HEXAGON | DATA FOR PUBLIC GOOD

Whitepaper

Unified by Open Standards:
GDI and Hexagon in collaboration

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Geospatial data analysis based on advanced machine learning techniques can help solve complex problems in multiple domains and help achieve the Sustainable Development Goals (SDG). Thus far there has been a challenge that stems from the lack of availability, non-interoperability and non-standard data formats that deterred from realising these benefits.

This challenge has been recognised by the National Geospatial Policy 2022 which envisages efficient access to the fundamental geospatial data available with various stakeholders in the country. The policy proposes a National Geospatial Data Registry (NGDR) as a centralized catalog for discovering and accessing geospatial data, and a Unified Geospatial Interface (UGI)—a standards-based digital platform to enable querying and exchange of data from NGDR and its partner nodes.

The development of the Integrated Geospatial Data-sharing Interface (GDI) is a step towards that direction. The GDI is a standardized platform that integrates diverse sources of spatial data, tools, and services into a cohesive and accessible interface. It aims to streamline access to geospatial information, promote interoperability across different systems, and facilitate seamless data sharing and analysis. By providing a unified access point, GDI enhances efficiency in geospatial data utilization, supports innovation in applications and services, and ensures consistency in data standards and protocols for users across various domains and industries. GDI provides a critical Digital Public Infrastructure (DPI) to readily access geospatial data through controlled access mechanisms.

GDI is being developed by the Centre of Data for Public Good (CDPG) under the Foundation for Science Innovation and Development. CDPG's aim is to democratise data and help harness its power by creating data exchange platforms and integrating them seamlessly into the broader context of 'Data for Public Good'. By ensuring that data exchange is conducted effectively, with a focus on privacy and security, CDPG strives to make the benefits of data accessible to all, promoting inclusivity in decision-making processes.

OGC Standards and how GDI leverages it to boost interoperability

OGC (Open Geospatial Consortium) standards are internationally recognized protocols that ensure geospatial data and services are interoperable across different platforms and systems. They enable seamless sharing, integration, and analysis of geographic information, regardless of source or format. In the geospatial sector, OGC standards play a vital role in fostering collaboration, improving data accessibility, and supporting the development of scalable, flexible geospatial solutions for government, industry, and research. CDPG has been an active technical committee member of OGC, contributing significantly to the development and implementation of next-generation REST API standards. As a leading implementer of emerging OGC standards, GDI has adopted key APIs including the Features API, Tiles API, Processes API, and Coverages API. GDI has also adopted the STAC APIs along with a few extensions, which is a community standard under OGC.

Parallely, CDPG has provided valuable feedback to the OGC CITE (Compliance, Interoperability, and Testing) program to enhance the compliance testing process. Beyond implementation, CDPG has extended several standard API workflows with robust authentication mechanisms and a flexible authorization framework—supporting security models like ACL, RBAC, and data marketplace policies tailored to diverse data providers. Additionally, GDI has advanced a streamlined data onboarding process through the OGC Processes API, enabling efficient and user-friendly dataset integration for various data contributors.

In addition to this, GDI enabled Canvas, a visualization tool built on OGC standards viz. OGC Features and OGC Tiles API that allows users to add resources from GDI Catalogue upon discovery. The consumers can add multiple datasets on the map, add colours and labels, view attributes of the dataset, and do simple visualizations such as viewing data bounded by a region and add panes to view and remove data from a region.

About Hexagon

Hexagon is the global leader in precision technologies at any scale. Our digital twins, robotics and AI solutions are transforming the industries that shape our reality. Headquartered in Sweden, it serves industries like geospatial, construction, public safety, and defense.

In GIS, its Safety, Infrastructure & Geospatial division delivers advanced tools for capturing, analyzing, and managing spatial data. In India, Hexagon supports key initiatives like Make in India, Digital India, ZED, and Bharatmala.

It plays a vital role in smart and safe city projects (e.g., UP 100, Dial 100/112) by enabling integrated emergency response systems. Hexagon also boosts mining safety and efficiency, and helps farmers reduce water use by up to 30% through smart agriculture solutions.

Hexagon Geospatial Portfolio – Core Capabilities

- **ERDAS IMAGINE:** Advanced remote sensing software for image analysis and data extraction.
- **GeoMedia:** GIS platform for spatial analysis, mapping, and workflows.
- **Luciad:** Real-time geospatial visualization tools for defense, aviation, and emergency response.
- **M.App Enterprise:** Platform for creating custom, lightweight geospatial applications.

Hexagon and OGC - Overview

- Hexagon is a principal member of the Open Geospatial Consortium (OGC) and has a notable and active presence in OGC through its various divisions, especially the Safety, Infrastructure & Geospatial (SIG) division.
- It contributes to the development and implementation of open geospatial standards.
- Several Hexagon business units, including Luciad (part of SIG) and ERDAS, are involved in OGC-related activities.

Hexagon Contributions to OGC Standards

- **Luciad Portfolio:** LuciadRIA, LuciadLightspeed, and LuciadFusion natively support various OGC standards (WMS, WFS, WMTS, 3D Tiles, etc.). Luciad actively contributes to OGC Testbeds and interoperability projects.
- **ERDAS IMAGINE & GeoMedia:** Support numerous OGC standards, enabling smooth interoperability with other GIS systems and data.
- **Hexagon Smart M.Apps & M.App Enterprise:** Designed for OGC compliance, enabling cross-platform data sharing. Hexagon also contributes to OGC Innovation Program initiatives focused on advancing geospatial standards.

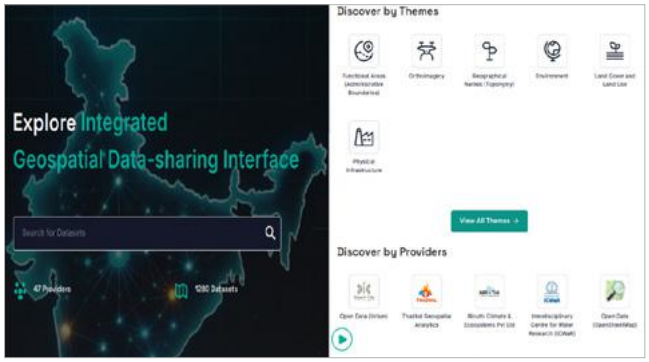
Why Hexagon Engages with OGC

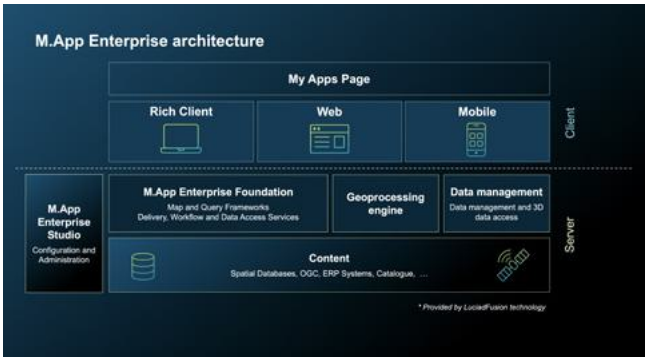
- **Interoperability:** Ensures its software integrates with other platforms.
- **Government and Enterprise Compliance:** Many governments' geospatial data standards mandate OGC compliance.
- **Thought Leadership:** Contributing to emerging standards in 3D GIS, real-time geospatial data, and digital twins.

Unified by Open Standards: GDI and Hexagon in collaboration

Hexagon-GDI coming together

Visualizing datasets from GDI to Hexagon's M.App Enterprise Application - Easy, Fast and Secure.





GDI's Catalogue interface

A key benefit of adopting standards is interoperability—when both client and server use a common protocol, integration becomes seamless. By using the globally accepted OGC standards, both Hexagon and GDI ensure faster, more efficient data exchange. This allows any geospatial app to access, analyze, and contribute data to GDI.

OGC Features API for its simplicity and flexibility were selected. It supports discovery and query operations via HTTP GET, enabling clients to explore datasets and retrieve features based on defined criteria.

The Catalogue of GDI is a dataset discovery portal and metadata store. It enables providers of data sources to describe them with data exchange based annotations to make discovery and consumption of data both automatable and semantically describable. For search and discovery, it allows users to search through text and geo-based queries. The catalogue is a JSON-LD document stored and based on the RDF information exchange model.

To visualise GDI datasets on the Hexagon's environment, M.App was selected for the following strength.

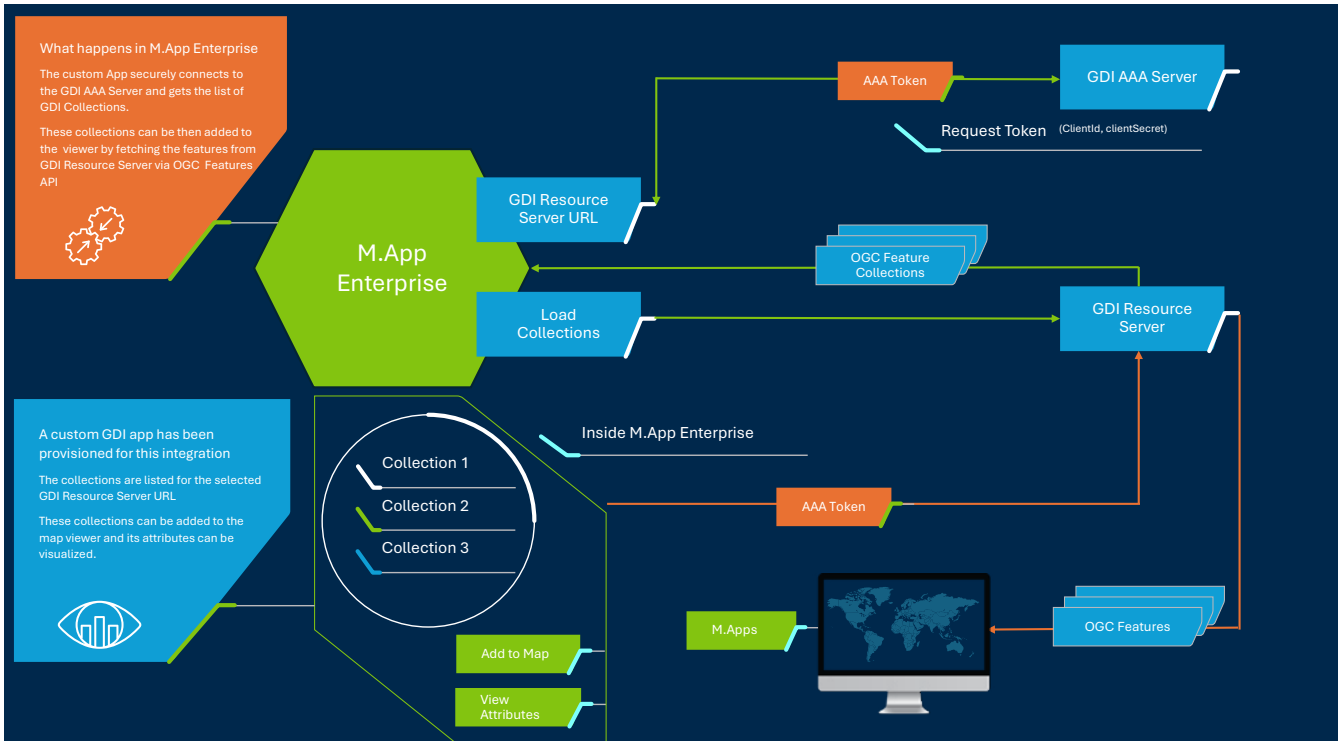
1. **Smart M.App Architecture:** Combines data, workflows, and analytics into domain-specific, actionable applications—moving beyond static maps.

2. **Enterprise-Grade Platform:** Supports on-prem, private cloud, and hybrid setups with robust integration, user access control, and data security.

3. **Modular & Extensible Design:** Offers app creation via M.App Studio, with support for custom plugins, APIs, and JavaScript-based customization.

4. **Advanced Data Integration & Visualization:** Handles spatial and non-spatial data, supports OGC standards, and is accessible via web and mobile platforms.

Technical approach



The Integration of Hexagon M.App Enterprise with the GDI OGC Features API was done using the following steps:

1. **Custom M.App Developed:** A tailored geospatial app was built using Hexagon M.App Enterprise to meet GDI-specific needs, supporting real-time data, user interaction, and dynamic visualization.
2. **India-Specific Layers Added:** Curated geospatial layers and various basemap options were integrated for better spatial analysis and context.
3. **Data Fetch via OGC Features API:** The app communicates with the GDI interface using the OGC Features API to retrieve and render geospatial data collections.
4. **Secure Token Authentication:** The app uses JWT tokens issued by GDI authorization server to securely access GDI resources, generated using Client ID and Secret credentials.
5. **Collection Display:** Authenticated users can view structured GDI data collections, which are paginated and displayed within the app.
6. **Auto-Zoom to Collection Extents:** Selecting a dataset zooms the map to its geographic bounds using metadata.
7. **3D Viewer Integration:** Datasets can be visualized in 3D, enhancing spatial understanding.
8. **Customizable Labels:** Users can modify dataset labels for clearer visualization.
9. **Attribute Display:** Each dataset includes detailed attribute data for analysis and decision-making.

Outcome

Figure 1 shows the drop down from where the user can select the Resource server URL in the M.App interface. Any Resource server that is OGC feature compliant can be integrated to the Hexagon's M.App Enterprise solution.

Figure 1: GDI-Hexagon's Interface

As can be seen in the Figure 2, the user can then select the desired collections and plot it on the map.

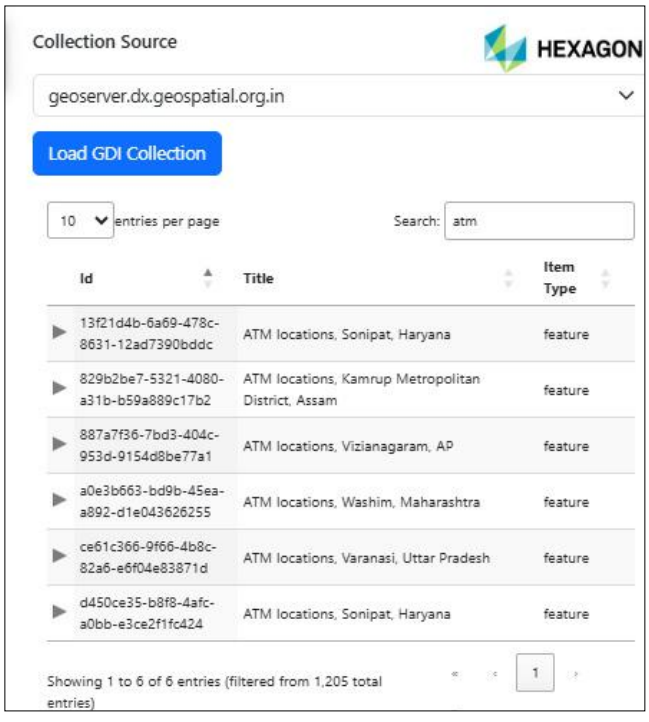


Figure 2 : GDI-Hexagon's Interface

As shown in Figure no. 3, the users can see the details of the feature data set such as Id, Title, Extents, CRS, etc.

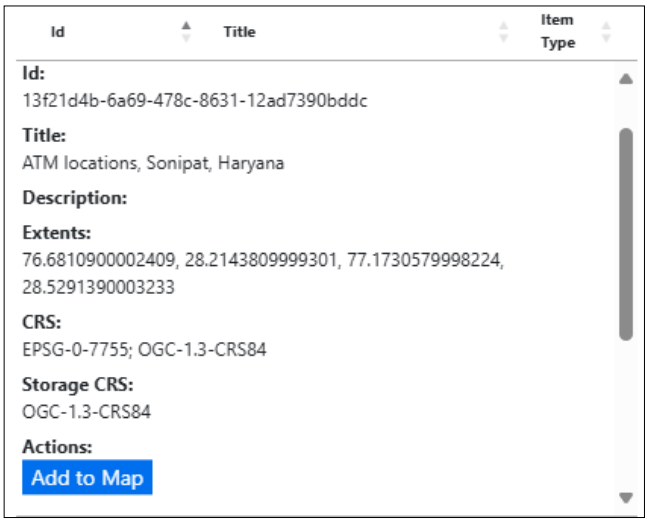


Figure 3: Metadata visualisation on the M.App interface

Figure 4 shows My Collections, where you add the choice of your collections from the list, view attributes and choose the labels to view on the map

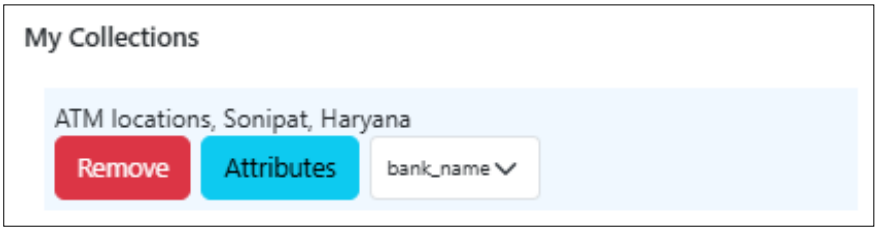


Figure 4: My collections page

Figure 5 shows the overall visualization in the 3D map along with feature properties in a tabular form.

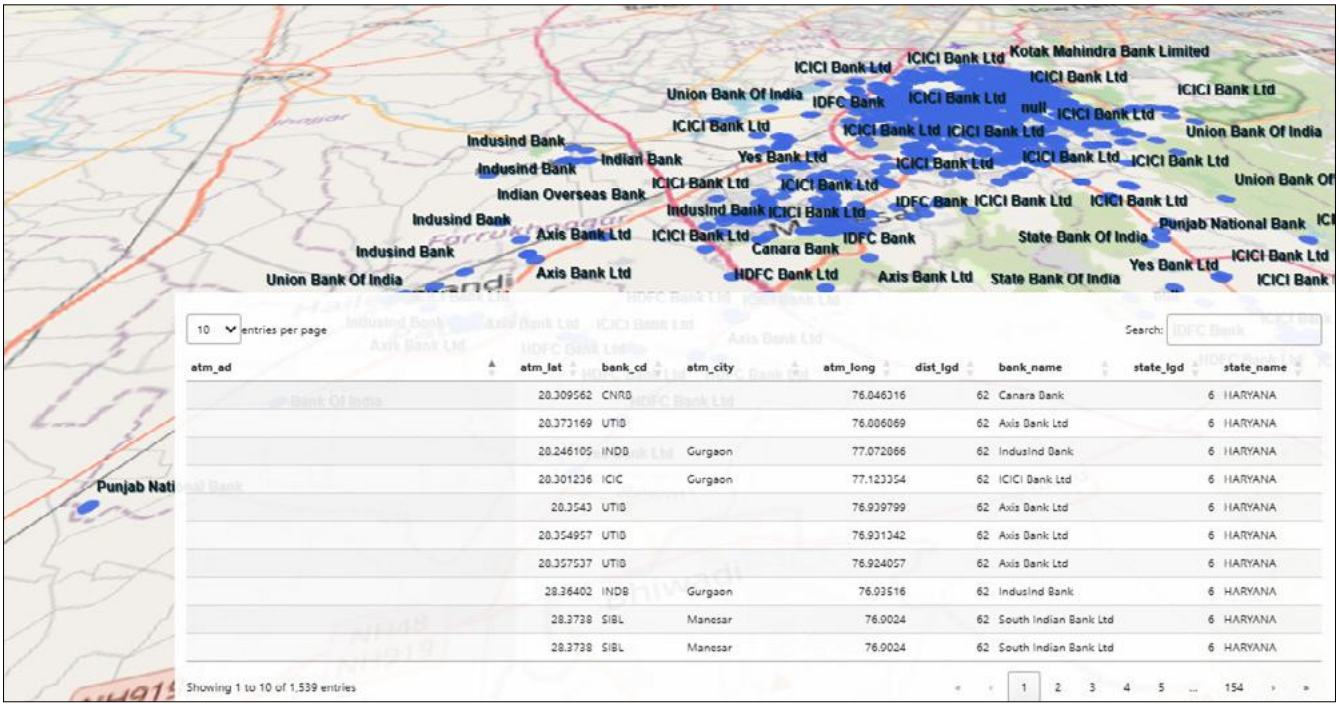


Figure 5 : Visualisation of GDI dataset on M.App interface

Conclusion: The adoption of globally recognized standards like those from the OGC plays a critical role in achieving true interoperability across geospatial systems. By aligning with OGC protocols, Hexagon and GDI enable seamless, efficient data exchange that empowers any geospatial application to access, analyze, and contribute to shared datasets. The selection of the OGC Features API—valued for its simplicity and flexibility—further streamlines discovery and querying of data through standard HTTP operations. This collaboration highlights how adherence to open standards can bridge the gap between robust enterprise platforms like M.App Enterprise and open-source solutions like GDI, paving the way for innovative, interoperable geospatial applications.

This application was developed by GDI and Hexagon teams during the OGC Code Sprint, March 2025 held at CDPG, IISc campus.

DATA FOR PUBLIC GOOD

The Centre of Data for Public Good (CDPG) is a pioneering initiative focused on advancing the responsible use of data and AI for societal benefit. We enable innovation and trust in digital public infrastructure by supporting open standards, secure data exchange, and impactful data-driven applications.

From cities to citizens, our initiatives promote transparency, interoperability, and sustainability across domains such as urban governance, healthcare, mobility, and agriculture etc. Anchored at IISc Bangalore and working with governments, academia, and industry, CDPG is shaping the future of data for public good in India and beyond.

Learn more at dataforpublicgood.org.in

Hexagon is the global leader in precision technologies at any scale. Our digital twins, robotics and AI solutions are transforming the industries that shape our reality.

Hexagon (Nasdaq Stockholm: HEXA B) has approximately 24,500 employees in 50 countries and net sales of approximately 5.4bn EUR. Learn more at hexagon.com and follow us @HexagonAB.