MBSE Three Ways

A Trio of Case Studies to Satisfy Any Appetite

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WHAT DO I NEED TO LEARN?

Models help us collect and organize facts so that we can gain insights from them. It's critical to have a plan for our models to ensure our efforts add value.

WHAT QUESTION AM I TRYING TO ANSWER?

Models, like design, anwer questions. It's imperative to identify the question(s) we need to answer before we begin.

What do I need to get started?

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What do I need to get started?

WHAT PROCESS DO I NEED TO IMPLEMENT?

MBSE represents a set of languages and toolsets. It is vital to have a robust development process identified to guide our deployement of MBSE.

WHO NEEDS TO RECEIVE INFORMATION CONTAINED IN MY MODEL?

As modelers, it is our responsibility to use our models to effectively communicate with our stakeholders. Our models must consider our stakeholders and their needs.

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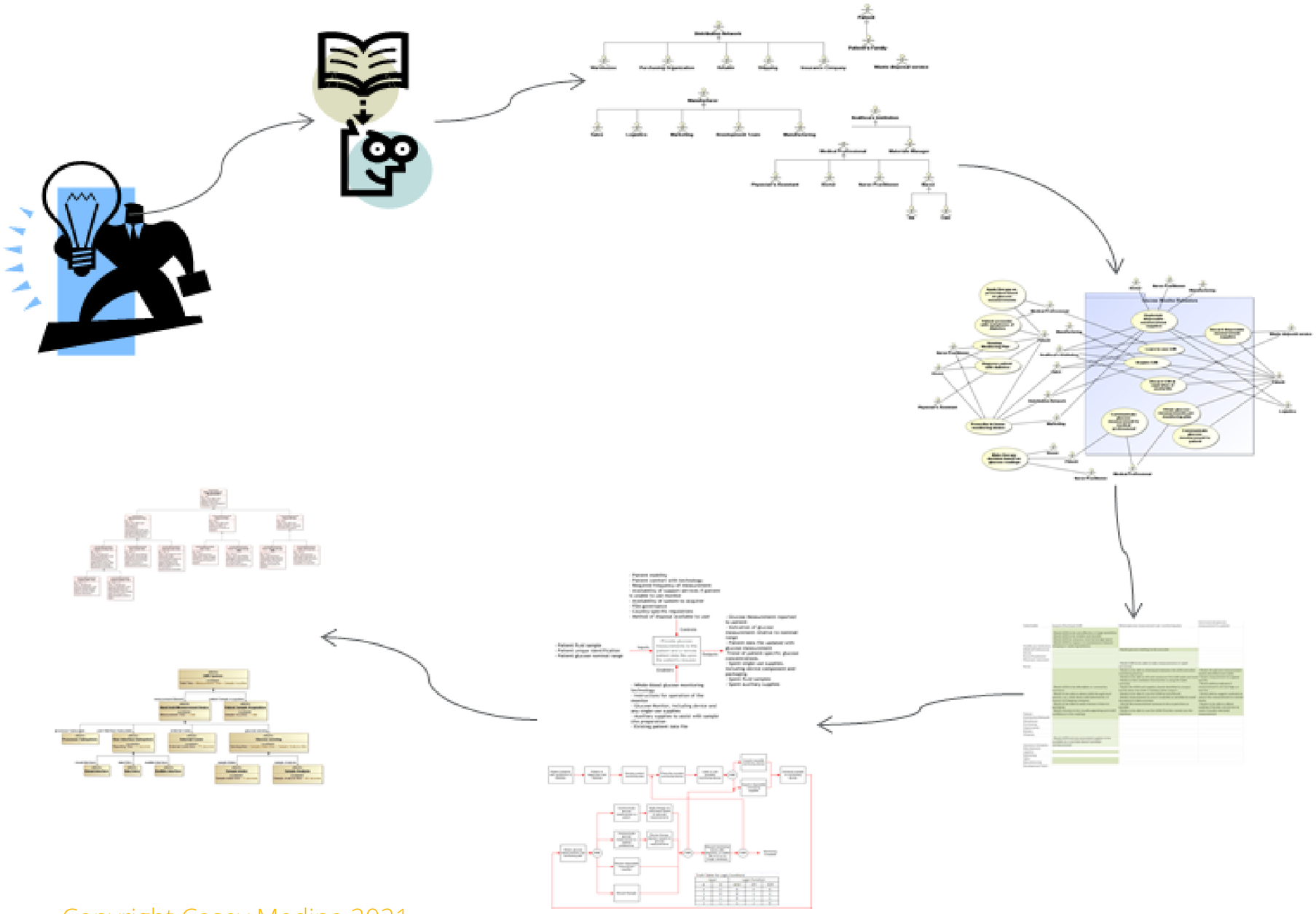
Tell the Story



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Change Management

MBSE ENABLES EFFICIENT, EFFECTIVE CHANGE MANAGEMENT

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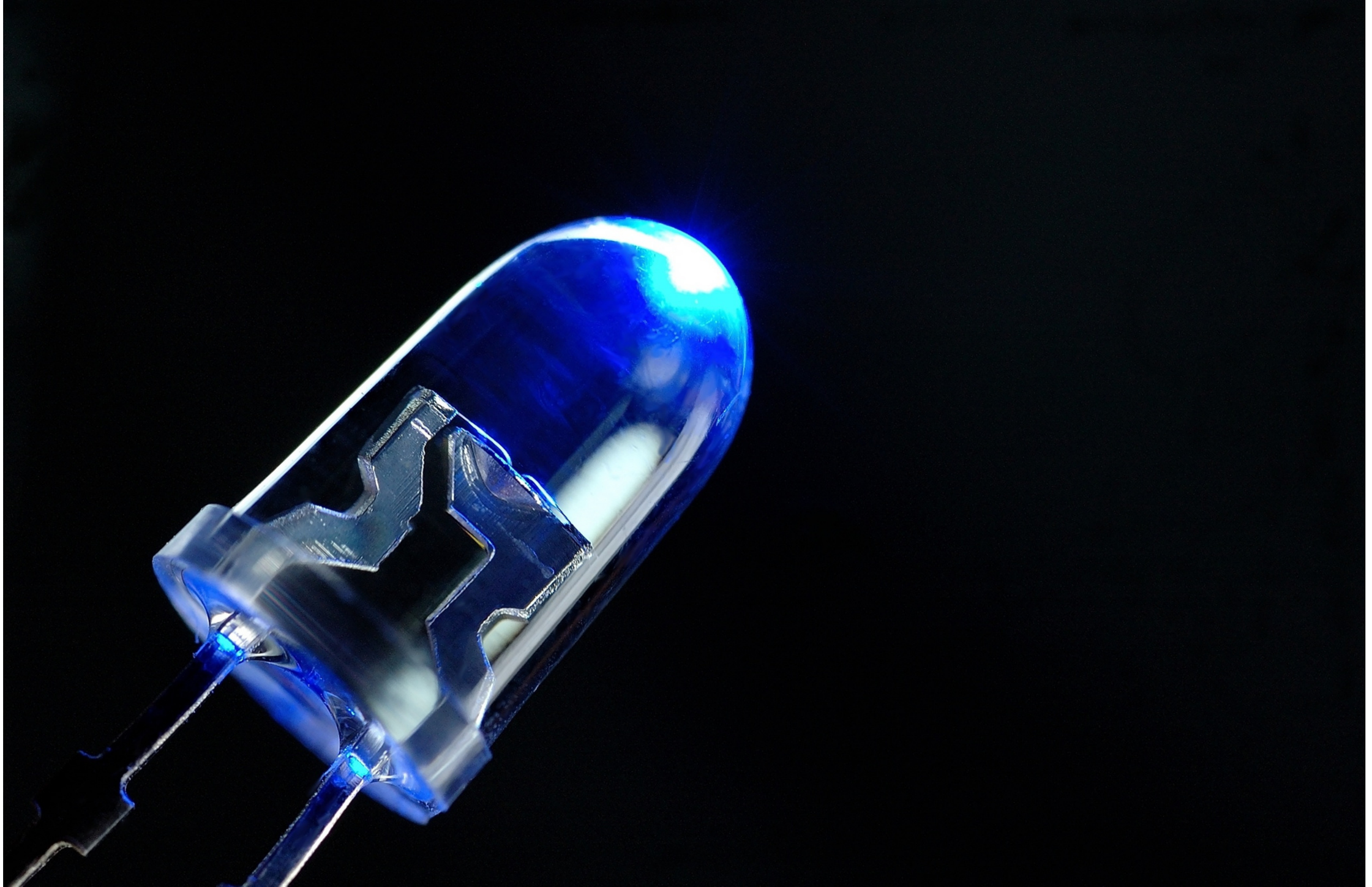

Our Problem:

AN LED IN AN IMAGING SYSTEM HAS GONE OBSOLETE. WE NEED TO FIND A SUITABLE REPLACEMENT

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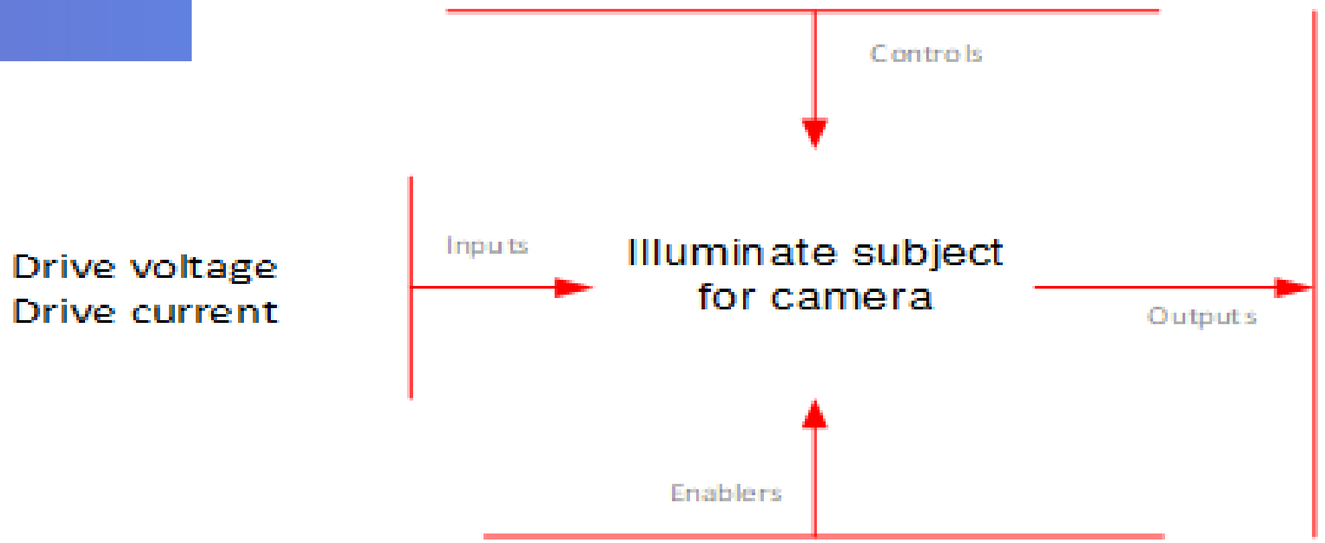
Describe the boundary

- Duty cycle
  - "rise and fall" times dictated by subject speed
- Necessary life of LED
- Camera sensitivity
- Acceptable light levels for camera



Drive voltage
Drive current

- Light output
  - Brightness
  - Beam angle
  - Field angle
  - Color (Wavelength)
  - Color temperature
- Waste heat

- Subject position
- LED expected life

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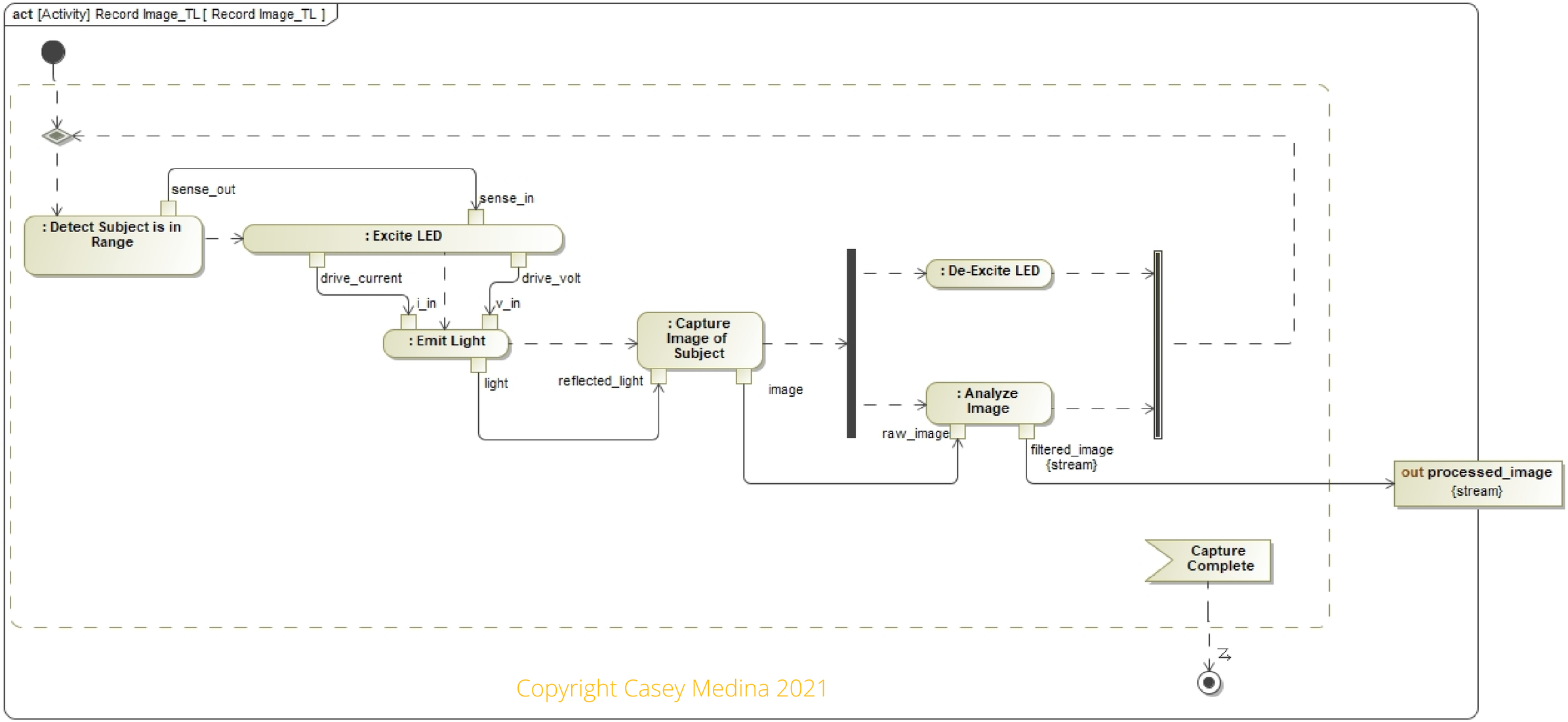
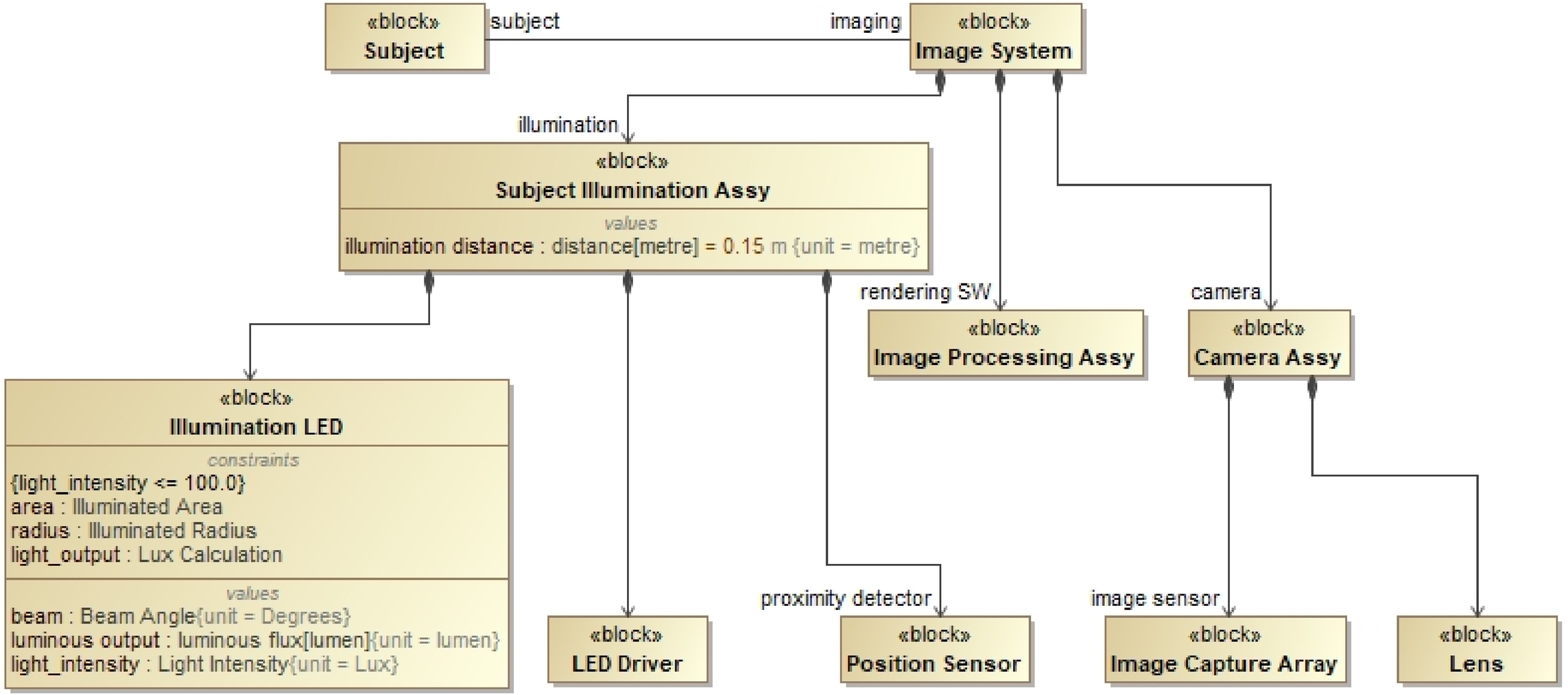
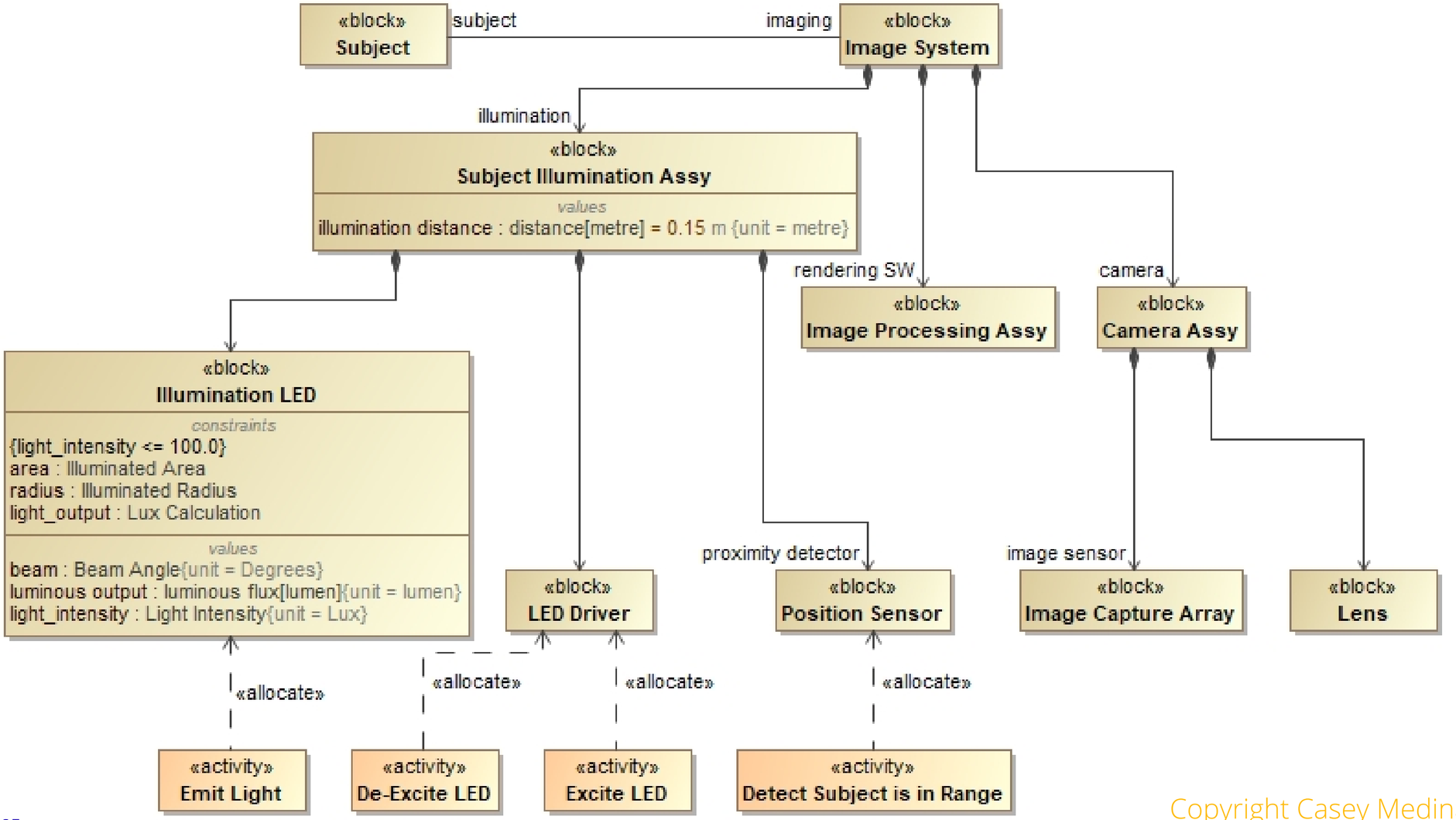
Describe the behavior



Describe the existing structure



Allocate behavior to structure



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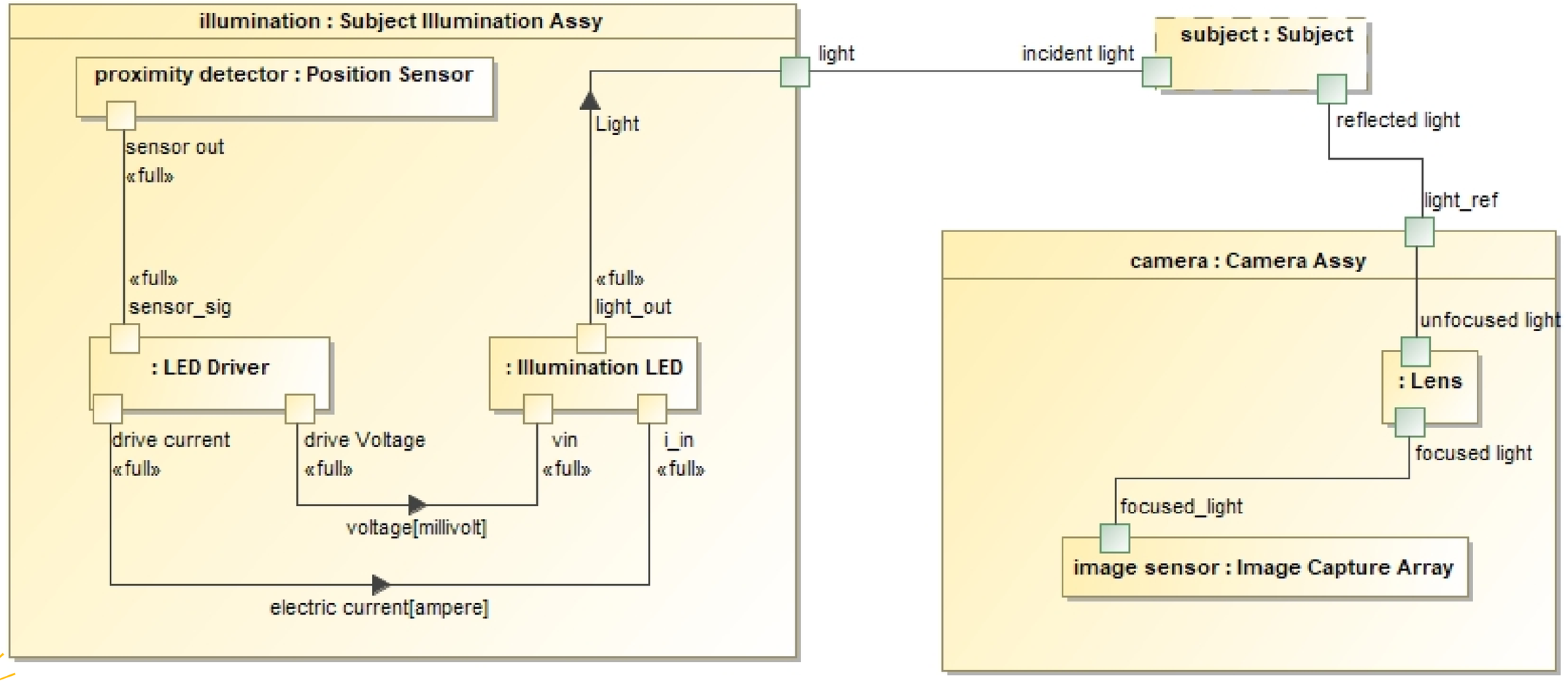
Describe the existing interfaces



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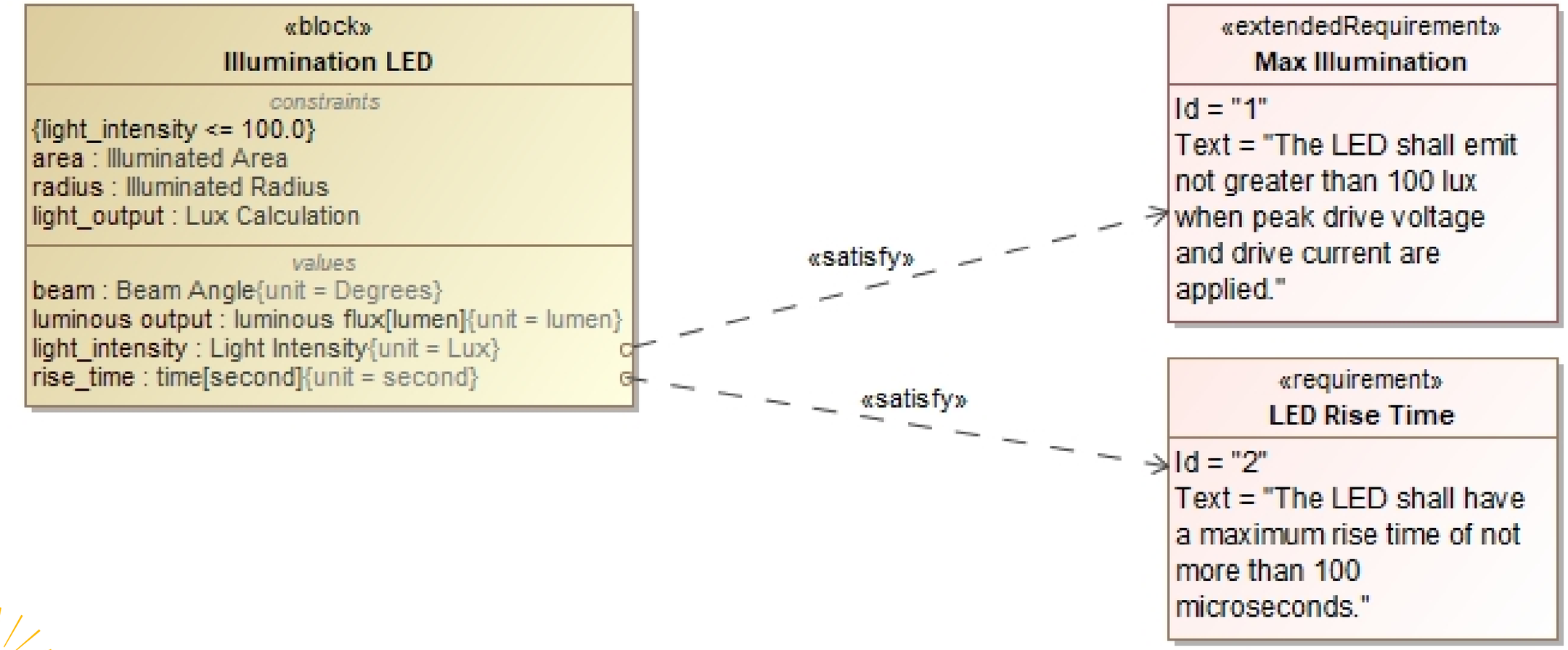
Ensure requirements are captured



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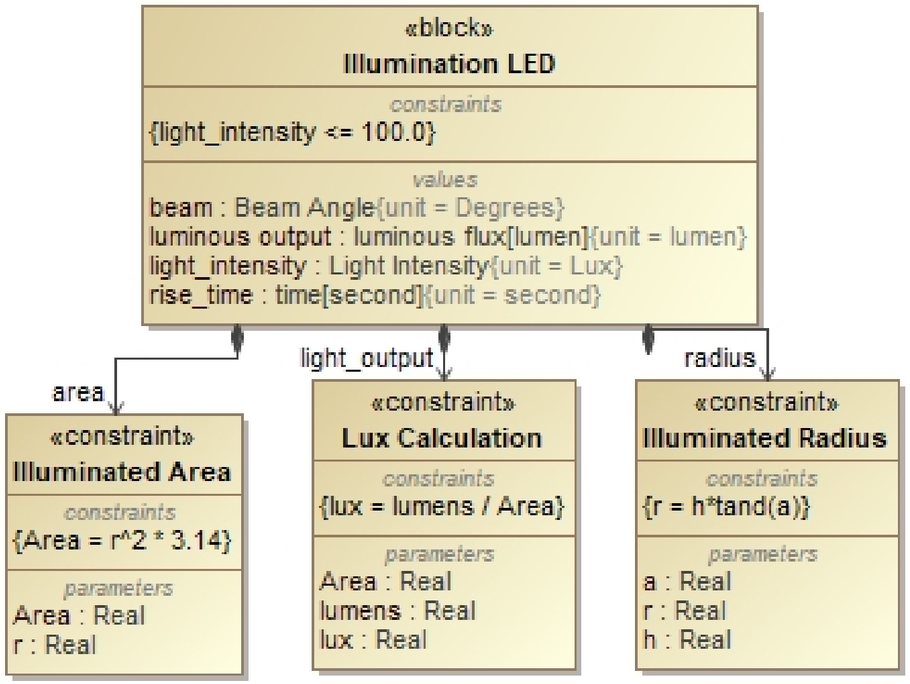
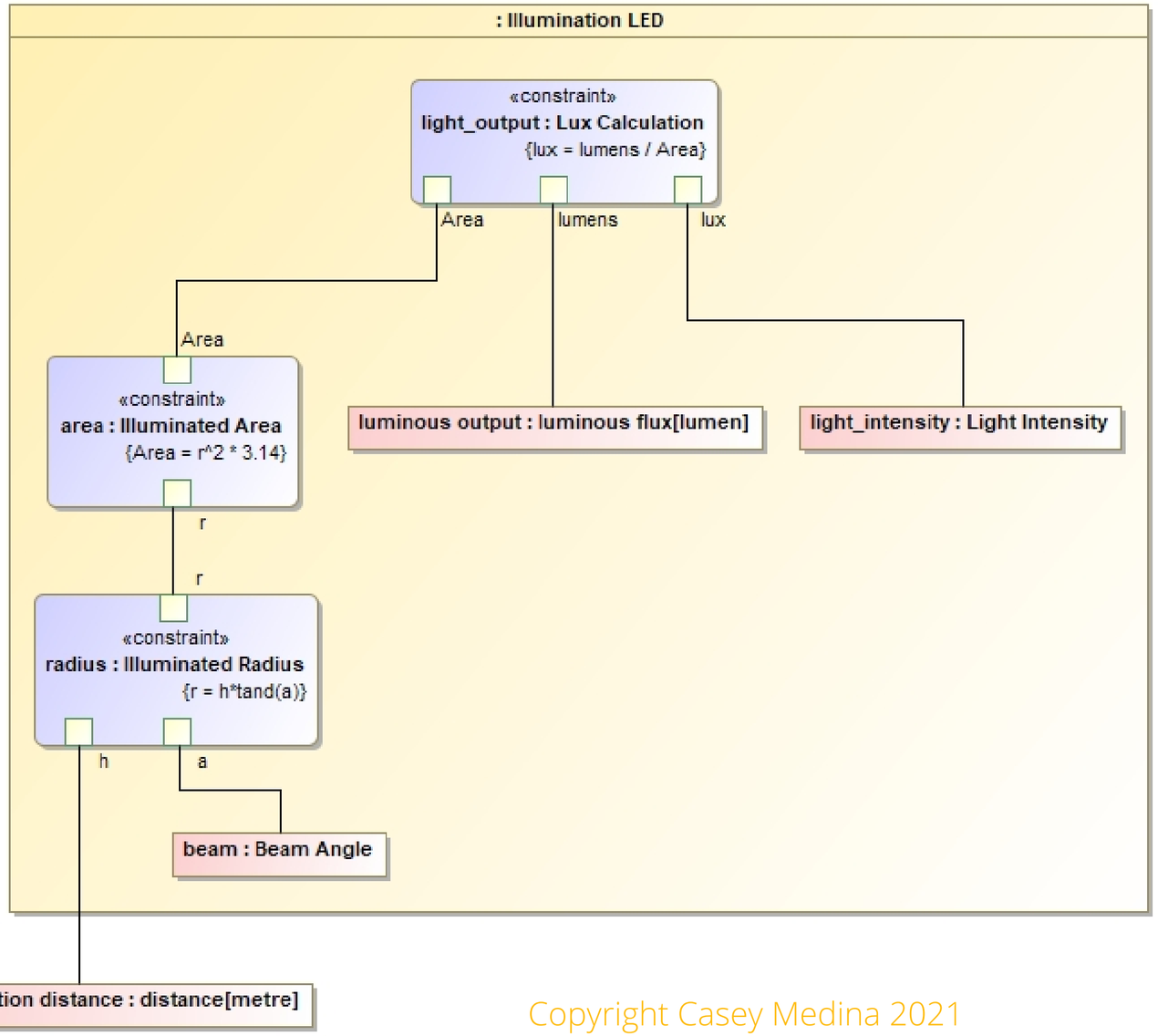
Identify Key Performance Parameters





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Identify and analyze possible alternatives

#	Name	illumination distance : distance[metre]	:Illumination LED.beam : Beam Angle	:Illumination LED.light_intensity : Light Intensity	:Illumination LED.luminous output : luminous flux[lumen]
1	subject Illumination Assy - LED 1	0.1 m	60	31.8471	3
2	subject Illumination Assy - LED 2	0.1 m	50	112.116	5
3	subject Illumination Assy - LED 3	0.1 m	50	89.6928	4

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MBSE and Process Design:

DEVELOP A COMPLIANT USABILITY DESIGN PROCESS

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functionality
design
Usability
simplicity
engaging

Our Challenge:

DEVELOP A COMPLIANT USABILITY ENGINEERING PROCESS FOR MEDICAL DEVICES

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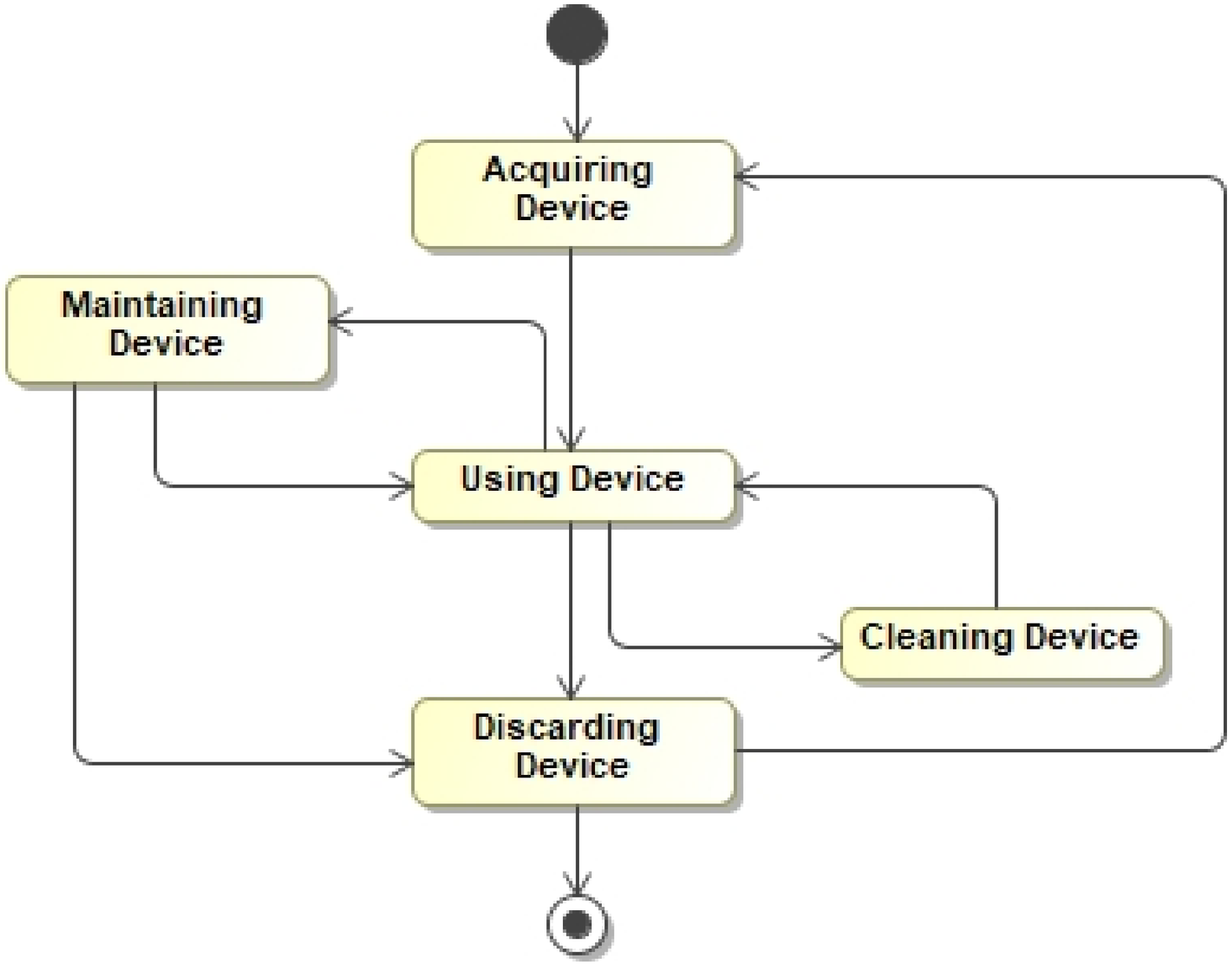
What is the lifecycle of a medical device?



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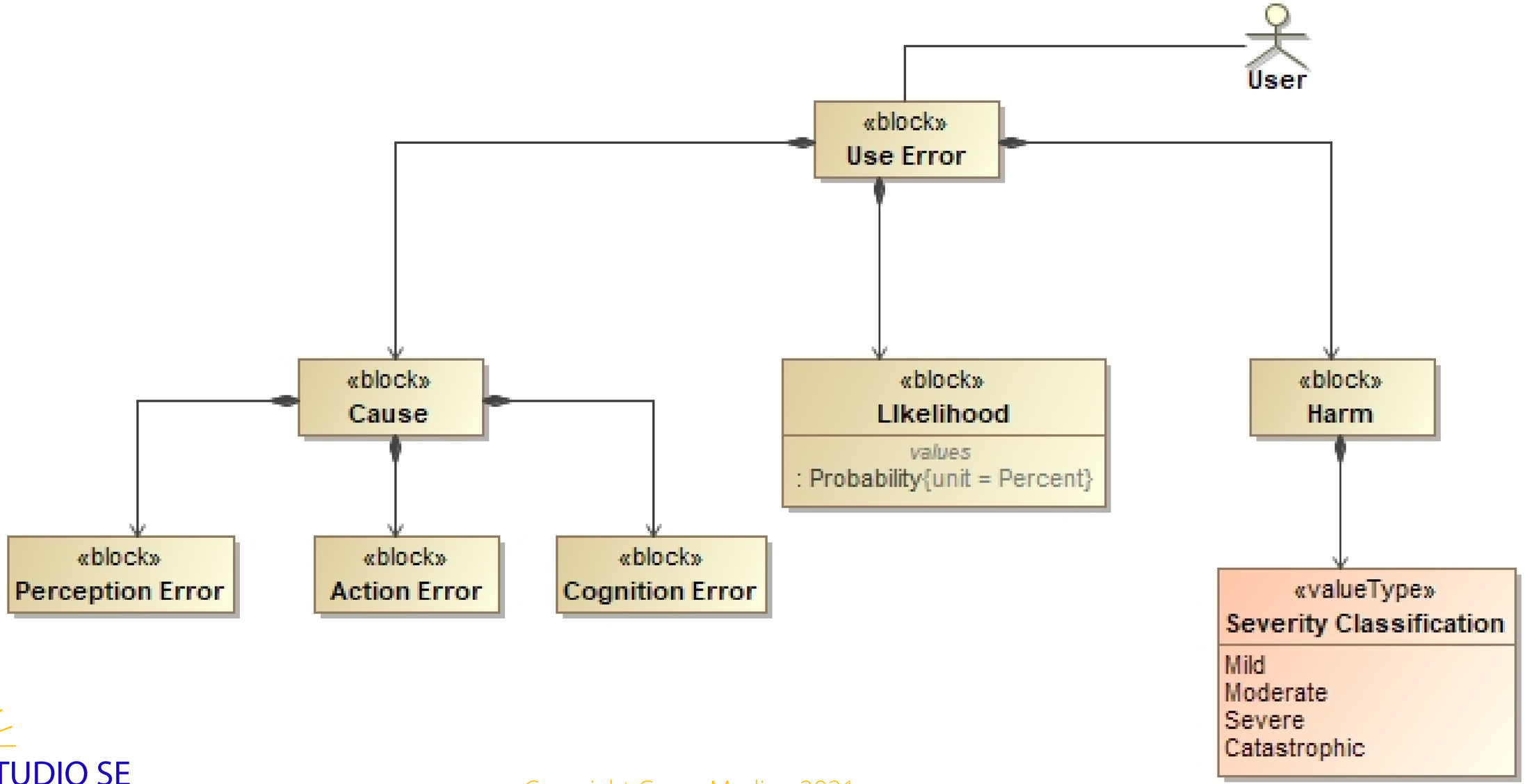
What is a use error?



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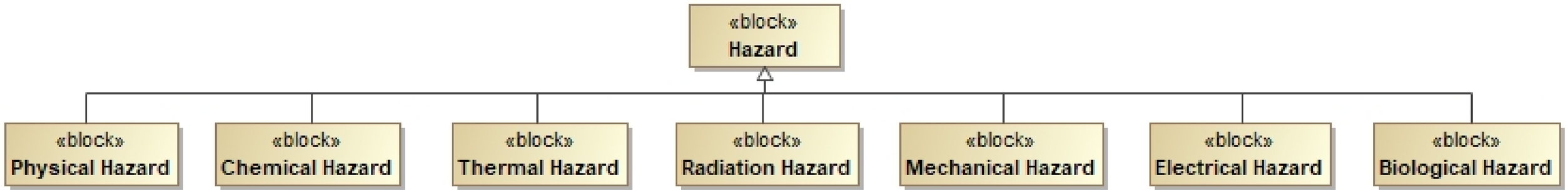
Use errors expose hazards



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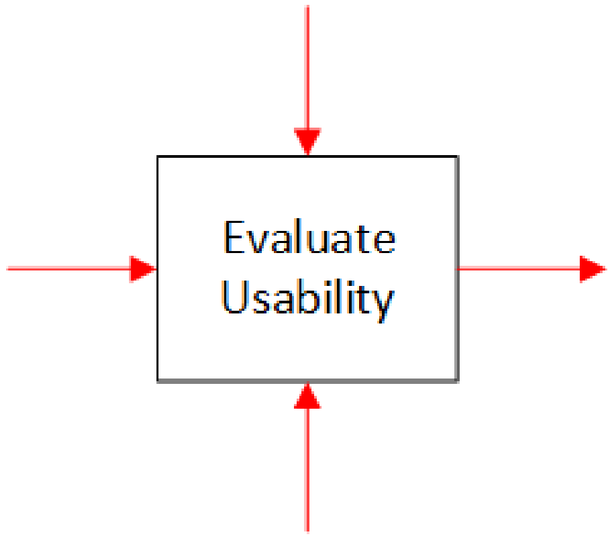
Describe the boundary

- Regulations
- Regional/cultural nuances
- Experience of Expert reviewers/users
- Maturity of design/prototype

- User Types
- User Characteristics
- Use Environments
- Environmental Characteristics
- Task List
- Interface Design/Prototype



- Evaluation Results
- Evaluated design changes (improved interface)
- Usability Risks and mitigations
- Usability Report
- Validation Evidence
- Finalized UI design

- Usability evaluation tools/ methods
- Human Factors Standards
- Expert Users
- Usability Engineering Process

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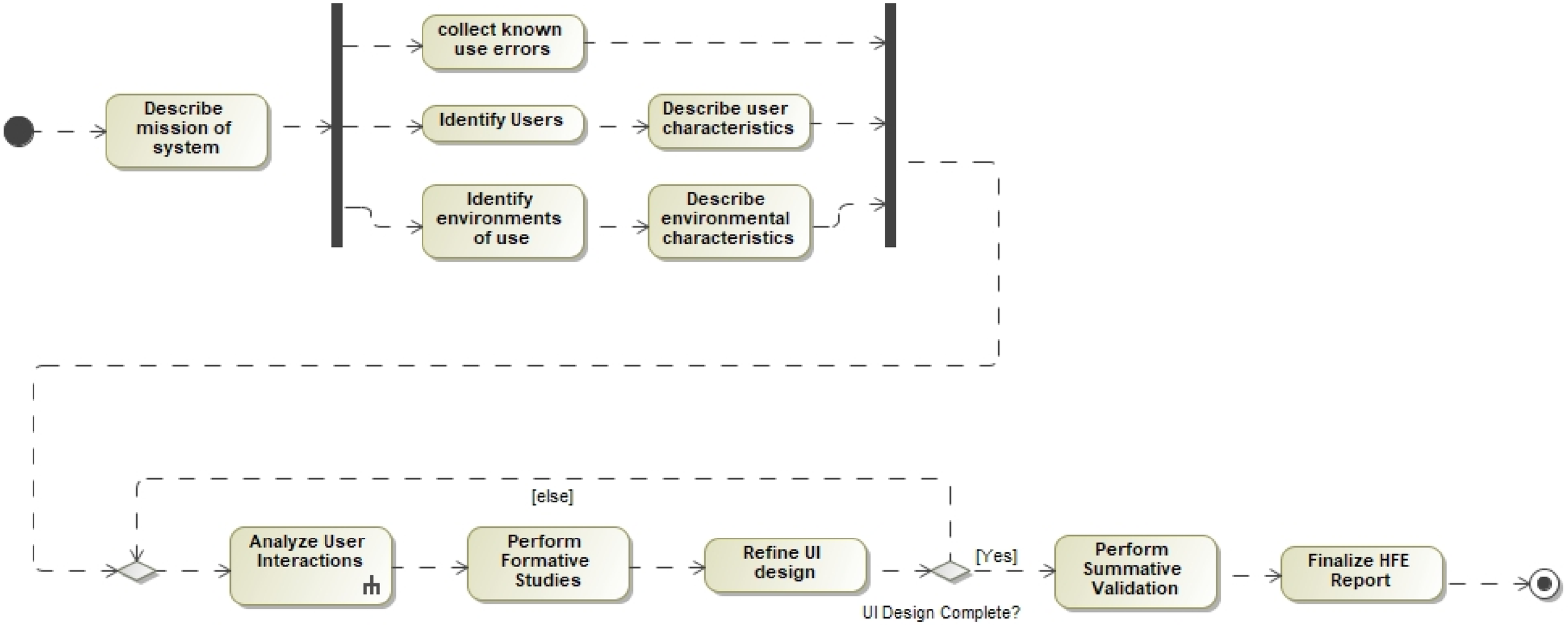
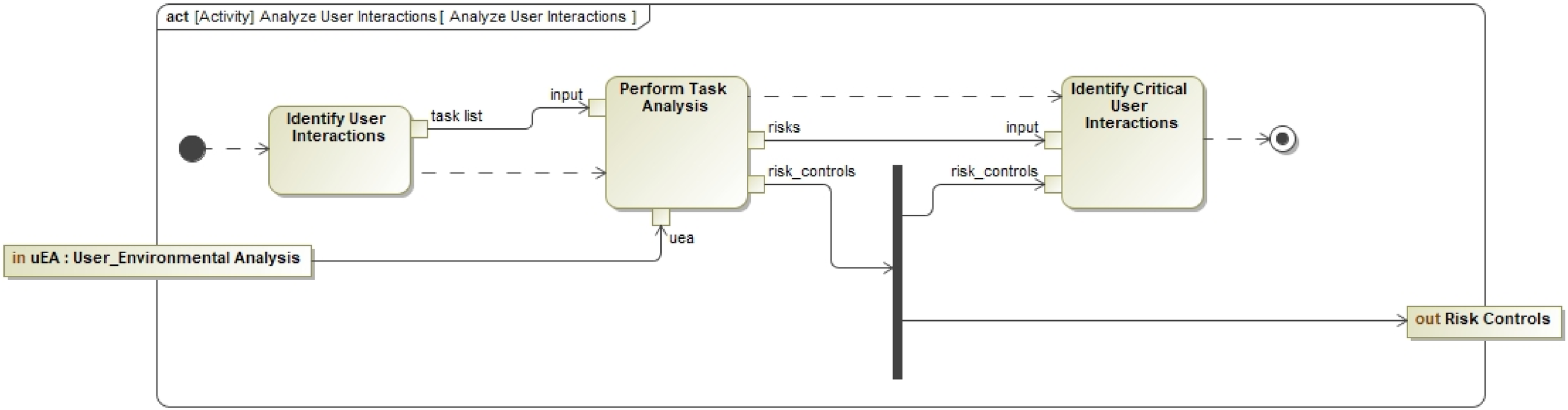
Identify the process steps



Identify information flow



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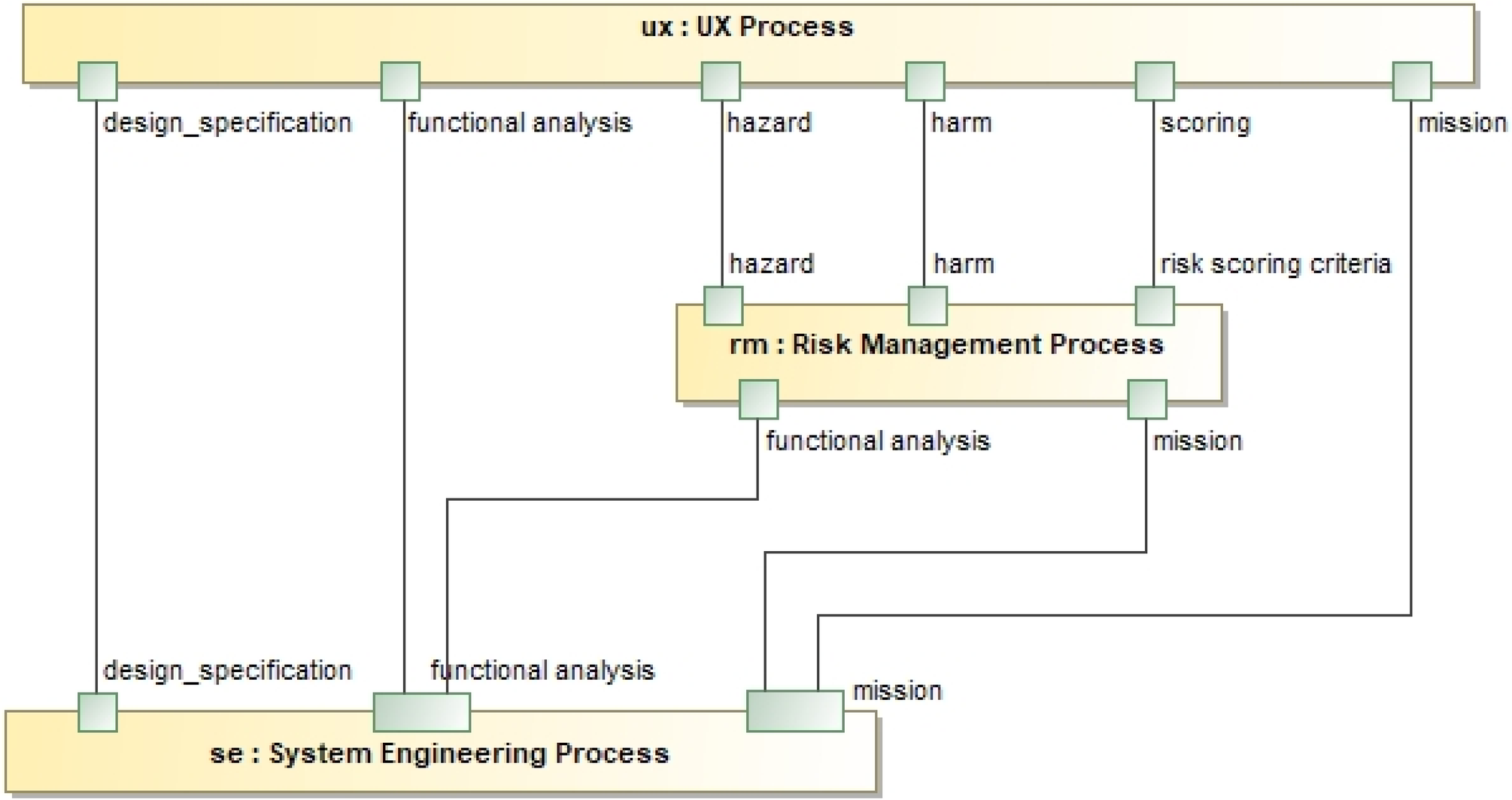
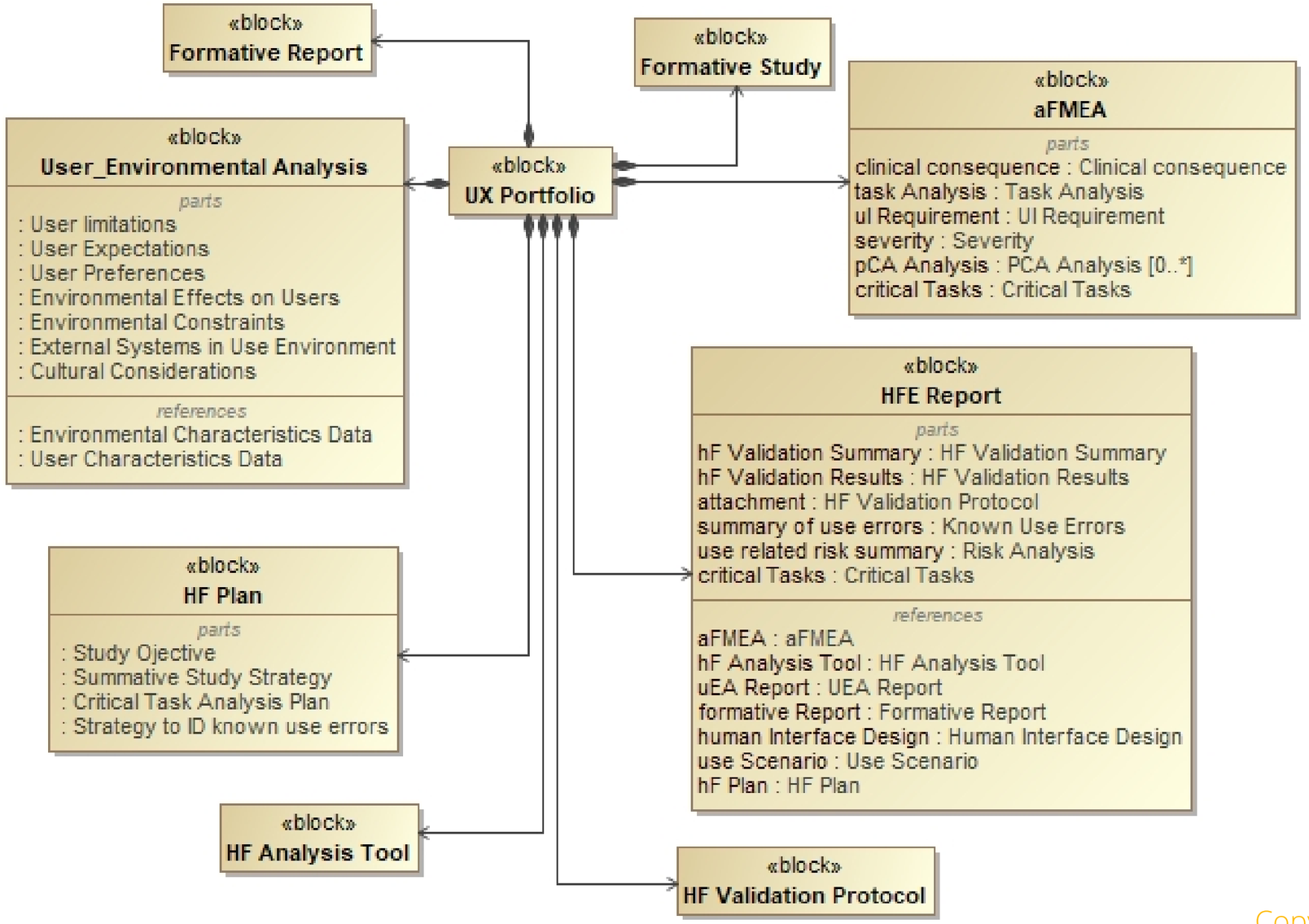
Identify interfaces to other processes



Identify necessary documents



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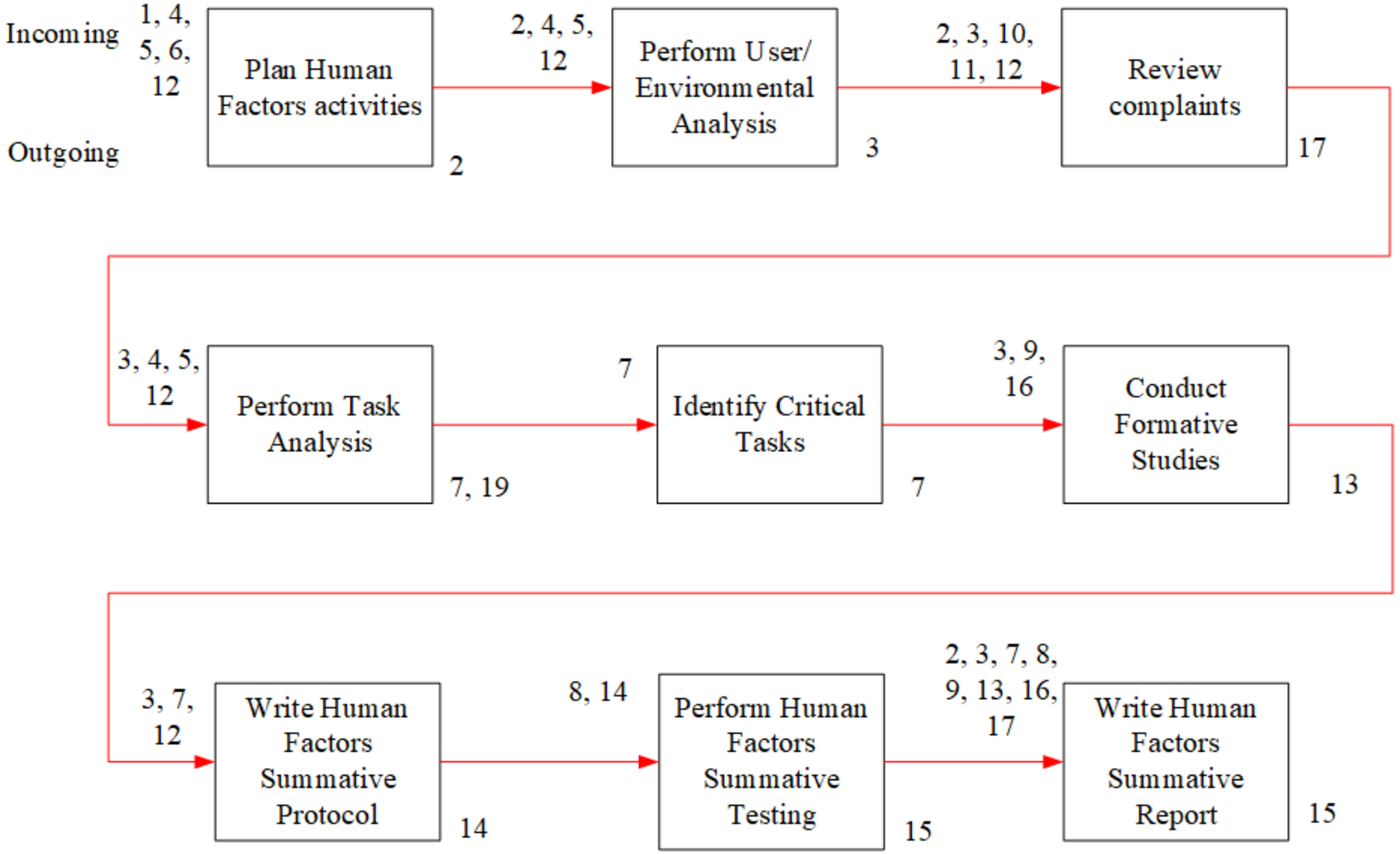
Translate into SOPs using vernacular



1 Project Design Plan
2 Human Factors Plan
3 User/Environmental Analysis
4 Market Research
5 Stakeholder Research
6 Design Validation Plan
7 Human Factors Task Analysis
8 Production-Equivalent Prototype
9 Engineering Prototype
10 MDRs
11 SQS Complaint Database
12 Intended Use Statement
13 HF Formative Evaluation
14 HF Summative Protocol
15 HF Summative Report
16 Labeling
17 Complaint Summary
18 Risk Mitigations

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MBSE and Social Systems:

CHARACTERIZING HOMELESSNESS TO IMPROVE SUPPORT SERVICE EFFECTIVENESS

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Seeking
Human
Kindness

Our Challenge:

IMPROVE THE ABILITY OF SUPPORT ORGANIZATIONS TO PROVIDE ASSISTANCE TO INDIVIDUALS EXPERIENCING HOMELESSNESS

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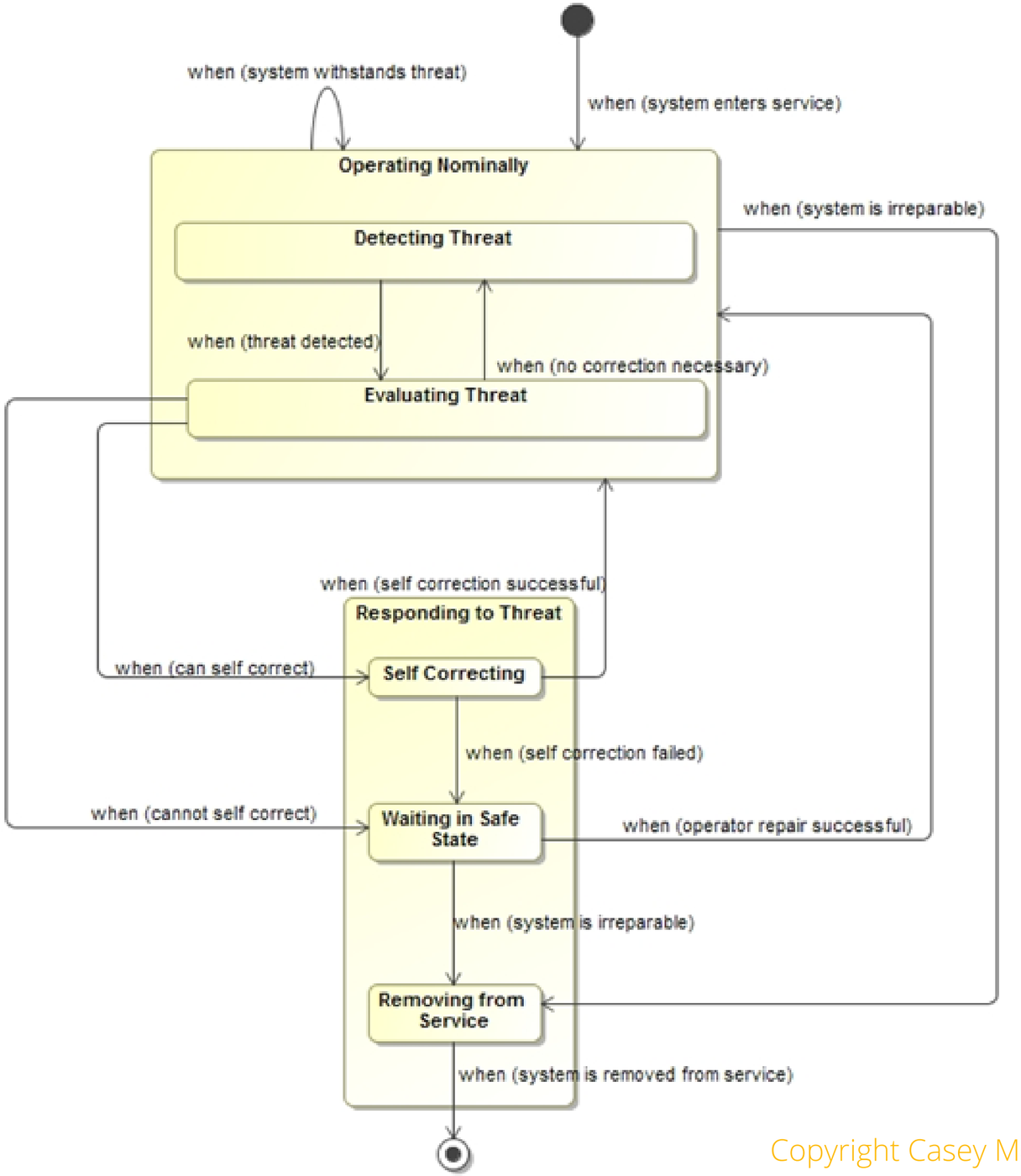

Let's first examine System Resiliency

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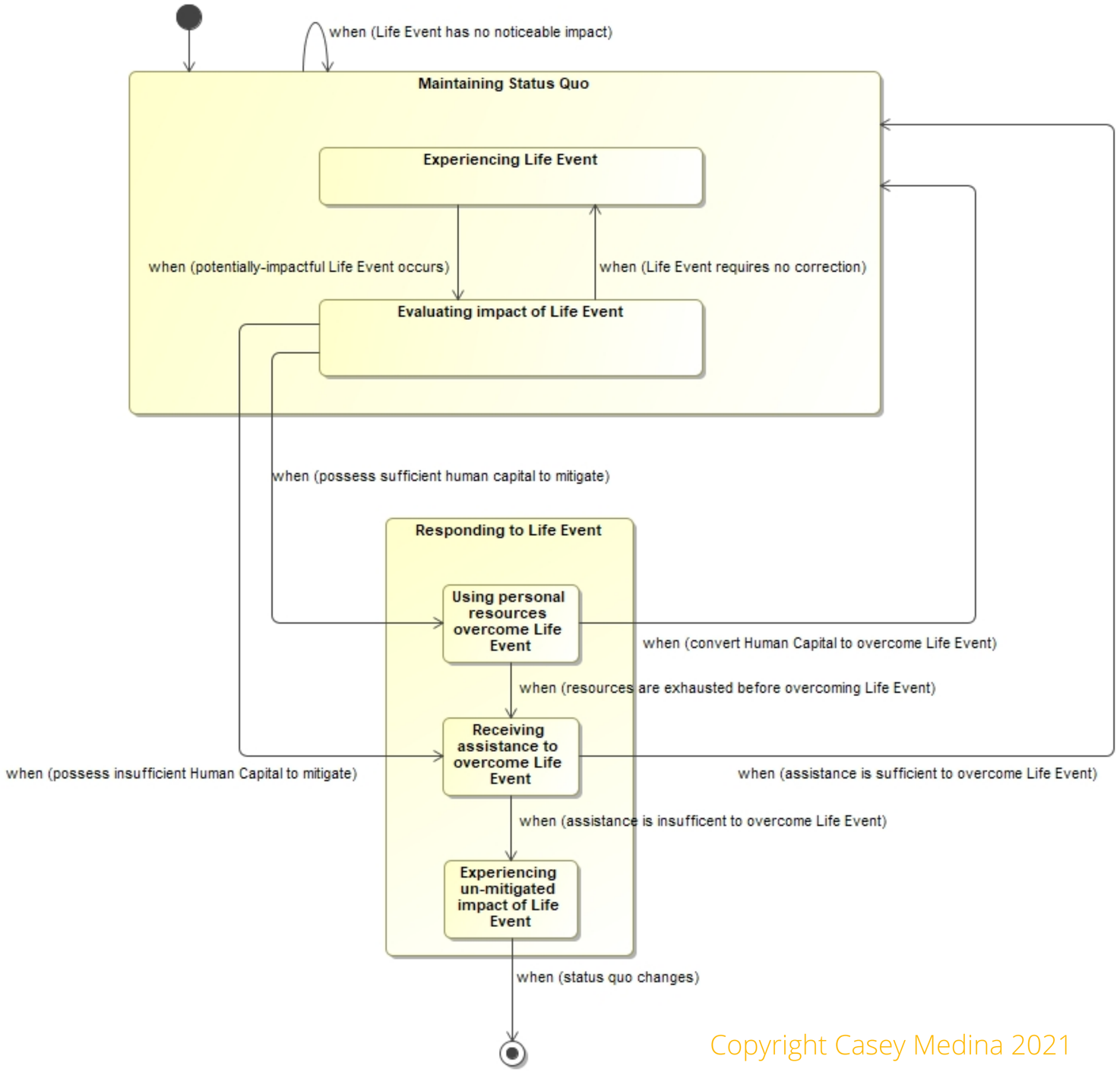

Next, we can apply it to the human experience

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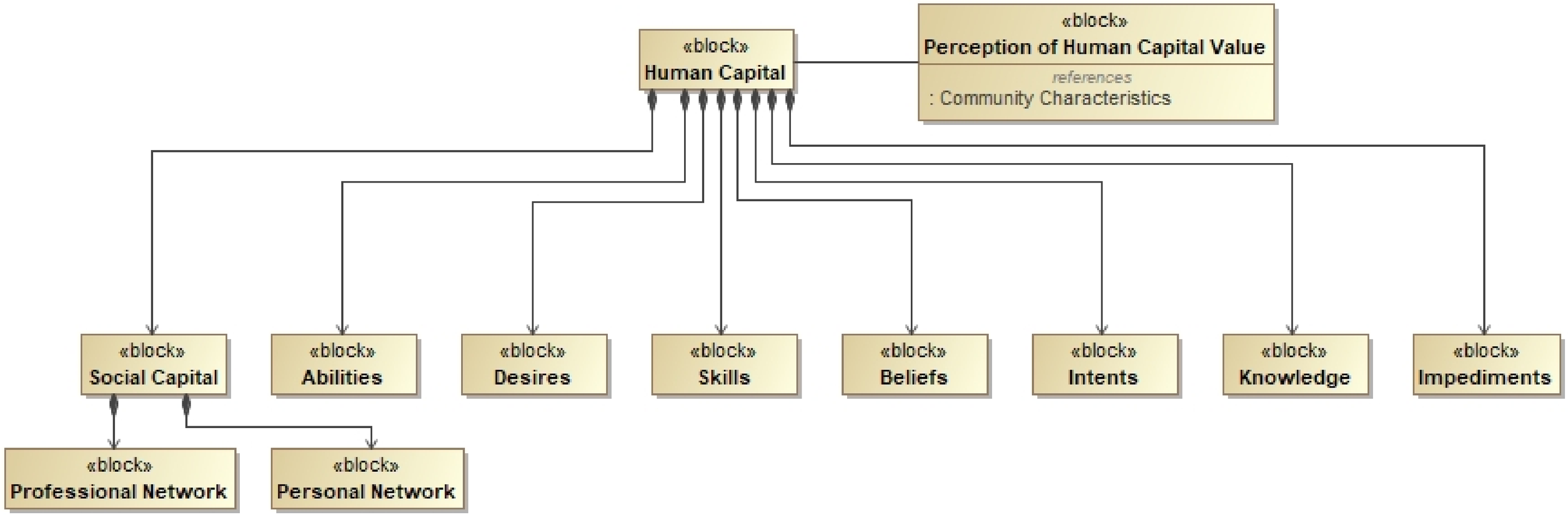
What is Human Capital?



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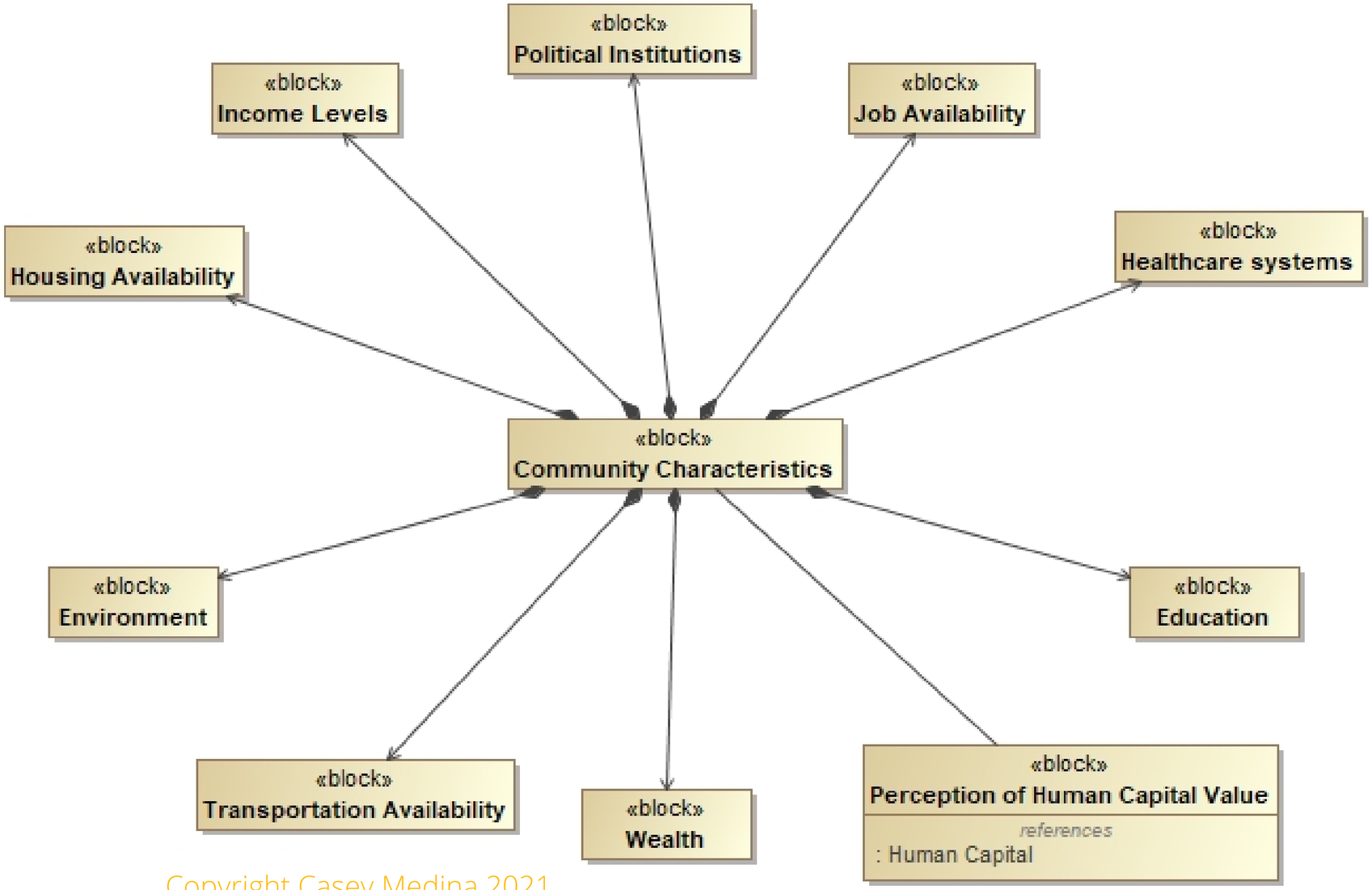
What determines the value of Human Capital?



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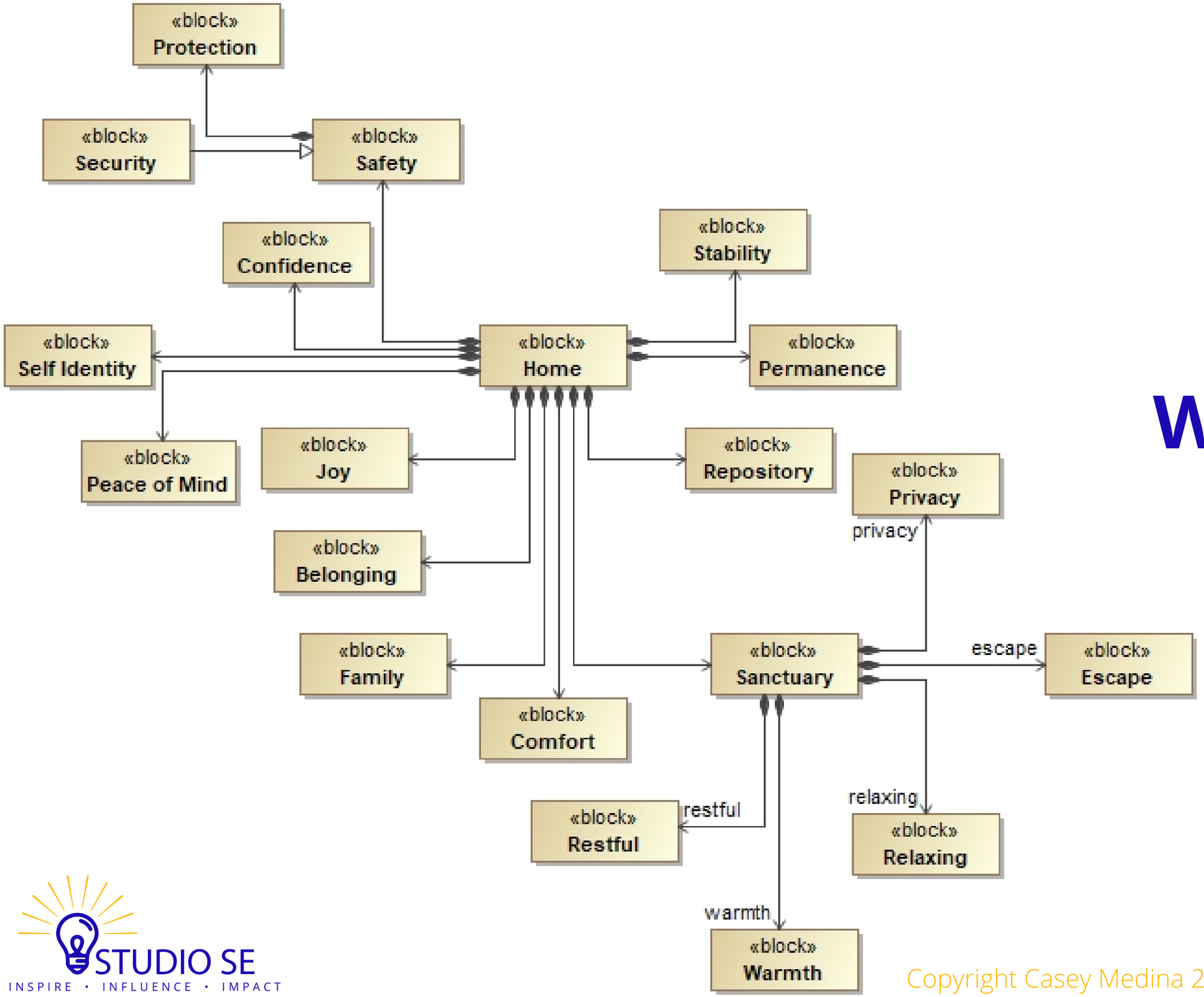

What is "Home?"

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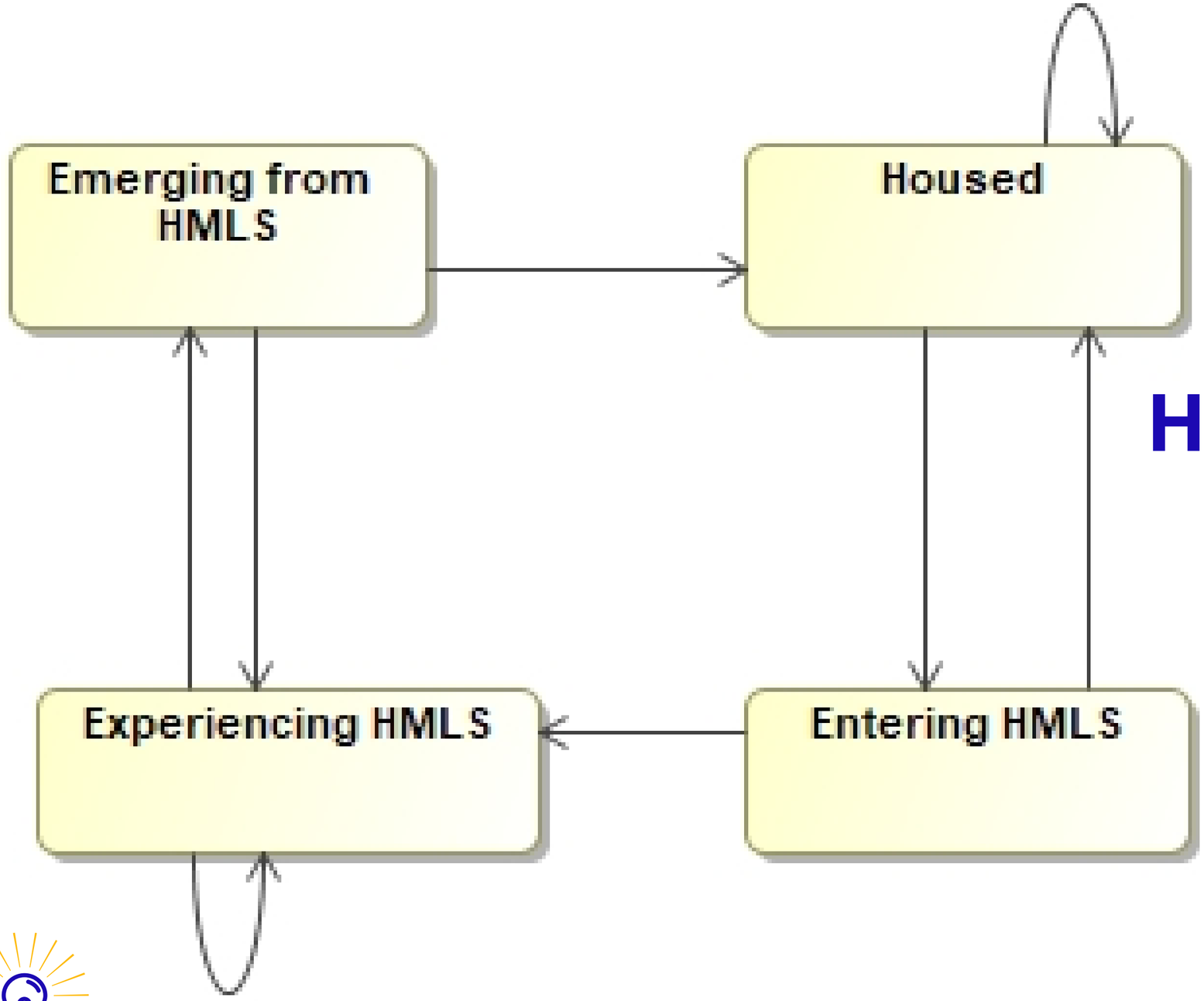

Experiencing Homelessness is a possible state of "being"

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APPLYING OUR ANALYSIS

How does this help?

We can use our understanding of the states of being housed and our analyses of home and human capital to help support organizations tailor the services to maximize their impact.

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Support services can be classified using our model

SOME SERVICES TARGET TRANSITIONS - EITHER ENCOURAGING POSITIVE OUTCOMES OR PREVENTING NEGATIVE OUTCOMES

OTHER SERVICES PROVIDE SUSTAINMENT SUPPORT FOR INDIVIDUALS. THESE SERVICES DON'T DIRECTLY IMPACT POSITIVE TRANSITIONS

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The analysis guides how services are delivered

SERVICE PROVIDERS BENEFIT FROM UNDERSTANDING HUMAN RESILIENCE

DETERMINING THE CATEGORY OF SERVICE FOCUSES IMPLEMENTATION

FOCUSED IMPLEMENTATION LEADS TO MORE EFFECTIVE ASSISTANCE

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MBSE gives us a set of tools

MBSE IS MOST USEFUL WHEN COUPLED WITH A ROBUST PROCESS

FOCUS ON BEHAVIOR FIRST

CONSIDER STAKEHOLDERS WHEN COMMUNICATING YOUR WORK

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Questions?

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Tutorial: March 13, 2021

Solving Problems with MBSE

Using SysML to Choose Our Path Forward

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