Faculty of Engineering & Applied Science

SOFE4790U – Distributed Systems

Homework: Gateways

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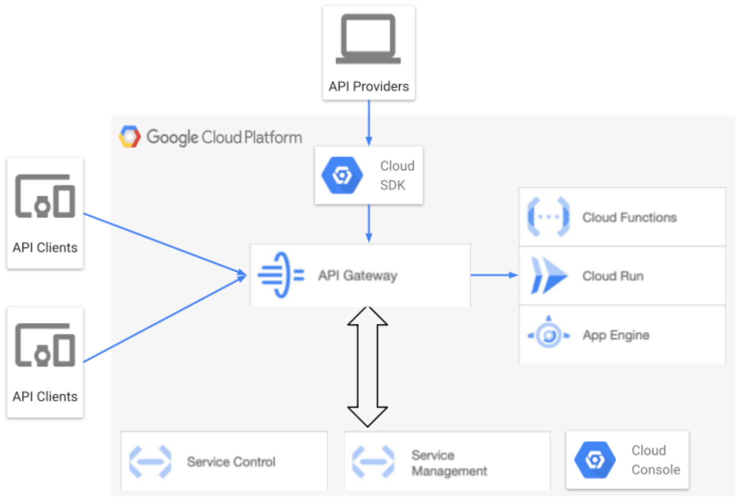
The idea of gateway is central to a distributed systems. Please read the following articles and try to come with a descriptions for. The requirements of a gateway, and a high level design of the various components needed for a gateway to operate.

Gateway Components

Components	Description
Gateway	Managing the services
Control	Applying management rules
Management	Managing and configuration
Console	Deploy, manage, and monitor

An example of a high-level design or architecture for a gateway is shown below, which is used to implement a Google API Gateway. The main components are the gateway API, service control, service management, google cloud CLI, and cloud console.

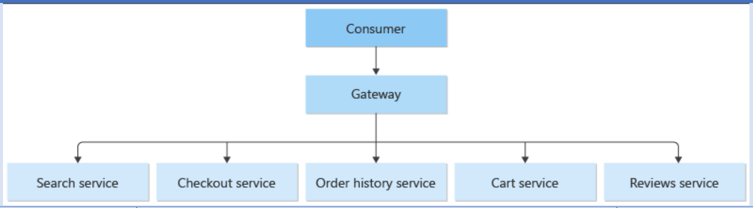
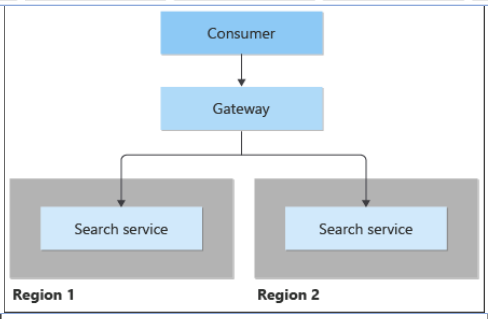
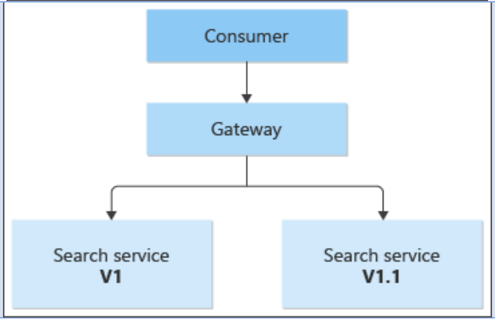


Gateway Requirements

Requirement	Description
Frontend IP	Ip address to access the gateway
Port	To identify and listen to the request
Certificate	Provides security and privacy
Listeners	Used to listen to the request and logically send the request to the backend services.
Protocols	A type of communication among the components. (HTTP, HTTPS)

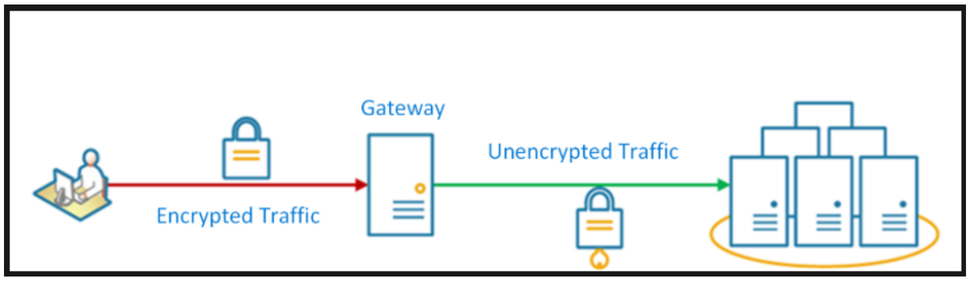
Gateway Routing Pattern

The concern is raised when multiple services, multiple instances of the same service, or multiple versions of the same service are updated, the client will be required to be updated as well. The solution to these concerns is deploying a gateway routing pattern which places a gateway at the endpoint and uses the application layer to route the traffic. This pattern allows the client to communicate with a single endpoint and hides the database or backend infrastructure. Examples of gateway routing patterns integrated within the applications are provided below.

Scenarios	Gateway Implentation
Multiple Services	 Consumer Gateway Search service Checkout service Order history service Cart service Reviews service
Multiple Instances of the the same servces	 Consumer Gateway Search service Search service Region 1 Region 2
Multiple Versions	 Consumer Gateway Search service V1 Search service V1.1

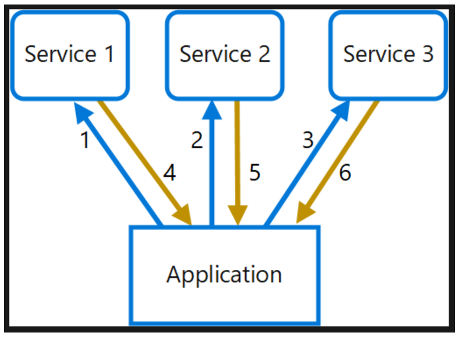
Gateway Offloading Pattern

As there are many applications which require services to be shared and deploying a service in each application causes overhead or deployments error. Some examples of services are security, authentication, and monitoring. Implementing each service with the application is complex, and the gateway offloading pattern is used to solve this issue. The solution is to add the services within the gateway and allowing to simplify the deployments. An example of a gateway offloading pattern is shown below.

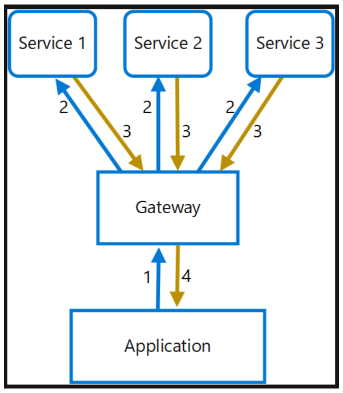


Gateway Aggregation Pattern

The gateway aggregation pattern is applied within applications which require communication with multiple requests to different databases or backend systems. When the client is sending multiple requests to the database or when it requires many services to perform one functionality, it will require the use of many resources, which will impact the performance and scalability of the application. An example of provided below where the application is requesting 3 services over a cellular network. The cellular network is unreliable, inefficient and has high latency, which may result in failure due to connectivity issues.



The solution is to implement a gateway in the middle to reduce the communication between the application and backend services. In the figure below, the gateway will receive the requests from the application, and the gateway will forward the requests to the services. The services will send back a response, and the gateway will combine the responses into a single response and forward it to the application.



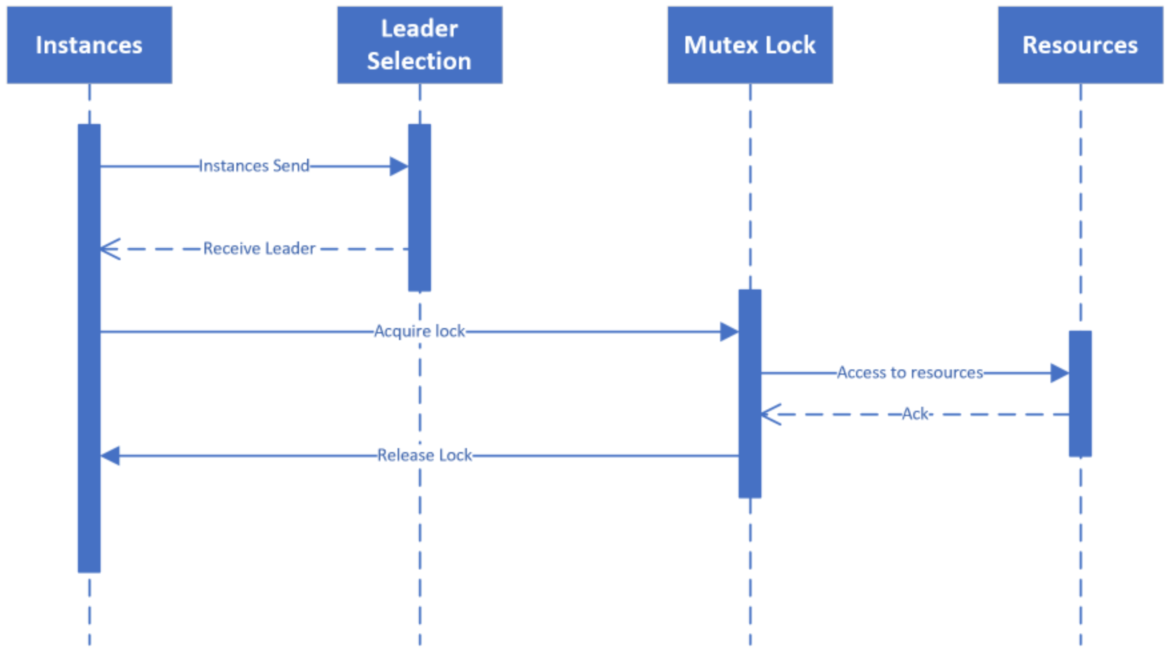
Because gateways are of such importance, they are typically using a clustering technique, where multiple instances of the gateways are deployed. Why would you do that?

Gateways use a clustering technique to allow redundancy, load balancing, and failover. This allows the use of another gateway in case one fails. The incoming requests are forwarded to the main gateway of the cluster, allowing for better performance and scalability.

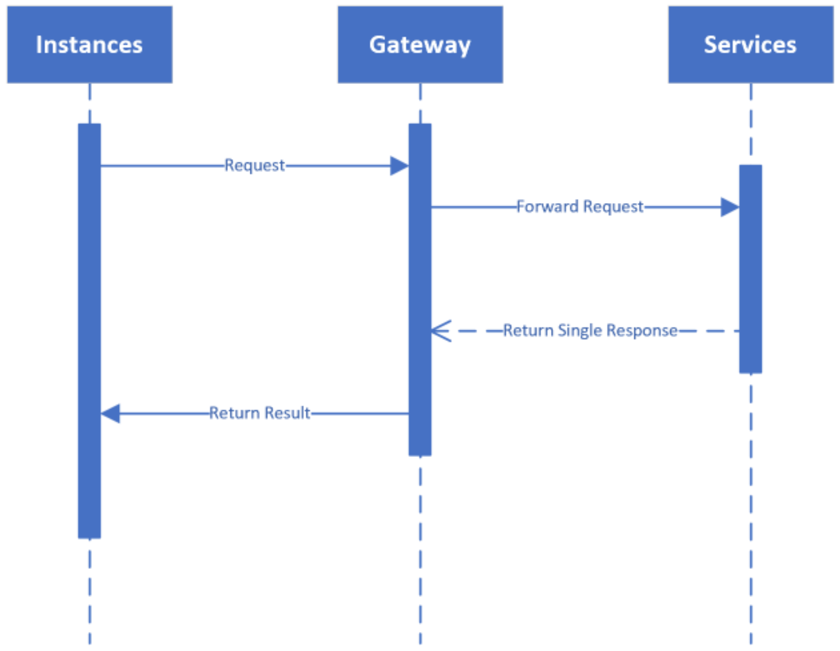
Leader Election Pattern

A typical cloud application consists of many tasks which may use the same resources in which a distributed system elects a leader to manger the other services. In a cloud application where multiple instances are provided to different users may be performing a task and needs to write to a database which is being shared by all the users. This may cause an issue as one task may overwrite the previous data. The leader election pattern is applied to coordinate and manage the instances.

Sequence Diagram for Leader Election Algorithm



Sequence Diagram for Gateway and multiple Instances


Instances
Gateway
Services
Request
Forward Request
Return Single Response
Return Result