

## Cascading Map Servers

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*As part of its Open Service Framework (OSF) the Open Geospatial Consortium (OGC) support the concept of service chaining such that any web application can be anything from a simple web spatial viewer to a spatially enabled and complex business application. The notion of chaining web services is not new but the application within a spatial context somewhat is. When chaining is applied at the OGC Web Map Server (WMS) level the concept of cascading WMSes presents additional options to the application and/or portal developer. But what are the benefits of a Cascading WMS when any given any web mapping application can simply access each published web Map Server directly? An applications developer needs to know why they are using or in fact not using a Cascading WMS.*

### Cascading WMS

According to the OGS spec, "A Cascading Map Server is a WMS that behaves like a client of other WMSes and behaves like a WMS to other clients. For example, a Cascading Map Server can aggregate the contents of several distinct map servers into one service. Furthermore, a Cascading Map Server can perform additional functions such as output format conversion or coordinate transformation on behalf of other servers." The cascading feature of the WMS specification is optional but for those vendors who support it there are a lot of things to consider and which make the cascading WMS server far more complex and valuable.

It works like this, a user defines the layer resources accessible by the WMS - as part of the standard meta data requirements of a WMS server - but can also refer to a WMS service as a remote resource. When you run a Get Capabilities request against the Cascading WMS the data resources defined in the remote (I use remote for a cascaded server but it could be on the same machine) WMS are included with a cascading indicator (cascaded attribute). The nesting level is recorded in the cascaded attribute in the Capabilities XML document and, given that the remote service could also be another cascading service which could in turn refer to local and remote data services, cascading could theoretically continue indefinitely. So the originating cascading WMS server can access all the layers defined in the local services as well as the remote or cascaded layers via the cascading WMS.

When a Get Map request (OGC WMS operation) is processed by the WMS server, the requests are sent to the appropriate resource such that any request for a cascaded data layer is handed off to the remote WMS to respond. To the remote WMS server,



this is a just another WMS request which it fulfills and returns the resultant map image back to the calling WMS server. This requires no additional provisions at the standard WMS level to support a cascaded request. The Cascading WMS will then make sure that the returned image is compatible with its client request and return it to the client integrated with all the other data layers. The cascading server needs to be aware of where the request originated from and its path in getting there so that it can prevent a deadly loop inside chained Cascading WMSes from happening.

## **Benefits**

Cascading WMSes can handle some things on behalf of the requesting client application or portal thus simplifying application development and enabling greater adoption of spatial enablement in the broader IT community. These are the real benefits of a Cascading WMS.

### ***WMS Versions***

The Cascading WMS must be able to support all mandatory components of all the approved versions of the OGC WMS specifications. Imagine what happens when a client application needs to access different WMS resources all of which could be supported to different versions of the WMS specification. The applications needs to be written in such a way that it must be aware of each server's supported WMS level. A Cascading WMS must handle this for the application client which then need only be concerned with the one specification level, that of the Cascading WMS. This is most important in an environment where specifications are continually being improved and approved and new services and products are being developed and published all the time.

### ***WMS Data Formats***

Some published WMSes simply support one or maybe two image output formats so a cascading WMS must support them all and also support the ability to reformat an image from the remote server into that which was requested by the client. A Cascading WMS also provides the opportunity to support additional formats that extend the range supported by OGC for whatever reason. Once again this complexity is delegated to the Cascading WMS thus off loading the client application of these concerns.

### ***WMS Spatial Reference Systems***

Many published WMSes will likewise only support a few Spatial Reference Systems (SRS) which are defined as combinations of cartographic projections and official datum. Its extremely important that all the map requests return data in the same coordinate space so each returned map must be re-projected into the requested SRS before being integrated at the client. A Cascading WMS handles these on-the-fly specialist transformations on behalf of the client applications once again offloading the client application of this complexity.

### ***Centralised Access Controls***

WMSes will be integral services of Spatial Data Infrastructures and or environments of federated organisations wishing to transparently share spatial data. The Casacading WMS offer single points of access that provide a gateway into these infrastructures. Access control

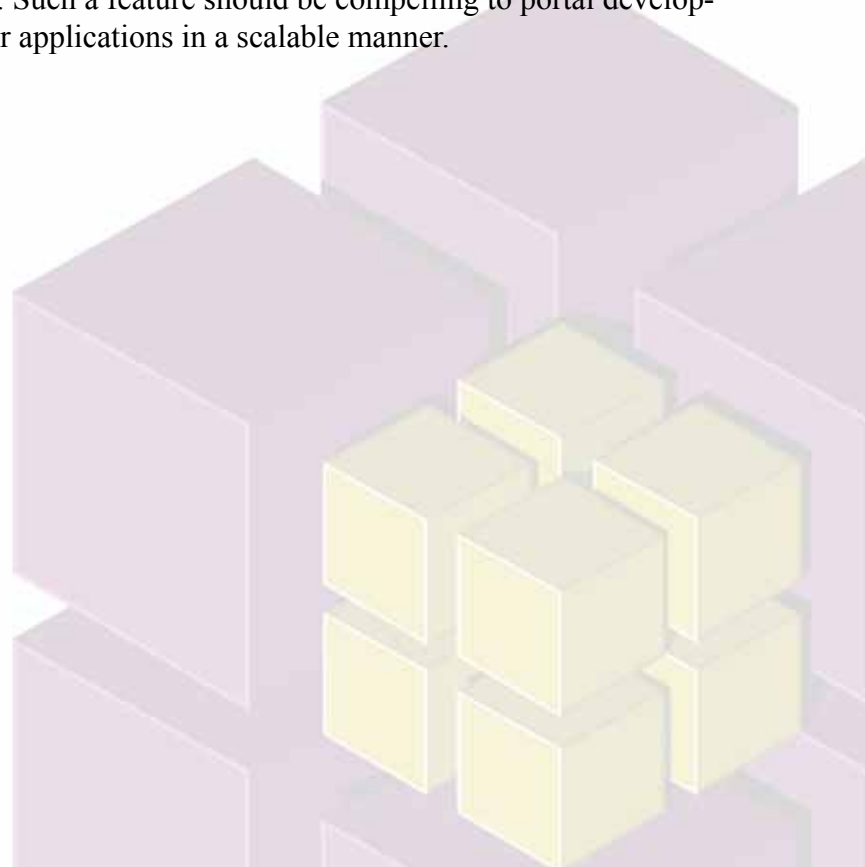
to spatial data can extend to OGC operations, spatial layers and spatial extents as part of the fine grain access control. Should a federation wish to support this gateway concept, a Cascading WMS provides the capability to manage fine grain access control for any data layer defined in its capabilities document. That means access to remote layers can be controlled at the cascading WMS level thus simplifying the client development to support data security.

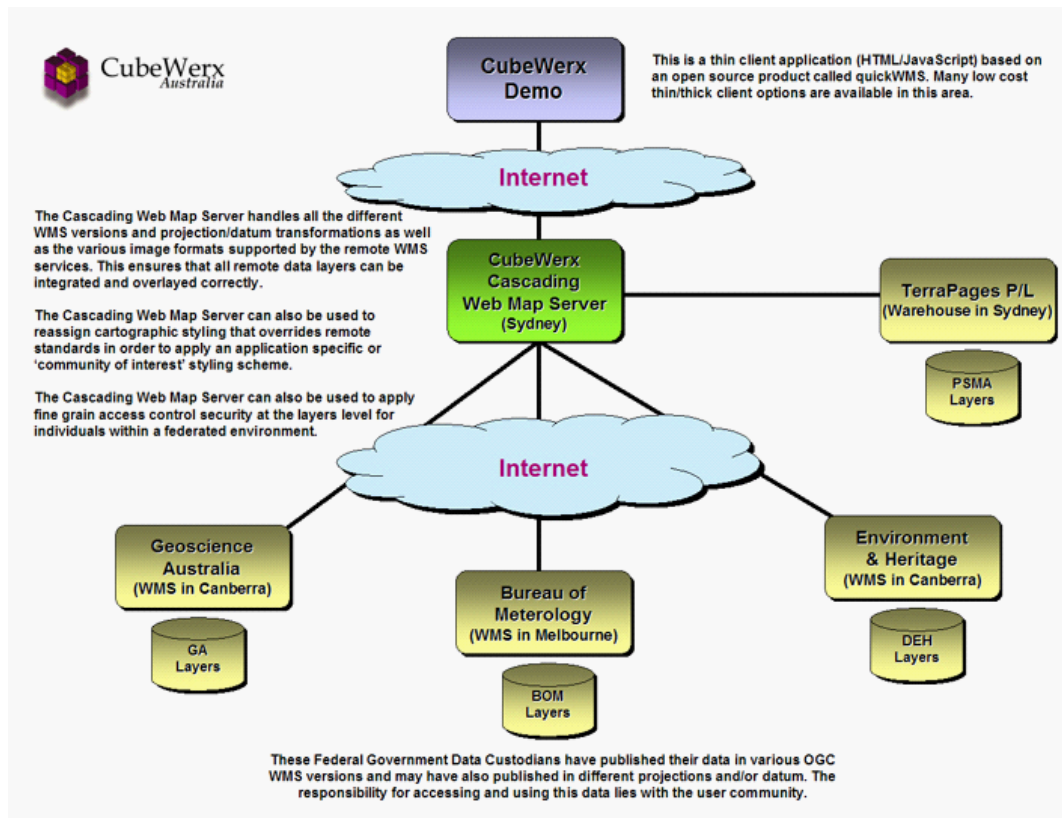
### ***Centralised SLD Management***

Several WMSes are now starting to support OGC's Style Layer Descriptor (SLD) specification which allows the requesting client to define the cartographic symbology or rendering styles of map features. SLDs are very useful in a shared environment given that the publishers cannot possibly cater for all the style requirements of its potentially unlimited user base once they publish their data. SLDs permit the user to control the symbology at the WMS service request time. In a federated environment SLDs can be defined at the Cascading WMS level and will automatically accompany the WMS cascaded service request to the remote WMS where it will be used to render the output map image which is then returned. A Cascading WMS can be setup to handle this forwarding of the SLD to the remote service as a centralised service.

### ***Scalability Considerations***

A Cascading WMS is a server point that offloads a lot of spatial processing that would have to be undertaken at the client or portal application level. This middleware layer is a single focal point in an infrastructure and will not only require redundancy to maximise uptime but is very easily scaled to provide additional capacity as load on the system inevitably increases. Multiple servers and load balances can be transparently added and optimised to provide this scalability. It is also very important to realise that the impact of offloading this specialist, spatial processing on the client/portal application is significant in that it becomes far simpler to develop and support. Such a feature should be compelling to portal developers wishing to spatially enable their applications in a scalable manner.





## Conclusions

Cascading WMSes are more than a theoretical nicety that happens to be supported by OGC. They provide many real benefits that make the integration of spatial data into web applications such as portals far easier. These benefits extend to centralised control and management within a federated environment of distributed resources to offloading the development process of a lot of spatial processing that has already been developed at the Cascading WMS level. It also provides serverside and logical points of scalability that are transparent to end users and applications. The real beneficiaries are those software developers who want to easily spatially-enable their applications and portals – Cascading WMSes make their tasks considerably simpler. System Integrators and web developers should at the very least be cognisant of the availability of Cascading WMSes and their benefits which could make them more competitive as more organisations recognise the benefits of spatial enablement.

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