GeoAI Data Platform for IoT Intelligence

DOTLOOM

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Outline

Background and Vision

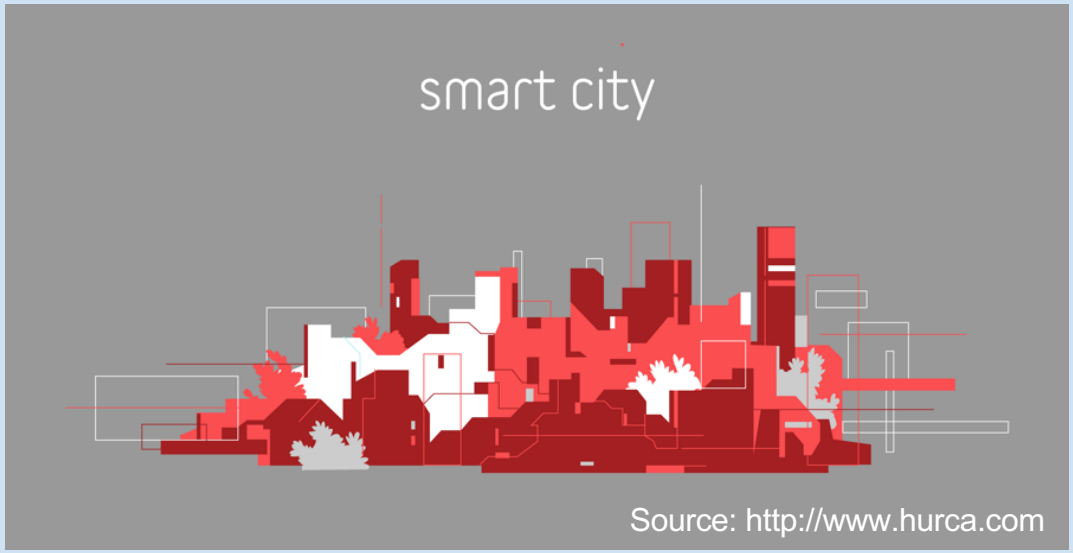
GeoAI Data Platform

DOTLOOM

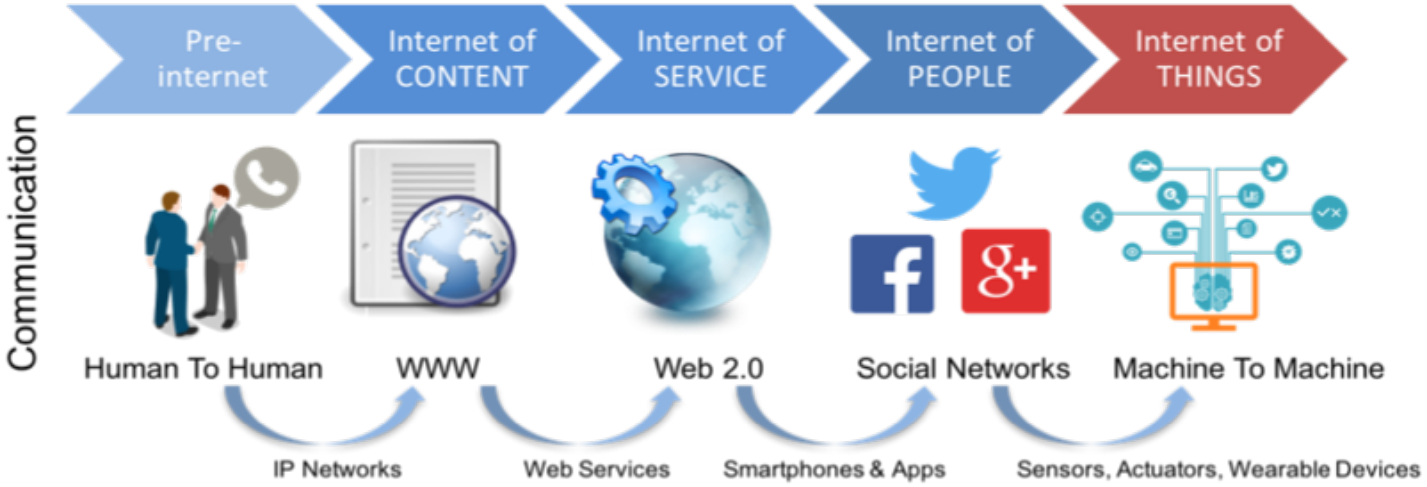
Next Steps

Background & Vision

~ IoT + AI + Geo ~



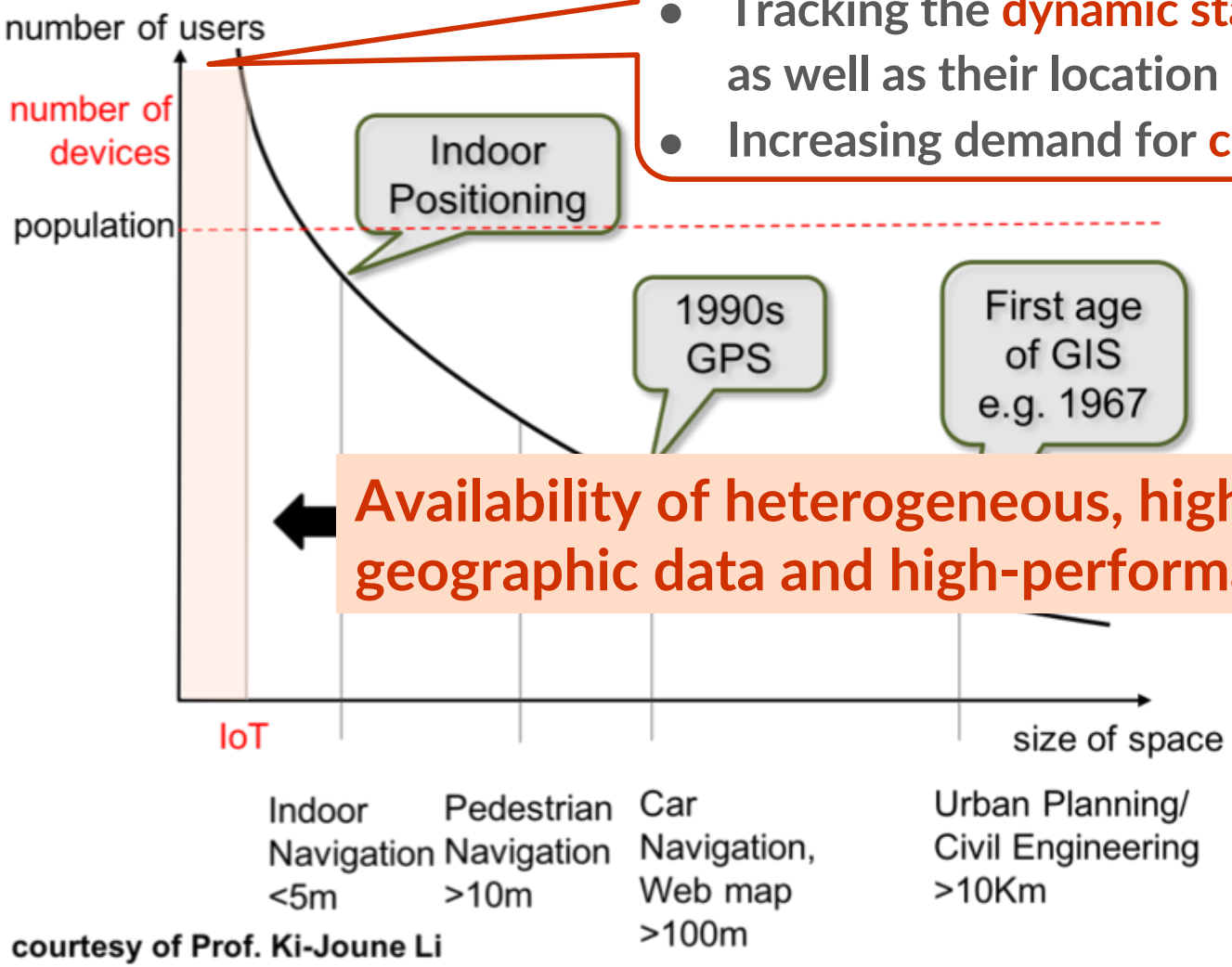
Internet of Things (IoT)



- An **infrastructure of interconnected** objects, people, systems and information resources together with **intelligent services** to allow them to process information of the physical and virtual worlds and react. (ISO/IEC JTC 1/SWG 5 AHG1)
- The fusion of the physical (reality) and virtual (perception) worlds accelerates geospatial capture, coordination, and intelligence in unprecedented ways.

Device-centric Geospatial Computing

- Tracking the **dynamic status** of physical things as well as their location in real time
- Increasing demand for **cm-scale** of space



Availability of heterogeneous, high-resolution geographic data and high-performance computing

courtesy of Prof. Ki-Joune Li

Next-generation Geospatial Services

- Push the geospatial intelligence into devices
- Perception, Automation, and Optimization of space where a thing can safely and efficiently keep geographically referenced activities

Self-space Services

Source: https://virtualrealitytimes.com/2017/03/22/what-is-mixed-reality/

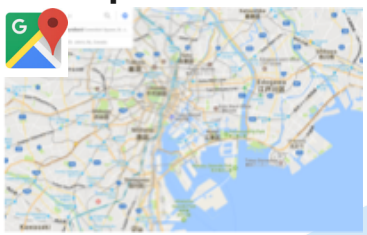
Identifying & Simulating locations

Location-based Services

Source: http://www.anarsolutions.com/location-based-services/

Tracking locations

Applications **Map Services**



Sharing locations

Edge Computing

Mobile Computing

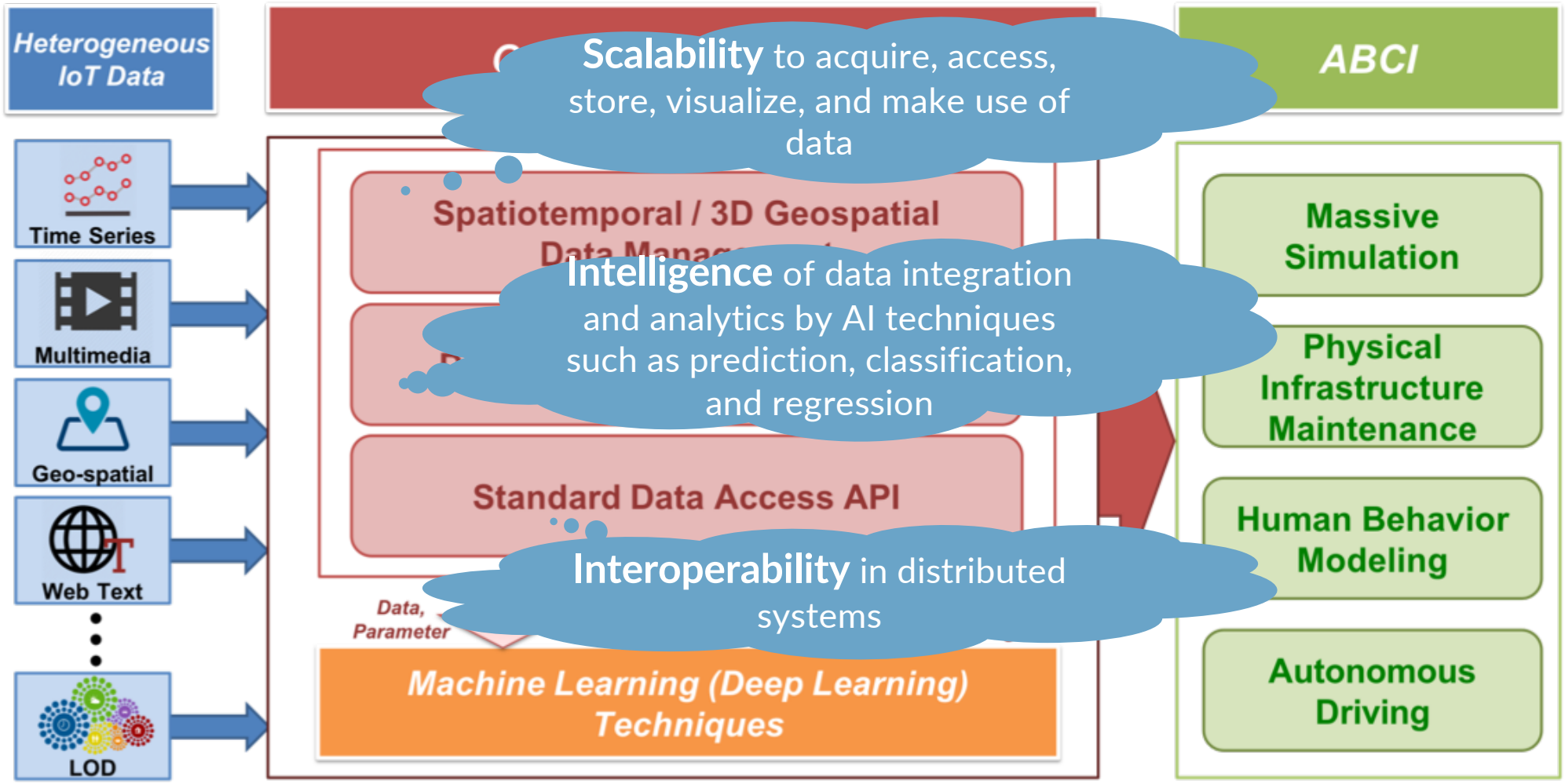
Networked Computing

Technologies

GIS Internet HTML XML SOA GPS Clouds Smartphones Wireless Networks Data Mining Geotagging NoSQL CPS IOT PDR Ambient intelligence Deep Learning Wearable Devices Human-centric media Handheld AR

GeoAI Data Platforms

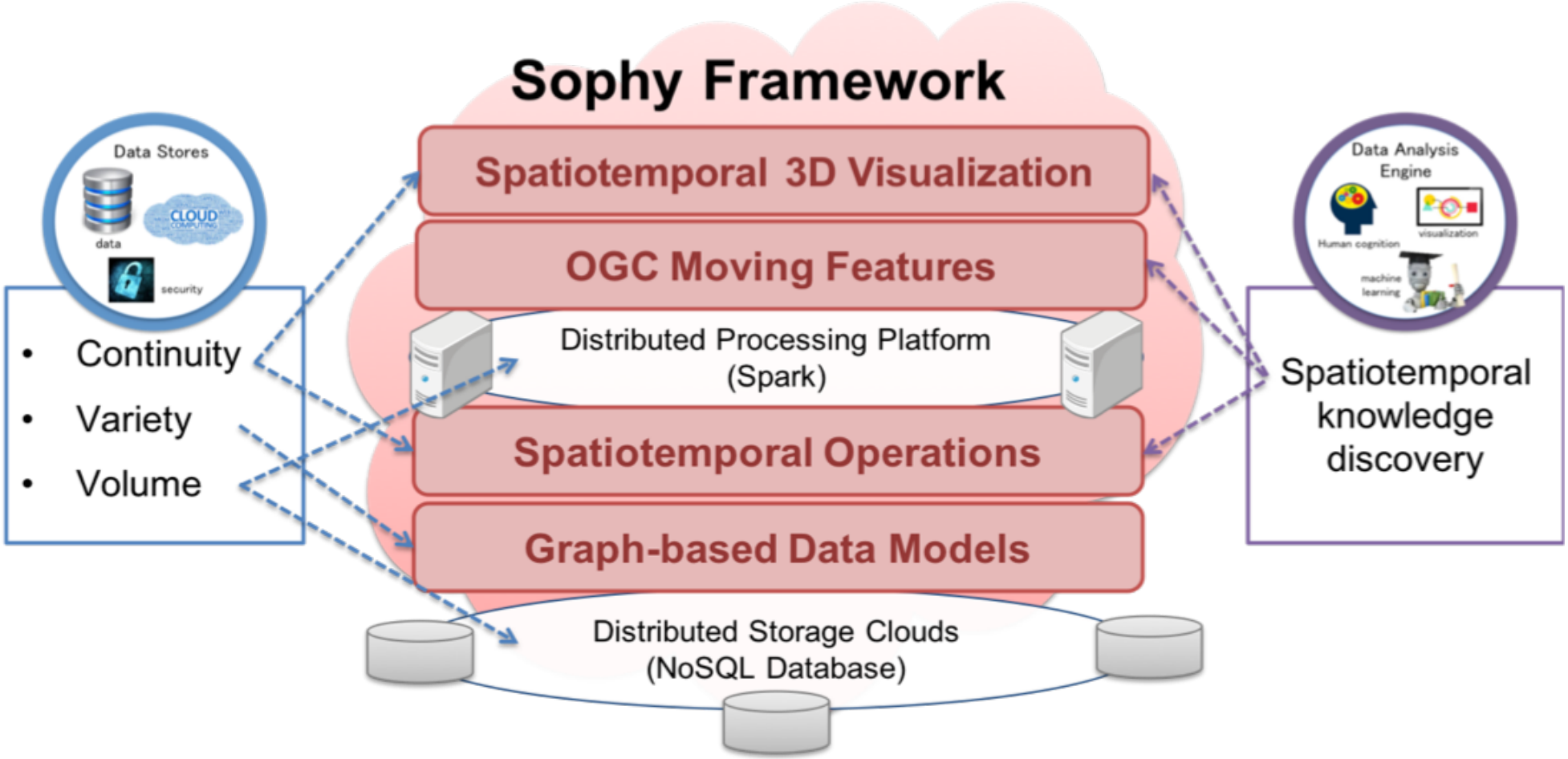
GeoAI Data Platform



AI Bridging Cloud Infrastructure (ABCI)- The worlds first large-scale OPEN AI Infrastructure; 1088x compute nodes with 4352x NVIDIA Tesla V100 GPUs, 476TiB of Memory, 1.6PB of NVMe SSDs, 22PB of HDD-based Storage, and Infiniband EDR for accelerating AI, Machine Learning, and Deep Learning workloads

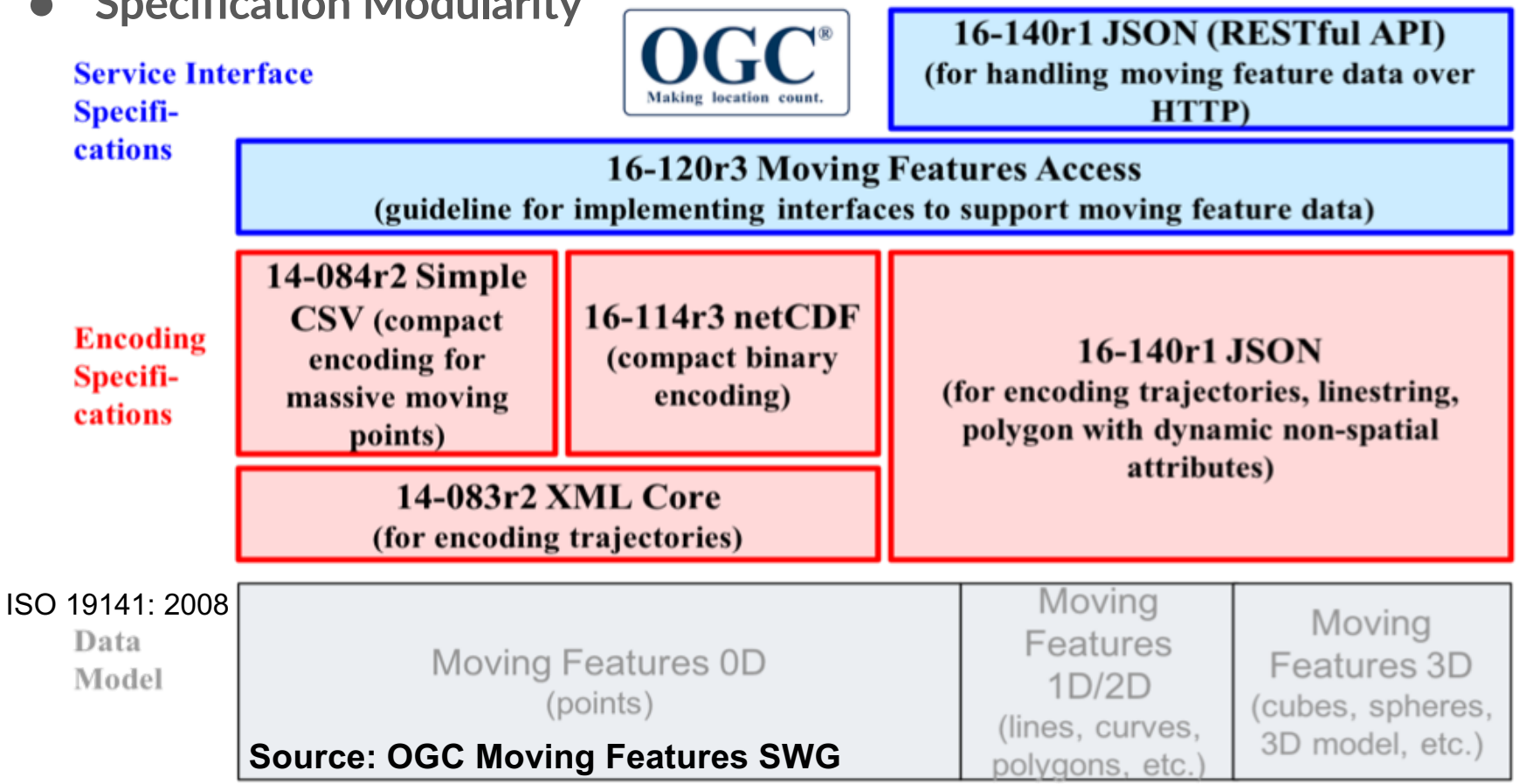
Spatiotemporal Data Management

- To manage and analyze spatiotemporal movements/changes and topological relationships (e.g. passes, enters, leaves, etc.)
- To encourage rapid and advanced utilization of spatiotemporal data

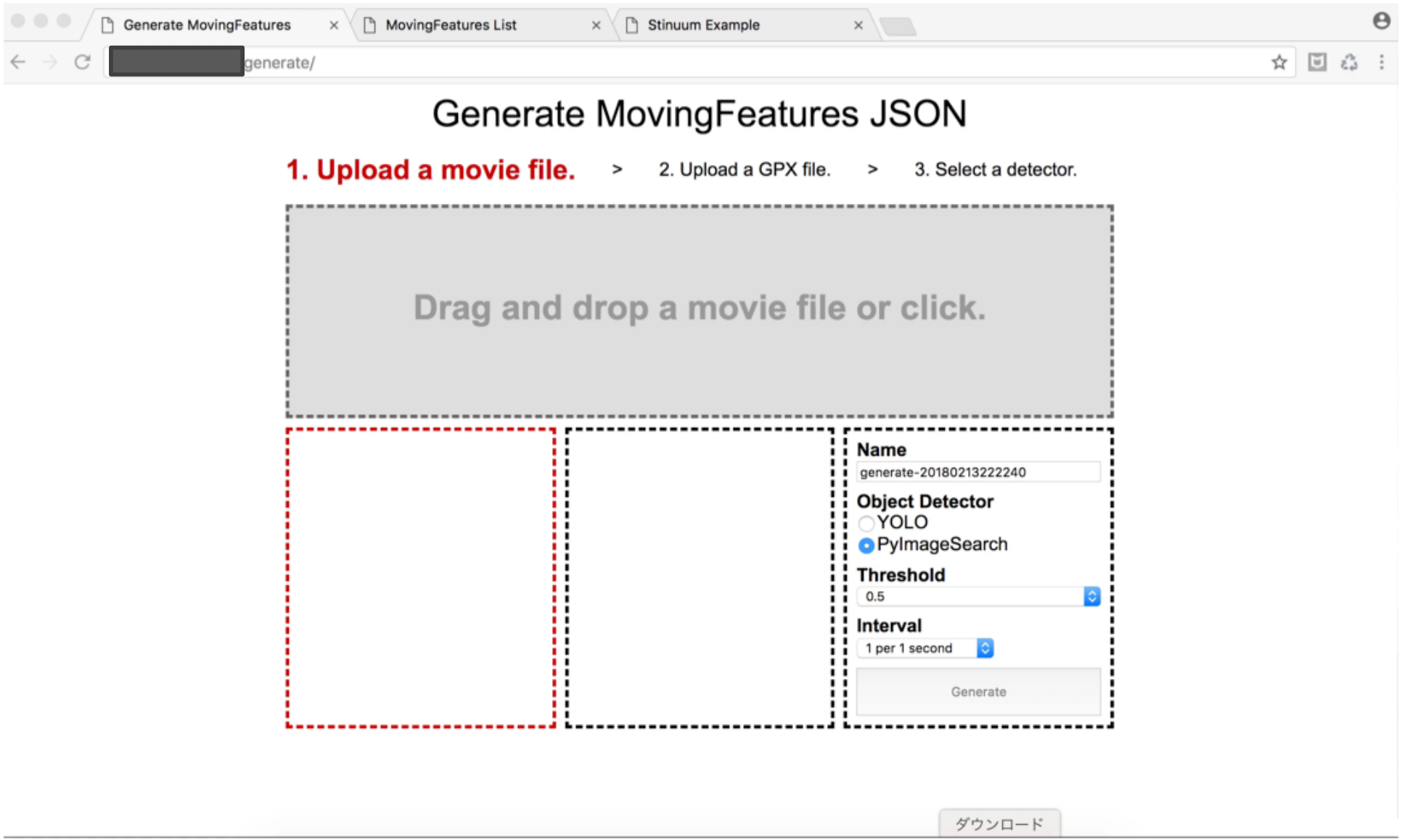


OGC Moving Features

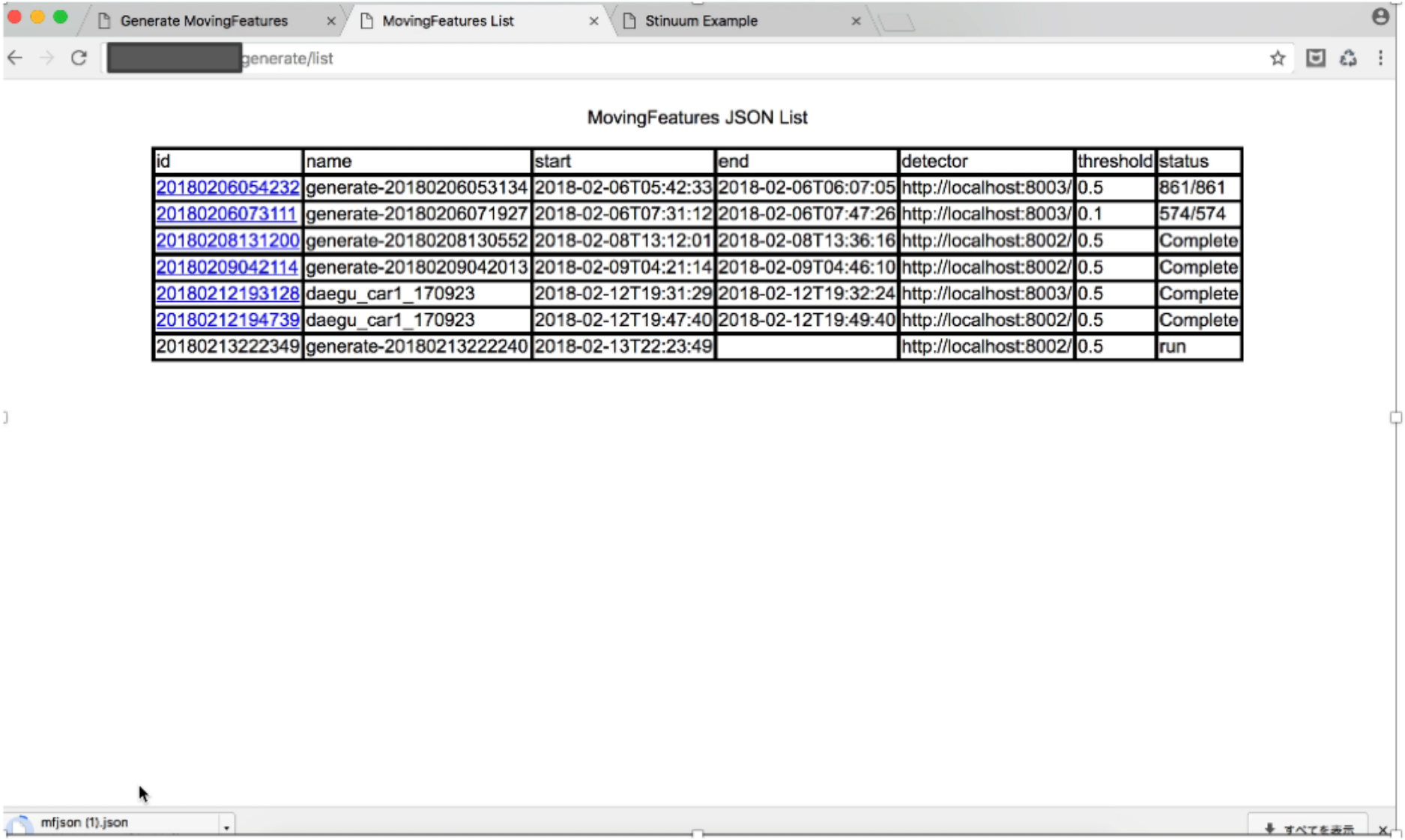
- International standards to integrate moving features (objects) for value-added services
- SWG chair members
  - Hitachi, Ltd. , University of Tokyo, AIST
- Specification Modularity



Data Integration on OGC Moving Features

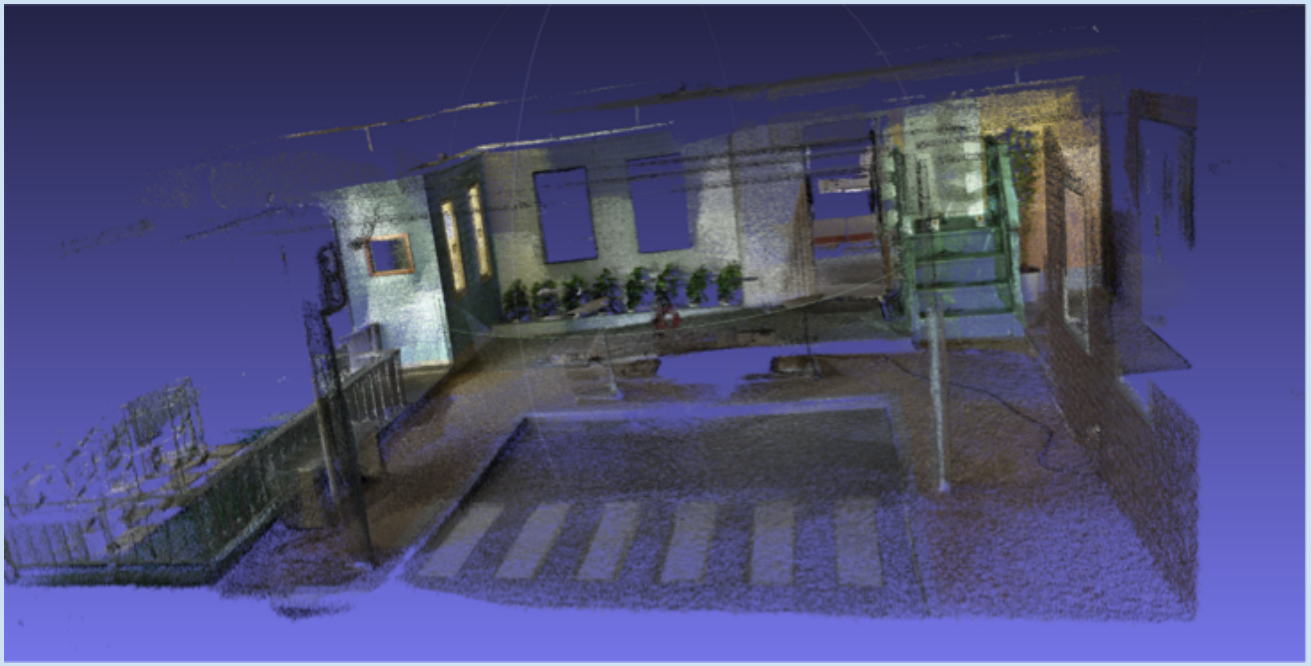


Data Integration on OGC Moving Features



id	name	start	end	detector	threshold	status
20180206054232	generate-20180206053134	2018-02-06T05:42:33	2018-02-06T06:07:05	http://localhost:8003/	0.5	861/861
20180206073111	generate-20180206071927	2018-02-06T07:31:12	2018-02-06T07:47:26	http://localhost:8003/	0.1	574/574
20180208131200	generate-20180208130552	2018-02-08T13:12:01	2018-02-08T13:36:16	http://localhost:8002/	0.5	Complete
20180209042114	generate-20180209042013	2018-02-09T04:21:14	2018-02-09T04:46:10	http://localhost:8002/	0.5	Complete
20180212193128	daegu_car1_170923	2018-02-12T19:31:29	2018-02-12T19:32:24	http://localhost:8003/	0.5	Complete
20180212194739	daegu_car1_170923	2018-02-12T19:47:40	2018-02-12T19:49:40	http://localhost:8002/	0.5	Complete
20180213222349	generate-20180213222240	2018-02-13T22:23:49		http://localhost:8002/	0.5	run

Data Integration on OGC Moving Features



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Distributed Data Platform for Point Cloud

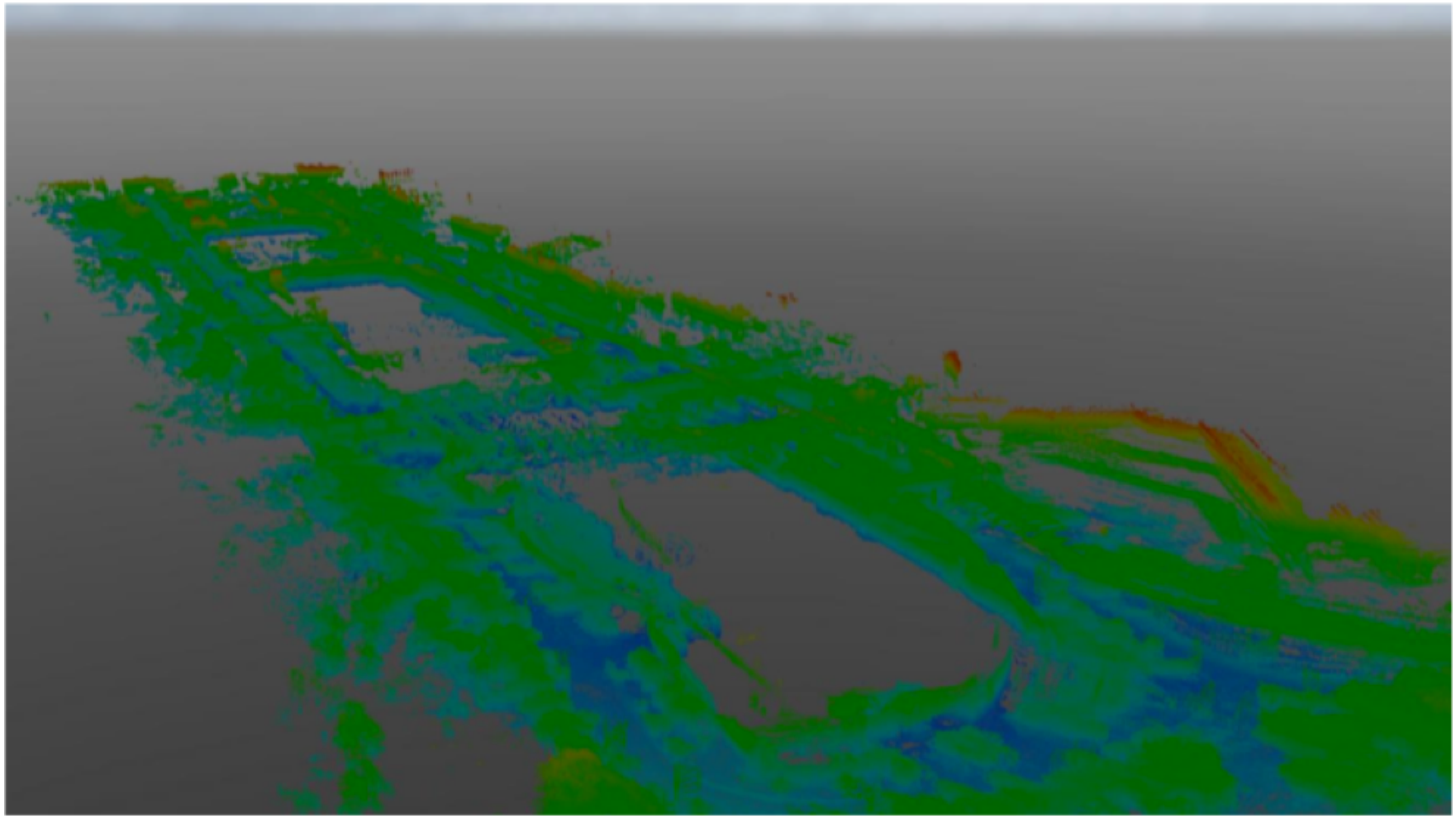
- To efficiently manage a large amount of 3D LiDAR point cloud.
- To easily share 3D LiDAR point cloud data.
- To automatically generate 3D Dynamic Map with high-performance computing architectures and AI techniques.

… because Big Data handling is hard!

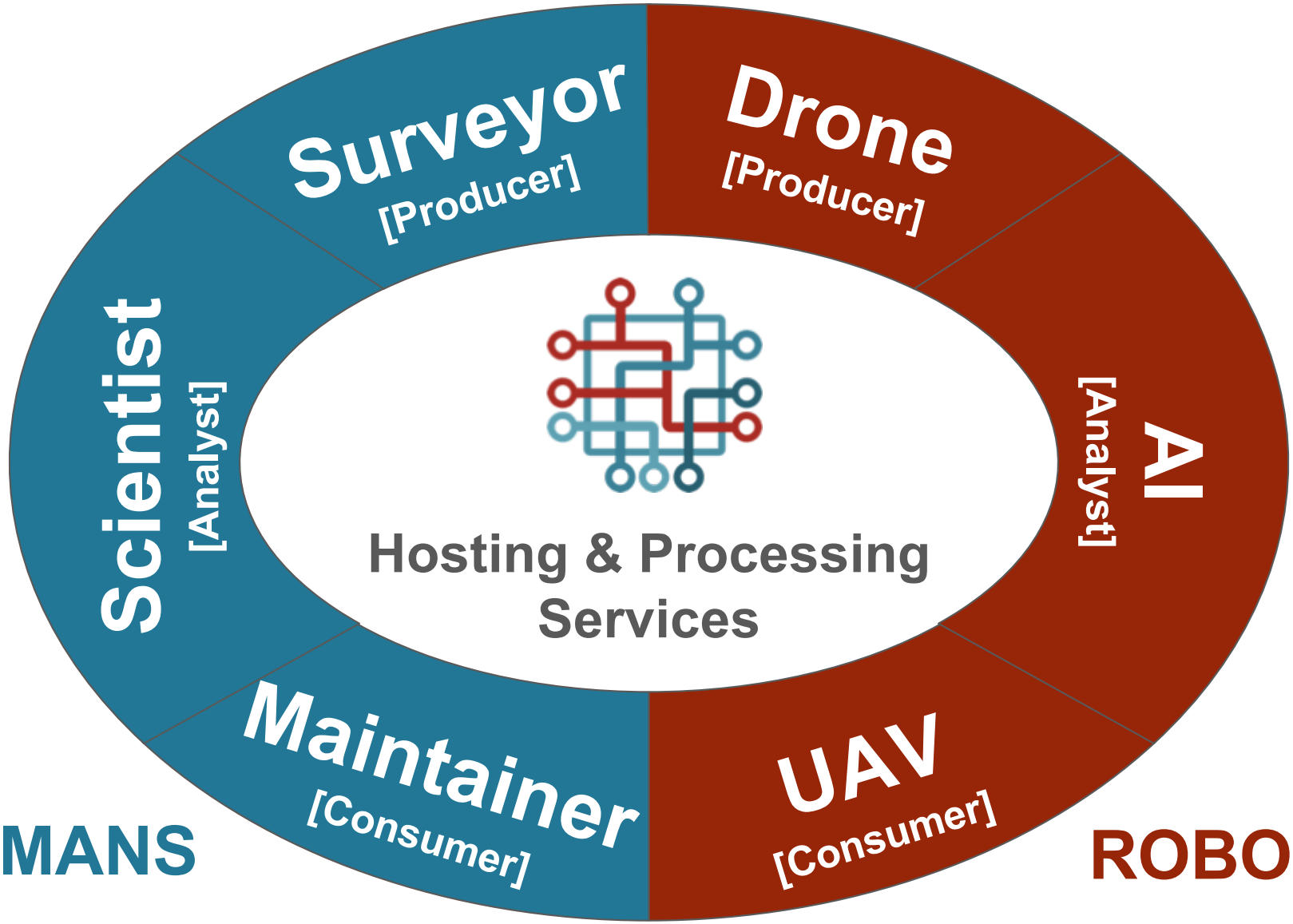
Source: http://www.clipartoday.com/clipart/occupations/occupations/artist_159630.html

- **Variety**
  - Aerial LiDAR, Mobile LiDAR, etc.
  - Linear Mapping LiDAR, Geiger-mode LiDAR, etc.
- **Volume**
  - 750m x 15pt/m^2
  - 47,856 (miles): 15.4TB
  - 850 billion pts
- **Velocity**
  - Time -> 4D
  - Dynamic changes

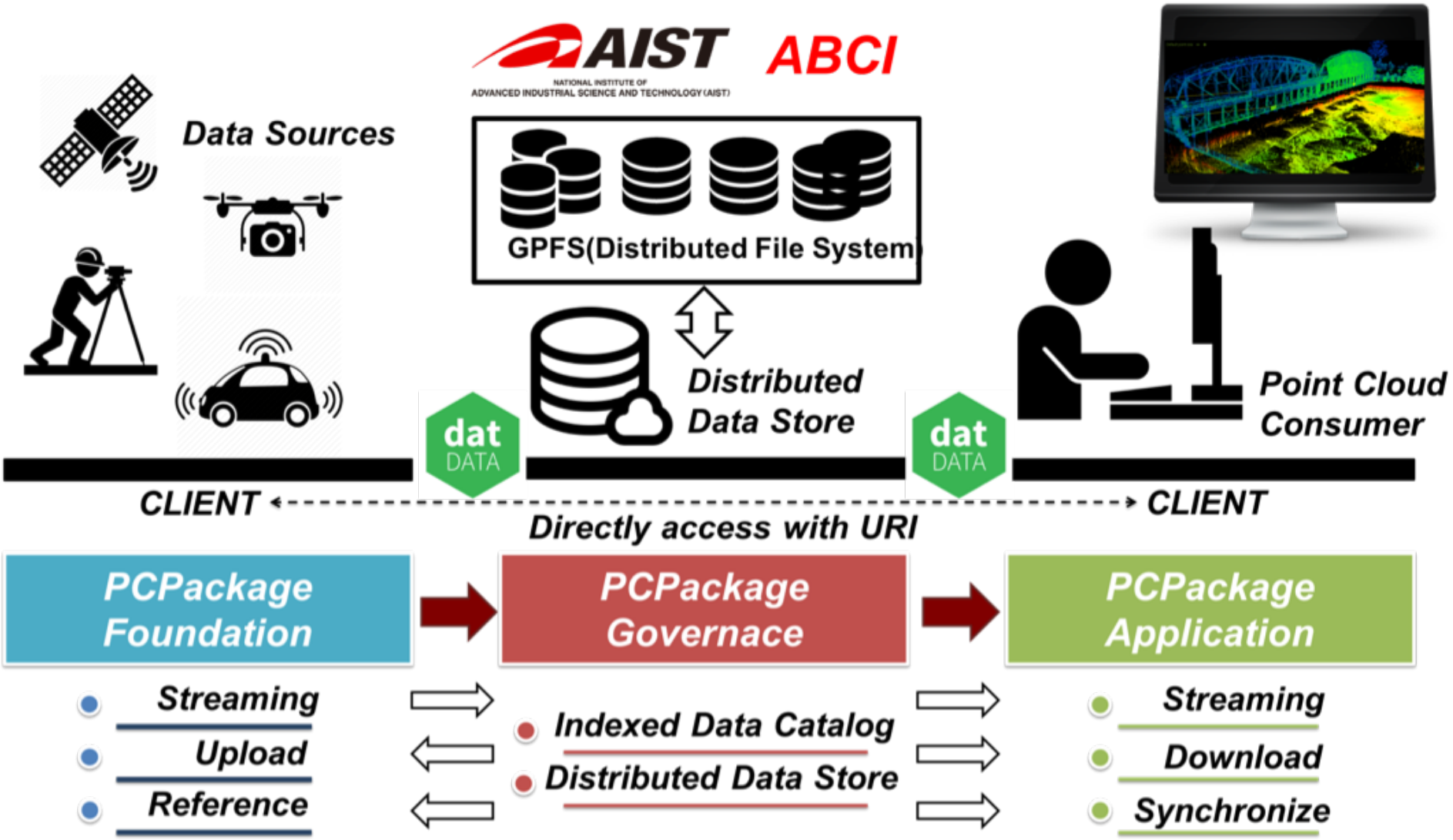
3D LiDAR Point Cloud



DOTLOOM Platform “Users”



Leveraging Dat-protocol



Why use Dat Protocol?

- **Distributed Sync**

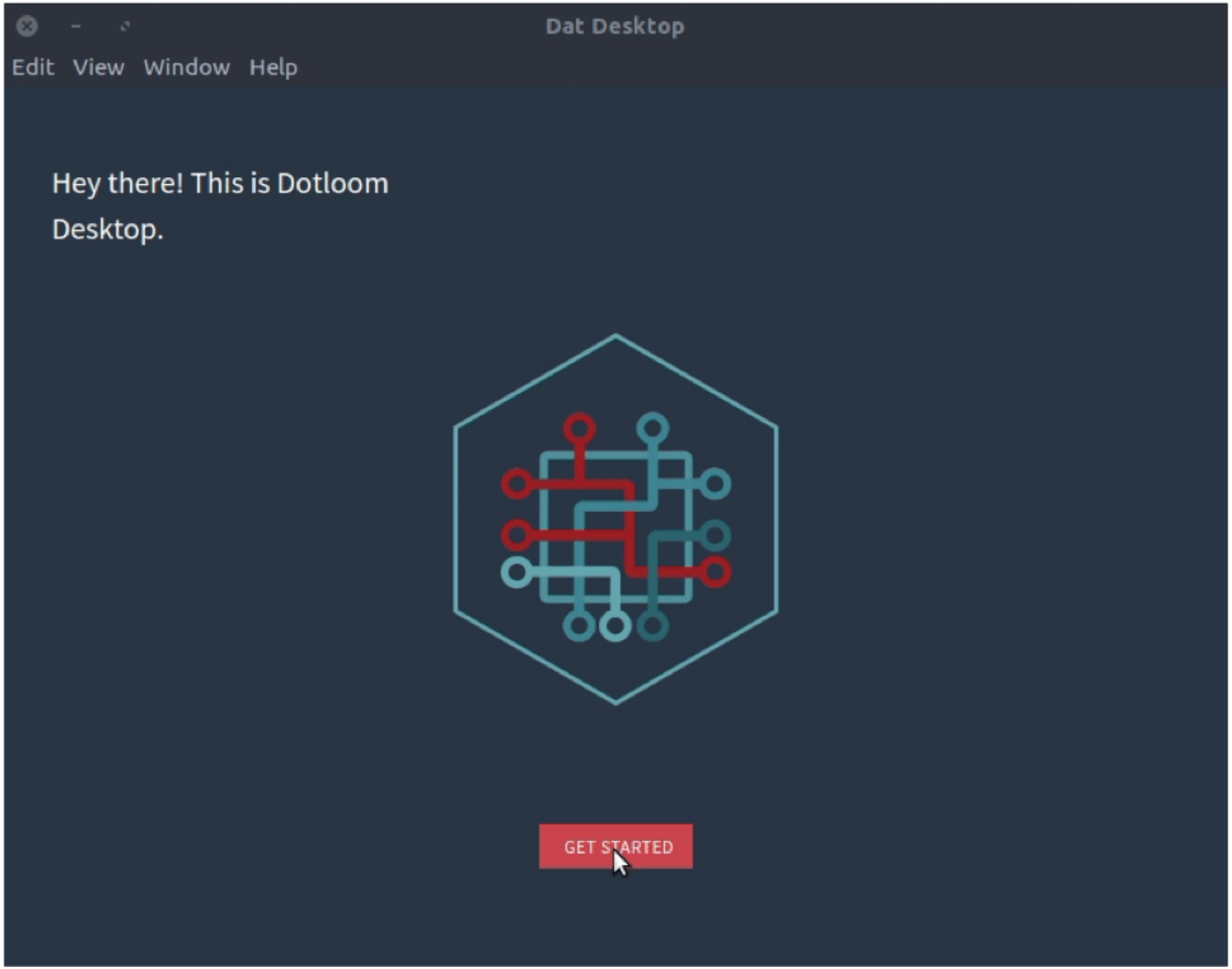
  Modeled after the best parts of Git, BitTorrent, and the internet, the Dat Protocol is a peer-to-peer protocol for syncing files and data across distributed networks.

- **Faster Speeds**

  Improving speeds while using less bandwidth sounds impossible. The Dat Protocol makes it the default by using a peer-to-peer network. Seamlessly add or remove hosts as needed.

- **Efficient Storage**

  Data is deduplicated between versions, reducing bandwidth costs and improving speed. Developers can create custom storage that work over a variety of protocols.



What next?

- Point cloud visualization (Potree/Cesium)
- Remote Instant Indexing
- Data Processing Pipeline
  - Generic processing/publishing framework
  - Point cloud processors (ie. PDAL support)
  - Object detection by using deep learning
  - Support for Docker container
- 3D Geospatial map creation and management

Management of Seamless 3D Geospatial Infrastructures

Thank you for your attention!