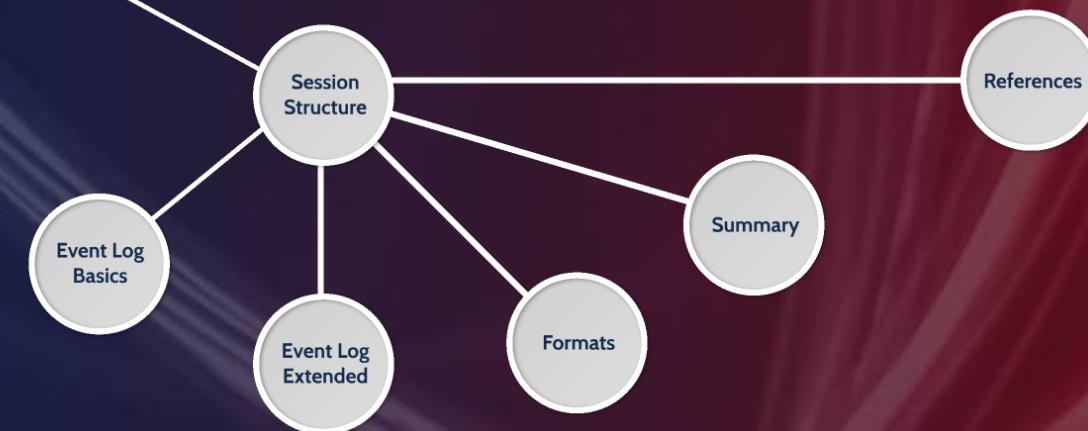


Foundations of Applied Process Mining

Data



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Session Structure

Learning Objectives –
The data dimension of a Process Mining project

Where to obtain process data in an organization

What is an event log

How further data can enable extended analysis

What are the concepts of the format of an event log

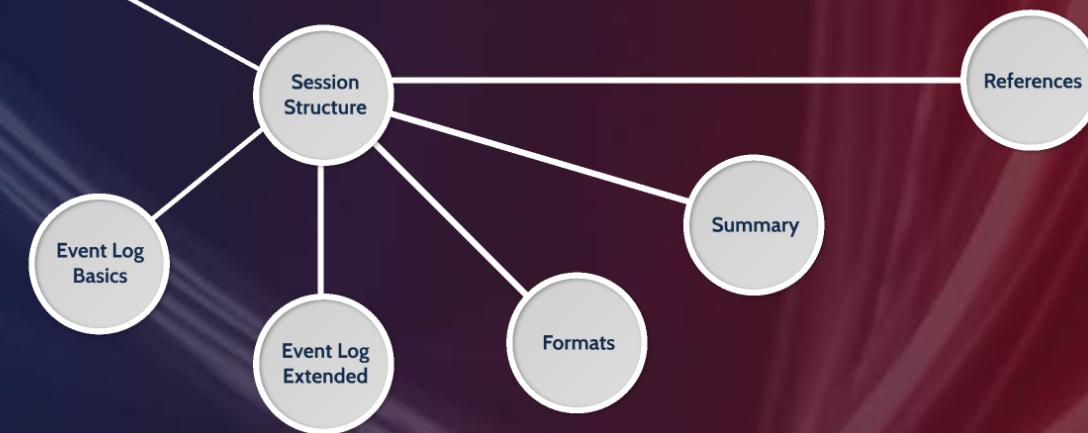
What is the difficulty of assembling the event log

If you want to read more,
references are always included
at the end of each session!



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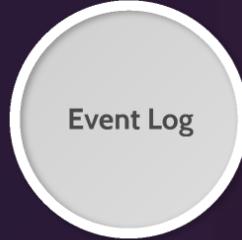
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Value is in the Data



Event Log

Value is in the Data



Where to find process data?

Event Log

Value is in the Data



Where to find process data?

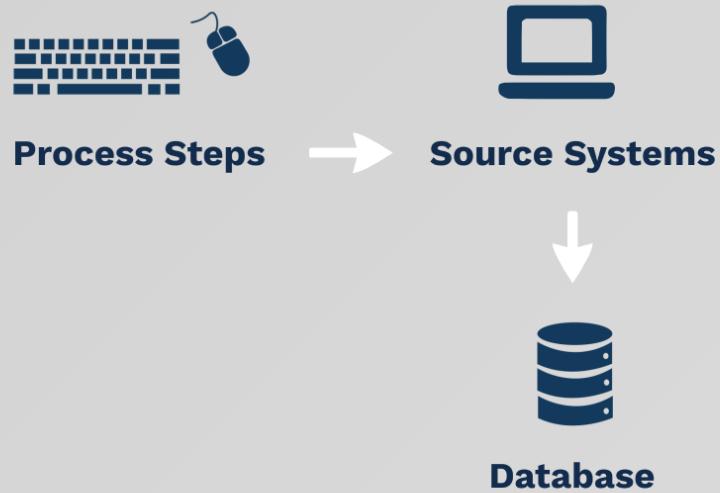
Processes



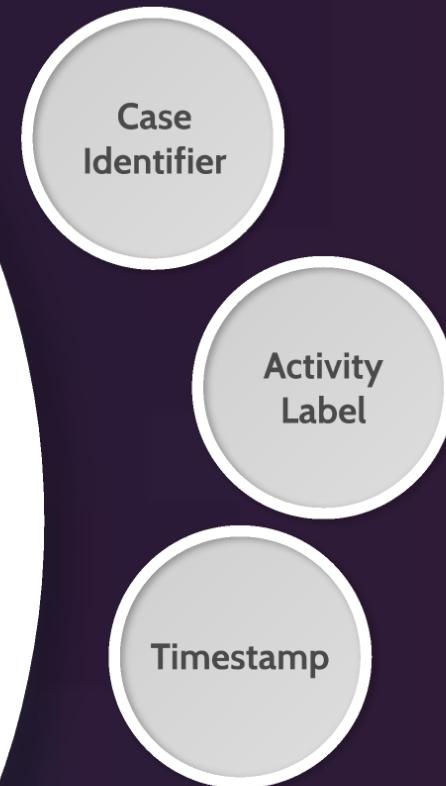
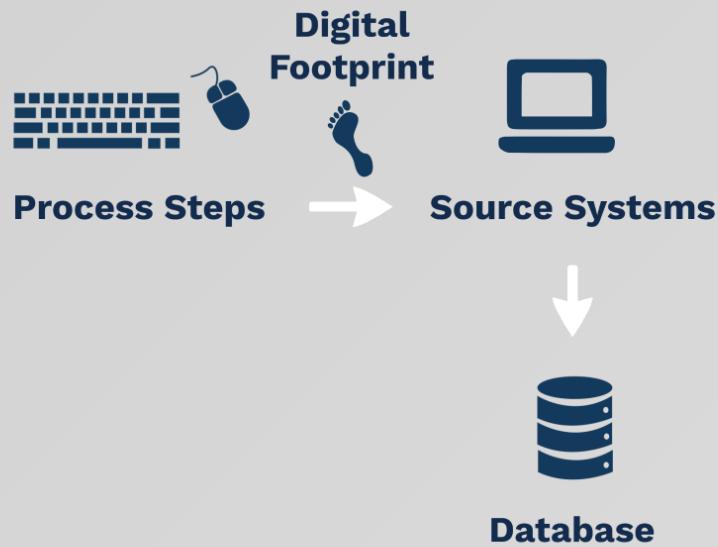
Supporting IT Systems

Event Log

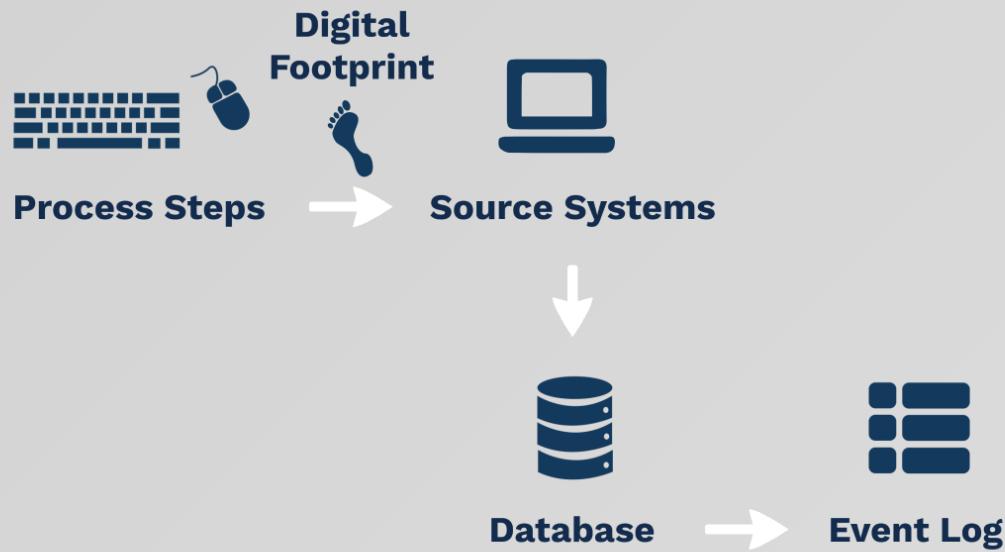
What is an Event Log



What is an Event Log



What is an Event Log



Structure of the Eventlog (1)

Case Identifier

Central object of
a process

Invoice			
Billed To	Order No.	Invoice Total	
XX Company xx street xx city 0000	1002	\$4500.00	
	Date Of Issue		
	10 / 08 / 19		
Description	Qty	Unit Price	Amount
Item 1	3	\$1000	\$3000
Item 2	5	\$500	\$1500
		Total	\$4500

Structure of the Eventlog (2)

Label / Activity

Process step



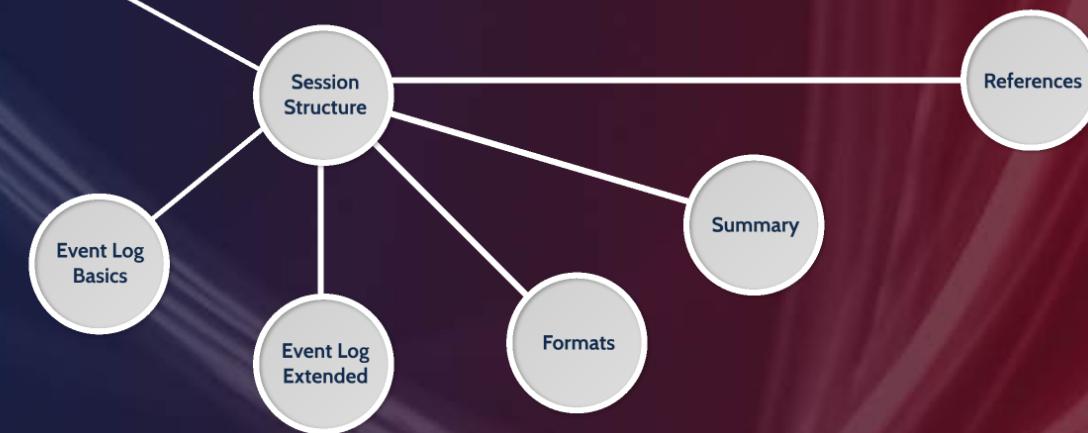
Structure of the Eventlog (3)

Timestamp Order of process step (crucial)

Invoice No	Activity	Timestamp
1002	Create Order	2018-11-13 01:05:37
1002	Receive Invoice	2018-11-20 01:04:41
1002	Receive Goods	2018-11-21 01:30:02
1002	Pay invoice	2018-11-22 07:45:16
1004	Create Order	2018-11-14 08:52:13
1004	Receive Goods	2018-11-17 11:50:21
1004	Receive Invoice	2018-11-22 14:16:18
1004	Pay invoice	2018-12-05 17:22:05
1005	Create Order	2018-11-07 13:20:18
1005	Receive Invoice	2018-11-10 16:07:02
1005	Receive Goods	2018-11-11 12:29:31
1005	Pay invoice	2018-12-11 08:00:18
1005	Receive Invoice	2018-12-14 09:10:45
1005	Receive Goods	2018-12-17 10:12:24
1005	Pay invoice	2018-12-23 08:50:07

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Event Log Enables Process Discovery



Extended
Analysis -
User Name

Extended
Analysis -
User Type

Extended
Analysis -
Case Table

Extended
Analysis -
Root Cause

Event Log Enables Process Discovery

The quality of the event log extends the possibilities of the analysis



Extended Analysis - User Name

Extended Analysis - User Type

Extended Analysis - Case Table

Extended Analysis - Root Cause

Extended Analysis Example 1 – Resource (1)

User Name

Resource
Mary
Steve
Anne
Bob
Mary
Steve
Anne
Bob
Hannah
Steve
Joseph
Bob
Jimmy
Hannah
Jonas

Extended Analysis Example 1 – Resource (1)

User Name

Resource
Mary
Steve
Anne
Bob
Mary
Steve
Anne
Bob
Hannah
Steve
Joseph
Bob
Jimmy
Hannah
Jonas



How departments work together

Extended Analysis Example 1 – Resource (1)

User Name

Resource
Mary
Steve
Anne
Bob
Mary
Steve
Anne
Bob
Hannah
Steve
Joseph
Bob
Jimmy
Hannah
Jonas



How departments work together



Data privacy –
need to anonymize the
user names

Extended Analysis Example 1 – Resource (2)

User Type

Resource
Human
Human
Machine
Machine
Human
Machine
Human
Human
Human
Machine
Human
Machine
Human
Machine
Machine

Extended Analysis Example 1 – Resource (2)

User Type

Resource
Human
Human
Machine
Machine
Human
Machine
Human
Human
Human
Machine
Human
Machine
Human
Machine
Machine
Machine

Automation rate =

$$\frac{\text{Machine}}{\text{Human} + \text{Machine}}$$

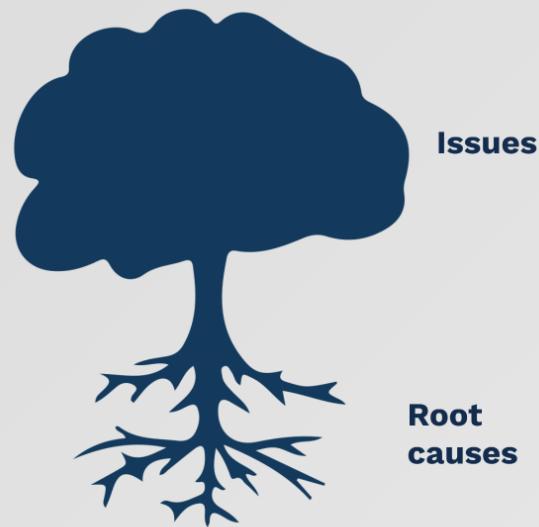
Extended Analysis Example 2 – Case Table (1)

Order No	Activity	Timestamp	Resource	??
1002	Enter order	2018-11-13 01:05:37	Mary	??
1002	Deliver goods	2018-11-20 01:04:41	Steve	??
1002	Create invoice	2018-11-21 01:30:02	Anne	??
1002	Payment	2018-11-22 07:45:16	Bob	??
1004	Enter order	2018-11-14 08:52:13	Mary	??
1004	Deliver goods	2018-11-17 11:50:21	Steve	??

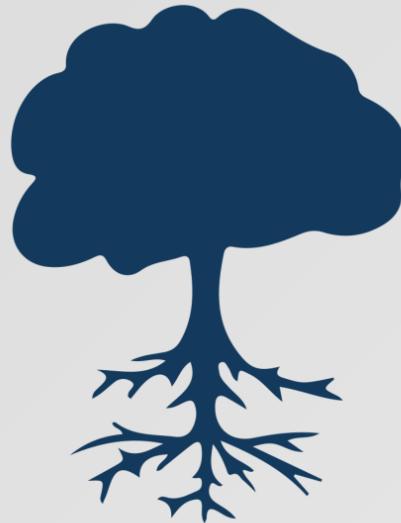


Which products were sold?
In which country?
How much was the sales value of
an order?

Extended Analysis Example 2 – Case Table (2)



Extended Analysis Example 2 – Case Table (2)



Issues

Sales process:

Order fulfillment time is long

**Root
causes**

Extended Analysis Example 2 – Case Table (2)



Issues

Sales process:

Order fulfillment time is long



Root causes

Differs per product?

For which product is it particularly long?

Extended Analysis Example 2 – Case Table (2)



Issues

Sales process:

Order fulfillment time is long



Root causes

Differs per product?

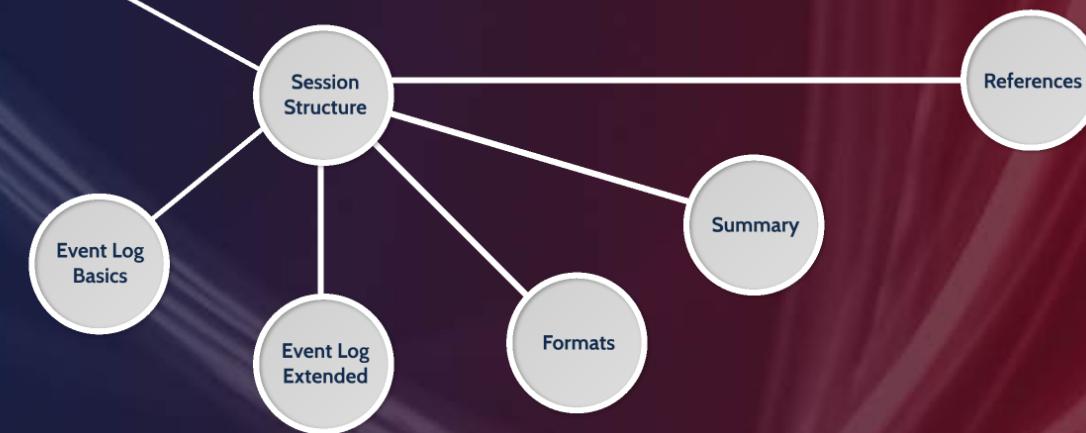
For which product is it particularly long?



Answers could be found!

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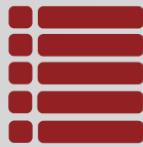


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Different Formats of Event Log



Different concepts but same core elements



XES/Flat-file

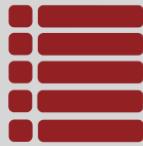
Database

Linked Data

Different Formats of Event Log



Different concepts but same core elements



Create your own simple log!



XES/Flat-file

Database

Linked Data

The XES Format



The XES Format

Meta Data



The XES Format



Meta Data

Case ID?

Timestamp - start or end?

Additional data?

The XES Format



Meta Data

Case ID?

Timestamp - start or end?

Additional data?



Problems:

The XES Format



Meta Data

Case ID?

Timestamp - start or end?

Additional data?



Problems:



Scalability?



Continuous logging?



Security?

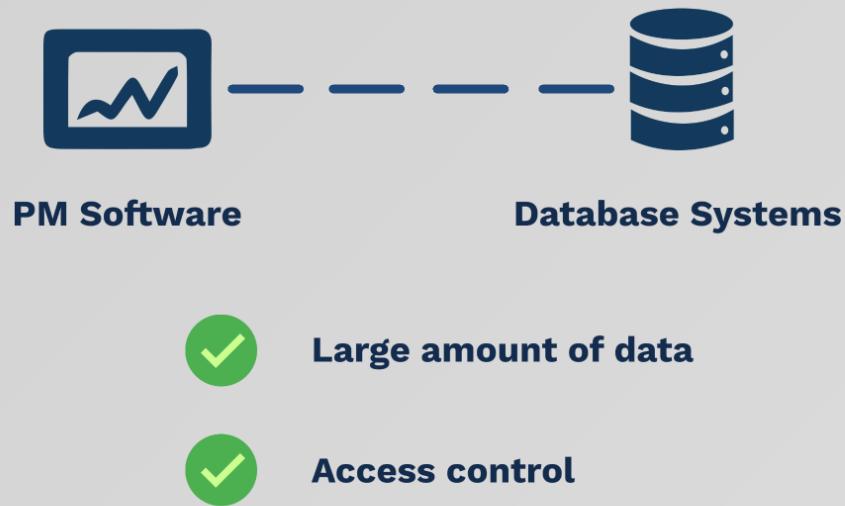
Relational Database



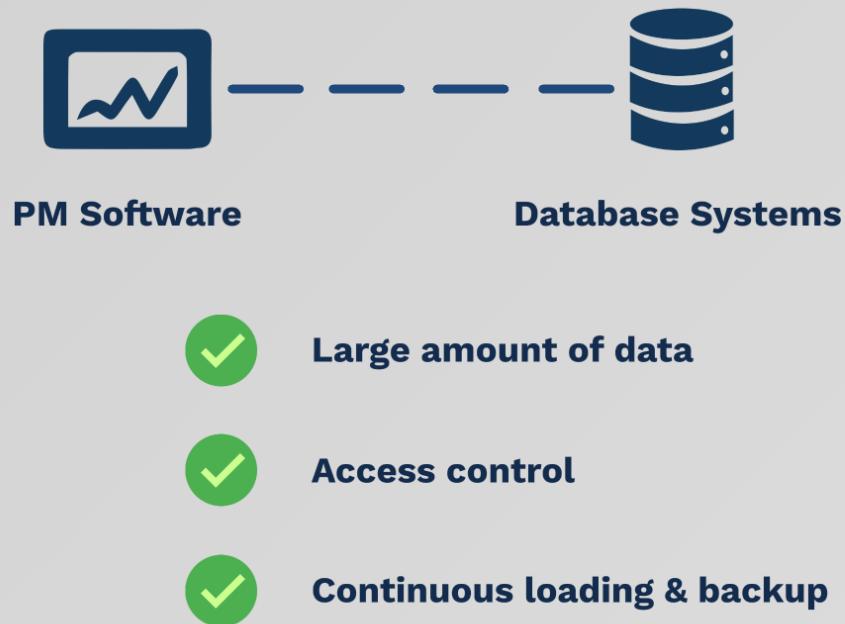
Relational Database



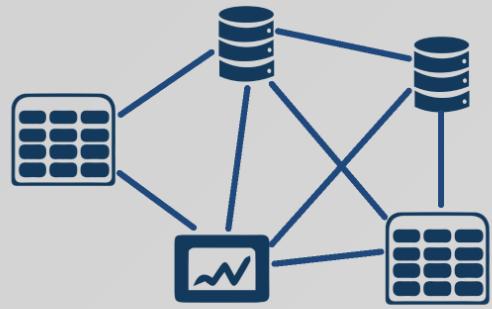
Relational Database



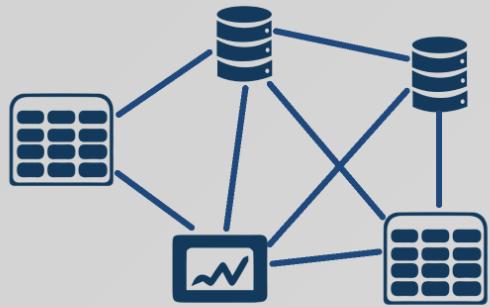
Relational Database



Multiple Data Sources

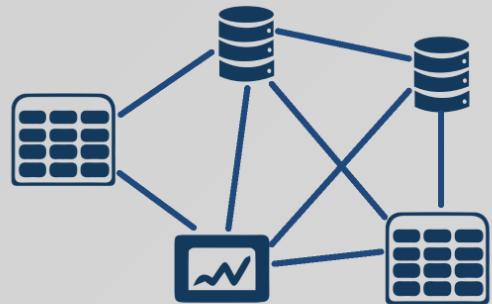


Multiple Data Sources



**most commercial Process Mining
software support connection to
database systems**

Multiple Data Sources



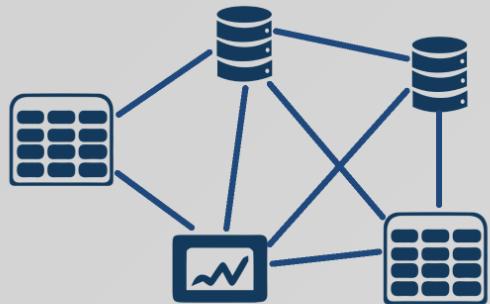
**most commercial Process Mining
software support connection to
database systems**

E.g.



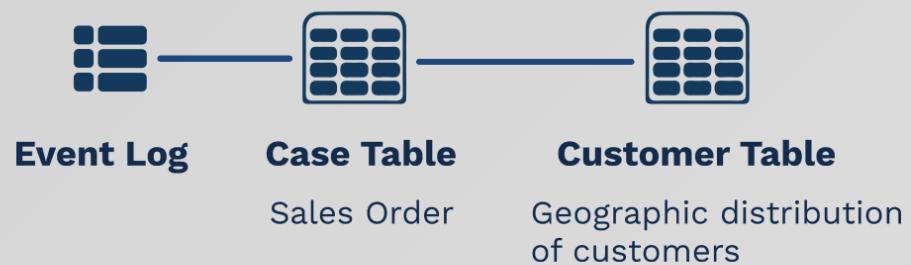
Event Log Case Table
Sales Order

Multiple Data Sources



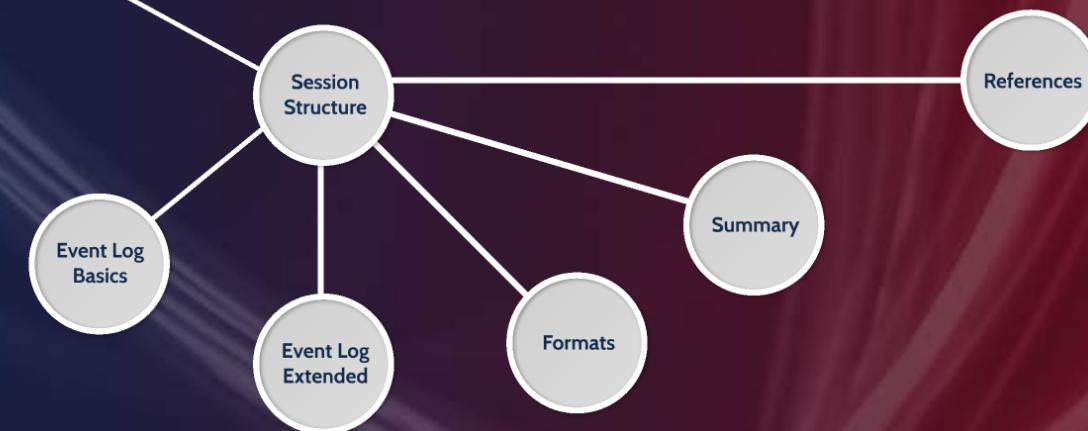
**most commercial Process Mining
software support connection to
database systems**

E.g.



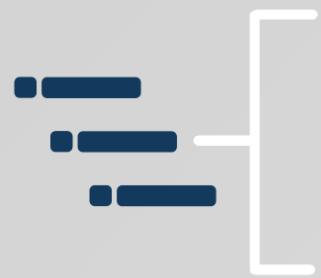
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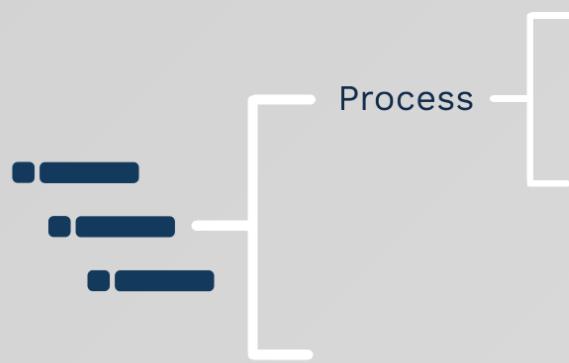
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Difficulty of Assembling the Event Log



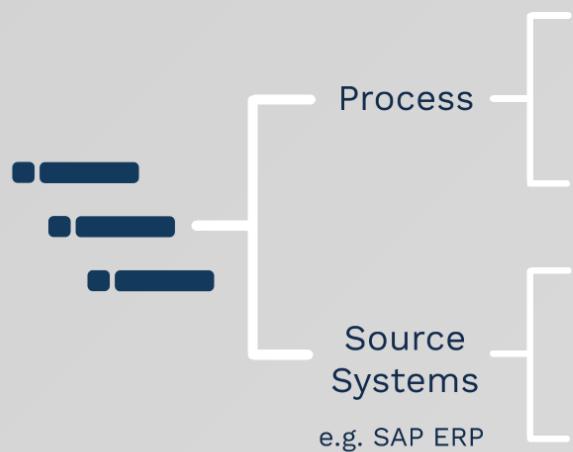
Summing
Up

Difficulty of Assembling the Event Log



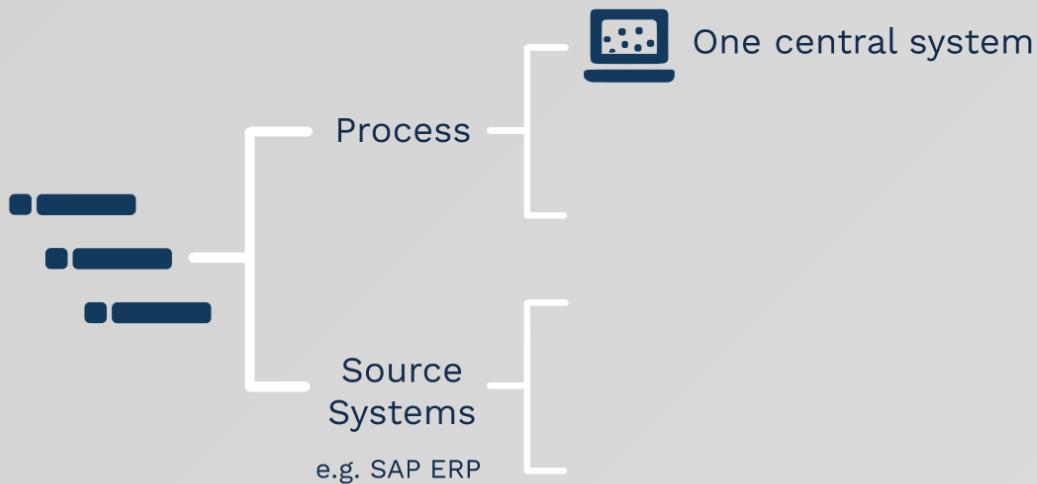
Summing
Up

Difficulty of Assembling the Event Log



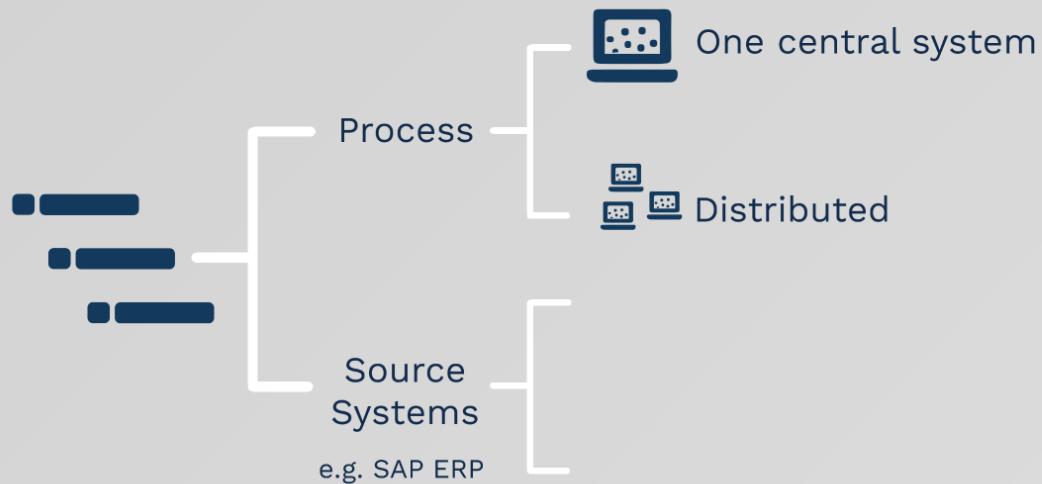
Summing
Up

Difficulty of Assembling the Event Log



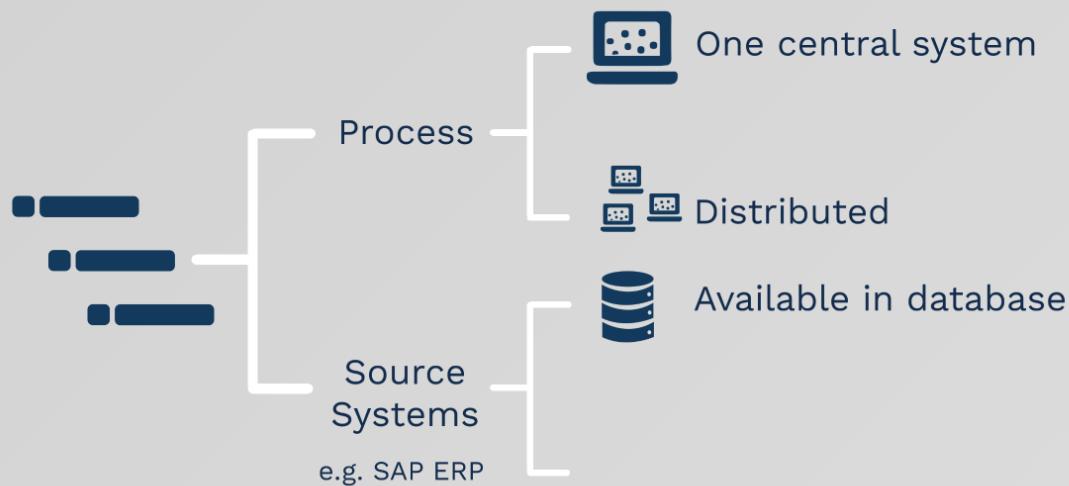
Summing
Up

Difficulty of Assembling the Event Log



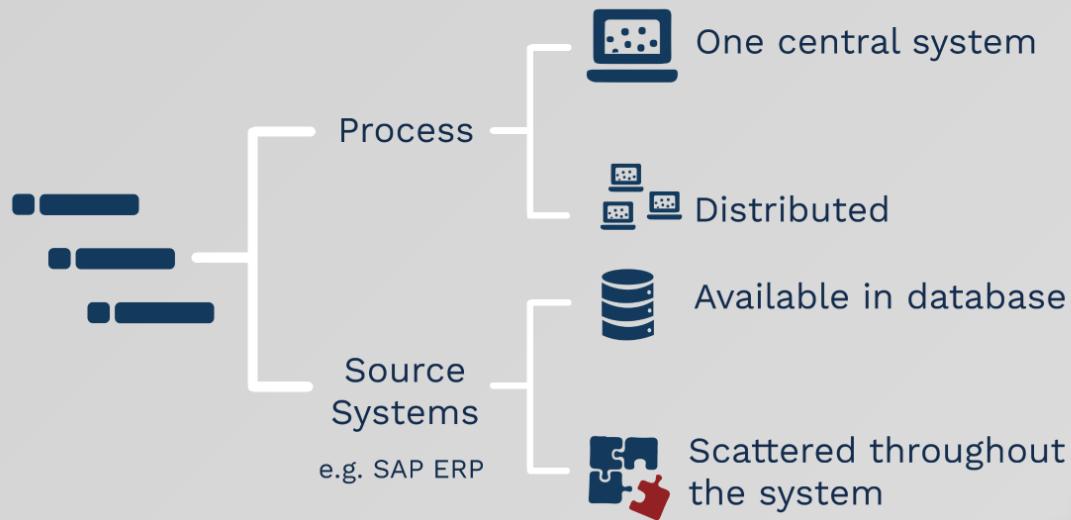
Summing
Up

Difficulty of Assembling the Event Log



Summing
Up

Difficulty of Assembling the Event Log

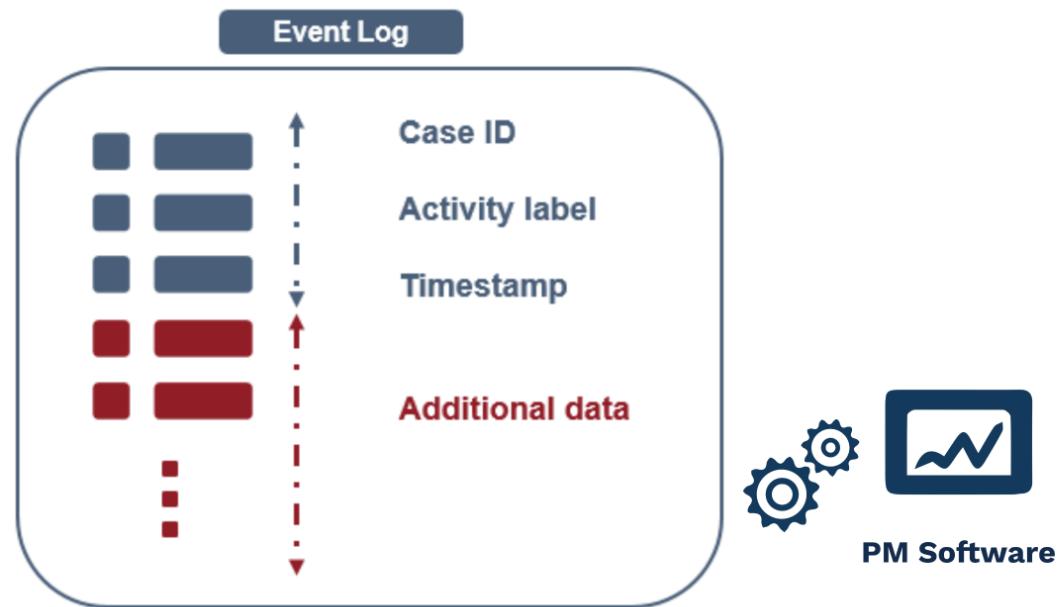


Summing
Up

Summing Up

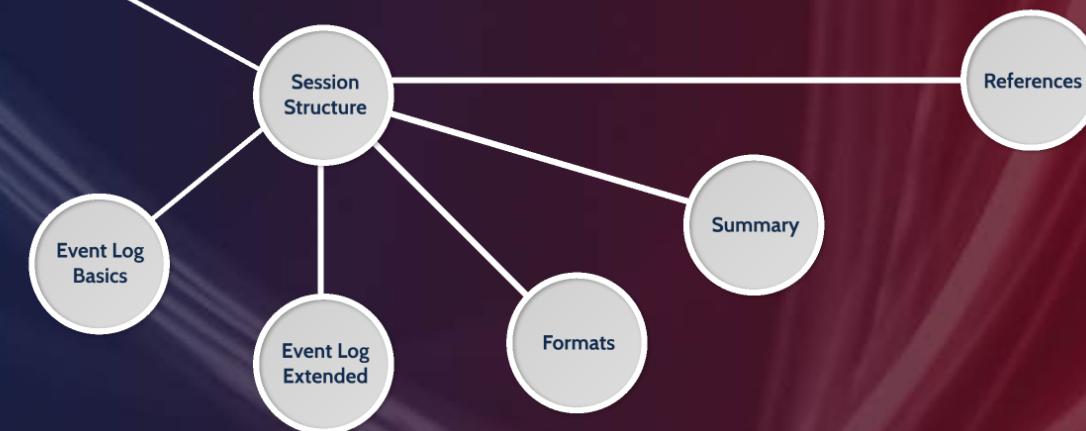


Summing Up



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Data



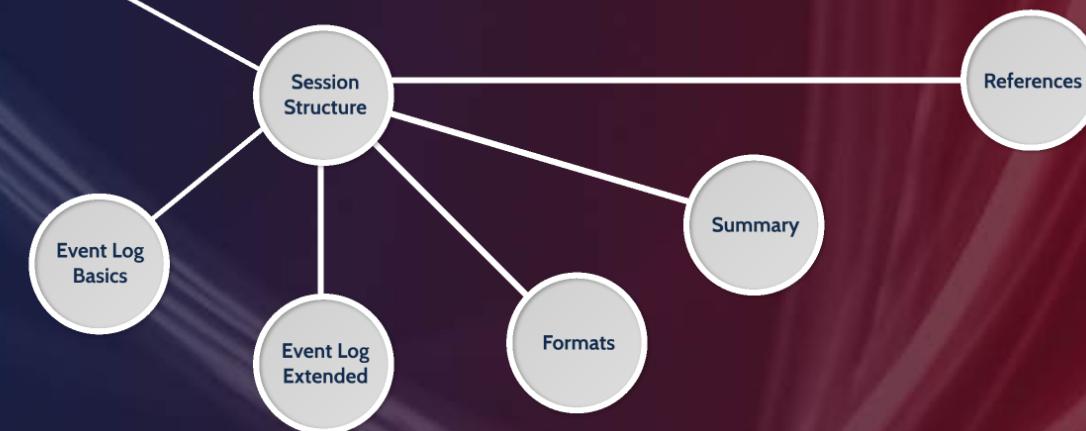
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References

1. Van Der Aalst, W. (2016). Process Mining: Data Science in Action (2nd ed.). Heidelberg: Springer.
2. Van Der Aalst, W. (2011). Process mining: discovery, conformance and enhancement of business processes (Vol. 2). Heidelberg: Springer.

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