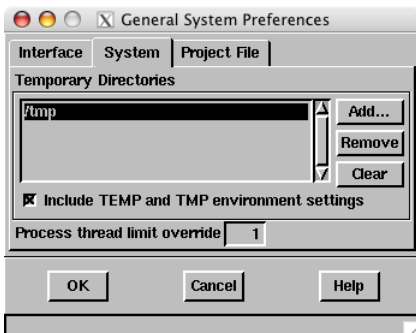


# Multi-Threaded JPEG2000 Compression/Decompression

JPEG2000 compression and decompression operations are multi-threaded in all TNT processes to allow simultaneous use of all of your computer's processor cores (2, 4, 8, or more). Multi-threading with 4 cores enables JPEG2000 operations to utilize 50 to 60% of each core's processing capacity (60 to 80% for dual-core systems), which provides particular speed benefits when the operation involves decompression and compression of large rasters, such as in import/export, extraction, or creating a mosaic.

Multi-threading to multiple cores offers considerable speed benefits in comparison to a single processing thread. Those speed benefits obviously depend on the number of cores, but also on other potentially limiting

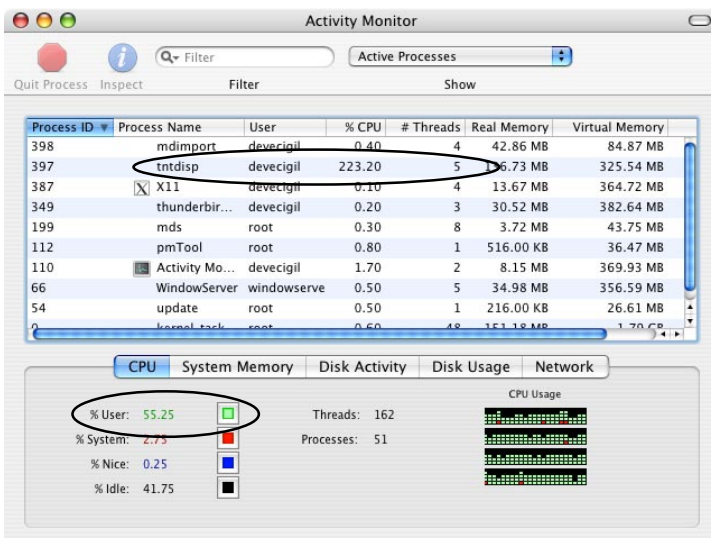
factors such as bus speed, hard drive speed, other concurrent processes that may be running, and whether or not the process is reading from and writing to different drives. You can evaluate the impact of multi-threading in TNT processes on your particular system by using the TNT General System Preferences to temporarily set the thread limit to 1, simulating a single-core system. Timing comparisons are provided below for a task involving both decompression and compression: exporting a large JPEG2000-compressed raster to a tiled set of lossy-compressed JP2 files. In these tests multi-threading resulted in routine usage of 50 to 60% of combined processor capacity on a four-core system, in comparison to 24 to 25% of combined capacity (nearly 100% of a single processor) when the process was limited to a single thread. The multi-threaded test processes thus finished in about one-half the time required under single-threading.



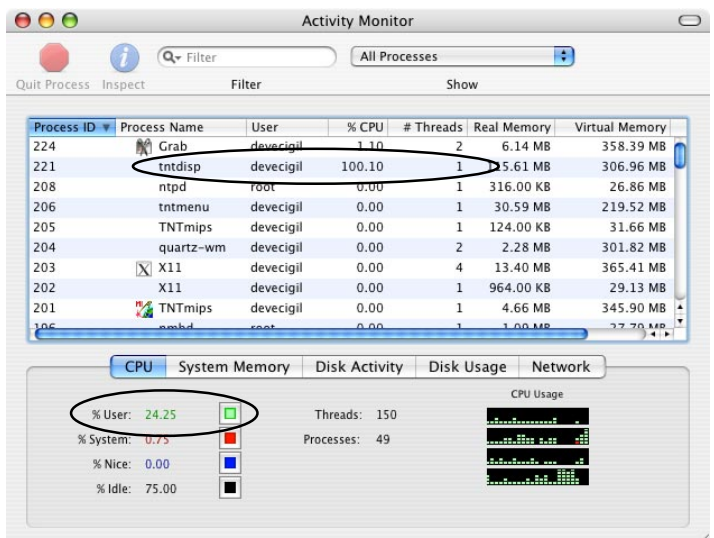
To test your multi-core system's performance against a simulated single-core system, set the Process thread limit to 1 in the General System Preferences (Tools / System / Preferences).

| Timing Comparison, Multi-Thread versus Single Thread   |   |                                    |
|--|---|------------------------------------|
| Task: Export JPEG-2000 compressed raster to tiled set of lossy-compressed JP2 files on Mac Four-Core 2.5 GHz G5 PowerPC; read from Firewire, write to SATA hard drive. |   |                                    |
| Input Raster (RGB Composite)   | JP2 Tiles                               | Processing Time                    |
| 48,203 columns x 35,612 lines<br>500 MB compressed   | 945, 1024 x 1024<br>cells, lossy 10:1   | <b>Multi-Threaded:</b> 11.1 min    |
|  |   | <b>Single Thread:</b> 23.6 min     |
| 115,000 columns x 145,000 lines<br>3.98 GB compressed  | 2,668, 2500 x 2500<br>cells, lossy 12:1 | <b>Multi-Threaded:</b> 1 hr 44 min |
|  |   | <b>Single Thread:</b> 3 hr 36 min  |

With Multi-Threading



Limited to Single Thread



Typical Activity Monitor views showing CPU usage by active processes during tiled JP2 export operation on four-core Mac G5 with multi-threading (left) and limited to a single thread (right). Multi-threading allowed 5 threads for tntdisp, the process name for the export operation. With multi-threading, CPU usage by the export typically ranged between 200 and 240% of the capacity of a single CPU (% CPU value in list), or 50 and 60% of the combined capacity of the four CPUs (% User value in lower part of window), with approximately equal usage between them (green bars in CPU Usage graphs in lower right part of window). When limited to a single-thread, the export process typically occupied 98 to 100% of the capacity of one CPU, and thus only 24 to 25% of combined CPU capacity.