Design a Geodatabase

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SEE WHAT OTHERS CAN'T

THE SCIENCE OF WHERE

Agenda

Design a Geodatabase

- Overview
- Motivations
- Design Approach
- Recommendations

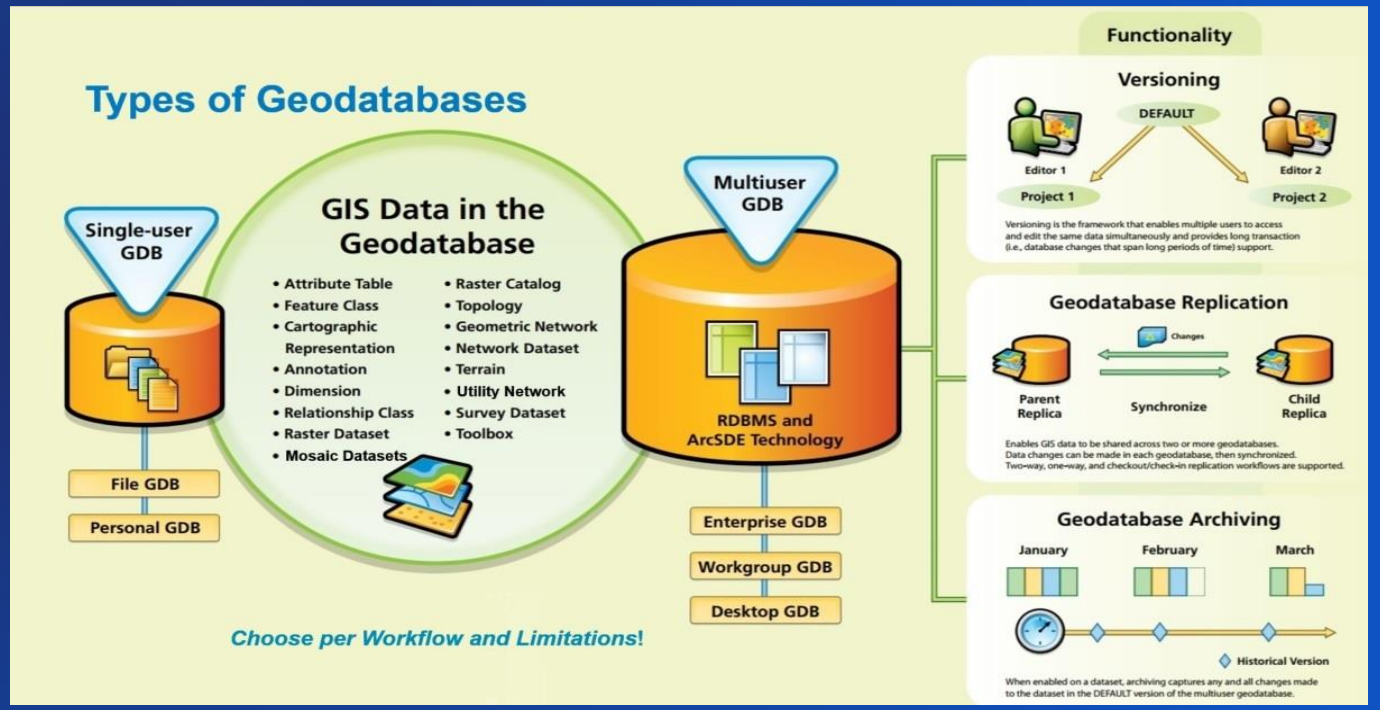
Key Considerations, Best Practices, Recommendations and Lessons Learned!

THE SCIENCE OF WHERE

Overview

Geodatabase (GDB)

- **Collection of Geographic Datasets of Various Types Stored in:**
  - **Common File System Folder**
  - ***Microsoft Access Database***
  - **Multiuser RDBMS * / ArcSDE**
    - **Oracle**
    - **Microsoft SQL Server**
    - **PostgreSQL**
    - **IBM DB2, Informix**
    - **SAP Hana 2.0 SPS02**



- **Native Data Structure for ArcGIS**
- **Primary Data Format Used for Editing and Data Management**

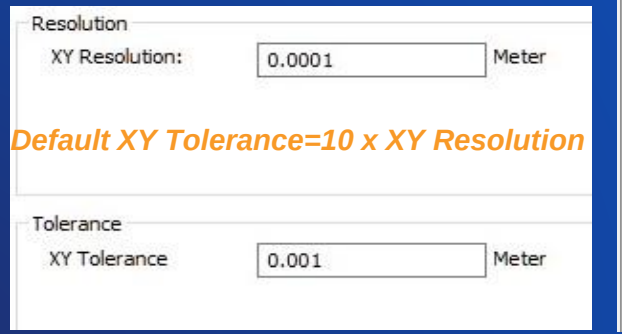
*** RDBMS – Relational Database Management System**

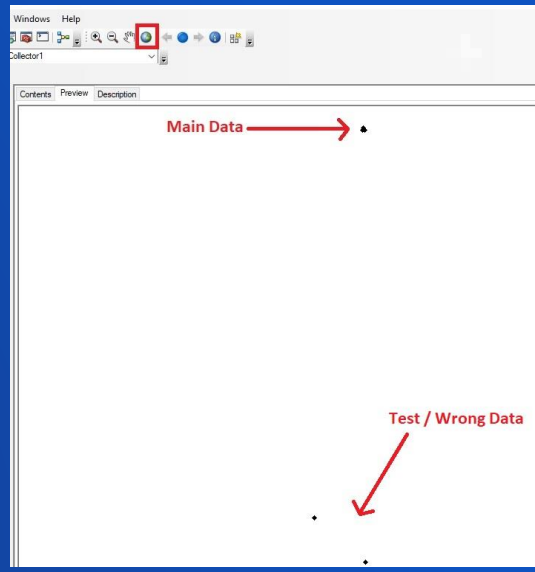
Motivations

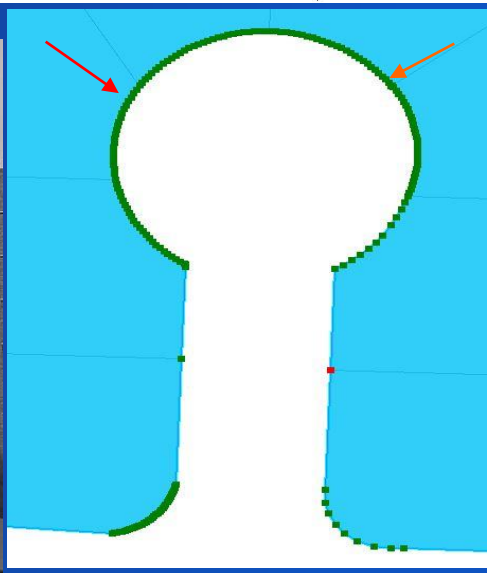
Why?

Efficient Implementation

- **Data Model Design – Don’ts**
  - *Non-default XY Resolution / Tolerance*
  - *Multiple Projections*
  - *Objectid based Relationship Classes*
  - *etc.*
- **Data Conversion – Don’ts**
  - *Extra Vertices*
  - *Insufficient QA/QC*
  - *Unusual Feature Extent*
  - *Loading static Raster data into GDB*
  - *etc.*







Avoid expensive rework!

Increase Performance and Scalability

Mitigate the risk with proper system capacity & maintenance

- **Workflow Estimations**
  - Number of outstanding versions
  - Versioning levels
  - Archiving
  - Traditional Vs Branch Versioning
  - etc.
- **Maintenance Plan**
  - Mandatory tasks to keep performance
  - Delta table records Vs # of CPUs
  - Roles and responsibilities
  - etc.

S.No	Display Scale	Layer Name	Before Maintenance- Display in Seconds	After Maintenance - Display in Seconds	Performance Improvement in %
1	50,000	RoadCL > 10,000	0.34	0.3	13.33%
2	15,000	Water Mains	0.15	0.09	66.67%
3	10,000	MapLink	1.02	0.08	1175.00%
4	10,000	CH2M_Mains	1.15	0.97	18.56%
5	10,000	Leaders	0.58	0.07	728.57%
6	10,000	Annotation	0.69	0.15	360.00%
7	10,000	Water Mains	0.96	0.6	60.00%
8	10,000	CTParcels	1.2	0.42	185.71%
9	6,000	CH2M_Mains	0.68	0.56	21.43%
10	6,000	Water Mains	0.88	0.52	69.23%
11	1,000	SwingTies	7.74	0.05	15380.00%
12	500	SwingTies	6.12	0.74	727.03%
13	500	Water Mains	0.72	0.24	200.00%
14	500	sbDriveways	0.37	0.16	131.25%

**Few private and orphan versions got skipped from maintenance for a long time and created the bottleneck!*

Failing to prepare is preparing to fail!

Efficient Workflows

Selection of GDBs drives efficiency

- **Number of users and types of users**
- **Workflows**
  - **Multi User editing - *Enterprise / Workgroup GDBs***
  - **Single User Editing – *FGDB***
  - **Replication - *EGDB → FGDB / EGDB***
  - **Read Only / Publication – *FGDB / EGDB***
  - **Mobile User offline editing – *EGDB***
  - **etc.**
- **Generally more than one Geodatabase is required!**

Mobile Data Collection - Offline Workflow Planning			
	Data Maintenance Workflow	Short duration Project Work	Ongoing Project Work
Version from which the feature service is published	Default version	Child version	Child version
Offline version is created for each	Downloaded map	User	User
Number of versions created	Many	Few	Few
Latency between offline edits and updates to Default version	Low	High (1 week)	High (Daily)
Maps involved in quality assurance	One map	All maps	All maps
Frequency that offline versions are deleted	Daily	At project completion	Never

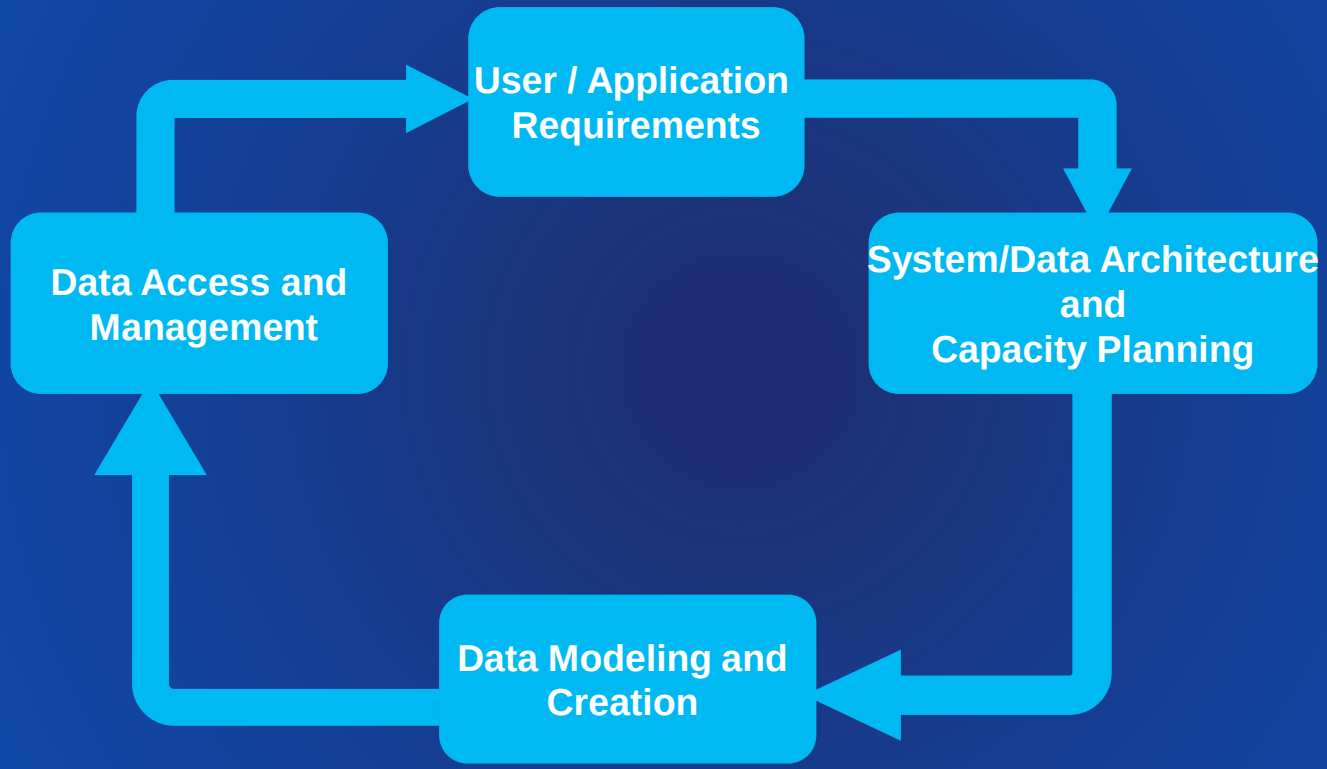
A goal without a plan is just a wish!

Design Approach

How?

Geodatabase Design – Holistic Approach

Define non-functional requirements also



Accommodate the requirements innovatively!

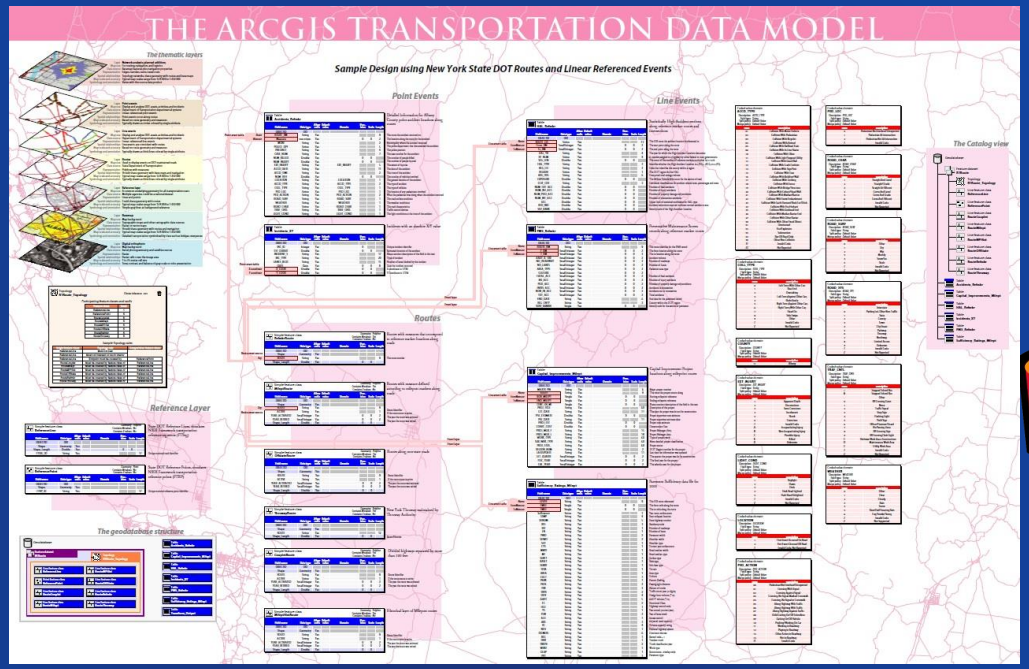
Architecture and Capacity Planning

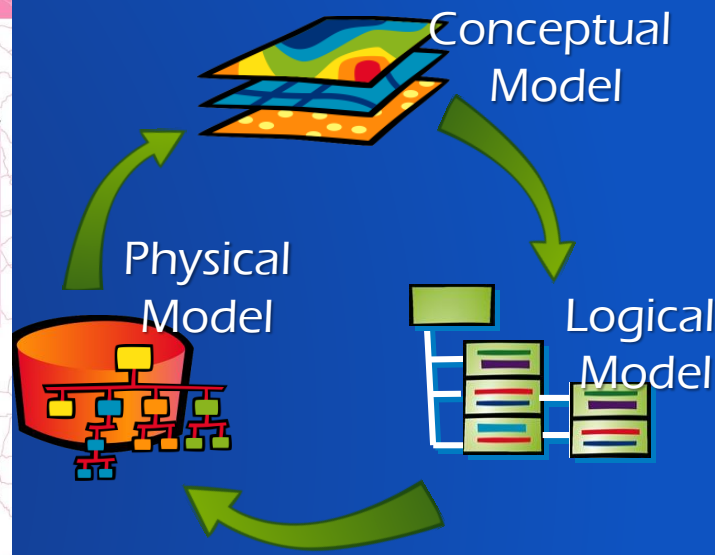
- Define architecture vision / foundation
  - Describe the System and its relationships
- Business Architecture
  - Define the business usage
- Application Architecture
  - Plan suitable software solutions / applications
- Data Architecture
  - Identify data requirements and management
- Technology Architecture
  - Select proper technology & capacity for IT Infrastructure

System architecture design reduces cost and improves productivity!

Geodatabase Design – Data Modeling

- **Conceptual Design**
  - Identify Business Requirements
  - Identify Thematic Layers
  - Identify Required Applications
  - Leverage Data Model Templates
  - Document





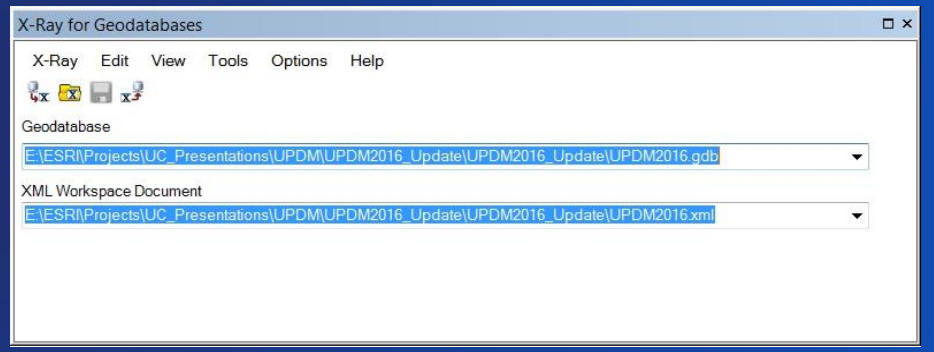
- **Logical Design**
  - Define Tabular Database Structure
  - Define Relationships
  - Determine Spatial Properties
  - Document

- **Physical Design**
  - Create and Implement Model Design
  - Generate Physical Schema in the RDBMS / FGDB
  - Testing and Validation
  - Document

Action without adequate design is actually a waste!

Geodatabase Design – Process

- Tools
  - X-Ray Add-In
  - Geodatabase Diagrammer
  - Sparx Systems' Enterprise Architect
  - Geometric Network Configuration Manager



Geodatabase Access and Management

Data is the brain of GIS nervous system!

- Create roles / groups based on the access level
  - Total access will slow connection time!
- Configure client applications to manage data
- Plan and execute Geodatabase maintenance tasks
- Tune and monitor Geodatabase

Connection Performance					
S.No	User Name	ArcCatalog Connection in Seconds with all access	ArcCatalog Connection in Seconds with reduced privileges	Performance difference in Seconds	Performance improvement in %
1	Rasu	30	12	18	150.00%
2	Andrew	21	12	9	75.00%

Capture, load and maintain data accurately!

Recommendations

What?

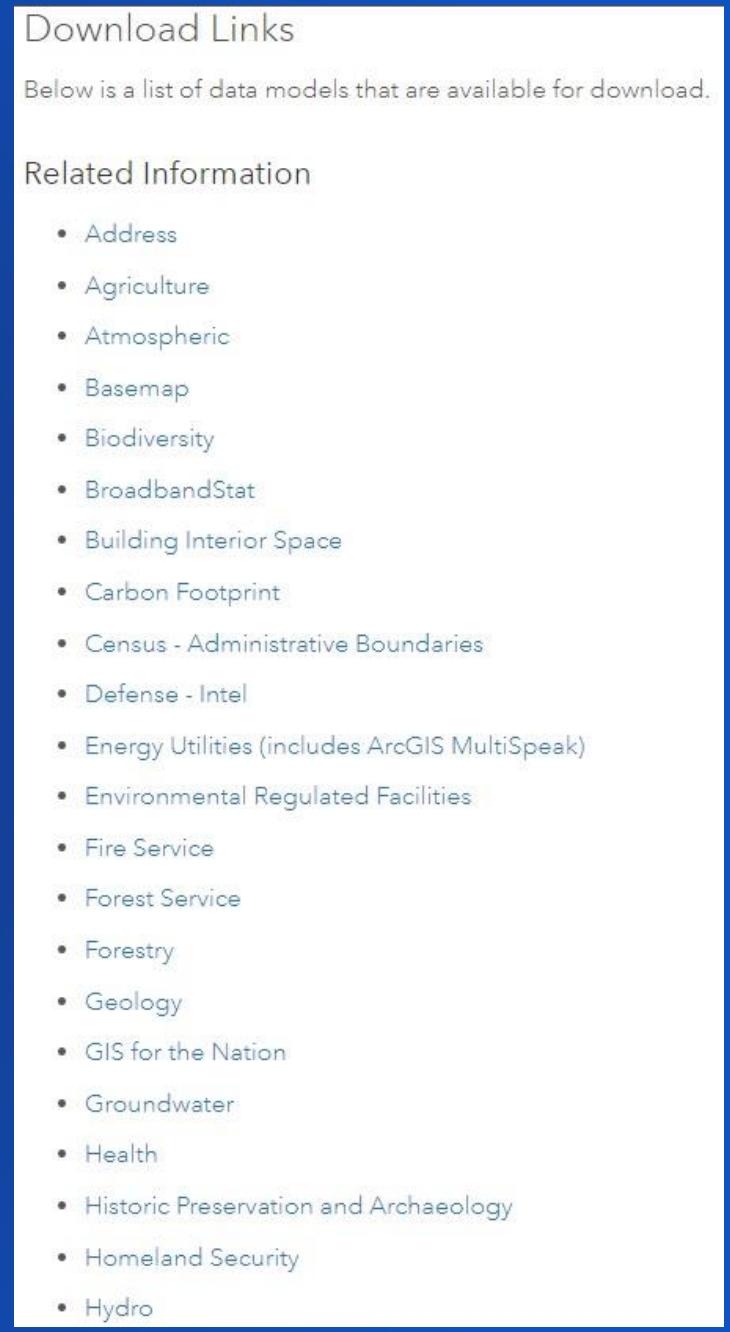
Design a Geodatabase – Best Practices

Plan, build and operate an important part of GIS nervous system!

- **Download, modify and use ArcGIS Data Models!**
  - **FAQ: Does Esri have industry-specific Data Models?**
  - **https://support.esri.com/en/technical-article/000011644**
  - **ArcGIS Solutions - Free industry-specific configurations for ArcGIS**
  - **http://solutions.arcgis.com/**

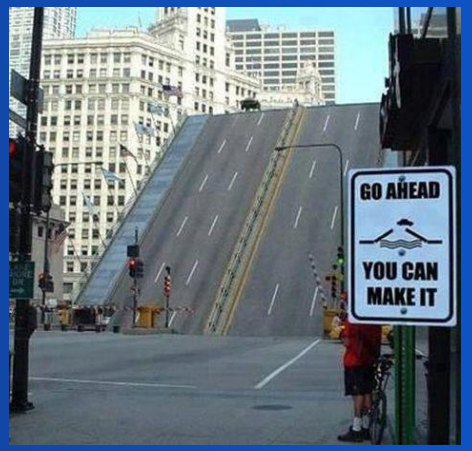
- **Either populate or drop empty feature classes / fields**
- **Fix missing / in-correct Domains and aliases for Fields**

Justify every single Geodatabase element!



Geodatabase Design – Best Practices

Data Model impacts storage and performance!



- **Select Single Coordinate System**
  - On the Fly Projection is expensive
  - Geometric Network editing does not support “On the Fly Projection”
- **Column / Domain Names and Field Lengths**
  - Avoid >10 Characters in Field Names
  - Put only the required length e.g. Text - 256 Vs NCLOB – 1,073,741,822
  - Select appropriate Field type
  - Apply only the required Precision and Scale
  - Define Not Null Fields

Field Properties

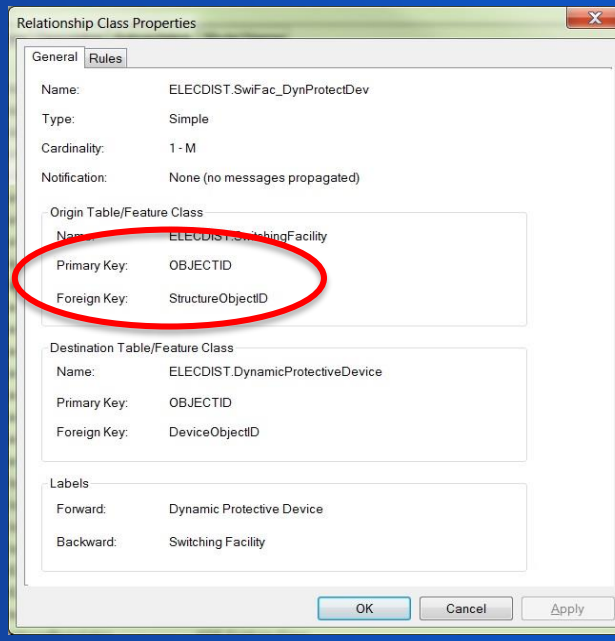
Alias	CustomerName	
Allow NULL values	Yes	
Default Value		
Domain		
Length	1073741822	

Justify every single Geodatabase element!

Build Geodatabase – Key Considerations

Data is the Backbone of GIS!

- Extra vertices impact performance
- Aim for 100% data accuracy
- Use Many to Many relationship classes only when necessary
- Don’t use Objectid as Primary Key for Relationship Classes
  - Unexpected Replication Behavior
  - Additional Processing During Synchronization
  - Use GlobalID

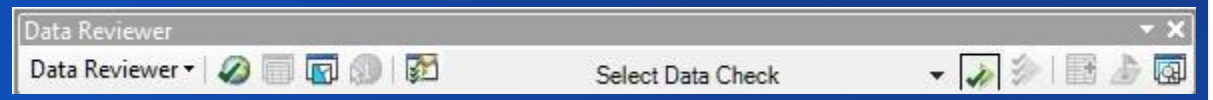


S.No	Display Scale	Layer Name	# of Displayed Features	Number of Vertices - Before Simplify	Number of Vertices - After Simplify	Before Simplification - Display in Seconds	After Simplification- Display in Seconds	Performance Improvement in %
1	50,000	Street_1_inch	35,093	105,695	101,060	2.36	0.5	372.00%
2	50,000	PARCEL_1_Inch	7,922	645,766	188,212	0.37	0.31	19.35%
3	25,000	Street_1_inch	11,192	31,112	29,620	0.69	0.2	245.00%
4	25,000	PARCEL_1_Inch	2,687	168,011	48,540	0.16	0.14	14.29%
5	20,000	Street_1_inch	7,590	20,494	19,574	1.59	0.16	893.75%

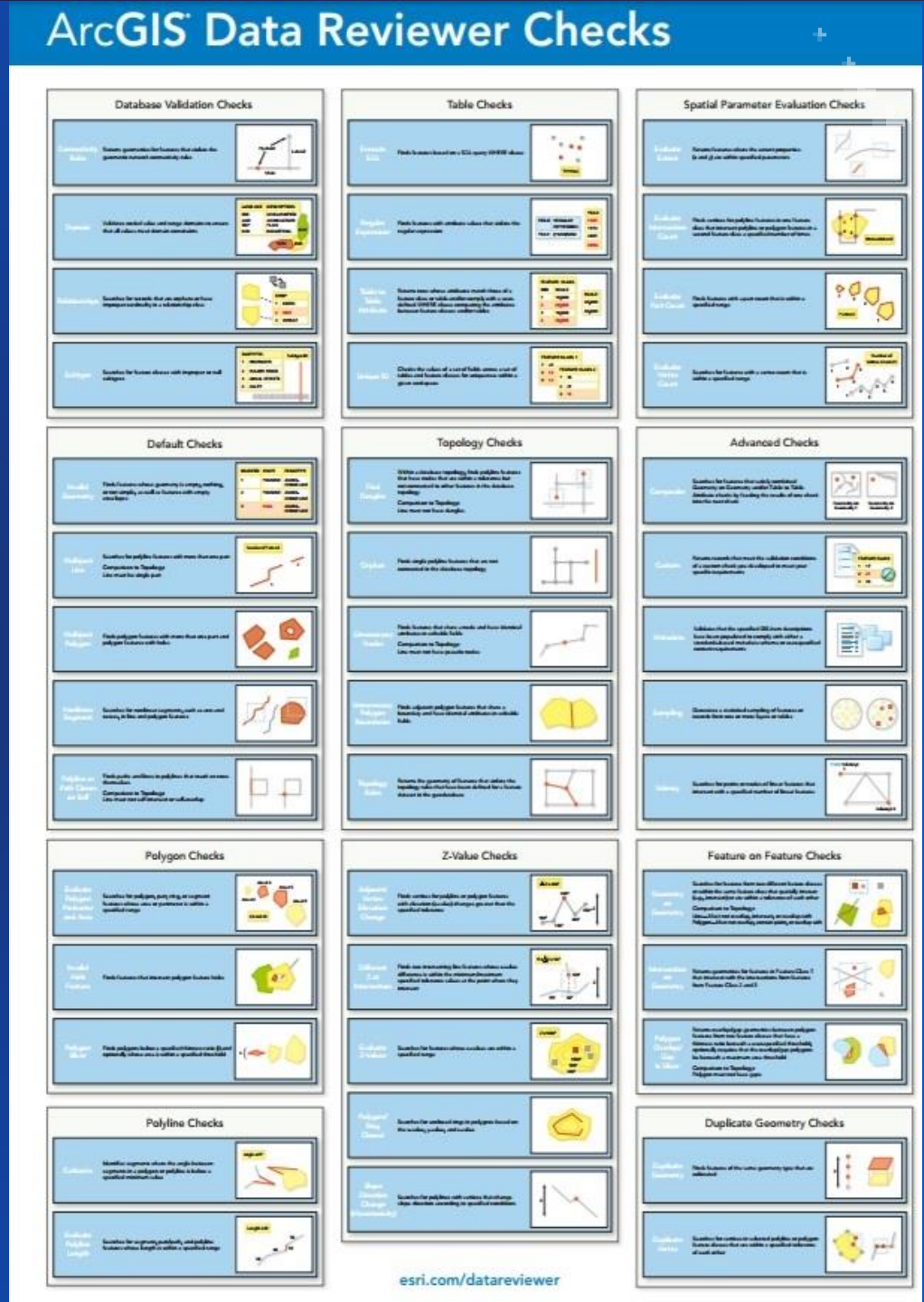
QA / QC - Recommendations

Data Integrity and Validation!

- **Design and Implement QA / QC Workflows**
  - Data Requirements for Software Functions
  - Accurate Data for Business
  - Maintain Data Integrity
- **Tools**
  - Domains, Subtypes, Topology, etc.
  - Attribute Assistant Add-In
  - ArcGIS Data Reviewer
  - ArcGIS Workflow Manager
  - Business Partner Products
  - Customization



Capture, Load and Maintain Data Accurately!

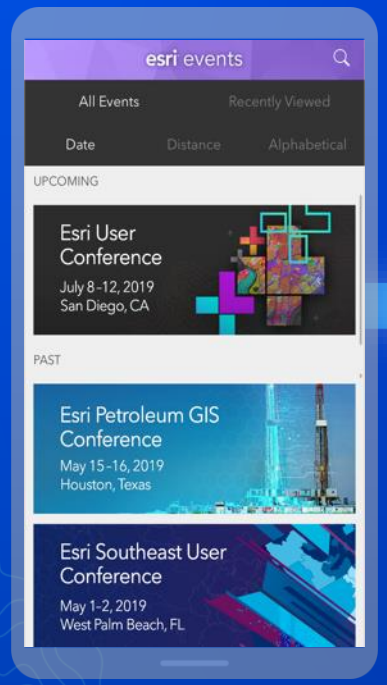


See us here

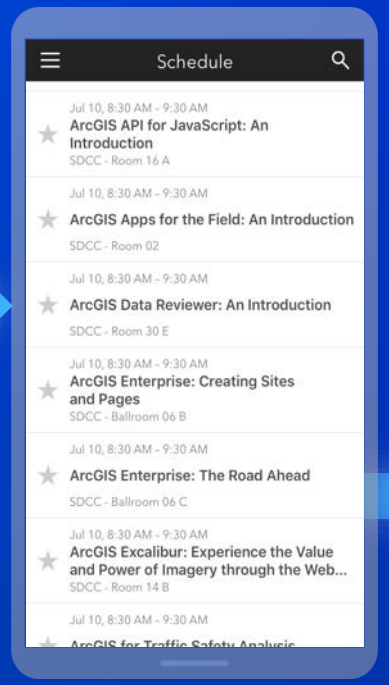
WORKSHOP	LOCATION	TIME FRAME
• Esri Best Practices: Implementing an Enterprise Geodatabase	• SDCC - Room 31 A	• Wednesday 7/10/2019 02:30 PM - 03:30 PM
• Enterprise Geodatabase: Automating Administration Tasks Using Python	• SDCC - Expo Demo Theater 04	• Thursday 7/11/2019 10:00 AM - 10:45 AM
• Geodatabase: Ensuring Data Quality with Attribute Rules and Contingent Values	• SDCC - Ballroom 06 E	• Thursday 7/11/2019 4:00 PM - 5:00 PM

Please Share Your Feedback in the App

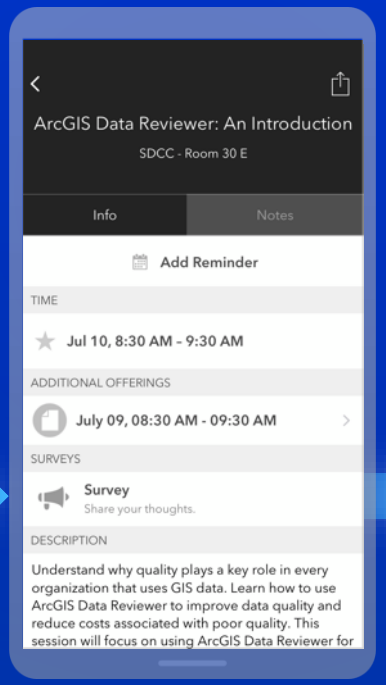
Download the Esri Events app and find your event



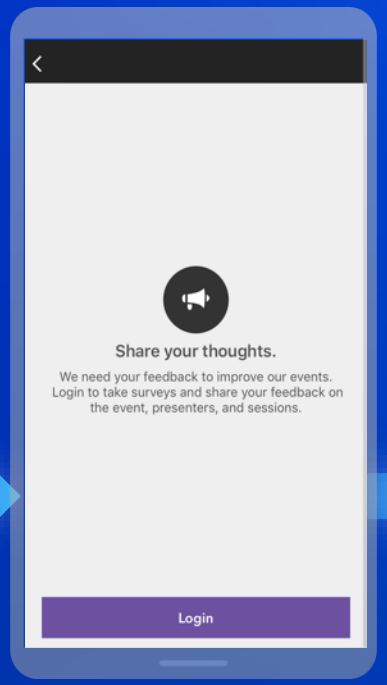
Select the session you attended



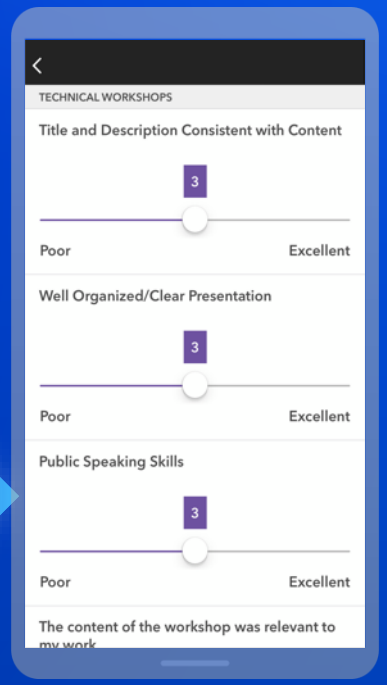
Scroll down to "Survey"



Log in to access the survey



Complete the survey and select "Submit"



Questions and Answers

Contact Info:

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Thanks!