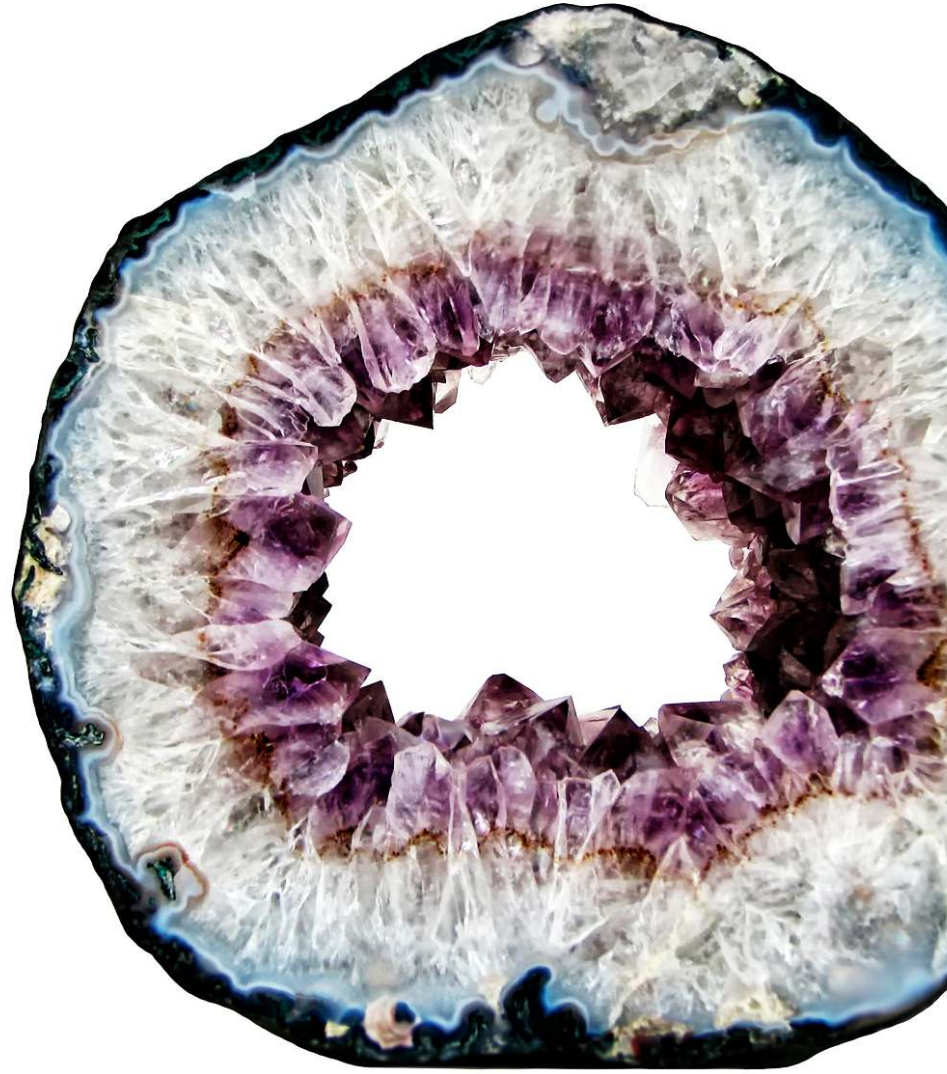


Deloitte Analytics
Applying
Process Mining
in an audit context

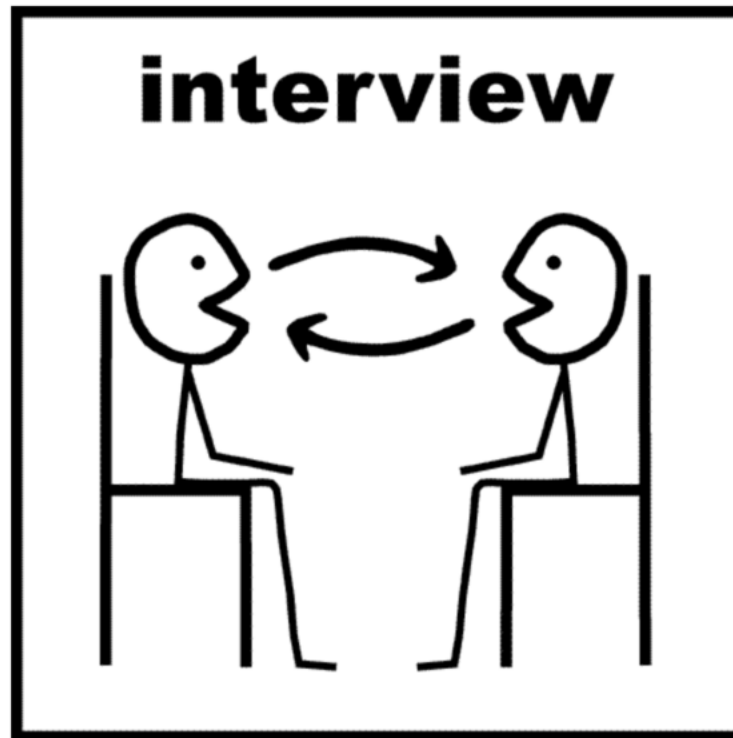


Process Mining Camp – June 4th 2012

7 Steps

1. Interview	3
2. Data dump	4
3. Event log creation	5
4. Process mining	6
5. Audit discussion	18
6. Process mining ²	19
7. Reporting	20

Step 1: Interview

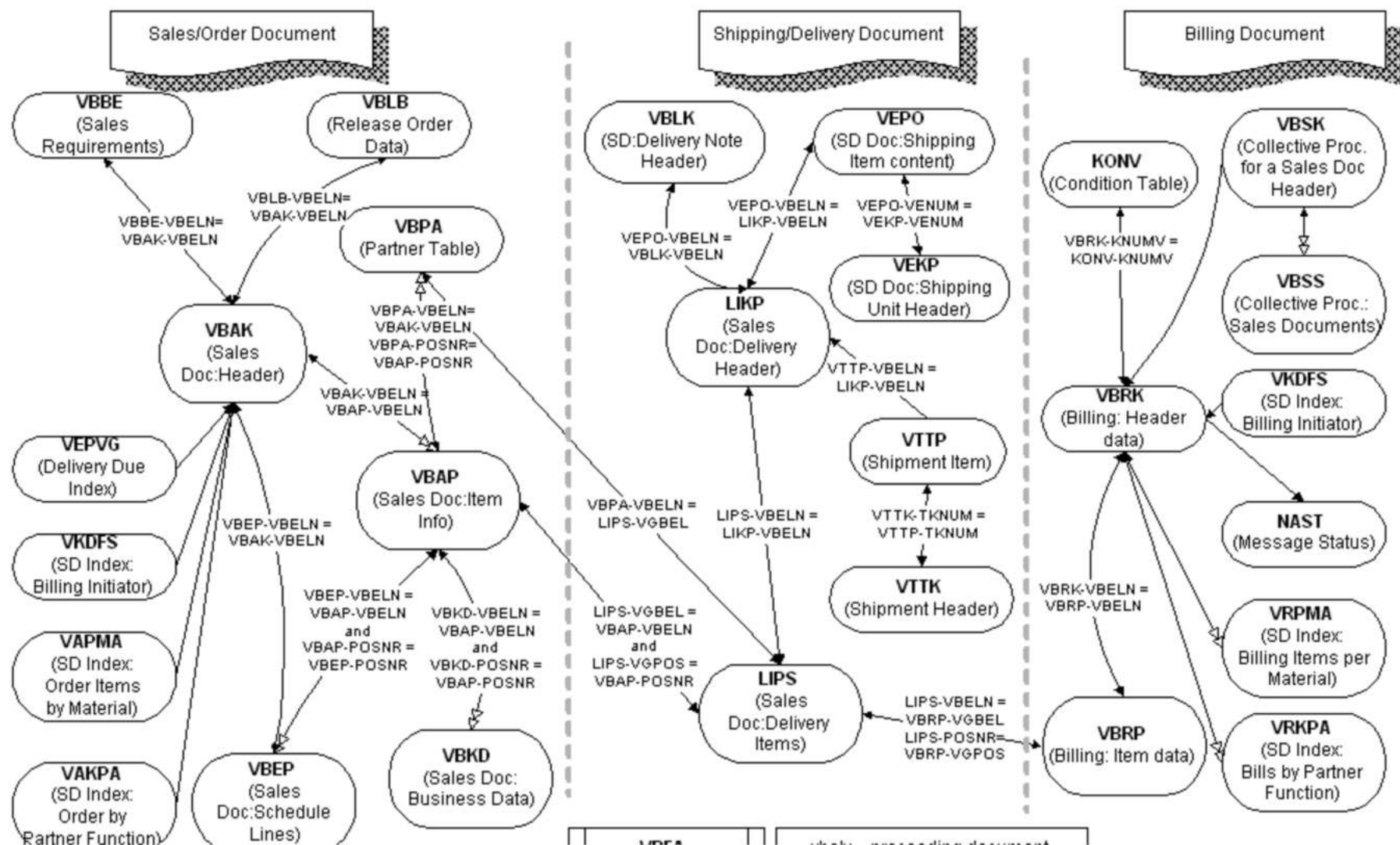


Step 2: Data dump

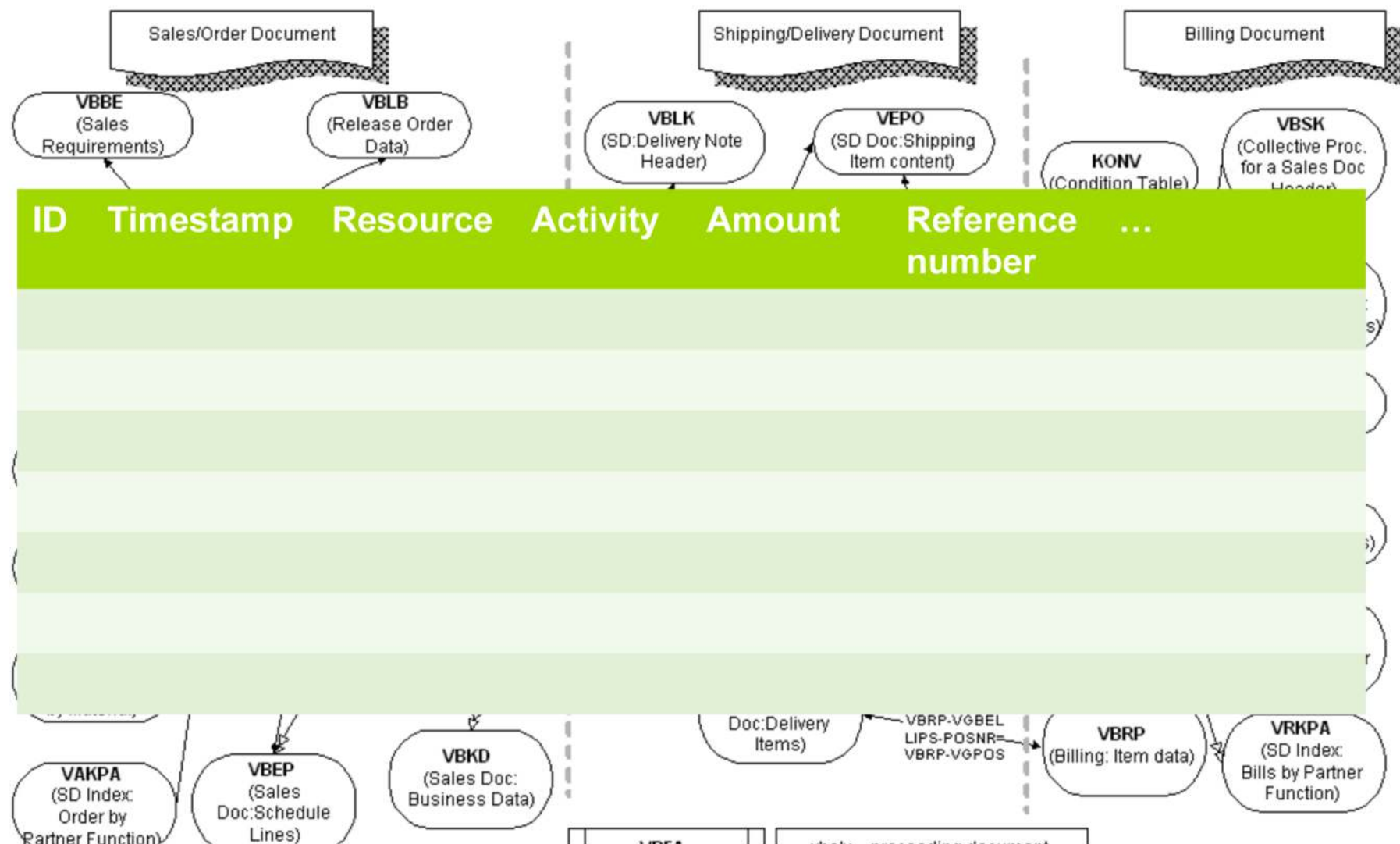
Current projects  SAP related

- Approach up till now: data request -> ABAP-file to be written by client
- New: data extraction tool of Deloitte OR own ABAP-file

Step 3: Event log creation



Step 3: Event log creation



Step 4 – Process Mining

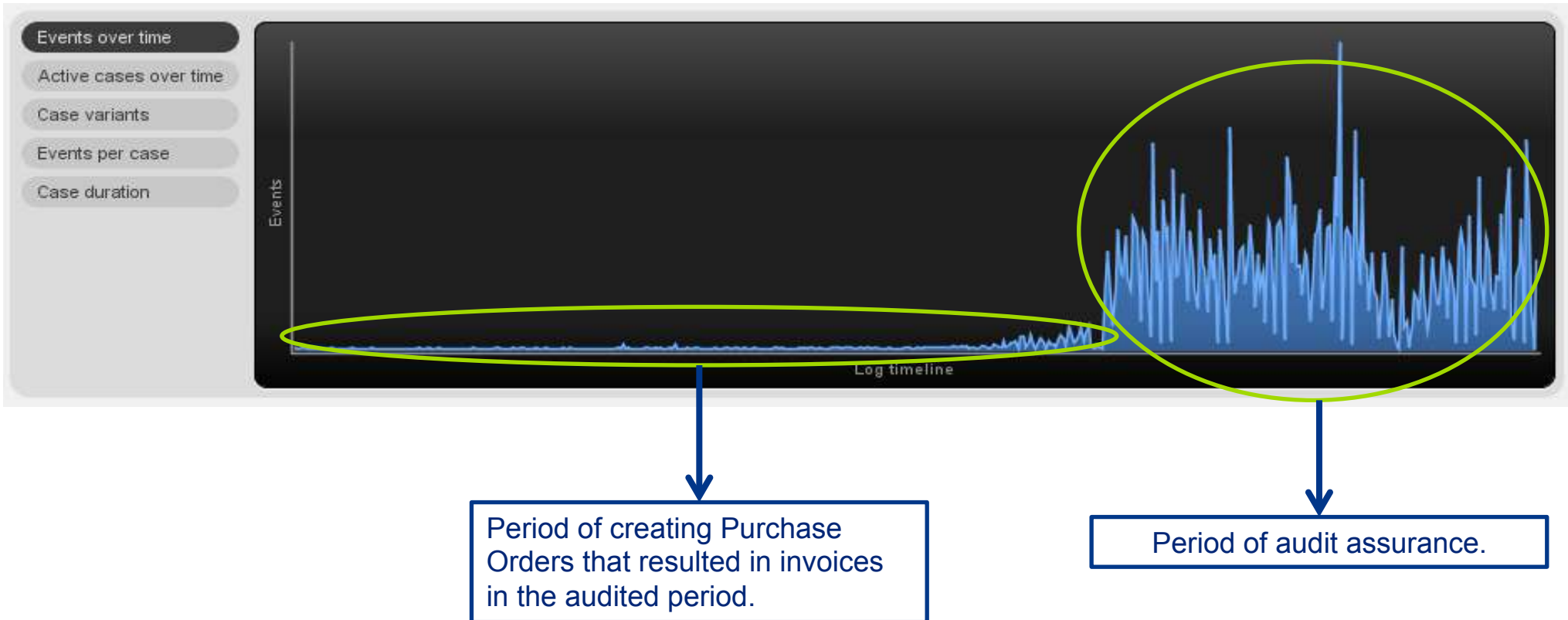
- Log description
- Pattern description
- Longest traces
- Depicting general model
- Depicting all behavior
- Originator-role -> Segregation of Duties
- Client specific internal control testing
- Social network

Log description

Key data	
Cases	41 536
Activities	8
Events	281 513
Resources	64
Start	19-05-2009
End	15-11-2011
Variants	1 317

1 317 different patterns are found to execute the procurement process.

Number of events over time



10 most frequent paths

	Pattern	Absolute frequency	Relative frequency	Total PO value	Average PO value
1	CreatePO –InvoiceReceipt - GoodsReceipt – Payment	16 824	52.08%	8 872 192.21€	527.35€
2	CreatePO – GoodsReceipt – InvoiceReceipt – Payment	13 387	41.44%	15 654 633.96€	1 169.39€
3	CreatePO – ChangeValue - GoodsReceipt – InvoiceReceipt – Payment	161	0.5%	1 741 846.61€	10 818.92€
4	CreatePO – GoodsReceipt – InvoiceReceipt – InvoiceReceipt - Payment	48	0.15%	411 395.26€	8 570.74€
5	CreatePO –InvoiceReceipt – InvoiceReceipt - GoodsReceipt – Payment	41	0.13%	357 902.00€	8 729.32€
6	CreatePO – GoodsReceipt – InvoiceReceipt – Payment – InvoiceReceipt – InvoiceReceipt – Payment – Payment	35	0.11%	44 624.93€	1 275.00€
7	CreatePO – GoodsReceipt – GoodsReceipt – InvoiceReceipt – InvoiceReceipt - Payment	30	0.09%	35 088.15€	1 169.61€
8	CreatePO – Sign1 – Sign2 – GoodsReceipt – InvoiceReceipt - Payment	27	0.08%	56 189.46€	2 081.10€
9	CreatePO – ChangeValue – ChangeValue – GoodsReceipt – InvoiceReceipt - Payment	27	0.08%	323 183.99€	11 969.78€
10	CreatePO – GoodsReceipt – GoodsReceipt – InvoiceReceipt – InvoiceReceipt – Payment – Payment	26	0.08%	89 511.73€	3 442.76€
	Total	30 606	94.74%		901.35€

10 cases with longest trace

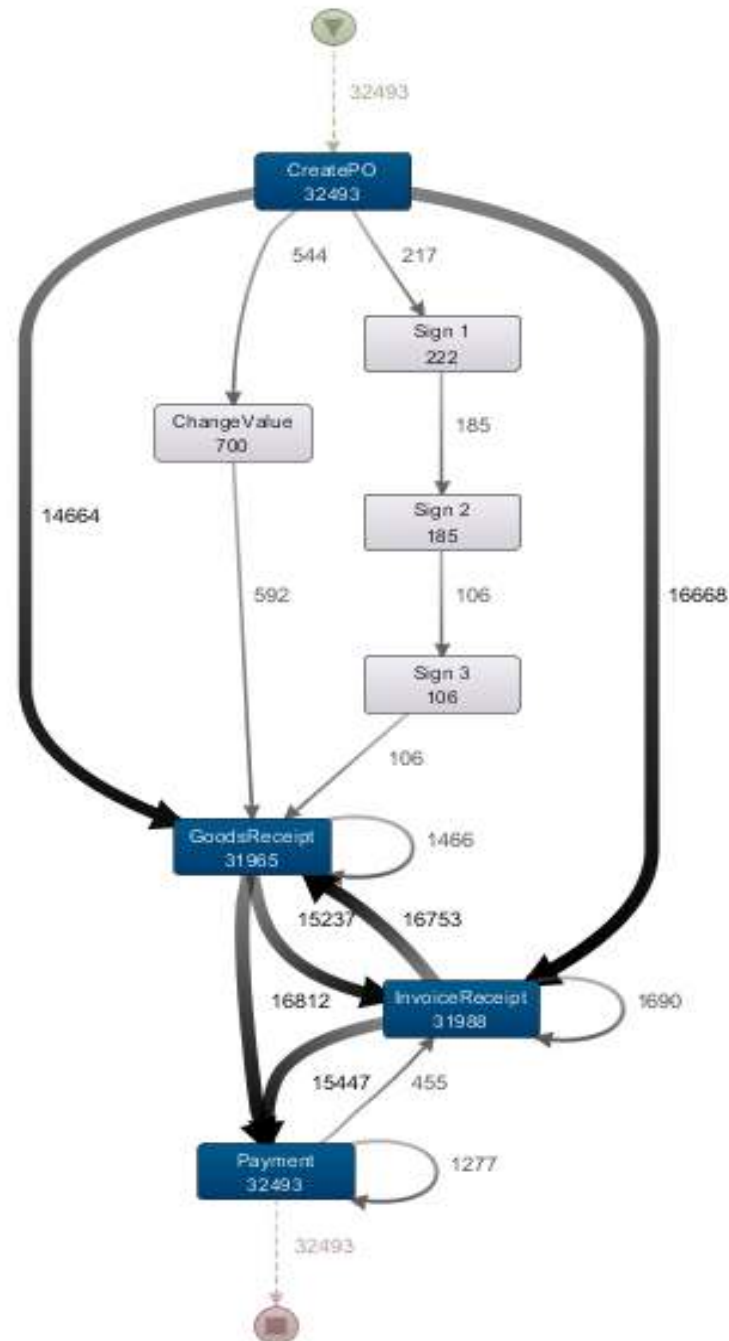
Case_ID	Number of events	PO_Value	Throughput time
45000854681	622	190.78 €	71d
45000838431	629	1 196.00 €	49d
45000778601	636	599.19 €	34d
45000688091	820	837.16 €	56d
45000871321	1 151	62.81 €	35d
45000750741	1 442	101.58 €	56d
450006872910	1 682	580 608.00 €	87d
450007468310	2 161	787 968.00 €	56d
450007638910	3 961	1 330 560.00 €	90d
450008080610	6 161	856 627.20 €	145d



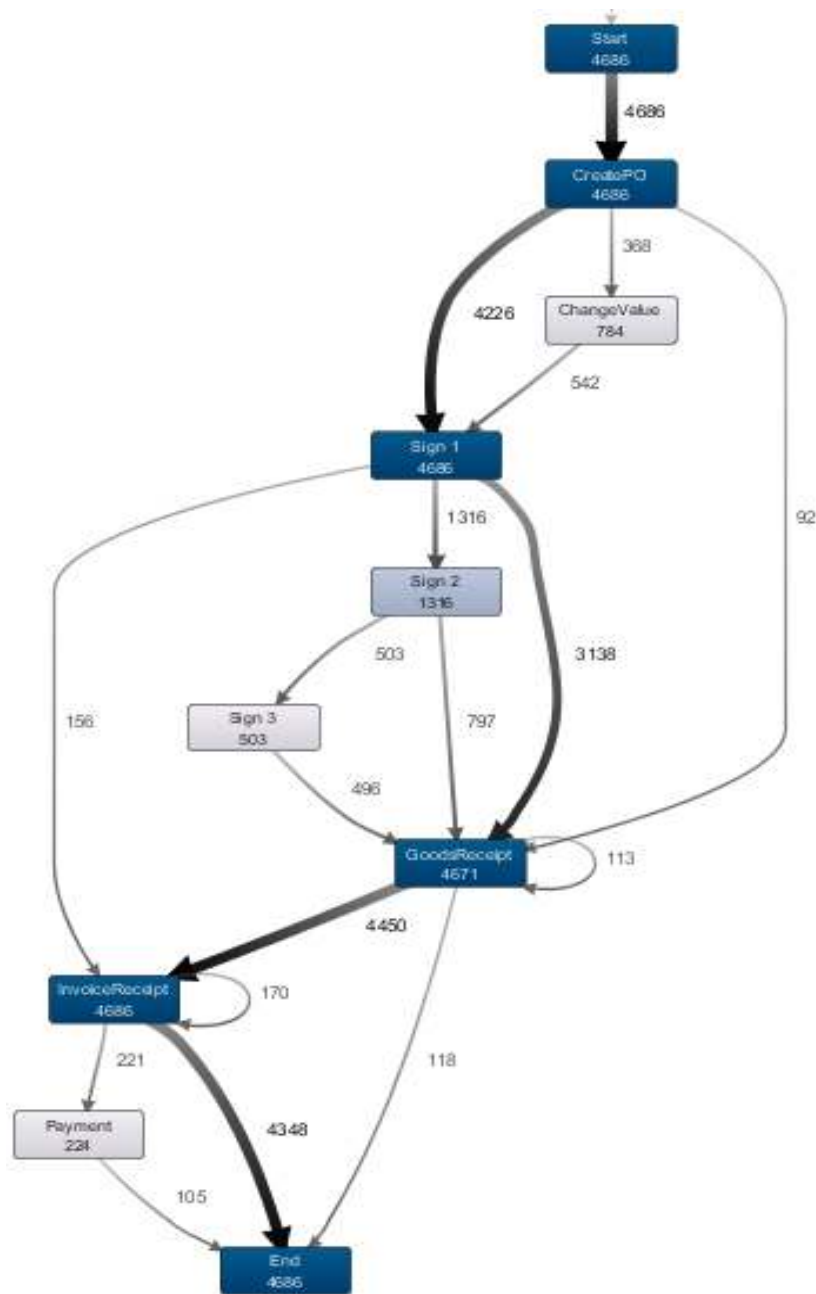
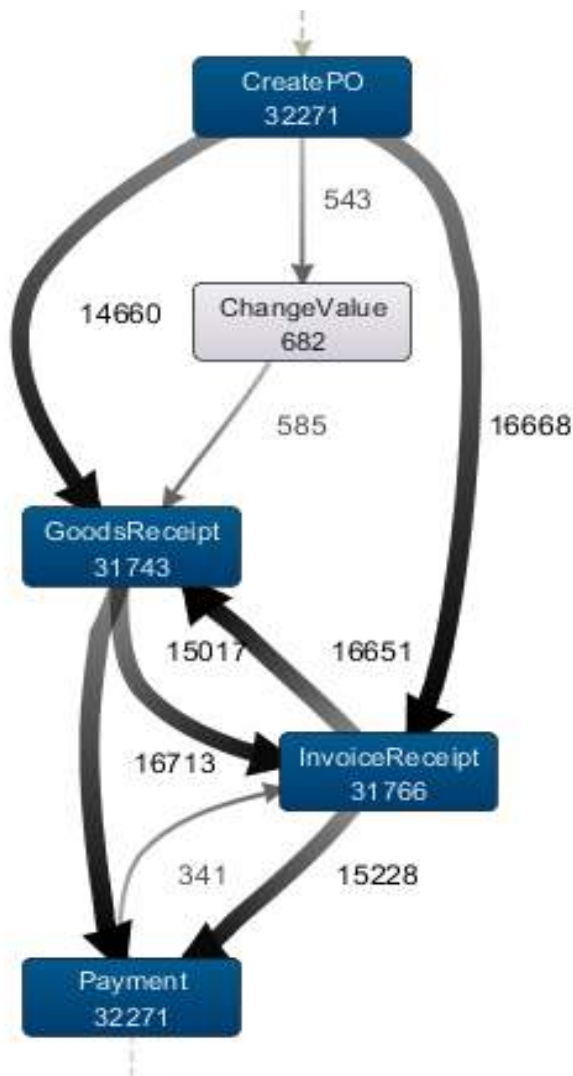
Number of activities
performed on that
case

General process model

total log

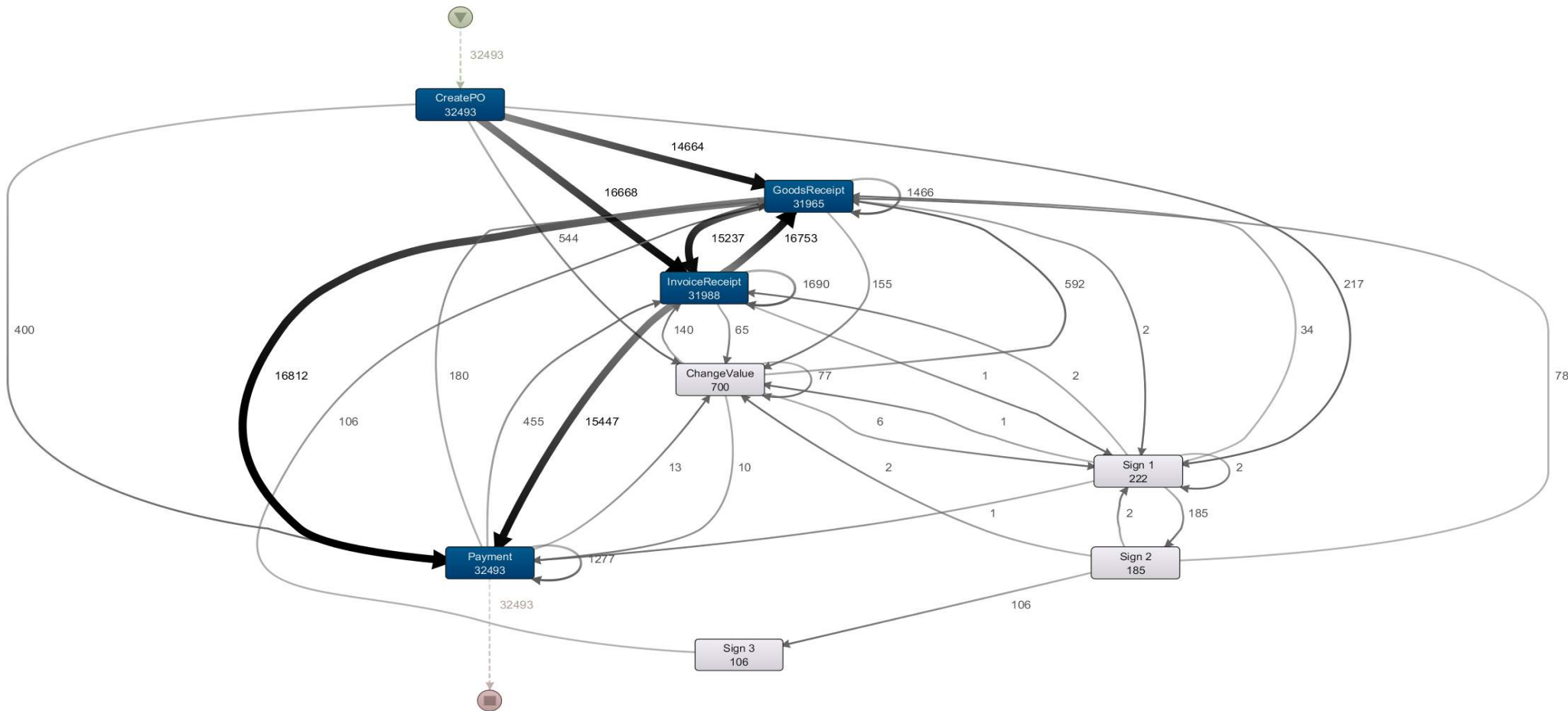


Process models with and without release strategy



Process model – all behaviour

Depicting all behaviour in the process model shows the unstructured reality of the event log.



Person (anony- mized)	Change Value	CreatePO	Invoice Receipt	Goods Receipt	Sign 1	Sign 2	Sign 3
1	0	0	0	2965	0	0	0
2	3	23	23	0	0	0	0
3	12	169	169	0	0	0	0
4	8	99	110	0	0	0	0
5	41	266	263	0	16	4	0
6	0	0	0	14	0	0	0
7	53	643	669	0	0	0	0
8	0	0	0	0	76	35	0
9	63	214	1428	0	0	0	0
10	0	0	0	1426	0	0	0
11	282	1045	1274	0	836	0	0
12	25	224	231	0	962	297	0
13	18	87	99	0	0	0	0
14	0	0	0	5	0	0	0
15	0	0	0	0	433	475	0
16	0	0	2	0	0	0	0
17	0	0	0	1969	0	0	0
18	157	793	800	0	691	0	0
19	0	0	0	0	87	38	0
20	0	0	0	0	0	49	0
21	0	0	0	0	43	0	0
22	0	0	0	0	8	0	0
23	0	0	0	2	0	0	0
24	5	131	103	0	418	83	0
25	133	311	361	0	274	0	0
26	2	72	89	0	395	0	0
27	4	8	8	0	0	0	0
28	0	1	0	0	127	39	0
29	0	0	0	0	20	80	549
30	0	0	6	0	0	0	0
31	0	0	1	0	299	119	0
32	3	165	51	0	0	0	0
33	41	254	275	0	51	6	0
34	0	0	0	0	329	204	0
35	0	0	0	0	18	0	0
36	0	0	23	0	0	0	0
37	0	0	0	198	0	0	0
38	0	145	139	0	68	32	0
39	0	36	12	0	0	0	0

Role-Task matrix

The role-taks matrix shows there is no segregation of authorities in the information system. This enlarges the **importance of a good Segregation of Duties testing.**

Segregations of Duties

Approval	Number of Sign's	Lower Boundary	Upper Boundary
Level 1	Sign 1	250€	2 500€
Level 2	Sign 1 – Sign 2	2 500€	10 000€
Level 3	Sign 1 – Sign 2 – Sign 3	10 000€	-

Testing of SoD:

Sign 1 – Sign 2 ➡ 280 PO's with violation(s)

Sign 2 – Sign 3 ➡ 1 violation

Approval	Number of PO's underneath the lower boundary	Number of PO's between the boundaries	Number of PO's above the upper boundary
Level 1	25	1 430	42
Level 2	7	277	6
Level 3	1	62	-
Total	33	1 769	48

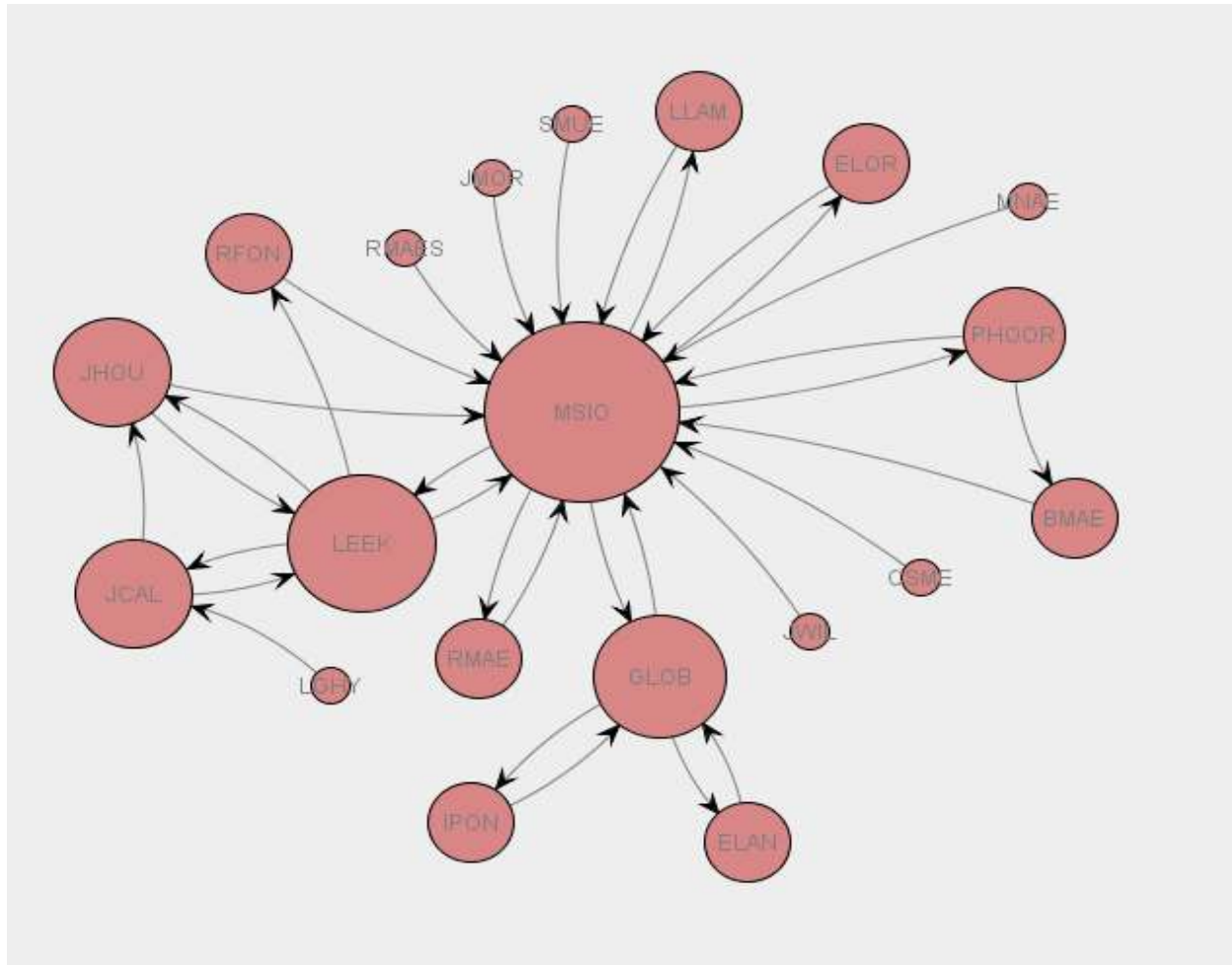
Violations of segregation of duties

	Activities tested for distinct executors	Number of PO's
Cases with 2 signatures	Sign 1 – Sign 2	280
	Create PO – Sign 1 – Sign 2	109
	Create PO – Sign 1 – Sign 2 – Goods Receipt	99
Cases with 1 signature	Create PO – Sign 1 – Goods Receipt	683
Cases without approval	Create PO – Goods Receipt	3 081
Total PO amount with violations of Segregation of Duty		... €

Testing other internal controls

Declarative language is very interesting for an auditor!

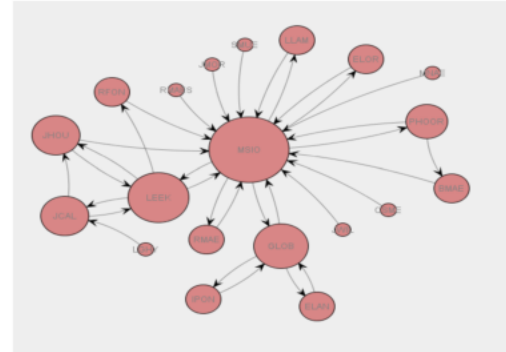
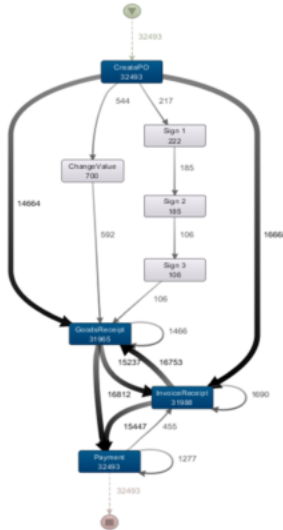
Social Network of people involved in release strategy



Step 5 – Audit discussion



Step 6 – Process Mining²



	Activities tested for distinct executors	Number of PO's
Cases with 2 signatures	Sign 1 – Sign 2	280
	Create PO – Sign 1 – Sign 2	109
	Sign 2	99
	Create PO – Sign 1 – – Goods Receipt	
Cases with 1 signature	Create PO – Sign 1 – Goods Receipt	683
Cases without approval	Create PO – Goods Receipt	3 081
Total PO amount with violations of Segregation of Duty		... €

Step 7 – Reporting

Process mining report will be integrated in audit report.



Thank you