Exploiting IBM SAFR to Solve Financial Accounting Challenges

Redguides
for Business Leaders

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- Produce higher quality financial reports with efficiency and agility
- Satisfy business and requlatory requirements for data transparency
- Improve decision making by consolidating and organizing data in a productive manner

Executive overview

Financial services companies face tremendous challenges related to information processing and financial reporting. Some of these challenges are caused by massive increases in both the amount of data and the complexity of financial systems that have occurred in recent years. Others are related to expanded regulatory demands for data transparency and compliance with specific reporting and audit requirements like International Financial Reporting Standards and GAAP. At the same time, the business demands that timely and accurate information be produced in a cost-effective manner, in ways that bestow a competitive advantage, and with the flexibility to respond quickly to changes within the business itself (such as through mergers and acquisitions) and in the larger context of the rapidly changing global economy.

In many organizations the processes for acquiring, maintaining, and accessing information have failed to keep pace with the demands of higher volumes and finer detail. Furthermore, many companies have failed to take advantage of computing capacity that has increased by orders of magnitude since their original, limited finance systems were designed. To be competitive, companies must exploit the power of today's computer systems to decrease IT system fragmentation, address scalability challenges, and decrease reporting pressures in order to provide timely underlying financial details as well as summary data.

A number of commonly used business intelligence (BI) solutions have attempted to alleviate these reporting and processing challenges, but fail to adequately address all the issues. These applications have inherent limitations that range from their effect on system performance, to lack of timeliness and detail of data, slow speed of producing reports, and the inability to access data over dispersed, disparate systems.

In contrast to these typical BI applications, IBM® Scalable Architecture for Financial Reporting (SAFR) provides a nearly ideal financial reporting environment. SAFR is much more than a reporting tool, though. It is an architecture and an approach that provides a complete programming environment, compatible with your existing systems, that solves data processing challenges across a variety of industries. SAFR enables quick and efficient processing, while scaling to deal with almost unimaginably large volumes of detail data, by leveraging the industry-leading capabilities of IBM System z®.

The SAFR Financial Management Solution (FMS), built on the SAFR platform, was developed over a decade of work with some of the world's largest financial services organizations. It provides accurate, consistent, transparent, and timely data at any desired

level of detail. FMS can produce multiple outputs, such as data cubes, reports, and data marts. Processing rules are under the control of finance rather than embedded in programs in source systems, and an intuitive user interface enables finance personnel to manage and control their own accounting rules and reports, and reduces the complexity of looking at the data. Reducing the amount of time spent on the low value mechanical activities of assembling numbers enables finance practitioners to shift their focus to more productive activities, like analyzing the data and making business decisions.

This IBM Redguide™ publication describes the SAFR solution and FMS, and demonstrates how these IBM offerings can help businesses solve their data processing challenges and meet their financial reporting needs.

Financial reporting challenges

The recent financial crisis has exposed systemic problems faced by the world's largest financial institutions when attempting to adequately account for and report on liquidity; positions; currency exposure; credit, market, and interest rate risk; and product, customer, and organizational performance. The CFO plays a critical role in correcting this problem by leveraging the financial data they already control, as well as leveraging scale to take out cost. But even industry insiders do not realize that financial institutions suffer a unique set of domain problems when it comes to financial reporting.

Standard financial systems architectures have remained unchanged in fundamental ways for decades. They tend to be built on a rather simple model that has been consistent since accounting was first automated (Figure 1). Transactions are posted using classifications to a summary structure, then reporting and analysis is done from the summary structure. Details captured at the transaction level but not posted to the summary structure are effectively lost from view.

Those lost or unreported details could be crucial to the business for a number of reasons, including:

- The ability to respond to rapid changes in the competitive business environment requires fast access to information, often compiled in totally new and unique ways.
- Good business decisions depend on timely and accurate information presented at the appropriate level of detail.
- The current regulatory environment demands a high level of transparency and traceability across the financial enterprise.

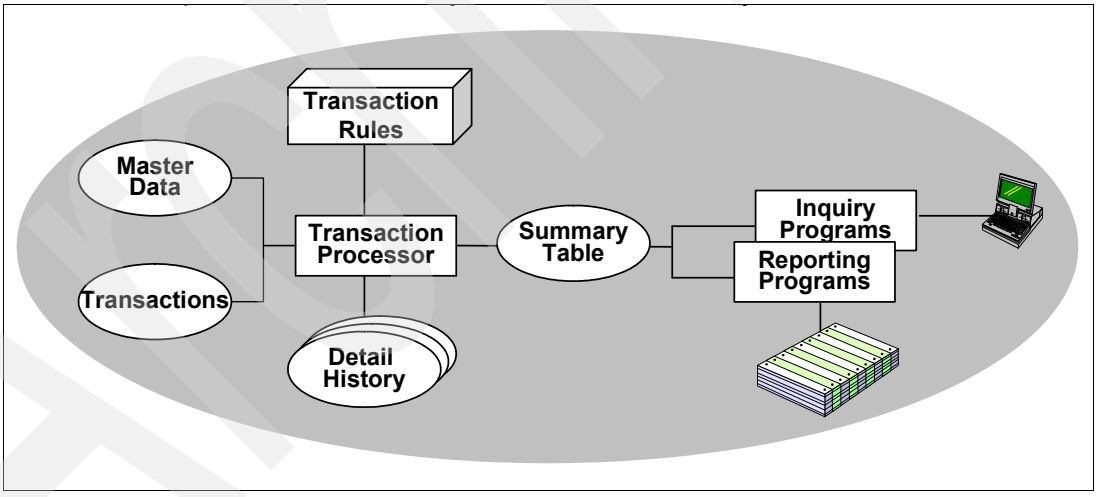

Figure 1 Business information systems model

The summary results generated by typical finance reporting systems are by and large accurate, and are clearly the first step in enabling actions. However, the responses tend to be similarly general, such as "reduce spending," "drive more revenue," or other broad brush management edicts. Reports that provide additional details would enable more specific actions, but standard reporting architectures provide limited amounts of such detail.

When the underlying drivers of results in summary reports are required (daily transaction details, for instance), ad hoc efforts are often employed to achieve some level of detailed data reporting. These efforts are generally manual in nature, and involve searching for details in

source systems, recreating the data in spreadsheets, and finally performing the analysis. These reactive processes are inherently inefficient and prone to error.

The next step in the quest for detailed data has been an automated IT solution. This usually means obtaining another copy of the detailed business events, creating another set of processes to post the details to summaries, and managing these different cuts of data that respond to only portions of the total business questions. In some cases, costly efforts are required to reconcile these results to the mainline summary flow (Figure 2). This approach leads to a proliferation of reports, summary structures, and systems.

These additional systems create parallel data feeds in different but related systems, resulting in duplicated processes, additional reconciliation demands, and redundant databases, and yet there still can be gaps in the desired data detail. The complex environment that results increases IT systems inventory and IT expense, requires additional mapping rules and reference data maintenance tasks, and is an easy target for manipulation.

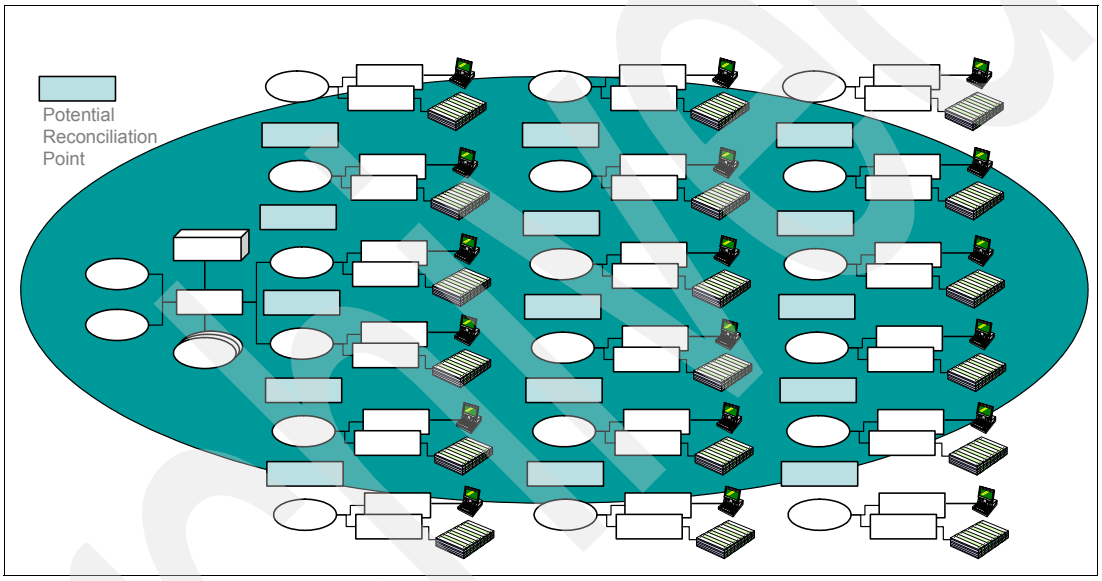

Figure 2 Multiple reporting solutions create reconciliation problems

This fragile reporting environment is fragmented in many organizations by the existence of multiple ledgers, databases, and financial data warehouses that represent various lines of business, or that have resulted from corporate mergers. Very large amounts of data often reside on many different platforms and in widely dispersed locations. Achieving a comprehensive view of such siloed data is identified as a huge reporting pain point in the financial sector.

The timeliness of data is another critical concern. Most business intelligence reporting is based on queries against information housed in data warehouses that are difficult to keep current. Most companies acknowledge a backlog of weeks to months in processing data into the appropriate data warehouse. Thus business decisions get made based on stale and potentially no longer valid data.

Significant performance problems are yet another challenge in the traditional finance reporting environment. Queries against large volumes of data can run for almost unimaginably long periods of time, hours or even days, and can degrade performance across the entire enterprise.

The result of all these challenges has been the evolution of a reporting structure that is, in general, distanced from the original data source, relying on summary data, and burdened by

complex reconciliation and restatement processes. As illustrated in Figure 3, there is the very real danger of misinterpretation when data is looked at in a fragmented state rather than holistically across the enterprise, leading to inaccurate conclusions and poor decisions.

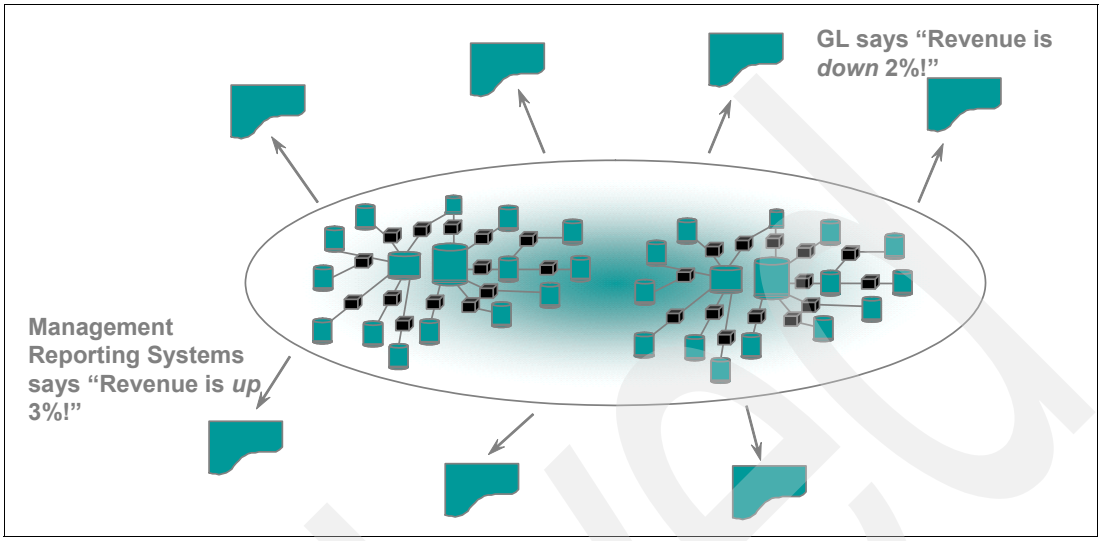

Figure 3 Data from different siloed data warehouses might foster inaccurate conclusions

In addition, with so many copies of the data, IT infrastructure teams must deal with increased levels of network traffic, server and storage resources, database administration, and workload management, as well as the risk associated with distributed privacy, security, and audit issues.

Striving for the ideal financial reporting system

Now that we have defined the challenges financial organizations face, let's take a moment to consider what capabilities we would want in a financial reporting system to solve these problems. An ideal system would utilize the best technology to produce timely, consistent, detailed, and transparent data outputs; have the flexibility to adapt to changing reporting requirements and business demands; and provide a secure and scalable environment. And it would deliver this functionality in a solution that could be implemented quickly and managed easily, all while reducing the total cost of the financial function.

Next we look at some of the approaches that have been taken to achieve an ideal financial reporting system, and identify the impediments to success that they face. Then we propose a transformational approach that comes much closer to delivering the ideal system.

Traditional financial reporting systems have failed to take advantage of the latest advances in computing technology. Instead they have relied on simply automating what had once been manual processes while adhering to the typical summary report framework. As demand grows for transparency of reporting details, this conventional reporting approach is reaching its practical limits.

Furthermore, business intelligence systems built to try to meet expanding reporting demands generally are not integrated with online systems and use copies of the operational data, which by their nature are subsets captured at some earlier point in time. And, as data is summarized and filtered for each new reporting system, this approach requires additional processes for accounting, auditing, reconciliation, and restatement. Information gap problems are solved in different ways as specific needs arise, perpetuating fragmentation in the finance systems architecture, and adding more and more costs. In other words, the efforts to meet

growing financial reporting needs have not been leading organizations towards an optimal environment, and in fact these efforts often have contributed to the problem.

Transforming financial reporting – the SAFR solution

To move towards the ideal reporting solution, companies need to transform their approach to acquiring, organizing, and synthesizing financial data across the enterprise. This transformation starts with rejecting the prevailing finance systems architecture that provides only summary results. Harnessing the power of today's processors and software enables daily tracking of customers/contract relationships. These details can be rapidly compiled to produce consistent, reconciled reports providing real business value.

The data store typically starts with finance data, and can be expanded to other finance processes such as risk assessment, and eventually to business performance reporting needs outside of the typical finance responsibilities. The unparalleled scale and performance inherent in SAFR means that business processes can be changed from monthly and quarterly to daily, and can enable spotting trends and minimizing risk in a timely fashion.

Our transformation solution goes to the heart of the detail required for business management as well as to meet legal and regulatory demands. The transformed system will:

- Address a much broader set of requirements than the existing fragmented systems supporting financial reporting
- Concentrate control, audit, maintenance, and support processes, resulting in higher quality information at a lower cost
- Adapt to changing requirements, scale to meet new demands, and be easy to implement

The IBM Scalable Architecture for Financial Reporting (SAFR) software and SAFR Financial Management Solution (FSM) provide a blueprint to transform financial reporting systems and deliver a solution that is cost-effective, adaptable, scalable, easy to use, easily auditable, and simple to implement.

Data processing challenges

Large organizations face a variety of data processing challenges related to the volume of data they handle, the complexity of processing, and also to the complex IT environments that develop as companies expand globally, merge, add lines of business, and so forth.

Conventional processing methods burden system resources with higher and higher usage, and they are unable to efficiently and economically scale to meet the processing needs of the largest companies. Processes compete for CPU cycles, memory, and I/O channels; sequential processing of large data volumes slows performance; multiple programs reading the same data results in resource contention.

Traditional ways of dealing with large volumes of data include creation of filtered or summarized files and adding indexes. But most companies struggle with the disadvantages of these approaches. Filtered files and summarized files are overhead, they require costly updating processes, and they take up disk space. It is difficult to handle changes in dimensions and to predict which records and fields should be retained. All the additional files add to the burden of reconciliations. Similar difficulties exist for indexes, plus the I/O through the indexes slows down mass data retrieval.

Solving data processing challenges – the SAFR approach

The SAFR FMS architecture solution and its reporting capabilities are powered by SAFR patented software, which is designed to handle wide-ranging data processing challenges. Thus, understanding how the SAFR software solves data processing problems provides key insights into how the SAFR FMS architecture makes financial systems transformation possible.

The SAFR solution is an architecture and approach to data transformation, data movement, and data processing. SAFR provides a programming environment that is compatible with your existing systems, enabling you to tailor your solution, integrating SAFR with UNIX® services and various BI tools.

SAFR solves business intelligence problems for extremely large volumes of data, especially in the financial services and insurance industries. Despite its name, however, SAFR is not confined to a role only in those industries. SAFR's processing power is also popular wherever performance is a top priority, such as among ERP users, including manufacturing companies with large databases and complex reporting needs.

SAFR has been used to solve processing, reporting, and analytical problems for over two decades in a wide variety of companies. In "SAFR sample projects" on page 18 we describe some of the non financial service needs that SAFR has satisfied; "SAFR technical features" on page 13 provides some of the technical details illustrating how SAFR and FMS have achieved these successes.

Introduction to SAFR and FMS

This section presents an introduction to the components that make up the SAFR infrastructure and describes how these elements have been refined into the FMS offering.

SAFR components

The SAFR infrastructure software, a hard asset with hundreds of thousands of lines of source code and a feature set rivaling some of the best known commercial software packages, is most often what is thought of when one refers to "SAFR." Shown in Figure 4 on page 8, it is the heart of the SAFR solution. It delivers:

- A high performance mainframe utility that allows business logic to be applied during batch scanning processes.
- A scan parallel processing engine that generates very efficient machine code for IBM z/OS®.
- In-memory piping between processes to eliminate additional I/O.
- Efficient join algorithms which operate on the order of 500,000 joins per CPU second, while its processing capabilities consistently achieve a throughput of a million records a minute.
- Multiple outputs via multiple processes in one pass through high volumes of reporting data.

The SAFR workbench is a parameter-driven front end that allows users to define metadata (for example, input record layouts, physical file characteristics, and lookup paths). Building SAFR views or queries is handled by the workbench through the SAFR view wizard and view

editor. Users specify the input files, transformation and filtering logic, output layout and format, and processing logic required to meet business needs.

The SAFR performance engines include the programs and scripts required to execute the logic specified in SAFR views. The performance engines consist of several steps required to efficiently process and format the input transaction and reference data.

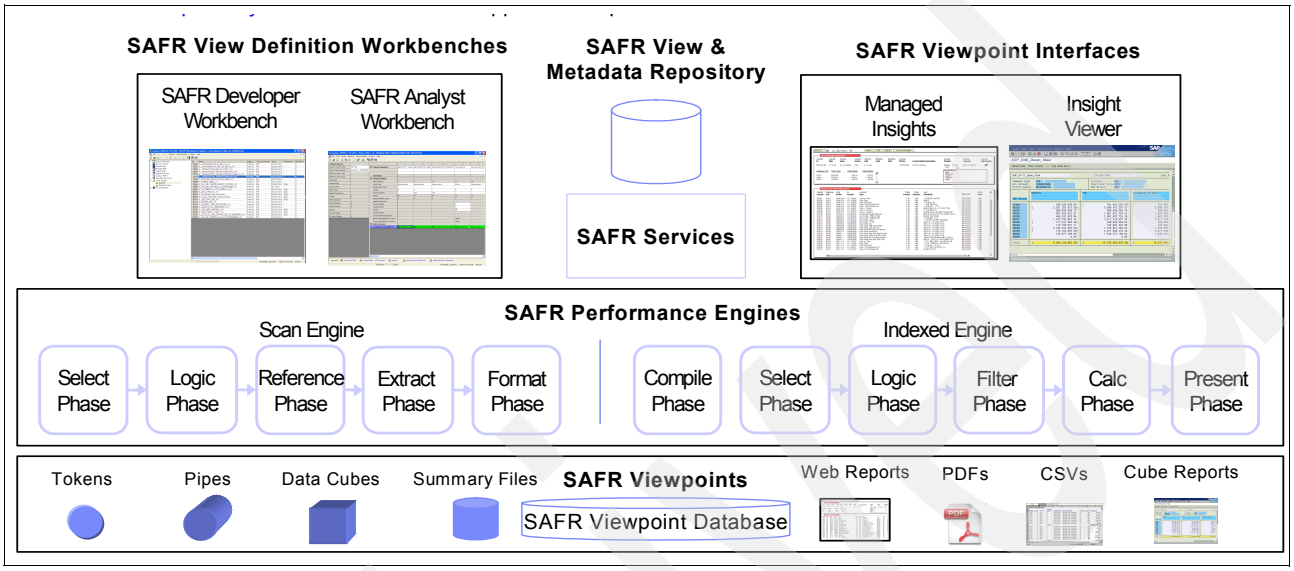

Figure 4 Infrastructure software conceptual framework

SAFR can access multiple types of mainframe-based data, including IBM DB2®. For example, it can read sequential files based on the input format specified, then look up certain fields in a VSAM file or in another sequential file. SAFR can produce output in yet another format – with additional calculations as required. The entire process is called a *"View,"* and any number of Views can be defined. SAFR also commonly processes data from other platforms that are fed into its engine. Potentially, any entity that can be read sequentially would be a good data source for SAFR.

SAFR use overview

Reporting and analysis systems can be divided into three functional areas: data sourcing or extraction, transformation, and loading (ETL); the data repository; and the presentation layer. Typically, separate vendor tools are applied in each area. SAFR crosses these boundaries to integrate and unify data resources. It supports ETL, data access and manipulation, and presentation functions.

SAFR provides direct access to data stored in a variety of formats. Similarly, SAFR can create several different output formats. Handling multiple business functions in a single tool, with the added capability of reading and producing different formats, allows you to solve difficult problems in a cost-effective manner.

SAFR is more than a combination of business intelligence processing functions and database query tools. It can be used to build complex application subsystems usually created by custom development. Examples of actual implementations created by our clients include multi-currency revaluation, billing systems, and cost allocations processes.

While many tools have complex operating environments and user interfaces that require prior programming experience to use proficiently, SAFR has a parameter-driven interface that

eliminates the need for custom coding and reduces the implementation time frame. Additionally, the parameter-driven interface permits both non-technical and technical users to use the tool effectively. For example, at one state government client approximately 200 finance users create SAFR views (that is, queries) to produce reporting results. At a manufacturing client, a handful of IT resources support the data repository and create standard and ad-hoc reports using SAFR.

SAFR Financial Management Solution

Over the last ten years, while configuring the SAFR infrastructure software for some of the largest financial services organizations, IBM Global Business Services® has refined an approach for the industry. This offering is the SAFR Financial Management Solution (FMS).

SAFR FMS is neither a typical IT system nor is it a standard business intelligence application; it is a comprehensive financial system architecture that can take you well into the 21st century by offering a new approach to business intelligence. While other reporting techniques require pre-processed files that are already summarized, filtered, or denormalized, and typically involve scores of systems, SAFR offers a solution that provides a complete view of the data with a single pass architecture that can post and report from the customer/contract level of detail.

It can do this by daily posting and reporting from an arrangement ledger, effectively managing millions of individual customer/contract ledgers each described by hundreds of required attributes for today's financial reporting. The solution transforms financial statements into daily, rather than monthly instruments to achieve the highest possible accountability, transparency, and timeliness.

SAFR increases relevance and cost effectiveness of financial information delivery by:

- Using rules defined by the business, enabling accounting processing control with minimal IT involvement.
- Helping mitigate issues with reconciliation and restatement through a single view of the data.
- Running quickly and efficiently.
- Scaling to deal with large volumes of detail data and table joins.
- Storing varied, complex data to generate reports from a single scan.
- Creating multiple outputs, such as cubes, reports, and data marts.
- Eliminating the need for additional transformations of the source data, allowing a simplified yet flexible and responsive data model.

Notice the similarity between this list and the characteristics of an ideal financial reporting system described previously.

Figure on page 10 presents a context diagram for the SAFR FMS. As implemented in a typical financial services company, the solution accepts daily feeds, beginning with legacy general ledgers and then transitioning to detailed product systems feeds at specific customer/contract relationship levels. In the accounting rules engine, the feeds become complete journal entries at the customer/contract or arrangement level. Processing rules are under the control of finance rather than embedded in programs in the source systems.

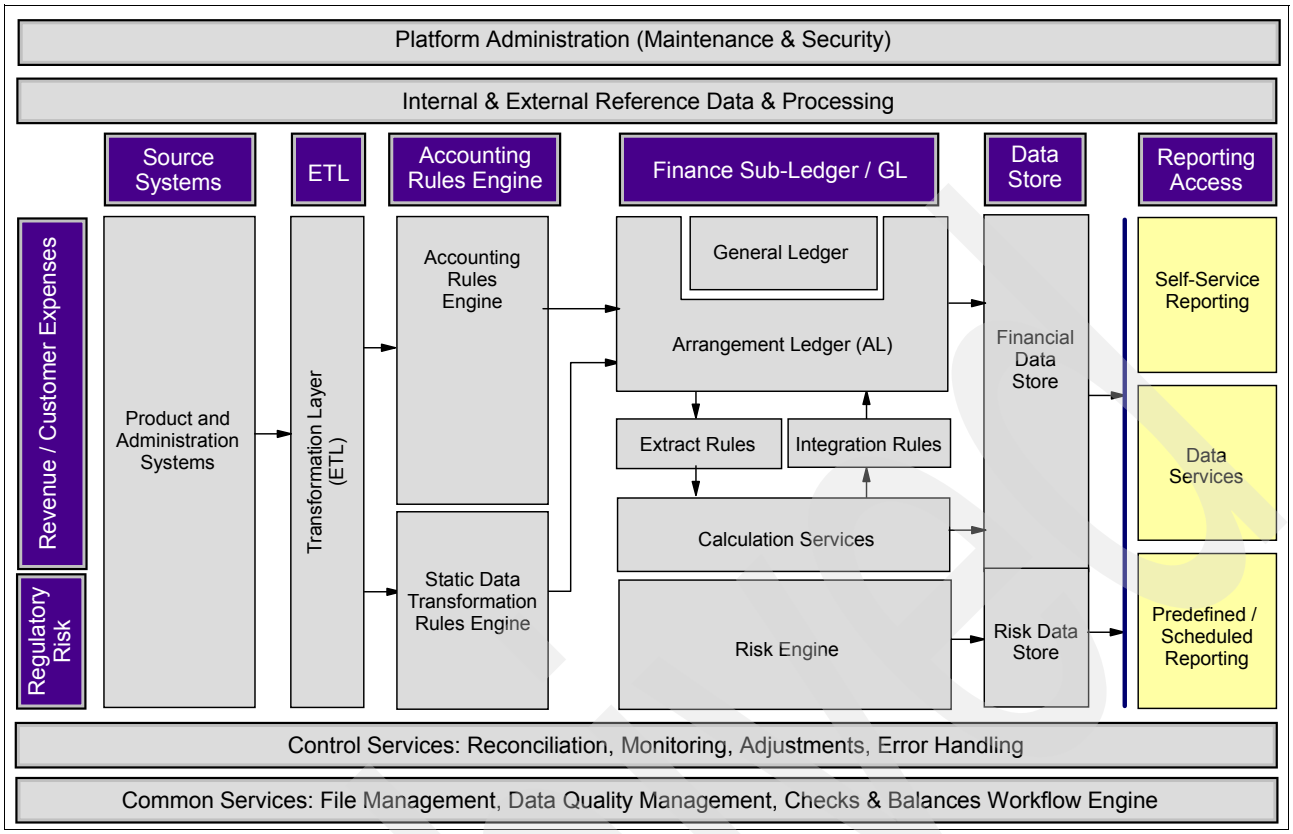

Figure 5 The SAFR Financial Management Solution

The journal entries are posted in an arrangement ledger on a daily basis, maintaining balances at the customer/contract level. The arrangement ledger generates additional journal entries based upon existing balances, performing all the accounting functions needed at this detail level. This includes multi-currency processes conversion, translation and revaluation; intra-unit and inter-unit elimination, reclassification reflecting differences in accounting treatments according to GAAP, and year-end close processing. It accepts and properly posts back-dated entries to the appropriate day, and walks forward reclassification processes for any affected attributes. It also summarizes the accounting rules engine journal entries to the accounting code block level and passes these to the general ledger.

The general ledger re-performs many of the arrangement ledger functions at the summary level. Thus the general ledger provides another control point for the traditional accounting view of the data. The arrangement ledger detects the need to perform reclassification, keeping the arrangement detail aligned with the summary general ledger information and preventing stranded balances.

The arrangement ledger accepts the general ledger results, and posts its detail and the summary journal entries, effectively maintaining complete daily balance sheets and P&Ls at the customer/contract as well as the summary level. Additionally, it accepts from the accounting rules engine arrangement records with hundreds of additional attributes to describe each customer/contract relationship, and counterparty or collateral descriptive attribute. These additional attributes can vary by products, geography, or organization. They can also be sourced and supplemented from external market and reference data. Thus the arrangement ledger balances are not described only by the limited attributes of the traditional accounting code block.

The arrangement ledger produces various cuts, perhaps ultimately numbering hundreds or even thousands of summaries to support information delivery for not only traditional accounting but also statutory, regulatory, management, and even risk reporting. The end result of arrangement ledger processing is the incredibly information-rich financial data store.

Information delivery includes multiple ways of accessing the arrangement ledger and financial data store. The major window is through SAFR Enhanced Managed Query. This parameter-driven Java™ application provides thousands of different permutations of the data. It allows drill-down from summaries to lower and lower levels of data without impacting online response time. It allows dynamic creation of new reports and multi-dimensional analysis of the detailed information in financial data stores. It uses many of the performance engine processing techniques for performance (refer to Figure 4 on page 8). Reports that require significant processing time are delivered via the SAFR Performance Engine. Extract facilities provide the ability to feed other applications with rules maintained by finance, again using the SAFR performance engines. Other reports provide automated reconciliation and audit trails.

Referring again to Figure 4 on page 8, the indexed engine is at the heart of managed insights. Report structure and layout are dynamically defined in the analyst workbench. The indexed engine uses the SAFR viewpoint database, loaded with outputs from the scan engine and other sources. The indexed engine creates reports in a fraction of the time required for other tools. Its unique capabilities allow for a movement-based data store, dramatically reducing data volumes required both in processing and to fulfill report request.

SAFR business value

The SAFR solution can help support corporate strategic decision-making. It has a proven track record and has been used to address real business problems such as high performance account activity analysis, product pricing, fraud detection, and multi-dimensional sales revenue analysis.

Among the business benefits that actual users are experiencing with SAFR are the following:

- Regulatory reporting: Classification of balance sheet positions by detailed breakdowns of customer, product, and maturity characteristics.
- Liquidity/interest rate risk management: Daily review of maturity gaps by account, product/deal, legal entity, cost center, and currency.
- Intercompany transactions and consolidation: Disciplined booking of intercompany transactions on a timely basis using consistent valuation and accounting treatments in a multi-GAAP/multi-currency world for deal-level visibility at both local and group levels on a daily basis.
- Transfer pricing: Deal-level detail to properly match funding rates with exposures and measure results of operations distinct from results of treasury actions on a net interest margin basis.
- Group reporting and analyses: For explaining the results of operations behind share price. Group finance organizations are the broadest consumers of detail data (International Financial Reporting Standards (IFRS) and Generally Accepted Accounting Principles (GAAP)).
- Re-class, multi currency, IUE, CE, interim close, year end close: Applying all accounting at the detailed financial event level.

Improved transparency and better decisions

The strength and uniqueness of SAFR lies in its ability to incorporate the freshest operational data along with detail history to provide the most up-to-date business reports.

Reporting directly from event or transaction level operational data, as shown in Figure 6, can produce timely, consistent, and transparent outputs, and can be highly responsive to changing business needs. Furthermore, enabling this single view of the data can help reduce the amount of siloed data in the enterprise and lessen the pain of complex infrastructure and accounting practices.

Transaction details usually have all the attributes needed for reporting processes. When reporting rules are separated from transaction systems, they can be changed over time using the inherent flexibility of detailed history data. The summary structures should be viewed as temporary, to report today's business intelligence, rather than a permanent viewpoint of the data. When summary structures are all produced from the same detailed data, additional reconciliations are not needed. Multiple perspectives, even restated views of history data, can be formulated using the same detail.

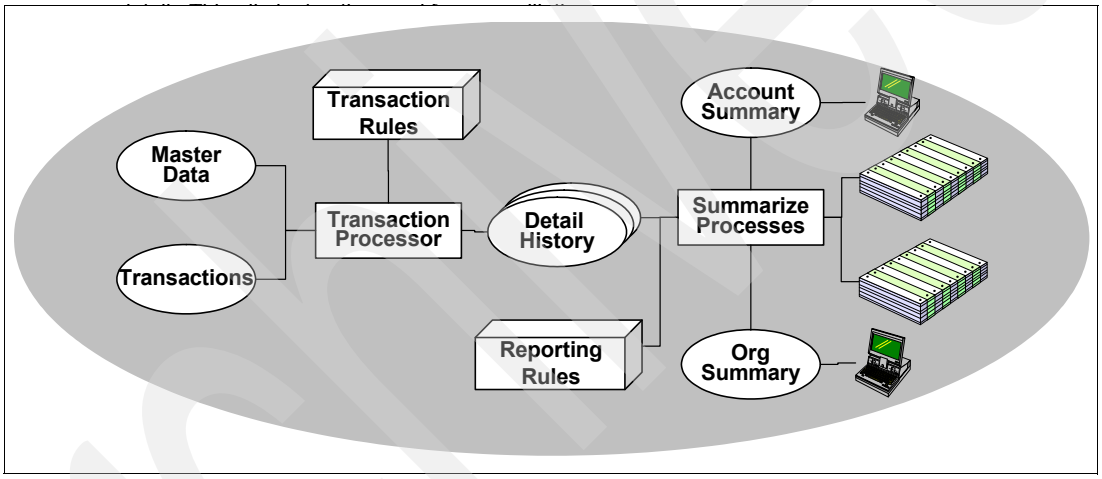

Figure 6 A solution for better reporting results

Other reporting techniques make it difficult to change the view of historical data, such as when you need to redraw roll-up structures, make retroactive adjustments, or backdate transactions. In contrast, SAFR's high performance effective-dated lookups enable the viewing of data across different points in time, making restatement and alternate viewpoints for business modeling easier.

Achieving BI objectives

Providing the business intelligence needed to improve business performance requires highly adaptable and responsive systems that can disseminate pertinent information at an appropriate level of detail. Using detailed transaction-level data as the backbone of what gets reported, SAFR provides an almost endless adaptability to changing business demands. Furthermore, because of the high performance processing of SAFR, new business questions can be answered quickly using existing detailed data.

IBM SAFR applies proven methods and techniques to deal with the high volume and scalability challenges that arise when providing that level of adaptability. The SAFR approach transforms how business information is managed and reported.

A SAFR solution can benefit companies of many sizes in a variety of industries. In particular, it can be very useful for organizations facing the following issues:

- Companies under regulatory scrutiny.
- Global corporations undertaking an enterprise finance systems initiative, including an ERP implementation focused on GL, standardizing local and group financial control.
- Companies with multiple ledgers and financial data warehouses.
- Large companies with significant diseconomies of scale and costs trending upwards.
- Companies with a lot of manual reconciliations/mapping for critical functions.
- Companies with significant performance problems or batch windows difficulty in any report and extract production processes.

For details on how to start with SAFR, refer to “Next steps” on page 22.

Controlling BI costs

In practice, SAFR is much like a “factory” for reports. Factories are able to manufacture products inexpensively on a per-unit basis because of the efficiency of sharing resources and processes. Similarly, SAFR can achieve economies of scale by executing multiple reports simultaneously and sharing resources. For example, if you are already running forty queries or reports, the forty-first report will add just a small incremental cost because you are already scanning the source data, and you might be able to share the data join information. Given the number of queries that SAFR can execute simultaneously, the SAFR solution can be very inexpensive when evaluated on a cost-per-report basis.

A SAFR solution can drive the following financial advantages:

- Finance system processing time and cycle time for reporting is reduced. This allows for changing reporting cycles from monthly or quarterly to daily, resulting in increased opportunity for analysis and earlier detection of problems.
- Outputs can be produced that are applicable to a wider segment of the organization, rather than focused on mandated but less meaningful regulatory or statutory reporting. This returns value to the business, rather than making finance appear as a stress on the organization.
- Reconciled views of the integrated financial data frees finance personnel to perform business analysis rather than system and data reconciliations, and reduces the overall cost of the finance function.

All of these financial advantages are critical to appropriately managing market and operational risk.

SAFR technical features

SAFR delivers trusted, timely, and relevant information from fragmented, disparate systems at the volume and velocity required to address diverse business needs. The features and capabilities it uses to accomplish this are outlined in this section.

High performance data processing tool

SAFR includes a high performance data processing platform that enables data management and analysis procedures that are not practical with standard tools. SAFR can empower most aspects of the data warehousing process including extraction, transformation, query processing, data mining, and report generation.

Single pass architecture

Unlike other query tools, which require that data be retrieved from disk each time it is needed, SAFR reads each record from the database or file once. Each record is made available to all queries being processed, thereby preventing wasted I/O or resource contention from multiple programs reading the same transaction data. This single pass architecture reduces the processing time for all users, efficiently uses available memory, and resolves multiple business problems simultaneously, thus making the most of your computing resources.

High speed lookups

SAFR can combine data from multiple files into a single report or extract at lightning speed. Experts have known for years that accessing data from memory is hundreds of times faster than accessing it from disk. Because SAFR is processing multiple queries, benefiting from highly optimized data transformation engines, it can use this feature without requiring a dedicated machine. SAFR's lookup algorithm is highly tuned and can process lookups at a speed of 500,000 per CPU second. This power gives you the ability to combine high volumes of data in the most meaningful ways.

Parallel processing

SAFR can use multiple processors to resolve queries in the shortest amount of time possible. SAFR efficiently handles extremely high volumes of data by breaking large files into smaller pieces, processing them in parallel, and recombining for multiple outputs. The use of parallel processing dramatically improves the speed of information delivery, yielding much higher performance than sequential processing.

Handling scalability issues

The aggregation of processes yields a high performance solution that is scalable to almost limitless size without adding costly additional hardware and incurring more operational overhead, as illustrated in Figure 7.

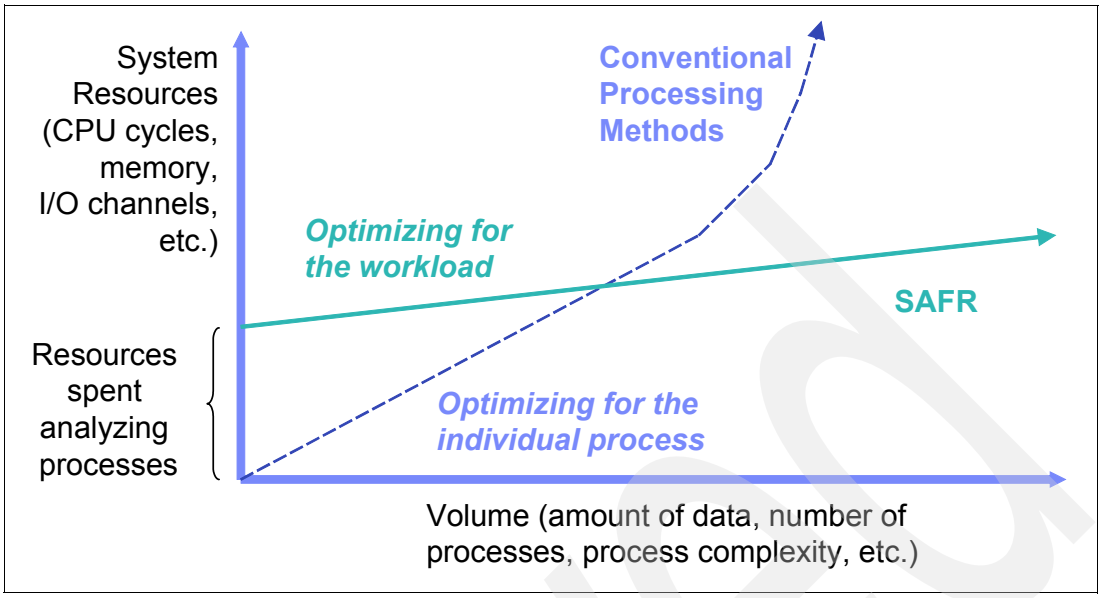

Figure 7 SAFR's aggregation process

As the amount of data and complexity of processing increases, conventional processing methods, which are optimized for each process, burden system resources with higher and higher usage; they are unable to efficiently scale to meet the processing needs of the largest organizations. SAFR is optimized for the whole workload being processed. SAFR analyzes the processes in the workload up front, then optimally aggregates processes, more efficiently using system resources as demand increases.

Open API for easy customization

SAFR has multiple API points. Through the use of APIs, you can develop functions to perform specialized processing. Users have created dozens of functions, executing specialized logic, performing complex data transformations, reading arcane database structures, or applying customized formatting to reports. Use of the APIs turns SAFR into a very powerful development environment.

Technology value

Implementing SAFR enables the organization to make the most efficient use of increasingly precious data center space, power, and cooling. Business intelligence solutions are among the most demanding consumers of costly server infrastructure, but a SAFR solution is designed to use computing resources in an optimal manner.

SAFR can enhance existing technology investments and extend the capabilities of large, packaged enterprise applications. It accomplishes this by executing highly tuned batch reporting workloads on an IBM System z. SAFR can exploit the IBM System z strengths by:

- Processing on a platform with lower processor footprint.
- Using compiled assembler-generated code for efficiency.
- Leveraging a single pass architecture utilizing in-memory joins with a small amount of read/write data.

- Accomplishing faster throughput rates of 1M transactions per minute (compared with a few thousands per minute in similar solutions).
- Using IBM's commercialized assets to cut the development time, reducing overall project implementation costs.
- Implementing a simpler architecture with few technology components to reduce the overall long-term maintenance costs.
- Running workloads utilizing zIIP processors to reduce overall infrastructure costs.

SAFR can help address the challenges of BI reporting design complexity by:

- Allowing a simpler data model, which avoids the use of indexes, so no provision needs to be made for them in the data model, and reduces the dependence on summary structures.
- Accomplishing the mass denormalization process (a basic part of report processing) efficiently. SAFR allows you to keep data in its original form normalized until the last minute.
- Allowing for easy changes to the data model. Prototyping is easier because of the simpler data model and limited number of files and tables required. The time required to move from concept to production is significantly reduced.

SAFR allows a true event-based architecture, enabling your information systems to provide insights into the complex events that surround measures of business performance much closer to the time those informative events occur. Thus your business intelligence systems can better empower management to run the business in real time, rather than just warehouse data for historical query.

SAFR and the IBM System z advantage

IBM System z, already an acknowledged leader in online transaction processing (OLTP), can be a solid foundation for operational business intelligence in your enterprise. Many vendors cannot supply a truly efficient and high performance operational reporting solution because using operational data has drawbacks, the volume of detail history can be overwhelming, and multiple requests contending for access to the data can cause bottlenecks and performance issues in traditionally distributed systems. But System z thrives in this environment.

SAFR exploits recent System z technology advances, including 64-bit z/architecture and the System z Integrated Information Processor (zIIP). SAFR workloads are highly tuned for processor efficiency and SMP exploitation, and typically demonstrate extremely high zIIP eligibility percentages. SAFR's algorithms depend on System z's tremendous I/O performance and z/OS Workload Management (WLM).

The core of SAFR relies on special algorithms that can aggregate multiple BI requests into a single pass of operational data. SAFR operates directly on sequential file (disk or tape), VSAM, and DB2 for z/OS data sources, but extensions are available to feed almost any data source from any platform into SAFR for efficient processing. DB2 is not required but is recommended as a repository for SAFR's metadata.

SAFR uses a single pass I/O approach and takes advantage of the IBM mainframe's extreme parallelism to create multiple reports concurrently. The software is extremely CPU-efficient, with an internal capability to execute report queries using generated, high performance System z assembler code. Most SAFR users run reports daily, generating massive amounts of standard reports efficiently, overnight, during a batch window; but jobs can run at any time,

within or outside your batch window, including concurrently and without disruption to online workloads. Many customers run SAFR at all hours, concurrently with OLTP.

SAFR requires the following hardware and software components:

- IBM System z9® or IBM System z10®
- IBM z/OS V1.8 or later
- IBM DB2 for z/OS or DB2 for Linux®
- UNIX and Windows® V8 or later (for use as a metadata repository and optionally as a data source)
- z/OS DFSORT or equivalent

In addition to making good use of traditional System z resources, SAFR can offload standard CPU cycles to the System z Integrated Information Processor (zIIP). By doing so, SAFR can make batch reporting workloads very cost-effective.

By employing economies of scale on System z, many previously intractable problems can now be solved quickly and efficiently. For those customers that do not currently have System z, options are available for either managed hosting or for near turn-key installation with rapid training.

Integrating SAFR and existing systems

The SAFR high performance solution integrates with existing systems to provide a single information landscape for the enterprise, including underlying levels of details.

Why integrate with SAFR

SAFR takes fragmented data from different sources and layouts and produces a consolidated, detailed view of it. The integration of SAFR with disparate data reporting systems:

- Scales to handle large volumes of detail data and table joins.
- Stores varied, complex data to generate reports from a single scan.
- Mitigates issues with reconciliation and restatement through a single view of the data.
- Creates a simplified, yet flexible and responsive data model.

Solution interfaces

Typical of most financial processes, information is fed from a large number of source data files. Within SAFR FMS, the Technical Transformation Layer (TTL) can be written in any language to accomplish basic interface processing and prepare for the accounting rules engine, and it can be on any platform. However, the FMS solution efficiently deals with detailed data feeds from product systems, and in order to achieve the required performance within processing windows, SAFR, used in the Arrangement Ledger (AL), is a z/OS based product. Thus an important consideration when deciding where TTL processes should be performed is minimizing data transfers between platforms to allow optimized AL processes.

SAFR can output extracts, using transformation rules to create interface files for your integrated enterprise. Therefore, integrating SAFR within your architecture can deliver the benefits of SAFR's high performance processing to other applications beyond FMS.

SAFR sample projects

In this section we present overviews of some real-world processing scenarios as implemented at IBM clients. Each project demonstrates key features of SAFR that lower costs, increase security and efficiency, or in other ways enhance the business. They also demonstrate the strength of the SAFR solution beyond the financial services industry.

SAFR helps reduce risk from fraud and mines data for lost revenue

The complexity of airline ticketing processing makes it an easy target for fraud. Statistical sampling at a major airline found millions of dollars in losses each month, but when statistical sampling could not stop the problem, the client turned to a SAFR solution instead. Programmers used the SAFR API to connect to their legacy hierarchical database. They executed queries against the database, looking for cases of fraud and suspicious patterns. SAFR spawned 30 parallel processes, which read 170 different partitions from the production database and resolved 23 different queries in a single scan of the source data. As a result, the company identified all the cases of fraud detected within the statistical sample. But SAFR took them beyond sampling, identifying all similar cases from an entire year's worth of tickets. The company immediately dismissed a number of employees and issued debit memos to violating travel agencies. It recovered millions of dollars in lost revenue.

The metrics for this SAFR solution were:

- Queries against a ticket database with four months of data, containing:
  - 14 million tickets
  - 562 million records
  - In approximately 50 entities
- More than 20 queries were designed to detect fraud in advance purchases, government fares, and exchanges.
- The queries yielded the following results:
  - 1 hour and 43 minutes elapsed time
  - 408 MB of memory used
  - Identified 48,681 potential violations

SAFR helps build a sales reporting system

A snack food company, with no prior z/OS or IBM System z experience, wanted to grow its business through its national sales force. To be effective, the sales force needed detailed customer, product, and organization reports for:

- A variety of time periods spanning three years
- 60,000 customer stores buying over 1 million units of the 2,000+ items per week

The solution was to:

- Build an event-based repository using SAFR to supplement a large ERP package

- Use SAFR effective-dated look ups to recast historical detail to reflect management, product, and customer structures

Using this repository along with simple to understand queries, members of the sales force could analyze customer and product information daily, weekly, monthly, YTD, and for specific periods from three years of data. The final result of this SAFR implementation was growth in net income. In addition, the SAFR solution helped the client integrate three additional companies.

SAFR helps set pricing policies

The reporting application at an insurance data warehouse uses SAFR for data access to the operational data store and sets pricing policies. The application runs during online hours, and the data store has the following characteristics:

- Loads and extracts data from a 1.4 TB (19 billion row) operational data store
- 40 different user queries or extracts for a total of 46 million output rows requiring joining data from (on average) 20 different entities

In just 20 minutes, the application achieved:

- 2.2 billion rows read
- 1.2 billion joins performed

Usage patterns/scenarios with SAFR and other IT domains

Although the name suggests SAFR only operates on financial data, and obviously that is an important market, SAFR's high performance processing provides benefits to almost any industry with large quantities of operational data.

Enterprise information management

SAFR is a high performance technology for your enterprise information management, to address data architecture, extraction, transformation, movement, storage, integration, and governance of enterprise information and master data.

Business intelligence and performance management

SAFR empowers discovery of business insights, decision making, and improved business performance; its high performance processing enables timely access, analysis, and reporting of actionable, accurate, and personalized information. SAFR also has close synergy with most business intelligence products, including IBM Cognos® and IBM InfoSphere™ solutions.

Advanced analytics and optimization

SAFR can provide more power to analytics and data optimization, helping clients gain greater precision and predictability out of every business decision that they make. IBM's advanced analytics and data optimization solutions and offerings allow clients to simplify, connect, and more effectively use information, and to get closer to their customers to be more competitive.

Service-oriented architecture

SAFR enables a true business-event-based architecture which can complement service-oriented architecture (SOA). As a business-driven IT architecture approach, SOA supports integrating the business as linked, repeatable business tasks, or services. This flexible approach allows organizations to update or reorchestrate or even incorporate new tasks to meet changing business conditions without rebuilding their systems.

Meeting non-functional requirements with SAFR

This section describes how the features of IBM System z perfectly complement the non-functional requirements of SAFR and FMS, thus demonstrating why System z is the recommended platform on which to implement a SAFR reporting solution.

Performance

The SAFR FMS is built for performance, which is one of the crucial factors that limits the ability of traditional financial systems to scale upward. The technology underpinning the SAFR solution is based on a traditional System z infrastructure with a minimum of overhead. Of course, SAFR also integrates well with other platforms to bring its performance benefits to broader architecture solutions. Refer to “SAFR and the IBM System z advantage” on page 16 for more details.

Capacity

One of SAFR’s greatest strengths is processing high volumes of data. The solution provides numerous approaches for managing the IT infrastructure to handle high volume while meeting performance objectives. A key to successfully handling high data volumes is parallel processing, and SAFR and FMS have parallel processing built in from the ground up.

The following types of parallelism are built into the system:

- The FMS system is architected for process parallelism of source systems; they are processed through the Technical Transformation Layer (TTL), the Accounting Rules Engine (ARE) and the Arrangement Layer (AL) as independent job flows (see Figure on page 10).
- The Scan Performance Engine (PE) generates and executes machine code in parallel, allowing thread parallelism for large source systems through the AL.
- The Indexed Performance Engine creates reports and extracts in parallel, and uses the scan PE techniques to retrieve process report data in parallel threads.

In other words, SAFR and FMS are built with capacity in mind.

Scalability

SAFR and the FMS architecture provide the ability to rapidly and readily accommodate volume demands. They are built to overcome scale issues.

For example, an actual client’s production arrangement ledger processing was measured as follows:

- It executed on a 10-CPU System z capable of 1,934 MIPS but limited to 80% of capacity by a workload governor. The SAFR Scan Performance Engine started at 03:15 AM, and completed at 03:45 AM. Within those 30 minutes of elapsed time, 21 parallel threads were processed, requiring 2:55:02 hours of CPU time. This is equal to using 6.05 CPU engines running at full capacity for 30 minutes.

- The processes allocated 906 input files and 493 output files for a total of 1,399 files. It read 2.4 billion records (190 Gigabytes), and wrote 72 million records (10 Gigabytes), totaling 1.4 million records (118.35 Megabytes) processed. It performed 873 million native SAFR joins, and 105 million custom extension joins, totaling 978 million joins for a join rate of 563,624 joins per second.

SAFR and FMS lead the industry on performance and scalability, leveraging the strengths of the IBM System z platform.

Availability

The Scan Performance Engine is z/OS zIIP-enabled, allowing transfer of FMS and SAFR workloads to lower-cost zIIP processors, thereby increasing availability on additional processors and lowering costs of the resulting platform.

The Indexed Performance Engine is designed for high availability with load balancing and failover capabilities embedded in the architecture. The Scan Performance Engine relies on System z Parallel Sysplex® built-in high availability to guarantee output delivery.

Systems management and operability

No particular system management facility factors are inherent in the solution. Workload management capabilities are required to manage the parallel processing performance. The solution is rather agnostic relative to specific system management facilities.

Security

The solution relies on RACF® (or equivalent) z/OS security for batch processing. The SAFR workbench, used in configuring processes while in development, has an imbedded security mode for specific developers. The solution accepts feeds from a customer security package to manage user interaction with report processes.

The security advantages are clear: SAFR operates in the strongest security environment and does not force businesses to copy sensitive data elsewhere. A basic security engineering principle is that information should not be spread more than necessary, and then only on a need-to-know basis. SAFR is consistent with this core principle and helps businesses avoid costly security breaches.

Total cost of ownership

IBM SAFR is designed to offer a low total cost of ownership to help increase the return on the IT investment. SAFR provides enterprise reporting at a low cost on a per-unit basis, scalability to grow with your organization's needs, and efficient use of system resources, such as CPUs, I/O channels, and memory. Customizable systems enable you to buy only the technology you need. Reduced need for manpower to build systems and rules can help save time and money.

Standards conformance

A SAFR solution can be configured to support a wide range of financial and auditing standards. It is used in production by major organizations reporting US GAAP, International Financial Reporting Standards (IFRS), and US financial regulatory standards for both banking and insurance. Refer to "SAFR business value" on page 11 for additional details on how SAFR helps the business deliver reports for regulatory compliance.

Future IT trends in financial reporting

Financial reporting transformation has recently become an important agenda item for most companies. Many factors are driving this awareness of a need for change, including escalating regulatory requirements, mergers and acquisitions, market competition, changing business needs, pressure to increase profits by reducing expenses, and so forth.

As companies look at revamping their business intelligence and financial reporting in order to get the relevant and timely details needed to make critical business decisions, several complementary IT trends are also emerging. We see the following trends as potentially important in helping companies achieve their business objectives.

High performance computing for financial reporting

The trend toward high performance computing for data analytics increases the need to exploit parallelism to create complex reports in a much shorter time, an increasingly important feature to look for in a reporting solution. Shrinking batch windows, IT cost reduction initiatives, and complex reporting requirements create challenges that cannot be managed using traditional tools. A high performance tool is needed. With its single pass architecture, parallel processing, join optimization, and ability to use more than one CPU at a time, SAFR is just such a tool.

Enterprise reporting at a low cost on a per-unit basis

The need to lower the cost of disseminating information across the enterprise continues with greater urgency. By deploying a tool such as SAFR to meet many business intelligence requirements in one comprehensive view, a more balanced utilization of IT and business resources can be achieved.

Predictive analytics

Data modeling and financial forecasting are important capabilities for achieving success in most businesses. However, the models will be only as good as the underlying data, so the ability of SAFR to make detailed, accurate, and timely data accessible quickly can be helpful to the accuracy and usefulness of predictive modeling.

Next steps

While the successes achieved in other organizations are impressive, you are undoubtedly more interested in what this technology can do for you. You might be wondering, specifically, how a SAFR solution can be implemented in your environment, and what benefits a SAFR engagement with IBM can bring to your business.

IBM consultants, in particular Global Business Services (GBS) practitioners, have expertise in the pertinent technologies. Equally important, they understand that business intelligence is not just about data, but about the business processes and decisions it enables. Our teams of consultants apply innovative thinking, practical tools and services, and targeted industry experience to help you meet your business challenges.

Getting started

A SAFR solution satisfies complex reporting requirements in complicated, data-rich environments, and therefore every implementation is a unique, closely tailored one. SAFR is not a discrete product, per se, but an approach to designing financial (and other) reporting systems.

Engagements usually begin with a careful examination of the current data environment, and often include the identification of one or more problem processes. A SAFR simulation or prototype project and benchmark tests are run to establish that the approach and reporting tools scale to meet your needs.

Transition strategy

Using the SAFR FMS methodology, a company can convert to a SAFR environment in a rapid but controlled, incremental manner that avoids the difficult-to-explain balance sheet reclassifications that are common with “big bang” approaches.

A typical phased approach to transformation would follow these steps:

- In phase one, the company reconciles and consolidates the legacy general ledgers (GLs). The new system runs in parallel with the existing reporting infrastructure.
- In phase two, the legacy reporting is fed from the SAFR account-level detail register. The company swaps the processing infrastructure without affecting any other end-user experiences.
- In phase three, the company iteratively converts to detail product feeds and the SAFR account-level detail register feeds the GL, providing a new control point for finance processes. Simultaneously, the company develops accounting rules for product processor system detail feeds using existing operational general ledger feeds through the SAFR account-level detail register as guideposts. When detailed accounting rules development is complete, the company cuts the feed from the product processor to the legacy operational system, and feeds the SAFR account-level detail register directly. As product system feeds are migrated over time, the SAFR account-level detail repository becomes a rich reporting repository, yet keeps the balance sheet stable.

  Note that while the technology is managed by IT personnel, finance experts retain control of the accounting rules. One of the great advantages of the SAFR approach is that it gives finance people the flexibility to manage and manipulate data and reports without them having to learn a great deal of complicated technology.
- The end state is straight-through financial processing. When all product processor systems feed the new environment, legacy operational GLs can be decommissioned. Additional descriptive attributes can be passed to the account level detail register over time as well, providing new cuts of financial data for new reporting applications.

Where to get more information

There are several ways to begin a discussion about how SAFR can be applied to meet your particular needs:

- Send an e-mail to AskSAFR@us.ibm.com
- Visit the following web site:

  ibm.com/systems/safr
- Contact your IBM sales representative. If you don’t have a representative already, call us at 1-888-SHOP-IBM.

Summary

The SAFR solution supports key corporate decision-making to ensure that everyone in the business is using relevant information to drive better business results. It has a proven track record of addressing real business problems, such as account activity analysis, product

pricing, fraud detection, and multi-dimensional sales revenue analysis. SAFR enables enterprises to better shape and influence business performance by improving the caliber of the reports that decision makers use.

At the same time it improves the usefulness of the data, SAFR lowers the cost of producing financial reports and reduces reporting complexities due to the proliferation of siloed business intelligence environments. The SAFR solution provides a single view of the data, handles high volumes of data, improves performance, helps solve batch windows difficulties, provides summary reports with an underlying level of detail to reduce risks, consolidates your application infrastructure to reduce IT costs, delivers better business intelligence, and is responsive to changing business requirements.

References

For more information, see the following web sites:

IBM Scalable Architecture for Financial Reporting

ibm.com/systems/z/advantages/dataserving/solutions/safr/

IBM Smarter Planet™ - IBM Scalable Architecture for Financial Reporting

ibm.com/ibm/ideasfromibm/us/smartplanet/topics/finance/20090126/solution_topic3.shtml

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