

Do you know where your sources are? Did you ever hear somebody say “gosh, it used to work” and say to yourself “exactly when?” Do you dread the answer to the question “what’s new?” Welcome to a world without software configuration management (SCM). SCM is one of the most important, yet arguably least visible discriminators in the Orchid® environment. This paper summarizes the state of the art for SCM for power plant simulation software.

The ultimate goal of SCM in power plant simulation is to establish and maintain the simulator software performance and its consistency with the simulator design data. SCM is an ANSI/ANS-3.5 requirement for any simulator project (see section 5 of ANSI/ANS-3.5-2009). However it is even more relevant in the context of New Build projects and engineering simulators where design data frequently changes.

L3 MAPPS has two broad objectives in its implementation of SCM:

- Track the simulator design data and its use in the simulation software, and
- Control and track changes to the simulation software.

Four key observations can be made with respect to these objectives that have guided the implementation of SCM in L3 MAPPS’ Orchid® environment. The first is that the configuration items (CI) that are encompassed by these two objectives, data on one hand and software on the other, are very different and require different methods for identifying, managing and documenting changes. The second is that these two CIs are strongly interrelated. As a result, L3 MAPPS has implemented a two-tier solution that reflects this difference. The third is that any SCM solution must be intuitive and freed from the more arcane aspects typical of SCM, and must be integrated into the project workflow in a manner that is not only easy to use but also encourages its use. The fourth is that traditional source “code” control tools are not designed for “graphical” model development environments. The overall result is an integrated SCM system designed specifically for the purpose of power plant simulator software.

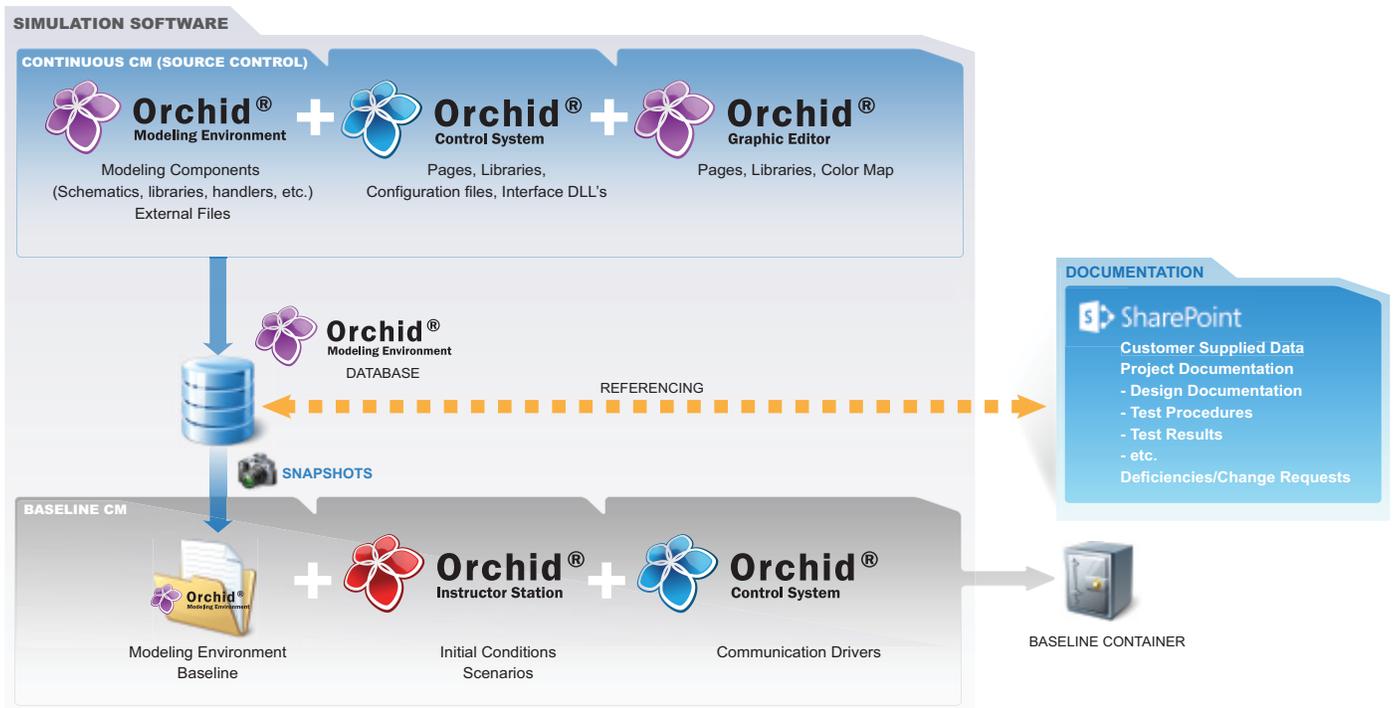
SharePoint

L3 MAPPS has adopted the Microsoft SharePoint platform to manage and track all project documentation. This includes customer-supplied data, project documentation created during development (design documents, test procedures, test results) and design change tracking.

SharePoint is a web-enabled platform used to facilitate collaboration, provide content management features, implement business processes, and supply access to essential information. It enables the L3 MAPPS Data Control Center to set up a centralized, access-protected space for document storing and sharing. Content management features include document search via metadata, check-in/check-out of documents, versioning and role-based access control. Documents can be stored, downloaded and edited, then uploaded for continued sharing.

In terms of access control, L3 MAPPS’ SharePoint implementation is designed to meet the security and export control requirements of its military and nuclear customers. Access to data resident on L3 MAPPS’ internal servers is controlled via user access permissions. Access to customer data is controlled via the IT department using a request/authorization process. Using SharePoint as the data management tool allows L3 MAPPS to:

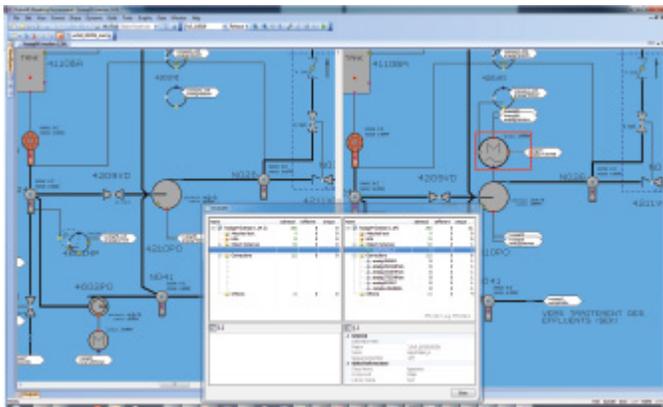
- Implement a formal process for overall project security classification determination



L3 MAPPS' SCM Process

beyond the revision comment entered by the user. And we have all seen (though, of course, never ourselves entered) helpful revision comments like “Have a nice day” and “Fixed.” The solution to the “what” is the Orchid® Modeling Environment Compare tool. Compare provides a visual comparison of two versions of a workspace and their CIs. Differences in schematics are indicated graphically. All differences including the presence or absence of an object in a schematic, object position, object connections and object parameterization are tracked. Differences in a simulation load configuration (order of execution, time-step, and processor assignment) are also tracked. A report providing the result of a comparison can be generated. Differences can be filtered according to user preferences.

XFer: Orchid® Modeling Environment is designed to support collaborative development. Users typically access a single, centralized database that stores all information related to schematics, libraries, files and configurations. Nevertheless, there are times when it is practical to have more than one database, typically when concurrent development is taking place in different locations. XFer can be used to synchronize different databases by providing a means to transfer workspaces and their contents between databases. Naturally versioning is applied when CIs are transferred to another database and the Compare tool provides a mechanism to determine differences.



“Compare” provides a visual comparison of two versions of a workspace and their CIs

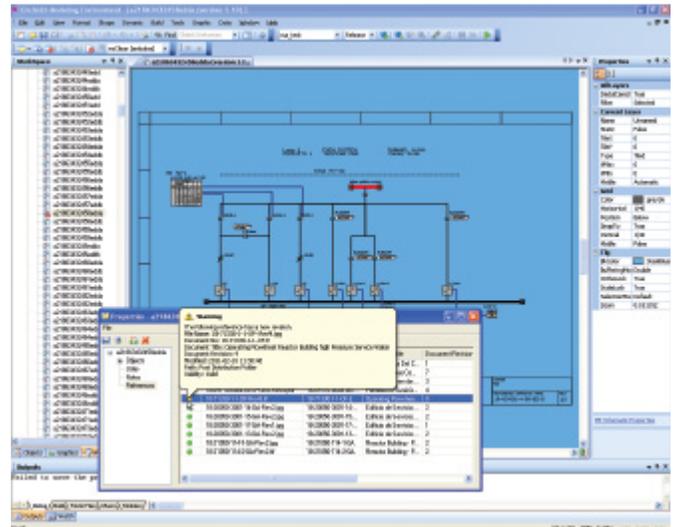
Data Referencing: Data referencing closes the loop between Orchid® Modeling Environment and the data in SharePoint. Data referencing provides traceability by making it possible to track data sources and their revisions to their use in the models. It provides a means of determining what design data has been used and where it has been used.

The data referencing feature in Orchid® Modeling Environment provides an interface to SharePoint and allows users to graphically link a schematic (in the case of P&IDs, for example) or an object (in the case of a pump curve, for example) in a model to the data in SharePoint. The user can query the SharePoint database from within Orchid® Modeling Environment and create a reference table that includes, for each document referenced, the official document number, title and revision number. Users can also generate a report listing all documents that have been referenced in the workspace

and the schematics or objects that have referenced them.

Orchid® Modeling Environment also validates data that has already been referenced against changes in the metadata for the document maintained in SharePoint and warns the user if a more recent version is available or if a field in the document metadata has been changed. This allows the user to validate and update as necessary the data used in the models whenever a new data source is made available.

L3 MAPPS has also developed a link between the SharePoint CR tool and the Orchid® Modeling Environment database, similar to the link used for data referencing. A user is required to reference a CR assigned to the user in the SharePoint database whenever a CI is checked in. This reinforces the SCM process by ensuring that any modification is traceable to a specific CR.



Orchid® Modeling Environment is equipped with a very useful link to SharePoint that facilitates data referencing

In the absence of specific data, developers may develop their models based on assumptions and simplifications. For this situation, Orchid® Modeling Environment allows users to enter, at the object and the schematic level, all assumptions and simplifications made during the development of the model. This information is stored once again in the Orchid® Modeling Environment database and can be queried at any time.

Tasks: Tasks are a sub-container of changes associated with a common modification. They are used to encapsulate all the work required to provide a complete solution or part of a solution to a multi-part CR. The feature allows multiple developers to contribute to a single CR, each using his own task, as well as to isolate different solutions from the same developer. When checking out components for modifications, the user must select an existing task or create a new task with which these components will be associated. This functionality also does not allow checked-in items from an incomplete solution to be made available to other users. To ensure a complete usable solution can be adopted by other users, changes made through a task are made available only when the task is closed.

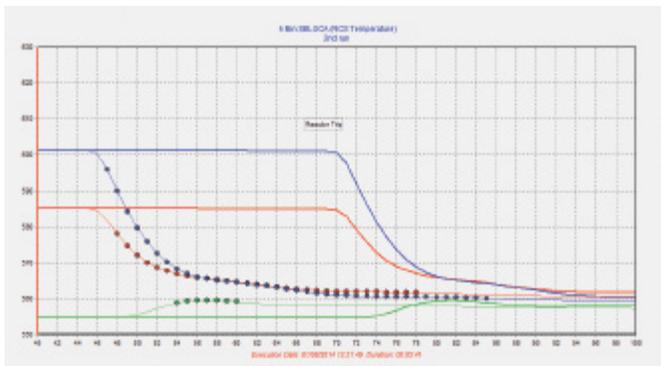


Baseline: A baseline is a virtual container of all the elements of a workspace, including tasks required for rebuilding a particular version of a configuration. The baseline feature includes a mechanism to associate a specific version of each of the Orchid® Modeling Environment CIs with a particular software release. It ensures that all elements of the baseline are known and accounted for, reducing the risk of unwanted changes being introduced. The content of the baseline is predetermined throughout the development cycle as defined by the task. A working/open release may contain multiple tasks contributed by users working on a particular software update. Once the baseline is closed, it cannot be unlocked. Users will no longer be able to contribute to it. A closed baseline will be a frozen collection of closed tasks together with other closed tasks from an existing closed release. Once closed, a baseline can be used to create a new workspace with the contents of the baseline for follow-on releases.

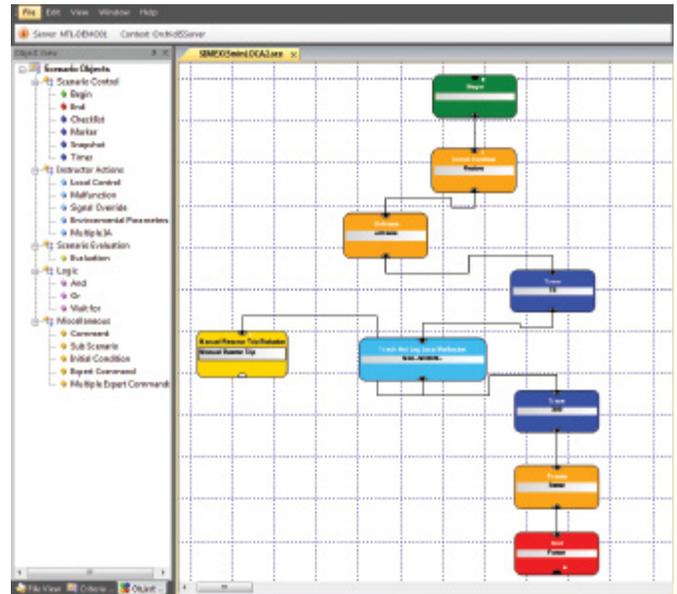
Role-based User Privileges: User privileges extend the login authentication to assignable user roles containing different rights and privileges. This feature is intended to limit unintended or unauthorized modifications. Examples include specific user privileges to modify libraries or handlers and create or close baselines.

Regression Testing

Of course, no SCM process is complete without an efficient means of performing regression testing of different simulation software baselines. L3 MAPPS' Scenario Manager and TPR testing tool, both part of the Orchid® Instructor Station, automate the process of testing, data collection and report generation. Scenario Manager provides a framework for the graphical creation and execution of structured, repeatable test scenarios. TPR in turn collects the data generated during the execution of a particular scenario. A scheduler allows the user to schedule test execution according to simulator availability. All results are archived for post-analysis. TPR functions include collection of operator actions, instructor actions, annunciator alarms, user defined time-based performance indicators and automated trending and report generation. Trends can be overlaid automatically against user selectable baselines with visual indication of deviations that are user-defined tolerances.



TPR test showing out-of-tolerance results compared to baseline data



Scenario Manager graphical creation and execution of structured, repeatable test scenarios

In Closing

L3 MAPPS' solution for SCM is informed by years of experience in deploying multiple, complex projects based on extensive use of graphical model development tools in a production environment. The solution is designed to ensure traceability and control through an intelligible and easy-to-use human system interface.

What about the Orchid® tools themselves?

Rest assured that L3 MAPPS follows a formal validation process consistent with its ISO 9001:2008 certification to ensure that updates to the tools are thoroughly tested prior to release. L3 MAPPS development teams build a release and perform a first test to ensure that all the updates planned for that release are included and functioning. A Release Candidate (RC) is then submitted to an L3 MAPPS independent test team responsible for verification and validation of the Orchid® tools. At the conclusion of the tests, a software validation report is produced. If the tests are successful, the tools will be ready for release; otherwise, they will be returned to the developers to address the identified deficiencies.



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