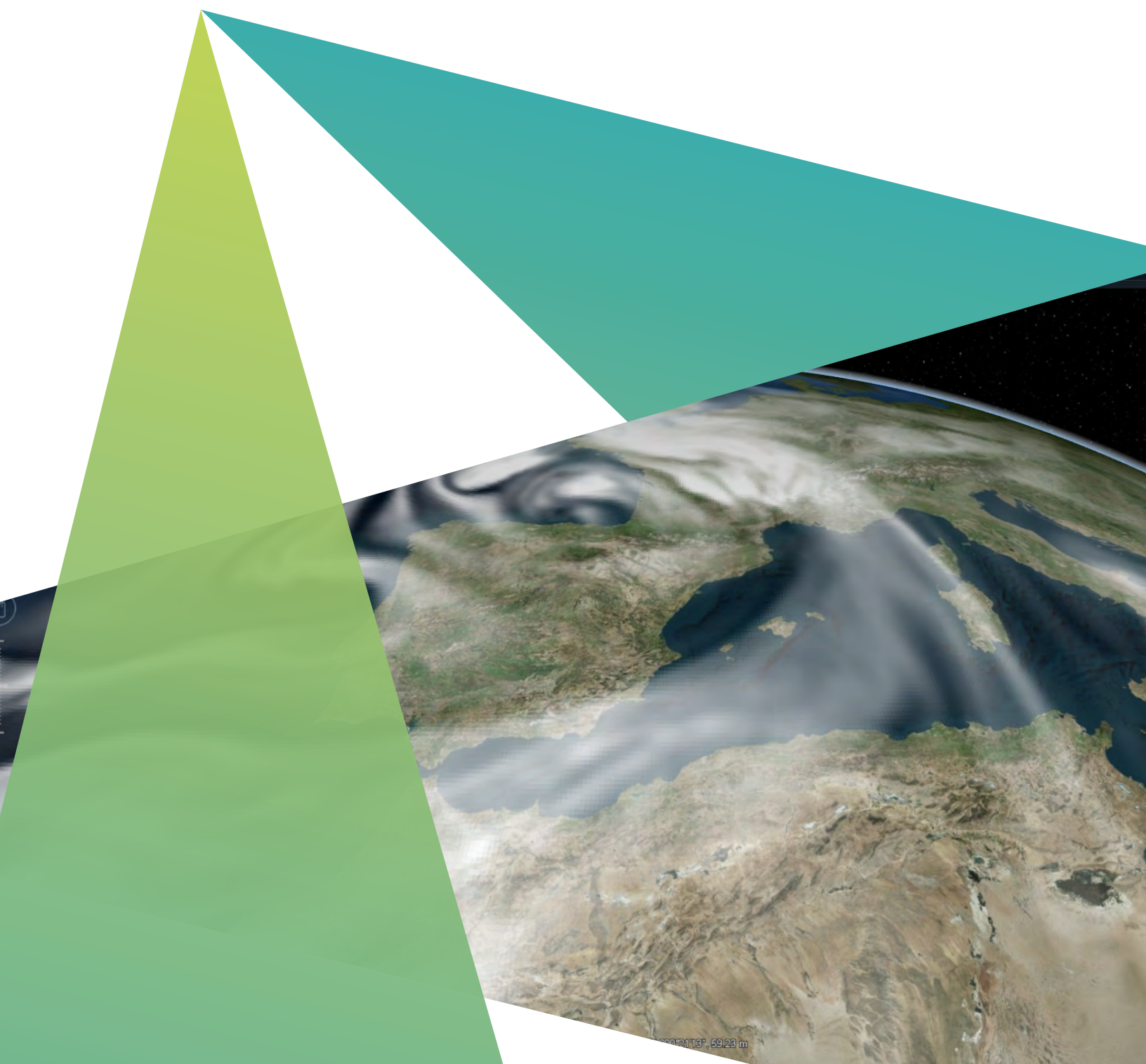# LuciadFusion

All-in-one server solution for geospatial data

LuciadFusion is an all-in-one server solution for your geospatial data management and data publication workflow. It allows users to manage their data intelligently, store and process a multitude of data formats and feed data to numerous applications. Features including powerful automatic cataloging and quick-and-easy data publication allow you to design, portray, process and set up advanced maps in a few simple clicks.

LuciadFusion offers intuitive data management for non-GIS specialists and faster data processing than with any other commercial solution. It allows you to organize your data so all users have one-click access to a data set specifically optimized for their needs.

Connecting directly to more than 200 data formats, the ready-to-use server solution installs quickly. You are instantly ready to start processing large volumes of data, fetching regular updates and publishing an impressive number of data formats. LuciadFusion Studio is a browser application that provides you with a friendly user interface with an integrated data preview that allows you to publish data in a few clicks.

Who needs LuciadFusion?

These are just a few examples of why users turn to LuciadFusion to solve their geospatial data challenges:

- Quickly publish large amounts of geospatial data in OGC standard formats with just a few clicks.

- Receive new images every hour and eliminate the delay for publication.

- Share ECDIS maritime data using OGC Services without hassle.

- Catalog raster and vector data from an external device in many different formats (Shape, KML, GeoTiff) in a matter of minutes.

- Serve weather data with temporal information allowing clients to quickly browse through time.

- Provide operational users access to large data sets of pound clouds and 3D meshes — remotely and from different types of applications.

- Share multi-gigabyte shape files as WMS, without rasterizing before publishing.

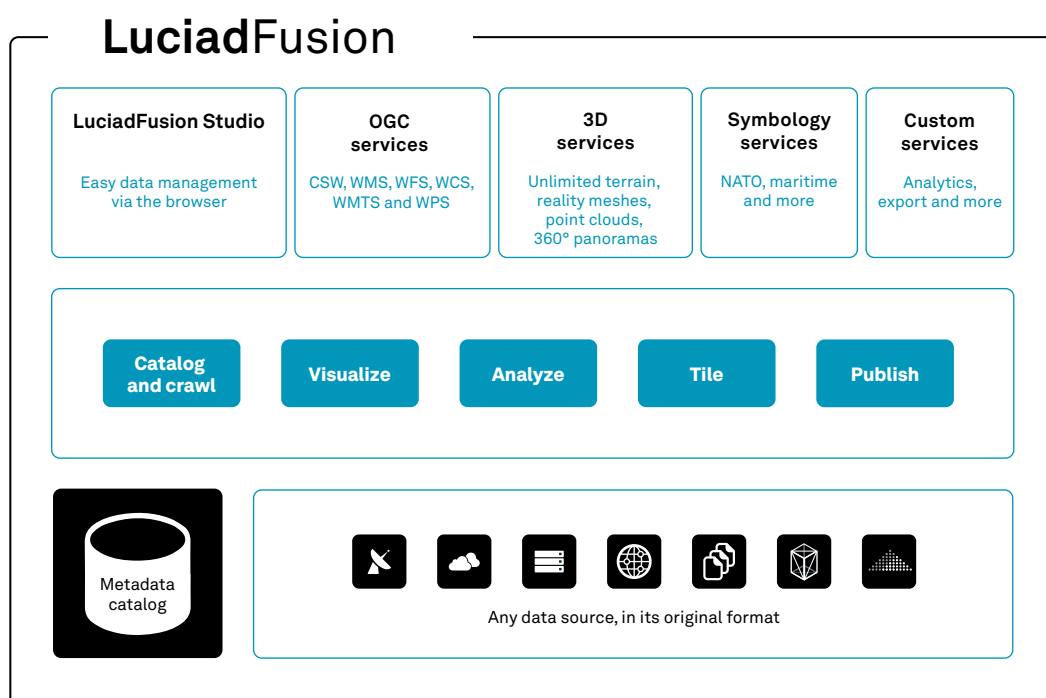- Bring line of sight calculations or even custom processing to a web-based application.

Figure 1 - With LuciadFusion, manage, visualize, analyze and publish data its original format on any platform

Key benefits

Built for users	• Quickly upload, find and manage data through LuciadFusion Studio's intuitive web interface • Publish data to any service in one click • Set up and create multiple OGC services • Optimize large and 3D data sets for fast streaming with the quickest tiling engine for elevation, (multispectral) imagery, weather data, 3D meshes and point clouds
Connect to 200+ data formats	• Connects to any database • Work with domain-specific formats and standards • Directly serves earth observation multi-spectral imagery • Handles dynamic 4D data, such as weather data • Connects natively to 200+ data formats, add custom formats through LuciadFusion's API

Add custom formats, styling and analytics	• Bring in new custom formats easily with LuciadFusion's API
	• Includes military symbology APP6 and MS2525
	• Add custom styling
	• Create new services for:
	  • Data
	  • Symbologies
	  • Custom data processing and analysis

Rely on full OGC open standards support	• Serve any data over open standards • Plug and play WMS, WFS, WMTS, WCS or 3D tiles by dragging and dropping to serve in less than one minute — no coding required!
Manage data dynamically	• Manage and serve data from any location • Keep data organized with data crawling, data discovery and metadata gathering • Combine vector and raster in one single product • Connect to data sources and allow LuciadFusion to find new data with automatic data discovery • Monitor data sources and set up scheduled crawling to automatically find new data
Deployable on any platform	• Deploy locally (from a USB stick or onboard a vessel or aircraft) • Trust in LuciadFusion's built-in security • Run LuciadFusion on Windows and Linux, on Amazon AWS, in a Docker container and more
Out-of-the-box COP	• Share a common operating picture (COP) that combines background imagery, military symbology, NVG files and any additional data • Combine any number of data sources in any format using any reference within a single common operating picture

Practical information

Connecting to LuciadFusion services can be done from:

- OGC-compliant browser applications, built on LuciadRIA or other platforms

- Desktop applications, built on LuciadLightspeed, LuciadCPillar or other platforms

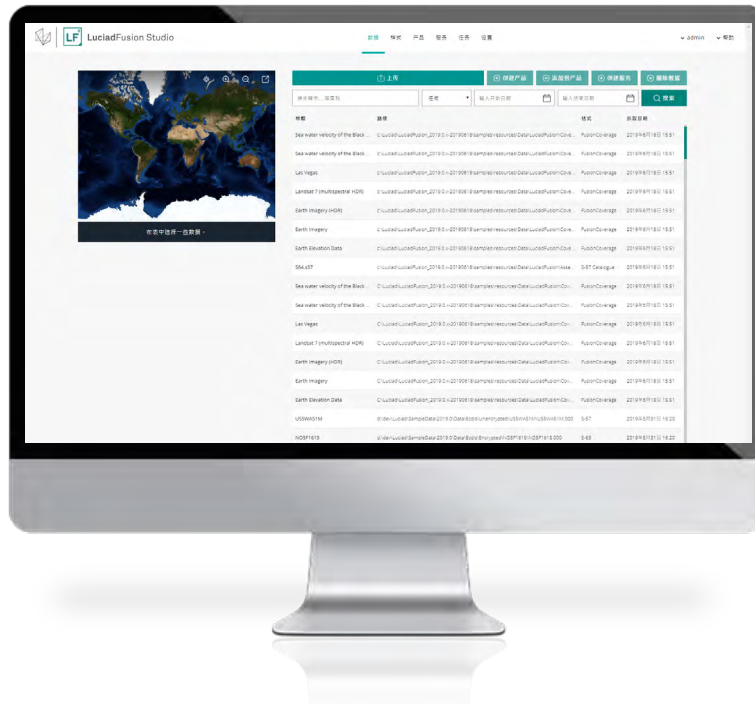- Mobile applications, built on LuciadMobile or other platforms.

Figure 2 - LuciadFusion offers intuitive data management for non-GIS specialists

Overview

LuciadFusion components are organized into product tiers. Depending on the needs of your organization, you can opt for LuciadFusion Essential, Advanced or Pro. In the Advanced and Pro tiers, powerful, extended functionality is available to you with extra options.
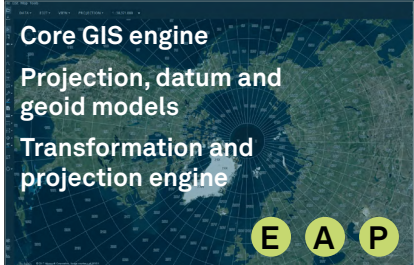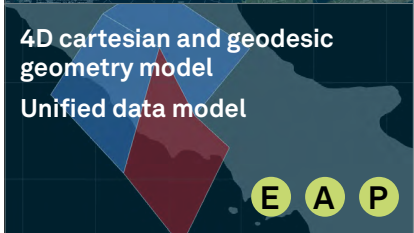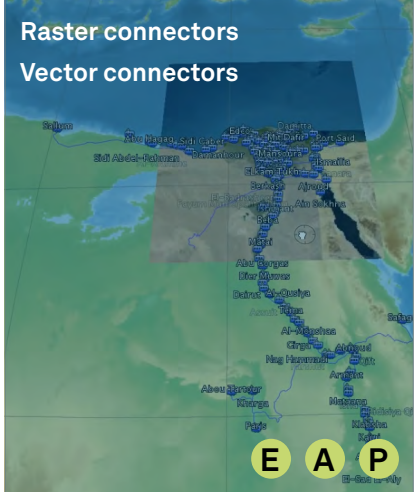
Legend

✅ Feature included

⭕ Optional feature
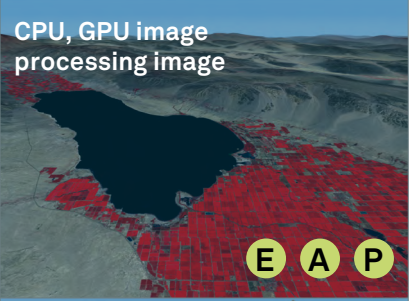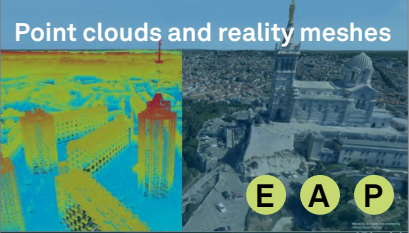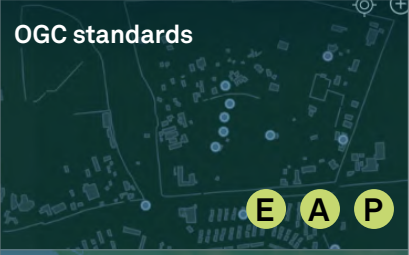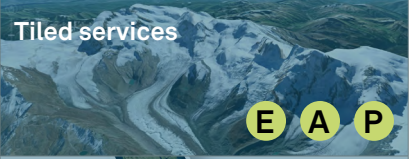
Functionality	Essential	Advanced	Pro
Core GIS engine	✅	✅	✅
Projection, datum and geoid models	✅	✅	✅
Transformation and projection engine	✅	✅	✅
4D cartesian and geodesic geometry model	✅	✅	✅
Unified data model	✅	✅	✅
Customizable symbology	✅	✅	✅
Raster connectors	✅	✅	✅
Vector connectors	✅	✅	✅
CPU, GPU image processing image	✅	✅	✅
Point clouds and reality meshes	✅	✅	✅
OGC standards	✅	✅	✅
OGC services	✅	✅	✅
Tiled services	✅	✅	✅
Tiling engine	✅	✅	✅
Symbology services	✅	✅	✅
Data management and catalog	✅	✅	✅
Data crawling and metadata harvesting	✅	✅	✅
Extensible web service platform	✅	✅	✅
Advanced GIS engine		✅	✅
Real-time engine		✅	✅
Advanced raster connectors		✅	✅
Database connectors		⭕	✅
Terrain analysis engine		⭕	⭕
Weather and environment standards		⭕	⭕
Graph and routing engine		⭕	⭕
Infrastructure standards			⭕
Radar connectors			⭕
Aviation standards			⭕
Defense standards			⭕
Defense symbology			⭕
Maritime standards			⭕
S-63			⭕

Functional specification
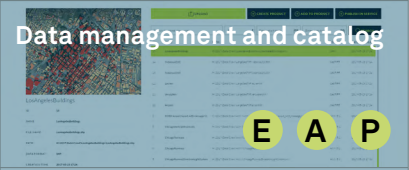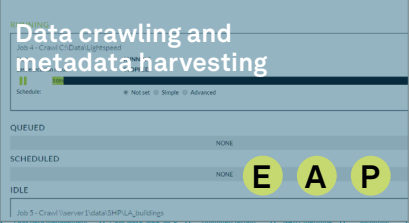
Below is a high-level, non-exhaustive overview of the functionality available in LuciadFusion. You can use the functionality it offers out of the box or extend it to meet user-specific requirements.

Core GIS engine **Projection, datum and geoid models** **Transformation and projection engine** E A P	• Access and represent data in any coordinate reference system (geodetic, geocentric, topocentric, grid) and in any projection. • Perform advanced geodetic calculations, transformations and ortho-rectification. • On-the-fly serving, fusion and tiling of data in any coordinate reference. Accurate and correct warping of both vector and raster data.
4D cartesian and geodesic geometry model **Unified data model** E A P	• Model any data format, represent all object geometries and their metadata and apply any data filter. • Includes support for complex geometries like geo-buffers, arcs and arc bands, radar coverage areas and so on. • Accurately represent radar coverage beams and other sensor detection ranges as 3D volumes, and set up geofencing for those volumes.
Customizable symbology E A P	• Apply flexible styling (layers, icons, line styles, fill styles, transparency, etc.) to your data and customize it using OGC-defined styled layer descriptor/symbology encoding (SLD/SE) standards through the LuciadFusion Studio. This includes both vector and raster data. • Extend SLD or implement and plug in custom layer factories to do advanced styling using, for example, density plots and heat maps. • Include processing in your styling, such as extracting contours from raster data before styling using fill and line styles. • Advanced labeling of vector data, including on-path labeling.

Raster connectors
 	
Vector connectors
 	
E A P
	• Access and serve data in many vector and raster formats natively, without pre-processing. Apply multi-leveling and tiling.
	• Use visualization, analysis and serving capabilities that are data-agnostic, and complementary with any data format.
	• Serve via the OGC protocols.
	• Out-of-the box native support for:
	  • Raster data: BIL, Bing Maps, BMP, DTED, ESRI TFW and JGW, ETOPO, GeoTIFF and BigTIFF, GIF, JPEG, JPEG2000, MapInfo TAB, PNG, PPM, USGS DEM, Open Street Map.
	  • Vector data: CGM, Collada, ESRI Shape, GeoJSON, MapInfo MIF and MAP, LiDAR LASer and LASZip (LAZ), OpenFlight (3D), OGC 3D tiles, OSGB 3D meshes, SVG, Wavefront OBJ (3D).
	• Adding support for new, custom formats is a straightforward, well-documented process.
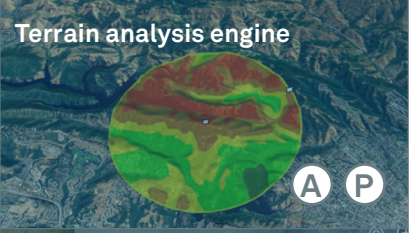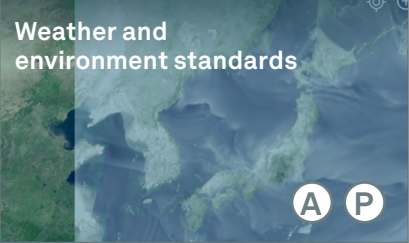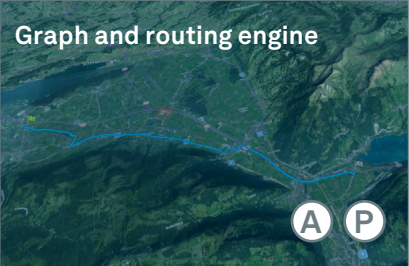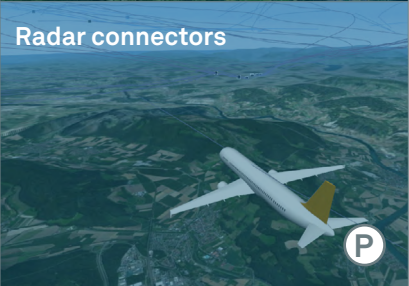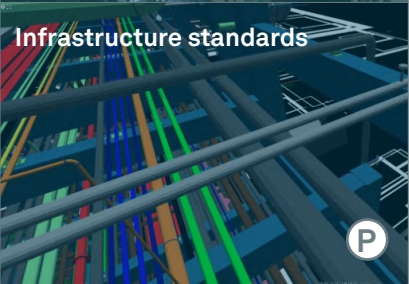
E Included in Essential   A Included in Advanced   P Included in Pro

CPU, GPU image processing image	• Benefit from advanced, high-performance processing and rendering of raster data, including high dynamic range (HDR) and multi-spectral imagery and multi-dimensional raster data. • Apply image processing chains using a complete set of image algebra operators before serving the data over OGC services, or before exporting data (for example, to OGC GeoPackage). • GPU-based default implementation for optimal performance, with automatic fallback to a multi-threaded CPU-based implementation.
Point clouds and reality meshes	• Connect to, visualize and serve unlimited point clouds and reality meshes. • Serve pre-tiled and multi-leveled point cloud data as optimized OGC 3D Tiles or HSPC stream. • Out-of-the-box native support for: • OSGB, LAS, LAZ, HSPC or OGC 3D tiles.
OGC standards	• Connect to several OGC web services, and read data in a variety of OGC formats. • Supported standards, formats and services: • OGC CSW, GeoPackage, GML, KML, WCS, WFS(-T), WMS, WMTS, OGC Filter 2.0 (Spatial filter capabilities can be enabled from the Advanced GIS Engine listed under Advanced and Pro options), OGC Symbology Encoding (SE), ISO 19115 metadata.
OGC services	• Serve any data via OGC services on the fly, directly from the source. Configure several OGC web service end points and automatically monitor data updates. Plug in support for your own custom data or styling. • Easy-to-use web frontend to manage data, metadata, styles, products and publish services. • Support for on-the-fly WMTS for any data source including but not limited to pre-tiled data sets WMTS from pre-tiled data sets. • Support for on-the-fly 3D tiles for OSGB mesh data sources, as well as processed LAS/ LAZ data. • OGC services: • OG WMS, WCS, WFS(-T), WMTS, CSW, 3D tiles.
Tiled services	• Serve pre-tiled data via Luciad Tile Services (LTS) for optimal performance. Using LTS, you can send multi-dimensional or elevation data tiles for client-side analysis.
Tiling engine	• Fuse, tile and multi-level large amounts of data using the tiling engine. • Build globes with detailed and accurate point-sampled terrain data, centimeter-accurate area-sampled (multispectral) imagery and multi-dimensional weather data and imagery. • Optimize point cloud data for direct access or streaming as OGC 3D tiles.

E Included in Essential   **A** Included in Advanced   **P** Included in Pro

Symbology services E A P	• Use a service to provide full sets of military symbology icons with icon styling specifications. Use the same icons across your system of systems, on the map, and in other UI components. Requires the Defense Symbology option.
Data management and catalog E A P	• Centrally organize, manage and serve all your geospatial data and styles from the LuciadFusion Studio web application, regardless of the format of that data. • Allow clients to discover data through an OGC CSW catalog.
Data crawling and metadata harvesting E A P	• Discover and aggregate all the geospatial data you have available by crawling your data repositories. Automatically collect and generate the metadata descriptions. • Define revisit intervals to automatically update services when data changes — for example, automatically publish an updated weather forecast or mission plan. • Integrate data crawling and data updates into your own workflow using the REST API.
Extensible web service platform E A P	• Benefit from a fast and reliable service application framework that hosts data publication and analysis services. • Benefit from service discovery, load balancing, failover and security integration. • Dynamically set up services using the REST API. • Integrate custom service types for data publication or processing.
Advanced GIS engine A P	• Calculate binary topological relations (e.g., overlaps, contains) and perform constructive geometry on shapes (e.g., union, intersection). • Apply this capability on Cartasian, geodesic and rhumb shapes.
Real-time engine A P	• Optimally connect to and serve dynamic data. • Pre-render, convert or relay data streams. Includes capabilities to translate and forward data streams in any format, such as the web-friendly GeoJSON format. • Perform analytics on real-time data.

Advanced raster connectors A P	• Connect to, visualize and serve specialized raster formats and access a GDAL connector to add support for several other raster formats.
	• Connect to, process and serve 360° panoramic imagery from various scanners.
	• Serve via the OGC service protocols and ECWP (for ECW data).
	
	• Directly supported formats:
	  • ECW, GeoPDF, GeoSPOT, JPEG2000 (including an encoder), MrSID, Spot DIMAP, Swiss DHM.
	• GDAL-supported formats including:
	  • ARC/Info Binary Grid(AIG), BSB Nautical Chart Format, ARC/Info Export E00 GRID, ENVI HDR Labelled Raster, ERDAS Imagine, ERDAS Imagine Raw, ILWIS Raster Map, Intergraph Raster, PCI Geomatics database File, PCRaster, Sentinel 1 SAR SAFE, Sentinel 2, SAR CEOS, SRTM HGT, GDAL Virtual, ASCII Gridded XYZ, etc.
	• 360° panoramic imagery formats:
	  • E57, Leica Pegasus.

E Included in Essential   A Included in Advanced   P Included in Pro

Database connectors (A) (P)	• Add support for connecting to and serving data directly from spatial databases. • Supported database formats: • IBM DB2, Informix Geodetic and Spatial Datablade, OGC GeoPackage, Oracle Locator and Oracle Spatial, PostGIS (PostgreSQL spatial database extension), SAP HANA (Beta), Microsoft SQLServer, SQLite.
Terrain analysis engine (A) (P)	• Perform calculations on terrain data, such as line of sight (LOS) or hypsometric calculations, and get an alternative view on the terrain data. • The engine can use hardware acceleration (for GPU equipped servers) but also includes a software implementation.
Weather and environment standards (A) (P)	• Integrate environmental data and preserve dimensional information when serving. • Pre-tile and organize into multiple levels of detail for serving as Luciad Tile Service (LTS). • Supported formats: • NetCDF ISC, GRIB V1/V2 weather data (WMO/ICAO Bulletin), SIGWX (BUFR).
Graph and routing engine (A) (P)	• Exploit the network structure of your geospatial data and make use of algorithms to construct graphs and solve your routing challenges. The graph engine offers support for all kinds of network-related processing, such as shortest path or cross-country movement calculation. Also enables the creation of flexible cost functions. • Integrate as processing service.
Radar connectors (P)	• Connect to and portray radar data captured in ASTERIX and ASDI formats. • Combined with the real-time engine, the radar connector offers fast and flexible visualization of ASTERIX and ASDI data, including radar video (ASTERIX Cat 240). • Supported formats: • Eurocontrol ASTERIX categories 1, 8, 10, 11, 21, 30, 48, 62, 240 and 244, and ASDI.
Infrastructure standards (P)	• Import and visualize your computer-aided designs into LuciadFusion to see your design in context. • Prepare your 3D models and cities for streaming via conversion of OBJ to OGC 3D tiles. Optionally compress tiles if the client applications support these optimizations. • Supported formats: • Autocad DWG/DXF, Microstation DGN, Hexagon Binz.

(P) Included in Pro   (A) Optional in Advanced   (P) Optional in Pro

|	
Aviation standards	• Model, render and serve aeronautical data such as airspaces, navaids, procedures and grid MORAs (minimum off route altitude). This includes options for custom styling. • Supported formats: • AIXM (3.3, 4.0, 4.5, and 5.1), ARINC 424, DAFIF(T).
Defense standards	• Integrate the various military data formats at your disposal for full situational awareness. • Supported formats: • ADRG, ASRP, BCI, CADRG, CIB, ECRG, NITF, NSIF, USRP, VPF products (VMAP0, VMAP1, VMAP2(i), DNC, DCW) including Geosym symbology, MGCP.

Defense symbology	• Benefit from full support for symbols and tactical graphics of the latest military symbology standards. NATO Vector Graphics support increases interoperability. This support encompasses the lookup, creation, visualization and serving of military symbols and tactical graphics.
	• Serve your NVG files in a matter of seconds over OGC-compliant services using simple drag and drop.
	• Supported symbology standards/ formats:
	   • APP-6A, APP-6B, APP-6C, APP-6D, MS2525b, MS2525c, MS2525d, NVG.
	   • Military grids: MGRS, CGRS and GARS.
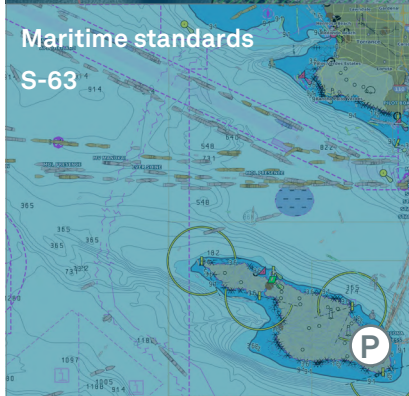
Maritime standards S-63	• Accurately render electronic navigational charts in 2D and 3D. Complies with standards defined by the International Maritime Organization (IMO) and the International Hydrographic Organization (IHO). Decodes data in the IHO S-57 format, and visualizes the charts in compliance with the IHO S-52 visualization standard. • Decode and portray electronic navigational charts in the encrypted IHO S-63 format. • Supported formats: • IHO S-57, IHO S-52, UKHO AML.

Ⓟ Optional in Pro

Use cases
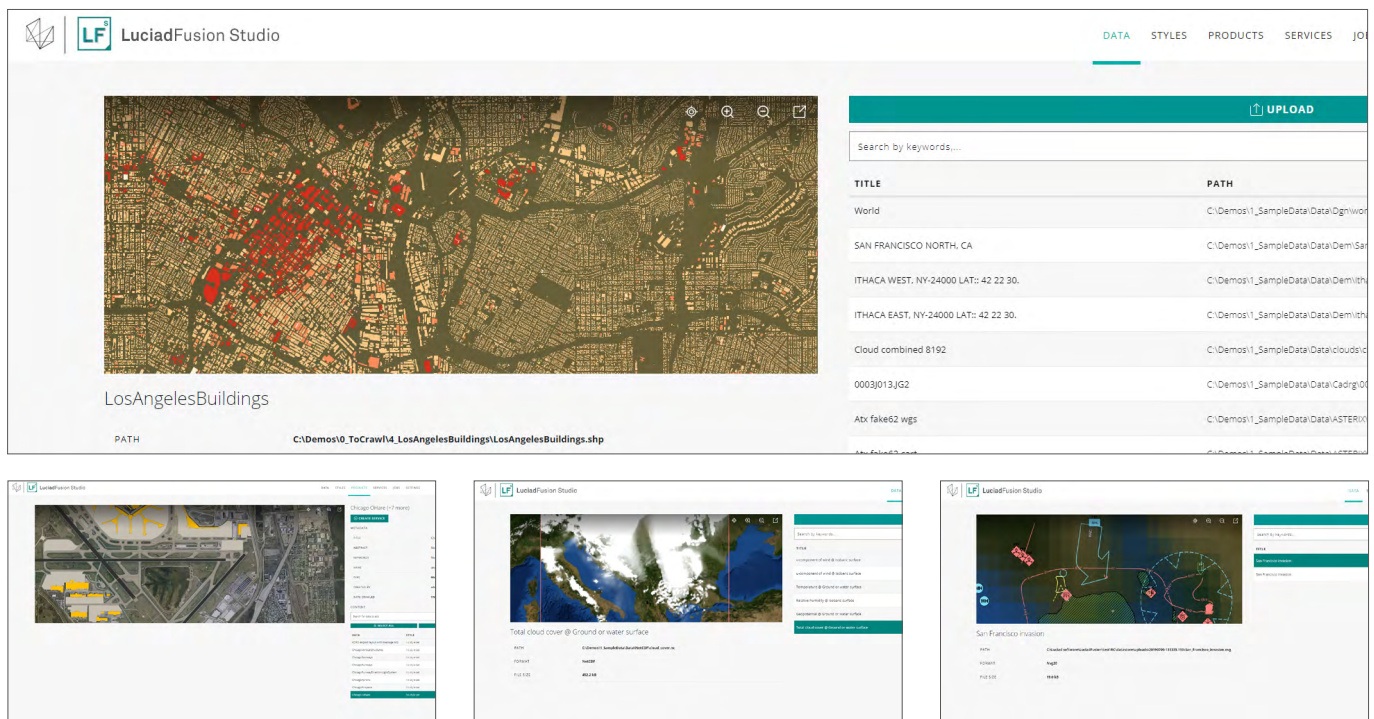
Figure 3 - Using LuciadFusion Studio, you can serve large vector datasets on the fly, with OGC SE filtering and styling applied automatically. You can set up data services in a few clicks, including domain-specific formats like AIXM5.1, NVG or S-57.

Figure 4 - LuciadFusion can be extended with additional analysis services, for example a service offering remote LOS calculations

Figure 5 - Visualization and analysis of multi-dimensional weather data in LuciadLightspeed Lucy, served by LuciadFusion as multidimensional WMTS

Figure 6 - LuciadFusion can connect to, optimize and serve unlimited point clouds and reality meshes

More information

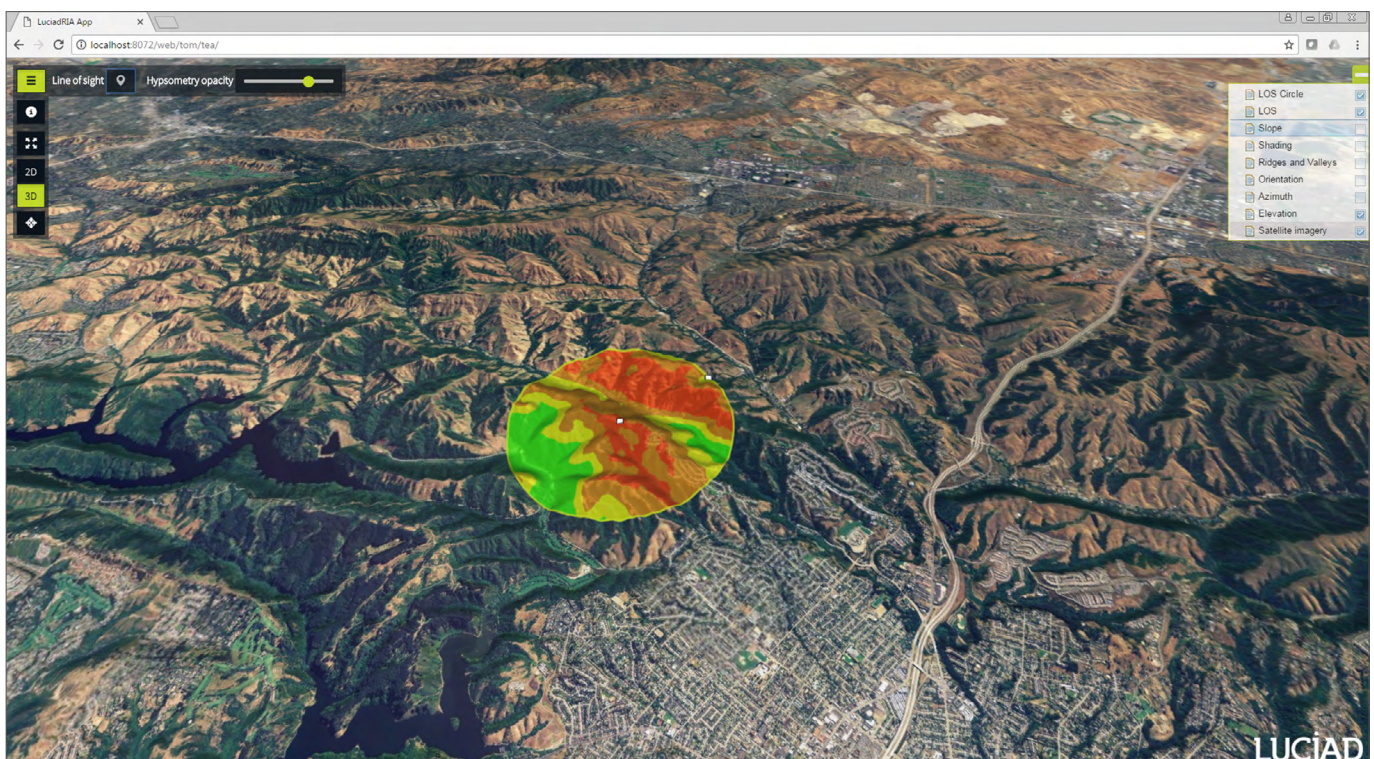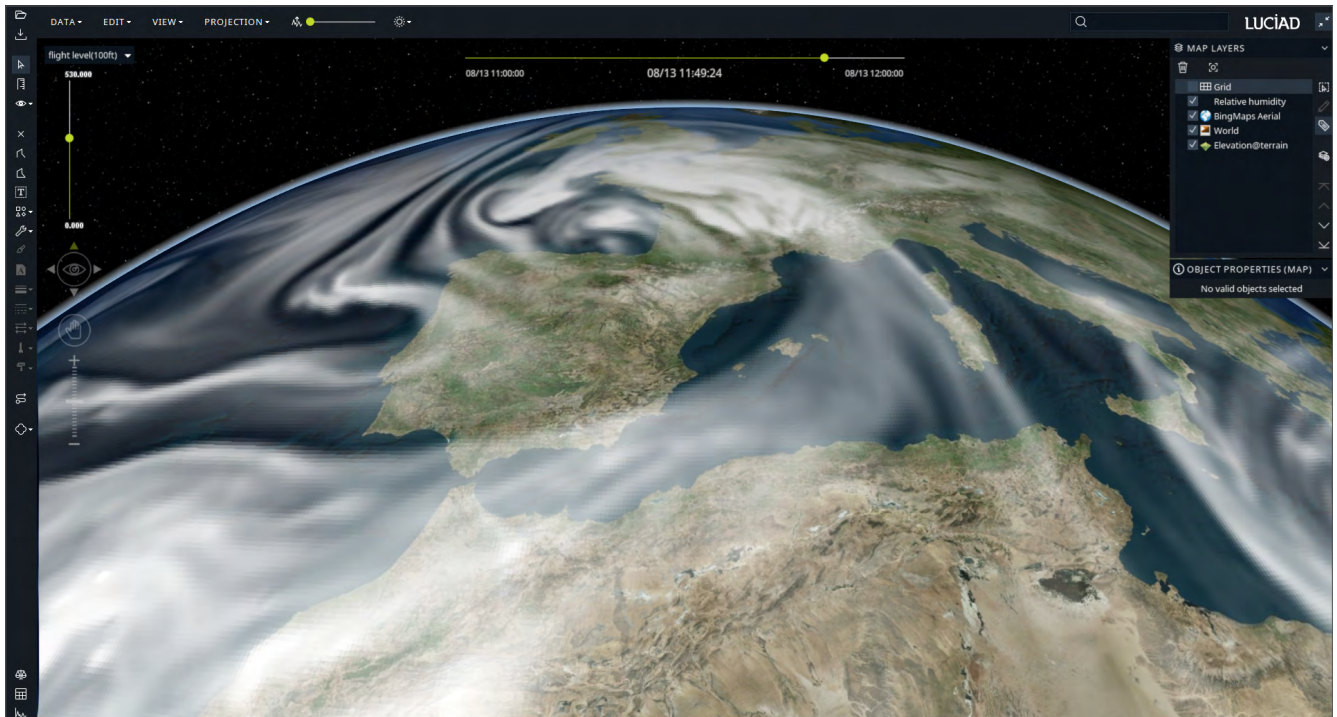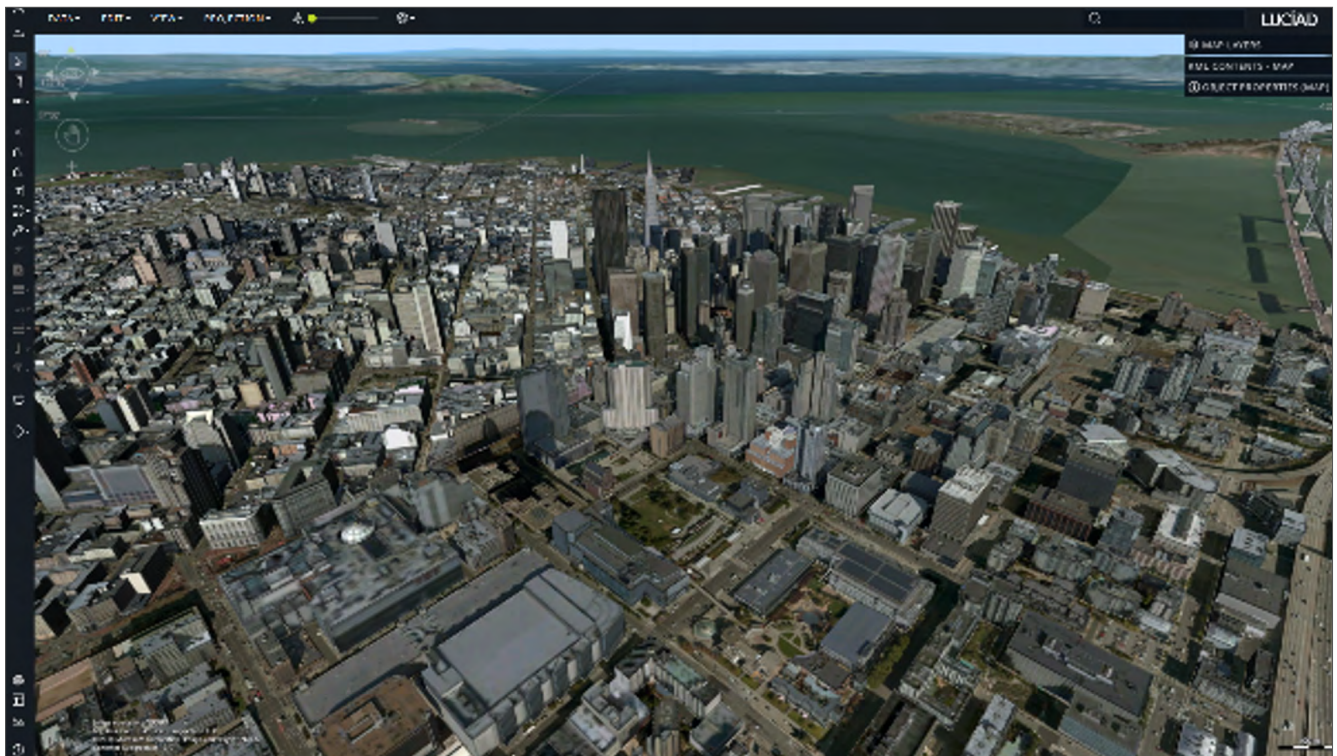LuciadFusion comes with:

- Ready-to-use LuciadFusion Studio application

- Guided user tours

- In-application help within LuciadFusion Studio

- Ready-to-use tiling engine application (DCM) with end-user guide

- Developer's guide with clear explanations and description of best practices

- API reference offering detailed description of all interfaces and classes

- Code samples for all components

- Build scripts, Maven POM files and sample servlets for easy project setup and deployment

- Release notes to see what's new

- Technical notes to consult technical requirements

To learn more or schedule a demo, contact us at **info.luciad.gsp@hexagon.com**.

For developer guides, code snippets, technical articles, videos and more, visit the **Luciad Developer Platform**.

HEXAGON

Hexagon is a global leader in digital reality solutions, combining sensor, software and autonomous technologies. We are putting data to work to boost efficiency, productivity, quality and safety across industrial, manufacturing, infrastructure, public sector, and mobility applications.

Our technologies are shaping production and people-related ecosystems to become increasingly connected and autonomous – ensuring a scalable, sustainable future.

Hexagon's Geospatial division creates solutions that deliver a 5D smart digital reality with insight into what was, what is, what could be, what should be, and ultimately, what will be.

Hexagon (Nasdaq Stockholm: HEXA B) has approximately 21,000 employees in 50 countries and net sales of approximately 3.8bn EUR. Learn more at **hexagon.com** and follow us @HexagonAB.