

EVENT SOURCING WITH JVM LANGUAGES

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JavaOne 2017

ABOUT ME

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- Wanted Event Sourcing in 2016

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- Wanted Event Sourcing in 2016
- Didn't like anything I saw
- Built my own thing - Grooves
- I solve problems in Health Care

WHERE I WORK



Transcend Insights® empowers population health management with The Platform Above—technology that rises above the data silos and connects care teams with the insights they need to succeed in a value-based care world.

ABOUT YOU

ABOUT YOU



ABOUT YOU



ABOUT YOU



ABOUT YOU



WHAT IS EVENT SOURCING

Treat your database like you treat your application logs

WHAT DOES THAT MEAN

Create

Read

~~Update~~

~~Delete~~

BAD EXAMPLE 1

Mark and Jane share a bank account. The account has a balance of \$75. Mark goes to an ATM and withdraws \$50. At the same time Jane attempts to withdraw \$50.

This is what our code looks like

```
1 @Transactional  
boolean withdraw(String accountNumber, double amount) {  
    double balance = accountService.getBalance(accountNumber);  
    if (balance > amount) {  
        balance -= account;  
        accountService.setBalance(accountNumber, balance);  
        return true;  
    } else {  
        return false;  
    }  
}
```

WHAT BANKS TYPICALLY DO

1. Blatt

Tag, Monat und Jahr der Eintragung 1	DM-Betrag der Einlage oder Rückzahlung in Buchstaben 2	Betrag der Einlage DM 3	Betrag der Rückzahlung DM 4
05.05. 86	Hebe ich ab dank 87		
07.05. 86	Ab	10	
26.05.	25		50
12.06.	95		15
28.06. 86	Technikum		26
09.06.	Via	40	

By Deutsche Bundespost (Scan by User)

The image shows a historical German banknote with five serial numbers (87, 97, 47, 32, 61) and their corresponding circular blue ink cancellations. The cancellations include the text 'BRD' and 'BRAUNSCHWEIG' along with dates like '28-6-85' and '3300'. A signature 'Reinhard' is also visible.

Guthaben	Unterschrift des Beamten und Tagesstempel
DM 5	
87	
97	
47	
32	
61	
46	

BUT THAT WAS BANKING

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If you can look at your logs and debug your application, you
are already doing that.

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are already doing that.

Banks defined their business model this way hundreds of
years ago.

WHAT ABOUT MY DOMAIN?

```
/* Aggregate */  
class Account {  
    String accountNumber;  
}
```

```
/* Events */  
abstract class Transaction {  
    Account account;  
}  
class AtmWithdrawal  
    extends Transaction {  
    String location;  
    double amount;  
}  
class AtmDeposit  
    extends Transaction {  
    String location;  
    double amount;  
}
```

```
/* Snapshot */  
class AccountSummary {  
    double balance;  
}
```

WHAT ABOUT MY DOMAIN?

```
/* Aggregate */  
class Patient {  
    String identifier;  
    String system;  
}
```

```
/* Events */  
abstract class PatientEvent {  
    Patient patient;  
}  
class MedicationPrescribed  
    extends PatientEvent {  
    String code;  
    int quantity;  
}  
class ProcedurePerformed  
    extends PatientEvent {  
    String code;  
}
```

```
/* Snapshot */  
class PatientSummary {  
    List<String> medications;  
    List<String> procedures;  
}
```

COMPUTING SNAPSHOTS

$$S_N = f(S_0, E_1 \dots E_N)$$

S_N Snapshot at Version N

S_0 empty snapshot

$E_1 \dots E_N$ events from position 1 through N

f query

BUT IT'S NOT THAT SIMPLE

INCREMENTAL COMPUTATION

This is what we would like to do

$$S_N = f(S_K, E_{K+1} \dots E_N)$$

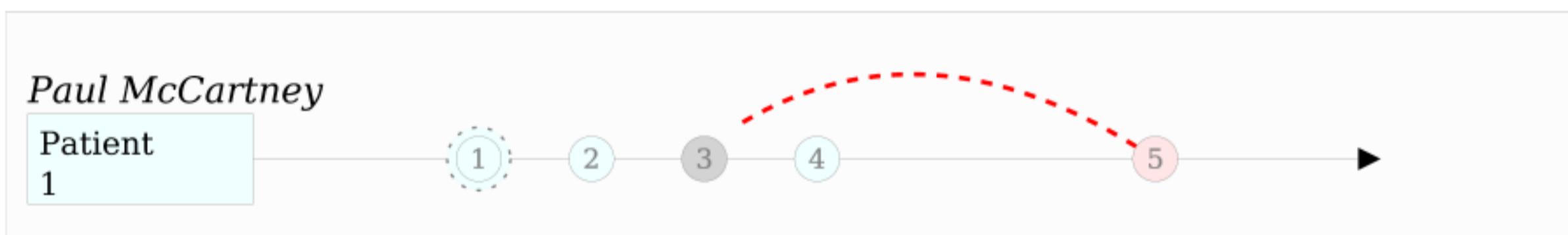
In Mathematics, it's called the distributive property

$$a + b + c = (a + b) + c$$

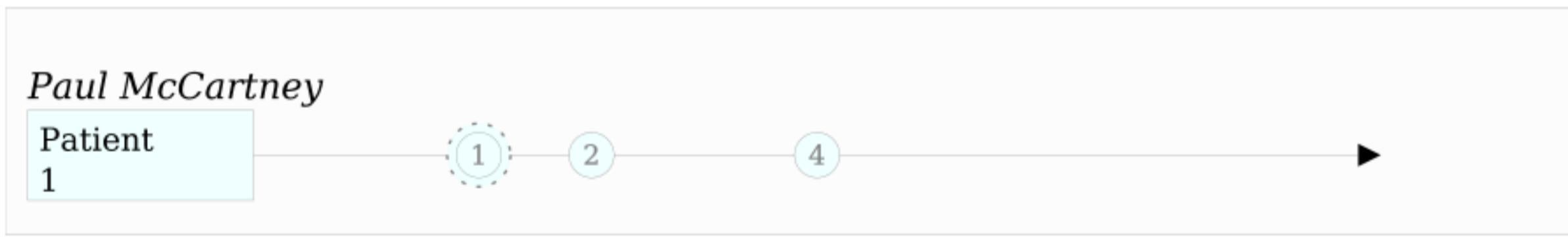
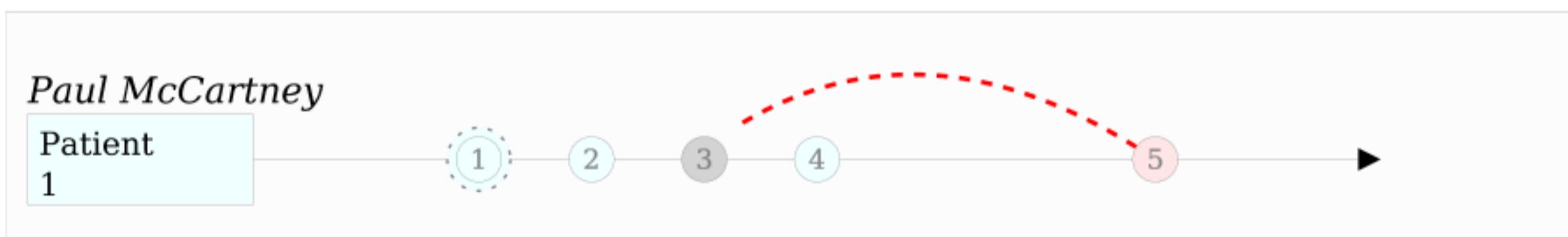
WE'RE NOT DONE YET

There are special events

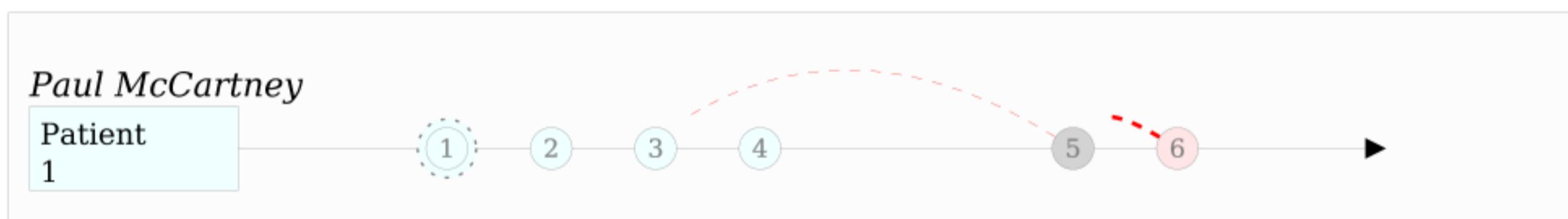
REVERT



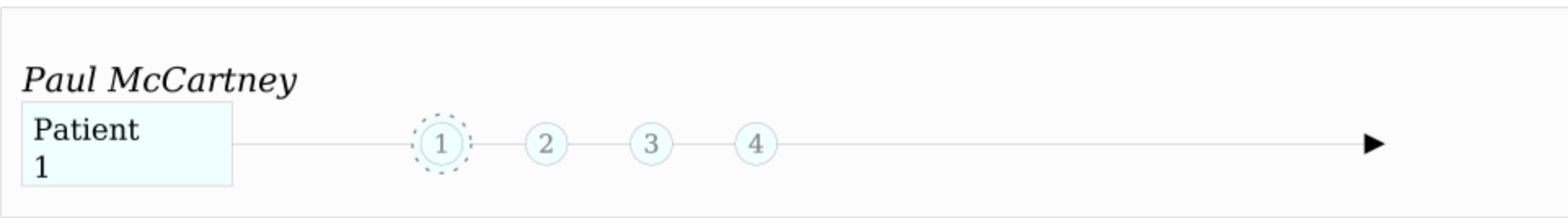
REVERT



REVERT AGAIN



REVERT AGAIN



MERGE/DEPRECATE



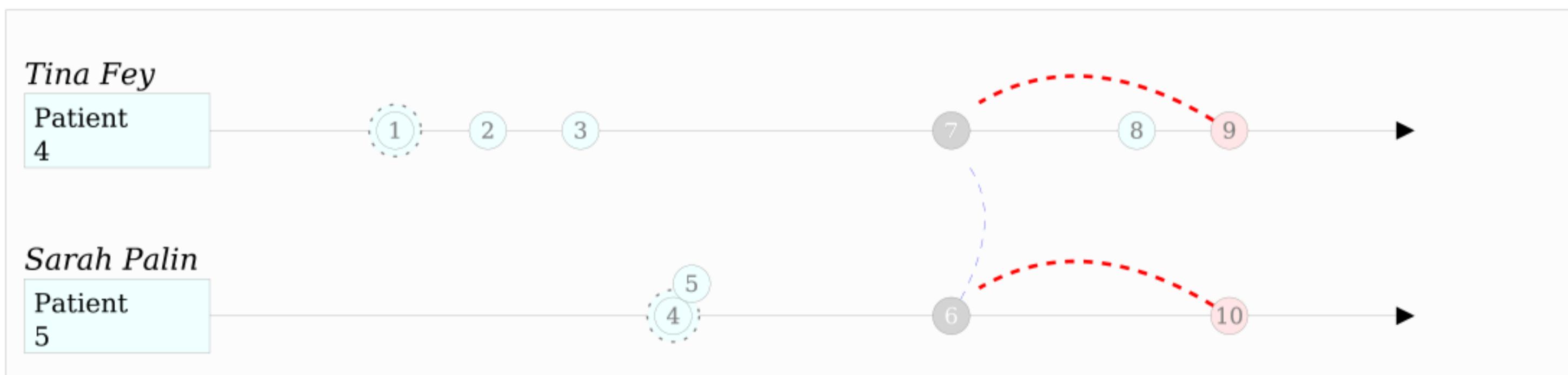
MERGE/DEPRECATE



REVERTING A MERGE



REVERTING A MERGE



BAD EXAMPLE 2

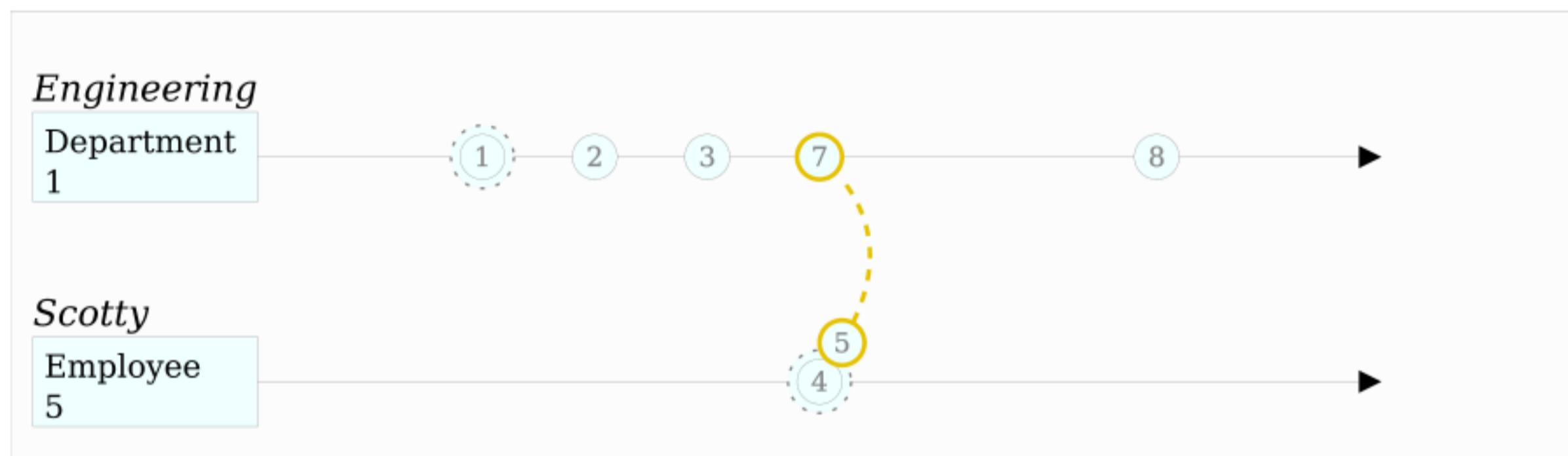
Employee

ID	EMP_NAME	DEPT_ID
1	Mr Spock	1
2	Scotty	2
3	Kirk	3
4	Janeway	3
5	La Forge	2

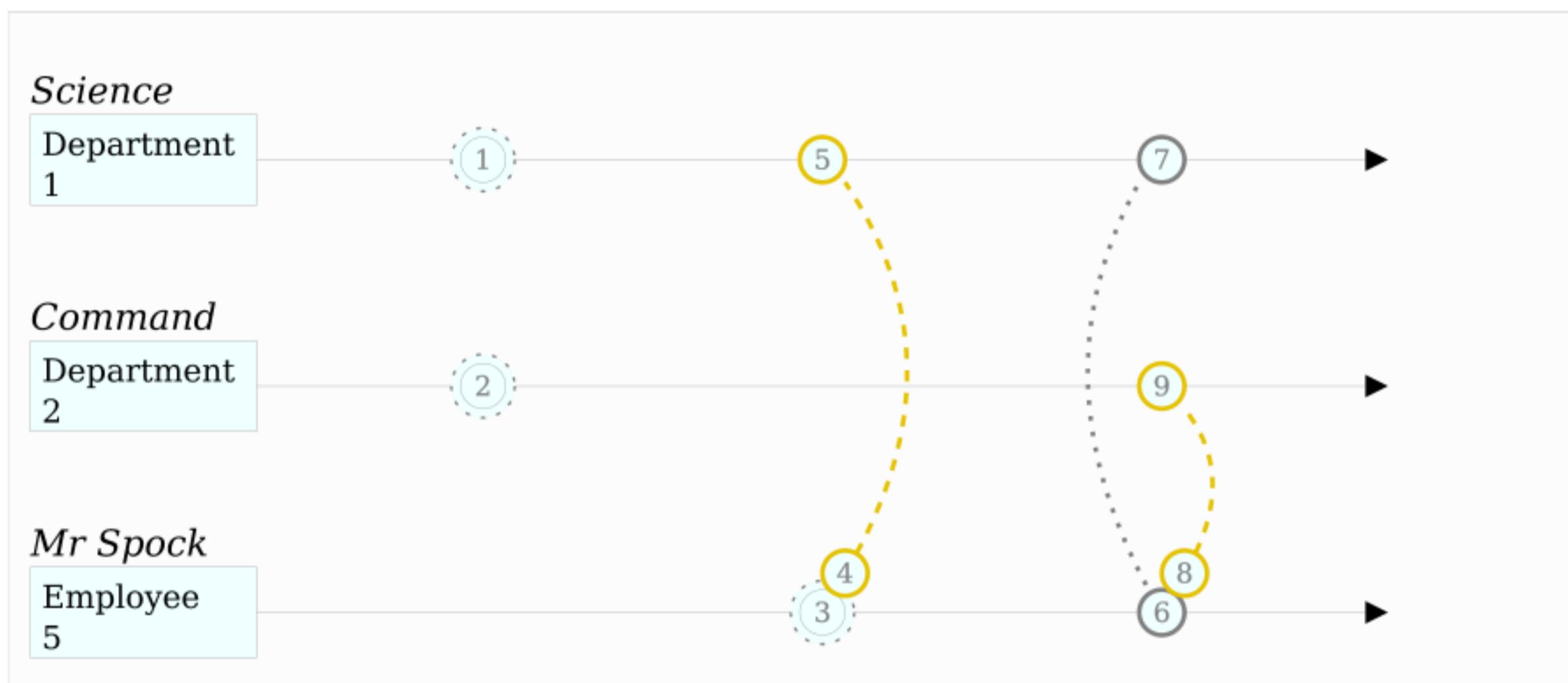
Department

ID	DEPT_NAME
1	Science
2	Engineering
3	Command

JOINS IN EVENT SOURCING



DISJOINS TOO



GROOVES DOMAIN OBJECTS

AGGREGATES

```
public class Patient implements AggregateType<Long> {  
    private Long id;  
    private String uniqueId;  
}
```

EVENTS

```
public abstract class PatientEvent implements
    BaseEvent<Long, Patient, Long, PatientEvent> {
    private Patient aggregate;
    private Long id;
    private String createdBy;
    private RevertEvent<Long, Patient, Long, PatientEvent> revertedBy;
    private Date timestamp;
    private Long position;

    @Override
    @NotNull
    public Observable<Patient> getAggregateObservable() {
        return aggregate != null ? just(aggregate) : empty();
    }
}
```

REAL EVENTS

```
public class PatientCreated extends PatientEvent {  
    private String name;  
}
```

SPECIAL EVENTS

```
public class PatientEventReverted
    extends PatientEvent
    implements RevertEvent<Long, Patient, Long, PatientEvent> {
    private Long revertedEventId;
}
```

SNAPSHOTS

```
public class PatientAccount
    implements JavaSnapshot<Long, Patient, Long, Long, PatientEvent>,
    Serializable {
    private Long id;
    private Patient aggregate;
    private Patient deprecatedBy;
    private List<Patient> deprecates = new ArrayList<>();
    private Long lastEventPosition;
    private Date lastEventTimestamp;

    private String name;
    private BigDecimal balance = new BigDecimal(0);
    private BigDecimal moneyMade = new BigDecimal(0);

    public Observable<Patient> getAggregateObservable() {
        return just(aggregate);
    }
}
```

GROOVES QUERIES

SATISFYING GROOVES

```
public class PatientAccountQuery<...> extends QuerySupport<...> {  
    ...  
}
```

Could also be `VersionedQuerySupport` or
`TemporalQuerySupport`

FETCHING SNAPSHOTS

```
@Override  
public PatientAccount createEmptySnapshot() {  
    return new PatientAccount();  
}  
  
@Override  
public Observable<PatientAccount> getSnapshot(  
    long maxPosition, Patient aggregate) {  
    ...  
}  
  
@Override  
public Observable<PatientAccount> getSnapshot(  
    Date maxTimestamp, Patient aggregate) {  
    ...  
}
```

FETCHING EVENTS

```
@Override  
public Observable<PatientEvent> getUncomputedEvents(  
    Patient aggregate, PatientAccount lastSnapshot, long version) {  
  
}  
  
@Override  
public Observable<PatientEvent> getUncomputedEvents(  
    Patient aggregate, PatientAccount lastSnapshot, Date snapshotTim  
  
}
```

HANDLING ERRORS

```
@Override  
default Observable<EventApplyOutcome> onException(  
    Exception e, PatientAccount snapshot, PatientEvent event) {  
    getLog().error("Error computing snapshot", e);  
    return just(CONTINUE);  
}
```

PROCESSING EVENTS

For languages like Java, Groovy

```
public Observable<EventApplyOutcome> applyPatientCreated(  
    PatientCreated event, PatientAccount snapshot) {  
    if (snapshot.getAggregate() == event.getAggregate()) {  
        snapshot.setName(event.getName());  
    }  
    return just(CONTINUE);  
}
```

...

PROCESSING EVENTS

For languages with case classes

```
override fun applyEvent(  
    event: PatientEvent.Applicable, snapshot: PatientAccount) =  
    when (event) {  
        is PatientEvent.Applicable.Created -> {  
            // Your logic here  
            just(CONTINUE)  
        }  
        is PatientEvent.Applicable.ProcedurePerformed -> {  
            // Your logic here  
            just(CONTINUE)  
        }  
        is PatientEvent.Applicable.PaymentMade -> {  
            // Your logic here  
            just(CONTINUE)  
        }  
    }
```

EVENTS

For languages with case classes

```
sealed class PatientEvent : BaseEvent<..> {
    // Properties and methods from equivalent java class

    sealed class Applicable : PatientEvent() {
        data class Created(val name: String) : Applicable()
        data class ProcedurePerformed(
            val code: String, val cost: Double) : Applicable()
        ...
    }

    data class Reverted(override val revertedEventId: String) :
        PatientEvent(), RevertEvent<..>
}
```

COMPLETENESS FOR JAVA

...and Groovy.

```
@Aggregate public class Patient {...}  
public abstract class PatientEvent {}  
  
@Event(Patient.class)  
public class ProcedurePerformed extends PatientEvent {}  
@Event(Patient.class)  
public class PaymentMade extends PatientEvent {}  
  
@Query(aggregate=Patient.class, snapshot=PatientAccount.class)  
public class PatientAccountQuery {  
    ...  
    Observable<EventApply0utcome> applyProcedurePerformed() {...}  
    Observable<EventApply0utcome> applyPaymentMade() {...}  
}
```

GOTCHAS



How many Tour de France General Classification Tour victories did this guy have on 2007-10-01?

EPA/JASPER JUINEN, 22 July 2004. Sourced from *vosizneias*

LANCE ARMSTRONG

1992	Joins Motorola	2002	
1993	DNF	2003	
1994	DNF	2004	
1995	36	2005	
1996	DNF	2005	Retires
1996-10	Diagnosed with Cancer	2009	Returns from retirement
1997-02	Declared cancer free	2009	3
1998	Joins US Postal	2010	23
1999		2010	Retires
2000		2012-10	Stripped of all wins from
2001			1998 through 2010

A photograph of Lance Armstrong, wearing the yellow overall leader's jersey, celebrating a victory by raising his arms in triumph. He is wearing a white and blue helmet and sunglasses. The background is blurred, showing other cyclists and spectators.

1. Based on what we knew in 2007,
How many TdF GC
Tour victories did he have on 2007-10-01?

2. Based on what we know in 2017,
How many TdF GC
Tour victories did he have on 2007-10-01?

A photograph of Lance Armstrong, wearing the yellow overall leader's jersey of the Tour de France, with his arms raised in triumph. He is wearing a white and blue helmet and sunglasses. The background is blurred spectators.

1. Based on what
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Tour victories did
he have on 2007-10-
01?

Ask the right question

ADVICE ON HANDLING DATA

- Be very careful about what your events look like.
- Don't worry much about what your snapshots look like.

COMMUNICATION IS KEY



Scott Bellware
@sbellware

 Follow

95% of the cost of event sourcing projects is explaining event sourcing

2:06 AM - Jun 11, 2017

 10  142  294

i

NON EVENT SOURCES OF DATA

When the intent of the user is not clear from the datasource.



The Story of Goldilocks and The Three Bears, Award Publications LTD

THANK YOU

Slidedeck bit.ly/2017-es

Grooves github.com/rahulsom/grooves

Sun 15:00	CON7610	Microservices Data Patterns: CQRS and ES
Mon 16:30	CON2526	Reactive Stream Processing with Swarm and Kafka
Mon 17:30	CON7474	ES, Distributed Systems, and CQRS with Java EE
Tue 13:15	CON4083	Async by Default, Synchronous When Necessary
Wed 14:45	CON4277	Three µS Patterns to Tear Down Your Monoliths