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|---|--|---|---|
| 1. <b>Buffering</b>   | <p>Queue of messages attached to the link</p> <p>Three ways:</p> <ul style="list-style-type: none"> <li>&gt; zero capacity: no messages are queued on a link sender must wait for the receiver</li> <li>&gt; bounded capacity: finite length of n messages</li> <li>&gt; unbounded: infinite length</li> </ul>   | 5. <b>Naming: Direct communication (properties)</b> | <p>Must name each other explicitly:</p> <ul style="list-style-type: none"> <li>&gt; send( P, Message); send message to p</li> </ul> <p><b>Properties</b></p> <ul style="list-style-type: none"> <li>&gt; links are established automatically</li> <li>&gt; a link is associated to <b>one</b> pair of communicating processes</li> <li>&gt; between each pair there exists exactly one link</li> <li>&gt; the link may be unidirectional, but usually bi-directional</li> </ul> |
| 2. <b>Communications in client-server systems</b>                   | <p>Sockets</p> <ul style="list-style-type: none"> <li>&gt; endpoint for communication (161.25.19.8:1625)</li> </ul> <p>Remote Procedure calls</p> <ul style="list-style-type: none"> <li>&gt; used between systems with network connections</li> </ul> <p>pipes</p> <ul style="list-style-type: none"> <li>&gt; allows two processes to communicate</li> </ul> <p>Unix signals</p> <ul style="list-style-type: none"> <li>&gt; used to notify the process of an event</li> </ul>   | 6. <b>Producer Consumer buffers</b>                 | <p>Unbounded: no practical limit on the size of the buffer</p> <p>Bounded: assumes that there is a fixed buffer size</p>  |
| 3. <b>Indirect Communication (properties of communication link)</b> | <p>Messages are directed to and received from mailboxes</p> <ul style="list-style-type: none"> <li>&gt; each mailbox has a unique id</li> </ul> <p>Properties</p> <ul style="list-style-type: none"> <li>&gt; link is established only if processes share a common mailbox</li> <li>&gt; A link may be associated with many processes</li> <li>each pair of processes may share several communication links</li> <li>&gt; may be unidirectional or bi-directional</li> </ul>   | 7. <b>Shared Memory</b>                             | <ul style="list-style-type: none"> <li>&gt; Area of memory shared among the processes that wish to communicate</li> <li>&gt; Communication is under the control of the users processes not the OS</li> </ul>  |
| 4. <b>Message passing (2 steps, implementation)</b>                 | <p>Processes communicate with each other without resorting to shared variables.</p> <ul style="list-style-type: none"> <li>&gt; if Processes p and q wish to communicate they need to :</li> <li>&gt;&gt;&gt; establish a <b>Communication link</b> between them</li> <li>&gt;&gt;&gt; exchange messages via send/receive</li> </ul> <p>Implementation</p> <ul style="list-style-type: none"> <li>&gt; physical: memory hardware bus, network</li> <li>&gt; logical: direct or indirect, synchronous or asynchronous, automatic or explicit buffering</li> </ul> | 8. <b>Synchronizaton</b>                            | <p>Message passing may be either blocking or non blocking</p> <ul style="list-style-type: none"> <li>&gt; <b>blocking is synchronous</b></li> <li>&gt;&gt;&gt; sending or receiving blocks</li> <li>&gt; <b>non-blocking is considered asynchronous</b></li> </ul>  |
|   |  | 9. <b>Two models of IPC</b>                         | <p>Shared Memory</p> <p>Message Passing</p>   |
|   |  | 10. <b>Types of Pipes</b>                           | <p><b>Ordinary</b></p> <p>Allows communication in standard producer consumer style</p> <ul style="list-style-type: none"> <li>&gt; producer writes to one end, consumer reads from the other end</li> <li>&gt; requires parent-child relationship</li> </ul> <p><b>Named</b></p> <ul style="list-style-type: none"> <li>&gt; no parent-child relationship needed</li> <li>&gt; several processes can use the same named pipe</li> </ul>   |