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# Creating, managing and utilizing a 3D Virtual City in ArcGIS 10.1


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- 3D Mapping & Ingredients of a 3D Virtual City
- Creating 3D Datasets with ArcGIS 10.1
- Analysis in 3D
- 3D Rendering APIs
- Publishing 3D data to the cloud
- Developer solutions for 3D Virtual City GIS
- Questions and Answers…

# What is 3D Mapping?

- Viewing & Analysis of spatial data in 3D: raster, vector, elevation
- Seamless transitions between global, local and street-level scale data
- Performing GIS analysis within a 3D context

# What can 3D Mapping do for you?

- Accurately represent real-world GIS entities
- Create realistic 3D virtual cities
- Visualize ‘what if’ scenarios
- Gain insights into your data, including:
  - 3D spatial relationships
  - Sizes / Scales
  - Visual Sensitivity (LOS, Skyline, Shadows)

# Esri's Solution for 3D Mapping & Visualization

- **Desktop:**
  - ArcGIS 3D Analyst (ArcGlobe and ArcScene)
  - ArcGIS City Engine (new at 10.1)
  - ArcReader / ArcGIS Explorer (available at no cost)
- **ArcGIS Engine Solutions:**
  - Globe Control
  - Scene Control
- **ArcGIS Server Solution:**
  - Globe Server
  - Allows analysts to publish rich GIS web Services
  - No programming required

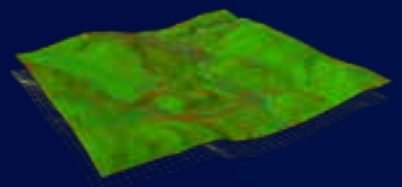
# Creating 3D Data Sets

- Data Collection
- Data Conversion
- Data Authoring
  - Out of the Box (using GUI)
    - Symbology
      - 3D Marker Symbols
      - Style Gallery
      - Using 3D Graphics
      - Extruding 2D datasets – Attribute Driven
  - Custom Solutions
    - Develop 3D objects using *multipatches*
      - MultiPatch Geometry

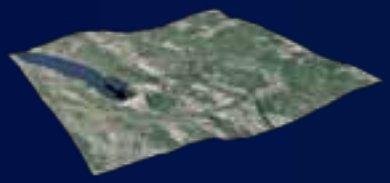
# Data Collection

## Types of Data

Elevation



Imagery

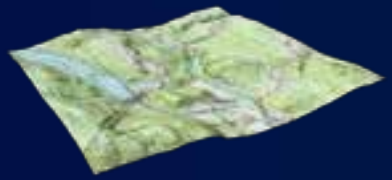


BIM/IFC

Models/Multipatches

Subsurface

Topographic

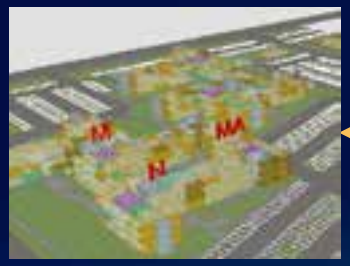


LIDAR

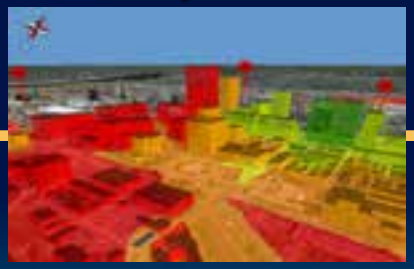
Points and lines

## Across Scales

Facility



City

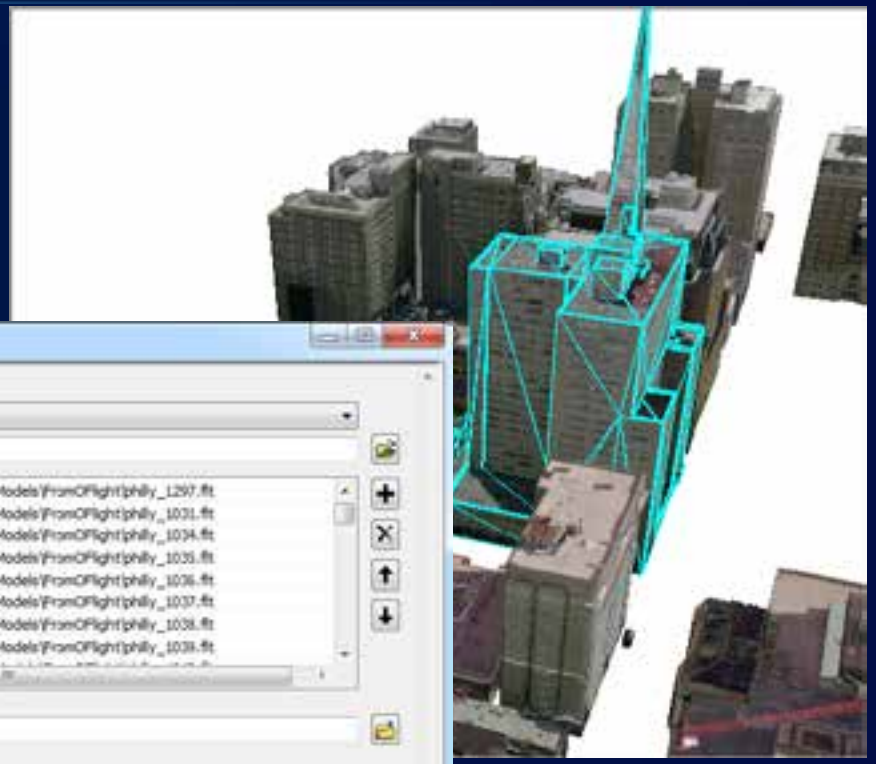


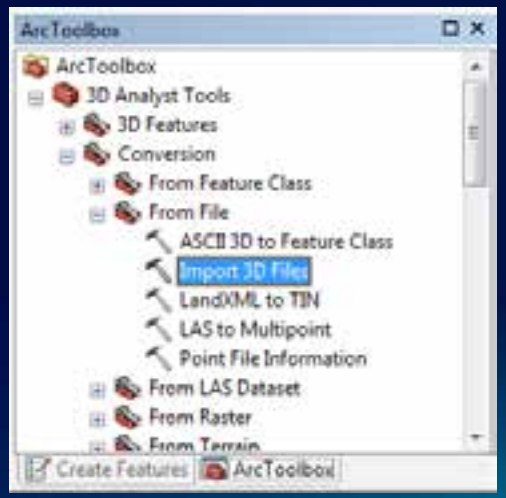
Regional / Global

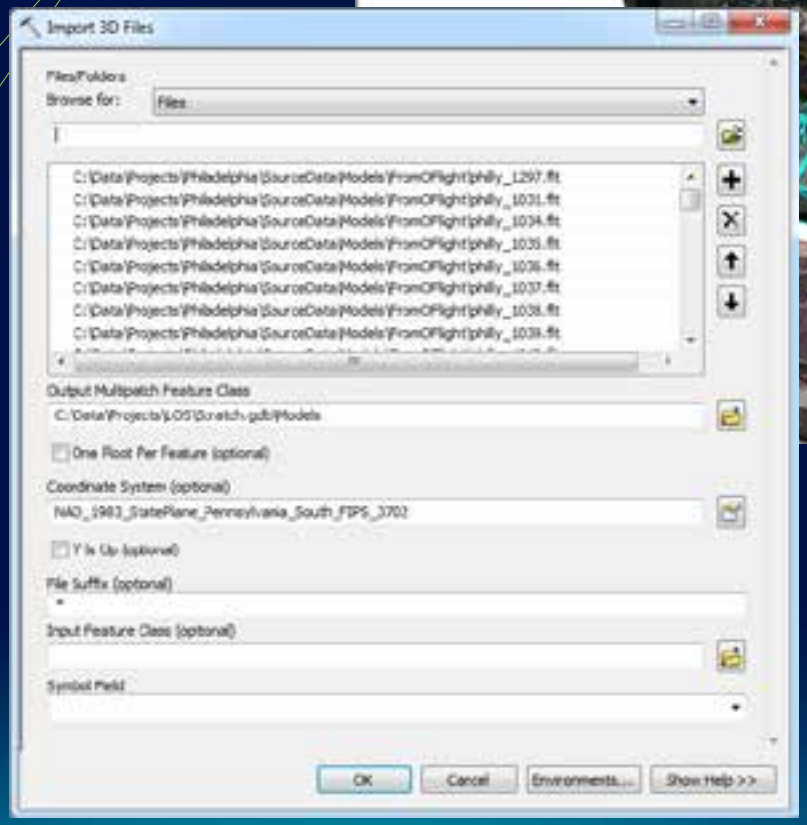
# Data Conversion: Import 3D Files

- **Input Formats**
  - 3D Studio Max
  - VRML
  - GeoVRML
  - SketchUp 6.0
  - OpenFlight
  - COLLADA

These formats can store geographic location

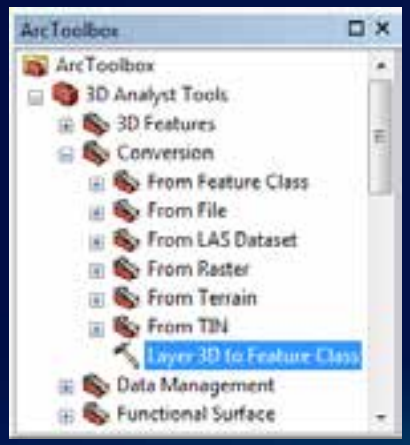


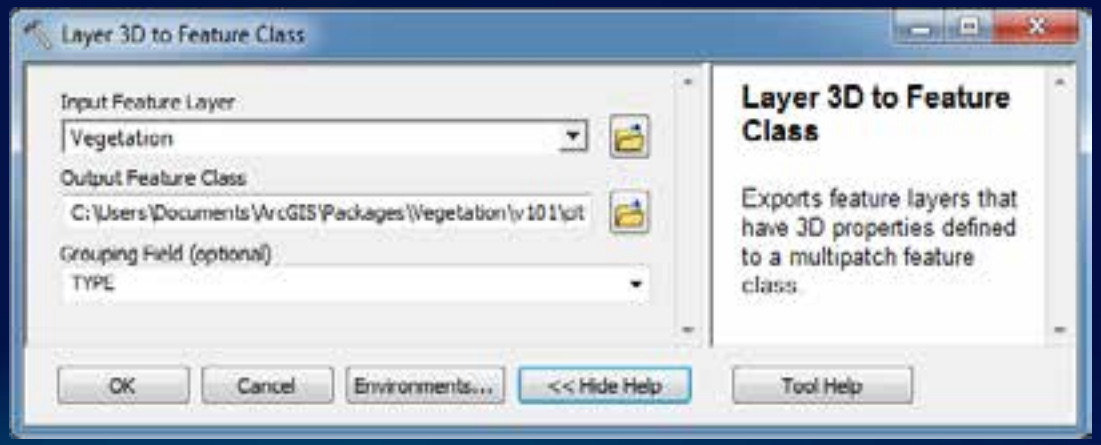


# Data Conversion: Layer 3D to Feature Class

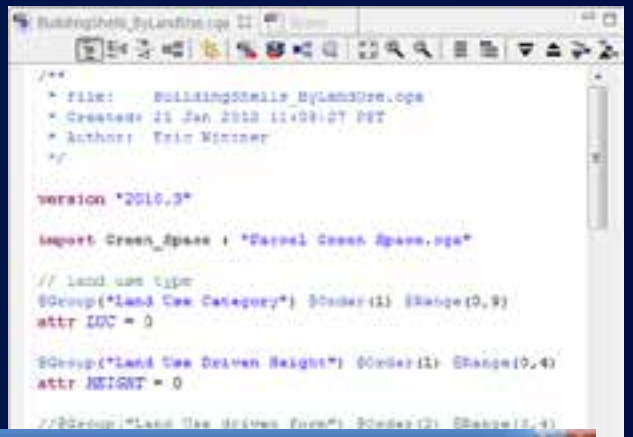
- 3D Symbology
- Extrusion Settings
- Texture Downsampling



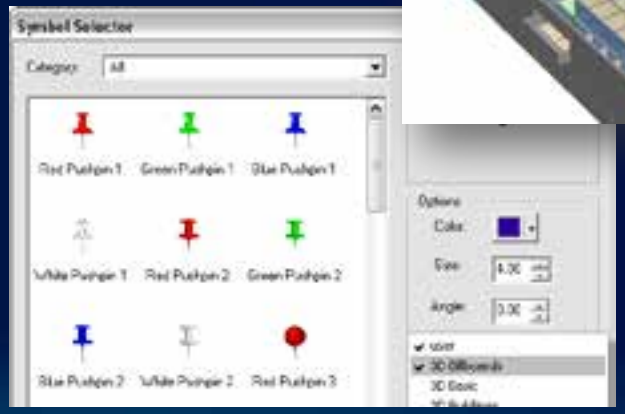
# Data Authoring – Procedural Techniques

- CityEngine
  - A platform for authoring rules capable of generating a variety of 3D Data.
  - 3D Content from scratch, or driven by GIS data
  - Types of output:
    - Buildings
    - Floors
    - Streets
    - Vegetation
    - Street Furniture
    - Cars
    - Pedestrians



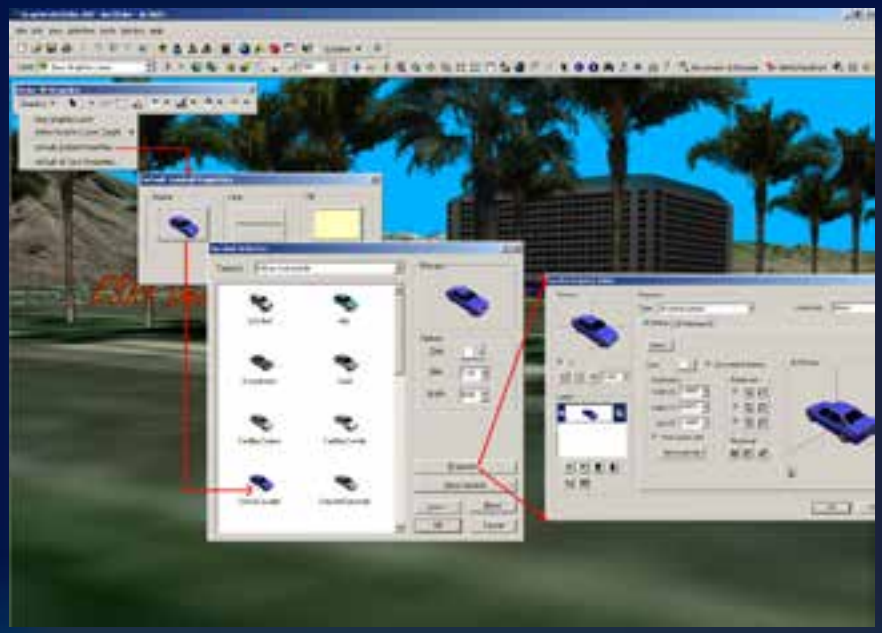
# Authoring – 3D Symbology

- Points
  - 3D Geometric primitives
  - 3D Models: Street furniture, etc.
  - 3D Character Markers
  - 3D Billboarded Markers
- Lines
  - 3D Texture Line Symbols
  - 3D Geometric primitives
- Polygons
  - 3D Texture Fill Symbols
- Multipatches



# Authoring: Adding Visualization elements

- UI based
  - 3D Graphics Toolbar
    - Digitize a point, line, polygons and text graphics
    - Apply 3D Symbology to the graphic elements
  - KML support



- Code Based – 3D Graphics Layer API

# Authoring: 3D Templates

**Provides a guide for how to author a 3D City**

- **Includes:**
  - **Globe document**
  - **Layers with pre-design symbology**
  - **Example data for exploration**
  - **Documentation**

**Search key word:**

**"3D Virtual City: Philadelphia"**

- **Additional data management, authoring and analysis templates available**

# 3D Data Management and Analysis

- **Managing LIDAR Data**
  - ***LAS Datasets***
  - ***Classification tools***
- **Shadow maps on the earth's surface:**
  - ***Skyline and Skyline Barrier***
  - ***Intersect 3D***
- ***Cumulative Line of Sight, using:***
  - ***Construct Site Lines***
  - ***Line of Sight***
  - ***3D Spatial Join***

  ***And many more …***

# Demonstration 1 & 2

Creating and Analyzing
3D Virtual Cities

# 3D Rendering APIs

- GlobeGraphics API
  - GraphicsLayer
  - GraphicsElement
- Customization  API
  - Application Customization
  - Support for CustomGlobe Layer
- OpenGL API
  - Globe framework provides mechanism to plug-in OpenGL calls
- 3D Solutions Engineering
  - Write your own App

# 3D Graphics Layer API Usage (C++)

```
//Create a new graphics layer
m_ipGlobeGraphicsLayer.CreateInstance(CLSID_GlobeGraphicsLayer);
ILayerPtr (m_ipGlobeGraphicsLayer)->put_Name(L“3DGraphicsLayer");

//Add the new graphic layer to the globe
IGlobePtr ipGlobe;
m_ipGlobeDisplay->get_Globe(&ipGlobe);
IScenePtr (ipGlobe)->AddLayer(ILayerPtr(m_ipGlobeGraphicsLayer),
  VARIANT_TRUE);
```

```
 //Activate the new graphics layer
IScenePtr (ipGlobe)-
  >ActiveGraphicsLayer(ILayerPtr(m_ipGlobeGraphicsLayer));
```

```
//Create the element’s geometry
IPointPtr ipPoint(CLSID_Point);
IZAwarePtr (ipPoint)->put_ZAware(VARIANT_TRUE);
ipPoint->PutCoords(position.longitude, position.latitude);
ipPoint->put_Z(position.altitude);
```

# 3D Graphics Layer API Usage (C++)

```
//Create the element's color (red)
IRgbColorPtr ipColor(CLSID_RgbColor);
ipColor->put_Red(255L);
ipColor->put_Green(0L);
ipColor->put_Blue(0L);
```

```
 //Set the element's symbol
IMarkerSymbolPtr ipMarkerSymbol(CLSID_SimpleMarker3DSymbol);
ISimpleMarker3DSymbolPtr (ipMarkerSymbol)->put_Style(esriS3DMSSphere);
ISimpleMarker3DSymbolPtr (ipMarkerSymbol)->put_ResolutionQuality(1.0);
ipMarkerSymbol->put_Size(700.0);
ipMarkerSymbol->put_Color(IColorPtr(ipColor));
```

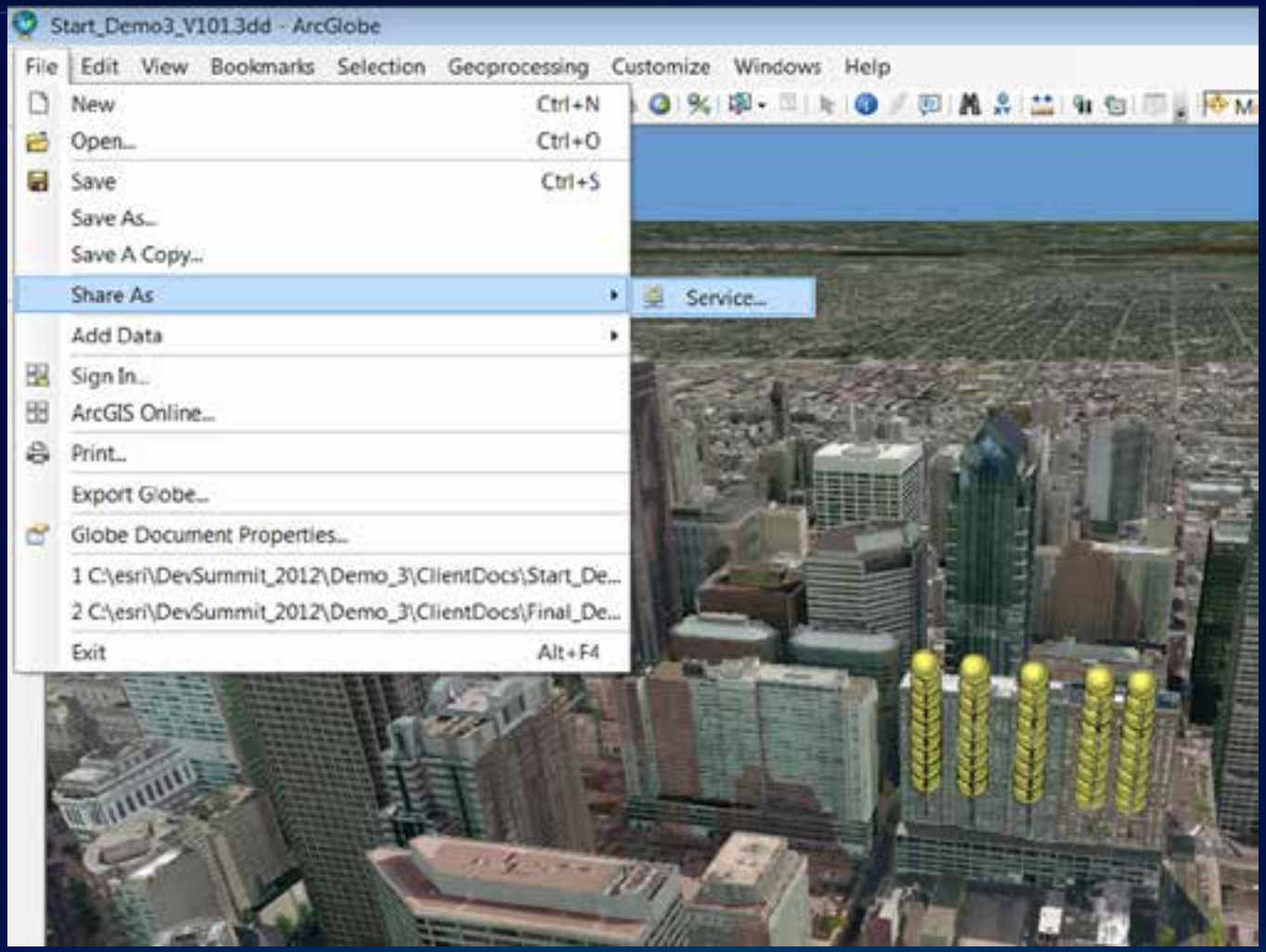
```
 //Create the new marker symbol element
IElementPtr ipTrackElement(CLSID_MarkerElement);
IMarkerElementPtr (ipTrackElement)->put_Symbol(ipMarkerSymbol);
ipTrackElement->put_Geometry(IGeometryPtr(ipPoint));
```

```
 //Add the graphic element to the graphics layer
IGrphicsContainerPtr(m_ipGlobeGraphicsLayer)->AddElement(ipTrackElement);
```

# Serving the 3D View: ArcGIS Server

- Publish the ArcGlobe document as a GlobeService
- Supports Web-based access
- All ArcGlobe supported data types can be served
- Supports Identify and Searching of features
- Animation is also supported

# Serving the 3D View: Sharing at ArcGIS 10.1



# Demonstration 3

Consuming 3D content
and
performing analysis
in the cloud

# Demonstration 4

write your own 3D app

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