National Institute of Urban Affairs

सत्यमेव जयते
Ministry of Housing and Urban Affairs
Government of India

Smart City
MISSION TRANSFORM-NATION

Technical Implementation Guidelines for Citizen-Centric Smart Governance (CCSG) Program

Draft for Consultation

Contents

CONTEXT

India's cities are driving the economic growth of the country. By 2030, urban India is projected to contribute more than 70% of India's GDP, and to be home to at least 40% of the population. Cities are home to a vibrant ecosystem of actors, across government, industry, academia, and civil society. To capitalize on the potential of India's cities and their ecosystems, it is important to drive greater collaboration between ecosystem actors.

National Urban Innovation Stack (NUIS) – A Digital Blueprint for Urban India

The Ministry of Housing and Urban Affairs (MoHUA), Government of India released the National Urban Innovation Stack (NUIS) strategy in February 2019. The NUIS program will build and provide a shared digital infrastructure - a collection of digital platforms - together with programmatic support to enable stakeholders across the urban ecosystem to adopt and scale up these platforms.

Designed with a deep understanding of the urban ecosystem, these platforms will provide a set of building blocks that can be assembled to meet local needs, reduce duplication of efforts, enhance equitable access to government services, and simplify the process of collaboration and solution development. NUIS will save costs and time, while ensuring flexibility and interoperability.

While the need for urban e-governance is felt across the country, different states and cities are at different stages of this journey. In creating national open digital platforms, the NUIS program aims to ensure that all states have equal opportunity to participate and develop solutions localized to their needs.

Citizen-Centric Smart Governance (CCSG)

Under the aegis of NUIS, the Citizen-Centric Smart Governance Program looks at ways to improve service delivery by urban local bodies (ULBs) and other government agencies that provide services in urban India. The urban ecosystem today struggles with constraints on capacity and data. This results in a lack of citizen-centric governance, affecting quality of service delivery and reducing the ease of doing business. ULB leaders, citizens and municipal employees need tools to manage the inherent complexity and dynamism of India's cities. To address these challenges at scale and speed, the CCSG Program will provide the following:

- An open digital platform (hereafter "national reference platform"), which states can adopt either on a central instance ("Platform-as-a-service" or PaaS model) or host at the state level. (*CCSG envisages state-wide adoption; the program is not intended for individual ULBs.*)
- Reference applications for specific services and functions, such as property tax, water / sewage connection, building plan approval, trade licenses, public grievance redressal, billing etc.
- A panel of service providers, who have been vetted and approved to work with states on implementing the platform, at pre-discovered rates.
- Standards for platforms, software, and data reporting related to municipal services delivery.
- Advisory and support on various elements of program design, to enable adoption of the platform and applications, in order to gain maximum value from the technology.

CCSG will enable states to rapidly digitise the systems used to register, monitor, and collect payments for key municipal services in an integrated manner across all ULBs in the state. By streamlining and automating the administration of service delivery, CCSG will make the entire process more transparent and accountable for citizens, while simplifying the day-to-day tasks of frontline employees, and providing powerful tools for administrators to use for performance monitoring and planning.

CCSG Technical Implementation Guidelines

The Technical Implementation Guidelines will help states identify ways to leverage the platforms, applications, and other support provided by the CCSG program in order to improve urban e-governance in their cities.

The CCSG program recognises that states and ULBs across India are at different stages of maturity in terms of e-governance. Some states are already using state-wide urban e-governance platforms to manage municipal functions. In other states, individual ULBs are using digital systems and tools to enable municipal service delivery.

A large number of ULBs across many states are yet to adopt such systems; this is especially true of census towns and statutory towns with populations of less than 100,000 persons, which make up the majority of Indian cities. The CCSG program aims to provide this "long tail of small cities", in particular, with a quick and simple way of adopting world-class e-governance systems and practices.

Keeping in mind this diversity of systems, the Technical Implementation Guidelines provide the following information:

- On-boarding options for states (i.e. to adopt or integrate with the CCSG platform)
- The types of standards that will be developed and applied as part of the CCSG program
- Links between the on-boarding options and the standards
- Support proposed to be provided by MoHUA and NIUA as part of the CCSG program
- The role proposed for states and ULBs as part of the CCSG program

PURPOSE AND AUDIENCE

This document presents the draft Citizen-Centric Smart Governance (CCSG) Technical Implementation Guidelines, together with illustrations of some of the concepts, and guiding questions for reader feedback. A final version of the CCSG Technical Implementation Guidelines will be prepared based on the feedback received on this draft.

The purpose of the finalised Guidelines document is to enable Urban Development Departments and ULBs to design and implement the digital infrastructure envisaged under the CCSG program. In particular, it will enable them to:

- Identify levels of compliance with the NUIS framework for adoption of digital infrastructure, with a focus on digitally-enabled service delivery.
- Identify and leverage support available from MoHUA for adoption of digital infrastructure, with a focus on digitally-enabled service delivery.

The primary audience for this document are:

- Principal Secretaries of the Urban Development Department of states & union territories in India
- Principal Secretaries of the Information Technology Department of states & union territories in India
- Urban Local Body (ULB) leaders (e.g. Municipal Commissioners) and senior officers in cities across India
- Other relevant experts (e.g. on governance, tech-enabled service delivery, urban India, technology policy, etc.)

Notes

1. While this consultation is open, a level of familiarity with urban e-governance in general, and platform thinking in particular, will be helpful when reading and commenting on this document. The NUIS Strategy and Approach (2019) can be a useful reference on these topics.
2. This document is to be read with the consultation / feedback form provided at this link. Readers are requested to go through the document, and to provide feedback based on their own experiences and expertise in this field. The fields for feedback in the form correspond to the guiding questions posed in this document.

ONBOARDING OPTIONS FOR STATES

Guidelines

The CCSG program will provide a national reference platform, including certain reference applications. States can choose from the following options:

- **Option 1: Adopt the national reference platform** in a 'Platform-as-a-Service' (PaaS) model

  States can use the centrally-hosted platform, which will be provided on a cloud server, and maintained by NIUA. The focus for states will primarily be to configure[1] the platform as needed.

- **Option 2: Create state instance of the national reference platform**

  States can use the national reference platform as a state-level platform, hosting it on a SDC or any other cloud. States that choose this option will need to procure the needed cloud infrastructure, work with technology partners to set up the platform on the cloud, and then proceed to configuring, customizing[2], and possibly extending[3] it.

- **Option 3: Integrate existing platforms and solutions** using OpenAPIs

  States can use their existing systems rather than adopting the national reference platform; they will only report data aggregates - as specified in the data reporting standards - using OpenAPIs, and this data will be integrated with data streams from states using the national platform.

- Partial adoption / Partial integration

  States can adopt the national reference platform (whether PaaS or state-hosted) with some of the reference applications, while integrating existing solutions for other applications.

[1] Configuration refers to establishing certain settings - e.g. what languages the interface will support, names and boundaries of cities and wards, etc. This does not involve writing new software, as the ability to establish or change these settings is a functionality that the platform will be designed to provide.

[2] Customization refers to making changes to a reference application. It may involve writing new software; however, the coding involved will be relatively minimal. This will be required if a particular use case is not provided for within the reference application.

[3] Extension refers to creating a new application, which was not provided with the platform. It will involve writing new software; the CCSG platform will use a micro-services architecture, which can simplify this process to some degree. This will be required if a state/ULB wants to provide a service for which no application has been provided.

Illustrations

In State A, most cities do not have a digital municipal service delivery system. Service requests are received over telephone and in person, and recorded in physical registers; bills are printed and mailed, and payments are made at service centres, mostly in cash. State A adopts the national reference platform and all the reference applications in the Platform-as-a-Service mode, directly configuring the website and mobile application to work in the local language.

State B has attempted to introduce state-wide digital systems for urban governance in the past. Most of the applications introduced during that effort have fallen into disuse, but a property tax self-assessment tool is still being used by all ULBs. Two municipal corporations are using custom-made software for online building plan approval as well. The capital city has recently adopted a software platform, covering multiple services, which can be accessed through a mobile app called "StateCares".

- State B is deciding whether to adopt the national reference platform, which it will host on its own SDC, or whether to expand the platform used in the capital to other ULBs while ensuring integration / data reporting as per the CCSG standards.
- Even if State B adopts the national reference platform as a state-hosted platform, the property tax and building plan approval applications in use will not be replaced; they will integrate with the platform to report the required data through open APIs.

TYPES OF STANDARDS

Guidelines

Standards provide a way for interoperability across multiple systems, which is required to ensure compatibility across the various systems and solutions used by ULBs in India. Compliance with standards increases the extensibility of the platform and applications, so that future needs and use cases can be met rapidly and relatively easily, by building on what already exists.

The CCSG program has identified three types of standards for digital platforms and software:

- **Data Reporting Standards (Aggregate Standards):**

  The platform/software should have the ability to report aggregate service data using Open APIs. As they will be asked to report aggregates rather than individual data points, they are also known as *aggregate standards*. Managing the creation and publishing of these standards is one of the tracks of work under the CCSG program.

- **Software Design Standards (Transaction Standards):**

  The platform/software should meet domain-specific standards in terms of its components and processes, such as Service Registries (e.g. Property registry, connection registry, trade registry), Workflows (e.g. Assessment Flow, New Connection flow, New License flow) and Transactions (e.g. payment of taxes, fees, challans). As they indicate how any transaction or interaction between components or processes should take place, they are also known as *transaction standards*. Managing the creation and publishing of these standards is one of the tracks of work under the CCSG program.

- **Architectural Standards for Platforms (Architectural Principles):**
  The platform should comply with the NUIS architectural principles, as published in the NUIS Strategy and Approach Paper. **(See Appendix 1.)** While it is possible for a single solution to comply with some of these principles as well, these principles are used to assess digital platforms as a whole, rather than individual applications.

Illustrations

"PTSoft" is a software for property tax self-assessment. It is a website-based tool where any resident of State M can enter some details about their property, and it will calculate what taxes are due. PTSoft has integrated with a payments gateway to enable online payments of this amount as well. State M receives data reporting standards, developed under the CCSG program, from MoHUA, and conveys these to the developers of PTSoft. They integrate with the APIs specified in the standards, to report data aggregates as required. PTSoft is compliant with data reporting standards under CCSG. State M is compliant with data reporting standards, at least in the domain of property tax.

State M also receives software design standards for the property tax domain from MoHUA, and shares these with the developers of PTSoft. They find that PTSoft is already compliant with most of the standards; they can

make the changes necessary for full compliance, but this will take 3-4 months. State M requests them to make these changes; at the end of this process, PTSoft is compliant with software design standards under CCSG. State M is compliant with software design standards under CCSG, at least in the domain of property tax.

"DigitalCity" is a platform for urban e-governance, covering multiple services such as property tax, building plan approval, public grievance redressal, and transfer of benefits and subsidies. DigitalCity is based on a monolith architecture, which cannot be easily unbundled; it does not provide a federated architecture, so it has to be installed afresh in any city that wishes to use it. DigitalCity is not compliant with architectural principles under CCSG. A state or city that uses DigitalCity will not be compliant with CCSG architectural principles, even if it is compliant with data reporting or software design standards in some specific domains.

LINK BETWEEN STANDARDS AND ONBOARDING OPTIONS

Guidelines

The CCSG program aims to ensure states and ULBs can achieve compliance with standards as easily and efficiently as possible. The standards and platform options correspond as follows:

- **Level 1: Compliant with Data Reporting Standards only**

  At this level, the ULB may or may not be using a digital infrastructure to enable service delivery. Whatever the underlying system, the ULB has adopted API-based reporting of aggregate data, in keeping with standards published by the CCSG program from time to time.

  Any state that adopts the national reference platform, whether in PaaS mode or hosted by the state itself (Option 1 / Option 2)*, will ensure compliance with data reporting standards. A state that does not adopt the platform will have to take specific steps to ensure compliance with data reporting standards* (Option 3).

- **Level 2: Compliant with Software Design Standards and Data Reporting Standards**

  At this level, the ULB has a digital infrastructure for service delivery, and this digital infrastructure is compliant with the software design standards published by the CCSG program from time to time. It is assumed that a digital infrastructure compliant with software design standards will have the capacity to report aggregate data through the specified API, hence will be compliant with data reporting standards.

  Any state that adopts the national reference platform in PaaS mode (Option 1) *will be assured of compliance with software design standards, as the reference applications will be updated periodically to ensure such compliance once the standards are developed. States that host the platform themselves* (Option 2) *will have to update the relevant applications on being notified that a new version has been developed in order to ensure compliance. States that do not adopt the platform will have to take specific steps to ensure compliance with software design standards* (Option 3)*; this may require switching out existing software or requiring the vendor / developer to update it to ensure compliance*.

- **Level 3: Compliant with Architectural Principles, Software Design Standards, and Data Reporting Standards**

  At this level, the ULB has a digital platform with applications for municipal service delivery; the platform is compliant with NUIS architectural principles, and applications on that platform are compliant with the software design standards for their respective domains. The platform reports data aggregates through the specified APIs.

  A state that adopts the national reference platform, whether in PaaS mode or hosted by the state itself (Option 1 / Option 2)*, will ensure compliance with the NUIS architectural principles. Reference applications will be updated to ensure compliance with software design standards as those are developed; states using the platform in PaaS mode will remain in compliance automatically* (Option 1)*, while states hosting the platform themselves will have to ensure the relevant updates take place* (Option 2).

States not using the national reference platform will have to adopt an alternate state-wide platform, while taking specific steps to ensure it is compliant with all three sets of standards (Option 3). *Converting existing stand-alone software into a platform is unlikely to be feasible; integrating existing software into a new state-wide platform could be attempted, though it will affect compliance with architectural principles and design standards, e.g. if some of that software is not open source.*

Illustrations

In State R, ULBs collect Property Tax using a paper-based system. Property records are maintained on paper, bills are printed and sent to citizens' home or business addresses, and payments are made in person by cash / cheque. The financial accounting system of the ULB is computerised, and is able to report specified aggregates - e.g. number of properties, total revenue collected, total amount charged but uncollected / overdue - through the specified API. State R is compliant with data reporting standards, but not with software design standards or architectural principles. If State R adopted the national reference platform, it would be compliant with all three sets of standards.

In State S, some ULBs have their own software for Property Tax collection; the components of that software - e.g. property registry, assessment flow, receipts / challans, payment gateway integration - are compliant with the software design standards as published by the CCSG program. Aggregate data is reported through the specified API. However, the software is a standalone product, not part of any larger platform. This system is compliant with data reporting standards as well as software design standards, but not with the architectural principles.

State S may adopt the national reference platform, either in PaaS mode or hosted by the state itself; even if the state continued with the existing property tax software, it would still be in compliance with all three sets of standards - provided that the property tax software were also open source. Otherwise, the state would have to switch to the property tax reference application (or any other application that met software design standards, and did not contradict architectural principles) to ensure compliance with all three sets of standards.

State T has adopted the centrally-hosted CCSG platform, and all ULBs in the state are using the reference solution for Property Tax provided with that platform. This ensures that they are compliant with architectural principles, software design standards, and data reporting standards.

ROLE of MoHUA & NIUA

Guidelines

In order to enable states and cities to fast-track their digital journey, the CCSG program will provide the following support to states:

- Provide a national reference platform, which states can adopt either in PaaS mode or choose to host themselves:
    - This platform will be selected by an evaluation panel from among candidates nominated by states (i.e. states will nominate platforms they are using and the panel will select), based on criteria that assess its compliance with NUIS architectural principles
    - It will include certain reference solutions / applications, which will be periodically updated to be compliant with transaction standards and aggregate standards
    - It will be maintained centrally, and states/ULBs will be able to easily adopt their own instances, i.e. a Software as a Service (SaaS) model
- Provide hand-holding support to states in areas such as program design, capacity-building, solution architecture, and technical support.
- Empanel service providers who can work with states to implement the platform, as well as to design and implement programs to boost adoption and gain maximum value from the platform.
- Constituting working groups to create and publish domain-specific standards for data reporting and software design. These standards will be created through a collaborative process between experts and key stakeholders from government, industry, academia, and civil society.
- Establish a process for assessment of state/ULB digital architectures, which can certify their compliance with aggregate standards, transaction standards, and NUIS architectural principles.

ROLE OF STATES AND ULBs

Guidelines

States, primarily through their urban development and IT departments, will be called upon to:

- Participate in consultations on the program offering, including this consultation;
- Nominate their systems for selection as the national reference platform. (Criteria for selection have been ;
- Choose an on-boarding option:
    - States and ULBs which have existing systems in place can consider compliance with data reporting standards, and then gradually moving to compliance with software design standards and/or architectural principles; they can also consider adopting the platform and some reference applications, e.g. for domains for which they do not have a software in place.
    - States and ULBs which do not have existing systems in place can choose between introducing their own platform (designed / hosted at state level) or adopting the centrally-hosted platform.

Illustrations

State H learns about the CCSG Program through this consultation. All ULBs in state H are currently using a software for online building plan approvals. The capital city of state H is using a platform that covers multiple municipal services. The Principal Secretary (Urban Development) of state H directs their staff to assess both of these against the platform selection criteria shared with state H by NIUA and MoHUA, and submits the platform used in the state capital for nomination.

State H is informed by NIUA that a different platform has been selected as the national reference platform. State H examines the options for platform adoption or integration, and decides to do the following:

- Adopt the national reference platform, in PaaS mode, in all ULBs except the state capital.
- In place of the reference application for building plan approvals, continue using the existing software, while ensuring it reports the required data aggregates through the specified APIs. The vendor / developer of this software is also informed of the possibility that software design standards will be published for this domain, and requested to prepare an action plan for how the software will be brought in compliance with such standards when they are issued.
- Work with the vendor / developer of the platform used in the capital city to ensure compliance with all three sets of standards to the maximum extent possible.

Appendix 1: NUIS Architectural Principles

The key guiding principles for the NUIS are:

1. Ecosystem Driven

NUIS will foster a vibrant ecosystem of urban actors and respond to their needs by enabling effective collaboration for the purpose of devising solutions that are relevant to the contexts of each urban challenge.

2. Interoperability through Open APIs and Open Standards

Interoperability is essential for NUIS to be able to support a large number of diverse use cases. NUIS must be built using open standards and avoid dependence on specific platforms or software frameworks that become a barrier to the participation of any actor in the ecosystem. In addition, the components of the stack would be loosely coupled using open interfaces (APIs). Adoption of open and vendor-neutral APIs and open standards and, wherever appropriate, choosing open source frameworks and components over proprietary ones, will help achieve the goal of interoperability. NUIS will integrate with all relevant open platforms of the government including Aadhaar, GSTN, UPI, BBPS, and BharatQR.

3. Inclusive

The design is aimed at ensuring that all segments of citizens can benefit from NUIS. Different instances of NUIS should be able to configure, extend or customize applications to cater to their specific needs. In addition, it can be leveraged across multiple channels - both digital and physical to engage and serve citizens effectively.

4. Minimalistic

The goal of the stack is to enable relevant solutions; hence it is important that the stack remains minimal and allows innovative solutions to emerge rather than forcing a particular type of solution. It may provide reference implementations to seed the imagination of the ecosystem, but should remain minimalistic to allow actors to respond to context and complexity.

5. Privacy and Security by Design

Managing security and privacy of data is crucial to building and maintaining trust between ecosystem participants and thus will be a critical design principle. All data access must be through API calls to ensure appropriate security controls. NUIS will provide standards and certification for data privacy and security. Except for open data, direct access to data will be prohibited and use of APIs will be mandated. NUIS will ensure privacy, data encryption and data integrity and will disseminate data only to authenticated and authorized stakeholders (both internal and external) through data fiduciaries.

6. Unbundling

Platforms achieve scale and flexibility by unbundling complex challenges into micro solutions and services and subsequently allowing their re-bundling in specific contexts. These layers rise from context-neutral bottom layers to more context-sensitive layers — similar to LEGO© building blocks. Unbundling promotes reusability,

lowers the barrier for new solutions and enhances participation by abstracting complexity under simple interfaces.

7. Designing for Evolvability and Scale

NUIS will need to keep pace with India's urban challenges as they evolve over the years. It will have an architecture that can easily accommodate new capabilities that will be needed as the ecosystem evolves and to incorporate new technologies as they emerge. The stack will be able to scale horizontally to hundreds of millions of users in the urban ecosystem and to handle trillions of data records. All components, including computer, network and storage resources, must be capable of scaling horizontally. Being cloud-ready and using commodity hardware will ensure that capital investments on the stack will be minimal. This will also give a choice of infrastructure to the actors and users and enable systems to evolve heterogeneously.

8. Transparency and Accountability through Data

The verified registry of all the entities and the non-repudiable transaction trails shall lead to higher trust and stronger accountability. NUIS will be data-driven and will use data generated through transactions for reporting and analysis. Public Open Data shall be made available via APIs for transparency. The access to open data will ensure high-quality analytics, accurate fraud detection, shorter cycles for system improvement and, most importantly, high responsiveness to user needs.

9. Non-Repudiable

The stack would enable the verifiability of data and its provenance and thereby ensure trust and accountability within the ecosystem. All data would be non-repudiable and verifiable. In order to energize the ecosystem for collaboration and interaction between actors.

10. Domain Modelling

Since NUIS must balance between abstraction, for wider adaptability, and context-specific solutions, the data specifications would remain generic without making concrete assumptions about the purpose for which the data is used. The data specifications would be extensible, allowing programs to model their own domain by adding new data attributes on top of available specifications.

11. Federated Architecture

To resolve for scale and ensure agency, the ability to solve must be distributed, empowering stakeholders to overcome the challenges they face. Hence, NUIS will have a federated architecture enabling actors to retain agency and choice in solutions.

12. Ensuring extensibility through the use of layered design

The design of NUIS will be modular, with clear separation of data storage, software services and APIs. Components will be minimalistic, independently replaceable and extensible. This will allow different components to be loosely coupled when building applications, thereby enabling application diversity. Different instances of the stack will be able to customize and create contextual solutions to serve their specific purpose.

13. Multi-Channel Access

With the rapid growth of net connectivity and the variety of electronic devices available in the market, it is important that the end user's access points and access interfaces are kept in mind while enabling access channels — Citizen Service Centres, PCs, Tablets, Smartphones, local kiosks and doorstep delivery — and ensuring an engaging user experience on all of these channels to enable rapid adoption and ease of operation by the end users. This will enable cities to effectively respond to the needs of all citizens including digitally excluded sections of the society.

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