Underground Geospatial Information Management in Singapore

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Singapore Land Authority

Key Missions

1. **To optimise Land Use in Singapore**
2. **The Trusted Authority for Land and Property Ownership**
3. ***The Geospatial Agency in Singapore***

Key Objectives

a. Protect property ownership rights in Singapore

b. Promote use of State land and properties for economic and social objectives

c. Preserve State land and assets for future generations, and to meet Singapore's needs

d. ***Advance geospatial information, science and technology to benefit Singapore***

SLA co-drives NSDI programme

Singapore Geospatial Collaborative Environment (SG-SPACE)

Co-drivers: SLA Singapore Land Authority, GovTech Singapore

Government-wide mechanism to make available the interoperable, organised and authoritative geospatial information, science and technology for:

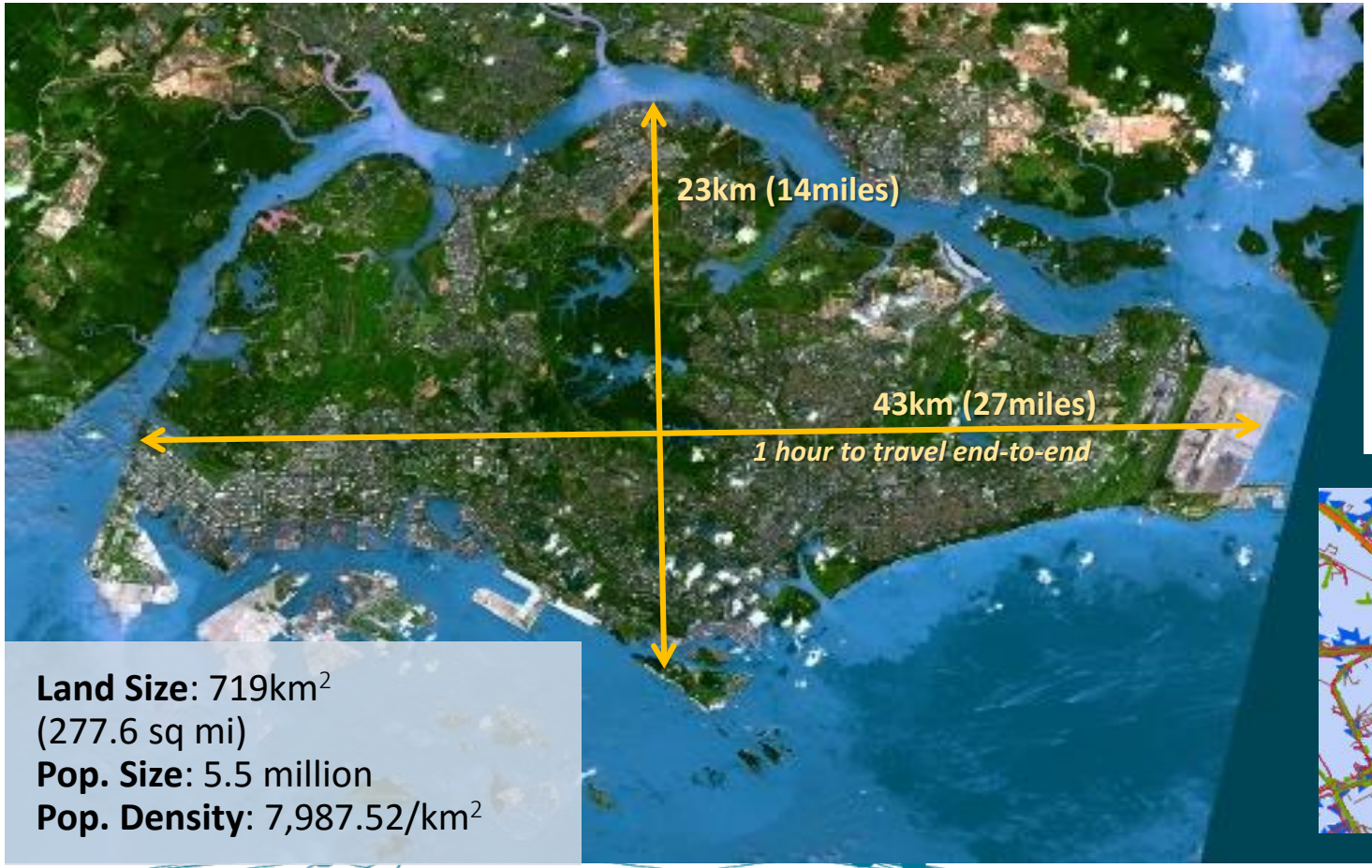
National-level Decision Making

Public Security

Cost-effective Businesses

Location Awareness among Citizens

Singapore a land-scarce city-state

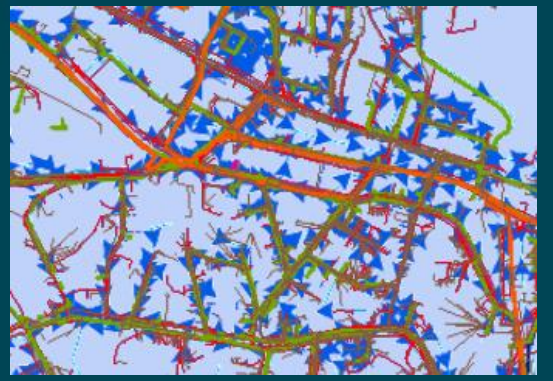


Land Size: 719km^2
(277.6 sq mi)
Pop. Size: 5.5 million
Pop. Density: 7,987.52/km^2

New York City

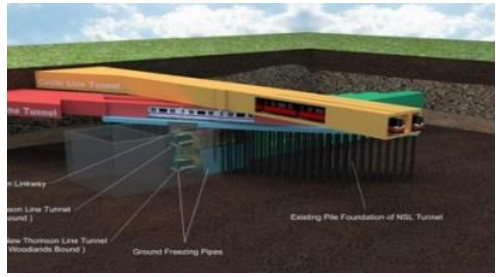
Land Size: 784 km^2
(302.5 sq mi)
Pop. Size: 8.55 million
Pop. Density:
10,831.1/km^2

(Illustration courtesy of Spaceshots)



1. Land scarcity and high urban density necessitate use of underground space
2. Increasing need to place underground developments in close proximity

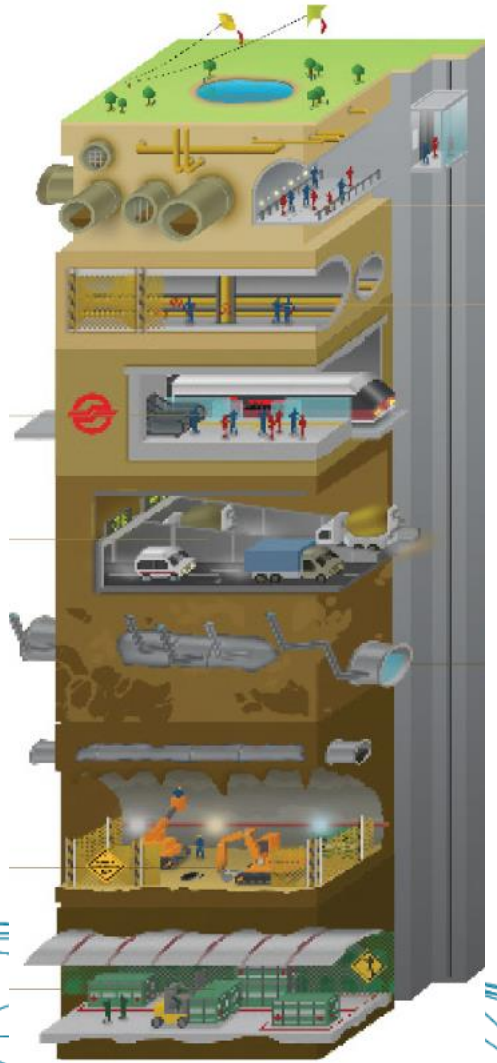
Extensive use of underground space locally



Transportation Tunnels

Deep Tunnel Sewerage System

Rock Cavern Development



Surface/Basement Levels:

1-3m: Utility lines (water pipes, telecom cables, power lines)

5-10m: Common Services Tunnel at Marina Bay

12-20m: Basement level space extensively used for retail, car parks and underground pedestrian Links, MRT, Roads/Expressways

20-50m: Deep Tunnel Sewerage System

60m: Power Transmission Cable Tunnels

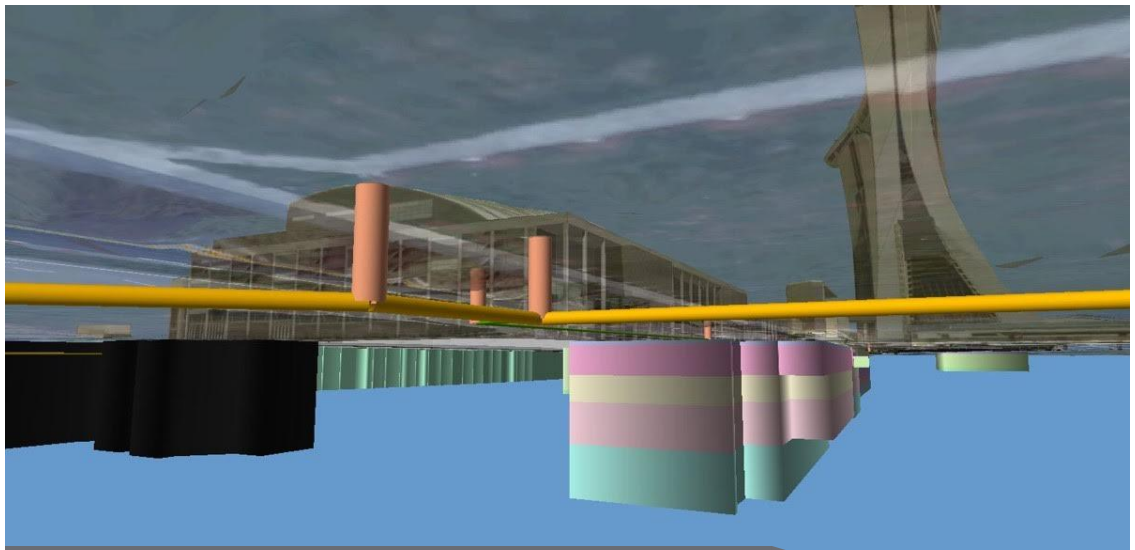
Deep Rock Cavern Level:

130-150m: Hydrocarbon Storage Facility

- Underground Defence Facility

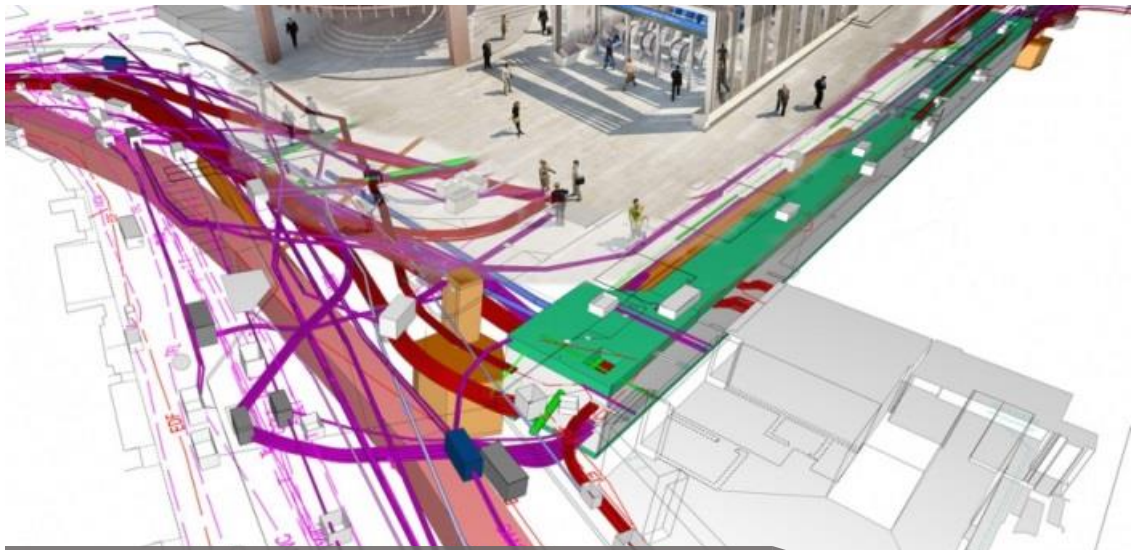
Existing Underground Geospatial Information (UGI) efforts

(Illustration courtesy of The Manufacturer)



3D Subterranean Boundary Data

1. In-house conversion from 2D plans to 3D GIS data
2. 170+ subterranean lots converted island-wide
3. Data to facilitate underground planning



Utility Survey Standard

a. To provide guidelines on data capturing to improve data reliability

b. Stipulates data and attributes to be collected

c. Guides surveyors to achieve ±100mm accuracy horizontally and vertically

Amendments to underground space acquisition and ownership

To support long term planning for use and underground space development

State Lands Act

1. Landowners possess 30m of subterranean land below the Singapore Height Datum (SHD)*
2. Land deeper than 30m SHD belong to the State

Land Acquisition Act

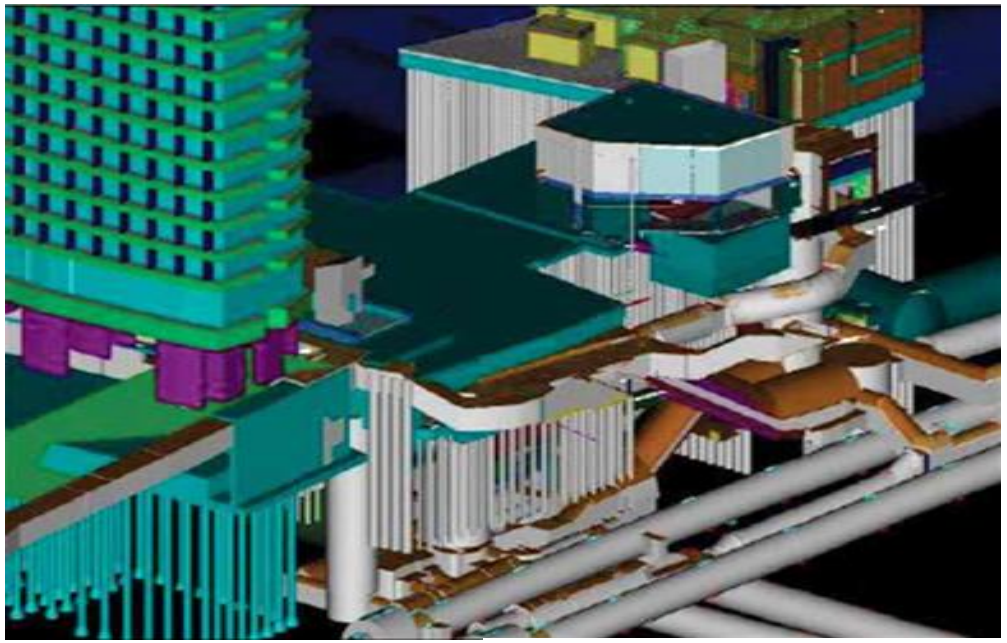
3. Government can acquire a specific stratum of underground or air space instead of the entire column of land, when developing public projects

(Illustration courtesy of Bloomberg)

* Fixed datum surface set at 0.000 metres of Singapore's historical mean sea level

Underground Master Plan in the works

To ensure systematic planning and space optimisation for underground space



(Illustration courtesy of Crossrail)

1. Focuses on specific areas suitable for underground developments

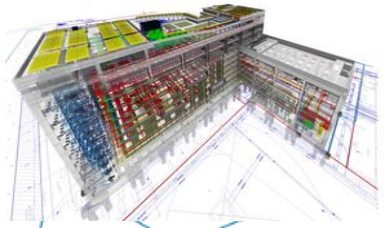
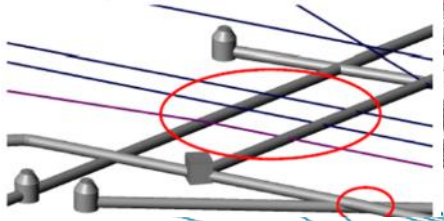
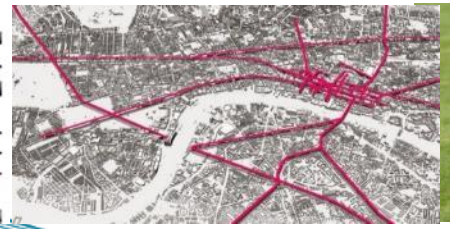
2. Complements Singapore Master Plan and integration with surrounding uses

Quality 3D UGI required

UGI challenges encountered

1 Data Governance	2 Data Completeness & Accuracy	3 Data Sharing	4 Data Standards
UGI ownership not clearly defined	Existing UGI: 1. Incomplete/hard to retrieve 2. Unreliable or inaccurate 3. Not georeferenced 4. Not digitised	No systematic sharing and some legal and confidentiality concerns	No common UGI standards

5 Data Platform	6 Technology	7 Funding
Yet to identify government-wide platform to support UGI use and sharing	Cost-effective and sustainable methods for UGI collection and management needs to be studied	Funding required by UGI owners in collection and management

Government-wide work group to holistically address UGI challenges

Underground Geospatial Information Management Work Group (UGIM WG)

Role

To coordinate government-wide effort to plan, formulate and implement a holistic strategy and approach for UGIM

Composition

Public agencies from 5 domains:

1. Urban Planning
2. Utility (Energy/Water/Telcom)
3. Transport & Mobility
4. Buildings & Structures
5. Technology

UGIM WG approach & current efforts

6 WG Focus Areas

1. **Establish Data Governance**
2. **Establish UGI Standards**
3. **Unlock UGI Sharing**
4. **Consolidate UGI & Identify Common Data Platform**
5. **Integrate Above & Underground Geospatial Information Management**
6. **Address Funding Concerns for UGI Collection & Management**

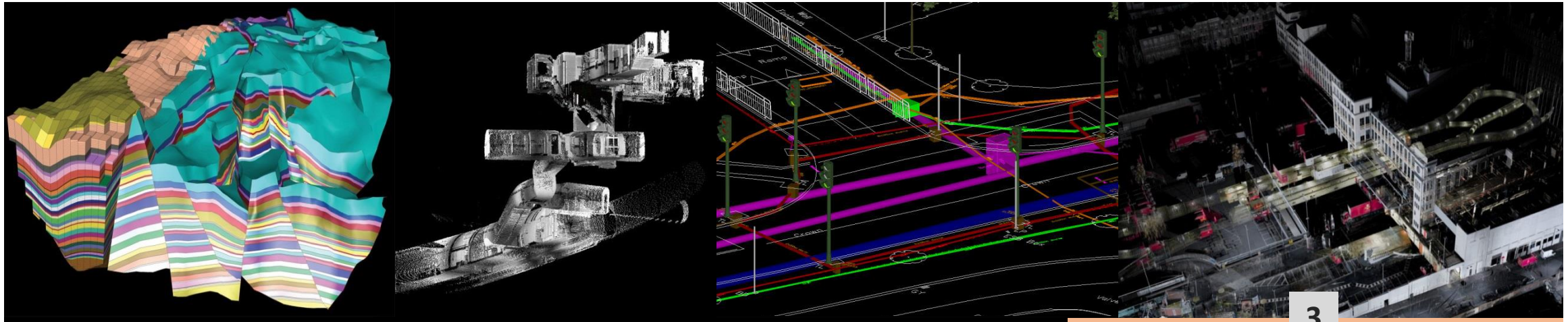
Current efforts

Established commitment and timeframe for UGI sharing in support of underground master plan

Government-wide workshop to identify planned/potential underground developments and UGI needs

Key challenges remain to be addressed

(Illustrations courtesy of Dynamic Graphics, Mike Annear, Murphy Surveys and *ScanLAB Projects respectively)*



1

Need to identify fundamental UGI datasets

→ Provides spatial reference for other UGI

2

UGI data models, standards & attributes to be aligned

→ Ensure UGI usefulness and interoperability

3

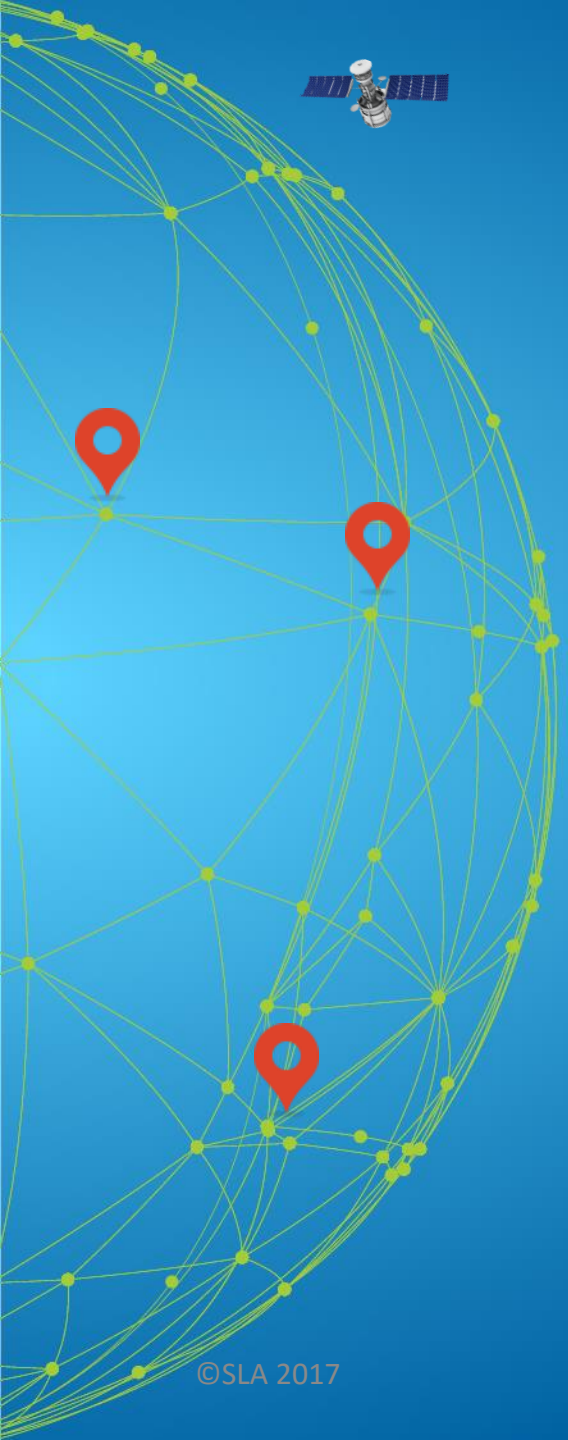
Cost implication in implementing new UGI-related requirements

→ Especially for utility agencies

Collaboration will be fundamental to address UGI issues

1. OGC UI Study a useful platform to tackle UGI challenges

2. Holistic framework and collaborative approach crucial to achieve common utility standard and ensure data interoperability



Thank You