Memory Management (continued)

• Windows Paging
• Wickedly Fun Exam Question
Page States
- Active (also called Valid)
- Transition
- Standby
- Modified
- Modified no-write
- Free
- Zeroed
- Rom
- Bad
Paging Features

- Local and Global page replacement
- LRU on top of FIFO
- Hard and Soft page faults

Figure 7-35  State diagram for page frames
<table>
<thead>
<tr>
<th>Stride</th>
<th>Seconds</th>
<th>Stride</th>
<th>Seconds</th>
<th>Stride</th>
<th>Seconds</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,</td>
<td>1.920</td>
<td>512,</td>
<td>11.890</td>
<td>262144,</td>
<td>18.250</td>
</tr>
<tr>
<td>2,</td>
<td>1.560</td>
<td>1024,</td>
<td>12.190</td>
<td>524288,</td>
<td>14.710</td>
</tr>
<tr>
<td>4,</td>
<td>2.780</td>
<td>2048,</td>
<td>12.960</td>
<td>1048576,</td>
<td>9.810</td>
</tr>
<tr>
<td>8,</td>
<td>5.530</td>
<td>4096,</td>
<td>14.280</td>
<td>2097152,</td>
<td>5.310</td>
</tr>
<tr>
<td>16,</td>
<td>11.450</td>
<td>8192,</td>
<td>16.510</td>
<td>4194304,</td>
<td>4.100</td>
</tr>
<tr>
<td>32,</td>
<td>16.470</td>
<td>16384,</td>
<td>22.070</td>
<td>8388608,</td>
<td>3.820</td>
</tr>
<tr>
<td>64,</td>
<td>15.000</td>
<td>32768,</td>
<td>22.390</td>
<td>16777216,</td>
<td>3.760</td>
</tr>
<tr>
<td>128,</td>
<td>13.390</td>
<td>65536,</td>
<td>21.510</td>
<td>33554432,</td>
<td>2.170</td>
</tr>
<tr>
<td>256,</td>
<td>12.310</td>
<td>131072,</td>
<td>20.270</td>
<td>67108864,</td>
<td>1.170</td>
</tr>
</tbody>
</table>

Size = 1024MB
Things to consider

- Zero pages
- TLB behavior
- Various cache levels
- Cache line sizes
Things to consider

• Virtual and physical caches
• Page coloring
• Side channel attacks