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Reporting after OGC Point Cloud DWG (prepared with Bart De Lathouwer)

After 97th OGC Technical Committee, Sydney, Australia

(Stan Tillman, Jan Boehm, Peter van Oosterom,

Point cloud DWG co-chairs), 3 December 2015

Contents

- Some background (Point Clouds)

- History of the Point Cloud DWG

- Point Cloud survey

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"time was ripe and that stars aligned"

- technology is rapidly democratising
- consensus that the focus should be on PC access and processing
  – with a focus on the latter, that is where the power/business will be
  – (data acquisition is not the money maker, its the added value you can bring to the PC)
- market players were aligning on the message and way forward
  – beginning of overlap with existing standards
- need for a consensus process to manage the PC roadmap

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Standardization of point clouds?

- ISO/OGC spatial data:
  - at abstract/generic level, 2 types of spatial representations: features and coverages
  - at next level (ADT level), 2 types: vector and raster, but perhaps points clouds should be added
  - at implementation/ encoding level, many different formats (for all three data types)

- nD point cloud:
  - points in nD space and not per se limited to x,y,z (n ordinates of point which may also have m attributes)
  - make fit in new ISO 19107 (recently revised).
  - note: nD point clouds are very generic; e.g. also cover moving object point data: x,y,z,t (id) series.

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Standardization actions

- Within OGC establish a point cloud DWG
- Probably better not try to standardize point clouds at database level, but rather focus on webservices level (more support/ partners expected)
- A lot of overlap between WMS, WFS and WCS
- Proposed OGC point cloud DWG should explore if WCS is good start for point cloud services:
  - If so, then analyse if it needs extension
  - If not good starting point, consider a specific WPCS, web point cloud service standards (and perhaps further increase the overlapping family of WMS, WFS, WCS,...)

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Agenda Boulder, Colorado USA
Point Cloud ad hoc, 1 June 2015

- **Scott Simmons, OGC:** Introduction to Point Cloud discussion and summary of standards efforts
- **Jeff Young, ASPRS:** ASPRS activities with LiDAR data
- **Chris Little, UK Met Office:** What (where and when) is the Point in Meteorology
- **Keith Ryden, Esri:** Enterprise community requirements for point clouds
- **Jason Smith, Exelis (NGA):** Sensor Independent Point Cloud (SIPC) data format, a profile of HDF5
- **Michael Gerlek, RadiantBlue:** Current situation and future work for point clouds
- **Peter Baumann:** Point clouds in coverages
- **Martin Isenburg, OSGeo:** Open Source community drivers for point cloud standards
- **Doug O'Brien, IDON Technologies:** ISO and point cloud standards

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Agenda Nottingham, UK
Point Cloud DWG, 15 September 2015

- **Stan Tillman, Intergraph:** Review the Charter
- Election of Chair(s)

- **Scott Pakula, Pixia:** Serving LiDAR thru existing OGC services
- **Barry Gleeson, RICS:** Point Cloud Usage in a Railway Context and rules/issues related to extraction and sharing
- **Gene Roe, Lidar News:** The ASTM E57 Data Interoperability Standard
- **Jan Boehm, University College London:** IQmulus - Cloud Platform for Point Cloud Processing
- **Peter Baumann, Jacobs University:** OGC WCS: fomat-independent point cloud services
- **Jean-Baptiste Henry, Thales:** Point Cloud from Photogrammetry
- **Edward Verbree, Delft University of Technology:** Management and direct use of massive point clouds

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Agenda Sydney, Australia
Point Cloud DWG, 3 December 2015

- **Stan Tillman, Intergraph:** Point Cloud Survey Overview

- **Martin Isenburg, rapidlasso GmbH:** The LASzip LiDAR compressor: past choices, current rewards, and future directions

- **Nathan Quadros, CRC for Spatial Information:** Bathymetric LiDAR Specifications and LAS Classification Standards

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Domain Working Group charter

- https://portal.opengeospatial.org/?m=projects&a=view&project_id=489 (initial date 23 july 2015, updated 30 oct 2015)
- DWG= discussion/documentation platform, change request exiting standards (not work on new standards)
- Problem Statement OGC Point Cloud DWG:
  - point cloud data has often been overlooked
  - stored in many formats
  - many domains such as .. LiDAR, Elevation, Seismic, Bathymetric, Meteorological, and Fixed/Mobile consumer sensors
- Examples de facto standards: ASPRS LAS, Sensor Independent Point Cloud (SIPC) based on HDF5
- greater interoperability between point cloud datasets and … interoperate with other OGC standards

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Motivation for the Survey

- With contributions provided in Nottingham, it was apparent there are many facets to point clouds

- When trying to determine what should be a focus of the DWG, it was decided that we needed to get a better understanding of the community. We should not approach this topic based on biases.

- We have put together a short survey that we feel will give us a general overview. If more details are needed on specific topics, we will plan a more directed survey on given topics.

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A Look at the Survey

- https://portal.opengeospatial.org/files/?artifact_id=66239

- Opening remarks survey:
  - You can pick multiple options as well as add your own options
  - For each option you pick please rate its importance high or low
  - If you wish please leave a comment in the last section

- Total of 14 questions

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1. What are your major sources for surface scan point clouds?

a. Airborne LiDAR

b. Terrestrial Lidar (including Mobile Mapping)

c. Indoor Laser Scanning

d. Photogrammetry

e. SONAR (single and multi-beam echo's)

f. Subsurface Point Cloud from Seismic

g. RADAR (PS-InSAR)

h. Other (please specify):

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2.   What formats do you use to store point clouds?

a. LAS (ASPRS)

b. LAZ

c. ZLAS

d. E57

e. PCD

f. POD

g. ASCII

h. PLY

i. SPD

j. Other (please specify):

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3. What formats do you use to transfer point clouds (both internally and to external entities)?

a. LAS (ASPRS)

b. LAZ

c. ZLAS

d. E57

e. PCD

f. POD

g. ASCII

h. PLY

i. SPD

j. Other (please specify):

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4. What are your most common use cases for point clouds?

a. Visualization

b. Digital Terrain Modelling

c. Feature Extraction

d. Forestry

e. GIS

f. Other (please specify):

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5. How do you store point clouds?

a. In a file on a computer

b. In a file on a network drive

c. In a database

d. In the cloud

e. Other (please specify):

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6.   What attributes do your point clouds contain besides XYZ coordinates?

a. Timestamp

b. Intensity

c. Colour

d. Classification

e. Pulse Form

f. Pulse Count

g. Direction and Length of Scanline

h. Other (please specify):

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7. What conversion do you apply to the point clouds in order to use them?

a. To regular grid (raster)

b. To TIN

c. To features (vector object after detection/recognition)

d. None, direct use of point clouds

e. Other (please specify):

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8. Which temporal aspect of point clouds are relevant for you?

a. Temporal granularity at point level

b. Temporal granularity at data set (a 'point cloud') level

c. Temporal resolution / update frequency years

d. Temporal resolution / update frequency months

e. Temporal resolution / update frequency days

f. Temporal resolution / update frequency seconds

g. Monitoring applications, change detection

h. Other (please specify):

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9. During what phase do you encounter interoperability challenges?

a. Data Acquisition

b. Storage / Management

c. Combining Data from multiple source

d. Change Reference System

e. Analysis / Simulation

f. Dissemination

g. Visualization / Interaction

h. Other (please specify):

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10.   What do you consider the most important area of point cloud standardization?

a. Data Model

b. File Format / Encoding

c. DBMS / SQL

d. Web Service (WxxS) protocol,

e. Other (please specify):

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11. What volume of point clouds have you managed/processed/stored/etc. in the last 12 month?

a. Less than 100 million (10^6) points

b. More than 100 million (10^6) points

c. More than 1 billion (10^9) points

d. More than 1 trillion (10^{12}) points

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12. What tools do you use?

a. PDAL

b. Potree

c. LAStools

d. GRASS

e. Esri ArcGIS

f.   Bentley Pointools

g. Leica CloudWorx

h. GeoMedia

i.   Oracle SDO_PC

j.   PosgreSQL/PostGIS

k. Other (please specify):

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Last 2 questions:

13. Do you use point clouds that are generated from moving objects / trajectories? (Yes/No)

14. Comments:

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Next Steps Survey

- Work with OGC Staff to create the survey

- Work with OGC Staff to advertise and promote the survey

- Execute the survey and capture results

- Report the survey results at the next TC meeting (7-11 March 2016, Washington D.C.)

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