

The background features a blue-tinted view of Earth from space, showing the curvature of the planet and some cloud cover. Overlaid on this is a complex network of glowing blue lines and dots, representing a global network or data flow. The overall aesthetic is futuristic and technological.

# Low Cost Location Accuracy Improvement

**For Developing Countries**



INTRODUCTION

PROJECT IDEA

COMPONENTS

DATA

LOCATION SERVICE



INTRODUCTION



# INTRODUCTION

PITB

PROJECTS

A large orange circle is centered on a black background. Inside the circle, the letters "PITB" are written in a white, bold, sans-serif font.

PITB



PITB

Punjab Information Technology Board

- Develop Applications for Govt Departments.
- Semi - Govt. Organization
- Several Development Teams: Android, .NET, GIS, Oracle, Web etc
- GDSG: Geospatial Data Science Team



- More than 580 projects are in progress
- Majority of the projects record location data through IOT devices e.g., mobiles, tablets, handheld PDAs etc.

PITB





PROJECTS





Education

Highways

Health



Government  
Departments

Livestock/  
Fisheries

Agriculture

Police

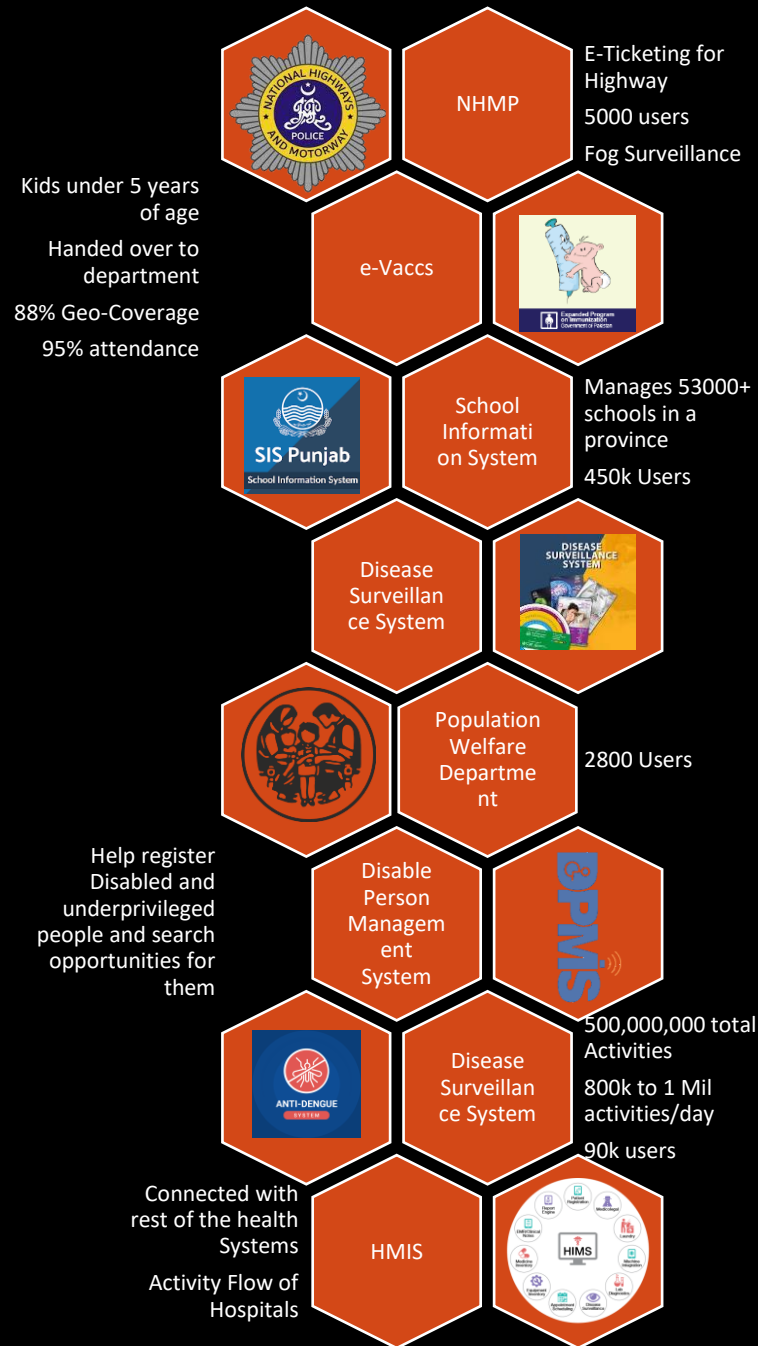
Water and  
Sanitation

Judiciary





- The projects usually require location based monitoring activities.
- Processing is computation intensive
- Independent servers for each project.
- Approx. 500k user base is using the location based applications

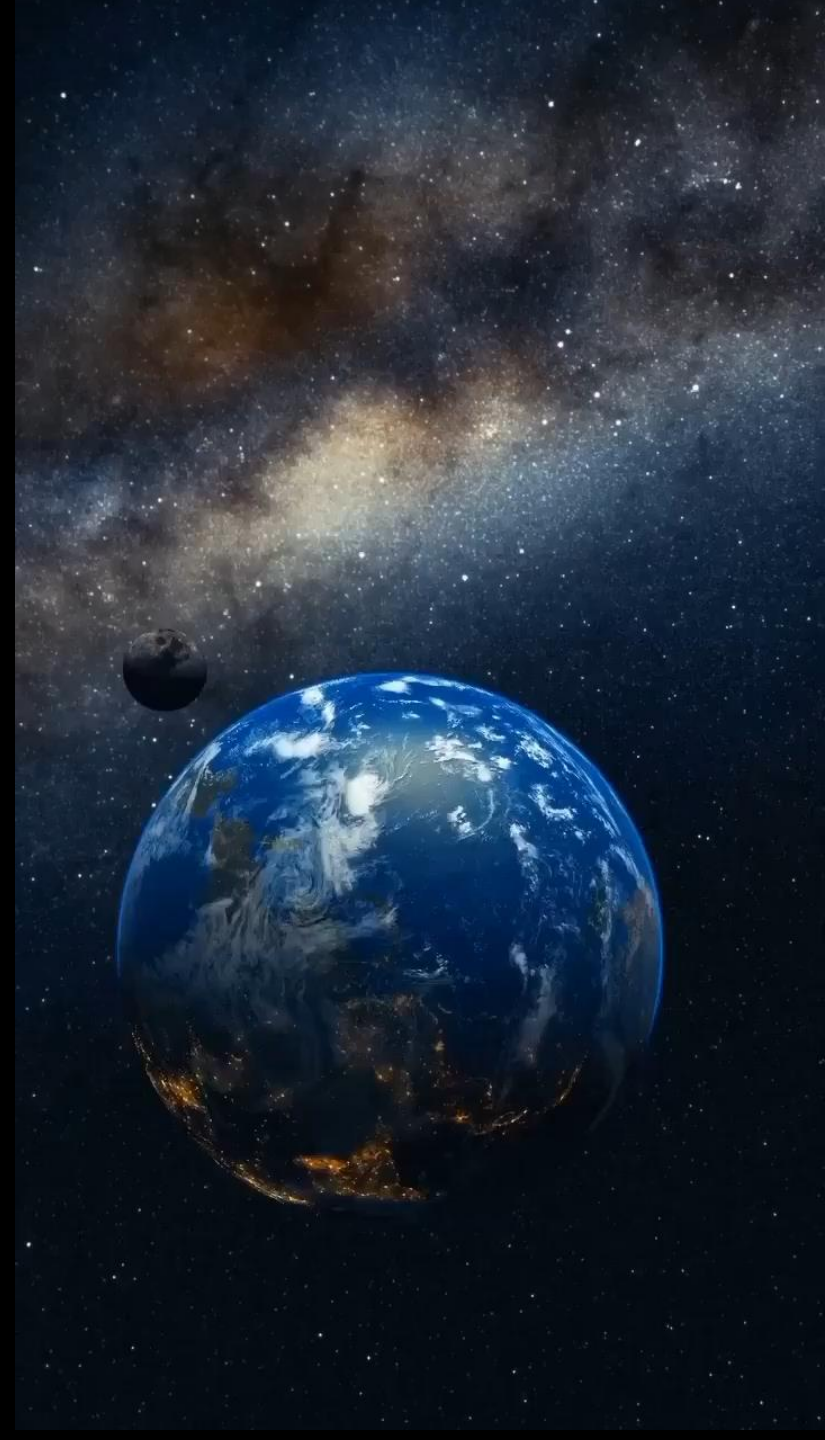




PROJECT IDEA

# PROJECT IDEA

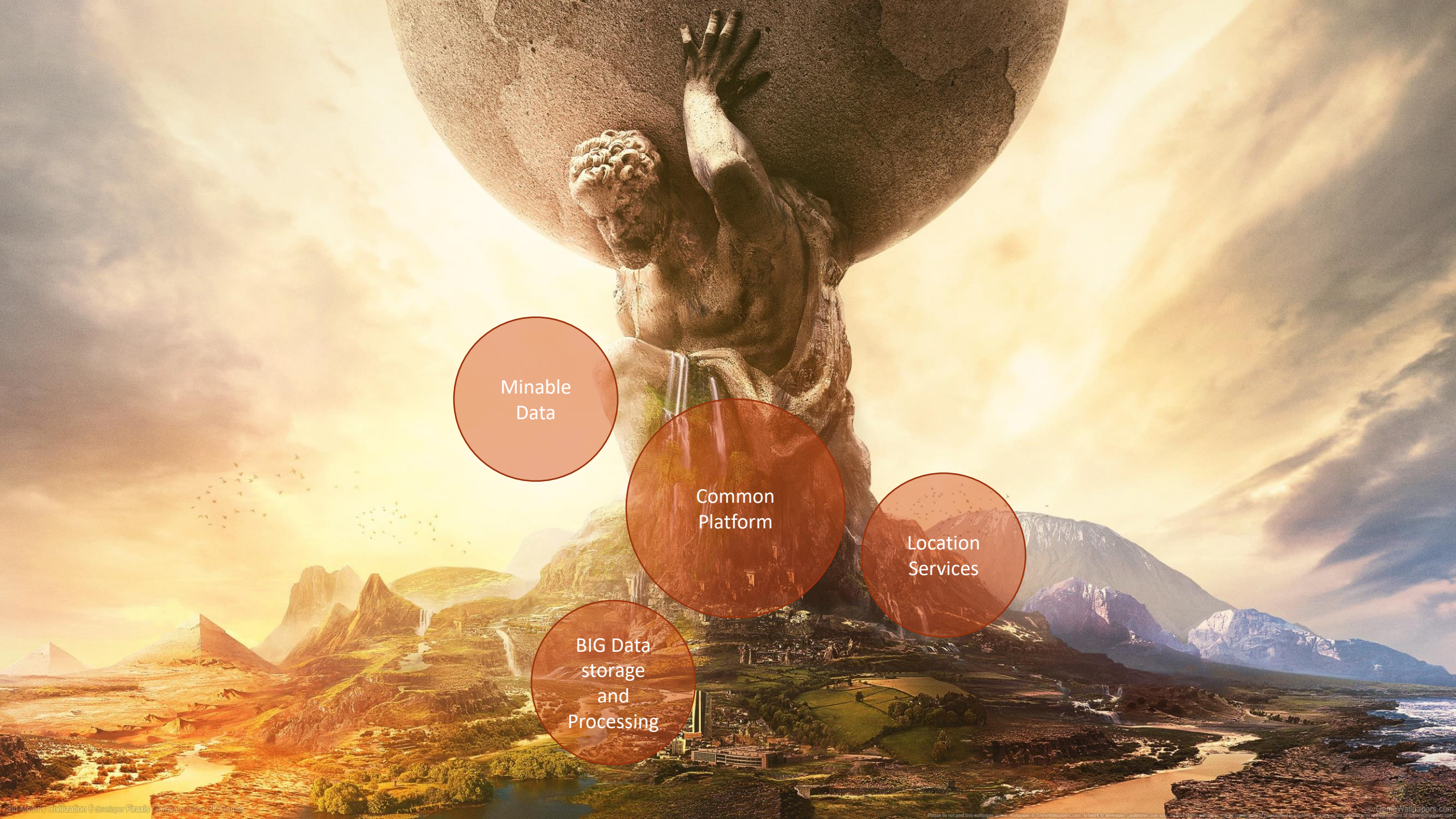
- Consolidated, Centralized and Distributed processing platform to
  - **Store**
    - **Visualize**
    - **Process**
    - **Collect**
  - **Manage**





- Spatial Data is Big
  - Velocity
  - Volume
  - Variety
  - Value etc.
- Spatial Big data Computation Intensive
- Big “Location” Data Inaccuracies





Minable  
Data

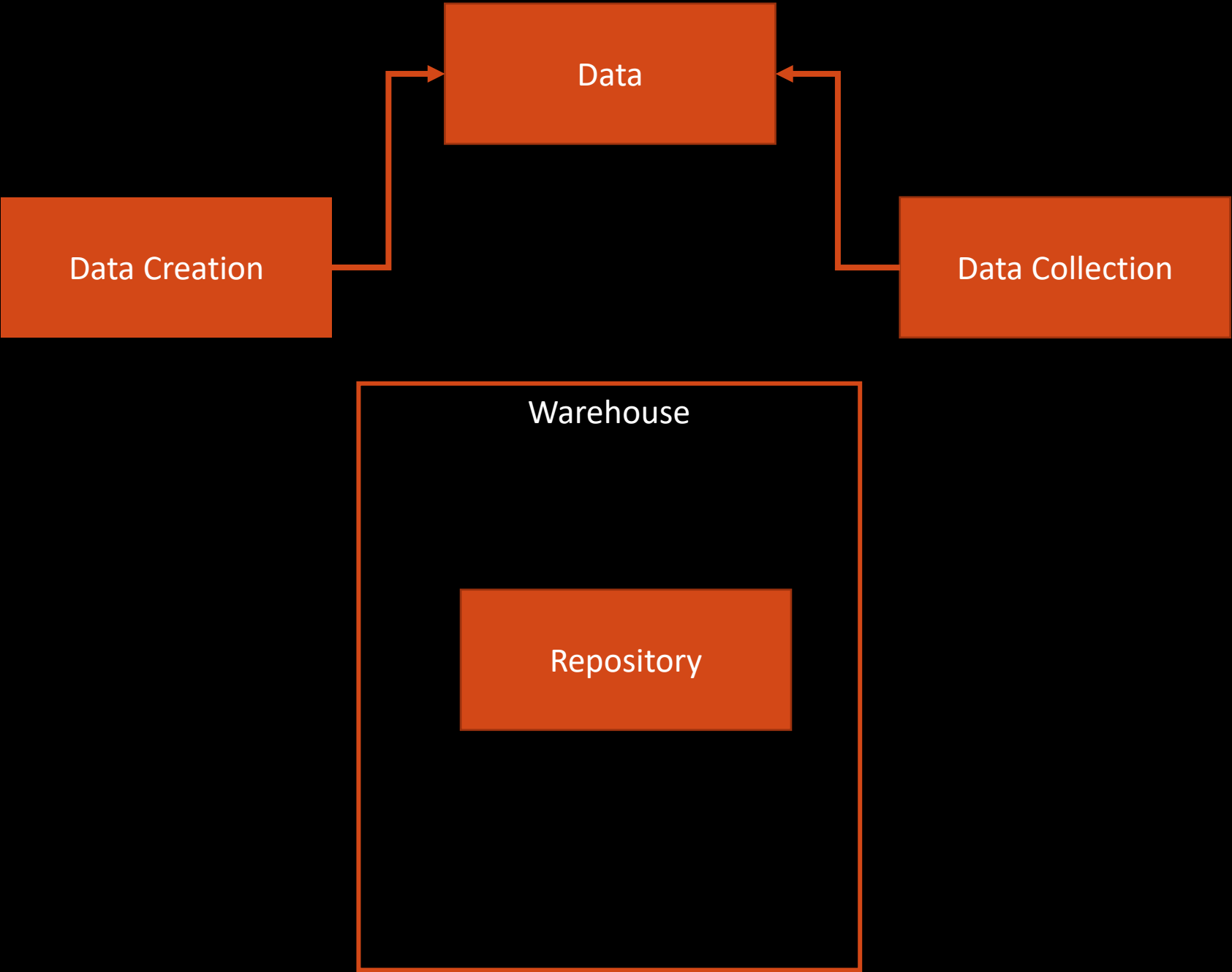
Common  
Platform

Location  
Services

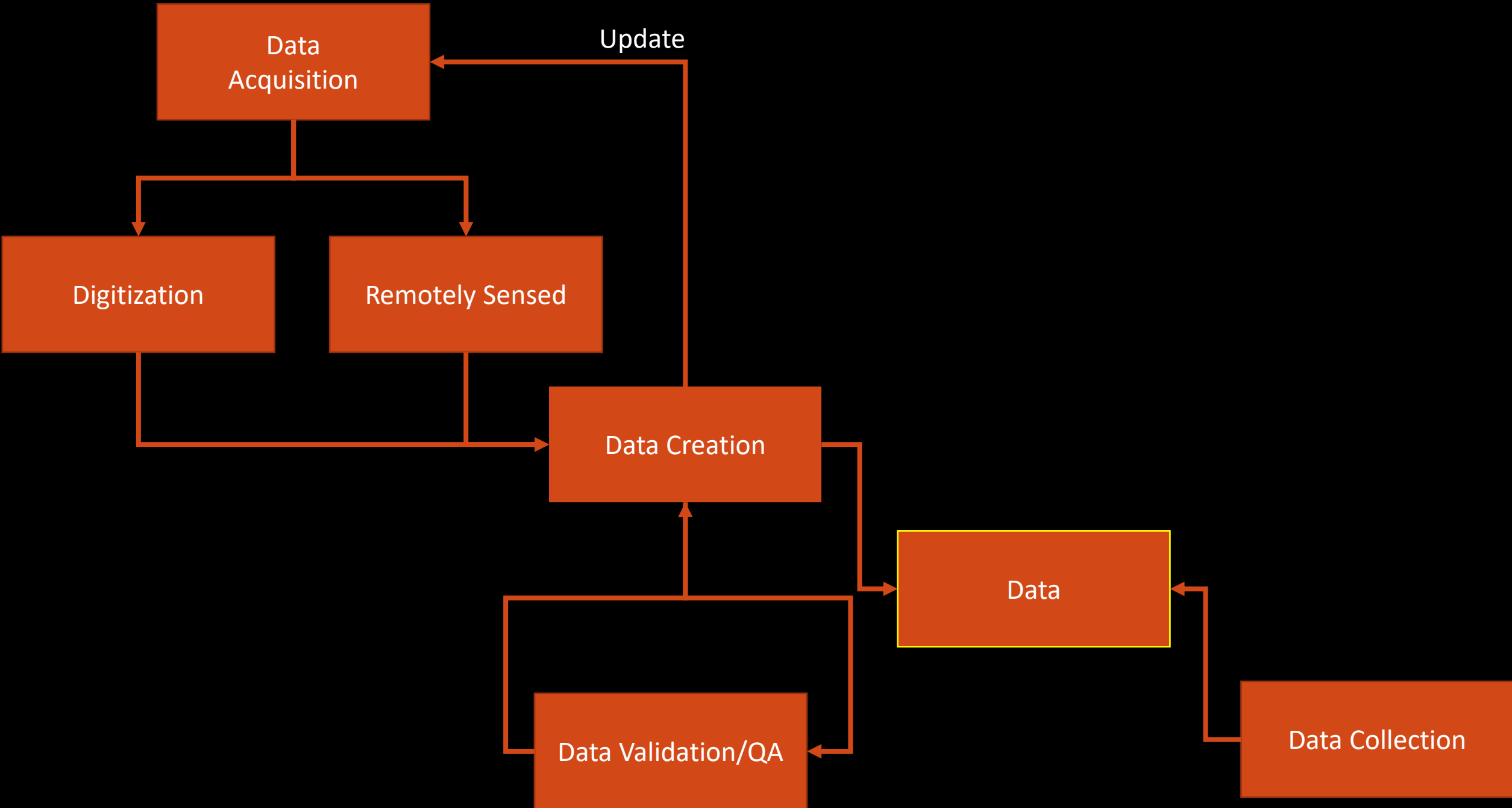
BIG Data  
storage  
and  
Processing



DATA







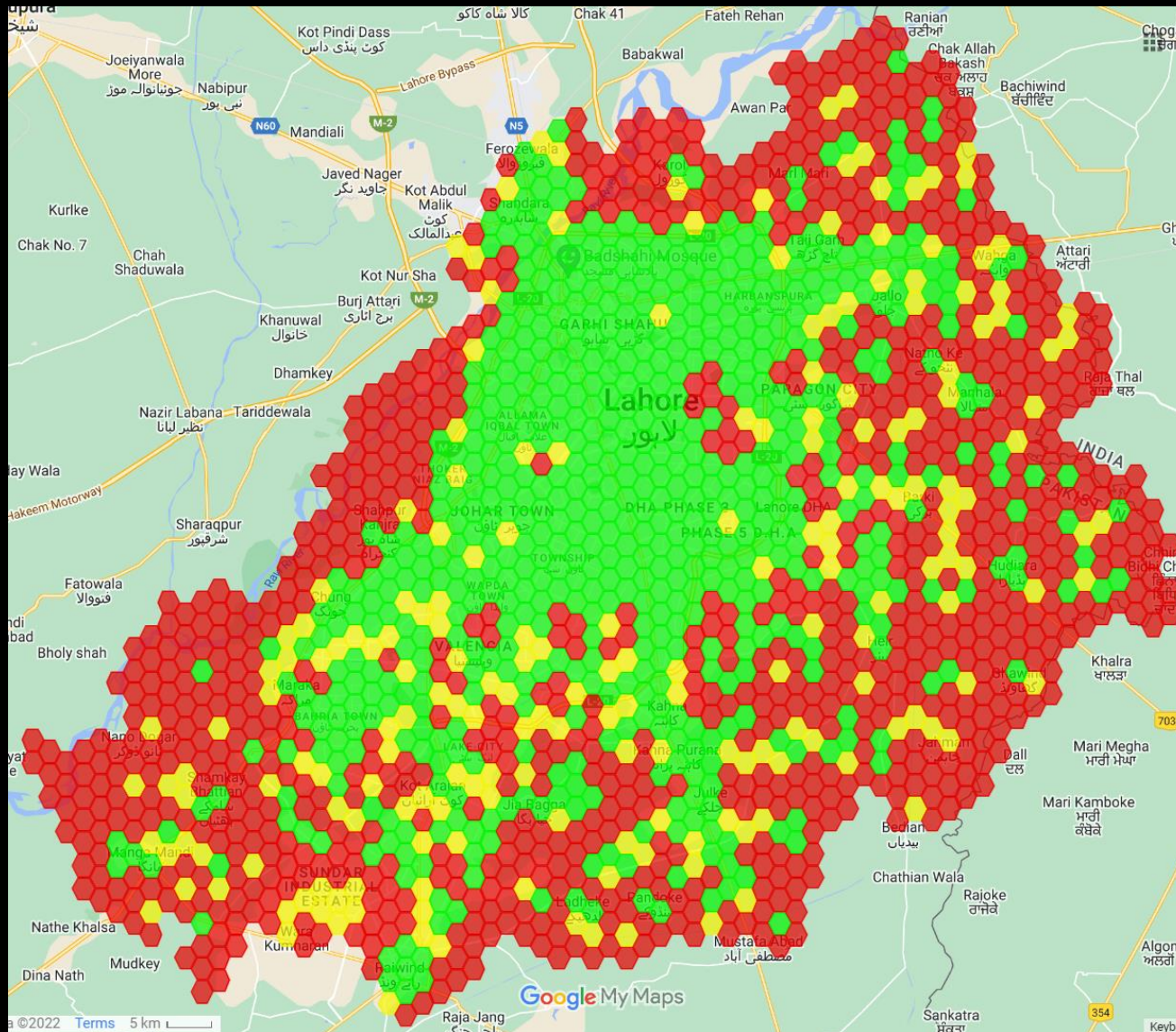


EXAMPLES

# Dengue Activity Analysis Map

Red Activity  
Yellow Insufficient  
Green Sufficient

- Activity of a single day-map of a city.
- Identify the missing areas using location data.
- Computation intensive, processed at the server for day-1.

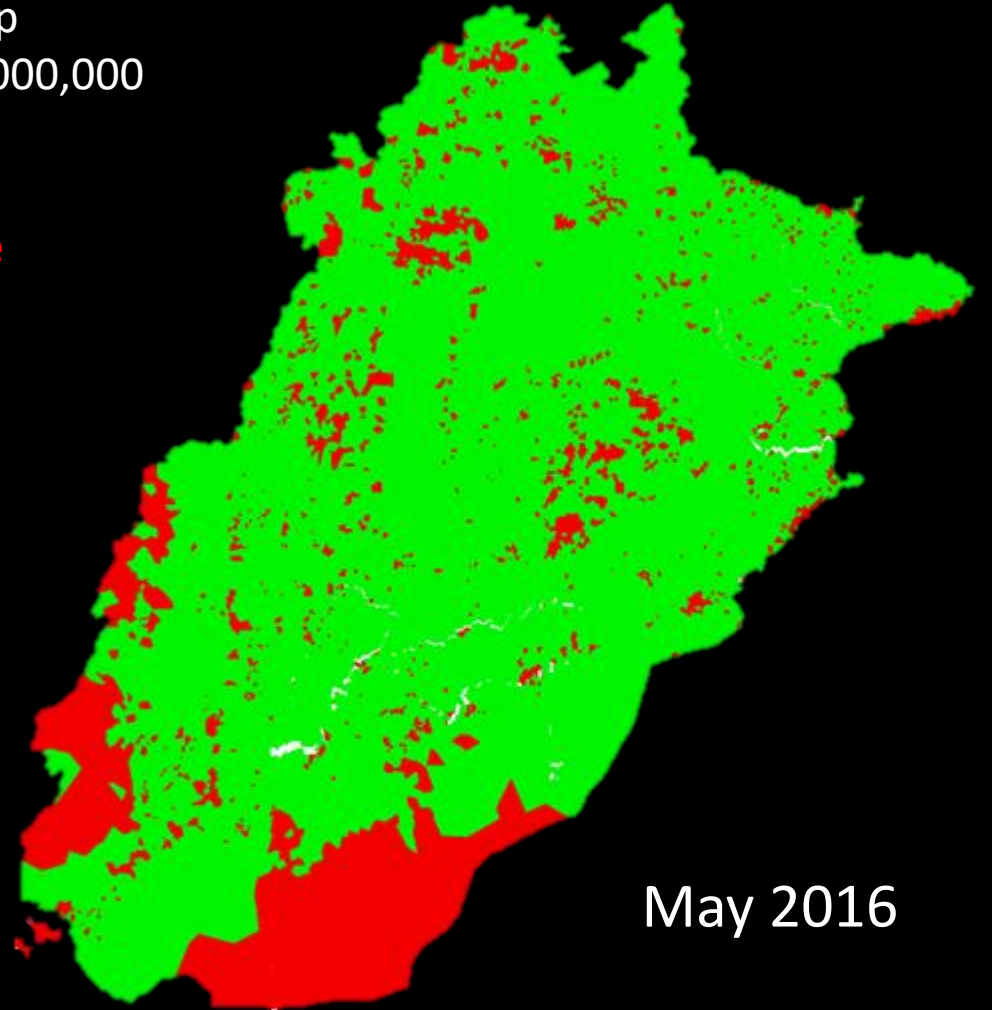
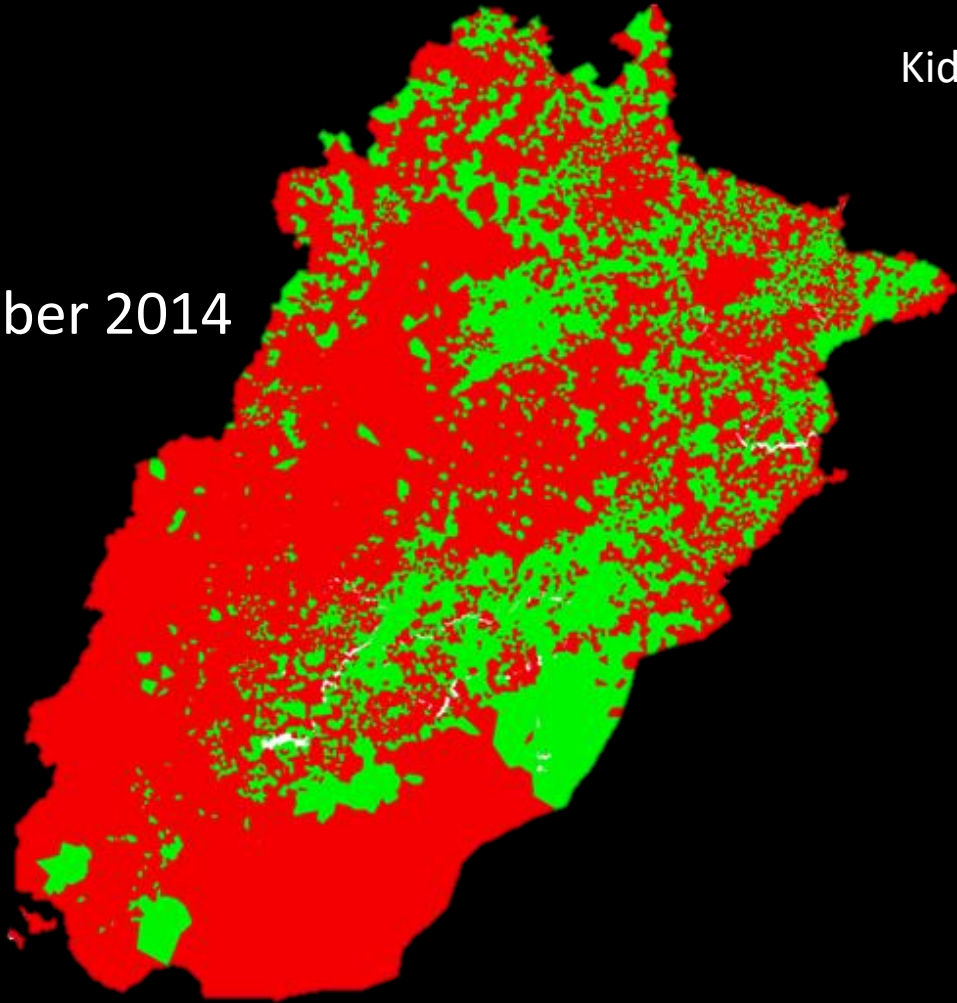


e-Vaccs

Kids Under 5 Years Vaccination  
Coverage Map  
Kids Vaccinated 15,000,000

No Coverage  
Coverage

October 2014



May 2016



COMPONENTS

# Components

- Project – Spatial Atlas Repository
- Spatial Services – Analyzing and Visualizing
- Server - Processing
- Repository - Storing

Projects

# Spatial Services

Server

Warehouse

Projects

### Spatial Services

Data Visualization

Data Processing

Data Science/Mining

Data Management

Data Collection

Server

Map Server

Image Server

Location Server

Feature Server

Tile Server

Data Server

### Warehouse

Repository

Server



Projects

Spatial Services

Data Visualization

Data Processing

Data Science/Mining

Data Management

Data Collection

Server

Server

Map Server

Image Server

Feature Server

Tile Server

Data Server

Warehouse

Repository

DETAILS

Location Server

A solid orange circle is centered on a black background. The text "LOCATION SERVICE" is written across the middle of the circle in white, uppercase letters.

LOCATION SERVICE



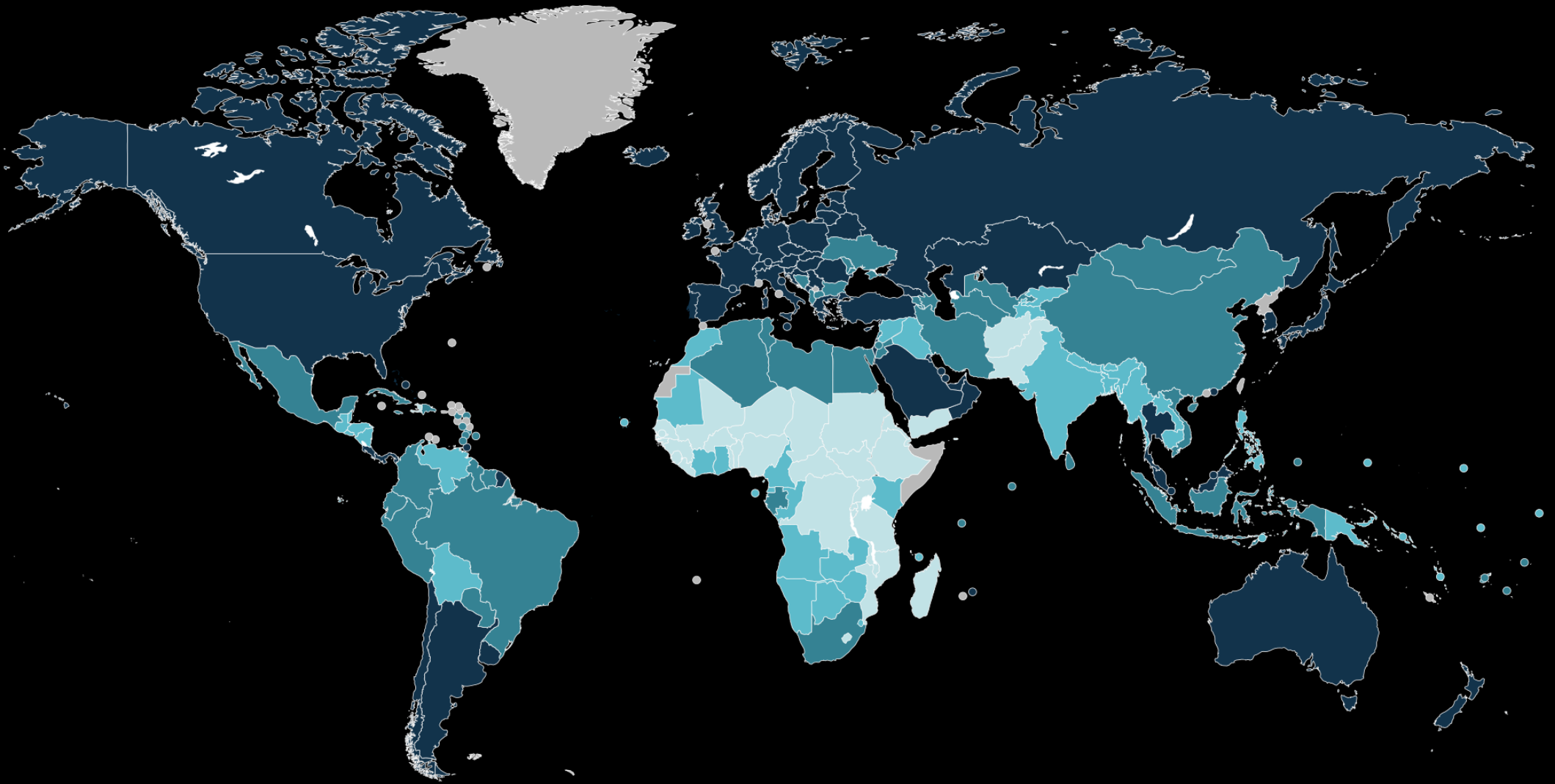
# LOCATION SERVICE

- Low Cost
  - Customizable
  - Integrate-able
  - Handle Big Data - Cloud
- Location Accuracy Improvement
  - Accuracy – Deep Learning
- Developing Countries
  - Local Solutions
  - Replicable

# Low Cost

- Cheap Receiver + Antenna + pi
- Mobiles with Dual Frequency Antenna
- Programming at Receiver level
- Calculations at Mobile Level
- Deep Learning(CNN) on raw location data
- L5 Signal – Beidou and QZSS
- Processing at Server level – Spark Hadoop





- Triangulation
- Correction at receiver end
- Corrections at server end



DETAILS



SERVER



REPOSITORY



DETAILS

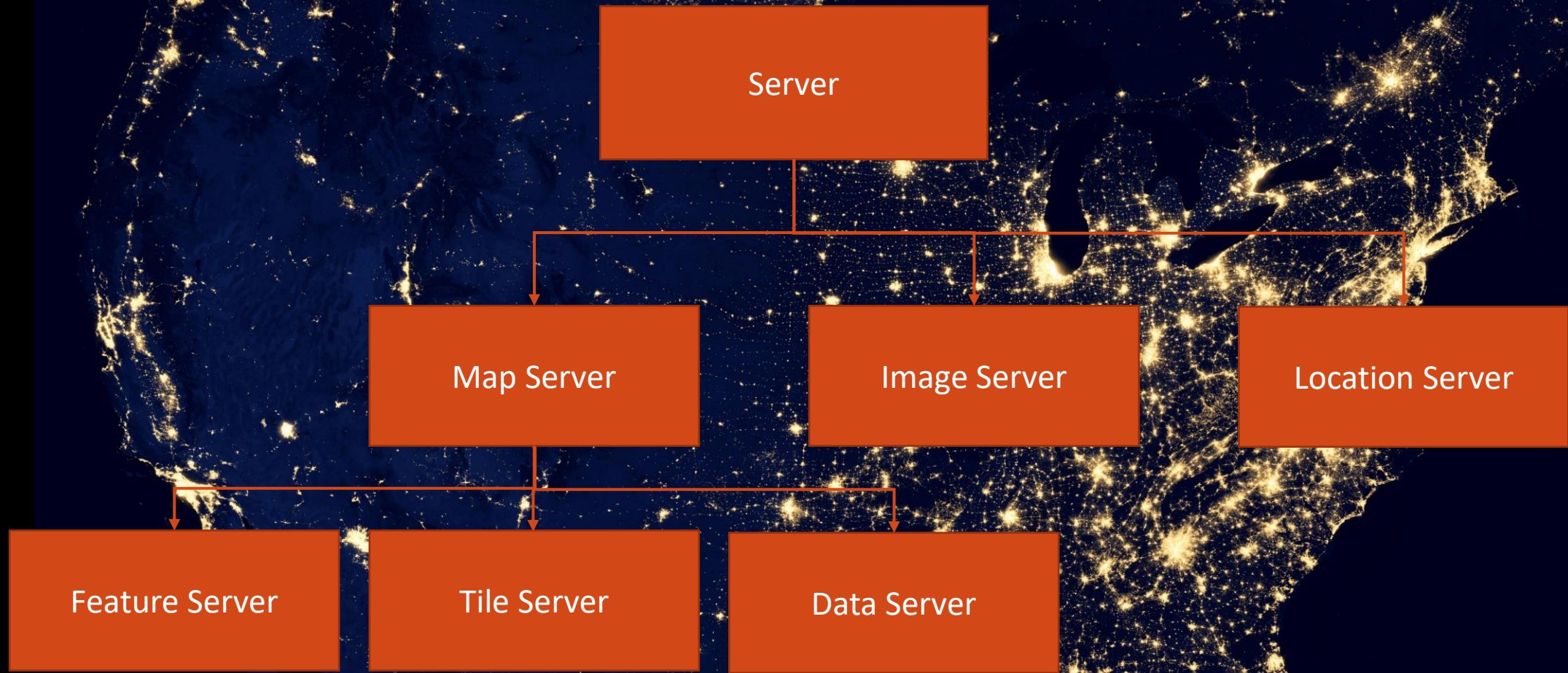


SERVICE



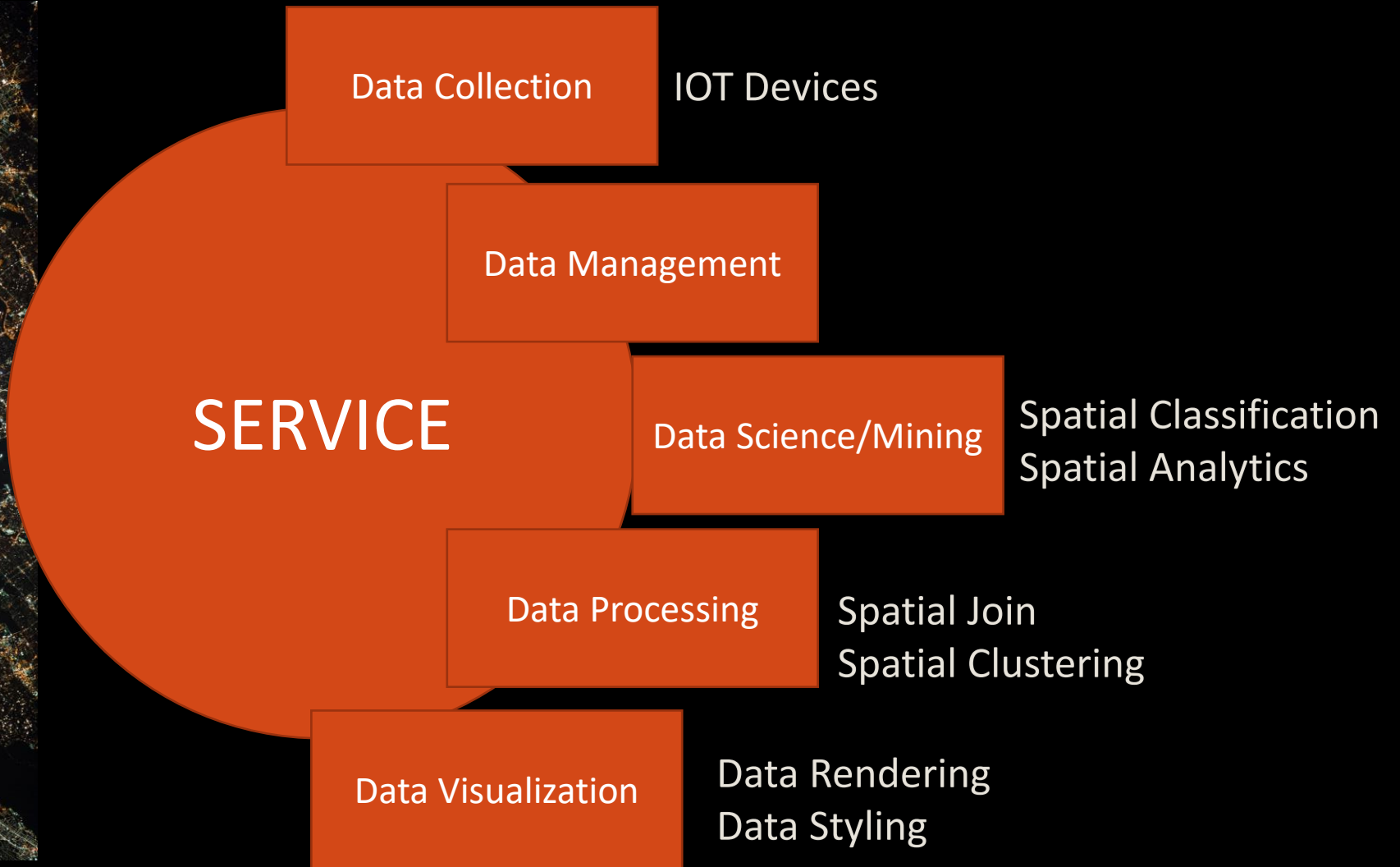
SERVER







SERVICE





REPOSITORY

DATA  
CLASSIFICATION

DATA  
ATTRIBUTES

REPOSITORY

- No SQL Datasets – MongoDB
- SQL Datasets – PostGres(PostGIS)
- SparkGIS – Spatial Query Processing
- MinIO – Storing data on Cloud
- Data Conversion Component



DATA  
CLASSIFICATION

- Institution / Department
  - LESCO, WASA, Irrigation Department, Agriculture, Health, Dengue, Covid, etc.
- Placename
  - Lahore, Peshawar, Kasur, Attock etc.
- Data Type
  - Image, Polygon, Raster, Line, Point, Mixed, Measured Line String, More
- Subject
  - Boundaries, Census, Transportation, imagery, BaseMaps, EarthCover, Oceans, Landuse, boundaries, Cities and towns, Administrative and political divisions, More



- Author(s)
- Description
- Publisher
- Collection
- Place(s)

- ◊ Subject(s)
- ◊ Format(s)
- ◊ Year(s)
- ◊ Held by
- ◊ Preservation record

Data Dictionary