



APIs: The Digital Connectors

Gateway to Digital Transformation

Lakmal Warusawithana

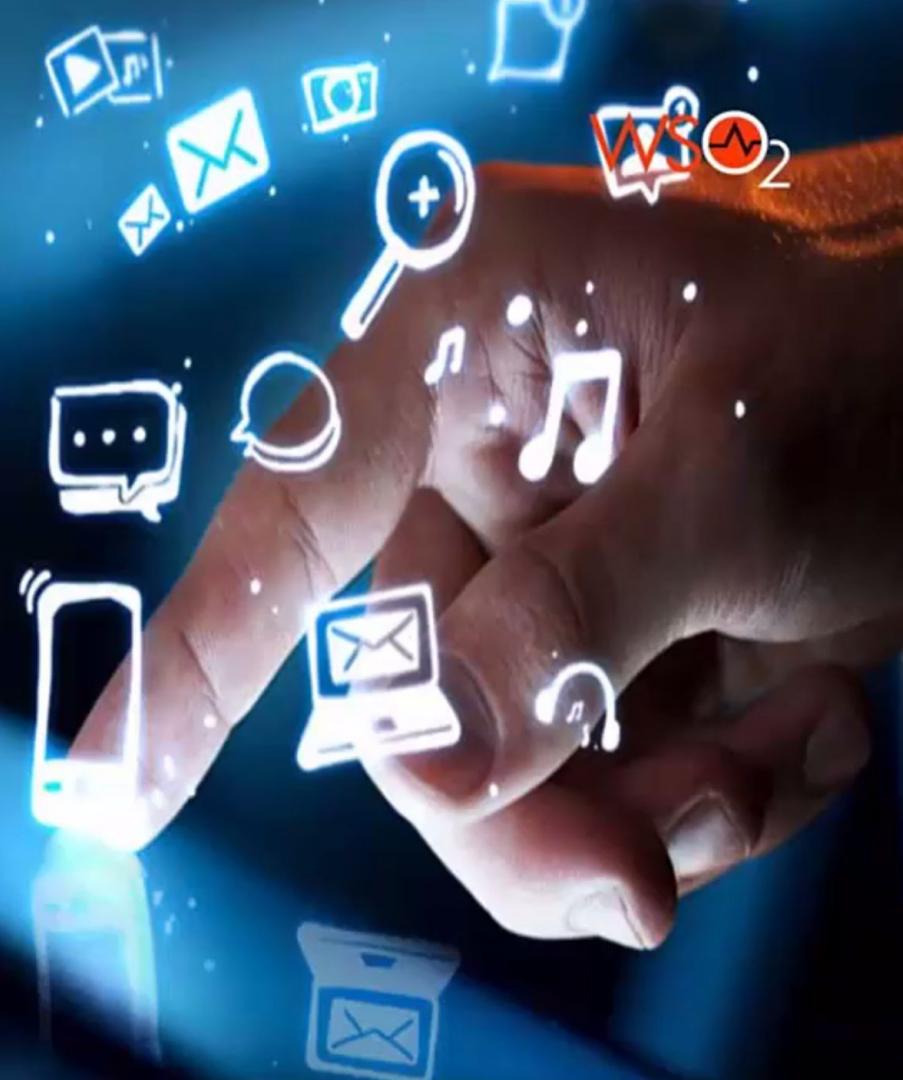
Director Cloud Architecture

May, 2017

Digital Transformation

is all about Digital Experience

Digital
Transformation is all
about creating a
“Digital Experience”
for your customers



Amazon GO





**It's not just about
becoming "Paperless"**

UBER



UBER

Ride

Drive

Cities

Get there
Your day belongs to you



Lottery

The image shows two screenshots of a mobile phone's messaging app interface. Both screenshots have a red dashed border at the top.

Screenshot 1 (Left):

- Top status bar: Mobitel LK, 2:23 PM, 73% battery.
- Message from 'Lucky889':

Successfully Subscribed to Supiri Vasana Sampatha. Draw dates: every Wed & Sat. Charges: Rs.20+ (telecom fee+Tax) per ticket. To Unsubscribe SMS SV OFF to 889. T&C please dial [0117889889](#)
- Time: Sun, Apr 23, 10:59 AM
- Message to 'Lucky889':

Rs.20.0 win from Supiri Vasana Sampatha is added to your wallet. Now you can buy tickets from your wallet. Current wallet balance is Rs.20.0 Call [117889889](#)
- Time: Wednesday 10:37 PM
- Message from 'Lucky889':

Rs.20.0 for Supiri Vasana Sampatha is charged from your wallet. Current wallet balance is Rs.0.0 Call [117889889](#)
- Time: Friday 4:22 PM

Screenshot 2 (Right):

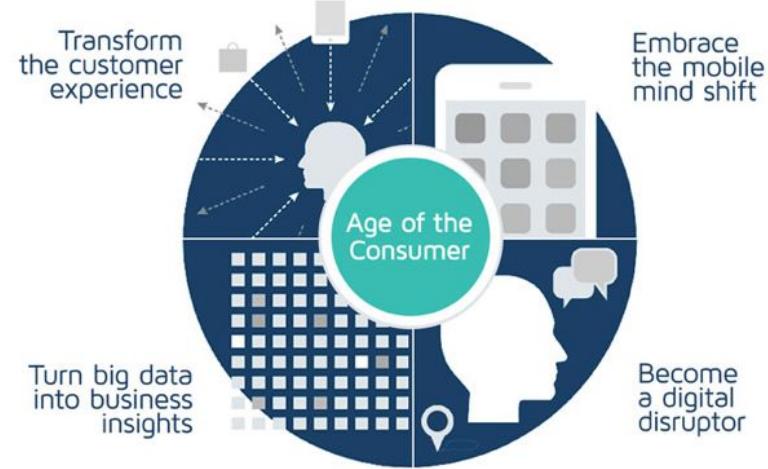
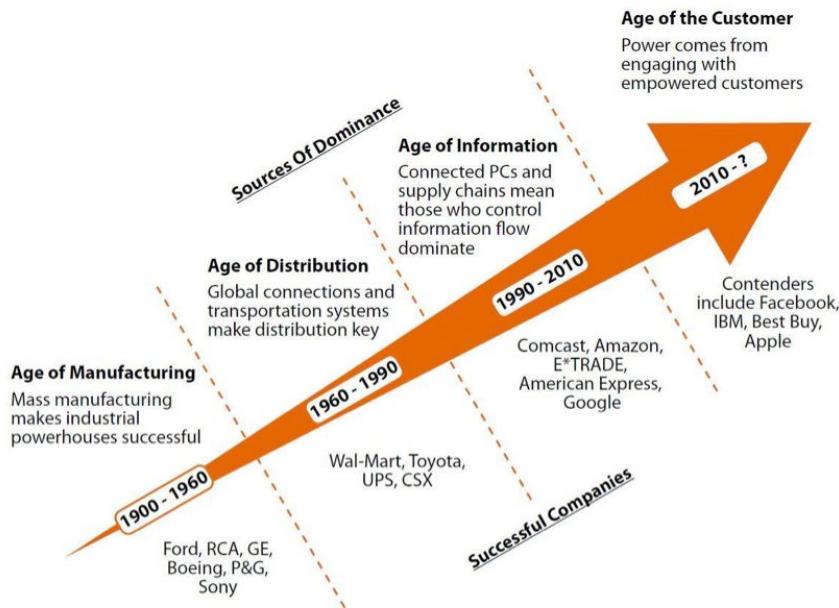
- Top status bar: Mobitel LK, 8:32 PM, 81% battery.
- Message from 'Supiri Vasana Sampatha':

Lottery - Supiri Vasana Sampatha
Draw No - 1217
S/N - [12170568673](#)
Ticket No - 23 8 9 22 47
Draw Date - 2017-04-26
Good Luck from Lucky889!
T&C dial [0117889889](#)
- Time: Wednesday 10:25 PM
- Message to 'Supiri Vasana Sampatha':

Congratulations! It's your lucky day!, You have won 20.0 for Supiri Vasana Sampatha [12170568673](#) [23 8 9 22 47](#) on 2017-04-26.

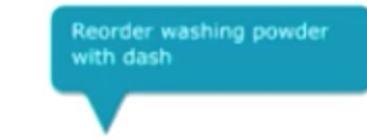
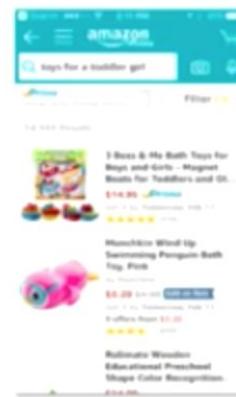
At the bottom of each screenshot is a toolbar with icons for camera, heart, A+, Text Message, and an upward arrow.

It Is The Age Of The Consumer



Source: Forrester Research

Following the Consumer



Connected Experience



Start your day off right.



"Alexa, tell Starbucks
to start my order."

Get started •



Top enabled skills



"Alexa, open
Thunderstorm
Sounds"



"Alexa, Play
Jeopardy!"



"Alexa, open Rain
Sounds"



"Alexa, open ocean
sounds"



"A

Ambient Noise: Thunderstorm Sounds
★★★★★ 508

Jeopardy! J6
★★★★★ 483

Ambient Noise: Rain Sounds
★★★★★ 294

Ambient Noise: Ocean Sounds
★★★★★ 176

Customer favorites this week



"Alexa, tell Bed Time
Story to Debbie"



"Alexa, Inspire Me."



"Alexa, open
Curiosity."



"Alexa, ask Chineasy
for today's lesson."



"'''

Connected Experience

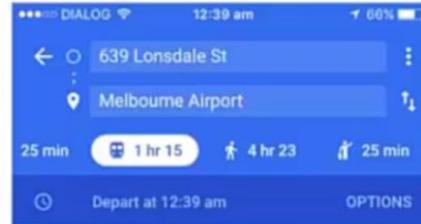
The screenshot shows a travel booking interface with the following details:

- Departure:** Roma Termini
- Arrival:** Lucerne
- Travel Type:** ONE-WAY (selected)
- Date:** Today, 20:00
- Passenger Count:** 1 Adult (26-59yr)
- Additional Options:** Add railcard, More options, Add new passenger type
- Accommodation:** Search accommodation with Airbnb
- Search Buttons:** Find trains, Download on the App Store

A red speech bubble points to the "Building a Connected Experience" text.

Connected Experience

API Complementing Each Other



1 hr 15 min
5:26 - 6:41 am
Every 12 min from Skybus Coach Terminal

1 hr 33 min
6:48 - 8:21 am
6:54 am from Southern Cross Station

1 hr 39 min
7:42 - 9:21 am
7:48 am from Southern Cross Station

Uber 25 min
Free first ride (up to A\$5)
A\$36-47
Estimate for uberX. Excludes tolls. Actual fare may vary.



Economy



uberGO
LKR620.81



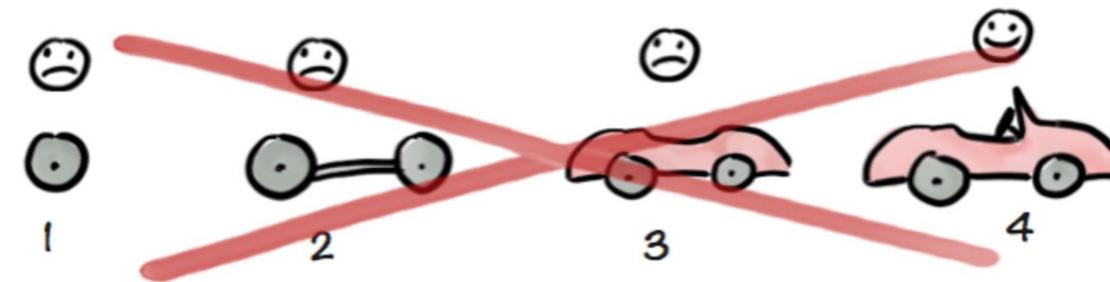
uberX
LKR977.62

1-4

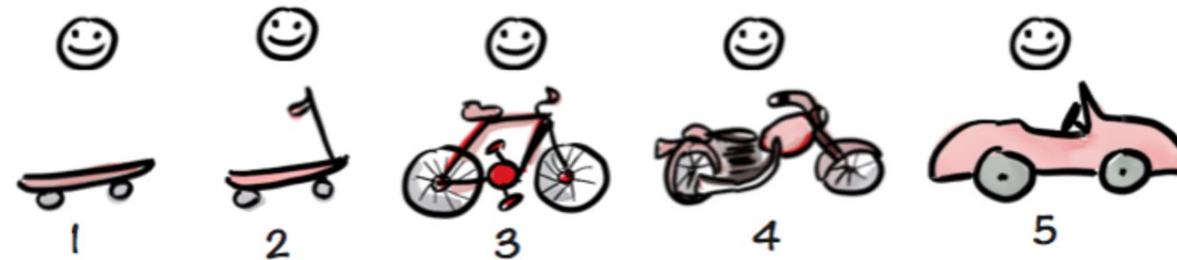
REQUEST UBERGO

Minimal Viable Product (MVP)

Not like this....

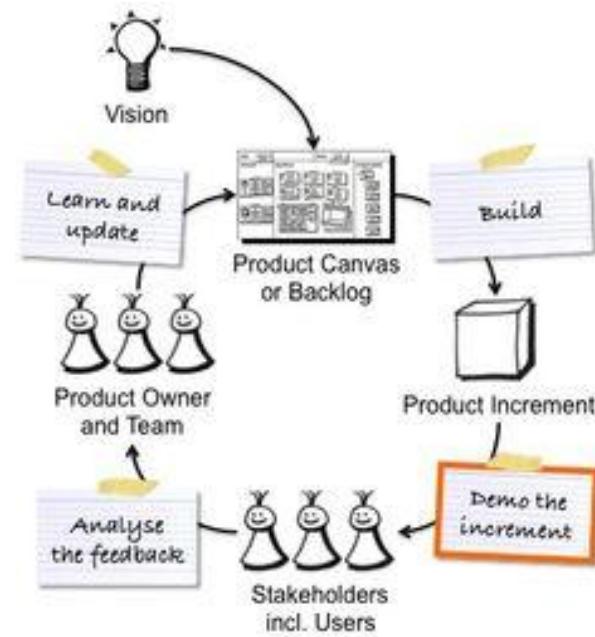


Like this!



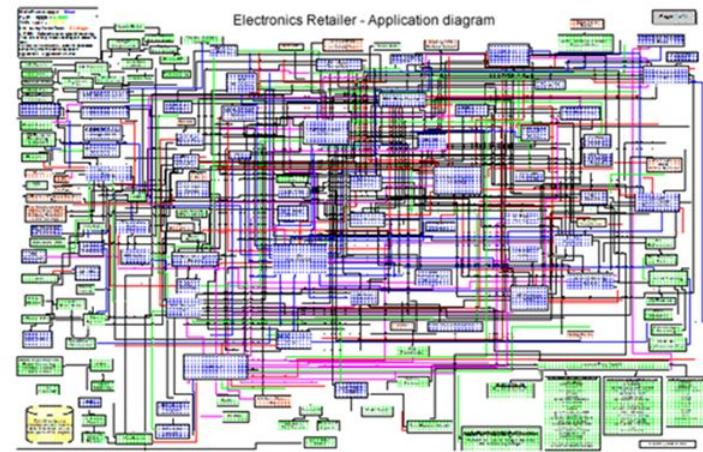
The Agile Enterprise

- Enterprises thrive to be more adaptive
- They understand that the market need changes by the day
- Organizations have to enable organic growth via new channels
- New challengers but new opportunity



Reality of Enterprise Systems Landscape

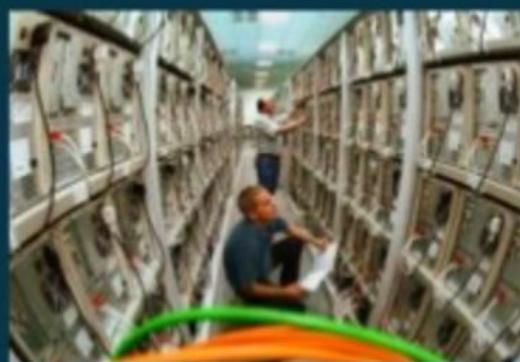
- Enterprise systems are complex
- Enterprise systems are bureaucratic
- Cannot afford the luxury of complete re-write or having a clean slate
- Comes with years of baggage



The Sliding Window Effect of Enterprise Architecture



*Mainframes
... with monoliths*



*Distributed systems
... with monoliths
... then SOA*

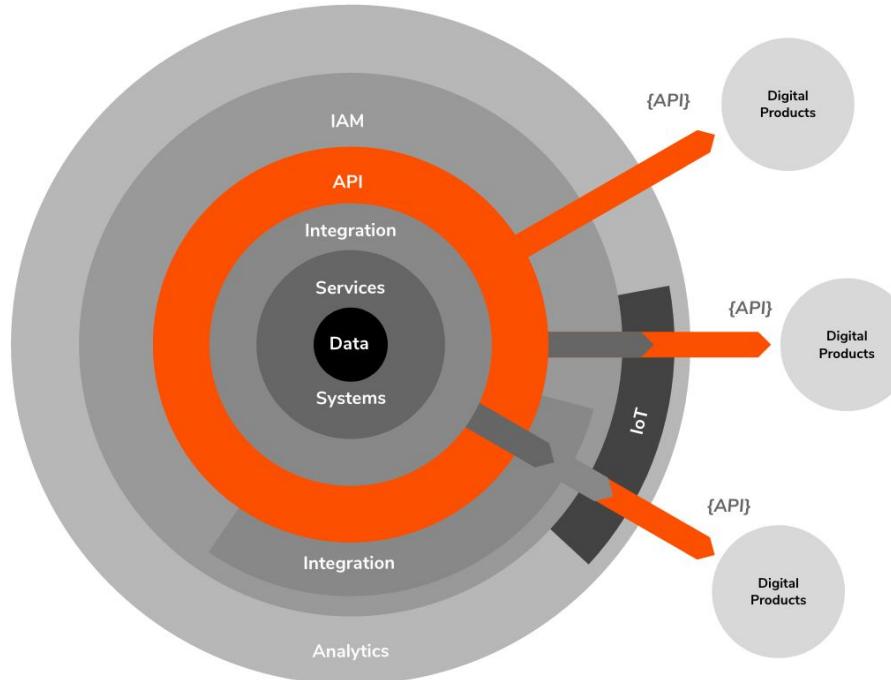


*Cloud servers
... with monoliths
... then SOA
... then micro-services*



Digital Enterprise

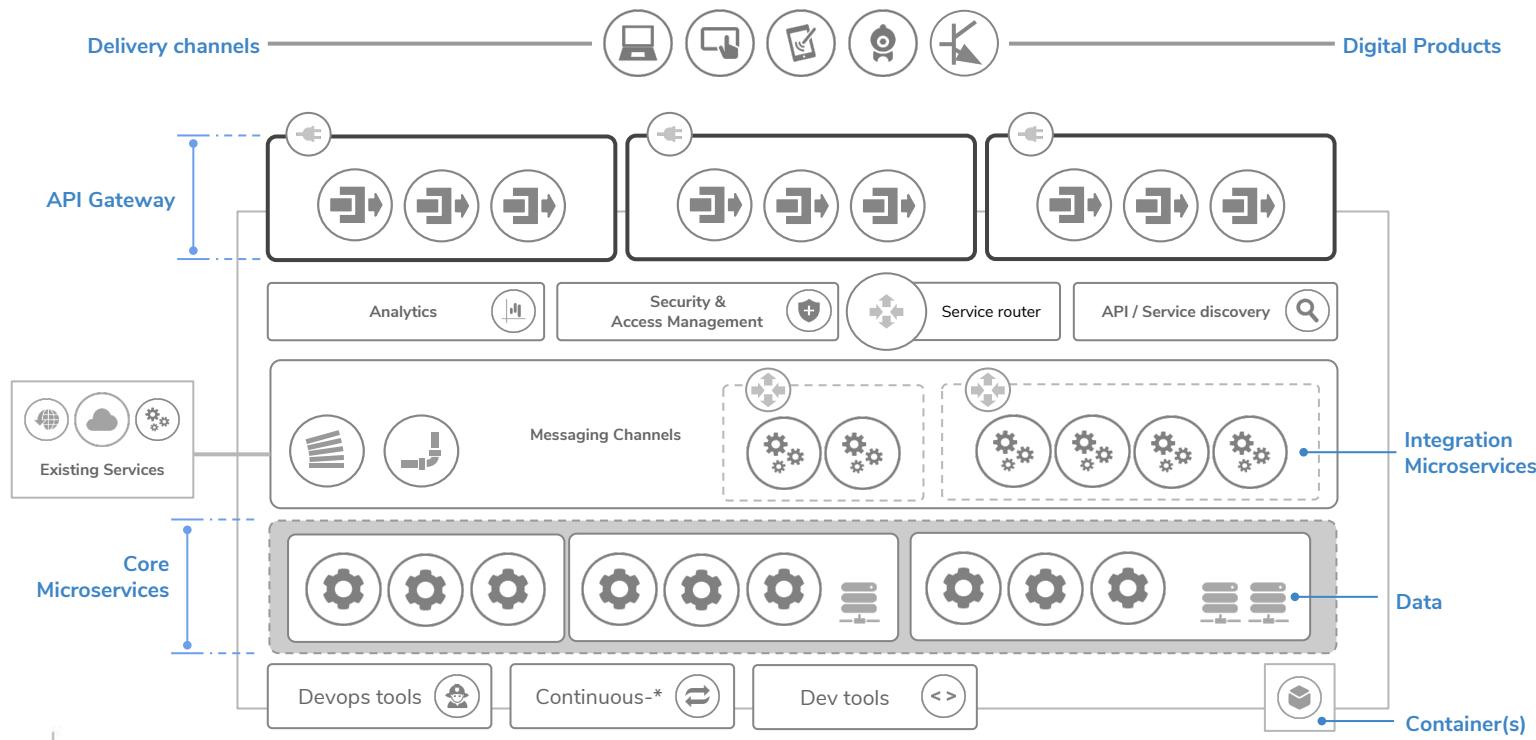
Reference Architecture



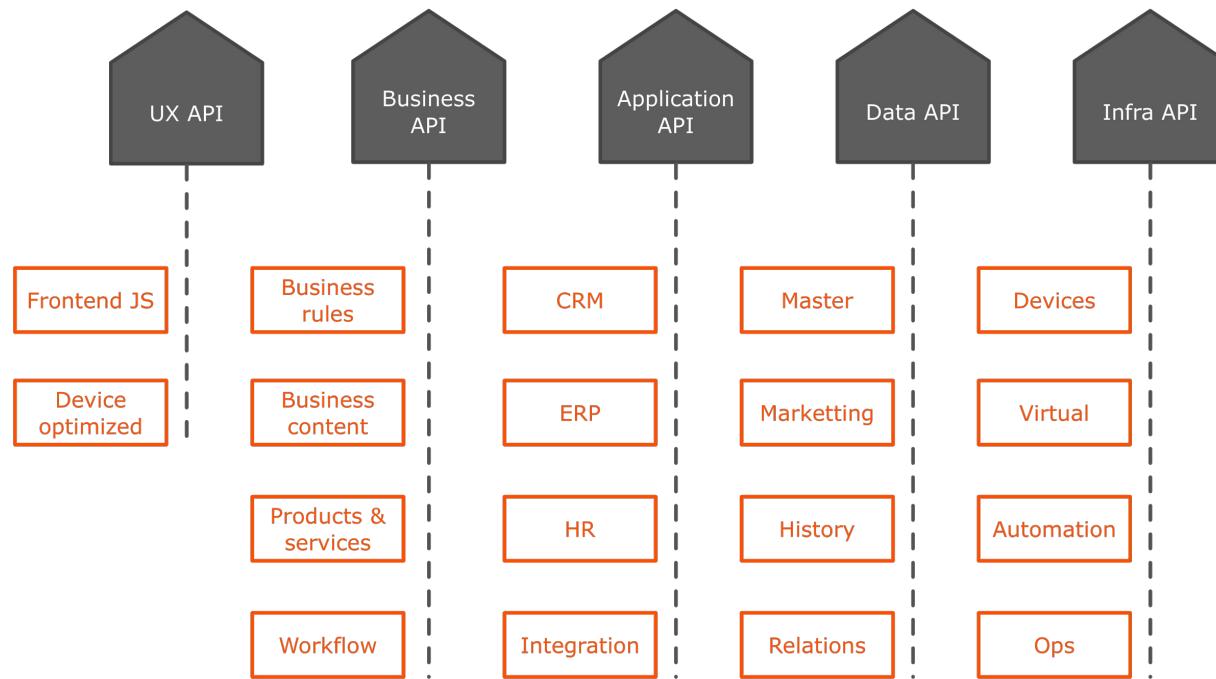
APIs hold the key to Digital Transformation



Present Day Enterprise Architecture



APIs are found in Every Layer



The modern API

- RESTful & JSON savvy - being lightweight, REST style conformant
- Well documented - Methods, operations, responses, error codes etc
- Manageable (life-cycle, version)
- Discoverable - Searchable, testable
- Measurable
- Secured - Multiple security protocol support, transformable

Digital Platform

A Digital Platform

People



Apps



APIs



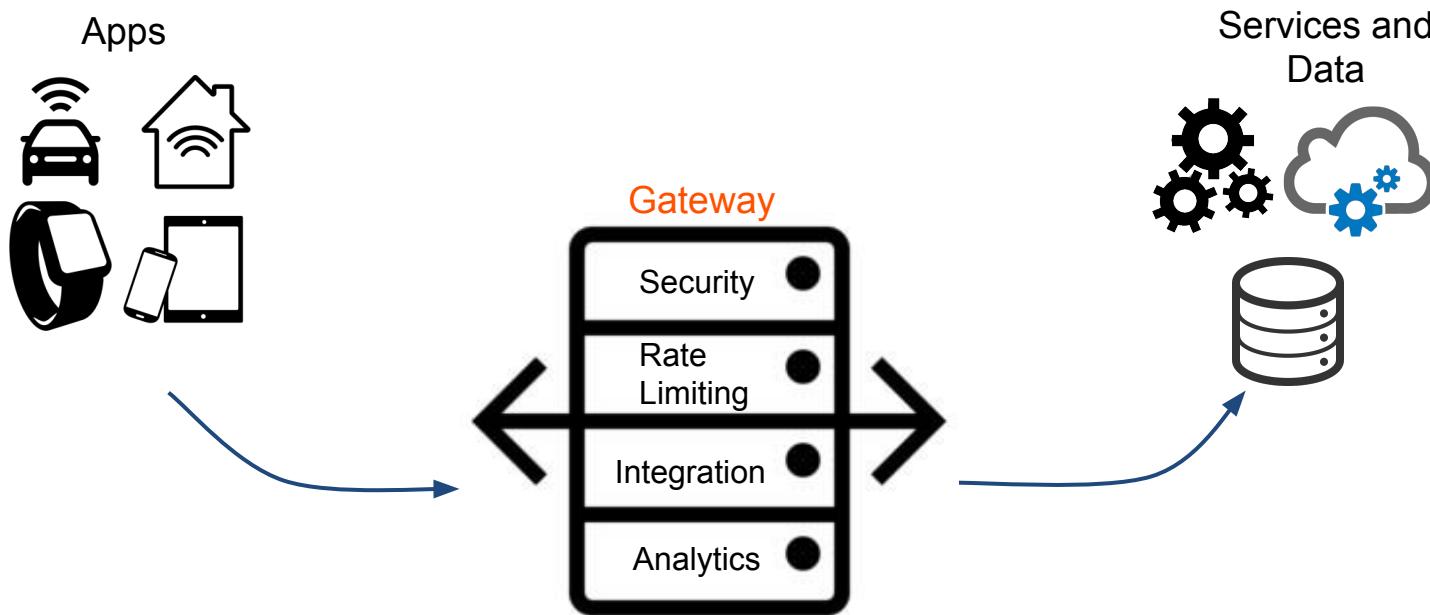
Services and Data



Key Performance Factors of an API Platform

- Security
- Rate Limiting
- Integration
- Analytics

API Gateway



Security: Identity

- Authentication
- Single Sign On
- Federation
- Authorization

Authenticate via Facebook to Airbnb APIs

Login By Facebook

Returns an access_token, given a valid Facebook user OAuth access token. See [the Facebook docs](#) to learn how to generate an FB access token.

NOTE: The returned access_token is required to hit logged-in endpoints.

Method: HTTP POST

Endpoint URL: <https://api.airbnb.com/v1/authorize>

Complete Curl Request (Press "Send to Hurl.it" to send in-browser test request):

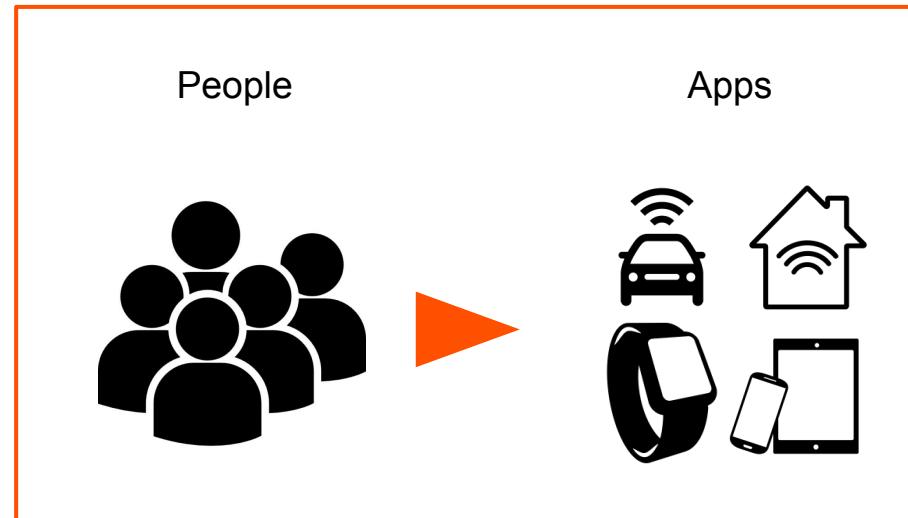
```
curl -X POST  
-d "client_id=3092nxybyb0tqw18e8nh5nty"  
-d "locale=en-US"  
-d "currency=USD"  
-F assertion_type=https://graph.facebook.com/me  
-F assertion=CAAAIEMtwcwBAMT070riSczKIgT3Nv0EnaZBWm0bwt914W  
-F prevent_account_creation=true  
https://api.airbnb.com/v1/authorize
```

[Copy to clipboard](#)

[Send to Hurl.it](#) [embedcurl.com by Runscope](#)

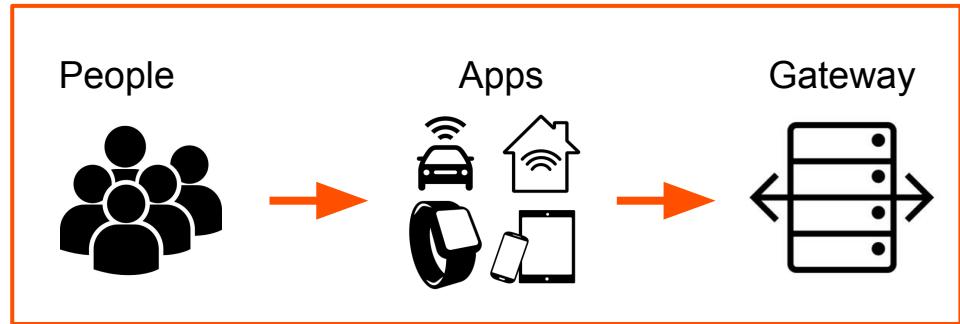
Security: Access Delegation

- Secure Trusted Clients
- Secure Untrusted Clients
- Unsecure Clients
- System to System Auth/z



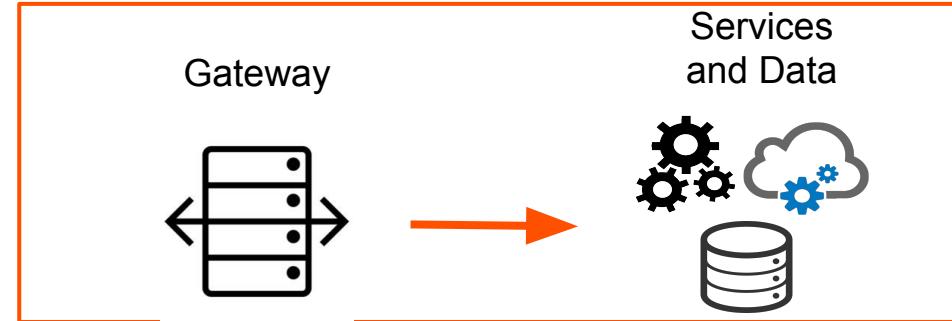
Rate Limiting: Front End

- Monetization
- Burst Control
- Fair Usage Policy
- Geographical Distribution
- Distribution by Device Type

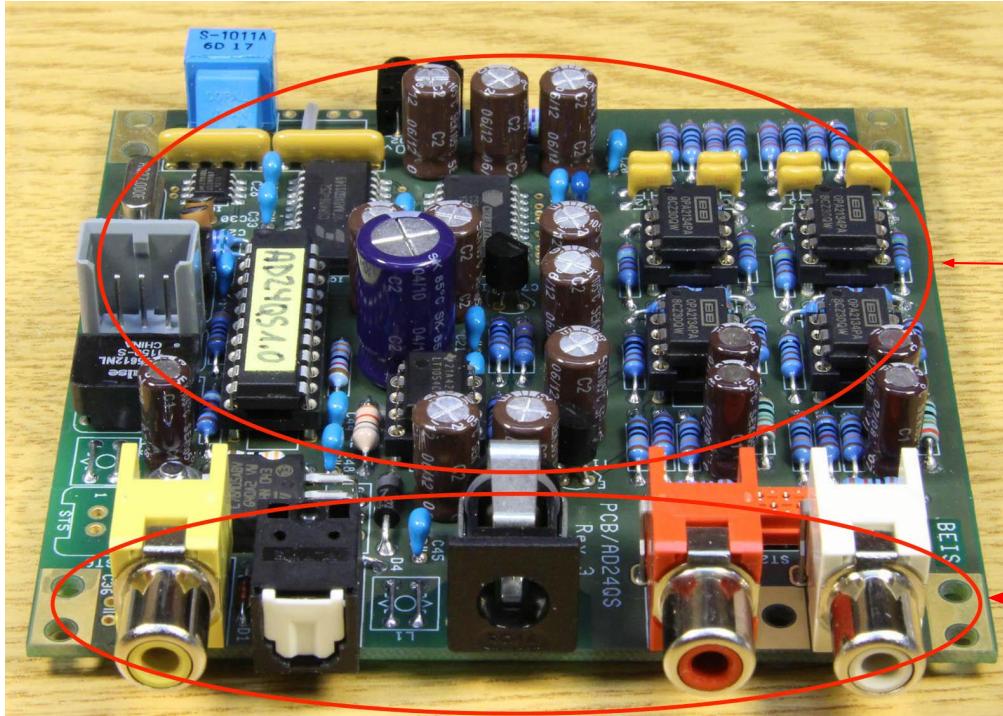


Rate Limiting: Back-End

- Prevent Total Service Outage at Peaks
- Back-End Server Maintenance



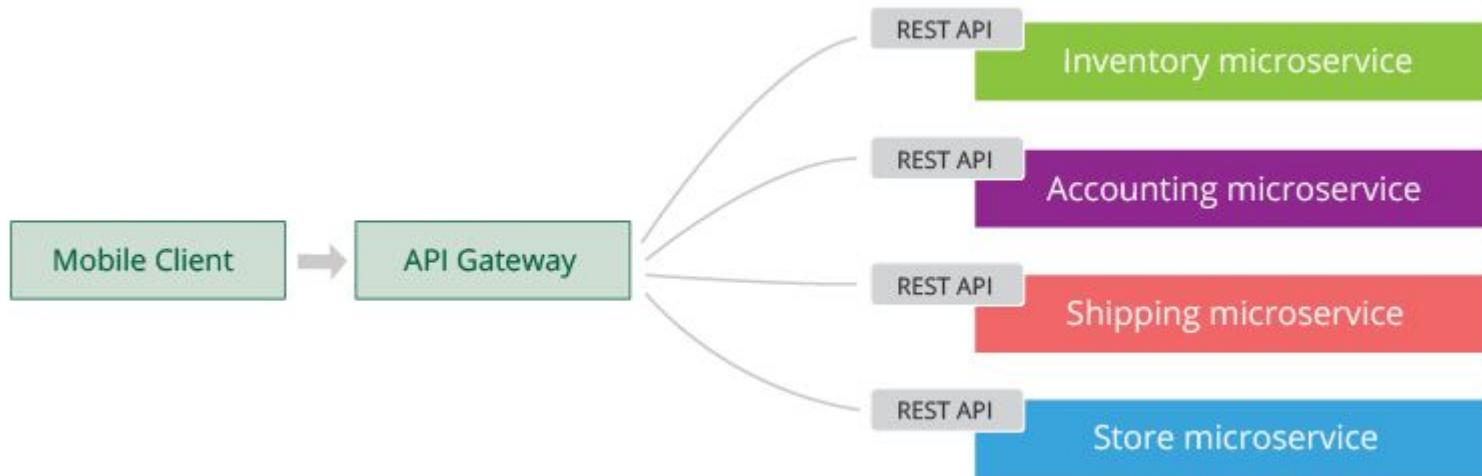
Integration



Integration

Interface

Integration



Integration

The Problem!

“At present tooling for API gateways is achingly immature and so while defining applications with API gateways is possible it’s most definitely not for the faint-hearted.”

Mike Roberts, August 2016 - “Serverless Architectures” on martinfowler.com

Integration

The Solution



Ballerina

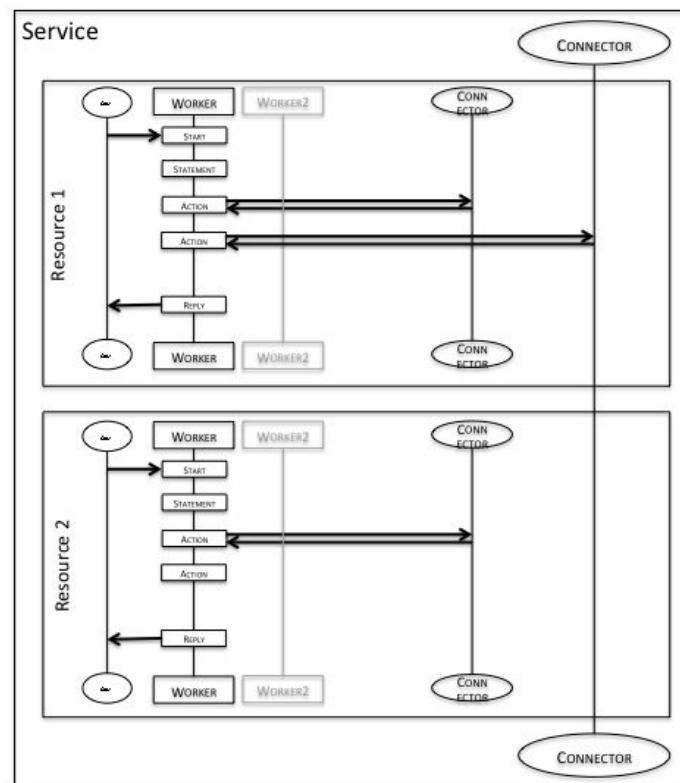
Flexible. Powerful. Beautiful.

Ballerina is a programming language that lets you
create integrations with diagrams.

ballerinalang.org



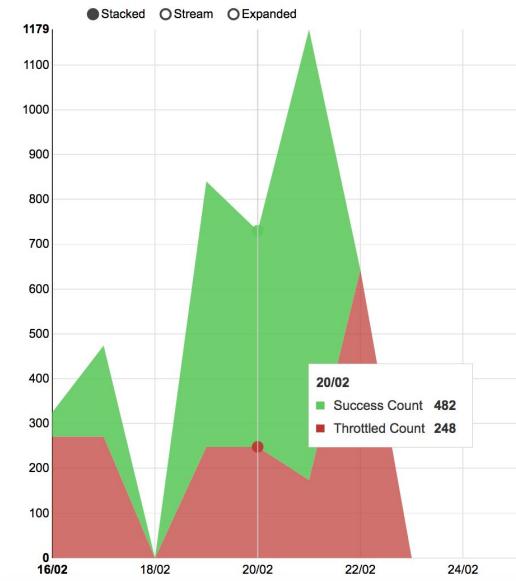
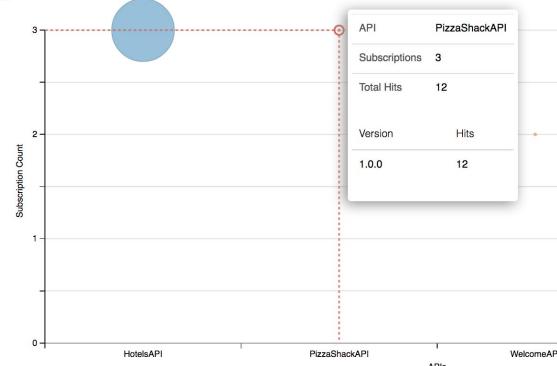
Ballerina



Ballerina

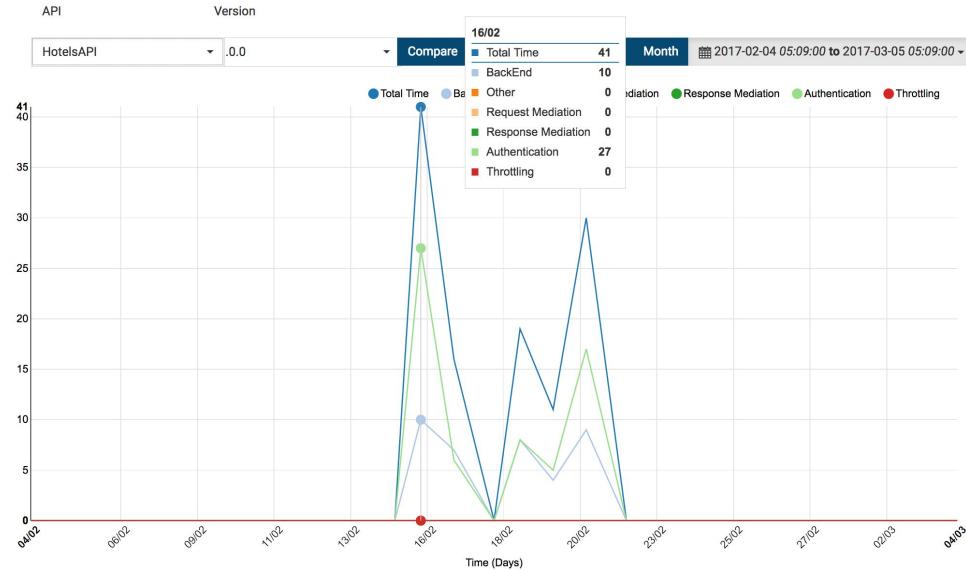
```
1 package restfulservice.samples;
2 import ballerina.net.http;
3
4 @http:BasePath ("/ecommerce")
5 service Ecommerce {
6     http:ClientConnector productsService = create http:ClientConnector("http://localhost:9090");
7
8     @http:GET
9     @http:Path ("/products/{productId}")
10    resource productsInfo(message m,
11        @http:PathParam("productId") string prodId) {
12        string reqPath = "/productsservice/" + prodId;
13        message response = http:ClientConnector.get(productsService, reqPath, m);
14        reply response;
15    }
16
17
18    @http:POST
19    @http:Path ("/products")
20    resource productMgt (message m) {
21        message response = http:ClientConnector.post(productsService, "/productsservice", m);
22        reply response;
23    }
24}
25
```

Analytics: Statistical Analysis



Analytics: Operational

- API Latency Distribution
- Alerting on Abnormalities
- API Health



WSO2 API Manager

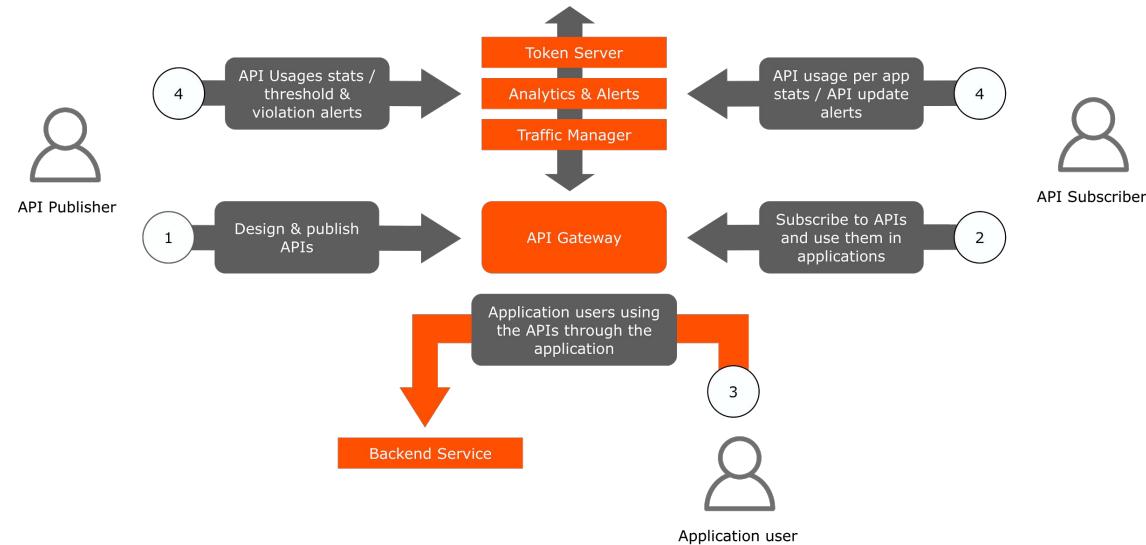
**Design, create, publish and manage APIs to
unlock the true value of your digital assets**

Battle hardened

- Currently at version 2.1.0 with over 6 years of engineering improvements across 15 stable releases
- Geo distributed and clustered deployments
 - In production at StubHub / Verizon / Motorola / BYU / BNY
- Same code base at WSO2 API Cloud running with four 9s uptime
- One major and 3 minor releases per year
- Automated deployment with puppet
- Containerized with Docker

WSO2 API Manager

- Available as a single downloadable package
- Available as a cloud / SaaS solution
- Flexible deployment choices
- High performance gateway
- API governance, marketplace solution



Cloud First or Start On-Prem



API Cloud



WSO2 Managed Cloud



Private On-Prem

- Multi-tenanted, shared everything
- WSO2 Hosted and managed
- Pay as you go
- Multi-region availability
- VPN tunnel to private DC
- Guaranteed uptime
- Limited options in customizing

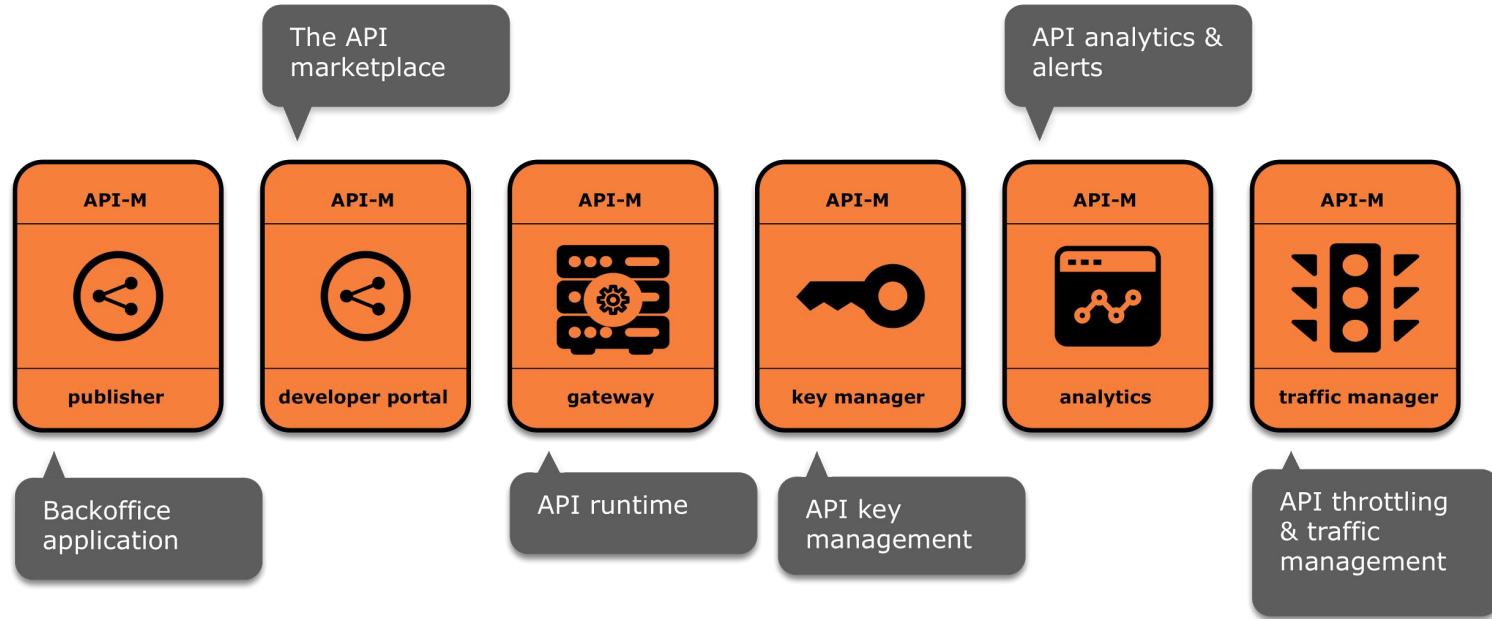
<http://wso2.com/api-management/cloud/>

- Privately hosted
- WSO2 managed
- Upgrades, patches installation
- Guaranteed uptime
- Full flexibility in customization
- Better control

<https://docs.wso2.com/display/ManagedCloud/WSO2+Managed+Cloud+Documentation>

- Self hosted
- Self managed
- Full flexibility
- Dev-ops learning curve
- Self managed upgrades

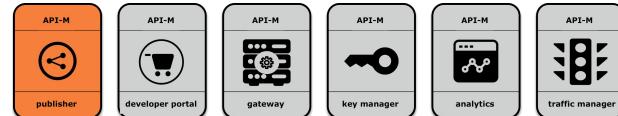
Componentized



Creating an API

Designing or Publicizing an API

Creating APIs



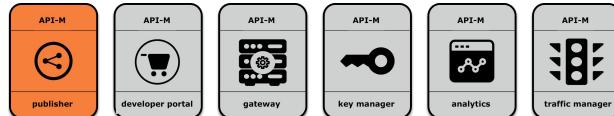
- Start with an existing endpoint/contract or design and prototype a new API
- Exposing SOAP services (convert to REST or as a passthrough)
- Exposing streaming APIs (Websocket endpoints)

The screenshot shows the WSO2 API Publisher interface. At the top, there's a navigation bar with 'HOME / APIS / ADD NEW API'. Below it is a header with 'API Walkthrough' and 'admin'. A 'GO BACK' button is also present. The main area starts with a 'Let's get started!' message and a 'Add New API' title. It features a list of four options, each with a radio button and a description:

- I Have an Existing API: Use an existing API's endpoint or the API Swagger definition to create an API.
- I Have a SOAP Endpoint: Use an existing SOAP endpoint to create a managed API. Import the WSDL of the SOAP service.
- Design a New REST API: Design and prototype a new REST API.
- Design a New Websocket API: Design and prototype a new Websocket API.

At the bottom right of the main area, there's a small purple circle with the number '0'.

Creating APIs



- API Design - Over the wizard & with swagger

API Definition

URL Pattern E.g., path/to/resource

GET POST PUT DELETE PATCH HEAD **more**

+ Add

Method	Path	Summary
POST	/order	+ Summary
GET	/menu	+ Summary
PUT	/order/{orderId}	+ Summary
GET	/order/{orderId}	+ Summary
DELETE	/order/{orderId}	+ Summary

Save **Next: Implement >**

Discard Changes **Apply Changes**

File Preferences Generate Server Generate Client Help

```
paths:
  /order:
    post:
      x-auth-type: Application & Application User
      x-throttling-tier: Unlimited
      description: Create a new Order
      parameters:
        - schema:
          $ref: '#/definitions/Order'
          description: Order object that needs to be added
          name: body
          required: true
          in: body
      responses:
        '201':
          headers:
            Location:
              description: The URL of the newly created resource.
              type: string
            Content-Type:
              description: The content type of the body.
              type: string
          schema:
            $ref: '#/definitions/Error'
            description: >>
              Created. Successful response with the newly created object as entity
              in the body. Location header contains URL of newly created entity.
        '400':
          schema:
            $ref: '#/definitions/Error'
            description: Bad Request. Invalid request or validation error.
        '415':
          schema:
            $ref: '#/definitions/Error'
            description: >>
              Unsupported Media Type. The entity of the request was in a not
              supported format.
    /menu:
      get:
        x-auth-type: Application & Application User
        x-throttling-tier: Unlimited
```

PizzaShackAPI

This is a RESTful API for Pizza Shack online pizza delivery store.
Version 1.0.0
Contact information
John Doe
architecture@pizzashack.com
http://www.pizzashack.com
License
Apache 2.0

Paths

/order

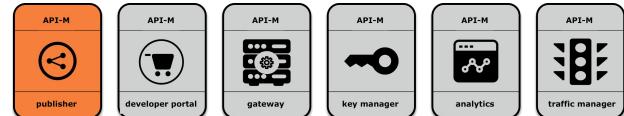
POST /order

Description
Create a new Order

Parameters

Name	Located in	Description	Required Schema
body	body	Order object that needs to be added	Yes

▼ Pizza Order {
 customerName: string
 delivered: boolean
 address: string
 pizzaType: string
 creditCardNumber: string



Managed or prototyped

- Point to a production backend or prototype at the gateway

Managed API
Provide the production and sandbox endpoints of the API to be managed.

Endpoint Type :* [HTTP/REST Endpoint](#)

Load Balanced Failover

Production Endpoint :* [? ?](#)

Sandbox Endpoint :* [? ?](#)

[Show More Options](#)

Prototyped API
Use the inbuilt JavaScript engine to prototype the API or provide an endpoint to a prototype API. The inbuilt...

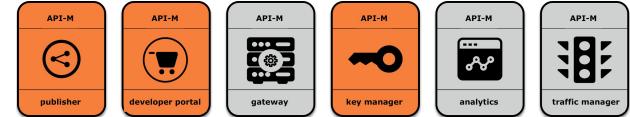
Implementation Method [Inline](#) [Endpoint](#)

Resources

GET	/*	+ Summary
<p>Description : + Add Implementation Notes</p> <p>Response Content Type :</p> <p>Parameters :</p> <p>Script :</p> <pre>1 mc.setProperty('CONTENT_TYPE', 'application/json'); 2 mc.setPayloadJSON('{ "data" : "sample JSON"}');</pre>		

Publishing an API

Enforcing Security and SLAs



Protecting APIs

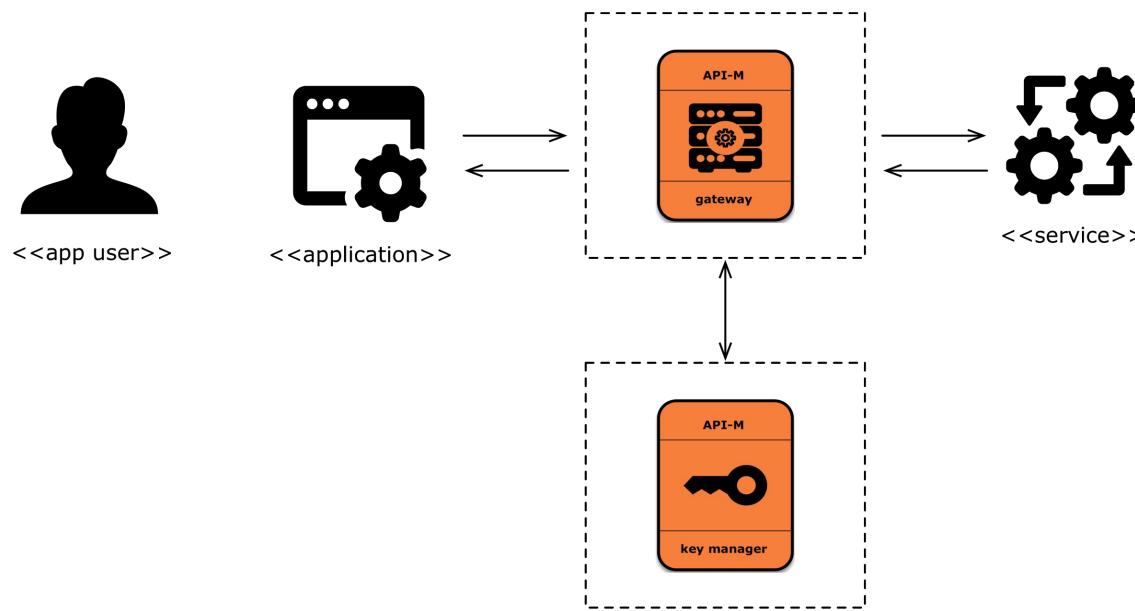
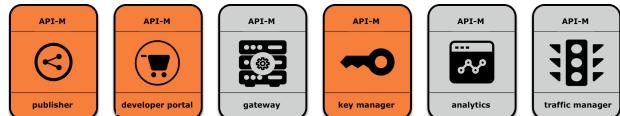
- Protecting for applications and users
- Controlling access and entitlement with scope
- Multi-Tier subscription model

Resources

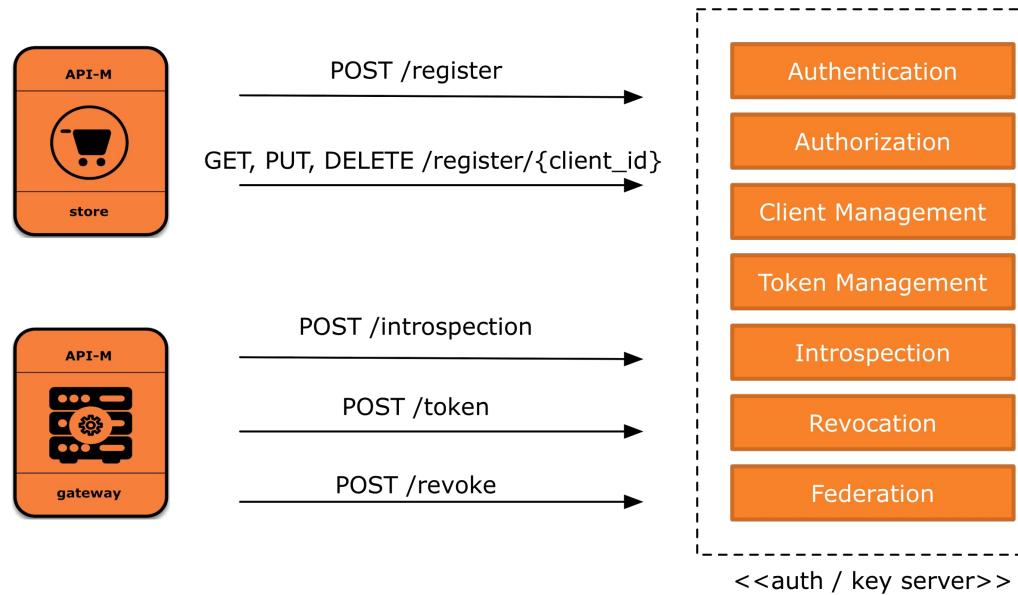
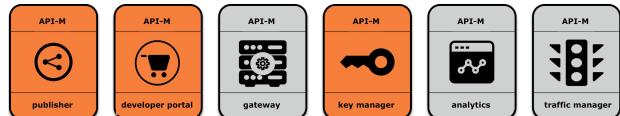
Scopes: [+ Add Scopes](#)

Method	URI	Summary	Entitlement	Quota	Action
POST	/order	+ Summary	Application & Application User	Unlimited	+ Scope
GET	/menu	+ Summary	Application & Application User	Unlimited	+ Scope
PUT	/order/{orderId}	+ Summary	Application & Application User	Unlimited	+ Scope
GET	/order/{orderId}	+ Summary	Application & Application User	Unlimited	+ Scope
DELETE	/order/{orderId}	+ Summary	Application & Application User	Unlimited	+ Scope

Protecting APIs



Authorization & Introspection

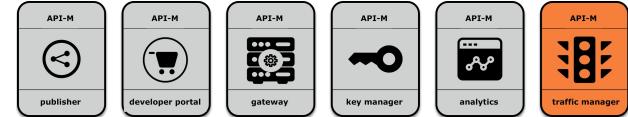


Client Application

- Encapsulate the client application
- Associates OAuth2 keys
- Support different integration patterns for application security through OAuth grant types
- Pre-generated access tokens for testing

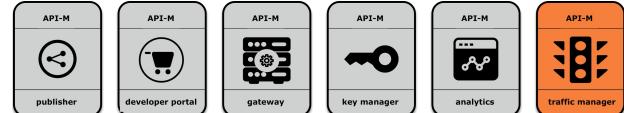
The screenshot shows the WSO2 API Manager 2.1.0 interface for managing client applications. The top navigation bar includes links for APPLICATIONS, APIs, FORUM, and ANALYTICS. The main content area displays the configuration for the 'pizza-hut-store' application. It features tabs for Details, Production Keys, Sandbox Keys, and Subscriptions. Under the Details tab, there are fields for Consumer Key and Consumer Secret. The Grant Types section lists several options, with Refresh Token, AIA-HTML, and Client Credential checked. Below this is a Callback URL input field. The Generating Access Tokens section contains two examples of cURL commands for generating access tokens using the Password and Client Credential grant types. At the bottom, the Generate a Test Access Token section allows users to enter an Access Token and set a Validity period (3600 seconds). A 'Regenerate' button is available for generating a new token.

Traffic Management



- Tier based simple model
 - Application developer selects the tier at app registration
 - Each tier is tied to a policy that describe the quota
 - Tiers can be applied at the application, API or at the API resource level
- Advance rule based models
 - Policies containing IP conditions, message attribute based conditions, transport header based conditions
 - Complex real time pattern based conditions

Traffic Management



Add Conditional Group

Condition Group
Sample description about condition group

IP Condition (selected) IP Condition Policy: Off

Header Condition Query Param Condition JWT Claim Condition

Execution Policy

Request Count: Request Count Request Count: * 5 Time: * 1

THROTTLING POLICIES

X GO BACK

Add Custom Rule

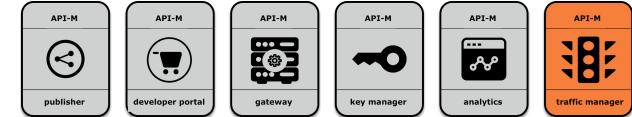
Name *

Description

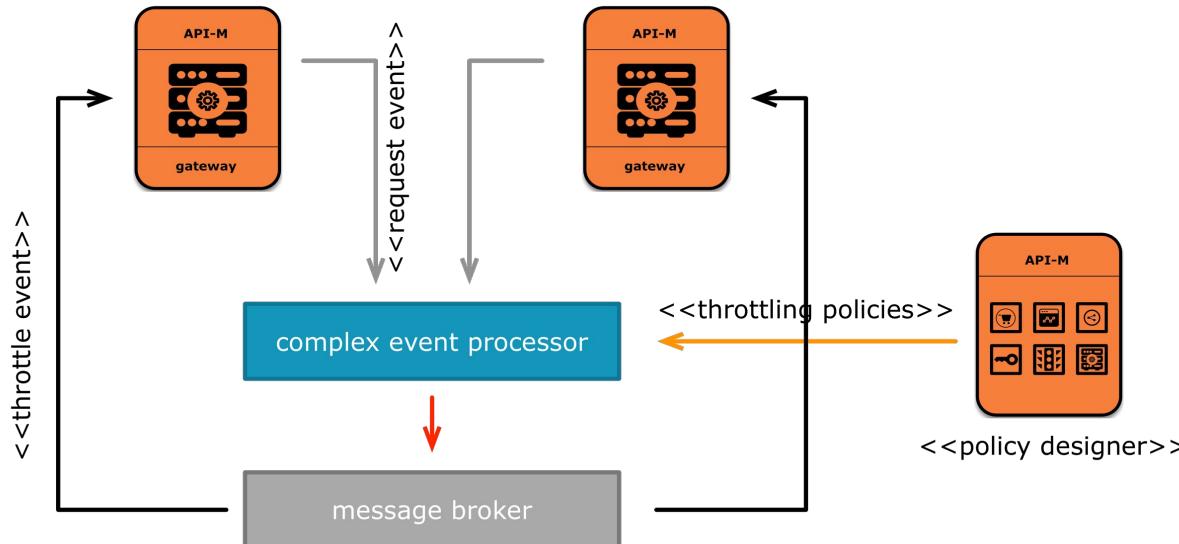
Key Template *

Siddhi Query *

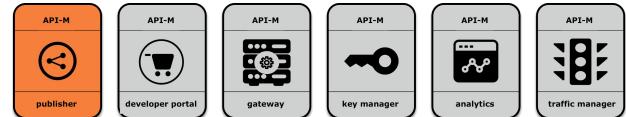
Show Sample



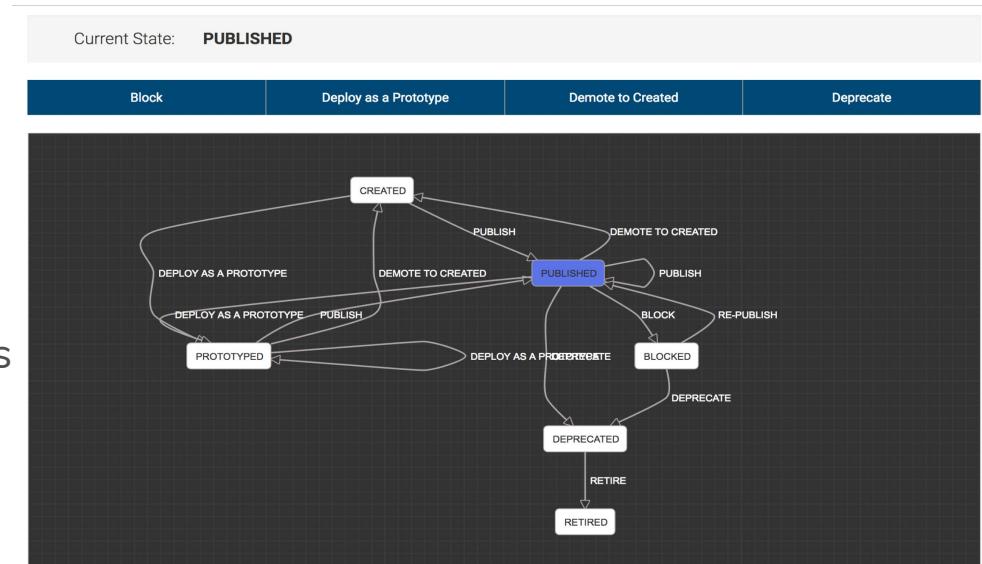
Traffic Manager Architecture



API Lifecycle Management



- Manage stages of an API
- Manage associated states
- Create a new version from an existing
- Audit changes to lifecycle states
- Support for custom lifecycles



Consuming an API

The developer portal / marketplace

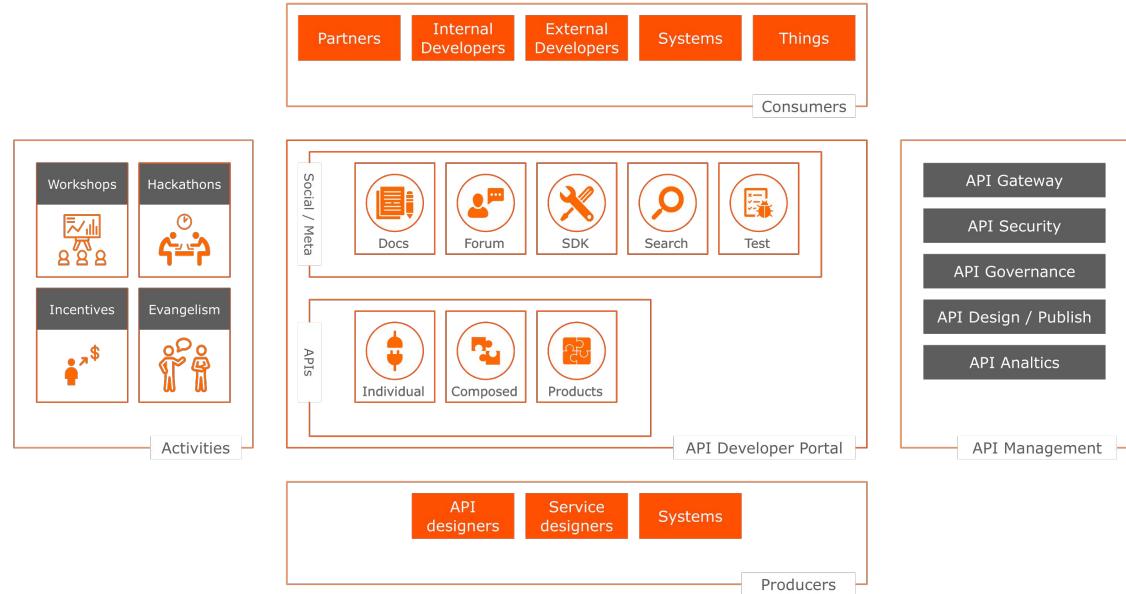
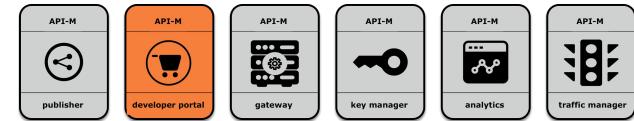
The Developer Portal

- Searchable (with context) - by name, tag, description, author etc.
- Social features: tagging, commenting, rating
- Minimalistic forum
- Themeable: change color, logo, view
- Configure alerts for application developers
- Application based API analytics
- OAuth2 application management
- API Monetization

The screenshot shows the WSO2 API Store developer portal. At the top, there is a navigation bar with tabs for 'APIS', 'APPLICATIONS', and 'STATISTICS'. Below the navigation bar, there is a sidebar titled 'TAGS' containing various tags such as 'ws02', 'users', 'stocks', 'stats', 'sports', 'social', 'profile', 'performance', 'organization', 'meetings', 'internet', 'id', 'hr', 'ftp', 'finance', 'exec', 'employees', 'employee', 'education', 'documents', 'documentation', 'business', 'bots', and 'AI'. The main content area is titled 'Recently Added APIs' and displays five cards for 'meeting-scheduler-v1.0', 'org-view-v1.0', 'stock-portfolio-v1.0.0', 'web-archives-v1.0.0', and 'ws02con-api-v1'. Below this, there is a section titled 'APIs' showing 12 more API cards, each with a thumbnail, name, version, developer information, and a star rating. The cards include 'CEO-Stats v1.0.0', 'certification v1.0.0', 'chat-bot v1.0.0', 'employees v1.0.0', 'file-transfer v1.0.0', 'id-card v1.0.0', 'meeting-scheduler v1.0.0', 'org-view v1.0.0', 'profile-service v1.0.0', 'sports v1.0.0', 'stock-portfolio v1.0.0', and 'user-directory v1.0.0'. At the bottom of the page, there is a footer with the text 'Powered by WSO2 API Cloud' and a small navigation bar with pages 1, 2, and >.

API Marketplace

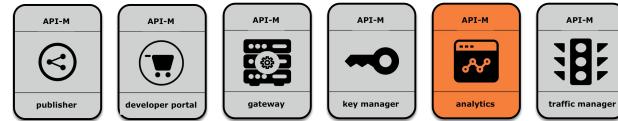
- An API Marketplace goes above and beyond the API Developer Portal and connects API Producers and API Consumers via Activities and Technology
- Activities and Evangelism such as Hackathons (Hackathon-in-a-box) promote creation and reuse of APIs



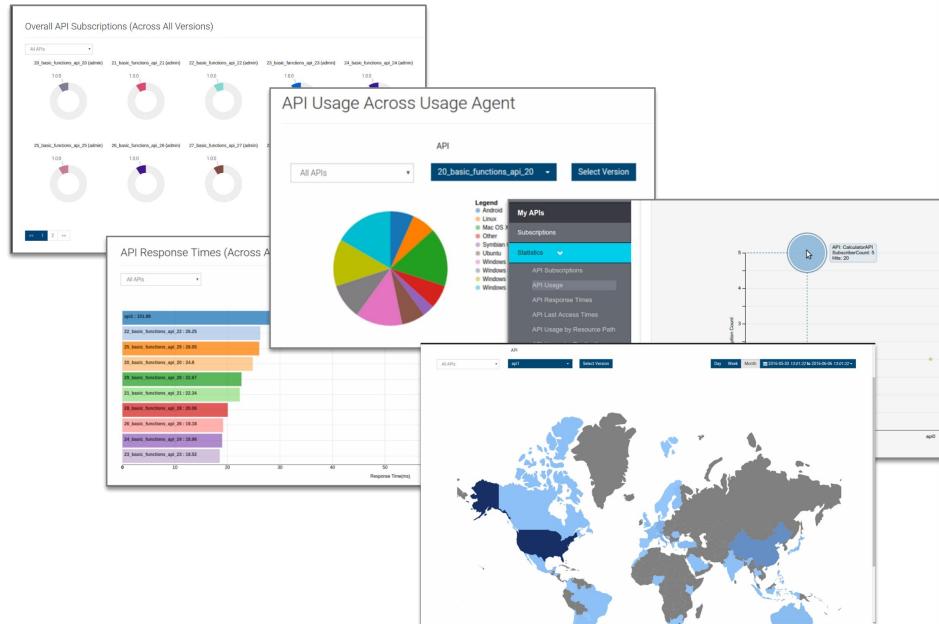
Monitoring an API

Analytics and Insight

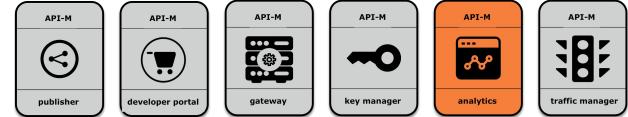
API Analytics: Batch



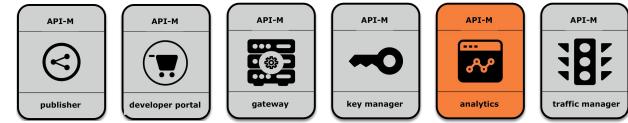
- Analytics dashboard on API stats
 - API Usage / Response times / Backend latency / Geo-location etc
- Stats on Applications for application owners (subscribers)
- Stats on subscriptions



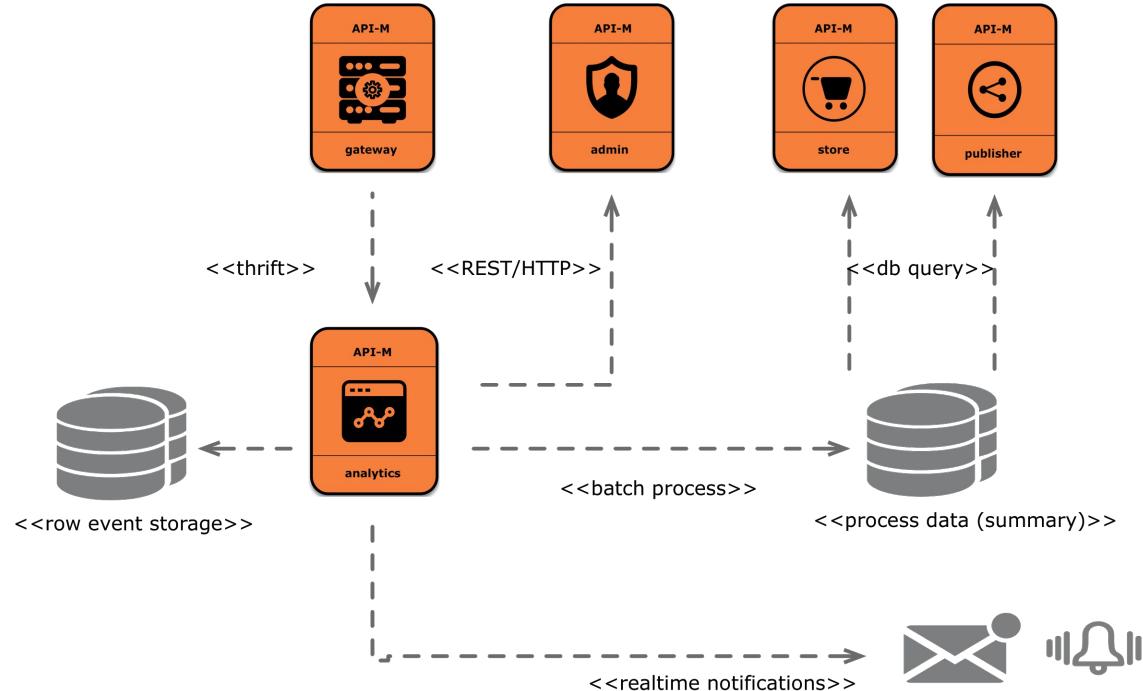
API Analytics: Realtime

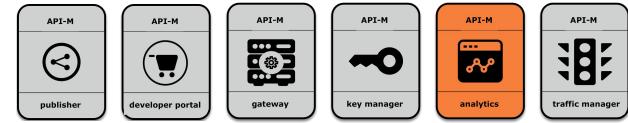


- Leverages real-time analytics streaming engine
- Used for various alerting use-cases
 - Fraudulent access token usage
 - Keeping API developers alerted on backend performance issues
 - Alerting on SLA violations
 - Alerting on tier crossing for subscriptions
- Detect trends
- Detect API call sequences that needs to be blocked
- Detect non-usage scenarios

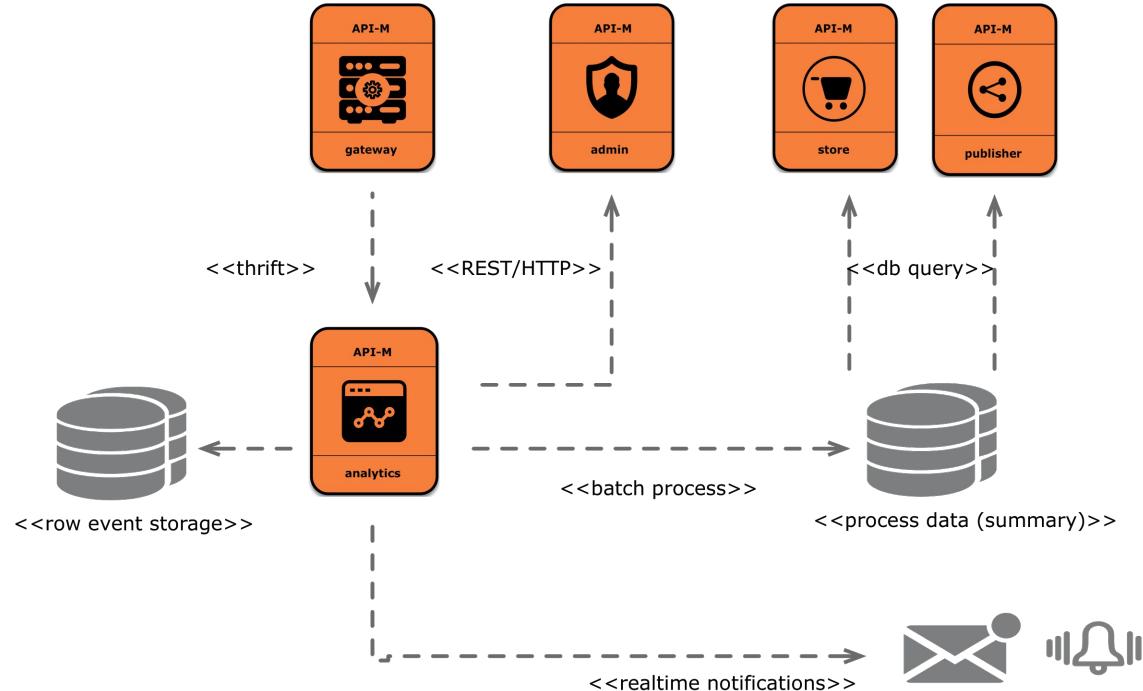


API Analytics: Architecture





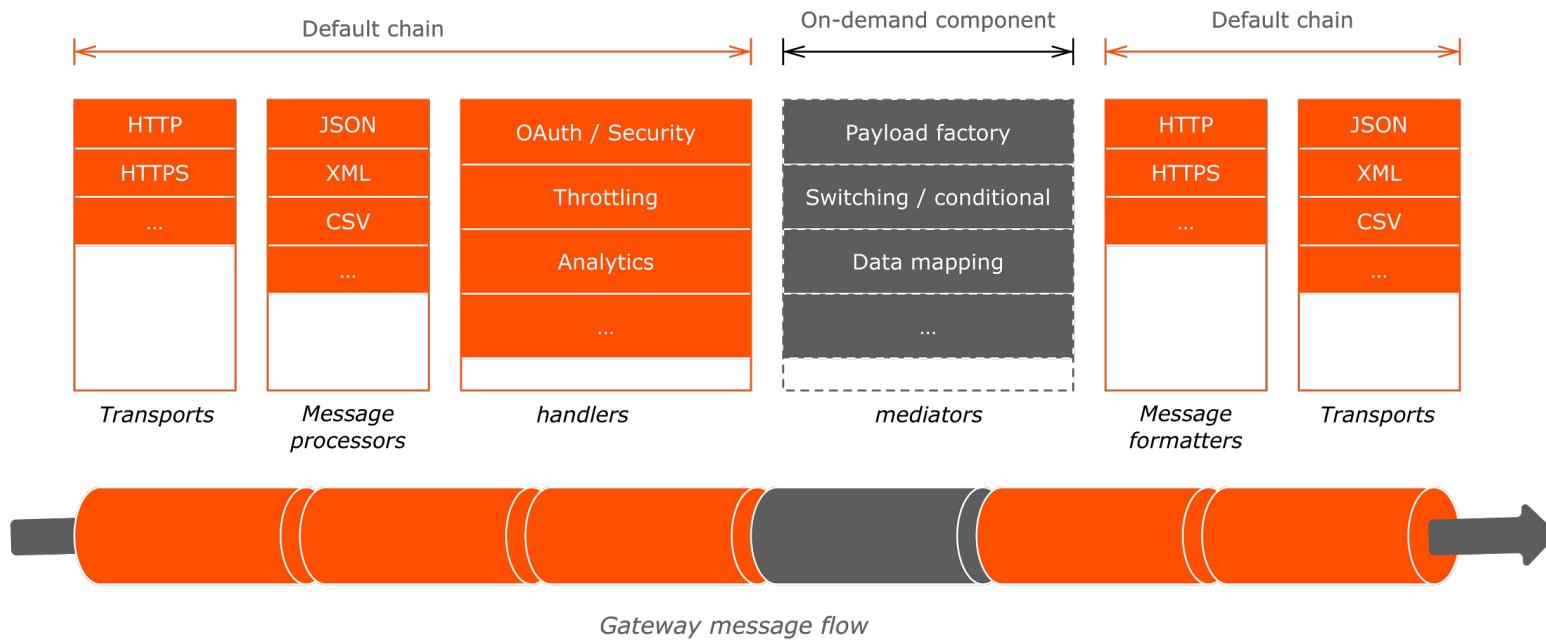
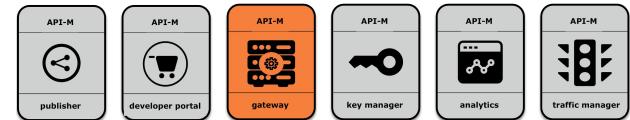
API Analytics: Architecture



The API Manager Runtime

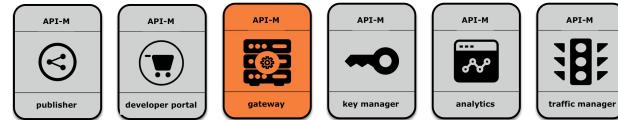
Processing Flow and Extensibility

API Gateway



Message mediation

- Message manipulation, transformation and enrichment
- WSO2 developer studio based tooling
- Wizard based mediation policy application



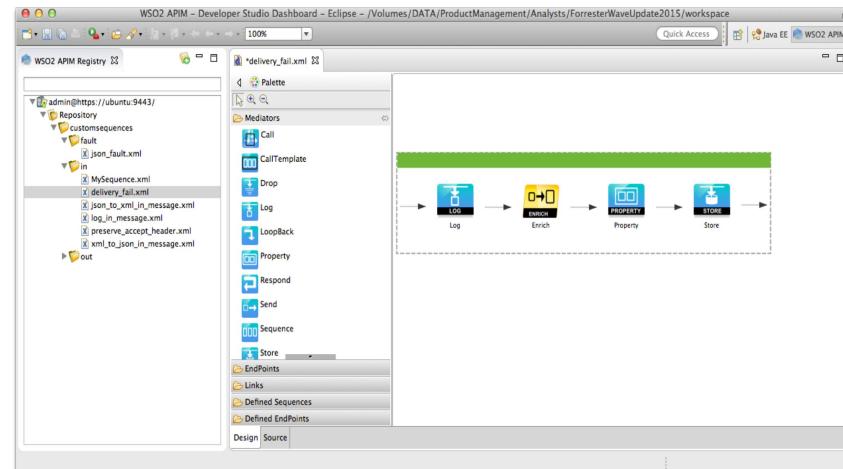
Message Mediation Policies

Enable Message Mediation Check to select a message mediation policy to be executed in the message flow

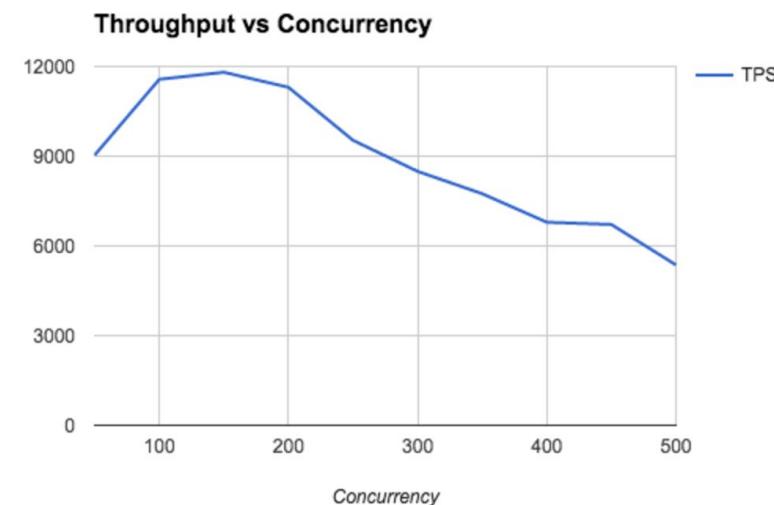
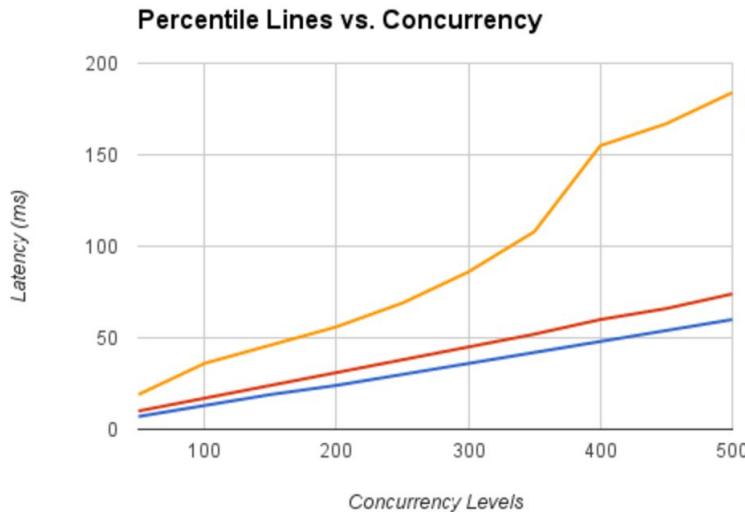
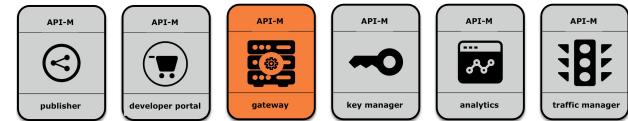
In Flow: None

Out Flow: None

Fault Flow: None



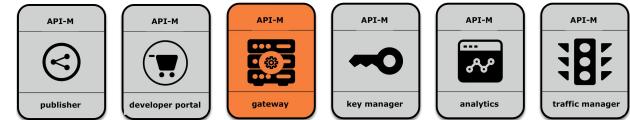
API Gateway Performance



WSO2 API Manager all in one simple deployment performance
H/W config: 4 core cpu with 8GB memory / c4.xlarge ec2 equivalent

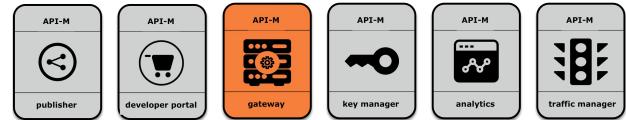
Extensibility & Enhancements

Extensibility & Enhancements



- API gateway handlers
 - Security handlers
 - Analytics handlers
- OAuth custom grant types
 - SAML extension grant type
 - NTLM / Kerberos
 - JWT extension grant

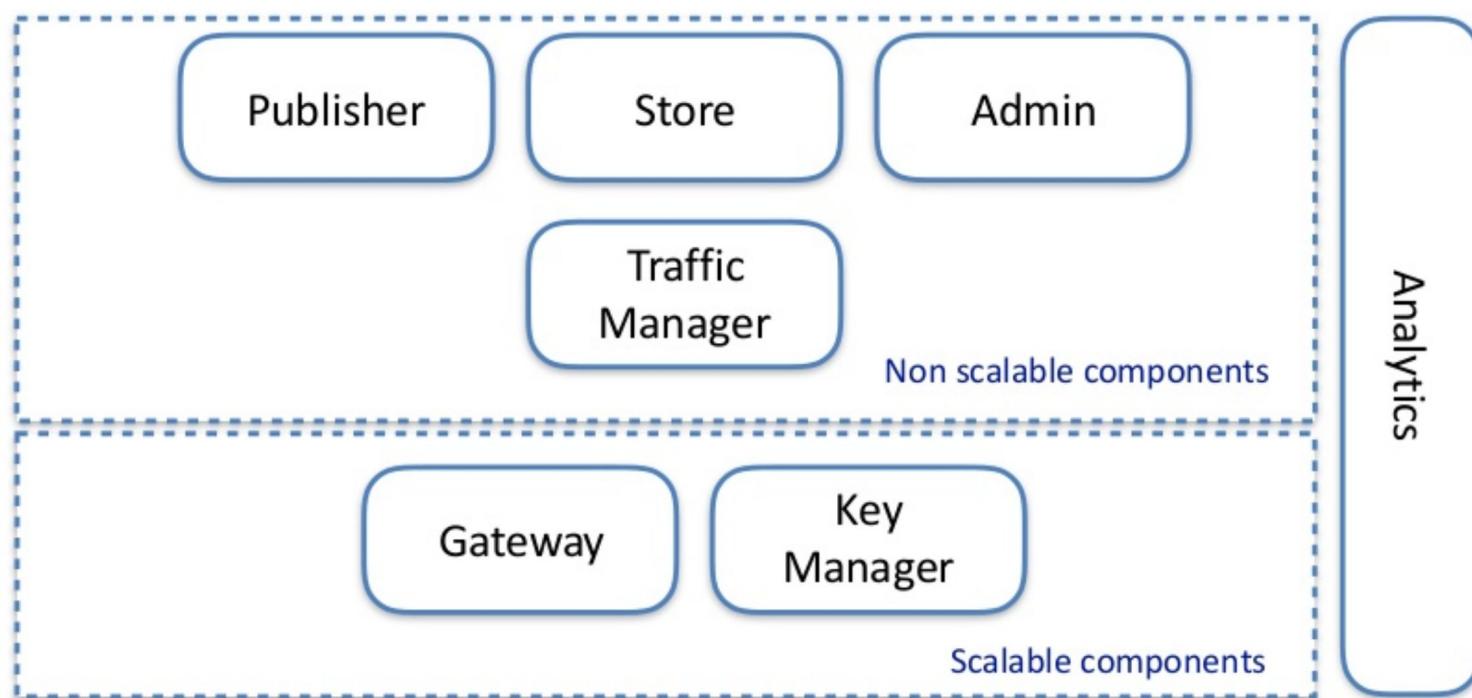
Extensibility & Enhancements



- OAuth scope handlers
 - Role based scope validation
 - XACML based scope validation
- Mediation extensions
 - Message transformation
 - Routing to backends
 - Payload validation
- Lifecycle extension
 - Executor plugin for lifecycle stages / transitions

Deep Dive into WSO2 API Manager

Understanding API Manager Components



Understanding the Storage

Storage Types

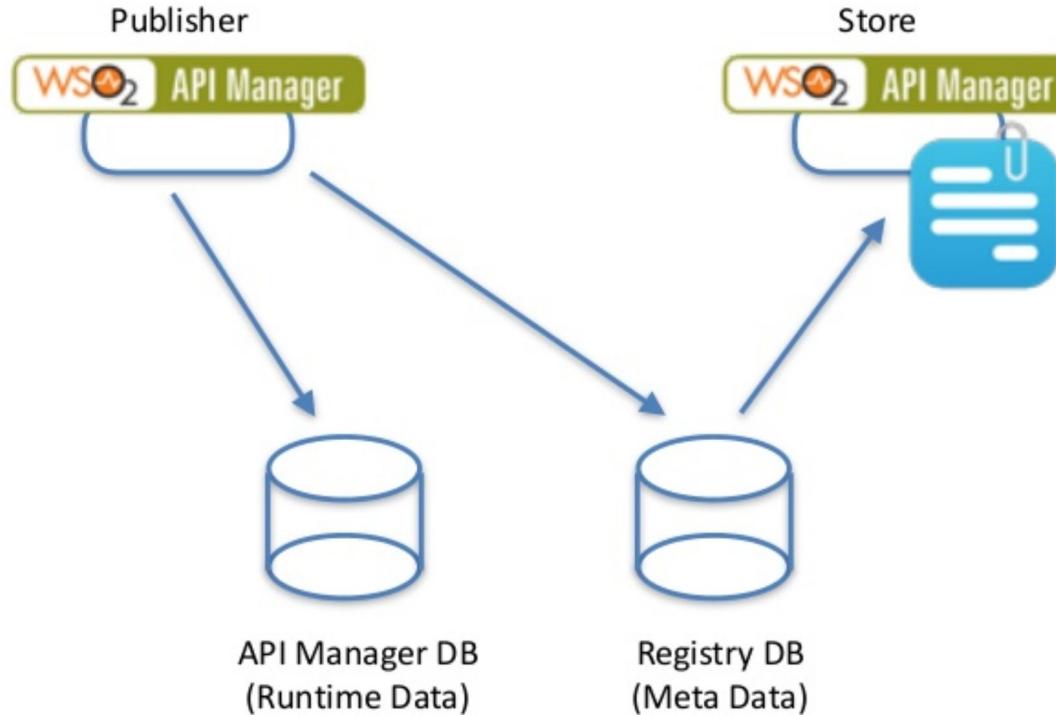
- Registry Database - Stores API Metadata, Tenant Key Stores, Documents, Tags
- API Manager Database - Stores API Runtime Data, Application Data, Token Data, etc
- Permissions Database - Stores role to permissions and user to permissions mappings
- Analytics Summary Database - Stores API/Application usage summary.

Understanding the Storage

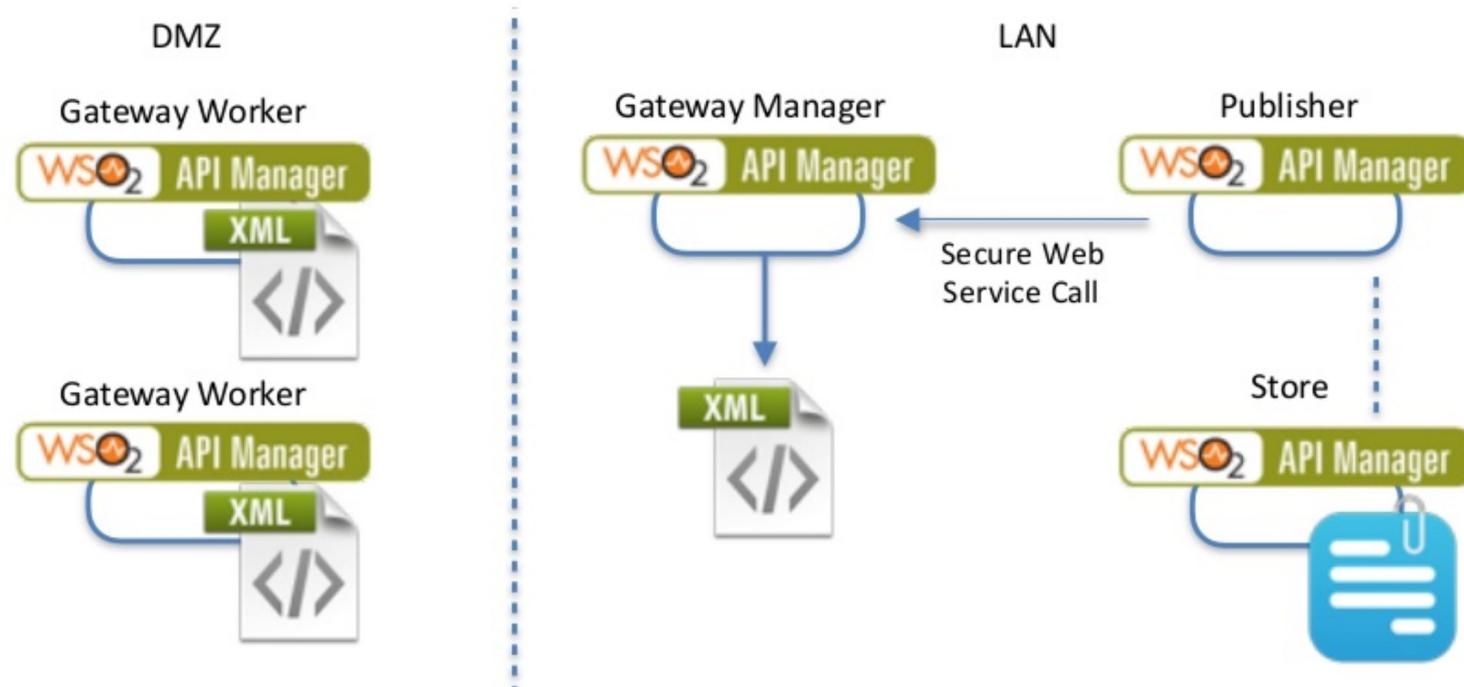
Understanding read/writes

Component	Reads only from	Writes to
Publisher	Permissions DB, Analytics DB	Registry, APIM DB
Store	Permissions DB, Analytics DB, Registry	APIM DB
Key Manager		Permissions DB, APIM DB, Registry
Traffic Manager	Permissions DB	

Create an API



Publishing an API



API: The runnable artifacts

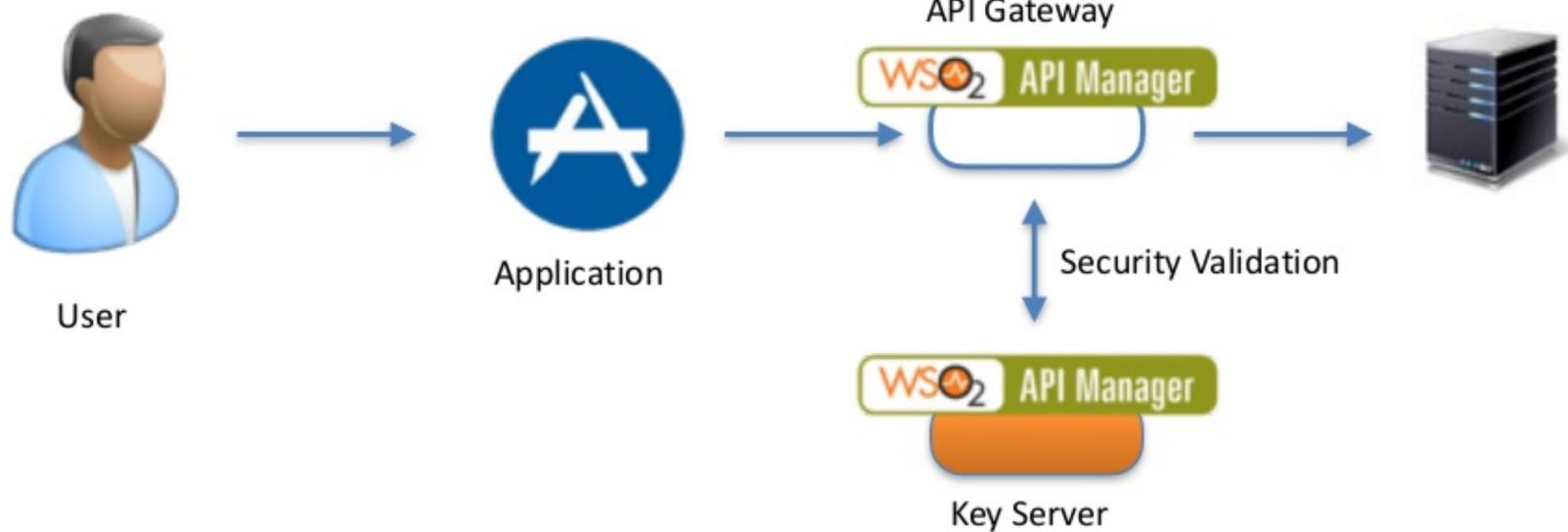
```
<api name="nuwan--Petstore"
    context="/petstore/1.0.0"
    version="1.0.0"
    version-type="context">

    <resource methods="POST PUT" url-mapping="/pet">
        ...
    <resource methods="DELETE PUT GET"
        uri-template="/user/{username}">
        ...
    <handlers>
        <handler
            class="org.wso2.carbon.apimgt.gateway.handlers.security.APIAuthenticationHandler">
            ...
        </handler>
    </handlers>
```

API: The handler Flow

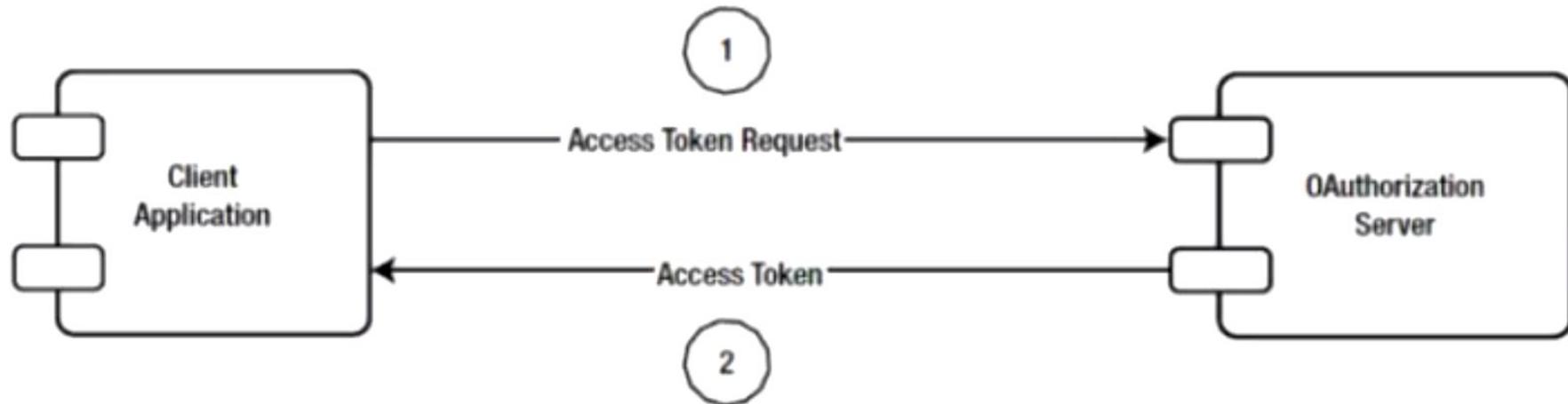
```
<handlers>
    <handler class="org.wso2.carbon.apimgt.gateway.handlers.common.APIMgtLatencyStatsHandler"/>
    <handler class="org.wso2.carbon.apimgt.gateway.handlers.security.CORSRequestHandler">
        <property name="apiImplementationType" value="ENDPOINT"/>
    </handler>
    <handler class="org.wso2.carbon.apimgt.gateway.handlers.security.APIAuthenticationHandler"/>
    <handler class="org.wso2.carbon.apimgt.gateway.handlers.throttling.ThrottleHandler"/>
    <handler class="org.wso2.carbon.apimgt.gateway.handlers.analytics.APIMgtUsageHandler"/>
    <handler class="org.wso2.carbon.apimgt.gateway.handlers.ext.APIManagerExtensionHandler"/>
</handlers>
```

API Security



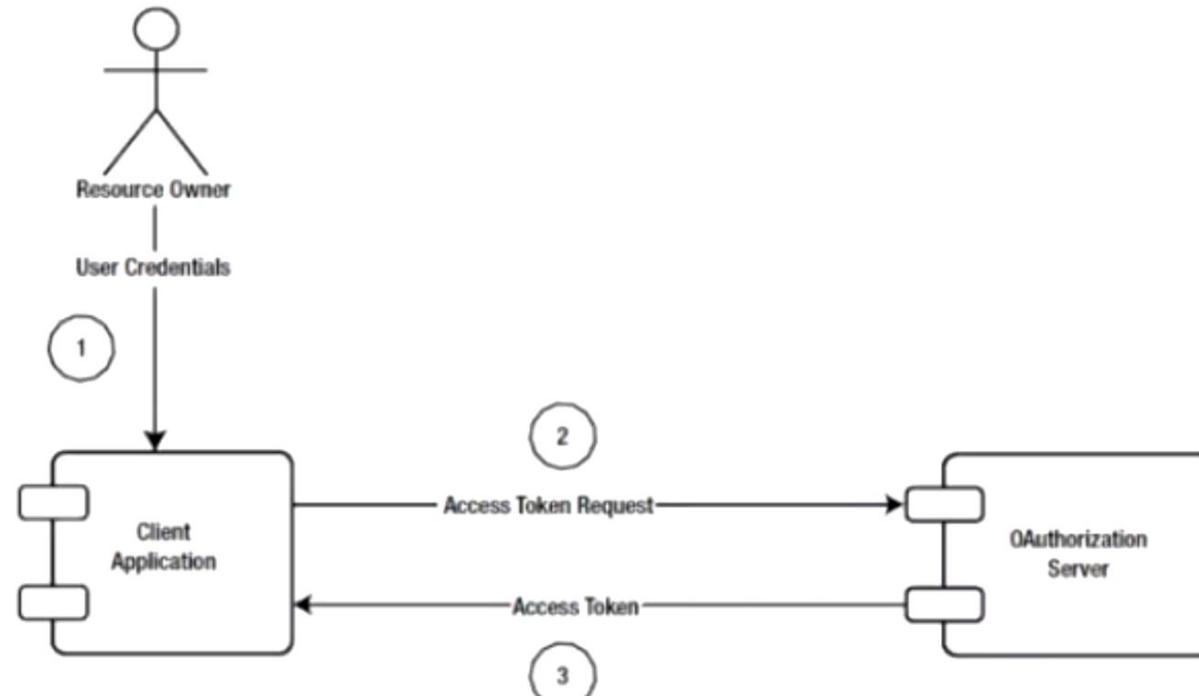
API Security

OAuth 2.0 Grants - Client Credentials



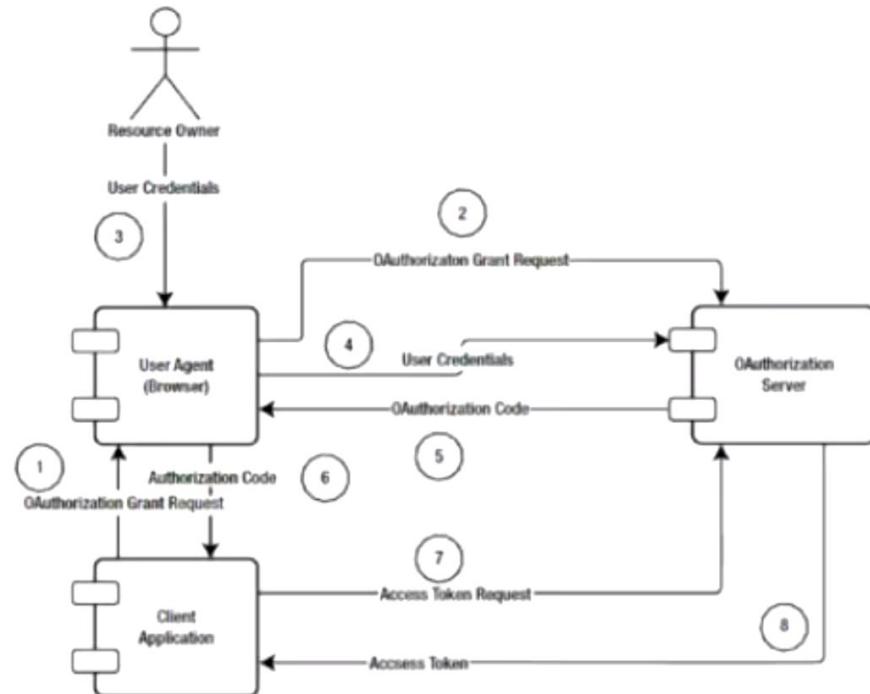
API Security

OAuth 2.0 Grants - Resource Owner Password



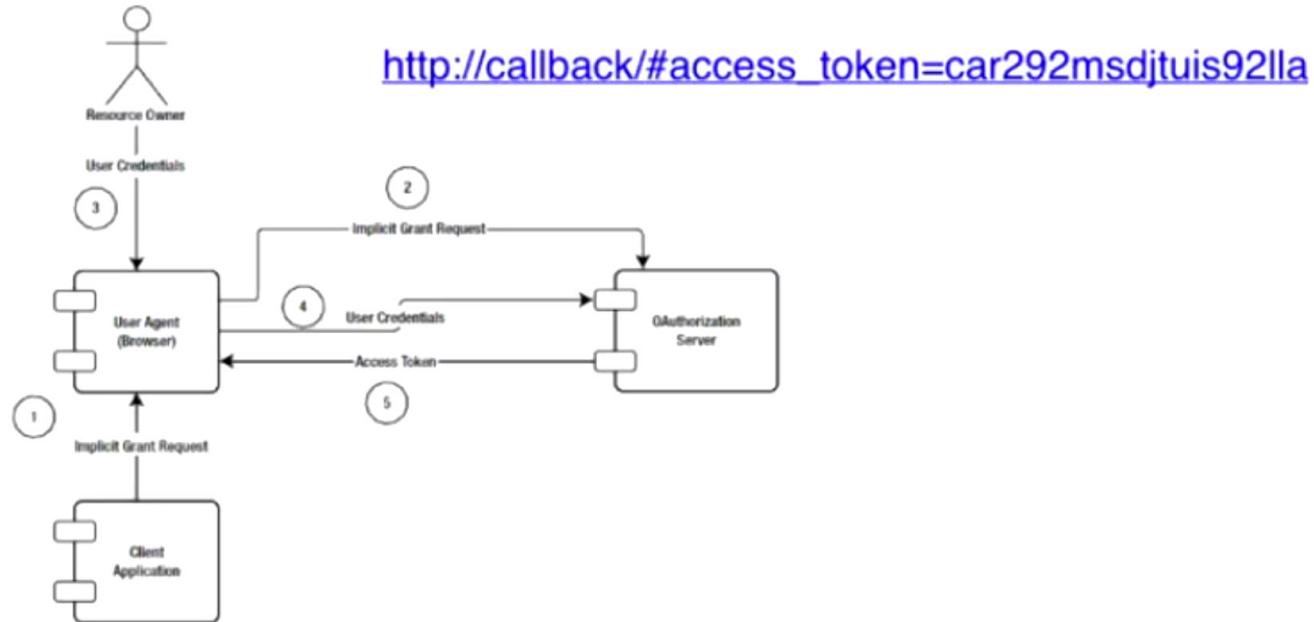
API Security

OAuth 2.0 Grants - Authorization Code

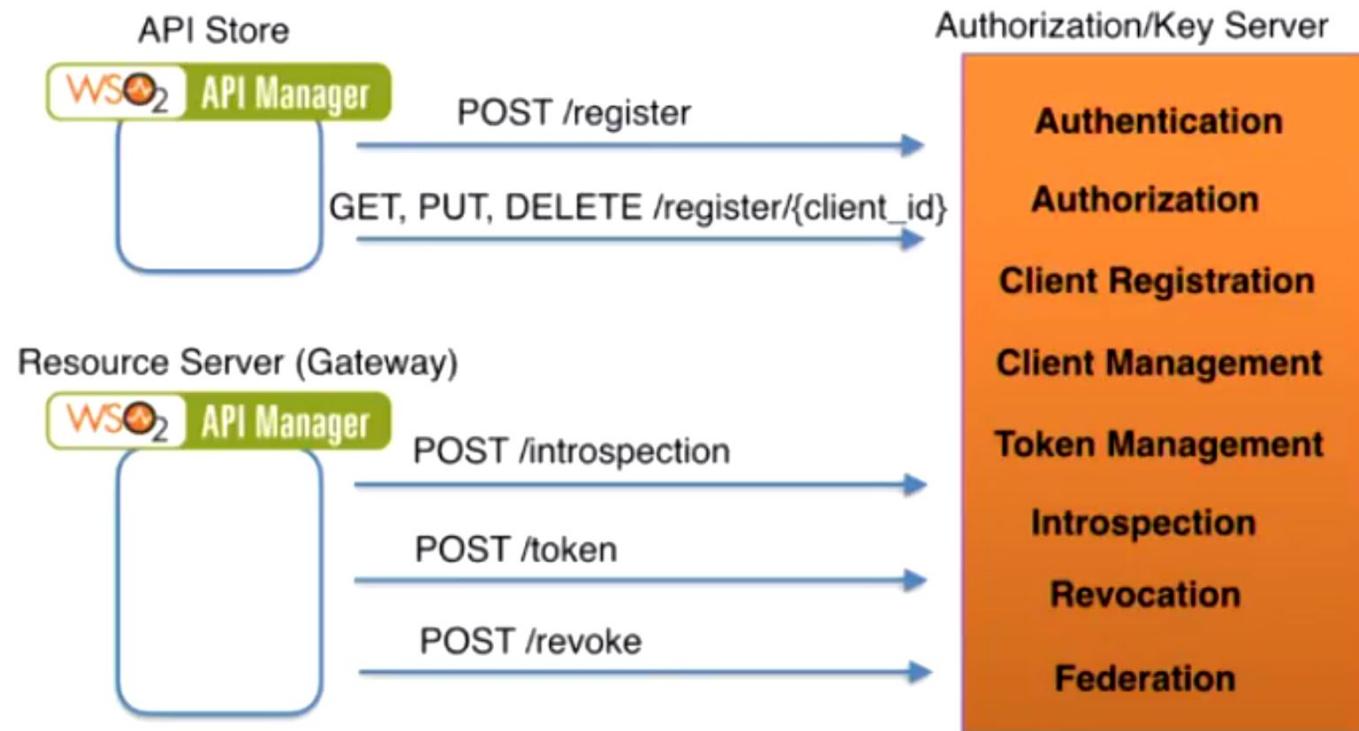


API Security

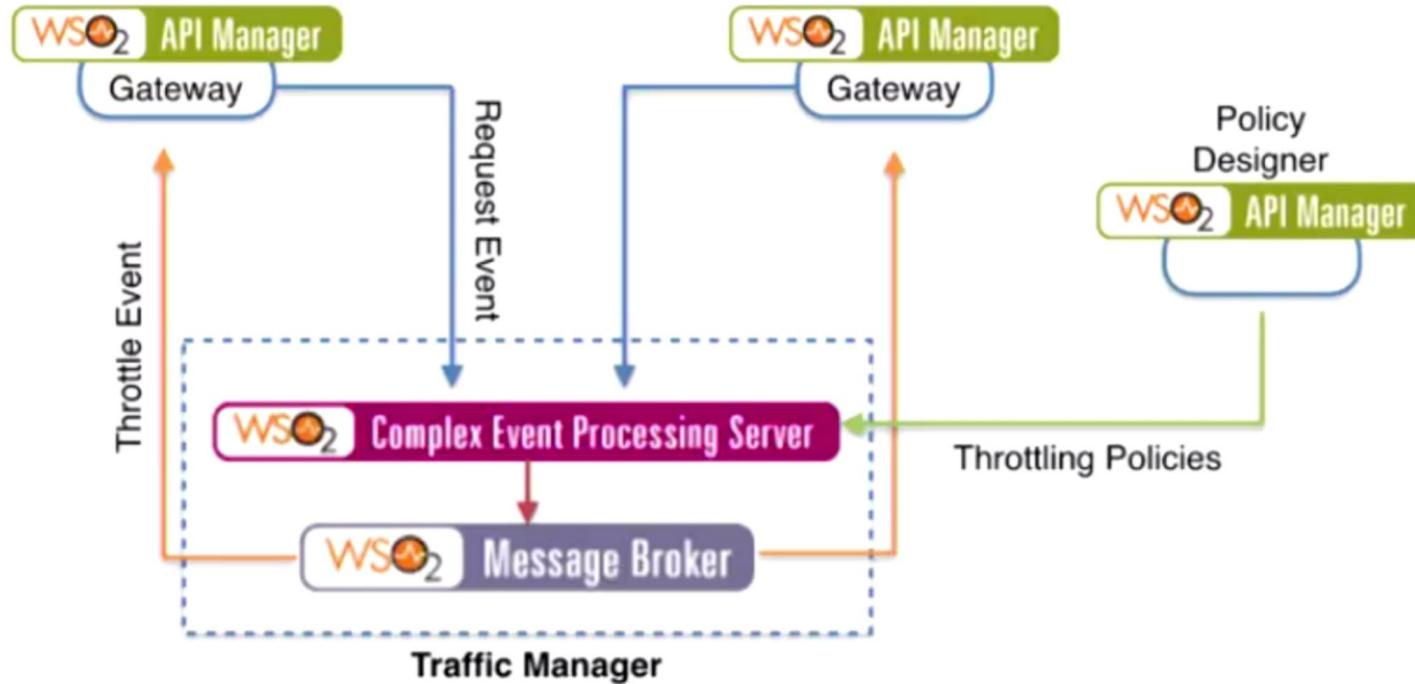
OAuth 2.0 Grants - Implicit



The Role of the Authorization/Key Server



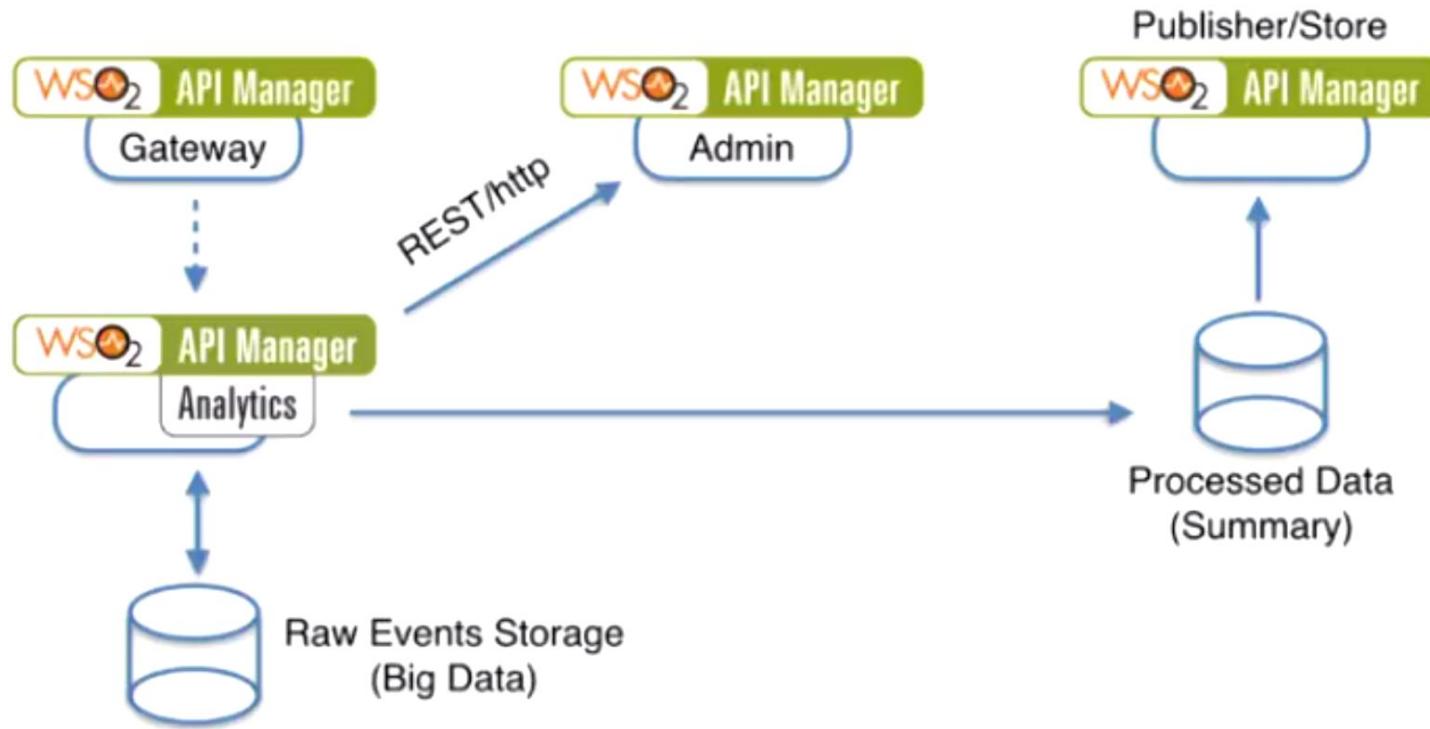
Traffic Management Architecture



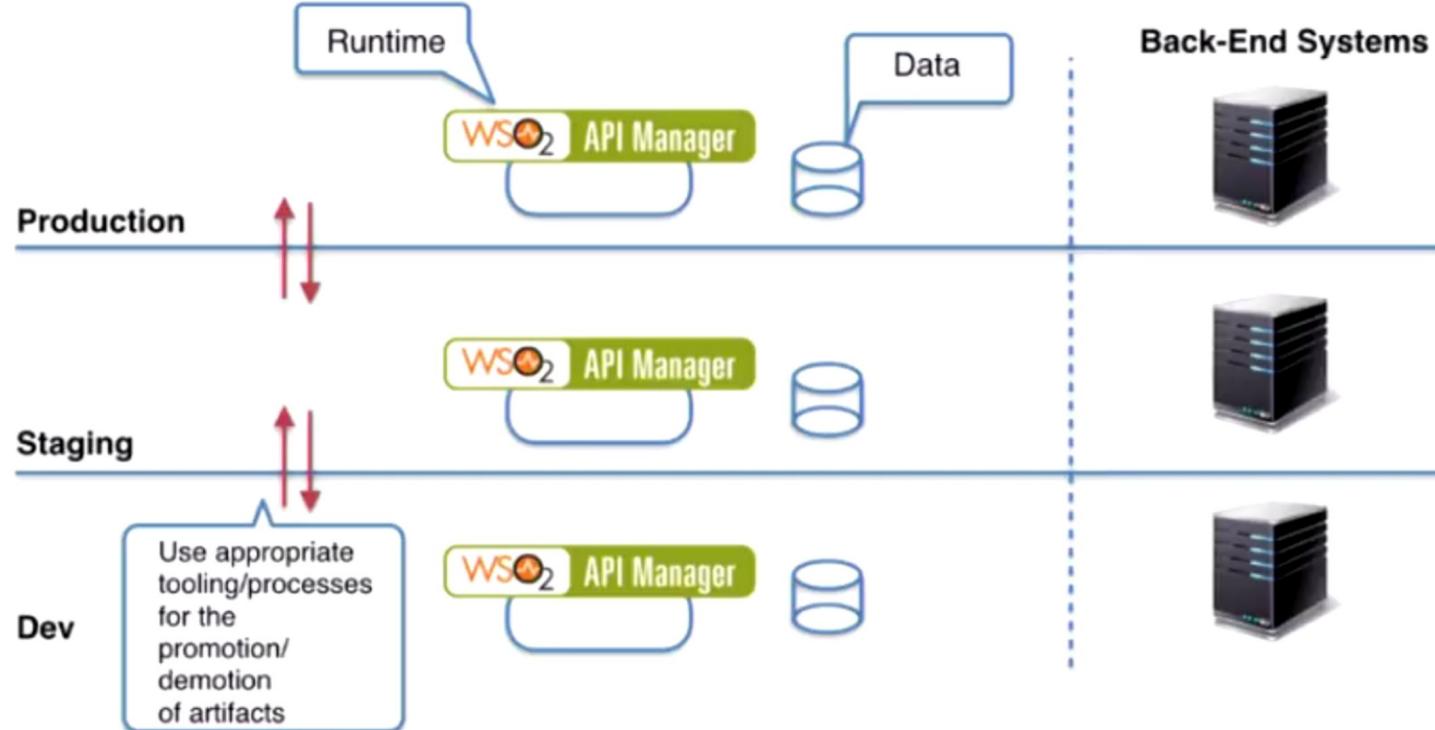
Traffic Manager Scalability

- The Traffic Manager does not scale
- A single Traffic Manager can handle up to 10 gateways at maximum capacity
- If a deployment consist of more than 10 gateways, the gateways should be divided into groups of clusters of 10 nodes each, having one Traffic Manager per group.

Analytics Architecture

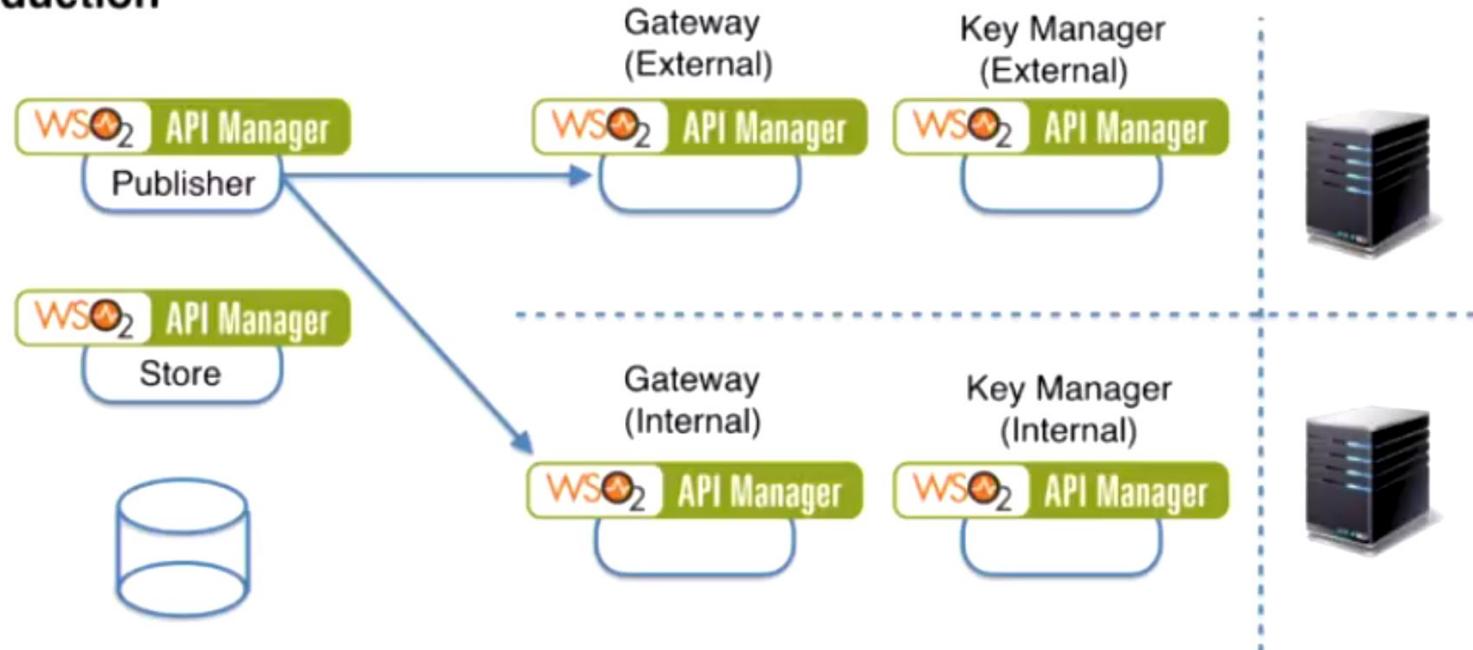


API: Stages vs Environments - Stages



API: Stages vs Environments - Environments

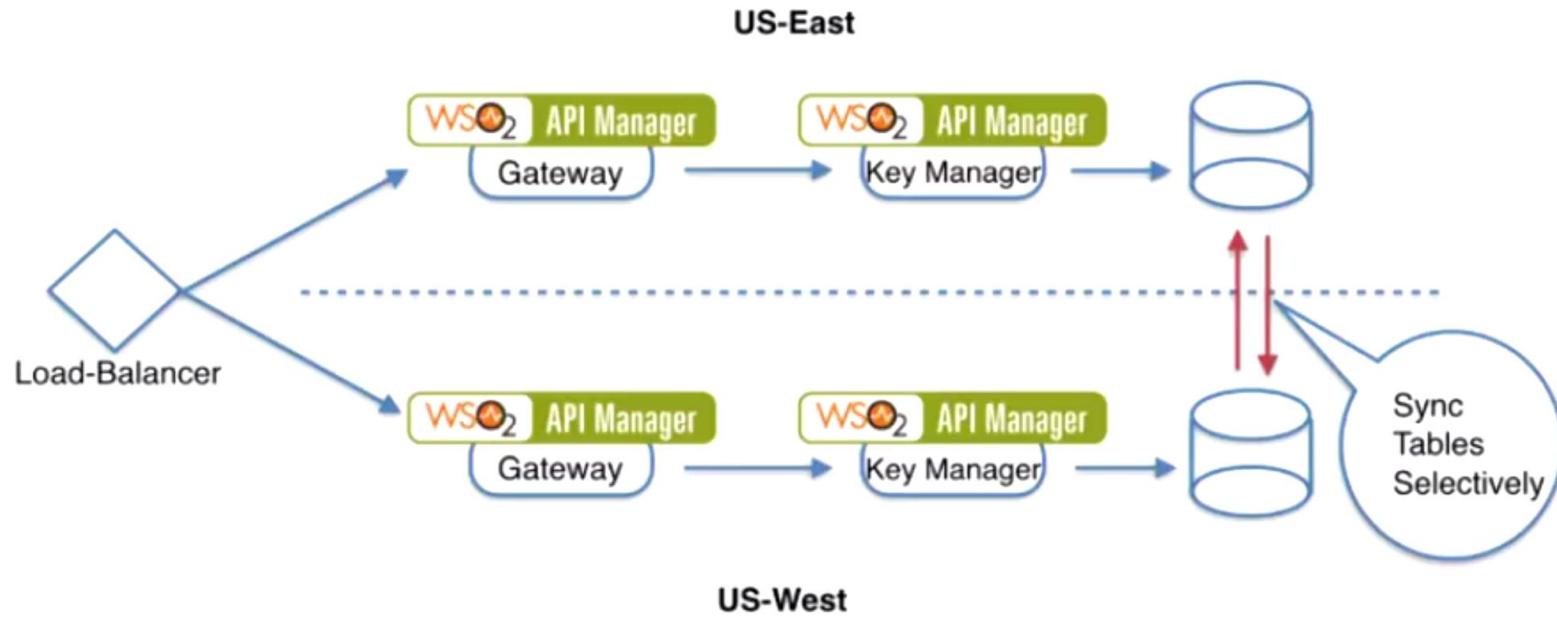
Production



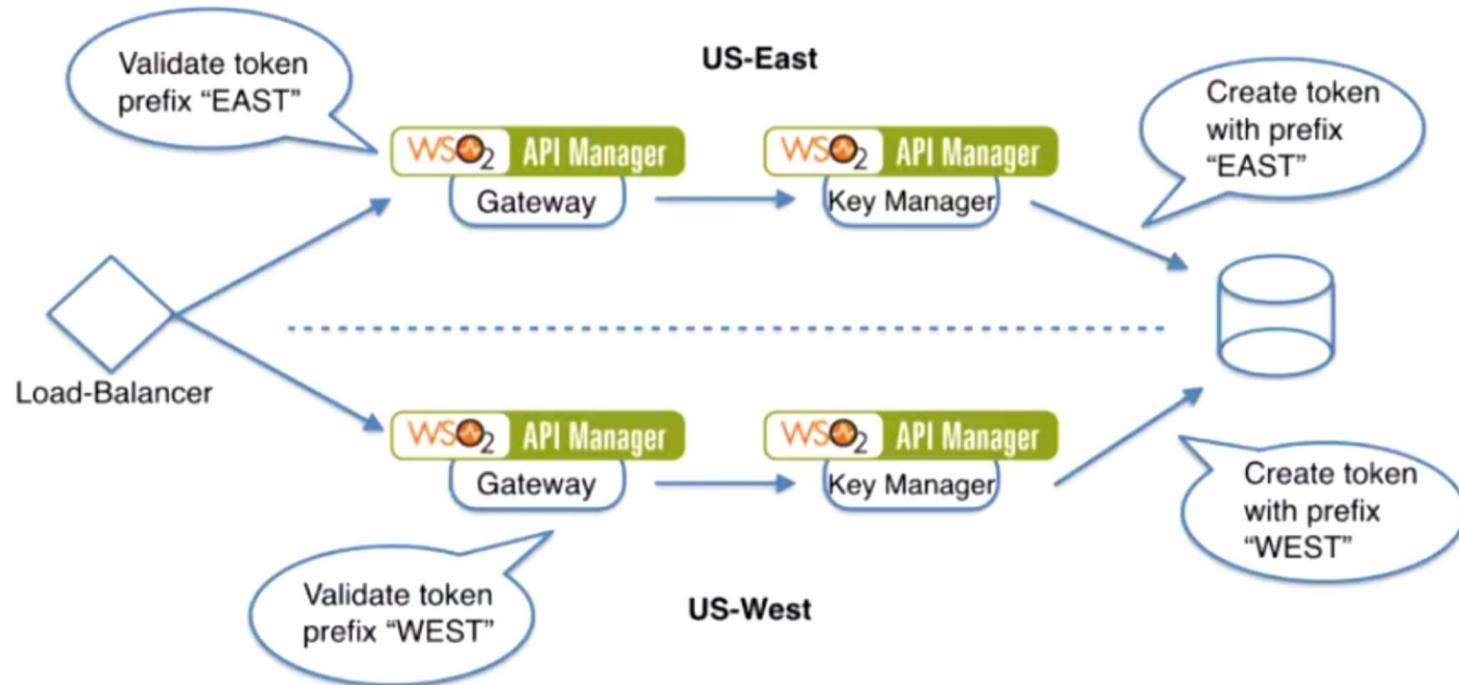
API: Stages vs Environments

Stage	Environment
Represents a state of an API	Represents the execution runtime of an API in a <u>given state</u>
An API may go through modifications when transferring between stages	The API Definition is fixed across environments
Shouldn't share data between stages	May share data across environments
Ownership of the API/data may change across stages	Ownership of the API/data remains same across all environments

Regional Gateways - Database Sync Pattern



Regional Gateways - Token Prefix Pattern



Regional Gateways - Token Prefix Pattern

```
public class CustomTokenGenerator extends OauthTokenIssuerImpl {  
  
    @Override  
    public String accessToken(OAuthTokenReqMessageContext tokReqMsgCtx) throws  
        OAuthSystemException {  
  
        String regionID = System.getProperty(REGION_ID);  
  
        if(log.isDebugEnabled()){  
            log.debug("Region ID = " + regionID);  
        }  
  
        String accessToken = UUID.randomUUID().toString();  
  
        return regionID != null ? regionID + accessToken : accessToken;  
    }  
}
```

Regional Gateways - Token Prefix Pattern

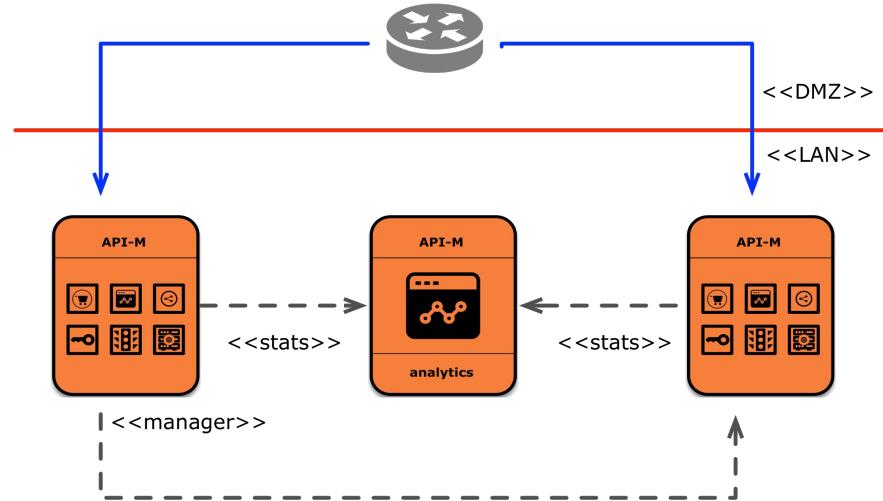
```
public class RegionValidator extends AbstractHandler {  
  
    public boolean handleRequest(MessageContext messageContext) {  
  
        String regionId = System.getProperty(REGION_ID);  
  
        if (log.isDebugEnabled()) {  
            log.debug("Region ID = " + regionId);  
        }  
  
        . . . . .  
  
        if(bearerToken == null || bearerToken.split(" ")[1].startsWith(regionId)){  
            //No bearer token provided or the provided bearer token is of the expected region.  
            return true;  
        }  
  
        handleAuthFailure(messageContext);  
  
        return false;  
    }  
}
```

Solutions & Deployment Patterns

Solutions & Deployment Patterns

API Manager minimal deployment with high availability

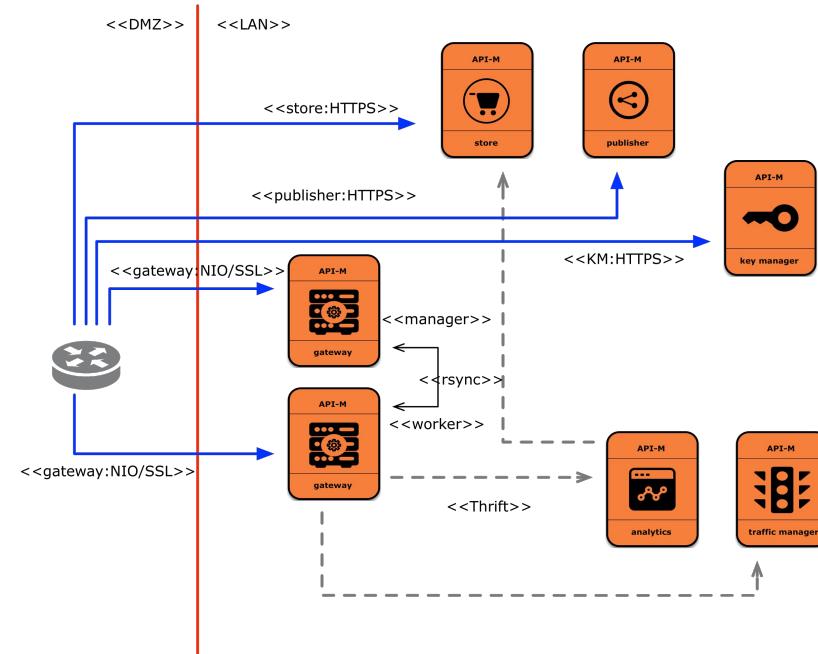
- Simple all-in-one deployment with analytics
- Dual node deployment for HA
- API artifact synchronization with rsync



Solutions & Deployment Patterns

Fully Distributed Deployment with HA

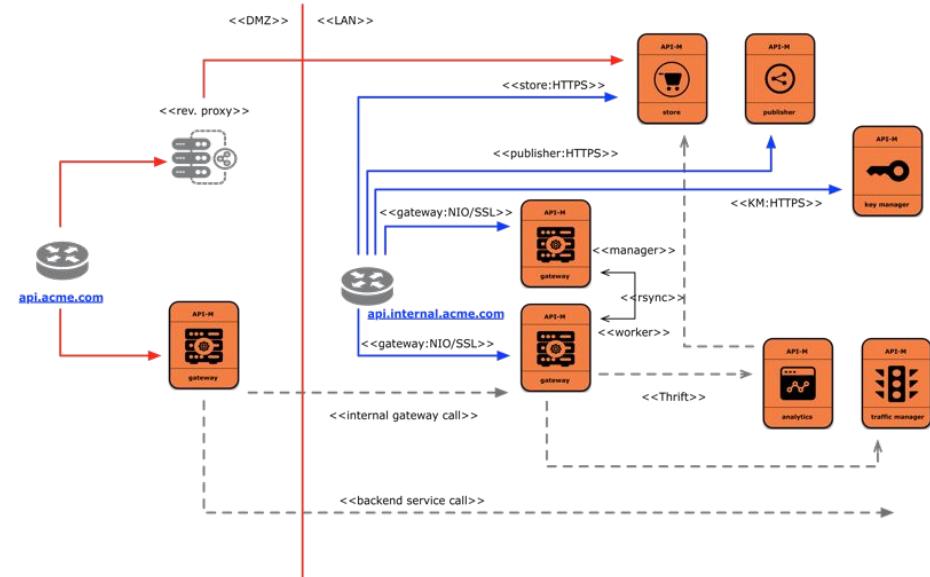
- Each component can be independently scaled
- With separation of concerns, the performance numbers are superior than the all in one mode



Solutions & Deployment Patterns

Internal / External API Management

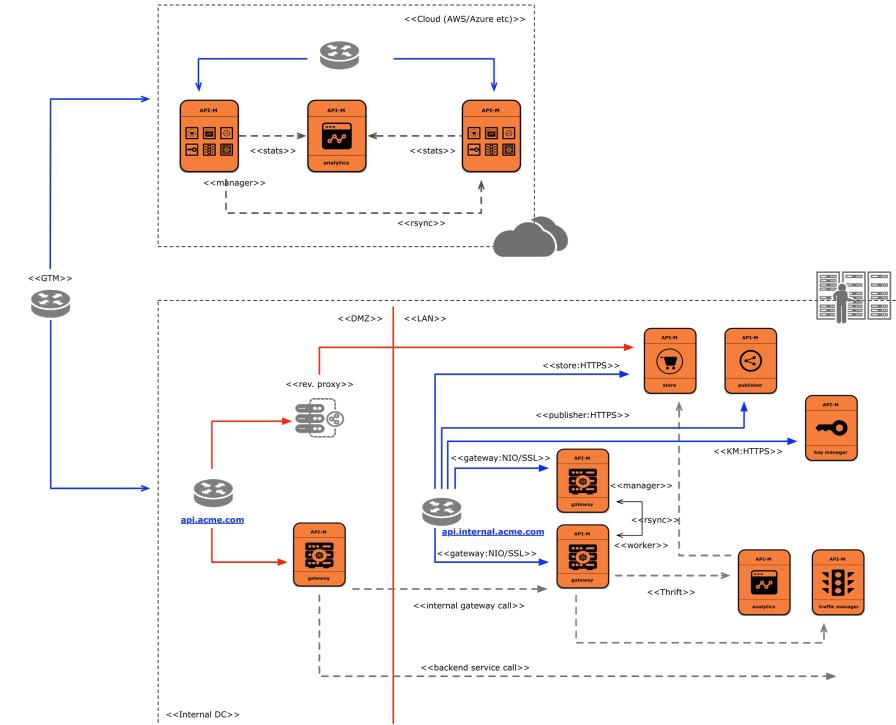
- APIs published from a single publisher
- Selectively deploy APIs for external access / internal access
- Expose API dev portal for internal / external access



Solutions & Deployment Patterns

Hybrid API Management - Cloud / On-prem

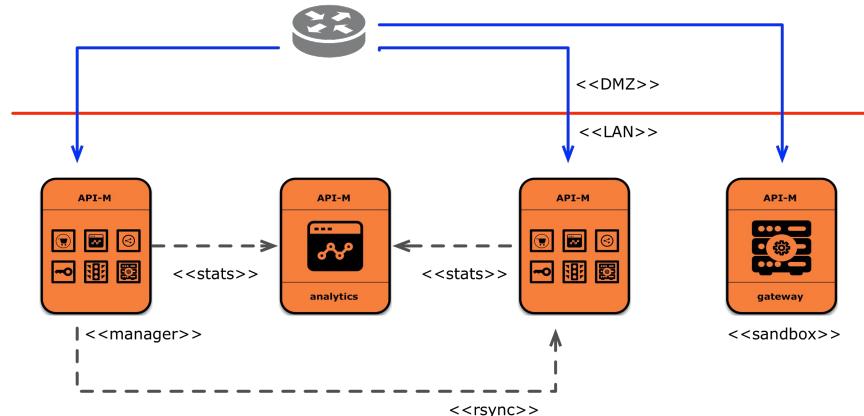
- Scalable deployment in the cloud
- Traffic routed with respective rules with a global traffic manager
- Two deployments are isolated, the cloud deployment points to the internal gateway for common APIs



Solutions & Deployment Patterns

Separate Sandbox

- Prototyped APIs are deployed separately to a sandbox gateway
- Does not affect the production traffic runtime
- Increased flexibility for testing and tuning



Solutions & Deployment Patterns

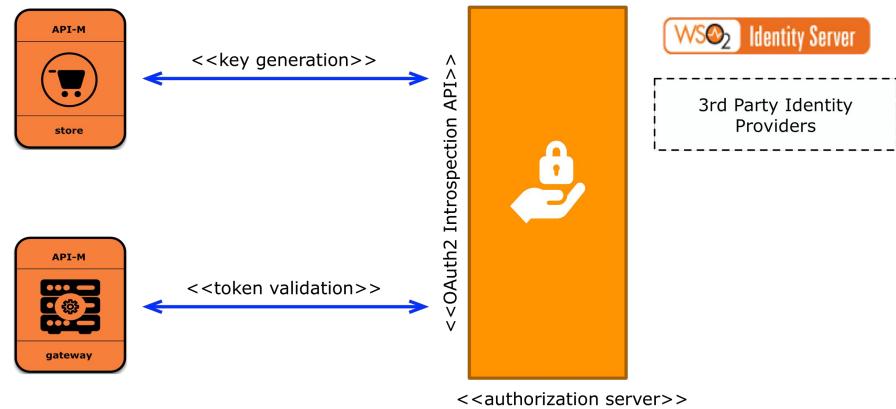
Multi-tenancy

- Used to separate internal business units and orchestrate API management for different org. Units
- Each unit gets a logically separated gateway / dev portal / publisher unit
- Can set up a common dev portal that lists all business units based portals

Solutions & Deployment Patterns

Thirdparty Key Manager Integration

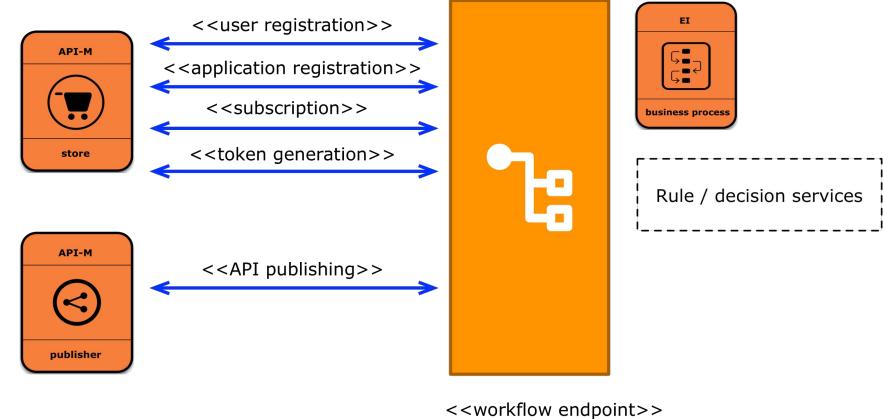
- Can connect to the corporate IDP
(If OAuth2 introspection API is supported)
- Doesn't have to use the inbuilt OAuth server



Solutions & Deployment Patterns

Workflows with and without BPEL

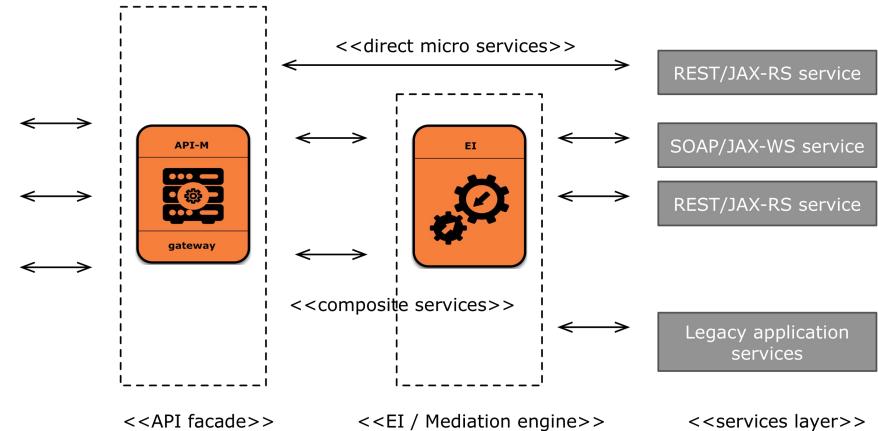
- All major interactions are tied to a workflow
- API Manager calls an external endpoint
- External service can be a BPEL workflow or a service endpoint



Solutions & Deployment Patterns

API Facade Pattern

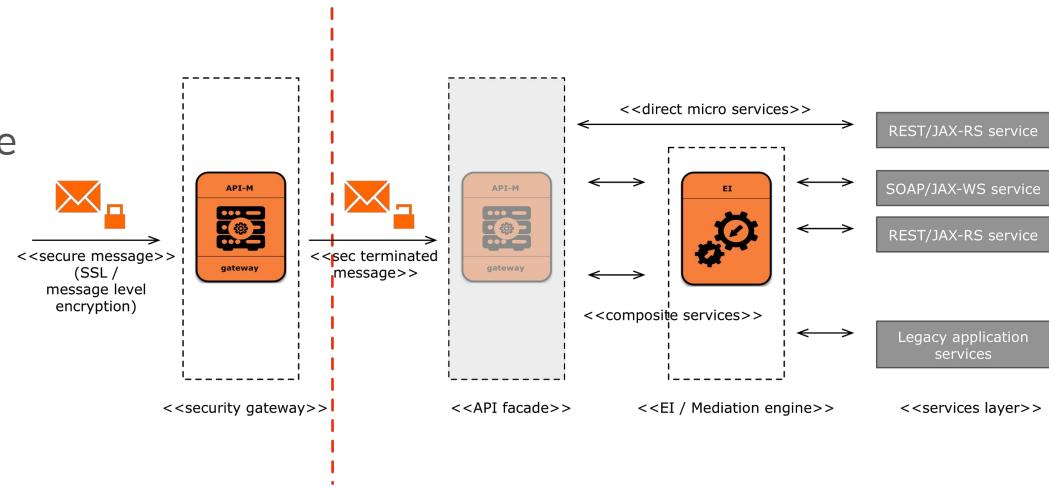
- API Gateway is kept as a lightweight pass through
- No message mediation hence can be deployed to the DMZ
- High performant - no message unmarshalling



Solutions & Deployment Patterns

Security termination at the DMZ

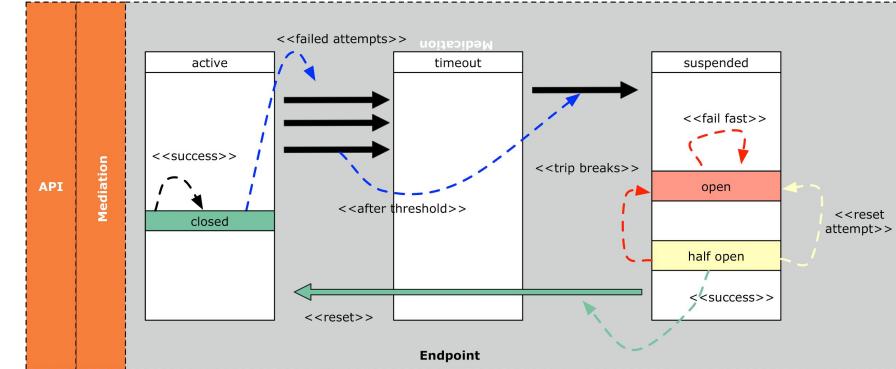
- Security termination at the DMZ (SSL stripping, message description etc.)
- Internal gateway is optional for the specific pattern



Solutions & Deployment Patterns

Circuit Breaker Pattern

- Implemented with mediation extensions
- Uses endpoint configuration in the API Gateway



API Management: Deployment Options

On-Premise

- Fast!
- Tight security
- Complete control
- Limited to available infrastructure
- Need to handle updates and upgrades

API Management: Deployment Options

Cloud

- Can leverage cloud infrastructure
- No infrastructure costs
- No maintenance costs



OVERVIEW

CLOUD

FEATURES

CUSTOMER STORIES

RESOURCES

API Cloud

WSO2 API Cloud is a public hosted version of award-winning open source WSO2 API Manager. It enables enterprises to quickly share their business capabilities with their customers and partners across the globe.



API CLOUD

Free sign-up. No credit card required.

[lakmal@wso2.com](#)

SIGN UP

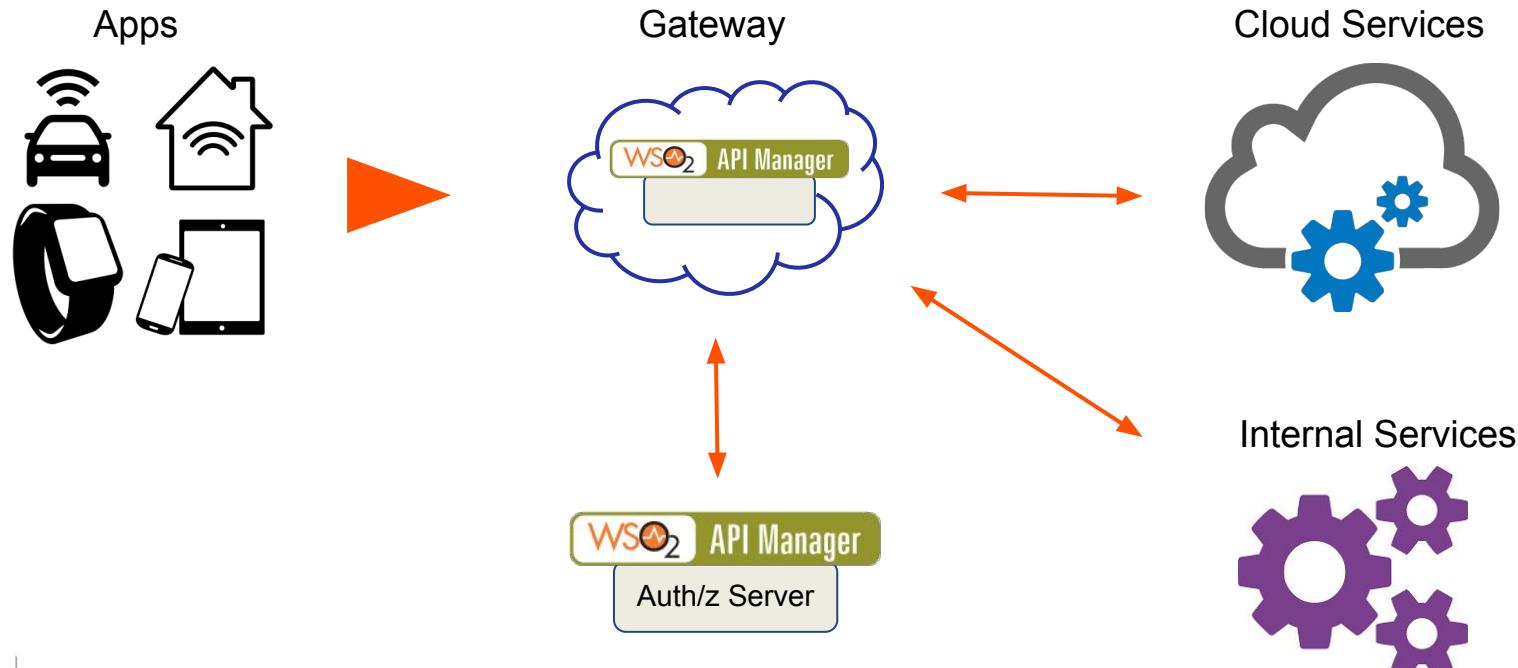
Signing up signifies that you have read and agree to the
[Terms of Use](#) and [Privacy Policy](#).

Already have an account?

SIGN IN

API Management: Deployment Options

Hybrid Cloud



WSO2 API Manager 2.1.0 Deployment tools

Docker and Puppet

API Manager: Recommended Deployment Patterns

Pattern-1



- Docker : <https://github.com/wso2/docker-apim/tree/release-2.1.0/docker-compose/pattern-1>
- Puppet :
https://github.com/wso2/puppet-apim/blob/v2.1.0/wso2am_runtime/hieradata/dev/wso2/wso2am_runtime/pattern-1/README.md

API Manager: Recommended Deployment Patterns

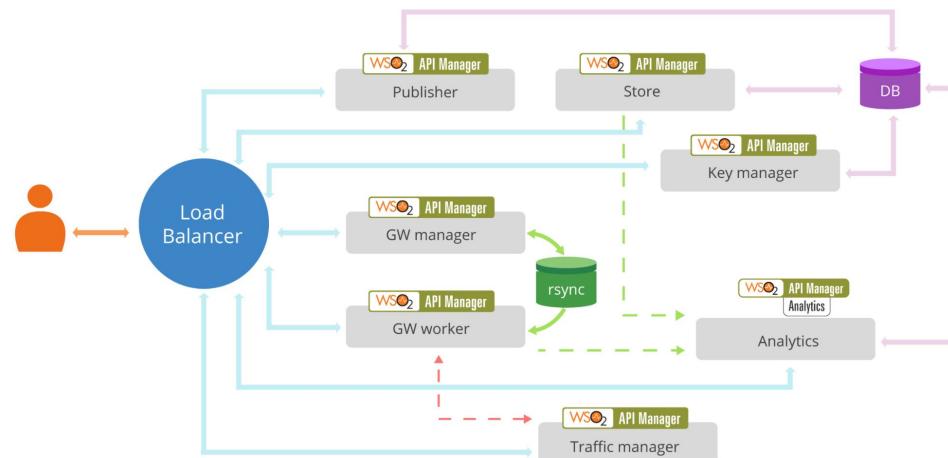
Pattern-2



- Docker : <https://github.com/wso2/docker-apim/tree/release-2.1.0/docker-compose/pattern-2>
- Puppet :
https://github.com/wso2/puppet-apim/blob/v2.1.0/wso2am_runtime/hieradata/dev/wso2/wso2am_runtime/pattern-2/README.md

API Manager: Recommended Deployment Patterns

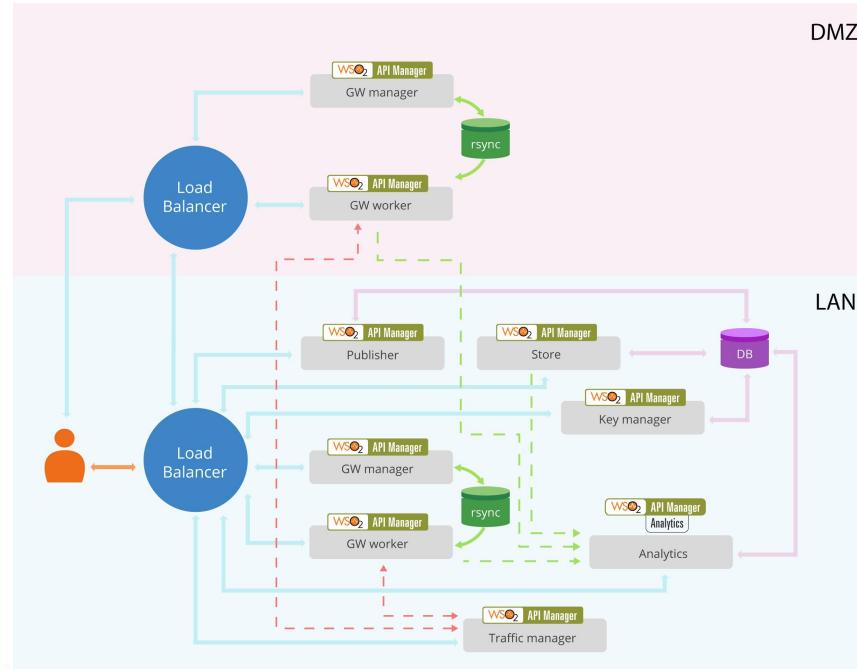
Pattern-3



- **Docker** : <https://github.com/wso2/docker-apim/tree/release-2.1.0/docker-compose/pattern-3>
- **Puppet** :
https://github.com/wso2/puppet-apim/blob/v2.1.0/wso2am_runtime/hieradata/dev/wso2/wso2am_runtime/pattern-3/README.md

API Manager: Recommended Deployment Patterns

Pattern-4



- **Docker :**

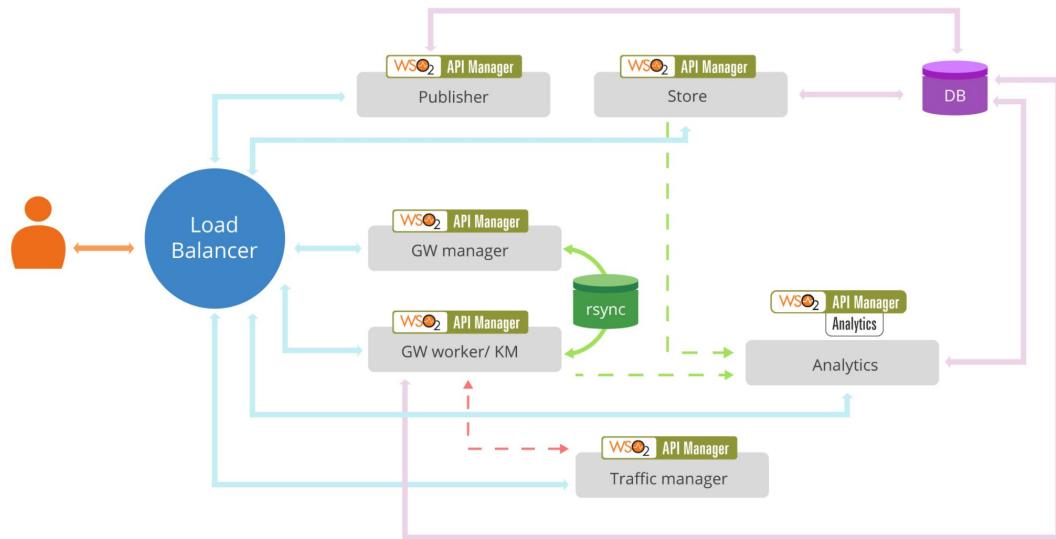
[https://github.com/wso2/docker-apim/tree/
release-2.1.0/docker-compose/pattern-4](https://github.com/wso2/docker-apim/tree/release-2.1.0/docker-compose/pattern-4)

- **Puppet :**

[https://github.com/wso2/puppet-apim/blob/
v2.1.0/wso2am_runtime/hieradata/dev/wso2
wso2am_runtime/pattern-4/README.md](https://github.com/wso2/puppet-apim/blob/v2.1.0/wso2am_runtime/hieradata/dev/wso2/wso2am_runtime/pattern-4/README.md)

API Manager: Recommended Deployment Patterns

Pattern-5



- **Docker :**

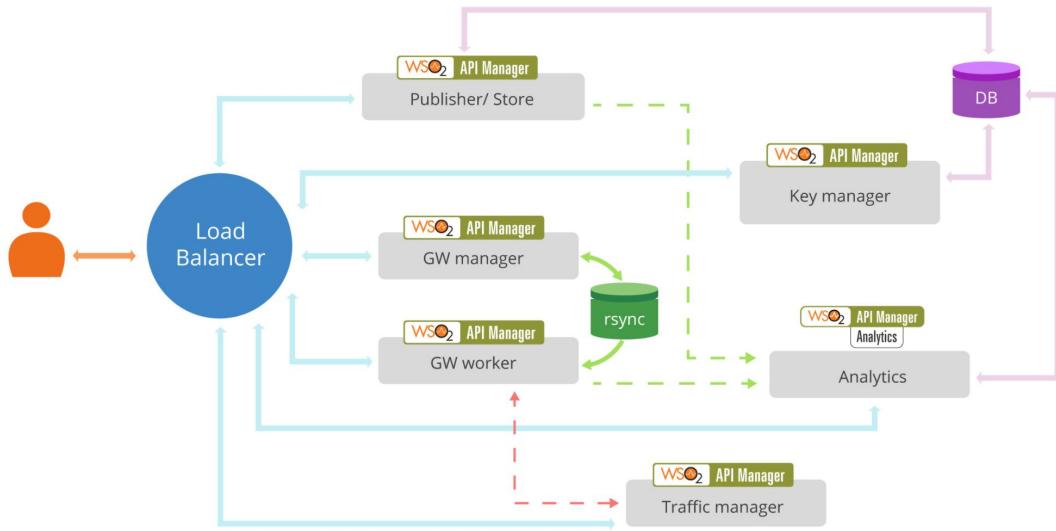
[https://github.com/wso2/docker-apim/tree/
release-2.1.0/docker-compose/pattern-5](https://github.com/wso2/docker-apim/tree/release-2.1.0/docker-compose/pattern-5)

- **Puppet :**

[https://github.com/wso2/puppet-apim/blob/
v2.1.0/wso2am_runtime/hieradata/dev/wso2/wso2am_runtime/pattern-5/README.md](https://github.com/wso2/puppet-apim/blob/v2.1.0/wso2am_runtime/hieradata/dev/wso2/wso2am_runtime/pattern-5/README.md)

API Manager: Recommended Deployment Patterns

Pattern-6



- **Docker :**

[https://github.com/wso2/docker-apim/tree/
release-2.1.0/docker-compose/pattern-6](https://github.com/wso2/docker-apim/tree/release-2.1.0/docker-compose/pattern-6)

- **Puppet :**

[https://github.com/wso2/puppet-apim/blob/
v2.1.0/wso2am_runtime/hieradata/dev/wso2/wso2am_runtime/pattern-6/README.md](https://github.com/wso2/puppet-apim/blob/v2.1.0/wso2am_runtime/hieradata/dev/wso2/wso2am_runtime/pattern-6/README.md)

API Manager: Recommended Deployment Patterns

Pattern-7



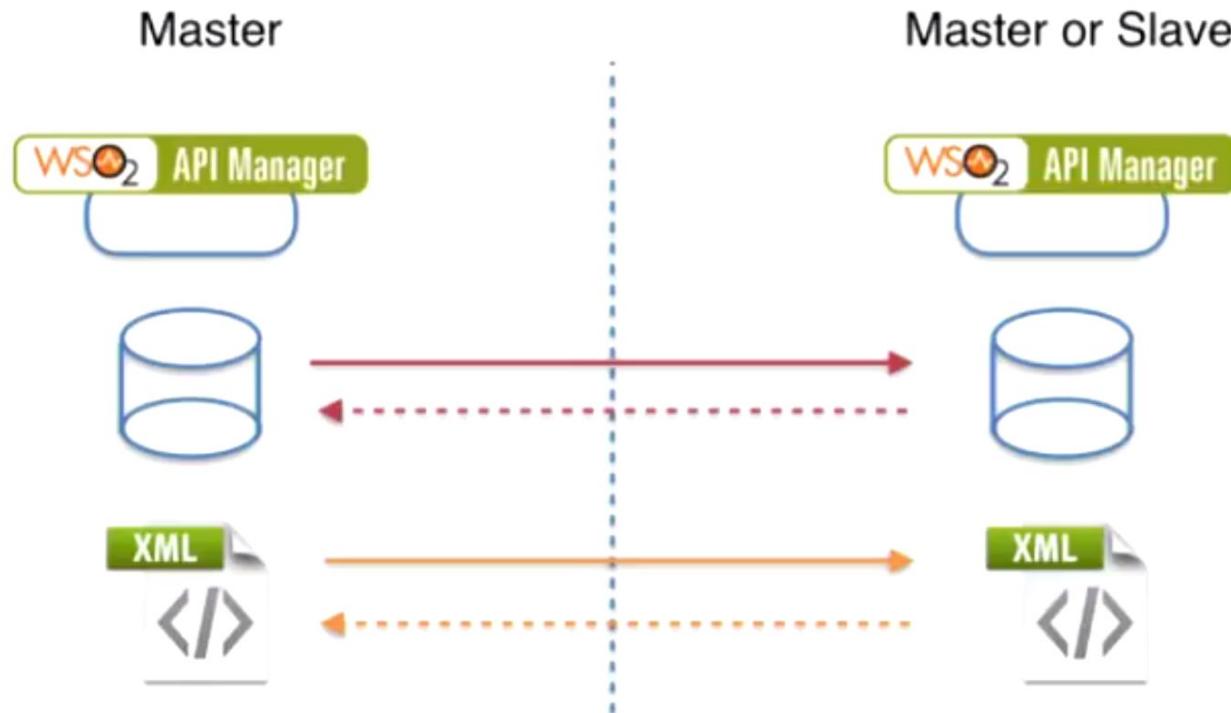
- Docker : <https://github.com/wso2/docker-apim/tree/release-2.1.0/docker-compose/pattern-7>
- Puppet :
https://github.com/wso2/puppet-apim/blob/v2.1.0/wso2am_runtime/hieradata/dev/wso2/wso2am_runtime/pattern-7/README.md

API Manager: Multi Datacenter Deployment

Types of Datacenter Deployment

- Single Master, Active-Active
- Single Master, Active-Passive (Disaster Recovery)
- Multi Master, Active-Active

API Manager: Multi Datacenter Deployment



Summary

WSO2 API Manager 2.1.0

- Key component for digital transformation
- Highly componentized
- High performance gateway
- Standardized security
- Rich developer portal for an effective API marketplace
- Comprehensive back office application (publisher portal) with API governance (design / runtime)
- Flexible deployment options
- Proven customer use-cases
- Progressive product roadmap

API Manager v3 and beyond

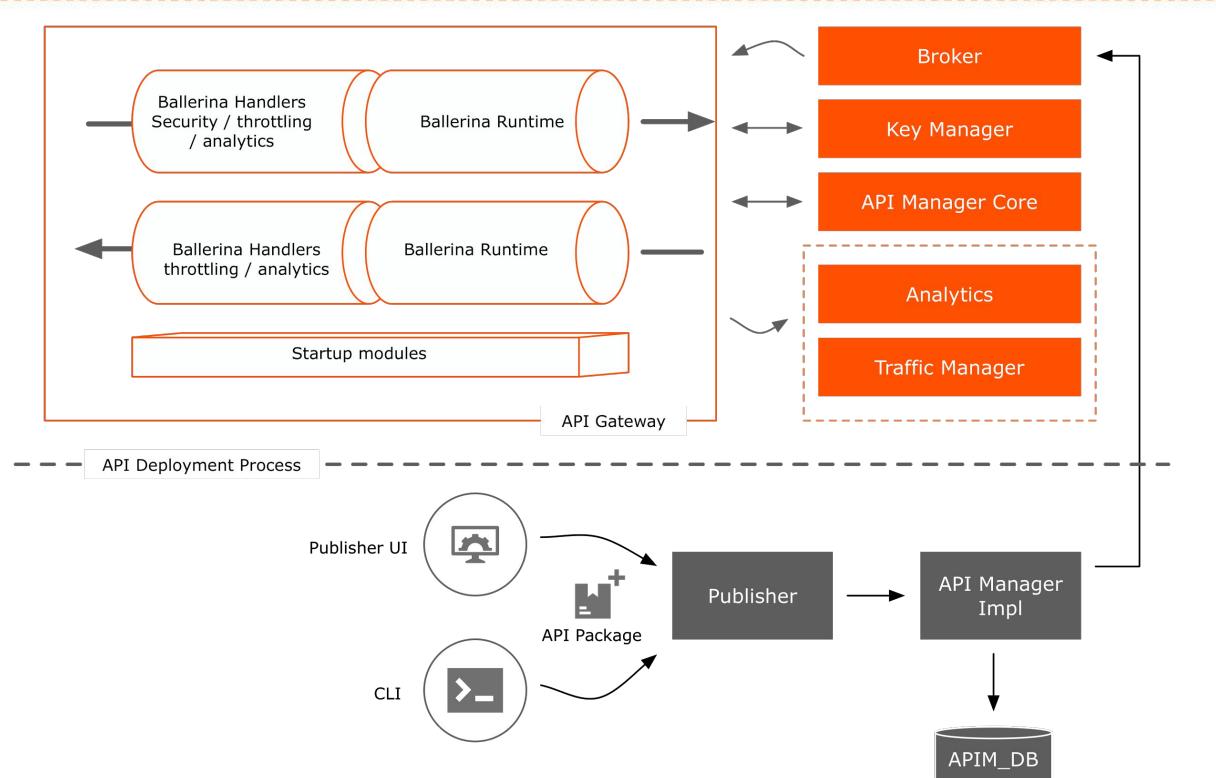
WSO2 API Manager Roadmap

API Manager v3 & beyond

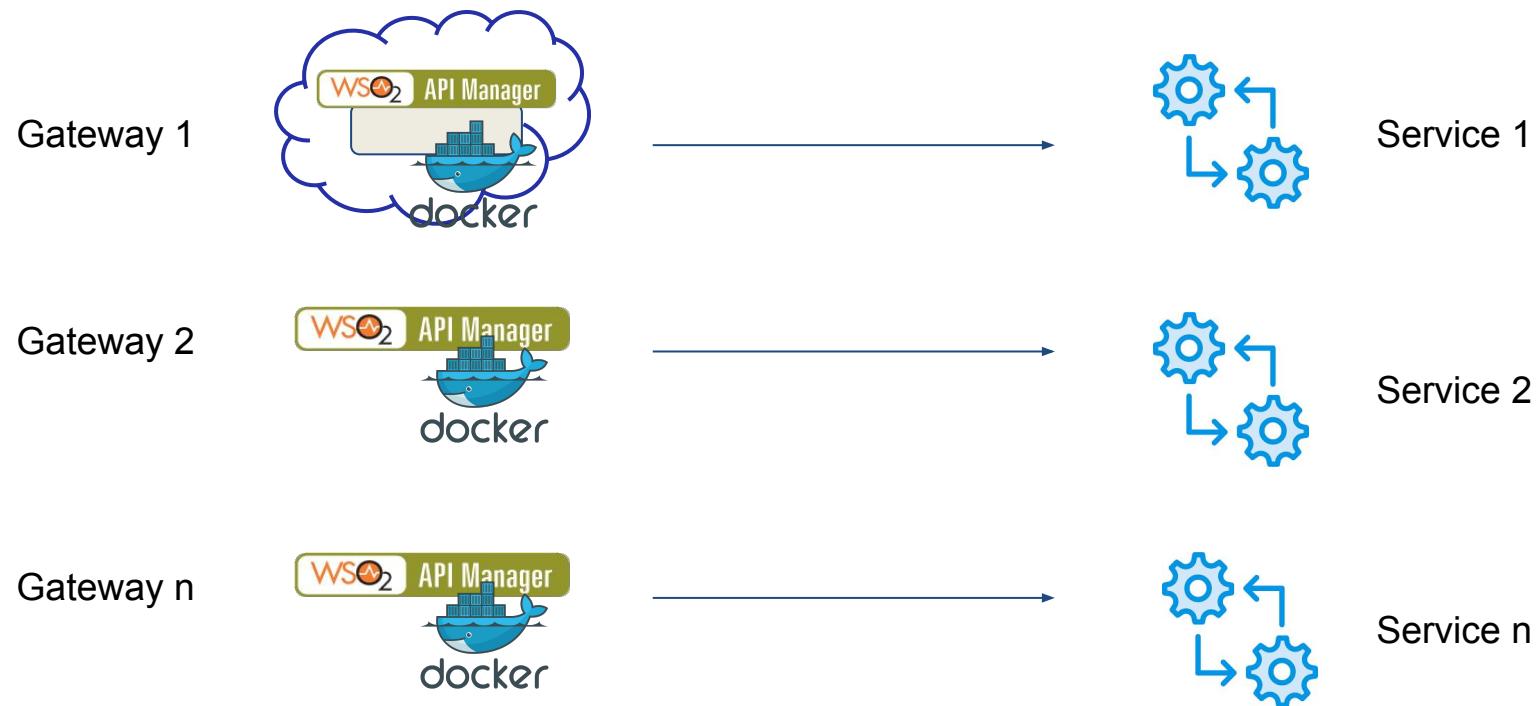
- Container Native, lean API Management
- Ballerina based gateway runtime
- Support the capability to dynamically spawn API Gateways as needed
- Client side caching and concurrency control
- Enhanced workflow support
- API composition
- Event based management protocol
- Richer management / admin API
- CLI based API deployment & environment promotion

API Manager v3 & beyond

High level architecture



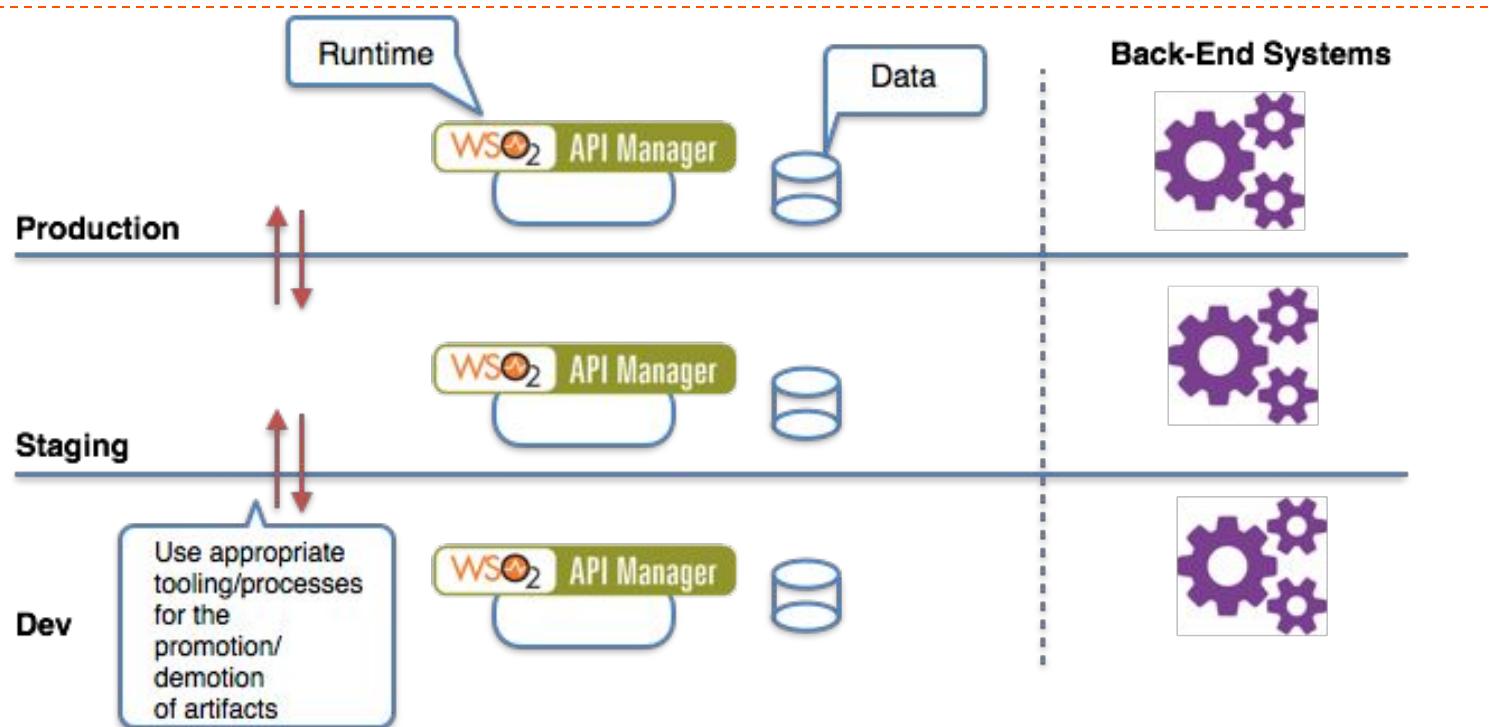
Micro Gateways: For Micro Services



The API Proxy Development Experience

- Tooling
- Testing (Enhanced)
- Collaboration
- API Stages

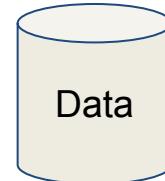
Stages of the API Proxy



Multitenancy: Shared



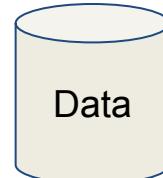
Runtime



Multitenancy: Shared



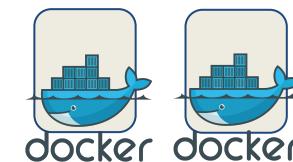
Runtime



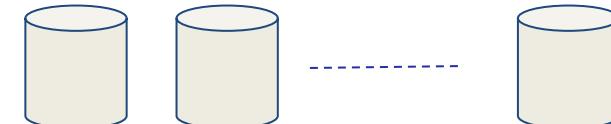
Multitenancy: Isolated



Runtime



Data



A few success stories

WSO2 API Manager in Action



REQUIREMENT

- To expand from an online marketplace for tickets to become a worldwide entertainment destination for fans, by developing an API-centric solution.
- Re-architect a successfully running business around this API solution.
- To build a developer community and enable partners to bring their content and services to the StubHub audience.
- A scalable and agile system that could evolve to handle continuously increasing high volumes of data.

SOLUTION

- StubHub uses WSO2 API Manager, WSO2 Enterprise Service Bus (WSO2 ESB) and WSO2 Identity Server to build APIs on a layer of user interfaces to create experiences. Native mobile apps are used to create a unified experience across mobile and desktop.
- StubHub's internal team members publish their APIs and manage API lifecycles through the Publisher component of WSO2 API Manager.
- The Store component of the WSO2 API Manager is where an API is exposed both to external and internal consumers, so they can create their applications.
- WSO2 Identity Server manages user authentication, key management and JSON Web Token (JWT) assertion.
- WSO2 ESB-based API Gateway routes all incoming requests and works with WSO2 Identity Server to authenticate them.



BNY MELLON

- Bank of New York Mellon used WSO2 to an API Portal that powers its NEXEN platform
- The solution allows the ability to abstract and expose a set of APIs to BNYM's partners and stakeholders, control access, monitor and meter and participate in an API ecosystem.
- Chose WSO2 because of our comprehensive platform and technical expertise.



Population Health Management Solutions

REQUIREMENT

- To create an API framework that exposes all Jiva services through APIs by leveraging the existing business logic to provide a healthcare solution to external applications and third-party vendors.
- To seamlessly integrate with internal and external systems in the healthcare industry.
- To reduce the IT burden and cost of having to deploy multiple systems for varying needs (extract, transform, load for batch processing of flat files, and RESTful or SOAP Web services for real-time processing).

SOLUTION

- With WSO2 API Manager, ZeOmega exposes Jiva's already existing business logic and services as APIs.
- WSO2 API Manager provides comprehensive security by authenticating, authorizing and controlling access to all these APIs.
- WSO2 API Publisher allows users to create, deploy, publish and retire APIs while providing complete API lifecycle management
- WSO2 API Store provides a central place for users to browse and subscribe to APIs.
- WSO2 Enterprise Service Bus was used to create a common mediation layer that performed data validations and provided out-of-the-box mediators for various enterprise integration patterns and data transformations (such as XML to JSON and back).

And more



How to Digitize your Business APIs

Demo

How to digitize your business APIs

Demo

- [Create and Publish an API](#)
- [Subscribe to an API](#)
- [Add API Documentation](#)
- [Grant types](#)
- [JWT support](#)
- [Identity Federation - Facebook login](#)
- [Throttling](#)
- [Analytics](#)
- [Docker compose based deployments](#)

Conclusion

Digital Transformation is a Journey, APIs play a critical part in it!

API MANAGEMENT

Build your digital foundation with an API marketplace for internal and external developer ecosystems

[LEARN MORE](#)

INTEGRATION

Platform enable your digital business with "micro-services" and "micro-integrations"

[LEARN MORE](#)

IDENTITY & ACCESS MANAGEMENT

Manage identity, security, and privacy across your digital business

[LEARN MORE](#)

SMART ANALYTICS

Create real-time, intelligent, actionable business insights and data products

[LEARN MORE](#)

INTERNET OF THINGS

Make mobile and IoT devices integral to your digital business

[LEARN MORE](#)

THANK YOU

wso2.com

