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Self-Adaptive Security Systems

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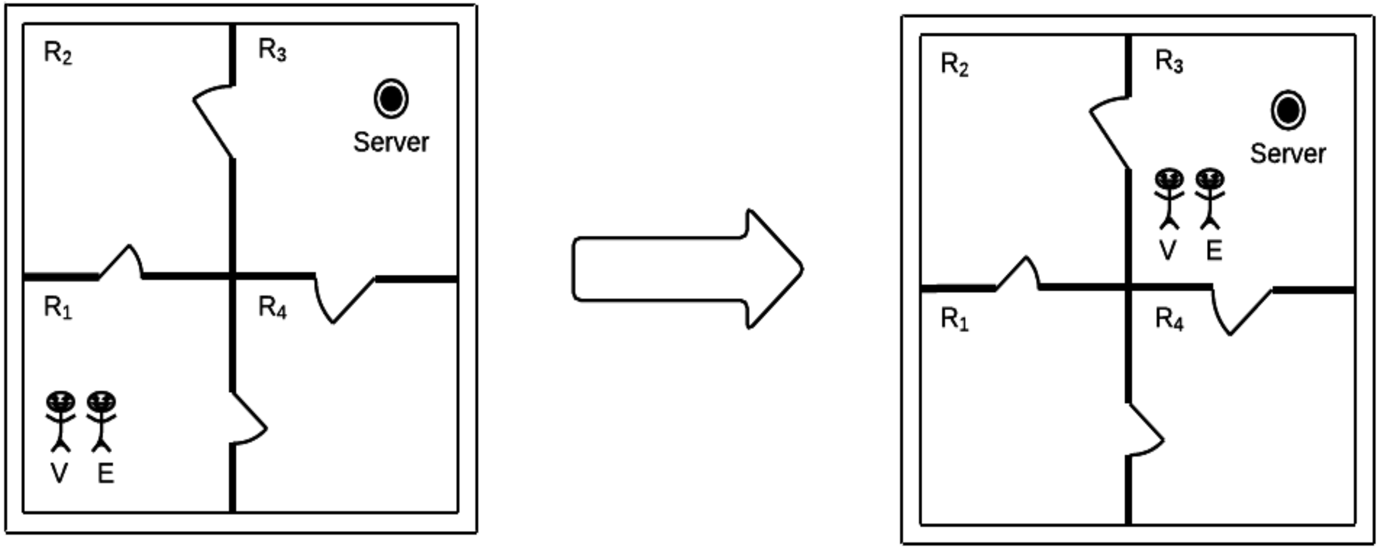
Self-Adaptive Security System

Aimee Borda

Motivational Example[1]

Security Policy: No visitor should be left alone with Server in R_3



[1] Pasquale, Liliana et al. "Topology aware adaptive security." in *Proc of the 9th International Symposium on Software Engineering for Adaptive and Self-Managing Systems* 2014.

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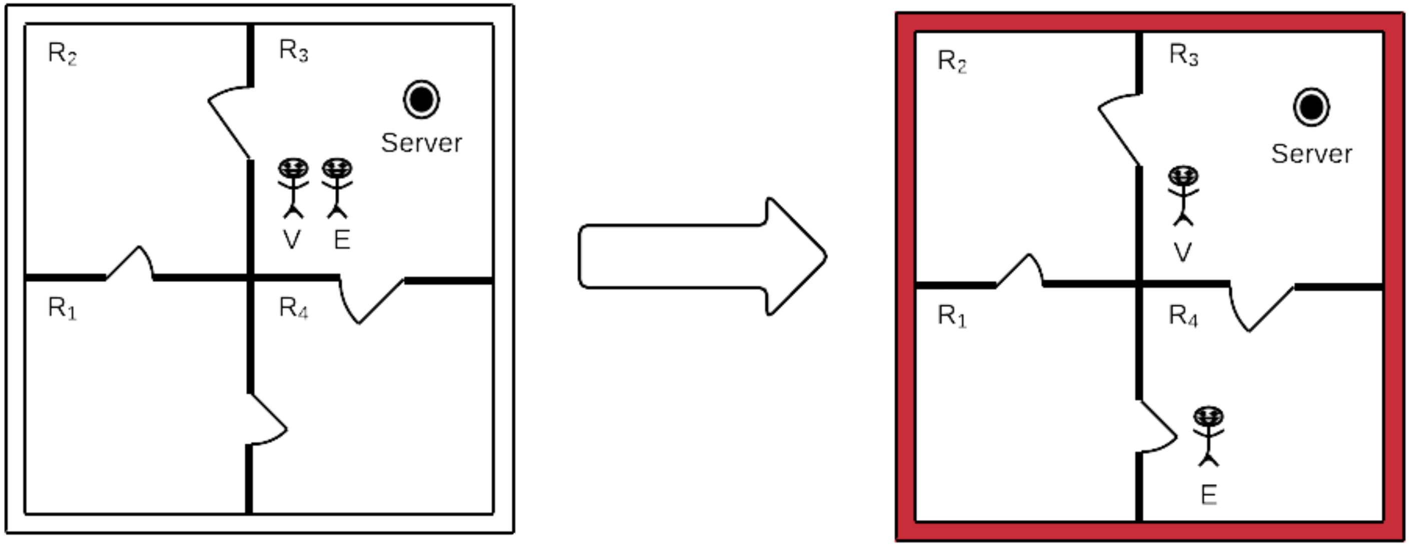
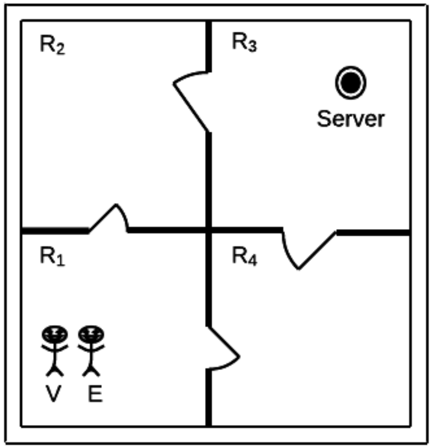


[1] Pasquale, Liliana et al. "Topology aware adaptive security." in *Proc of the 9th International Symposium on Software Engineering for Adaptive and Self-Managing Systems* 2014.

Motivational Example[1]

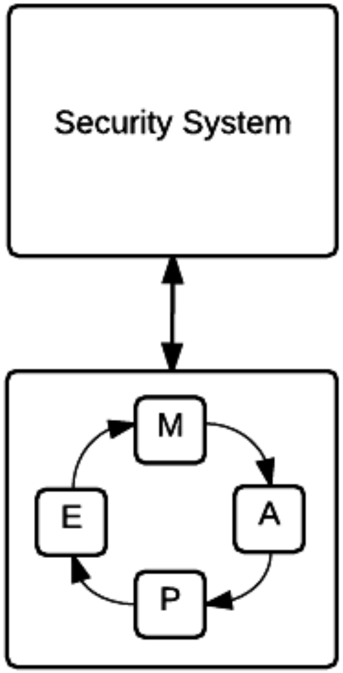
20 Visitors & 20 Employees



$$\left.\begin{array}{l}
e_1 \text{ in } R_1 \Rightarrow v_1 \text{ allowed in } R_1 \\
e_1 \text{ in } R_1 \Rightarrow v_1 \text{ allowed in } R_2 \\
e_1 \text{ in } R_1 \Rightarrow v_1 \textbf{not} \text{ allowed in } R_3 \\
e_1 \text{ in } R_1 \Rightarrow v_1 \text{ allowed in } R_4 \\
e_1 \text{ in } R_2 \Rightarrow v_1 \text{ allowed in } R_1 \\
e_1 \text{ in } R_2 \Rightarrow v_1 \text{ allowed in } R_2 \\
e_1 \text{ in } R_2 \Rightarrow v_1 \textbf{not} \text{ allowed in } R_3 \\
e_1 \text{ in } R_2 \Rightarrow v_1 \text{ allowed in } R_4 \\
e_1 \text{ in } R_3 \Rightarrow v_1 \text{ allowed in } R_1 \\
e_1 \text{ in } R_3 \Rightarrow v_1 \text{ allowed in } R_2 \\
e_1 \text{ in } R_3 \Rightarrow v_1 \textbf{ allowed} \text{ in } R_3 \\
e_1 \text{ in } R_3 \Rightarrow v_1 \text{ allowed in } R_4 \\
e_1 \text{ in } R_4 \Rightarrow v_1 \text{ allowed in } R_1 \\
\qquad\qquad \vdots
\end{array}\right\}
\begin{array}{l} 20 * 20 * 4 \\ = 1600 \end{array}$$

[1] Pasquale, Liliana et al. "Topology aware adaptive security." in *Proc of the 9th International Symposium on Software Engineering for Adaptive and Self-Managing Systems* 2014.

MAPE Feedback Loop[2]



4-Step Adaptive Process:

1. Monitor
2. Analysis
3. Planning
4. Execution

[2] Tsigkanos, Christos et al. "Engineering topology aware adaptive security: Preventing requirements violations at runtime." *Requirements Engineering Conference (RE), 2014 IEEE*

What exactly do we want to Verify?

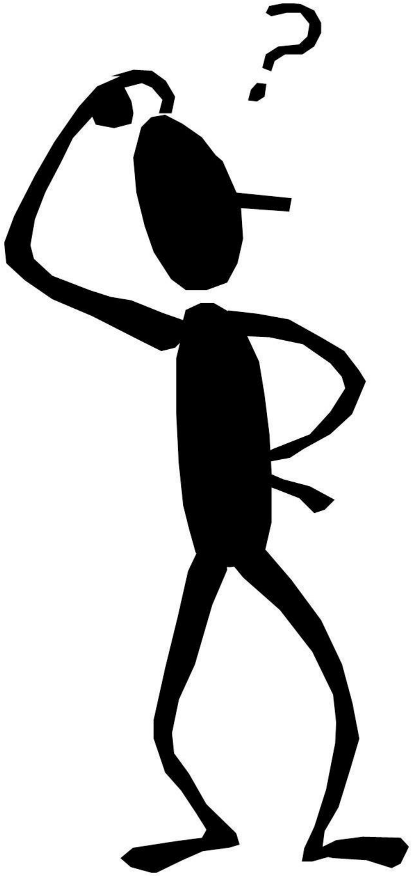
We want to show that our system is **correct** wrt a set of Security Policies

Because of the increased complexity, we need **compositional** reasoning:

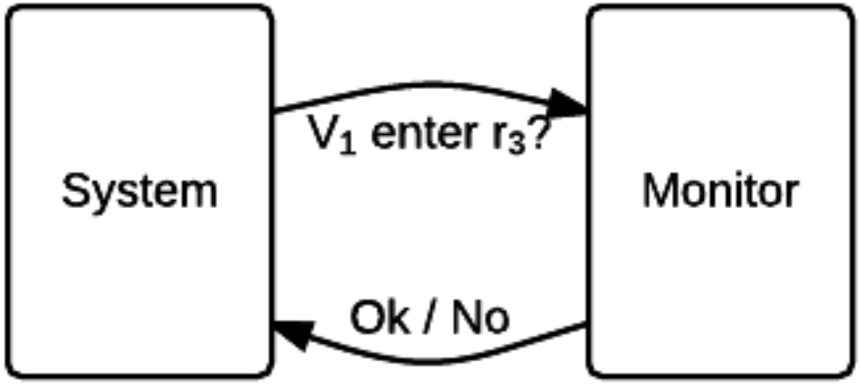
- Monitoring : all events are detected
- Analysis: all violations are found
- Planning: counter-measures guards against all violations
- Execution: plan implemented faithfully

[2] Tsigkanos, Christos et al. "Engineering topology aware adaptive security: Preventing requirements violations at runtime." *Requirements Engineering Conference (RE), 2014 IEEE*

How can we verify such Systems?



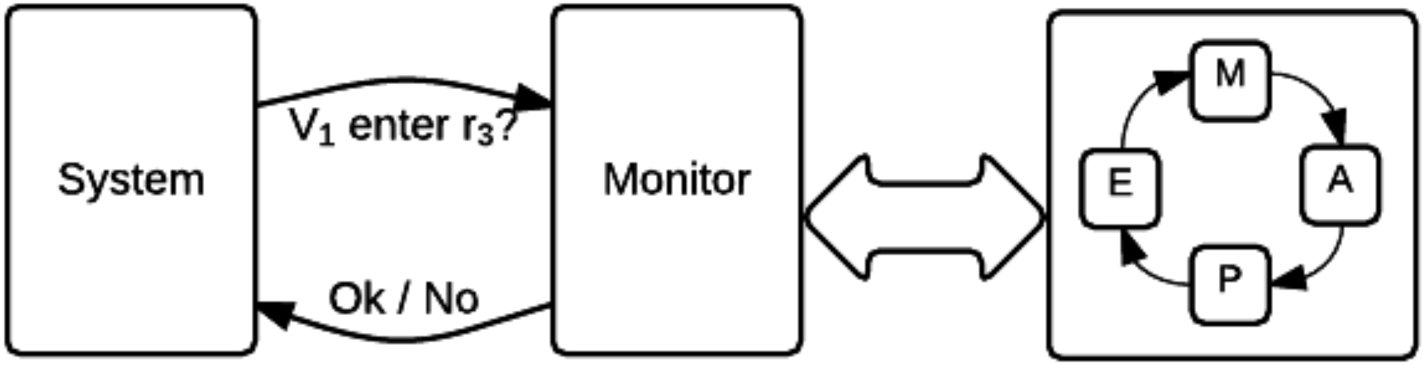
Run-time Monitoring[3,4]



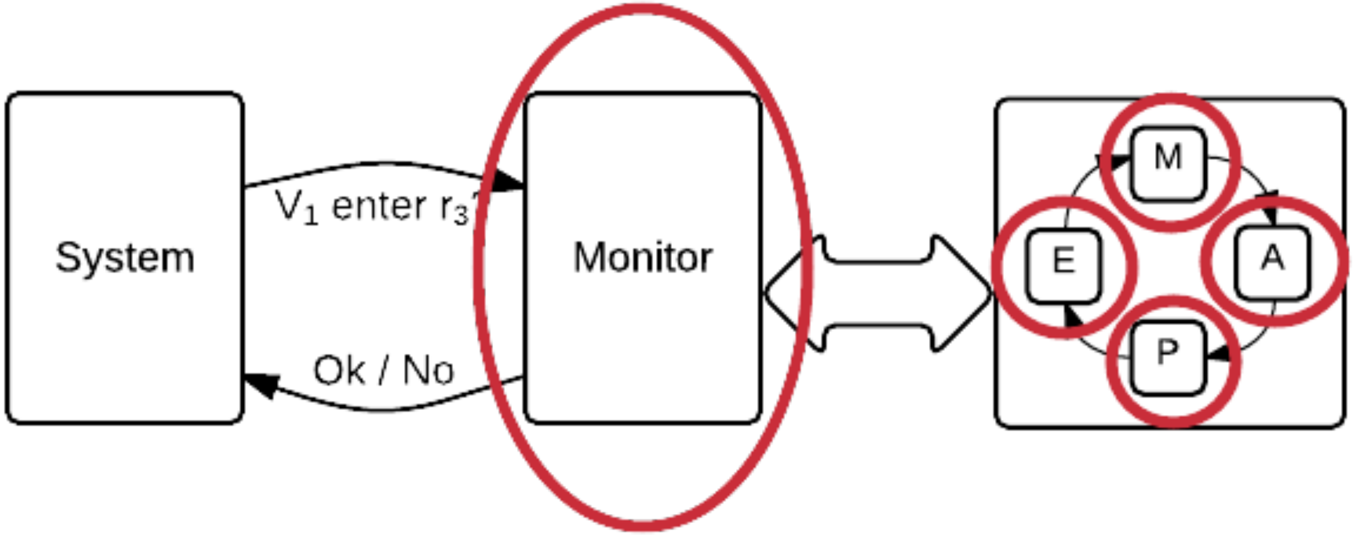
[3] Schneider, Fred B. "Enforceable security policies." ACM Transactions on Information and System Security (TISSEC) 2000

[4] Bauer, Lujo, et al. "More enforceable security policies." in *Proc. of the Workshop on Foundations of Computer Security (FCS'02), Denmark* 2002.

Our Approach: Adaptive Monitors



Verifying Adaptive Monitors



Conclusion

Research Questions:

- What is the right model for SASS?
- When is a SASS correct?
- What verification techniques can we apply?
- How can we tackle complexity?

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Thank You!

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