



UNIVERSITAT POLITÈCNICA  
DE CATALUNYA  
BARCELONATECH



Software and Service  
Engineering Group



UNIVERSIDAD DEL  
AZUAY

# Dealing with Goal Models Complexity using Topological Metrics and Algorithms

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L. Méndez, L. López, C. P. Ayala

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- Proposal
  - Ranking approach
  - Clustering approach
- Conclusions

# Motivation

## Context

Our research work applies  $i^*$  to model the business implications of Open Source Software (OSS) adoption. iStar allows:

- To identify the dependencies with external stakeholders
- To model the business goals (involved in OSS adoption) and its relationships.
- To identify how the OSS impact is propagated to business goals
- To model the different ways in which an organization can adopt OSS

# Motivation

## Models

We have a catalogue of  $i^*$  models:

- Open Innovation (OI) maturity levels
- OSS Adoption Strategies

The OI maturity models have been constructed in a systematic way:

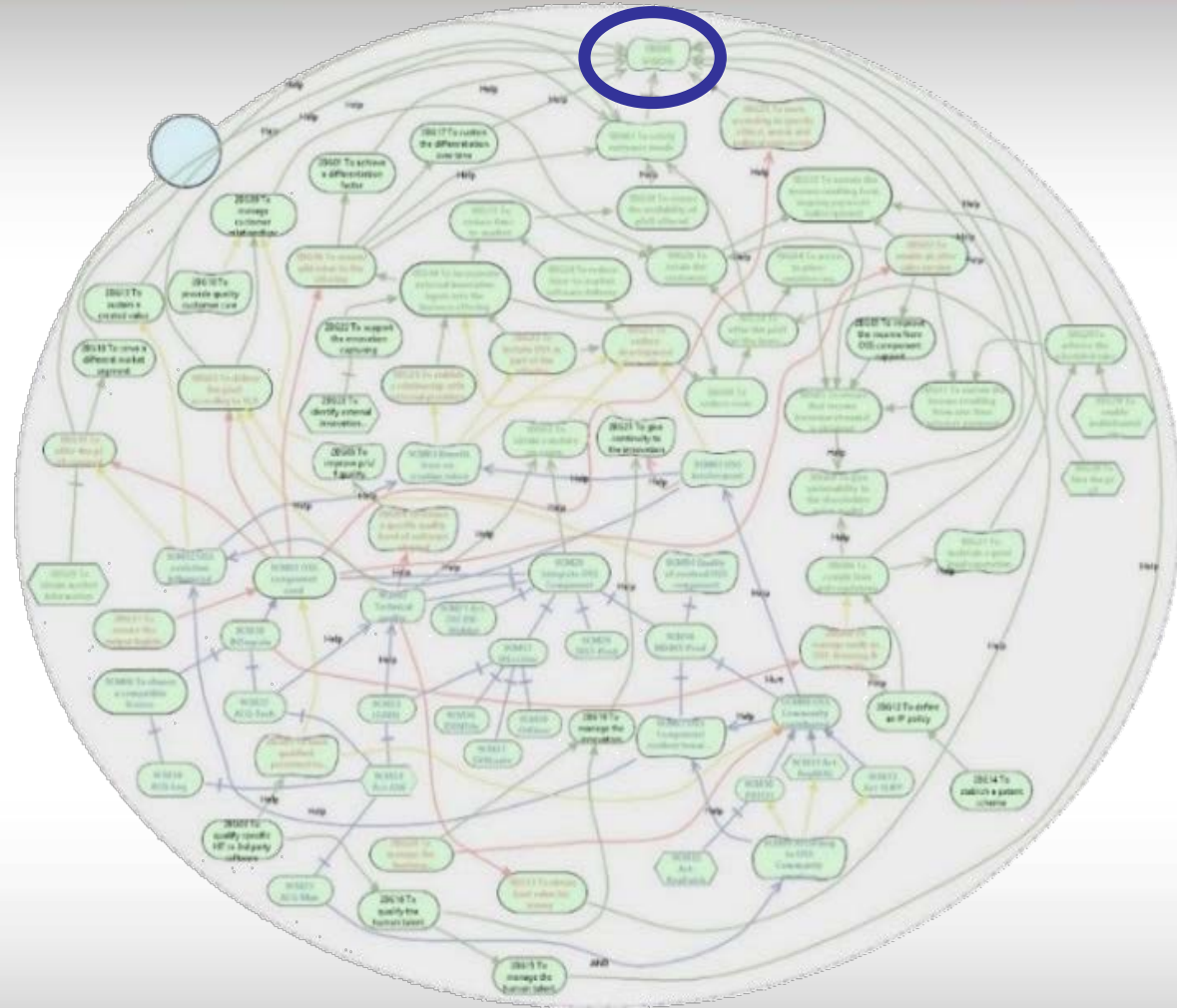
- Organization “Vision” is the root
- Elements are refined homogeneously
  - balanced model

# Motivation

## The goal model

80 goals

More than 120 links



# Motivation

## Current situation

The business goal models are extensive and complex

## The complexity problem

- It is difficult to understand, verify, and manage
- It is hard to estimate the outcome of an action
- The probability of poor maintenance increases

# Motivation

## The proposal

Approaches  
to reduce the complexity



### Ranking

Manageable set of goals  
that are relevant for a  
specific analysis

### Clustering

Modules of goals (clusters) that  
can integrate a hierarchy with  
different levels of abstraction

# The Ranking Approach

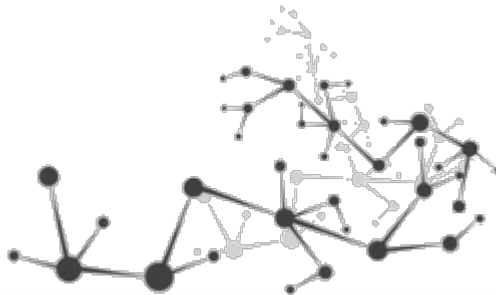
## Main Idea

A selective analysis is more efficient than an exhaustive one



Manageable set

## Foundations



- Notion of 'importance'
- The relative importance
- PageRank centrality metric



# The Ranking Approach

| Pos.             | Goal   | PR Value | Level           | #Sub goals |
|------------------|--|----------|-----------------|------------|
| 1 <sup>st</sup>  | VISION   | 0.160799 | 0               | 79         |
| 2 <sup>nd</sup>  | To give sustainability to the shareholder value model                | 0.065000 | 1 <sup>st</sup> | 63         |
| 3 <sup>rd</sup>  | To ensure that income are obtained as planned                        | 0,058618 | 2 <sup>nd</sup> | 44         |
|                  | ...  |          |                 |            |
| 15 <sup>th</sup> | To incorporate external innovation inputs into the business offering | 0,020421 | 4 <sup>th</sup> | 22         |
|                  | ...  |          |                 |            |
| 25 <sup>th</sup> | To offer the p/s/f required  | 0,008413 | 2 <sup>nd</sup> | 16         |
|                  | ...  |          |                 |            |
| 67 <sup>th</sup> | To establish a patent scheme   | 0,001985 | 4 <sup>th</sup> | 0          |
|                  | ...  |          |                 |            |
| 80 <sup>th</sup> | To ensure the output logistic (customer delivery)                    | 0,001985 | 4 <sup>th</sup> | 0          |



Manageable set

# The Clustering Approach

## Main Idea

To modularize in order to divide an extensive model into small, more manageable modules that can be analyzed and maintained as a unit

## Foundations

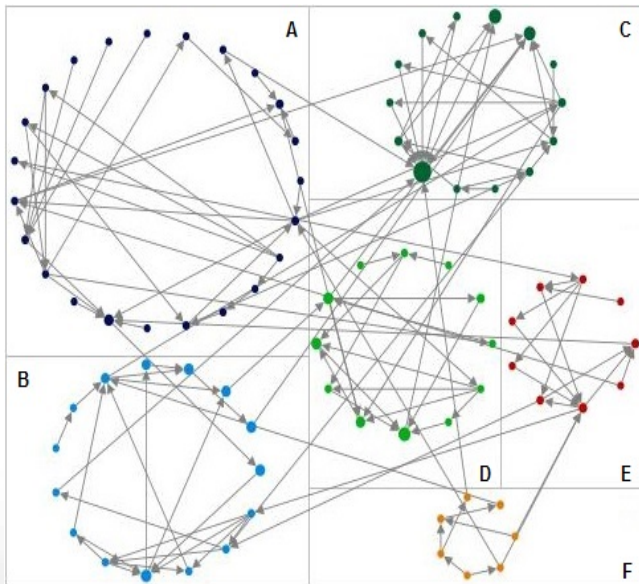


Manageable set

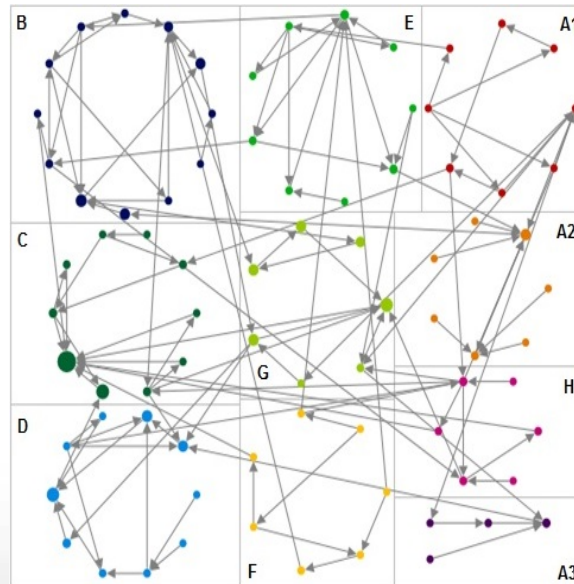
- Notion of 'cluster'
- Clustering algorithms
- Community structures as modules

# The Clustering Approach

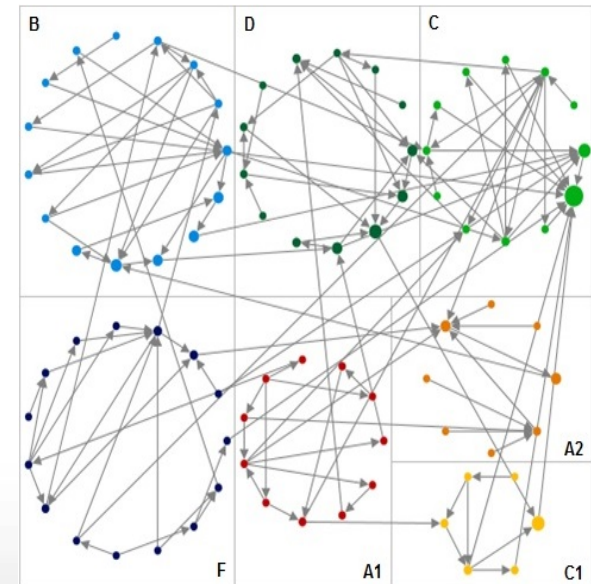
Clauset-Newman-Moore  
(CNM)



Wakita-Tsurumi  
(WT)



Girvan-Newman  
(GN)



# The Clustering Approach

## Clustering Algorithms

- Clauset-Newman-Moore (CNM)
- Wakita-Tsurumi (WT)
- Girvan-Newman (GN)

| Code               | Cluster Name                    | CNM      | WT        | GN       |
|--------------------|---------------------------------|----------|-----------|----------|
| A                  | Quality                         | 23       | -         | -        |
| A1                 | Quality (component integration) | -        | 8         | 11       |
| A2                 | Quality (component selection)   | -        | 7         | 8        |
| A3                 | Quality (customer issues)       | -        | 4         | -        |
| B                  | Offer & Innovation              | 15       | 12        | 15       |
| C                  | Strategy & Law compliance       | 14       | 10        | 12       |
| D                  | Incomings                       | 12       | 10        | 13       |
| E                  | OSS Community                   | 9        | 9         | 15       |
| F                  | Human Talent                    | 7        | 7         |          |
| C1                 | Law compliance (only)           | -        | -         | 6        |
| G                  | Offer delivery                  | -        | 7         | -        |
| H                  | Not clear                       | -        | 6         | -        |
| <b># Clusters:</b> |                                 | <b>6</b> | <b>10</b> | <b>7</b> |

# Conclusions

## Ranking Approach

- Generates a ranking of goals
- Allows organization to select a manageable set of goals according to its major relative importance

## Central benefit:

Working with this manageable set, the organization can focus the effort on goals considered as high priority

# Conclusions

## Clustering Approach

- Helps to identify clusters of goals that can become modules
- The more appropriated clustering algorithm is the one that generates the least number of groups

## Central benefit:

Improving of understanding, analysis and maintenance of the goal model, through the hierarchy of modules

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# Questions?



emendez@lsi.upc.edu  
llopez@essi.upc.edu

lmendez@uazuay.edu.ec  
cayala@essi.upc.edu