# Architecture and Development of Just-in-Time Networks using Infrastructure-as-Code for SchoolBell.chat

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## ABSTRACT

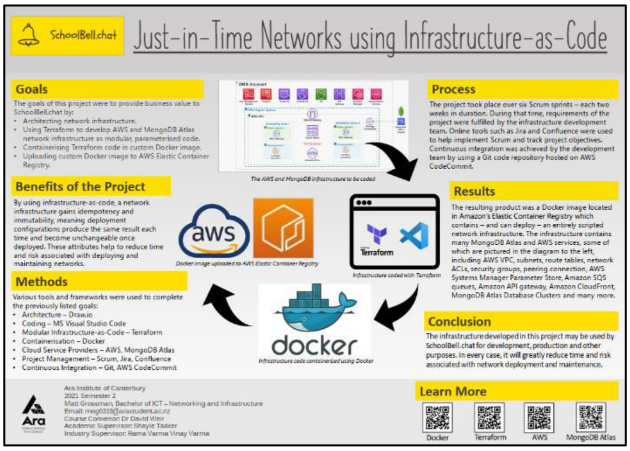
This poster describes the project undertaken by Matt Grossman, a student at Ara Institute of Canterbury, while interning at SchoolBell.chat during the capstone project of the Bachelor of ICT. The goals of the project were to design a suitable network architecture and to then transform that architecture into infrastructure-as-code using Terraform. After that, to containerise that infrastructure in a Docker image and upload the image to Amazon Elastic Container Registry. The Scrum framework was employed throughout the project to provide mechanisms to direct development and team progress. The result was a network infrastructure which can be deployed and removed in under an hour, and which provides time and risk saving benefits regarding network deployment and maintenance.

**Keywords**: Infrastructure-as-Code, Containerise, Terraform, Docker, Amazon, Scrum

## 1. Introduction

Ara Institute of Canterbury Ltd. is a tertiary education provider in Christchurch, New Zealand. This project is a requirement of the Bachelor of ICT degree and was completed, in partnership with SchoolBell.chat, during the final semester.

SchoolBell.chat is a technology start-up company based out of Te Ōhaka – Centre for Growth and Innovation in Christchurch. Their objective is to enhance education experiences for children through parent-teacher communication (SchoolBell.chat, 2021).



SchoolBell.chat

Just-in-Time Networks using Infrastructure-as-Code

Goals

The goals of this project were to provide business value to SchoolBell.chat by:

- Architecting network infrastructure.
- Using Terrafom to develop AWS and MongoDB Atlas network infrastructure as modular, parameterised code.
- Containerising Terraform code in custom Docker image.
- Uploading custom Docker image to AWS Elastic Container Registry.

The AWS and MongoDB infrastructure to be coded

Benefits of the Project

By using infrastructure-as-code, a network infrastructure gains idempotency and immutability, meaning deployment configurations produce the same result each time and become unchangeable once deployed. These attributes help to reduce time and risk associated with deploying and maintaining networks.

Docker image uploaded to AWS Elastic Container Registry

Infrastructure coded with Terraform

Infrastructure code containerised using Docker

Methods

Various tools and frameworks were used to complete the previously listed goals:

- Architecture – Draw.io
- Coding – MS Visual Studio Code
- Modular Infrastructure-as-Code – Terraform
- Containerisation – Docker
- Cloud Service Providers – AWS, MongoDB Atlas
- Project Management – Scrum, Jira, Confluence
- Continuous Integration – Git, AWS CodeCommit

Process

The project took place over six Scrum sprints – each two weeks in duration. During that time, requirements of the project were fulfilled by the infrastructure development team. Online tools such as Jira and Confluence were used to help implement Scrum and track project objectives. Continuous integration was achieved by the development team by using a Git code repository hosted on AWS CodeCommit.

Results

The resulting product was a Docker image located in Amazon's Elastic Container Registry which contains – and can deploy – an entirely scripted network infrastructure. The infrastructure contains many MongoDB Atlas and AWS services, some of which are pictured in the diagram to the left, including AWS VPC, subnets, route tables, network ACLs, security groups, peering connection, AWS Systems Manager Parameter Store, Amazon SQS queues, Amazon API gateway, Amazon CloudFront, MongoDB Atlas Database Clusters and many more.

Conclusion

The infrastructure developed in this project may be used by SchoolBell.chat for development, production and other purposes. In every case, it will greatly reduce time and risk associated with network deployment and maintenance.

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*Figure 1. Poster for the Panel Presentation*

## 2. Project Goal

Before the project, SchoolBell.chat was manually deploying new network environments for a variety of purposes, including development and production. This was time consuming and led to configuration drift. The goal of this project was to provide an immutable and idempotent network infrastructure-as-code, thereby securing against configuration drift and greatly reducing time spent in network deployment and maintenance.

## 3. Process

The project proceeded within the Scrum framework. Continuous integration was implemented by the development team sharing code using a Git repository hosted in AWS CodeCommit. Microsoft Visual Studio Code was used by the development team for coding requirements and Terraform and Docker for the infrastructure-as-code and containerisation requirements, respectively. The project was 12 weeks in duration, encompassing a one-week onboarding phase followed by five and a half fortnightly Scrum Sprints (Schwaber & Sutherland, 2020).

# 4. Conclusion

This project provided a substantial experience working with emerging network technologies such as infrastructure-as-code and containerisation. I also gained knowledge and confidence in working within the Scrum framework.

The infrastructure-as-code itself has many applications. It may be adapted for a variety of consumer or development purposes. As well, the deployment processes may be further abstracted and automated, providing more benefits and ease-of-use.

# 5. References

SchoolBell.chat. (2021, Jan 01). *SchoolBell.chat*. Retrieved Nov 11, 2021, from www.schoolbell.chat: https://www.schoolbell.chat

Schwaber, K., & Sutherland, J. (2020, Nov 01). *The 2020 Scrum GuideTM*. Retrieved Aug 29, 2021, from Scrum Guides: https://scrumguides.org/scrum-guide.html