recovery energy environment economy
2011 CSPG CSEG CWLS Convention

Recovery and Growth Through Openness in Oil and Gas

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Summary

There is a quiet revolution going on in science, and it is coming to oil and gas. The bad news is that it will make you very uncomfortable. The good news is that it will speed up development, make technology cheaper, and be more fun. The revolution is openness: open software, open data, open ideas and open teams. Why this is good for you may be rather counter-intuitive. It's not altruism, and it's not generosity; it's all about excellence.

Introduction

In some fields, openness is paramount. Without openness in life sciences, for example, doctors and drugs could not be trusted. Without openness in physics, results cannot be reproduced and checked. Reproducibility is everything. As a result, there are dozens of organizations, journals, committees, forums, conferences and websites dedicated to promoting open content in these fields.

At first sight, this sort of openness looks incompatible with industrial secrets and competitive advantage. But ask yourself this: what is your competitive advantage? If you think it is your software, your data, or even your workflows, then I believe you may be neglecting the things that really drives new insights and innovation: your people, the ideas they have, and the decisions they make. I believe that changing this is the fastest way to achieving positive disruptive change in our industry.

This paper looks at what openness means today; what is already going on to promote non-traditional collaboration in oil and gas, particularly in geology and geophysics; and ways even a traditional company can start to explore some of the principals of openness.

Controlled openness

It's a common misconception that free and open means there is no control or value for the creator, but here is a broad palette of new, open licensing options that are just as robust as copyright. Two areas in which there is a rich ecosystem of alternatives to traditional ownership are software licensing and publishing.

Just as in traditional licensing agreements, an open-source software provider usually stipulates that, by downloading the software and/or the code, you agree to the terms and conditions of their license. There are dozens of open-source software licenses, but broadly speaking they can be categorized as non-permissive (also known as 'copyleft') or permissive, with some shades in between. Permissively protected code may be licensed on more restrictive terms than those of the original license (for example, you can keep the code private). Non-permissive licenses, the most important of which is the GNU General Public License, or GPL, can force its terms onto any code that incorporates code it protects.

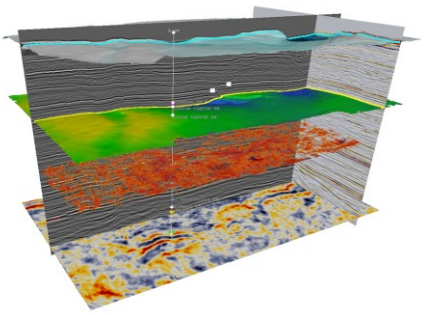
There is a range of licenses available to those publishing non-software creations, such as writing, drawings, and photographs. But by far the most common is the Creative Commons family of licenses. These licenses communicate which rights the creator reserves, and which are waived for the benefit of others. Perhaps the most common is CC-BY-SA, or Attribution Share Alike, meaning that derivative work must be attributed and licensed under the same or similar terms. Wikipedia.org, for example, uses this license.

Open software in geoscience

You may think this is all very well, but a large, serious business, needs large, serious (and expensive) software. But the Apache web server software, the Firefox web browser, and the Linux operating system are open source projects and are almost certainly in your software portfolio today. And now open source software is blossoming in geophysics. There are at least a dozen mature open source tools for geophysicists, most of which are seismic processing toolkits (see table). A handful of them have been around since the early 1980s and are solid and well-maintained, being used by dozens of practitioners and researchers every day. Others are very new, notably Madagascar and OpendTect, both launched in 2003. Having a successful company behind you helps with rapid development: OpendTect is maintained by dGB Earth Sciences.

Category	Software	Description	Originator	License	Platforms	Language
Processing packages	Madagascar	Seismic processing	Sergey Fomel and others	GPL	Cross-platform	C
	FreeUSP, FreeDDS	Seismic processing	Amoco, BP	Custom	UNIX, Linux	C, C++, Fortran
	Open-PSEIS	Parallel seismic processing	Randy Seltzer	GPL	Windows	C#, C, Fortran
	CWP/SU (Seismic Un*x)	Seismic processing	Stanford, Colorado School of Mines	BSD-style	UNIX, Linux	C, Fortran 77
	SEPlib	Seismic processing	Stanford	BSD-style	Cross-platform	C, Fortran
Processing utilities	GSEGYView	Display SEG-Y files	Vladimir Bashkardin	GPL	Cross-platform	C, Fortran
	SegyPY, SegyMAT	Read and write SEG-Y files	Thomas Mejer Hansen, University of Copenhagen	LGPL	Cross-platform	Python
	Delivery	Bayesian inversion	Csiro Petroleum	GPL, BSD	Cross-platform	Java
	WaveletExtractor	Well-ties	Csiro Petroleum	GPL, BSD	Cross-platform	Java
	GPLib++	Seismic and magnetotelluric processing	Max Moorkamp, Dublin Inst. Advanced Studies	GPL	UNIX, Linux	C++
	JavaSeis	Pre-stack seismic I/O	ARCO	CPL	Cross-platform	Java
	kogeo	Geophysical analysis and visualization	University of Hamburg	GPL	Windows	C++
	Mines JTK	Signal processing and display	Dave Hale, Colorado School of Mines	CPL	Cross-platform	Java
	JRG	Modeling and basic processing	John Louie, University of Nevada	Custom	Cross-platform	Java
	Jive3D	Modeling and tomographic inversion	James Hobro, University of Cambridge	Custom	UNIX, Linux	Fortran
	SLIMpy	Processing front end	Felix Herrmann, University of British Columbia	LGPL	Cross-platform	Python
Integrated packages	OpendTect	Geoscience interpretation and visualization	dGB Earth Sciences	GPL or custom	Cross-platform	C++
	GeoCraft	Geophysical analysis and visualization	ConocoPhillips	MIT-style	Cross-platform	Java
	IGeoS (formerly SIA)	Geophysical processing and analysis	University of Saskatchewan	Custom	UNIX, Linux	C++

OpendTect, shown here, is an especially interesting case, because it is licensed in two different ways. You can download a GPL-protected version, which is intended for educational, research and non-commercial use. Thanks to the GPL, anything you develop and share on top of this version is public domain. But you can choose a traditional commercial license, allowing you to, for example, develop and sell your own plug-ins for the software.



Open-source geological applications are much harder to come by, and all of the ones I know of are fairly small utilities, not powerful tools. For example, there are no tools I know of for log display, interpretation, correlation, or petrophysical evaluation. It's unclear what the reason for this is; there are plenty of geospatial tools like geographic information systems, and open-source is flourishing in other high-level sciences like archaeology (which even has a foundation to promote open source development!).

Open data in geoscience

Efforts are being made to free data, especially where that data was acquired by public institutions like governments agencies. The UK Onshore Geophysical Library (UKOGL.org.uk) has been a directory of seismic data in the UK since the 1990s; the Geoscience Data Repository (gdr.nrcan.gc.ca) performs the same function for Natural Resources Canada, but has an order of magnitude less data in it. Public bodies must work to ensure that their data is easily accessible without special tools or knowledge.

A new model for open data is the Open Seismic Repository (opendtect.org/osr/), published by dGB Earth Sciences and affiliated with their OpendTect software. The company is bringing its deep domain expertise and experience with licensing to data publishing, making it easy to release data. This sort of effort is very important if we are to provide real-world examples to people trying to develop better tools and techniques. Industry should donate more data to this program and ones like it.

Open ideas in geoscience

There are several ways the scientific community shares ideas: conversation, conferences, journals, blogs, and even open notebooks. Journals are perhaps the most conventional formal channel, and are often held under strictly traditional terms of copyright. This usually means that only members of the publishing organization can download the content (as with the CSPG, for example), and nobody may use the content without permission of the publisher (at least in theory). The community has adapted to get science done in these circumstances. The thinking is that this 'pay-wall' generates revenue and encourages people to join the organization. The risk is that nobody does, so the journal dies of obscurity.

Open access journals are appearing even in the geosciences. For example, The Open Geology Journal is published by bentham.org, PloS ONE (plosone.org) accepts geoscience articles, and there are dozens more: Advances in Geosciences, eEarth, International Journal of Geomatics and Geosciences, to name a few. Many of them are published under Creative Commons licenses. One innovative openness exercise in geophysics is reproduciblity.org, the home of the Madagascar seismic processing suite. The emphasis is on primary research in geophysics, with open workflows, open code, and refreshable documentation.

Conferences are inherently open, insofar as anyone can come to them (for a price), but the structure of most conferences in geoscience is still quite traditional: a person speaks to an audience, with almost no interaction and certainly no actual work done at the conference. In contrast, a new type of conference, sometimes called an unconference, centers on semi-formal panel discussions, break-outs, and collaboration through open discussion. Ideas and results are captured on-the-fly and online. People can even participate from afar, via simultaneous webcast. We should explore ways to make our conferences more rewarding, especially for practitioners in operating companies, where contribution is not often actively encouraged.

Openness in a closed corporation

I think the best way for an organization to realize some of the benefits of openness, without relinquishing the comfort of proprietary data and industrial secrets, is to fully embrace openness within the boundaries of the corporation. Here are three examples showing how easily this can be tried:

Open tools

Ensure that all proprietary tools that people are using in their work are open and modifiable. This includes spreadsheets, templates, and even webpages. How many times a day do people in your organization find errors in tools, but are unable to do anything about it? Often, the tool doesn't even have any clear ownership, so even if the fault-discover wants to do something, she can't. Even if there is a named owner, chances are good that the person has other responsibilities now, or has left the company. I believe that good corporate practice starts with trust and cooperation, and that treating people this way elicits their best performance.

Open workflows

Most companies have tools for sharing ideas within the organization: instant messenging, discussion groups, wikis, etc. But the effectiveness of these tools is easily undermined by cultural deficiencies. I have heard a manager forbid a question from being asked of another department because it might reflect poorly on them. Another manager refused to let a sister department have some data because “it's ours”. Yet another would mail paper copies of presentations to people who asked for them, so as not to have to give away the file. This sort of pathological behaviour is driven by suspicion, jealousy, and insecurity, and it may seem to protect one's interests in the short term, but in the long term undoubtedly harms the organization and, eventually, the individual too. It is the job of senior managers to signal whether this is acceptable.

Open teams

Most corporations are structured more or less hierarchically. There is one person at the top, a handful of people underneath him, each with handfuls of people of their own. There is substantial overhead in changing anything: a person moving to a new team may have to move to a new floor, change business cards, re-do their personal goals, perhaps even move buildings and change phone numbers. Forming *ad hoc* teams to solve real problems as they arise, or moving people with deep domain knowledge to help where they are needed, or just making the most of your limited human resources, is difficult or even impossible: who will they report to? Whose budget is it? Who will approve their goals? The challenge for management is to create an open corporate infrastructure where these questions don't get in the way of solving problems.

Conclusions

- There are good reasons to adopt a more open attitude in oil and gas exploration and development: it can accelerate innovation, encourage standards, and increase engagement among professionals.
- Many tools and processes have been developed, especially in software and publishing.
- There are lots of projects making open software, publishing open data, and sharing ideas openly. The industry should embrace these initiatives, and find ways to help them succeed.
- There are ways to apply some of the principles of openness within an otherwise closed organization:
  - Develop and promote open tools;
  - Share workflows openly with other;
  - Enable open, ad hoc teams.