

CREWES computer systems

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ABSTRACT

Much of the research performed at CREWES is centred on numerical geophysics. Computers and the software packages they run are thus important tools. This report lists the major systems and software packages available to our researchers.

COMPUTER HARDWARE

The computers used by CREWES run mostly UNIX (Solaris and Linux) and Windows operating systems (Windows 2000 and XP). Porting software from one type of system to another is an expensive process and, in the past, licensing has also been an issue. Therefore, some packages are only available on certain operating systems.

The steady increase in performance of the PC over the last few years, and the availability of licensing on Linux, has led to PCs being the most commonly available and fastest machines at CREWES. A batch of 15 2.4 GHz PCs has recently been received and distributed to graduate students about a month before the publication of this report. Many older desktop and laptop PCs (generally 700 MHz or faster) are available to CREWES researchers in their offices and in a common computer room. A new Linux cluster has recently come online, which will better allow research into optimizing algorithms for parallel computing (Figure 1). Table 1 lists only the larger UNIX workstations.

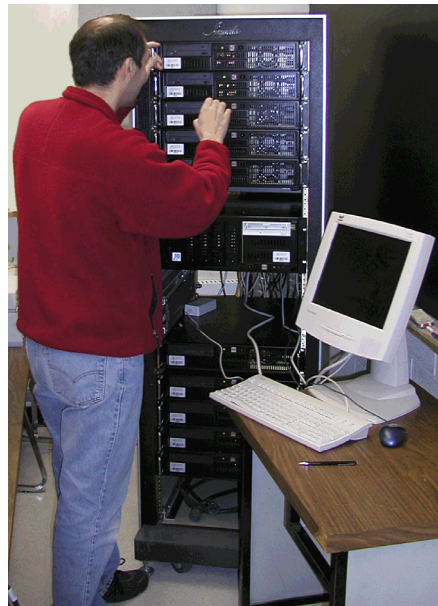


FIG. 1. An eleven node Linux cluster, currently running Matlab and ProMAX.

Table 1. CREWES workstations with specifications

Number of systems	Model	Processor	RAM (MB)
1	Linux cluster	3 GHz Pentium 4, 11 nodes	2048 per node
1	Sun Ultra Enterprise 450	Quad 450 MHz Ultrasparc	4096
1	Sun Ultra 60	Dual 366 MHz Ultrasparc	1280
5	Sun Ultra 10	400 MHz Ultrasparc	128
3	Sun Netra AX1105-500	500 MHz UltraAX-e2	2048

CREWES provides its staff members and many of its students with PCs and a standard set of software. Upgrades are regularly installed on public machines, and on personal machines as the need arises. Table 2 provides a brief list of frequently installed non-geophysical software.

Table 2. Non-geophysical software installed on CREWES computers

Microsoft Office XP	Word processing, spreadsheet /e-mail / database
Matlab	Mathematics, statistics, graphing
Mozilla	Web browsing / e-mail
cygwin	Linux environment running under Windows
WinSCP	scp client
Tera Term Pro	ssh client

COMPUTER SOFTWARE

The following briefly describes some of the software which has been acquired by donation, in-kind payment, or purchase.

Landmark Graphics Corporation

CREWES has a long history of support from Landmark. Landmark continues to provide the latest versions of their geophysical, geological and reservoir engineering applications. Among the most used Landmark applications are ProMAX 2D, 3D and VSP (for seismic processing), and SeisWorks 2D and 3D (for interpretation). ProMAX has been installed on various Solaris and Linux machines. Landmark has also supplied many of their other geoscience packages (Appendix A).

GeoGraphix, which has become a Landmark affiliate since our last systems report, continues to donate their suite of seismic modelling 2D/3D interpretation, petrophysical and well-log analysis software to the University. A variety of packages offer an integrated modelling and interpretation environment for Windows.

Hampson-Russell

Hampson-Russell Software Services, now a part of Veritas DGC, has continued to donate several licenses for UNIX/Windows based geophysical software packages. These include (see Appendix A for a more complete list) AVO - for AVO analysis, STRATA - for post-stack seismic inversion, GEOSTAT - for geostatistical analysis and mapping, GLI3D – for 3D refraction statistics analysis, EMERGE – for multi-attribute analysis and reservoir parameter prediction, PRO4D to model rock physics including fluid effects, and PROMC – which allows the combination of P-P, P-S volumes and model data. Reservoir parameters such as porosity, lithology, and permeability can be computed using well logs and seismic data, along with seismic attributes calculated by the program,

Norsar

The Norsar interactive modeling package enables users to build a geophysical model including anelasticity, perform kinetic and dynamic ray tracing, and generate synthetic seismograms.

Paradigm

Paradigm supports the University by providing several copies of the SeisX 2D and 3D interpretation packages, allowing one to interpret 2D and 3D data, map faults and horizons, and visualize them in three dimensions. Grid balancing and interactive phase/amplitude matching are also available. At the time of writing, Paradigm and CREWES were engaged in discussions on a possible closer relationship, which may provide additional applications from their vast product line.

PUBLISHING

Writing and publishing the yearly CREWES report is a major operation. The report is produced using a digital authoring workflow in Microsoft Word. Completed papers are submitted to an Internet-based database using a web browser interface. The use of an Internet-based data management system continues to work well, and simplifies editing and compilation of the report. The SQL database management software, which is available to all sponsors, minimizes conflicts between authors and editors.

Because of the large number of reports, only abstracts and handouts of PowerPoint presentations are printed for the meeting. The reports are converted from MS Word format to Adobe Acrobat's Portable Document Format (PDF), and distributed to sponsor meeting attendees on a CD along with software releases and recently completed theses. This format simplifies future releases of material on the website.

NETWORK

The CREWES computer systems are all linked with a 10/100 baseT Internet-protocol network. Although not always physically close and connected to one cluster of hubs and switches, the University's intermediate network sections makes the fragmentation of the CREWES network transparent to the users. The Geology and Geophysics department is distributed throughout the Earth Sciences building. A fiber-optic backbone connects network switches on each floor. This year virtual local area networks were created within the building using "VLAN tagging features" in the network switches. This has allowed us

to have more flexibility in our physical network layout, and has optimized our network capacity.

SUMMARY

Through frequent upgrading the CREWES project has maintained a collection of powerful computers and capable software. This has been only been possible thanks to the continuing support of our sponsors and donors. With these improvements, we continue to be able to investigate new, sometimes data-intensive, real-world geophysical problems. We would like to thank the sponsors of CREWES and our valued software donors for making this research possible.

APPENDIX A – SOFTWARE LIST

The following list describes software that is currently licensed and available to CREWES researchers. The list excludes system software and utilities, or less-used software. Since new software may be added at any time, and some software licenses may have been left to expire, this list represents a snapshot of the state of our systems at this time.

Data Loading / Management / Analysis

Package	Vendor	Description
Matlab	Mathworks	Mathematics and statistics package with 2-D and 3-D graphing capability.
Seismic Data Loader	Panther	Simple data loading to / from SeisWorks / SeisX / SEG Y formats.
GEOSTAT	Hampson Russell	Geostatistical analysis of parameters from well logs or seismic.
OpenWorks	Landmark	Data management of seismic, well, interpretation, engineering, production data.

Well log analysis

Package	Vendor	Description
LogM	Geographix	Entry, computation and management of well logs. Can generate synthetic seismograms.
PetroWorks	Landmark	Geographical well log editing, analysis and interpretation.
Syntool	Landmark	Synthetic seismogram generation.
Quikwell+	Landmark	Tools for seismic well log analysis, log editing, and interactively building stratigraphic or structural models.

Modelling

Package	Vendor	Description
LogM	GeoGraphix	Stratigraphic modelling system.
Struct	GeoGraphix	Seismic modelling of structural geology.
AVO	Hampson Russell	Interactive AVO modelling, analysis, and inversion.
GLI3D	Hampson Russell	Static corrections using a near-surface geological model.
EMERGE	Hampson Russell	Multi-attribute analysis and reservoir parameter prediction.
STRATA	Hampson Russell	Post stack stratigraphic analysis and inversion package, model building, wavelet extraction, seismic inversion.
PRO4D	Hampson Russell	Rock physics modeling, including effects due to fluids.
PROMC	Hampson Russell	Combine P-P, P-S volumes and model data.
MIMIC+ QUIK+	Landmark	Geologic model building, depth conversion and visualization / Forward ray-trace modelling for calculating the 2D and 3D seismic response to depth models.
VESPA+	Landmark	Viscoelastic wave equation modelling for flat, multi layered earth models.
TDQ	Landmark	Time-to-depth and depth-to-time conversions, 3-D velocity model building using both seismic and well logs.
ProMAX 2D/3D	Landmark	Complete 2-D and 3-D seismic processing.
ProMAX VSP	Landmark	VSP processing system.
ProMAX 3DPSDM	Landmark	3-D prestack depth migration.
ProMAX MVA	Landmark	Depth-domain migration velocity analysis and modelling in complex geologic/velocity situations.
Poststack	Landmark	Interactive post stack seismic processing for interpreters.
PAL	Landmark	Post stack attribute library, provides horizon and volume oriented seismic attribute extraction.

Interpretation

Package	Vendor	Description
Seisvision 2D/3D	Geographix	Interpretation of 2-D / 3-D seismic data
Openvision	Landmark	3-D visualization of combined seismic, well log and engineering data.
SeisWorks – 2D / 3D / Zap!	Landmark	Seismic interpretation with horizon picking, fault interpretation and correlation, seismic attribute analysis and data display. 3D automatic horizon tracking.
StratWorks	Landmark	Geologic interpretation, well log correlation, cross-sections and mapping.
SeisCube	Landmark	Interpretation, visualization, and animation of data volumes in three dimensions.
Rave	Landmark	Finds and visualizes relationships among various seismic and reservoir attributes in map and cross-section views.
Zmap+ full configuration	Landmark	Integrated surface mapping and modelling using data and interpretations from seismic, geologic, petrophysical, and 3-D geocellular models. Line gridding, mistie resolution, map migration and time-to-depth conversion.
Raymap+ / Siva+	Landmark	Map migration and depth conversion in complex exploration plays. Produces depth models from interpreted seismic data. SIVA+ uses interactive model based ray tracing to compute interval velocity maps from seismic trace or stacking velocity data.