Global Future Cities Programme

Smart GIS Training: Session 1
GIS Fundamentals

26 October 2021 (15:30)

Agenda

1. Overview
2. GIS Fundamentals
3. Application
4. Practical

Introductions

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Overview

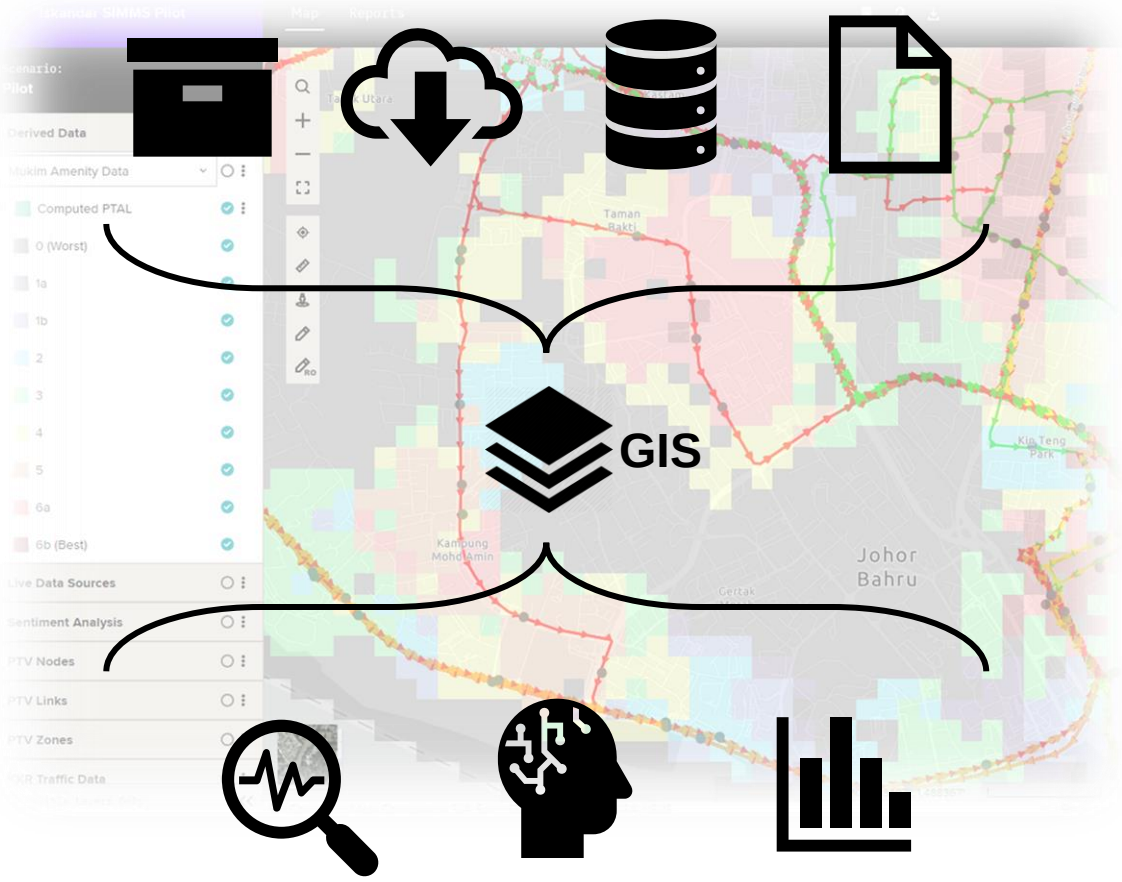
Overview

Over the next 3 sessions we will look at the work performed to produce the Smart GIS as part of the pilot project on the Iskandar intervention:

- Collect Data
- Process it into GIS formats
- Apply analytics
- Produce visualisations
- Generate additional functionality

We will cover:

- GIS Fundamentals
- Derivation of Data
- Advanced Analytics



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GIS Fundamentals

GIS Fundamentals

Basic GIS data introduction

GIS Best Practice

- Naming
- Fields & Attribute

Online GIS Introduction

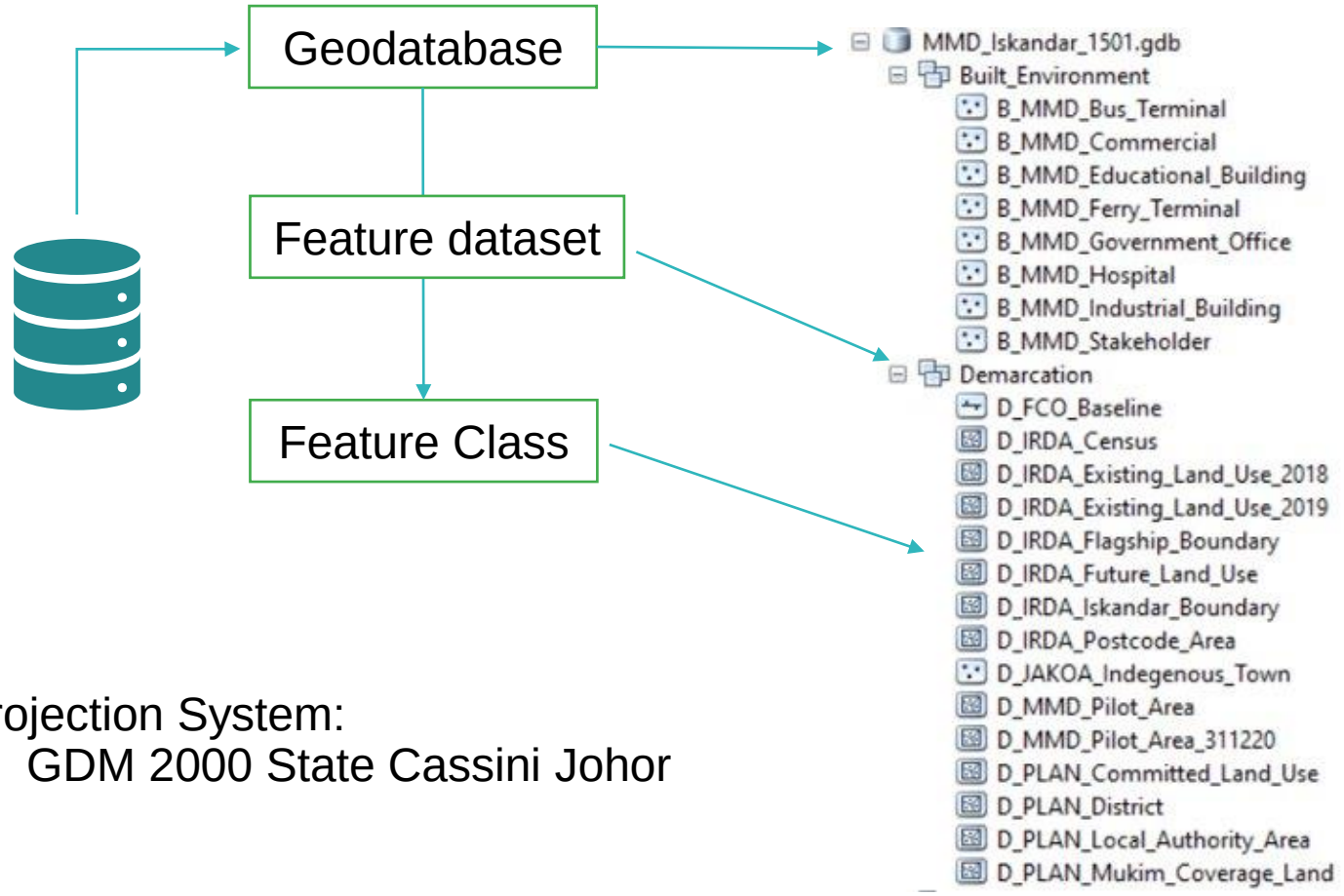
- Data formats
- Data template preparation

Cloud storage, direct links, API links

How do we use APIs?

Basics

SHAPEFILE	Category	GEODATABASE
• Groups several individual files that work together (typically geometry, attributes, and indexing) • Near-universal compatibility with all GIS software packages • Considered the most portable format in GIS as users outside of Esri environments/geodatabases can access files	Key Benefits	• Groups similar data into one database • Allows topology setup, coded value domains, raster catalogs, relationship classes, and geometric networks • Increases spatial function performance speed
Greater than .gdb	File Size	Less than .shp
10 characters	Field Name Length Limit	64 characters
2 GB	File Size Limit	Limited by computer hard drive storage space
Limited only by operating system	Table /Feature Class Name Length	160 characters
Vector	Data Types	Vector, Raster and more complex data such as topology
Can't be used in a field (0 used instead)	NULL Values	Supported
No	File Compression	Yes
No	Proprietary Esri Format	Yes



Projection System:

- GDM 2000 State Cassini Johor

Best Practice - Standard

- THM – or theme. This is a 1-letter abbreviation indicating the dataset theme or category in accordance with MS1759:2015 .
- ORIG – or Originator. This is a 3 to 5 letter abbreviation depicting the name of company who first created the dataset.
- BriefName – A short descriptive name describing the content of the dataset. This should not have spaces, separate words with an underscore is used instead.
- Suffix – To modify or add descriptive text to a filename.

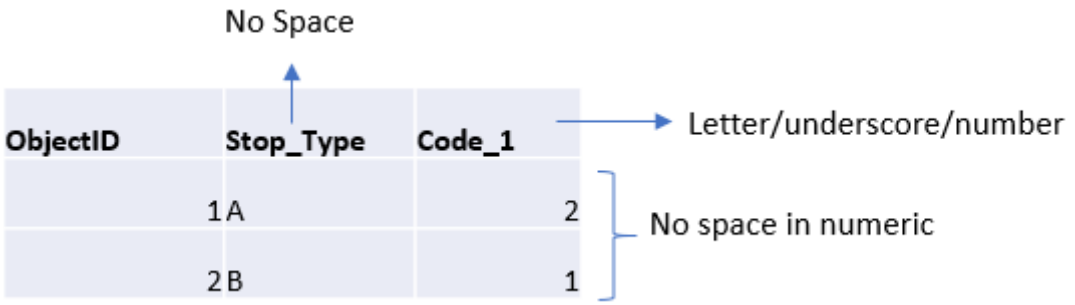
Theme	Originator Code	Feature Name	Suffix	Feature Name
B	MMD	LastBusTerminal	Pt	B_MMD_LastBusTerminal
B	MMD	Stakeholder	Pt	B_MMD_Stakeholder
T	IRDA	CCTV	Pt	T_IRDA_CCTV

Processing

- Data Standards
- Field type and properties
- Field names
- Field characters
- Attribute Accuracy

Field type	Storable range	Size (Bytes)	Applications
Short integer	-32,768 to 32,767	2	Numeric values without fractional values within specific range; coded values
Long integer	-2,147,483,648 to 2,147,483,647	4	Numeric values without fractional values within specific range
Float (single-precision floating-point number)	approximately -3.4E38 to 1.2E38	4	Numeric values with fractional values within specific range
Double (double-precision floating-point number)	approximately -2.2E308 to 1.8E308	8	Numeric values with fractional values within specific range

Feature Class	Subtype	Domain
		Officer A
	New	Officer B
	Completed	None
		Officer C
	Investigate	Officer D

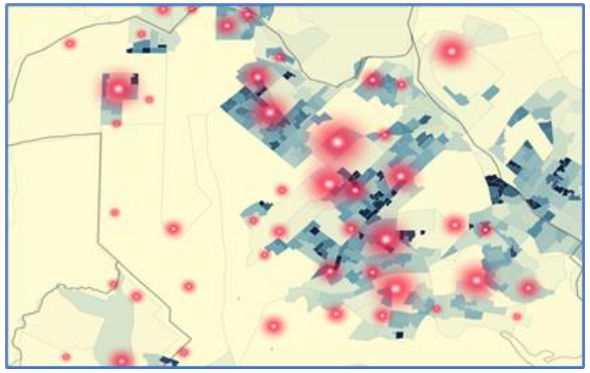


Only use text and numeric characters; avoid using special characters such as “! @ # % { } | / \ ~”. Commas should not be used in fields as they may cause problems when transferring data. Separations should either be represented as a space, underscore or a hyphen.

Online GIS & Web Layer

Hosted feature layer is a group of similar geographic features (point, line, polygon) that have been published (stored) in ArcGIS Online

- GeoJSON file (.geojson or .json)
- Microsoft Excel files (.xlsx or .xls)
- Comma-separated values (CSV) file (.csv)
- File geodatabase (.zip)
- Shapefile (.zip)
- etc



Web Map

Type of other web layers:

- Imagery layer
- Map Image layer
- Tile layer
- Scene layer

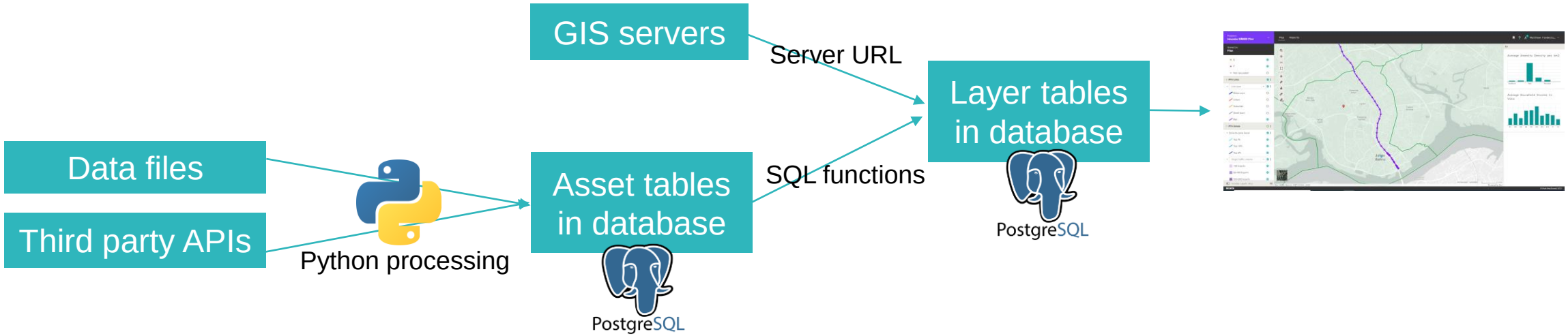
Layers:

- T_FCO_Road (0)
- T_MMD_Weighting_Station_Complex (1)
- T_PAJ_Bus_Outsite_Iskandar (2)
- T_PAJ_Bus_Within_Iskandar (3)
- T_CCTV (4)
- B_MMD_Commercial (5)
- B_MMD_Educational_Building (6)
- B_MMD_Industrial_Building (7)
- B_MMD_Hospital (8)
- B_MMD_Government_Office (9)
- B_MMD_Ferry_Terminal (10)
- B_MMD_Bus_Terminal (11)
- B_MMD_Stakeholder (12)
- D_PLAN_District (13)
- D_PLAN_Mukim_Coverage_Land (14)
- D_PLAN_Local_Authority_Area (15)
- D_MMD_Pilot_Area (16)
- D_IRDA_Existing_Land_Use_2019 (17)
- D_PLAN_Committed_Land_Use (18)
- D_FCO_Baseline (19)
- D_IRDA_Census (20)
- D_IRDA_Postcode_Area (21)
- D_IRDA_Iskandar_Boundary (22)
- D_IRDA_Future_Land_Use (23)
- D_IRDA_Flagship_Boundary (24)
- D_IRDA_Existing_Land_Use_2018 (25)
- D_JAKOA_Indegenous_Town (26)
- U_MMD_Meteorological_Station (27)
- U_MMD_Rainfall_Station (28)
- U_IRDA_ChargeEV_Unit (29)
- U_IRDA_ChargeEV_Station (30)

Cloud storage, direct links, API links

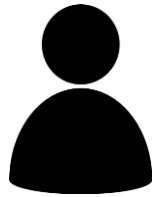
Overview

- Objective: display all kinds of geospatial data in one place
- ArcGIS servers, data files such as .shp and .gdb, third party APIs
- Solution: Moata platform



Find out more about Moata's applications: https://www.mottmac.com/digital/moata

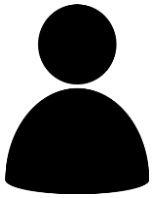
How do we use APIs?



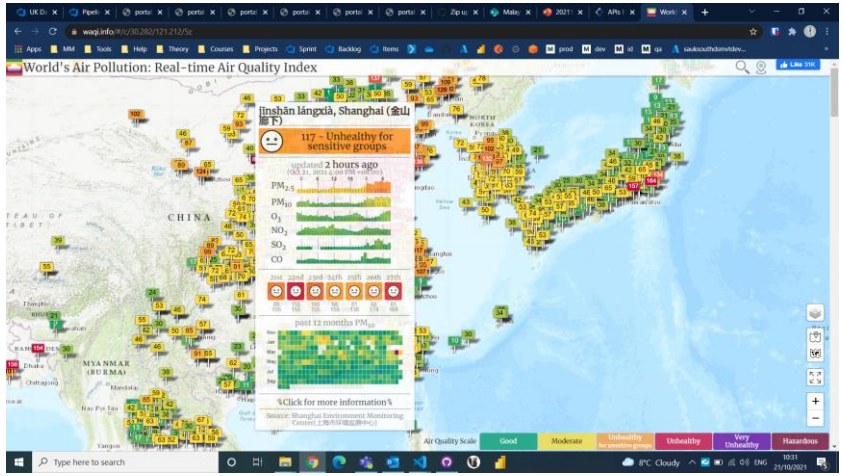
API

- API: Application Programming Interface

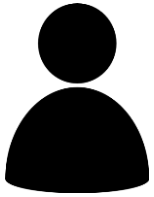
I want to know the air quality in Shanghai



Manual




```
import requests
url = 'https://api.waqi.info/feed/shanghai/?token=...'
req = requests.get(url)
data = req.content
```



API

```
{
   status: "ok",
   data: {
      aqi: 70,
      time: {
         s: "2021-06-20 09:00:00"
      },
      city: {
         name: "Shanghai",
         url: "http://aqicn.org/city/shanghai/",
         geo: [
            "31.2047372",
            "121.4489017"
         ]
      },
      iaqi: {
         pm25: "..."
      }
   }
}
```

- A programmatic API will allow you to get data from a website/app in an **automated** way

Application

Application

ArcGIS servers

- Each layer must point towards a data source to visualise
- Given a url we can extract the necessary info (geometries, attributes, styling)
  - For example: https://onemap.mbip.gov.my/arcgis/rest/services/.../MapServer
  - Other supported types include FeatureServer urls and Web Map Service/Web Map Tile Service urls

Interface to allow users to add their own layers is currently in testing

Application

Data files

- Files are processed in Python to tabular format with text-represented geometries

	A	B	D	F	
1	unique_id	route_id	num_trips	route_long_name	geometry
2	Route_0321cfcbecb7f6e062f1d294_inbound	0321cfcbecb7f6e062f1d294	9	Service ID CT1	LINESTRING (103.78926 1.49886, 103.78899 1.49863, 103.
3	Route_0321cfcbecb7f6e062f1d294_outbound	0321cfcbecb7f6e062f1d294	9	Service ID CT1	LINESTRING (103.76499 1.46354, 103.76472 1.46404, 103.
4	Route_03418837d7e991a5eebb9f42_inbound	03418837d7e991a5eebb9f42	7	Service ID P213	LINESTRING (103.62827 1.53824, 103.6282 1.5383, 103.62
5	Route_03418837d7e991a5eebb9f42_outbound	03418837d7e991a5eebb9f42	7	Service ID P213	LINESTRING (103.5898 1.44678, 103.58984 1.44703, 103.5
6	Route_08862d50c23665b56e6e1fbf_inbound	08862d50c23665b56e6e1fbf	25	Service ID 331	LINESTRING (103.62827 1.53824, 103.6282 1.5383, 103.62
7	Route_08862d50c23665b56e6e1fbf_outbound	08862d50c23665b56e6e1fbf	25	Service ID 331	LINESTRING (103.76499 1.46354, 103.76472 1.46404, 103.

- Uploaded via Moata API to our SQL database in the cloud
- Layers are configured to point towards the relevant assets in the database

Application

Third party APIs

- Query API in Python and process to tabular format with text-represented geometries

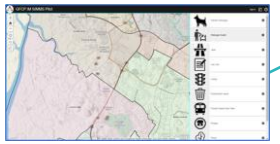

```
{
   status: "ok",
   data: {
      aqi: 70,
      time: {
         s: "2021-06-20 09:00:00"
      },
      city: {
         name: "Shanghai",
         url: "http://aqicn.org/city/shanghai/",
         geo: [
            "31.2047372",
            "121.4489017"
         ]
      },
      iaqi: {
         pm25: "..."
      }
   }
}
```


	A	B	C	D	E
1	Name	Today's AQI	WKT		
2	Shanghai	70	POINT(121.4489017 31.2047372)		

- As before, upload to database and configure layers to point to the relevant assets
- Use of Microsoft Azure services to host the Python code on the cloud and run once per day

Data collection template preparation from the pilot project

- Citizen Feedback Portal
- Traffic Light Survey
- Traffic Count Portal



3. Apps Interface

4. User submit data

Synchronize Changes

Map

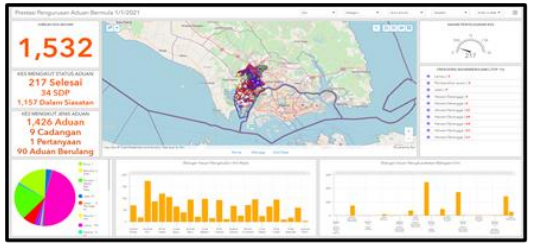
2. Database

Publish

View, Filter, Edit

1.Prepare Data Template

5.Dashboard



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Practical

Practical

Template for Field worker to verify road in study area

Use QGIS & Online GIS to run some examples

Preparation template for data collection

- Add data
- Add fields
- Field type and properties
- Field names
- Intersect
- Publish data as a hosted feature service (URL link provided for SIMMS)
- Collector/Web Application for field worker

Tutorial Data: https://arcgis.com/home/item.html?id=220c18e8208d40deb21a97d609b6e5d9

Summary

Summary

Theory

- GIS Fundamentals (best practice, naming conventions, data formats)
- Online storage and interaction (direct links, APIs)

Application (via SIMMS)

- ArcGIS servers (Moata Platform)
- Data collection

Practical

- Basic GIS operations
- Publishing to ArcGIS Online for data collection

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Thank you