

Esri's ArcGIS Enterprise

IT4GIS

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Today's Topics

- Part 1: ArcGIS Enterprise architecture
- Part 2: Storing and serving data for **The Enterprise**
- Part 3: Enterprise workflow
 - Versioning and Replication

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ArcGIS Enterprise

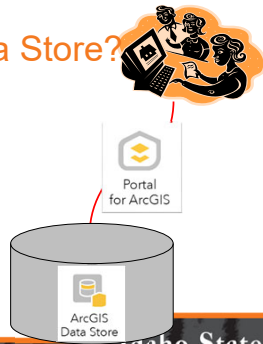


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What is the Data Store?

- A spatially-enabled Object-relational DBMS (PostgreSQL is default)
- Stores Data (it is named the Data Store) and helps serve these data to clients via a network



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Its All Just Data

- As far as PostgreSQL (or any ORDBMS) is concerned, our point, line, or polygon *feature classes* are no different from what Esri calls "stand-alone table"
- Why?

OBJECTID	Shape	File Name	File Number	File Identifier	Area	Perim	Z	No. RM	Source Primary	Source Secondary	Shape Length	Shape Area	
1	Polygon 2D	August Complex	10257097	ACCS-482	58054	102568	2025	1	4738.801041	NFC	Unknown	1218151.67801	4738801041.61747
2	Polygon 2D	Base	10308020	DRY-ACCL	58079	90425	2021	1	3086.761402	NFC	IRWPN	1134111.145248	3086761402.888371
3	Polygon 2D	Changren Complex	10400	00000	80808	80808	2015	1	2482.8217	NASA RECOVER	DOI BB	1138821.811881	2482821780.410843
4	Polygon 2D	WV	10400	00000	20480	17000	2007	1	2047.40479	NASA RECOVER	DOI BB	890524.807257	2047404790.807257
5	Polygon 2D	NORTHFOUR	10400	00000	11880	30176	1988	1	2286.842108	NASA RECOVER	DOI BB	707638.751707	2286842108.751649
6	Polygon 2D	LAKE CREEK	10400	00000	11732	36480	1988	1	2285.030629	NASA RECOVER	DOI BB	548203.891251	2285030629.891642
7	Polygon 2D	WV	10400	00000	20173	90382	2012	1	2017.011982	NASA RECOVER	DOI BB	148715.03884	2017011982.158443
8	Polygon 2D	WV	2011-020	00000	34163	58153	2011	1	2177.821296	NASA RECOVER	DOI BB	462477.43884	2177821296.464715
9	Polygon 2D	WV	00000000	00000000	22532	30185	2002	1	2027.818106	NASA RECOVER	DOI BB	484117.27884	2027818106.278815

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Differentiation

- What differentiates a feature class from a stand-alone table?
 - The SHAPE field (recall *inheritance* from the Feature CLASS in the ArcObjects framework)
 - Area and Length fields are topologically derived from the SHAPE field
- What is the SHAPE field (really!)
 - It is a field (attribute) storing LOB data
 - This may seem *special* to us, but its just another DATA TYPE

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So These are Really the Same

- To an ORDBMS, yes!

OBJECTID	Shape	File Name	File Number	File Identifier	Area	File Name	File ID	Source Primary	Source Secondary	Shape_Length	Shape_Area
1	Polygon ZM	August Complex	00070207-AC20-4	1	3	00E1D05D-6D37-4C3L...	08425	NFC	Unknown	133013037803	47780344.627147
2	Polygon ZM	Dike	01090302-Q987-4	2	4	2016-WYVMA5-016116	08425	NASA RECOVER	DOI BB	1598021.611880	3888753451.695777
3	Polygon ZM	Champan Complex	11M4	3	7	01081A702-C047-4F0D...	08427	NASA RECOVER	DOI BB	600024.387257	2343454570.887737
4	Polygon ZM	WORTHY FORK	WYVMA5-016250	4	8	2016-WYVMA5-016250	08427	NASA RECOVER	DOI BB	767676.757797	238942106.29249
5	Polygon ZM	LAKE CREEK	WYVMA5-016250	5	9	01A8047E-095E-404A...	08429	NASA RECOVER	DOI BB	549026.89125	239532620.895462
6	Polygon ZM	n/a	00067	6	10	2016-WYVMA5-16-006	08429	NASA RECOVER	DOI BB	348757.538864	22771181.72461
7	Polygon ZM	n/a	2011-020	7	11	01B07C46-F8D0-40B...	08429	NASA RECOVER	DOI BB	602477.638664	2177821225.64481
8	Polygon ZM	n/a	0000003	8	12	2016-WYVMA5-016231	08429	NASA RECOVER	DOI BB	404117.277884	2027119355.734815
9	Polygon ZM	n/a	0000003	9	13	02D4B3472-608D-40E...	08430				
10	Polygon ZM	n/a	0000003	10	14	2016-WYVMA5-16-006	08430				
11	Polygon ZM	n/a	0000003	11	15	01A8228C3-6D93-4E2...	08431				

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Why use ArcGIS Enterprise?

Advantages:

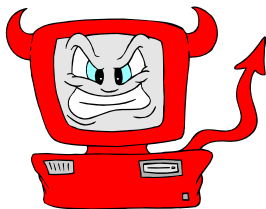
- Enable *versioning* to prevent data loss or degraded data integrity
- Centralize data management
- Make the most current geospatial data is available always



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Why? (cont'd)



Disadvantages

- Data management role
- RDBMS administration role
- Capital expenditure

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To Use Enterprise...or Not ...

- What will help make this decision?
 - ROI
 - TCO
 - Is this the correct technology for the problem?

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ArcGIS Data Structures

ArcGIS

Vector objects

Feature class
Shapefiles
Coverages

Raster objects

Grids
Images

GDB

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The GDB

- **Can** store tables, vector feature classes (layers), relationship classes, topology layers, and raster layers



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Layers and Layer Files

- All GIS data are considered LAYERS in ArcGIS.
- BTW, A LAYER FILE is different than a LAYER.
 - It is a file you save in ArcGIS Pro to retain customized settings and appearance for a LAYER.
 - The LAYER FILE refers to the LAYER (feature class, shape file, image, or grid), as well as...
 - Providing instructions regarding visualization/symbology, text/labelling, scale/display thresholds, etc.

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The Workspace

- ArcView
 - Collection of ArcView shape files in a folder
- Geodatabase

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Geodatabases

- Personal pGDB (not supported in ArcGIS Pro)
- Mobile GDB
- File-based fGDB
- Enterprise
 - Data Store (formerly known as ArcSDE Personal or ArcSDE Professional)

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File-based Geodatabase

- fGDB
- Stores vector and raster layers in the file/folder structure.
- Limitations
 - Multi-user (max = 10)
 - 1 Editor (no versioning)
 - Max size is 1 TB



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The GeoPackage

- A database for geospatial data based on SQLite
 - It is open and platform independent
- A GeoPackage database can store:
 - Vector features
 - Raster imagery
 - Stand-alone attribute tables
- Supported in ArcGIS but not proprietary to Esri

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Workgroup Geodatabase

- Uses MS SQL Server Express
- Limitations
 - 10 GB
 - Supports versioning/replication but only one editor
- **NOT** an enterprise solution but a great way to learn the enterprise workflow



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Enterprise Geodatabase

- Uses PostgreSQL, DB2, Oracle, SQL Server, and SAP HANA
- No software size limits and unlimited number of users
- **Can** accommodate vector and raster data



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Given all these differences,
there are really many
similarities

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Geospatial Data Storage (Vector)

- Vector geospatial data are stored as Feature classes
- Non-spatial data are stored as stand-alone tables
- Relationship classes can be used to connect feature classes and stand-alone tables



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Geo-spatial Data Storage (Raster)

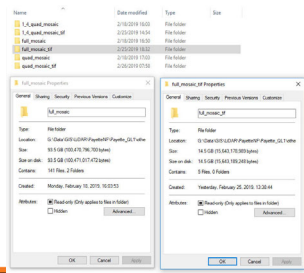
- Two methods
 - Stand-alone raster dataset
 - Mosaic Dataset
- **The Enterprise GDB is not the best solution to store raster GIS data**
 - Size considerations
 - Performance issues
- This is because raster data is handled by ArcGIS and not natively by the ORDBMS

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Stand-alone Raster Datasets

- Do not store these within a GDB
 - Performance is slow
 - Consumes a lot of space in the GDB



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Mosaic Datasets

- Fantastic use of the fGDB

NAIP2009_ImageService
Image Service
NAIP2011_ImageService
Image Service
NAIP2013_ImageService
Image Service
NAIP2015_ImageService
Image Service

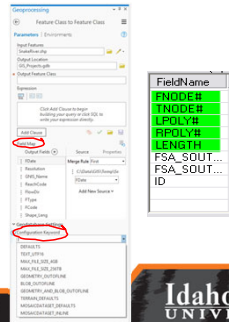
NAIP.gdb
NAIP
NAIP2009
NAIP2011
NAIP2013
NAIP2015
id_1m_2017
id_fgdc_2017
id_ghp_2017
NAIP.gdb
NAIP Overviews

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Loading Vector Data into a GDB

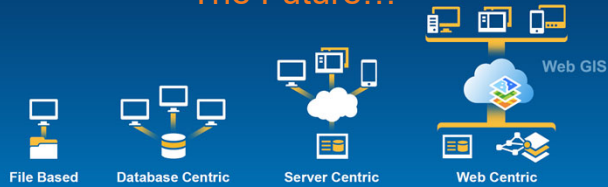
- PART 1: Feature classes



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Leveraging Common Computing Architecture The Future...



- Works seamlessly across all devices
- Reduces need for custom applications
- Platform for integration with other business systems
- Cross organizational collaboration
- Ready to use content and services
- Content management system

Questions...



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Geodatabases in an Enterprise Workflow

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Presentation and Discussion

UNDERSTANDING AND MANAGING WORKFLOW

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Let's Get Started

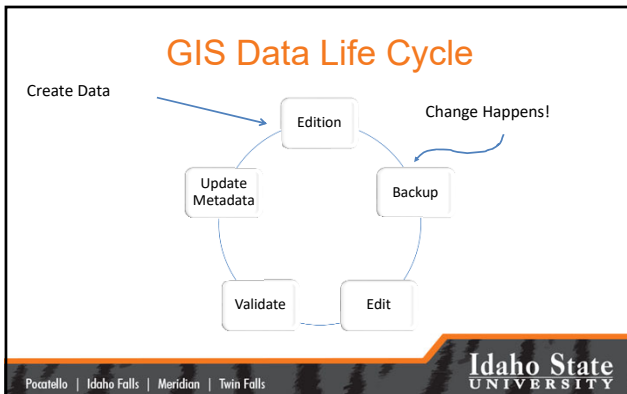
- GIS is...
 - Data-driven
 - Powerful
 - Dynamic



• Adjectives

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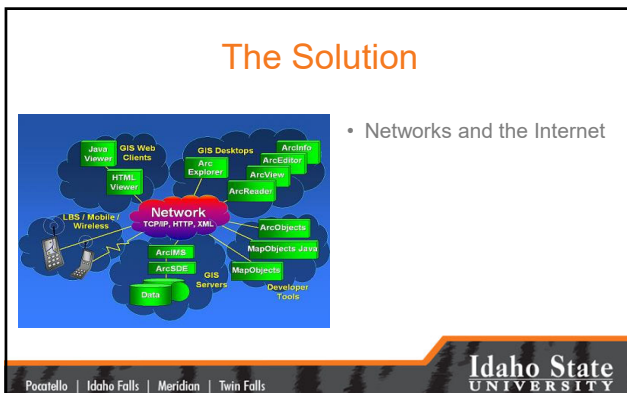


The Bottleneck

- Distributing the new edition via the network

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A New Problem is Born

- “MY” version

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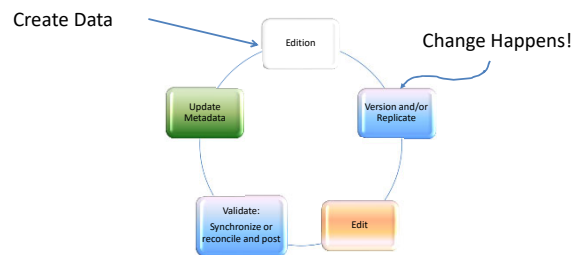
GIS Grows Up!

- ORDBMS
 - Keep the benefits of network connectivity
 - Eliminate the problem of “MY” version
 - Eliminate the bottleneck
 - And, change the cycle of events

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GIS Data Life Cycle



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Backup vs. Versioning

- Backups and archiving are still critical steps for the enterprise.
- BUT, not part of the GIS Life Cycle any longer

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In the Beginning...

- Backups were made in case we really messed up
- Edits were made to the original
- Copies of the “clean” new edition were distributed

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Today...

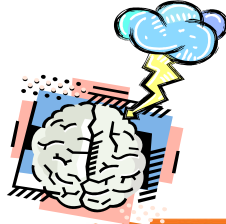
- The original [parent] is versioned [a child is born]
- Edits are made to the child, not the parent
- “Clean” edits are copied [synchronized or posted] to the parent.

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Benefits Of This Approach

- Brainstorm!!!
 - Minimize downtime
 - Processes completed within the RDBMS



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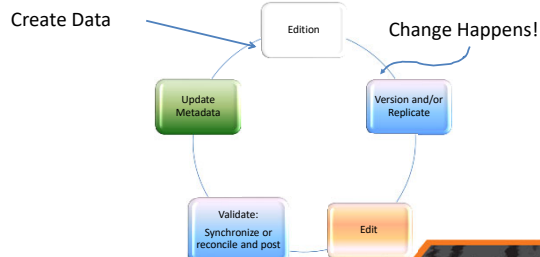
The Role of Backups

- Data retention and moving older data offline without deleting it
 - See the Data Retention and Deletion guidelines for your organization
- Legal requirements

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GIS Data Life Cycle...Today



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Questions/Discussion?



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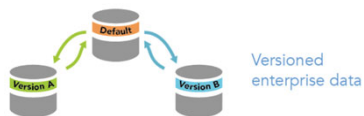
Presentation and Discussion

REPLICATION AND VERSIONING

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What is Versioning



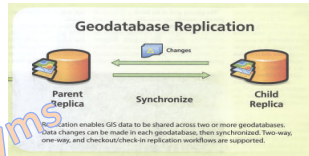
- A framework enabling multiple, simultaneous edits to a feature class in **high isolation** (i.e., other users in the enterprise cannot see your edits)
- It tracks changes to the feature class. It is not a copy of the feature class

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What is Replication?

- Duplication
- Copying
- Mirroring



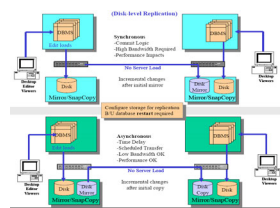
•Synonyms

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True Replication...

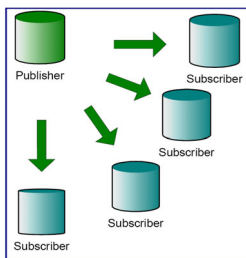
- Does not need ArcGIS
- Every RDBMS can be replicated natively
- However, using ArcGIS to perform the replication
 - Is easy
 - Better supports GIS workflows



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Why Replicate?



- Enable *disconnected* editing for:
 - Performance/load balancing
 - Network load reduction
 - Publishing data to subscribers

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Network Load Reduction

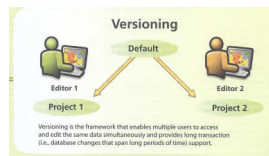
- The **network** is a **primary bottleneck** in the Enterprise

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Focus on Versioning...

- One database
- Parent edition (tables) remains live/usable
- Child edition(s) simultaneously edited
- Roll-up is seamless

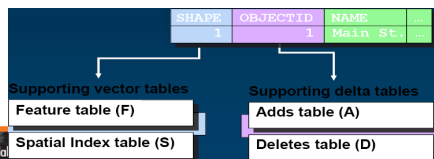


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Versioning: Principal Concepts

- Edits are stored in "Supporting Tables"
- Geographic changes (linework) are stored in Supporting Vector Tables
- Attribute changes are stored in Supporting Delta Tables.



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Delta Tables

- A = Add (insert)
- D = Delete
- U = Update (delete existing then add)

Supporting delta tables

Adds table (A)

Deletes table (D)

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A Tree is Formed

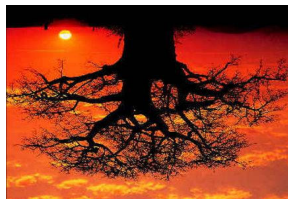
- As versions are created and changes are made, a tree grows
 - Q: What kind of tree?
 - A: A *State Tree*



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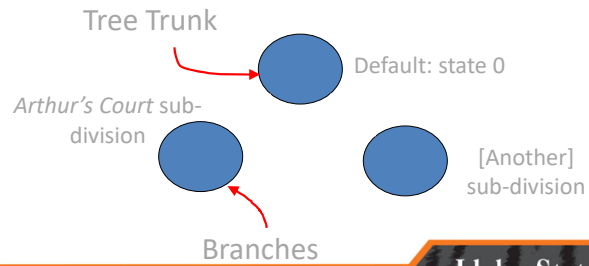
Sort of an Upside-down Tree



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The State Tree



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Multiple Versions

- Multiple versions are allowed
 - Versions can be based upon location (north edits, south edits), projects (sub-divisions), or other logic decided upon by the GIS Manager.
- Batch reconcile and post are supported

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The Day of Reconciliation

- Arthur's Court sub-division edits have been completed
 - Time to **reconcile**
 - This process looks for conflicts
 - Once all conflicts have been resolved...
 - Reconciliation is complete

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Post

- To roll-up the edits back to the “trunk of the state tree” we Post

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Two Approaches to Versioning

- **Classic/traditional versioning** where the editor connects directly to the RDBMS and makes edits within the database
- **Branch versioning** where the editor connects via the web and makes edits through a feature services model (not directly connected to the RDBMS)

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Under Traditional Versioning

- Performance can degrade with active databases
 - Workflow itself can generate unnecessary versions
 - Delta tables will become large over time
- Substantial role for the DB Admin and GIS Manager

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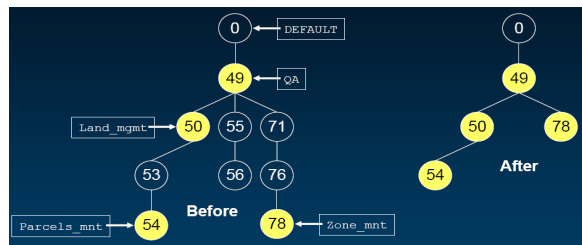
The Cure

- For many of these ArcGIS-centric performance issues is *compressing the database*
 - Moves common rows from delta tables into base tables
 - Reduces depth of the state tree by removing states no longer needed

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Compression Example



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Under Branch Versioning....

- DB Admin role is nearly eliminated
 - Compression is not needed
- All versions are flat, Parent-Child relationships
- No "grand-child" versions
- You will learn Branch versioning

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Key Concepts

- Object-Relational databases enable GIS for the Enterprise
- The enterprise geodatabase centralizes data management
- Understand Enterprise workflow

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Professional Hints and Tips

- Work Smarter not Harder
 - Processing lots of files with Model Builder and File Iterator



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Questions/Discussion?



Let's connect to Portal

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