Day 2

Technical Systems and Data Readiness

Registration

National Broadband Mapping Systems in Botswana
12—14 August 2025
Gaborone, Botswana

Global Gateway

BOCRA

ITU

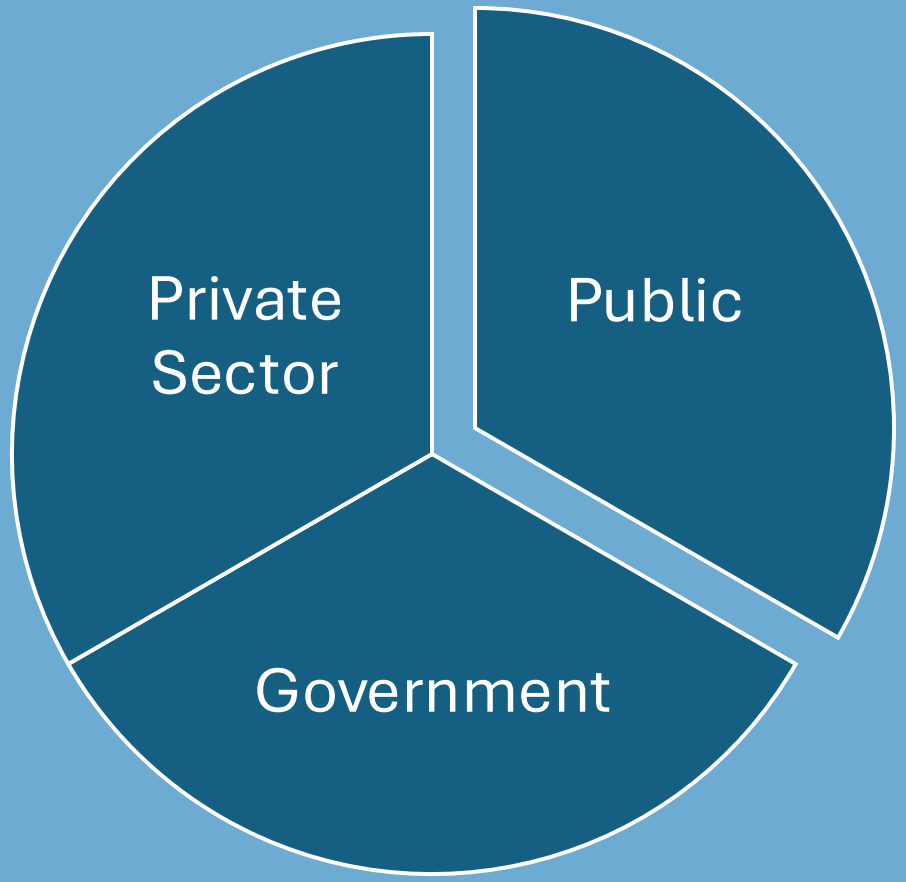
Welcome Coffee

Opening Remarks: Strategic Technical Priorities for Broadband Infrastructure Mapping

Mr. Tebogo Ketshabile

Botswana Communications Regulatory Authority

1. Who:



2. What:

- Transmission (Fibre, Radio)
- Access Networks Coverage
- Connected Public Facilities (Schools, Kgotla, Clinics, etc)
- QoS data
- Covered Population data

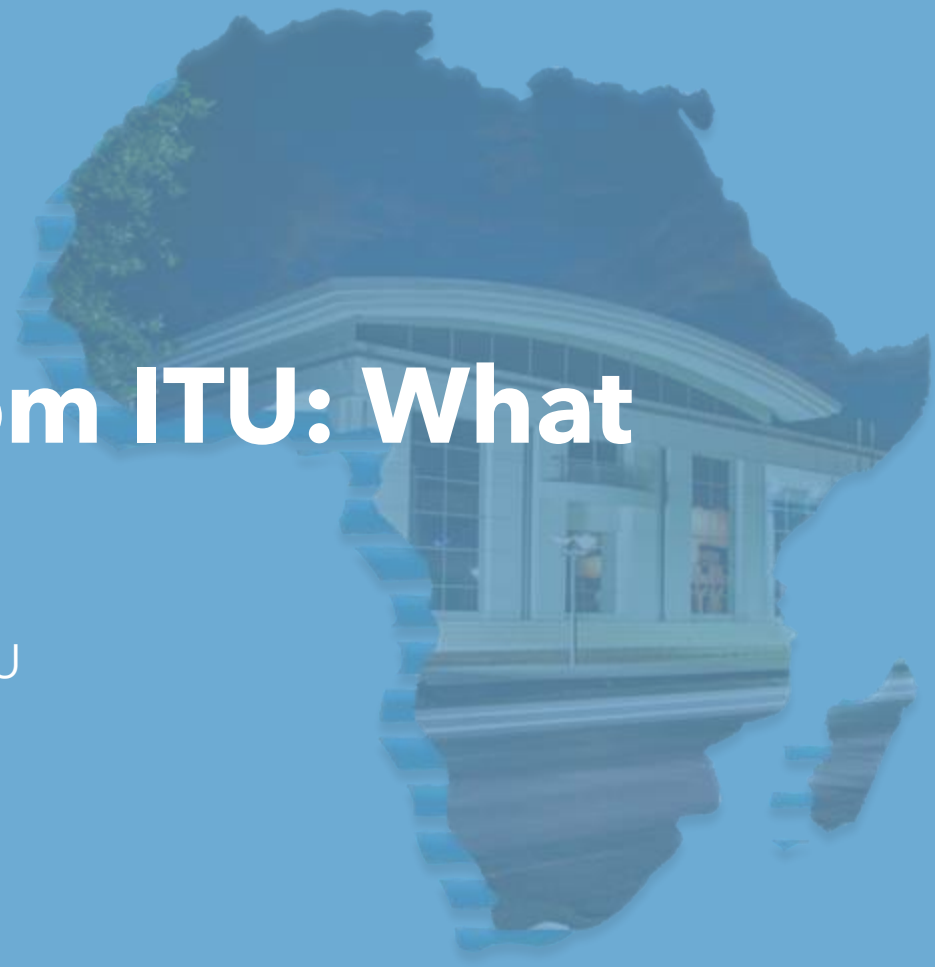
3. How:

- Public-Private Collaboration
- Standardization of Mapping Protocols
- Regulatory and Legal Framework
- Capacity Building

4. Why:

- Identify and Address connectivity Gaps
- Empower the users
- Socio-Economic Impact

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



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

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

Mr. Marko Simoncic
ITU Speaker, Slovenia

Mr. Primoz Ursic
ITU Speaker, Slovenia

Mr. Gregor Baliz
ITU Speaker, Slovenia

Q&A and Discussion for session 3

Coffee Break

Objectives of Day 2

DAY 2 - Technical Systems & Data Readiness	
9:00 – 9:15	Recap of Day 1 and Objectives of Day 2
9:15 – 9:45	Opening remarks: Strategic Technical Priorities for Broadband Infrastructure Mapping
9:45 – 11:15	SESSION 3: Case Studies from ITU: What Lessons Apply?
11:15 – 11:30	Tea Break
11:30 – 12:30	SESSION 4: Technical Deep-Dive: Architecture, Standards, Tools & Data Ecosystem
12:30 – 13:00	SESSION 6: Policy Deep-dive: Presentation of Upcoming Policy Analysis Work
13:00 - 14:00	LUNCH BREAK
14:00 - 15:00	PARALLEL SESSIONS: Co-Creation Dialogue on Architecture, Data Sources & Technical Constraints Co-Creation Dialogue on the policy and regulatory work
15:00 – 15:30	Tea Break
15:30 – 16:30	PARALLEL SESSIONS: Co-Creation Dialogue on Architecture, Data Sources & Technical Constraints Co-Creation Dialogue on the policy and regulatory work

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

Mr Dana Jon Kamason

Representative, ITU

Mr Thapelo Sethebethe

Botswana Communication Authority (BOCRA)

Representative

BoFiNet

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

Setting the stage & Moderation: Mr. Dana Jon Kamason, Project Manager, Africa-BB-Maps, ITU

Africa-BB-Maps – Geospatial Software Choices for Nigeria

Global Gateway

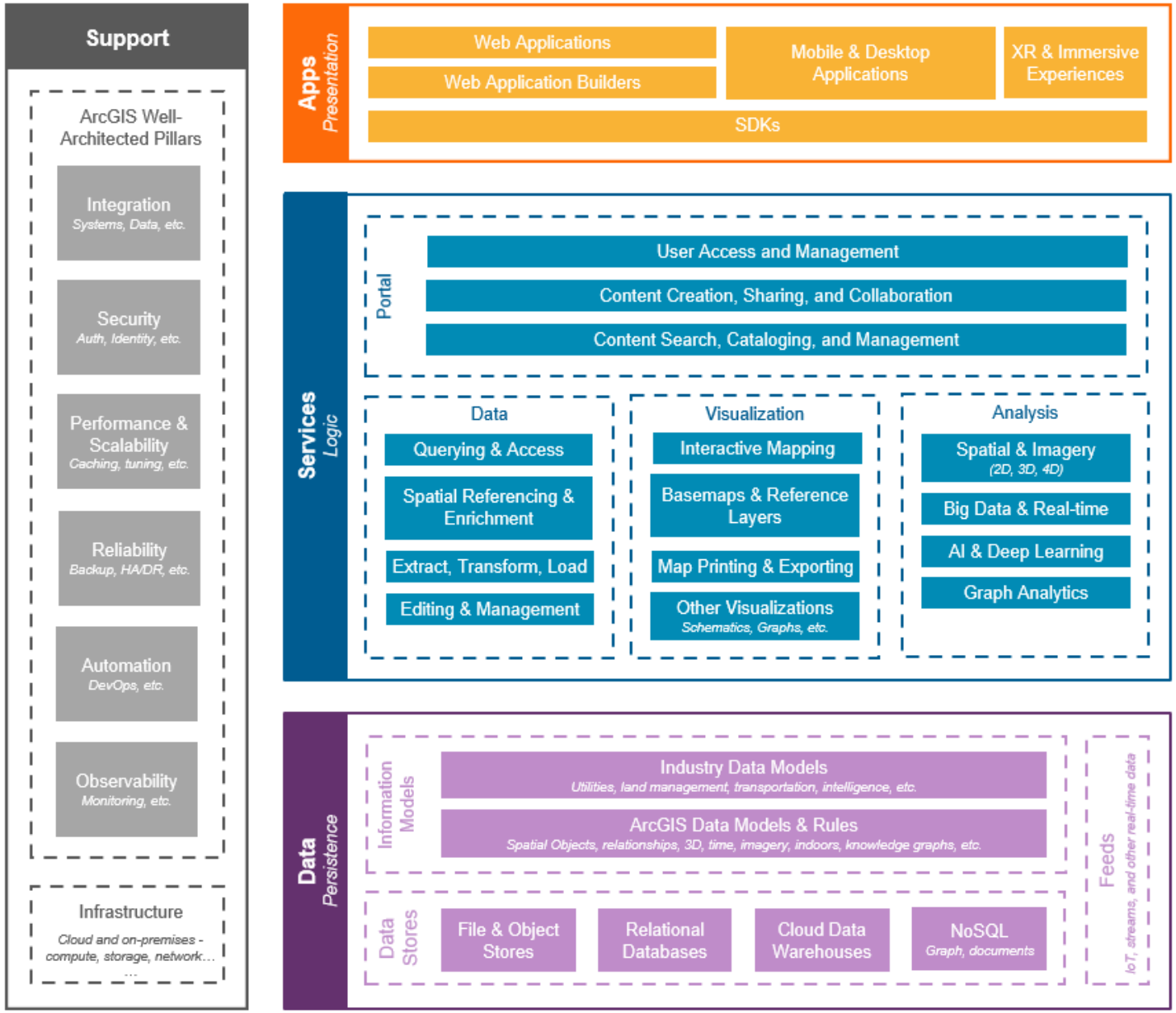
BOCRA

ITU

Africa-BB-Maps – Geospatial Software Botswana's Choice

ArcGIS

Africa-BB-Maps – ArcGIS Architecture



Source: Esri

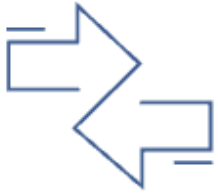
Africa-BB-Maps – ArcGIS Architecture Pillars

Best Practice and Design Recommendations

Security

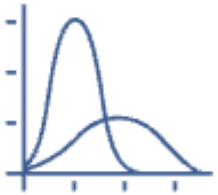
Performance & Scalability

Reliability



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

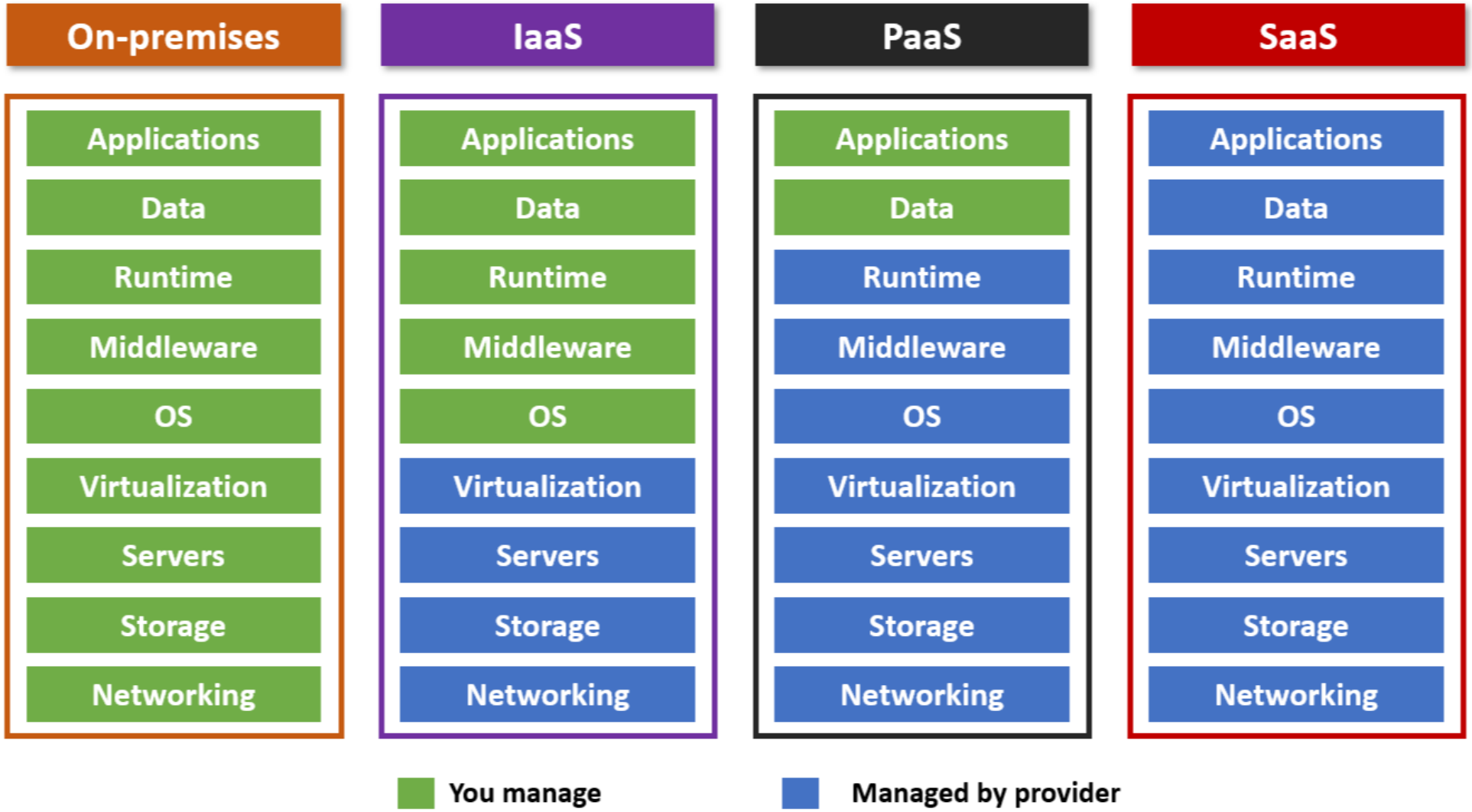
Imagery data management and analytics

Mobile operation and offline data management

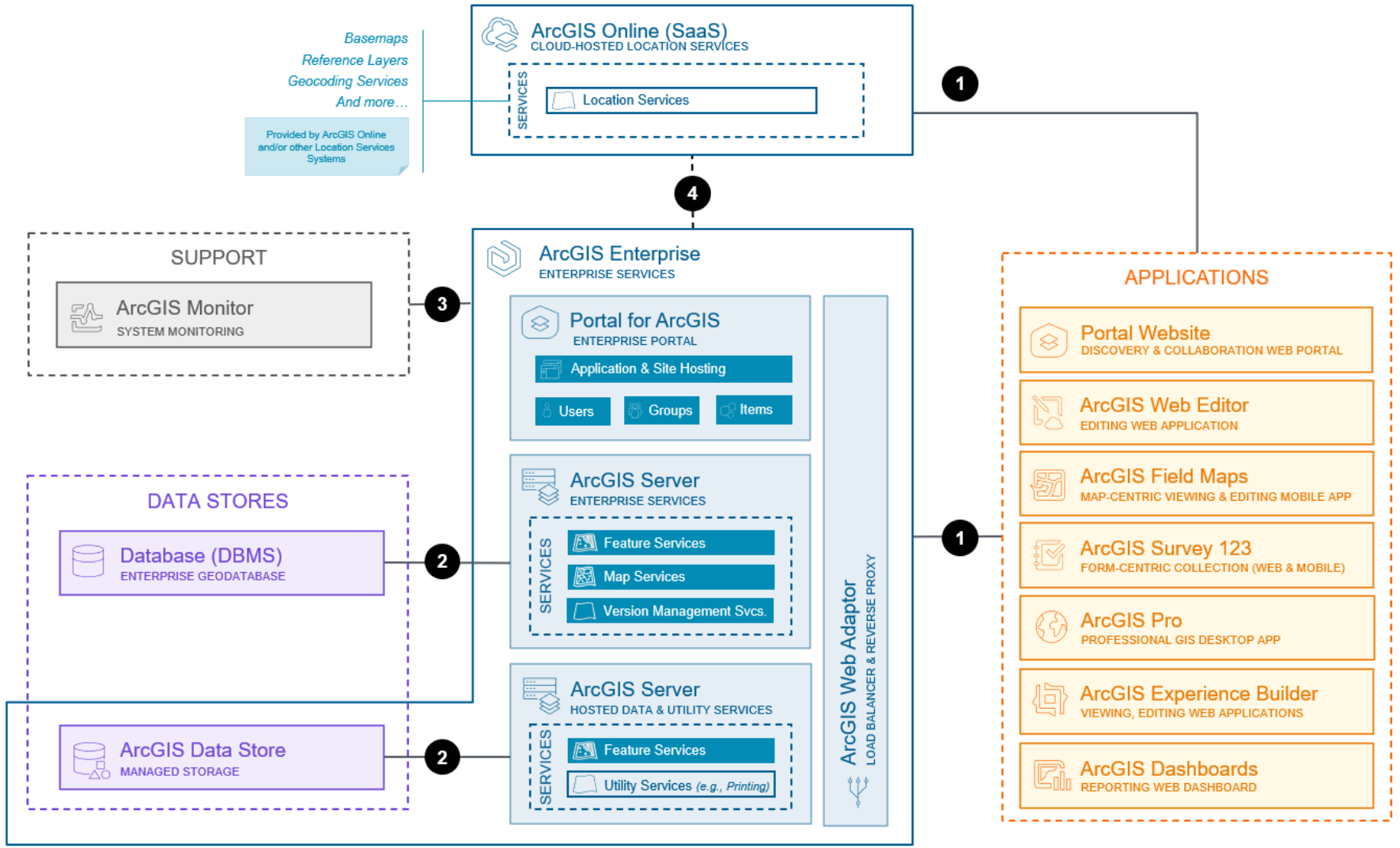
Real-time data streaming and analytics

Big data analytics

Africa-BB-Maps – ArcGIS Architecture Deployment Model

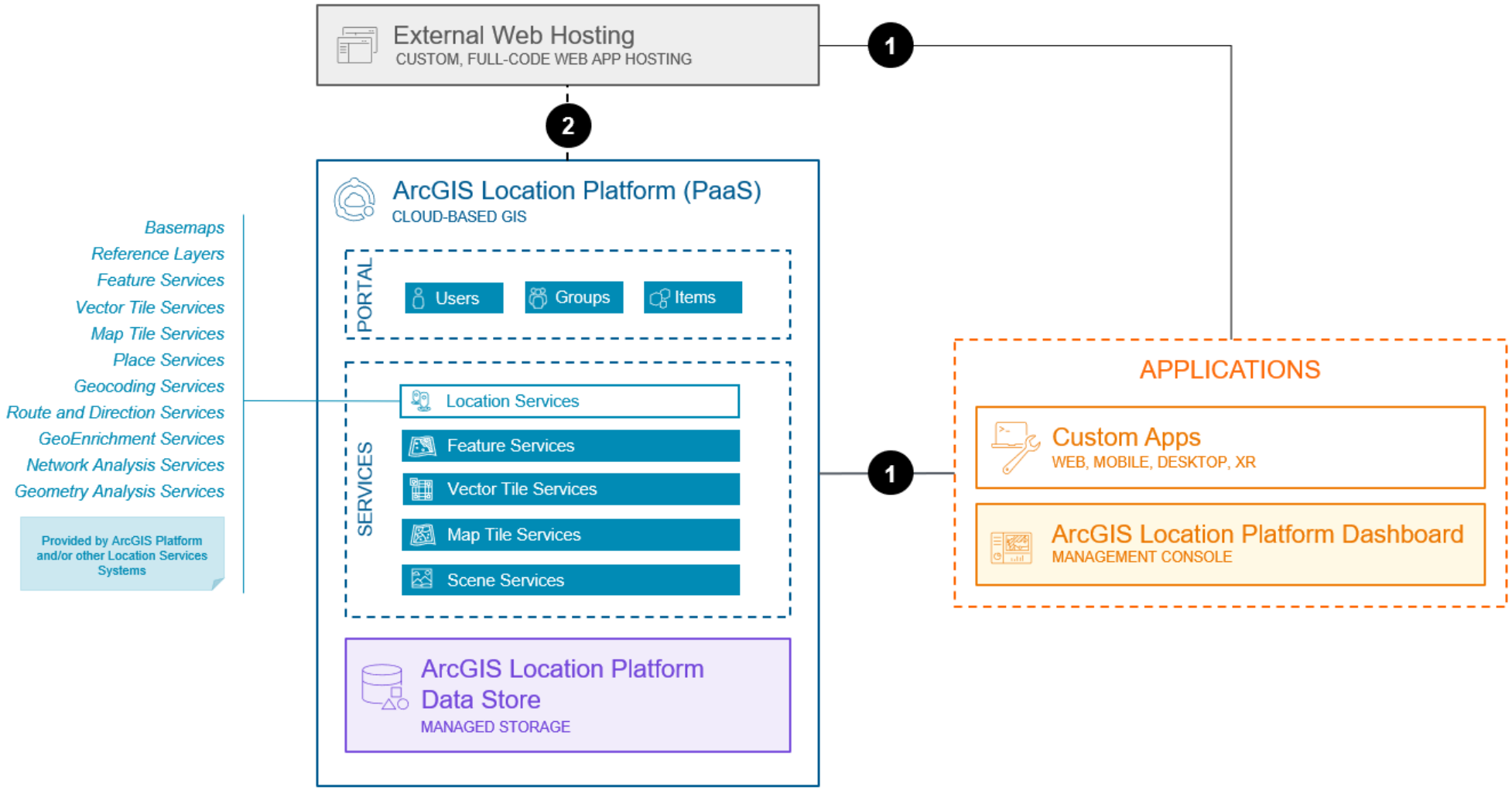


Africa-BB-Maps – ArcGIS IaaS/On-Premises



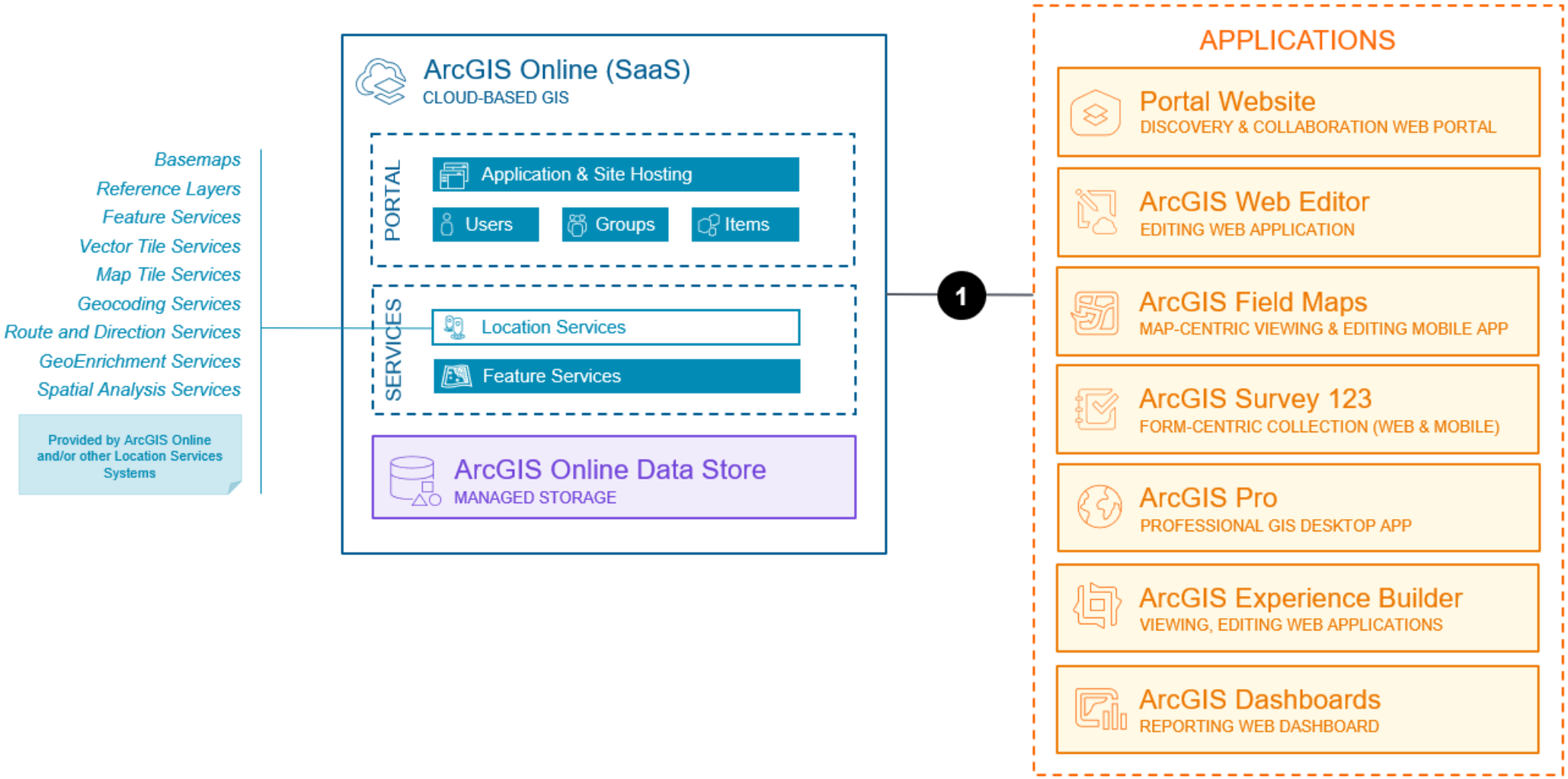
Source: Esri

Africa-BB-Maps – ArcGIS PaaS



Source: Esri

Africa-BB-Maps – ArcGIS SaaS



Source: Esri

Geospatial
Open Source & Open Data

Africa-BB-Maps – Geospatial Open Source Software

https://www.osgeo.org/

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

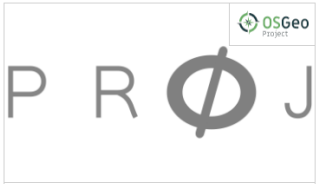
PostGIS

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

Website Source Documentation

https://www.osgeo.org/projects/

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

FDO

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

Website Documentation

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

https://www.osgeo.org/projects/

Africa-BB-Maps – Geospatial Open Source Projects

Loader

A loader for geographic data in GML and KML (that needs some preparation before ...

Website Source Documentation

mapfish

Create reports that contain maps!

Website Source Documentation

MapGuide Open Source

MapGuide Open Source is a web-based platform that enables users to develop and d...

Website Source Documentation

OSSIM

OSSIM is an open source, C++ (mostly), geospatial image processing library used ...

Source

OWSLib

OWSLib is a Python package for client programming with Open Geospatial Consortiu...

Website Source Documentation

Portable GIS

GIS on a USB stick, for windows

Website Source Documentation

mappyfile

A Python library to create, parse, modify, and format MapServer Mapfiles....

Website Source Documentation

Mesh Data Abstraction Library (MDAL)

Mesh Data Abstraction Library (MDAL) is a translator library for more than 15 un...

Website Source Documentation

MobilityDB

An open source geospatial trajectory data management & analysis platform...

Website Source Documentation

PROJ-JNI

PROJ-JNI provides a Java Native Interface for PROJ C/C++ library....

Website Source Documentation

Pronto Raster

Pronto Raster is a C++ library for calculations with raster data. The library is...

Website Source Documentation

rasdaman

Scalable datacube analytics

Website Source Documentation

Open Data Cube

The Open Data Cube is a Python library and suite of supporting applications that...

Website Source Documentation

Opticks

Opticks is an expandable remote sensing and imagery analysis software platform t...

Website Source

OSGeo4W

OSGeo4W is a binary distribution of a broad set of open source geospatial softwa...

Website Source Documentation

TEAM Engine

The Test, Evaluation, And Measurement (TEAM) Engine is a testing facility that e...

Website Source Documentation

TorchGeo

TorchGeo: datasets, samplers, transforms, and pre-trained models for geospatial ...

Website Source Documentation

XYZ / MAPP

Open source presentation, controller, domain, and service layers for cloud nativ...

Website Source Documentation

https://www.osgeo.org/projects/

Africa-BB-Maps – Geospatial Open Source Projects

Bezitopo

A land surveying CAD package under development

Website Source

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

https://www.osgeo.org/projects/

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

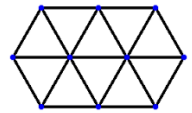
Kaoto is an integration editor to create and deploy workflows in a visual, low-c...

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

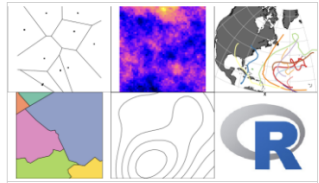
LERC is an open-source image or raster format which supports rapid encoding and ...

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

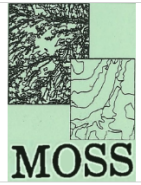
RasterFrames® enables analysts, data scientists and EO specialists to easily...

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

https://www.osgeo.org/projects/

‘Open Data applies the principles of ***free and open*** to geospatial data’

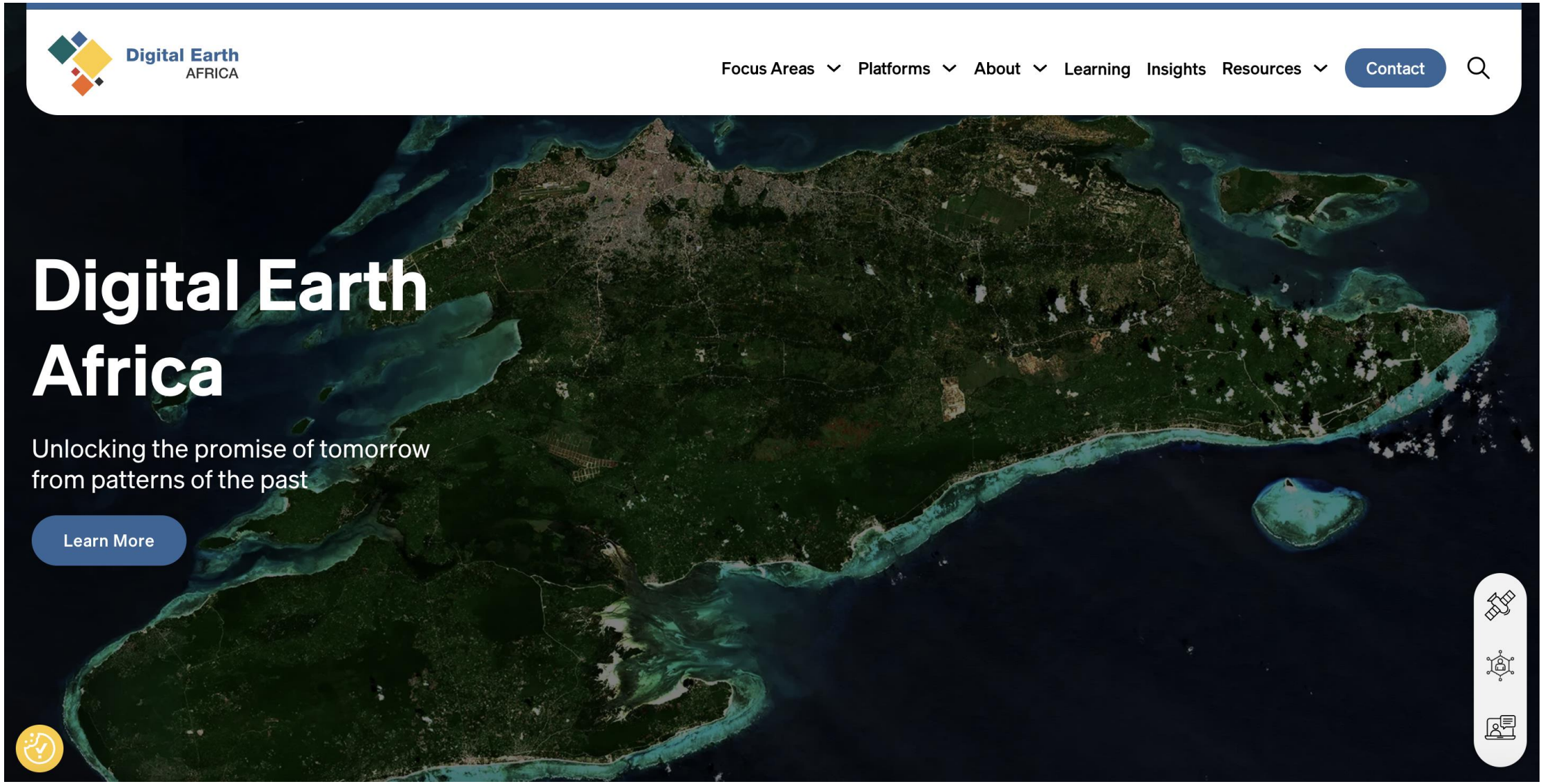
Africa-BB-Maps – Geospatial Open Data (Global)

https://www.openstreetmap.org

Africa-BB-Maps – Geospatial Open Data (Global)

https://www.copernicus.eu/en/access-data/conventional-data-access-hubs

Africa-BB-Maps – Geospatial Open Data (Africa)

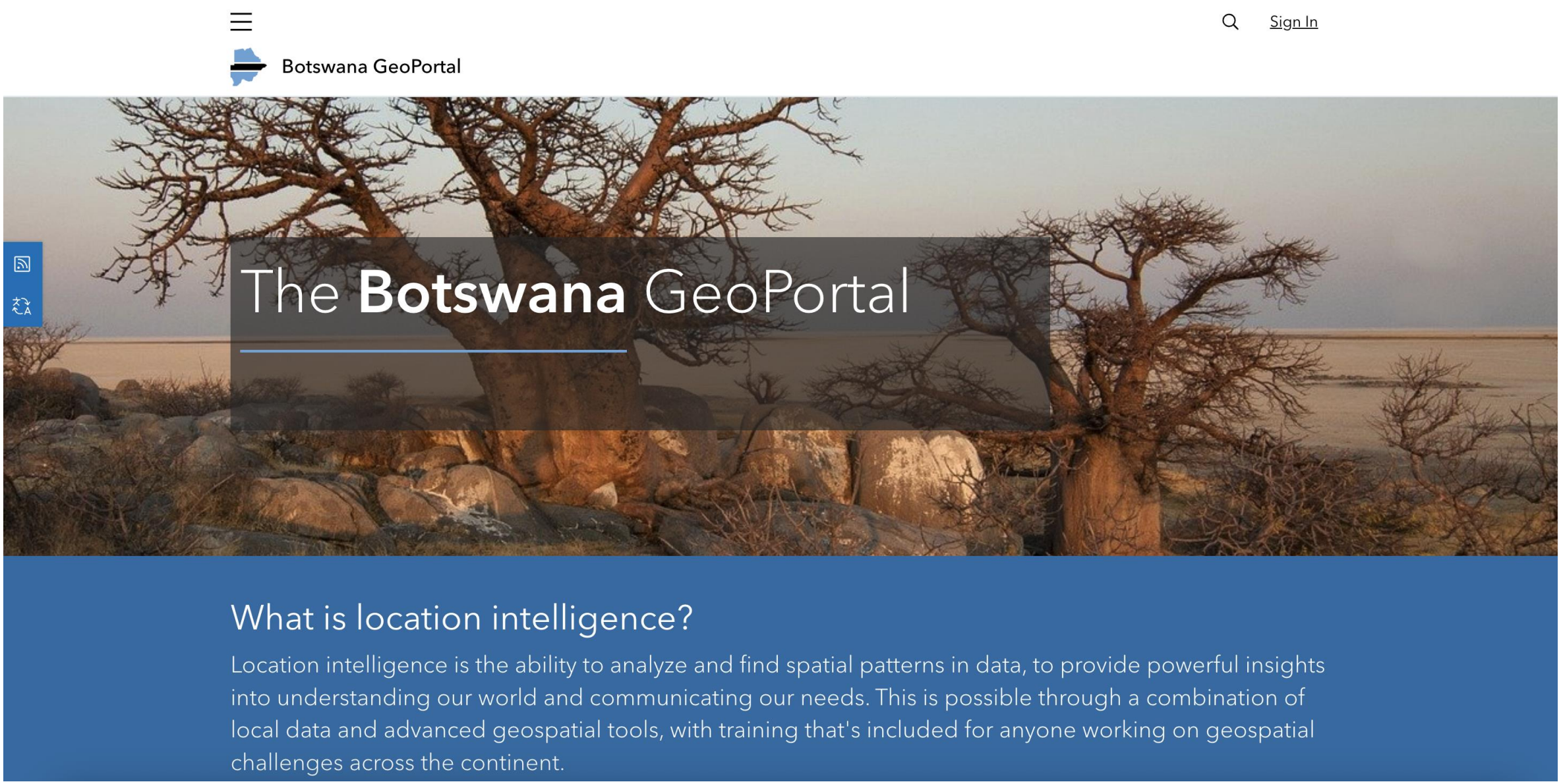


https://digitalearthafrica.org/en_za

Africa-BB-Maps – Geospatial Open Data (Africa)

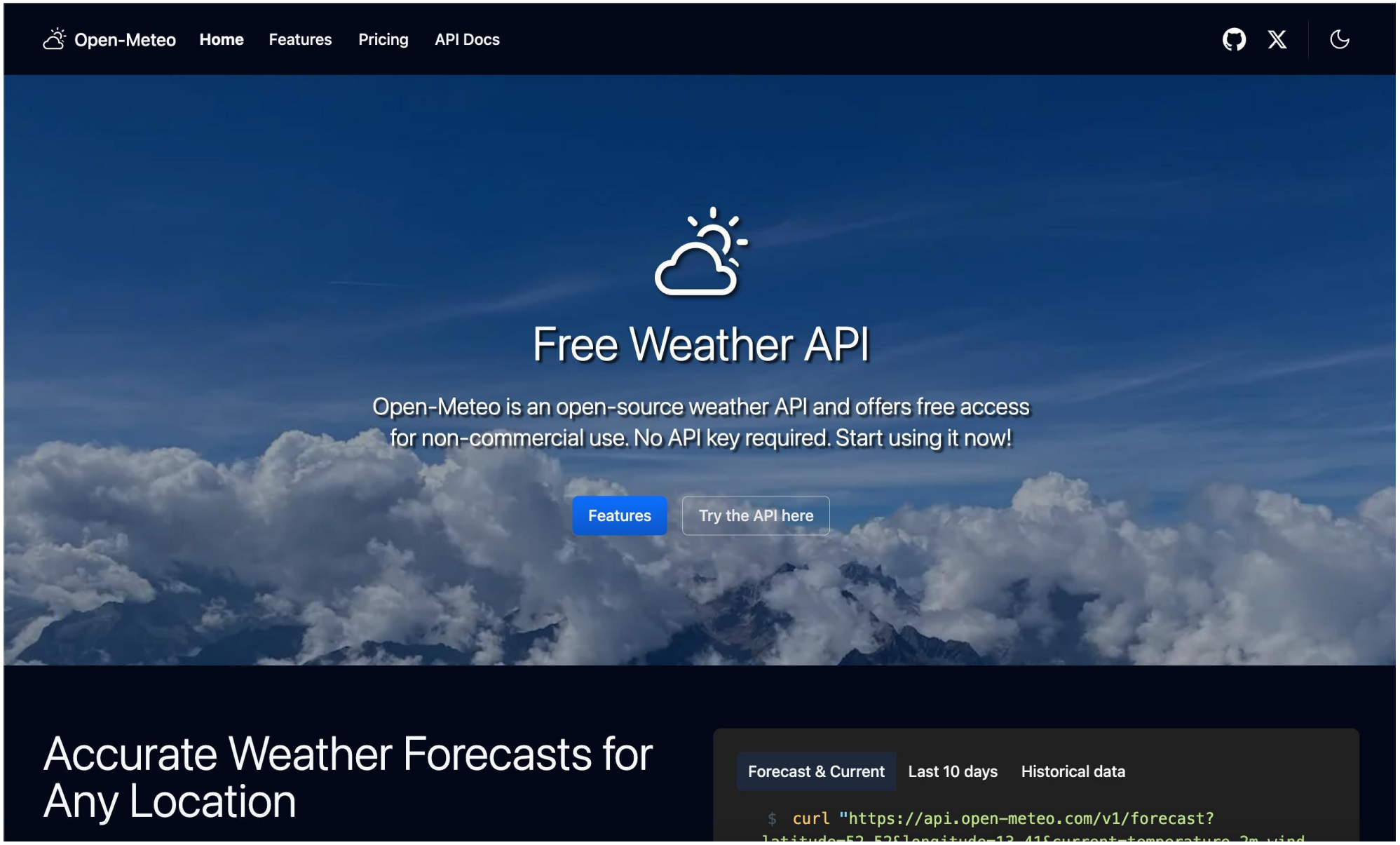
https://www.africageoportal.com

Africa-BB-Maps – Geospatial Open Data (Botswana)



https://www.africageoportal.com

Africa-BB-Maps



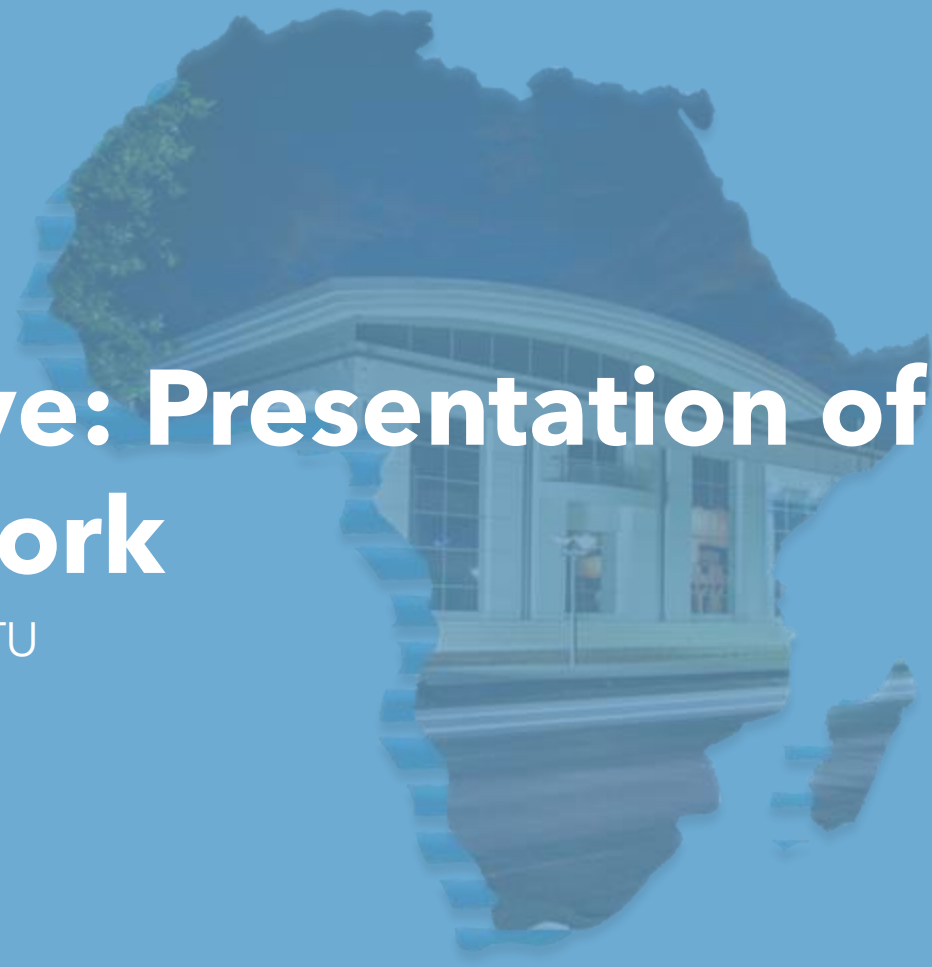
source: https://open-meteo.com/

Q&A and Discussion for session 4

Estimated end time: 13:00

SESSION 6: Policy Deep-Dive: Presentation of upcoming policy analysis work

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



Introduction – Context – Background – Problem statement

Section	Title
1	INTRODUCTION
1.1	Background
1.2	Context
1.3	Problem statement
1.4	Purpose of the guidelines
1.5	Disclaimer

Strategies, policies and regulatory environments for broadband mapping

2.1	Strategic and policy drivers for broadband mapping
2.2	A regulatory framework for mapping
2.2.1	The EU Guidelines on State Aid for Broadband (2013)
2.2.2	The Broadband Cost Reduction Directive (2014)
2.2.3	The European Electronic Communications Code (2018)
2.3	Regulatory improvements and developments
2.3.1	Revision of the EU Guidelines on State Aid for Broadband
2.3.2	Revision of the Broadband Cost Reduction Directive
2.3.3	BEREC's implementation of the EECC
2.3.4	The European experience in the field of dispute settlement mechanism
2.4	Minimum policy and regulatory requirements to implement a broadband mapping system

Project setup and technical requirements for broadband mapping

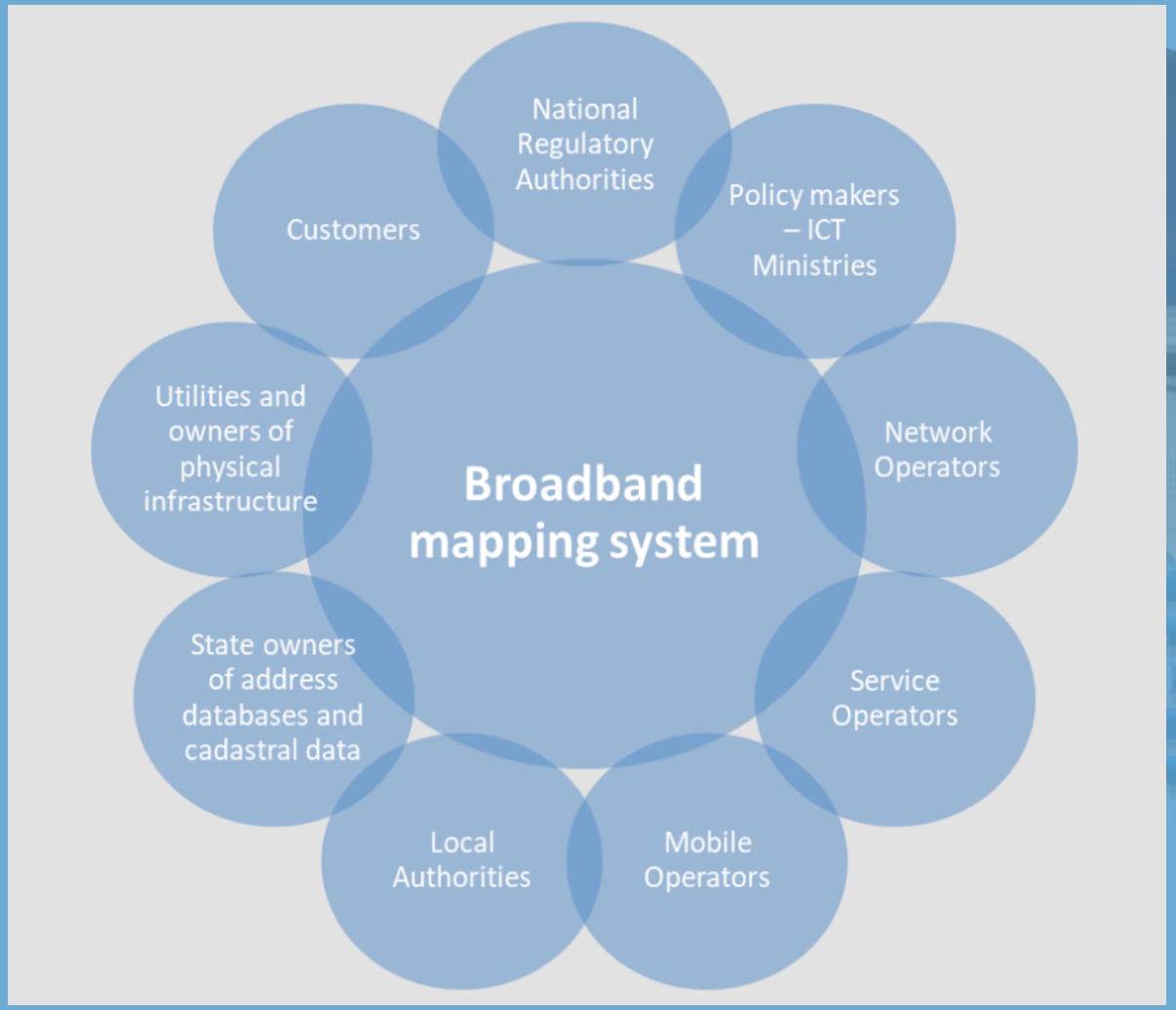
3.1	Project setup
3.1.1	Project framework and objectives
3.1.2	Project design
3.3	Minimum technical and project requirements to implement a broadband mapping system

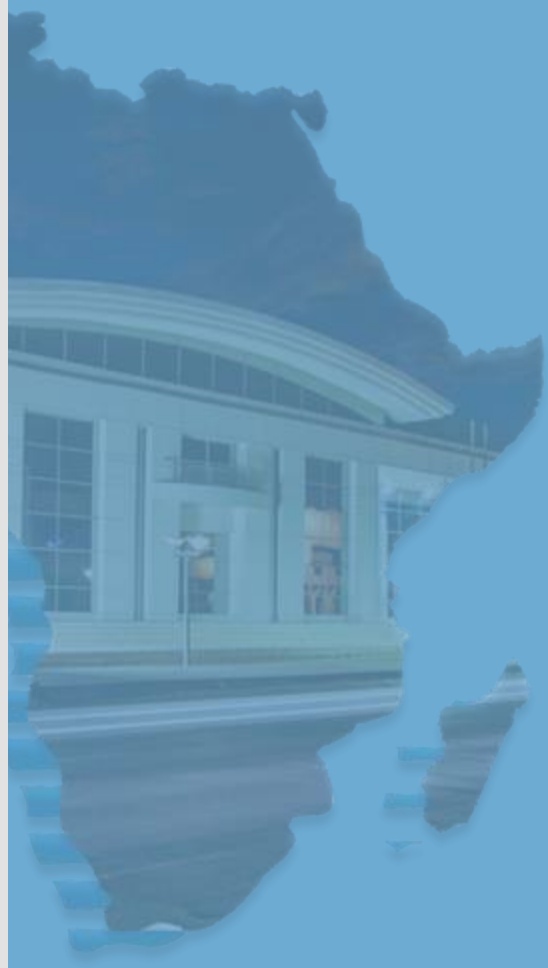
Project setup and technical requirements for broadband mapping
Project Management / Common Challanges

4.1	Data quality
4.1.1	Data confidentiality
4.1.2	Data sources
4.1.3	Reporting types
4.1.4	Regulation
4.1.5	Stakeholder costs

4.2 General Success Factors
4.2.1 Stakeholder involvement
4.2.2. Clear definition on types of mapping
4.2.3. Internal sponsorship
4.2.4 Efficient reporting tool
4.2.5 Reporting support

4.3 Long term sustainability
4.3.1 Investment in reporting tools
4.3.2 Collection tool adaptability and development
4.3.3 Visualisation tools
4.3.4 Tools' promotion
4.3.5 Data application
4.3.6 Open-source solutions
4.3.7 Change management


National Regulatory Authorities
Policy makers – ICT Ministries
Network Operators
Service Operators
Mobile Operators
Local Authorities
State owners of address databases and cadastral data
Utilities and owners of physical infrastructure
Customers
Broadband mapping system



Infrastructure Mapping	Service Mapping
The activity entailing the gathering, structuring and representing: georeferenced data on passive physical infrastructure (e.g., pipes, ducts, poles, manholes, base stations, mobile towers, etc.) represented in lines and nodes; information about the type of infrastructure deployed (fiber/copper, water pipes, electricity); information about the owners of that infrastructure (fixed/mobile telecommunications, other network operators, national and local government, etc.)	The activity entailing the gathering, structuring and representing: data about service availability (including bandwidth and or type of technology used to offer the service), data about the number of broadband service offers from operators data about the estimated quality of service available for a specific address and/or a specifically defined geographical area (e.g., 100m x 100m grid)
Investment Mapping	**Demand Mapping**
The activity entailing the gathering, structuring and representing: data about planned investments aimed at developing broadband infrastructure and services in a defined geographical area (e.g., region, municipality), including relevant information about publicly and/or privately funded projects. Investment maps may include reports about areas characterized by market failure or sub optimal outcomes	The activity entailing the gathering, structuring and representing: data about the quantity and quality of broadband demand for bandwidth desired by the end user. the level of financial allocation foreseen in association with that given broadband fixed service.

Table 1 **Four Types of Broadband Mapping Systems**

Checklist 1 - Policy and Regulatory Checklist

1. Define the rationale and objectives for broadband mapping at the country level
2. Identify relevant institutions and stakeholders and their roles
3. Include the rationale and mandate in strategic documents (e.g., broadband plans, ICT strategies)
4. Provide a platform for long term engagement and consultation with all stakeholders (operators, regional and local administrations, etc.)
5. Analyse the legislative framework and propose reform as needed - Infrastructure sharing (infrastructure mapping) - Allocation of public funding (service mapping) - Objective of the map - Obligation for the authority to deliver the map - Obligation for stakeholders to provide information - Other
6. Ensure the NRA (or other Competent Authority) has the necessary mandate, budget and human resources to implement the provisions of the law
7. Define common technical definitions and methods to carry out the broadband mapping exercise. Consult with stakeholders.
8. Establish a dispute settlement mechanism fit for the national context
9. Plan regular evaluations of the mapping and of its the usefulness in fulfilling its objectives. adjust the map and any related normative provisions, if necessary, in accordance with the assessment, changes in objectives or legal/regulatory framework every 4-5 years to ensure they are fit for purpose
OUTPUT: review of enabling environment and recommendations and/or report describing existing boundaries of the regulatory framework for broadband mapping

Lunch Break

SESSION 5: Co-Creation Dialogue on Architecture, Data Sources & Technical Constraints

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

SESSION 5: Co-Creation Dialogue on Architecture, Data Sources & Technical Constraints

Technical Group 1

Systems Architecture & Deployment Models

Key Area:

- **Enterprise GIS / Open source**
- **Scalable Deployment Architectures**

Technical Group 2

Data Management

Key Area:

- **Data Governance,**
- **Standaridisation,**
- **Collection Mechanisms;**
- **Validation, QC& QA**

Policy Group 1

Policy Group 2

Key Area:

- **Internal, legal or policy barriers;**
- **Coordination challenges between data providers and BOCRA**
- **Data ownership and confidentiality**
- **Institutional limitations**
- **National & Regional harmonization**

Coffee Break