10 years of work in Runtime Verification

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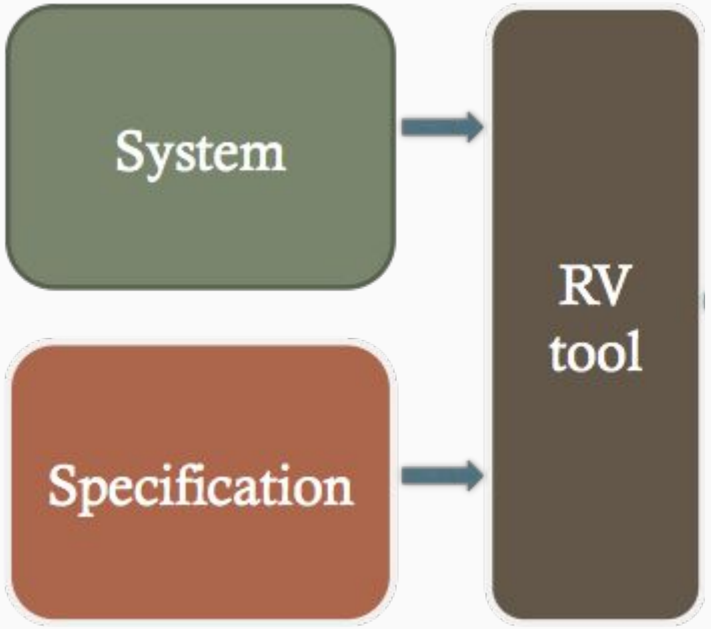
Runtime Verification

System
Specification

Runtime Verification



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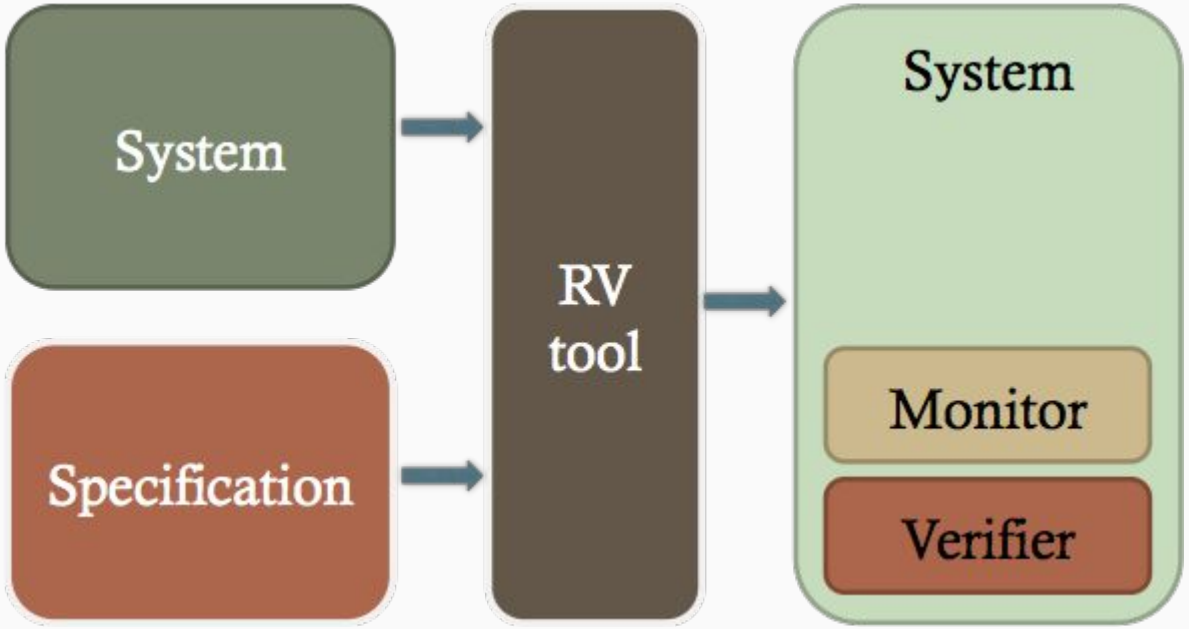

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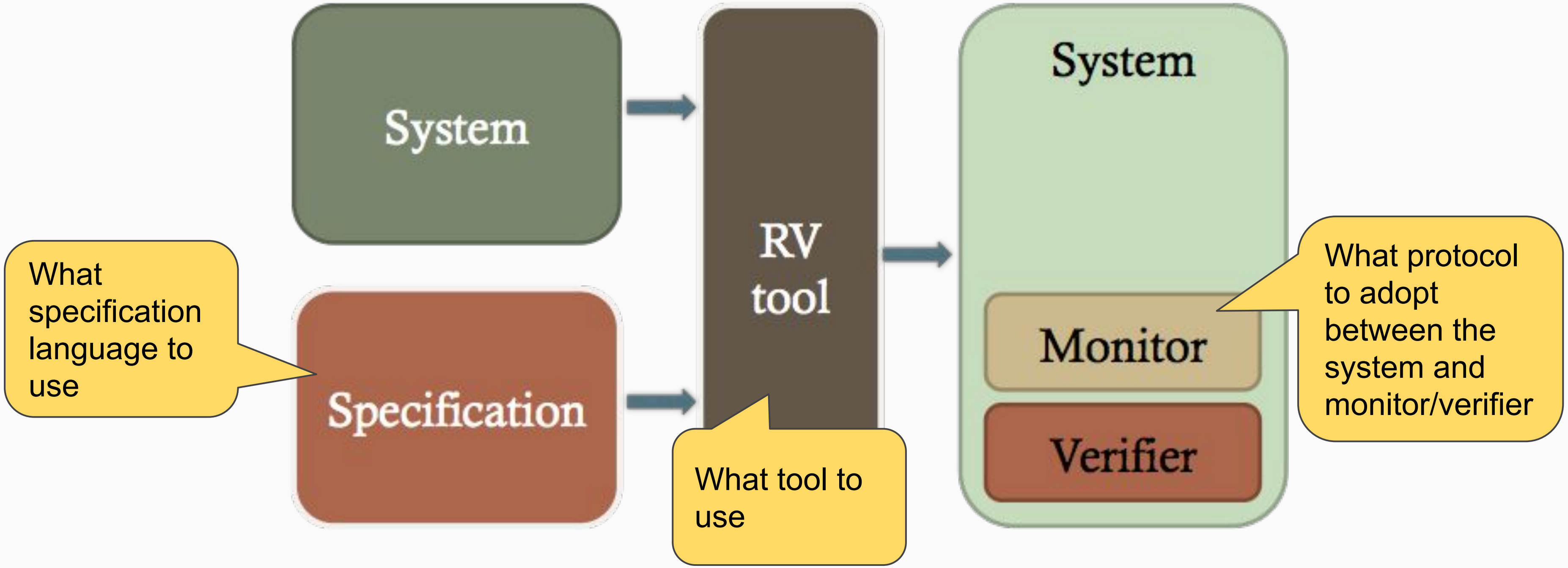
System
Specification
RV tool
System
Monitor
Verifier
What specification language to use
What tool to use
What protocol to adopt between the system and monitor/verifier

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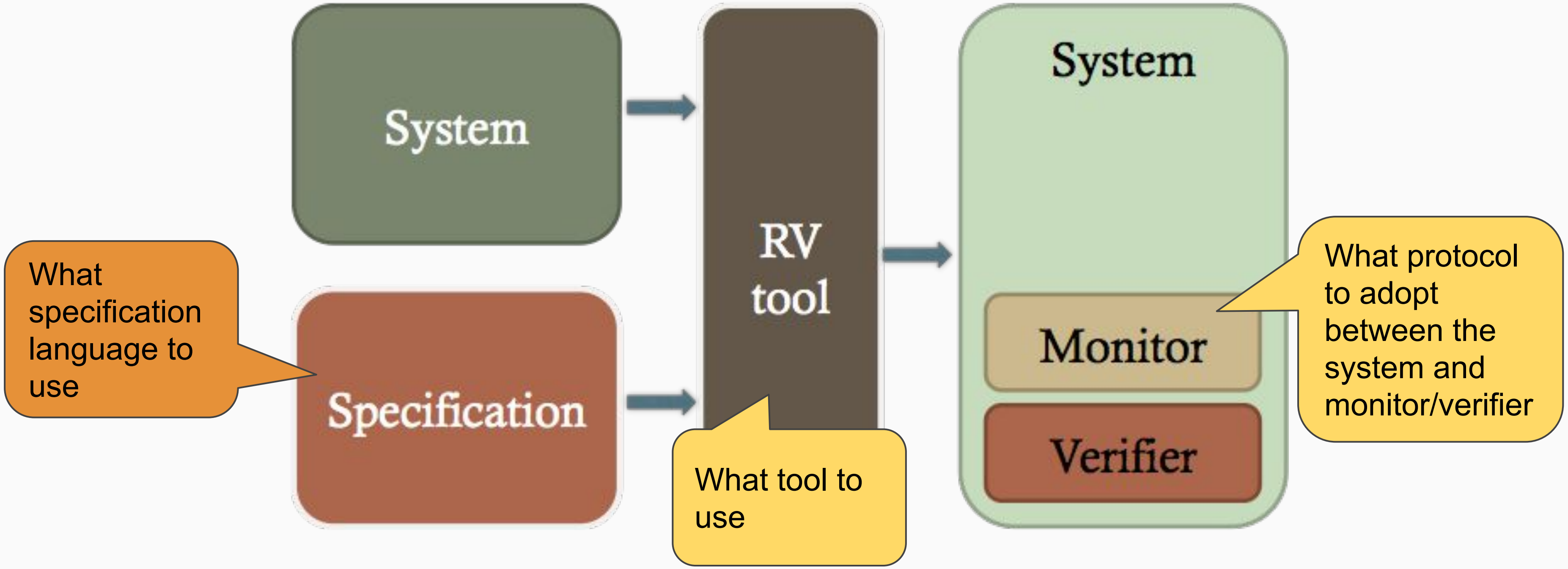
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Specification Languages - Expressivity

Support for:

Sequencing of events **“No write before a login”**

Real-time **“Never more than 5 bad logins in 1 minute”**

Per-object **“For each user, total spending cannot exceed €100 per day”**

Specification Languages - Understandability

Formats:

- Logics **(!login)* write**
- Automata (finite state machines)
- Domain-specific languages (sometimes as controlled natural languages)

Domain-specific languages

VISA regulations **“A non-verified cardholder can only spend €X per month”**

Tax fraud **“Tax payers declaring an income less than X% of the last Y-year average”**

Business intelligence **“Alert me whenever a post gets more than X negative comments in Y minutes”**

Fraud risk **“Increase risk score by X% for each transfer from country Y with amount greater than Z”**

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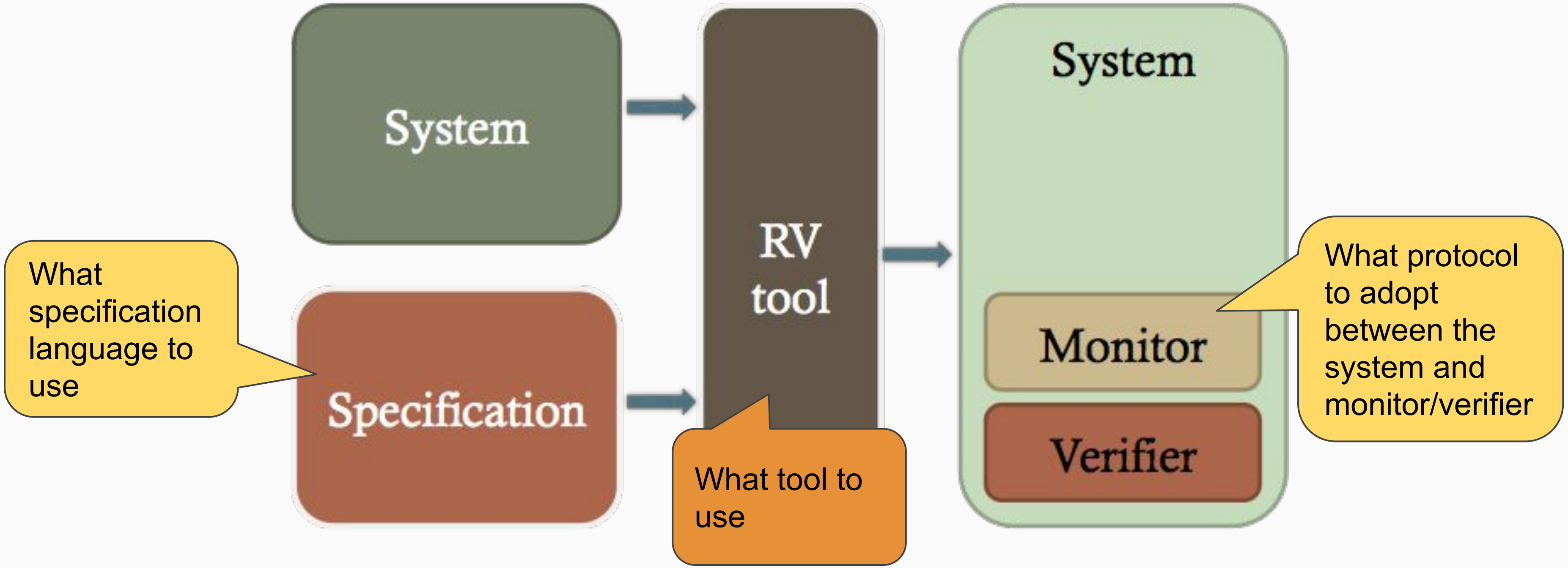
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Technologies

Java + AspectJ

Java + Kafka/RabbitMQ/etc

Erlang

C

A mixture of technologies

Architectures

Monolith systems

Distributed systems with a global clock

Distributed systems

Ways of obtaining events

By modifying the code

By intercepting communication

From a data source (eg: database)

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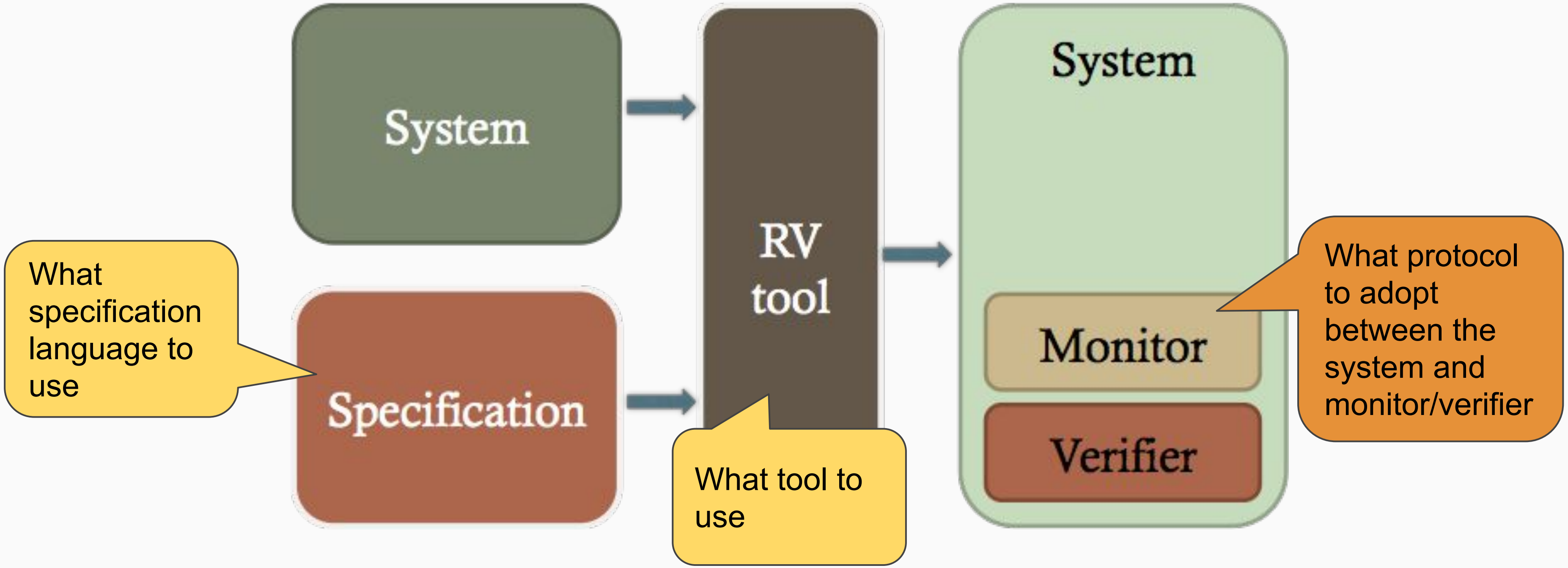
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Monitor and System work in parallel?

System and monitor wait for each other

System runs independently of the monitor

What happens when a problem is detected?

The monitor simply raises an alert

The monitor can “fix” the situation