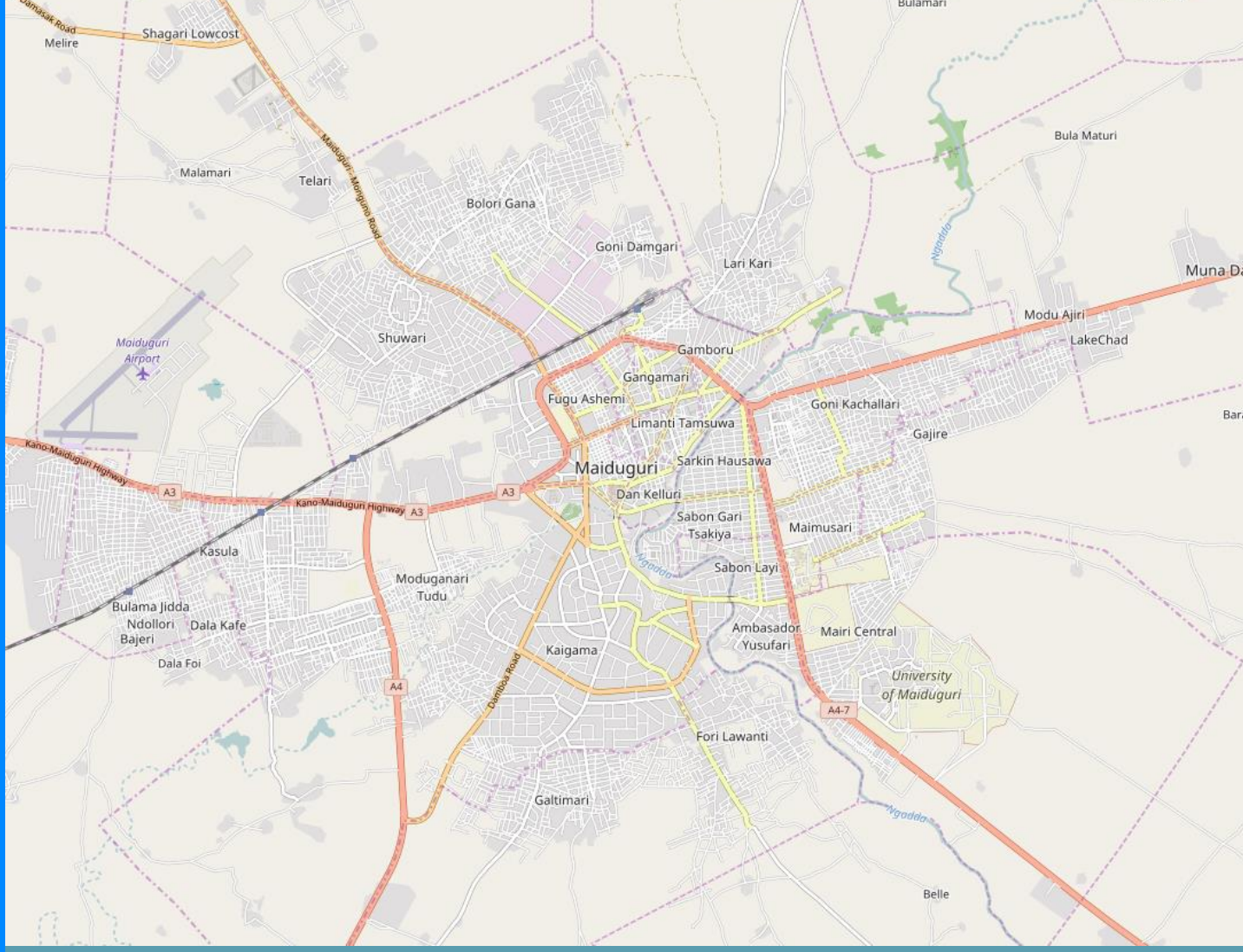

OpenStreetMap roads for WFP

Automatic data extraction process for roads, from OpenStreetMap into WFP Postgresql database

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Software Requirements

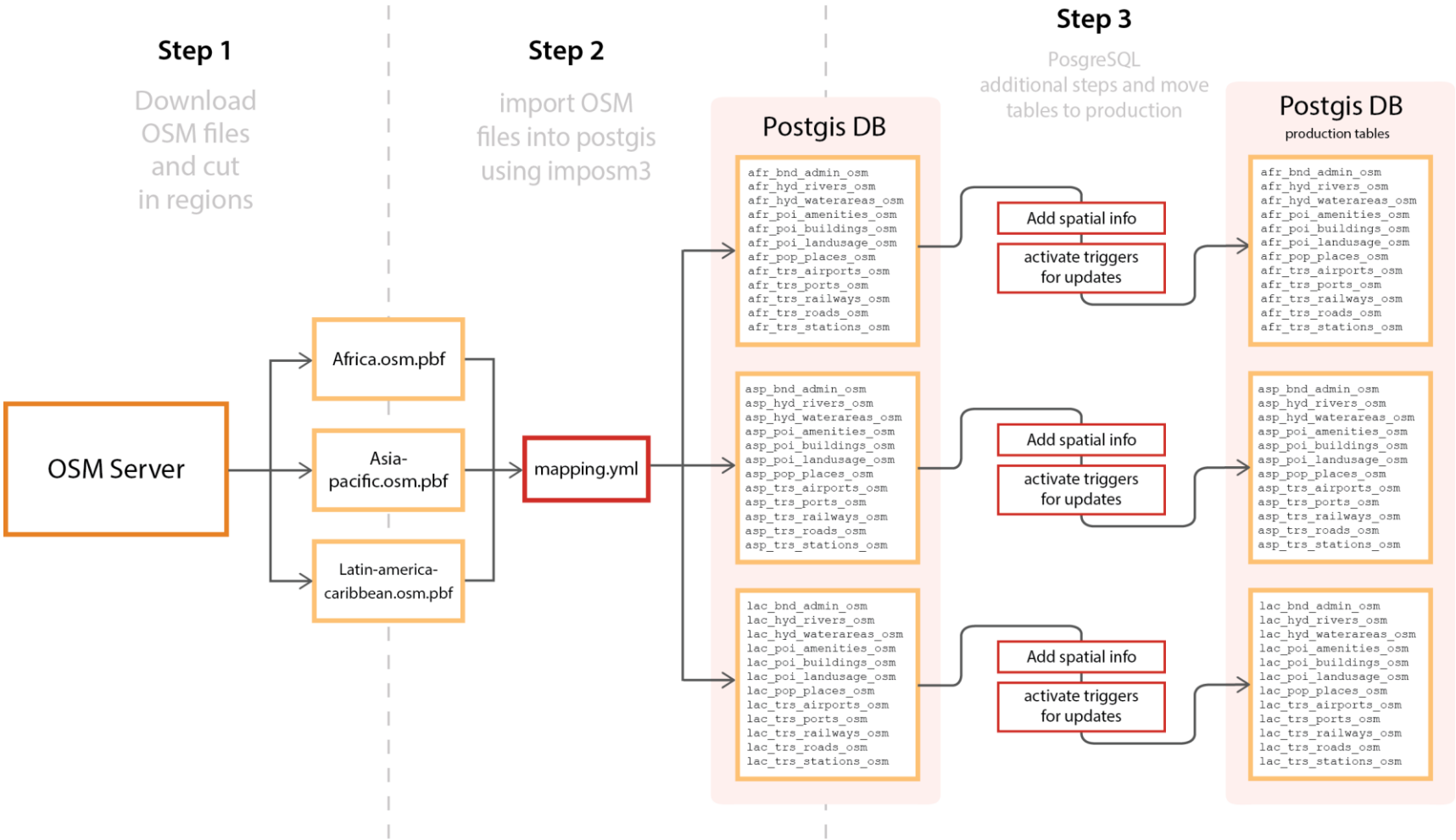
Few software are needed to run the process:

- **imposm3** and its dependencies. Pre-compiled versions for Ubuntu 64bit can be downloaded on imposm3 github page. Imposm3 only runs on **Unix** OS (in WFP case, Ubuntu version has been used).
- **osmconvert** and **osmupdate**. You can do this by installing the osmctools with apt-get. It will install all you need to manipulate OSM files.
- **PostgreSQL** with **PostGIS** extension in the destination server (any version)

Importing OpenStreetMap file with imposm3

To have a detailed explanation of the import process with imposm3, you can read the official documentation. The steps described here are specific to WFP usage. A chart summarizing the whole importing procedure is shown on the next page.

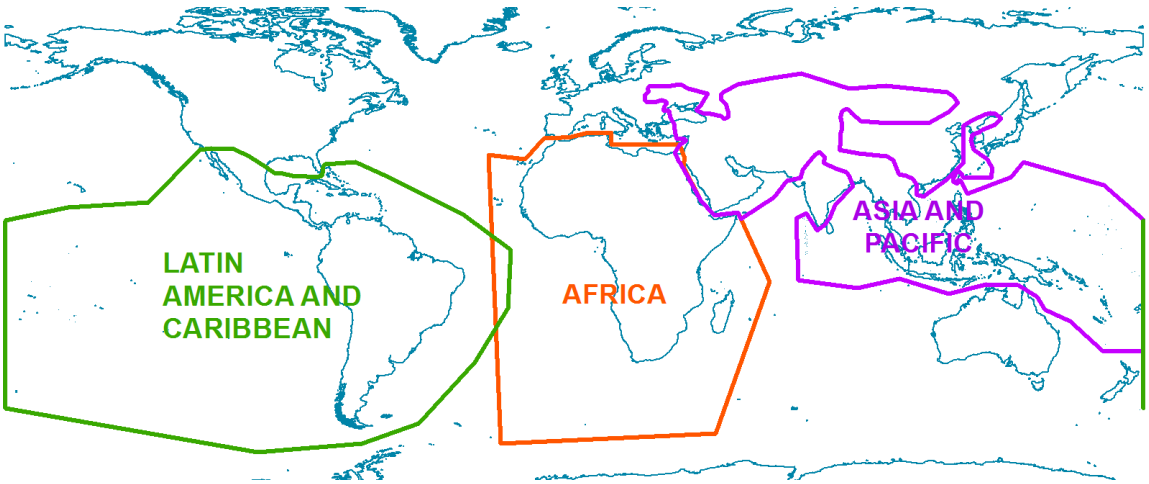
Import OpenStreetMap into Postgresql, descriptive chart



Step 1: Download OSM files and cut in regions

Imposm3 needs PBF files to import into PostgreSQL. In our case, we used either a PBF "as is" from geofabrik for the Africa region. The Latin America and Caribbean (LAC) region and for Asia and Pacific (ASP) have been customized to include countries that are of interest for WFP operations.

The PBF files for LAC and ASP regions were extracted from the OSM planet file (global OSM extract) that was cut using osmconvert. The polygons for each region are shown on the below map. Note that Europe, North America, Russia, Japan, China, India, South Korea, Taiwan, Australia and New Zealand have been excluded.



Step 2: Import the OSM PBF files into postgis database using imposm3

The big advantage of imposm3 over other software is that it is very fast and allows you to define a custom destination data structure. The data structure of the destination database is defined by a *Mapping file* written in *yaml* format (cf. imposm3 documentation). This mapping file tells also which OSM objects are imported in the database and how, based on their tags.

For WFP, most of the brainstorming has been to focus on the extraction of OSM roads. WFP has a standard data structure for roads and the idea was to keep this same structure using the OpenStreetMap data. For other layers, a more generic schema was used, similar to the standard one provided by default in the imposm3 example-mapping.yml file.

This chapter will focus only on documenting the tags that were used for the extraction of roads and explain which choices were made.

WFP transportation data structure

WFP, as the global lead agency for the Logistics Cluster, is maintaining a global geo-database on transportation infrastructures, also called UNSDI-T[1]. It contains data on:

- Roads
- Ports
- Airports
- Waterways
- Bridges
- Obstacles
- Railways

The database was built to provide a common standard for terminology, methodology and policies for transportation data. It is based on a continuous work that has been initiated in 2004 by WFP and UNJLC (United Nations Joint Logistics Centre), together with humanitarian logisticians, in order to capture relevant information for logistics planning in humanitarian emergency operations.

The standard data structure allows capturing information as follows:

- road surface type
- road surface condition
- seasonality (is the road accessible all year or not?)
- road practicability (what kind of vehicle can pass on the road)
- current operational status
- … and many others that might not be fully relevant for the current extracts

For further reference, diagrams and schemas on the UNSDI-T data structure, domains and datasets are available on the Logistics Cluster website here. To have a better idea of the data structure used for roads, a zipped empty shapefile can be downloaded here as well as assessment forms.

[1] The UNSDI-T database was created as part of the UNSDI (UN Spatial Data Infrastructure) project, the "T" meaning "Transportation". Currently, it is part of the WFP Spatial Data Infrastructure.

WFP road data schema and OpenStreetMap roads

As stated earlier, the idea of having road extracts from OSM was to have OpenStreetMap data in a UNSDI-T format, in order to have both the huge advantages of OSM data (constantly updating, very detailed, global coverage, easy to edit, …) together with information that is relevant for humanitarian logistics.

Some research was done to identify the OSM tags that are matching a UNSDI-T domain. Some tags were quite obvious as they are already quite widely used in OSM (ie. Road surface) but some had been used only very rarely (ie. practicability, not documented on OSM wiki). However, all the tags that were used in the final mapping file are using existing OSM tags and none needed to be created. In the below table, you'll see a description of the OSM tags that have been selected and the corresponding UNSDI-T domain. Compared to the complete UNSDI-T model, the schema presented here is actually only a small subset, selecting only the most frequently used information.

WFP road dataset column name	**values**	**OSM tag or WFP calculated value**
osm_id	Any value from OSM	Osm object identifier
geometry	Postgis geometry	PostgreSQL geometry
sourceid	WFP source ID or source name	Left blank
notes	Any value from OSM	note
onme Official road name	Any value from OSM	ref
rtenme Route name	Any value from OSM	name
ntlclass National Inventory Road Class. Typical usage is to put the classification of the source dataset when importing data into the WFP dataset.	motorway, motorway_link, trunk, trunk_link, primary, primary_link, secondary, secondary_link, tertiary, tertiary_link, road, track, service, living_street, unclassified, residential, path, footway	highway
fclass functional class	1: Highway, 2: Primary Road, 3: Secondary Road, 4: Tertiary Road, 5: Residential, 6: Track/Trail, 7: Path/Footway	calculated by WFP[2]
numlanes Number of lanes	Any value from OSM	lanes
srftpe Surface type	Paved, Gravel, Dirt/Sand, Steel, Wood, Grass, Unspecified	surface
srfcond Surface condition	Rough (<40kph), Smooth (>40kph), Snow/Ice, Mud, Unspecified	smoothness
isseasonal Affected by season	Any value from OSM	seasonal

[2] To see the detail of what highway value corresponds to which functional class, see next chapter

curntprac Current practicability. I.e. what kind of vehicle can pass on the road?	Non-motorized, Motorbike, 4WD < 3.5MT, Light truck < 10MT, Heavy truck < 20MT, Truck + Trailer > 20MT, Unspecified	practicability
gnralspeed General average speed	Any value from OSM	maxspeed
rdwidthm Road width (in meters)	Any value from OSM	width
status	Left blank for potential future edition on layer extracts (i.e. Logistics Cluster Access Constraints information: Open, Closed, Restricted)	WFP edits
iselevated Is elevated/suspended over ground surface	Yes: 1, No: 0	bridge
iso3	Iso3 code of the country	automatically calculated by WFP
country	Country name	automatically calculated by WFP
last_update	Date and time of last edition of the object in WFP DB (not the timestamp of OSM)	automatically calculated by WFP

During the response of Haiti earthquake in 2010, a Humanitarian Data Model (HDM) for OpenStreetMap had been proposed. It contains tags that would be useful for humanitarian response and the transportation part contains mostly tags and domains that come from the UNSDI-T. For example, the "practicability" tag comes from this first HDM. The model was used only rarely by OSM mappers and the HDM is currently under revision.

OSM highway tag value and WFP functional class

In the WFP data structure, roads are classified in seven categories, named "Functional Class":

- Highway
- Primary road
- Secondary road
- Tertiary road
- Residential road
- Track/Trail
- Pathway

This classification describes the function of the road and its importance at the national level. A very comprehensive guide on the definitions of this classification can be found on the OSM wiki on how to edit highway tag for Africa.

OpenStreetMap highway tag can have many more values than the above six. In order to always fit into this schema, a conversion matrix has been created to convert highway tag values into functional class value as follows:

WFP functional class	highway tag value
highway	motorway
primary road	primary, trunk
secondary road	secondary
tertiary road	motorway_link, primary_link, secondary_link, tertiary, tertiary_link, road
residential	residential, living street, service
track/trail	unclassified, track
pathway	path, footway

Step 3: Additional steps

To allow country extracts and to have an idea on when the data is updated from OpenStreetMap, some additional columns have been added. The tags exist in OSM (i.e: is_in:country) but this is not automatic and many features might be missed. Hence, to add this information, the easiest way is to calculate it with a spatial query in the PostgreSQL database after the import with imposm3.

In each table, 3 additional columns have been added that do not come from OpenStreetMap but are calculated at the database level after the first import and every time the data is updated:

- Country name: "**country**"
- Iso3 code: "**iso3**"
- Last update date and time (UTC): "**last_update**"

The values of these columns are calculated directly in PostgreSQL, without any input from OpenStreetMap data.

Updating the WFP OSM PostgreSQL database

OpenStreetMap data is constantly edited and can change very frequently. OpenStreeMap edits will be changing even more often in emergency contexts, following also HOT activations. Hence, it will be very important for the WFP OSM database extracts to keep updating with the OpenStreetMap database.

The process for updating the database is done with imposm3. The software supports updating a PostgreSQL database with OSC files (OSM change files). The update process is then possible going through the following steps:

- Update of the 3 regional OSM PBF files using osmupdate software
- Calculate the OSM change file between the old and new OSM file to create a OSC change file for each region (using osmconvert software)
- Apply the change files to the PostgreSQL database with imposm3

The updating process has been set up to an hourly process for each region. The reason to have frequent updates is mainly to avoid loading the server too much. If the updates are frequent, the volume of data to update will be small and the update processing will be lighter.

Publication of the WFP OpenStreetMap road extracts

WFP is willing to share the roads data extracts with other humanitarian partners. The GIS unit of the Emergency Preparedness and Support to Response of WFP is very active in map production during emergencies for supporting the Logistics Cluster operations. In the light of other initiatives supported by the global Information Management Working Group, such as the coordinated data scramble or the publication of the Common Operational Datasets, the publication of the data used by WFP could be useful to other organizations.

Road datasets are available for each country where WFP or the Logistics Cluster has an ongoing emergency operation. These country extracts are available through the WFP geonode (geonode.wfp.org) and the Humanitarian Data Exchange platform known as HDX (data.humdata.org).

The map showing the coverage of the three macro-regions used in the WFP database show the coverage of the available data. However, the publication of the road datasets will be made available by country as zipped shapefiles.