

CS 4072 - Topics in CS

Process Mining

Lecture # 03

February 21, 2022

Spring 2022

FAST - NUCES, CFD Campus

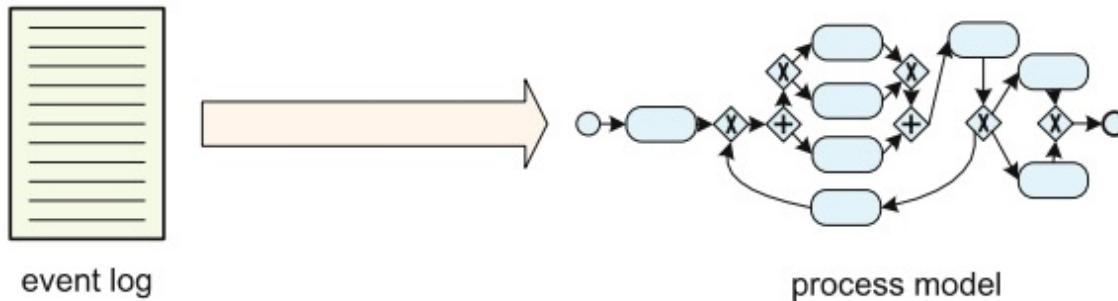
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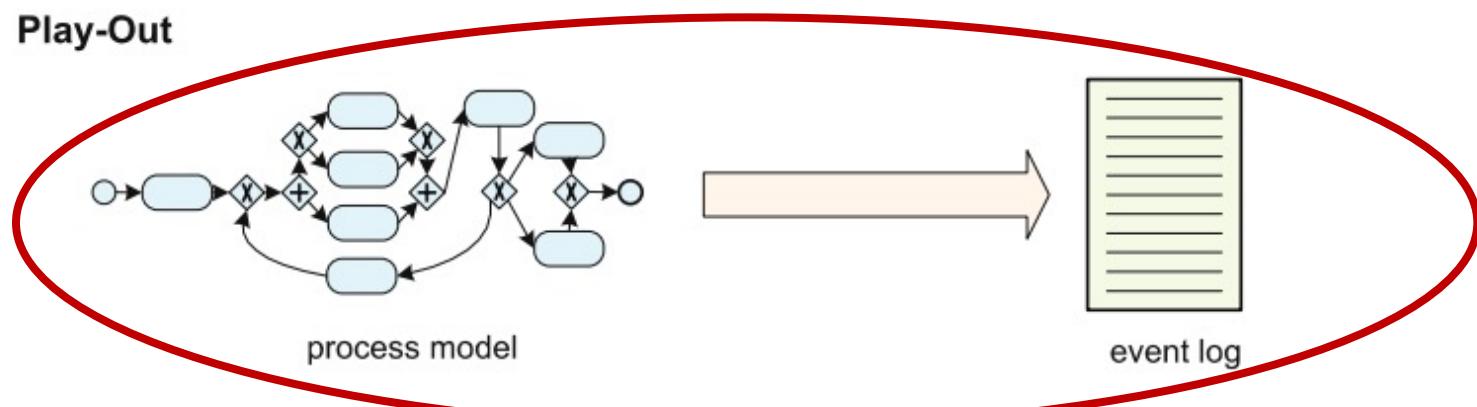
Today's Topics

- ▶ Process mining tasks
 - ▶ Play-in
 - ▶ Play-out
 - ▶ Replay

Play-In



Play-Out



Replay

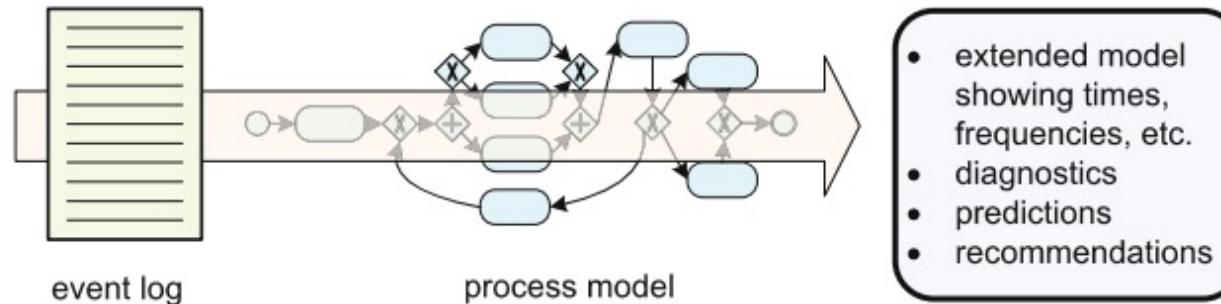
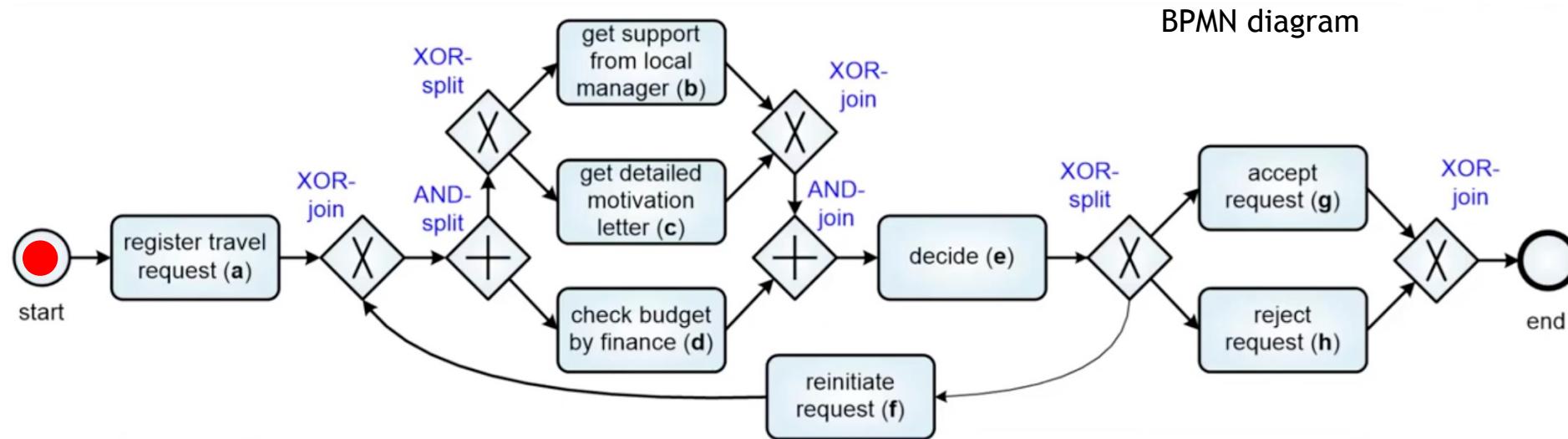


Fig. 1.8 Three ways of relating event logs (or other sources of information containing example behavior) and process models: *Play-in*, *Play-out*, and *Replay*

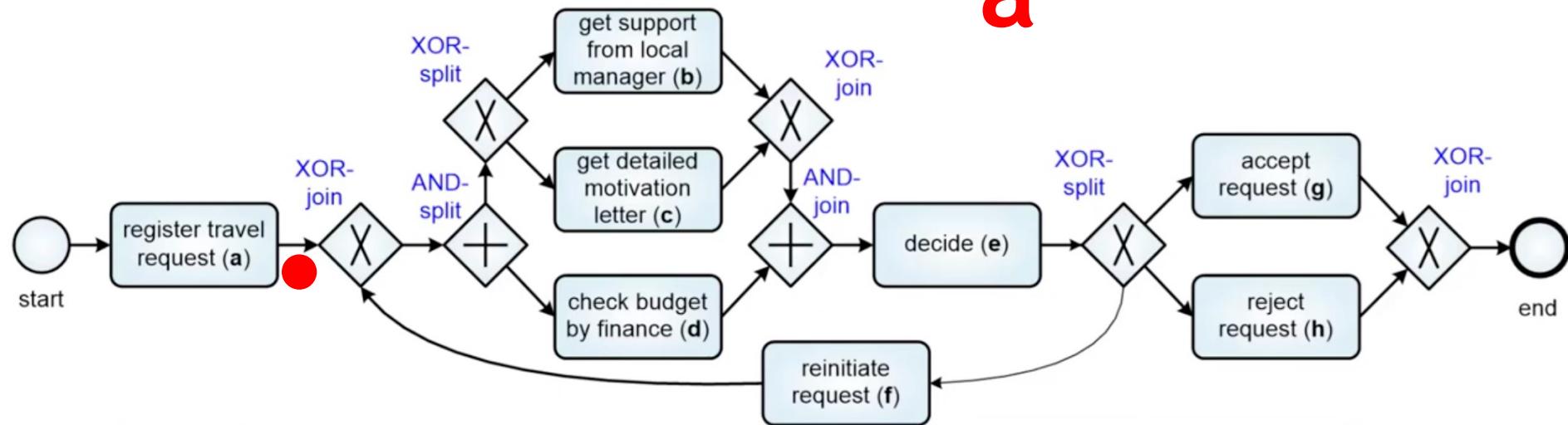
Play-Out: an example



Case	Activity	Timestamp	Resource

Play-Out: an example

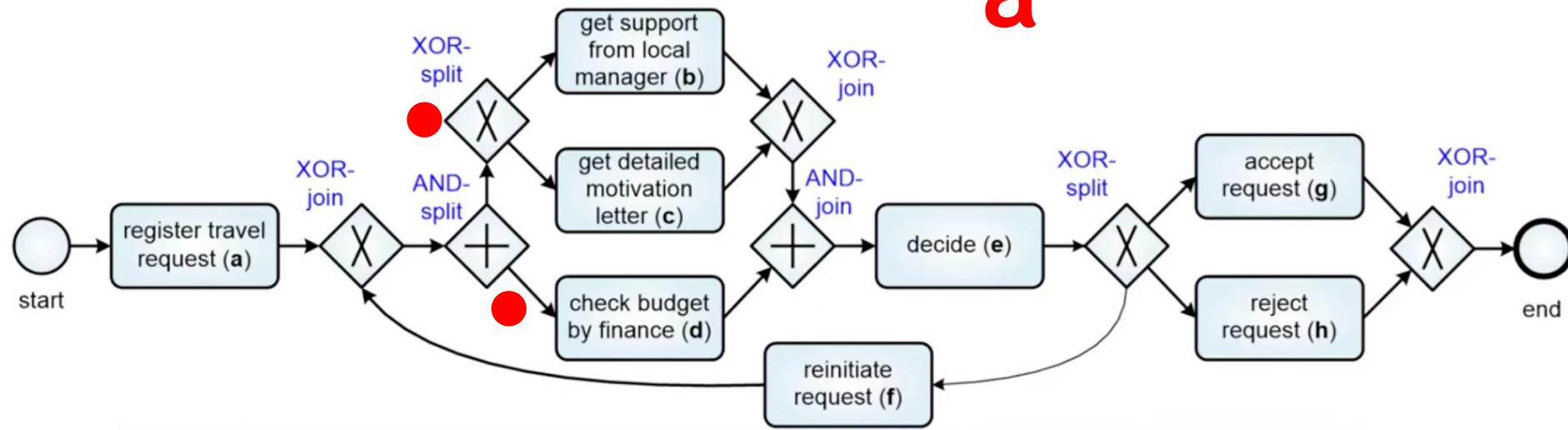
a



Case	Activity	Timestamp	Resource
116	a	14-02-2018: 08:30	Ahmed

Play-Out: an example

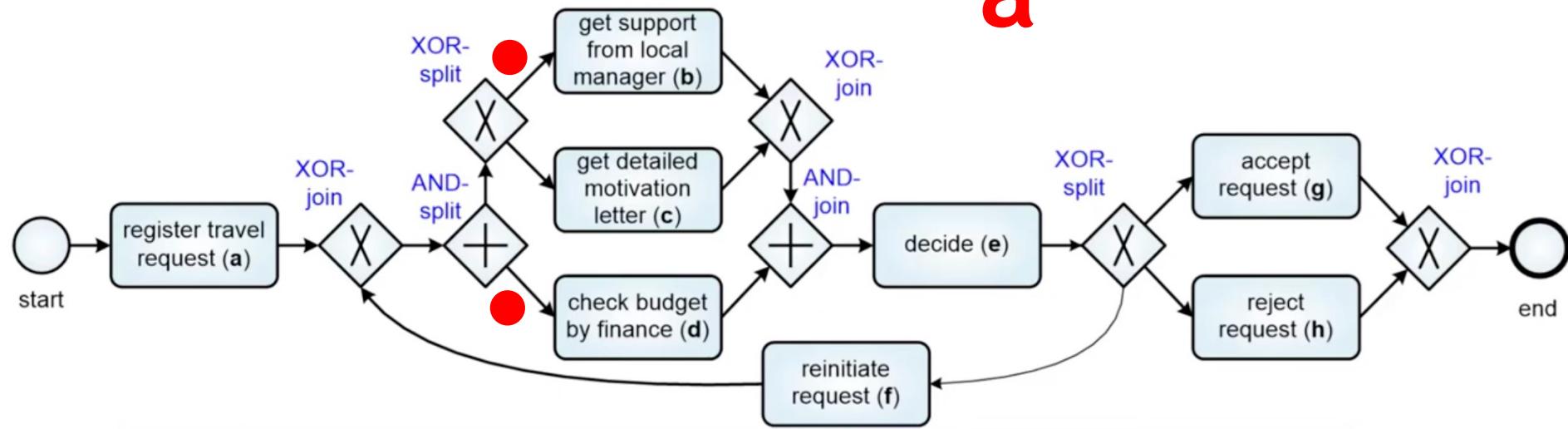
a



Case	Activity	Timestamp	Resource
116	a	14-02-2018: 08:30	Ahmed

Play-Out: an example

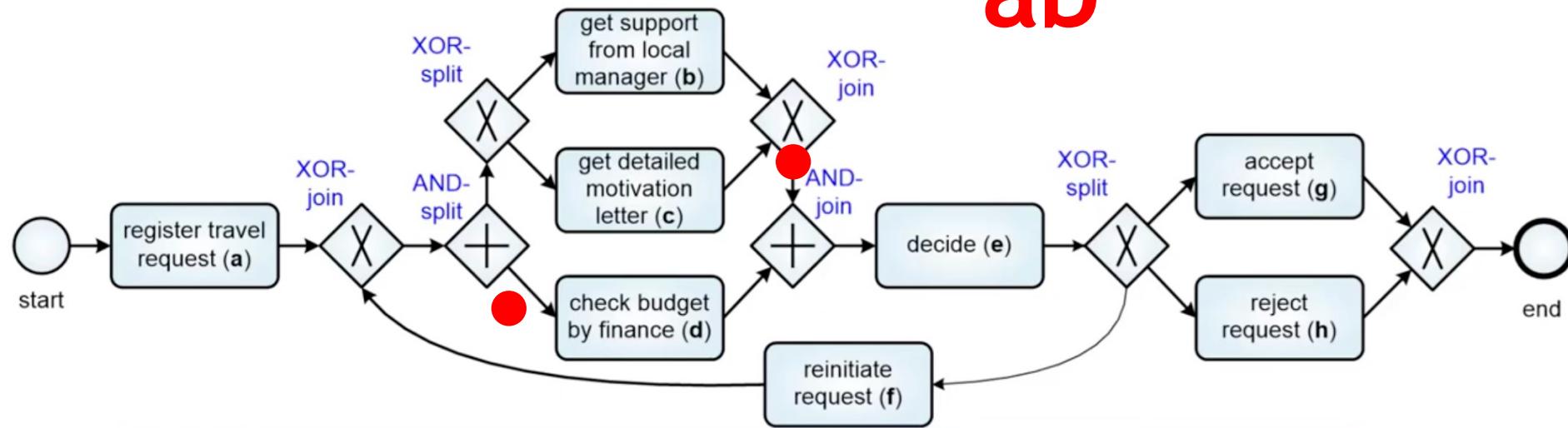
a



Case	Activity	Timestamp	Resource
116	a	14-02-2018: 08:30	Ahmed

Play-Out: an example

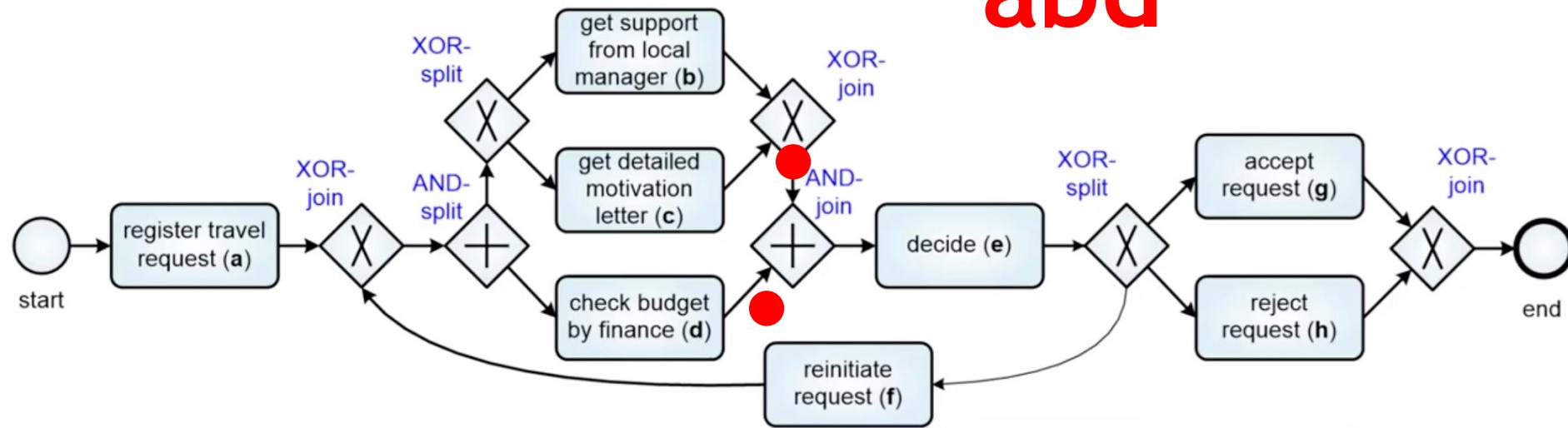
ab



Case	Activity	Timestamp	Resource
116	a	14-02-2018: 08:30	Ahmed
116	b	14-02-2018: 08:35	Hassan

Play-Out: an example

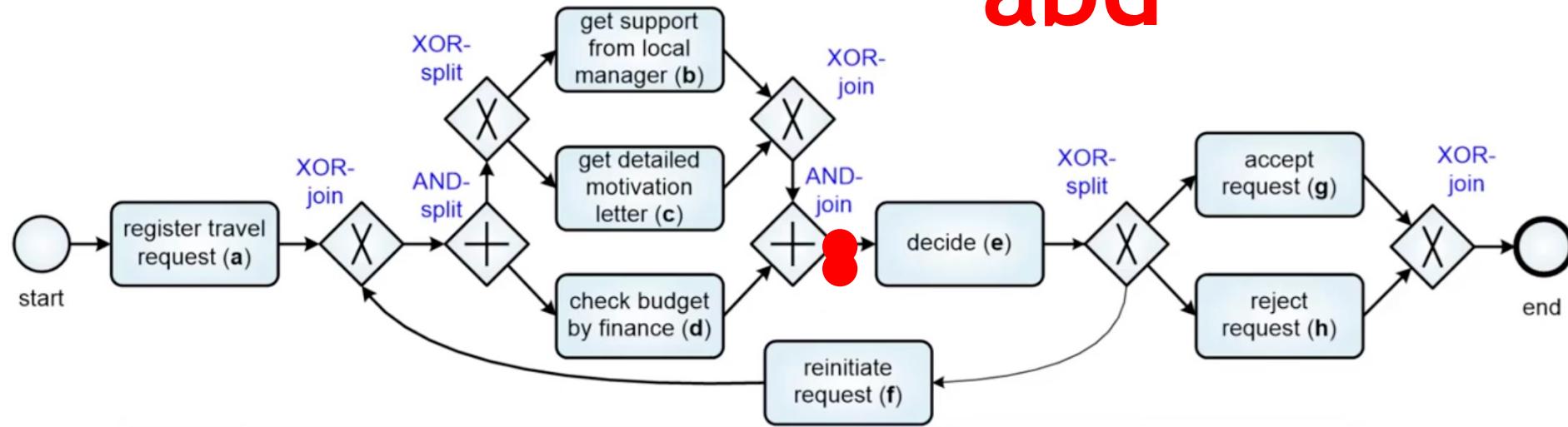
abd



Case	Activity	Timestamp	Resource
116	a	14-02-2018: 08:30	Ahmed
116	b	14-02-2018: 08:35	Hassan
116	d	14-02-2018: 08:45	Ahmed

Play-Out: an example

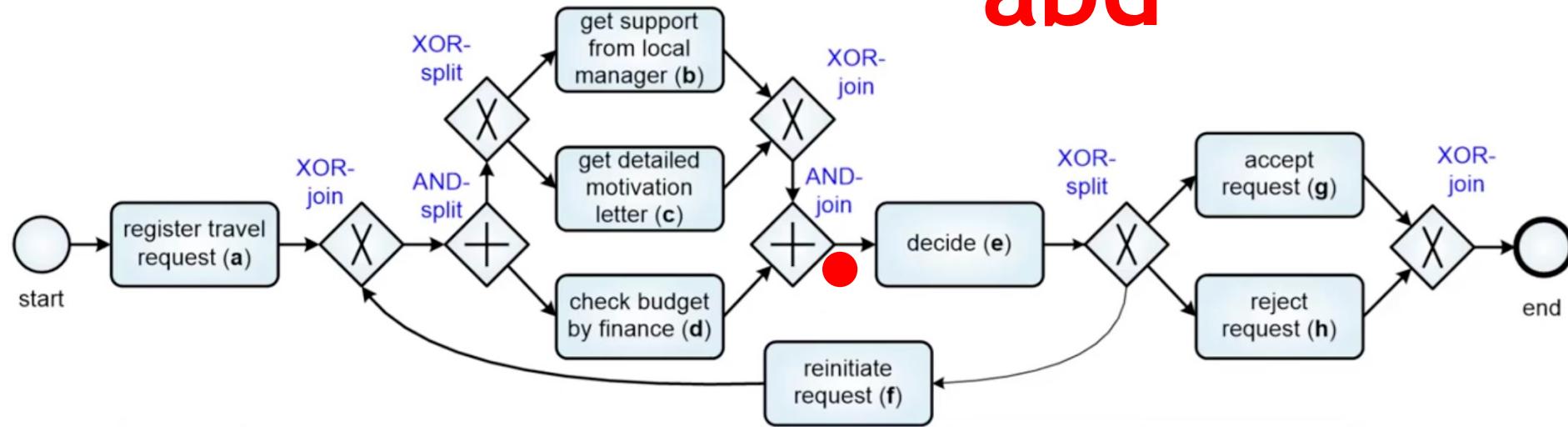
abd



Case	Activity	Timestamp	Resource
116	a	14-02-2018: 08:30	Ahmed
116	b	14-02-2018: 08:35	Hassan
116	d	14-02-2018: 08:45	Ahmed

Play-Out: an example

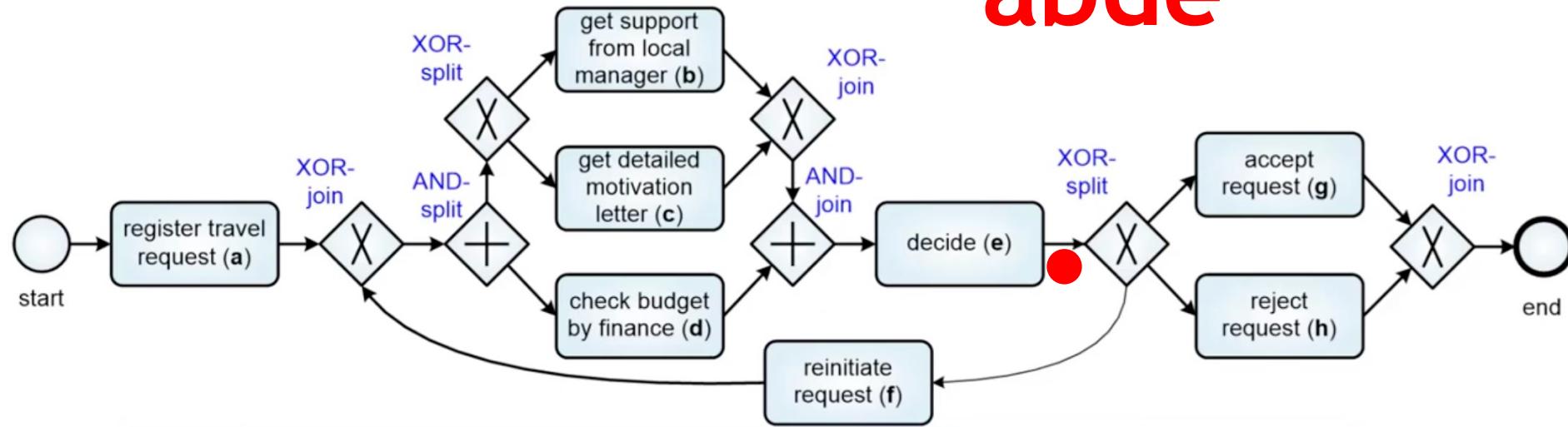
abd



Case	Activity	Timestamp	Resource
116	a	14-02-2018: 08:30	Ahmed
116	b	14-02-2018: 08:35	Hassan
116	d	14-02-2018: 08:45	Ahmed

Play-Out: an example

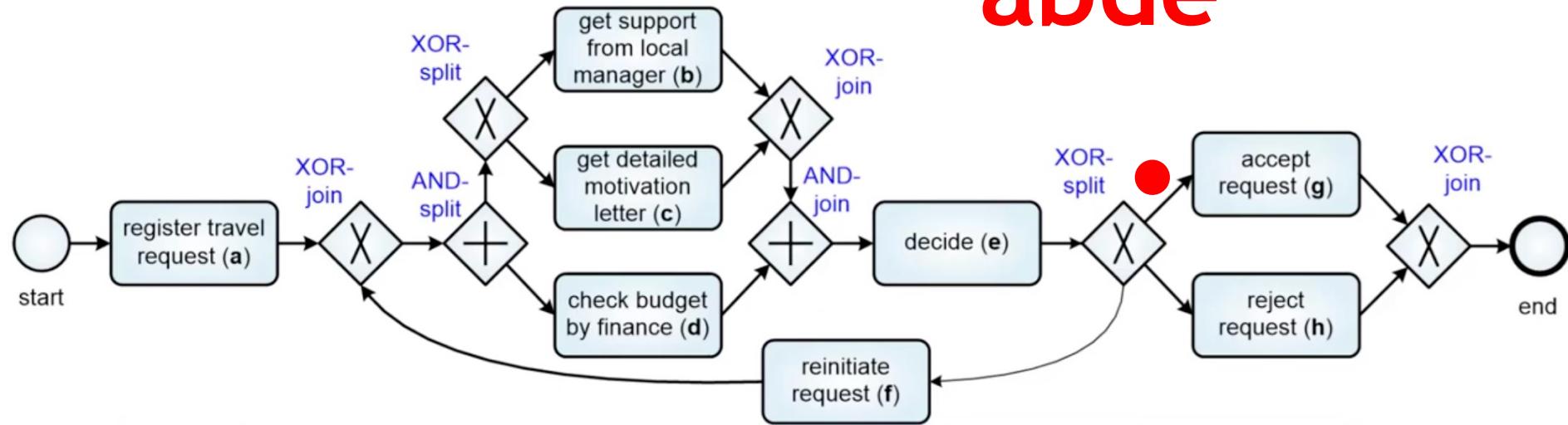
abde



Case	Activity	Timestamp	Resource
116	a	14-02-2018: 08:30	Ahmed
116	b	14-02-2018: 08:35	Hassan
116	d	15-02-2018: 10:12	Ahmed
116	e	14-02-2018: 08:45	Zara

Play-Out: an example

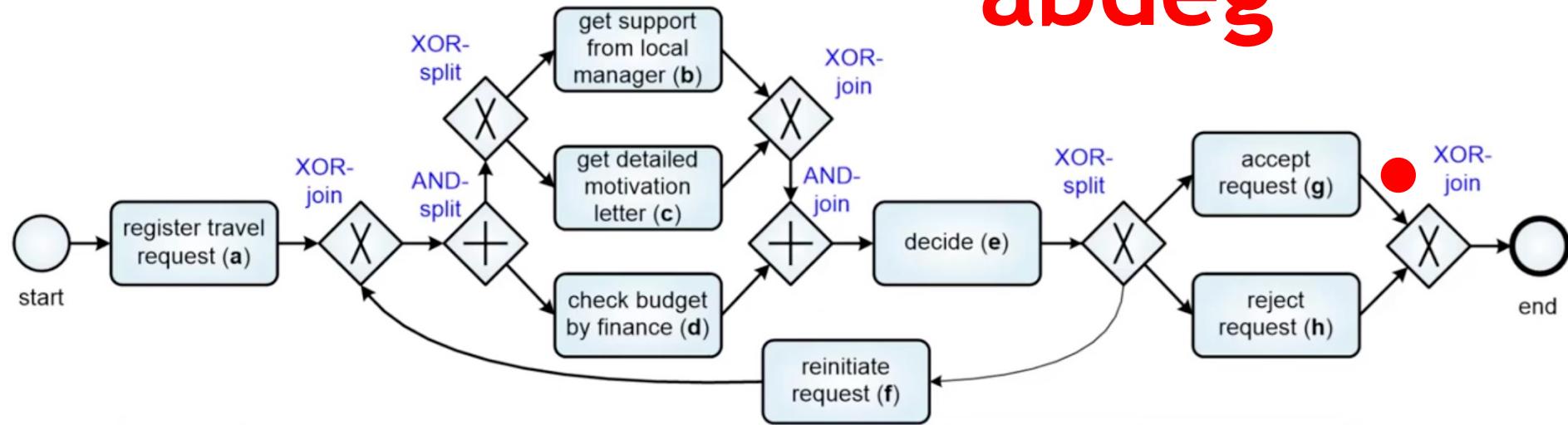
abde



Case	Activity	Timestamp	Resource
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116	b	14-02-2018: 08:35	Hassan
116	d	15-02-2018: 10:12	Ahmed
116	e	14-02-2018: 08:45	Zara

Play-Out: an example

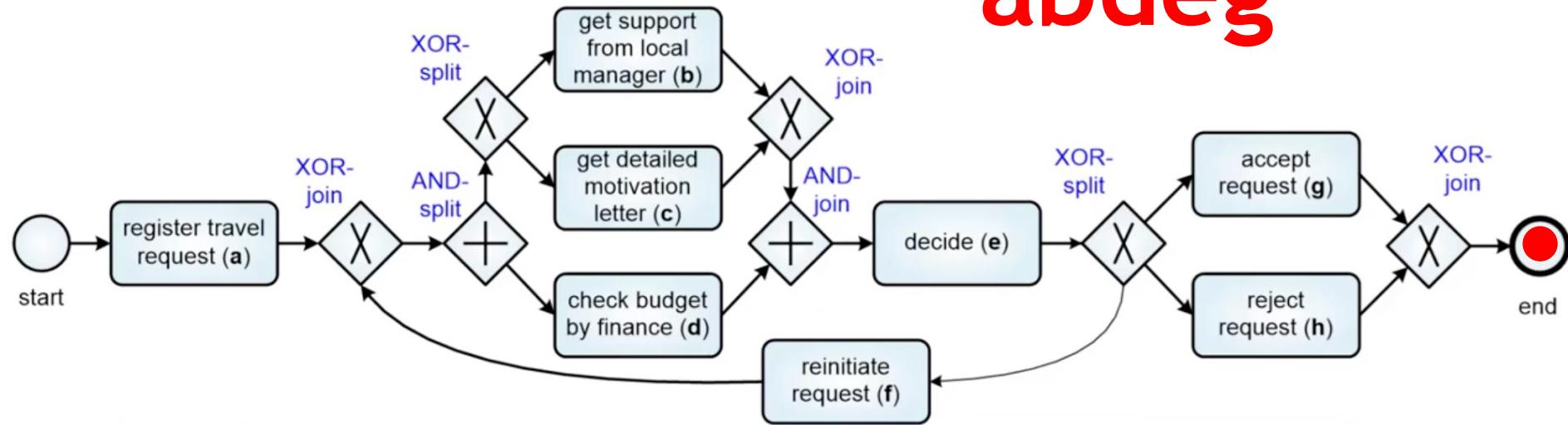
abdeg



Case	Activity	Timestamp	Resource
116	a	14-02-2018: 08:30	Ahmed
116	b	14-02-2018: 08:35	Hassan
116	d	15-02-2018: 10:12	Ahmed
116	e	15-02-2018: 11:00	Zara
116	g	15-02-2018: 11:17	Shams

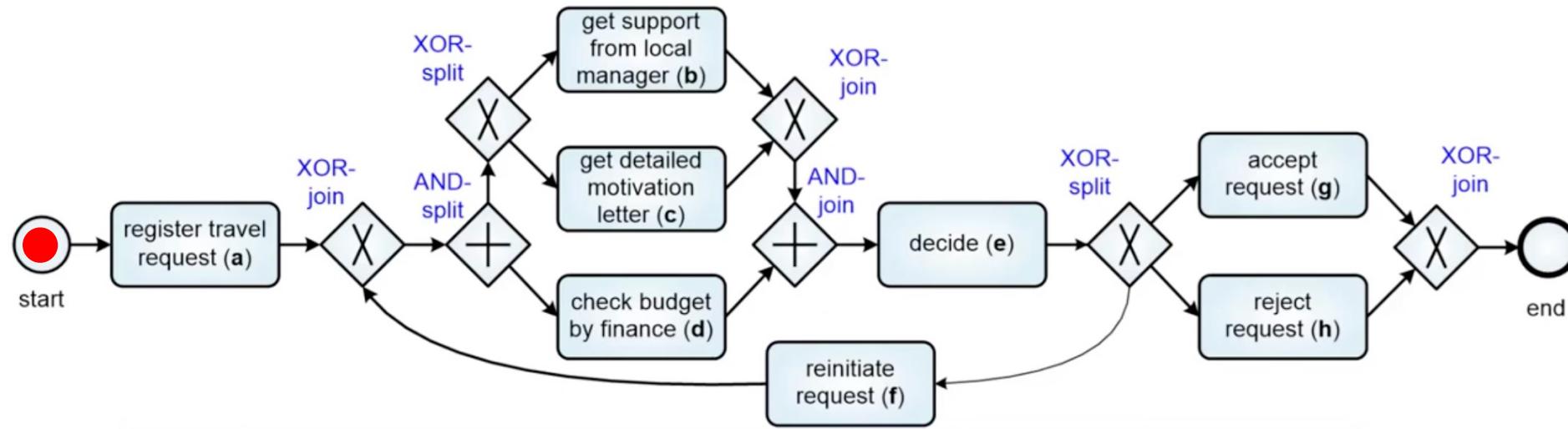
Play-Out: an example

abdeg



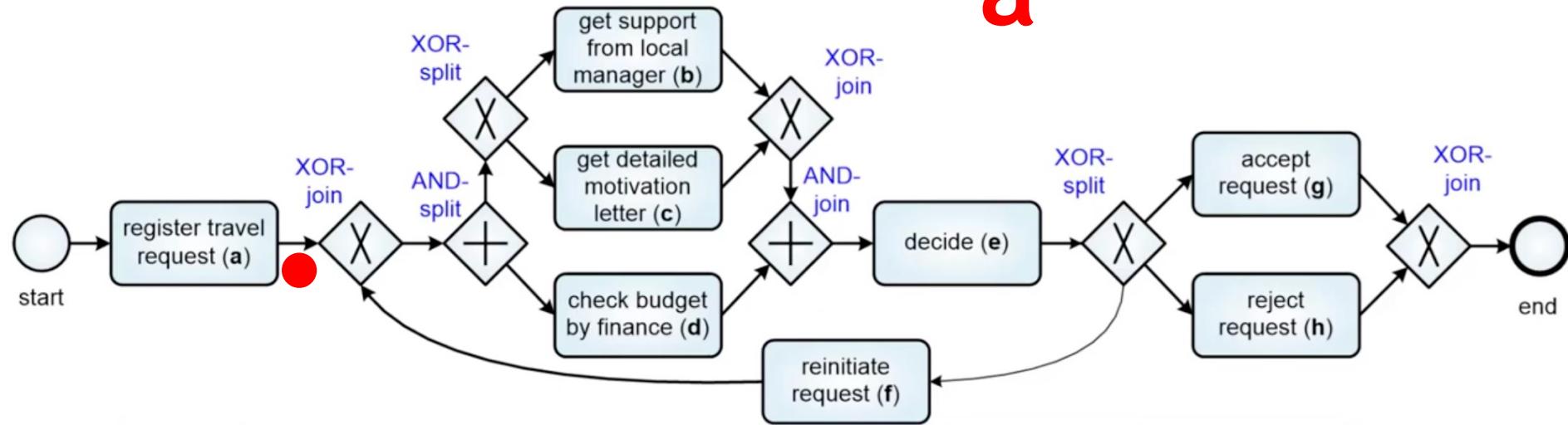
Case	Activity	Timestamp	Resource
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116	b	14-02-2018: 08:35	Hassan
116	d	15-02-2018: 10:12	Ahmed
116	e	15-02-2018: 11:00	Zara
116	g	15-02-2018: 11:17	Shams

Play-Out: another example



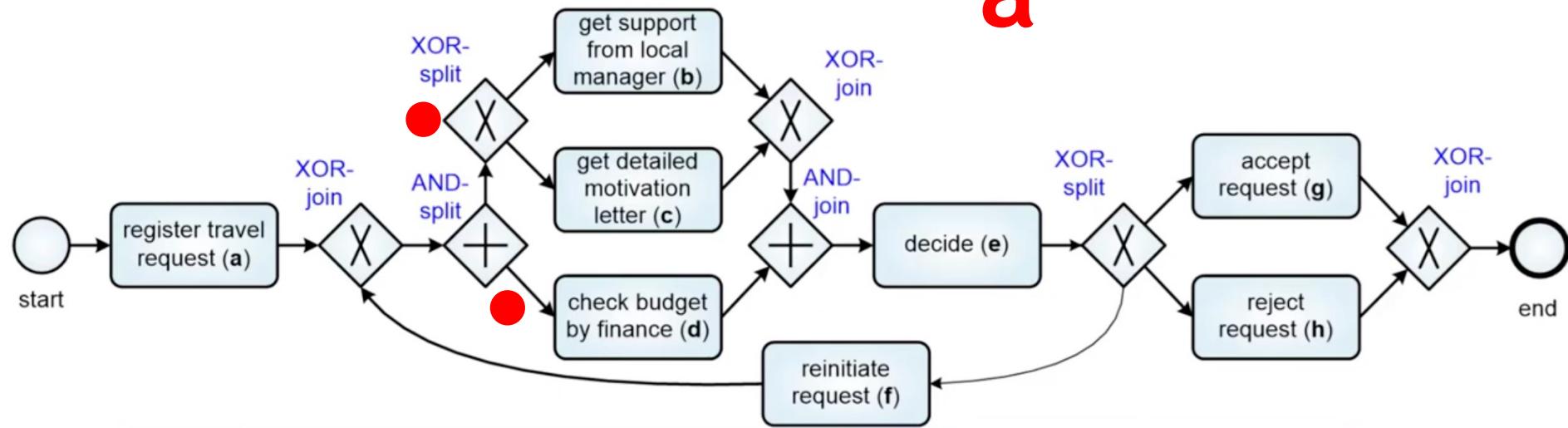
Play-Out: an example

a



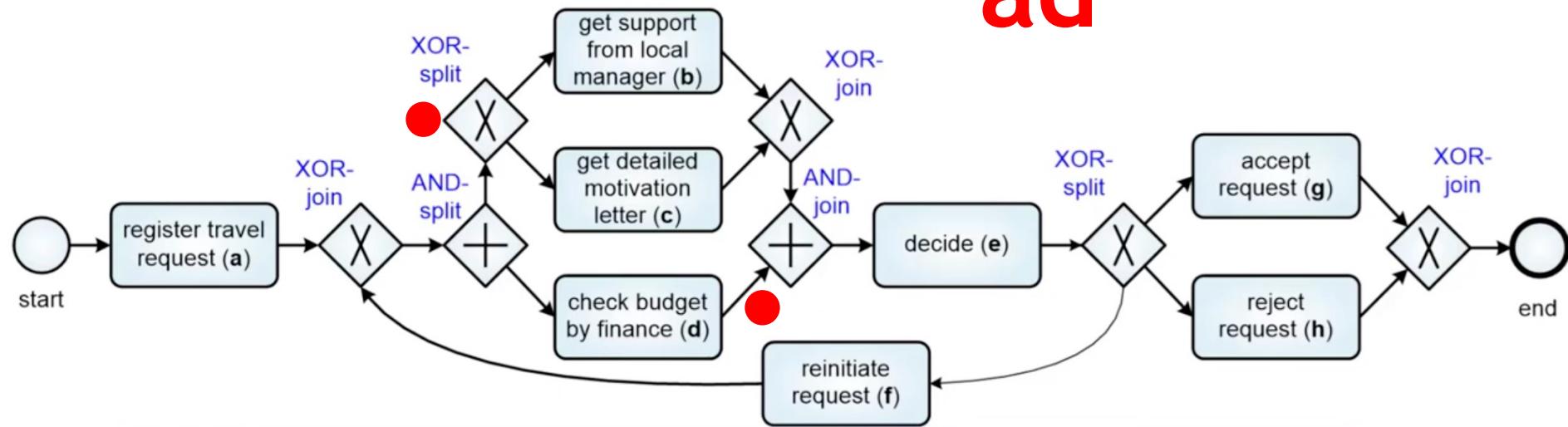
Play-Out: an example

a



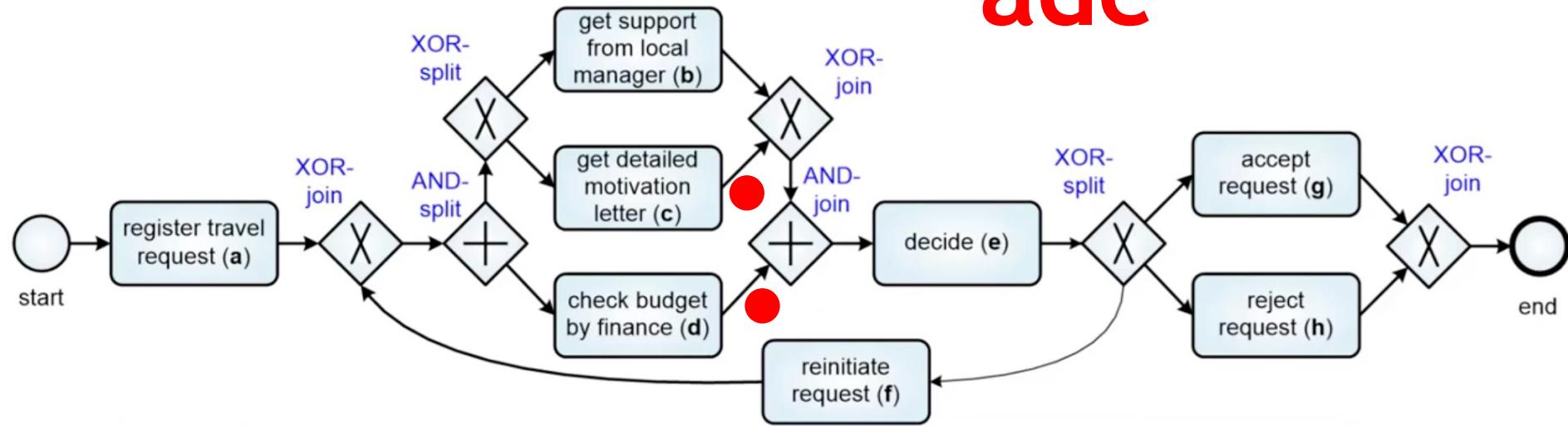
Play-Out: an example

ad



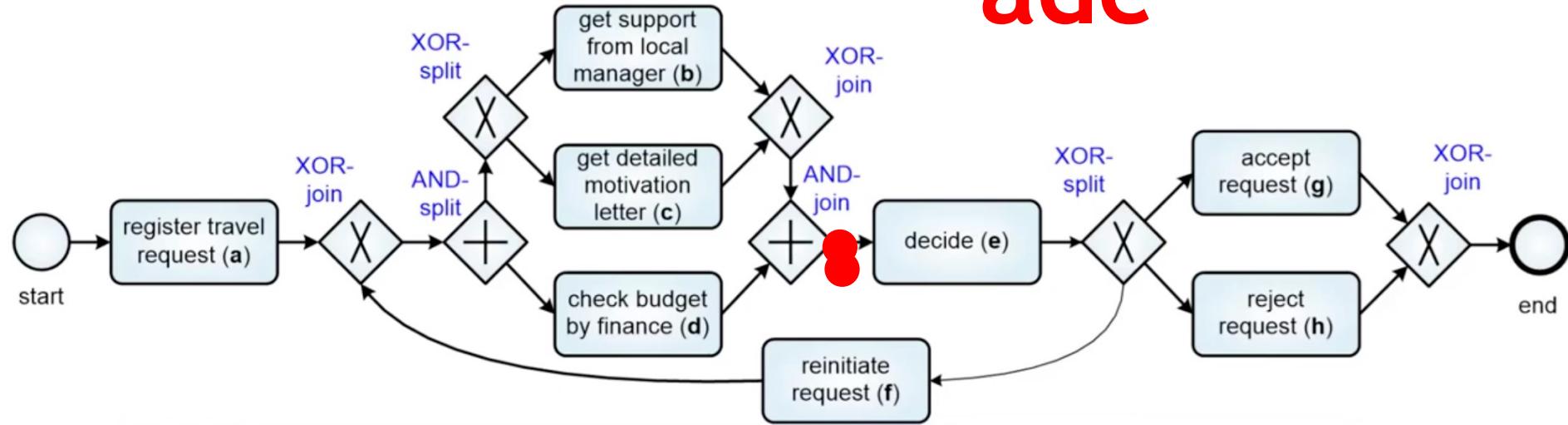
Play-Out: an example

adc



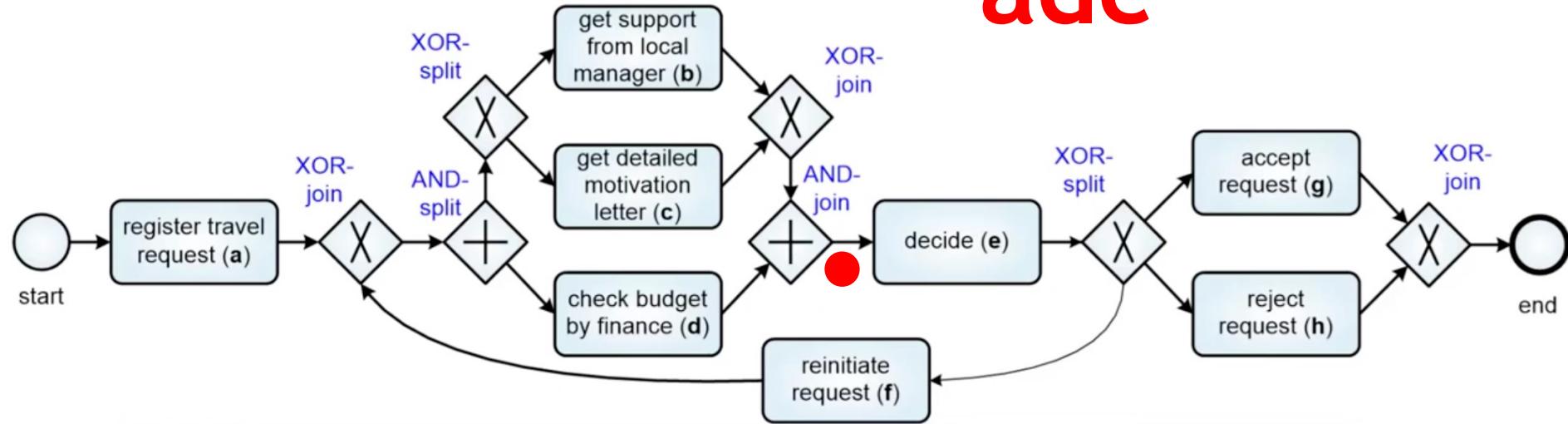
Play-Out: an example

adc



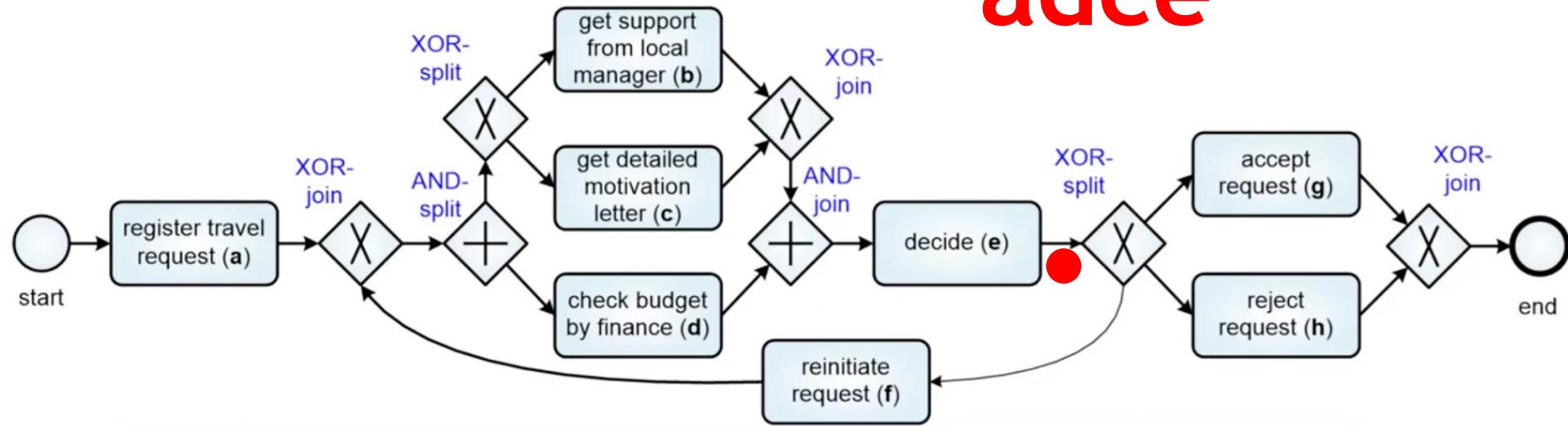
Play-Out: an example

adc



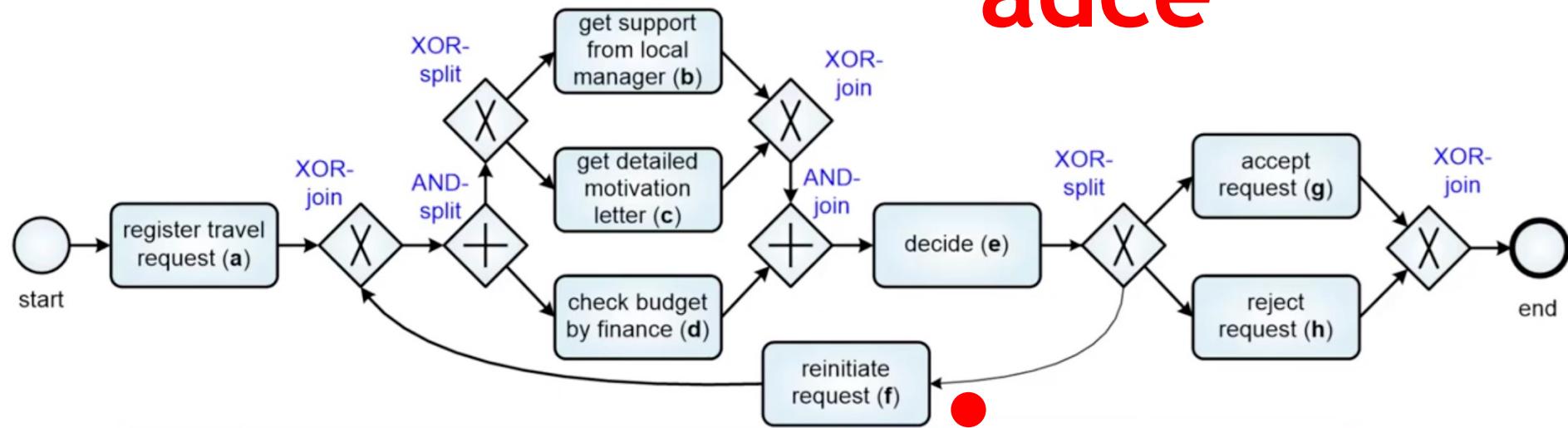
Play-Out: an example

adce



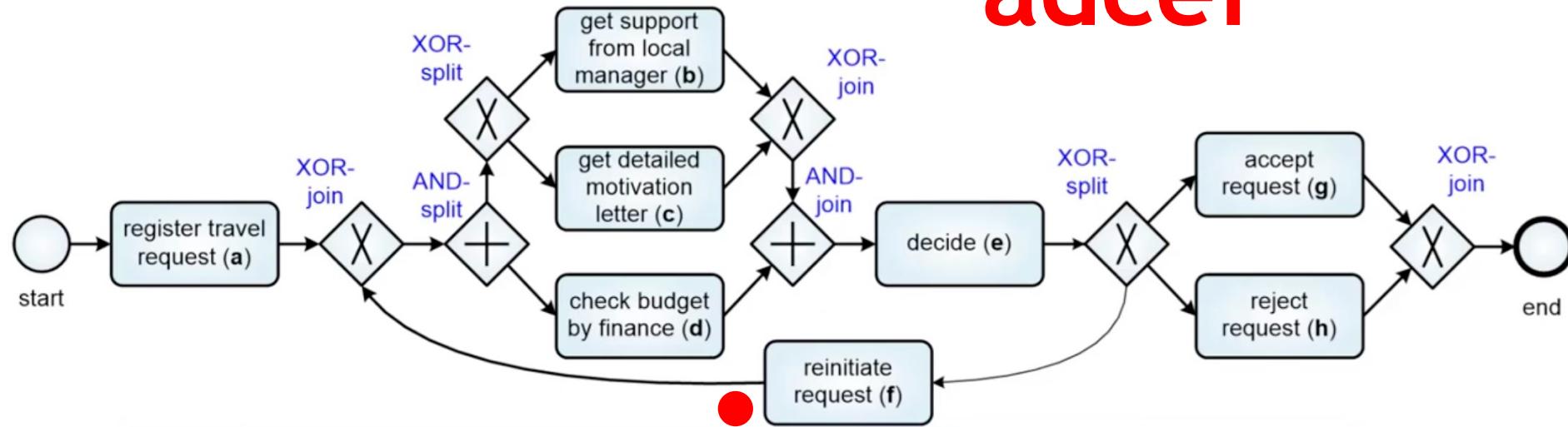
Play-Out: an example

adce



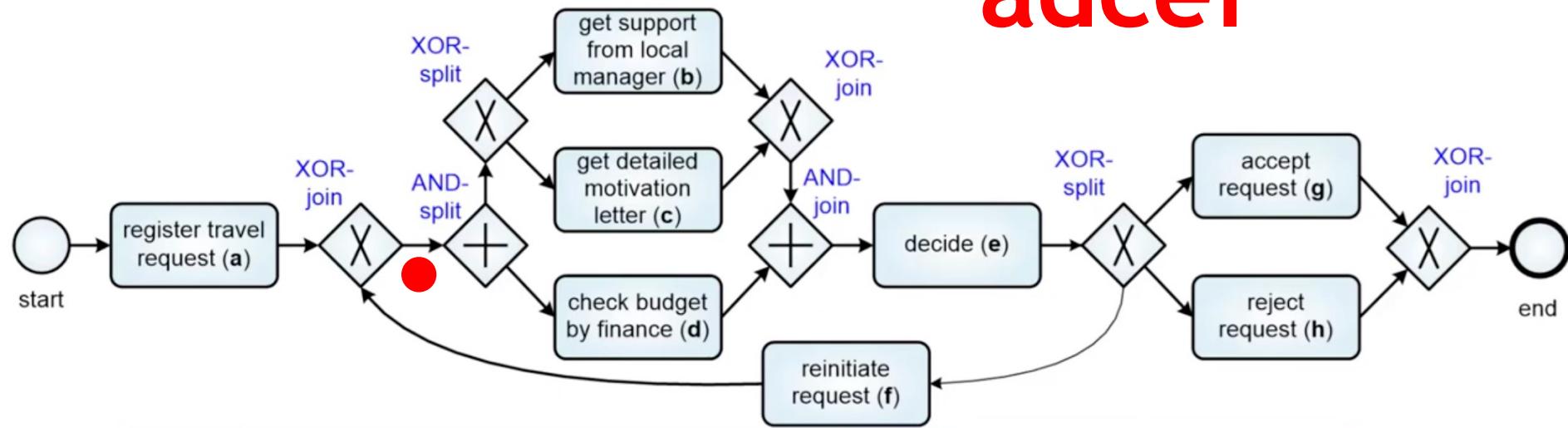
Play-Out: an example

adcef



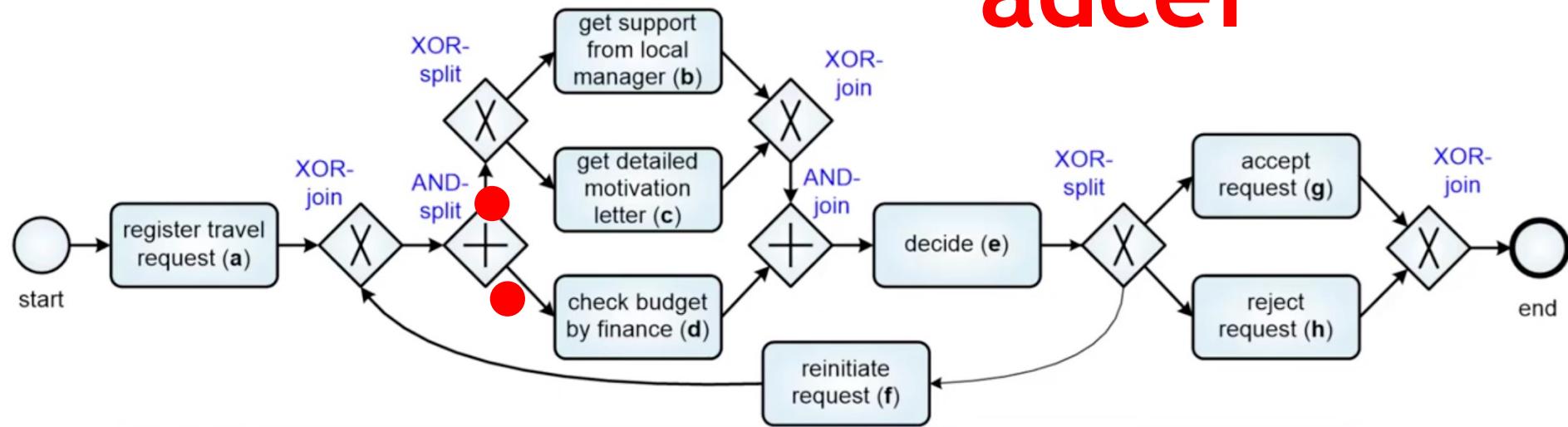
Play-Out: an example

adcef



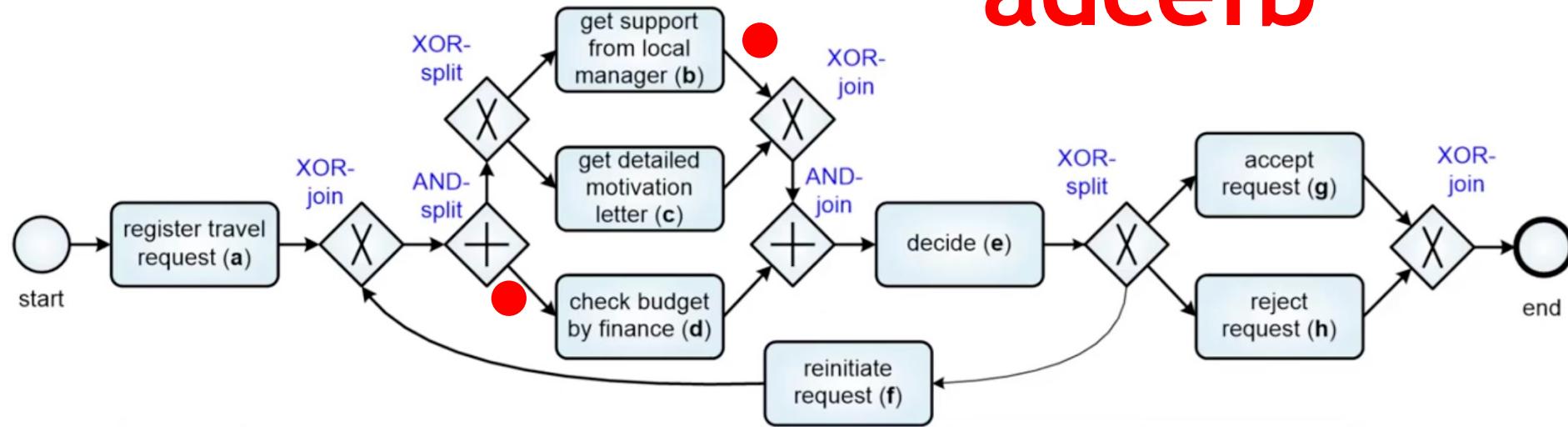
Play-Out: an example

adcef



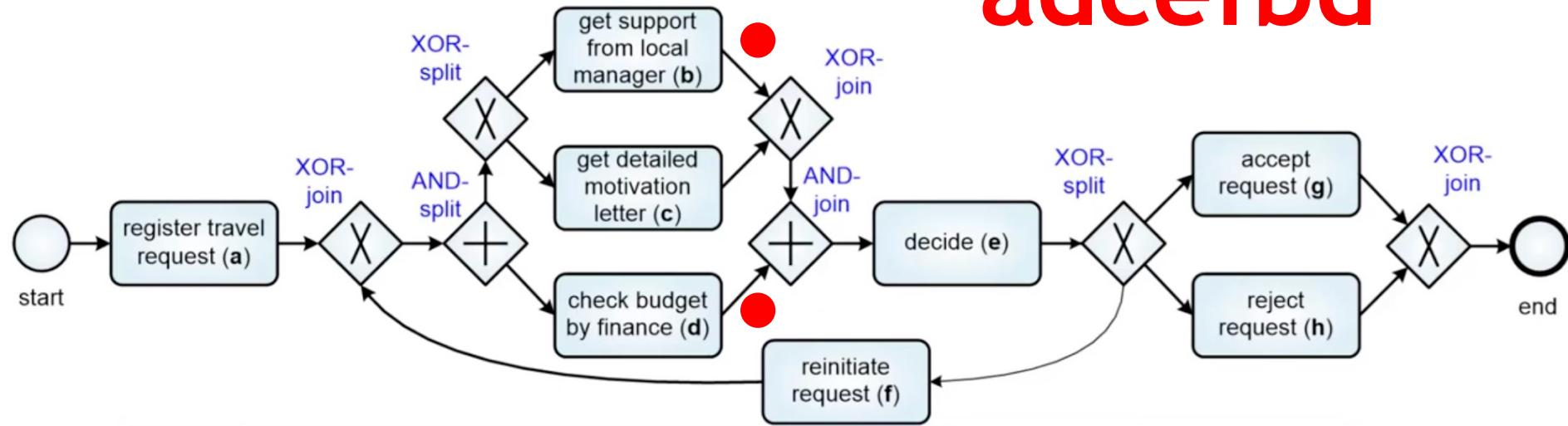
Play-Out: an example

adcefb



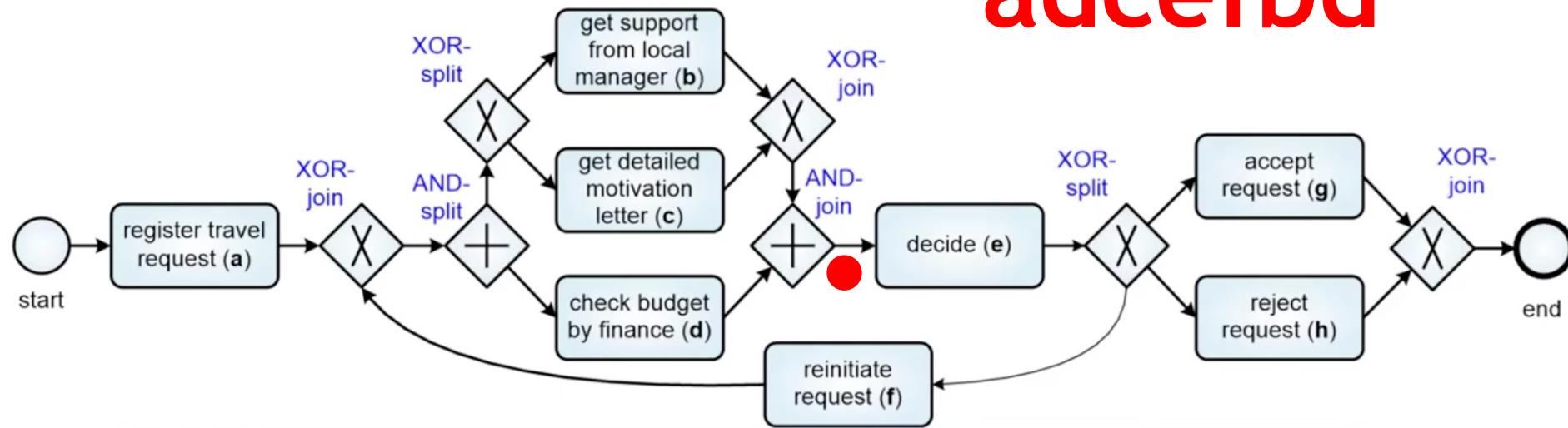
Play-Out: an example

adcefbd



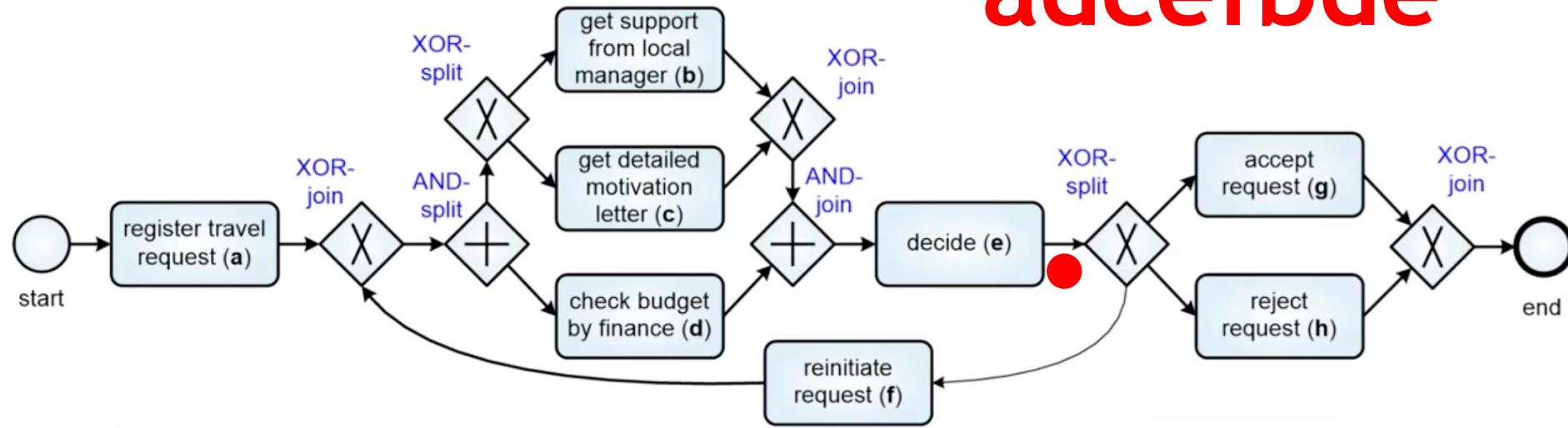
Play-Out: an example

adcefbd



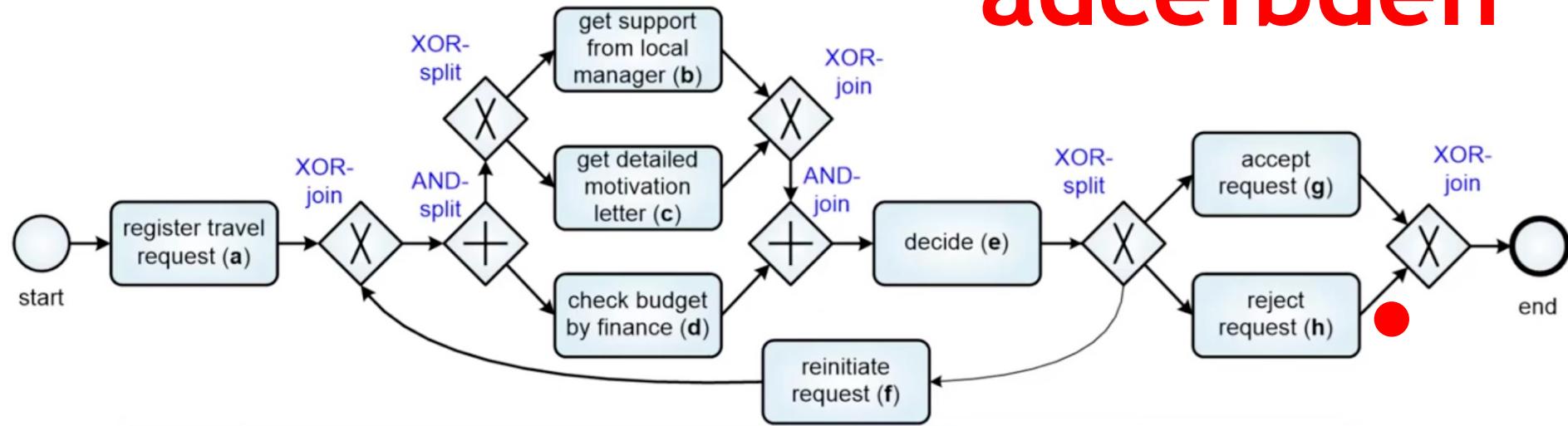
Play-Out: an example

adcef bde



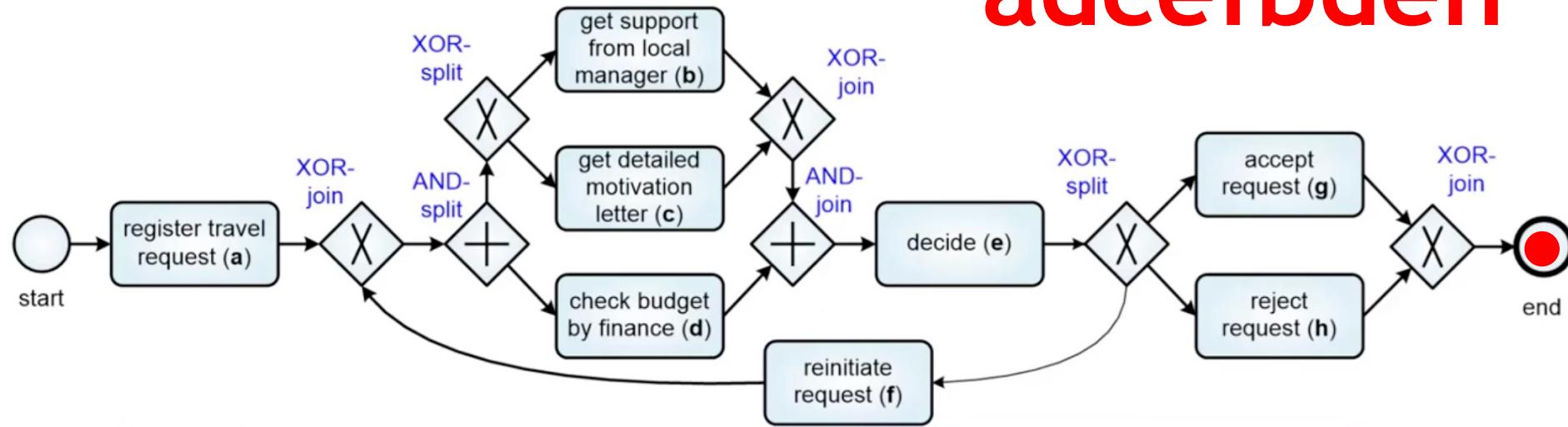
Play-Out: an example

adcefbdbeh

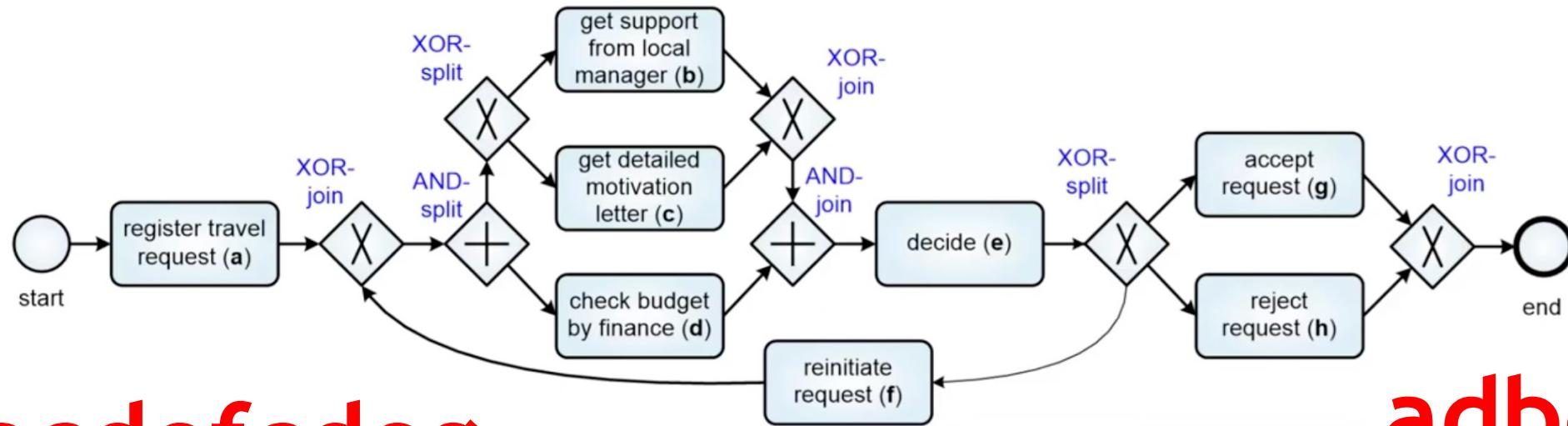


Play-Out: an example

adcefbdbeh



Play-Out: process model allows for many more scenarios



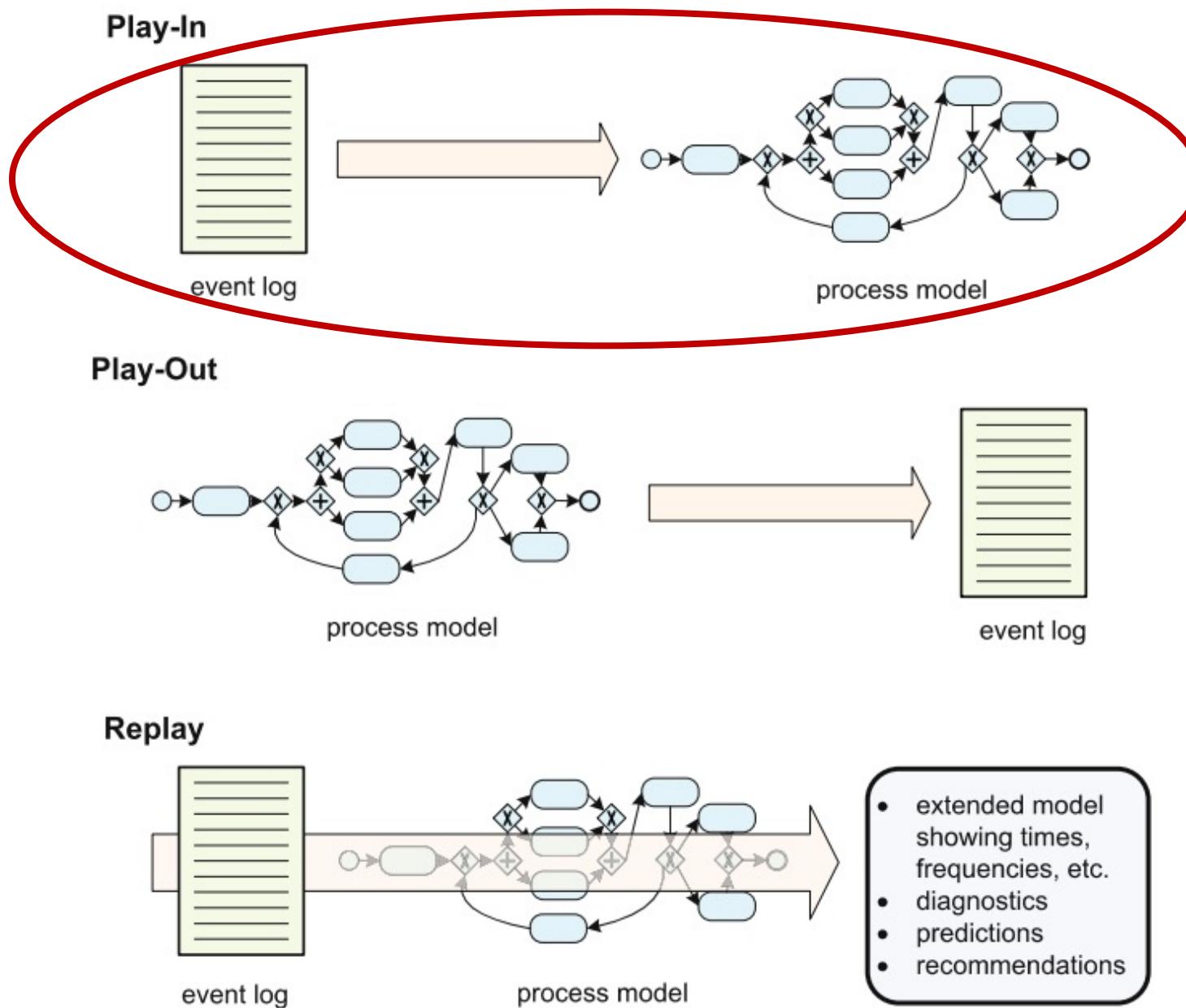
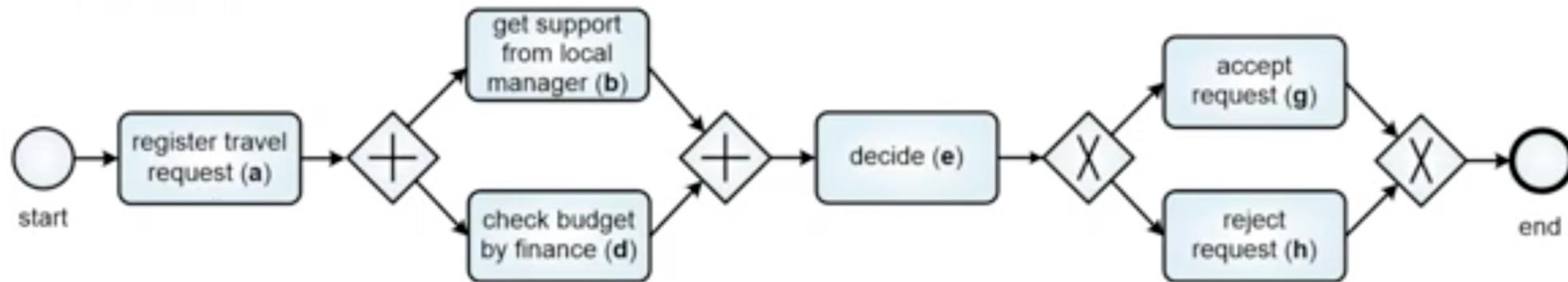


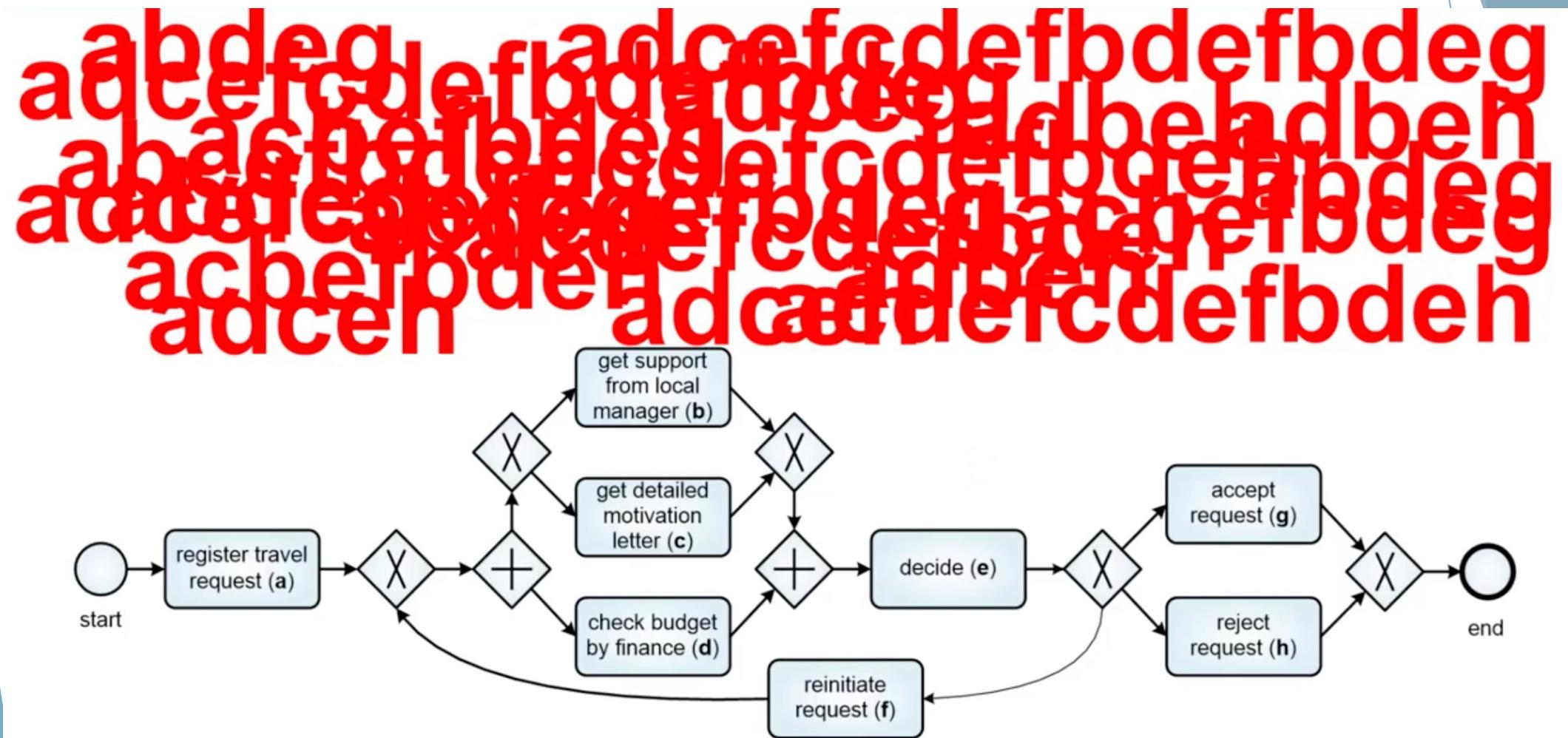
Fig. 1.8 Three ways of relating event logs (or other sources of information containing example behavior) and process models: *Play-in*, *Play-out*, and *Replay*

Play-In: simple process allowing 4 traces

abdeg adbeg abbeg adbeh
abdeh abdeh abdeg abdeh
abdeh abdeh abdeh adbeh
adbeh adbeh adbeh adbeh



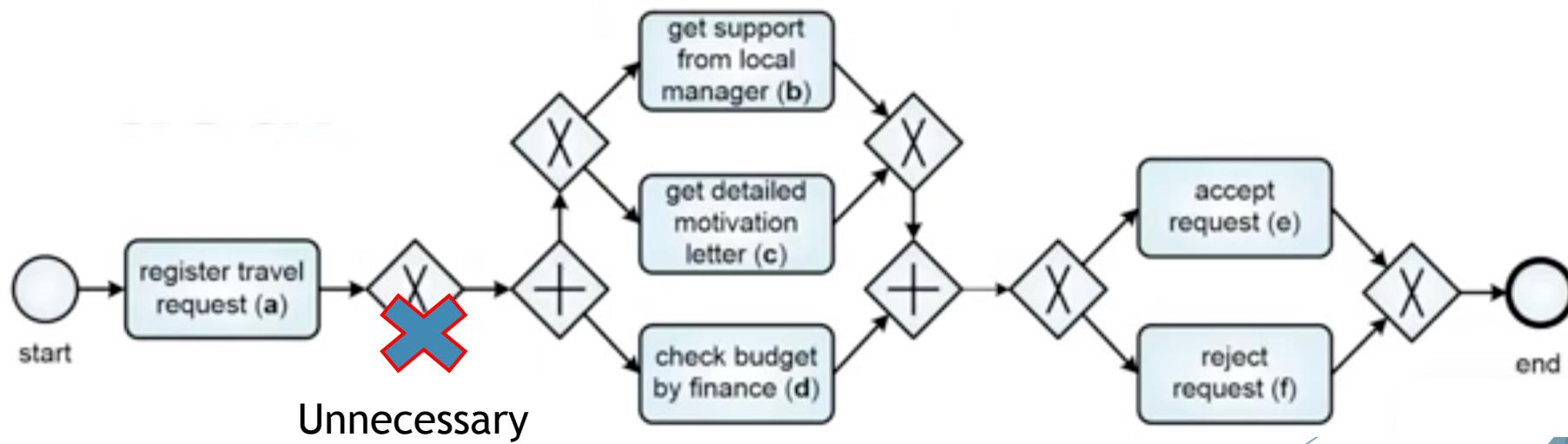
Play-In: process allowing many traces



Practice Work: solution

- ▶ Create a process model that allows the following traces.

abde abdf abdf
adbe acde adbe adce abdf
adbe acdf adbe adcf



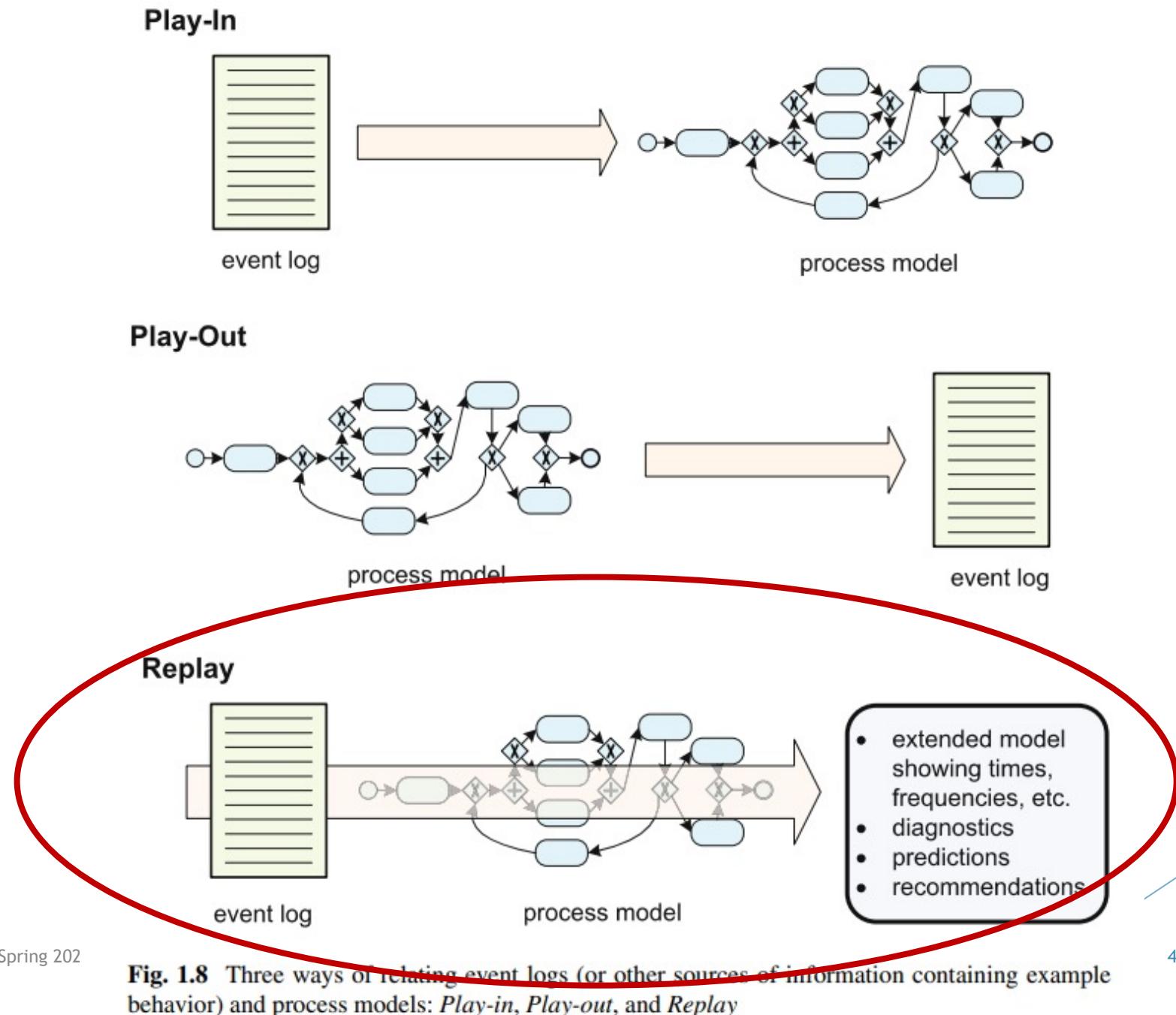
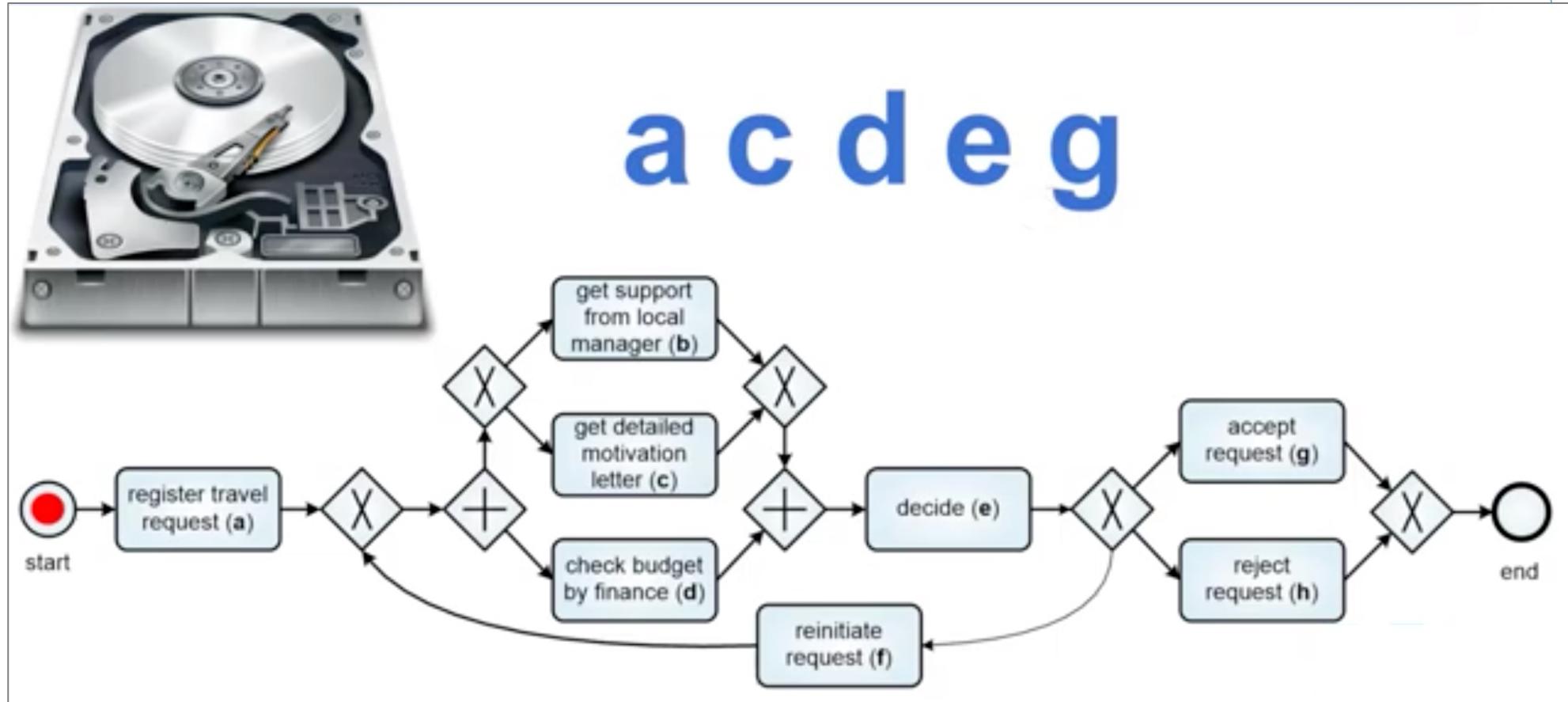
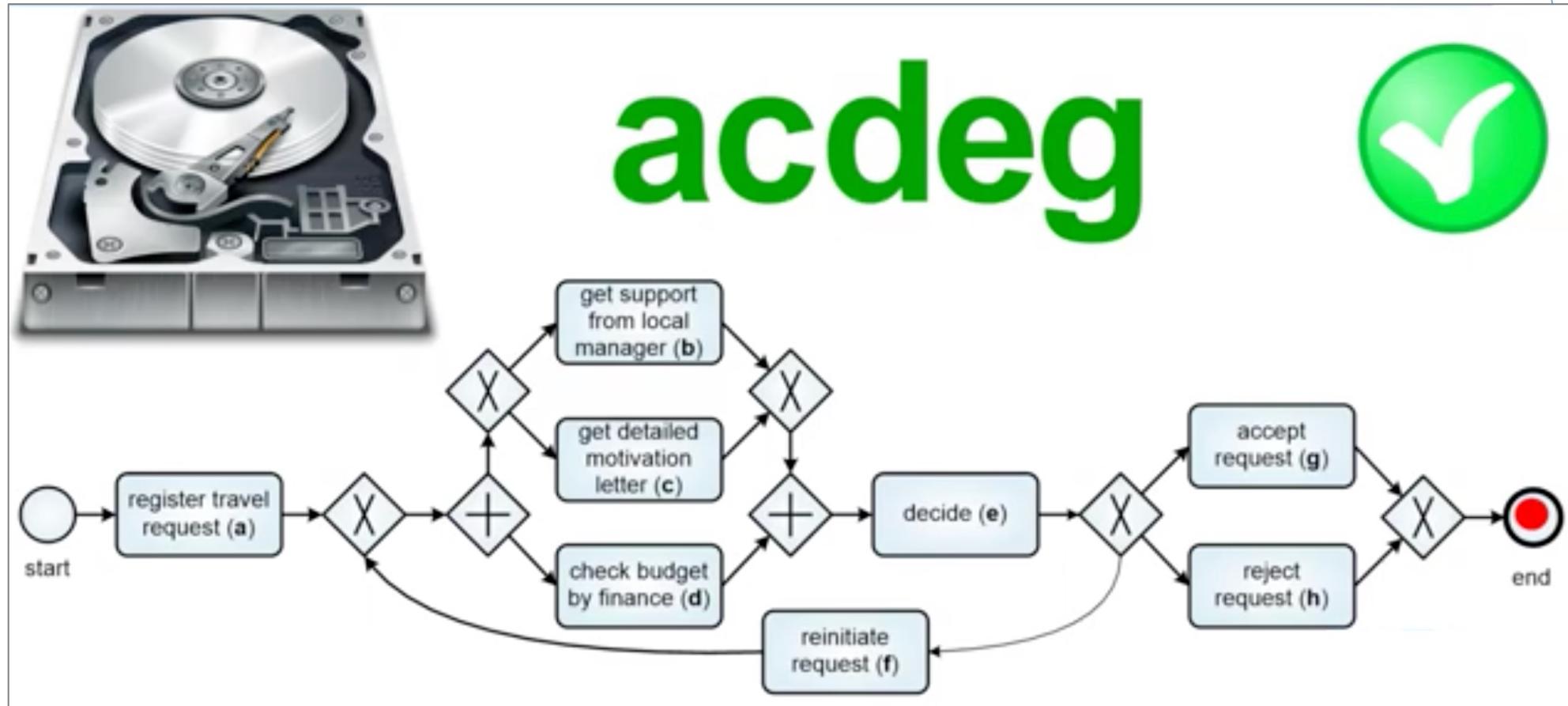


Fig. 1.8 Three ways of relating event logs (or other sources of information containing example behavior) and process models: *Play-in*, *Play-out*, and *Replay*

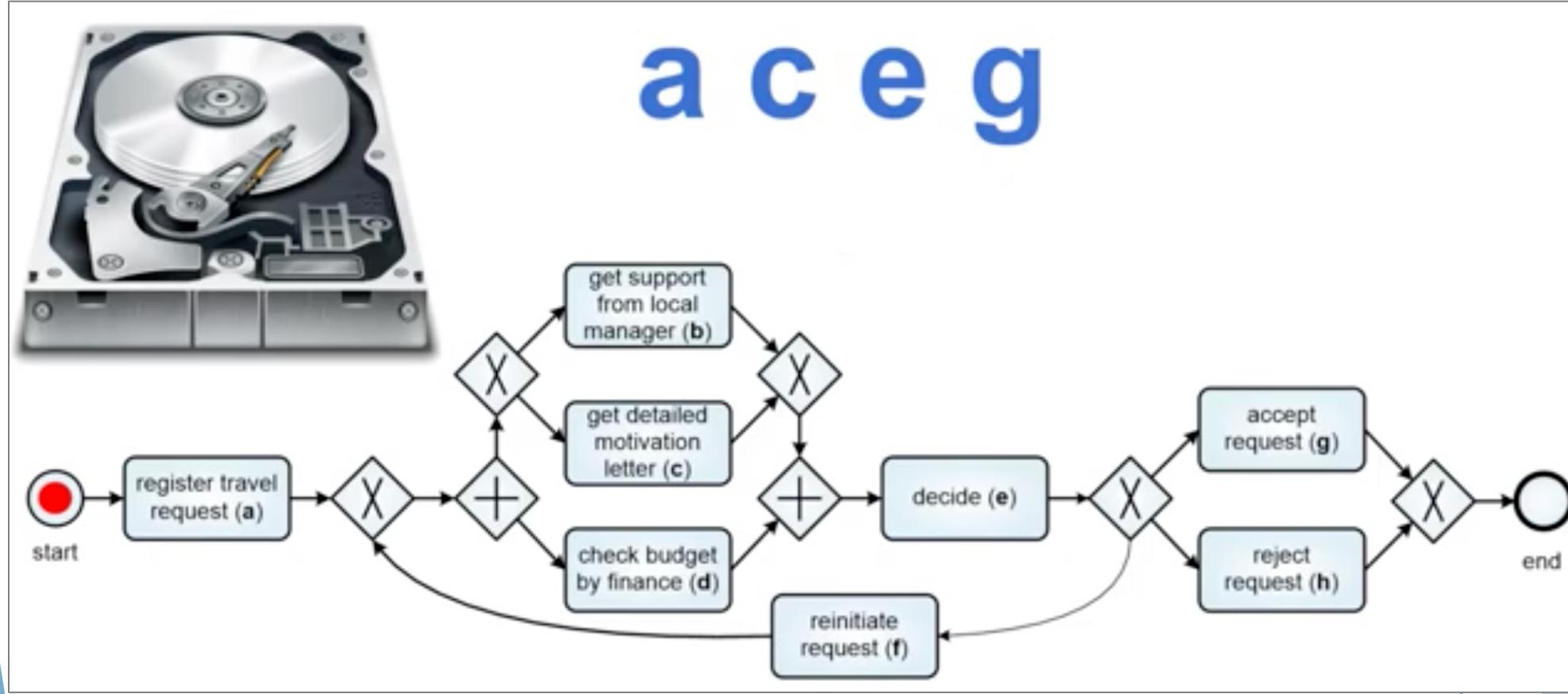
Replay: example 1



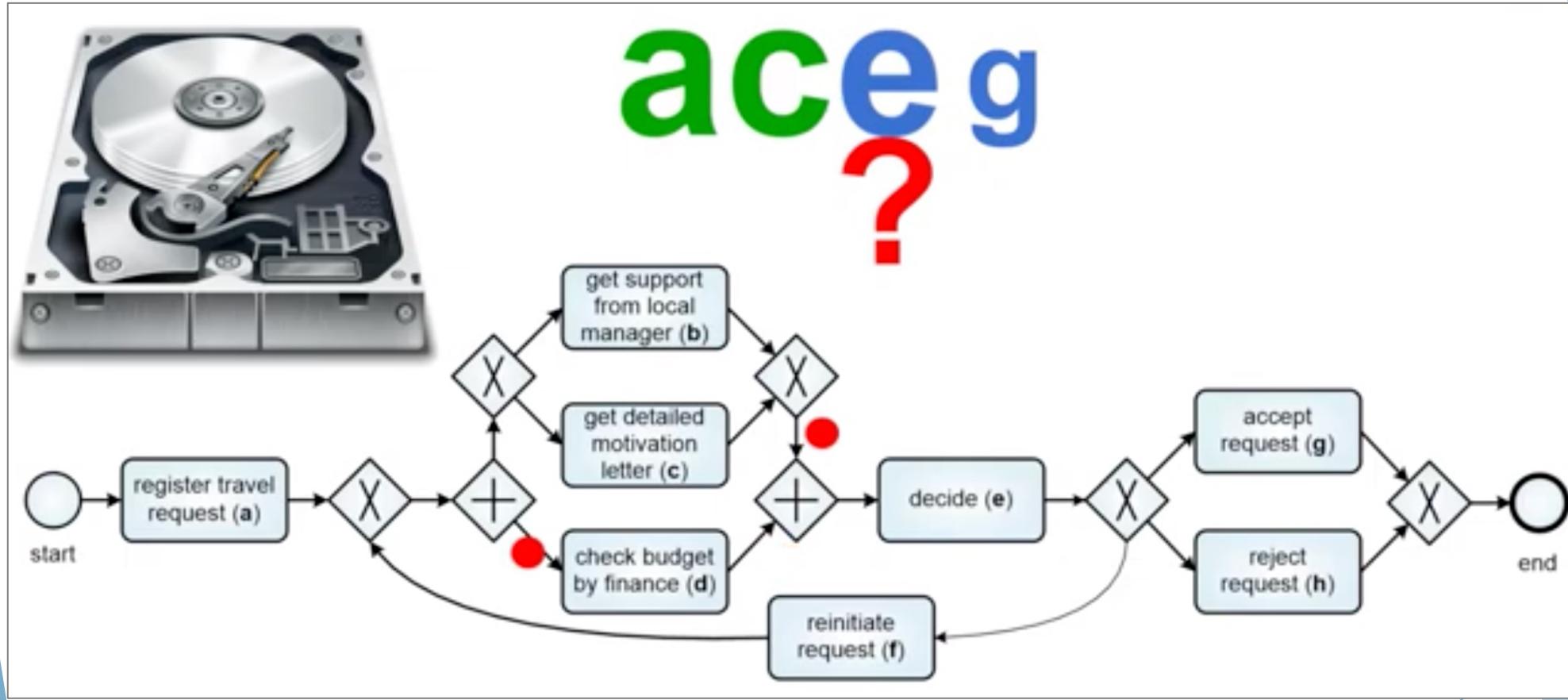
Replay



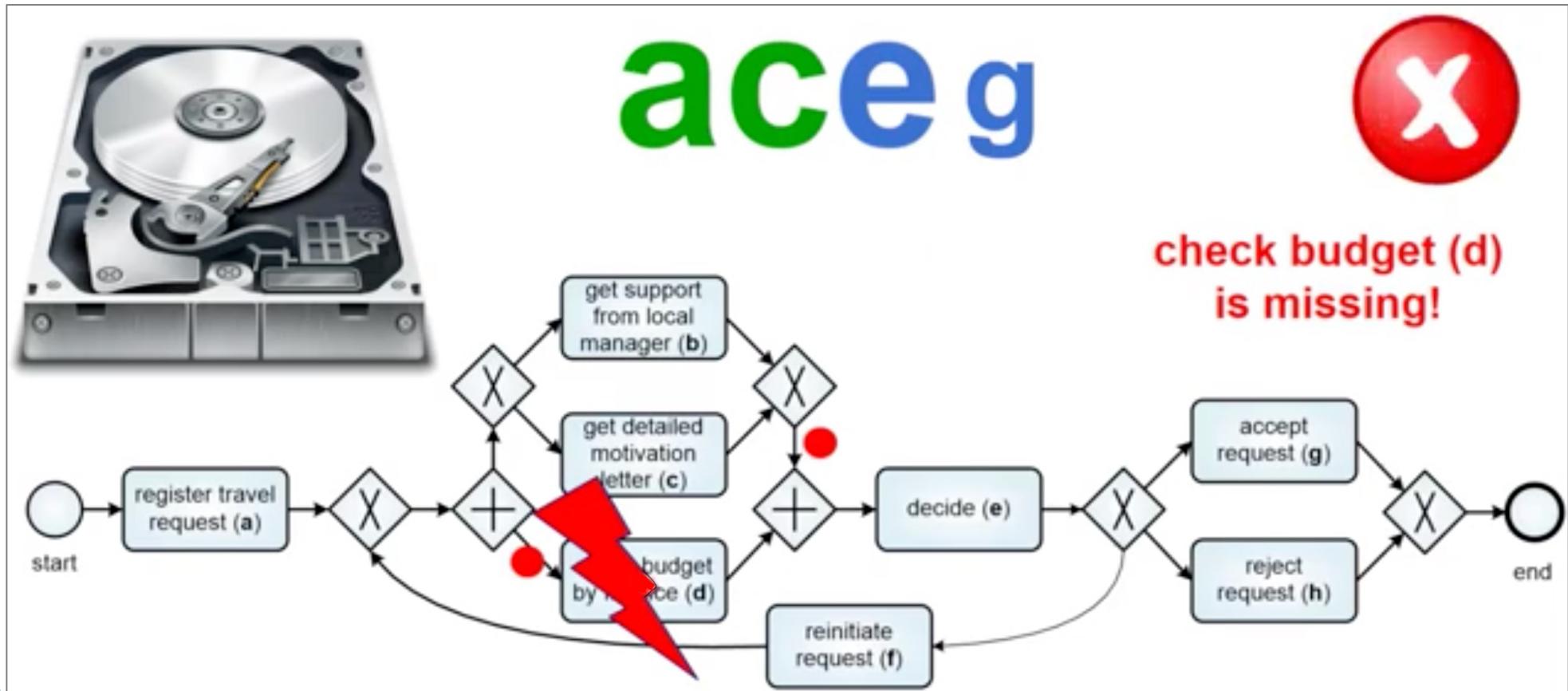
Replay: example 2



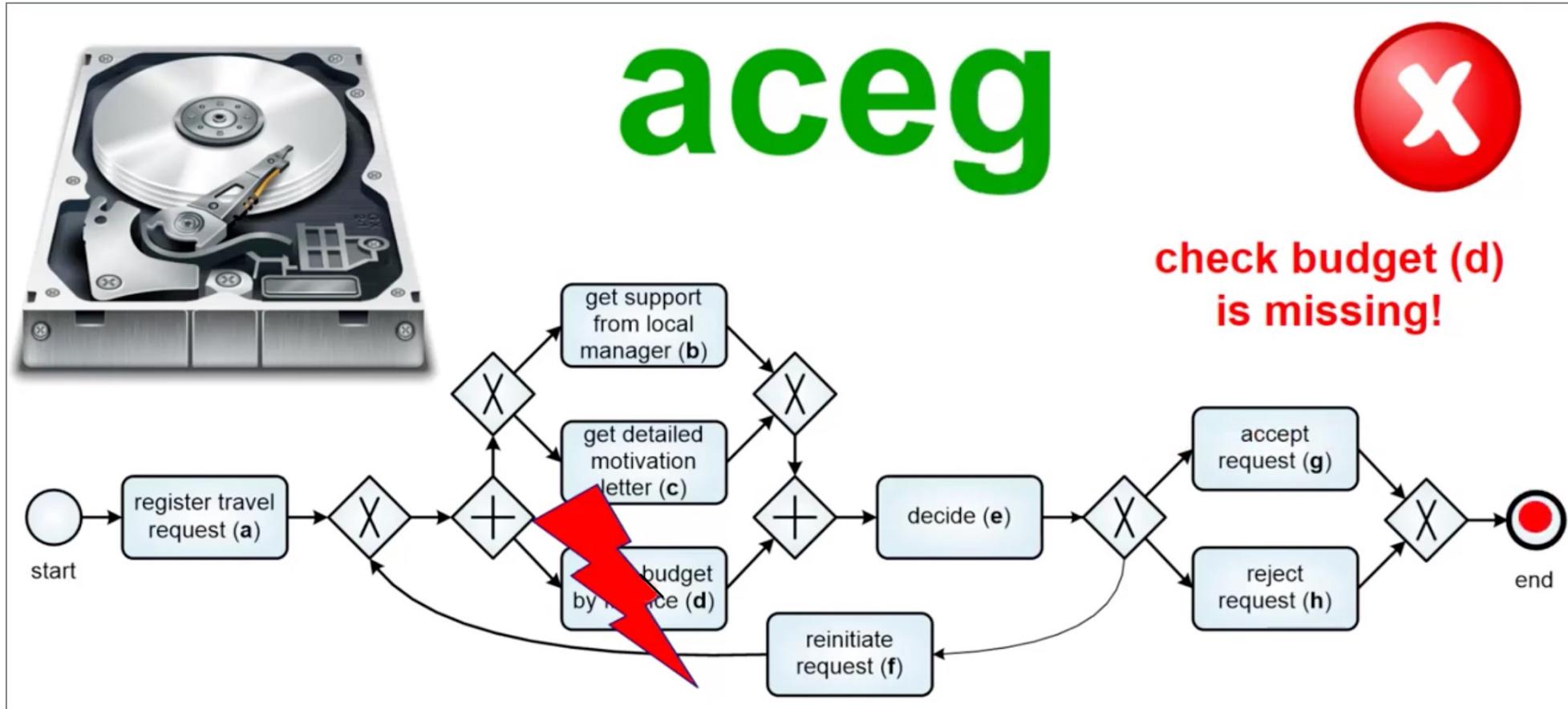
Replay



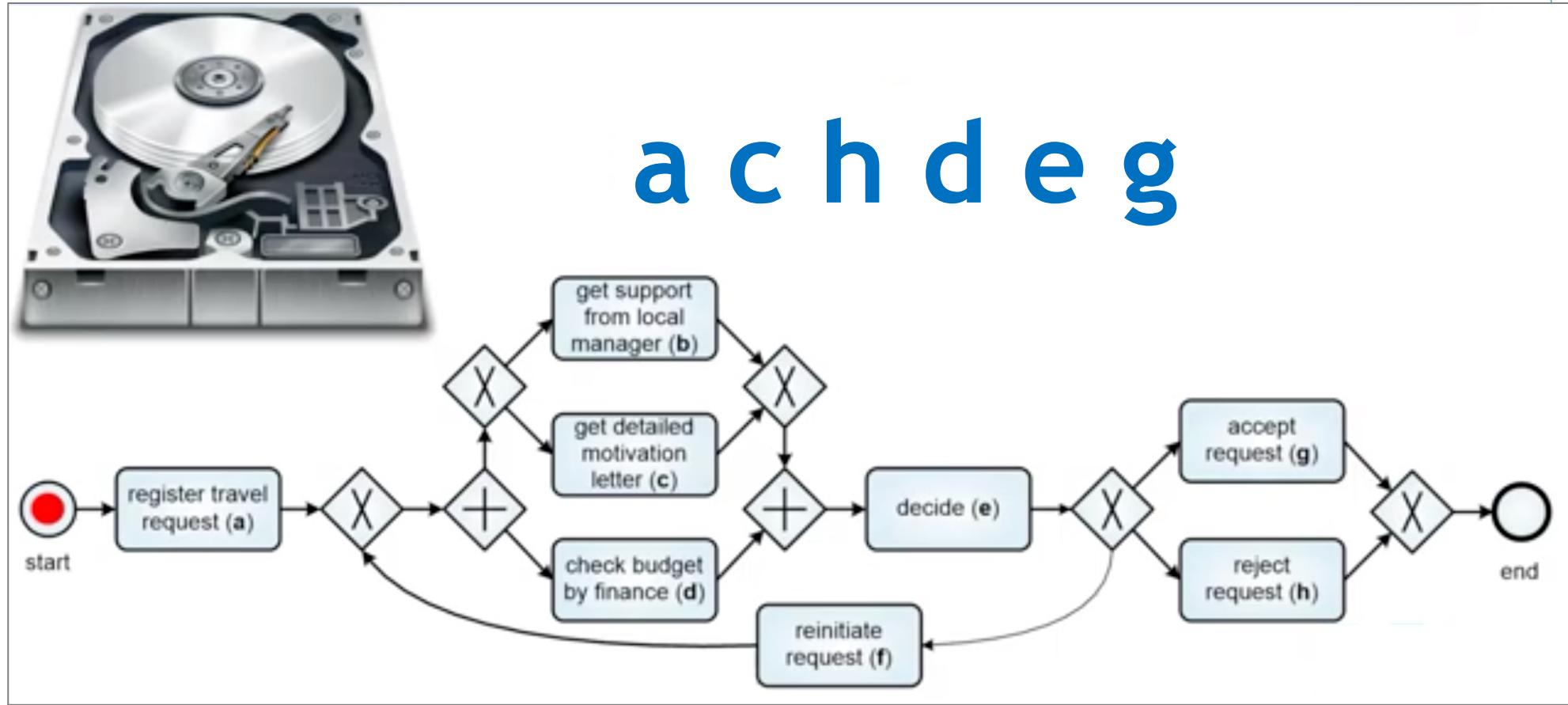
Replay



Replay

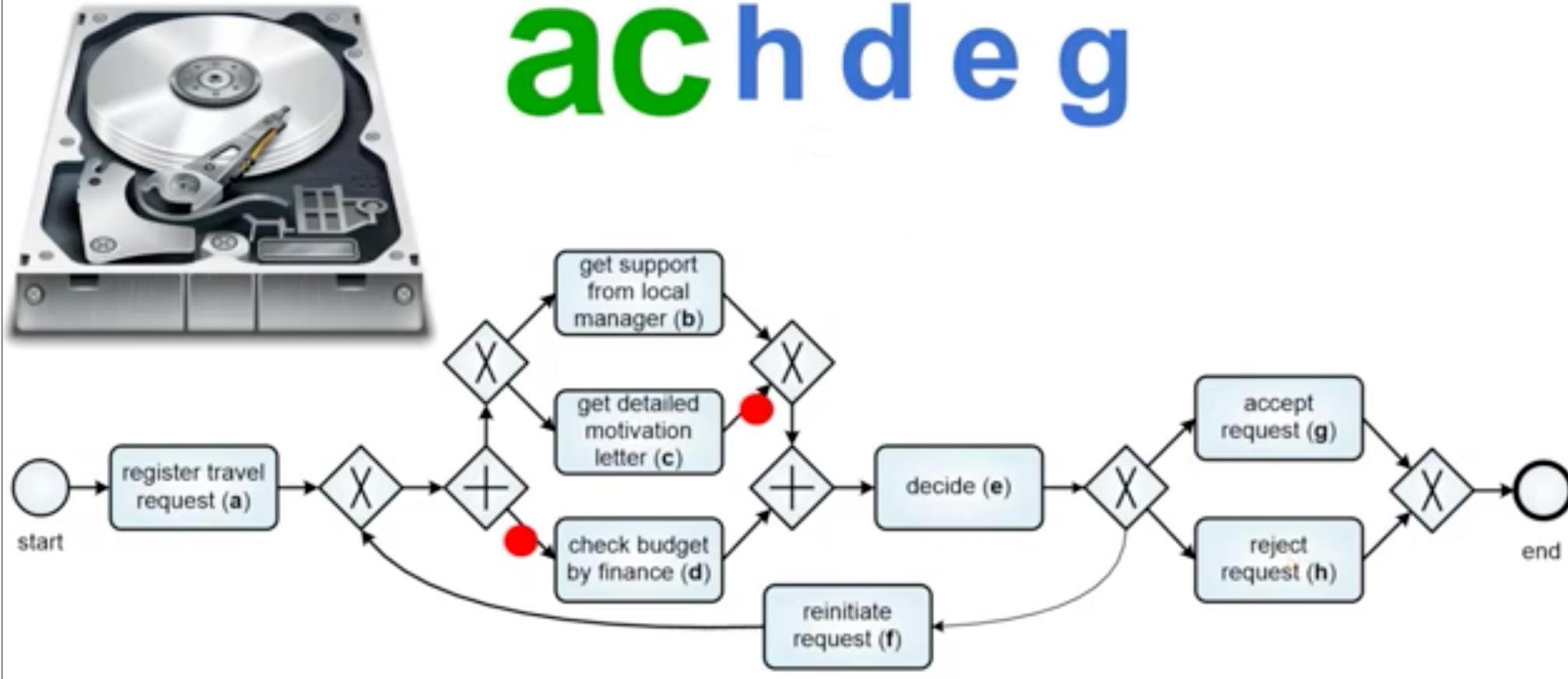


Replay: example 3

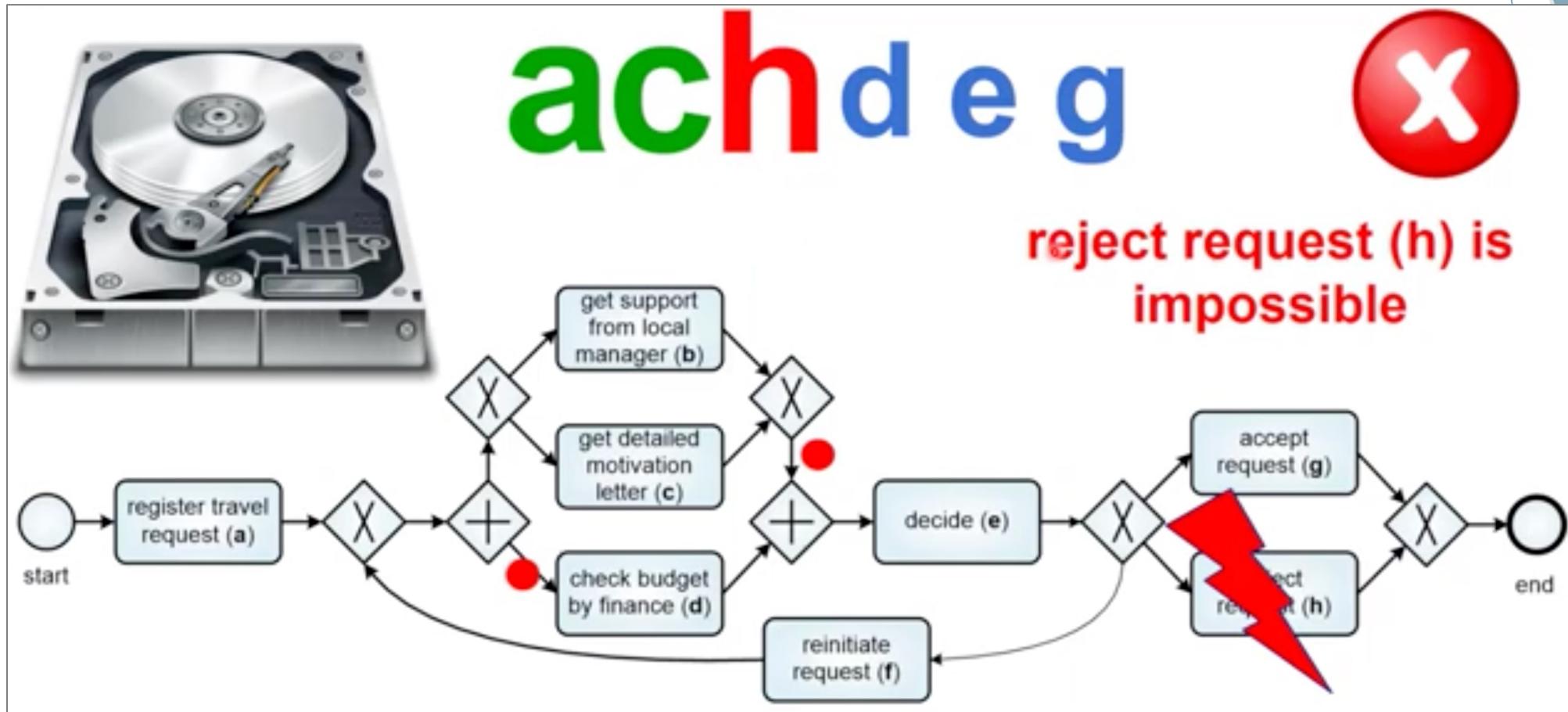


Replay

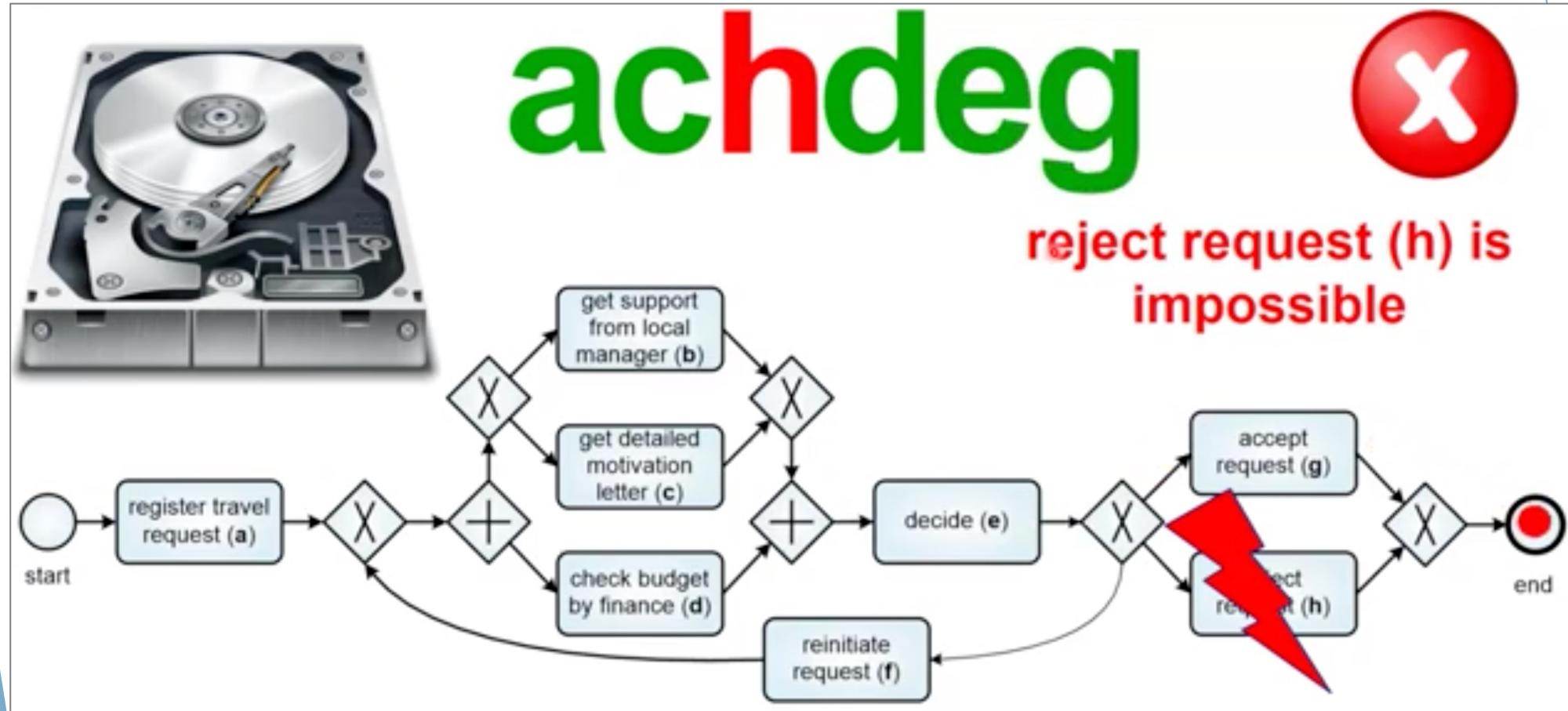
a c h d e g



Replay

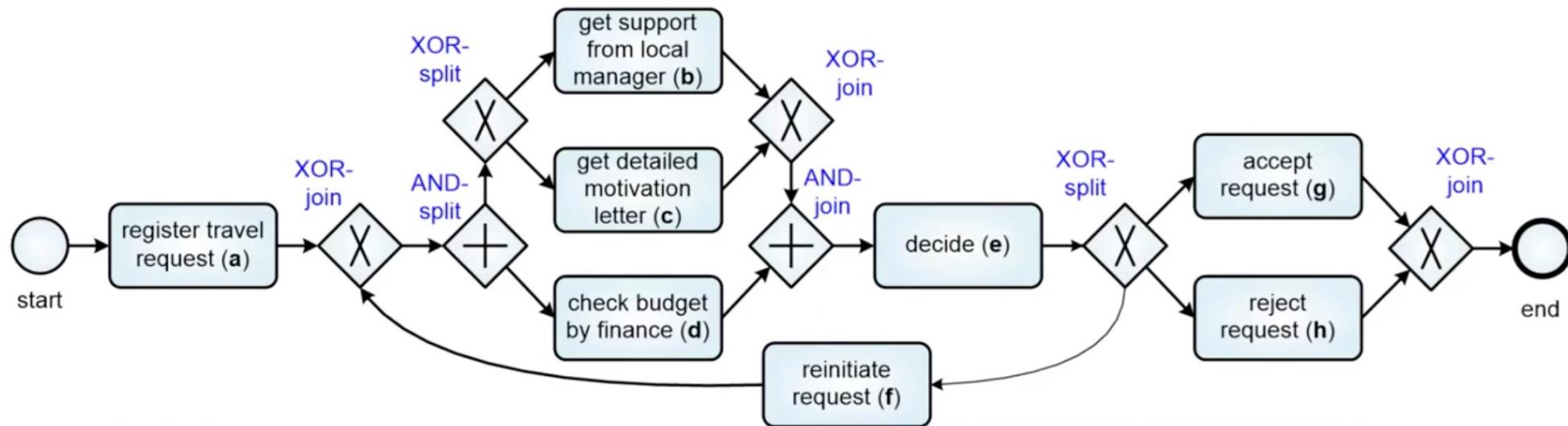


Replay



Answer

- ▶ Which traces are possible in the given model?
 - ▶ abdceh **No!** cannot do both b and c
 - ▶ adcefbddeg **Yes!**
 - ▶ aceh **No!** missing d



Replay with timestamps



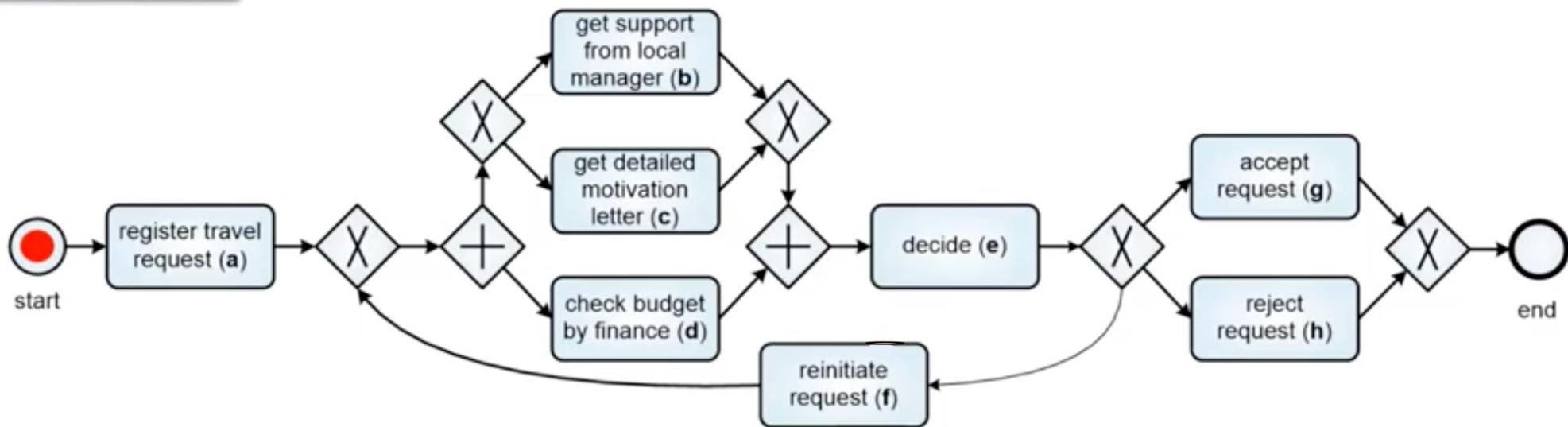
a^{9.15}

c^{9.20}

d^{9.35}

e^{10.15}

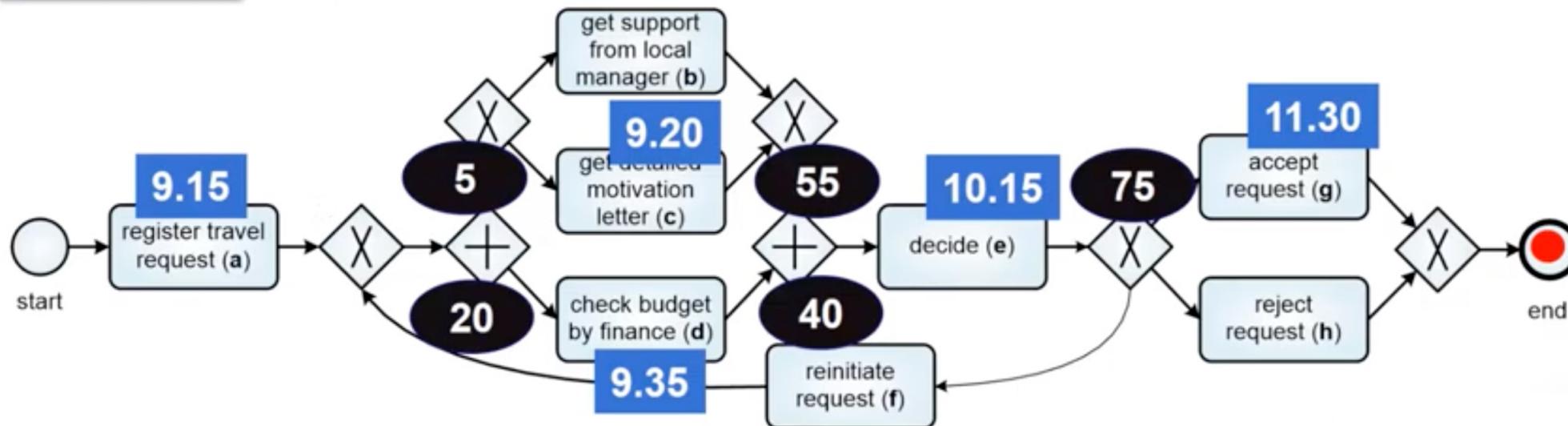
g^{11.30}



Replay with timestamps

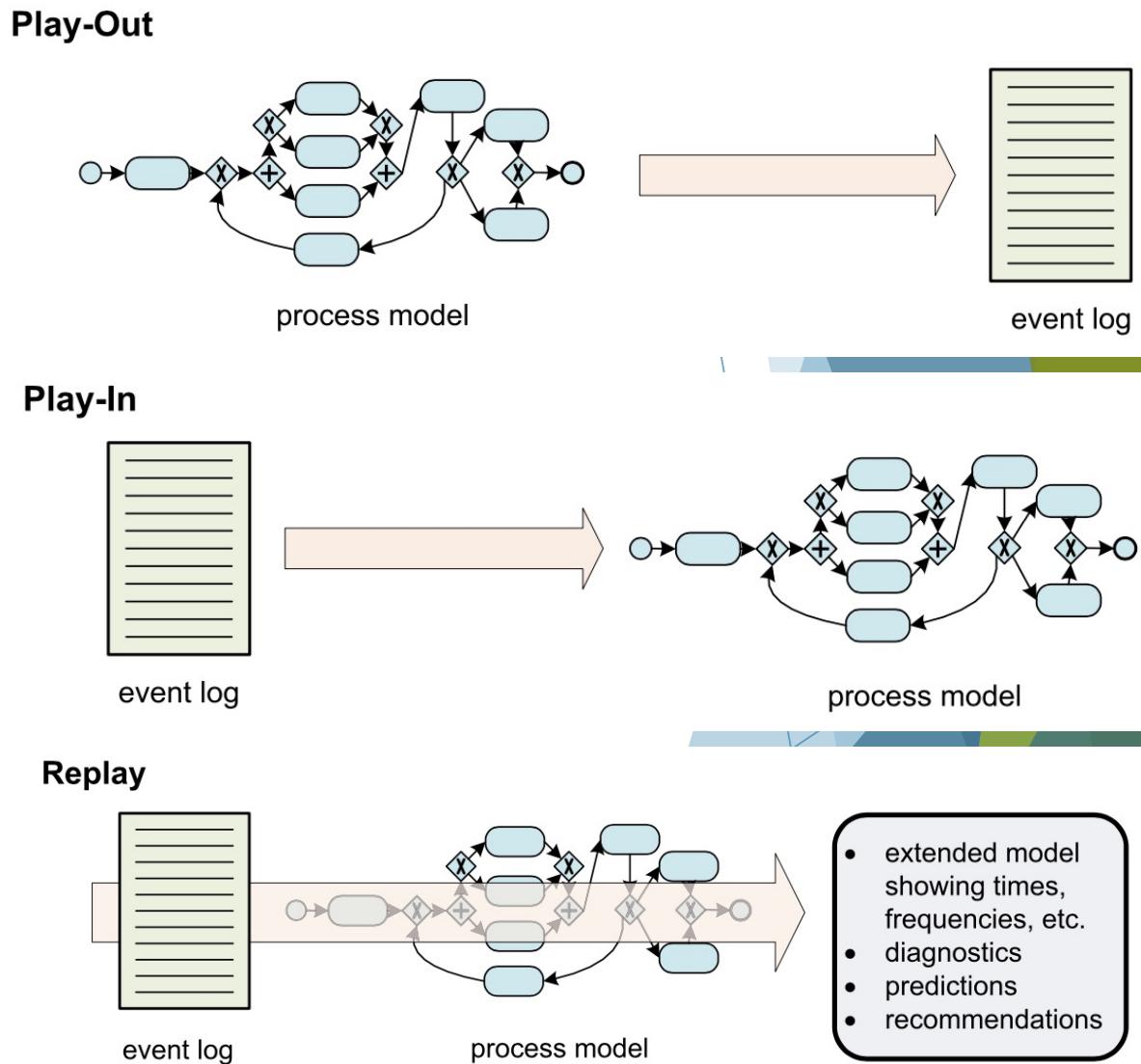


a^{9.15} c^{9.20} d^{9.35} e^{10.15} g^{11.30}



Summary

- ▶ Play-out
 - ▶ Simulation
 - ▶ Workflow automation
 - ▶ Model checking
 - ▶ ...
- ▶ Play-in
 - ▶ Process discovery: learning de facto process models from observed behavior
- ▶ Replay
 - ▶ Aligning modeled/discovered and observed behavior
 - ▶ The most important form of process mining!
 - ▶ Confrontation between model and reality



Reading Material

- ▶ Chapter 2: Aalst