Introduction

COMP750 Distributed Systems
What is a Distributed System?

A distributed system consists of a collection of autonomous computers linked by a computer network and equipped with distributed system software.
What is a Distributed System?

A distributed system is a collection of independent computers that appears to its users as a single coherent system.
What is a Distributed System?

“A distributed system is one where you can’t get your work done because a computer you didn’t even know existed has crashed."

- Leslie Lamport
Almost Distributed Systems

- Multiprocessor
- Server with multiple terminals
Why distributed systems?

- People are distributed, data are distributed
- Performance / cost
- Modularity
- Expandability
- Availability
- Scalability
- Reliability
Goals

- Connect users to resources
- Hide the fact that resources are distributed
  - Open
  - Scalable
  - Robust
  - Efficient and powerful
## Transparency in a Distributed System

<table>
<thead>
<tr>
<th>Transparency</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access</td>
<td>Hide differences in data representation and how a resource is accessed</td>
</tr>
<tr>
<td>Location</td>
<td>Hide where a resource is located</td>
</tr>
<tr>
<td>Migration</td>
<td>Hide that a resource may move to another location</td>
</tr>
<tr>
<td>Relocation</td>
<td>Hide that a resource may be moved to another location while in use</td>
</tr>
<tr>
<td>Replication</td>
<td>Hide that a resource may be shared by several competitive users</td>
</tr>
<tr>
<td>Concurrency</td>
<td>Hide that a resource may be shared by several competitive users</td>
</tr>
<tr>
<td>Failure</td>
<td>Hide the failure and recovery of a resource</td>
</tr>
<tr>
<td>Persistence</td>
<td>Hide whether a (software) resource is in memory or on disk</td>
</tr>
</tbody>
</table>

Different forms of transparency in a distributed system.
Structure of a Distributed System

A distributed system organized as middleware.
Note that the middleware layer extends over multiple machines.