IUDX and the Transformational Role of Data in Urban Sectors

The India Urban Data Exchange (IUDX) is an initiative created in partnership with IISc, Bangalore. It facilitates secure, authenticated and managed sharing of data amongst various data platforms. IUDX is deployed in 15 Indian cities and being rapidly rolled out in many more every month

BY DR INDER GOPAL

Getting control of data through a data exchange

Cities around the world have learned that they possess a new valuable asset – data generated by their various departments and agencies. An example being streams of data from Internet of Things (IOT) sensors (e.g. Air Quality, Traffic). Some of the data is demographic or geographical, others may be from municipal tax or property records, yet others are legal documents or registrations, and then there are historical data from archival sources.

Each set of data has its own security and privacy considerations, as well as commercial, monetary or subscription aspects. Cities such as Copenhagen and Manchester have taken ownership of their data assets by creating data exchanges, which are software platforms that allow controlled sharing of data by providing common ways of accessing and representing data. An important idea behind a data exchange is that data silos are actually not a bad thing as each silo often represents a domain-optimized service that performs that function very well. Instead of breaking silos or moving data en-masse into a central repository, this approach chooses to interconnect the disparate and distributed entities through a common data exchange. This provides a way for accessing data in a unified, common format, allowing for sharing of data

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between different departments in a city, as well as opening up data for third party developers to create innovative new applications and citizen services. In addition, there is an opportunity for third party providers of data, or third-party providers of data analytics or data annotation, to participate in what becomes a data marketplace.

It is important to understand the distinction between a data exchange and an open data platform (such as data.gov.in). A data exchange allows the owner of the data to strictly control data sharing and define which entity has access the datasets. It is also possible to define access policies and data pricing models. An open data platform, on the other hand allows open access to all comers, eliminating control of who gets access. A data exchange can increase dramatically the amount and type of data that will be shared as the data providers will retain control of their data.

The IUDX initiative

The Smart Cities Mission within GOI Ministry of Housing and Urban Affairs is committed to incorporating data-intelligence in addressing urban challenges of present and future. The India Urban Data Exchange (IUDX) is one such initiative created in partnership with IISc, Bangalore. It facilitates secure, authenticated and managed sharing of data amongst various data platforms and helps cities to strategically focus on unlocking the power of urban data in key sectors. IUDX is deployed in 15 Indian cities and is being rapidly rolled out in many more every month. IUDX is completely open source, based on an underlying framework of open APIs, data models, and the security, privacy and accounting mechanisms that will facilitate, easy and efficient exchange of data among disparate urban data silos. IUDX draws on ideas and, where feasible, code, from best-of-breed global projects such as Fiware. However, IUDX is heavily skewed towards the Indian ecosystem, cultural norms, city nomenclature, payment and identification systems, etc. and therefore the solution is particularly suitable for Indian Smart Cities.

Stakeholder Value

It is expected that all stakeholders in the Indian Smart City ecosystem will gain from the initiative. Within each of the cities, citizens and the community will benefit through the availability of better, more innovative, and cheaper applications and services. The cities themselves will benefit from the reduced development cost and faster development times enabled by a standard platform, together with the ability to choose vendors freely and avoid vendor lock-in.

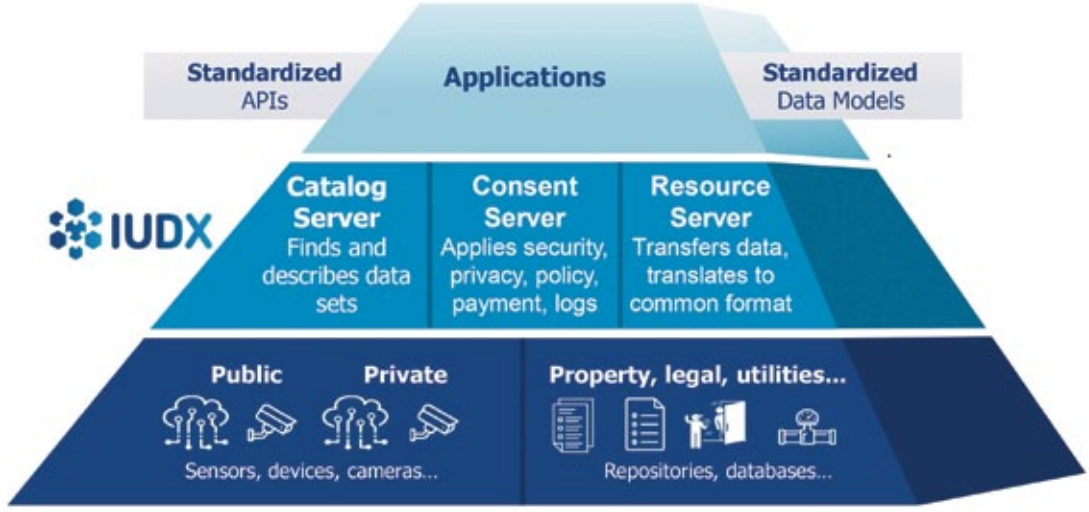
They will see new source of revenue through the unlocking of data assets, and will unleash innovation from entrepreneurs and community, without any cost to themselves. Industry will benefit enormously through the improved ability to find skills and rapidly ramp up projects. They will also see reduced development expenses enabled by a standardized and open source platform, and be able to focus on innovation and differentiated value rather than design basic platform software. Start-ups, in particular, will benefit from the decrease in heterogeneity IUDX provides.

Third party sources of data (such as private apartment complexes) will have a new opportunity to share and monetize their assets. Academic institutions and research labs will be able to conduct more meaningful research by having direct access to a wide variety of data.

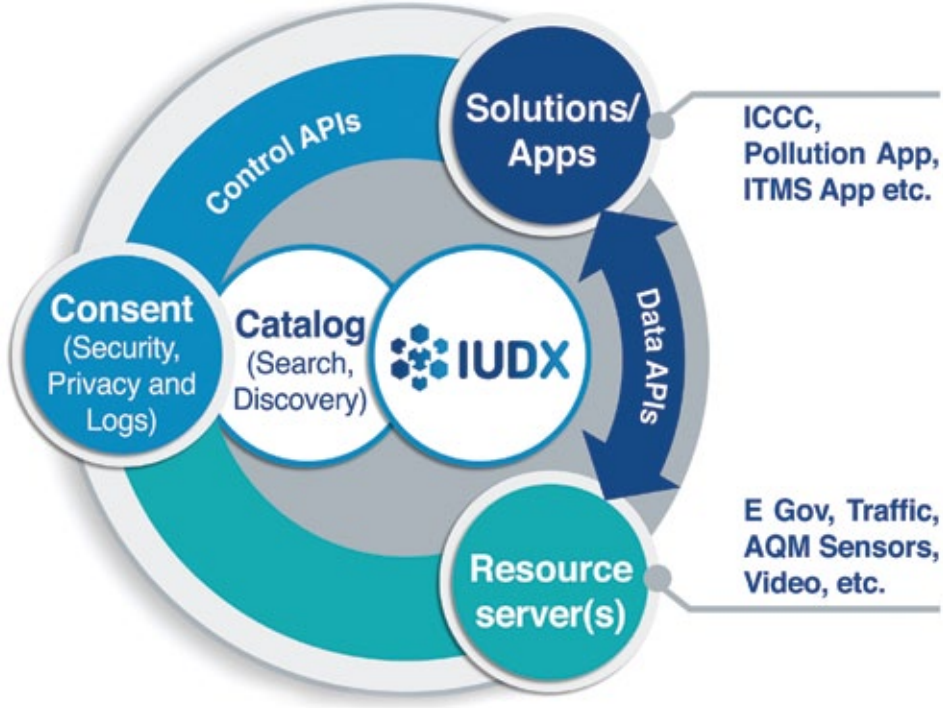
IUDX Overview

IUDX is an open source software platform that will facilitate secure, authenticated and managed exchange of data amongst various data platforms, third party authenticated and authorized applications and other data sources, data producers and consumers, both within a city to begin with and scaled up across cities eventually at a national level, in a uniform and seamless way. The platform provides full control to the data owners as to what data to expose and to whom. Built-in accounting mechanisms enable connect with payment gateways which will form the foundations for a data marketplace. The whole platform is developer friendly, via definitions of open APIs (Application Program Interfaces) and data schema templates (formats for interpreting data), so that a whole new application ecosystem gets created.

This is a simplified layered picture of the platform. The lowest layer is composed of a variety of data



The architecture below depicts the relationships and flows between these components.



sources, some public and some private, generating various forms of data. On top are a variety of applications that use the data to deliver useful services to the city and its citizens. These applications may be created by the city itself or by third parties such as industry partners or entrepreneurial start-ups. The applications will deliver services such as improving mobility, optimizing waste management, enhancing citizen safety, etc.

In the middle is the IUDX platform - a cloud based service that delivers three basic functions.

- A catalogue server that enables the identification and location of relevant data sets
- A consent server that allows ensures that only those that are allowed to share the data in accordance with policies defined by the data owner can do so, and

> In Varanasi, IUDX has enabled an application that uses data from garbage bin sensors, garbage cart and garbage truck GPS sensors and other sources to dynamically manage waste pickup for operational efficiency.

- One or more resource servers that transfer data from the data provider to the data consumer while transforming the data into a common data format.

IUDX enables sharing of data without losing control. It allows data to be located and identified through a catalogue server; ensures the data consumer is authorized access in accordance with the data provider's policies through the consent server; and ensures that data is transferred from provider to consumer in an understandable format through a resource server.

Governance and Operating Models

Since IUDX is set up as a collaborative project, broad city, industry, entrepreneur, community and governmental involvement is essential for the project to succeed. Industry partners will provide key technical skills and guidance for the project.

The operation of IUDX is governed by a board of advisors, a technical steering committee, and a data policy and ethics committee. To understand the need for three distinct governing bodies, we should understand that IUDX has three distinct aspects. IUDX operates as a non-profit company (it is technically a subsidiary of a non-profit operated by IISc) and it functions as any other company. Normal corporate governance is provided by the board of advisors as described below. IUDX will only succeed if there is a strong partnership and collaboration with the broad public data ecosystem. While some of the relationships will be ad hoc and informal, many are formalized as membership in a IUDX consortium. The IUDX consortium and its membership form the core of a community-based governance and operational model.

Use cases for implementation

IUDX has been successfully deployed in 15 pioneer cities with many dozens of use-cases that have brought great value to citizens. Three illustrative examples are discussed below:

Transit: The use of GPS devices coupled with apps to show real-time location of city transit busses and trains has been a resounding success in many cities across the world. IUDX has actually taken this one step further by using real-time fare collection data to enable an estimate current bus occupancy. In Surat, bus customers can now see whether or not seating is available in an arriving bus before attempting to board. This simple feature is credited with an increase of about 5% in ridership.

Solid waste: In the holy city of Varanasi, IUDX has enabled an application that allows the city to dynamically manage waste pickup for operational efficiency and for higher citizen satisfaction, saving at least 15% in overall cost. The application is based on real-time data from garbage bin sensors, and garbage truck GPS and loading sensors, and crowd sourced data to identify areas of garbage build-up.

Safe city: Using IUDX, the city of Pune has created a citizen safety app that uses real time data from smart street-lights, crowd density and crowd gender diversity, as well as data on nature of buildings on a street. Using this app, citizens can automatically find "the safest part" to walk through in Pune based upon current conditions.

Conclusion

The widespread use of the IUDX platform will dramatically enhance the power of new data-driven services available to citizens and administrators, and also increase the speed at which these can be created.

It is expected that the collateral benefit on the broader public and private sector eco-systems will be equally significant. As city administrators and private companies see the value of sharing their data, it is expected to create a virtuous cycle — more data will be collected and shared, which will enable new services to enhance the value of data collected. The ultimate beneficiary will be the urban Indian citizen and the quality of life in our cities.

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