



adaptTo()

APACHE SLING & FRIENDS TECH MEETUP

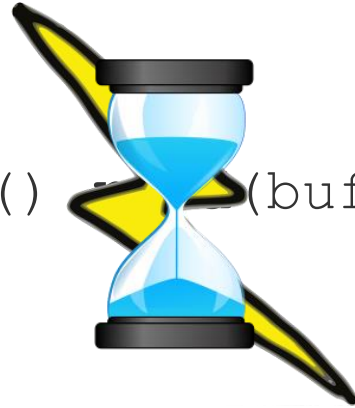
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OSGi Asynchronous Services: more than RPC

Michael Dürig, Adobe Research

Some typical code

```
socket.getInputStream() (buffer);
```



Timings on typical hardware...

Execute CPU instruction	1ns
Fetch from L2 cache	7 ns
Fetch from memory	100 ns
Read from disk	8 ms
Network round-trip Europe-US	150 ms

source: <http://norvig.com/21-days.html#answers>

Execute CPU instruction	1 s
Fetch from L2 cache	7 s
Fetch from memory	1.6 min
Read from disk	13.2 weeks
Network round-trip Europe-US	4.8 years

source: <http://norvig.com/21-days.html#answers>

- OSGi RFC 206: Asynchronous Services
- Promise
- Example

Goals

- Improve **resource utilisation**
 - Parallelism
 - Non blocking IO
- Automatic **thread management**
 - Runtime vs. hard coded

- Asynchronous method calls
 - Return `Promise<T>` instead of `T`
 - **Direct** implementations
 - **Mediation** through `Async`



Mediating a service

```
Async async = ...
```

```
ServiceReference<Weather> ref = ...
```

```
Weather weather = async.mediate(ref, Weather.class);
```

```
Promise<Boolean> sunnyPromise = async.call(weather.isSunny());
```




Promise<T>?

- Encapsulation of a value that
 - **maybe** available at some **later** time
 - can be **read** multiple times
 - **immutable** once resolved



Promise callback

```
sunnyPromise.then(...
```



Promise callback: success

```
weather.isSunny().then(  
  success -> {  
    if (success.getValue()) {  
      println("Sun fun and nothing to do");  
    } else {  
      println("Singing in the rain");  
    }  
  }},
```

...

Promise callback: failure

```
weather.isSunny().then(  
  success -> {  
    if (success.getValue()) {  
      println("Sun fun and nothing to do");  
    } else {  
      println("Singing in the rain");  
    }  
  },  
  failure -> {  
    failure.getFailure().printStackTrace();});
```

- Promises capture the effects of
 - **latency**: when the call back happens
 - **error**: which call back happens



Promise<T>!



Vendor Service

```
interface Vendor {  
    Promise<Offer> getOffer(String item);  
}
```

```
class Offer {  
    public Offer(Vendor vendor,  
                String item,  
                double price,  
                String currency) {  
        ...  
    }  
}
```




Exchange Service

```
Promise<Offer> convertToEuro1 (Offer offer) ;
```

```
Promise<Offer> convertToEuro2 (Offer offer) ;
```

Goals

- Get offer from vendor
- Convert to € with **recovery**
- Fail **gracefully**
- Non **blocking!**



getOffer...

```
Promise<Offer> getOffer(Vendor vendor, String item) {  
    return vendor  
        .getOffer(item);  
}
```



flatMap

```
Promise<R> flatMap(T -> Promise<R>)
```



flatMap

```
Promise<R> flatMap(Offer -> Promise<R>)
```



flatMap

```
Promise<Offer> flatMap(Offer -> Promise<Offer>)
```



flatMap

```
Promise<Offer> flatMap(Offer -> Promise<Offer>)
```

```
Promise<Offer> convertToEuro1(Offer);
```



getOffer: convert to €

```
Promise<Offer> getOffer(Vendor vendor, String item) {  
    return vendor  
        .getOffer(item)  
        .flatMap(offer -> convertToEuro1(offer));  
}
```




recoverWith

```
Promise<R> recoverWith(Promise<?> -> Promise<R>)
```



recoverWith

```
Promise<Offer> recoverWith(Promise<?> -> Promise<Offer>)
```



recoverWith

```
Promise<Offer> recoverWith(Promise<?> -> Promise<Offer>)
```

```
Promise<Offer> convertToEuro2(Offer);
```



getOffer: fallback

```
Promise<Offer> getOffer(Vendor vendor, String item) {  
    return vendor  
        .getOffer(item)  
        .flatMap(offer -> convertToEuro1(offer))  
        .recoverWith(failed -> convertToEuro2(offer));  
}
```



recover

```
Promise<R> recover (Promise<?> -> R)
```



recover

```
Promise<Offer> recover(Promise<?> -> Offer)
```



getOffer: fail gracefully

```
Promise<Offer> getOffer(Vendor vendor, String item) {  
    return vendor  
        .getOffer(item)  
        .flatMap(offer -> convertToEuro1(offer))  
        .recoverWith(failed -> convertToEuro2(offer))  
        .recover(failed -> Offer.NONE);  
}
```



Non blocking

Act on `Promise<T>` instead of `T`



Demo

Summary

- Promises capture **latency** and **error**
 - Non blocking
 - Focus on main path
- **Decouple** parallelisation
 - Better resource utilisation
 - Application scalability

<http://goo.gl/pB9fza>





Appendix

- Encapsulation of a value that
 - **should** be made available at some later time
 - can be **written** once
 - **immutable** once resolved

What about `j.u.concurrent.Future`?

- Blocking semantics
 - No callbacks
- Not composable
 - No `map/flatMap/filter/...`

- Support material: <https://github.com/mduerig/async-support/wiki>
 - Session slides
 - Runnable demo
 - Links to further reading
- RFC 206: <https://github.com/osgi/design/tree/master/rfcs/rfc0206>
 - Public draft of OSGi RFC 206: Asynchronous Services
- OSGi Alliance: <http://www.osgi.org/>

- RxJava: <https://github.com/ReactiveX/RxJava>
 - Observables: taking Promises one step further
- Akka: <http://akka.io/>
 - Toolkit for concurrent and distributed applications on the JVM