

IUDX Technical Steering Committee

November 2020



Technical Steering Committee: Format and Objectives

- Participants:
 - Nominated Members representing their organizations (IUDX consortium members, Key Government agencies, Funding agencies)
 - Invited Members based on technical expertise
- Regular Meetings every 1-2 months
 - Special meetings on particular topics as needed (e.g. video, analytics, security, data models ..)
- Purpose:
 - Advise the IUDX Development team in strategic technical decisions and give feedback on their proposed direction.
 - Recruit collaboration on development (sign up for sub-projects that will become part of IUDX)
- Format:
 - Presentation and layout of any open issues (committers for that area)
 - Open discussion (will be recorded and available for all)
- Objective:
 - Move towards an open-source multi-party collaborative project (a la Linux Foundation)

IUDX Technical Overview and Future Directions

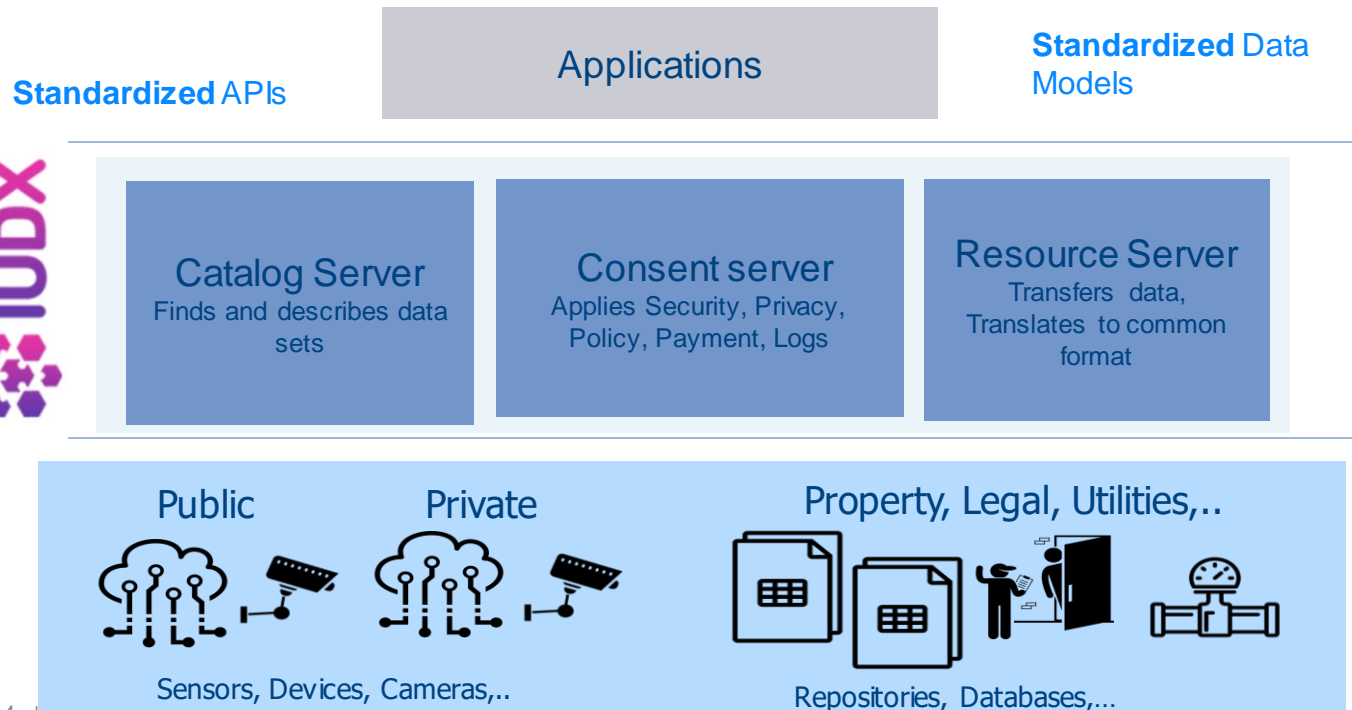
November 2020



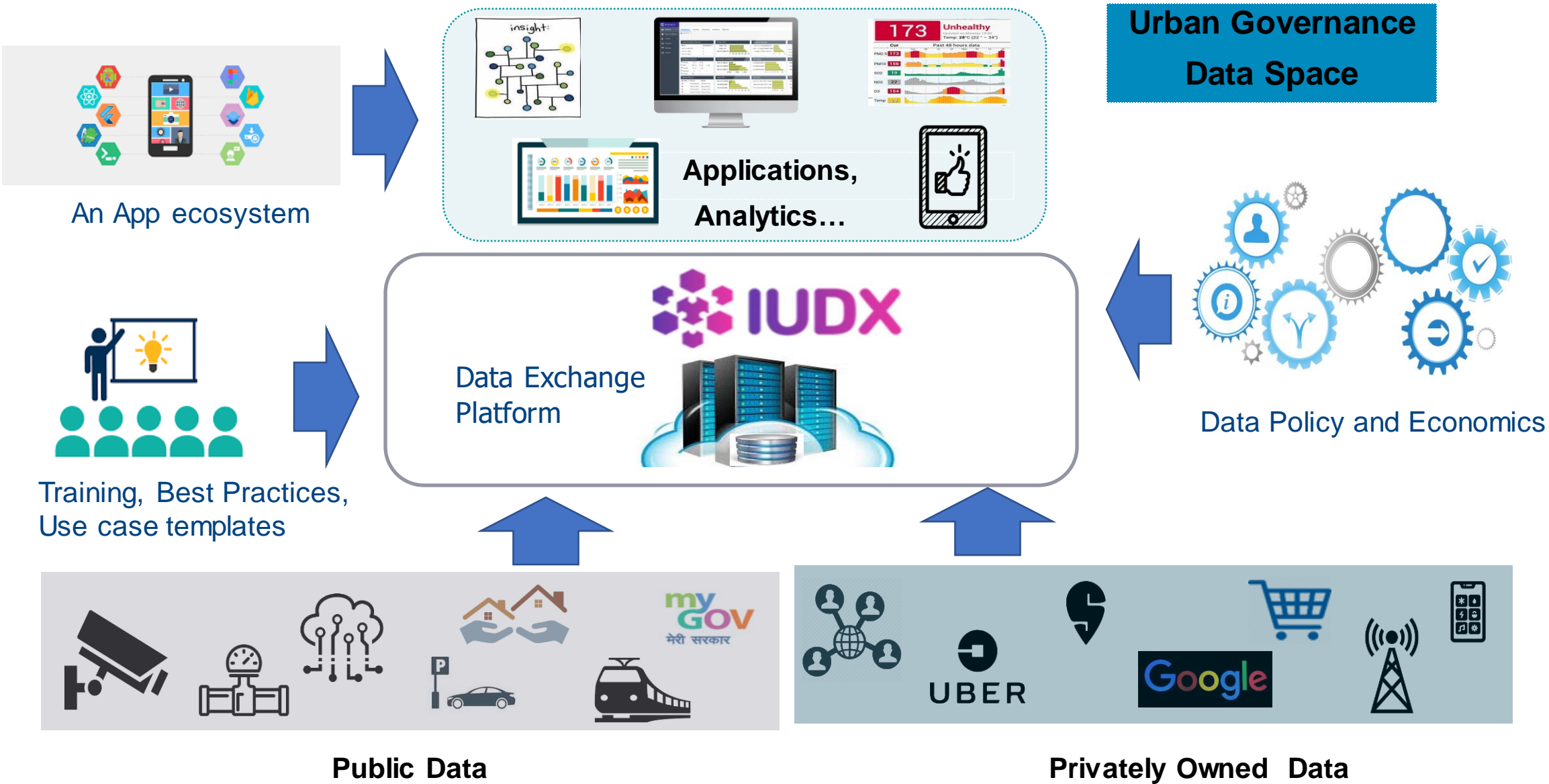
Smart City Mission and Indian Institute of Science came together to conceptualize & build IUDX

Controlled & secure any-any exchange of all forms of public and privately owned ***non-personal*** data—not just "***open data***"

- **Dedicated Program Unit** with an expert staff
- **Open Source** (*code freely available*)
- **Collaborative-** Govt, Industry, Academia, citizens and communities
- **Governance, Policy and Economic** framework being developed
- **Smart Cities:** To be deployed as cloud service in 10 cities this year, 20 next year.
- **Other sectors** have strong applicability to be explored



A data *space* built around IUDX



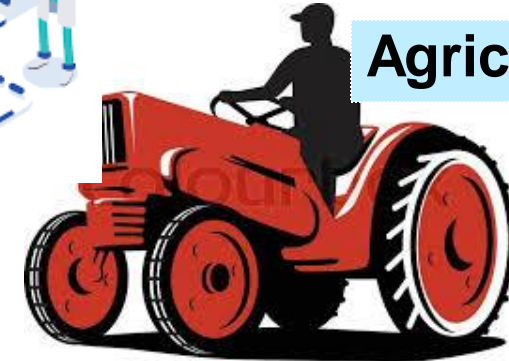
Beyond smart cities--- for all non-personal data



Mobility



Healthcare

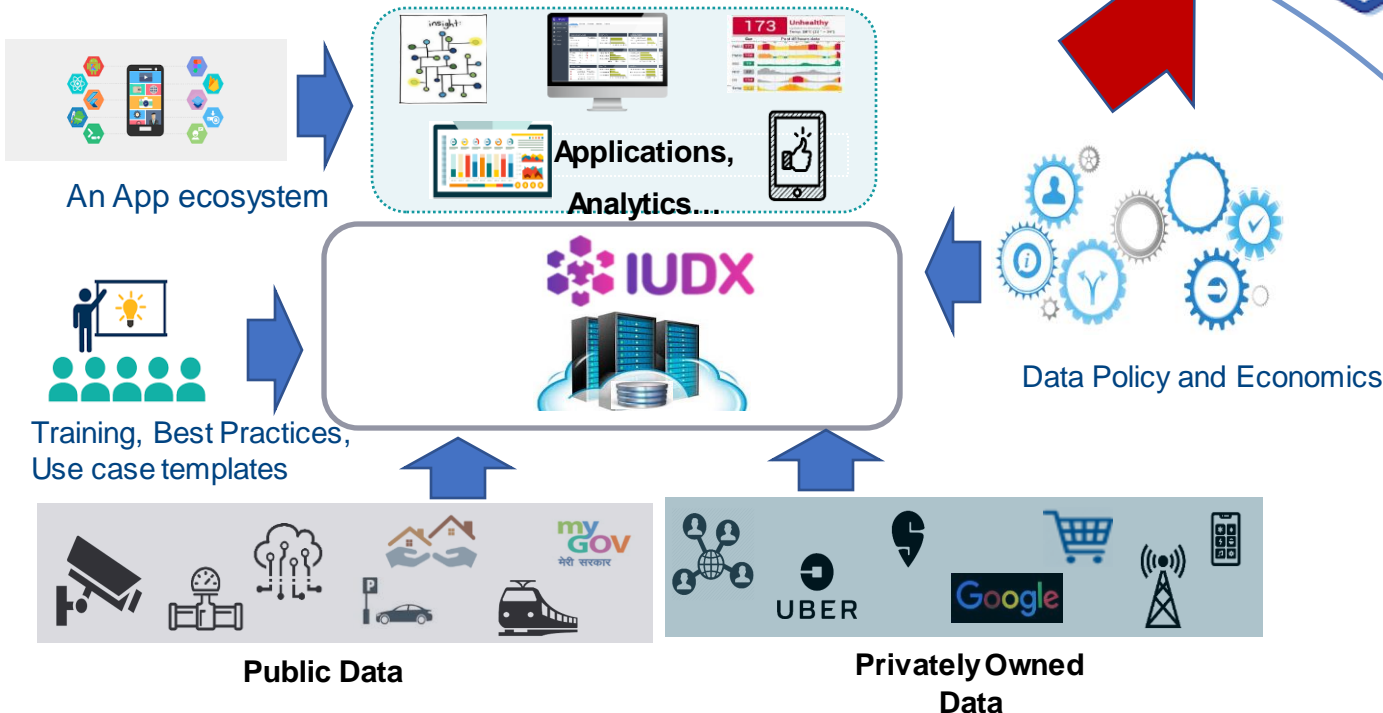


Agriculture



Industrial

Variety of Data Spaces based on same framework



IUDX Stakeholders and concerns

Data Consumer would like to

- Discover data sources of interest
- Access data from these sources in a secure fashion
- Get authorizations for data sources that are not open
- Get additional context for data
- Ease of operations

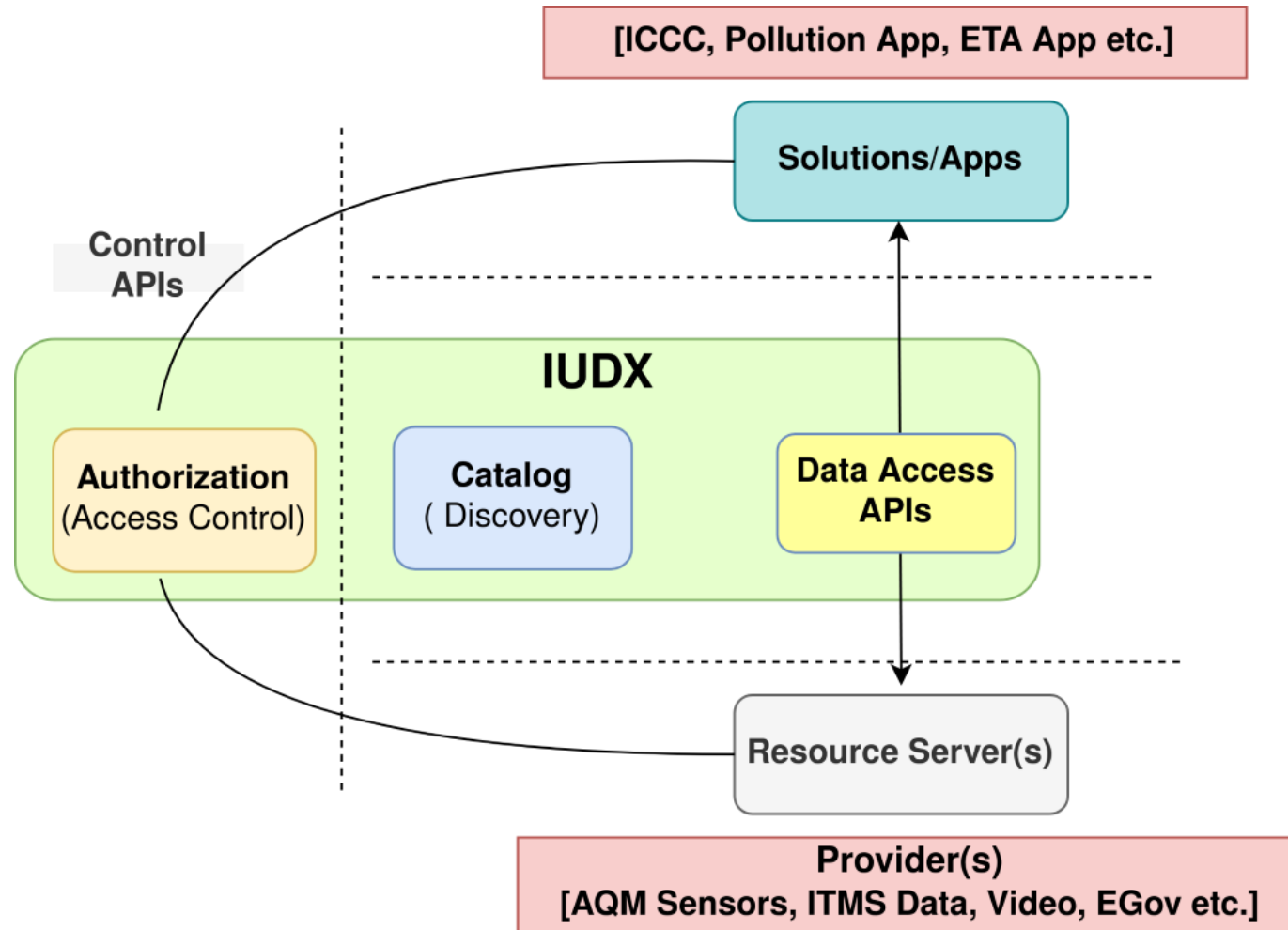


Data Provider would like to

- Control access to its data sources
 - Create, update, delete policies
- Data to be served according to the set policies only
- Onboard data from its sources and add meta-information to make the resource discoverable
- Ease of operations



IUDX: An Open Data Exchange Platform



- **Framework Enables**

- Exchange of data between various IT systems
- **Non-personal** data

- **Two key stakeholders**

- Data Consumers/App Developers
- Data providers

- **Catalogue**

- Information about data sets
- Discovery by app developers
- Data models

- **Authorization**

- Access Control
- Data privacy

- **Standardized APIs to access data**

- **Standardized Data Models**

Connects data sources to solution providers to extract full value

Catalogue Server

- Meta-information about resources
 - Search and discovery
 - Additional context
 - Data Descriptors
- Catalogue APIs
 - Search
 - Geo-spatial (polygon, line, bounding box),Text, Property, Relationship search
 - Management APIs
 - Create, Retrieve, Update and Delete items

Discovery of
resources

Data interpretation
and interoperability

Additional info for
smarter use of data

Store of meta-information JSON-LD documents

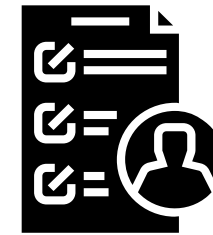
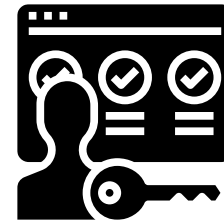
Authorization Server

- Allows data sharing while respecting ownership and privacy requirements
 - Only the authorized entities can get tokens to access the private/protected data
- Main functions of Authorization Server
 - **Authorization** to grant access to protected resources
 - Token grant
 - Validation of access tokens
 - **Managing policies** which specify access rules
 - **Who** can access, **What** data, For **how** long etc.
 - Using simple policy language
 - **Authentication** to identify all parties
 - X.509 Digital Certificate based authentication

Auth server enables **Asynchronous authorization** grant

Authorization APIs

- Request for an access token
- Set consent rules
- Append to existing consent rules
- Get the list of current consent rules
- Validate an access token
- Revoke token(s)
- Audit tokens



Provides simple set of APIs to **automate consent** of data providers.
Inspired by UMA 2.0 Standards.

IUDX Resource Server

- IUDX data plane
- Data pipeline
 - Data access
 - APIs, Subscriptions
 - Auth and catalogue integration
 - Compliance with privacy requirements
 - Data served only if a valid token is presented for secure data
 - Data ingestion
 - Publish endpoints
 - Adaptor/Connector Registrations
 - Data broker
- IUDX 2.0 Data APIs
 - Search and Count
 - Spatial
 - Circle, Polygon, BBox, Linestring
 - Temporal
 - Between, Before, After
 - Attribute
 - Property $>$, $<$, $>=$ and $<=$
 - Complex
 - Subscriptions
 - Streaming, Callback

IUDX 2.0 Data APIs are harmonized with ETSI NGSI-LD Specifications for Data Access

Design Principles

- **Open APIs** and **data models**
- **Consent Driven**
 - Allows sharing of data only if an explicit consent is provided by the data provider
- **Secure by design**
 - Security considerations are part of the design right from the start and all the best practices are followed
- **Minimalistic**
- **Open source**
 - Uses leading tools, technologies from the open-source industry
- **Cloud deployable**
 - Designed for cloud deployment and utilize the state-of-the-art cloud infrastructure
- **Scalable and Elastic by design**
 - Upfront considerations for scalable and elastic designs for all the software components
- **Service oriented**
 - Incorporate service-oriented designs which can be scaled up/down without affecting the other components

Security and Privacy

- Security best practices
 - TLS based secure communications
 - Between all components of IUDX
 - All services are exposed as per the access control policies
 - Certificate based authentications for issuing tokens
 - Communication between IUDX components is not exposed to public IP network
 - Using API gateway for authenticating, controlling and analyzing API traffic
 - Explicit validation for HTTP requests to debar invalid requests
 - Limited port exposure for all the public services
 - Rate limiting provisions for preventing DDOS attacks for open resources

Security built into all architectural components

Technology Stack

API
Server

VERT.X



Data
Broker



Data
Ingestion



Development and
Testing Tools



Java, Javascript



Postman

Data
Store



Elasticsearch



PostgreSQL



Memcached

API Gateway and
Security

NGINX



Deployment,
Scaling and
Clustering



hazelcast



Logging and
System Metrics



Micrometer



Loki



Prometheus

User Interface



Angular

System
Monitoring

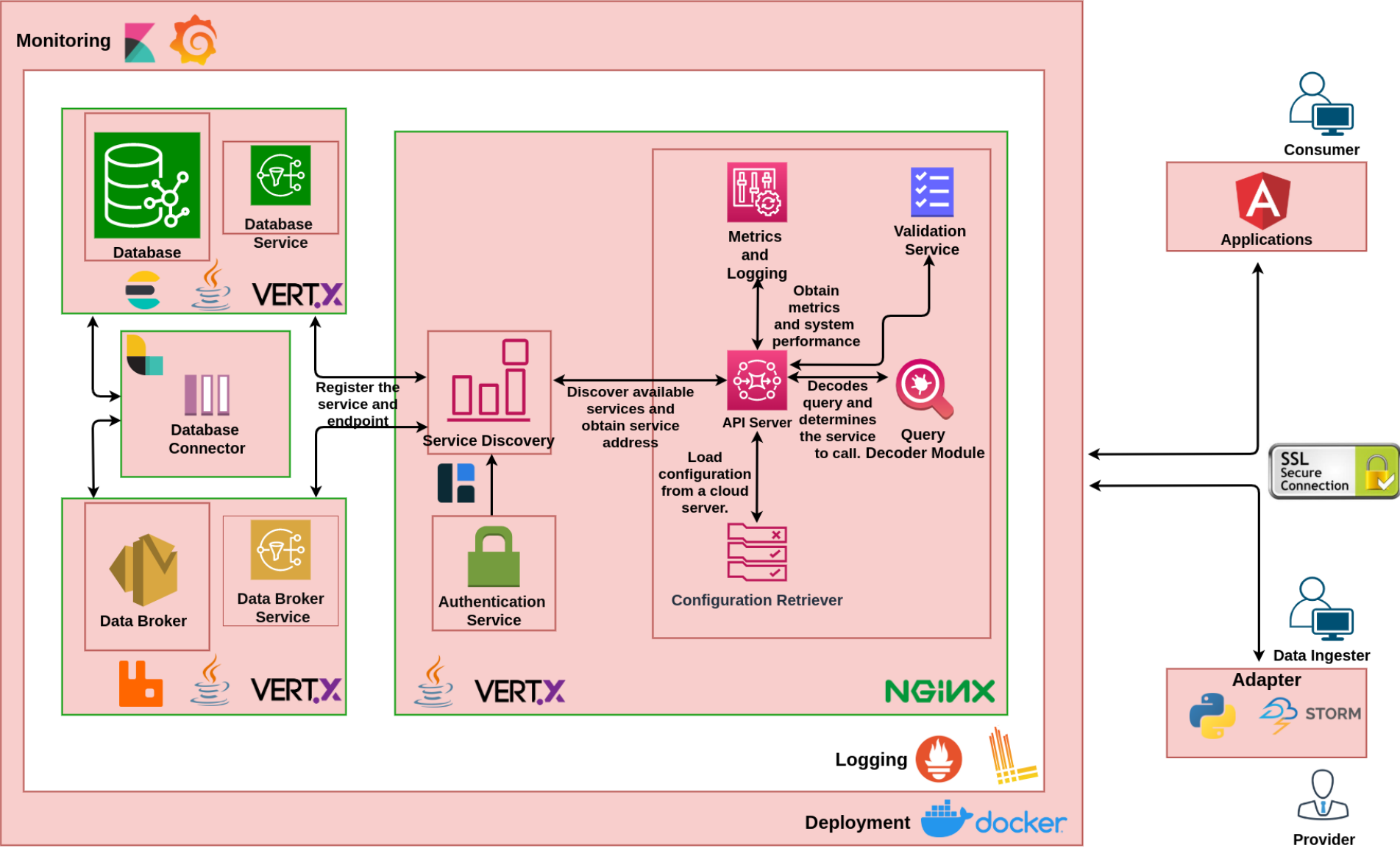


Grafana



Kibana

Solution Architecture: Resource Server



IUDX Deployment

- Dedicated deployment team
- Deployed in cities of Pune, Surat and Varanasi
 - Select datasets onboarded
 - Use cases planned
- A total of 10 cities by the end of March
- Demo ...

Next Releases

- Release 2.5 (End-March)
 - Feature upgrades
 - Faster TIP mechanisms
 - Consent facilitation framework
 - File server APIs
 - Metering and audit APIs
 - Multi-factor authentication
 - User centric upgrades
 - UI Panels for providers/consumers, Dashboards
 - Data Analytics and visualizations
 - Performance upgrades
 - New scalable ingestion framework
 - Upgrades in DevOps (e.g., Kubernetes based DevOps)
 - Clustering

Next Releases (1)

- Release 3.X
 - Video
 - Serving video data
 - Analytics
 - Data Analytics
 - Privacy preserving data/video analytics
 - Data quality
 - Data marketplace APIs
- Request TSC inputs regarding the above

To summarize ...

- IUDX is a data exchange service that
 - Hosts and manages meta-information about resources and facilitates their discovery (Catalogue)
 - Facilitates exchange of data (Resource Server)
 - Facilitates authentication, authorization and accounting mechanisms (Auth Server)
- Defines 2 main participants
 - Data providers
 - Data Consumers/Applications
- Defines the flow of information between
 - Providers/Consumers and catalogue
 - Consumers and Resource servers
 - Providers/Consumers/Resource-servers and Authorization servers

Thank You