Evolving Distributed Heterogeneous Systems

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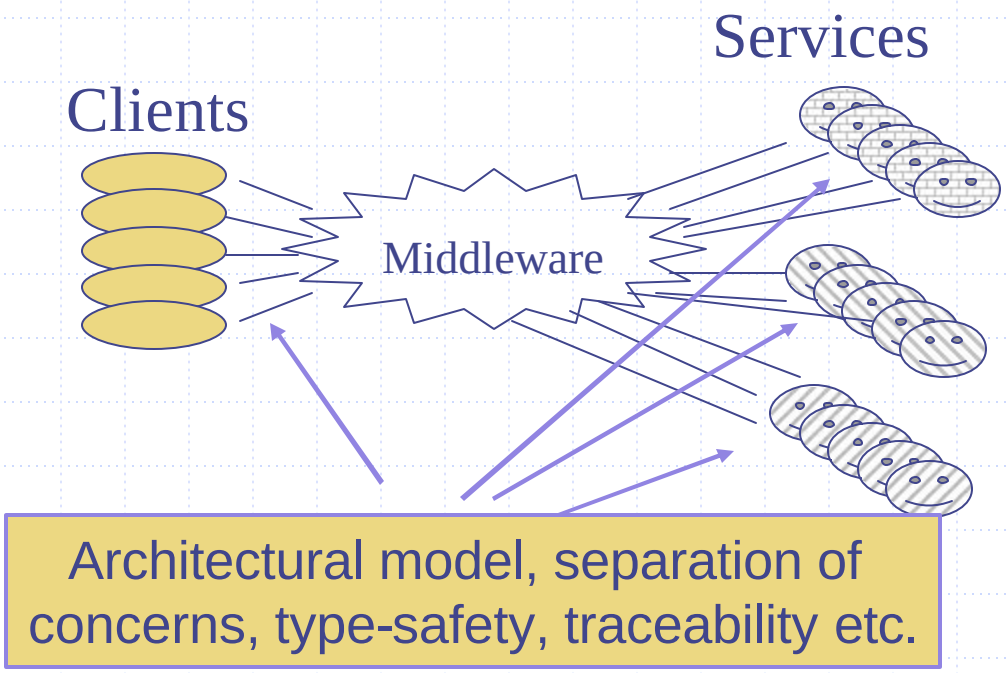
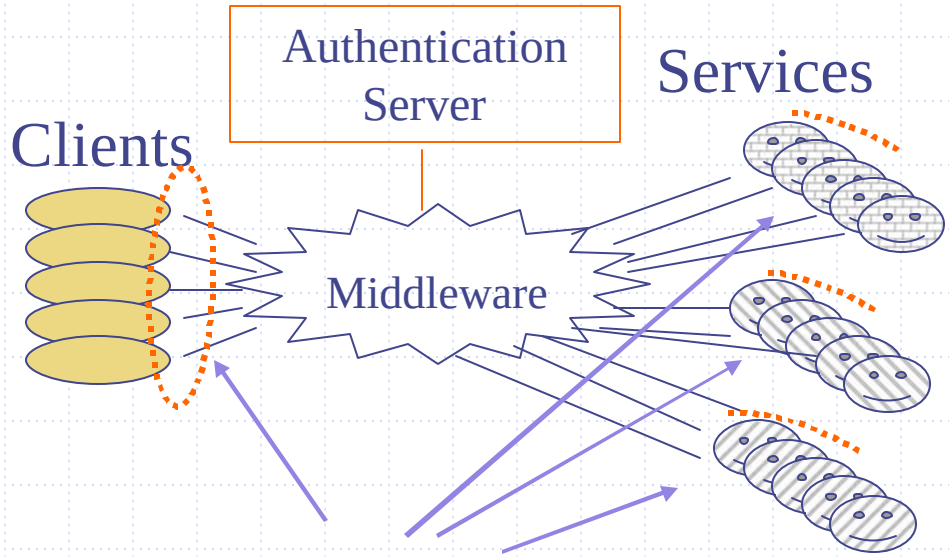
A distributed system.



For example:

- ***Clients:*** *patients:*
- ***Services:*** *doctors, pharmacists, and insurers.*

Now add Security



No model, code delocalization, no traceability, no type-safety (?), concern not separated

- *Non-local policy, e.g., pick one doctor only for "psychotropic" drugs.*
- *Fine-grained policies: e.g., state-full, w/delegation, data-dependent etc.*

Now add another feature

(Fault-tolerance, Logging…etc)

- Same problem as before, scattered implementation.
- *but worse…* features interact. Where is the interaction?

What we hope for.

- Separation of concerns:
  - A coherent unit where each feature lives
  - Ditto where interactions are handled.
- Architectural Modeling and Code generation
  - Architectural modeling of non-functional features
  - Architectural modeling of feature interactions
  - Traceability to implementation.
- Embrace Heterogeneity
  - Interoperability
  - Opportunistic use of available language tools.
- Type-safe & Conceptually well-founded
  - To enable static analysis, optimization, etc.

Some Potential Solutions.

- AOP.
- Wrappers.
- Monadic-style programming.
- Reflective techniques.
- Dynamic Techniques.

… all help, but not completely. We need synthesis, not only in better tools, but also for better methods.

If we solve this problem….

- Non-functional features easier to design, implement, and evolve.
- Feature-interactions ditto.
- Better-quality and better-performing systems.

What we hope for.

- *Separation* of concerns.
- Controlled, separable, *composition* of concerns.
- *Typesafety*
- Architectural *modeling and traceability*
- *Inter-operability* (legacy, binary-only etc).
- *Opportunistic* use of existing tools.

Difficulties

- Implementation de-localized (even scattered), but must be co-ordinated.
- Possibly different languages.
- Maintenance:
  - Tracking policy changes
  - Or even just fixing bugs.