Architecture-Supported Audit Processor

Interactive, Query-Driven Assurance

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Document Markings

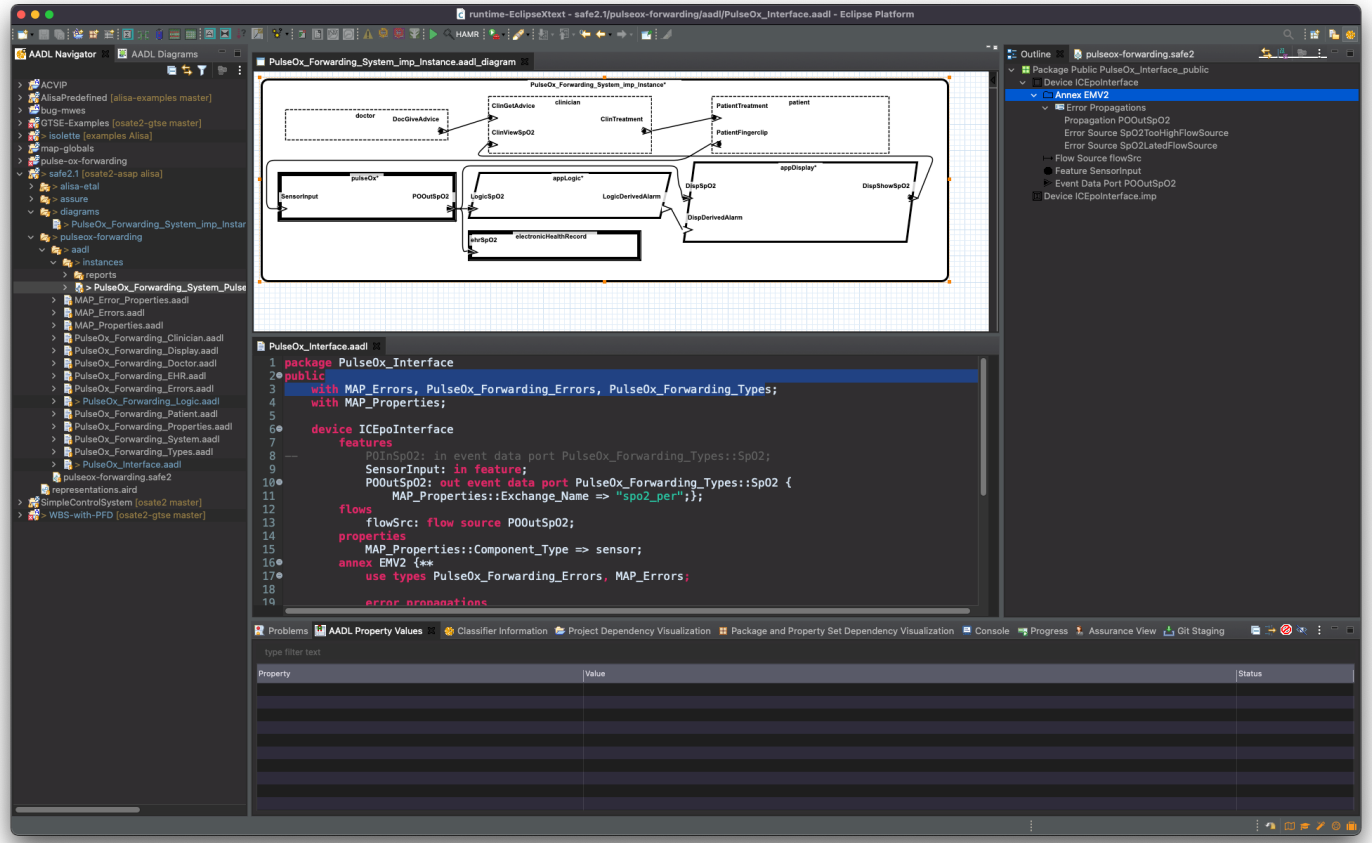
This material is based upon work funded and supported by the Department of Defense under Contract No. FA8702-15-D-0002 with Carnegie Mellon University for the operation of the Software Engineering Institute, a federally funded research and development center.

DM21-0766

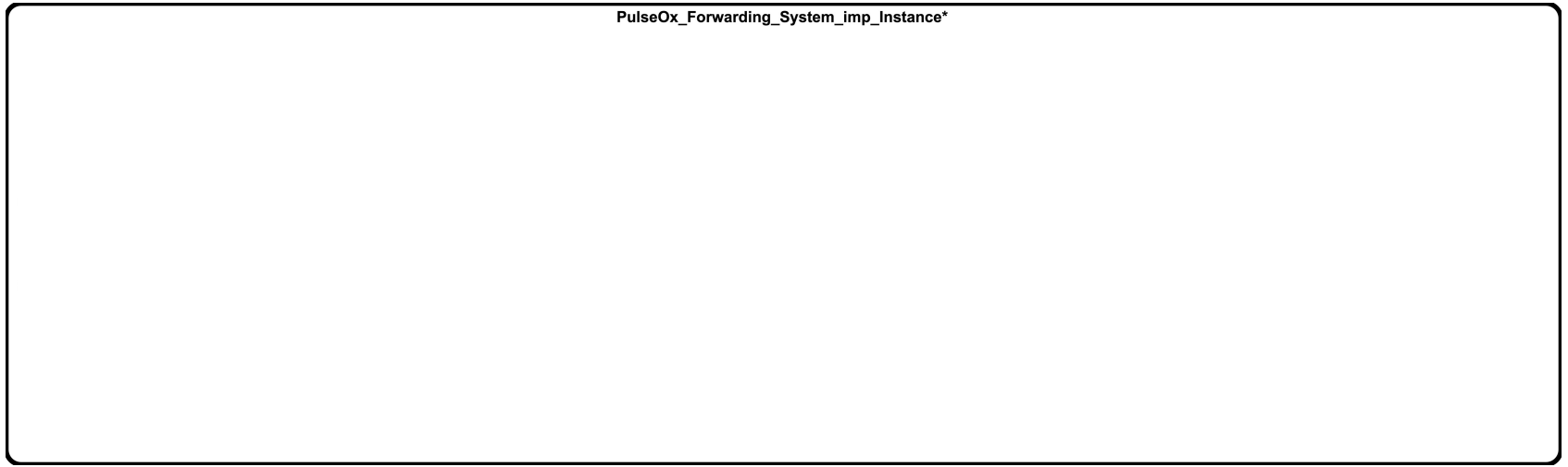
Outline

1. **Background**
    1. AADL / OSATE
    2. PulseOx Forwarding
    3. STPA, SAFE
2. ASAP: Three Viewpoints
3. Future Work

AADL & OSATE

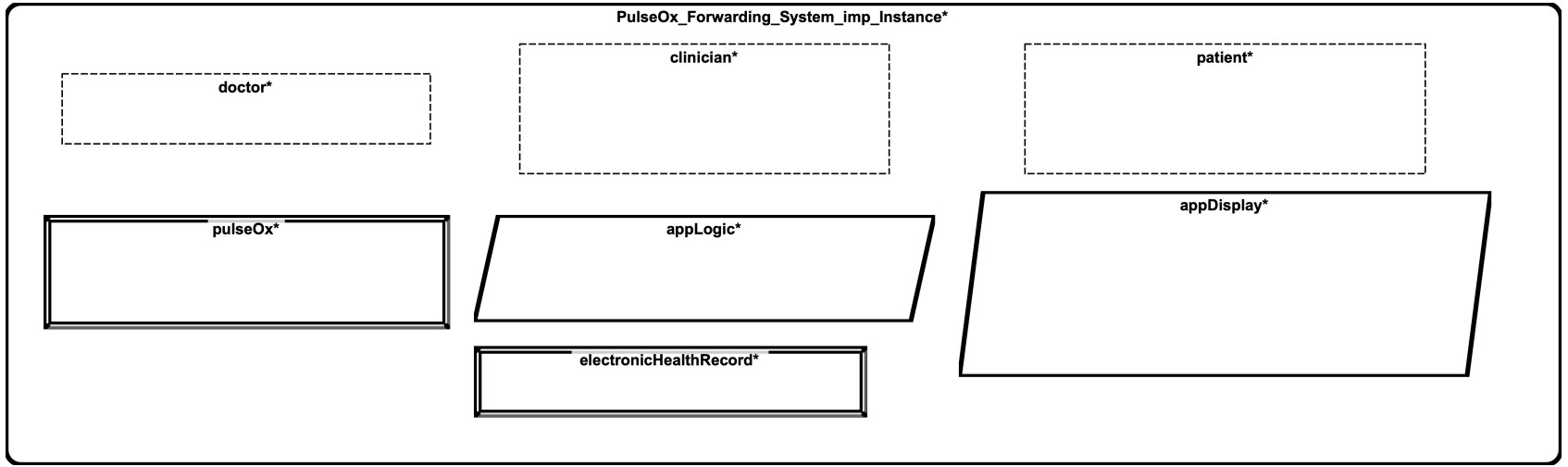


The PulseOx Forwarding Example



Pulse oximeter reads blood-oxygen saturation from a patient, monitoring software displays an alarm if values are out of expected range

The PulseOx Forwarding Example



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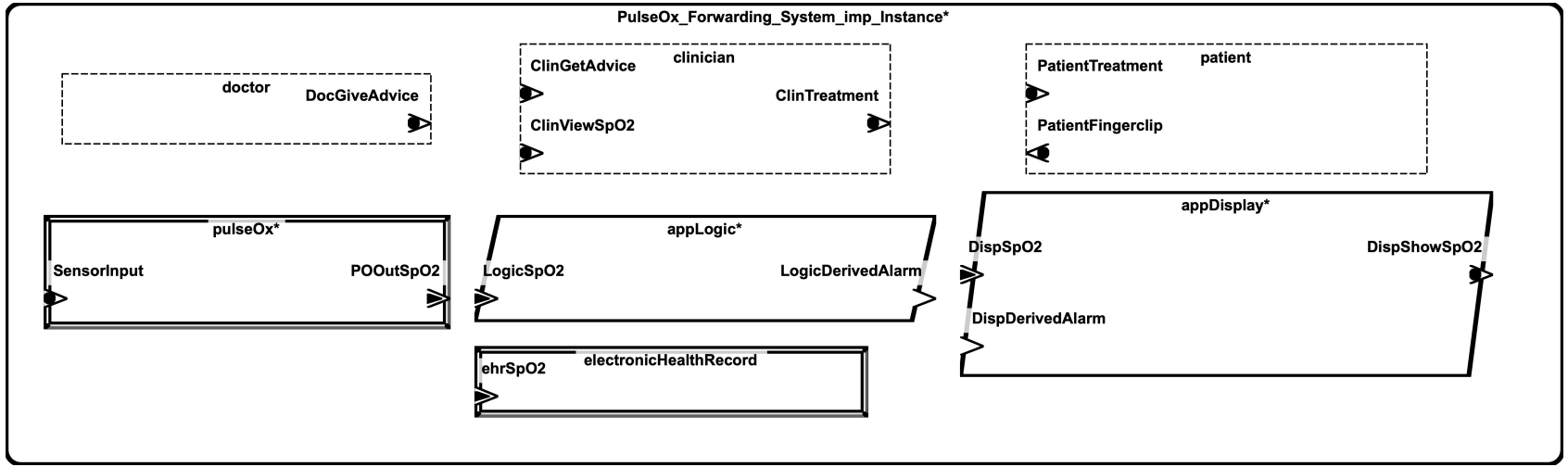
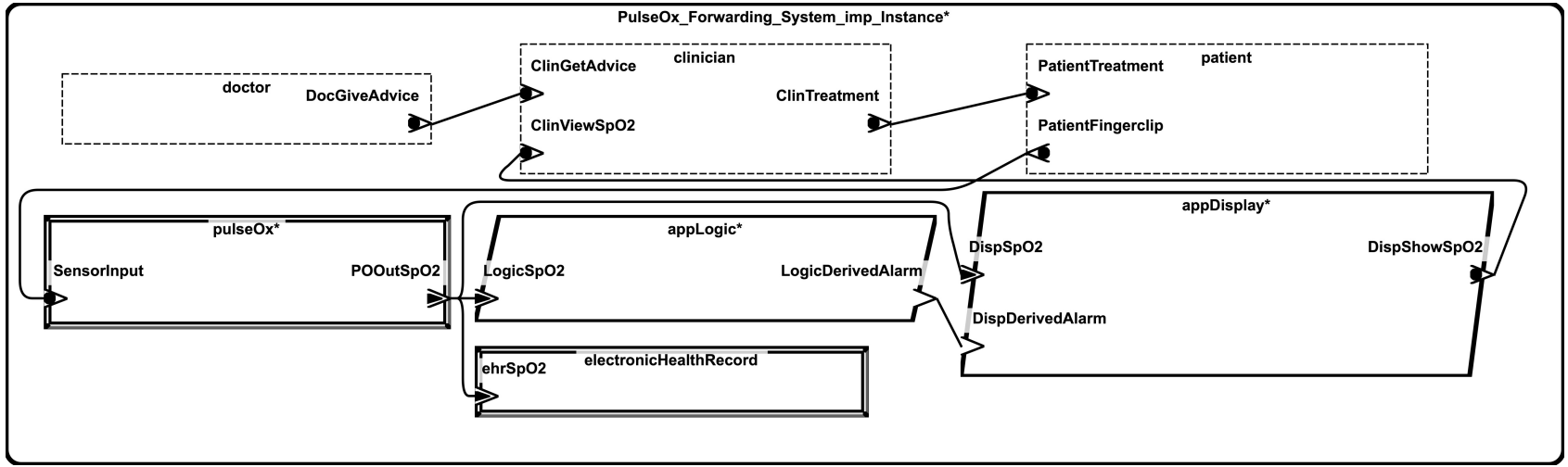


The PulseOx Forwarding Example



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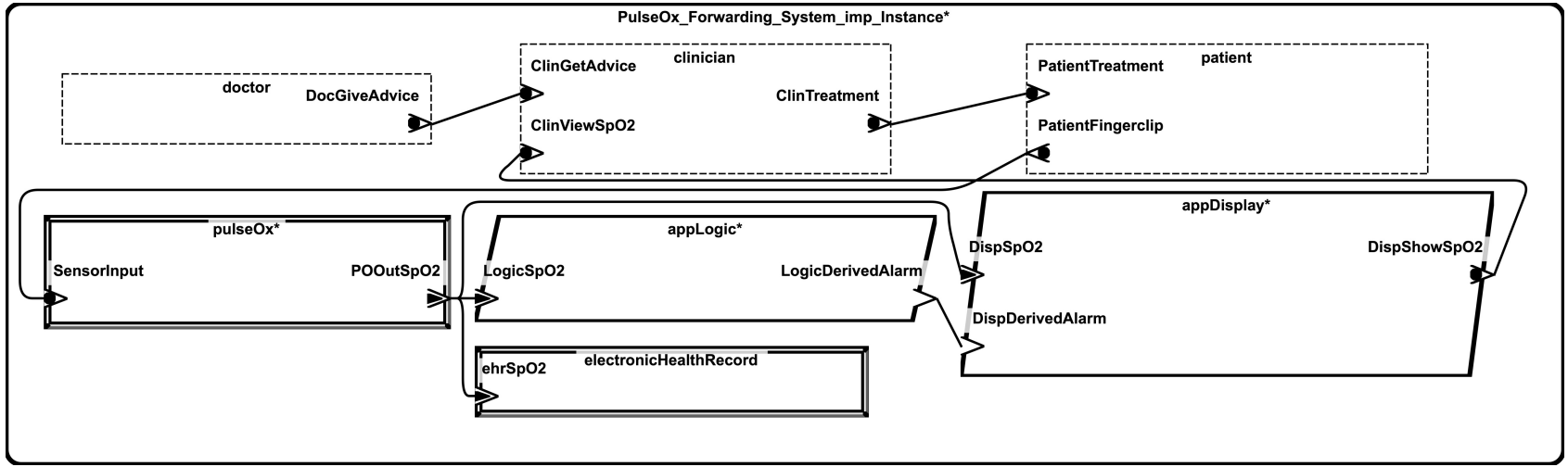

- Safety problem to avoid: Incorrect SpO_2 displayed

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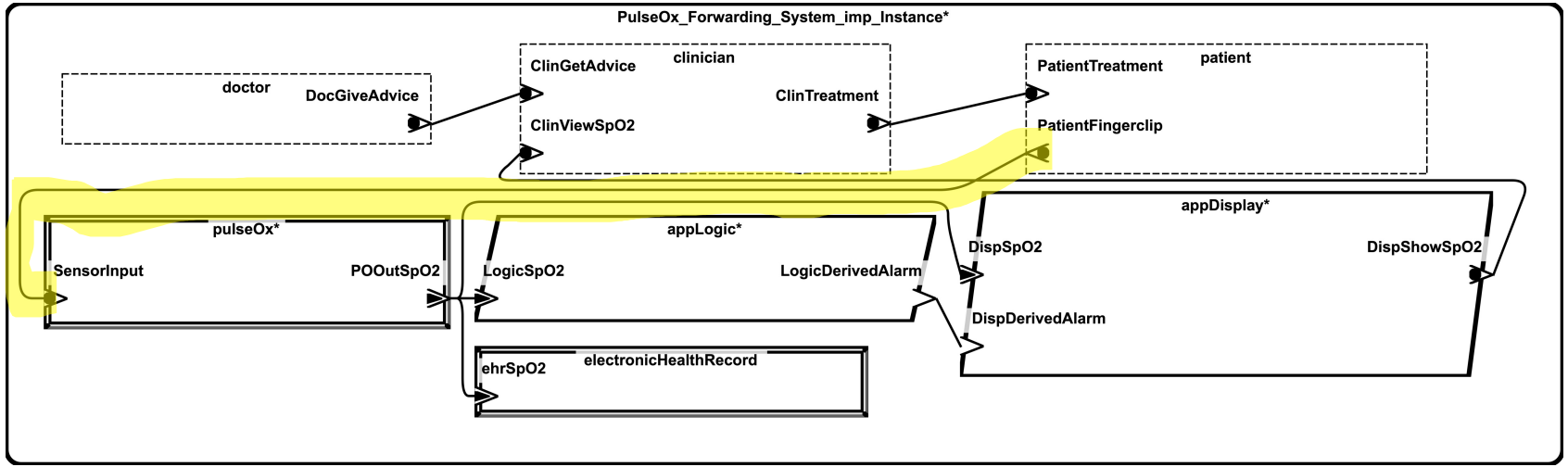

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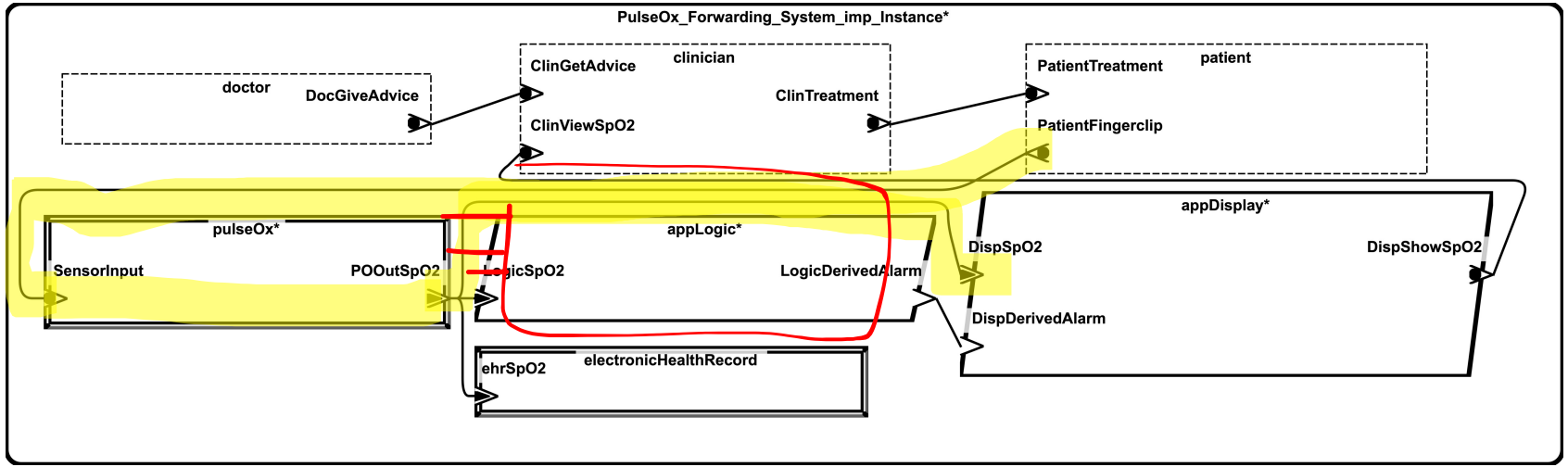

- Safety problem to avoid: Incorrect SpO_2 displayed
- AADL's "Error Modeling" (EMV2) annex can model these error propagations

STPA & SAFE

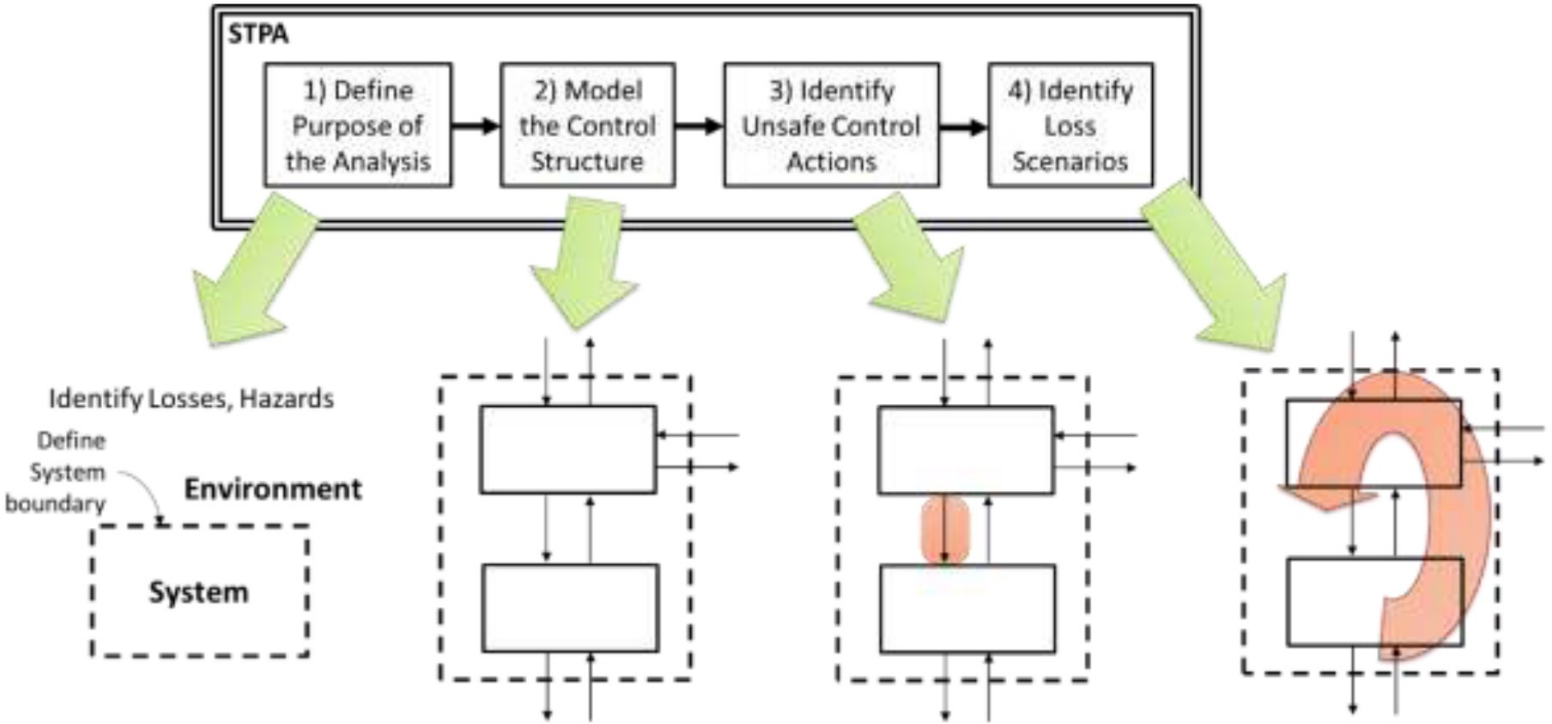

Figure 2.1: Overview of the basic STPA Method

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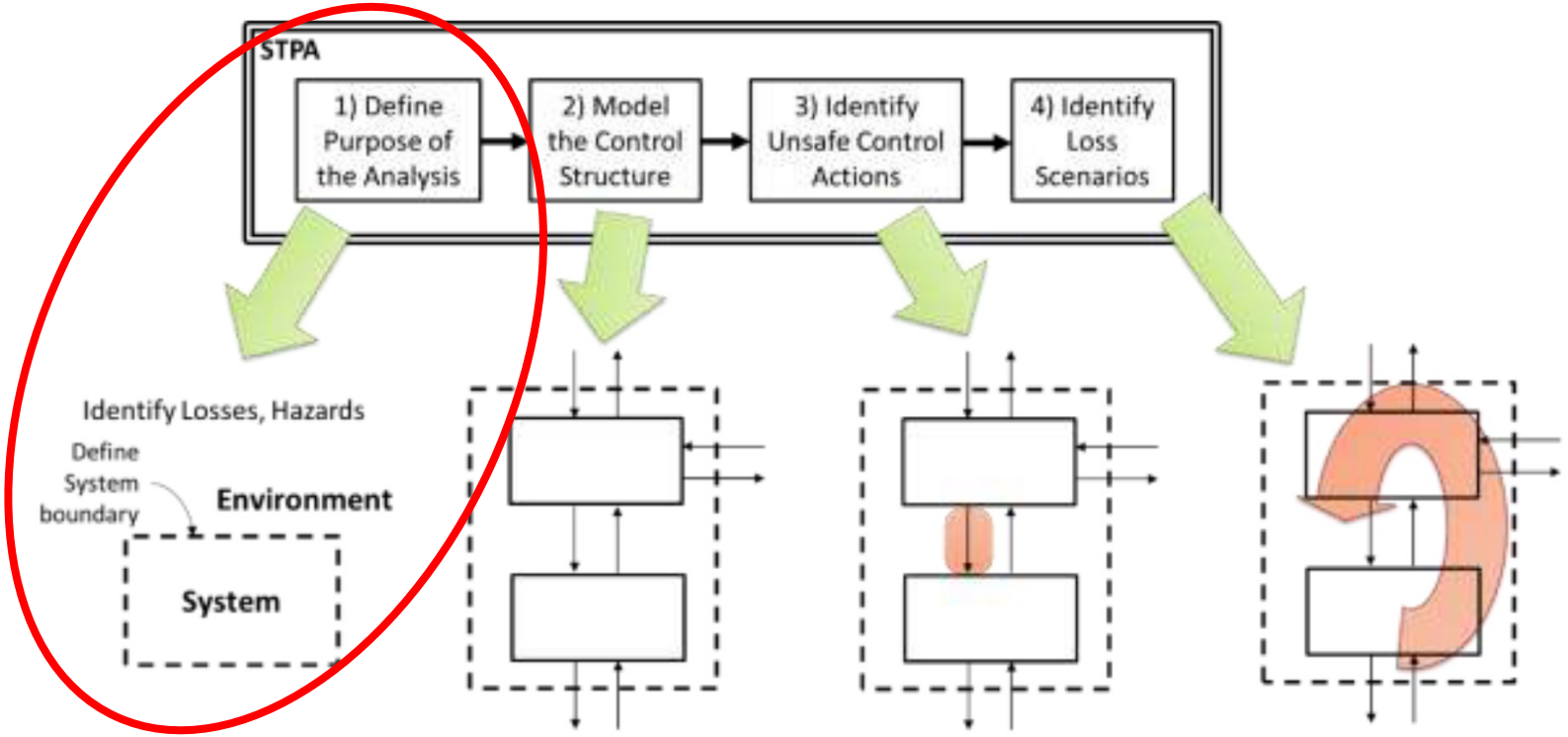
Outline

1. Background
2. **ASAP: Three Viewpoints**
    1. Fundamentals
    2. Connected Neighbors
    3. Unsafe Control Actions
3. Future Work

Viewpoint 1: Fundamentals



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Viewpoint 1: Fundamentals (Hierarchy)

representations.aird | pulseox-forwarding.safe2 | new Fundamentals

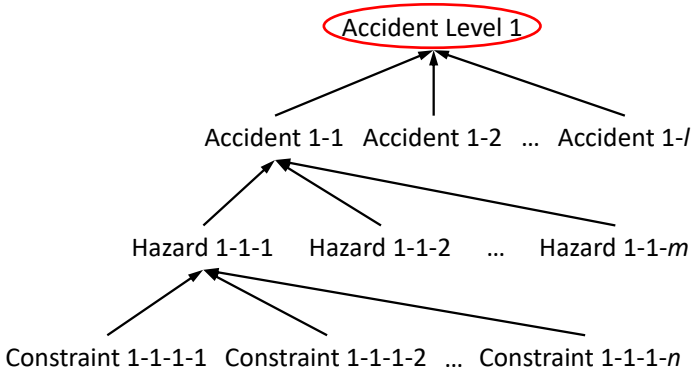
- DeathOrInjury
  - PatientHarmed
    - BadInfoDisplayed
      - ShowGoodInfo
    - InfoLate
      - ShowInfoOnTime

Problems | Properties | AADL Prop | Classifier In | Progress | Error Log

Hazard BadInfoDisplayed

Semantic

Property	Value
Hazard BadInfoDisplayed	
Accident	Accident PatientHarmed
Constraint	Constraint ShowGoodInfo
Description	Incorrect information is sent to the display
Environment Element	Abstract patient
Error Type	Error Type SpO2ValueHigh
Explanations	
Hazardous Factor	SpO2 Information
Name	BadInfoDisplayed
System Element	Event Data Port DispSpO2



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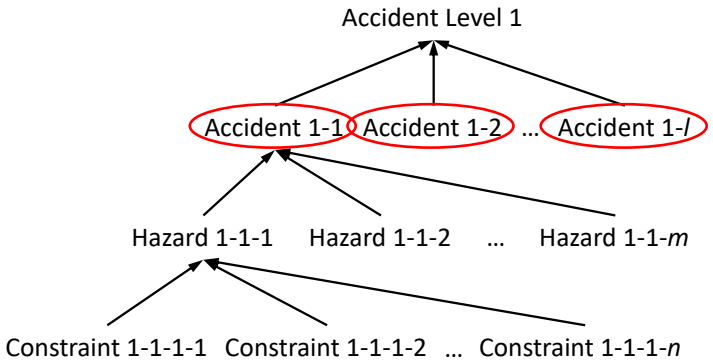

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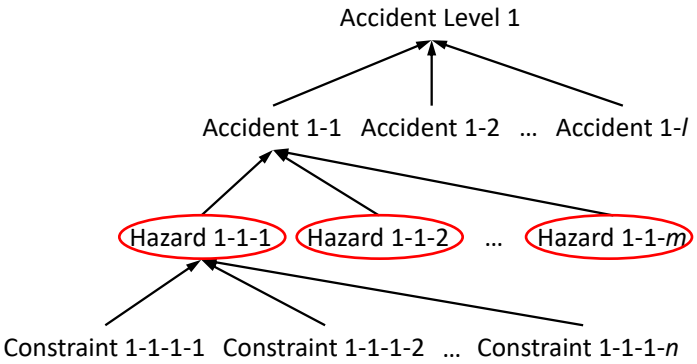

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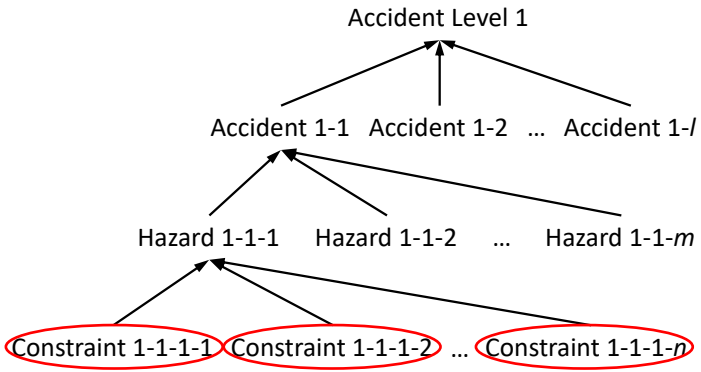
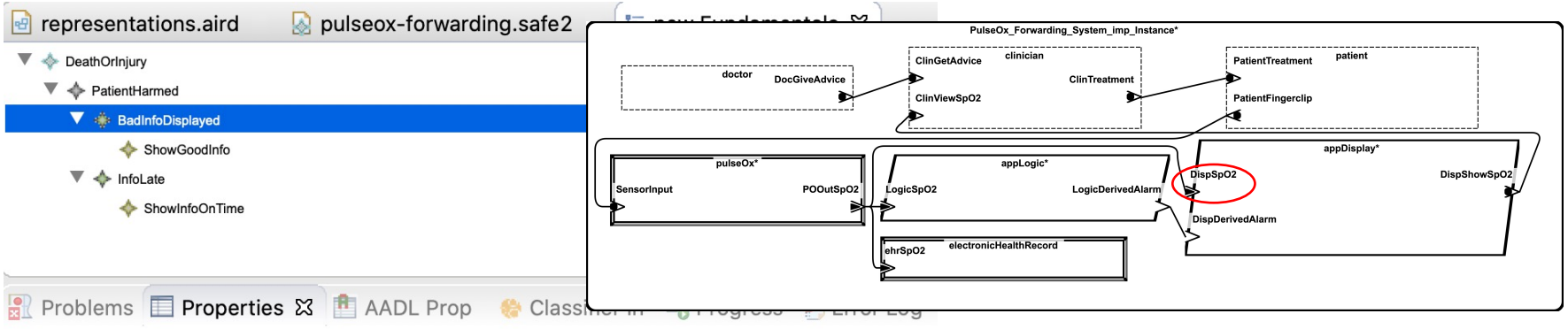


Viewpoint 1: Fundamentals

How can we tie our rather abstract fundamentals hierarchy to our very concrete system architecture?

SAFE (paraphrased, via STPA) uses the definition of a hazard: a system state, and a worst-case environment state.

Viewpoint 1: Fundamentals (Link to system)



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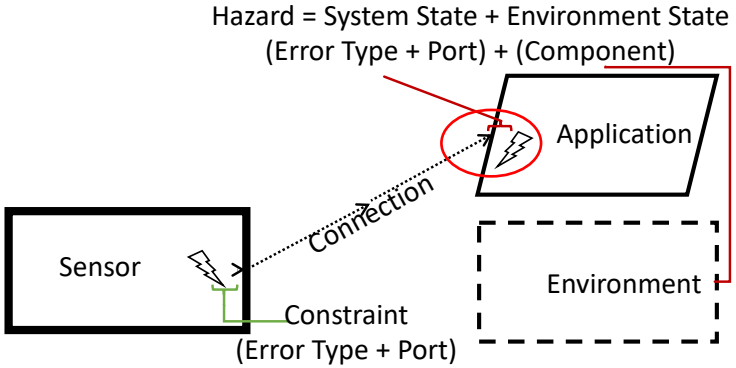

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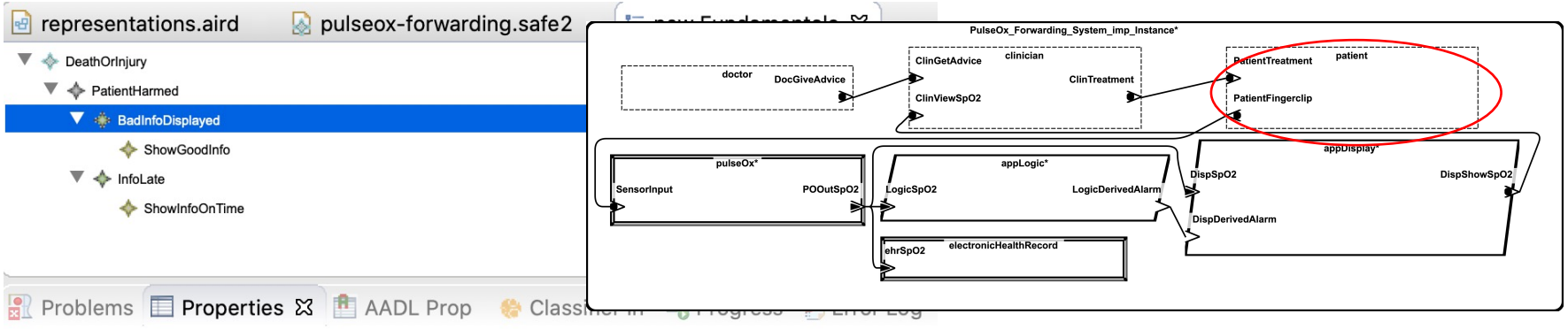

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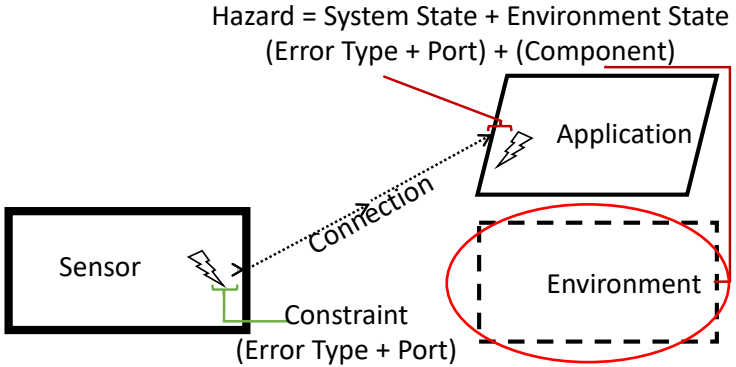

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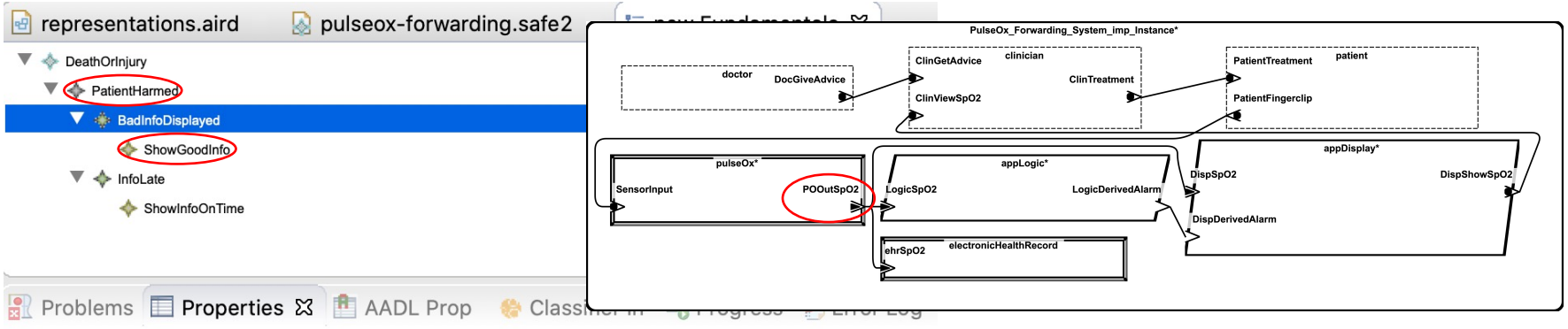

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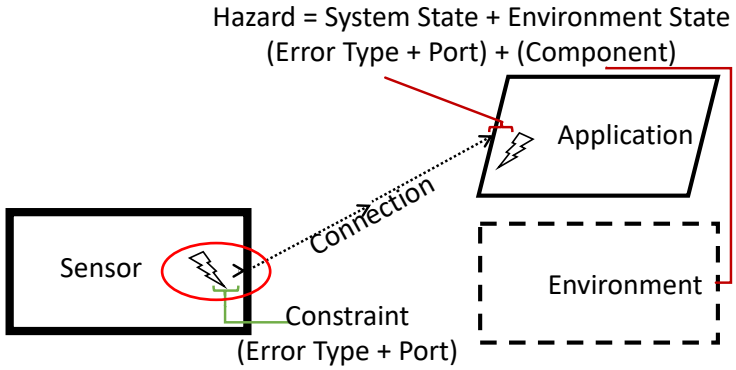
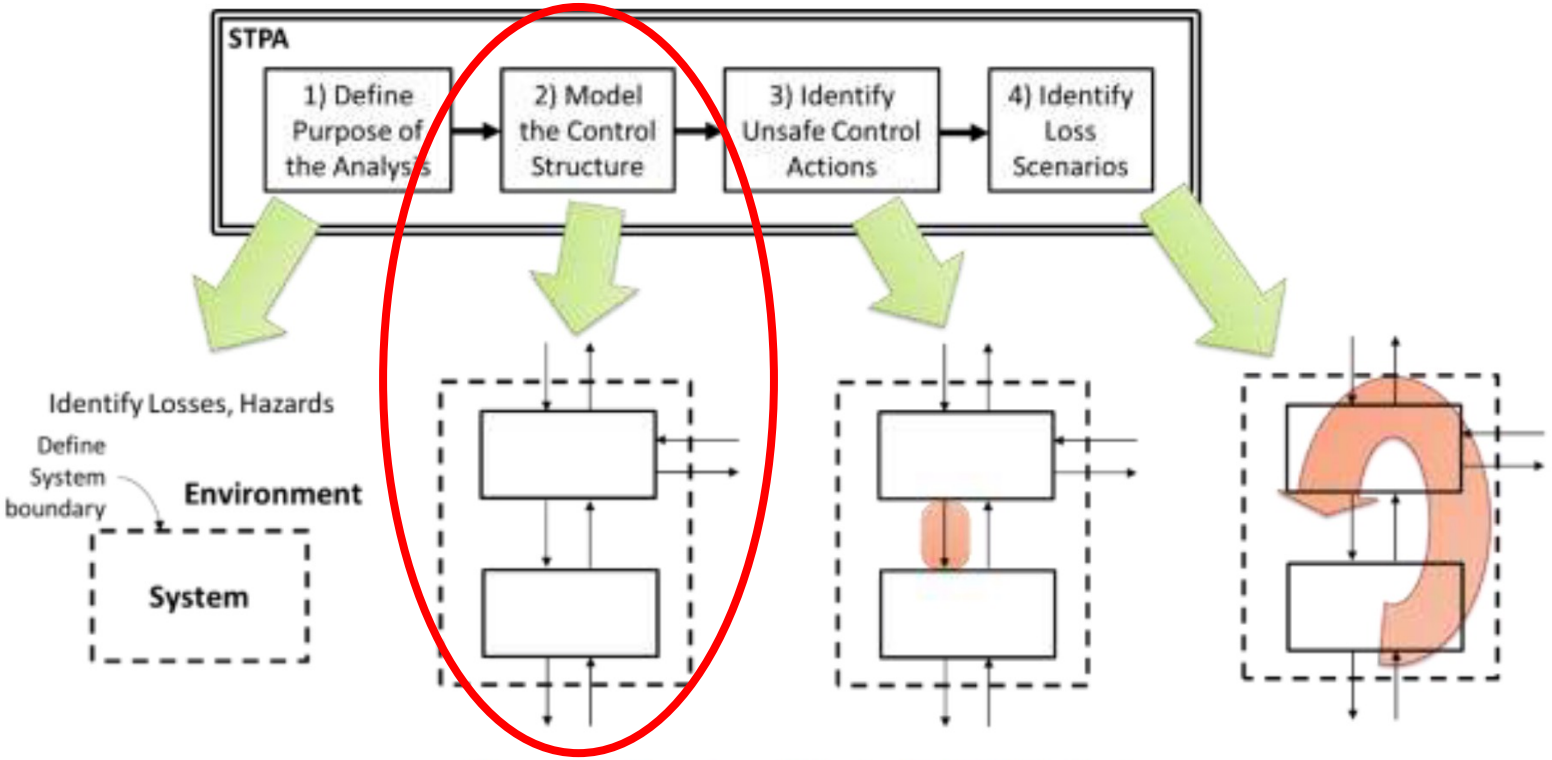


Viewpoint 2: Connected Neighbors



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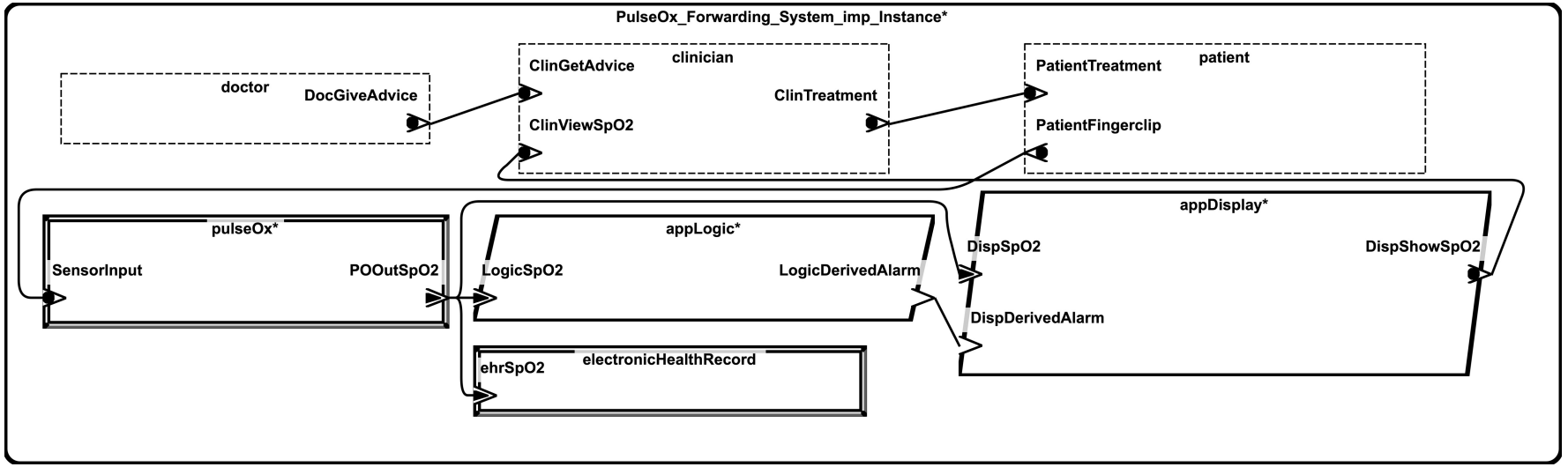

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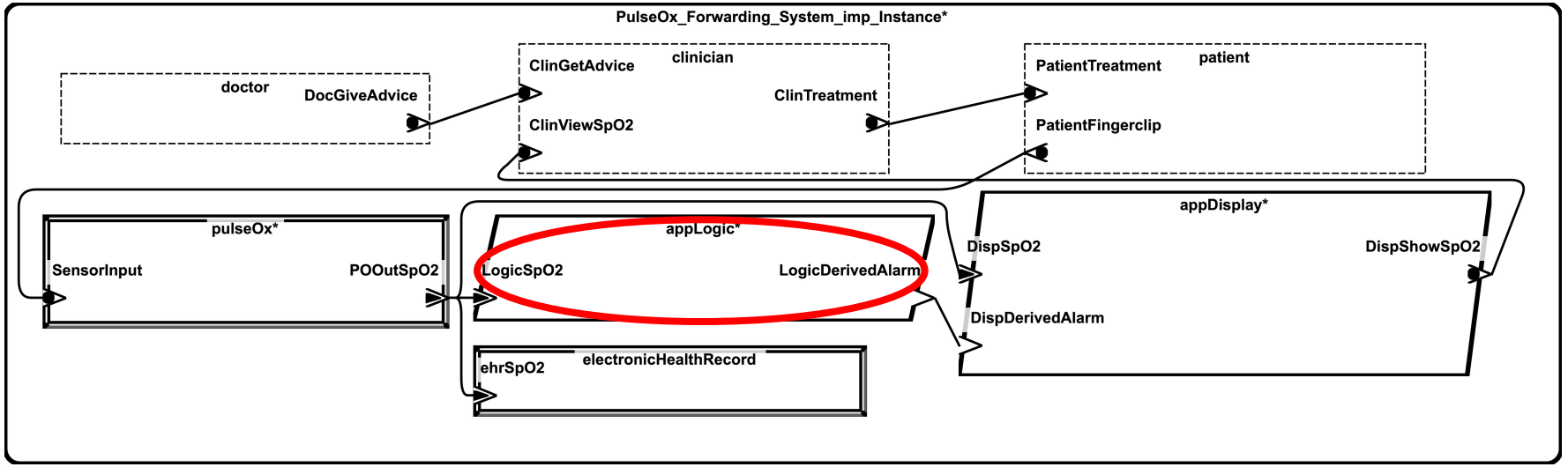

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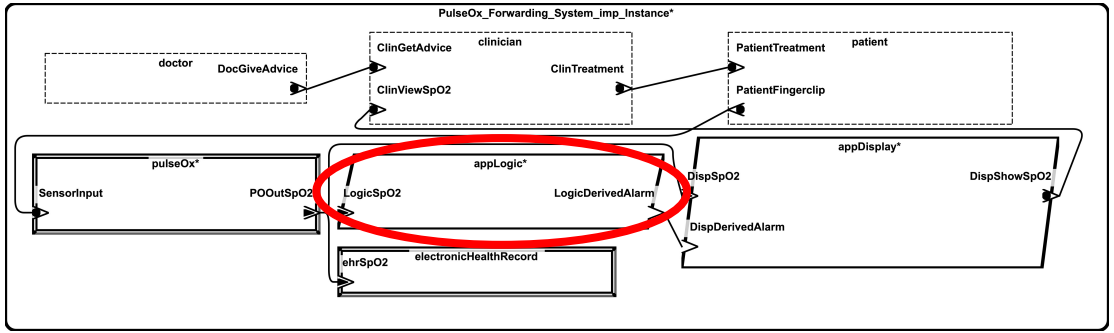
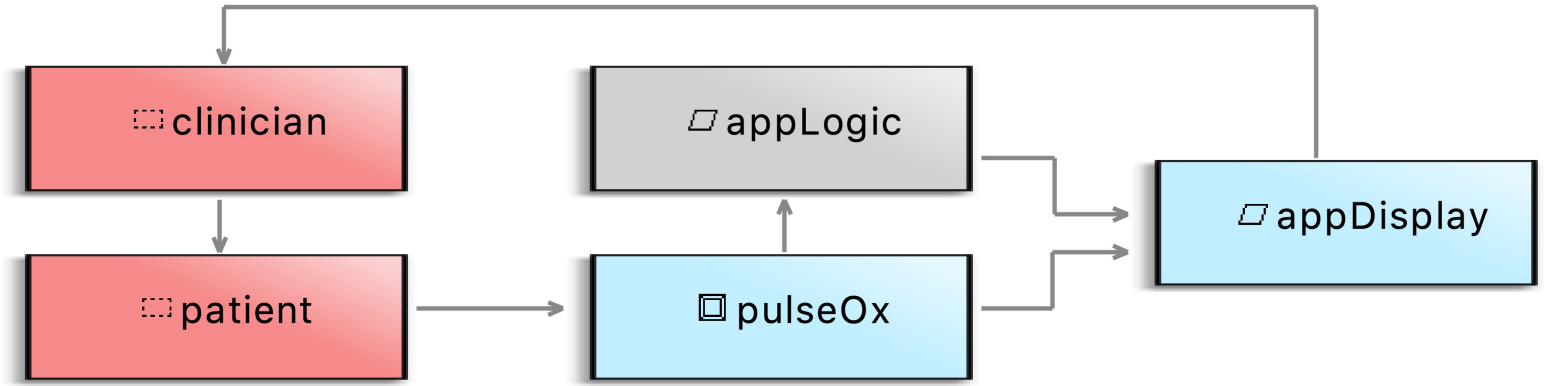
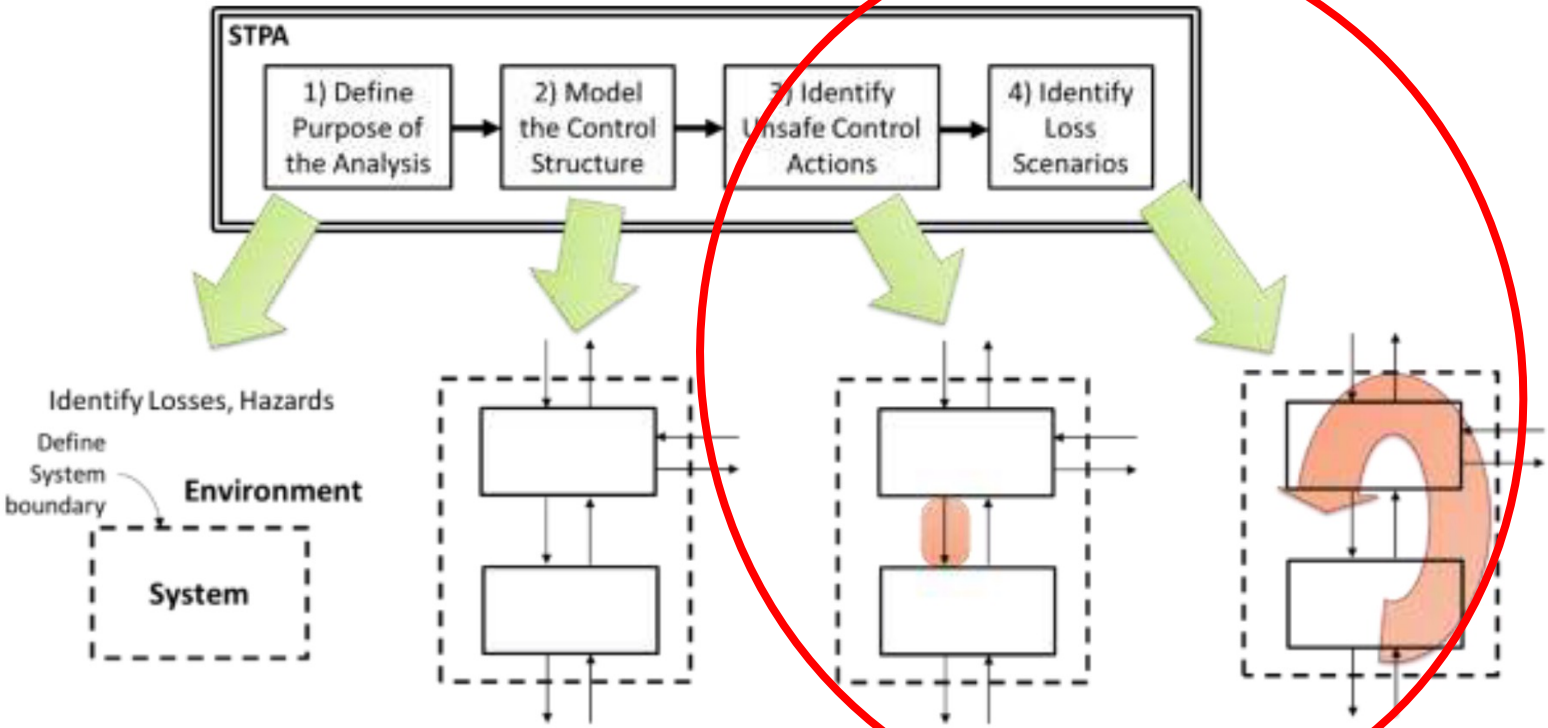




Viewpoint 3: Unsafe Control Actions



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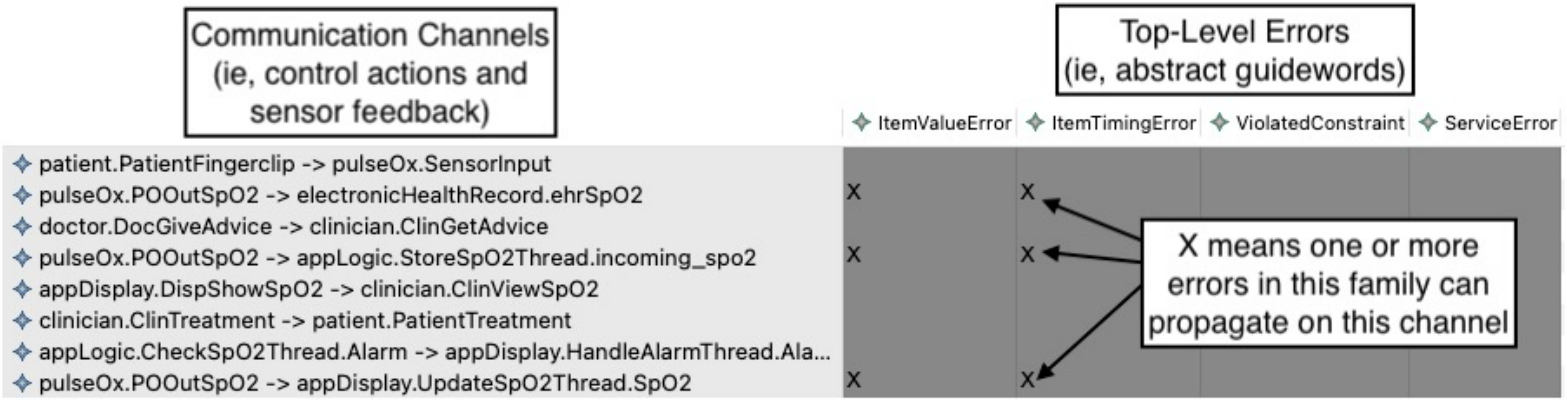
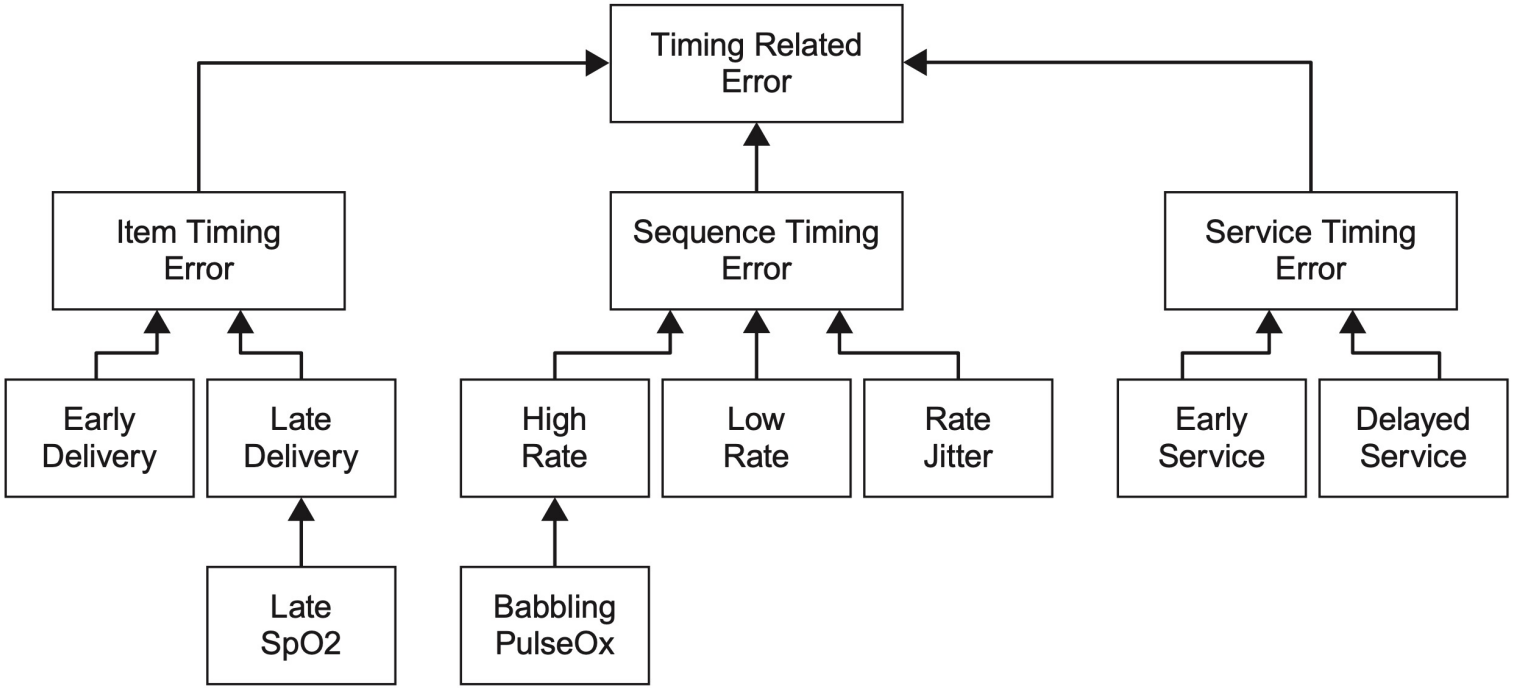


Interlude: The EMV2 Error Library



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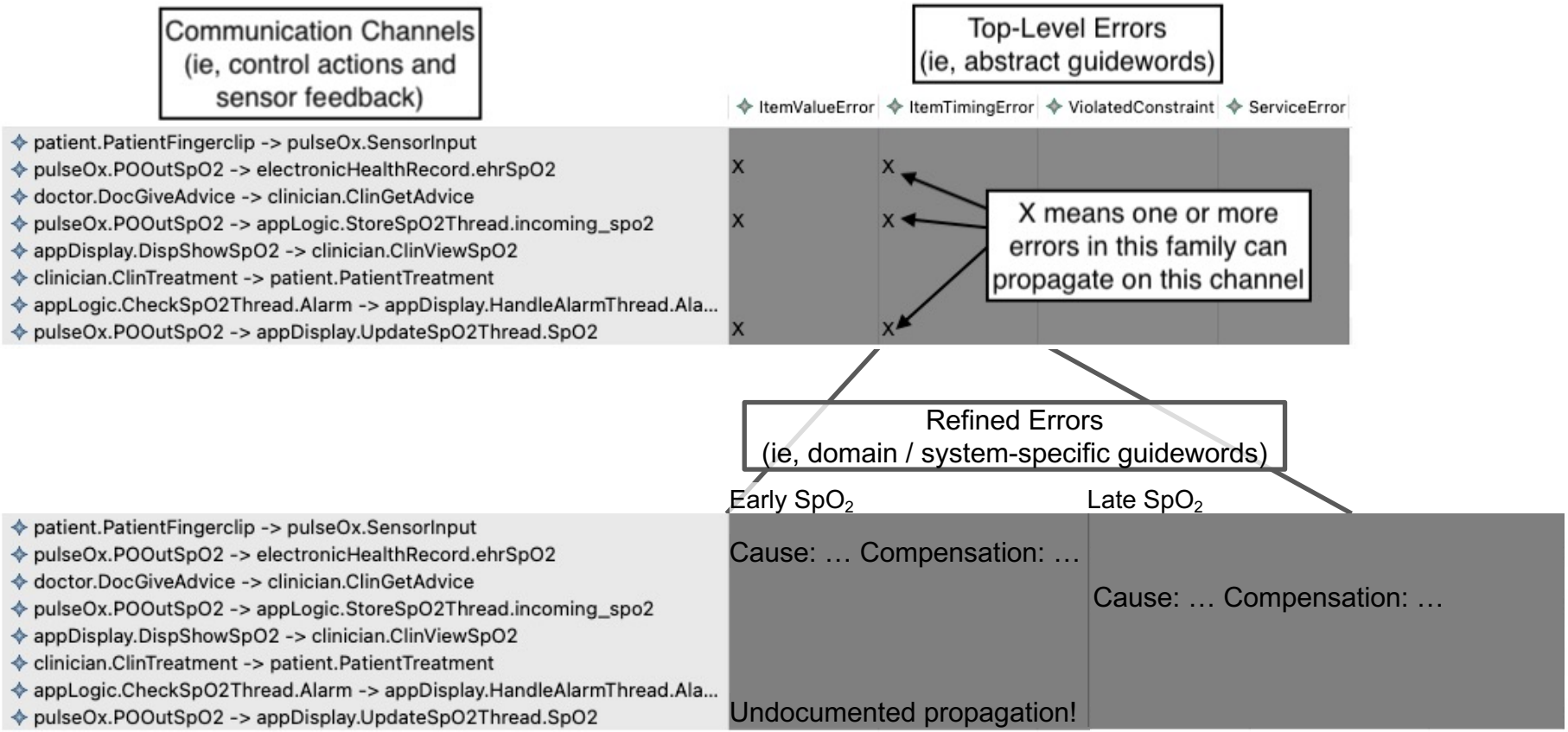

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1. Background
2. ASAP: Three Viewpoints
3. **Future Work**

Future Work

1. The “Focus” Action
2. Discovering accident causation