

Micro Services

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↳ Why are monolythic systems 'evil' ?

Because of their dependencies:

- Software is not easy to test
- And hard to refactor
- Effects of changes can not be isolated
- Working with multiple developers/teams is challenging
- No reuse of functionality
- Runtime and deployment dependencies:
 - Performance and scaling
 - Deployment of features and releases

↳ **Monolyths arise from bad design,
independent of the technology!**

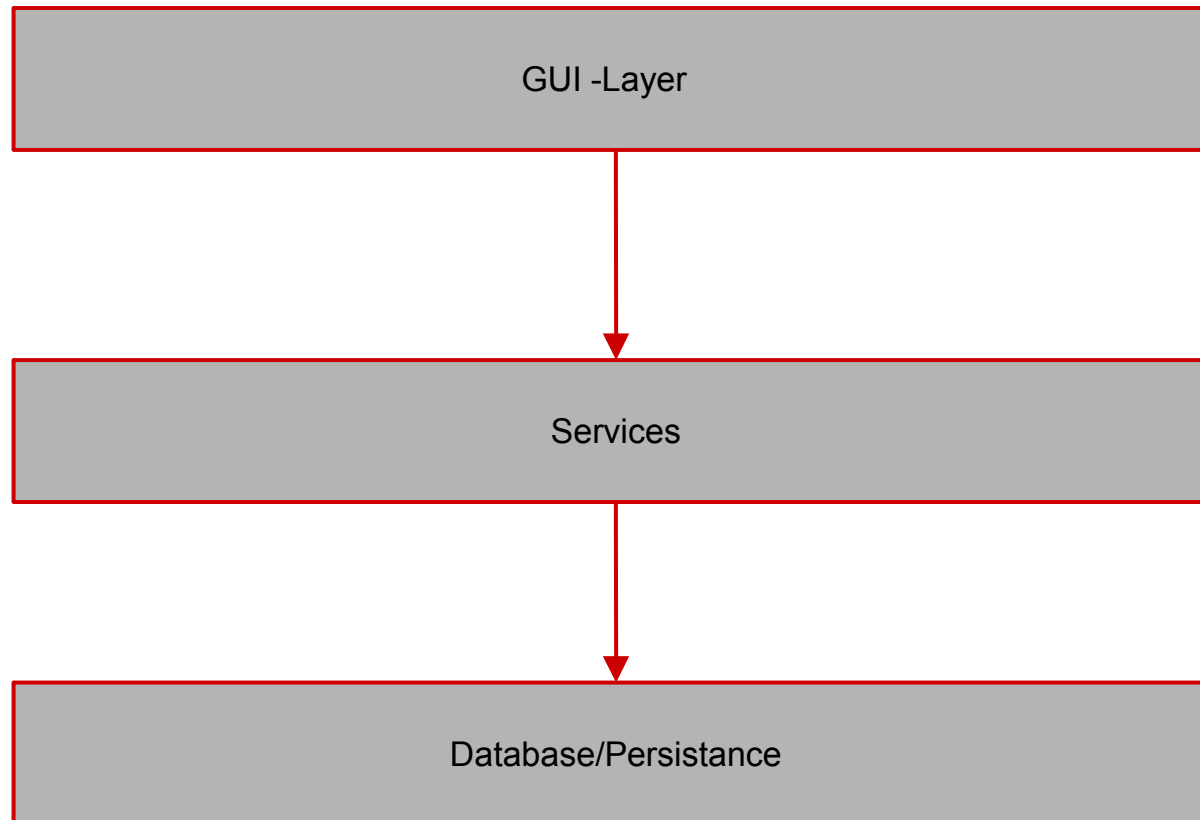
- You can build a monolyth with every software framework.
- Even distributed systems with a lot of services can be monolythic.
- And even software with monolythic builds and deployments may have a good internal structure.

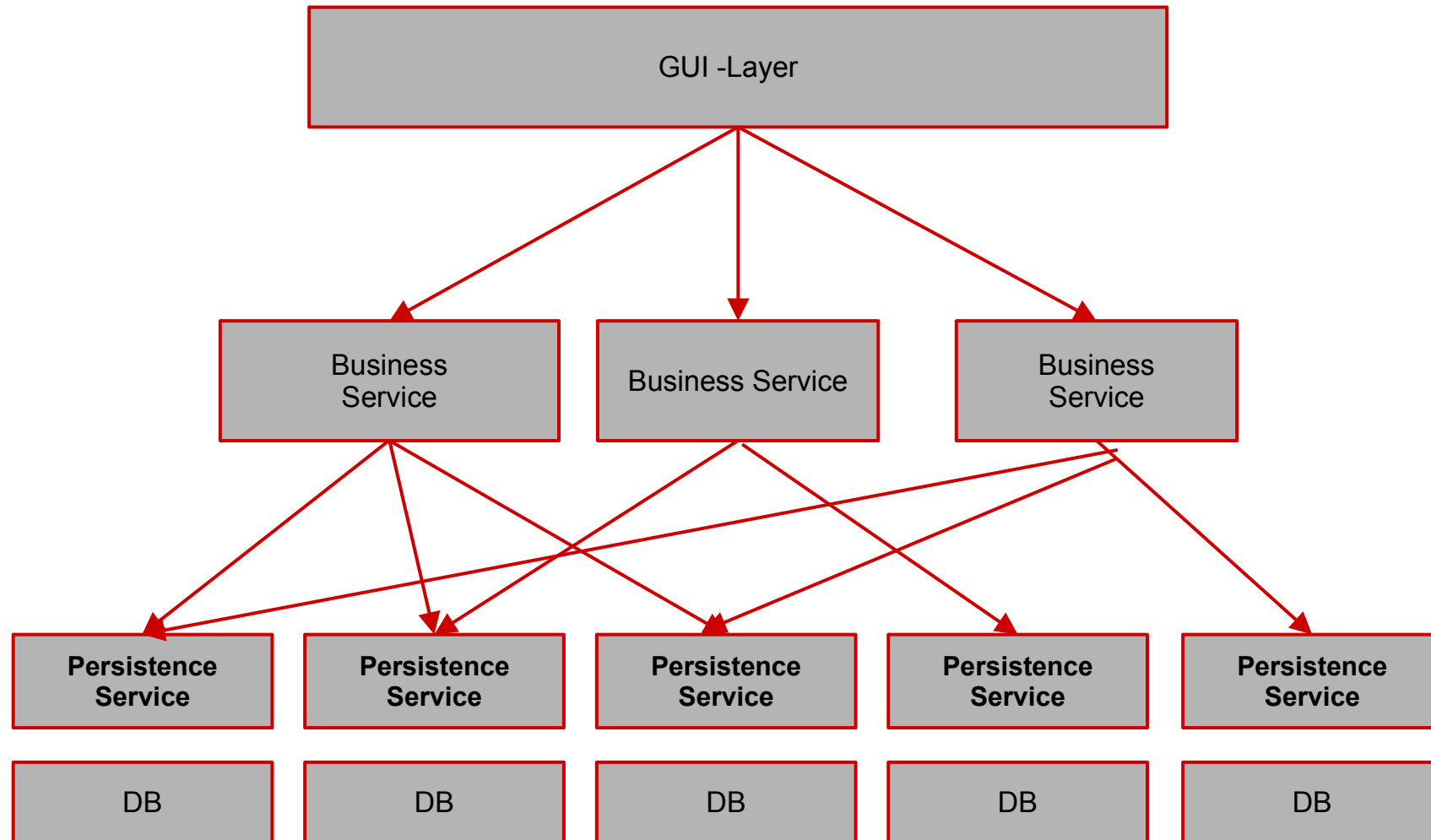
↳ **So, choosing a popular micro services framework is not enough!**

- ↳ Split the application in functional modules
- ↳ Maximal reduction of dependencies between different functional parts
- ↳ Vertical teams (End-to-End)

Classical Approach

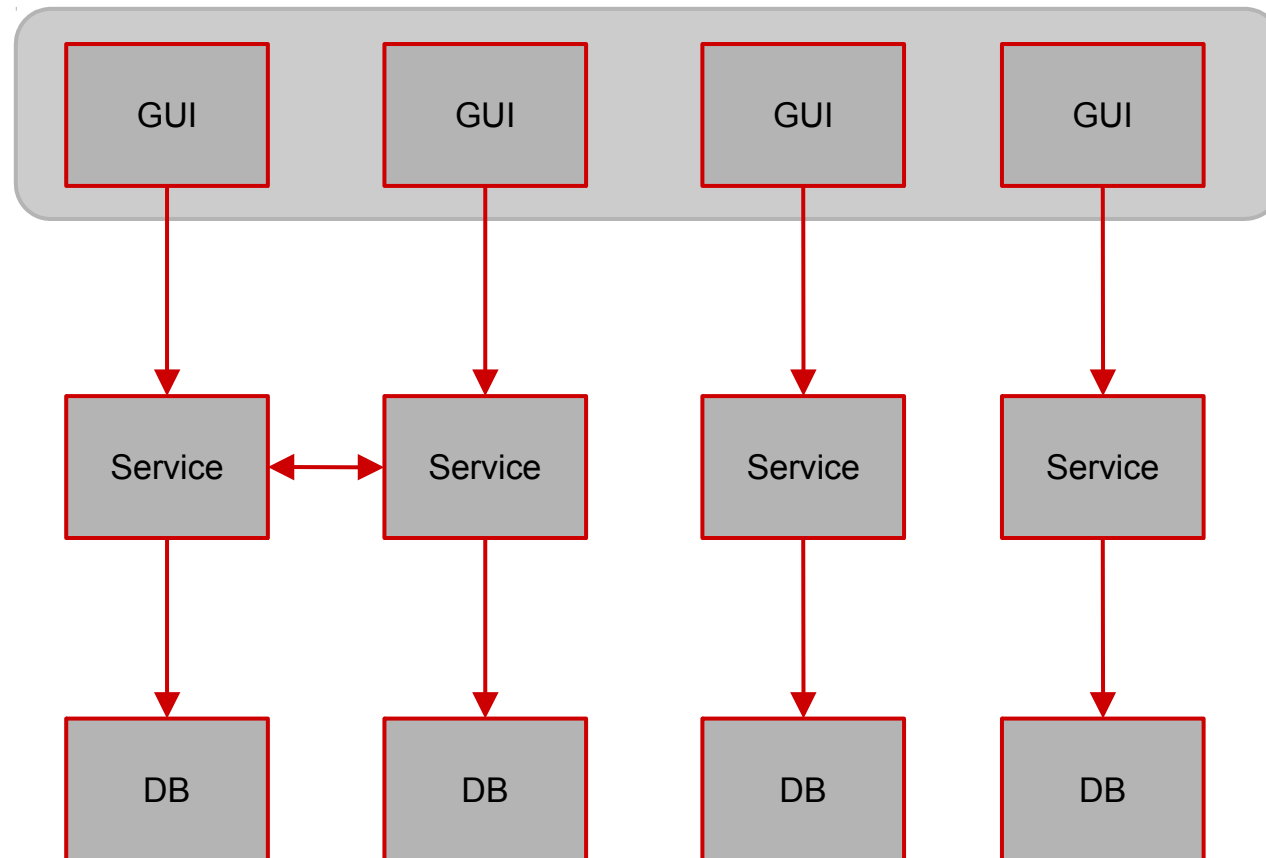
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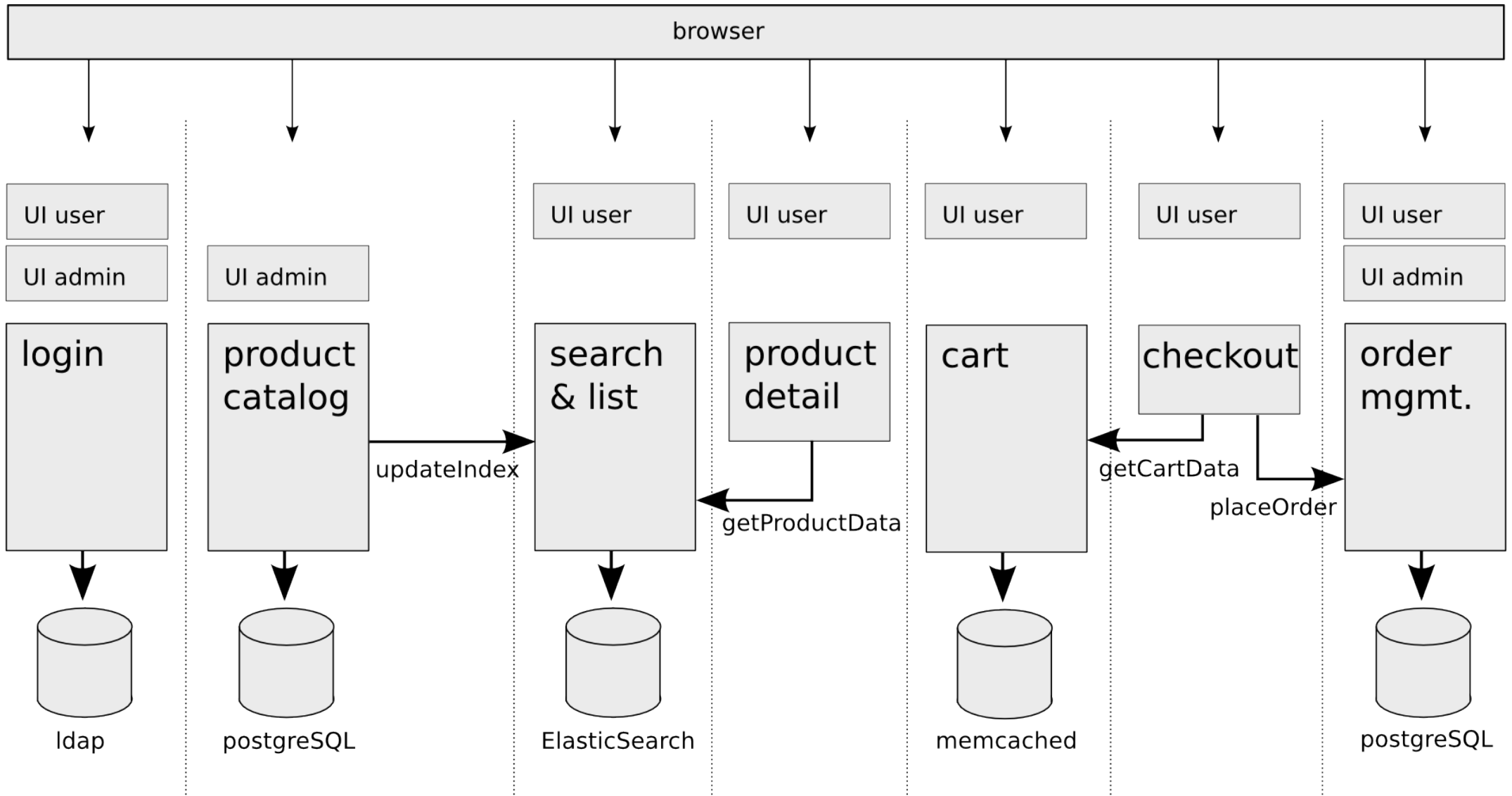
The Micro Services Way...

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Shop Example

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Micro Services

by James Lewis:

Small with a single responsibility

- Each application only does one thing
- Small enough to fit in your head
 - “If a service is bigger than your head, than it is too big”
- Small enough that you can throw them away
 - Rewrite or Maintain

by James Lewis:

Located in different VCS roots

- Each application is completely separate
- Domain Driven Design / Conway's law
 - Domains in different bounded contexts should be distinct - and it is ok to have duplication
 - Use physical separation to enforce this
- There will be common code, but it should be library and infrastructure code
 - Treat it as you would any other open source library
 - Stick it in a nexus repo somewhere and treat it as a binary dependency

No application servers

- Every service runs in it's own process
- Every service brings it's own environment

Choose the right stack for the requirements

- 1 monolyth → 1 stack, 100 Micro Services → flexibility
- Free choice of: OS, language, framework, database, ..
- But: Be careful!

New feature, new service?

- At first check, if a feature should build a new functional module
- Only in the second step extend an existing service
- **Rule:** Merging services is easy, splitting is hard!

- Spring Boot
- Dropwizard
- Vert.x

↳ Design goal:

Every service should have it's own exclusive database

Strategies

- NoSQL / document oriented design
- Treat foreign keys as REST URI references
- When a service needs external data: Call a service
- Don't fear data redundancy
- Replication of data: Pulling feeds with changelogs

Tradeoff solutions

- Multiple schemas within the same database
- Read-only views for data of other services
- Use DB features for replication (e.g. database link)

↳ **Design goal:**
Services should provide their UI themselves

Strategies

- Every service serves the full page, including layout and menu bar
- Commitment on one CSS naming schema
- Central asset service (menu, styles, common resources)
- Single page apps only within one service
- GUI composition only on the client (in the browser)
- Use UI fragments / widgets when embedding data of another service

Problem: The security context is spread over 100 services

Solution: Identity Management System

- Identity Management is also a service module (or even multiple)
 - Service for management of identities
 - Service for login/logout
 - Service for self administration
- OAuth2 allows distribution of the login to different services

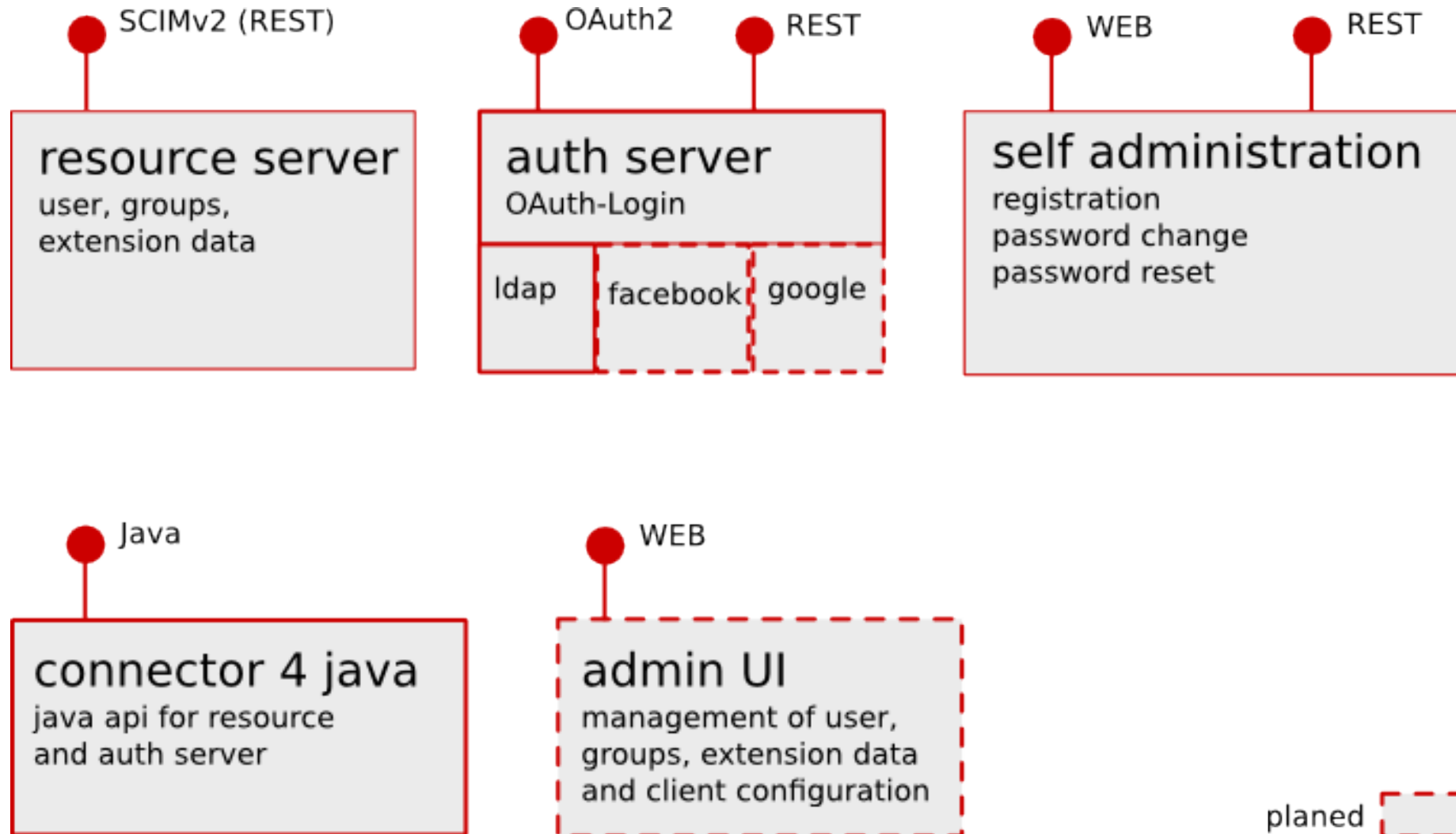
Variant a: Shared Cookie

- All services are available under the same domain
- The login service creates a cookie available to all others
 - Username, timestamp, roles/permissions
 - Crypted and signed
- All services can verify the cookie by checking the signature

Variant b: Independent Applications

- Every service maintains it's own session
- Login is done by OAuth2
 - Double redirect
 - Token exchange
- The login service maintains a sessions as well
- Multiple logins are done transparent to the user

<https://github.com/osiam/>



↳ **Everything is allowed**

But: You should establish one standard for your platform.

Principles

- Loose coupling – services should not know about each other
- Smart endpoints, dumb pipes
 - No intelligence in the communication channel
 - No ESB

↳ **REST is a good choice for many scenarios**

- Easy consumable with all languages
- Interfaces are maintainable towards compatibility
- URI references are helpful for navigation to different services and abstraction of the physical location of resources.

Asynchronous Messaging

- Reliable event distribution
- High performance
- Load protection of critical services

Resilience

- Tolerance against failures
- Error recovery
- Avoid error cascades

API Versioning

- Don't do it for internal APIs!

Unit Tests

- Integration tests suffice in many cases because the services are small
- Test the isolated service (Other services should be mocked)

Consumer Driven Tests

Idea: The integration tests of a service will be defined and implemented by the consumer (not by the service provider).

No release before the service passes all consumer's tests

- Test with the real expectations, not with the service specification
- Very smart concept, but hard to maintain
- Has the risk of high test-redundancy for common APIs

Contiuous Delivery

- Create a deployment pipeline
- Need to automate everything

↳ One monolyth may be easy to deploy, 100 Micro Services may not!

Packaging & Provisioning

- Usage of established standards: DEB, RPM, ...
- Robust init scripts
- Configuration management: Puppet, Chef, ...

↳ **1 Micro Service : 1 Linux System**

Docker

- LXC based virtualisation
- Similar to changeroot (but a lot better!)
- Slim and fast
- Based on git, so changes of the images can be tracked

For Hardliners

- Install the Micro Service by shipping and starting the system image
- No packaging
- No init scripts

Realtime metrics

- Monitor, what currently happens
- Fast reaction to problems
- Do monitoring inside the application, not outside
- Tools: Metrics, Spring Boot Actuator

Logging

- Manual search in logs of 100 services is not possible
- Central log aggregation
- Filtering and analyses in realtime
- Tools: Logstash, Graylog2, Kibana, Apache Flume, fluentd

Micro Services are a promising paradigm

↳ But, you should always be careful with new paradigms!

- Inventarisation of many services
- Challenging for operations
- High network load (if not done right)
- New way of thinking
- The freedom of technology selection may lead to chaos, if it is no governance

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Thank You!