Working with OGC WCS

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The Open Geospatial Consortium, Inc. (OGC) Web Coverage Service (WCS) provides an open specification for sharing coverages (aka. image/raster datasets) on the web.

WCS Core establishes three request types to serve the coverages:

- GetCapabilities: returns XML-encoded descriptions of service properties and the coverages offered by the WCS service requested.
- DescribeCoverage: returns XML-encoded descriptions of coverages properties (such as their location in space and time) offered by the WCS service requested.
- GetCoverage: returns a coverage in a specific data format after processed by request parameters (bounding box, spatial reference, interpolation method, rows/columns, resolution, a slice in multi-dimensions etc.)
Working with OGC WCS – Overview

• ArcGIS Server side WCS support:
  - ArcGIS WCS Server exposes as an extension of an ArcGIS Image Server, Map Server, or Geodata Server (1.0, 1.1.x, 2.0.1)
  - ArcGIS WCS service can be consumed in 3rd party client apps. e.g. ENVI, QGIS.

• ArcGIS Client side WCS support:
  - WCS Server connection and WCS consumption through ArcGIS Desktop (ArcMap/ArcGIS Pro: (1.0, 1.1.x)
  - ArcGIS SDKs for customizing WCS client apps:
    - ArcGIS JavaScript APIs (1.0, 1.1.x, 2.0.1)
    - ArcObjects .NET/Java/C++ SDKs (1.0, 1.1.x)
  - ArcGIS WCS client can consume WCS service hosted by 3rd party GIS server. e.g. geoserver
## Working with OGC WCS – ArcGIS Server

- ArcGIS WCS Server is a fully compliant product (version 1.0.0, 1.1.1, and 2.0.1) and certified by OGC.

<table>
<thead>
<tr>
<th>ArcGIS Enterprise 10.6</th>
<th>Registered: 2018-01-23</th>
</tr>
</thead>
<tbody>
<tr>
<td>KML 2.2.0</td>
<td>Certified: 2018-02-23</td>
</tr>
<tr>
<td>KML (Level 2) 2.2.0</td>
<td>Certified: 2018-02-23</td>
</tr>
<tr>
<td>KML (Level 3) 2.2.0</td>
<td>Certified: 2018-02-23</td>
</tr>
<tr>
<td>WCS 2.0 Interface Standard - Core: Corrigendum 2.0.1</td>
<td>Certified: 2018-02-23</td>
</tr>
<tr>
<td>Web Coverage Service (WCS) Implementation Specification (Corrigendum) 1.0.0</td>
<td>Certified: 2018-02-23</td>
</tr>
<tr>
<td>Web Coverage Service (WCS) Implementation Specification Corrigendum 1 1.1.1</td>
<td>Certified: 2018-02-23</td>
</tr>
<tr>
<td>Web Feature Service 2.0 Interface Standard (also ISO 19142) 2.0</td>
<td>Certified: 2018-03-07</td>
</tr>
<tr>
<td>Web Map Service (WMS) Implementation Specification 1.3.0</td>
<td>Certified: 2018-02-23</td>
</tr>
<tr>
<td>Web Map Service Client (WMS) Implementation Specification 1.3.0</td>
<td>Certified: 2018-03-07</td>
</tr>
<tr>
<td>Web Map Service 1.1.1</td>
<td>Certified: 2018-03-07</td>
</tr>
</tbody>
</table>
Working with OGC WCS – ArcGIS Server

- ArcGIS WCS Server is implemented through ArcGIS Image Server, Map Server, and Geodata Server
- Support all versions: 1.0.0, 1.1.0, 1.1.1, 1.1.2, and 2.0.1
- Support exporting coverages in formats: GeoTIFF, HDF, JPEG, JPEG2000, and PNG
- Support multiple WCS 2.0.1 extensions:
  - Service Extensions: Scaling Extension; Range Subsetting Extension; CRS Extension; Interpolation Extension
  - Protocol Extensions: KVP/GET; XML/POST
  - Application Profile: Earth Observation
Working with OGC WCS – Beyond specifications

- Raster function template as additional coverages:
  - ArcGIS WCS Server does not serve the coverages only, it also serves ArcGIS’s powerful raster processing potentials at server side.
Working with OGC WCS – Beyond specifications

- Raster function template can chain multiple ArcGIS build-in raster functions and customized Python raster functions together.
More projections available:
- Not limited to “crsSupported” inside the xml response of DescribeCoverage or GetCapabilities requests.
- ArcGIS WCS Server integrates with ArcGIS projection engine to support all EPSG+ESRI WKID-based spatial reference reprojections (~6000 projections).
Dynamic mosaicking:
- Backed by mosaic dataset technology, hundreds of thousands of images can be served through one service, as one single mosaic, dynamically processed by server.
- GetCoverage for any of the mosaicked rasters through, e.g.,
- Easily WCS-able multidimensional data (NetCDF, HDF, GRIB) through mosaic dataset (variables, dimensions, etc).

To access a variable data at a dimension value, using, e.g.,
&time=2014-06-29T00:00:00.000Z
&rangeSubset=water_temp:nearest[StdZ[-5000]]
Working with OGC WCS – licensing

- **Licensing:**
  - GIS Server license
    - Standard – single raster datasets
    - Advanced – raster functions
  - Image Server license
    - For mosaic dataset served as WCS

- **Security:**
  - Inherits ArcGIS Server’s security model
  - The security for a WCS service is managed by controlling the security of its parent map, geodata, or image service. It supports token-based security and you can add a valid token in a http request for a secured WCS service. If a particular service user is denied access to an ArcGIS service coverage resource, it will not be able to access the coverage resource regardless of whether they try to consume it through SOAP, REST, or WCS interfaces.
Working with OGC WCS – ArcGIS Desktop

- Support consuming WCS in version: 1.0.0, 1.1.0, 1.1.1, and 1.1.2
- Support basic authentication through http/https
- Support optional parameters that can be used by GetCoverage as defined by the WCS server
- Support displaying coverage properties from DescribeCoverage
Working with OGC WCS – ArcGIS Desktop

- After importing the WCS layer into the ArcMap/Pro:
  - Support identifying pixel values of coverage
  - Support displaying coverage in various new renders and raster function templates
  - Support displaying coverage in various data frame projections supported by ArcGIS, including all EPSG coordinate systems; even if WCS Server doesn’t have them in supported CRSs
  - Support converting coverage to various raster formats supported by ArcGIS; even if WCS Server doesn’t have them in supported formats
  - Coverages can be consumed throughout ArcGIS, in Geoprocessing tools, Image Analysis Window, mosaic datasets etc, just like any other local raster datasets
• Available in ArcGIS JavaScript API 3.18+. (not supported in 4.x yet)
• Support accessing and consuming WCS in versions: 1.0.0, 1.1.0, 1.1.1, 1.1.2, and 2.0.1.
  - For version 2.0.1, it supports servers that support GEOTIFF coverage and implements the following extensions: Scaling, Interpolation, Range Subsetting, CRS, and KVP/Get.
• Class: esri/layers/WCSConnection
  - A helper class to discover available coverages in an OGC Web Coverage Service
• Class: esri/layers/WCSCoverageDescription
  - Models the coverage properties offered by the WCS Server. This class normalizes the variations across different versions of WCS Coverage Description
• Class: esri/layers/WCSLayer
  - Retrieves coverage (raster) data and renders it on the client app.
Working with OGC WCS – ArcObjects SDKs

- **WCSLayer CoClass:**
  - WCSLayer accesses a coverage served through an OGC WCS service and visualize the pixels of the coverage in ArcGIS.
  - A WCSLayer supports most of the functions that a RasterLayer provides. The display can be manipulated by accessing through IRasterLayer interface as all other raster layers.

- **IWCSLayer Interface:**
  - IWCSLayer Interface provides access to the properties and methods of WCSLayer.

```csharp
[C#]

string URL = "http://liason1/arcgis/services/dem/mapserver/wcs/wcs?";
IWCSLayer wclayer = new WCSLayerClass();
wclayer.Create(URL, "1", "1.0.0");

//Access raster.
IRasterLayer rasterlayer = (IRasterLayer)wclayer;
IRaster2 raster = (IRaster2)rasterlayer.Raster;

//Access raster dataset.
IRasterDataset rasterset = raster.RasterDataset;
```

<table>
<thead>
<tr>
<th>Property</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CoverageName</td>
<td>The WCS coverage name.</td>
</tr>
<tr>
<td>Create</td>
<td>Creates a WCS layer from given WCS coverage definition.</td>
</tr>
<tr>
<td>Refresh</td>
<td>Refreshes layer once any of layer properties has changed.</td>
</tr>
<tr>
<td>ResamplingType</td>
<td>The request resampling (Interpolation) type.</td>
</tr>
<tr>
<td>ServiceURL</td>
<td>The WCS service URL.</td>
</tr>
<tr>
<td>Timeout</td>
<td>The request timeout value in seconds.</td>
</tr>
<tr>
<td>Version</td>
<td>The WCS service version.</td>
</tr>
</tbody>
</table>
## Working with OGC WCS – Compare with ArcGIS Image Service

<table>
<thead>
<tr>
<th>Feature</th>
<th>WCS (rectified coverage)</th>
<th>Image Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dynamic mosaicking</td>
<td>Basic support as defined by service</td>
<td>Full support with client side control</td>
</tr>
<tr>
<td>On the fly processing</td>
<td>Basic support as defined by service</td>
<td>Full support with on demand customization</td>
</tr>
<tr>
<td>Coverage delivery</td>
<td>Basic support as defined by spec</td>
<td>Better compression (LERC)</td>
</tr>
<tr>
<td>Variables, dimensions</td>
<td>Not flexible (2.0.1 requires fixed offset, range and domain are in parallel)</td>
<td>Fully compatible with NetCDF convention</td>
</tr>
<tr>
<td>Cataloging</td>
<td>N/A (handled by catalog service)</td>
<td>Query and sort by attribute, geometry in millions of scenes.</td>
</tr>
<tr>
<td>Information model</td>
<td>Basic modeling of raster dataset</td>
<td>Comprehensive information model with dedicated auxiliary info support: multidimensionalInfo, colormap, VAT, histograms, wavelength, transformations, metadata etc.</td>
</tr>
<tr>
<td>Data exploratory API</td>
<td>N/A</td>
<td>Mensuration, Get Samples, Compute Stats &amp; Histograms, Project, Identify, Query</td>
</tr>
<tr>
<td>API</td>
<td>KVP/GML</td>
<td>REST/JSON</td>
</tr>
</tbody>
</table>
Working with OGC WCS – Road ahead

• On current plan:
  - Server side:
    - Support more application profiles (e.g. MetOcean-WCS).
  - Client side:
    - Support WCS 2.0.1 in ArcGIS Pro.
    - Support WCS layer type items in ArcGIS Online/Portal for ArcGIS.
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