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API Runtime Orchestration with Istio and OpenAPI 3

IstioCon, Apr 2022

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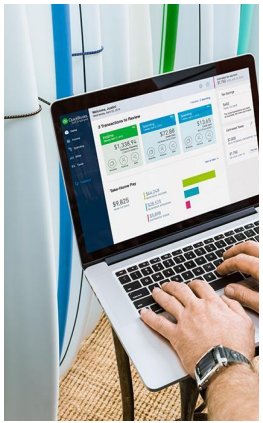
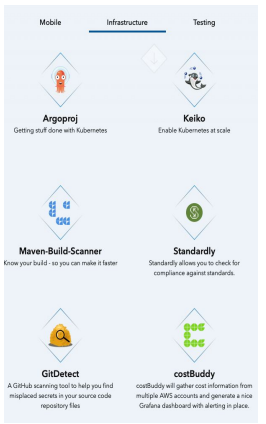
Who We Are

1983	1993	19	$9.6B FY21	60M	75
Founded	IPO	Locations	Revenue	Customers	Projects





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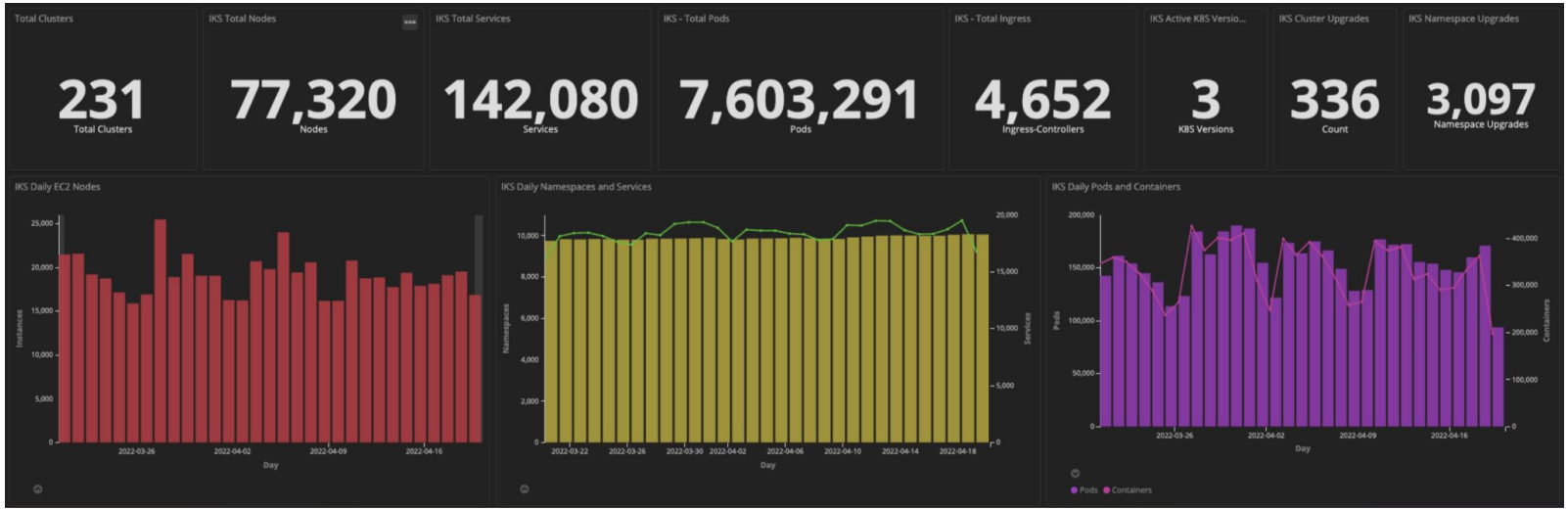
Intuit Scale Statistics

- 900+ Teams
- 5000+ Developers
- 200+ Clusters
- 7000+ Namespaces
- ~77,320 Nodes



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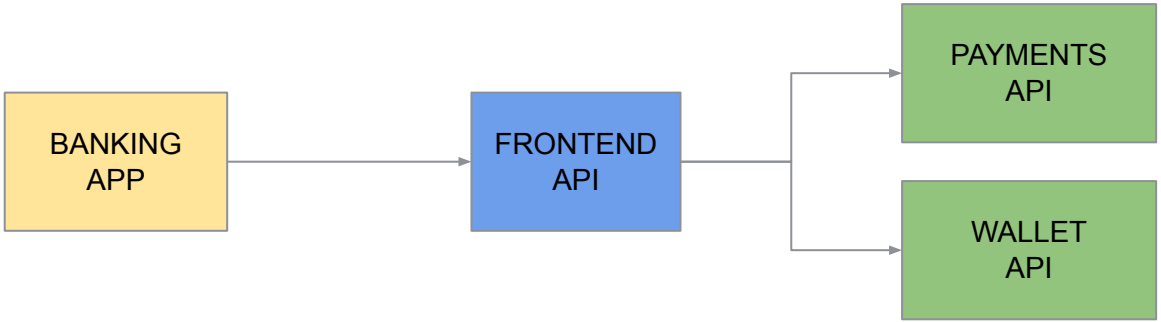
Orchestration APIs

- An API that integrates on top of multiple APIs to provide an offering is referred to as an Orchestration API
- Orchestration APIs are generally built using Special Purpose Services Orchestration Layer (SPSOL)



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Challenges

- Development and delivery of new orchestration APIs requires more effort and it is time consuming
- API orchestration is business-critical but the integration process moves slowly
- Lack of documentation/governance and visibility
- Technological complexity with setting up runtime manifests/resources

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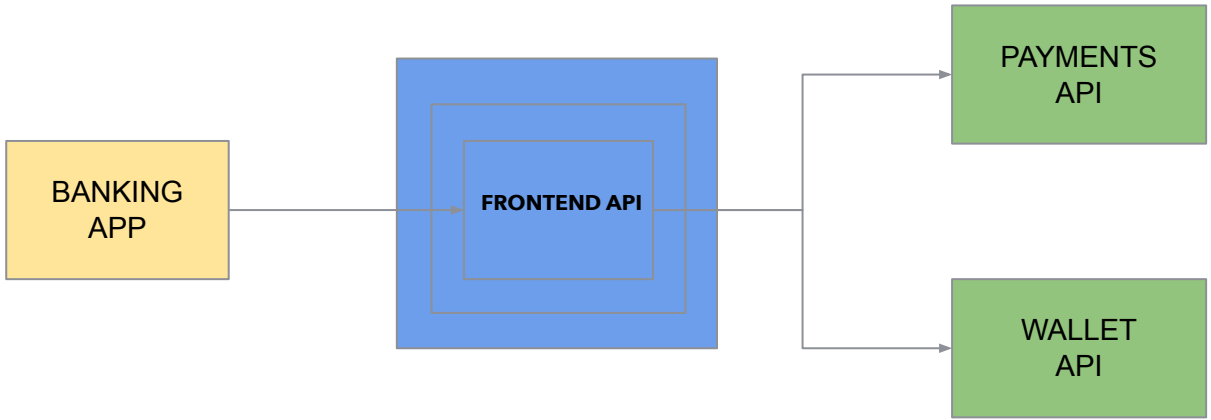
Challenges illustrated..

- Frontend API starts out as a simple proxy/aggregator
- Business logic makes its way into it as new use cases arise
- As time progresses, the Frontend API becomes an orchestration monolith.



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How about a Low Code/No Code Solution that has..

- Runtime semantics in the API contract
- Declarative description of API orchestration
- Runtime manifests created at deployment time
- With dynamic traffic routing rules

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OpenAPI 3 aka Open API Specification 3.0

- Based on original swagger 2.0 specification
- Provides a standard format to define and describe RESTful APIs

```
openapi: 3.0.0
info:
  version: 1.0.0
  title: Simple Artist API
  description: A simple API to illustrate OpenAPI concepts
servers:
  - url: https://example.io/v1
# Basic authentication
components:
  securitySchemes:
    BasicAuth:
      type: http
      scheme: basic
security:
  - BasicAuth: []
paths: {}
```


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Extending the OpenAPI 3 Specification

- Open API 3 custom extensions provide a way to extend functionality not provided as part of the Open API specification.
- Indicated by custom properties that start with ***x- (Ex: x-logo)***

```
components:
  securitySchemes:
    APIGatewayAuthorizer:
      type: apiKey
      name: Authorization
      in: header
      x-amazon-apigateway-authtype: oauth2
      x-amazon-apigateway-authorizer:
        type: token
        authorizerUri:
arn:aws:apigateway:us-east-1:lambda:path/2015-03-31/functions/arn:aws
:lambda:us-east-1:account-id:function:function-name/invocations
        authorizerCredentials: arn:aws:iam::account-id:role
        identityValidationExpression: "^x-[a-z]+"
        authorizerResultTtlInSeconds: 60
```


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API Patterns Supported By Runtime Orchestration

- API aggregation
  - Aggregates calls to multiple APIs to a single API response (Payment and wallet APIs can be aggregated as a single banking API)
- API transformation
  - Transform responses of existing APIs
- API Proxy
  - Proxy the requests for existing APIs

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Runtime Manifests from API Contract

- Kubernetes Resources
  - Deployment
  - Service
  - Ingress
- Istio Routing Rules
  - Virtual Service

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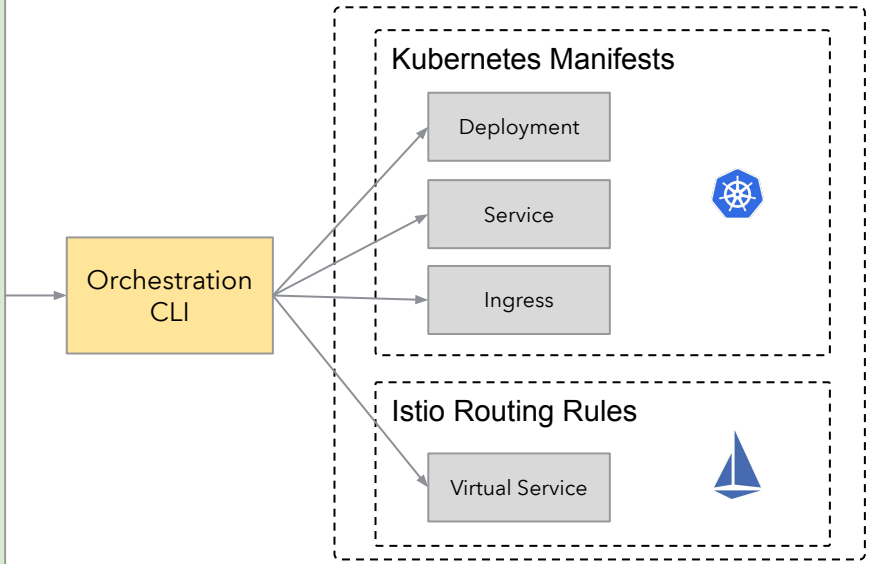
Runtime Manifests Generation

API Contract

```
openapi: 3.0.3
info:
  title: Banking API
  description: Banking API for aggregating

…
paths:
  /banking:
    x-orx-container:
      $ref: '#/components/x-orx-containers/api-aggregation-container'
    get:
      summary: Banking aggregation API

...
  x-orx-containers:
    api-aggregation-container:
      image: docker.com/runtime-aggregation-code:latest
      containerPort: 8080
```



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Traffic Routing Rules

- East-West traffic routing
  - Zero additional overhead - Service mesh enables this communication already using Istio Virtual Services
- North-South traffic routing
  - API Gateway as Service 0 on Service Mesh
  - mTLS and private-networking for services behind API Gateway
- Istio Virtual Services automatically replicated to other clusters by Admiral to support this across K8s clusters

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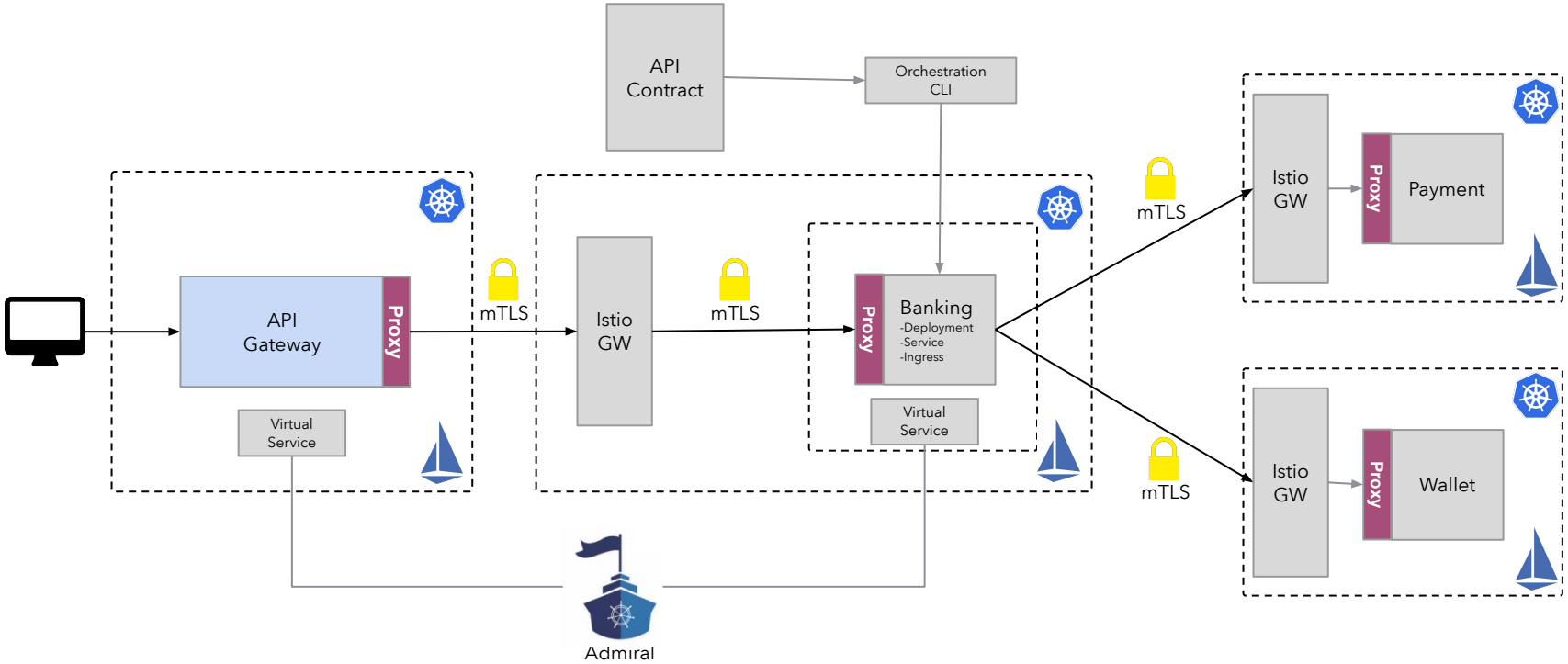
API Runtime Orchestration



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Benefits to the Ecosystem

- Provides faster API extensibility to the developers and thus provides faster time to market for new orchestration APIs
- Can handle AuthZ/AuthN to make only selected data accessible to selected users
- Customization of APIs at the edge
- Enable API governance & review by means of "Orchestration as code" using a proven API definition standard
- Optimizing API response times by pruning extra hops seen on SPSOLs

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Demo

Wrapping up...

- Orchestration is built using standard API specification
- Declarative definition that can provide better visibility and governance model
- Routing rules are dynamically built, which means less maintenance overhead
- Orchestration is isolated and allows independent and safer updates

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Resources/Links

One pager - API Orchestration Using Istio & Admiral

Open API 3

Related Talk at IstioCon 2022 - API Gateway on Service Mesh - Complete Zero Trust

Admiral - An Istio Ecosystem Project for automatic multi-cluster configuration

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Thank You