



SAP® FORECASTING AND REPLENISHMENT

A HIGH-VOLUME PERFORMANCE SHOWCASE

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Automated Forecasting and Replenishment in a High-Volume Retail Environment

Automated forecasting and replenishment is all about striking the ideal balance between stock investment and customer service. Current economic conditions pose complex challenges for today's retailers. Spending has slowed, multiple channels proliferate, and consumers expect maximum value and exceptional service. With ever-expanding choices on where, how, and when they shop, consumers are becoming less loyal and routinely cross-shop. Retailers are chasing shrinking purses and vying with each other to capture the attention of demanding and fickle shoppers.

Faced with this reality, retailers are becoming more focused and are adopting a more targeted and proactive approach. They are looking for accurate, real-time customer sales information that helps them deliver the right products to the right locations in the right quantity – to achieve customer loyalty and offer an exceptional customer experience. The most successful retailers are already making decisions and targeting customer segments based on their understanding of consumer demand. Fundamental to supporting this proactive, customer-centric response is ensuring product availability and product offerings that match customer needs. You can ensure product matches, deliver better choices, and develop a better

store image. Shoppers come to depend on a consistent shopping experience because you offer the products and selections they expect.

The SAP® Forecasting and Replenishment application helps retailers strike the ideal balance between minimizing inventory ownership and maximizing customer service. Using sophisticated algorithms and automation technology, the application accurately forecasts all sales, including promotions, with the best fit to future demand, thereby ensuring optimized stock levels at each store location. Although stock planners may opt to review certain order proposals before they are executed, 98% or more is a common key performance indicator (KPI) for degree of automation.

SAP customers want to know how they can achieve 98% automation in their high-volume businesses. And they're particularly concerned about how much it will cost. So SAP and hardware partner Sun Microsystems Inc. launched a joint project to quantify the requirements and benefits for SAP Forecasting and Replenishment. The goal was to prove that the application is not only highly scalable, but also that – with a reasonable hardware investment – it can be effective in the tight nightly time windows that are typical in retail businesses.

What follows are the striking results of the performance initiative by SAP and Sun.

Typical SAP Forecasting and Replenishment Processing

The most time-critical processing steps in SAP Forecasting and Replenishment are:

- Data synchronization with the forecasting and replenishment processing (FRP) engine that calculates forecasts and requirements
- Creation of order proposals
- Update of the forecast results and nonexceptional analytics

Individual tasks are performed once per night, in a particular sequence for each location, such as a store or distribution center; some of the steps, of course, require availability of the sales data.

Figure 1 illustrates the forecasting and replenishment process. Note that this performance showcase did not take into account the data transfer from the enterprise resource planning (ERP)

system into SAP Forecasting and Replenishment nor the loading of point-of-sale (POS) data via the SAP POS Data Management application, shown as the POS inbound processing engine (PIPE) in the figure. Nor was business intelligence part of the system landscape. In the figure, those activities are crossed out.

Two options are available for the sequence of processing steps: run all tasks for a location in a single job ("all-in-one") or split them up into several consecutive jobs ("step-by-step"). Selecting a sequence option should be based on the customer's prerequisites, such as availability of required data.

Test Data Structure

Performance proofs need to be realistic so that retailers can relate the results

to their own businesses. For this reason, the showcase used a **high-volume archetype** in terms of number of product and store combinations, data structure, and business scenario:

- 1,450 stores with varying sizes from 1,000 to 60,000 products per store (approximately 41 million product/store combinations in total)
- 20% of the product assortment having daily sales occurrences
- Actual stock-out situations on 2% of these products and potential stock-out threatening to impact 8% of the products
- Store order proposals created for 20% of all articles in active assortment
- Forecast executed daily for 25% of all products per store
- Demand influencing factors assigned at product and location level to approximately 1.1% of the products to simulate the impact of weekly promotions

Because SAP and Sun agreed that the focus was on authenticity of the scenario, they avoided the tweaking sometimes done in benchmark exercises where maximum throughput of data is the only KPI.

Technological Infrastructure

As shown in Figure 2, the central instance (CI) was a Sun SPARC Enterprise M8000 server with an Oracle database, the SAP instance, and Solaris Resource Manager to fence the resource consumption of the SAP instance. Application servers were two Sun Fire V890 servers.

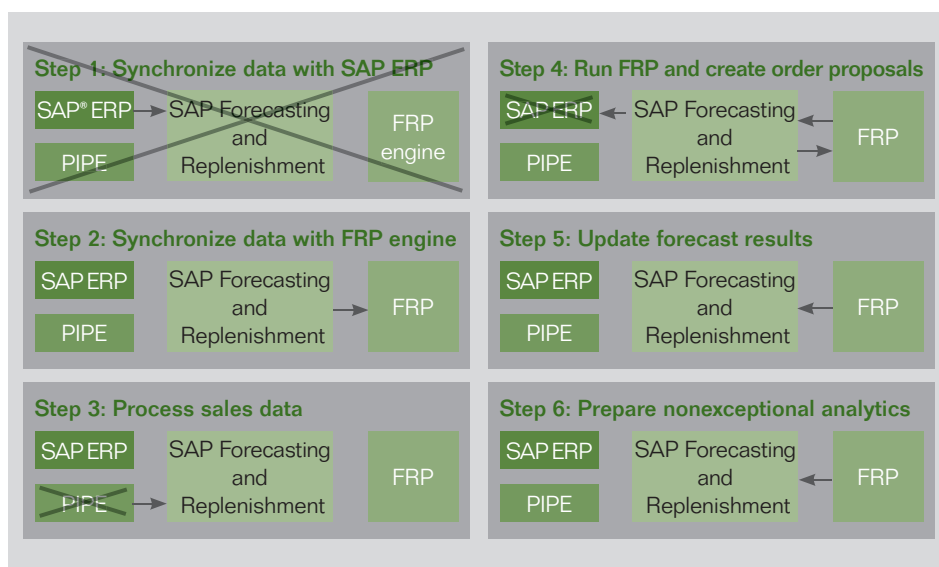


Figure 1: SAP Forecasting and Replenishment Performance Showcase

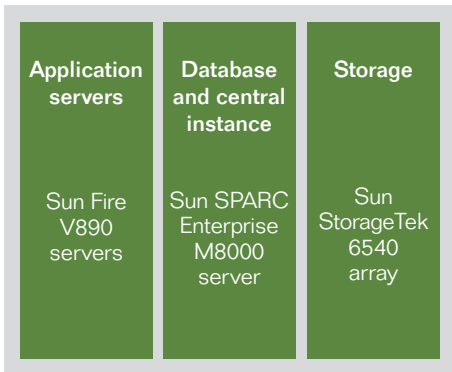


Figure 2: Hardware Configuration Used in the Performance Showcase

Five disk trays within a Sun StorageTek 6540 array were in use within a storage area network (SAN) environment. Store data files were held on Solaris ZFS file systems for persistence and “snapshotting.”

Results and Findings

The **all-in-one option** processed the more than 40 million product and store combinations in 7:05:22 hours for all steps, including updating of the weekly analytical reports (steps 2, 4, 5, and 6 in Figure 1). Because the all-in-one option processes all sequences in one step, it tends to run faster than the step-by-step option. However, especially when there is a small time window, it requires a very high throughput of data, which in turn calls for high-end hardware.

The **step-by-step option** took 8:32:19 hours (steps 2, 4, 5, and 6 in Figure 1). This option benefits from the flexibility of the solution: because sequences can be run separately and scheduled in

times of lesser system load, the step-by-step option is cheaper in terms of hardware. The choice of which option to use is, as always, dependent on the customer’s individual situation.

(In both cases the loading of sales data [step 3] took another 26 minutes to process 8 million records.)

The bottom line is that the runtimes show that the processing of large volumes can be easily scheduled within the expected nightly windows at SAP’s retail customers. They typically receive master data, stock information, and sales data until 10:00 p.m., run only the forecast and requirement calculation in the critical time slot, and schedule updates of forecast and analytics in the more relaxed hours before 6:00 a.m.

This showcase revealed several important lessons regarding the architecture it takes to run large installations of SAP Forecasting and Replenishment:

- It’s important to provide sufficient main memory for the database, file system cache, and SAP software instances. You need approximately 4 GB of main memory per hardware thread.
- A large data buffer on the database is essential.
- Handling of the database’s log buffer and log files turned out to be the most critical bottleneck. As a rule of thumb: to optimize performance, share all active spindles for all file systems.
- Hybrid data storage is recommended for a three-tier configuration (optional on a two-tier configuration). In the all-in-one scenario, there was only a minor difference in the runtime of

hybrid versus central data storage.

- If hybrid data storage is in place, you need to ensure that slow I/O operations on the application server don’t harm the processing of the store data files. The Sun file system (ZFS type) did a great job here – not a single disk read operation on the location-specific data on the file system was performed; all data was read from the ZFS data file buffer.
- If you can execute the individual process steps for a single location together, you can achieve a higher throughput.

Using these tips for their system setup, high-volume retailers will be able to run SAP Forecasting and Replenishment with an acceptable performance level, fully exploiting the capacity of their hardware.

The exercise shows that SAP Forecasting and Replenishment is scalable at reasonable costs for hardware and processing time. Retail customers are able to leverage their investment quickly and use the solution to increase service levels, improve assortment strategies, and ultimately succeed in increasing customer satisfaction and retention.

If you are interested in more detail on this performance showcase for SAP Forecasting and Replenishment, please contact your SAP account manager or visit www.sap.com.

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