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The bridge to possible

API Gateways Evolution to Distributed & Edge Environments

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BRKETI-2002

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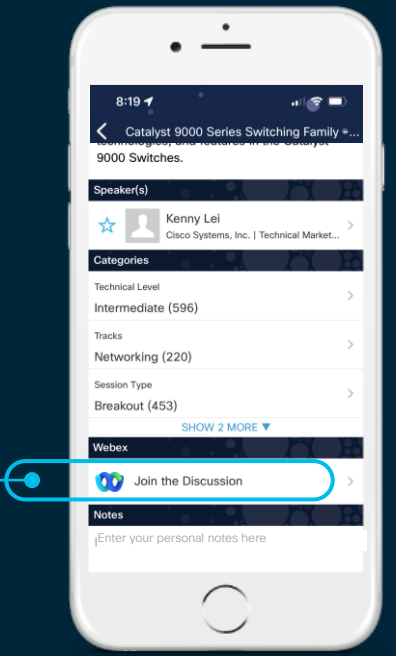

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Agenda

- Introduction
- What Problems Do API Gateways Solve?
- Emerging Distributed & Edge API Gateway Use Cases
- Demo – Self Serve App Publishing, API Exposure and Topology Abstraction
- Key Takeaways – Give Us Your Use Cases

About This Talk and the Speakers

- Tim and John work in Cisco's Emerging Technologies and Incubation BU
- We are also contributors to various open source projects over the years (Kubernetes, Istio, Networkservicemesh and various Openstack projects)
- Much of our work is exploratory and related to potential future products or services with many proof of concept efforts
- Therefore, much of the content in this talk is not currently available in any Cisco product or service

Introduction

API Management Market to reach US $ 21.68 billion By 2028

Source: Adroit Market Research

API Gateway and API Management Players

- Broad spectrum of players in the API gateway and management space
  - Open source (Emissary, KrakenD)
  - Open source with Enterprise option (Gloo Edge, EnRoute, Kong)
  - Enterprise only (Tyk, Ambassador, Mulesoft)
  - Managed Service (all the Hyperscalers have an option)
  - Service meshes as an API gateway (Istio, Linkerd (w/integrations))
  - Dataplane options (Envoy, HAproxy, Nginx + custom)

Cloud API Management vs. Edge Compute

- The API management market for cloud-based APIs is expected to have a CAGR of 30+%
- The edge compute CAGR is also expected to be in the 30+% range
- But these are not orthogonal markets
- This talk will cover the intersection of the edge and API management markets

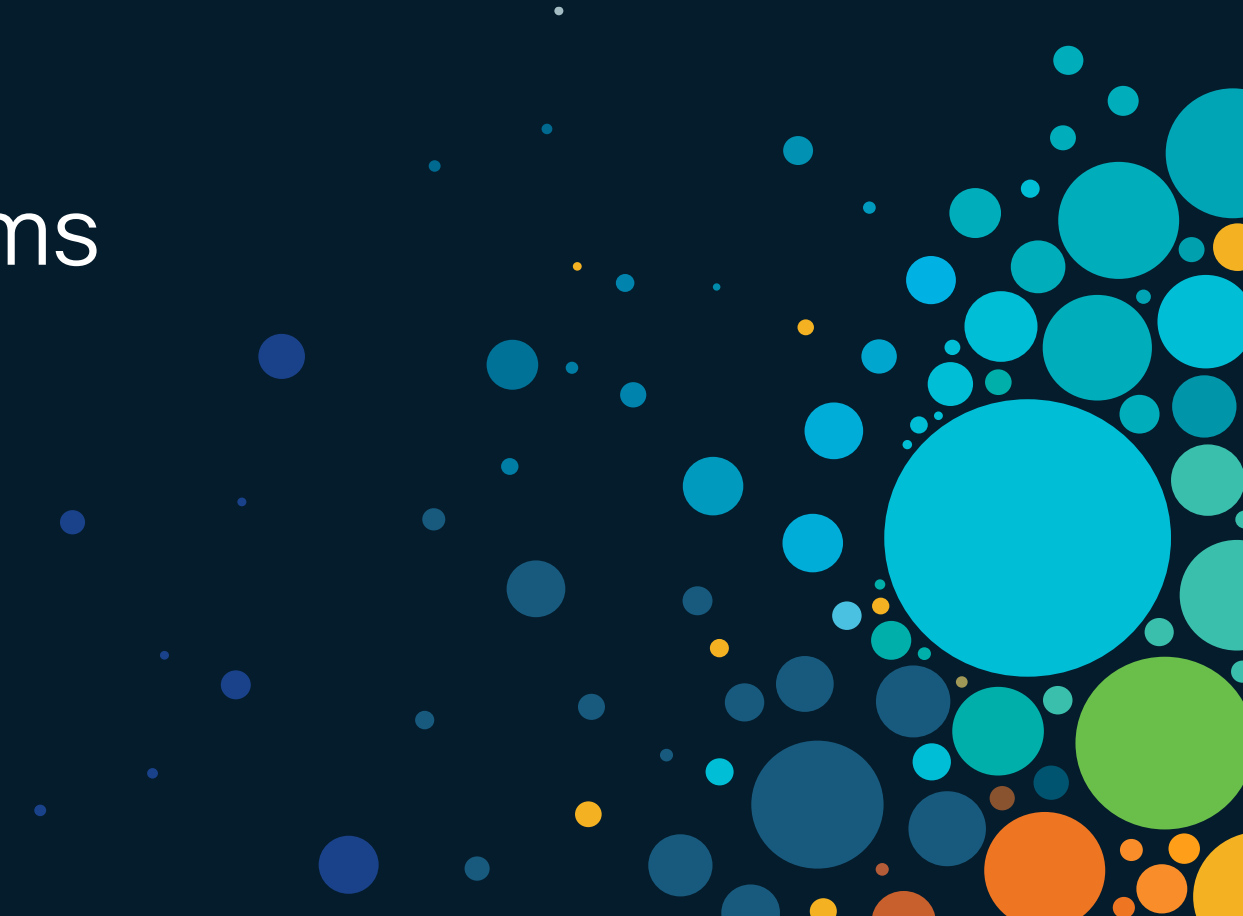
Edge API Management

- It's a nascent space
  - Any mention of edge by the current API management players = cloud edge not edge computing
- Edge platform providers focusing on core infrastructure requirements (compute, storage and networking)
  - 2nd order capabilities like API management is an under served market
- The edge players are starting to move into the API management space:
  - https://fauna.com/blog/how-to-build-an-edge-api-gateway-with-fastlys-compute-edge-and-fauna
  - https://blog.cloudflare.com/api-gateway/

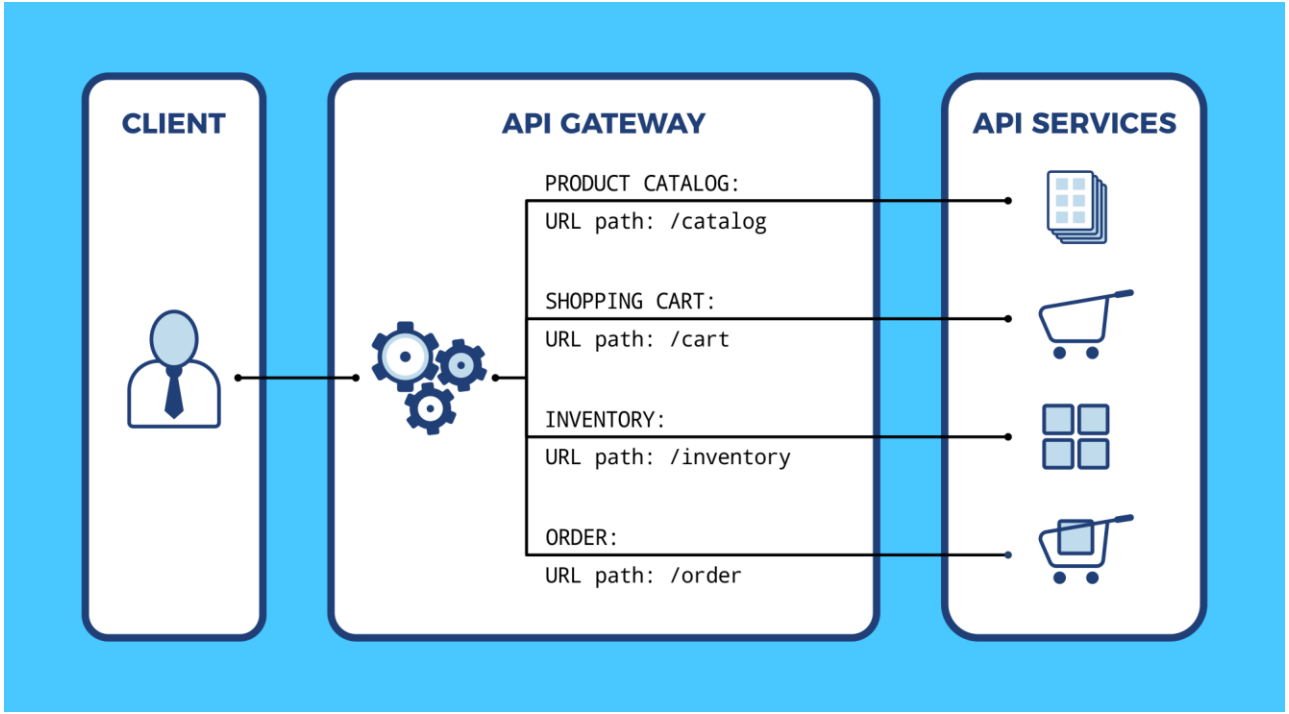
Edge APIs are Different than Cloud APIs

- The APIs offered at the edge will be different than cloud-based APIs
  - Cloud-like REST APIs will also be offered on the edge, but also many other protocols and formats, especially MQTT are required
  - Much smaller API surface area – edge-based API backends provide much narrower set of services
  - Topology matters for edge
- How the APIs at the edge will be consumed will also be different
  - Generally tighter organization relationship(s) between API consumer and producer
  - Topology awareness and ability to abstract topology important
  - Network isolation will be common and global reachability may be constrained

What Problems Do API Gateways Solve?



Typical API gateway

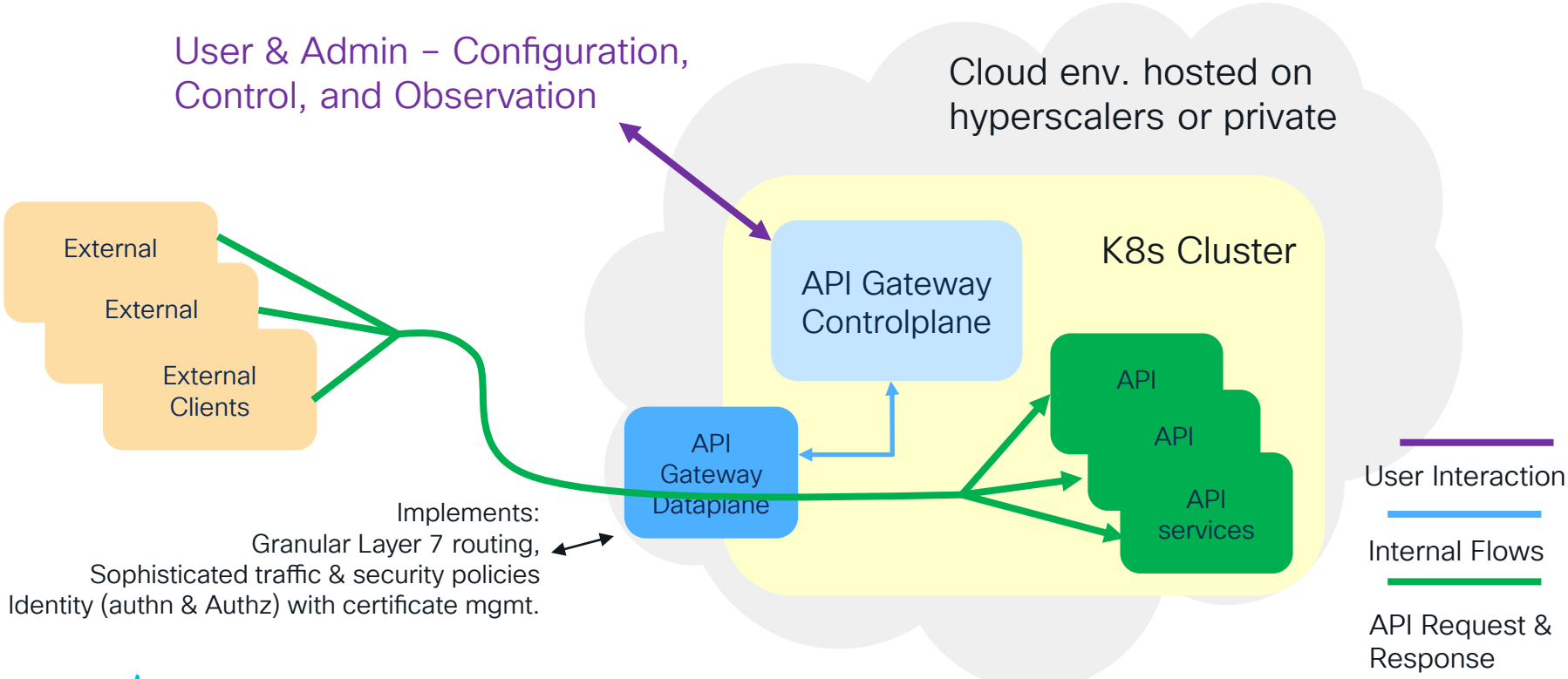


Source: https://www.haproxy.com/blog/using-haproxy-as-an-api-gateway-part-1

Problems Solved by Cloud API Gateways

- Unburden the application layer of common functions and ensure implementation in a common way
- Provide an abstraction or demarcation point so the client API contract and the backend API implementation can be loosely coupled and evolve independently
- Allow organization or persona decoupling
  - Network or security requirements can be implemented in the gateway vs. each application
  - An entire companies APIs can be represented consistently at the gateway without tight coupling for each group providing the APIs
- Allow a control point in the data path to implement fine grained policy across the entire API suite in both a consistent and aggregated fashion

Reference Cloud API Gateway Architecture on K8s



Distribution & Federation Results In Complexity

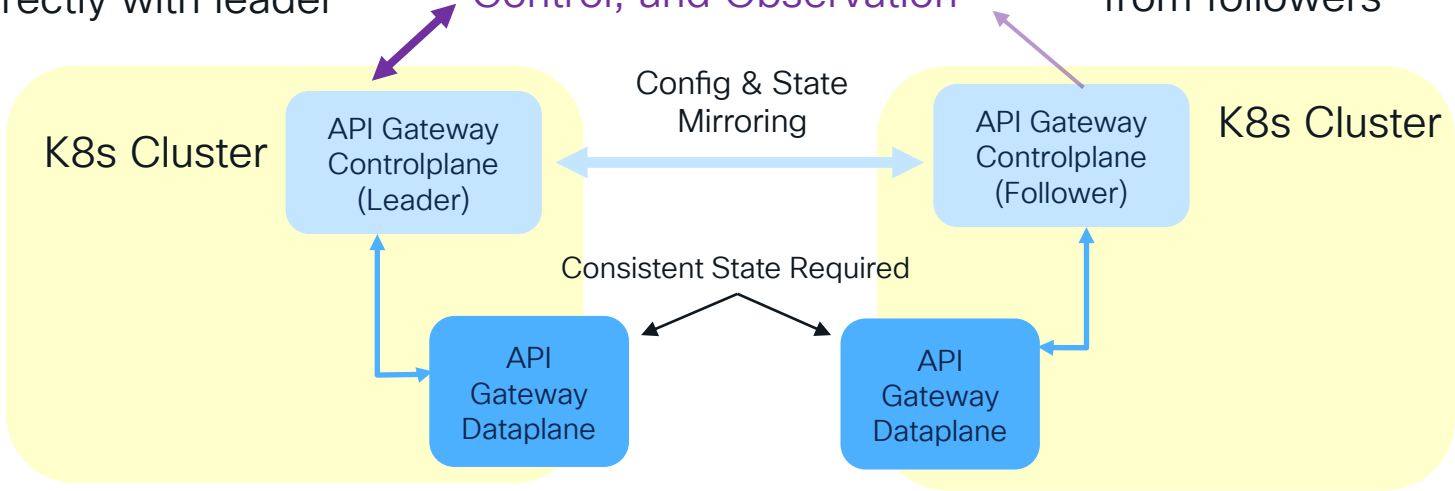
- Maintaining consistency as API backends become distributed over many environments is challenging
- Identity and certificate distribution and signing must be consistent to ensure tight authentication and authorization
- Service discovery and service advertisement must encompass all the environments and become global
- Service advertisement must be integrated with DNS systems
- Potential paths for the Layer 7 API routing explode

Reference Distributed API Gateway Architecture

Primary configuration directly with leader

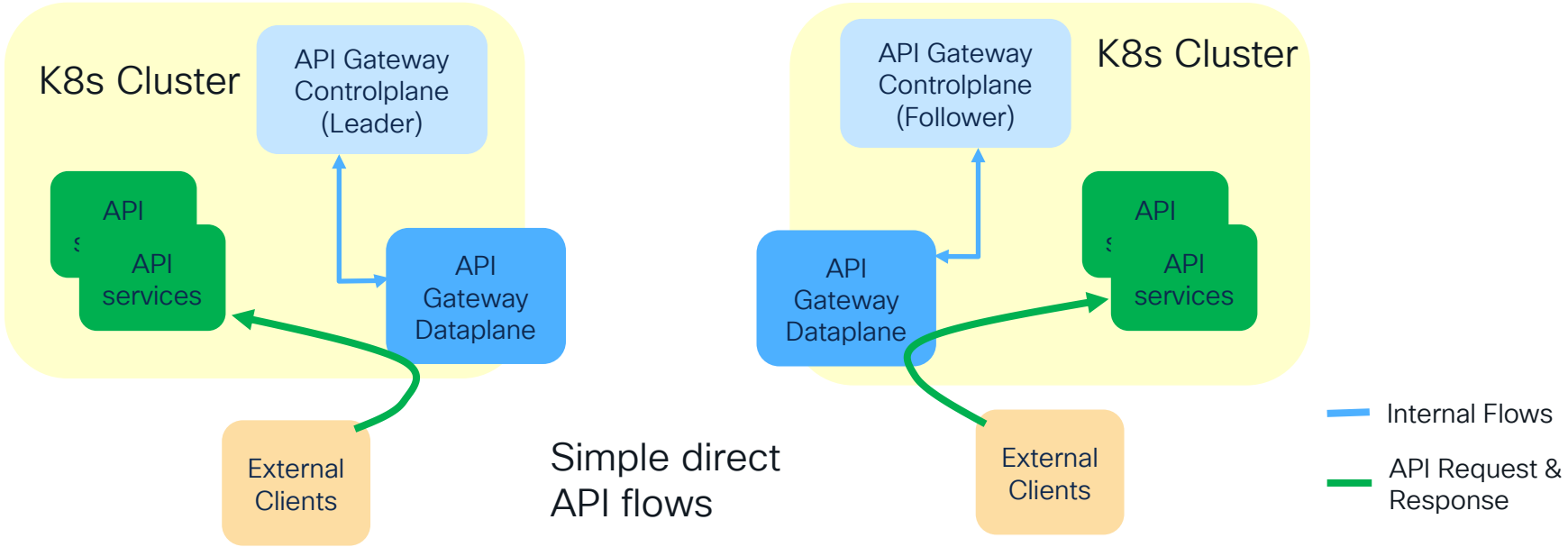
User & Admin – Configuration, Control, and Observation

Telemetry and observation from followers

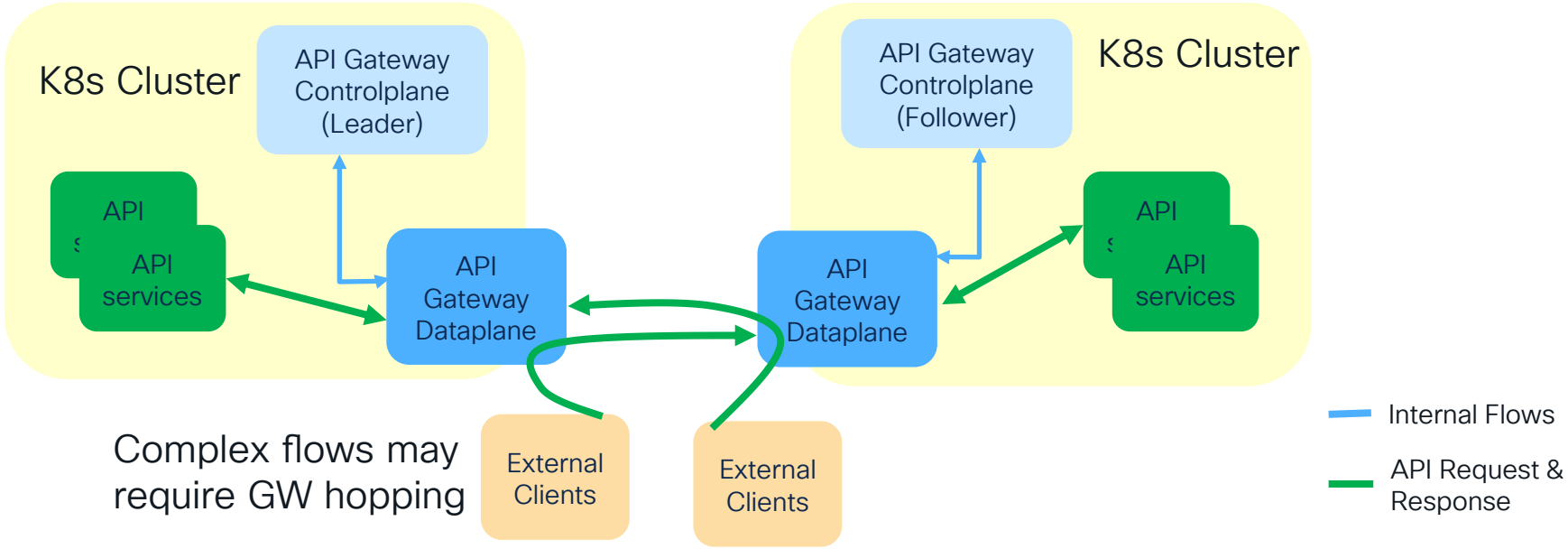


When distributed gateways are deployed consistent state for Layer 7 routing, identity and traffic/security policy is mandatory

Reference Distributed API Gateway Architecture



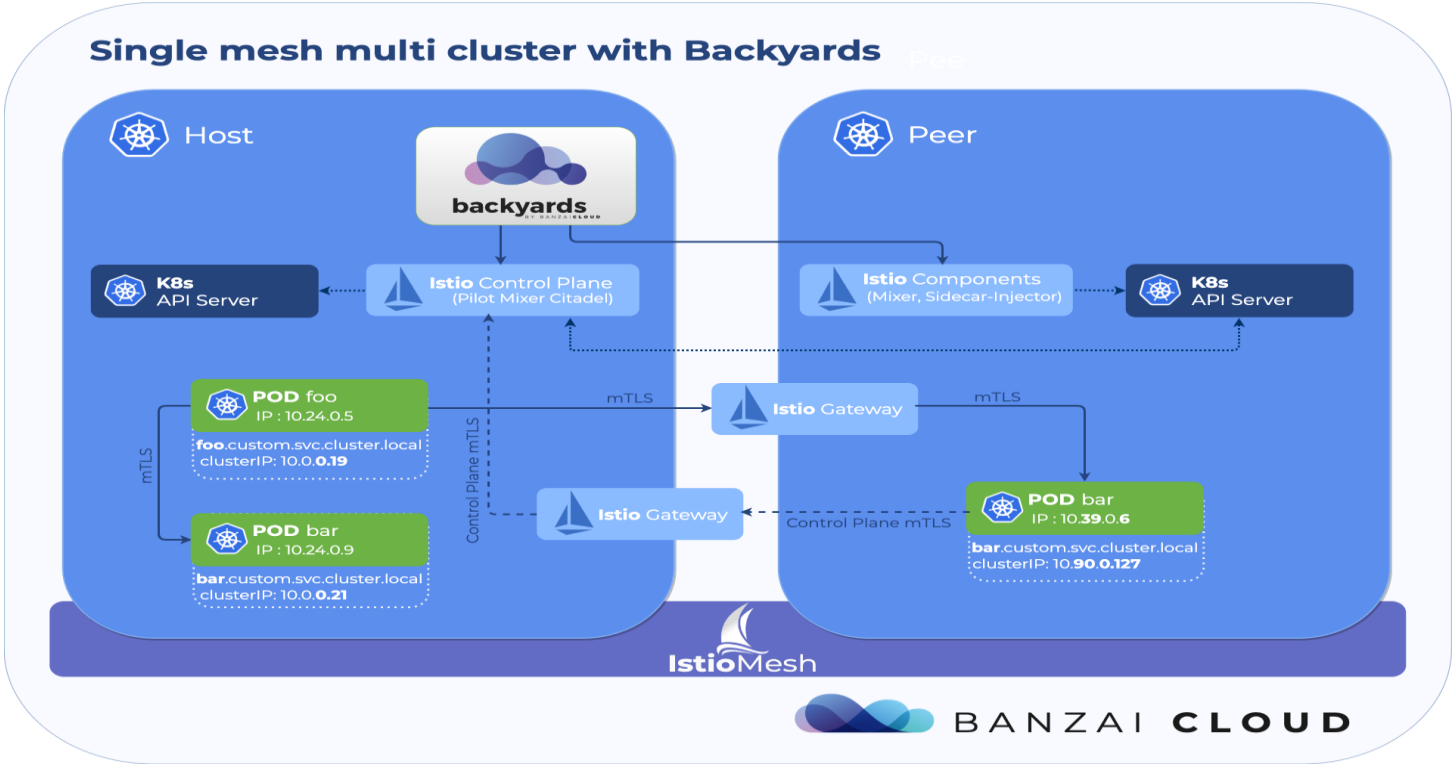
Reference Distributed API Gateway Architecture



Multicluster Service Mesh as Distributed API Gateway

- A multicluster service mesh is a great platform for API gateway functions
  - The state consistency issues are handled directly by the service mesh
  - Controls are available for how services should be exposed per site, inter-site and intra-site
  - Seamless identity across all sites
  - Most service mesh platforms provide all the necessary API gateway functions with appropriate configuration
- Cisco's Service Mesh Manager is an example
  - https://techblog.cisco.com/blog/backyards-multicluster-istio
  - https://banzaicloud.com/blog/backyards-release-1-3/
  - https://smm-docs.eticloud.io/docs/overview/features/multi-cluster/
- Give it a try https://calisti.app/ - Free license for cisco's Service Mesh Manager

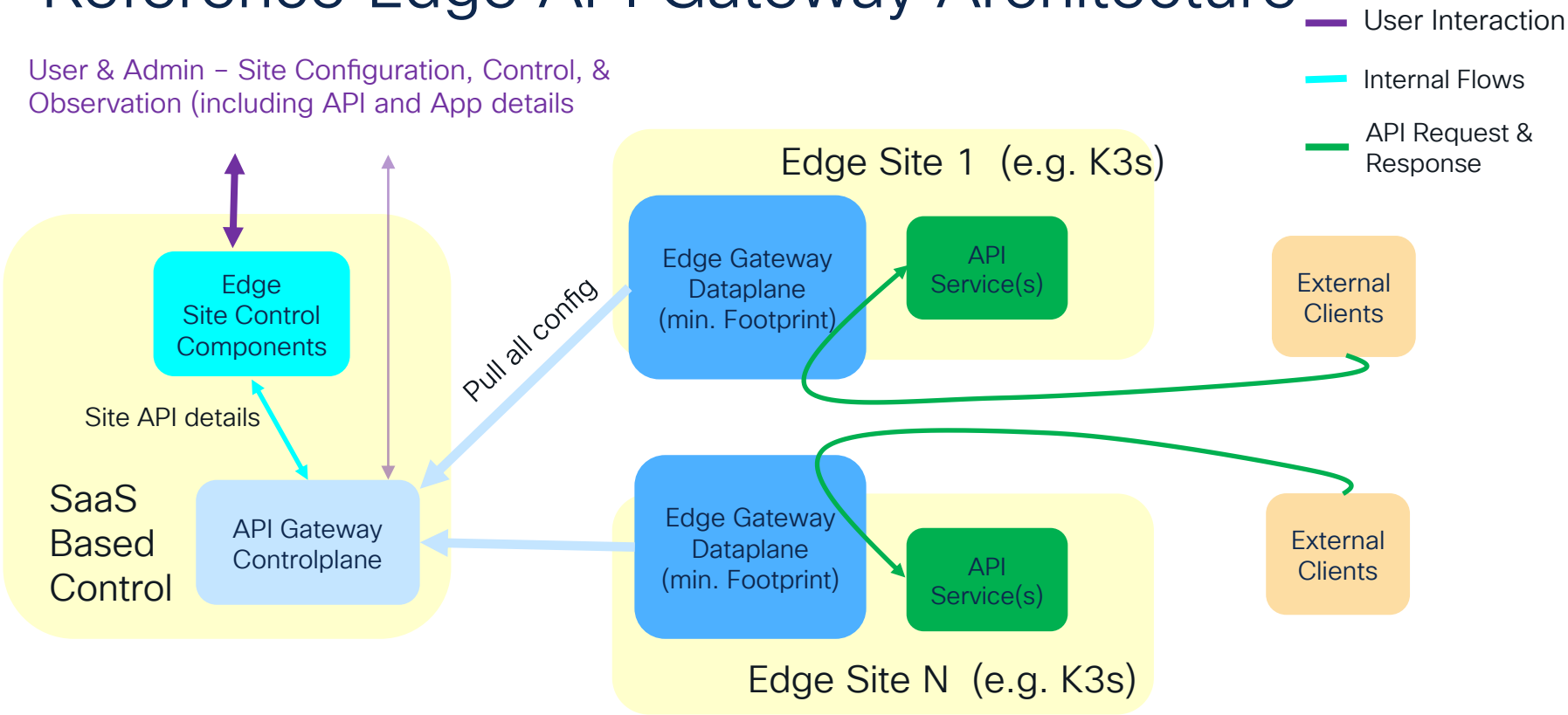
Multicluster Service Mesh Architecture



How Does This Relate to APIs on the Edge

- API gateways for edge environments are not common. A few reasons:
  - The APIs offered at the edge aren't just HTTP and REST based (e.g., MQTT)
  - The edge networking may be constrained (e.g., not globally reachable or always available)
  - Tight constraints on edge resource consumption (e.g., requires control and management planes remote from the gateway dataplane)
  - The sheer number of edge sites causes challenges
- Multicluster Service Mesh all the way to edge is impractical due to resources
- Due to lack of available solutions, edge applications and APIs subsume all functions into the application layer or push it to cloud based backends

Reference Edge API Gateway Architecture



API Gateway Edge Use Cases

Prototyping, Validating and Iterating

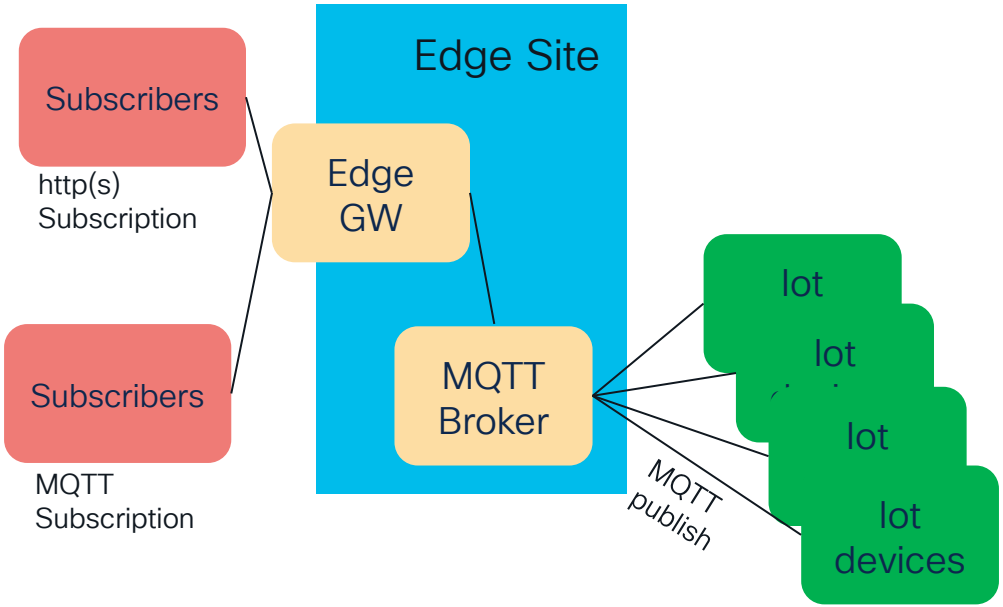
Use Cases and Business Problems

- With our current work we are developing prototypes for several use cases
- The use cases are emerging and evolving rapidly so all input appreciated
- Including edge gateways in the solutions allows for:
  - Additional automation and orchestration
  - Abstraction of topologies, protocols and/or API contract
  - Provide simple and consistent policy enforcement across wide spectrum of APIs

IOT Problems

- Mismatched protocols
  - IOT devices and brokers communicate via MQTT – but some publishers or subscribers to the data want to talk REST via HTTPS
  - Solution – use edge gateways to handle the protocol conversion
- TLS security
  - IOT devices are increasing TLS enabled – but certificate distribution and management is challenging
  - Solution – have the edge gateway manage certificate distribution and plug in to an identity provider or certification signing authority

Edge Gateway + Local Data Relay/Broker (e.g. MQTT)



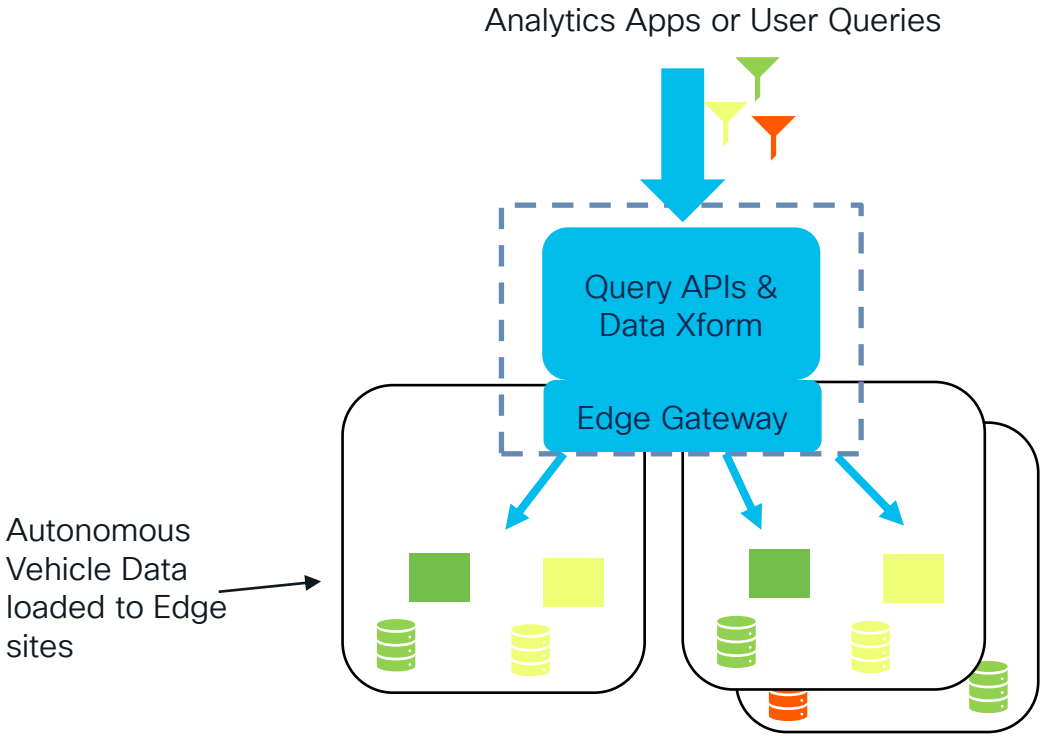
Edge Gateway could provide

- MQTT Pub/Sub access for https producers and consumers
- Access control for Clients/Subscribers
- Ease discovery of the MQTT broker service(s) for the devices
- Facilitate cert signing and distribution for broker and IoT devices
- Full TLS/mTLS from subscriber to device

Data to the Edge problems

- Data is increasing being handled on the edge which includes
  - Capturing and collecting
  - Analyzing
  - Forwarding or pruning
  - Transforming – compression, summarization, formats, etc.
  - Caching, storing
- Providing topology abstraction via edge gateways can be a significant simplification

Topology Unaware Data via Edge Gateway

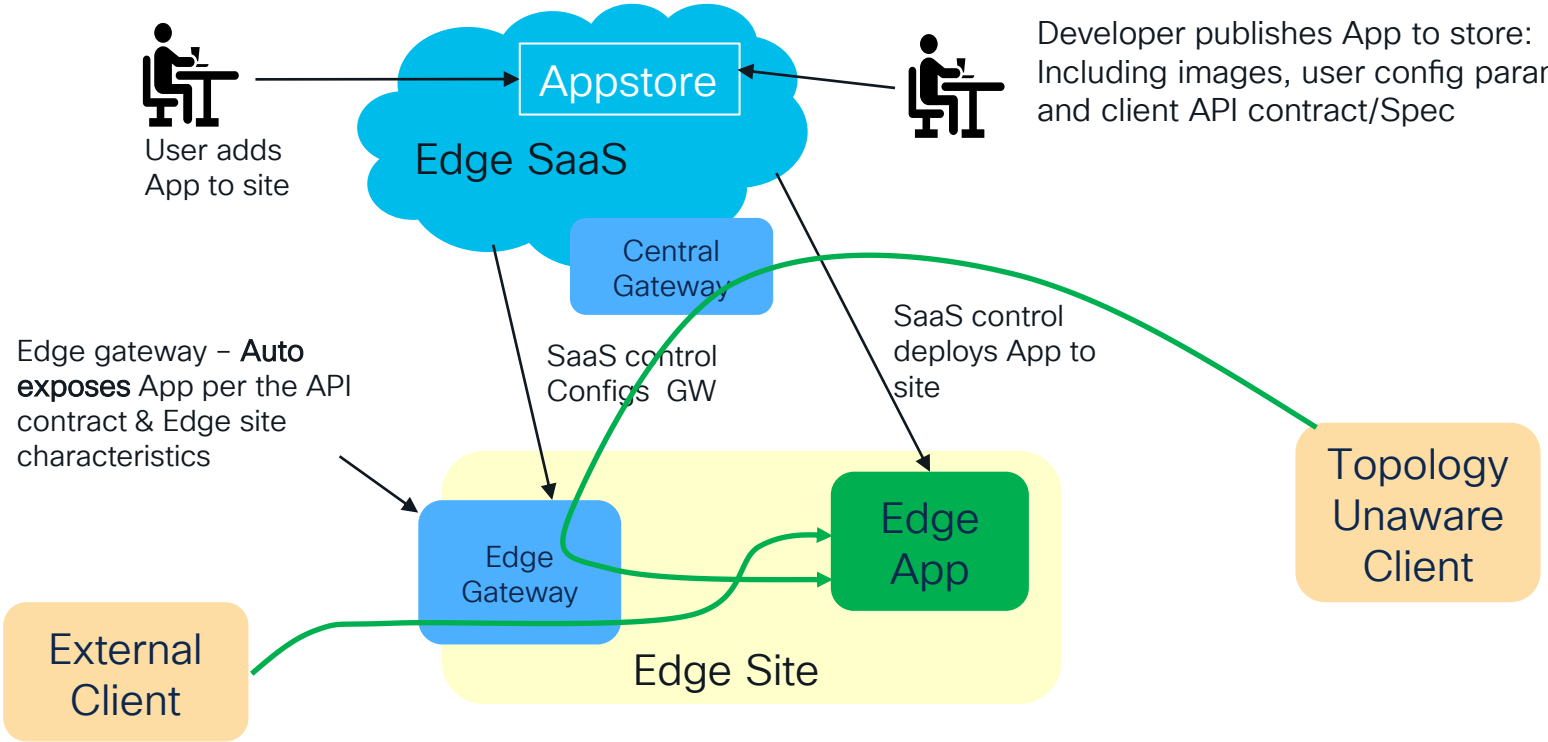


Value Proposition:

- Query API is topology unaware
  - Allows easy access to local data across all edge sites.
- Apps "discover" normalized data from query API
  - Data source origin info can be attributes of data in query API
  - Apps do not need to track instances of data sources out of band of query API
- Data Sources and transforms able to be dynamically added/removed/updated without modification of query API
- Space for administrative boundaries (e.g., operations and policy)

Demo – Self Serve App Publishing, API Exposure and Topology Abstraction

Demo Sequence



Key Takeaways – Give Us Your Use Cases

Commitment to Edge Use Cases

- Edge use cases and the APIs that will be offered on edge sites are rapidly emerging and evolving
- There are lots of players focusing on providing the edge platform basics (compute, storage, networking) but 2nd order capabilities under served
- Our goal is to provide value a bit higher up the stack which is still a nascent market
- Provide an easy button for edge API production and consumption

Call To Action

- This is a nascent market with rapid evolution of:
  - the environments
  - the protocols
  - the technology
  - the edge applications
  - the overall use cases
- We would love to hear about:
  - any potential use cases
  - problems you are facing
  - view on the general space
- We will adopt any feedback into our planning

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