

# A competitive analysis of open web mapping technologies

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Track 4: Maps and the Internet

Keywords: web mapping, open mapping technologies, competitive analysis, user interface design, cartographic interaction

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**BACKGROUND:** Since the last ICC meeting in Paris, the technical practice of web mapping has shifted away from the use of a single, proprietary technology (e.g., Adobe Flash & Flex) towards decentralized, open technologies based on JavaScript. In part motivated by the rise of mobile devices, this transition can be interpreted as a return in web mapping to the open practices employed for web design more broadly. The move to open web mapping techniques presents a renewed opportunity within Cartography to comply with broader web design standards (HTML5/CSS3) and to expand the ways in which maps are used online.

**OBJECTIVES:** This technological shift has resulted in a growing number of code libraries, development frameworks, tile renderers, and APIs for web mapping. Despite their potential, there are limited resources that effectively collect and evaluate these decentralized technologies, and few provide insight into how they are best leveraged both individually and in combination across web mapping contexts. The objectives of this research are threefold: (1) identify the variety of open web mapping technologies currently available, (2) organize these technologies into a consistent and logical framework based on their intended purpose and structure, and (3) compare these technologies according to the functionality they support to recommend how to best to make use of them.

**METHODS:** We conducted a competitive analysis study to identify, organize, and compare existing web mapping technologies. Competitive analysis is a method drawn from Usability Engineering in which the capabilities of competing products (in these case, web mapping technologies) are compared against one another to identify strengths, weaknesses, and potential opportunities for new products. The competitive analysis began with a collection period spanning several weeks in which team members submitted technologies by name and URL into an online spreadsheet. After reaching saturation, we evaluated web mapping options according to twenty-seven functional requirements identified as relevant to web mapping, with the requirements organized into the higher level categories of *representation* (i.e., the graphic encoding of information) and *interaction* (i.e., the ability for the user to manipulate the

representation). Two coders then independently conducted a content analysis using the twenty-seven part coding scheme to improve the quality and reliability of the results.

**RESULTS:** Figure 1 provides an overview of the competitive analysis study using a two-dimensional matrix visualization, with the collected technologies listed along the vertical axis and the functional requirements listed along the horizontal axis. The darkest shaded cells indicate functions that both coders agreed are supported natively by the technology, while the white cells indicate functions that both coders agreed are not possible with the technology. Horizontally, the matrix visualization reveals variation between specialist technologies designed to support a small set of functions and multi-purpose technologies that support numerous functions, although perhaps not as well. Vertically, the matrix visualization reveals widely supported features and functionality in contemporary web mapping technologies (e.g., imagery basemaps, custom overlays/overlay toggling, panning/zooming), as well as many advanced thematic representation or cartographic interaction techniques requiring further attention and development.

**CONCLUSION:** The work presented here provides a snapshot of the current technological practice of web mapping. Of course, any effort to characterize the existing landscape of web mapping technologies is sure to be dated as soon as completed. In future work, the matrix framework will be maintained as an online blog curated through the University of Wisconsin Cartography Lab.

# COMPETITIVE ANALYSIS OF WEB MAPPING TECHNOLOGIES BY FUNCTIONALITY

