



Photographer: Alexander Karlsson/Försvarsmakten

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Pär-Anders Albinsson, FOI Scientist, Swedish Defence Research Agency (FOI)

The Swedish Defence Research Agency (FOI) supports the Swedish Armed Forces in their ongoing transition towards a model-based capability development process. Among other things, FOI looks at new ways to visualize and navigate among large volumes of data in search of interesting insights that are hard to see in traditional spreadsheets. The prototypes developed as part of the initiative demonstrate how information visualization and interaction techniques can support model-based capability development involving large hierarchical data sets. Two cases were chosen as a context for the prototypes: analysis of the Armed Forces materiel plan and analysis of relations between NATO requirements and Swedish military units.

Swedish Defence Research Agency Tests TIBCO Spotfire® Analytics Platform for Defence Materiel Planning and Interoperability Requirements Analysis

The Swedish Defence Research Agency is involved in several projects concerning the processes around defence planning and capability development. These processes are intertwined and affected by each other and external factors. The planning and development environment is dynamic, with frequent changes in conditions, complicating the extensive task of moving from general planning of tasks and capabilities at a high level, down to more concrete descriptions of units, equipment and personnel needed to carry out the tasks and realize the capabilities. Today, materiel planning is divided among multiple groups of people analyzing and producing various documents and spreadsheets that aren’t easily interconnected, making it difficult to grasp the overview of current conditions such as economy, unit needs and materiel delivery.

ADVANTAGES OF A MODEL-BASED CAPABILITY DEVELOPMENT

The Armed Forces is moving toward a model-based capability development for methodologically tackling the problems inherent in its current procedures. Modeling the activities and organizing data that now may be described differently depending on the project will provide the ability to dynamically manage and ensure consistency among all processes.

In other words, it is much more efficient to use common shared models of the underlying information throughout the whole process of defence planning and capability development as opposed to heterogeneous processes with conflicting static and internal descriptions of the information, which has to be merged and analyzed manually.

Example: A low-level requirement for a tactical radio system should be traceable to an overlying user need, which in turn is traceable to a higher level goal to reach a certain capability. All of these objects (requirement, user need, goal, capability) are dealt with by different people in different parts of the Armed Forces. Using the Spotfire® analytics platform, all of the objects can be represented in a shared common model for all the constituents, ensuring a coherent overlying process. If the goal changes for one objective, it will be easy to analyze the consequences for the other objects in the model.

DEVELOPING THE PROTOTYPES

The Swedish Defence Research Agency (FOI), one of Europe's leading research institutes for defence and security, decided to carry out an information visualization project to tackle the identified problems. The project followed two tracks:

1. A prototype that could navigate among thousands of materiel planning projects that were ongoing over the next ten years
2. A prototype that would make it easier to identify which NATO requirements could be met by military units as part of their cooperative relationship.

This case study focuses on the materiel planning prototype.

FOI Scientist Pär-Anders Albinsson determined that treemapping would be the ideal technique to visually depict the large amounts of hierarchically structured data. He reviewed alternatives and determined that TIBCO Spotfire® analytics platform was the best technology to get the prototypes developed as quickly as possible. The Spotfire analytics platform was ready to go, off-the-shelf, providing the needed flexibility to manage large volumes of data and link between visualizations, as well as serve as a presentation tool. Also, thanks to the Spotfire analytics platform's tolerant import features, data cleaning and preparation efforts could be reduced.

Around 15,000 rows of data (each representing a separate project) were partially randomized for confidentiality purposes and imported into the Spotfire analytics platform. Albinsson created a dashboard that provided the ability to easily go between different views, depending on the analytical task.

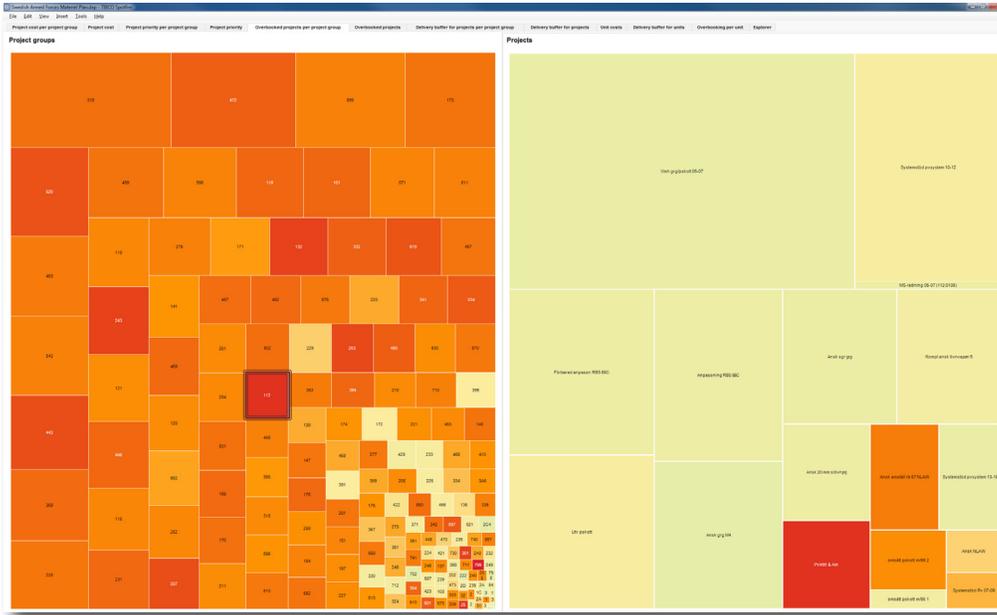


Figure 1 (For confidentiality reasons the data in the visualizations are randomized.)

INTERACTING WITH THE VISUALIZATIONS

On the left side of Figure 1 is a representation of Armed Forces projects at the highest level. Each rectangular box is a collection of projects; the larger the box, the greater total economic size of the projects within the group. Each project may have multiple military units associated with it, representing the units' needs of the output of the project. The color of the box represents how much of the planned output of the projects is needed by units; the darker the color, the more in demand the materiel. The color coding of the project groups represents the highest-demand underlying project. A dark red project group means that the worst-case project in the project

group is overbooked – that is, units express a total need that is larger than the currently planned output.

The outlined box in Figure 1 indicates it has been selected to be drilled into for further analysis; the projects which comprise that box are depicted on the right. The dark red box in the lower right indicates that the amount of that particular materiel cannot meet demand for the various units for which it is needed. “To swiftly go through data like this would have been extremely difficult, or perhaps impossible, using current spreadsheets,” says Albinsson.

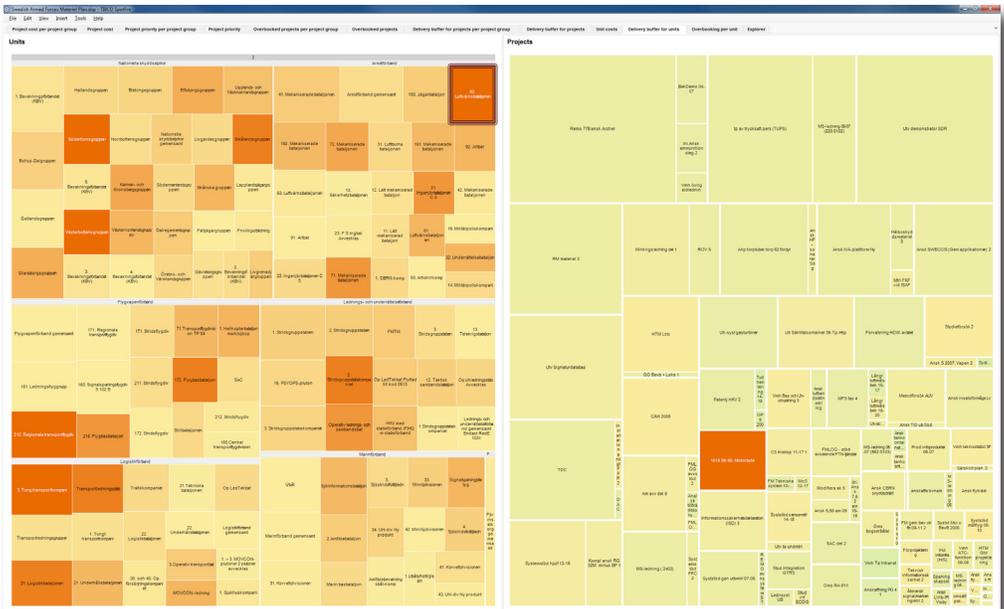


Figure 2 (For confidentiality reasons the data in the visualizations are randomized.)

Figure 2 looks at the demand for materiel from the perspective of each unit, making it easy to see how much each unit needs of a particular materiel across projects. The user can click on a branch of service and view the economic size of a unit in relation to projects. A summary of all projects for a selected unit is populated on the right. The color coding quickly shows if there is problem with a planned delivery deadline for projects connected to a given unit. Greener colors represent there being adequate time between the planned delivery of materiel and the project deadline. Redder colors indicate the materiel would be delivered after the project deadline. "This graphical display greatly facilitates grasping the current status of units' dependence on materiel risking missing deadlines," says Albinsson. "Again, this wouldn't be easily accomplished with static spreadsheets."

After a series of successful demonstrations for potential users, the project got extended to further advance the prototypes. The Spotfire analytics platform clarifies the dynamic relationship between each unit's needs, requirements, equipment and capabilities by providing a coherent overview, powerful zooming and filtering functions as well as details on demand. Also, by giving the Armed Forces new ways to interact with and present the large and complicated data sets, the Spotfire analytics platform helps to better understand and articulate the underlying needs of models.

The next phase of the project is underway currently – to advance the prototypes to the next stage using actual data from additional sources.



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