MineRP Integration Solutions

Are you managing data or using data to manage?

Paper

MineRP

Are you managing data, or using data to manage?

About the Author

Anton van der Walt is appointed as Chief Technology Officer at MineRP, with 24 years in GIS and software development inside the mining industry, he shares his valuable input on data management.

The issue with Expert Solutions

The mining industry is notorious for its variety of fragmented expert systems, with a total count of more than 330 single subject, single-discipline systems produced by over 90 different vendors. Within a mid-sized mining enterprise, there could easily be as many as 30 disparate systems, and only a few will have proper integration capabilities. Most will have proprietary file formats and vendors unwilling to standardise and make use of open, published file formats.

The majority of these systems are so embedded in the business process that it is nearly impossible to replace without extreme costs. Expert systems are mostly focused on single mining disciplines receiving expert input , processing it, and producing expert output, with little to none thought given to integration.

This limitation causes serious problems for cross functional processes such as inter-disciplinary collaboration and sharing of data.

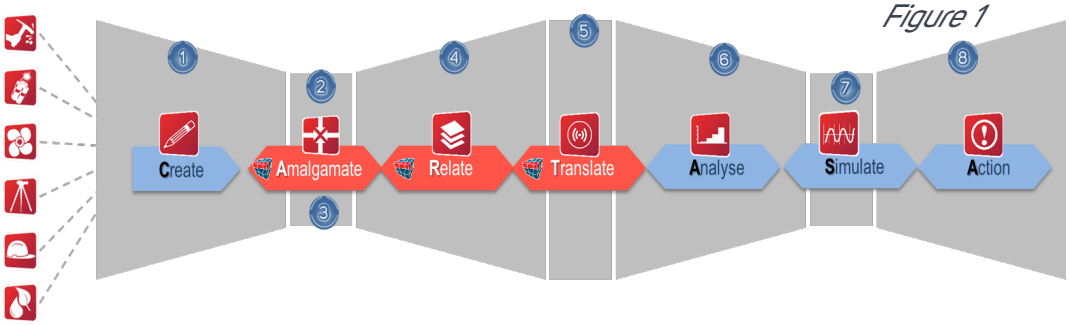
Many expert systems have export capabilities, produce a typical exchange format to be imported by the next system. However, these data exchange files cause a litany of data management nightmares, and are rarely sustainable solutions. This type of integration also destroys valuable data.

Why is integration necessary?

Within a single discipline, exchanging data is easy because data formats and expert systems in use are normally the same, or will produce output files that are exchangeable. Within a single department, there would normally be only one person who takes ownership of the final dataset that is produced. This makes data management within that department a simple task and part of the daily operations. When you add the upstream and downstream use of the same data, the picture becomes much more complex.

Expert systems are not designed with data sharing in mind, exchanging data becomes a totally new expert environment on its own. In many cases expert systems created by the same vendor do not even integrate properly with one another. The biggest issue is that the exchange mechanism leaves multiple copies of similar data sets throughout the network, with no designated person to manage these data sets and files.

The MineRP double bow tie
Figure 1



1. Seamless interoperability between mining disciplines
2. Amalgamated source data - all you mining data in a single, standardised, spatial database
3. Standards-based information management
4. Spatial dashboards, three dimensional analysis, visualization and animation of entire mining technical data set
5. Mining information ready to model, analyse and simulate
6. Unlimited analysis combining MTS,ERP and other input
7. End-to-end simulation for optimization at any level and any point
8. Workflow enabled at any level and any point

Ways to integrate data

The biggest challenges mines face when integrating data:

- Data quality management
- Data and exchange format standardization, and
- Old-school proprietary and protected formats in which data exists

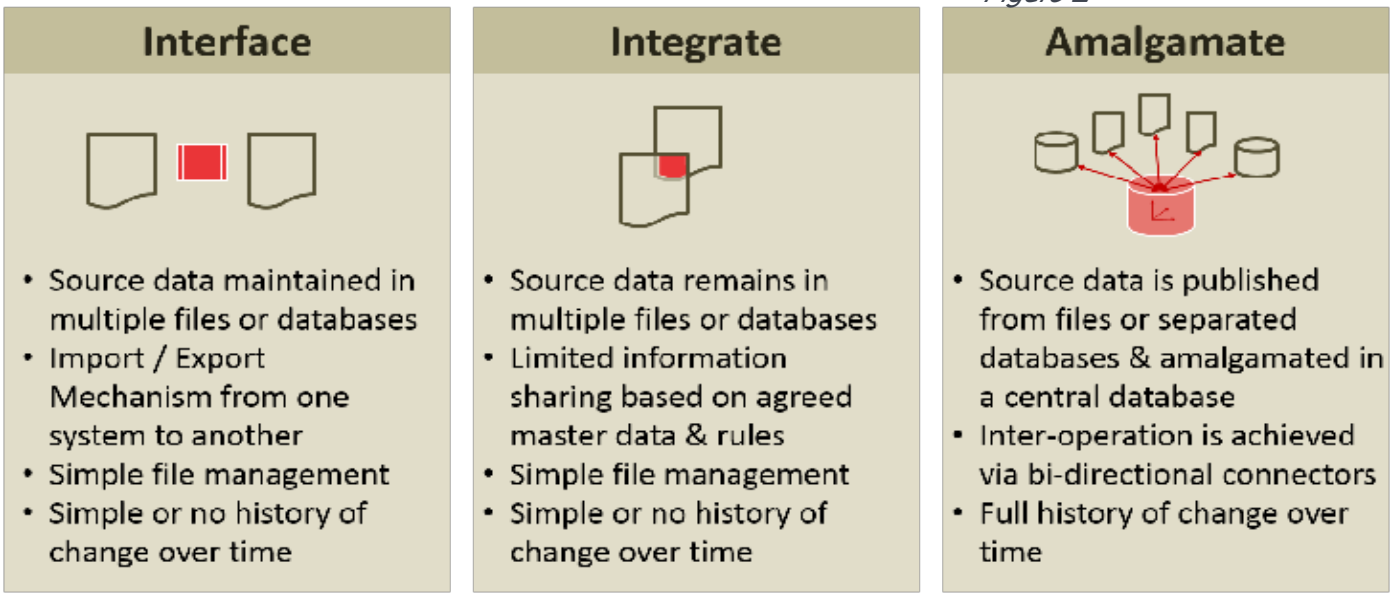
Master Data management

Whether data is needed for enterprise-reporting, life of business planning, descriptive analytics, or optimization, the integration challenge remains the same. Each system has its own Master Data, and elements of Master Data are reproduced & re-captured without consideration of ownership. Examples of such Master Data could be workplace names, reef types, activity types and even seemingly simple things like people information. Imagine the amount of effort mapping these Master Data items across multiple systems, trying to standardise naming conventions and the definitions of entities.

Are newer systems better?

Most mining technical systems were developed before integration and data exchange were in demand, and many IT/IM experts assume replacing these systems with newer technologies will solve these issues. Experience has taught me that this is not the case. Even with access to the latest technologies, hardware, software, platforms, methods and modelling tools, mining expert systems are still badly fragmented. In reality, new systems only provide new formats to standardize and more data management issues. The better approach is to find an integration partner who is fluent in expert system subject matter as well as the know-how to deal with the complexities of your data integration and data management demand. Also important to understand is the difference between system interfaces, system integration, and amalgamation of source data onto a simple platform.

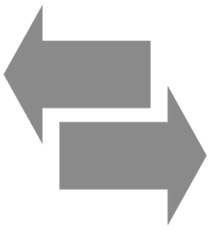
Approaches to integration
Figure 2



5 Integration objectives

Amalgamate around space - All the data, all the time.
Collection, standardisation and combination of data from fragmented mining technical systems, as attributes of a single definition of space and spatial objects. In laymans terms this process entails the bi-directional connection of all mining technical systems to a single version of three dimensional space defined in MineRP SpatialDB.

Standardise formats - OGC Compliance, Open standards
Amalgamated mining data, both spatial data as well as related information is standardised in MineRP's SpatialDB. Spatial data is stored in compliance with the OGC Simple Features for SQL standards in such a way that all other OGC compliant systems are able to consume data stored in SpatialDB.



Exchange Seamlessly- Connectors, Convertors, MiODS.
Information from mostly file-based mining technical systems can be exchanged bi-directionally with SpatialDB. This means SpatialDB can receive data from any MTS as well as recreate amalgamated data in a format compatible with those systems. The MineRP integrated operational data store (MiODS) acts as a reporting database in order to relieve the impact of spatial reporting and analysis on transactional systems utilising SpatialDB.

Retain Integrity - SOX Compliance, Ability to re-create data, traceable, transparent, Auditable.
The MineRP platform supports corporate governance requirements through its ability to carry history of change, authoring information and other pertinent data about data, thereby delivering auditability and transparancy of information flow from source to destination.

Guarantee safety & security - Disaster Recovery & Backup.
MineRP's integrated security and authorization capabilities provide a reliable mechanism for centralised management and safeguarding of all your amalgamated mining technical data.

Space as the golden thread

Finding a common denominator across the disparate MTS data sets was not easy. MineRP looked beyond the apparent and identified that the only viable common denominator was the geographical space that the data existed in. Geographical space is not always explicitly defined, but nevertheless is an attribute of each actual data element.

As many systems don't have spatially enabled data sets, MineRP uses the implied spatial location as the master element. With space as the common denominator, all the data captured in the collection of MTS systems is stored as either attributes or properties of any given spatial object, at any given point in time. This approach allows MineRP to recreate the state and status of any given point in your mine at any give point in its life cycle, past,current or planned.

MineRP's Interoperability Framework

Having resolved to using space as common denominator, MineRP amalgamates data sets from various expert systems into a single, logical data store. By developing a model-to-model interoperability framework whereby different source systems can be read and data elements interpreted at an aboriginal level, there is little to no loss of precious source information. This model-to-model interoperability is enabled by bi-directional connectors and convertors that will populate a spatially-enabled, centralised logical database called SpatialDB.

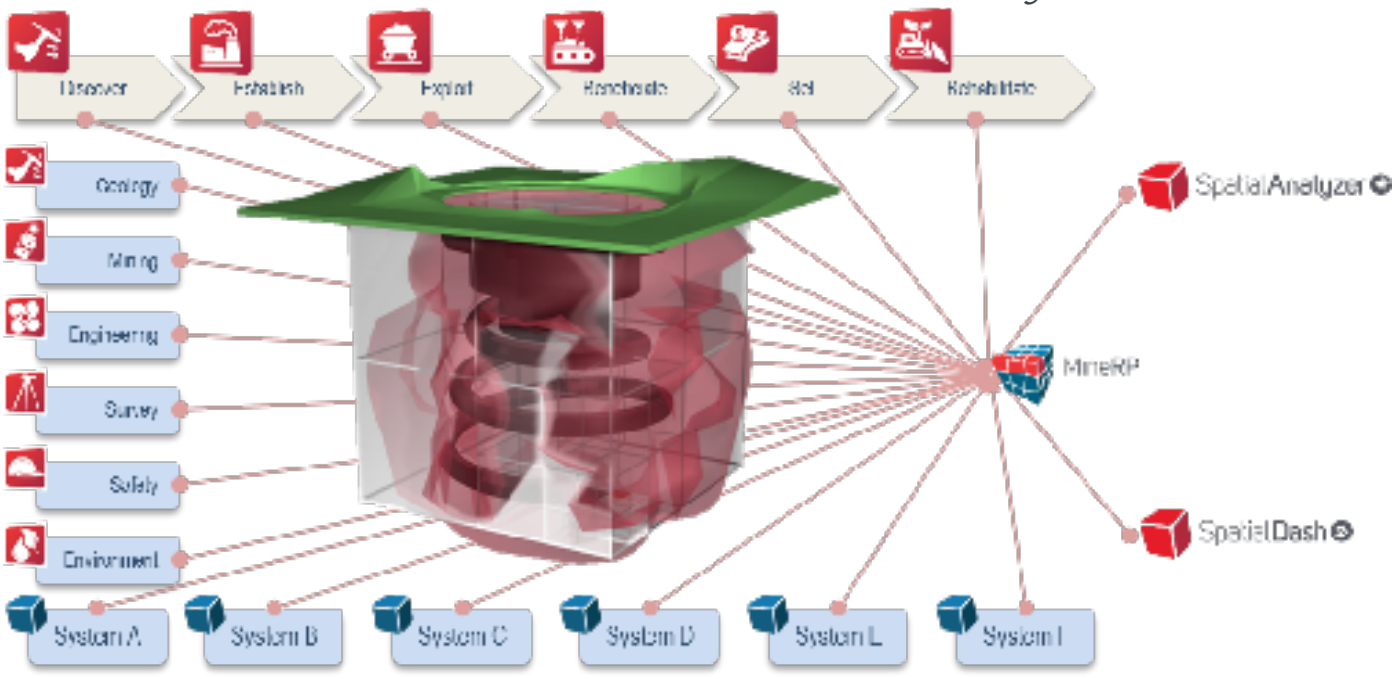
Inside SpatialDB each and every data element is spatially referenced. MineRP SpatialDB has mining specific data type capabilities, typically not found in other spatial database engines.

This removes the complexity of dealing with different data types. Dealing with attribute data through an Entity-Attribute-Value (EAV) model combined with a Relational DBMS (RDBMS), every piece of information is stored, including enough meta-data to reproduce the original data set in its native form.

Having data in a central, spatially enabled RDBMS has little value unless there are mechanisms to serve the data to receiving systems. The MineRP interoperability framework provides these required bi-directional interfaces to support seamless data exchange between fragmented expert systems.

> "MineRP allows interoperability between fragmented mine technological systems."

Integrating fragmented MTS
Figure 3



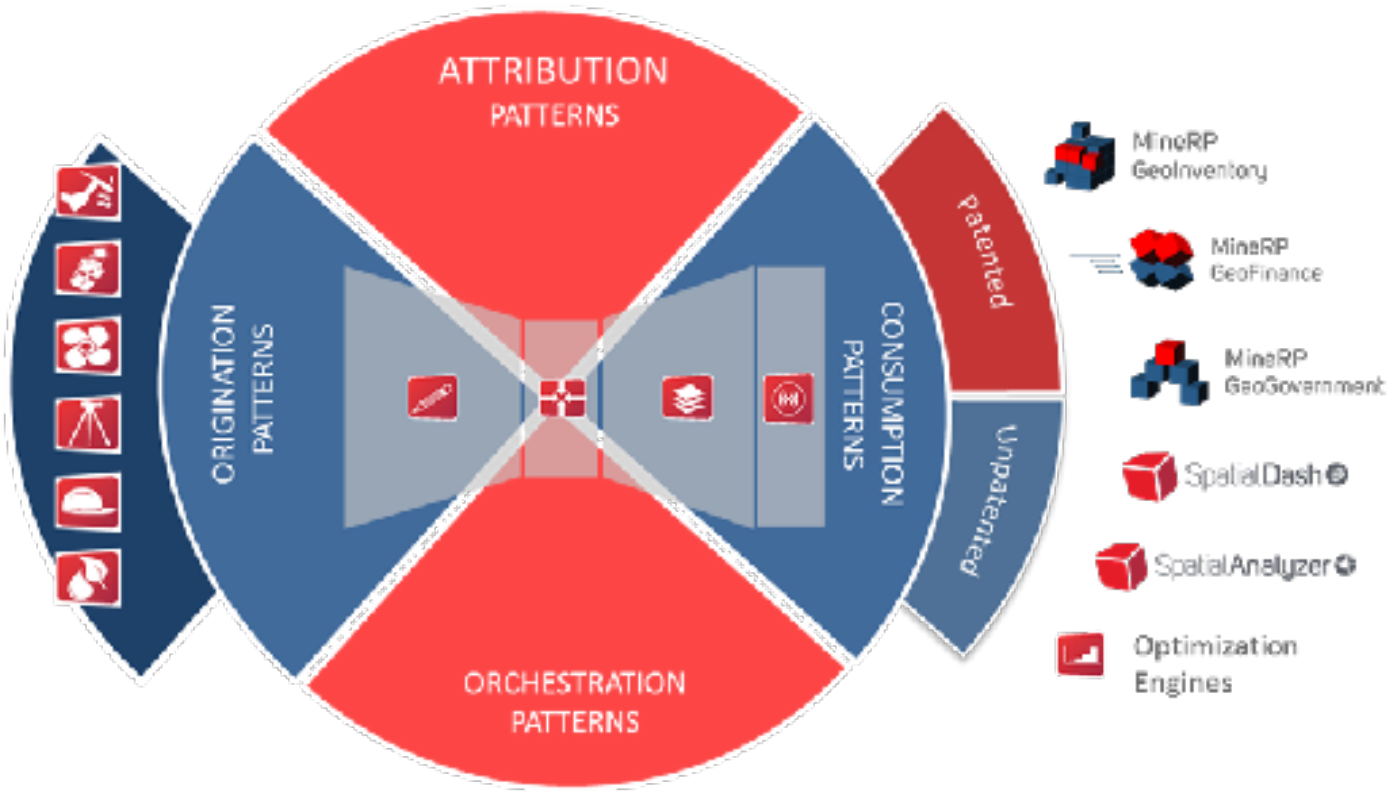
Enterprise Data Orchestration

Exchange does not only happen between single subject and single-discipline systems, but these single discipline systems feed larger ERP systems. This necessitates the further development of standard protocols & mechanisms for data exchange between SpatialDB and ERP solutions. Employing standards like OGC's Simple Features for SQL, Web Map Services and Open Data Services that support these standards, enables direct access to an integrated data set through SpatialDB without having to deal with complex file exchange formats. This completely eliminates the risk of duplicated, out of date or unavailable source data.

Merely focusing on the mechanics of integration and data exchange is not adequate. It is crucial to include good practices of data management including data governance, architecture, development, security, operations management, warehousing & BI content management and most importantly quality Management as well.

Such a holistic approach to mining information management is the only way to guarantee long-term success. The robust Spatial Enterprise Integration Platform provided by MineRP forms a reliable technology base upon which mines can build their mine technical information management strategy.

Data patterns
Figure 3



MineRP Software Integration

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