



Formal Modeling and Analysis of Communication Spaces

Tony Modica

Examples of Communication Spaces



Skype offers different communication modes:

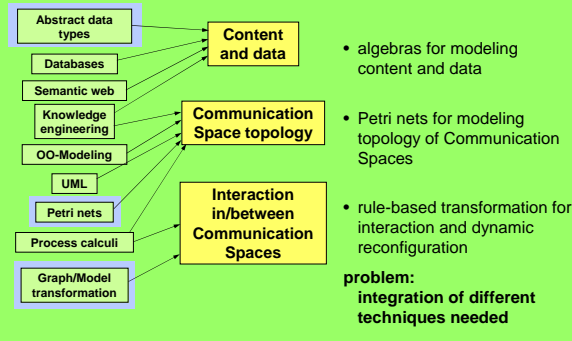
- direct calls
- dynamic managed conferences
- persisting text transmission
- file transmission

contact management

status management (online, offline, away, SkypeMe, do not disturb)

adequate case study for modeling of human-centric Communication Spaces

Formal modeling approach



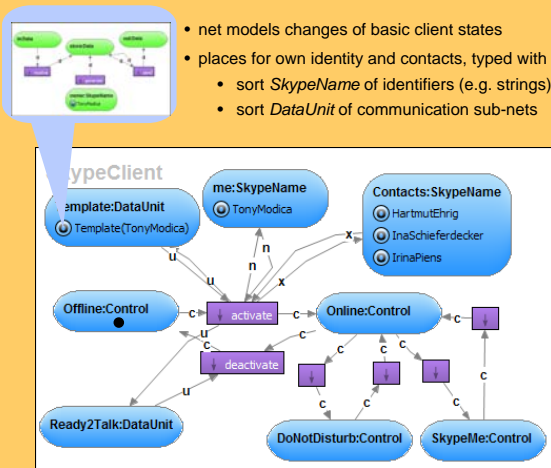
New approach: extension of classic Petri nets with

- algebraic data tokens and firing conditions
 - Petri nets as “higher-order” tokens in the main system net
 - tokens being distinguishable by having an “individual”
 - “reconfiguration” via Petri net transformation rules
- yielding **reconfigurable algebraic higher-order Petri nets with individual tokens (AHOI)**

General guideline

- focus on observable behavior, user activities**
- due to closed source, proprietary net protocols
- user clients:**
- representation as net components
 - actions modeled as
 - state change (transition firing)
 - system change (reconfiguration)
- network/system activities:**
- generally realized as reconfiguration
 - possibly reacting to a client request
- concise visual system representation**
- clean up unused structures

Modeling Skype with AHOI-nets



User client component of “TonyModica”

Temporary net structure created by rule for exchange of contact data

User client component of “IrinaPiens”



Example for contact exchange

Skype system configuration: two clients “TonyModica” and “IrinaPiens”

“TonyModica” requested contact exchange, realized by application of transformation rule creating temporary structure

“IrinaPiens” may accept or deny request.

Firing “accept”: copy identity token “TonyModica” to contact place of “IrinaPiens” and vice versa.

Firing “deny”: only move control token to “Finished”.

Plans for PhD thesis

- develop AHOI-nets as formal modeling approach including**
- flexibility (fewer abstract rules)
 - preciseness (control reconfiguration/system)
 - expressiveness (extended rule matching)
- examine system properties**
- in Skype, e.g. access rights are respected
 - entries in contact lists must have been confirmed by correspondent contact’s client
 - establish communication only if access is granted
 - simulation of models in tool
 - formal analysis, ensuring consistency

Summary of current results

- publications within IGP H-C3**
- 2 conference papers (FASE, INTERSYMP)
 - 3 workshop papers (AWPN, GT-VMT, PNGT)
 - 1 article published in book
 - 1 technical report
- presentations**
- “Implementing Petri Net Transformations using Graph Transformation Tools” at 3rd Workshop on Petri Nets and Graph Transformations in Leicester, England
 - 3 talks about Communication Spaces in Prof. Ehrig’s research colloquium
- tool development**
- development of graphical AHOI Editor in Eclipse
 - framework for quickly building graphical editors in Eclipse
 - package for animating graphical Eclipse editors