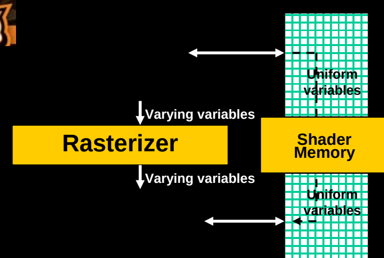
More Details of the Graphics Pipeline

(and Why the Shading Languages Give You Access to Things You've Never Heard Of)

Mike Bailey
CS 519

Oregon State University



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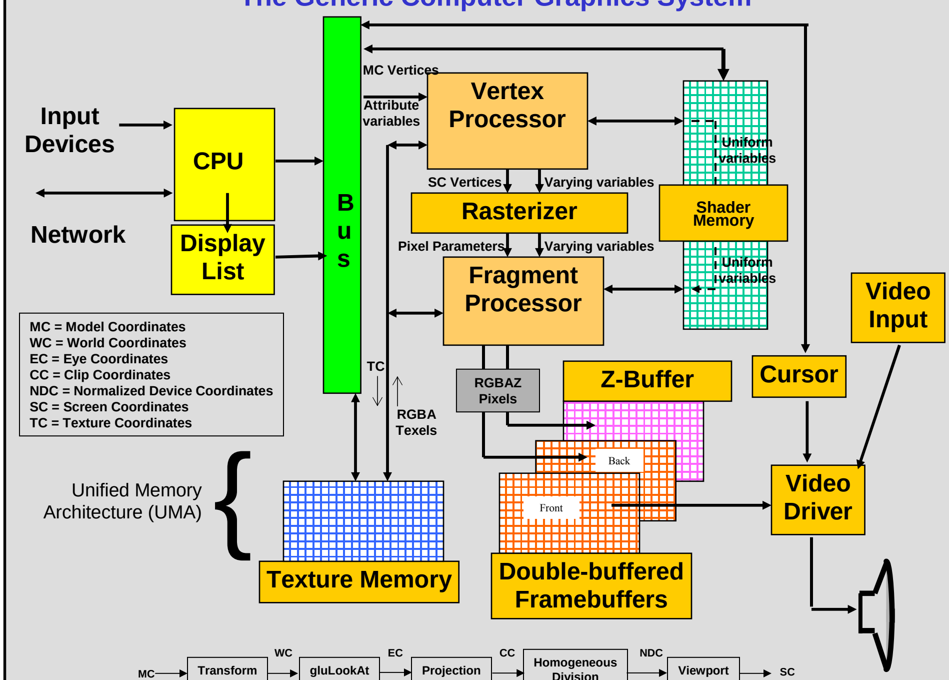
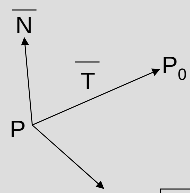
The Generic Computer Graphics System



Transforming a Surface Normal



Before transformation:

$T = (P0 - P)$

$N \cdot T = 0$, or expressed in matrix notation:

$\underset{1x3}{\{N\}^T} \; \underset{3x1}{\{T\}} = 0$

After transformation:

$T' = (P_0' - P') = ([M]\{P_0\} - [M]\{P\}) = [M](\{P_0\} - \{P\}) = [M]\{T\}$

$N' \cdot T' = 0$, or, expressed in matrix notation:

$\underset{1x3}{\{N'\}^T} \; \underset{3x1}{\{T'\}} = 0$

If [Q] is the matrix which needs to transform the normal, then:

$\underset{(3x3 \; 3x1)^T}{([Q]\{N\})^T} \; \underset{3x1}{\{T'\}} = 0$, then, substituting for $\{T'\}$:

$([Q]\{N\})^T [M] \{T\} = 0$, then, distributing the transpose:

$\{N\}^T [Q]^T [M] \{T\} = 0$, then, associating the 2 middle terms:

$\{N\}^T ([Q]^T [M]) \{T\} = 0$, then, remembering that $\{N\}^T \{T\} = 0$:

$[Q]^T [M] = [I]$, so that Q must equal:

$Q = ([M]^{-1})^T$