THE MUDDI PATH TOWARDS A CLEARER UNDERGROUND

DAVID JONES REPORTS ON HOW ORDNANCE SURVEY EXPERTISE IN DATA MODELS IS INFLUENCING MAJOR PROJECTS IN THE UK, AND WHY IT COULD BE REPLICATED AROUND THE WORLD.

Engineers across the world suffer regular headaches over infrastructure buried underground. Whether it is the stress of making sure their team avoids striking hidden electricity cables, not knowing where ageing assets are during disaster responses, or costs soaring after stumbling upon unexpected pipes. Having a clearer picture of what lies under the surface would ease a lot of minds.

For years a group of leading data scientists at the Open Geospatial Consortium, an international panel of experts, have been grappling with this problem and how to solve it.

They formed a working group to create a concept – the Model for Underground Data Definition and Integration – known as MUDDI for short. Its purpose was to create an international standard for mapping geospatial data underground. The model visualises subsurface infrastructure assets and characterises the underground environment that contains them, then defines a data store for it all. This information can be shared easily among all parties working in the same underground space and turned into a map.

Ordnance Survey's Chris Popplestone and Carsten Roensdorf have been key contributors to the project, lending their expertise and thinking to create the MUDDI model.

Chris explained the MUDDI model was developed from existing geographic data standards INSPIRE, CityGML and the International Standardization for Organizations, and will eventually become an international standard in its own right. He said the concept of a 'harmonised data model' can be applied to lots of diverse data challenges and MUDDI was an example of that.

"The harmonised data model is a central target into which all of the source infrastructure data is transformed," Chris said. "The source data comes in all different shapes and sizes, but it all gets transformed to this harmonised model.

"We start off with a conceptual model of how this transformed data will look and we use various tools to focus that down into a physical model that can then be implemented as a data store and then deployed by a development team."

"The source data comes in all different shapes and sizes, but it all gets transformed to this harmonised model" – Carsten Roensdorf



Proof of concept

The first chance to prove that the MUDDI model worked came with pilot testing for the National Underground Asset Register (NUAR), a programme led by the UK Government's Geospatial Commission (https://www.gov.uk/government/organisations/geospatial-commission)

Two pilots were successfully user tested in both North East England and London, and work has started to build and roll-out the system nationally under the leadership of engineering consultants Atkins. It involves developing a UK profile of the MUDDI model, focused on safe digging.

Data is collected from 650 or so data or asset owners by software company 1Spatial, which delivers the data transformation and data ingestion part of the process.

OS is shaping the harmonised NUAR data model, based on MUDDI, building the data store and creating the platform that will serve up the transformed infrastructure data through a map-based user interface.

If all goes to plan, it will give those digging-up a road a tool that shows existing subsurface pipes and cables in a clear, uniform way.

Chris said: "The feedback we got from the NUAR pilot has fed into a newer iteration of the MUDDI model, and that is now forming the basis of the national roll out of NUAR.

"There has been a lot of international involvement and that is being looked at very carefully for other international projects that are planning to follow a similar approach."

Challenges

What makes the MUDDI concept exciting is that it can be adapted to suit different use cases, and different national regulations and standards. This is an idea designed from the ground up to be replicated around the world. However, to make it work, the model must be fed, and that is where the challenges lie.

Collecting data is a messy, complicated process. It gets even messier and more complicated when it has been collected by hundreds and hundreds of different organisations and companies of various shapes and sizes. Each one may have classified its data a different way, meaning there can be several ways of describing the same type of pipe. The same type of cable found in West Sussex can be called something completely different in the West Midlands.

Chris said: "Because we know that is a risk, we have tried to make everything about the data model and its implementation as responsive as possible. Working under the Geospatial Commission we helped to build in flexibility to the UK's 'excavation profile,' alongside strong governance structures, to try and streamline any additions that need to be made, so we don't have to completely tear down data stores and rebuild them because we have found a new type of pipe.

"That is part of what the data model is designed to solve. There is potentially so much variation that we must be able to make tweaks and add things that we haven't come across in other data sets. So, things like terminology can be quite different between different companies – we must make sure when we come across a new term it is a genuinely a new thing rather than something else that we have already modelled under a different name."

Other domestic uses

The harmonised model concept is in use for other national infrastructure projects in the UK.

OS is just finishing its work supporting a national project looking at energy systems.

Chris said: "This is a completely different data model to MUDDI and NUAR, but it is the same idea. Again, you have several different data providers with completely different data sets and the data gets transformed to this target and then presented in a consistent way."

The concepts behind MUDDI can be applied to the management of diverse types of data. Examples could be land use, land ownership or flood risk. Again, the model would be built along the same framework, with diverse data sets and different data providers, all coming in through a transformation pipeline to a 'harmonised' target.

The MUDDI working group has also started work examining issues created by movement within sub-surfaces underground. Problems can develop rapidly, such as flooding in sub-surfaces, or gradually with the spread of contaminants. The group is testing two use cases using MUDDI - surface water flooding underground structures via vertical shafts and leakage from underground storage tanks.

International

Another benefit of the MUDDI model is that it can be adapted to build national profiles, taking into account the differing regulatory environments found underground around the world.

Voices at the Open Geospatial Consortium that helped shape and influence MUDDI come from as far and wide as New Zealand, the Netherlands, Belgium, the US, Canada, and Scotland.

Carsten, who co-chairs its working group and continues to advise on the development process, believes this gives MUDDI a greater chance to succeed globally.

He said: "Through MUDDI and other forums we have built-up a good picture of the worldwide activities in the underground data integration space.

"We are watching the development in other countries, across Europe, in North America and parts of Asia. Through these activities we are also getting a better understanding about a variety of use cases, including answering environmental questions and increasing a city's resilience, for example in dealing with bigger storm and flooding events that affect underground infrastructures.

"It is interesting to see the differences in the implementation in different countries and cities and even better to spot commonalities between the different approaches."

The hope is, with the progress the MUDDI model is making underground, engineers of the future will endure much milder headaches when pondering how to dig up street corners in years to come.

For more information about Ordnance Survey data insights visit the OS Control Today, Shape Tomorrow webpage (https://www.ordnancesurvey.co.uk/business-government/control-today-shape-tomorrow)

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