OSGi™ Community Event 2011

Structuring Software Systems with OSGi

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Agenda

- OSGi: basic structure and declaration
- Interface Usage
- Layers
- Services and Layers
- Versioning
- Testing
- Assemblies

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- **OSGi: basic structure and declaration**
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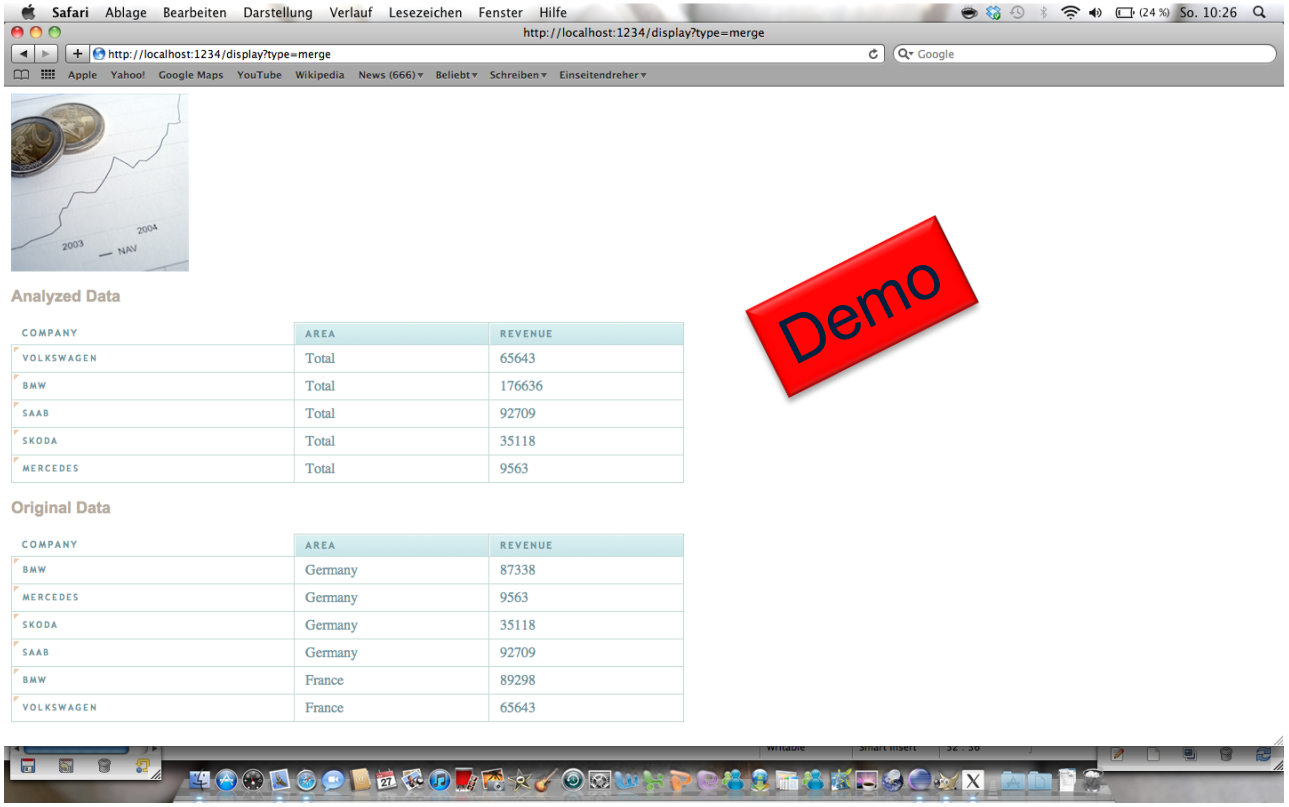
Principles of Modularity

- Decoupling
  - Logic has to be decoupled, otherwise the structure evolves into a monolithic block („architecture erosion“)
- Simplicity
  - Design the concepts as simple as possible, otherwise the system solves non-existing requirements
- Extensibility
  - Decoupling implies that frameworks are open for logic
  - Extensibility for logic is not the exception, but rather the common principle for all frameworks

OSGi basics

- **Bundles** are the atomic entities for structuring (containing binaries)
- **Services** are the communication means between bundles
- **Exported packages** are the public interface of bundles
- **Imported packages** define the usages of bundles

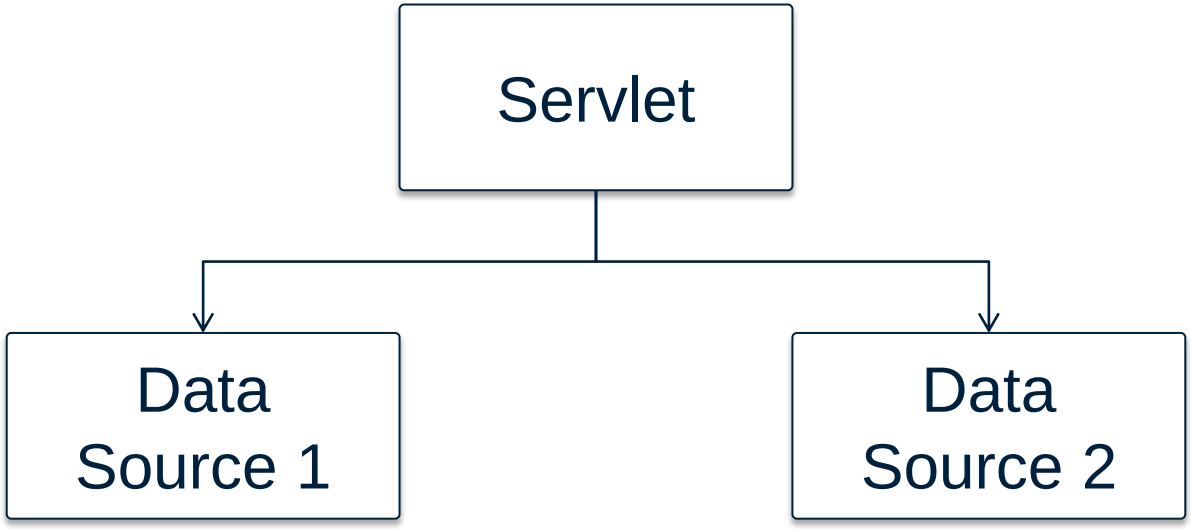
Example



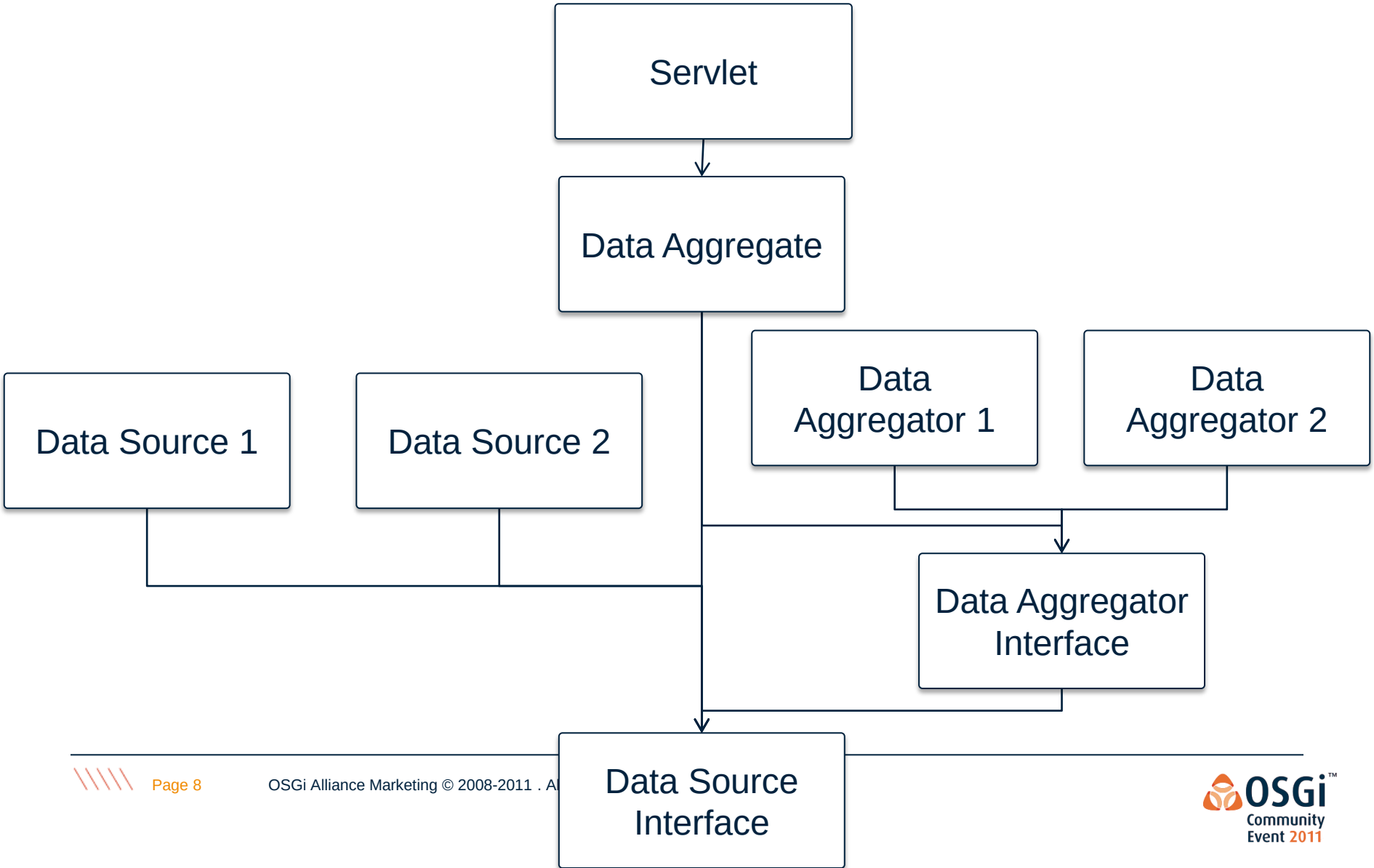
- Web application to analyze data
- OSGi bundles, services, and exported packages are used to structure the application

Structure of Application

- Fulfills the business requirements, but no modularity (decoupling, extensibility)



Structure Of Application



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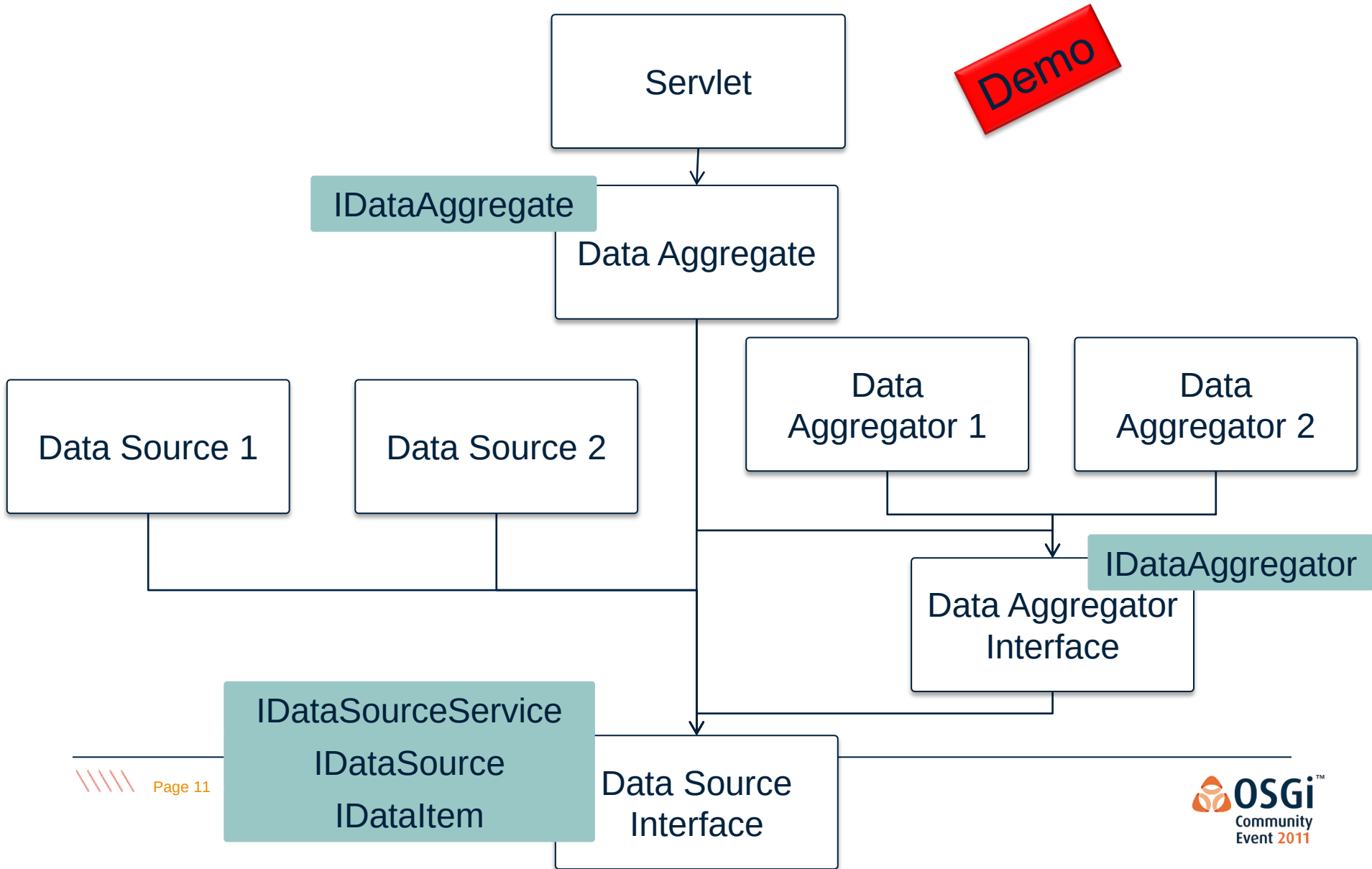
Interface Usage

- Implementation should only use interfaces → Services in OSGi
- Services are difficult to implement in OSGi fulfilling all lifecycle requirements (Service Tracker, Service Listener) → „boilerplate coding“
- Frameworks: **Declarative Services** (DS) is part of the OSGi specification, Blueprint, etc.
  - DS are meant to declare the dependencies of services and service usage
  - DS is a mechanism to bring dependency injection into OSGi

Structure Of Application



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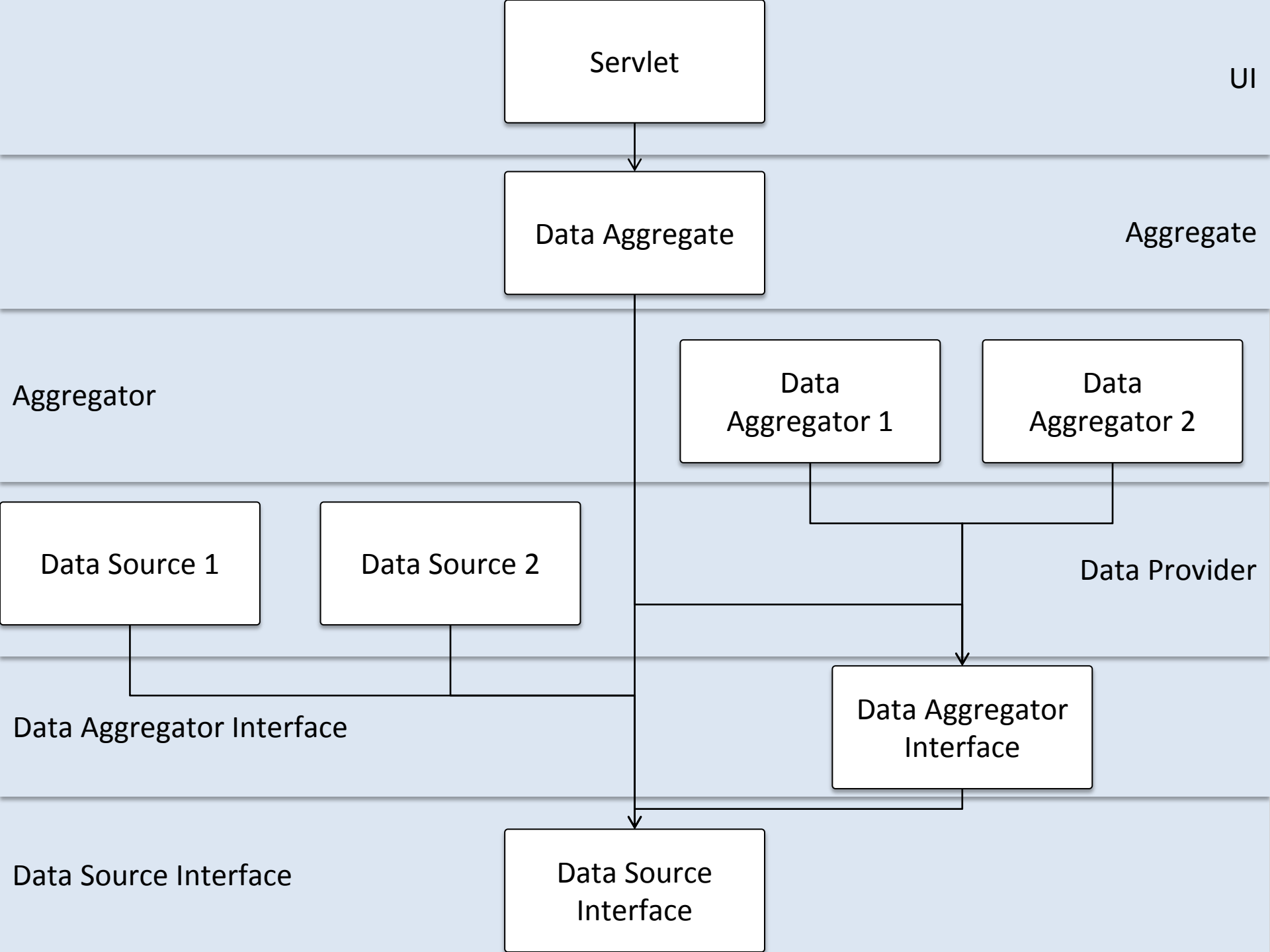
Layers

- In architecture, layers are used to structure the software
- Entities within a layer can only have dependencies to lower layers
- Bundles in OSGi belong to one layer only
- In reality more coarse grained frameworks are used
  - Feature (P2, Eclipse)
  - Application (Aries)
  - OSGi sub system specification
- For simplicity in these examples only bundles are used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Data Aggregate
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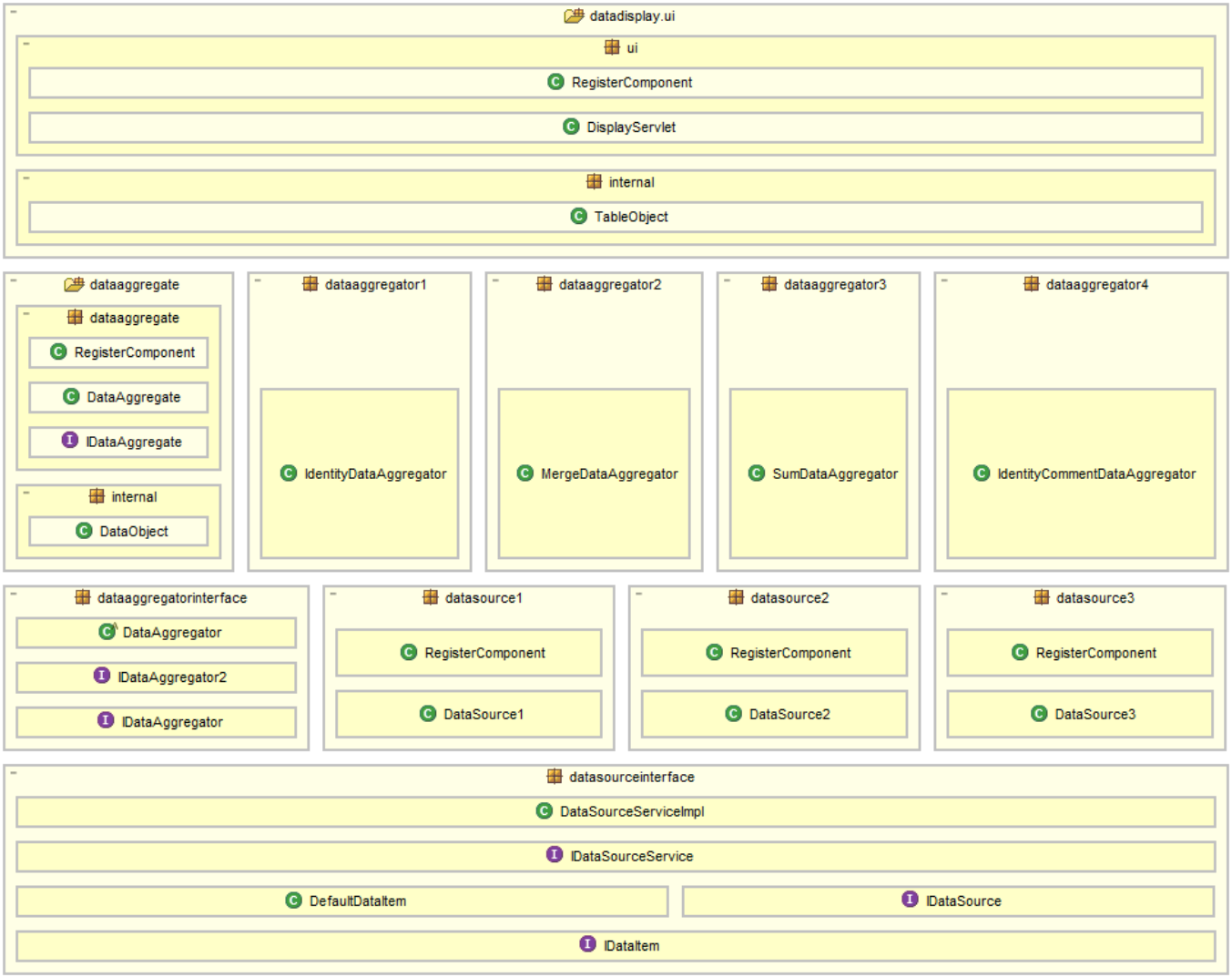
Data Source 2
Data Provider
Data Aggregator Interface
Data Aggregator
Interface
Data Source Interface
Data Source
Interface

Class Structure

- Classes fit to bundle structure



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Interface of a Layer

- Layers should have a clear interface
- API (Application Programming Interface)
  - is defining the publicly available functionality
  - is an interface
  - is implemented as service in OSGi
  - Example: IDataAggregate, IDataSourceService
- SPI (Service Provider Interface)
  - is defining the extension point
  - is implemented as service in OSGi in a separate bundle
  - Example: IDataSource, IDataAggregator

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Versioning in OSGi

- Bundles and exported packages are versioned
- Usage of versioning is different for implementation, API, SPI
  - Implementation: can be replaced easily, because interface is not changed
  - API: can be evolved in a compatible way, but implementation has to be adapted, too
  - SPI: evolution is difficult, because if interfaces are extended, then the old implementations are not valid any more
    - Java evolution: Ix → Ix2, e.g. IDataAggregator → IDataAggregator2 in the same package

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Testing

- Layers have to be separately testable
  - Mock objects (Easy Mock)
- Example: DataAggregate layer

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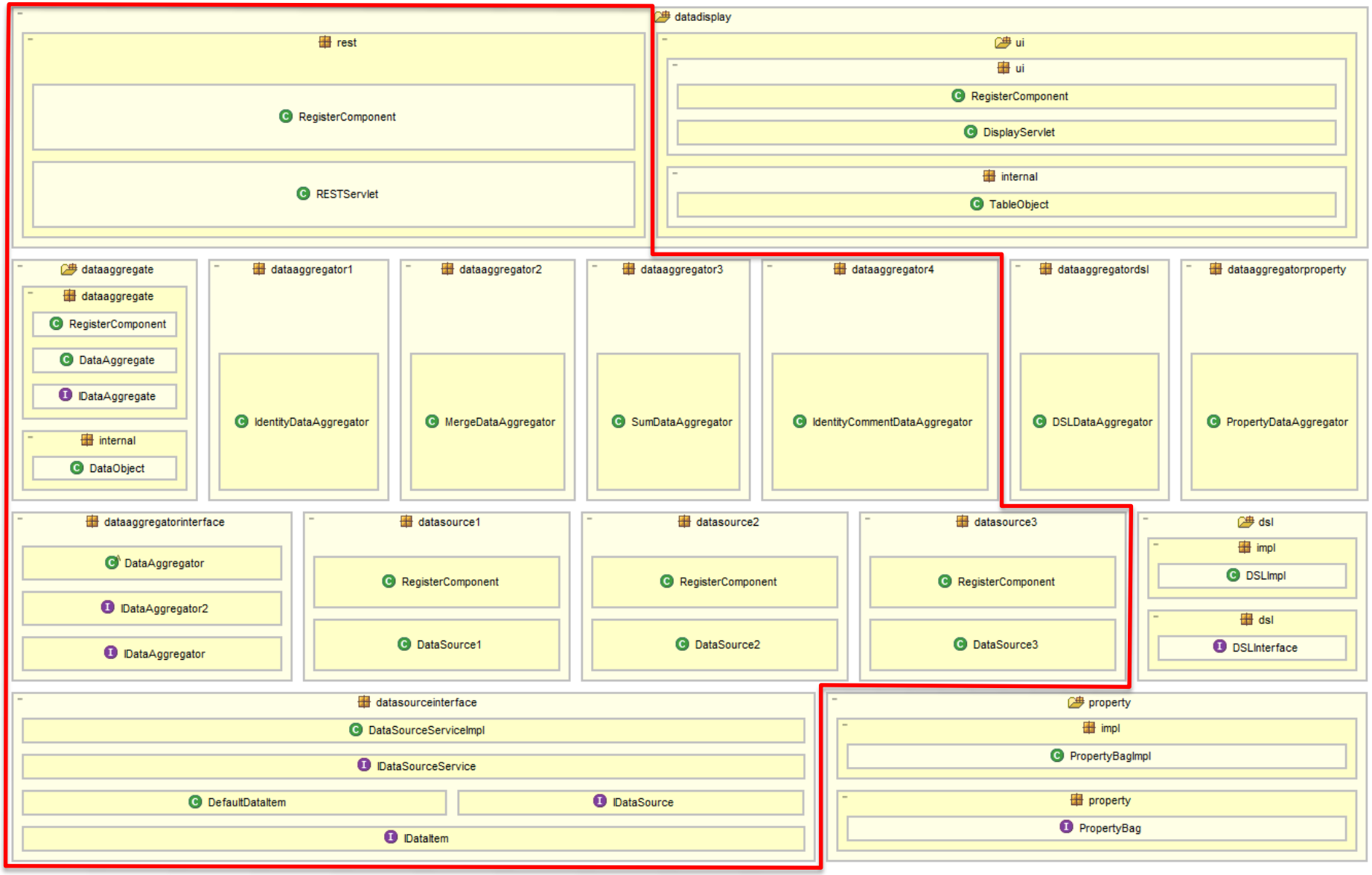
- **Assemblies**

Multiple assemblies

- Bundles assembled into multiple assemblies (e.g. products)
- An assembly contains bundles from different layers
  - A layer does not have to be used completely
- Examples:
  - Other access layer (REST)
  - Configuration data aggregator
  - DSL data aggregator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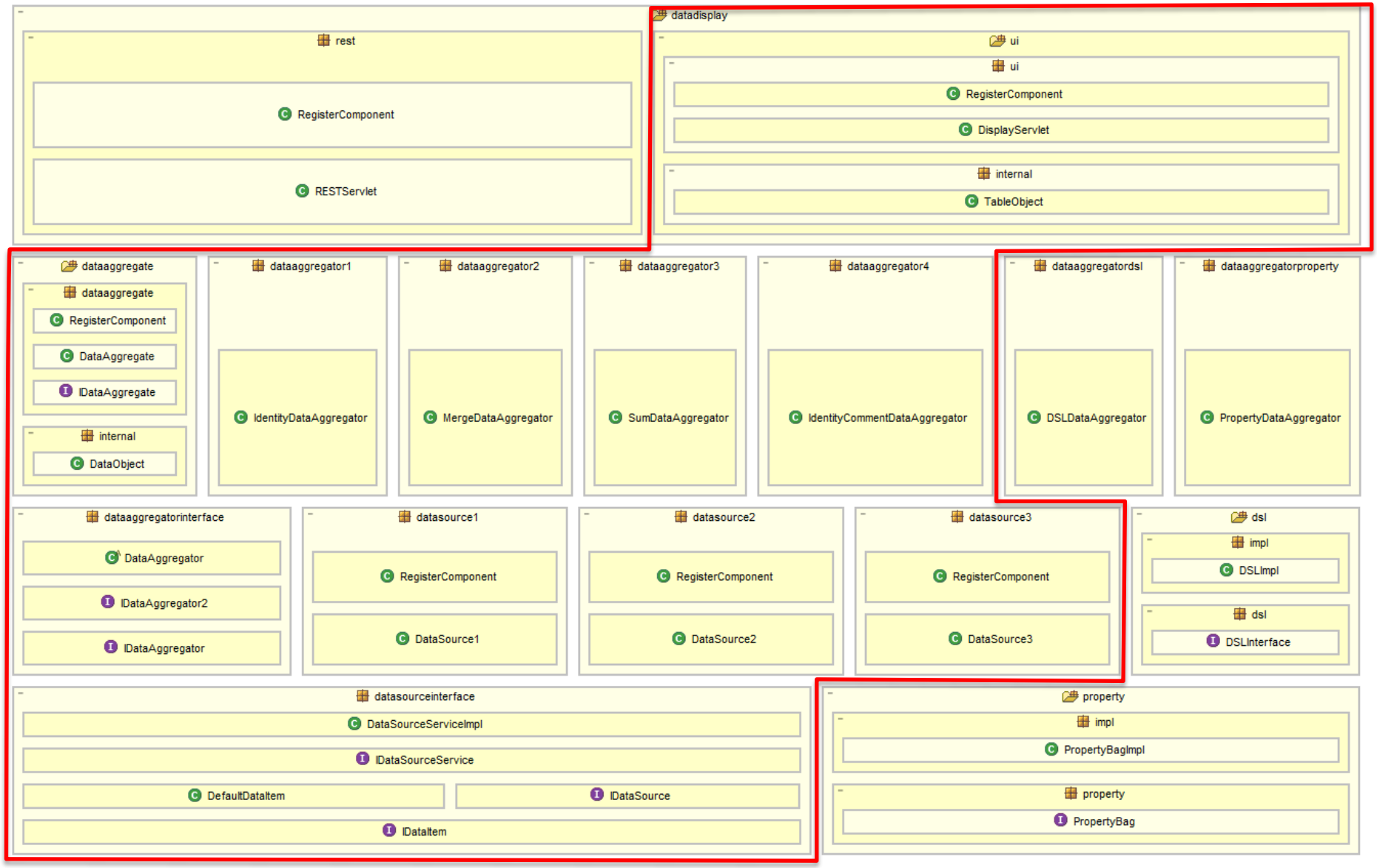
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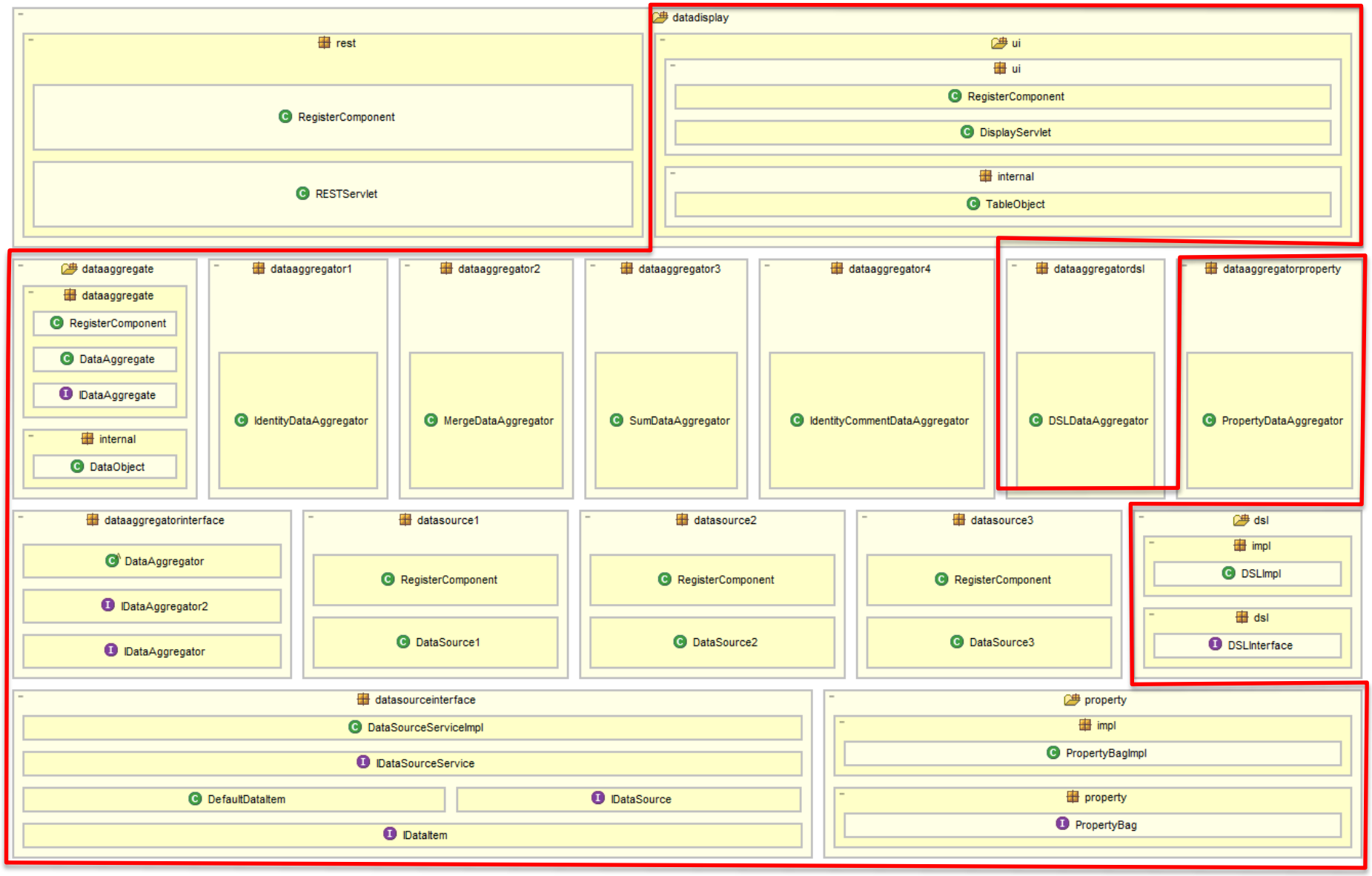
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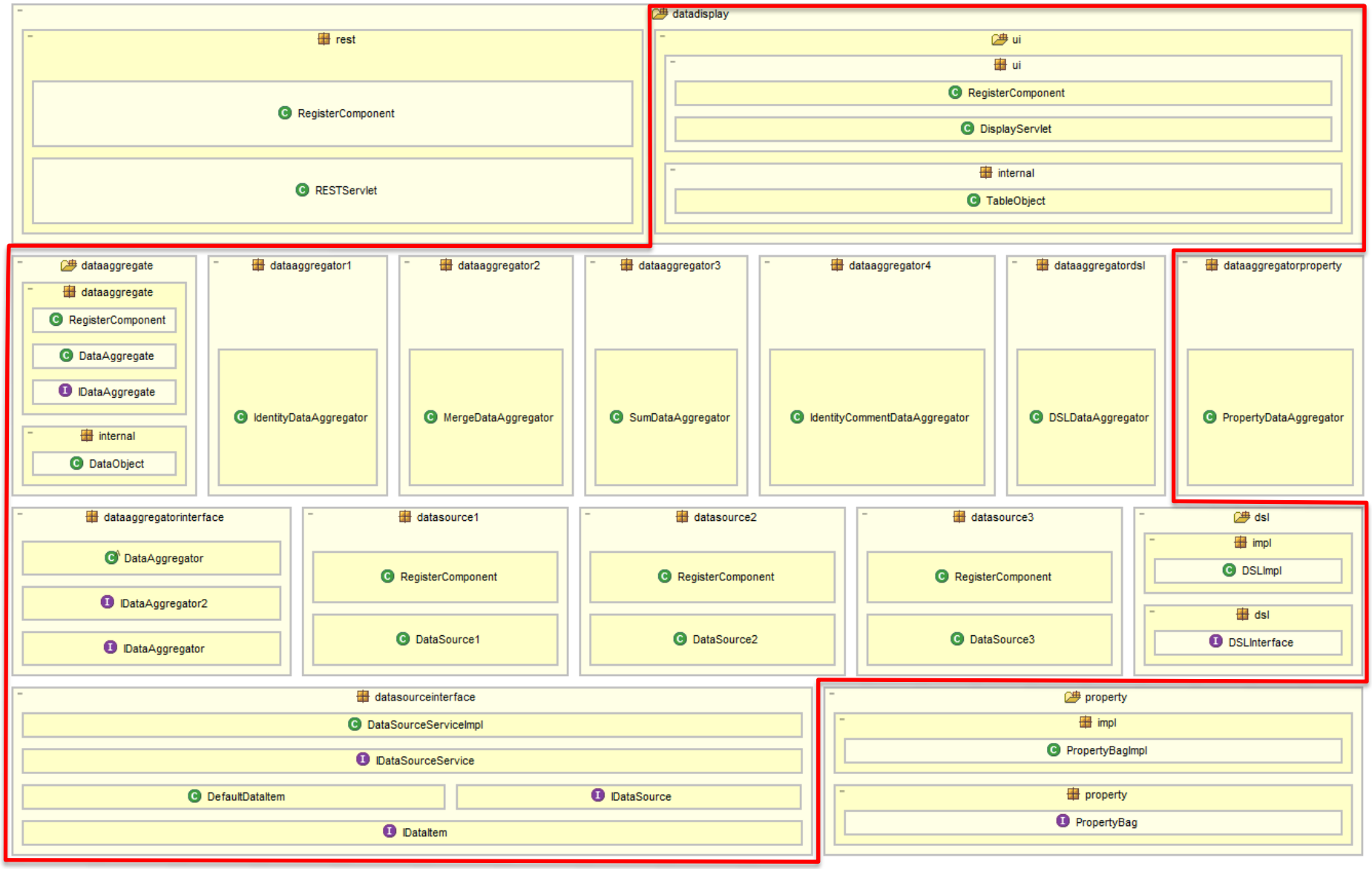
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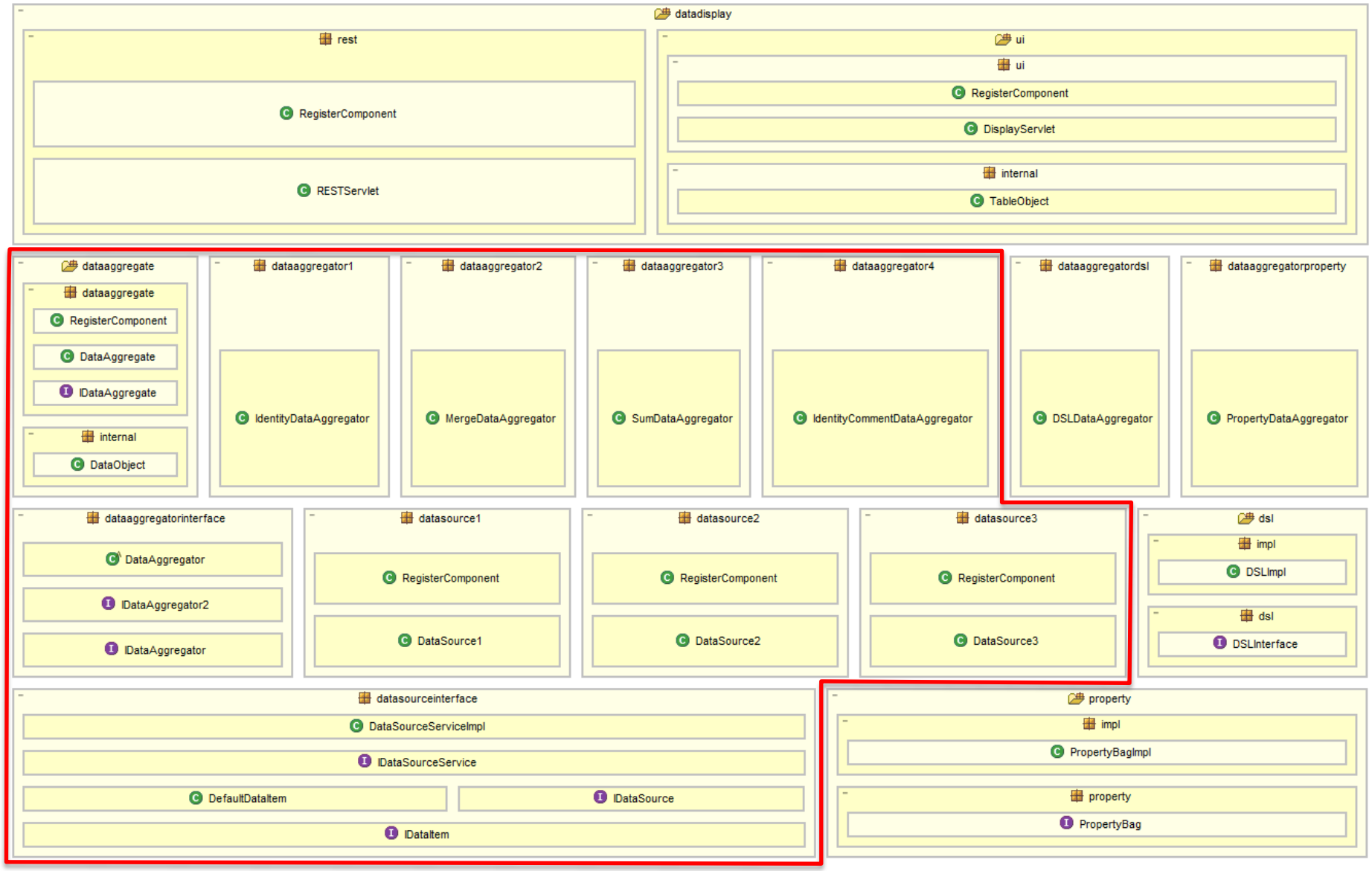
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Summary

- Module and service concepts should be used to structure software
- Bundles expose clear interfaces
- Communications works by using services (minimum requirement between layers)
- Layers are testable separately
- Different assemblies should be possible