

Offline Runtime Verification with Real-Time Properties: A Case Study

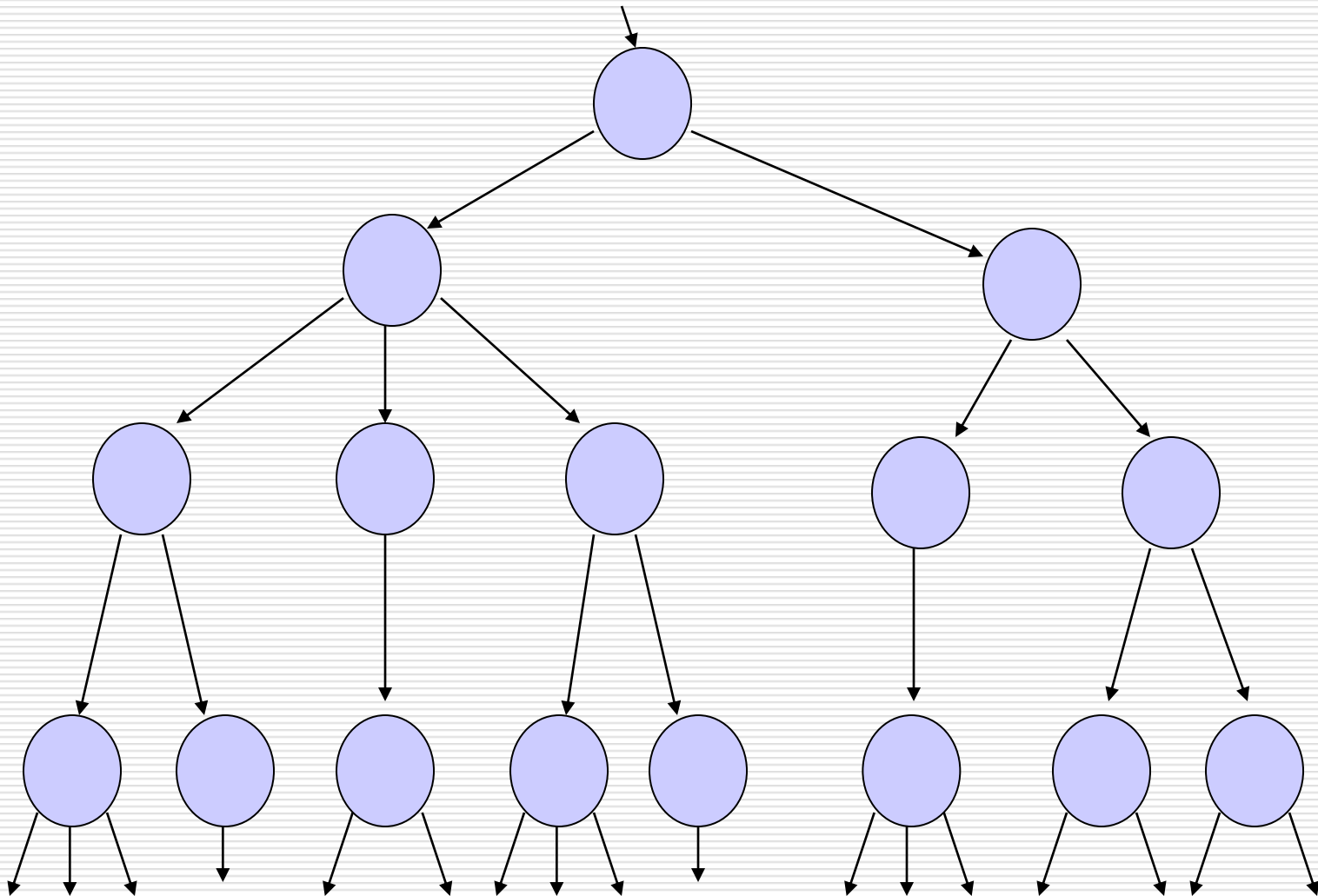
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WICT 2009

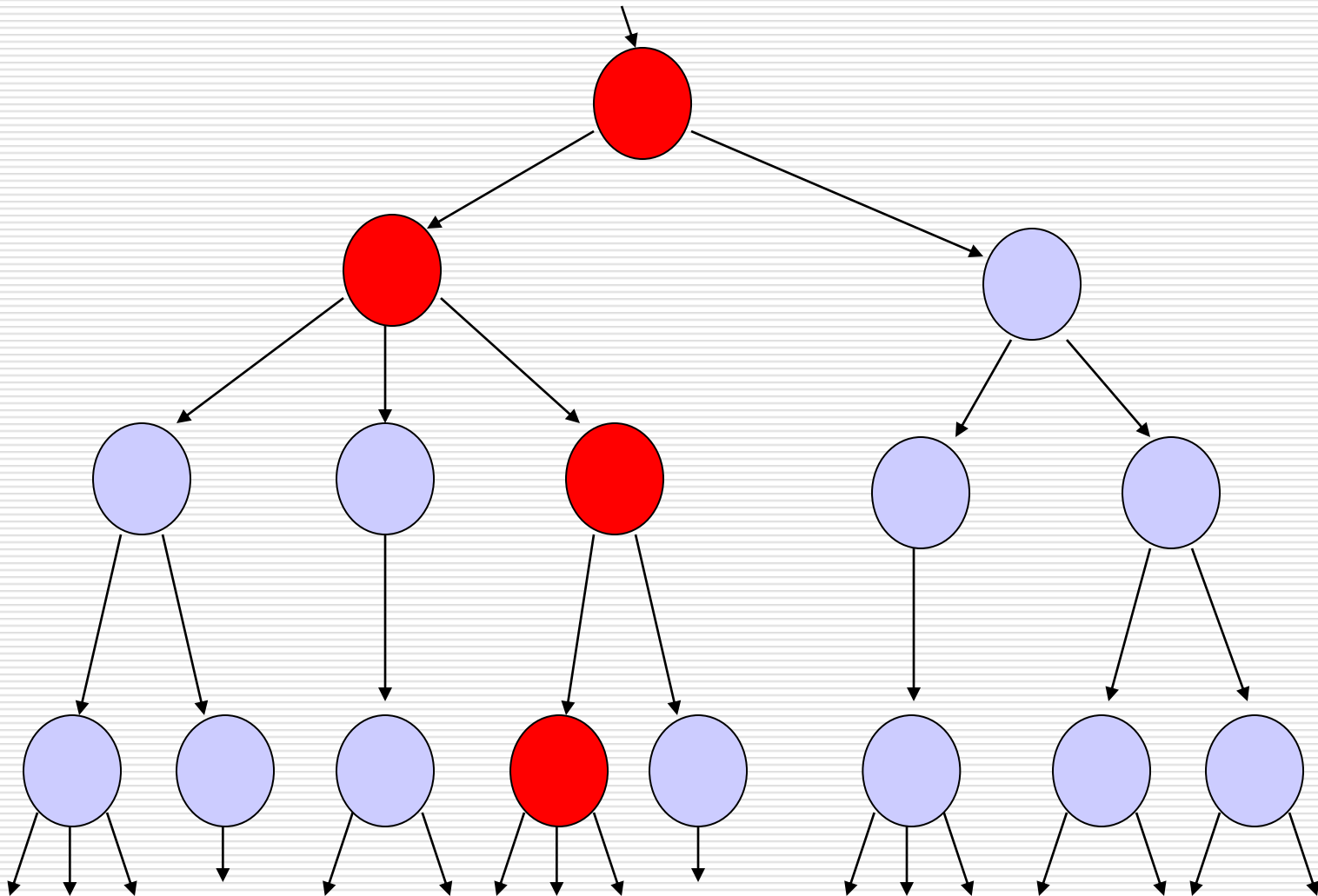
Motivation

- Computer systems have bugs
- Even after testing!
- Model checking does not scale up
- Check system at runtime

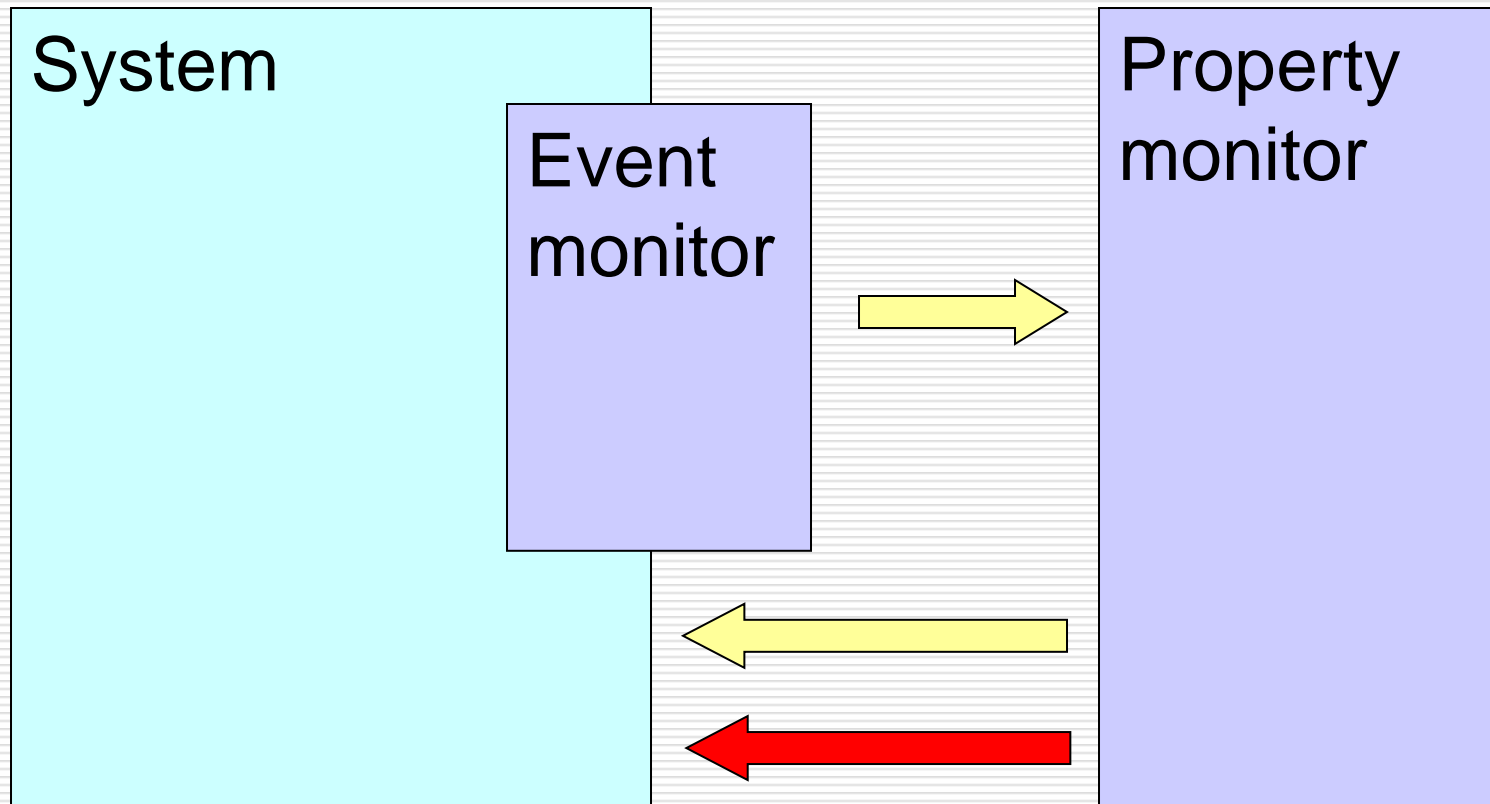
A System's Behaviour



A System's Behaviour



Runtime Verification

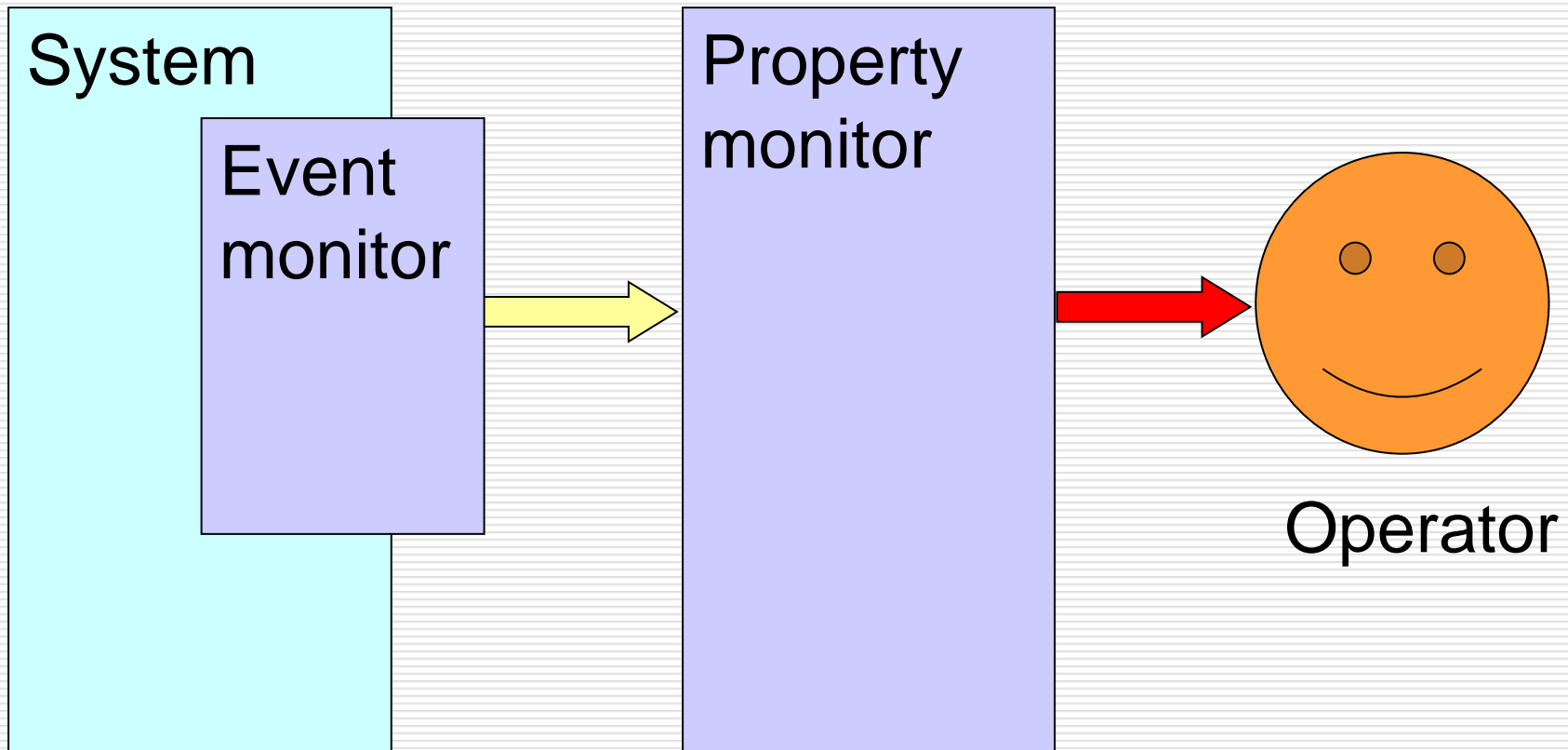


Problem

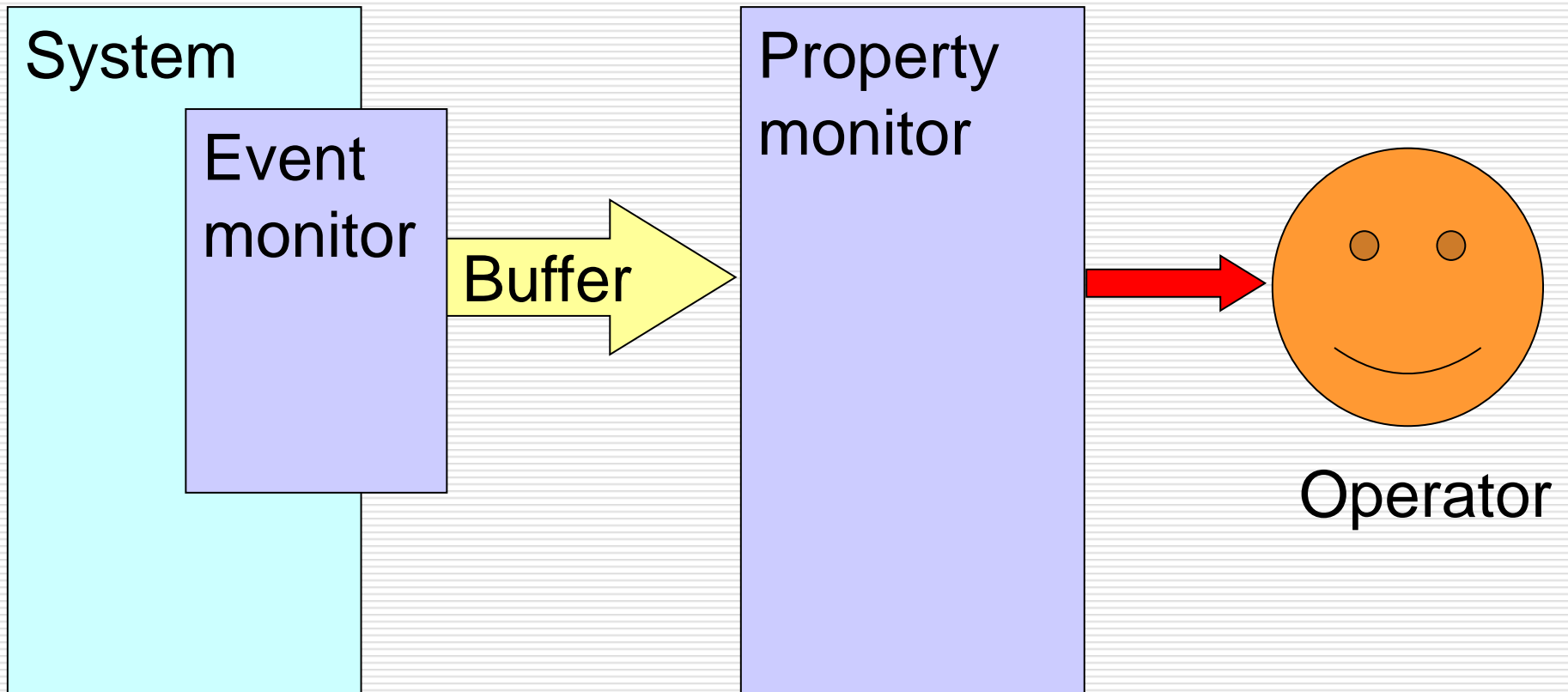
- Monitor can slow down the system
- May cause availability issues

- Offline runtime verification

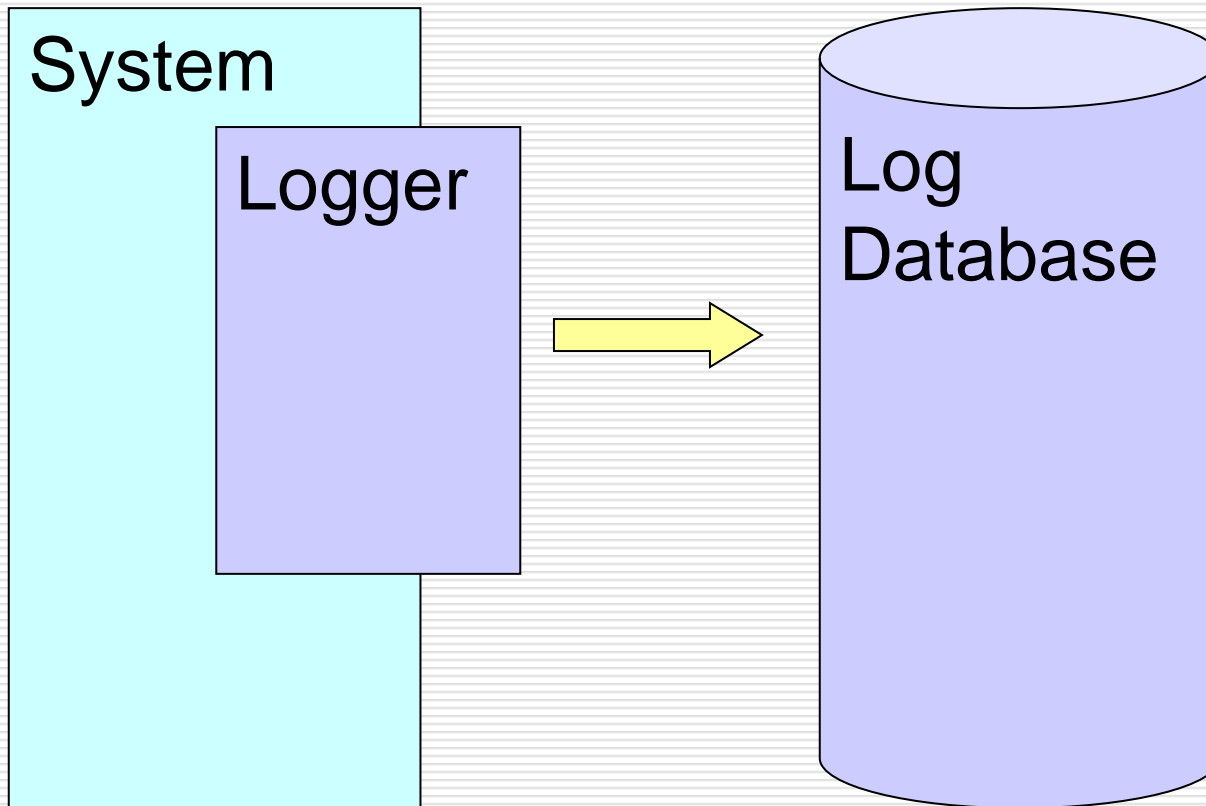
Offline Runtime Verification



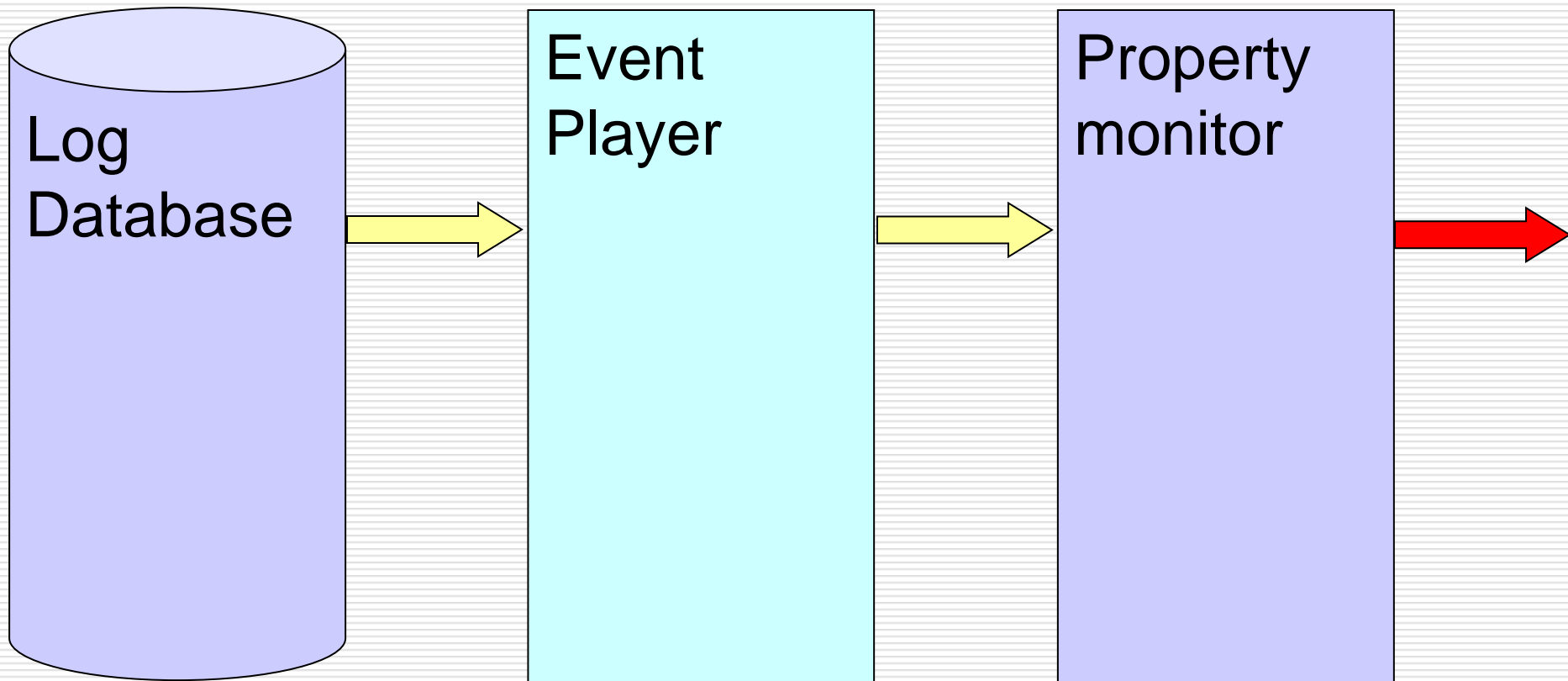
Offline Runtime Verification



Case Study



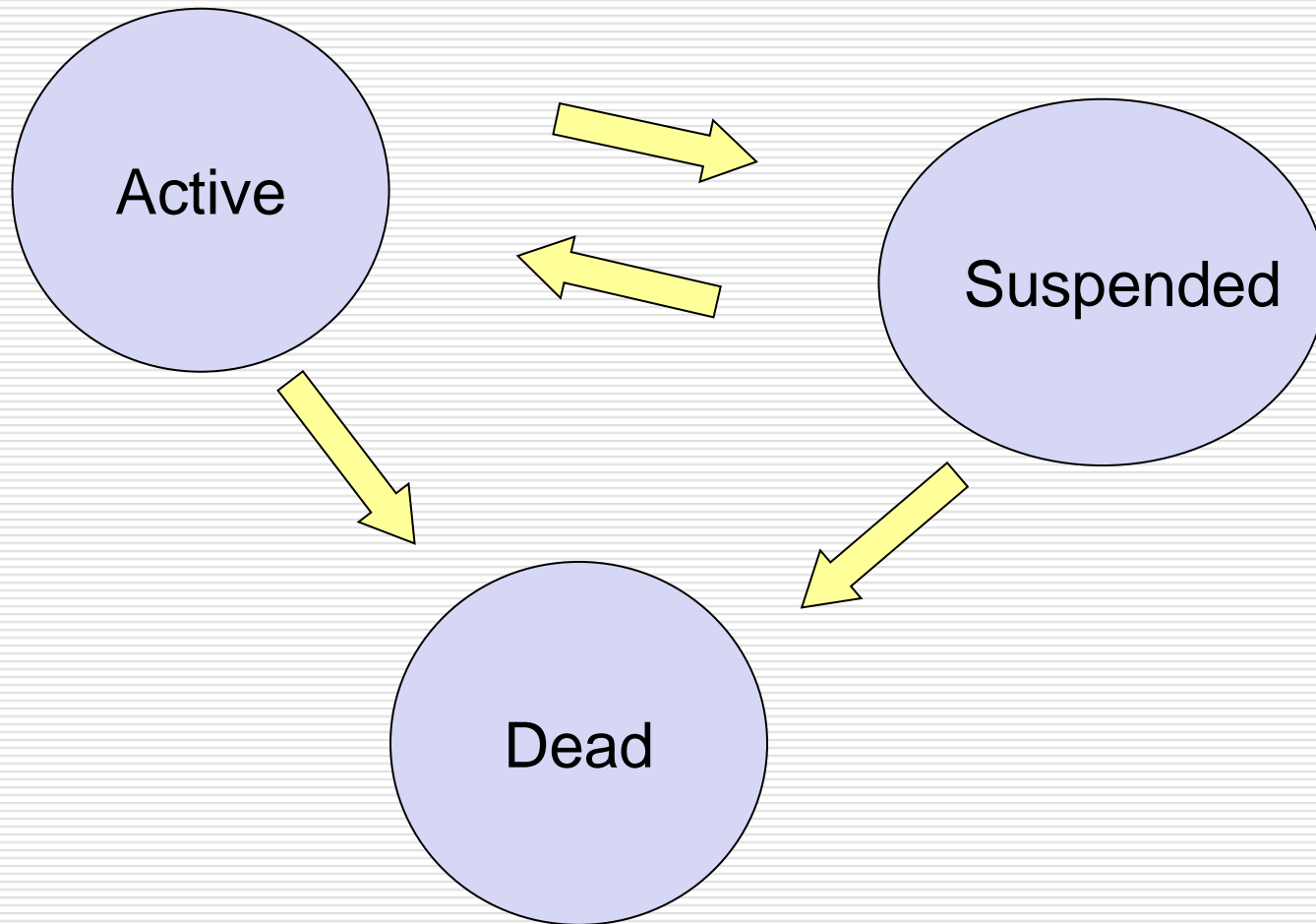
Replaying Events



Properties Monitored

- Life cycle
- Real-Time
- Rights
- Amounts
- Others

Life cycle



Real-Time

- The user is suspended after 5 months of inactivity
- A user account is closed after 2 years of inactivity

Amounts

- The user is not allowed to make more than 100 transactions per month
- The user is not allowed to spend more than \$10000 per month

User Rights

- Ensure that a user has the right to make a transaction (when performing one)
- Ensure that user has the right to change the password

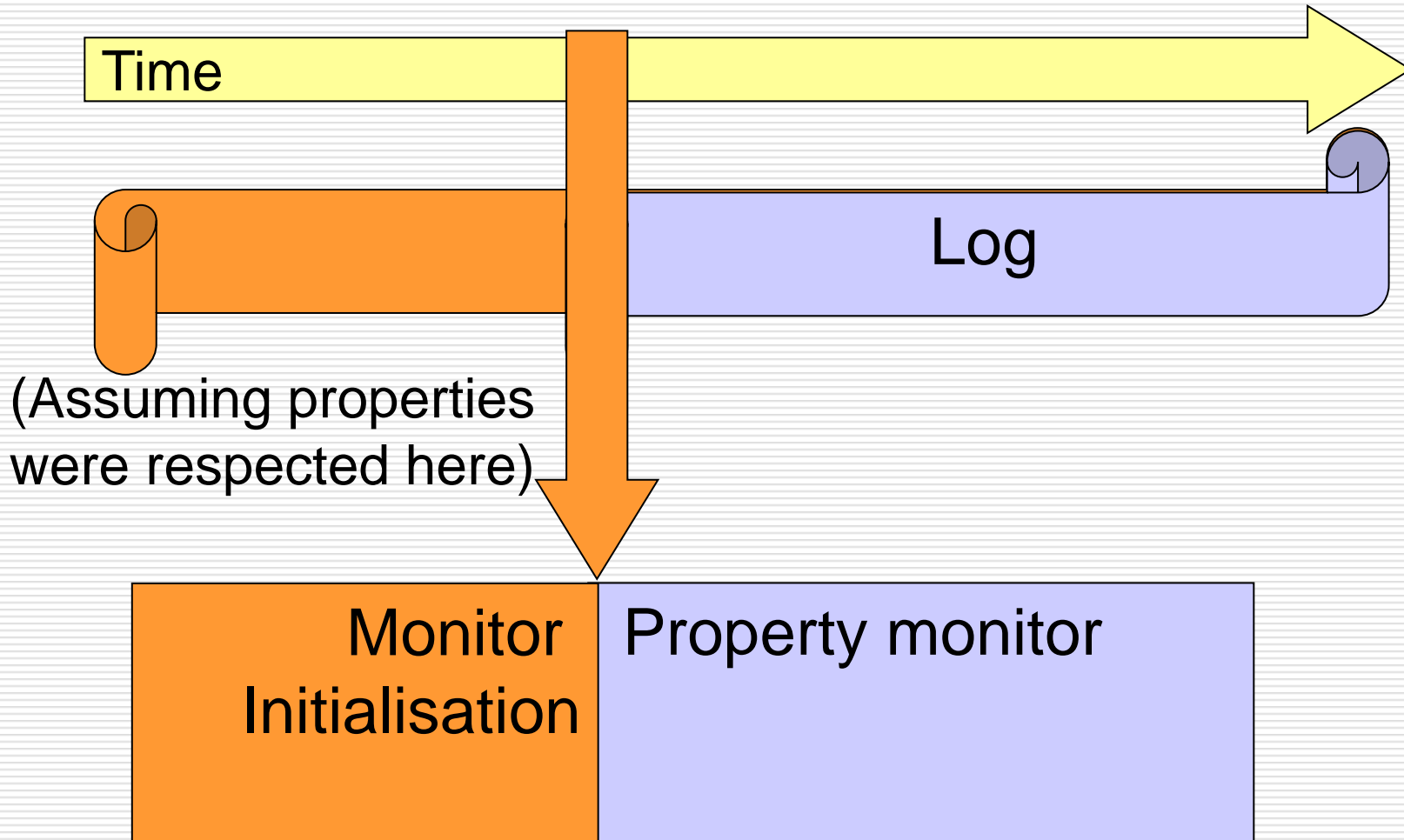
Others

- Ensure that a fee is charged upon reactivation of user account
- Ensure that one of the user's credit cards is a default credit card
- Ensure that the total credit card balances is not negative

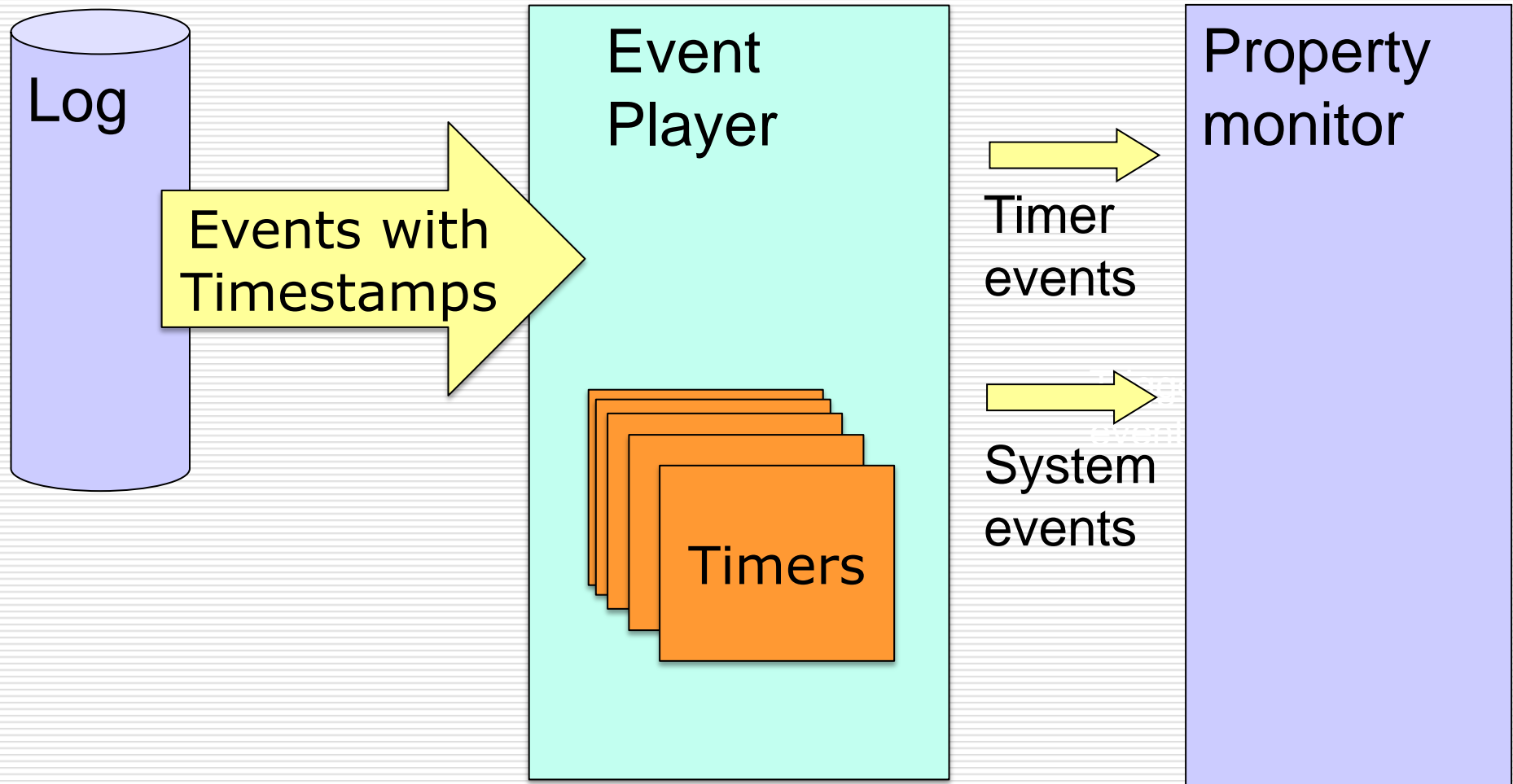
Initialisation Issues

- A system to be monitored may have been running for years
- We may not wish the monitor to start from the beginning!
- Therefore we need intelligent initialisation

Intelligent Initialisation



Fictitious Clocks



Future Work

- Gather statistical data
- Optimise the framework

Conclusions

- A non-intrusive runtime monitoring architecture
- Able to check for real-time properties