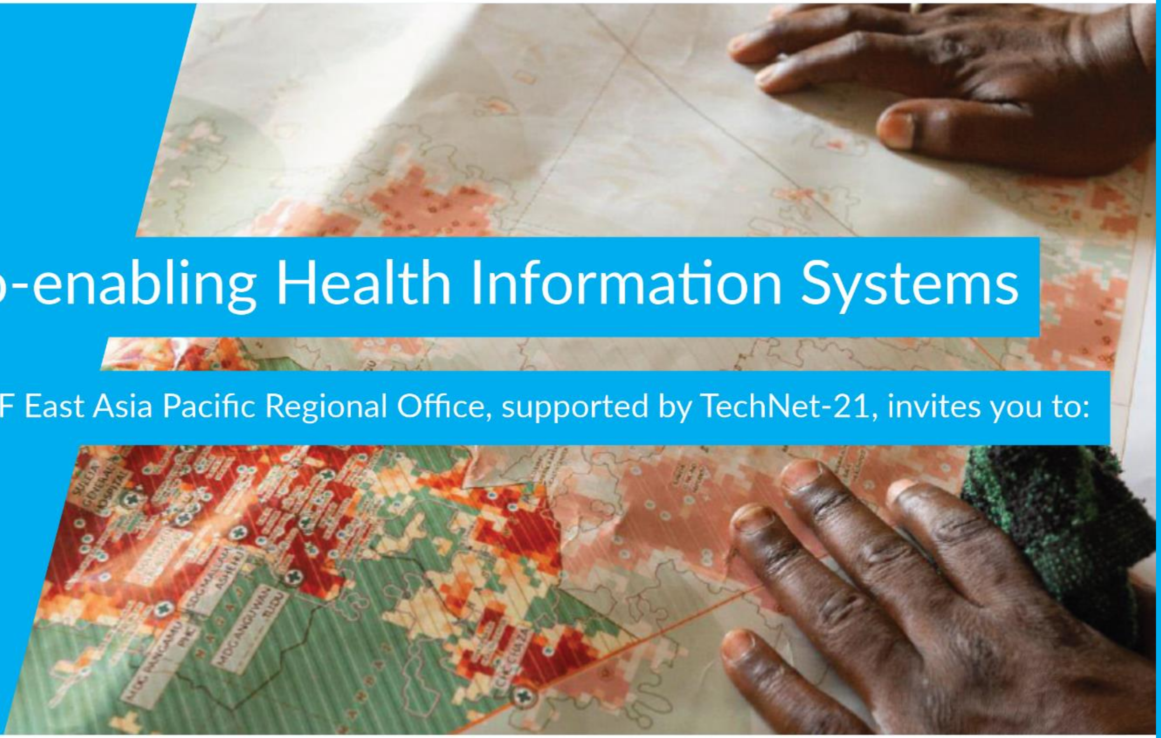
unicef for every child

MORU Tropical Health Network · HEALTH GEOLAB Hub

TechNet-21 The Technical Network for Strengthening Immunization Services

Geo-enabling Health Information Systems

UNICEF East Asia Pacific Regional Office, supported by TechNet-21, invites you to:



Learn how to geo-enable health information systems and programmes

Join us for a bi-weekly web-series starting **19 June 2024**

- Demonstrate the potential of geospatial data and technologies in public health
- Introduce HIS geo-enabling framework and its implementation in countries
- Provide knowledge and resources to implement the HIS geo-enabling framework

Go to https://tn21.org/UNICEF-EAPRO
or Scan QR Code to Register

Ongoing registration

Joining any one session also permitted

6 Modules of around 2 hours each…except module 4

Certificates provided on completion by UNICEF & MORU

Workshop Objectives

Disseminate operational guidance materials that can assist countries in implementing the geo-enablement process for health programs in general and the development and implementation of micro plans in particular

More specifically:

- Demonstrate the potential of geospatial data and technologies in public health
- Introduce the HIS geo-enabling framework and its implementation in countries
- Transfer knowledge, expertise and resources that will allow participants to implement the HIS geo-enabling framework in their respective country

➡ At the end of this workshop, it is expected that the participants will have a better understanding of what geospatial data and technologies can bring to public health programs and how to geo-enable their health information system in a sustainable way to benefit from this type of data and technologies

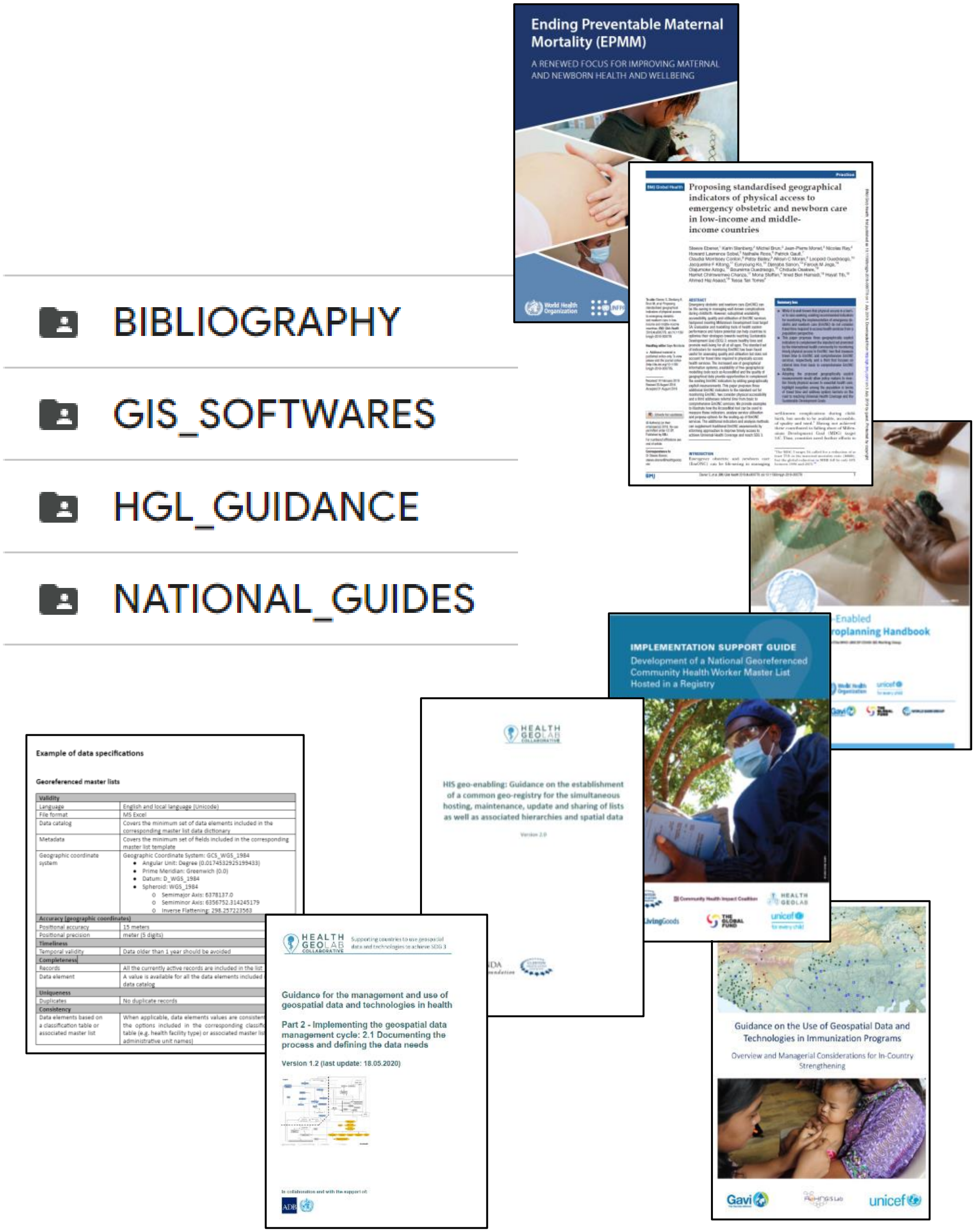
➡ This is not a GIS training

Workshop material

https://bit.ly/4d2nfTS

- REFERENCE_MATERIAL
- PRESENTATIONS

- BIBLIOGRAPHY
- GIS_SOFTWARES
- HGL_GUIDANCE
- NATIONAL_GUIDES

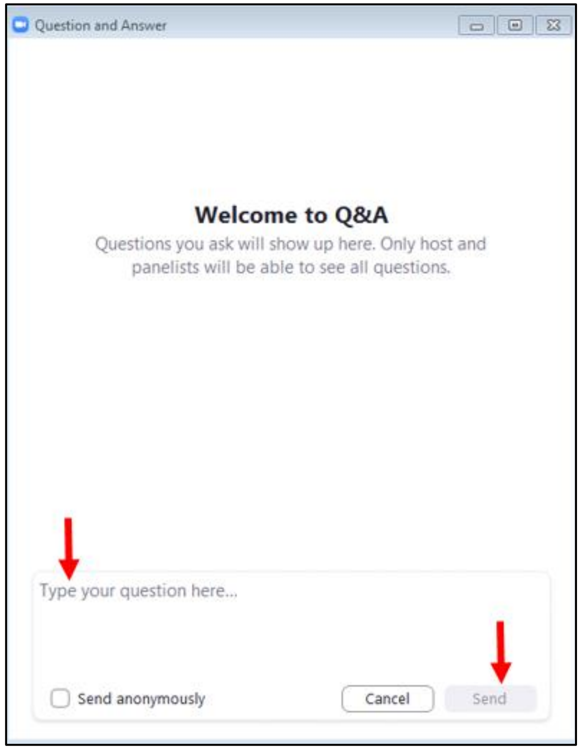


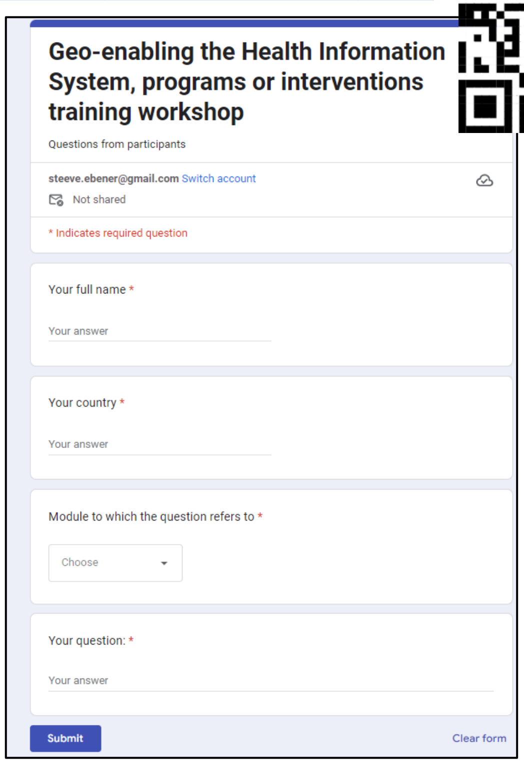
Glossary of terms: https://bit.ly/37Wje0v

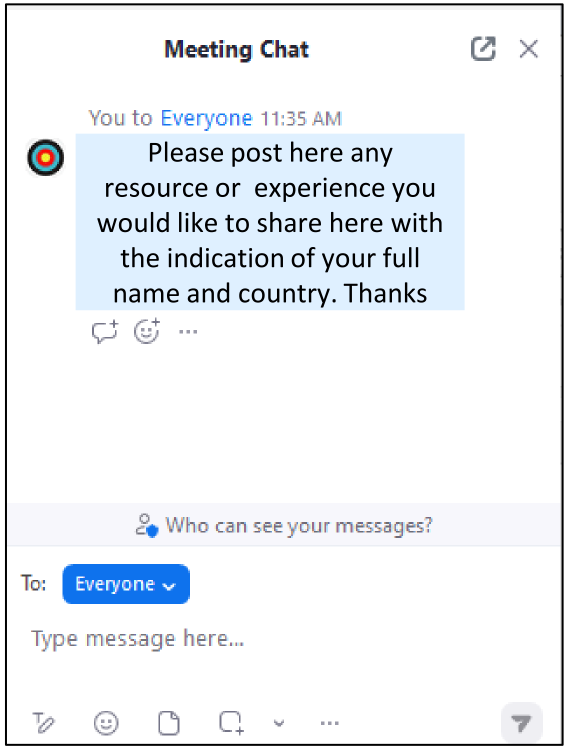
Slides and recording: https://healthgeolab.net/hub/resources/training-materials/unicef_regional_workshop/

Questions and knowledge sharing during the modules?

https://tinyurl.com/3999y744







Please post your questions in the Zoom Q&A (not the chat)

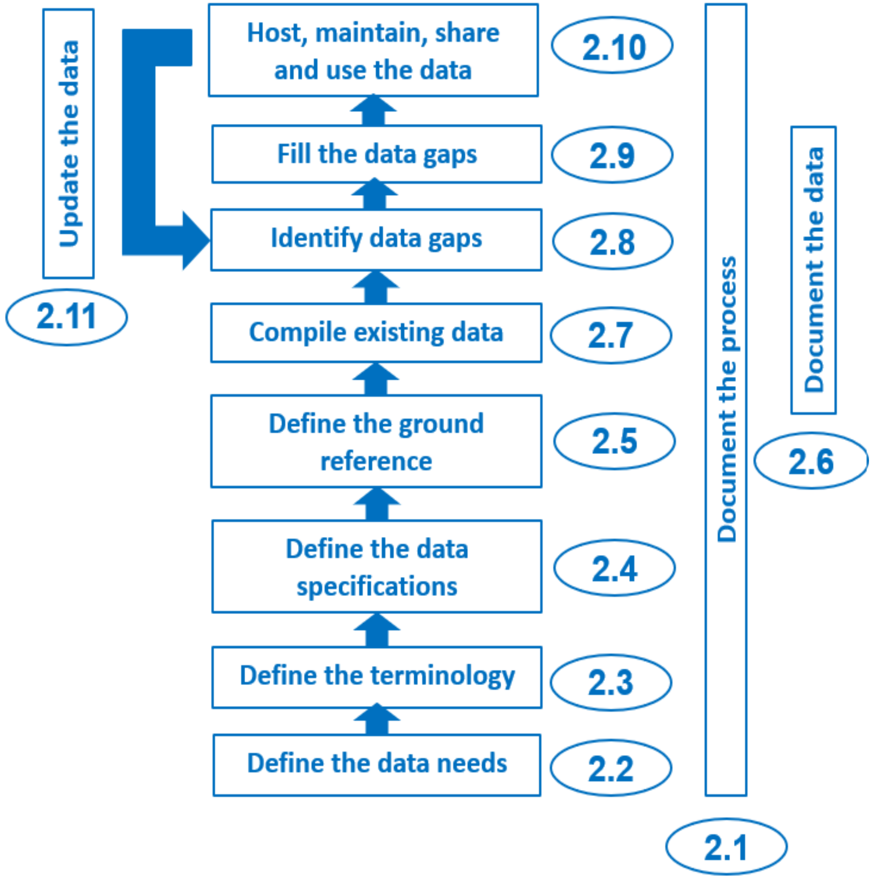
You can also ask questions using this short Google form (between modules for example)

We will answer them as much as possible during the modules

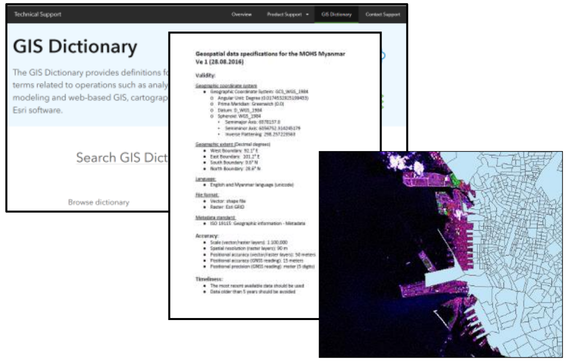
You can share any resource or experience you see relevant to the participants in the chat

We will also be using the chat to share information

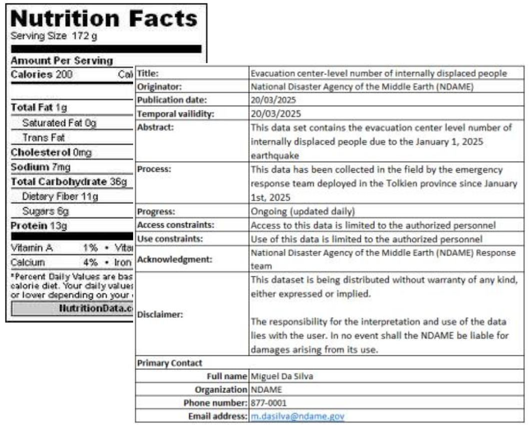
Recap of Module 4



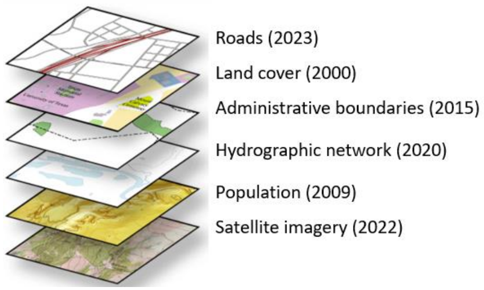
Introduction to the geospatial data management cycle

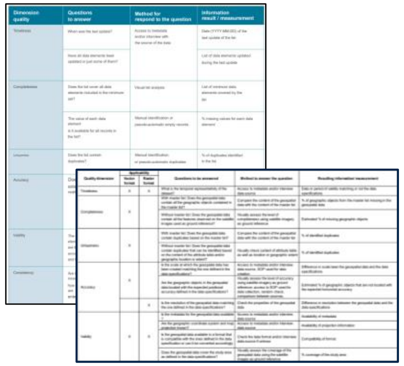


Terminology, data specifications and ground reference



Metadata





Compile existing data, identify and fill data gaps

Implementation of the data management cycle

Geo-enabling the Health Information System, programs or interventions training workshop for Asia Pacific

...and beyond

Module 5

Agenda - Module 5

15 min - Recap of Module 4 and agenda of Module 5

30 min – **Session 16:** Introduction to geospatial technologies

30 min - **Session 17:** Introduction to Global Navigation Satellite System (GNSS)

30 min - **Session 18:** Introduction to Geographic Information System (GIS)

30 min - **Session 19:** Introduction to the concepts of registry and Common Geo-Registry (CGR)

➡ Geospatial technologies

Geo-enabling the Health Information System, programs or interventions training workshop for Asia Pacific

...and beyond

Session 16: Introduction to geospatial technologies

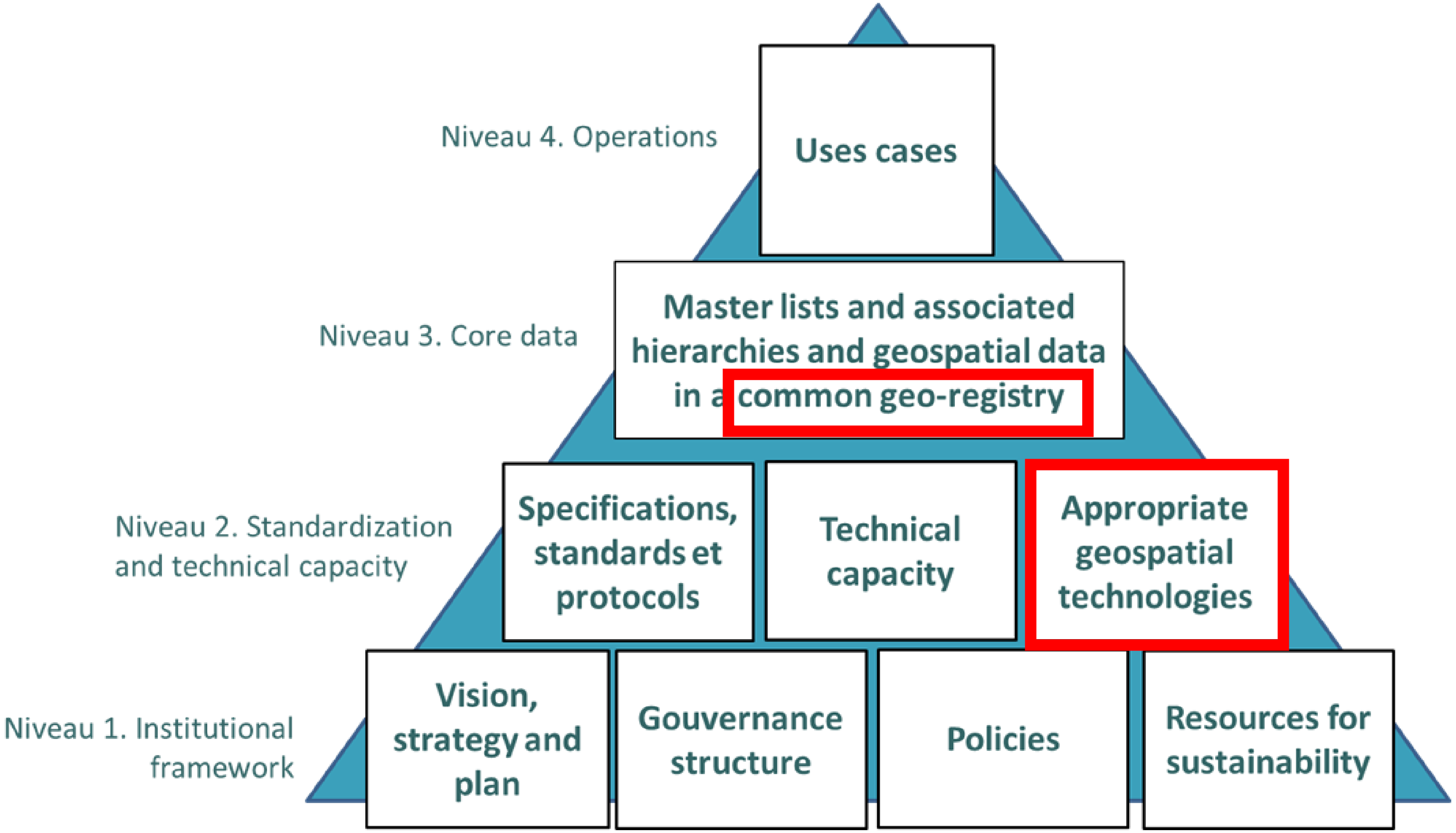
Geospatial Technology – Definition

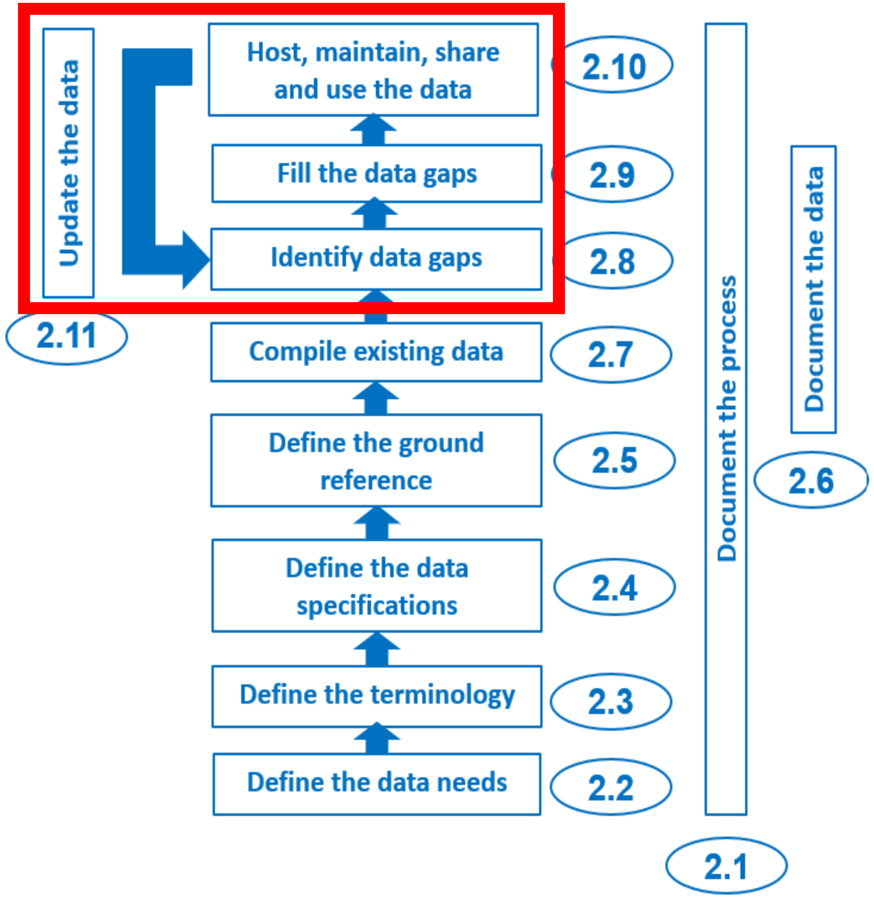
Set of technological approaches such as Geographic Information Systems (GIS), Global Navigation Satellite Systems (GNSS), photogrammetry, and remote sensing (RS), for acquiring and manipulating geographic data.[1]

This also includes new technologies that are starting to be deployed (e.g., Common Geo-Registry (CGR))

[1] Modified from: https://support.esri.com/en-us/gis-dictionary/geospatial-technology

Place of Geospatial technologies in the HIS geo-enabling framework and geospatial data management cycle





Technology supporting content and use cases, not driving them!

Evolution of geospatial technologies

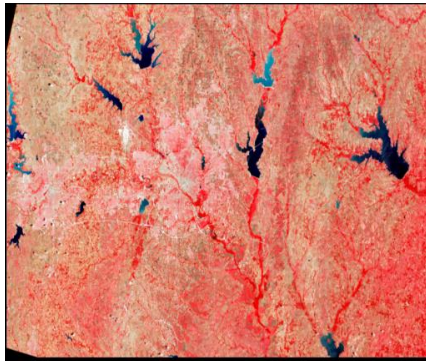
These technologies have evolved enormously over the last 50 years

GIS

GNSS

Remote sensing

1970s



First fully operational image from ERTS (LANDSAT) satellite, July 25, 1972, of Dallas, Texas.

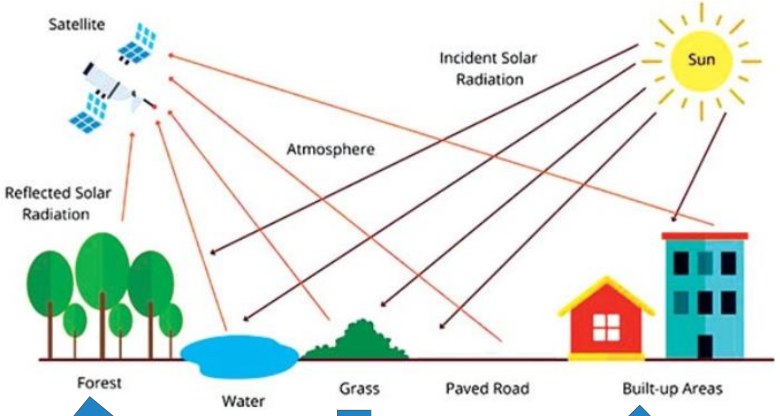
Credit: NASA's Earth Observatory.

2024

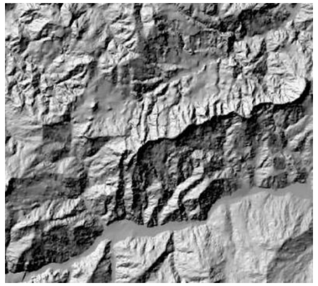
Geospatial Technologies – Remote Sensing (RS)

Remote sensing: Process of detecting and monitoring the physical characteristics of an area by measuring its reflected and emitted radiation at a distance (typically from satellite or aircraft)

- A censor attached to a flying object (satellite, plane, drone) captures the radiation in question



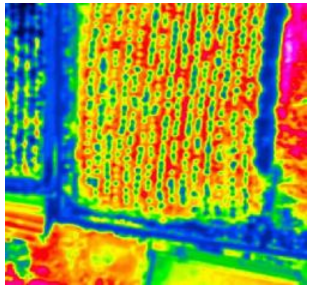
- Examples of derived data



Altitude

Images

Land cover

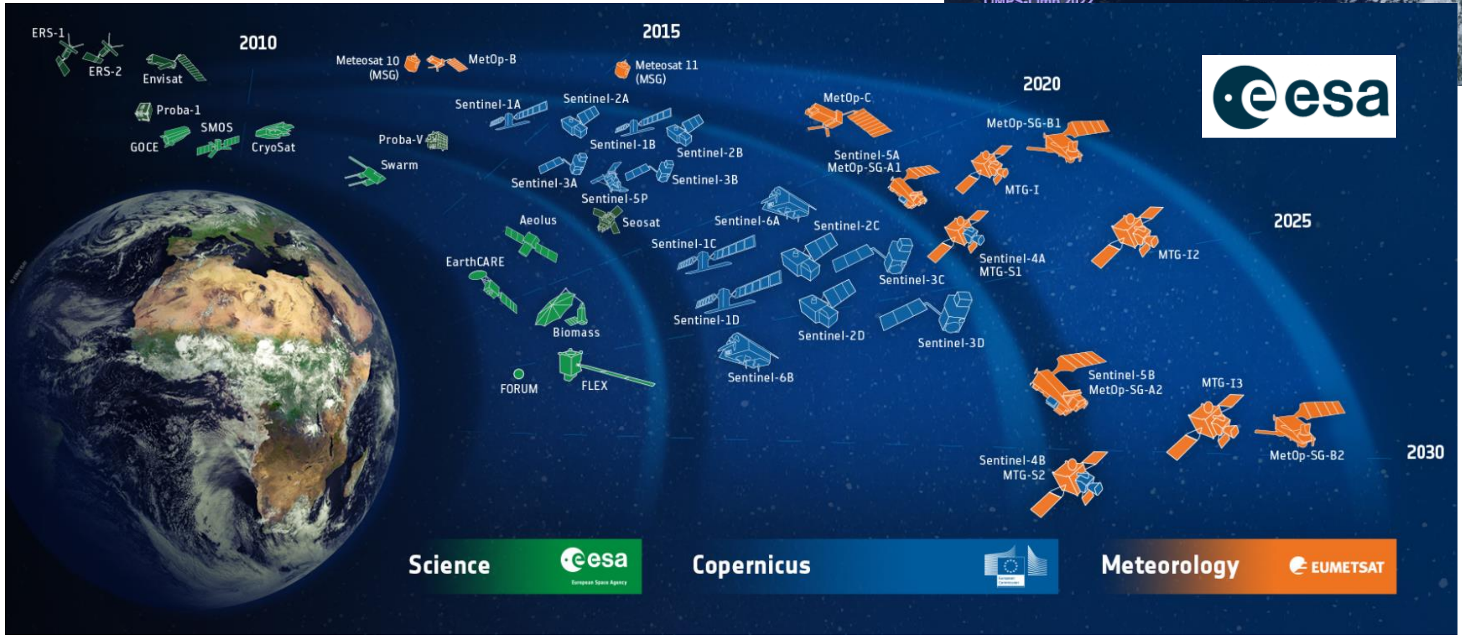


Temperature

Geospatial Technologies – Remote Sensing (RS)

…. and there are plenty of satellites!

Only those from the National Aeronautics and Space Administration (NASA) and European Space Agency (ESA) shown here



Geospatial Technologies – Remote sensing to combat malaria

A use which began a long time ago and which continues to support programs to combat vector-borne diseases in particular (example for Malaria presented here)

1994

Ecological Applications, 4(1), 1994, pp. 81–90
© 1994 by the Ecological Society of America

REMOTE SENSING OF TROPICAL WETLANDS FOR MALARIA CONTROL IN CHIAPAS, MEXICO[1]

KEVIN O. POPE
Geo Eco Arc Research, 2222 Foothill Boulevard, Suite E-272, La Cañada, California 91011 USA
ELISKA REJMANKOVA
Division of Environmental Studies, University of California, Davis, California 95616 USA
HARRY M. SAVAGE
Medical Entomology and Ecology Branch, Division of Vector Borne Infectious Disease (DVBID), Center for Disease Control, Fort Collins, Colorado 80522 USA
JUAN I. ARREDONDO-JIMENEZ AND MARIO H. RODRIGUEZ
Centro de Investigación de Paludismo, A.P. 537, Tapachula, Chiapas 30700 México
DONALD R. ROBERTS
Department of Preventative Medicine and Biometrics, Uniformed Services University of the Health Sciences, 4301 Jones Bridge Road, Bethesda, Maryland 20814 USA

2005

Parassitologia 47: 81-96, 2005

Application of Geographical Information Systems and Remote Sensing technologies for assessing and monitoring malaria risk

P. Ceccato[1], S.J. Connor[1], I. Jeanne[2], M.C. Thomson[1]

2017

3rd ICOIRS 2017 IOP Publishing
IOP Conf. Series: Earth and Environmental Science 165 (2018) 012012 doi:10.1088/1755-1315/165/1/012012

Application of Remote Sensing and GIS for Malaria Disease Susceptibility Area Mapping in Padang Cermin Sub-District, District of Pesawaran, Lampung Province

Adhina Azdah Hanifati[1], Anggi Permata[1], Dian Mustofa[1], Dita Eko Wulandari[1*], Intan Dewi Ratnasari[1], Nabila Anggita Ekafitri[1], Yusron Hidayat Ridho[1] and Prima Widayani[1]
[1]Cartography and Remote Sensing, Departement of Science Information Geography, Faculty of Geography, Gadjah Mada University, Yogyakarta 55281, Indonesia
dita.eko.w@mail.ugm.ac.id

2021

McMahon et al. Int J Health Geogr (2021) 20:28
https://doi.org/10.1186/s12942-021-00282-0
International Journal of Health Geographics
RESEARCH Open Access

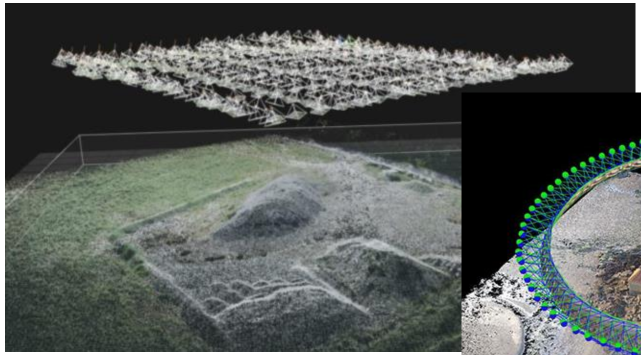
Remote sensing of environmental risk factors for malaria in different geographic contexts

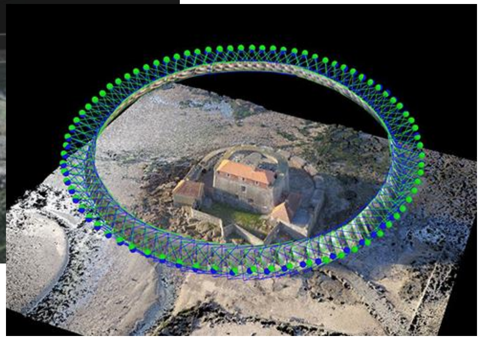
Andrea McMahon[1], Abere Mihretie[2], Adem Agmas Ahmed[3], Mastewal Lake[4], Worku Awoke[5] and Michael Charles Wimberly[1*]

Geospatial Technologies – Photogrammetry

Photogrammetry: Determination of the dimension of objects, by means of measurements made on photographic perspectives of these objects.

- A camera is attached to a flying object or to the ground





- Examples of derived data

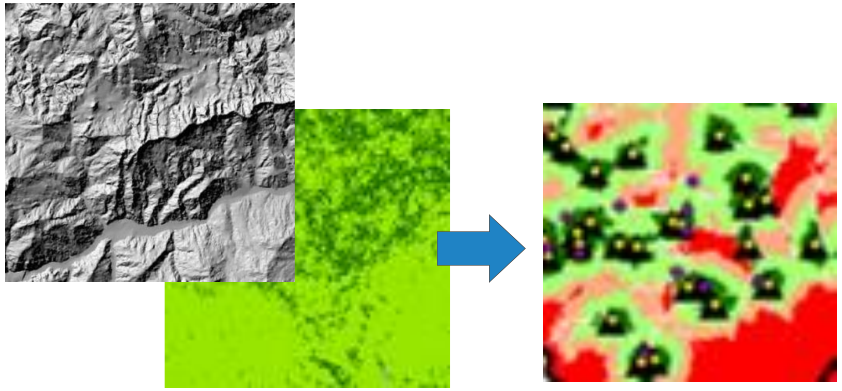
Topography

3D views

Use of remote sensing and photogrammetry for other applications

Automatic, or semi-automatic, extraction of geographic features visible on satellite (or other) imagery including building footprints which are core to population estimation and spatial distribution (Session 15)

Using satellite (or other) imagery as a ground reference to assess and improve the quality of geospatial data (Session 15)

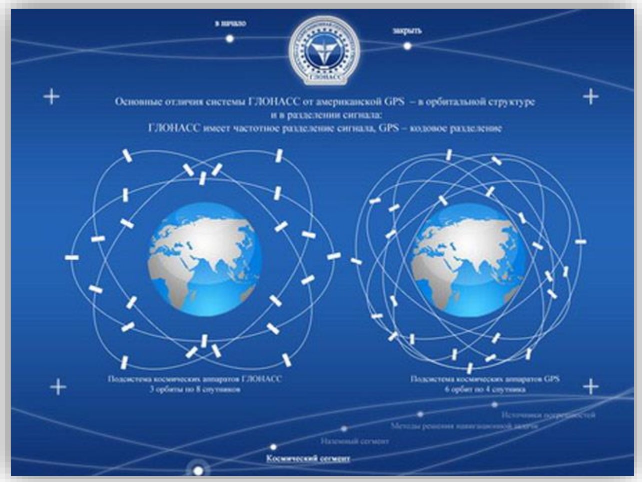


Use of the digital elevation model and land cover to analyze accessibility to care

Remote sensing and photogrammetry generates key geospatial data needed to operationalize several of the applications of geospatial data and technologies

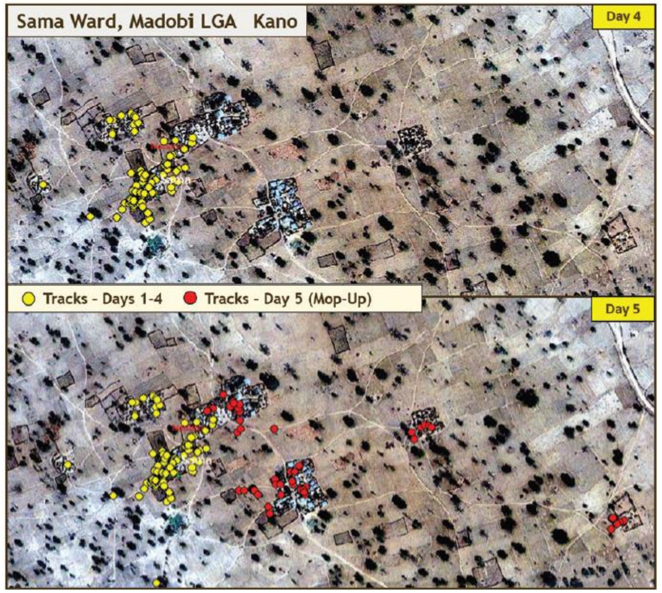
Geospatial Technologies – Global Navigation Satellite Systems (GNSS)

Use of a Global Navigation Satellite System (GNSS) enabled device to get to a particular location (navigate), track movements or collect geographic coordinates (latitude, longitudes) in the field



Global Navigation Satellite System (GNSS)

Navigation



Tracking to support Polio eradication in Nigeria

Collection of geographic coordinates in the field

Covered in more details in Session 17

Geospatial Technologies – Geographic Information Systems (GIS)

Two types of definitions

"A **computer system** that analyzes and displays geographically referenced information"

"**Computer tool** for representing and analyzing all the things that exist on earth as well as all the events that occur there"

➡ GIS as a geospatial technology - software

"**Information system** designed to collect, store, process, analyze, manage, and present all types of spatial and geographic data"

"**Information system** set up by an organization to describe the spatial objects, phenomena, and processes that are necessary for its action "

➡ GIS as an information system

➡ Often a source of confusion

➡ Both covered in more details in Session 18

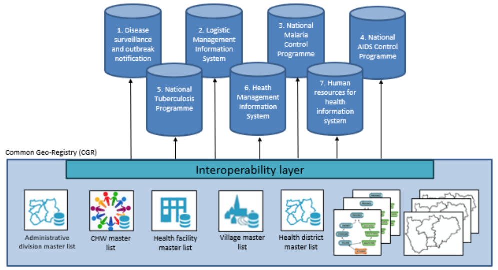
Geospatial Technologies – Registries and Common Geo-Registry (CGR)

Registry: IT solution to store, maintain, validate, update and share a master list.

- Container that manages only one master lists and potentially its associated hierarchies and geospatial data

Common Geo-Registry: IT solution that allows the simultaneous hosting, management, regular update, and sharing of master lists as well as associated hierarchies and geospatial data for the geographical objects core to development in general and public health in particular.

- Container that simultaneously manages multiple master lists and their associated hierarchies and geospatial data



- Both covered in more detail in Session 19

…and in the end

Please remember that:

- Technology is not supposed to guide the process but to support it
- The choice of technology(ies) must be based on clearly defined needs

➡ Choosing the technology(ies) is not the starting point of the process

- And above all,...Garbage in – Garbage out!

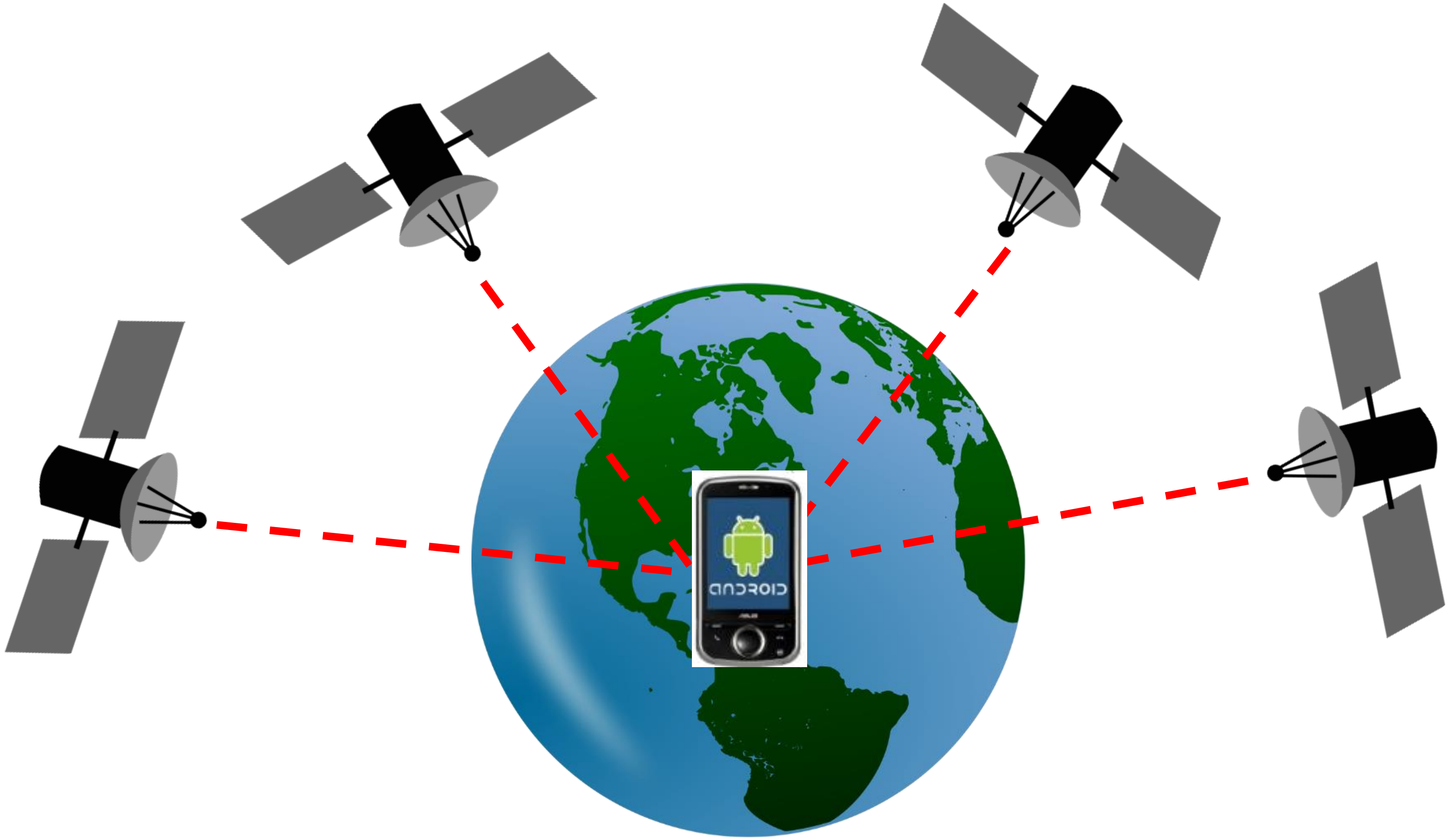
Geo-enabling the Health Information System, programs or interventions training workshop for Asia Pacific

…and beyond

Session 17: Introduction to Global Navigation Satellite System (GNSS)

Global Navigation Satellite System (GNSS)

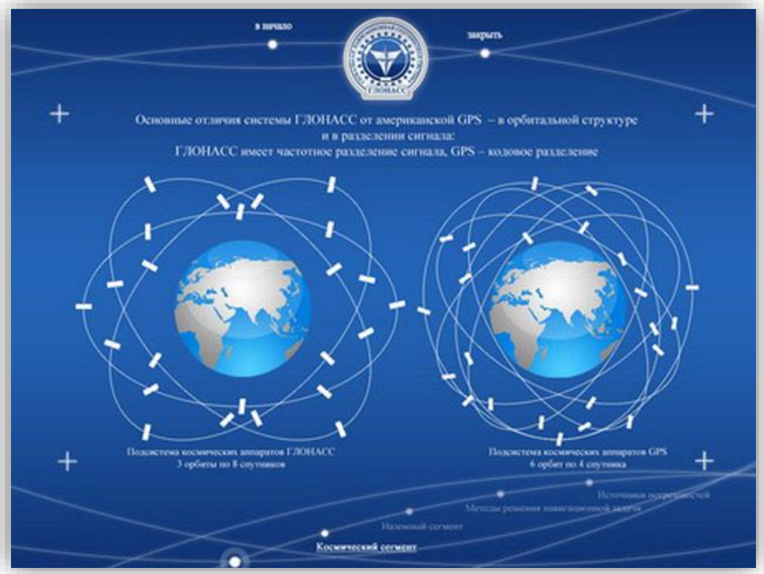
Constellation of satellites providing signals from space that transmit positioning and timing data to GNSS receivers. The receivers then use this data to determine its location.



Global Navigation Satellite Systems (GNSS)

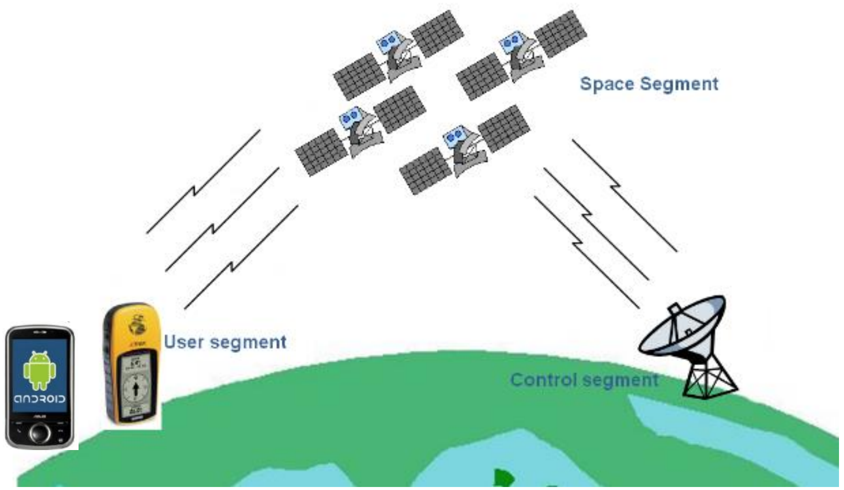
There are currently four different satellite navigation systems providing autonomous geospatial positioning:

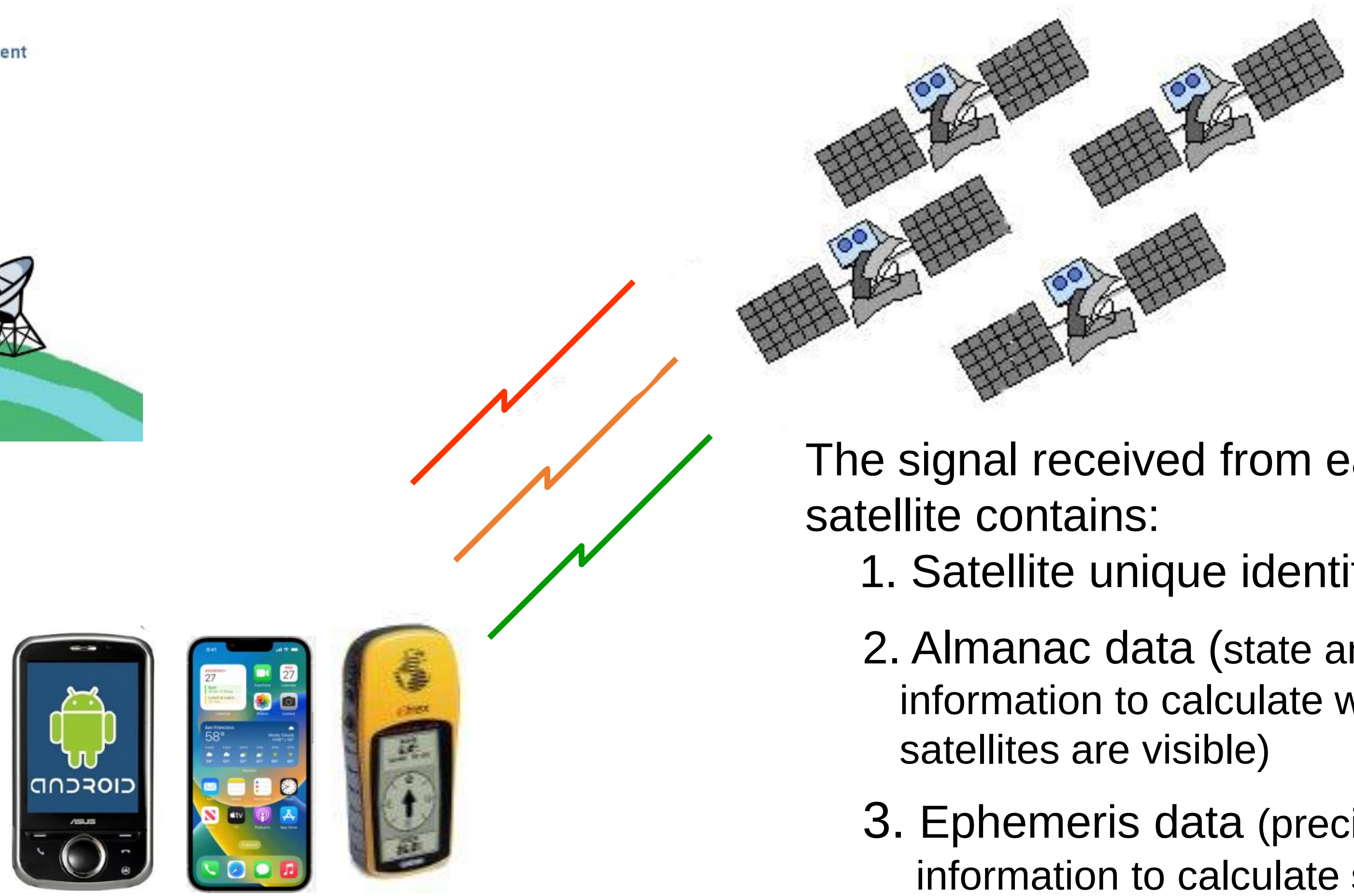
GPS (USA), GLONASS (Russia), BeiDou (China), and Galileo (EU).



System	GPS	GLONASS	BeiDou	Galileo
Owner	United States	Russian Federation	China	European Union
Orbital altitude	20, 180 km (12, 540 mi)	19, 130 km, (11, 890 mi)	21, 150 km, (13, 140 mi)	23,222 km , (14, 429 mi)
Period	11.97 h, (11 h 58 min)	11.26 h, (11 h 16 min)	12.63 h, (12 h 38 min)	14.08 h, (14h 5min)
Number of satellites	32 (at least 24 by design)	28 (at least 24 by design) including: 24 operational 2 under check by the satellite prime contractor 2 in flight tests phase	5 geostationary orbit (GEO) satellites, 30 medium Earth orbit (MEO) satellites	4 in-orbit validation satellites + 8 full operation capable satellites in orbit 22 operational satellites budgeted
Frequency	1.57542 GHz (L1 signal) 1.2276 GHz (L2 signal)	Around 1.602 GHz (SP) Around 1.246 GHz (SP)	1.561098 GHz (B1) 1.589742GHz (B1-2) 1.20714 GHz (B2) 1.26852 GHz (B3)	1.164-1.215 GHz (E5a and E5b) 1.260-1.300 GHz (E6) 1.559-1.592 GHz (E2-L1-E11)
Status	Operational	Operational	22 satellites operational, 40 additional satellites 2016-2010	8 satellites operational, 22 additional satellites 2016-2020

GNSS – How it works





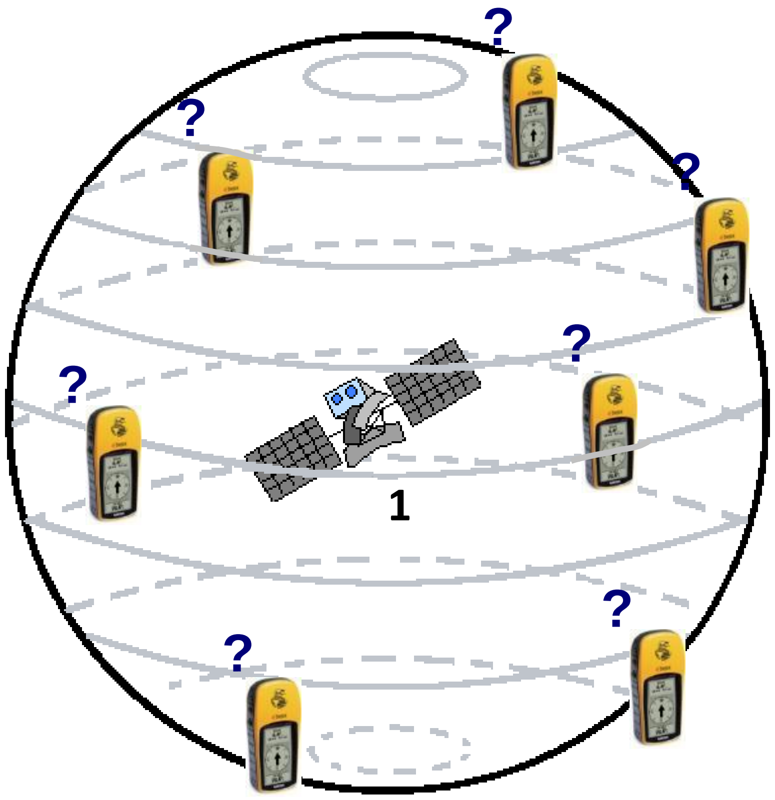
No need for internet!!!

The signal received from each satellite contains:

1. Satellite unique identifier
2. Almanac data (state and orbital information to calculate which satellites are visible)
3. Ephemeris data (precise orbital information to calculate satellite location)

GNSS – How it works

When receiving the signal from only one satellite

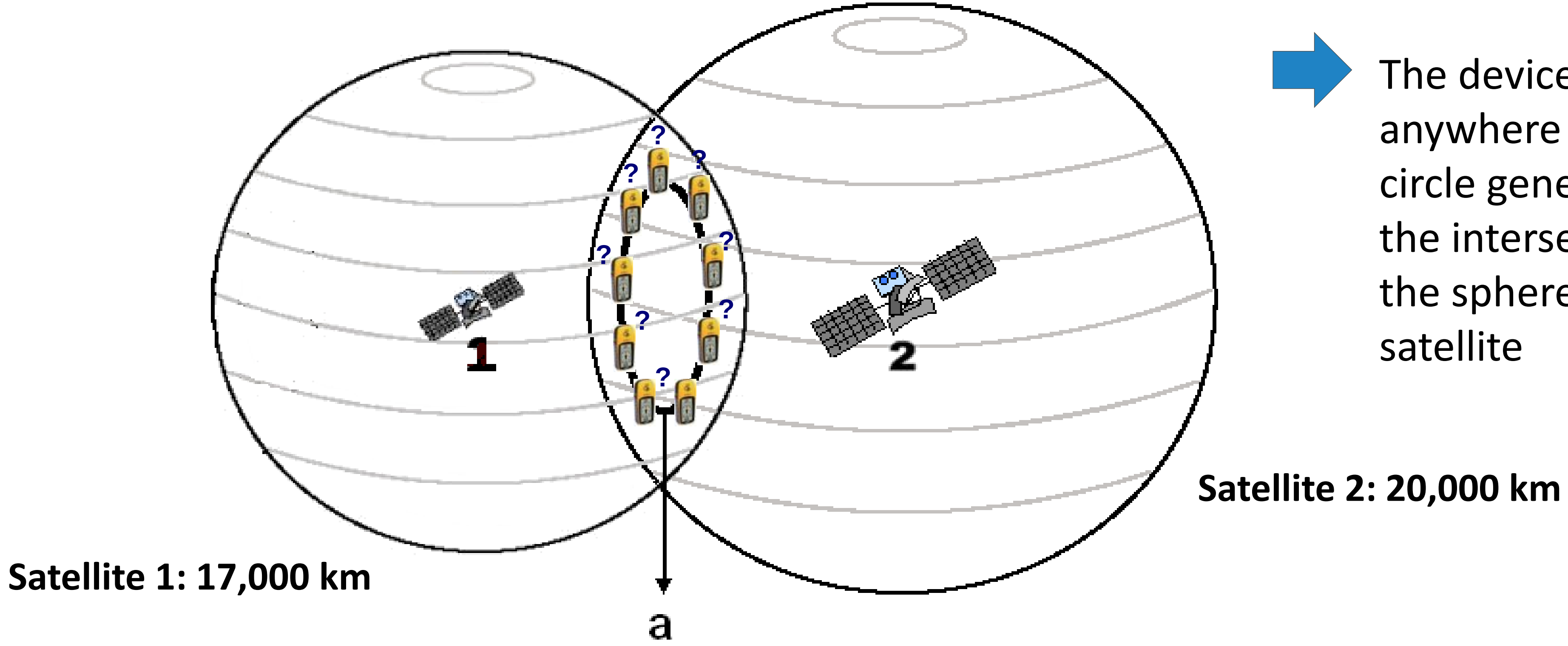


Satellite 1: 17,000 km

➡ The device can be anywhere of a sphere with a radius equal to the distance measured between the satellite and the device

GNSS – How it works

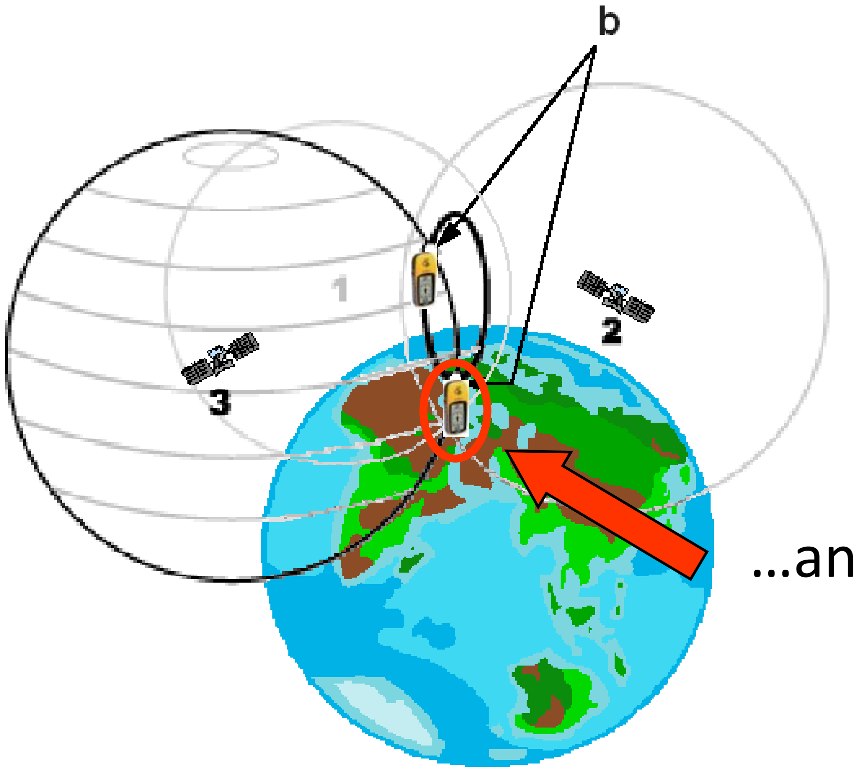
When receiving the signal from only one satellite



The device can be anywhere along the circle generated by the intersection of the sphere of each satellite

GNSS – How it works

As soon as you receive the signal from 3 satellites... ➜ Intersection between the circle and one more sphere => 2 points



...and with 4 signals ➜ Only 1 point possible

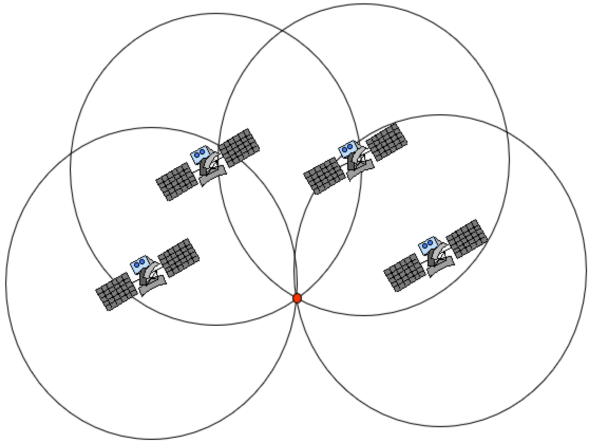
➜ Reason why you need at least 4 satellite signals to get a good reading

➜ Facilitated by the existence of the 4 constellations (if your device can receive their signal)

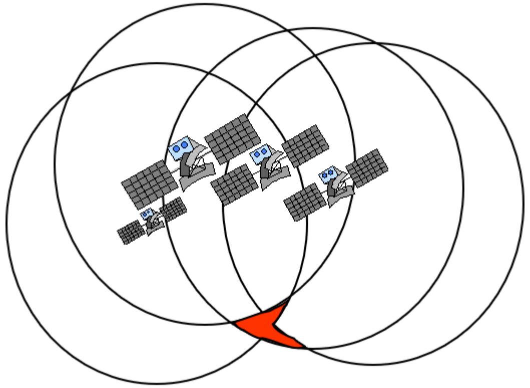
GNSS - Source of signal errors

Another thing which is facilitated by the existence of the 4 constellations

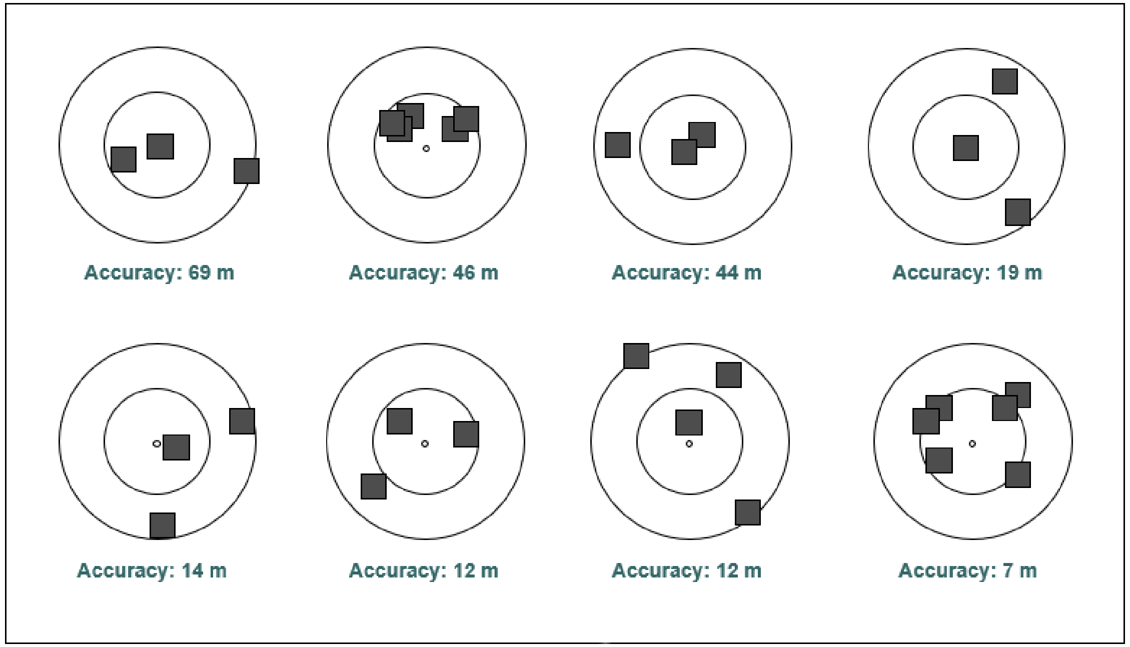
Positional Dilution of Precision (PDOP)



Good PDOP



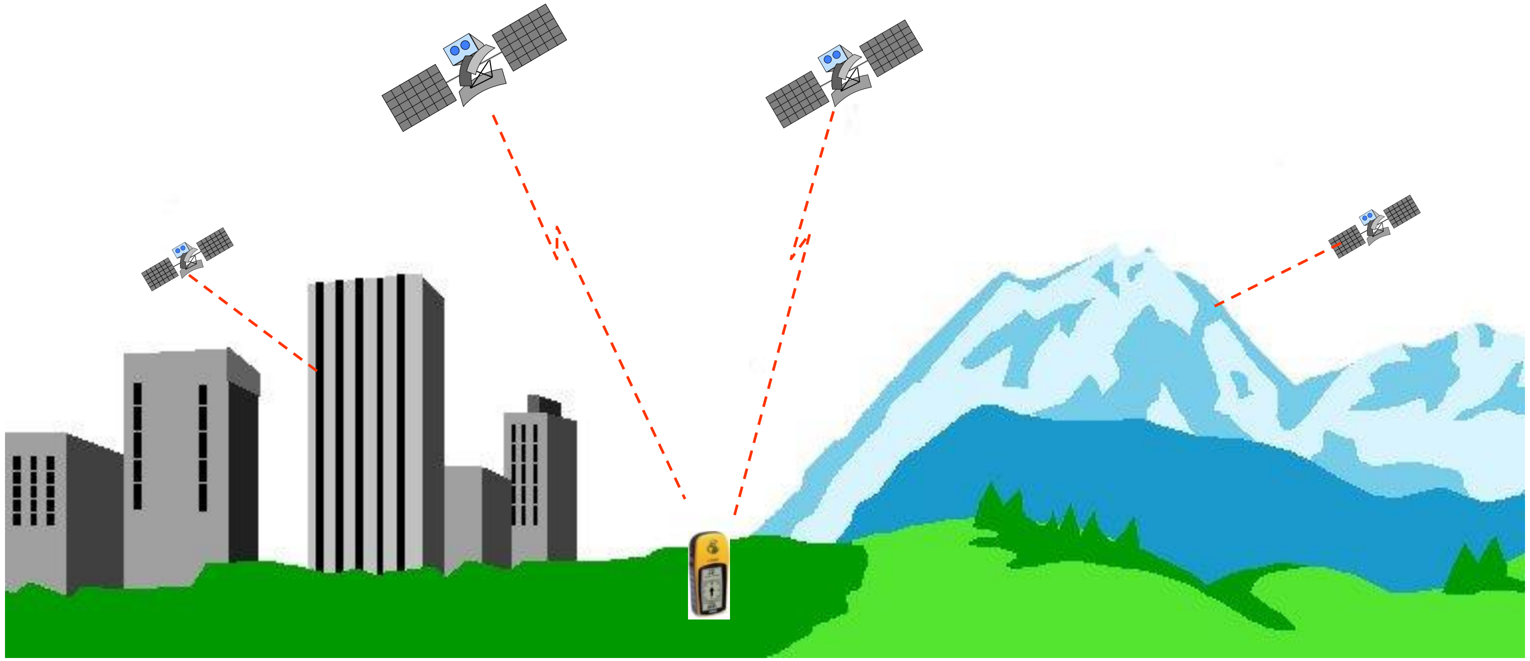
Poor PDOP



It is preferable to have a good dispersion and to look at the accuracy measurement given by the device

GNSS - Source of signal errors

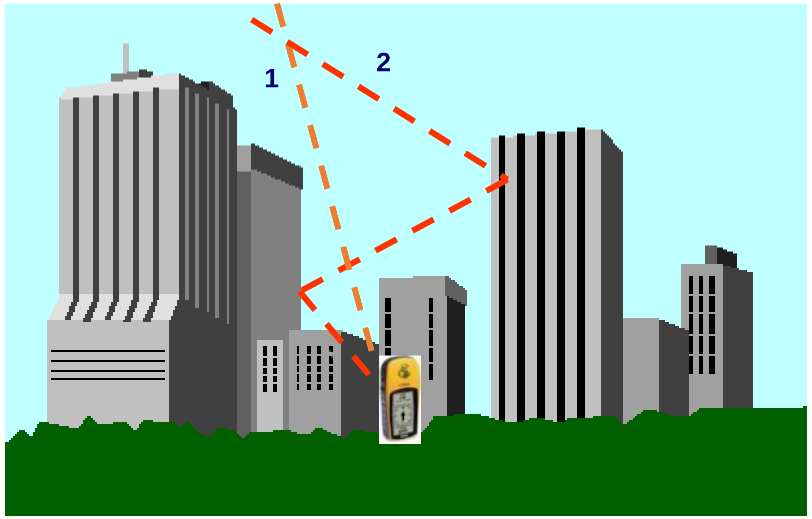
Natural or artificial barriers

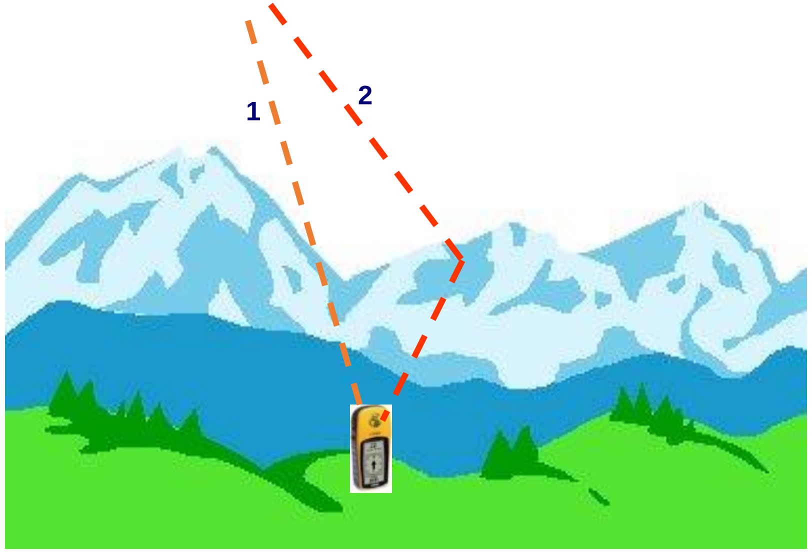


➡ Important to be in the most open space possible when collecting geographic coordinates

GNSS - Source of signal errors

Signal multipath





➡ Important to be in the most open space possible when collecting geographic coordinates

GNSS - Devices

➡ Large selection / Different prices!

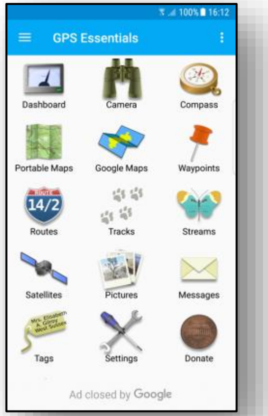
Minimum requirements:

1. Allows to be configured as follows:
   a. Position format (decimal degrees: hddd.ddddd)
   b. Map datum/Cartographic reference system: WGS84
   c. Map spheroid: WGS84
   d. Distance and speed: Meter
2. Provide a reading with at least 5 decimal places to reach a level of precision down to the meter
3. Display the following information:
   a. Number of satellite signals received
   b. Accuracy measure
4. Having access to GPS and GLONASS constellations (Also having access to Galileo and Bei Dou is a big plus)

➡ A smart phone with a good GNSS receiver and an app is the option being used the most frequently nowadays

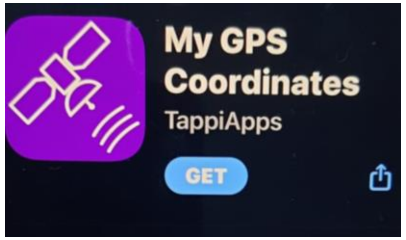
GNSS Apps for smart phones (Android, iPhone)

Android



GPS Essentials is a free app available for Android devices with a built-in GNSS receiver that complies with all the recommended requirements

iPhone



"My GPS coordinates" is a free app available for Apple devices (iPhone/iPad)

➡ These app can be used as an alternative to dedicated GNSS-enabled devices when collecting geographic coordinates as it complies with the specifications discussed in previous slides.

GNSS - Unit setting

Distance and Speed **Metric**
Elevation (Vertical Speed) **Metric(m/min)**

Position Format **hddd.ddddd**
Map Datum **WGS84**
Map Spheroid **WGS 84**

Must match the data specifications

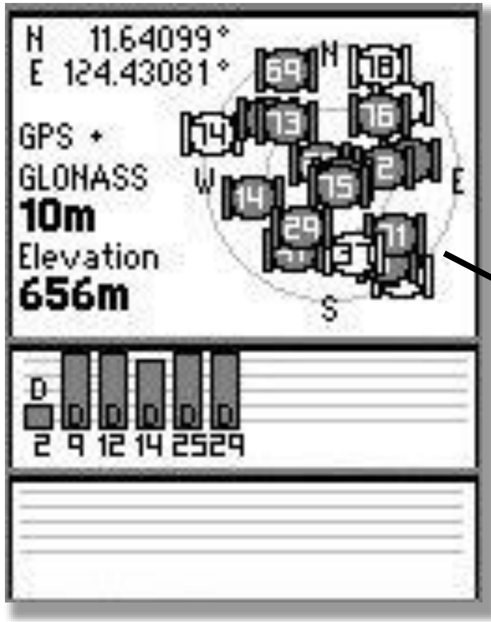
Taking a reading

Coordinates

GPS and GLONASS activated

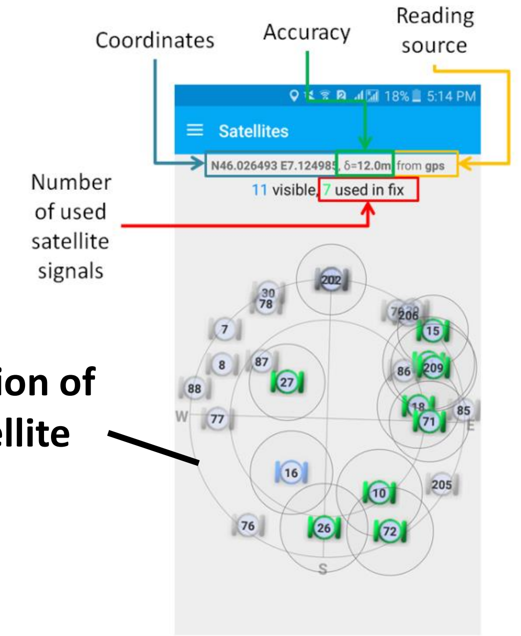
Accuracy value

Number of satellite signals received



GNSS device

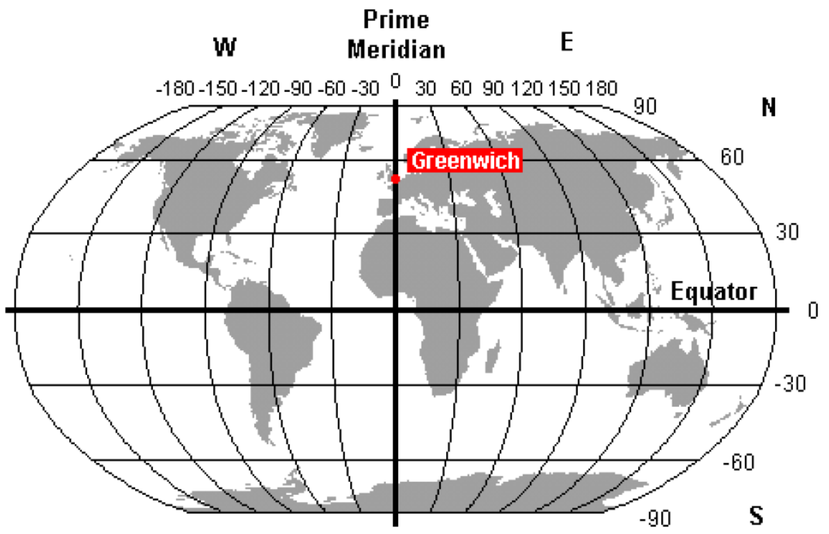
Position of satellite

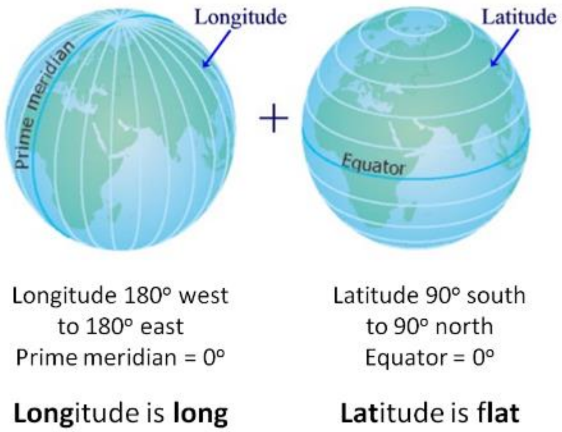


Mobile phone + app

GNSS - Why using decimal degrees (latitude and longitude)?

- Easiest georeferencing method to use
  - Standardized, stable, unique, infinitely fine resolution
- Uses a well-defined and fixed frame of reference
  - Based on the Greenwich (Prime) Meridian and the Equator
- Most used in geospatial technologies
  - Can be easily projected if needed





GNSS - Scale, accuracy and precision

Classification	Map examples	Range examples	Expected positional accuracy (m)
Large scale	Village, town or sub national level map	1:1 - 1:10,000	0 - 8
		1:50,000 - 1:100,000	26 - 52
		1:250,000 - 1:500,000	130 - 259
Medium scale	Country map	1:750,000 - 1:1,000,000	389 - 518
		1:1,500,000 - 1:2,000,000	777 - 1,036
Small scale	World map	1:5,000,000 - 1:10,000,000	2,591 - 5,182
		1:25,000,000 - 1:50,000,000	12,954 - 25,908

15 m

Recommended

Number of captured digits	Example (Longitude)	Maximum potential error (m)	Precision level
1	120.9	11,132	
2	120.93	1,113	Kilometre
3	120.037	111	Hectometre
4	120.9376	11	Decametre
5	120.93761	1	Metre

GNSS - Data collection methods

Without GNSS-enabled device

<table>
<tr><td rowspan="2">Needs
Scalability</td><td>Main data use: visualization</td><td colspan="3">Main data use: Geographic component of a point type registry, visualization, spatial analysis and spatial modeling</td></tr>
<tr><td>Accuracy: low to moderate</td><td>Accuracy: moderate to high</td><td colspan="2">Accuracy: high</td></tr>
<tr><td>High</td><td>1. Paper form + device without GNSS + offline map application</td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">Moderate to low</td><td>2. Paper form + device without GNSS + offline map application + min/max lat/long annex</td><td>4. Paper form + GNSS enabled device with accuracy indicators</td><td>7. Paper form + GNSS enabled device with accuracy indicators + min/max lat/long annex or offline map application</td><td>10. Paper form + GNSS enabled device with accuracy indicators + min/max lat/long annex + offline map application</td></tr>
<tr><td>3. Electronic form (table) + device without GNSS + offline map application + min/max lat/long annex</td><td>5. Electronic form (table) + GNSS enabled device with accuracy indicators</td><td>8. Electronic form (table)+ GNSS enabled device with accuracy indicators + min/max lat/long annex or offline map application</td><td>11. Electronic form (table) + GNSS enabled device with accuracy indicators + min/max lat/long annex + offline map application</td></tr>
<tr><td>Low</td><td></td><td>6. Data collection application integrated in the GNSS enabled device with accuracy indicators</td><td>9. Data collection application integrated in the GNSS enabled device with accuracy indicators + min/max lat/long annex or offline map application</td><td>12. Data collection application integrated in the GNSS enabled device with accuracy indicators + min/max lat/long annex + offline map application</td></tr>
</table>

With GNSS-enabled device

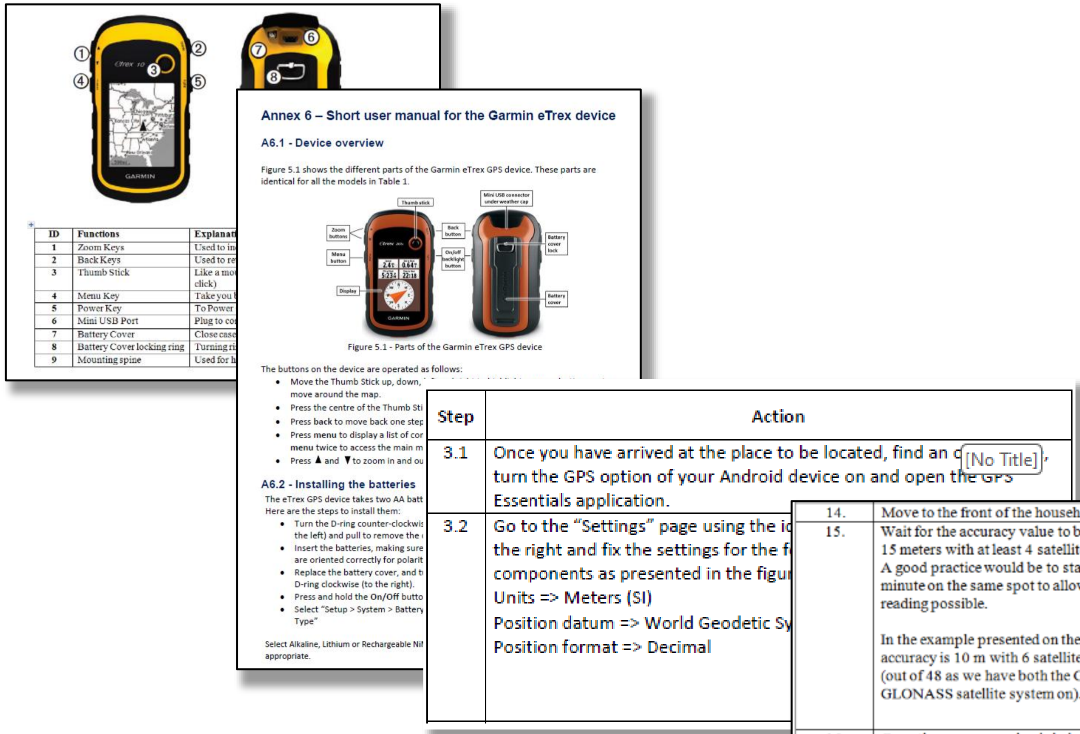
https://www.healthgeolab.net/DOCUMENTS/Guide_HGLC_Part2_4_2.pdf

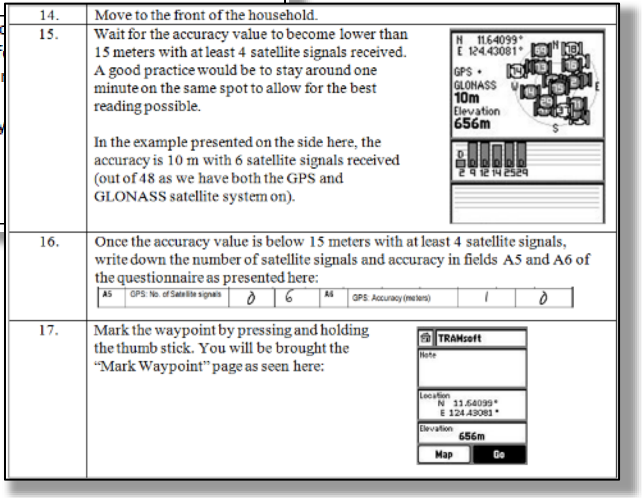
GNSS - Standard Operating Procedure (SOP)

It is important to have and follow a Standard Operating Procedure (SOP)

The SOP should at least cover:

1. Description of the device being used
2. Device and/or app user manual (buttons, functions, etc.)
3. How to configure the device and/or app
4. Material to use in addition to the device and/or app (e.g. form, other documents)
5. Step-by-step process for data collectors





It is also important to have an SOP for the supervisors

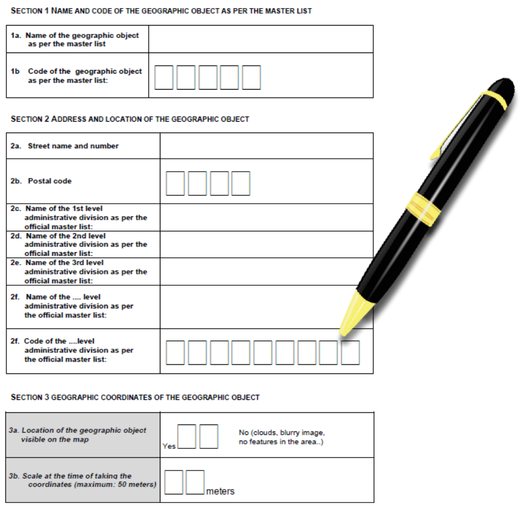
https://www.healthgeolab.net/DOCUMENTS/Guide_HGLC_Part2_4_2.pdf

GNSS – Before data collection

This phase is critical for the data collectors to be independent in the field and able to collect high quality geographic coordinates with minimal supervision

Two primary actions:

1. Prepare the material needed to implement the selected data collection method
2. Select and train the data collectors and their supervisor(s)



SECTION 1 NAME AND CODE OF THE GEOGRAPHIC OBJECT AS PER THE MASTER LIST

1a. Name of the geographic object as per the master list	
1b Code of the geographic object as per the master list:	☐☐☐☐☐

SECTION 2 ADDRESS AND LOCATION OF THE GEOGRAPHIC OBJECT

2a. Street name and number	
2b. Postal code	☐☐☐☐
2c. Name of the 1st level administrative division as per the official master list:	
2d. Name of the 2nd level administrative division as per the official master list:	
2e. Name of the 3rd level administrative division as per the official master list:	
2f. Name of the .... level administrative division as per the official master list:	
2f. Code of the ....level administrative division as per the official master list:	☐☐☐☐☐☐☐☐☐

SECTION 3 GEOGRAPHIC COORDINATES OF THE GEOGRAPHIC OBJECT

3a. Location of the geographic object visible on the map	Yes ☐ ☐ No (clouds, blurry image, no features in the area..)
3b. Scale at the time of taking the coordinates (maximum: 50 meters)	☐☐ meters

GNSS – Before data collection (material preparation)

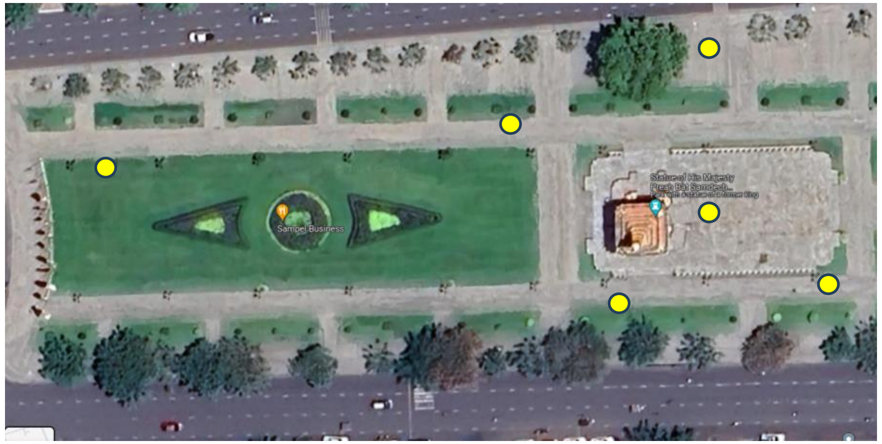
The preparation of the material must cover the:

1. Selection of the collection method that will be implemented
2. Adjustment of the data collection form to match the selected method
3. Creation of the electronic form, if required
4. Preparation of the associated documents and material
5. Development of the SOP to be implemented in the field
6. Installation of the applications on the devices if required
7. Configuration of the devices and/or app and verification that the GNSS receiver is working correctly
8. Preparation of the training material

Landmark visible on satellite images

Device readings

GNSS receiver working correctly



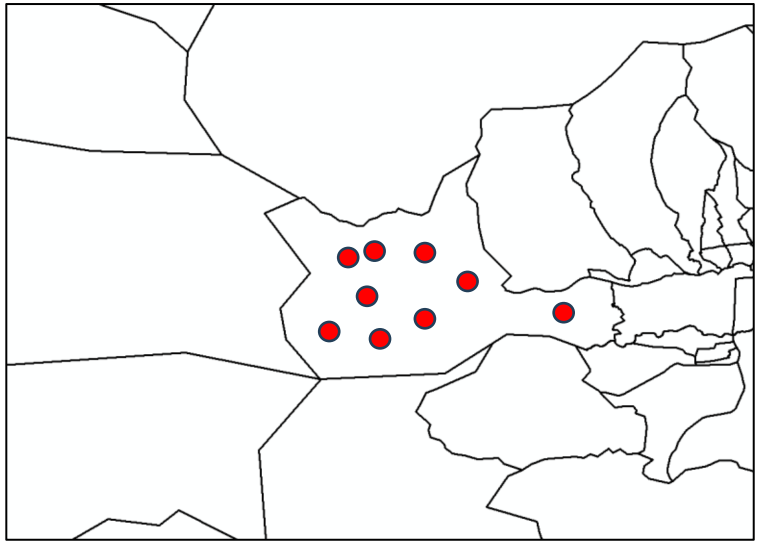
Potential issues with the GNSS receiver

GNSS – Before data collection (selection and training of collectors)

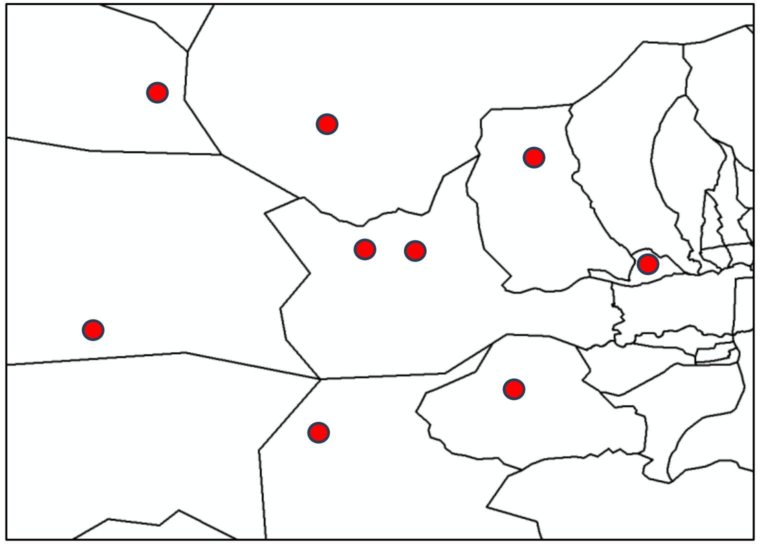
Knowledge and experience in using GNSS-enabled devices should be considered when selecting data collectors and their supervisor(s).

In addition to selecting qualified data collectors, training data collectors and their supervisor(s) is one of the, if not the most, important steps in the pre-survey process.

This is what will make the difference between…



…this…



..and this

GNSS – Before data collection (training)

The training should aim to provide a good understanding and proper use of the different documents, the data collection equipment, and SOPs. The training should also cover appropriate troubleshooting methods regarding commonly encountered issues while in the field

To achieve these goals, the training should at least cover the following topics:

1. Overview of existing GNSS and use of the chosen GNSS-enabled device
2. Introduction to the GNSS-enabled device
3. SOP to complete the data collection instrument
4. Hands-on practice session

It is important to:

- Allocate enough time for the above-mentioned session.
- Ensure that the participants can ask questions.
- Give copies of the different documents to all the participants.
- Ensure every participant has the opportunity for hands-on practice of using a GNSS-enabled device.
- Check all the GNSS-enabled devices to be used in the field if not already done

GNSS – During data collection

During the field data collection exercise, the data collectors should follow the SOP using the associated documents that have been provided to them.

Despite a high-quality training session, it remains important to verify the methods used to collect the geographic location information and address any unexpected issues while the data collectors are in the field.

The following verification steps should be followed depending on available resources and the extent of the surveyed area:

1. On-site spot checks of data accuracy and completeness conducted by the data collection supervisor. Part of the check for accuracy can be performed using Survey123 for ArcGIS, Maps.Me, or Google Maps as way to ensure that the point is falling in the expected area.
2. Verification of the data remotely through periodic submissions of the collected data in a spreadsheet, either using Google Sheets online or emailing a Microsoft Excel spreadsheet to the data collection supervisor. For certain applications, a purpose-designed online database system may be used as well. However, these solutions usually require a regular access to the internet.

GNSS – After data collection

Ensure that the collected data is organized in a structured table that can be saved as a spreadsheet (e.g. in Microsoft Excel) and should contain all the fields that are on the data collection form

HF_Name	HF_Code	Address	Pos_Code	Reg_name	Prov_name	Mun_name	Bgy_name	Bgy_code	Nbr_Sat	Accuracy	Wtin_box	Wtin_map	Latitude	Longtitude	Waypoint	Comments	Op_Name	Dev_brand	Dev_ser	Coll_date
SANTANDER RURAL HEALTH UNIT	903	NATIONAL ROAD	6026	REGION VII	CEBU	SANTANDER	POBLACION	PH072245008	10	9.3	Yes	Yes	9.41705	123.3349	1	None	Daniel Durand	Garmin eTrex 30	30E00828	10-12-12
ALCANTARA RURAL HEALTH UNIT	1399	NA	6033	REGION VII	CEBU	ALCANTARA	POBLACION	PH072201007	10	10.5	Yes	Yes	9.97036	123.4024	1	None	Daniel Durand	Garmin eTrex 30	30E00828	10-12-12
ALCOY RURAL HEALTH UNIT	1437	NATIONAL HIGHWAY	6023	REGION VII	CEBU	ALCOY	POBLACION	PH072202006	11	10.1	Yes	Yes	9.70925	123.50729	2	Reading taken 10 meters away from the facility	Josephine Baker	Garmin eTrex 20	30E00615	10-12-12
BALIRI RURAL HEALTH UNIT	1454	NA	6036	REGION VII	CEBU	BARILI	POBLACION	PH072210038	9	10.0	Yes	Yes	10.11565	123.50997	1	None	Josephine Baker	Garmin eTrex 20	30E00615	10-12-12
BORBON RURAL HEALTH UNIT	1458	NA	6008	REGION VII	CEBU	BORBON	POBLACION	PH072213015	10	10.3	Yes	Yes	10.88766	124.02753	1	None	Daniel Durand	Garmin eTrex 30	30E00828	10-12-12
MINGLANILLA RURAL HEALTH UNIT I	1465	NA	6046	REGION VII	CEBU	MINGLANILLA	POBLACION WARD IV	PH072232013	10	10.1	Yes	Yes	10.24579	123.79552	1	None	Josephine Baker	Garmin eTrex 20	30E00615	10-12-12
MINGLANILLA RURAL HEALTH UNIT II	1897	LIPATA STREET	6046	REGION VII	CEBU	MINGLANILLA	LINAO	PH072232007	10	10.3	Yes	Yes	10.25576	123.80998	1	None	Josephine Baker	Garmin eTrex 20	30E00615	10-12-12
RONDA RURAL HEALTH UNIT	1983	NA	6034	REGION VII	CEBU	RONDA	POBLACION	PH072239011	10	10.4	Yes	Yes	10.00051	123.40961	2	Reading taken on the nearby parking	Josephine Baker	Garmin eTrex 20	30E00615	10-12-12
SAMBOAN RURAL HEALTH UNIT	2032	NA	6027	REGION VII	CEBU	SAMBOAN	POBLACION	PH072240011	11	10.0	Yes	Yes	9.52916	123.30664	1	None	Daniel Durand	Garmin eTrex 30	30E00828	10-12-12
CONSOLACION RURAL HEALTH UNIT	2890	NA	6001	REGION VII	CEBU	CONSOLACION	POBLACION OCCIDENTAL	PH072219013	10	10.2	Yes	Yes	10.37651	123.95548	1	None	Josephine Baker	Garmin eTrex 20	30E00615	10-12-12
BADIAN RURAL HEALTH UNIT	2971	NA	6031	REGION VII	CEBU	BADIAN	POBLACION	PH072207020	10	10.4	Yes	Yes	9.86547	123.39327	1	None	Daniel Durand	Garmin eTrex 30	30E00828	10-12-12
MENDELLIN RURAL HEALTH UNIT	3245	NA	6012	REGION VII	CEBU	MEDELLIN	POBLACION	PH072231014	10	9.7	Yes	Yes	11.13814	123.96175	1	None	Daniel Durand	Garmin eTrex 30	30E00828	10-12-12
SAN REMEGIO RURAL HEALTH UNIT	3830	NA	6011	REGION VII	CEBU	SAN REMIGIO	POBLACION	PH072243020	9	9.5	Yes	Yes	11.0844	123.93526	1	None	Josephine Baker	Garmin eTrex 20	30E00615	10-12-12
SOGOD RURAL HEALTH UNIT	3846	NA	6007	REGION VII	CEBU	SOGOD	POBLACION	PH072247016	10	8.0	Yes	Yes	10.74711	124.00234	1	None	Josephine Baker	Garmin eTrex 20	30E00615	10-12-12
MALABUYOC RURAL HEALTH UNIT	4618	NA	6029	REGION VII	CEBU	MALABUYOC	BARANGAY I (POB.)	PH072229015	9	10.2	Yes	Yes	9.65667	123.32608	1	None	Josephine Baker	Garmin eTrex 20	30E00615	10-12-12
TABOGON RURAL HEALTH UNIT	4662	NA	6009	REGION VII	CEBU	TABOGON	POBLACION	PH072248018	7	7.9	Yes	Yes	10.93972	124.02554	1	None	Josephine Baker	Garmin eTrex 20	30E00615	10-12-12
OSLOB RURAL HEALTH UNIT	4734	SAN JOSE STREET	6025	REGION VII	CEBU	OSLOB	POBLACION	PH072235020	10	9.7	Yes	Yes	9.52043	123.43307	1	None	Daniel Durand	Garmin eTrex 30	30E00828	10-12-12
TABUELAN RURAL HEALTH UNIT	4902	NA	6044	REGION VII	CEBU	TABUELAN	POBLACION	PH072249016	9	10.6	Yes	Yes	10.82051	123.86578	1	None	Josephine Baker	Garmin eTrex 20	30E00615	10-12-12
SIBONGA RURAL HEALTH UNIT	4953	NA	6020	REGION VII	CEBU	SIBONGA	POBLACION	PH072246021	10	10.3	Yes	Yes	10.0168	123.62104	1	None	Josephine Baker	Garmin eTrex 20	30E00615	10-12-12
DAANBANTAYAN RURAL HEALTH UNIT I	5321	NA	6013	REGION VII	CEBU	DAANBANTAYAN	POBLACION	PH072221016	11	9.9	Yes	Yes	11.25073	123.99672	1	None	Daniel Durand	Garmin eTrex 30	30E00828	10-12-12
CATMON RURAL HEALTH UNIT	5776	NA	6006	REGION VII	CEBU	CATMON	POBLACION	PH072216019	11	9.9	Yes	Yes	10.72265	124.01185	1	None	Daniel Durand	Garmin eTrex 30	30E00828	10-12-12
DUMANJUG RURAL HEALTH UNIT	6660	NA	6035	REGION VII	CEBU	DUMANJUG	POBLACION	PH072224039	11	10.4	Yes	Yes	10.05895	123.43551	1	None	Daniel Durand	Garmin eTrex 30	30E00828	10-12-12
BOLIJON RURAL HEALTH UNIT	7249	NATIONAL HIGHWAY	6024	REGION VII	CEBU	BOLJOON	POBLACION	PH072212005	10	10.3	Yes	Yes	9.62875	123.47986	1	None	Josephine Baker	Garmin eTrex 20	30E00615	10-12-12
CARMEN RURAL HEALTH UNIT	7262	NA	6005	REGION VII	CEBU	CARMEN	POBLACION	PH072215016	9	9.9	Yes	Yes	10.58881	124.0162	1	None	Daniel Durand	Garmin eTrex 30	30E00828	10-12-12
GINATILAN RURAL HEALTH UNIT	7668	NA	6028	REGION VII	CEBU	GINATILAN	POBLACION	PH072225012	10	10.2	Yes	Yes	9.56988	123.312	1	None	Daniel Durand	Garmin eTrex 30	30E00828	10-12-12
MOALBOAL RURAL HEALTH UNIT	7669	NA	6032	REGION VII	CEBU	MOALBOAL	POBLACION EAST	PH072223010	11	10.5	Yes	Yes	9.9364	123.39281	1	None	Josephine Baker	Garmin eTrex 20	30E00615	10-12-12
ALEGRIA RURAL HEALTH UNIT	7670	NA	6030	REGION VII	CEBU	ALEGRIA	POBLACION	PH072203007	9	10.0	Yes	Yes	9.72951	123.33949	1	None	Daniel Durand	Garmin eTrex 30	30E00828	10-12-12
MALINGIN BARANGAY HEALTH STATION	15099	NA	6013	REGION VII	CEBU	DAANBANTAYAN	MALINGIN	PH072221012	11	9.9	Yes	Yes	11.219	124.01289	1	None	Daniel Durand	Garmin eTrex 30	30E00828	10-12-12

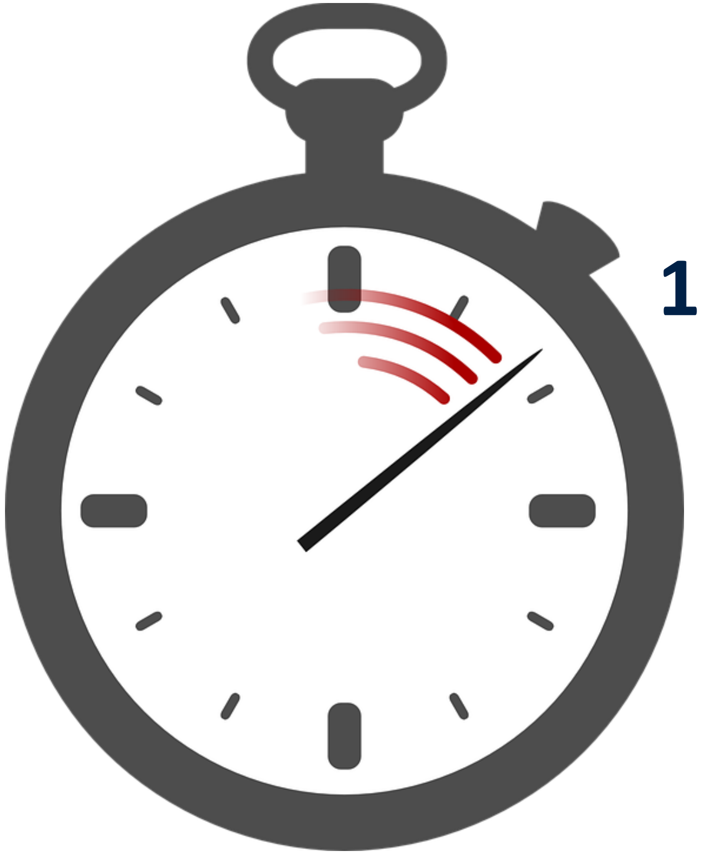
Don’t forget about the data catalogue and metadata worksheets covered during Session 14

GNSS - Summary

- Choose the appropriate GNSS-enabled device (check the quality of the GNSS receiver) and data collection method
- Use a pre-established Standard Operating Procedure (SOP) which includes all the necessary information for the data collectors to properly collect coordinates in the field (e.g. source of error signals) as well as a SOP for the supervisors
- Collect high accuracy (instrumental accuracy below 15 meters) and high precision (5 digits after the decimal point) coordinates
- Invest in a good training for data collectors and supervisors
- Establish a good monitoring process during data collection
- Properly store and document the geographic coordinates resulting from the data collection exercise

Note: Pay attention to potential ethical issues when locating or tracking individuals with a high accuracy !!!

Short break



10 min

Geo-enabling the Health Information System, programs or interventions training workshop for Asia Pacific

…and beyond

Session 18: Introduction to Geographic Information System (GIS)

Geographic Information Systems (GIS)

Two types of definitions

"A **computer system** that analyzes and displays geographically referenced information"

"**Computer tool** for representing and analyzing all the things that exist on earth as well as all the events that occur there"

➡ GIS as a geospatial technology- software

"**Information system** designed to collect, store, process, analyze, manage, and present all types of spatial and geographic data"

"**Information system** set up by an organization to describe the spatial objects, phenomena, and processes that are necessary for its action "

➡ GIS as an information system

➡ Often a source of confusion

GIS as a software

Desktop GIS software:

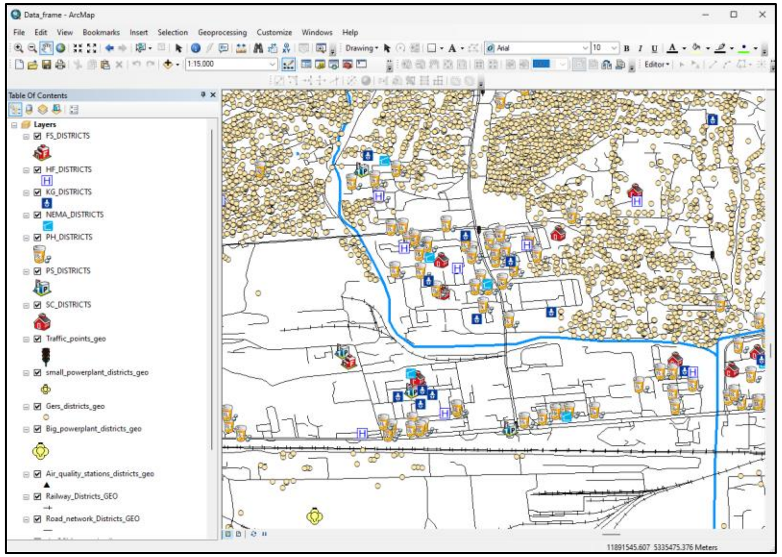
- Most used type of tool and providing the widest number of features. The most used being QGIS and ArcMap/ArcGIS Pro

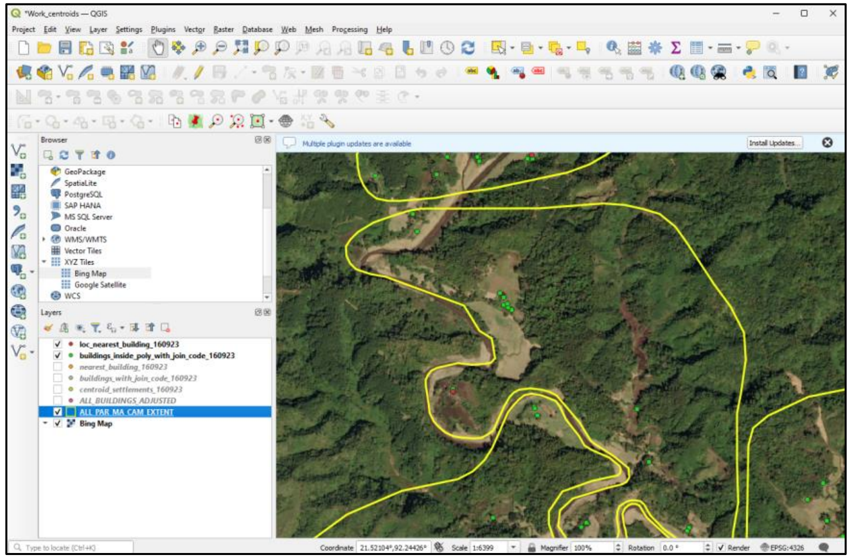
Online GIS application:

- Not as fast nor offering as many features as desktop GIS programs but still providing much of the same functionality (examples: ArcGIS Online (proprietary) or GeoNode (open source))
- Can provide a convenient bridge between desktop work and a mobile work environment
- Deployed either on the cloud or on a local server, each of which has a cost

GIS extensions:

- Additional tools that are required to operationalize certain applications and/or not available by default in desktop or online GIS software
- Available as extensions (example: ArcGIS Spatial Analyst Extension)

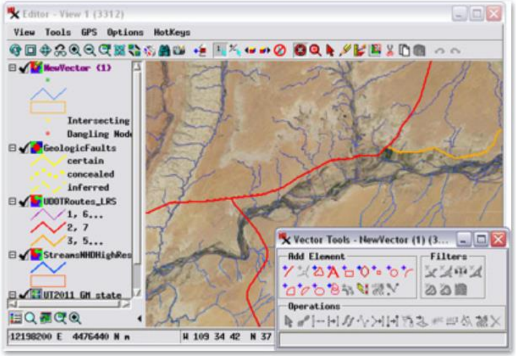


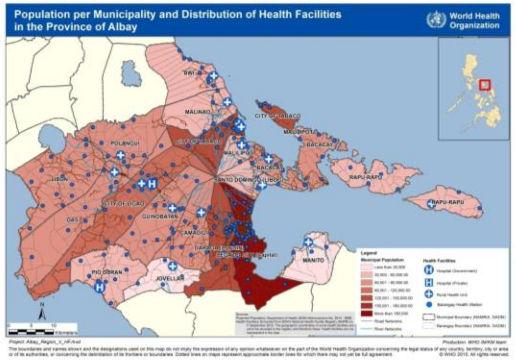


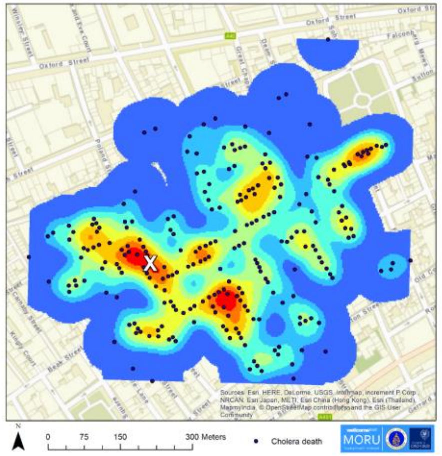
GIS as a software

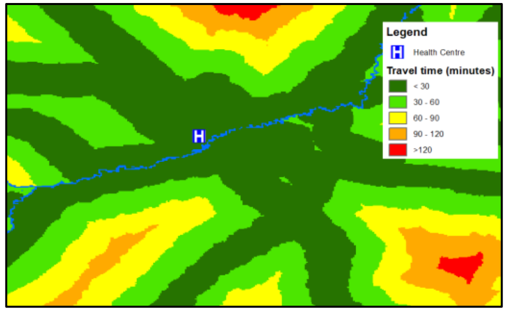
A real GIS software allows you to perform:

- <u>Geospatial data management</u>: All the disciplines related to managing geospatial data as a valuable resource (creating, editing,…)
- <u>Thematic mapping</u>: the process of creating thematic maps to convey information about a single topic or theme, such as population density or health.
- <u>Spatial analysis</u>: The process of examining the locations, attributes, patterns, and relationships of features in spatial data in order to address a question or gain useful knowledge
- <u>Spatial modeling</u>: A methodology or set of analytical procedures used to derive information about spatial relationships between geographic phenomena









➡ Software and applications not performing the above should not be considered a GIS software

Not everything is a GIS software!

Database management systems with a thematic mapping interface

➡ «Bridges» with GIS software that are existing or under development

Online mapping applications

GIS Based application

➡ « Real » GIS software

- ArcMap, ArcGIS, ArcGIS Pro www.esri.com
  - The most complete and versatile
  - Complete GIS ecosystem
  - Technical support
  - Proprietary (free/reduced cost licenses for the health sector)
- QGIS (www.qgis.org)
  - Very good for thematic mapping, sometimes limited for other functionalities but constantly improved
  - Open Source, limited technical support
  - Free

GIS – Open Source vs. Proprietary

The choice between the two must be based on the context, needs, and resources available.

Some examples:

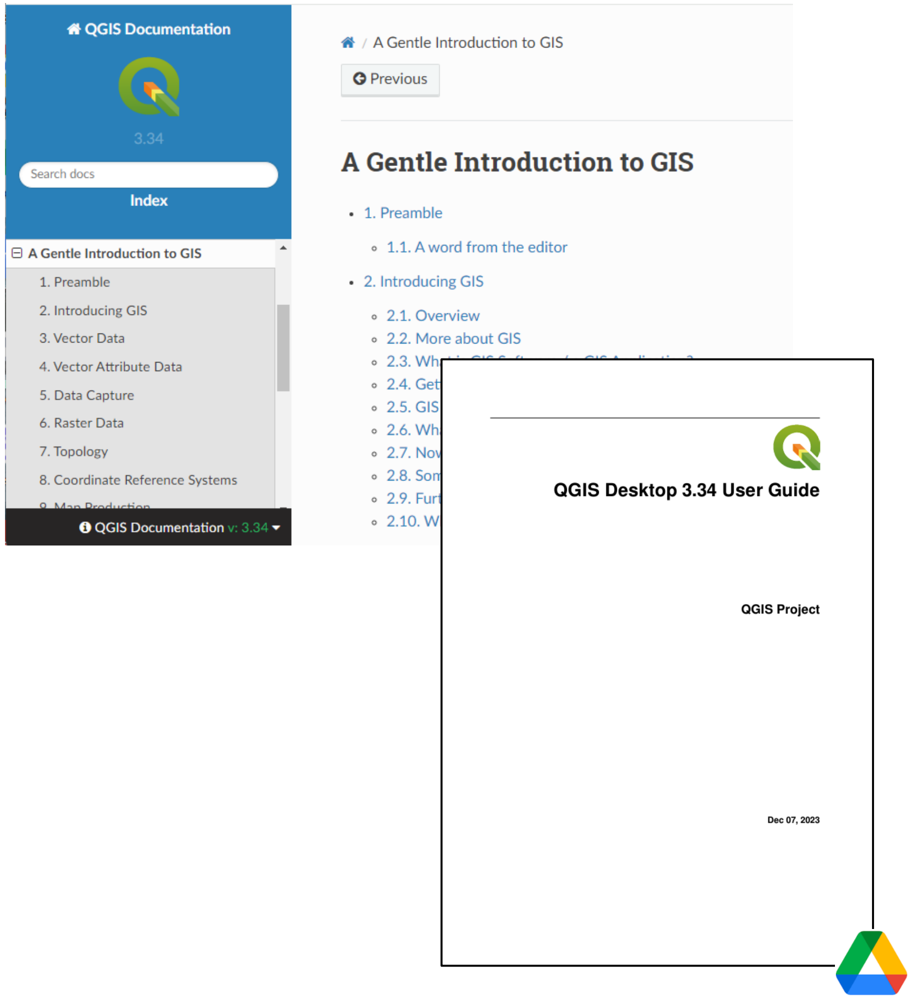
Use	Open source	Proprietary
Creation of thematic maps occasionally	X	
Creation and management of quality geospatial data	X	X
Mapping support in an emergency operations center		X
Need to be able to move directly from field data collection to an online and desktop solution		X

- Very often the solution is a combination of the two options
- The most important thing is to have access to quality data and qualified personnel and to ensure that the work carried out is based on solid and documented processes.

GIS Resources - QGIS

The QGIS website provides resources for their users:

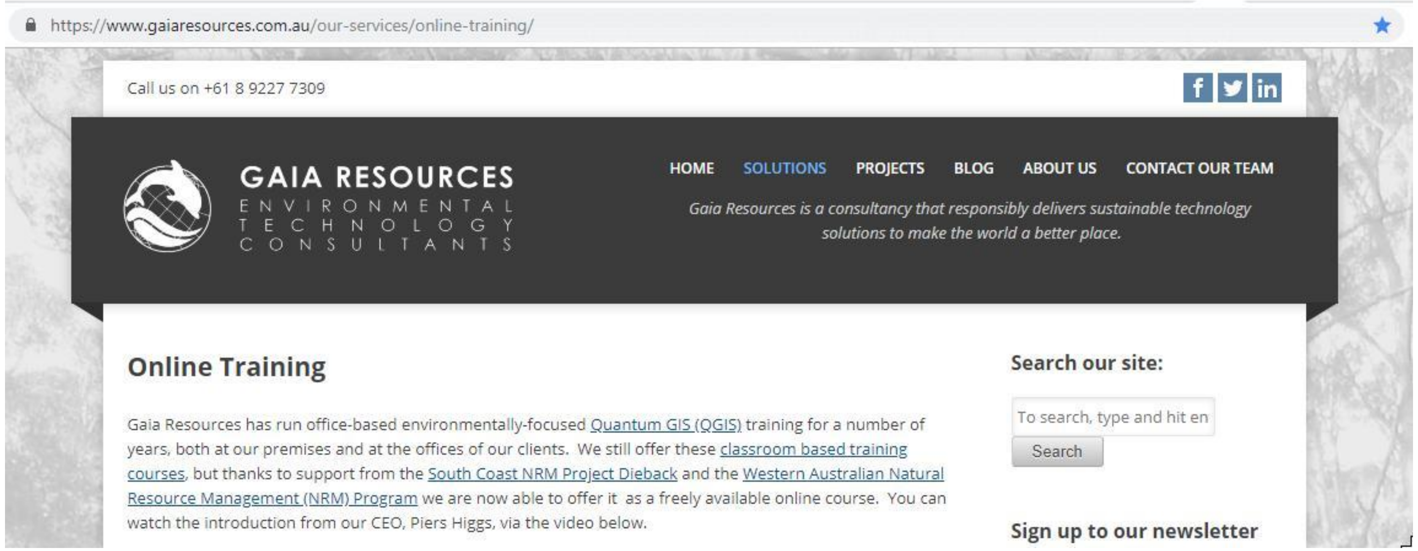
- A Gentle Introduction to GIS https://docs.qgis.org/3.34/en/docs/gentle_gis_introduction/index.html
- QGIS User Manual
  - Online: https://docs.qgis.org/3.34/en/docs/user_manual/
  - PDF: https://docs.qgis.org/3.34/pdf/en/QGIS-3.34-DesktopUserGuide-en.pdf
- QGIS Training Manual
  - Online: https://docs.qgis.org/3.34/en/docs/training_manual/
  - PDF: https://docs.qgis.org/3.34/pdf/en/QGIS-3.34-TrainingManual-en.pdf



GIS Resources - QGIS

There are different QGIS courses you can find online such as:

- YouTube offers many video tutorials on different QGIS topics: www.youtube.com
- Environmental QGIS Training from Gaia Resources: https://www.gaiaresources.com.au/our-services/online-training/



It is a self-paced course you can follow on YouTube: https://www.youtube.com/playlist?list=PLfInsSYJw1lQ_vii1wxePr7aKqBOziKVQ

GIS Resources - Esri

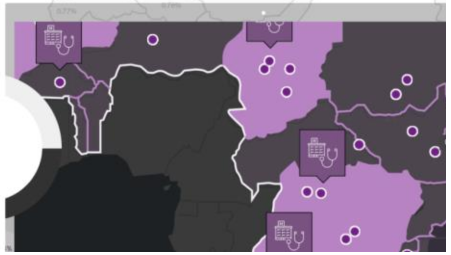
Esri Global Public Health Grant Program: https://bit.ly/2PjysU1

Global Public Health Grant Program | Overview | Eligibility | Apply Now

Global Public Health

Grant Program

Esri grants provide GIS tools and training for ministries of health and government health agencies in countries with low- and middle-income economies.



Free for 2 years, very reduced cost after that

What's included

The Global Public Health Grant Program for ministries of health and government health agencies provides access to the GIS tools needed for success. Recipients will receive the following:

Online

- 2 GIS Professional User Type licenses
- 3 Creator User Type licenses
- 5 ArcGIS Insights licenses

Extensions

- ArcGIS Spatial Analyst license
- ArcGIS Network Analyst license
- ArcGIS Geostatistical Analyst license

Desktop

- 2 ArcGIS Pro Licenses (one for each GIS Professional License)

After the grant period

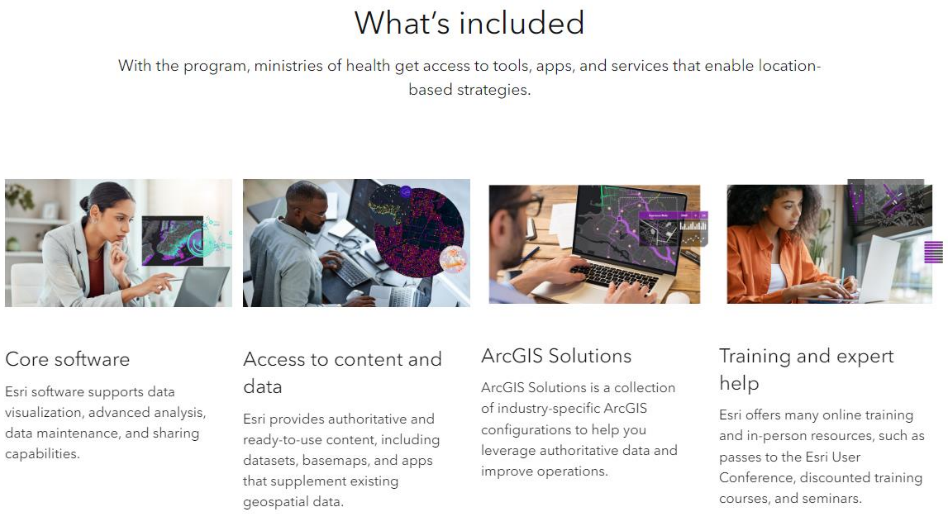
After the two-year grant period, participants have the option to purchase a special low-cost software deal, ensuring that their software use is not interrupted. This access features the same software as the grant but can be purchased by multiple departments within a ministry or agency, allowing them to expand their use of geospatial tools. More information about this option will be shared with grant recipients towards the end of their two-year grant period.

➡ Visit the website to see if your country is eligible for the grant (111 countries)

GIS Resources - Esri

Geospatial Enablement Program for Global Public Health: https://bit.ly/3AAVWBe

Offers more robust discounted software packages that include training and services

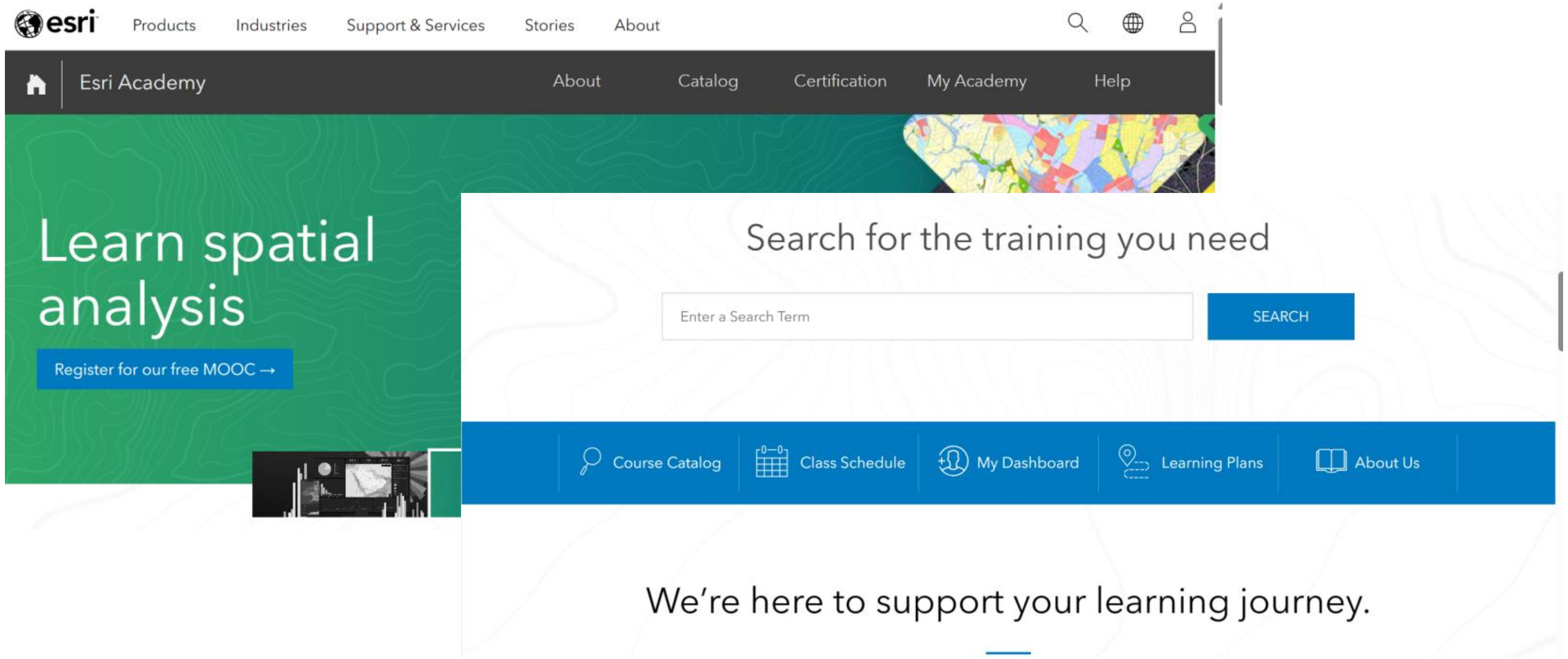


globalhealth@esri.com.

Visit the website to see if your country is eligible for the program

GIS Resources - Esri

https://www.esri.com/training/



https://healthgeolab.net/resources/reference-materials/

Starter kits

The following starter kits have then been developed to help new users to get started with Esri technology:

- ArcMap 10.5 with authorization code starter kit
- ArcGIS Online
- Survey123 for ArcGIS
- Story Maps
- Unlimited access to Esri's e-Learning
- Migration to ArcGIS Pro
- ArcGIS Pro Map Series
- ArcGIS Solution Coronavirus Case Dashboard

GIS as an information system

"Information system set up by an organization to describe the spatial objects, phenomena and processes that are necessary for its action"

➡ Combines and articulates data, **equipment**, **software**, **organizational structures** (including personnel), and **methods** to represent and analyze geographic objects necessary for project implementation

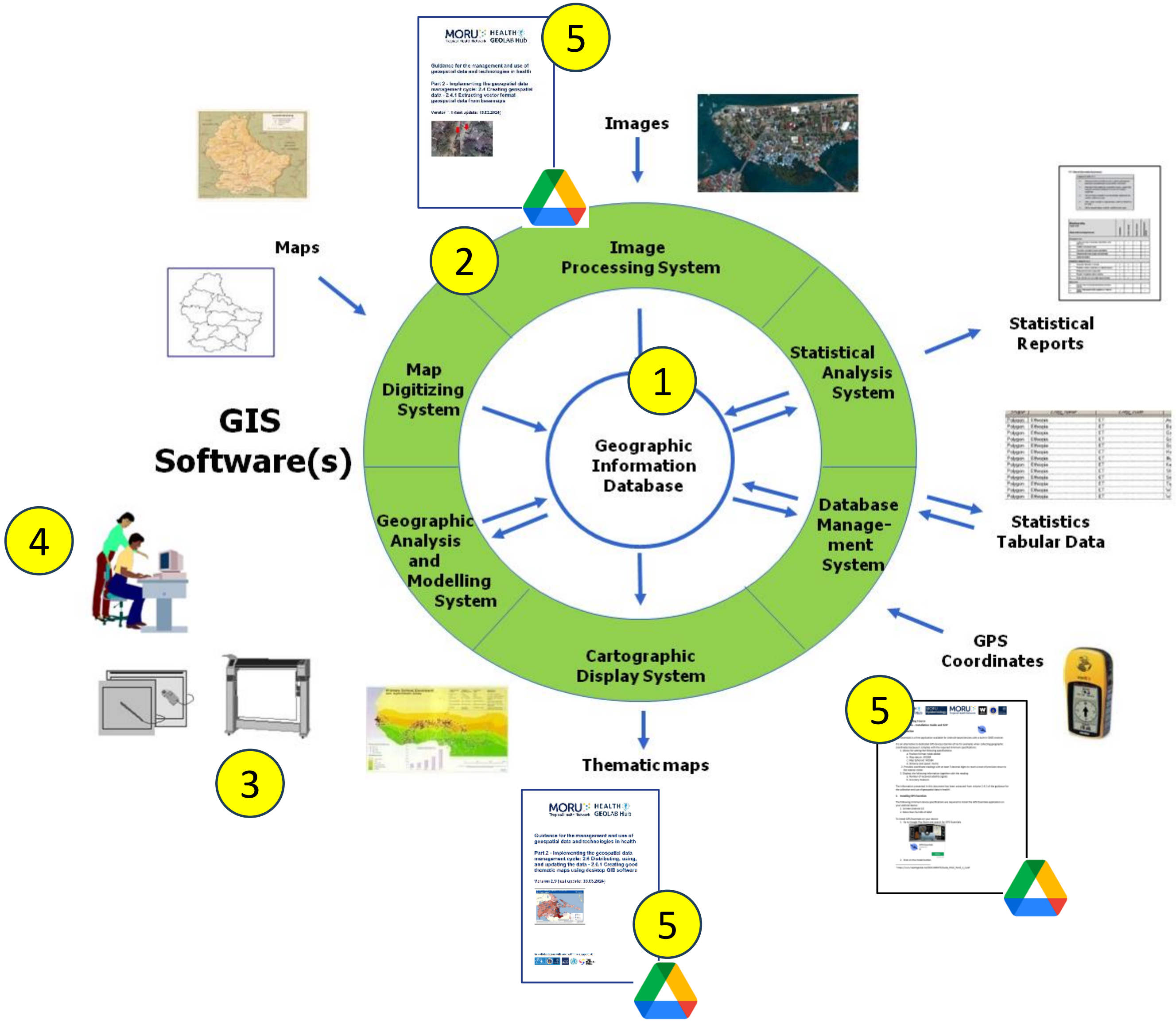
➡ GIS is not just about software!

Essential elements of a GIS as an information system

1. Data
2. Software
3. Equipment
4. People
5. Methods

➡ Data at the center of the system

➡ Part of a geo-enabled information system



Geo-enabling the Health Information System, programs or interventions training workshop for Asia Pacific

…and beyond

Session 19: Introduction to the concepts of registry and Common Geo-Registry (CGR)

unicef
MORU Epidemiology
MORU Tropical Health Network
wellcome
UNIVERSITY OF OXFORD
HEALTH GEOLAB Hub

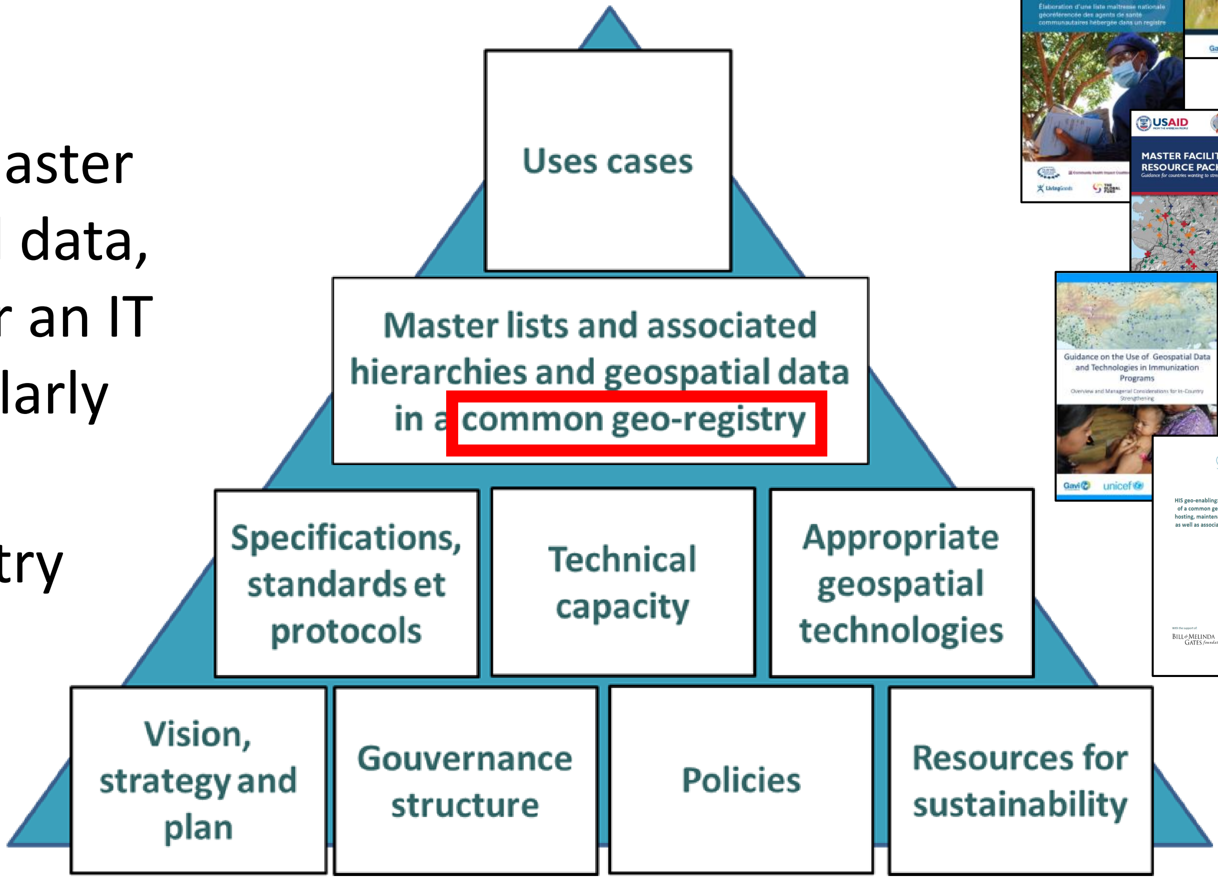
The importance of the registry concept in the HIS geo-enabling framework

Master lists are pivotal to the framework and the operationalization of strong use cases supporting planning and decision making

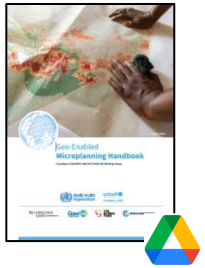
As the information contained in these master lists, as well as the associated geospatial data, evolves through time, there is a need for an IT solution that would store, manage, regularly update and share them

➡ Registry or common geo-registry

➡ Ideally deployed/developed and maintained as part of the geo-enablement of the HIS



The concept of registry



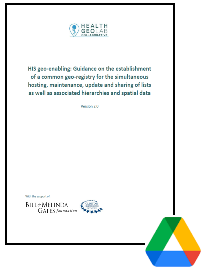
An IT solution that allows storing, managing, validating, updating and sharing the master list for a specific geographic object. It is the “container” for the master list.

- Example of the Health Facility Registry Servie (HFRS) from the Department of Health of the Philippines: https://nhfr.doh.gov.ph/Home

- Container that manages a single master list…

…but Public Health requires considering several types of geographic features/objects at the same time (health facilities, administrative units, villages, etc.) and these features/objects are connected to each other through different types of relationships (geographic, administrative, referral,…) and their proper geography. In addition, all this changes through time….

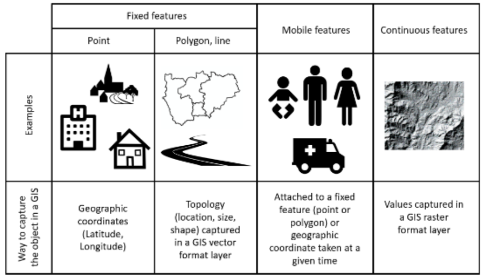
The concept of Common Geo-Registry (CGR)

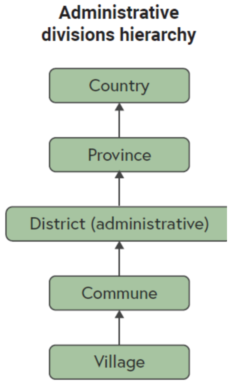


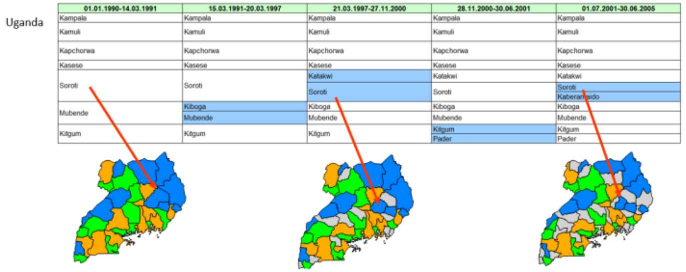
IT solution that allows the simultaneous hosting, management, regular update and sharing of all the master lists as well as associated hierarchies and geospatial data for the geographic objects core to development in general and public health in particular.[1]

Container that simultaneously manages, regularly update and multiple master lists and their associated hierarchies and geospatial data:

- Unlimited number of geographic features (facilities, administrative divisions, reporting divisions, villages,…) geographies and hierarchies
- Multiple organizations and different types of users
- Handles changes over time down to the data element level
- Accessible by any information system part of, or outside, the HIS
- Supports the National Spatial Data Infrastructure (NSDI)







1. https://healthgeolab.net/DOCUMENTS/Guidance_Common_Geo-registry_Ve2.pdf

Common Geo-Registry (CGR) guidance

The concept of Common Geo-Registry is born during a workshop which took place in Phnom Penh in June 2017 [1].

The structure of the first version of the CGR guidance document was defined during this workshop

The first version of the CGR guidance was released in August 2017 and discussed during a workshop with the University of Oslo in April 2018 to identify if DHIS2 could serve as a CGR [2].

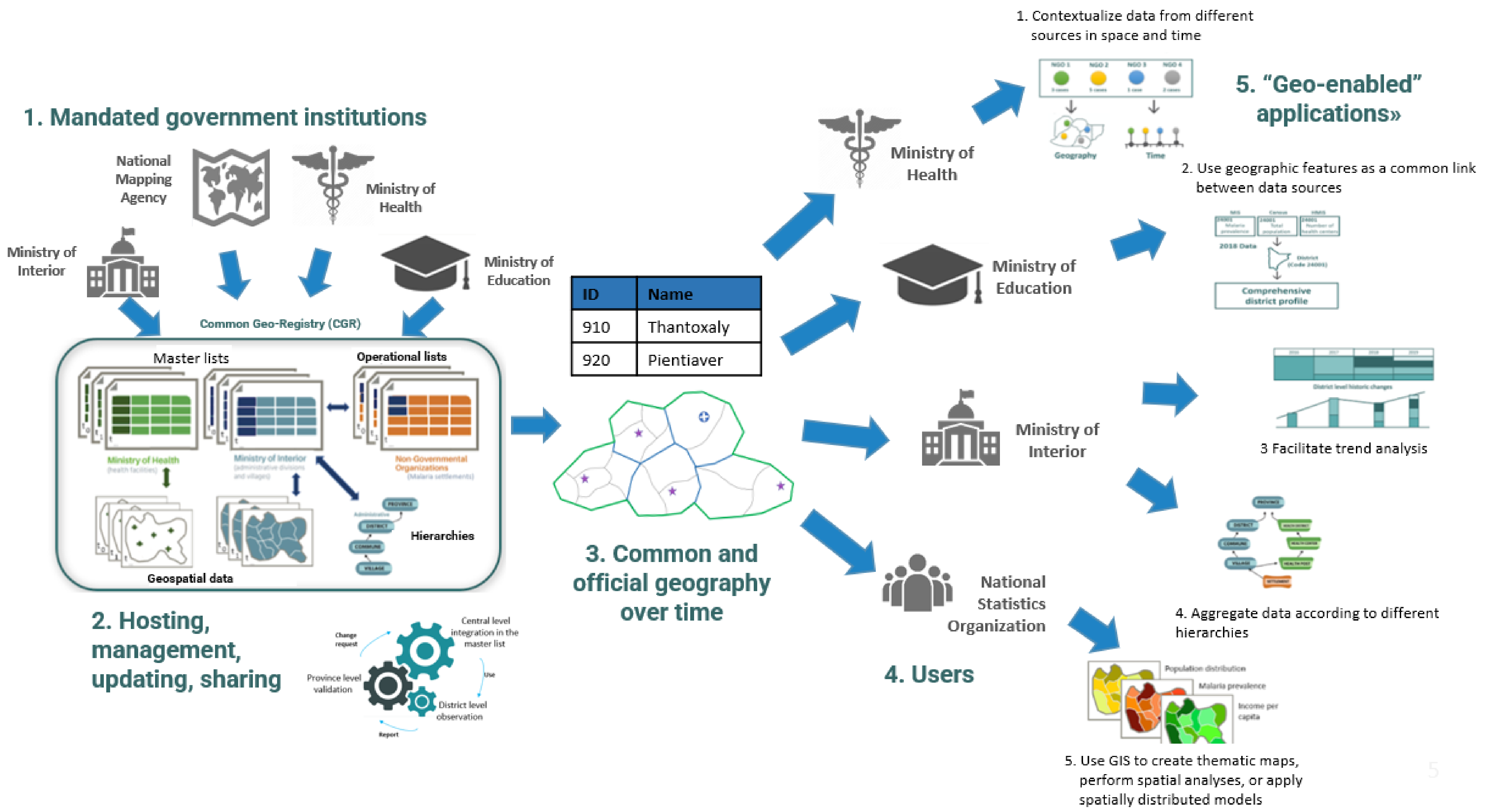
As neither DHIS2 nor other existing solution were complying with the requirements of a CGR, a new IT solution has been developed as part of the implementation of the Digital Solution for Malaria Elimination initiative (DSME) → GeoPrism Registry (https://geoprismregistry.com/)

The lessons learned during the development and deployment of this new IT solution led to the release of the 2nd version of the CGR guidance in 2022 [3].

1. https://www.healthgeolab.net/MEETINGS/CGR_2017/Geo-Registriy_Workshop_Final_Exec_Sum_010717.pdf
2. https://www.healthgeolab.net/MEETINGS/CGR_OSLO_2018/DHIS2_CGR-Exec_Sum_April18.pdf
3. https://healthgeolab.net/DOCUMENTS/Guidance_Common_Geo-registry_Ve2.pdf

unicef MORU Epidemiology MORU Tropical Health Network wellcome UNIVERSITY OF OXFORD HEALTH GEOLAB Hub

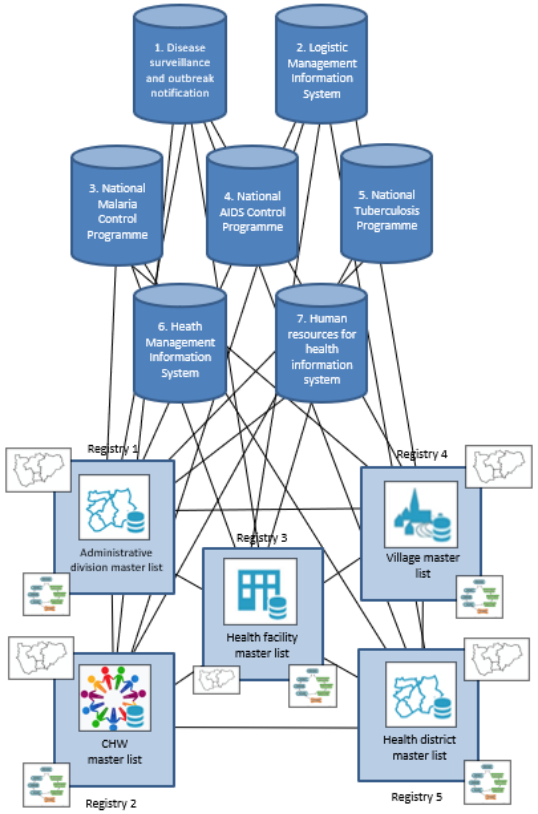
The Concept of Common Geo-Registry (CGR)



ID	Name
910	Thantoxaly
920	Pientiaver

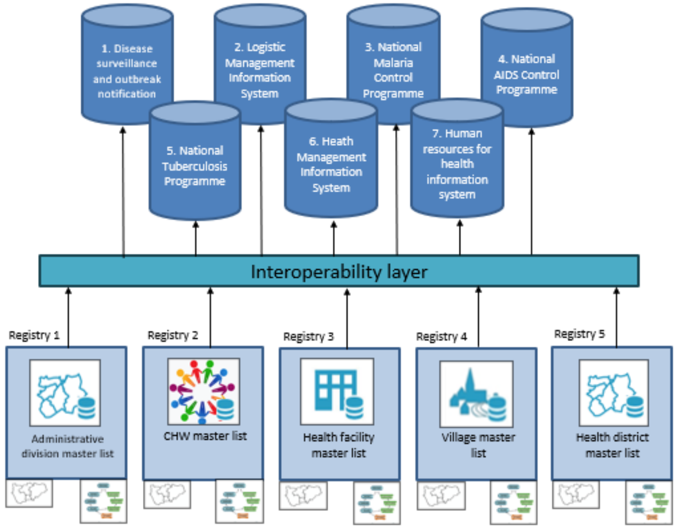
From separated registries to a Common Geo-Registry (CGR)

1. One registry per geographic features, no interoperability layer



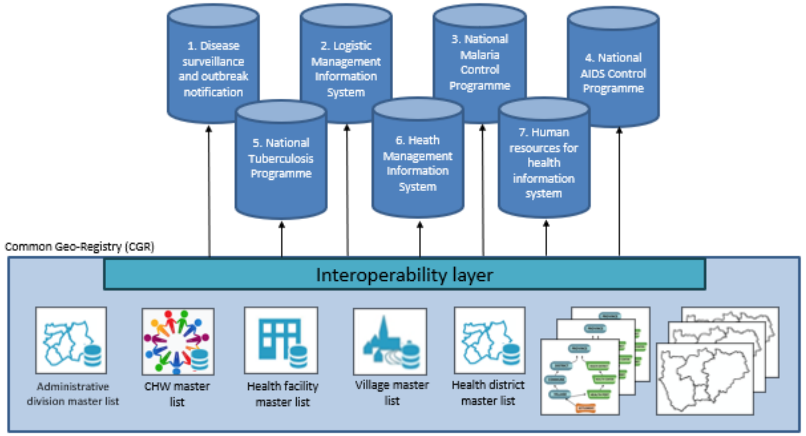
- Large number of registries to maintain
- Important volume of exchange to ensure data quality between registries and information systems
- Very difficult to scale up

2. One registry per geographic features with a separated interoperability layer



- Large number of registries to maintain
- Still a significant volume of exchange between registries to ensure data quality, including consistency between them
- Difficult to scale up

3. One common geo-registry with an integrated interoperability layer



- Only one registry to maintain
- Exchange only needed between the common geo-registry and each information system
- Facilitates data quality including consistency
- Easier to scale up

Model promoted by the HIS geo-enabling framework

CGR or HFRS - Strategic outcomes

Strategic outcomes can be expressed in terms of the benefits that would be provided to the health sector once a HFRS or a CGR has been deployed and operationalized:

- Data standardization and quality: A CGR or HFRS enforces data standardization and, as such, the quality of the information collected and stored in the master list
- Interoperability: A CGR or HFRS enables data interoperability and sharing between information systems collecting, managing and or analyzing facility level data and information.
- Online access: A standardized CGR or HFRS facilitates online use of information contained in the master list including, when appropriate, the creation of a public-facing portal for users to access basic information about nearby health facilities
- Data-driven decision making: Well-maintained master list(s) accessible through a CGR or HFRS empowers policymakers, healthcare administrators, and stakeholders with accurate, ideally real-time data and reports. This facilitates evidence-based decision-making, allowing for informed policy formulation, strategic planning, and resource allocation
- Efficient resource management: By centralizing information about geographic features core to public health, a CGR or HFRS first reduces duplication of efforts through the centralized management and regular update of the master list(s). It then enables efficient resource allocation for better health care access and delivery. It aids in identifying gaps in services, redistributing resources, and strategically planning infrastructure development

CGR or HFRS - Strategic outcomes

- Optimized public health interventions: Timely access to master lists of quality through a registry enables authorities to design and implement targeted public health interventions efficiently
- Enhanced coordination and collaboration: The sharing and accessibility of up-to-date information across various stakeholders within the healthcare system foster collaboration and coordination not only at the national but also regional and global level. This proves invaluable during emergencies, public health crises, and routine healthcare delivery
- Transparency and accountability: The transparency offered by comprehensive master list(s) hosted in a registry fosters accountability among healthcare providers and institutions. It allows for monitoring quality standards, compliance with regulations, and assessing the performance of facilities
- Innovation and research: Researchers and analysts benefit from the data contained in the registry to conduct studies, analyzing trends, and identifying areas for improvement. This aids in fostering innovation and driving advancements in healthcare practices

Programmatic benefits or use cases are not included here because a HFRS or a CGR are meant to support any program or intervention in view of the nature of their content

CGR or HFRS - Technical outcomes

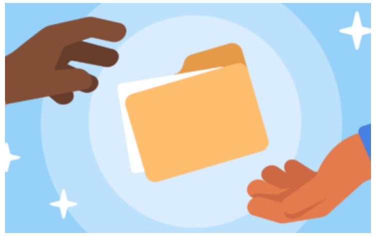
HFRS: *A platform for storing, managing, and sharing the health facility master list and associated data and information*

CGR: *IT solution that allows the simultaneous hosting, management, regular update and sharing of all the master lists as well as associated hierarchies and geospatial data for the geographic objects core to development in general and public health in particular.*

➡ The technical outcomes for both a CGR or HFRS are in their definition:

- Store: Provide the necessary functionalities to ensure the storage, security and scalability of the registry’s content in a usable, reliable, cost-effective, and performing environment

- Manage: Provide the necessary functionalities for the authorized users to effectively manage the content of the registry and ensure its quality and integrity
- Share: Provide the necessary functionalities to ensure proper access to the registry’s content as well as its exchange with other systems and applications as articulated by the national digital health enterprise architecture



➡ Business requirements

CGR or HFRS – Strategic and technical outcomes

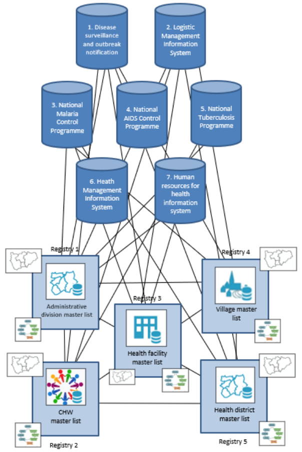
In conclusion the expected strategic and technical outcomes are the same for a HFRS or a CGR

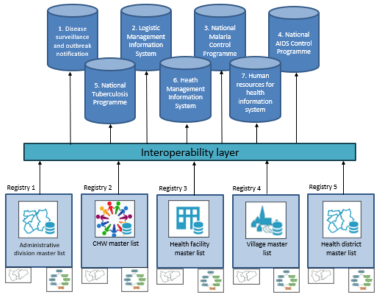
➡ The difference between the two reside in the number of geographic features being managed

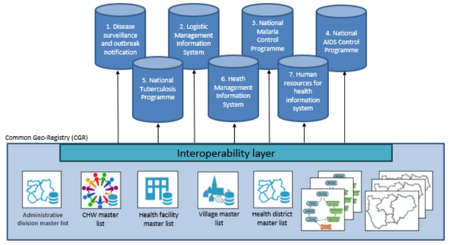
- Health Facility Registry Service (HFRS): once single geographic feature, health facilities in this case
- Common Geo-registry (CGR): an indefinite number of geographic features, including health facilities

➡ A CGR can be used as a HFRS but a HFRS can't be used as a CGR

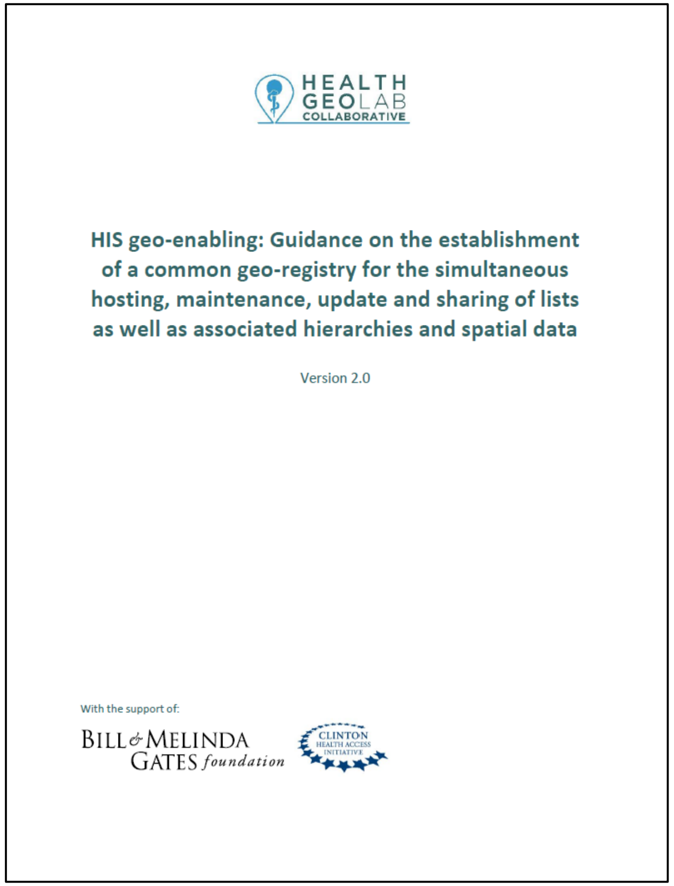
➡ Strategic decision to be made considering the digital health infrastructure being implemented in the country







Common Geo-Registry (CGR) guidance


HEALTH GEOLAB COLLABORATIVE

HIS geo-enabling: Guidance on the establishment of a common geo-registry for the simultaneous hosting, maintenance, update and sharing of lists as well as associated hierarchies and spatial data

Version 2.0

With the support of:

BILL & MELINDA GATES foundation

CLINTON HEALTH ACCESS INITIATIVE

Table of content

1. Introduction (concept, use cases and benefits)
2. CGR content (geographic features and objects, data elements and classification tables, hierarchies and conceptual data model, lists, geospatial data, changes over time, content related considerations)
3. CGR functional requirements (data and information flow, organizations and users, required functionalities)
4. CGR supporting environment (HIS geo-enabling framework)
5. Conclusion

➡ Content to guide countries in the choice of the appropriate IT solution to serve as a CGR

Functional requirements - CGR

Annex 4 – CGR minimum required functionalities

1. CGR setup (11 required functionalities)

At the platform level:

1. Manage different organizations (create, edit, inactivate)
2. Support different data governance models (centralized, decentralized, federated)
3. Capture organization information
4. Provide organization information to users who need it
5. Manage localization for the user interface (select, import, edit, export)
6. Invite organizations to the CGR

At the organization level:

7. Define roles having specific rights down to the geographic object type level (e.g., administrator, maintainer, contributor)
8. Manage user accounts (create, edit, inactivate)
9. Assign a role to each user
10. Provide user information to users who need it
11. Invite users to the CGR

2. Define geographic object types, data elements, classification tables, and hierarchies (27 required functionalities)

Geographic object types:

1. Handle as many geographic object types as needed to cover the defined conceptual data model
2. Attach each geographic object type to a specific organization
3. Manage geographic object types (add, edit, delete)
4. Manage metadata for each geographic object type
5. Differentiate between master and non-master geographic object types
6. Specify access rights for each geographic object type (public, restricted, or private)
7. Define the geometry for each geographic object type (point, line, polygon)
8. Handle changes over time for each geographic object type down to a specific date (temporal validity of a given geographic object type)
9. Group geographic object types for the purpose of generating lists at the group level
10. Manage (add, edit, delete) core CGR data elements (uniquely identify, classify, locate, and contact) and store them in a data dictionary
11. Handle the format necessary to manage the core CGR data elements (text, date, Boolean, enumerated) as well as multiple languages
12. Manage metadata for each data element
13. Specify if the values for a particular data element are meant to be unique
14. Specify access rights for each data element (public, restricted, or private)
15. Specify if a particular data element is mandatory when adding new geographic objects
16. Create, edit, delete, and export the classification table associated with the enumerated data elements

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Hierarchies:

17. Handle as many hierarchies as needed to cover the defined conceptual data model
18. Attach a hierarchy to a specific organization
19. Differentiate between master and non-master hierarchies
20. Specify access rights for each hierarchy (public, restricted, or private)
21. Manage hierarchies (add, edit, delete)
22. Graphically visualize the structure and content of a hierarchy
23. Handle changes over time down to a specific date (temporal validity of a hierarchy)
24. Manage metadata for each hierarchy
25. Use the same geographic object type in several hierarchies (no duplication of information)
26. Combine geographic object types from different organizations in a given hierarchy
27. Inherit the structure of other hierarchies having a geographic object type in common
28. Export a hierarchy in the form of a report

3. Import lists and geospatial data (6 required functionalities)

1. Import lists separately from geospatial data
2. Import the data either from the user's computer or from an external system
3. Specify the period over which the data being imported is valid (start/end date)
4. Specify the type of import (information for new records, update of existing information (overwrite), filling of value gaps)
5. Specify for which data elements the data is being imported, including the parents of the geographic object across the hierarchies in which it is included for the concerned organization
6. Match the data elements in the file being imported with those defined at the geographic object type level

4. Curate lists and geospatial data (9 required functionalities)

1. Identify and correct data element format validity issue (e.g., text imported against a date format data element)
2. Identify and correct hierarchy inconsistencies (correct parent attribution across the concerned hierarchies)
3. Identify and correct duplicates across geographic objects of the same type
4. Identify and correct temporal gaps for a given data element (missing values over a given period)
5. Identify and correct gaps for a given data element across all geographic objects of a same type (e.g., health facilities for which the type is missing)
6. Inform users about changes in the upper part of a hierarchy (e.g., creation of a new administrative unit requires the health facilities to be re-attributed according to the new structure)
7. Identify and correct orphans in a given hierarchy (e.g., new village not yet attached to a health facility as part of a catchment area)
8. Identify when the information for a given data element has been updated for the last time across all the geographic objects
9. Prevent from sharing the content from the working environment until it has been completely curated

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5-7. Manage and share CGR content (29 required functionalities)

Lists:

1. Manage (create, edit, delete) as many lists as needed
2. Attach each list to a specific organization
3. Differentiate between master and non-master lists
4. Specify access rights (public, restricted, or private)
5. Make the distinction between the lists in the working environment and those that are being shared with users outside the organization
6. Use a unique set of geographic objects to generate any list (no duplication of geographic objects across the CGR)
7. Integrate multiple hierarchies in the same list or a different hierarchy in separate lists
8. Manage the metadata of each list
9. Access the data dictionary for the data elements included in the list
10. Manage lists at the geographic object level (add, edit, inactivate)
11. Handle data element changes over time down to a specific date
12. Create, visualize, and edit lists for any given temporal validity (date, period) without losing other data
13. Persist different versions of lists for each temporal validity to preserve what was referenced in the past (e.g. 01.01.2020-v1, 01.01.2020-v2, 01.01.2020-v3)
14. Explore the content of a list for a given temporal validity (date), including search and filter
15. Export lists for a given temporal validity (date, period) in a format readable by users together with metadata and data dictionary
16. Access the list and associated information, including metadata through a REST or streaming API

Geospatial data:

17. Manage (create, edit, delete) geospatial data associated with any list
18. Attach each geospatial data to a specific organization
19. Enable/disable geometry editing by geographic object type
20. Differentiate between master and non-master geospatial data
21. Specify access rights (public, restricted, or private)
22. Make the distinction between the geospatial data in the working environment and those that are being shared with users outside the organization
23. Manage the metadata of each geospatial data
24. Access the data dictionary for the data elements included in the attribute table of the geospatial data
25. Manage geospatial data at the geographic object level (add, edit, delete geometry)
26. Handle changes in geometry over time down to a specific date
27. Create, visualize, and edit geospatial data for any given temporal validity (date, period) without losing other data
28. Persist different versions of geospatial data for each temporal validity to preserve what was referenced in the past (e.g. 01.01.2020-v1, 01.01.2020-v2, 01.01.2020-v3)
29. Explore geospatial data on a map for a given temporal validity (date) including search and filter
30. Export geospatial data in a usable format for a given temporal validity (date or period) with metadata and data dictionary
31. Access the geospatial data with metadata through a REST or streaming API

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Historical changes:

1. Capture and export changes over time for given geographic objects in the form of a report
2. Provide a REST API that supports queries on historical changes

8. Submit and treat change requests (6 required functionalities)

1. Submit change requests for any of the data elements associated with a given geographic object type (add, edit, inactivate) and a given temporal validity (date, period)
2. Review, accept, or reject the change requests that have been submitted down to the data element level
3. Provide the necessary information for the request to be reviewed (information before and after the change, temporal validity of the new information, reason for the request, etc.)
4. Provide the necessary information to follow up with the user who submitted the request if needed
5. Consult and monitor the change requests that have been submitted (including filtering and search)
6. Modify the change requests that have been submitted as long as they have not been reviewed

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➡ 93 functional requirements without criticality level

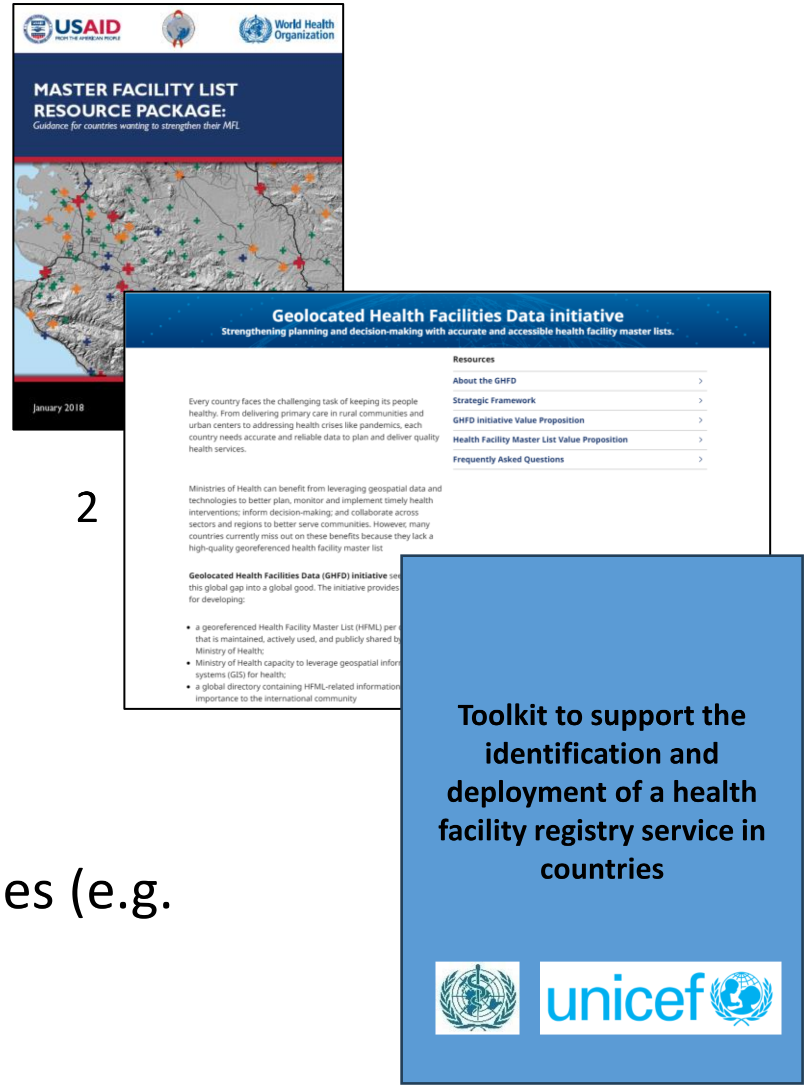
Health Facility Registry Service (HFRS) toolkit

The Master Facility List Resource package released by WHO in January 2017 launched the concept of a Facility Registry Service as a software solution that stores and shares the Master Facility List (MFL)

As part of its activities, the WHO Geolocated Health Facilities Data (GHFD) initiative established a Sub Working Group on Health Facility Registry Minimum Requirements (subWG RMR)

The toolkit to support the identification and deployment of a Health Facility registry Service (HFRS) in countries is born from the activities of this Sub Working Group

➡ Still to be published but we have started testing it in countries (e.g. Cambodia)



1. https://www.who.int/publications/i/item/-9789241513302
2. https://www.who.int/data/GIS/GHFD

Health Facility Registry Service (HFRS) toolkit

Toolkit to support the identification and deployment of a health facility registry service in countries

Table of content

→ Organized as a process to guide countries to choose the appropriate IT solution to serve as a HFRS

Functional and non-functional requirements - HFRS

Functional requirements: Product features or functions that developers must implement to enable users to accomplish their tasks

Requirement code	Requirement wording	Requirement type	Criticality level
RMR F1			
RMR F2			
RMR F3			
RMR F4			
RMR F5			
RMR F6			
RMR F7			

Requirement code	Requirement wording	Requirement type	Criticality level
RMR F8	Data Import: Support data import to enable the bulk addition of facility information	Functional requirement (data import)	Required
RMR F9			
RMR F10			
RMR F11			
RMR F12			
RMR F13			
RMR F14			

Requirement code	Requirement wording	Requirement type	Criticality level
RMR F15	Comprehensive time management and data preservation: Provide comprehensive time management and data preservation functionalities, including effective dating, historical data retention and time-based reporting	Functional requirement (time dimension management)	Required
RMR F16	Data validation and quality control: Implement data validation checks to ensure alignment with defined standards, prevent the entry of inaccurate or incomplete information as well as data quality control including but not limited to identifying missing and/or out-of-date information, cross-referencing, deduplicating, data cleansing and ensuring data consistency through time to maintain the high quality of the HFRS' content	Functional requirement (quality control)	Required
RMR F17	Basic reporting and analytics: Provide basic reporting and analytics that facilitate data curation and allow users to have a general overview of the master list's content for a given date (e.g. number of health facilities by type)	Functional requirement (reporting & analytics)	Recommended
RMR F18	Advanced reporting and analytics: Provide advanced reporting and …	Functional …	
RMR F19			
RMR F20			

Requirement code	Requirement wording	Requirement type	Criticality level
RMR F21	Updating mechanism: Operationalize the updating mechanism that has been defined to support the curation and regular update of the health facility master list content (closures, openings, data element changes)	Functional requirement (updating mechanism)	Required
RMR F22	Versioning: Support version control system that allows users to view and compare different versions of the HFML for a given date, facilitating effective tracking of data changes.	Functional requirement (versioning)	Recommended
RMR F23	Notification and alerts: Provide a notification system to alert users about updates and/or changes in the health facility master list based on their specific needs	Functional requirement (notification)	Optional
RMR F24	Data Export: Support data export to an Excel spreadsheet to enable the bulk extraction of facility information with the associated data dictionary and metadata in an Excel spreadsheet and other format as needed (e.g. .csv) as well as the associated geospatial data when applicable	Functional requirement (Data export)	Required

Non-functional requirements: Requirements describing how a system should perform

Requirement code	Requirement wording	Requirement type	Criticality level
RMR NF1			
RMR NF2			
RMR NF3			
RMR NF4			
RMR NF5			
RMR NF6			
RMR NF7			

Requirement code	Requirement wording	Requirement type	Criticality level
RMR NF8	User-friendly interface: Provide an intuitive, user-friendly interface that allows authorized users to navigate the system and perform tasks efficiently.	Non-functional requirement (usability)	Recommended
RMR NF9	User training resources: Provide user documentation, training materials, and support resources to help users learn to use the system effectively.	Non-functional requirement (usability)	Recommended
RMR NF10	Public access: Allow public access to view data that is relevant and accessible to the public.	Non-functional requirement (usability)	Recommended
RMR NF11	Mobile access: Provide the capacity to access the HFRS for consultation and the submission of change requests while in the field	Non-functional requirement (usability)	Optional
RMR NF12	Language localization: Support full language localization of the platform (screens, prompts, tooltip help, pick lists, metadata field names, and messages (except unanticipated system-level error messages) should be available in the user's default language to the extent translations are available.	Non-functional requirement (localization)	Required
RMR NF13	Governance model: Support the HFML's data governance models in place (centralized, decentralized, federated)	Non-functional requirement (localization)	Recommended
RMR NF14	Hosting model: Support the preferred hosting model for the health facility master list (cloud or locally hosted)	Non-functional requirement (localization)	Recommended
RMR NF15	Accessibility: Support accessibility features available in the operating environment as described in level A of the W3C Web Content Accessibility Guidelines v. 2.0	Non-functional requirement (localization)	Optional
RMR NF16	Data exchange: Provide flexible standards-based APIs (e.g. RESTful API, HL7 FHIR) for data exchange and this in alignment with the in-country existing information system architecture	Non-functional (interoperability)	Recommended

➡ Also applicable to a CGR

➡ 24 functional and 16 non-functional requirements with recommended criticality level

Module 6 – Schedule and Agenda

Schedule Module 6 11 September 2024 (Bangkok 12pm / Geneva 6am / Fiji 6pm)
15 min - Recap of Module 5 and agenda of Module 6
15 min - **Session 20**: Define the strategy(ies) to be implemented to fill the gaps identified during the assessment
30 min – **Session 21:** Develop the action plan aiming at filling the gaps in the HIS geo-enabling framework
30 min - **Session 22:** Implement the action plan
30 min – **Session 23**: Assess, document and sustain the result of the action plan implementation
15 min - **Session 24**: HIS, program or intervention geo-enabling resources (recap and additional ones)
15 min - End of workshop

➡ Development and implementation of the action plan

Thank you for your attention and see you all again soon!