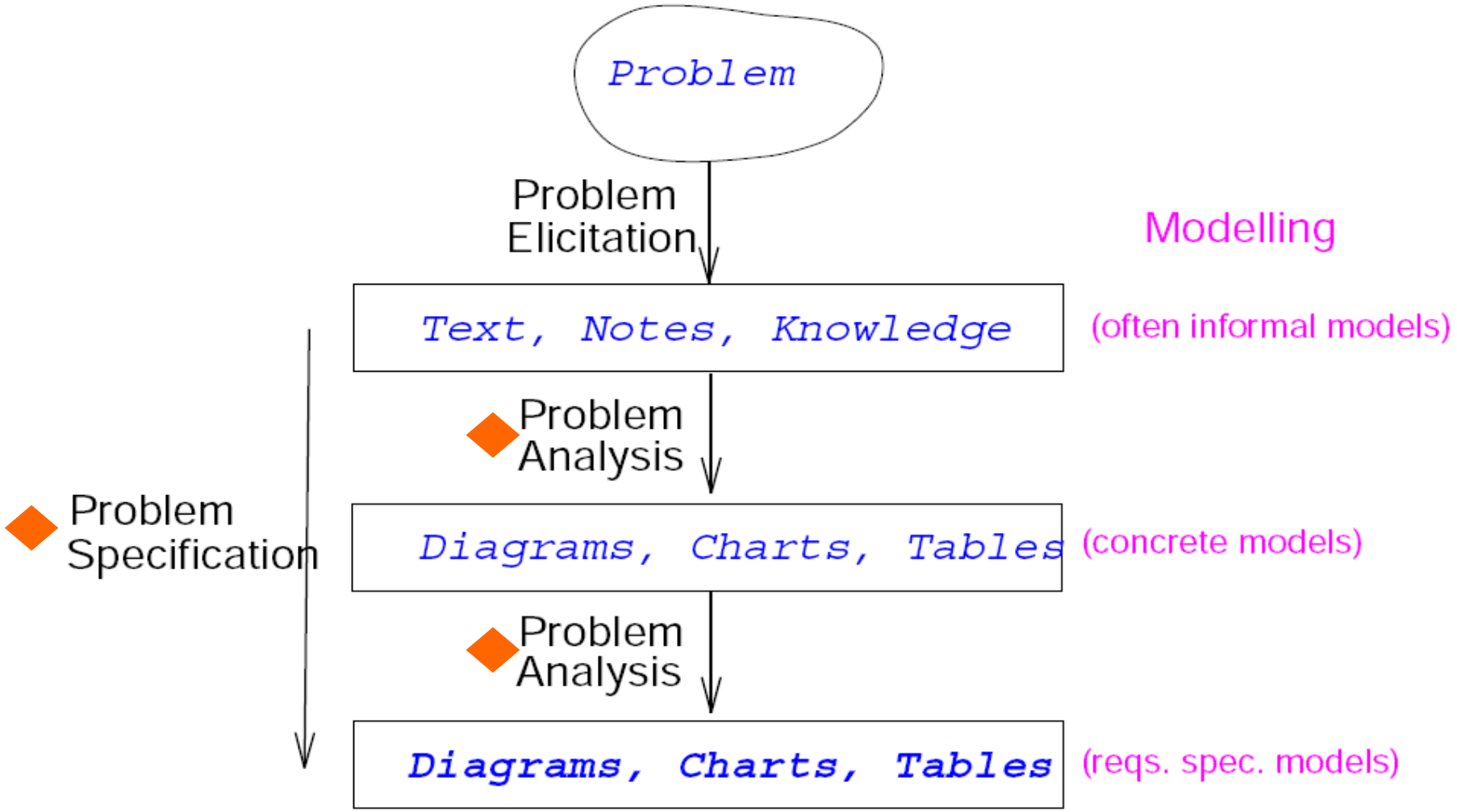
Requirements Analysis, ***Modeling*** and Specification

- Requirements Analysis, Modeling and Specification
- Problem
- Carving the Solution Space
- Prioritizing Requirements

What is a *Model*?

Requirements Analysis, Modeling & Specification

A continuous loop



How many cycles do you go through in your project?

It is more important to understand the problem than the solution. [Albert Einstein]

"A problem unstated is a problem unsolved"

Douglas Ross, 1977

From Sam Supakkul's presentation

Is "The sky falling down" a problem to you?

What is a problem?

Is storm coming a problem?

http://www.skystef.be/images/Lightning/slides/2008-06-02-1818-Kampenhout.jpg

Yes, if we want to have outdoor fun

Problem

http://www.alphabetgolf.co.uk/alphabetgolf.co.uk/Outdoor%20Party%20Dance.jpg

No, if we're dying for it

Blessing

http://www.alphabengolf.co.uk/alphabengolf.co.uk/Outdoor%20Party%20Dance.jpg

Problem or not depending on the goal we have

Problem

Blessing

What is a problem?

Undesirable situation

hurts

Goal

causes

Phenomenon

A phenomenon or
a situation
that hurts our goals

Goals

↔

Problems

↔

Alternatives

↔

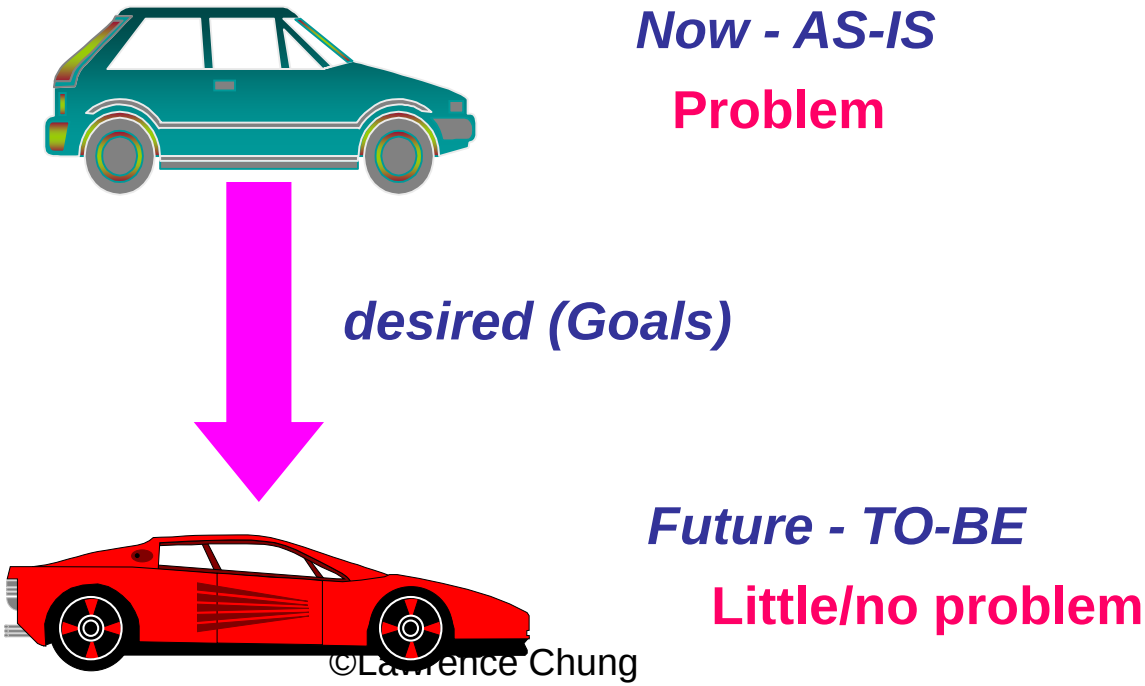
Selection

http://www.trustworthyappliancesservice.com/images/edited_thought_bubble3.GIF
http://1.adnet.com/blogs/stop_sign.png
http://mercyoldest.files.wordpress.com/2009/07/choices.jpg
http://splinedoctor.com/blog/wp-content/uploads/2009/02/choose1.jpg

Problem = TO-BE – AS-IS ?

It is more important to understand the problem than the solution. [Albert Einstein]

A problem can be defined as the difference between things as ***they are now*** and things as ***they are desired***.



Exercise: Student Application Processing System

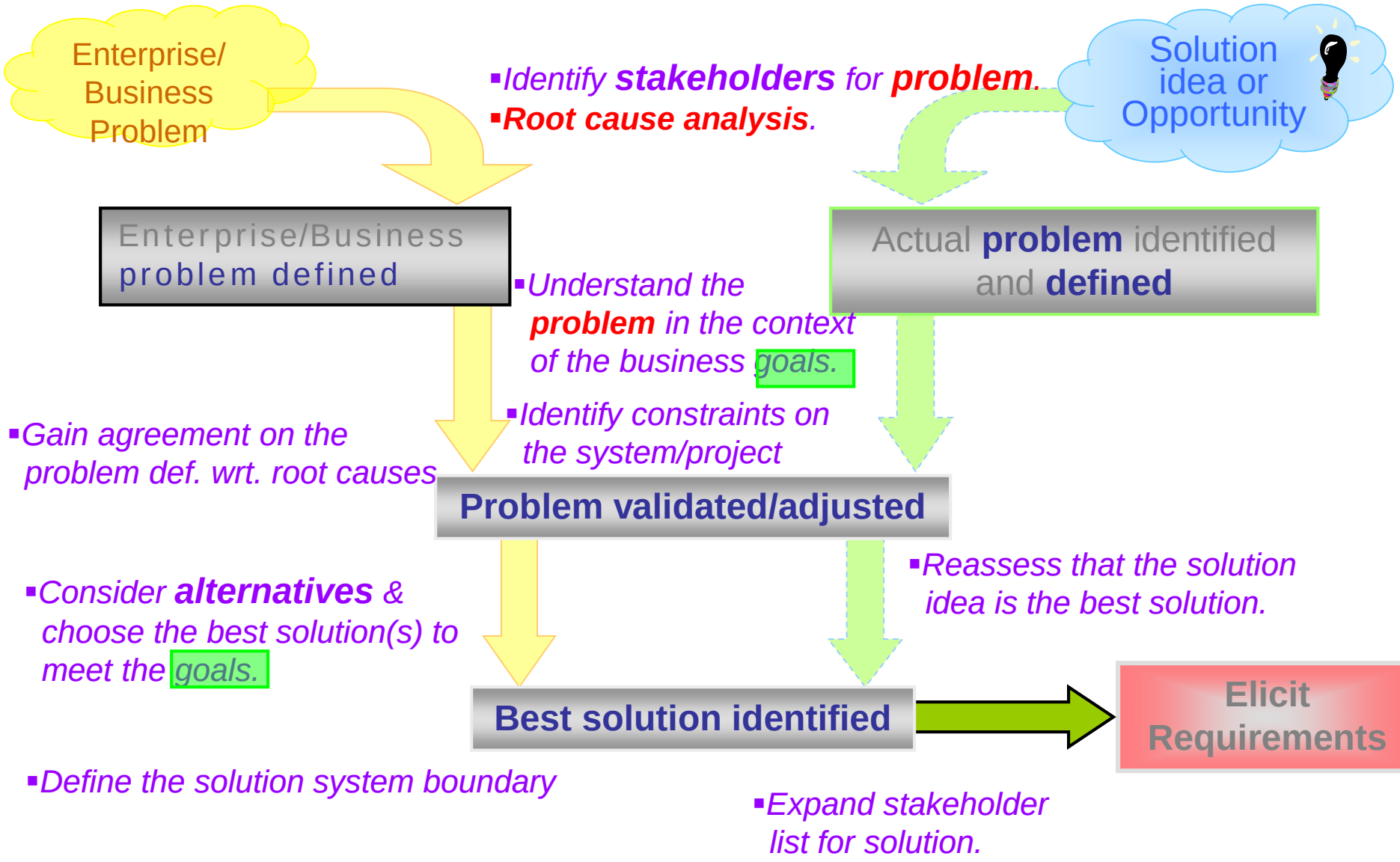
(AS-IS)

(TO-BE)

(Problem)

To be continued later …

A Problem Analysis Roadmap



What are requirements – about problem or solution?

One Man's Ceiling is Another Man's Floor!

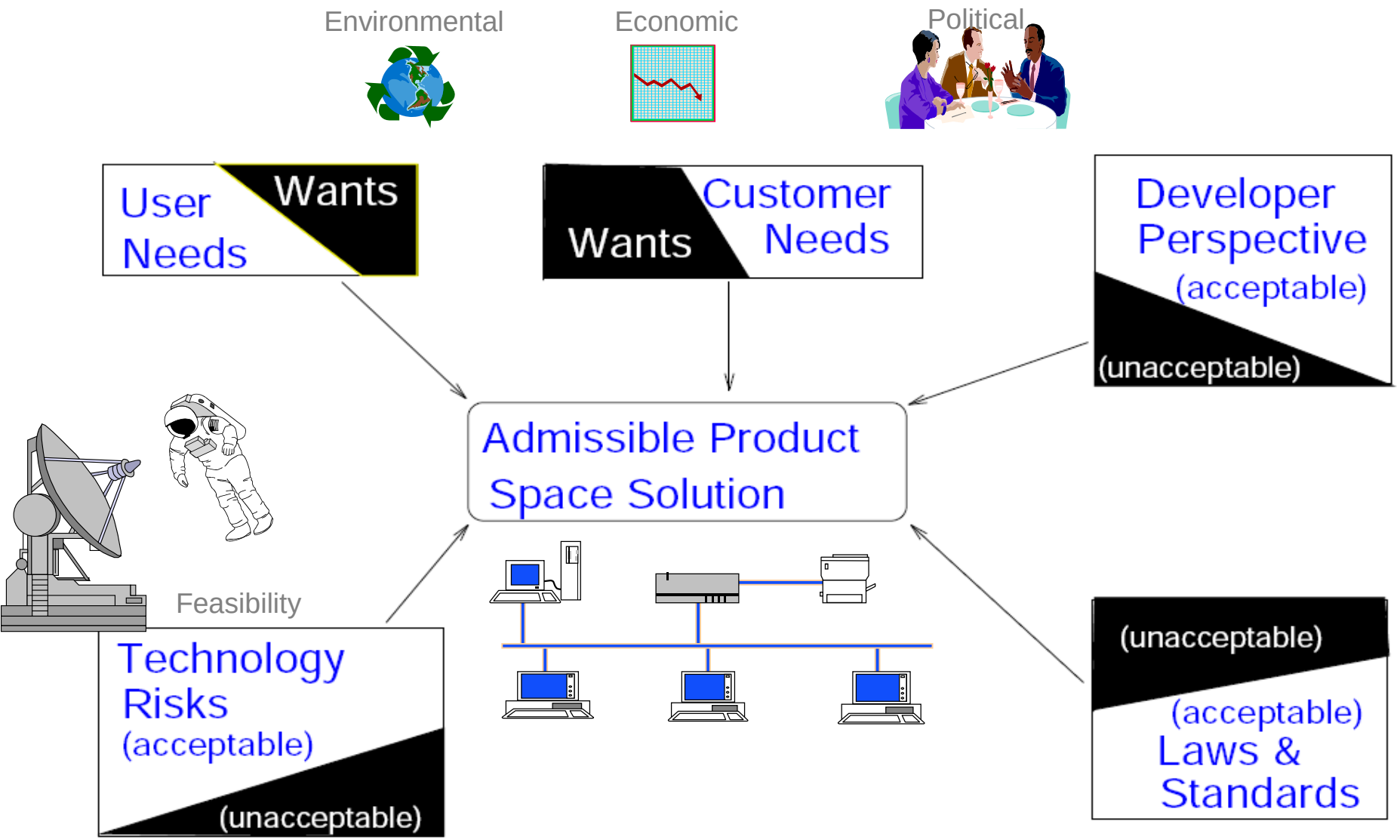
One Man's Problem is Another Man's Solution!

One Man's Floor is Another Man's Ceiling!

One Man's Solution is Another Man's Problem!

Carving the Product Space

Requirements represent a compromise.

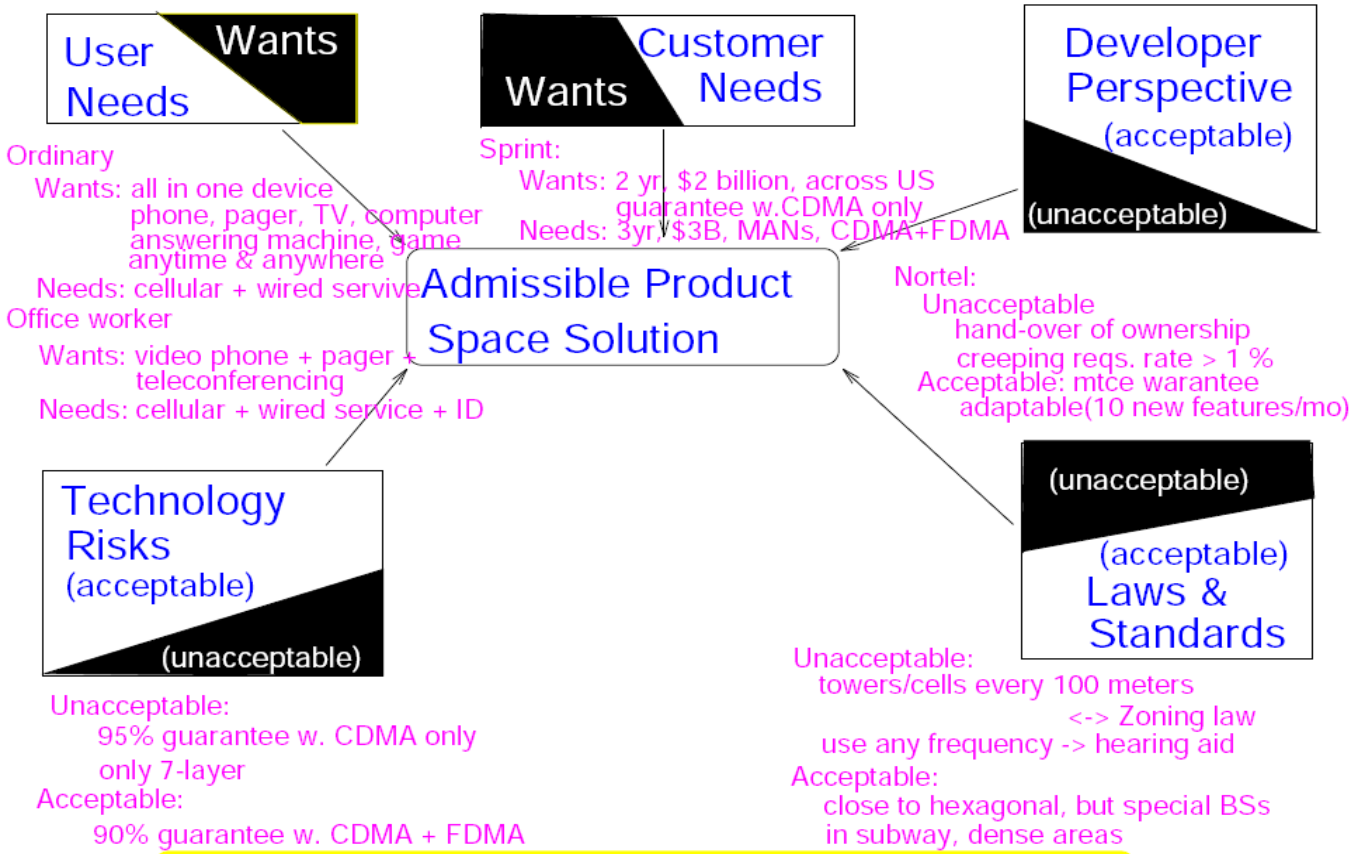


Carving the Product Space

Requirements represent a compromise.

Example

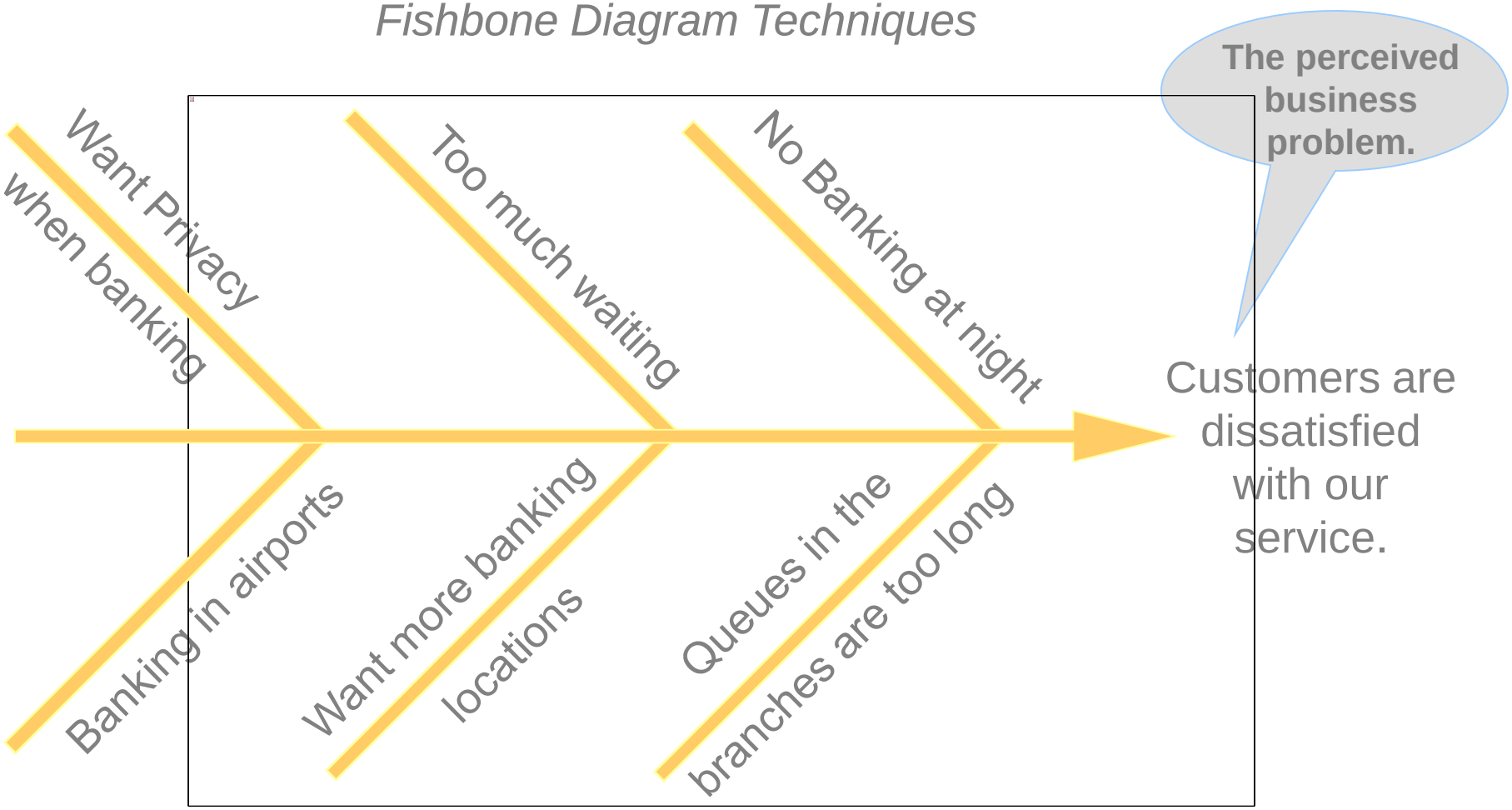
E.g., Wired/Wireless phone& PCS



Varying degrees of acceptable/unacceptable solutions

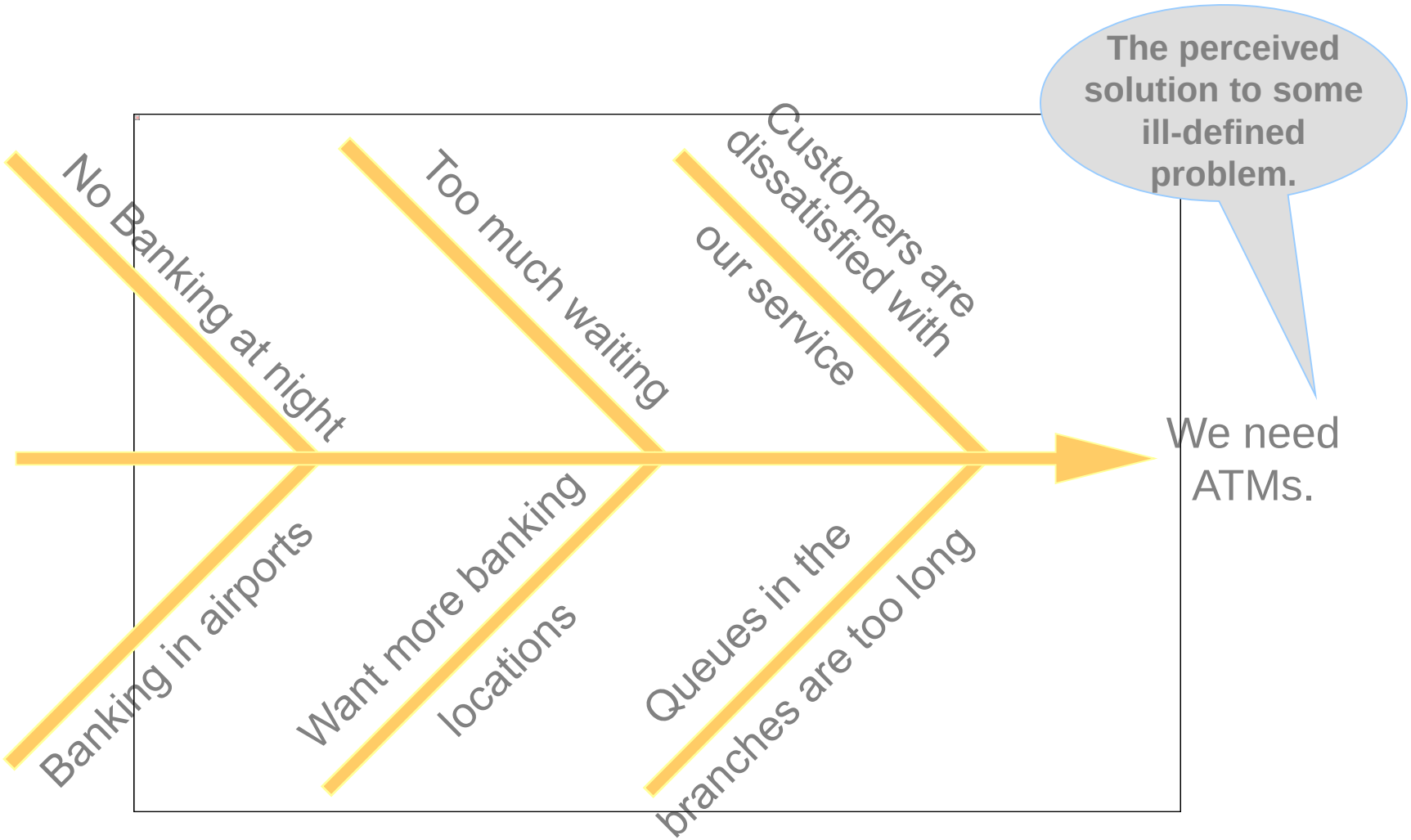
What Is the Problem Behind the Problem?

Fishbone Diagram Techniques



List contributing causes to the identified problem.
Keep asking "Why?" (expand each rib).

Problem Analysis – Validating a Solution

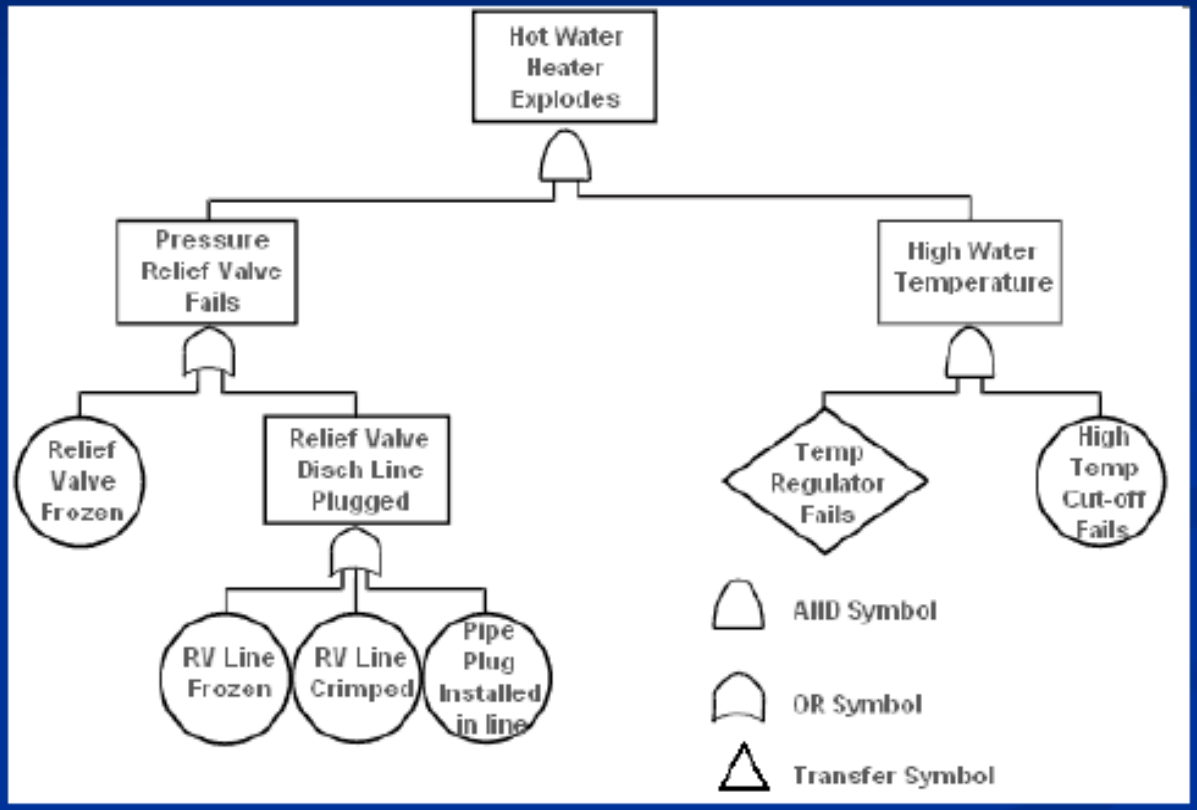


List the reasons why the solution is the right solution.
Keep asking "Why?" (expand each rib).

What is the problem of your project? Why is your solution the right solution?

Representation of problems

fault tree diagram

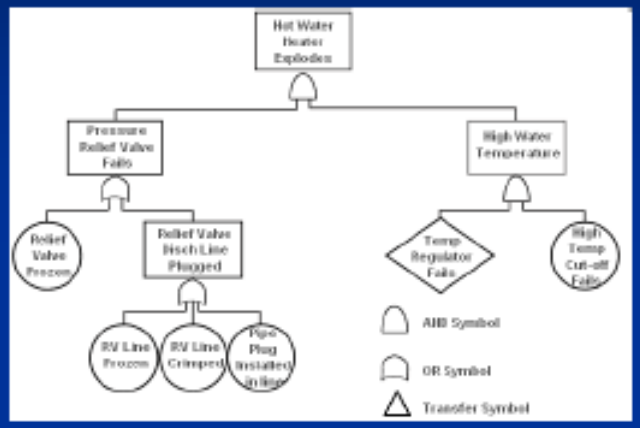


Which is better – Fishbone Diagram or FTD??

http://www.qualitytrainingportal.com/resources/problem

Representation of problems

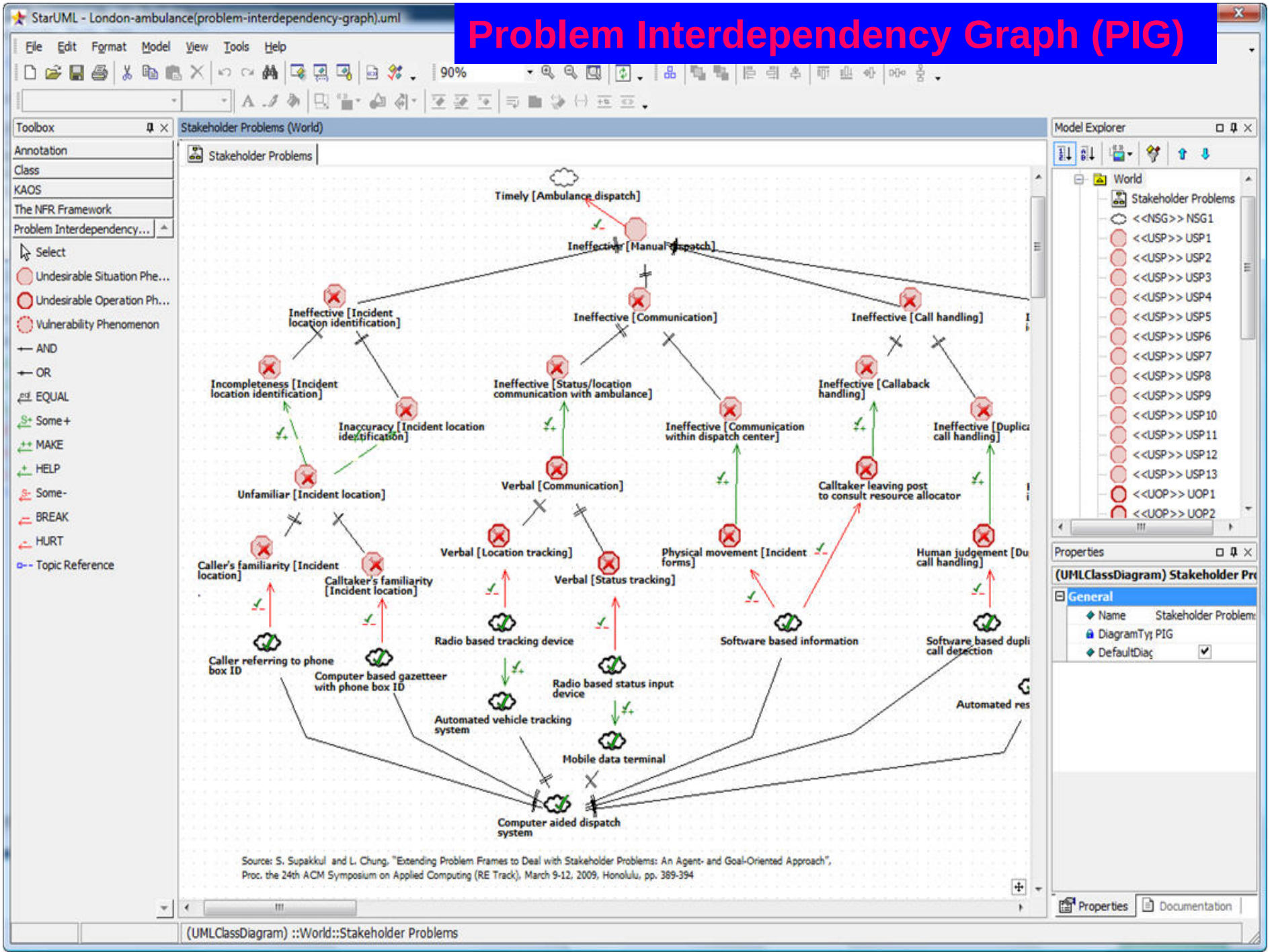
fault tree diagram



???

- Clear relationships between siblings
  - AND/OR
- No relationship with
  - Goals
  - Alternatives

Problem Interdependency Graph (PIG)

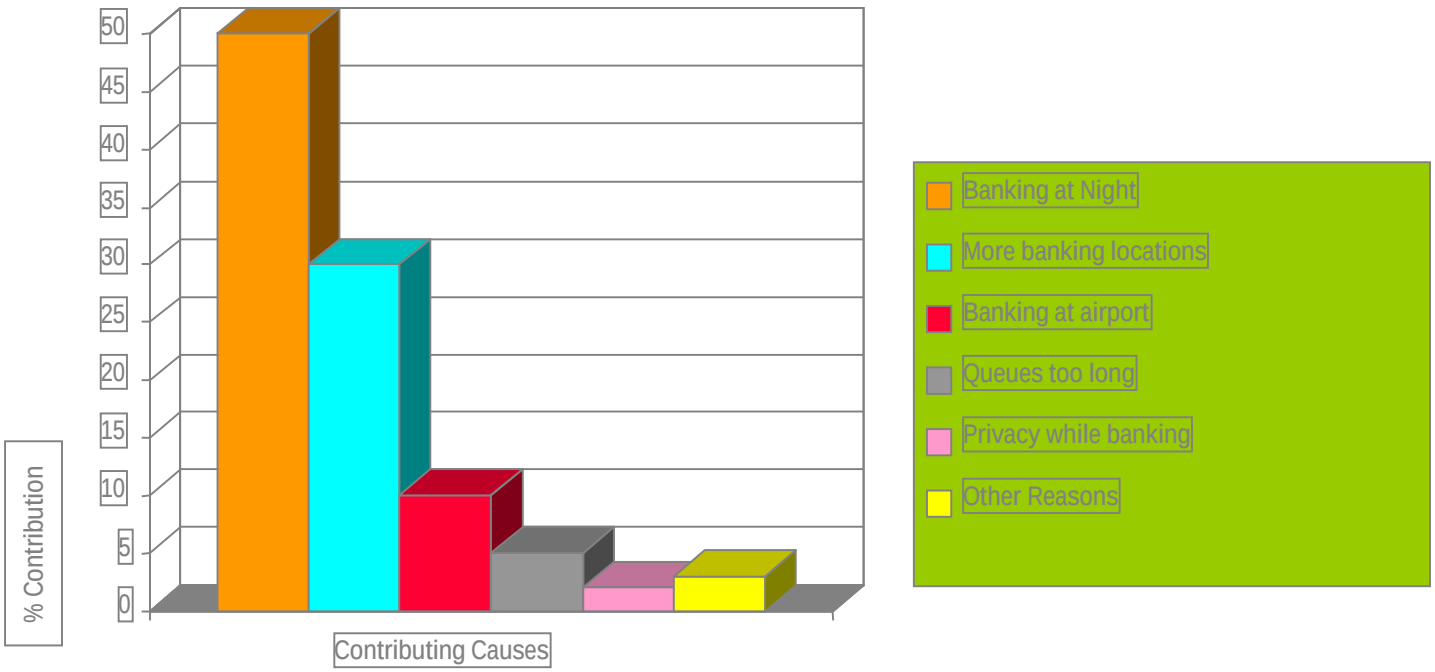


But what if there are too many problems?

Pareto principle

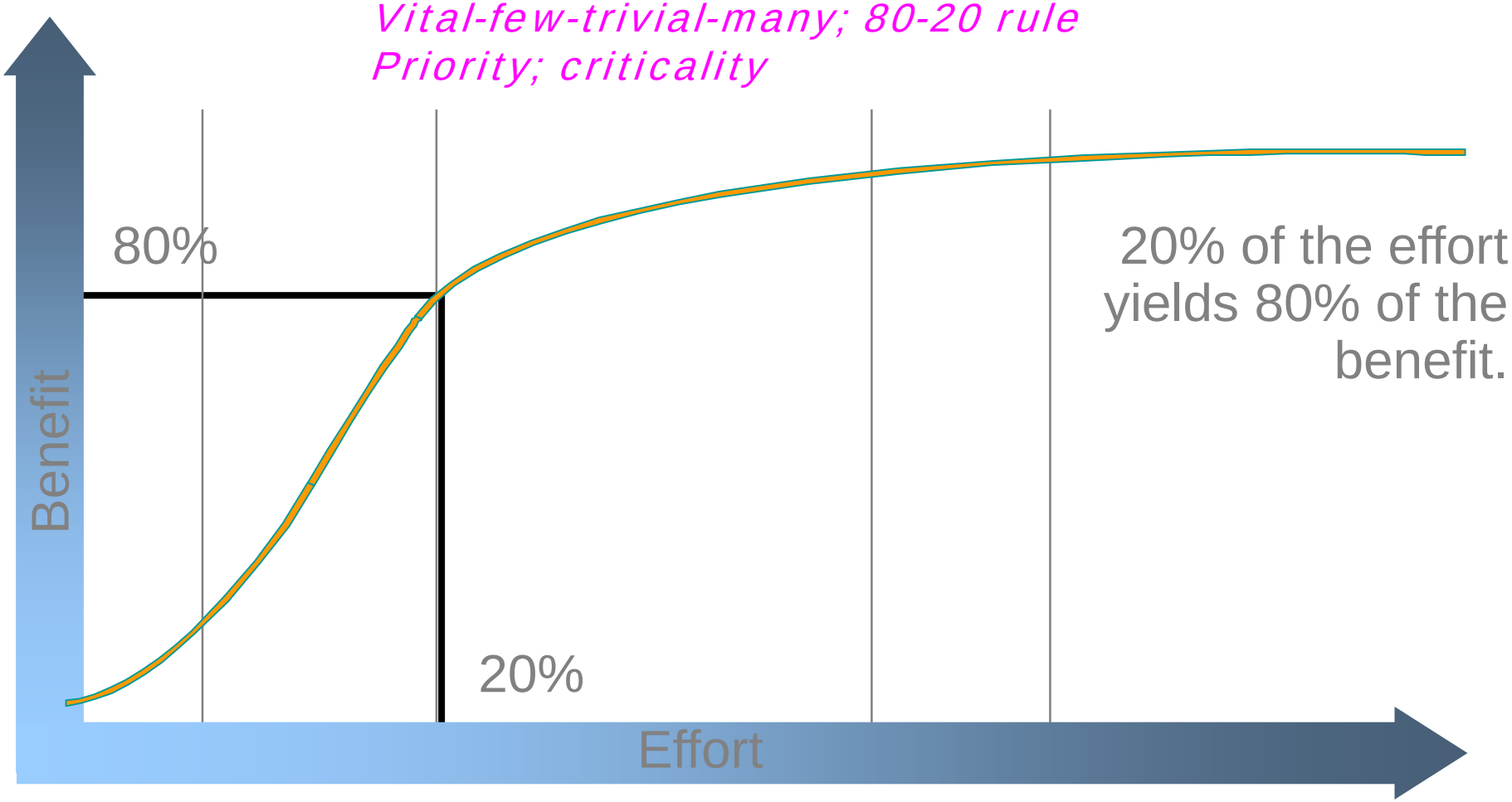
In economics
The original observation was in connection with income and wealth. Pareto noticed that 80% of Italy's wealth was owned by 20% of the population.[4] He then carried out surveys on a variety of other countries and found to his surprise that a similar distribution applied. [1896, Wikipedia]

Pareto effect Analysis



Focus on Largest Contributors - *Pareto's Law*

Vital-few-trivial-many; 80-20 rule
Priority; criticality



Rank in order. Use the 80-20 Rule to focus on the top contributing causes to address the greatest portion of the problem.

What are in the 20% of the problem of your project?

Requirements Prioritization

An Analytic Hierarchy Process (AHP) Approach *[Karlsson & Ryan 1997]*

Given n requirements,

- Create n x n matrix
- Compare each pair
  - entry (i, j)=
    - 1 if i and j are of equal value
    - 3 if i is slightly more preferred than j
    - 5 if i is strongly more preferred than j
    - 7 if i is very strongly more preferred than j
    - 9 if i is extremely more preferred than j

    } subjective/ ad hoc
  - entry (j, i) = 1/entry (I, j)

- Estimate the eigenvalues
  - Calculate the sum of each column
  - Divide each entry by the sum of it's column
  - Calculate the sum of each row
  - Divide each row sum by n

This gives a value for each requirement based on estimated percentage of total value of the project

Requirements Prioritization

An Analytic Hierarchy Process (AHP) Approach

Example

	r1	r2	r3	r4
r1	1	1/3	2	4
r2	3	1	5	3
r3	1/2	1/5	1	1/3
r4	1/4	1/3	3	1

normalize columns

	r1	r2	r3	r4
r1	0.21	0.18	0.18	0.48
r2	0.63	0.54	0.45	0.36
r3	0.11	0.11	0.09	0.04
r4	0.05	0.18	0.27	0.12

sum the rows

sum	Sum/4
1.05	0.26
1.98	0.50
0.34	0.09
0.62	0.16

*Also should compute the consistency index, since the pairwise comparisons may be inconsistent

Is the matrix consistent?

Using "Shall" and Related Words

- "**shall**" indicates a binding provision, i.e., one that must be implemented by the specification users.
- To state non-binding provisions, use "**should**" or "**may**."
- Use "**will**" to express a declaration of purpose (e.g., "The government will furnish ...") or to express future tense

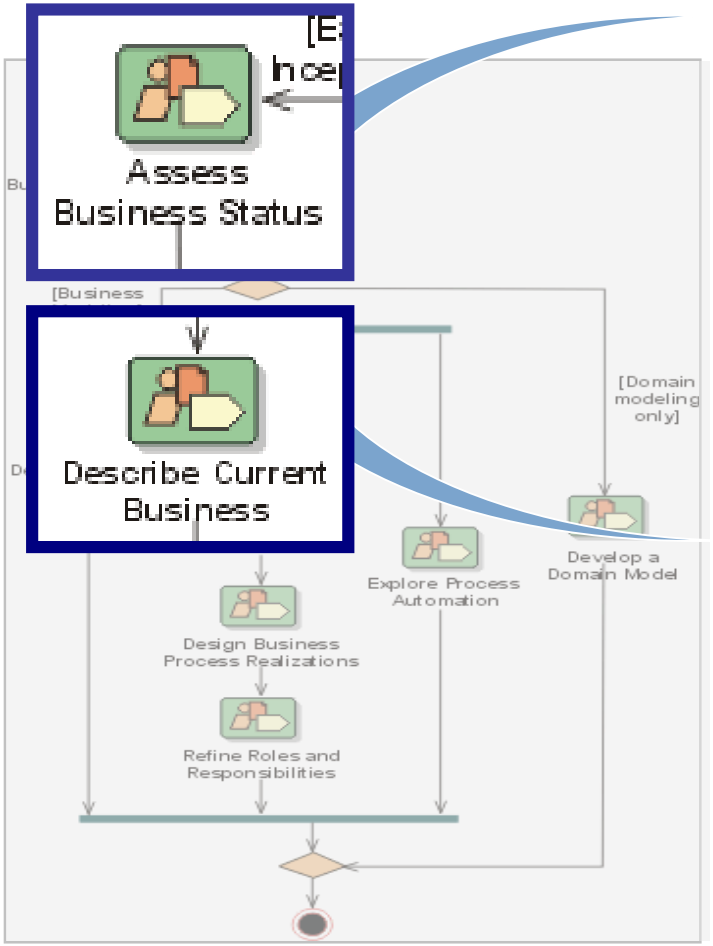
IEEE Std. 830-1998. IEEE Recommended Practices for Software Requirements Specifications. IEEE Computer Society. 20 Oct. 1998.

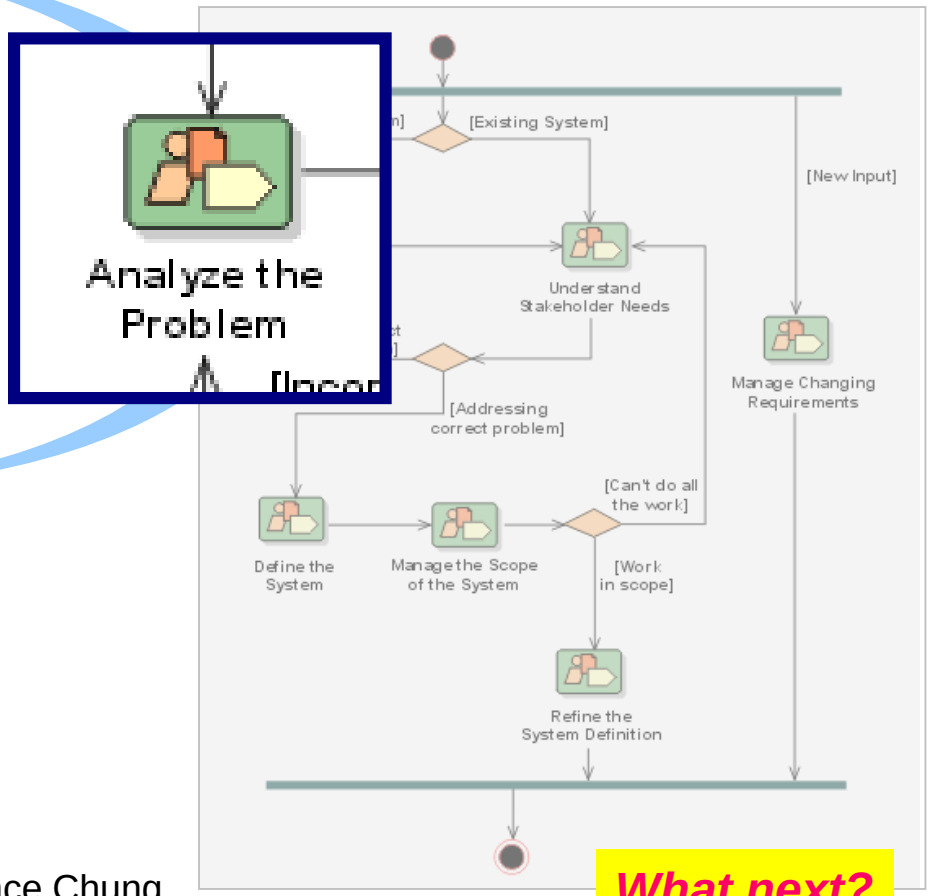
- Appendix

D, S achieves R to solve P in D

Domain/World/Enterprise/Business

D, Problem => Requirements => Specification

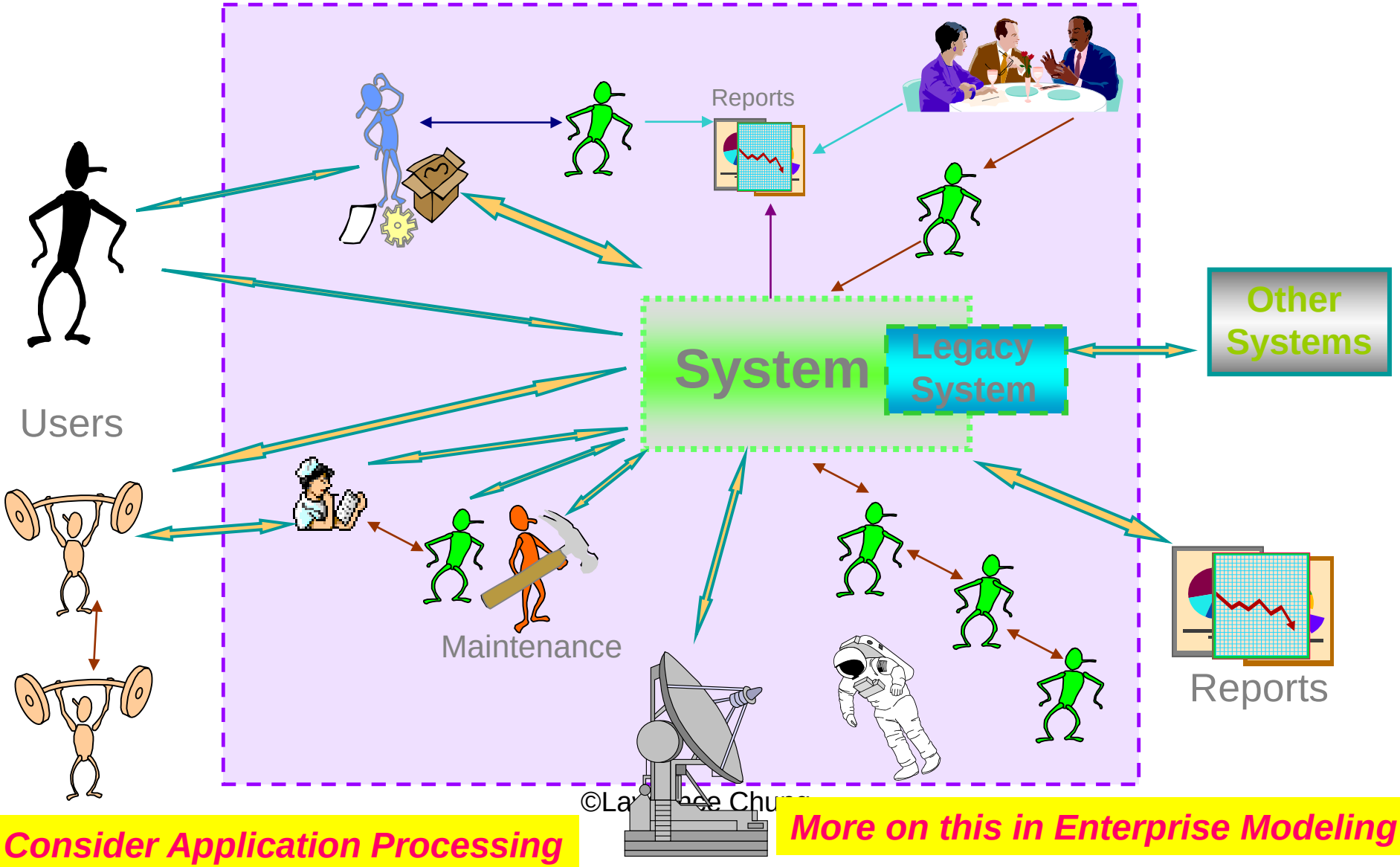




What next?

D, S achieves R to solve P in D

Define Boundaries for the Enterprise/Business and the Solution



Consider Application Processing

More on this in Enterprise Modeling

D, S achieves R to satisfy/satisfice G (solve P) in D

M^G, $Prog^G$ |= S^G; S^G, D^G |= R^G; R^G, D^G |= G; (G |= ¬P) V (G |~ ¬P)

Exercise

An Application Processing System

D: include a functional model, a workflow model, an informational model, a BM

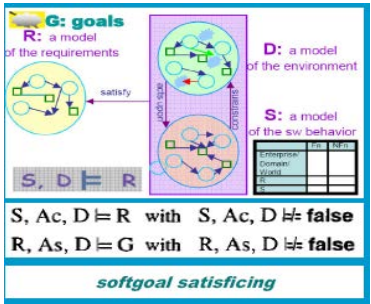
P: include complaints (both external and internal), weaknesses, etc.

G: include wants and needs countering P – both hard and soft

R: include an interaction model between D and S

S: include a functional model, an informational model, a behavioral model

Requirements should contain *nothing but* information about the environment.



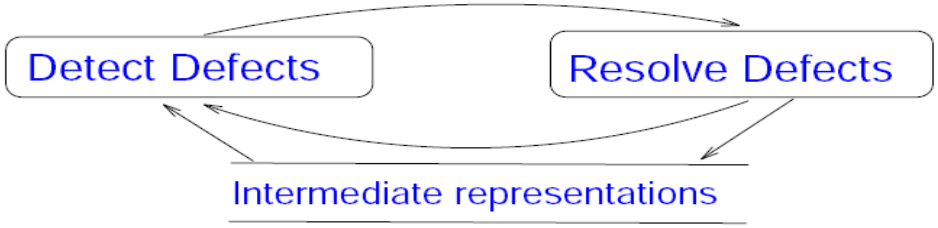
Modeling is Everywhere

- Problem Elicitation
  - exploratory, brain-storming, open-ended thinking
  - elaboration of unclear goals and needs
  - identification of sources, views, needs & wants

Wicked Problem

process of understanding real-world problems, how they relate to stakeholder needs, and proposing solutions to meet those needs.

- Problem Analysis



  - determination of "real" users (<= identification of sources)
    (e.g., stratification during sampling, questionnaires & interviewing)
    customers, tellers, other employees
  - clarification of goals (e.g, Goal-directed approach)
  - detecting differences in views and integrating them, & recording rationale
  - resolving a mismash of wants and needs
  - prioritization of defects
  - understanding (all constraints on the) solutions and evaluating them
  - risk analysis (e.g., scenarios)
- Problem Specification
  - choose formal notations
  - create a formal model of the requirements

One Man's Ceiling is Another Man's Floor!

Modeling is NOT Perfect

[adapted from Jackson, 1995, p124-5]

- There will always be phenomena in the model that are not present in the application domain
- There will always be phenomena in the application domain that are not in the model
- Perfecting the model is not always a good use of your time

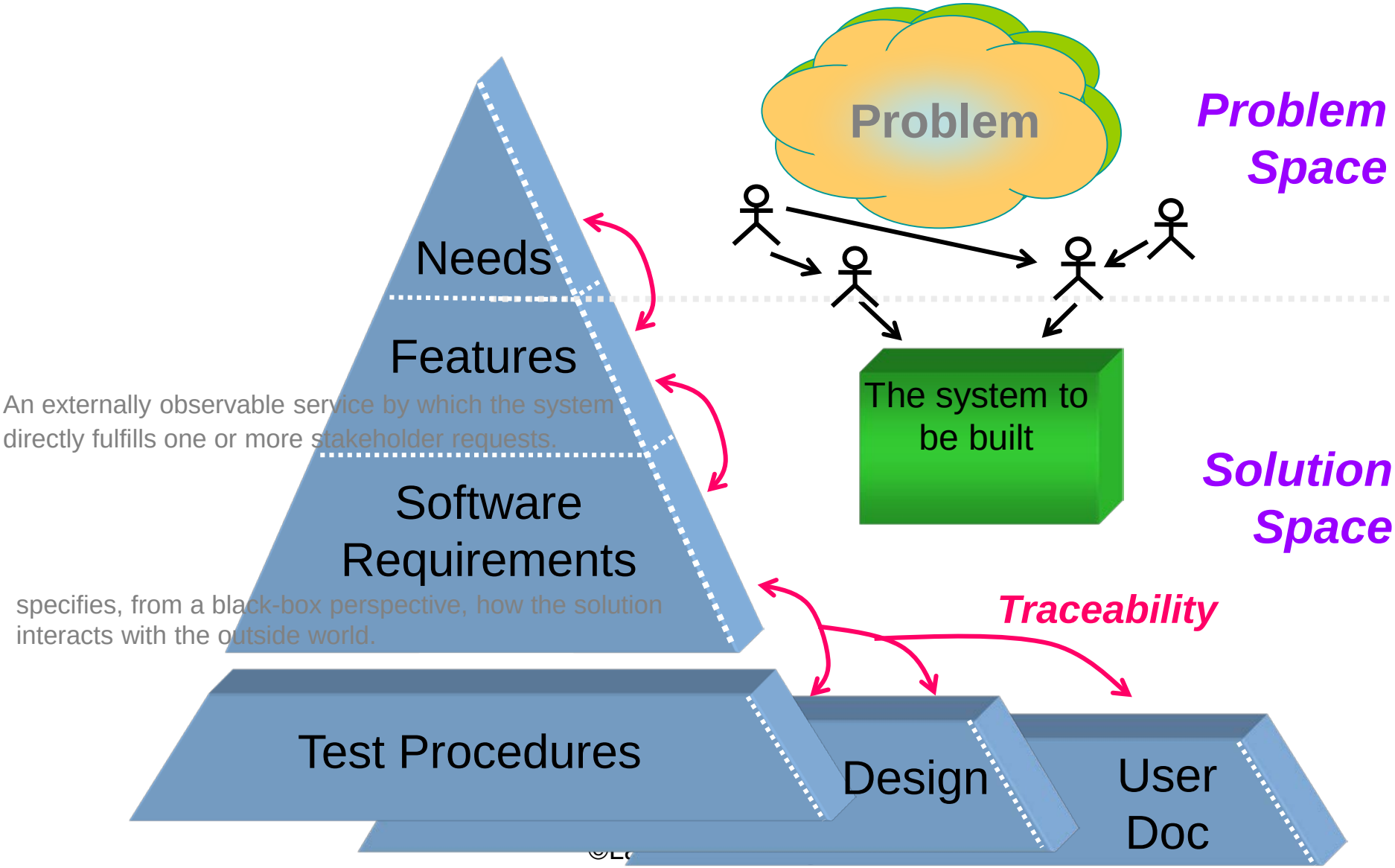
Stakeholders in the Vision Document

Who are some of the stakeholders for your projects?

Stakeholder - An individual who is materially affected by the outcome of the system or the project(s) producing the system.

Stakeholder	Registrar
Representative	Kelly Hansen
Description	User
Type	The Registrar is typically a college-educated professional with full computer skills. The Registrar is trained and experienced with the use of the current batch-oriented registration .
Responsibilities	The Registrar is responsible for administering course registration for each school term. This includes supervising administrative and data entry personnel.
Success Criteria	The registrar's primary responsibility will be maintaining student and professor databases, and opening/closing courses to registration. The registrar's office will also be required to perform ….
Involvement	The registrar's primary responsibility will be maintaining student and professor databases, and opening/closing courses to registration. The registrar's office will also be required to perform…..
Deliverables	Management reviewer – especially related to functionality and usability of features required by the Registrar staff.
Comments/ Concerns	None

Carving the Product Space



Carving the Product Space

Requirements exist at many levels of abstraction, possibly with diff. terminology

What
How

What
How

What
How

Stakeholder ***Needs***

Why?

Product or System ***Features***

Why?

Software ***Requirements***

Design Spec
Test Procedures
Documentation Plans

traceability