Digital Twin for Smart Cities

Ramy Ahmed Fathy
Vice-chairman, ITU-T Study Group 20, ITU
A digital twin is a digital replica of something in the physical world. It could be a car, a mobile phone, or even a city.
Digital Twin for Cities

1. Improve Operational Efficiency
2. Optimize Energy Consumption
3. Enhance Disaster Preparation
4. Improve Mobility and Transportation
5. Improve Urban Design
6. Increase Measuring and Monitoring
Digital Twin and Modeling City Wide Scenarios

- Situation Analysis
- Risk Assessment
- Cost Benefit Analysis
- Resilience Planning
Digital Twin for Urban Solutions

HELSINKI, FINLAND
Using its digital twin to develop a creative virtual tour of the city to support tourism

SINGAPORE
Using Virtual Singapore, a dynamic 3-D city model and collaborative data platform to support city stakeholders in driving innovations

AMARAVATI, INDIA
Utilizing the digital twin to monitor the city’s construction process in real-time; carry out climate change-related simulations and analysis; and create digital twin user IDs
The International Telecommunication Union (ITU) is the United Nations specialized agency for information and communication technologies (ICTs).
How ITU Supports Digital Twins

ITU: International Telecommunication Union – the UN specialized agency for ICTs

Joint IEC-ISO-ITU Smart Cities Task Force

JCA-IoT and SC&C: Joint Coordination Activity on IoT and Smart Cities and Communities

U4SSC: United for Smart Sustainable Cities initiative

ITU-T Study Group 20: ITU Study Group on IoT and Smart Cities and Communities
ITU-T’s Focus on IoT and Smart Sustainable Cities

ITU-T Study Group 20 (SG20) is responsible for:

1. Internet of things (IoT) and its applications, and smart cities and communities (SC&C)
2. Big data aspects of IoT and SC&C, e-services and smart services for SC&C
ITU-T Study Group 20 (SG20)

Q1/20  Interoperability and interworking of IoT and SC&C applications and services

Q2/20  Requirements, capabilities and architectural frameworks across verticals enhanced by emerging digital technologies

Q3/20  IoT and SC&C architectures, protocols and QoS/QoE

Q4/20  Data analytics, sharing, processing and management, including big data aspects, of IoT and SC&C

Q5/20  Study of emerging digital technologies, terminology and definitions

Q6/20  Security, privacy, trust and identification for IoT and SC&C

Q7/20  Evaluation and assessment of Smart Cities and Communities
ITU-T Study Group 20 Question 1 and Digital Twin

Q1/20
Interoperability framework of digital twin systems in smart cities and communities
ITU-T Study Group 20 Question 2 and Digital Twin

Q2/20 Requirements and capabilities of a digital twin system for smart cities

Q2/20 Requirements and capability framework of digital twin for intelligent transport system

Q2/20 Requirements and capability framework of digital twin for smart firefighting
ITU-T Study Group 20 Question 5 and Digital Twin

Q5/20
Interaction between physical and digital cities for building smart sustainable city
Q7/20
Concept and use cases of a digital twin in smart sustainable cities
Collaborations

Joint Coordination Activity on Internet of Things and Smart Cities and Communities (JCA-IoT and SC&C)

- 2 ongoing work items

17 new Recommendations approved
- 1 ongoing work item
- 6 Technical Reports agreed

Organization of World Smart City Forums
- Working team on Smart City Terminology

Joint IEC-ISO-ITU Smart Cities Task Force

- To build synergies on ongoing work in ITU-T, IEC and ISO related to smart cities and communities;
- To maximize efforts in order to identify new areas of cooperation related to smart cities and communities;
- To develop a holistic view on smart cities and communities taking into consideration the scope, areas of work and expertise of ITU-T, IEC and ISO to support smart cities and communities development.
United for Smart Sustainable Cities

City Platforms

Economic recovery in cities and urban resilience building in the time of COVID-19

Guiding principles for artificial intelligence in cities

Innovative Financing Instruments for Smart Sustainable Cities

Procurement Guidelines for Smart Sustainable Cities
Digital Twin for Smart Cities

- Benefits of Digital Twin for Cities
- Urban Solutions from Digital Twin
- ITU’s Continued Role in Digital Transformation
- Current ITU Recommendations
- Collaboration is Key
Thank you!

Questions? Interested in learning more?
Let us know!

Email
u4ssc@itu.int

Website
ITU-T, Smart Sustainable Cities
Additional Information
U4SSC KPIs

Currently implemented in:

- Dubai
- Singapore
- Moscow
- Riyadh
- Valencia
- Wels
- Pully
- Bizerte
- Montevideo
- Krimpen aan den Ijssel

150+ more cities!
Applications of the U4SSC KPIs

The U4SSC KPIs help cities to:

- Track progress
- Perform trend analysis
- Benchmark performance
- Compare results
Accelerating City Transformation Using Frontier Technologies

Sheds light on the impact of frontier technologies in cities and on citizens
Other U4SSC Publications

- **Simple ways to be smart**: Identifies smart interventions not requiring excessive material or capacity inputs, but helping cities be sustainable.
- **Blockchain for smart sustainable cities**: Gives insight into the potential of blockchain technology in building trust within cities.
- **A guide to circular cities**: Provides a framework to improve circularity in cities.
- **City Science Application Framework**: Offers a four-step methodology to assess, prioritize and boost city applications.
Examples of ITU-T SG20 standards

**Interoperability**

- Recommendation ITU-T Y.4200: ‘Requirements for the interoperability of smart city platforms’
- Recommendation ITU-T Y.4201: ‘High-level requirements and reference framework of SCPs’
- Recommendation ITU-T Y.4459: ‘Digital entity architecture framework for Internet of things interoperability’
- Recommendation ITU-T Y.4500.13: ‘oneM2M – Interoperability testing’
- ITU-T Y Supplement 61: ‘Features of application programming interfaces for IoT data in SC&Cs’
- Technical Specification D3.3: ‘Framework to support data interoperability in IoT environments’
### Examples of ITU-T SG20 standards

**Data Management & Processing**

<table>
<thead>
<tr>
<th>Recommendation ITU-T Y.4114: ‘Specific requirements and capabilities of the Internet of things for big data’</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommendation ITU-T Y.4560: ‘Blockchain-based data exchange and sharing for supporting Internet of Things and Smart Cities and Communities’</td>
</tr>
<tr>
<td>Recommendation ITU-T Y.4561: ‘Blockchain-based data management for supporting IoT and SC&amp;Cs’</td>
</tr>
<tr>
<td>TR D2.1: ‘Data process and management framework for IoT and SC&amp;Cs’</td>
</tr>
<tr>
<td>TR D2.3: ‘Web based data model on IoT and smart city’</td>
</tr>
<tr>
<td>TR D4.3: ‘Overview of technical enablers for trusted data’</td>
</tr>
<tr>
<td>TS D4.4: ‘Framework to support IoT data quality management’</td>
</tr>
<tr>
<td>TS D.5: ‘Data economy: commercialization, ecosystem, and impact assessment’</td>
</tr>
</tbody>
</table>
Examples of ITU-T SG20 standards

**Master Plan and Assessment**

- ITU-T Series Y Supplement 32: 'A guide for city leaders'
- ITU-T Series Y Supplement 33: 'Master Plan'
- ITU-T Series Y Supplement 68: 'Framework for Internet of things ecosystem master plan'
- Recommendation ITU-T Y.4903/L.1603: 'Key performance indicators for smart sustainable cities to assess the achievement of sustainable development goals'
- Recommendation ITU-T Y.4904: 'Smart sustainable cities maturity model'
- Recommendation ITU-T Y.4905: 'Smart sustainable cities impact assessment'
- Recommendation ITU-T Y.4906: 'Assessment framework for digital transformation of sectors in smart cities'
Examples of ITU-T SG20 standards

**Emergency Response & Management**

- Recommendation ITU-T Y.4102: ‘Requirements for IoT devices and operation of IoT applications during disasters’
- Recommendation ITU-T Y.4116: ‘Requirements of transportation safety services including use cases and service scenarios’
- Recommendation ITU-T Y.4119: ‘Requirements and capability framework for IoT-based automotive emergency response system’
- Recommendation ITU-T Y.4467: ‘Minimum set of data structure for automotive emergency response system’
- Recommendation ITU-T Y.4468: ‘Minimum set of data transfer protocol for automotive emergency response system’
- Recommendation ITU-T Y.4558: ‘Requirements and functional architecture of smart fire smoke detection service’
Examples of ITU-T SG20 standards

**IoT Security, Trust & Identification**

- Recommendation ITU-T Y.4805: ‘Identifier service requirements for the interoperability of smart city applications’
- Recommendation ITU-T Y.4806: ‘Security capabilities supporting safety of the Internet of Things’
- Recommendation ITU-T Y.4807: ‘Agility by design for telecommunication/ICT systems security used in the IoT’
- Recommendation ITU-T Y.4808: ‘Digital entity architecture framework to combat counterfeiting in Internet of things’
- Technical Report: ‘Cybersecurity, data protection and cyber resilience in smart sustainable cities’
Examples of ITU-T SG20 standards

**Health and Accessibility**

- Recommendation ITU-T Y.4110/Y.2065: ‘Service and capability requirements for e-health monitoring services’

- Recommendation ITU-T Y.4117: ‘Requirements and capabilities of IoT for support of wearable devices and related services’

- Recommendation ITU-T Y.4204: ‘Accessibility requirements for the Internet of things applications and services’