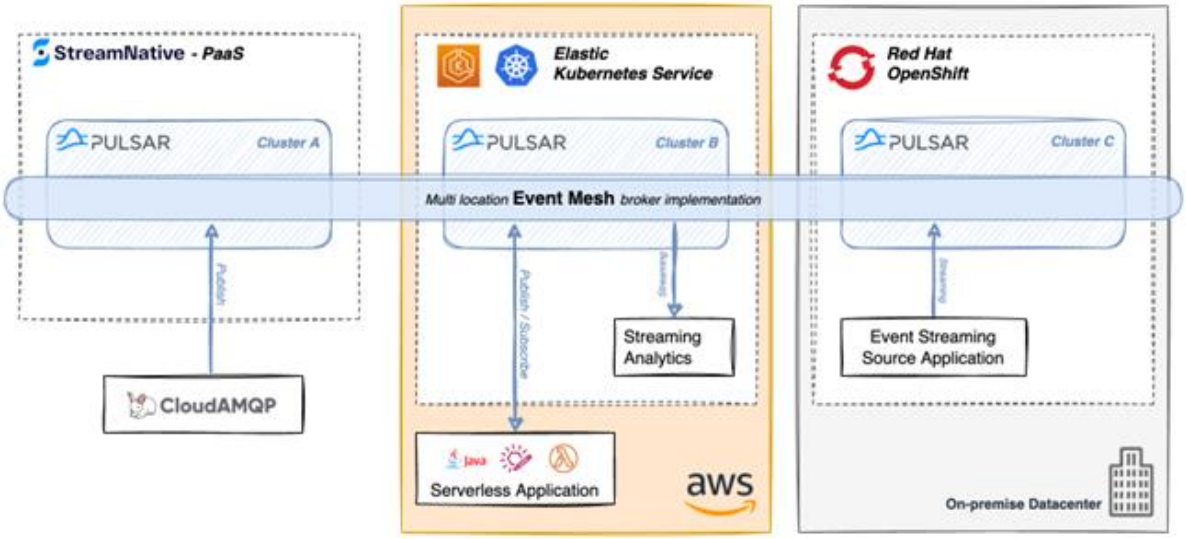
Opdracht 1: Multi-cloud Event Mesh using Apache Pulsar

Type: Internship
Location: Kontich and/or Ghent (+ home office)

Introduction

Large enterprises typically have a myriad of business-critical applications that are running in both private data centers and public clouds such as AWS, Google Cloud, or Microsoft Azure. One of the biggest challenges of today is enabling seamless connectivity between these applications in a highly distributed IT environment.
An essential component to support this reliable connectivity is message-oriented middleware. In this area, the industry has made major improvements by introducing cloud-native messaging solutions and event streaming platforms. These advancements have led to the introduction of a 'new' Event Mesh (1) paradigm.



In this internship, you'll design and set up an Event Mesh implementation using ***Apache Pulsar***. The setup should enable seamless interoperability between Public Cloud, On-premises and a PaaS environment in a single architecture.
These types of setups are rapidly gaining traction as enterprises are adopting a multi-cloud strategy and need these separate locations to cooperate in a ***loosely coupled*** and ***highly resilient*** way.

(1) "An event mesh is a dynamic infrastructure that delivers events from producers to consumers via a network of interconnected "event brokers." Event mesh is environment-agnostic, designed to deliver events across disparate cloud platforms, no matter where the applications are deployed—public, private, and hybrid cloud, PaaS, the Internet-of-Things (IoT), and even no cloud—without the need for configuration of event routing." – *Red hat*
https://www.redhat.com/en/topics/integration/what-is-an-event-mesh

Internship assignment

In this internship you'll setup 3 scalable Apache Pulsar clusters:

- A PaaS setup using StreamNative.
- On top of EKS, the Kubernetes service of Amazon Web Services (AWS)

- On top of OpenShift, the Kubernetes Platform of Red Hat.

You'll configure and demonstrate the Event Mesh concept on these clusters. And provide a seamless routing experience between the three different locations.
You'll code and demonstrate three common use cases requested by our i8c clients:

- Develop and integrate an AWS based serverless application
- Develop and integrate an event streaming & analytics pipeline
- Integrate a 3rd party RabbitMQ PaaS provider using the AMQP protocol

What you will learn

This internship will introduce you to a large set of emerging technologies in today's IT market:

- Latest messaging and streaming technology: **Apache Pulsar**
- You will get acquainted with the public cloud technologies:
  - **Kubernetes** & **Openshift** Container orchestration platforms
  - **AWS** (EKS, Lambda, S3, Amazon API Gateway, Amazon EventBridge)
- You will get introduced to **Enterprise Integration,** and **architectural patterns** like microservices, eventing, messaging and API Management.
- Programming will be done in **Java**

Who should apply?

- You are a final year IT student who is not afraid of a challenge.
- You are an analytic person who is proficient in abstract reasoning.
- You are eager to learn new technologies and have an interest in cloud technologies.
- You are able to work independently.
- You have Java (or JavaScript/Node.js) knowledge.
- You are able to use DevOps principles.

Opdracht 2: GraphQL for cloud-based Enterprise Integration

Type: Internship
Location: Kontich and/or Ghent + Home Office

Introduction

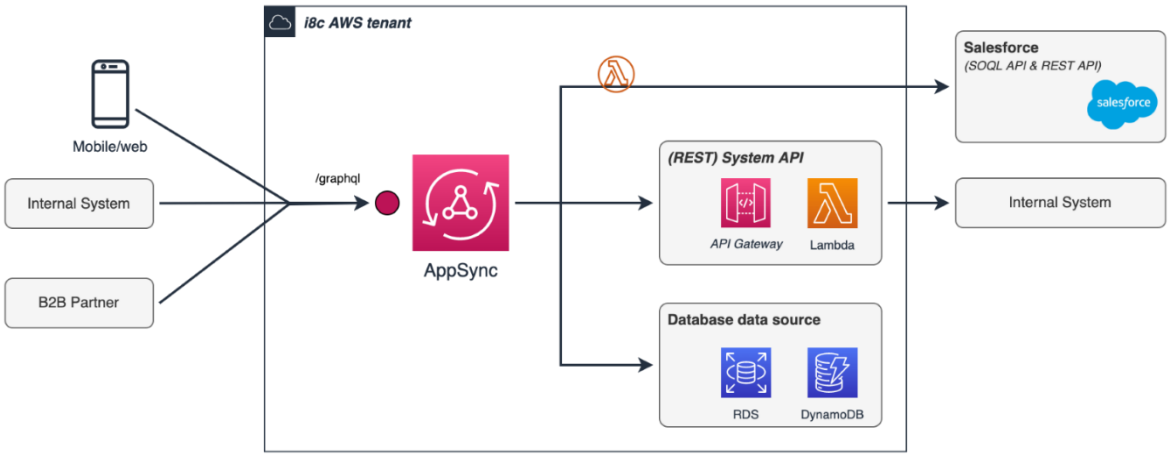
Connectivity through managed APIs is an essential part of today's IT ecosystems. It's the main driver for building connected and real-time organizations. There is a multitude of different API standards available that systems use to expose their data and functionalities. The most commonly used today are 'REST APIs' and 'SOAP Web Services'. But GraphQL is gaining a lot of traction as new API technology. It promises to become a cornerstone in tomorrow's IT architectures. In this internship, you will research the usage of ***GraphQL for cloud-based enterprise integration*** use cases. You'll also build a prototype that should enable i8c's customers to kickstart their GraphQL journey. You'll build this on top of today's leading cloud provider AWS (Amazon Web Services).

Internship assignment

The project consists of two parts, a research part and the development of a prototype.
You will investigate and apply the following research questions:

- How can GraphQL create value for some typical i8c customers?
- What are the pros/cons of using GraphQL in these use cases?
- Provide a software market analysis on the different available implementations (Apollo, AWS AppSync, …)
- How does it integrate with typical enterprise off-the-shelf systems like Salesforce, SAP, Workday, Okta, Cognito, … ?
- Research best-practises on using GraphQL. Including scalability, caching, authentication & authorization, traffic management, and change management.

You will develop a GraphQL prototype that demonstrates a unified data access use case. The exposed GraphQL interface should provide a single entry point to data aggregated from different source systems. The backend sources include Salesforce, custom REST APIs, and cloud databases. The prototype will be built on AWS Serverless technology using AppSync and Lambda (FaaS).



What you will learn

This internship will introduce you to a large set of emerging technologies in today's IT market. You will get acquainted with the latest AWS based cloud technologies (Serverless stack: Lambda,

AppSync, DynamoDB, …) and major enterprise platforms (Salesforce, Workday, …). It will introduce you to Enterprise Integration and architectural patterns like API Management. Programming will be done in Node.js, Typescript and/or JavaScript and you will be introduced to DevOps principles like CI/CD and Infrastructure as Code.

Who should apply?

- You are a final year IT student who is not afraid of a challenge.
- You are an analytic person who is proficient in abstract reasoning.
- You are eager to learn new technologies and have an interest in cloud technologies.
- You are able to work independently.
- You have basic microsoft knowledge.

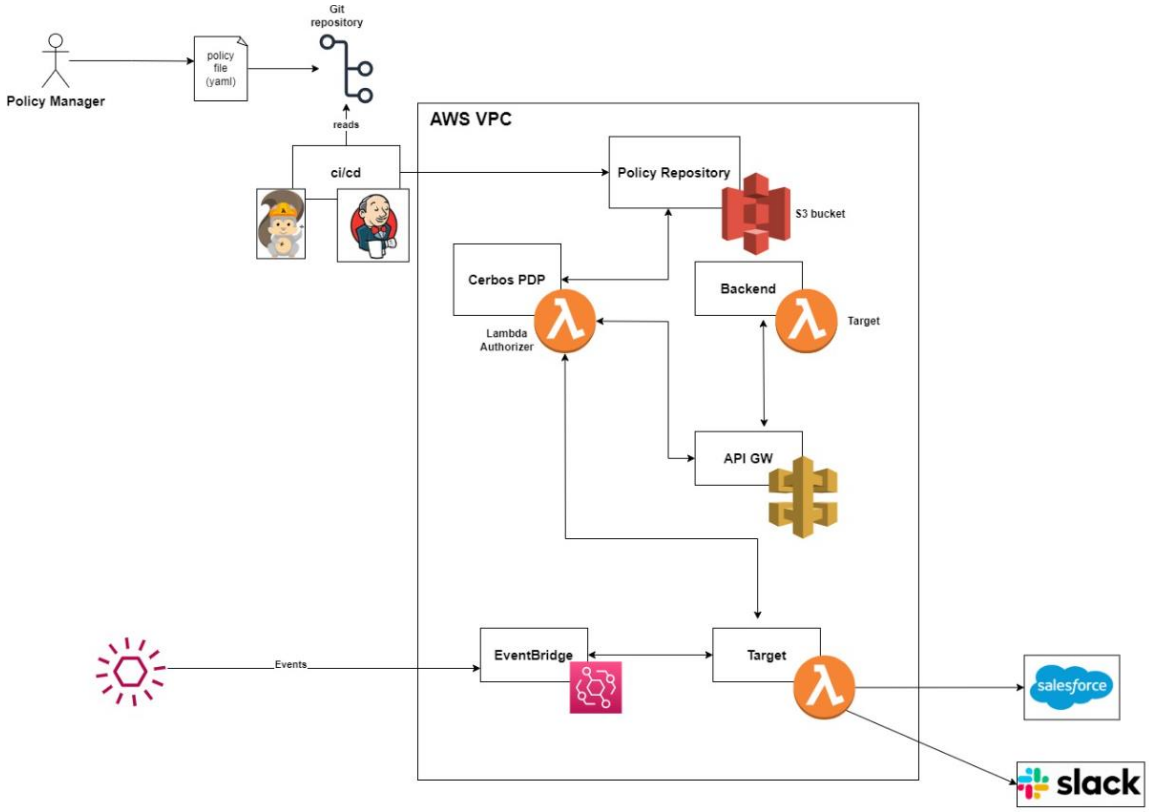
Opdracht 3: Scalable role-based authorization layer in a cloud event-driven platform

Type: Internship
Location: Kontich (+ home office)

Introduction

In this internship, you'll build a scalable event-driven cloud platform that enforces a strict security mechanism at the application layer. The platform builds on top of today's leading cloud provider AWS (Amazon Web Services), and it leverages an open source RBAC[1] framework (Cerbos[2]). The cloud platform can be used in any functional domain, from the finance sector where only some banks can send payment instructions to other banks, or in a logistic company where the different couriers can send real-time events for the status of the delivery. In this way, the receivers of the parcel could get proper notifications and be always up to date with the status of the delivery.

The platform needs to guarantee the delivery of the messages to potentially multiple consumers, by being able to resubmit them in case of need (like unavailability of the target system). A set of nonfunctional requirements like scalability and traceability needs to be addressed as well. Two main integration patterns will be covered: the synchronous use case where a set of REST APIs will be exposed by an API gateway and the asynchronous one, where producer and consumers are totally decoupled. In both use cases, the authorization mechanism needs to enforce that only legitimate producers can push a specific set of events or specific API clients can retrieve certain type of resources (like the status of my parcel). In both cases, Cerbos will be used as the cloud RBAC mechanism.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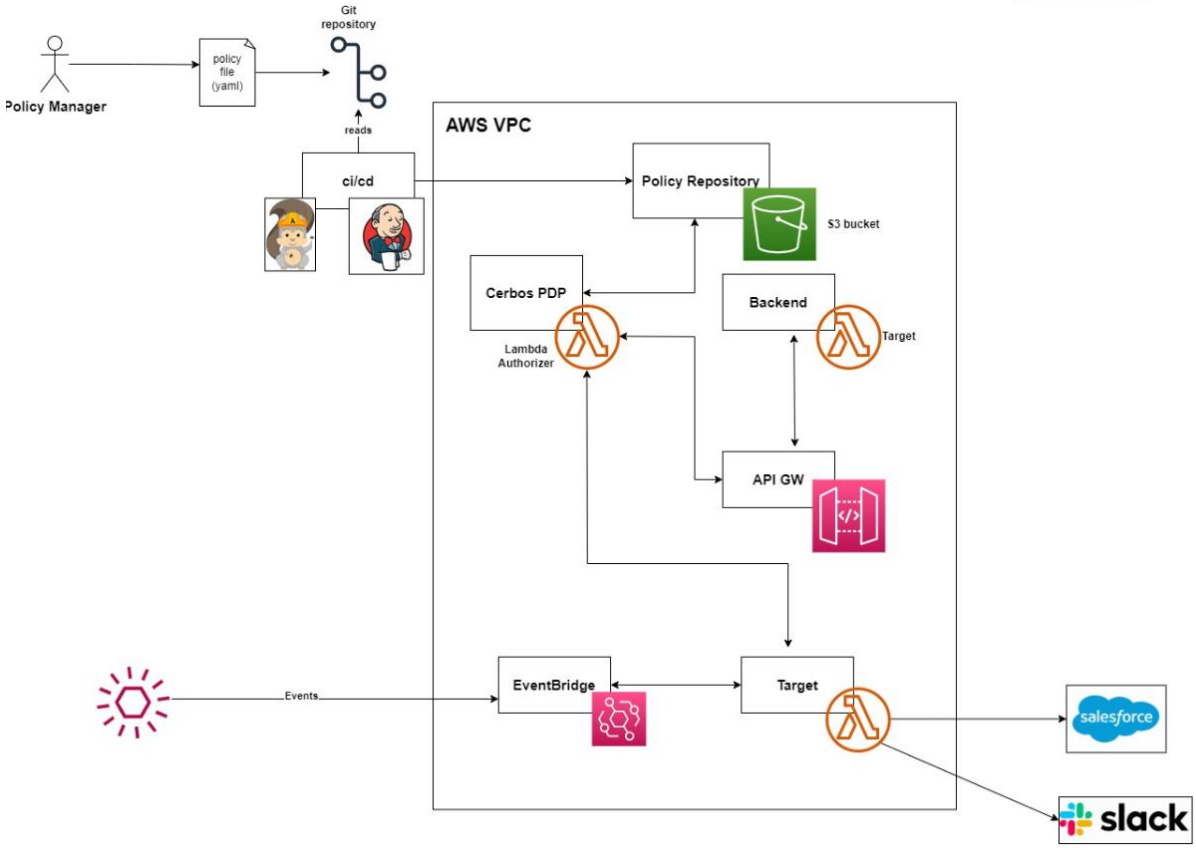
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Internship assignment

During this internship you'll focus on following use cases:

- ***Deploying Cerbos PDP as lambda function in the AWS VPC.*** Automate the deployment using AWS Cloudformation/SAM[3].
- **Create a CI/CD pipeline with Jenkins or similar to automatically deploy policy files in a S3 Bucket.** The policy file describes in a YAML format, which event (resources) a specific role is allowed to consume or produce.
- ***Securing a set of REST endpoints with an API gateway.*** The goal is to apply an industry standard authorization mechanism like Client credential Oauth flow together with custom RBAC enforcement using Cerbos.
- ***Define an event-driven platform that can receive events from multiple sources and dispatch them to various targets.*** The implementation of the platform will be using AWS EventBridge and implements a microservices architecture. The core of the system relies on Cerbos to make sure only legitimate consumers can receive the events they subscribed for.

You'll implement the integrations according to microservices and cloud integration best practices.

What you will learn

This internship will introduce you to a large set of emerging technologies in today's IT market. You will get acquainted with the latest AWS based cloud technologies (Serverless stack: Api gateway, Lambda, EventBridge, …) . It will also introduce you to Enterprise Integration and architectural patterns like Event-driven microservices. Programming will be done in Node.js, Typescript and/or JavaScript.

Who should apply?

- You are a final year IT student who is not afraid of a challenge.
- You are an analytic person who is proficient in abstract reasoning.
- You are eager to learn new technologies and have an interest in cloud technologies.
- You are able to work independently.
- You have Java or JavaScript/Node.js knowledge.
- You are able to use DevOps principles.
- You are willing to learn and implement security best practices.