



Towards Open Configuration

- A Research Agenda -

Alexander Felfernig¹, Martin Stettinger¹, Gerald Ninaus¹, Michael Jeran¹,
Stefan Reiterer², Andreas Falkner³, Gerhard Leitner⁴, and Juha Tiihonen⁵

¹Graz University of Technology, Austria • ²SelectionArts, Austria •

³SIEMENS AG, Austria • ⁴University of Klagenfurt, Austria, ⁵Aalto University, Finland

¹alexander.felfernig@ist.tugraz.at

Agenda

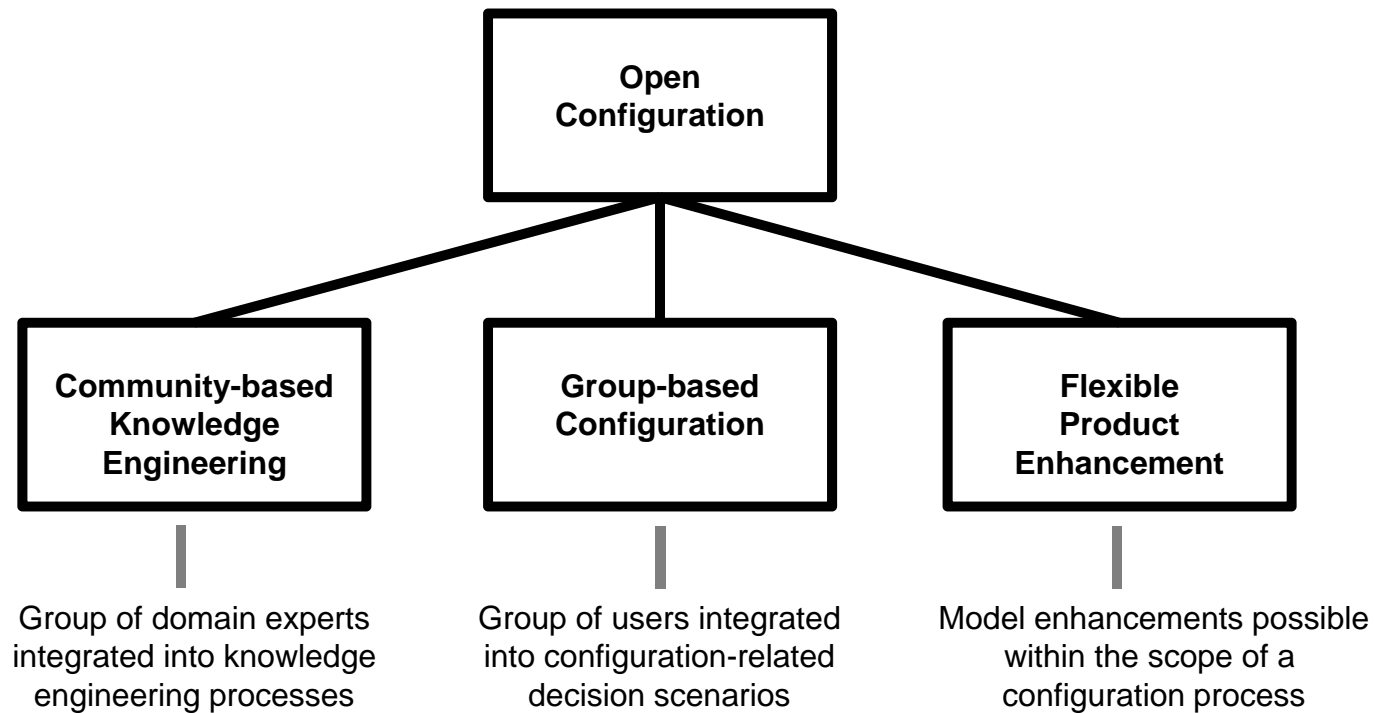
- Motivation
- Research Issues
 - Community-based Knowledge Engineering
 - Group-based Configuration
 - Flexible Product Enhancement

Motivation

- Existing Improvements
 - Automated Testing & Debugging
 - Intelligent User Interfaces
- Knowledge Engineering Challenge
 - Increasing amount & complexity of KBs
 - Missing scalability due to limited resources
- Decision Support Challenge
 - Support of only single users
 - Flexible configuration enhancement not possible

👉 **Tackle these issues with „Open Configuration“**

Open Configuration



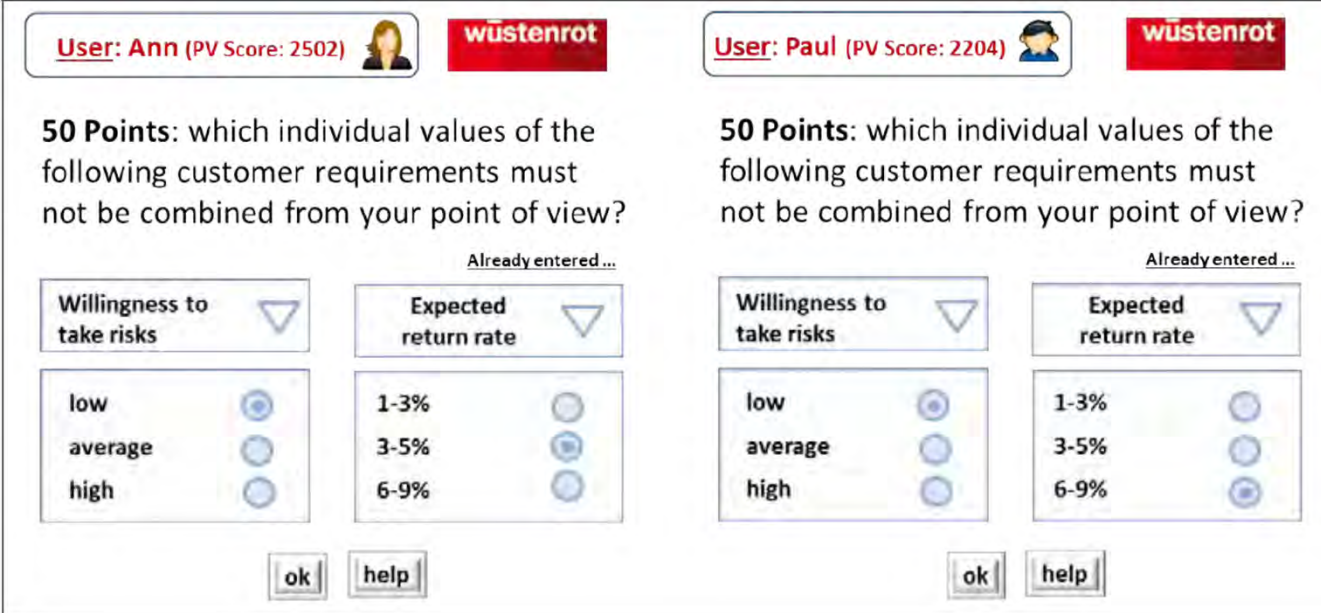
Community-based Knowledge Engineering

- Basic idea of „end user programming“
- Includes concepts of „Human Computation“
- „Micro tasks“ are designed to be easily feasible

| micro task topic | description |
|------------------|---|
| variables | definition/evaluation of variables included in V |
| questions | definition/evaluation of questions related to $v_i \in V$ |
| dialog sequences | definition/evaluation of question sequences |
| constraints | definition/evaluation of constraints in C |
| examples | definition/evaluation of test cases in T |
| diagnoses | evaluation of conflict resolution alternatives for C |

Game-based Constraint Acquisition: Example

- Example: „Compatibility Constraints“
- Two-player game
- Goal: establish consensus by minimizing #estimates

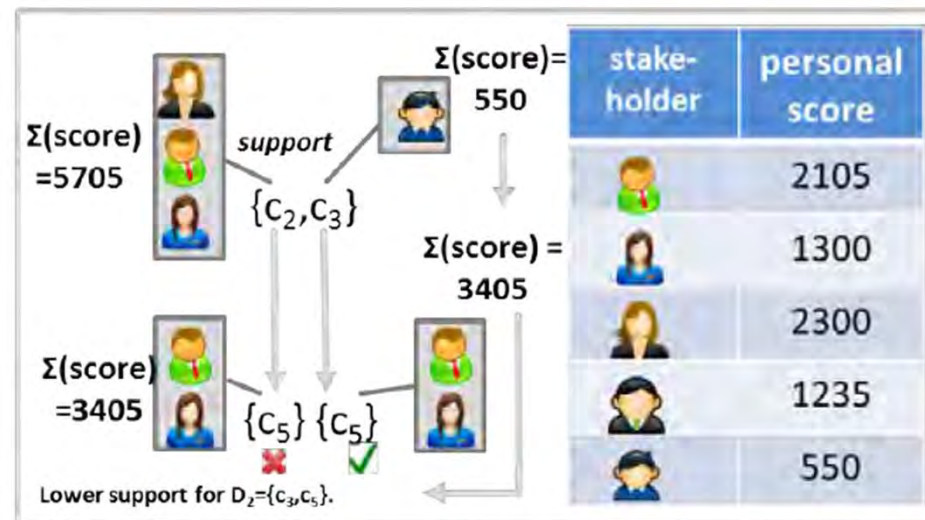
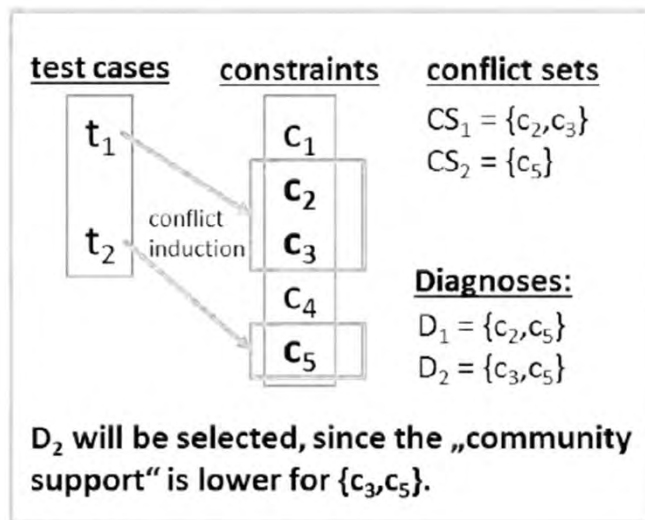


The screenshot shows two side-by-side game panels for users Ann and Paul. Both panels are for the 'wüstenrot' brand. Each panel asks the user to select 50 points for which individual values of customer requirements must not be combined. The requirements are 'Willingness to take risks' and 'Expected return rate'. Each requirement has three radio button options: low, average, and high. The 'Already entered...' section shows that for both users, 'low' risk and '1-3%' return rate are selected. 'ok' and 'help' buttons are at the bottom of each panel.

| User | PV Score | Willingness to take risks | Expected return rate |
|------|----------|---------------------------|----------------------|
| Ann | 2502 | low | 1-3% |
| Paul | 2204 | low | 1-3% |

Group-based Diagnosis of Faulty Configuration Knowledge Base: Example

- Example: faulty knowledge base
- Task: community has to decide about diagnosis Δ
- Diagnosis $\Delta \subseteq C$: $C - \Delta$ consistent



Group-based Configuration: Relevant Future Scenarios

| ID | domain for group-based configuration | components and constraints | decision makers |
|----|--|--|---|
| 1 | software release plans | requirements, releases, dependencies, preferences | stakeholders in software project |
| 2 | product line scoping and open innovation | (new) features, constraints between features, preferences | representatives from different departments, customers |
| 3 | bundle configuration (e.g., hotel, flight, tour, etc.) | (new) destinations, hotels, sightseeing tours, (resource) constraints, preferences | travel group |
| 4 | stakeholder selection for a new software project | (new) persons, constraints regarding competences and resources, preferences | (initial) team members |
| 5 | architectural design in software development | components, interfaces, technologies, constraints between components, preferences | (distributed) software project members |
| 6 | financial service configuration | financial services, resource constraints, preferences | family members |
| 7 | building configuration (e.g. smart home, office block) | rooms, furniture, light control equipment, constraints between components, preferences | family members, suppliers, company representatives |
| 8 | funding decisions | project proposals, resource constraints, preferences | evaluators, consultants, decision makers |

Group-based Configuration: Sketch of Future Recommendation Scenarios

- Example: different possible instances (destinations)
- Task: selection of one instance
- Recommendation: instance a group is willing to accept

| destination | Lindwurm | Großglockner | Pyramidenkogel | Isonzo Valley |
|-----------------|----------|--------------|----------------|---------------|
| Ben | 1 | 1 | 0 | 0 |
| John | 1 | 1 | 0 | 0 |
| Kate | 0 | 0 | 1 | 1 |
| least misery | 1 | 0 | 1 | 0 |
| majority voting | 1 | 1 | 0 | 0 |

Flexible Product Enhancement

- Scenarios where product model is changed within the scope of the configuration process
- Example: Product Line Engineering
- Relevant features are selected and parametrized within the scope of the configuration process
- Scenarios:
 - Product line scoping: which feature added/deleted from model
 - Open Innovation: similar to product line scoping (not necessarily a Software Engineering context)
 - Postponement scenarios : for example, product configured by the retailer but not by the producer

Open Issues

- Serious games for different constraint types
- Intelligent constraint aggregation mechanisms
- Manipulation detection („attacking configurators“)
- Support for Group based Configuration
- Consensus-fostering group recommendations

Thank You!