Progress towards fully digital cadastral survey data exchange in Australia and New Zealand

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Presented today by
Jeff NEEDHAM
Adrian WHITE

Overview of presentation

- Who are we?

- Standardisation and development of land boundary transfer specifications

- Development of the 3D Cadastral Survey Data Model

- Extensions to support 3D data

- Next steps and online resources

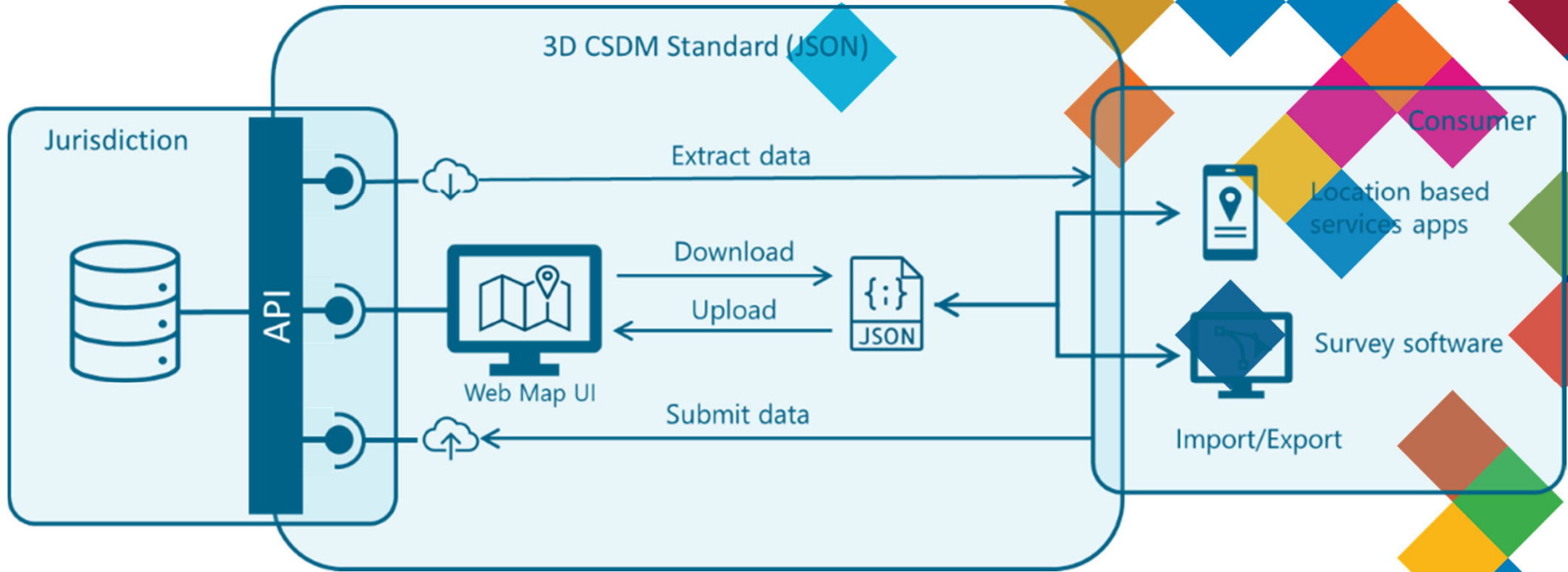# Who we are? Australian and New Zealand surveying and mapping agencies

- Intergovernmental Committee on Surveying and Mapping (ICSM)
  - Inter-jurisdictional group of New Zealand and Australian state and territory surveying and mapping agencies

- Cadastral Working Group (CWG)
  - A sub-group to discuss and develop land boundary and land recording systems and processes

- Digital Plan Lodgement sub-committee (DPL)
  - New sub-group within CWG to focus on digital evolution of submissions to governmental agencies

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Standardisation and development of land boundary transfer specifications

- On review of current and future survey plan and survey field record requirements.
  - Australian jurisdictions and New Zealand have many similarities, although mixed approaches and adoption levels for digital submission of survey data (LandXML, CSD, dwg/dxf, CEXML)
  - Jurisdictions wish to enable Cadastre 2034 digital submission requirements
  - Jurisdictions wish to enable 3D submissions

- No nationally or internationally adopted digital data standard exists for the exchange of (digital) 3D cadastral survey information

- Decided to develop our own data standard
  - Utilise existing ISO and OGC standards
  - Leverage existing pre-published components
  - Interchangeable over time
  - Align with modern surveying practice

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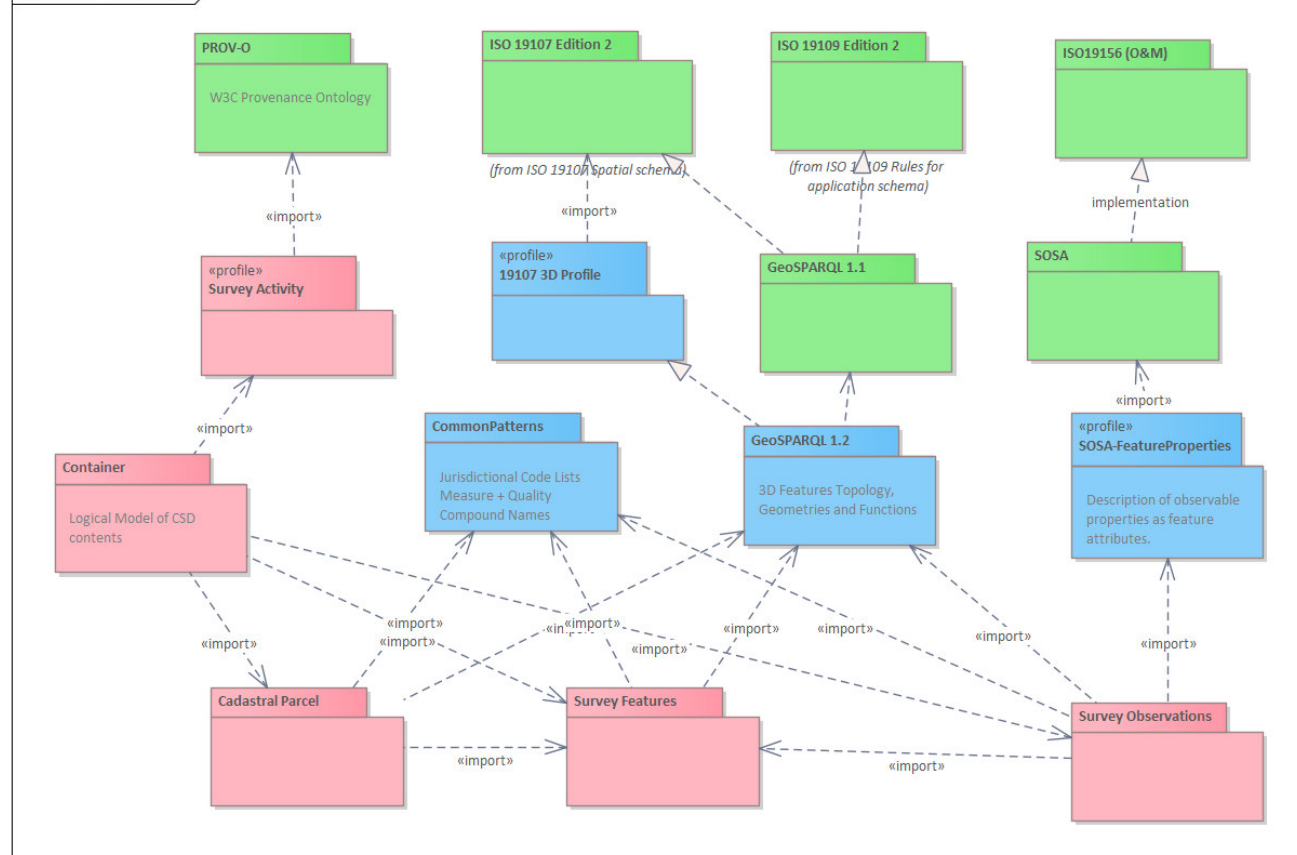Australia

3D Cadastral Survey Dataset Model

3D CSDM

Adopt elements from:

- International Standards
  - JSON-LD
  - SOSA
  - geoJSON
  - GeoSPARQL

- Australian/New Zealand Standards
  - ICSM Address Model
  - ICSM vocabularies
  - Local jurisdictional language

https://icsm-au.github.io/3d-csdm-design/2022/spec.html#_relationship_to_other_models

3D CSDM – standards modification

- Adding 3D element to geoJSON format

- Surveying is relative

  – Modification of geoJSON from absolute positions to relative

```
"place": {
        "coordinates" : [ "399529.112", "6462628.624"]}
```

```
"place": {
        "coordinates" : [ "399529.112", "6462628.624", "10.45" ]}
```

```
"geometry": { "type": "Point",
"coordinates": [116.0045347, -31.88682252]},
```

```
"geometry": { "type": "LineString",
    "coordinates": [[116.0045347, -31.88682252],
                    [115.85307516, -31.95335671]]},
```

```
"feature": [ {
"id" : "187", "place": {
"coordinates" : [ "399529.112", "6462628.624", "10.45"
]}}]},
"id" : "188", "place": {
"coordinates" : [ "399560.451", "6462632.273", "10.45"
]}}]],
```

```
"features" : [{
  "id" : "106", "type" : "Feature",
        "geometry" : null,
        "topology" : {"type" : "LineString",
                      "references" : [ "187,188" ]},

Multi-Linestring example
"references" : [ "187,188,189,190,191,192"]},
```

3D CSDM example

Extensions to support 3D data

- 3D CSDM standard in 2.5D

- Development to true 3D schema

ceiling

floor
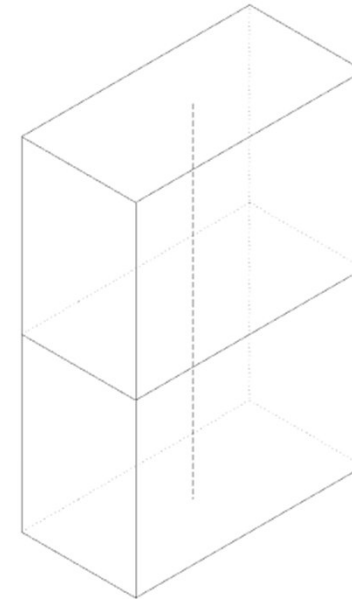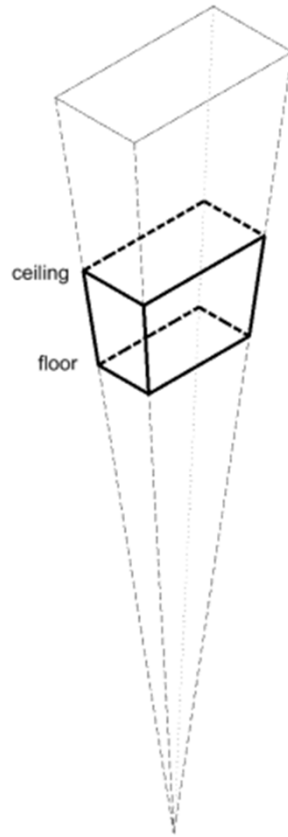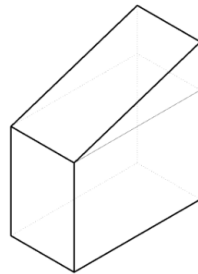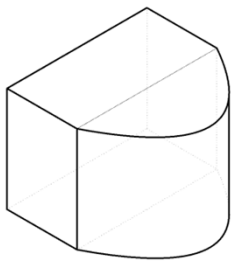
x1,y1,unlimited

x5,y5,GL:10.0

x9,y9,GL-60.96

Digital Plan Lodgement next steps

- New Zealand and Australian jurisdictions working on implementation plans to adopt 3D CSDM
  - New Zealand, Victoria and Western Australia have developed jurisdictional profiles
  - NSW profile in development

- Continue engaging survey software vendors and providers

- 3D schema development

What can you do?

- Check out the docs:

ICSM 3D CSDM repositories. Available online at https://github.com/icsm-au

ICSM Conceptual Model for 3D Cadastral Survey Dataset Submissions. Available online at https://icsm-au.github.io/3d-csdm-design/2022/spec.html

- Give us feedback

Thank you for listening

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Spatial elements

▼ LineString Example

```
{
  "type": "LineString",
  "references": [
    "4047592",
    "8979167",
    "7954590",
    "7137005",
    "7515825",
    "9130050",
    "6683755",
    "6281411",
    "8675916",
    "9206048",
    "5547445"
  ]
}
```
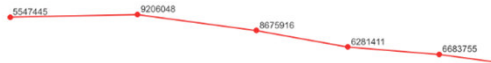

▼ Arc Segment with Centre

```
{
  "type": "arcWithCentre",
  "startPoint": {
    "references": [
      "111"
    ]
  },
  "endPoint": {
    "references": [
      "222"
    ]
  },
  "centrePoint": {
    "references": [
      "333"
    ]
  },
  "radius": 10,
  "orientation": "ccw"
}
```

▼ Arc Segment by Chord
Same as LandXML.ReducedArcObservation definition

```
{
  "type": "arcByChord",
  "startPoint": {
    "references": [
      "111"
    ]
  },
  "endPoint": {
    "references": [
      "222"
    ]
  },
  "chordBearing": 35.0,
  "chordLength": 5.8,
  "radius": 10,
  "orientation": "ccw"
}
```

▼ Arc by Centre Point with Start and End Angles

```
{
  "type": "arcByStartEndFromCentre",
  "centrePoint": {
    "references": [
      "333"
    ]
  },
  "startAngle": 35.0,
  "endAngle": 123.0,
  "radius": 10,
  "orientation": "cw"
}
```

▼ Arc Length

```
{
  "type": "arcLengthFromStart",
  "startPoint": {
    "references": [
      "111"
    ]
  },
  "centrePoint": {
    "references": [
      "333"
    ]
  },
  "arcLength": 5.0,
  "radius": 10,
  "orientation": "ccw"
}
```

▼ Circle by Centre

```
{
  "type": "circleByCentre",
  "centrePoint": {
    "references": [
      "333"
    ]
  },
  "radius": 100
}
```

```json
"observedVectors" : [
  {
    {
      "id" : "observedVectors",
      "type" : "FeatureCollection",
      "featureType" : "observedVector",
      "features" : [
        {
          "id" : "2",
          "type" : "Feature",
          "featureType" : "observedVector",
          "geometry" : null,
          "topology" : {
            "type" : "LineString",
            "references" : [ "8,7" ]
          },
          "properties" : {
            "purpose" : "interest-boundary",
            "comment" : ""
          }
        },

          {
            "type" : "Feature",
            "geometry" : null,
            "properties" : {
              "hasFeatureOfInterest" : "2",
              "resultTime" : "",
              "hasResult" : {
                "distance" : "7.62",
                "angle" : null
              },
              "distanceType" : "icsm-distance-type:ground",
              "distanceAccuracy" : 4000,
              "angleType" : "icsm-angle-type:bearing",
              "angleAccuracy" : null
            }
          }
```
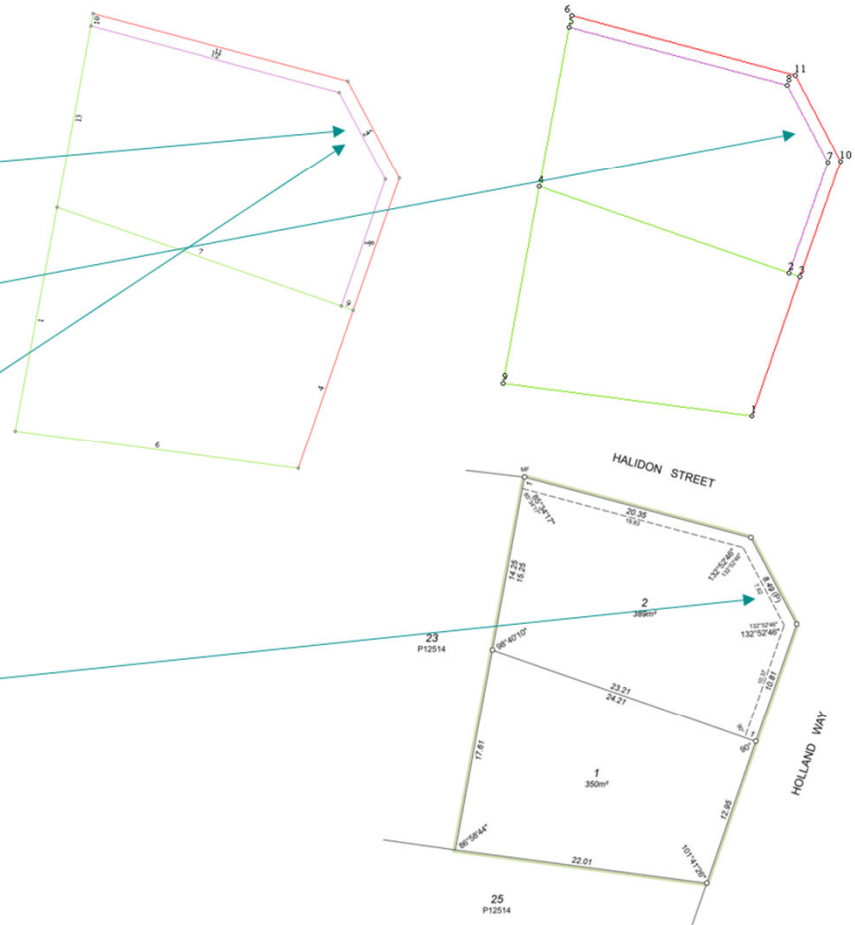
```
"parcels" : [
    {
    {
        "id" : "PrimaryParcel",
        "type" : "FeatureCollection",
        "featureType" : "PrimaryParcel",
        "properties" : null,
        "features" : [
    },
    {
        "id" : "SecondaryParcel",
        "type" : "FeatureCollection",
        "featureType" : "SecondaryParcel",
        "properties" : null,
        "features" : [
    }

"parcels" : [
    {
        "id" : "PrimaryParcel",
        "type" : "FeatureCollection",
        "featureType" : "PrimaryParcel",
        "properties" : null,
        "features" : [
        {
            "id" : "4",
            "type" : "Feature",
            "geometry" : null,
            "topology" : {
                "type" : "Polygon",
                "references" : [ "7","13","10","11","5","8","9" ]
            },
            "properties" : {
                "appellation" : {
                    "label" : "2",
                    "hasPart" : "add back in as appelation subset"
                },
                "area" : "389",
                "parcelType" : "wa-parcel-type:freehold",
                "parcelPurpose" : "wa-parcel-purpose:lot",
                "parcelState" : "created"
            }
        },
```
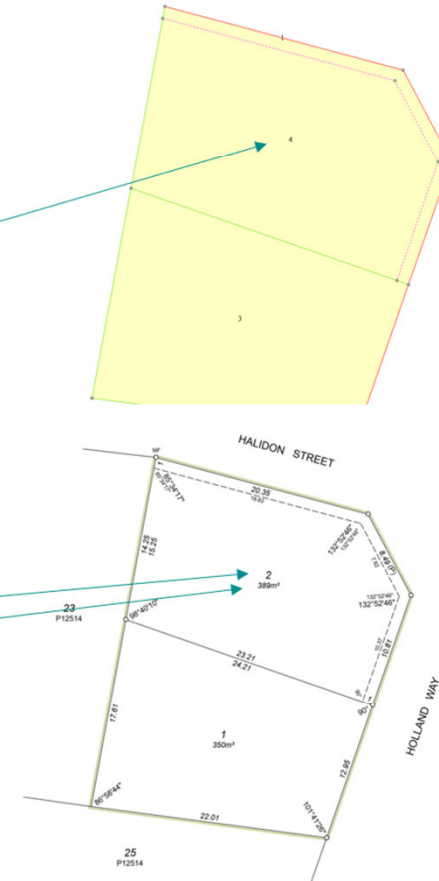
```
"observedVectors" : [
    {
        "id" : "SubtendedAngle",
        "type" : "FeatureCollection",
        "featureType" : "SubtendedAngle",
        "features" : [
            {
                "id" : 130002,
                "type" : "Feature",
                "featureType" : "SubtendedAngle",
                "geometry" : null,
                "topology" : {
                    "type" : "SubtendedAngle",
                    "references" : [ "5,12,13" ]
                },
                "properties" : {
                    "purpose" : null,
                    "comment" : ""
                }
            },
        ]
    },
    "features" : [
        {
            "type" : "Feature",
            "geometry" : null,
            "properties" : {
                "hasFeatureOfInterest" : 130002,
                "resultTime" : "",
                "hasResult" : {
                    "distance" : "",
                    "angle" : 85.57138888888889
                },
                "distanceType" : "",
                "distanceAccuracy" : "",
                "angleType" : "icsm-angle-type:angle",
                "angleAccuracy" : "0.0056"
            }
        },
```

C,B,A

A
B
C