prepare for.....

Proxy Deep Dive

JUG Nue - 20161117

@SvenRuppert

@SvenRuppert

has been coding java since 1996

Head of R&D

reply Group

Germany - Munich

@SvenRuppert

has been coding java since 1996

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has been coding java since 1996

Projects in the field of:

- Automobile-industry
- Energy
- Finance / Leasing
- Space- Satellit-
- Government / UN / World-bank

Where?

- Europe
- Asia - from India up to Malaysia

prepare for.....

Proxy Deep Dive - the first steps

some words about Adapter, Delegator
and the first Proxy

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Why a Proxy ?

Proxies you can use them for :

generic parts inside your application

decouple parts of your applications

hiding technical stuff

Why a Proxy ?

but it must be easy to use like....

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```
final InnerDemoClass original = new InnerDemoClass();
```

Why a Proxy ?

but it must be easy to use like....

```
final InnerDemoClass original = new InnerDemoClass();
final InnerDemoInterface demoLogic =
```

Why a Proxy ?

but it must be easy to use like....

```
final InnerDemoClass original = new InnerDemoClass();
final InnerDemoInterface demoLogic =
ProxyBuilder.createBuilder(InnerDemoInterface.class, original)
```

Why a Proxy ?

but it must be easy to use like....

```
final InnerDemoClass original = new InnerDemoClass();
final InnerDemoInterface demoLogic =
        ProxyBuilder.createBuilder(InnerDemoInterface.class, original)
                .addLogging()
```

Why a Proxy ?

but it must be easy to use like....

```
final InnerDemoClass original = new InnerDemoClass();
final InnerDemoInterface demoLogic =
        ProxyBuilder.createBuilder(InnerDemoInterface.class, original)
                .addLogging()
                        .addMetrics()
```

Why a Proxy ?

but it must be easy to use like....

```
final InnerDemoClass original = new InnerDemoClass();
final InnerDemoInterface demoLogic =
    ProxyBuilder.createBuilder(InnerDemoInterface.class, original)
        .addLogging()
            .addMetrics()
                .addSecurityRule(() -> true)
```

Why a Proxy ?

but it must be easy to use like....

```
final InnerDemoClass original = new InnerDemoClass();
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Why a Proxy ?

but it must be easy to use like....

```
final InnerDemoClass original = new InnerDemoClass();
final InnerDemoInterface demoLogic =
    ProxyBuilder.createBuilder(InnerDemoInterface.class, original)
        .addLogging()
            .addMetrics()
                .addSecurityRule(() -> true)
                    .addSecurityRule(() -> true)
                        .build();
```

Why a Proxy ?

but it must be easy to use like....

Why a Proxy ?

but it must be easy to use like....

```
@Inject
@Proxy(virtual = true, metrics = true)
Service service;
```

Difference between Proxy and Adapter

Adapter v Proxy - Pattern Hello World

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Adapter - or called Wrapper

maybe : Use an Adapter if you have to use an incompatible interface between two systems.

In detail I am using/talking about an **Adapter with Delegator**.

Adapter v Proxy - Pattern Hello World

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Adapter v Proxy - Pattern Hello World

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```
public class LegacyWorker {
  public void writeTheStrings(String[] strArray){
    Arrays.stream(strArray).forEach(System.out::println);
  }
}
```

Adapter v Proxy - Pattern Hello World

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public class LegacyWorker {
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```
public interface WorkerAdapter {
  public void workOnSomething(List<String> stringListe);
}
```

Adapter v Proxy - Pattern Hello World

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  }
}
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```
public interface WorkerAdapter {
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}
```

```
public class Adapter implements WorkerAdapter {
  private LegacyWorker worker = new LegacyWorker();
  @Override
  public void workOnSomething(List<String> stringListe) {
    final String[] strings = stringListe.toArray(new String[0]);
    worker.writeTheStrings(strings);
  }
}
```

Adapter v Proxy - Pattern Hello World

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Adapter v Proxy - Pattern Hello World

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Adapter v Proxy - Pattern Hello World

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Adapter v Proxy - Pattern Hello World

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    final String[] strings = stringListe.toArray(new String[0]);
    worker.writeTheStrings(strings);
  }
}
```

Adapter v Proxy - Pattern Hello World

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```
public class Main {
  public static void main(String[] args) {
    final ArrayList<String> strings = new ArrayList<>();
    Collections.addAll(strings, „A","B","C","D");


    new Adapter().workOnSomething(strings);
  }
}
```

Adapter v Proxy - Pattern Hello World

@SvenRuppert

```
public class Main {
  public static void main(String[] args) {
    final ArrayList<String> strings = new ArrayList<>();
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Adapter v Proxy - Pattern Hello World

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Adapter v Proxy - Pattern Hello World

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```

- No need to know the LegacyWorker

Adapter v Proxy - Pattern Hello World

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  }
}
```

- No need to know the LegacyWorker
- No inheritance between LegacyWorker and Adapter

Adapter v Proxy - Pattern Hello World

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```
public class Main {
  public static void main(String[] args) {
    final ArrayList<String> strings = new ArrayList<>();
    Collections.addAll(strings, „A","B","C","D");


    new Adapter().workOnSomething(strings);
  }
}
```

- No need to know the LegacyWorker
- No inheritance between LegacyWorker and Adapter
- only a transformation of an interface

Adapter v Proxy - Pattern Hello World

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```
public class Main {
  public static void main(String[] args) {
    final ArrayList<String> strings = new ArrayList<>();
    Collections.addAll(strings, „A","B","C","D");


    new Adapter().workOnSomething(strings);
  }
}
```

- No need to know the LegacyWorker
- No inheritance between LegacyWorker and Adapter
- only a transformation of an interface
- same creation time for Delegator and Adapter

Proxy - the easiest version

We need a few steps to come from an Adapter with Delegator to a Proxy

Proxy - the easiest version

We need a few steps to come from an Adapter with Delegator to a Proxy

- We need to know the LegacyWorker

Proxy - the easiest version

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- We need to know the LegacyWorker
- Inheritance between LegacyWorker and Adapter

Proxy - the easiest version

We need a few steps to come from an Adapter with Delegator to a Proxy

- We need to know the LegacyWorker
- Inheritance between LegacyWorker and Adapter
- do not use it like an Adapter !

Proxy - the easiest version

We need a few steps to come from an Adapter with Delegator to a Proxy

- We need to know the LegacyWorker
- Inheritance between LegacyWorker and Adapter
- do not use it like an Adapter !

please show the code

Proxy - the easiest version - (Delegator)

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```
public interface Service {
  String work(String txt);
}
```

Proxy - the easiest version - (Delegator)

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```
public interface Service {
  String work(String txt);
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```

```
public class ServiceImpl implements Service {
  public String work(String txt) {
    return "ServiceImpl - " + txt;
  }
```

Proxy - the easiest version - (Delegator)


```
public interface Service {
  String work(String txt);
}
```

```
public class ServiceImpl implements Service {
  public String work(String txt) {
    return "ServiceImpl - " + txt;
  }
```

```
public class ServiceProxy implements Service {
  private Service service = new ServiceImpl();
  public String work(String txt) {  return service.work(txt); }
}
```

Security Proxy

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Security Proxy


```
public class ServiceProxy implements Service {
  private Service service = new ServiceImpl();
  public String work(String txt) {  return service.work(txt); }
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Security Proxy


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public class ServiceProxy implements Service {
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What could we change now ?

Security Proxy

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```
public class ServiceProxy implements Service {
  private Service service = new ServiceImpl();
  public String work(String txt) {  return service.work(txt); }
}
```

What could we change now ?

SecurityProxy:
execute only if it is allowed

Security Proxy

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```
public class ServiceProxy implements Service {
  private Service service = new ServiceImpl();
  public String work(String txt) {  return service.work(txt); }
}
```

What could we change now ?

SecurityProxy:
execute only if it is allowed

```
public class ServiceSecurityProxy implements Service {
  private Service service = new ServiceImpl();
  private String code;                                  //who will set this ?
  public String work(String txt) {
    if(code.equals(„hoppel")) { return service.work(txt); }
    else                      { return "nooooop"; }
  }
}
```

Security Proxy

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```
public class ServiceProxy implements Service {
  private Service service = new ServiceImpl();
  public String work(String txt) {  return service.work(txt); }
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```

What could we change now ?

SecurityProxy:
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public class ServiceSecurityProxy implements Service {
  private Service service = new ServiceImpl();
  private String code;                              //who will set this ?
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```

Remote Proxy - JDK only

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Remote Proxy - JDK only

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What could we change now ?

RemoteProxy:
execute outside of my process

Remote Proxy - JDK only

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public class ServiceProxy implements Service {
  private Service service = new ServiceImpl();
  public String work(String txt) {  return service.work(txt); }
}
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What could we change now ?

RemoteProxy:
execute outside of my process

```
Service proxy = new ServiceRemoteProxy();
String hello = proxy.work(„Hello");
```

Remote Proxy - JDK only

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```
public class ServiceProxy implements Service {
  private Service service = new ServiceImpl();
  public String work(String txt) {  return service.work(txt); }
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What could we change now ?

RemoteProxy:
execute outside of my process

```
Service proxy = new ServiceRemoteProxy();
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Remote Proxy - JDK only

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```
public class ServiceProxy implements Service {
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}
```

What could we change now ?

RemoteProxy:
execute outside of my process

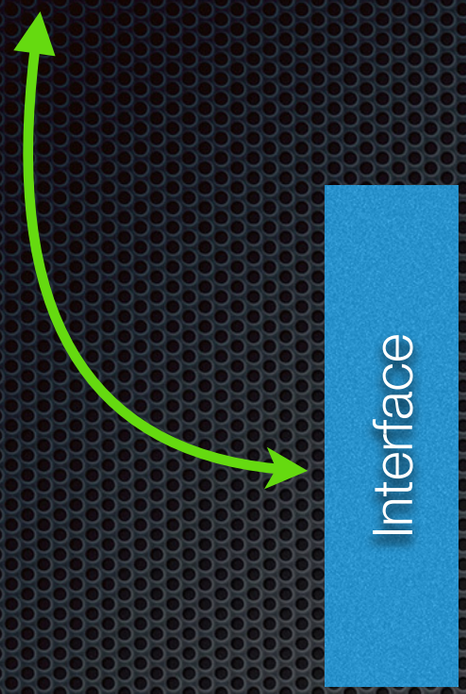
```
Service proxy = new ServiceRemoteProxy();
String hello = proxy.work(„Hello");
```

some work needed

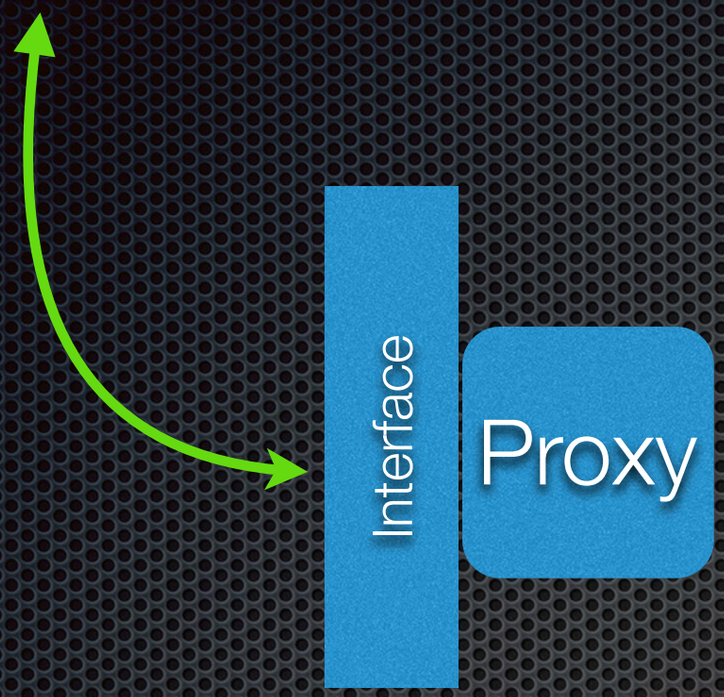
Remote Proxy - JDK only

Remote Proxy - JDK only

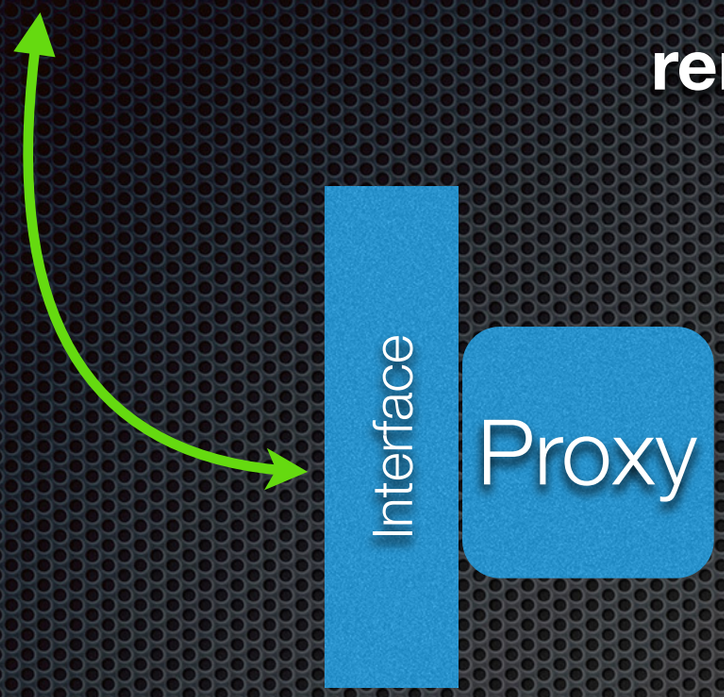
Remote Proxy - JDK only



Remote Proxy - JDK only



Remote Proxy - JDK only



Remote Proxy - JDK only

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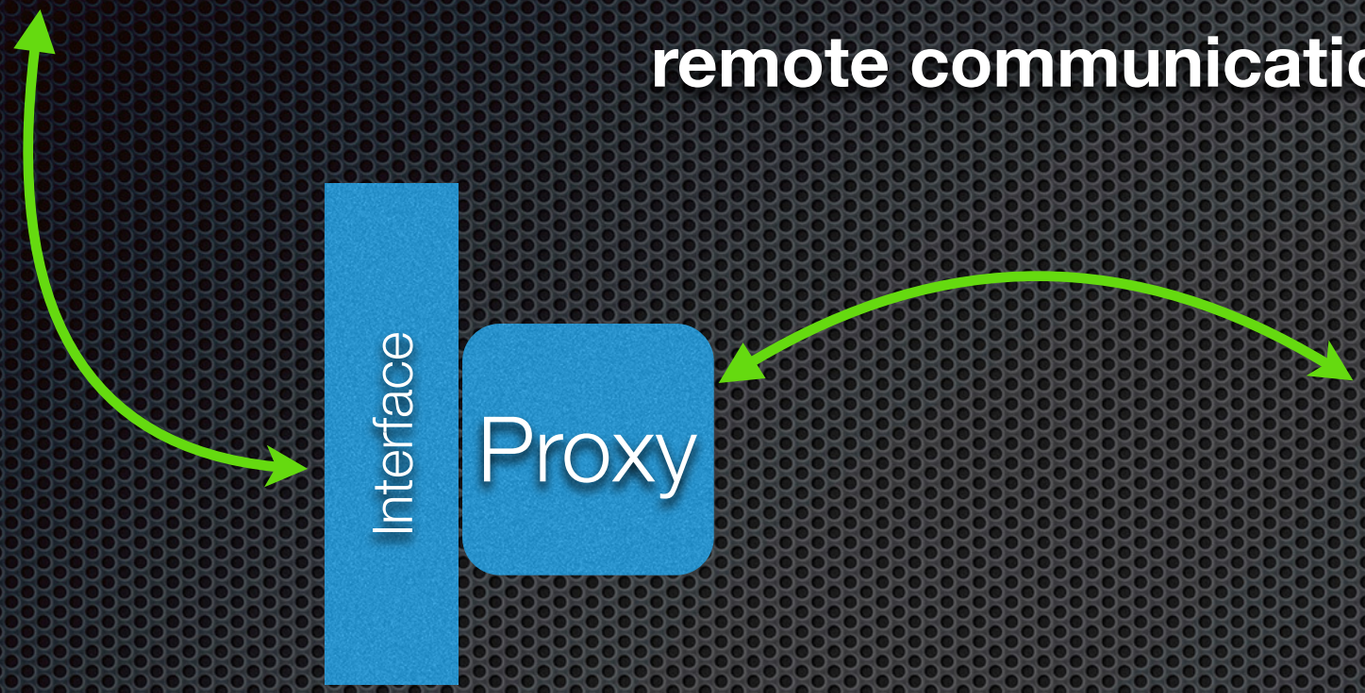
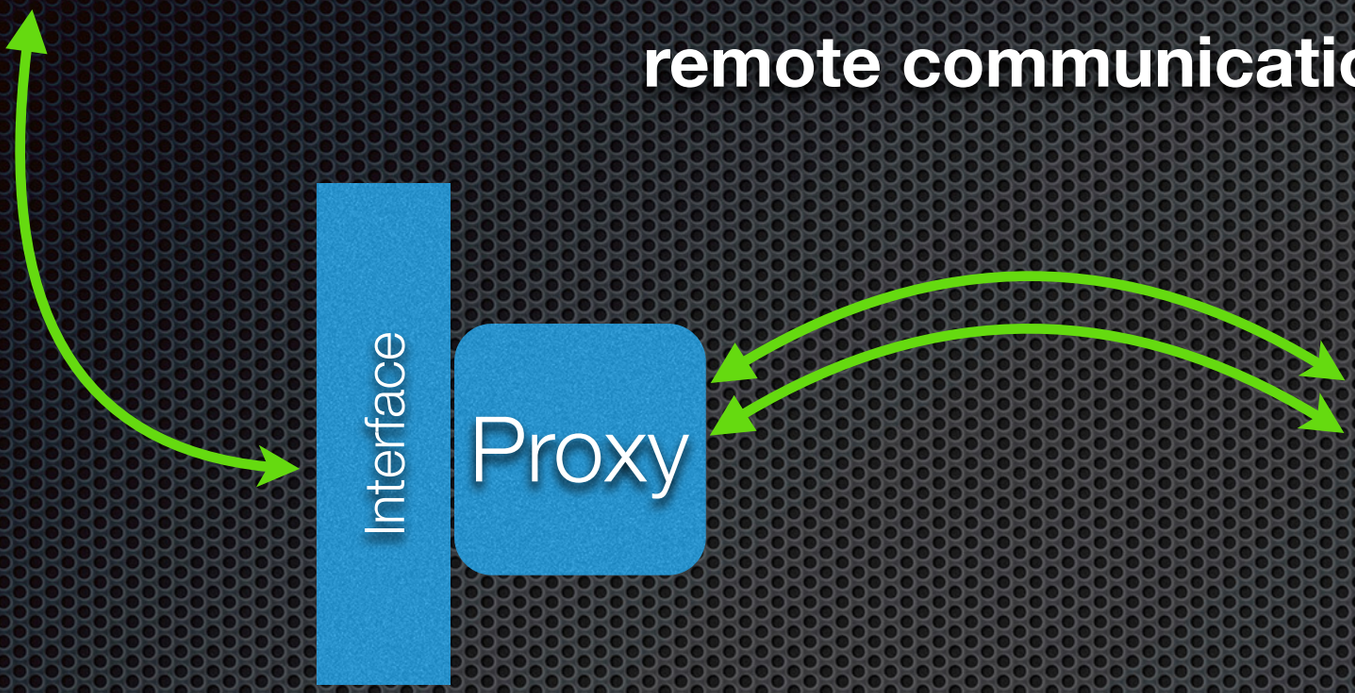


Remote Proxy - JDK only



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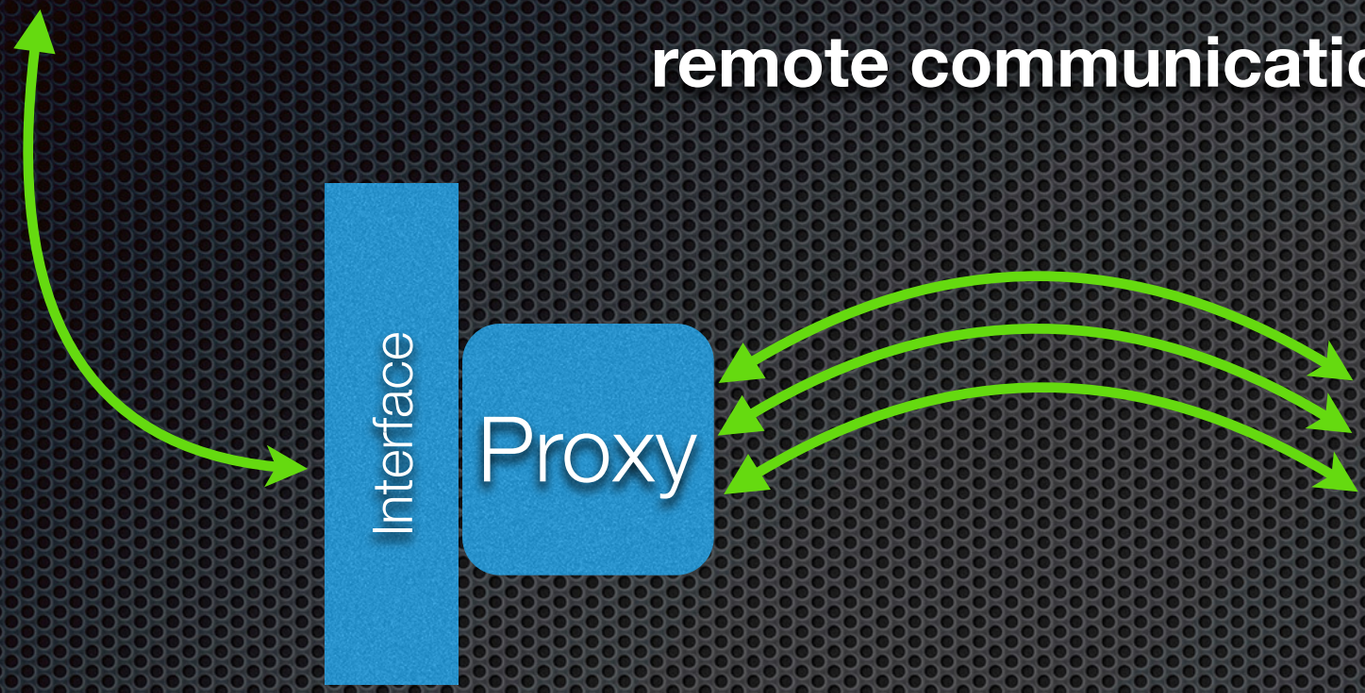

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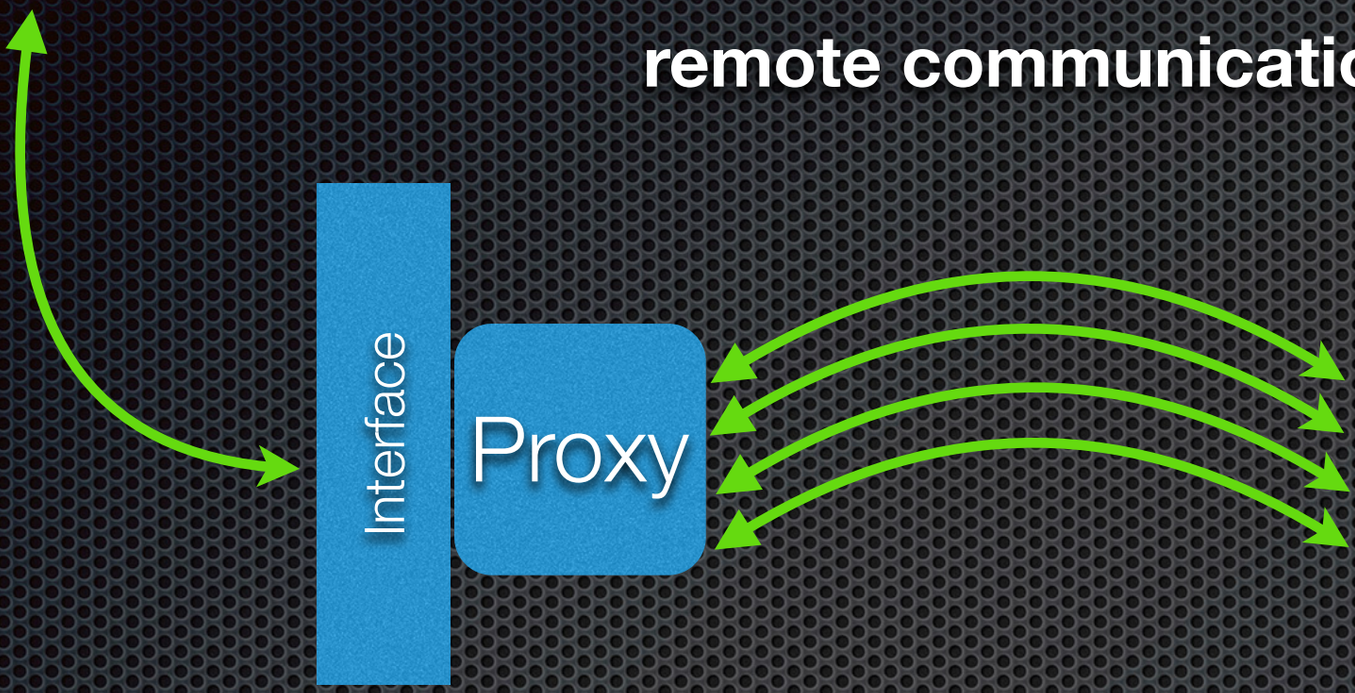

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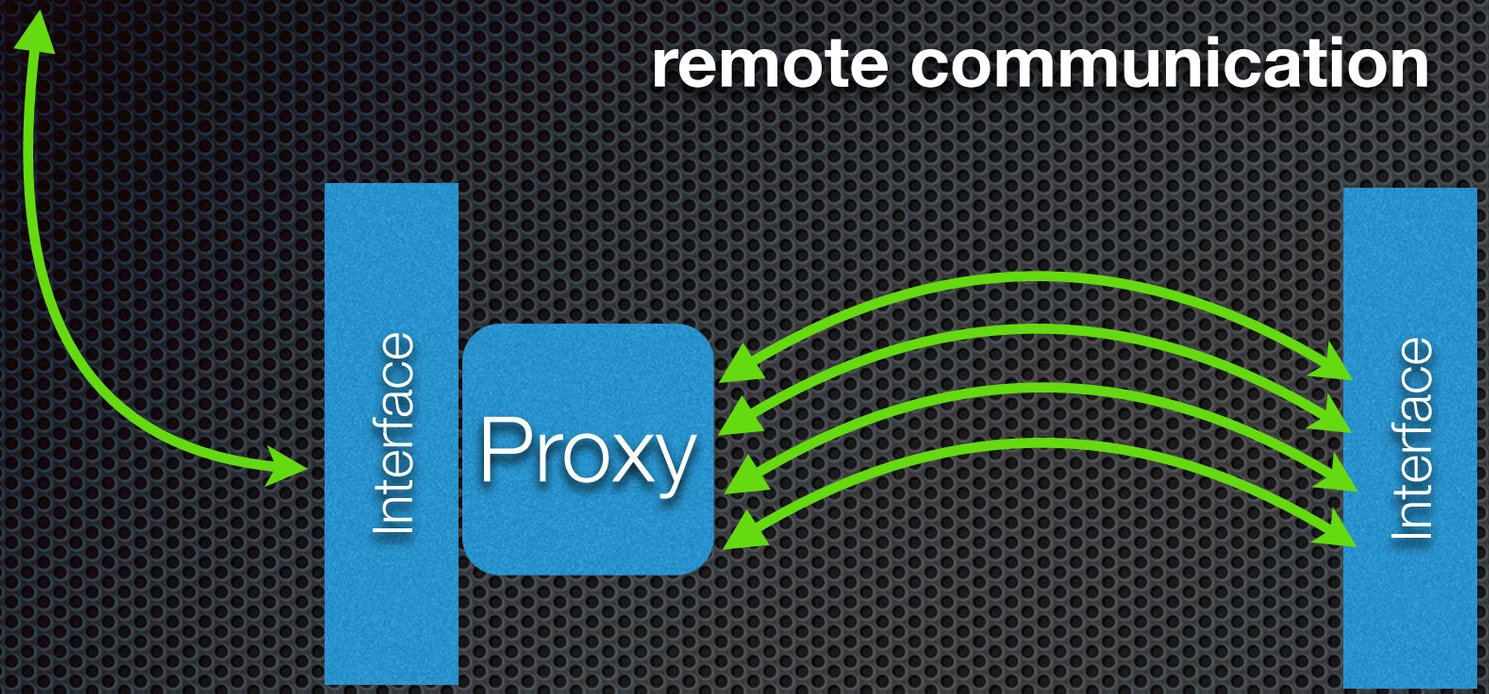

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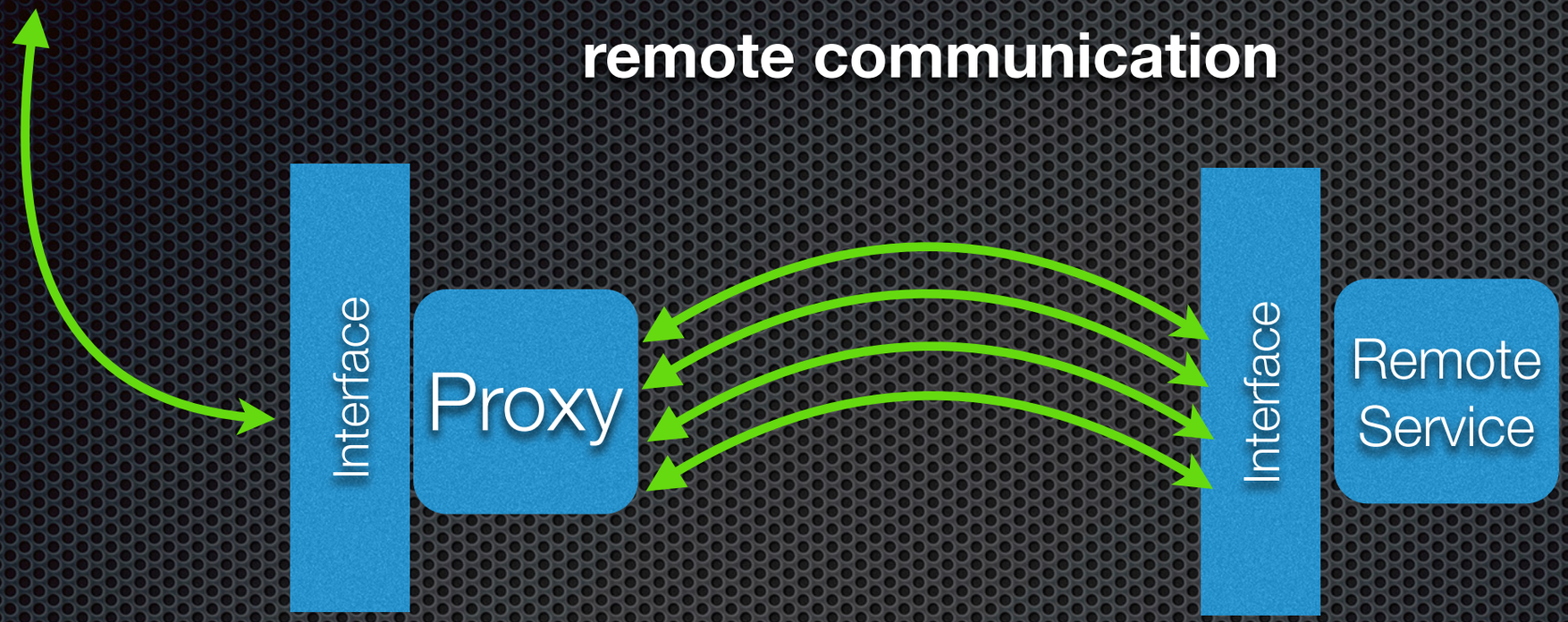

Remote Proxy - JDK only

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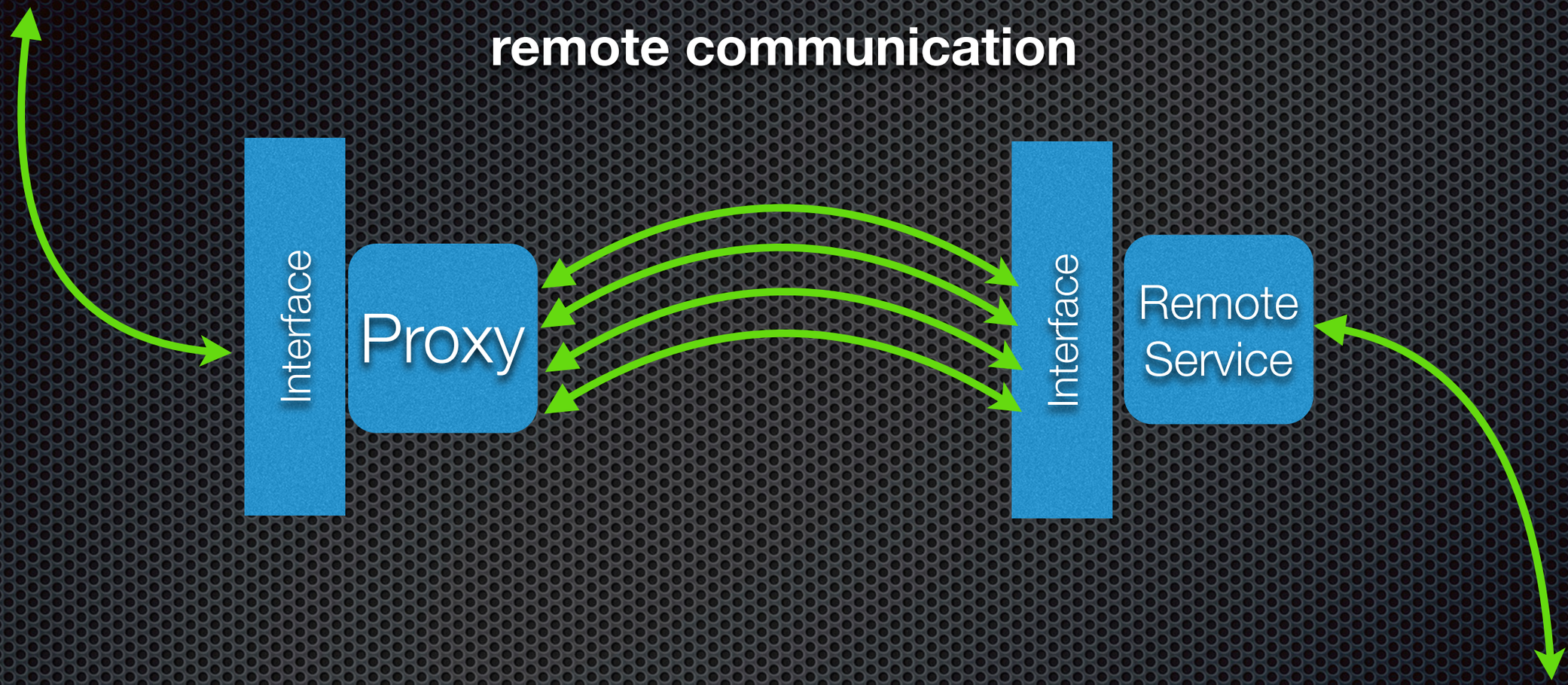

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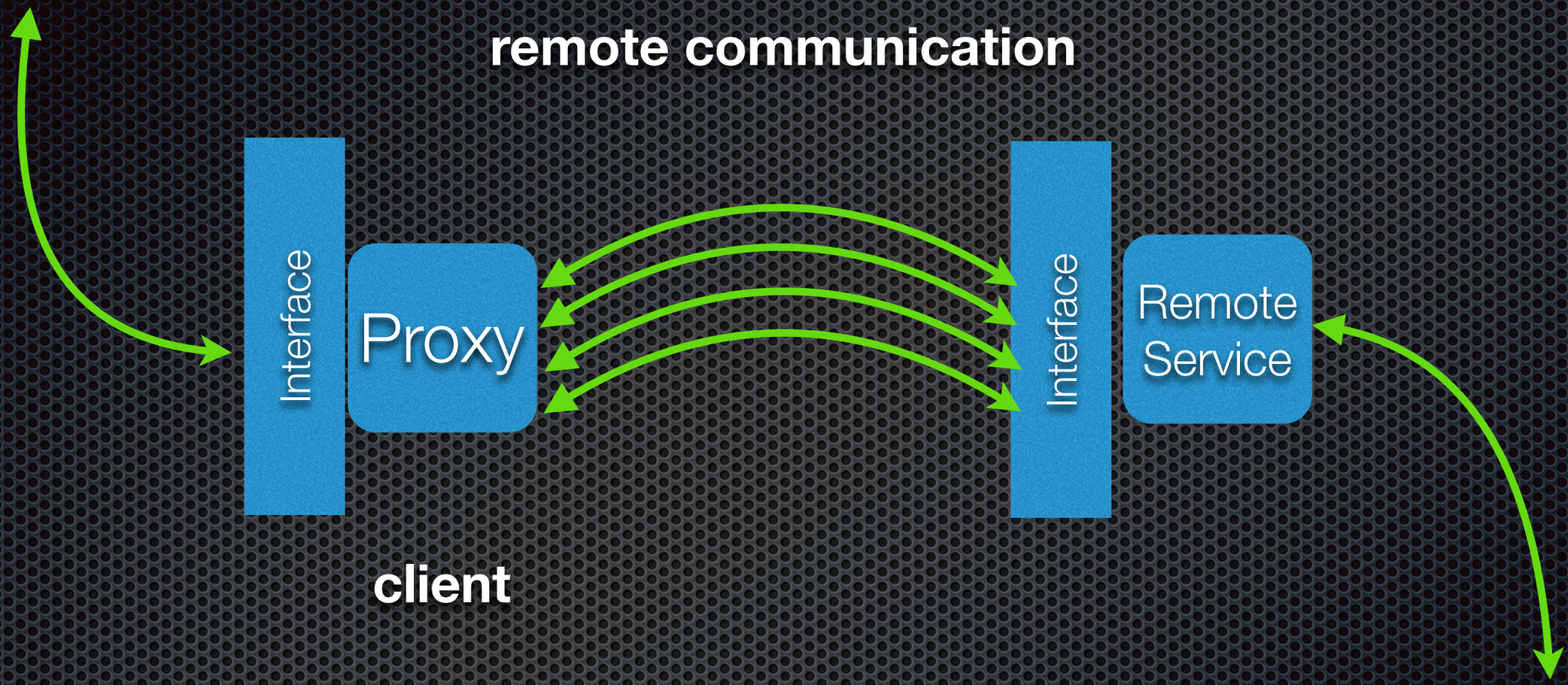

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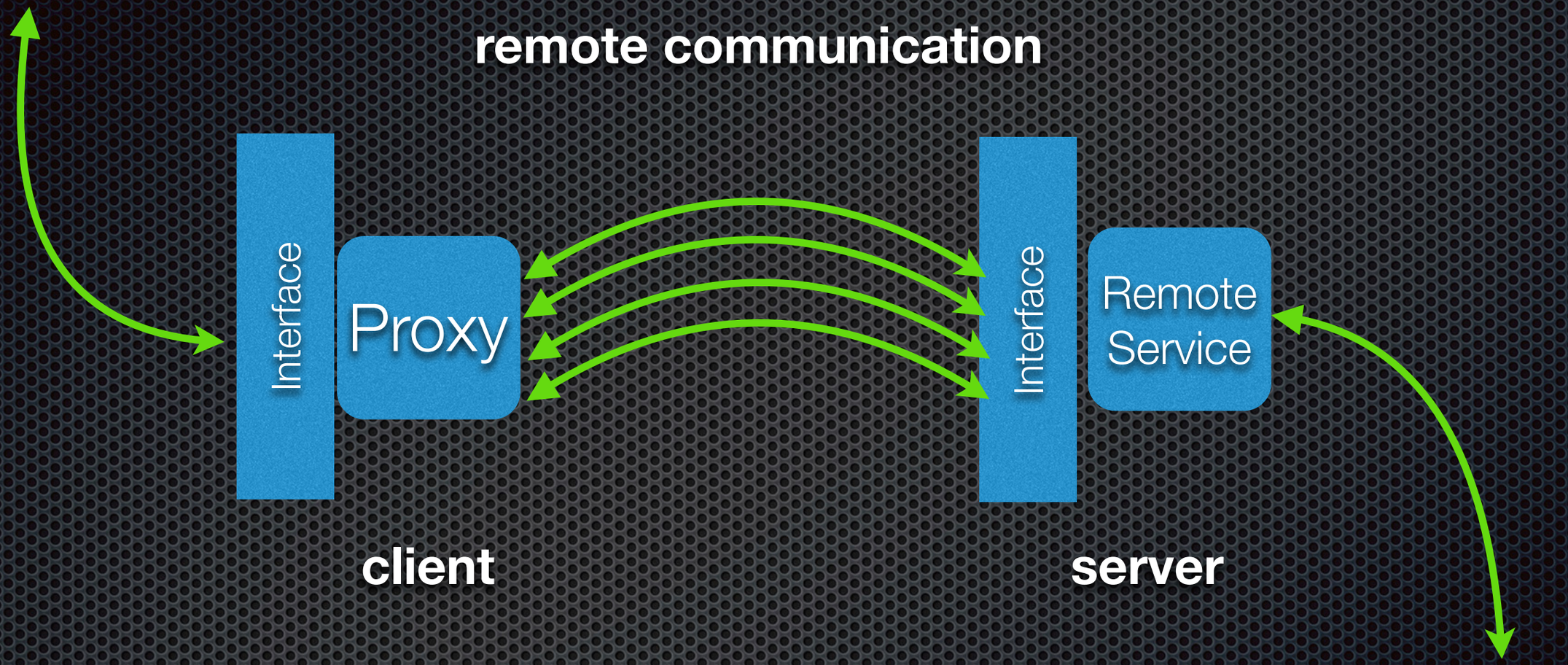

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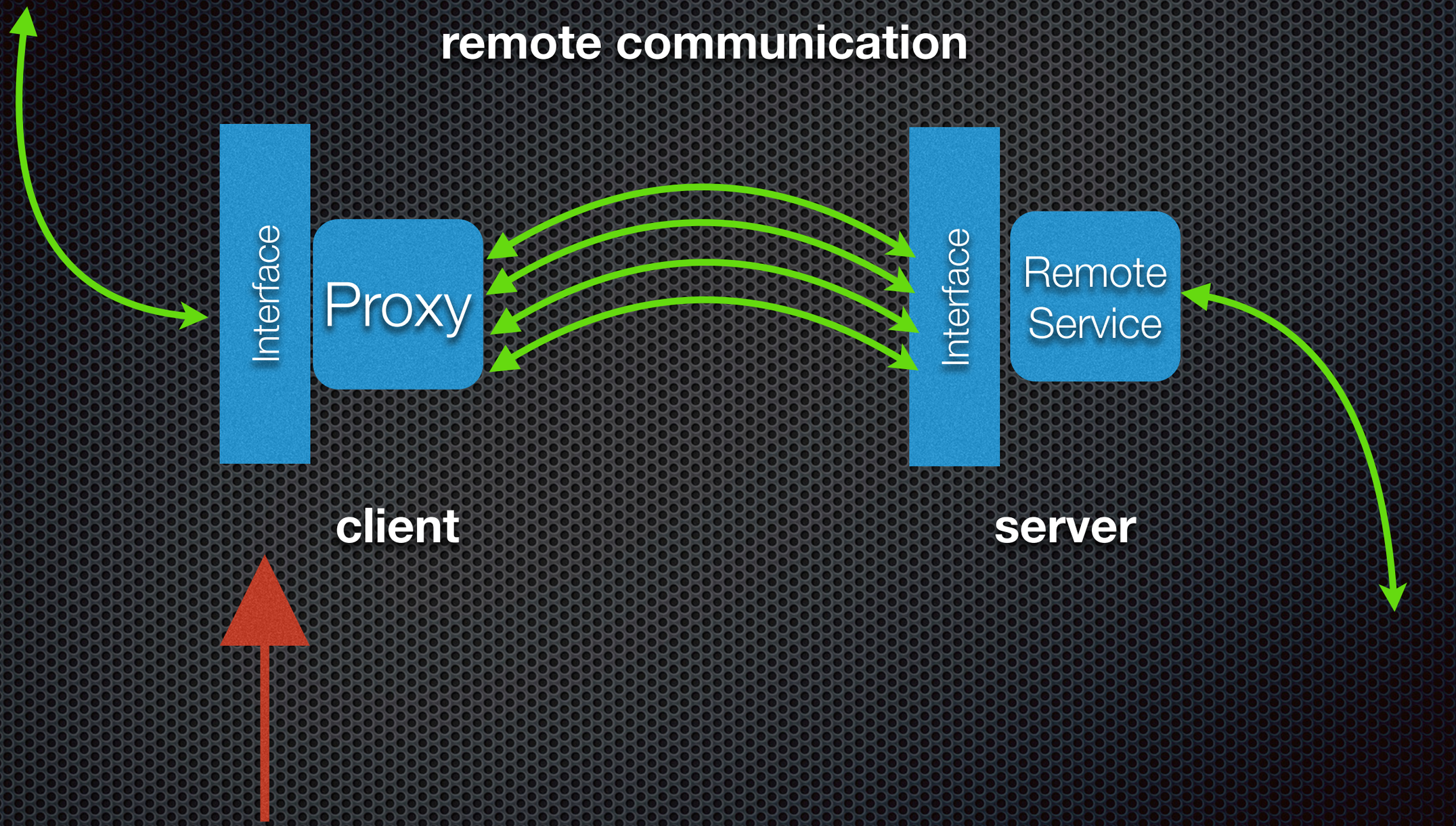

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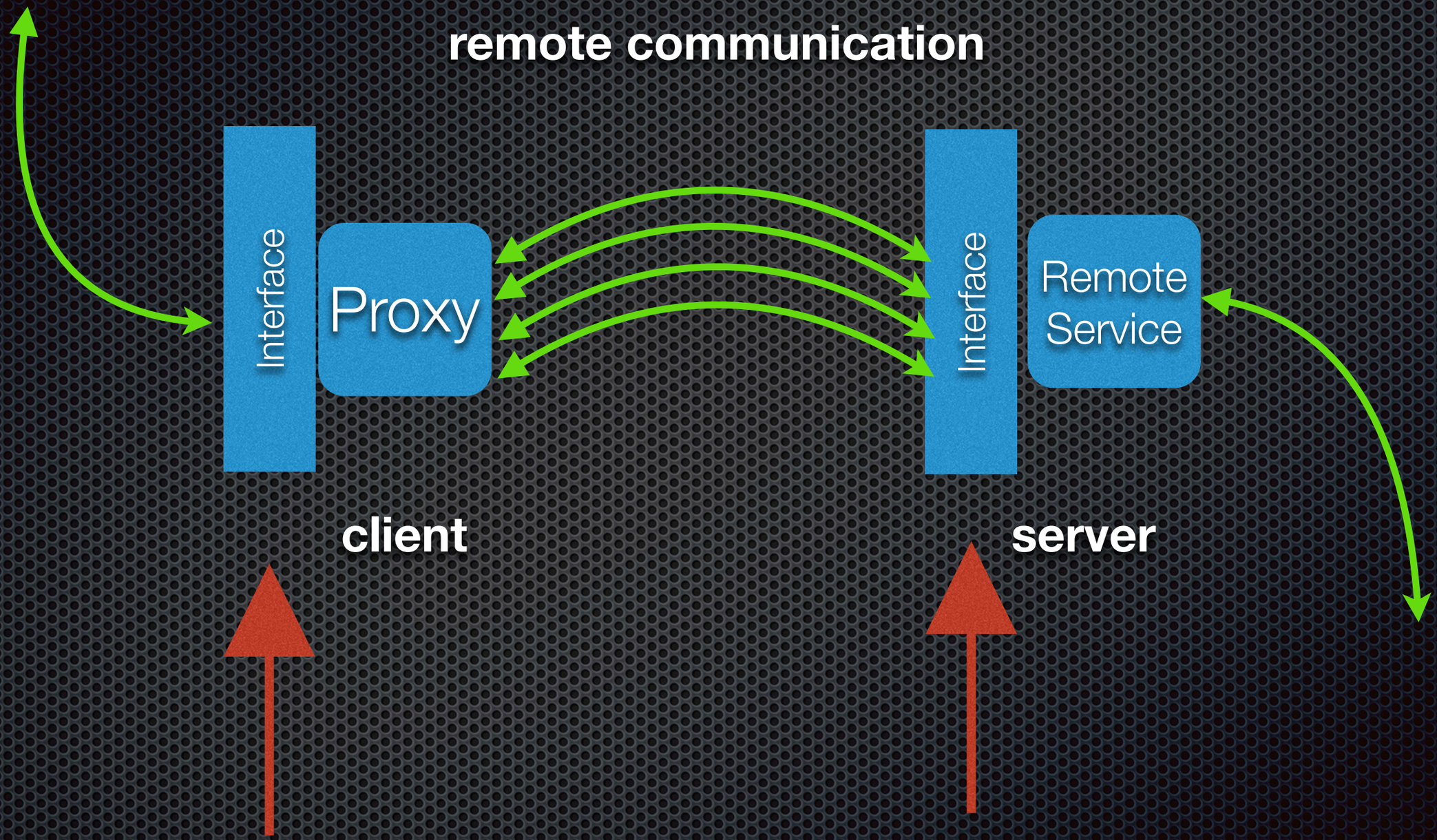

Remote Proxy - JDK only


```
@WebService
@SOAPBinding(style = SOAPBinding.Style.RPC)
public interface Service {
  @WebMethod
  public String work(String txt);
}
```

Remote Proxy - JDK only

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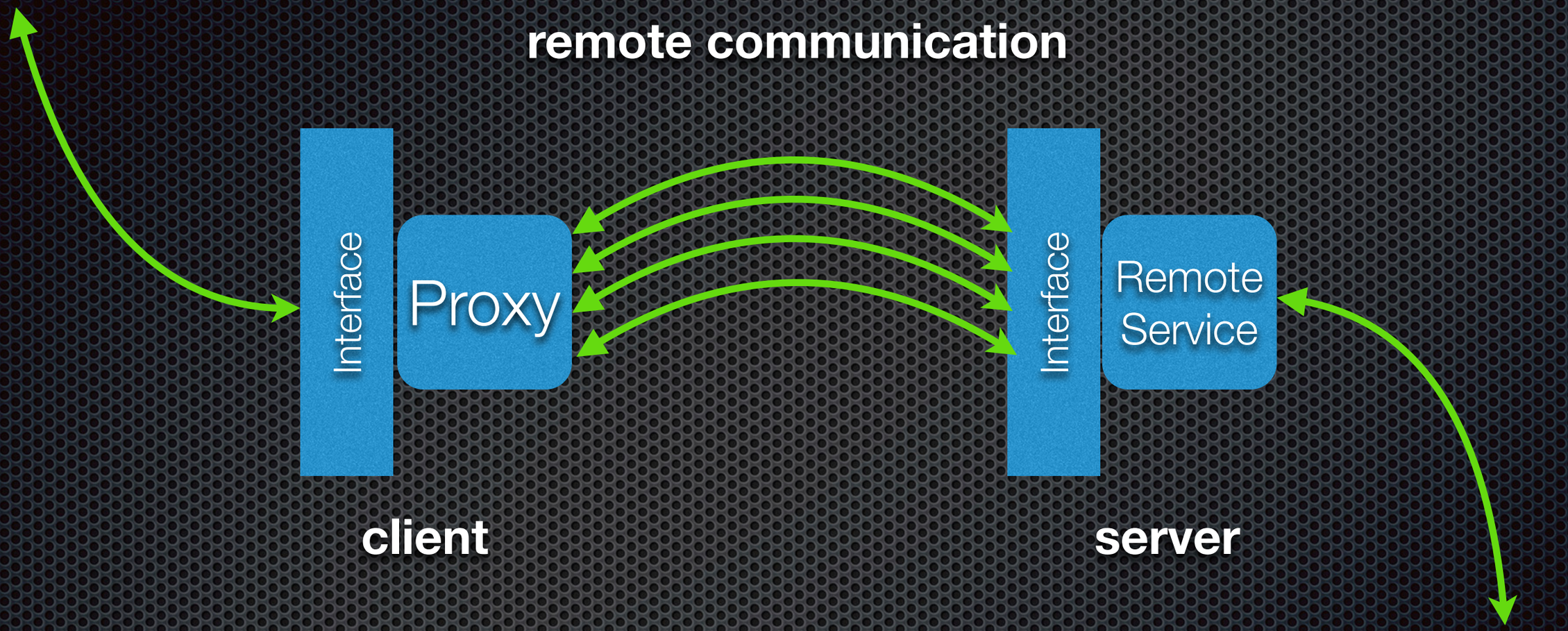

Remote Proxy - JDK only

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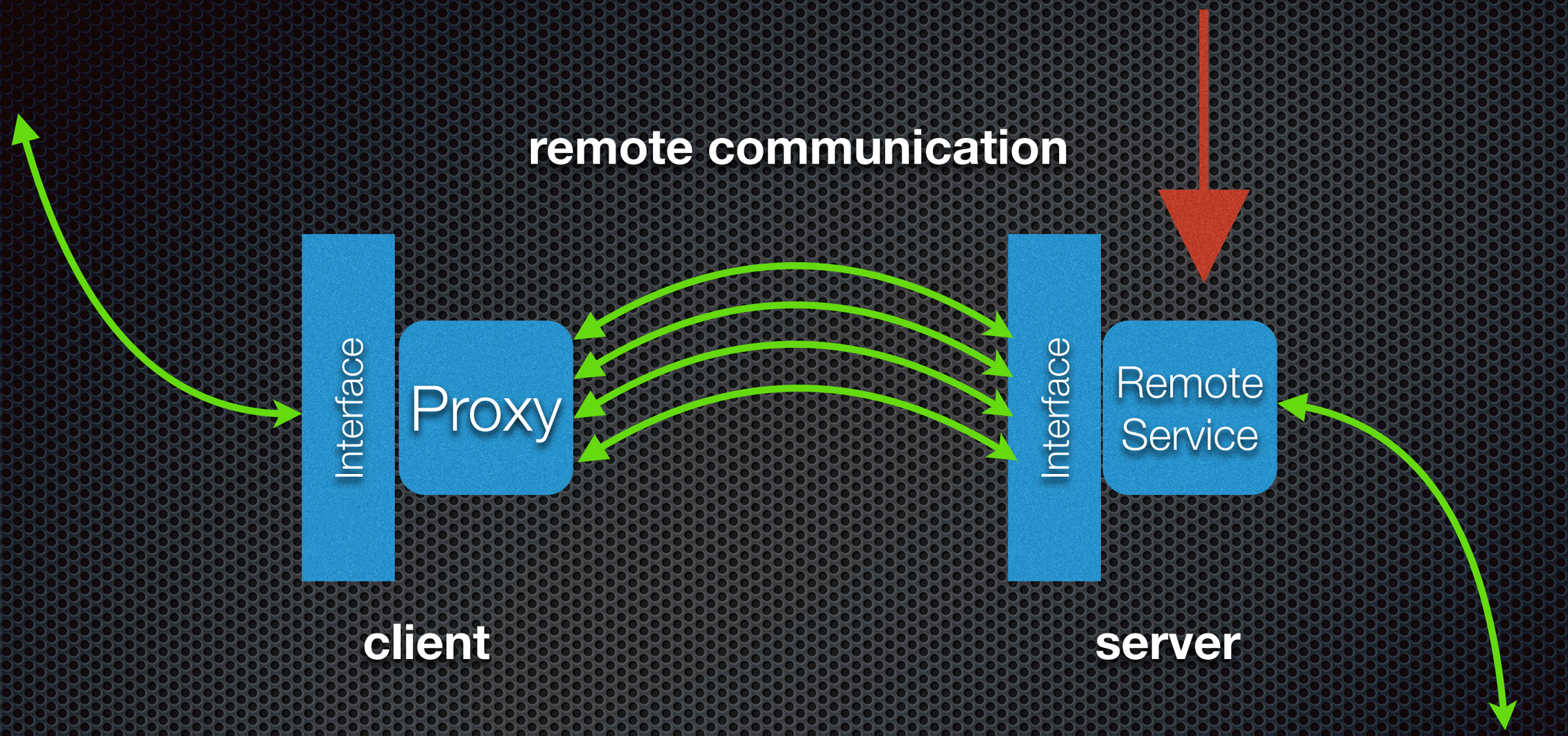

Remote Proxy - JDK only


```
@SOAPBinding(style = SOAPBinding.Style.RPC)
@WebService(endpointInterface = "org.rapidpm.Service")
public class ServiceImpl implements Service {
  @Override
  public String work(String txt) {
    return "ServiceImpl - " + txt;
  }
}
```

Remote Proxy - JDK only

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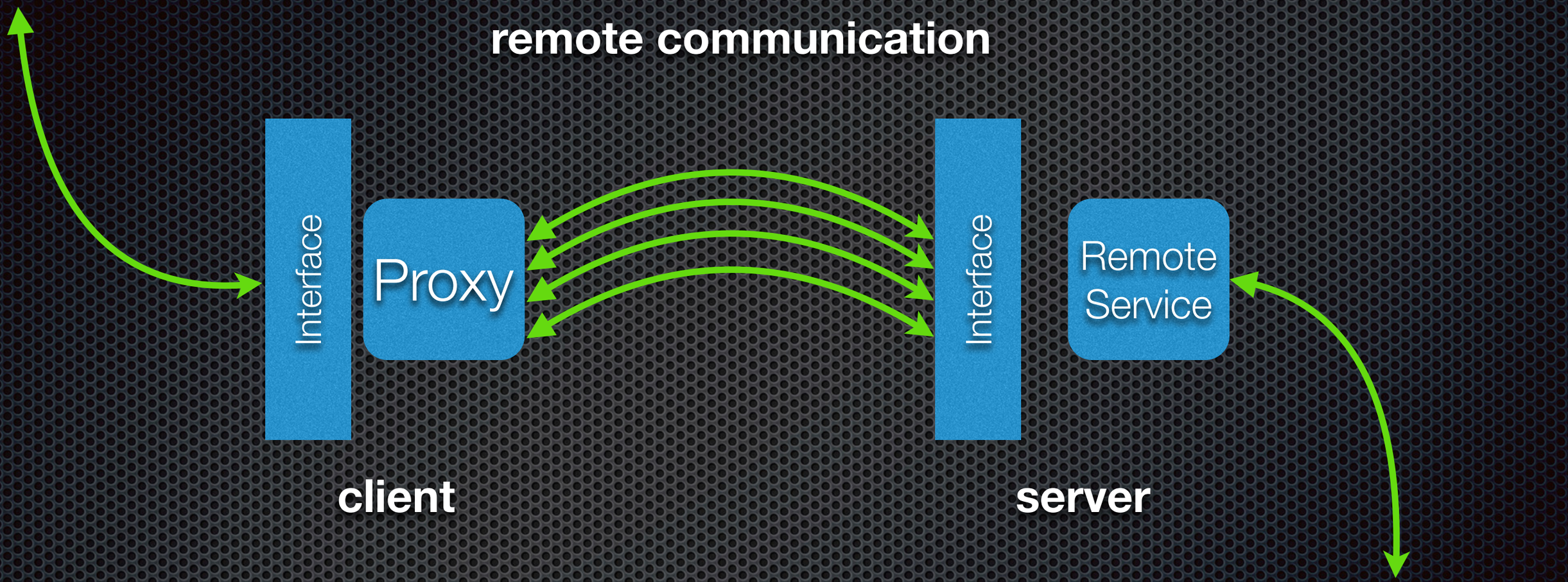

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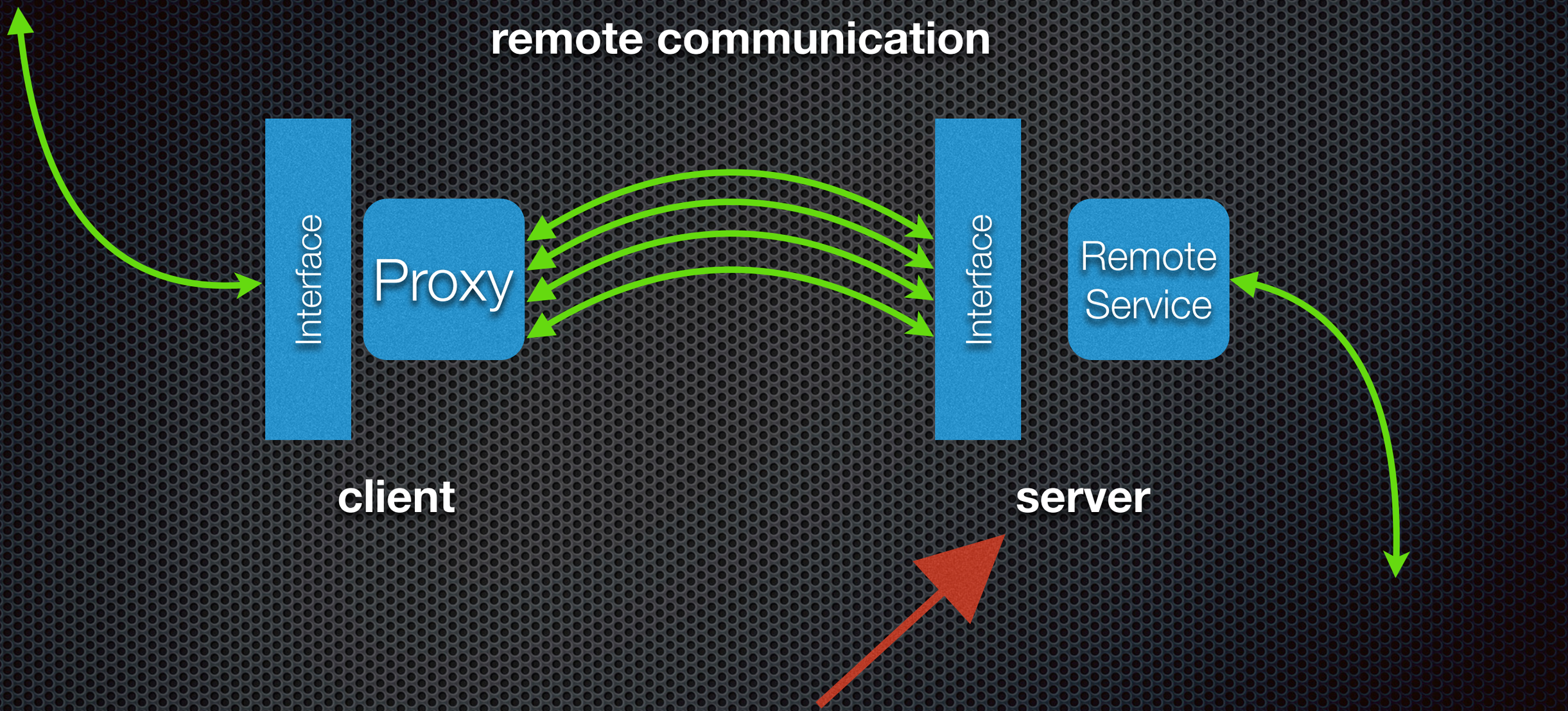

Remote Proxy - JDK only


```
final String address = "http://localhost:9999/ws/service";
final ExecutorService threadPool = Executors.newFixedThreadPool(10);

final Endpoint endpoint = Endpoint.create(new ServiceImpl());
endpoint.setExecutor(threadPool);
endpoint.publish(address);

System.out.println("endpoint = " + endpoint.isPublished());
```

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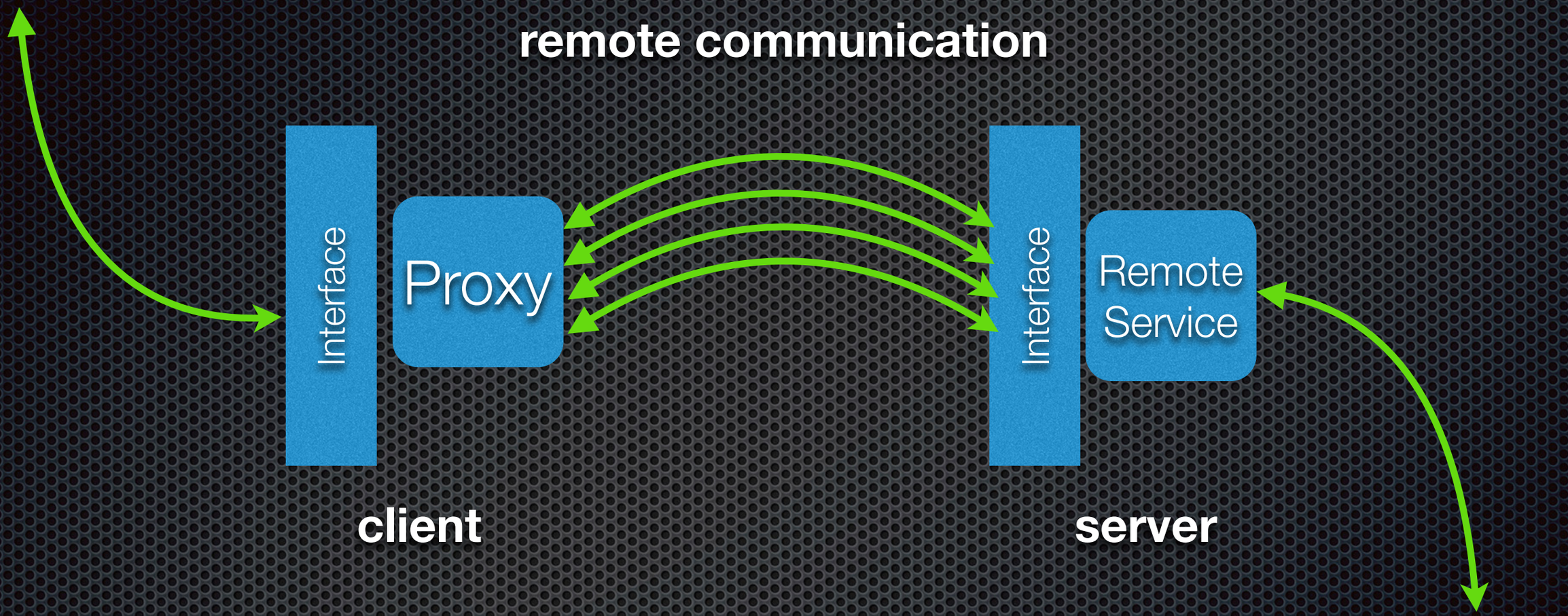
Remote Proxy - JDK only

@SvenRuppert



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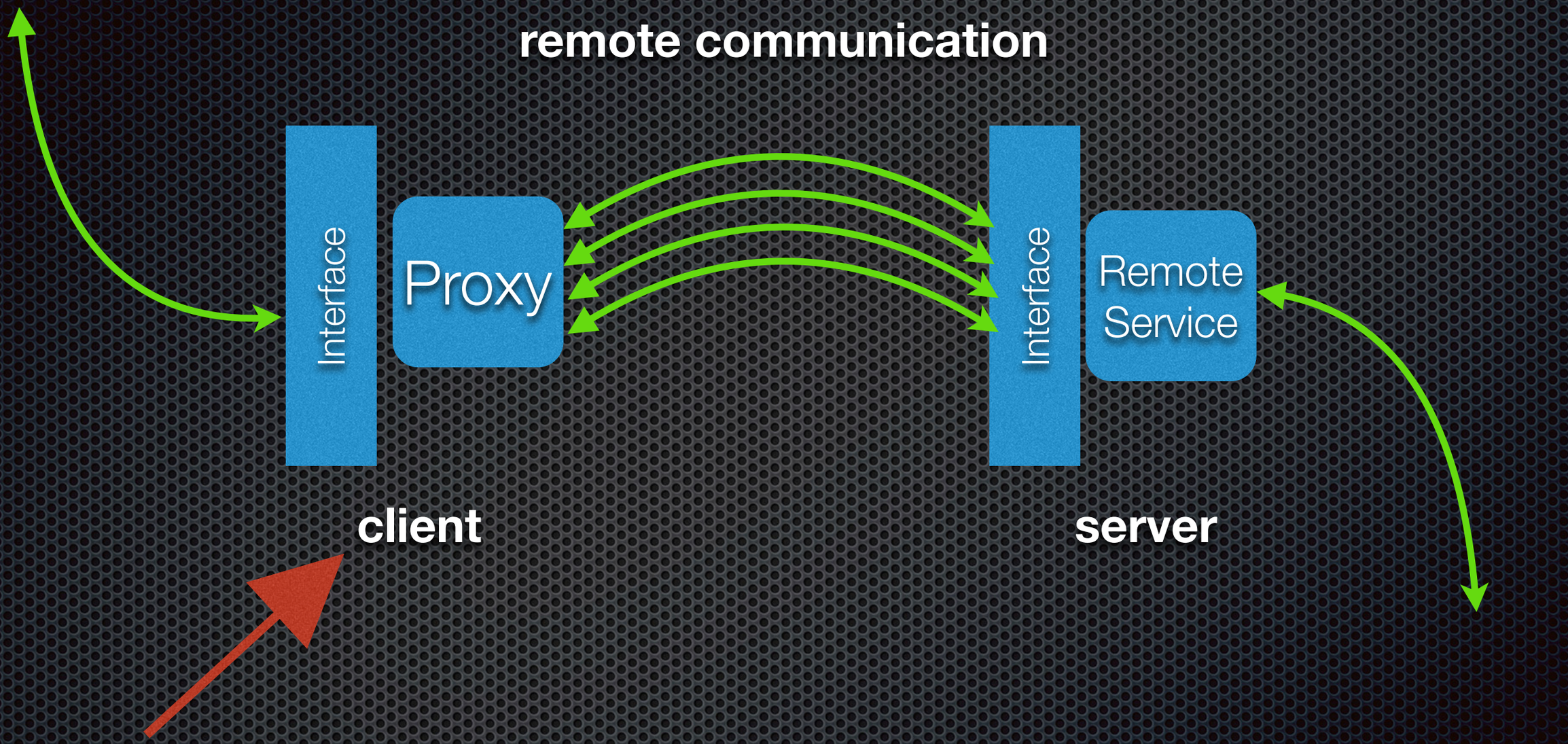

Remote Proxy - JDK only


```
public class ServiceRemoteProxy implements Service {

  private URL url;
  private Service realSubject;
  final String namespaceURI = "http://rapidpm.org/";
  final String localPart = "ServiceImplService";

  public ServiceRemoteProxy() {
    try {
      url = new URL("http://localhost:9999/ws/service?wsdl");
      QName qname = new QName(namespaceURI, localPart);
      javax.xml.ws.Service service = javax.xml.ws.Service.create(url, qname);
      realSubject = service.getPort(Service.class);
    } catch (MalformedURLException e) {
      e.printStackTrace();
    }
  }
  public String work(String txt){
    return realSubject.work(txt);
  }
}
```

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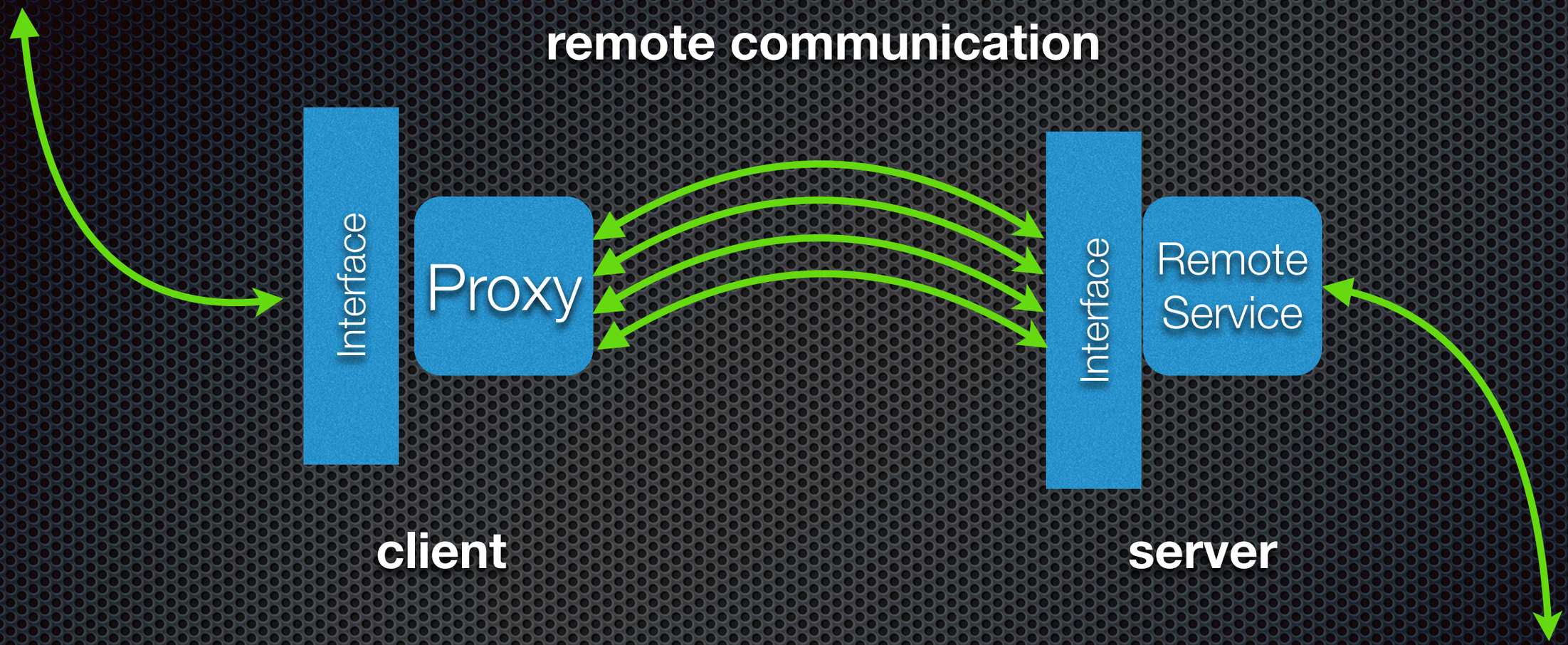

Remote Proxy - JDK only

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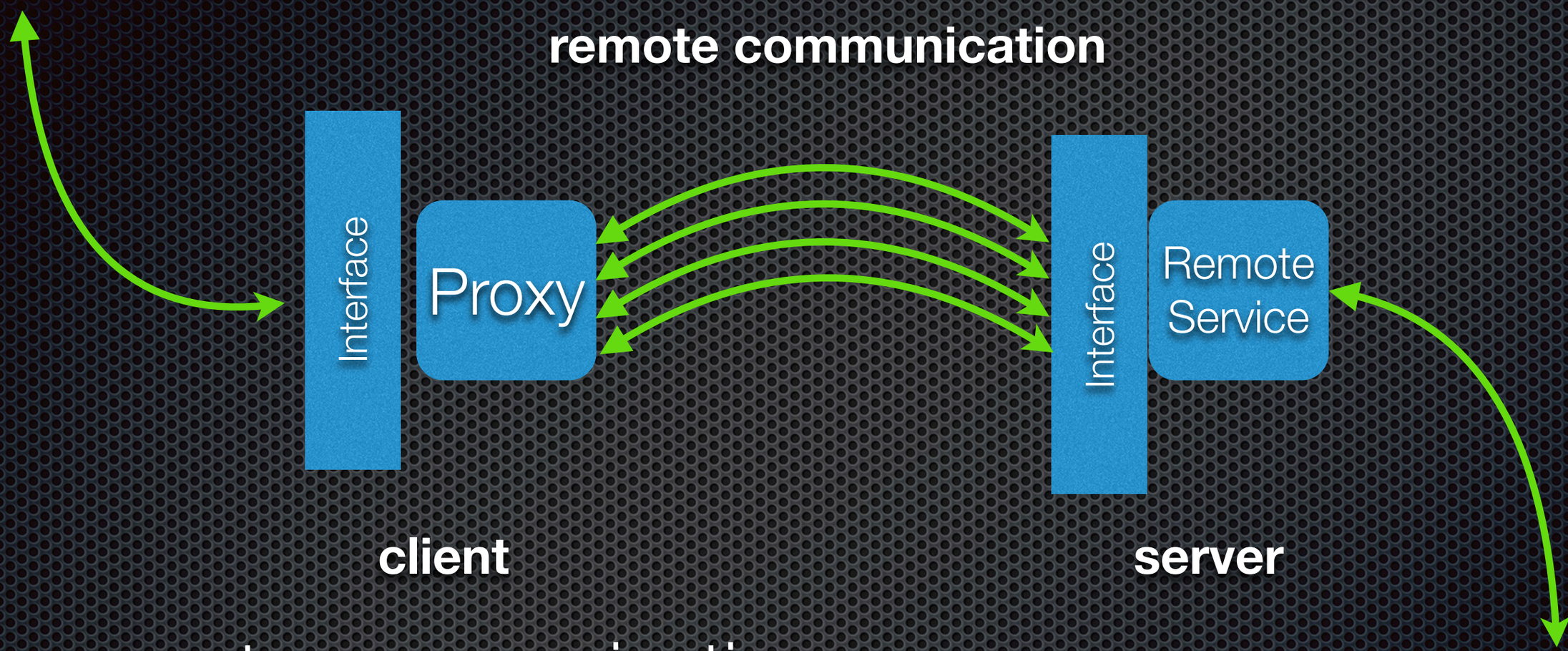
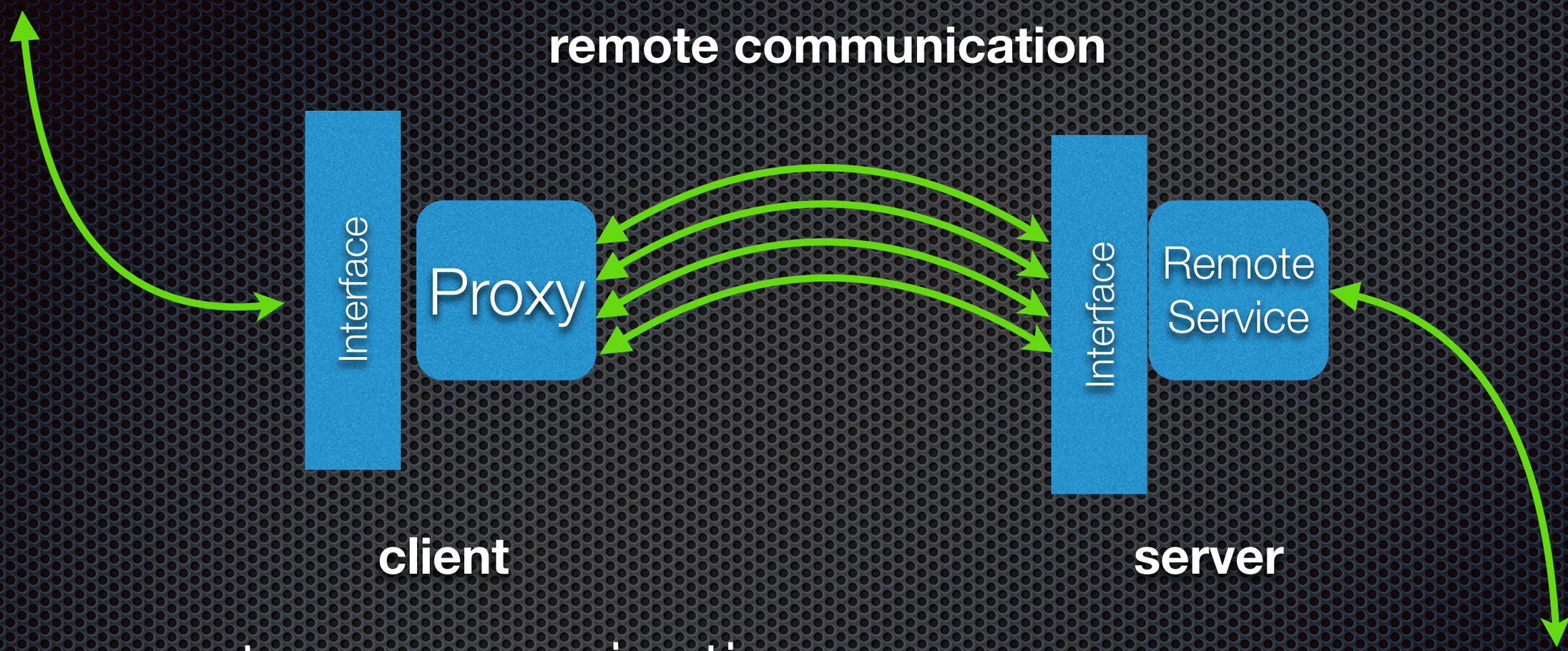


- remote communication

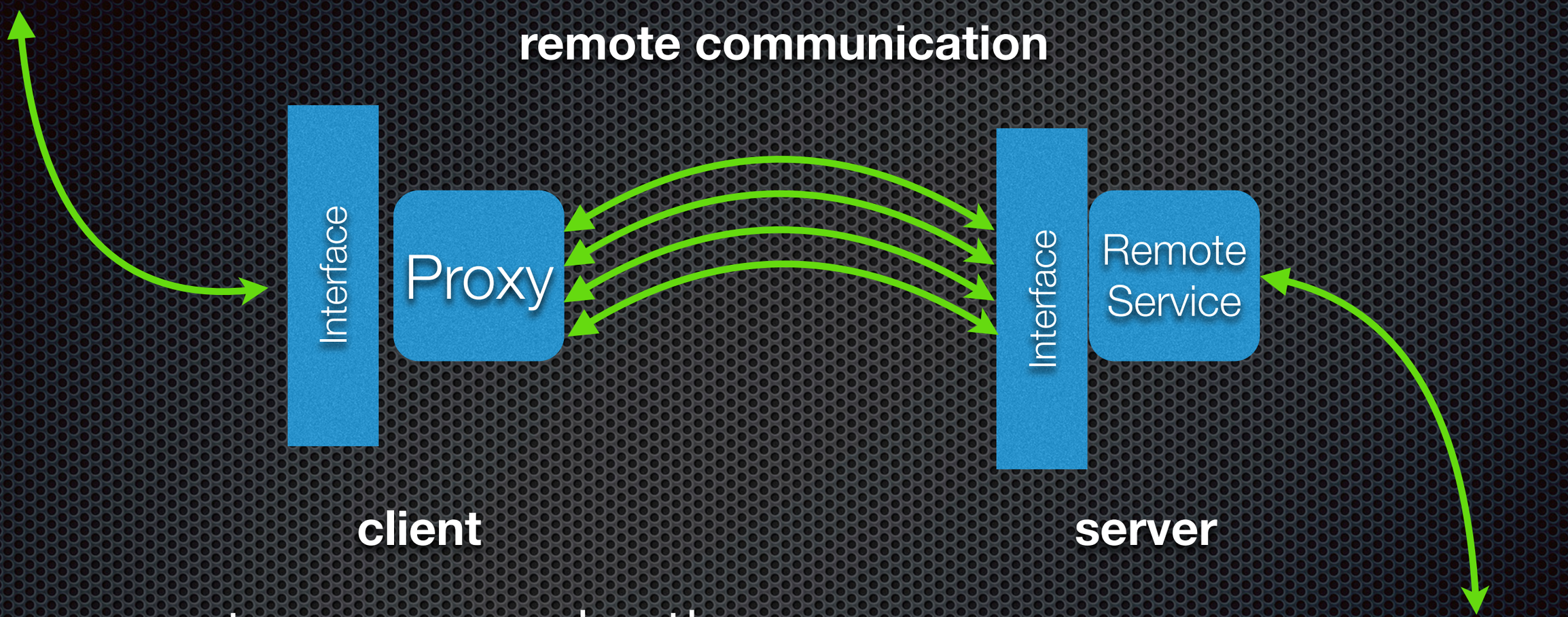
Remote Proxy - JDK only



- remote communication
- most of this is technology based work

Remote Proxy - JDK only

@SvenRuppert



- remote communication
- most of this is technology based work
- **goal: developer will see no remote communication**

Virtual Proxy

@SvenRuppert

Virtual Proxy

@SvenRuppert

```
public class ServiceProxy implements Service {
  private Service service = new ServiceImpl();
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}
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Virtual Proxy

@SvenRuppert

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What could we change now ?

Virtual Proxy

@SvenRuppert

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Virtual Proxy:
create the Delegator later

Virtual Proxy

@SvenRuppert

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Virtual Proxy: create the Delegator later

```
public class VirtualService implements Service {
  private Service service = null;
  public String work(String txt) {
    if(service == null) { service = new ServiceImpl(); }
    return service.work(txt);
  }
}
```

Virtual Proxy


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This is NOT ThreadSafe

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@SvenRuppert

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This is NOT ThreadSafe

fixed decision for an implementation

how to combine it with a FactoryPattern ?

Virtual Proxy


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Virtual Proxy

@SvenRuppert

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Virtual Proxy


```
if(service == null) { service = new ServiceImpl(); }
```

```
public interface ServiceFactory {
  Service createInstance();
}
```

```
public interface ServiceStrategyFactory {
   Service realSubject(ServiceFactory factory);
}
```

Virtual Proxy - Not - ThreadSafe

@SvenRuppert

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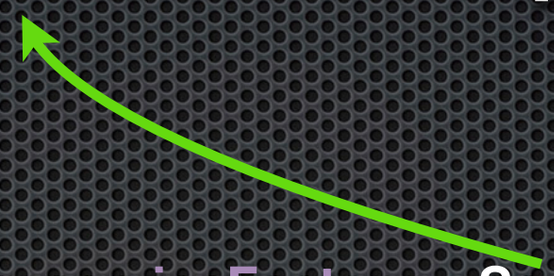

```
private ServiceFactory serviceFactory = ServiceImpl::new;
```

Virtual Proxy - Not - ThreadSafe

@SvenRuppert

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Virtual Proxy - Not - ThreadSafe

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```

```
private ServiceFactory serviceFactory = ServiceImpl::new;
```

```
public class ServiceStrategyFactoryImpl implements ServiceStrategyFactory {
    Service realSubject;
    public Service realSubject(final ServiceFactory factory) {
        if (realSubject == null) {
            realSubject = factory.createInstance();
        }
        return realSubject;
    }
}
```

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```

```
public class ServiceProxy implements Service {
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  private ServiceStrategyFactory strategyFactory = new ServiceStrategyFactoryImpl();
```

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public class ServiceProxy implements Service {
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  }
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```
public class ServiceProxy implements Service {
  private ServiceFactory serviceFactory = ServiceImpl::new;
  private ServiceStrategyFactory strategyFactory = new ServiceStrategyFactoryImpl();
  public String work(String txt) {
    return strategyFactory .realSubject(
  }
}
```

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```

Virtual Proxy - Synchronized


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```
private ServiceFactory serviceFactory = ServiceImpl::new;
```

```
public class ServiceStrategyFactorySynchronized implements ServiceStrategyFactory {
  Service realSubject;
  public synchronized Service realSubject(final ServiceFactory factory) {
    if (realSubject == null) {
      realSubject = factory.createInstance();
    }
    return realSubject;
  }
}
```

Virtual Proxy - Synchronized

@SvenRuppert

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if(service == null) { service = new ServiceImpl(); }
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```
private ServiceFactory serviceFactory = ServiceImpl::new;
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}
```

This is ThreadSafe

Virtual Proxy - Method Scoped


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Virtual Proxy - Method Scoped


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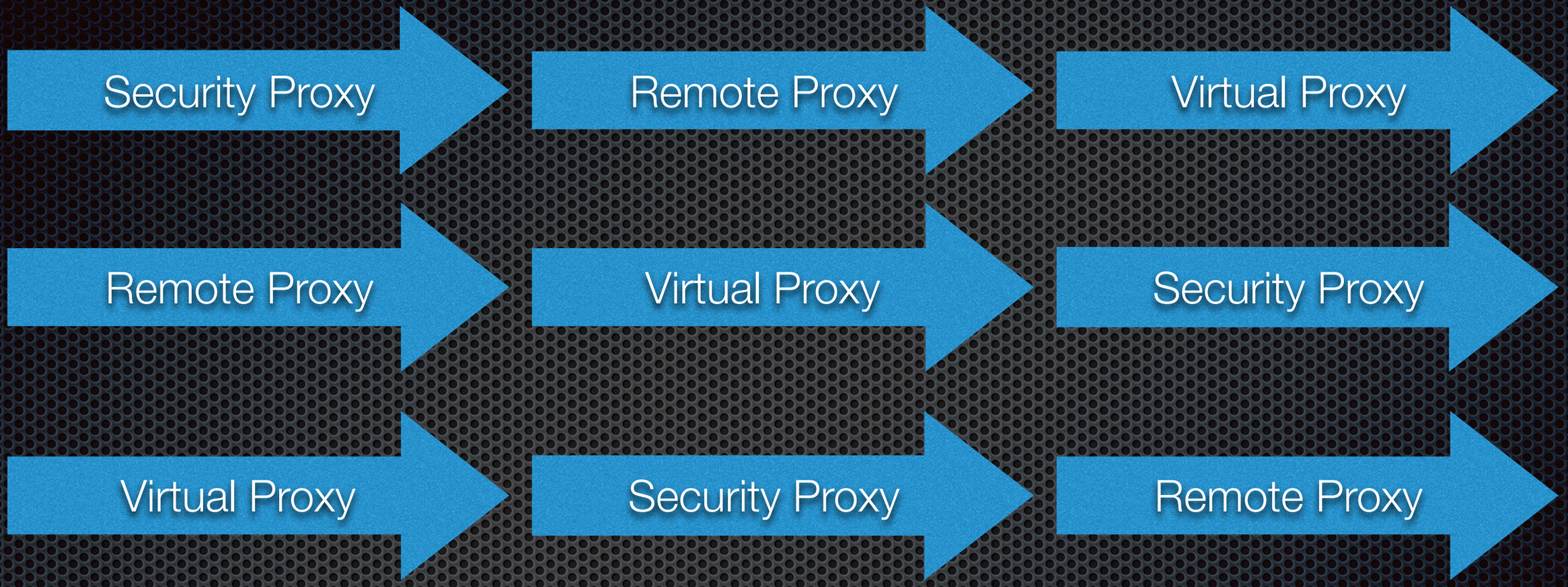
Combining Proxies

@SvenRuppert



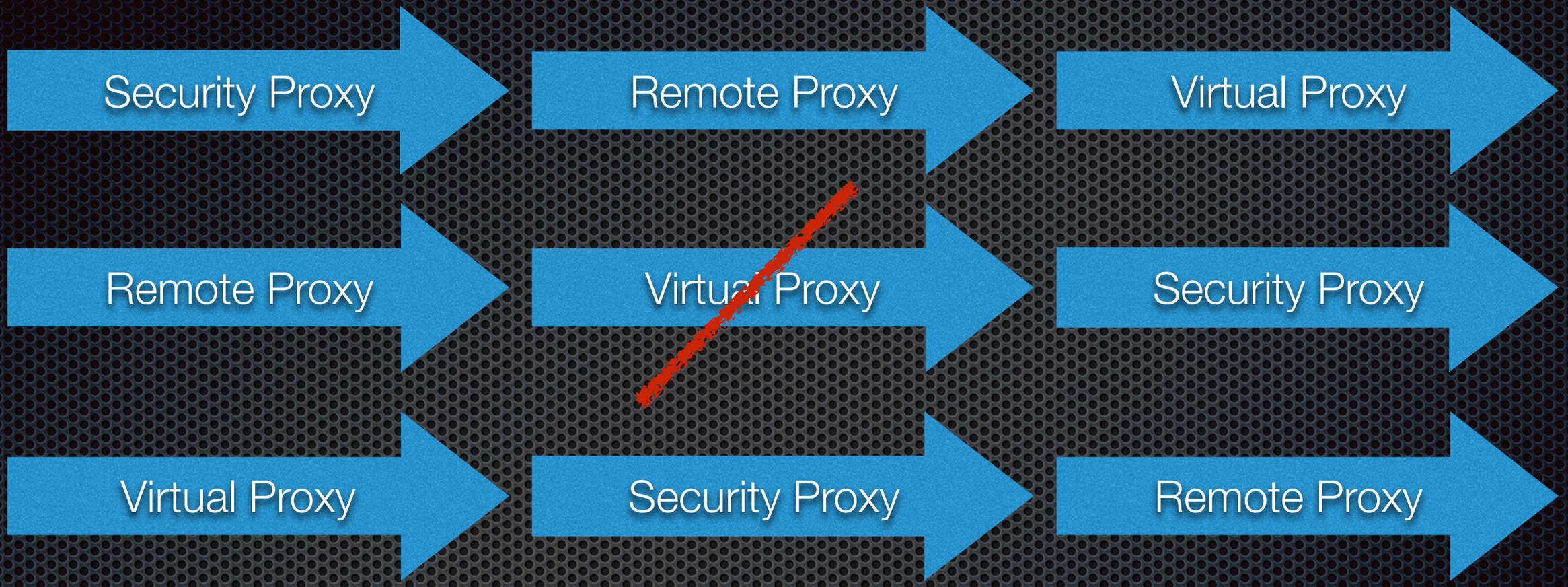
combining Proxies is easy

VirtualProxies are mostly the last one

SecurityProxies are mostly the first one ?

Combining Proxies

@SvenRuppert



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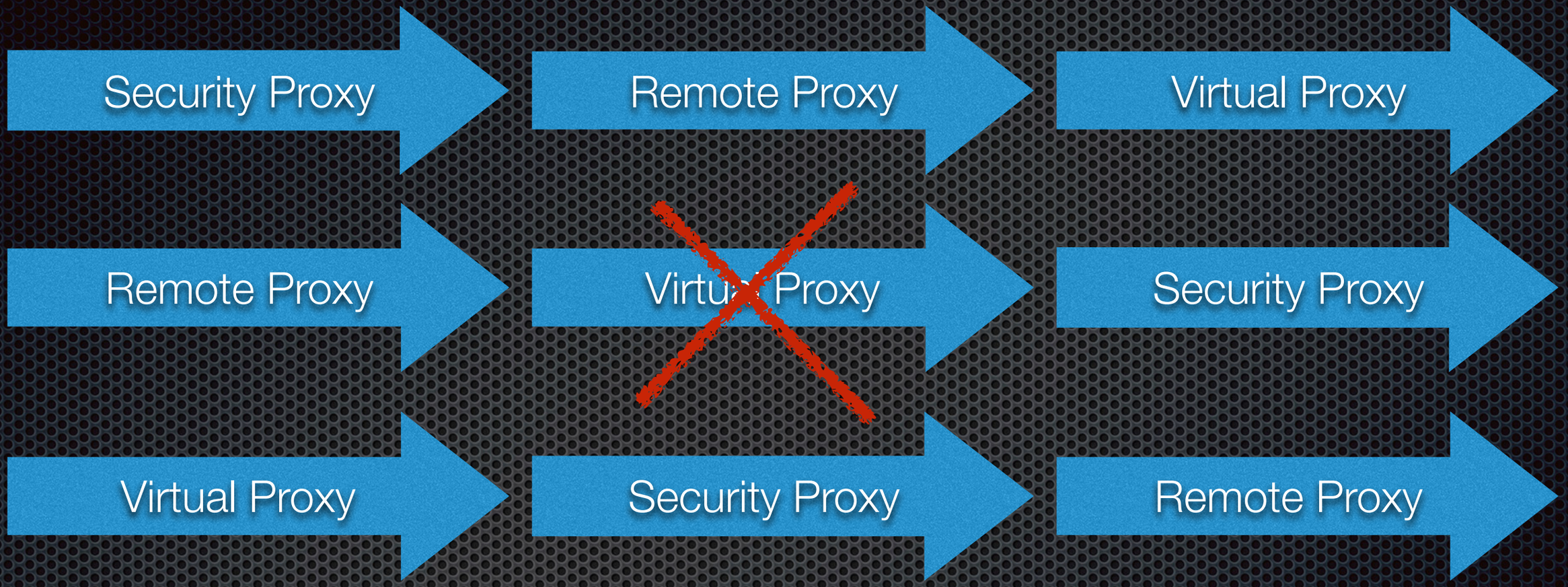

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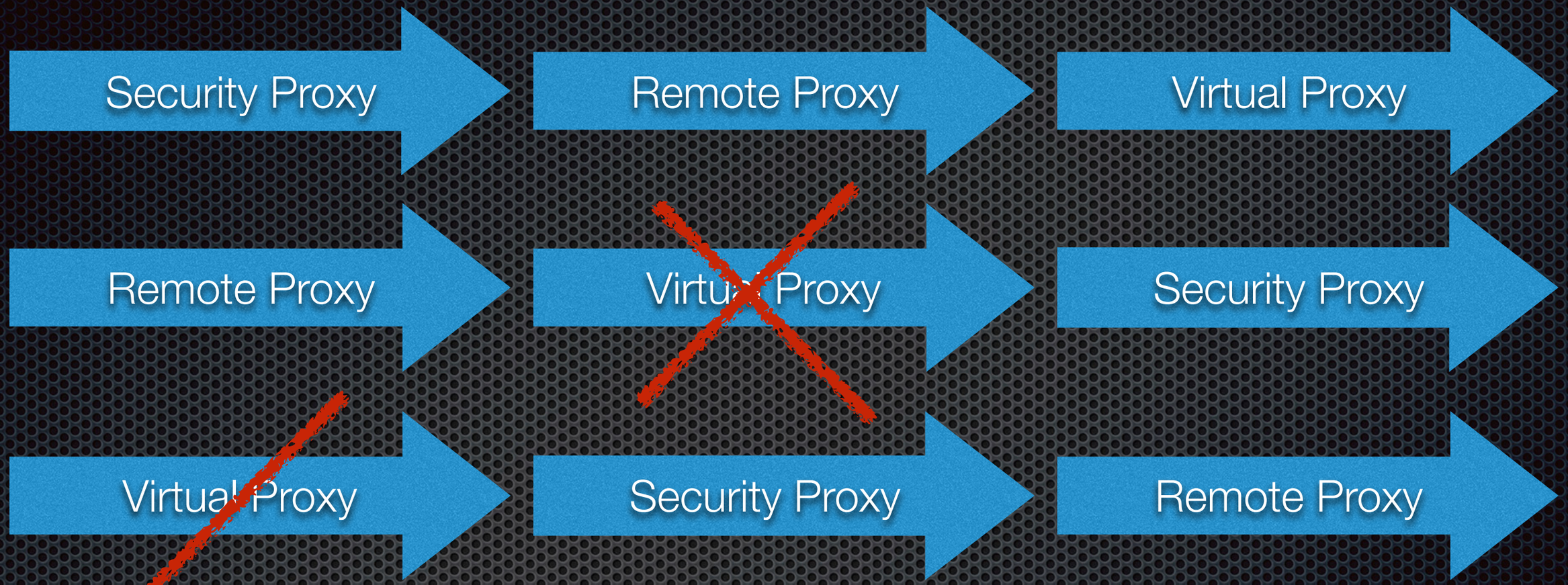

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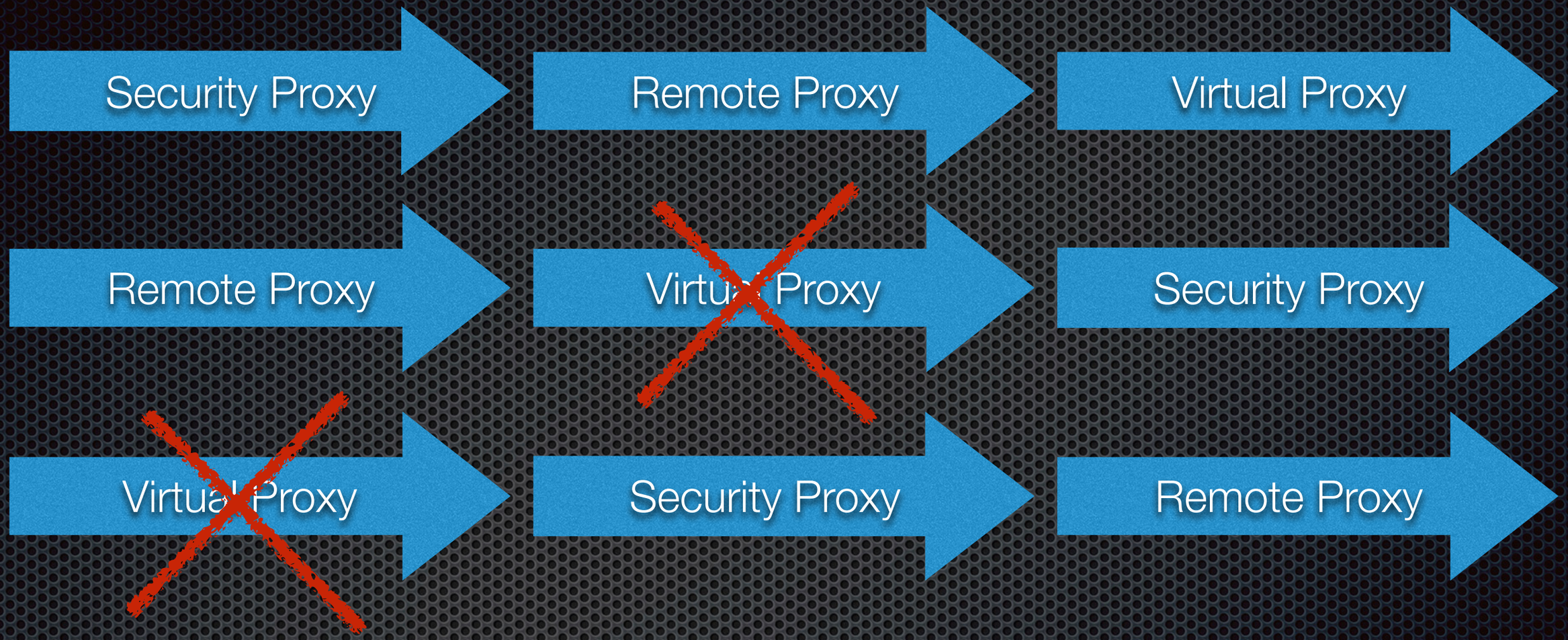

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Combining Proxies - SecureVirtualProxy

@SvenRuppert

Security Proxy

Virtual Proxy

```
public class SecureVirtualProxy implements Service {
  public SecureProxy() { out.println("SecureProxy " + now()); }
  private Service service = new VirtualProxy();
  //SNIPP....
  public String work(String txt) {
    if(code.equals("hoppel")) { return service.work(txt); }
    return                    { return "nooooop"; }
  }
}
```

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public class VirtualProxy implements Service {
  public VirtualProxy() { out.println("VirtualProxy " + now()); }
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hard wired proxies

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Combining Proxies - SecureVirtualProxy

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hard wired proxies

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  public VirtualProxy() { out.println("VirtualProxy " + now()); }
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  public String work(String txt) {
    if(service == null) { service = new ServiceImpl(); }
    return service.work(txt);
  }
}
```

Combining Proxies - SecureVirtualProxy

@SvenRuppert

Security Proxy

Virtual Proxy

we need a Generic Proxy

hard wired proxies

What could we change now ?

Combining Proxies - SecureVirtualProxy

@SvenRuppert

Security Proxy

Virtual Proxy

we need a Generic Proxy
since JDK1.3 we have it

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What could we change now ?

Combining Proxies - SecureVirtualProxy

@SvenRuppert

we need a Generic Proxy
since JDK1.3 we have it
the DynamicProxy

hard wired proxies

What could we change now ?

prepare for.....

Proxy Deep Dive - DynamicProxies

some words about :
how to use and how to extend....but.. also what is not nice

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Dynamic Proxy - Hello World

How to use it ?

Dynamic Proxy - Hello World

How to use it ?

java.lang.reflect.Proxy

Dynamic Proxy - Hello World

@SvenRuppert

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java.lang.reflect.Proxy

we need an interface : here Service

Dynamic Proxy - Hello World

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we need an implementation : here ServiceImpl

Dynamic Proxy - Hello World

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```
Service proxyInstance = Service class.cast( Proxy.newProxyInstance(
    Service.class.getClassLoader(),
    new Class<?>[]{Service.class},
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      private final ServiceImpl service = new ServiceImpl();
      @Override
      public Object invoke(Object proxy, Method method, Object[] args) throws Throwable {
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Dynamic Proxy - Hello World

How to use it ?

java.lang.reflect.Proxy

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```

OK, step by step , please

Dynamic Proxy - Hello World

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Dynamic Proxy - Hello World

@SvenRuppert

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Service proxyInstance = Service.class.cast (
```

Dynamic Proxy - Hello World

@SvenRuppert

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Dynamic Proxy - Hello World

@SvenRuppert

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Dynamic Proxy - Hello World

@SvenRuppert

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Dynamic Proxy - Hello World

@SvenRuppert

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how to make a VirtualProxy ?

Dynamic Virtual Proxy

@SvenRuppert

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Service proxyInstance = Service.class.cast (
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Dynamic Virtual Proxy


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@SvenRuppert

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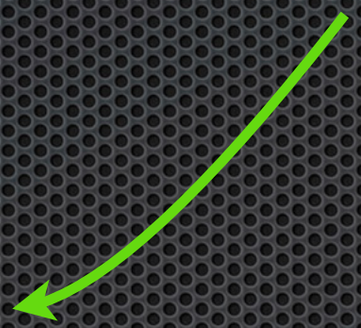

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@SvenRuppert

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Dynamic Proxy - make it generic


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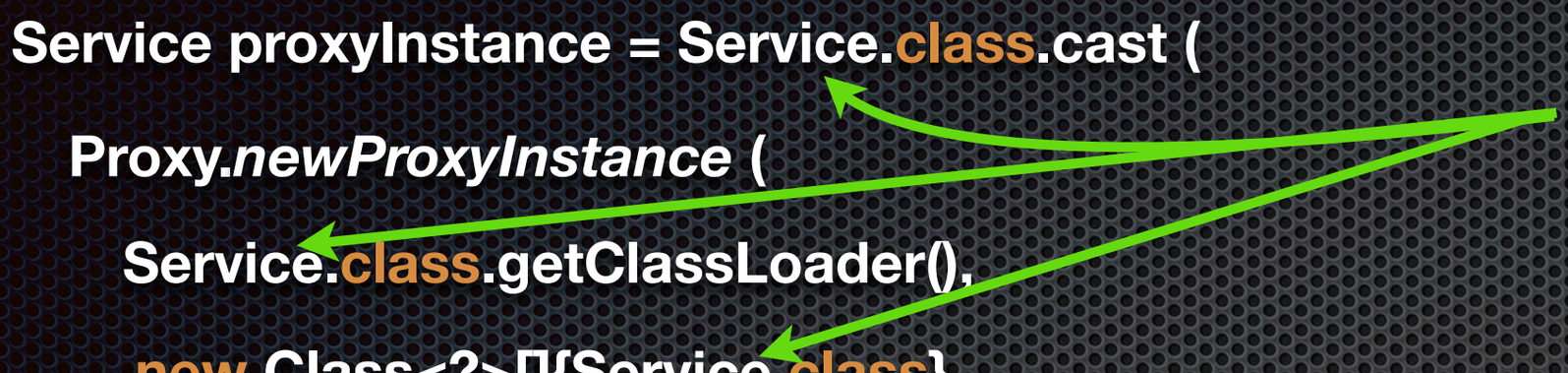

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get it from outside

Dynamic Proxy - make it generic

@SvenRuppert

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get it from outside

we will remove it

Dynamic Proxy - make it generic


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Dynamic Proxy - make it generic

@SvenRuppert

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        }
    )
);
```

get it from outside

we will remove it

we will get it from outside

and finally we will call it ProxyGenerator

Dynamic Proxy - make it generic


```
public class ProxyGenerator {
  public static <P> P makeProxy(Class<P> subject, P realSubject) {
    Object proxyInstance = Proxy.newProxyInstance(
        subject.getClassLoader(),
        new Class<?>[]{subject},
        new InvocationHandler() {
          @Override
          public Object invoke(final Object proxy, final Method m, final Object[] args) throws Throwable {
            return m.invoke(realSubject, args);
          }
        }
    );
    return subject.cast(proxyInstance);
  }
}
```

Dynamic Proxy - make it generic


```
public class ProxyGenerator {
  public static <P> P makeProxy(Class<P> subject, P realSubject) {
    Object proxyInstance = Proxy.newProxyInstance(
        subject.getClassLoader(),
        new Class<?>[]{subject},
        (proxy, m, args) -> m.invoke(realSubject, args)
    );
    return subject.cast(proxyInstance);
  }
}
```

Dynamic Proxy - make it generic

with DynamicProxies

- we are writing less (more generic) code
- we can create VirtuaI-/Remote-/Security Proxies

Dynamic Proxy - make it generic

with DynamicProxies

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but how to combine Proxies more generic ?

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Factory-Method-Pattern

Dynamic Proxy - make it generic

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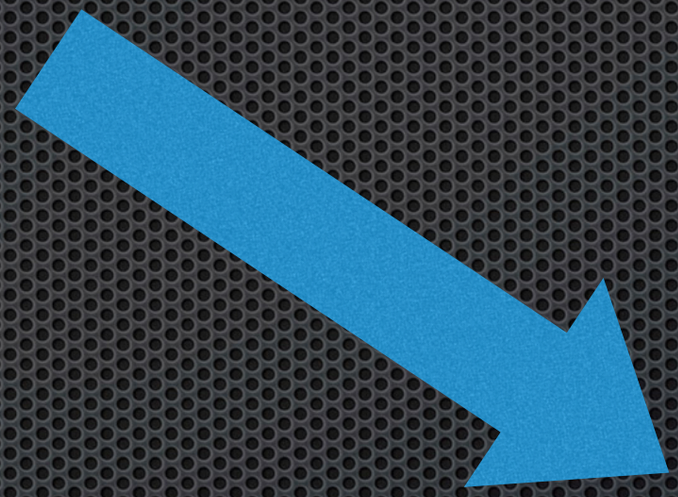
Factory-Method-Pattern



Dynamic Proxy - make it generic

but how to combine Proxies more generic ?

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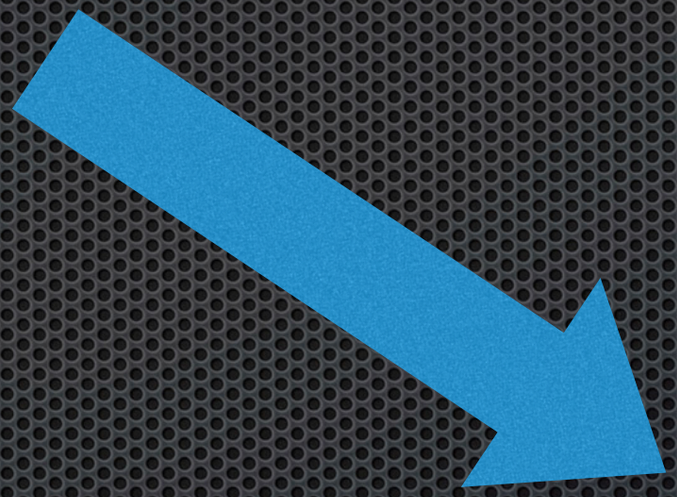
Factory-Method-Pattern



Builder-Pattern

but how to combine Proxies more generic ?

let´s think about Two possible ways:

but how to combine Proxies more generic ?

let´s think about Two possible ways:

1 Security Proxy with 2 Rules and 1 VirtualProxy

but how to combine Proxies more generic ?

let´s think about Two possible ways:

1 Security Proxy with 2 Rules and 1 VirtualProxy

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let´s think about Two possible ways:

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OK, we need a generic CascadedProxy

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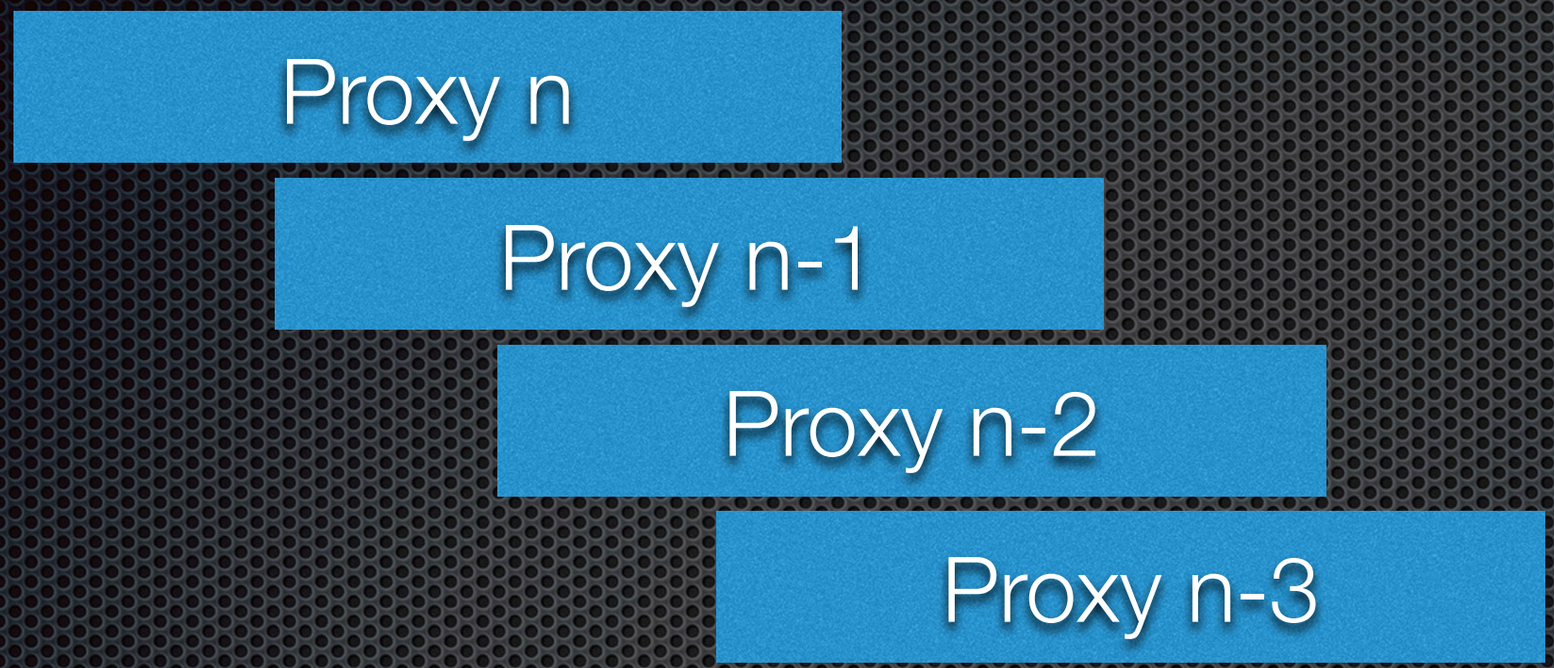
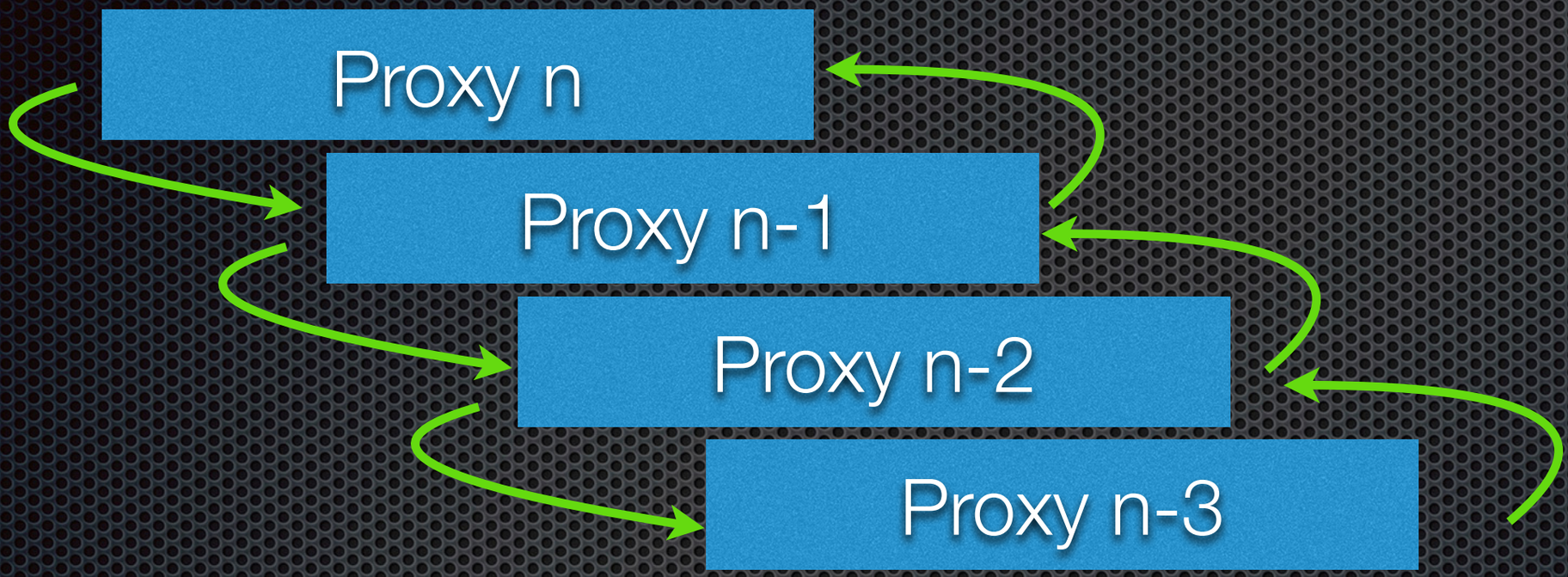


a child must know his parent

first we only add different DynamicProxies

always the same target interface

OK, we need a generic CascadedProxy



a child must know his parent

first we only add different DynamicProxies

always the same target interface

DynamicProxyBuilder

for example: add n SecurityRules

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```
public interface SecurityRule {
  boolean checkRule();
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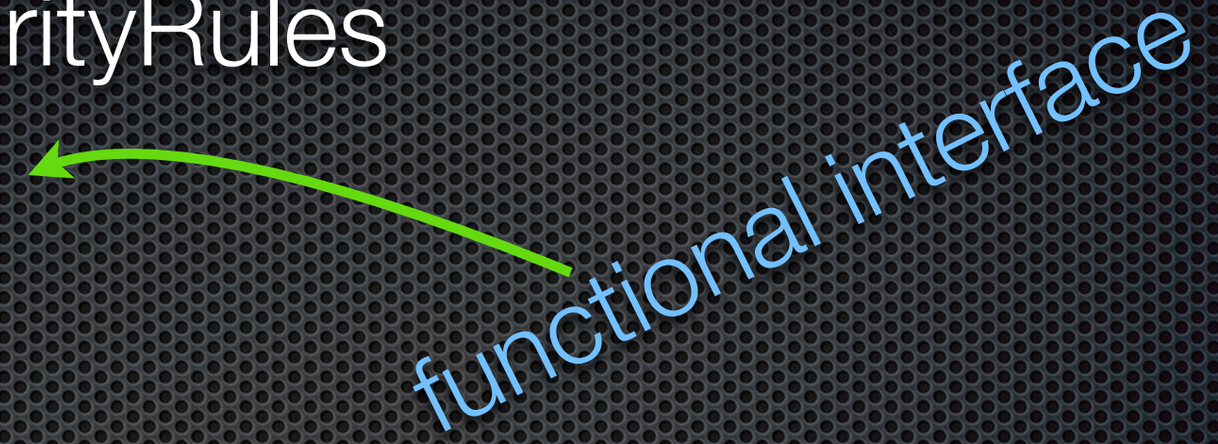

DynamicProxyBuilder

@SvenRuppert

for example: add n SecurityRules

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public interface SecurityRule {
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functional interface

```
private List<SecurityRule> securityRules = new ArrayList<>();
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DynamicProxyBuilder

@SvenRuppert

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```
Collections.reverse(securityRules);
securityRules.forEach(this::build_addSecurityRule);
```

DynamicProxyBuilder

@SvenRuppert

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  final ClassLoader classLoader = original.getClass().getClassLoader();
  final Class<?>[] interfaces = {clazz};
  final Object nextProxy = Proxy.newProxyInstance(
      classLoader, interfaces,
      new InvocationHandler() {
        private T original = ProxyBuilder.this.original;
        public Object invoke(Object proxy, Method method, Object[] args) throws Throwable {
          final boolean checkRule = rule.checkRule();
          if (checkRule) {
            return method.invoke(original, args);
          } else {
            return null;
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      });
  original = (T) clazz.cast(nextProxy);
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DynamicProxyBuilder

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          } else {
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      });
  original = (T) clazz.cast(nextProxy);
  return this;
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```

last child

DynamicProxyBuilder

@SvenRuppert

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last child

work on child

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@SvenRuppert

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work on child

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          }
        }
      });
  original = (T) clazz.cast(nextProxy);
  return this;
}
```

last child

work on child

set child for next level

DynamicProxyBuilder

@SvenRuppert

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          } else {
            return null;
          }
        }
      });
  original = (T) clazz.cast(nextProxy);
  return this;
}
```

last child

work on child

set child for next level

how this will be used ?

DynamicProxyBuilder

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DynamicProxyBuilder

@SvenRuppert

```
final InnerDemoClass original = new InnerDemoClass();
```

DynamicProxyBuilder

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```
final InnerDemoClass original = new InnerDemoClass();
final InnerDemoInterface demoLogic =
```

DynamicProxyBuilder

@SvenRuppert

```
final InnerDemoClass original = new InnerDemoClass();
final InnerDemoInterface demoLogic =
    ProxyBuilder.createBuilder(InnerDemoInterface.class, original)
```

DynamicProxyBuilder

@SvenRuppert

```
final InnerDemoClass original = new InnerDemoClass();
final InnerDemoInterface demoLogic =
    ProxyBuilder.createBuilder(InnerDemoInterface.class, original)
        .addLogging()
```

DynamicProxyBuilder

@SvenRuppert

```
final InnerDemoClass original = new InnerDemoClass();
final InnerDemoInterface demoLogic =
    ProxyBuilder.createBuilder(InnerDemoInterface.class, original)
        .addLogging()
            .addMetrics()
```

DynamicProxyBuilder

@SvenRuppert

```
final InnerDemoClass original = new InnerDemoClass();
final InnerDemoInterface demoLogic =
    ProxyBuilder.createBuilder(InnerDemoInterface.class, original)
        .addLogging()
            .addMetrics()
.addSecurityRule(() -> true)
```

DynamicProxyBuilder

@SvenRuppert

```
final InnerDemoClass original = new InnerDemoClass();
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            .addMetrics()
                .addSecurityRule(() -> true)
                    .addSecurityRule(() -> true)
```

DynamicProxyBuilder

@SvenRuppert

```
final InnerDemoClass original = new InnerDemoClass();
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    ProxyBuilder.createBuilder(InnerDemoInterface.class, original)
        .addLogging()
            .addMetrics()
                .addSecurityRule(() -> true)
                    .addSecurityRule(() -> true)
                        .build();
```

DynamicProxyBuilder

@SvenRuppert

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how to deal with different interfaces ?

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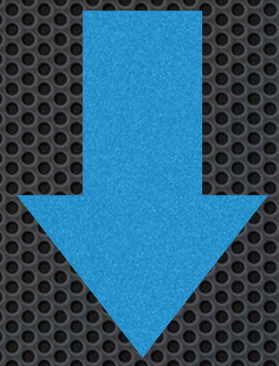

DynamicProxyBuilder

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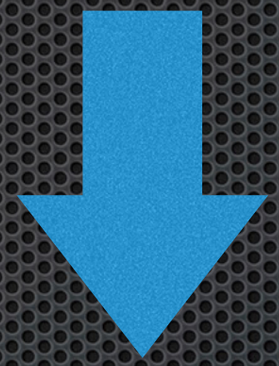

we need a generic NestedBuilder

NestedBuilder - The Beginning

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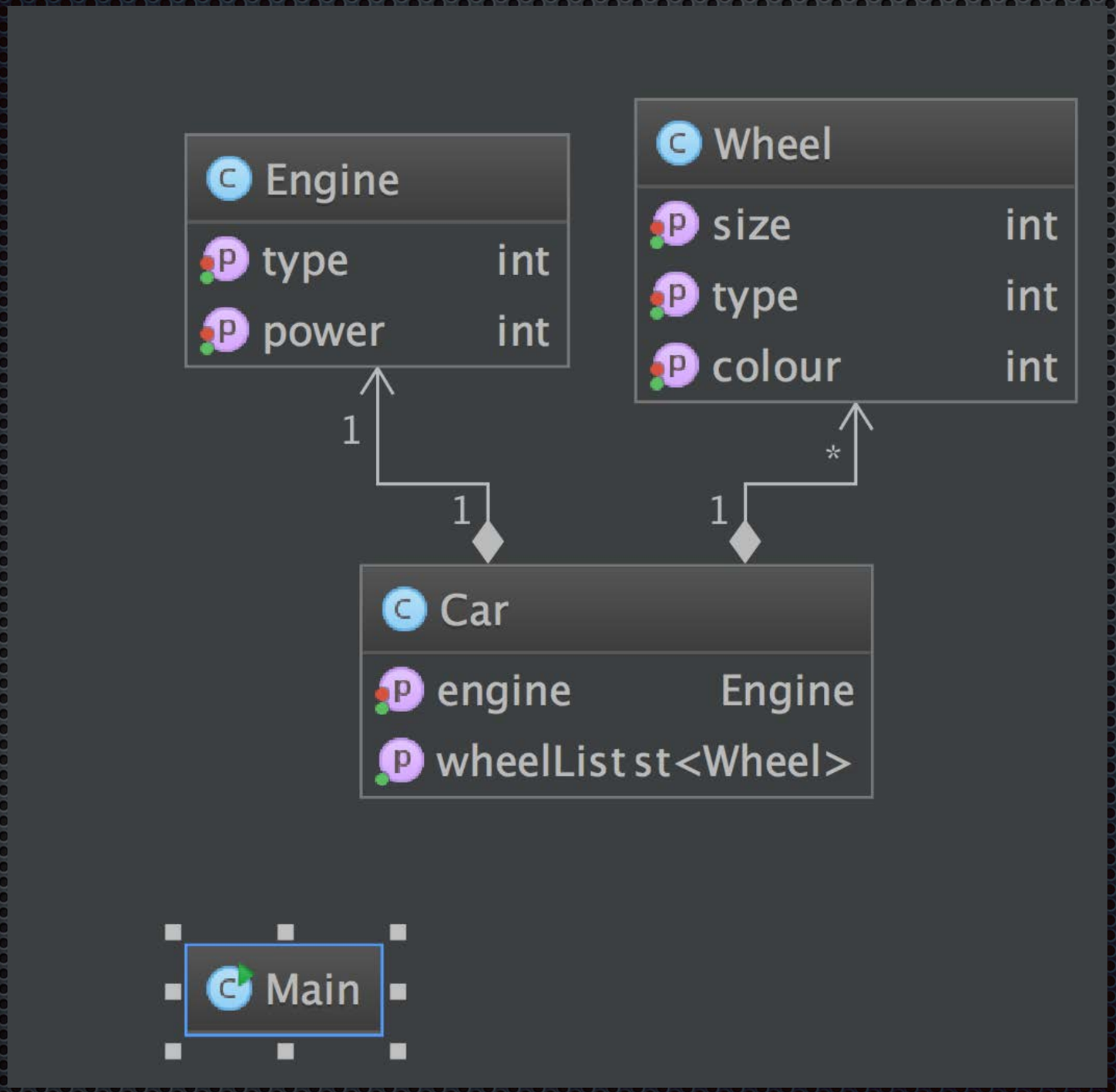

NestedBuilder - The Beginning

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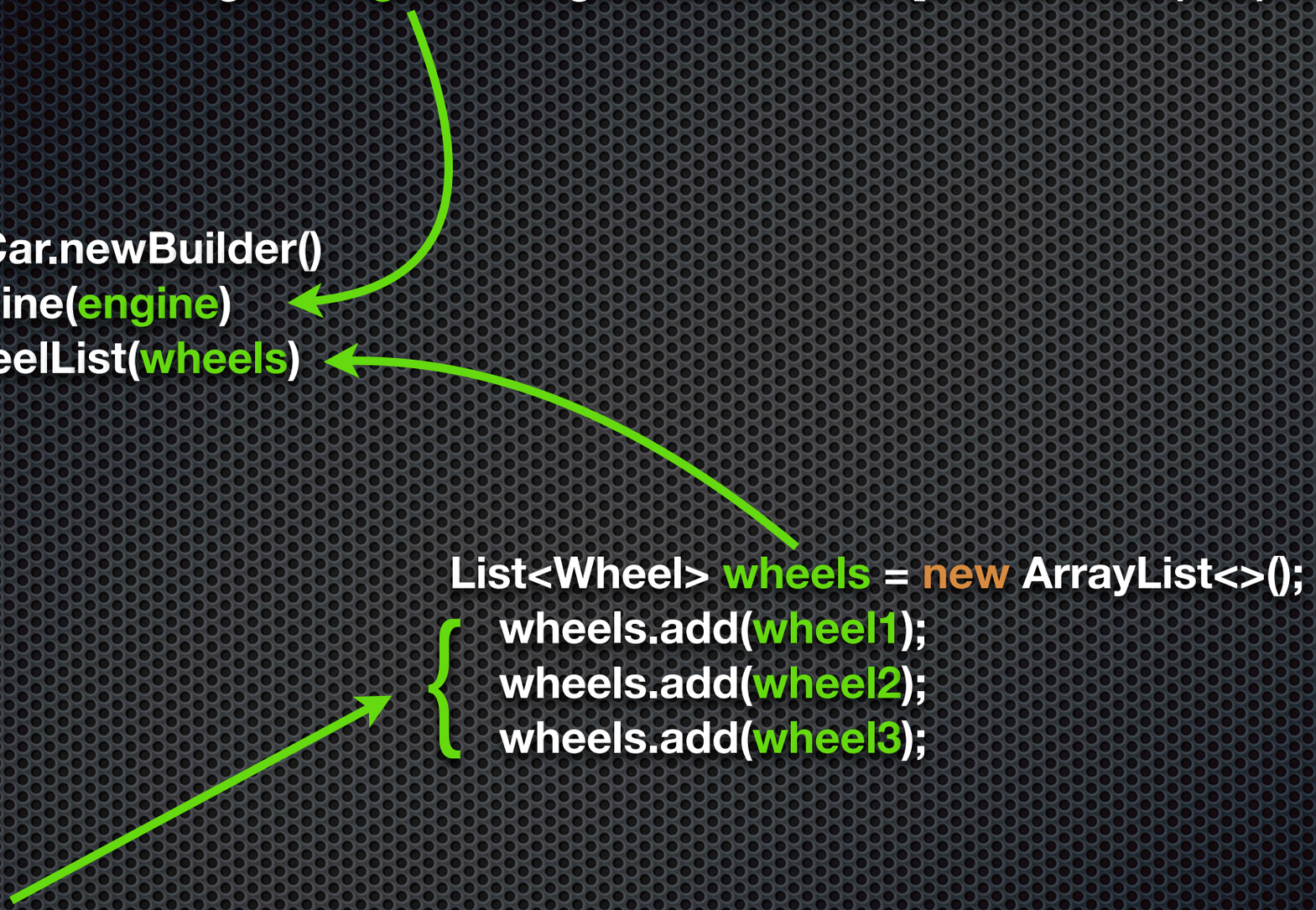

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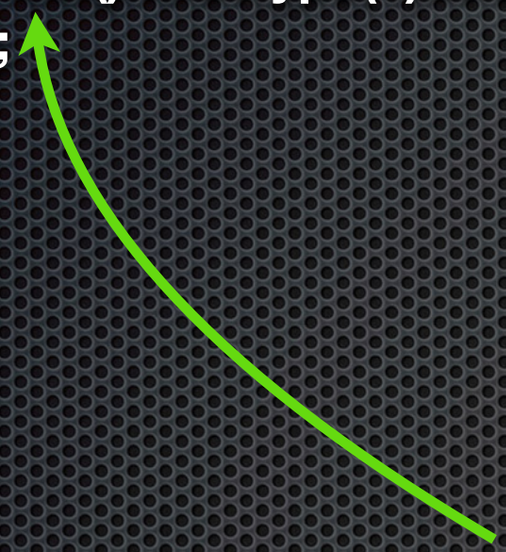

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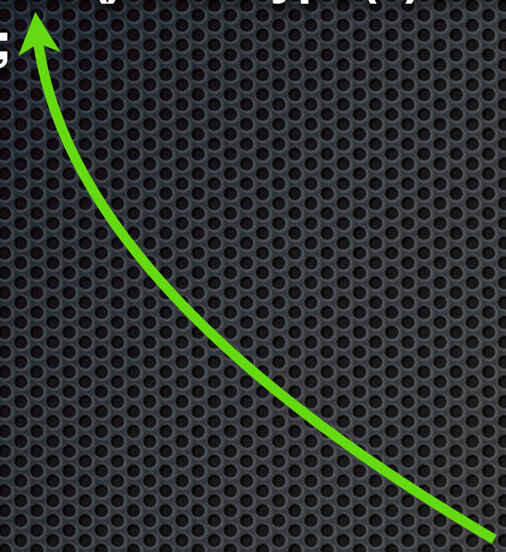

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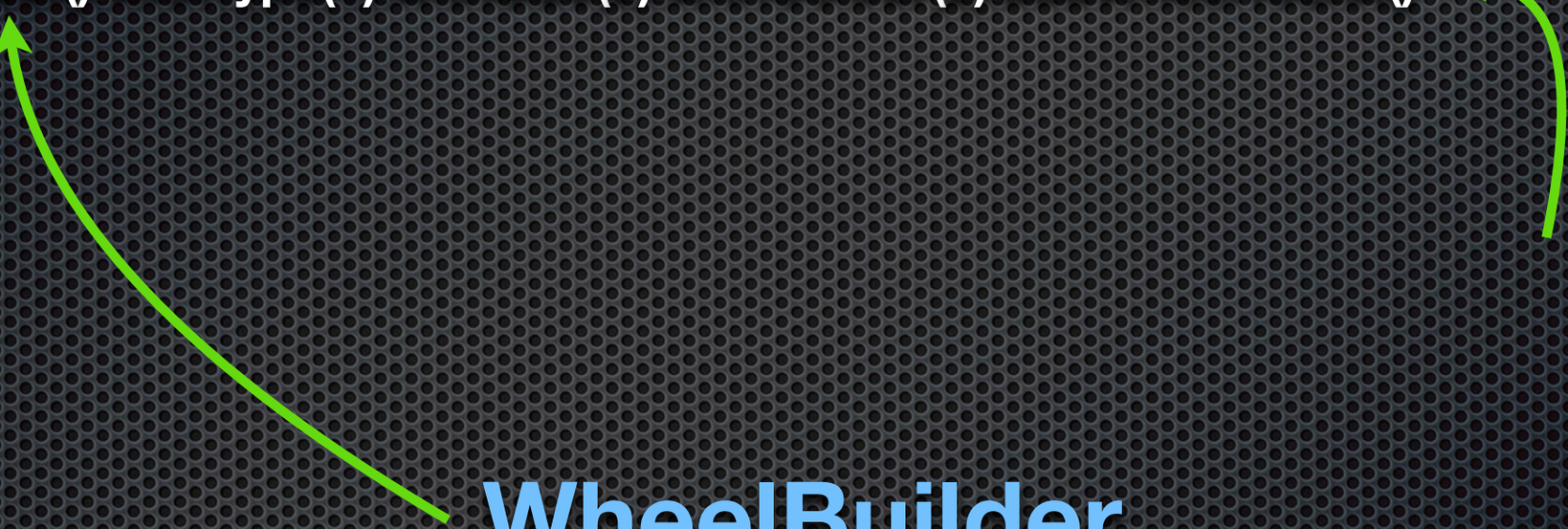

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WheelListBuilder

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now we have to combine all

NestedBuilder - The Beginning

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```
Car car = Car.newBuilder()
    .addEngine().withPower(100).withType(5).done()
    .addWheels()
        .addWheel().withType(1).withSize(2).withColour(2).addWheelToList()
        .addWheel().withType(1).withSize(2).withColour(2).addWheelToList()
        .addWheel().withType(1).withSize(2).withColour(2).addWheelToList()
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    .build();
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.done()
.build();
```

NestedBuilder - The Pattern

@SvenRuppert

```
public abstract class NestedBuilder<T, V> {

  public abstract V build()
  protected T parent;

  public <P extends NestedBuilder<T, V>> P
  withParentBuilder(T parent) {
      this.parent = parent;
      return (P) this;
  }
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parent will connect itself...

NestedBuilder - The Pattern

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   try {
     V build = this.build();
     String methodname = "with" + build.getClass().getSimpleName();
     Method method = parentClass.getDeclaredMethod(
                                          methodname, build.getClass());
     method.invoke(parent, build);
   } catch (NoSuchMethodException
            | IllegalAccessException | InvocationTargetException e) {
            e.printStackTrace();
   }
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  public T done() {
    Class<?> parentClass = parent.getClass();

    try {
      V build = this.build();
      String methodname = "with" + build.getClass().getSimpleName();
      Method method = parentClass.getDeclaredMethod(
                                          methodname, build.getClass());
      method.invoke(parent, build);
    } catch (NoSuchMethodException
            | IllegalAccessException | InvocationTargetException e) {
              e.printStackTrace();
    }
  }
```

NestedBuilder - The Pattern

@SvenRuppert

```
public abstract class NestedBuilder<T, V> {

  public T done() {

    Class<?> parentClass = parent.getClass();

    try {
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      Method method = parentClass.getDeclaredMethod(
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      method.invoke(parent, build);
    } catch (NoSuchMethodException
            | IllegalAccessException | InvocationTargetException e) {
              e.printStackTrace();
    }
  }
```

connect itself with parent

NestedBuilder - The Pattern

@SvenRuppert

NestedBuilder - The Pattern

the basic steps in short words

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the Parent-Builder will hold the Child-Builder

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the Child-Builder will extend the NestedBuilder

NestedBuilder - The Pattern

the basic steps in short words

the Parent-Builder will hold the Child-Builder
the Parent-Builder will have a addChild - Method

the Child-Builder will extend the NestedBuilder

the rest could be generated with a default Builder-Generator

NestedBuilder - The Pattern


```
public class Parent {
  private KidA kidA;
  private KidB kidB;
  //snipp.....
  public static final class Builder {
    private KidA kidA;
    private KidB kidB;
    // to add manually
    private KidA.Builder builderKidA = KidA.newBuilder().withParentBuilder(this);
    private KidB.Builder builderKidB = KidB.newBuilder().withParentBuilder(this);

    public KidA.Builder addKidA() {
      return this.builderKidA;
    }
    public KidB.Builder addKidB() {
      return this.builderKidB;
    }
    //---------
```

NestedBuilder - The Pattern

@SvenRuppert

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public class Parent {
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NestedBuilder - The Pattern

@SvenRuppert

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    }
    //---------
```

connect itself with child

NestedBuilder - The Pattern

@SvenRuppert

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public class Parent {
  private KidA kidA;
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  public static final class Builder {
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      return this.builderKidB;
    }
    //---------
```

connect itself with child

NestedBuilder - The Pattern

@SvenRuppert

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    public KidA.Builder addKidA() {
      return this.builderKidA;
    }
    public KidB.Builder addKidB() {
      return this.builderKidB;
    }
    //---------
```

connect itself with child

switch to Child-Builder

NestedBuilder - The Pattern


```
public static final class Builder
                    extends NestedBuilder<Parent.Builder, KidA> {
```

NestedBuilder - The Pattern

@SvenRuppert

```
public static final class Builder
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```

NestedBuilder - The Pattern


```
public static final class Builder
                    extends NestedBuilder<Parent.Builder, KidA> {
```

only extends on Child-Builder

NestedBuilder - The Pattern

@SvenRuppert

NestedBuilder - The Pattern


```
Parent build = Parent.newBuilder()

   .addKidA().withNote("A").done()
   .addKidB().withNote("B").done()

   .build();
System.out.println("build = " + build);
```

NestedBuilder - The Pattern


```
Parent build = Parent.newBuilder()

   .addKidA().withNote("A").done()
   .addKidB().withNote("B").done()

   .build();
System.out.println("build = " + build);
```

and a child could be a parent in the same time

NestedBuilder - The Pattern


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Parent build = Parent.newBuilder()

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   .build();
System.out.println("build = " + build);
```

and a child could be a parent in the same time

```
Parent build = Parent.newBuilder()

    .addKidA().withNote("A")
                .addKidB().withNote("B").done()
    .done()

    .build();
System.out.println("build = " + build);
```

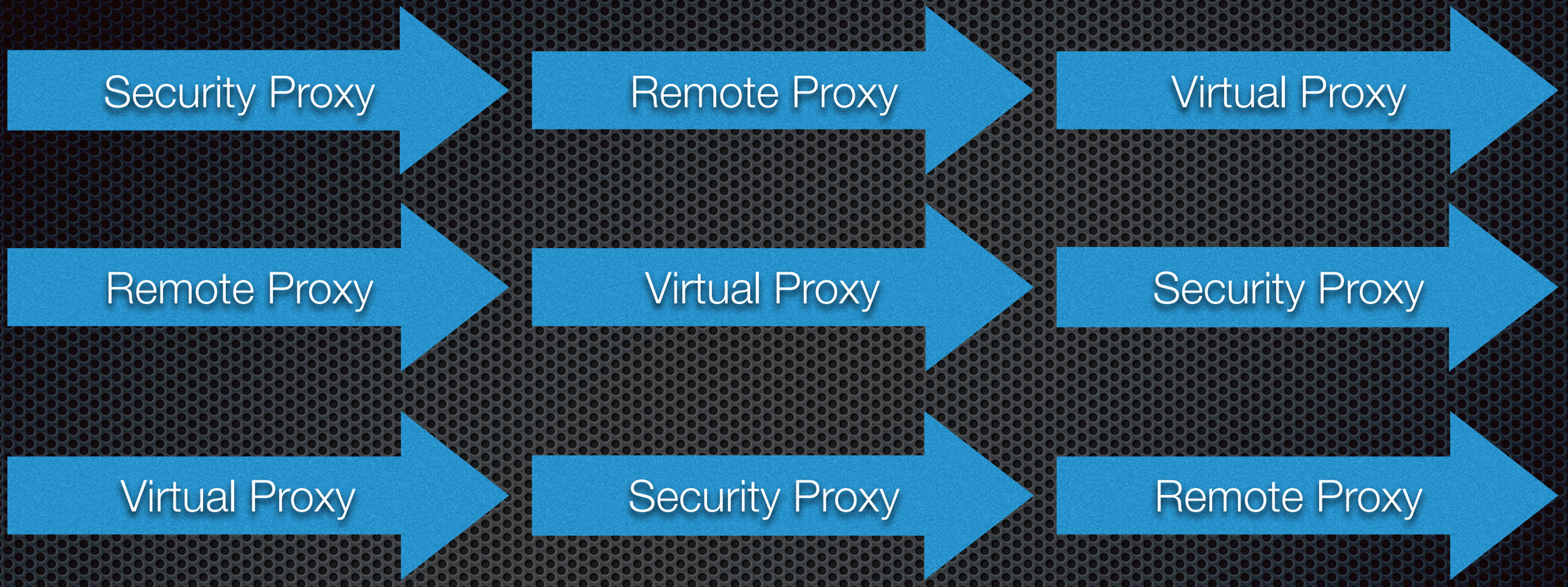
NestedProxyBuilder - The Goal

@SvenRuppert

handwritten , params for diff Proxies

Combining Proxies

@SvenRuppert



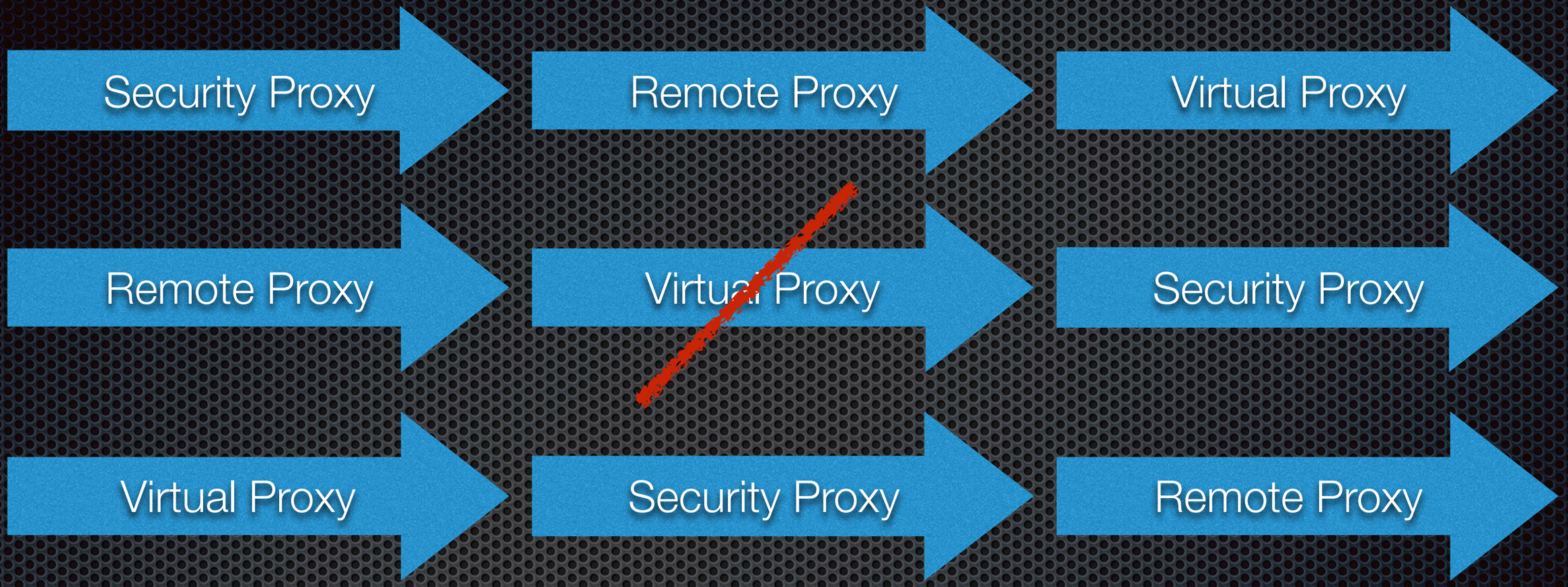
combining Proxies is easy

VirtualProxies are mostly the last one

SecurityProxies are mostly the first one ?

Combining Proxies

@SvenRuppert



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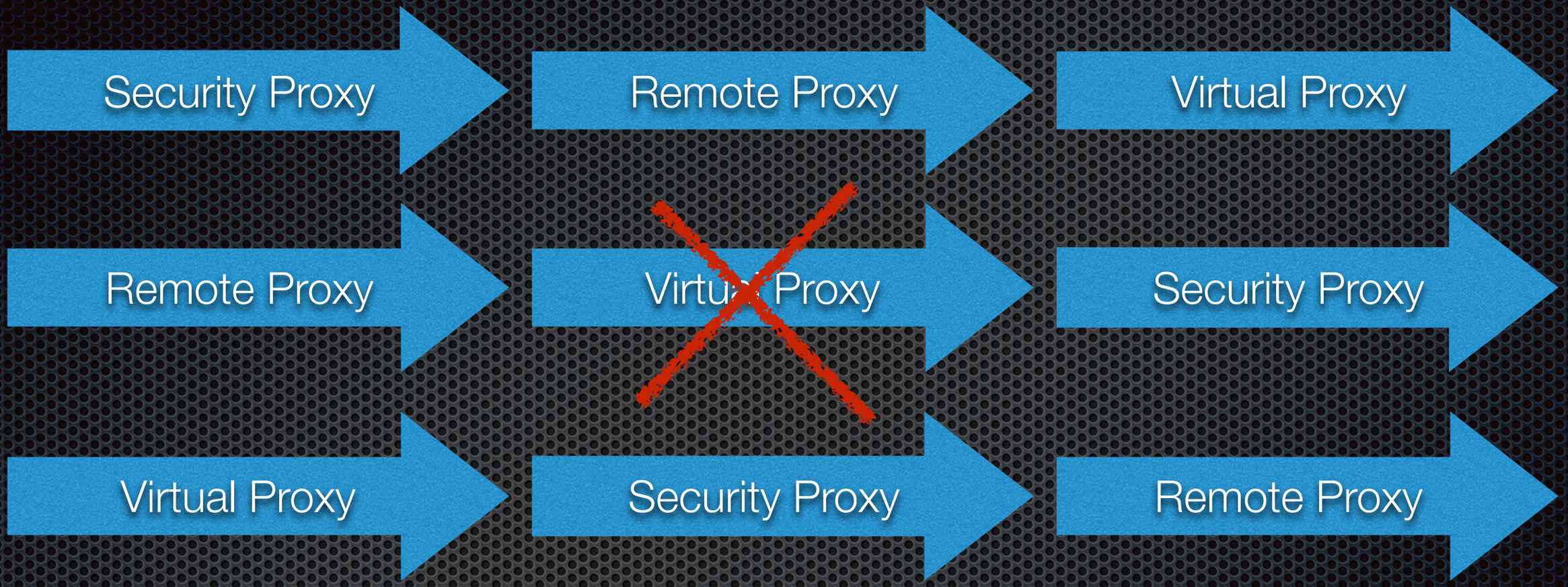

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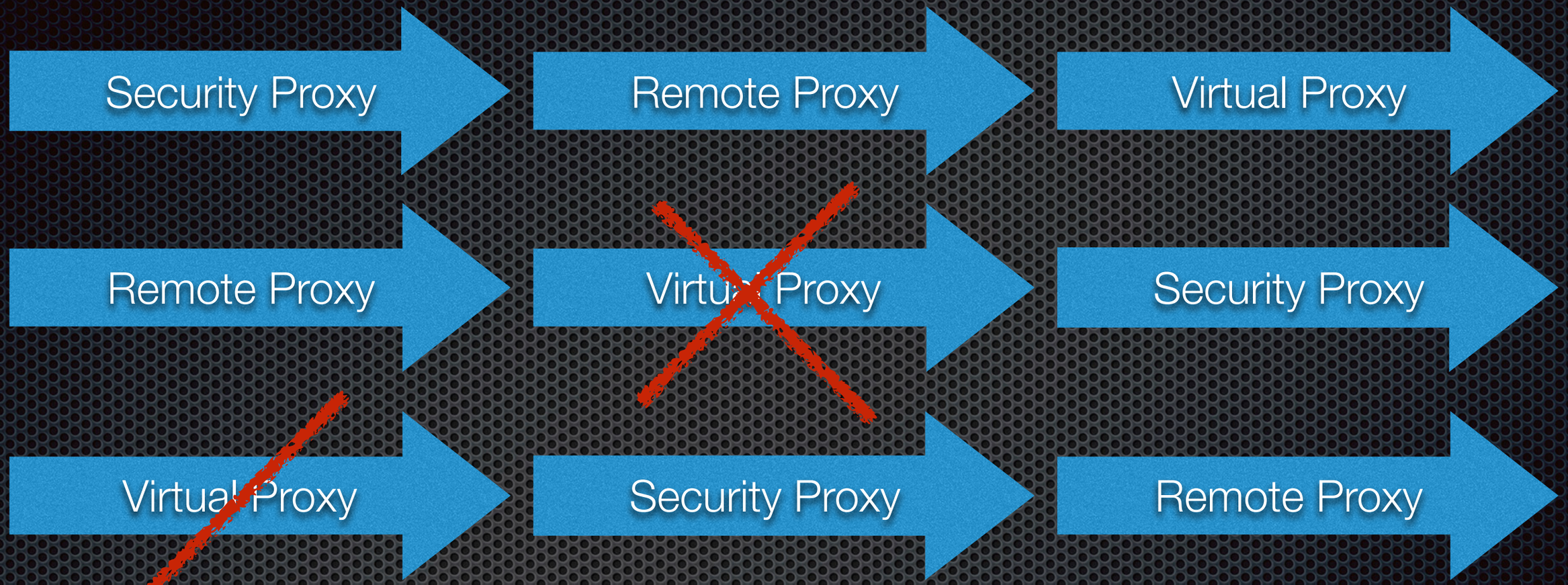

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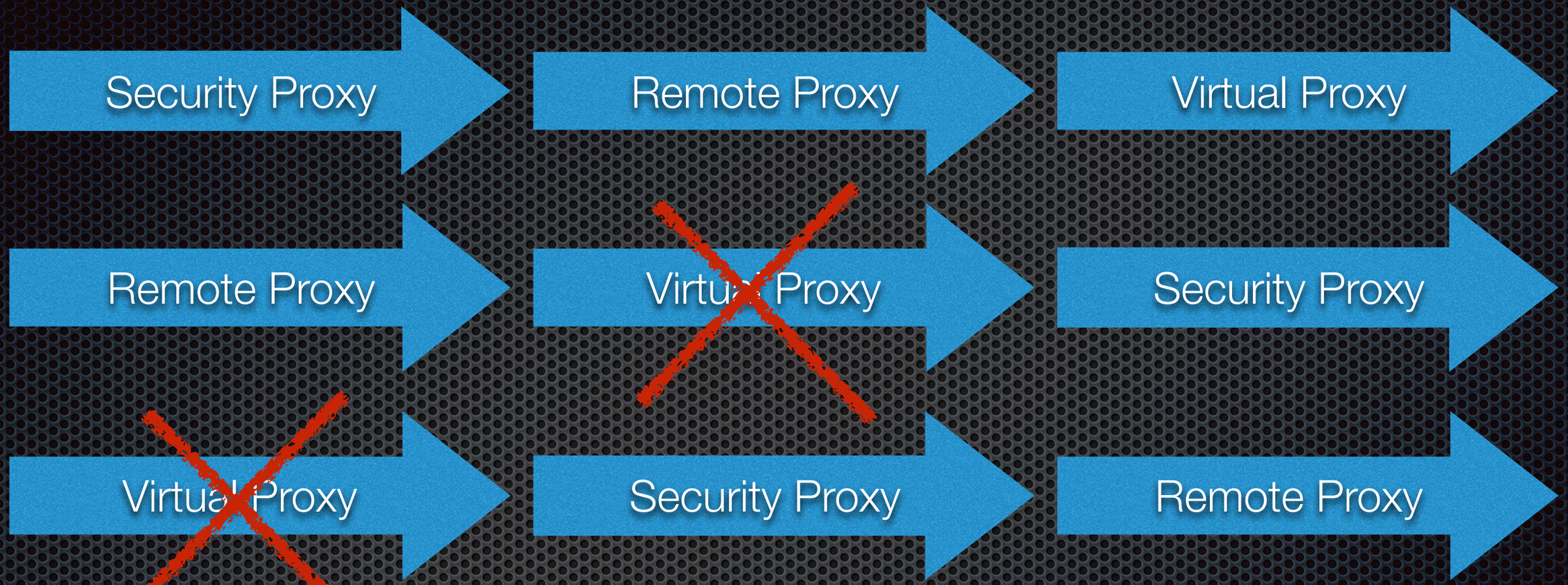


combining Proxies is easy

VirtualProxies are mostly the last one

SecurityProxies are mostly the first one ?

DynamicProxyBuilder

@SvenRuppert

One functionality leads to one Proxy Instance

runtime overhead for every Proxy - but

make the first design simple.. optimize later

DynamicObjectAdapter - orig Version

the original Version of the DynamicObjectAdapter

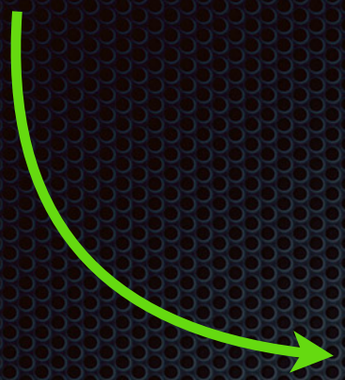
was written by Dr. Heinz Kabutz

DynamicObjectAdapter - orig Version

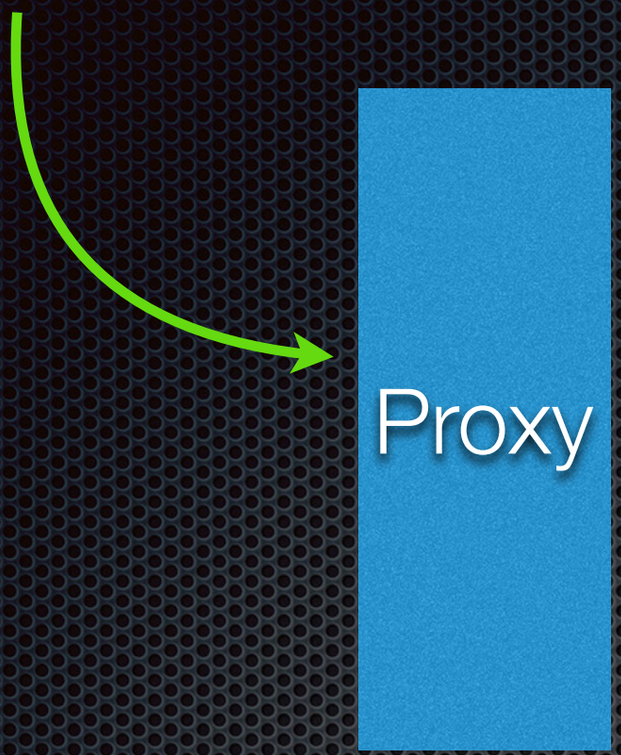
@SvenRuppert

DynamicObjectAdapter - orig Version

@SvenRuppert

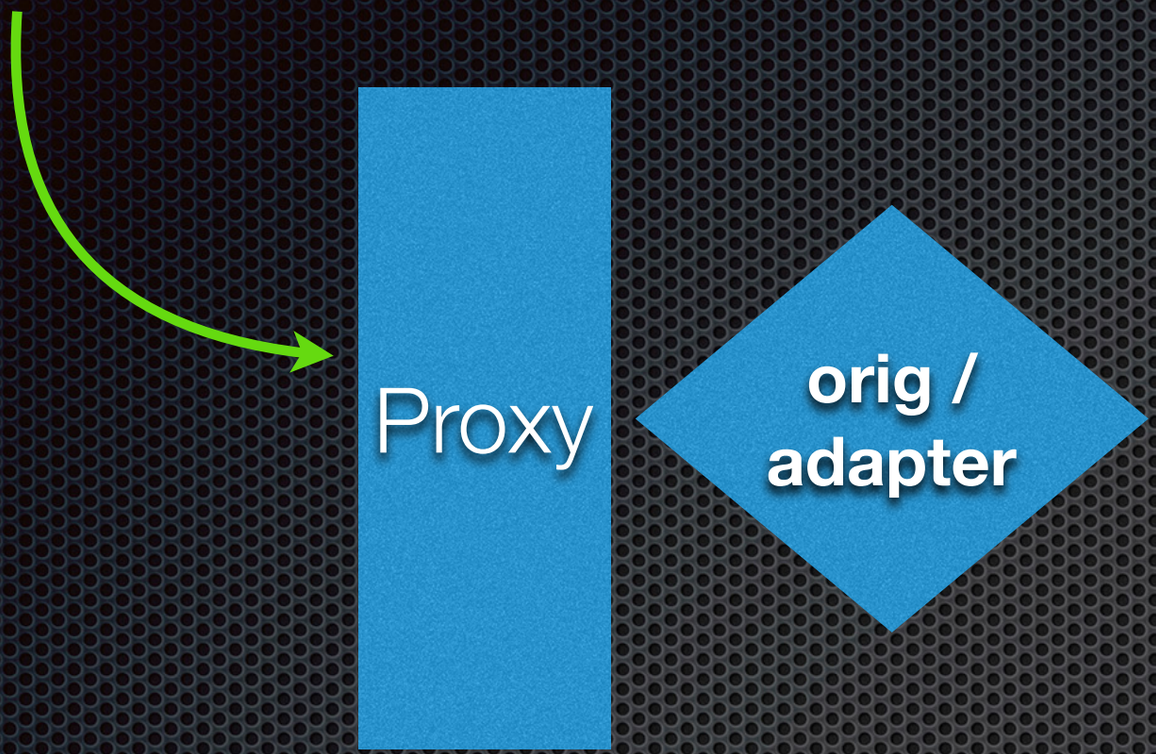


DynamicObjectAdapter - orig Version



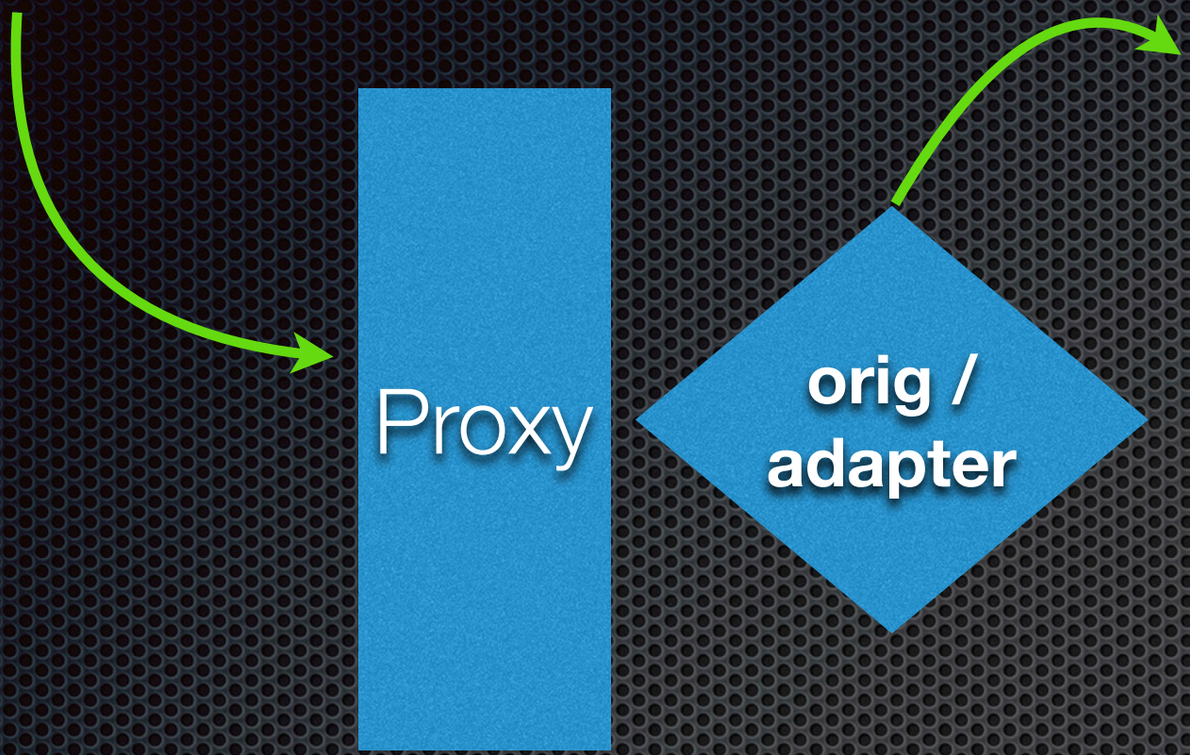
DynamicObjectAdapter - orig Version

@SvenRuppert



DynamicObjectAdapter - orig Version

@SvenRuppert



DynamicObjectAdapter - orig Version

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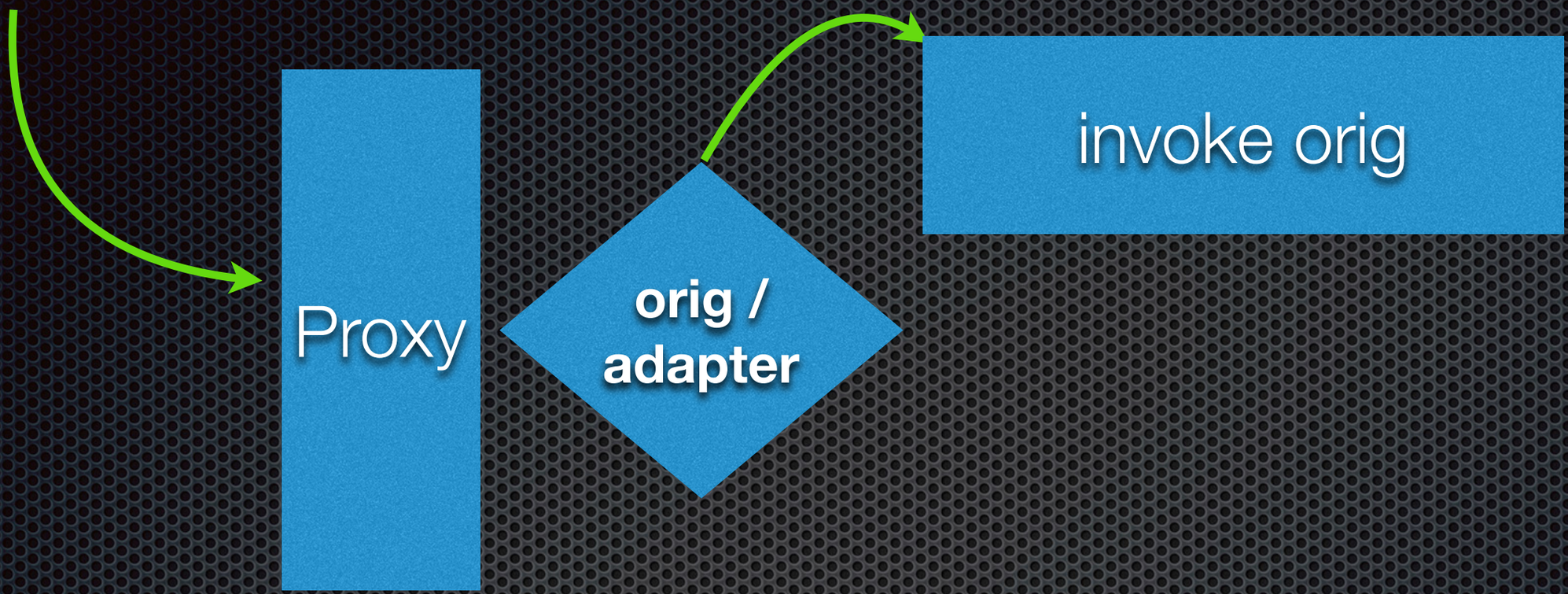
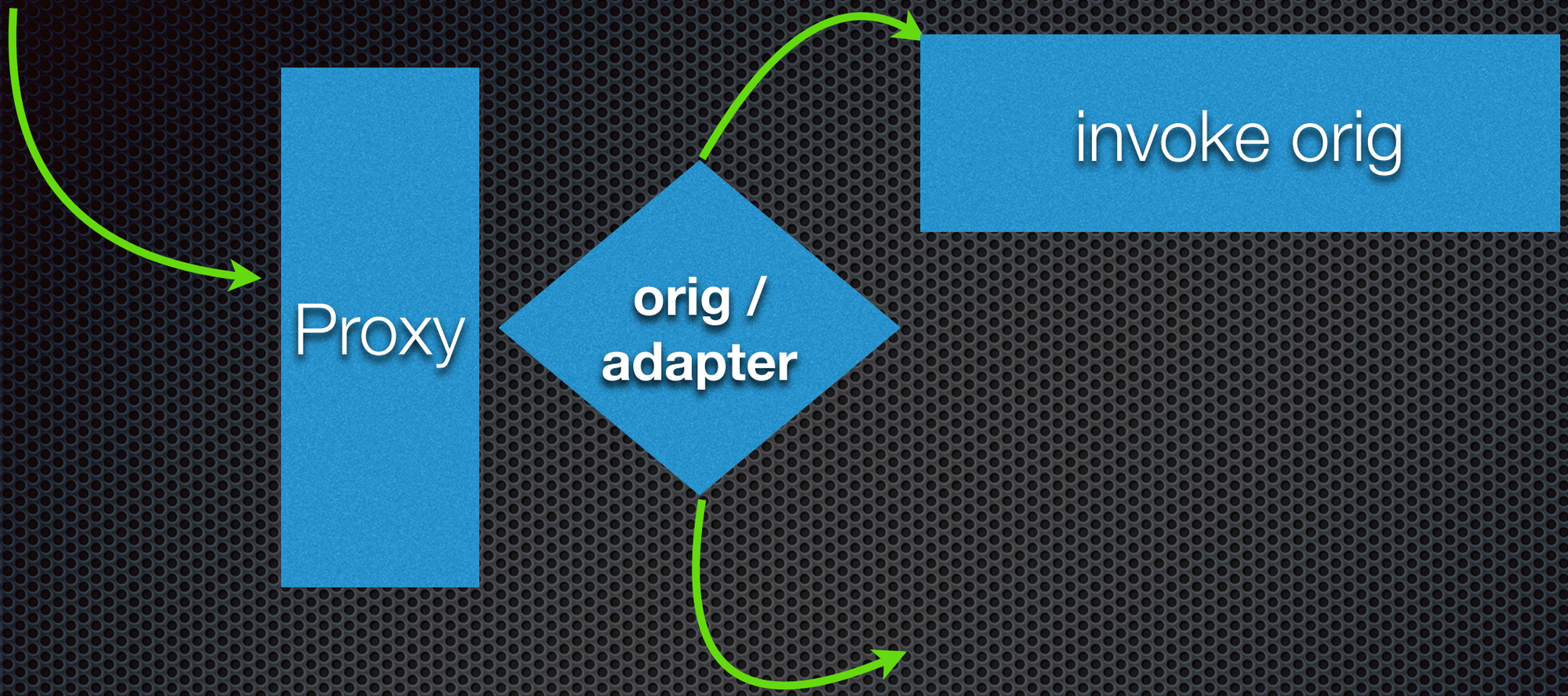


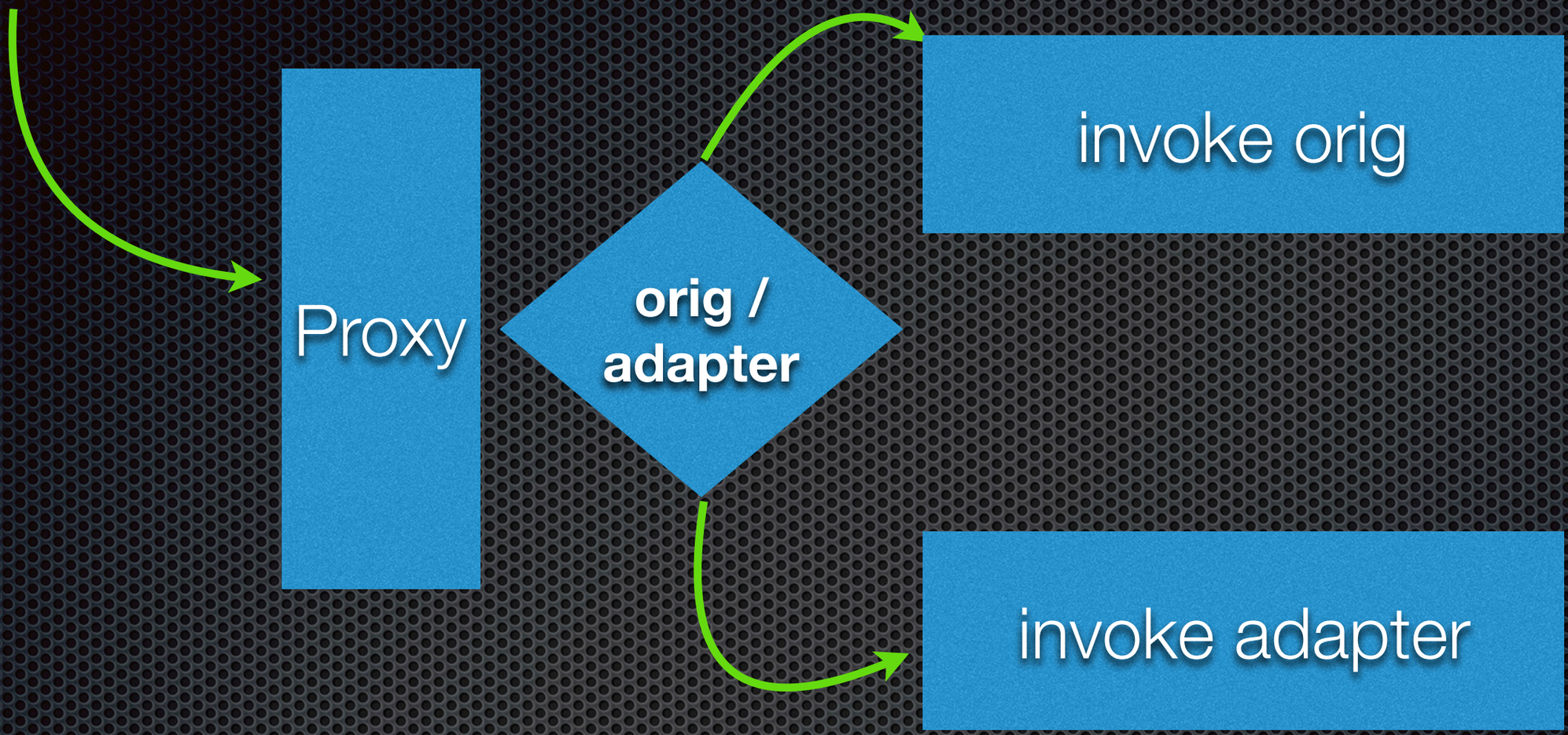
DynamicObjectAdapter - orig Version

@SvenRuppert



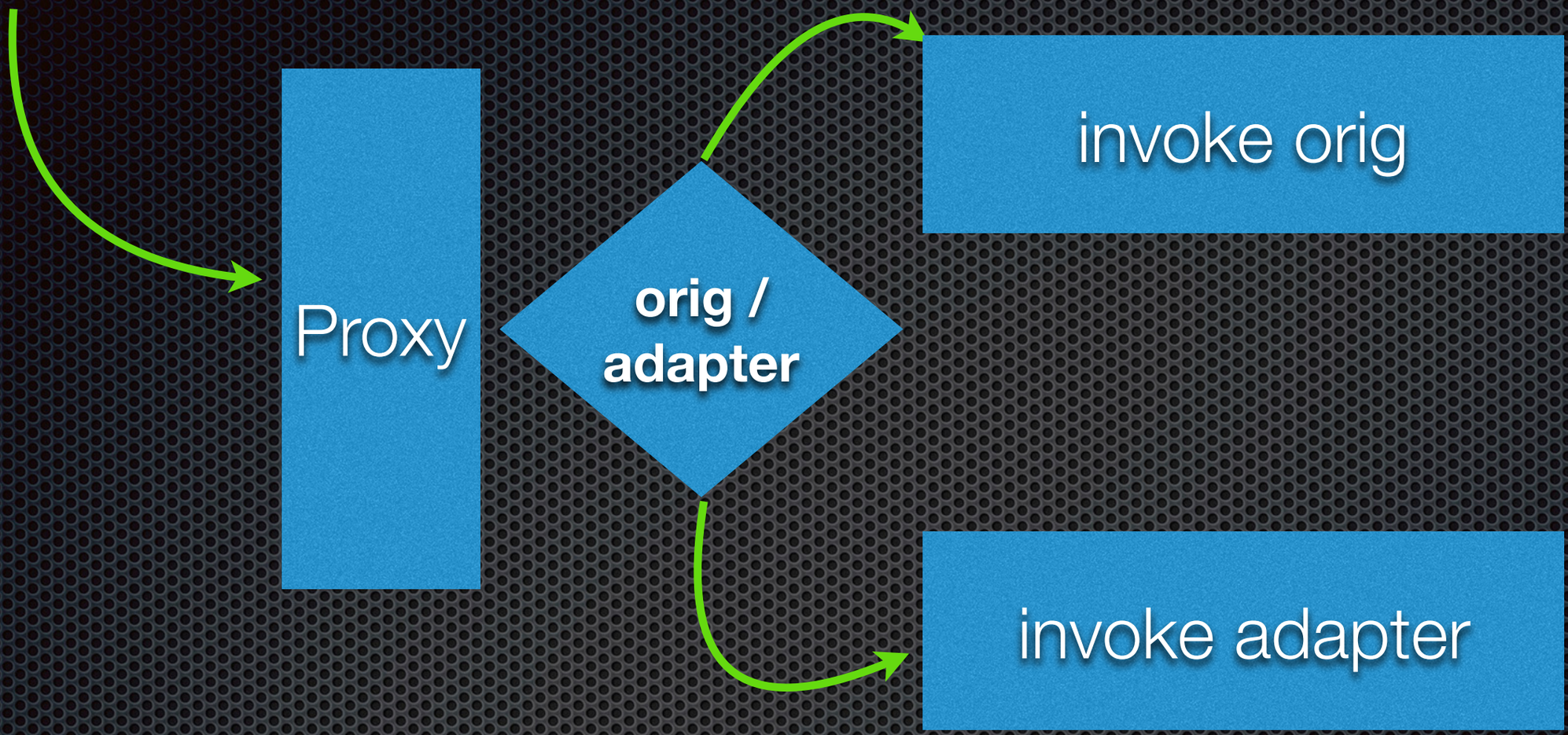
DynamicObjectAdapter - orig Version

@SvenRuppert



DynamicObjectAdapter - orig Version

@SvenRuppert



Goal: do not need to write an Adapter with Delegator

DynamicObjectAdapter - orig Version

core concept:
switching between method implementations

DynamicObjectAdapter - orig Version

core concept:
switching between method implementations

how to identify a method?

DynamicObjectAdapter - orig. Version


```
public interface Service {
  String doWork_A();
}

public static class ServiceImpl implements Service {
  public String doWork_A() {
    return ServiceImpl.class.getSimpleName();
  }
}
```

DynamicObjectAdapter - orig Version

how to identify a method?

```
public class MethodIdentifier {
    private final String name;
    private final Class[] parameters;

    public MethodIdentifier(Method m) {
        name = m.getName();
        parameters = m.getParameterTypes();
    }
     // we can save time by assuming that we only compare against
    // other MethodIdentifier objects
    public boolean equals(Object o) {
        MethodIdentifier mid = (MethodIdentifier) o;
        return name.equals(mid.name) &&
                Arrays.equals(parameters, mid.parameters);
    }
    public int hashCode() { return name.hashCode(); }
}
```

DynamicObjectAdapter - orig Version

@SvenRuppert

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DynamicObjectAdapter - orig. Version

@SvenRuppert

DynamicObjectAdapter - orig. Version

@SvenRuppert

```
private static class DOAInvocationHandler<T extends I, I> implements InvocationHandler {
```

DynamicObjectAdapter - orig. Version

@SvenRuppert

```
private static class DOAInvocationHandler<T extends I, I> implements InvocationHandler {
  private Map<MethodIdentifier, Method> adaptedMethods = new HashMap<>();
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DynamicObjectAdapter - orig. Version

@SvenRuppert

```
private static class DOAInvocationHandler<T extends I, I> implements InvocationHandler {
  private Map<MethodIdentifier, Method> adaptedMethods = new HashMap<>();
  private T original;
```

DynamicObjectAdapter - orig. Version

@SvenRuppert

```
private static class DOAInvocationHandler<T extends I, I> implements InvocationHandler {
  private Map<MethodIdentifier, Method> adaptedMethods = new HashMap<>();
  private T original;    private Object adapter;
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DynamicObjectAdapter - orig. Version

@SvenRuppert

```
private static class DOAInvocationHandler<T extends I, I> implements InvocationHandler {
  private Map<MethodIdentifier, Method> adaptedMethods = new HashMap<>();
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  private void addAdapter(Object adapter) {
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DynamicObjectAdapter - orig. Version

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DynamicObjectAdapter - orig. Version

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  private void addAdapter(Object adapter) {
     this.adapter = adapter;
     final Class<?> adapterClass = adapter.getClass();
```

DynamicObjectAdapter - orig. Version

@SvenRuppert

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     Method[] methods = adapterClass.getDeclaredMethods();
     for (Method m : methods) {
```

DynamicObjectAdapter - orig. Version

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  private void addAdapter(Object adapter) {
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     final Class<?> adapterClass = adapter.getClass();
     Method[] methods = adapterClass.getDeclaredMethods();
     for (Method m : methods) {
        final MethodIdentifier key = new MethodIdentifier(m);
```

DynamicObjectAdapter - orig. Version

@SvenRuppert

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  private void addAdapter(Object adapter) {
     this.adapter = adapter;
     final Class<?> adapterClass = adapter.getClass();
     Method[] methods = adapterClass.getDeclaredMethods();
     for (Method m : methods) {
      final MethodIdentifier key = new MethodIdentifier(m);
      adaptedMethods.put(key, m);
```

DynamicObjectAdapter - orig. Version

@SvenRuppert

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private static class DOAInvocationHandler<T extends I, I> implements InvocationHandler {
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@SvenRuppert

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public Object invoke(Object proxy, Method m, Object[] args) throws Throwable {
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@SvenRuppert

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     Method[] methods = adapterClass.getDeclaredMethods();
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        final MethodIdentifier key = new MethodIdentifier(m);
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    try {
      final MethodIdentifier key = new MethodIdentifier(m);



  }
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  public Object invoke(Object proxy, Method m, Object[] args) throws Throwable {
    try {
      final MethodIdentifier key = new MethodIdentifier(m);
      Method other = adaptedMethods.get(key);



  }
}
```

DynamicObjectAdapter - orig. Version

@SvenRuppert

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```
  public Object invoke(Object proxy, Method m, Object[] args) throws Throwable {
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       final MethodIdentifier key = new MethodIdentifier(m);
       Method other = adaptedMethods.get(key);
       if (other != null) { return other.invoke(adapter, args);  }


  }
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DynamicObjectAdapter - orig. Version

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       if (other != null) { return other.invoke(adapter, args);  }
       else               { return      m.invoke(original, args);   }

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DynamicObjectAdapter - orig. Version

@SvenRuppert

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      Method other = adaptedMethods.get(key);
      if (other != null) { return other.invoke(adapter, args);  }
      else               { return      m.invoke(original, args);   }
    } catch (InvocationTargetException e) { throw e.getTargetException(); }
  }
}
```

DynamicObjectAdapter - orig. Version

@SvenRuppert

```
private static class DOAInvocationHandler<T extends I, I> implements InvocationHandler {
  private Map<MethodIdentifier, Method> adaptedMethods = new HashMap<>();
  private T original;    private Object adapter;
  private void addAdapter(Object adapter) {
    //SNIPP
  }
```

what could be a problem ?

```
  public Object invoke(Object proxy, Method m, Object[] args) throws Throwable {
    try {
      final MethodIdentifier key = new MethodIdentifier(m);
      Method other = adaptedMethods.get(key);
      if (other != null) { return other.invoke(adapter, args);  }
      else               { return      m.invoke(original, args);   }
    } catch (InvocationTargetException e) { throw e.getTargetException(); }
  }
}
```

DynamicObjectAdapter - orig. Version

@SvenRuppert

```
private static class DOAInvocationHandler<T extends I, I> implements InvocationHandler {
  private Map<MethodIdentifier, Method> adaptedMethods = new HashMap<>();
  private T original;    private Object adapter;
  private void addAdapter(Object adapter) {
    //SNIPP
  }
```

what could be a problem ?

what could be improved ?

```
  public Object invoke(Object proxy, Method m, Object[] args) throws Throwable {
     try {
       final MethodIdentifier key = new MethodIdentifier(m);
       Method other = adaptedMethods.get(key);
       if (other != null) { return other.invoke(adapter, args);  }
       else               { return      m.invoke(original, args);   }
     } catch (InvocationTargetException e) { throw e.getTargetException(); }
  }
}
```

DynamicObjectAdapter - orig. Version

@SvenRuppert

```
private Map<MethodIdentifier, Method> adaptedMethods = new HashMap<>();

private T original;    private Object adapter;
private void addAdapter(Object adapter) {
```

what could be a problem ?

what could be improved ?

DynamicObjectAdapter - orig. Version

@SvenRuppert

```
private Map<MethodIdentifier, Method> adaptedMethods = new HashMap<>();

private T original;    private Object adapter;
private void addAdapter(Object adapter) {


    public interface Service {
      String doWork_A();
    }
```

what could be a problem ?

what could be improved ?

DynamicObjectAdapter - orig. Version

@SvenRuppert

```
private Map<MethodIdentifier, Method> adaptedMethods = new HashMap<>();

private T original;    private Object adapter;
private void addAdapter(Object adapter) {
```

what could be a problem ?

what could be improved ?

```
  public interface Service {
    String doWork_A();
  }

public class Adapter_A {
  public String doWork_A() { .. }
}
```

DynamicObjectAdapter - orig. Version

@SvenRuppert

```
private Map<MethodIdentifier, Method> adaptedMethods = new HashMap<>();

private T original;    private Object adapter;
private void addAdapter(Object adapter) {
```

what could be a problem ?

what could be improved ?

```
  public interface Service {
    String doWork_A();
  }
```

```
public class Adapter_A {
  public String doWork_A() { .. }
}
```

```
public class Adapter_B {
  public String doWork_B() { .. }
}
```

DynamicObjectAdapter - orig. Version

@SvenRuppert

```
private Map<MethodIdentifier, Method> adaptedMethods = new HashMap<>();

private T original;    private Object adapter;
private void addAdapter(Object adapter) {
```

what could be a problem ?

what could be improved ?

```
  public interface Service {
    String doWork_A();
  }
```

```
public class Adapter_A {
  public String doWork_A() { .. }
}
```

```
public class Adapter_B {
  public String doWork_B() { .. }
}
```

DynamicObjectAdapter - orig. Version

@SvenRuppert

```
private Map<MethodIdentifier, Method> adaptedMethods = new HashMap<>();

private T original;    private Object adapter;
private void addAdapter(Object adapter) {
```

what could be a problem ?

what could be improved ?

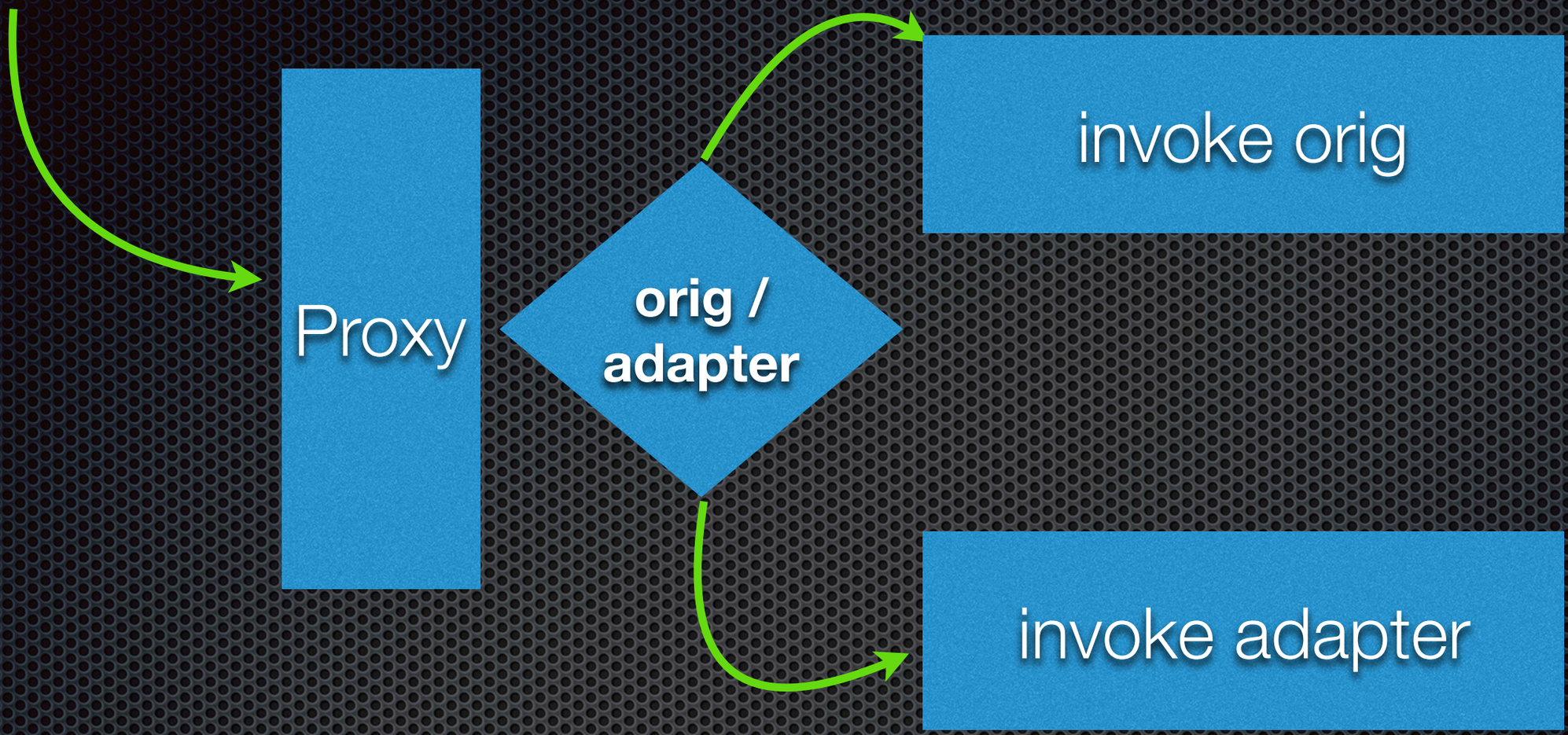
```
  public interface Service {
    String doWork_A();
  }
```

```
public class Adapter_A {
  public String doWork_A() { .. }
}
```

```
public class Adapter_B {
  public String doWork_B() { .. }
}
```

DynamicObjectAdapter - orig Version

@SvenRuppert



DynamicObjectAdapter - ext. Version

first extension !

DynamicObjectAdapter - ext. Version


```
public interface Service {
  String doWork_A(String txt);
  String doWork_B(String txt);
}

public static class ServiceImpl implements Service {

  public String doWork_A(String txt) {
    return "doWorkd_A_Original";
  }

  public String doWork_B(String txt) {
    return "doWorkd_B_Original";
  }
}
```

DynamicObjectAdapter - ext. Version


```
public interface Service {
  String doWork_A(String txt);
  String doWork_B(String txt);
}
```

```
public interface ServiceAdapter_A {
  String doWork_A(String txt);
}

public interface ServiceAdapter_B {
  String doWork_B(String txt);
}
```

DynamicObjectAdapter - ext. Version


```
public interface Service {
  String doWork_A(String txt);
  String doWork_B(String txt);
}
```

```
public interface ServiceAdapter_A {
  String doWork_A(String txt);
}

public interface ServiceAdapter_B {
  String doWork_B(String txt);
}
```

DynamicObjectAdapter - ext. Version

@SvenRuppert

```
public interface Service {
  String doWork_A(String txt);
  String doWork_B(String txt);
}
```

functional interface

```
public interface ServiceAdapter_A {
  String doWork_A(String txt);
}

public interface ServiceAdapter_B {
  String doWork_B(String txt);
}
```

DynamicObjectAdapter - ext. Version


```
public interface Service {
  String doWork_A(String txt);
  String doWork_B(String txt);
}
```

functional interface

```
public interface ServiceAdapter_A {
  String doWork_A(String txt);
}

public interface ServiceAdapter_B {
  String doWork_B(String txt);
}
```

DynamicObjectAdapter - ext. Version

@SvenRuppert

```
public interface Service {
  String doWork_A(String txt);
  String doWork_B(String txt);
}
```

functional interface

```
public interface ServiceAdapter_A {
  String doWork_A(String txt);
}
```

functional interface

```
public interface ServiceAdapter_B {
  String doWork_B(String txt);
}
```

DynamicObjectAdapter - ext. Version

@SvenRuppert

```
private Map<MethodIdentifier, Method> adaptedMethods = new HashMap<>();
private Map<MethodIdentifier, Object> adapters = new HashMap<>();

private T original;
private Class<T> target;
```

DynamicObjectAdapter - ext. Version

@SvenRuppert

```
private Map<MethodIdentifier, Method> adaptedMethods = new HashMap<>();
private Map<MethodIdentifier, Object> adapters = new HashMap<>();

private T original;
private Class<T> target;

private void addAdapter(Object adapter) {
```

DynamicObjectAdapter - ext. Version

@SvenRuppert

```
private Map<MethodIdentifier, Method> adaptedMethods = new HashMap<>();
private Map<MethodIdentifier, Object> adapters = new HashMap<>();

private T original;
private Class<T> target;

private void addAdapter(Object adapter) {
  final Class<?> adapterClass = adapter.getClass();
```

DynamicObjectAdapter - ext. Version

@SvenRuppert

```
private Map<MethodIdentifier, Method> adaptedMethods = new HashMap<>();
private Map<MethodIdentifier, Object> adapters = new HashMap<>();

private T original;
private Class<T> target;

private void addAdapter(Object adapter) {
  final Class<?> adapterClass = adapter.getClass();
Method[] methods = adapterClass.getDeclaredMethods();
```

DynamicObjectAdapter - ext. Version

@SvenRuppert

```
private Map<MethodIdentifier, Method> adaptedMethods = new HashMap<>();
private Map<MethodIdentifier, Object> adapters = new HashMap<>();

private T original;
private Class<T> target;

private void addAdapter(Object adapter) {
  final Class<?> adapterClass = adapter.getClass();
  Method[] methods = adapterClass.getDeclaredMethods();
  for (Method m : methods) {
```

DynamicObjectAdapter - ext. Version

@SvenRuppert

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private Map<MethodIdentifier, Method> adaptedMethods = new HashMap<>();
private Map<MethodIdentifier, Object> adapters = new HashMap<>();

private T original;
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private void addAdapter(Object adapter) {
  final Class<?> adapterClass = adapter.getClass();
  Method[] methods = adapterClass.getDeclaredMethods();
  for (Method m : methods) {
    final MethodIdentifier key = new MethodIdentifier(m);
```

DynamicObjectAdapter - ext. Version

@SvenRuppert

```
private Map<MethodIdentifier, Method> adaptedMethods = new HashMap<>();
private Map<MethodIdentifier, Object> adapters = new HashMap<>();

private T original;
private Class<T> target;

private void addAdapter(Object adapter) {
  final Class<?> adapterClass = adapter.getClass();
  Method[] methods = adapterClass.getDeclaredMethods();
  for (Method m : methods) {
    final MethodIdentifier key = new MethodIdentifier(m);
    adaptedMethods.put(key, m);
```

DynamicObjectAdapter - ext. Version

@SvenRuppert

```
private Map<MethodIdentifier, Method> adaptedMethods = new HashMap<>();
private Map<MethodIdentifier, Object> adapters = new HashMap<>();

private T original;
private Class<T> target;

private void addAdapter(Object adapter) {
  final Class<?> adapterClass = adapter.getClass();
  Method[] methods = adapterClass.getDeclaredMethods();
  for (Method m : methods) {
    final MethodIdentifier key = new MethodIdentifier(m);
    adaptedMethods.put(key, m);
    adapters.put(key, adapter);
```

DynamicObjectAdapter - ext. Version

@SvenRuppert

```
private Map<MethodIdentifier, Method> adaptedMethods = new HashMap<>();
private Map<MethodIdentifier, Object> adapters = new HashMap<>();

private T original;
private Class<T> target;

private void addAdapter(Object adapter) {
  final Class<?> adapterClass = adapter.getClass();
  Method[] methods = adapterClass.getDeclaredMethods();
  for (Method m : methods) {
    final MethodIdentifier key = new MethodIdentifier(m);
    adaptedMethods.put(key, m);
    adapters.put(key, adapter);
  }
}
```

DynamicObjectAdapter - ext. Version

@SvenRuppert

```
private Map<MethodIdentifier, Method> adaptedMethods = new HashMap<>();
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DynamicObjectAdapter - ext. Version

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private Map<MethodIdentifier, Method> adaptedMethods = new HashMap<>();
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public Object invoke(Object proxy, Method method, Object[] args) throws Throwable {
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DynamicObjectAdapter - ext. Version

@SvenRuppert

```
private Map<MethodIdentifier, Method> adaptedMethods = new HashMap<>();
private Map<MethodIdentifier, Object> adapters = new HashMap<>();

private T original;
private Class<T> target;

public Object invoke(Object proxy, Method method, Object[] args) throws Throwable {
try {
final MethodIdentifier key = new MethodIdentifier(method);
Method other = adaptedMethods.get(key);
```

DynamicObjectAdapter - ext. Version

@SvenRuppert

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private Map<MethodIdentifier, Method> adaptedMethods = new HashMap<>();
private Map<MethodIdentifier, Object> adapters = new HashMap<>();

private T original;
private Class<T> target;

public Object invoke(Object proxy, Method method, Object[] args) throws Throwable {
try {
final MethodIdentifier key = new MethodIdentifier(method);
Method other = adaptedMethods.get(key);

if (other != null) {
  return other.invoke(adapters.get(key), args);
 } else {
  return method.invoke(original, args);
 }
```

DynamicObjectAdapter - ext. Version

@SvenRuppert

```
private Map<MethodIdentifier, Method> adaptedMethods = new HashMap<>();
private Map<MethodIdentifier, Object> adapters = new HashMap<>();

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try {
  final MethodIdentifier key = new MethodIdentifier(method);
  Method other = adaptedMethods.get(key);

  if (other != null) {
    return other.invoke(adapters.get(key), args);
   } else {
    return method.invoke(original, args);
   }
  } catch (InvocationTargetException e) {
   throw e.getTargetException();
  }
 }
```

DynamicObjectAdapter - ext. Version

@SvenRuppert

```
private Map<MethodIdentifier, Method> adaptedMethods = new HashMap<>();
private Map<MethodIdentifier, Object> adapters = new HashMap<>();

private T original;
private Class<T> target;
```

if you will use this without a Builder

you can add useless Adapter !!

DynamicObjectAdapter - ext. Version

@SvenRuppert

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private Map<MethodIdentifier, Method> adaptedMethods = new HashMap<>();
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```

if you will use this without a Builder

you can add useless Adapter !!

Add some typed with-Methods

DynamicObjectAdapter - orig Version

@SvenRuppert

Add some typed with-Methods

```
public AdapterBuilder<T> withDoWork_A(ServiceAdapter_A adapter) {
  addAdapter(adapter);
  return this;
}
```

DynamicObjectAdapter - orig Version

@SvenRuppert

Add some typed with-Methods

```
public AdapterBuilder<T> withDoWork_A(ServiceAdapter_A adapter) {
  addAdapter(adapter);
  return this;
}
```

remember

DynamicObjectAdapter - orig Version

@SvenRuppert

Add some typed with-Methods

```
public AdapterBuilder<T> withDoWork_A(ServiceAdapter_A adapter) {
  addAdapter(adapter);
  return this;
}
```

remember

```
public interface Service {
  String doWork_A(String txt);
  String doWork_B(String txt);
}
```

DynamicObjectAdapter - orig Version

@SvenRuppert

Add some typed with-Methods

```
public AdapterBuilder<T> withDoWork_A(ServiceAdapter_A adapter) {
  addAdapter(adapter);
  return this;
}
```

remember

```
public interface Service {
  String doWork_A(String txt);
  String doWork_B(String txt);
}

public interface ServiceAdapter_A {
  String doWork_A(String txt);
}
```

DynamicObjectAdapter - orig Version

How to use this?

DynamicObjectAdapter - orig Version

How to use this?

```
Service service = AdapterBuilder.<Service>newBuilder()
```

DynamicObjectAdapter - orig Version

@SvenRuppert

How to use this?

```
Service service = AdapterBuilder.<Service>newBuilder()
        .withTarget(Service.class)
```

DynamicObjectAdapter - orig Version

How to use this?

```
Service service = AdapterBuilder.<Service>newBuilder()
        .withTarget(Service.class)
        .withOriginal(new ServiceImpl())
```

DynamicObjectAdapter - orig Version

How to use this?

```
Service service = AdapterBuilder.<Service>newBuilder()
        .withTarget(Service.class)
        .withOriginal(new ServiceImpl())
        .withDoWork_A((txt) -> txt + "_part")
```

DynamicObjectAdapter - orig Version

How to use this?

```
Service service = AdapterBuilder.<Service>newBuilder()
        .withTarget(Service.class)
        .withOriginal(new ServiceImpl())
        .withDoWork_A((txt) -> txt + "_part")
        .build();
```

DynamicObjectAdapter - orig Version

How to use this like a mock ?

DynamicObjectAdapter - orig Version

@SvenRuppert

How to use this like a mock ?

```
Service service = AdapterBuilder.<Service>newBuilder()
```

DynamicObjectAdapter - orig Version

@SvenRuppert

How to use this like a mock ?

```
Service service = AdapterBuilder.<Service>newBuilder()
        .withTarget(Service.class)
```

DynamicObjectAdapter - orig Version

@SvenRuppert

How to use this like a mock ?

```
Service service = AdapterBuilder.<Service>newBuilder()
        .withTarget(Service.class)
        .withOriginal(null)
```

DynamicObjectAdapter - orig Version

@SvenRuppert

How to use this like a mock ?

```
Service service = AdapterBuilder.<Service>newBuilder()
        .withTarget(Service.class)
        .withOriginal(null)
        .withDoWork_A((txt) -> txt + "_part")
```

DynamicObjectAdapter - orig Version

@SvenRuppert

How to use this like a mock ?

```
Service service = AdapterBuilder.<Service>newBuilder()
        .withTarget(Service.class)
        .withOriginal(null)
        .withDoWork_A((txt) -> txt + "_part")
        .build();
```

generated DynamicObjectAdapterBuilder @SvenRuppert

To much boring code to write

but we want to have a type-safe version

if wrong... compile must break

generated DynamicObjectAdapterBuilder @SvenRuppert

To much boring code to write

but we want to have a type-safe version

if wrong... compile must break

What could we change now ?

generated DynamicObjectAdapterBuilder @SvenRuppert

remember

generated DynamicObjectAdapterBuilder @SvenRuppert

remember

```
public interface Service {
  String doWork_A(String txt);
  String doWork_B(String txt);
}
```

generated DynamicObjectAdapterBuilder @SvenRuppert

remember

```
public interface Service {
  String doWork_A(String txt);
  String doWork_B(String txt);
}

public interface ServiceAdapter_A {
  String doWork_A(String txt);
}

public interface ServiceAdapter_B {
  String doWork_B(String txt);
}
```

generated DynamicObjectAdapterBuilder @SvenRuppert

remember

```
public interface Service {
  String doWork_A(String txt);
  String doWork_B(String txt);
}

public interface ServiceAdapter_A {
  String doWork_A(String txt);
}

public interface ServiceAdapter_B {
  String doWork_B(String txt);
}
```

generated DynamicObjectAdapterBuilder @SvenRuppert

remember

```
public interface Service {
  String doWork_A(String txt);
  String doWork_B(String txt);
 }
public interface ServiceAdapter_A {
  String doWork_A(String txt);
}

public interface ServiceAdapter_B {
  String doWork_B(String txt);
}
```

functional interface

generated DynamicObjectAdapterBuilder @SvenRuppert

use Annotation Processing

generated DynamicObjectAdapterBuilder @SvenRuppert

use Annotation Processing

create a marker like
@DynamicObjectAdapterBuilder

generated DynamicObjectAdapterBuilder @SvenRuppert

use Annotation Processing

create a marker like
@DynamicObjectAdapterBuilder

```
@Retention(RetentionPolicy.SOURCE)
@Target(ElementType.TYPE)
public @interface DynamicObjectAdapterBuilder {
}
```

generated DynamicObjectAdapterBuilder @SvenRuppert

use Annotation Processing

create a marker like
@DynamicObjectAdapterBuilder

```
@Retention(RetentionPolicy.SOURCE)
@Target(ElementType.TYPE)
public @interface DynamicObjectAdapterBuilder {
}
```

```
public class AnnotationProcessor extends AbstractProcessor
```

generated DynamicObjectAdapterBuilder @SvenRuppert

use Annotation Processing

with every compile you will get actual

generated DynamicObjectAdapterBuilder @SvenRuppert

use Annotation Processing

with every compile you will get actual

Functional-Interfaces for the Adapters

generated DynamicObjectAdapterBuilder @SvenRuppert

use Annotation Processing

with every compile you will get actual

Functional-Interfaces for the Adapters

generated AdapterBuilder

StaticObjectAdapter

to avoid the latency of the dynamic Proxy

we could implement **static ObjectAdapter**

the basic idea is the same as we had
with the **DynamicObjectAdapter**

StaticObjectAdapter

@SvenRuppert

split the interface into Functional Interfaces

create for every Functional Interface an attribute

at runtime: if an attribute

is available invoke the method .....

otherwise use the delegator

StaticObjectAdapter

@SvenRuppert

```
public interface Service {
  String doWorkA(String txt);
  String doWorkB(String txt);
}
```

StaticObjectAdapter

@SvenRuppert

```
public interface Service {
  String doWorkA(String txt);
  String doWorkB(String txt);
}
```

```
public interface Service_DoWorkA_Adapter{
  String doWorkA(final String txt);
}
public interface Service_DoWorkB_Adapter{
  String doWorkB(final String txt);
}
```

StaticObjectAdapter


```
public interface Service {
  String doWorkA(String txt);
  String doWorkB(String txt);
}
```

```
public interface Service_DoWorkA_Adapter{
  String doWorkA(final String txt);
}
public interface Service_DoWorkB_Adapter{
  String doWorkB(final String txt);
}
```

StaticObjectAdapter

@SvenRuppert

```
public interface Service {
  String doWorkA(String txt);
  String doWorkB(String txt);
}
```

functional interface

```
public interface Service_DoWorkA_Adapter{
  String doWorkA(final String txt);
}
public interface Service_DoWorkB_Adapter{
  String doWorkB(final String txt);
}
```

StaticObjectAdapter

@SvenRuppert

StaticObjectAdapter

@SvenRuppert

```
public class ServiceStaticObjectAdapter implements Service {
```

StaticObjectAdapter


```
public class ServiceStaticObjectAdapter implements Service {
  private Service service;
```

StaticObjectAdapter


```
public class ServiceStaticObjectAdapter implements Service {

  private Service service;
  private Service_DoWorkA_Adapter doWorkAAdapter;
```

StaticObjectAdapter


```
public class ServiceStaticObjectAdapter implements Service {

  private Service service;
  private Service_DoWorkA_Adapter doWorkAAdapter;
  private Service_DoWorkB_Adapter doWorkBAdapter;
```

StaticObjectAdapter


```
public class ServiceStaticObjectAdapter implements Service {

  private Service service;
  private Service_DoWorkA_Adapter doWorkAAdapter;
  private Service_DoWorkB_Adapter doWorkBAdapter;

  public String doWorkA(final String txt) {


  }
```

StaticObjectAdapter

@SvenRuppert

```
public class ServiceStaticObjectAdapter implements Service {

  private Service service;
  private Service_DoWorkA_Adapter doWorkAAdapter;
  private Service_DoWorkB_Adapter doWorkBAdapter;

  public String doWorkA(final String txt) {
    if (this.doWorkAAdapter != null)

  }
```

StaticObjectAdapter


```
public class ServiceStaticObjectAdapter implements Service {

  private Service service;
  private Service_DoWorkA_Adapter doWorkAAdapter;
  private Service_DoWorkB_Adapter doWorkBAdapter;

  public String doWorkA(final String txt) {
    if (this.doWorkAAdapter != null)    return this.doWorkAAdapter.doWorkA(txt);

  }
```

StaticObjectAdapter

@SvenRuppert

```
public class ServiceStaticObjectAdapter implements Service {

  private Service service;
  private Service_DoWorkA_Adapter doWorkAAdapter;
  private Service_DoWorkB_Adapter doWorkBAdapter;

  public String doWorkA(final String txt) {
    if (this.doWorkAAdapter != null)    return this.doWorkAAdapter.doWorkA(txt);
                                        return service.doWorkA(txt)
  }
```

StaticObjectAdapter


```
public class ServiceStaticObjectAdapter implements Service {

  private Service service;
  private Service_DoWorkA_Adapter doWorkAAdapter;
  private Service_DoWorkB_Adapter doWorkBAdapter;

  public String doWorkA(final String txt) {
    if (this.doWorkAAdapter != null)    return this.doWorkAAdapter.doWorkA(txt);
                                        return service.doWorkA(txt)
  }
```

We can generate this !

generated StaticObjectAdapter

@SvenRuppert

with AnnotationProcessing

split the interface with **@StaticObjectAdapter**

write functional interfaces

generate the StaticObjectAdapter

mark the Adapter with **@IsObjectAdapter**

prepare for.....

Proxy Deep Dive - StaticVirtualProxy - at Runtime

some words about :
how it works..and what you can do with this..

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generate Static Proxies at Runtime

@SvenRuppert

this is based on the
Newsletter Nr **180** and Nr **181**
from **Dr. Heinz Kabutz**

http://www.javaspecialists.eu/archive/Issue180.html

http://www.javaspecialists.eu/archive/Issue181.html

generate Static Proxies at Runtime

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questions are:

generate Static Proxies at Runtime

@SvenRuppert

questions are:

How to compile In-Memory ?

generate Static Proxies at Runtime

@SvenRuppert

questions are:

How to compile In-Memory ?
What is the right ClassLoader ?

generate Static Proxies at Runtime

@SvenRuppert

How to compile In-Memory ?

generate Static Proxies at Runtime

@SvenRuppert

How to compile In-Memory ?

you will need the **JavaCompiler** from tools.jar

generate Static Proxies at Runtime

@SvenRuppert

How to compile In-Memory ?

you will need the **JavaCompiler** from tools.jar

a holder for the SourceCode

generate Static Proxies at Runtime

@SvenRuppert

How to compile In-Memory ?

you will need the **JavaCompiler** from tools.jar

a holder for the SourceCode

```
public class GeneratedJavaSourceFile extends SimpleJavaFileObject {

  private CharSequence javaSource;


  public GeneratedJavaSourceFile(String className, CharSequence javaSource) {
    super(URI.create(className + ".java"), Kind.SOURCE);
    this.javaSource = javaSource;
  }

  public CharSequence getCharContent(boolean ignoreEncodeErrors)
      throws IOException {
    return javaSource;
  }
}
```

generate Static Proxies at Runtime

@SvenRuppert

How to compile In-Memory ?

you will need the **JavaCompiler** from tools.jar

a holder for the SourceCode

```
public class GeneratedJavaSourceFile extends SimpleJavaFileObject {

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generate Static Proxies at Runtime

@SvenRuppert

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    return javaSource;
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}
```

generate Static Proxies at Runtime

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How to compile In-Memory ?

you will need the **JavaCompiler** from tools.jar

a holder for the SourceCode

```
public class GeneratedJavaSourceFile extends SimpleJavaFileObject {

  private CharSequence javaSource;

  public GeneratedJavaSourceFile(String className, CharSequence javaSource) {
    super(URI.create(className + ".java"), Kind.SOURCE);
    this.javaSource = javaSource;
  }

  public CharSequence getCharContent(boolean ignoreEncodeErrors)
      throws IOException {
    return javaSource;
  }
}
```

the generated source code

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How to compile In-Memory ?

a holder for the ByteCode

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How to compile In-Memory ?

a holder for the ByteCode

```
public class GeneratedClassFile extends SimpleJavaFileObject {
  private final ByteArrayOutputStream outputStream = new ByteArrayOutputStream();
  public GeneratedClassFile() {
    super(URI.create("generated.class"), Kind.CLASS);
  }

  public OutputStream openOutputStream() {
    return outputStream;
  }

  public byte[] getClassAsBytes() {
    return outputStream.toByteArray();
  }
}
```

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How to compile In-Memory ?

a ForwardingJavaFileManager

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How to compile In-Memory ?

a ForwardingJavaFileManager

```
public class GeneratingJavaFileManager
             extends ForwardingJavaFileManager<JavaFileManager> {

private final GeneratedClassFile gcf;

  public GeneratingJavaFileManager(
               StandardJavaFileManager sjfm,
               GeneratedClassFile gcf) {
    super(sjfm);
    this.gcf = gcf;
  }
  public JavaFileObject getJavaFileForOutput(
                          Location location, String className,
                          JavaFileObject.Kind kind, FileObject sibling)
      throws IOException {
    return gcf;
  }
}
```

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will force the JavaCompiler to write to this instance

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How to compile In-Memory ?

the compile task itself

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How to compile In-Memory ?

the compile task itself

```
GeneratedJavaSourceFile gjsf = new GeneratedJavaSourceFile(className, javaSource);
```

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How to compile In-Memory ?

the compile task itself

```
GeneratedJavaSourceFile gjsf = new GeneratedJavaSourceFile(className, javaSource);

DiagnosticCollector<JavaFileObject> dc = new DiagnosticCollector<>();
```

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How to compile In-Memory ?

the compile task itself

```
GeneratedJavaSourceFile gjsf = new GeneratedJavaSourceFile(className, javaSource);
DiagnosticCollector<JavaFileObject> dc = new DiagnosticCollector<>();
JavaCompiler jc = ToolProvider.getSystemJavaCompiler();
```

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How to compile In-Memory ?

the compile task itself

```
GeneratedJavaSourceFile gjsf = new GeneratedJavaSourceFile(className, javaSource);
DiagnosticCollector<JavaFileObject> dc = new DiagnosticCollector<>();
JavaCompiler jc = ToolProvider.getSystemJavaCompiler();
StandardJavaFileManager stdFileManager  = jc.getStandardFileManager(dc, null, null);
```

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```
GeneratedJavaSourceFile gjsf = new GeneratedJavaSourceFile(className, javaSource);

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JavaCompiler jc = ToolProvider.getSystemJavaCompiler();

StandardJavaFileManager stdFileManager  = jc.getStandardFileManager(dc, null, null);

GeneratedClassFile gcf = new GeneratedClassFile();

GeneratingJavaFileManager fileManager
                                = new GeneratingJavaFileManager(stdFileManager, gcf);
```

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JavaCompiler jc = ToolProvider.getSystemJavaCompiler();

StandardJavaFileManager stdFileManager  = jc.getStandardFileManager(dc, null, null);

GeneratedClassFile gcf = new GeneratedClassFile();

GeneratingJavaFileManager fileManager
                              = new GeneratingJavaFileManager(stdFileManager, gcf);


JavaCompiler.CompilationTask task
                          = jc.getTask(null, fileManager, dc, null, null, singletonList(gjsf));
```

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How to compile In-Memory ?

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                              = new GeneratingJavaFileManager(stdFileManager, gcf);


JavaCompiler.CompilationTask task
                          = jc.getTask(null, fileManager, dc, null, null, singletonList(gjsf));

return task.call();
```

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What is the right ClassLoader ?

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What is the right ClassLoader ?

could be: **public Unsafe.defineClass()**

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could be: **public Unsafe.defineClass()**

or: **private static Proxy.defineClass0()**

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could be: **public** **Unsafe.defineClass()**

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both versions are depending on the selected JVM

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but this solution will have no roundtrip over the hard disc

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What is the right ClassLoader ?

could be: **public** **Unsafe.defineClass()**

or: **private static** **Proxy.defineClass0()**

both versions are depending on the selected JVM

but this solution will have
no roundtrip over the hard disc

will create and compile
Proxies at runtime

prepare for.....

Proxy Deep Dive - Summary

what we reached, what we could do now

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Summary

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we got type-safe ProxyBuilder

..type-safe generated DynamicObjectAdapter

..at runtime we could change the chain of Proxies

..could be used for
(Dynamic)
Dependency Injection Implementations

Summary

If you are interested....

have a look at **GITHUB**

ProxyBuilder

Dynamic-Dependency-Injection

Java-Microservice

or contact me ;-) @SvenRuppert

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Thank You !!!

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