Requirements for Parallel Network Interface in PSCAD

With the Parallel Network Interface (PNI) feature, multiple subsystems, comprising a large electric network, are bound together and run simultaneously over multiple processor cores, resulting in a significant increase in overall simulation speed.

For optimum results, one processor core should be made available for every subsystem, along with one additional core available to run the PSCAD computations. For example, three subsystems could be run on a single computer with a four-core processor.

The number of processor cores that can be used in a PNI study depends on the number of "parallel simulations" programmed on your PSCAD license. A standard v5.0.2 license, for example, containing eight parallel simulations would allow the use of parallel runs over eight cores. Additional parallel simulation capabilities are available for purchase via our Sales Desk (sales@pscad.com).

Table 1 lists the number of parallel simulations available for both certificate and lock-based licensing.

PSCAD Version	Certificate Licensing		Lock-based Licensing	
	Default	*Purchase additional parallel simulations*	*Default*	*Purchase additional parallel simulations*
v4.6.0	8 parallel simulations	Yes (max. 64)	4 parallel simulations	No
v4.6.1	8 parallel simulations	Yes (max. 64)	4 parallel simulations	Yes (max. 64)
v4.6.2 to v5.0.2	8 parallel simulations	Yes (max. 64)	8 parallel simulations	Yes (max. 64)

Table 1: Available Parallel Simulations

Running on a Single Computer

When PNI is performed on a single computer, the optimal ratio of parallel simulations to cores is 1:1, with a recommended maximum of 2:1. Table 2 specifies the optimal and recommended ratios.

Desired number of parallel runs	Licensed capabilities	Single computer		Multiple computers
		Number of computer cores		Optimal number of computer cores
		Optimal	*Recommended Minimum*	
8	8 parallel simulations	8	4	8
16	16 parallel simulations	16	8	16
32	32 parallel simulations	32	16	32
64	64 parallel simulations	64	32	64

Table 2: Recommended Number of Parallel Simulations and Computer Cores

Hyper-threading may affect the performance of PNI simulations. However, the choice of trade-off between using just the physical cores (by turning off Hyper-threading) and effect in performance due to Hyper-threading depends on the user's choice and comfort.

Running over Multiple Computers

When PNI is performed over multiple computers, the optimal ratio of parallel simulations to cores is 1:1. Table 2 specifies the optimal ratios.

The Cluster Launch System (CLS) may be used for coordinating simulations over multiple computers. Separate PSCAD licenses are not required on each connected computer; only one PSCAD license is required.

PSCAD v5.0 supports Remote Direct Memory Access (RDMA) over InfiniBand and RoCE networks to speed up inter-process communication across the multiple computers. RDMA capabilities are available on request.

> **NOTE**: Specialized hardware is required for RDMA functionality. For more information, please contact the PSCAD Support Team.

For details on task parallelism and other high performance computing features, please refer to the article Parallel and High Performance Computing.