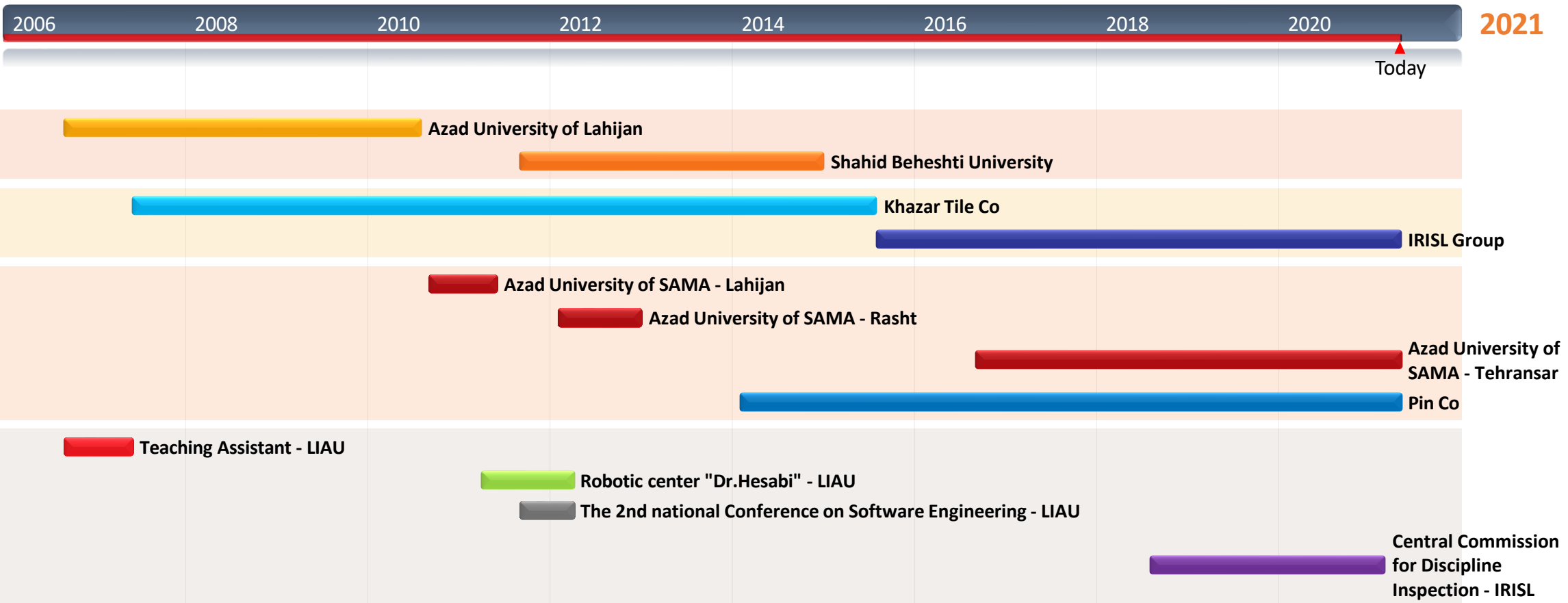


# Process Mining & Digital Process Twins

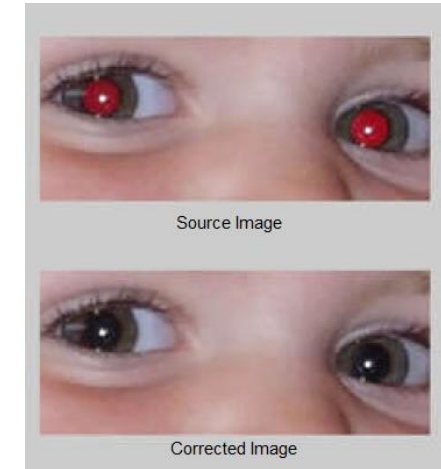
FERDOWSI UNIVERSITY OF MASHHAD  
WEB TECHNOLOGY LABORATORY

# Majid Zoughy Roudsary



# Master Thesis

- ▶ Presenting a new mechanism for Red Eye Detection and Correction based on Adaptive Fuzzy techniques
- ▶ Employing both Image Processing and Machine Learning
- ▶ using ANFIS (Neuro-Fuzzy)
- ▶ Automatically removing the red eye phenomenon in images that were shot in the dark



Supervisor: Dr. Ebrahimi Moghadam

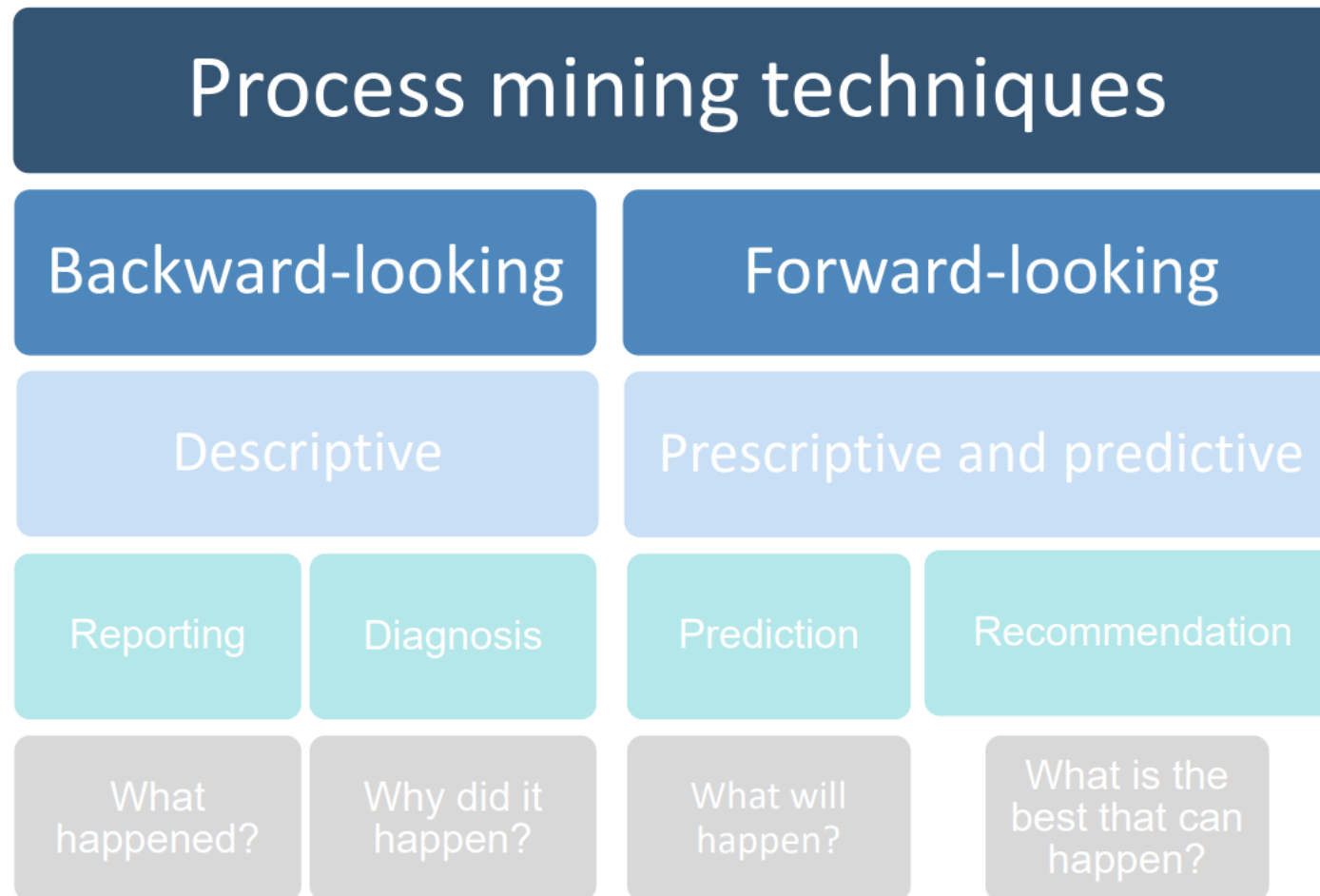
# Process Mining Leaders



# Process Mining Leaders



# Process Mining Techniques

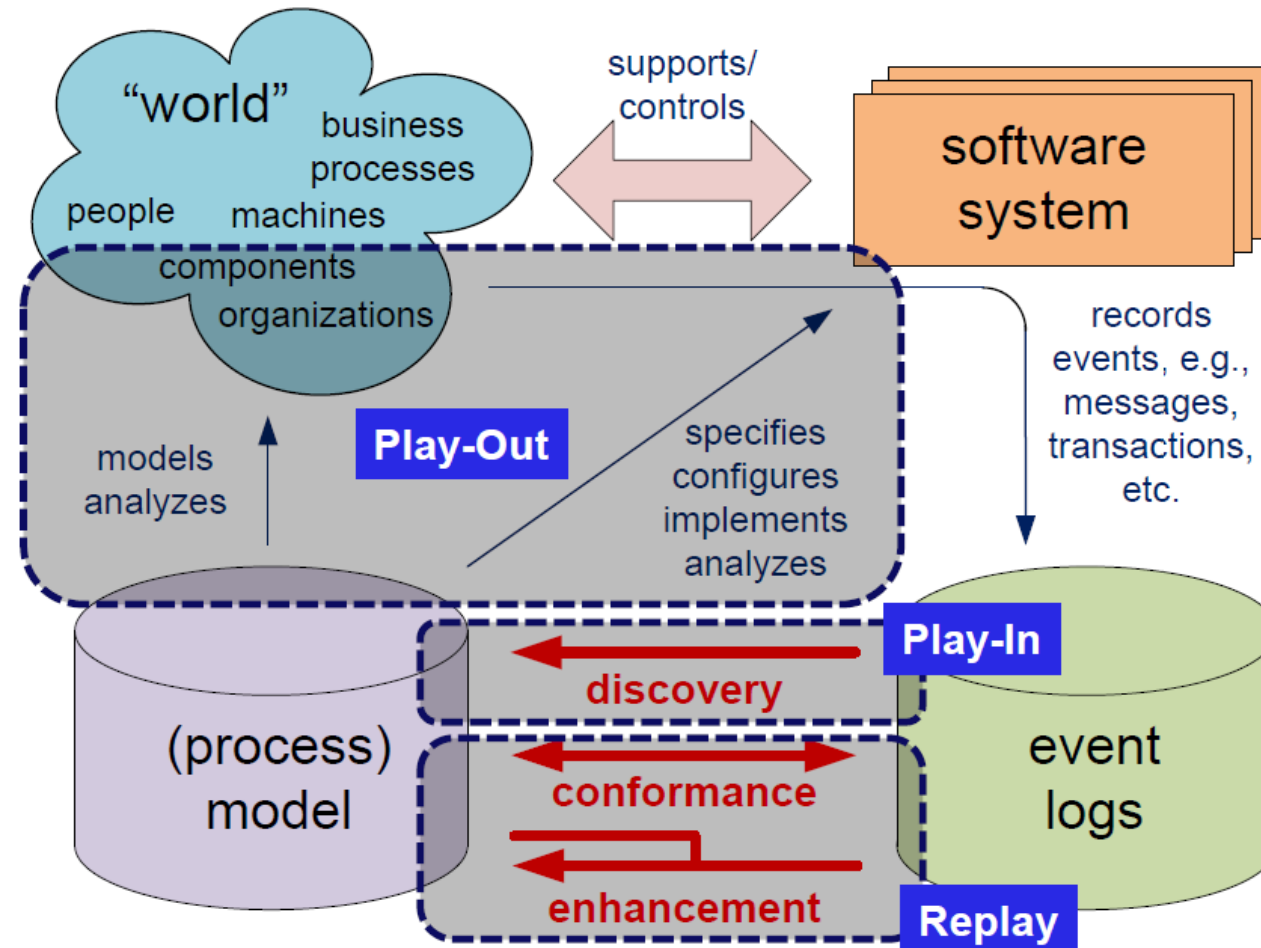




# Process Mining Roadmap

- ▶ Data driven  
Valuable insight (performance)
- ▶ Question driven  
Specific questions (uncertainties, deviation)
- ▶ Goal driven  
KPIs (cost reduction, response times)

# Types of Process Mining



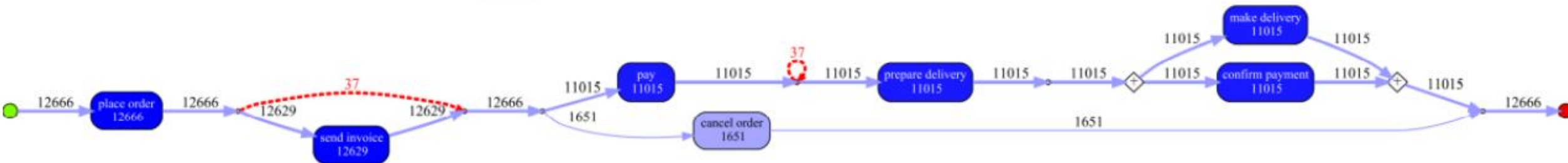
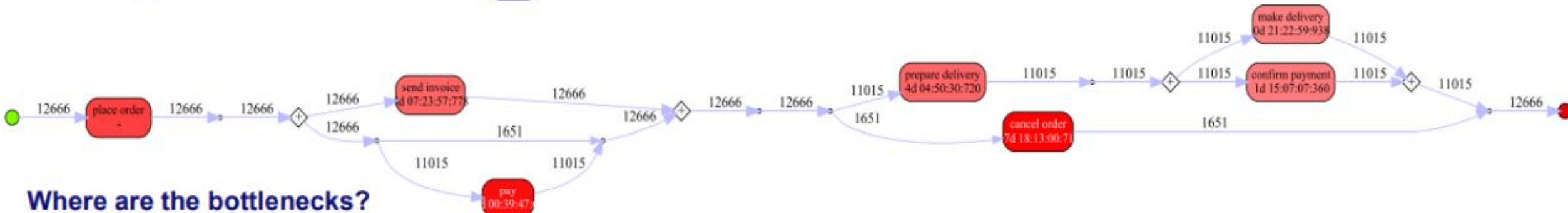
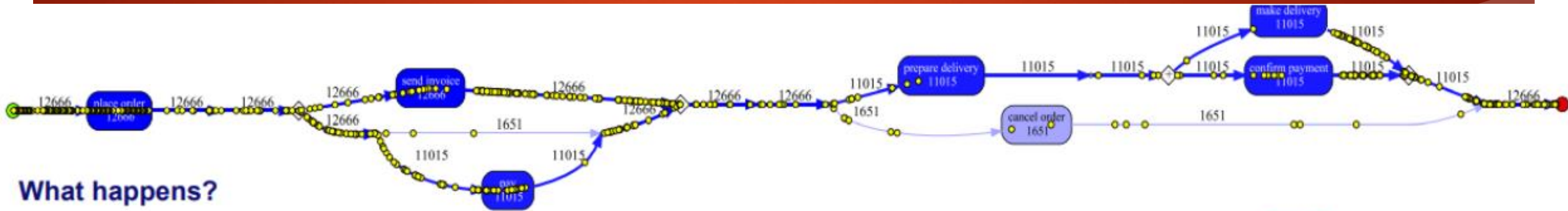


# Discovery

71,043 events  
12,666 cases  
7 activities

id	activity	resource	timestamp	process	instance	status	details
1	place order	customer	2013-01-01 10:00:00	order	1	success	
2	send invoice	customer	2013-01-01 10:05:00	order	1	success	
3	pay	customer	2013-01-01 10:10:00	order	1	success	
4	prepare delivery	customer	2013-01-01 10:15:00	order	1	success	
5	make delivery	customer	2013-01-01 10:20:00	order	1	success	
6	confirm payment	customer	2013-01-01 10:25:00	order	1	success	
7	place order	customer	2013-01-01 10:30:00	order	2	success	
8	send invoice	customer	2013-01-01 10:35:00	order	2	success	
9	cancel order	customer	2013-01-01 10:40:00	order	2	success	
10	place order	customer	2013-01-01 10:45:00	order	3	success	
11	send invoice	customer	2013-01-01 10:50:00	order	3	success	
12	pay	customer	2013-01-01 10:55:00	order	3	success	
13	prepare delivery	customer	2013-01-01 11:00:00	order	3	success	
14	confirm payment	customer	2013-01-01 11:05:00	order	3	success	
15	make delivery	customer	2013-01-01 11:10:00	order	3	success	
16	place order	customer	2013-01-01 11:15:00	order	4	success	
17	pay	customer	2013-01-01 11:20:00	order	4	success	
18	send invoice	customer	2013-01-01 11:25:00	order	4	success	
19	prepare delivery	customer	2013-01-01 11:30:00	order	4	success	
20	make delivery	customer	2013-01-01 11:35:00	order	4	success	
21	confirm payment	customer	2013-01-01 11:40:00	order	4	success	
22	place order	customer	2013-01-01 11:45:00	order	5	success	
23	pay	customer	2013-01-01 11:50:00	order	5	success	
24	send invoice	customer	2013-01-01 11:55:00	order	5	success	
25	prepare delivery	customer	2013-01-01 12:00:00	order	5	success	
26	confirm payment	customer	2013-01-01 12:05:00	order	5	success	
27	make delivery	customer	2013-01-01 12:10:00	order	5	success	
28	place order	customer	2013-01-01 12:15:00	order	6	success	
29	pay	customer	2013-01-01 12:20:00	order	6	success	
30	send invoice	customer	2013-01-01 12:25:00	order	6	success	
31	prepare delivery	customer	2013-01-01 12:30:00	order	6	success	
32	make delivery	customer	2013-01-01 12:35:00	order	6	success	
33	confirm payment	customer	2013-01-01 12:40:00	order	6	success	
34	place order	customer	2013-01-01 12:45:00	order	7	success	
35	pay	customer	2013-01-01 12:50:00	order	7	success	
36	send invoice	customer	2013-01-01 12:55:00	order	7	success	
37	prepare delivery	customer	2013-01-01 13:00:00	order	7	success	
38	confirm payment	customer	2013-01-01 13:05:00	order	7	success	
39	make delivery	customer	2013-01-01 13:10:00	order	7	success	
40	place order	customer	2013-01-01 13:15:00	order	8	success	
41	pay	customer	2013-01-01 13:20:00	order	8	success	
42	send invoice	customer	2013-01-01 13:25:00	order	8	success	
43	prepare delivery	customer	2013-01-01 13:30:00	order	8	success	
44	confirm payment	customer	2013-01-01 13:35:00	order	8	success	
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47	pay	customer	2013-01-01 13:50:00	order	9	success	
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53	pay	customer	2013-01-01 14:20:00	order	10	success	
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67	prepare delivery	customer	2013-01-01 15:30:00	order	12	success	
68	confirm payment	customer	2013-01-01 15:35:00	order	12	success	
69	make delivery	customer	2013-01-01 15:40:00	order	12	success	
70	place order	customer	2013-01-01 15:45:00	order	13	success	
71	pay	customer	2013-01-01 15:50:00	order	13	success	
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74	confirm payment	customer	2013-01-01 16:05:00	order	13	success	
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77	pay	customer	2013-01-01 16:20:00	order	14	success	
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80	confirm payment	customer	2013-01-01 16:35:00	order	14	success	
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82	place order	customer	2013-01-01 16:45:00	order	15	success	
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115	prepare delivery	customer	2013-01-01 19:30:00	order	20	success	
116	confirm payment	customer	2013-01-01 19:35:00	order	20	success	
117	make delivery	customer	2013-01-01 19:40:00	order	20	success	
118	place order	customer	2013-01-01 19:45:00	order	21	success	
119	pay	customer	2013-01-01 19:50:00	order	21	success	
120	send invoice	customer	2013-01-01 19:55:00	order	21	success	
121	prepare delivery	customer	2013-01-01 20:00:00	order	21	success	
122	confirm payment	customer	2013-01-01 20:05:00	order	21	success	
123	make delivery	customer	2013-01-01 20:10:00	order	21	success	
124	place order	customer	2013-01-01 20:15:00	order	22	success	
125	pay	customer	2013-01-01 20:20:00	order	22	success	
126	send invoice	customer	2013-01-01 20:25:00	order	22	success	
127	prepare delivery	customer	2013-01-01 20:30:00	order	22	success	
128	confirm payment	customer	2013-01-01 20:35:00	order	22	success	
129	make delivery	customer	2013-01-01 20:40:00	order	22	success	
130	place order	customer	2013-01-01 20:45:00	order	23	success	
131	pay	customer	2013-01-01 20:50:00	order	23	success	
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150	send invoice	customer	2013-01-01 22:25:00	order	26	success	
151	prepare delivery	customer	2013-01-01 22:30:00	order	26	success	
152	confirm payment	customer	2013-01-01 22:35:00	order	26	success	
153	make delivery	customer	2013-01-01 22:40:00	order	26	success	
154	place order	customer	2013-01-01 22:45:00	order	27	success	
155	pay	customer	2013-01-01 22:50:00	order	27	success	
156	send invoice	customer	2013-01-01 22:55:00	order	27	success	
157	prepare delivery	customer	2013-01-01 23:00:00	order	27	success	
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160	place order	customer	2013-01-01 23:15:00	order	28	success	
161	pay	customer	2013-01-01 23:20:00	order	28	success	
162	send invoice	customer	2013-01-01 23:25:00	order	28	success	
163	prepare delivery	customer	2013-01-01 23:30:00	order	28	success	
164	confirm payment	customer	2013-01-01 23:35:00	order	28	success	
165	make delivery	customer	2013-01-01 23:40:00	order	28	success	
166	place order	customer	2013-01-01 23:45:00	order	29	success	
167	pay	customer	2013-01-01 23:50:00	order	29	success	
168	send invoice	customer	2013-01-01 23:55:00	order	29	success	
169	prepare delivery	customer	2013-01-02 00:00:00	order	29	success	
170	confirm payment	customer	2013-01-02 00:05:00	order	29	success	
171	make delivery	customer	2013-01-02 00:10:00	order	29	success	
172	place order	customer	2013-01-02 00:15:00	order	30</		

# Conformance Checking



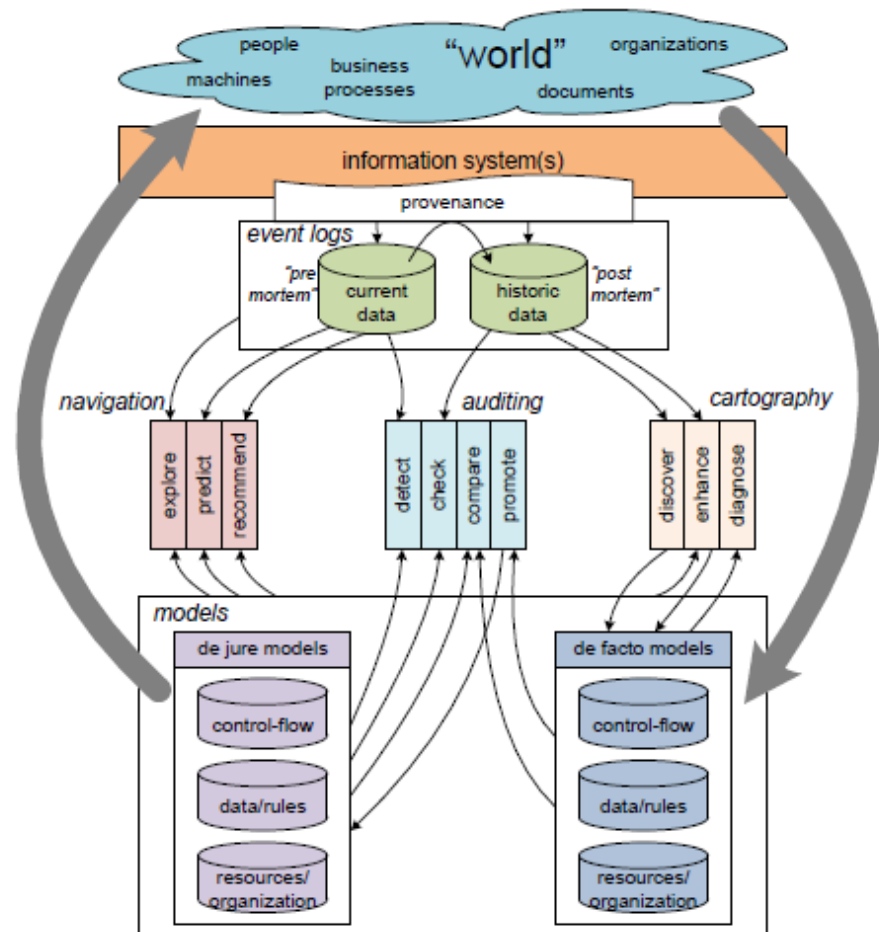
Answer to What Questions!



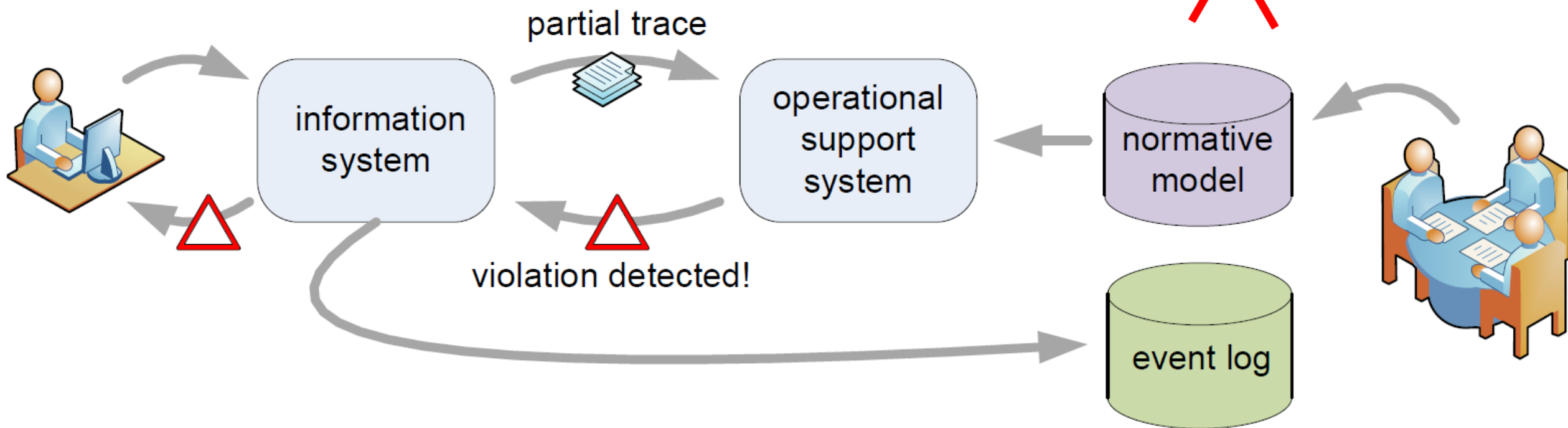
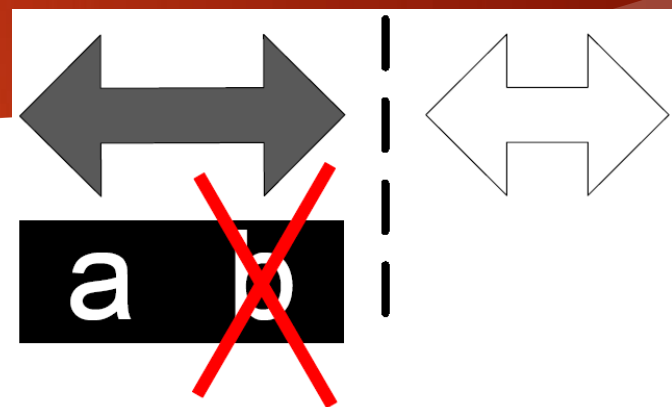
# Happy Path



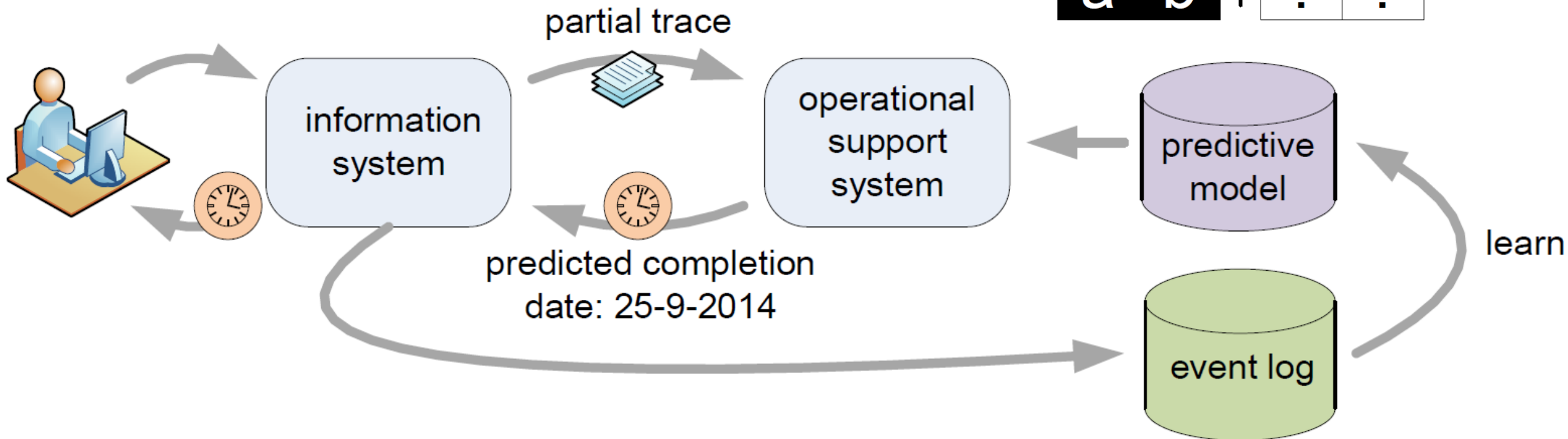
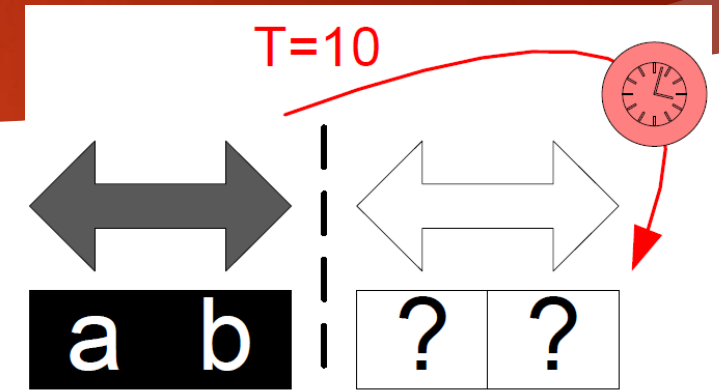
# Refined Process Mining Framework



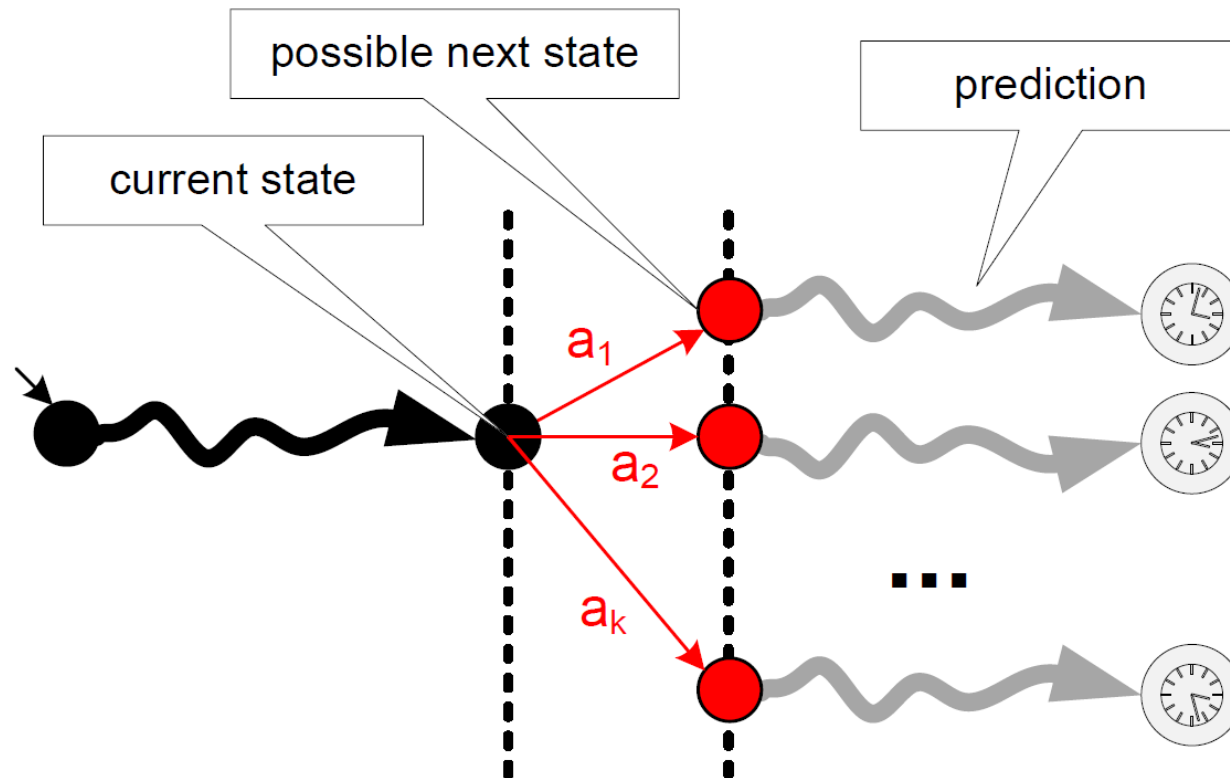
Detect: b does not fit the model



Predict: some prediction is made about the future

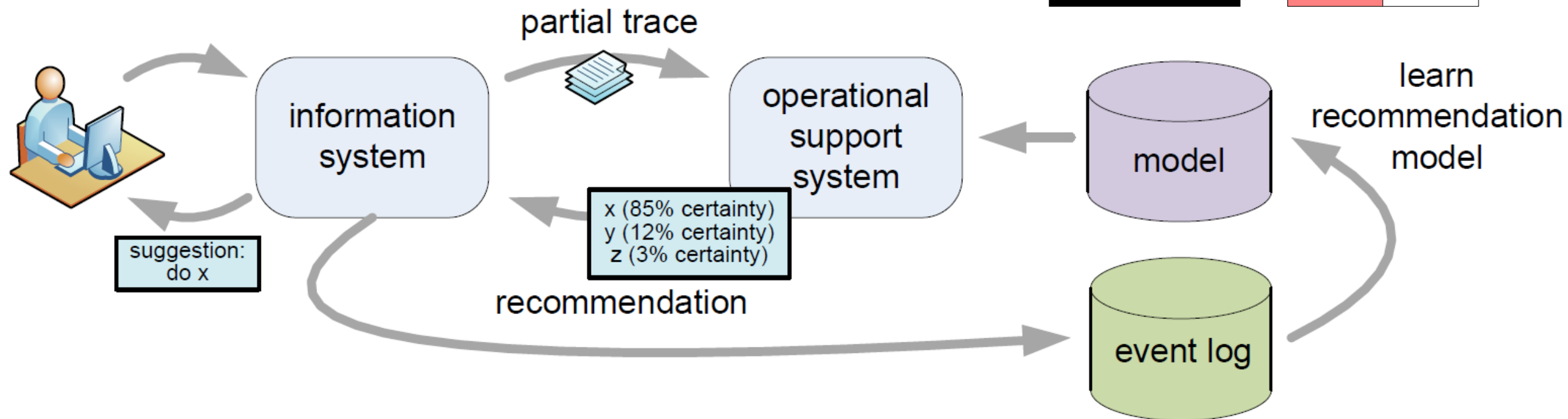


ability to predict  $\rightarrow$  ability to recommend

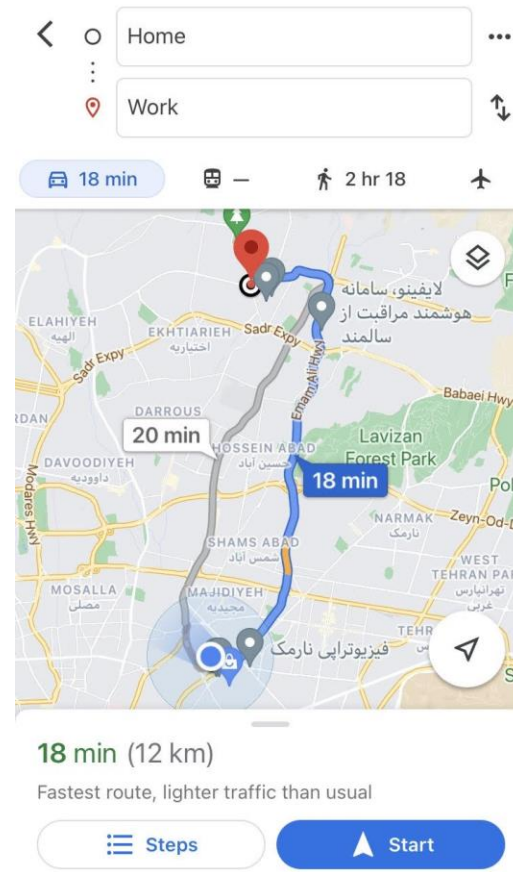
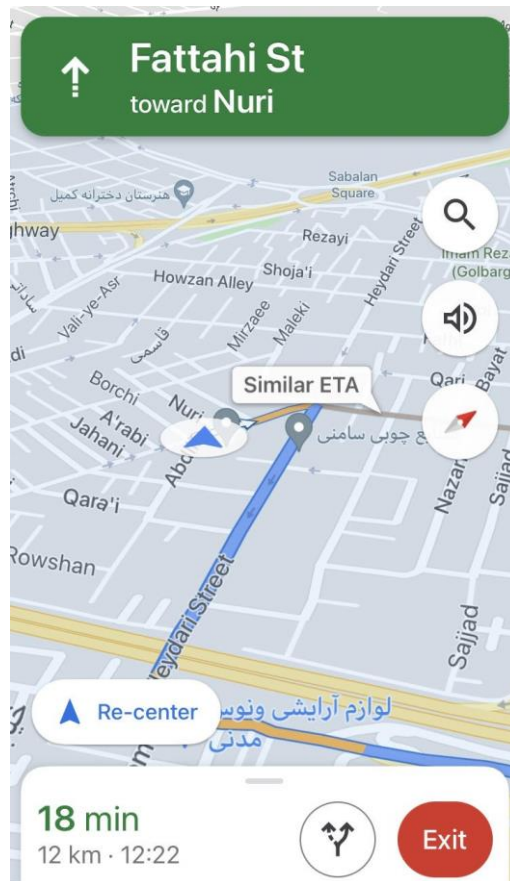




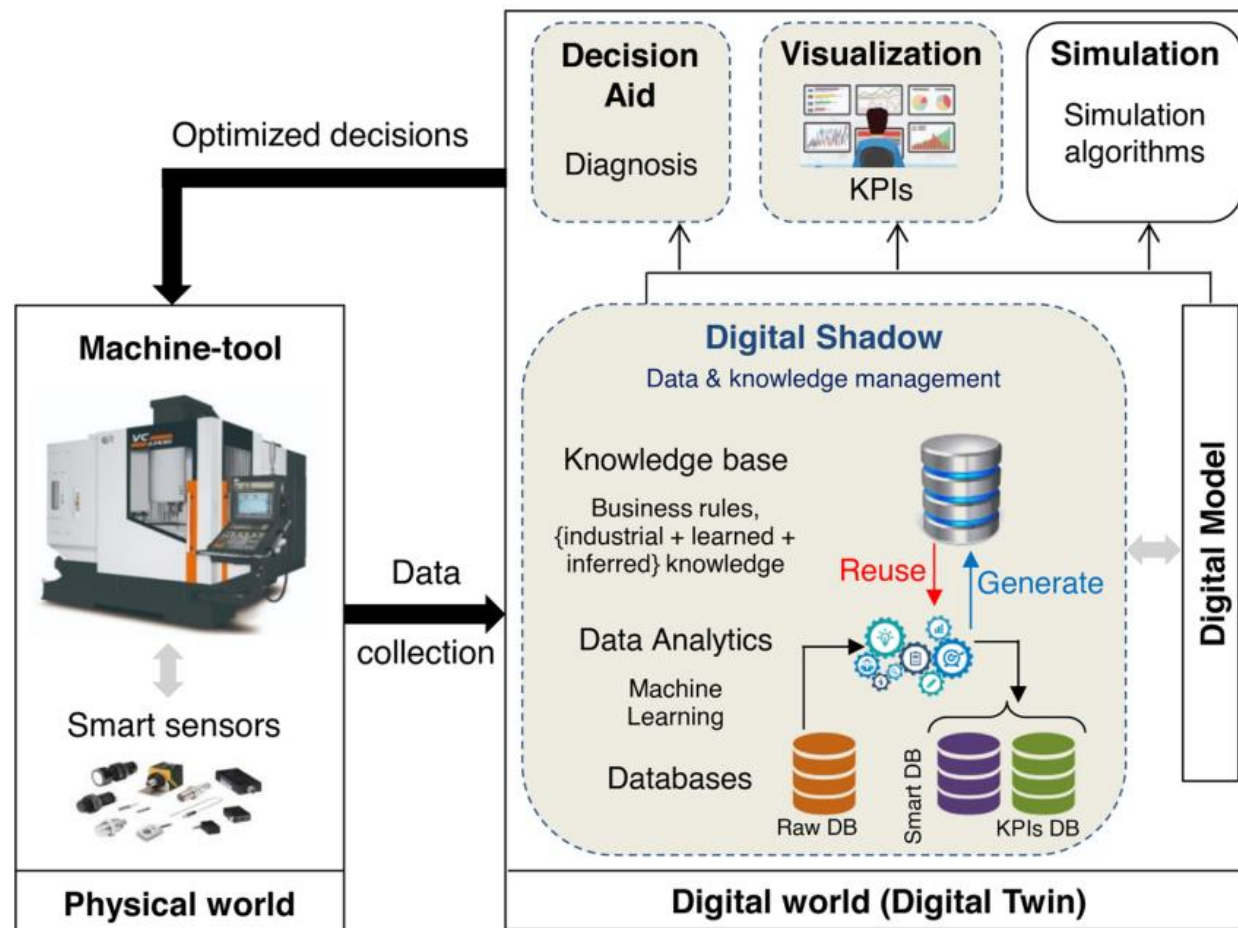
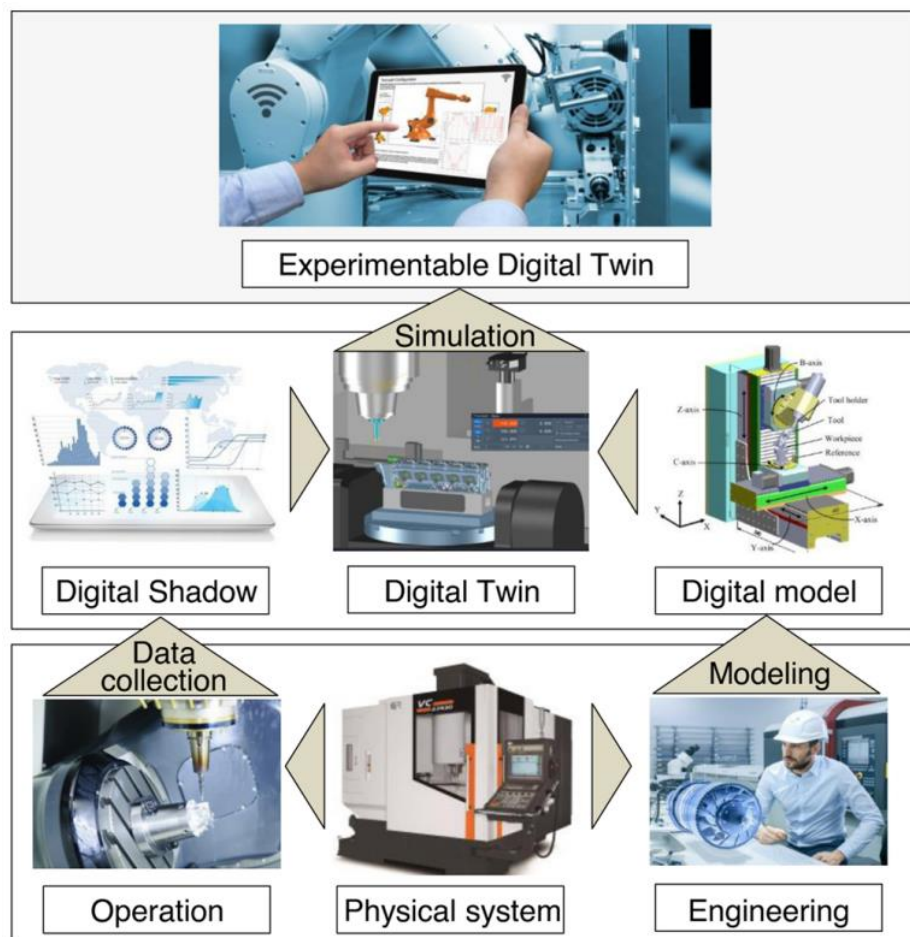
Recommend: based on past experiences  
c is recommended



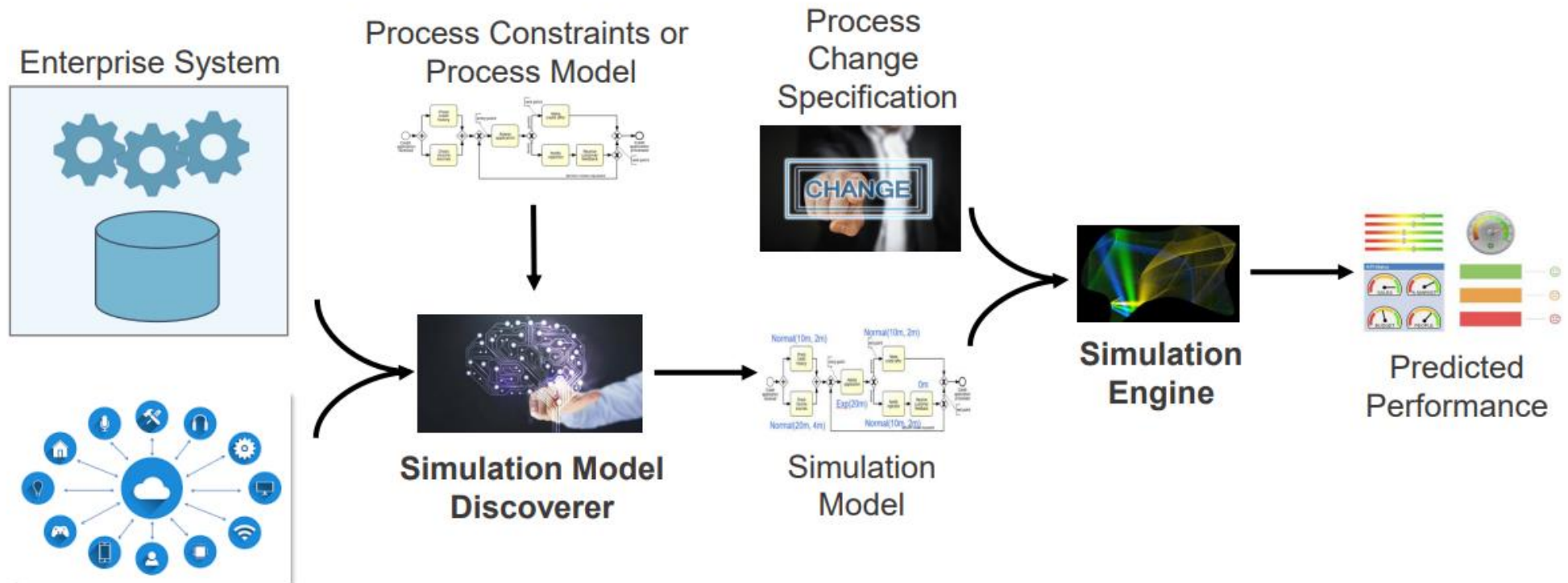
# Process models are like maps



# Digital Twins

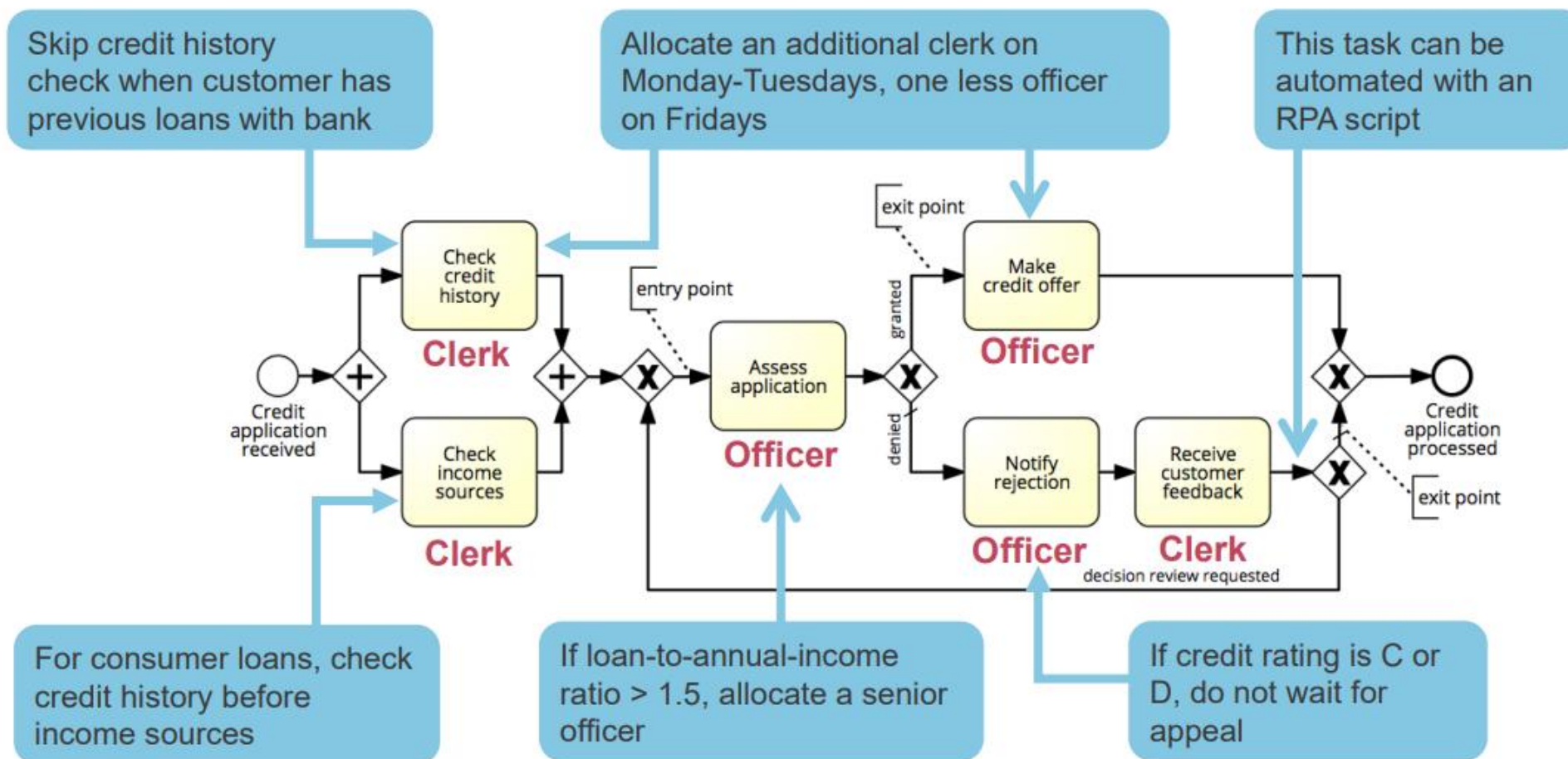


# Digital Process twins

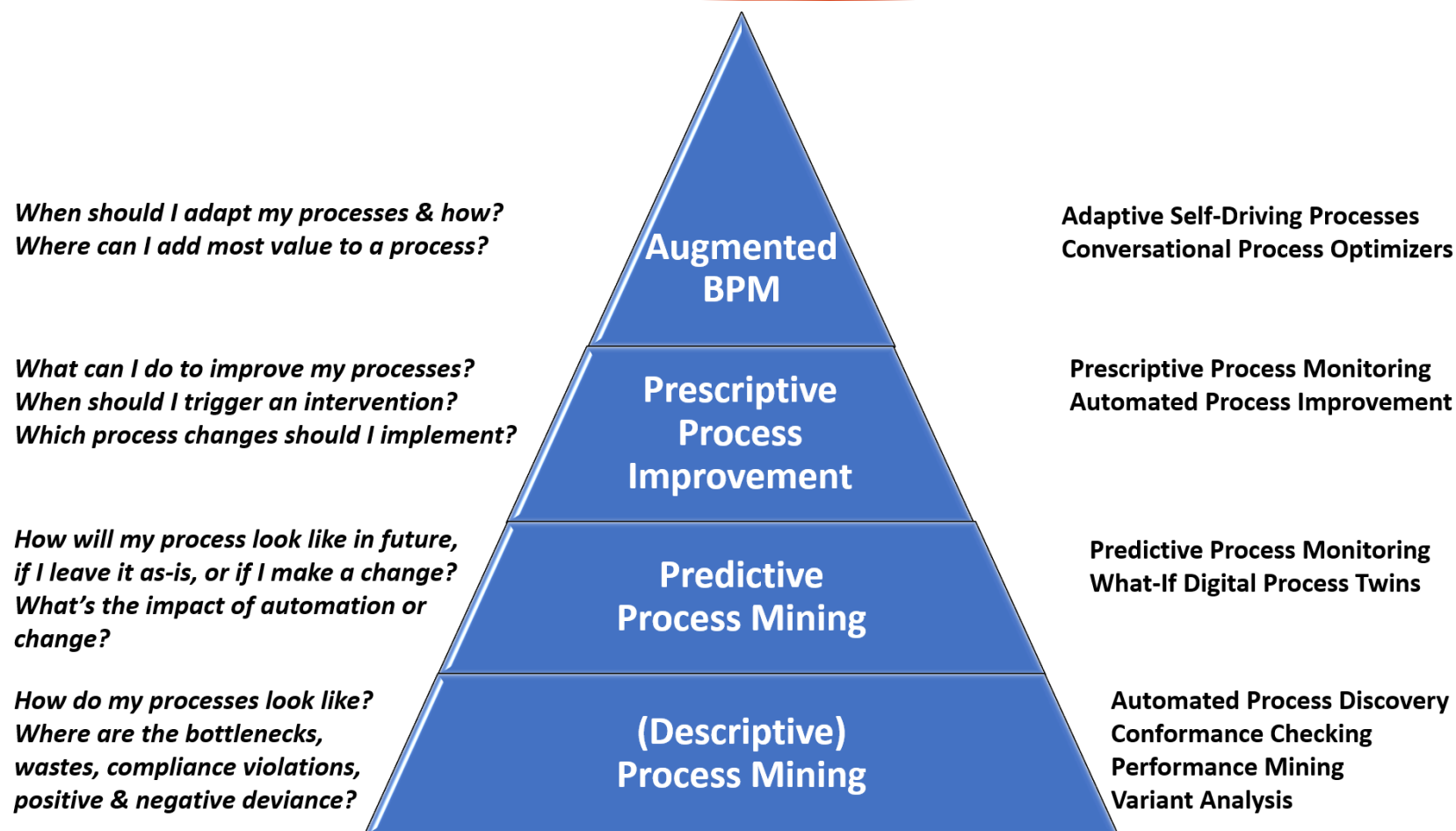




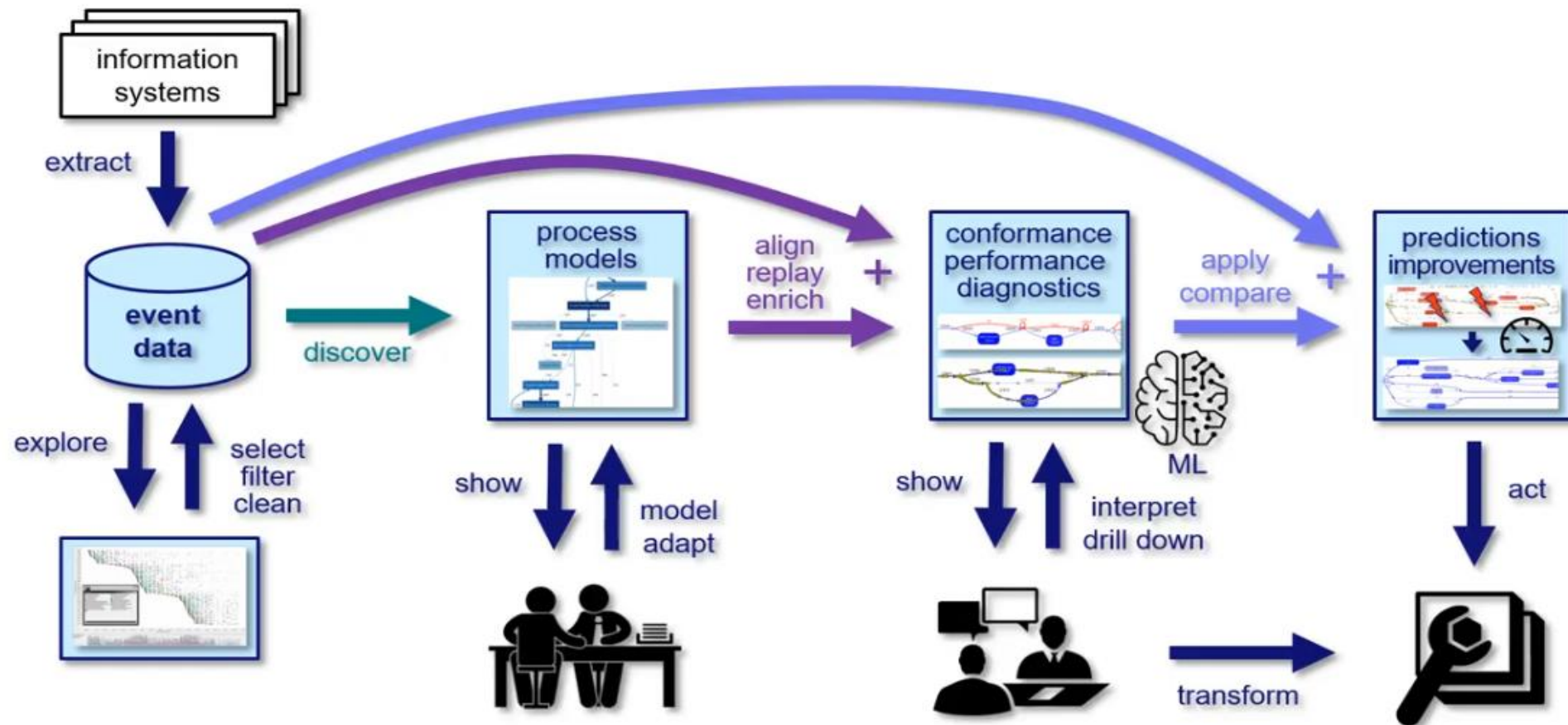
# Automated Process Improvement



# The Augmented BPM pyramid



# Turning data into value!





Thank you for your attention!

