What's new in Carmenta Server version 4.5

Carmenta Server provides all the necessary functionality for managing, publishing and distributing maps and other geospatial data to end users via Internet and intranet services.

The main focus with this release of Carmenta Server has been to improve support for web map clients. We have introduced the popular Cesium[1] open-source library and added a 3D extension to the Carmenta Web Explorer map client, in addition to the 2D map based on the OpenLayers[2] open-source library.

We have also streamlined the application development process by adding a new vector visualisation function that facilitates the re-use of server-based vector visualisation as a service, as well as adding a new symbol service for customised symbols.

In addition, vector data performance is now considerably improved thanks to tiled vector layers that support the Mapbox Vector Tile (MVT) format.

A rich new JavaScript API has been added to the Carmenta Web Explorer client, thereby simplifying the development of rich map applications with support for both 2D and 3D maps.

Below is a more detailed summary of the improvements and new features.

3D map client

Support for 3D maps has been added to Carmenta Web Explorer, our web-based map client in Carmenta Server, by integrating the Cesium open-source JavaScript library. This means that background maps, map overlays and object layers will now be able to use the same map services for both 2D and 3D, and virtually any map application based on Carmenta Web Explorer can now easily and seamlessly switch between 2D and 3D map views.

A new terrain service with elevation rasters in the Cesium heightmap-1.0 format has also been added to Carmenta Server. This means that the Carmenta Web Explorer's 3D globe can use any combination of elevation raster data from Carmenta Server to create its terrain model from. It can also be used as a Cesium Terrain Provider by stand-alone Cesium clients. The terrain service is tiled at different resolution levels and can be cached in the Carmenta Server Tile Store in memory and on disk, as well as in the browser running the Cesium client.

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[1] Cesium is an open-source JavaScript library licensed under the Apache License, Version 2.0 (Alv2). More information can be found on the Cesium web site, www.cesiumjs.org

[2] OpenLayers is an open-source JavaScript library licensed under the 2-clause BSD License (FreeBSD). More information can be found on the OpenLayers web site, www.openlayers.org

Figure 1. Realistic 3D imagery with the Carmenta Web Explorer 3D map client

WFS services published in Carmenta Server now support 3D coordinates, which means that vector layers can also be used as overlay layers in 3D maps with the correct elevation applied to all objects.

Visualisation service

Carmenta Server 4.5 comes with a new visualization service that significantly streamlines application development.

With this new visualisation service, the map client automatically uses the vector visualisation defined in the map configuration published on the server. This means that developers will now be able to design and verify the visualisation of points, lines and polygons using our standard Carmenta Server SDK tools: Carmenta Studio and Carmenta Explorer. Once published, the visualisation service converts vector data into a style function (JavaScript), which can be loaded by the map client.

The style function is fully integrated with Carmenta Web Explorer and is automatically loaded and applied when a vector service is loaded. It can also be loaded manually and used by any stand-alone map client.

The visualization service is available for both 2D and 3D maps (OpenLayers and Cesium map clients).
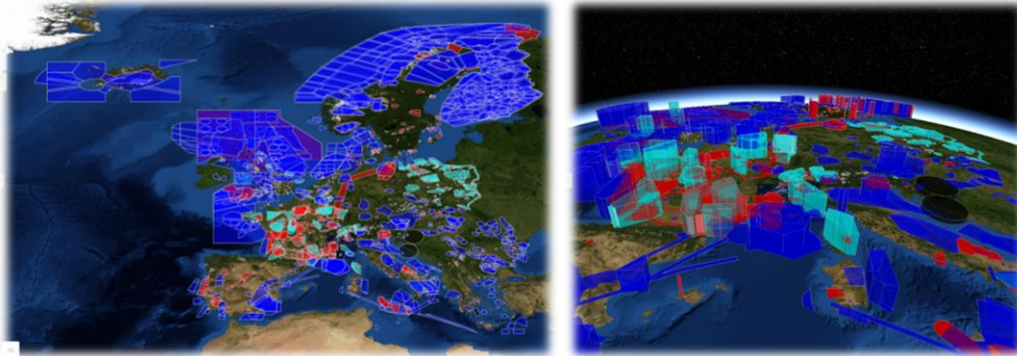
Figure 2.   Vector visualisation rendered in Carmenta Web Explorer 2D and 3D maps using the new visualisation service

Symbol service

To maximise the re-use of server visualisation, we have extended the functionality of the visualisation service by adding a powerful new symbol service that allows the client to load complex vector symbols for client vector features directly from the server. With this dynamic service, relevant symbols automatically becomes available as downloadable bitmaps when a new map configuration containing vector layers with symbol visualisation, such as tactical symbols or complex combined symbols, is published.

The client accesses the symbol service by loading the style function that is supplied by the visualization service. As with the visualization service, the symbol service is fully integrated with Carmenta Web Explorer. Available symbols are automatically added and applied, but can also be loaded manually and used by stand-alone map clients. Symbols are cached in the normal browser cache.

The symbol service supports both 2D and 3D maps.

Figure 3.   Tactical symbols, supplied by the symbol service, displayed in Carmenta Web Explorer 2D and 3D maps

Tiled vector layers

Carmenta Server 4.5 now support MVT (Mapbox Vector Tile) tiled vector layers, which means significantly better performance for vector maps. Vector tiles can either be encoded using an optimised, highly compressed exchange format (Google Protobufs, PBF), or a plain GeoJSON format.

All vector data is encoded relative to its tile, which means that tiled data can be cached for high performance: both server-side by Carmenta Server Tile Store, and in the client's browser cache, resulting in significantly faster vector maps while still allowing flexible visualisation by the client.

In addition, vector tiles can be combined with the new visualisation and symbol services, so server-defined vector visualisation can be also re-used if necessary. By combining these new services, you can use vector data for background maps or together with raster data for hybrid maps, thereby narrowing the gap between vector and raster maps in terms of performance.

New JavaScript API

We have completely re-designed Carmenta Web Explorer, our web-based map client in Carmenta Server, exposing a new JavaScript API for application integration and interaction. The new JavaScript API allows custom application code to access server services, map layers, tool interaction and other functionalities in 2D and 3D maps at a higher level, without restricting access to the underlying low-level interfaces of the integrated open-source libraries that Carmenta Web Explorer uses for 2D (OpenLayers) and 3D (Cesium).
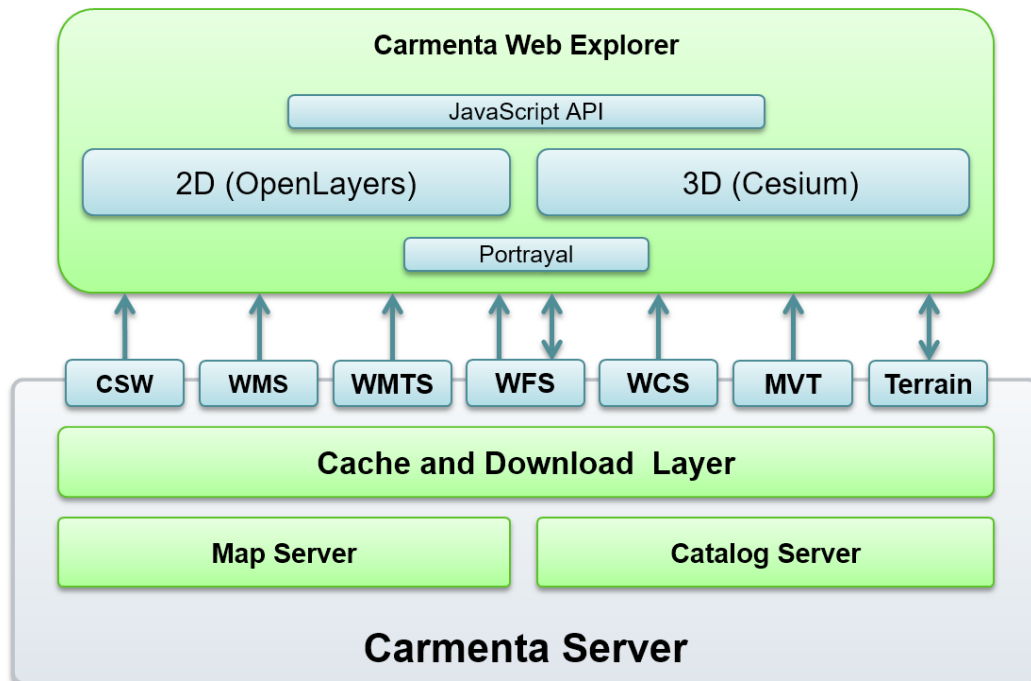
Figure 4. **The architecture of Carmenta Server and Carmenta Web Explorer, showing the new JavaScript API**

The Carmenta Web Explorer JavaScript API greatly simplifies the development of rich and complex map client applications, for example when setting up an application with one or more map windows and connecting them to server services.

Key features of the new API:

- Data model with well-defined classes and class hierarchy
- Event handling for common map interactions
- Utility functions (for background maps etc)
- Shared API for both 2D and 3D
- Layer handling functions
- Catalogue service (OGC CSW) client for map server querying
- Joint portrayal component for 2D and 3D that re-uses server vector visualization

For applications that support both 2D and 3D maps, the functions for setting up and interacting with the various map clients are encapsulated in a shared interface. This means that these operations can be carried out via the same interface regardless of which map client the end user is viewing and interacting with, while still allowing access to the underlying interfaces for more advanced tasks and tasks specific to the individual map clients.

For developers, the JavaScript API also means access to the Carmenta Web Explorer map client's rich user interface, including panels, tools and other user controls.

Our goal has been to make the start-up process in the development of 2D and 3D map client applications as simple and smooth as possible, while still providing all the necessary functionalities that will enable the applications to evolve into rich and advanced spatial applications over time. With Carmenta Server SDK, full reference documentation for the Carmenta Web Explorer API is included, together with various tutorials and samples.

The Carmenta Web Explorer map client that is used as map previewer in Carmenta Server, has been re-built using the same JavaScript API, and is still available as basis for a custom map application, while still allowing extension through the JavaScript API. This further shortens the development time to get started with a new map application.

Other significant improvements and additions

- Clearer presentation of statistics and log data in the web-based Carmenta Server administration tool, making it easier for system administrators to analyse service problems
- Several new features have been added to Carmenta Web Explorer, including a zoom to rectangle tool and a flexible scale bar
- The integrated OpenLayers client library has been upgraded to OpenLayers 4
- Geodata packages can now be installed and removed while the server is still running
- The WMS GetFeatureInfo request now supports TIME and ELEVATION parameters
- The visualization of S52 sea charts can now be customised using several different colour palettes
- Views and layers now support visual effects for colour adjustment, brightness, colour saturation etc
- Density heat maps can now be generated from point collections
- Improved blending of multiple semi-transparent layers for higher clarity overlay layers
- Updated Carmenta Server SDK tools for creation and testing of map configurations (Carmenta Studio and Carmenta Explorer) with a new modern look and feel
- Improved handling of TIFF files, with support for YCbCr and CMYK colour spaces, JPEG compression and built-in overviews
- Improved label organizing capabilities to better support label placement for polygons and lines