



Summer Internship Project Showcase

Automating IoT Connection
in NUS Campus

Presented by
Khairul Iman
Hong Wei Yang

Introduction

Process Flow
Pain Points
Developmental timeline

01

Architecture & Implementation

Architecture
Core Implementation

02

Challenges Faced

03

Agenda

04

Project Outcomes

05

Demo

06

Future Improvements
& Conclusion



01

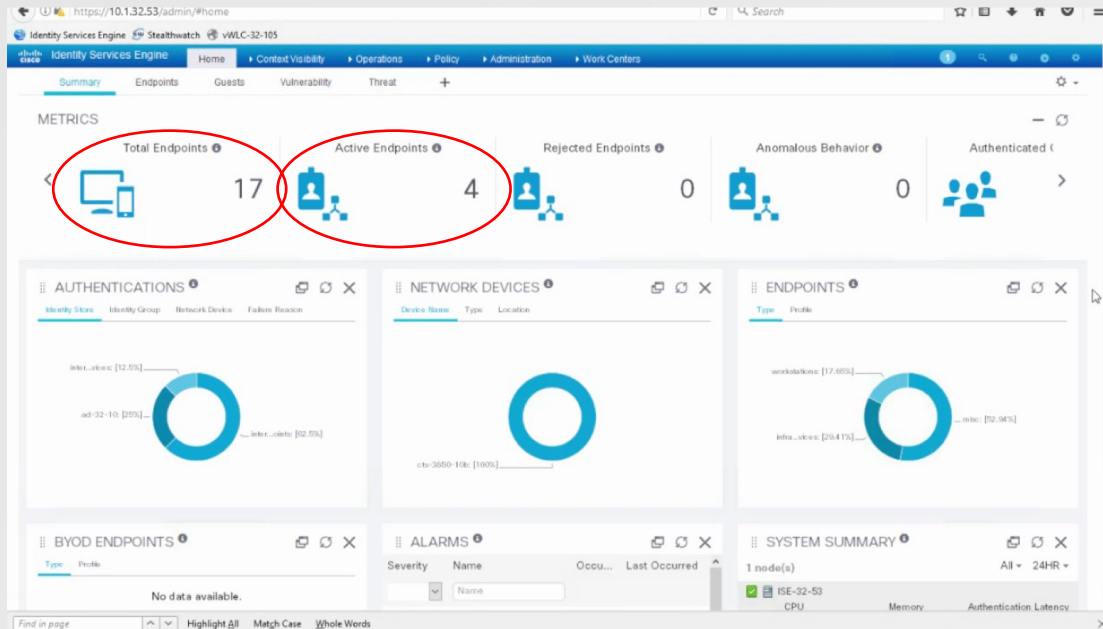
Introduction & Process Flow

How IoT Devices Connect to Campus Network

MAC Media Access Control Address



Organizational Unique Identifier Universally Administered Address



Original Process Flow



Wants IoT
device to be
connected to
campus network



Open a ticket via NUS
nTouch or by emailing
IT Care with relevant
information of his
device



Network
administrator will
then configure the
device inside
Cisco ISE Portal



Upon completion,
user can now
connect his device
to campus network



Pain Points on Existing Flow



Manual Provisioning

Currently, the network administrators are provisioning network access to researcher's IoT devices manually.

They are attending to such provisioning on a case-by-case basis, through NUS ticketing system.

Ad-Hoc Requests



Inefficient delay

Provisioning network access to IoT devices might take up to 1 week, for a very simple and repetitive task.



Aim

- Free up network administrator's time
- Improve the waiting time to provision network access down to an **instant**

Solution

IoT provisioning in Cisco ISE is a repetitive task

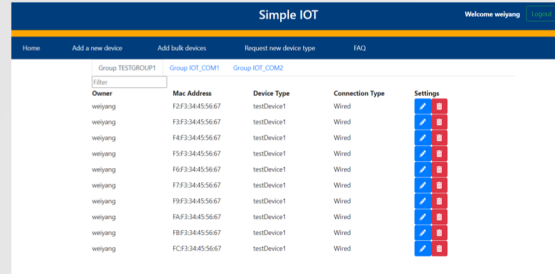
Automate the provisioning process is the key solution

























New Process Flow



Wants IoT
device to be
connected to
campus network

A screenshot of the Simple IoT web interface. The header shows 'Simple IoT' and 'Welcome wilyang'. Below the header is a navigation bar with links: Home, Add a new device, Add bulk device, Request new device type, and FAQ. The main content area displays a table of device information. The table has columns for Owner, Mac Address, Device Type, Connection Type, and Settings. The data is organized into three groups: Group TESTGROUP1, Group KOT_COM1, and Group KOT_COM2. Each group contains a list of devices with their respective details. The Settings column shows a blue checkmark and a red 'X' icon for each device.

Owner	Mac Address	Device Type	Connection Type	Settings
wilyang	F2F334455667	testDevice1	Wired	 
wilyang	F3F334455667	testDevice1	Wired	 
wilyang	F4F334455667	testDevice1	Wired	 
wilyang	F5F334455667	testDevice1	Wired	 
wilyang	F6F334455667	testDevice1	Wired	 
wilyang	F7F334455667	testDevice1	Wired	 
wilyang	F8F334455667	testDevice1	Wired	 
wilyang	F9F334455667	testDevice1	Wired	 
wilyang	FAF334455667	testDevice1	Wired	 
wilyang	FBF334455667	testDevice1	Wired	 
wilyang	FCF334455667	testDevice1	Wired	 

Logs in to Simpleiot
.nus.edu.sg and keys in his
device information.



Provisioning of
campus network
access is instant,
user can start
connecting his
device
immediately

Timeline

Early May

Handing over previous project from NSW & Introduction to Ansible and Cisco ISE

Mid May

Architecture & Database Design

Early June

Implementation, Staging & Deployment to Production Server

Mid July

User Testing, Documentation & Preliminary Review

End July

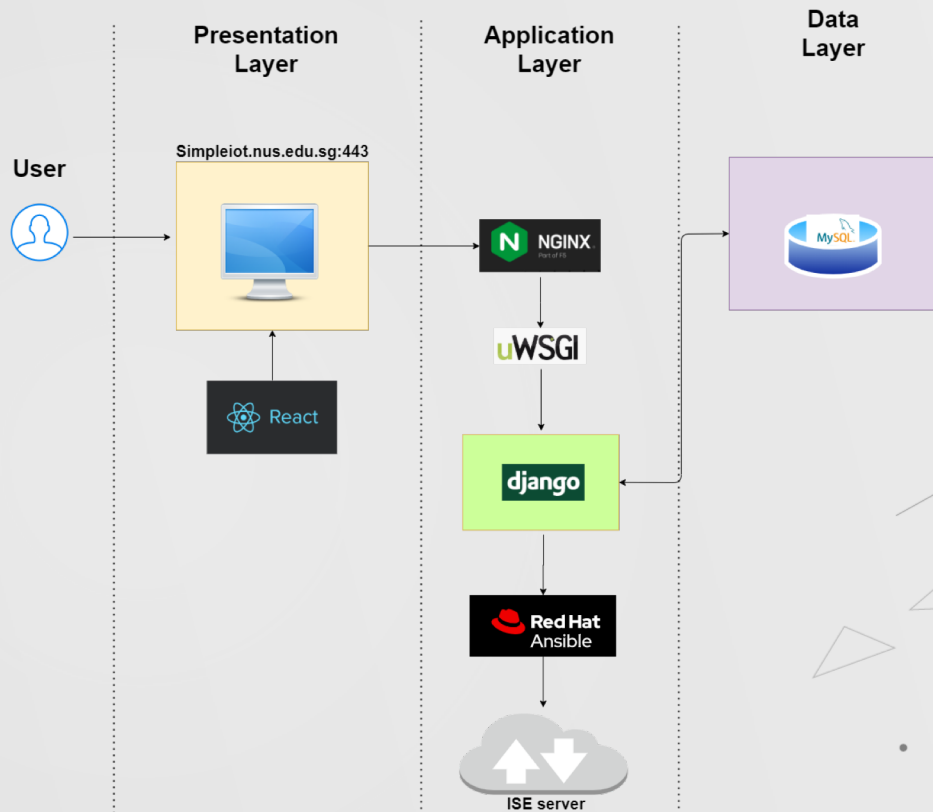
Final Review & Preparation of deliverables



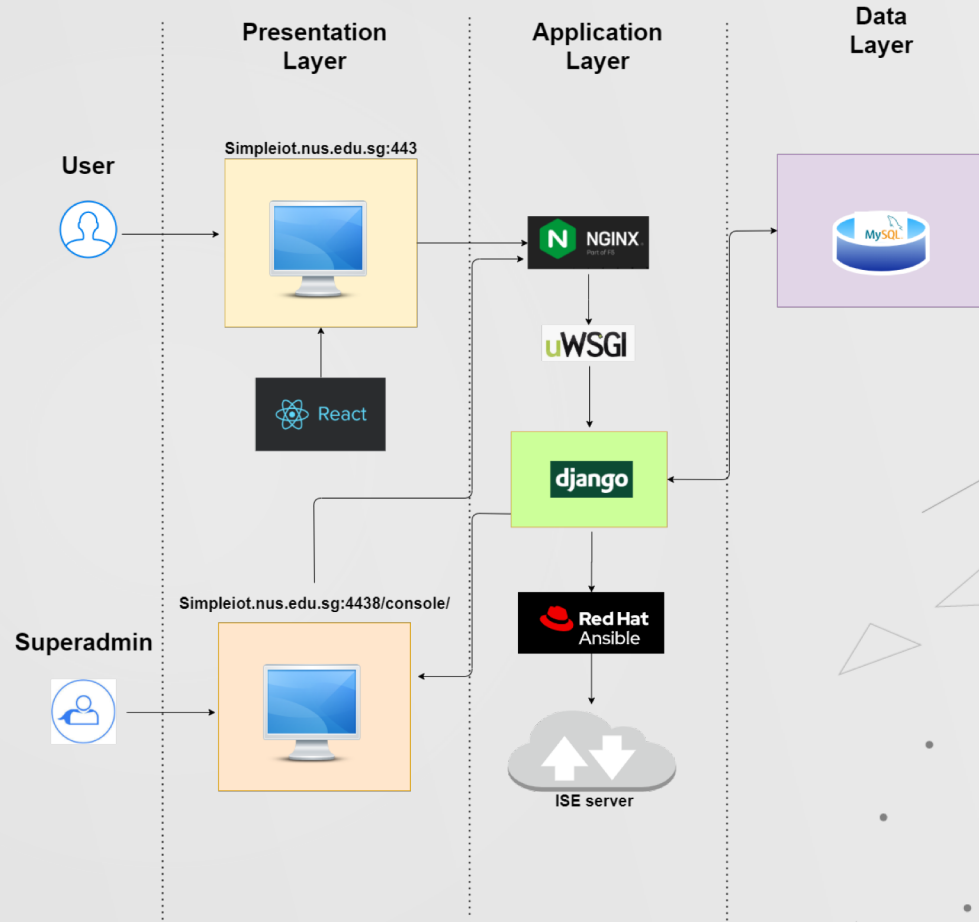
02

Architecture

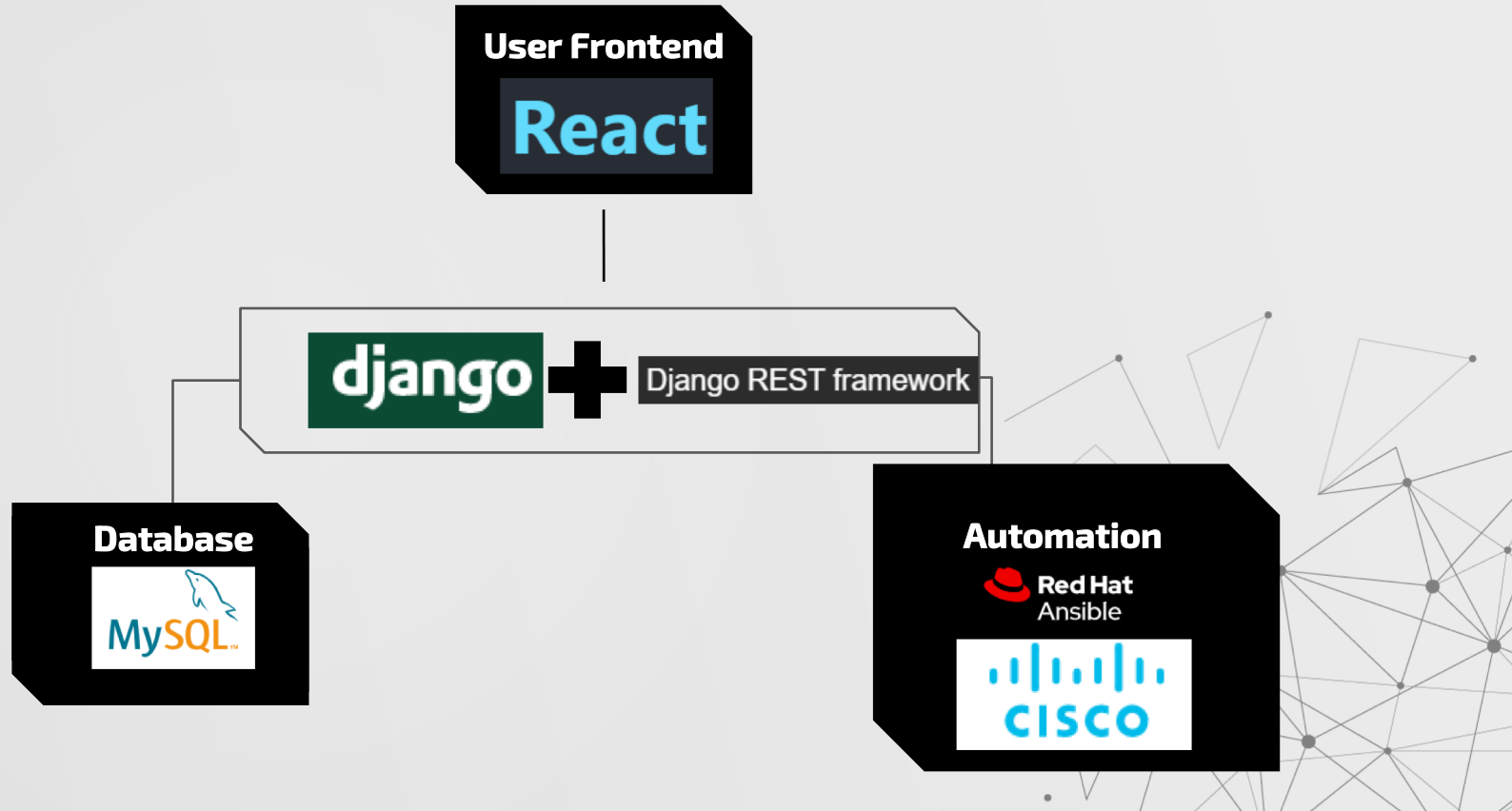
System Architecture: simpleiot.nus.edu.sg



System Architecture: simpleiot.nus.edu.sg



Core Implementation and rationale



03

Challenges Faced



Challenges

Complexity of Project

Adapting to New Software



Internal Security Protocols





04

Project Outcomes

Project Outcomes

Scalable Automation Platform

IoT Provision Process
Redefined and can
be achieved instantly

Operation Efficiency

Engineers can perform
more higher value tasks

Better User Experience

Improve the user
Experience by reducing
the turnaround time

The background features a complex network of thin grey lines connecting various-sized dark grey circular nodes. These nodes are scattered across the frame, with a higher concentration in the upper right and lower right areas, creating a web-like or molecular structure. The overall aesthetic is minimalist and technical.

05

Demo



06

Further Improvements & Conclusion



Key Improvements

More automation features could be added, such that network administrators need not set up the initial Authorisation Profile in Cisco ISE

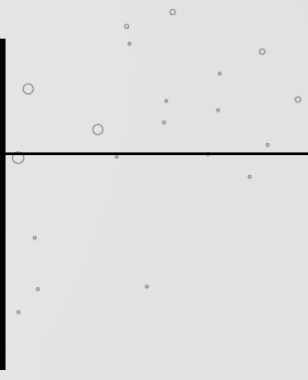
Higher Automation

Dashboard interface can be more fully flushed out. This would provide a more seamless user experience for researchers and network administrators.

UI/UX

Enable the users in the allowed list to login using their NUSNET credentials

Login integrations with AD



Final thoughts

Rewarding

This was truly a rewarding project to be part of.

Interesting

We learnt a great deal of new skills, such as deployment and working with RESTful APIs.

Independance

Doing things on my own is ok, but it is also okay to ask for help.

A high-contrast, black and white photograph of a computer circuit board. The image is a close-up, focusing on a central integrated circuit (chip) which is a dark, square component with a grid of pins. To the right of the chip, there is a connector with several vertical pins. The background shows various other components of the board, including what appears to be a keyboard connector on the right and various traces and components on the left. The lighting creates strong highlights and shadows, emphasizing the textures and shapes of the hardware.

Questions?