



## Tesseral Parallel Computation Options

**Tesseral Technologies'** goal is to provide our clients with a user-friendly software package and with a high quality product and service. The basic package variant **Tesseral Windows Workplace**, independently of the version, runs under Windows operation system. This allows creating and editing models, computing synthetic shotgathers and processing seismic data.

Presently, 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.

- ✓ Since calculations on one, even multi-core PC for big modeling jobs could be still time consuming, the software package enables to parallel the calculations in several PCs using “network” version – for Windows or using “cluster” version for Linux- or Windows-clusters.

### New! Implemented GPU modeling procedures

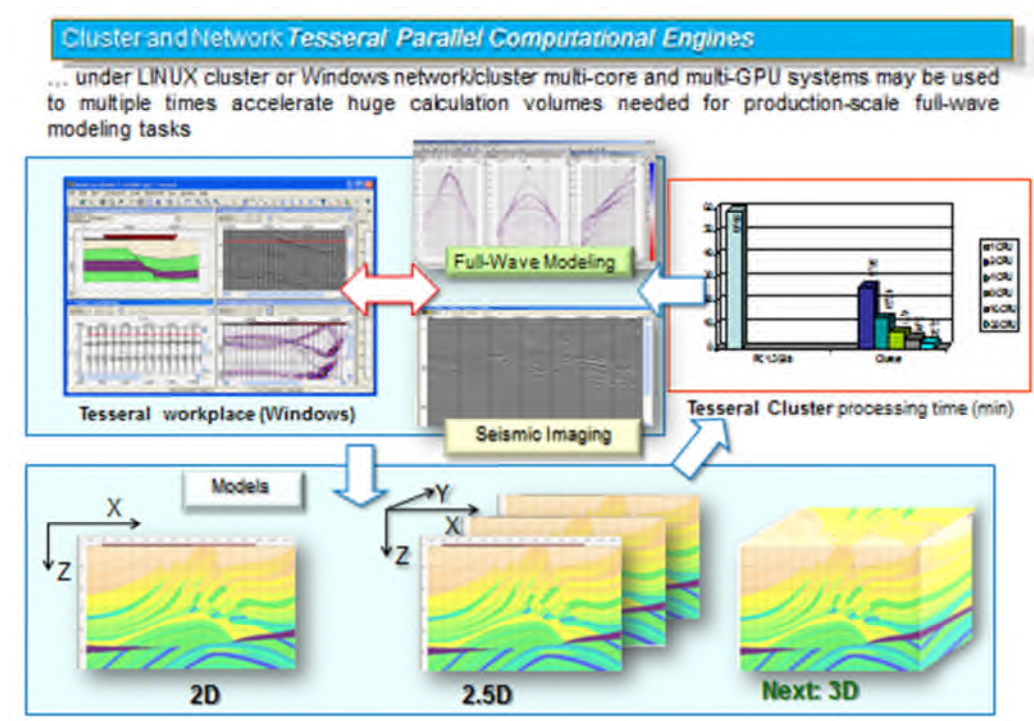
- ✓ In connection with the progress of high-performance computing, especially on a general-purpose graphics cards (GPU) is provided (since 2012) option of 2D-2C and 2.5D-3C modeling using GPU. In case of modeling 3D-3C wave fields it becomes possible to run modeling computations for complexly built geologic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

#### Comparison with CPU Intel Xeon E5345

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

**Variant for Windows: Tesseral Farm** 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 license for the network version is encoding number of remote *nodes* used as a calculation unit depends on a number of *nodes* bundled in the calculations. The network can have more *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. The network version works even with heterogeneous Windows networks. Variant for Windows-cluster is allowing to carry out parallel calculations on Windows cluster.

Parallel computations engine **Tesseral LC** under Linux operational system allow to increase the speed of calculations in proportion to the quantity of processors in the cluster. LINUX multiprocessor systems based on standard processors may be used to accelerate huge calculation volumes needed for full-wave modeling and data processing.



### Variants Tesseral LC and Tesseral Farm include:

- At least one *Tesseral Windows Workplace*.
- For Windows: at least one *Tesseral Farm* utility for starting of parallel calculations of modeling and depth migration on *nodes* in a local user's network. The PC which runs *Tesseral Farm* in this case is called *Control Workstation*.
- The *parallel computations engine*, which can be installed on any number of computers in a local Windows network or Linux or Windows cluster nodes.

For basic operations is used PC workstation (Control workstation) with *Tesseral Windows Workplace* variant (included in price of *Tesseral LC* or *Farm* license), allowing to transfer data on cluster for running calculations which are using the task script created within *Tesseral Windows Workplace*. In such way, by parallelizing of calculations, time of getting of the results can be reduced many times. After calculations are finished, resulting data is transferred back to Control workstation for subsequent processing. Simultaneous performance of several parallel calculation tasks in *Tesseral Farm* is not supported.

Cluster variant *Tesseral (Linux or Windows)* is using the cluster's standard software (any *MPI* realization). For Windows it can be freeware *MPICH*, for Linux *MPICH*, *LAM MPI*, *MVAPICH*, *SCALI MPI*, etc. Usually *computing modules* running under *Tesseral Linux* are compiled for functioning in such environments. 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 *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.