PLACE

A disruptive model for mapping the earth

What is PLACE?

We are a non-profit technology organization.

Our mission is to map the urban world in ultra-high resolution and make these maps more open, reliable and accessible… to help improve lives, create economic opportunity, strengthen public services and better care for the environment.

Why PLACE?

We believe mapping is a critical public good that Governments have struggled to maintain

We believe that mapping is more critical than ever to make progress in climate, health, and livability given the rapid pace of change in many countries around the world. You can’t manage what you can’t see and measure.

Nations should determine what gets mapped and when it is mapped in their country and own the resulting data

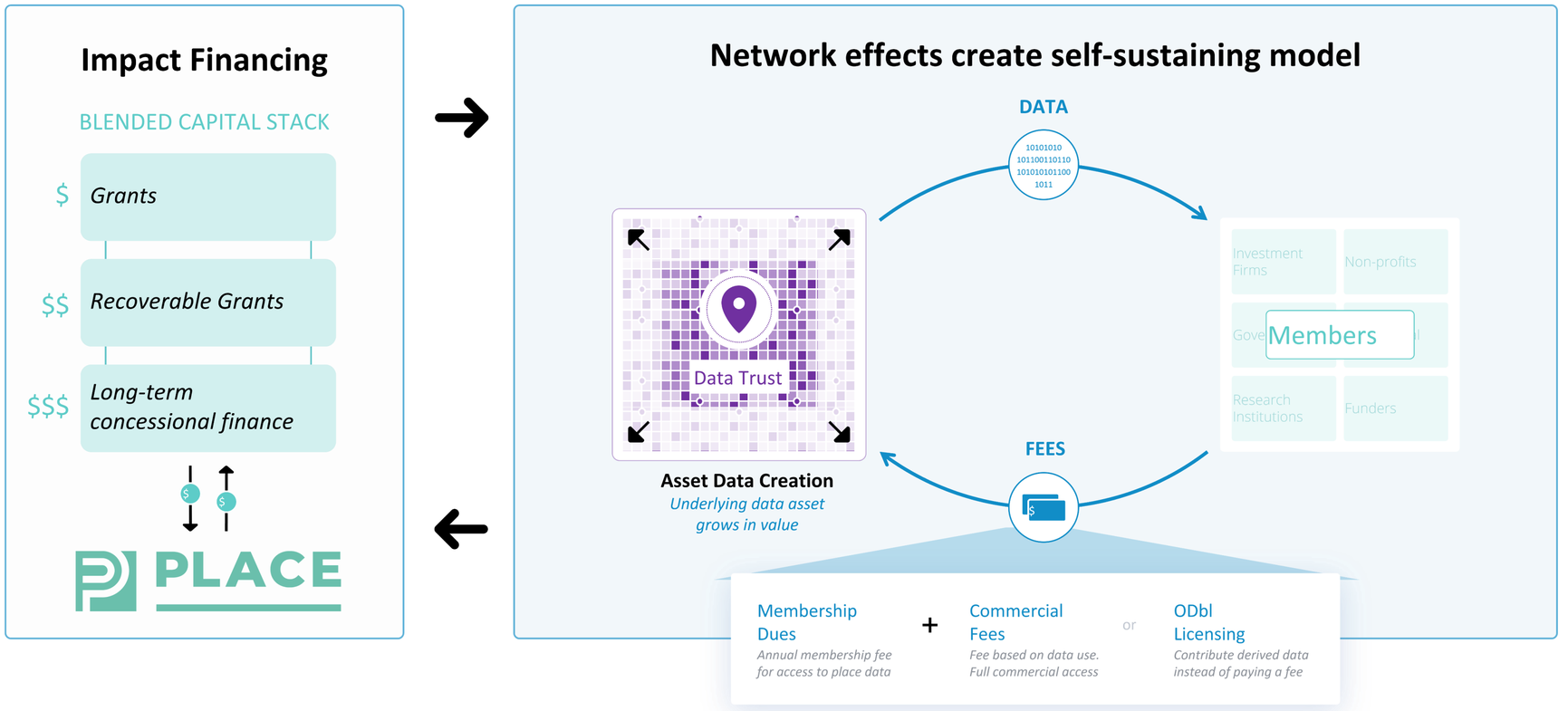
We don’t think the largest mapping agencies should be private firms

The Opportunity

There is an opportunity to address this market failure by collaborating with government and business and enabling the creation of a new financing and data stewardship model for mapping

A Disruptive Model

PLACE has created a model that is centered on a membership driven data trust called PLACE Trust. The model disrupts the current status quo of mapping and returns control of mapping back to local entities.



How it Works?

PLACE begins all our activities in partnership with government.

We train and fund local entities to collect ultra high-resolution optical mapping imagery with aerial and street camera systems, manage stewardship of this mapping data in the PLACE data trust and make it available to members through our platform using secure API access.

PLACE Purpose

To enable others by focusing on primary data

We only collect data that is:

- **observable or detectable** at street-level or above using high resolution, high accuracy sensors
- provides **high fidelity**, visually understandable primary information about places
- acquired by **local, in-country firms** under contract to PLACE using open-source, open component platforms
- enables PLACE members to **add value**

We do not collect data that is:

- **derived or interpreted** including *infrastructure* – roads, railways, building outlines; *physical features* – land cover/land use, settlements, hydrology; and *subsurface data* – soils, geology, underground utilities
- **authoritative** or requiring the approval/ recognition of Government (e.g., property ownership, addresses, administrative boundaries)
- **inferred** e.g., how much a parcel is worth? Has someone paid their electricity bill? How many people live here?
- **reference data** i.e., geodetic and levelling networks that give the surveyors the physical links to a co-ordinate system

DATA

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PLACE Data – The building blocks for others

PLACE collects hyperlocal, georeferenced optical imagery from the air and the ground across urban geographies

PLACE Aerial

5cm GSD resolution, color, geo-referenced aerial imagery

- Acquired using mapping/surveying drones
- Geo-referenced RGB optical imagery
- Ortho mosaics and digital surface models
- Air quality measures (with additional sensor)

PLACE Ground

High resolution, color, geo-referenced street imagery

- Acquired using mobile mapping systems
- Geo-referenced RGB optical imagery
- 360-degree street images
- Air quality measures (with additional sensor)

Ortho-mosaic

An ortho mosaic is a geo-referenced image map produced using Structure from Motion (SfM). High positional accuracy is achieved with ground control points (GCPs).

PLACE has been investing in drone technology since 2016. PLACE image maps can be acquired using PLACE's aerial platform, **PLACE Aerial** or a member's own drone solution.

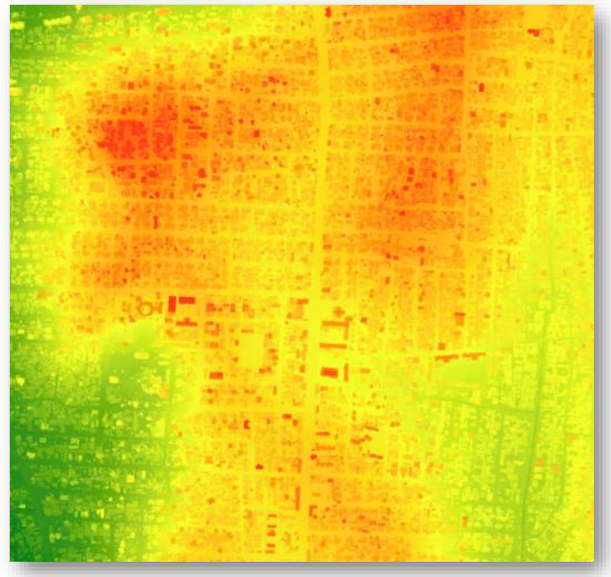
Drones should deliver 5cm or smaller GSD RGB georeferenced aerial imagery in RAW/JPG format acquired with suitable camera equipped with fixed focal length lens. Georeferencing by means of linear interpolation of exposure events in carrier phase PPK GNSS fixed solution trajectories preferred*. Min. forward overlap 80%, min. lateral overlap 70%. Images must be radiometrically balanced, clear and sharp.

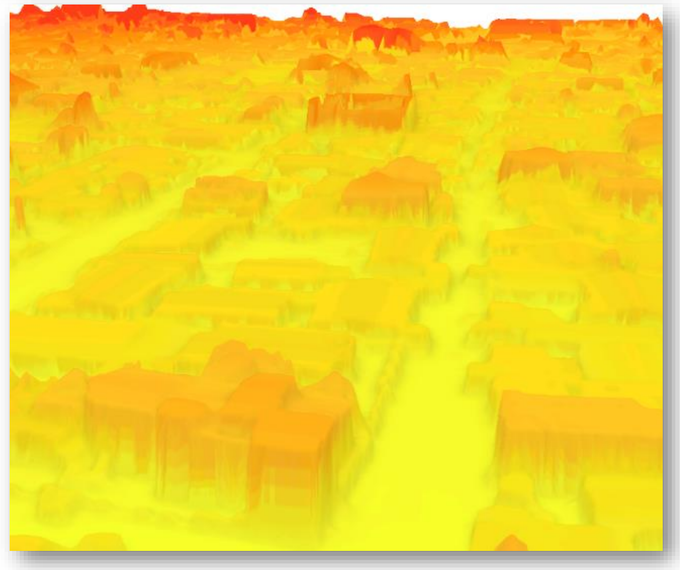
** Georeferencing by means of trigger tags on standalone GNSS trajectories may be acceptable on a case-by-case basis.*

Digital Surface Model

A digital surface model (DSM) is also produced from Structure from Motion processing and represents elevation above a modelled surface showing the heights of structures such as buildings and trees.

DSMs are produced from depth maps as part of the SfM process and not from LIDAR (laser imaging, detection, and ranging). The raster surface (GSD ~6cm) reports an ellipsoid height in meters.



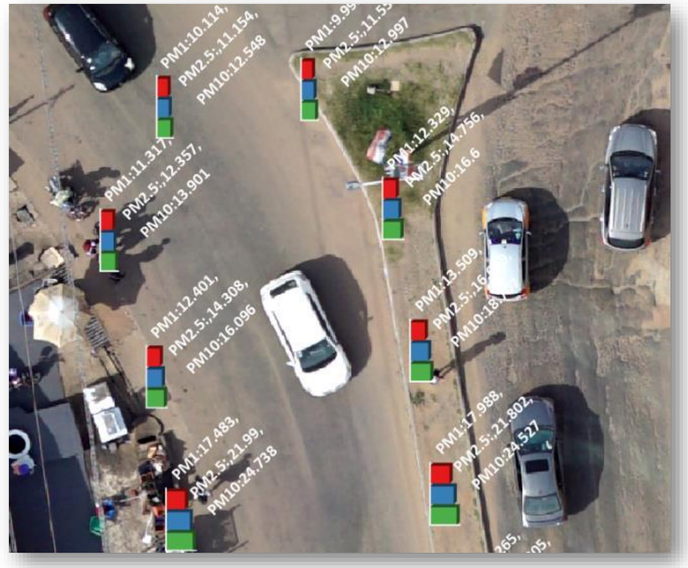


** A depth map is an image map with pixel values between 0 and 255, where 0 is the farthest pixel and 255 the nearest. A pixel's location defines its position on a Z axis.*

Air Quality

Air quality sensors on PLACE platforms records particulate measures (PM1, PM 2.5 and 10) at intervals of between 1 and 20m.

The air quality sensor can record particulates at 400 ft/122m (PLACE Aerial) or at ground level (PLACE Ground). WHO air quality guidelines estimate that reducing annual average fine particulate matter (PM2.5) concentrations from levels of 35 µg/m^3, common in many developing cities, to the WHO guideline level of 10 µg/m^3, could reduce air pollution-related deaths by around 15%*.



**Source: World Health Organization Ambient (outdoor) air pollution. WHO Air quality guidelines for Particulate matter (PM) are PM2.5: 25 µg/m^3 24-hour mean; PM10: 25 µg/m^3 24-hour mean.*

Terrestrial Imagery

Terrestrial imagery is collected using mobile mapping systems (MMS). Walked (back-pack) or driven (car-mounted) these systems produce 360-degree street images.

We use commercial street camera systems including Insta360 and Mosaic. Our MMS platforms do not collect LIDAR data. MMS must geo-reference images with enough cameras/sufficient field of view (FOV) for a minimum overlap of 20-30%. MMS can have additional sensors.

COLLECTION

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PLACE Platform History

Investing in hyperlocal image mapping since 2016

Drone certification
- Drones approved for use for cadastral surveying in the Philippines

Operational testing
- Drones used for image mapping in Africa, Asia and South America.
- Drones operational at >3000m in Colombia

Mobile Mapping
- Develop a back-pack mounted street camera tested in Ghana
- Car mounted system tested in US

Continued R&D
- Continue to test, learn and improve our image platforms delivering high fidelity, high accuracy image mapping for PLACE members.

2016 2017 2018 2019 2020 2021 2022 2023 2024 2025

Early designs
- Copters and VTOLS were tested; limitations in scope and ease of operation led to investigation of other operational platforms

Fixed wing platform
- Move to fixed wing/twin prop configuration for large area mapping increasing endurance over copters; can capture 250 ha at 5cm GSD per 90 min flight flying at 400ft (122m).
- PLACE Aerial is built using open component/ commercially sourced technology

Platform development
- New optical cameras for image acquisition
- Parachutes for safety in case of drone failure
- Extending the operational range and endurance
- Adding sensors e.g., Near Infrared (NIR)
- Switch to commercial 360-degree street camera systems

Abidjan

Bogota

Accra

PLACE Aerial

A **fixed wing autonomous optical drone** built from commercial/open-source components.

PLACE Aerial is 1070mm long with a wingspan of 1960mm.

The hull is made of EPO; the fuselage and wings are made from frangible foam.

Dual batteries are connected in parallel – if one fails you still have the option to perform a safe landing with the energy remaining in the functioning battery.

There are 3 IMUs – two sets of accelerometers and gyros dampened for orientation control and dead-reckoning, one set hard mounted for vibration monitoring; redundant altitude sensors: barometer, rangefinder, GNSS; and digital airspeed sensor with pitot tube.

PLACE Aerial Specifications

Platform specification	
Ground Sampling Distance (GSD) at 122 m (400 ft)	5 cm
Positional accuracy (with GCPs)	8 - 10 cm (3.1 in – 3.9in)
Weight (+ battery payload)	5.5kg (12lbs)
Endurance	1.5 hrs.
Range	90km
Coverage per flight/overlap	250 ha/70% side lap, 80% forward overlap
Controller	ArduPilot
Approach angle (Landing)	17º
Landing area	10m x 50m landing strip
Batteries	2 x 7000 mAh
Camera	Digital mirrorless camera, 16-24mm fixed focal length, 24MP, 24bit-RGB*
Antennae	Dual frequency helical GNSS and telemetry

Panasonic SN-GCJA5 Laser Particulate Matter Sensors

Air quality specification	
Particulates measured	PM 1, PM 2.5 & PM 10
Reading interval	1 sec (equals ~18m flown)
Reading height	122m (400ft)

**A Sony a6000 camera was used it is now being switched to Sony a7 ii camera.*

PLACE Ground

Commercial mobile mapping system sourced from multiple vendors.

We use several platforms – Mosaic 51, Insta360 Pro 2 and GoPro Max we did early testing with our own street camera system.

Insta360 Pro 2 in use in Abidjan, Cote D'Ivoire.

On onboard GPS unit writes location data in WGS84, to an image's EXIF header. Post processing removes PII information and generates 360-degree views. For platform specifications visit the vendor website.

PLATFORM

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Data Processing

The PLACE Trust is hosted in Azure with additional components for data uploads, processing and sharing.

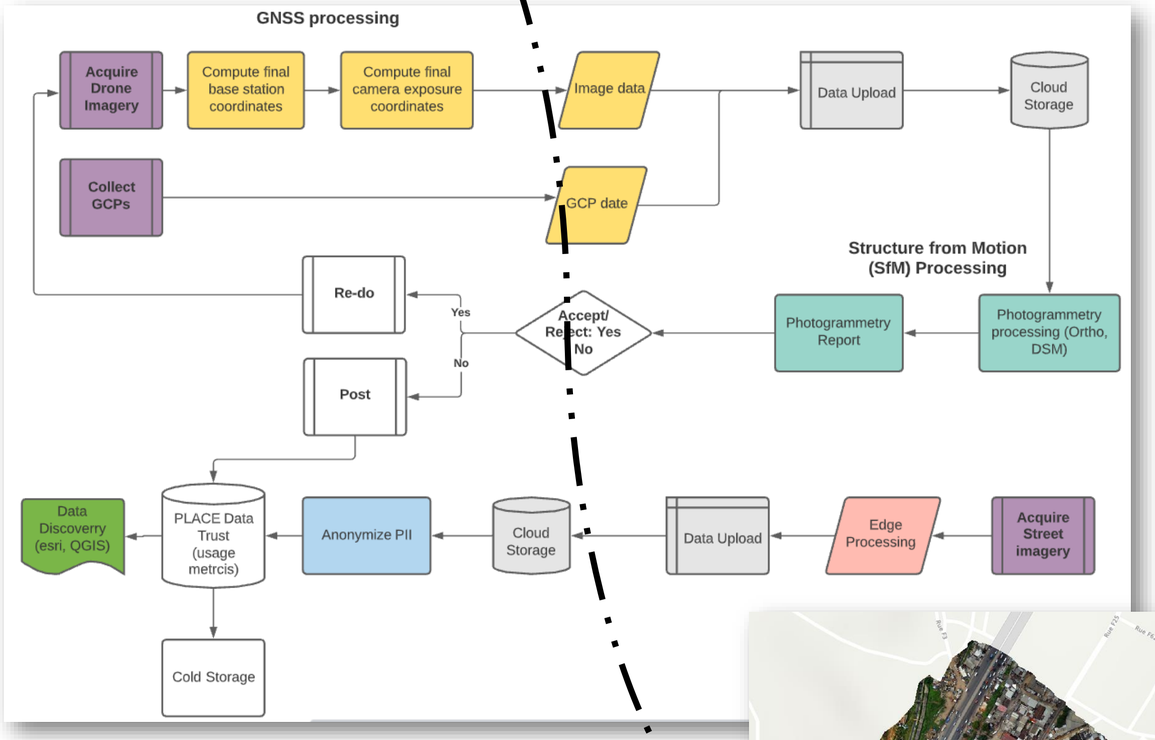
After collecting imagery using the PLACE Aerial and PLACE Ground platforms, we upload data directly from data collection sites into Azure.

We then use photogrammetry software and structure from motion to generate ortho mosaics/DSMs from the drone imagery and anonymization software to remove PII on the imagery.

We then use web services to share the imagery we have collected.

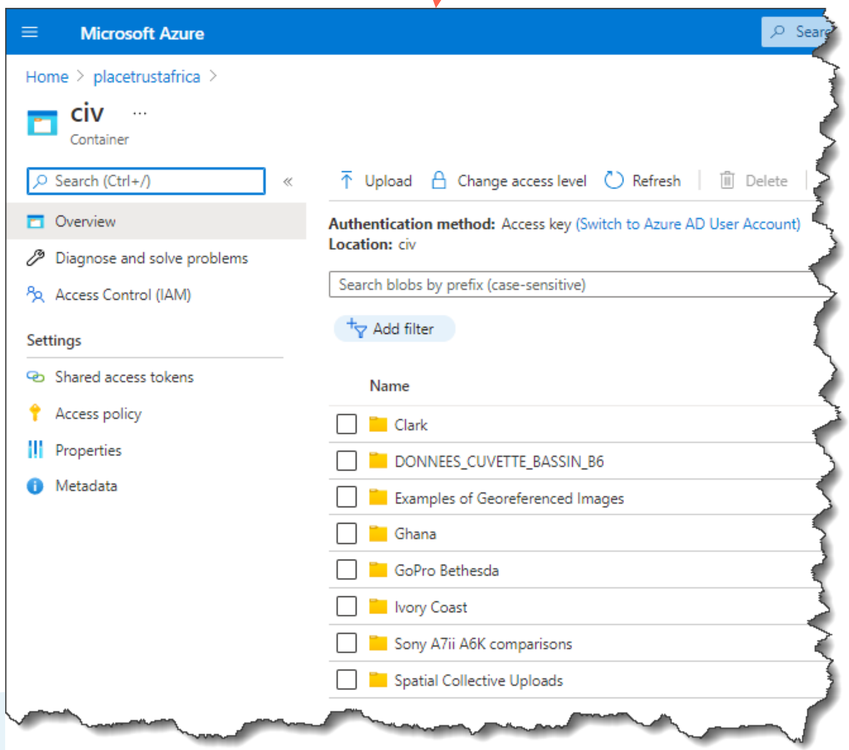
Azure

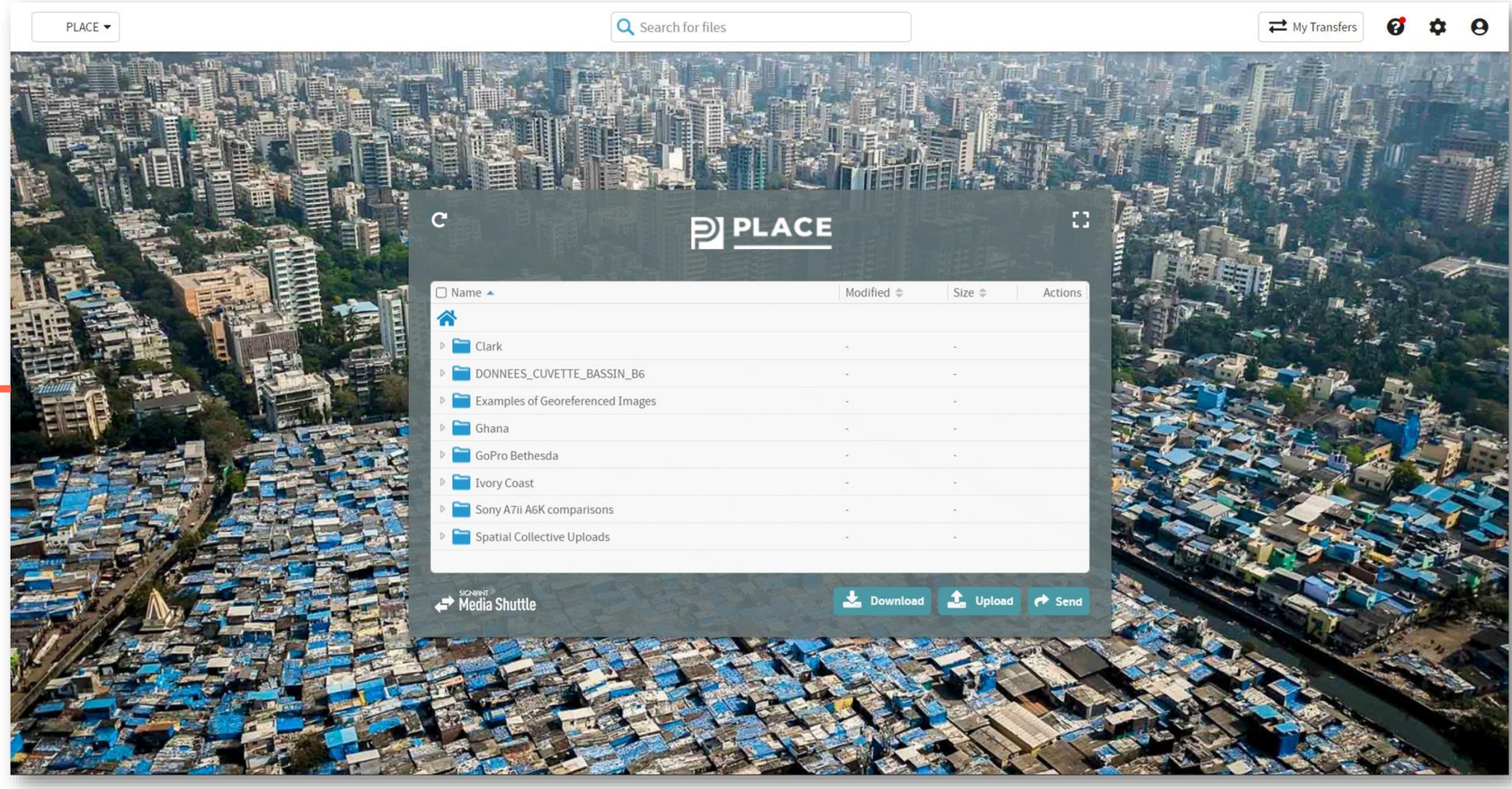
From field to cloud



PLACE Shuttle

- Transfers to Azure can be up to 100 times faster than standard methods such as FTP
- Image uploads trigger processing workflows





PLACE Shuttle is a web-based app to upload imagery to Azure. Only authorized users can use PLACE Shuttle. Typical upload speeds in Abidjan were 31.9 Mb/s, with 30GB uploaded in around 2 hours. See https://downloadtimecalculator.com/Upload-Time-Calculator.html.

Upload Imagery uploaded to the cloud

Process Container invoked to process imagery

Publish Imagery published as an image service

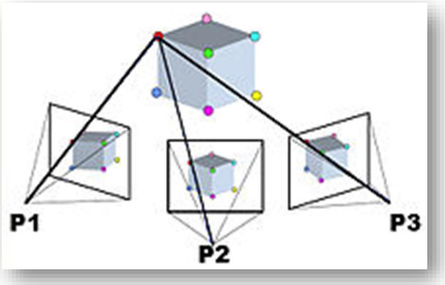
1

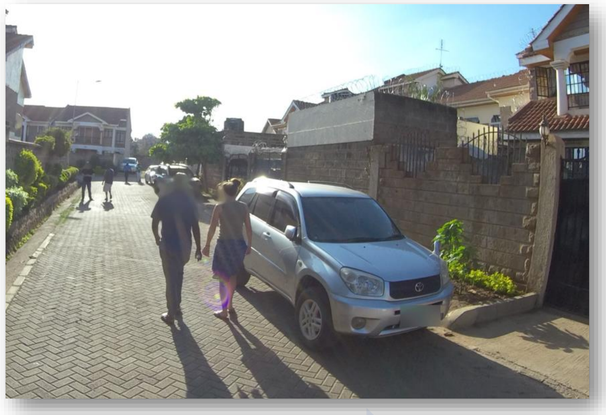
PLACE SfM & PLACE PII

- We use Kubertnes to deploy a container once imagery has been uploaded using PLACE Shuttle.
- Containers make efficient, unattended use of Azure resources only utilizing them when needed.
- Container runs SfM on the aerial imagery generating a sparse point cloud, digital surface model (DSM) and ortho image (GeoTIFF).
- Street imagery is anonymized using COTs software.

Kubernetes is an open-source container-orchestration system for automating computer application deployment, scaling, and management. It was originally designed by Google and is now maintained by the Cloud Native Computing Foundation.

Structure from Motion (SfM) photogrammetry is a method of approximating a three-dimensional structure using two dimensional images. Photographs are stitched together using photogrammetry software to make the three-dimensional (3D) model and other products like ortho maps.





We use anonymization software in the cloud or on board the MMS platform to anonymize faces and number plates appearing on street imagery.

Upload Imagery uploaded to the cloud

Process Container invoked to process imagery

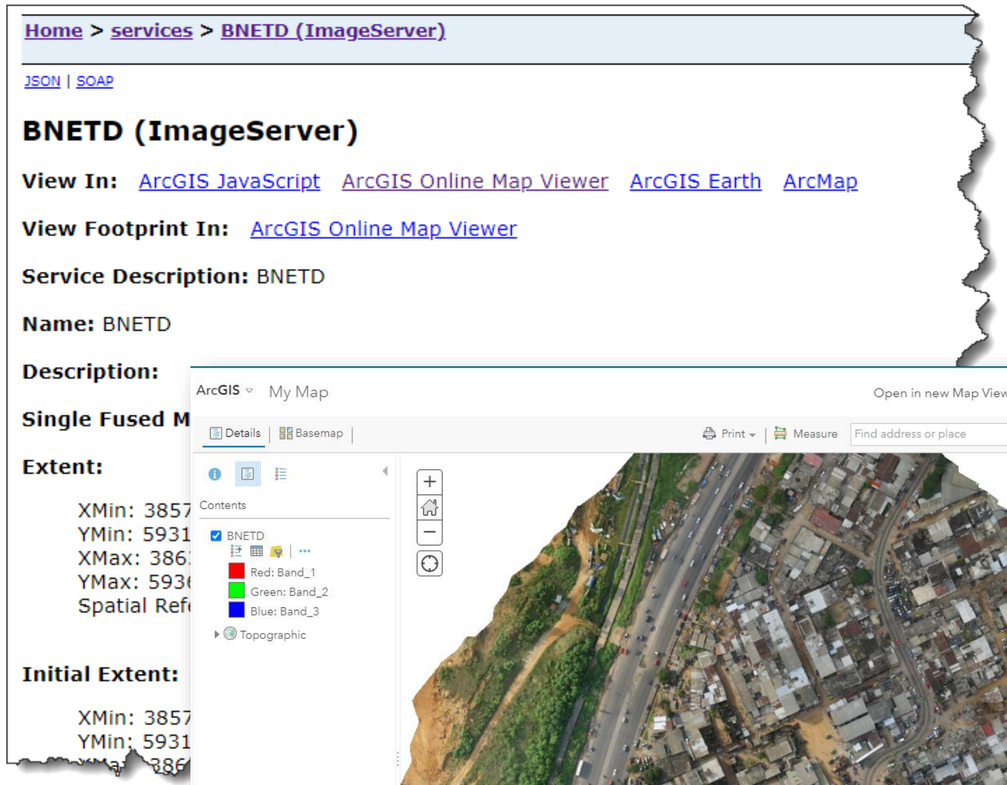
Publish Imagery published as an image service

2

PLACE Share

- We’re using Esri image server to share the imagery we have processed providing members access to the data we produce.
- Ortho-imagery read directly from Azure.
- PLACE members able to use image services (REST API) to consume imagery for use cases, etc.

Image services provide fast and simplified web access to imagery



Upload Imagery uploaded to the cloud

Process Container invoked to process imagery

Publish Imagery published as an image service

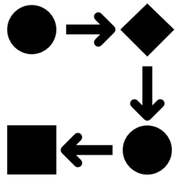
Road Map (2022 ->)

- **Performance and tuning** by continuing to optimize the SfM workflow for speed and cost and assessing alternative SfM engines/platforms.

- Additional **workflow events** including reporting, QA gates, PII anonymization on street imagery & automated publishing of image services.

- **Discovery tools** to enable PLACE members find, access and consume to the data they need, tools will adhere to industry standards (e.g., STAC).

- **User management** to control platform access, assign permissions, and track usage metrics, etc.



Completion of SfM processing should trigger the publishing of an image service with notification to members. QA, reporting and PII automation to be added.

The SpatioTemporal Asset Catalog (STAC) specification provides a common language to describe a range of geospatial information, so it can more easily be indexed and discovered.

Platform access will be aligned to membership role, metrics will allow PLACE to see what imagery is being used, how often, the most active members, etc.

All code we produce will be published to GitHub under CC or equivalent licensing.

PLACE

thisisplace.org

JOIN US AND BECOME PART OF PLACE

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