Android Services & Local IPC: The Activator Pattern (Part 1)

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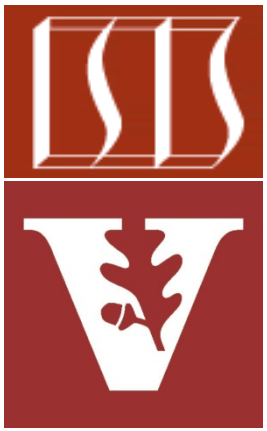

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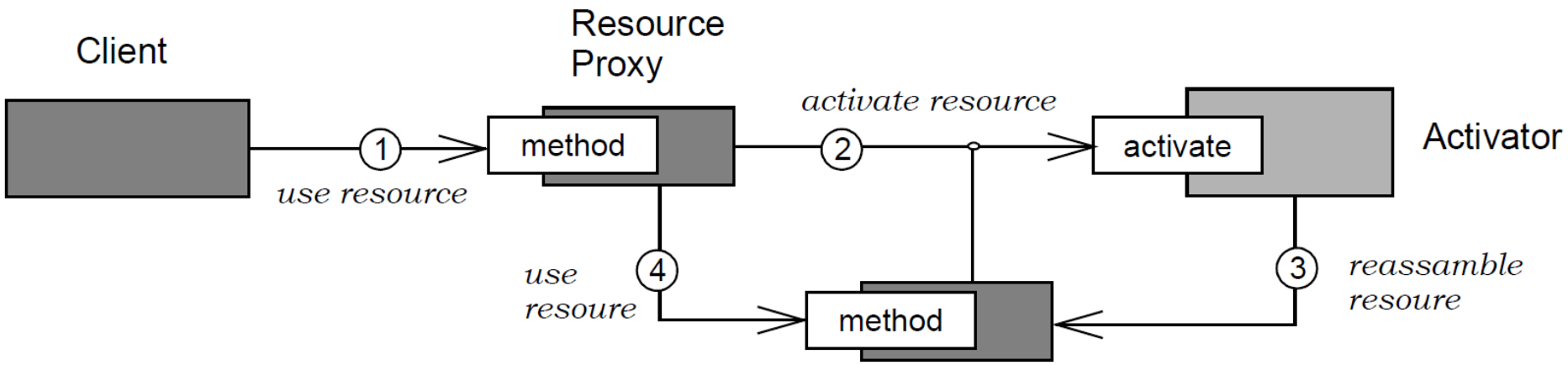
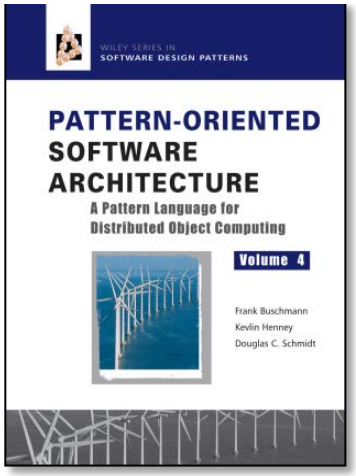
Learning Objectives in this Part of the Module

- Understand the *Activator* pattern



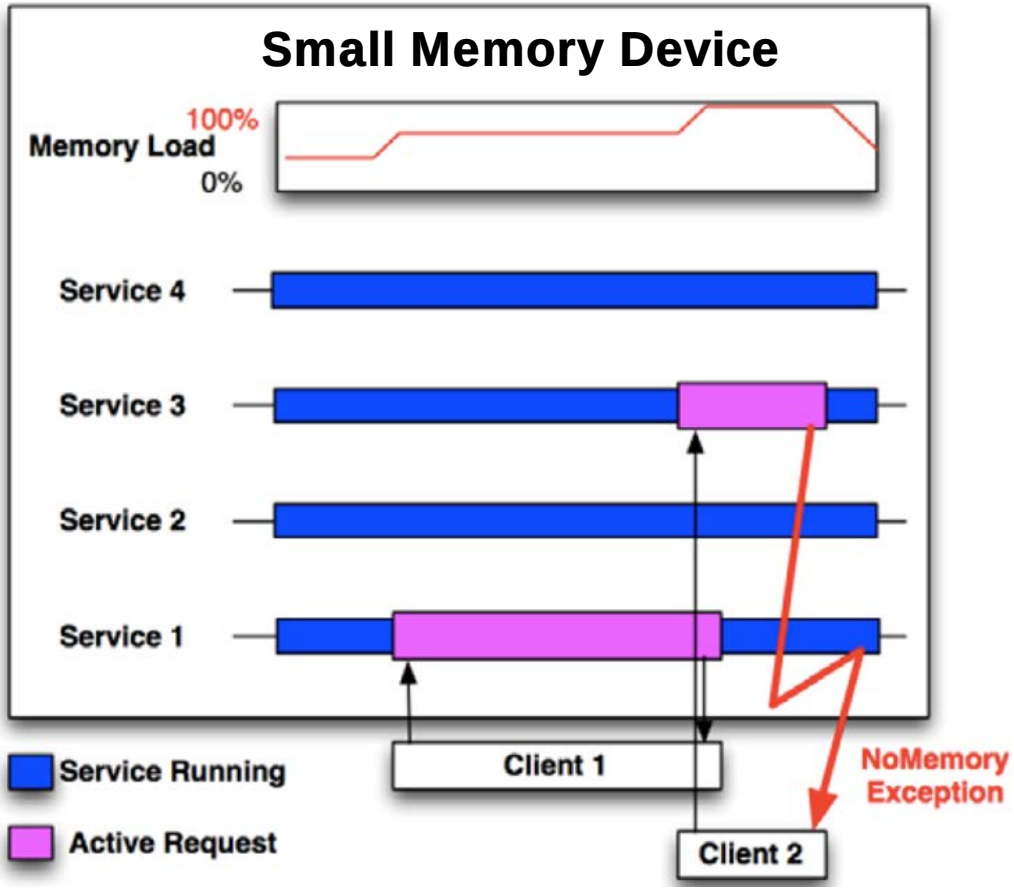

Efficiently and Transparently Automating Scalable On-demand Activation and Deactivation of Services with the Activator Pattern



Challenge: Minimizing Resource Utilization

Context

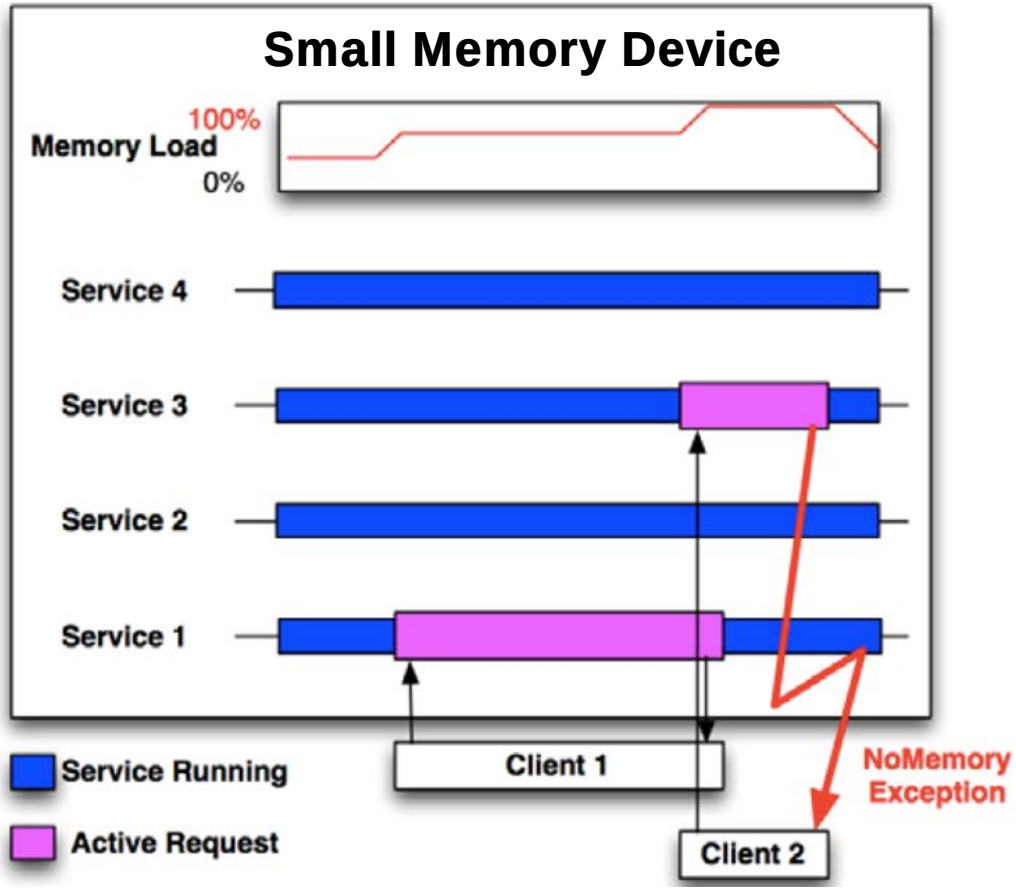
- Resource constrained & highly dynamic environments
  - Random-access memory (RAM) is a valuable resource in any software environment



Challenge: Minimizing Resource Utilization

Context

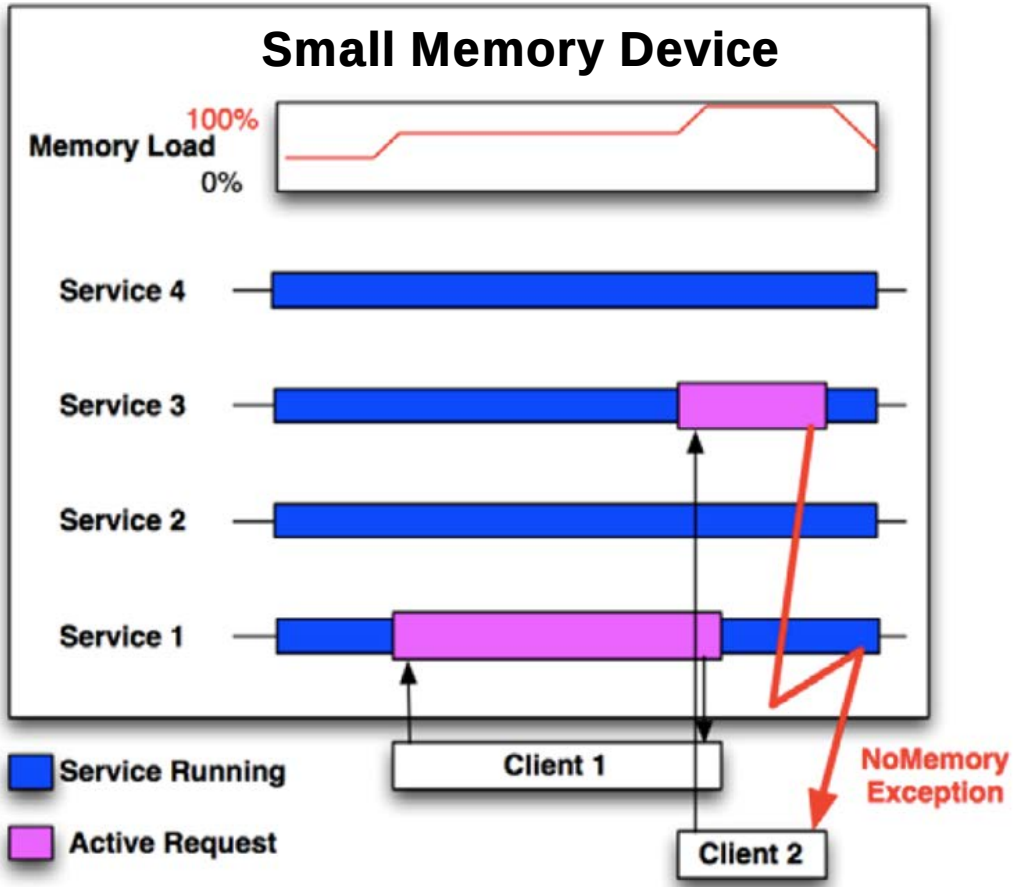
- Resource constrained & highly dynamic environments
  - Random-access memory (RAM) is a valuable resource in any software environment
  - It's even more valuable on a mobile OS like Android where physical memory is often constrained



Challenge: Processing a Long-Running Action

Problem

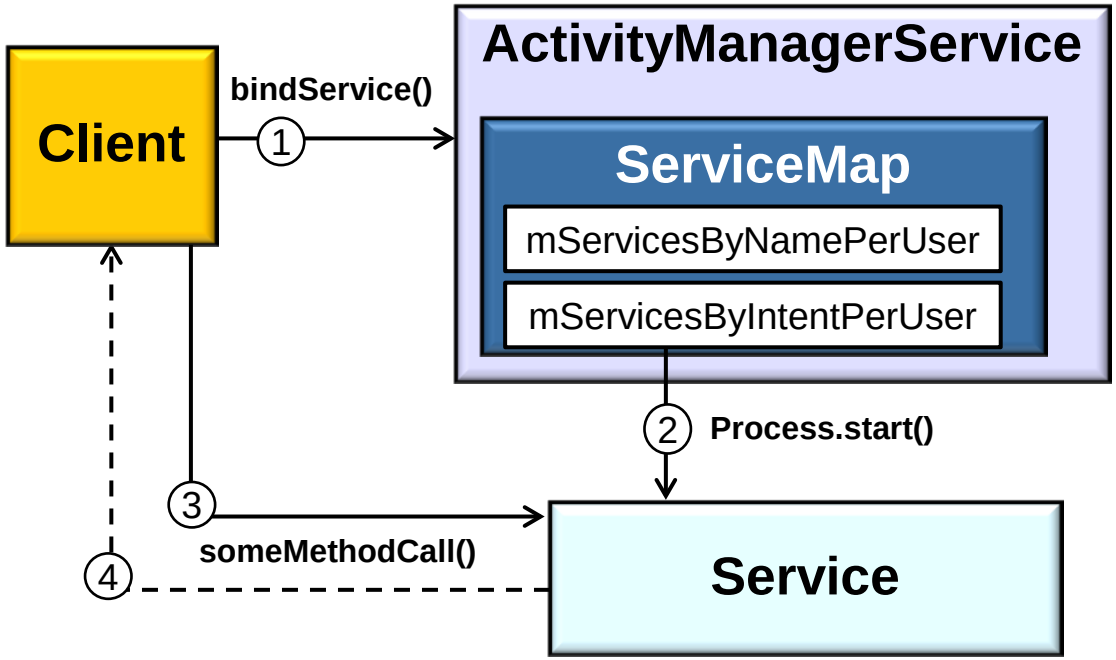
- It's not feasible to have all App Service implementations running all the time since this ties up end-system resources unnecessarily



Challenge: Processing a Long-Running Action

Solution

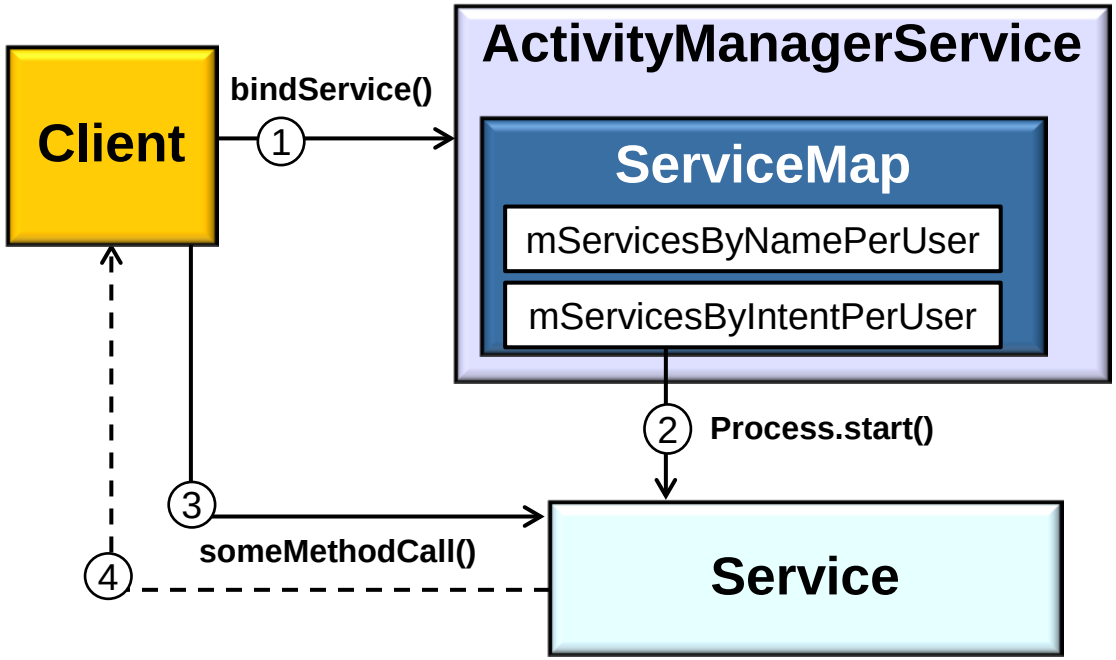
- Apply the *Activator* pattern to activate & deactivate Android Services automatically
  - If your app needs a Service to perform work in the background, don't keep it running unless it's actively performing a job



Challenge: Processing a Long-Running Action

Solution

- Apply the *Activator* pattern to activate & deactivate Android Services automatically
  - If your app needs a Service to perform work in the background, don't keep it running unless it's actively performing a job
  - Be careful to never leak your Service by failing to stop it when its work is done

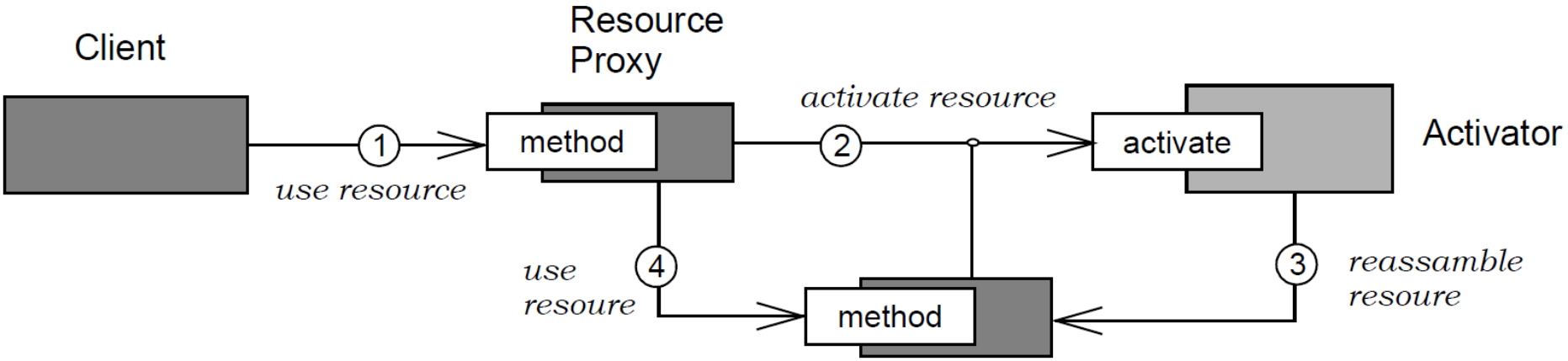


developer.android.com/training/articles/memory.html#Services has more info

Activator POSA4 Design Pattern

Intent

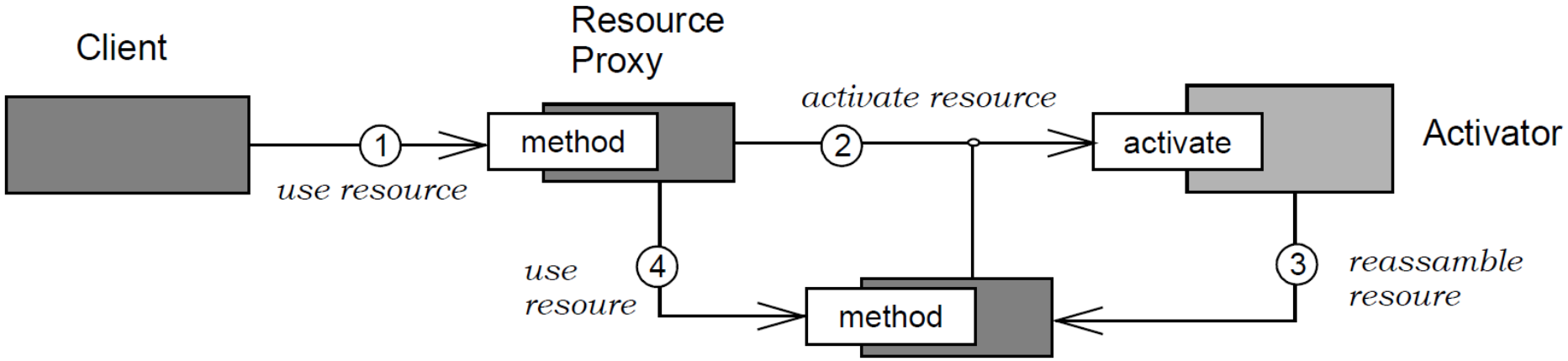
- *Activator* automates scalable on-demand activation & deactivation of service execution contexts to run services accessed by many clients without consuming excessive resources



Activator POSA4 Design Pattern

Applicability

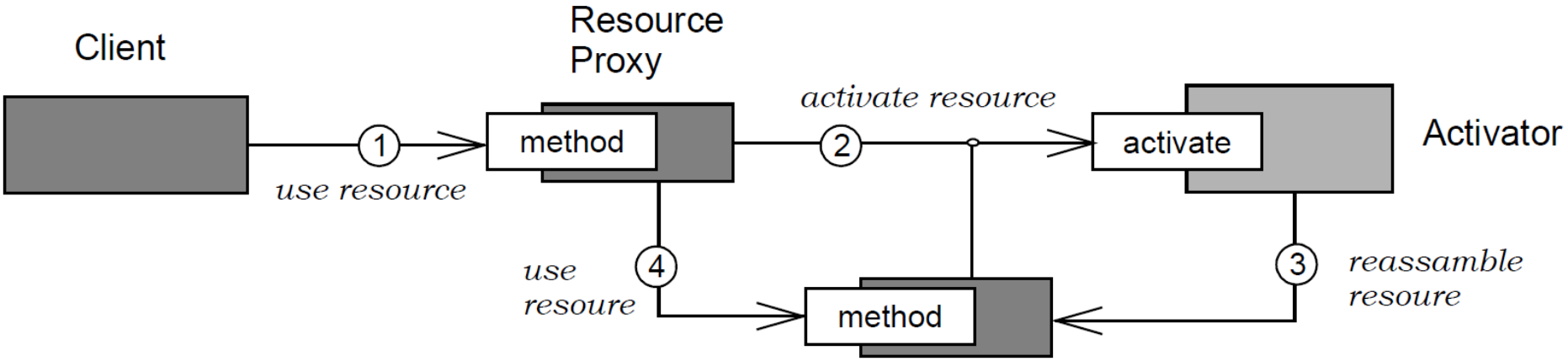
- When services in a system should only consume resources when they are accessed actively by clients



Activator POSA4 Design Pattern

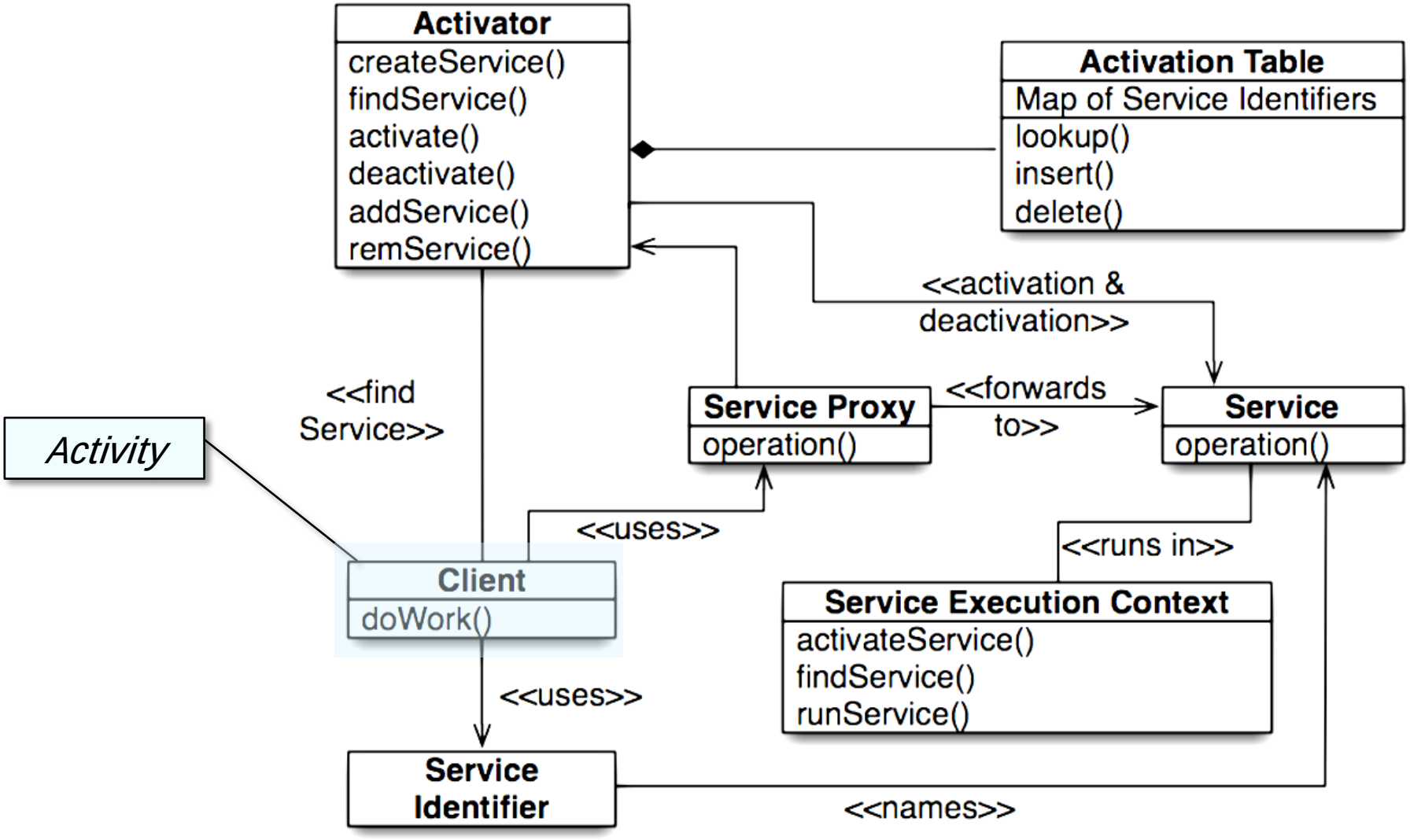
Applicability

- When services in a system should only consume resources when they are accessed actively by clients
- When clients should be shielded from where services are located, how they are deployed onto hosts or processes, & how their lifecycle is managed



Activator POSA4 Design Pattern

Structure & Participants



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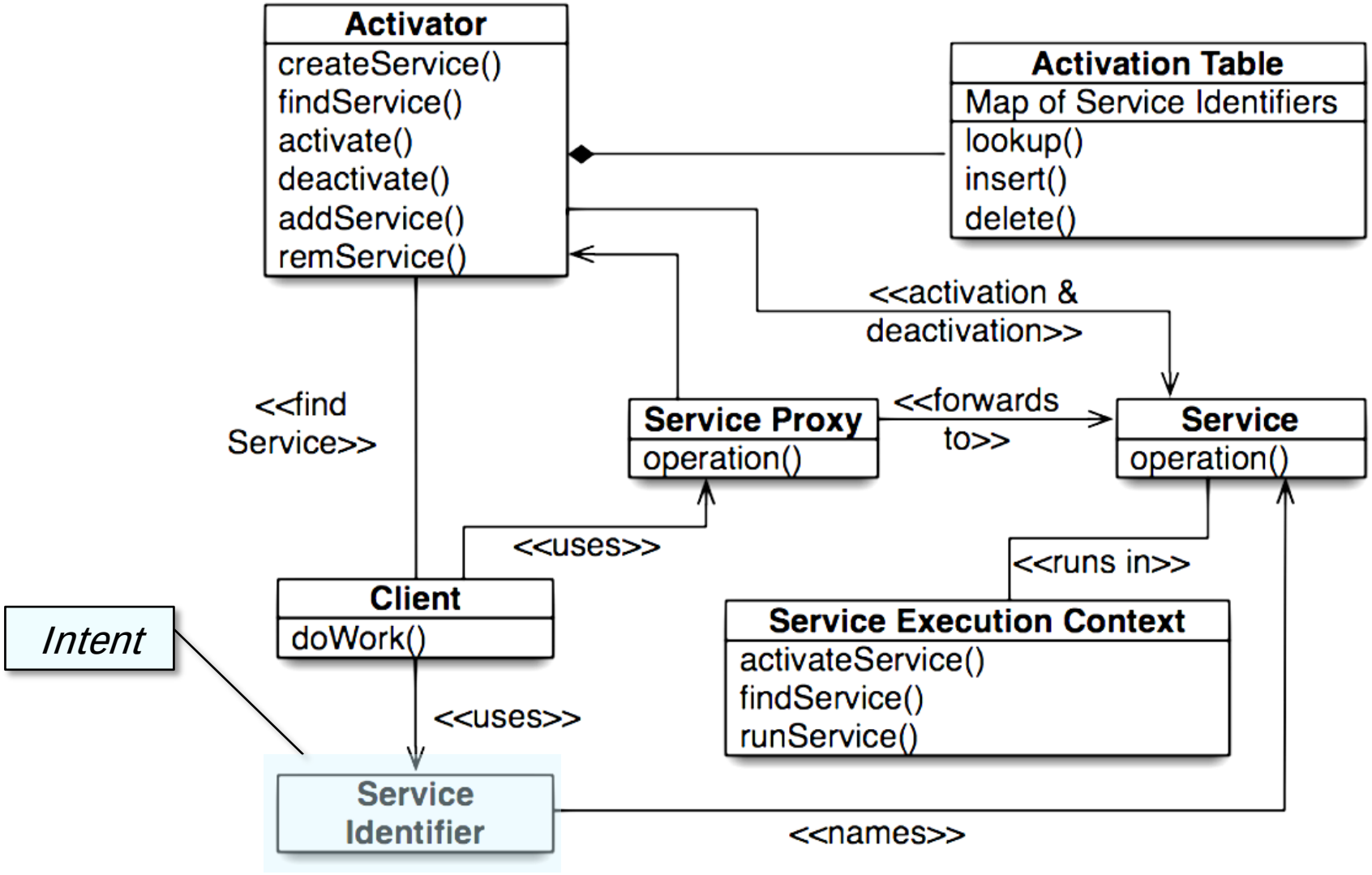

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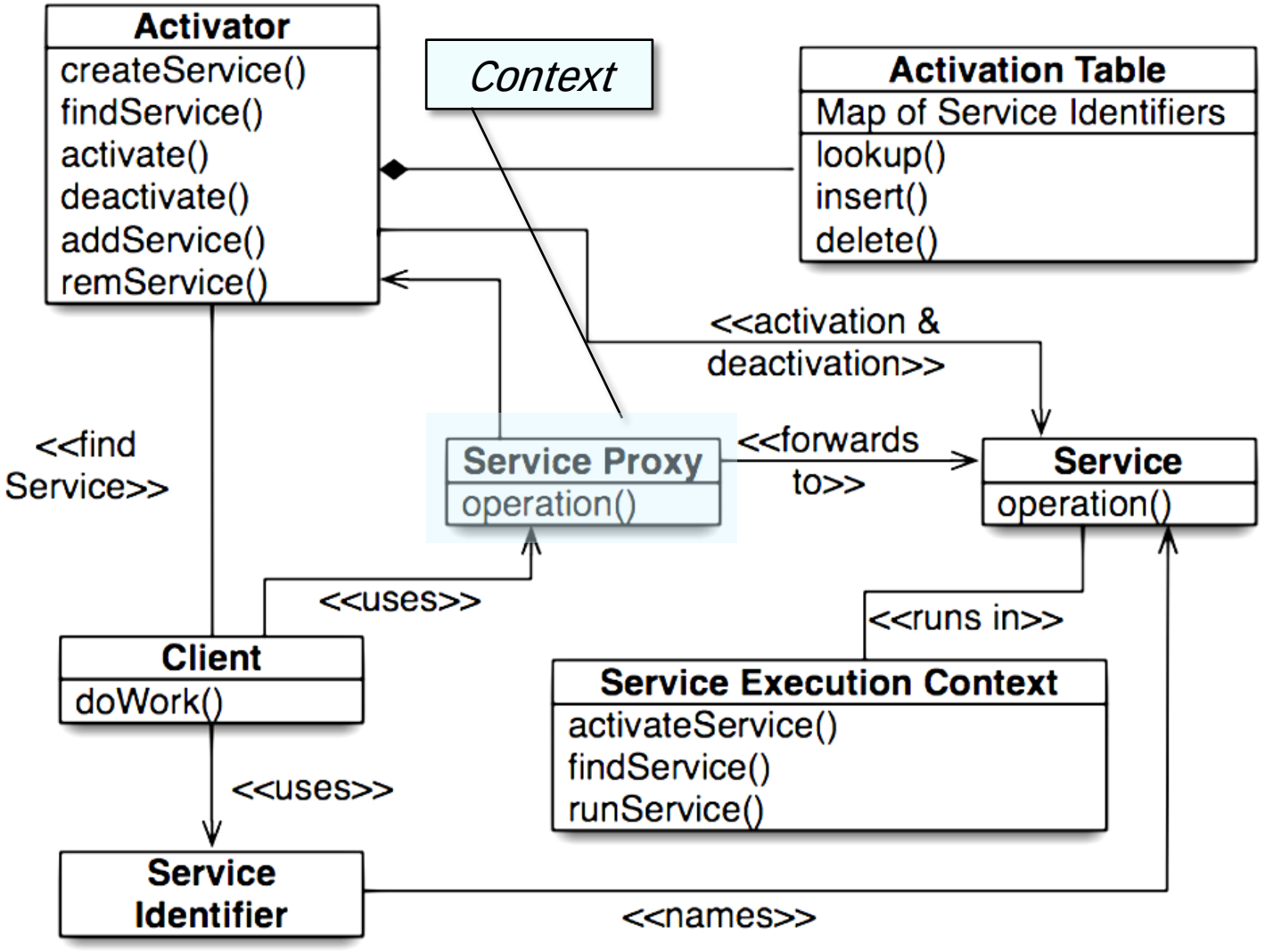

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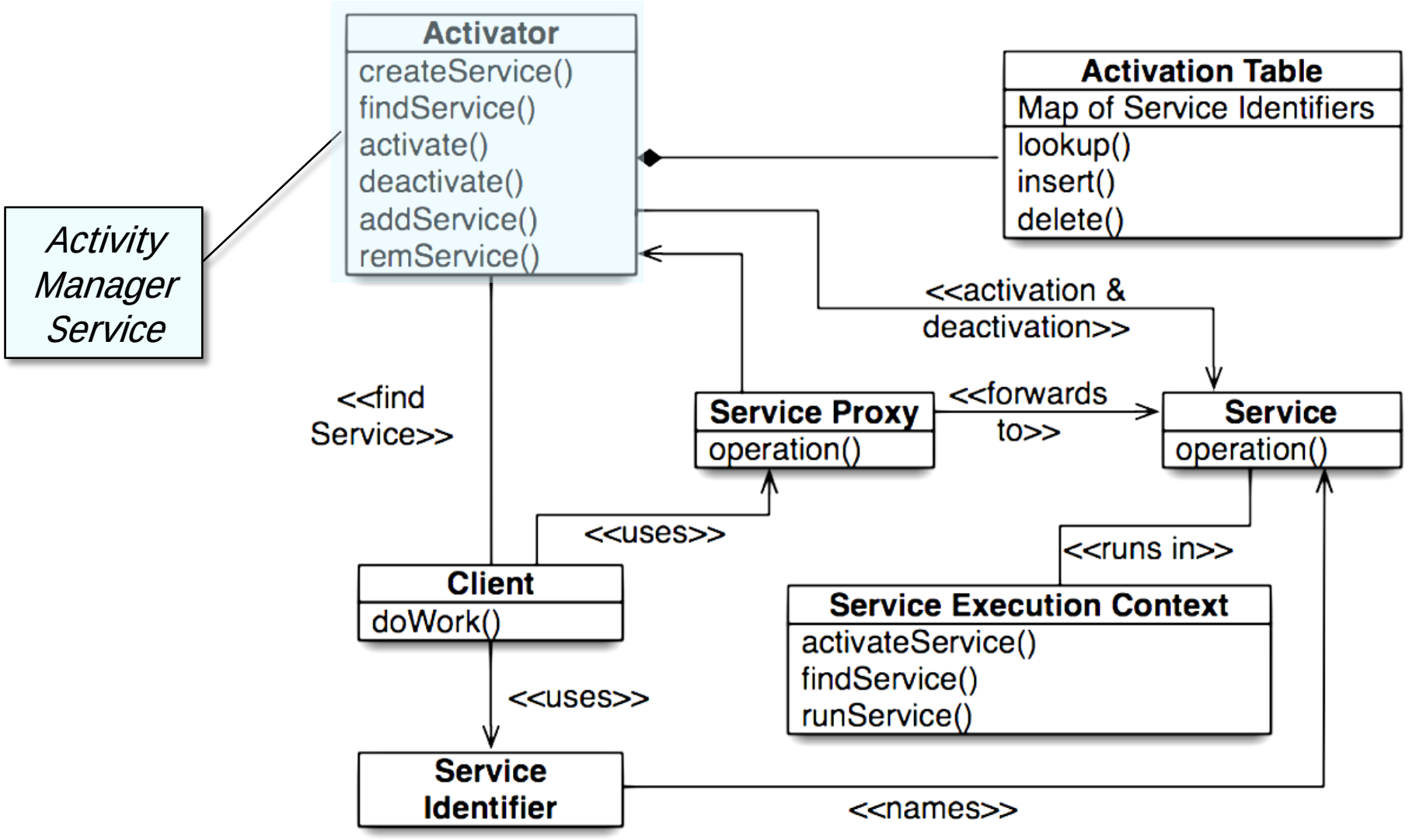

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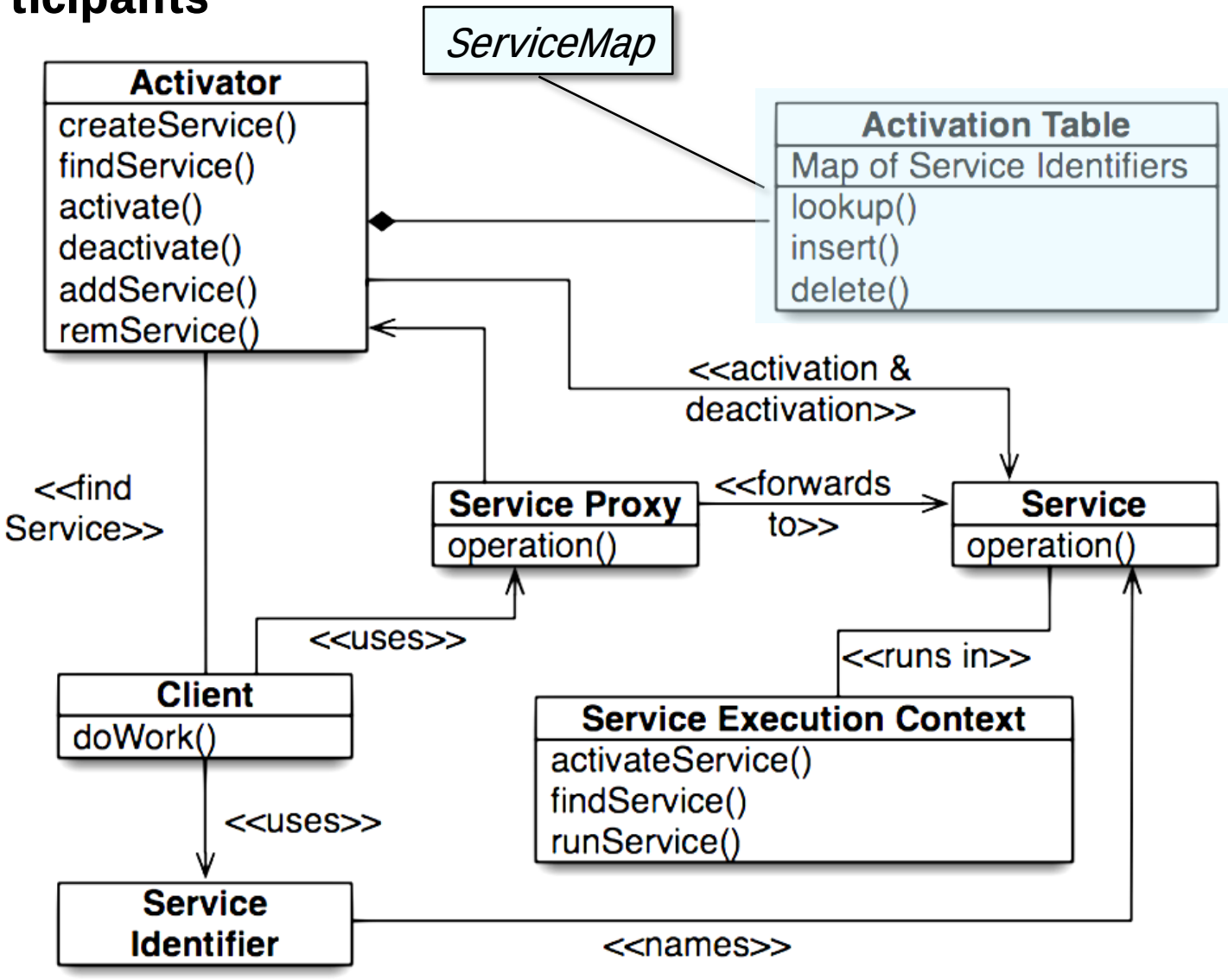

Activator POSA4 Design Pattern

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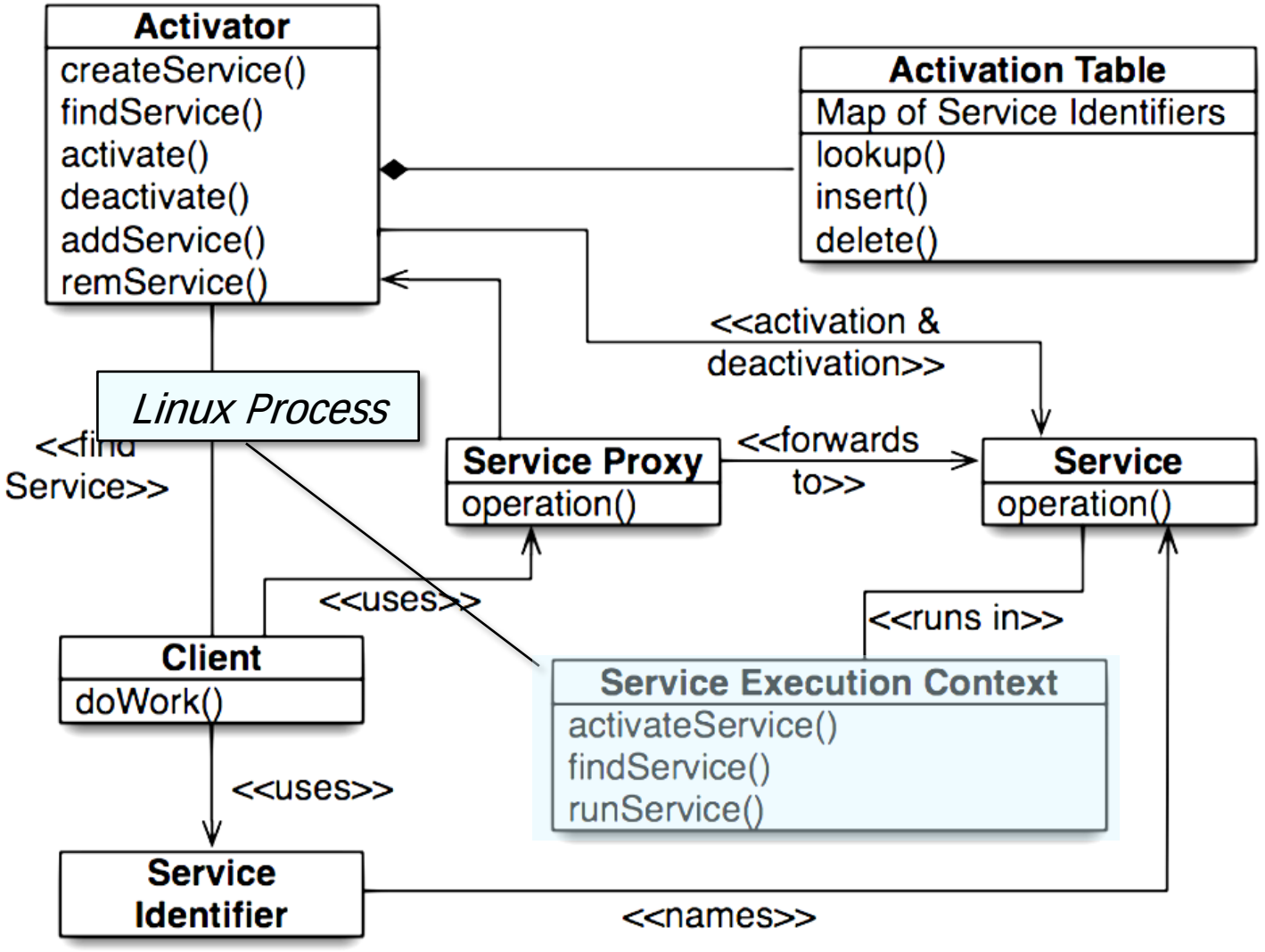

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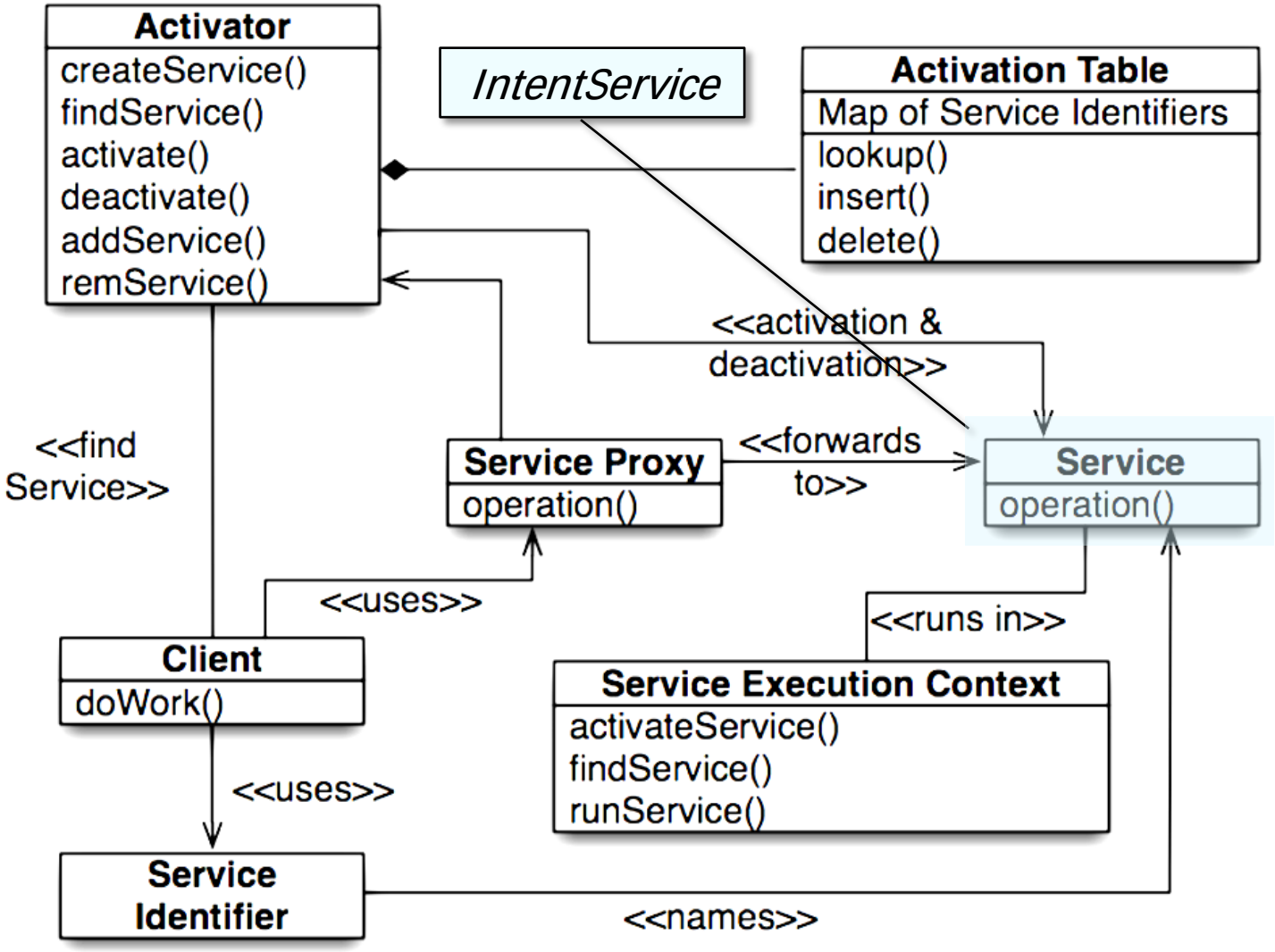
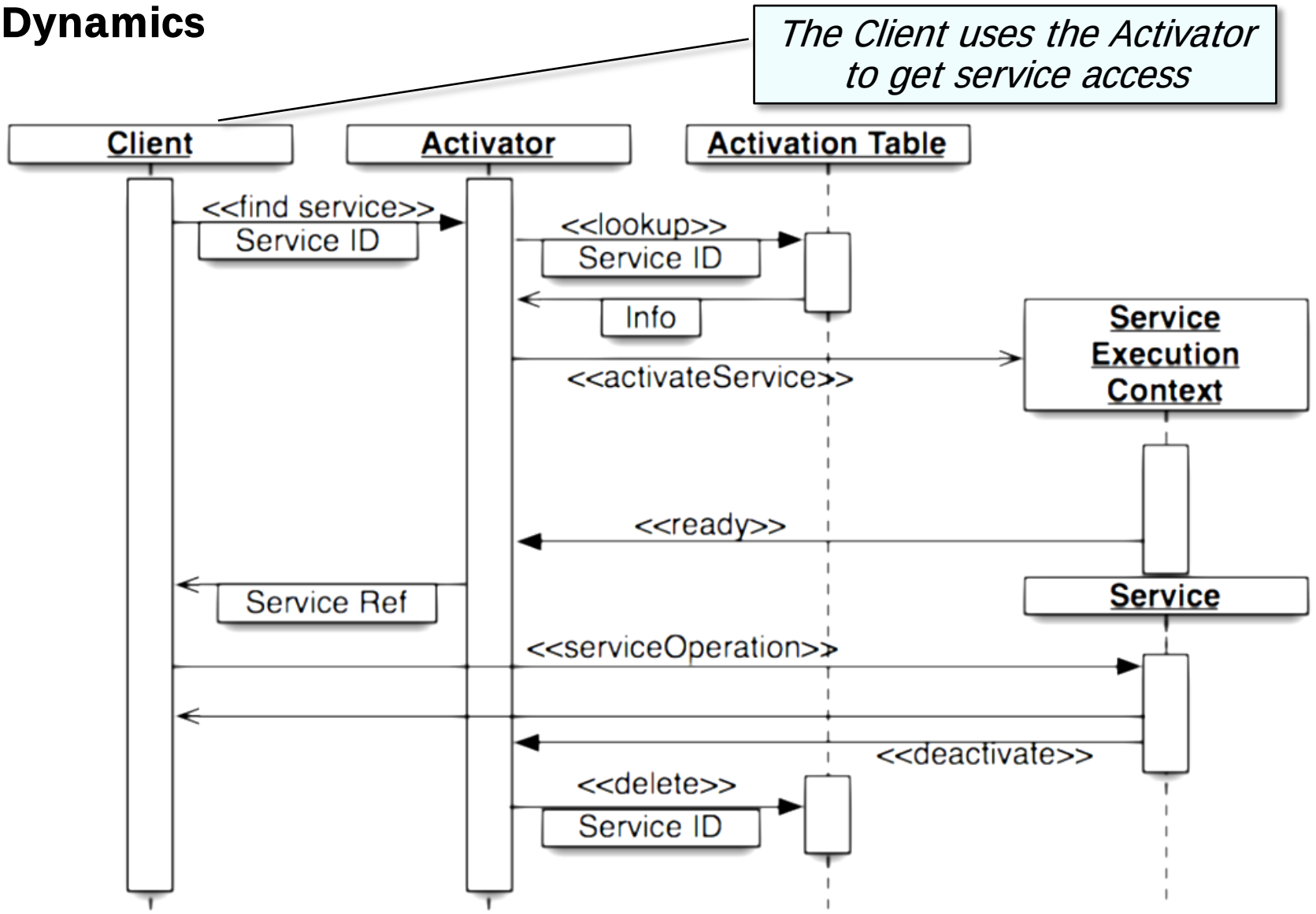


Activator POSA4 Design Pattern

Dynamics



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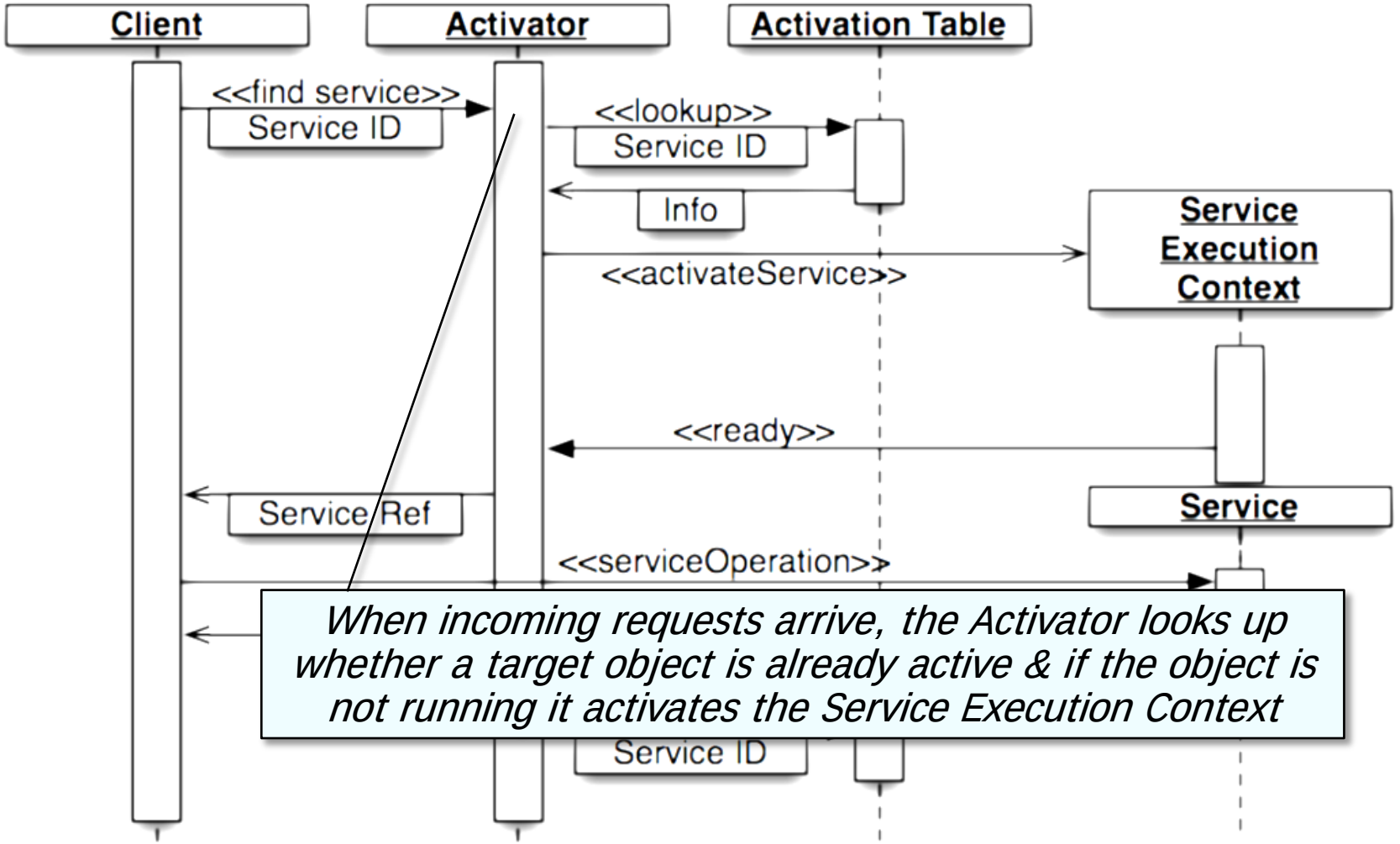

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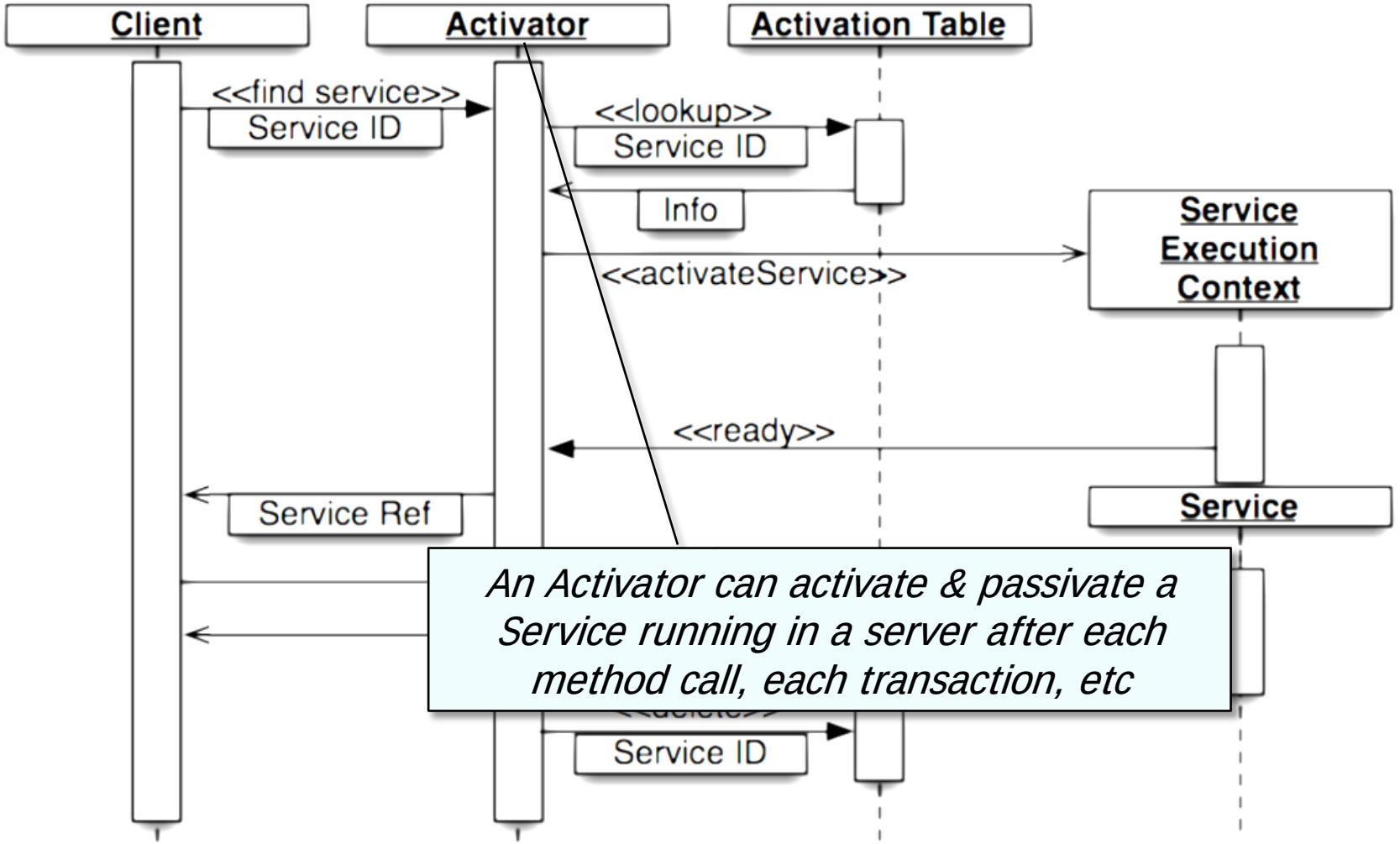

Activator POSA4 Design Pattern

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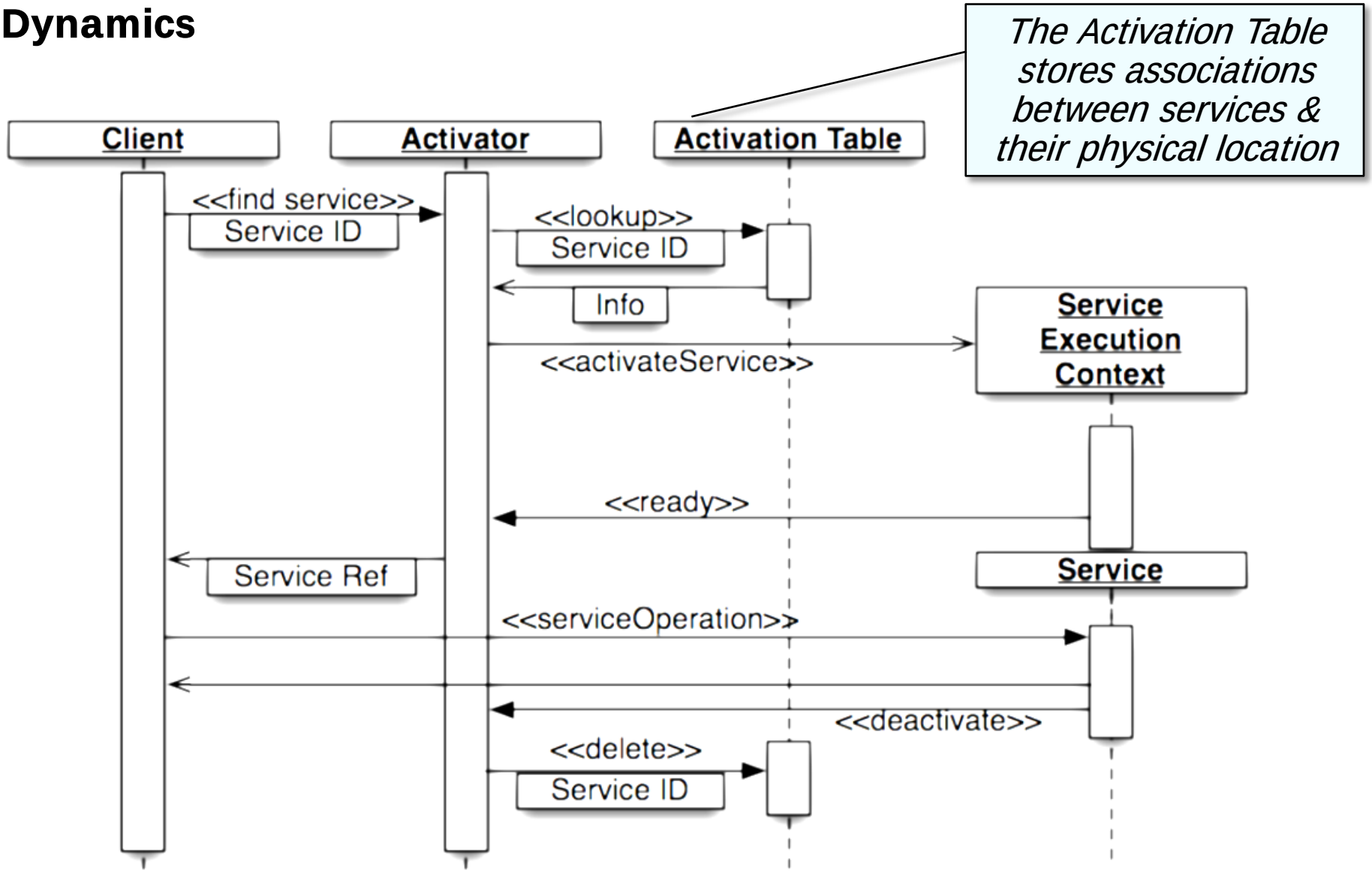

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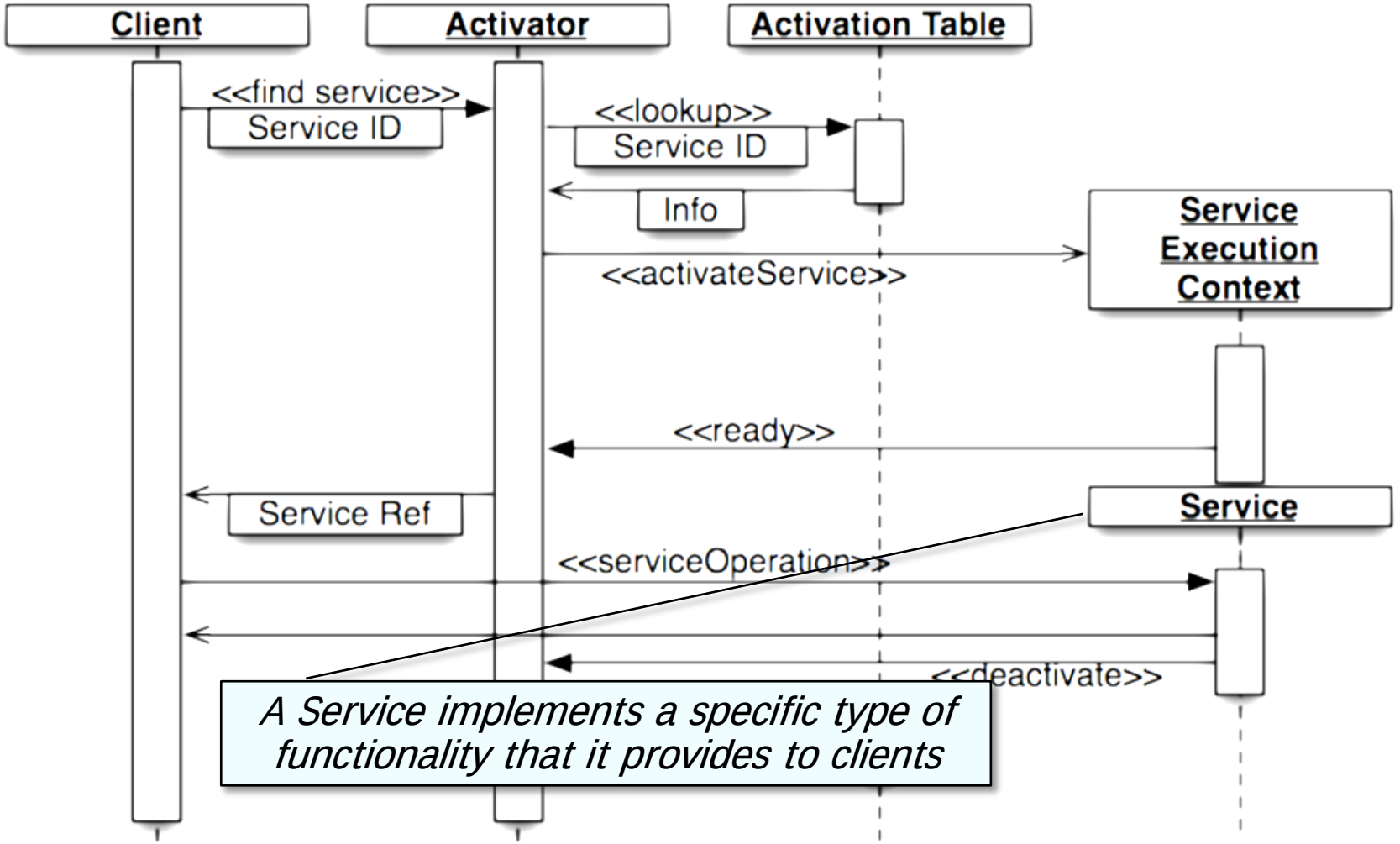
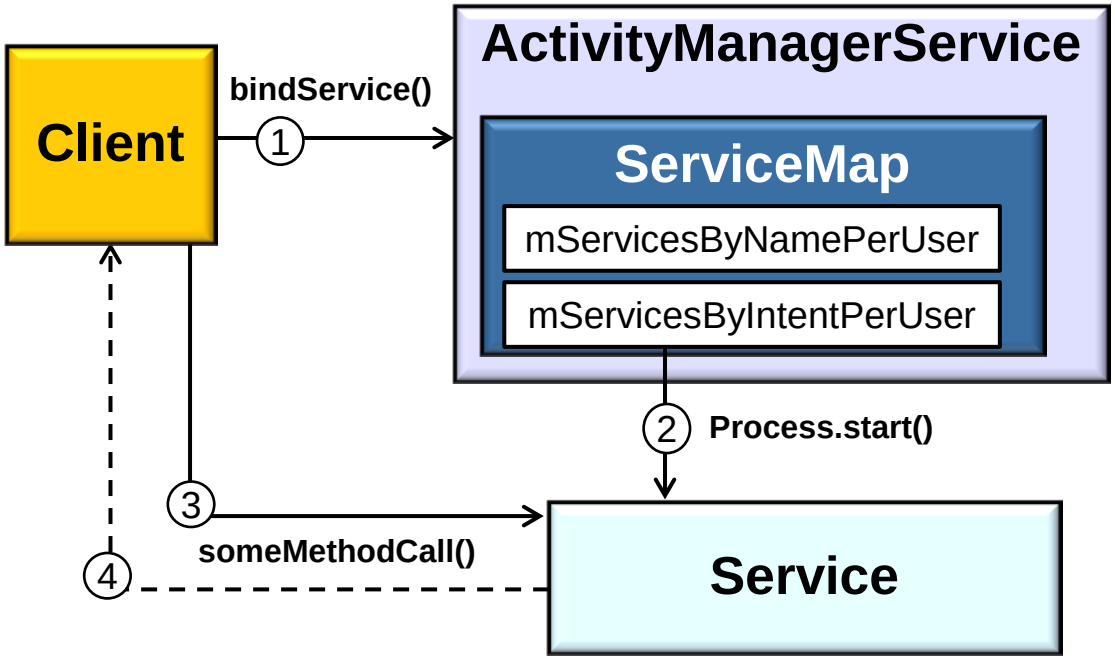


Activator POSA4 Design Pattern

Consequences

+ More effective resource utilization
  - Servers can be spawned "on-demand," thereby minimizing resource utilization until clients actually require them

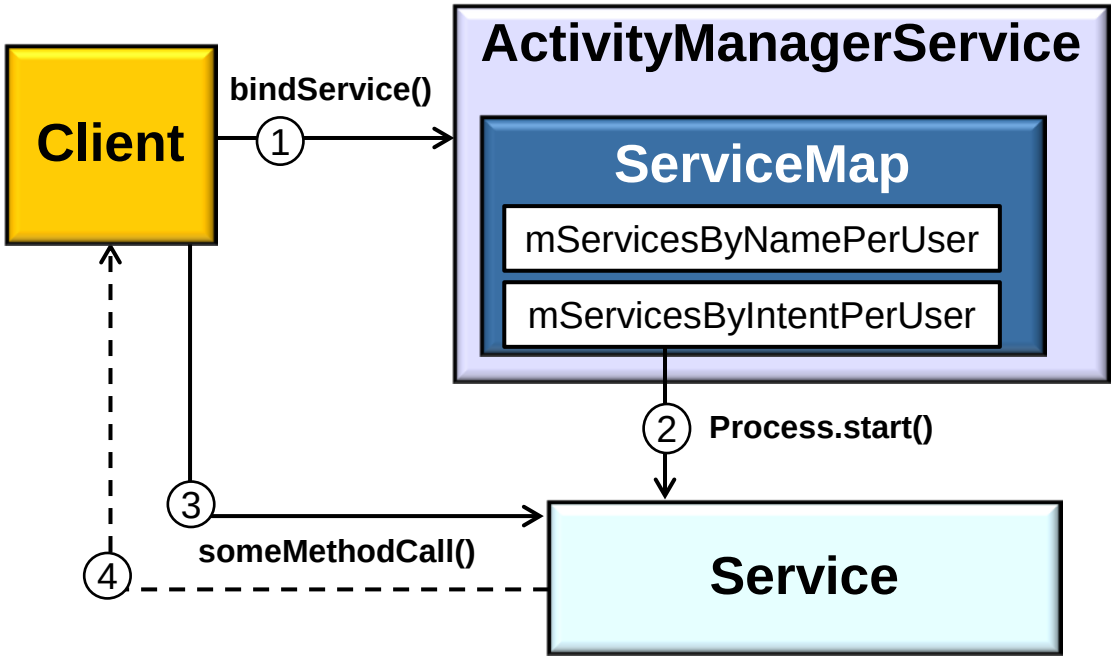


Activator POSA4 Design Pattern

Consequences

+ More effective resource utilization

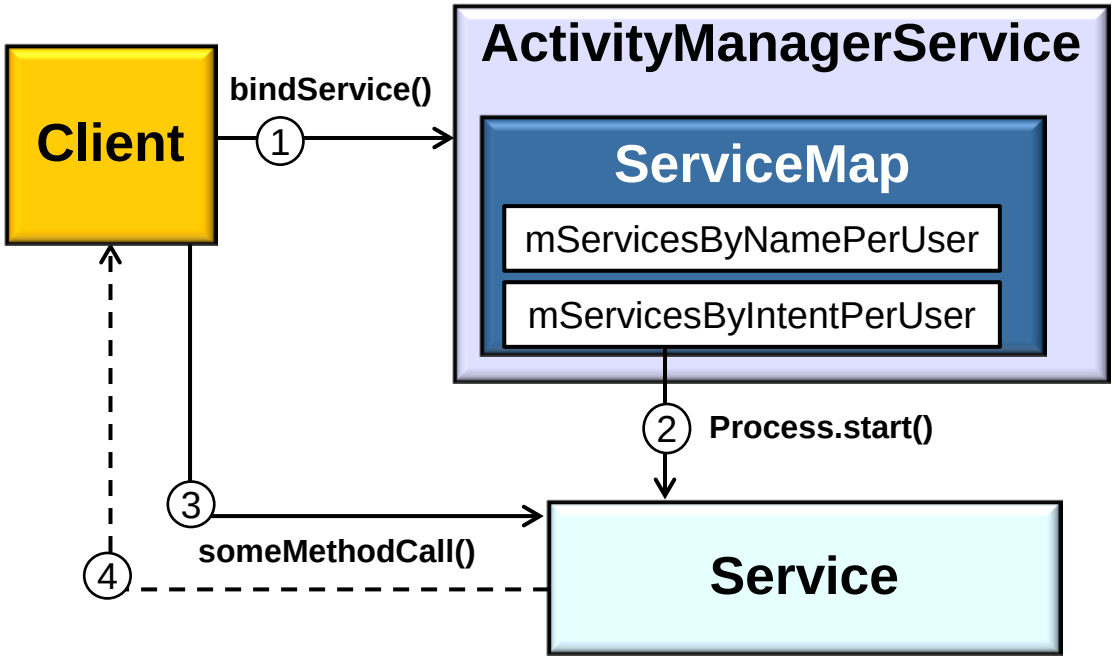
+ Coarse-grained concurrency
  - By spawning server processes to run on multi-core/CPU computers



Activator POSA4 Design Pattern

Consequences

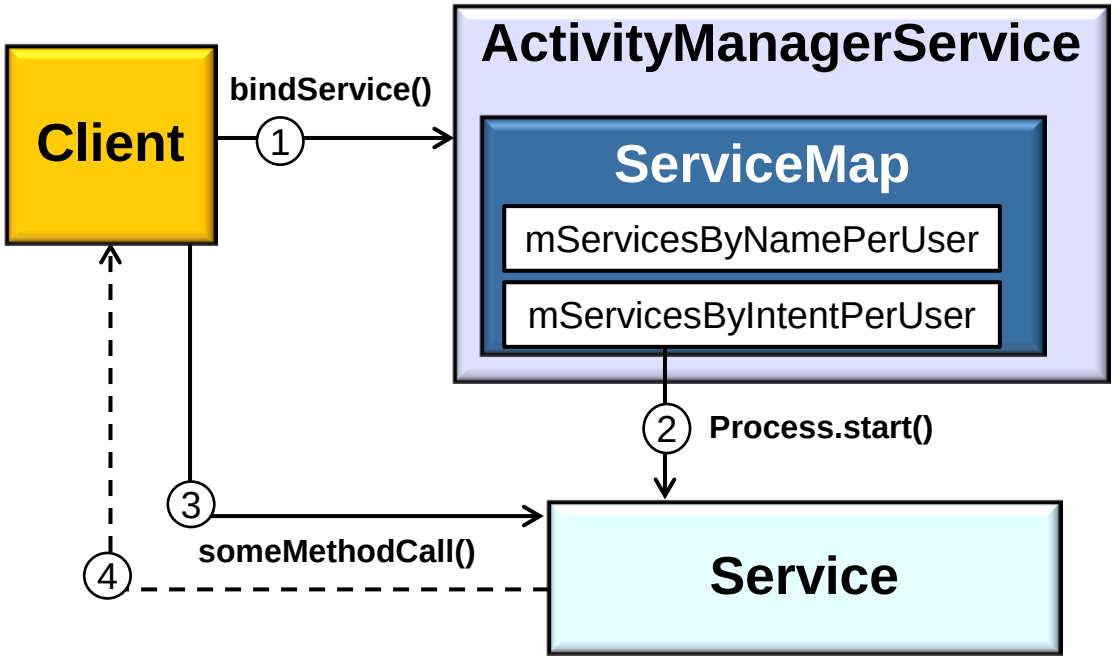
+ More effective resource utilization
+ Coarse-grained concurrency
+ Modularity, testability, & reusability
  - Application modularity & reusability is improved by decoupling server implementations from the manner in which the servers are activated



Activator POSA4 Design Pattern

Consequences

– Lack of determinism & ordering dependencies
  - Hard to determine or analyze the behavior of an app until its components are activated at runtime



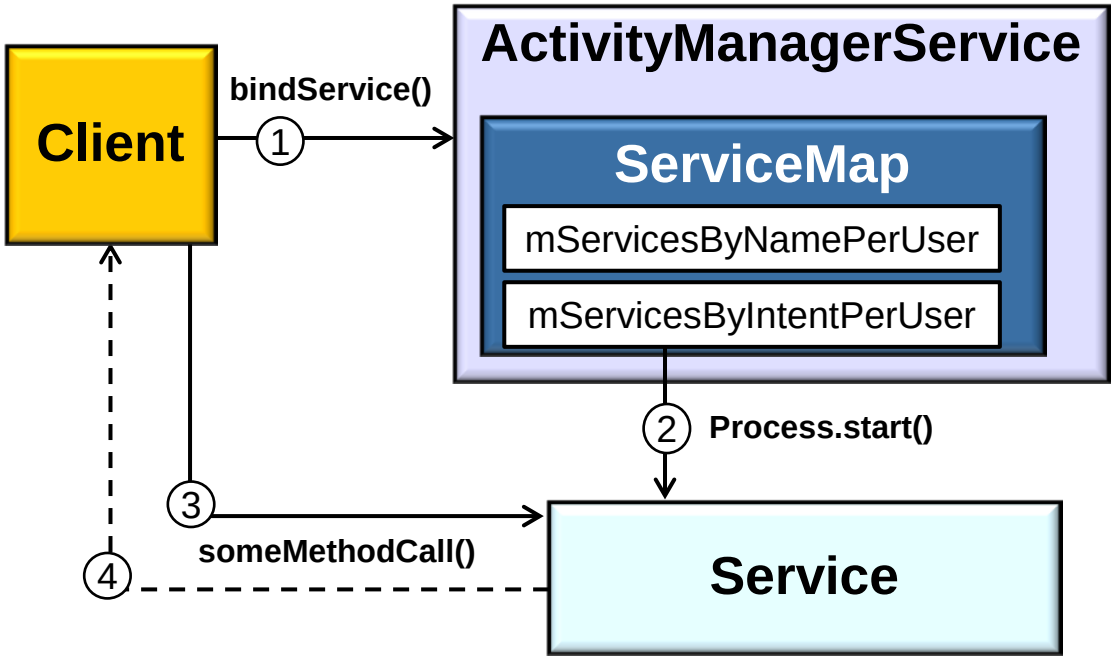
Activator POSA4 Design Pattern

Consequences

– Lack of determinism & ordering dependencies

– Reduced security & reliability

- An application that uses *Activator* may be less secure or reliable than an equivalent statically-configured application



Activator POSA4 Design Pattern

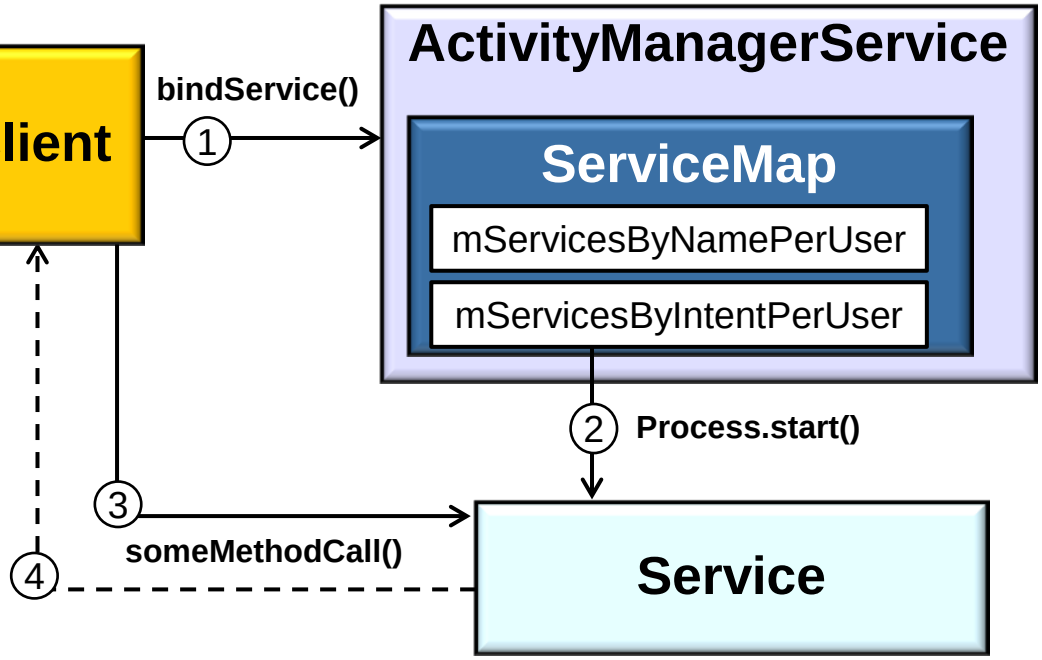
Consequences

– Lack of determinism & ordering dependencies

– Reduced security & reliability

– Increased run-time overhead & infrastructure complexity

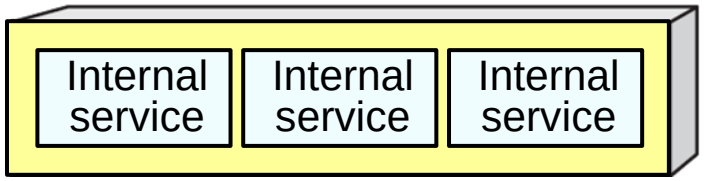
- By adding levels of abstraction & indirection when activating & executing components



Activator POSA4 Design Pattern

Known Uses

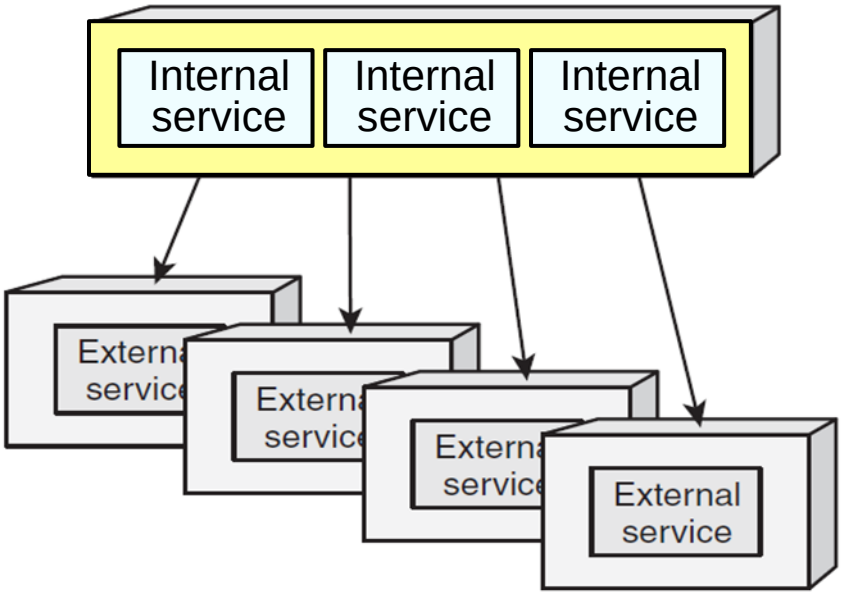
- UNIX Inetd “super server”
  - Internal services are fixed at static link time
    - e.g., **`ECHO`** & **`DAYTIME`**



Activator POSA4 Design Pattern

Known Uses

- UNIX Inetd “super server”
  - Internal services are fixed at static link time
  - External services can be dynamically reconfigured
    - e.g., **FTP**, **TELNET**, & **HTTP**



See en.wikipedia.org/wiki/Inetd for more on Inetd

Activator POSA4 Design Pattern

Known Uses

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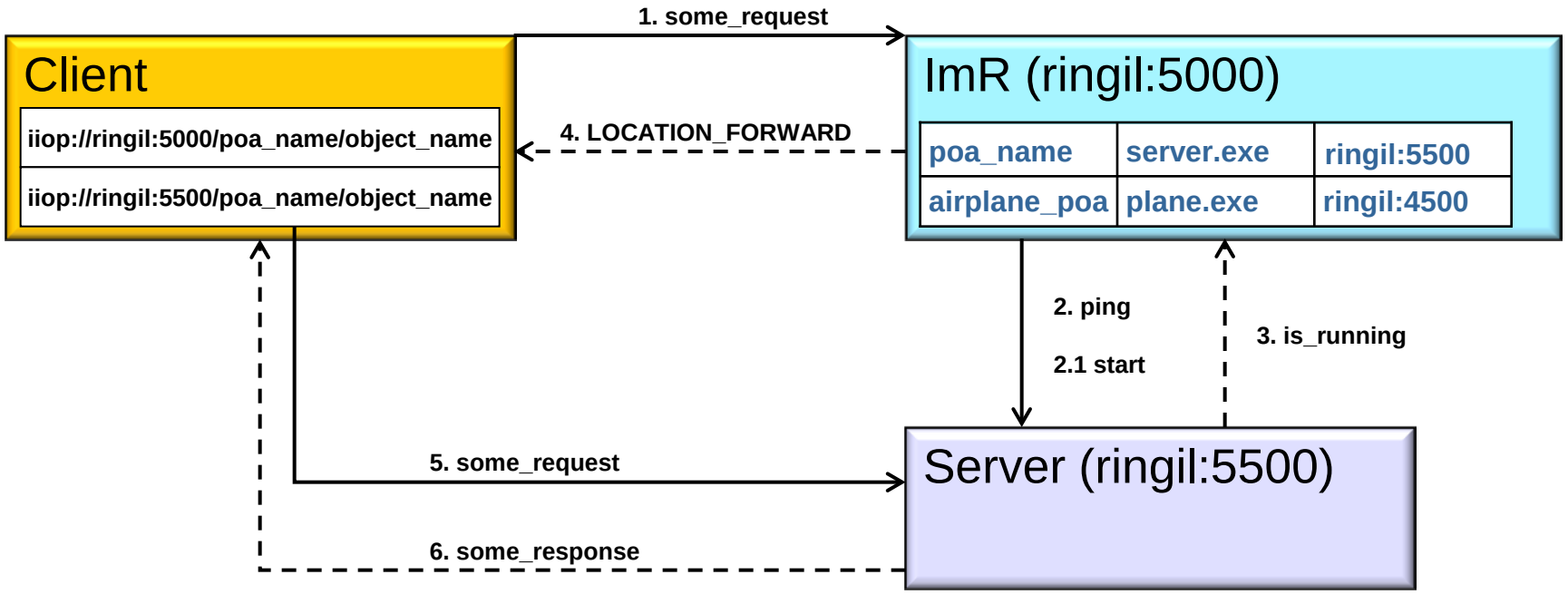
- CORBA Implementation Repository



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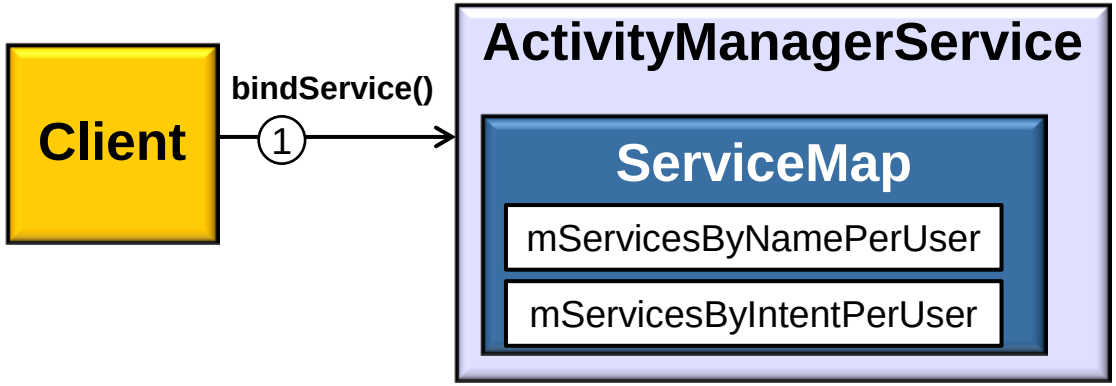
- Android ActivityManagerService



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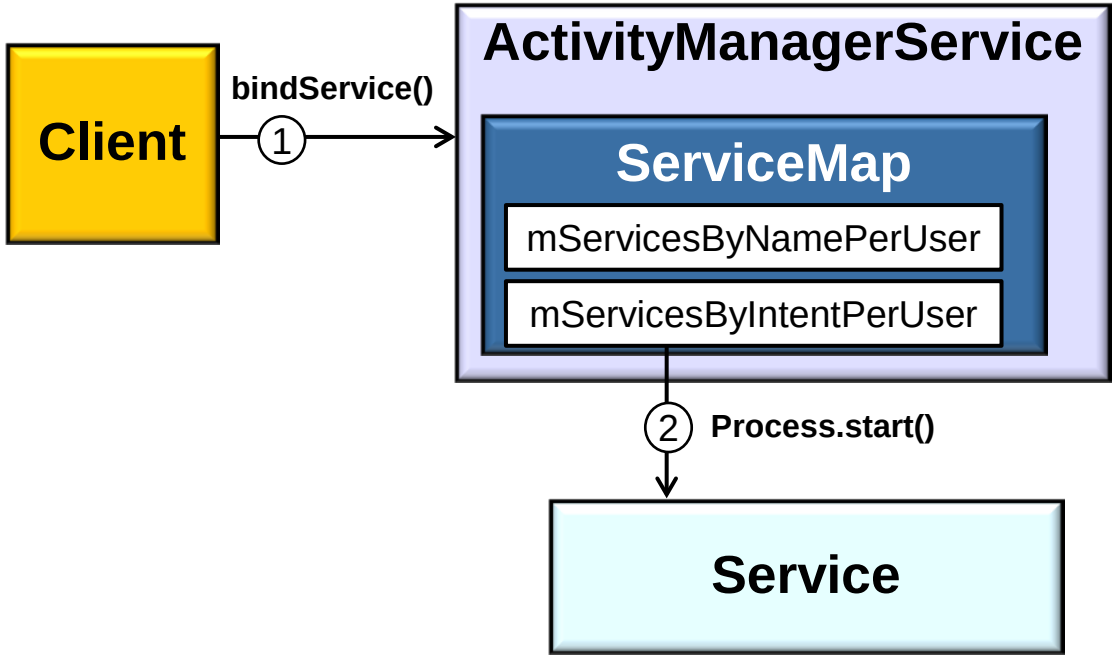

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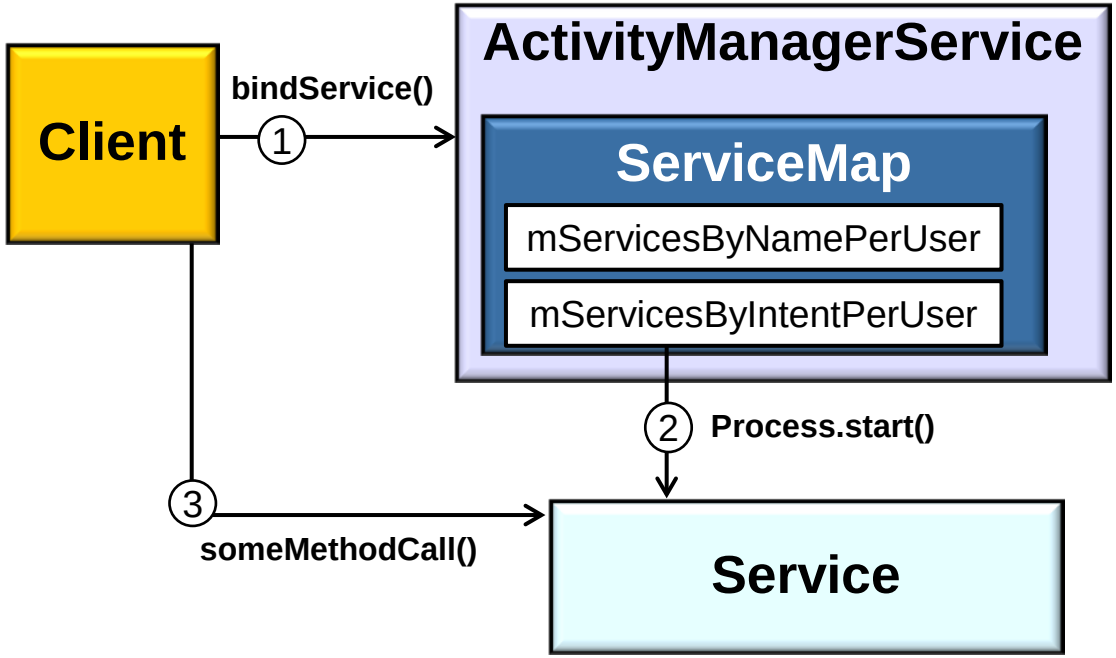

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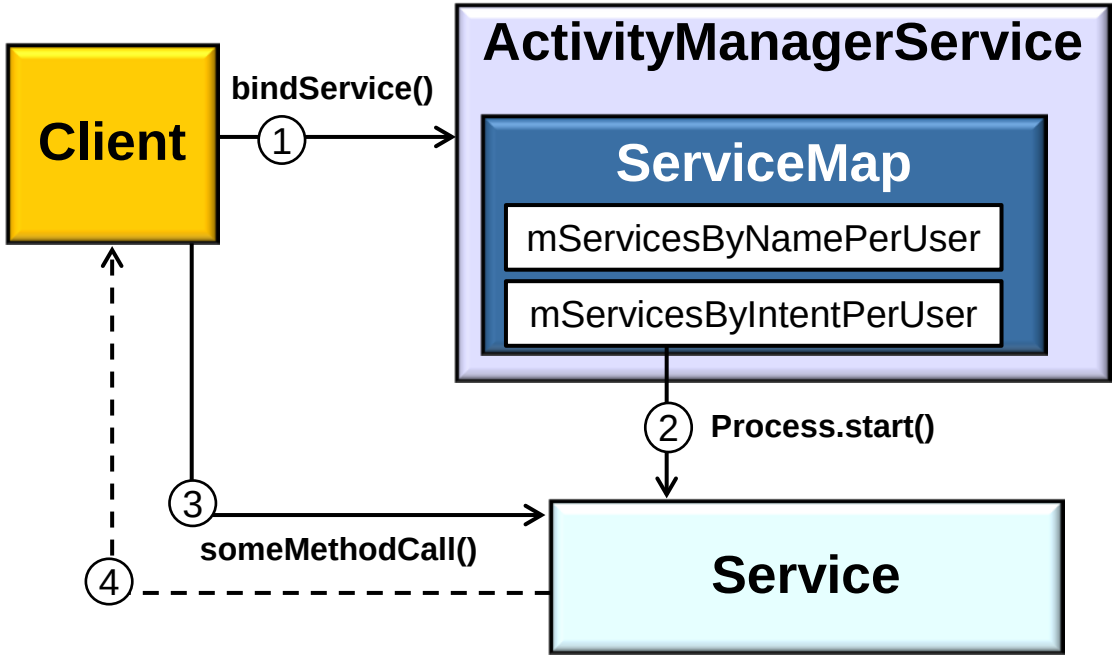
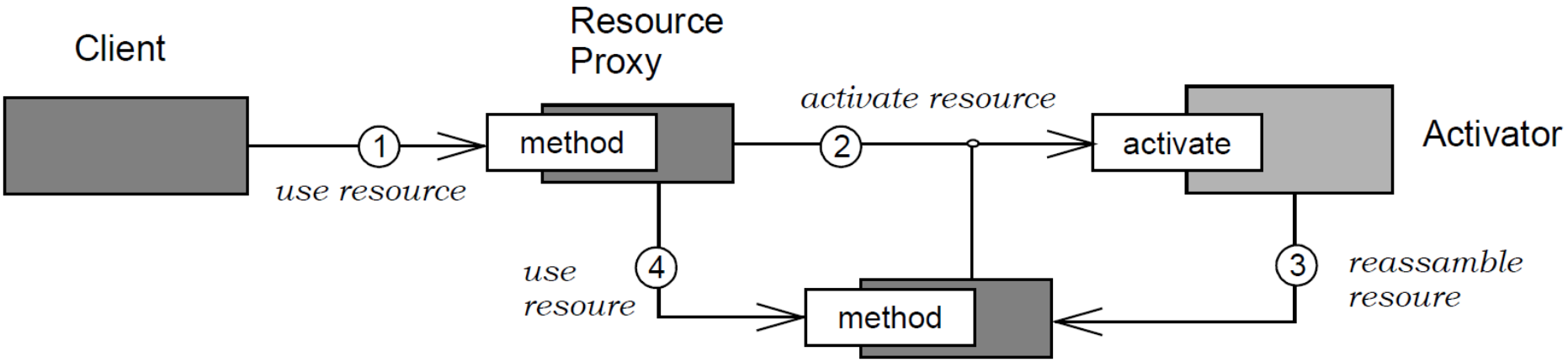
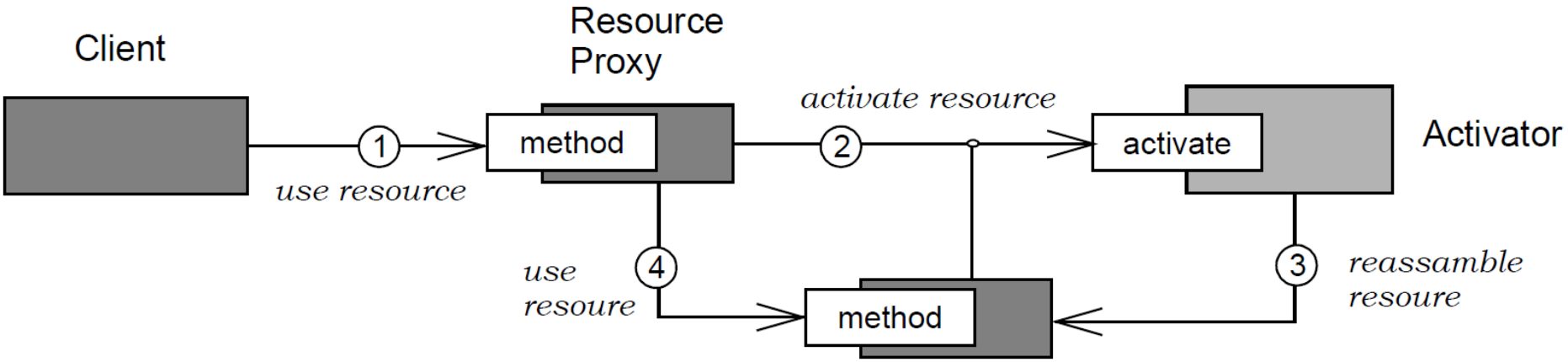


Summary



- *Activator* frees clients from the responsibility of (re)activating the resources they use
  - It appears to them as if all resources were always (virtually) available

Summary



- *Activator* frees clients from the responsibility of (re)activating the resources they use
- *Activator* also ensures that (re)activating a resource incurs minimal overhead because it maintains information about how to optimize this process
  - e.g., an activator could reload the resource's persistent state & reacquire the needed computing resources in parallel, thereby speeding resource initialization