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White Paper

Spreadsheet Agility within EDM – Centralized, Audited, Compliant.

A new approach to integrating analytics within Enterprise Data Management

This paper describes how spreadsheet calculations and analytics can be integrated within a centralized, audited Enterprise Data Management (EDM) process. Given regulations such as BCBS 239 and Dodd-Frank mandating a reduction in the reliance upon manual end-user processes, such an approach offers the flexibility, agility and ease of use that business users desire, but within a framework that meets the needs of auditors and regulators for increased data quality, transparency and reduced operational risk.

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1 Spreadsheets – the Solution or the Problem?

Despite all of the regulatory change over recent years, Microsoft Excel retains its crown as the world's most popular trading and risk management system. The spreadsheet is a fantastic productivity tool for financial markets professionals who know what business functionality they need, but do not have the software skills or resources to build this functionality in the timeframes demanded by the market.

Spreadsheets can also become an IT, management and regulatory nightmare. Spreadsheets often move from being an ad-hoc trader tool to becoming a sophisticated, complex and business critical application that is extremely difficult for IT to support. For example, traders pricing OTC derivatives in spreadsheets are a significant operational risk for IT and management to consider. The implications of excessive dependence on spreadsheets are further exacerbated by recent regulations such as BCBS 239 and Dodd Frank insisting on effective governance of derived data and End User Computing (EUC) models contained in spreadsheets. Extensive and unstructured usage of spreadsheets without governance and transparency can translate into higher regulatory charges that directly affect profitability and may even impact the viability of the business.

Whilst the use of Enterprise Data Management (EDM) is often advocated as a way in which operational risk can be reduced, traditional EDM systems on the whole fail to address the issue of spreadsheets and spreadsheet data. One of the main reasons is that traditional EDM architectures are not capable of supporting the more complex and unstructured datasets found in spreadsheets, nor are they designed to support analytics and the management of derived data.

This whitepaper describes SpreadSheet Inside, a business-focussed technology which forms part of Xenomorph's TimeScape EDM+ Enterprise Data Management system. SpreadSheet Inside allows all of the productivity and innovation benefits of spreadsheet usage while addressing the key concerns of spreadsheet risk and control within financial markets. This approach allows business users to define spreadsheet logic in the way they are used to, it enables IT to leverage and control spreadsheet calculations through centralized access permissioning, and it delivers the data quality, transparency and reduced operational risk the auditors and regulators are now demanding.

2 Practical Advantages and Issues

The list below represents some of the situations in which Xenomorph has seen extensive spreadsheet use and over-use:

- Pricing Complex Instruments

- Generation of Historic Derived Data

- Statistical Analysis/Arbitrage

- Custom Index/Basket Analysis

- Trade Blotters/Reporting

- Product Control

- Risk Calculations – VAR

- Tick Data Analysis

For more background on these examples, please see *"Appendix 1 - Practical Examples of Spreadsheet Use and Misuse"*.

Spreadsheets are used in the situations described above because:

- Time to market with ideas is critical to market share and profitability

- Market timelines are too short for current technology delivery

- Data storage, analysis and reporting can be done in one environment

- Spreadsheets avoid controls and approval processes for development

- End-users can use them!

The last point of usability should not be underrated since it underpins the usage of spreadsheets as a kind of "pressure relief valve" for traders trying to gain market share in a complex, fast-moving and extremely competitive environment. While spreadsheets have many plus points as outlined above, they can also create serious management issues for financial institutions because they are not:

- Structured/documented/version controlled/reviewed

- Centralised and user access controlled

- Scalable, fault-tolerant and robust

- Transparent and open

- Planned and considered as part of a coherent IT overview

The issues outlined above can lead to a situation where traders, product controllers and risk managers have multiple versions of a spreadsheet for local data storage and calculations. As a result it becomes very difficult for other key departments to ensure data consistency, calculation consistency and transparency of access.

3 SpreadSheet Inside Design Goals

Although some of the spreadsheet issues described above are procedural as much as technical, Xenomorph's approach to dealing with the disadvantages of spreadsheets in financial markets is to address the negative side of their usage whilst leaving their positives in place. As a result, when thinking about this issue Xenomorph targeted a solution that enables:

- Spreadsheet usage while addressing spreadsheet issues

- Easy definition and centralisation of functions and statistical analytics

- Integration with client and 3rd party analytics and pricing models

- Centralisation of pricing models and complex instrument management

- Transparent API access to all major programming environments

- Centralised user access permissioning

- Vast amounts of data to be analysed (e.g. tick-data series)

- Reporting and analysis on both simple and complex data

Figure 1 below shows that while end users are able to edit and view spreadsheet calculations, the fact that the calculation and the data reside server side translates to greater consistency (across front, middle and back-offices), transparency and fundamentally to less operational risk:
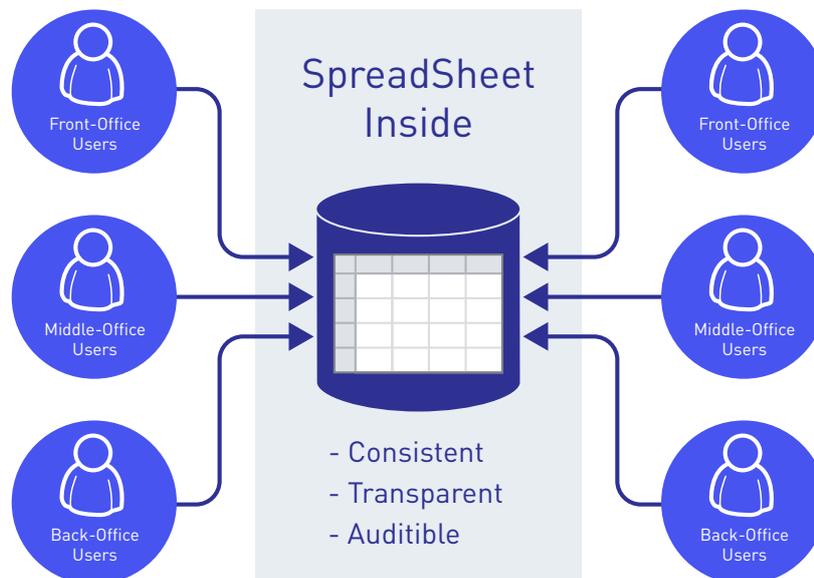

Figure 1 – Centralised, transparent and audited spreadsheet-like calculations with TimeScape EDM+ and SpreadSheet Inside

4 Formula Grid Data

SpreadSheet Inside provides spreadsheet-like operations inside the data management processes of TimeScape EDM+. These spreadsheet operations are defined through a new data type within TimeScape EDM+ called a Formula Grid. Thus, with Formula Grids, it is possible to define spreadsheet calculations that are centralised and occur server-side within the TimeScape EDM+ architecture.
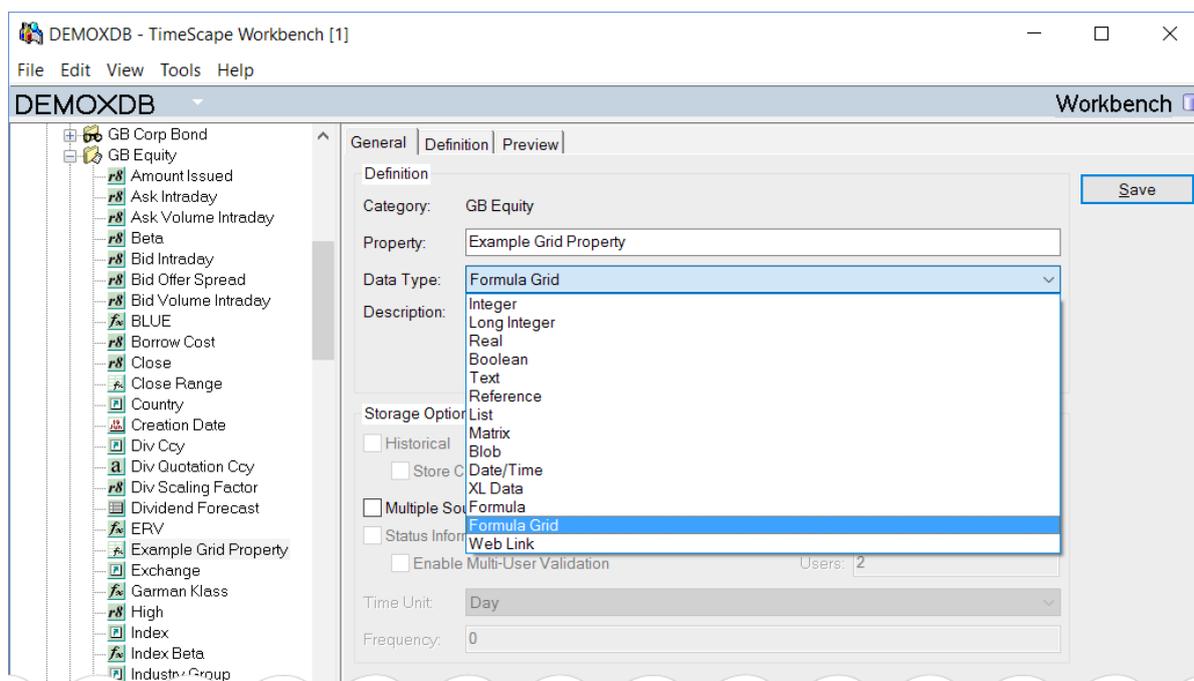

Figure 2 – Adding a Formula Grid to GB Equity Schema

To illustrate this, Figure 2 above shows how to add a formula grid as a standard property of the instrument category "GB Equity". In this instance, a property called "Example Grid Property" has been created and its data type is being assigned to type Formula Grid from the dropdown shown.

5 An Example – Calculating Historic Position Value in USD

Starting with a relatively simple example, let's imagine that we want to see the value of our current position in all "GB Equity" instruments represented in US Dollars. We start with the "Example Grid Property" created in Figure 2 and move to the definition tab as shown below:
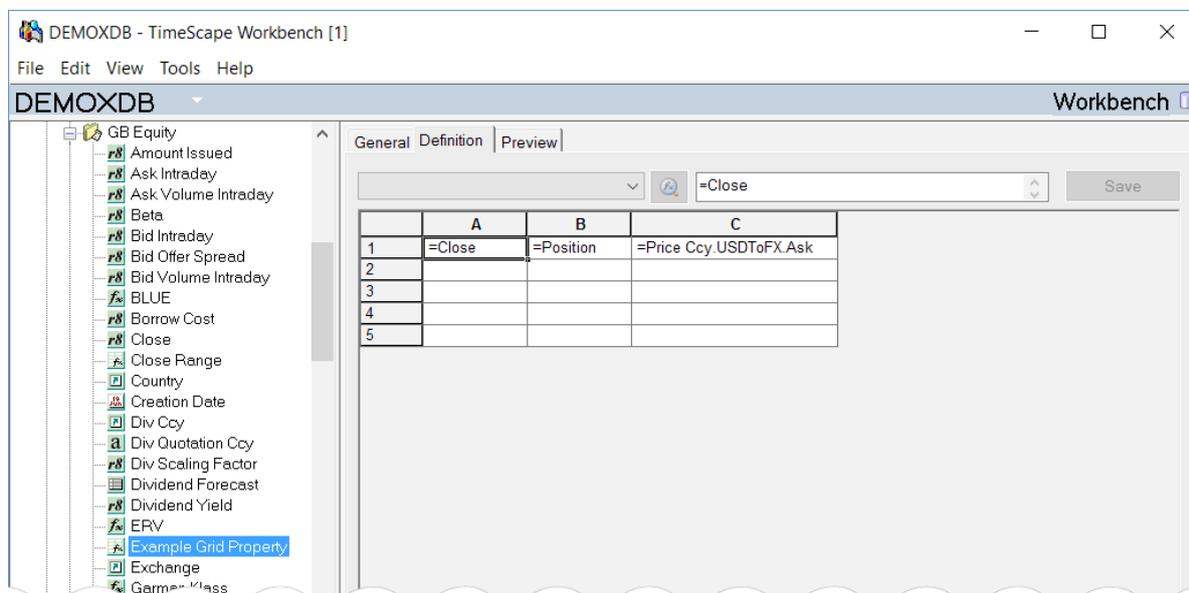

Figure 3 – Spreadsheet Definition for the "Example Grid Property"

What we see in cell A1 of the spreadsheet is the expression "=Close" which means assign the closing price for each GB Equity to this cell. As the "Close" property is historic, a whole price time series is attached to this cell. In the second cell B1 "=Position" means that for each GB Equity the position should be used. Finally in cell C1, "Price Ccy.USDToFX.Ask" means find the price currency of the equity in question, find the associated fx rate and put the ask side of the fx time series into the cell.

If we take a look at the "Example Grid Property" for a GB Equity instrument such as Vodafone, then what is displayed differs from what you might expect inside of an Excel spreadsheet. The main difference is that the time series array data requested in cells A1 (the close equity price) and C1 (the ask fx rate to USD) remains in one cell when displayed, as shown in Figure 4 below. 2043 daily equity prices are contained in cell A1 and 968 daily fx rates are contained in C1. The Vodafone stock's position is the value shown in cell B1.
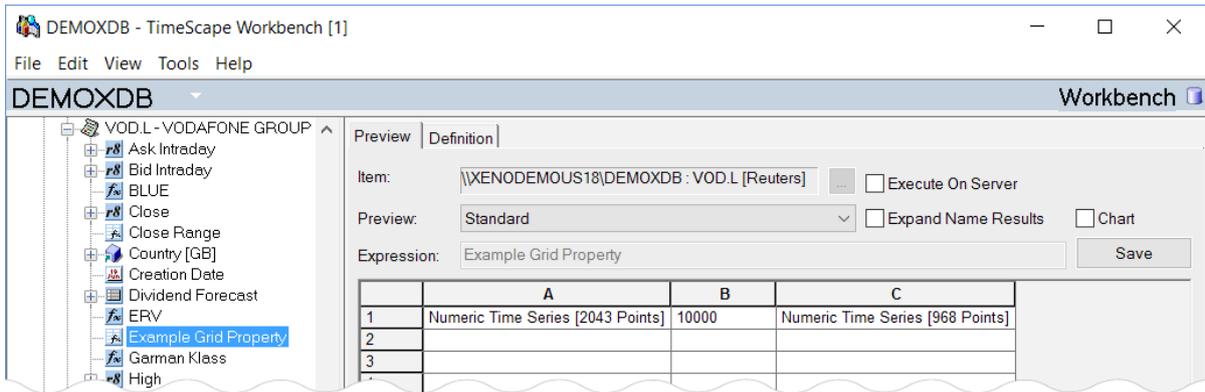
Figure 4 – Viewing the "Example Grid Property" for Vodafone Stock

It is possible to expand out this spreadsheet view into 2 dimensions as shown in Figure 5 below. Here we can see that the closing price data in cell A1 of the definition is automatically expanded out as a date-value array in columns A and B, the position value of 10,000 is automatically shifted to cell C and the fx ask series is in columns D and E.
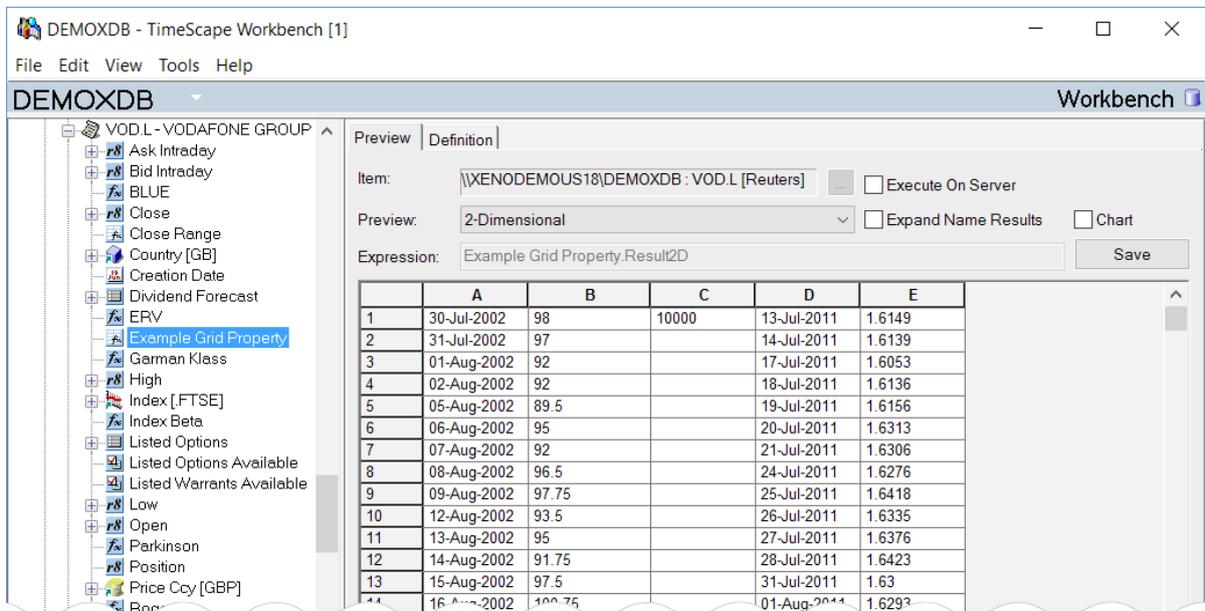

Figure 5 – Spreadsheet Definition for the "Example Grid Property"

Going back to the spreadsheet definition for the "Example Grid Property", then we are now going to add the final output calculation "=A1*B1*C1" into cell A2 and hide row 1 so that the intermediate calculation is not seen by the end user. It is worth noting that when the multiplication of equity prices and fx rates is done, they will be correctly aligned in date-time so that only valid intersecting data is returned. This definition is shown below in Figure 6:
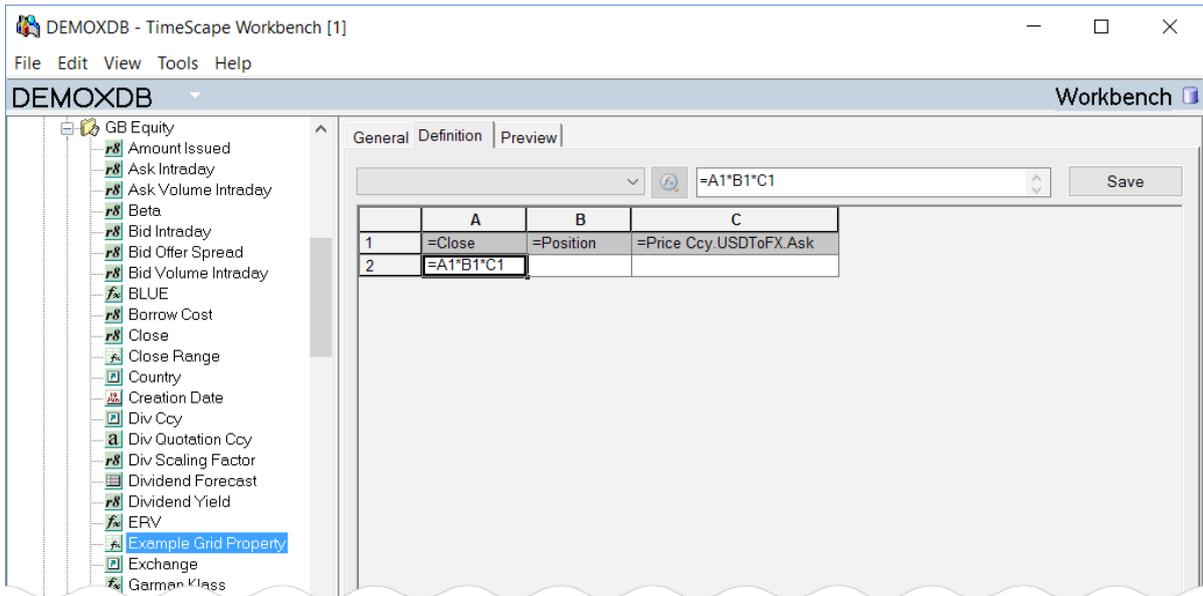

Figure 6 – Outputting the Result and Hiding the Calculation Row

Now that we have completed the definition, the output from requesting the "Example Grid Property" for any GB Equity is the historic USD position in each stock. This "Example Grid Property" is just the same in property (data) terms as a piece of data such as country, dividends or volume, but is actually defined as a calculation which is executed inside the database, a calculation that end users do not necessarily need to be made aware of. Put another way, the Formula Grid within TimeScape EDM+ allows spreadsheet operations to be effectively defined as a stored procedure inside the database.

This is illustrated in Figure 7 below where instead of viewing just Vodafone, we can now switch to any GB Equity (in this case HSBC) and automatically find the historic USD position:
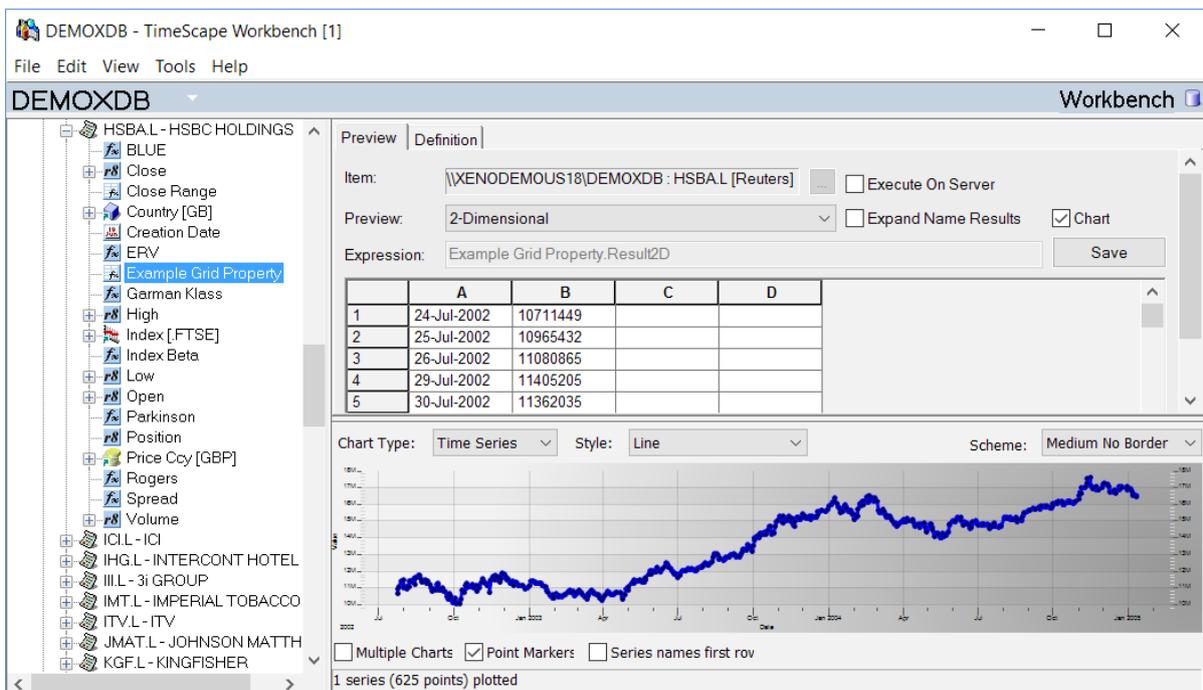

Figure 7 – Historic USD Position for any GB Equity

In this way the intermediate calculation is hidden, and all end users see is the resultant time series, which can be used for further calculations inside of TimeScape, TimeScape for Excel or any of TimeScape's programming interfaces.

6 TimeScape QL+ and SpreadSheet Inside

TimeScape EDM+ provides a query language for manipulating time series and static data; this query language, TimeScape QL+, is exposed natively inside every Formula Grid. TimeScape QL+ has the following features:

- User-friendly access to financial instruments and other financial objects

- Direct support for complex data types e.g. arrays, matrices, cubes etc.

- Support for SQL like filtering and reporting operations

- Manipulation and conversion of the time dimension of historic data

- Rules for data interpolation/filling/alignment

- Direct support for the addition of array/historic data

- Easy extension of functionality and entities by users

As a result, SpreadSheet Inside can support extremely complex server-side calculations that involve any combination of the above types of operation, including the incorporation of a client's proprietary analytics inside TimeScape QL+ and hence inside the Formula Grid spreadsheets illustrated in this document.

7 Excel XLL Addin Support

TimeScape EDM+ supports Excel XLL add-ins natively within TimeScape QL+ and SpreadSheet Inside. This enables statistical, yield curve and pricing analytics previously only available inside Excel to be deployed, calculated and linked to data centrally within TimeScape EDM+. Also, output results such as fair value, greeks and implied volatility calculations can be exposed without exposing (or allowing access to) intermediate calculations.

8 Summary

This paper has provided a brief introduction to SpreadSheet Inside, a business-focussed technology that embeds and centralises spreadsheet-like operations within TimeScape EDM+, Xenomorph's Enterprise Data Management system.

The management of unstructured spreadsheet data is a key concern for financial institutions, especially now that regulations such as Dodd-Frank and BCBS 239 are mandating greater automation and a move away from manual data processing. As part of TimeScape EDM+, SpreadSheet Inside provides business users with the agility and ease of use they need to innovate and respond to changing market needs. However for IT, compliance, auditors and regulators this same analytical functionality is delivered within an Enterprise Data Management process that is centralized, audited and secure.

Appendix 1 - Practical Examples of Spreadsheet Use and Misuse

- **Pricing Complex Instruments**
  Bringing together pricing models and data using Microsoft Excel as database, calculation server and front-end GUI. Usually implemented within spreadsheets because time to market was critical to the profitability of the trade and the development timeframe for instrument integration in mainstream systems could not be met.

- **Generation of Historic Derived Data**
  A variation on the above, where the spreadsheet environment is used as the glue to bring together models and data for generating derived data such as implied volatility and other data not observable directly in the market.

- **Statistical Analysis/Arbitrage**
  Performing complex statistical analysis on arrays of historic data in order to identify trading opportunities or risks. This type of analysis tends to become unwieldy as the amount of data and complexity increases. Particular problems can occur when the user wants to scan multiple instruments as a screening exercise first rather than analyse one at a time in detail.

- **Custom Index/Basket Analysis**
  Correlation, volatility and general statistical analysis on large datasets potentially involving tens or hundreds of price series corresponding to the constituents of a custom index or basket. The size of the datasets involved, the aligning of these datasets in time, linking to calculations and changing of compositions can cause productivity issues here.

- **Trade Blotters/Reporting**
  Spreadsheets still seem to be the preferred front-end for very flexible real-time portfolio monitoring/hedging by traders. Maintaining consistency between trader spreadsheets and core system calculations/data is a big issue here.

- **Product Control**
  Used to do comparative analysis against pricing models and reports generated by trading groups. Consistency of data is the main issue here but is otherwise a sensible usage of spreadsheets for ad-hoc one off analysis of new models.

- **Risk Calculations – VAR**
  It is sometimes surprising how many risk systems are built as tactical spreadsheets but become business critical as time progresses and business expands.

- **Tick Data Analysis**
  Tick data even for just one price series presents its challenges with potentially hundreds of thousands or millions of data points per historical price field. Even if spreadsheets can cope with a million rows of data this is not a productive way to analyse this type of data.

About Xenomorph

Xenomorph provides trusted data management solutions to many of the world's leading financial institutions. The company has more than two decades' experience managing large volumes of complex data and analytics. Over that time, we have consistently reinvested in our technology, culminating in our latest generation enterprise data management platform TimeScape EDM+.

Our software is built to be future-proof. With our rules-based single-stack architecture, flexible data model, easily configurable workflow engine and integrated feature updates, TimeScape EDM+ empowers you to address any future requirements. It can be operated by business users without any prior programming expertise, which means it offers a truly agile and cost effective solution to address evolving business, regulatory and technology trends. The platform also excels at managing and validating model-derived data, thereby enabling firms to address their model risk management challenges by making sure inputs and outputs of business critical models are always validated and kept in sync.

For more information on Xenomorph, our clients, services and solutions, please see www.xenomorph.com.

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