

# Application Story



## Surromed Inc.

Is a pioneering biomarker—enabled drug discovery and development company.

## Situation

Needed an analysis workflow application for biomarker discovery.

## Software Solution

- S-PLUS® Server
- Spotfire DecisionSite

## Results

- A robust, integrated analysis workflow application for biomarker discovery.
- Performed more sophisticated analyses more efficiently.
- Industry-leading analytics transform raw data into reliable and actionable information.
- Easy-to-use, Spotfire DecisionSite interface empowers users with modest technical skills.
- Greater access to analytics and information improves quality of decision-making enterprise-wide.

## Company Overview

SurroMed is pioneering biomarker-enabled drug discovery and development through the integration of many data sources and the application of advanced statistical analysis and interactive visualization. Surromed integrates data from sources including MLS Cytometry, Immunoassay, Mass Spectrometry, Proteomics, Metabolomics, Gene Expression and SNPs. These data are managed in an Oracle data warehouse and disease-focused data subsets are analyzed by SurroMed and its pharmaceutical development partners to identify biomarkers for development of new therapeutic products, diagnostic tests for early disease detection, disease staging, patient stratification, and in guiding and monitoring therapy.

## The Challenge

Surromed decision-makers need to integrate these comprehensive clinical and bioanalytical data from a clinical and systems biology perspective; and to enable advanced statistical analysis, reporting and interactive visualization for biomarker discovery from the integrated data.

Surromed analyzes and integrates data from sources including MLS Cytometry, Immunoassay, Mass Spectrometry, Proteomics, Metabolomics, Gene Expression and SNPs. Surromed's mass spectrometry and microvolume laser scanning cytometry include proprietary assay platforms and data analysis processes operating in SurroMed's discovery lab. The data are managed in an Oracle data warehouse, and disease-focused data subsets are analyzed through SurroStat™ for identification of biomarkers. For example, the proteomics and metabolomics data facilitate differential profiling of proteins from 1-D & 2-D mass spectrometry data using proprietary statistical analysis methodology; and the microvolume laser scanning cytometry allows quantitative cellular immunophenotyping.

## The Solution

The data management and analysis is achieved through an integrated software system, SurroStat, developed by SurroMed. Two key components of SurroStat are Insightful's *S-PLUS® Server* and *Spotfire® DecisionSite™* offered together by both Insightful and Spotfire as the *DecisionSite S-PLUS Server Solution*. Insightful's S-PLUS Server provides advanced statistical analysis and reporting using S+Graphlets and the S-PLUS XML reporting gateway. Spotfire's Decision Site provides advanced interactive visualization as well as user defined Guides and DecisionSite Posters for analysis sharing. The S-PLUS Server and DecisionSite are integrated within the SurroStat user experience. Surrostat users can prepare datasets using DecisionSite then send the dataset to S-PLUS Server

for statistical analysis and reporting. Results from the S-PLUS Server are returned as either reports (html, pdf etc) or datasets for continued interactive analysis in DecisionSite.

The SurroStat architecture backbone comprises a J2EE Application Server with EJB, Servlets and JSP application components involved in data processing and presentation of the user interface. The web application is configured through a set of XML files that allow elegant management of SQL scripts and S-PLUS analytics.

Direct statistical analysis operations are managed through an asynchronous job management and job submission process. Job transactions start when a user submits an analysis. The parameters for the analysis (e.g. S-PLUS functions and arguments) are persisted in job metadata tables, and the data are retrieved and formatted into csv files appropriate for the analyses requested. The analysis parameters and functions are then held in a message queue. Jobs in the queue are activated through an EJB container that makes an MDB instance available for the next message in the queue. The job parameters are extracted from the message and sent to S-PLUS Server for execution. The S-PLUS Server architecture flows seamlessly in this environment with its JavaConnect layer and tag libraries for direct access of the S-PLUS engine through jsp scripts.

The SurroStat user interface shows all submitted jobs and results/status. Jobs that error out send emails to the submitter with error reports. Job results can be simply clicked to launch views of the data and S-PLUS reports including S+Graphlets.

The biomarker discovery data warehouse is managed off-line through an extensive ETL process involving extraction of LIMS sample information and combining this with patient information to populate a set of star schemas to support the analysis and visualization. There are a number of raw data staging areas involved in the data integration process.

Prepared datasets may be launched with Spotfire from the SurroStat user interface or viewed in the preparation of a statistical analysis. Spotfire Decision Site provides interactive visualization and filtering of data through a simple-to-use interface with sliders and data integration controls. The Decision Site interactive analysis often reduces multivariate data to focused datasets of interest. Repeatable operations can be captured and managed through Decision Site guides. Such guides can be managed through the Spotfire user interface and provide convenient access for future analyses of the same type.

In SurroStat, the Decision Site user interface is configured to automatically launch an S-PLUS Server analysis on a dataset that has been assembled in Decision Site, through the *DecisionSite S-PLUS Server Solution*. This integration of DecisionSite and S-PLUS allows the user to choose an S-PLUS analytic from the DecisionSite user interface. The user is then prompted for inputs to the underlying S-PLUS functions via a simple user interface. DecisionSite then sends the prepared data to S-PLUS Server via a SOAP message. S-PLUS Server then analyzes these data and returns data to DecisionSite for further analysis or sends results to a standardized web report, available through the SurroStat user interface.

SurroStat has integrated the best of breed technologies to create a powerful analytic and visualization platform for biomarker discovery. The Spotfire DecisionSite user interface with guides and collaborative posters, along with its advanced visualization and filtering provides a very rewarding user experience and keeps the user close to the data. The Insightful S-PLUS Server provides rigorous, validated statistical analysis within a batch production environment, as well as flexible configuration and solid tabular and graphical reports through S+Graphlets. The combination of the *DecisionSite S-PLUS Server Solution* with the SurroStat data warehouse and integrated architecture enables deep biomarker discovery.

## Results and In-field Innovation

Biomarkers are crucial advance in drug portfolio management and prioritization of drug development effort. Biomarkers allow drug companies to obtain early evidence of drug performance in expensive development efforts. Applications in the context of clinical trials include confirmation of a drug response, dose-response demonstration, definition of trial populations and surrogate endpoint determination. Biomarkers also play important roles in development of diagnostic tests for early disease detection, disease staging, patient stratification, and in guiding and monitoring therapy.

The combination of rigorous, validated statistical analysis through Insightful's S-PLUS Server, with the advanced visualization and rewarding user interface of Spotfire's DecisionSite make SurroStat the application of the future in the identification and validation of biomarkers for development of new therapeutics and diagnostics.

## Key Benefits

- Flexible, extensible solution integrates easily with existing systems.
- Industry-leading S-PLUS analytics transform raw data into reliable and actionable information.
- Easy-to-use, Spotfire DecisionSite interface empowers users with modest technical skills.
- Greater access to analytics and information improves quality of decision-making enterprise-wide.

## Application

- Drug Discovery & Development

## Products

- S-PLUS Server on Solaris server
- Spotfire DecisionSite on Windows desktop
- SUN server hardware
- SUN ONE J2EE Application Server
- Oracle data warehouse
- Ingenuity pathway analysis
- Flow cytometry hware/sware
- Mass spectrometry hware/sware