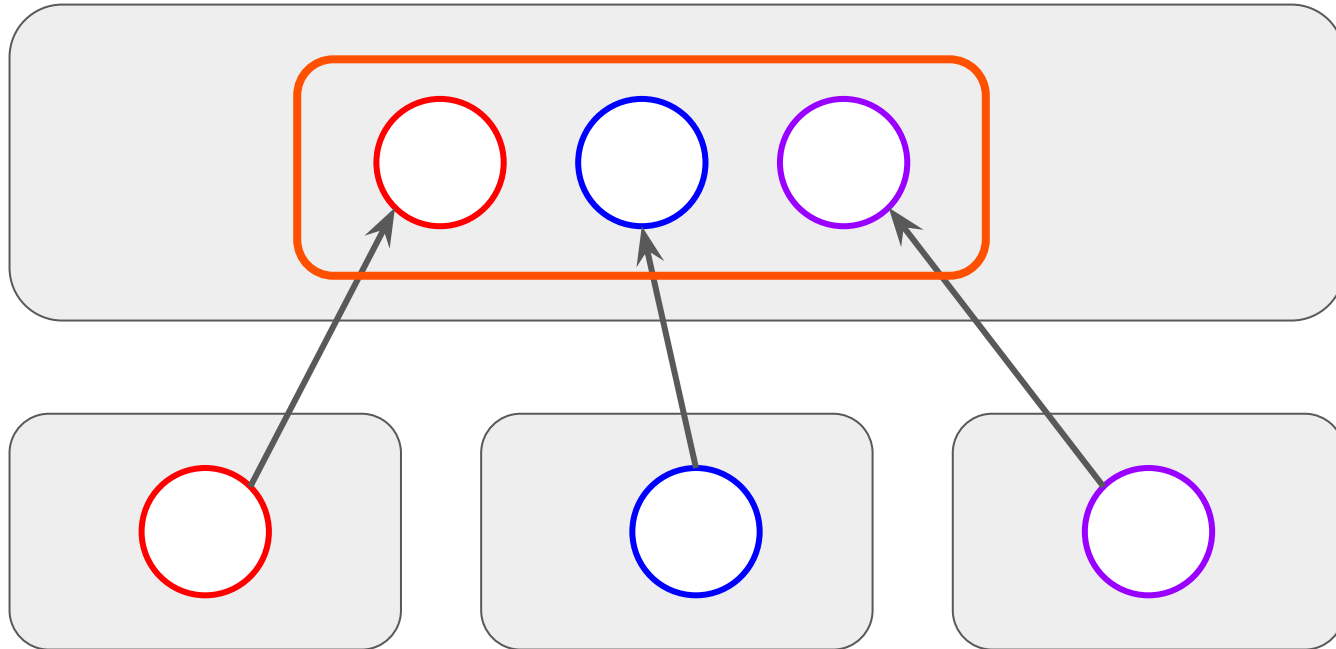


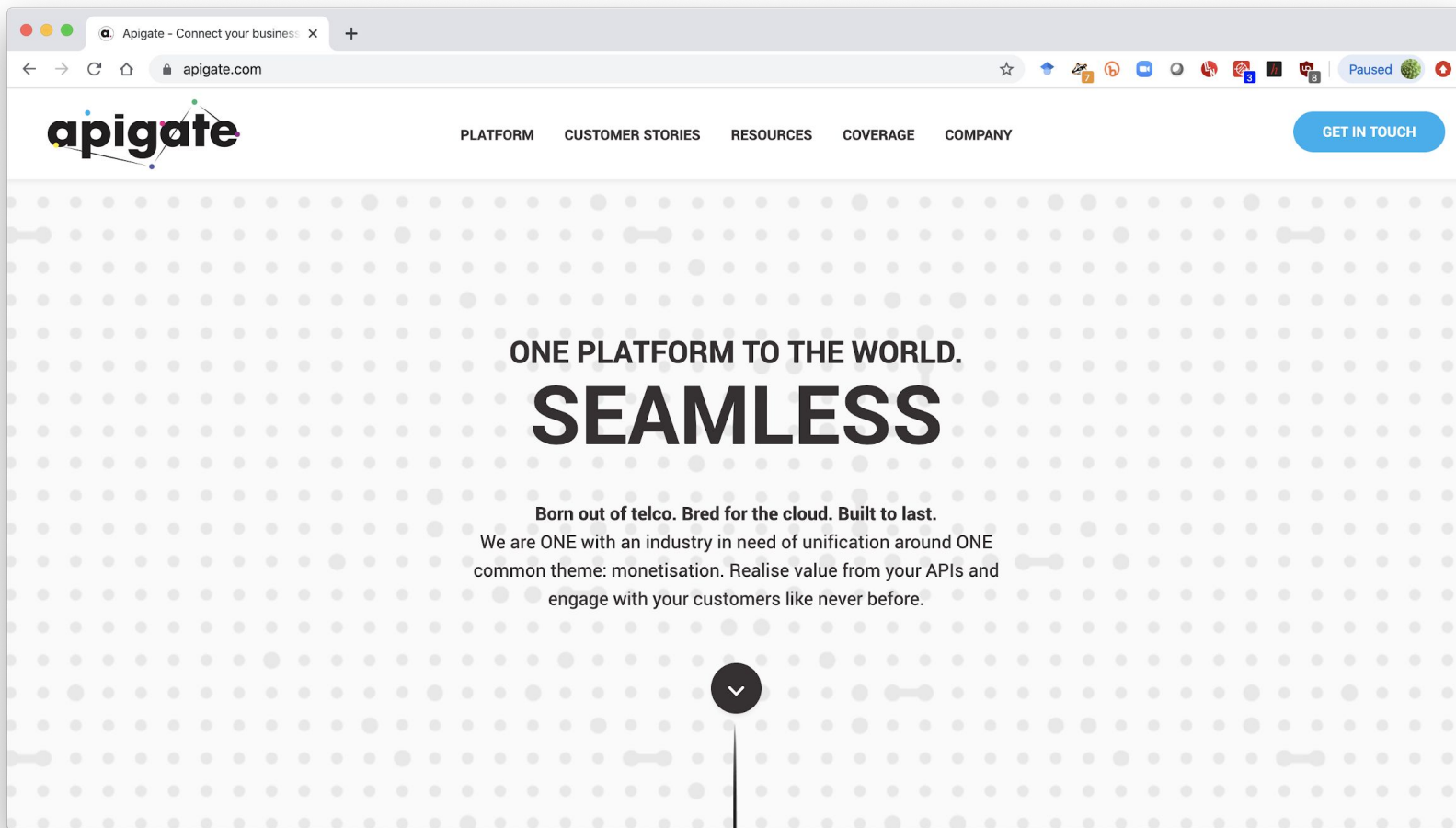
BalanceCheck-v3  
admin

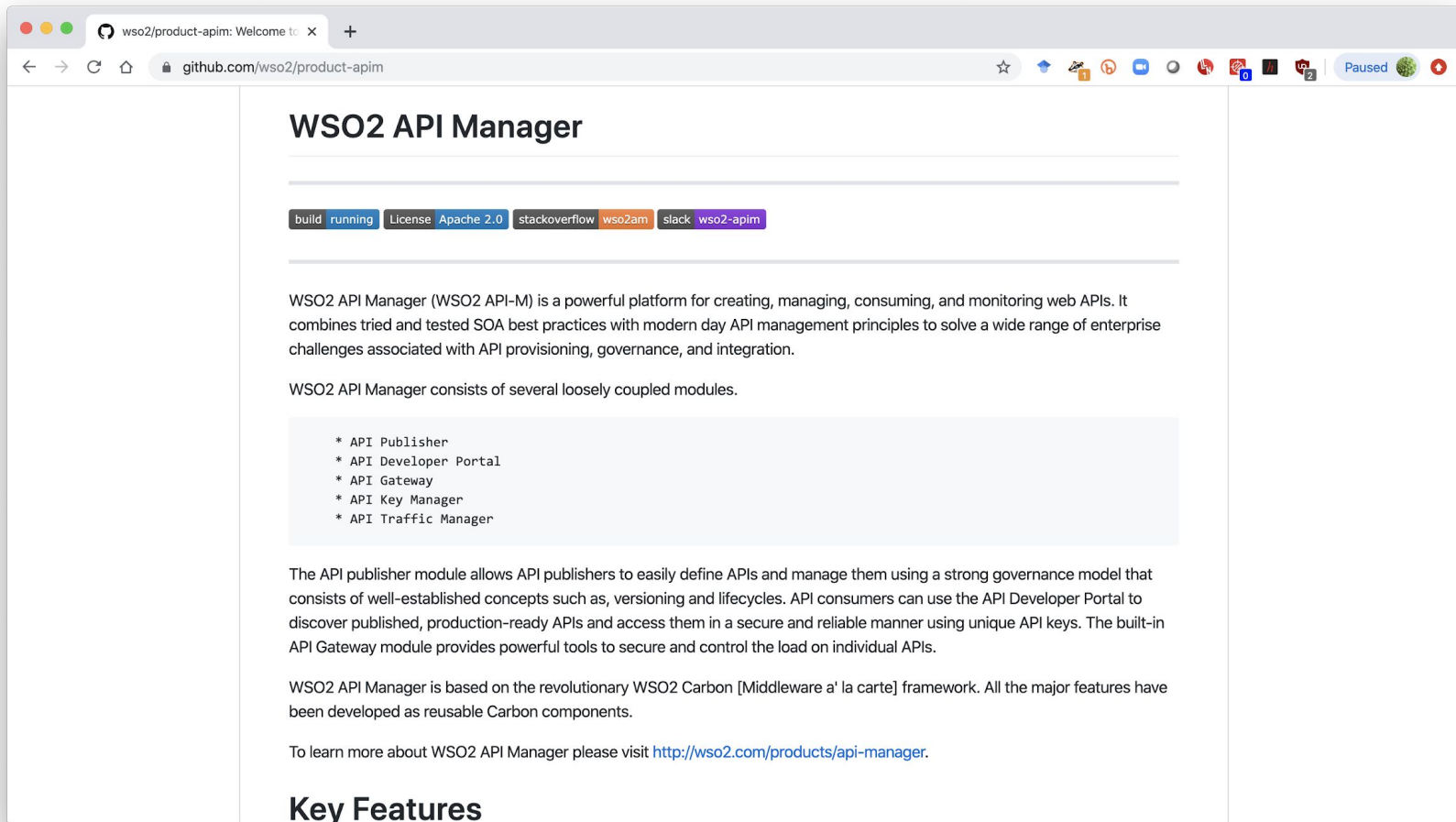
Create your own mobile applications

Generate Revenue

## #5. Aggregator API Marketplace







The screenshot shows a web browser window displaying the GitHub repository for WSO2 API Manager. The browser's address bar shows the URL `github.com/wso2/product-apim`. The page title is "WSO2 API Manager". Below the title, there are several tags: `build`, `running`, `License Apache 2.0`, `stackoverflow wso2am`, and `slack wso2-apim`. The main content of the page describes WSO2 API Manager (WSO2 API-M) as a powerful platform for creating, managing, consuming, and monitoring web APIs. It mentions that 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. It also states that WSO2 API Manager consists of several loosely coupled modules, which are listed in a bulleted format: 

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

 The text further explains that 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. It also mentions that 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. Finally, it provides a link to learn more about WSO2 API Manager: <http://wso2.com/products/api-manager>. The page ends with a section titled "Key Features".

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

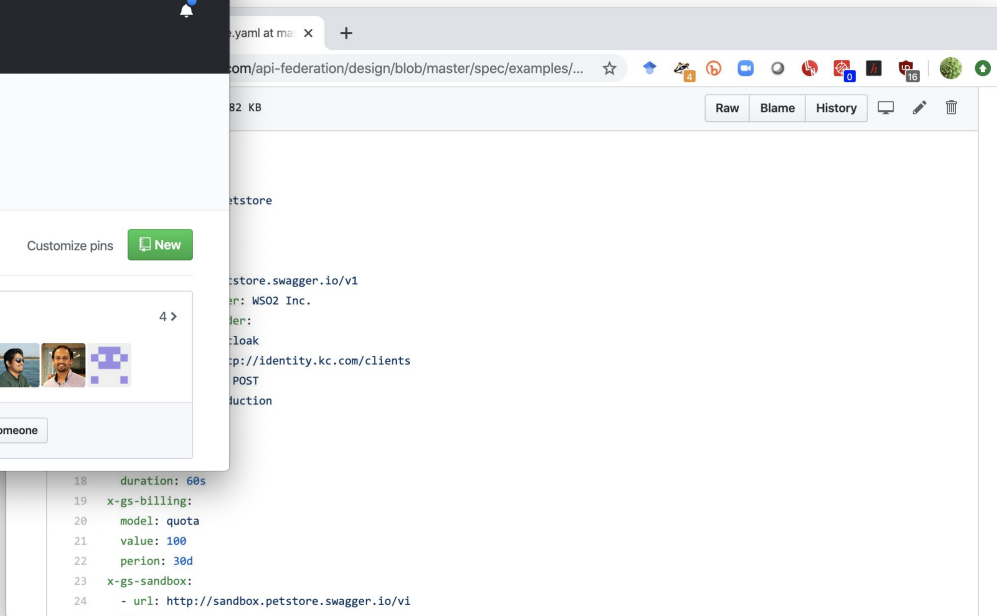
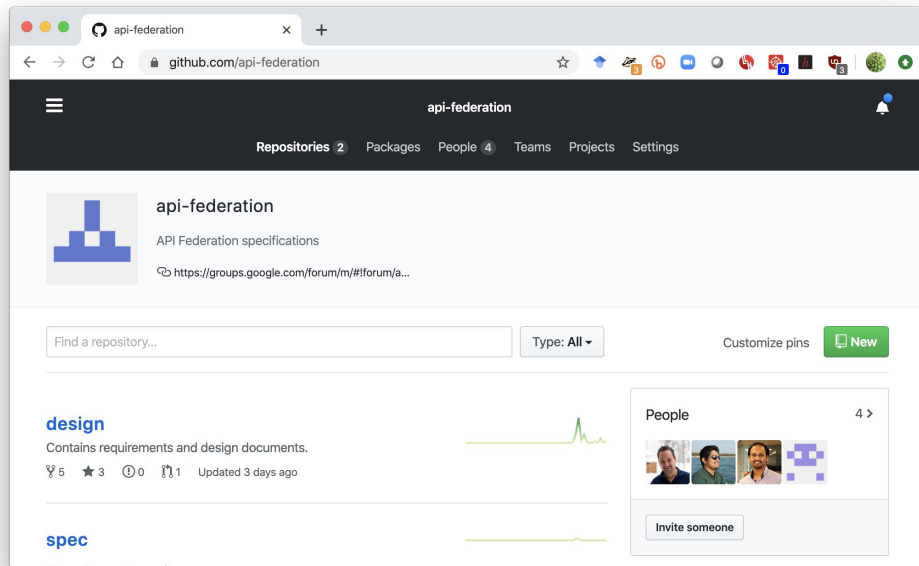
## Key Features

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



# API Federation specification group

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



“

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!

paul@wso2.com

<https://www.linkedin.com/in/paulfremantle/>

<https://wso2.com>

@pzfreo