WMS - Operations

This section provides detailed information about the types of WMS requests a client is able to perform to a WMS server.

WMS Operations

Operation	Description
GetCapabilities	Retrieves metadata about the service, including supported operations and parameters, and a list of the available layers.
GetMap	Retrieves a map image for a specified area and content.
GetFeatureInfo (optional)	Retrieves the underlying data, including geometry and attribute values, for a pixel location on a map.
DescribeLayer (optional)	Indicates the WFS or WCS to retrieve additional information about the layer.
GetLegendGraphic (optional)	Retrieves a legend for a map.

Exceptions

When a request from a client to a WMS Server is not performed properly, a Server needs to report an exception. Formats in which a WMS Server can report exceptions are shown in the table bellow.

Exceptions

Format	Syntax	Notes
XML	application/vnd.ogc.se_xml	The error is described in XML.
PNG	application/vnd.ogc.se_inimage	The error is return as an image.
Blank	application/vnd.ogc.se_blank	A blank image is returned.
JSON	application/json	The error is reported as a simple JSON representation.

GetCapabilities

Request

A WMS server responding to a **GetCapabilities** request returns metadata about the service, including supported operations and parameters, and a list of the available layers.

An example of a GetCapabilities request is:

```
http://metaspatial.net/cgi-bin/ogc-wms.xml?
SERVICE=WMS&
VERSION=1.3
REQUEST=GetCapabilities&
```

This is a link to a GetCapabilities request.

There are three parameters (and values) being passed to the WMS server, `SERVICE=WMS`, `VERSION=1.3`, and `REQUEST=GetCapabilities`.

- The `SERVICE` parameter tells the server that a WMS request is forthcoming.
- The `VERSION` parameter tells the server what version of the WMS is being requested.
- The `REQUEST` parameter tells the server that the operation requested is the *GetCapabilities* operation.

The WMS standard requires that requests always includes these three parameters. The table bellow summarizes the parameters and values required to perform the request.

Parameters of the GetCapabilities Operation

Parameter	Required	Description
SERVICE	Yes	Service name. Value is `WMS`.
VERSION	Yes	Service version. Value is one of `1.0.0`, `1.1.0`, `1.1.1`, `1.3`.
REQUEST	Yes	Operation name. Value is `GetCapabilities`.

Response

The response is a Capabilities XML document with a detailed description of the WMS service. It contains three main sections:

Sections Capabilities Document

Service	Contains service metadata such as the service name, keywords, and contact information for the organization operating the server.
Request	Describes the operations the WMS service provides and the parameters and output formats for each operation.
Layer	Lists the available coordinate systems and layers. In some servers (e.g. Geoserver) layers are named in the form "namespace:layer". Each layer provides service metadata such as title, abstract and keywords.

GetCapabilities Layer Style Section

The GetCapabilites response contains a *Layer* section, which details about the style available to that layer. In the example bellow the available style is *default*.

```xml
<Layer queryable="0" opaque="0" cascaded="0">
  <Name>nationalparks</Name>
  <Title>National Parks</Title>
  <EX_GeographicBoundingBox>
    <westBoundLongitude>-4.43064</westBoundLongitude>
    <eastBoundLongitude>1.99728</eastBoundLongitude>
    <southBoundLatitude>50.3532</southBoundLatitude>
    <northBoundLatitude>55.5917</northBoundLatitude>
  </EX_GeographicBoundingBox>
  <BoundingBox CRS="EPSG:27700"
        minx="246828" miny="56378.4" maxx="652374" maxy="633117"/>
  <Style>
    <Name>default</Name>
    <Title>default</Title>
    <LegendURL width="110" height="22">
      <Format>image/png</Format>
      <OnlineResource xmlns:xlink="http://www.w3.org/1999/xlink"
        xlink:type="simple"
        xlink:href="..."/>
    </LegendURL>
  </Style>
</Layer>
```

GetMap

Request

A WMS server responding to a **GetMap** request returns a map image for a specified area and content.

The core parameters specify one or more layers and styles to appear on the map, a bounding box for the map extent, a target spatial reference system, and a width, height, and format for the output. The information needed to specify values for parameters such as `layers`, `styles` and `Spatial Reference Systems (SRS)` can be obtained from the Capabilities document.

The response is a map image, or other map output artifact, depending on the format requested.

An example of a GetMap request is:

```
http://metaspatial.net/cgi-bin/ogc-wms.xml?
VERSION=1.3.0&
REQUEST=GetMap&
SERVICE=WMS&
```

```
LAYERS=DTM,Overview,Raster_250K,Topography,nationalparks,Infrastructure,Places&
STYLES=,,,,,,&
CRS=EPSG:27700&
BBOX=424735.97883597884,96026.98412698413,467064.02116402116,127773.01587301587&
WIDTH=400&
HEIGHT=300&
FORMAT=image/png&
BGCOLOR=0xffffff&
TRANSPARENT=TRUE
```

This is a link to a GetMaprequest.

The getMap request accesses a server with data from Great Britain. The request specifies a set of layers (DTM, Overview, Raster_250K, Topography, nationalparks, Infrastructure and Places) with no particular style (STYLES=,,,,,,). The coordinate reference system (CRS) is EPSG:27700, which is the Ordnance Survey National Grid reference system. The image is returned in a PNG transparent format with width 400 and height 300 pixels.The backgorund color is white (Hex code=0xffffff).

The table bellow summarizes the parameters and values.

Standard Parameters for the GetMap Operation

Parameter	Required?	Description
service	Yes	Service name. Value is `WMS`.
version	Yes	Service version. Value is one of `1.0.0`, `1.1.0`, `1.1.1`, `1.3`.
request	Yes	Operation name. Value is `GetMap`.
layers	Yes	Layers to display on map. Value is a comma-separated list of layer names.
styles	Yes	Styles in which layers are to be rendered. Value is a comma-separated list of style names, or empty if default styling is required. Style names may be empty in the list, to use default layer styling.
srs *or* crs	Yes	Spatial Reference System for map output. Value is in form `EPSG:nnn`. `crs` is the parameter key used in WMS 1.3.0.
bbox	Yes	Bounding box for map extent. Value is `minx,miny,maxx,maxy` in units of the SRS.
width	Yes	Width of map output, in pixels.
height	Yes	Height of map output, in pixels.
format	Yes	Format for the map output.
transparent	No	Whether the map background should be transparent. Values are `true` or `false`. Default is `false`

bgcolor	No	Background color for the map image. Value is in the form `RRGGBB`. Default is `FFFFFF` (white).
exceptions	No	Format in which to report exceptions. Default value is `application/vnd.ogc.se_xml`.
time	No	Time value or range for map data.
sld	No	A URL referencing a StyledLayerDescriptor XML file which controls or enhances map layers and styling
sld_body	No	A URL-encoded StyledLayerDescriptor XML document which controls or enhances map layers and styling

Another WMS request examples is as follows:

```
http://localhost:8080/geoserver/wms?
request=GetMap
&service=WMS
&version=1.1.1
&layers=topp%3Astates
&styles=population
&srs=EPSG%3A4326
&bbox=-145.15104058007,21.731919794922,-57.154894212888,58.961058642578&
&width=780
&height=330
&format=image%2Fpng
```

The request specifies the `topp:states` layer to be output as a PNG map image in SRS EPGS:4326 and using default styling *population*.

A WMS request can also be sent via HTTP POST as an XML document, as folllows:

```xml
<?xml version="1.0" encoding="UTF-8"?>
<ogc:GetMap xmlns:ogc="http://www.opengis.net/ows"
            xmlns:gml="http://www.opengis.net/gml"
    version="1.1.1" service="WMS">
    <StyledLayerDescriptor version="1.0.0">
        <NamedLayer>
          <Name>topp:states</Name>
          <NamedStyle><Name>population</Name></NamedStyle>
        </NamedLayer>
    </StyledLayerDescriptor>
    <BoundingBox srsName="http://www.opengis.net/gml/srs/epsg.xml#4326">
        <gml:coord><gml:X>-130</gml:X><gml:Y>24</gml:Y></gml:coord>
        <gml:coord><gml:X>-55</gml:X><gml:Y>50</gml:Y></gml:coord>
    </BoundingBox>
    <Output>
        <Format>image/png</Format>
        <Size><Width>550</Width><Height>250</Height></Size>
    </Output>
</ogc:GetMap>
```

Response

The response of a GetMap request is an image.

If the request is wrong the server will return an error message.

Time

The `TIME` parameter allows filtering a dataset by temporal slices as well as spatial tiles for rendering. The TIME attribute for WMS GetMap requests is described in version 1.3 of the WMS specification.

Specifying a time

The format used for specifying a time in the WMS TIME parameter is based on ISO-8601. The precision might varied depending on the server.

The parameter is:

```
TIME=<timestring>
```

Times follow the general format:

```
yyyy-MM-ddThh:mm:ss.SSSZ
```

where:

- `yyyy`: 4-digit year
- `MM`: 2-digit month
- `dd`: 2-digit day
- `hh`: 2-digit hour
- `mm`: 2-digit minute

- `ss`: 2-digit second
- `SSS`: 3-digit millisecond

The day and intraday values are separated with a capital `T`, and the entire string is suffixed with a `Z`, indicating UTC for the time zone. (The WMS specification does not provide for other time zones.)

WMS Servers will apply the `TIME` value to all temporally enabled layers in the `LAYERS` parameter of the GetMap request.

Layers without a temporal component will be served normally, allowing clients to include reference information like political boundaries along with temporal data.

Examples of Time Values for the TIME parameter in GetMap requests

Description	Time specification
December 12, 2001 at 6:00 PM	`2001-12-12T18:00:00.0Z`
May 5, 1993 at 11:34 PM	`1993-05-05T11:34:00.0Z`

Specifying an absolute interval

A client may request information over a continuous interval instead of a single instant by specifying a start and end time, separated by a `/` character.

In this scenario the start and end are *inclusive*; that is, samples from exactly the endpoints of the specified range will be included in the rendered tile.

Examples of Time Values for Absolute Intervals

Description	Time specification
The month of September 2002	`2002-09-01T00:00:00.0Z/2002-09-30T23:59:59.999Z`
The entire day of December 25, 2010	`2010-12-25T00:00:00.0Z/2010-12-25T23:59:59.999Z`

Specifying a relative interval

A client may request information over a relative time interval instead of a set time range by specifying a start or end time with an associated duration, separated by a `/` character.

One end of the interval must be a time value, but the other may be a duration value as defined by the ISO 8601 standard. The special keyword `PRESENT` may be used to specify a time relative to the present server time.

Examples of Time Values for Relative Intervals

Description	Time specification
The month of September 2002	`2002-09-01T00:00:00.0Z/P1M`
The entire day of December 25, 2010	`2010-12-25T00:00:00.0Z/P1D`
The entire day preceding December 25, 2010	`P1D/2010-12-25T00:00:00.0Z`
36 hours preceding the current time	`PT36H/PRESENT`

Reduced accuracy times

The WMS specification also allows time specifications to be truncated by omitting some of the time string. Usually servers will treat the time as a range whose length is equal to the *most precise unit specified* in the time string. For example, if the time specification omits all fields except year, it identifies a range one year long starting at the beginning of that year.

Examples of Time Values for Reduced Accuracy Times

Description	Reduced Accuracy Time	Equivalent Range
The month of September 2002	`2002-09`	`2002-09-01T00:00:00.0Z/2002-09-30T23:59:59.999Z`
The day of December 25, 2010	`2010-12-25`	`2010-12-25T00:00:00.0Z/2010-12-25T23:59:59.999Z`

Reduced accuracy times with ranges

Reduced accuracy times are also allowed when specifying ranges. The ranges are inclusive. Some servers (e.g GeoServer) effectively expands the start and end times as described above, and then includes any samples from after the beginning of the start interval and before the end of the end interval.

Examples of Time Values for Reduced Accuracy Times with Ranges

Description	Reduced Accuracy Time	Equivalent Range
The months of September through December 2002	2002-09/2002-12	2002-09-01T00:00:00.0Z/ 2002-12-31T23:59:59.999Z

12PM through 6PM, December 25, 2010	2010-12-25T12/ 2010-12-25T18	2010-12-25T12:00:00.0Z/ 2010-12-25T18:59:59.999Z

Specifying a list of times

Some Servers, such a GeoServer can also accept a list of discrete time values. This is useful for some applications such as animations, where one time is equal to one frame.

The elements of a list are separated by commas.

If the list is evenly spaced (for example, daily or hourly samples) then the list may be specified as a range, using a start time, end time, and period separated by slashes.

Examples of List with Time Values

Description	List notation	Equivalent range notation
Noon every day for August 12-14, 2012	TIME=2012-08-12T12:00:00.0Z, 2012-08-13T12:00:00.0Z, 2012-08-14T12:00:00.0Z	TIME=2012-08-12T12:00:00.0Z/ 2012-08-18:T12:00:00.0Z/ P1D
Midnight on the first of September, October, and November 1999	TIME=1999-09-01T00:00:00.0Z, 1999-10-01T00:00:00.0Z, 1999-11-01T00:00:00.0Z	TIME=1999-09-01T00:00:00.0Z/ 1999-11-01T00:00:00.0Z/ P1M

Specifying a periodicity

The periodicity is also specified in ISO-8601 format: a capital P followed by one or more interval lengths, each consisting of a number and a letter identifying a time unit:

Unit	Abbreviation
Years	Y
Months	M
Days	D
Hours	H
Minutes	M
Seconds	S

The Year/Month/Day group of values must be separated from the Hours/Minutes/Seconds group by a `T` character. The T itself may be omitted if hours, minutes, and seconds are all omitted. Additionally, fields which contain a 0 may be omitted entirely.

Fractional values are permitted, but only for the most specific value that is included.

The period must divide evenly into the interval defined by the start/end times. So if the start/end times denote 12 hours, a period of 1 hour would be allowed, but a period of 5 hours would not.

For example, the multiple representations listed below are all equivalent.

- One hour: P0Y0M0DT1H0M0S, PT1H0M0S or PT1H
- 90 minutes: P0Y0M0DT1H30M0S, PT1H30M or P90M
- 18 months: P1Y6M0DT0H0M0S, P1Y6M0D, P0Y18M0DT0H0M0S or P18M

GetFeatureInfo

Request

A WMS server responding to a **GetFeatureInfo** request returns the underlying data, including geometry and attribute values, for a pixel location on a map. It is similar to the WFS GetFeature operation, but less flexible in both input and output. The one advantage of `GetFeatureInfo` is that the request uses an (x,y) pixel value from a returned WMS image. This is easier to use for a naive client that is not able to perform true geographic referencing.

The standard parameters for the GetFeatureInfo operation are:

Parameters for the GetFeatureInfo Operation

Parameter	Required	Description
SERVICE	Yes	Service name. Value is `WMS`.
VERSION	Yes	Service version. Value is one of `1.0.0`, `1.1.0`, `1.1.1`, `1.3`.
REQUEST	Yes	Operation name. Value is `GetFeatureInfo`.
QUERY_LAYERS	Yes	Comma separated list of layers to be queried`
INFO_FORMAT	No	Format for the feature information response (MIME type).
FEATURE_COUNT	No	Maximum number of features to return. Default is 1.
i	Yes	Pixel column point on the map. 0 is left side. `x` is the parameter key used in WMS 1.1.0.
j	Yes	Pixel row on the map. 0 is the top. `y` is the parameter key used in WMS 1.1.0.
EXCEPTIONS	No	Format in which to report exceptions. The default value is `application/vnd.ogc.se_xml`.

Example formats are as follows:

Formats for `INFO_FORMAT` parameter in a the GetFeatureInfo Request

Format	Syntax	Notes

TEXT	`info_format=text/plain`	Simple text output. (The default format)
GML 2	`info_format=application/vnd.ogc.gml`	Works only for Simple Features
GML 3	`info_format=application/vnd.ogc.gml/3.1.1`	Works for both Simple and Complex Features
HTML	`info_format=text/html`	Uses HTML templates that are defined on the server.
JSON	`info_format=application/json`	Simple JSON representation.

An example request for feature information from the `topp:states` layer in HTML format is:

```
http://localhost:8080/geoserver/wms?
request=GetFeatureInfo
&service=WMS
&version=1.1.1
&layers=topp%3Astates
&styles=
&srs=EPSG%3A4326
&format=image%2Fpng
&bbox=-145.151041%2C21.73192%2C-57.154894%2C58.961059
&width=780
&height=330
&query_layers=topp%3Astates
&info_format=text%2Fhtml
&feature_count=50
&x=353
&y=145
&exceptions=application%2Fvnd.ogc.se_xml
```

An example request for feature information in GeoJSON format is:

```
http://localhost:8080/geoserver/wms?
&INFO_FORMAT=application/json
&REQUEST=GetFeatureInfo
&EXCEPTIONS=application/vnd.ogc.se_xml
&SERVICE=WMS
&VERSION=1.1.1
&WIDTH=970&HEIGHT=485&X=486&Y=165&BBOX=-180,-90,180,90
&LAYERS=COUNTRYPROFILES:grp_administrative_map
&QUERY_LAYERS=COUNTRYPROFILES:grp_administrative_map
&TYPENAME=COUNTRYPROFILES:grp_administrative_map
```

The result will be:

```json
{
"type":"FeatureCollection",
"features":[
    {
        "type":"Feature",
        "id":"dt_gaul_geom.fid-138e3070879",
        "geometry":{
            "type":"MultiPolygon",
            "coordinates":[
                [
                    [
                        [
                            XXXXXXXXXX,
                            XXXXXXXXXX
                        ],
                        ...
                        [
                            XXXXXXXXXX,
                            XXXXXXXXXX
                        ]
                    ]
                ]
            ]
        },
        "geometry_name":"at_geom",
        "properties":{
            "bk_gaul":X,
            "at_admlevel":0,
            "at_iso3":"XXX",
            "ia_name":"XXXX",
            "at_gaul_l0":X,
            "bbox":[
                XXXX,
                XXXX,
                XXXX,
                XXXX
            ]
        }
    }
],
"crs":{
    "type":"EPSG",
    "properties":{
        "code":"4326"
    }
},
"bbox":[
    XXXX,
```

```
    XXXX,
    XXXX,
    XXXX
]
}
```

References

- GeoServer WMS reference - Creative Commons 3.0
- GeoServer Time Support in GeoServer WMS - Creative Commons 3.0