TESSERAL GEO MODELING

Tesseral Farm – Installation, Licensing, Running

➢ From company's website *http://www.tesseral-geo.com* **you can download**:

✓ *… latest versions of the Tesseral Products using* **page /Download.** You can also download **Samples Database** *containing a set of prebuilt models, templates and data samples which can be useful at initial learning and application of the package*.

✓ **User Documentation** *using page* **/Support**.

✓ For **other variants of Tesseral products** please refer to corresponding product tab at *http://www.tesseral-geo.com/support.en.php*.

✓ Due to onrush of technology sharply increasing multi-core CPU and GPU-computing power and volume of operative and disk memory, PC's have reached productivity of high-power workstations at incomparably lower cost. The UNIX-like operation systems earlier functioning only on servers and workstations, now are accessible for PC running under Linux-system.

✓ The seismic modeling earlier accessible only in the simplified mode (ray-tracing schemes, the scalar wave equation) is also thriving in parallel with growth of computing facilities power. It has reached incomparably greater accuracy of calculations owing to use of more complete approximations of the wave equation – acoustic, elastic, elastic with anisotropy. However volumes of the calculations demanded for realization of more complex approximations of the wave equation, sharply grow with increase of quantity of the parameters used for greater adequacy of seismic model to a real geologic medium.

GPU modeling procedures

✓ In connection with the progress of high-performance computing, especially on a general-purpose graphics cards (GPU) is provided (since 2012) option of 2D-2C and 2.5D-3C modeling using GPU. In case of modeling 3D-3C wave fields it becomes possible to run modeling computations for complexly built geologic media in a reasonable time span with 25-50-fold acceleration relating to 1-core performance:

● NVidia GeForce 560 Ti
   ● Speedup: x30-x50 times
● NVidia Tesla M2050 (recommended)
   ● Speedup: x40-x60 times

Comparison with CPU Intel Xeon E5345 2.33

Tesseral Farm Windows Computation Engine

… enables to use a local windows network for parallel calculations. It allows to carry out calculations on a local PC network, in this way accelerating (in proportion to number of simultaneously used PC) the full-wave modeling and data processing for real models of geological medium. The network version works even with heterogeneous Windows networks. Variant for Windows-cluster is allowing to carry out parallel calculations on Windows cluster.

… allows to implement cluster for high-performance parallel calculations in *Windows XP/ Vista/7 /8 and*

later computers *network*. Compared to numerous Unix-based analogs, clusters organized with *Tesseral Farm* require significantly less preparation efforts, flexible connection topology, and unmatched scalability. After connecting computers (*Nodes*) to a local network and defining some (or all) computers' cluster membership, you can run models against *Tesseral Farm* to distribute the workload between cluster members, control calculations on individual *Tesseral Node* computer, and collect the result.

Network workstations or cluster are organized using *Tesseral Workstation (2D and/or Pro)* product and one (or many) installation of *Tesseral Farm*. The computer having *Tesseral Farm* running (call it the control workstation, or host computer) is initiating and controlling other cluster member computers, call them servers, or nodes (with licensed *Tesseral* package or its computation module). Control workstation also can be used for running computations using *Tesseral Farm.* Cluster membership is limited by existing local area network only and possible configurations can be quite flexible:

- single control workstation, multiple servers;

- multiple dedicated workstations and multiple servers.

✓ Cluster variant is using the cluster's standard software (any *MPI* realization). For Windows it can be freeware *MPICH*. Differences between a cluster variant for Windows from network variant are occurring in licensing. If *number of nodes* is big enough, a cluster version allows to start simultaneously several parallel calculation tasks on different segments of the cluster. However the cluster structure is fixed. Network variant of *Tesseral Farm* allows to change easily a set of PC units for calculation, but does not provide simultaneous performance of more than one parallel calculation tasks. Hence, it is more appropriate for a small number of PC units.

Requirements

A Windows network must be set-up between computers that you want to use. <u>File sharing</u> over the network <u>must be enabled</u> in the network settings. Some over-reacting anti-virus software may block the functioning of this program; such software should be updated or disabled.

Licensing

Tesseral Farm license relates to control workstation (computer having *Tesseral Workstation* and *Tesseral Farm* installed). In this license is also indicated *maximum number of cores* used on network PC's (servers), which may run parallel computations distributed through network.

The network can have more available *nodes* (processors on network PC which can be engaged into parallel calculations) than those ones licensed, however user have to determine the PCs to be used before launching the calculations. Any network PC with installed computation module and properly registered may run computations under direction of control workstation.

Installation steps

- Choose a Control workstation (host computer) among the computers in the network. Any computer can be the host. The host computer may or may not participate in the computations, depending on your choice.

Prepare the control workstation (host computer)

- Download or use supplied from the installation disk the *TesseralFarmHost.exe*.

- Follow the on-screen instructions.

- After the installation is completed, start the *TesseralFarm.exe* program.

When it runs for the first time, it displays a registration dialog.

- The program offers you to search your network for servers with installed computational engines. If you have a lot of computers on the network, this process may take a long time, but it is recommended that you continue. If the program automatically finds all your nodes, you are done with the installation. If you don't see some of your servers in the list, verify that you can access them in the *My Network Places* window. You can repeat the automatic search for computers as many times as you want by selecting *Actions>Add All Available Servers* (it never deletes the already listed servers even if they become unavailable; it just adds newly found ones). Alternatively, you may add servers manually.

- To add a server manually, select *Add server* on the *Actions* menu.

- In the *Remote server name* field type in the name of the remote server (node) that you prepared in step *3.1,* in the form *NodeName* or *\\NodeName*. Click *Add Server*.

- Repeat the step *8* for each node you want to add.

- If you wish to add the local host computer to the cluster to make it perform the computations (if it's not already added automatically), perform the step *8* for the host computer too, and type in its network name (in this case, the host also plays the role of a node, and the preparation of nodes as described in step *3.1* must have been performed for it.) The host computer is listed as *<local>* in the list of servers.

- To exclude a server from computations temporarily, uncheck it.

- To remove a server from the cluster and thus permanently exclude it from computations, right-click on its name and choose *Remove server*.

Prepare server computers (nodes of the network)

✓ Download or use supplied from the installation disk the *TesseralFarmNode.exe*.

✓ The following steps must be performed on **each** node:

- Run the TesseralFarmNode.exe.

- Follow the on-screen instructions. Choose a place for *TesseralFarm* folder (do not change name of folder), which will be used to hold temporary calculation results. The folder must be on a drive with enough free storage space (usually not less than 1-5 Gb) for holding input data files and intermediate result files.

✔ The computational engine is always installed into *\Program Files\Common Files\tsrFarmService*, and always starts from remote *Control Workstation (host computer).*

Preparing Data

- In *Tesseral Workplace (2D or Pro)*Prepare the data by invoking the command *Run>CLUSTER: Create task…(or Run>Migration (Depth Domain)>CLUSTER: Create task…)* . In the dialog that opens, adjust all necessary options and choose or create the folder for storing the data.

- The command prepares the *runtask.ini* file and several more files. The task file has a simple structure and can be edited manually if needed in any text editor and saved as plain ASCII text.

In addition to the runtask.ini, the data files are as follows:

- for modeling, the *<modelname>.tam* file with polygon model and optionally the raster model *<modelname>-PQR-Complex.tgr* file if you are going to run complex model (see Tesseral-2D manual for details);

- for migration, the raster model file *<modelname>+Modl-PQR.tgr*, the seismogram file *<modelname>+Gath<XX>.tgr,* optionally the time file *<modelname>+Time<XX>.tgr* and *aperture.bas* file with apertures.

Running

– Start the *TesseralFarm.exe* program by navigating to its shortcut in *Tesseral-2D Launch* folder on *Desktop* (if installed) or do the same from *Start/Programs/Tesseral* folder. At startup, the program tests all active network connections.

✓ If you do not want a certain node to take part in computations, uncheck it.

– Choose *File/Open*, navigate to the folder with stored *runtask.ini* file, and select it.

✓ The distribution of workload over the cluster nodes is shown in the column *Queue*. For modeling tasks, the range of shot point numbers is shown for each node. For migration, each node's load is indicated as a fraction number in the range 0 to 1. You can edit these numbers by right-clicking them and choosing *Edit calculation range*.

– Click *START*. The program starts copying the task files to nodes (which can be nearly instantaneous or take several minutes, depending on the data files sizes and the speed of your network), then the computation starts. You can monitor the computations in individual nodes in the column *% done*.

✓ If you want to terminate the computation on an individual node, right-click the node and choose *Break calculation*.

✓ If you want to stop computations for all nodes, click *STOP*.

Collecting results

✓ After the computation on each node completes, the resulting files are stored in the folder from which you started the computations.

✓ If you ran modeling, you get resulting files for each source point in the model. You can use the **TesseralWorkplace** *(2D or Pro)* for their following interpretation and processing.