

IEC ACADEMY WEBINAR Q&A

Conversation between City Information Modelling and Urban Digital Twins: 2021 Virtual Forum 22 & 23 June 2021

No.	Questions	Answers
Theories and concepts		
1.	Is CIM commonly identified as City Info. Model in IEC/ISO? This is because in IEC/TC 57 Common Information Model is CIM. This might cause further confusion like DT for Digital Transformation, or Digital Twin, for example.	CIM and DT are commonly used globally to refer to City Information Modelling and Digital Twins.
2.	How can we use the CIM in a developing country?	CIM represents the process of digitalisation of the urban design and planning process, so if this digitalisation need/demand is there, you will start doing CIM. The key is then to adopt open standards, open data and open tools. This will remove economic and legal barriers of access to essential technology that supports CIM.
3.	For Cities in Operation, how would you differentiate between Urban Platforms & CIM?	City Information Modelling is a robust and vigorous practice. The City Information Modelling Platform is one type of urban platforms focusing on data relevant to City Information Modelling.
4.	Any city is a system of flows - in transports, financial, people, energy, etc. How can such flows be linked(?) to digital twins?	These are indeed essential aspects of modelling, analysing and visualising a city. These can be linked to digital twins in different ways: real-time data from sensors via Application Programming Interface (API), temporal data sets, simulated based on models and Artificial Intelligence (AI). This enables different types of flows in the cities to be captured and used for a better city management.
5.	A CIM platform is supposed to be implemented to coordinate various BIMs that correspond the Digital Twin of physical buildings located in the city to be modelled by the CIM. So is the CIM platform primarily based on connecting the existing Building models to realize the new functions/services to be provided through the platform?	A CIM platform is not only for connecting Building Information Modelling (BIMs). CIM is a much larger scale that requires integration of BIM, Geographical Information System (GIS), Internet of Things (IoT) and other relevant standards.
6.	What are the definitions of CIM and UDT? This is the key to analyse and understand the differences of CIM and UDT.	There isn't a single definition for CIM. CIM, as a practice and process, is related to the underlying technologies, of which Urban Digital Twin (UDT) is one. In Dr. Jorge Gil's presentation, there was a diagram, which offers a start to discuss the overlap and relation between CIM and UDT. Built on top of standard City Information Modelling, the city digital twin is software that represents the physical city across its lifecycle, using real-time data to enable understanding, learning and reasoning.

Technologies, practices, and case studies		
7.	If the system needs to be modelled from the bottom-up won't we need a different AI based on self-organisation? instead of centrally designed top-down design?	<p>It is meaningful to have a method of modelling from bottom-up for the system. However, it would be better if we combine the top-down modelling method with bottom-up modelling method. The former method focus on macro-level characteristics for simulation and the latter one focus on micro-level characteristics for expression. In this condition, the complexity of city can be described better.</p> <p>System construction includes two ways, bottom-up and top-down. The top-down approach, namely government-led, is that the government builds a system according to management needs, and enterprises and individuals use the system to provide data. The bottom-up approach, namely self-initiated by the enterprise, is that a system is built by the enterprise according to the enterprise development, and the data results need to be reported to the government. In this way, the government needs to establish corresponding mechanisms and standards to standardize system interfaces and data from bottom to top.</p> <p>These two methods are normally used together.</p>
8.	What about city digital twin and AI: do we already have examples of applications?	<p>We have the example to embed AI (Artificial Intelligence) model into a digital twin for buildings so that it can manage the energy saving for the physical building automatically.</p> <p>AI enables automatic checking whether the building complies with the original plan during the whole life cycle.</p>
9.	How to manage different kinds of city data properly?	<p>There is an existing body of good practice and standards of handling different kinds of BIM data. This is also true for data related to digital twins.</p> <p>More widely, there is a lot of good practices related to the governance of data quality, data sharing, distributed computing, and open data standards.</p> <p>We can establish a standard system for data collection, processing, exchange and sharing, and then manage data more effectively according to these standard systems.</p>
10.	Is there any sandbox test model with Spatial data that can be used for creating domain specific digital twin or do all testing need to use "real" spatial data for testing?	<p>It is necessary to use a sandbox test model for creating domain specific digital twin. During the test, simulated spatial data can be used instead of "real" spatial data.</p> <p>Digital twins in a specific field need to be created based on a sandbox test model of spatial data related to the field, and the test data can be a synthetic data set artificially generated by a computer under special condition. It has the same data and statistics as real data, and is a digital mirror image of real data.</p>
11.	Does CIM include building floor data? I think it will be useful for evacuation and firefighting when a fire occurs in a high-rise building.	City information modelling does include building floor data both above and underground. Building floor data is a very important data in city information modelling.

12.	How is CIM data updated? Will it work if the facilities and roads that were there when we planned are gone when we actually did it?	The city should establish the data update mechanism to ensure the reality of the data, which is mainly based on authority departments responsible for authority data. Improving transparency and data sharing in urban planning shall be included in this mechanism. This also can be checked by using aerial imagery capture.
13.	How can we enable data sharing between providers in CIM to facilitate sharing data for Machine Learning models without compromising the sharing? If it is only for training model but not owner of the models then the models can be shared for profits or different purposes?	<p>To meet the demand of the machine learning in artificial intelligence and deep learning under urban application, the CIM platform can provide both the training function interface of machine learning and the standard specification of data sharing (such as format, attributes, etc.). Maybe we need to enrich data, algorithms, training model, and open the interface of the model to make machine learning more powerful. In this case, Providers can also share the generated training model. A training model can support a provider's personalized application and requirements.</p> <p>Data security is an important issue. In CIM, data sharing between providers should comply with data security requirements, and also be permitted by the owner. If necessary, limited data sharing and exchange can be carried out within the scope permitted by national laws.</p>
14.	What should I keep in mind when using a CIM created in one city in another? What are the issues when trying to link CIM between cities?	If we look at CIM as practice and planning/design process, its general framework is transferable between cities if those processes are similar. Furthermore, the underlying Integrated Urban Model, or Urban Digital Twin, should be based on data standards that can be easily applied on both cases, and linked. If a CIM/UDT was created ad-hoc, as a one-off 3D geodata modelling exercise, it will be very hard to expand, adopt elsewhere or link to.
15.	<p>What Data Open Formats can be used in UDT and CIM?</p> <p>We can see the OGC: CityGML (https://www.ogc.org/standards/citygml) and the community standard CityJSON (https://www.cityjson.org/) used in many DT projects.</p> <p>In BIM we see general use of IFC (buildingSMART) open standard (https://www.buildingsmart.org/standards/bsi-standards/industry-foundation-classes/), and IFC is being expanded to be used not only on Buildings but also Infrastructures (Rail, Road, Airport, etc).</p> <p>What should be the data open format to be used in CIM and UDT?</p>	More than data format, it is important to define linked data models. A city is a complex of many systems, and it is most likely that we will link data models and standards from different domains. CityGML is a good start because it looks at the city, but it needs expansion for different systems as the focus has been largely on the buildings. IFC overlaps, and can be linked, to offer more detail of individual buildings/infrastructures. But other data models/standards are needed and are being developed (waste, energy, mobility, and planning process) to address objects, systems, their attributes and relations of the city not covered by any of the two.
16.	How is Context Information handled in CIM and/or Digital Twin?	In terms of spatial context, CIM/UDT has to cover it as it is not only about buildings. For instance, if it is about policy, legal or planning context, it must cover it in terms of metadata, regulations, performance targets, that are also part of the planning process.
17.	How is Context Information handled in CIM and/or Digital Twin? Or it is NOT important?	Same as above.
18.	Which software can be used for CIM and for UDT respectively? Which platform do you find suitable for both of them, and do you think that we need to develop more suitable ones, or we can say that now we have what is required?	CIM is not a single software, but an ecosystem of tools. Depending on the role of the actor/stakeholder in the process (planner, architect, asset manager, citizen) they will certainly be using different software.

		<p>Currently most of digital twin systems are built from scratch with different design pattern. This requires the development toolkits to build standard digital twin objects in each industry, and then a low code platform to orchestrate the digital twin instances within certain digital threads to build specific digital twin scene.</p> <p>Cities can either purchase proprietary software or build it themselves using open source.</p>
19.	What kind of software do we use? Or is it still to be programmed depending on the needs of the city?	We can choose some common proprietary software, and then develop some application software. As an example, AsiaInfo Technologies is developing a digital twin DevOps Platform to build smart city.
20.	How does CIM or DT relate to Intelligent Operation Centre?	IOC (Intelligent Operation Centre) is the operation centre that IS built on top of CIM and city digital twins.
21.	Is IOC virtual operation centre using DT?	<p>IOC is not purely a virtual operation centre. IOC is a centre which integrates and interconnects information and processes, provides a platform for city operations and management. IOC involves a list of human and non-human actors (e.g. IoT devices).</p> <p>It might be the best practice to implement IOC based on the digital thread that drives the interoperation among city digital twins.</p>
Standards work		
22.	Do you see room for standards in the AI models for optimization and prediction in DTs?	Yes, absolutely. These standards may include functional requirements of such AI models, information exchange protocols, etc.
23.	How do you envisage the possibility of establishing a network of Digital Twins based on a common architecture?	We will need to implement interoperability standards to facilitate this.
24.	<p>JTC 1/SC 41 is developing horizontal standards for DTs. Will there be a special focus for UDTs?</p> <p>How do we make sure that these horizontal standards are OK for the urban domain?</p>	<p>Horizontal means generic across all sectors such as smart cities, manufacturing, etc.</p> <p>Each sector should be able to build on these horizontal standards when developing their sector specific one. This means that, for instance, a UDT reference architecture would have the generic DT reference architecture as normative reference.</p>
25.	As CIM is a tool for urban planners and decision makers - how to ensure it won't be misused as a surveillance/control tool - can standards stop that from happening?	It is more a question of regulations that would refer standards.
26.	Are you considering cyber-attacks in the development of IoT standards & how to protect against them?	Standards on IoT security are developed by ISO/IEC JTC 1/SC 27 (Cybersecurity) in collaboration with SC 41. See ISO/IEC DIS 27400 as well as CD 27402.
27.	What are the standards or definition language (DL) going to be used for CIM which is globally accepted? Or we see different DLs contributing towards CIM?	The development of CIM/UDT is still too early to know what will be practical. However, it is likely there will be different DLs contributing towards CIM/UDT.
28.	Why use cases placed at the last part only? In my understanding Use cases are to be prepared and used to identify the gaps in the existing standards. Is it different in Smart City Domain?	Use cases are much important in the standards work. However, without a foundational concept, and things like a schema and agreed conventions to identify and share this information it is not possible to express these use cases in a way that others can use.

	Brushing up use cases is one thing, identifying gap from use case is another, in my understanding through more than 10 years experiences in energy related use case developments.	Agree there is no quick answer. What the roadmap tried to do is point out we need to begin modelling processes and provided 1) a placeholder for a standard to recommend how to do it and 2) a placeholder standard series to capture use cases we can gain consensus on. This is no easy feat, but too many organizations are using tech to solve output problems, instead of using tech to solve process problems
29.	Why did you not concentrate on the example for Smart Cities, instead of manufacturing?	Manufacturing is given as an example since standardization for Digital Twin is more advanced than the ones for Smart Cities.
Panel discussion		
30.	When you talk about these systems being complex do you mean complicated, or complex in the sense of complexity science, where the whole is more than the sum of the parts and you get unexpected collective behaviour?	The city is indeed complex, as in complexity science, not just a sum of physical objects such as buildings. They are support for the complex flows of people, goods, information, resources, at different temporal and spatial scales.
31.	COVID 19 so overwhelmingly impacted Southeast Asia's economy. Could CIM be applied effectively for our region? Or, what should the policy maker in our region do?	COVID 19 has overwhelmingly impacted every region in the world. CIM can provide useful tools to help. You may find this link pertinent: https://www.socialscienceinaction.org/resources/smart-cities-and-covid-19-implications-for-data-ecosystems-from-lessons-learned-in-india/
32.	When can we apply smart city in Iraq?	Smart cities can be implemented in an incremental fashion using specific smart technologies to tackle specific city challenges. However, it is useful to adopt an overall framework and standard to help with this.
33.	Do you think that using CIM will promote new job opportunities in the developing countries??	CIM represents the digitalisation of the urban design and planning process, supported by a diversity of digital technologies. All this requires new skills, services, products, so certainly will offer new job opportunities. If there is a demand from the planning process to become digital, to support sustainable smart cities, these opportunities will be real.
34.	Don't organisations first need to identify the "why?" before they decide on the "how"?	Certainly! The starting point of CIM is the applications layer in the planning process. What is the stage in the process? What are the planning questions? These define use cases for CIM, and consequently define the data, models, users and tools to be developed. If they do not ask the question 'why', organisations end up with a generic digital tool or solution that at best serves to advocate digitalisation in urban planning.
35.	Another good reference to find information and collaborate with practitioners in industry about DTs is the CDBB DT Hub https://digitaltwinhub.co.uk/	This is a good reference for DT.
36.	Who can summarize the differences between CIM and Digital Twins?	CIM is starting from the urban design and planning process, it is a practice that involves many actors and tools. UDT is an integrated urban data model and technology that can support CIM. Built on top of standard City Information Model, the city digital twin is software that represents the physical city across its lifecycle, using real-time data to enable understanding, learning and reasoning.

		Here is an example of harmonising and standard requirements (https://www.a-specstandards.com.au/). This will lay the foundation for many requirements.
37. 1- 27	Would you agree that CIM and DT is limited to the understanding of very few who are more interested in design of these tools, and that more is required to disseminate to the implementation level, which requires much of Multidisciplinary kind of capacity Building?"	Indeed, there has been much of a technology focus, and most engaged with it are the tool designers/makers. Initially this was important to overcome certain barriers and see what we can do, but now the goal should be more about engaging "real" users, use cases and applications, so that it becomes aligned with people needs and processes.
38.	What is the basic difference between CIM and UDTs? Is it a question of provenance/history/different routes to analyse the same problem?	Partly, they overlap, but have a slightly different focus. CIM comes more from urban design and planning focused on parametric design and analytics. UDT comes more from modelling and simulation of the cities.
39.	Don't you think Developing a comprehensive Common Data Formats for importing in either DT Platforms or CIM Platform is a major imperative, otherwise each platform shall be working in SILO?	Completely agree! CIM needs an integrated urban data model describing the city as much as Urban Digital Twins do. It is more the case that different implementations use different standards, if any. It is imperative to further develop and link these standards. The comprehensive common data formats are important to define the CIM, which is the base for digital twin software. Moreover the interface for digital twin also needs to be standardized so that they can interoperate each other.
40.	Would it be correct to say that CIM is 3D while DT is 4D with time as the Fourth Dimension?	This may be an oversimplification of both City Information Modelling and Digital Twins. Both of them have a time dimension in the perspective that they deal with dynamic aspects of the city, and its transformation, analysis and simulation.
For any further questions, please contact the IEC Academy, academy@iec.ch , and don't forget to browse through the IEC SyC Smart Cities & ISO/IEC JTC 1/SC 41 webpages!		