NIUA - CDG

Citizen-Centric Smart Governance (CCSG) Program

Implementation Guidelines for the National Urban Governance Platform (NUGP)

Version 3 (Draft) - Nov 2020

GLOSSARY

Centre for Digital Governance (CDG)	Launched on 25th June 2020, the Centre for Digital Governance at NIUA will serve as the institutional home for all programs and platforms under NUIS.
Citizen-Centric Smart Governance (CCSG) Program	Citizen-Centric Smart Governance is one of 7 focus areas identified in the NUIS Strategy and Approach. The CCSG Program, as one of the flagship programs of the CDG, will identify or create a number of the building blocks and governance mechanisms envisaged by NUIS.
Domain Working Group	In order to devise standards on a given topic, CCSG will create working groups. These groups will include members from government, industry, academia, and civil society, and work in a collaborative manner to come up with standards that should have wide acceptability among persons working on that specific domain. "Domain" refers to a certain area of work; in the context of the CCSG program, for instance, the domains will be municipal services - e.g. property tax, water and sewerage, trade licences etc.
National Institute of Urban Affairs (NIUA)	The National Institute of Urban Affairs is India's leading national think tank on urban planning and development. As a hub for the generation and dissemination of cutting-edge research in the urban sector, NIUA seeks to provide innovative solutions to address the challenges of a fast urbanising India, and pave the way for more inclusive and sustainable cities of the future. NIUA has been appointed as the "anchor institution" for NUIS by the Ministry of Housing and Urban Affairs, and has launched the Centre for Digital Governance to consolidate these programs.
National Urban Governance Platform (NUGP)	The National Urban Governance Platform is one of the core technological offerings of the CCSG program. This platform will be developed and maintained by the CDG as a free and open-source platform, in keeping with the NUIS Digital Blueprint, to provide a common digital infrastructure for urban e-governance to States and ULBs across India. The NUGP will come with reference solutions for certain priority domains. The CDG will maintain a centrally-hosted instance of the NUGP, which states can adopt with relatively minimal customisation, as a way to jump-start their urban e-governance journey.
National Urban Innovation Stack (NUIS)	The National Urban Innovation Stack is a digital blueprint for creating a common digital infrastructure for urban India. The NUIS Strategy and Approach explains the guiding principles,

	layers, key components, and the role of standards and certifications in creating the Stack.
Platform	In the context of NUIS, a platform refers specifically to an open digital platform. This is a collection of software components ("building blocks"), which are created as microservices and interact through the use of APIs. A complex software system, which can perform multiple functions, is deconstructed into a digital platform by following the principle of unbundling.
Program	A program is an initiative undertaken by a given actor or group of actors to achieve a defined mission or goal. A program can have multiple activities, outputs, and outcomes which it pursues as part of its mission. For programs created in the context of NUIS, one of these outcomes will be the creation of open digital platforms or their building blocks. While such work will tend to take place at a central level, these platforms and programs can further support the establishment of state-level programs that adopt and align with the mission or goals of the central-level program.
Solution (and Reference Solution)	A solution can be defined in the abstract as any method or process to address a problem. In the context of NUIS, solutions will take the form of a software application; such applications are said to run "on top of" a platform, leveraging the various microservices and capabilities provided by the platform. Platforms developed in keeping with NUIS will include certain "reference solutions", which are intended to illustrate to the ecosystem how such solutions/applications could function. A reference solution may not be directly used, but can form the basis for an actual operational solution with relatively little effort.
Urban Local Body (ULB)	Urban Local Bodies are the Constitutionally-mandated third tier of government for urban areas. They are responsible for the 18 areas of work described in the 12th Schedule. Depending on the size of the city, the ULB can be a Municipal Corporation (population above 10 lakhs), Municipal Council (population between 1-10 lakhs), or Nagar Panchayat (population below 1 lakh). Most ULBs in India are Nagar Panchayats.

CONTEXT

With more than half a billion internet subscribers and increasing connectivity, India is one of the largest and fastest-growing markets for digital transformation. Digital adoption, however, remains uneven across segments and sectors. With an aspiration to make India a trillion-dollar economy, through inclusive and empowering growth, the Government of India aims to develop secure and stable digital infrastructure and leverage technology to deliver all government services to citizens digitally.

India's cities are driving economic growth of the country. **By 2030, urban India will contribute more than 70% of India' GDP, and be home to at least 40% of the national population.** Our ability to seamlessly adopt emerging technologies into urban governance holds the key to transforming India, and will be a key enabler in our journey towards becoming an economic powerhouse. This story of technologically-enabled, citizen-centric transformation should be the story of every city of India.

To address the need for scale and speed, it is essential to establish a framework for large-scale and rapid digitization and adoption. **Recognizing this need, the Minstry of Housing and Urban Affairs (MoHUA) released the National Urban Innovation Stack (NUIS) Strategy and Approach in February 2019.** NUIS is envisioned to create a digital public good, which will provide stakeholders across the "quadruple helix" of government, industry, academia, and civil society in urban India with digital tools and platforms, standards, specifications, and certifications that enable them to act in coordinated and integrated ways to address the needs of the cities in which they live and work.

With the goal to facilitate adoption and put technology at the core of operations across the ecosystem, an anchor is needed to tie the strengths of all the stakeholders together. Responding to this pressing need, **the National Institute of Urban Affairs (NIUA) has created the Center for Digital Governance (CDG) to anchor and operationalize the NUIS Strategy and Approach.**

Envisioned as a trusted partner for digitally-enabled governance transformation, CDG will work across multiple practice areas, including Research, Communications, Platforms, Governance, Learning, and Partnerships. Collectively, these will support State and City Governments across India as they engage in the following key initiatives

- Create model policies and frameworks for digital governance;
- Provide critical digital infrastructure as public good;
- Forge strategic linkages to galvanize the ecosystem;
- Build and nurture leadership capacities in urban professionals; and
- Build a shared narrative on digital technology for urban development.

The aspiration is to allow digital forces to enable the ease with which citizens and organizations can connect, collaborate, transact, and share information. State and city administrators can increase productivity by automating routine tasks, and rely on data-based decision-making to drive governance and policy making. Citizens and businesses can experience improvements in ease of living and ease of doing business as a result.

The launch of the CDG will kickstart two priority programs: Citizen Centric Smart Governance (CCSG) and National Urban Learning Platform (NULP). CCSG aims to improve the delivery of services by urban local bodies (ULBs) and other government agencies in urban India. The urban ecosystem today struggles with constraints on capacity and data. This results in governance that is not citizen-centric, effective, or efficient. ULB leaders, citizens and municipal employees need tools to manage the inherent complexity and dynamism of India's cities and towns.

To address these challenges at scale and speed, the CCSG Program will provide the following:

- An open digital platform - the National Urban Governance Platform (NUGP) - together with reference applications for some services (property tax, water connection, public grievance redressal, etc.), which states can adopt and implement in the modes specified here.

- Standards for platforms, software, and data reporting related to municipal services delivery, which will be developed by working groups of domain experts and technologists, who will be nominated and convened by CDG at NIUA.

- A panel of service providers, who have been vetted and approved to work with states on implementing the platform, together with indicative rates for their services.

- 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 available.

By providing these program offerings to states, CCSG will enable states and ULBs to:

- Rapidly digitise the systems used to register, monitor, and collect payments for key municipal services in an integrated manner, leading to increased revenue generation by ULBs.

- Automate or support repetitive administrative functions, including especially the compiling and reporting of data, thereby enhancing effective capacity of ULB personnel.

- Streamline and make transparent the administration of service delivery, thus making the entire process simpler for citizens and frontline employees, leading to time and effort savings, as well as improved communications and trust.

- Develop reliable datasets of administrative data, which can be used by city and state-level leaders for monitoring progress, managing performance, and as a basis for planning future projects or developments based on the cities' own data.

PURPOSE

The Guidelines provided in this document will help states identify ways to leverage the standards, platforms, and reference applications provided by the CCSG program. They will also help states and service providers anticipate and plan for the sequence of actions necessary to implement the NUGP.

The CCSG program recognises that states and ULBs across India are at different stages of maturity in terms of urban 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.

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

- Different modes of platform implementation - i.e. options for states to adopt or integrate with the NUGP, based on their circumstances & needs.
- Specific actions that states will have to undertake in each mode of platform implementation.
- Support to such implementation from the CCSG program, including standards, empanelled service providers, and program design advisory.

INTENDED AUDIENCE

This document presents the Citizen-Centric Smart Governance (CCSG) Technical Implementation Guidelines. This version of the TIG was prepared after a series of consultations with various stakeholders including state urban development department leaders, Smart City CEOs and staff, experts on the urban sector, representatives from IT and ITES companies, and individual citizens[1].

The primary audience for this document are:

- Principal Secretaries of the Urban Development Department of states & union territories in India, and other personnel in their department, who would be actively involved with any such implementation
- Principal Secretaries of the Information Technology Department of states & union territories in India, and other personnel in their department, who would be actively involved with any such implementation
- Urban Local Body (ULB) leaders (e.g. Municipal Commissioners) and senior officers in cities across India, who would be actively involved with any such implementation
- Other relevant experts and service providers (e.g. on governance, tech-enabled service delivery, urban India, technology policy, etc.)

[1] For details of the feedback received, please see the following document:

IMPLEMENTATION OPTIONS FOR STATES

Guidelines

The CCSG program will provide an open digital platform (NUGP), along with reference applications for certain services / domains. Over a period of time, the CCSG program will also publish standards relevant to the platform and a number of domains.

States wishing to implement the CCSG program can choose from the following options:

- **Option 1: Adopt centrally-hosted NUGP instance**
    - CDG at NIUA will maintain a central instance of NUGP on a cloud server.
    - States can implement this centrally-hosted instance, focusing mainly on configuring[2] the platform and solutions as per the needs of their ULBs.
    - This option has the advantage of being relatively quicker and lower in cost to implement, and will automatically ensure that the system adopted is compliant with NUIS standards. It may be particularly suitable for "greenfield" ULBs, that do not have much e-governance infrastructure in place.
- **Option 2: Create state instance of the national reference platform**
    - As NUGP is free and open source software, States can create their own instance, hosting it on a cloud server of their choice (or at a state data centre, etc.)
    - States that choose this option will need to procure the needed cloud infrastructure, and can work with technology partners on configuring, customizing[3], and possibly extending[4] the platform and solutions as per their needs.
    - This option has been designed keeping in mind the needs of "brownfield" states, who have some experience with e-governance systems, and would like to set up a new state-wide system for urban e-governance; it could also be considered by "greenfield" states that are willing to invest the resources and time associated with setting up a state-level instance of the platform.

[2] 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.

[3] 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.

[4] 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 microservices 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.

- **Option 3: Integrate existing platforms and solutions** through compliance with standards / through standards-compliant APIs.
    - The CCSG program will publish standards for urban e-governance systems, including on data reporting and Open APIs. (See section on Types of Standards, below.)
    - States or ULBs that prefer to continue using their existing systems can do so while ensuring integration through compliance with these standards.
    - This option has been designed keeping in mind the needs of "mature" states, where there are already existing state-wide urban e-governance systems in use, and there is no rationale for switching to a new system.
- **Partial adoption / Partial integration**
    - States can implement NUGP (whether centrally-hosted or state-hosted) on a state-wide level, using some of the reference applications, while integrating existing solutions for other applications.
    - States can implement NUGP (whether centrally-hosted or state-hosted) in some ULBs, while other ULBs continue to use the systems they already have, achieving integration through standards compliance.
    - This option would be relevant to states where there are existing state-wide applications for certain services already in use, or where certain ULBs - e.g. the state capital - have already adopted an urban e-governance system. (The more such intra-state variations are to be integrated, however, the greater the complexity of the program implementation. The state may determine a scope of implementation that limits such complexity, at least initially.)

Illustration

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 central instance of NUGP and all the reference applications, 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 NUGP, 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 NUGP 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.

NUGP IMPLEMENTATION OVERVIEW

Implementation of NUGP will take place in seven stages:

- Stage Zero: Program set-up
- Stage One: Program kick-off
- Stage Two: Solution design
- Stage Three: Customisation and Configuration
- Stage Four: User Acceptance Testing (UAT) and Go-Live
- Stage Five: Statewide Rollout
- Stage Six: Sustenance and Ongoing Improvement

For the purposes of this section, we will assume that the state has selected Option 1 (adopt the centrally-hosted instance of NUGP). The stages described below will remain the same even if states choose option 2 (create a state-hosted instance); the only additional steps required will be to identify and secure cloud infrastructure where the state instance can be hosted.

Stage 0: Program Setup

In this stage, formal agreements are signed between NIUA-CDG, the state government, and the key implementation partner, which will be referred to hereafter as the Systems Integrator (SI). The scope of the program to be implemented in the state is determined, and procurement related to the program is planned.

Specific tasks that the state government has to complete in this stage are:

- Create a state steering committee, and appoint a nodal officer
- Establish initial program scope (i.e. which ULBs and which modules are to be covered)
- Define a procurement process, and identify funding sources
- Identify an SI and begin their on-boarding

This stage is complete at the point that the implementation partner is on-boarded and the program scope is defined. The state government may also bring on board external consultants to serve as a program management unit (PMU); in this document, the term “state government” will be used to cover both government employees and any such PMU/consultant working with them.

Stage 1: Program Kick-off

In this stage, a program charter is defined - including timelines and milestones - and agreed upon by the steering committee and SI. State-specific branding (name, logo, any tagline etc.), if any, is also decided at this stage; the platform and solutions will be referred to using that brand thereafter.

Specific tasks that the state government and SI have to collaboratively complete in this stage are:

- Establish program charter (what targets will be achieved in what timeline, including roles and responsibilities of stakeholders for the tasks / steps involved)
- Identify initial / pilot ULBs for implementation
- Create data collection format and teams, and initiate master data collection in pilot ULBs
- Organise kick-off workshop with key stakeholders in pilot ULBs, to set expectations and strategise for the implementation in those ULBs.

This stage is complete at the point that the program charter is adopted, the kick-off workshop has been completed, and master data collection in pilot ULBs is underway.

Stage 2: Solution Design

In this stage, collected data is used to determine how data for the entire project will be organised. A detailed implementation plan is developed in keeping with the program charter, and any state-specific modifications to the solutions are mapped / agreed upon.

Specific tasks for the state government, SI, and other relevant stakeholders in this stage are:

- Standardise data structure (taxonomies, ontologies, data models) and workflows / process flows for the modules to be implemented
- Identify and initiate any policy changes necessary as part of the implementation (e.g. adopt new regulations on property tax, model building bylaws, define grievance routing process and targets / SLAs, etc.)
- State-specific requirements are communicated to the partner(s) who is/are going to make the software modifications required
- Complete relevant procurement (e.g. computers, phones, internet connections, physical workspaces where required) for the pilot ULBs

This stage is complete at the point that a detailed project plan has been defined, data specifications and workflows have been defined, and master data collection for pilot ULBs is completed.

Stage 3: Customisation and Configuration

In this stage, the solution is made ready for users (ULB employees) to test. This includes completing the configuration of the solution(s) as well as user guides or similar collaterals, and preparing monitoring reports and/or dashboards.

Specific tasks for the state government, SI, and other relevant stakeholders in this stage are:

- Ensure that master data is cleaned, validated, and approved for use
- Collect baseline data from the pilot ULBs (required to measure performance and adoption once the solution is deployed)
- Identify participants for user acceptance testing (UAT)
- Designate ULB-level nodal officers for day to day operations and support

This stage is complete at the point that the solution is ready for UAT, and a UAT session with identified participants is scheduled.

Stage 4: UAT and Go-Live

In this stage, the customised product is tested and refined as necessary based on feedback from the UAT. The deployment plan, together with a schedule for monitoring and review calls, is adopted - so that once the solution is ready, it can be scaled up from pilot to other ULBs.

Specific tasks for the state government, SI, and other relevant stakeholders in this stage are:

- Receive user sign-off on the solution (i.e. successful UAT)
- Arrange and conduct training workshops for ULB employees (i.e. training on how to use the new solution)
- Ensure helpdesk and other support mechanisms are in place, to support ULB employees when the solution is rolled out in the pilot and subsequent ULBs
- Ensure procurement of relevant items is planned in subsequent ULBs, with modifications as required in case there were any difficulties with procurement in the pilot ULBs.

This stage is complete at the point that the pilot is considered successful.

Stage 5: Statewide Rollout

In this stage, the solution(s) as approved by users and tested in the pilot ULBs are rolled out in all other target ULBs. This rollout can be done in a phased manner, in keeping with the deployment plan, and will be accompanied by training of ULB employees on the new system. Any bug fixes or other support necessary should be provided to ensure that the system remains stable and operational even as the number of users is scaled up.

Specific tasks for the state government, SI, and other stakeholders in this stage are:

- Ensure rollout as per deployment plan (including procurement, policy changes, and training for ULB employees)
- Monitor progress and support as required

This stage is complete at the point that ULBs as targeted are all brought live.

Stage 6: Sustenance and Ongoing Improvement

In this stage, the focus moves from deployment to ensuring adoption / uptake of the new system by ULB employees and citizens. Over time, improvements can be made to the system, with new features or solutions being introduced based on the feedback and needs on the ground.

Specific tasks for the state government, SI, and other stakeholders in this stage are:

- Establish adoption metrics and monitoring frameworks
- Create or assign a team to focus on driving adoption and resolving barriers to access
- Conduct awareness campaigns to improve public knowledge of the new system and drive citizen adoption

This is the stable state of a system once operational, and does not have any specific point of completion. Improvements in functionality, support, and adoption can continue to be made.

TYPES OF STANDARDS

Standards will be most relevant for states that select Option 3 (integration through standards) or the partial adoption / partial integration option. The link between on-boarding options and standards is further explained in the subsequent section.

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.

Illustration

"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.

LINKING STANDARDS & IMPLEMENTATION OPTIONS

Guidelines

The CCSG program aims to ensure states and ULBs can achieve compliance with standards as easily and efficiently as possible. Standards are developed in keeping with the principle of Minimalism (see Appendix 1), with the goal of ensuring technical (semantic and syntactic) interoperability while permitting multiple innovative solutions to emerge.

CDG will support states with roadmaps for achieving standards compliance as each set of domain standards is developed and published. At the highest level, the link between standards compliance and on-boarding options is 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.*

Illustration

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.

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 Modeling

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.