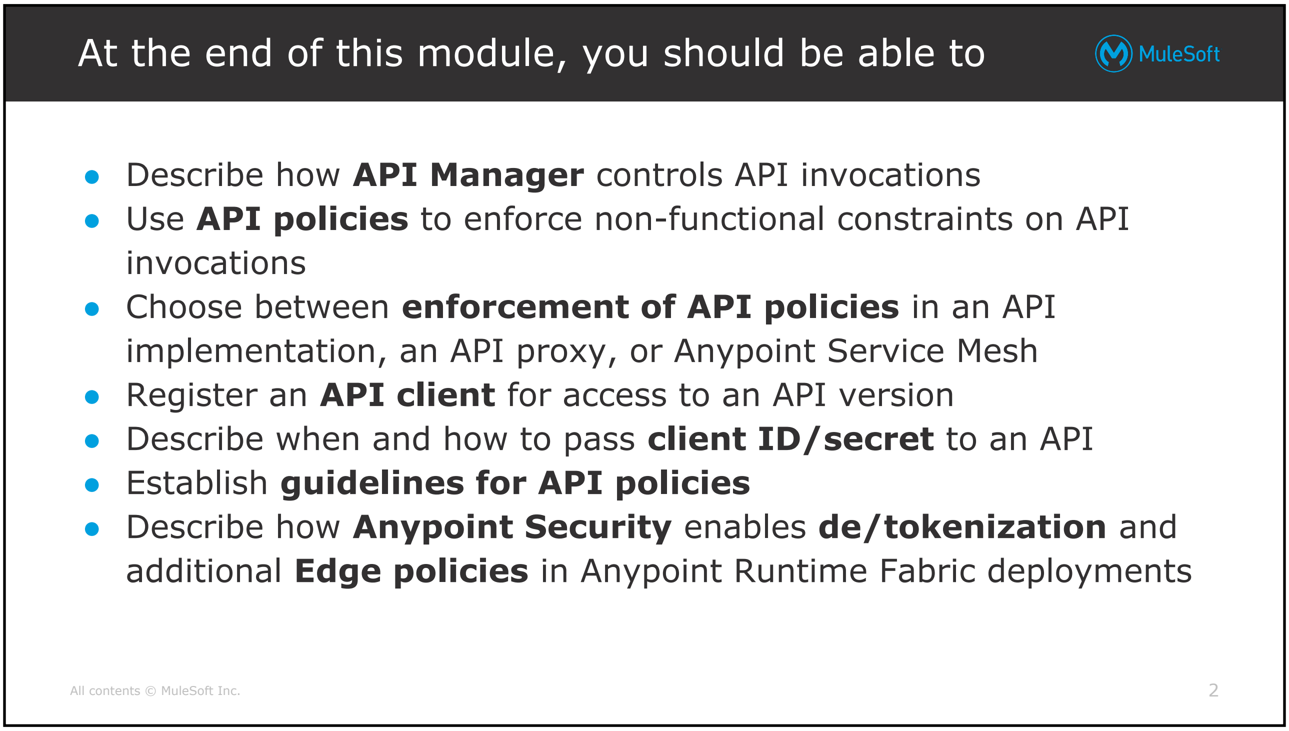
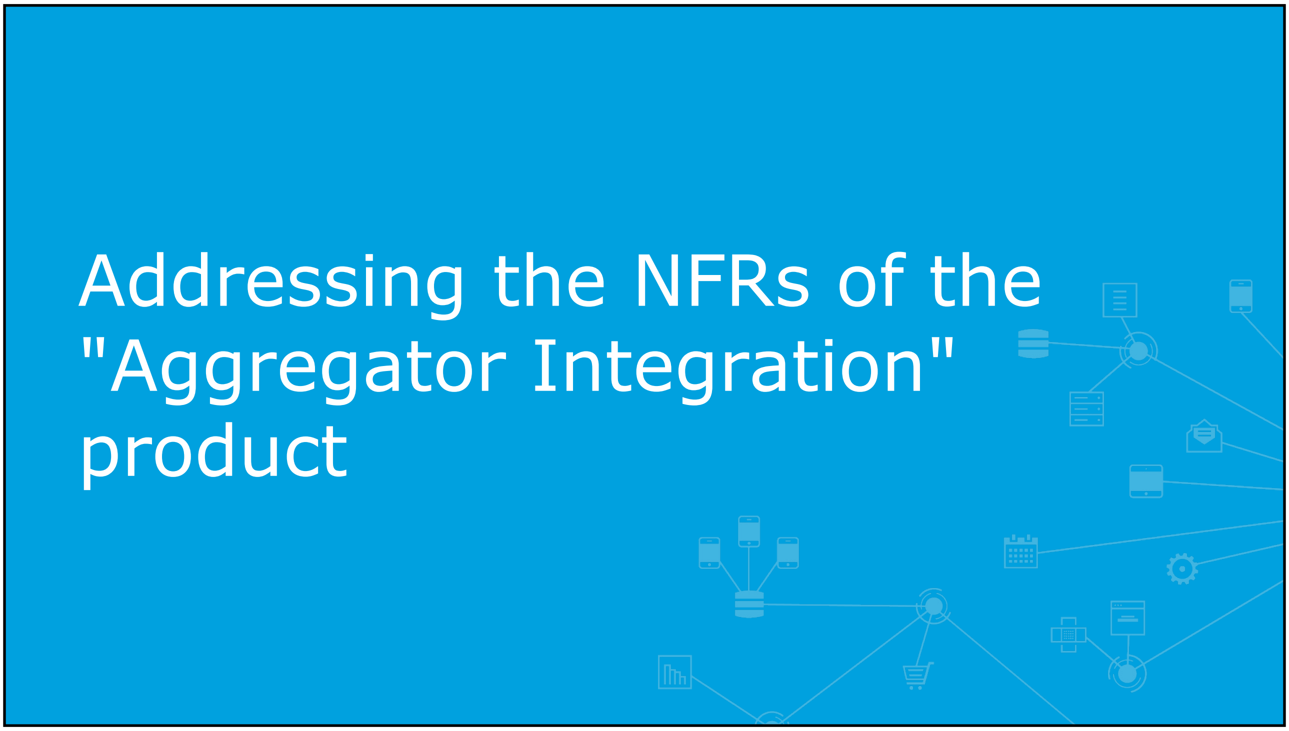
Module 5
Enforcing NFRs on the Level of API Invocations Using Anypoint API Manager

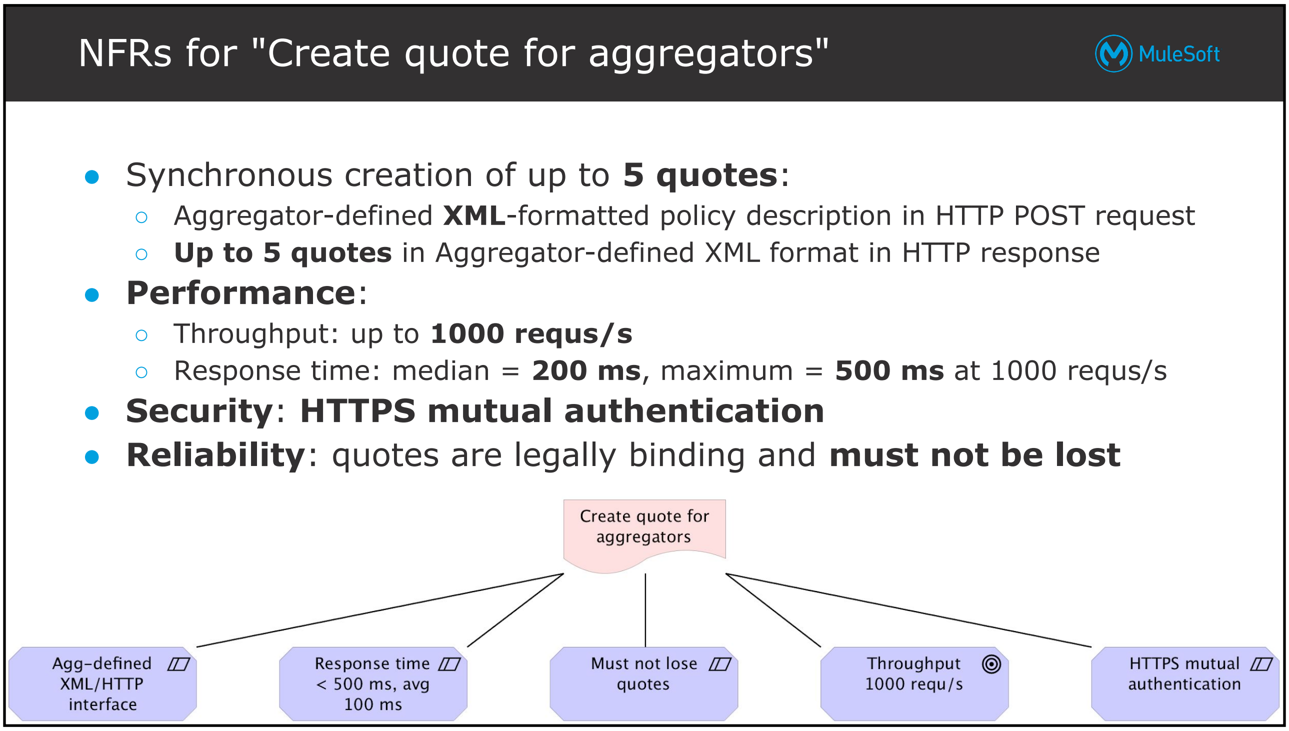


At the end of this module, you should be able to

- Describe how **API Manager** controls API invocations
- Use **API policies** to enforce non-functional constraints on API invocations
- Choose between **enforcement of API policies** in an API implementation, an API proxy, or Anypoint Service Mesh
- Register an **API client** for access to an API version
- Describe when and how to pass **client ID/secret** to an API
- Establish **guidelines for API policies**
- Describe how **Anypoint Security** enables **de/tokenization** and additional **Edge policies** in Anypoint Runtime Fabric deployments



Addressing the NFRs of the "Aggregator Integration" product



NFRs for "Create quote for aggregators"

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- Synchronous creation of up to **5 quotes**:
  - Aggregator-defined **XML**-formatted policy description in HTTP POST request
  - **Up to 5 quotes** in Aggregator-defined XML format in HTTP response
- **Performance**:
  - Throughput: up to **1000 requs/s**
  - Response time: median = **200 ms**, maximum = **500 ms** at 1000 requs/s
- **Security**: **HTTPS mutual authentication**
- **Reliability**: quotes are legally binding and **must not be lost**

Create quote for aggregators

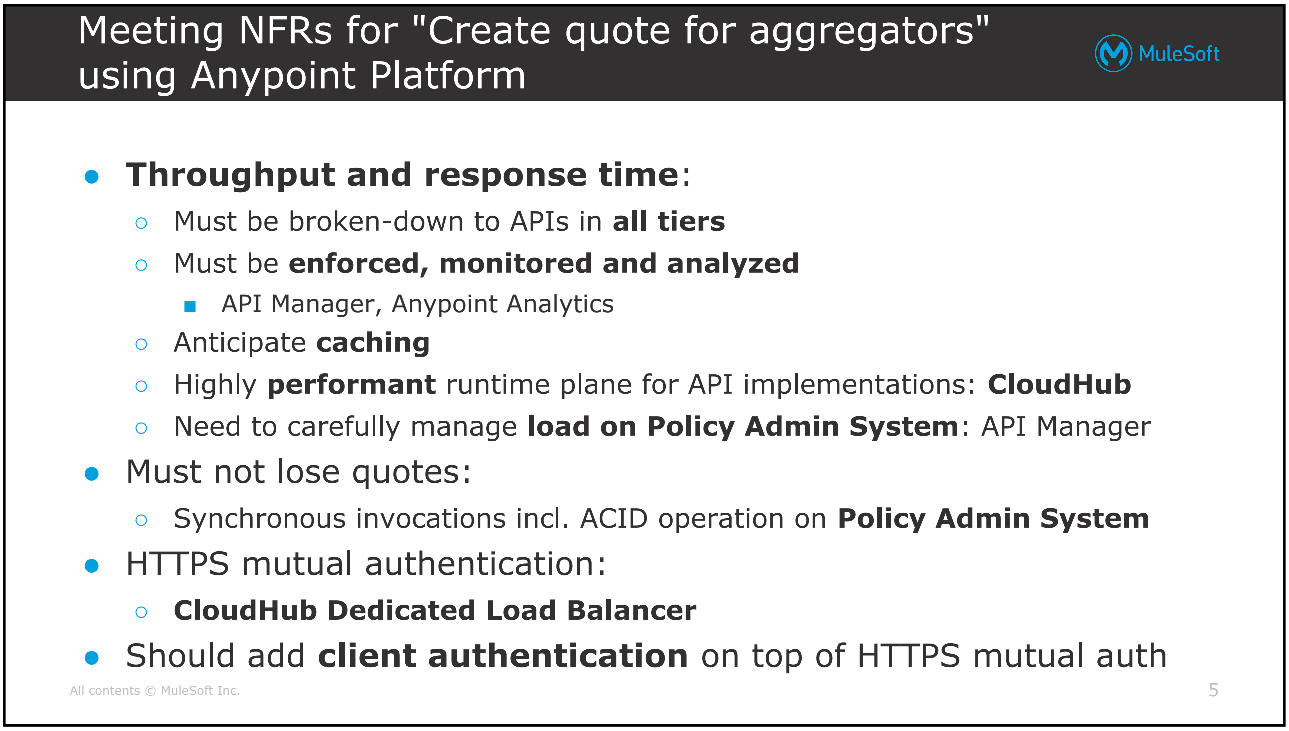
Agg-defined XML/HTTP interface

Response time < 500 ms, avg 100 ms

Must not lose quotes

Throughput 1000 requ/s

HTTPS mutual authentication



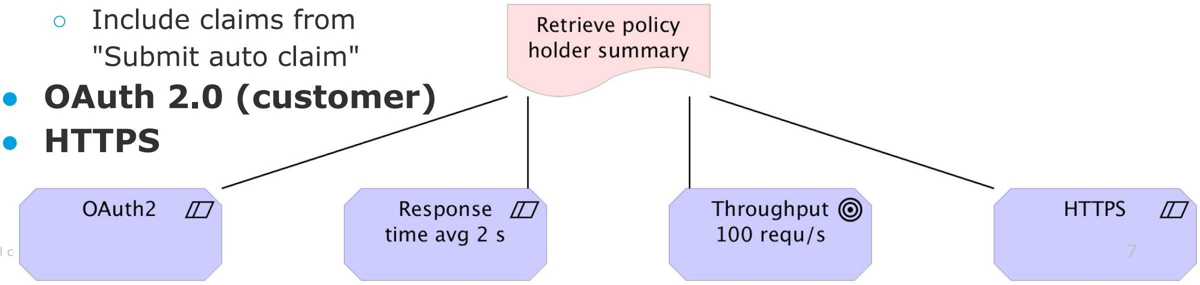
Meeting NFRs for "Create quote for aggregators" using Anypoint Platform

- **Throughput and response time**:
  - Must be broken-down to APIs in **all tiers**
  - Must be **enforced, monitored and analyzed**
    - API Manager, Anypoint Analytics
  - Anticipate **caching**
  - Highly **performant** runtime plane for API implementations: **CloudHub**
  - Need to carefully manage **load on Policy Admin System**: API Manager
- Must not lose quotes:
  - Synchronous invocations incl. ACID operation on **Policy Admin System**
- HTTPS mutual authentication:
  - **CloudHub Dedicated Load Balancer**
- Should add **client authentication** on top of HTTPS mutual auth

Addressing the NFRs of the "Customer Self-Service App" product

NFRs for "Retrieve policy holder summary"

- Part of "Customer Self-Service App" product
  - Might be opened-up to **external API consumers**
- **Synchronous** HTTP request-response chain
- **Performance**:
  - Ill-defined, aim for **100 requs/s**
  - Aim for avg response time of **2 s** at 100 requs/s
- **Consistency**:
  - Include claims from "Submit auto claim"
- **OAuth 2.0 (customer)**
- **HTTPS**

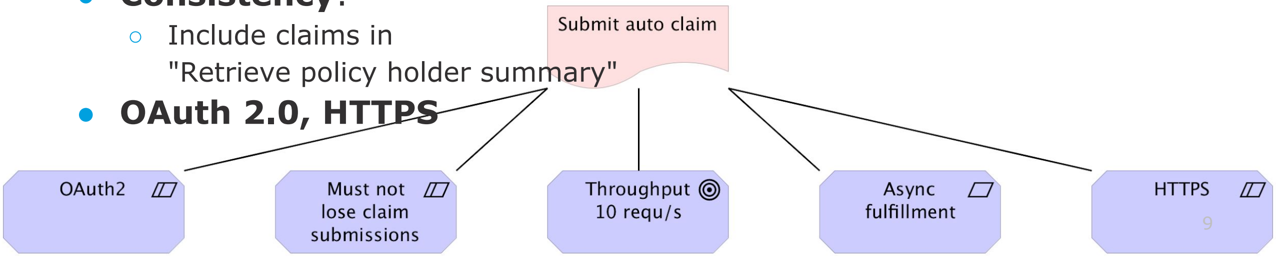


Meeting the NFRs for "Retrieve policy holder summary" using Anypoint Platform

- **Throughput and response time**:
  - **Not challenging**
  - Future use may change that
  - Highly **scalable** runtime plane: **CloudHub**
- **HTTPS**:
  - **Document** in API spec
  - Ensure in **API implementation**
- **OAuth 2.0**:
  - Enforce with **API Manager**
  - Requires Identity Provider for **Client Management**
    - PingFederate
- **Consistency**:
  - Through **event notifications**

NFRs for "Submit auto claim"

- Request over HTTP with claim submission and **asynchronous processing** of the submission
  - Processing submission requires lengthy downstream processing steps
- **Performance**:
  - Ill-defined, aim for **10 requs/s**
  - **No response time requirement** because processing is asynchronous
- Reliability: claim submissions **must not be lost**
- **Consistency**:
  - Include claims in "Retrieve policy holder summary"
- **OAuth 2.0, HTTPS**



Submit auto claim

OAuth2

Must not lose claim submissions

Throughput 10 requ/s

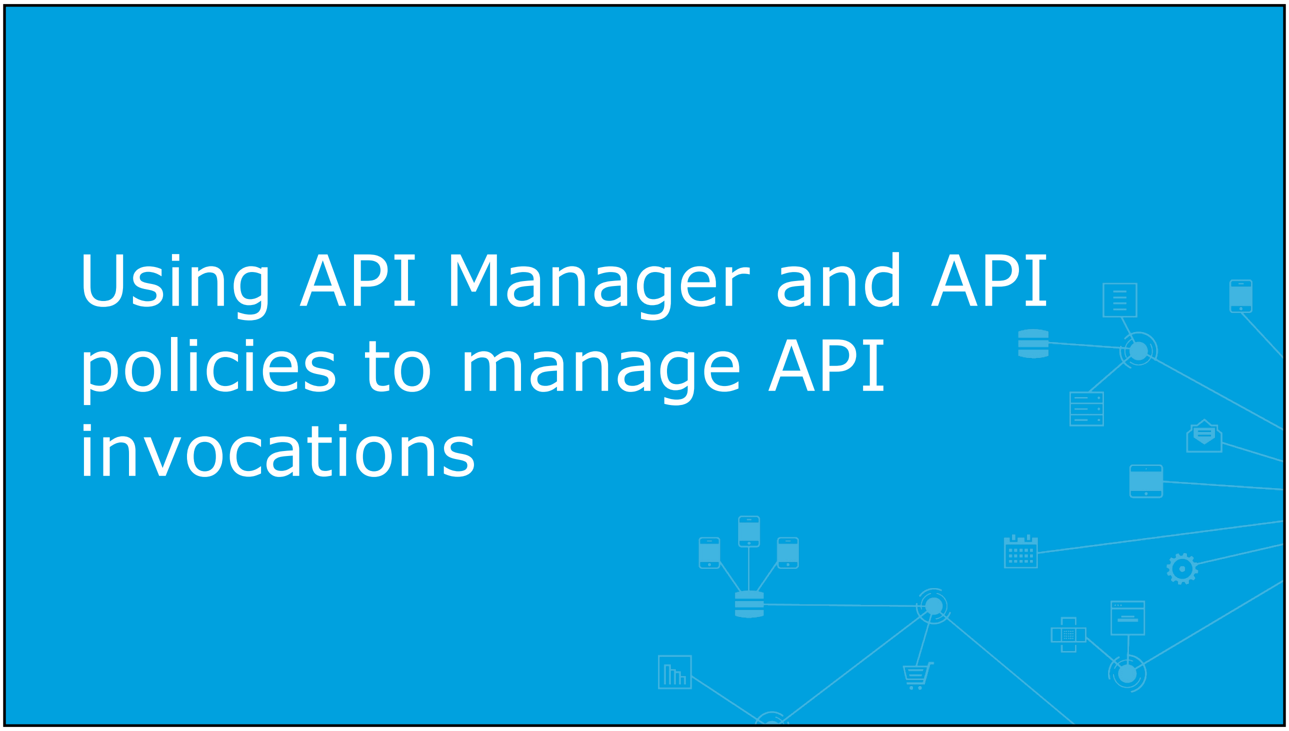
Async fulfillment

HTTPS

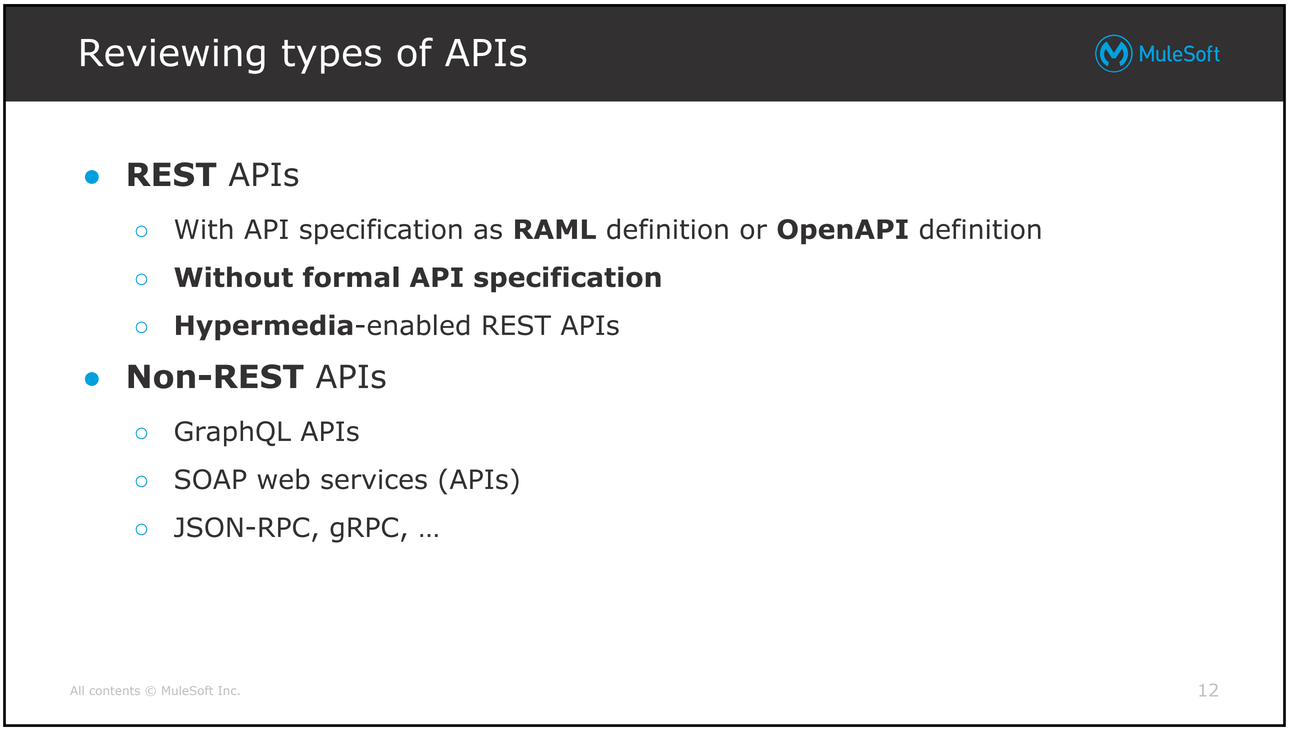
Meeting the NFRs for "Submit auto claim" using Anypoint Platform

New NFRs for this feature:

- **Async processing** of claim submission and no claim submission loss:
  - **Messaging system**
    - To trigger **async processing without message loss**
    - **Anypoint MQ**
    - Mule runtime **persistent VM queues** as in CloudHub
  - **Persistence mechanism**
    - To store async **correlation** information
    - Mule runtime **Object Store** as in CloudHub
- **Consistency**:
  - Through **event notifications**



Using API Manager and API policies to manage API invocations



Reviewing types of APIs

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- **REST** APIs
  - With API specification as **RAML** definition or **OpenAPI** definition
  - **Without formal API specification**
  - **Hypermedia**-enabled REST APIs
- **Non-REST** APIs
  - GraphQL APIs
  - SOAP web services (APIs)
  - JSON-RPC, gRPC, …

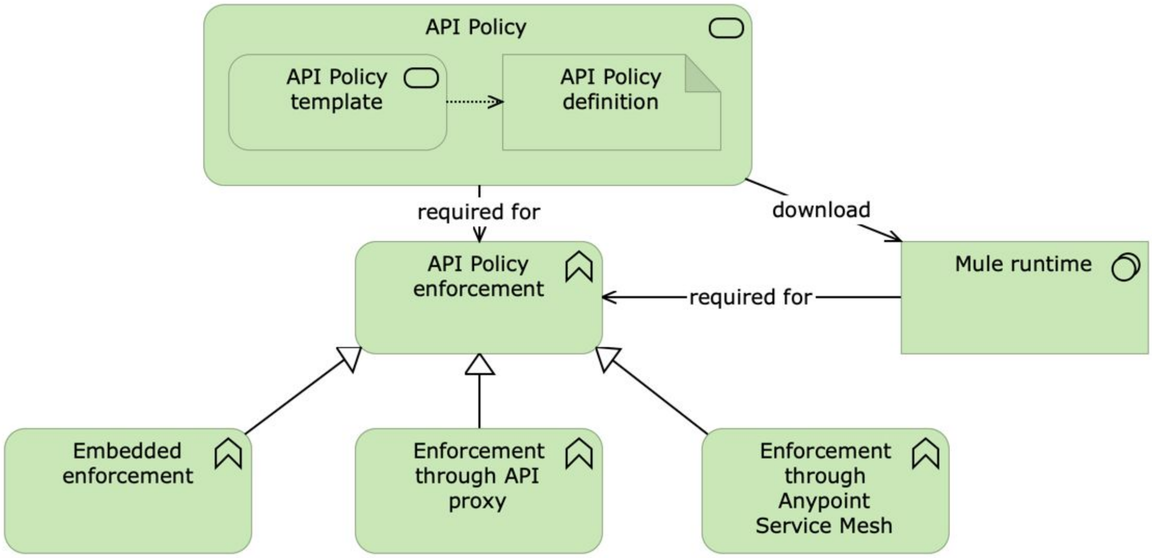
API management on Anypoint Platform

- Using **API Manager** and **API policies**
- On the level of **HTTP**
- Applicable to **all types of HTTP/1.x APIs**
  - Therefore not to WebSocket APIs or HTTP/2 APIs
- Special support for **RAML-defined APIs**
  - Allow definition of **resource-level** API policies
  - In addition to the **endpoint-level** API policies available for all APIs

Defining API policy

- Defines a typically **non-functional requirement**
- Applied to an **API** (instance)
- Injection into **API invocation** between API client and endpoint
  - Without changing API implementation
- Consists of
  - API policy **template** (code and parameter descriptions)
  - API policy **definition** (parameter values)

Enforcement of API policies



Enforcement of API policies

- On Anypoint Platform, API policies are always **enforced from within a Mule app**:
  - **API implementation** can **embed** enforcement of API policies
  - **API proxy** deployed infront of the API implementation proper to enforce API policies
  - **Anypoint Service Mesh** for Kubernetes-deployed non-Mule API implementations
- API policies **downloaded at runtime** from API Manager

Providing API management for Mule apps

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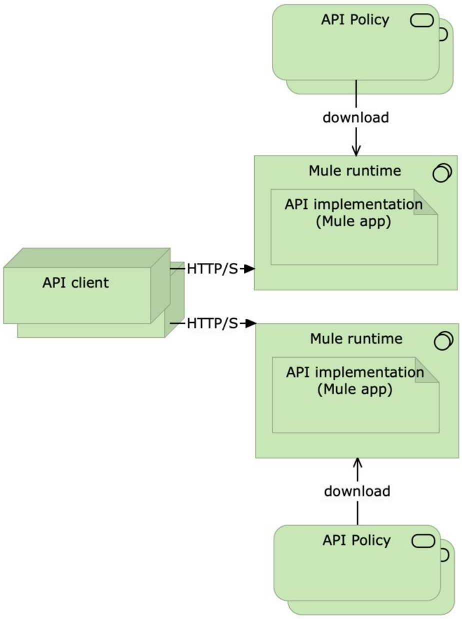
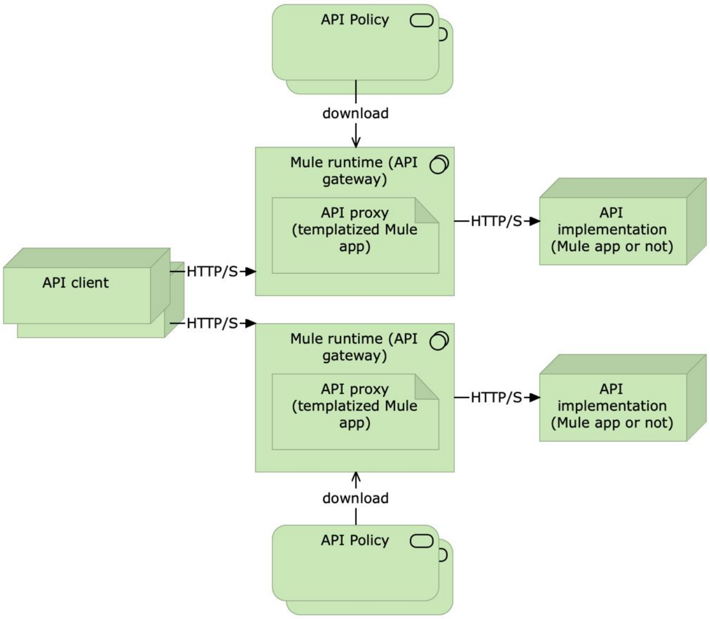
- Always executes in a **Mule runtime**
- Use API **policy enforcement function** of this Mule runtime
  - **Embed** API policy enforcement



Providing API management via API proxies

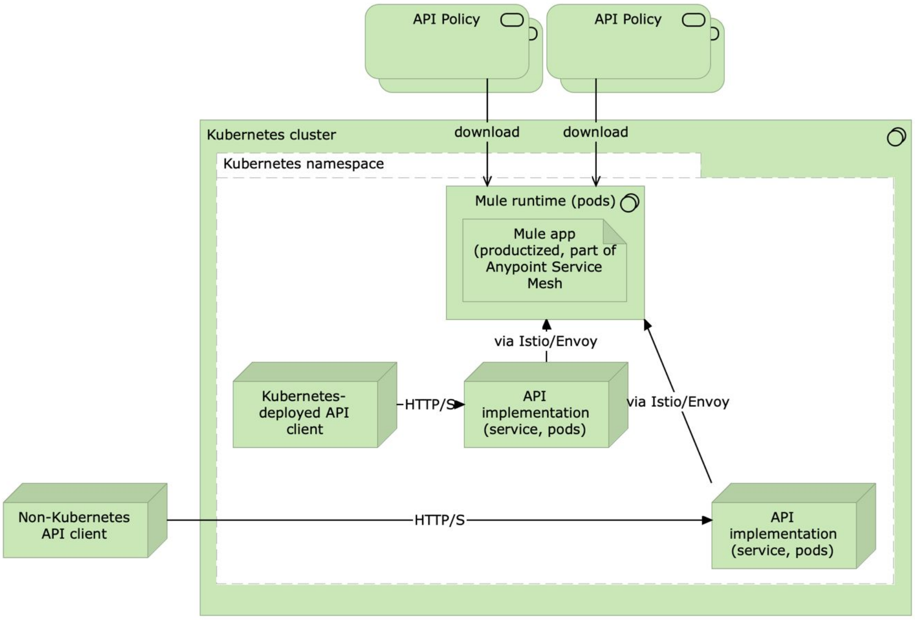
MuleSoft

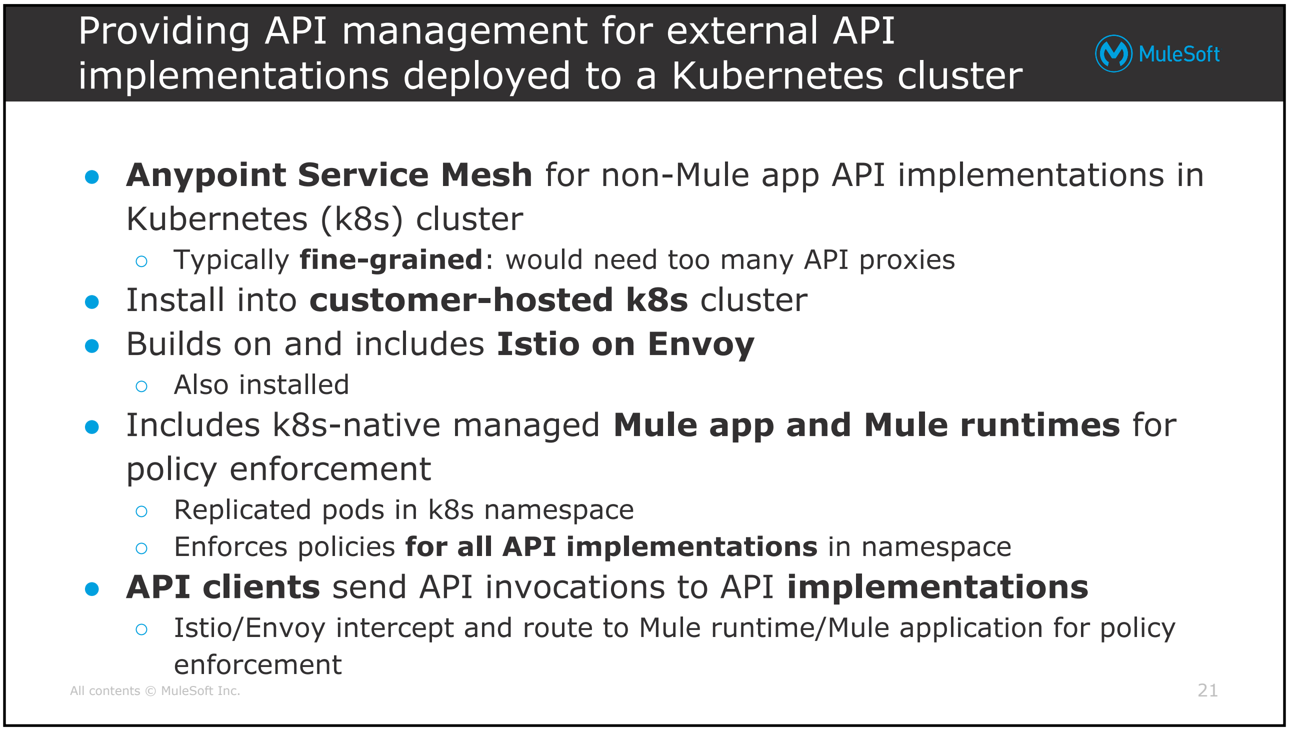

API Policy
download
Mule runtime (API gateway)
API proxy (templatized Mule app)
HTTP/S
API implementation (Mule app or not)
API client
HTTP/S
HTTP/S
Mule runtime (API gateway)
API proxy (templatized Mule app)
HTTP/S
API implementation (Mule app or not)
download
API Policy

Providing API management via API proxies

- Enable policy enforcement for **any API implementation**
  - Must use if **not Mule app** and **not Kubernetes**-deployed
- API proxy is **templated Mule app**
  - **Auto-generated** by API Manager
- Deployed to Mule runtime: **API Gateway**
  - Technical a "normal" Mule runtime
  - On iPaaS (CloudHub): **auto-provision** API Gateway with API proxy
- Exactly **one API implementation** per API proxy
- **API clients** must send API invocations to proxy
- API proxy sends **separate API invocation** to API implementation
- Interface API client->API proxy and API proxy->implementation is **HTTP-based API**
- For **coarsed-grained APIs**: add separate **node**

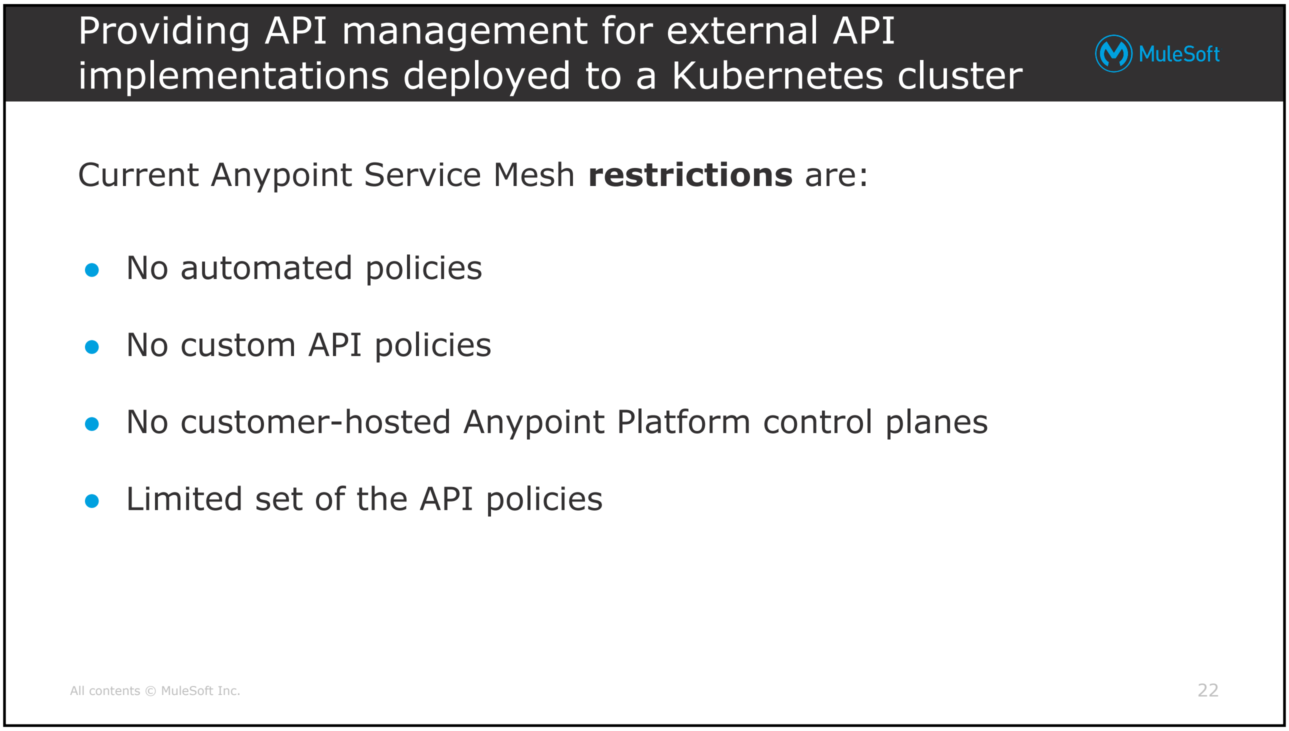
Providing API management for external API implementations deployed to a Kubernetes cluster


API Policy
API Policy
Kubernetes cluster
download
download
Kubernetes namespace
Mule runtime (pods)
Mule app (productized, part of Anypoint Service Mesh
via Istio/Envoy
Kubernetes-deployed API client
HTTP/S
API implementation (service, pods)
via Istio/Envoy
Non-Kubernetes API client
HTTP/S
API implementation (service, pods)



Providing API management for external API implementations deployed to a Kubernetes cluster

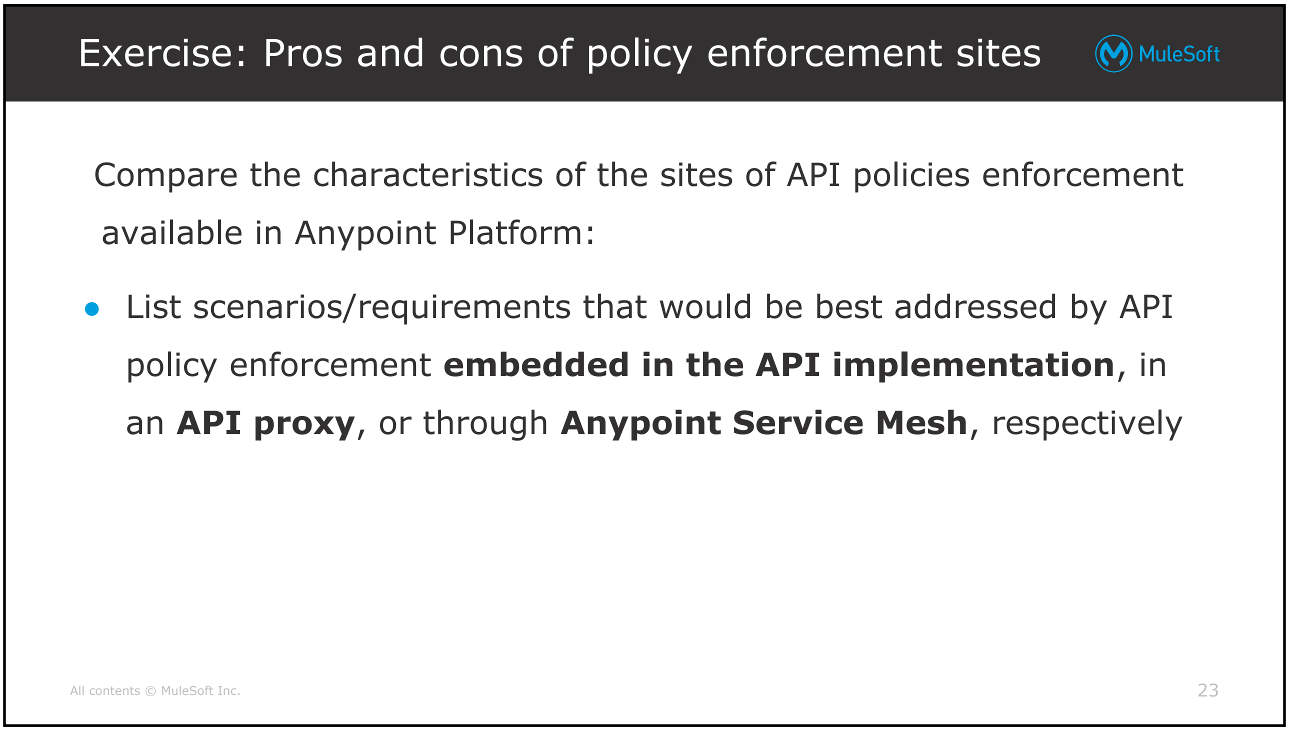
- **Anypoint Service Mesh** for non-Mule app API implementations in Kubernetes (k8s) cluster
  - Typically **fine-grained**: would need too many API proxies
- Install into **customer-hosted k8s** cluster
- Builds on and includes **Istio on Envoy**
  - Also installed
- Includes k8s-native managed **Mule app and Mule runtimes** for policy enforcement
  - Replicated pods in k8s namespace
  - Enforces policies **for all API implementations** in namespace
- **API clients** send API invocations to API **implementations**
  - Istio/Envoy intercept and route to Mule runtime/Mule application for policy enforcement



Providing API management for external API implementations deployed to a Kubernetes cluster

Current Anypoint Service Mesh **restrictions** are:

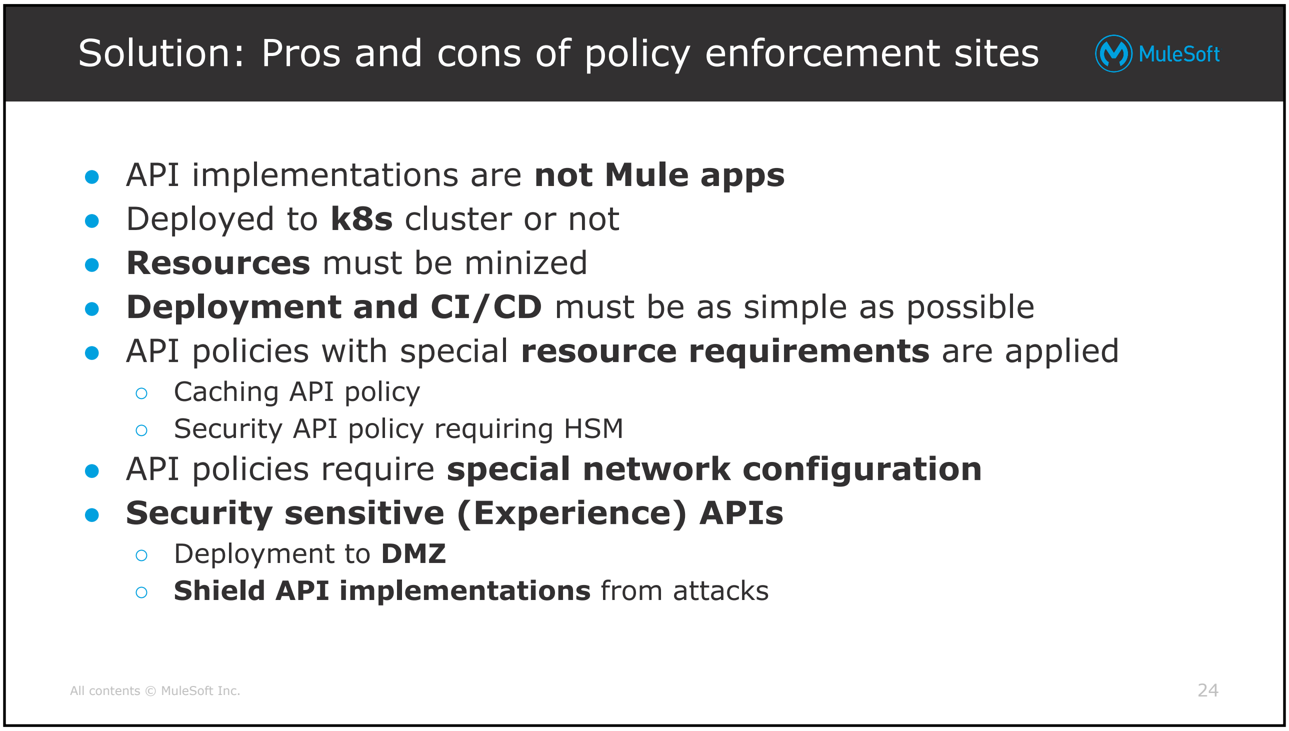
- No automated policies
- No custom API policies
- No customer-hosted Anypoint Platform control planes
- Limited set of the API policies



Exercise: Pros and cons of policy enforcement sites

Compare the characteristics of the sites of API policies enforcement available in Anypoint Platform:

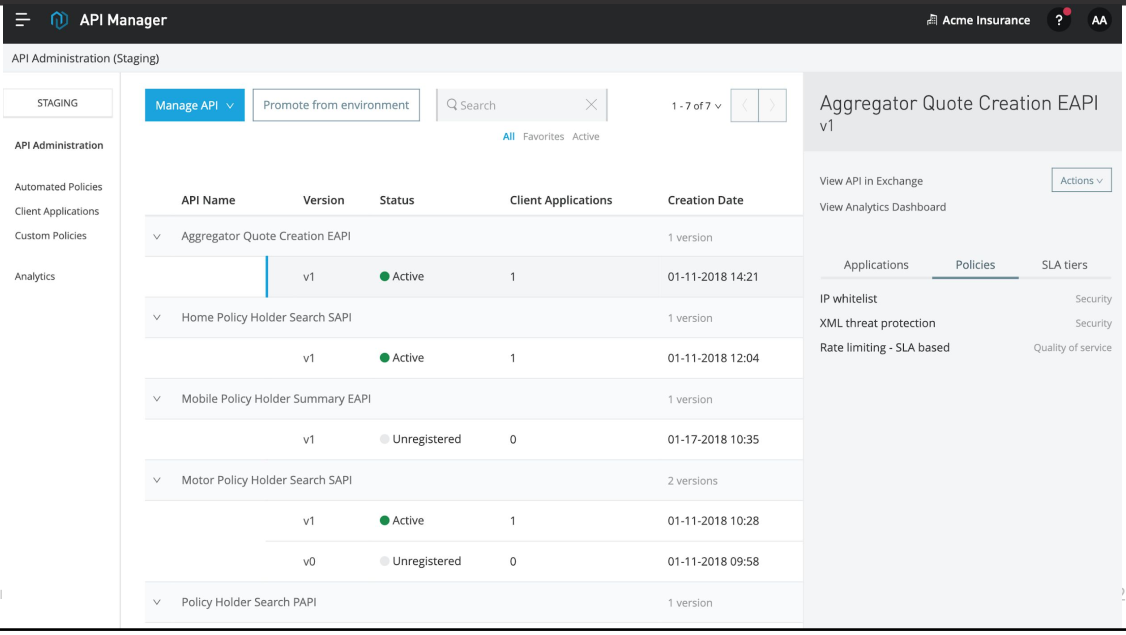
- List scenarios/requirements that would be best addressed by API policy enforcement **embedded in the API implementation**, in an **API proxy**, or through **Anypoint Service Mesh**, respectively



Solution: Pros and cons of policy enforcement sites

- API implementations are **not Mule apps**
- Deployed to **k8s** cluster or not
- **Resources** must be minized
- **Deployment and CI/CD** must be as simple as possible
- API policies with special **resource requirements** are applied
  - Caching API policy
  - Security API policy requiring HSM
- API policies require **special network configuration**
- **Security sensitive (Experience) APIs**
  - Deployment to **DMZ**
  - **Shield API implementations** from attacks

Managing APIs with API Manager



API Manager

Acme Insurance ? AA

API Administration (Staging)

STAGING

API Administration

Automated Policies

Client Applications

Custom Policies

Analytics

Manage API ⌄ | Promote from environment | Search | 1 - 7 of 7 ⌄

All Favorites Active

API Name	Version	Status	Client Applications	Creation Date
Aggregator Quote Creation EAPI				1 version
	v1	● Active	1	01-11-2018 14:21
Home Policy Holder Search SAPI				1 version
	v1	● Active	1	01-11-2018 12:04
Mobile Policy Holder Summary EAPI				1 version
	v1	○ Unregistered	0	01-17-2018 10:35
Motor Policy Holder Search SAPI				2 versions
	v1	● Active	1	01-11-2018 10:28
	v0	○ Unregistered	0	01-11-2018 09:58
Policy Holder Search PAPI				1 version

Aggregator Quote Creation EAPI
v1

View API in Exchange | Actions ⌄

View Analytics Dashboard

Applications | Policies | SLA tiers

IP whitelist	Security
XML threat protection	Security
Rate limiting - SLA based	Quality of service

Managing APIs with API Manager

- Management of APIs using **API instances**
  - **API instance** = endpoint for API with major version in environment
- Configuration of **API policies** for a given API instance
  - Select API policy template and parameterize it with API policy definition
  - **OOTB and custom** API policies
- Configuration of **automated policies** for all API instances in an **environment**
- Contacted from site of API policy enforcement to **download all API policies** that must be enforced
- Definition of **alerts** based on API invocations

Managing APIs with API Manager

- Admin of **API clients** ("Client Applications")
  - API consumers use Exchange to request access
- API consumers use **Exchange to request access** to an API
- Access to Anypoint **Analytics**

Selectively applying an API policy to some resources and methods of an API

- By default API policies are applied to **entire API endpoint**
  - Represented as API instance in API Manager
- APIs defined with an **API spec** (RAML or OpenAPI definition) can apply API policies also to selected combinations of **API resources and HTTP methods**

API policies

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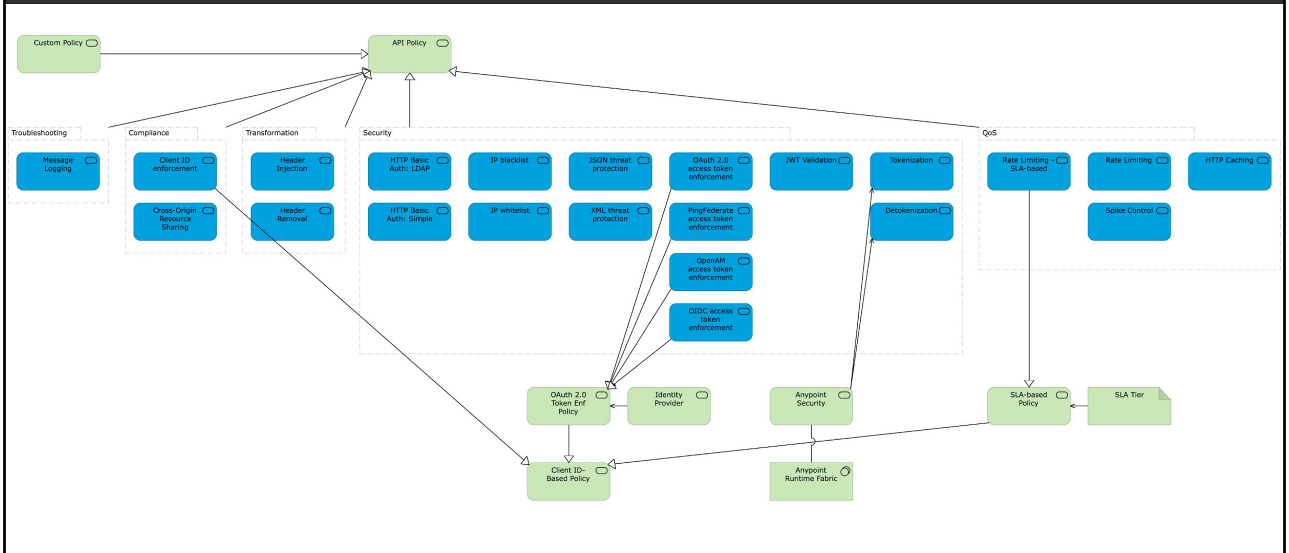

Custom Policy

API Policy

Troubleshooting

Message Logging

Compliance

Client ID enforcement

Cross-Origin Resource Sharing

Transformation

Header Injection

Header Removal

Security

HTTP Basic Auth: LDAP

HTTP Basic Auth: Simple

IP blacklist

IP whitelist

JSON threat protection

XML threat protection

OAuth 2.0 access token enforcement

PingFederate access token enforcement

OpenAM access token enforcement

OIDC access token enforcement

JWT Validation

Tokenization

Detokenization

QoS

Rate Limiting - SLA-based

Rate Limiting

Spike Control

HTTP Caching

OAuth 2.0 Token Enf Policy

Identity Provider

Anypoint Security

SLA-based Policy

SLA Tier

Client ID-Based Policy

Anypoint Runtime Fabric

API policies

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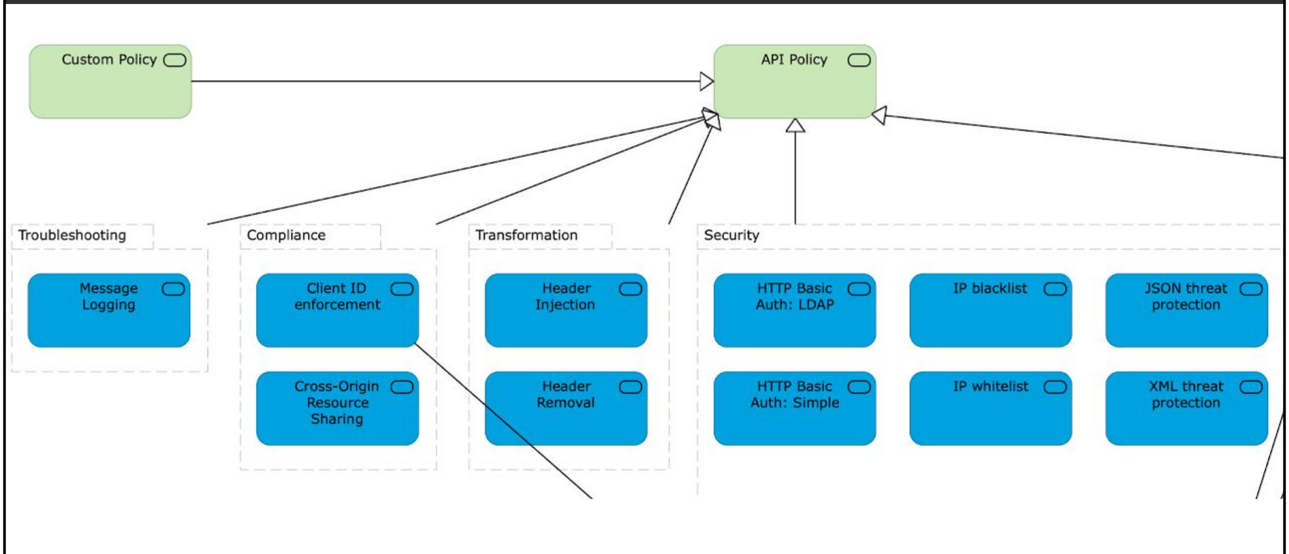

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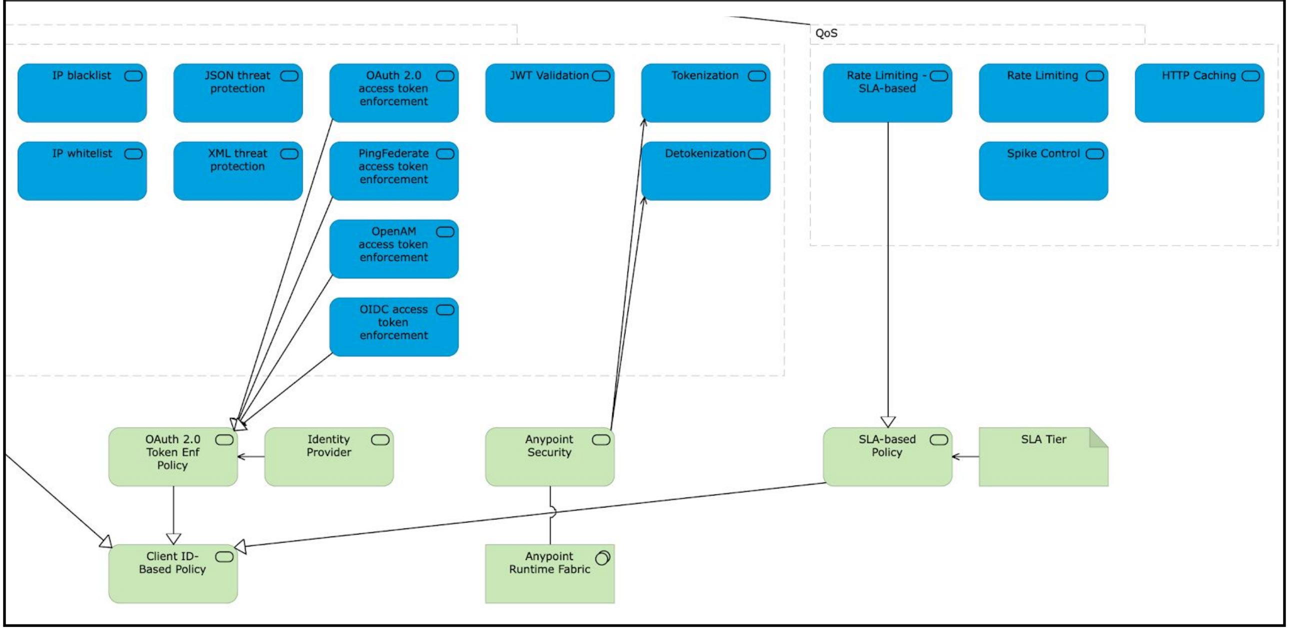

API policies as Aspect-Oriented Programming

- API policies are **AOP** applied to API invocations:
  - **Ordered**, API implementation/proxy as last element
  - **Incoming HTTP request** passed down this chain, returning **HTTP response** passed up
  - API policies implement "**around advice**":
    - Execute code **before/after** handing control to the **next element** in the chain
    - **Change HTTP request/response** if desired
  - In Mule 4: also applied to **outgoing HTTP requests**

Understanding custom API policies

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- **Implementing and applying** custom API policies:
  - Very similar to **Mule apps**
  - Packaged and deployed to **Exchange**
    - Contains both **policy template** (code and parameter descriptions)
  - **API Manager** retrieves policy from Exchange and shows **configuration UI** to enter the definition (parameter values)
  - Policy template and definition **downloaded to any Mule runtime** that registers as that API instance

Compliance-related API policies

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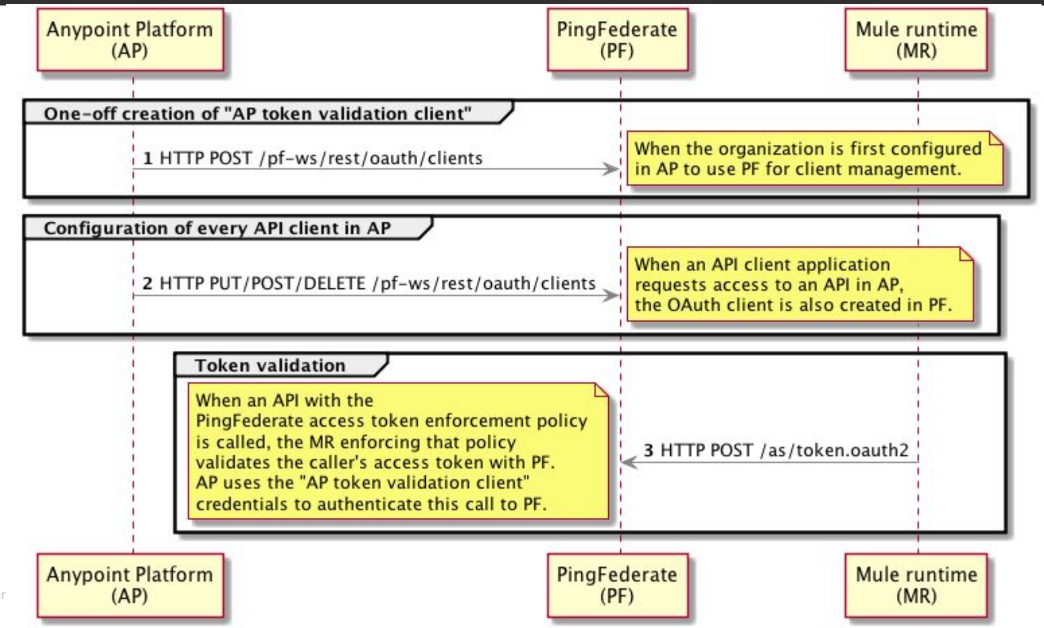
- **Client ID enforcement**
- **CORS control**
  - Interacts with API clients for **Cross-Origin Resource Sharing**:
    - Rejects HTTP requests whose **Origin** request header does not match configured origin domains
    - Sets **Access-Control-*** HTTP response headers to match configured cross-origins, usage of credentials, etc.
    - Responds to CORS pre-flight **HTTP OPTIONS requests**
  - Can be important for Experience APIs invoked from a **browser**

Security-related API policies

- Authentication/Authorization
  - **OAuth 2.0 token enforcement** API policies
    - Require matching Identity Provider configured for **Client Management**
      - OpenAM, PingFederate or OIDC DCR compatible (Okta)
    - Discouraged “OAuth 2.0 access token enforcement using external provider” requires access to Mule OAuth 2.0 provider or other configured in the policy
  - **Basic Authentication: LDAP/Simple**
    - Incorporate access to Identity Provider
- **IP-based** access control
  - **blacklisting, whitelisting**
- Payload **threat protection**
  - Guard against attacks sending over-sized HTTP request bodies
  - **Limit size of XML or JSON bodies**
- **De/Tokenization**
  - Only with Anypoint Security on Runtime Fabric

Interactions with OAuth 2.0 Client Management



Anypoint Platform (AP)

PingFederate (PF)

Mule runtime (MR)

One-off creation of "AP token validation client"

1 HTTP POST /pf-ws/rest/oauth/clients

When the organization is first configured in AP to use PF for client management.

Configuration of every API client in AP

2 HTTP PUT/POST/DELETE /pf-ws/rest/oauth/clients

When an API client application requests access to an API in AP, the OAuth client is also created in PF.

Token validation

When an API with the PingFederate access token enforcement policy is called, the MR enforcing that policy validates the caller's access token with PF. AP uses the "AP token validation client" credentials to authenticate this call to PF.

3 HTTP POST /as/token.oauth2

Anypoint Platform (AP)

PingFederate (PF)

Mule runtime (MR)

Java Web Tokens (JWTs)

- Compact **claims** representation format for
  - HTTP **Authorization** headers
  - URI query parameters
- **Claim**:
  - Piece of information asserted about a subject
  - Represented as a **name/value pair** (String/JSON pair)
- **Claims Set**:
  - **JSON object** containing the claims in the JWT
  - May be **digitally signed** or **integrity protected**
    - using JSON Web Signature (**JWS**)
  - May be **encrypted**
    - using JSON Web Encryption (**JWE**)
- **JOSE header** describe **cryptographic operations** applied to the Claims Set
- **Unsecured JWTs**: created without a signature or encryption

Source: IETF RFC 7519

JWT Example 1: JWS using HMAC

- JOSE Header
  - JWT that is JWS and MACed using the HMAC SHA-256 algorithm:
  - { **"typ"**: "JWT", **"alg"**: "HS256" }
- JWT Claims Set
  - { **"iss"**: "joe", **"exp"**: 1300819380, **"http://org.com/is_root"**: true }
- Complete JWT
  - Above JSON objects are normalized, base64-encoded, MACed,
  - MAC is normalized and base64-encoded
  - All 3 parts concatenated with .
  - **eyJ0<snip>NiJ9.eyJp<snip>VlfQ.dBjf<snip>EjXk**

Source: IETF RFC 7519

JWT Example 2: Unsecured JWT

- JOSE Header
  - JWT that is JWS and MACed using the HMAC SHA-256 algorithm:
  - { **"alg"**: "none" }
- JWT Claims Set
  - { **"iss"**: "joe", **"exp"**: 1300819380, **"http://org.com/is_root"**: true }
- Complete JWT
  - Above JSON objects are normalized, base64-encoded
  - Both parts concatenated with . plus trailing . for missing signature
  - **eyJh<snip>lIn0.eyJp<snip>VlfQ**.

Source: IETF RFC 7519

JWT Claims

- **Registered** Claim Names
  - Registered in the IANA "JSON Web Token Claims" registry:
  - "iss" (Issuer) "sub" (Subject)
  - "aud" (Audience) "exp" (Expiration Time)
  - "nbf" (Not Before) "iat" (Issued At)
  - "jti" (JWT ID)
- **Public** Claim Names
  - Either registered as above
  - or Collision-Resistant Name (**namespaced**)
- **Private** Claim Names
  - **Agreed** between producer and consumer of a JWT

Source: IETF RFC 7519

Propoagating user claims in JWTs within an application network

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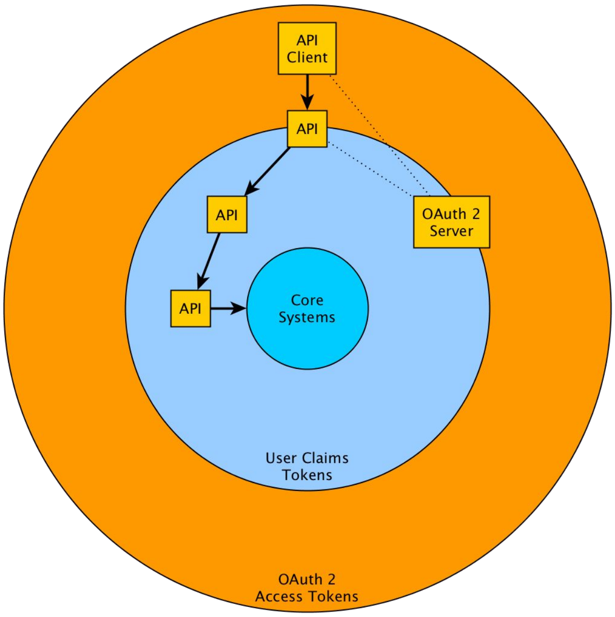

JWT signing and signature validation

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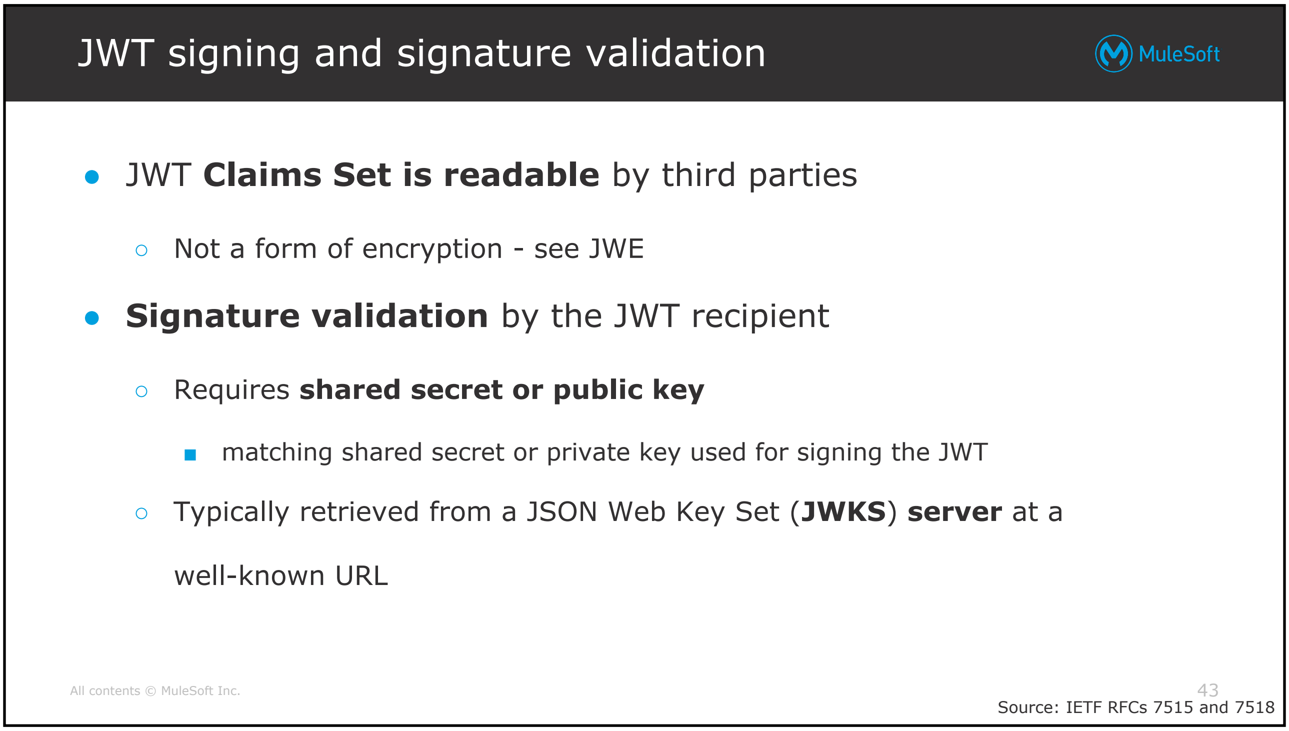
- According to **JWS**
- Either: Message Authentication Code (**MAC**)
  - **HMAC** algorithm
  - **Shared secret** for signing and signature validation
  - **Integrity checks** JWT Claims Set
- Or: **digital signatures**
  - **RSA** or **ECDSA**
  - **Public/private key pair**
    - Private key for signing
    - Public key for signature validation
  - **Integrity checks** JWT Claims Set
  - **Identifies originator** (= is in possession of private key)

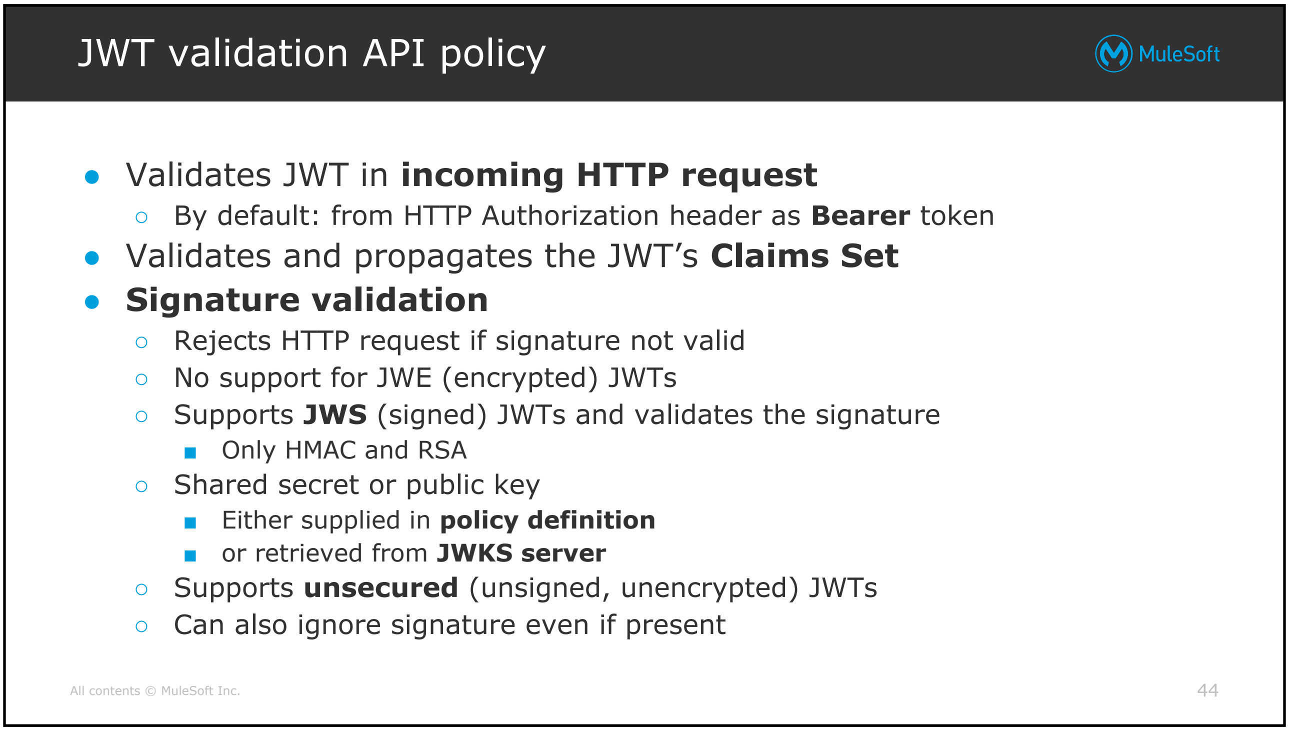
Source: IETF RFCs 7515 and 7518



JWT signing and signature validation

- JWT **Claims Set is readable** by third parties
  - Not a form of encryption - see JWE
- **Signature validation** by the JWT recipient
  - Requires **shared secret or public key**
    - matching shared secret or private key used for signing the JWT
  - Typically retrieved from a JSON Web Key Set (**JWKS**) **server** at a well-known URL

Source: IETF RFCs 7515 and 7518



JWT validation API policy

- Validates JWT in **incoming HTTP request**
  - By default: from HTTP Authorization header as **Bearer** token
- Validates and propagates the JWT’s **Claims Set**
- **Signature validation**
  - Rejects HTTP request if signature not valid
  - No support for JWE (encrypted) JWTs
  - Supports **JWS** (signed) JWTs and validates the signature
    - Only HMAC and RSA
  - Shared secret or public key
    - Either supplied in **policy definition**
    - or retrieved from **JWKS server**
  - Supports **unsecured** (unsigned, unencrypted) JWTs
  - Can also ignore signature even if present

JWT validation API policy

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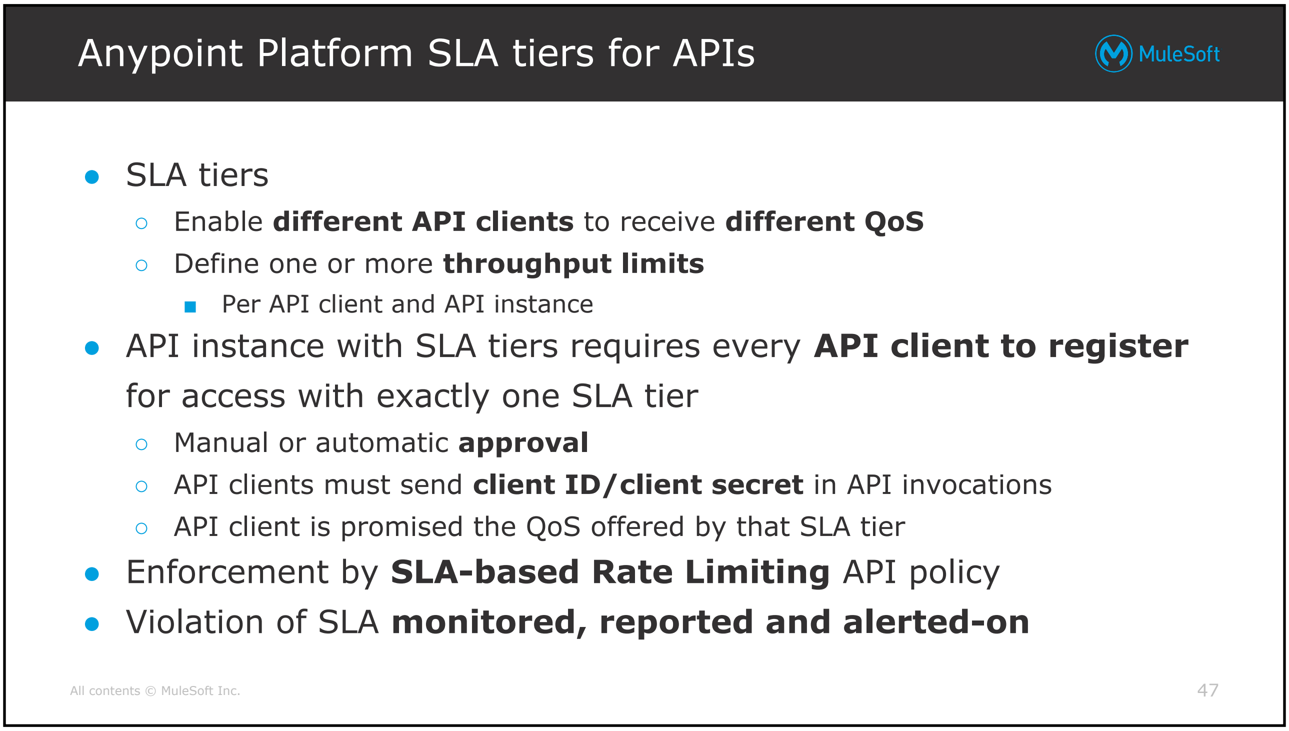
- **Claims Set validation**
  - Rejects HTTP request if the JWT Claims Set does not match config
  - Supports all types of JWT Claims (registered, public, private)
- **Claims Set propagation**
  - Claims Set passed **to Mule app** that enforces JWT validation API policy
  - Local, **in-process** propagation in variable

QoS-related API policies

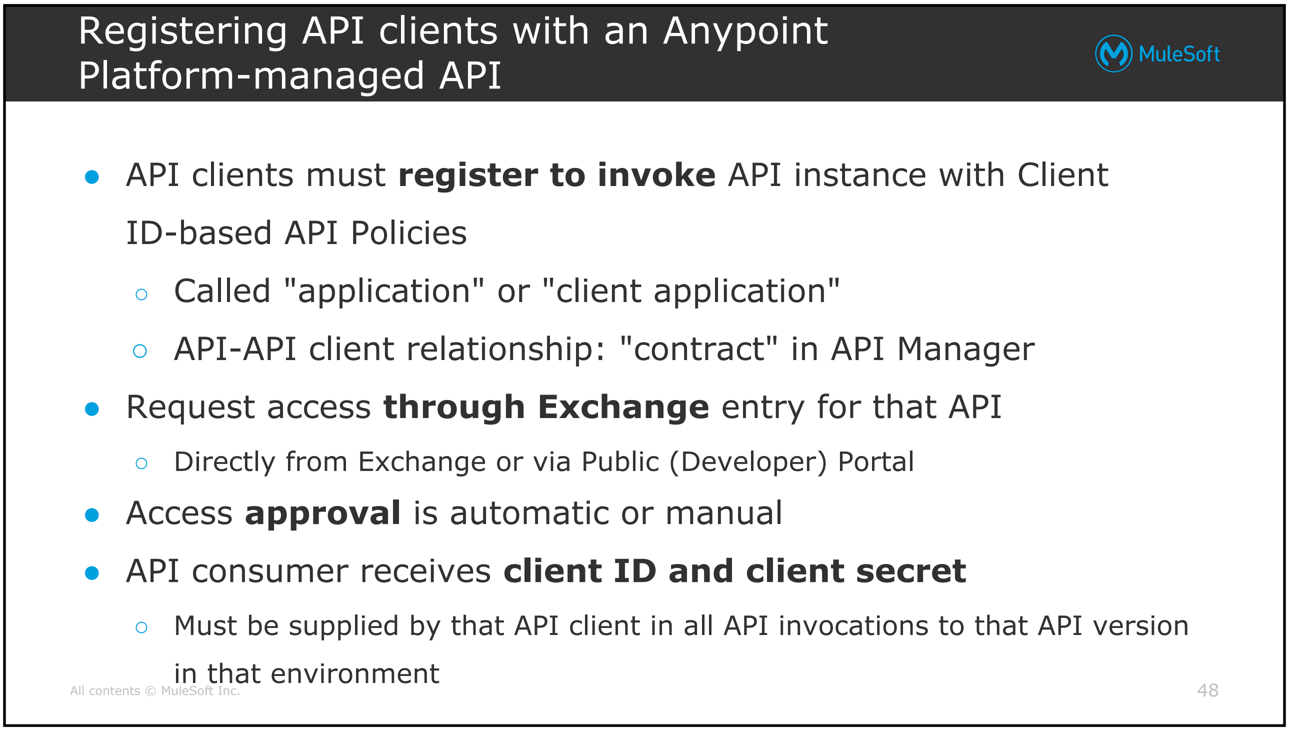
MuleSoft

- Quality of Service (QoS) related API policies on Anypoint Platform enforce **throughput limit** in # of API invocations per unit of time:
  - **Rate Limiting**: rejects requests above limit
  - **Spike Control**: queues requests above limit
- Two different ways to define the throughput limit:
  - **Non-SLA-based** (Rate Limiting and Spike Control)
    - Limit defined on API policy definition
    - Enforced for that API instance **across all API clients**
  - **SLA-based** (Rate Limiting)
    - Limit defined in an **SLA tier**
      - **API clients must register** with the API instance at a particular SLA tier
    - **Enforced separately** for each registered API client
      - API client must identify itself with **client ID**
- **X-RateLimit-*** HTTP response headers optionally inform API client of remaining capacity



Anypoint Platform SLA tiers for APIs

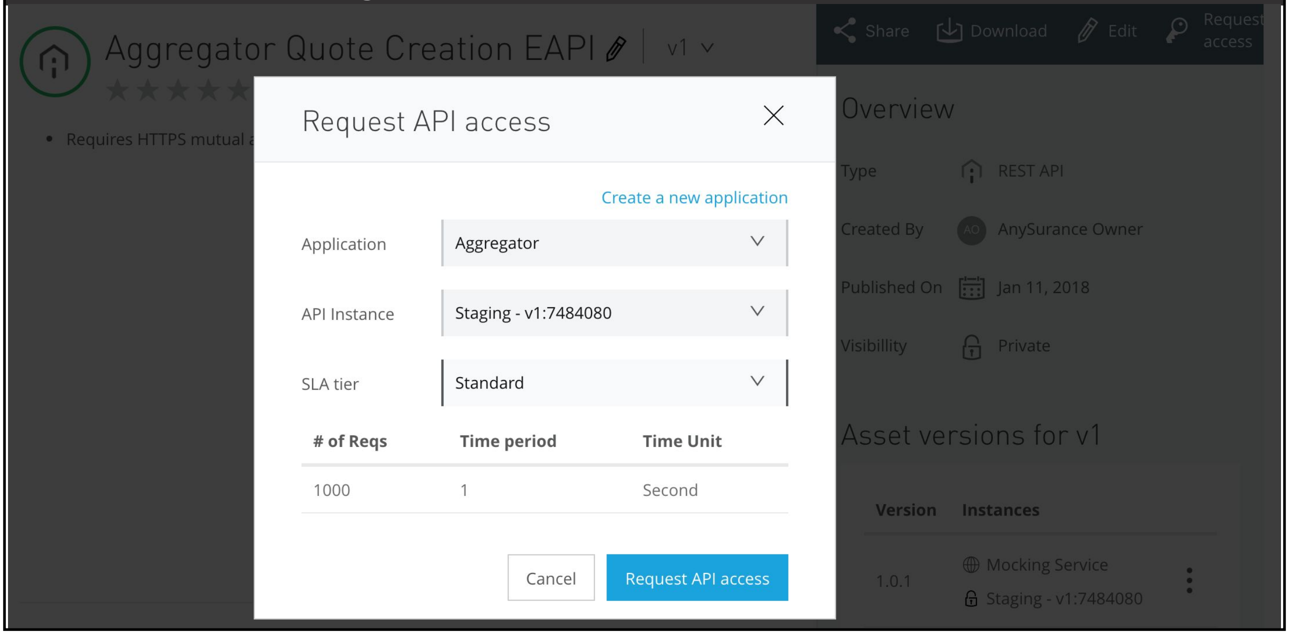
- SLA tiers
  - Enable **different API clients** to receive **different QoS**
  - Define one or more **throughput limits**
    - Per API client and API instance
- API instance with SLA tiers requires every **API client to register** for access with exactly one SLA tier
  - Manual or automatic **approval**
  - API clients must send **client ID/client secret** in API invocations
  - API client is promised the QoS offered by that SLA tier
- Enforcement by **SLA-based Rate Limiting** API policy
- Violation of SLA **monitored, reported and alerted-on**



Registering API clients with an Anypoint Platform-managed API

- API clients must **register to invoke** API instance with Client ID-based API Policies
  - Called "application" or "client application"
  - API-API client relationship: "contract" in API Manager
- Request access **through Exchange** entry for that API
  - Directly from Exchange or via Public (Developer) Portal
- Access **approval** is automatic or manual
- API consumer receives **client ID and client secret**
  - Must be supplied by that API client in all API invocations to that API version in that environment

Registering API clients with an Anypoint Platform-managed API



- Requires HTTPS mutual a

Request API access

Application: Aggregator

API Instance: Staging - v1:7484080

SLA tier: Standard

# of Reqs	Time period	Time Unit
1000	1	Second

Type: REST API

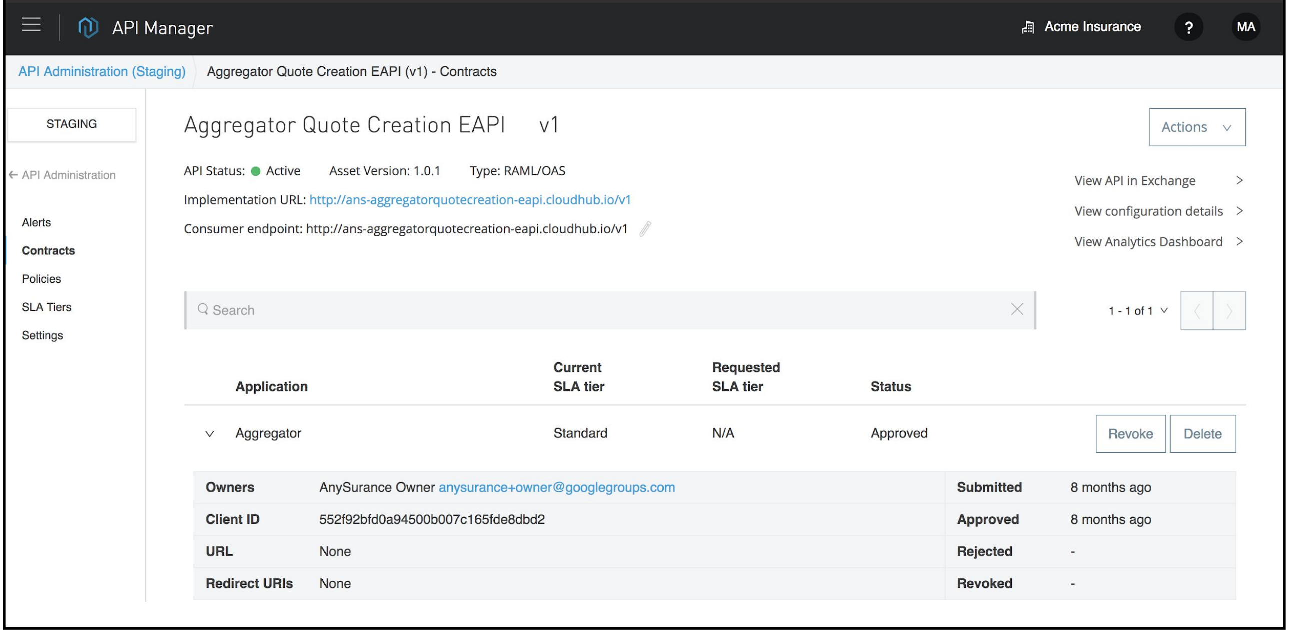
Created By: AnySurance Owner

Published On: Jan 11, 2018

Visibility: Private

Version	Instances
1.0.1	Mocking Service Staging - v1:7484080

Registering API clients with an Anypoint Platform-managed API



API Administration (Staging) Aggregator Quote Creation EAPI (v1) - Contracts

Aggregator Quote Creation EAPI v1

API Status: Active Asset Version: 1.0.1 Type: RAML/OAS

Implementation URL: http://ans-aggregatorquotecreation-eapi.cloudhub.io/v1

Consumer endpoint: http://ans-aggregatorquotecreation-eapi.cloudhub.io/v1

Application	Current SLA tier	Requested SLA tier	Status
Aggregator	Standard	N/A	Approved

Owners	AnySurance Owner anysurance+owner@googlegroups.com	Submitted	8 months ago
Client ID	552f92bfd0a94500b007c165fde8dbd2	Approved	8 months ago
URL	None	Rejected	-
Redirect URIs	None	Revoked	-

Client ID-based API policies

- API policies that require **API clients to identify** themselves:
  - **Client ID enforcement**
  - Rate Limiting - **SLA-based**
    - Retrieve SLA tier by client ID
      - Also enforce presence and validity of **client ID** and secret (optional)
  - **OAuth 2.0** access token enforcement
    - Token implicitly carries client ID
    - Policy **exchanges token for client ID** and passes it to SLA-based API policy
- **Client ID and client secret** passed in API invocations as defined by the API policy
  - **Query parameters**
  - Custom request **headers**
  - Standard **Authorization header** as in HTTP Basic Authentication

HTTP Caching API policy

- **Server-side** caching
- Caches **entire HTTP responses**
  - status code, headers, body
  - Size limit of 1MB
- Only if
  - **HTTP request expression** is true:
    - Default: HTTP method is GET or HEAD
  - **HTTP response expression** is true
    - Default: status code is in restricted set of 2xx, 3xx, 4xx or 5xx
- May honor many **caching directives** (HTTP headers)
- **Cache invalidation** via HTTP request header

HTTP Caching API policy - caching parameters

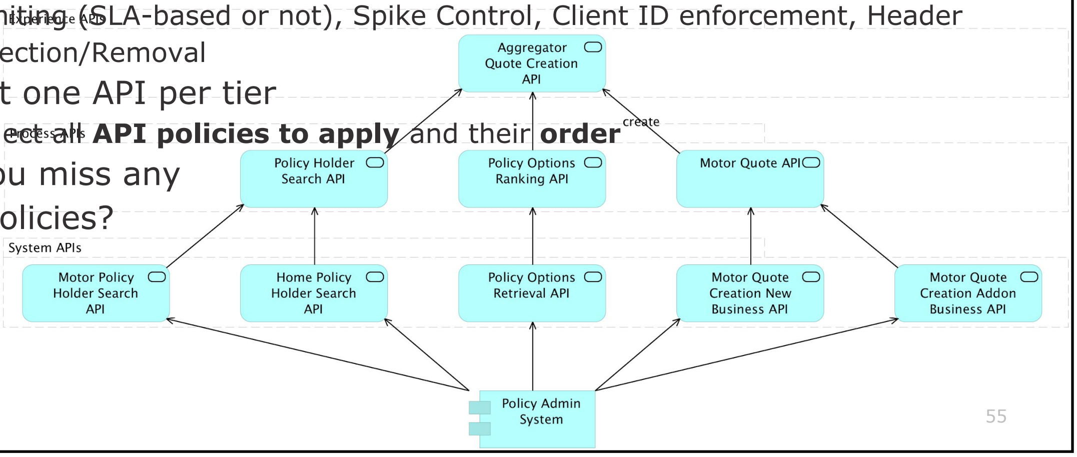
- Key
  - Default: request path
- Number of entries
- Time-to-live
- Distributed
- Persistent

Transformation API policies

- To manipulate **HTTP headers** in requests and responses:
  - **Header Injection**
    - Values are **expressions** and hence dynamically evaluated
  - **Header Removal**
- For instance, to propagate transcation IDs as HTTP headers along chains of API invocations

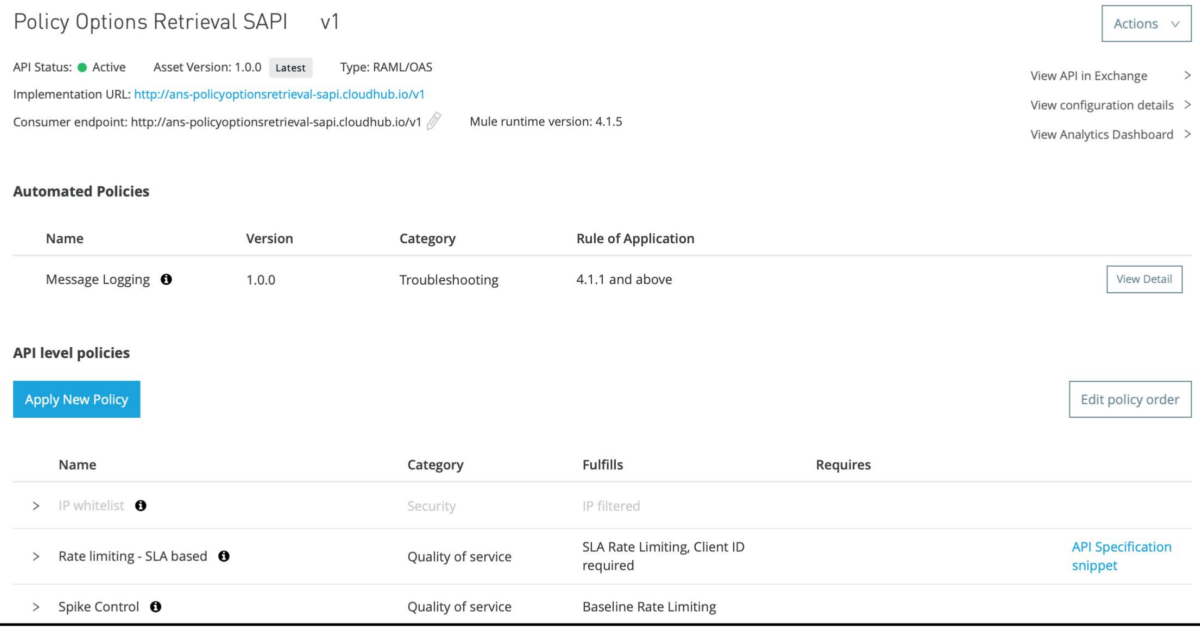
Exercise: Select API policies for all tiers in Acme Insurance's application network

1. Using OOTB API policies
   - CORS, HTTP Basic Auth Simple/LDAP, IP black/whitelist, JSON/XML threat protection, PingFederate/OpenAM/OIDC access token enforcement, Rate Limiting (SLA-based or not), Spike Control, Client ID enforcement, Header Injection/Removal
2. Select one API per tier
   - Select all **API policies to apply** and their **order**
3. Do you miss any API policies?



Experience APIs
Aggregator Quote Creation API
create
Process APIs
Policy Holder Search API
Policy Options Ranking API
Motor Quote API
System APIs
Motor Policy Holder Search API
Home Policy Holder Search API
Policy Options Retrieval API
Motor Quote Creation New Business API
Motor Quote Creation Addon Business API
Policy Admin System

Choosing appropriate API policies for System APIs



Policy Options Retrieval SAPI v1

Actions

API Status: ● Active Asset Version: 1.0.0 Latest Type: RAML/OAS

Implementation URL: http://ans-policyoptionsretrieval-sapi.cloudhub.io/v1

Consumer endpoint: http://ans-policyoptionsretrieval-sapi.cloudhub.io/v1 Mule runtime version: 4.1.5

View API in Exchange >

View configuration details >

View Analytics Dashboard >

Automated Policies

Name	Version	Category	Rule of Application	
Message Logging	1.0.0	Troubleshooting	4.1.1 and above	View Detail

API level policies

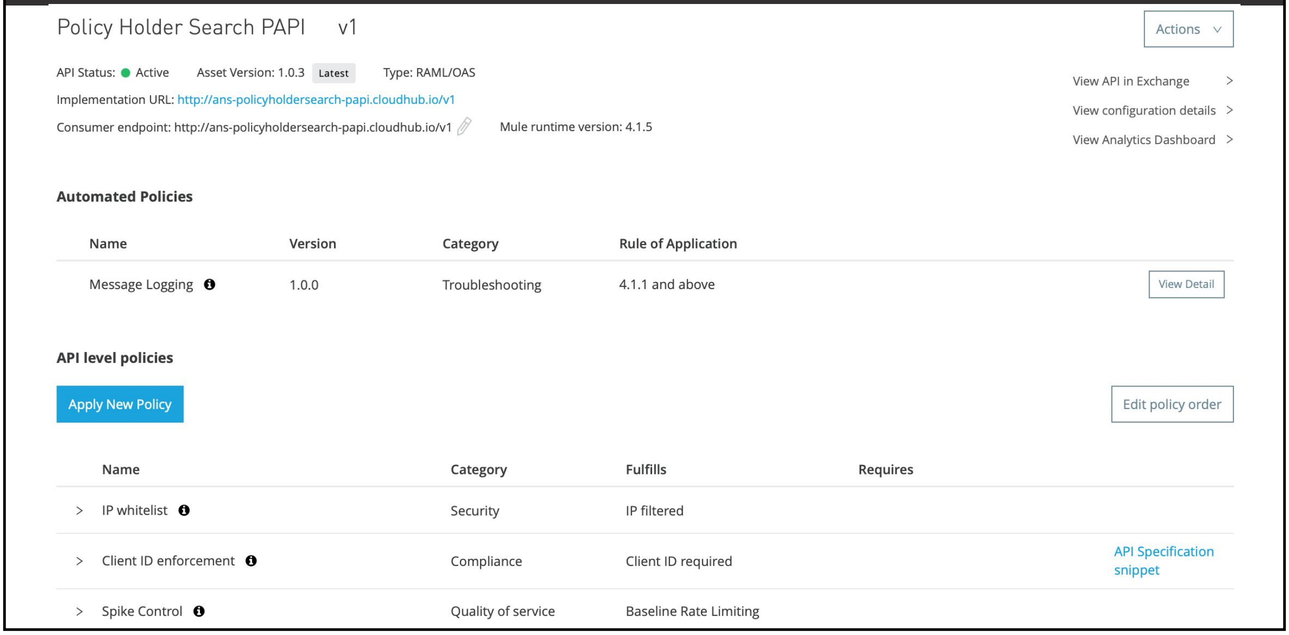
Apply New Policy

Edit policy order

Name	Category	Fulfills	Requires	
> IP whitelist	Security	IP filtered		
> Rate limiting - SLA based	Quality of service	SLA Rate Limiting, Client ID required		API Specification snippet
> Spike Control	Quality of service	Baseline Rate Limiting		

Choosing appropriate API policies for Process APIs

MuleSoft



Policy Holder Search PAPI v1

API Status: Active Asset Version: 1.0.3 Latest Type: RAML/OAS

Implementation URL: http://ans-policyholdersearch-papi.cloudhub.io/v1

Consumer endpoint: http://ans-policyholdersearch-papi.cloudhub.io/v1 Mule runtime version: 4.1.5

Automated Policies

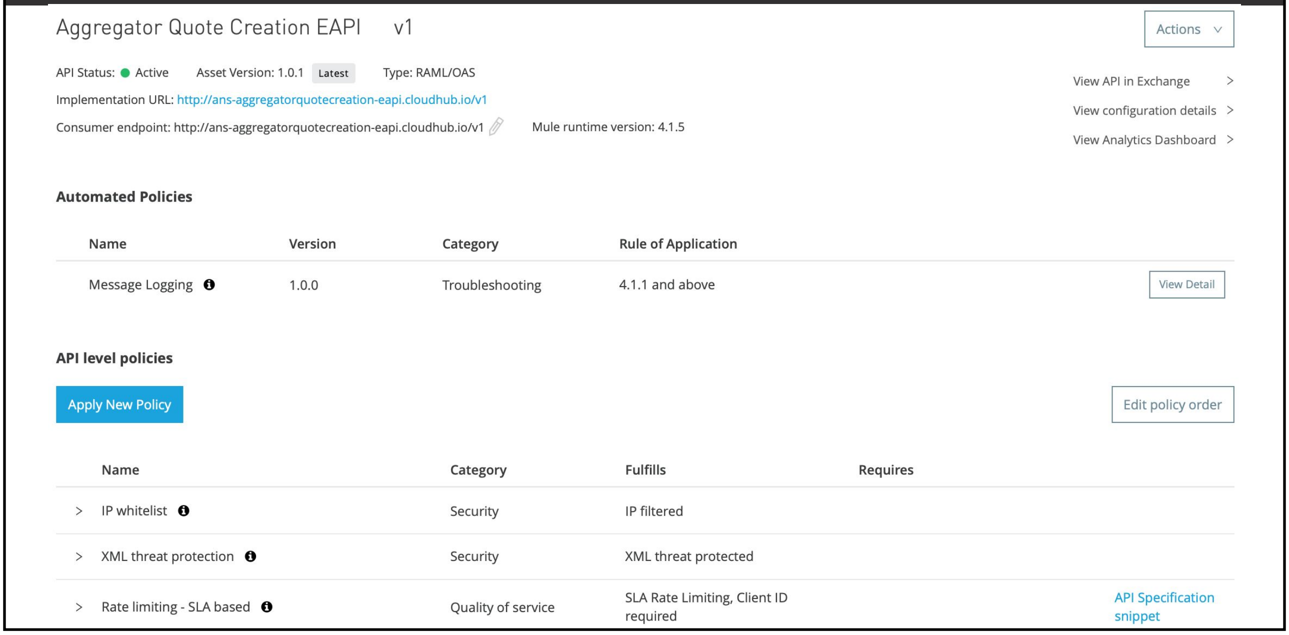
Name	Version	Category	Rule of Application
Message Logging	1.0.0	Troubleshooting	4.1.1 and above

API level policies

Name	Category	Fulfills	Requires	
IP whitelist	Security	IP filtered		
Client ID enforcement	Compliance	Client ID required		API Specification snippet
Spike Control	Quality of service	Baseline Rate Limiting		

Choosing appropriate API policies for Experience APIs

MuleSoft



Aggregator Quote Creation EAPI v1

API Status: Active Asset Version: 1.0.1 Latest Type: RAML/OAS

Implementation URL: http://ans-aggregatorquotecreation-eapi.cloudhub.io/v1

Consumer endpoint: http://ans-aggregatorquotecreation-eapi.cloudhub.io/v1 Mule runtime version: 4.1.5

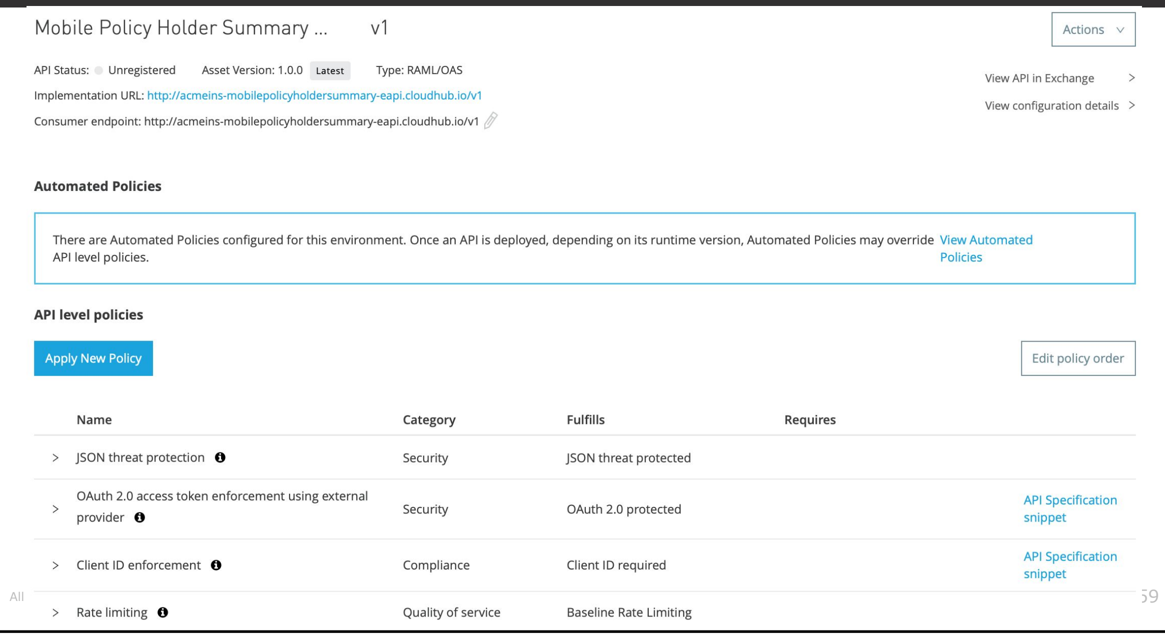
Automated Policies

Name	Version	Category	Rule of Application
Message Logging	1.0.0	Troubleshooting	4.1.1 and above

API level policies

Name	Category	Fulfills	Requires	
IP whitelist	Security	IP filtered		
XML threat protection	Security	XML threat protected		
Rate limiting - SLA based	Quality of service	SLA Rate Limiting, Client ID required		API Specification snippet

Choosing appropriate API policies for Experience APIs



Mobile Policy Holder Summary ... v1

Actions

API Status: Unregistered Asset Version: 1.0.0 Latest Type: RAML/OAS

Implementation URL: http://acmeins-mobilepolicyholdersummary-eapi.cloudhub.io/v1

Consumer endpoint: http://acmeins-mobilepolicyholdersummary-eapi.cloudhub.io/v1

View API in Exchange >

View configuration details >

Automated Policies

There are Automated Policies configured for this environment. Once an API is deployed, depending on its runtime version, Automated Policies may override API level policies. View Automated Policies

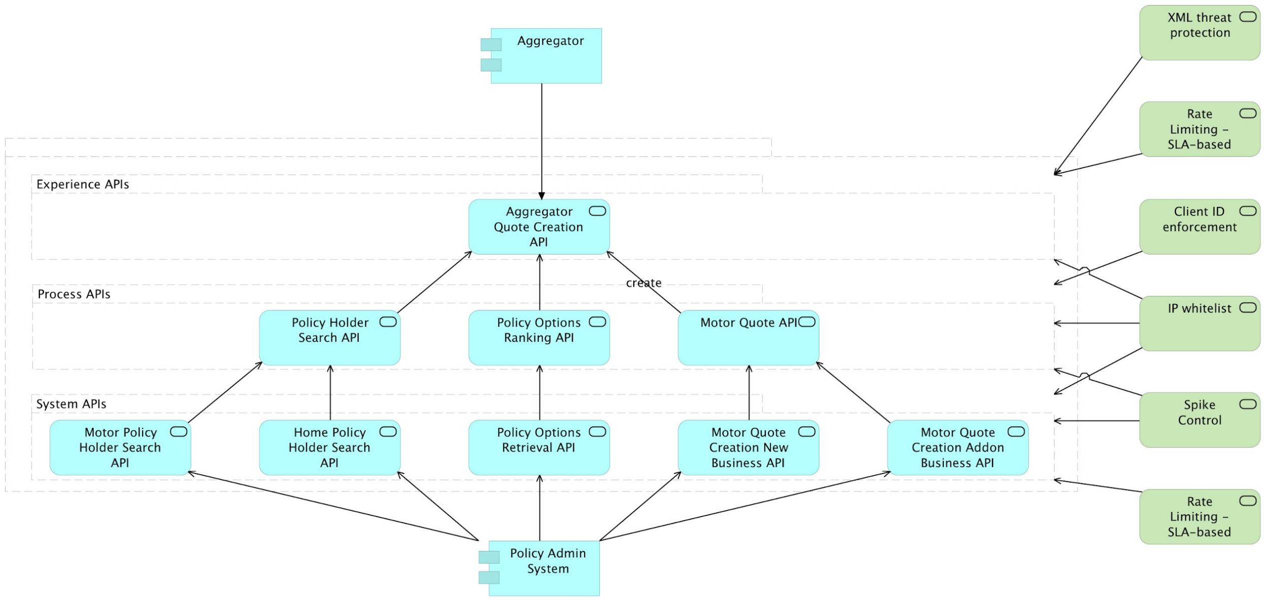
API level policies

Apply New Policy

Edit policy order

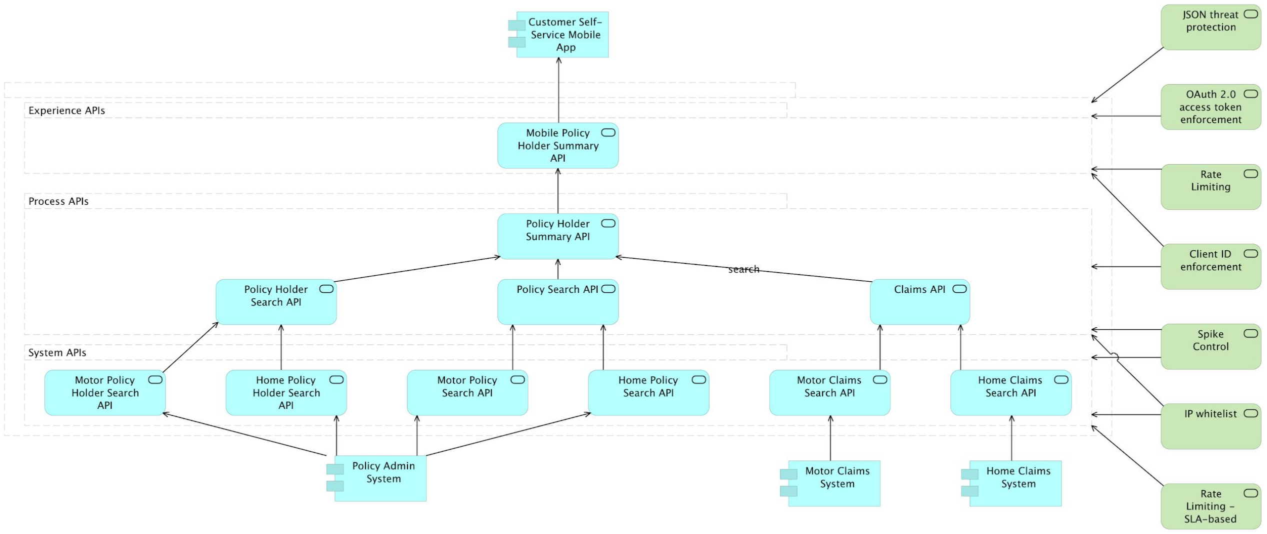
Name	Category	Fulfills	Requires	
> JSON threat protection	Security	JSON threat protected		
> OAuth 2.0 access token enforcement using external provider	Security	OAuth 2.0 protected		API Specification snippet
> Client ID enforcement	Compliance	Client ID required		API Specification snippet
> Rate limiting	Quality of service	Baseline Rate Limiting		

API policies for "Create quote for aggregators"

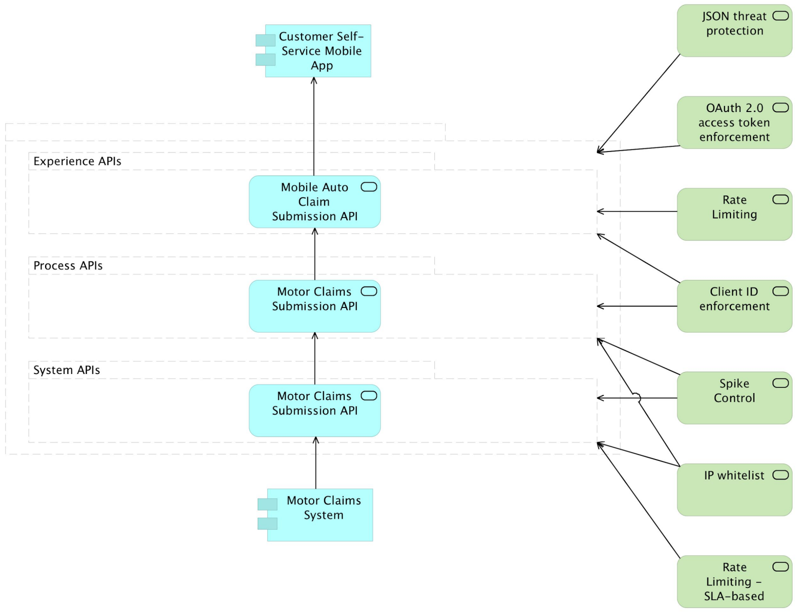


Aggregator
Experience APIs
Aggregator Quote Creation API
create
Process APIs
Policy Holder Search API
Policy Options Ranking API
Motor Quote API
System APIs
Motor Policy Holder Search API
Home Policy Holder Search API
Policy Options Retrieval API
Motor Quote Creation New Business API
Motor Quote Creation Addon Business API
Policy Admin System
XML threat protection
Rate Limiting – SLA-based
Client ID enforcement
IP whitelist
Spike Control
Rate Limiting – SLA-based

API policies for "Retrieve policy holder summary"



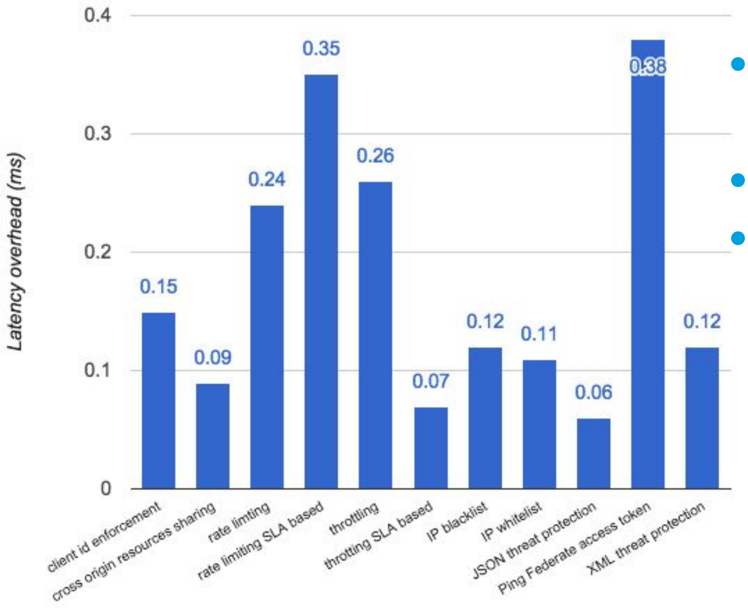
API policies for "Submit auto claim"


Customer Self-Service Mobile App
Experience APIs
Mobile Auto Claim Submission API
Process APIs
Motor Claims Submission API
System APIs
Motor Claims Submission API
Motor Claims System
JSON threat protection
OAuth 2.0 access token enforcement
Rate Limiting
Client ID enforcement
Spike Control
IP whitelist
Rate Limiting - SLA-based

Reflecting the application of API policies in the API spec of an API

- Many API policies **change HTTP request/response**:
  - Require certain HTTP request headers: **Authorization**
  - Require certain query parameters: **client_id**
  - Add HTTP response headers: **X-RateLimit-Limit**
- **Change contract** between API client and API implementation
- Must be reflected in **API spec** of the API
  - RAML has specific support for **securitySchemes** such as OAuth 2.0
  - In other cases define **RAML traits**
- **C4E** owns definition of reusable **RAML fragments**
  - Publish to **Exchange** to encourage consumption and reuse.

Latency overhead of applying API policies

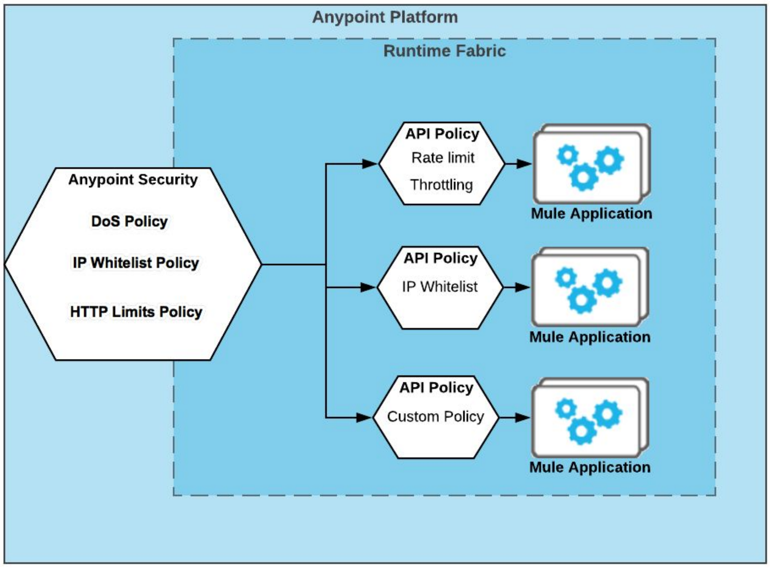


- Increase in HTTP request-response latency
- through API policies
- enforced embedded in API implementation

Using Anypoint Security and Edge policies in addition to API Manager and API policies

Anypoint Security

MuleSoft



Anypoint Security

- To implement **perimeter defence** in customer-hosted deployments of Anypoint Platform runtime plane (only) on **Anypoint Runtime Fabric** (RTF)
- Serves as Kubernetes **Ingress** and enforces **Edge policies**
  - Ingress provides **load-balancing** and **SSL termination** for **external API clients** of API implementations deployed to Kubernetes cluster
- Includes **Secrets Manager** for storing **certificates** needed for enabling TLS traffic, optionally with **mutual auth**, to the Ingress
- Anypoint Security and Edge policies **independent** of API Manager and API policies
  - enforce core set of similar NFRs
- Edge policies enforced **once for all APIs** exposed from RTF
  - API policies enforced separately for each API implementation
- **API policies** typically enforced as **2nd line of defence**

Edge policies supported by Anypoint Security

At least the following Edge policies:

- Content Attack Prevention (**CAP**) by **limiting HTTP request** properties
  - HTTP methods, header size, body size, URL path length, …
- **Whitelisting** of API client IP addresses
  - similar to IP-based access control in API policies
- Web Application Firewall (**WAF**) security policy enforcing the **OWASP Core Rule Set**:
  - SQL injection, cross-site scripting, local file inclusion, HTTPoxy, Shellshock, session fixation, …

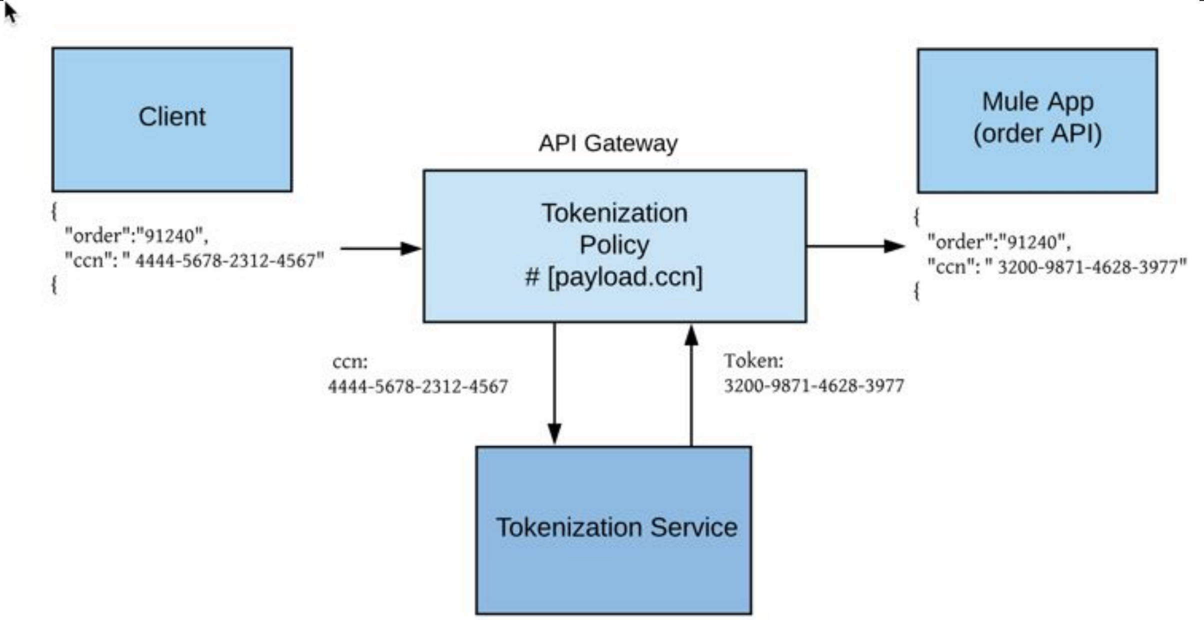
Edge policies supported by Anypoint Security

MuleSoft

- **DoS attack prevention** through monitoring of API clients' HTTP requests
  - Rate limiting or blocking client IP address upon detection of DoS attack
  - Other Edge policies and API policies can escalate policy violations to DoS policy to contribute to detection of DoS attack
  - Defined by rules in DoS policy

Tokenizing sensitive information in API invocations

MuleSoft



Client

```
{
 "order":"91240",
 "ccn":" 4444-5678-2312-4567"
{
```

API Gateway

Tokenization Policy
[payload.ccn]

Mule App (order API)

```
{
 "order":"91240",
 "ccn":" 3200-9871-4628-3977"
{
```

ccn:
4444-5678-2312-4567

Token:
3200-9871-4628-3977

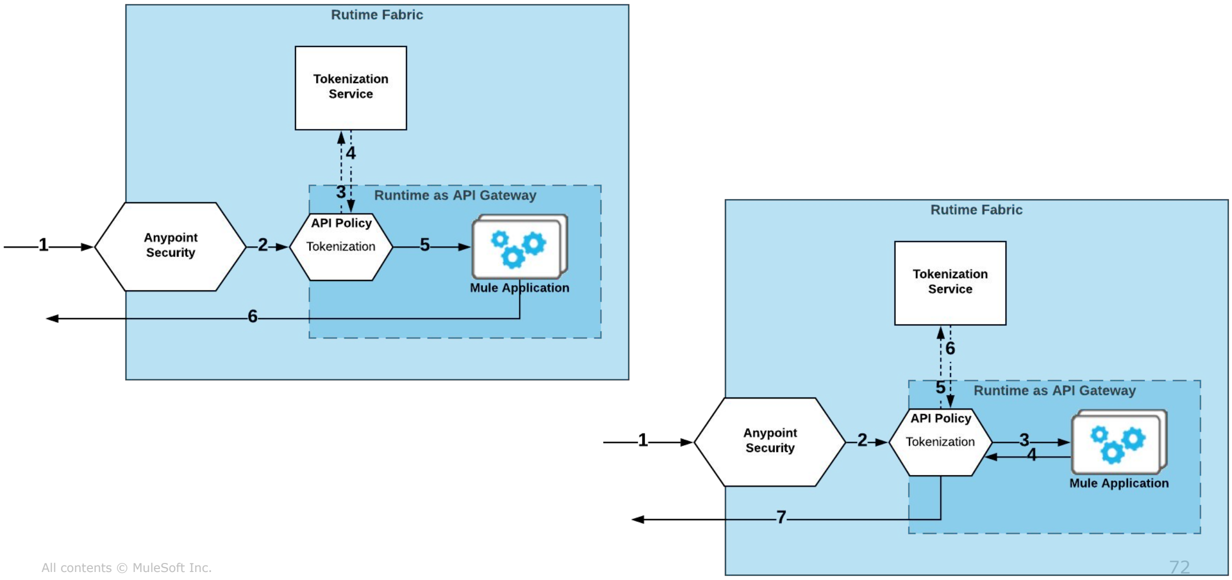
Tokenization Service

Tokenizing sensitive information in API invocations

A security feature of **Anypoint Security** and is enabled by a **Tokenization Service** and corresponding **API policies** (not Edge policies):

- Tokenization **replaces sensitive information** (credit card number, SSN, account number, any regex, …) with a **reversable token**
- **Detokenization** restores the original sensitive information
- Typically **format-preserving** such that downstream systems' validation rules are not violated
  - **1234-5678-9012-3456 -> 9264-1956-3442-3456** (tokenization of credit card number, configured to preserve format and keep last 4 digits)

Tokenizing sensitive information in API invocations

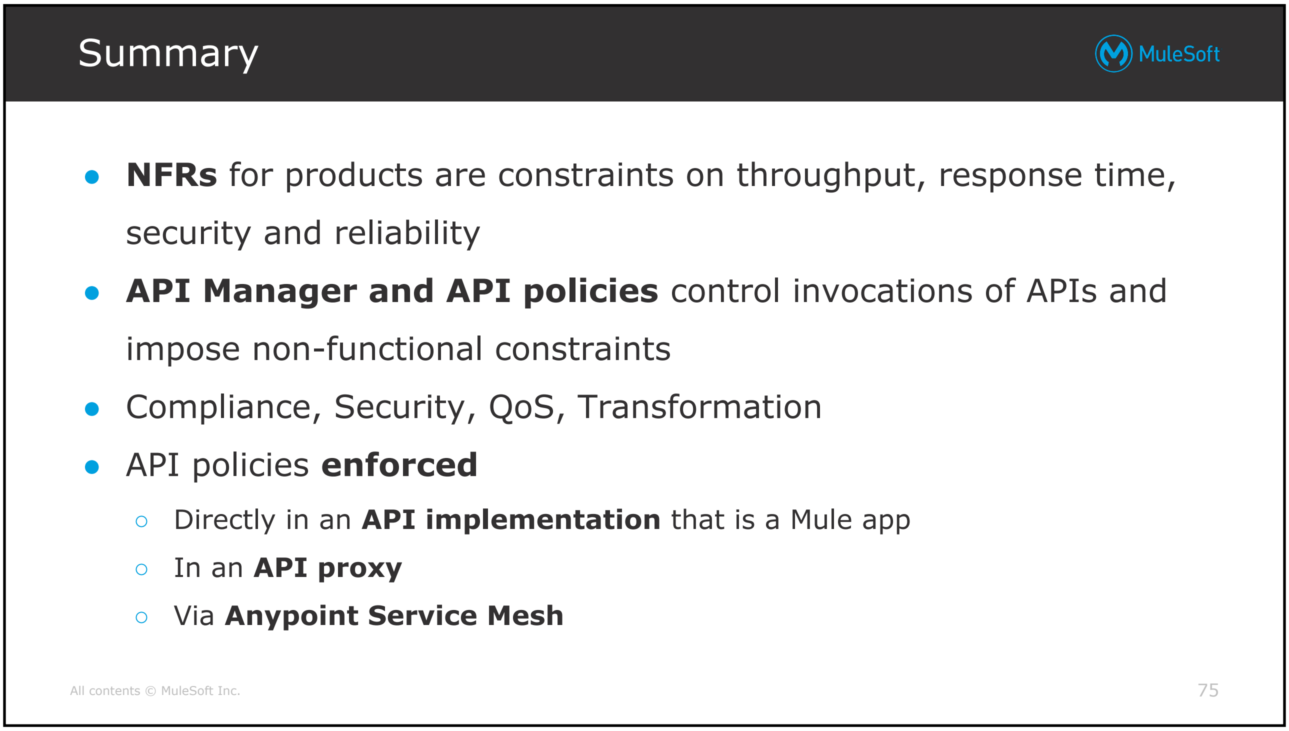


Tokenizing sensitive information in API invocations

MuleSoft

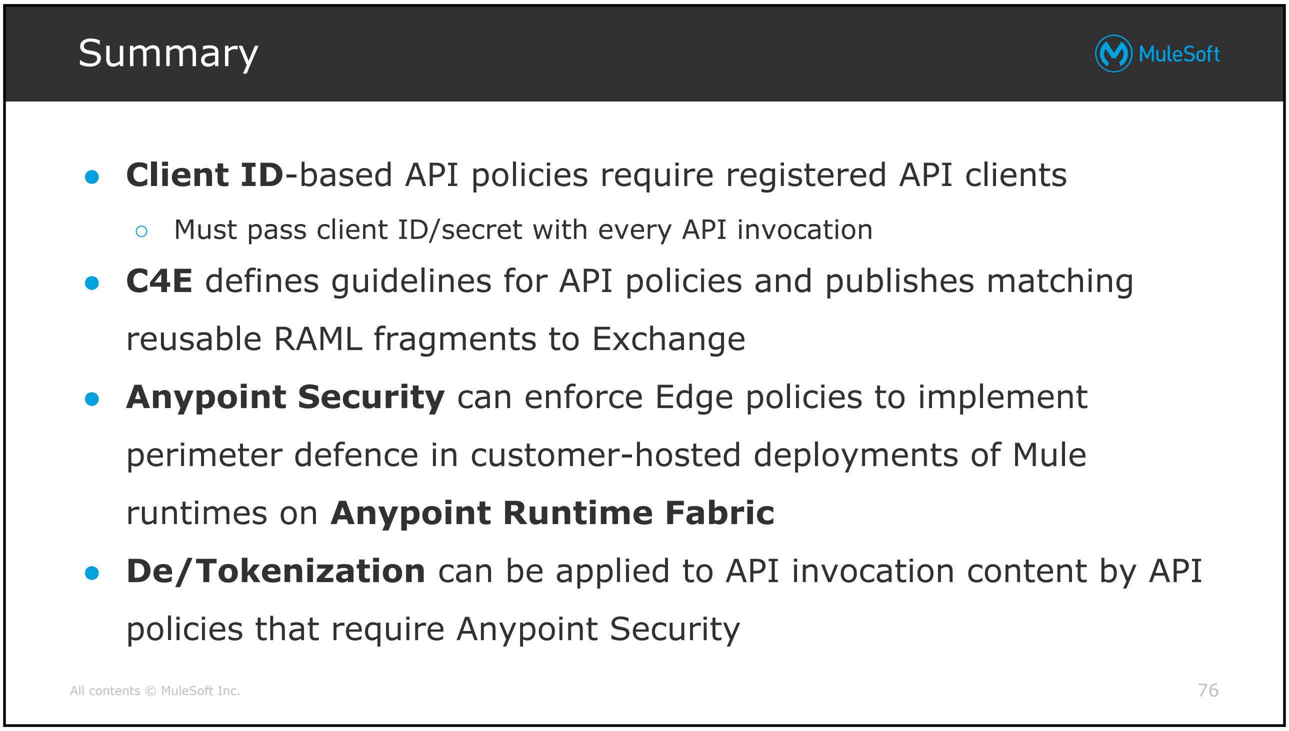
- Applied to **HTTP requests** or **responses** sent to/from individual APIs by configuring the **Tokenization and Detokenization API policies** via Anypoint API Manager on the corresponding API instances
- Tokenization **Service** is deployed to RTF and these API policies delegate to it the actual de/tokenization
- Anypoint Security implements **vaultless tokenization**
  - There is no database that stores the original, clear-text values
  - Tokens are not amenable to brute-force attempts of detokenization

Summary



Summary

- **NFRs** for products are constraints on throughput, response time, security and reliability
- **API Manager and API policies** control invocations of APIs and impose non-functional constraints
- Compliance, Security, QoS, Transformation
- API policies **enforced**
  - Directly in an **API implementation** that is a Mule app
  - In an **API proxy**
  - Via **Anypoint Service Mesh**



Summary

- **Client ID**-based API policies require registered API clients
  - Must pass client ID/secret with every API invocation
- **C4E** defines guidelines for API policies and publishes matching reusable RAML fragments to Exchange
- **Anypoint Security** can enforce Edge policies to implement perimeter defence in customer-hosted deployments of Mule runtimes on **Anypoint Runtime Fabric**
- **De/Tokenization** can be applied to API invocation content by API policies that require Anypoint Security