The Open Source model in GeoSciences and OpendTect in particular

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Summary

Open Source models have proven to be very successful for creating and maintaining high-tech products such as operating systems and general utilities. So far, Open Source is rarely used for larger scale, high-tech end-user applications, which to date remain mostly close-source/proprietary. In this paper we will argue that Open Source systems can also be a good alternative for such proprietary (and expensive) systems. We believe that the future belongs to Open Source systems that provide a free base for general tasks while more advanced functionalities are offered in the form of plugins. Such plugins can either be released as free, Open Source extensions, or as proprietary, commercial ones. In this paper we describe the conversion of the closed-source d-Tect system into OpendTect that is both a functional Open Source seismic interpretation system and a research and development environment. Considerable intelligence, time and effort has been put in, and will remain to be put in the future, to maintain and extend the open source software. We conclude that the implementation and support of the open source model is not trivial, and requires resources and commitment to its objectives.

Introduction

In the geosciences, like in any other discipline, Open Source software usage is rapidly increasing. On the Operating System level especially *Linux* is becoming very successful. One level higher, more and more geoscience applications use a number of generally usable Open Source toolkits. Good examples are the platform-independent GUI library *Qt* and for 3D visualization there are *COIN* and *VTK*. Until recently, there were very few Open Source alternatives at the end-user level.

Open Source models have a range of potential benefits:

- Continuity.
- Stability.
- Development speed.
- Acceptance level.
- Innovation.
- Usability.
- Value for money.

Different users will prioritize these benefits in different ways. For major E&P companies continuity and stability are key issues that decide whether or not a software product will be adopted. Major companies are reluctant to buy software from small vendors as the future of such companies and their products cannot be guaranteed. Continuity is not an issue with Open Source models because the software will survive even if the parent company doesn't. Many complex Open Source systems have proven to be more stable than alternative commercial systems because of the large developer base that helps to debug and test. Smaller companies put more emphasis on costs and value for money. For example, compared to proprietary commercial systems OpendTect is tens to hundreds of times cheaper (for academic users price is not an issue as the base system is free for R&D, education and evaluation purposes. Moreover dGB offers free access to its commercial plugins to Universities). More important for R&D users is that software like this is easy to use and stimulates new ideas, which can be tested fast and efficiently.

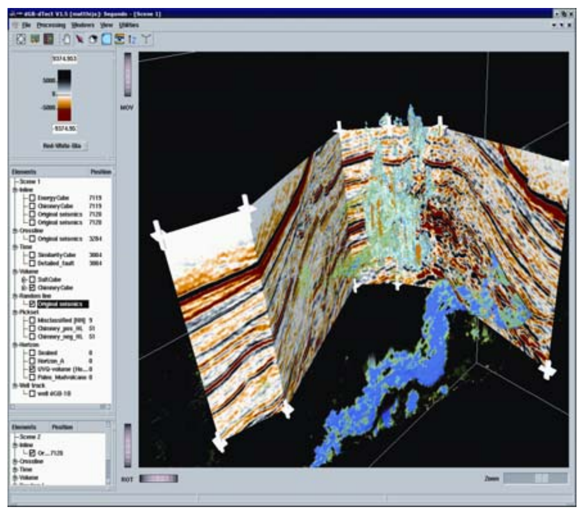

Fig 1: OpendTect impression.

OpendTect

OpendTect is an open source software system that has originally been designed for seismic analysis, visualization and interpretation (Fig. 1). It enables geologists and geophysicists to process, visualize and interpret multi-volume seismic data using attributes and modern visualization techniques such as stereo viewing and volume rendering. Because of its open source structure, OpendTect is not only a functional interpretation system; it is also a research and development environment for seismic analysis. The software is currently supported on PC-Linux, Sun-Solaris, SGI-Irix, Mac-OS/X and MS Windows (2000/NT/XP). Heavy processing of large volumes can be carried out in batch mode on multiple machines. Any combination of platforms and machines (single processors, dual processors and clusters) that can be accessed through the network can be used for this purpose.

The Road to Open Source

OpendTect started out as d-Tect, a commercial product developed by dGB that was released mid 2002 (e.g. de Groot, et.al., 2004). After one year of technical and commercial success (50 licenses world-wide) it was realized that a) market penetration was not keeping pace with the software's potential and b) the internal development force was too small to implement all ideas and extensions within acceptable time-frames. Continuing with a proprietary development scheme implied that d-Tect would remain a successful niche product but would not evolve into a complete seismic interpretation system as the owners had originally intended. It was thus decided to make a radical switch to Open Source.

essential ingredient was the creation of the new opendtect.org website, ftp server, e-mail addresses and mailing lists.

The conversion of the d-Tect system to Open Source cost about half a man-year. This is probably the lowest amount of effort for a medium-sized system (about 200 kLOC). The d-Tect system was already designed to be portable, modular and with a good dependency-management. Still, the transformation into OpendTect forced quite a few changes, most of which are definitely for the better. Since the first open source release development efforts have focused on extending the environment and developing new tools. In this way OpendTect managed to grow from a niche product for seismic attribute processing and pattern recognition into a trace interpretation system with unique capabilities.

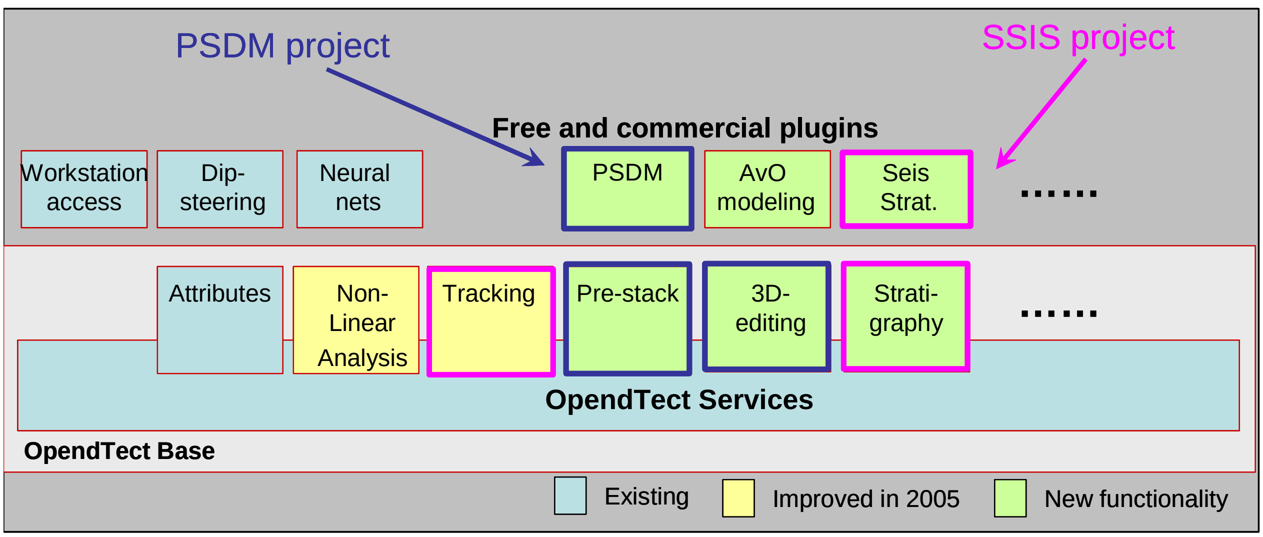

Fig 2: Impact of SSIS and PSDM development on OpendTect.

Open Source does not mean "throw it over the wall and see what happens". In the months preceding the actual opening of the system, a major re-development took place to create a plugin architecture, upgrade the documentation (code, end-user and application management), generate example plugins, and port the code to Windows (NT/XP/2000). Further, the code was cleaned up and all references to proprietary code were removed. Proprietary commercial functionality (Neural networks and Dip Steering) were re-developed as plugins to OpendTect Base system. Another

User-driven growth

The overall aim for OpendTect is to support innovative, easy-to-use seismic applications. To safeguard that the system becomes unwieldy by implementing ad-hoc requests from the rapidly growing user community the custodians (dGB) have grouped development possibilities into a number of projects that can be sponsored. The way in which OpendTect grows is thus driven by sponsors, hence by the end-users. Sponsors can choose to fund open-ended projects and fixed-term projects. Open-ended projects consist of sub-projects of variable size, which can start at any time. Fixed-term projects have fixed time schedules and fixed deliverables. These projects start when sufficient financial commitment is received. There are currently two large multi-client, fixed-term projects under way: SSIS which aims to develop a Sequence Stratigraphic Interpretation System and PSDM for Pre-Stack Depth Migration. Both projects are described below. Fig. 2 is a schematic overview of the OpendTect system that shows where SSIS and PSDM fit in. Note that development takes place in the open source part of the system as well as in the commercial plugin layer. This is typical. Most development projects are beneficial to both the open source users and the commercial users. Sponsors have to accept that part of their funding is used to the benefit of the (non-paying) open source community. As a rule of thumb general tools and services end up in the open source domain while application specific functionality may yield a new commercial plugin.

SSIS project

SSIS is a multi-client, fixed term project. dGB, Shell, Statoil, BG, TNO and the Dutch government are partners in the project that runs until end 2005. SSIS aims to develop an environment that supports seismic sequence stratigraphic interpretation principles. Important aspects of this environment are:

1) Capability to track and edit events (reflectors, faults, 3D bodies).
2) Identification and labelling of events (sequence boundaries, system tracts, etc.).
3) Capability to transform and analyze the data in the chrono-stratigraphic domain.

The project aims to develop new workflows that will be tested in proprietary case studies. Towards the end of 2005 a commercial plugin should be released. Intermediate results that will not end-up in the commercial plugin will be released as open source as and when ready. Fig. 3 and 4 show some of the proposed SSIS capabilities.

PSDM project

PSDM is a collaboration between dGB and GDC. It runs until mid 2006 and aims to deliver commercial software for Pre-Stack Depth Migration. The commercial software, called PSDM Base, will support all tools required to perform a complete PSDM workflow: velocity picking, model building and migration with a Kirchoff algorithm. PSDM Base will support similar plugin architecture as the rest of OpendTect to enable fast–track development of more advanced functionality. Within the scope of PSDM project the partners intend to develop a tomography plugin for faster updating of the velocity field in between PSDM cycles. As with SSIS the PSDM project is also beneficial to the open source user community. PSDM broadens the scope of OpendTect in two domains: pre-stack data analysis and model building.

Conclusions

It was argued that the Open Source model used by OpendTect is a successful alternative for creating and maintaining complex high-tech end-user applications. Costs, continuity, stability, innovation and speed of development will be difficult to match by systems that continue to use conventional, proprietary models. The implementation and support of the open source model is not trivial, though. It requires resources and commitment to the objectives

References

de Groot, P., Ligtenberg, H., Oldenziel, T., Connolly, D. and Meldahl, P. (Statoil), 2004. Examples of multi-attribute, neural network-based seismic object detection. In GS Memoir No. 29 "3D Seismic Technology; Application to the Exploration of Sedimentary Basins.". Editors Davies, R.J., Cartwright, J.A., Stewart, S.A, Lappin, M. and Underhill, J.R..

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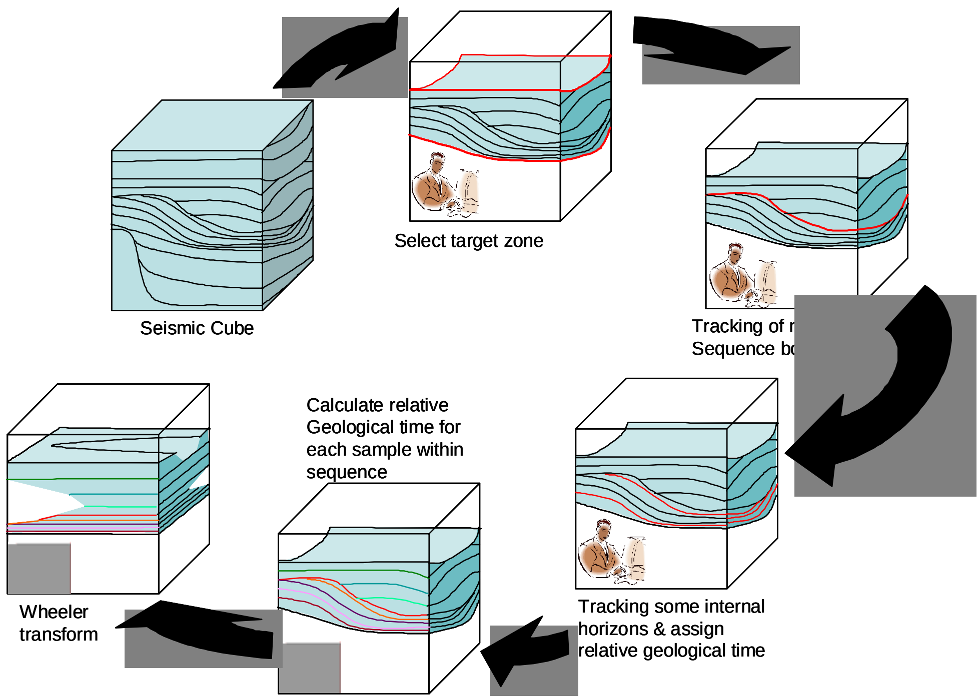

Fig 3: SSIS workflow for chrono-stratigraphic analysis.

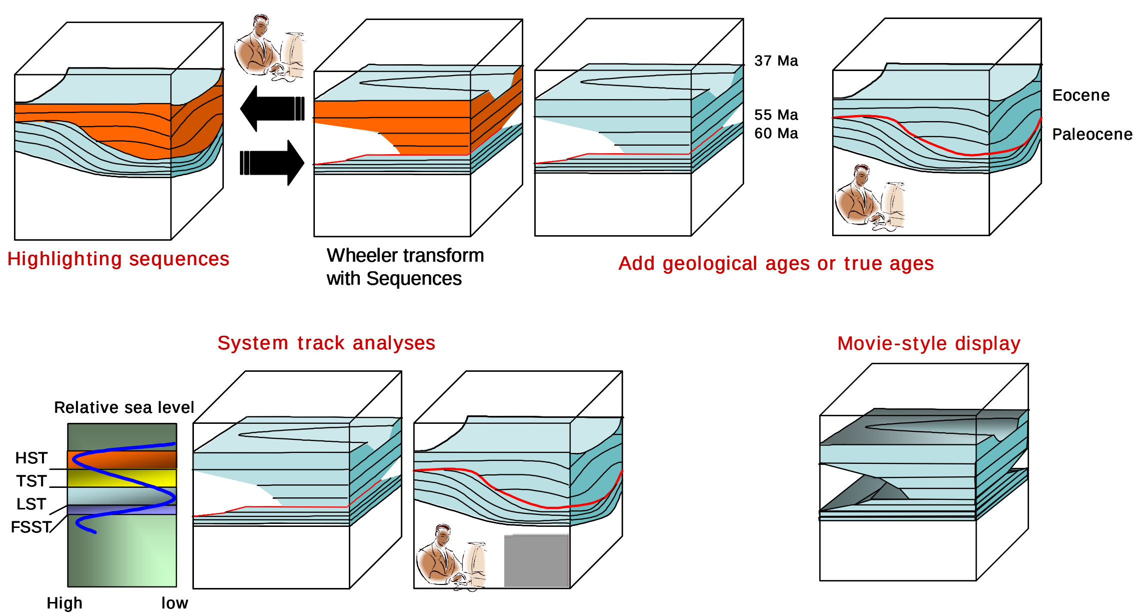

Fig 4: SSIS possibilities.