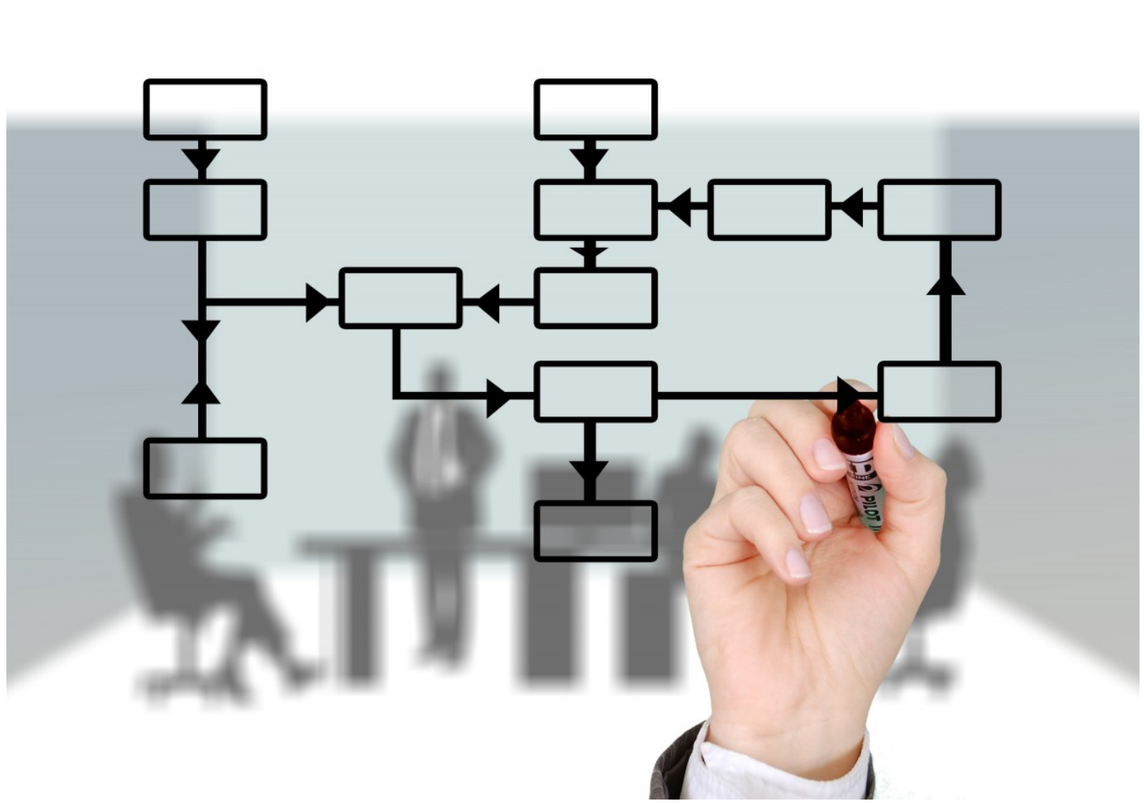
BUSINESS PROCESS ANALYTICS IN R

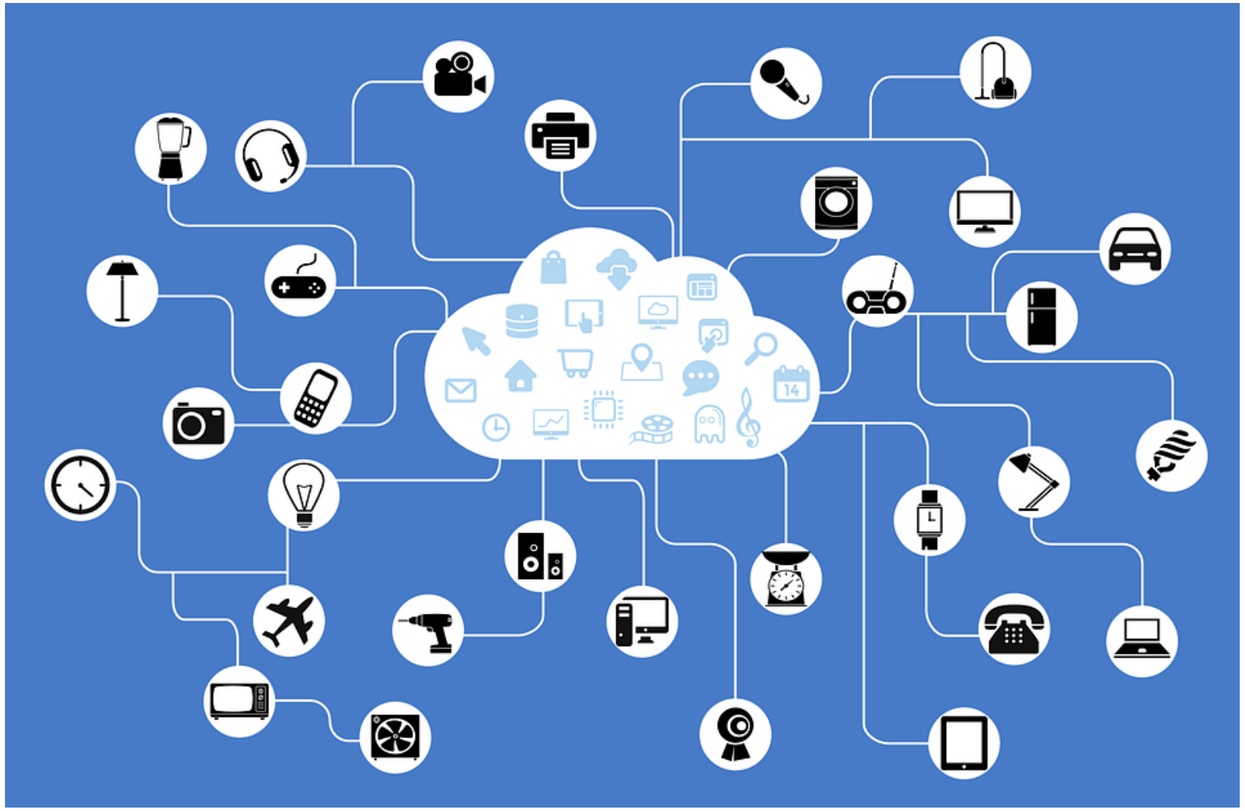
Introduction to Process Analytics

Gert Janssenswillen
Creator of bupaR

Business Processes



Event data

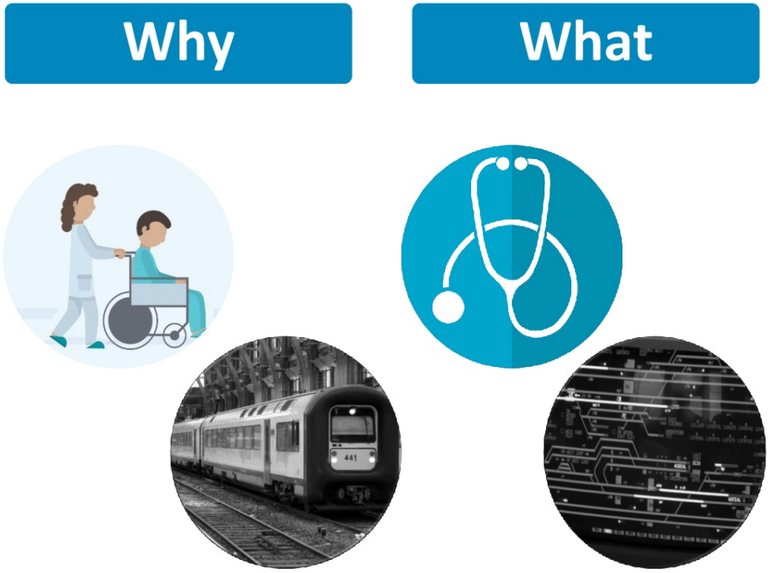


Process data

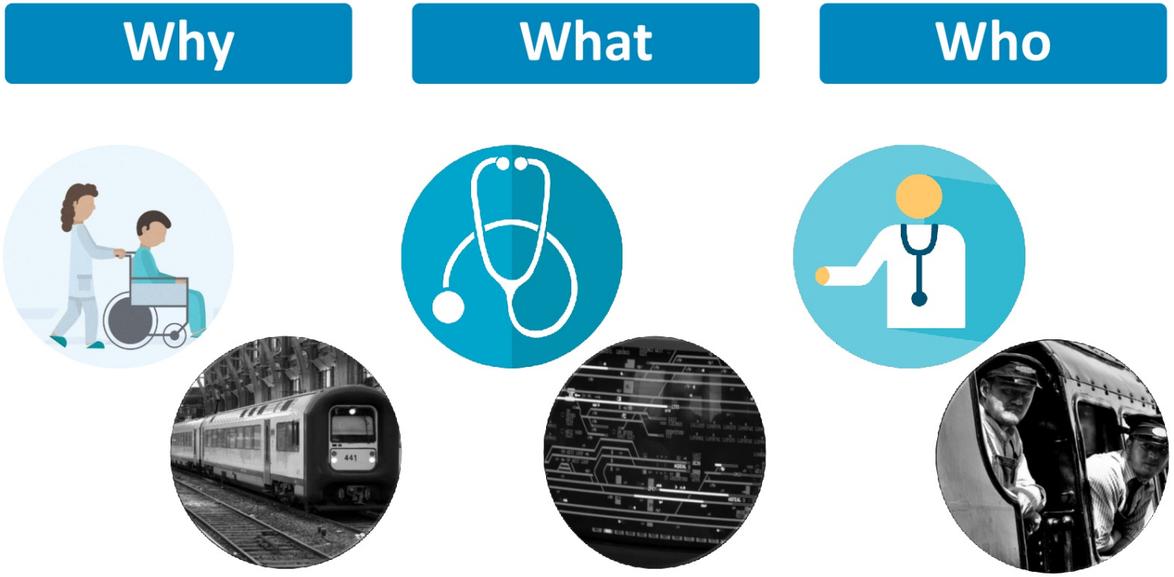
Why?

Why **What** **Who**

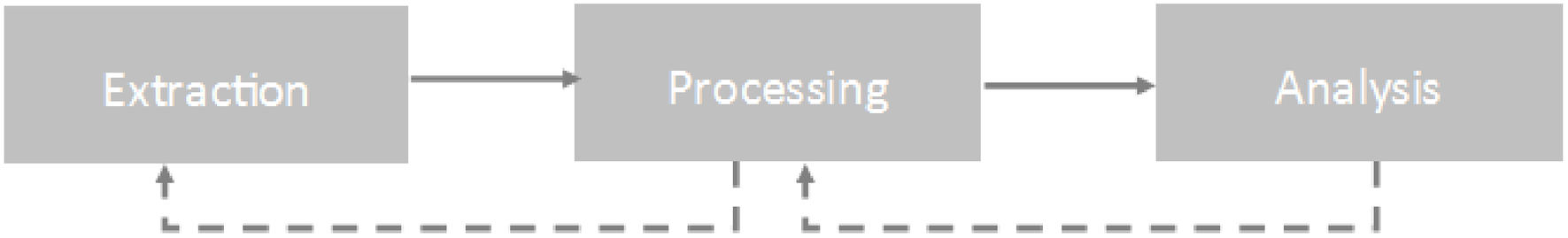
What?



Who?



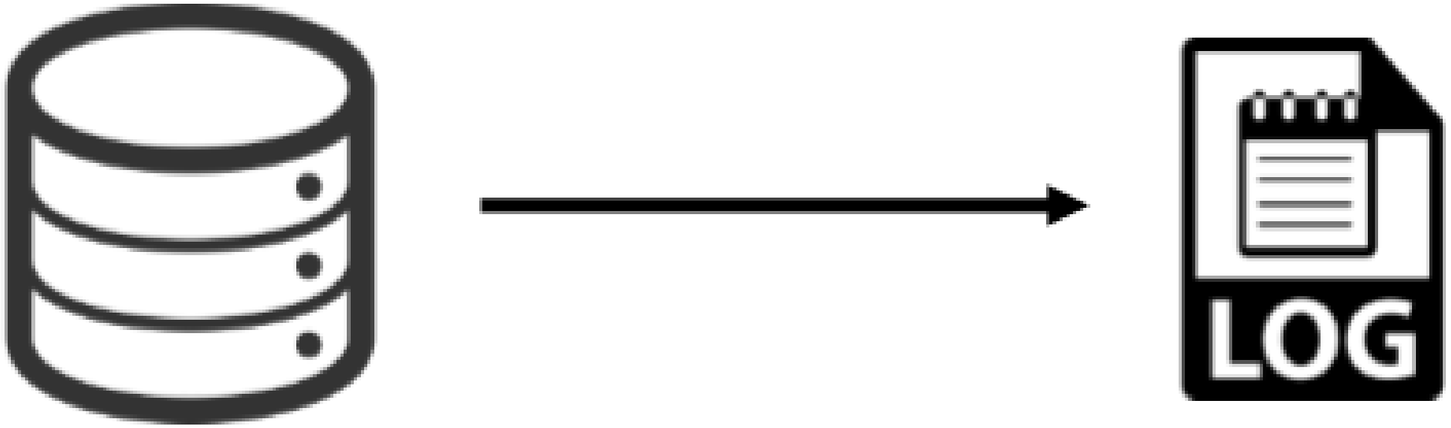
Process analysis workflow



1. **Extraction**: transform raw data into event data
2. **Processing**: enrich and filter event data
3. **Analysis**: gain useful insights in the process

Event Data Extraction

From raw data to event data



Event Data Preprocessing

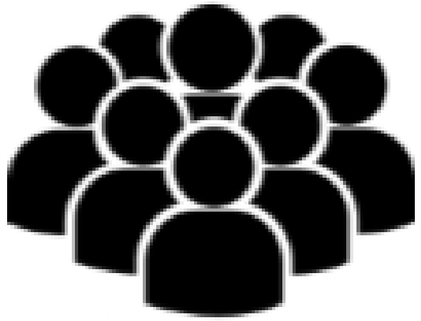
Aggregation: remove redundant details

Enrichment: add useful data attributes

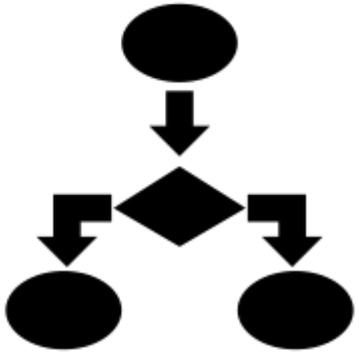
Filtering: focus your analysis

Event Data Analysis

Organizational



Control-flow



Performance

And also

- Multivariate analysis
- Include additional data attributes

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Let's practice!

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Activities as cornerstones of processes

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Example: Online learning

A first glimpse of the event log

Getting an idea about the event log scope

- How many **cases** are described?
- How many distinct **activities** are performed?
- How many **events** are recorded?
- What is the **time period** in which the data is recorded?

A first glimpse of the event log

```
library(bupaR)
```

This information can be viewed by printing the summary of an event log

```
summary(learning)
```

or using count functions.

```
> n_cases(learning)
498
> n_activities(learning)
10
> n_events(learning)
3645
```

Activities

Activities describe the flow of the process

- Which actions are performed?
- In what order are they performed?

Exploring activities

```
> activity_labels(learning)
```

```
 [1]  "Consult Dictionary"   "Consult Theory Pages" "Exercise 1"
 [4]  "Exercise 2"           "Exercise 3"           "Exercise 4"
 [7]  "Exercise 5"           "Exercise 6"           "Exercise 7"
 [10] "Assessment"
```

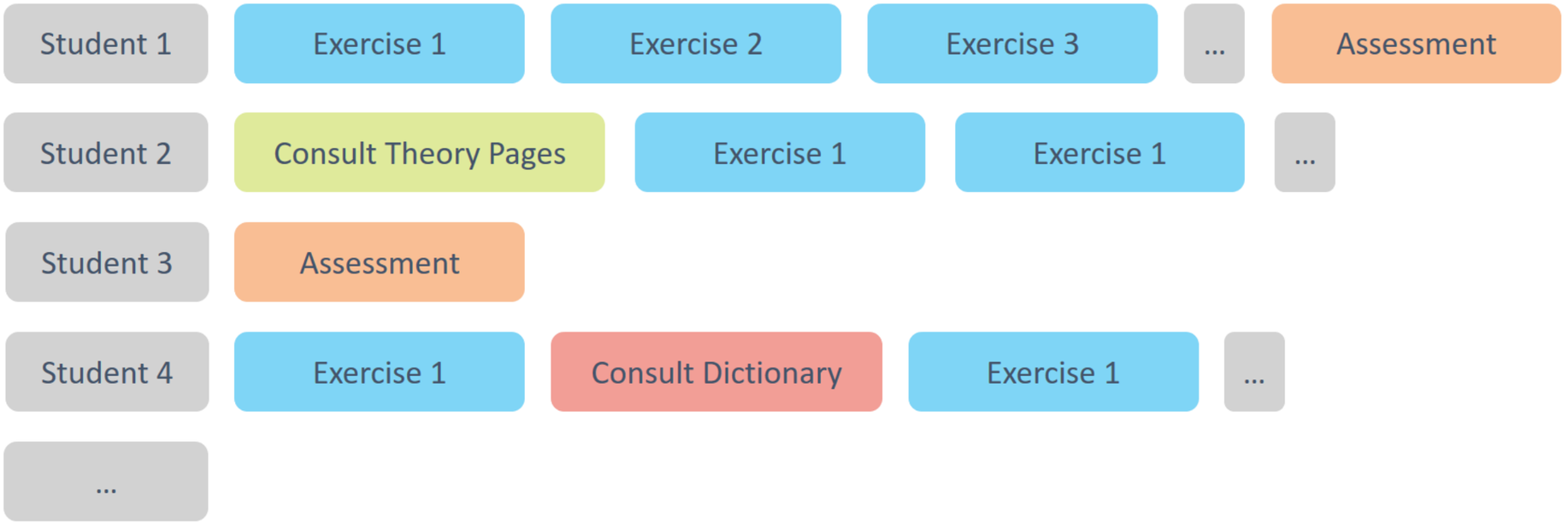
Exploring activities

```
activities(learning)
```

```
# A tibble: 10 x 3
   action               absolute_frequency relative_frequency
    <chr>                             <dbl>              <dbl>
 1 Exercise 1                          516              0.142
 2 Assessment                          498              0.137
 3 Exercise 2                          493              0.135
 4 Exercise 4                          442              0.121
 5 Exercise 3                          436              0.120
 6 Exercise 5                          360              0.0988
 7 Exercise 6                          302              0.0829
 8 Exercise 7                          299              0.0820
 9 Consult Dictionary                  165              0.0453
10 Consult Theory Pages                134              0.0368
```

Exploring sequences of activities

Each case is described by a sequence of activities, its **trace**.



Exploring sequences of activities

- A frequency table of traces can be retrieved with the `traces` function

```
traces(learning)
```

- They can be visualized using the `trace_explorer` function

```
trace_explorer(learning)
```

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Components of process data

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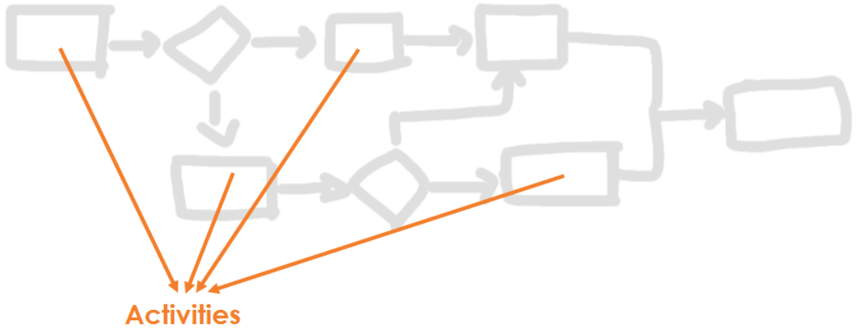
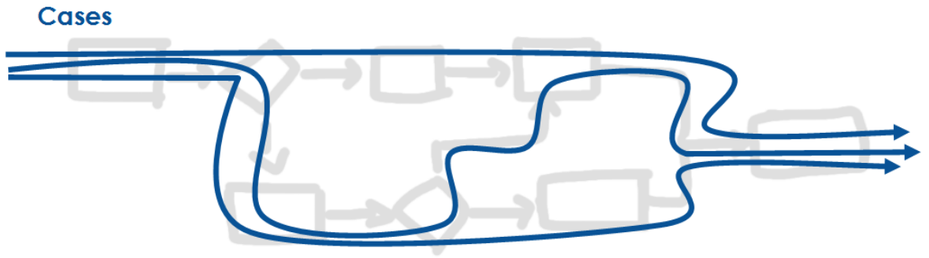
Cases and activities



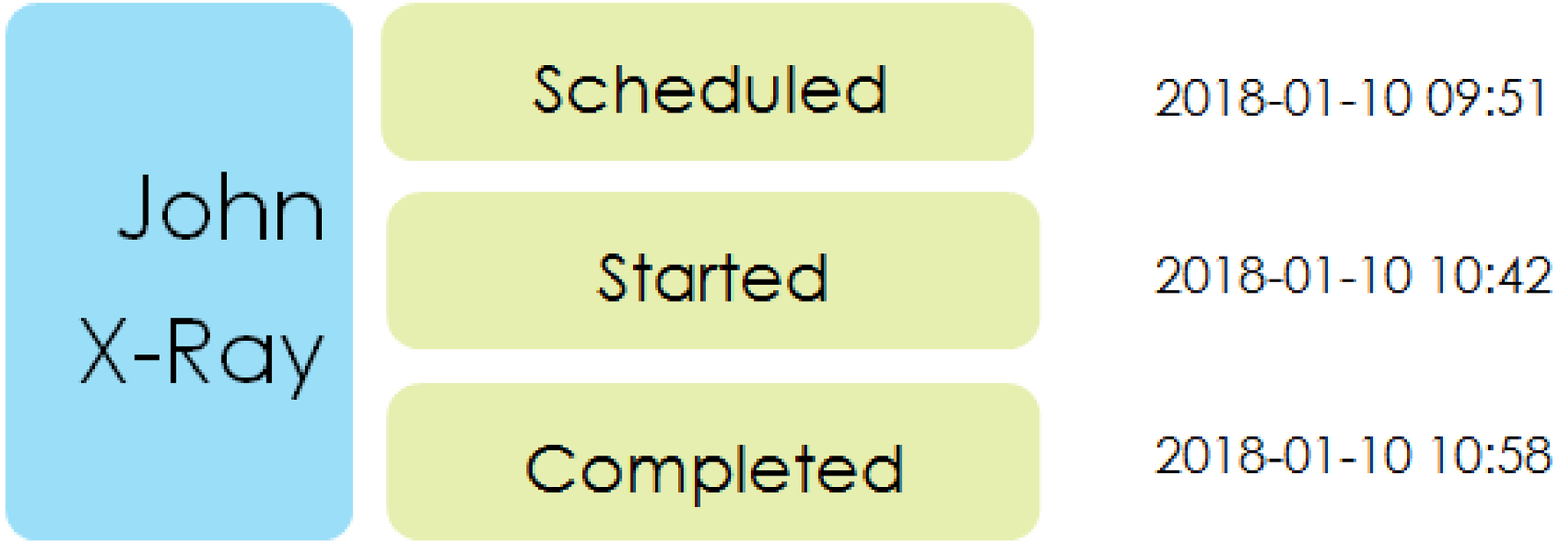


Activity instances

Activity instance = **occurence** of an activity

	Patient	Activity	Started at
1	John	Registration	2018-01-10 09:41
2	Emily	Registration	2018-01-10 10:36
3	John	X-Ray	2018-01-10 10:42

Events


John
X-Ray
Scheduled
Started
Completed
2018-01-10 09:51
2018-01-10 10:42
2018-01-10 10:58

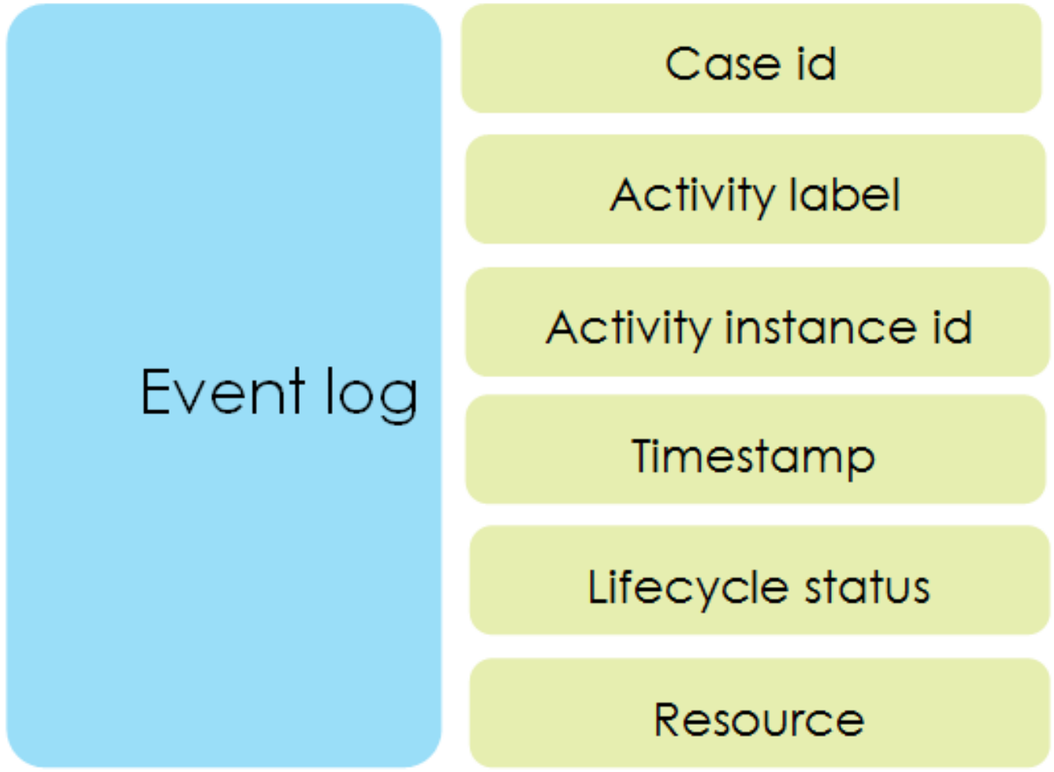
Event log

Instance	Patient	Activity	Status	Time
1	John	Registration	Start	2018-01-10 09:41
3	John	X-Ray	Schedule	2018-01-10 09:51
2	Emily	Registration	Start	2018-01-10 10:36
3	John	X-Ray	Start	2018-01-10 10:42
3	John	X-Ray	Complete	2018-01-10 10:58

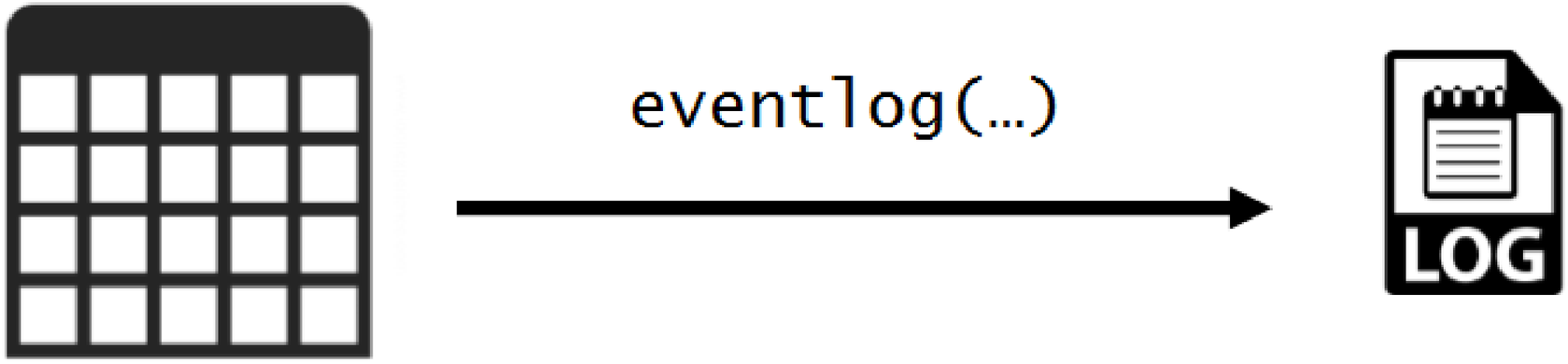
Resources

Instance	Patient	Activity	Status	Time	Resource
1	John	Registration	Start	2018-01-10 09:41	Mr. Owens
3	John	X-Ray	Schedule	2018-01-10 09:51	Dr. Russell
2	Emily	Registration	Start	2018-01-10 10:36	Mr. Fleming
3	John	X-Ray	Start	2018-01-10 10:42	Dr. Russell
3	John	X-Ray	Complete	2018-01-10 10:58	Dr. Russell

Recap: event log



Create event log object




```
event_data %>%
    eventlog(case_id = "patient",
             activity_id = "handling",
             activity_instance_id = "handling_id",
             timestamp = "time",
             lifecycle_id = "registration_type",
             resource = "employee")
```

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