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Government of India

Department of Telecommunications

Artificial Intelligence & Digital Intelligence Unit (AI & DIU)

Dated: 15th of February 2024

New Delhi

Invitation of "Expression of Interest" (EoI) for "Digital Twin: Sangam" Proof of Concept (PoC) on Planning & Design of Infrastructure harnessing Digital Twin.

1. Invitation from the Department of Telecommunications (DoT):

The Department of Telecommunications (DoT) extends a special invitation to industry leaders, tech companies, experts, startups, institutions and innovators to participate in an "Expression of Interest" (EoI). This invitation is anchored around an innovative "Proof of Concept" (PoC), focused on revolutionizing the Planning & Design of Infrastructure. At the heart of this PoC is the integration of Digital Twin technology with comprehensive mobility insights, drawing from a wide spectrum of data sources, including key insights from the telecom sector.

DoT is seeking forward-thinking contributors who are keen to explore how this convergence of digital technology and telecom data can bring about a transformative shift in infrastructure planning and design. This EoI is not just an opportunity to contribute to a cutting-edge project; it is a platform to shape the future of infrastructure planning and design. The Proof of Concept (PoC) initiated under this Expression of Interest (EoI) is officially designated as 'PoC: Digital Twin - Sangam.'

2. Introducing 'Digital Twin: Sangam':

Under the title 'Digital Twin: Sangam,' this initiative is strategically crafted to demonstrate a practical use case in the realm of infrastructure planning and

design. It adopts a data-driven, unified approach, displaying how integrated data analytics can significantly improve the process of infrastructure development. This initiative may serve as a model for leveraging comprehensive data insights to streamline and optimize the planning and designing phases of infrastructure projects. Aim is to demonstrate how integrating these data streams can expedite and enhance decision-making, leading to a more nuanced and informed approach to various infrastructure challenges.

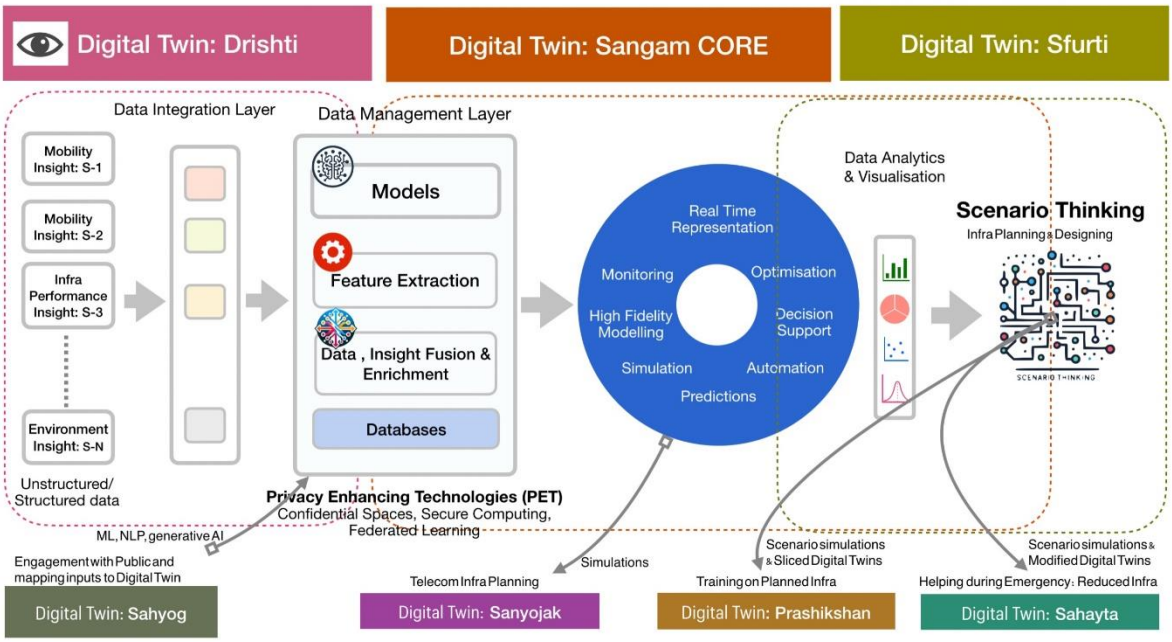
2.1. Sub-parts of the Digital Twin: Sangam

2.1.1. The "Digital Twin: Sangam" Proof of Concept (PoC) is structured into various sub-parts, each focusing on specific aspects of event management. These sub-parts, or Sub-Digital Twins, would interconnect with each other through “Sangam Core” to achieve the objectives of the envisioned Digital Twin: Sangam. For example, there would be Sub-Digital Twins such as “Digital Twin - Sanchar Sanyojak”: Focused on the Digital Twin of telecom networks in the event area; “Digital Twin - Drishti”: Focused on generating insights about visitor movements, arrivals, and departures; “Digital Twin - Sfurti”: Focused on demonstrating the infrastructure's ability to adapt and reconfigure for new layouts and requirements agilely.

2.1.2. The 'Digital Twin: Sangam' Proof of Concept is a dynamic, evolving initiative that hinges on the seamless integration of various sub-components. These components should evolve and interoperate seamlessly with each other, ensuring the PoC's overall success in achieving its desired goals.

2.1.3. New sub-components may also be introduced as the project progresses, responding to the specific needs and situations that arise. This adaptability ensures that 'Digital Twin: Sangam' remains relevant and effective throughout its development. For example, “Digital Twin: Sahyog” may be developed for Public Engagement in planning and designing of the event. AI Integration may be one of the key areas of expansion for inclusion of a

sub-component focused on Public Engagement through AI-Driven Narrative Creation. This feature may harness the capabilities of advanced AI tools, including speech-to-text conversion and natural language processing (NLP), Generative AI to transform public feedback into actionable insights. By integrating these insights with Digital Twin technology, aim is to incorporate community perspectives directly into the Digital Twin for planning and design process. This approach may not only provide a contextual understanding of the inputs but it may also ensure that the insights are effectively combined with Digital Twin technology for more comprehensive and informed decision-making.



2.1.4. Further, development of a new sub-part for contextual training, leveraging Digital Twin technology and edge machine learning (ML) to provide targeted skill enhancement and may be named Digital Twin: Prashikshan. Another sub-part focusing on operational efficiency in emergencies. Utilizing advancements in telecom connectivity, like 5G, to ensure efficient operation of dispersed health and emergency facilities. This is crucial for rapid identification, location, and communication, bolstered by the Digital Twin's contextual data for effective responses may be named as Digital Twin: Sahayta.

2.1.5. At the heart of this ecosystem is the 'Digital Twin: Sangam Core', a central hub that binds all these subparts together, offering core functionalities critical for the success of the entire project. Overall impact of 'Digital Twin - Sangam' is set to revolutionize event management by integrating these advanced technologies to streamline preparation, enhance response efficiency, and improve public engagement strategies.

2.2. 'Digital Twin - Sangam': an apt choice

2.2.1. The 'Digital Twin - Sangam' is chosen for its unique ability to enhance large-scale event management, from traditional approaches that often rely on modular, temporary setups with limited attendee insights. This PoC tackles the common challenges in event management, by utilizing scenario thinking, simulations for 'what if' scenarios, and predictive analytics to offer precise predictions and flexible strategies. This is particularly effective in temporary and modular event setups, and when equipped to make changes allowing for rapid adaptation and implementation of model suggestions. In the Indian context, the PoC emphasises understanding local mobility and mobility behavioural patterns, crucial for developing solutions that resonate with India's unique demographic nuances. It would help in providing local insights for tailored solutions. This innovative approach is expected to significantly diminish uncertainties and foster efficient, data-driven and evidence-based decision-making processes.

2.2.2. Large-scale events often present unique challenges due to the atypical composition of attendees compared to the area's usual demographics. During such events, the stress on local facilities and infrastructure reaches its peak. In this context, nuanced insights and strategic planning become crucial to not only enrich the attendee experience but also to mitigate the strain on infrastructure and the environment.

2.2.3. The 'Digital Twin - Sangam' PoC is designed to showcase how the integration of Digital Twin technology with state-of-the-art digital

communication and computational tools can effectively address these challenges. The PoC will leverage technologies such as Computer Vision and Artificial Intelligence (AI) to play a pivotal role in analysing complex data sets, providing deeper insights into attendee behaviour and infrastructure usage. It is also aimed to leverage Privacy Enhancing Technologies (PETs): Ensuring that the increased data collection and analysis uphold privacy standards is a key aspect of the PoC, addressing potential privacy concerns. Internet of Things (IoT) technology would be instrumental in real-time monitoring and management of event infrastructure, enhancing the capacity for responsive planning and design.

2.2.4. These advanced tools are expected to be instrumental in gathering comprehensive data, extracting valuable insights, and developing strategies that optimise the management of large-scale events. By doing so, the PoC aims to demonstrate the capability to plan and design infrastructure more effectively, balancing attendee experience with environmental and infrastructural sustainability.

2.2.5. The selection of 'Digital Twin - Sangam' for the Proof of Concept is not only apt but also holds the promise of transformative impacts in the field of event management. This PoC is poised to deliver groundbreaking outcomes, optimising event preparation and response through cutting-edge digital solutions, and setting a new standard for efficient and responsive event management on a grand scale.

2.2.6. While the 'Digital Twin - Sangam' PoC is primarily focused on revolutionising event management, the skills, insights, and solutions developed through this initiative have the potential to be invaluable in a wide range of scenarios, extending their relevance and utility to various fields where these newfound capabilities can be effectively leveraged.

2.2.7. Digital Twin: Sangam is structured with several interconnected sub-parts and emphasises the modularity and reusability of these components. This design approach enables the sub-parts to serve as versatile building

blocks, applicable in other solutions that require similar capabilities. Such a structure not only incentivizes participants across the value chain but also unlocks the vast potential of telecom data and Digital Twin technology across various scenarios.

2.2.8. Ultimately, 'Digital Twin: Sangam' seeks to demonstrate the effective utilisation of unified data, along with advanced connectivity and computational technologies, to plan and design infrastructure. The goal is to create solutions that both mitigate impacts and maximise utility value, showcasing a new paradigm in infrastructure planning and designing.

3. Expectations and Anticipated Outcomes:

The "Digital Twin - Sangam" PoC uniquely combines Digital Twin Technology with advanced telecom sector data, aiming to drive both economic growth and social progress. Central to this initiative is the development of India-specific applications that leverage cutting-edge technologies like edge computing, augmented reality, virtual reality, and IoT.

Key anticipated outcomes of the PoC are following:

3.1. Innovative Integration: The PoC seeks to align infrastructure development with the distinct behavioural patterns of the masses, ensuring that advancements in telecom are not only economically impactful but also socially relevant.

3.2. Technological Synergy: By fostering synergies between startups and the telecom sector, the PoC encourages the creation of a balanced, collaborative ecosystem. This involves sharing cutting-edge telecom technologies, data, and insights, and integrating them with inputs from various sectors.

3.3. Data and Insight Utilisation: A significant aim is to develop an architecture that not only facilitates data or insight sharing but also addresses any concerns related to it using telecom and computational technologies.,

3.4. **Driving Innovation and Efficiency:** The initiative is designed to unlock new value by promoting innovation and efficiency in infrastructure planning and design. Startups are encouraged to merge telecom data with their unique insights, contributing to a robust and interconnected ecosystem.

3.5. **Global Digital Leadership:** This PoC positions India to redefine its role in the global digital landscape, highlighting its ability to innovate and lead in a crucial industry.

3.6. **Collaborative and Sustainable Solutions:** At its core, "Digital Twin - Sangam" focuses on bridging sectoral gaps, fostering a collaborative environment where shared knowledge leads to the adoption of emerging technologies. This collaboration empowers startups and the telecom sector, enhancing the ecosystem's relevance to contemporary infrastructure challenges and driving the development of informed, effective, and sustainable solutions.

It is expected that 'Digital Twin: Sangam' will not only confirm the efficiency and accuracy of using varied data in complex project planning but also showcase the potential for rapid adaptation to evolving circumstances. This initiative is poised to establish new benchmarks in smart, sustainable, and adaptable infrastructure planning. We envision 'Digital Twin: Sangam' as a pioneering model for future infrastructure planning, design and development.

4. Two stage Expression of Interest (EoI)

Expression of Interest (EoI) is invited in two-stages EoI.

4.1. First Stage of the EoI

4.1.1. The initial stage of the EoI invites participants to delve into the broad thematic areas outlined in the envisioned Proof of Concept (PoC). In this stage, participants are encouraged to utilize their unique skills and expertise within the context of the PoC. They would be facilitated with networking opportunities, allowing them to connect with potential partners whose skills and capabilities complement their own.

4.1.2. This stage would play a crucial role for stakeholders in grasping the PoC's complexity, gain a comprehensive understanding of the PoC's complex nature, encompassing various challenges and opportunities. This will also help them in deepening their knowledge of possibilities of technical solutions in the Digital Twin domain, particularly those leveraging the emerging capabilities of the telecom sector and possibilities of fusing telecom data or insights with other sources of data or insights. Participants in the first stage of the EoI will have the opportunity to collaborate and experiment with potential solutions alongside other contributors. This exploratory phase sets the groundwork for potentially developing more comprehensive solutions in the second stage. These advanced solutions are aimed at making meaningful social and economic impacts, filling gaps that are currently unaddressed by potential stakeholders.

4.1.3. The insights and understanding gleaned from the first stage will inform the development of a more detailed and structured set of requirements. This will lay the groundwork for launching the second stage of the EoI, where these refined requirements will guide more targeted and advanced proposals from participants.

4.1.4. Opportunities to the participants of the first stage

The initial stage of the process presents several key opportunities for both platform providers and seekers, particularly in the realm of developing Digital Twin-based solutions:

a. **Exploring Foundational Layers:** Participants will have the chance to explore and share the capabilities of foundational layers, such as the features, tools, and utilities integral to GIS and Cloud platforms. This exploration is crucial for understanding how these platforms can support the development of Digital Twin solutions.

b. **Data or Insight Integration and Solution Development:** The stage facilitates understanding how data or insights from a variety of sources can be ingested and utilised in creating innovative Digital Twin solutions. This includes exploring new ideas and potential solutions that can be developed using these integrated data sets or insights.

c. **Facilitating Data and Insight Exchange:** It offers a platform for data or insight seekers and providers to interact and exchange information about the types of data that are required, currently available, or need to be created for the envisioned PoC. This exchange is vital for aligning data availability with the specific needs of developing solutions.

d. **Enabling Informed Solution Creation:** By providing these opportunities, the first stage aims to ensure that all participants, whether they are seeking or providing data and insights, have a clear understanding of the requirements. This clarity is essential for the effective development of solutions tailored to the PoC's objectives.

4.1.5. Setting Foundation for Collaborative and Impactful Journey

The first stage of the PoC would extend beyond just formulating detailed technical specifications. This phase of the PoC would be pivotal in guiding stakeholders to:

a. **Understand the Broader Impact:** Gain a comprehensive understanding of the social and economic impacts that Digital Twin and Telecom insights can bring. This includes assessing how these technologies can transform various sectors and improve community well-being.

b. **Address Sustainable Development Goals (SDGs):** Explore how innovative solutions, combining telecom data such as mobility insights with Digital Twin Technology, can effectively address SDGs challenges. This involves developing new services and products that not only meet current needs but also promote sustainability and resilience.

c. **Empower Startups in Social Entrepreneurship:** Provide startups with opportunities to gain valuable experiences and insights in the fast-evolving field of social entrepreneurship. This stage is a platform for startups to immerse themselves in real-world challenges and innovative problem-solving.

d. **Inspire Innovation and Idea Sharing:** Create an environment where startups feel inspired to share new ideas on leveraging telecom data and insights. Encourage a culture of creativity and innovation, essential for the continuous evolution of technology and services.

e. **Collaborative Problem Solving:** Facilitate opportunities for stakeholders to work collaboratively in diverse teams. Focus on utilising telecom data and insights combined with Digital Twin Technology to tackle large-scale event and SDGs challenges in innovative ways.

f. **Networking and Building Connections:** Offer a conducive platform for all stakeholders to build new friendships and professional connections. These relationships will be instrumental in fostering participation and collaboration in the second stage of the PoC.

The first stage of the two-stage EoI would set the foundation for a collaborative, innovative, and impactful journey. It would provide an opportunity for all involved to contribute meaningfully towards creating powerful and more meaningful solutions during the second stage of the PoC and would also provide opportunities to all stakeholders to forge lasting partnerships.

4.1.6. Screening at the First Stage of the EoI

On receipt of the EoI, technical discussions/ presentations would be held with the short-listed participants, which are prima facie considered technically capable to contribute in developing solutions using digital twin technologies.

Companies/organisations, institutions or individuals who are participating in the EoI shall abide by the laws and regulation of India.

4.1.7. Deliverables of the First Stage of the 'Digital Twin - Sangam' PoC

a. Development of a Living List of Use Cases:

- A dynamic and evolving list of potential use cases will be curated, undergoing critical review to assess their viability and relevance. This living list will serve as a valuable resource for participants in the second stage, guiding their focus and considerations.
- The list is designed to be flexible, allowing for continuous expansion and adaptation based on emerging insights and ideas.

b. Presentation of Proposed Solutions:

- By the end of the first stage, each participant, whether individually or as part of a group, is required to present at least one solution relevant to the PoC.
- The proposed solution should be detailed, outlining how it can be realized using foundational layers' capabilities and data or insights obtained from other partners.
- The presentation must highlight the participant's specific contributions during the first stage and outline plans for further development in the second stage, should they choose to continue with the same solution.

- Presentations should encompass both first-order and second-order impacts of the use case, detailing both tangible and intangible benefits. Additionally, they should articulate strategies for ensuring the solution's commercial viability, including pathways for sustainability and potential for scaling up.

c. Inclusion in the Living List:

- All proposed solutions will be incorporated into the living list, mapped against the identified use cases.
- Additionally, the list will also include emerging use cases with potential for future development, identifying areas that warrant deeper exploration.

These deliverables are designed to foster a structured yet adaptable approach, ensuring that the first stage of the PoC not only identifies promising solutions but also lays the groundwork for continuous innovation and exploration in subsequent stages.

4.1.8. Stage One is an Exploratory Phase Without Financial Incentives

The first stage of the Expression of Interest (EoI) process is designed as an exploratory phase and does not include financial incentives. This stage is categorized as a **"Non-committal" EoI**, meaning participation in the second stage is not limited exclusively to those shortlisted in the first stage.

a. **Advantages of Early Participation:** Participants engaging in the first stage will have distinct advantages moving forward. They will gain a deeper understanding of the project's context, develop a broader network with other participants, and have the opportunity to try and test various preliminary solutions.

b. **Consideration for Second Stage Participation:** The level and nature of involvement during the first stage will be taken into account when finalizing proposals for the second stage. Additional participants may be

introduced in the second stage if needed to ensure a diverse range of capabilities or to better meet the PoC's objectives.

c. **Second Stage Entry Requirements:** New participants joining directly in the second stage must make a detailed presentation. This presentation is crucial to demonstrate their potential contributions towards the PoC's goals. If an existing participant from the first stage opts to pursue a different solution in the second stage, they are also required to present their new approach for further consideration. The primary aim is to align the participant pool with the envisioned objectives of the PoC, maximizing the potential for successful outcomes.

4.2. Second and Final Stage of the EoI:

On the basis of the insights and understanding gleaned from the first stage, a more detailed and structured set of requirements would be formulated. The refined requirements will be to get more targeted and advanced proposals from the participants to the second stage of the EoI. In the second stage of the EoI, all proposals would be considered except the proposals rejected at the first stage of the EoI. However these proposals would be considered in the context of the revised requirements of the second stage of the EoI.

Any participant, invited to the PoC at first stage, but not in a position to demonstrate PoC due to modification in the specifications or terms and conditions, would be given the option to withdraw from the participation proceedings.

Disclaimer:

"*This EoI is merely an invitation to participate in an experimental initiative and not any kind of formal Offer or Tender and does not bind DoT from any kind of commitment by the DoT or the Government of India. It may be noted that Participants will not receive any financial compensation for developing, preparing, or demonstrating their PoC.*

This initiative is purely experimental in nature and is intended to foster innovation and collaborative effort in the field. Participation in this PoC does not provide any preferential treatment, advantages, or guarantees regarding the award of any future work related to this or any other project undertaken by the DoT or the Government of India.

The PoC does not address or deal with the issues related to copyrights, intellectual property rights, patents, or similar concerns. Participants are responsible for ensuring that their submissions do not infringe on any third-party rights.

Engagement in this PoC is entirely voluntary and at the discretion of the participating organisations and experts. Participants should consider their ability to commit the necessary resources without expectation of direct financial return."

4.2.1. Outcomes of the EoI's Final Stage

The second stage of the EoI is designed to bring start-ups, industry leaders, and stakeholders together to develop and demonstrate solutions in the context of the PoC. This collaboration aims to shape the future of infrastructure planning and design using Digital Twin technology, alongside advanced telecom and computational technologies. This stage is focused on nurturing innovation and developing practical, data-driven solutions. It also encourages creative thinking and aims to extend the applicability of the developed skills and insights beyond event management, contributing to a diverse range of fields.

This would encourage the generation of innovative ideas that not only promise economic gains but also effectively address the challenges in

infrastructure planning and design. The focus is on creating solutions that significantly enhance the utility and efficiency of infrastructure systems.

This stage is an opportunity for participants to explore and propose business models that harness the combined potential of telecom data and Digital Twin Technology. The objective is to develop concepts that are not only financially viable but also contribute to improving infrastructure planning, design, development and management processes.

Key outcomes the participants of the second stage of the EoI are expected to demonstrate are:

a. **Building an Inclusive Ecosystem for Innovation:** Participants will work towards creating a strong, inclusive ecosystem that fosters innovation and entrepreneurship. The goal is to develop solutions that facilitate faster, better, and more cost-effective infrastructure planning and design.

b. **Developing a Value-Driven Ecosystem:** Demonstrations in this stage will showcase how a unified, data-driven and evidence-based approach can lead to a value chain-driven ecosystem. The functionalities developed will have potential reuse beyond the PoC, contributing to the entire lifecycle and continuous improvement of the ecosystem. The strategy of utilising interconnected sub-parts is designed to effectively align incentives throughout the entire value chain. This approach ensures that all components work synergistically, fostering a cohesive and mutually beneficial ecosystem.

c. **Establishing Digital Service Centers:** The developed functionalities will be showcased as potential service centres, extending their utility to global scenarios and contributing to international standards in similar domains.

d. **Developing tailored Simulation Models:** This stage will focus on creating simulation and predictive analytics models to understand the mobility behavioural patterns of crowds, specifically tailored for event management in India. Should there be a need for specific or historical data not currently available, the stage will also explore methodologies for data collection and processing to facilitate the immediate development of these models.

e. **Setting the Framework for International Standards:** This stage involves developing a model framework and specifications to exploit the capabilities and ecosystem developed, laying the groundwork for establishing international standards.

- A crucial outcome of this stage is the creation of a new reference framework for government bodies. This framework will be based on the insights and understanding developed during the PoC.
- The framework aims to serve as a guide, enabling other stakeholders to effectively utilise telecom data and insights, along with Digital Twin Technology, for their specific purposes. It is envisioned as a tool that can be adapted and applied across various sectors, enhancing the broader application of the learnings from the PoC.
- This approach is designed to not only benefit government entities but also to empower other stakeholders by providing them with a comprehensive, tested model that they can leverage for their infrastructure-related initiatives.

f. **Bridging Development and Commercialization:** A roadmap will be created to transition these solutions from the development stage to commercialization, effectively bridging the gap between the two.

g. **Fostering Synergies and Capacity Building:** Expectations are high for creating synergies among diverse players, including start-ups, telecom service providers, and GIS platform providers. This collaboration will aid in capacity building and developing models tailored to the mobility behavioural patterns of the Indian populace, particularly for event management.

The second stage of the EoI is thus a critical phase in translating innovative ideas into practical, scalable solutions that have the potential to transform the landscape of infrastructure planning and design. It is a step towards actualizing the practical applications of the technologies and strategies explored in the PoC, paving the way for widespread adoption and impact.

4.2.2. Deciding Intellectual Property Rights in the EoI Process

a. **IPR Ownership:** Intellectual Property Rights generated by participants during the project will remain with the respective participants. However, the Department of Telecommunications (DoT) reserves the first right of refusal for preferential access to these technologies, including product development, market introduction, and investment opportunities.

b. **IPR Agreement and Protection:** The specific terms regarding intellectual property will be established among the participating entities before commencing solution development in stage two of the EoI. All parties involved will commit to protecting any intellectual property that arises from the project.

c. **Reporting and National Interests:** Institutions or organisations may be required to submit periodic reports to the DoT for at least one year, detailing the status of IPR creation and commercialization efforts. Crucially, all IPR must reside within India, ensuring national access and control, especially in emergency situations to safeguard national interests. The DoT will maintain the first right of refusal regarding these IPRs.

5. Detailed Information and Participation Guidelines:

Prospective participants are encouraged to thoroughly review the details outlined in the annexed document (Annexure-I), which provides comprehensive information on the PoC's objectives, scope, and participation criteria. Additionally, Annexure-II presents “Guidelines for Reference Standards in Digital Twin Technology and Applications,” vital for understanding the technological framework of the PoC.

5.1. PoC Venue for Innovation: One of the major cities of India:

5.1.1. For the first stage of the EoI, as such there is no specific location, participants are supposed to workout their arrangements. However, they are encouraged to get networked with all types of participants and make their best endeavour to explore working with most of the participants.

5.1.2. During the first stage, DoT will facilitate by conducting events periodically to steer the work, facilitate networking, exploring, and collaborating from time to time and it may also make other arrangements for better coordination, cooperation among the participants. Participating organisations may also be requested to organise the events or make arrangements to conduct sessions on technologies, tools, utilities and specific ideas for the benefit of all participants, that may be in the interest of the success of the PoC.

5.1.3. For presentations in the beginning and at the end of the First stage, participants might be required to travel to Delhi or any other city as specified from the.

5.1.4. For the second stage of the EoI, one of the major city of India, will be chosen as the location for demonstrating this PoC.

5.2. The Duration of the PoC:

5.2.1. For the First stage, after finalisation of list of participants, within two months, all participants are required to finish the tasks of the first stage.

5.2.2. For the second stage, subsequent to completion of the first stage, the requirements will be notified. However, the duration of the PoC is tentatively set for approximately six months from the announcement date of the finalised list of participating players for the second stage. This time frame is planned to allow for a thorough exploration of the PoC's objectives, encouraging participants to deliver their best within this period.

5.3. Collaborative Invitation: Uniting Expertise for Innovation

5.3.1. This Expression of Interest (EoI) calls upon a diverse range of organisations and experts to join in this initiative. The objective is to harness collective expertise and resources, fostering a multidisciplinary approach towards achieving the goals set out in the Proof of Concept.

5.3.2. Participants in this EoI are expected to work synergistically, contributing their unique skills and insights. This collaborative environment is designed to cultivate a culture of innovation and shared learning. By participating in the 'Digital Twin: Sangam' PoC, organisations and individuals have the unique opportunity to showcase their capabilities, contribute to an innovative project, and position themselves as leaders in the field of digital infrastructure planning.

5.3.3. We look forward to receiving insightful and forward-thinking responses that align with the vision of the "Digital Twin: Sangam" project, marking a significant step towards the future of digital infrastructure planning and designing.

5.4. Synergizing Expertise for 'Digital Twin: Sangam' PoC Implementation

The effective implementation of the 'Digital Twin: Sangam' PoC relies on a synergistic collaboration among diverse participants. Each player is expected to bring their unique strengths, capabilities, and resources to the table. To illustrate the intricate collaboration required, a schematic diagram (not

exhaustive) will detail the multifaceted layers and the corresponding inputs needed.

5.5. Fostering Collaboration and Resource Sharing in the EoI Process:

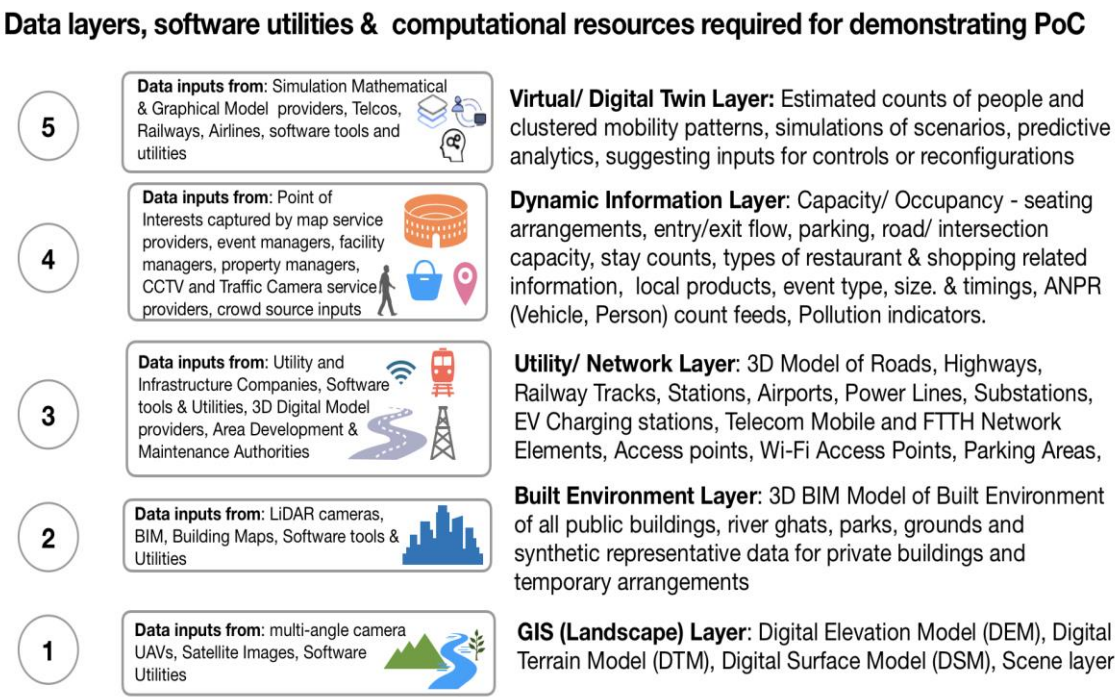
Particiapnts responding to the Expression of Interest (EoI) are encouraged to actively contribute essential resources crucial for the success of the “Digital Twin: Sangam” PoC. This includes the provision and sharing of computational power, specialized Application Programming Interfaces (APIs), software licenses and other tools, utilities and engines relevant for the purpose. These resources are not solely for individual benefit but are instrumental in cultivating a cooperative and collaborative environment. This approach enables all involved parties to work together more effectively and efficiently. Additionally, the contribution of skilled professionals for the development, execution, and demonstration of the PoC is of paramount importance. Their expertise and involvement are foundational to the collective success of the project, ensuring a well-coordinated and skillfully executed collaborative effort.

5.6. Structured Data Layers for Comprehensive Input Integration:

The architecture of the PoC is methodically segmented into five distinct layers, each serving a specific function and requiring targeted inputs:

5.6.1. GIS (Landscape) Layer (Layer-1):

- Comprises Digital Elevation Model (DEM), Digital Terrain Model (DTM), Digital Surface Model (DSM), and Scene layer.
- Inputs from multi-angle camera UAVs, Satellite Images, processed and rendered by participants with relevant Software Utilities.
- Ideal for GIS domain companies or experts.



5.6.2. Built Environment Layer (Layer-2):

- Includes 3D BIM Model of public infrastructure and synthetic data for private buildings and temporary structures.
- Inputs from LiDAR cameras, BIM, Building Maps, and Software tools & Utilities.
- Suitable for companies or experts in surveys, architectural solutions, and software tool provision.

5.6.3. Utility/Network Layer (Layer-3):

- Contains 3D Models of transportation networks, power infrastructure, telecom networks, parking areas, etc.
- Inputs from Utility and Infrastructure Companies, 3D Digital Model providers, and Area Development & Maintenance Authorities.
- Appropriate for companies or experts in network inventory, planning, surveys, and software tools.

5.6.4. Dynamic Information Layer (Layer-4):

- Details on Capacity/Occupancy, event information, Auto

Numbering Plate Recognition (ANPR) counts, pollution indicators.

- Inputs from map service providers, event and facility managers, Closed Circuit TeleVision (CCTV) and Traffic Camera service providers, crowd-sourced data.
- Ideal for companies or experts in automated data capture, application or service provision.

5.6.5. Virtual/Digital Twin Layer (Layer-5):

- Offers simulations, predictive analytics, and control/reconfiguration suggestions.
- Inputs from Simulation Model providers, Telcos, Railways, Airlines, software tools, and utilities.
- Suitable for companies or experts in animation, gaming, virtual asset development, Augmented Reality, Virtual Reality and behaviour simulations.

6. Classification of EoI Participants

The categorization of participants in the Expression of Interest (EoI) is a crucial step towards harnessing the full potential of the 'Digital Twin: Sangam' PoC. This process is designed to align the unique capabilities and expertise of each participant with the specific needs and goals of the project, ensuring a cohesive and effective multidisciplinary collaboration.

To facilitate this alignment, participants are grouped according to their relevance to the five distinct layers defined in the 'Digital Twin: Sangam' PoC. This grouping ensures that the contributions of companies, experts, and specialists are precisely matched to the layers where their expertise can have the most significant impact. The following outlines the classification of participants corresponding to each layer:

6.1. Participants for GIS (Landscape) Layer (Layer-1):

6.1.1. Geographical Information System (GIS): Companies or Specialists in creating Geospatial Digital Twins.

6.1.2. Unmanned Aerial Vehicles (UAV) and Satellite Imagery: Companies conducting surveys or providing aerial and satellite data.

6.1.3. Advanced End User Devices and Gateways: Companies or Experts in LiDAR, high-resolution cameras, and related technologies.

6.2. Participants for Built Environment Layer (Layer-2):

6.2.1. Generative Design and Building Information Modeling (BIM): Companies or Professionals in architecture, BIM, and CAD tools.

6.2.2. Visualization and Interactive Design: Companies or Professionals creating visualisations for built environments.

6.2.3. 3D Printing or Additive Manufacturing: Companies or professionals in 3D printing or additive manufacturing to demonstrate innovative ways to create infrastructure components.

6.3. Participants for Utility/Network Layer (Layer-3):

6.3.1. Machine-to-Machine (M2M) and Internet of Things (IoT): Providers of M2M or IoT-based solutions for utilities and infrastructure.

6.3.2. Computer Vision and Analysis: Companies and Experts in object and activity classification, especially for providing statistical information in real time about the activities in a particular area. Activities may be related to persons and vehicles and usage of infrastructure.

6.3.3. Geo-tagged network inventory: Companies or Experts involved in creating and maintaining geo-tagged network inventories especially for infrastructure and utilities.

6.4. Participants for Dynamic Information Layer (Layer-4):

6.4.1. Application Providers:

- **CCTV and ANPR Systems:** Specialists in Closed Circuit Television (CCTV) and Automated Number Plate Recognition (ANPR) technologies, adapted to provide detailed vehicle-related statistics. Their contributions are critical in monitoring and analysing vehicular movements and patterns.

- **Environmental Data Experts:** Providers of environment-related information, crucial for understanding and managing the ecological impact of large-scale events.

- **Event Information Specialists:** Companies that offer comprehensive city or event-related information, aiding in the overall management and coordination of the event.

6.4.2. Facility Providers/Event Organisers or Managers:

- **Event Planning and Design Specialists:**
  Organisations and experts specialising in the planning and design of large-scale events, facilities, and venue arrangements. They focus on optimising hall or area capacities to accommodate diverse event needs effectively.
- **Booking and Ticketing System Managers:**
  Entities engaged in managing bookings or ticketing for large-scale events. Their systems are crucial for providing real-time insights into performance during entry and exit processes, aligning these procedures with the effectiveness of infrastructure plans and designs.
- **Communication and Alert Dissemination Experts:**
  Organizations responsible for distributing important alerts and information to event attendees. Their role is pivotal in ensuring effective communication, contributing to an enhanced overall event experience.
- **Event Personnel Training Providers:**

Entities dedicated to training personnel for event management, focusing on equipping individuals from diverse sources and backgrounds with the necessary skills to handle various aspects of large-scale event operations.

6.5. Participants for Virtual/Digital Twin Layer (Layer-5):

6.5.1. Cloud Computing for Digital Twin Platforms:

- **Innovative Platforms and Solutions:** Companies offering advanced cloud computing platforms and solutions specifically designed to support Digital Twin operations.
- **Privacy-Enhancing Technologies:** These include capabilities like Federated Learning (FL), Trusted Execution Environment (TEE), Multi-Party Secure Computing (MPC-sec), anonymization, and data aggregation to enhance user privacy.
- **Robust APIs:** Provision of Application Programming Interfaces (APIs) tailored for various services relevant to the envisioned Digital Twin, facilitating seamless integration and functionality.

6.5.2. Creation of Virtual Worlds:

- **Expertise in Immersive Technologies:** Specialists in gaming engines, Augmented Reality (AR), Virtual Reality (VR), and Mixed Reality (MR) who create immersive and interactive virtual environments.
- **Collaborative Interfaces:** Capabilities that enable broad participation from various domains, including the public, in the planning and design of infrastructure projects, fostering a more inclusive and collaborative process.

6.5.3. Advanced End User Devices and Gateways:

- **Cutting-Edge Technology Providers:** Companies and experts specializing in AI/ML, edge computing, and Internet of Things (IoT) sensors and actuators.
- **Simulation and Virtual Environment Support:** These advanced devices and gateways are critical in creating realistic simulations and enhancing virtual environments, crucial for the effective implementation of Digital Twin technology.

6.5.4. Natural Language Processing (NLP), Speech to Text (STT) and Generative AI: Companies and specialists proficient in leveraging artificial intelligence crucial for transforming audio data into insightful narratives, their expertise may lie in:

- **Speech-to-Text Conversion:** Utilizing advanced speech recognition technology to accurately transcribe audio data. This process is essential for capturing diverse public opinions and feedback, which are often vocalised and recorded in various settings.

- **Natural Language Processing (NLP):** Employing NLP and Generative AI techniques to analyse the transcribed text. This includes identifying and combining similar themes, as well as distinguishing contrasting viewpoints, to form a coherent narrative.

- **Multilingual Support:** Catering to the linguistic diversity of the country by supporting multiple languages and dialects. This capability ensures inclusivity and comprehensiveness in understanding and integrating public feedback.

The primary purpose of including such AI-based technologies and applications is to explore possibilities to engage the public effectively in the planning and design of infrastructure solutions. By processing audio data gathered from public interactions, these companies and specialists may provide valuable insights that reflect a wide range of perspectives and needs. This approach may not only enrich the planning process but may also foster a more participatory and inclusive infrastructure development.

6.5.5. Data Fusion, Enrichment and Privacy: Companies and Experts specializing in Data Fusion, Enrichment, and Privacy playing a crucial role in harmonizing and enhancing various data sets while maintaining stringent data security and privacy standards. Their expertise may involve:

- **Privacy-Enhancing Data Fusion:** Developing methods to combine data from multiple sources in a way that enhances the overall value of the information while rigorously protecting privacy. This approach is vital to safeguard sensitive commercial data and individual privacy.
- **Handling Diverse Data Sets:** The expected diversity in the sources, volumes, types, and quality of data necessitates sophisticated fusion techniques. These methods aim to substantially enrich the combined output, providing a more comprehensive and insightful perspective.
- **Balancing Enrichment with Privacy Concerns:** Implementing models and techniques that effectively enrich data while addressing privacy concerns of both individuals and organisations contributing data. This balance is essential to ensure the ethical use of data and maintain trust among all stakeholders.
- **Effectiveness in Data Utilisation:** Ensuring that the fused and enriched data sets are not only secure and private but also effective in delivering meaningful insights for the 'Digital Twin: Sangam' PoC.

  The expertise of these companies and professionals is pivotal in achieving a data environment that is both rich in insights and respectful of privacy and commercial sensitivities.

6.5.6. Telecommunications: AI-Driven Insights and Network Simulations:

- **Movement Analysis Experts:** Companies and specialists leveraging AI to provide thematic insights on people's movements, crucial for understanding crowd dynamics and network demand.

- **Network Digital Twin Creation:** Focused on developing Network Digital Twins for simulating various scenarios in network planning

and design. This capability is key to optimizing network coverage and capacity in response to real-time demands.

6.5.7. Application Providers: Comprehensive Data and Navigation Solutions:

- **Navigation and Survey Tools:** Providers of navigation apps and travel surveys, offering vital data for understanding movement patterns and preferences.

- **Automated Counting and Environmental Insights:** Specialising in the automatic counting of vehicles and individuals, and providing environmental data. These technologies are essential for comprehensive event management and infrastructure planning.

Each category is tailored to bring together diverse yet complementary skills and technologies, fostering a collaborative environment that is key to the successful realisation of Digital Twin technology. This structured approach is to maximise the efficacy of each participant's contribution but also enhances the overall synergy within the project.

The EoI participants may also apply under more than one category.

7. Sub-Components of the 'Digital Twin: Sangam' PoC

The "Digital Twin: Sangam" Proof of Concept (PoC) is structured into various sub-parts, each focusing on specific aspects of event management. These sub-parts, or Sub-Digital Twins, can be further divided, if required, into multiple phases to accommodate the evolving and maturing solutions. Examples include:

7.1. Digital Twin - Sanchar Sanyojak:

7.1.1. Key objectives of this sub component are

- Focused on the Digital Twin of telecom networks in the event area.
- Enables simulations for planning and designing mobile network capacity, coverage, and quality of service.
- Provides real-time insights into network performance, supporting decisions for reconfigurations or adjustments.

7.1.2. This sub-component would showcase adaptation to the ever-changing demands of large-scale event environments. By employing advanced simulation techniques, this would showcase moving beyond the limitations of static data, incorporating real-world variables and dynamics. This would be utilizing sophisticated simulations to explore various network planning scenarios, allowing for a proactive approach to network design and management.

7.1.3. It would also provide immediate and actionable insights into network performance. This feature is essential for identifying and addressing potential issues swiftly, ensuring optimal network functionality during critical moments. The capability to quickly implement changes and enhancements to the network in response to real-time data. This agility is pivotal in maintaining robust telecom support, especially during large-scale events where network demands can fluctuate significantly.

7.1.4. Through these advanced capabilities, this sub-component aims to showcase how the integration of dynamic data and real-time analytics can significantly improve telecom network planning and management.

7.2. Digital Twin - Drishti:

7.2.1. Key objectives of this sub component are

- Generates insights about visitor movements, arrivals, and departures.
- Offers aggregated statistics on transportation modes and general traffic flow.

- Presents predictive analytics and scenario simulations for event facilities, aiding in infrastructure planning and design.

7.2.2. This Sub-Component would showcase advanced visitor dynamics understanding. This sub-component is engineered to provide deep insights into visitor dynamics at large-scale events. This would showcase how nuanced comprehension would be helpful to effectively manage large gatherings and optimize event experiences.

7.2.3. It will demonstrate how advanced data collection and analysis can lead to a better understanding of visitor mobility behaviours and patterns. This insight is pivotal for tailoring infrastructure to accommodate the specific needs of large crowds.

7.2.4. Utilizing knowledge about visitor dynamics, this sub-component will showcase ways to make infrastructure planning and design more adaptable to the requirements of different transport modes and traffic flows. The aim is to create more efficient and user-centric event environments.

7.2.5. This sub-component will illustrate the use of predictive analytics and various scenario simulations to anticipate and plan for different event conditions. It will demonstrate how these tools can be used to proactively address potential challenges, ensuring that the infrastructure is well prepared to meet the diverse demands of the event.

7.2.6. By showcasing these capabilities, this sub-component aims to prove how a data-driven, analytical approach can significantly enhance event facility planning and management. It will validate the concept that understanding visitor dynamics through advanced technologies is essential for creating responsive and effective event infrastructures.

7.3. Digital Twin - Sfurti:

7.3.1. Key objectives of this sub component are

- Assists in simulating and testing scenarios for optimized event infrastructure planning and design.
- Provides a unified view of people flow, from entry to parking, seating, and exit.
- Demonstrates the infrastructure's ability to adapt and reconfigure for new layouts and requirements agilely.

7.3.2. This sub-component would showcase agility and optimizing event Infrastructure. This would showcase enhancing the efficiency and adaptability of event infrastructure. Its primary function is to demonstrate how effective streamlining of event facilities can be achieved through the use of digital twin technology.

7.3.3. It will showcase the use of digital twins in testing and simulating various scenarios for event infrastructure. Emphasizing practical, real-world applications, this approach aims to identify the most efficient and effective planning and design strategies.

7.3.4. This component will illustrate how digital twins can bring together diverse aspects of event management, such as seating arrangements, parking logistics, and road traffic control. By creating a digital thread that links these functions, it provides a comprehensive view of people flow from entry through to seating.

7.3.5. The sub-component will demonstrate the potential of digital twin technology in making infrastructure more adaptable. It will show how digital twins can be used to reconfigure layouts and respond to evolving requirements quickly, ensuring that the infrastructure remains relevant and functional in various scenarios.

7.3.6. By highlighting these capabilities, the sub-component aims to validate how digital twin technology can be effectively utilized to streamline event infrastructure. It seeks to prove that a holistic, data-driven approach to infrastructure planning and design can lead to more flexible, responsive, and efficient event management solutions.

7.4. Digital Twin: Sangam Core - The Integrative Hub of the PoC Ecosystem

7.4.1. The 'Digital Twin: Sangam' PoC is a comprehensive ecosystem composed of various interconnected subparts, each playing a crucial role in the holistic implementation of Digital Twin technology. At the heart of this ecosystem is the 'Digital Twin: Sangam Core', a central hub that binds all these subparts together, offering core functionalities critical for the success of the entire project.

7.4.2. Functionality of Digital Twin: Sangam Core:

- **Integration and Coordination:** The Core serves as the integrative platform, seamlessly connecting subparts like 'Digital Twin: Drishti', 'Digital Twin: Sfurti', 'Digital Twin: Sahyog', 'Digital Twin: Sahayta', and 'Digital Twin: Prashikshan'. It ensures that the insights and inputs from these subparts are effectively consolidated and utilized.
- **Advanced Modelling and Simulations:** Equipped with high-fidelity modelling capabilities, the Core facilitates sophisticated simulation models and predictive analytics. This functionality is crucial for scenario planning and decision support, enabling stakeholders to anticipate and prepare for various situational dynamics.
- **Automation and Optimization:** The Core is designed to automate processes and optimize infrastructure planning and management, integrating the latest advances in AI and ML for enhanced efficiency.
- **Interactive Training and Evaluation:** By simulating diverse scenarios, the Core aids in training and evaluating personnel through 'Digital Twin: Prashikshan', adapting to the ever-changing infrastructural landscape, including emergency situations addressed by 'Digital Twin: Sahayta'.

- **Public Engagement and Experimentation:** 'Digital Twin: Sahyog' feeds into the Core, allowing public interaction and experimentation on draft versions of the Digital Twin. This participatory approach ensures that public feedback is tested and validated before being integrated into the main framework.
- **Telecom Infrastructure Integration:** 'Digital Twin: Sanyojak' focuses on telecom infrastructure planning and design, feeding essential data into the Core for a comprehensive view of the telecom landscape and its impact on overall infrastructure planning.

7.4.3. In essence, 'Digital Twin: Sangam Core' acts as the central nervous system of the PoC, orchestrating and harmonizing the functionalities of all subparts. It ensures that the diverse elements of the ecosystem work in unison, leading to a cohesive, efficient, and responsive Digital Twin framework. This Core is pivotal in realizing the full potential of the 'Digital Twin: Sangam' initiative, enabling a sophisticated, data-driven approach to infrastructure planning and management.

7.5. New sub-components may be introduced as the project progresses, responding to the specific needs and situations that arise. This adaptability ensures that 'Digital Twin: Sangam' remains relevant and effective throughout its development.

7.6. In summary, 'Digital Twin: Sangam' is not just an exploration of technology but a concerted effort to bring together various aspects of digital innovation for comprehensive infrastructure development. Its success lies in the harmonious integration of these evolving sub-components, each contributing to a more efficient, responsive, and inclusive planning process.

8. Responses to the Expression of Interest (EoI):

Interested parties are invited to submit their detailed responses to this EoI before the specified deadline. Submissions should comprehensively cover the following aspects:

8.1. Profile Information:

- **For Companies:** Provide a detailed company profile, including areas of expertise, previous experience in similar projects, and any relevant achievements or recognitions.

- **For Experts:** Submit a comprehensive professional profile, highlighting qualifications, experience in the field of digital infrastructure planning or related technologies, and any notable contributions or publications.

8.2. Proposed Approach or Methodology:

Outline your overall approach or methodology for participating in the PoC. This should include your strategic vision, objectives, and how you plan to contribute to the project's goals.

8.3. Technological Resources:

Detail the utilities, software, hardware, and applications you plan to use and offer to others for the development and demonstration phases of the PoC. Explain why these resources are suitable and how they align with the objectives of the PoC.

8.4. Human Resources Commitment:

Specify the expert resources and developers that will be dedicated to the PoC. Include information on their roles, experience, and the extent of their involvement during the PoC duration.

8.5. Additional Information:

If there are any other pertinent facts, items, or unique offerings that you wish to mention, please include them here. This may include innovative ideas, potential collaborations, or specific advantages your participation brings to the PoC.

8.6. Interested parties who have valid authorization and also have competence and experience to carry out such development and demonstrations are requested to submit the EoI along with the supporting documents on the DoT website at the link specified. Last date for submission is 30 days from the publishing of this EoI. Preregistration can be done immediately on the DoT website at the link specified.

9. Final Selection and Participation Criteria for 'Digital Twin: Sangam' PoC

9.1. For the first stage of the 'Digital Twin: Sangam' EoI, selection criteria is aimed to assemble a dynamic and capable group of participants who can collectively contribute to the innovative execution of the 'Digital Twin: Sangam' PoC.

9.2. All applicants with proven experience in Digital Twin technology or in any of the relevant fields outlined in the EoI will be favorably considered. Even without specific experience in Digital Twin technology, applicants with relevant skills and potential to contribute significantly to the PoC will be seriously considered if the situation does not warrant putting restrictions on the number of candidates. However, if the number of participants is exceedingly high, selection may prioritize those who demonstrate knowledge and expertise.

9.3. A strong emphasis is placed on creative and innovative thinking. Participants offering novel approaches or unique perspectives are highly valued and will be crucial for sustained participation.

9.4. Applicants would be required to apply under various categories like individual/ govt organization/ company/ startup/ MSMEs/ academic/ R&D institutions etc. Applicants applying in any of the above-mentioned categories should provide detailed information about their field of expertise and envisioned contributions, including past projects, technical skills, and innovative ideas. Applicants applying, as a company / startup will be asked to provide relevant documents like company registration

details, domain of the company, office, website details etc.

9.5. The Department of Telecommunications (DoT) will finalize and announce the list of participants for the 'Digital Twin: Sangam' Proof of Concept (PoC) based on the responses received to the Expression of Interest (EoI). The DoT is committed to fostering broad participation in this experimental initiative and anticipates that all participants will engage earnestly, proactively, and with a focus on the success of the PoC.

9.6. Participants are encouraged to engage with the spirit of collaboration and innovation, ensuring their contributions align with the goals and requirements of the 'Digital Twin: Sangam' PoC. If required, DoT may constitute Project Monitoring and Steering Group (PMSG) to facilitate collaboration and take decisions to achieve the desired objectives of the PoC.

9.7. Please ensure that your response is clear, detailed, and aligns with the objectives and scope of the PoC as outlined in the EoI document. Submissions must be formatted professionally and be submitted by the specified deadline on the website as mentioned in the EoI document.

Important Note

The following are conditions for continued participation in the first stage:

Active and Relevant Contribution: Participants are expected to contribute meaningfully to the PoC. This includes demonstrating competence in their respective areas and maintaining active involvement in the project's activities.

Potential Delisting: In the event that a participant is found to be lacking in relevant competence, is inactive, or is adversely impacting the progress of the PoC, the DoT reserves the right to delist them from the project. Such decisions may be made at any stage of the PoC or EoI process.

No Obligation for Explanation: The DoT may delist participants without providing specific reasons. The decision will be made in the best interest of the project's objectives and overall progress.

No Financial Liability: The DoT will not bear any financial implications that may arise for the participants as a result of their delisting.

Law Abiding Organizations: Companies/organizations, institutions or individuals who are participating in the EoI shall abide the laws and regulation of the India

For any further clarifications or information in the respect of this EoI may be sought from ADG (AI & DIU), Department of Telecommunications, Sanchar Bhawan, 20 Ashoka Road New Delhi, India PIN -110001, email: adg.diu-dot@gov.in with subject of the Email to be specified as Digital Twin: Sangam.

Navneet Kabra

ADG (AI &DIU)

Department of Telecommunications (DoT)

Government of India
12th Floor, Sanchar Bhawan
20, Ashoka Road, New Delhi-1100001
adg.diu-dot@gov.in

Enclosures:

Annexure-I: The Concept of Digital Twin: Sangam, Objectives, Scope and Participation Criteria of the PoC

Annexure-II: Guidelines for Reference Standards in Digital Twin Technology and Applications

Annexure-I

Digital Twin: **Sangam**

The concept, objectives, scope, and success criteria for the PoC.

Table of Content

Executive Summary

This document serves as an invitation to industry players and experts to partake in a pioneering endeavour: planning and designing infrastructure systems leveraging the digital technology platform that facilitates collaborative work and integrated planning and allows evaluation of various scenarios. Invitation is to develop and demonstrate digital technology platforms with the aim to address the challenges of managing large-scale events and urban developments, leveraging the potential of Digital Twin technology and other advanced digital solutions.

Reflecting the principle of 'Sangam,' or convergence, this document delves into the fusion of cultural, social, and technological elements in managing large gatherings. It explores how Digital Twin technology can transform the planning and execution of such events, underscoring a holistic approach that combines cultural sensibilities with cutting-edge technology.

Further, the document highlights a shift from traditional event management practices to a more dynamic, data-driven approach and how real-time insights and predictive analytics, would facilitate a more responsive and effective management strategy. In achieving this, how Digital Twin technology is going to play a role.

The integration of Digital Twin technology with various external data sources is presented in the document to emphasise the need of this synergy and how it would be crucial for generating accurate and detailed insights, essential for the complex task of managing large-scale events and planning and design of infrastructure.

With the possibility of leveraging telecom data and navigation apps to have a more accurate and comprehensive picture of mobility of the people, the document focuses on the application of Digital Twin technology in managing visitor flow and its impact on the environment and society. It highlights how technological innovation, coupled with community feedback, can lead to sustainable and effective event management.

The document presents a city as a key example to develop and demonstrate “Digital Twin: Sangam” to plan and design infrastructure and may include a number of various sub-parts such as “Digital Twin: *Drishti*”, “Digital Twin: *Sanchar Sanyojak*”, “Digital Twin:*Sfurti*” etc. The purpose is to demonstrate how planning and designing of infrastructure can be improvised by leveraging connected common data environments and Digital Twin technology.

Document also provides an outline of the structured approach and various phases involved in implementing the Digital Twin PoC in a major city of India. This section sequentially maps out each stage of the project, from data collection to analysis and leveraging it for planning and design of infrastructure.

At the end, the document concludes by succinctly presenting the objectives and expected results of the Digital Twin PoC. It emphasises the transformative potential of this technology in achieving better planning and designing of infrastructure.

Finally, the document lists the diverse range of expertise and industry players invited to contribute to the PoC. This inclusive approach highlights the necessity of collaborative efforts in realising the full potential of Digital Twin technology in modern infrastructure management.

1. Introduction

In the realm of infrastructure project planning and design, a significant challenge lies in the lack of access to contextualised data, which is crucial for a nuanced understanding of the project requirements. Traditional platforms used in planning and design often operate in silos, hindering the iterative improvement process and limiting the involvement of operation teams and end-users.

The need for a more integrated approach is clear. There is a growing demand for platforms and tools that can aggregate diverse information sets, providing a unified environment for comprehending the full context of a project and deriving meaningful insights. Such a platform would integrate 'Systems of Records'—encompassing asset information management, predictive analytics, and performance benchmarks—across multiple teams or partners, enabling real-time updates and contextualised data usage.

Moreover, these platforms should foster cross-functional collaboration that is not only faster and more cost-effective but also conducive to remote working and adept at addressing unforeseen challenges. Ideally, they would serve as a bridge, seamlessly connecting project and operations teams, thereby facilitating smoother project handovers and ensuring continuous alignment throughout the project lifecycle.

1.1. Embracing Dynamic Simulation in Design:

Current simulation practices in infrastructure design often rely on static data, such as predefined input values, which fall short in replicating real-world dynamics. In contrast, incorporating dynamic and varied data during the conceptual design stage can significantly enhance scenario planning. It allows the design team to integrate practical insights and suggestions, enabling operational teams to respond more agilely and effectively during the operational phase. This approach shifts the focus from static planning to dynamic, real-world applicability, ensuring more resilient and adaptable infrastructure.

1.2. Enhancing Stakeholder Collaboration and Remote Communication:

A Planning and Design Platform that offers comprehensive visibility to all stakeholders can revolutionize the design process, particularly in improving remote communication. Such a system should automate progress monitoring and clarify deliverable expectations. The result is a more streamlined handover between the project and operational teams, reducing the need for on-site activity and enhancing remote communication efficiency. This platform fosters a more integrated, collaborative environment, bridging gaps between different stages of the project lifecycle.

1.3. Streamlining Infrastructure Planning and Creation Processes:

One of the major challenges during implementation is aligning material and product specifications with design requirements, especially when sourcing from diverse suppliers. New market entrants often struggle to meet these specifications, posing a risk of non-compliance. If the supplied materials or on-ground constructions align perfectly with the design, activities traditionally done sequentially could be executed in parallel, facilitating reconfigurations and reducing on-site work. This approach not only streamlines the procurement process but also enhances the overall efficiency and agility of the project execution.

1.4. Developing Ability to Reconfigure in an Agile Manner:

Equipping operational teams with the knowledge and skills to agilely reconfigure and repurpose infrastructure is crucial. Training must be precise and effective, focusing on the capabilities and potential adaptabilities of the infrastructure. This ensures that teams are well-prepared to respond to changing needs and scenarios, enhancing the long-term functionality and resilience of the infrastructure.

2. Enhancing Planning and Management through Real-Time Digital Insights

Managing grand events like the Tamil Sangam or Kumbh Mela presents a formidable challenge, given their dynamic nature and multi-faceted components. The primary difficulty lies in the unpredictability of attendee numbers and their diverse interests, especially when the event spans multiple days with activities spread throughout. Although existing administrative measures have been largely successful in averting major issues, they often lack precise insights into visitor movements and behaviours. This is where the potential of Digital Twin technology comes into play. By offering a granular view of visitor dynamics at an aggregated level, this technology could significantly enhance the management of such events. It enables event organisers to not only foresee and prepare for various scenarios but also to adapt in real-time, improving overall event experience and ensuring smooth operations.

Current strategies like event registration and mobile app launches offer some insights into potential visitors' profiles and interests. However, these methods have limitations. Participants often do not provide detailed information, partly because their plans are not firmly set in advance. This leads to event managers and supply side players—those providing facilities, amenities, and entertainment—making educated guesses and assumptions about attendee needs.

Temporary solutions often bridge the gap between demand and supply for event resources. Yet, these are constrained by local regulations and the capacity of the event's infrastructure. For example, simply expanding seating areas is ineffective without a corresponding increase in traffic management and amenities. Moreover, assuming a uniform response from a diverse crowd can lead to planning shortfalls.

In contrast, technology-driven systems offer a more nuanced understanding of event dynamics. Real-time monitoring and management capabilities of modern digital technologies, especially Digital Twins, provide deeper insights into visitor behaviour and interdependencies within the event ecosystem. This technology enables a more agile and responsive approach to event management, ensuring

not only overall satisfaction but also addressing specific needs at a micro level. The ability to adapt in real time to the evolving requirements of a diverse and dynamic crowd represents a significant leap forward in the field of event management.

3. Synergizing with Diverse Data Sources and Simulate Scenarios for Enhanced Insights

Digital Twin technology stands out as a pivotal tool in managing complex event scenarios. It serves as a virtual model of physical entities—encompassing assets, people, processes, and systems—and is adept at analysing behaviours and interrelationships. Digital Twins enable the simulation of 'What-if' scenarios, offering predictive insights based on real-time data synchronisation. This constant flow of information allows for ongoing refinement of strategies and actionable insights.

The integration of Generative AI and Machine Learning further enhances the predictive accuracy of Digital Twins, especially when fed with relevant, detailed, and comprehensive data. The use of Data and Machine Learning Operations (MLOps) or AIOps pipelines ensures continual improvement in the system's precision. The real-time data synchronisation, coupled with a closed-loop feedback system, effectively narrows the gap between actual outcomes and predictions.

Enhancing the Digital Twin's capabilities, data fusion from various external sources plays a crucial role. Insights from Telecom Service Providers (TSPs), navigation apps, and transport authorities like Civil Aviation, Indian Railways, and State Road Transport contribute significantly. Additionally, data from CCTV networks, Automatic Number Plate Recognition (ANPR) systems, and toll gates enrich the Digital Twin with more granular, accurate, and detailed information. This comprehensive data integration enables a clearer understanding of the visitor dynamics approaching and participating in the event.

In the realm of Digital Twin technology, a critical aspect is the development and implementation of unified data or insight models tailored for a wide range of

applications. These models must be adept at accurately capturing and reflecting the complexities of various scenarios. This includes the ability to model topologies and provide real-time, detailed descriptions of specific areas, along with their dynamic interactions and changes.

Furthermore, these unified data models are essential for harnessing the full potential of data to generate insights based on diverse array of data or insight sources. They are instrumental in establishing diverse analytical frameworks for tasks such as emulation, diagnosis, predictive analysis, and ensuring reliability in specific application contexts. Importantly, these models should offer user-friendly interfaces for seamless interaction with the unified data repository. They must also support the emulation of scenarios and the iterative optimization of solutions, aligning with the evolving requirements of infrastructure planning and event management.

Incorporating such advanced unified data or insight models within Digital Twin technology is not just an enhancement but a necessity. It underpins our commitment to fostering a collaborative, data-driven approach in modern infrastructure projects, ensuring precision, adaptability, and efficiency in managing large-scale events and urban developments.

4. Integrating Technology and Community Engagement for better solutions

Effective management of visitor flow at event sites necessitates mapping their movement on the physical layout of the event area and its surroundings. It's crucial to identify current issues and areas where attendee expectations exceed the services provided. Enhanced visibility and control, both soft (like informational campaigns) and hard (like physical barriers), enable the identification of potential actions and the assessment of previous measures' effectiveness. Digital Twin simulations of the area can pinpoint bottlenecks in any component of the event ecosystem, thereby elevating the overall experience and freeing event managers from engaging in unproductive activities.

The focus should be on minimizing negative impacts like air and water pollution, traffic congestion, noise, and long queues, while maximizing positive aspects such as visitor satisfaction, participation, religious engagement, social interactions, and economic benefits, especially for local businesses and traditional practices.

Furthermore, awareness campaigns can play a significant role in mitigating negative effects. These campaigns, targeting places where visitors commonly stay, can encourage discipline and discourage environmentally harmful or misguided practices. They can also promote the use of efficient public transportation systems.

Incorporating tech-led solutions allows for community engagement in the planning process. Using Speech-To-Text (STT) applications to convert audio feedback into text, and then employing AI/ML tools to synthesize these inputs, can provide valuable, consolidated insights for event designers. This approach enables the processing of vast amounts of unstructured data, which was previously unmanageable.

Modern platforms and tools capable of creating virtual worlds open up new possibilities for creative problem-solving. These platforms enable residents, visitors, and stakeholders to participate in the design phase, offering their ideas and concerns in a more structured and actionable manner. Such collaborative and innovative approaches are essential in designing and managing large-scale events effectively.

5. A Model for Digital Twin-Powered Event Management

To exemplify the capabilities of Digital Twin technology, a major city of India will be selected for a Proof of Concept (PoC). This city will present a unique opportunity to demonstrate how Digital Twin, integrated with various information sources, can transform event management and strategic planning.

The project aims to leverage data-driven technologies to address challenges like air and water pollution, traffic congestion, and noise levels. It also seeks to influence visitor mobility behaviour towards more environmentally friendly

practices. Beyond managing the main event, understanding visitors' broader interests can lead to more nuanced and effective planning, enhancing the overall experience. This includes creating itineraries that promote local tourism, offering alternative attractions in and around the city, which not only diversifies the visitor experience but also benefits the local economy.

Furthermore, the project intends to explore how this comprehensive understanding of the event ecosystem.

6. Implementation Phases of “Digital Twin: Sangam” PoC in an Indian city

The 'Digital Twin: Sangam' PoC comprises various components and stages, each contributing to the creation of a comprehensive Digital Twin for effective infrastructure planning and event management. Different components, such as Layer-1, Layer-2, and Layer-3, are developed and demonstrated, often in parallel. As the PoC progresses, these components become interconnected and evolve to form a cohesive Digital Twin.

A significant focus is on the development of the foundational layers (Layer-1, Layer-2, Layer-3) and the subsequent layers (Layer-4 and Layer-5). Ideally, Layer-4 and Layer-5 would follow the establishment of the initial layers. However, for the PoC, these stages may proceed simultaneously and merge at a later stage. This parallel development allows diverse players to contribute from the outset and showcase their expertise.

This approach enables participants from various domains to engage early in the project, fostering mutual understanding of each other’s capabilities and how these can be synergistically utilised to achieve the PoC's objectives. Accelerating the pace of work, this strategy keeps all participants actively engaged and committed to the project's success.

The development and demonstration of the 'Digital Twin: Sangam' PoC involve a series of key activities, each critical to the project's advancement. These activities are outlined in detail as below:

6.1. Creation and Surveying of the 3D Digital Twin:

- The first step involves creating a 3D Digital Twin of the PoC area.
- A comprehensive drone/aerial survey, equipped with 5-angle sensor cameras, will cover the entire Area of Interest to collect detailed data.

6.2. Data Processing and GIS Integration:

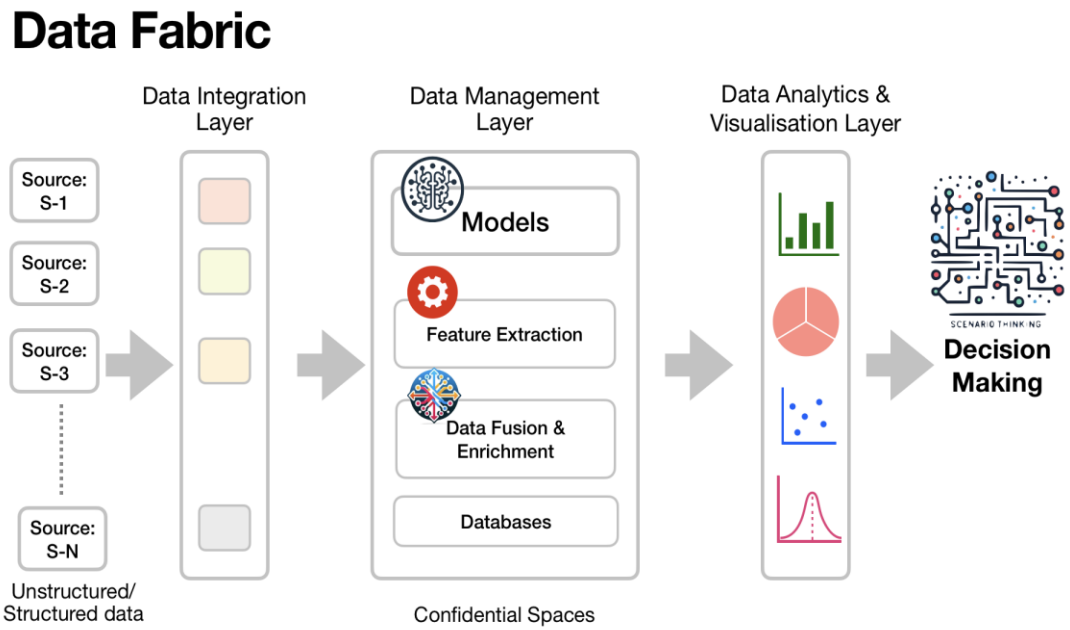
- Using a GIS Engine, the drone data will be processed to produce crucial outputs such as Digital Surface Models, Ortho images, DSM Mesh, point clouds, and 3D Meshes.
- Geo AI integration will enable the extraction of specific details like building footprints, tree cover, and road networks.
- Manual corrections within the GIS environment will further refine the data, focusing on extracting Multi-patch from the 3D Mesh for better interaction.

6.3. Detailed Modelling and BIM Integration:

- Detailed modelling of planned areas will be done using GIS Engine's procedural modelling capabilities.
- Integration with Building Information Modeling (BIM) will add realistic details to heritage structures and industries.
- Indoor navigation features will enable virtual tours, offering a comprehensive view of redevelopment areas.

6.4. Data Enrichment and Integration:

- Relevant data from concerned sources will be gathered and integrated with spatial locations.
- GIS surveys and field maps will fill any data gaps, capturing essential information on demographics, socio-economic indicators, and industrial structures.
- TSP data will provide insights into visitor inflow, outflow, and cumulative profiles, helping identify tourist hotspots.



6.5. Sub-Components of the 'Digital Twin: Sangam' PoC

The "Digital Twin: Sangam" Proof of Concept (PoC) is structured into various sub-parts, each focusing on specific aspects of event management. These sub-parts, or Sub-Digital Twins, can be further divided, if required, into multiple phases to accommodate the evolving and maturing solutions. Examples include:

6.5.1. Digital Twin - Sanchar Sanyojak:

a. Focused on the Digital Twin of telecom networks in the event area.

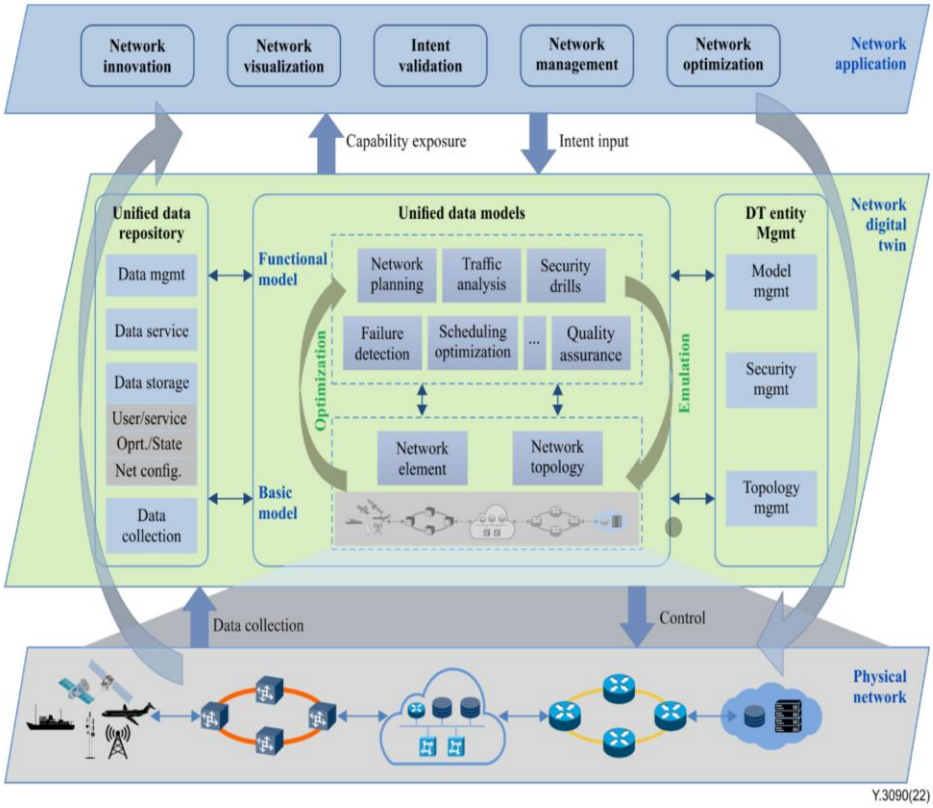
b. Enables simulations for planning and designing mobile network capacity, coverage, and quality of service.

c. Provides real-time insights into network performance, supporting decisions for reconfigurations or adjustments.

For example, Digital Twin of Telecom Network may be created to simulate various scenarios for planning and designing coverage, capacity and quality of service in the large-scale event area.

For creating such a digital twin, Recommendations of ITU Y.3090 “Digital twin network – Requirements and architecture” may be referred (https://www.itu.int/rec/dologin_pub.asp?lang=e&id=T-REC-Y.3090-202202-I!!PDF-E&type=items). These recommendations provide

definition and key characteristics of Digital Twin Network and also includes Functional requirements, Service Requirements, Architecture and Security considerations of Digital Twin Network.



A Reference Architecture of Digital Twin Network (ITU Recommendations Y.3090)

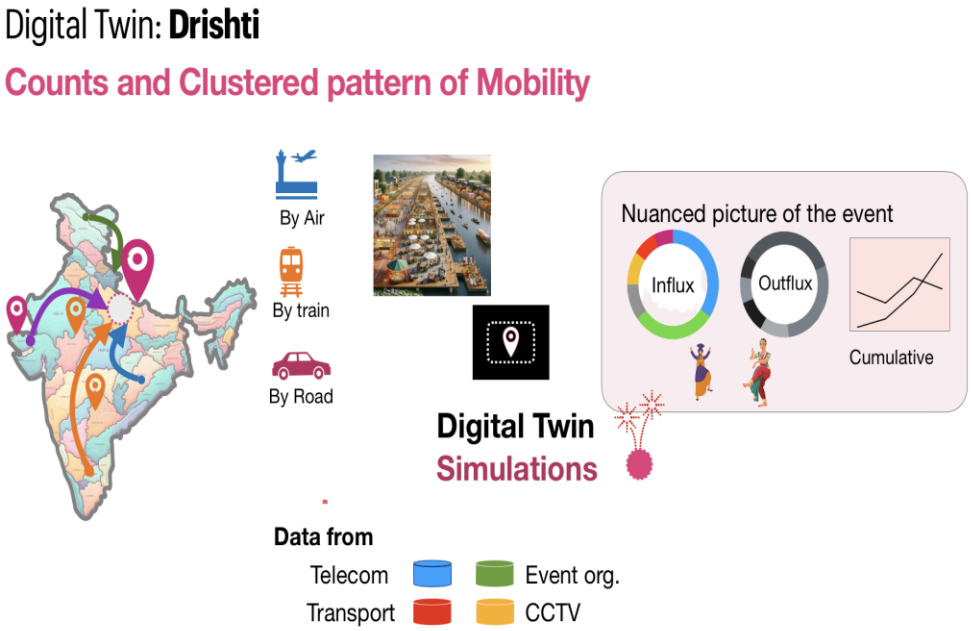
Appendix to the Recommendations also provides few use cases with details about the benefits of digital Twin Network.

6.5.2. Digital Twin - Drishti:

a. Generates insights about visitor movements, arrivals, and departures.

b. Offers aggregated statistics on transportation modes and general traffic flow.

c. Presents predictive analytics and scenario simulations for event facilities, aiding in infrastructure planning and design.

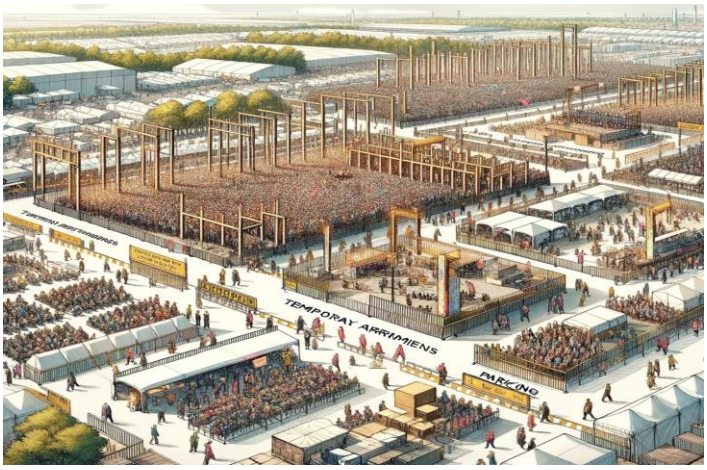


6.5.3. Digital Twin - Sfurti:

a. Assists in simulating and testing scenarios for optimised event infrastructure planning and design.

b. Provides a unified view of people flow, from entry to parking, seating, and exit.

c. Demonstrates the infrastructure's ability to adapt and reconfigure for new layouts and requirements agilely.



Additional sub-parts may be developed to fulfil the comprehensive objectives of "Digital Twin: Sangam." These components should evolve and interoperate seamlessly with each other, ensuring the PoC's overall success in achieving its desired goals.

7. Envisioning Indian cities' Future with Digital Twin Technology

This Proof of Concept (PoC) is set to explore the multifaceted applications of Digital Twin technology in addressing city's unique challenges. The focus extends from preserving the city's rich cultural heritage to optimizing its urban infrastructure and nurturing the skills of its esteemed weaver community.

The successful implementation of this PoC is anticipated to pave the way for a journey towards sustainable growth. It aims to enable more informed decision-making processes and ensure the preservation and celebration of the city's intricate cultural tapestry. By embracing the capabilities of Digital Twins, a city can look forward to a future where tradition and technology harmoniously coexist, fostering both cultural preservation and urban development.

8. Collaborative Expertise for the Digital Twin PoC in Indian cities

As part of the Proof of Concept (PoC) for Digital Twin technology, a diverse array of players from various fields will be invited to contribute their expertise. To facilitate this alignment, participants are grouped according to their relevance to the five

distinct layers defined in the 'Digital Twin: Sangam' PoC. This grouping ensures that the contributions of companies, experts, and specialists are precisely matched to the layers where their expertise can have the most significant impact. The following outlines the classification of participants corresponding to each layer:

8.1. GIS (Landscape) Layer (Layer-1):

a. **Geographical Information System (GIS):** Companies or Specialists in creating Geospatial Digital Twins.

b. **Unmanned Aerial Vehicles (UAV) and Satellite Imagery:** Companies conducting surveys or Providing aerial and satellite data.

c. **Advanced End User Devices and Gateways:** Companies or Experts in LiDAR, high-resolution cameras, and related technologies.

8.2. Built Environment Layer (Layer-2):

a. **Generative Design and Building Information Modeling (BIM):** Companies or Professionals in architecture, BIM, and CAD tools.

b. **Visualization and Interactive Design:** Companies or Professionals creating visualisations for built environments.

c. **3D Printing or Additive Manufacturing**: Companies or professionals in 3D printing or additive manufacturing to demonstrate innovative ways to create infrastructure components.

8.3. Utility/Network Layer (Layer-3):

a. **Machine-to-Machine (M2M) and Internet of Things (IoT):** Providers of M2M or IoT-based solutions for utilities and infrastructure.

b. **Computer Vision and Analysis:** Companies and Experts in object and activity classification, especially for providing statistical information in

real time about the activities in a particular area. Activities may be related to persons and vehicles and usage of infrastructure.

c. **Geo-tagged network inventory:** Companies or Experts involved in creating and maintaining geo-tagged network inventories especially for infrastructure and utilities.

8.4. Dynamic Information Layer (Layer-4):

a. Application Providers:

- **CCTV and ANPR Systems:** Specialists in Closed Circuit Television (CCTV) and Automated Number Plate Recognition (ANPR) technologies, adapted to provide detailed vehicle-related statistics. Their contributions are critical in monitoring and analysing vehicular movements and patterns.

- **Environmental Data Experts:** Providers of environment-related information, crucial for understanding and managing the ecological impact of large-scale events.

- **Event Information Specialists:** Companies that offer comprehensive city or event-related information, aiding in the overall management and coordination of the event.

b. Facility Providers/Event Organisers or Managers:

- **Event Planning and Design Specialists:**

  - Organisations and experts specialising in the planning and design of large-scale events, facilities, and venue arrangements. They focus on optimising hall or area capacities to accommodate diverse event needs effectively.

- **Booking and Ticketing System Managers:**

- Entities engaged in managing bookings or ticketing for large-scale events. Their systems are crucial for providing real-time insights into performance during entry and exit processes, aligning these procedures with the effectiveness of infrastructure plans and designs.

- **Communication and Alert Dissemination Experts:**

  - Organisations responsible for distributing important alerts and information to event attendees. Their role is pivotal in ensuring effective communication, contributing to an enhanced overall event experience.

- **Event Personnel Training Providers:**

  - Entities dedicated to training personnel for event management, focusing on equipping individuals from diverse sources and backgrounds with the necessary skills to handle various aspects of large-scale event operations.

8.5. Virtual/Digital Twin Layer (Layer-5):

a. Cloud Computing for Digital Twin Platforms:

- **Innovative Platforms and Solutions:** Companies offering advanced cloud computing platforms and solutions specifically designed to support Digital Twin operations.

- **Privacy-Enhancing Technologies:** These include capabilities like Federated Learning (FL), Trusted Execution Environment (TEE), Multi-Party Secure Computing (MPC-sec), anonymization, and data aggregation to enhance user privacy.

- **Robust APIs:** Provision of Application Programming Interfaces (APIs) tailored for various services relevant to the envisioned Digital Twin, facilitating seamless integration and functionality.

b. Creation of Virtual Worlds:

- **Expertise in Immersive Technologies:** Specialists in gaming engines, Augmented Reality (AR), Virtual Reality (VR), and Mixed Reality (MR) who create immersive and interactive virtual environments.

- **Collaborative Interfaces:** Capabilities that enable broad participation from various domains, including the public, in the planning and design of infrastructure projects, fostering a more inclusive and collaborative process.

c. Advanced End User Devices and Gateways:

- **Cutting-Edge Technology Providers:** Companies and experts specialising in AI/ML, edge computing, and Internet of Things (IoT) sensors and actuators.

- **Simulation and Virtual Environment Support:** These advanced devices and gateways are critical in creating realistic simulations and enhancing virtual environments, crucial for the effective implementation of Digital Twin technology.

d. Natural Language Processing (NLP), Speech to Text (STT) and Generative AI: Companies and specialists proficient in leveraging artificial intelligence crucial for transforming audio data into insightful narratives, their expertise may lie in:

- **Speech-to-Text Conversion:** Utilising advanced speech recognition technology to accurately transcribe audio data. This process is essential for capturing diverse public opinions and

feedback, which are often vocalised and recorded in various settings.

- **Natural Language Processing (NLP) and Generative AI:** Employing NLP and Generative AI techniques to analyse the transcribed text. This includes identifying and combining similar themes, as well as distinguishing contrasting viewpoints, to form a coherent narrative.

- **Multilingual Support:** Catering to the linguistic diversity of the country by supporting multiple languages and dialects. This capability ensures inclusivity and comprehensiveness in understanding and integrating public feedback.

The primary purpose of including such AI-based technologies and applications is to explore possibilities to engage the public effectively in the planning and design of infrastructure solutions. By processing audio data gathered from public interactions, these companies and specialists may provide valuable insights that reflect a wide range of perspectives and needs. This approach may not only enrich the planning process but may also foster a more participatory and inclusive infrastructure development.

e. **Data Fusion, Enrichment and Privacy:** Companies and Experts specialising in Data Fusion, Enrichment, and Privacy playing a crucial role in harmonising and enhancing various data sets while maintaining stringent data security and privacy standards. Their expertise may involve:

- **Privacy-Enhancing Data Fusion:** Developing methods to combine data from multiple sources in a way that enhances the overall value of the information while rigorously protecting privacy. This approach is vital to safeguard sensitive commercial data and individual privacy.

- **Handling Diverse Data Sets:** The expected diversity in the sources, volumes, types, and quality of data necessitates sophisticated fusion techniques. These methods aim to substantially enrich the combined output, providing a more comprehensive and insightful perspective.

- **Balancing Enrichment with Privacy Concerns:** Implementing models and techniques that effectively enrich data while addressing privacy concerns of both individuals and organisations contributing data. This balance is essential to ensure the ethical use of data and maintain trust among all stakeholders.

- **Effectiveness in Data Utilisation:** Ensuring that the fused and enriched data sets are not only secure and private but also effective in delivering meaningful insights for the 'Digital Twin: Sangam' PoC.

  The expertise of these companies and professionals is pivotal in achieving a data environment that is both rich in insights and respectful of privacy and commercial sensitivities.

f. Telecommunications: AI-Driven Insights and Network Simulations:

- **Movement Analysis Experts:** Companies and specialists leveraging AI to provide thematic insights on people's movements, crucial for understanding crowd dynamics and network demand.

- **Network Digital Twin Creation:** Focused on developing Network Digital Twins for simulating various scenarios in network planning and design. This capability is key to optimizing network coverage and capacity in response to real-time demands.

g. App Providers: Comprehensive Data and Navigation Solutions:

- **Navigation and Survey Tools:** Providers of navigation apps and travel surveys, offering vital data for understanding movement patterns and preferences.

- **Automated Counting and Environmental Insights:** Specializing in the automatic counting of vehicles and individuals, and providing environmental data. These technologies are essential for comprehensive event management and infrastructure planning.

Each category is tailored to bring together diverse yet complementary skills and technologies, fostering a collaborative environment that is key to the successful realisation of Digital Twin technology. This structured approach is to maximise the efficacy of each participant's contribution but also enhances the overall synergy within the project.

The EoI participants may also apply under more than one category..

9. Success Criteria of PoC

The "Expression of Interest" (EoI) invites participants to demonstrate infrastructure planning and design using Digital Twin technology in a connected common data environment, and expects that only those organisations and experts would participate who are ready to invest their best efforts. Since this is an experimental initiative and without any financial compensation for developing and demonstrating PoC. The PoC also grants no preferences or guarantees in award of any future work in this regard. The PoC also does not deal with issues such as the copyrights or intellectual property rights, patents etc.

The success criteria of PoC is focused on the intrinsic and long-term benefits of participation and utility for the society. Success criteria is as below:

9.1. **Innovative Use of Digital Twin Technology:** Participants should demonstrate innovative applications of Digital Twin technology in infrastructure planning and design. Emphasis should be on creativity, feasibility, and the potential to address real-world challenges.

9.2. **Quality of Data Integration and Management:** Success will be measured by the ability to effectively integrate and manage data within a connected common data environment. This includes the accuracy, comprehensiveness, and usability of the data presented.

9.3. **Collaboration and Interdisciplinary Integration:** Participants should exhibit strong collaboration skills, working effectively with other industry players. The ability to integrate knowledge from different fields and cooperate in a multi-disciplinary environment is key.

9.4. **Presentation and Communication Skills:** Participants should be able to clearly and compellingly present their concepts and designs. This includes the ability to articulate the benefits and potential of their solutions to a diverse audience.

9.5. **Scalability and Sustainability:** Proposals should demonstrate scalability and sustainability, indicating how the solutions can be adapted for broader use and how they contribute to sustainable infrastructure development.

9.6. **Market Potential and User Sensitisation:** Participants should showcase solutions that have the potential to create better market conditions and sensitize end-users about the benefits of digital twin technology in infrastructure planning.

9.7. **Contribution to the Field:** The initiative should be seen as a contribution to the field of digital infrastructure planning, setting a precedent for future developments and collaborations.

9.8. **Commitment and Resource Investment:** Though there is no financial reward, participants should demonstrate commitment by devoting adequate time and resources to ensure the success of their demonstration.

9.9. **Adherence to Project Guidelines and Deadlines:** Participants must adhere to the project guidelines and meet all deadlines, showcasing their reliability and professionalism.

9.10. **Feedback and Iterative Improvement:** Willingness to receive and incorporate feedback, demonstrating a commitment to continuous improvement and adaptability.

The success criteria are aimed at fostering a spirit of innovation and collaboration, rather than offering immediate financial or competitive advantages. The opportunity lies in showcasing expertise, contributing to a pioneering field, and building a reputation as a forward-thinking player in the realm of digital infrastructure planning.

Annexure-II

Guidelines for Reference Standards in Digital Twin Technology and Applications

In the context of defining and describing various aspects of Digital Twin technology, participants are advised to primarily refer to the International Telecommunication Union (ITU) Recommendations Y.3090. This document offers a comprehensive framework and serves as a key reference for understanding the broader definitions and descriptions pertinent to Digital Twin technology.

Should there be specific aspects not adequately covered by the ITU Recommendations, or if additional details are necessary, participants are encouraged to consult and cite other relevant international standards. The use of these supplementary standards should align with the specific requirements and complexities of Digital Twin-related aspects.

In instances where industry-wide norms are generally accepted but not formally standardized, such norms may be considered valid references. However, participants must provide detailed documentation and justification for their use. This includes a clear explanation of the norms, their relevance to the project, and how they contribute to the understanding or implementation of Digital Twin technology.

It is imperative that all references and standards used are clearly cited and documented in submissions. This ensures transparency, consistency, and the integrity of the information provided, aligning with the best practices in the field of Digital Twin technology.

For Geographical Information System (GIS) related data and information, participants have to comply with the provisions under relevant national laws or specific directions issued by the Department of Science and Technology, or Survey of India (SoI).

For creation of new data and for processing data, storing it or transferring it, relevant prevailing laws would be complied with