Summary

Geographic Information System Software Assessment and Validation Study Comparative Product Performance Results

Emergency responders are faced with the formidable task of evaluating multiple software products and selecting only those products that best support mission requirements and enhance operational processes. The process of identifying, evaluating, and selecting these software products is both time consuming and difficult. Prior to software procurement, it is important to verify product functions and capabilities to ensure the product meets agency requirements and expectations. As a SAVER Program technical agent, the Space and Naval Warfare System Center (SPAWARSYSCEN), Charleston has been tasked by the U.S. Department of Homeland Security, Preparedness Directorate, Office of Grants and Training to conduct a study on geographic information system software. The software Assessment and
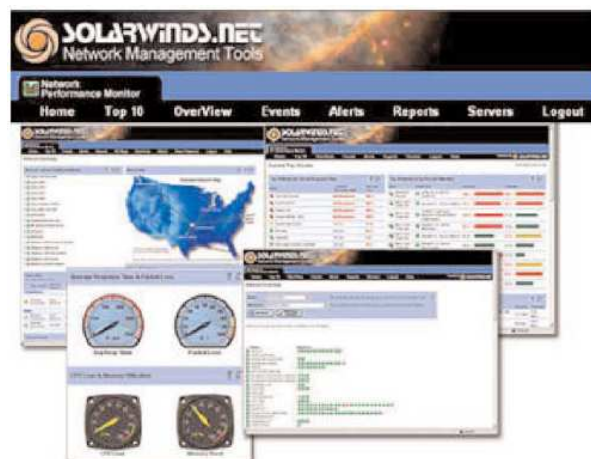
Validation (A&V) report presents comparative performance results for three GIS software products utilizing a combination of objective performance monitoring approaches and subjective functional or performance metrics.

The A&V process used in the study can assist agencies during evaluation of multiple software products in simulated computing environments. The assessment and validation involved conducting hands-on operation of commercial GIS software products following seventeen preestablished work processes. The work processes covered a range of core GIS mapping and analysis capabilities, including the following:

- Merge Data
- Clip Entity, Attribute Query, and Computer-Aided Design File Conversion
- Address Geocoding
- Add a Web Mapping Service
- Generate a Buffer
- TIFFS and On-the-Fly-Projection
- Managing Metadata
- Joining Tablet
- Create, Edit, Reshape, Vertex Editing, and Measurements.
- Create Hyperlinks
- Tabular Calculation and Reports
- Spatial Querying
- Exporting to a Spatial Database
- Map Labeling
- Thematic Classification
- Image Classification – Georeferencing
- Create a Map and Export to a PDF File
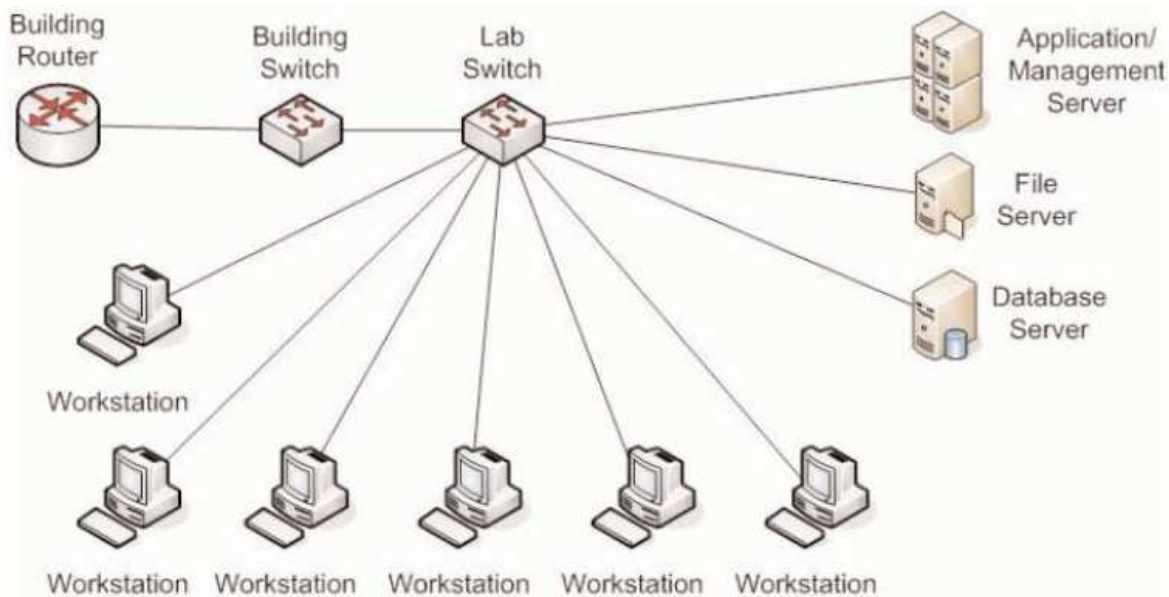
Sample Assessment and Validation Network Architecture

These work processes were assessed by collecting various objective metrics, such as network utilization, network and workstation CPU load and memory used, page faults, and network bytes. In addition, the level of user interaction required to execute the work processes was collected to characterize the relative complexity of completing tasks using the software. The user interaction results also include the assessors' subjective input, such as software product work process values scores, software quality values, and practitioner comments.

For the purpose of the comparative assessment, functional requirements were defined by practitioners from GIS user community, therefore, software products with the highest potential for meeting those requirements were selected, and a formal, independent assessment of those products was conducted. The A&V report presents the formal approach of the GIS Software Study, including a comprehensive list of GIS mapping tools, capability requirements, and performance results.

During the execution of the work processes, the network and server management software collected various metrics, such as network utilization, network CPU load, network memory used, workstation CPU load, and workstation memory used. In addition, each software application was evaluated using a computer network performance utility. The performance parameters that displayed significant relative performance were Page Faults/sec. Network Bytes Received/sex, Network Bytes Sent/sec. paging File Percent Usage, Percent Disk Read time, and Percent Processor Time.

A Human-Machine Interface (HMI) approach was used to provide and objective means of characterizing the relative complexity of completing a workflow task using the software. The HMI scores are the normalized measure of human-machine interactions required to complete the task.

In addition to the objective metrics, the assessors' subjective input, such as the software product work process value scores, the software quality values, and practitioner software operation comments are also presented in the report.

Finally, the report documents the lessons learned during the study to help individuals considering software assessment avoid pitfalls and issues. These lessons learned are beneficial for those trying to either repeat this assessment process or introduce variations on the A&V process such as those encountered during this software product assessment.

Conclusion

The formal sudy was designed to capture comprehensive performance results from GIS A&V on selected software products using representative process workflows. The combination of subjective assessor ratings and objective network performance results provides more comprehensive information for trying to make a software selection decision. Instead of recommending or singling out a specific software package as "the best," the report provides a comprehensive listing of GIS software packages and assessment performance results for three GIS products based on core GIS functions. Each software product was assessed and validated at the individual criteria level; however, summary recommendations were not made. Not all products could complete all of the established work processes further emphasizing the need to evaluate multiple software products to increase the likelihood of finding the software tool with the "highest potential" of meeting the user requirements.

The results are representative of a cross-section of

basic to advance GIS software capabilities and may not represent an agency's current workflow. The formal assessment process should be tailored to represent the user's true workflow, as any comparison can only apply for the given conditions of budget, operational requirements, technical resources, network structure, etc., unique to each agency.

Software capabilities change frequently, so the user should seek vendor input when tailoring the work process and should validate those products on a periodic basis to ensure they still meet agency needs, specification, and expectations. Refer to the GIS Software Selection Guide for more information on the identification of the highest potential software products that lead into a formal product assessment. The formal A&V assists agencies in understanding how GIS software will operate in a computer network, utilize desktop and network resources, and meet user expectations.

The full report can be found on the SAVER Web Site along with other SPAWARSYCEN reports dealing with GIS technology.