

Chapter 60 - Hardware TnL With The Coprocessor System

Transform and lighting is a good coprocessor job. It is heavy enough to matter, regular enough to batch, and naturally described by shared input and output buffers.

In the checked case-study tree, the main game runs on M68K and the TnL service runs as an IE64 coprocessor worker. The M68K side owns game state and display-list traversal. The worker receives vertex batches, matrices, lighting state, and output addresses.

Here "hardware TnL" means TnL work moved onto another IE bus CPU through the coprocessor system. It is not a fixed-function TnL unit inside Voodoo. Voodoo remains the raster card that receives the transformed vertices later in the pipeline.

60.1 What Crosses The Boundary

Each batch contains:

Field	Meaning
Matrix	Current transform matrix
Texture scale	S and T scale factors
Vertex count	Number of source vertices
Source pointer	Address of the input vertex array
Output pointer	Address of the transformed vertex array
Geometry mode	Lighting and texture-generation flags
Light state	Ambient, directional, and coefficient data

The request header is 152 bytes. Multi-byte fields are big-endian on the M68K side. The worker reads the request and writes the transformed vertices back to shared RAM.

60.2 What Stays Local

The M68K side keeps:

- Game state.
- Display-list traversal.
- Matrix and light selection.
- Voodoo draw-call ordering.
- Decisions about when the previous batch must be drained.

The worker keeps:

- Repeated vertex transformation.
- Lighting calculation for each submitted vertex.
- Writing the transformed vertex records.

- Advancing its mailbox tail when a request is complete.

That split avoids turning the coprocessor into a remote procedure call for every tiny operation.

60.3 Coarse Work Wins

The port does not send one multiplication at a time. It sends a batch. The batch is large enough for the worker to do real work before the caller has to inspect completion state.

The M68K caller also uses the shared mailbox ring directly for frequent batch dispatch after the service has started. That keeps the hot path close to RAM and avoids paying a full command-device cost for each vertex group.

60.4 The General IE Lesson

Use coprocessors for coarse, shared-memory jobs. Put a complete piece of work in RAM, pass a pointer, let the worker finish it, and read a small status result. If the boundary is too fine, the mailbox becomes the programme.