Reasonable RPC with Remotely

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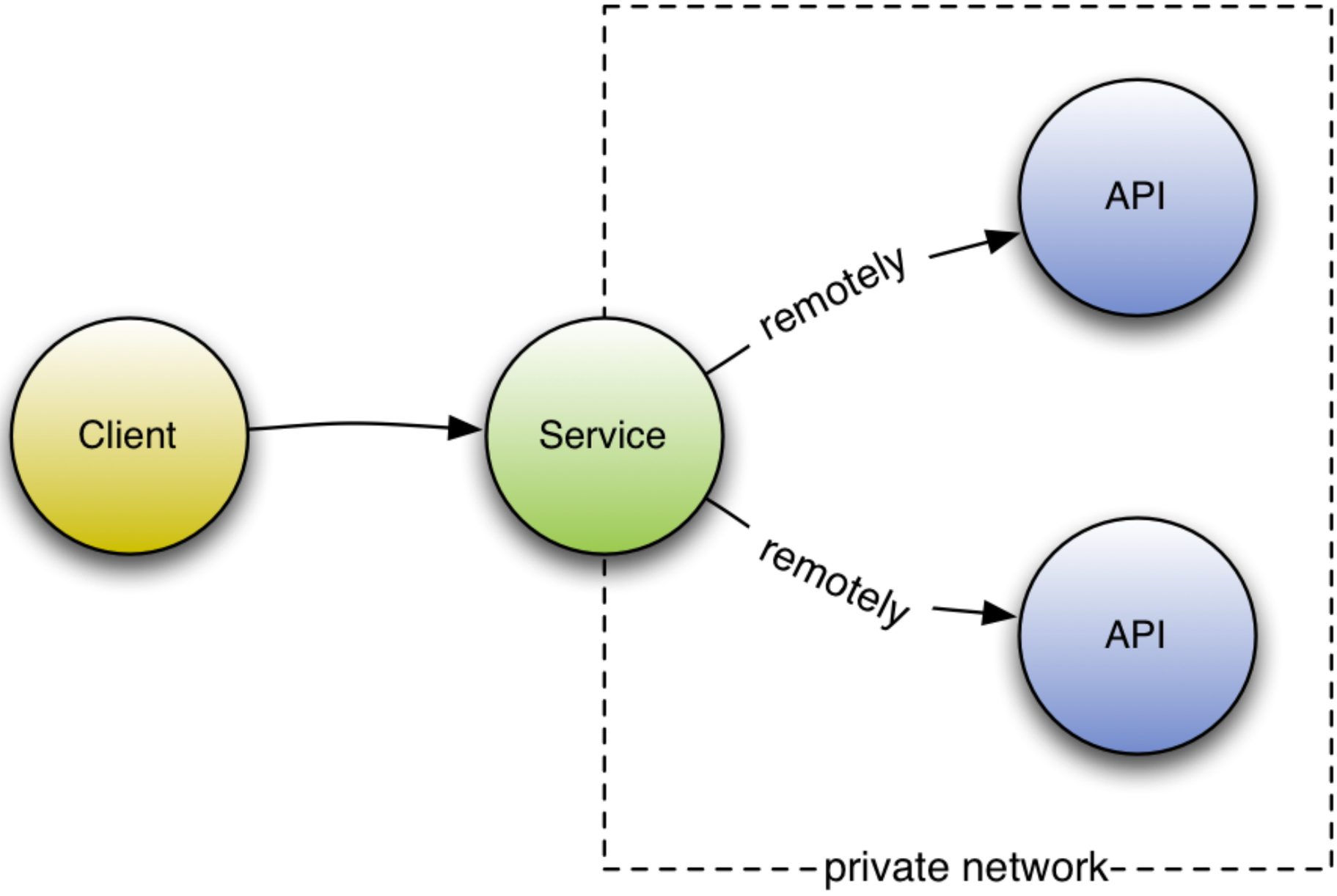

API
remotely
Client
Service
remotely
API
private network

Existing solutions

No panaceas. Just tradeoffs.

Monolith

- All functionality in a single binary
- Doesn’t scale
- Difficult to evolve and maintain

Broker pattern

- Message bus or broker mediates between services
- Single point of failure/integration
- If broker goes down, the whole system is down

Message-passing

- Lightweight and inexpensive
- Reliable and scales well
- Discovery is a pain

Message passing solutions

- Finagle
- Thrift
- Akka
- HTTP*(JSON+XML)/REST

Finagle

- Imperative API
- No reuse
- Too powerful
- No higher-order constructs

Thrift

- All of the problems with Finagle
- Tough tooling
- Documentation is lacking
- No formal spec for wire format

Akka

- Too powerful
- Untyped
- Actor system API bleeds to the outside
- Behavior of complex systems
  is unreasonable

HTTP*(JSON+XML)/REST

- Unproductive, developer time wasted
  - Marshalling/unmarshalling
    - Defining HTTP endpoints and using HTTP clients
- Resources wasted on HTTP layer and parsing
- Does what we want, but at tremendous cost

Our Vision

Productivity, Safety, Reuse

Productivity

Don’t want to think about:

- HTTP protocol specifics
- Every possible failure mode
- Serialization format
- Compatibility

Safety

- Ad-hoc evolution doesn't scale
- Incompatibilities should be compile-time failures
- Fail as early as possible

Reuse

- Use an actual programming language
- Build protocols from modular primitives
- Compose large protocols from small ones

Remotely

RPC for reasonable people

Remotely

RPC for reasonable people

Remotely

- Pilot for Verizon open-source
- Taking the time to build exactly what we want to use
- You can use it too!

Remote call

```
val x = factorial(9)
```

Remote reference

```
factorial: Remote[Int => Int]
```

Applying a remote function

```
val x: Remote[Int] =
  factorial(9)
```

Getting a response

```
val x: Response[Int] =
  factorial(9).run(endpoint)
```

Response monad

```
type Demo[A] = Kleisli[Response, Endpoint, A]

implicit def remoteToK[A](r: Remote[A]): Demo[A] =
  Kleisli.ask[Response, Endpoint].flatMapK(r.run)

def call: Demo[(Movie,List[Actor])] = for {
  a <- MovieClient.getMovie("m2")
  b <- MovieClient.getActors(a)
} yield (a,b)
```

Running Responses

```
val address = new InetSocketAddress("10.1.0.1",8080)

val exe: Task[(Movie,List[Actor])] = for {
  transport <- NettyTransport.single(address)
  endpoint   = Endpoint.single(transport)
  output    <- call(endpoint)(Context.empty)
  _         <- transport.shutdown
} yield output

val (movie, actors) = exe.run
```

Demo

Feature Pageant

Binary Codecs

- Fast, lightweight binary serialization
- Built on *scodec*
- Ships with codecs for standard Scala types
- Easy to make codecs for your own types

- Future goal:
  Fully automate codec-creation

Pluggable transports

- Uses Netty 4 out of the box
- Akka I/O
- Netty 3
- ØMQ

Pluggable transports

```
type Handler =
  Process[Task,BitVector] =>
  Process[Task,BitVector]
```

Endpoints

```
case class Endpoint(
  connections: Process[Task,Handler])
```

Endpoint combinators

```
def circuitBroken:
  (Duration,Int,Endpoint) => Endpoint

def failoverChain:
  (Duration,Process[Task,Endpoint]) => Endpoint
```

Context-passing

- Context provides arbitrary container for experiment propagation.
- Every request tagged with a UUID.
- Contains stack of request UUIDs.
  - highlights the “path” through the system request graph when debugging.

Pluggable monitoring

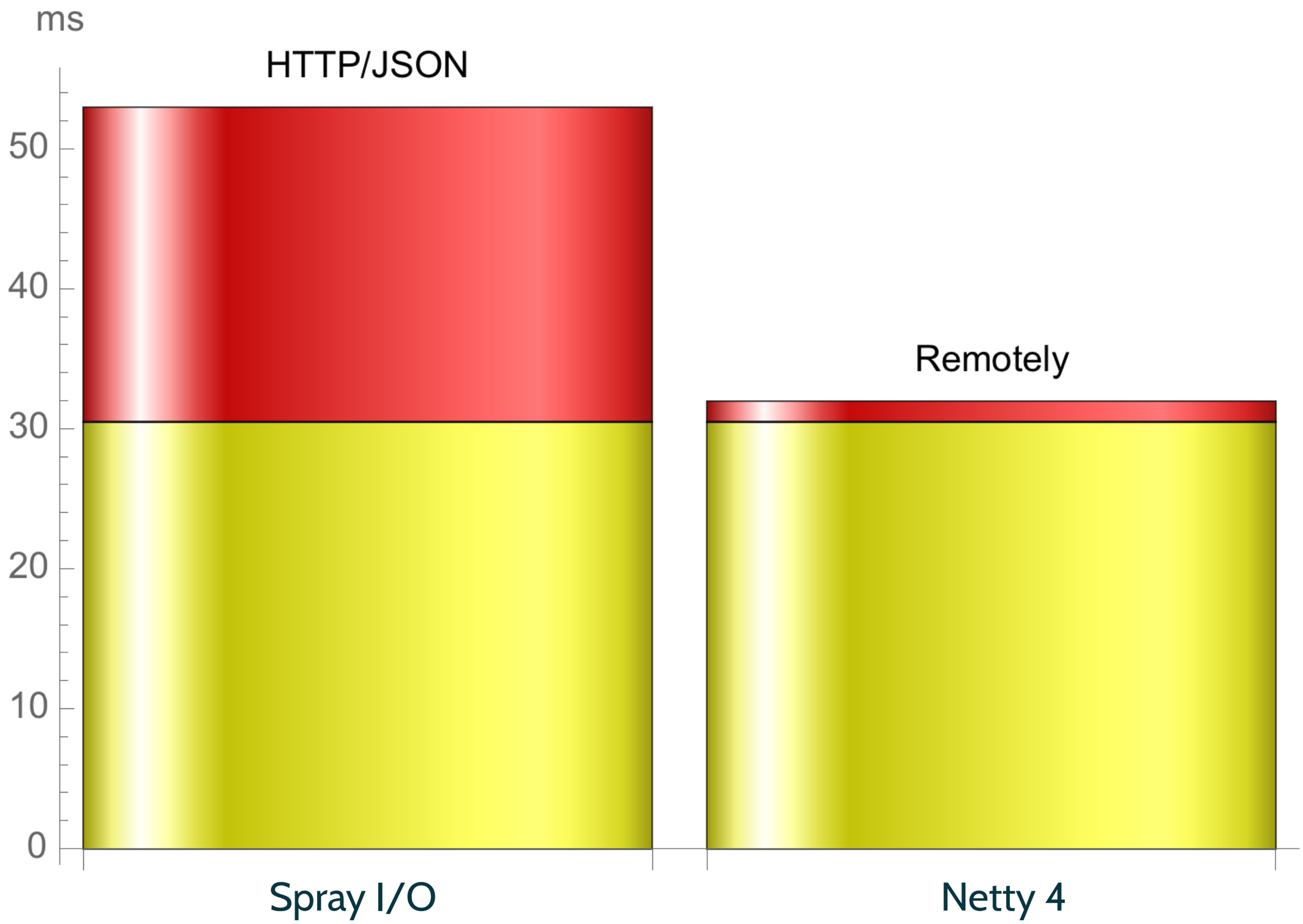
- Report round-trip latency timing.
- Trace every request uniquely.
- Trace the request stack entirely.
- Bring your own by implementing the `Monitoring` trait.
  - Uses println out of the box.

Capability checking

- Protocol versioning over time inevitable
- Determine client/server compatibility before establishing connection

How fast is it?

- Went from 56 ms to 32 ms (production payload)
- In benchmarks on modest hardware
  - Min: ~400 µs
  - Mean: ~1.5 ms
- Throughput is an issue currently


ms
HTTP/JSON
50
40
30
20
10
0
Remotely
Spray I/O
Netty 4

Future work

- Prettier API
- Drastically improve throughput
- Extensible protocol language
- More built-ins for e.g. server-side map and flatMap
- Remote polymorphic functions

Summary

- Remotely is productive
- It's safe
- It promotes code reuse
- You can contribute!

EOF

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github.com/oncue/remotely

github.com/oncue/remotely-demo