



DAFNI

Introduction to DAFNI

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Science and
Technology
Facilities Council

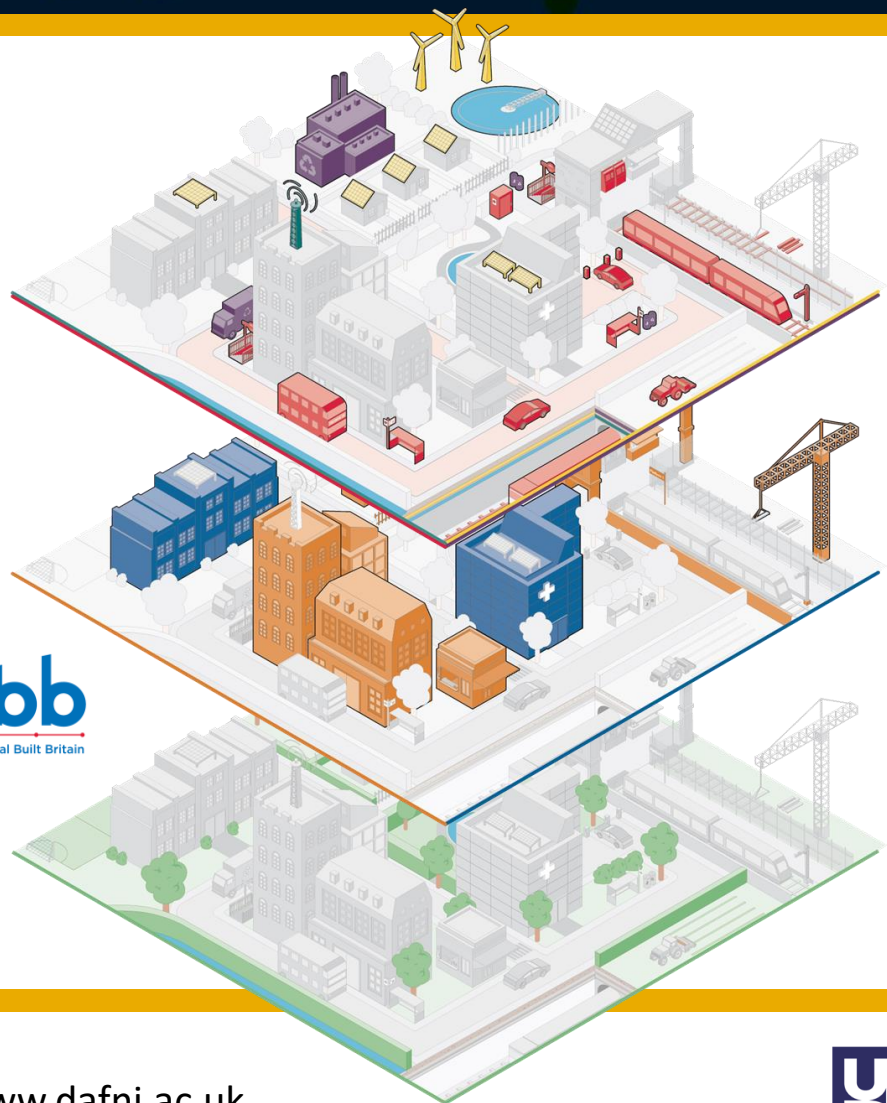


Engineering and
Physical Sciences
Research Council



UKCRIC

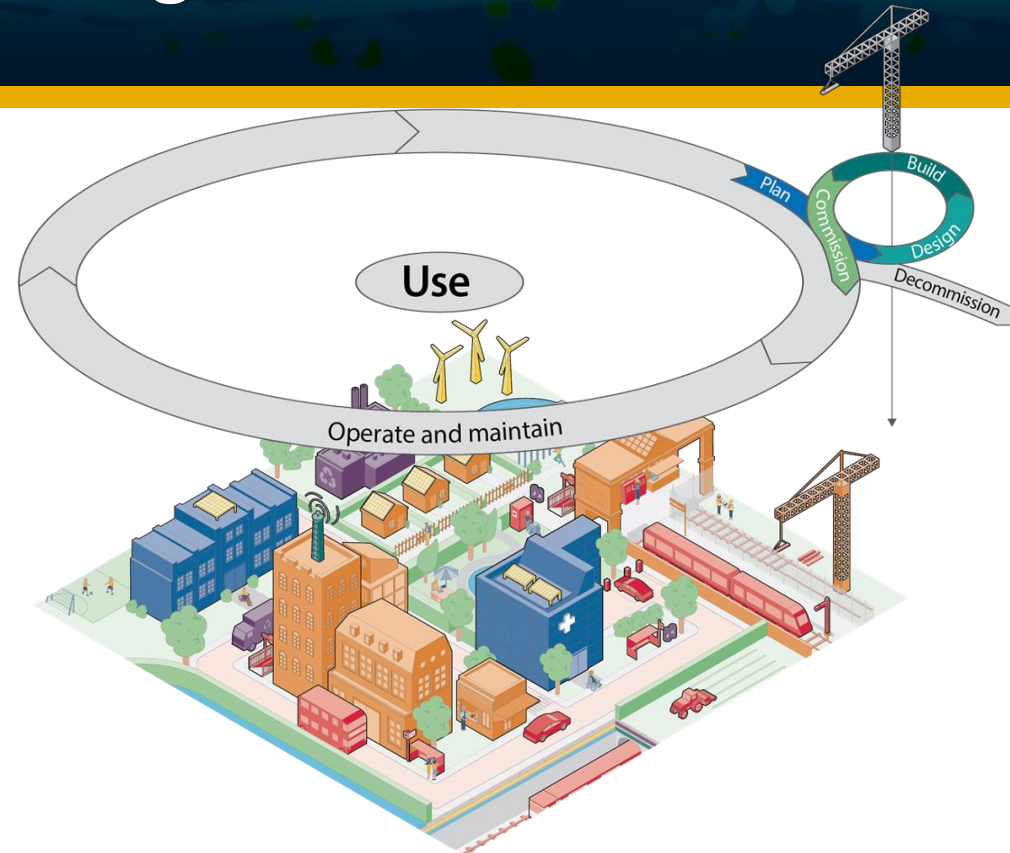
Why DAFNI ?



Economic
infrastructure

Social
infrastructure

Natural
environment

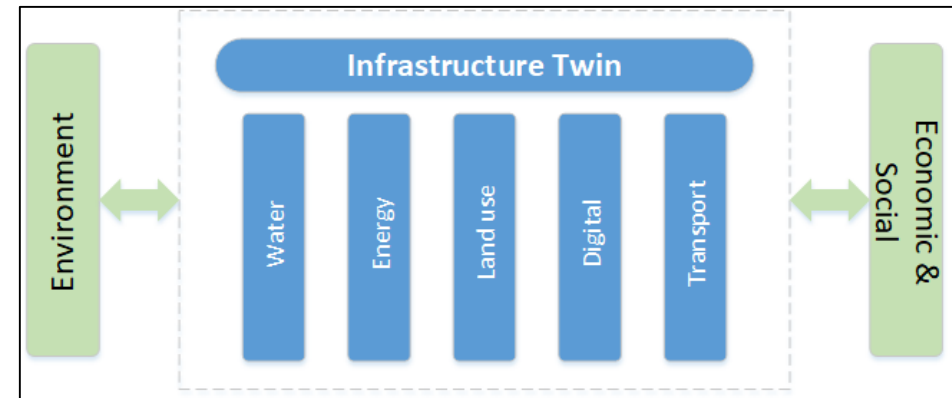


Built environment

- **Scaling up**
 - More data
 - Higher resolution
 - More compute resources
- **Integration between models**
 - Capture the interdependencies
 - Integration across scales - Nation to Item
 - Integration across sectors
- **Data integration and exchange.**
 - Share data between infrastructure models
 - Security respected
 - Common standards for interchange and interoperation
 - Common Metadata standards
- **Supporting an ecosystem of Digital Twins**
 - Integrated data infrastructure
 - Connections to sensors and “real-time” I/O
 - Analysing large-scale historic data to propose decisions



Integration across scales



Integration across sectors

- **A Place for sharing and combining data and models**
- **A Place to support collaborations**
- **A Place as a legacy**

- **A hybrid high-performance computing platform**
- **A secure repository for heterogeneous national infrastructure data and models.**
- **A collaborative platform to research and develop multi-system models of infrastructure assets and systems**
- **A place to make data and models available for long-term accessibility**

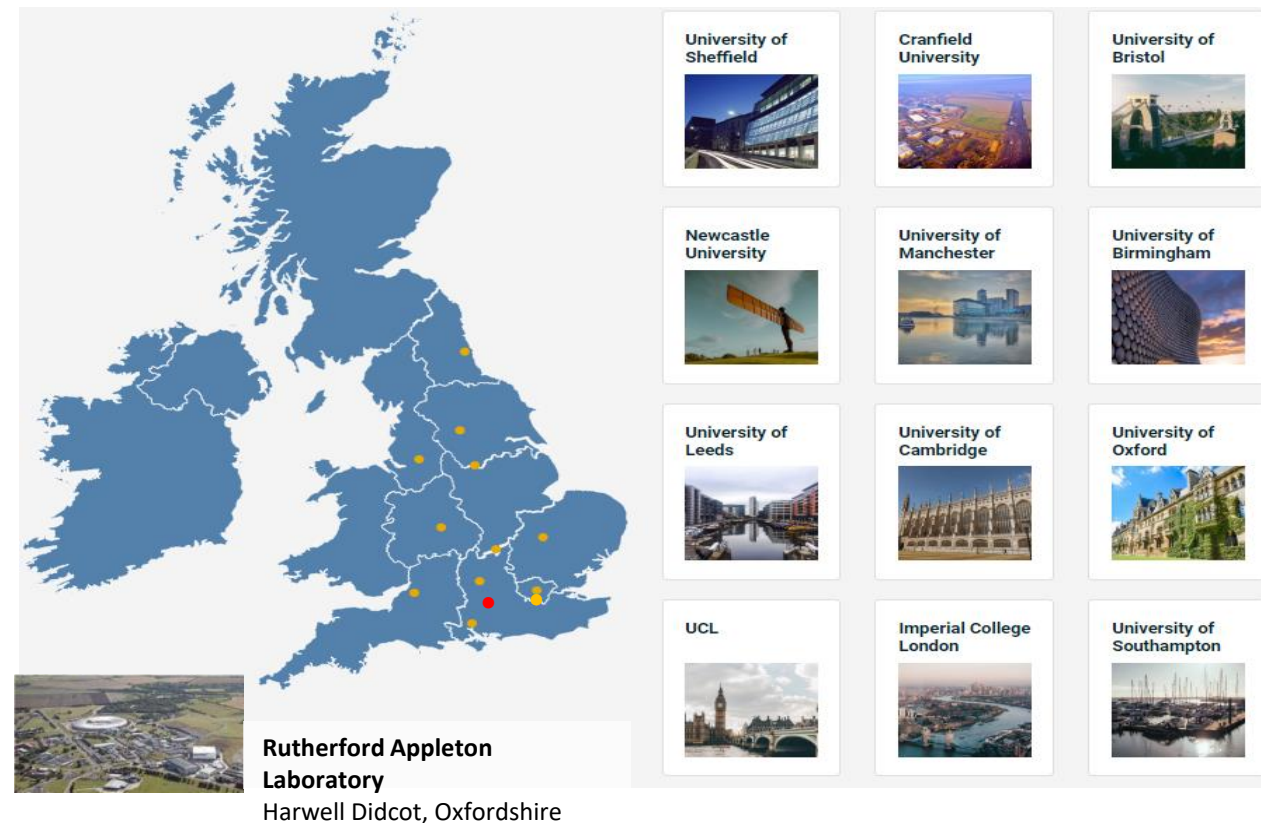
What DAFNI can offer

Providing a computing platform to improve decision making for national infrastructure

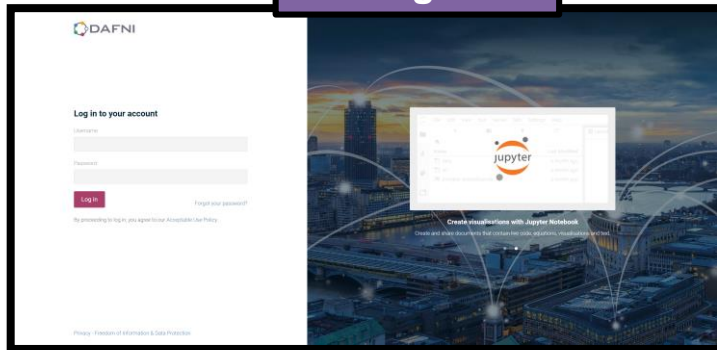
UK's next generation platform to support research into infrastructure decisions: planning, investment, design and operation.

- £8M investment 2017-2021 under the UKCRIC programme
- 12 partner universities
+ STFC as development and hosting partner

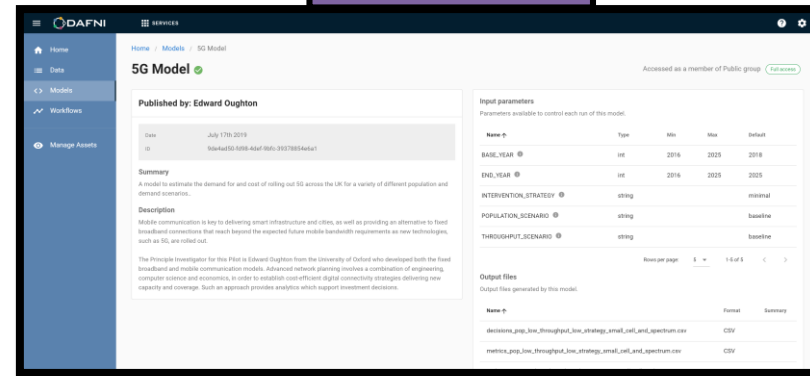
Partnerships between Academia, Government, Industry



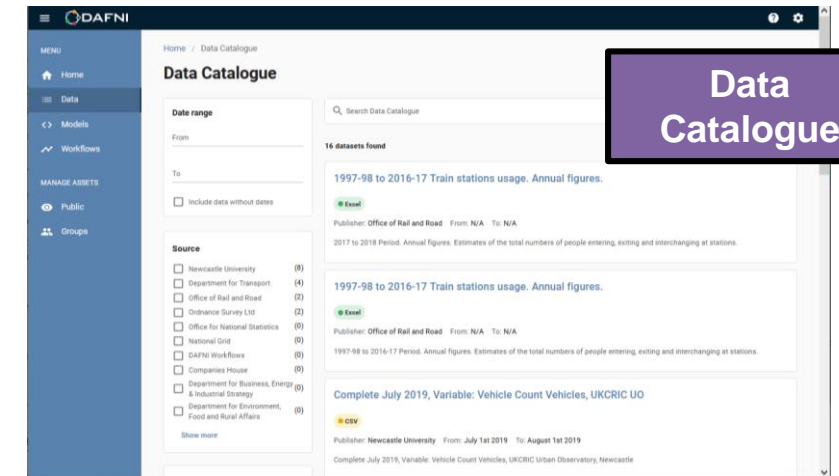
Login



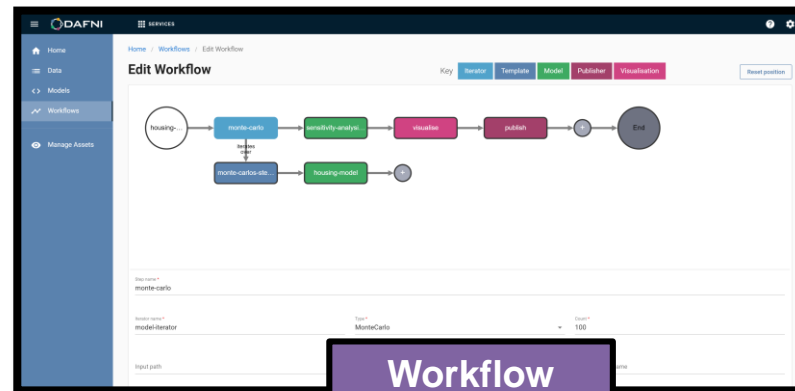
Data



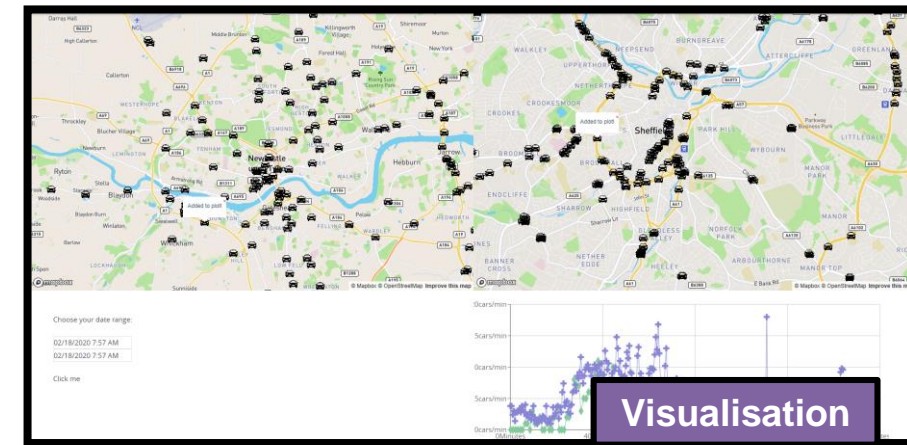
Data Catalogue



Models

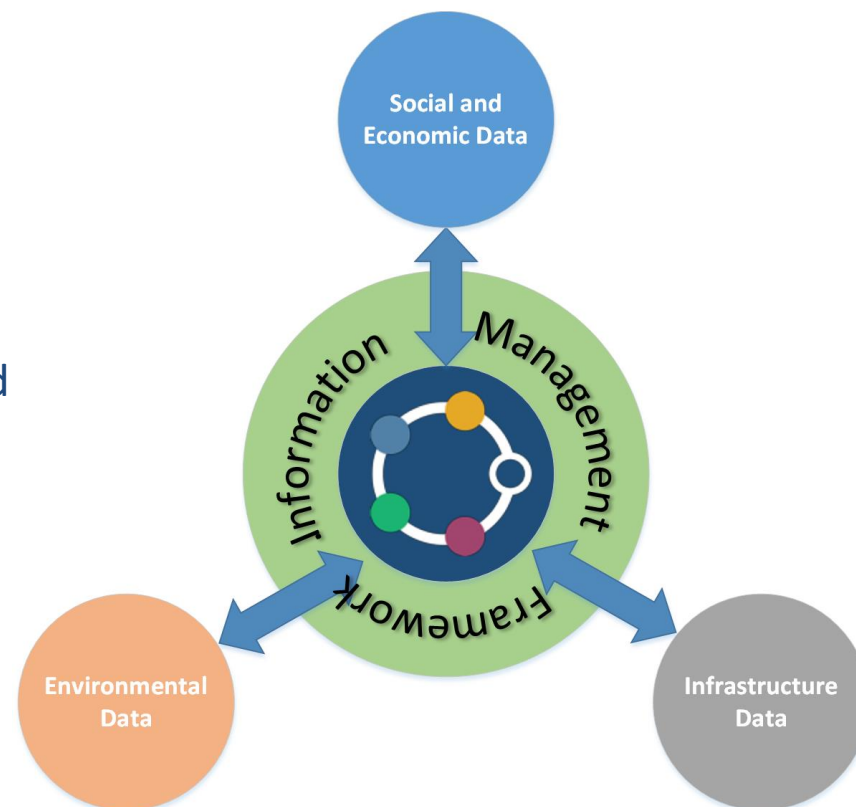


Workflow Management



Visualisation

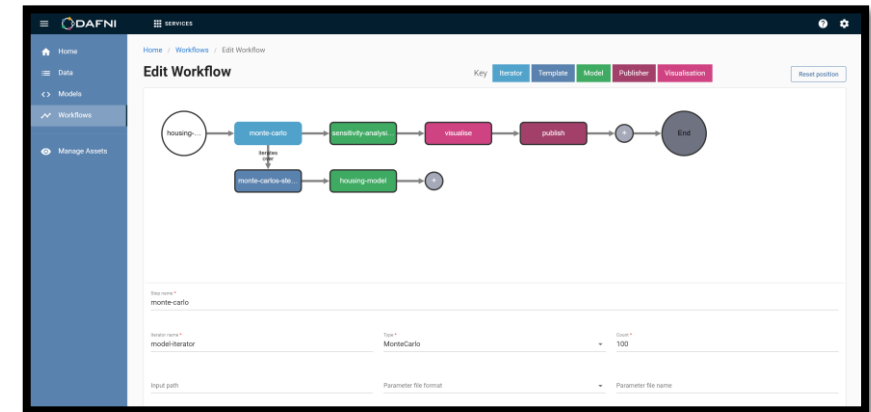
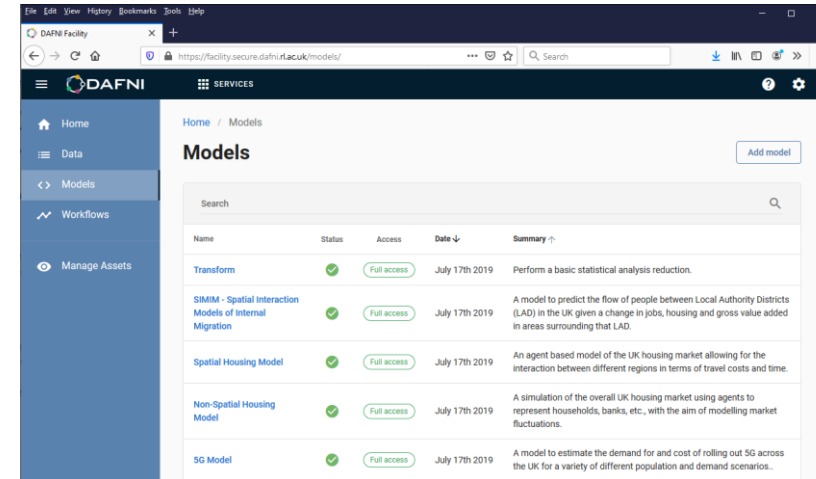
- DAFNI provides a Data Hub
 - Data sharing
 - Data integration
 - Data curation
- The DAFNI NID provides
 - A trusted secure space to hold and access data
 - Importing from and linking to other data sources
- A metadata framework for the data catalogue
 - DCAT 2.0
 - Common search and access



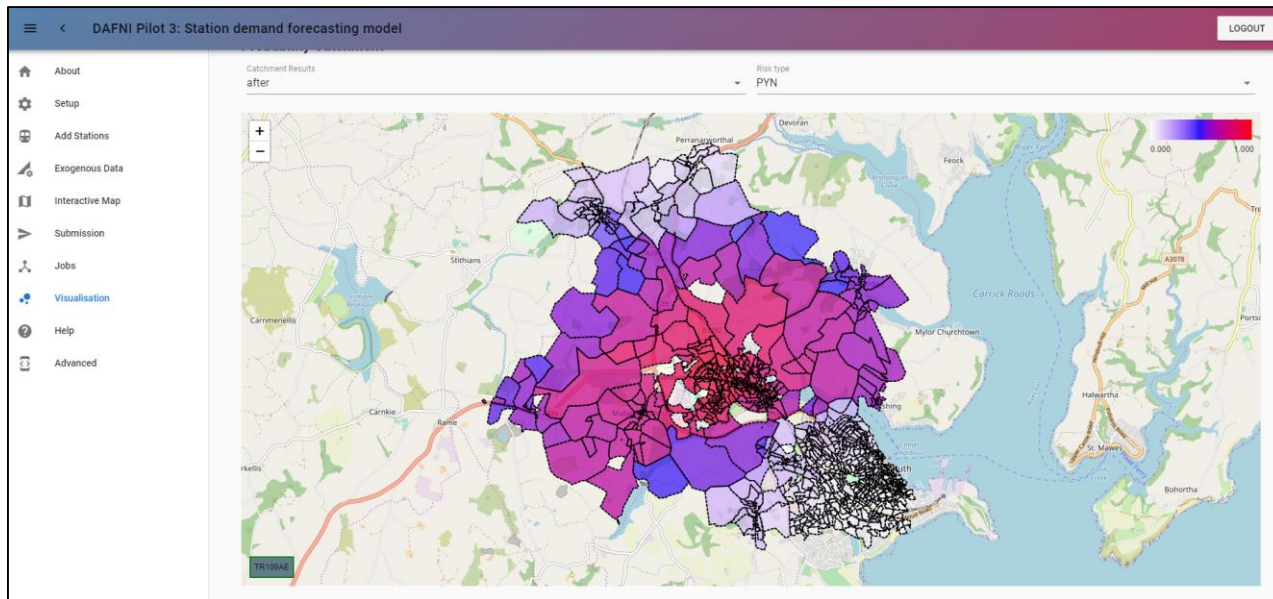
A platform for integrating and combining data

- DAFNI's NID provides basis for representing data from different sources
 - Extensible to sectors: water, energy, transport ...
 - Support an Ontological framework for data
- A data store – but not all data needs to be held centrally

- Upload models from anywhere into a model repository
 - Models “containerised” using Docker
 - Independent of code and operating systems
 - Sharing models
 - Within the same security framework
- Models can then be run on the HTC cluster
 - Kubernetes orchestration of containers
 - Scale up models for more compute
 - Access to data in the NID
 - Access to visualisations
- The NIMS allows workflows to be constructed
 - Chaining models together
 - Coupling models together
- Key feature of providing an Infrastructure Ecosystem
 - Coupling different sectors
 - Coupling different scales

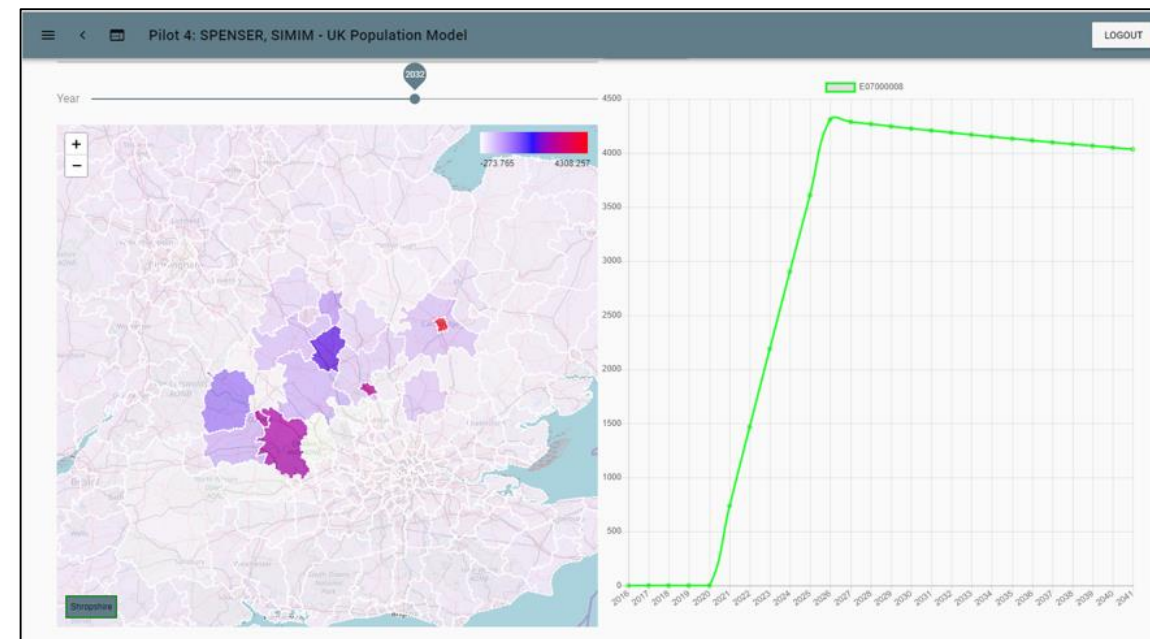


How is DAFNI being used?



A map showing the probability catchments of Penryn station after adding a new station in Helston
Station demand model, University of Southampton

Map showing the CAMCOX corridor and the movement of people given a change in households, jobs and GVA
SIMIM model, University of Leeds



From 2011 the UK Infrastructure Transitions Research Consortium (ITRC) has developed:

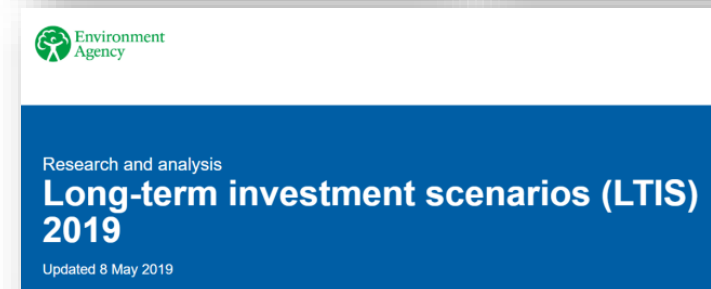
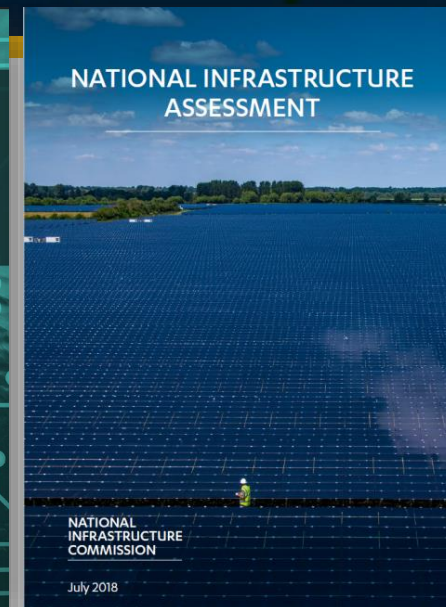
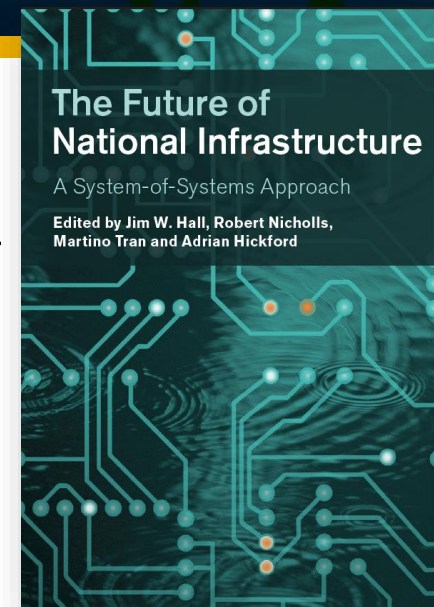
The NISMOD national system-of-systems model (energy-transport-digital-water-waste) for infrastructure **planning** in Britain

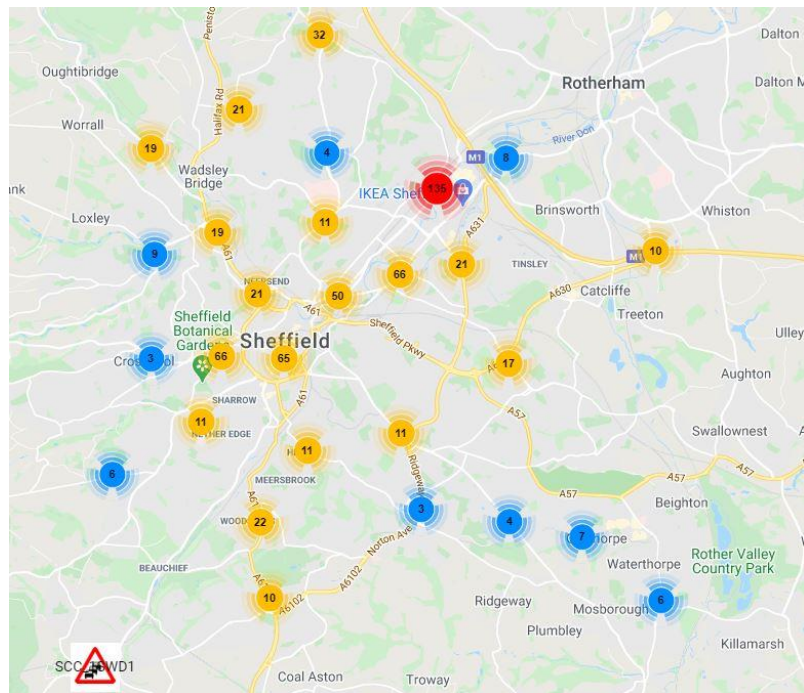
- NISMOD was used in the UK's first National Infrastructure Assessment

National modelling of climate **risks** to infrastructure networks

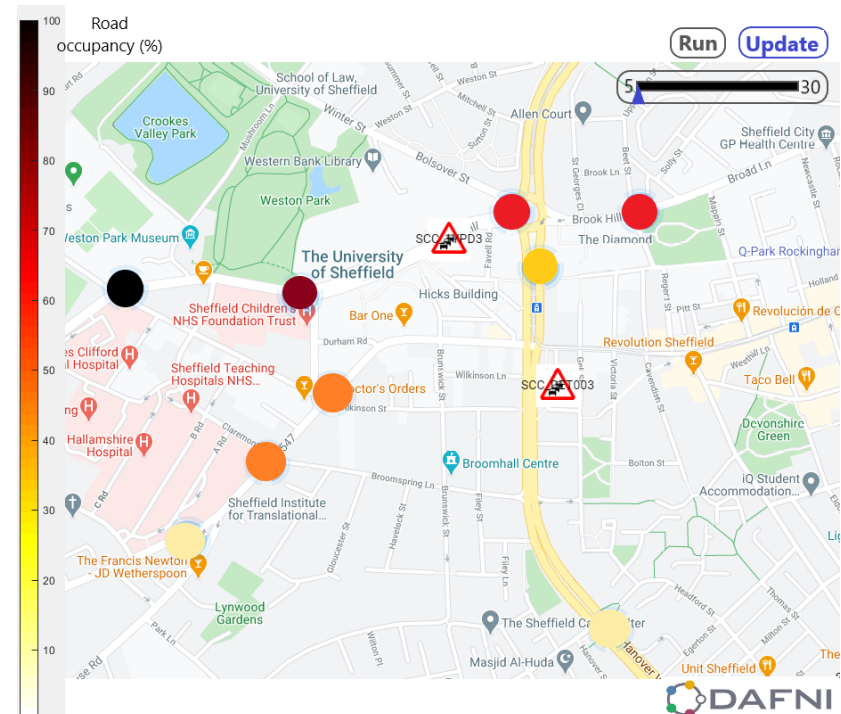
- Used to inform the Environment Agency's long term investment strategy for flood defences
- Analysis for the National Infrastructure Commission's resilience study

NISMOD is being migrated to a new £8million **facility** DAFNI: the Data and Analytics Facility for National infrastructure





- Use traffic data from the Sheffield Urban Observatory
 - 640 sensors that report traffic flow (no. of cars/min)
 - Time resolution: 5 min
- Build AI-based model
 - updates in real-time for each sensor
 - predicts evolution of traffic (ex: 30 min ahead)
- Create a digital replica of the Sheffield traffic
- Identify areas where congestion will occur



Use cases:

- Traffic monitoring system that predicts congested areas
- Real-time traffic flow optimization



The University Of Sheffield.

**Christian Genes,
Daniel Coca**

Summary

DAFNI Phase 1: 2017-21: 4 year development programme

Requirements gathering, design, implementation
Now in an intense development phase

Getting pilot users onto the platform

Pilot programme

Champions programme

Webinars

Hackathons – particularly with the Urban

Observatory programme

Final event – July 2021

Please talk to us! info@dafni.ac.uk

DAFNI Phase 2

Long-term sustainability for production beyond September 2021

Seeking to establish a hybrid model: platform support and contributions from projects.

A production platform

Setting up a service management environment

Operating the platform

User support, operations, help desk

Getting more users on the platform

Looking towards further development:

Digital Twins: running long-running models with real-time input and outputs

Support for Machine Learning models

Richer data infrastructure

An extended framework for integrating models.

An environment for research collaboration

For researchers, government and industry exploring new ideas in modelling

DAFNI Platform offers:

- A HTC platform supporting research and technology transfer
- Data sharing within a common information infrastructure
- Scaling and coupling models
- A long-term legacy for keeping such models accessible

Still work to be done:

- Digital Twin Pilots
- Experimenting with a more dynamic data management framework
- Data Ontology Support

Supporting sustainable development of infrastructure for our regions, cities, rural areas and down to the household level.



DAFNI

Thank You

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www.dafni.ac.uk



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UKCRIC

- New project – led by University of East Anglia
- Assess the risk of climate change
 - Flooding
 - Health risk from extreme heat
 - Agriculture and biodiversity
- Affect of approaches to adaptation
 - Case studies in the Clyde Catchment, Norfolk Broads
 - Towards CCRA4
- Multi-systems modelling approach
- Working with DAFNI to provide
 - A framework for combining models together
 - A place where users can go to access and run workflows
 - A legacy where models can be accessed for the long-term

