The Architecture of a Dynamically Updatable, Component-Based System

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Outline

- Background
- Kinds of updates
- DUCBS
- Update Request
- Examples
- Conclussions
- Issues
- Future work

Background

- Updates perspectives:
  - Implementation perspective: easiness of implementing the changes
    - CBM – framework for updatable system
      - encapsulation
      - Isolation
      - DA -> (Packages/Services) -> Components -> Objects -> Methods / Data
  - Distributed perspective: Reconfiguration
    - DA = set of components + connections (configuration represented in ADL / IDL)
    - Addition/removal/update of component
  - Runtime perspective

Kind of updates 1
Runtime perspective

	Dynamic (in use)	Static (not used)
State-less	(Dynamic linking) If dynamic then must be statefull !	replace -> restart
State-full	State transfer function	Checkpoint -> replace -> recreate state -> restart

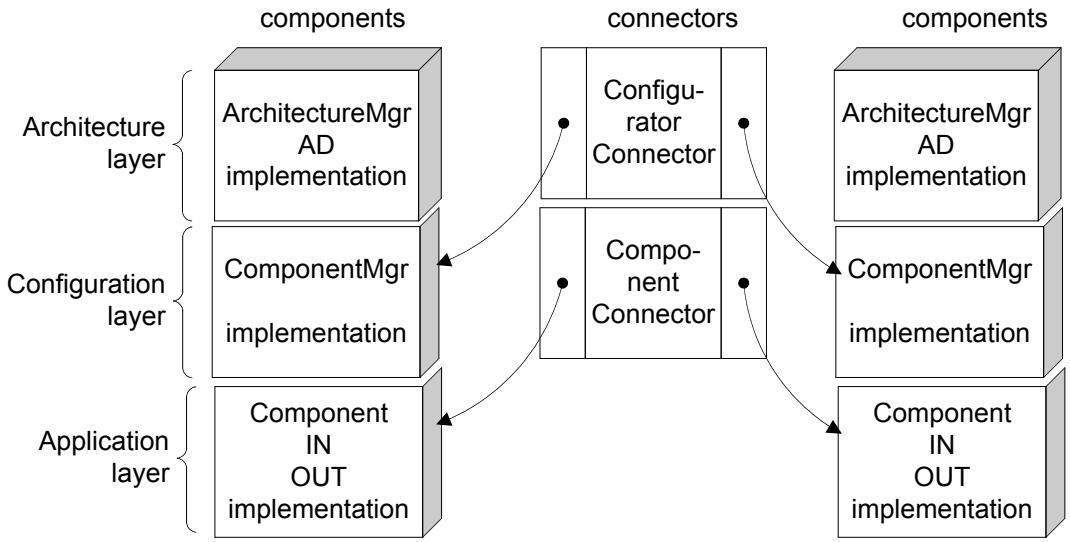
Kinds of updates 2
Runtime-Distributed perspective

- Local updates
  - exchanging objects not connected to the interface
- Global
  - Exchanging object connected to the interface
    - Requires maintaining the communication channels

How to handle that many updates?

- Any of these updates are possible …
- Unanticipated updates
- Propose an architecture called DUCBS ☺

DUCBS



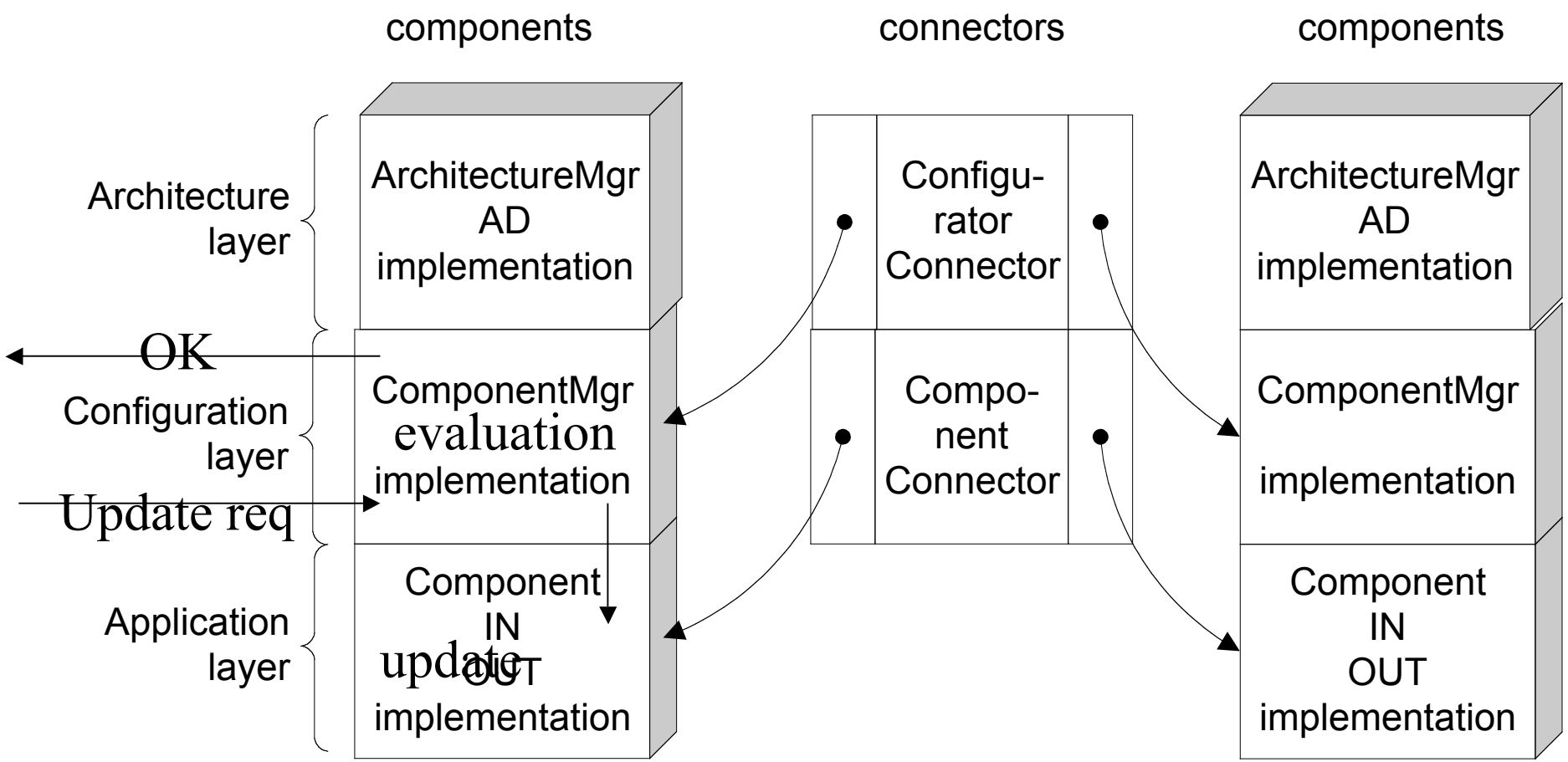
- Separation between application semmantincs and update semmantics
- Meta level communication – asynchronous
- Connectors support synchronous communication
- Space for authentication

Update Request

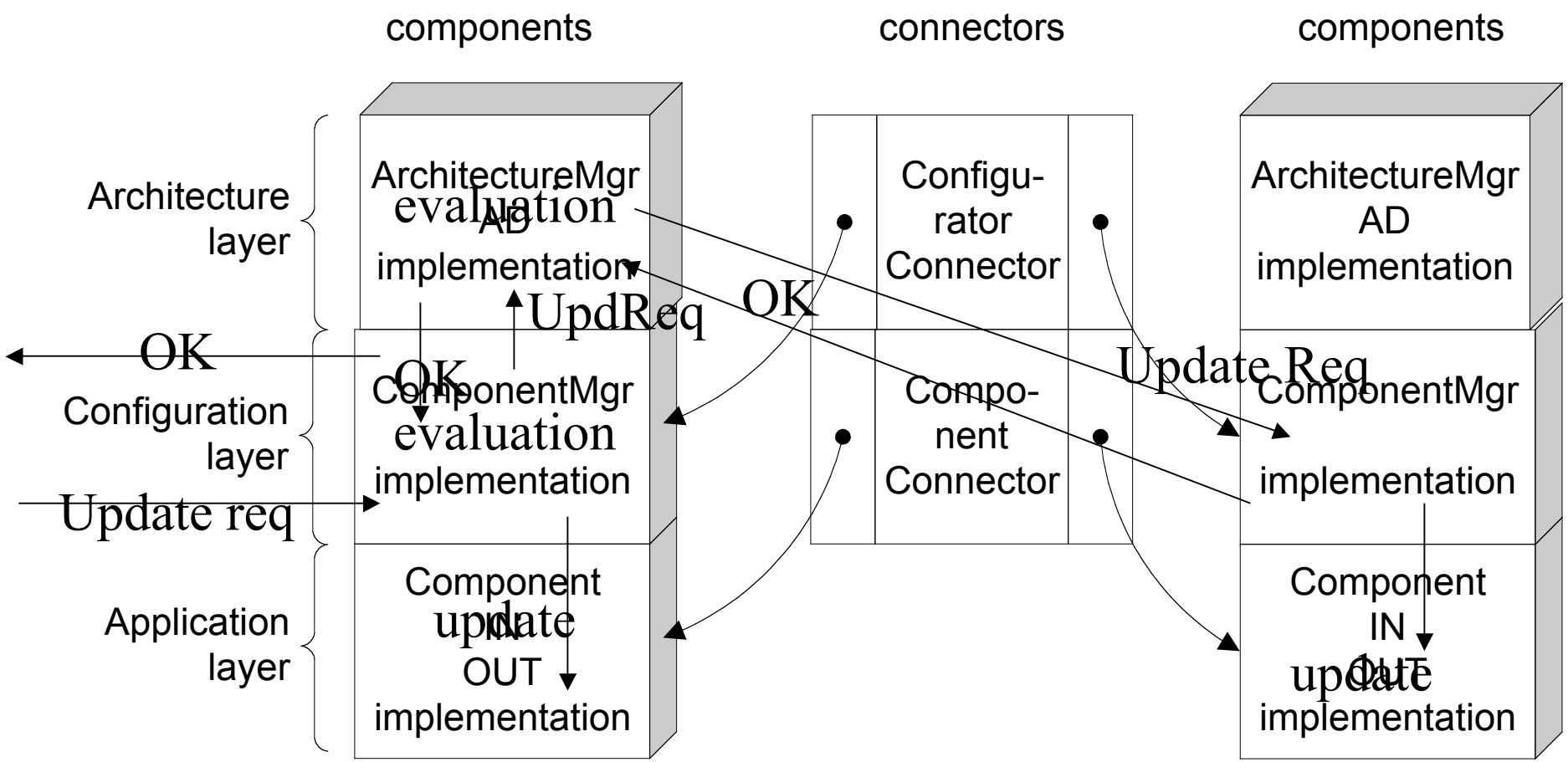
- *update type* – addition/removal/update
- *list of updated objects*
- *new versions of the objects* - implementations
- *update method* for each object: replace/dynamic
- *update function* - state transfer function
- *update constrains* – order/relation of (sub)updates

```
<update_descriptor>
  <add_obj to="server01//comp1">
    <object name="C">
      <implementation>...</>
    </object>
  </add>
  <remove_obj from="server01//comp1">
    <object name="D">
    </object>
  </remove>
  <update_obj in="server01//comp1">
    <object name="A" method="replace">
      <old_version>1.0</>
      <new_version>1.1</>
      <implementation>...</>
    </object>
  </update>
  <update_obj in="server01//comp1">
    <object name="B" method="dynamic">
      <old_version>1.1</>
      <new_version>1.2</>
      <update_function>...</>
      <implementation>...</>
    </object>
  </update>
</update_descriptor>
```

Example 1. Update of a local component



Example 2. Update of a global component



Conclusion

- Multi-layered UDCBM
- Handles many kinds of updates by:
  - Dynamic: using update function
  - Distributed: propagating updates using ADL/IDL
- Separation of application and update logic
- ”Space” for future improvements security/control methods
- No restrictions for the update logic / process / protocol

Issues

- CBM: EJB, CORBA
- Reflection - Java reflection too primitive
  - Unload class missing
  - Method's state missing
  - JVM separate language / byte code

Future work

- Prototyping
  - CBM architecture
  - Reflection issues
- Update request/process
  - Granularity (relations between updated parts)
  - Order