**Ocean Software Development Framework**

Extend your workflow in the Petrel platform for Petrel reservoir and production engineering

**BENEFITS AND FEATURES**

- Create time saving plug-ins for simple data manipulation
- Automate repeatable workflows to enhance productivity for new users and experts
- Create guided workflows to lessen the learning curve for new users
- Enables reservoir engineering analysis and data analytics
- Integrates and enhances data processing from geology to gridding, reservoir simulation, and production evaluation
- Supports both conventional and unconventional shale studies
- Allows optimization and uncertainties studies for history matching, volumetric calculation, field development planning
- Provides results analysis and charting windows for reservoir quality control and data validation
- Enables custom simulation in Petrel workflows

The Petrel® E&P software platform enables reservoir engineers to collaborate effortlessly with each other as well as with geoscience and production specialists. The Ocean® software development framework’s application programming interface (API) unlocks elements of the reservoir engineering and production engineering modules to enable developers to extend its capabilities with new features. Company developers can concentrate on extending primary functionality while independent developers can provide additional components in the form of plug-ins. Plugins can vary in their complexity, from a simple time-saving algorithm that automates a manual data-manipulation process that can be created in minutes by someone with basic programming skills to plug-ins that provide more complex capabilities, such as a custom simulator that will require greater commitment by a team of programmers and oilfield experts.

Below is a small sample of Ocean framework APIs that are available to create various plug-ins that support reservoir engineers and petroleum engineers in their everyday work.

**Fluid**

Professionals involved in petroleum exploration and production have varying reasons for analyzing and describing the hydrocarbon fluids and water found together in petroleum reservoirs. The fluid API plays an important role in many petroleum disciplines’ plug-ins. For reservoir engineers, one of the key uses of this data is in reservoir simulation. For production engineers, one of the key uses is in well completion design. The Ocean framework enables you to programmatically create a black-oil fluid model and a compositional fluid model. The Ocean framework’s fluid API can be used in many different types of plug-in workflows, such as guided workflow plug-ins, plug-ins that check the quality of the fluid data, or plug-ins that help you to model hydraulic fracturing for a large field with many wells.

**Rock physics**

One of the objectives in modeling rock mechanics for a reservoir simulation is to understand the interaction between fluids and the reservoir rock. There are a number of functions of saturation, or pressure used in simulation that represent the physics of fluids and the rock. The Ocean framework APIs enable you to programmatically create saturation, compaction, and adsorption functions.

*EasyFrac plug-in developed by Schlumberger, available in the Ocean store.*
Ocean Software Development Framework

The Ocean framework’s rock physics API will enable you to create plug-ins that can extend the Petrel platform to support various methods of simulation such as enhanced oil recovery (EOR).

Custom simulators
The EclipseFormatSimulator API assists in adding a specific simulator to enable your custom workflow, or bring your full-field simulator to the Petrel platform. Once your simulator supports input/output in the ECLIPSE* industry-reference reservoir simulator 100/300 format, it can be seamlessly plugged into the Petrel platform to run from the plug-in, or in the Define Simulation Case process and results will be automatically imported to the Petrel results pane. Custom cases and tabs are also available to fully support your simulator’s functionality within the Petrel platform.

Grids
The aim of gridding in reservoir simulation is to turn the geological model of the field into a discrete system on which the fluid flow equations can be solved. The Petrel platform’s reservoir model representation is the pillar grid. The construction of pillar grid reservoir models is facilitated by the processes in the interactive grid construction in the Petrel platform (i.e., the processes in the structural modeling process folder).

The Ocean framework API enables the creation and manipulation of grids. The cell property representations offer full manipulation through the API (i.e., to create, read, update, and delete). Access to local grid refinement and stair-step modeling is also supported. The PillarFault API enables modeling of reservoirs that contain faults.

Development strategy
The development strategies facility is used to tell a simulator how a field will be developed, which wells will produce, or inject, what the pressure...
rate controls and limits are, what operations will be carried 
out on the wells over time, etc. Whether you run an industry-standard 
simulator such as the ECLIPSE simulator (100/300), or a custom 
simulator, an essential part of the simulation setup is to specify 
development strategies. Ocean supports a full scale of standard 
development strategy rules, both for history and prediction, 
and enables custom rules. An existing development strategy domain 
object provides limited functionality to access development strategy 
collection, create/delete strategy, and limited read access to name 
and description. The 2014 release overcomes this with the development 
strategies namespace which has been introduced to provide types 
to create, read, and edit development strategy, and work with 
the control date, wells, groups, and rules folders.

Results and charting
The visualization and charting functionality facilitates presentation 
and QC of simulation results, which is an important step for many 
workflows. The Ocean framework APIs allow presentation 
of simulation case results on virtually any suitable window (2D, 3D, 
function window, charting, map, and other types). One method 
of presentation is facilitated by the ToggleWindow simulation case 
results facility created by the simulator, or constructed using 
the results provider API. Another method of presenting results 
is to use the study and chart objects used in the results charting 
and analysis facility. Either method gives the plug-in developer 
the flexibility of charting and presenting various intermediate, 
summary, or final simulation results.

Completion-level observed data
Production monitoring and surveillance is a key function 
in the production engineering module. Completion-level data 
can help you to evaluate inflow and outflow performance at any depth 
range that has a flow rate associated with it between reservoir 
and wellbore. You can evaluate the intervals that are not performing 
and make decisions for remedial action. The import of completion-level 
data is currently done with the OFM* well and reservoir analysis 
software data connector, or through the split manager and use of split 
sets. With the completion-level observed data API you can write 
a plug-in to automate the import of data from third-party vendors 
to create completion level observed data sets. The data sources 
can be from Microsoft Excel, Oracle, or SQL servers. Once 
production history is in the Petrel platform, as a completion level 
observed dataset, it can be used in the well section window to display 
production alongside completion and log data in a preconfigured 
production track, as well as used in the production bubble mapping 
and production mapping processes.

Split sets
Split sets are used to back-allocate wellbore production by splitting 
well-level observed data into completion intervals. The Ocean

Production interpretation module uses chart and study objects to show results.

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Sample code to read the completion level observed data.

Sample code to perform the splitting operation.
framework API for split sets allows you to create, edit, and delete splits sets in a Petrel platform project. This will enable you to create a plug-in that imports zonal allocations from an external data source and create split sets with wells, perforations, and factors based on the imported data. This split set can then be applied to the well-level observed data, which will generate a completion-level dataset that can then be used with the production analytics function, such as the well section window production track, production bubble mapping, and production mapping processes.

The split set manager offers an even allocation as the default algorithm. With the Ocean framework API, you can create custom splitting algorithms that end users can access through the algorithm list in the split manager interface. Algorithms such as:

\[
\frac{\phi h}{\mu} \phi h, kh,
\]

and h can be programmed into the split manager with this API.

**Developer resources**

There are numerous developer resources available for the Petrel platform plug-in developer on the Ocean framework.

**Ocean software development kit (framework)**

When you install the Ocean framework, you will have access to the following documents:

- **OceanPetrel:** This is the main help file to assist Ocean framework developers to search various APIs on domain objects.
- **Petrel UI Guide:** This guide defines the Petrel platform user experience through a set of look-and-feel rules for Ocean developers to follow to ensure consistency with the Petrel platform.
- **Sample code:** Sample code that demonstrates how to use the API for a number of domain objects. For example, custom domain objects, custom simulators, and SeismicAttributes, among others.
- **Wizards:** Wizard applications that can enable the Ocean framework developer to get started on their plug-in quickly. There are nine wizards that are included with the Ocean Framework.

**Visual studio tools**

In the visual studio environment there are a number of tools available to the Ocean framework developers.

- **Ocean search page:**
  To search for webinars, how-to videos, and sample code.
- **Project upgrade tool:**
  To help upgrade projects to the latest release.
- **Ocean quality assistant:**
  To help with testing of your plug-in.
- **Ocean start page:**
  Easy access to search, find out what’s new, how-to videos, and tools.
- **Ocean support:**
  This is where you can submit your questions and issues.
- **Ocean forum:**
  This is where you can ask other developers questions.
- **Ocean Store**
  There is a wealth of information and resources available to the Ocean developer in the Ocean Store—such as the “getting started” section, where you can find information about training, webinars, and case studies—to name a few. In the Ocean developer resources section you can find a developer’s guide that covers many subjects relating to plug-in development.

The resources mentioned are just a small sample of what is available. For details on all the resources, please visit the Ocean Store.

There are numerous developer resources available

E-mail sisinfo@slb.com or contact your local Schlumberger representative to learn more

software.slb.com/ocean