<table>
<thead>
<tr>
<th>Type</th>
<th>Cost</th>
<th>Latency</th>
<th>Contention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus</td>
<td>(O(n))</td>
<td>1</td>
<td>Worst</td>
</tr>
<tr>
<td>Full crossbar</td>
<td>(O(n^2))</td>
<td>1</td>
<td>Best</td>
</tr>
<tr>
<td>Omega Network</td>
<td>(nk \log n / \log k)</td>
<td>(O(\log n))</td>
<td></td>
</tr>
<tr>
<td>Tree</td>
<td>(O(n))</td>
<td>(O(\log_2 n))</td>
<td></td>
</tr>
<tr>
<td>Hypercube</td>
<td>(O(n \log n))</td>
<td>(O(\log n))</td>
<td></td>
</tr>
<tr>
<td>Ring</td>
<td>(O(n))</td>
<td>(O(n))</td>
<td></td>
</tr>
<tr>
<td>Mesh</td>
<td>(O(n))</td>
<td>(O(V_n))</td>
<td></td>
</tr>
</tbody>
</table>
More Detail, Omega Network

* Omega Network (Duncan Laurie, UIUC)

\[ \begin{array}{c}
\text{k x k} \\
\vdots \\
\text{k x k}
\end{array} \]

\[ \vdots \]

\[ \text{col. (1)} \]

\[ \text{col. (log}_k \text{ n)} \]

Example: \( n = 8, \ k = 2 \)

Banyan Tree (G. Jack Lipovski, UT)

\( l = \# \text{ of levels of switches} \)

\( p = \# \text{ of connection on processor side} \)

\( n = \# \text{ of connections on memory side} \)
BANYAN TREE (CONTINUED)

A Switch:

\[ \ldots \]
\[ m \]

Example: \( l = 2, \ p = 2, \ m = 3 \)

Example: \( l = 3, \ p = 2, \ m = 3 \)
BANYAN TREE (Cont.)

Example: \( l = 4, p = 2, m = 3 \)

\[ \text{81 memories} \]

Note: \( p^l \) processors, \( m^l \) memories

Level 1 switches: \( p^{l-1} \)
\[ \begin{align*}
2 & : m \cdot p^{l-2} \\
3 & : m^2 \cdot p^{l-3} \\
& \vdots \\
1 & : m^{l-1}
\end{align*} \]

Note: For both Omega and Banyan:

A unique path from each to each.
Omega Networks (Bonus Example)