What is Bentley Descartes?

Image Processing
- Raster Geo-Referencing
- Advanced raster transformation (warping, register)
- Raster Scene Creation (merge tool)
- Persistent coordinate system transformation
- Raster Mosaic Creation
- Image Mosaicing (Contrast Stretch, Density slicing, etc)
- Viewing Oracle Spatial Georaster
- Viewing Raster DEM and applying filter on Raster DEM

Hybrid Raster/Vector
- Binary Raster Editing (ala I/RAS B)
- Color Raster Editing
- Snap on raster content
- Raster to Vector conversion and Vector to Raster conversion
- Convert Raster Text to Vector Text

3D Modeling
- Advanced Textures Creation/Editing (e.g., 3D building texture)

Terrain Modeling
- Create Scalable Terrain Model (STM)
- Billions of points DTM
- Display Scalable Terrain Model
- High-Resolution Draping of Imagery on STM
- Export to MicroStation Terrain

Point Cloud Processing
- Point Cloud Classification, Editing
- Point Cloud Line Draping
- Point Cloud Advanced Export
- Point Cloud Geometry Extraction
- Point Cloud Visual Explorer
- Point Cloud Smart Snap Mode
What’s new in V8i (SELECTseries 3)

- Point Cloud Processing
  - Point Cloud Classification
  - Point Cloud Line Draping
  - Point Cloud Advanced Export
  - Point Cloud Geometry Extraction
  - Point Cloud Visual Explorer
  - Point Cloud Smart Snap

- Scalable Terrain Model
  - Create Scalable Terrain Model (STM)
  - Billions of points DTM
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Point Clouds: Industry-wide, Entire Lifecycle
Point Clouds for Infrastructure: The Benefits

- Cheaper and safer
  - Field operations are shortened, reducing field cost and risks
- Enables creation of traditional 3D model
- Enables hybrid workflow
  - No requirement to vectorize everything
  - Easy to update model by updating point cloud
  - Reduce design time
- Bring the field truth to everyone’s desk
  - Reduce the need for field operations
  - Measure on demand

Point Clouds for Infrastructure: Challenges?

- Accessing
  - Interoperability needs
  - Enterprise access
- Understanding
  - Viewing, navigate
  - Focus
- Extracting Information
  - Measure and edit
  - Extract geometries
  - Link information to objects in point cloud
What is LiDAR?

- A method to determine size and location of objects by measuring the return from a scanning laser
  - Terrestrial
  - Mobile
  - Airborne

- Produce large data sets that used to require specialized software to view, extract and model for CADD use

Airborne Scanning

- Large areas, relatively low density
Mobile Scanning

- Relatively large areas, medium density

Terrestrial Scanning

- Small areas, medium – high density
LiDAR process

• Planning:
  – Determine area to be scanned and methodology
  – Determine vertical and horizontal accuracy
  – Determine result set (Intensity, RGB, classification)…

• Raw processing
  – Spatial registration
  – Point Cloud colorizing & Clean-up
  – Automatic Classification…

• Post processing (i.e. where Bentley starts)
  – Visualise,
  – Measure,
  – Extract models,
  – Hybrid workflows,

Point Cloud support in desktop products

• Support for
  – High speed display and viewing of very large point clouds
  – Clipping of point cloud for faster display and better visualization
  – Multiple presentation modes
    • Classification
    • RGB
    • Intensity
    • Elevation
  – Snapping to the point cloud
  – Many formats supported
    • BIN, CL3, FLS, FWS, LAS, PTG, PTS, PTX, 3DD, RDB, RXP, RSP, XYZ, e57
Advanced Point Cloud Workflows

Why you need Descartes for Point Cloud

- Need to leverage point cloud data on engineering projects
- Need to fix point cloud classification mistakes
- Difficulty understanding very dense point clouds
- Difficulty selecting the correct points from very dense point clouds
- Requirement to produce point cloud deliverables
Point Cloud support in desktop products

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Point Cloud Functionality Overview

**Bentley Pointools**
- Clash Detection
- Color Editing
- Conversion
- Visualization
- Element Manipulation
- Fly Through Movie
- Segmentation and Classification
- Layer based editing

**Bentley Descartes**
- Clash Resolution (not yet with Point Clouds)
- Clip/section manager
- Create scalable terrain model from point clouds
- Smart Snap on point clouds
- Cylinder & plane extraction
- Enhanced display style manager

**Bentley Pointools View**
- Conversion
- Measurement
- Visualization

**MicroStation, Navigator, Civil, Geospatial, Plant, Building Products**
- View, manipulate, control point clouds
- Publish to Navigator for iPad
- Fast, reliable native data type
- Third party APIs

**ProjectWise**
- Centrally manage point clouds
- Stream point clouds to multiple clients

**Bentley Geo Web Publisher**
- View 3D scenes on the web including point clouds
Bentley Descartes

- Point Cloud Processing
  - Point Cloud Classification Editing
  - Point Cloud Line Draping
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Visual Explorer

- Patent pending technology
- Visual helper dynamically re-coloring points in the cursor neighborhood
- Simplifies understanding of complex point clouds
Smart Snap

- Fully integrated with MicroStation AccuSnap
- Pick key points such as the lowest, highest, average or median point
- Simplifies modeling with point clouds

Draping/Snapping

- Automatically drape/snap lines or points
- Convert line approximation into lines following the point cloud surface exactly
- Convert random points into points exactly on the point cloud surface
Classification Editing

- Fix classification errors
- Eliminate point cloud noise
- Enables hybrid/retrofitting workflows

Geometry Extraction

- Extract primitives from point cloud
  - Planes
  - Cylinder
  - Cylinder center line
- Based on a point cloud subset selection
- Produce vector models from point cloud

Demonstration
Bentley Acquired Pointools Q4 2011

• The leading hardware-neutral provider of point cloud software
• Point clouds become a fundamental data type
• Point cloud support to be ubiquitous in Bentley products

Pointools Products for standalone point cloud processing

• Bentley Pointools View [iWare]
  – Fastest Point cloud viewer
  – (previously Pointools View Pro in free mode)
• Bentley Pointools POD Creator [iWare]
  – Batch import of Point Cloud data
• Bentley Pointools
  – View, Edit, Animate, Render
  – (previously Pointools Edit)
## Bentley Descartes vs. Bentley Pointools

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<thead>
<tr>
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<th>Descartes</th>
<th>Bentley Pointools</th>
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<tbody>
<tr>
<td><strong>Pros</strong></td>
<td>• Numerous tools to support geometry extraction</td>
<td>• Very focused</td>
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<tr>
<td></td>
<td>• Advanced CAD/AEC capabilities</td>
<td>• Fastest display on the market</td>
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<td></td>
<td>• High quality rendering with Luxology</td>
<td>• Intuitive navigation/fly through</td>
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<td></td>
<td>• High interoperability with engineering files</td>
<td>• Easy to create nice animation/rendering</td>
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<tr>
<td></td>
<td>• Multiple Views</td>
<td>• Fast rendering</td>
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<tr>
<td><strong>Cons</strong></td>
<td>• Limitation of Luxology rendering &amp; MicroStation animation</td>
<td>• Single View</td>
</tr>
<tr>
<td></td>
<td>• speed improvements required</td>
<td>• No CAD/AEC capabilities</td>
</tr>
<tr>
<td></td>
<td>• Not as easy to use</td>
<td>• Limited interoperability with CAD/AEC (no properties)</td>
</tr>
<tr>
<td></td>
<td>• No support of normal in rendering</td>
<td>• No tools to extract geometries</td>
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<tr>
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<td>• Display performance not good enough with very high density point clouds</td>
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### Advanced Terrain Modeling Workflows
Why you need Descartes for Terrain Modeling

• Large scale visualization requirements
• Need to use very large data sets in engineering projects
• Need to display high resolution imagery on the terrain

Imagery courtesy Quebec City

Scalable Terrain Model

• STM is a revolutionary new technology that enables high-performance display of digital terrain models (DTMs) covering very large areas and containing billions of points
• For viewing huge digital terrain models at geospatial scale
  – City, Region, State, Country
• Potential users
  – Municipal, States, Federal agency and government
  – EPC working in GIS
  – Large infrastructure project
Demo – Scalable Terrain Model and High-Resolution Draping

- Scalable Terrain Model display
- High-resolution draping

Data provided by Quebec City and Images provided by Aero-Photo (1961) Inc, Quebec, Canada

Benefits – Scalable Terrain Model

- Enables high-performance display of terrain models covering very large areas and containing billions of points and breaklines
- Saves time by displaying very large seamless terrain models enabling unprecedented workflows dealing with wide areas
- Scalable Terrain Model comes with high-resolution draping capabilities to display the raster backdrop on the terrain model with extremely good resolution regardless of the terrain model or image size
- The STM is easily kept up to date by synchronizing it with a wide variety of sources including DGN, Civil DTM, Point Cloud, XYZ. As the sources changes you can easily regenerate the STM
Wrap-up

- Point clouds are viewable in most Bentley desktop products
- Bentley Descartes is the tool for advanced point cloud workflows
- Bentley Descartes also adds tools for fast display of very large digital elevation models and draped imagery
- Bentley Descartes works directly with most Bentley desktop software.