

# *Exploring RxJava*

Jake Wharton





# *Exploring RxJava 2*

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# Why Reactive?

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system synchronously...

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Unless you can model your entire system synchronously, a single asynchronous source breaks imperative programming.

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interface UserManager {  
    User getUser();  
}
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```
interface UserManager {  
    User getUser();  
    void setName(String name);  
    void setAge(int age);  
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UserManager um = new UserManager();
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um.setName("Jane Doe");
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```

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interface UserManager {  
    User getUser();  
    void setName(String name); // <-- now async  
    void setAge(int age); // <-- now async  
}
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um.setName("Jane Doe");  
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# Why Reactive?

```
interface UserManager {  
    User getUser();  
    void setName(String name, Runnable callback);  
    void setAge(int age, Runnable callback);  
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}
```

```
UserManager um = new UserManager();  
System.out.println(um.getUser());
```

```
um.setName("Jane Doe", new Runnable() {  
    @Override public void run() {  
        System.out.println(um.getUser());  
    }  
});
```



# Why Reactive?

```
interface UserManager {  
    User getUser();  
    void setName(String name, Listener listener);  
    void setAge(int age, Listener listener);  
  
    interface Listener {  
        void success(User user);  
        void failure(IOException e);  
    }  
}
```

# Why Reactive?

```
UserManager um = new UserManager();  
System.out.println(um.getUser());  
  
um.setName("Jane Doe");
```

# Why Reactive?

```
UserManager um = new UserManager();  
System.out.println(um.getUser());  
  
um.setName("Jane Doe", new UserManager.Listener() {  
    @Override public void success() {  
        System.out.println(um.getUser());  
    }  
  
    @Override public void failure(IOException e) {  
        // TODO show the error...  
    }  
});
```



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```
UserManager um = new UserManager();
System.out.println(um.getUser());

um.setName("Jane Doe", new UserManager.Listener() {
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    }
    @Override public void failure(IOException e) {
        // TODO show the error...
    }
});

um.setAge(40, new UserManager.Listener() {
    @Override public void success() {
        System.out.println(um.getUser());
    }
    @Override public void failure(IOException e) {
        // TODO show the error...
    }
});
```

# Why Reactive?

```
UserManager um = new UserManager();
System.out.println(um.getUser());

um.setName("Jane Doe", new UserManager.Listener() {
    @Override public void success() {
        System.out.println(um.getUser());
    }

    um.setAge(40, new UserManager.Listener() {
        @Override public void success() {
            System.out.println(um.getUser());
        }
        @Override public void failure(IOException e) {
            // TODO show the error...
        }
    });
});

@Override public void failure(IOException e) {
    // TODO show the error...
}
});
```

# Why Reactive?

```
public final class UserActivity extends Activity {
    private final UserManager um = new UserManager();

    @Override protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);

        setContentView(R.layout.user);
        TextView tv = (TextView) findViewById(R.id.user_name);
        tv.setText(um.getUser().toString());

        um.setName("Jane Doe", new UserManager.Listener() {
            @Override public void success() {
                tv.setText(um.getUser().toString());
            }
            @Override public void failure(IOException e) {
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        TextView tv = (TextView) findViewById(R.id.user_name);
        tv.setText(um.getUser().toString());

        um.setName("Jane Doe", new UserManager.Listener() {
            @Override public void success() {
                if (isDestroyed()) {
                    tv.setText(um.getUser().toString());
                }
            }
            @Override public void failure(IOException e) {
                // TODO show the error...
            }
        });
    }
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    private final UserManager um = new UserManager();

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        setContentView(R.layout.user);
        TextView tv = (TextView) findViewById(R.id.user_name);
        tv.setText(um.getUser().toString());

        um.setName("Jane Doe", new UserManager.Listener() {
            @Override public void success() {
                runOnUiThread(new Runnable() {
                    @Override public void run() {
                        if (isDestroyed()) {
                            tv.setText(um.getUser().toString());
                        }
                    }
                });
            }
            @Override public void failure(IOException e) {
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                    @Override public void run() {
                        if (isDestroyed()) {
                            tv.setText(um.getUser().toString());
                        }
                    }
                });
            }
            @Override public void failure(IOException e) {
                // TODO show the error...
            }
        });
    }
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```

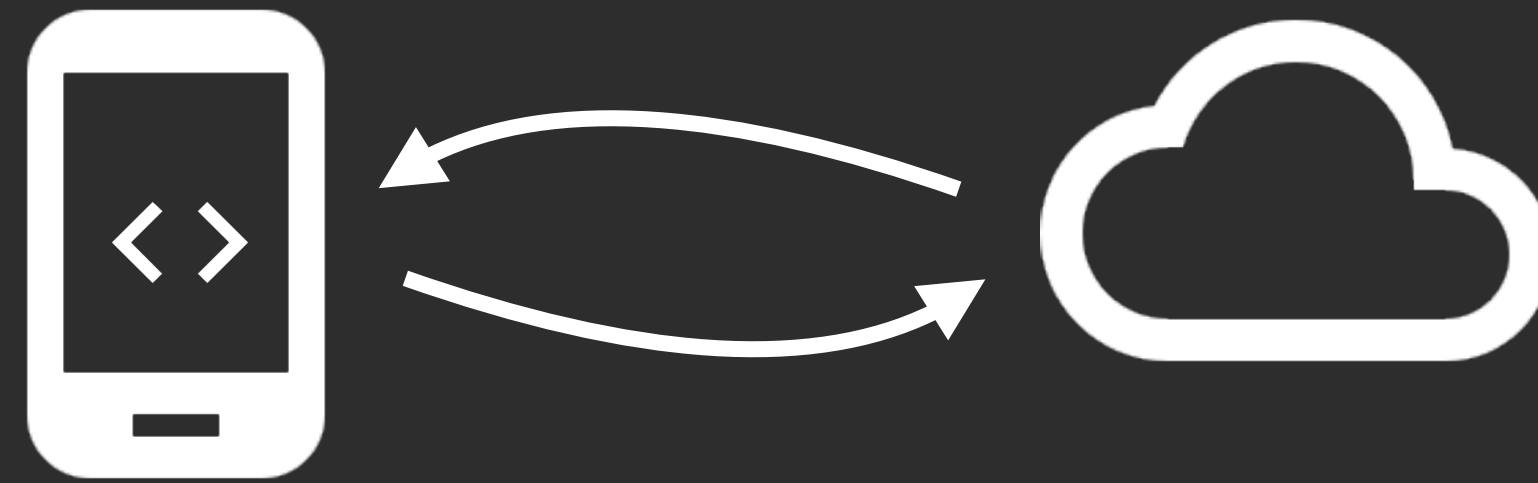
# Why Reactive?



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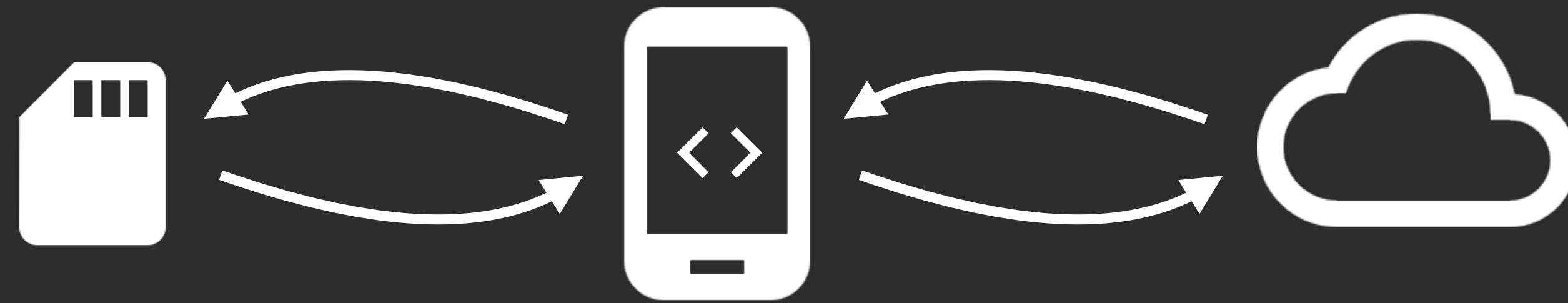


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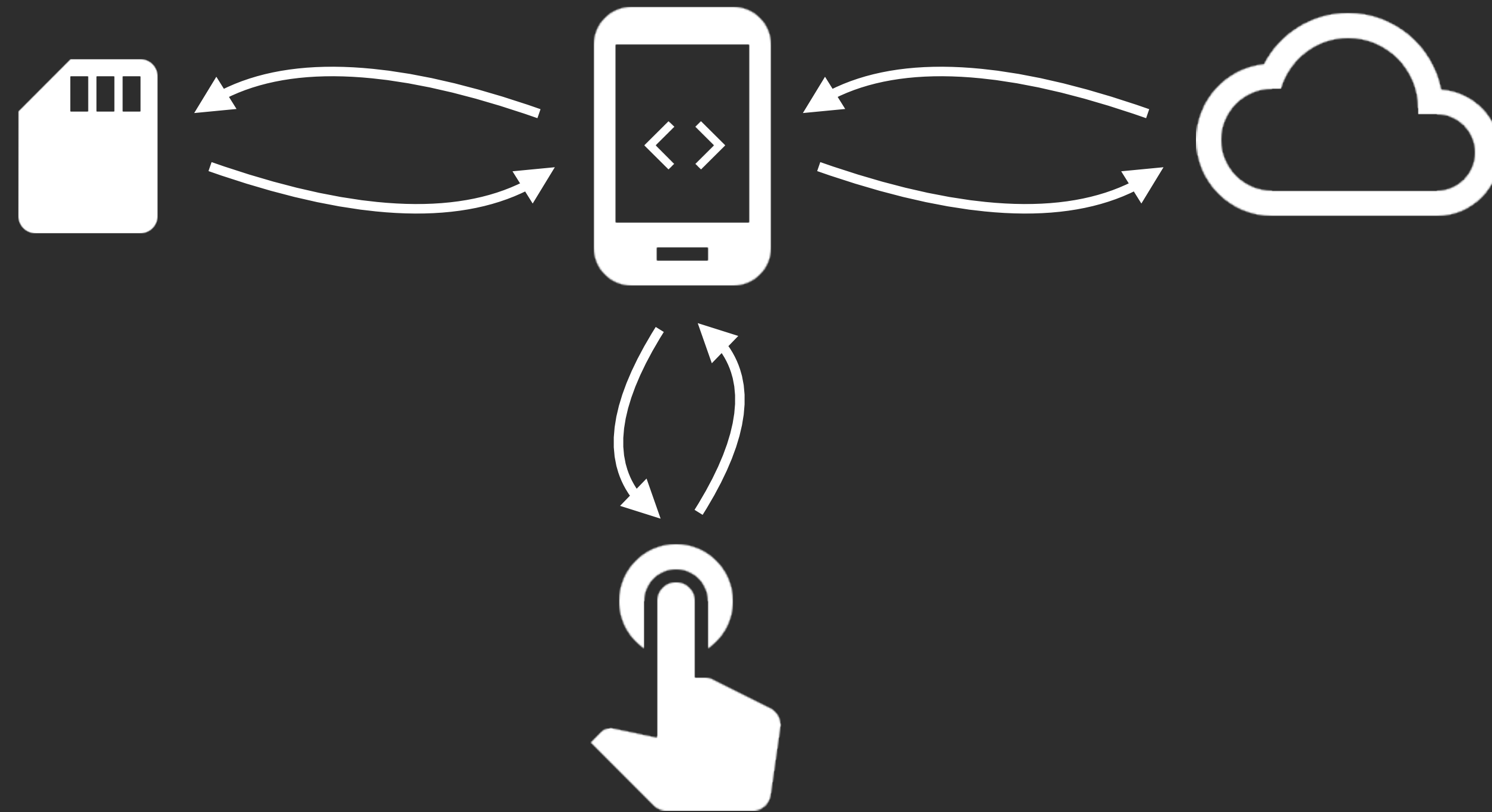




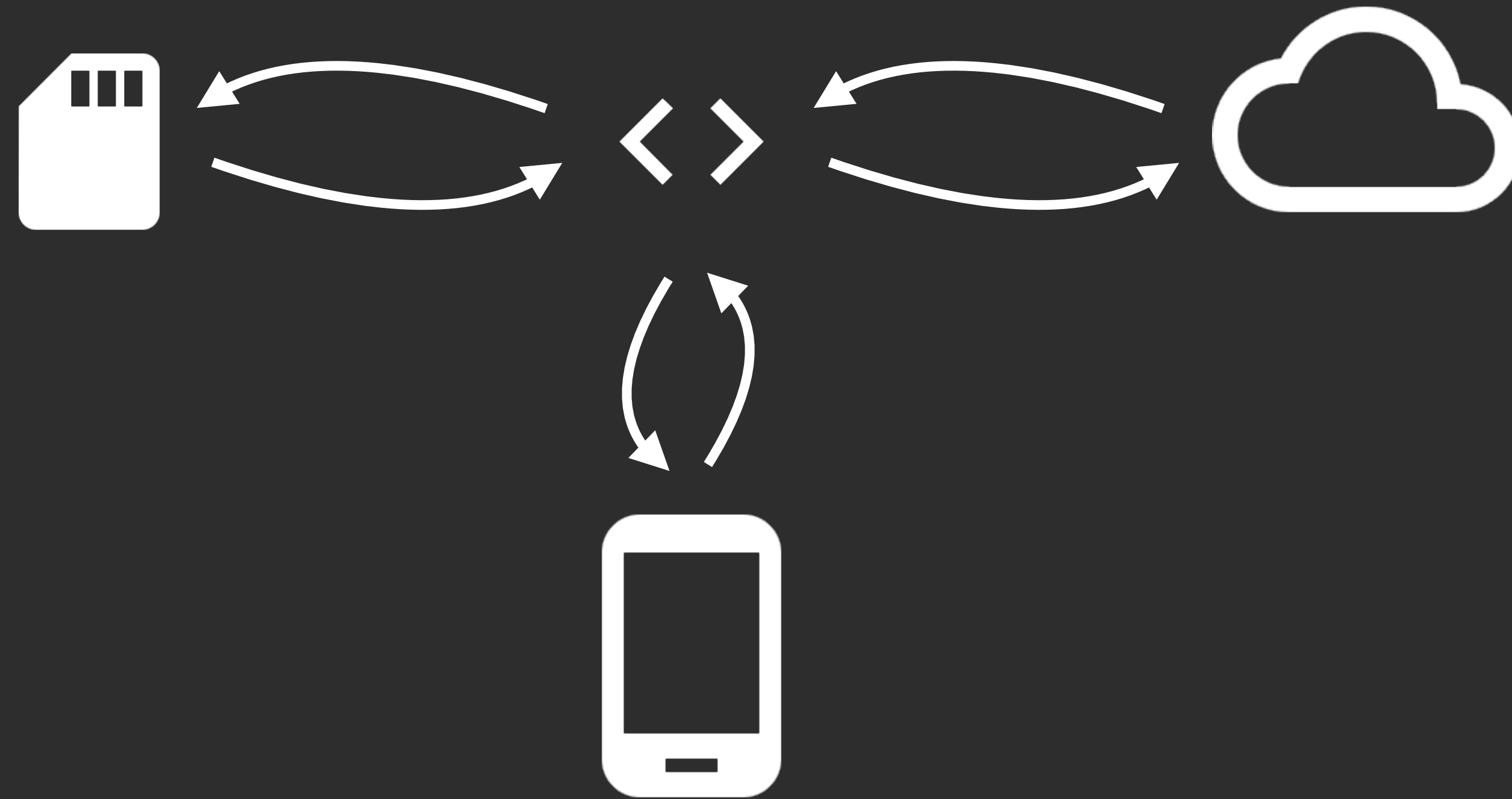
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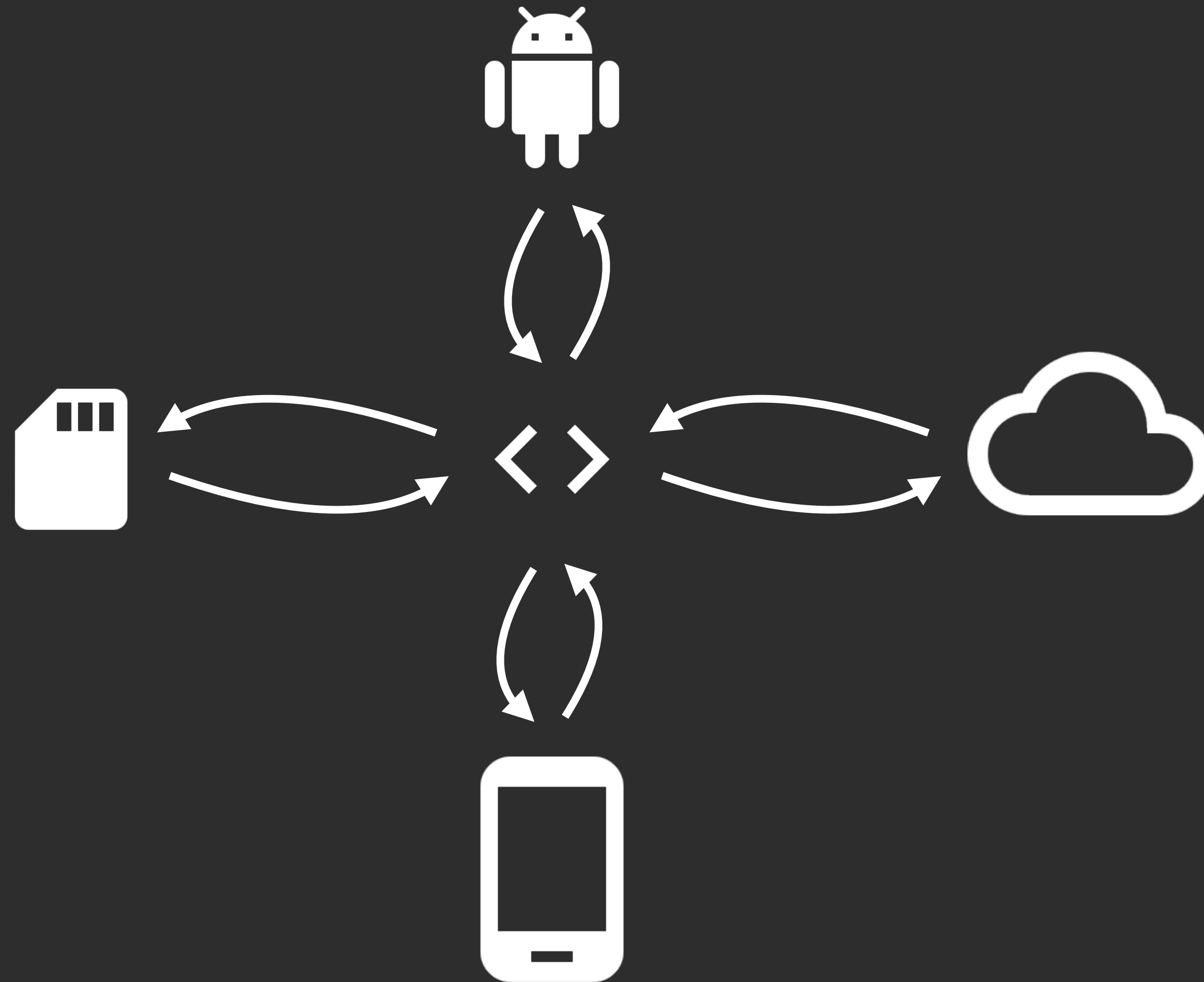
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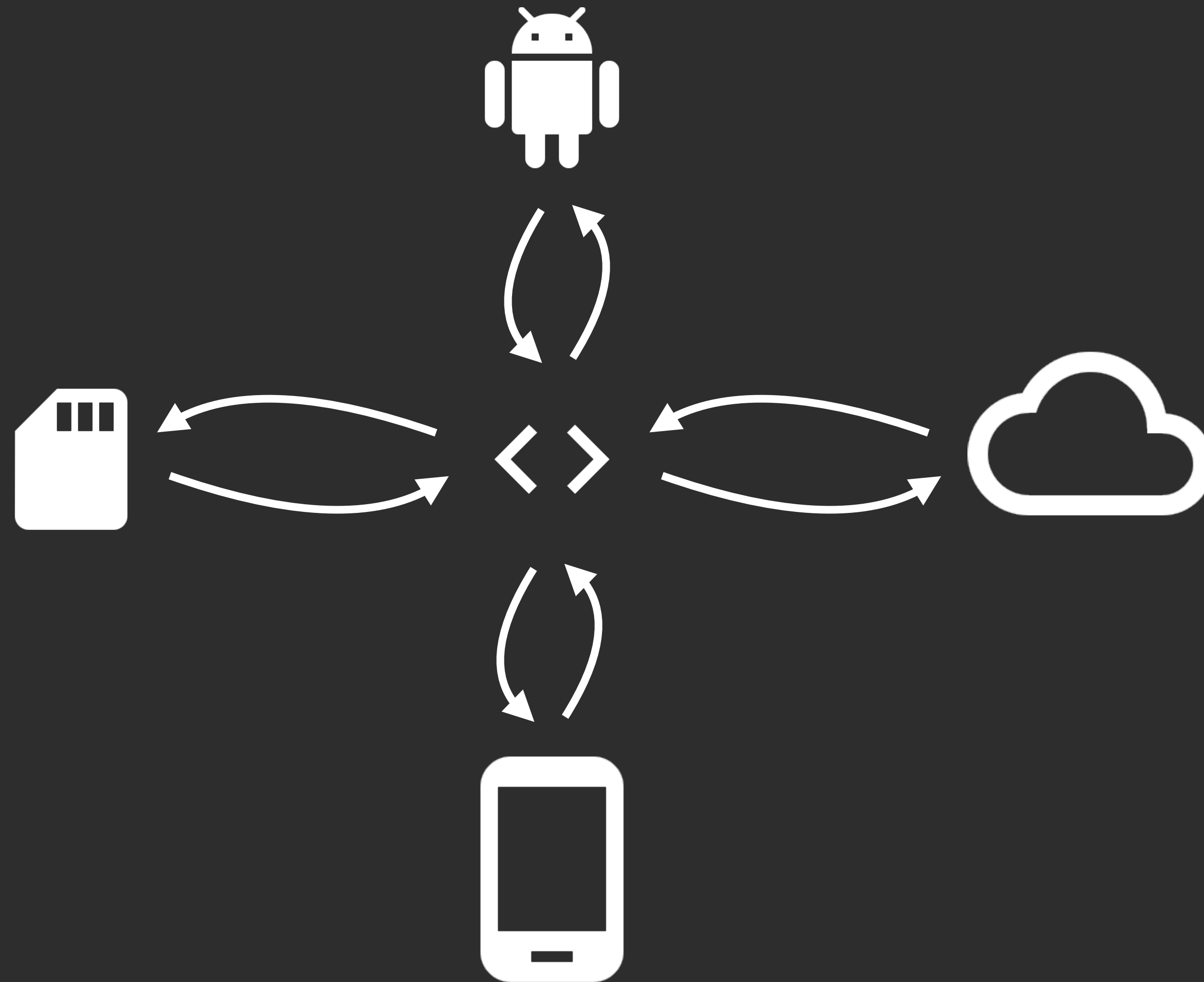


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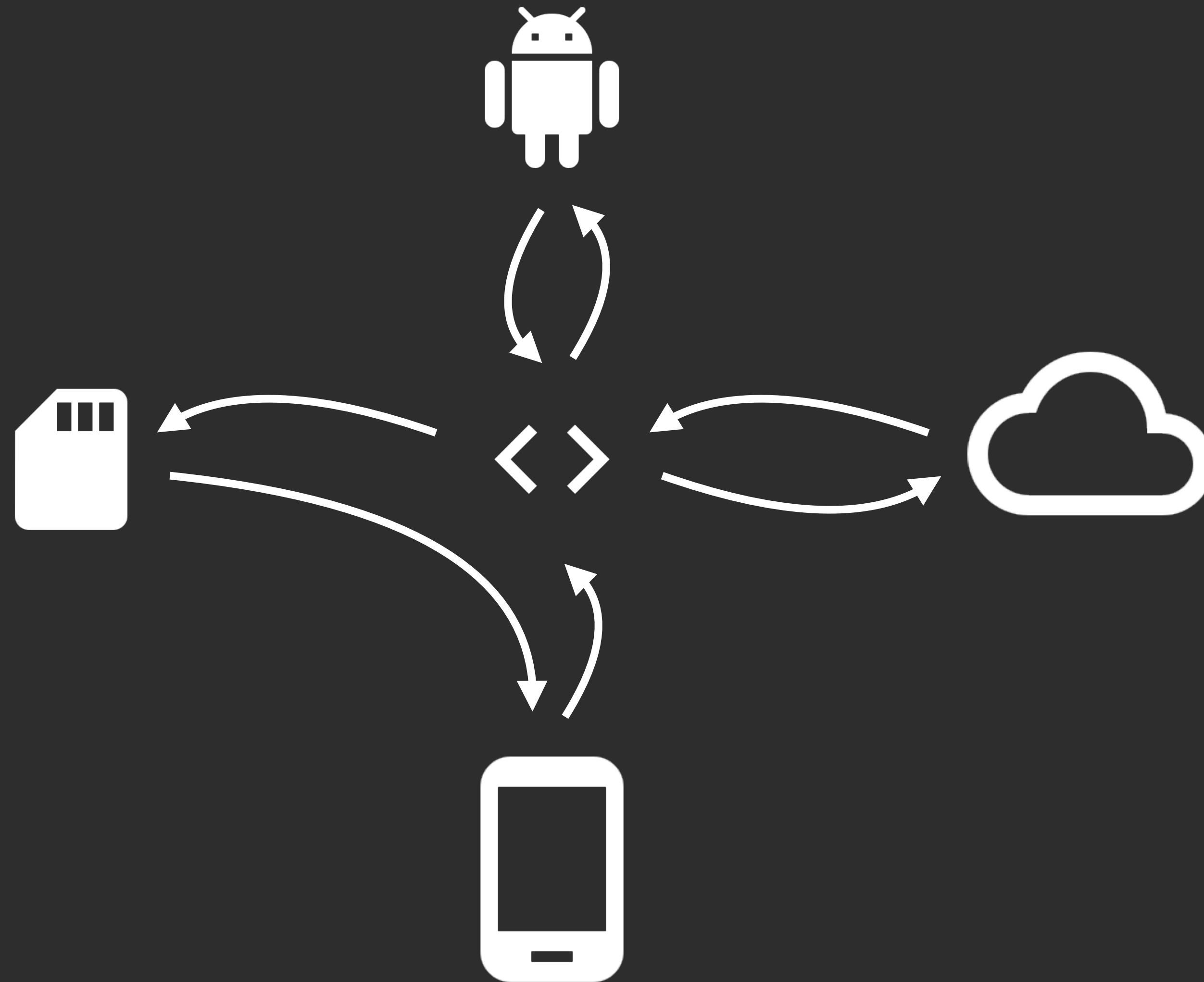
Unless you can model your entire system synchronously, a single asynchronous source breaks imperative programming.



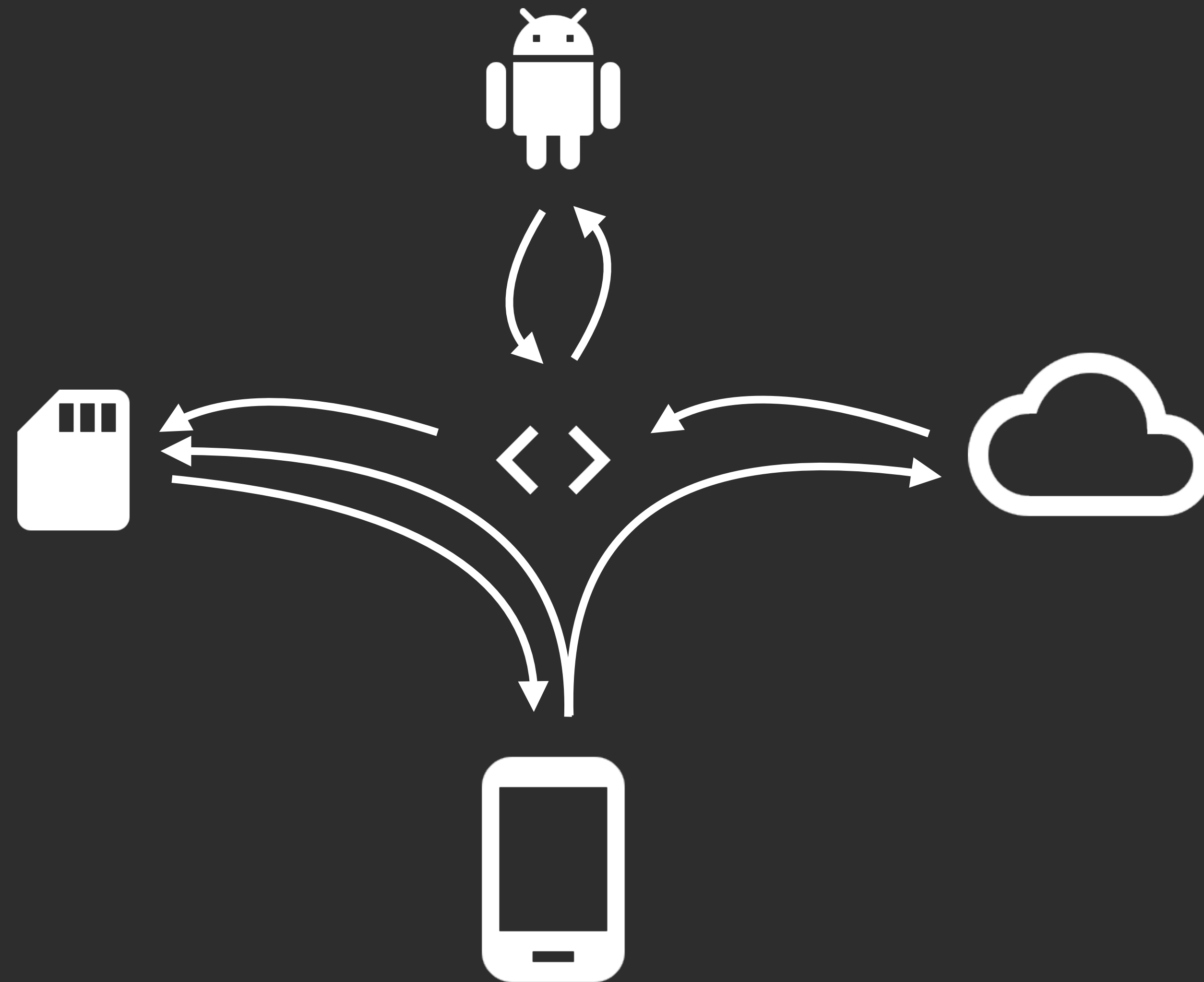
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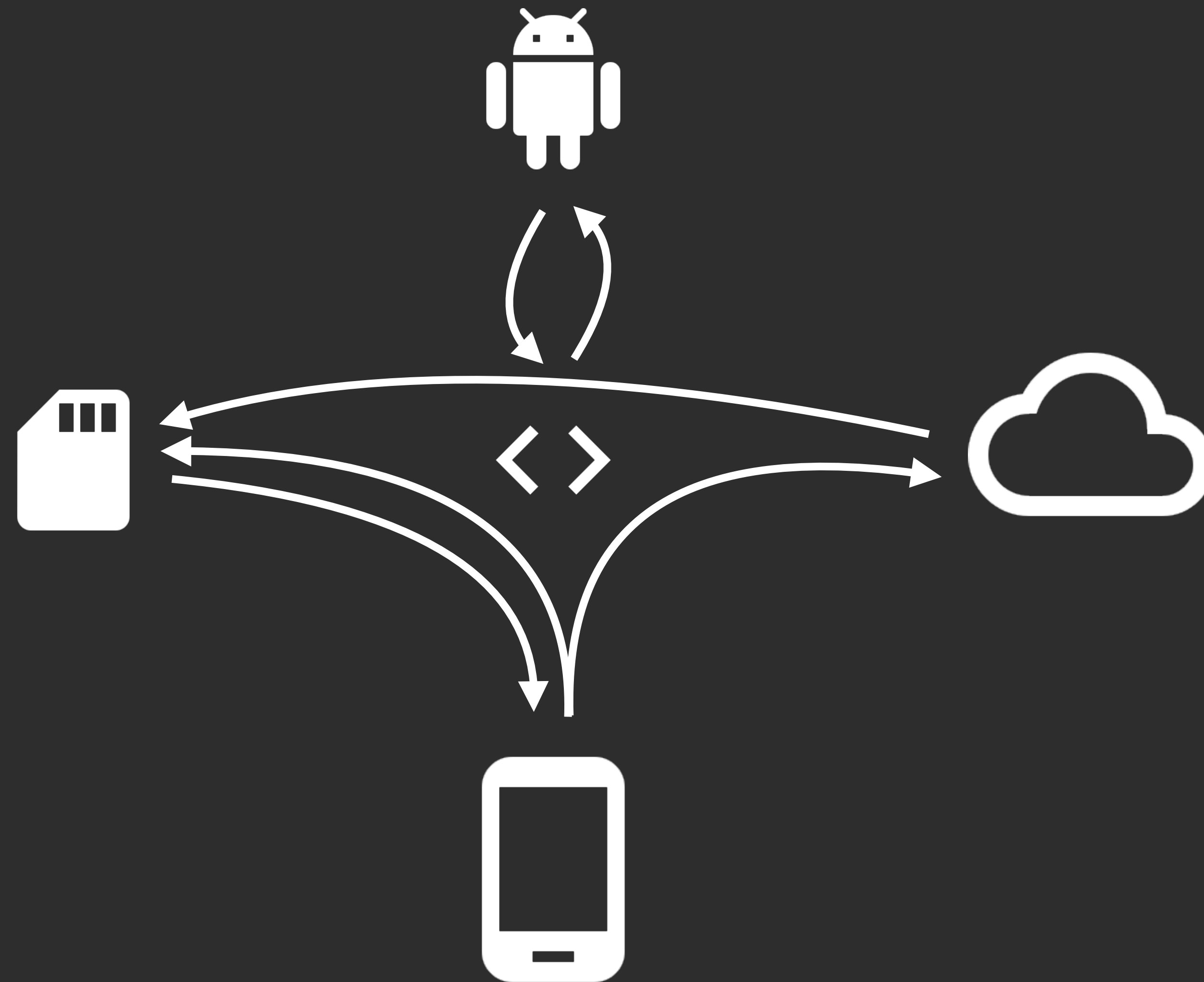
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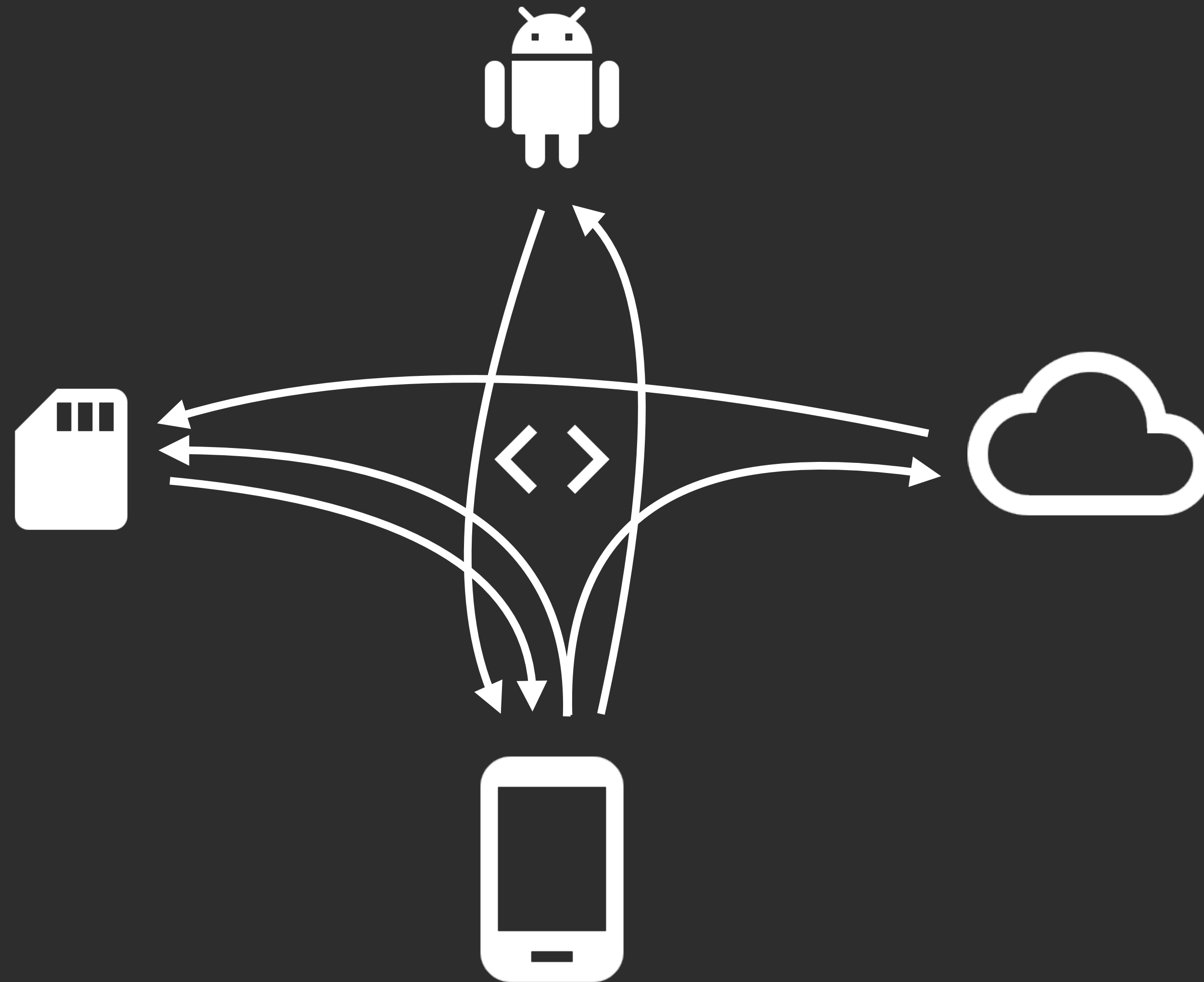
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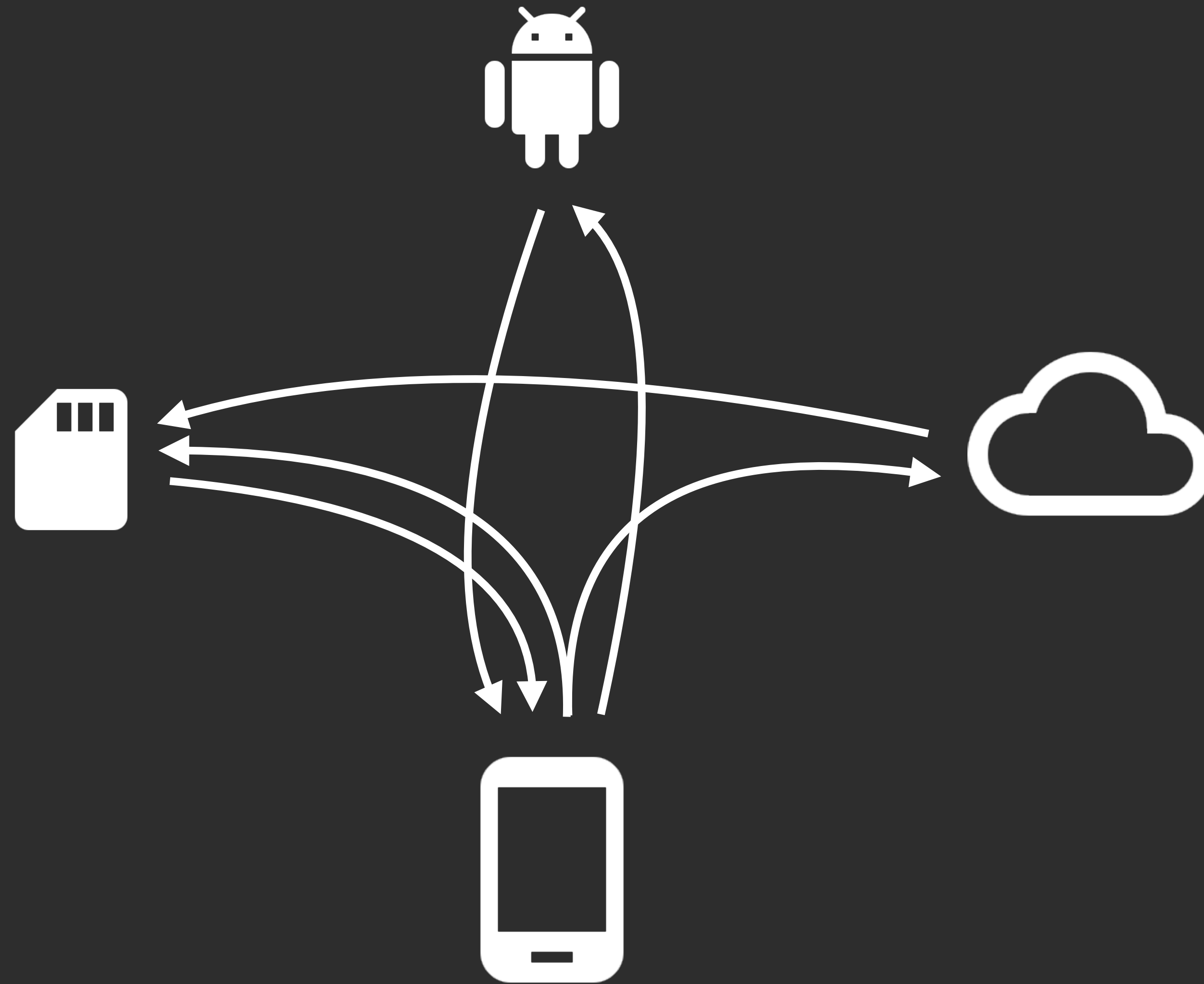


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# RxJava

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# Sources

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- Single item, many items, or empty.
- Terminates with an error or succeeds to completion.
- May never terminate!
- Just an implementation of the Observer pattern.

# Sources

- `Observable<T>`
- `Flowable<T>`

# Sources

- `Observable<T>`
  - Emits 0 to n items.
  - Terminates with complete or error.
- `Flowable<T>`
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# Sources

- `Observable<T>`
  - Emits 0 to n items.
  - Terminates with complete or error.
  - Does not have backpressure.
- `Flowable<T>`
  - Emits 0 to n items.
  - Terminates with complete or error.
  - Has backpressure.

# Flowable vs. Observable

# Flowable vs. Observable

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- Backpressure allows you to control how fast a source emits items.
- RxJava 1.x added backpressure late in the design process.
- All types exposed backpressure but not all sources respected it.
- Backpressure, like inheritance, must be designed for.

# Flowable vs. Observable

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Observable<MotionEvent> events  
    = RxView.touches(paintView);
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Observable<Row> rows  
    = db.createQuery("SELECT * ...");
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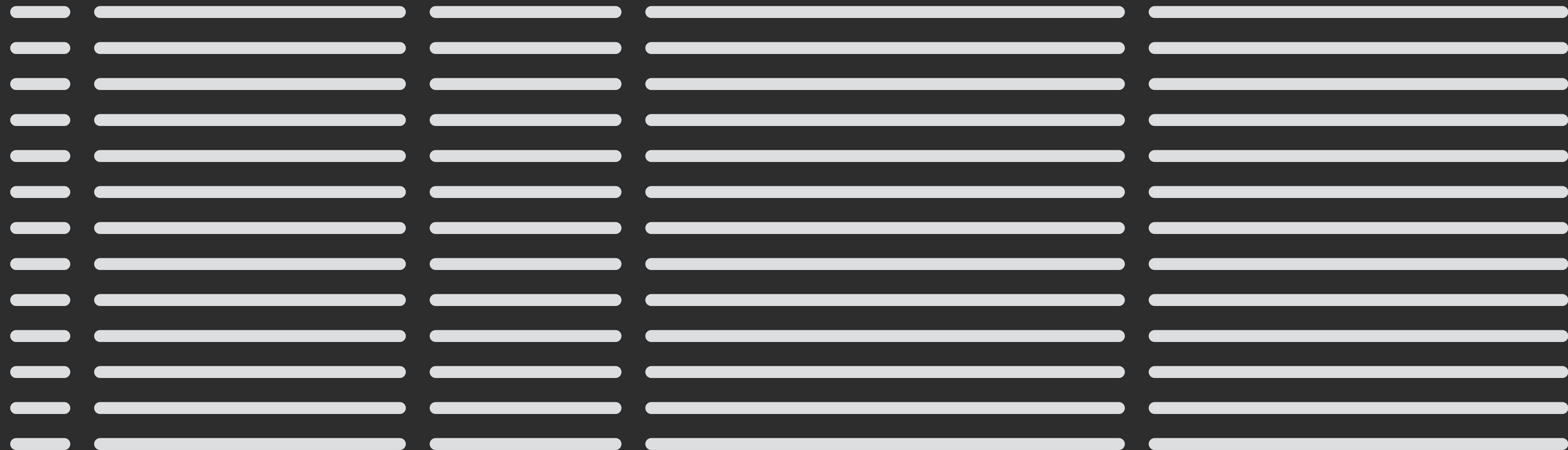


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MissingBackpressureException

# Flowable vs. Observable

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```

# Flowable vs. Observable

`Observable<MotionEvent>`

`Flowable<Row>`

# Flowable vs. Observable

Observable<MotionEvent>

```
interface Observer<T> {  
    void onNext(T t);  
    void onComplete();  
    void onError(Throwable t);  
    void onSubscribe(Disposable d);  
}
```

Flowable<Row>

```
interface Subscriber<T> {  
    void onNext(T t);  
    void onComplete();  
    void onError(Throwable t);  
    void onSubscribe(Subscription s);  
}
```

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# Flowable vs. Observable

Observable<MotionEvent>

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}
```

```
interface Disposable {  
    void dispose();  
}
```

Flowable<Row>

```
interface Subscriber<T> {  
    void onNext(T t);  
    void onComplete();  
    void onError(Throwable t);  
    void onSubscribe(Subscription s);  
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# Flowable vs. Observable

Observable<MotionEvent>

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interface Observer<T> {  
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Flowable<Row>

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interface Subscriber<T> {  
    void onNext(T t);  
    void onComplete();  
    void onError(Throwable t);  
    void onSubscribe(Subscription s);  
}
```

```
interface Subscription {  
    void cancel();  
    void request(long r);  
}
```

	Backpressure	No Backpressure
0...n items, complete error	Flowable	Observable

# Reactive Streams

...is an initiative to provide a standard for asynchronous stream processing with non-blocking back pressure.

# Reactive Streams

```
interface Publisher<T> {  
    void subscribe(Subscriber<? super T> s);  
}
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interface Subscription {  
    void request(long n);  
    void cancel();  
}
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# Reactive Streams

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interface Publisher<T> {  
    void subscribe(Subscriber<? super T> s);  
}  
  
interface Subscriber<T> {  
    void onNext(T t);  
    void onComplete();  
    void onError(Throwable t);  
    void onSubscribe(Subscription s);  
}  
  
interface Subscription {  
    void request(long n);  
    void cancel();  
}  
  
interface Processor<T, R> extends Subscriber<T>, Publisher<R> {  
}
```



	Backpressure	No Backpressure
0...n items, complete error	Flowable	Observable

	Reactive Streams (Backpressure)	No Backpressure
0...n items, complete error	Flowable	Observable

# Sources

```
interface UserManager {  
    User getUser();  
    void setName(String name);  
    void setAge(int age);  
}
```

# Sources

```
interface UserManager {  
    Observable<User> getUser();  
    void setName(String name);  
    void setAge(int age);  
}
```

# Source Specializations

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- Encoding subsets of `Observable` into the type system.

# Single

- Either succeeds with an item or errors.
- No backpressure support.

# Single

- Either succeeds with an item or errors.
- No backpressure support.
- Think "reactive scalar".



# Completable

- Either completes or errors. Has no items!
- No backpressure support.

# Completable

- Either completes or errors. Has no items!
- No backpressure support.
- Think "reactive runnable".

# Maybe

- Either succeeds with an item, completes with no items, or errors.
- No backpressure support.

# Maybe

- Either succeeds with an item, completes with no items, or errors.
- No backpressure support.
- Think "reactive optional".

# Source Specializations

- Encoding subsets of `Observable` into the type system.
  - `Single` – Item or error. Think "scalar".
  - `Completable` – Complete or error. Think "runnable".
  - `Maybe` – Item, complete, or error. Think "optional".

	Reactive Streams (Backpressure)	No Backpressure
0...n items, complete error	Flowable	Observable
item complete error		Maybe
item error		Single
complete error		Completable

# Sources

```
interface UserManager {  
    Observable<User> getUser();  
    void setName(String name);  
    void setAge(int age);  
}
```

# Sources

```
interface UserManager {  
    Observable<User> getUser();  
    Completable setName(String name);  
    Completable setAge(int age);  
}
```



# Creating Sources

# Creating Sources

```
Flowable.just("Hello");  
Flowable.just("Hello", "World");
```

```
Observable.just("Hello");  
Observable.just("Hello", "World");
```

```
Maybe.just("Hello");
```

```
Single.just("Hello");
```

# Creating Sources

```
String[] array = { "Hello", "World" };  
List<String> list = Arrays.asList(array);
```

```
Flowable.fromArray(array);  
Flowable.fromIterable(list);
```

```
Observable.fromArray(array);  
Observable.fromIterable(list);
```

# Creating Sources

```
Observable.fromCallable(new Callable<String>() {  
    @Override public String call() {  
        return getName();  
    }  
});
```

# Creating Sources

```
Observable.fromCallable(new Callable<String>() {  
    @Override public String call() throws Exception {  
        return getName();  
    }  
});
```

# Creating Sources

```
OkHttpClient client = // ...  
Request request = // ...
```

```
Observable.fromCallable(new Callable<String>() {  
    @Override public String call() throws Exception {  
        return client.newCall(request).execute();  
    }  
});
```

# Creating Sources

```
Flowable.fromCallable(() -> "Hello");
```

```
Observable.fromCallable(() -> "Hello");
```

```
Maybe.fromCallable(() -> "Hello");
```

```
Single.fromCallable(() -> "Hello");
```

```
Completable.fromCallable(() -> "Ignored!");
```

# Creating Sources

```
Flowable.fromCallable(() -> "Hello");
```

```
Observable.fromCallable(() -> "Hello");
```

```
Maybe.fromCallable(() -> "Hello");
```

```
Maybe.fromAction(() -> System.out.println("Hello"));
```

```
Maybe.fromRunnable(() -> System.out.println("Hello"))
```

```
Single.fromCallable(() -> "Hello");
```

```
Completable.fromCallable(() -> "Ignored!");
```

```
Completable.fromAction(() -> System.out.println("Hello"));
```

```
Completable.fromRunnable(() -> System.out.println("Hello"));
```



# Creating Sources

```
Observable.create();
```

# Creating Sources

```
Observable.create(new ObservableOnSubscribe<String>() {  
    @Override  
    public void subscribe(ObservableEmitter<String> e) throws Exception {  
        e.onNext("Hello");  
        e.onComplete();  
    }  
});
```

# Creating Sources

```
Observable.create(new ObservableOnSubscribe<String>() {  
    @Override  
    public void subscribe(ObservableEmitter<String> e) throws Exception {  
        e.onNext("Hello");  
        e.onComplete();  
    }  
});
```

# Creating Sources

```
Observable.create(new ObservableOnSubscribe<String>() {  
    @Override  
    public void subscribe(Observer<String> e) throws Exception {  
        e.onNext("Hello");  
        e.onComplete();  
    }  
});
```

# Creating Sources

```
Observable.create(new ObservableOnSubscribe<String>() {  
    @Override  
    public void subscribe(ObservableEmitter<String> e) throws Exception {  
        e.onNext("Hello");  
        e.onComplete();  
    }  
});
```

# Creating Sources

```
Observable.create(e -> {  
    e.onNext("Hello");  
    e.onComplete();  
});
```

# Creating Sources

```
Observable.create(e -> {  
    e.onNext("Hello");  
    e.onNext("World");  
    e.onComplete();  
});
```

# Creating Sources

```
OkHttpClient client = // ...  
Request request = // ...
```

```
Observable.create(e -> {  
    client.newCall(request).enqueue(new Callback() {  
        @Override public void onResponse(Response r) throws IOException {  
            e.onNext(r.body().string());  
            e.onComplete();  
        }  
        @Override public void onFailure(IOException e) {  
            e.onError(e);  
        }  
    });  
});
```



# Creating Sources

```
OkHttpClient client = // ...  
Request request = // ...
```

```
Observable.create(e -> {  
    Call call = client.newCall(request);  
    call.enqueue(new Callback() {  
        @Override public void onResponse(Response r) throws IOException {  
            e.onNext(r.body().string());  
            e.onComplete();  
        }  
        @Override public void onFailure(IOException e) {  
            e.onError(e);  
        }  
    });  
});
```

# Creating Sources

```
OkHttpClient client = // ...
Request request = // ...

Observable.create(e -> {
    Call call = client.newCall(request);
    e.setCancellation(() -> call.cancel());
    call.enqueue(new Callback() {
        @Override public void onResponse(Response r) throws IOException {
            e.onNext(r.body().string());
            e.onComplete();
        }
        @Override public void onFailure(IOException e) {
            e.onError(e);
        }
    });
});
```

# Creating Sources

```
OkHttpClient client = // ...  
Request request = // ...
```

```
Observable.create(e -> {  
    Call call = client.newCall(request);  
    e.setCancellation(() -> call.cancel());  
    call.enqueue(new Callback() {  
        @Override public void onResponse(Response r) throws IOException {  
            e.onNext(r.body().string());  
            e.onComplete();  
        }  
        @Override public void onFailure(IOException e) {  
            e.onError(e);  
        }  
    });  
});
```

# Creating Sources

```
View view = // ...
```

```
Observable.create(e -> {  
    e.setCancellation(() -> view.setOnClickListener(null));  
    view.setOnClickListener(v -> e.onNext(v));  
});
```

# Creating Sources

```
Flowable.create(e -> { ... });
```

```
Observable.create(e -> { ... });
```

```
Maybe.create(e -> { ... });
```

```
Single.create(e -> { ... });
```

```
Completable.create(e -> { ... });
```

# Observing Sources

# Observing Sources

Observable<String>

```
interface Observer<T> {  
    void onNext(T t);  
    void onComplete();  
    void onError(Throwable t);  
    void onSubscribe(Disposable d);  
}
```

Flowable<String>

```
interface Subscriber<T> {  
    void onNext(T t);  
    void onComplete();  
    void onError(Throwable t);  
    void onSubscribe(Subscription s);  
}
```

# Observing Sources

Observable<String>

```
interface Observer<T> {  
    void onNext(T t);  
    void onComplete();  
    void onError(Throwable t);  
    void onSubscribe(Disposable d);  
}
```

```
interface Disposable {  
    void dispose();  
}
```

Flowable<String>

```
interface Subscriber<T> {  
    void onNext(T t);  
    void onComplete();  
    void onError(Throwable t);  
    void onSubscribe(Subscription s);  
}
```

```
interface Subscription {  
    void cancel();  
    void request(long r);  
}
```



# Observing Sources

```
Observable<String> o = Observable.just("Hello");

o.subscribe(new Observer<String>() {
    @Override public void onNext(String s) { ... }
    @Override public void onComplete() { ... }
    @Override public void onError(Throwable t) { ... }

    @Override public void onSubscribe(Disposable d) {
        ???
    }
});
```

# Observing Sources

```
Observable<String> o = Observable.just("Hello");

o.subscribe(new DisposableObserver<String>() {
    @Override public void onNext(String s) { ... }
    @Override public void onComplete() { ... }
    @Override public void onError(Throwable t) { ... }
});
```

# Observing Sources

```
Observable<String> o = Observable.just("Hello");

o.subscribe(new DisposableObserver<String>() {
    @Override public void onNext(String s) { ... }
    @Override public void onComplete() { ... }
    @Override public void onError(Throwable t) { ... }
});

// TODO how do we dispose???
```

# Observing Sources

```
Observable<String> o = Observable.just("Hello");
```

```
DisposableObserver observer = new DisposableObserver<String>() {  
    @Override public void onNext(String s) { ... }  
    @Override public void onComplete() { ... }  
    @Override public void onError(Throwable t) { ... }  
}  
o.subscribe(observer);
```

# Observing Sources

```
Observable<String> o = Observable.just("Hello");
```

```
DisposableObserver observer = new DisposableObserver<String>() {  
    @Override public void onNext(String s) { ... }  
    @Override public void onComplete() { ... }  
    @Override public void onError(Throwable t) { ... }  
}  
o.subscribe(observer);  
  
observer.dispose();
```

# Observing Sources

```
Observable<String> o = Observable.just("Hello");

o.subscribe(new DisposableObserver<String>() {
    @Override public void onNext(String s) { ... }
    @Override public void onComplete() { ... }
    @Override public void onError(Throwable t) { ... }
});
```

# Observing Sources

```
Observable<String> o = Observable.just("Hello");

o.subscribeWith(new DisposableObserver<String>() {
    @Override public void onNext(String s) { ... }
    @Override public void onComplete() { ... }
    @Override public void onError(Throwable t) { ... }
});
```

# Observing Sources

```
Observable<String> o = Observable.just("Hello");
```

```
Disposable d = o.subscribeWith(new DisposableObserver<String>() {  
    @Override public void onNext(String s) { ... }  
    @Override public void onComplete() { ... }  
    @Override public void onError(Throwable t) { ... }  
});
```

```
d.dispose();
```



# Observing Sources

```
Observable<String> o = Observable.just("Hello");
```

```
CompositeDisposable disposables = new CompositeDisposable();
```

```
disposables.add(o.subscribeWith(new DisposableObserver<String>() {  
    @Override public void onNext(String s) { ... }  
    @Override public void onComplete() { ... }  
    @Override public void onError(Throwable t) { ... }  
}));
```

```
disposables.dispose();
```

# Observing Sources

```
Observable<String> o = Observable.just("Hello");  
o.subscribeWith(new DisposableObserver<String>() { ... });
```

```
Maybe<String> m = Maybe.just("Hello");  
m.subscribeWith(new DisposableMaybeObserver<String>() { ... });
```

```
Single<String> s = Single.just("Hello");  
s.subscribeWith(new DisposableSingleObserver<String>() { ... });
```

```
Completable c = Completable.completed();  
c.subscribeWith(new DisposableCompletableObserver<String>() { ... });
```

# Observing Sources

```
Flowable<String> f = Flowable.just("Hello");  
f.subscribeWith(new DisposableSubscriber<String>() { ... });
```

```
Observable<String> o = Observable.just("Hello");  
o.subscribeWith(new DisposableObserver<String>() { ... });
```

```
Maybe<String> m = Maybe.just("Hello");  
m.subscribeWith(new DisposableMaybeObserver<String>() { ... });
```

```
Single<String> s = Single.just("Hello");  
s.subscribeWith(new DisposableSingleObserver<String>() { ... });
```

```
Completable c = Completable.completed();  
c.subscribeWith(new DisposableCompletableObserver<String>() { ... });
```

# Observing Sources

```
Flowable<String> f = Flowable.just("Hello");  
f.subscribeWith(new DisposableSubscriber<String>() { ... });
```

```
Observable<String> o = Observable.just("Hello");  
o.subscribeWith(new DisposableObserver<String>() { ... });
```

```
Maybe<String> m = Maybe.just("Hello");  
m.subscribeWith(new DisposableMaybeObserver<String>() { ... });
```

```
Single<String> s = Single.just("Hello");  
s.subscribeWith(new DisposableSingleObserver<String>() { ... });
```

```
Completable c = Completable.completed();  
c.subscribeWith(new DisposableCompletableObserver<String>() { ... });
```

# Observing Sources

```
Flowable<String> f = Flowable.just("Hello");
Disposable d1 = f.subscribeWith(new DisposableSubscriber<String>() { ... });

Observable<String> o = Observable.just("Hello");
Disposable d2 = o.subscribeWith(new DisposableObserver<String>() { ... });

Maybe<String> m = Maybe.just("Hello");
Disposable d3 = m.subscribeWith(new DisposableMaybeObserver<String>() { ... });

Single<String> s = Single.just("Hello");
Disposable d4 = s.subscribeWith(new DisposableSingleObserver<String>() { ... });

Completable c = Completable.completed();
Disposable d5 = c.subscribeWith(new DisposableCompletableObserver<String>() { ... });
```

# RxJava

- A set of classes for representing sources of data.
- A set of classes for listening to data sources.
- A set of methods for modifying and composing data.

# RxJava

- A set of classes for representing sources of data.
- A set of classes for listening to data sources.
- A set of methods for modifying and composing data.

# Operators



# Operators

- Manipulate or combine data in some way.

# Operators

- Manipulate or combine data in some way.
- Manipulate threading in some way.

# Operators

- Manipulate or combine data in some way.
- Manipulate threading in some way.
- Manipulate emissions in some way.

# Operators

```
String greeting = "Hello";
```

# Operators

```
String greeting = "Hello";  
String yelling = greeting.toUpperCase();
```

# Operators

```
Observable<String> greeting = Observable.just("Hello");  
String yelling = greeting.toUpperCase();
```

# Operators

```
Observable<String> greeting = Observable.just("Hello");  
Observable<String> yelling = greeting.map(s -> s.toUpperCase());
```

# Operators

```
Observable<String> greeting = Observable.just("Hello");  
Observable<String> yelling = greeting.map(s -> s.toUpperCase());
```



# Operators

```
@Override public void success() {  
    runOnUiThread(new Runnable() {  
        @Override public void run() {  
            tv.setText(um.getUser().toString());  
        }  
    });  
}
```

# Operators

```
Observable<User> user = um.getUser();
```

# Operators

```
Observable<User> user = um.getUser();  
Observable<User> mainThreadUser =  
    user.observeOn(AndroidSchedulers.mainThread());
```

# Operators

```
Observable<User> user = um.getUser();  
Observable<User> mainThreadUser =  
    user.observeOn(AndroidSchedulers.mainThread());
```

# Operators

```
OkHttpClient client = // ...  
Request request = // ...
```

```
Response response = client.newCall(request).execute();
```

# Operators

```
OkHttpClient client = // ...  
Request request = // ...
```

```
Observable<Response> response = Observable.fromCallable(() -> {  
    return client.newCall(request).execute();  
});
```

# Operators

```
OkHttpClient client = // ...  
Request request = // ...
```

```
Observable<Response> response = Observable.fromCallable(() -> {  
    return client.newCall(request).execute();  
});  
Observable<Response> backgroundResponse =  
    response.subscribeOn(Schedulers.io() );
```

# Operators

```
OkHttpClient client = // ...  
Request request = // ...
```

```
Observable<Response> response = Observable.fromCallable(() -> {  
    return client.newCall(request).execute();  
});  
Observable<Response> backgroundResponse =  
    response.subscribeOn(Schedulers.io());
```



# Operators

```
OkHttpClient client = // ...  
Request request = // ...
```

```
Observable<Response> response = Observable.fromCallable(() -> {  
    return client.newCall(request).execute();  
});  
Observable<Response> backgroundResponse =  
    response.subscribeOn(Schedulers.io() );
```

# Operators

```
OkHttpClient client = // ...  
Request request = // ...
```

```
Observable<Response> response = Observable.fromCallable(() -> {  
    return client.newCall(request).execute();  
})  
    .subscribeOn(Schedulers.io());
```

# Operators

```
OkHttpClient client = // ...  
Request request = // ...
```

```
Observable<Response> response = Observable.fromCallable() -> {  
    return client.newCall(request).execute();  
})  
    .subscribeOn(Schedulers.io())  
    .observeOn(AndroidSchedulers.mainThread());
```

# Operators

```
OkHttpClient client = // ...  
Request request = // ...
```

```
Observable<Response> response = Observable.fromCallable() -> {  
    return client.newCall(request).execute();  
})  
    .subscribeOn(Schedulers.io())  
    .observeOn(AndroidSchedulers.mainThread())  
    .map(response -> response.body().string());
```

# Operators

```
OkHttpClient client = // ...  
Request request = // ...
```

```
Observable<Response> response = Observable.fromCallable() -> {  
    return client.newCall(request).execute();  
})  
    .subscribeOn(Schedulers.io())  
    .observeOn(AndroidSchedulers.mainThread())  
    .map(response -> response.body().string()); // NetworkOnMainThread!
```

# Operators

```
OkHttpClient client = // ...  
Request request = // ...
```

```
Observable<Response> response = Observable.fromCallable() -> {  
    return client.newCall(request).execute();  
})  
    .subscribeOn(Schedulers.io())  
    .map(response -> response.body().string()) // Ok!  
    .observeOn(AndroidSchedulers.mainThread());
```

# Operator Specialization

# Operator Specialization

Observable





# Operator Specialization

Observable



`first()`

# Operator Specialization

Observable



`first()`

Observable



# Operator Specialization



`first()`



# Operator Specialization



get(0)



# Operator Specialization

Observable



`first()`

Observable



# Operator Specialization

Observable



`first()`

Single



# Operator Specialization



# Operator Specialization

Observable



`first()`

Single





# Operator Specialization

Observable



`first()`

Single



`NoSuchElementException`

# Operator Specialization

Observable



`first()`

# Operator Specialization

Observable



`firstElement()`

# Operator Specialization

Observable



`firstElement()`

Maybe



# Operator Specialization

Observable



`firstElement()`

Maybe



# Operator Specialization

Observable



`ignoreElements()`

# Operator Specialization

Observable

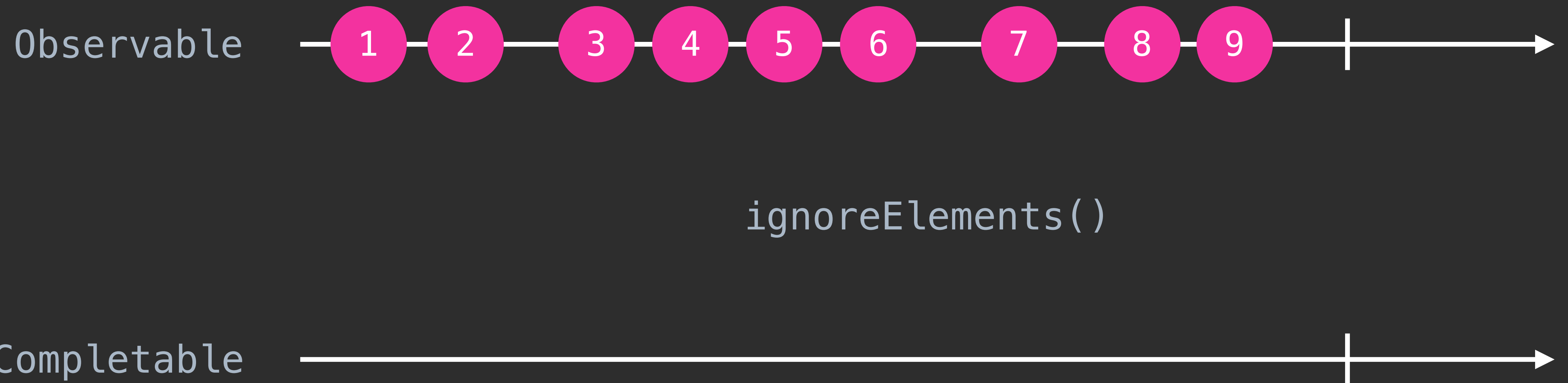


`ignoreElements()`

Completable



# Operator Specialization





# Operator Specialization

Flowable



`ignoreElements()`

Completable



# Operator Specialization

Flowable



`firstElement()`

Maybe



# Operator Specialization

Flowable



`first()`

Single



To From		Flowable	Observable	Maybe	Single	Completable
Flowable			toObservable()	reduce() elementAt() firstElement() lastElement() singleElement()	scan() elementAt() first()/firstOnError() last()/lastOnError() single/singleOnError() all()/any()/count() (and more)	ignoreElements()
Observable	toFlowable()			reduce() elementAt() firstElement() lastElement() singleElement()	scan() elementAt() first()/firstOnError() last()/lastOnError() single/singleOnError() all()/any()/count() (and more)	ignoreElements()
Maybe	toFlowable()	toObservable()			toSingle() sequenceEqual()	toCompletable()
Single	toFlowable()	toObservable()	toMaybe()			toCompletable()
Completable	toFlowable()	toObservable()	toMaybe()		toSingle() toSingleDefault()	

To From		Flowable	Observable	Maybe	Single	Completable
Flowable			toObservable()	reduce() elementAt() firstElement() lastElement() singleElement()	scan() elementAt() first()/firstOnError() last()/lastOnError() single/singleOnError() all()/any()/count() (and more)	ignoreElements()
Observable	toFlowable()			reduce() elementAt() firstElement() lastElement() singleElement()	scan() elementAt() first()/firstOnError() last()/lastOnError() single/singleOnError() all()/any()/count() (and more)	ignoreElements()
Maybe	toFlowable()	toObservable()			toSingle() sequenceEqual()	toCompletable()
Single	toFlowable()	toObservable()	toMaybe()			toCompletable()
Completable	toFlowable()	toObservable()	toMaybe()	toSingle() toSingleDefault()		

To From		Flowable	Observable	Maybe	Single	Completable
Flowable			toObservable()	reduce() elementAt() firstElement() lastElement() singleElement()	scan() elementAt() first()/firstOnError() last()/lastOnError() single/singleOnError() all()/any()/count() (and more)	ignoreElements()
Observable	toFlowable()			reduce() elementAt() firstElement() lastElement() singleElement()	scan() elementAt() first()/firstOnError() last()/lastOnError() single/singleOnError() all()/any()/count() (and more)	ignoreElements()
Maybe	toFlowable()	toObservable()			toSingle() sequenceEqual()	toCompletable()
Single	toFlowable()	toObservable()	toMaybe()			toCompletable()
Completable	toFlowable()	toObservable()	toMaybe()	toSingle() toSingleDefault()		

# Being Reactive

# Being Reactive

```
um.getUser()
```



# Being Reactive

```
um.getUser()  
    .observeOn(AndroidSchedulers.mainThread())
```

# Being Reactive

```
um.getUser()  
    .observeOn(AndroidSchedulers.mainThread())  
    .subscribeWith(new DisposableObserver<User>() {  
        @Override public void onNext(User user) {  
        }  
        @Override public void onComplete() { /* ignored */ }  
        @Override public void onError(Throwable t) { /* crash or show */ }  
    });
```

# Being Reactive

```
um.getUser()  
    .observeOn(AndroidSchedulers.mainThread())  
    .subscribeWith(new DisposableObserver<User>() {  
        @Override public void onNext(User user) {  
            tv.setText(user.toString());  
        }  
        @Override public void onComplete() { /* ignored */ }  
        @Override public void onError(Throwable t) { /* crash or show */ }  
    });
```

# Being Reactive

```
disposables.add(um.getUser()  
    .observeOn(AndroidSchedulers.mainThread())  
    .subscribeWith(new DisposableObserver<User>() {  
        @Override public void onNext(User user) {  
            tv.setText(user.toString());  
        }  
        @Override public void onComplete() { /* ignored */ }  
        @Override public void onError(Throwable t) { /* crash or show */ }  
    }));
```

# Being Reactive

```
// onCreate
disposables.add(um.getUser()
    .observeOn(AndroidSchedulers.mainThread())
    .subscribeWith(new DisposableObserver<User>() {
        @Override public void onNext(User user) {
            tv.setText(user.toString());
        }
        @Override public void onComplete() { /* ignored */ }
        @Override public void onError(Throwable t) { /* crash or show */ }
    }));

// onDestroy
disposables.dispose();
```

# Being Reactive

```
um.setName("Jane Doe")
```

# Being Reactive

```
um.setName("Jane Doe")  
    .subscribeOn(Schedulers.io())
```

# Being Reactive

```
um.setName("Jane Doe")  
    .subscribeOn(Schedulers.io())  
    .observeOn(AndroidSchedulers.mainThread())
```



# Being Reactive

```
um.setName("Jane Doe")
    .subscribeOn(Schedulers.io())
    .observeOn(AndroidSchedulers.mainThread())
    .subscribeWith(new DisposableCompletableObserver() {
        @Override public void onComplete() {
        }
        @Override public void onError(Throwable t) {
            // retry or show
        }
    });
```

# Being Reactive

```
um.setName("Jane Doe")
    .subscribeOn(Schedulers.io())
    .observeOn(AndroidSchedulers.mainThread())
    .subscribeWith(new DisposableCompletableObserver() {
        @Override public void onComplete() {
            // success! re-enable editing
        }
        @Override public void onError(Throwable t) {
            // retry or show
        }
    });
```

# Being Reactive

```
disposables.add(um.setName("Jane Doe")
    .subscribeOn(Schedulers.io())
    .observeOn(AndroidSchedulers.mainThread())
    .subscribeWith(new DisposableCompletableObserver() {
        @Override public void onComplete() {
            // success! re-enable editing
        }
        @Override public void onError(Throwable t) {
            // retry or show
        }
    }));
```

# Architecture

# Architecture

- Less allocation to create a stream.
- Less overhead when subscribing to a stream.

# RxJava 2

# RxJava 2

- Build an app that reacts properly instead of copes desperately!

# RxJava 2

- Build an app that reacts properly instead of copes desperately!
- Final release scheduled for 2016-10-29.



# Living with 1.x and 2.x

```
class RxJavaInterop {
    static <T> Flowable<T> toV2Flowable(rx.Observable<T> o) { ... }
    static <T> Observable<T> toV2Observable(rx.Observable<T> o) { ... }
    static <T> Maybe<T> toV2Maybe(rx.Single<T> s) { ... }
    static <T> Maybe<T> toV2Maybe(rx.Completable c) { ... }
    static <T> Single<T> toV2Single(rx.Single<T> s) { ... }
    static Completable toV2Completable(rx.Completable c) { ... }

    static <T> rx.Observable<T> toV1Observable(Publisher<T> p) { ... }
    static <T> rx.Observable<T> toV1Observable(Observable<T> o, ...) { ... }
    static <T> rx.Single<T> toV1Single(Single<T> o) { ... }
    static <T> rx.Single<T> toV1Single(Maybe<T> m) { ... }
    static rx.Completable toV1Completable(Completable c) { ... }
    static rx.Completable toV1Completable(Maybe<T> m) { ... }
}
```

# Living with 1.x and 2.x

[github.com/akarnokd/RxJava2Interop](https://github.com/akarnokd/RxJava2Interop)

```
class RxJavaInterop {  
    static <T> Flowable<T> toV2Flowable(rx.Observable<T> o) { ... }  
    static <T> Observable<T> toV2Observable(rx.Observable<T> o) { ... }  
    static <T> Maybe<T> toV2Maybe(rx.Single<T> s) { ... }  
    static <T> Maybe<T> toV2Maybe(rx.Completable c) { ... }  
    static <T> Single<T> toV2Single(rx.Single<T> s) { ... }  
    static Completable toV2Completable(rx.Completable c) { ... }  
  
    static <T> rx.Observable<T> toV1Observable(Publisher<T> p) { ... }  
    static <T> rx.Observable<T> toV1Observable(Observable<T> o, ...) { ... }  
    static <T> rx.Single<T> toV1Single(Single<T> o) { ... }  
    static <T> rx.Single<T> toV1Single(Maybe<T> m) { ... }
```

```
dependencies {  
    compile 'io.reactivex.rxjava2:rxjava:2.0.0-RC3'  
    compile 'io.reactivex.rxjava2:rxandroid:2.0.0-RC1'  
  
    // Optionally...  
    compile 'com.github.akarnokd:rxjava2-interop:0.3.0'  
}
```





# *Exploring RxJava*

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