Process Migration - II

Models and Approaches



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Outline



- Introduction to Process Migration
- Models and Possibilities
- Load Balancing using Process Migration
- Migrating Resource Segment
- Challenges for creating Global Reference

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Migrating Resource Segment



- The resource segment cannot always be simply transferred along with the other segments without being changed.
 - e.g., say a process holds a reference to a specific TCP port through which it was communicating with other (remote) processes.
 - Such reference is held in resource segment.
 - When the process migrates, it has to give up the port and request a new one at the destination.

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Migrating Resource Segment



- In some other cases, transferring a reference may not be a problem.
 - e.g., a reference to a file by means of an absolute URL will remain valid irrespective of the machine where the process that holds the URL resides.

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Process to Resource Binding



- Binding by Identifier
 - A process refers to a resource by its identifier.
- Binding by Value
 - A process refers to only the value of a resource.
- Binding by Type
 - A process indicates it needs only a resource of a specific type

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Binding by Identifier



- Here, process requires precisely the referenced resource, and nothing else.
 - e.g., a process uses a URL to refer to a specific Web site
 - e.g., a process refers to an FTP server by means of that server's Internet address.
- References to local communication endpoints also lead to a binding by identifier.

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Binding by Value



- Here, the execution of the process would not be affected if another resource provides that same value.
 - when a program relies on standard libraries, such as in C or Java.
 - the exact location of such libraries in the local file system may differ for between sites.
 - Not the specific file, but its content is required for proper execution of the process.

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Binding by Type



- This is the weakest among the three types of binding
- This is exemplified by references to local devices, such as printers, scanners and like that...

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Resource to Machine Binding



- Unattached
 - can be easily moved to another machine
 - Data-file only used by the migrating program
- Fastened
 - can be moved at a higher cost
 - local databases and complete Web sites
- Fixed
 - can't be moved to another machine
 - local devices, local communication endpoint

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Binding and Migration Strategies



- Combining three types of process-toresource bindings, and three types of resource-to-machine bindings, leads to nine combinations
- Let's consider each of these and decide the strategies.

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Binding and Migration Strategies



- Let's consider binding by Identifier
 - When resource is unattached, move it along with the migrating code.
 - However, if the resource is shared by other processes, create a global reference, i.e., reference across machine boundaries.
 - An example of such a reference is a URL.
 - Also establish a global reference, when the resource is fastened or fixed.

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Binding and Migration Strategies



- Let's consider binding by Value
 - Consider a fixed resource.
 - Combination of a fixed resource and binding by value may occur, for example, if a process assumes that memory is shared between processes
 - Establishing a global reference in this case would mean that we need to implement distributed shared memory mechanism.
 - Obviously, This is not really a viable solution.

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Binding and Migration Strategies



- Fastened resources referred by value, could be typically runtime libraries.
 - Normally, copies of such resources are available on target machine, or should be copied before code migration takes place.
- Establishing global reference is better when huge amount of data is involved.
 - If the resource is unattached, then copy (or move) it to the new destination.
- If it is shared between processes, then establish a global reference.

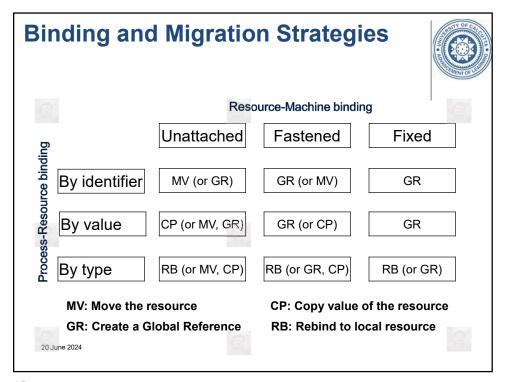
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Binding and Migration Strategies



- The last case deals with bindings by Type.
 - Irrespective of the resource-to-machine binding, the obvious solution is to rebind the process to a locally available resource of the same type.
 - Only when such a resource is not available, will we need to copy or move the original one to the new destination, or establish a global reference.

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Challenges for creating GR



- Creating a global reference may be prohibitively expensive.
 - Consider, for example, a program that generates high-quality images for a dedicated multimedia workstation.
- Fabricating high-quality images in real time is a compute-intensive task. So, the program may be moved to a highperformance compute server.

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Challenges for creating GR



- However, creating a global reference to the multimedia workstation means setting up of a path between the two machines.
 - Besides, significant processing is involved at both ends to meet the bandwidth requirements of transferring the images.
 - The net result could be that moving the program to the server is aborted, only because the cost of creating the global reference is too high.

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Challenges for creating GR



- Let's consider a process for migration that's using a local communication endpoint.
- Here, we are dealing with a fixed resource to which the process is bound by identifier.



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Challenges for creating GR



- There could be two alternate solutions.
 - One solution is to let the process set up a connection to the source machine after it has migrated and install a separate process at the source machine that simply forwards all incoming messages.
 - The main drawback of this approach is that whenever the source machine malfunctions, communication with the migrated process may fail.

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Challenges for creating GR



- The other solution is to have all processes that communicated with the migrating process, change their global references, and send messages to the new communication endpoint at the target.
 - This has a very high the global references of every other process that communicates with the migrating process

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Thanks for your kind attention

