

# DAY 2: Technical Systems & Data Readiness

6 August 2025, 9:00



# RECAP: Recap of Day 1 and Objectives of Day 2

**Mr. Dana Jon Kamason**

Project Manager, Africa-BB-Maps, ITU

**XXX**

Rapporteur NCC



# Opening remarks: Strategic Technical Priorities for Broadband Infrastructure Mapping in Nigeria

**Engr. Abraham Oshadami**

Executive Commissioner  
Technical Services NCC



# SESSION 3: case Studies from ITU: What Lessons Apply ?

**Moderator:** Mr. Elind Sulmina, **Project Officer, Africa-BB-Maps, ITU**



# SESSION 3: Case Studies from ITU: What Lessons Apply ?



**Ms. Agnieszka Gladysz**

ITU Speaker, Poland



**Ms. Joanna Antczak**

ITU Speaker, Poland



**Mr. Vladimir Dukovic**

ITU Speaker, Croatia

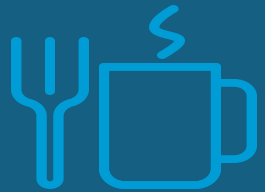
# Q&A and Discussion for Session 3

Estimated end time: 11:15



# Coffee Break

11:15 – 11:30





# SESSION 4: Technical Deep-Dive: Architecture, Standards, Tools & Data Ecosystem

**Moderation:** Mr. Dana Jon Kamason, Project Manager, Africa-BB-Maps, ITU





# SESSION 4: Technical Deep-Dive: Architecture, Standards, Tools & Data Ecosystem



**Engr. Maigana Gidado**

Deputy Director, Technical  
Standards and Network  
Integrity, NCC

**XXX**

Representative, ITU



**Ahmed Nabawy**

Ookla LLC



# Africa-BB-Maps – Geospatial **Software Choices** for Nigeria



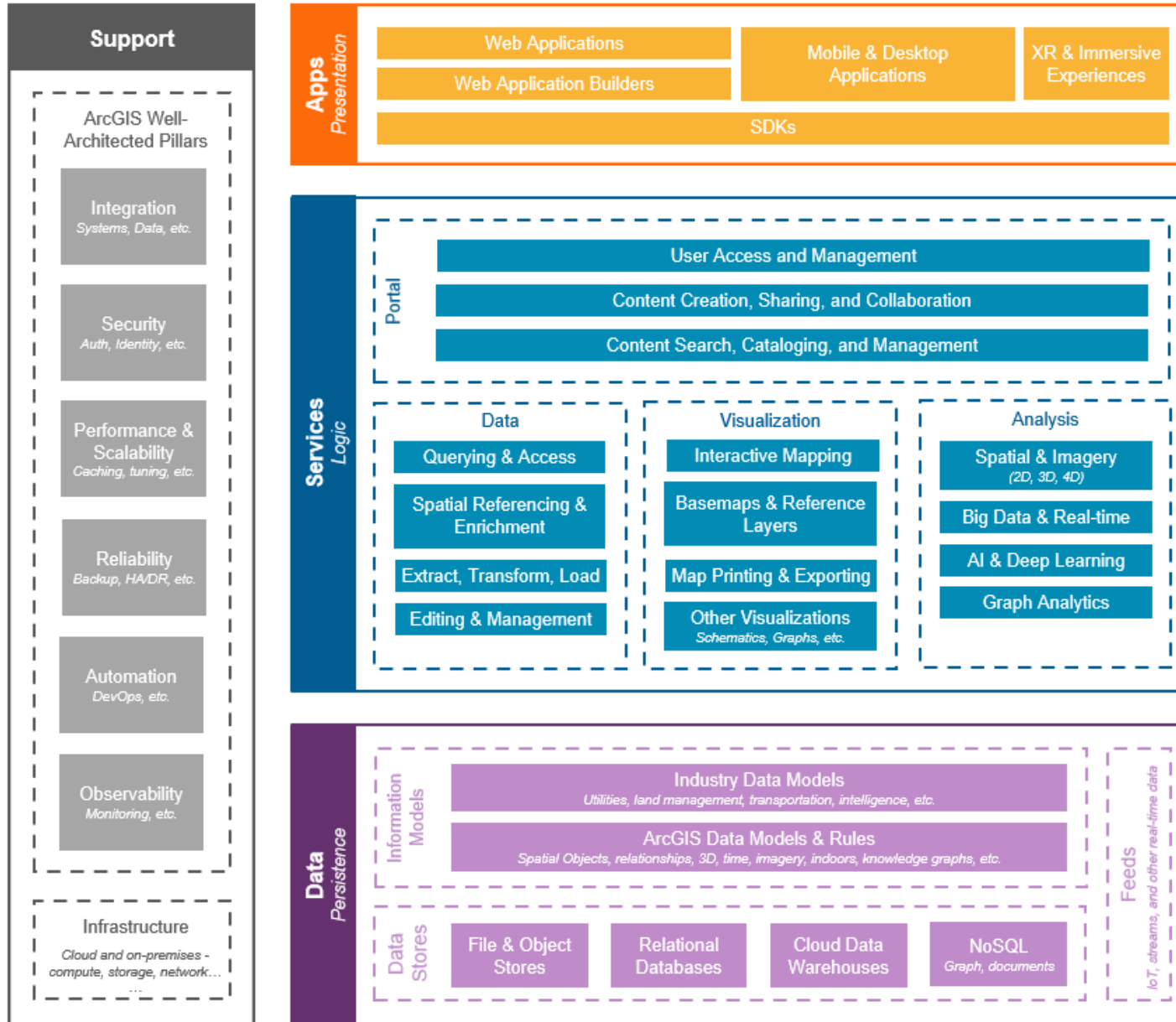
# Africa-BB-Maps – Geospatial **Software Choices** for Nigeria



# ArcGIS



# Africa-BB-Maps – ArcGIS Architecture



# Africa-BB-Maps – ArcGIS Architecture Pillars

## Best Practice and Design Recommendations



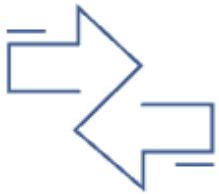
Reliability



Performance & Scalability



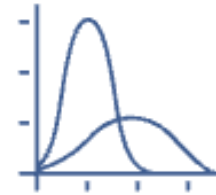
Security



Integration



Automation



Observability

# Africa-BB-Maps – ArcGIS Architecture Systems Patterns

Geospatial in Nature, Supports Multiple Deployment Models



Location Services



Self-service mapping,  
analysis, and sharing



Enterprise application  
hosting and  
management



Data editing and  
management



Imagery data  
management and  
analytics



Mobile operation and  
offline data  
management

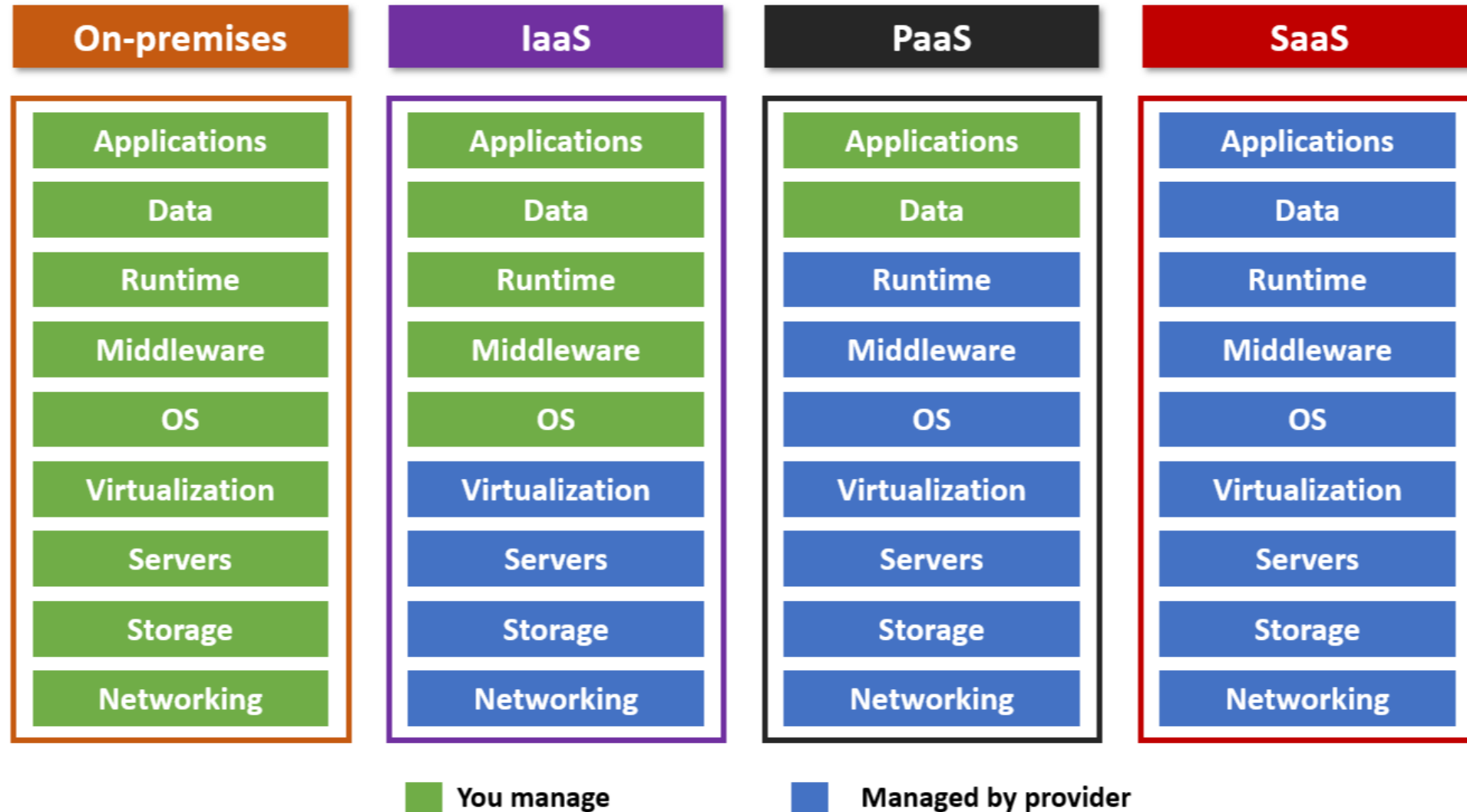


Real-time data  
streaming and  
analytics



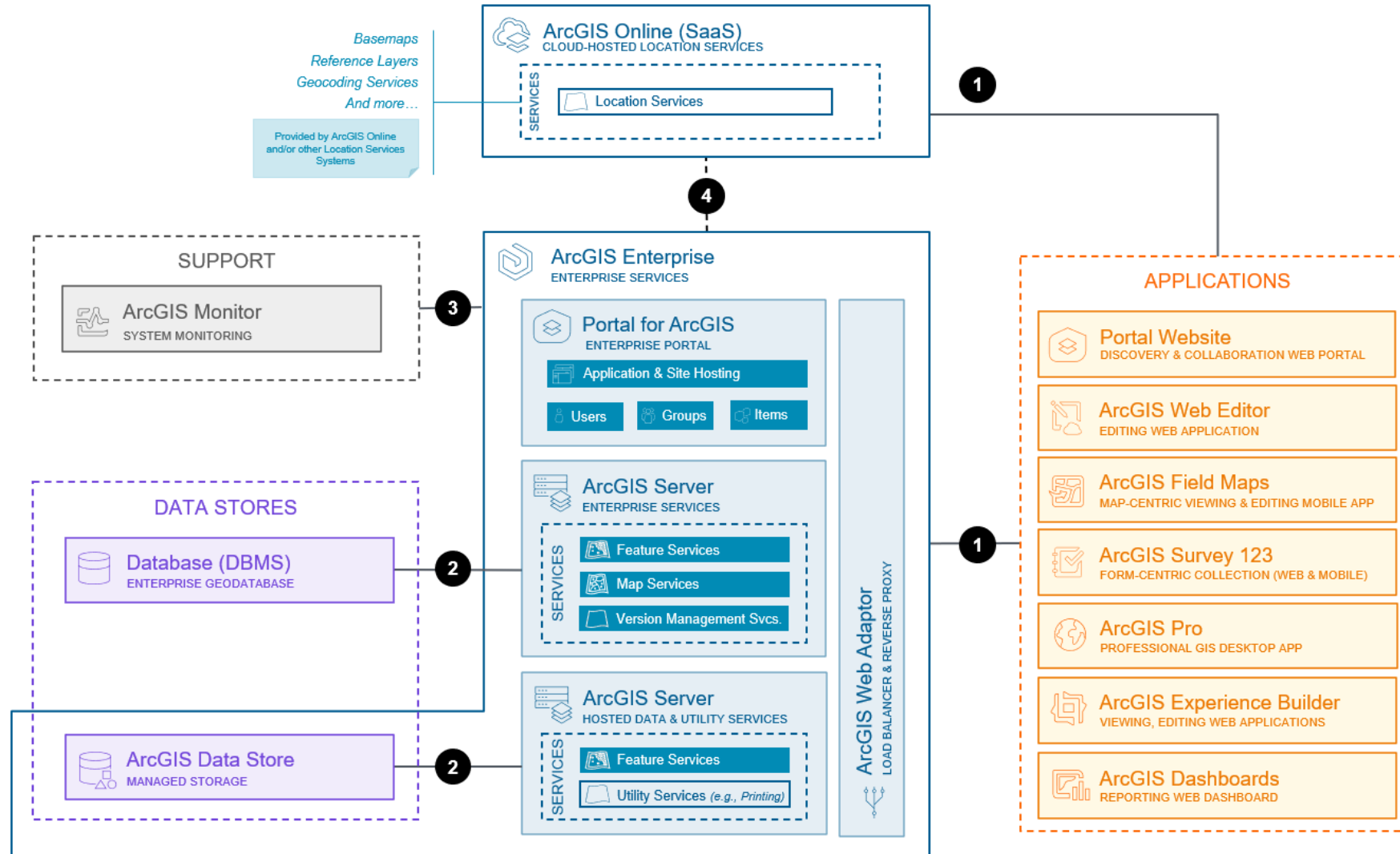
Big data analytics

# Africa-BB-Maps – ArcGIS Architecture Deployment Model

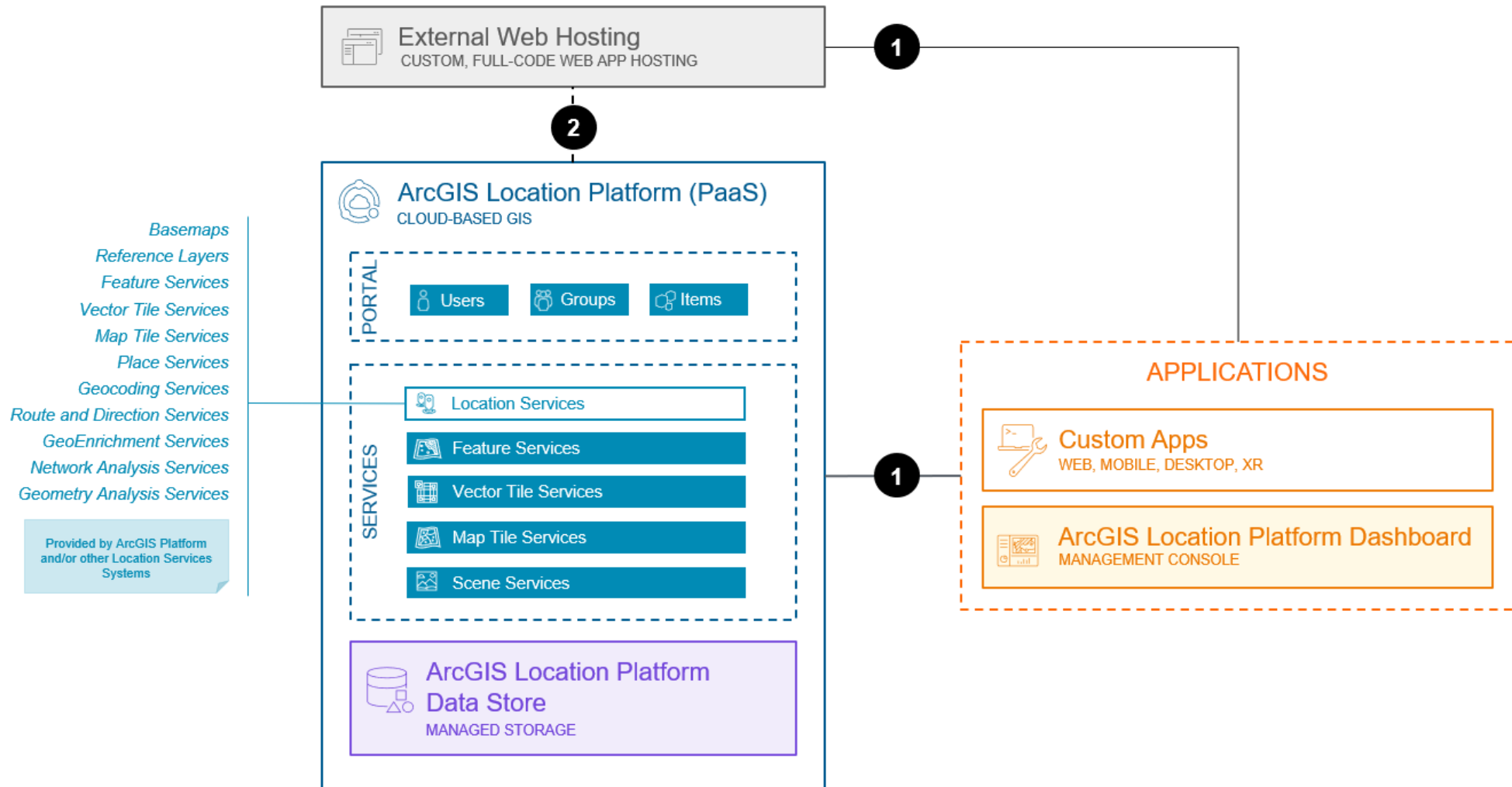




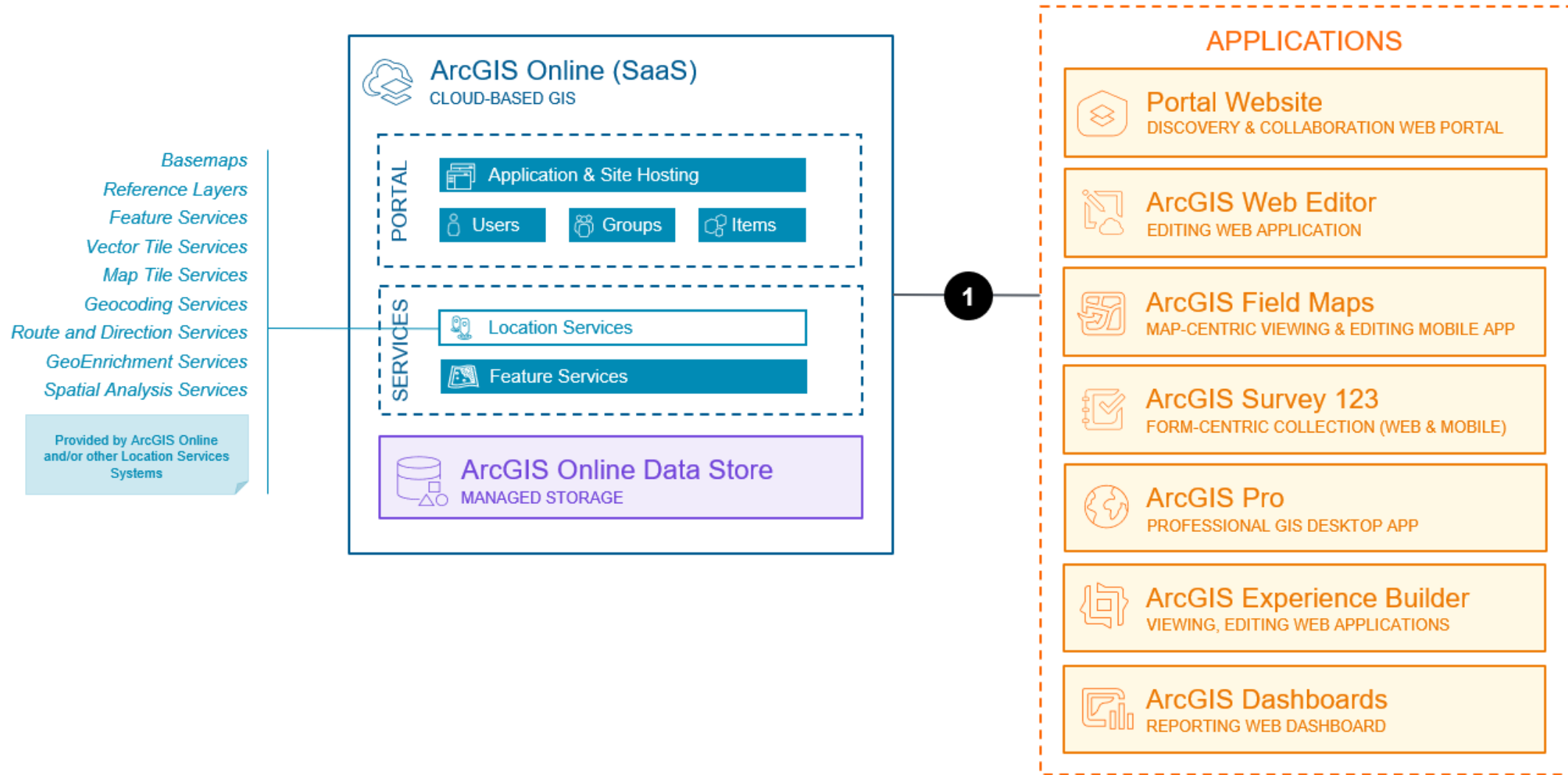
# Africa-BB-Maps – ArcGIS IaaS/On-Premises



# Africa-BB-Maps – ArcGIS PaaS



# Africa-BB-Maps – ArcGIS SaaS



# Geospatial Open-Source & Open Data



# Africa-BB-Maps – Geospatial Open-Source Software



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[Resources](#)

[About OSGeo](#) ▾

[Initiatives](#) ▾

[Community](#) ▾

## The Open Source Geospatial Foundation

[About OSGeo](#)

[Donate](#)

### Open source projects

Open source is so much more than technology. Meet the projects that are here to help you!

[Choose a project](#)

[All Projects](#)

### About open source geo

Powerful, secure and flexible; open source gives you the freedom to "Do Geo" your way

[Open source geo](#)

### Helping you succeed

Support provided by local chapters, service providers and research collaboration.



[Connect with OSGeo](#)

[Science and Education](#)







# Africa-BB-Maps – Geospatial Open-Source Projects



## deegree

deegree is open source software for spatial data infrastructures and the geospat...



[Website](#) [Source](#) [Documentation](#)



## GDAL/OGR

GDAL is a C++ translator library for more than 200 raster and vector geospatial ...

[Website](#) [Source](#) [Documentation](#)



## GeoMoose

GeoMoose is a Web Client JavaScript Framework for displaying distributed cartogr...

[Website](#) [Source](#) [Documentation](#)



## gvSIG Desktop

gvSIG is a powerful, user-friendly, interoperable GIS used by thousands o...



[Website](#) [Source](#) [Documentation](#)



## Mapbender

Mapbender is a web based geoportal framework to publish, register, view, navigat...



[Website](#) [Source](#) [Documentation](#)



## MapServer

Known as one of the fastest mapping engines in the world, MapServer is an Open S...



[Website](#) [Source](#) [Documentation](#)



## GeoNetwork

A catalog to manage spatially referenced resources. It provides powerful metadat...

[Website](#) [Source](#) [Documentation](#)



## GeoNode

GeoNode is a web-based application and platform for developing geospatial inform...

[Website](#) [Source](#) [Documentation](#)



## GEOS

GEOS (Geometry Engine - Open Source) is a C++ port of the Java Topology Su...

[Website](#) [Source](#) [Documentation](#)



## Marble

Versatile, yet easy to use. Use Marble similar to a desktop globe; pan around an...



[Website](#) [Source](#)



## OpenLayers

OpenLayers makes it easy to put a dynamic map in any web page. It can display ma...



[Website](#) [Source](#) [Documentation](#)



## Orfeo ToolBox

Orfeo ToolBox is an open-source project for state-of-the-art remote sensing, inc...



[Website](#) [Source](#) [Documentation](#)



## GeoServer

Designed for interoperability, GeoServer publishes data from any major spatial d...



[Website](#) [Source](#) [Documentation](#)



## GeoTools

An open source Java library providing a standards compliant approach for visuali...


[Website](#) [Source](#) [Documentation](#)



## GRASS

GRASS is a powerful computational engine for raster, vector, and geospatial proc...

[Website](#) [Source](#) [Documentation](#)



## OSGeoLive

OSGeoLive is a self-contained bootable DVD, USB thumb drive or Virtual Machine b...

[Website](#) [Source](#) [Documentation](#)



## pgRouting

pgRouting extends the PostGIS / PostgreSQL geospatial database providing routing...

[Website](#) [Source](#) [Documentation](#)




## PostGIS

PostGIS adds GIS spatial types and support to PostgreSQL. It is used by Database...

[Website](#) [Source](#) [Documentation](#)

# Africa-BB-Maps – Geospatial Open-Source Projects



**PROJ**

PROJ is a generic coordinate transformation software that transforms geospatial ...

[Website](#) [Source](#) [Documentation](#)



**pycsw**

pycsw is an OGC CSW server implementation written in Python. Started in 2010 (mo...

[Website](#) [Source](#) [Documentation](#)



**pygeoapi**

pygeoapi is an OGC API to geospatial data

[Website](#) [Source](#) [Documentation](#)



**Feature Data Objects**

**FDO**

FDO Data Access Technology is an API for manipulating, defining and analyzing ge...

[Website](#) [Documentation](#)



**GC2 VIDI**

**GC2/Vidi**

A platform for building spatial data infrastructure and deploying browser based ...


[Website](#) [Source](#) [Documentation](#)



**GeoExt**

A JavaScript Toolkit for Rich Web Mapping Applications


[Website](#) [Source](#) [Documentation](#)



**PyWPS**

PyWPS is an implementation of the Web Processing Service standard from the Open ...


[Website](#) [Source](#) [Documentation](#)



**QGIS Desktop**

QGIS is the leading Free and Open Source Desktop GIS. It allows you to create, e...

[Website](#) [Source](#) [Documentation](#)



**ZOO-Project**

ZOO-Project is a C-based WPS (Web Processing Service) implementation. It is an o...

[Website](#) [Source](#) [Documentation](#)



**GeoHealthCheck**

GeoHealthCheck is a Python application to support monitoring OGC Web Services up...

[Website](#) [Source](#) [Documentation](#)



**GeoServer Client PHP**

GeoServer Client PHP is library for interacting with the GeoServer API.


[Website](#) [Source](#) [Documentation](#)



**GeoStyler**

generic styler for geodata

[Website](#) [Source](#) [Documentation](#)



**actinia**

Actinia is an open source REST API for scalable, distributed, high performance p...


[Website](#) [Source](#) [Documentation](#)



**EOEPCA+**

EOEPCA+'s vision is to streamline the access to and processing of earth observat...

[Website](#) [Documentation](#)



**ETF**

ETF is a testing framework for validating data and APIs in Spatial Data Infrastr...


[Website](#) [Source](#) [Documentation](#)



**GeoWebCache**

GWC is a tile server and caching proxy written in Java.

[Website](#) [Source](#) [Documentation](#)



**Giswater**

An intelligent technology, free and open source for the integral water cycle man...

[Website](#) [Source](#) [Documentation](#)







































**istSOS**

IstSOS is an OGC Sensor Observation Service server implementation written in Pyt...

[Website](#) [Source](#) [Documentation](#)



# Africa-BB-Maps – Geospatial Open-Source Projects

  <b>Loader</b> A loader for geographic data in GML and KML (that needs some preparation before ...) <a href="#">Website</a> <a href="#">Source</a> <a href="#">Documentation</a>	  <b>mapfish</b> Create reports that contain maps! <a href="#">Website</a> <a href="#">Source</a> <a href="#">Documentation</a>	  <b>MapGuide Open Source</b> MapGuide Open Source is a web-based platform that enables users to develop and d... <a href="#">Website</a> <a href="#">Source</a> <a href="#">Documentation</a>	  <b>OSSIM</b> OSSIM is an open source, C++ (mostly), geospatial image processing library used ... <a href="#">Source</a>	  <b>OWSLib</b> OWSLib is a Python package for client programming with Open Geospatial Consortiu... <a href="#">Website</a> <a href="#">Source</a> <a href="#">Documentation</a>	  <b>Portable GIS</b> GIS on a USB stick, for windows <a href="#">Website</a> <a href="#">Source</a> <a href="#">Documentation</a>
  <b>mappyfile</b> A Python library to create, parse, modify, and format MapServer Mapfiles.... <a href="#">Website</a> <a href="#">Source</a> <a href="#">Documentation</a>	  <b>Mesh Data Abstraction Library (MDAL)</b> Mesh Data Abstraction Library (MDAL) is a translator library for more than 15 un... <a href="#">Website</a> <a href="#">Source</a> <a href="#">Documentation</a>	  <b>MobilityDB</b> An open source geospatial trajectory data management & analysis platform... <a href="#">Website</a> <a href="#">Source</a> <a href="#">Documentation</a>	  <b>PROJ-JNI</b> PROJ-JNI provides a Java Native Interface for PROJ C/C++ library.... <a href="#">Website</a> <a href="#">Source</a> <a href="#">Documentation</a>	  <b>Pronto Raster</b> Pronto Raster is a C++ library for calculations with raster data. The library is... <a href="#">Website</a> <a href="#">Source</a> <a href="#">Documentation</a>	  <b>rasdaman</b> Scalable datacube analytics <a href="#">Website</a> <a href="#">Source</a> <a href="#">Documentation</a>
  <b>Open Data Cube</b> The Open Data Cube is a Python library and suite of supporting applications that... <a href="#">Website</a> <a href="#">Source</a> <a href="#">Documentation</a>	  <b>Opticks</b> Opticks is an expandable remote sensing and imagery analysis software platform t... <a href="#">Website</a> <a href="#">Source</a>	  <b>OSGeo4W</b> OSGeo4W is a binary distribution of a broad set of open source geospatial softwa... <a href="#">Website</a> <a href="#">Source</a> <a href="#">Documentation</a>	  <b>TEAM Engine</b> The Test, Evaluation, And Measurement (TEAM) Engine is a testing facility that e... <a href="#">Website</a> <a href="#">Source</a> <a href="#">Documentation</a>	  <b>TorchGeo</b> TorchGeo: datasets, samplers, transforms, and pre-trained models for geospatial ... <a href="#">Website</a> <a href="#">Source</a> <a href="#">Documentation</a>	  <b>XYZ / MAPP</b> Open source presentation, controller, domain, and service layers for cloud nativ... <a href="#">Website</a> <a href="#">Source</a> <a href="#">Documentation</a>

# Africa-BB-Maps – Geospatial Open-Source Projects



## Bezitopo

A land surveying CAD package under development

[Website](#) [Source](#)



Coastal Modelling Environment

## CoastalME

CoastalME (Coastal Modelling Environment) is a Free Open Source and Software for...

[Website](#) [Source](#) [Documentation](#)



## DigiAgriApp

DigiAgriApp is a software solution aimed at anyone with cultivated land....

[Website](#) [Source](#) [Documentation](#)



## GeoMesa

GeoMesa is an open-source, distributed, spatio-temporal database built on a numb...

[Website](#) [Source](#) [Documentation](#)



## Geopaparazzi

Geopaparazzi is a tool developed to do very fast qualitative engineering/geologi...

[Website](#) [Source](#) [Documentation](#)



## geOrchestra

geOrchestra is the free, modular, interoperable & secure Spatial Data Infras...

[Website](#) [Source](#) [Documentation](#)



## eodash

Publish and integrate Earth Observation data in a dashboard application through ...

[Website](#) [Source](#) [Documentation](#)



## EOxServer

EOxServer is a Python application and framework for presenting Earth Observation...

[Website](#) [Source](#) [Documentation](#)



## ESA-NASA WorldWind

WorldWind is a free, open source API for a virtual globe. WorldWind allows devel...

[Website](#) [Source](#)



## GeoTrellis

GeoTrellis is a geographic data processing library designed to work with large g...

[Website](#) [Source](#) [Documentation](#)



## GeoWave

GeoWave is a software library that connects the scalability of distributed compu...

[Website](#) [Source](#) [Documentation](#)



## GET-IT - Geoinformation Enabling ToolKIT starterkit®

The Geoinformation Enabling ToolKIT starterkit® (GET-IT) is the software suite f...

[Website](#) [Source](#) [Documentation](#)



## First Draft GIS

First Draft GIS is an Artificial Intelligence that makes the first draft of a ma...

[Website](#) [Source](#) [Documentation](#)



## Flexurba

Flexurba is an open-source R package to flexibly reconstruct the Degree of Urban...

[Website](#) [Source](#) [Documentation](#)



## Geomajas - OSGeo Heritage Project

Note: This project is an OSGeo Heritage Project – it is no longer maintain...

[Source](#)



## GIFramework Maps

GIFramework Maps is a .NET based web mapping application designed and developed ...

[Website](#) [Source](#) [Documentation](#)



## Giro3D

Giro3D is an open-source JavaScript framework for visualizing and interacting wi...

[Website](#) [Source](#) [Documentation](#)



## Gisquick

Let's share GIS much quicker!

[Website](#) [Source](#) [Documentation](#)

# Africa-BB-Maps – Geospatial Open-Source Projects



## HOT Tasking Manager

The purpose of the Tasking Manager is to divide a large mapping project into sma...

[Website](#) [Source](#) [Documentation](#)



## JTS Topology Suite

JTS is an open source spatial library defining geometry, spatial relationships, ...

[Website](#) [Source](#) [Documentation](#)



## Kaoto

Kaoto is an integration editor to create and deploy workflows in a visual, low-c...

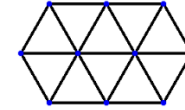
[Website](#) [Source](#) [Documentation](#)



## pdal

The Point Data Abstraction Library (PDAL) provides command line tools and a libr...

[Website](#) [Source](#) [Documentation](#)



## PerfectTIN

Converts point clouds to TINs

[Source](#)



## py3dtiles

Python library and command-line for 3dtiles

[Website](#) [Source](#) [Documentation](#)



## Koop

An Open Geospatial ETL Engine so you can leave geospatial data where it lives an...

[Website](#) [Source](#) [Documentation](#)



## Leaflet

Open-source JavaScript library for mobile-friendly interactive maps

[Website](#) [Source](#) [Documentation](#)



## LERC Limited Error Raster Compression

LERC is an open-source image or raster format which supports rapid encoding and ...

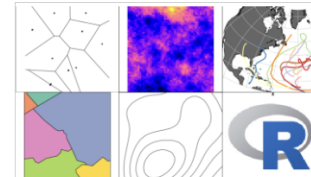
[Website](#) [Source](#) [Documentation](#)



## QField

Get your QGIS fieldwork done efficiently and comfortably.

[Website](#) [Source](#) [Documentation](#)



## R-Spatial

A set of R packages for handling and analysing spatial data, built upon OSGeo co...

[Website](#) [Source](#) [Documentation](#)



## RasterFrames

RasterFrames® enables analysts, data scientists and EO specialists to easily...

[Website](#) [Source](#) [Documentation](#)



## Masterportal

Masterportal is an open source geoviewer (WebGIS) compliant to OGC standards. It...

[Website](#) [Source](#) [Documentation](#)



## MOSS

Map Overlay and Statistical System (MOSS) The Map Overlay and Statistical System...

[Website](#) [Source](#) [Documentation](#)



## MovingPandas

Python library for movement trajectory data exploration and analysis.

[Website](#) [Source](#) [Documentation](#)



## SFCGAL

SFCGAL is a C++ wrapper library around CGAL (Computational Geometry Algorithms L...

[Website](#) [Source](#) [Documentation](#)



## Tegola

Tegola is a high performance Mapbox Vector Tile server written in Go. In a nutsh...

[Website](#) [Source](#)



## Terra Draw

Terra Draw is an open source JavaScript library for drawing and editing geometri...

[Website](#) [Source](#) [Documentation](#)

# Africa-BB-Maps – Geospatial Open Data

“Open Data applies the principles of *free and open* to geospatial data”

# Africa-BB-Maps – Global Geospatial **Open Data**



# Africa-BB-Maps – Global Geospatial **Open Data**



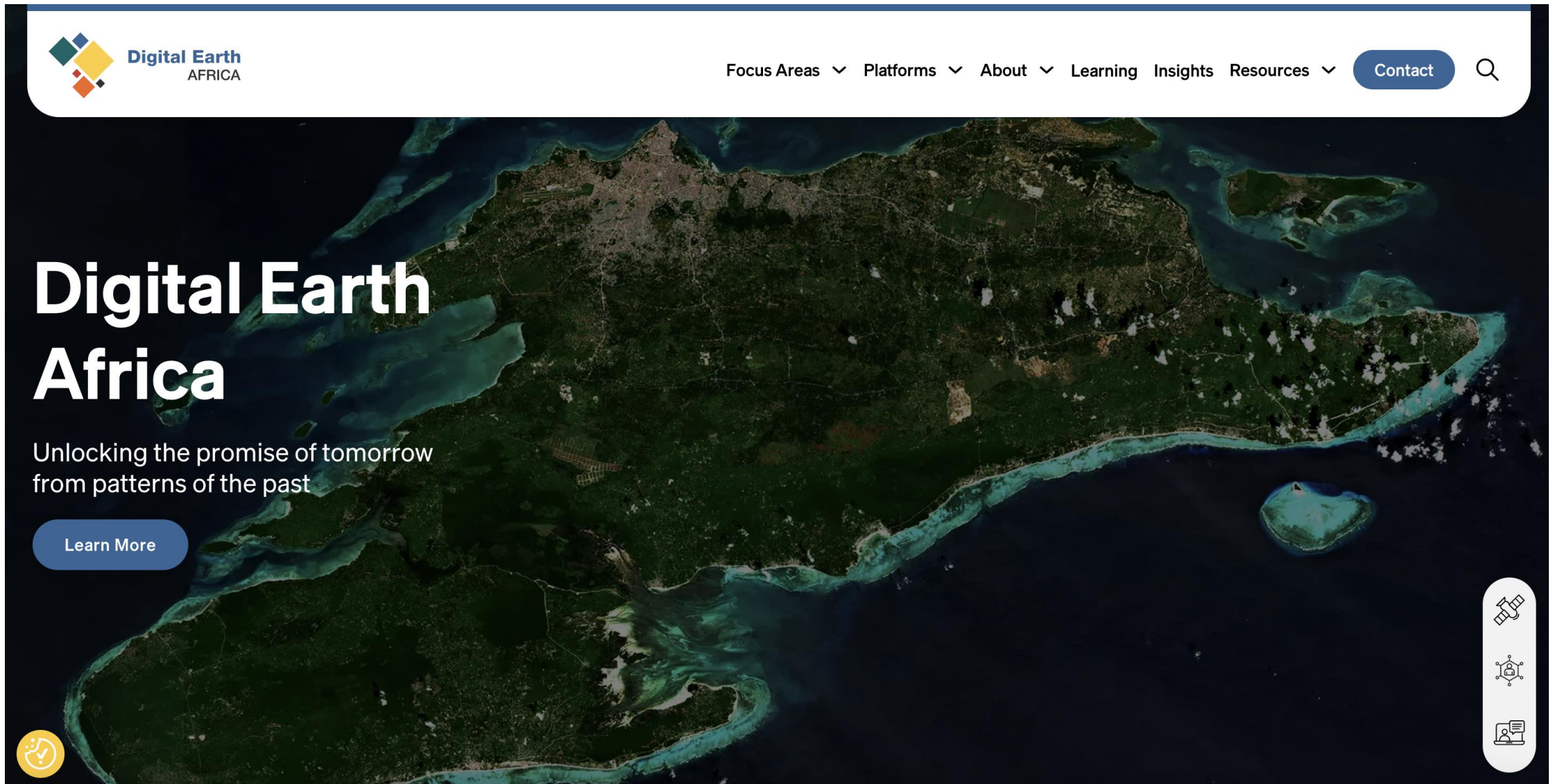


# Africa-BB-Maps – Global Geospatial Open Data





# Africa-BB-Maps – Africa Geospatial Open Data



[https://digitalearthafrika.org/en\\_za/](https://digitalearthafrika.org/en_za/)



# Africa-BB-Maps – Africa Geospatial Open Data

[Data Library](#)[Learning Center](#)[Geospatial Tools](#)[Community ▼](#)

## The Africa GeoPortal

Inspiring communities through geography



Location intelligence is the ability to analyze and find spatial patterns in data, to provide powerful insights into understanding our world and communicating our needs. This is made possible through a combination of local data and advanced geospatial tools, along with training that's included for anyone working on geographic challenges across the continent.

[GET STARTED](#)

<https://www.africageoportal.com/>



## The **Nigeria** GeoPortal

Inspiring communities through location intelligence

### What is location intelligence?

Location intelligence is the ability to analyze and find spatial patterns in data, to provide powerful insights into understanding our world and communicating our needs. This is possible through a combination of local data and advanced geospatial tools, with training that's

## PPT 4 SESSION 4

Setting the stage & Moderation:

Mr. Dana Jon Kamason, Project Manager, Africa-  
BB-Maps, ITU

(Systems architecture & Data Standards)

# LEO on open source

Present what software EU NRAs use.

Talk about hybrid usage and distinguish backend apps from frontend open source solutions.

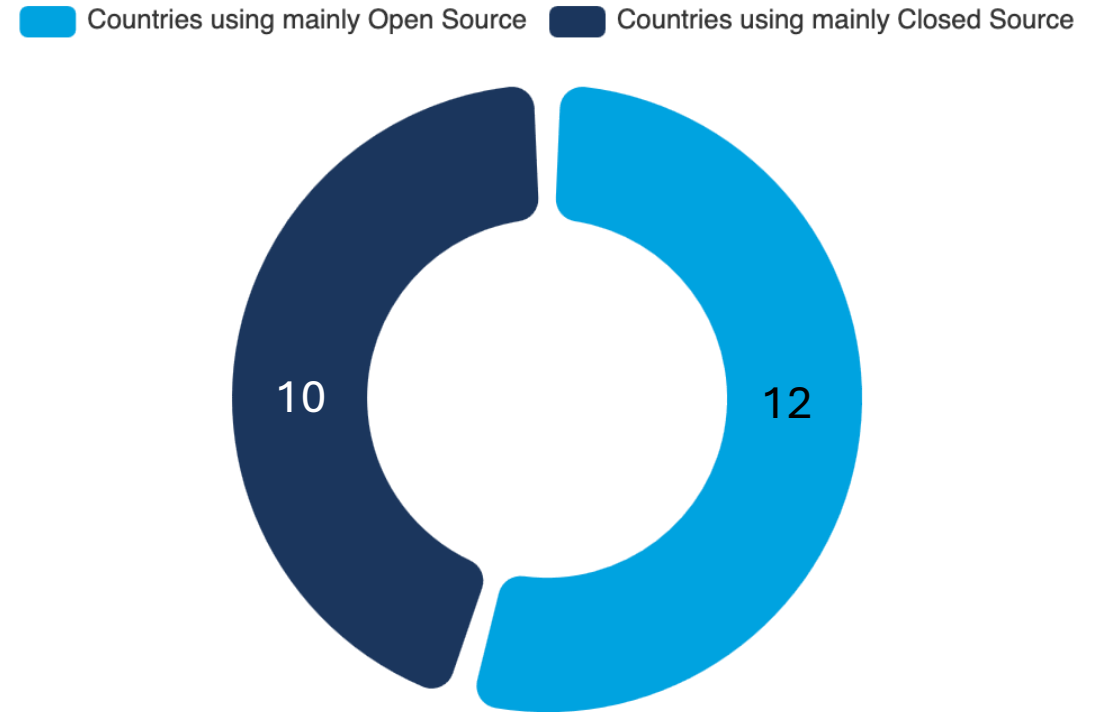
# Open Source: Definition

- INSERT DEF
- EXAMPLES OF SOFTWARE
- GRAPH ON THE RIGHT ?



# Open Source in GIS: Statistics

- European NRAs use different technologies to implement broadband mapping.
- The software used can either be Open-source (made available for free under a permissive license), or Proprietary (owned by a private company that monetizes its services).
- Most countries use a mix of proprietary and open-source software.



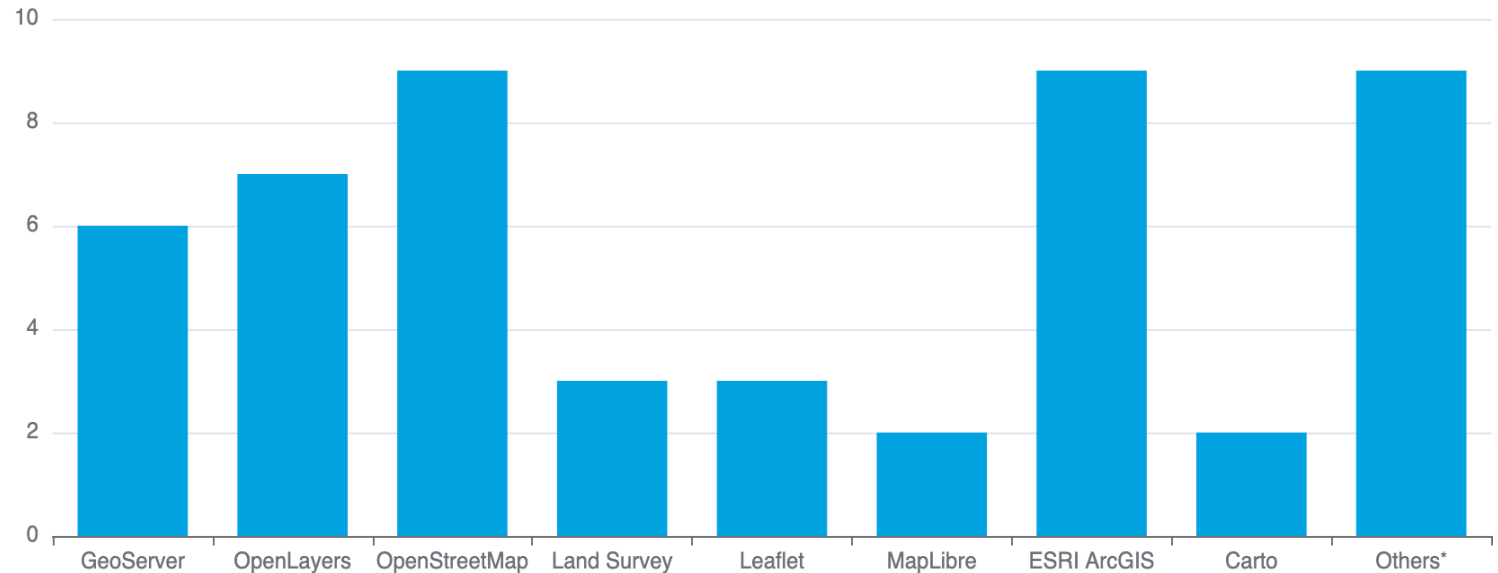
*Across 22 European countries studied, 12 use mostly open source software.*



# Open-Source GIS Software

CHANGE GRAPH to have a distinction between closed and open. And order by sizes. + add legend.

- European NRAs use different software, each having its purpose (data storage, data procurement, map design, map display...)
- This graph shows the most used software solutions across 22 different European countries.



\*Others: OpenFreeMap, OpenMapTiles, MapBox, MapTiler, Stratix, Mapy, Google Maps, Wigeogis, Salesforce

Land Survey refers to national databases used by countries to have a detailed map of the national territory (e.g. IGN in France or NLS in Finland).

# Open vs. Closed Source: how to choose?

# Q&A and Discussion for Session 4

Estimated end time: 13:00



# LUNCH BREAK

13:00 – 14:00



# SESSION 5: Group discussions on technical specifications (architecture, data sources, limitations) – co-creation session

**Moderation:** Mr. Dana Jon Kamason, Project Manager, Africa-BB-Maps, ITU



# SESSION 5: Group discussions on technical specifications (architecture, data sources, limitations) – co-creation session

Estimated end time: 15:30

## Group 1

Systems architecture &  
Deployment Models

## Group 2

Open-Source Technologies  
& Open Data

## Group 3

Data Standardization &  
Collection Mechanisms

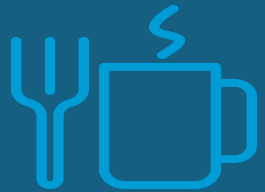
## Group 4

Statistics, Validation, Quality  
Control & Assurance



# Coffee Break

15:30 – 16:00



# RECAP: Recap of Day 2 and Objectives of Day 3



**Mr. Dana Jon Kamason**

Project Manager, Africa-BB-Maps, ITU

**XXX**

Rapporteur NCC

