
AWS
re:Invent
NOV. 28 – DEC. 2, 2022 | LAS VEGAS, NV

DEI301

Equity in smart cities and transport

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University of Melbourne

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University of Melbourne

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Agenda

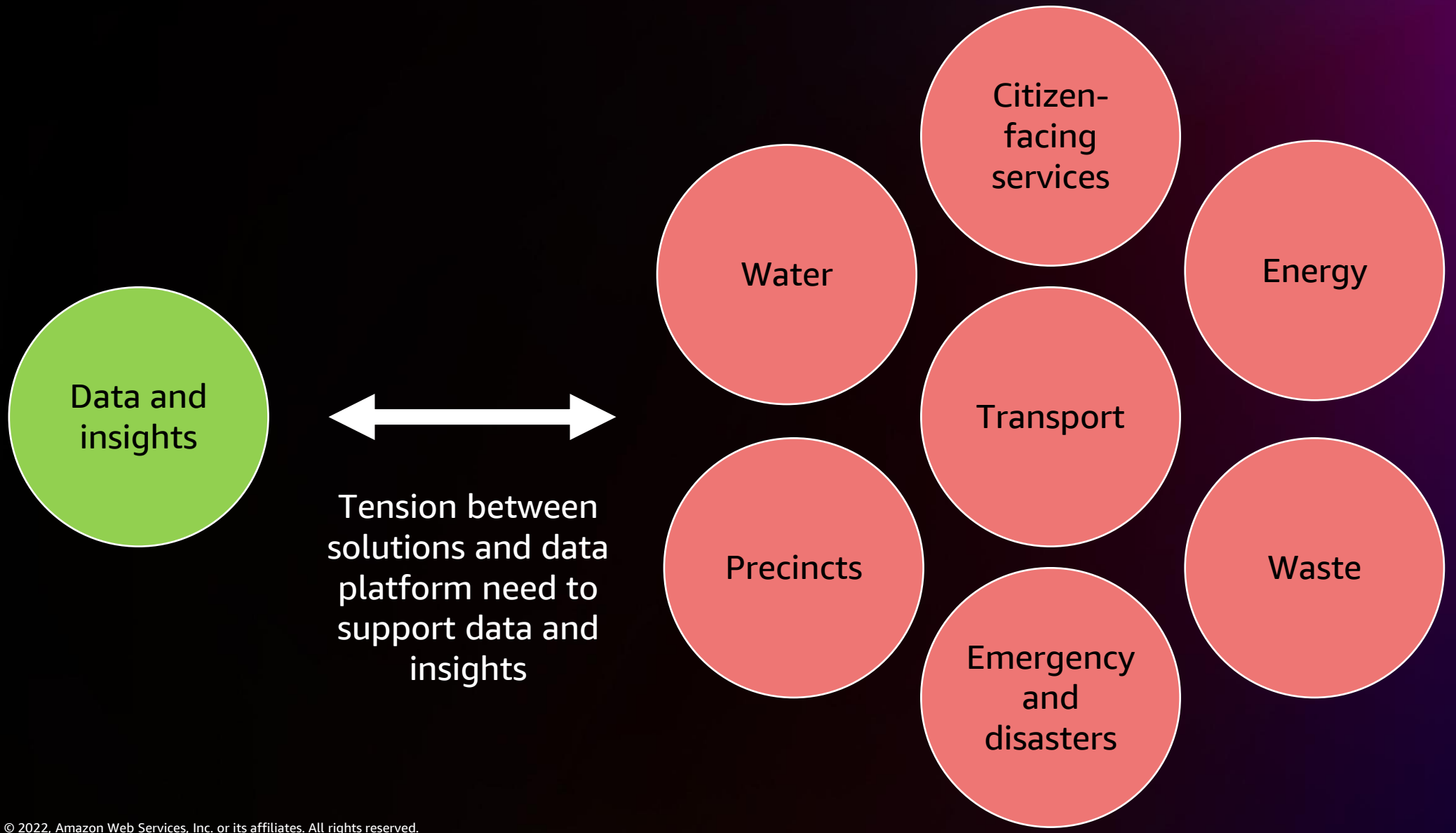
Transforming society with technology

Inclusivity and accessibility for citizens in smart cities:

- Idea 11 – Australian Smart City Project
- Smart campus design at the University of Melbourne
- The Bus Shelter & See Me Project

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Transforming society with technology



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AWS smart city competency

Best-in-class AWS Partners with proven customer success and deep technical knowledge across smart city areas: urban data platforms & insights, urban infrastructure, and citizen services.

Identify



- Customers can easily identify a shortlist of offerings on AWS Partner Solution Finder on a desired smart city area, be it water, lighting, or citizen engagement, to name a few

Validate



- AWS solutions architects validate these offerings following best delivery practices and sound architecture

Promote



- AWS provides resources to showcases these offerings to customers, partners, and sales teams. AWS also builds a community of partners for collaboration

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Empowering data-driven urban planning with big data and analytics

Place Intelligence | CAMPBELLTOWN CITY COUNCIL

Read the case study

Place Intelligence, an AWS Smart City Partner based in Australia, provided Campbelltown City Council with location intelligence services to understand how the city functions and support decision-making that's backed up by data

Place Intelligence's solution uses Amazon S3 with Amazon Glacier for storing and archiving big datasets, Amazon WorkSpaces to power remote teams, and Amazon EC2 for highly scalable, on-demand computing

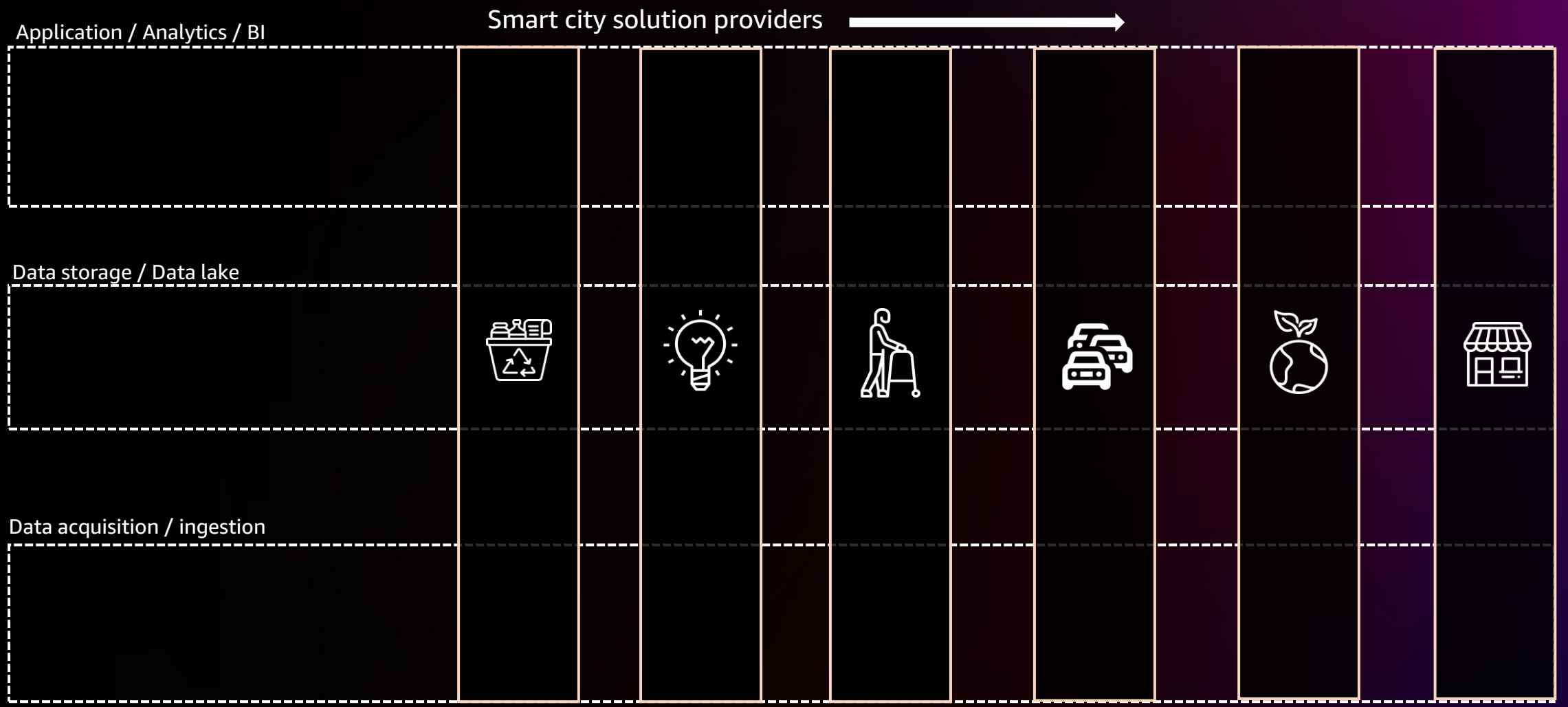
The solution has helped the city council track the success metrics of the City Council Activation Program, as well as carry out effective urban planning backed by data-driven decisions



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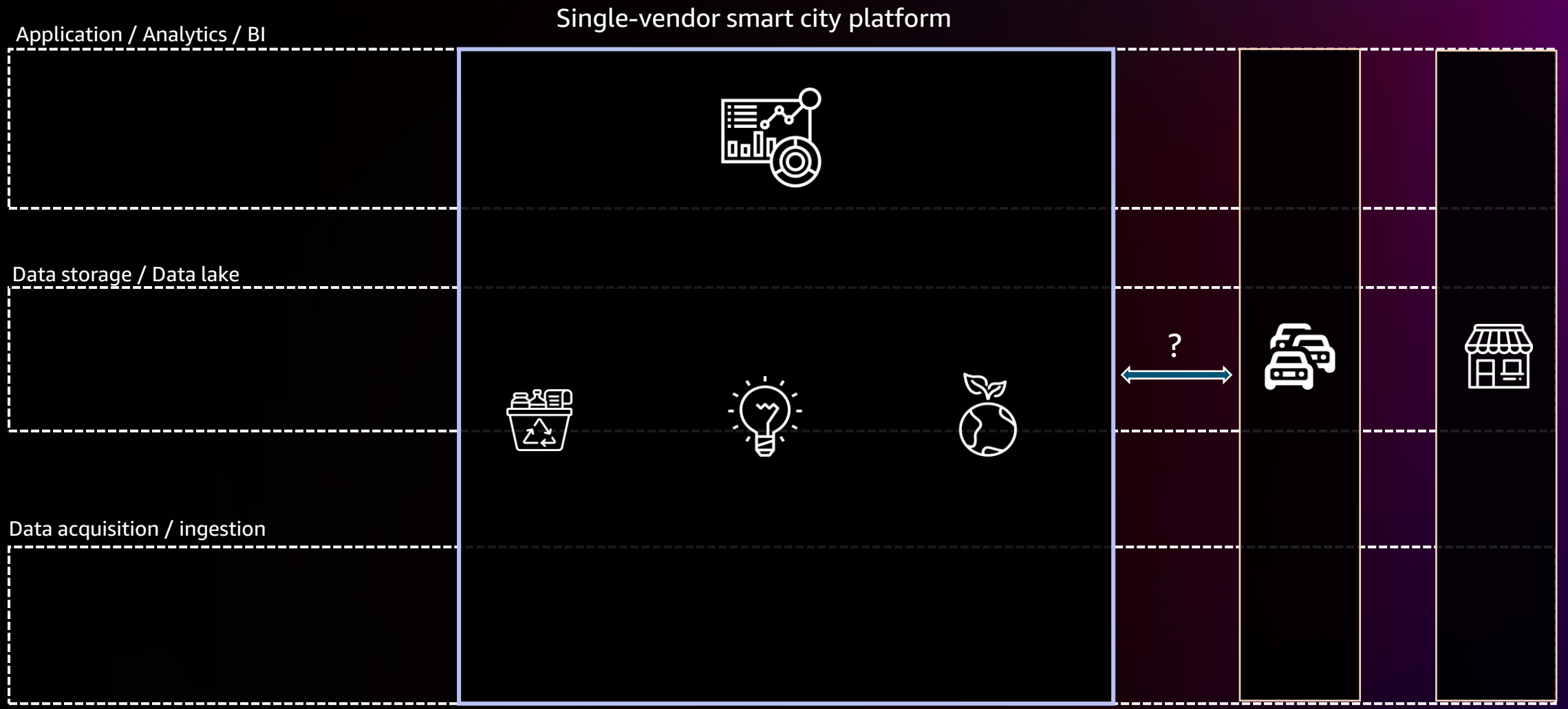
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Share data... break down silos



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Share data... break down silos



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Smart Data Models

A GLOBAL PROGRAM LED BY

FIWARE IUDX OPEN & AGILE SMART CITIES tmforum

"Smart Data Models is a collaborative initiative to provide multisector agile standardized free and open-licensed data models based on actual use cases and adopted open standards"

https://smartdatamodels.org/

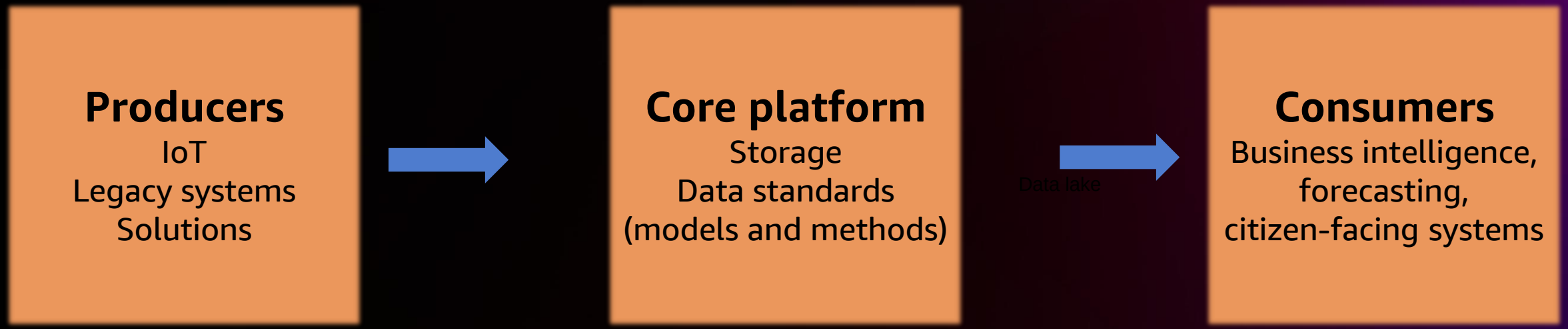
+700 data models compliant with NGSI

in 12 domains

Smart parking | Air quality | Noise pollution | Devices - sensors | Weather monitoring | Traffic monitoring | Waste management | Smart lighting

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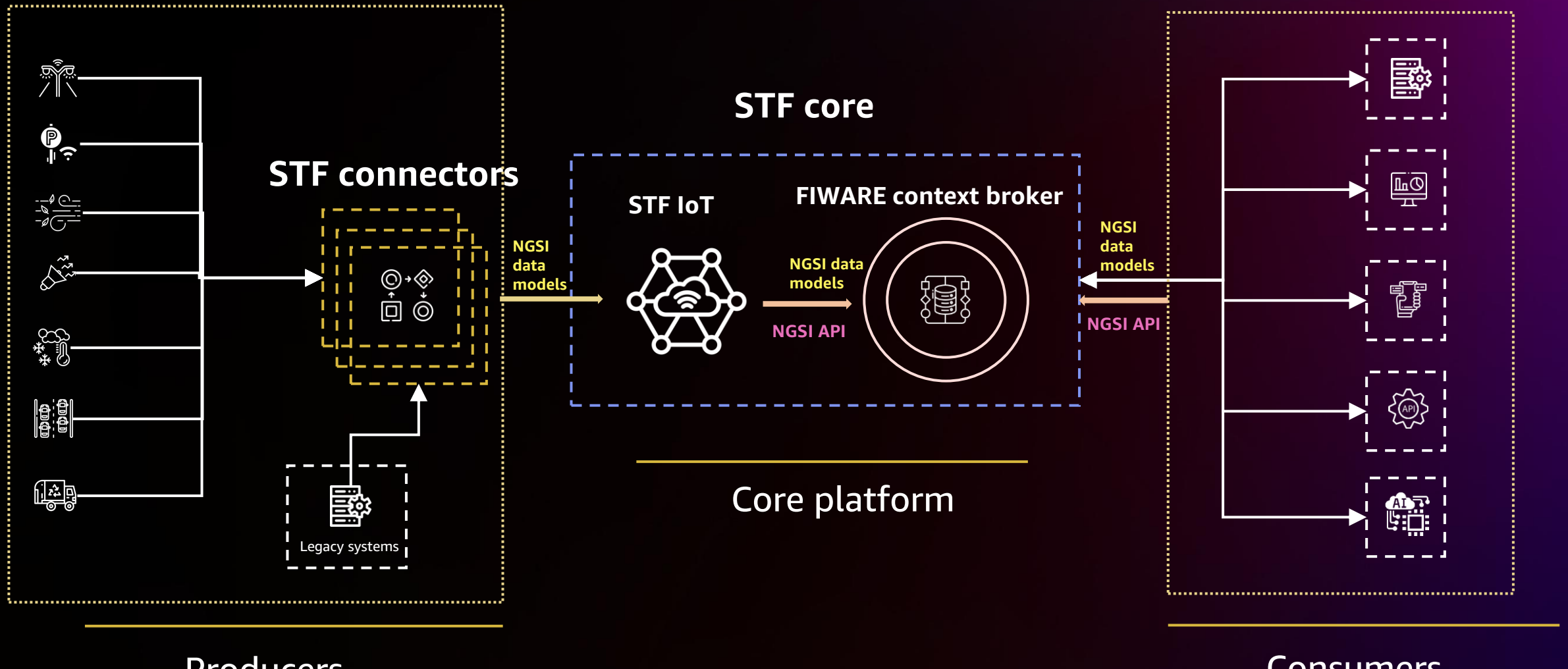
Smart city platform



aws Partner Network

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Smart territory framework



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https://github.com/aws-samples/aws-stf

Transforming society

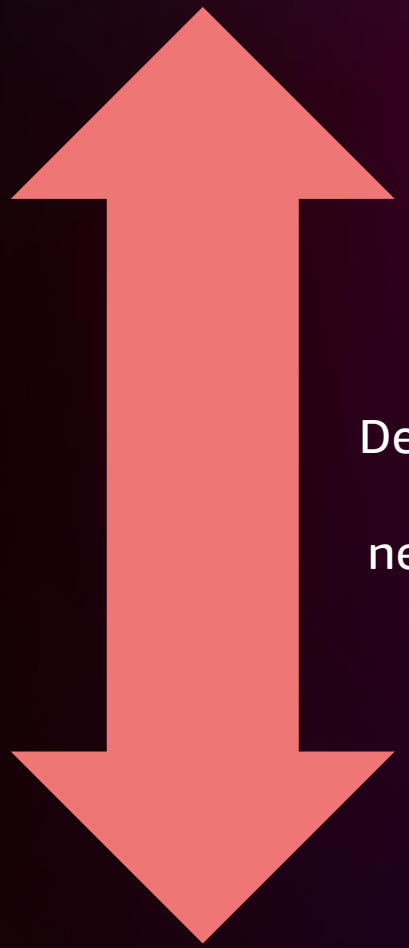
Make better decisions, faster

Respond better to the unexpected

Create better citizen experience

Uncover new opportunities

Improve efficiency



Democratize access
to
networks and data

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AWS Partner Idea 11 – Australian Smart City Project



idea 11

- Public safety
- Waste and recycling
- Energy
- Lighting control
- Sustainability
- Building automation
- Parking meters
- Disaster management

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Inclusivity for citizens in smart cities



Hello Sunday Morning is bringing the health support community online

Scaled to 35,000 weekly active users at no extra cost

We Care is delivering essential mental health support to those unable to visit in person

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Accessibility for citizens in smart cities

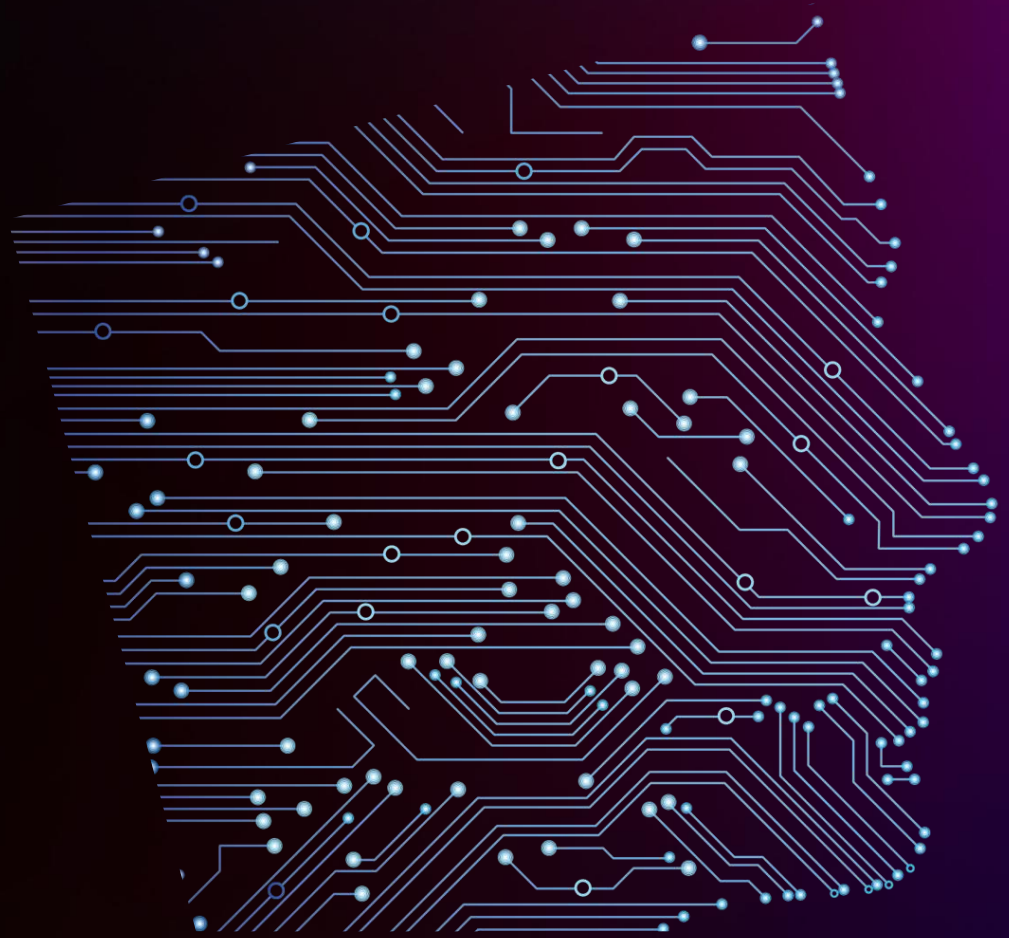


JioVio brings personalised and predictive healthcare to rural residents

The City of Sabae is using AWS to provide information to and receive information from more citizens

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Smart campus



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University of Melbourne

 # 1
in Australia

 # 34
in the world

 # 8
in graduate employability worldwide

54 000+ students
51% undergraduate
49% graduate

430 000+
living alumni

40%
international students
from 150 nationalities

24%
of undergraduates
undertook an international experience

$500
million
in research income

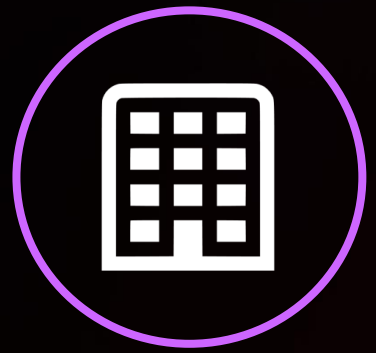


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Smart campus focus areas



Campus operations



Estate planning



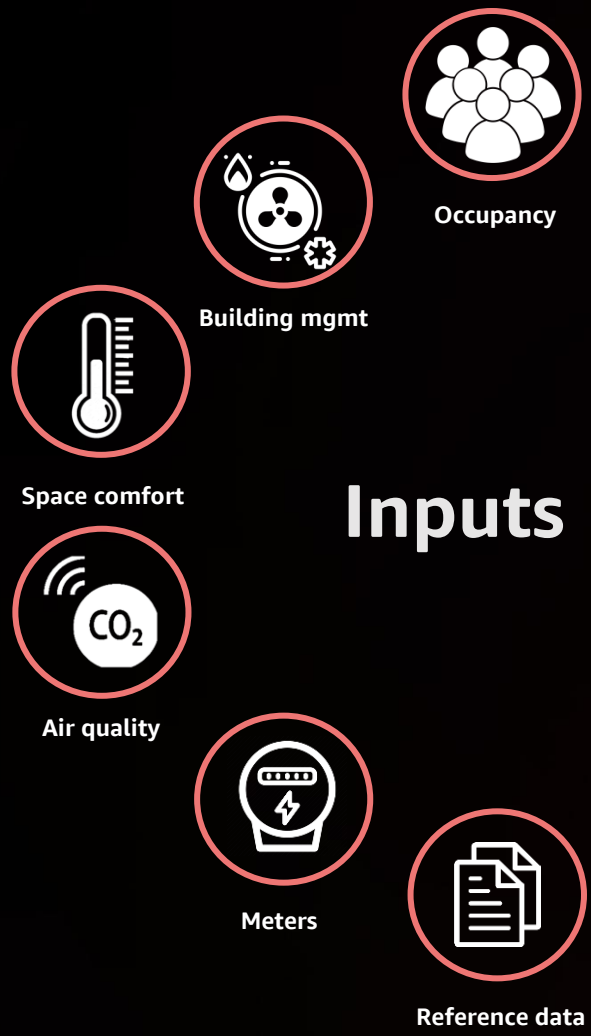
Campus experience



Sustainable campus

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UoM smart campus



Inputs

University of Melbourne

Smart Campus Platform

THE UNIVERSITY OF MELBOURNE

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Outputs



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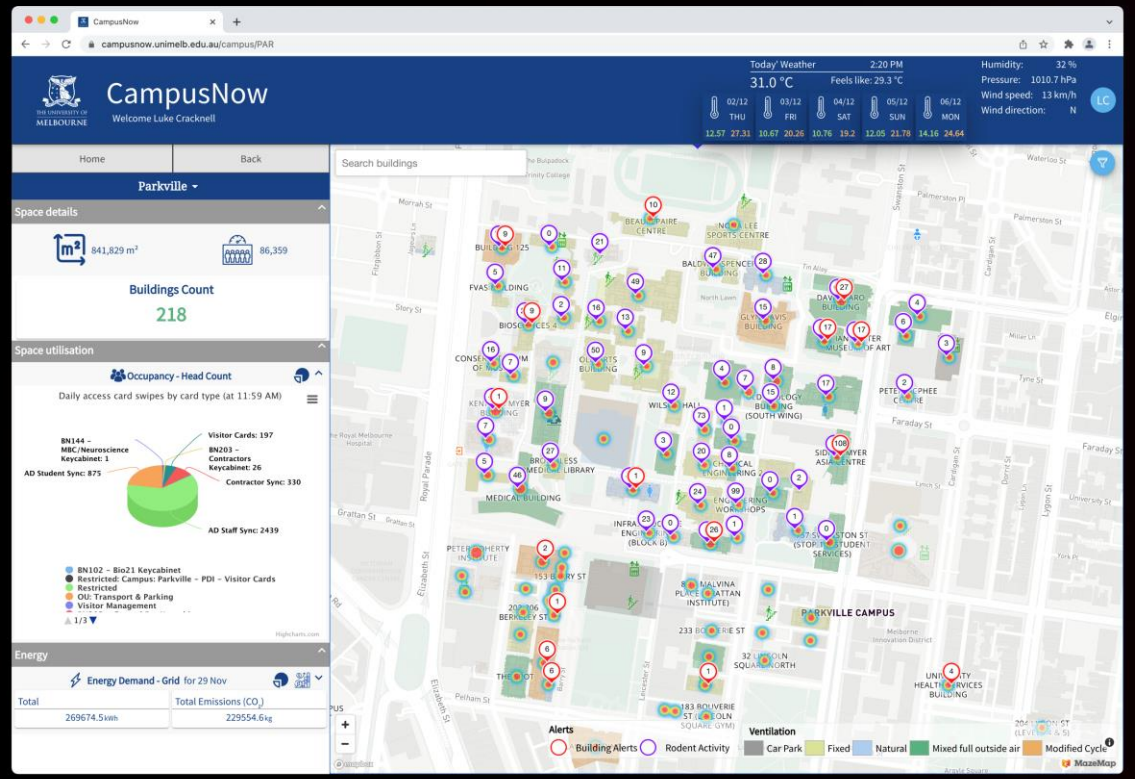
UoM smart campus

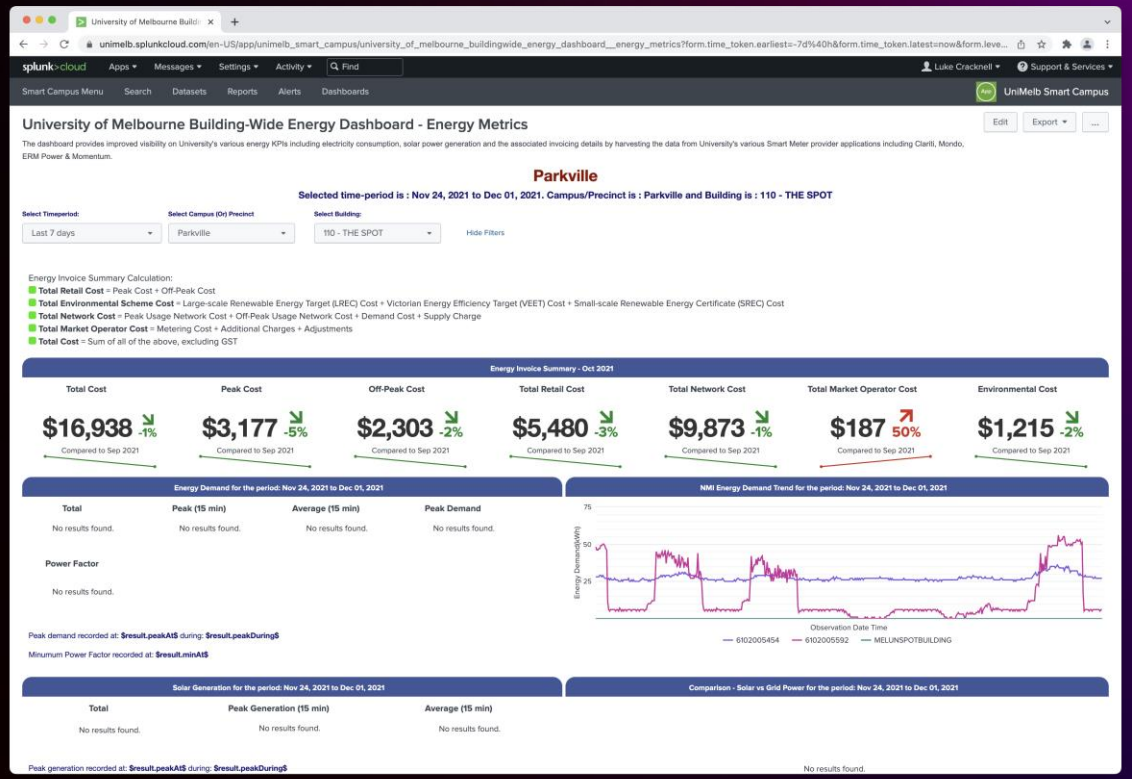
We support a wide **spectrum** of users, each with distinct requirements and abilities



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Smart campus visualization and reporting



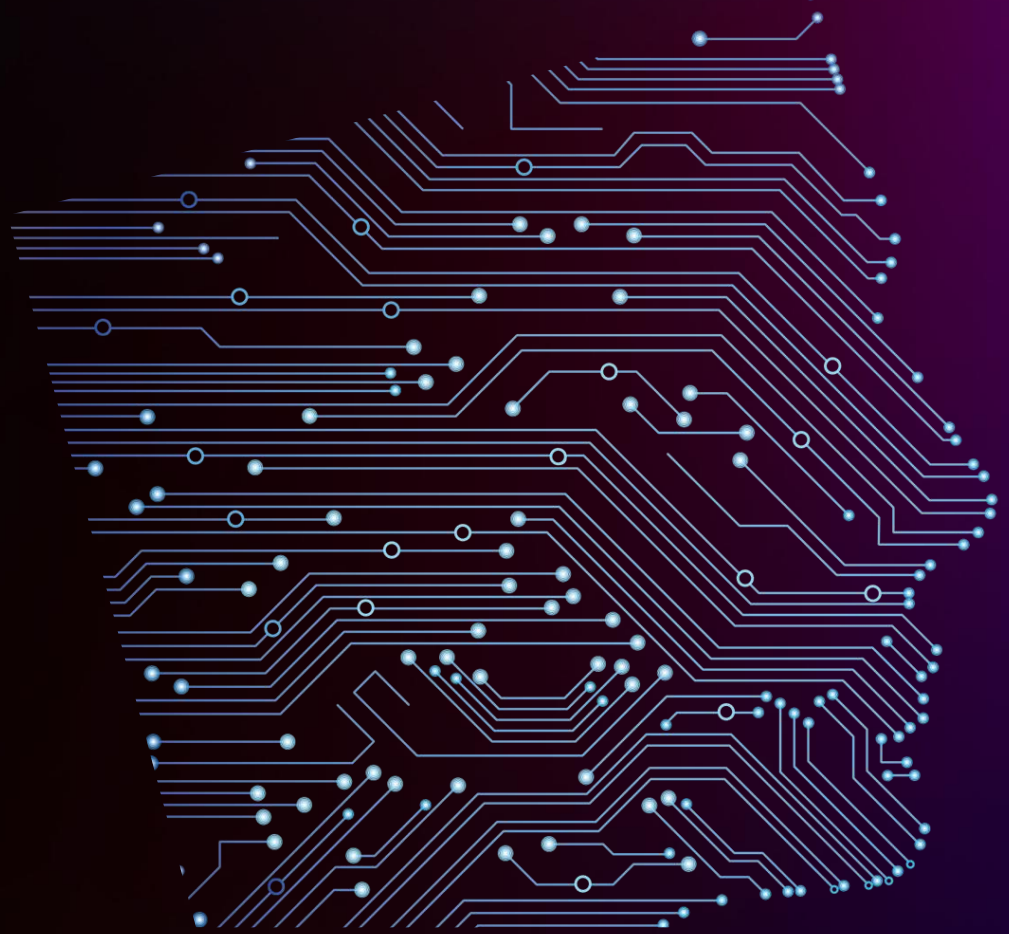


CampusNow
real-time view

Smart campus splunk dashboards
historical reporting

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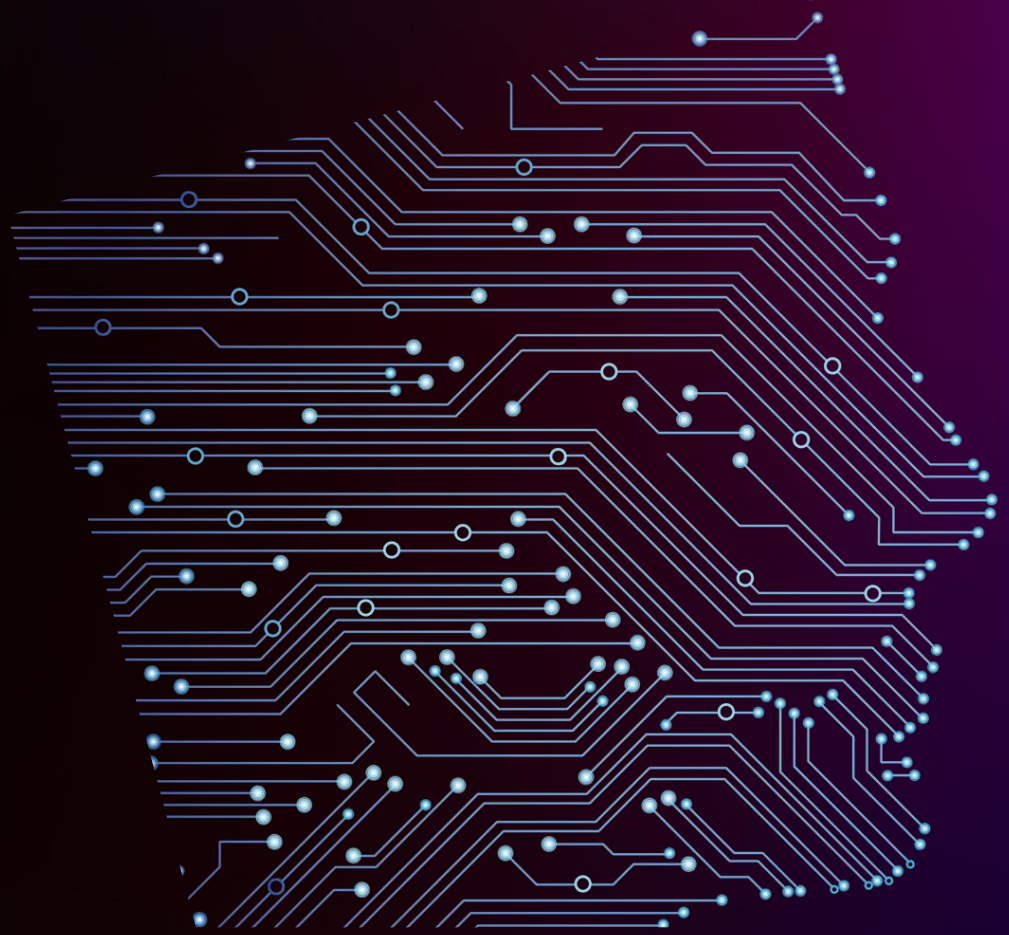
Use case examples



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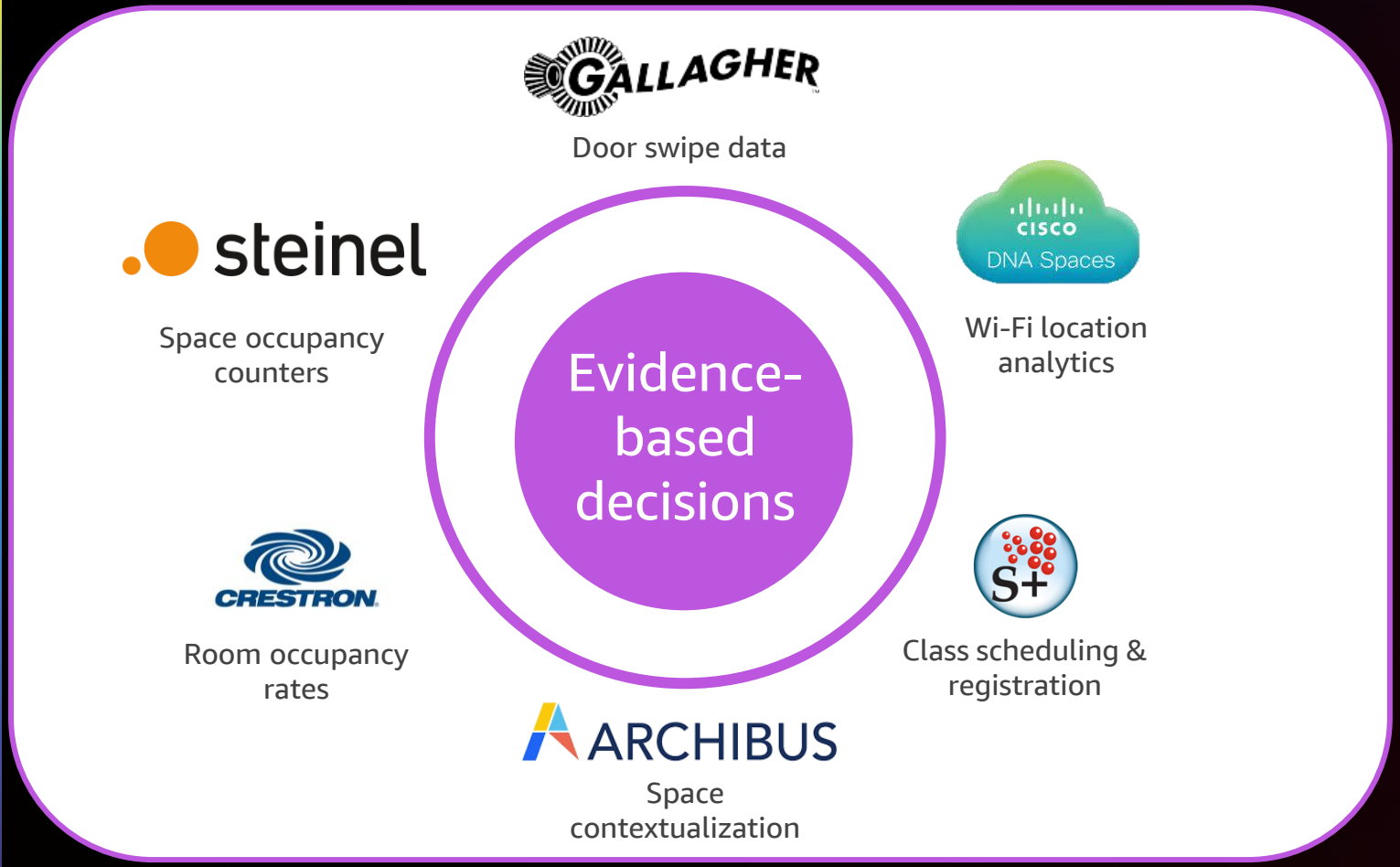
Use case examples

Estate planning



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Estate planning



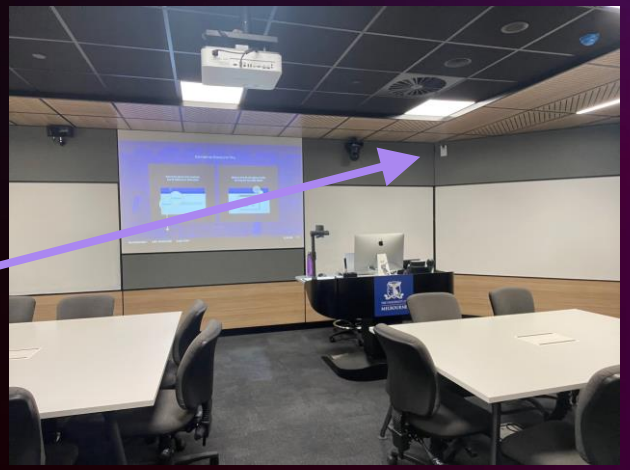
- **Sensor fleet**
- **System integrations**
- **Contextualization**
- **Reporting**

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Estate planning

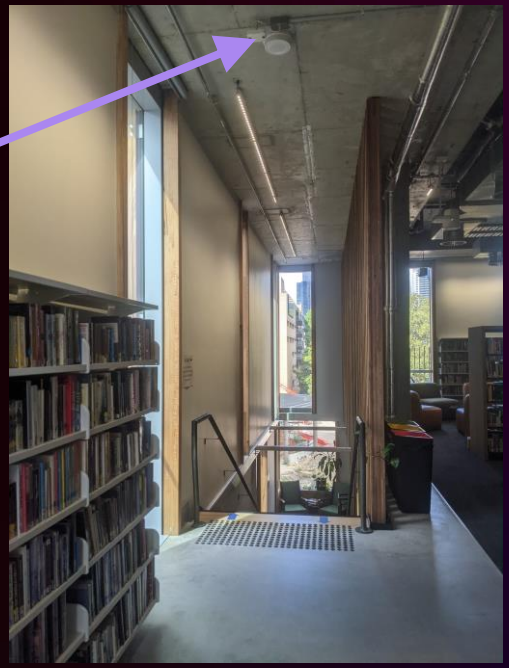
steinel





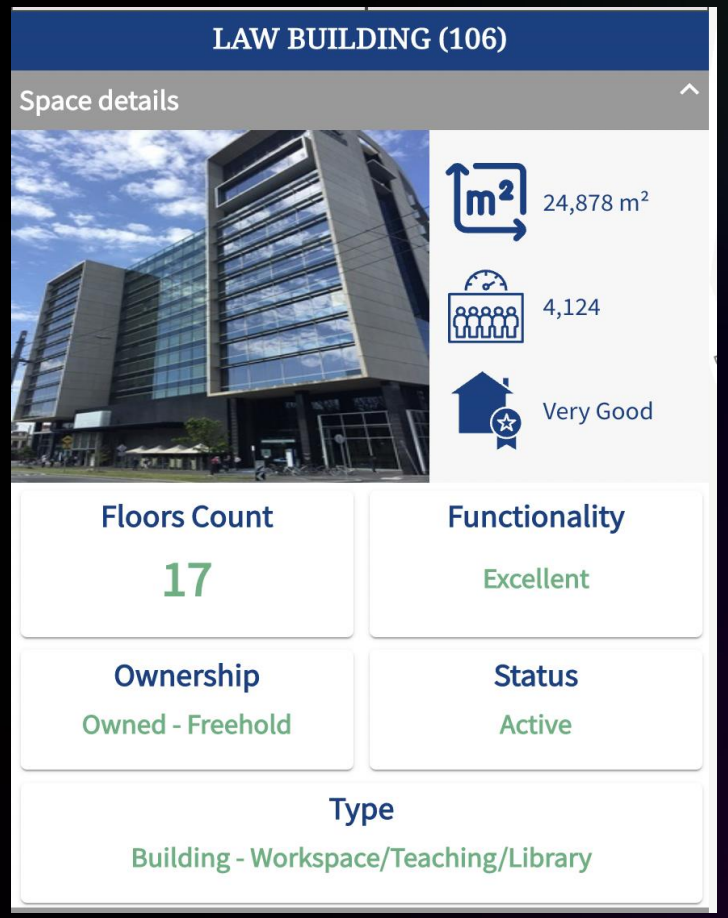
XOVIS



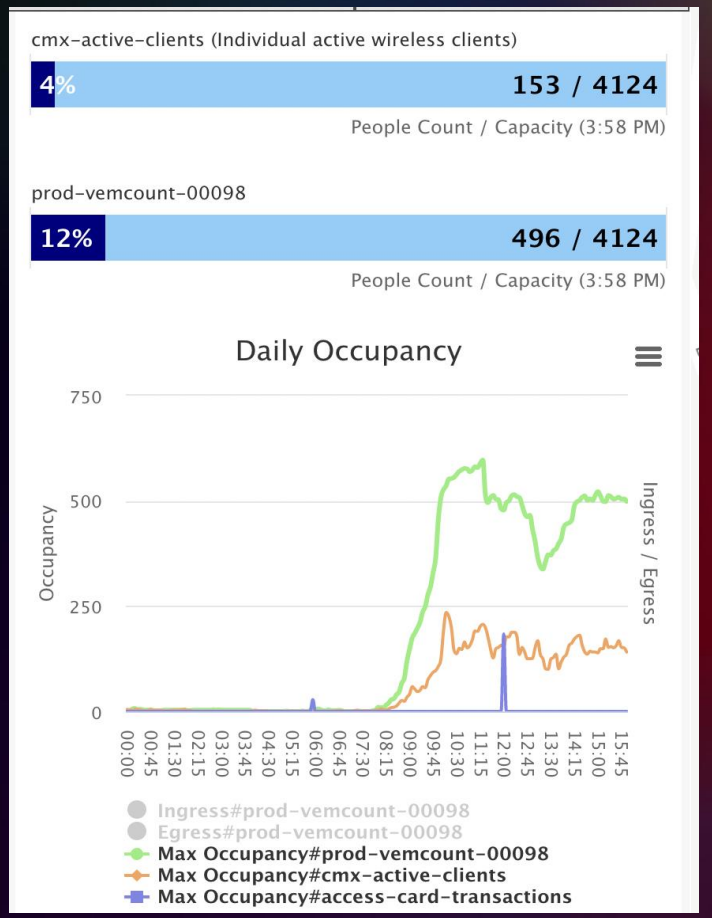


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Estate planning – Space utilization



Building reference data



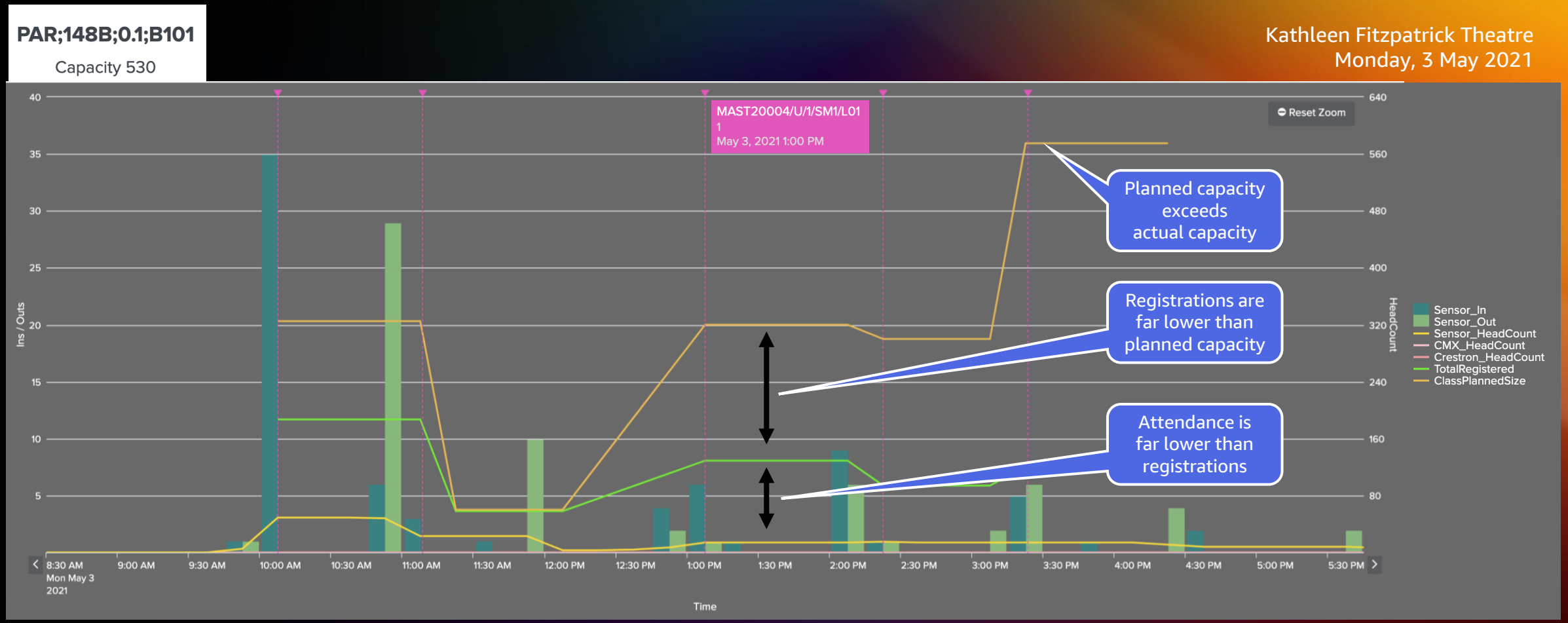
Real-time occupancy + recent history



Busy times; modelled based on historical data

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Estate planning – Space utilization



Sensor data is automatically contextualized against other enterprise datasets, including location data (Archibus), class timetabling data (Syllabus Plus), and class registration data (Allocate Plus), to identify underutilization of spaces

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Estate planning



Benefits

Improved **efficiencies** in the use of space

Are our spaces meeting the needs of a **diverse community** of students?

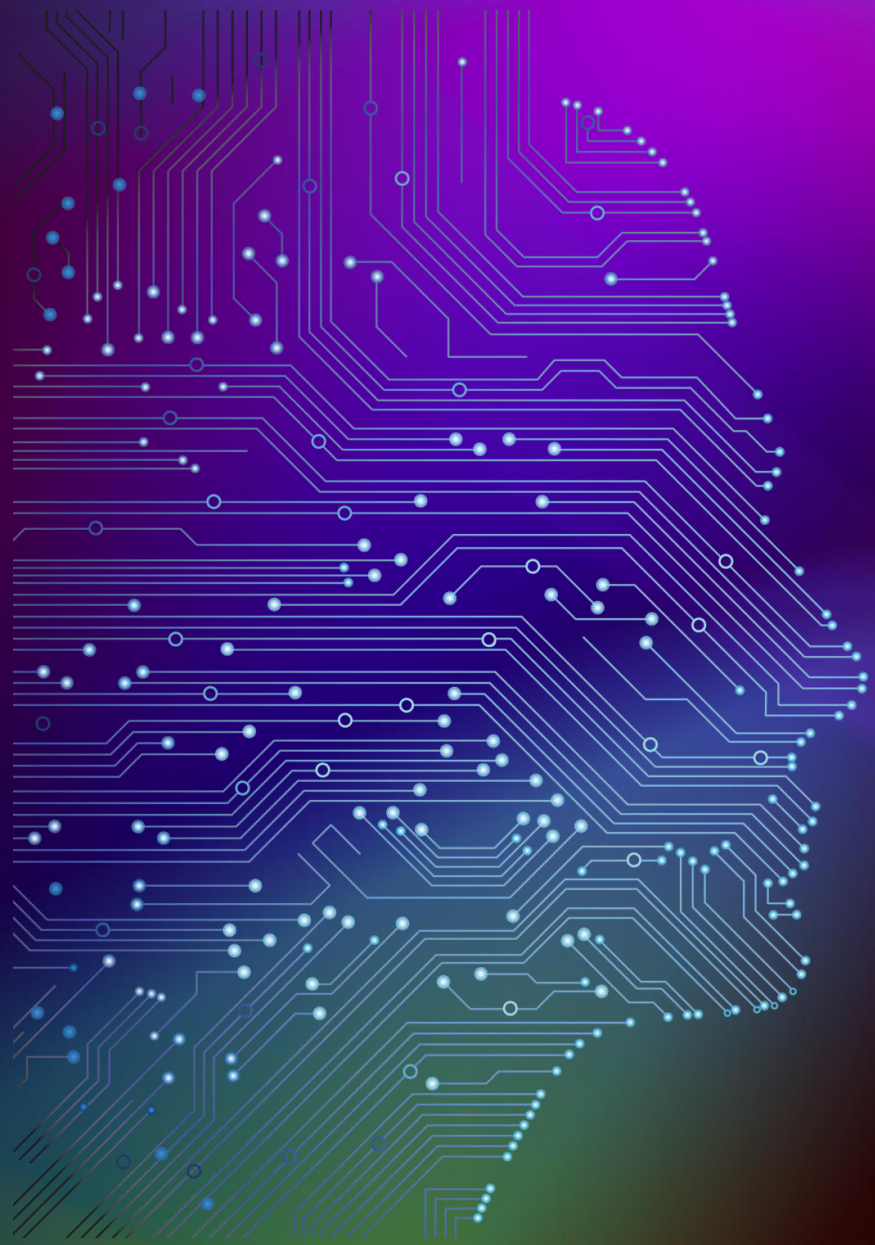
Data-driven maintenance scheduling for clean, **safe** spaces

Evidence-based capital investments

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A safe post-COVID return to campus



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A safe return to campus

Develop ventilation best practices

University academics + Campus management

CO_2 data

Door swipe data

QR code

Building mgmt System

Class scheduling
Class registration

Space contextualization

Smart Campus

THE UNIVERSITY OF MELBOURNE

University Public Health Network team

Contact tracing

Building occupancy reporting

Campus management

Instant notifications

Air quality reporting

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A safe return to campus – Sensor data



- CO2 sensor
- Temperature sensor
- Humidity sensor
- Light sensor
- Motion detection sensor (PIR)

ELSYS

LoRaWAN®

THE THINGS NETWORK

MESHED

Buildings
415

Teaching Spaces
850+

Total Sensors
~2.5k

LoRaWAN

BMS integration

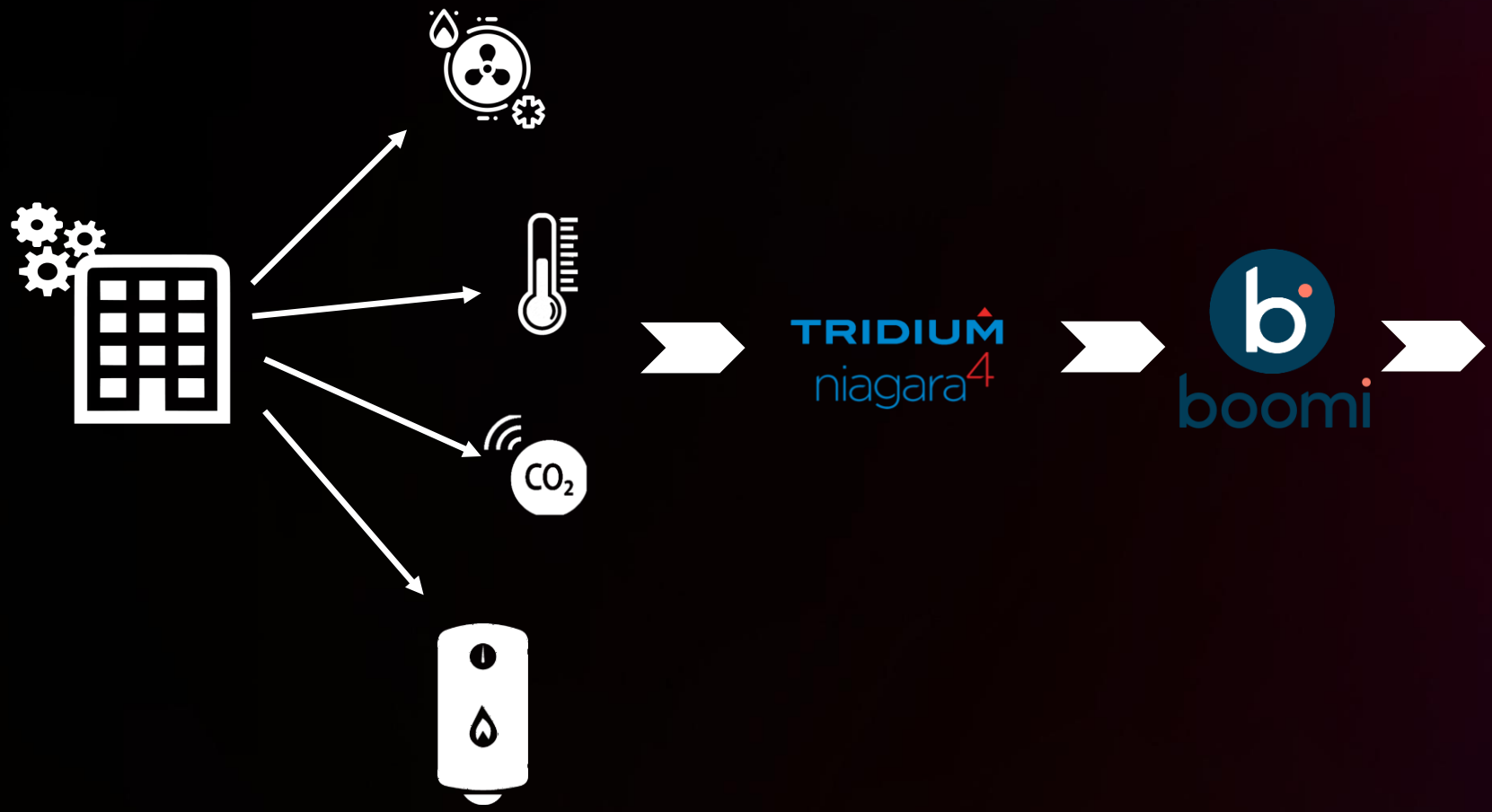
Contextualization

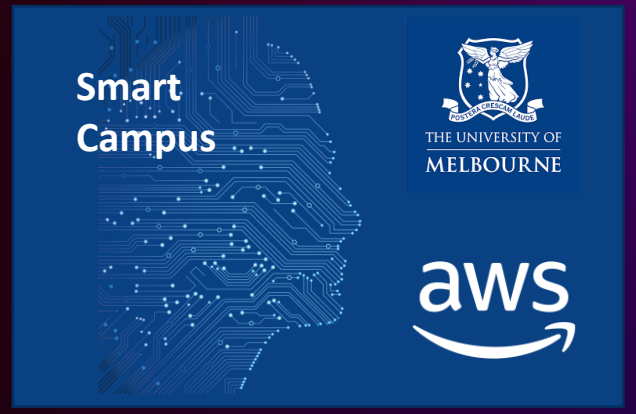
Reporting

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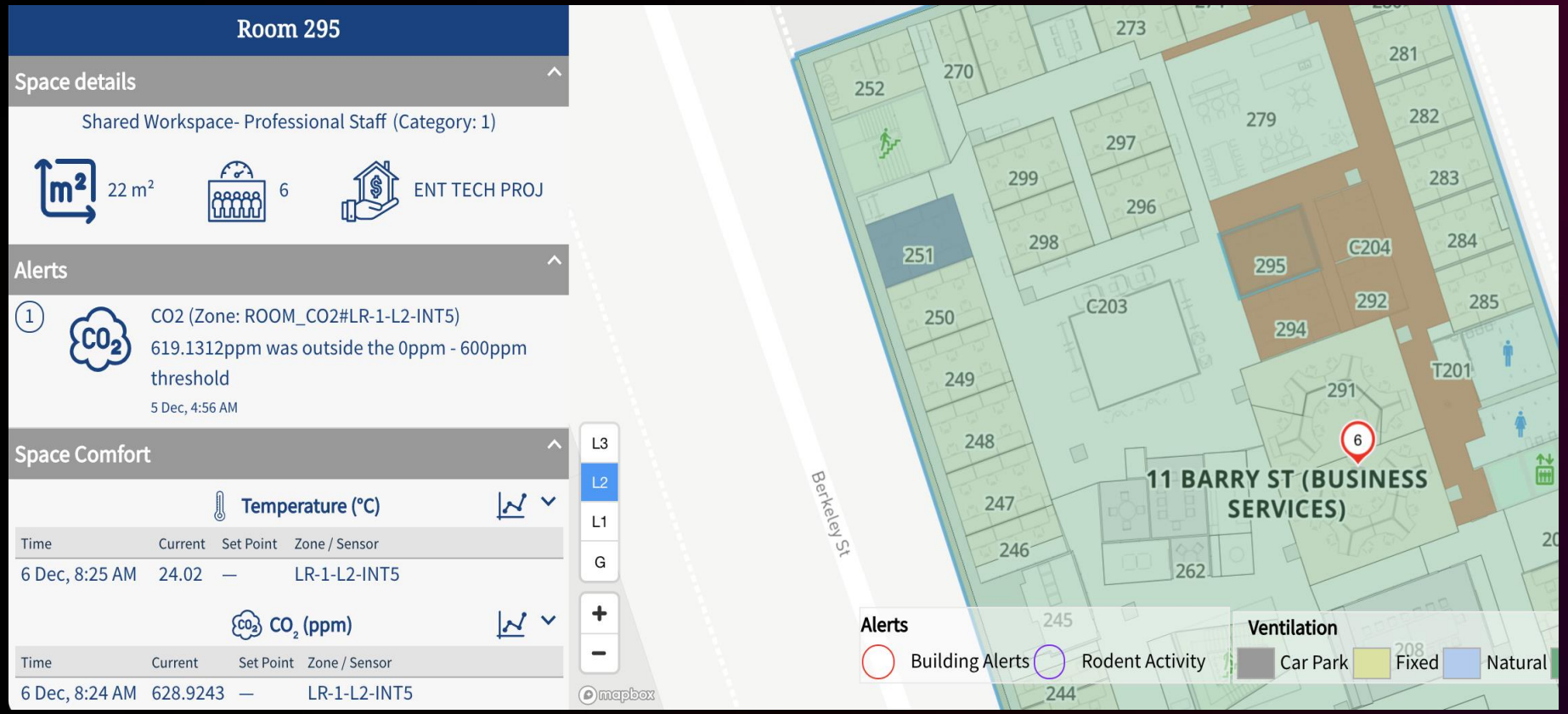
A safe return to campus – BMS data





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A safe return to campus



Real-time view of air quality and alerts via the CampusNow web app

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A safe return to campus



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A safe return to campus



DateTime	LocationCode	value	sensorName	sensorType	Description	Severity	Campus	Building	BuildingCode
2022-08-01 06:30	PAR;192;3	Abnormal	AHU_1	BMS	CO2 (Zone: ROOM_CO2#AHU_1) 628.7596ppm was outside the 0ppm - 600ppm threshold	LOW	PAR	192	PAR;192
2022-08-01 06:30	PAR;261;0;G31	Abnormal	FCU_5	BMS	CO2 (Zone: ROOM_CO2_LEVEL#FCU_5) 1597ppm was outside the 0ppm - 600ppm threshold	SEVERE	PAR	261	PAR;261
2022-08-01 06:25	STH;862;0;103	Abnormal	ers-co2-000645	LORAWAN	CO2 (Zone: ROOM_CO2#ers-co2-000645) 786ppm was outside the 0ppm - 600ppm threshold	LOW	STH	862	STH;862
2022-08-01 06:05	PAR;266;2;C204	Abnormal	LR-1-L2-INT5	BMS	CO2 (Zone: ROOM_CO2#LR-1-L2-INT5) 666.5513ppm was outside the 0ppm - 600ppm threshold	LOW	PAR	266	PAR;266
2022-08-01 00:55	PAR;110;2;2013	Abnormal	ers-co2-000181	LORAWAN	CO2 (Zone: ROOM_CO2#ers-co2-000181) 607ppm was outside the 0ppm - 600ppm threshold	LOW	PAR	110	PAR;110
2022-08-01 00:55	PAR;133;2;241	Abnormal	ers-co2-000500	LORAWAN	CO2 (Zone: ROOM_CO2#ers-co2-000500) 606ppm was outside the 0ppm - 600ppm threshold	LOW	PAR	133	PAR;133
2022-07-31 23:50	STH;862;4;415	Abnormal	ers-co2-000819	LORAWAN	CO2 (Zone: ROOM_CO2#ers-co2-000819) 607ppm was outside the 0ppm - 600ppm threshold	LOW	STH	862	STH;862
2022-07-31 22:35	STH;862;0;113	Abnormal	ers-co2-000024	LORAWAN	CO2 (Zone: ROOM_CO2#ers-co2-000024) 606ppm was outside the 0ppm - 600ppm threshold	LOW	STH	862	STH;862
2022-07-31 22:15	STH;862;4;413	Abnormal	ers-co2-000826	LORAWAN	CO2 (Zone: ROOM_CO2#ers-co2-000826) 646ppm was outside the 0ppm - 600ppm threshold	LOW	STH	862	STH;862
2022-07-31 22:05	PAR;263;2;216	Abnormal	ers-co2-000251	LORAWAN	CO2 (Zone: ROOM_CO2#ers-co2-000251) 65515ppm was outside the 0ppm - 600ppm threshold	SEVERE	PAR	263	PAR;263
2022-07-31	PAR;110;2;2019	Abnormal	ers-co2-	LORAWAN	CO2 (Zone: ROOM_CO2#ers-co2-000186) 606ppm was outside the 0ppm - 600ppm	LOW	PAR	110	PAR;110

Alerts

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A safe return to campus

Benefits

Multidisciplinary initiative; IT staff, facilities management & UoM researchers

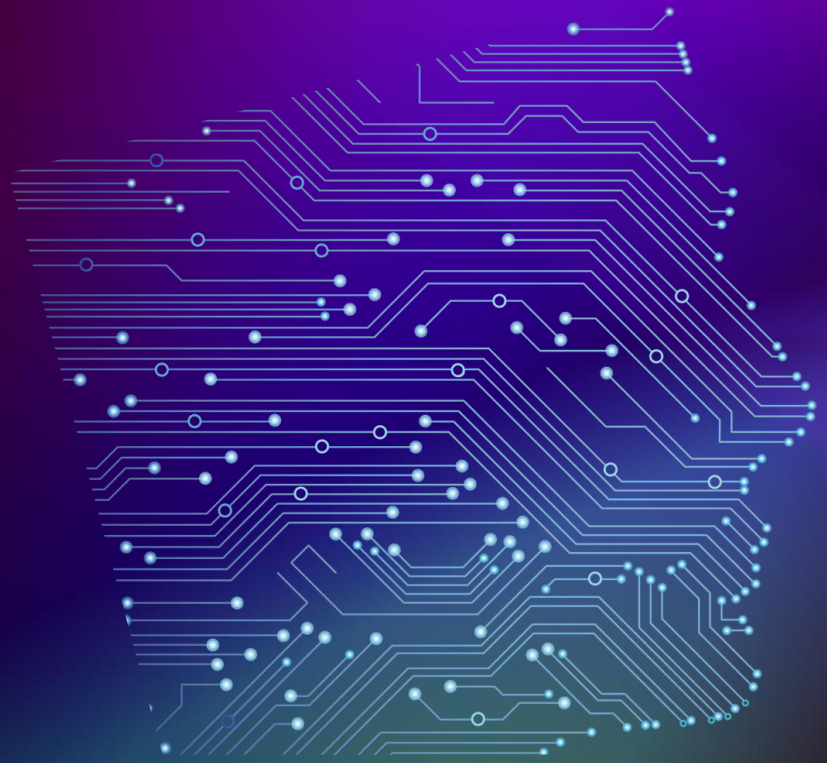
QR-based contact tracing in place well **before** state-wide government roll-out

Proactive air quality interventions in teaching & learning spaces

Quantitative evidence of safe and inclusive learning spaces, support a return to campus

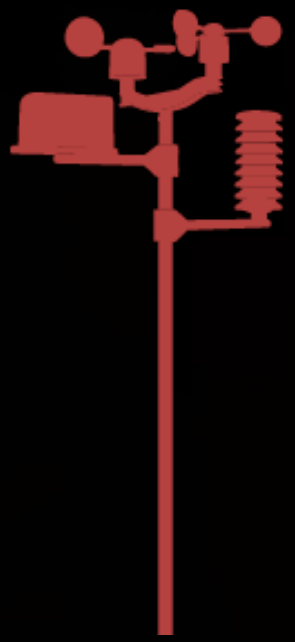
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Open accessible data



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Inclusive data – Open Geospatial Consortium (OGC)



Procedure

Feature of interest

Phenomenon time

Observed property

Result

Unit of measurement

O&M Data Model (OGC and ISO 19156:2011(E))

```
{
  "id":"davis123-1549109700000",
  "procedure":{"href":"davis123.json"},
  "featureOfInterest":{"href":"PAR-106-1-GM15"},
  "phenomenonTime":{"instant":"2023-02-
02T00:15:00.000Z"},
  "resultTime":"2023-02-02T00:15:00+0000",
  "member":
  [
    {"href":"DataStandards&ModelsWeather"},
    {
      "id":"Temp-1549109700000",
      "type":"Measurement",
      "observedProperty":{"href":"Temperature"},
      "result":{"value":54,"uom":"DegreesCelceius"}
    },
    {
    "id":"Humidityt-1549109700000",
    "type":"Measurement",
     "observedProperty":{"href":"Humidity"},
     "result":{"value":54,"uom":"Percent"},
    }
  ]
}
```

Open Geospatial Consortium

Data ecosystem: OGC observations & measurements (O&M) model

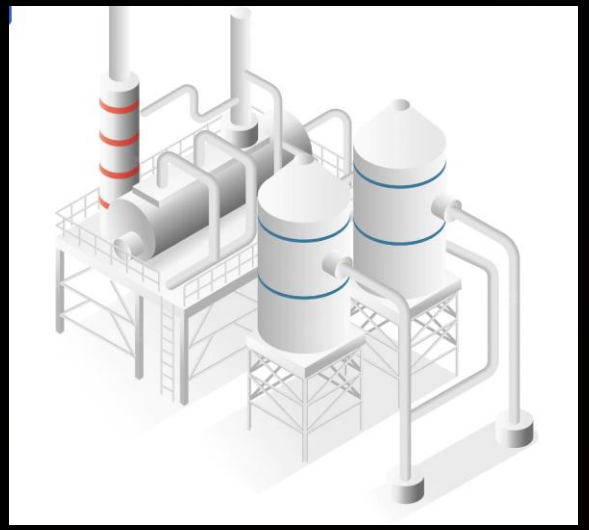
Open standard supporting geospatial & IoT data and communities

Single schema to enhance data interoperability between parties & systems

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Inclusive data – Project haystack



Ontology

Data Types

File Types

HTTP API

Semantic data

Site

Space

Physical asset

Data point

IoT device

Weather

Project Haystack

Fixed, general data types called **kinds**; facilitates interoperable exchange of data

Extensible, open standard well suited to building management system (BMS) data sets

Standard for BMS data at UoM and with its service providers.

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Open data ecosystem



Benefits

Using open data standards brings **inclusive access** and interoperability to our data

LoRaWAN **accessible** to students, researchers, and other members of our community

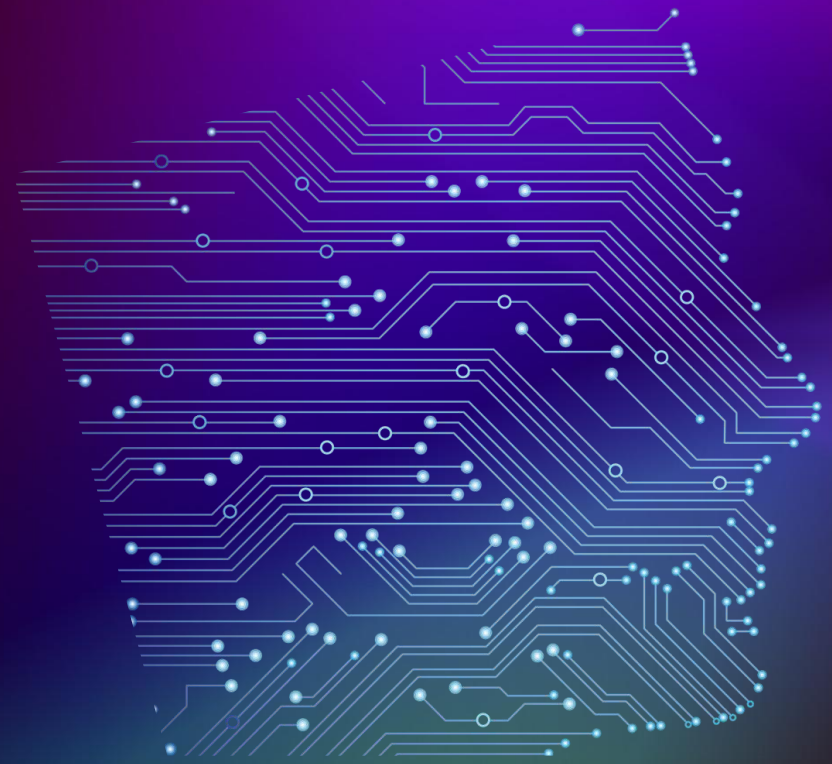
Standard and published APIs and integrations, further aid in inclusive and open access

Doubles as an operational resource and well as a teaching & learning resource

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Supporting infrastructure



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Our technology stack



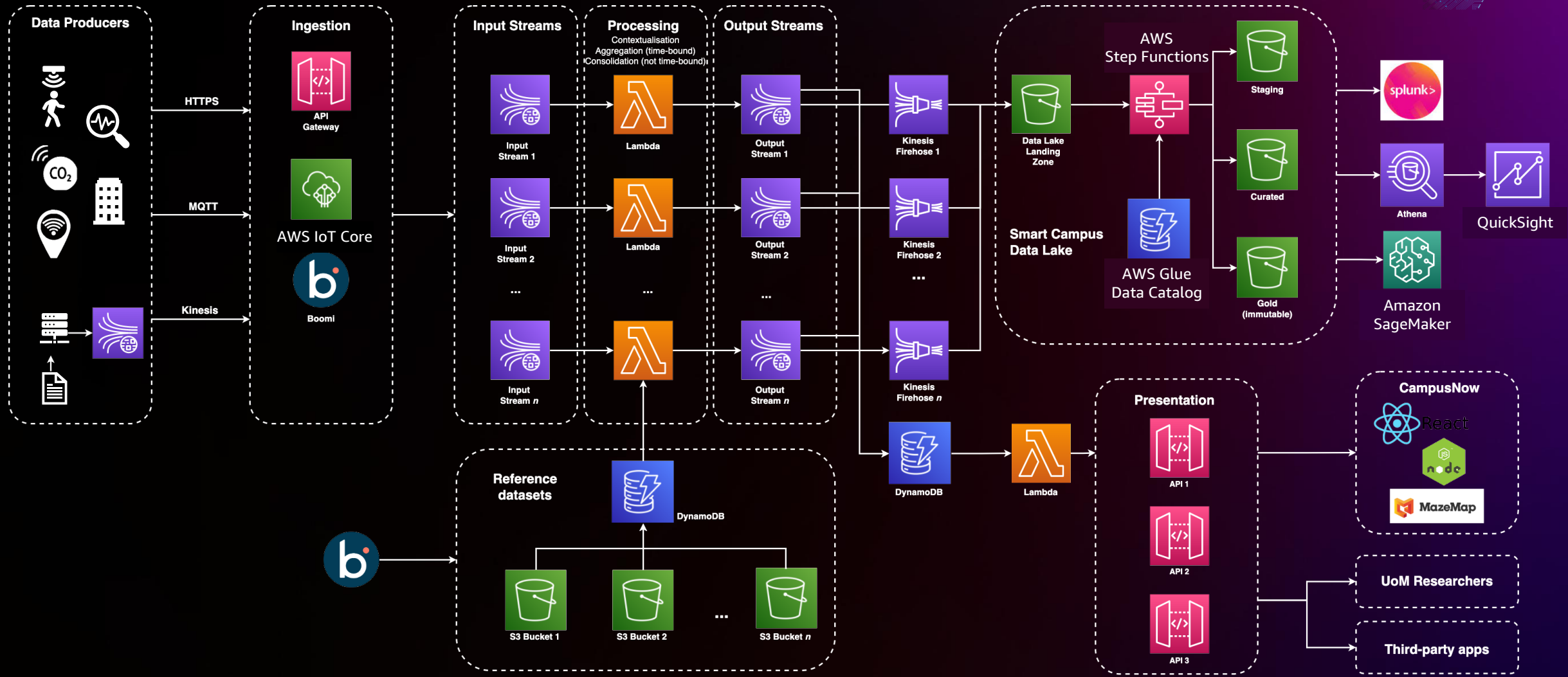
Data direction

1. Acquisition	2. Ingestion	3. ETL	4. Analytics	5. Visualization
LoRaWAN, Wi Fi, CO_2, API	AWS IoT Core, Amazon Kinesis Data Firehose, Amazon API Gateway, boomi	AWS Lambda, Amazon S3, Amazon DynamoDB	Amazon Athena, python, scikit learn, NumPy	Amazon QuickSight, React, splunk>, node JS

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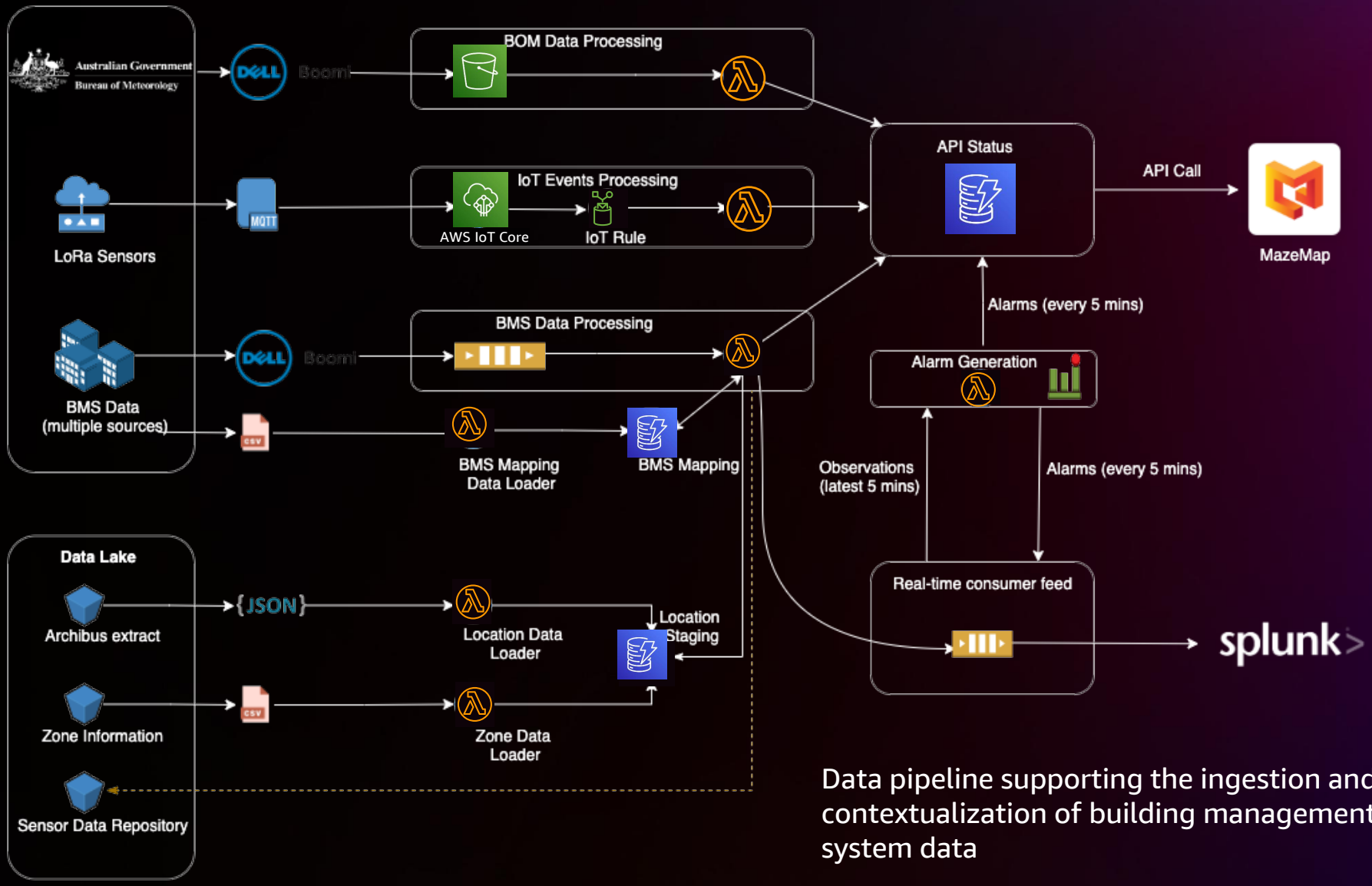
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Stitching it together



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Example pipeline



Data pipeline supporting the ingestion and contextualization of building management system data

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Learning the hard way



Invest the time in developing your data and observation models *up front*

Invest the time in developing data governance and curation processes *up front*

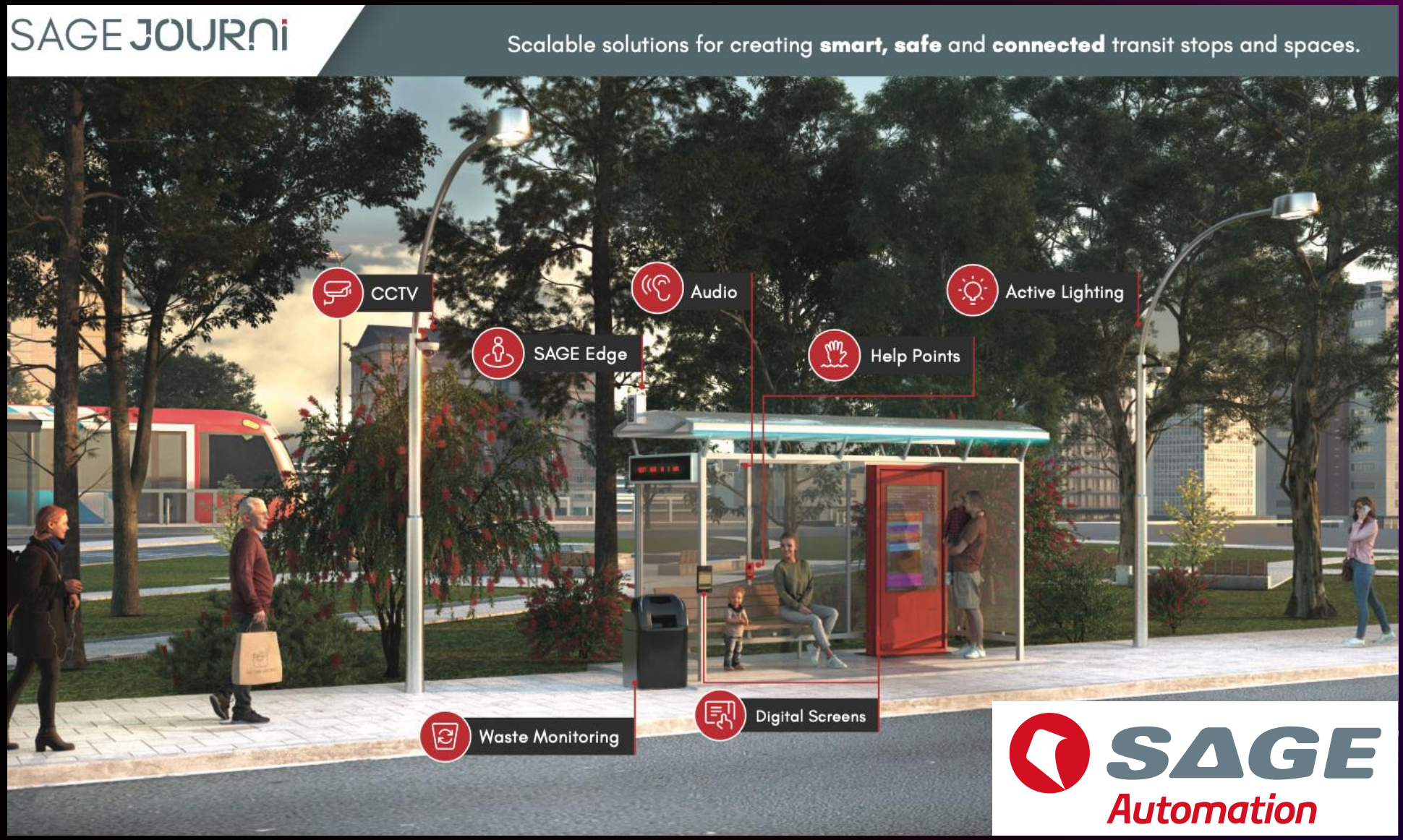
Consider how this will work at scale, in particular your **service delivery model**

Limit the diversity of and sprawl of your IoT device fleets

aws

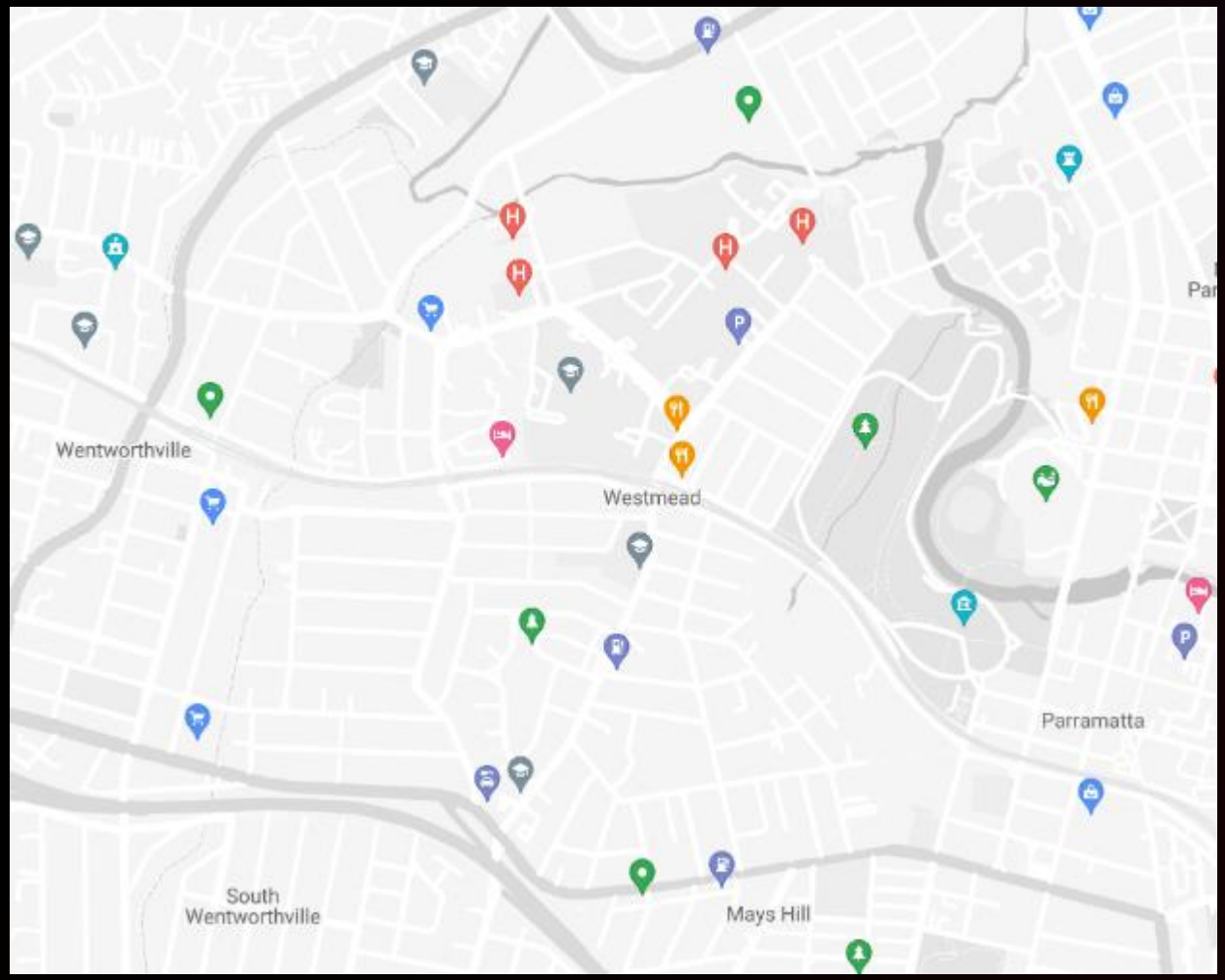
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Westmead bus stop



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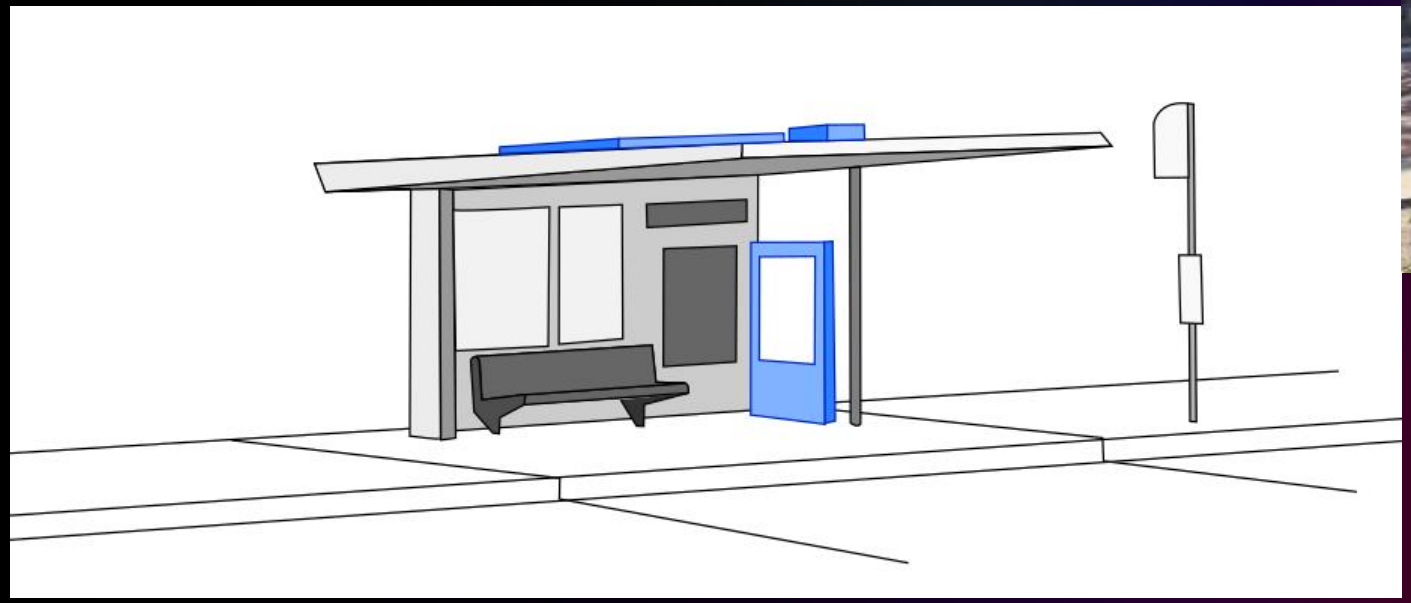
Westmead bus stop



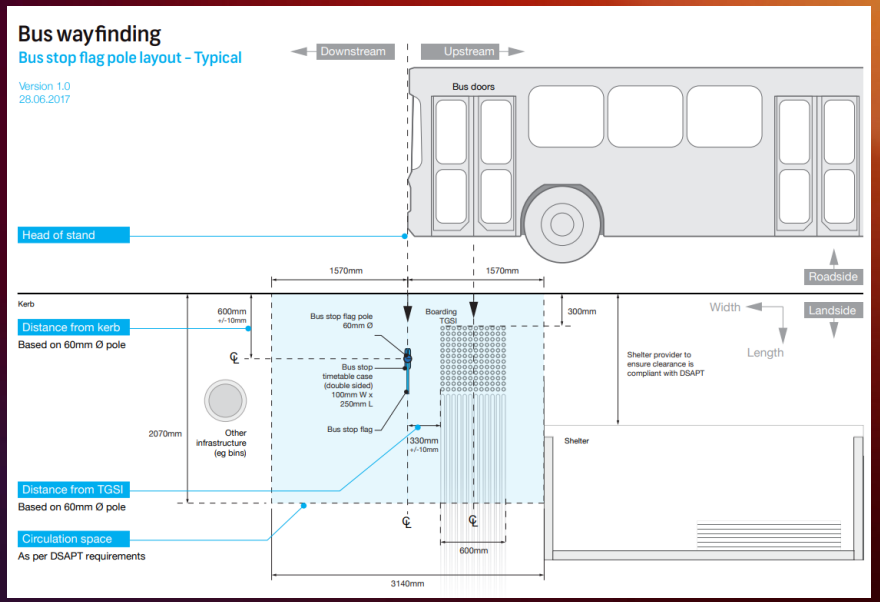
- Located near a major Sydney hospital
- Online schedules aren’t for everybody
- Services need to be responsive to different needs

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Westmead bus stop – Concept design

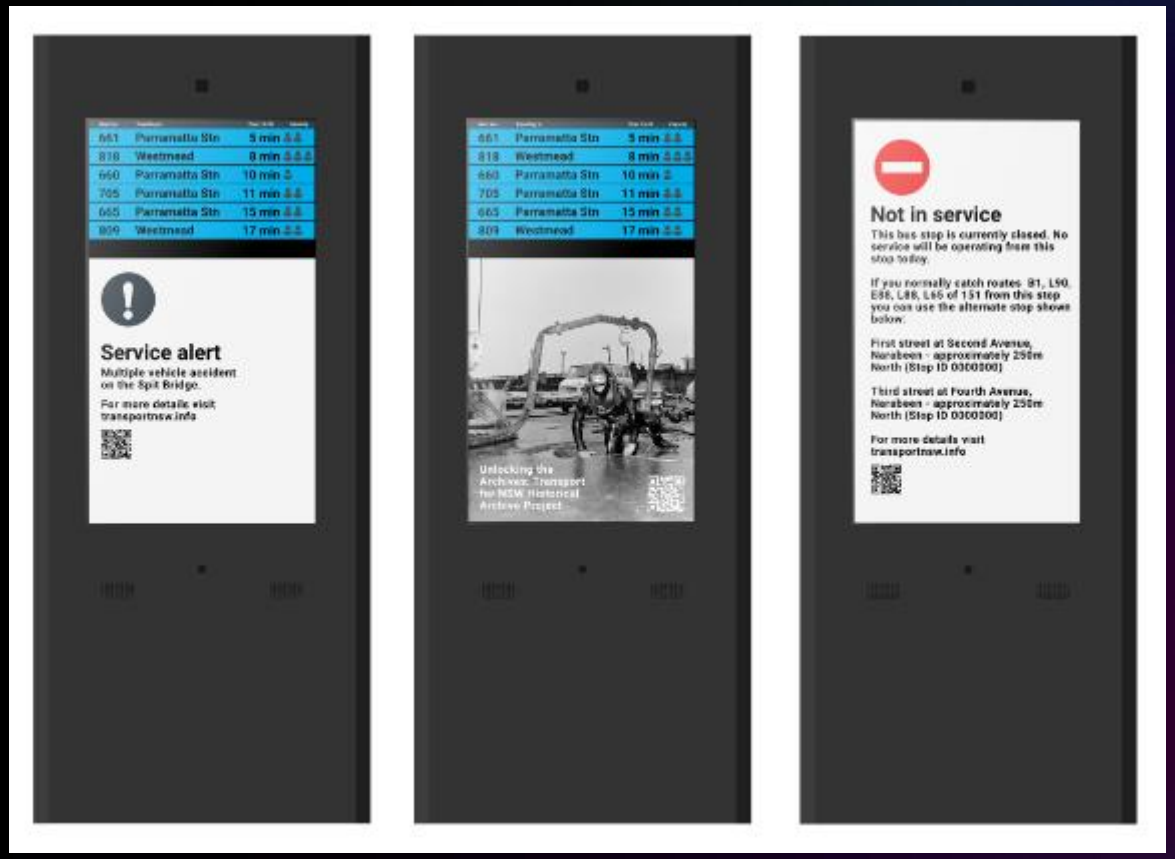






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Westmead bus stop – UX







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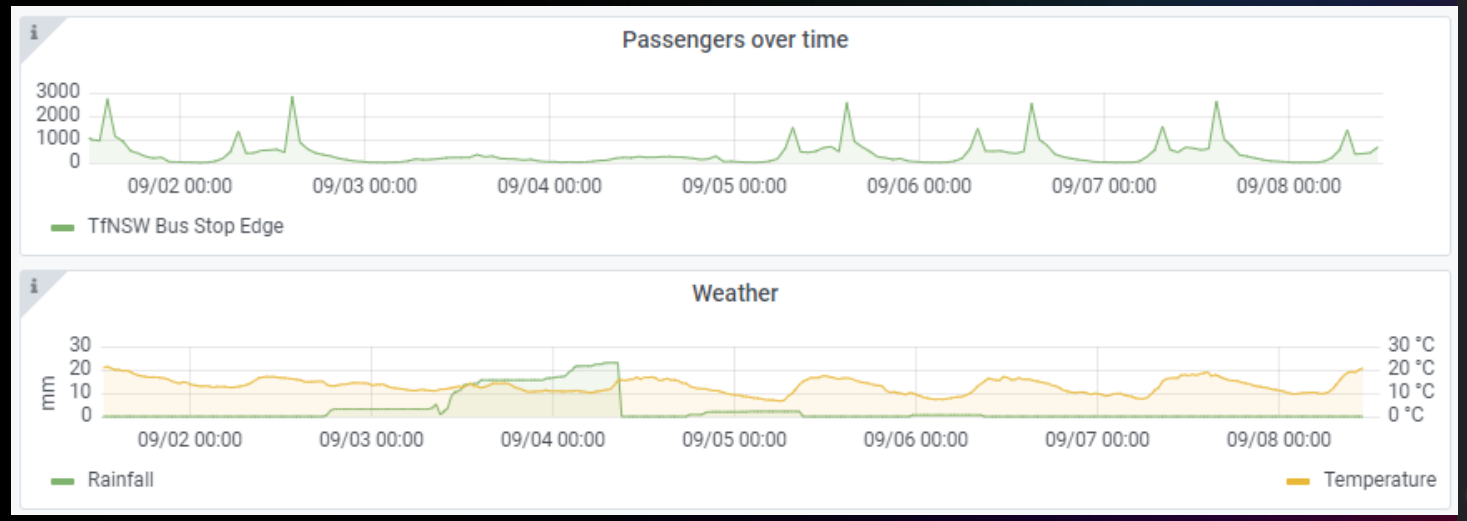
Westmead bus stop – Installation

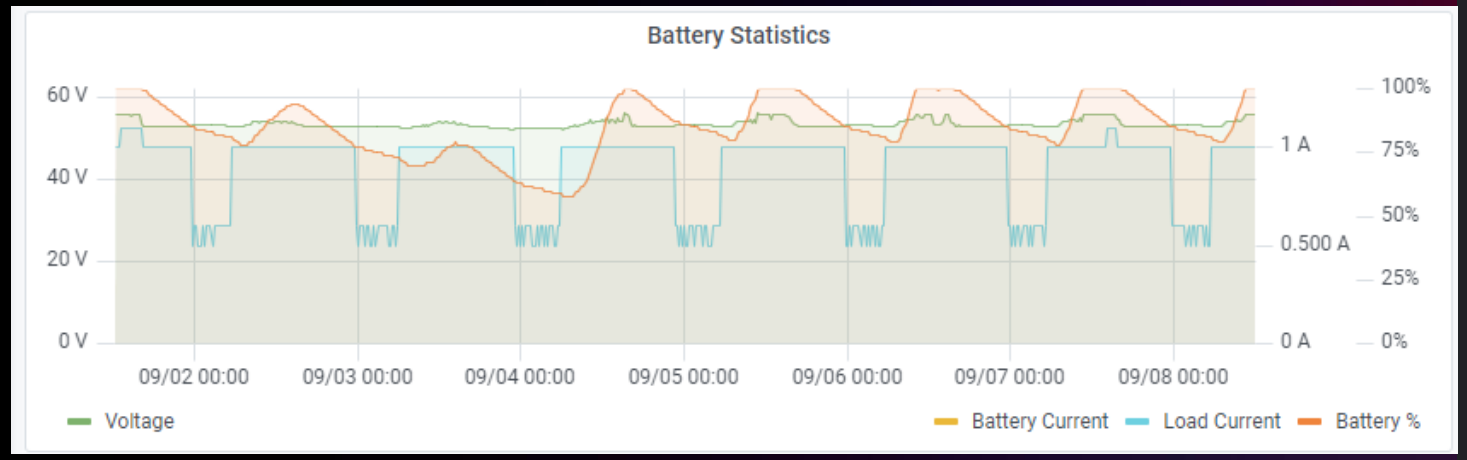


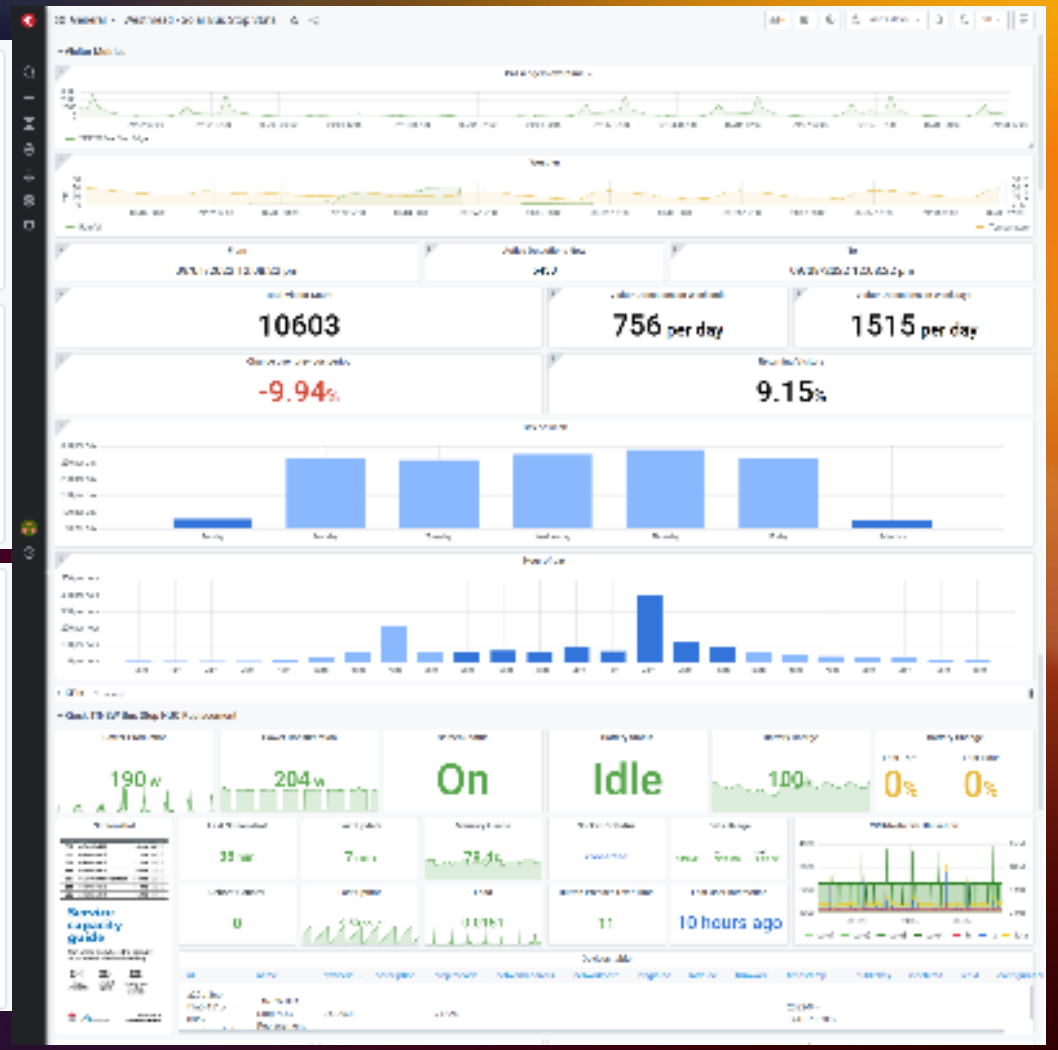


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Westmead bus stop – Installation

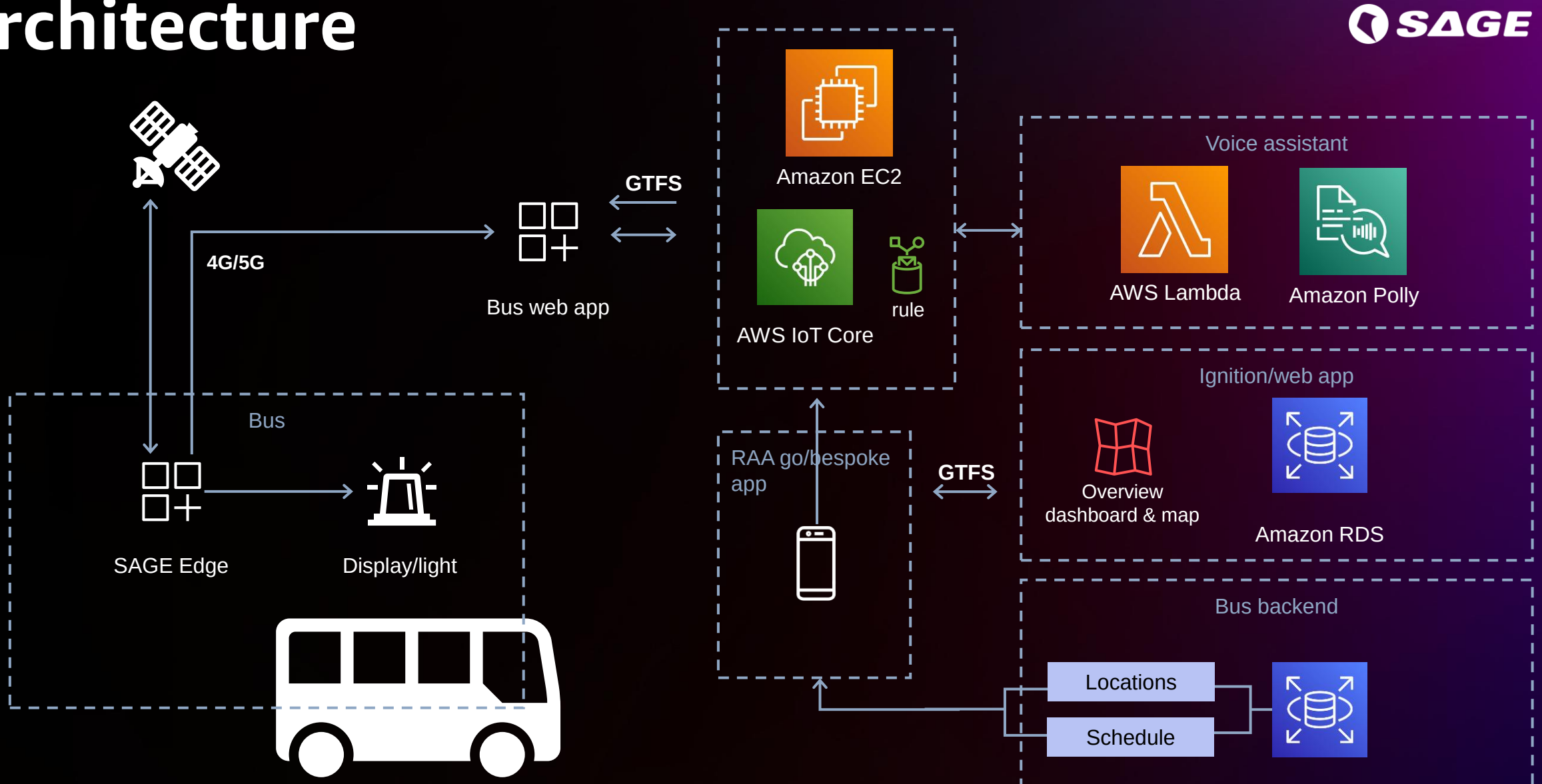






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Architecture



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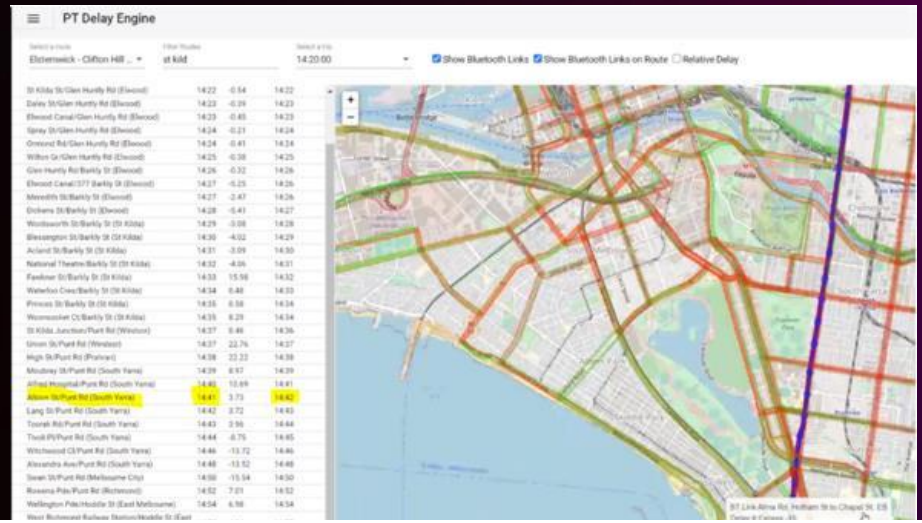
The ‘See Me’ Project

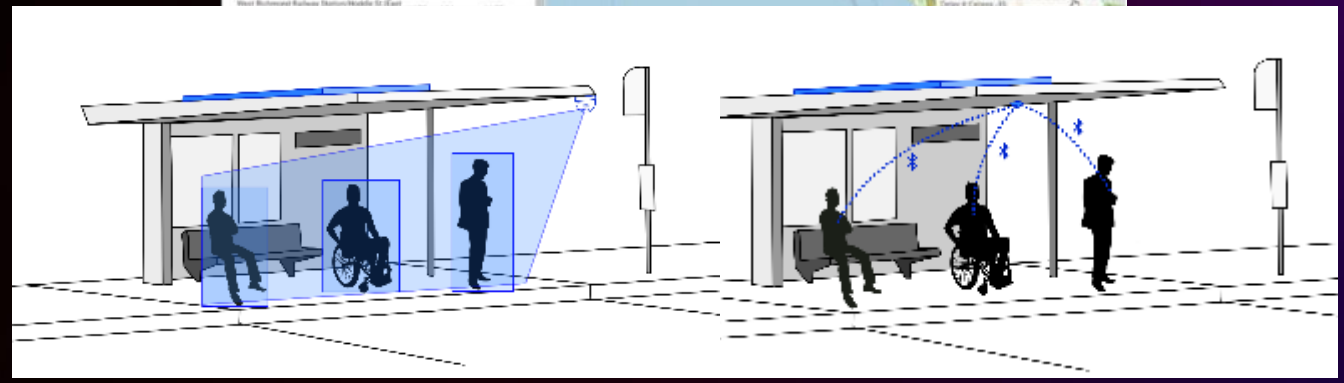


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Where to from here?







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Transform your business with AWS IoT solutions



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