Weaving Multiple Viewpoint Specifications in Goal Oriented Requirements Analysis

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Outline

- Background and Purpose of this Research
- Techniques for weaving viewpoints.
  - Graph composition, and
  - Cross-Cutting Tables for weaving goal graphs.
  - Aspect Patterns for weaving elements in a use case model.
- Case Study
- Conclusions and Future Works.

What is Viewpoint?

- One view point shows fragments of req. of a stakeholder.
- There are multiple viewpoints because of multiple stakeholders.
- Viewpoints should be integrated in a req. specification.
- Viewpoints are hard to be managed when they are written together.
- Examples of different viewpoints:
  - Functional view and Non-functional view.
  - Users' view, developers' view, maintainers' view ....

Background

- Goal Oriented Requirements Analysis (GORA) and Use Case Modeling (UCM) are useful for requirements elicitation.
- Two Problems:
  1. No guideline to describe different viewpoints respectively.
  2. No support for collaboration among stakeholders.

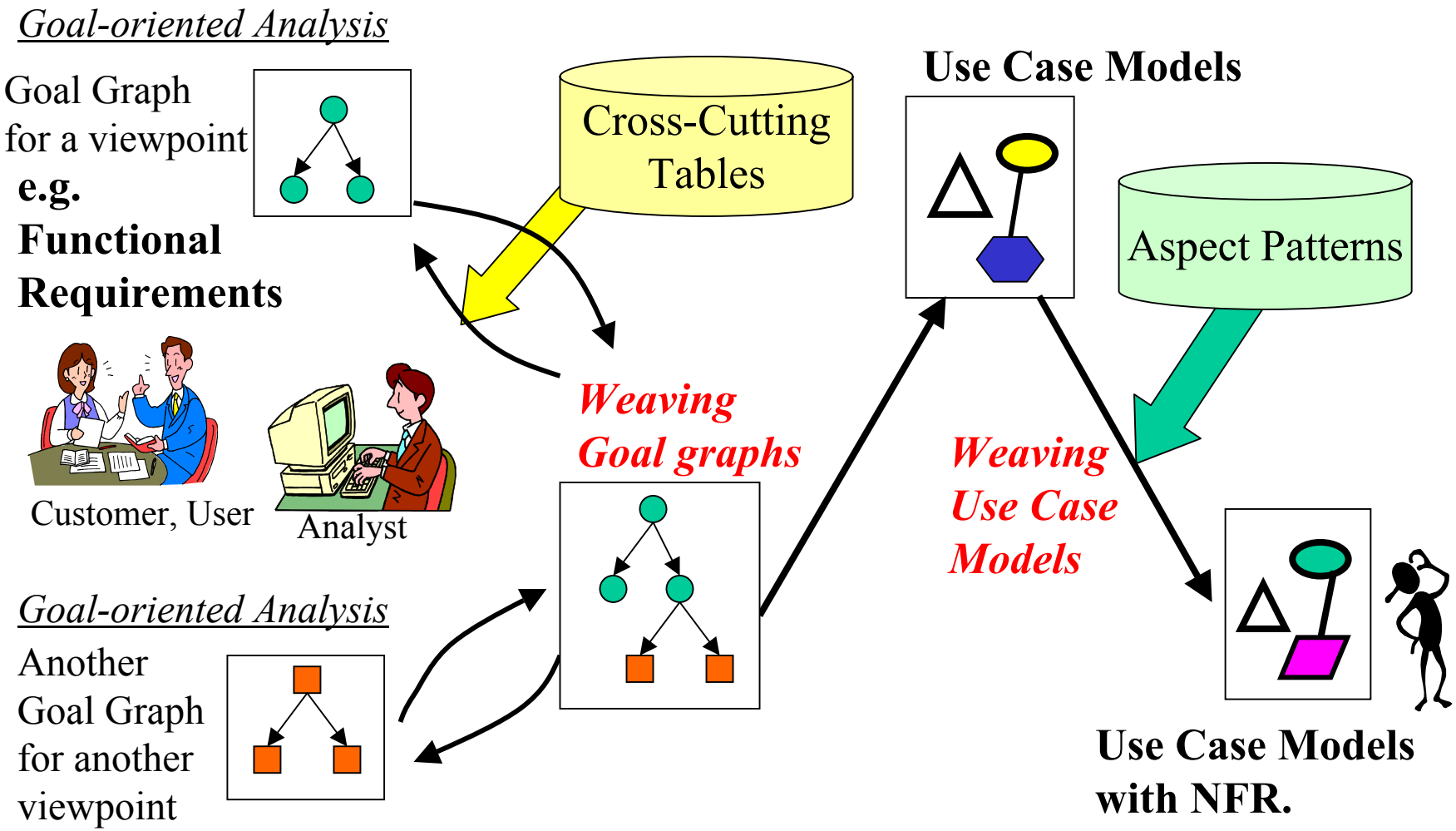
Purpose of this Research

- An Integration of viewpoints approach into GORA and UCM
  - for overcoming last two problems.
- Techniques for weaving viewpoints:
  1. Weaving several Goal Graphs

     by the graph composition and Cross-Cutting Table.
  2. Weaving Non-Functional Req. (NFR) into a Use Case Model or a Use Case Description

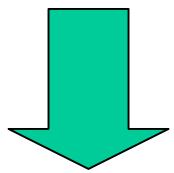
     by Aspect patterns.

Req. Elicitation Process



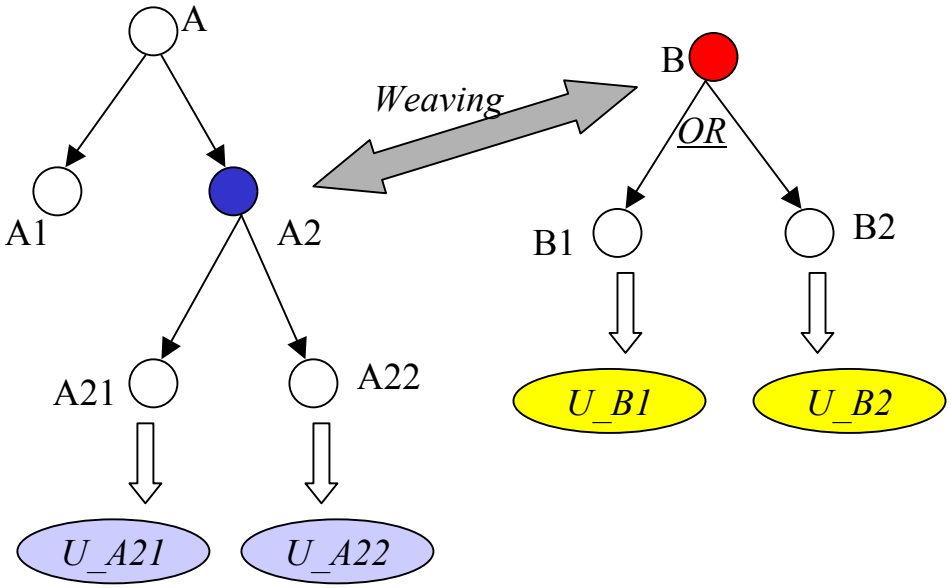
Weaving Goal Graphs

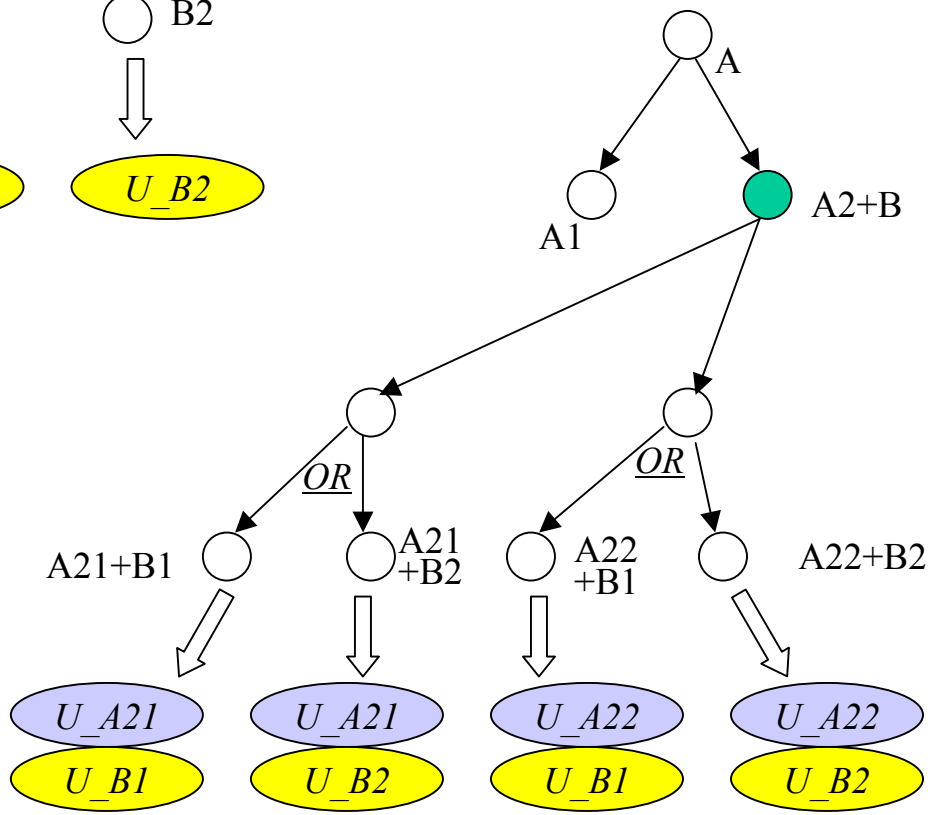
- Goal hierarchy is represented in simple AND-OR (directed acyclic) graphs.
- Relationship among goals can be written in logical formula.



- We can weave goals graphs in the same way as logical formulas.

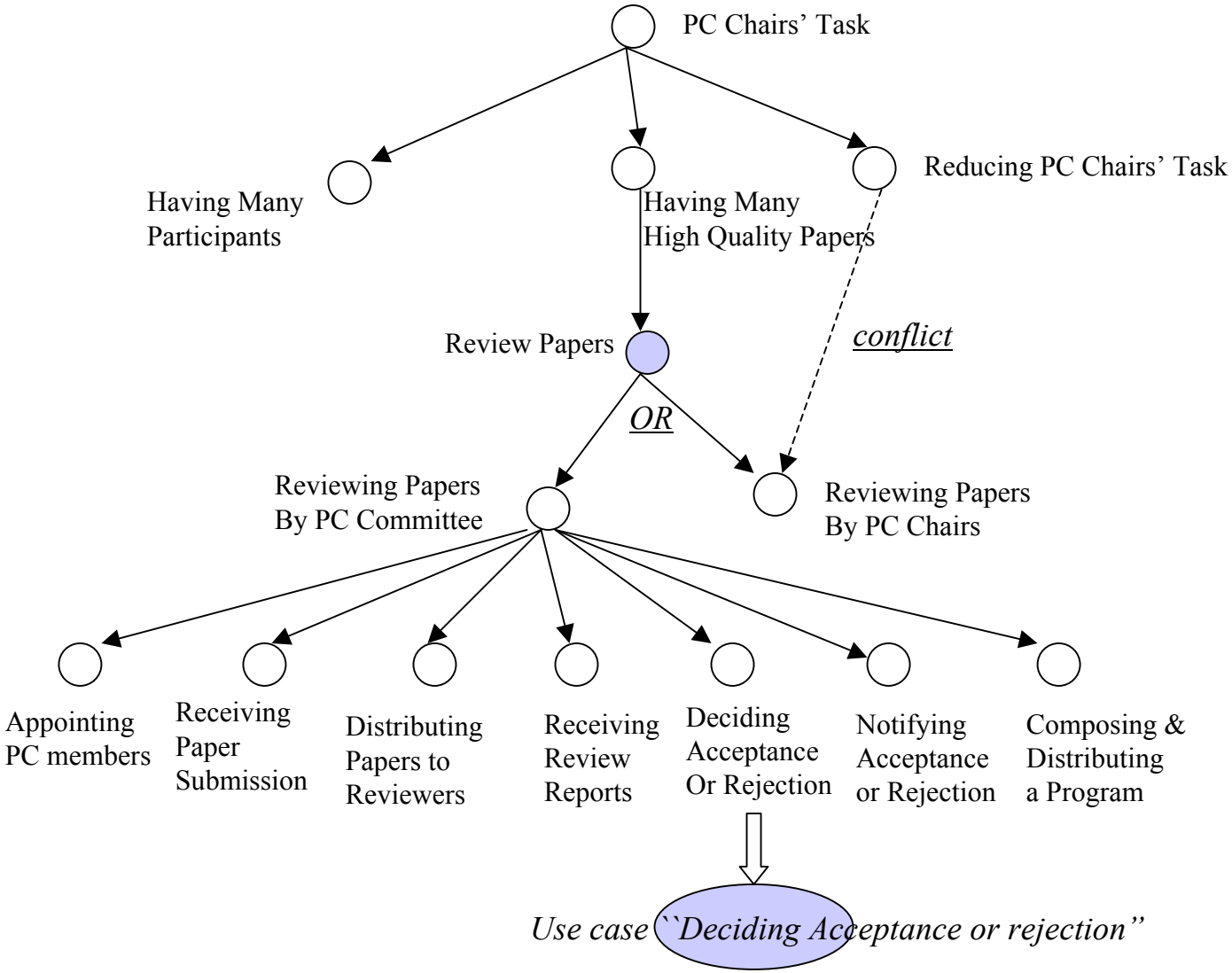
Weaving Two Goal Graphs



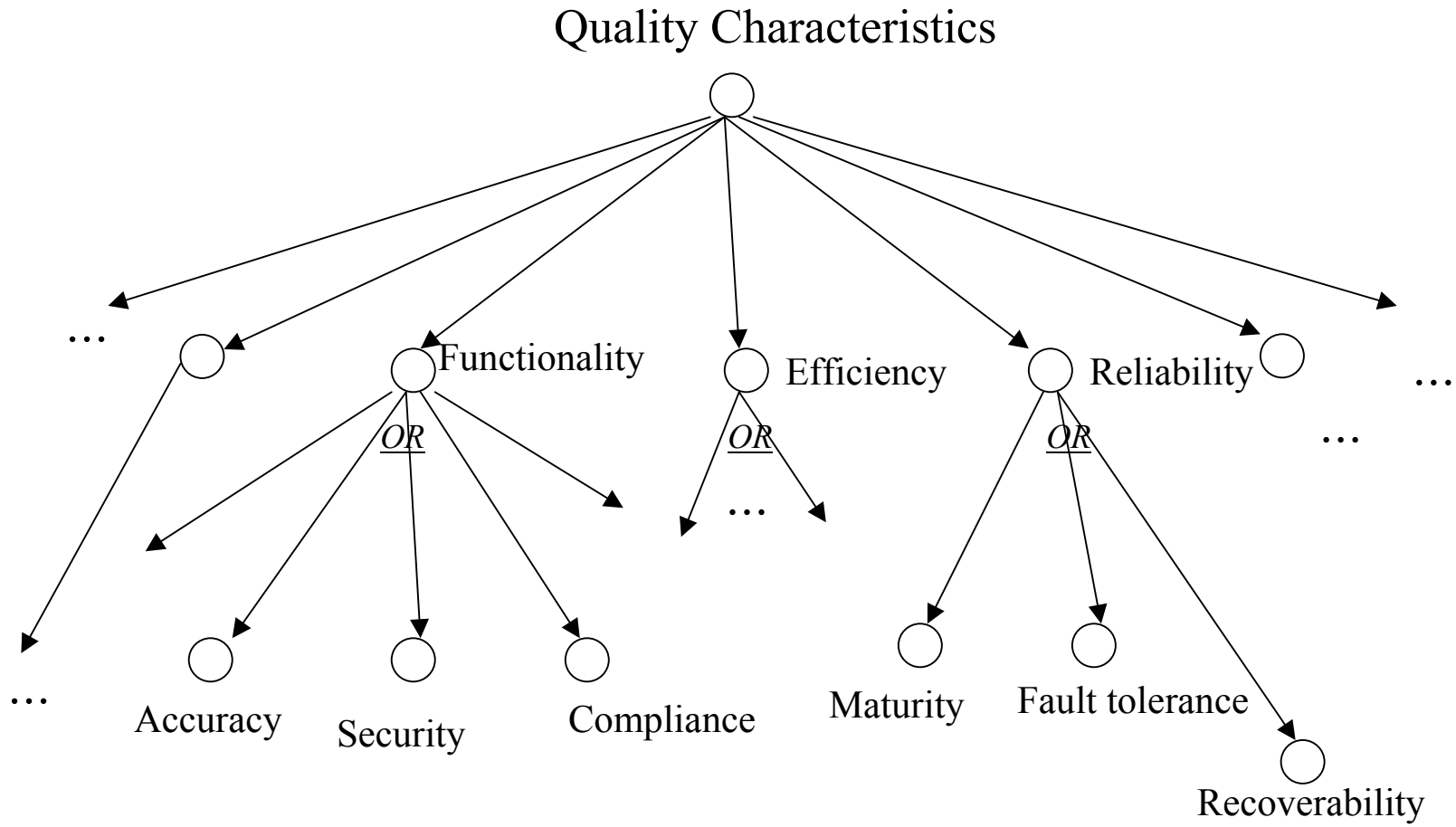


Weave A2 and B
Distribute B1, 2 to A21, 22
Leaves => use cases
By use case level weaving,
U_A21, U_B1 are integrated.

Goal Graph of FR: A viewpoint

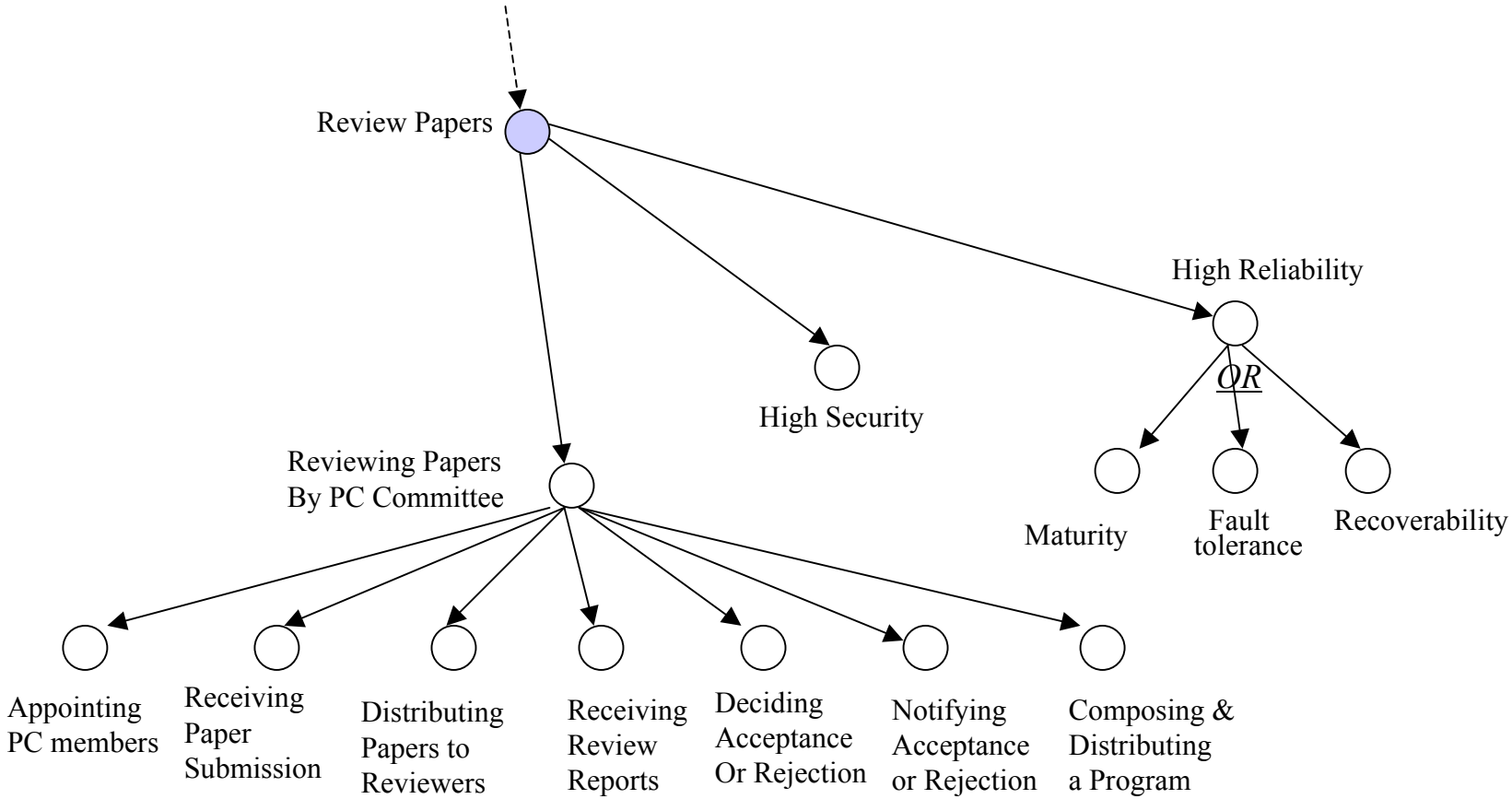


Non-Functional Goals: Another



From ISO9126 standards or other taxonomies.

Mixture of FR and NFR in a Graph



This graph is too complex without multiple viewpoint.
Multiple viewpoint prevent such complexity.
However ... too many possibilities.

Cross-Cutting Table (Matrix)

- Represent explicit relationship between two different viewpoints, e.g. FR and NFR.
- Advantages
  - Do not have to examine all possibilities in weaving goal graphs.
  - Easy to find trade-offs between two viewpoints.
- Hierarchical representation is OK.

Example of Cross-Cutting Table

FR \ NFR	Security	Reliability
Appoint PC members		
Receiving Paper Submissions	X	X
Distributing Papers to Reviewers	X	X
Receiving Review Reports	X	X
Deciding Acceptance or rejection	X	X
Notifying Acceptance or Rejection	X	X
Composing & Distributing a Program		

1st level

FR \ NFR	Maturity	Fault-tolerantness	Recoverability
Appoint PC members			
Receiving Paper Submissions		X	X
Distributing Papers to Reviewers	X		X
Receiving Review Reports		X	X
Deciding Acceptance or Rejection	X		X
Notifying Acceptance or Rejection	X		X
Composing & Distributing a Program			

2nd level

Elements of Use Case Modeling

- Use Case Diagram with data and control dependencies.

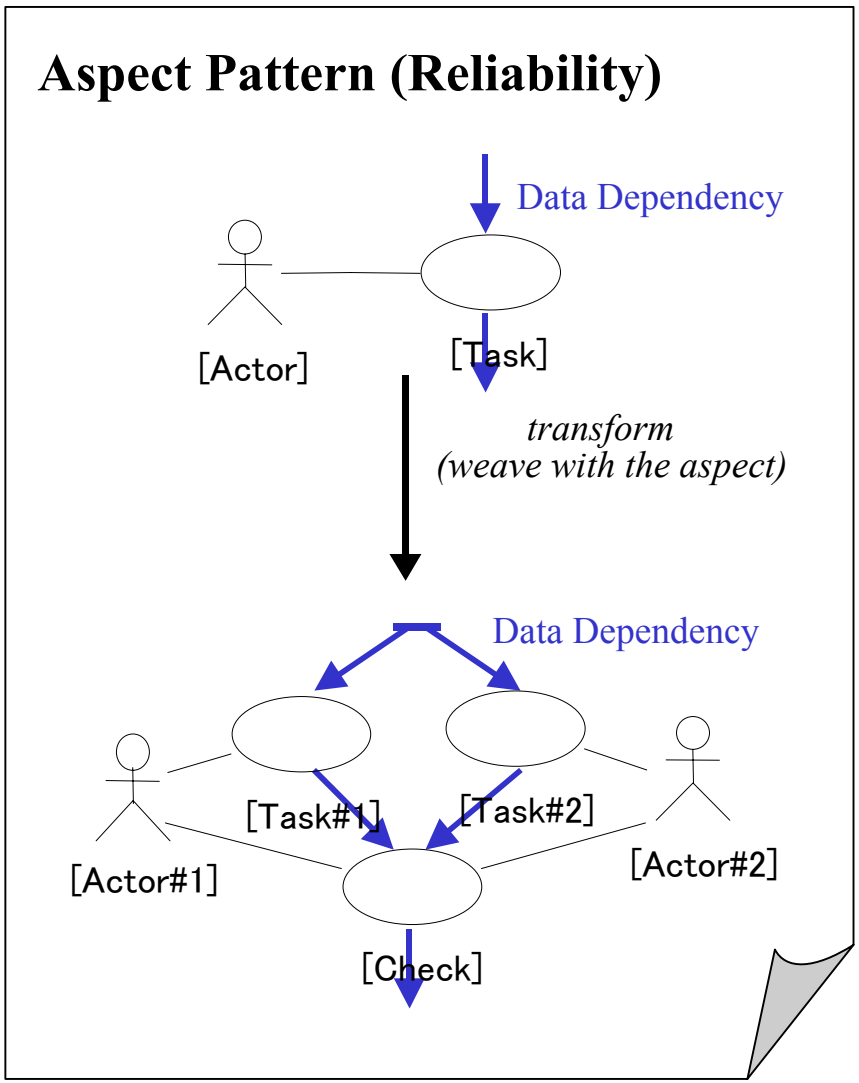
  ⇨ Use Case Map technique.

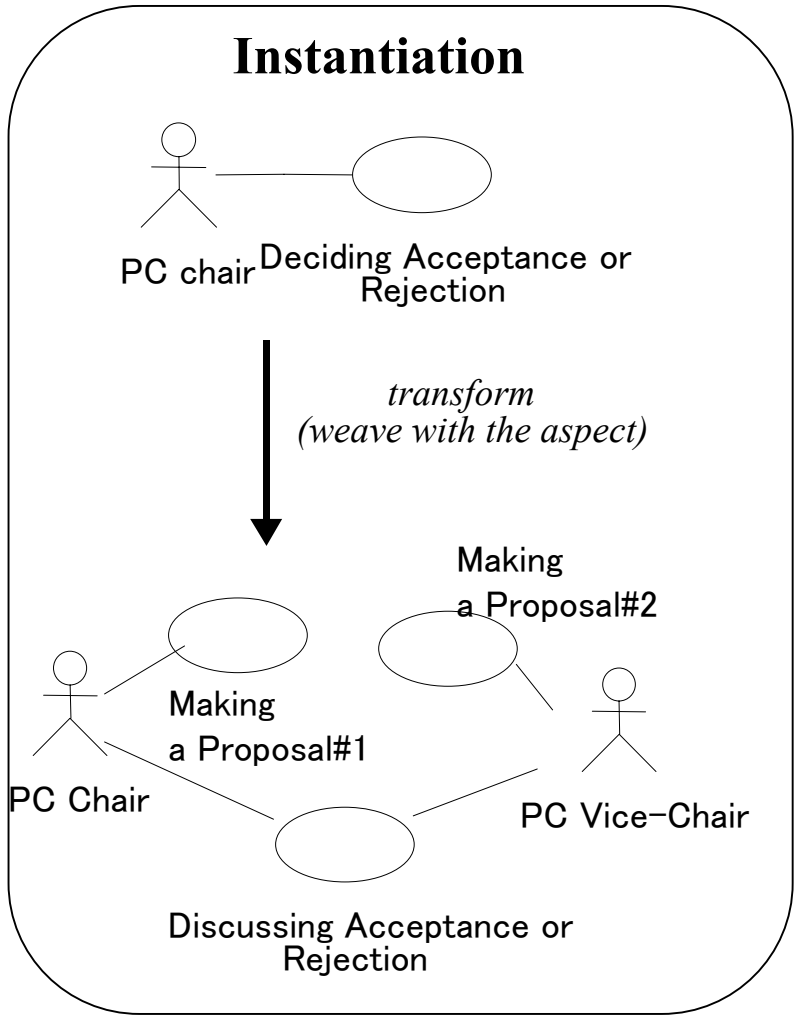
- Use Case Description represented by notations for behavior. e.g. scenario.

Aspect Patterns

- Templates for weaving several viewpoints in the level of use case modeling.
- Two types of patterns:
  - Transforming topology of a part of use case map so as to weave a specific viewpoint.
  - Transforming use case description so as to weave a specific viewpoint.
    - e.g. inserting specific activity in an original scenario

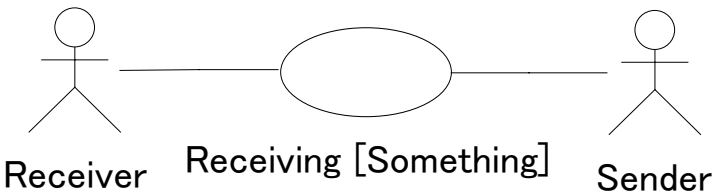
Example of use case map transformation



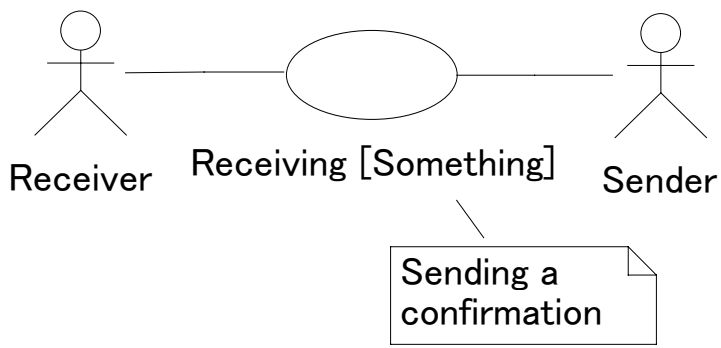


Example of UCD transformation

Aspect Pattern (Reliability)



Transform *(add an activity in a use case)*



Receiving [Something]
Objective, Actors, Activation Condition
Activity Flow
1. Receiving [Something] from [Sender].
2. Checking [Something].

Alternative or Exceptional Flow
2.5 Inform [Sender] if incomplete.

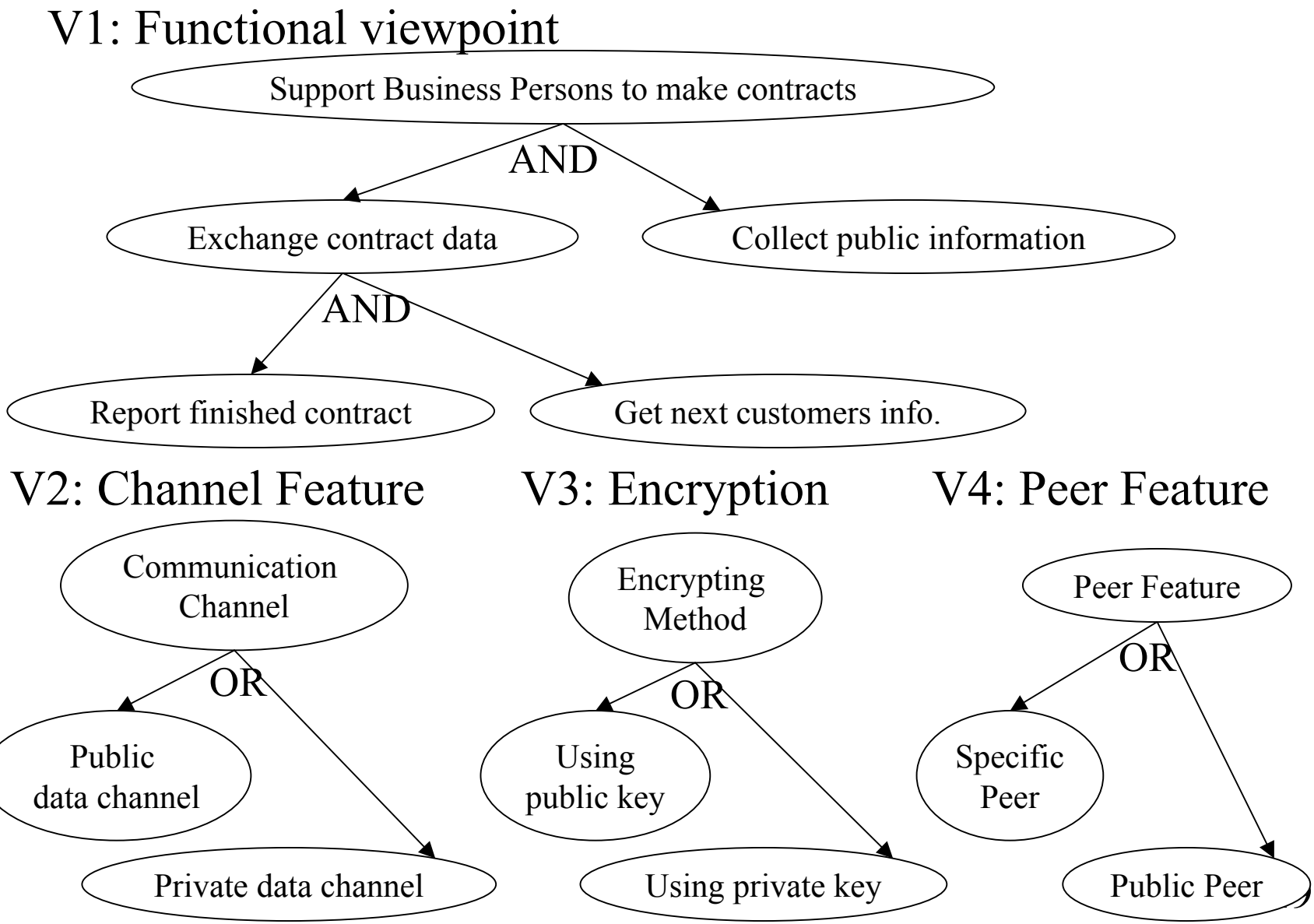
Receiving [Something]
Objective, Actors, Activation Condition
Activity Flow
1. Receiving [Something] from [Sender].
2. Checking [Something].
3. Sending a Confirmation to [Sender].

Alternative or Exceptional Flow
2.5 Inform [Sender] if incomplete.

A Case Study

- Purpose: to examine the advantages/disadvantages of our method.
- Problem: A simple system to support business persons.
- Four viewpoints and six cross-cutting tables.
  - V1: Functional viewpoint
  - V2: Comm. channel feature
  - V3: Encryption
  - V4: Peer Feature
- No aspect patterns were used.

Goal Graphs in each viewpoint



Cross-Cutting Tables

V2 \ V1	Report	Get next	Collect
Pub chan.	X	X	X
Pri. chan.	X	X	

V3 \ V1	Report	Get next	Collect
Pub key	X	X	
Pri. key	X	X	

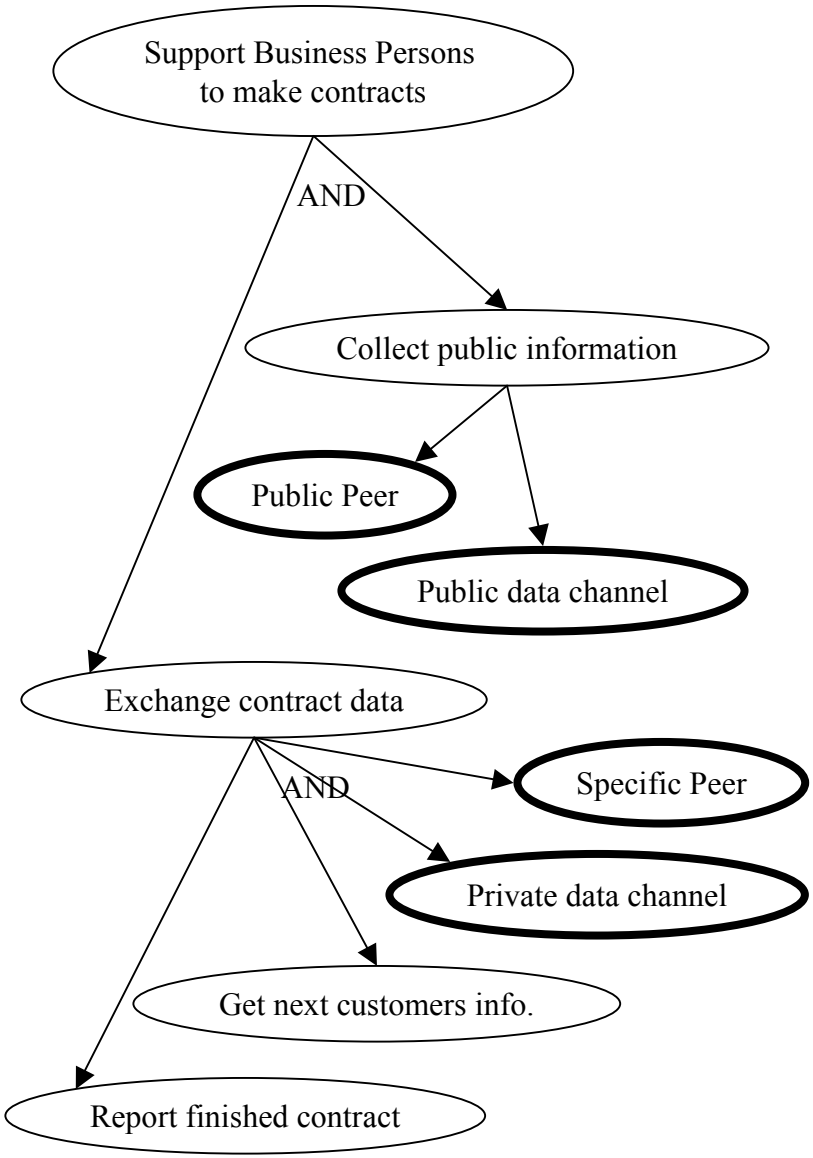
V4 \ V1	Report	Get next	Collect
Specific	X	X	
Public			X

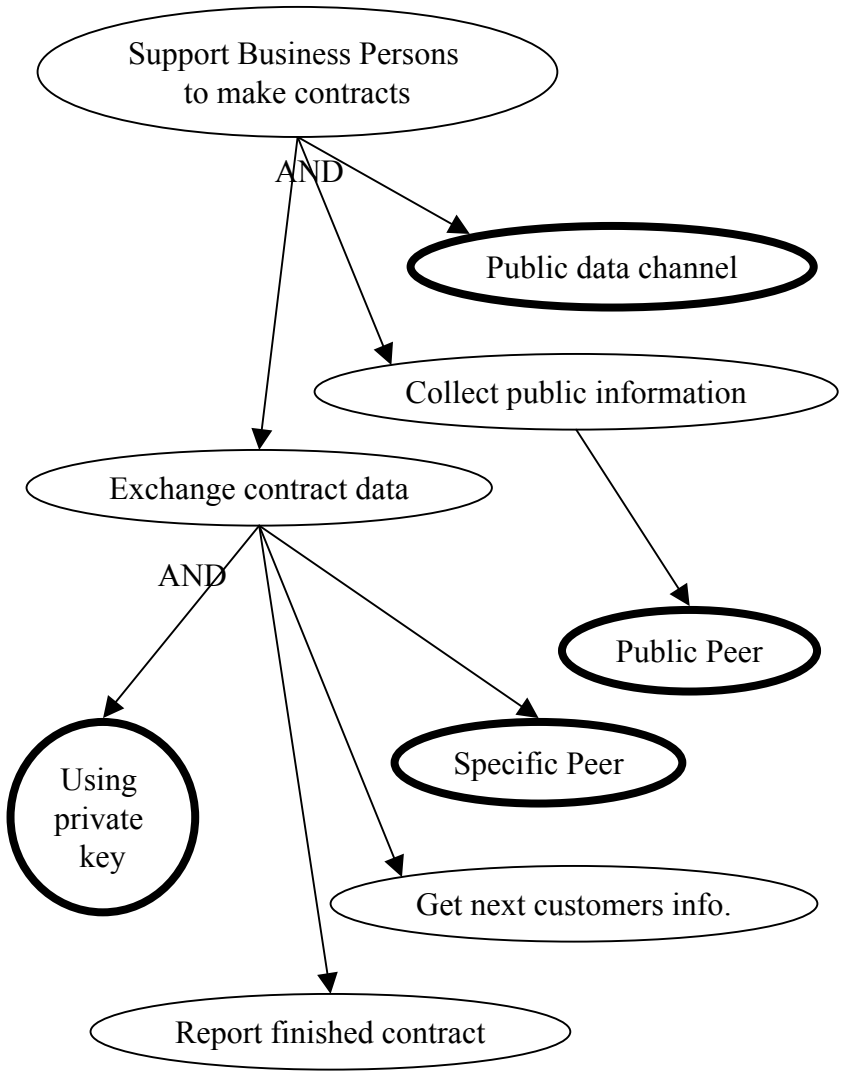
V2 \ V3	Pub. key	Pri. key
Pub chan.	X	X
Pri. chan.		

V2 \ V4	Specific peer	Public peer
Pub chan.	X	X
Pri. chan.	X	

V3 \ V4	Specific peer	Public peer
Pub. key	X	X
Pri. key	X	

Weaved Graphs (two possibilities)





Lesson Learned

- We could concentrate on each viewpoint respectively because we could weave them later.
- Viewpoints of NFR seem to be reusable because they do not depend on a problem.
  - Also, cross-cutting tables about NFR viewpoints seem to be reusable.
- We can systematically find alternatives of weaved goal graphs.
- CASE tool support must be required because it was hard to write and weave goals graphs manually.

Conclusion

- Propose a method to weave different viewpoints in goal oriented req. analysis and use case modeling.
- Basic techniques:
  - Goal composition
  - Cross-Cutting Tables
  - Aspect patterns
- We achieved a small case study to examine this method.

Future Works

- CASE tool support must be required especially in weaving goal graphs.
- Aspect patterns and its mining methods are required.
- Combination between our method (and its supporting tools) and collaboration tools such as groupware should be investigated.
  - Stakeholders can intrinsically collaborate with each other with our method,
  - but there is no explicit guideline now.