Agenda

Cross-Cutting Concern & Observability Patterns

- Cross-Cutting Concern Patterns
  - Externalized Configuration
  - Service Discovery
  - Circuit Breaker
  - Retry Pattern
- Observability Patterns
  - Microservices Logging
  - Microservices Tracing
  - Microservices Monitoring

Cross Cutting Concern Patterns

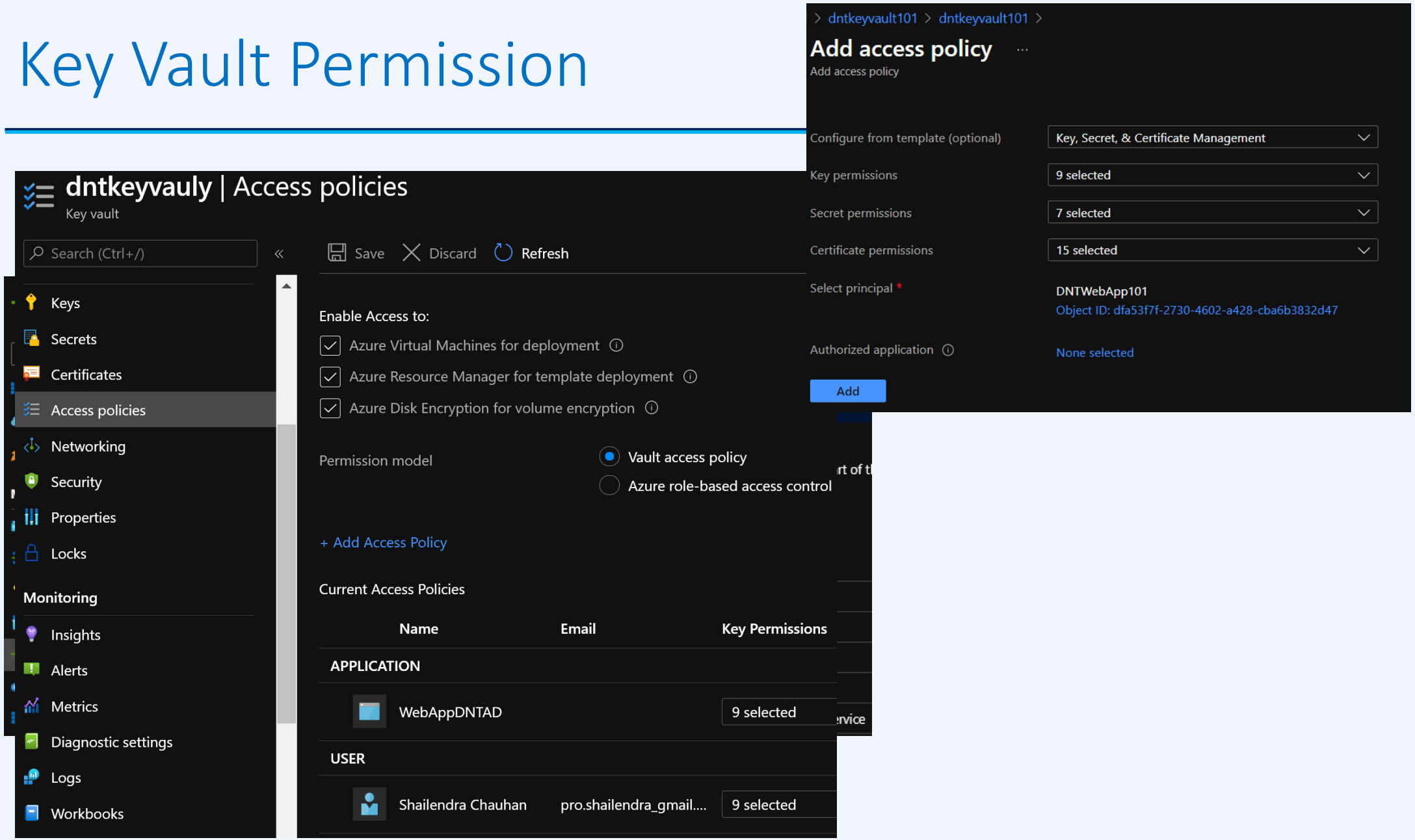
Problem: How to handle cross cutting concerns?

- **Externalized configuration** - externalize all configuration such as database location and credentials
- **Service discovery** - How does the client of an RPI-based service discover the network location of a service instance?
- **Circuit Breaker** - invoke a remote service via a proxy that fails immediately when the failure rate of the remote call exceeds a threshold

Externalized Configuration: Azure Key Vault

- Azure Key Vault is a safe place to store passwords, connection strings, access codes, and certificate keys
- Fully managed by Azure, so you don't have to worry about the underlying infrastructure.
- You can use Azure Key Vault from your .NET application using the *Microsoft.Azure.KeyVault* NuGet package

Key Vault Permission



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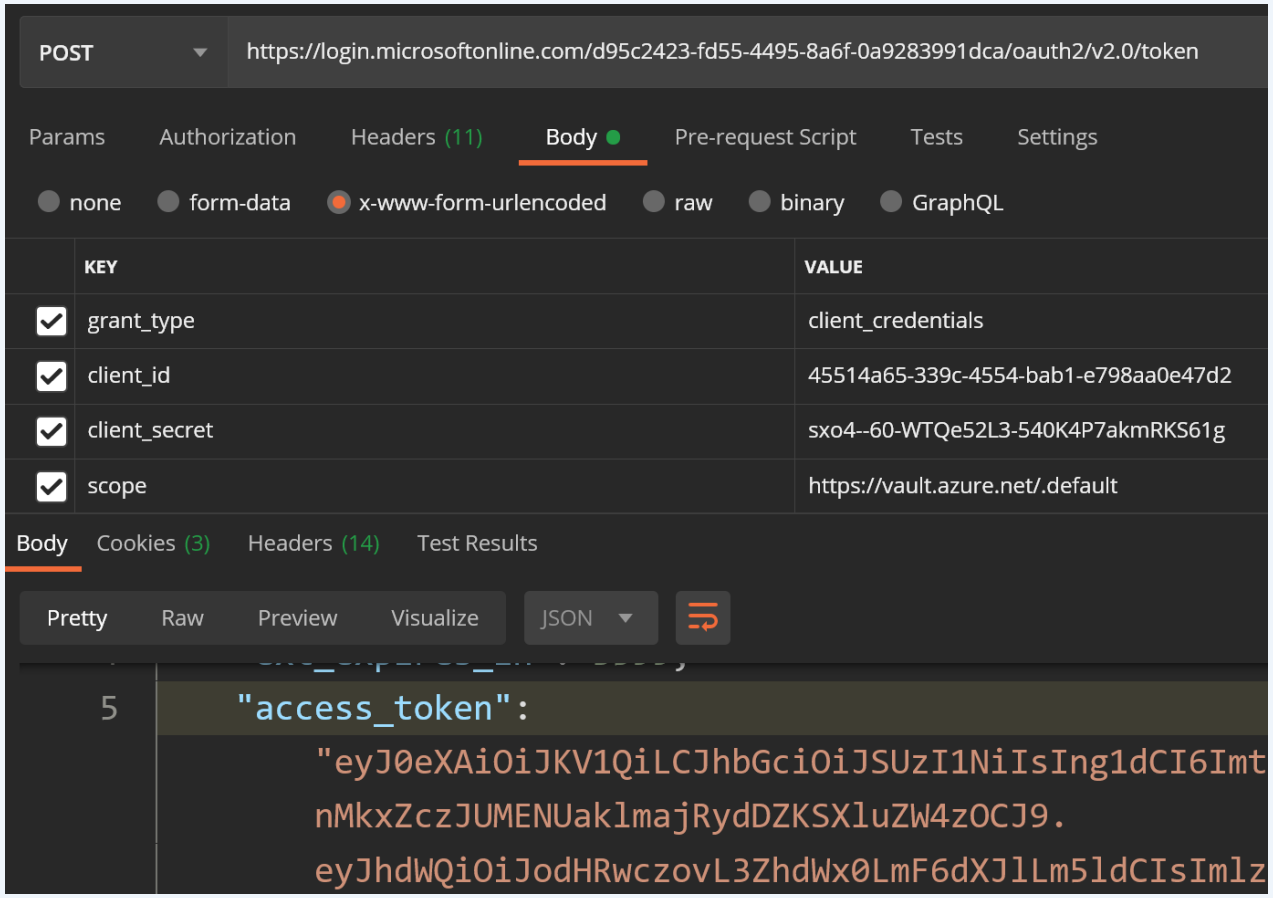
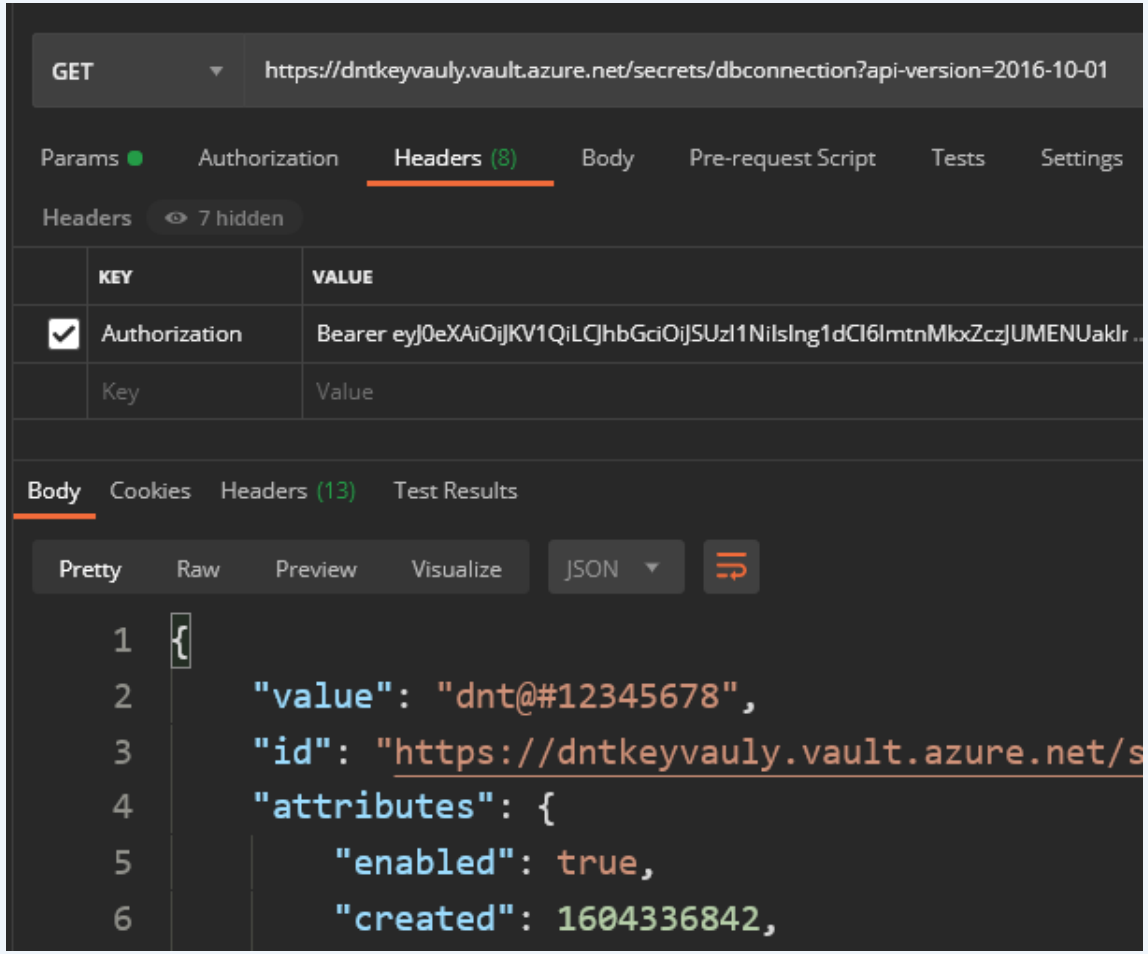
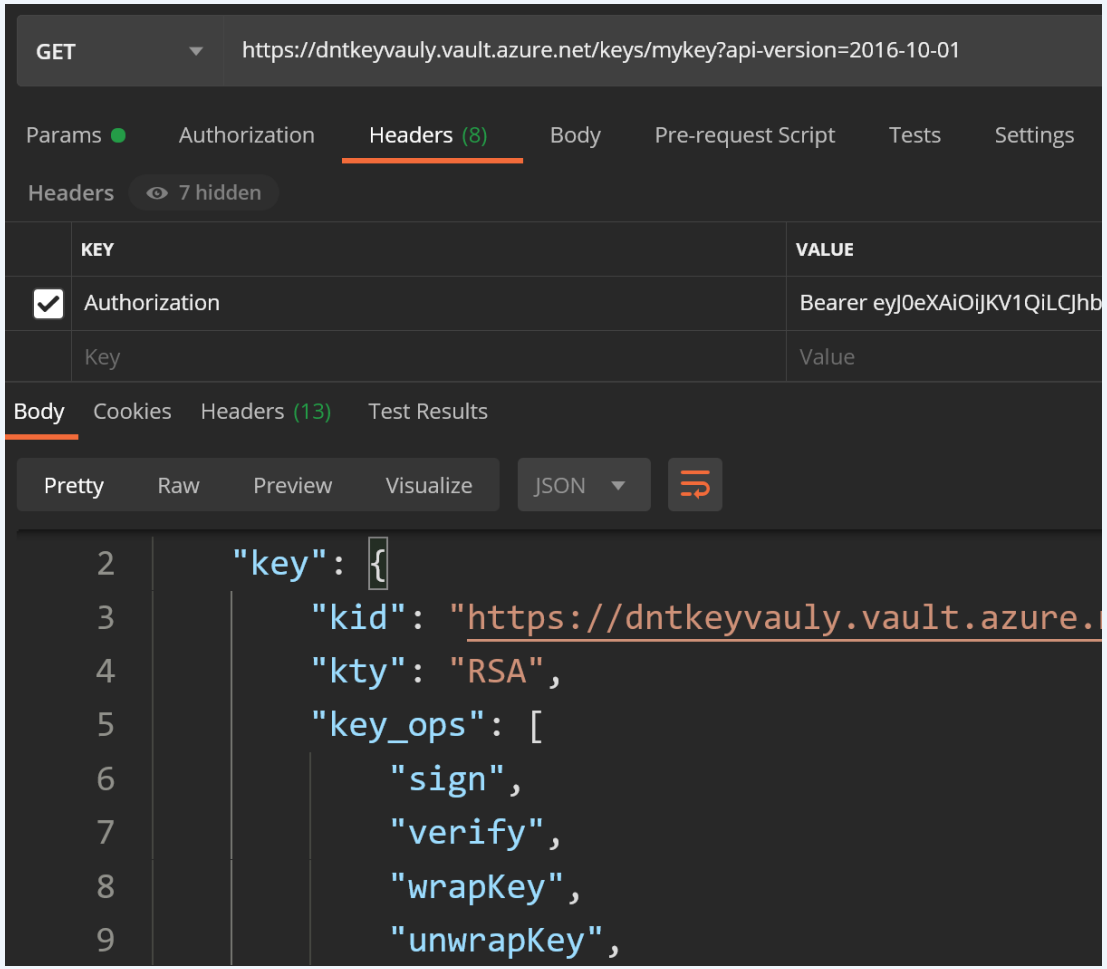
Requesting Token from Azure AD




```
grant_type:client_credentials
client_id:45514a65-339c-4554-bab1-e798aa0e47d2
client_secret:sxo4--60-WTQe52L3-540K4P7akmRKS61g
scope:https://vault.azure.net/.default
```

Accessing Key Vault Secrets and Keys





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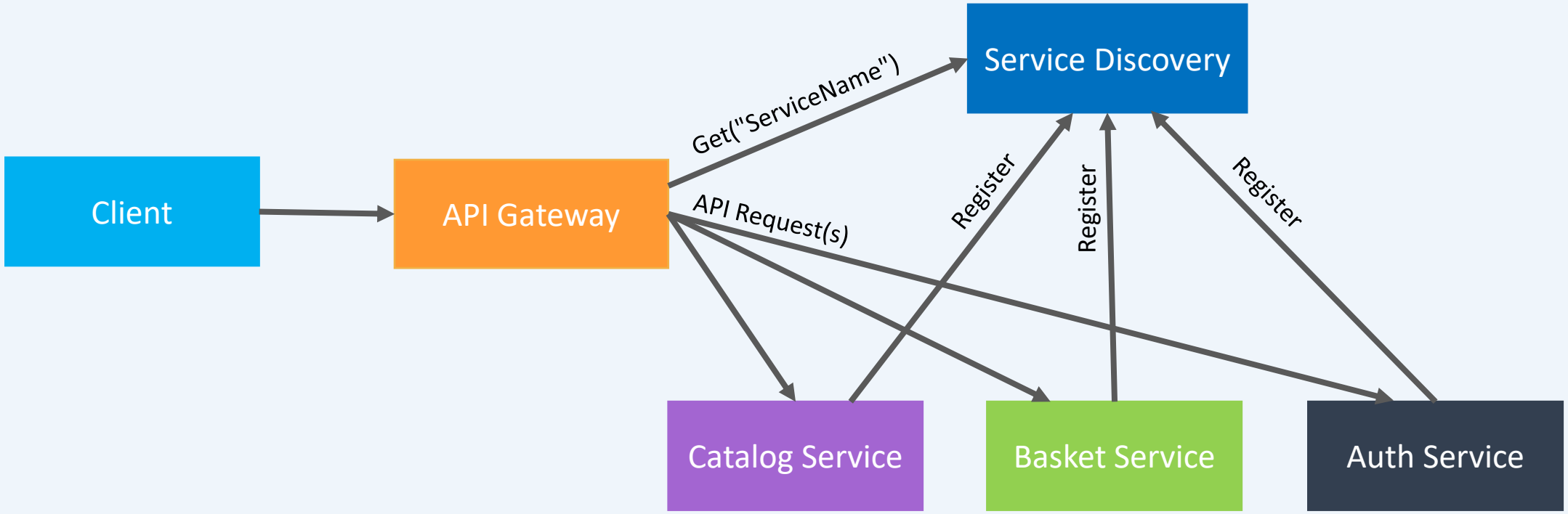
Service Discovery



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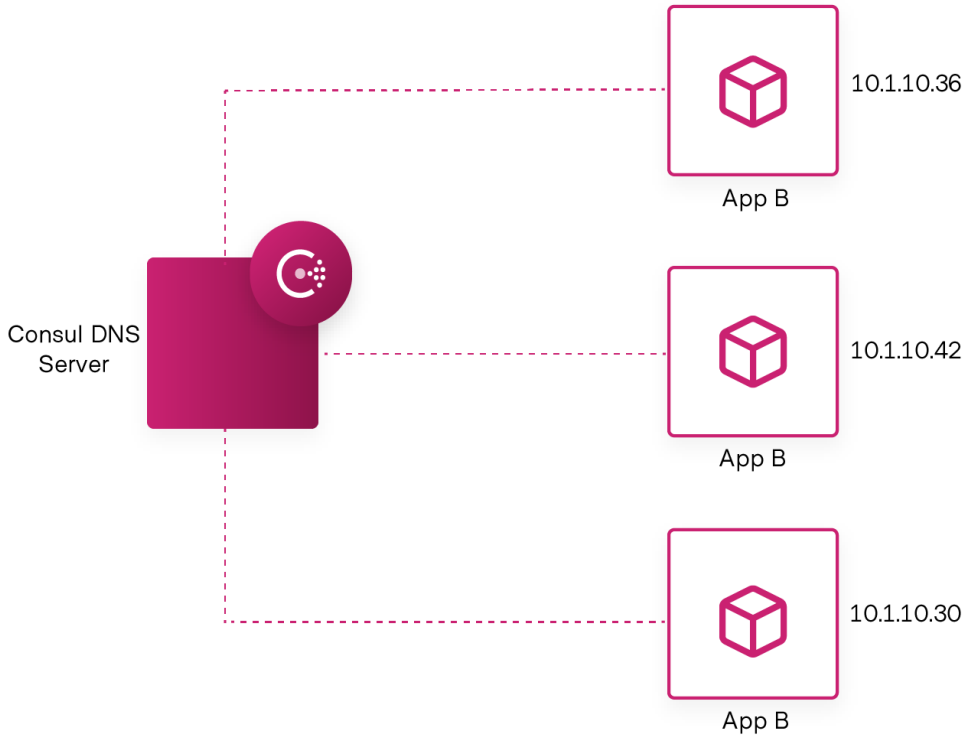
Service Discovery Using Consul

- Discover, Register, and Resolve services for application workloads across any cloud.
- Automatically add and remove services based on health checking.

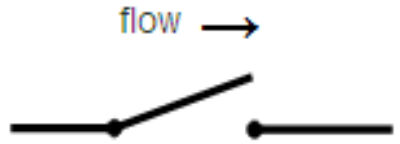
```
> docker pull consul
> docker run -p 8500:8500 consul

//inside docker instance
> consul services deregister -id=web
```



Circuit Breaker Pattern

- A circuit breaker is an electronic component like fuse that opens a circuit so that no current can flow through it. As a result, it prevents the damage caused by excess current from an overload or short circuit.



- To prevent an application from trying to invoke a remote service or access a shared resource if this operation is highly likely to fail.
- The circuit-breaker tracks the number of times an API call has failed. Once it crosses a threshold number of failures in a row, it doesn't even try to call the API for subsequent requests.

Polly

- Polly is a .NET library that allows developers to express policies such as Retry, Circuit Breaker, Timeout, Bulkhead Isolation, and Fallback in a fluent and thread-safe manner.
- If the failure scenario is occurring due to load issues (e.g. a database is trying to handle too many operations), a circuit-breaker policy will prevent the situation from getting worse whereas a retry policy would almost certainly have cause a bigger problem

```
public void ConfigureServices(IServiceCollection services)
{
   services.AddHttpClient("basketapi")
           .SetHandlerLifetime(TimeSpan.FromMinutes(5))
           .AddPolicyHandler(GetCircuitBreakerPolicy());
}
```

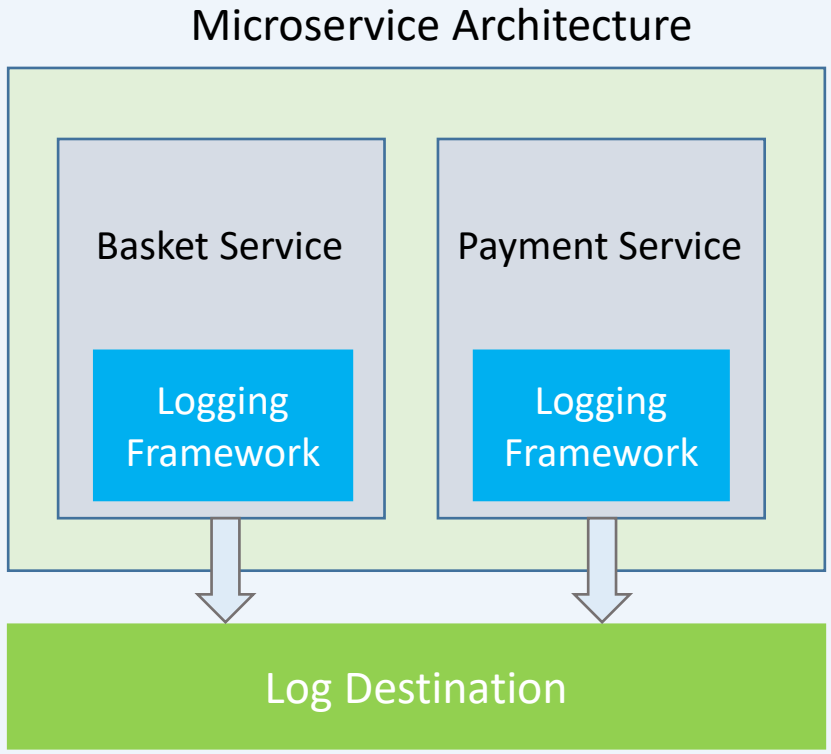
```
static IAsyncPolicy<HttpResponseMessage> GetCircuitBreakerPolicy()
{
    return HttpPolicyExtensions
                .HandleTransientHttpError()
                .CircuitBreakerAsync(2, TimeSpan.FromSeconds(10));
}
```

Observability Patterns

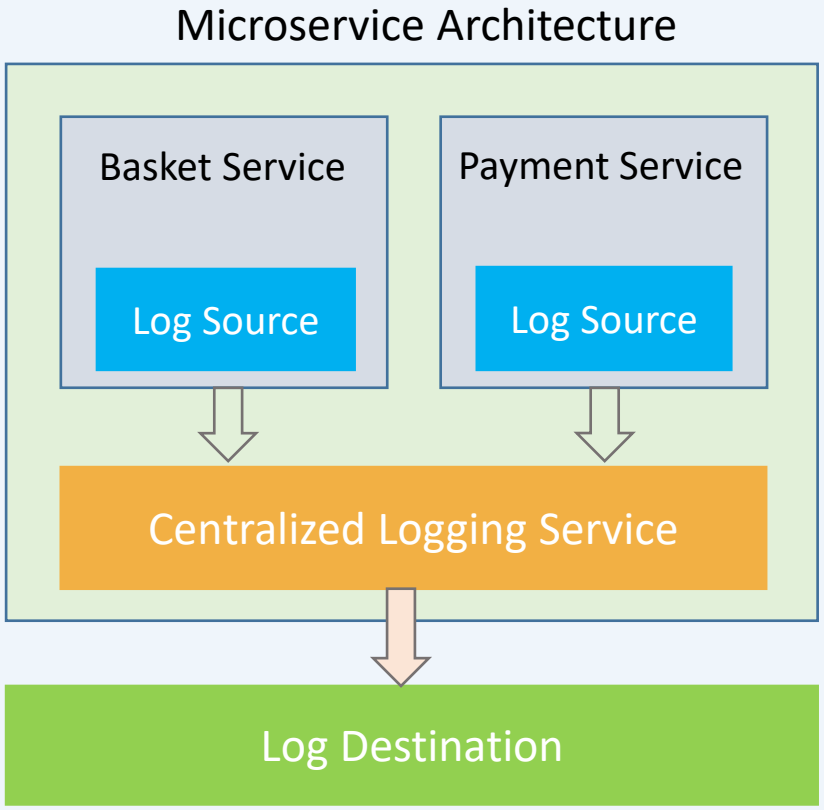
Problem: How to understand the behavior of an application and troubleshoot problems?

- **Log aggregation** - aggregate the application logs
- **Application metrics** - instrument a service's code to gather statistics about operations
- **Exception tracking** - report all exceptions to a centralized exception tracking service that aggregates and tracks exceptions and notifies developers.
- **Health check API** - service API (e.g. HTTP endpoint) that returns the health of the service and can be pinged, for example, by a monitoring service
- **Audit logging** - record user activity in a database

Microservices Logging



Logging in Each Service



Centralized Logging Service

Logging with ELK Stack

- **Elastic Search** is a NoSQL database that is capable of taking all logs, index them and making them searchable.
- **LogStash** is a log collector and a known format for storing logs in a structured JSON format.
- **Kibana** is a UI that can connect to Elastic Search and provide a usable interface for searching logs, making queries, and making dashboards and charts out of those queries.

ELK Stack Docker Setup

> docker-compose up -f docker-compose.yml

---- Or -----

> docker-compose up

- Accessing Dashboard
  - Kibana: *localhost:9200*
  - Elastic Search UI: *localhost:5601*

Open Telemetry

- An observability framework for cloud-native software.
- Used to the instrument, generate, collect, and export telemetry data (metrics, logs, and traces) for analysis in order to understand your software's performance and behavior.
- Supports all officially supported versions of .NET Core and .NET Framework except for .NET Framework 3.5 SP1.
- Zipkin is a distributed tracing system. It helps gather timing data needed to troubleshoot latency problems in service architectures.

```
docker run -d -p 9411:9411 openzipkin/zipkin
```