Microservices AntiPatterns and Pitfalls

By

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What is

Antipattern	something that seems like a good idea when you begin, but leads you into trouble
Pitfall	something that was never a good idea, even from the start

Data-Driven Migration AntiPattern

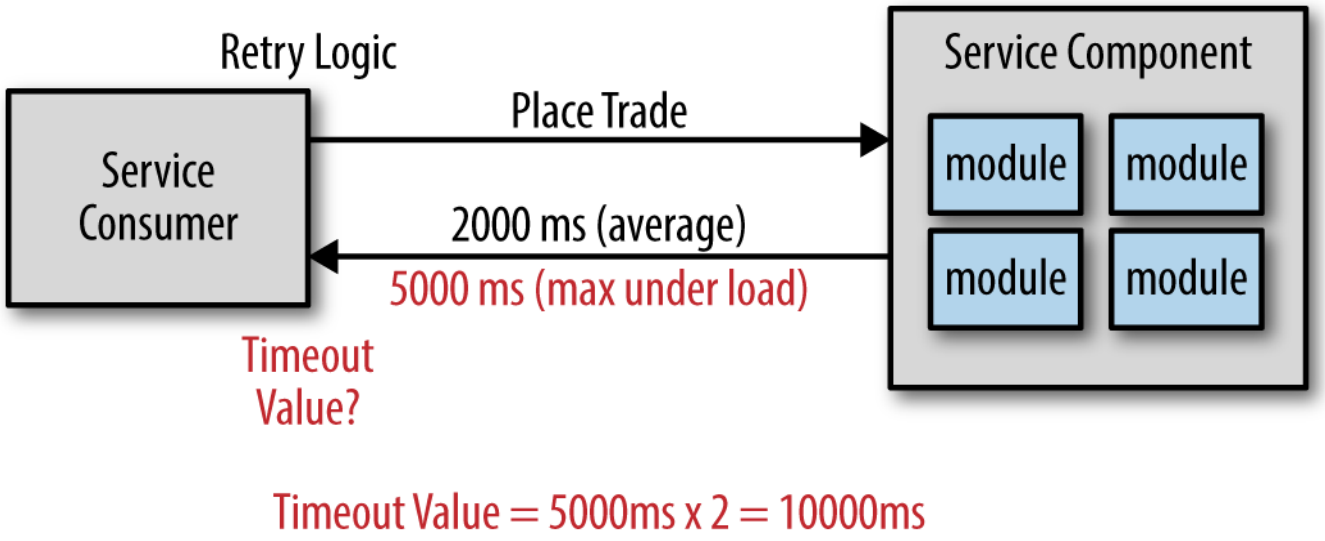
- This occurs mostly when you are migrating from a monolithic application to a microservices architecture.
- **Too Many Data Migrations**
  - The main problem with this type of migration path is that you will rarely get the granularity of each service right the first time.
- **Functionality First, Data Last**
  - to avoid this antipattern is to migrate the functionality of the service first and worry about the bounded context between the service and the data later.

The Timeout AntiPattern

- Challenges of any distributed architecture is managing remote process availability and responsiveness.
- If service is available but not responsive, user won't wait for infinite. This will need timeout value.
- **How to calculate timeout value?**
    1. calculate the database timeout within the service
        - determine the service timeout
    2. calculate the maximum time under load
        - double it, thereby giving you that extra buffer in the event it some- times takes longer.

The Timeout AntiPattern

- It causes *every request* from service consumers to have to wait 10 seconds just to find out the service is not responsive
- We need response in 2 sec

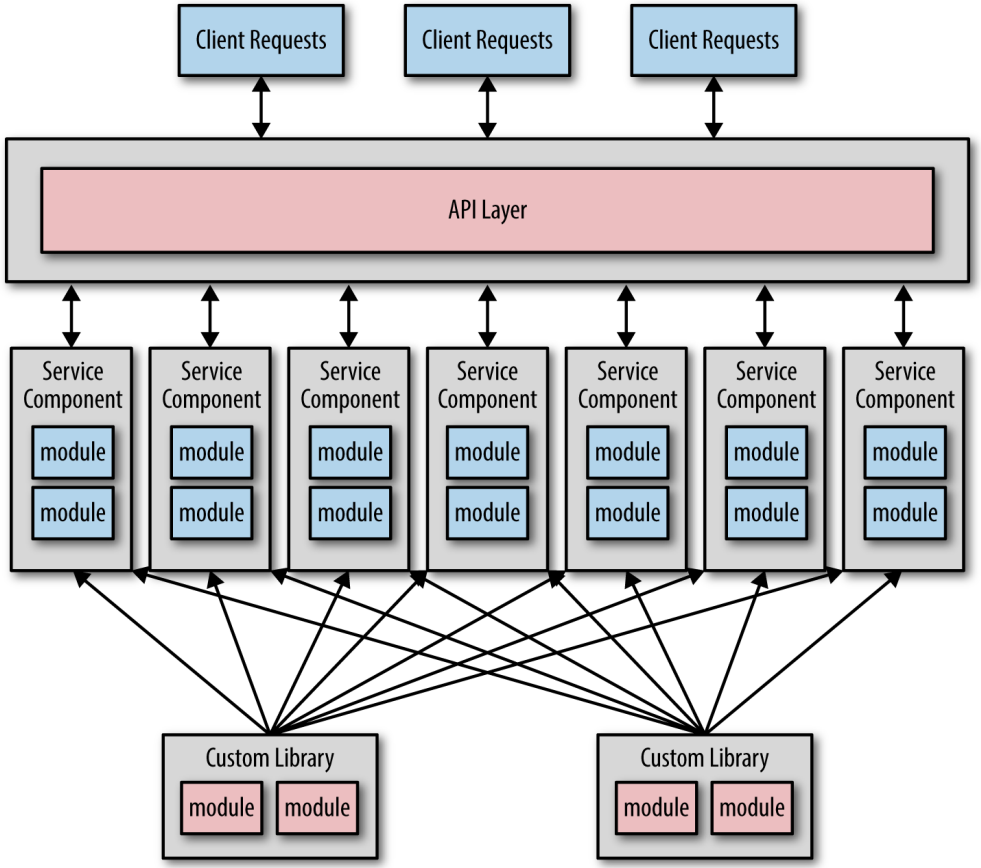


The Timeout AntiPattern

- **Using the Circuit Breaker Pattern**
  - monitors the remote service, ensuring that it is alive and responsive.
  - if service is live, allow requests.
  - If service is unresponsive, the circuit breaker opens, thus preventing requests from going through until the service once again becomes responsive
- **How?**
  - Use Ping, fake transaction
  - Monitor all request, once threshold is reached.
    - Break the path. Allow 1 of 10 request.
    - Once service is normal. Allow all requests.
- E.g.
  - Loadbalancer
  - K8s

The “I Was Taught to Share” AntiPattern

- Services use common libraries.
- We keep common libraries in.jar common.
- **Too Many Dependencies**
  - several issues, including overall reliability, change control, testability, and deployment.



The “I Was Taught to Share” AntiPattern

- **Techniques for Sharing Code**
  - best way to avoid this antipattern is simply not to share code between services.
  - Use libraries versioning
  - create context-based libraries like *security.jar*, *persistence.jar*, *dateutils.jar*

Reach-in Reporting AntiPattern

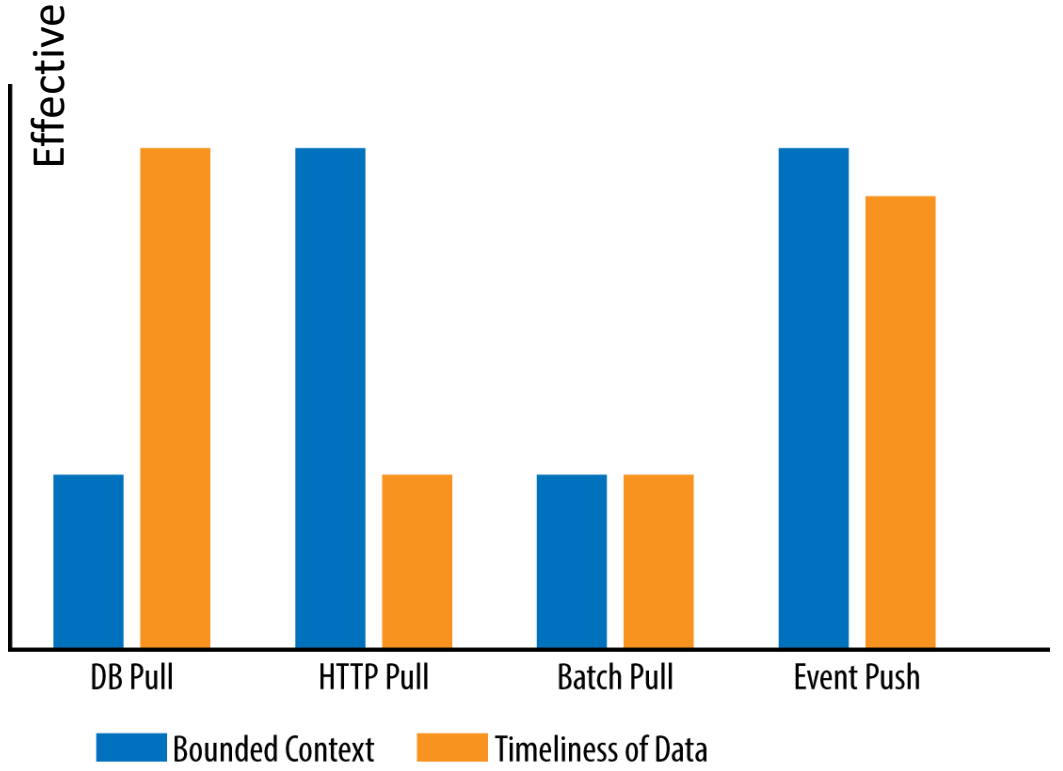
- **Issues with Microservices Reporting**
- Database pull
  - Pull the data directly from the service databases
  - Couple of applications together use a shared database.
  - This means that the services no longer own their data.
  - database refactoring affects all applications together.

Reach-in Reporting AntiPattern

- Pull data through http api
  - it is unfortunately too slow, particularly for complex reporting requests.
  - the data volume might be too large of a payload for a simple HTTP call.
- Batch pull model
  - separate reporting database or data warehouse that contains the aggregated and reduced reporting data.
- Event-based push model
  - asynchronous event processing to make sure the reporting database has the right information as soon as possible.

Reach-in Reporting AntiPattern

- The HTTP pull model preserves the bounded context, but has issues associated with timeouts and data volume.
- The batch pull model turns out to be the least-desirable model out of the four options because optimizes neither the bounded context nor the timeliness of data.
- Only the event-based push model maximizes both the bounded context of each service and the timeliness of reporting data.



Grains of Sand Pitfall

- The *grains of sand pitfall* occurs when architects and developers create services that are too fined-grained. Wait—isn't that why it's called *micro*services in the first place? The word "micro" implies that a service should be very small, but how small is "small"?
- small as a "class"?
- A service performs a specific function in the system.
- The service should have a clear and concise roles and responsibility statement and have a well-defined set of operations.
- The number of implementation classes should not be a defining characteristic for determining the granularity of a service.

Grains of Sand Pitfall

- **Analyse Service Scope and Function**
  - Documenting or verbally stating the service scope and function is a great way to determine if the service is doing too much.
  - Using words like “and” and “in addition” is usually a good indicator that the service is probably doing too much.
- **Analyse Database Transactions**
  - In microservice, it is extremely difficult to maintain an ACID transaction between two or more remote services.
  - microservices architectures generally rely on a technique known as BASE transactions (basic availability, soft state, and eventual consistency)
  - if you can’t live with eventual consistency you will generally move from fine-grained services to more coarse-grained ones, thereby keeping multiple updates coordinated within a single service context,

Grains of Sand Pitfall

- **Analyze Service Choreography**
  - commonly referred to as interservice communication.
  - decreases the overall performance of your application since each call to another service is a remote call.
    - 5 * 100 msec = ½ sec in interservice communication.
  - The more remote calls you make for a single business request, the better the chances are that one of those remote calls will fail or time out.
  - If you find you are having to communicate with too many services to complete single business requests, then you've probably made your services too fine-grained.

Developer Without a Cause Pitfall

- Programmers know the benefits of everything and the trade-offs of nothing. ☹
- Architects must understand both.

Developer Without a Cause Pitfall

- **Making the Wrong Decisions**
  - fine-grained service -> impacts performance and reliability -> impacts interservice communication time between them
  - What if multiple service are consolidated to avoid above?
    - It increases reliability
  - What about trade-offs?
    - Trade-offs are Deployment, change control, and testing
  - Reverse is true for Coarse service to finer services.

Jump on the Bandwagon Pitfall

- While the microservices architecture is a very powerful and popular architecture style, it's not suited for every application or environment.

Advantage	Disadvantage
Deployment	*Need Organizational change*
Testability	*Interservice communication Performance*
Change control	*Reliability is low*
Modularity	Invest in *DevOps*
Scalability	

Jump on the Bandwagon Pitfall

- What are my business and technical goals?
- What am I trying to accomplish with microservices?
- What are my current and foreseeable pain points?
- What are the primary driving architecture characteristics for this application (e.g., performance, scalability, maintainability, etc.)?

The Static Contract Pitfall

- This occurs when you fail to version your service contracts from the very start, or even not at all.
- How to support changes in contract? (request schema)
  - use versioning
- Version can be in header
  - difficult to implement.
  - Headers are not just in HTTP.

The Static Contract Pitfall

- **Schema Versioning**
- version is known after parsing the data
- complex schema interfere with automatic conversion.
  - like JSON to Java obj

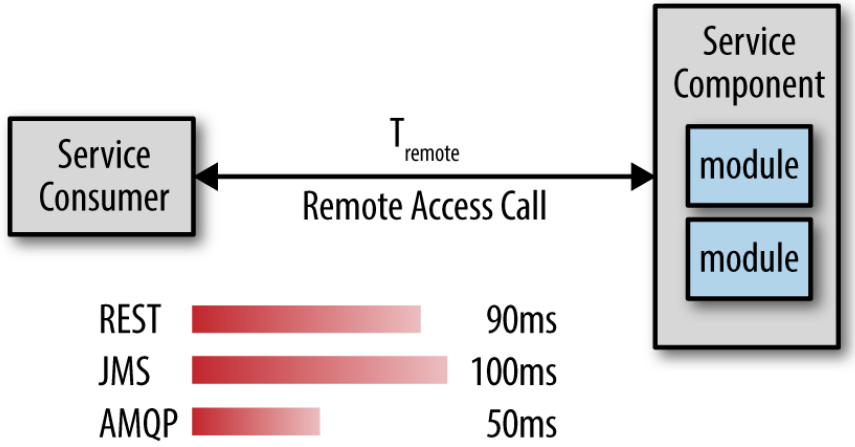
```
{
  "$schema": "http://json-schema.org/draft-04/schema#",
  "properties": {
    "version": {"type": "integer"},
    "acct": {"type": "number"},
    "cusip": {"type": "string"},
    "sedol": {"type": "string"},
    "shares": {"type": "number", "minimum": 100}
  },
  "required": ["version", "acct", "shares"]
}
```

Are We There Yet Pitfall

- This pitfall occurs when you don’t know how long the remote access call takes
- You might assume the latency it around 50 milliseconds, but have you ever measured it?
- Do you know what the average latency is for your environment?
- Do you know what the “long tail” latency is (e.g., 95, 99, 99.5 percentiles) for your environment? Measuring both metrics is important, because even with good average latency, bad long-tail latency can destroy you.

Are We There Yet Pitfall

- **Measuring Latency**
  - important piece we miss while measuring latency is protocol latency



Give It a Rest Pitfall

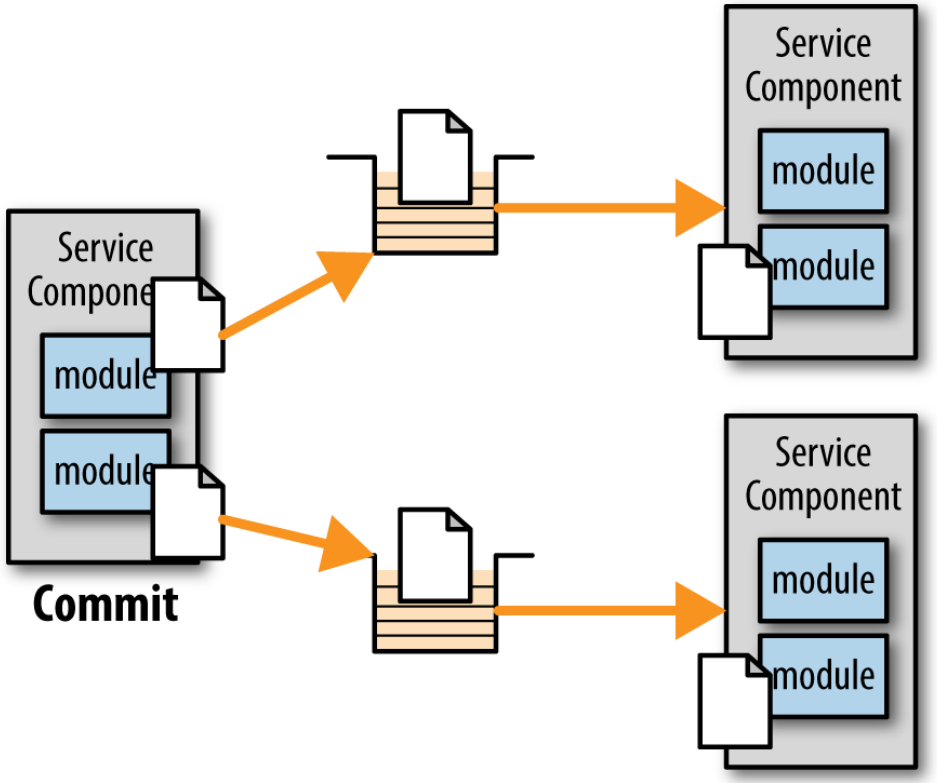
- REST is popular
- The give it a rest pitfall is about using REST as the only communication protocol and ignoring the power of messaging to enhance your microservices architecture.
- For example, in a RESTful microservices architecture,
  - how would you handle asynchronous communications?
  - What about the need for broadcast capabilities?
  - What do you do if you need to manage multiple remote RESTful calls within a transactional unit of work?

Give It a Rest Pitfall

- **Asynchronous Requests**
  - Use asynchronous communication for interservice communication (Kafka)
  - increases overall performance
  - increases reliability
    - no need to use circuit breaker, timeout
- **Broadcast Capabilities**
  - REST can't broadcast (RabbitMQ can)
  - where do we use broadcast? Share market data is broadcasted to various brokers

Give It a Rest Pitfall

- **Transacted Requests**
  - Message is sent chunks. Commit is used to mark end of message.
  - Until the service consumer performs a commit, those messages are held in the queues.
  - Once the service consumer performs a commit, both messages are then released.



Based on

- Microservices AntiPatterns and Pitfalls
  - By Mark Richards