Microkernel Architecture

Software Architecture

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So far...

Simplicity – Monolith, Pipeline

Modularlity – Layered, Pipeline

Definition 0. Extensibility

Features or extensions can be easily added to the software over its lifespan.

Question

How easy is it to extend *Monolith*, *Layered* or *Pipeline*?

Question

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Answer

Monolith – Everything in one container

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Answer

Monolith – Everything in one container

Layered – Typically all layers

Pipeline – Create a new filter

Definition 0. Interoperability

Software can easily share information and exchange data with internal components and other systems.

Question

What about interoperability?

Question

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Answer

Monolith – Everything in one container

- Internal External

Question

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Answer

Monolith – Everything in one container

- Internal External

Layered – Nearest Neighbour

- Internal External

Question

What about interoperability?

Answer

Monolith – Everything in one container

- Internal External

Layered – Nearest Neighbour

- Internal External

Pipeline – Standard Interface

- Internal External

Question

What if I want simplicity, extensibility and interoperability?

Question

What if I want simplicity, extensibility and interoperability?

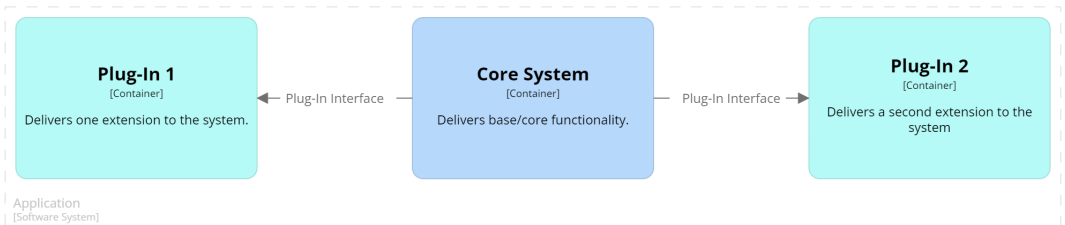
Answer

Consider *Microkernel Architecture*

§ Microkernel Architecture

Definition 0. Microkernel Architecture

Core system providing interfaces that allow plug-ins to extend its functionality.



Definition 0. Registry

Tracks which plug-ins are available to the core system and how to access them.

Loading Plug-ins

Static Loading when application starts

Dynamic Loading as needed at run-time

Registry designed for the selected strategy

Question

Can you think of a *microkernel architecture*?

Question

Can you think of a *microkernel architecture*?

Answer

Web Browser?

Definition 0. Independent Plug-in Principle

Plug-ins should be independent, with no dependencies on other plug-ins. The only dependency on the core system is through the plug-in interface.

Definition 0. Standard Interface Principle

There should be a single interface that defines how the core system uses plug-ins.

Question

Does a plug-in architecture equate to a microkernel architecture?

Question

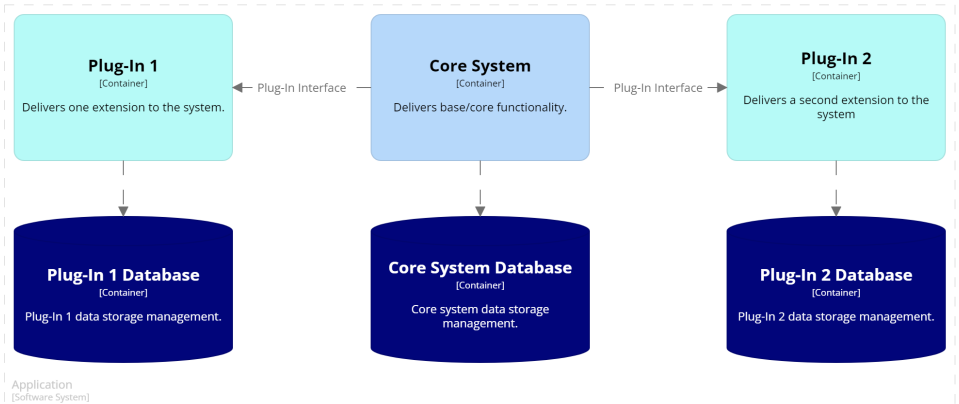
Does a plug-in architecture equate to a microkernel architecture?

Answer

What about *IntelliJ*?

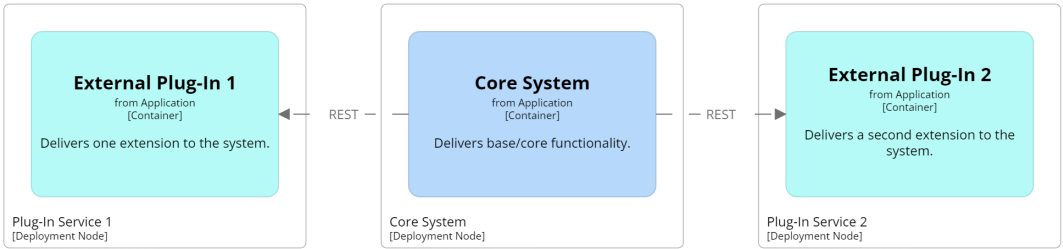
Plug-ins with Separate Databases

- Plug-ins cannot access core system data
  - Core system may pass data to the plug-in
- Plug-ins may have their own persistent data

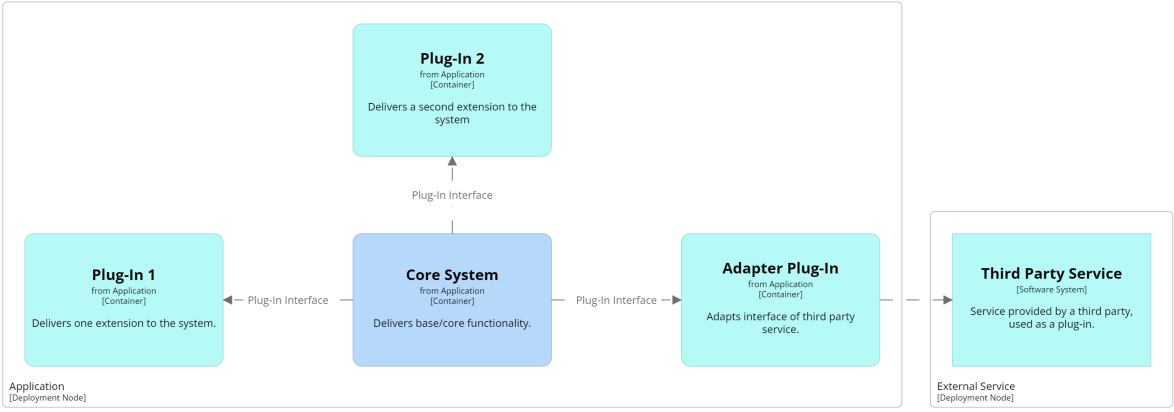


Plug-ins as External Services

- Need communication protocol
- Registry records communication contract
  - e.g. URL of the REST endpoint & data passed to it

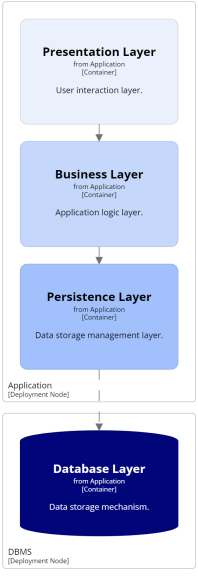


Adapting Non-Conforming Interfaces

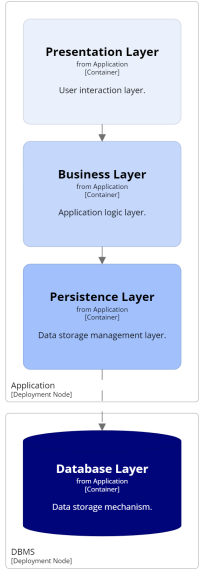


§ Technical & Domain Partitioning

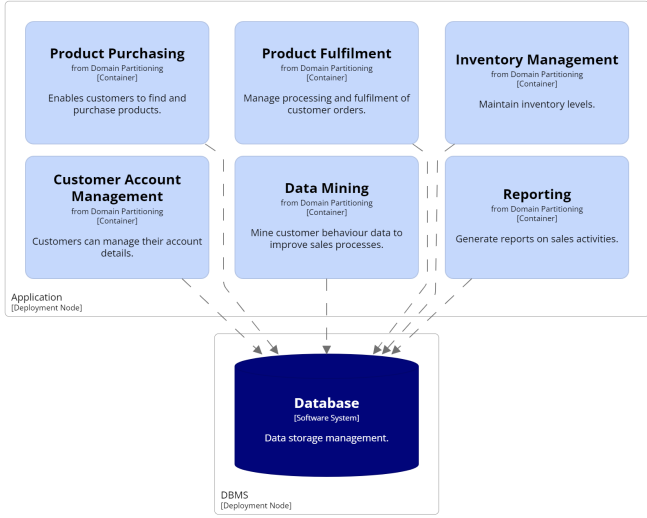
Technical Partitioning



Technical Partitioning



Domain Partitioning



Question

Is the microkernel architecture suited to *technical* or *domain* partitioning?

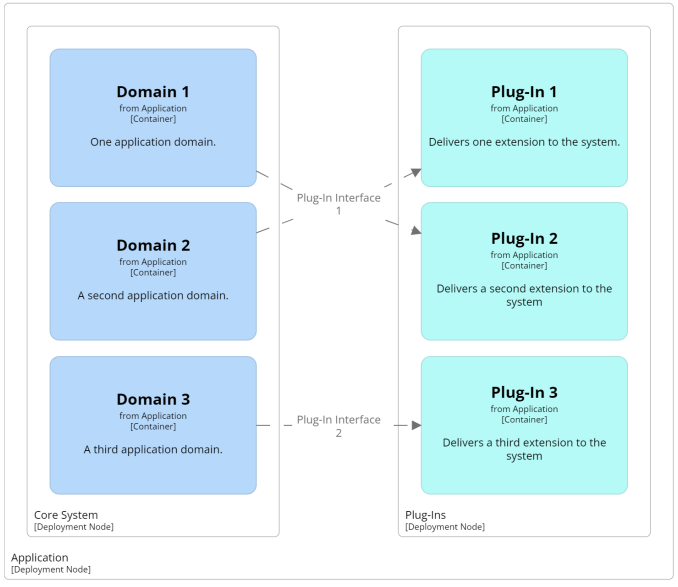
Question

Is the microkernel architecture suited to *technical* or *domain* partitioning?

Answer

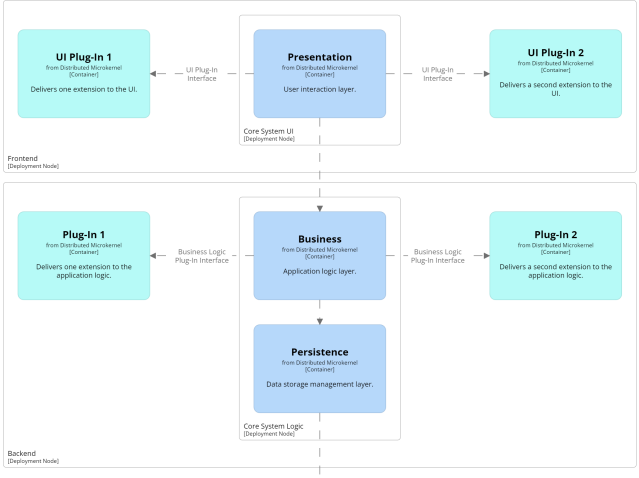
Core system can be partitioned either way.

Domain Standard Interfaces



Distributed Microkernel

- Partitions in the core system can be distributed
  - Technical or domain partitions
  - Plug-ins could also be distributed



§ Media Server Example

Question

What types of systems could use a *microkernel architecture*?

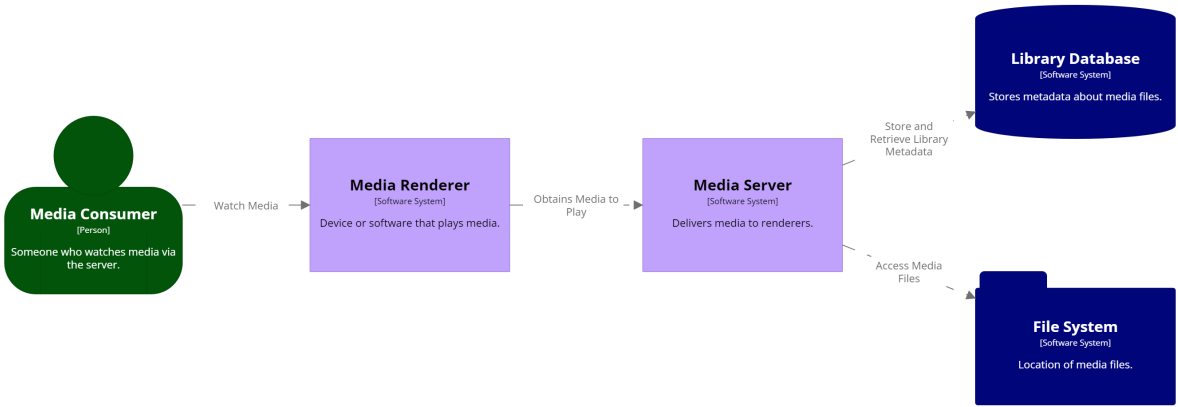
Question

What types of systems could use a *microkernel architecture*?

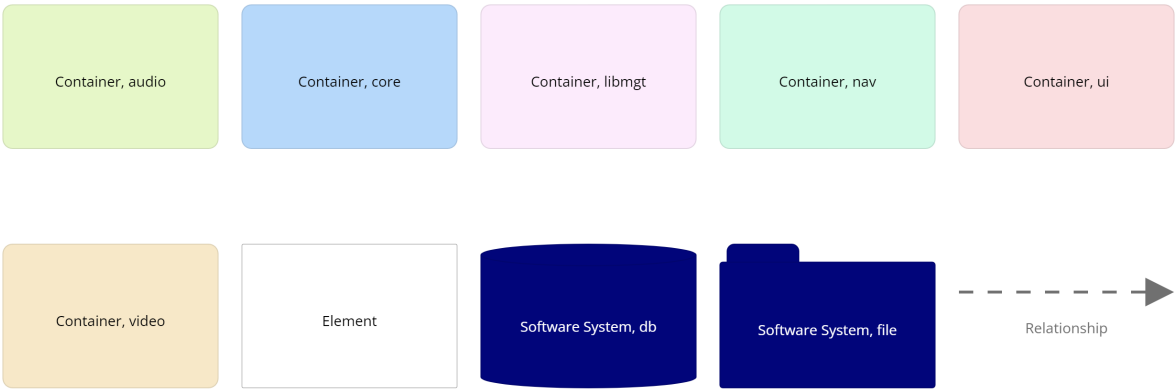
Answer

- Social media aggregator
- IoT management & processing
- Media server

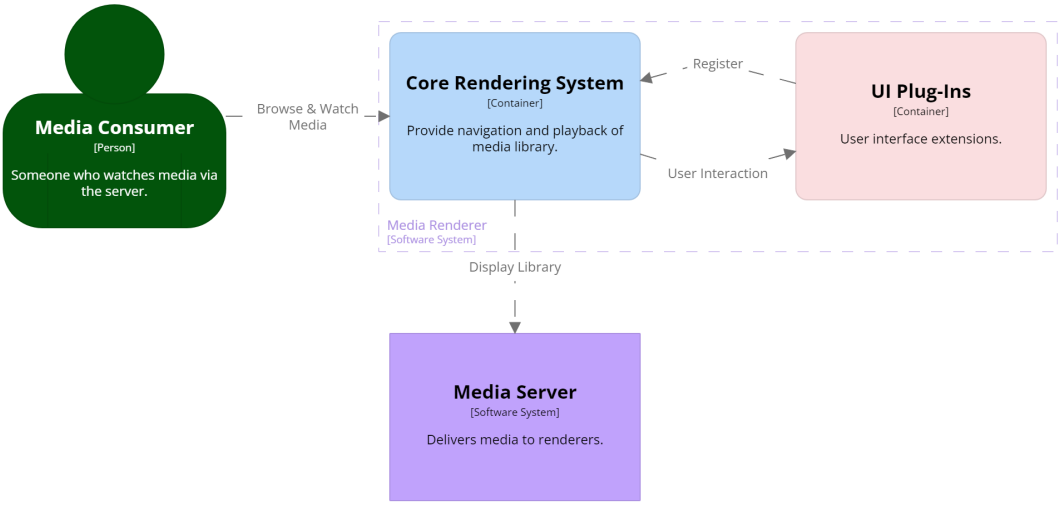
Media Server & Renderer



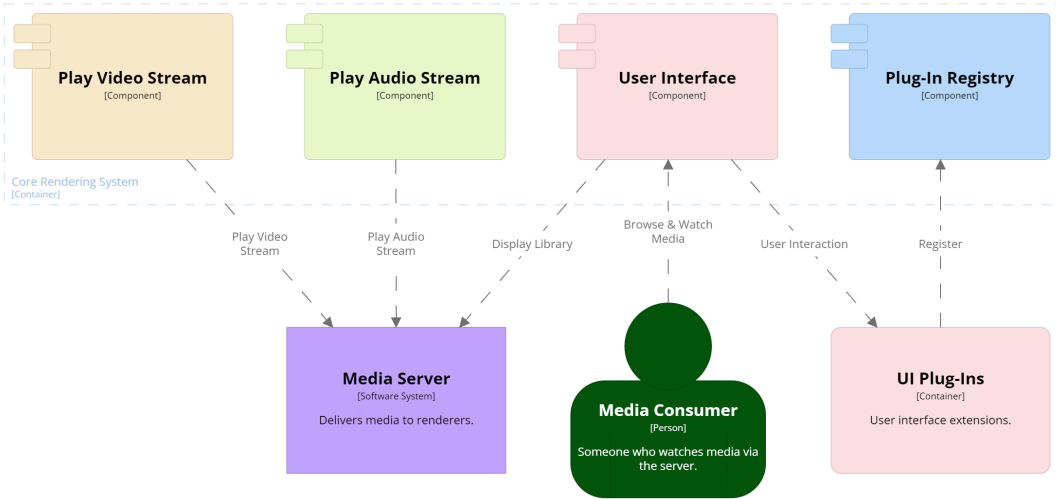
Domain Colour Key



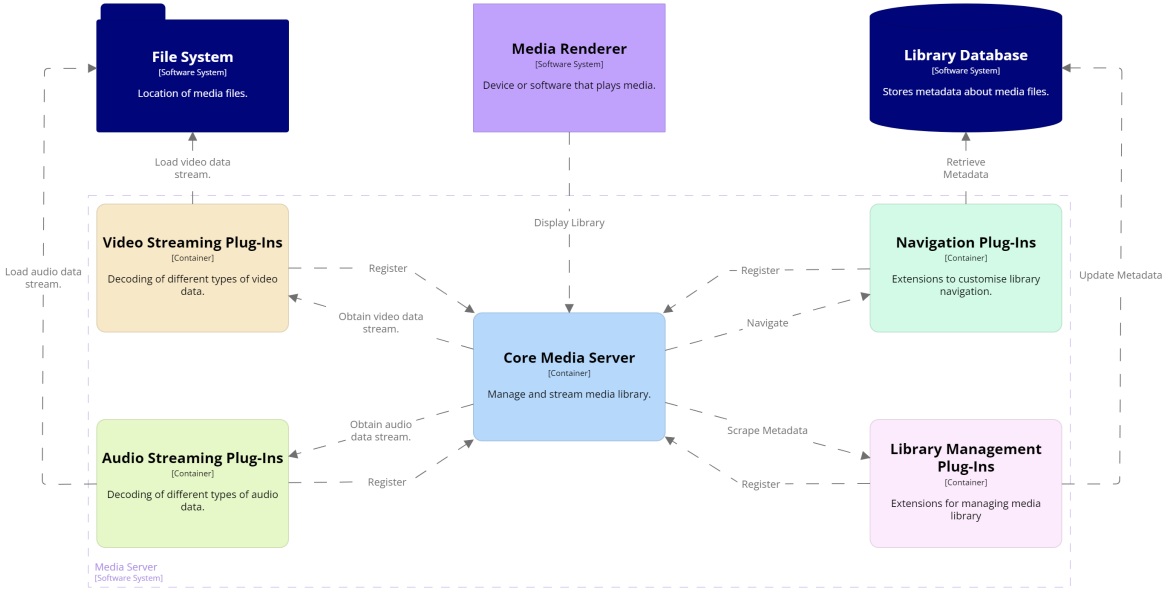
Media Renderer



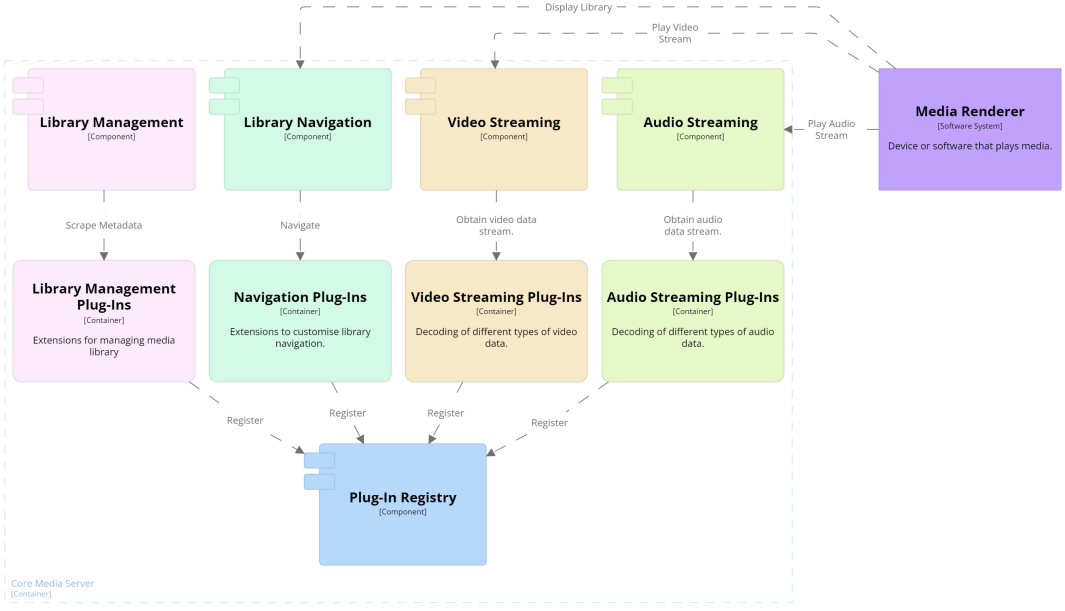
Core Rendering System Components



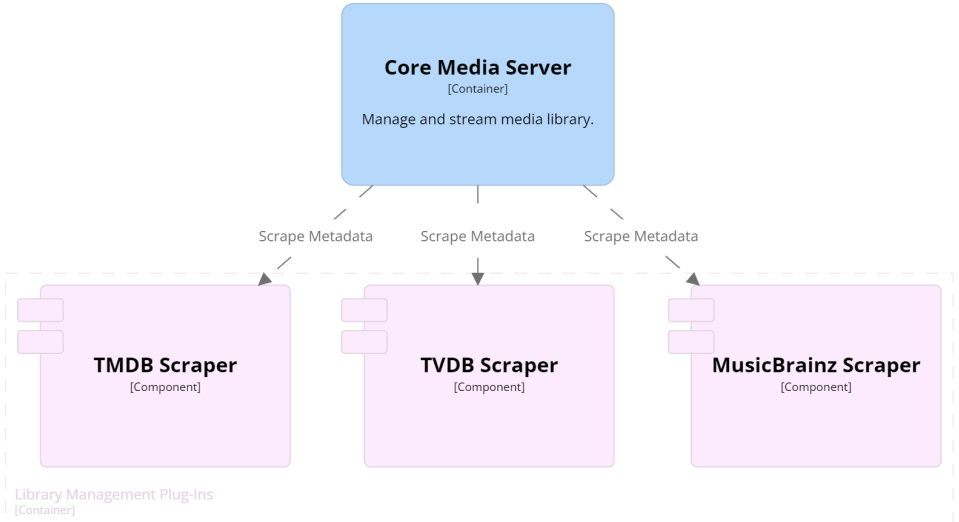
Media Server



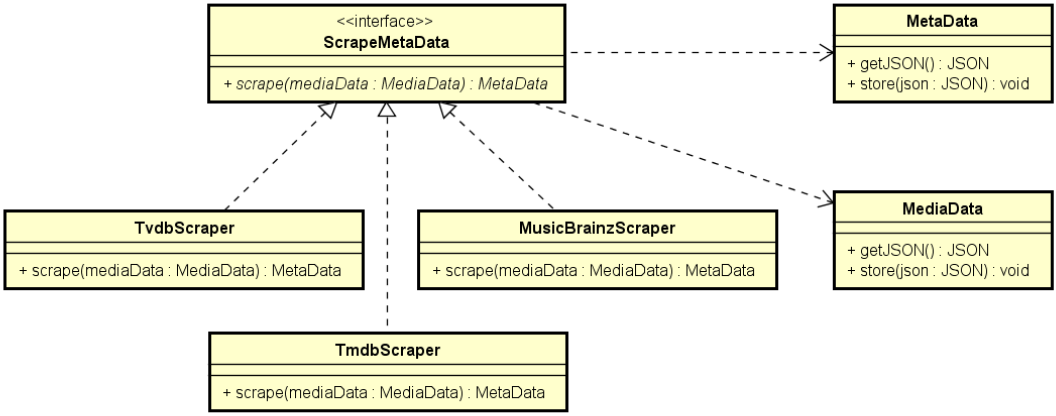
Core Media Server Components



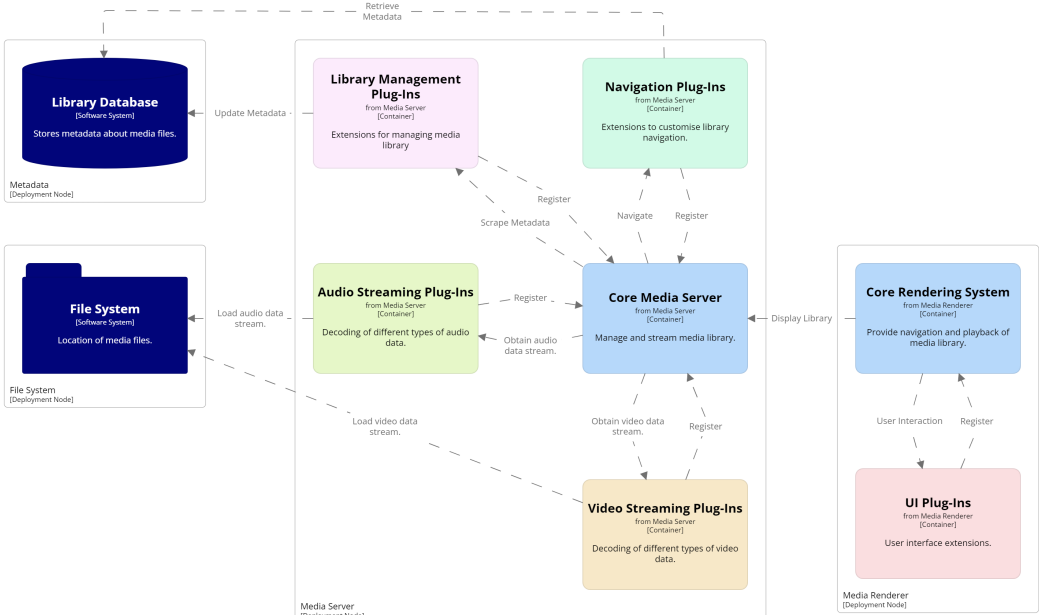
Media Library Management Components



Scrape Metadata Interface



System Deployment



§ Conclusion

Microkernel Pros & Cons

Simplicity Core system & Plug-in interface

Extensibility Plug-ins

Interoperability Plug-ins

Scalability

Reliability