GIS Database and Scripting Architecture Migration at Community Transit

April 18, 2017

Snohomish County GIS Users Group

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GIS Program Coordinator

Presentation Overview
Project Orientation

- Community Transit Overview
- GIS Program Overview
- Introduction to the Project and Process
- System and Database Design Overview
- Legacy Architecture (ArcInfo Workstation) Tools Review
- Modern Architecture (ArcGIS Desktop) Tools Introduction

Presentation Overview
The Solution

- Hired David Howes, LLC – GIS Professional Development
- Team Composed of David Howes and Jeff Berry (FocusGeo)
- Overview of:
  - New File Geodatabase
  - New Data Management Tools
  - New Database Connection
  - Issues Faced / Comments / Wisdom

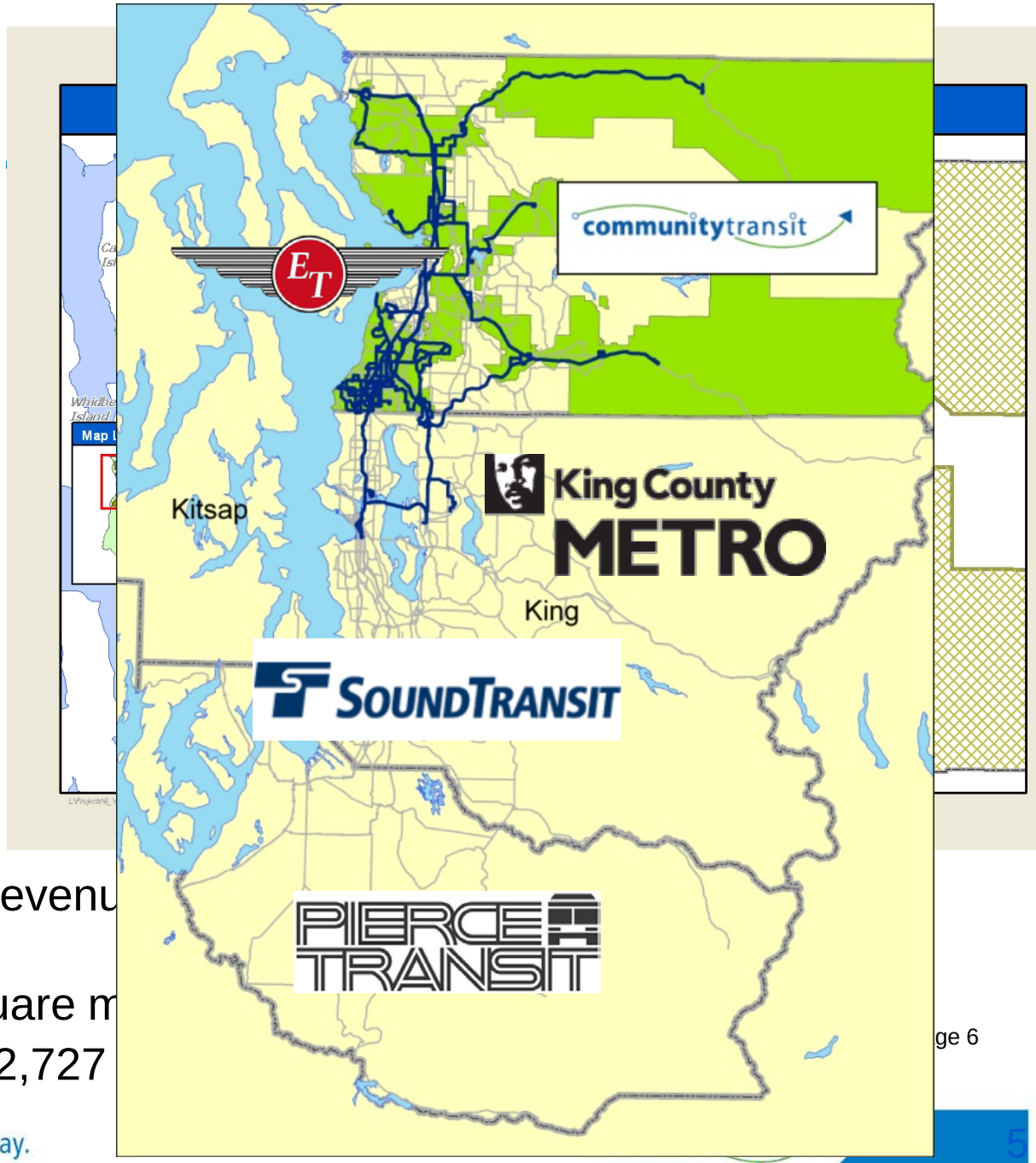
Presentation Overview
The Solution

- Overview of:
  - New ArcPy / Python Data Processing Scripts
  - Issues Faced / Comments / Wisdom
- Project Status Today
- Conclusions / Takeaways / Lessons Learned
- Question & Answer

Community Transit
A Brief Summary

- Local and Regional Transit Agency for Snohomish County since 1976
- 25 Local Routes, 20 Commuter Routes
- Swift Blue Line Bus Rapid Transit
- 9.8 million Passenger Trips in 2014
- An average of 36,000 passengers on an average weekday.
- ~800 Employees (including contracted services)
- 22 Park & Ride Lots (7355 spaces)
- 27 Park & Pool Lots (893 spaces)
- 224 Fixed Route Buses
- 411 Vanpool Vans (~3400 passenger trips per day)
- 52 DART Paratransit Vehicles (~760 passenger trips per day)

Communi
Service Area



- Majority of CT revenu
  this area.
- Area: 1308 square m
- Population: 542,727

GIS Program Overview

- Mission Critical Community Transit Project GIS Support
- ATIS Regional Trip Planner Support and Administration
- GIS Mapping, Data, and Service Requests
- GIS Database Administration and Maintenance
- GIS Software Management and Administration
- GIS User Support
- Special Enterprise GIS Projects
- APTS Transit Technologies System Support
  - Generates Real-Time Data

The Many Jobs of a Lone GIS Professional

The Project

- Replace Legacy ESRI ArcInfo Workstation based Master Database Engine
  - ArcInfo Coverages (2 coverages, 3 feature classes)
  - ArcEdit Data Editing Tools (~10 custom tools)
  - AML Program Scripting (~80 pages of code)

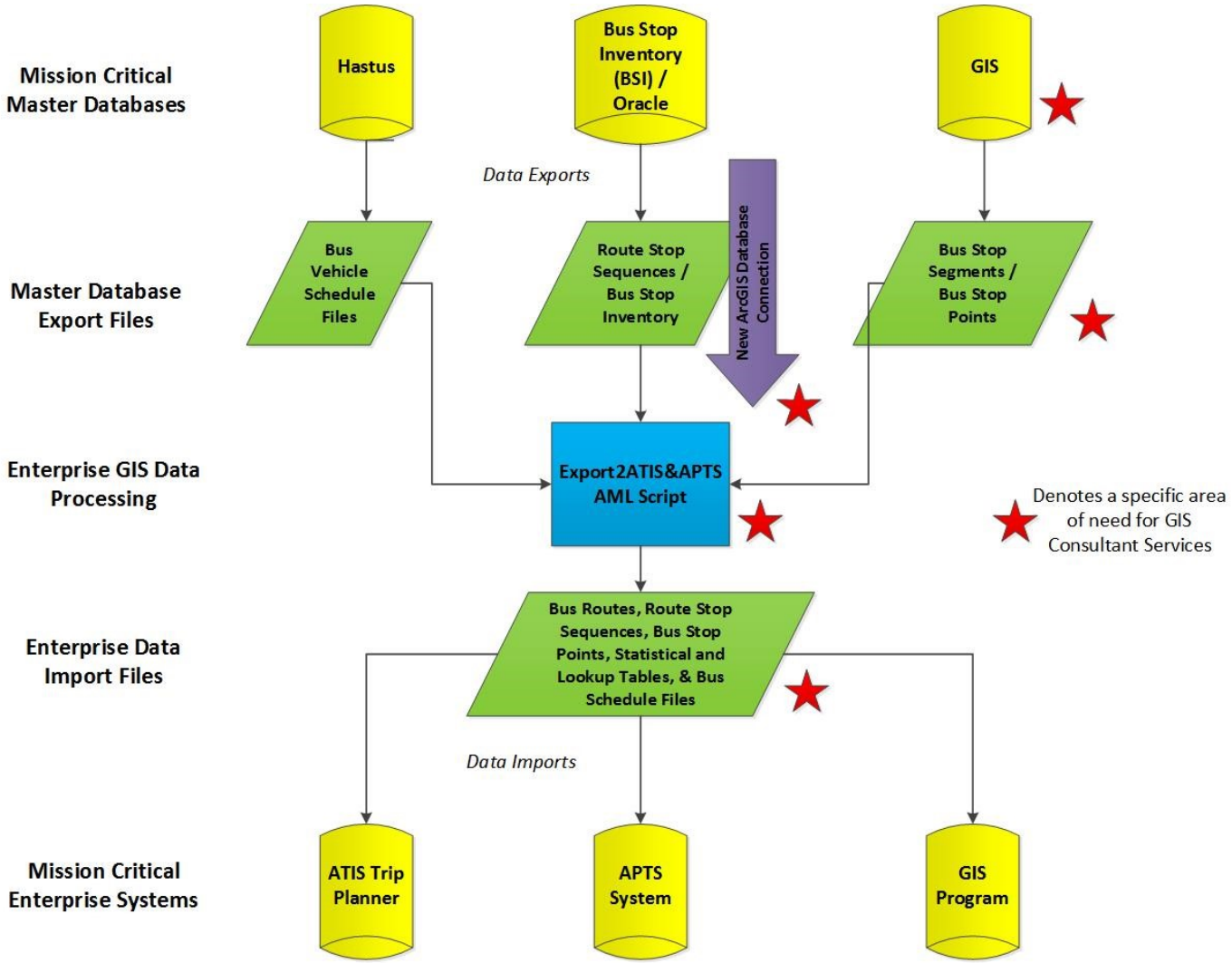
- Implement Modern ESRI ArcGIS Desktop based Master Database Engine
  - File Geodatabase (3 feature classes)
  - ArcMap Data Editing Tools (new editing toolbar using .Net)
  - ArcPy/Python Data Data Processing Scripting (~ 4000 lines of code)

- Why Wait So Long? ESRI Recommended It
- Project Drivers and Assumptions
  - Windows 7 / ArcInfo Workstation Life Cycle Expiration
  - Conceptual and Logical Database Design Still Good
  - Use of Python Coding Preferred
- Hire a Consultant/Vendor to **Partner** With

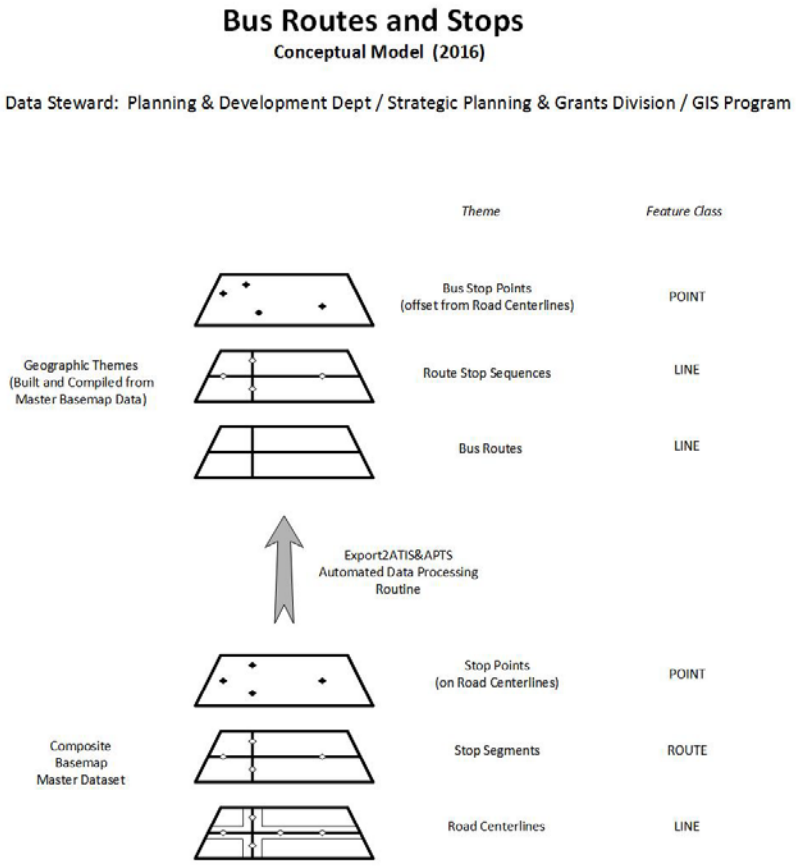
The Process

- Write a Scope of Work for the Project
  - Conceptual High Level to Cover all Major Areas / Deliverables of Project
  - Enough Detail to Eliminate Guesswork
  - Included Conceptual Diagrams and Copies of all Legacy AML Scripting
- Work with Procurement Department
  - Coordinated RFP Writing
  - Defined Steps / Timeline in Procurement Process
  - Provided Support During all Phases of Project
- Write and Issue RFP
  - Include Questions for Evaluation
  - Answer Questions from Potential Vendors
- Select a Consultant / Vendor
  - Grade Responses
  - Conduct Follow-Up Interviews
  - Make Final Selection
- Work with Consultant / Perform Work
- Project Wrap-Up

System Design Overview



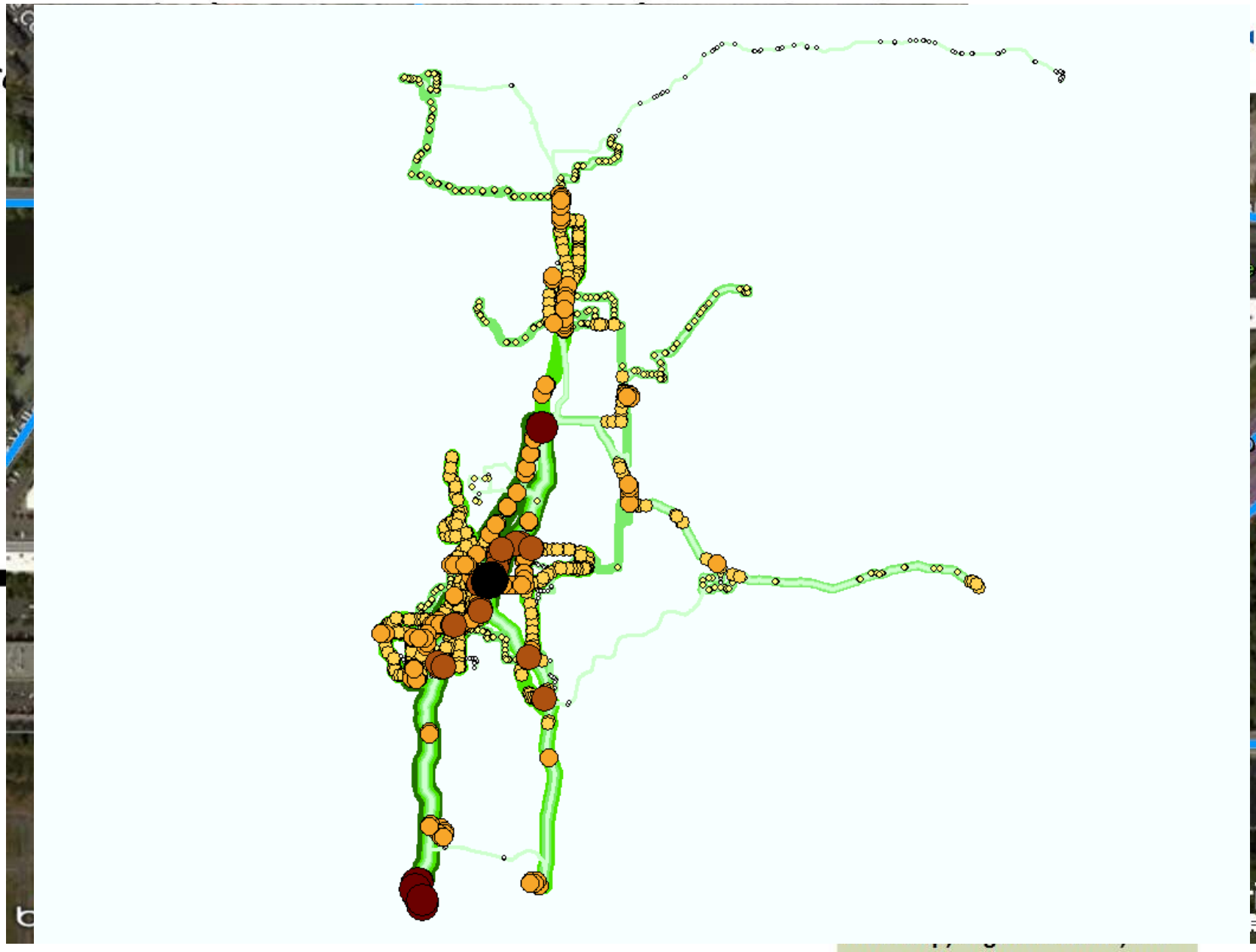
Conceptual GIS Database Design

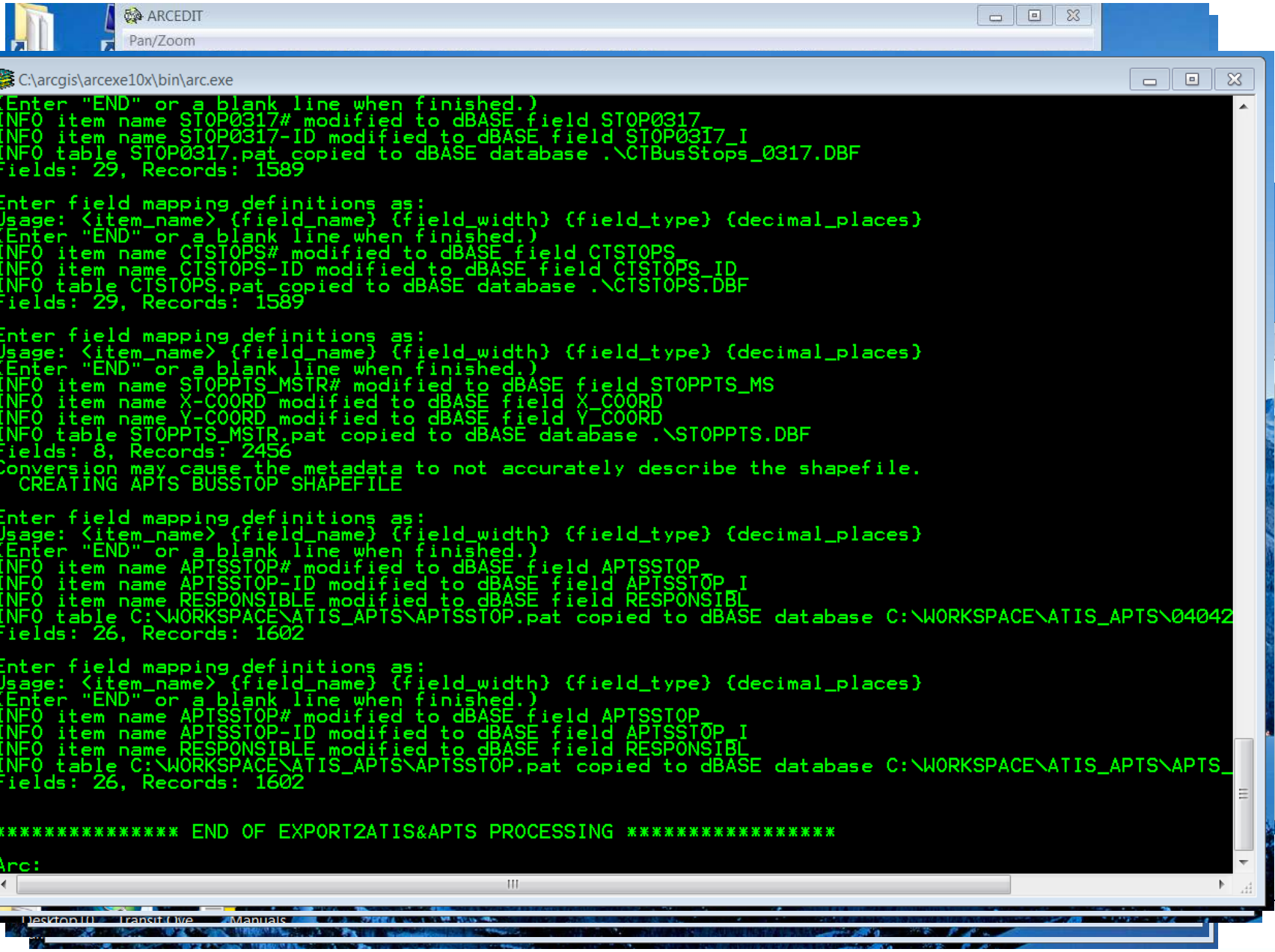


Derived Final Datasets

Data Processing Scripts

Master Feature Classes (Building Blocks)




ARCEDIT
Pan/Zoom
C:\arcgis\arcexe10x\bin\arc.exe
(Enter "END" or a blank line when finished.)
INFO item name STOP0317# modified to dBASE field STOP0317_
INFO item name STOP0317-ID modified to dBASE field STOP0317_I
INFO table STOP0317.pat copied to dBASE database .\CTBusStops_0317.DBF
Fields: 29, Records: 1589
Enter field mapping definitions as:
Usage: <item_name> {field_name} {field_width} {field_type} {decimal_places}
(Enter "END" or a blank line when finished.)
INFO item name CTSTOPS# modified to dBASE field CTSTOPS_
INFO item name CTSTOPS-ID modified to dBASE field CTSTOPS_ID
INFO table CTSTOPS.pat copied to dBASE database .\CTSTOPS.DBF
Fields: 29, Records: 1589
Enter field mapping definitions as:
Usage: <item_name> {field_name} {field_width} {field_type} {decimal_places}
(Enter "END" or a blank line when finished.)
INFO item name STOPPTS_MSTR# modified to dBASE field STOPPTS_MS
INFO item name X-COORD modified to dBASE field X_COORD
INFO item name Y-COORD modified to dBASE field Y_COORD
INFO table STOPPTS_MSTR.pat copied to dBASE database .\STOPPTS.DBF
Fields: 8, Records: 2456
Conversion may cause the metadata to not accurately describe the shapefile.
CREATING APTS BUSSTOP SHAPEFILE
Enter field mapping definitions as:
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(Enter "END" or a blank line when finished.)
INFO item name APTSSTOP# modified to dBASE field APTSSTOP_
INFO item name APTSSTOP-ID modified to dBASE field APTSSTOP_I
INFO item name RESPONSIBLE modified to dBASE field RESPONSIBL
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Fields: 26, Records: 1602
Enter field mapping definitions as:
Usage: <item_name> {field_name} {field_width} {field_type} {decimal_places}
(Enter "END" or a blank line when finished.)
INFO item name APTSSTOP# modified to dBASE field APTSSTOP_
INFO item name APTSSTOP-ID modified to dBASE field APTSSTOP_I
INFO item name RESPONSIBLE modified to dBASE field RESPONSIBL
INFO table C:\WORKSPACE\ATIS_APTS\APTSSTOP.pat copied to dBASE database C:\WORKSPACE\ATIS_APTS\APTS_
Fields: 26, Records: 1602
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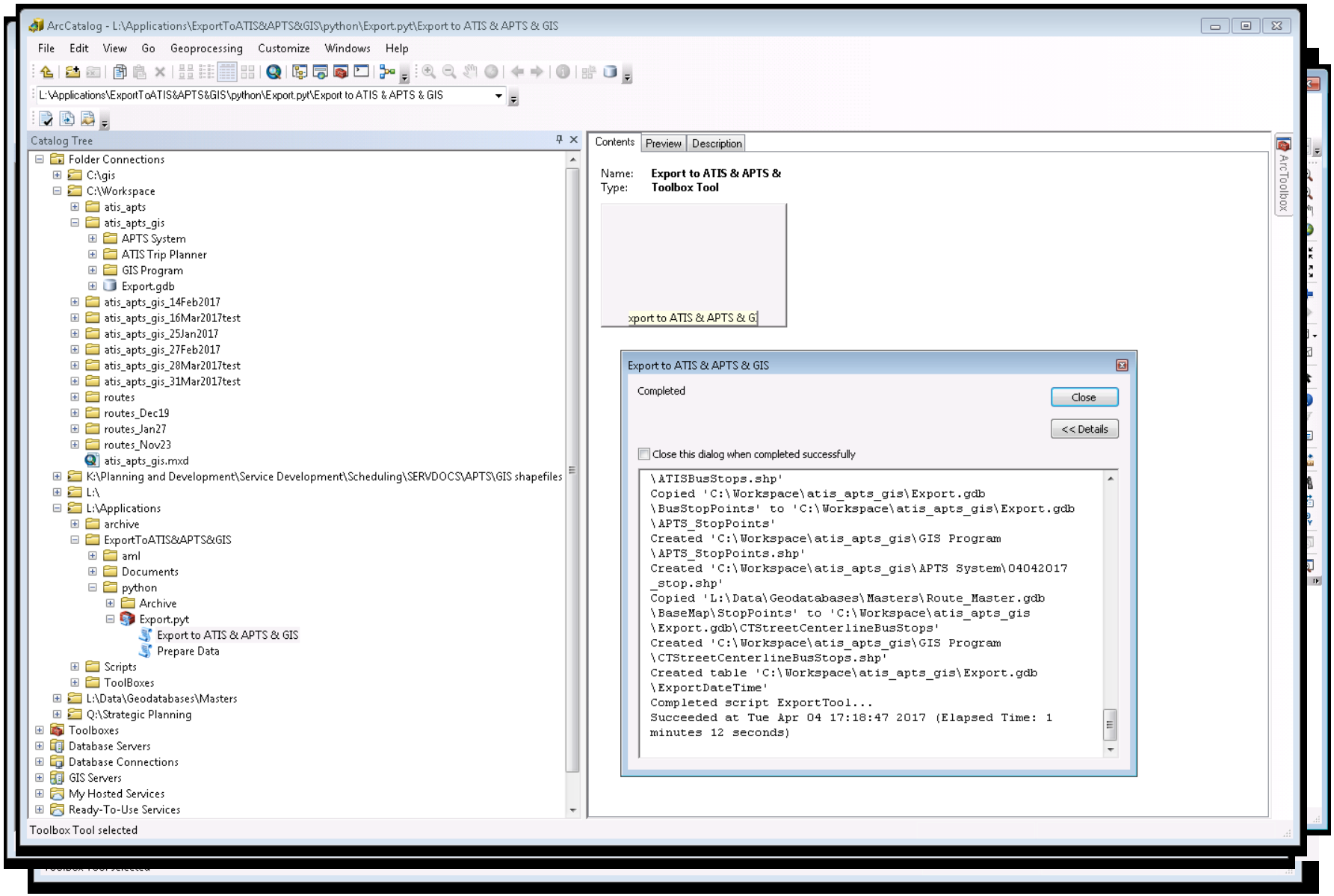
ArcCatalog - L:\Applications\ExportToATIS&APTS&GIS\python\Export.pyt\Export to ATIS & APTS & GIS
File Edit View Go Geoprocessing Customize Windows Help
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Catalog Tree
Folder Connections
C:\gis
C:\Workspace
atis_apts
atis_apts_gis
APTS System
ATIS Trip Planner
GIS Program
Export.gdb
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atis_apts_gis_16Mar2017test
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routes
routes_Dec19
routes_Jan27
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archive
ExportToATIS&APTS&GIS
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Documents
python
Archive
Export.pyt
Export to ATIS & APTS & GIS
Prepare Data
Scripts
ToolBoxes
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Q:\Strategic Planning
Toolboxes
Database Servers
Database Connections
GIS Servers
My Hosted Services
Ready-To-Use Services
Toolbox Tool selected
Contents Preview Description
Name: Export to ATIS & APTS & Toolbox Tool
Type:
xport to ATIS & APTS & G
Export to ATIS & APTS & GIS
Completed
Close
<< Details
Close this dialog when completed successfully
\ATISBusStops.shp'
Copied 'C:\Workspace\atis_apts_gis\Export.gdb
\BusStopPoints' to 'C:\Workspace\atis_apts_gis\Export.gdb
\APTS_StopPoints'
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\APTS_StopPoints.shp'
Created 'C:\Workspace\atis_apts_gis\APTS System\04042017
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Copied 'L:\Data\Geodatabases\Masters\Route_Master.gdb
\BaseMap\StopPoints' to 'C:\Workspace\atis_apts_gis
\Export.gdb\CTStreetCenterlineBusStops'
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\CTStreetCenterlineBusStops.shp'
Created table 'C:\Workspace\atis_apts_gis\Export.gdb
\ExportDateTime'
Completed script ExportTool...
Succeeded at Tue Apr 04 17:18:47 2017 (Elapsed Time: 1
minutes 12 seconds)
ArcToolbox

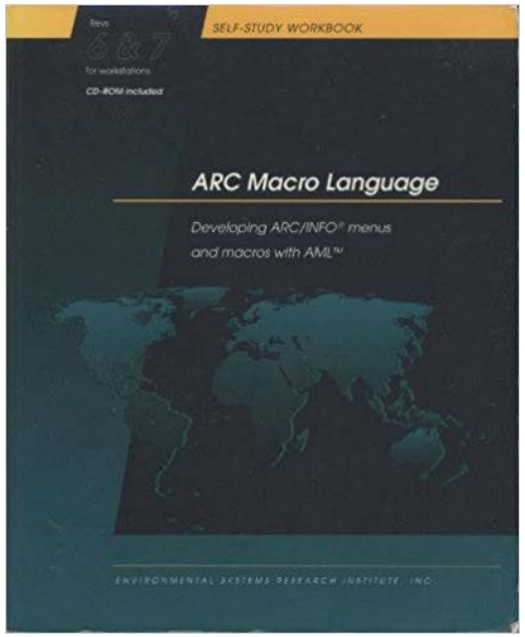
Presentation of the Solution

- **David Howes, LLC**
  - **GIS Professional Development**
  - david@dhowes.com
  - 253.312.3441

- **Jeff Berry**
  - **FocusGeo**
  - jeffb@focusgeo.xyz
  - 509.885.8299

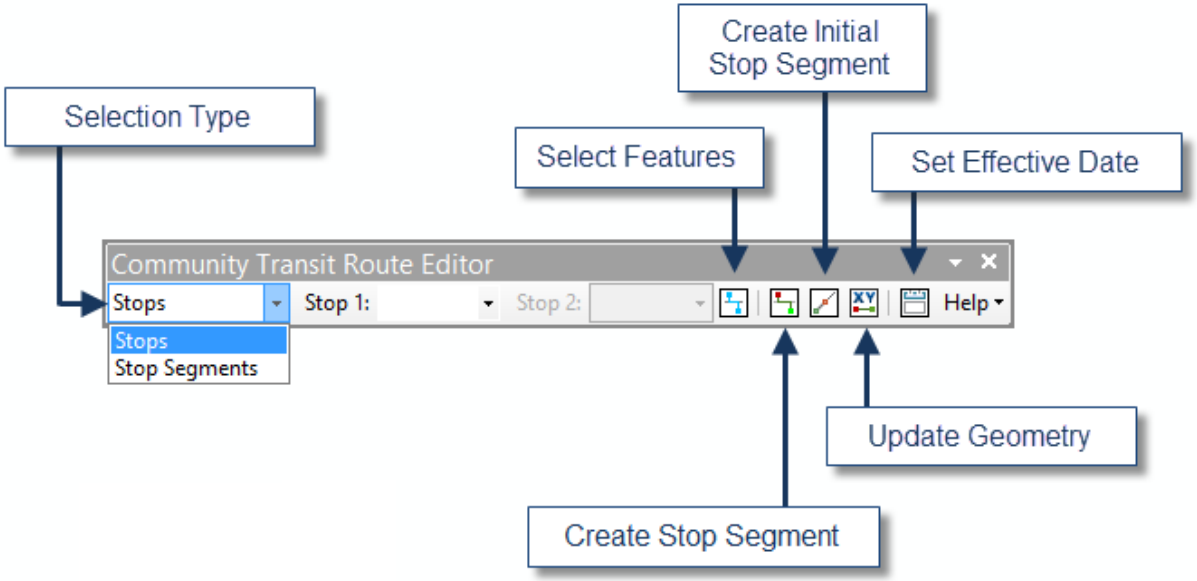
Community Transit ArcInfo AMLs

- Used set of AMLs to control editing of stops and stop segments in coverage format.
- Many of the AMLs commands used for setting up the current environment, performing selections, rendering features, etc.
- Data stored in coverages. Stop segments managed in a route feature class.



Community Transit Route Editor

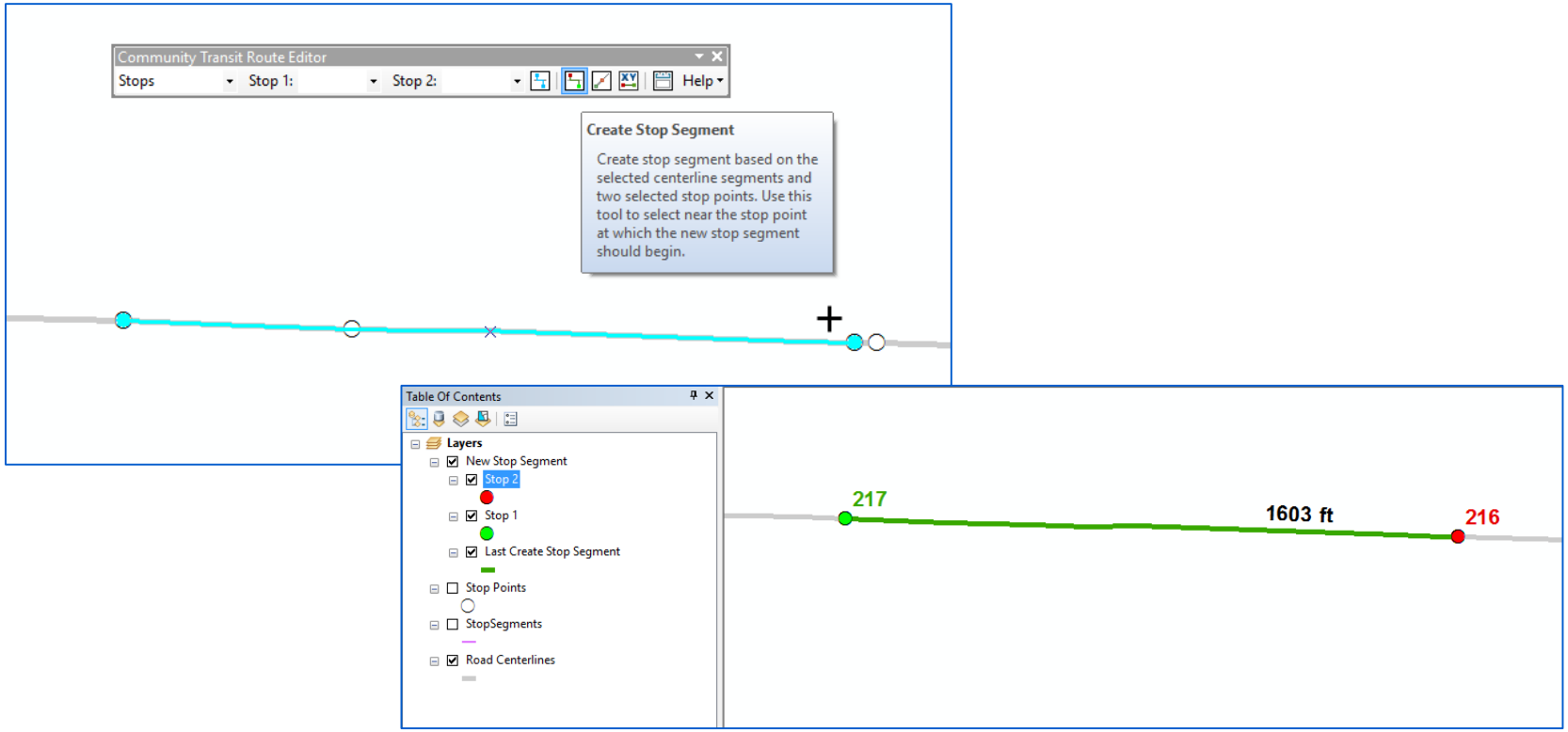
- Add-in for ArcGIS Desktop to replace and improve legacy ArcInfo tools
- Utilize native ArcMap capabilities as much as possible
- Customized toolset to streamline editing workflow



Design Goals

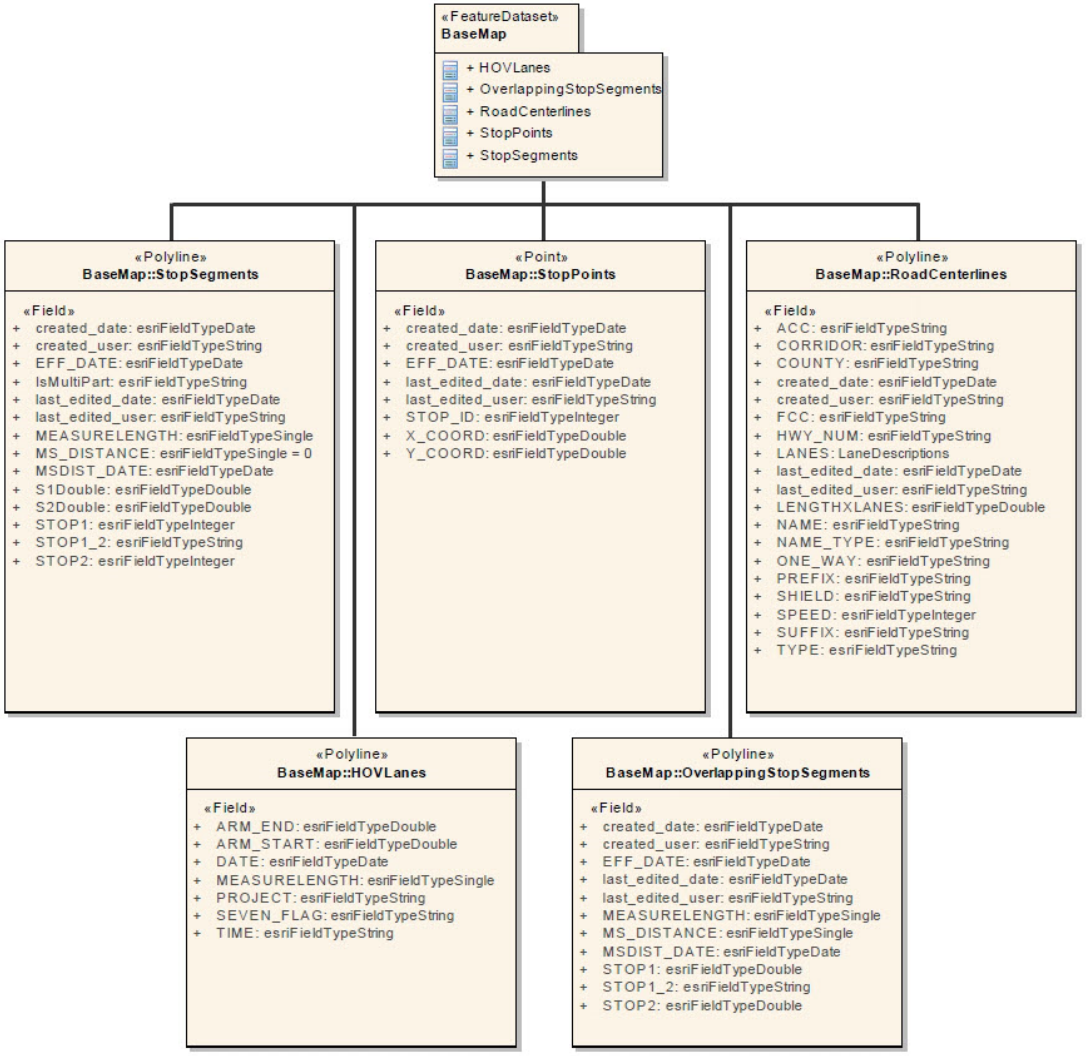
- Leverage ArcMap
- Include data validation checks in editing workflow

Example: Creating stop segments



Community Transit Geodatabase

- Stop Segments
- Stop Points
- Road Centerlines



Topology

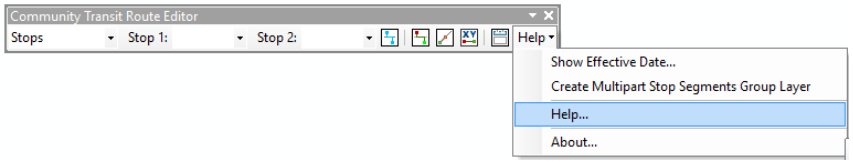
- Coverage format used route feature to maintain stop segment topology
- New geodatabase uses topology
- Requires

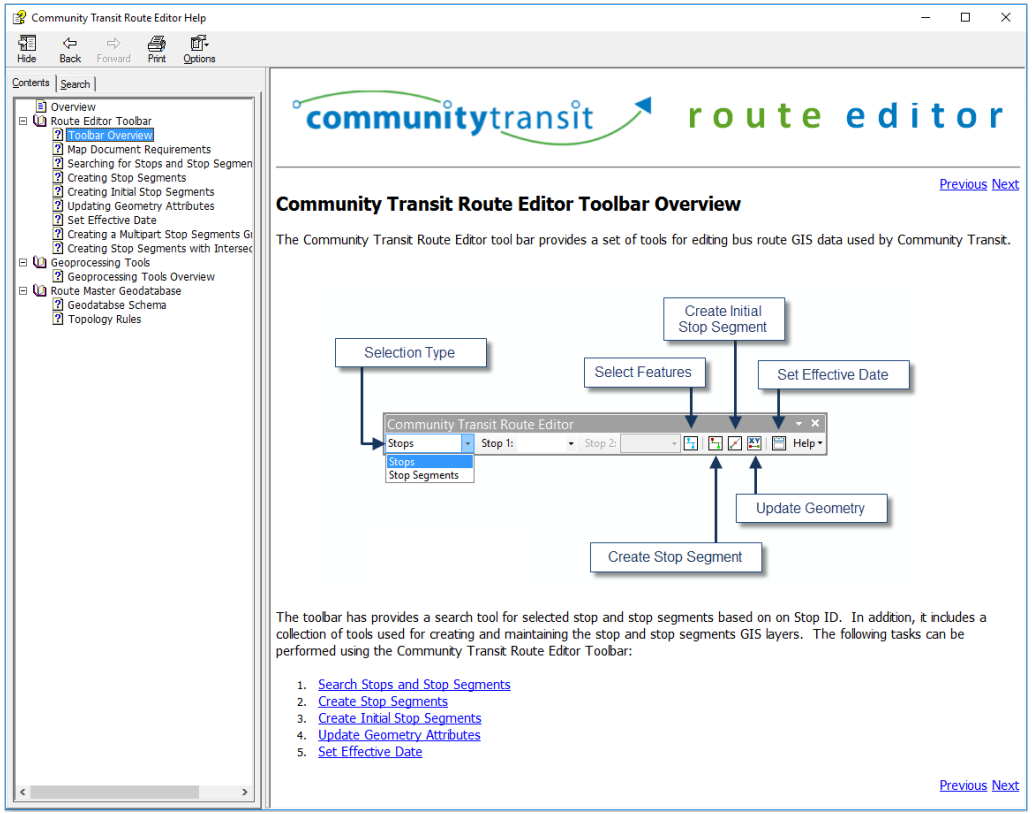
Feature Class	Rule	Feature Class
RoadCenterlines	Must Be Single Part	
StopSegments	Must Be Covered By Feature Class Of	RoadCenterlines
StopSegments	Endpoint Must Be Covered By	StopPoint
StopSegments	Must Be Single Part	
StopPoints	Must Be Covered By Endpoint Of	StopSegments
RoadCenterlines	Must Not Overlap	
RoadCenterlines	Must Not Have Dangles	
Stop Segments	Must Not Have Dangles	

Python vs. .NET

- Originally began toolbar development in Python
- ArcMap Editor and *arcpy.da.Editor* do not play well together:
  - Edit operations performed through arcpy.da.Editor not placed on ArcMap edit stack
  - No undo, no notification to save
- Switched to .NET to support a more seamless editing workflow

Route Editor Help File





Project Status Today

- New Master File Geodatabase in Full Production
- New Data Maintenance Tools in Full Production
- New Database Connection in Full Production
- New ArcPy / Python Scripting in Full Production
- ATIS Trip Planner Data Approved / In Full Production
- GIS Program Data Approved / In Partial Production
- APTS System Data Approved / Not in Production
- For A Temporary Period will be Retaining ArcInfo Workstation System until APTS Issue Resolved
- Project will Conclude at End of April

Conclusions / Takeaways / Lessons Learned

- Community Transit
  - Well written Scope of Work / RFP helped a lot
  - Assistance from Procurement / IT Depts. helped a lot
  - New File Geodatabase and Maintenance Tools Superior to Old Tools (.NET is better than Python)
  - New ArcPy / Python Scripting Far Superior in Efficiency
  - QA/QC Test Script would have helped
  - Unwritten Project Assumptions sometimes results in unforeseen issues
  - Thanks to David Howes and Jeff Berry for Truly Partnering and doing the Work Successfully!

Conclusions / Takeaways / Lessons Learned

- Professional development

  Ensure that deliverables can serve as learning aids and resources, while fulfilling core operational needs

- Coding Considerations
  - Provide robust and informative code that allows for simple testing and re-use - e.g., Python toolbox with main function and clean error handling
  - Always use the right tools for a given situation and be adaptable

Thank You!

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