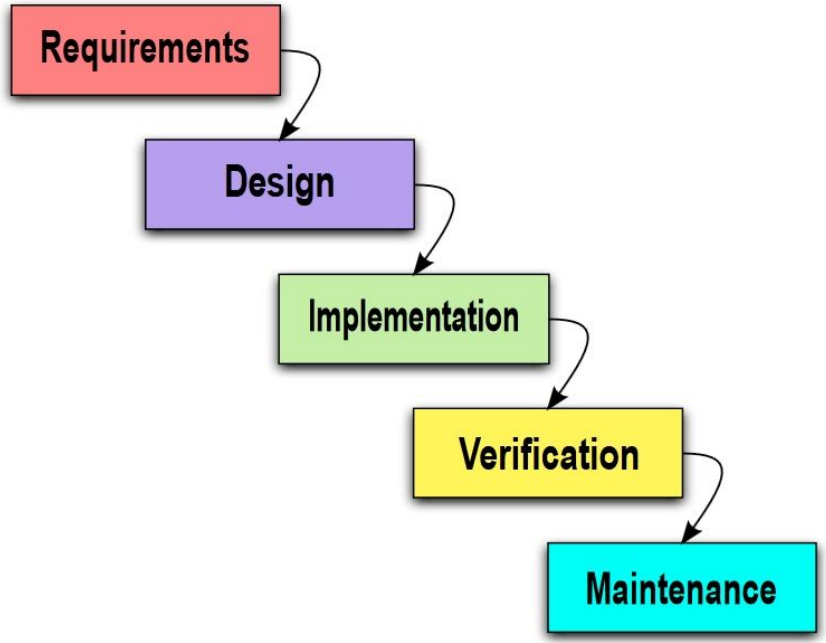
Detection of Conflicting Functional Requirements in a Use Case-Driven Approach

Jan Hendrik Hausmann, Reiko Heckel and Gabi Taentzer, 2002

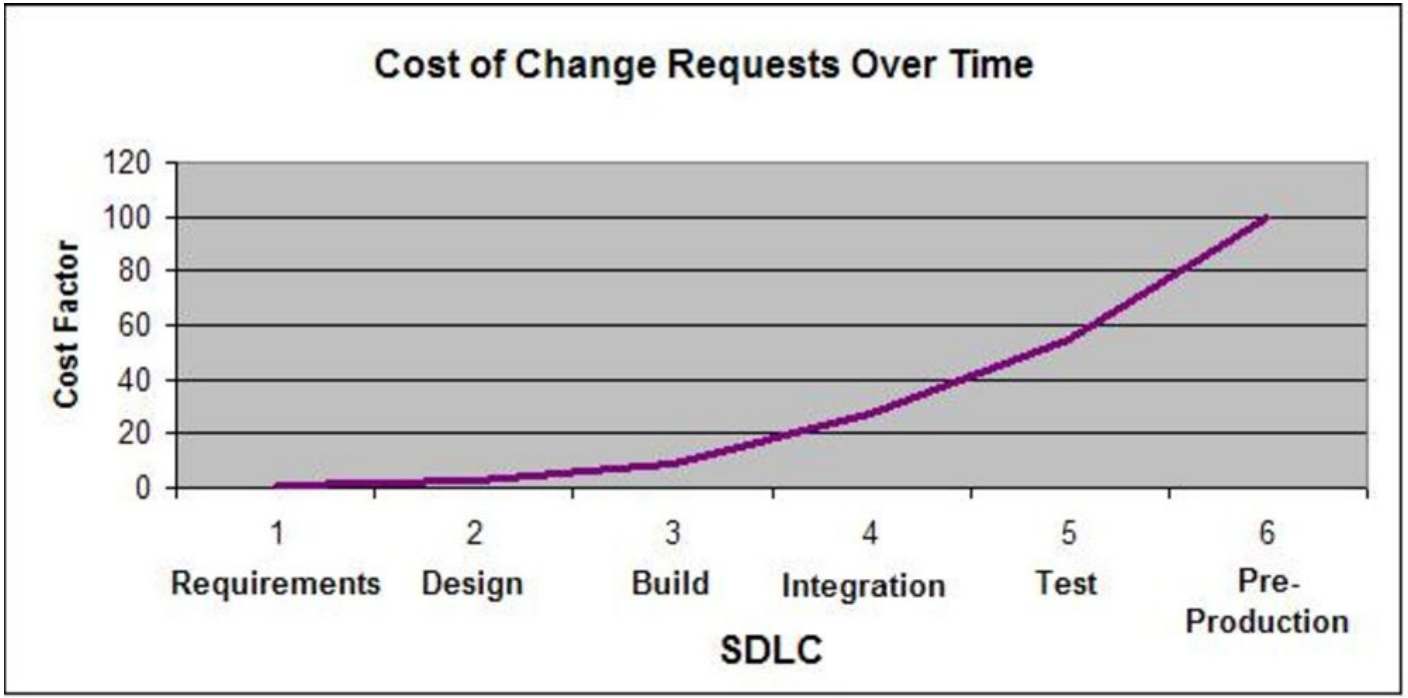
Presented by: Laura Walsh

Motivation

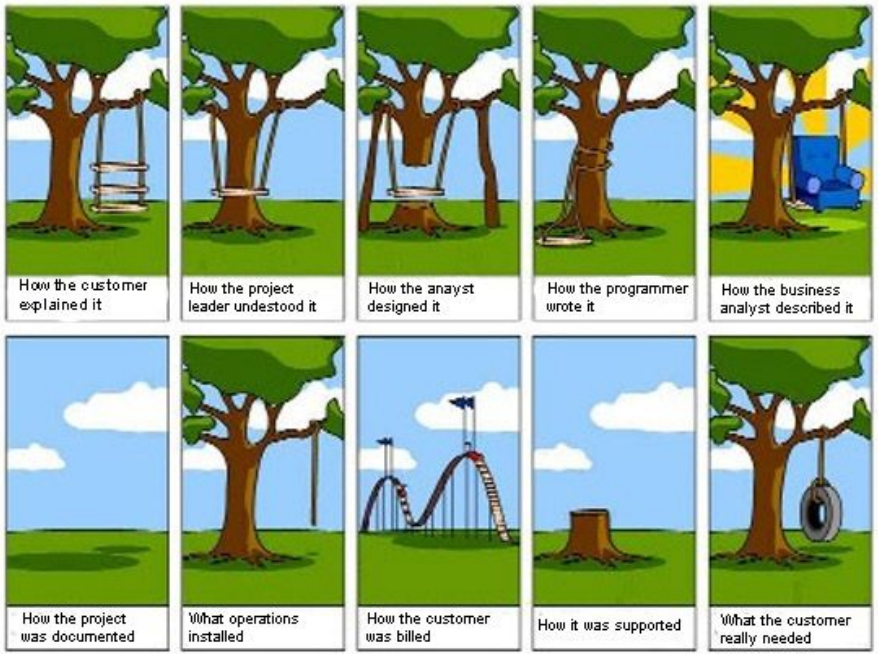


Find conflicting requirements as early as possible!

Motivation


Cost of Change Requests Over Time
Cost Factor
120
100
80
60
40
20
0
1
Requirements
2
Design
3
Build
4
Integration
5
Test
6
Pre-
Production
SDLC

Goal



- Analyse the requirements of the system before starting to build it, in order to identify whether there may be conflicting requirements

- Add information to UML models which tell the modeller where there is the potential for conflicts

Types of Consistency to Maintain

1. **Consistency of aspects**

   Use cases refer to situations from the problem domain which are not represented in the static model.

2. **Consistency of views**

   Semantic overlap between use cases expressing different requirements.

Running Example

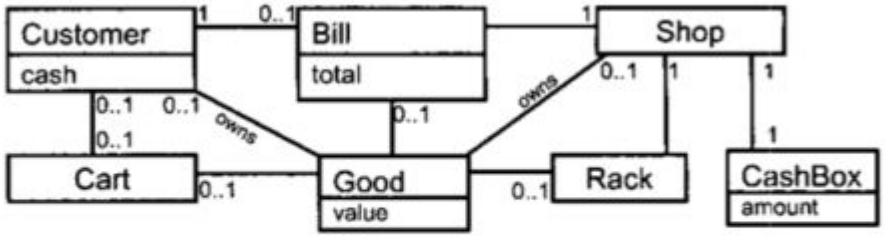


Figure 1: Class diagram of the shop

Class diagram - to represent static requirements

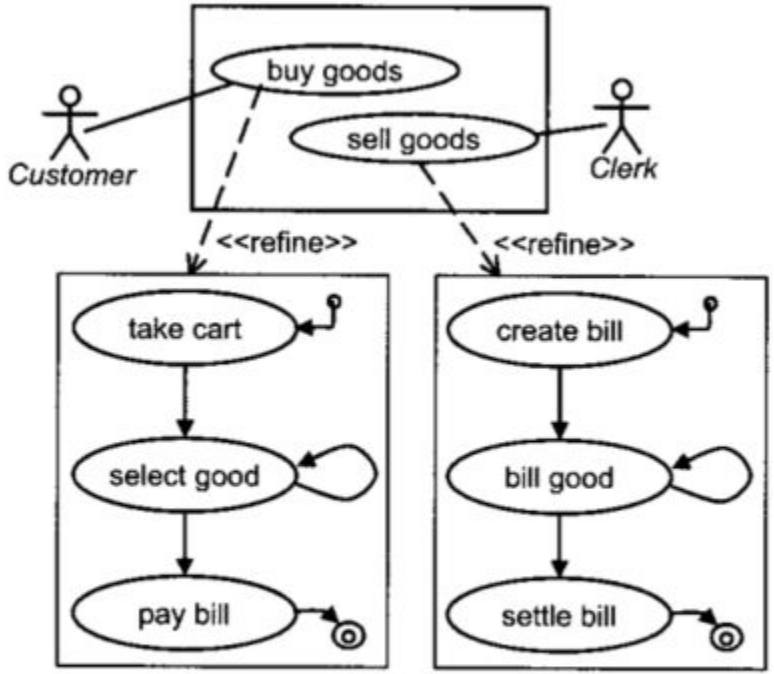


Figure 3: Use case diagram of the shop

Use case diagram- to represent dynamic requirements

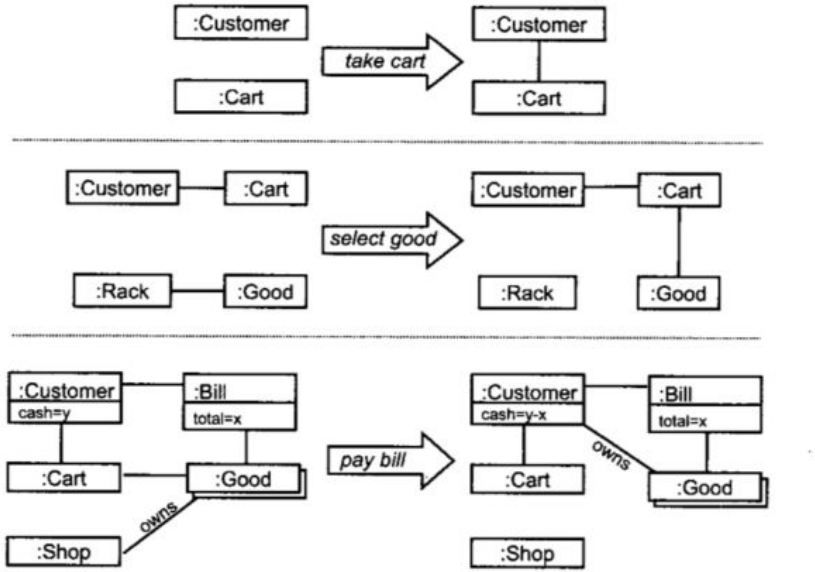


Figure 4: Action specifications for use case buy goods

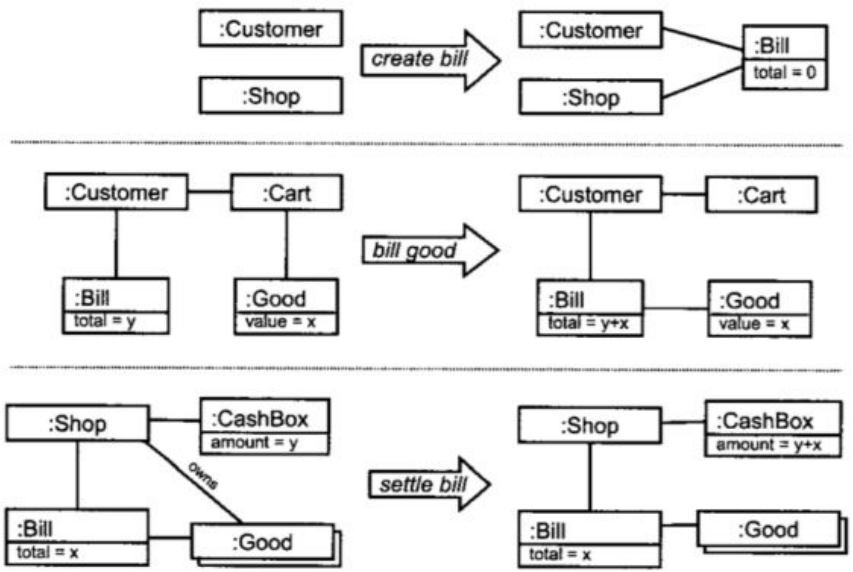


Figure 5: Action specifications for use case sell goods

Action specifications - to represent functional requirements

Rules

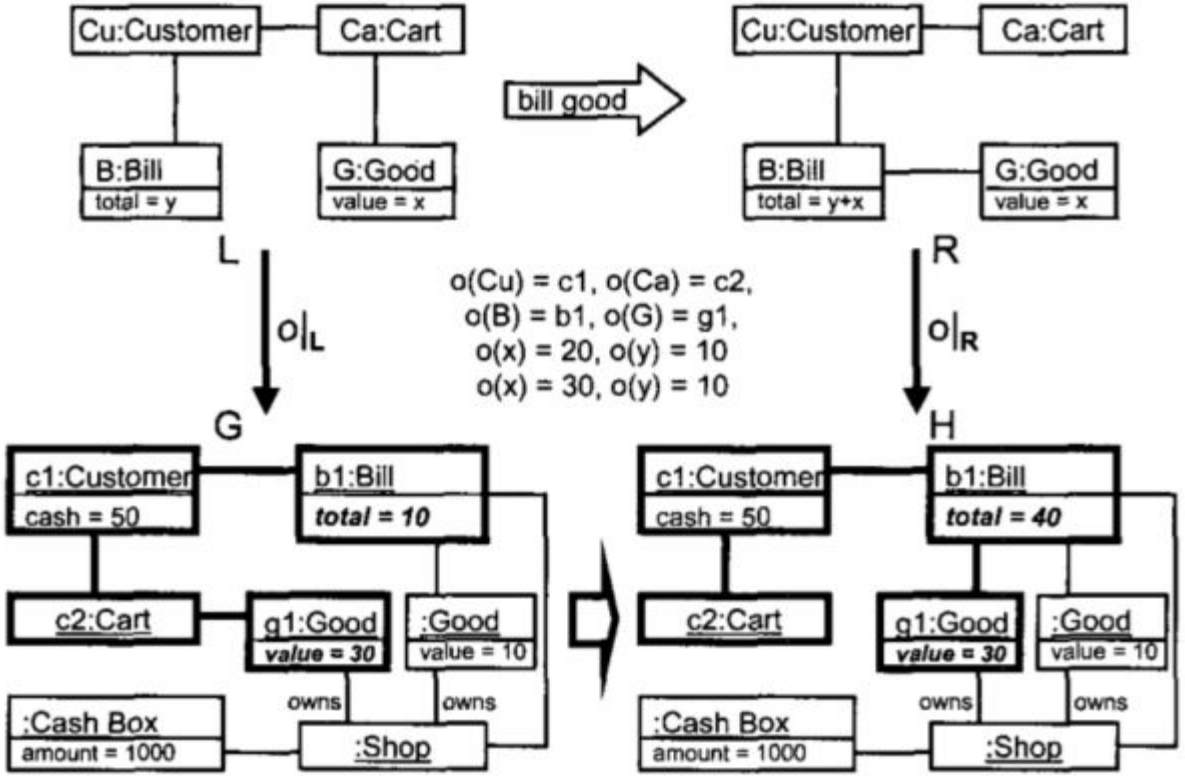


Figure 7: Application of the rule bill good

Representing the Model

Typed graph transformation system G = <TG, C, P, π>

TG = Type Graph (an abstract representation of the class diagram)

C = Constraints (what is allowable in the system)

P = Rule/action names

π = mapping between rule names (from P) and the expression of the rule in TG

What Causes a Conflict?

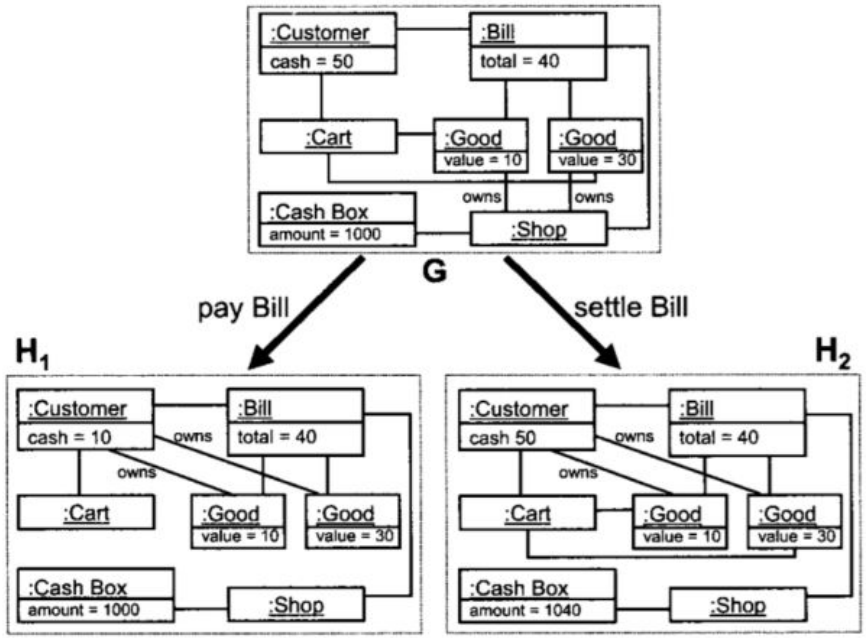


Figure 9: A conflict between pay bill and settle bill

Parallel Independence:
there can be no overlap in the items that are *deleted* by two transformations

Sequential Independence:
there can be no overlap in the items that are *created* by two transformations

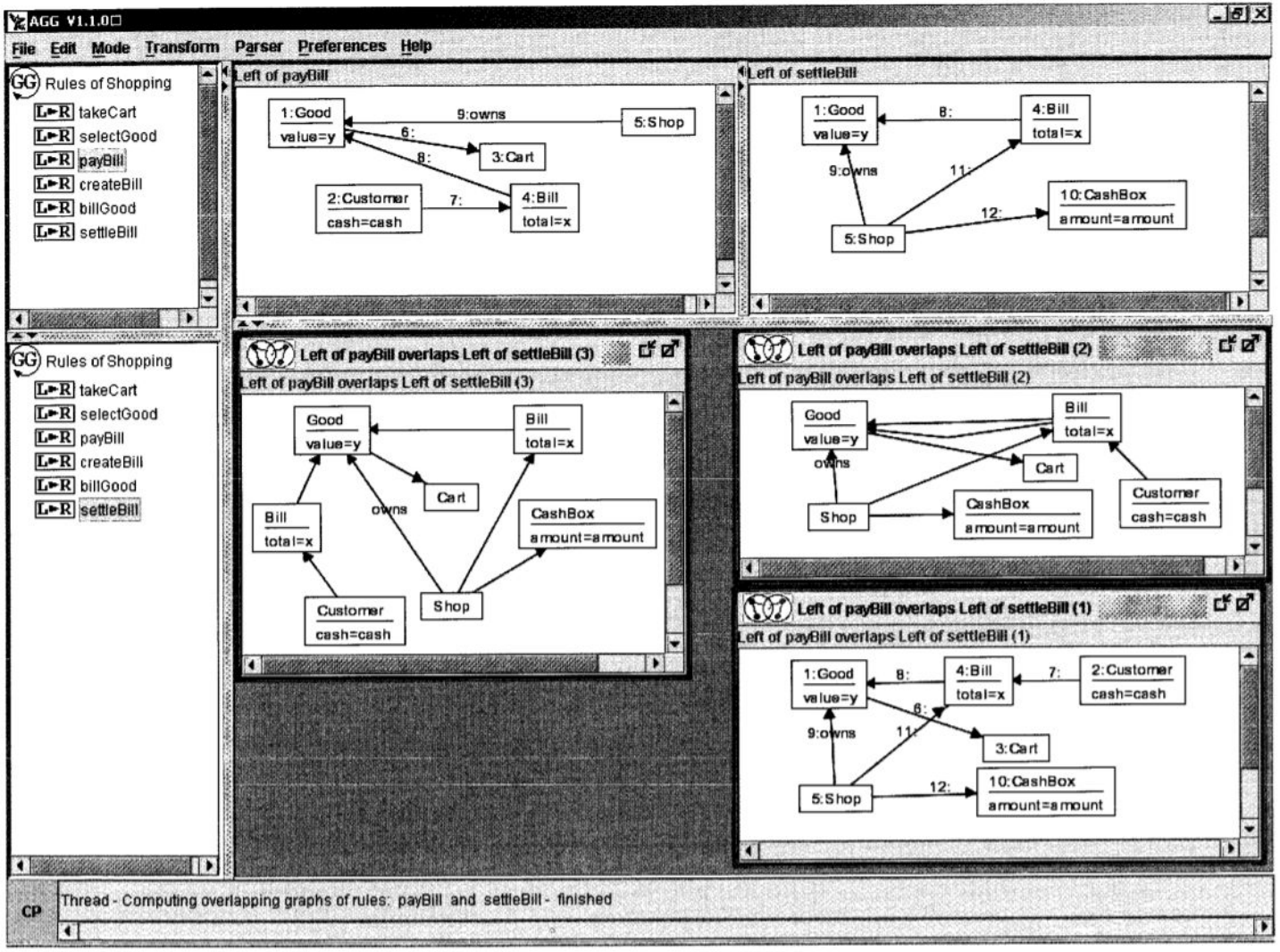
Finding Conflicts

The Attributed Graph Grammar System:

A Development Environment for Attributed Graph Transformation Systems

The Homebase

Find all **critical pairs** among transformations (can be done using graph transformation system AGG)


AGG V1.1.0
File Edit Mode Transform Parser Preferences Help
Rules of Shopping
takeCart
selectGood
payBill
createBill
billGood
settleBill
Left of payBill
1:Good value=y
9:owns
5:Shop
6:
3:Cart
8:
2:Customer cash=cash
7:
4:Bill total=x
Left of settleBill
1:Good value=y
8:
4:Bill total=x
9:owns
11:
10:CashBox amount=amount
5:Shop
12:
Rules of Shopping
takeCart
selectGood
payBill
createBill
billGood
settleBill
Left of payBill overlaps Left of settleBill (3)
Left of payBill overlaps Left of settleBill (3)
Good value=y
Bill total=x
Cart
owns
Bill total=x
CashBox amount=amount
Customer cash=cash
Shop
Left of payBill overlaps Left of settleBill (2)
Left of payBill overlaps Left of settleBill (2)
Good value=y
Bill total=x
owns
Cart
Shop
CashBox amount=amount
Customer cash=cash
Left of payBill overlaps Left of settleBill (1)
Left of payBill overlaps Left of settleBill (1)
1:Good value=y
8:
4:Bill total=x
7:
2:Customer cash=cash
6:
9:owns
11:
3:Cart
5:Shop
12:
10:CashBox amount=amount
CP
Thread - Computing overlapping graphs of rules: payBill and settleBill - finished

Strengths

- Simple implementation that has the potential for great improvement (of efficiency, cost cutting) to the requirements phase of software modelling

- Approach allows modeller to use their own CASE tool (along with AGG tool which already exists)

Weaknesses

- No study on whether their proposed additions to use case models would actually help modellers

- As the class diagram grows larger and more complicated, there will be many conflicts to sort through. Is it reasonable to expect modellers to manually review each flagged potential conflict?

Final Thoughts / Questions

- Small scope of the study

- Which (if any) techniques have been widely adopted since this paper was published?

Discussion

- How could the scope have been expanded?
- What are some ways that the researchers could have conducted a study to find out if their ideas had a significant impact?
- Do you think this process has the potential to be used by modellers? Why or why not?