One hub.
Multiple expertise.

Enabling reliable digital solutions

MASTER THESIS PROJECTS 2024

SWISS DIGITAL NETWORK PFE BOOK

SWISS DIGITAL NETWORK

PFE 2024

Table of Contents

Swiss Digital Network

Swiss Digital Network is the first independent and open Digital Transformation Consulting Network in Switzerland, providing **consulting, engineering & educational services related to digital and cloud transformation.**

As a unique, innovative and evolving consulting network, we believe in democratizing key digital transformation capabilities to ensure that every organization, regardless of size or industry, can benefit from the latest digital technologies and trends.

One hub, multiple expertise

Our network offers multiple areas of expertise to cater to a range of client needs, from software delivery to cultural and organizational transformation.

Our comprehensive range of consulting services is powered by cells of experts who specialize in different areas of Digital Transformation expertise; all united **under one hub with multiple capabilities.**

AI-powered Testing & **Continuous Verification**

Culture-first & holistic **Digital Transformation Consulting**

Digital Operating Model for DevOps, DataOps & MLOps

Continuous Delivery Pipelines for Data, ML Models & ML Code

Effective SRE Transformation & Implementation

ML-driven Observability & AIOps for Software and ML Systems

EoS #1

Design & Build a Continuous Security Verification /CSV) Solution

The end-of-study project aims to **develop a continuous security verification (CSV) solution for test and production environments.**

To achieve this, several essential elements will be considered, including **security scanning, -testing, -monitoring, -logging, and -analytics for various CI/CD platforms.**

The project will start by **identifying the capabilities of a CSV solution** in terms of **Security Verification, Data Collection, Storage, ML-driven Processing, Analytics, and Visualization.** Using this list of capabilities and taking advantage of available open-source and commercial tools, the project will **design a robust and effective CSV solution** that will meet the specific needs of **dynamic test and production environments.**

The project will also include the **creation of a demonstration pipeline** that illustrates the use of CV to detect and manage vulnerabilities in system logs, thereby improving the security and reliability of dynamic environments.

Keys: CV, CI/CD, Security scanning tools (SONAR, Snyk...), ML, NLP.

EoS #2

ML-driven Analytics of Observability Traces & Logs

The main objective of the end-of-study project is to discern the essential **Machine Learning (ML) capabilities required to process logs effectively and OTEL traces of observability data** for critical operational use cases, encompassing monitoring, alerting, and incident handling.

We then prioritize these use cases according to their potential benefits and **evaluate the most appropriate ML algorithms,** considering implementation complexities, prior knowledge, data volume, pre-processing complexities, and computational requirements.

A crucial aspect is to develop a detailed plan for standardizing ML engines across various use cases, minimizing customization while ensuring seamless integration in data acquisition, pre-processing, **data architecture/format, model selection,** and result formatting.

The project will also include the set-up of a reusable demonstration environment with reusable Observability Data (traces/logs) from different telemetry pipelines/sources to illustrate different **ML capabilities/algorithms**. This platform is then used to implement and evaluate the ML Algorithms previously identified and compare them to existing tools on the market, such as Honeycomb, Dynatrace, Grafana, and similar.

Keys: ML, OpenTelemetry-Traces / logs, telemetry pipelines, Observability Engineering.

EoS #3

Advanced Continuous Verification Lab

The end-of-study project aims to extend the existing Lab environment to illustrate **effective continuous verification capabilities** for advanced DevOps environments such as **Chaos Engineering.**

The project begins with State of the Art of Advanced DevOps Solutions: Research and document the current state of **Chaos Engineering, Resiliency Testing, and ML-driven QA,** including popular tools, methodologies, and best practices. This analysis will provide valuable insights into the latest trends and technologies in the DevOps landscape.

Reproduce **the Lab infrastructure** with the implementation of various new tools to make a comparison between the status quo and the next-generation features. By **implementing a CI/CD pipeline, testing capabilities to ensure quality gates, test observability, and chaos engineering,** a complete **continuous verification setup** is being showcased and evaluated against a benchmark.

Keys: CI/CD, ML-driven testing, Monitoring, Chaos Engineering

Tools: Harness (next-gen), Cypress, Verica, Terraform.

EoS #4

Enhancing the Digital Highway Cockpit with Value Stream Management & DORA Analytics & Dashboards

The end-of-study project aims to enhance the Digital Highway Cockpit through a comprehensive assessment and monitoring of **DevOps Value Stream and Delivery Performance metrics** such as the **DORA metrics.**

This project **investigates and identifies key parameters** significantly influencing DevOps Value Streams and operations performance within the Digital Highway. **The Digital Highway** is a generic blueprint for **DevOps & MLOps** pipelines with advanced **Observability and Continuous Verification Capabilities.** The objective is to gain a deeper understanding of these parameters and how they can be **instrumented, measured, and analyzed.**

The project will start with the **state-of-the-art analysis of DevOps Value Stream Management (VSM) and DORA best practices (methodologies and technologies).** By examining various metrics, such as the DORA metrics and how they can be tracked, the study will aim to provide actionable insights for organizations seeking to design and build **DevOps VSM and DORA analytics capabilities** to improve their software delivery and operations performance.

Ultimately, the project will advance knowledge in the DevOps field and help teams apply these identified capabilities to enhance their organizational performance.

Keys: DevOps Value Stream Management, DevOps DORA, DevOps tooling chain from collaboration through CI/CD, Testing, monitoring and incident management, **Data Analytics & ML applied to VSM & DORA metrics.**

EoS #5

Reference Architecture for the Digital Highway for ML Systems

Reference Architecture: The thesis proposes a structured reference architecture for diverse pipelines, addressing data pipelines for data ingestion and processing, model pipelines for training and evaluation, and application pipelines for deploying models into production environments.

MLOps Integration: It emphasizes MLOps as the backbone of the Digital Highway, focusing on automated ML-specific pipelines and continuous integration and delivery, facilitating a smooth transition from data and model development to operational deployment.

Continuous Verification and Quality Gates: The work merges continuous verification with quality gates to ensure each step passes rigorous performance criteria at every stage of the pipeline, embedding quality assurance into the continuous delivery process of data, model, and application.

Observability: Observability principles are highlighted for their importance in monitoring ML systems in real-time, providing insights into the performance and the ability to rectify issues as they arise promptly. Observability patterns have to be integrated into the different pipelines.

SRE Principles for ML Systems: The application of SRE principles to ML systems is introduced, detailing how concepts like error budgets and service level agreements can be tailored to maintain the reliability and availability of ML applications, ensuring consistent system performance.

Keys: MLOps, Testing, Quality gates, Observability for ML, SRE for ML, CI/CD/CV

SWISS DIGITAL NETWORK

How to apply

To apply, for any questions or further information please contact:

Ms. Chantal Ebel
chantal.ebel@digital-innovation-partner.ch