# Requirements Engineering

## (Summer 2022)

Prof. Nan Niu (nan.niu@uc.edu)

https://github.com/nanniu/RE-Summer2022

# Today's Menu

**Friday (July 15)**
Form & quality of requirements

First:
Two RE Stories

**Monday (July 18):**
Req.s Modeling
ASN3 Release

**Tuesday (July 19):**
Visual modeling notations
ASN3 Q&A

# Last Friday's Take-Aways

→Most common form of requirements is: _____

→Characteristics of a good SRS are: _____

→Agile req.s are often expressed in: _____

→Nonfunctional req.s are: _____

focus

stakeholders in RE.....

# So, You Think You Know Others' Goals?

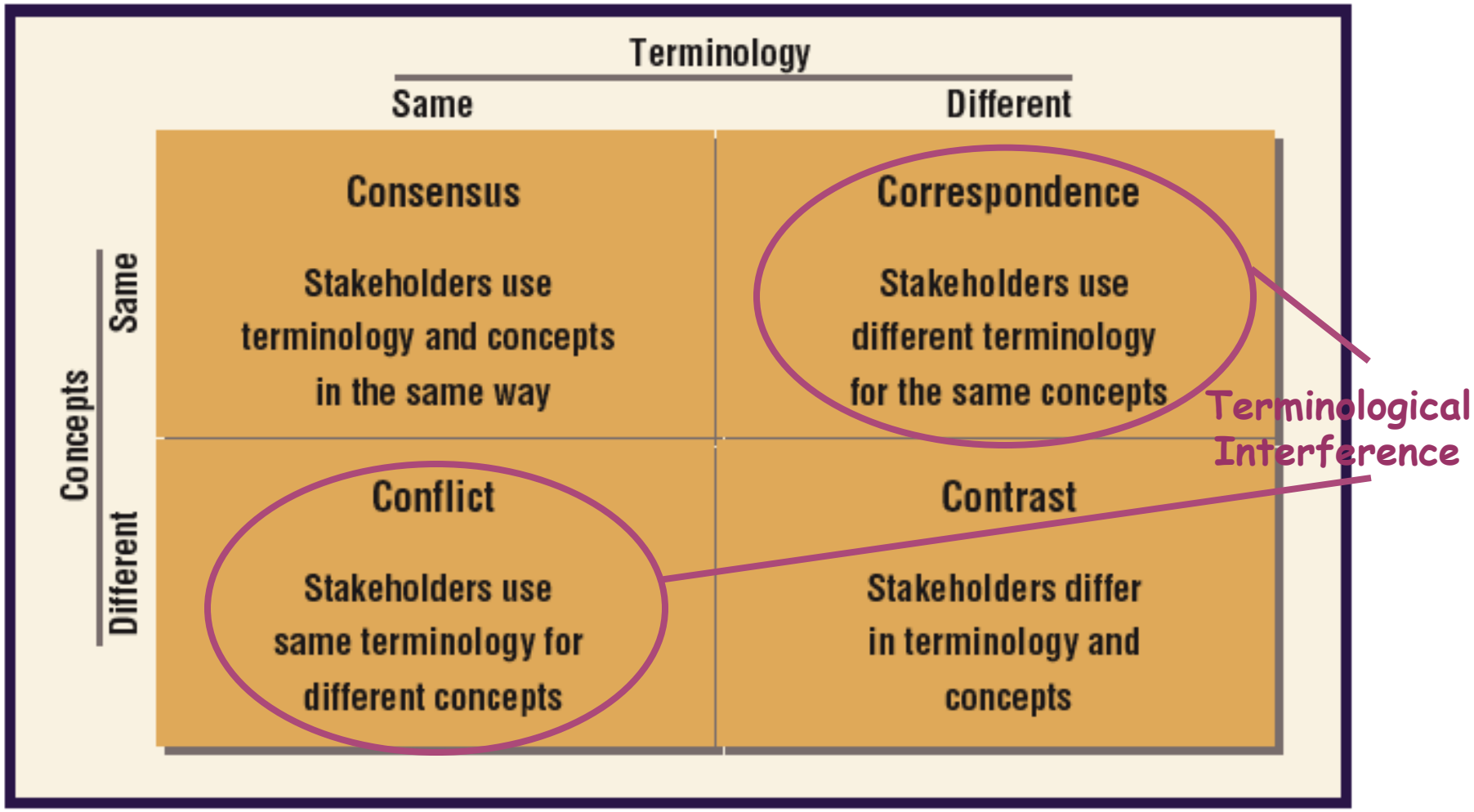
## A Repertory Grid Study

**Nan Niu and Steve Easterbrook,** *University of Toronto*



***Source:*** *https://homepages.uc.edu/~niunn/papers/SW07.pdf*

# Concepts and Terminology



# Repertory Grid Technique (RGT)

- George Kelly (1955), psychotherapy

- verbalize how people construe certain factors within the area of interest

  - verbalizations: constructs (bipolar in nature)

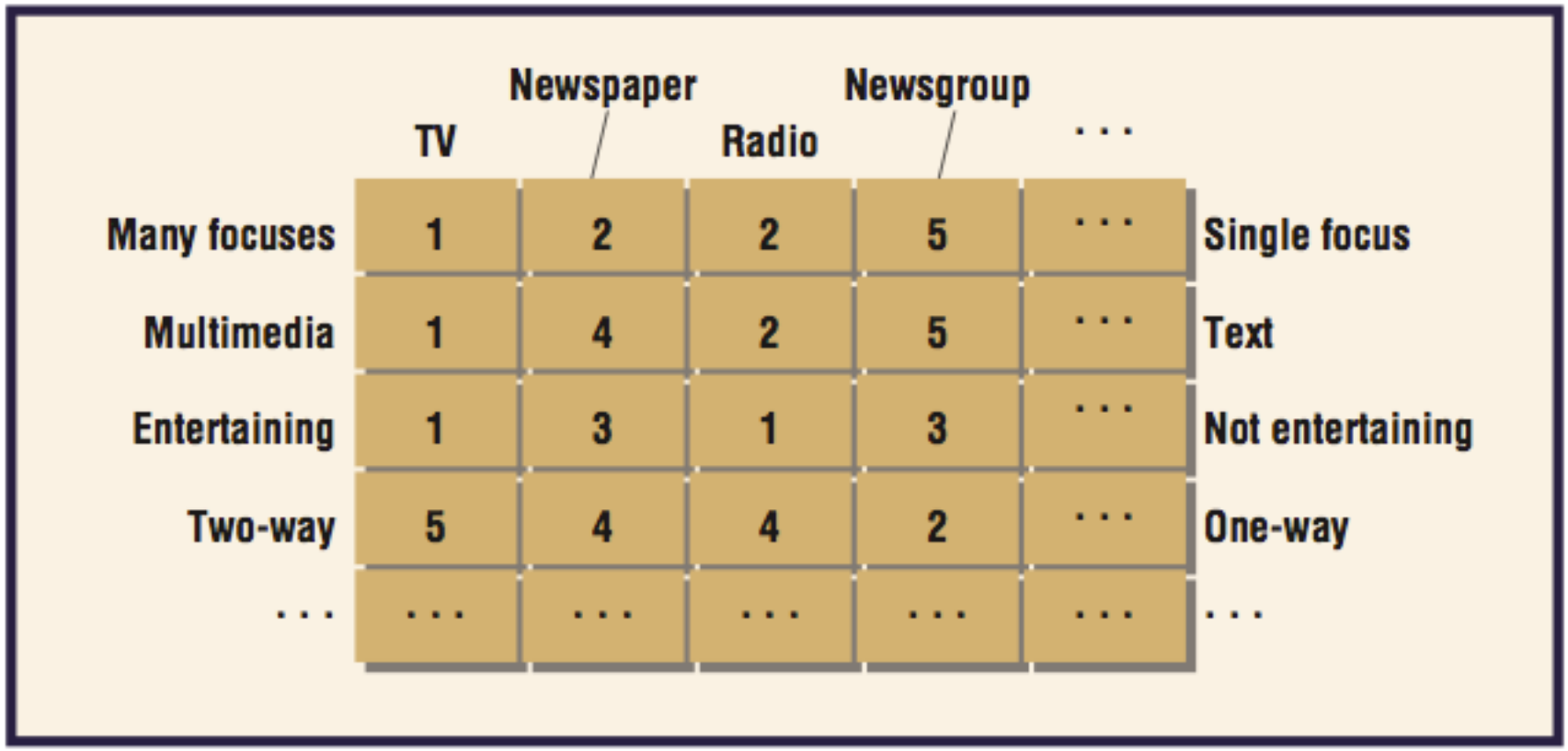
  - factors: elements

# RGT Example

- Information sources
  - TV, Newspaper, Radio, NewsGroup, Web, etc.
  - elements in RGT

- Triad: (A) TV (B) Newspaper (C) NewsGroup
  - construct: many focuses (A,B) vs. single focus (C)
  - as a rating scale (1-5), and each element is assigned a rating on that construct

# Sample Repertory Grid



| | TV | Newspaper | Radio | Newsgroup | ... | |
|---|---|---|---|---|---|---|
| Many focuses | 1 | 2 | 2 | 5 | ... | Single focus |
| Multimedia | 1 | 4 | 2 | 5 | ... | Text |
| Entertaining | 1 | 3 | 1 | 3 | ... | Not entertaining |
| Two-way | 5 | 4 | 4 | 2 | ... | One-way |
| ... | ... | ... | ... | ... | ... | ... |

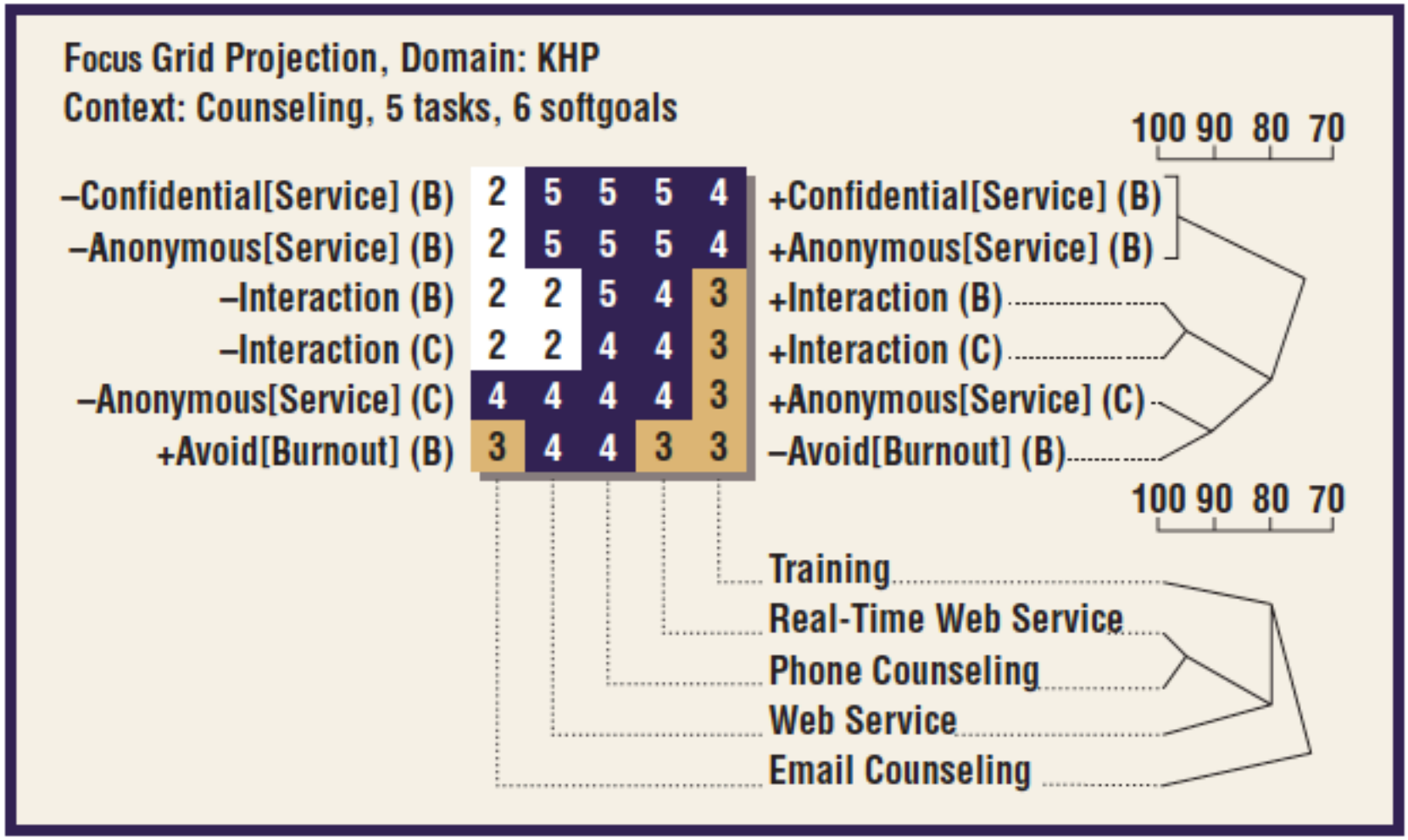
# Requirements Goal Models

- Softgoals – Constructs – Unique to personal views
- Tasks – Elements – Shared among stakeholders

- Assume: people focusing on similar topics would agree on the definition of a common set of concrete tasks within the area of interest

- Idea: compare stakeholder's constructs by how they relate to a shared set of concrete entities, rather than by any terms the stakeholders use to describe them

# Kids Help Phone




B - Bob C - Cem

# Observations

- Trivial correspondence
  - High-level softgoals about counseling: Good, Helpful, Proper, High-Quality, etc.
- Numerical threshold
  - Anonymous[Service] (Cem) versus (Bob)
- Conflicts beyond terminological level
  - (Ana) "Consult New Technique" would "Make-Difficult[Work]", hence hurt "Avoid[Burnout]"
  - (Bob) "Consult New Technique" could help "High[Morale]", thus help "Avoid[Burnout]"
- This leads us to Assignment3
  - Terms & constructs, in isolation, are hard to understand ➔ Let's build a model

# Today's Take-Aways

→ *i**: what, why, & how?

→ Assignment3: what & when?

# Assignment 3

→ Given 15 functional requirements (FRs)

RE-Summer2022 / Assignments /

ASN3-FRs-July18.pdf

→ Objectives

- Understand the 15 FRs and build an *i** model based on your understanding
- Make sure that your *i** model contains all the 5 element/ node types, 3 relationship/edge types, at least 3 softgoals, and both positive and negative softgoal contribution links

# ASN3: When & how to submit?

→ Before 11:59pm on Wednesday (July 20)

→ Email your ASN1 solution in one PDF or PNG (or JPG/JEPG) file to summercourse_re@163.com before the deadline

↳ Subject and attachment of your email: Assignment_No_Name

➢ e.g., Assignment_3_Jinzhi_Shan (as the email subject) and Assignment_3_Jinzhi_Shan.png (as the email attachment)

| Year | Category of Paper | Authors | Title of Paper |
|---|---|---|---|
| 2007 | | Eric Yu | Towards Modelling and Reasoning Support for Early-Phase Requirements Engineering |

## *i**

Two views (SD & SR)

Five nodes (actors, goals, softgoals, tasks, resources)

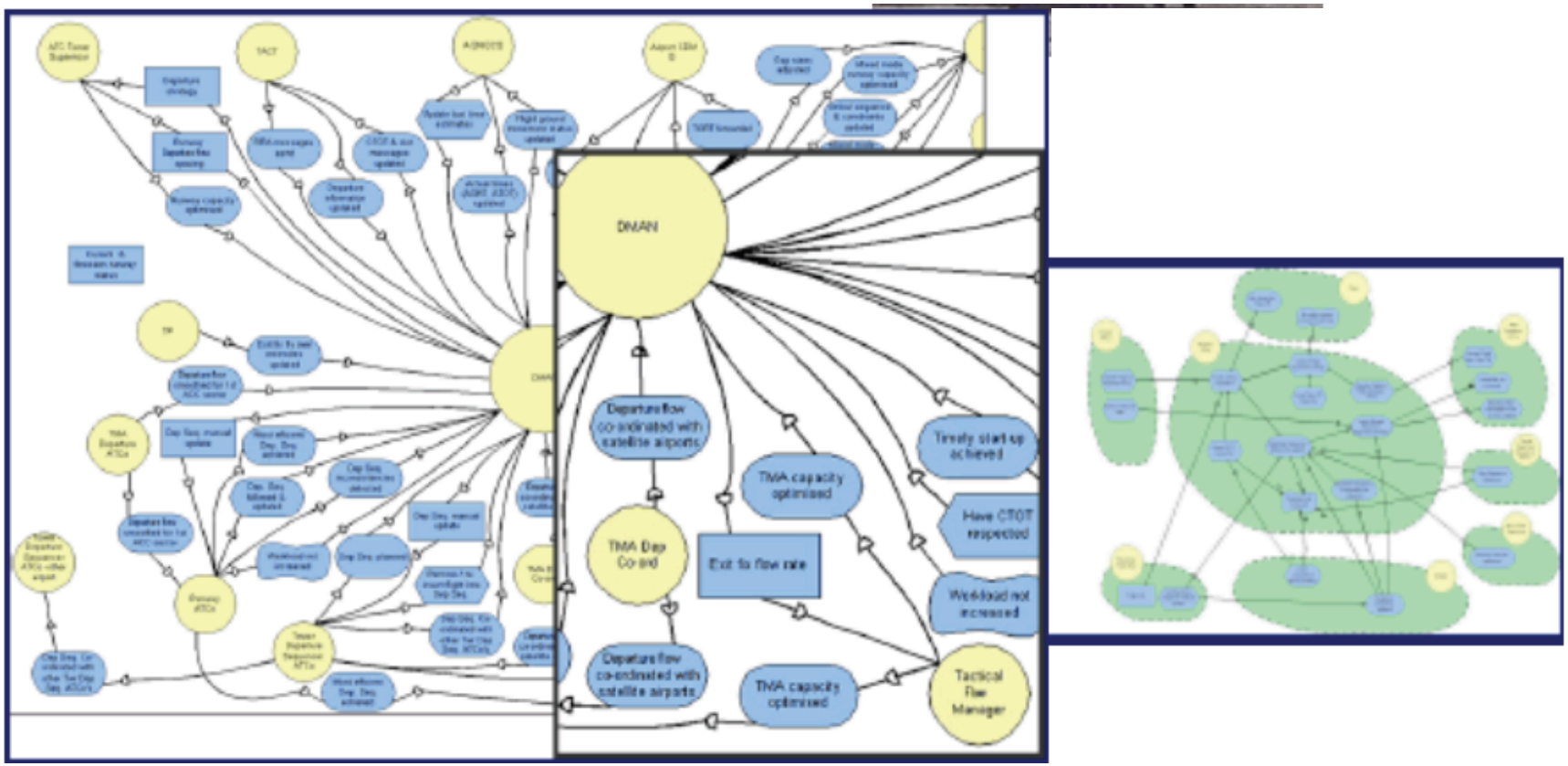
Three edges (dependency, decomposition, softgoal contribution)

# Practical Impacts of *i**

→ International standard
- User Requirements Notation (URN)
  - Goal Requirements Language (GRL) www.itu.int/rec/T-REC-Z.151/en
- Initiated from the telecom industry
- ITU-T Recommendation Z.151


→ Real-world applications
- Air traffic control
  - N. Maiden *et al.* "Model-Driven Requirements Engineering: Synchronising Models in an Air Traffic Management Case Stud", CAiSE, 2004.
- Food safety
  - A. Perini and A. Susi. "Designing a Decision Support System for Integrated Production in Agriculture: An Agent-Oriented Approach", Environmental Modelling and Software Journal, 19(9), September 2004.
- Hospital wards
  - S. Kethers *et al.* "Modelling Trust Relationships In A Healthcare Network: Experiences With The TCD Framework", ECIS 2005.

# Air Traffic Control

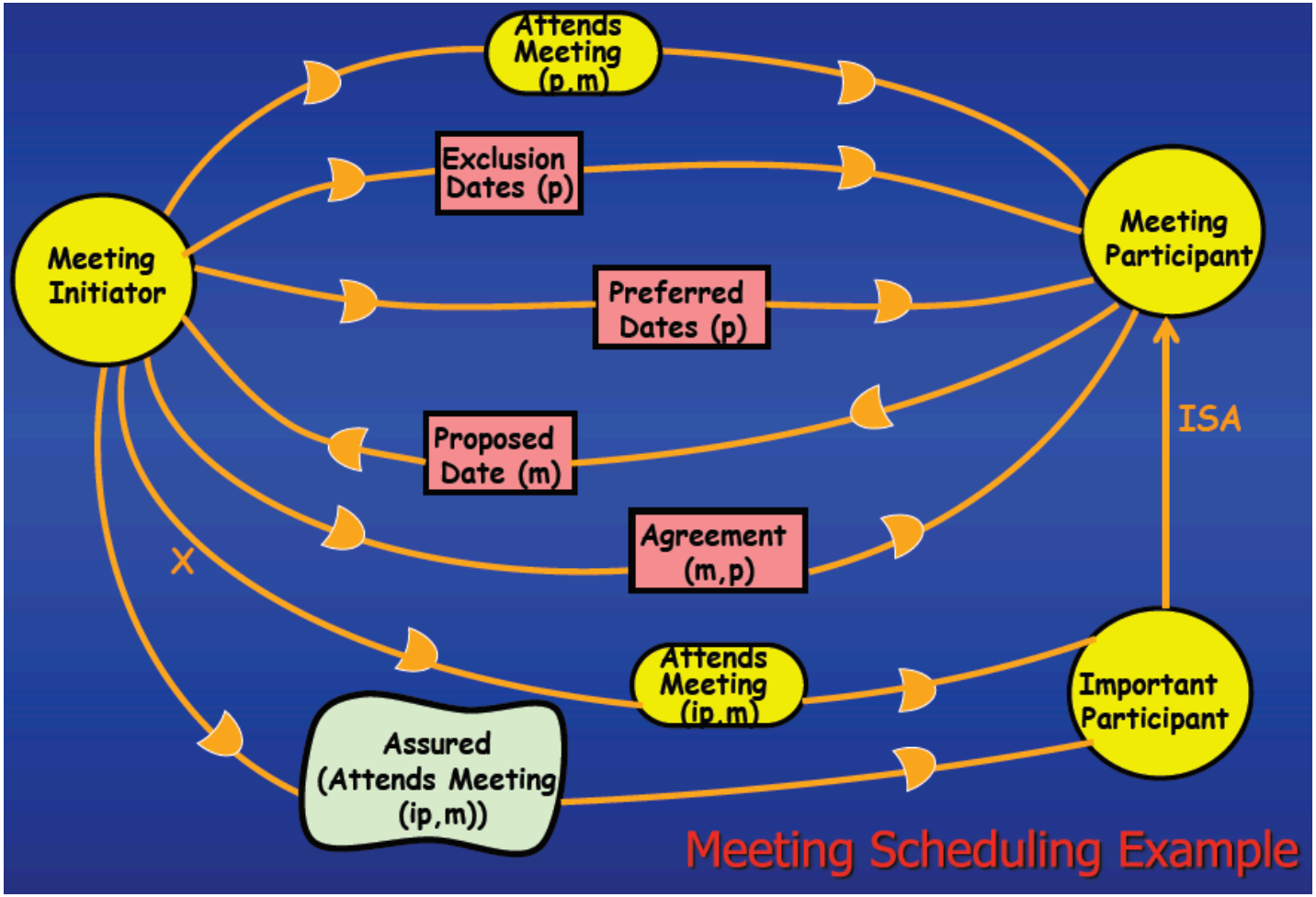


# Air Traffic Control

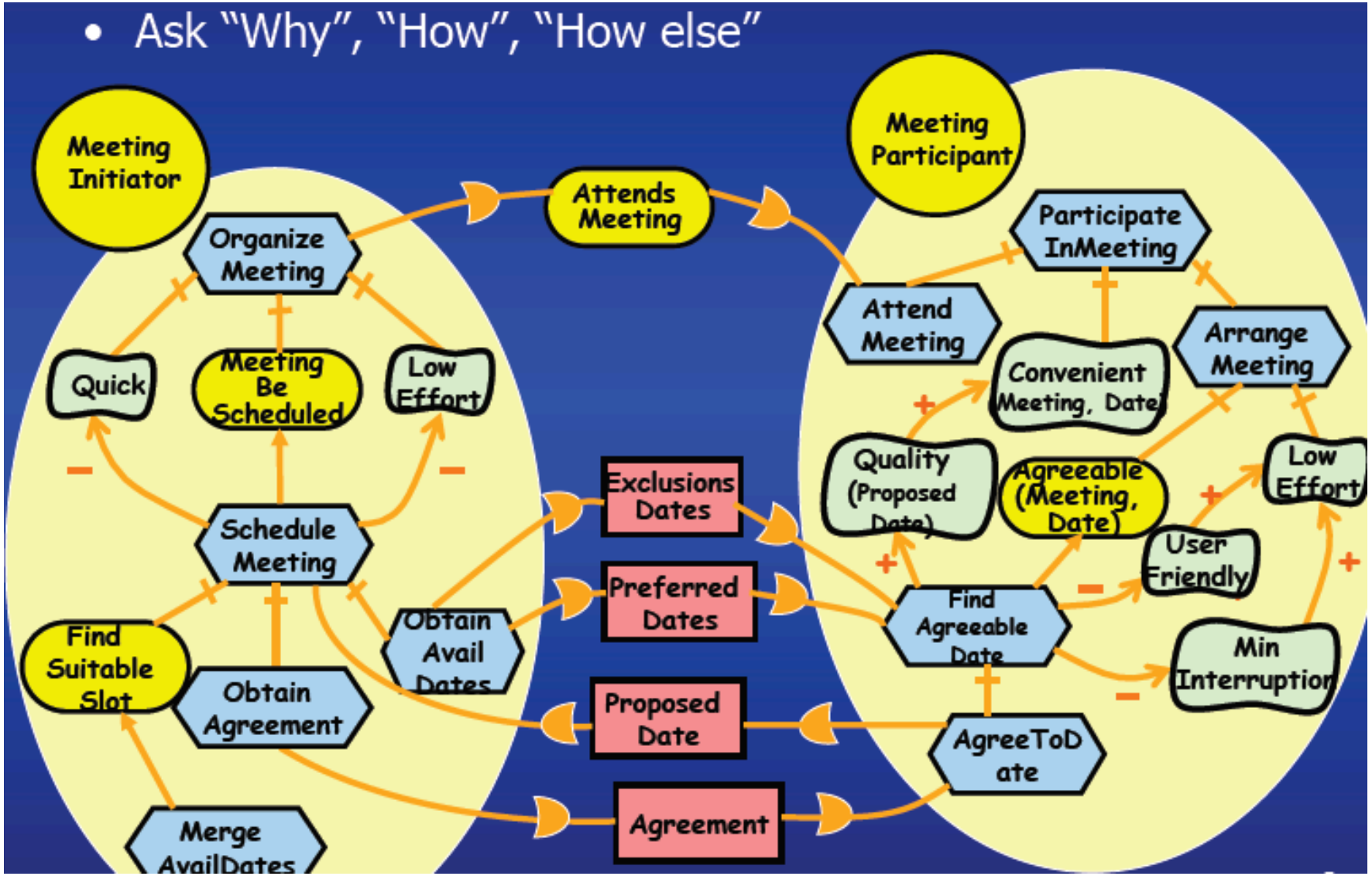





# Strategic Dependency (SD)



# Strategic Rationale (SR)



# Class Exercise – *i** Modeling

- Let's model our summer course
  - Who're the key stakeholders/actors?
  - How're they depended on each other?
    - Resource dependency is my first choice
  - What're their (hard) goals?
  - How to decompose the goals (into tasks)?
  - What're the means and/or alternatives to achieve the goals?
  - Are there any softgoals?
  - How're the softgoals supported or hindered?
    - Some task can help a softgoal but hurt another

# Assignment 3

- *i** modeling, compared with use cases and other requirements modeling techniques, treat softgoals (NFRs) as a first-class citizen

- Objectives
  - Understand the 15 FRs and build an *i** model based on your understanding
  - Make sure that your *i** model contains all the 5 element/ node types, 3 relationship/edge types, at least 3 softgoals, and both positive and negative softgoal contribution links

- Due: before 11:59pm on Wednesday (July 20)

# Goal Analysis

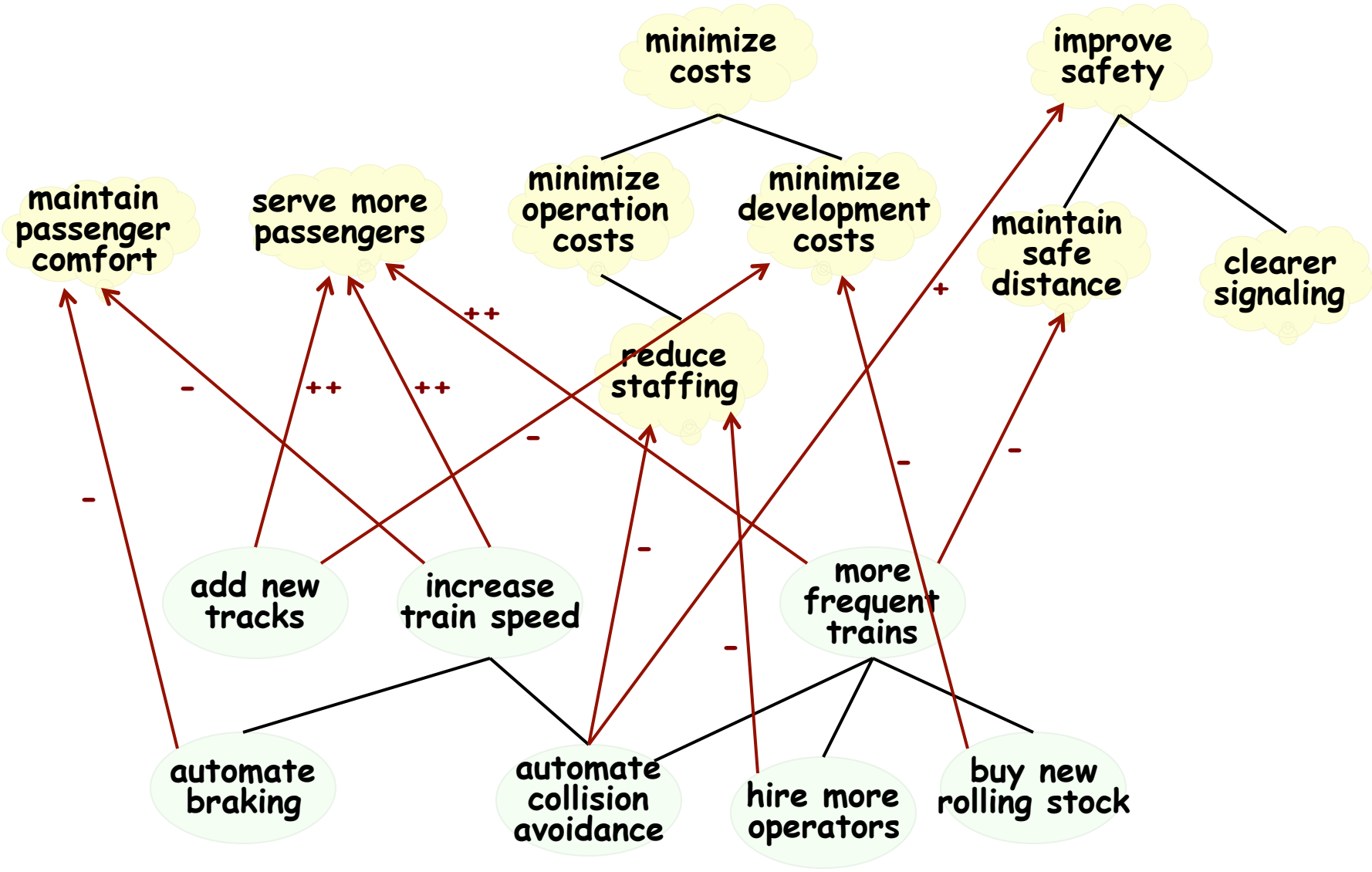
- Goal Elaboration:
  - "Why" questions explore higher goals (context)
  - "How" questions explore lower goals (operations)
  - "How else" questions explore alternatives
- Relationships between goals:
  - One goal helps achieve another (+)
  - One goal hurts achievement of another (-)
  - One goal makes another (++)
    - Achievement of one goal guarantees achievement of another
  - One goal breaks another (--)
    - Achievement of one goal prevents achievement of another
  - Precedence ordering (must achieve goals in a certain order)
- Obstacle Analysis:
  - Can this goal be obstructed, if so how?
  - What are the consequences of obstructing it?

# Softgoals as Selection Criteria

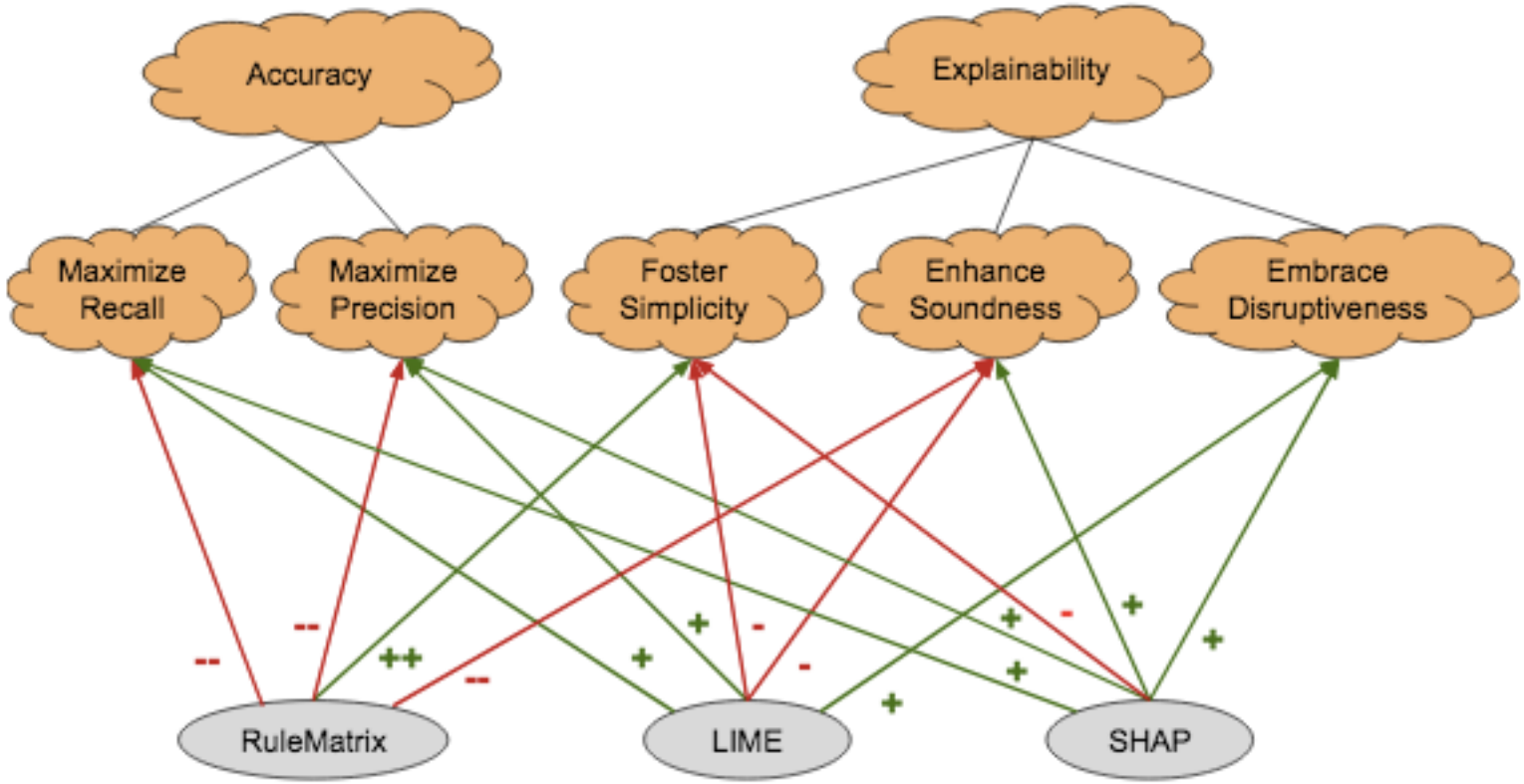
Bay Area Rapid Transit

*What're (high-level) softgoals of BART?*

# Softgoals as Selection Criteria



# Softgoal Interdependence Graph (SIG)




ESEC/FSE 2021

**XAI Tools in the Public Sector: A Case Study on Predicting Combined Sewer Overflows**



*Source:* https://doi.org/10.1145/3468264.3468547

# Rolling Deadline

- 10% of the total grade
  - An oral presentation whenever you're ready, but no later than Monday (July 25, 2022)
  - Email the instructor (nan.niu@uc.edu) when you're ready, and the instructor will confirm your RE Story presentation date & time
  - Each presentation is 5-10 minutes & real-time
  - You shall prepare very well the supporting materials, e.g., slides, photos, etc.
  - I will email your grade (out of 10), and my comments if any, after your presentation