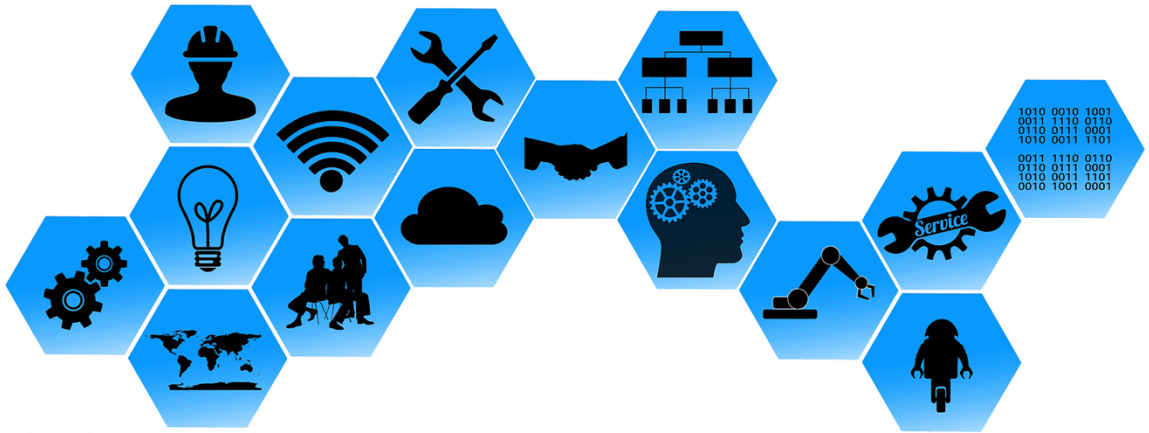
# A Job Centric Approach To Validating Your System Design

“Is there a way for us to know if we are about to develop the right system??”



**Systems engineering** (SE) is a transdisciplinary approach and means to enable the realization of successful systems. Successful systems must ~~satisfy the needs of~~ their customers, users and other stakeholders.

delight

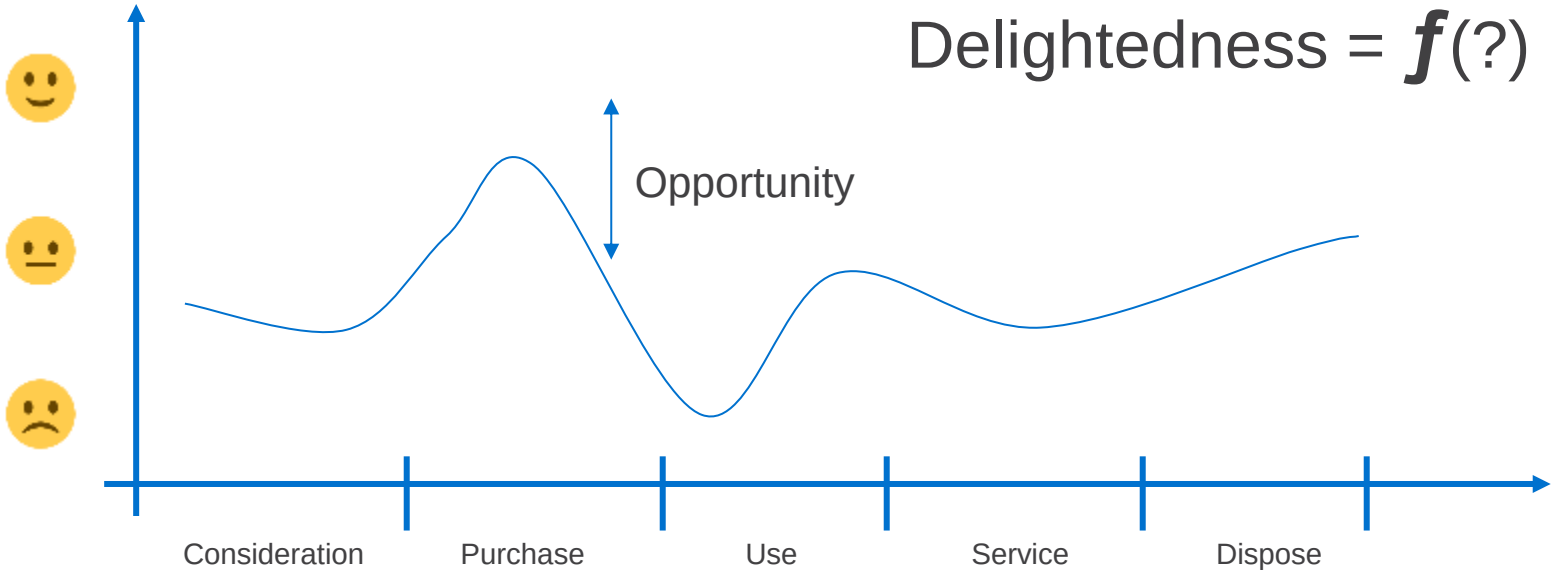
# Problem Statement

“How do we know that a proposed design will be appreciated by the stakeholders? Will we be winning in the marketplace?”

“We passed system verification, is that a guarantee for success?”

“What if we knew the metrics the stakeholders are using to measure value/success?!”

# Journey Maps



# Are Mature Systems Fully Optimized?

minimize the probability
of filling the wrong fuel

## Design A


## Design B

# Recognizing Where Value Is Generated

HERE

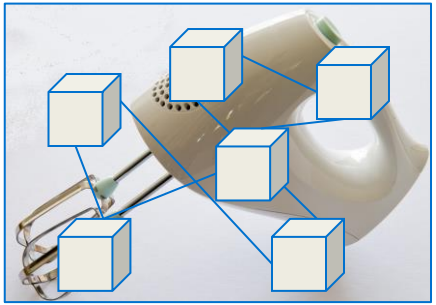
## System context

- Where value is created and measured
- Collaborative!

## System (black box)

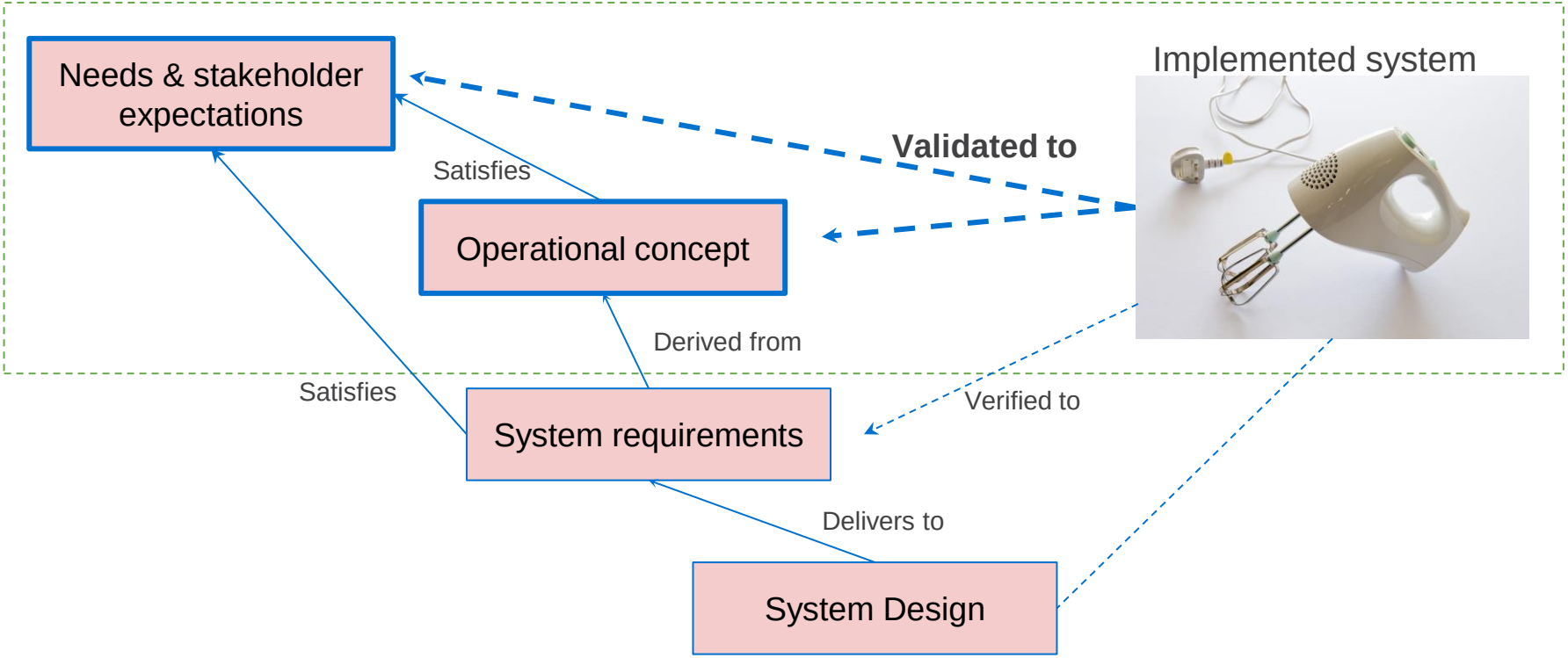
- Emerging functions/behavior/ properties

## System (white box)

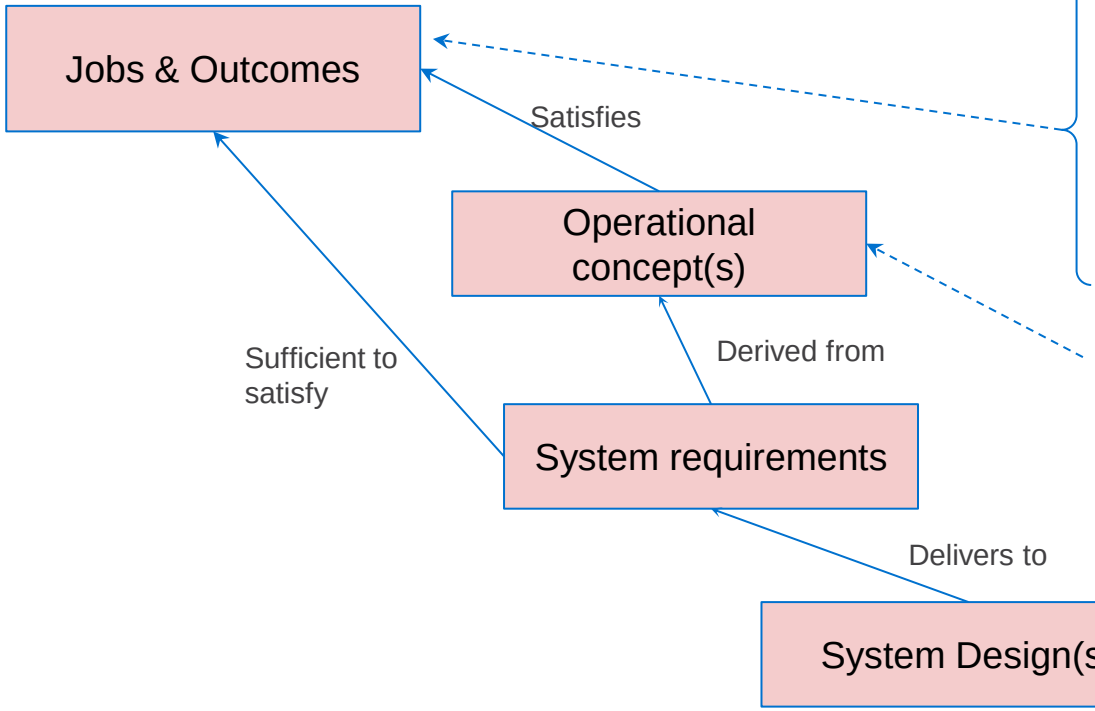


- Part performance
- Interactions

# Let’s Break It Down…Into Boxes



# Needs Elicitation Technique




- **Define Functional jobs**
  - Closely related to the purpose of the system
- **Define Outcomes**
  - how success is measured throughout the job

**Define operational concept(s)** that delivers to Need and Outcomes (storytelling)

# Needs Elicitation Technique

Jobs & Outcomes

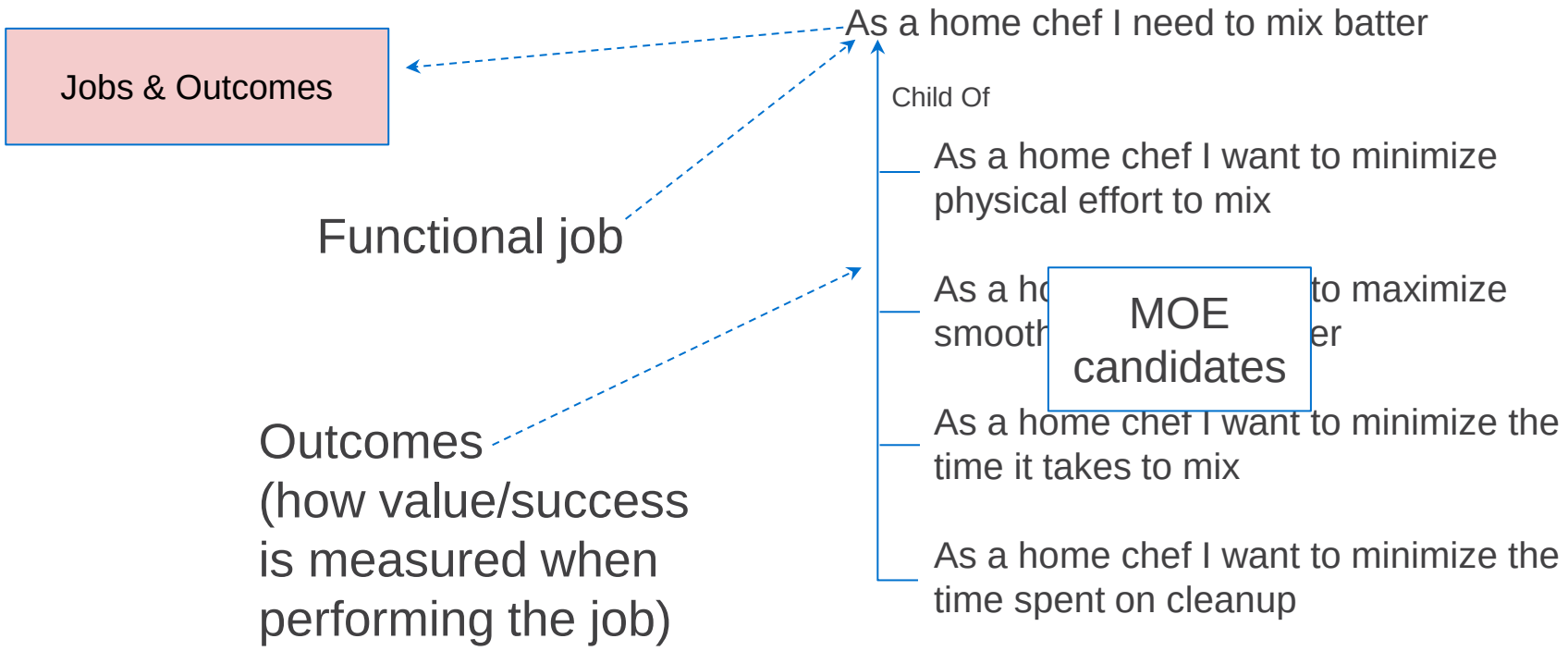
-**Functional job**: Mix batter

Transformed to a Need statement:
*As a family member I need to mix batter so that I can make pancakes*

-**Outcomes, how value is measured**
How is the stakeholder consciously or unconsciously measuring success throughout the job?

Think minimize or maximize something:
*minimize physical effort*
Need statement:
*As a family member I want to minimize physical effort of mixing batter*

# Needs Elicitation Technique



# Needs Elicitation Technique

Jobs & Outcomes

As a home chef I need to mix batter

Child Of

- As a home chef I want to minimize physical effort to mix
- As a home chef I want to minimize the time it takes to mix
- As a home chef I want to minimize the time spent on preparing/cleanup

Delightedness = $f$(?)

Value = $f$(vm1…vmN)

Concept A

Concept B

# Comparing Concepts

| | Concept A | Concept B |
|---|---|---|
| |  |  |
| As a home chef I want to minimize physical effort to mix | 🙂 | ☹️ |
| As a home chef I want to maximize smoothness of the batter | 🙂 | ☹️ |
| As a home chef I want to minimize the time it takes to mix | 🙂 | ☹️ |
| As a home chef I want to minimize the time spent on preparing/cleanup | ☹️ | 🙂 |

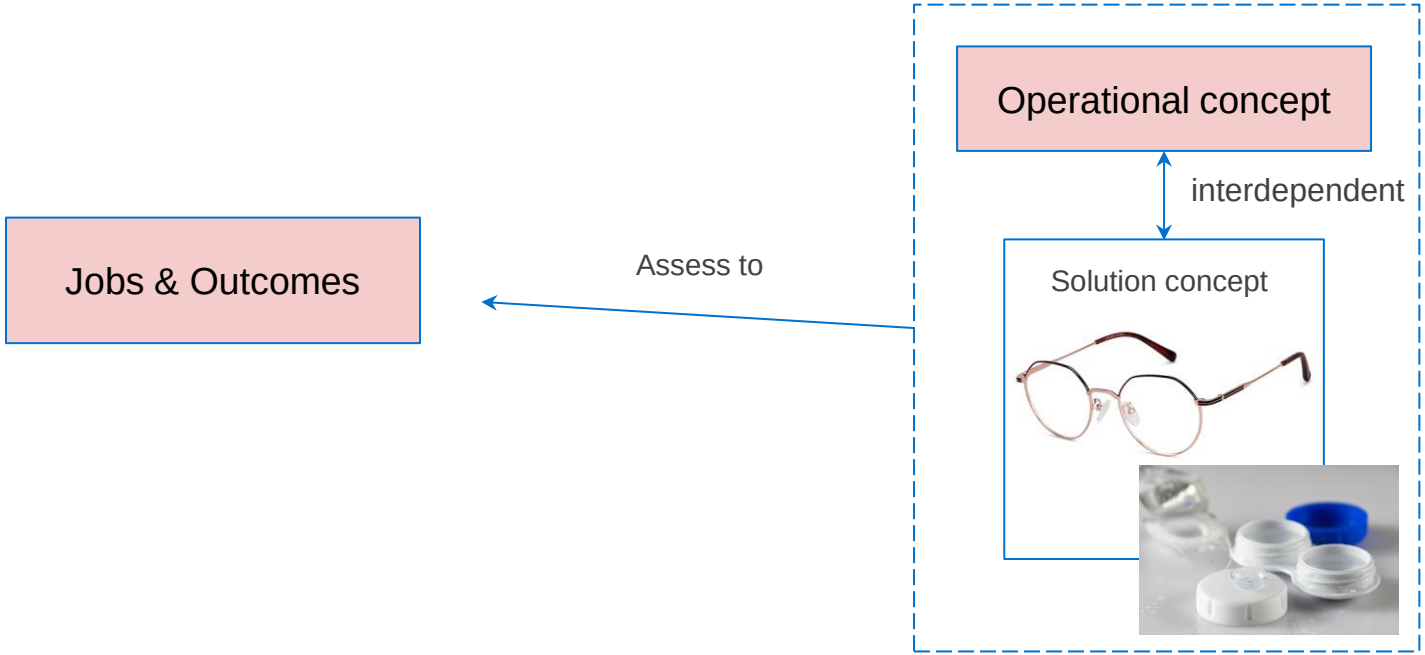
# Comparing Concepts

| | Your new product | Competitor |
|---|---|---|
| |  |  |
| As a home chef I want to minimize physical effort to mix | 🙂 | ☹️ |
| As a home chef I want to maximize smoothness of the batter | 🙂 | ☹️ |
| As a home chef I want to minimize the time it takes to mix | 🙂 | ☹️ |
| As a home chef I want to minimize the time spent on preparing/cleanup | 😐 | 😐 |

# How to discover outcomes?

- Tacit knowledge - Many are already known
- Interviews - “Walk the job” with users
- Survey/Interview to understand which outcomes that are underserved
- Survey/Interview to understand the importance of each outcome

# Assessing Delivered Value

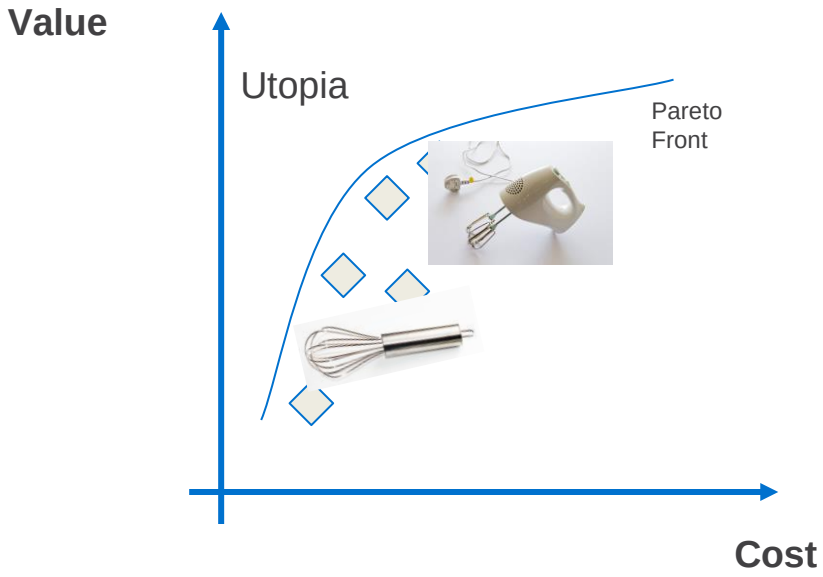


# Comparing Concepts - Pugh matrix

| | | |
|---|---|---|
| minimize physical effort to mix | | + |
| maximize smoothness of the batter | | + |
| minimize the time it takes to mix | | + |
| minimize the time spent on preparing/cleanup | | - |
| Cost | | - |

You can visualize things like:
-When one concept is completely dominated by another
-When a proposed new design benefit some metric but makes other metrics worse
-We are not moving the needle on any of the value metrics

# Trade Space Analysis - Gold Standard




Solution Concept

vm = value metric

**Value = $f$(vm1, vm2… vmN)**

# Supporting Ideas

# User Value metrics vs System performance

Job:
Backing out

User value metric:

As a driver I want to **minimize the time I need to wait** for the camera before I can start backing out

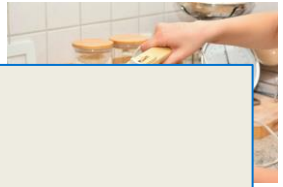
System performance metric:

The car shall **display backup camera video within TARGET seconds** from when input power is supplied

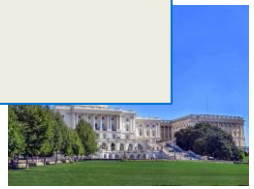
Analysis - Translation

# Systems Thinking Heuristic

“There is no way to know why a system was designed in a certain way by looking inside the boundary of the system”



Which job is someone trying to perform in the different life cycles of the system?

How do they measure success?

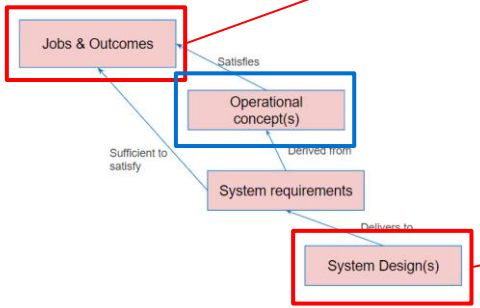
# Example

# Job: Calling someone

Functional need statement:
As an individual I want to make a call so that I can verbally communicate with another person

# Job: Calling someone

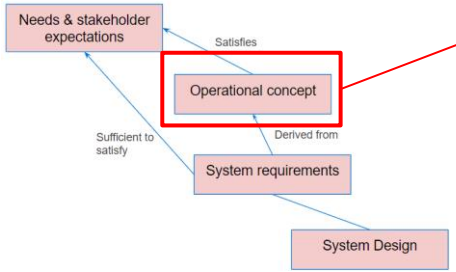
Outcomes:
- Minimize operations
- Minimize time
- Minimize risk of dialing the wrong number




# Describe Jobs Through Storytelling

- Collaborative, you do not need to be an engineer to participate
- Reveals if we know how our system will/should be used
- Aligns the team on how the system will/should be used
- An excellent artifact to validate your design to, can it support the desired stories?
- Describe rainy as well as sunny day scenarios
- Reduces risk when the system is modified
- Use Cases can be extracted by analyzing stories

# Job: Calling someone




Recall or look up the number to call. Lift the phone off the hook, pick the hole corresponding to the number and turn the dial counter clockwise until the stop. Repeat for the remaining numbers

Recall or look up the number to call. Lift the phone off the hook. Press the first number on the keypad. Repeat for the remaining numbers

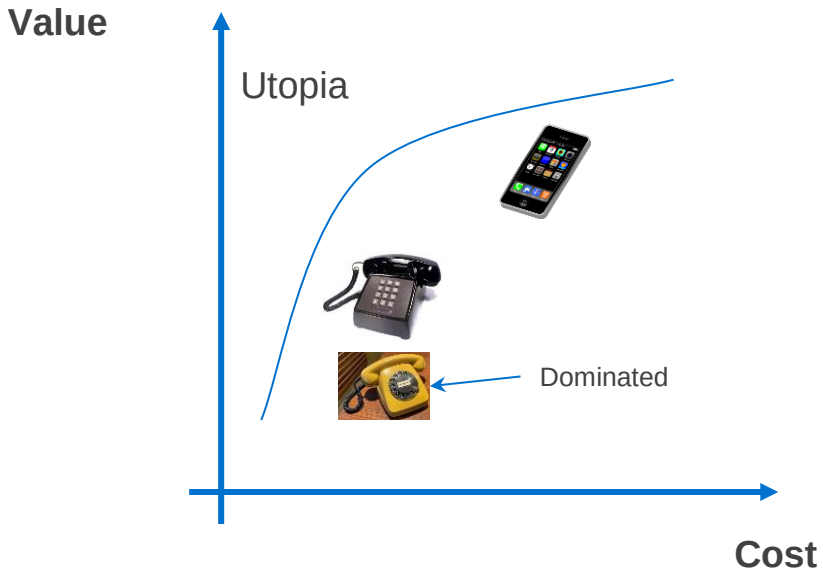
Swipe to unlock phone, tap messages, tap the person to call, tap “call”

# Value comparison

| | Datum | | |
|---|---|---|---|
| |  |  |  |
| Minimize operations | | + | + |
| Minimize time | | + | ++ |
| Minimize risk of dialing the wrong number | | | + |
| Cost | | | -- |

Value = Benefit - Cost

# Plotted Trade Space

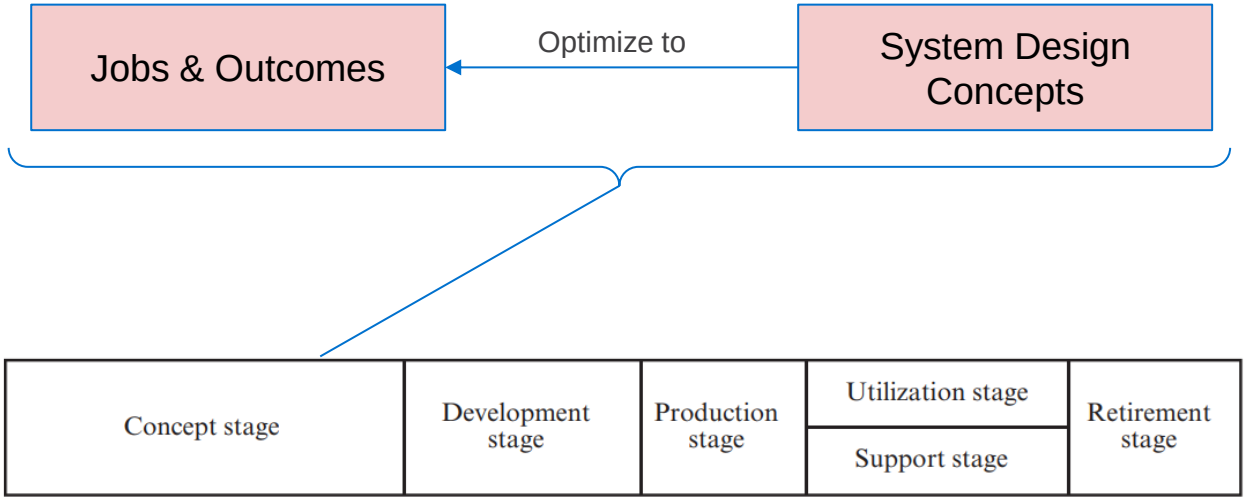



- Solution Concept

vm = value metric

**Value = *f*(vm1, vm2… vmN)**

# Summary


Jobs & Outcomes
Optimize to
System Design Concepts
Concept stage
Development stage
Production stage
Utilization stage
Support stage
Retirement stage

# Thank You !