Modeling Efficient Work Flows: Automating Bus Stop Updates at CTA
Track: Transportation
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The Chicago Transit Authority has recently implemented a new schedule-driven Automated Voice Annunciation System (AVAS) for its bus fleet of more than 1800 buses, serving over 12,000 bus stops.

AVAS requires the bus stop database to be highly accurate, necessitating frequent updates. The update procedure in place contained too many steps to be efficient.

In response, CTA's GIS group built an automated work flow that captures and updates database changes, calculates x-and-y coordinate points, updates feature classes in SDE, and assigns user privileges. This process uses the personal geodatabase, ArcSDE 9.0, and ModelBuilder.

Attendees will benefit from learning how to establish a work flow that results in less work with increased efficiency and accuracy.

Introduction

The Chicago Transit Authority (CTA) is the second largest transit property in the United States, providing more than 440 million rides per year. CTA has a rolling stock of 2,041 buses and 1,190 heavy-rail cars. There are 12,280 bus stops and 143 rail stations. Due to current funding issues facing mass transit providers CTA is exploring new technologies as a means to better manage its resources and to become more efficient. One technology adopted is an Automated Voice Annunciation System (AVAS) on the bus fleet.

Implemented in response to a legal settlement of behalf of the ADA community, our entire bus fleet has been equipped with the AVAS system which announces the bus-stop both visually and auditory, and provides regularly scheduled public address announcements. The AVAS system contains the entire current system schedule on

each vehicle. AVAS also provides post-time schedule adherence and passenger counting data at the stop-level. Future plans include real-time management and public information systems, and possibly integration with fare data. The importance for having an accurate inventory of our bus stops is key to building accurate on-board schedules and generating usable data for analysis.

GIS - Background

GIS is utilized by many departments within the agency. The GIS team supports software distribution and core/base layers on Oracle 9i, through ArcSDE. We utilize two ArcInfo concurrent-seat licenses (mainly for editing), 18 ArcView concurrent-seat, 13 ArcView single-seat (mainly laptops), one ArcIMS, and several extensions. The integration of ArcIMS has made it possible to serve many reports and query-tools containing spatial attributes company-wide across our Intranet. This has gained support for the usefulness of GIS applications.

Problem

AVAS and ArcIMS demand a highly accurate bus stop database. This is challenging because we make frequent changes as a result of: 1.) Bus stop consolidation and elimination program; 2.) Advertising shelter program; 3.) Long-term construction projects. The demand to maintain an accurate inventory led the GIS staff to refine the update process using ESRI ModelBuilder. This paper will explain the update process pre and post ModelBuilder.

The Pre-ModelBuilder process required 18 unique steps to update the geodatabase.

Each of these steps was conducted separately and with frequent updates problems

regularly occurred. The process is described in the flow chart in Figure 1.

Figure 1 – Process of updating bus stop geodatabase prior to ModelBuilder application.
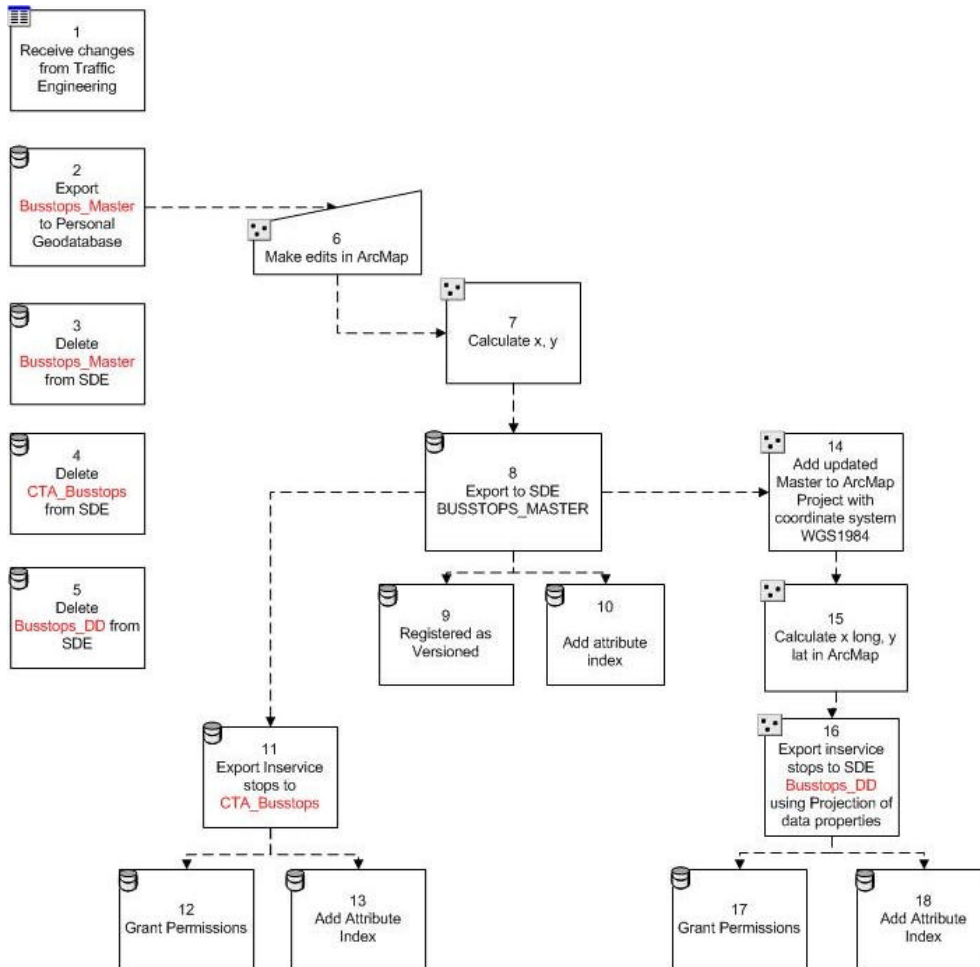
The update process was very time-consuming and if any steps, such as granting user

permissions, was omitted, the outcome could turn into a minor disaster, like causing

ArcIMS to go down.

ModelBuilder

At the release of ArcGIS 9.0, we explored ModelBuilder application, and the possibility that it could automate the 18-step process of updating our bus stop geodatabase. With research, and the 3-day course: *Advanced Analysis with ArcGIS* , the GIS team built a model that automates the database changes, calculates x-and-y coordinate points, updates feature classes in SDE, and assigns user privileges quickly without missing critical steps.

Our model utilizes standard ArcTools found within "Conversion Tools" and "Data Management Tools." Below we provide a general description of each step and the entire process is described in Figure 2. At the end of this paper, we provide the python script from the model.

The ModelBuilder application automates the updating of our bus stop geodatabase with the following 15-step process:

1.) Deletes current bus stops (in State Plane) utilizing **DeleteFeatures_management**

2.) Deletes current bus stops (in WGS-84) utilizing **DeleteFeatures_management**

3.) Delete X and Y fields in bus stop Master utilizing **DeleteField_management**

4.) Add XY coordinates to Master utilizing **AddXY_management**

5.) Create new bus stop Master utilizing **FeatureClassToFeatureClass_conversion**

6.) Add attribute index to bus stop master utilizing **AddIndex_management**

7.) Grant user privileges to bus stop master utilizing **ChangePrivileges_management**

8.) Create new featureclass in WGS-84 utilizing **FeatureClassToFeatureClass_conversion**

9.) Delete X and Y fields to bus stop featureclass in WGS-84 utilizing **DeleteField_management**

10.) Re-project bus master to update featureclass in WGS-84 utilizing **Project_management**

11.) Add X and Y coordinates to featureclass in WGS-84 utilizing **AddXY_management**

12.) Add attribute index to featureclass in WGS-84 utilizing **AddIndex_management**

13.) Grant privileges to featureclass in WGS-84 utilizing **ChangePrivileges_management**

14.) Add attribute index to updated master utilizing **AddIndex_management**

15.) Register Master as versioned utilizing **RegisterAsVersioned_management**

Conclusion

The ModelBuilder application in ArcGIS 9.0 establishes a work flow resulting in less work for the GIS team, coupled with increased efficiency and accuracy of data serving our AVAS, ArcIMS, and ArcSDE applications.

Figure 2 – Process flow of updating bus stop geodatabase using ModelBuilder application.
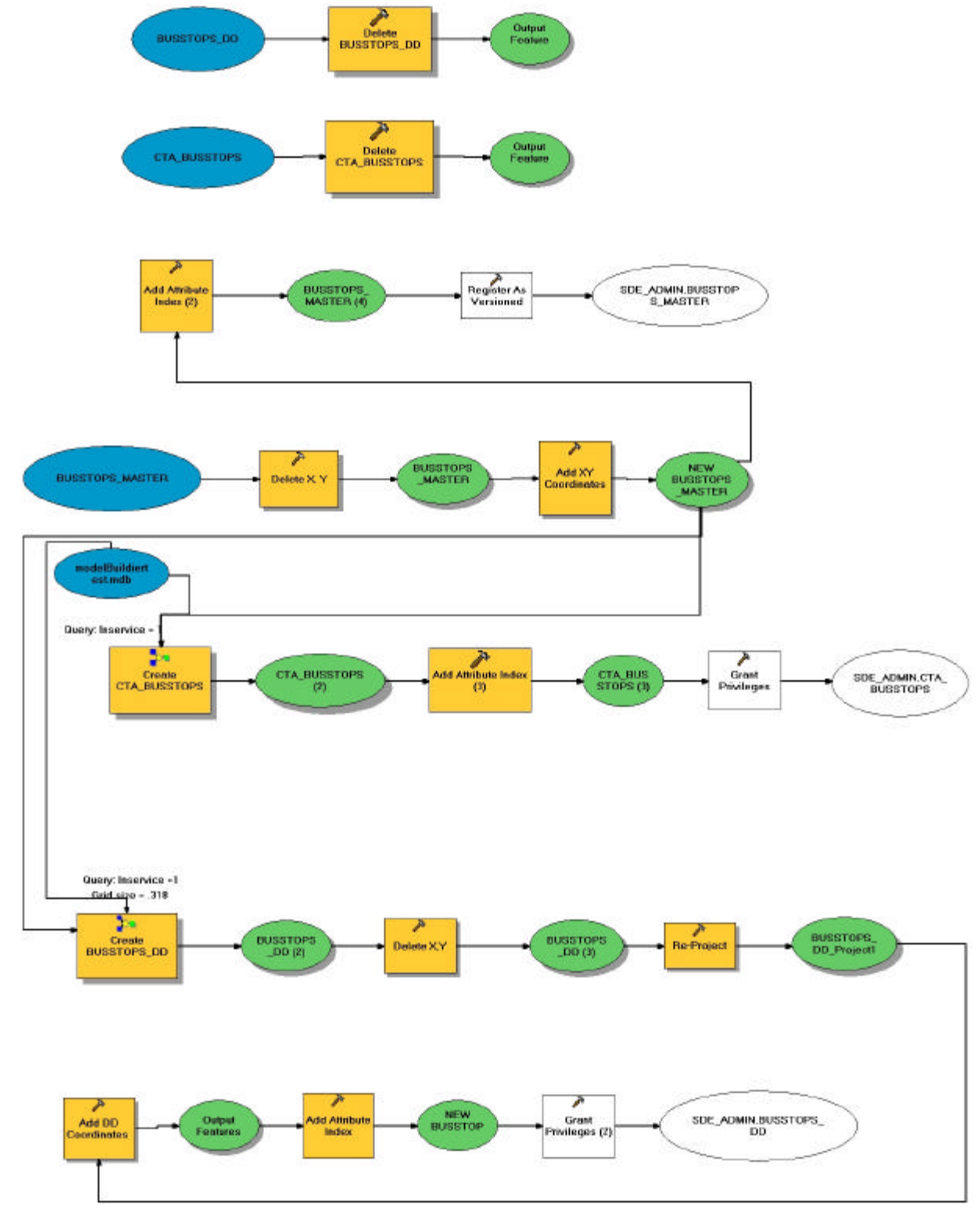
Attachment 1: Python Script Output

```
# ---------------------------------------------------------------------------
# pythonscript.py
# Created on: Fri Jun 03 2005 06:51:11 AM
#   (generated by ArcGIS/ModelBuilder)
# ---------------------------------------------------------------------------

# Import system modules
import sys, string, os, win32com.client

# Create the Geoprocessor object
gp = win32com.client.Dispatch("esriGeoprocessing.GpDispatch.1")

# Set the necessary product code
gp.SetProduct("ArcInfo")

# Load required toolboxes...
gp.AddToolbox("C:/Program Files/ArcGIS/ArcToolbox/Toolboxes/Conversion Tools.tbx")
gp.AddToolbox("C:/Program Files/ArcGIS/ArcToolbox/Toolboxes/Data Management Tools.tbx")

# Set the Geoprocessing environment...
gp.outputCoordinateSystem = ""
gp.workspace = "U:\\MY DOCUMENTS\\GIS\\GEODATATBASE\\modelBuildiertest.mdb"


# Local variables...
BUSSTOPS_MASTER = "U:\\MY
DOCUMENTS\\GIS\\GEODATATBASE\\SDE_UPDATES.mdb\\BUSSTOPS_MASTER"
BUSSTOPS_MASTER__2_ = "U:\\MY
DOCUMENTS\\GIS\\GEODATATBASE\\SDE_UPDATES.mdb\\BUSSTOPS_MASTER"
NEW_BUSSTOPS_MASTER = "U:\\MY
DOCUMENTS\\GIS\\GEODATATBASE\\SDE_UPDATES.mdb\\BUSSTOPS_MASTER"
Output_Feature_Class = "U:\\MY
DOCUMENTS\\GIS\\GEODATATBASE\\modelBuildiertest.mdb\\CTA_BUSSTOPS"
CTA_BUSSTOPS = "U:\\MY
DOCUMENTS\\GIS\\GEODATATBASE\\modelBuildiertest.mdb\\CTA_BUSSTOPS"
Output_Feature_Class__2_ = "U:\\MY
DOCUMENTS\\GIS\\GEODATATBASE\\modelBuildiertest.mdb\\BUSSTOPS_DD"
BUSSTOPS_DD = "U:\\MY
DOCUMENTS\\GIS\\GEODATATBASE\\modelBuildiertest.mdb\\BUSSTOPS_DD"
BUSSTOPS_DD__2_ = "U:\\MY
DOCUMENTS\\GIS\\GEODATATBASE\\modelBuildiertest.mdb\\BUSSTOPS_DD"
modelBuildiertest_mdb = "U:\\MY DOCUMENTS\\GIS\\GEODATATBASE\\modelBuildiertest.mdb"
CTA_BUSSTOPS__2_ = "U:\\MY
DOCUMENTS\\GIS\\GEODATATBASE\\modelBuildiertest.mdb\\CTA_BUSSTOPS"
BUSSTOPS_DD__3_ = "U:\\MY
DOCUMENTS\\GIS\\GEODATATBASE\\modelBuildiertest.mdb\\BUSSTOPS_DD"
Output_Features = "U:\\MY
DOCUMENTS\\GIS\\GEODATATBASE\\modelBuildiertest.mdb\\BUSSTOPS_DD_Project1"
BUSSTOPS_DD_Project1 = "U:\\MY
DOCUMENTS\\GIS\\GEODATATBASE\\modelBuildiertest.mdb\\BUSSTOPS_DD_Project"
NEW_BUSSTOPS_DD = "U:\\MY
DOCUMENTS\\GIS\\GEODATATBASE\\modelBuildiertest.mdb\\BUSSTOPS_DD_Project1"
BUSSTOPS_MASTER__4_ = "U:\\MY
DOCUMENTS\\GIS\\GEODATATBASE\\SDE_UPDATES.mdb\\BUSSTOPS_MASTER"
```

```
CTA_BUSSTOPS__3_ = "U:\\MY
DOCUMENTS\\GIS\\GEODATATBASE\\modelBuildiertest.mdb\\CTA_BUSSTOPS"
SDE_ADMIN_CTA_BUSSTOPS = ""
SDE_ADMIN_BUSSTOPS_DD = ""
SDE_ADMIN_BUSSTOPS_MASTER = ""

# Process: Delete CTA_BUSSTOPS...
gp.DeleteFeatures_management(CTA_BUSSTOPS)

# Process: Delete BUSSTOPS_DD...
gp.DeleteFeatures_management(BUSSTOPS_DD)

# Process: Delete X, Y...
gp.DeleteField_management(BUSSTOPS_MASTER, "X;Y")

# Process: Add XY Coordinates...
gp.AddXY_management(BUSSTOPS_MASTER__2_)

# Process: Create CTA_BUSSTOPS...
gp.FeatureClassToFeatureClass_conversion(NEW_BUSSTOPS_MASTER, modelBuildiertest_mdb,
"CTA_BUSSTOPS", "[INSERVICE] =1", "OBJECTID OBJECTID VISIBLE;SYSTEMSTOP SYSTEMSTOP
VISIBLE;STREET STREET VISIBLE;CROSS_ST CROSS_ST VISIBLE;DIR DIR VISIBLE;POS POS
VISIBLE;ROUTESSTPG ROUTESSTPG VISIBLE;INSERVICE INSERVICE VISIBLE;OLDRTES
OLDRTES VISIBLE;OWLROUTES OWLROUTES VISIBLE;SHELTER SHELTER VISIBLE;CITY CITY
VISIBLE;WARD WARD VISIBLE;BUSPADS BUSPADS VISIBLE;FAUX_STOP FAUX_STOP
VISIBLE;LON LON VISIBLE;LAT LAT VISIBLE;POINT_X POINT_X VISIBLE;POINT_Y POINT_Y
VISIBLE;POINT_Z POINT_Z VISIBLE;POINT_M POINT_M VISIBLE", "SAME_AS_TEMPLATE",
"SAME_AS_TEMPLATE", "", "0")

# Process: Add Attribute Index (3)...
gp.AddIndex_management(CTA_BUSSTOPS__2_, "SYSTEMSTOP", "", "UNIQUE", "ASCENDING")

# Process: Grant Privileges...
gp.ChangePrivileges_management(CTA_BUSSTOPS__3_, "", "")

# Process: Create BUSSTOPS_DD...
gp.FeatureClassToFeatureClass_conversion(NEW_BUSSTOPS_MASTER, modelBuildiertest_mdb,
"BUSSTOPS_DD", "[INSERVICE] = 1", "OBJECTID OBJECTID VISIBLE;SYSTEMSTOP SYSTEMSTOP
VISIBLE;STREET STREET VISIBLE;CROSS_ST CROSS_ST VISIBLE;DIR DIR VISIBLE;POS POS
VISIBLE;ROUTESSTPG ROUTESSTPG VISIBLE;INSERVICE INSERVICE VISIBLE;OLDRTES
OLDRTES VISIBLE;OWLROUTES OWLROUTES VISIBLE;SHELTER SHELTER VISIBLE;CITY CITY
VISIBLE;WARD WARD VISIBLE;BUSPADS BUSPADS VISIBLE;FAUX_STOP FAUX_STOP
VISIBLE;LON LON VISIBLE;LAT LAT VISIBLE;POINT_X POINT_X VISIBLE;POINT_Y POINT_Y
VISIBLE;POINT_Z POINT_Z VISIBLE;POINT_M POINT_M VISIBLE", "SAME_AS_TEMPLATE",
"SAME_AS_TEMPLATE", ".318", "0")

# Process: Delete X,Y...
gp.DeleteField_management(BUSSTOPS_DD__2_, "POINT_X;POINT_Y")

# Process: Re-Project...
gp.Project_management(BUSSTOPS_DD__3_, BUSSTOPS_DD_Project1,
"GEOGCS['GCS_WGS_1984',DATUM['D_WGS_1984',SPHEROID['WGS_1984',6378137.0,298.2572235
63]],PRIMEM['Greenwich',0.0],UNIT['Degree',0.0174532925199433]]", "NAD_1983_To_WGS_1984_1")

# Process: Add DD Coordinates ...
gp.AddXY_management(BUSSTOPS_DD_Project1)
```

```
# Process: Add Attribute Index...
gp.AddIndex_management(Output_Features, "SYSTEMSTOP", "", "UNIQUE", "ASCENDING")

# Process: Grant Privileges (2)...
gp.ChangePrivileges_management(NEW_BUSSTOPS_DD, "", "")

# Process: Add Attribute Index (2)...
gp.AddIndex_management(NEW_BUSSTOPS_MASTER, "SYSTEMSTOP", "", "UNIQUE",
"ASCENDING")

# Process: Register As Versioned...
gp.RegisterAsVersioned_management(BUSSTOPS_MASTER__4_)
```