Cloud Optimized Geotiff

Open-source GIS Israel
By Guy Doulberg

About Guy Doulberg

- In the last 3 years working for Satellogic
- Leads the team that is responsible for delivering satellogic product

About Satellogic

- Aregintian startup
- Founded in 2011
- The mission is important to the rest of the talk

Satellogic Accessible Satellite data

Accessible

We provide the most affordable and up-to-date geo-information analytics on planet Earth, enabling access to geospatial-driven insights at the right price point for our customers.

Frequency + Resolution

With strategic orbits and frequent revisits, we provide industry-best frequency at high resolution. Our 1-meter resolution is the sweet spot for monitoring economic activity and high-frequency change.

Satellogic Challenge

- How to store in our data
- How to retrieve our data
- Without being bankrupt
- In a safe place

Satellogic - implementation

- Store rasters on Azure Blob Storage
- Store rasters a Cloud Optimized GeoTiff (COG)

COG words explained

Why cloud?

Cloud Storage is elastic, cheap and safe

- You pay only for what you are actually using
- When you pay it is cheap compared to other solution
- The cloud providers grant you some data-availability SLA - you don’t need to manage it

Cloud storage price list

	PREMIUM	HOT	COOL	ARCHIVE
First 50 terabyte (TB) / month	$0.195 per GB	$0.0196 per GB	$0.01 per GB	$0.0023 per GB
Next 450 TB / Month	$0.195 per GB	$0.0189 per GB	$0.01 per GB	$0.0023 per GB
Over 500 TB / Month	$0.195 per GB	$0.0181 per GB	$0.01 per GB	$0.0023 per GB

What need to be Optimized?

Data retrieval - performance

- COG is intended to be used on big areas of high resolution.
- The client would like to retrieve only the data that is required and no more than that.

Data retrieval - cost

Operations and data transfer prices

	PREMIUM	HOT	COOL	ARCHIVE
Write Operations (per 10,000)[1]	$0.0228	$0.054	$0.10	$0.12
List and Create Container Operations (per 10,000)[2]	$0.065	$0.054	$0.054	$0.054
Read Operations (per 10,000)[3]	$0.0019	$0.0043	$0.01	$6
All other Operations (per 10,000), except Delete, which is free	$0.0019	$0.0043	$0.0043	$0.0043
Data Retrieval (per GB)[4]	Free	Free	$0.01	$0.024
Data Write (per GB)[4]	Free	Free	$0.0025	Free

Why GeoTiff?

GeoTiff - legacy support

- The community wanted existing systems will work without a change

COG description

COG description

A file format that uses:

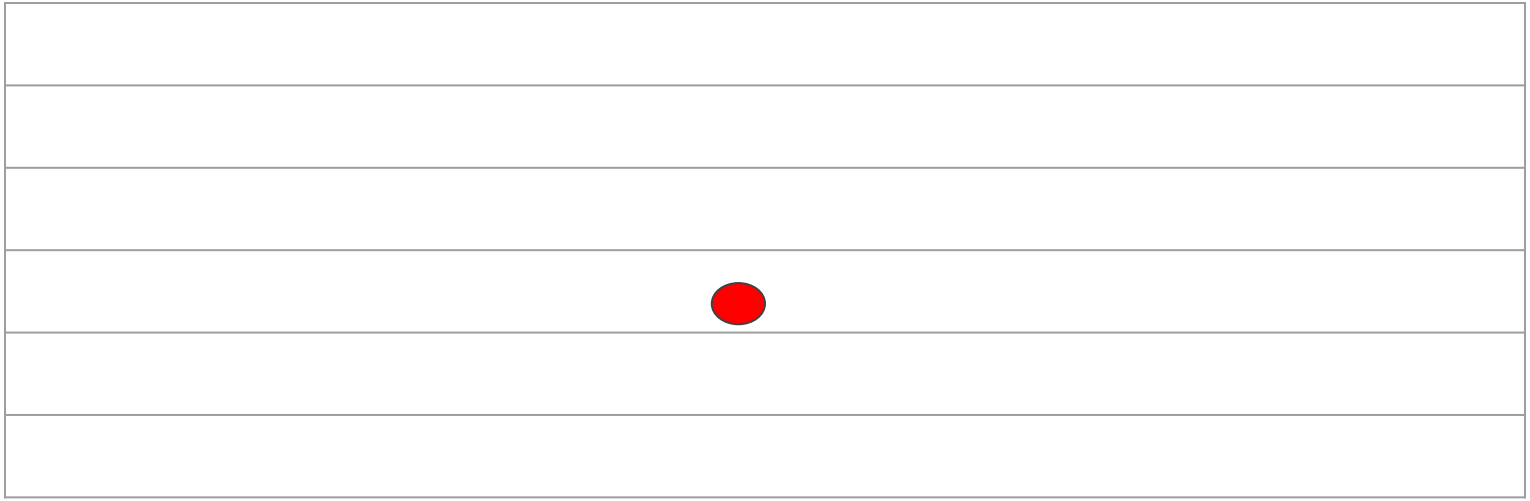
- Tiling
- Overviews
- HTTP range
- IFD at the top of a file

Using the above techniques will optimize your data for the cloud

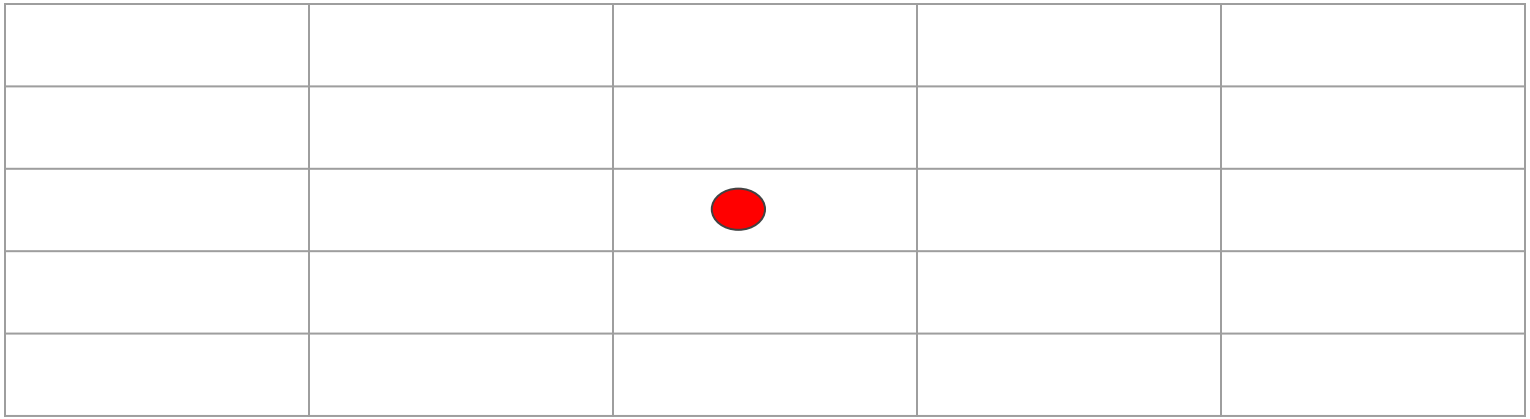
GeoTiff: Tiled

- A Tiled GeoTiff is a Tiff that uses tiles to store its data.
- Tiles instead of Stripes
- A Tile has width and height
- Common tiles sizes: 256X256, 512X512

GeoTiff: retrieving a pixel in a stripe

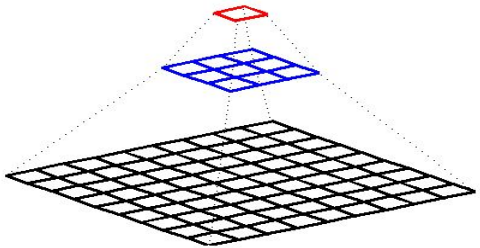


GeoTiff: retrieving a pixel in a tile

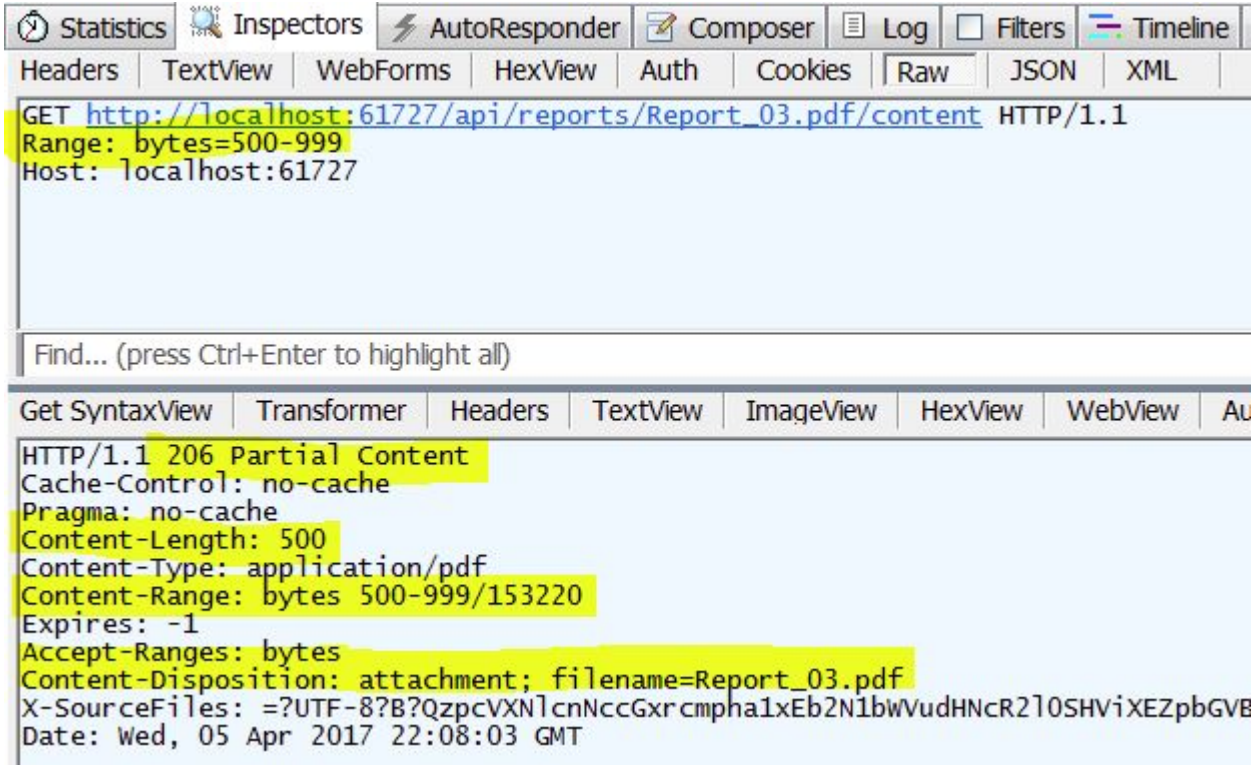


Geotiff: Overviews

- A Geotiff with overviews is a Geotiff constructed out of several Geotiffs.
- Each Geotiff is for a different resolution (pyramid)
- Overviews are used to cache resampled lower resolution pixels
-



HTTP Ranges request



COG - IFD Locations

- An IFD is a pointer to the location of the first tile
- A GeoTiff with overviews has several IFD one for each overview
- A COG must have its IFDs located in the first data block

Putting it all together

Data Retrieval example

- Most cases user needs are different from the way the raster was stored.
- A user defines an Area of Interest (AOI) and resolution
- For example: WMS, XYZ requests

COG - Classic data retrieval

- Fetch the header of a cog file (<16KB)
- Pick the IFD by resolution
- Calculate the tiles needed according to the tiles offsets in the IFD

Demos

Using COGs

Landsat file

- https://landsat-pds.s3.amazonaws.com/c1/L8/189/027/LC08_L1TP_189027_20170403_20170414_01_T1/LC08_L1TP_189027_20170403_20170414_01_T1_B4.TIF

Qgis

- Adding a cog as a layer

Rasterio

- notebook

Creating COGs

Gdal_translate

- Follow the steps here: https://trac.osgeo.org/gdal/wiki/CloudOptimizedGeoTIFF#Preparation

Telluric

- https://github.com/satellogic/telluric
- A library developed by satellogic (including me)

Rasterio

- https://github.com/cogeotiff/rio-cogeo

Nice tools

Cog Explorer

1. Use javascript library to visualize cogs
2. https://geotiffjs.github.io/cog-explorer/#long=16.370&lat=48.210&zoom=5&scene=&bands=&pipeline=

marblecutter

- Flask or Lambda to server xyz of cogs
- https://hi.stamen.com/stamen-aws-lambda-tiler-blog-post-76fc1138a145

Thank you