

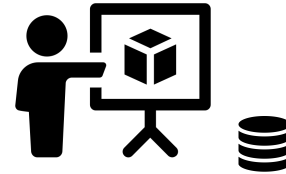


Multiple Case Notion in Log Extraction

Rachel Brabender and Oliver Clasen

Current State of the Art

- XES notation as the current standard to visualize a process flow
- object-centric information systems are builded on top of relational database technology
- There are already approaches to extract XES log files from object-centric data



Event Log Extraction from Databases

**How to retrieve events from
database?**



Redo Logs



In-table
versioning



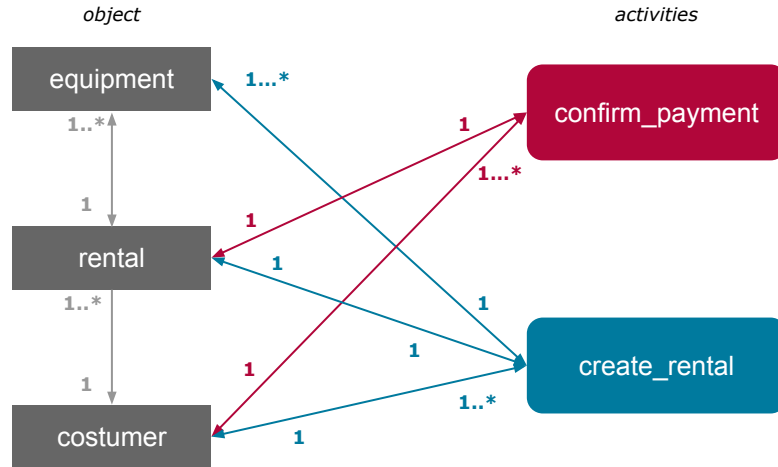
Domain
Knowledge



Time

It requires ...

Discover a Relational Database of a Rental Shop



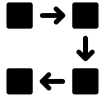
Event Log

event identifier	activity	timestamp	objects involved		
			costumer	rental	equipment
1	<i>create_rental</i>	2020-02-20 22:21	{c1}	{r1}	{e1,e2}
2	<i>confirm_payment</i>	2020-02-21 08:22	{c1}	{r1}	{}
3	<i>create_rental</i>	2020-02-21 10:10	{c2}	{r2}	{e2}

Chart 4

From object-centric data to the XES format

Challenges [1]



"It is required to identify the case id for the whole process."



"The quality of the input data gets compromised."



"Interactions between process instances get lost."



"The data perspective is only secondary."

Modeling Notations

	eXtensible Event Stream (XES)	eXtensible Object-Centric (XOC)
<i>Perspective</i>	Inheritance Hierarchy Structure (Top-Down Approach)	Object-Centric Data (e.g. database tables)
<i>Log entries</i>	Single Case Notion: events belonging to cases	Multiple Case Notions: events describing interaction between objects
<i>Relations</i>	1 case to 1...* events and 1 event to 1 case	1 object to 1...* events and 1 event to 1..* objects
<i>Drawback</i>	the decision for a perspective discards information	tend to become complex and difficult to understand



can be used to describe a certain perspective

Goal

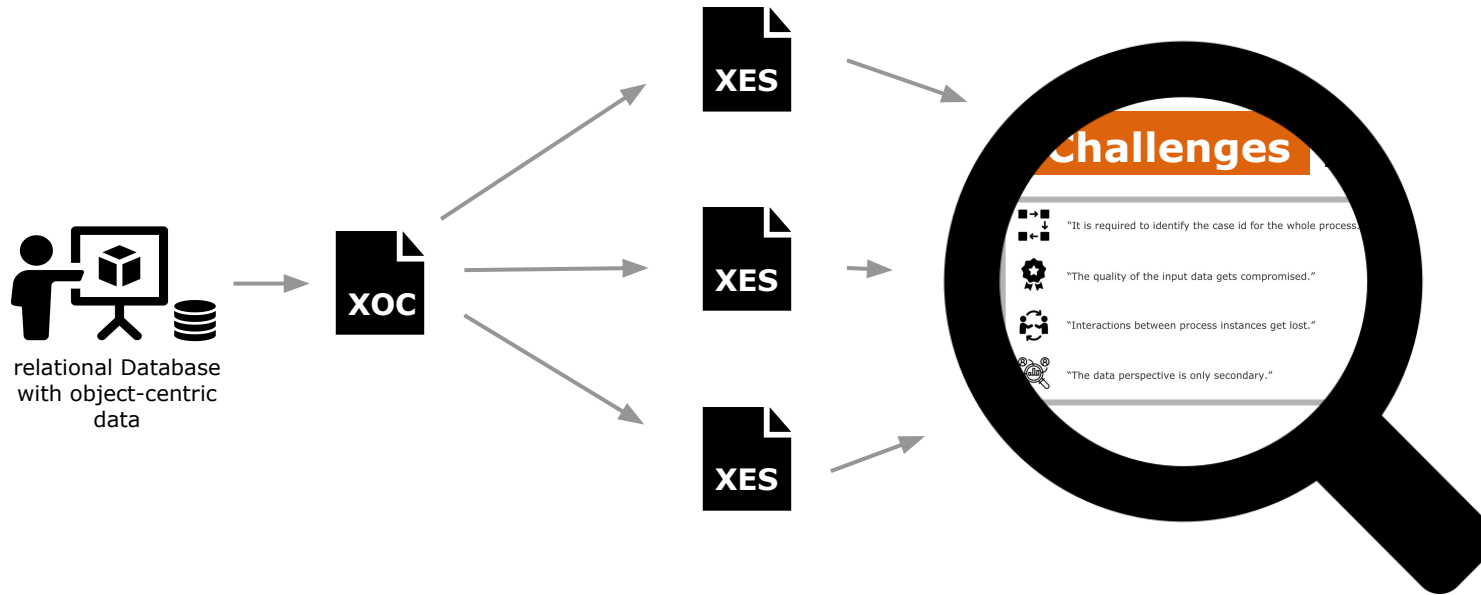


Chart 7

Milestones



Model of our Process in a Online Rental Shop

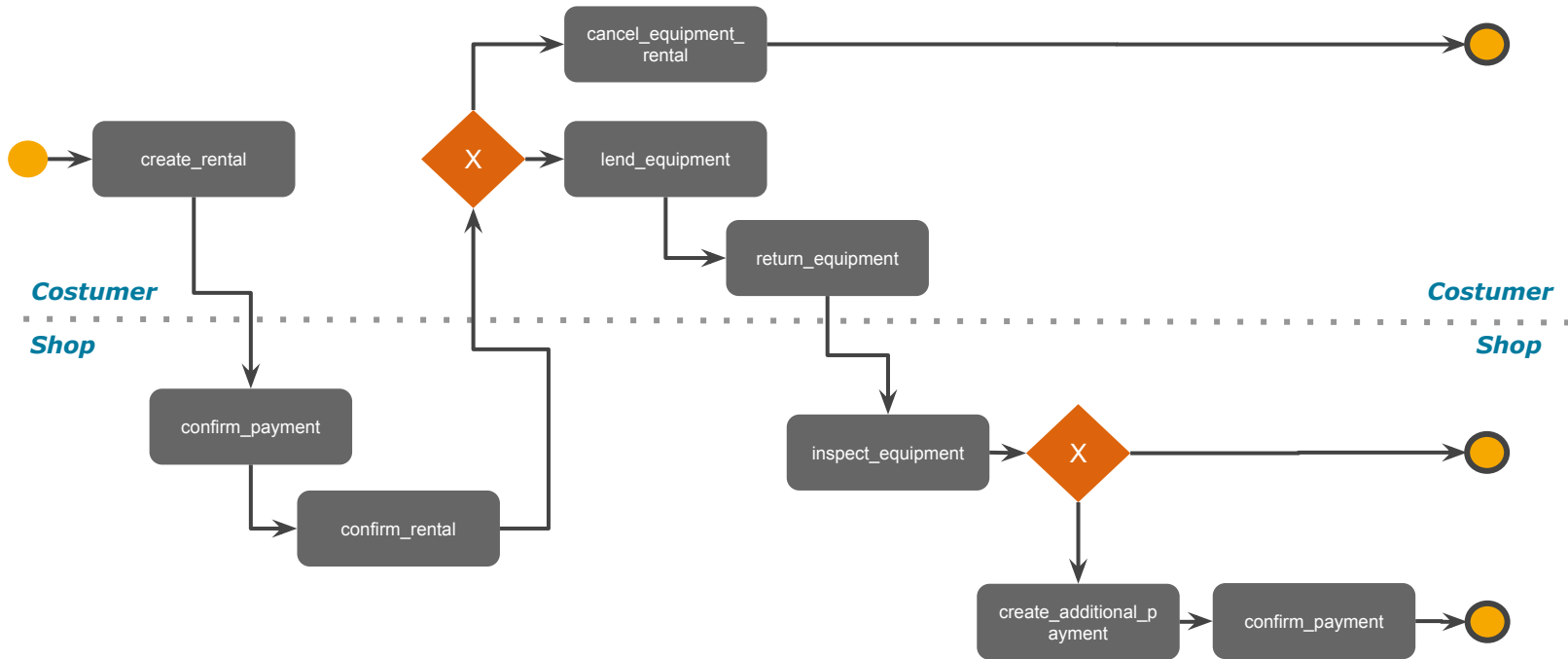
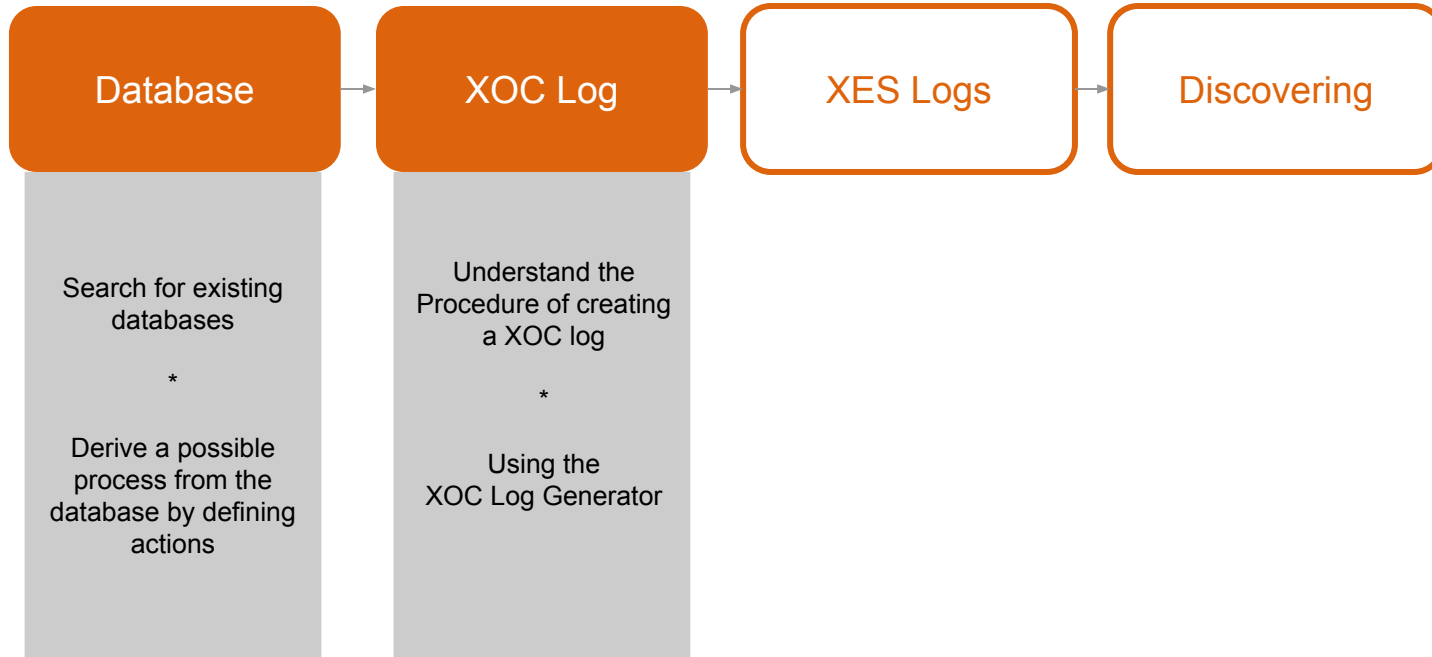


Chart 9

Milestones



XOC Log Generator

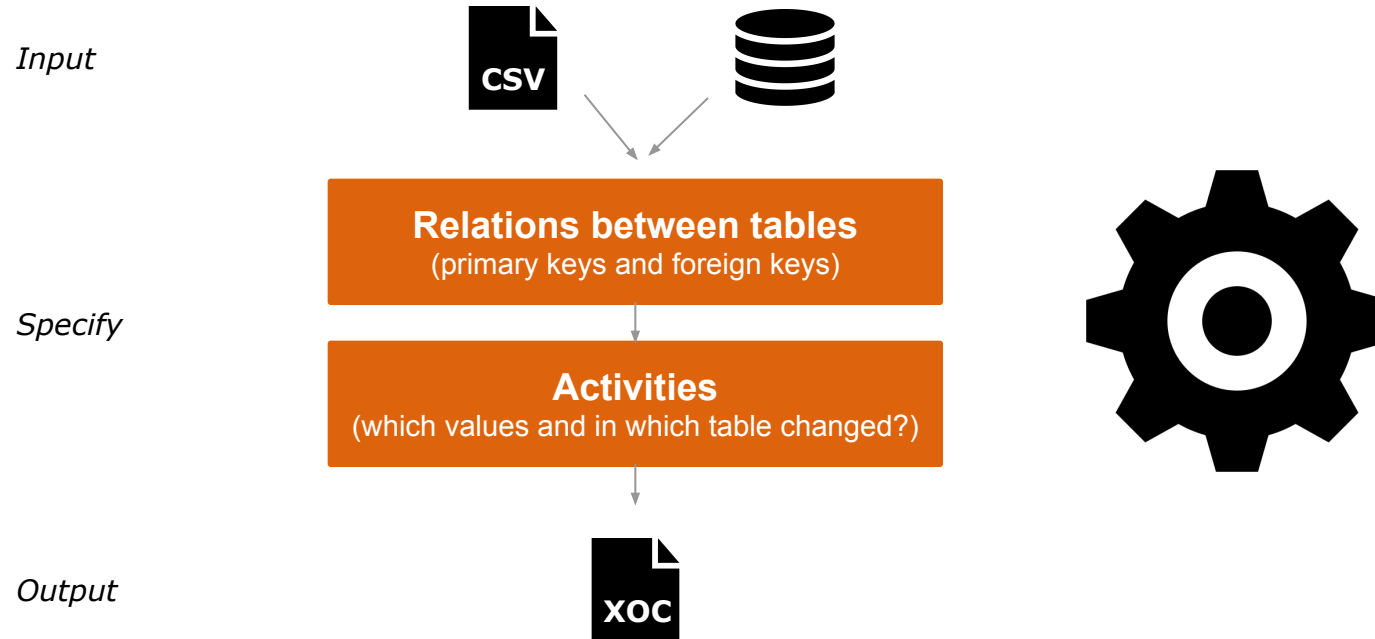


Chart 11

Milestones

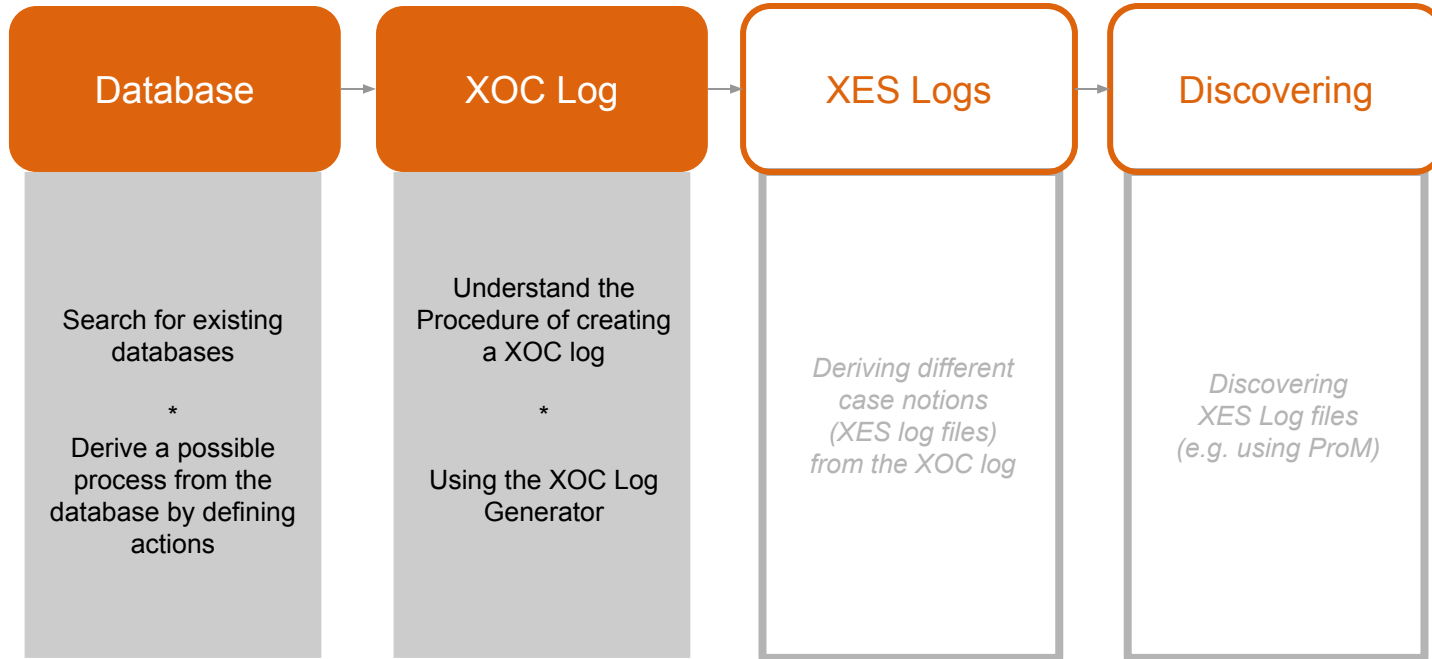
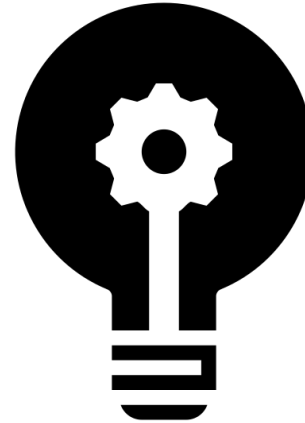


Chart 12

Take away

- **Challenges** of dealing with object-centric data from databases
 - **Extract Case ID**
 - **Loss of interaction between process instances**
- **XOC Log notation for object-centric data**
- Our **next steps**
 - Enrich our database
 - Derive XES logs from the XOC log
 - Discover XES logs



Bibliography

- [1] Li G., de Murillas E.G.L., de Carvalho R.M., van der Aalst W.M.P. (2018) Extracting Object-Centric Event Logs to Support Process Mining on Databases. In: Mendling J., Mouratidis H. (eds) Information Systems in the Big Data Era. CAiSE 2018. Lecture Notes in Business Information Processing, vol 317. Springer, Cham
- [2] van der Aalst W.M.P. (2019) Object-Centric Process Mining: Dealing with Divergence and Convergence in Event Data. In: Ölveczky P., Salaün G. (eds) Software Engineering and Formal Methods. SEFM 2019. Lecture Notes in Computer Science, vol 11724. Springer, Cham

XOC Log Generation

selected tables: 9

- payment_line
- shipment
- shipment_line
- order_line
- payment
- invoice
- element_relation
- customer
- order

table structure

class name: order_line

activity name:

field number: 32 activity attribute column number: 0 activity column number: 0 fk column number: 1 pk column number: 1

index	field(s)	name(s)	pk(c)	fk(c)	constraint(c)	activity(c)	attribute(s)
1	rowid	rowid	<input checked="" type="checkbox"/>	<input type="checkbox"/>			null
2	fk_commande	order_id	<input type="checkbox"/>	<input checked="" type="checkbox"/>			null
3	fk_parent_line	fk_parent_line	<input type="checkbox"/>	<input type="checkbox"/>			null
4	fk_product	id_product	<input type="checkbox"/>	<input type="checkbox"/>			null
5	label	label	<input type="checkbox"/>	<input type="checkbox"/>			null
6	description	description	<input type="checkbox"/>	<input type="checkbox"/>			null
7	tva_tx	tax_ratio	<input type="checkbox"/>	<input type="checkbox"/>			null
8	localtax1_tx	localtax1_tx	<input type="checkbox"/>	<input type="checkbox"/>			null
9	localtax1_type	localtax1_type	<input type="checkbox"/>	<input type="checkbox"/>			null
10	localtax2_tx	localtax2_tx	<input type="checkbox"/>	<input type="checkbox"/>			null
11	localtax2_type	localtax2_type	<input type="checkbox"/>	<input type="checkbox"/>			null
12	qty	qty	<input type="checkbox"/>	<input type="checkbox"/>			null
13	remise_percent	discount_percent	<input type="checkbox"/>	<input type="checkbox"/>			null
14	remise	discount_amount	<input type="checkbox"/>	<input type="checkbox"/>			null
15	fk_remise_except	fk_remise_except	<input type="checkbox"/>	<input type="checkbox"/>			null
16	price	VP_price	<input type="checkbox"/>	<input type="checkbox"/>			null
17	subprice	original_price	<input type="checkbox"/>	<input type="checkbox"/>			null
18	total_ht	total_amount_without...	<input type="checkbox"/>	<input type="checkbox"/>			null
19	total_tva	total_tax_amount	<input type="checkbox"/>	<input type="checkbox"/>			null
20	total_localtax1	total_localtax1	<input type="checkbox"/>	<input type="checkbox"/>			null

activity impacting field

remove

order_line rowid

table relation

remove

fk_commande payment_line rowid

activity referring class

remove

payment_line order_line->s...

output

output configuration

log format:

☐ simple

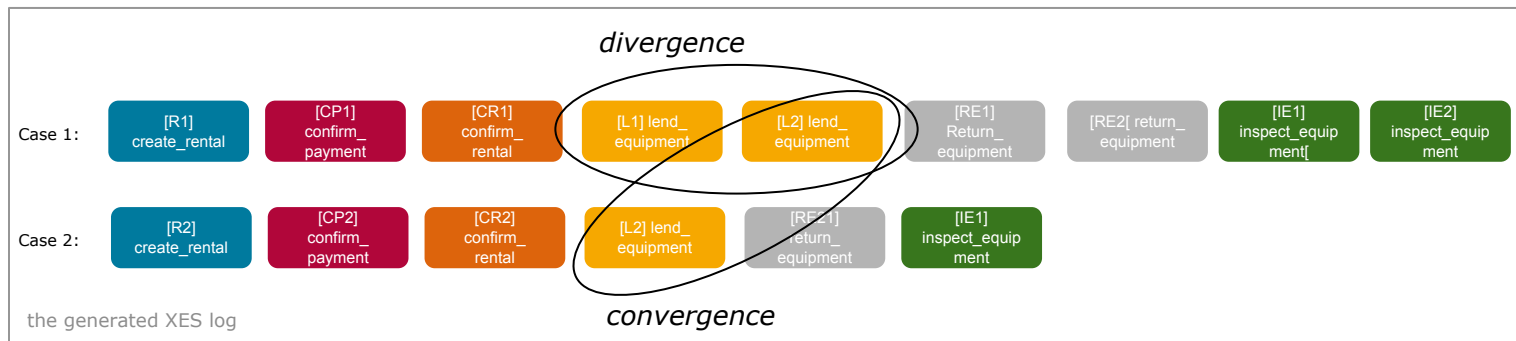
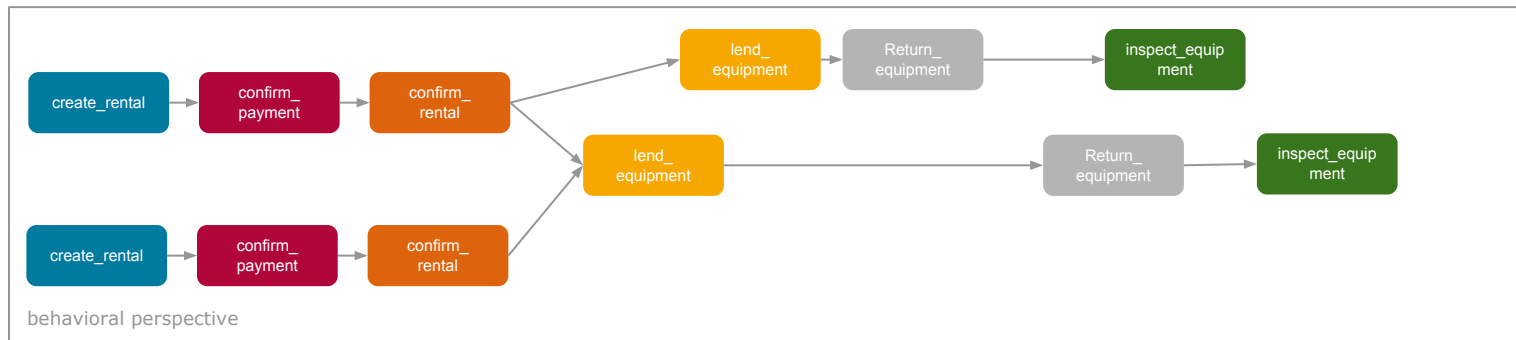
☒ total

output log to disk

save log in ProM

Chart 15

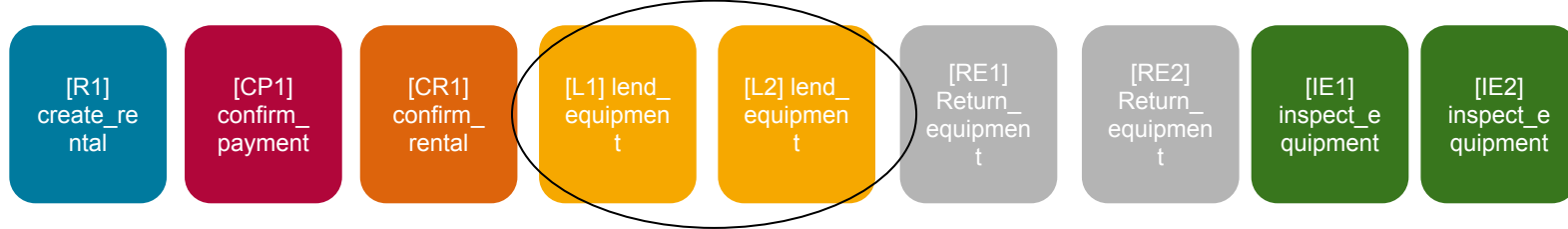
The Convergence and Divergence Problem [2]



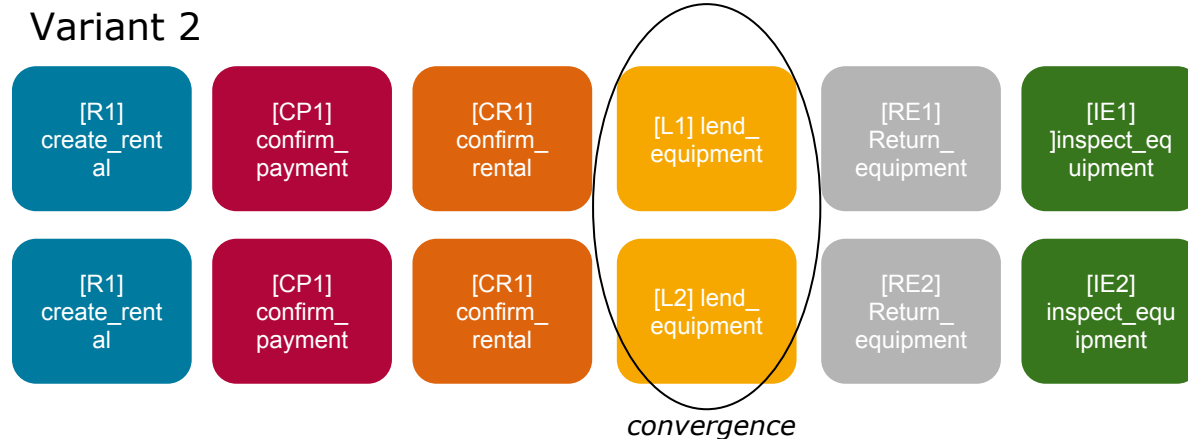
The Convergence and Divergence Problem [2]

Variant 1

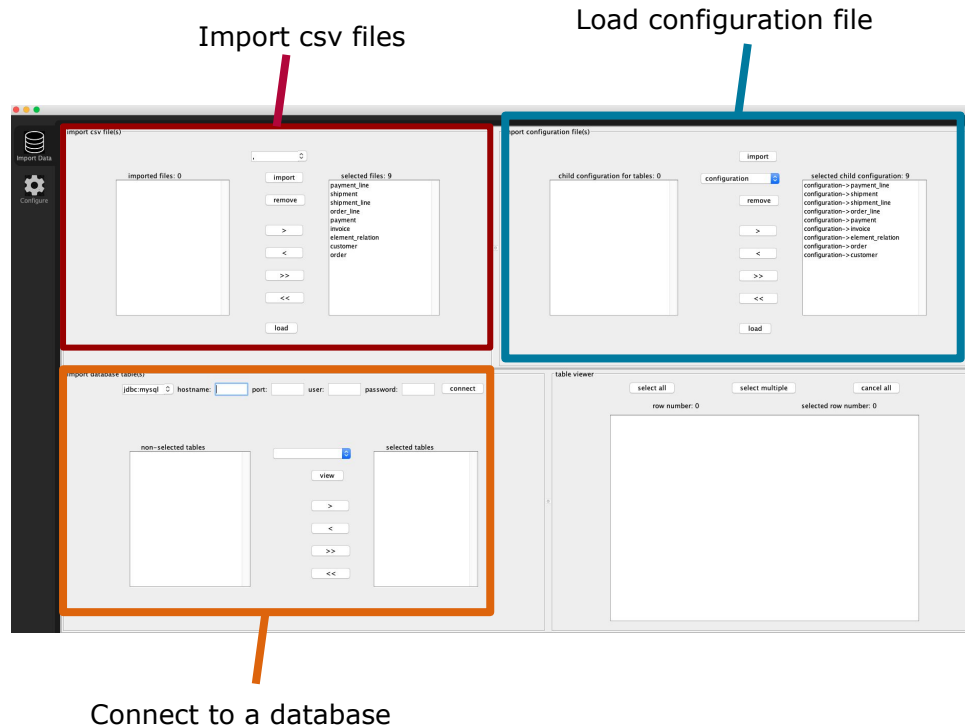
divergence



Variant 2



XOC Log file generator

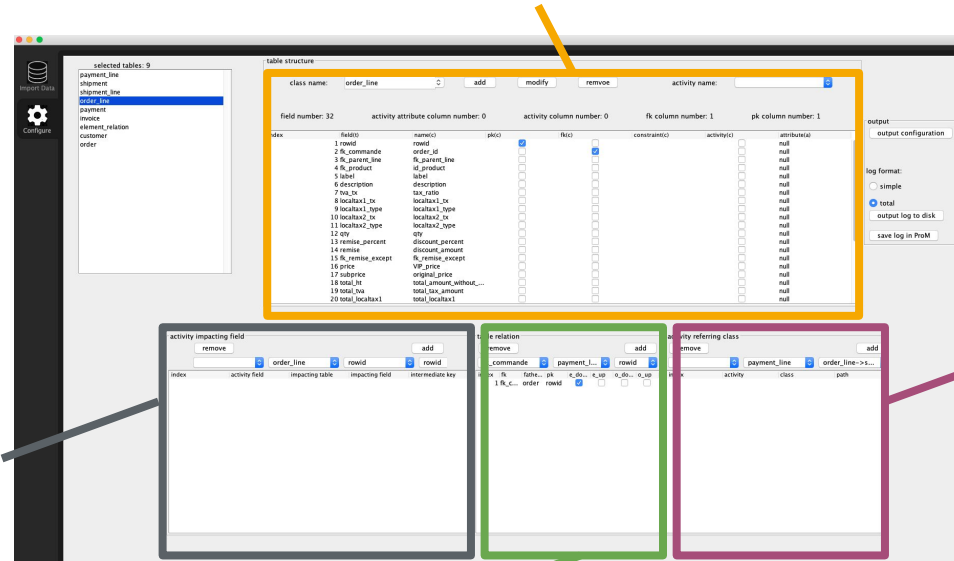


Define:

- A table always refers to an object and define for this the PK and the FKs
- Set a tick for a column in the column 'activity' to create an activity and the column should be holding a timestamp indicating when that activity happened
- Column 'attribute' has been never used in the example dataset

Describing effects of activities: map a column to its impacted column (modifying the value)

- Activity field = all columns marked as activity
- Impacting table = table to be influenced by this activity
- Impacting field = columns of the table impacted by the activity
- Intermediate field = key as a bridge to get to the impacting field



The screenshot shows the 'table structure' configuration window for the 'order_line' table. The window is divided into several sections:

- Left Panel:** A list of tables including 'payment_line', 'shipment_line', 'order_line', 'payment', 'invoice', 'element_relation', 'customer', and 'order'. 'order_line' is selected.
- Table Structure Table:** A table with columns: field number, field(s), name(s), pk(s), fk(s), constraints, activity(s), and attribute(s). It lists 20 fields for the 'order_line' table, including 'rowid', 'order_id', 'parent_line', 'id_product', 'label', 'description', 'tax_rate', 'localtax1_type', 'localtax1_rate', 'localtax2_type', 'city', 'remise_percent', 'discount_amount', 'remise', 'remise_except', 'price', 'subprice', 'total_net', 'total_tax_amount', and 'total_localtax1'. The 'activity' column is checked for fields 1 through 19.
- Activity Impacting Field:** A section for defining the activity field, showing 'order_line' as the impacting table and 'rowid' as the impacting field.
- Activity Relation:** A section for defining the relation between tables, showing 'order_line' as the impacting table and 'payment_line' as the impacted table, with 'rowid' as the intermediate key.
- Activity Referring Class:** A section for defining the activity referring class, showing 'payment_line' as the activity class and 'order_line' as the path.

This area is only important when by an action does some changes in more than one table. For each of them create an entry and declare the order.

Defines the relation between the tables

- E_up means that this key is a FK
- E_down means that the id is a PK and is used in another table as a FK