OS Organization

- Monolithic
- Layered
- Modular
- Microkernels

- Pros and Cons: consider size, maintainability and correctness, extensibility and flexibility, performance, portability, ability to support existing applications…
Microkernels

• Liedtke: “… to minimize the kernel and to implement whatever possible outside of the kernel…”.

• What is a minimal kernel?
  – Provide minimal set of services, & support a minimal set of abstractions
  – Everything else implemented as a service outside of the ukernel

<table>
<thead>
<tr>
<th>Abstraction</th>
<th>Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address space</td>
<td>Map, grant, flush pages</td>
</tr>
<tr>
<td>Execution context, i.e, thread</td>
<td>Context switch</td>
</tr>
<tr>
<td>Communication channel between address spaces</td>
<td>IPC/RPC</td>
</tr>
</tbody>
</table>

- and unique identifiers
- many other examples exist…
- is good performance feasible?