CORE REQUIREMENTS OF SDM

Peter Bartholomew*, Mark Norris†

***NAFEMS GBR, †InfoSys GBR**

1 INTRODUCTION

This paper is intended to provide a simple introduction to SDM and makes frequent reference to the work of the NAFEMS SDM WG. You might well argue that this should not be needed at a specialist SDM conference; we have an informed audience and pretty much everyone knows what they mean by SDM. Whilst this may be true, it is not to say, however, that such opinions necessarily agree with one another.

It is natural for a vendor to see things from the viewpoint of the existing functionality of their software products and in the light of the customers whose needs they serve. Ideas held by PDM vendors, simulation vendors, process integration vendors and data standardisation bodies might well diverge.

Similar differences can arise amongst the user community across different industrial sectors, since the working practices that each take for granted may not be universal. The SDM WG launched a survey to try to capture sentiment from both the user community and vendor community concerning the requirements for SDM. At the broadest level there was a reasonable consensus but with some clearly identifiable differences between OEMs, their supply chain companies and their software suppliers.

So the approach I intend to take is to identify a set of core requirements that must be present in an SDM system and then identify some avenues of further development that will deliver additional value in the appropriate circumstances.

2 CLASSIFICATION

A starting point is to identify what data is to be managed and with what purpose. For product data management, there is a clear requirement that the geometry created in one CAD system should be understood by competitor systems. This is usually of less importance for simulation data; there is no overriding business case for running an Ansys data deck through Abaqus, for example. The implication of this is that the data does not need to be managed at a full level of detail.

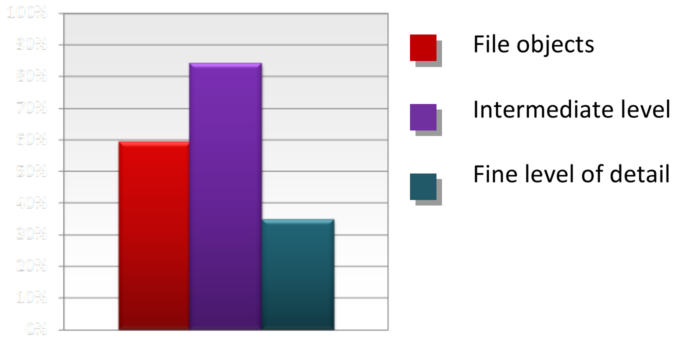

Figure 1 The level of data abstraction to be handled by an SDM system

This assertion was borne out by the survey results, which showed that by far the greatest interest was in the management of data objects at an intermediate level. Despite that, there is still some interest in the capture of fine-grained information although it is not clear whether that applies solely to key data items extracted for a summary report or whether it is the comprehensive detail that would be required for standardisation and the exchange of data between applications.

This suggests that, at the core of the system, there must be a mechanism for capturing metadata but also there is a need for a separate repository for the data objects themselves. It leads one towards the sort of software architecture shown below in figure 2. The data objects will include representations of geometry and fields over that geometry. To be accessible for future use it is essential that the formats used to record the information are defined, so that the appropriate readers / authoring tools may be invoked.

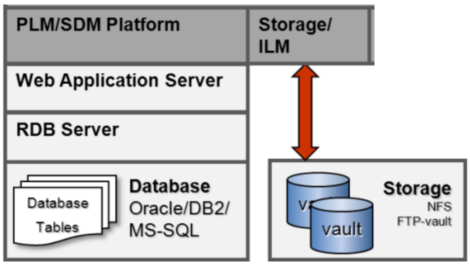

Figure 2 Schematic of an SDM system (partial)

3 LINKS TO PRODUCT

For some, the link to PDM is absolutely central to their modelling practices and it may well make sense for the simulation data to be managed within an enhanced PDM system. For other industries the simulation models may not be based upon mechanical CAD representations at all and it is better to have a system more closely coupled with the simulation toolset. Either way, what is essential is to be able to relate simulations to the real-world events they are meant to represent.

4 CAPTURE OF PROCESS

One of the major differences between PDM and SDM systems is the degree of importance attached to process. To establish confidence in an engineering simulation one is likely to rely less on an examination of the output and, instead, place a greater reliance on gaining an understanding of the process that led to the result. Typical of the questions asked are:

- What codes were used?
- What product (and product configuration) was analysed?
- What loading scenarios were modelled?
- Who performed the analysis?
- What past experience did they have?
- Is there service or test information available for similar products?
- What degree of correlation is achieved with analysis?

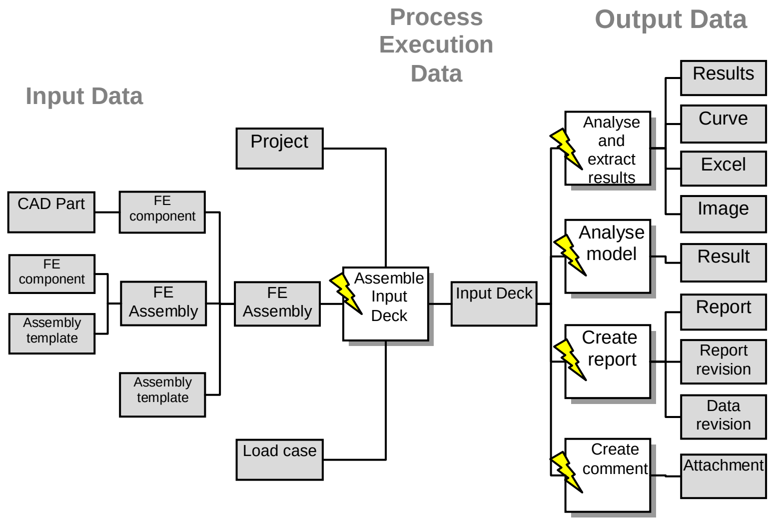

Figure 3 Information Structure; Inputs, Information Creation Processes, Outputs & Results

To enable such questions to be answered, the process description must be captured along with the output; that is, in essence, an electronic version of the traditional engineer's logbook. The process to be captured may be far from simple, as suggested by the snippet of a process chain shown in. This process capture is probably the defining characteristic that separates SDM systems from simple content management.

5 DATA ACCESS

The separation of data and process is a key feature of any data management system since it allows the data to be made available to multiple applications and enables it to live beyond the lifecycle of the applications it was intended to serve. Nevertheless, some processing functions are required simply to record and access the data. The first requirement is that human users should be able to access information from the SDM system. This would typically require some form of web interface to allow remote access.

A particularly important feature would be a search capability, primarily operating on the metadata but with the possibility of searching items in the data repository. By recording process links, the data should also be navigable allowing the user to track an audit trail.

The second, as important, aspect of data access is the programmatic interface to software applications. It must be possible for software applications to identify and access data objects with semantic precision. Much of the value of SDM systems lies in their ability to provide timely data to enable processes to be automated.

6 SECURITY AND INTEGRITY

Any data management system, whether a relational database or a web-based system, must comply with a number of basic rules, in order to provide data integrity and security. Entity integrity requires that each data object must be assigned a unique identifier to ensure references to it are unambiguous.

Referential integrity must also be ensured. This requires that any data object that is referenced by another (by foreign key for example) must exist and cannot be deleted without first removing references to it. Error 404 in a web-based system is due to a lack of referential integrity in that pages may be deleted by the owner irrespective of whether they have been referenced elsewhere. The practical implication of this is that even the data owner should not have direct access to the data vault; changes to the data stored should only be permitted through the use of the SDM system. It is then possible to store the authority for deletion of the data object whilst maintaining the integrity of the audit trail.

In addition to data integrity issues, the system must also respect business rules and any overriding security considerations.

7 ADDED VALUE

Logically a data management system should provide what it says and no more. It may support all sorts of advanced functionality but there is no commitment to provide it.

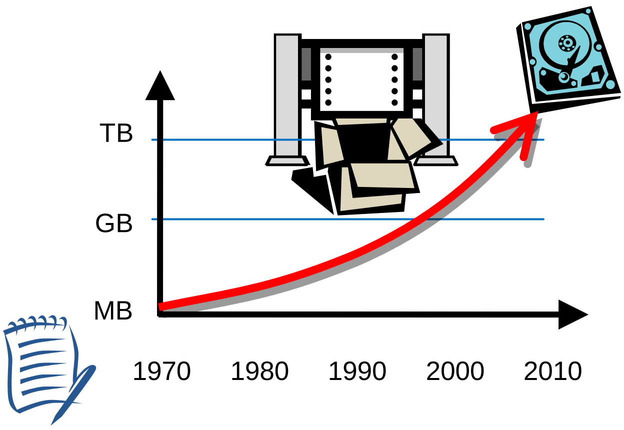

Figure 4 Growth of simulation data over four decades

That said, a primary motivation for the introduction of SDM is that the explosive growth in the volume of data in use to qualify products and improve their design has outstripped the capability of manual systems to keep track of the information. If the move to computer-based data management has simply replaced manual documentation by computer forms and manual data entry, a bottle-neck remains which can only get worse.

An obvious extension therefore is to associate the SDM system with a process capable of generating metadata automatically. In the first instance, this is likely to be a by-product of the scripts that run the simulation software but notionally it is also feasible to extract key results from simulation output. An effective SDM system simply provides the basic support for any number of process improvements that may well be specific to particular industry sectors and roles within the supply chain.