Testing Strategies in a Micro-Service Architecture

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The Plan

- Micro-Services:
  - Definition
  - Anatomy
  - Architecture
- Testing
  - Unit
  - Integration
  - Component
  - End to End
  - Contracts
- Questions?

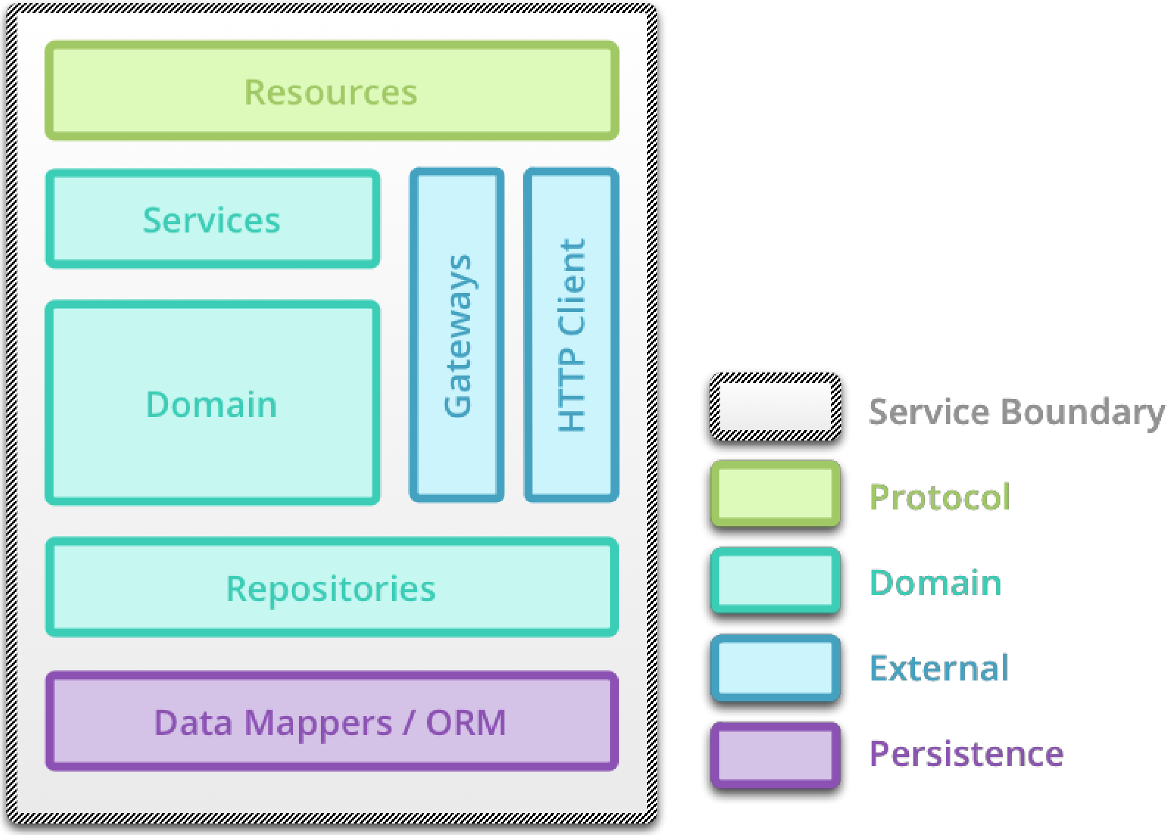
Definition of a Micro-Service

Micro-service

A small web service supporting a specific task in a broader application work flow.

- Micro in size, usually less than 1000 lines of code.
- Single responsibility principle applied at the service level.
- Often RESTful, modelling concepts as resources and using hyperlinks to associate them.
- May or may not have a UI beyond the core API.

Anatomy of a Micro-Service: Components



Resources

Services

Domain

Gateways

HTTP Client

Repositories

Data Mappers / ORM

Service Boundary

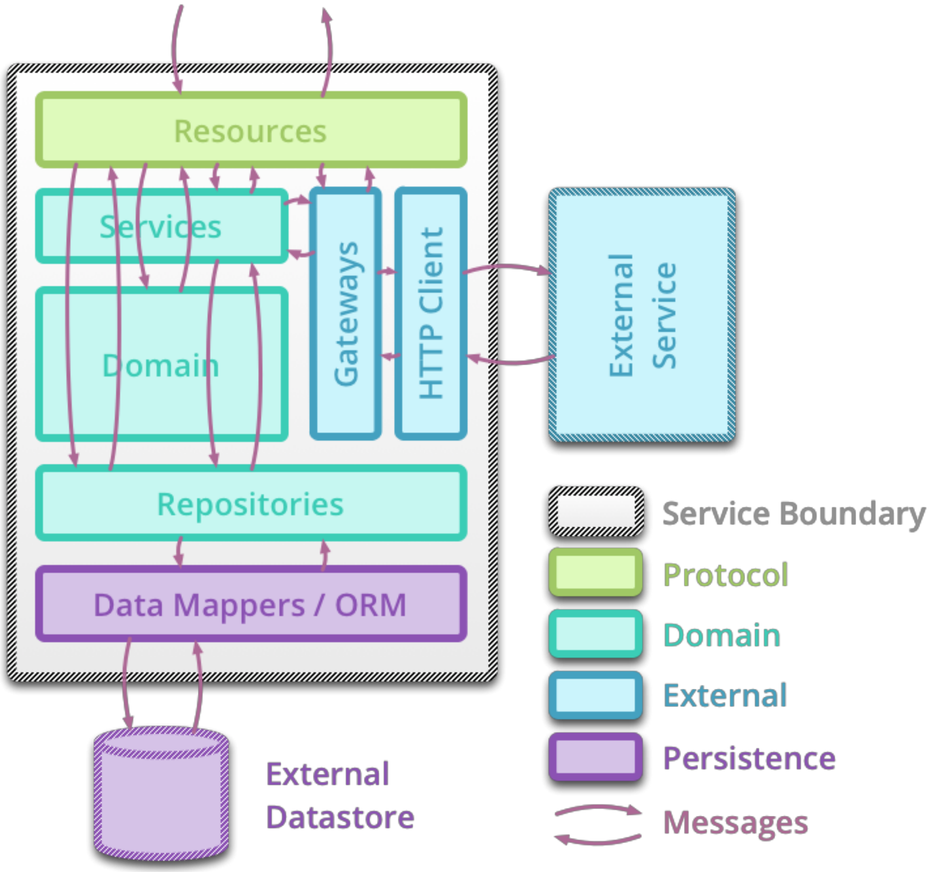
Protocol

Domain

External

Persistence

Anatomy of a Micro-Service: Communications



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External Datastore

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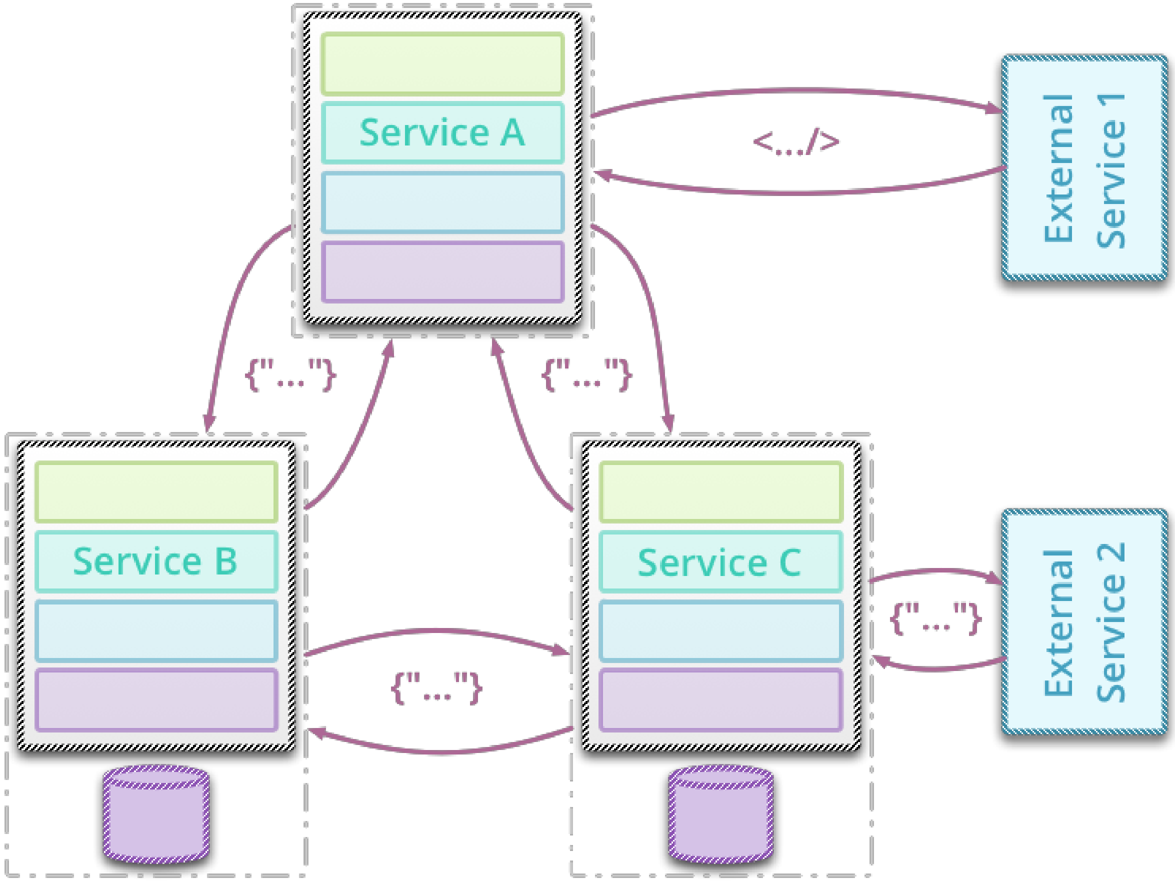
Messages

Micro-Service Architecture



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Micro-Service Testing: Unit Level

Unit test

> A test of the smallest piece of testable software in the application, isolated from the remainder of the code, to determine whether it behaves as expected.
>
> — MSDN

Micro-Service Testing: Unit Level

- Two styles of unit testing, **mockist** and **classic**.
  - Classic: State based behaviour testing.
  - Mockist: Interaction testing supported by mocks.
- What should be unit tested?
  - Services are commonly a rich domain surrounded by plumbing and coordination code.
  - Domain often lends itself to a classic style of testing.
  - Plumbing and coordination logic usually easier to test using a mockist style.
- The more micro the services, the more plumbing and coordination logic overall.
- Does comprehensive unit testing pay off?

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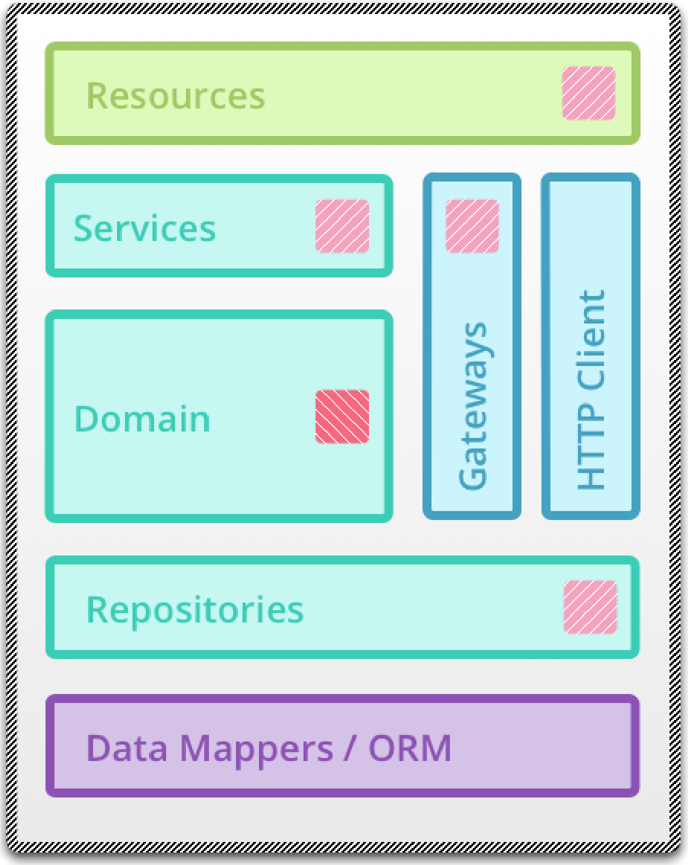
Micro-Service Testing: Unit Level



▨ Unit - Mockist

▨ Unit - Classic

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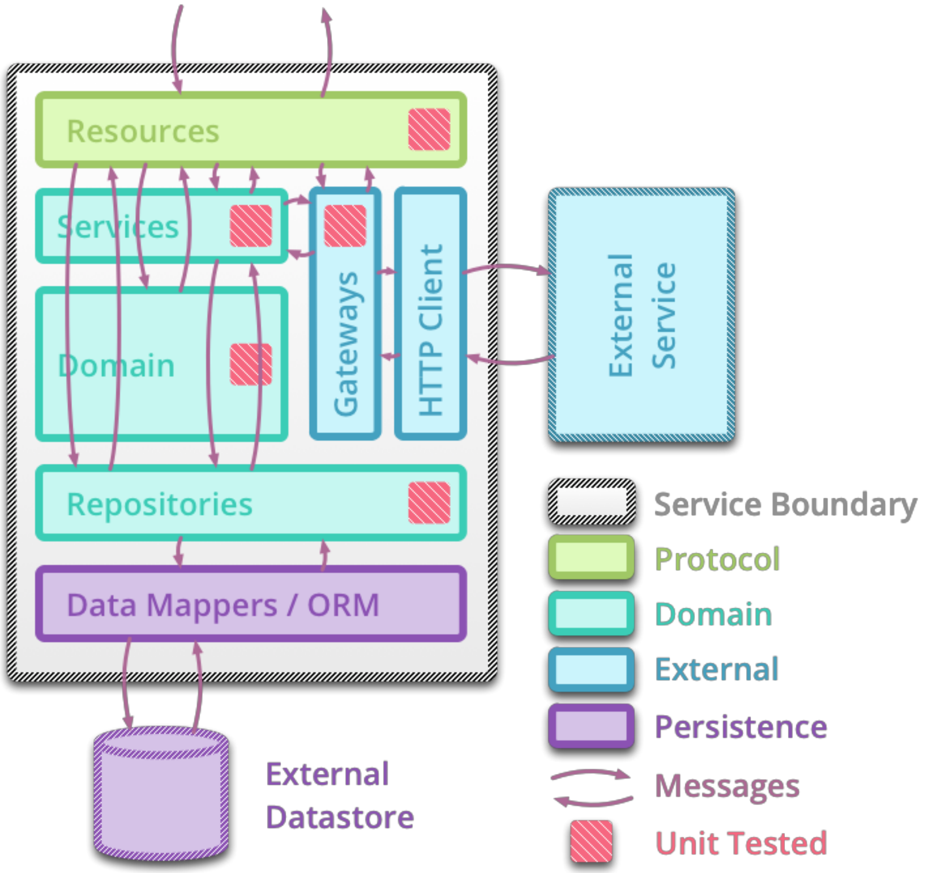
Micro-Service Testing: Progress...



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Micro-Service Testing: Integration Level

Integration test

> A test to verify the communication paths and interaction between components and to detect interface defects.
>
> — [1] [2] [3]

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Micro-Service Testing: Integration Level

- Test the gap between our integration code and the external system to which we are integrating, e.g., **other services**, **data stores** or **caches**.
- Not necessarily comprehensive, cover basic success and error paths.
- Other mechanisms exist for verifying the external system's contract.
- Are they valuable?

  + Provide fast feedback whilst iterating on integration modules.

  - Have a dependency on a system not necessarily in our control.

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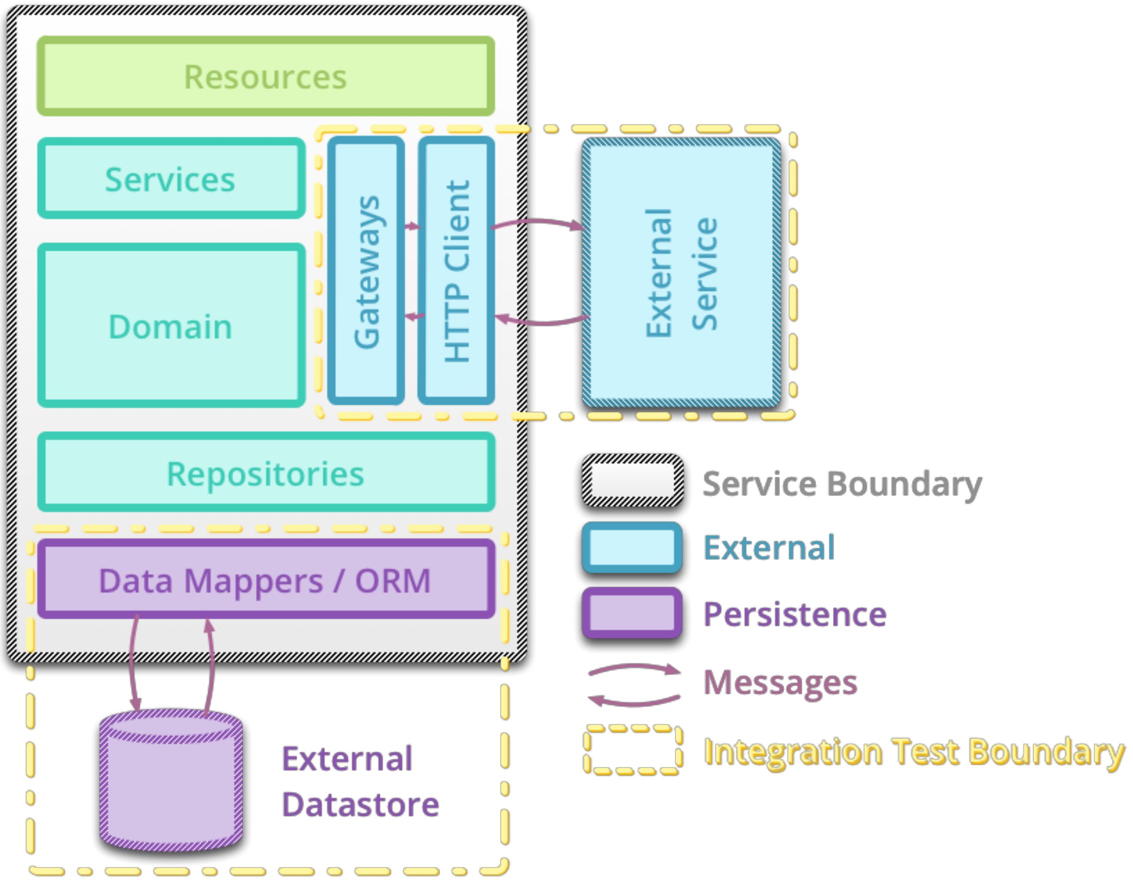
Micro-Service Testing: Integration Level



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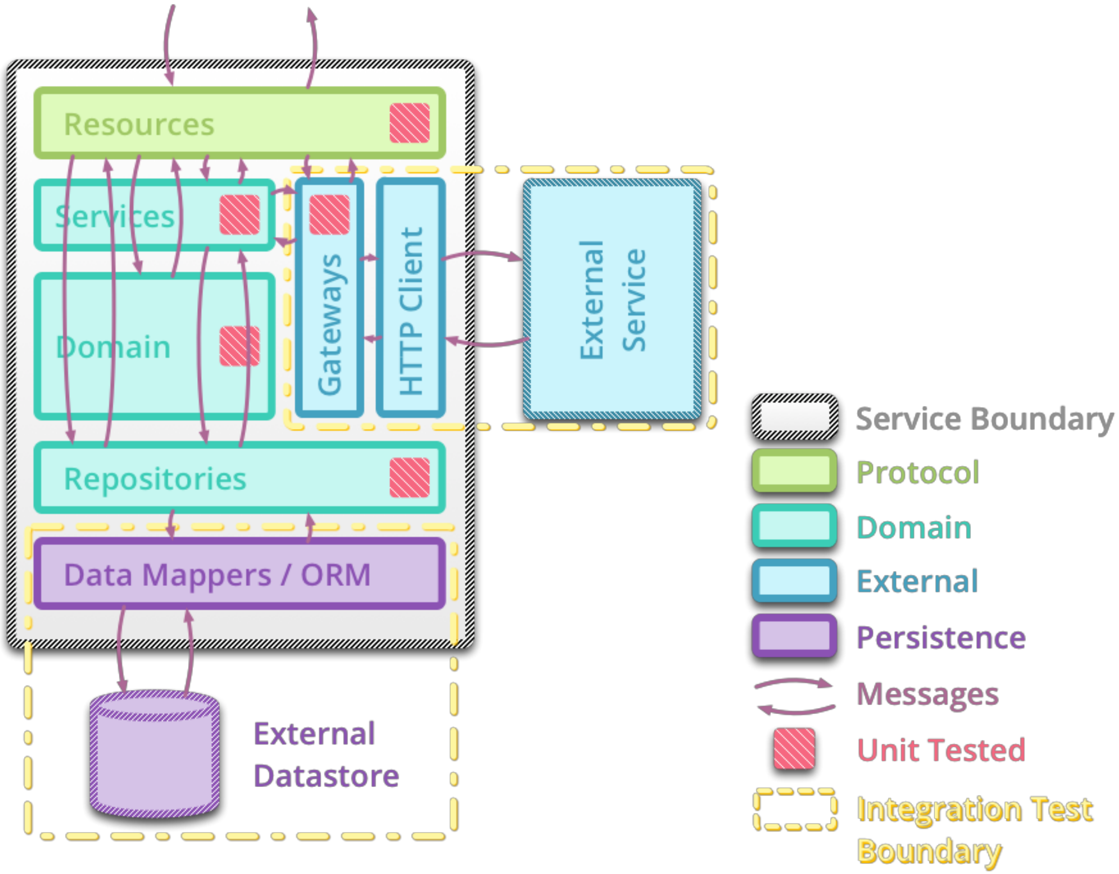
Micro-Service Testing: Progress...



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Unit Tested

Integration Test Boundary

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Micro-Service Testing: Component Level

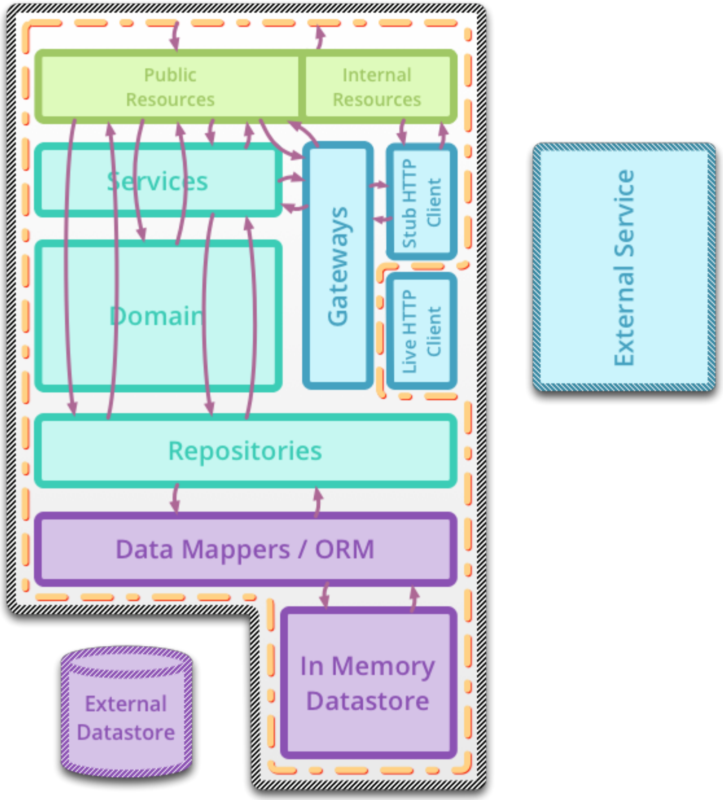
Component test

> A test that limits the scope of the exercised software to a portion of the system under test, by manipulating the system through internal code interfaces and by using test doubles to isolate the code under test from other components.
>
> — Martin Fowler

Micro-Service Testing: Component Level

- Treat each microservice as a component
- Lots of options!
  - in-process vs. out of process
  - internal stubbing vs. external stubbing
  - real datastore vs. in-memory datastore
- Act as acceptance tests at the service level, testing the core business purpose of the service.
- Often care more about the contract of the service than other test suites.

Micro-Service Testing: Component Level: In Process



- ▨ Service Boundary
- 🟩 Protocol
- 🟩 Domain
- 🟦 External
- 🟪 Persistence
- ⇄ Messages
- ⬚ Component Test Boundary

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Aside: Internal Resources

- Whilst it might seem strange, internal resources prove very useful
  - e.g., logs, feature flags, database commands, metrics, maintenance controls
- Can be locked down at the network level to avoid accidents in production, for example, by prefixing all with `/internal/...`
- Often evolve to public resources during the lifetime of a code base.

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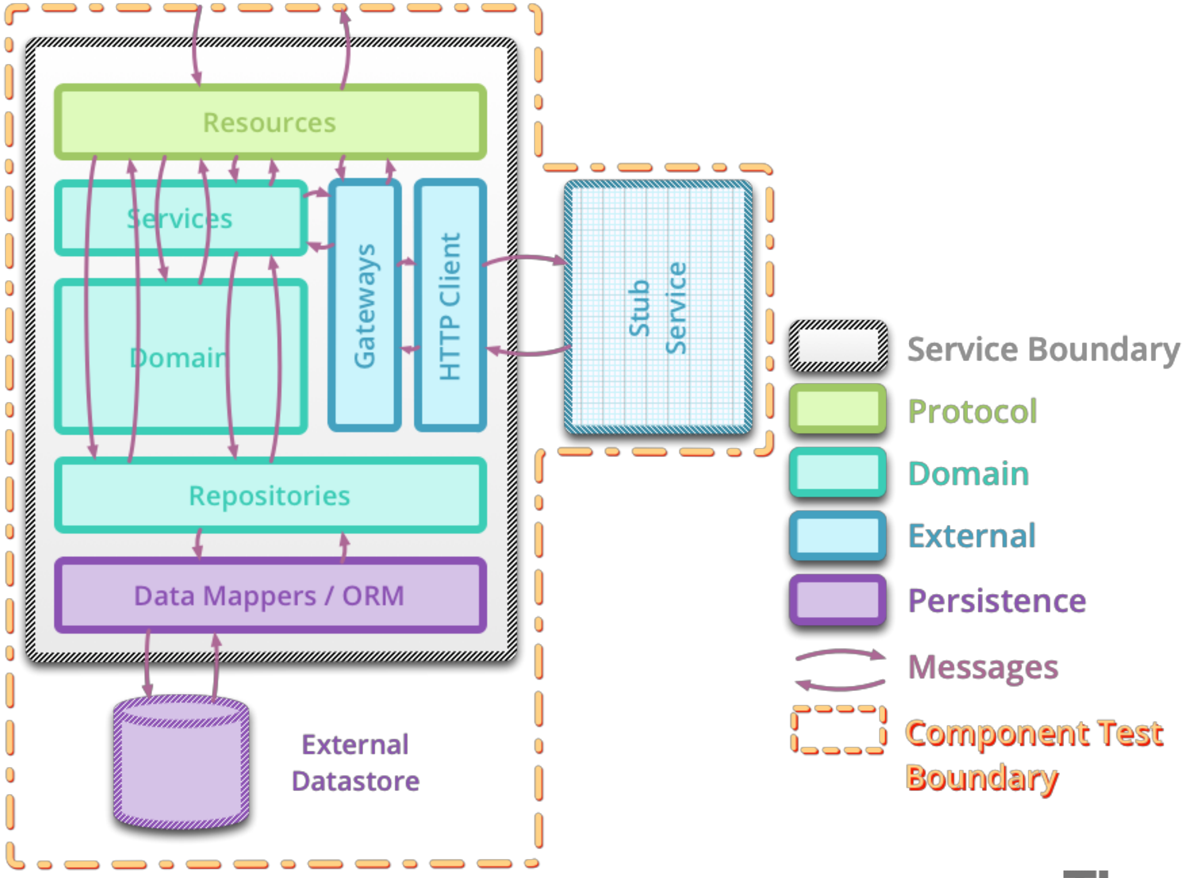
Micro-Service Testing: Component Level: Out of Process



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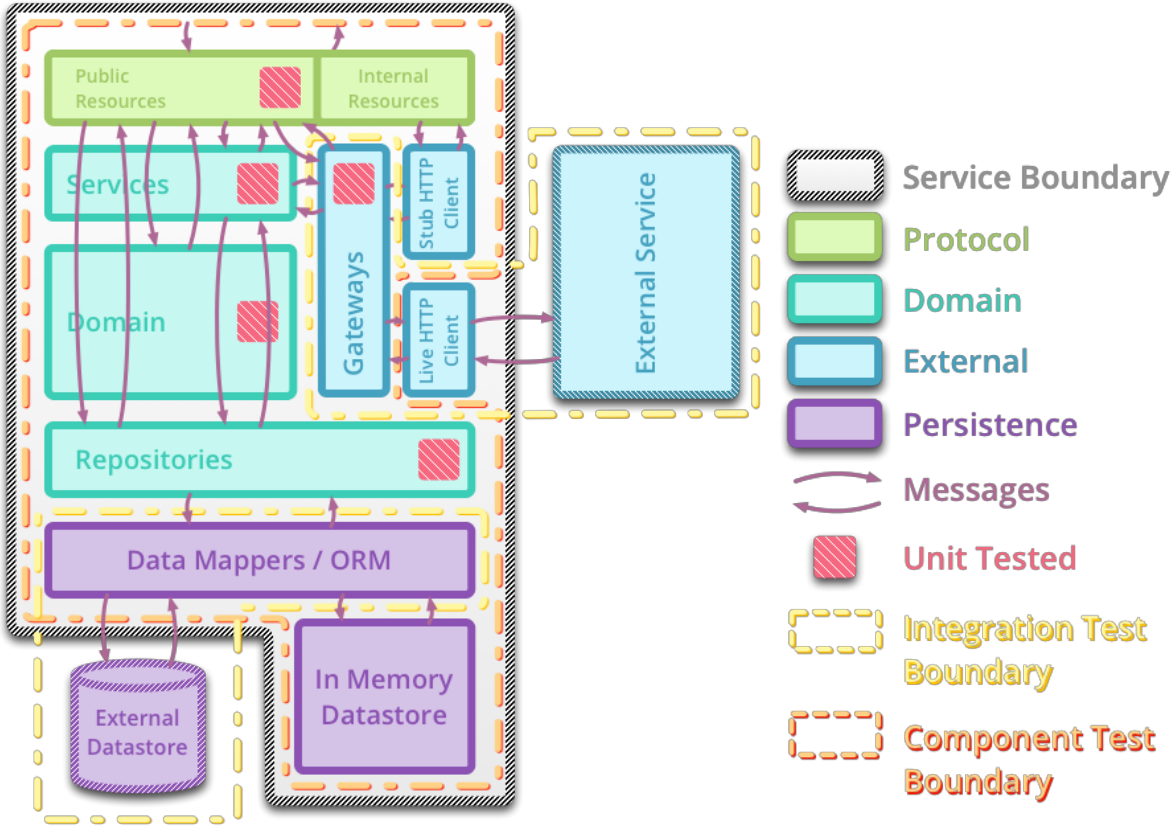
Micro-Service Testing: Progress...



Micro-Service Testing: End to End

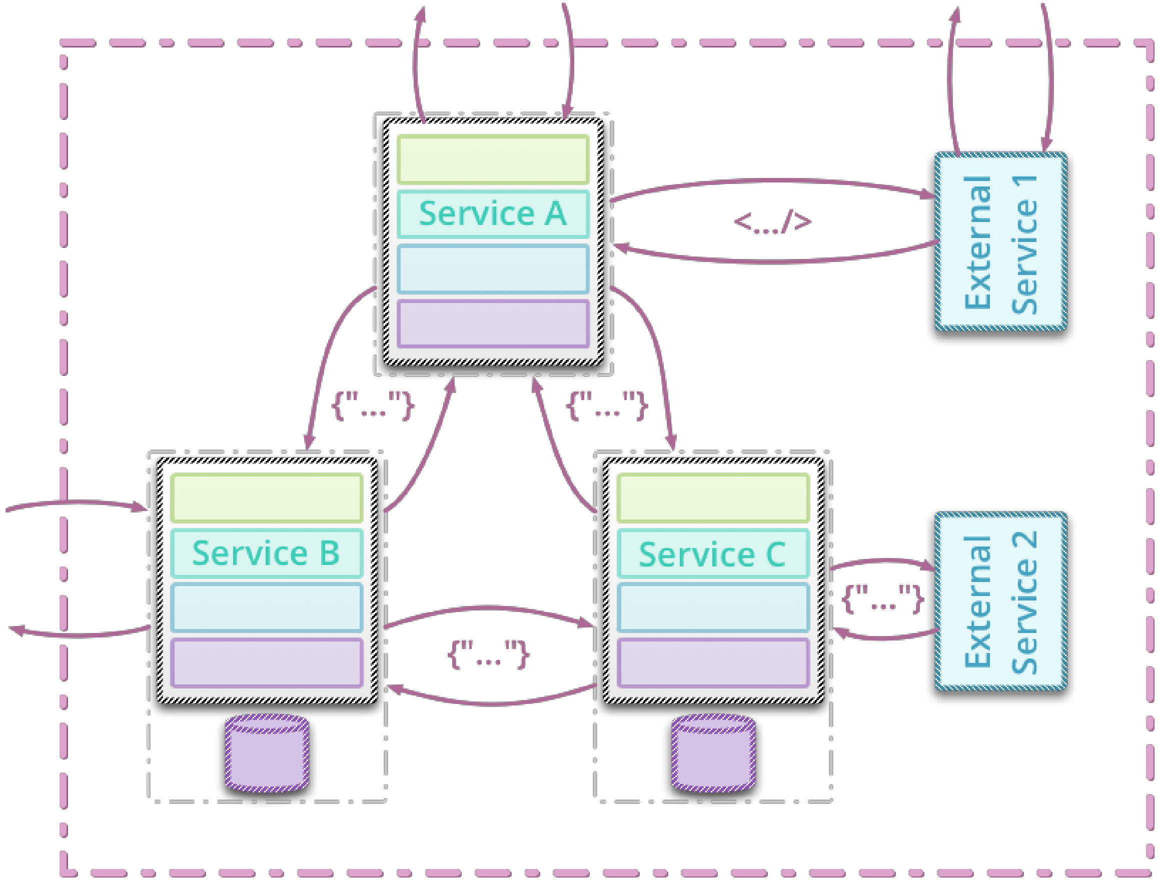
Functional test

> A test that verifies that a system meets external requirements and achieves its goals, testing the entire system, end to end.
>
> — [1]

Micro-Service Testing: End to End

- Exercise as much of the fully deployed system as possible.
- Often more business facing, utilising business readable DSLs.
- Tend to be more brittle or expensive than other levels of testing, in which case, should be few in number.

Micro-Service Testing: End to End



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Micro-Service Testing: Contract Tests

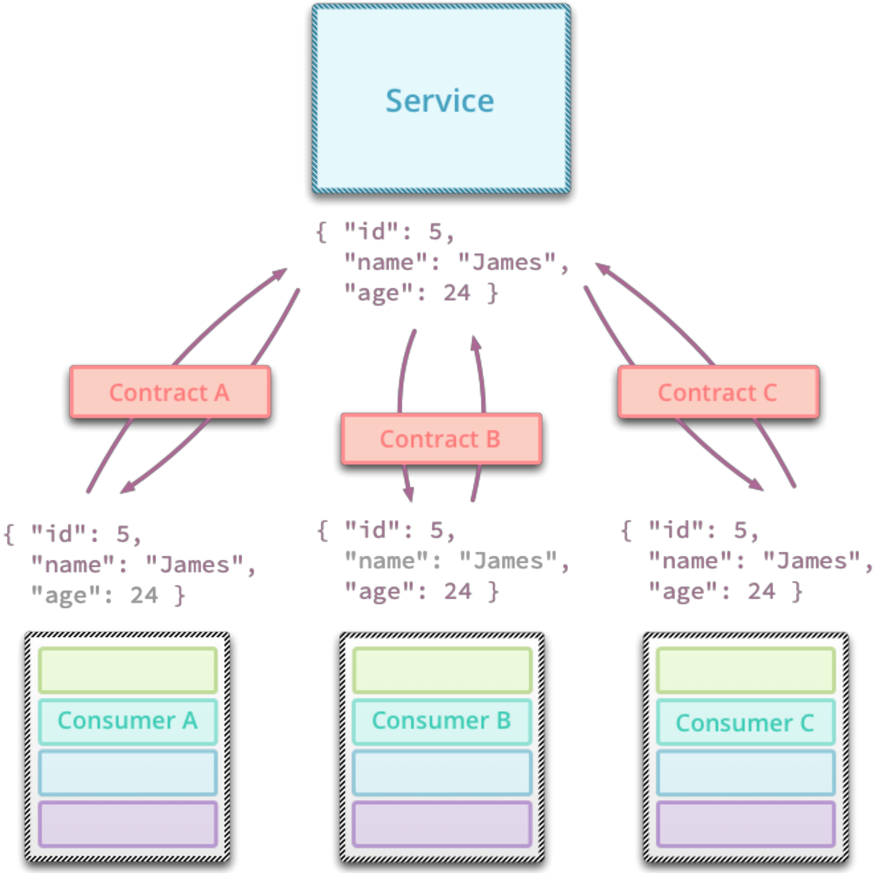
Contract tests

> A test at the boundary of an external service verifying that it meets the contract expected by a consuming service.
>
> — Me

Micro-Service Testing: Contract Tests

- Completely decoupled from consuming service.
- Assert against only those aspects of the external service required by the consuming service.
- Not component tests, only checking inputs and outputs at the service's interface.
- Ideally, packaged and runnable in the external service's pipeline.

Micro-Service Testing: Contract



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Questions?