

Systems Mining: from process logs to system models

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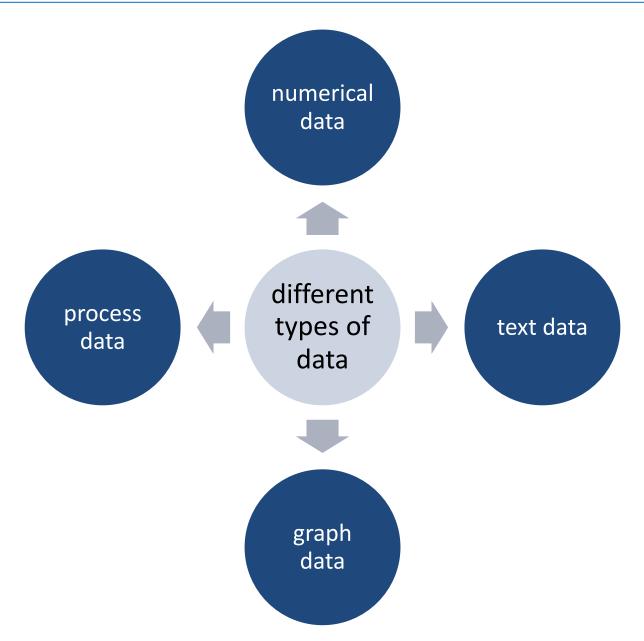






Mining different types of data

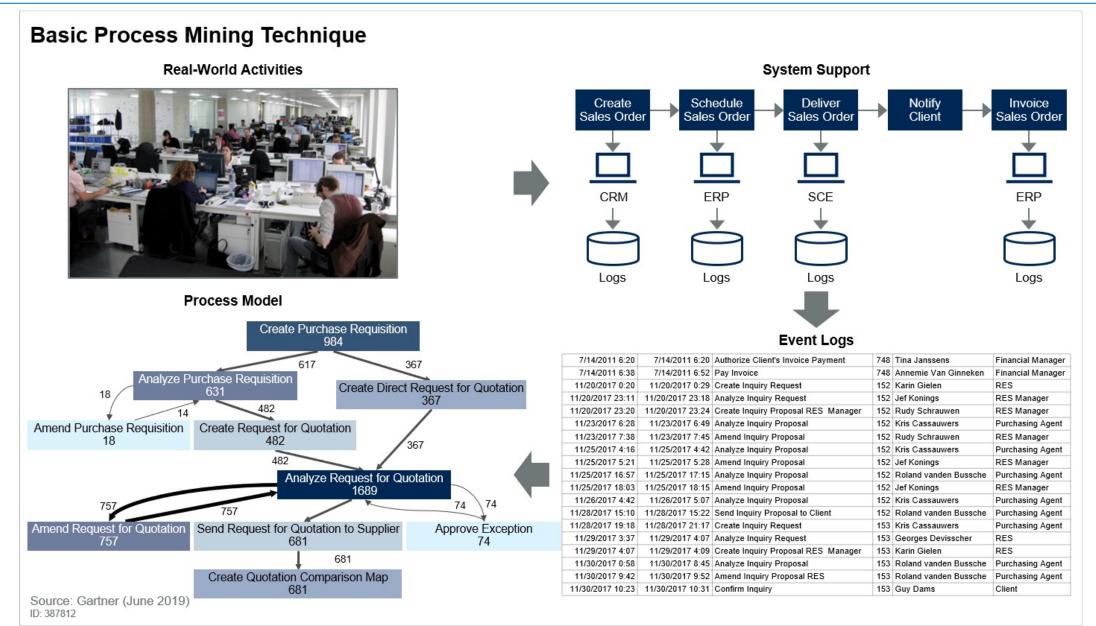




Process Mining – the basic narrative according Gartner (2021)







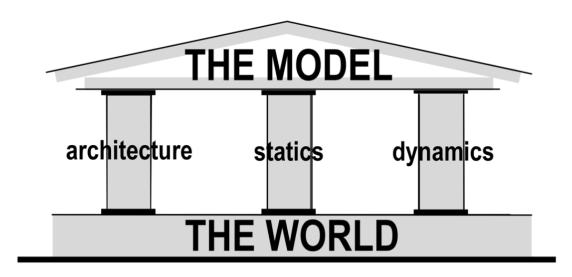


A comprehensive conceptual model of a computer-integrated system:

(1) is structured architecture

(2) includes data and real-life items statics

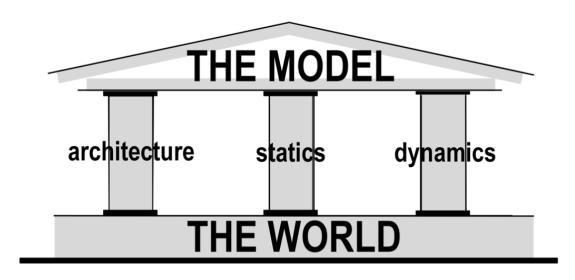
(3) is locally updated. **dynamics**





A comprehensive conceptual model of a computer-integrated system:

- (1) is structured architecture composition matters!
- (2) includes data and real-life items statics
- (3) is locally updated. **dynamics**



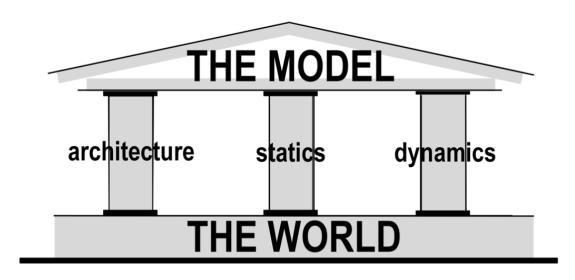


A comprehensive conceptual model of a computer-integrated system:

(1) is structured architecture composition matters!

(2) includes data and real-life items statics objects matter!

(3) is locally updated. **dynamics**



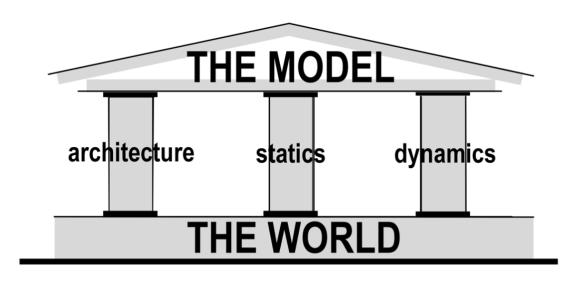


A comprehensive conceptual model of a computer-integrated system:

(1) is structured architecture composition matters!

(2) includes data and real-life items statics objects matter!

(3) is locally updated. dynamics causality matters!





What is inside a log?



Name of the event	involved agents	involved data	time stamp	Name of the event	involved agents	involved data	time stamp	200	lame of he event	involved agents	involved data	time stamp
shirt to take home	vendor V1 Alice	shirt	1	Alice pays	cashier Alice	50€ receipt	3	E	Bob pays	cashier Bob	170€ voucher	4
shoes to be ordered	vendor V2 Bob	shoes	2	hat not on offer	vendor V2 Claire	-9	4		nanding over	vendor V1 Alice	receipt packed shir	5 rt
V1 packs shirt	vendor V1	shirt	1									

What is inside a log?

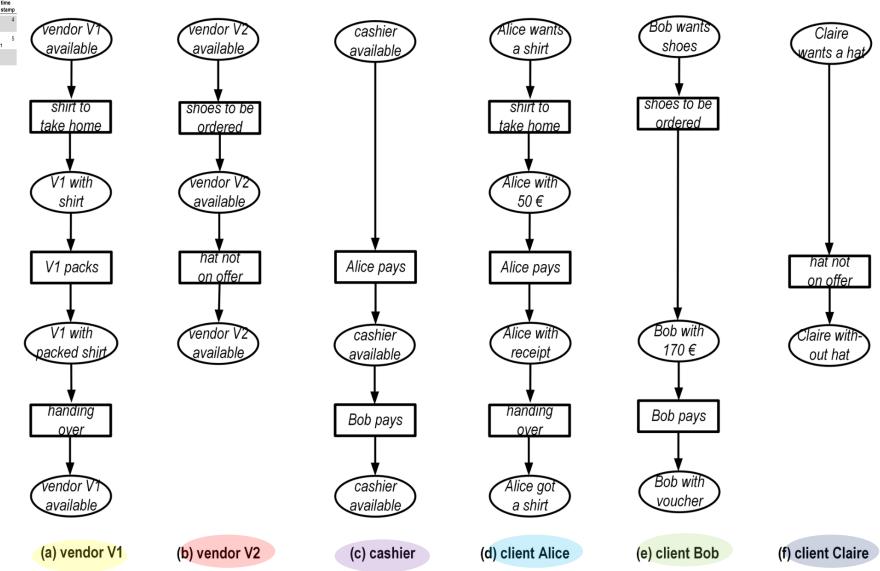


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shoes to be ordered	vendor V2 Bob	shoes	2	hat not on offer	vendor V2 Claire	- 1	4	handing over	vendor V1 Alice	receipt packed shi	5 rt
V1 packs shirt	vendor V1	shirt	1								

What is inside a log? Some lifelines of items

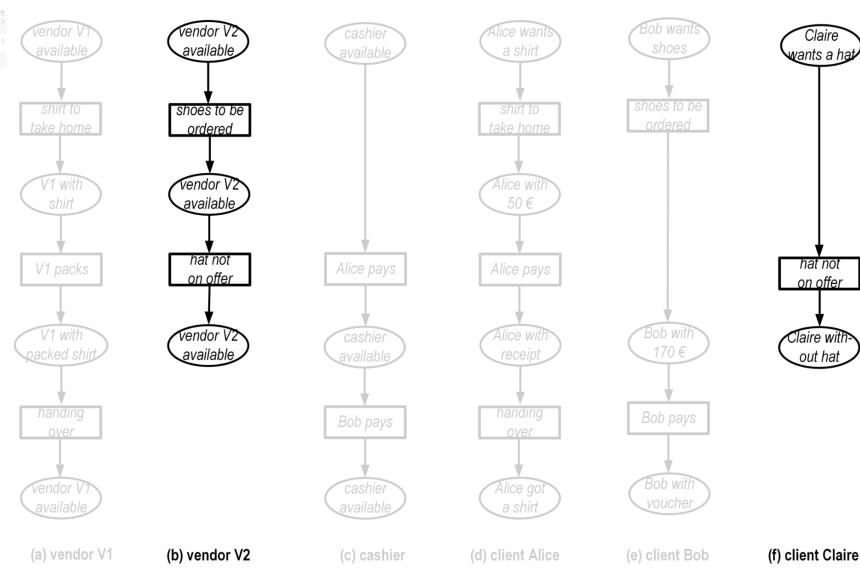


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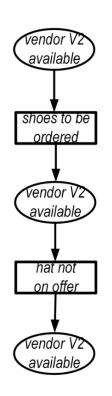




Name of the event	involved agents	involved data	time stamp	Name of the event	involved agents	involved data	time stamp	Name of the event	involved agents	involved data	time stamp
						50€ receipt				170€ voucher	
		shoes					4				



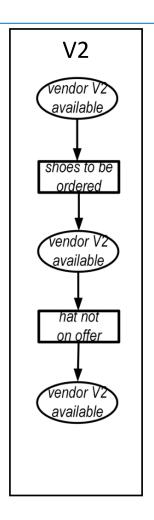


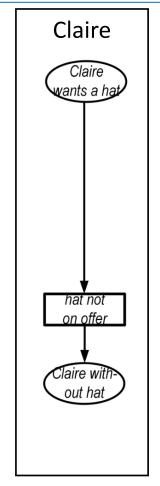




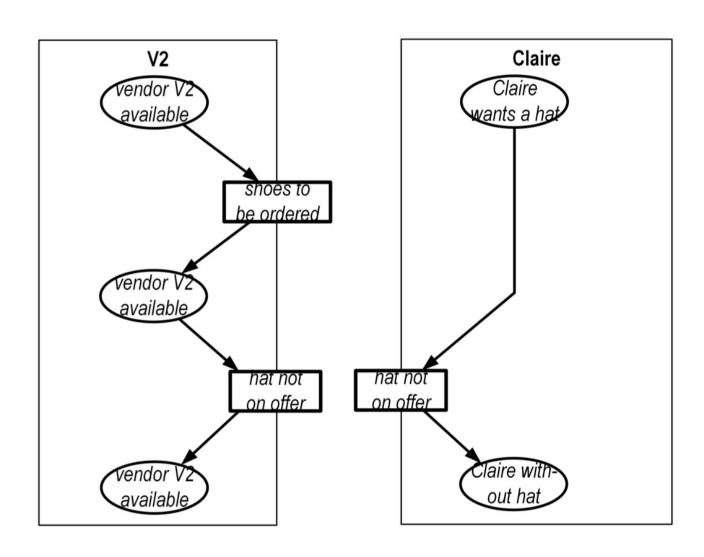
(b) vendor V2 (f) client Claire



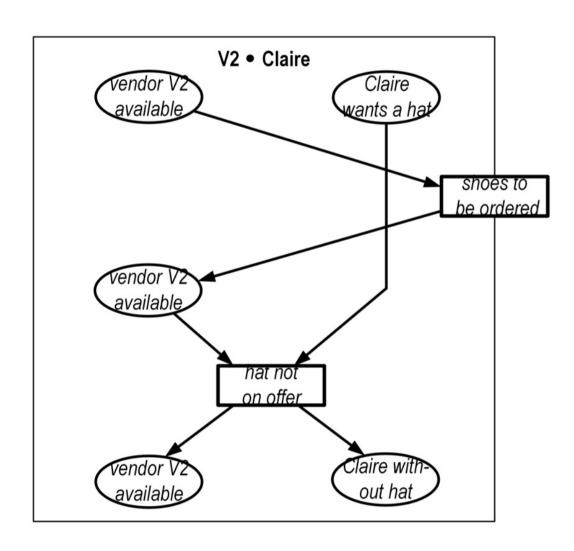






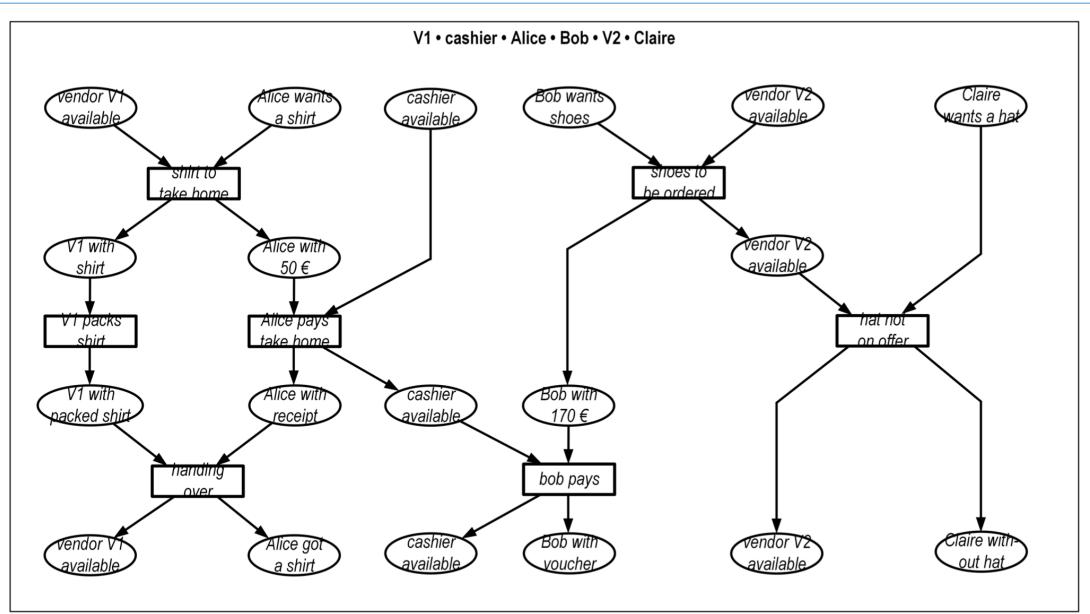






The complete run





Structures and signature



sets

M: {Alice, Bob, Clara} set of clients

V: {V1, V2} set of vendors

C: {c1} set of cashiers

I: {hat, shoes, shirt} set of items

P: {1€, 2€, ..., 1000€} amounts of money

V: {<hat>, <shoes>, <shirt>} set of vouchers

W: {[hat], [shoes], [shirt]} set of wrapped items

<u>I</u>: {hat, shoes, shirt} set of descriptions of items

functions

Structures and signature



sets

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<u>I</u>: {hat, shoes, shirt} set of descriptions of items

functions

p: $I \rightarrow W$ p(z) = [z] for $z \in I$.

 $v: I \longrightarrow V$ $v(z) = \langle z \rangle$ for $z \in I$.

 $\underline{\hspace{0.1cm}}(z) = \underline{z}$

set symbols

M: clients

V: vendors

C: cashiers

I: items

P: prices

V: vouchers

W: wrapped items

<u>I</u>: descriptions of

items

function symbols

 $f: I \rightarrow P$

 $p: I \longrightarrow W$

 $v: I \longrightarrow V$

_: I → <u>I</u>

variables

x: clients

y: vendors

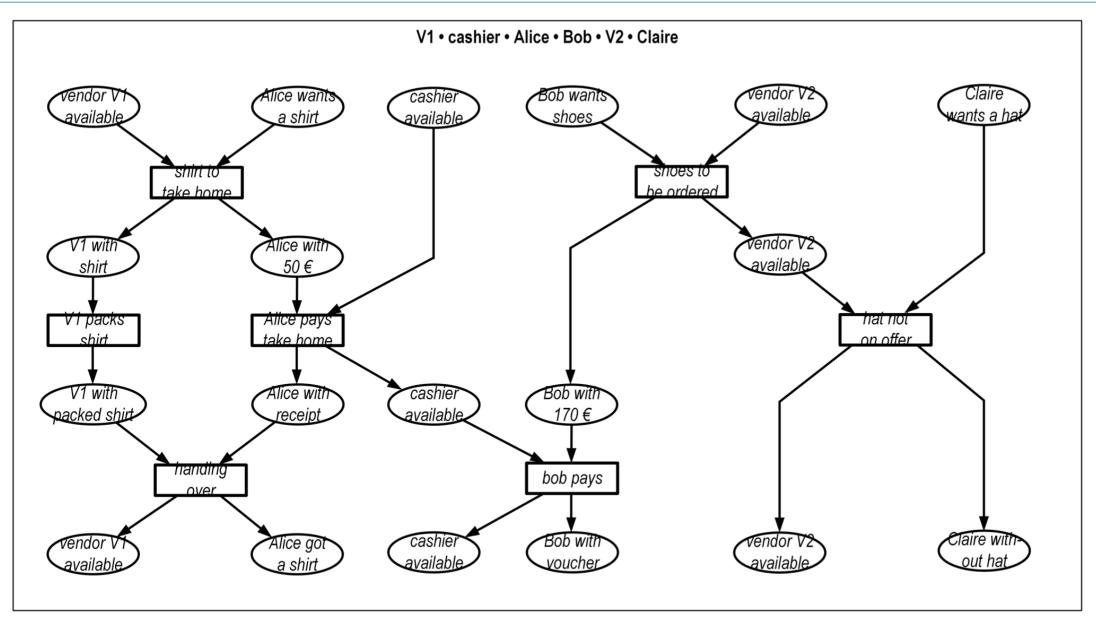
z: items

<u>z</u>: description

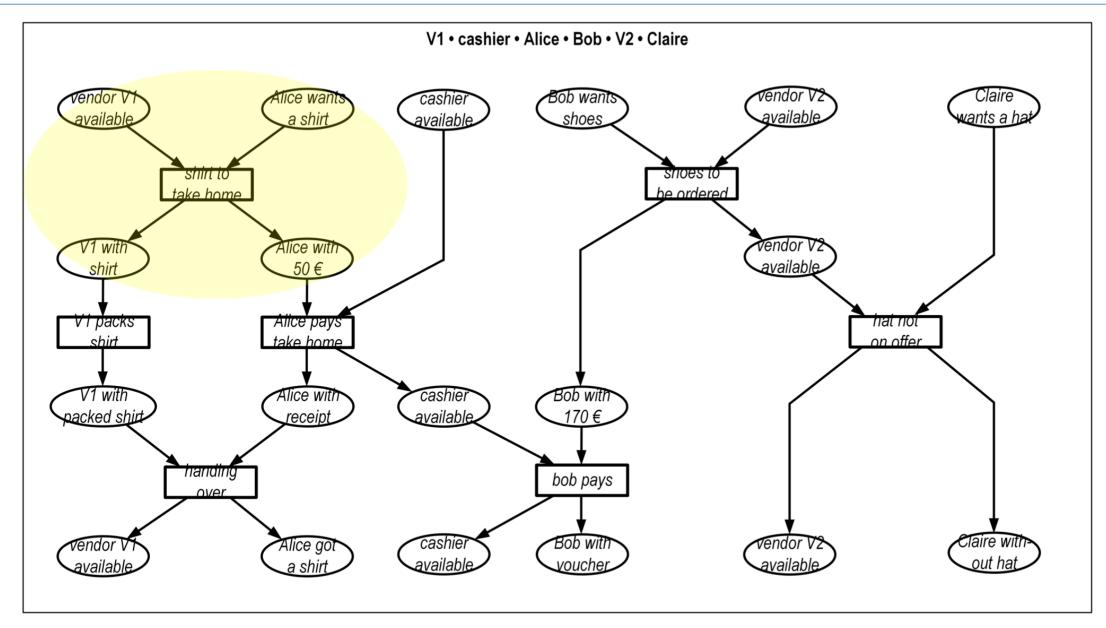
of item z

c: cashier

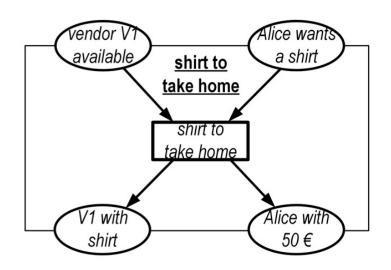






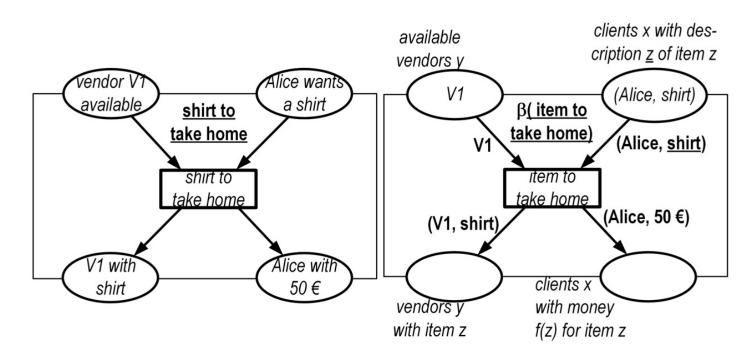






(a) occurrence atom shirt to take home





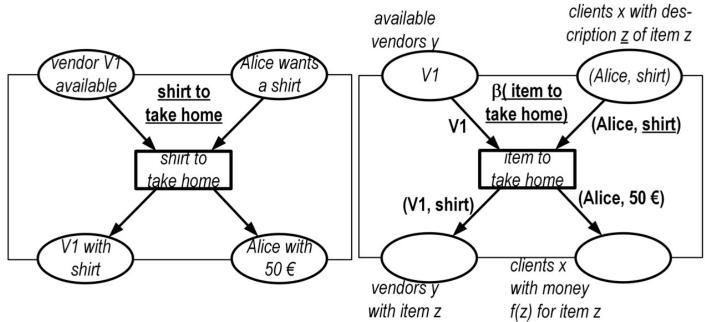
(a) occurrence atom *shirt to take* home

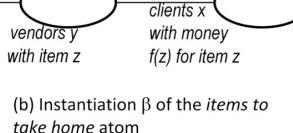
(b) Instantiation β of the *items to take home* atom

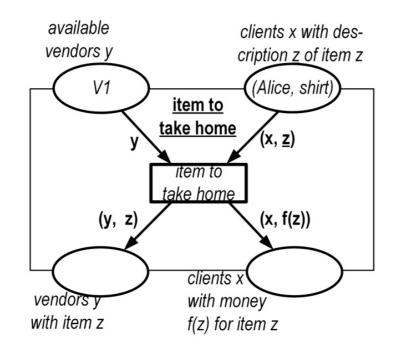
(a) occurrence atom shirt to take

home





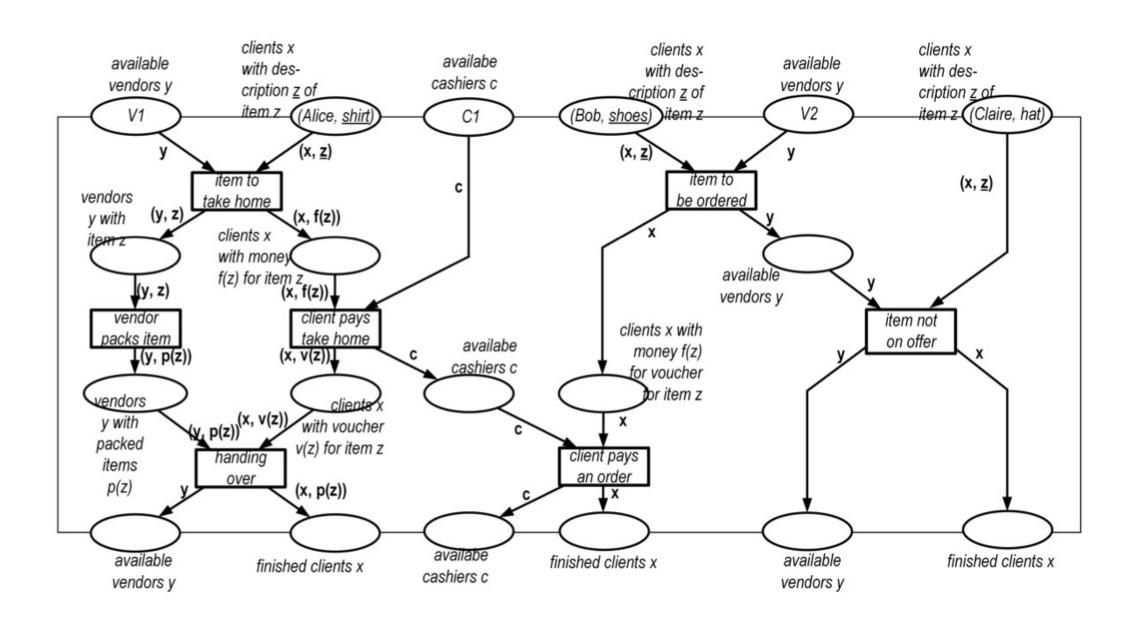




(c) system atom item to take home: generalization of the shirt to take home module.

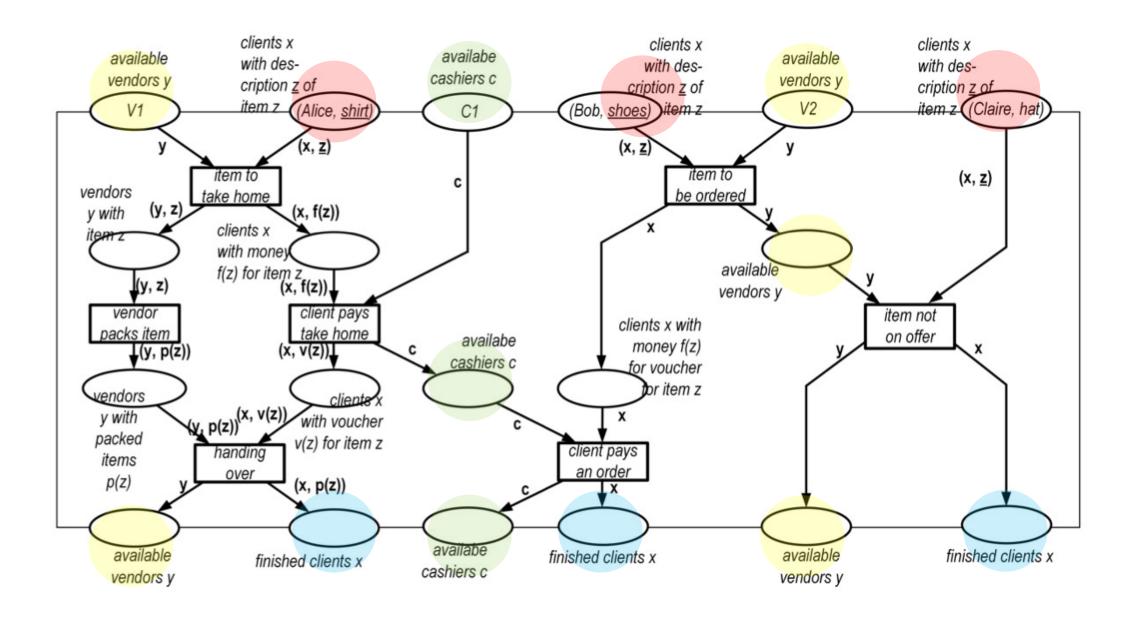
Composing all system atoms





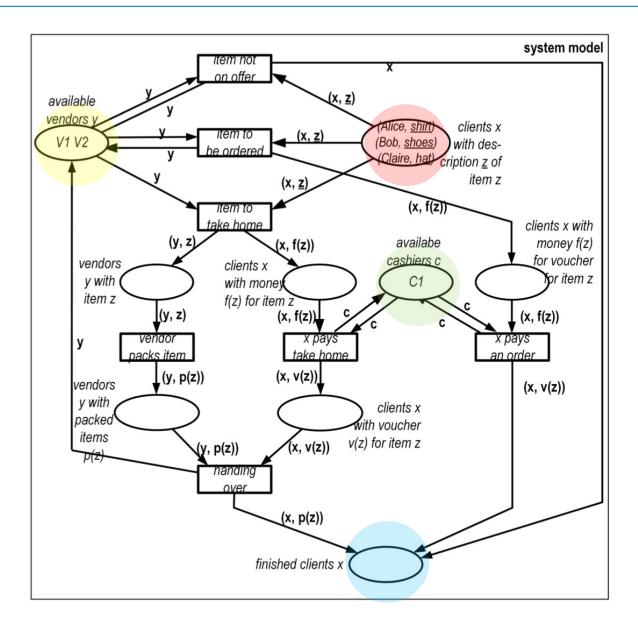
Constructing a system model





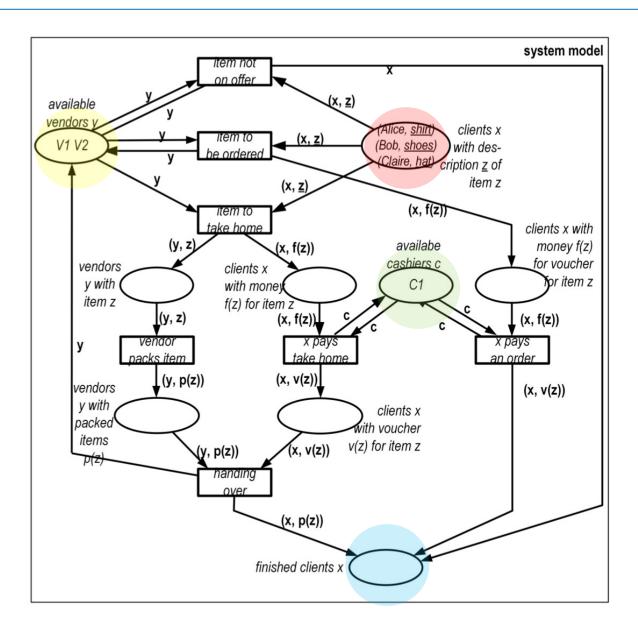
Constructing a system model





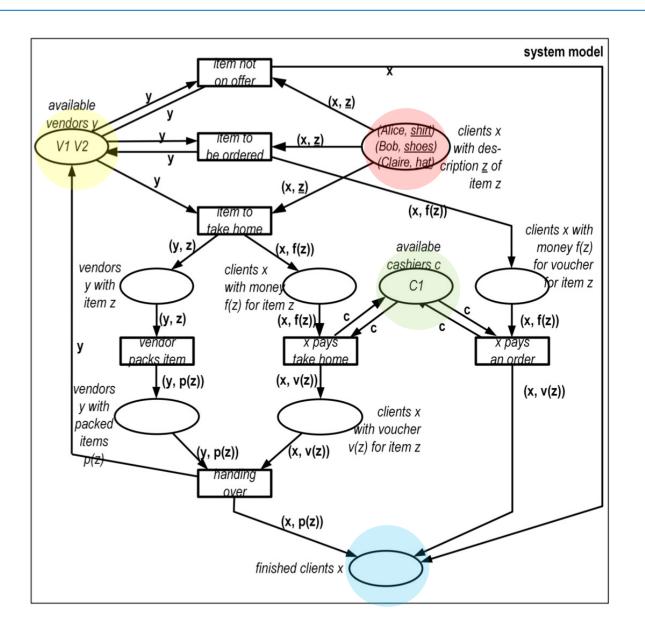
From a system model to the schema

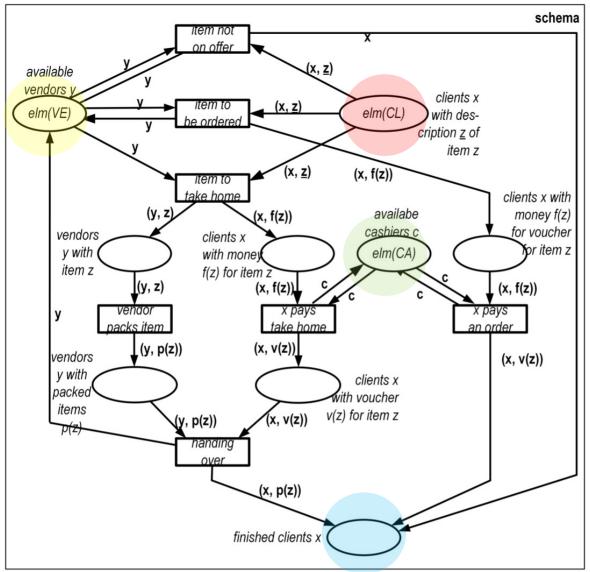




From a system model to the schema









How to mine a system model? Systems Mining in a nutshell

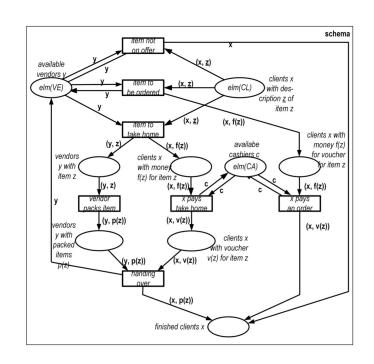


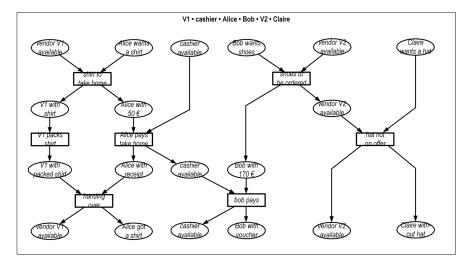


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Phase I: from logs to runs



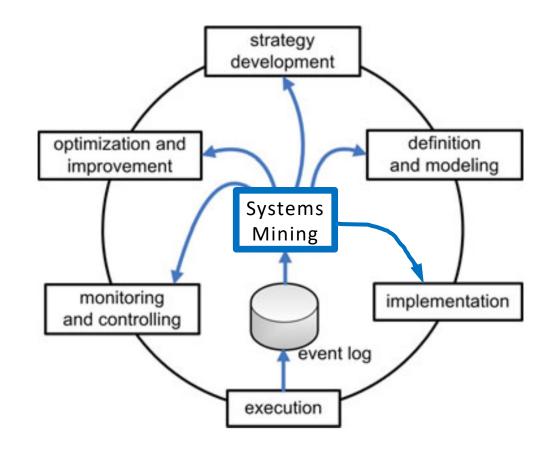


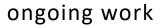


Phase II: from runs to systems

Outlook







- tool support
- laboratory and field studies
- conformance checking and process prediction



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