ESRI DEVELOPER SUMMIT

10-12 November | Berlin, Germany

Accessing Your Enterprise Geodatabase using SQL

Hao LEE

November 12 , 2015

Assumptions

- Basic knowledge of SQL and relational databases
- Basic knowledge of the geodatabase
- We'll hold all questions until the end

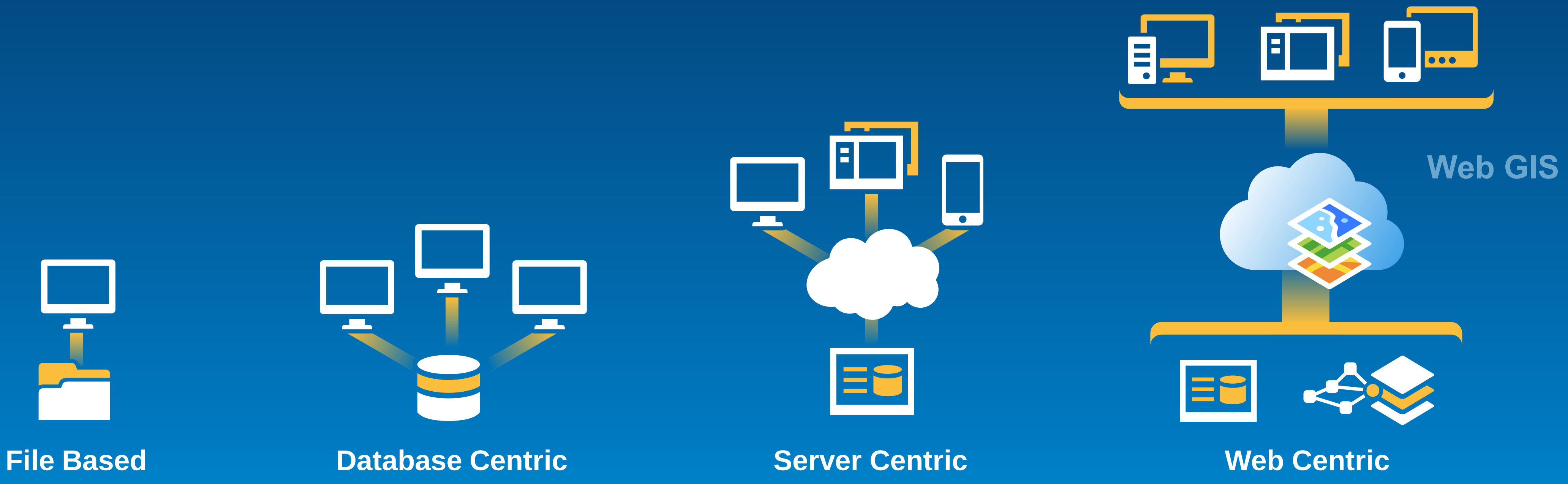
Please turn off cell phones

Agenda

- RDBMS support in ArcGIS
- Geodatabase and it’s system tables
- Demo – Querying geodatabase schema
- Editing geodatabase feature classes from SQL
- Discovery functions
- Demo – Editing versioned and non versioned feauture class
- Summary of dos and don’ts

ArcGIS Supports Multiple Implementation Patterns

- Leveraging Common Computing Architecture

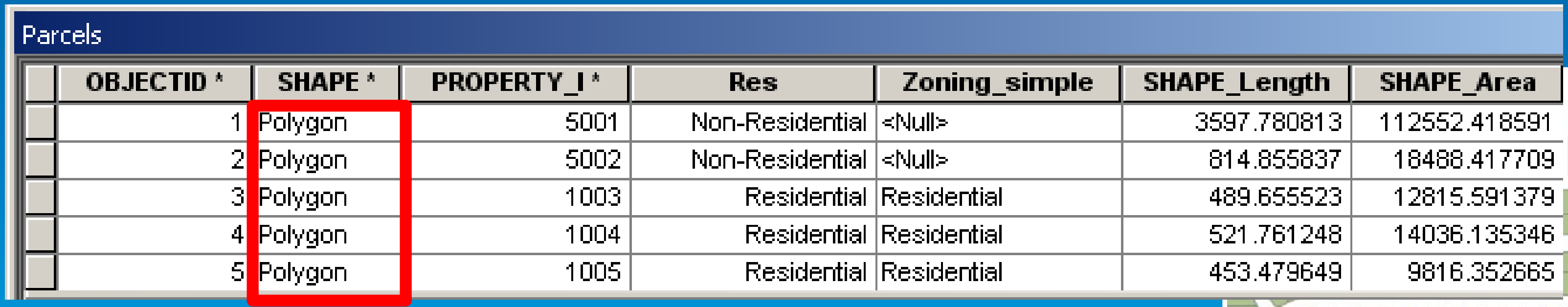


Database

- You can access spatial or non-spatial data in a DBMS to use in ArcGIS
  - Geodatabase and Database access
    - Oracle, SQL Server, DB2, Informix, PostgreSQL,
  - Database access only
    - Netezza, Teradata, SAP HANA, ALTIBASE, Windows Azure SQL Database
- You can connect directly to a supported database and view data by making a connection from the Catalog tree in ArcGIS for Desktop
- To filter what data appears in ArcMap, you can use a query layer
- Use SQL to access the data

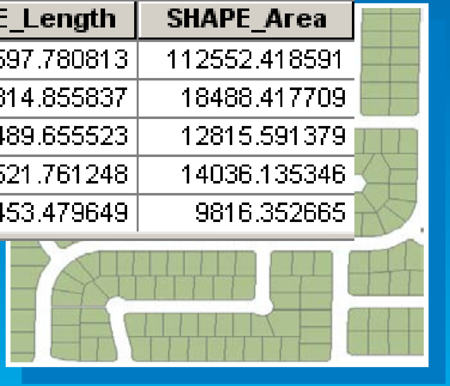
Accessing spatial data from ArcGIS

- A table with a column that stores a spatial type
  - We call this a feature class
- Each row represents a feature
- The fields in each row represent attributes or properties of the feature
- One of the fields holds the feature geometry which is stored as a spatial type



Parcels

OBJECTID *	SHAPE *	PROPERTY_I *	Res	Zoning_simple	SHAPE_Length	SHAPE_Area
1	Polygon	5001	Non-Residential	<Null>	3597.780813	112552.418591
2	Polygon	5002	Non-Residential	<Null>	814.855837	18488.417709
3	Polygon	1003	Residential	Residential	489.655523	12815.591379
4	Polygon	1004	Residential	Residential	521.761248	14036.135346
5	Polygon	1005	Residential	Residential	453.479649	9816.352665



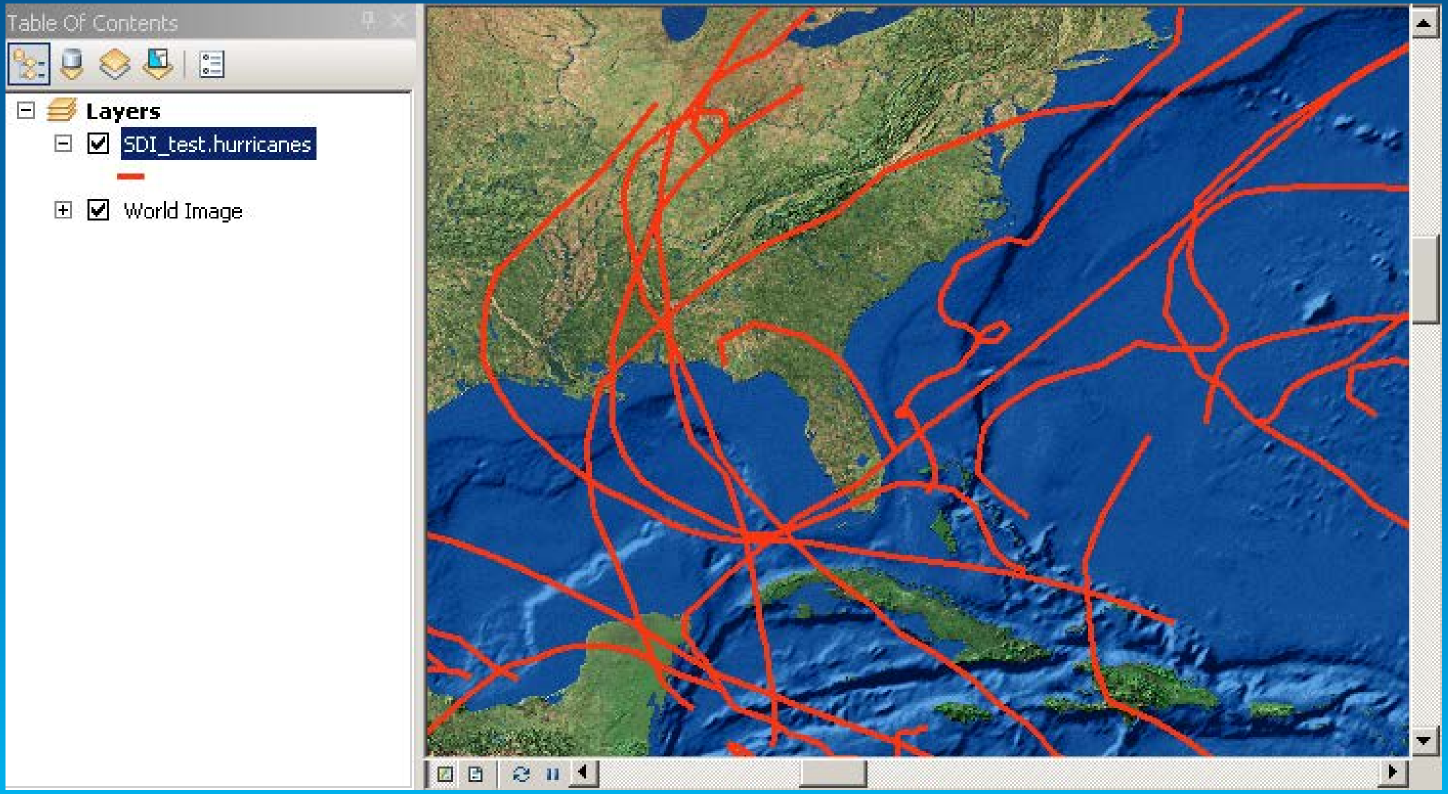
Viewing database data in ArcGIS

- Tables (with and without a spatial type) are viewed in ArcGIS through a query layer
  - Define the layer yourself or let ArcGIS discover how to define it
- Query Layer is a layer that is defined by a SQL query
  - Provide data integration with geodatabases as well as from databases
  - Can quickly integrate spatial and non-spatial information into GIS projects independently of where and how that information is stored

Viewing database data in ArcGIS

- **Simple SQL query**

```
SELECT * FROM dbo.HurricaneTracks_2005 hurricane
```



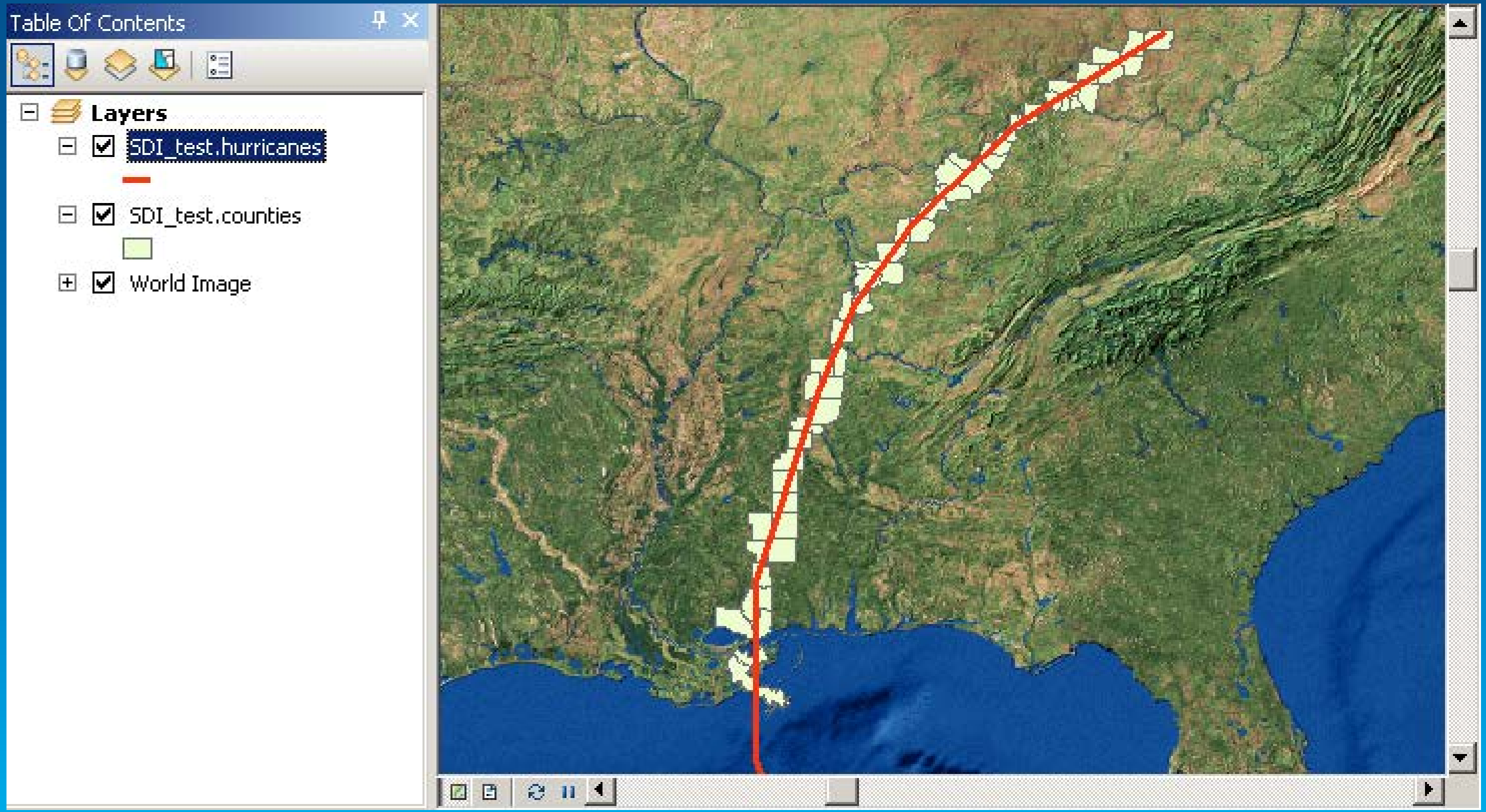
Viewing database data in ArcGIS

- **Complex queries that use casting, derived columns and spatial operators**

```
SELECT county.id, county.State_name,
county.NAME county_name, county.POP1990 population,
CAST(county.POP1990 as decimal)/CAST(states.POP1990 as decimal)*100 PctStatePop,
county.Shape FROM dbo.HurricaneTracks_2005 hurricane
join dbo.counties county
on hurricane.Shape.STIntersects(county.shape) = 1
Join dbo.states states
on states.state_fips = county.state_fips
 WHERE hurricane.NAME = 'KATRINA'
```

Viewing database data in ArcGIS

- Complex queries that use casting, derived columns and spatial operators



Other Database Tasks

- Connecting to a database
- Supported data types
- Viewing data and query layers
- Some administration tasks
  - Managing permissions
- Create new tables and alter schema

Building on top of database functionality

- When you want to do more with your data

  - Store business rules with the data so they’re available to everyone who accesses the data
  - Advanced data modeling like transportation or utility networks
  - Store and work with detailed cartography
  - Multiple editors working on the same data at the same time without impacting each other.

The Geodatabase

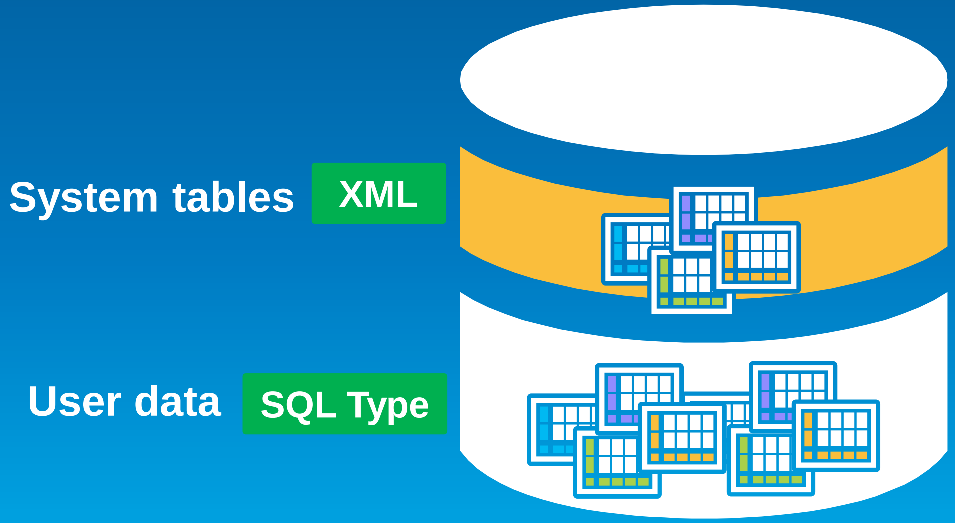
- A physical store of geographic data
  - Scalable storage model supported on different platforms
- Core ArcGIS information model
  - A comprehensive model for representing and managing GIS data
  - Implemented as a series of simple tables
- A transactional model for managing GIS workflows
- APIs for accessing data

Geodatabase is based on relational principles

- The geodatabase is built on a relational database
  - Functionality consistent across each enterprise DBMS
- Database provides:
  - Storage of geographic data in tables
  - Extended functionality and data integrity
- Application logic provides:
  - GIS integrity and behavior
  - Business rules, topology, networks, etc.

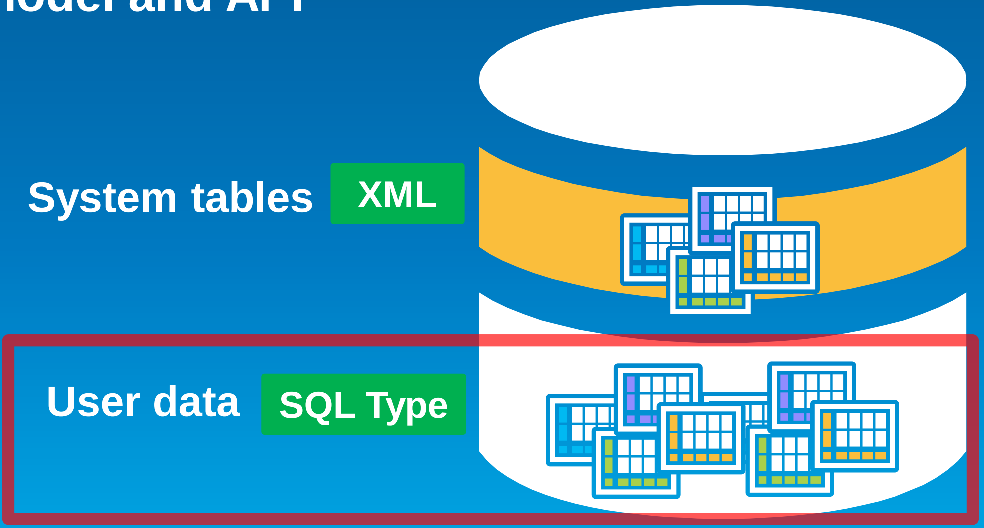
Geodatabase schema

- There are two sets of tables
  - Dataset tables (user-defined)
  - Geodatabase system tables (schema is controlled by ArcGIS)



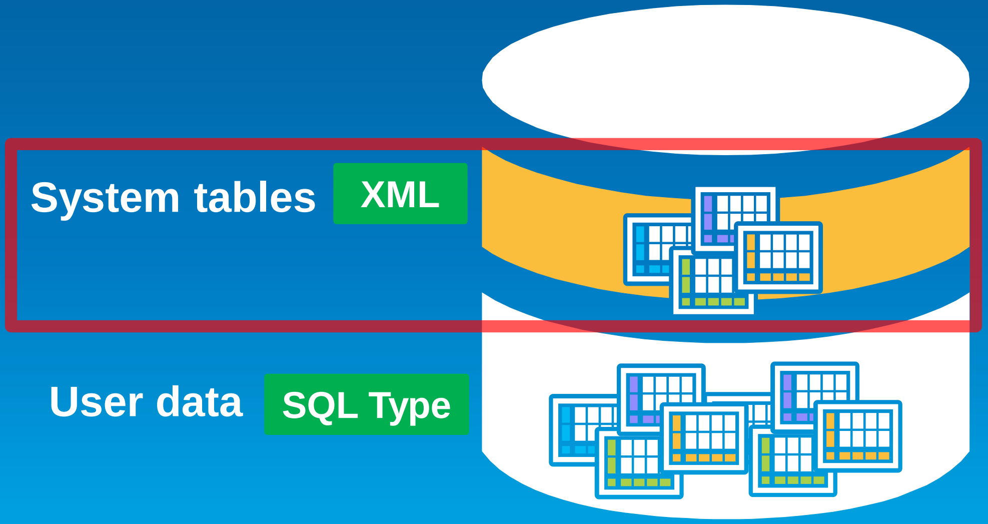
User-defined tables

- Stores the content of each dataset in the geodatabase
- Datasets are stored in 1 or more tables
- Spatial types enhance the capabilities of the geodatabase
  - SQL access to geometry
  - Industry standard storage model and API

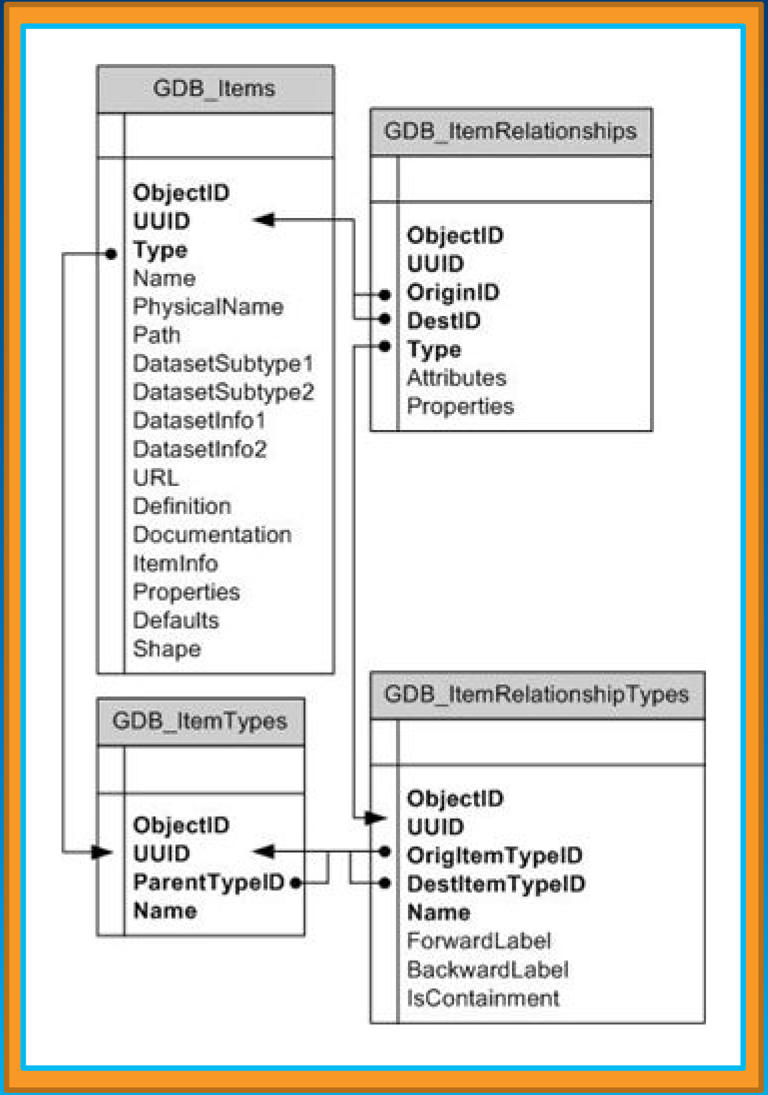


Geodatabase system tables

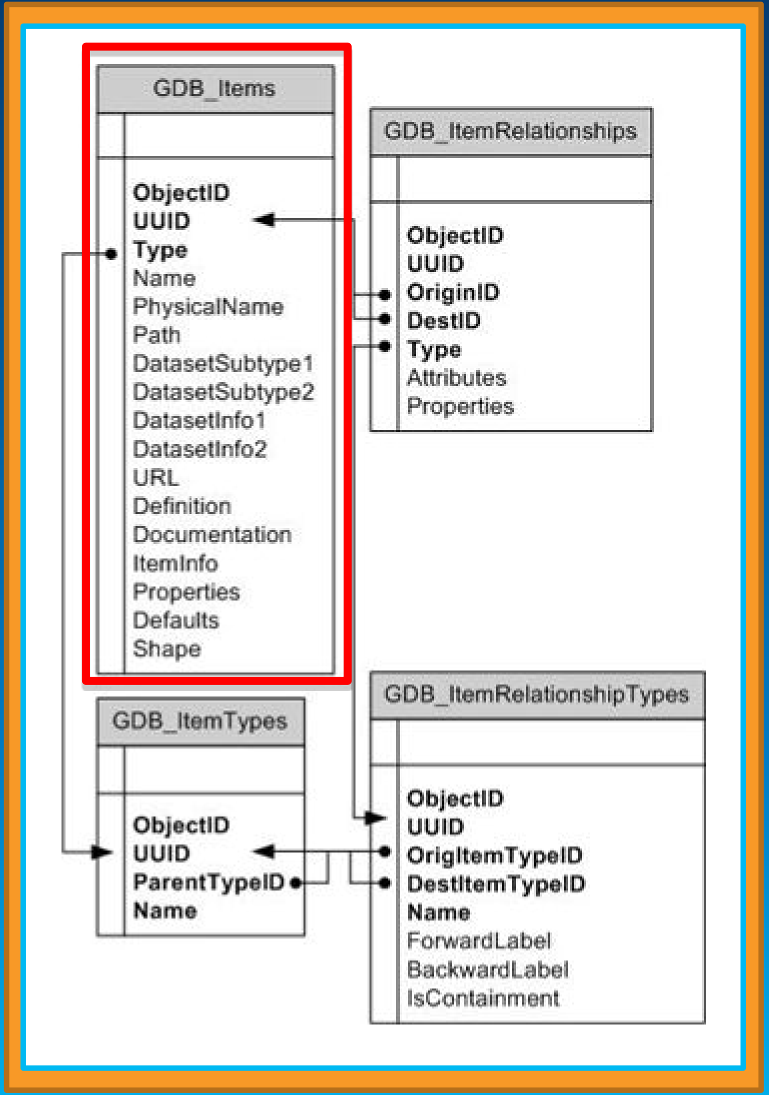
- System tables store definitions, rules and behavior for datasets
- Tracks contents within a geodatabase
- 4 main system tables
- Geodatabase schema is stored primarily within an XML field



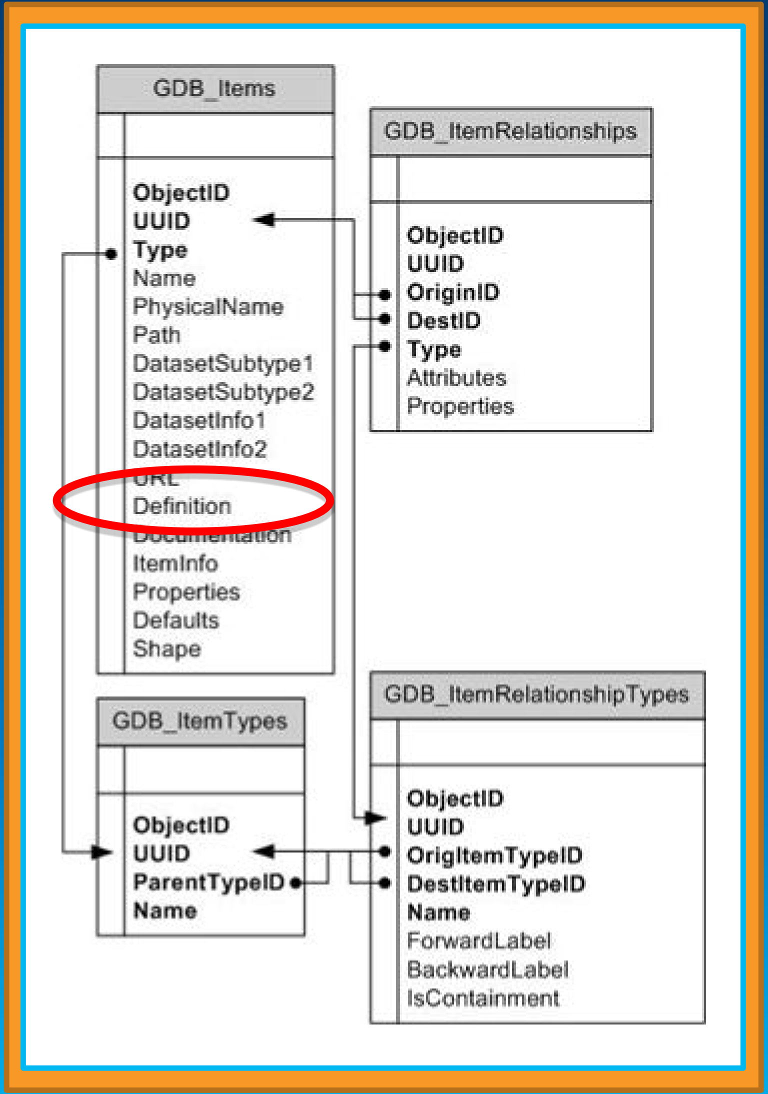
Geodatabase schema



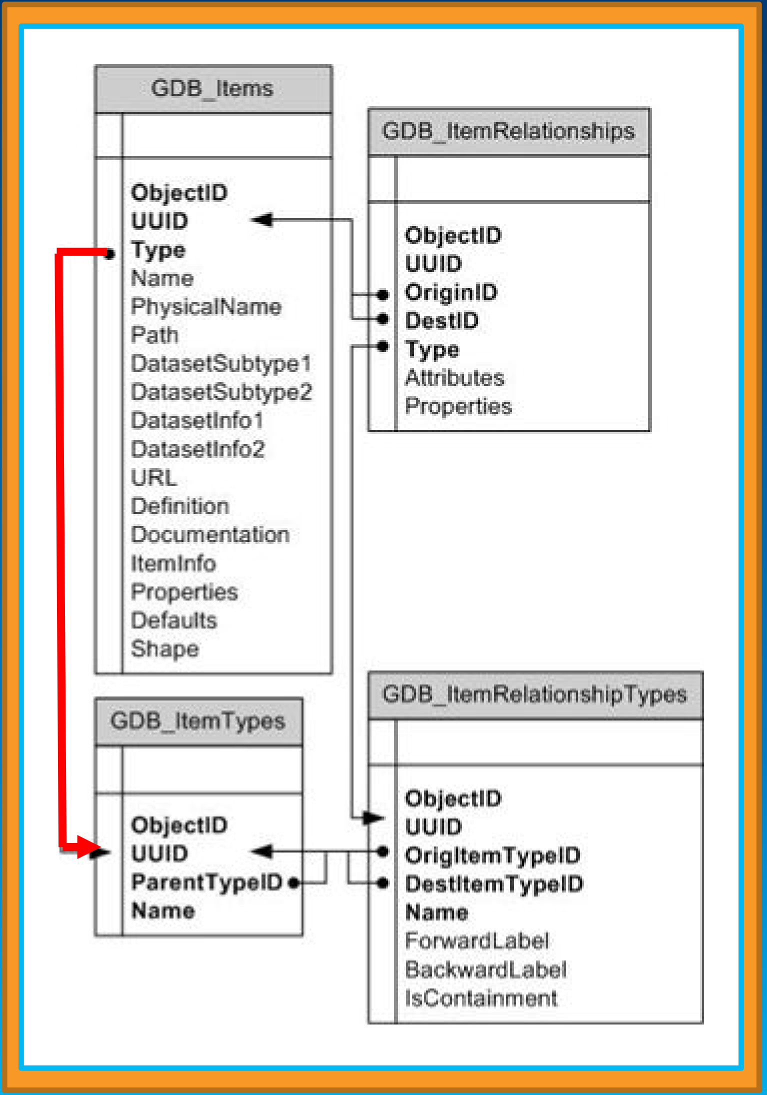
Geodatabase schema



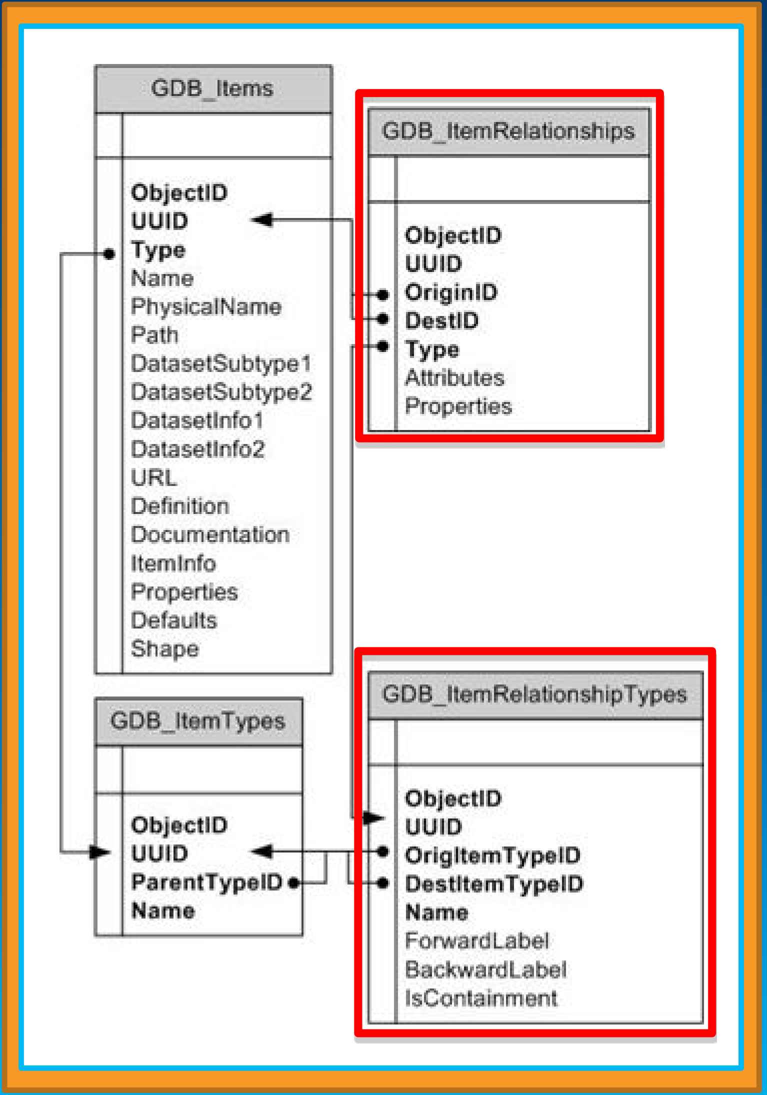
Geodatabase schema



Geodatabase schema



Geodatabase schema

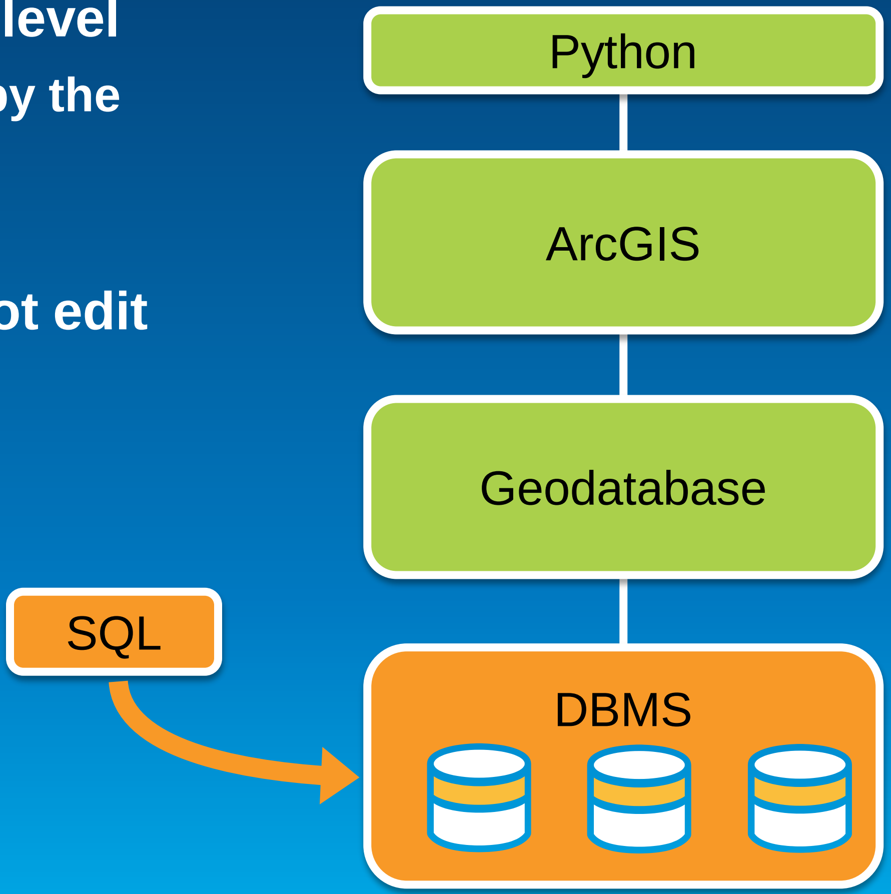


Accessing your geodatabase using SQL

- Access schema and properties of existing datasets
  - Use SQL statements to query the *definition* field on the *gdb_items* table
    - Oracle and Informix use GDB_Items_vw
- Editing tables/feature classes, whether versioned or not
  - Use versioned views with versioned classes
- Create tables with SQL that contain spatial or raster types
- Leverage SQL functions to evaluate attributes and spatial relationships, perform spatial operations, and return and set spatial properties.

Accessing your geodatabase using SQL

- With SQL, you access the data at the DBMS level
  - Bypass behaviors and functionality enforced by the geodatabase or ArcGIS clients
- Need to be aware of what you can and cannot edit
  - Relationship classes
  - Geometric networks
  - Topology…



Demo

Querying the geodatabase schema

- Look at system tables
- Relationships
- Domain references

What is a spatial type?

- A type that stores geometry data in a single spatial attribute
  - Geometry type, coordinates, dimension, spatial reference
- Spatial index
  - Improves spatial searches
- Relational and geometry operators and functions
  - Constructors – creates new geometry
  - Accessor – return property of a geometry
  - Relational – perform spatial operations
  - Geometry – transform from one geometry to another

Benefits of a spatial type

- With SQL and a spatial type you can
  - Create tables with a spatial attribute
  - Read and analyze spatial data
  - Insert, update and delete simple features
- Enhances efficiency
  - Data and methods are stored in the database
  - Applications access native dbms type
- Access using common APIs and SQL
  - Standard functions
  - Well-known interchange formats

Creating geodatabase feature classes using SQL

- Use SQL to create and populate tables

```
CREATE TABLE hazardous_sites
  (oid INTEGER NOT NULL, site_id INTEGER,
   name VARCHAR(40), location sde.st_geometry)
```

-

- Need to register the table with the geodatabase to participate in geodatabase functionality

- Once registered, you cannot modify table schema (e.g. add a field) through SQL
  - DML is okay, DDL is not okay

Editing geodatabase feature classes using SQL

- What can you edit?
  - Simple features (points, lines, polygons)
  - Without geodatabase behavior
  - Use the *Is_Simple* function to determine whether your data can edited
- Editing non-versioned tables
  - Edit tables directly
- Editing versioned tables
  - Edit special *versioned view* instead of tables

Editing the ObjectID field

- Every geodatabase feature class or table has an ObjectID field
  - Unique, not null integer
- Value is generated and maintained by ArcGIS
- Non-versioned inserts
  - Use *RowID_Name* to determine name of ObjectID field
  - Use *Next_RowID* function to obtain next ObjectID value
- Versioned inserts
  - ObjectID obtained automatically by versioned view
- Never *update* an ObjectID field

Editing versioned tables and feature classes

- Versioning
  - Supports concurrent editing with long transactions
  - Undo/redo experience
  - No locking or data extraction required

- All changes written to delta tables
  - Adds (a) table and Deletes (d) table
- Edits are assigned an identifier (state_id)
- A version references a lineage of state_ids

Versioned views

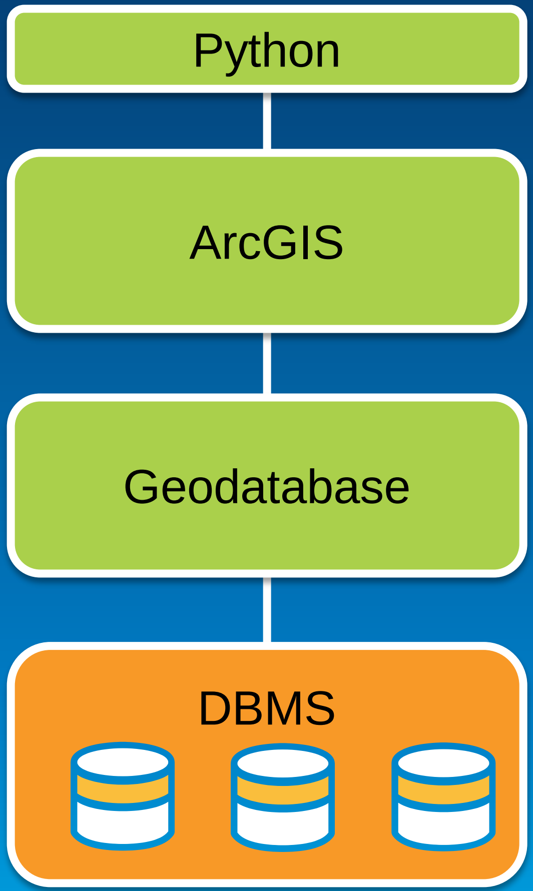
- Specialized view to work with versioned data using SQL
  - Uses stored procedures, triggers and functions to access and edit versioned tables
- Result set is based on versioned query
- Created on a single versioned table, contains all columns
- Created automatically when feature class or table is versioned
- Versioned must be reconciled through ArcGIS

Demo

Editing

Discovery functions
Non-versioned edits
Versioned view edits

Guidelines for using SQL and the geodatabase



- Understand the geodatabase system tables and their structure
- Avoid changing data that affects geodatabase software level behavior
- Geodatabase awareness
  - You have it
  - The database does not

Guidelines for using SQL and the geodatabase

- Do perform spatial operations
- Do query spatial and attribute information
- Do INSERT, UPDATE and DELETE geometries
  - As long as you pay attention to behavior
- Do INSERT, UPDATE and DELETE attribute data
  - As long as you pay attention to behavior
- Do write efficient SQL

Guidelines for using SQL and the geodatabase

- DO NOT update the objectid (row_id) value
- DO NOT modify geometries for feature classes participating in
  - Topologies, geometric networks, network datasets, terrains, parcel fabrics, geodatabase replication, schematic datasets, feature-linked annotation…
- DO NOT update attributes that define geodatabase behavior
  - Enable/Disabled attributes, ancillary attributes, weight attributes…

- Use *Is_Simple* to check

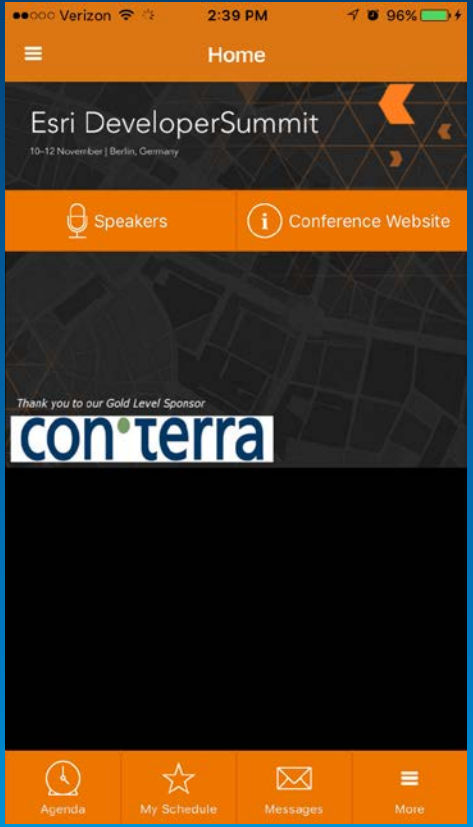
Resources

- Comprehensive documentation covering
  - Accessing dataset properties
  - Editing geodatabase data
  - Esri spatial and raster type reference
- Get started at:

https://desktop.arcgis.com/en/desktop/latest/manage-data/using-sql-with-gdbs/sql-access-to-geodatabase-data.htm

Please Take Our Survey!

Download the Esri Events app and find your event



●●○○○ Verizon 2:39 PM 96%

Home

Esri DeveloperSummit
10-12 November | Berlin, Germany

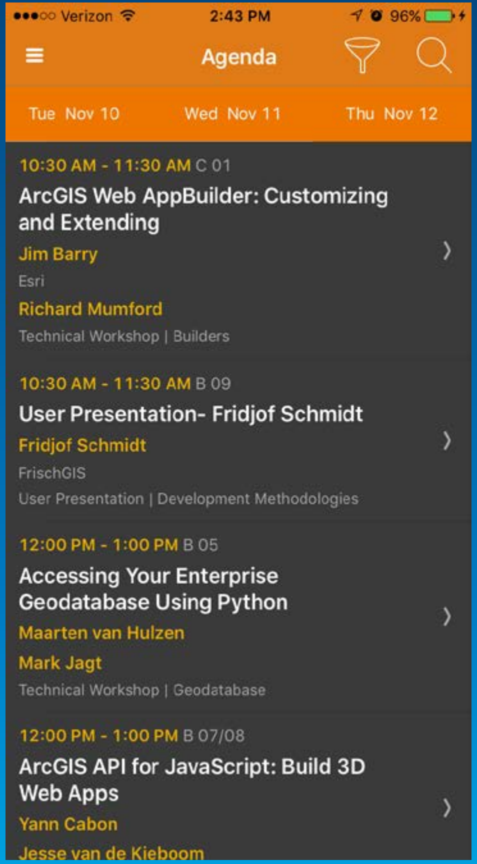
Speakers | Conference Website

Thank you to our Gold Level Sponsor

con terra

Agenda | My Schedule | Messages | More

Select the session you attended



●●●○○ Verizon 2:43 PM 96%

Agenda

Tue Nov 10 | Wed Nov 11 | Thu Nov 12

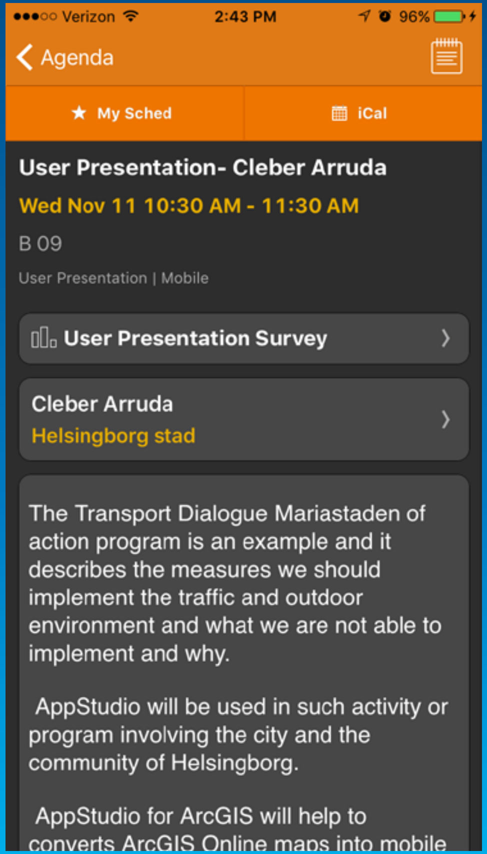
10:30 AM - 11:30 AM C 01
ArcGIS Web AppBuilder: Customizing and Extending
Jim Barry
Esri
Richard Mumford
Technical Workshop | Builders

10:30 AM - 11:30 AM B 09
User Presentation- Fridjof Schmidt
Fridjof Schmidt
FrischGIS
User Presentation | Development Methodologies

12:00 PM - 1:00 PM B 05
Accessing Your Enterprise Geodatabase Using Python
Maarten van Hulzen
Mark Jagt
Technical Workshop | Geodatabase

12:00 PM - 1:00 PM B 07/08
ArcGIS API for JavaScript: Build 3D Web Apps
Yann Cabon
Jesse van de Kieboom

Select “User Presentation Survey” or “Technical Workshop Survey”



●●●○○ Verizon 2:43 PM 96%

Agenda

My Sched | iCal

User Presentation- Cleber Arruda
Wed Nov 11 10:30 AM - 11:30 AM
B 09
User Presentation | Mobile

User Presentation Survey

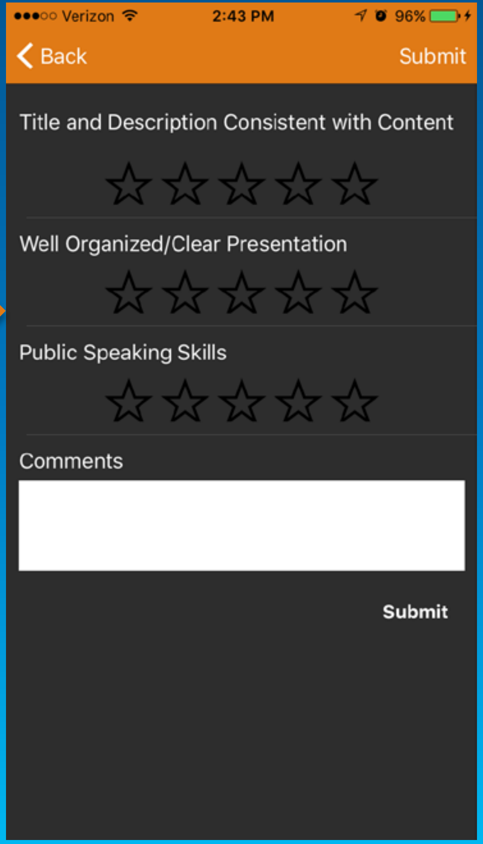
Cleber Arruda
Helsingborg stad

The Transport Dialogue Mariastaden of action program is an example and it describes the measures we should implement the traffic and outdoor environment and what we are not able to implement and why.

AppStudio will be used in such activity or program involving the city and the community of Helsingborg.

AppStudio for ArcGIS will help to converts ArcGIS Online maps into mobile

Complete Answers and Select “Submit”



●●●○○ Verizon 2:43 PM 96%

Back | Submit

Title and Description Consistent with Content
☆☆☆☆☆

Well Organized/Clear Presentation
☆☆☆☆☆

Public Speaking Skills
☆☆☆☆☆

Comments

Submit