

Title	Software Architecture with Accountability and Evolvability
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Citation	
Issue Date	2005-03-11
Type	Presentation
Text version	publisher
URL	http://hdl.handle.net/10119/8276
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Description	JAIST 21世紀COEシンポジウム2005「検証進化可能電子社会」 = JAIST 21st Century COE Symposium 2005 “Verifiable and Evolvable e-Society”, 開催 : 2005年3月10日~11日, 開催場所 : 石川ハイテク交流センター, Technical session 4 <Modelling and Evolution>

Software Architecture with Accountability and Evolvability

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JAIST 21st Century COE Symposium 2005.
“Verifiable and Evolvable e-Society”
March 11th, 2005

Prof. Katayama’s Motivation

- Can you dependably leave your life to infrastructure information system ?
- Modeling and Implementing e-Society by applying advanced technologies in Computer Science.

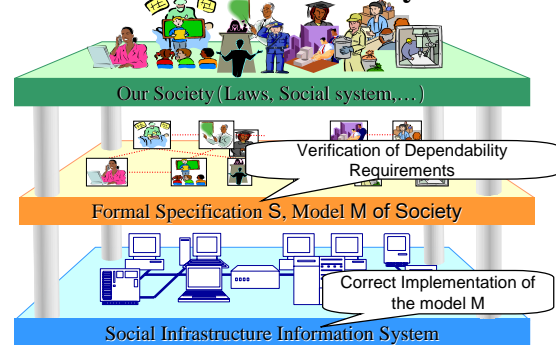


Dependability Requirements of e-Society(Prof. Katayama’s Definition)

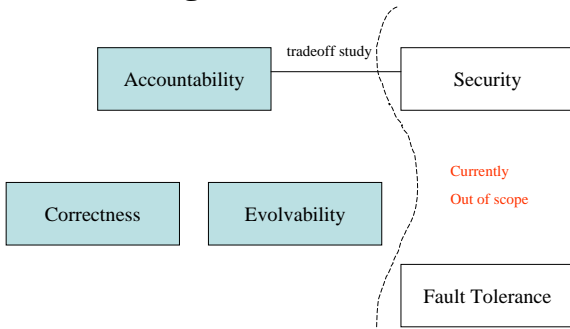
- 1. Correctness**
Are the functions correct? (“Is my tax correctly calculated?”)
Are they consistent with laws?
- 2. Accountability**
Is the information system built to be able to answer questions about it?
“Why my tax is correct?”
- 3. Security**
No illegal data access, Privacy protected...
- 4. Fault Tolerance**
Can to tolerate accidents?
- 5. Evolvability**
Could e-society system be changed according to the change of society?



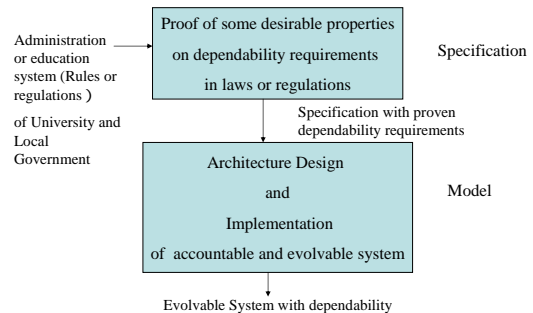
Model Driven Approach to Realize Dependable e-Society



Dependability Requirements (Range of Consideration)



Our Approach



Goal and Scope of Our Team

- Proving Dependability Requirements of e-Society using Heavy weight Ontology
 - Prof. Ikeda
 - Dr. Hayashi
- Designing Evolvable and Accountable System using Advanced Object-Oriented Technologies including Feature/Aspect Oriented approach
 - Prof. Ochimizu
 - Associate Prof. Suzuki
 - Dr. Fujieda
 - Dr. Hattori
 - Dr. Amano
 - Mr. Hayasaka (PhD. Student)
- Target Domains
 - Administration of Local Government
 - Education System of University

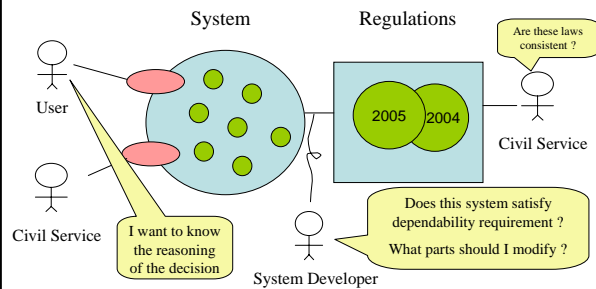
Topics of Today (Preliminary Consideration)

- Definition
 - Accountability
 - Evolvability
- Expected Tools for Model Implementation
 - Variation Point modeling of PL

What are the Origin of Accountability

- Officers of Civil Services
 - What should we do to improve the welfare of the aged ?
 - What kinds of regulation should be enacted?
 - What is a role of Information System ?
- Citizens
 - How can we reduce the tax payment?
 - What are the related regulations.
 - What should we do to use the system ?
- Each stakeholder has own:
 - **Semantics: understanding of the real world (origin)**
 - **Languages: to express ones needs** special thanks to Mr. Kumagai. This definition was obtained from the discussion with him
 - **Concerns to the System**

Stakeholders of Information System

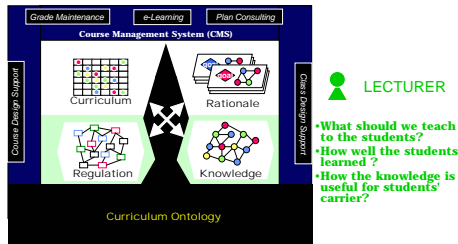


Ontology-aware Course Consulting System (Prof. Ikeda)

Feature: Ontology-aware Guidance Generation (Semantics&Language)

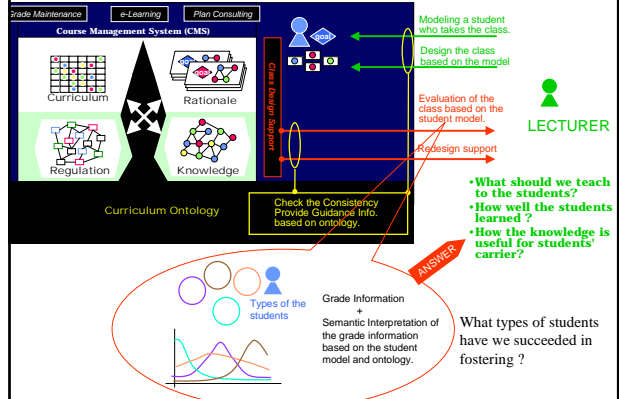
- STUDENT**
- Which class should I take to achieve my goal ?
 - Does my plan satisfy the course regulation?
 - How should we change my plan?

- FACULTY DESIGNER**
- How the change of regulation effects on the students' plan
 - How the course design matches with students' needs
 - How well the course works?



- What should we teach to the students?
- How well the students learned ?
- How the knowledge is useful for students' carrier?

Ontology-aware Course Consulting System (Prof. Ikeda)

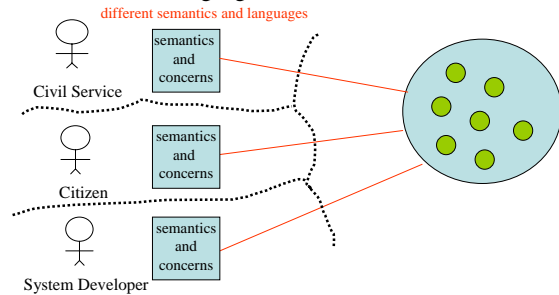


- What should we teach to the students?
- How well the students learned ?
- How the knowledge is useful for students' carrier?

What types of students have we succeeded in fostering ?

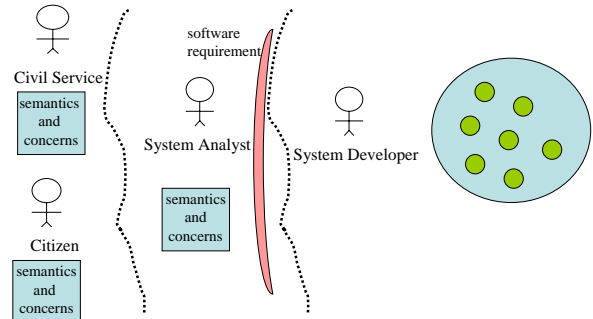
Our Definition of Accountability

- Various kinds of stakeholders can access the system before/after system development using their own semantics and languages



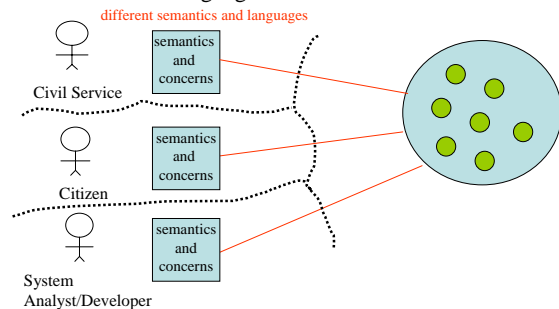
Software Engineering Approach

Translation and loss of accessibleness



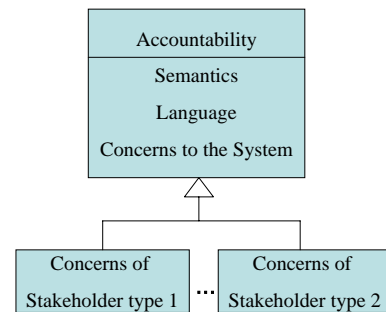
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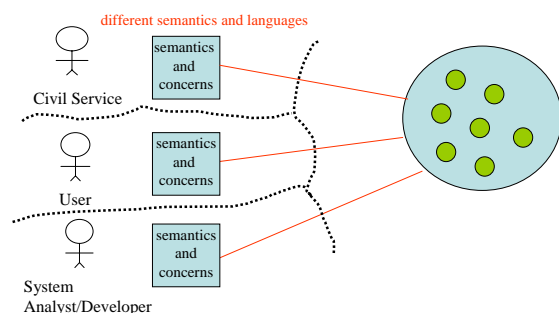
Accountability

- The system can answer the question from the stakeholder based on their semantics using their languages



Then We Can Define Evolvability

- Maintaining the correspondence between stakeholders' concerns and components of the system

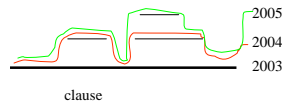
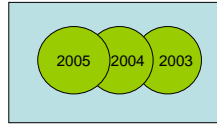


Candidates for the Implementation

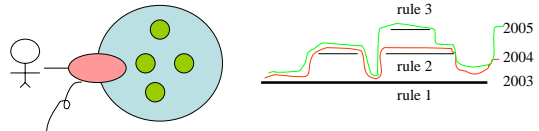
- Evolution related issues
 - Applying **Product Line Technology** following Gomaa's PLUS method
 - **Variation points modeling** on version of regulations
- Accountability related issues
 - **Component Design** based on accountability
 - **Framework Design** based on execution order of components

Structure and Type of Regulations

- Regulations are managed by Change History
 - Like SCCS Delta
- Type of Regulations
 - Rules
 - Workflows
 - Calculation



Variation Points Modeling

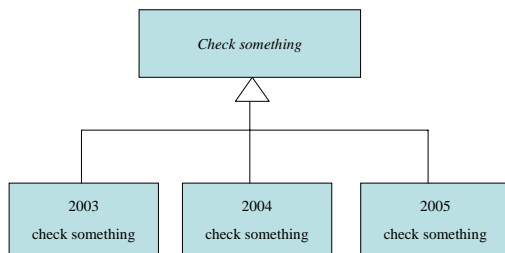


Usecase Name: Explain Something
Reuse Category: Kernel
Description

- Input necessary data
- Check something
- Output it

Name: check something
Type of functionality: mandatory alternative
Line numbers: 2
Description of functionality:
 Apply rule1 in 2003, rule2 in 2004, rule3 in 2005

Component Design (under consideration)



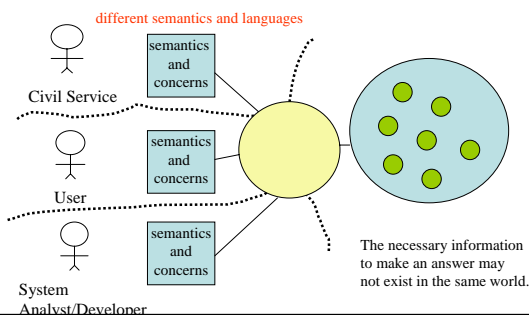
- **Dynamic Binding** to the corresponding component
- **Component specification** considering the proper units for accounting

Conclusion (Research Plan)

- Method and Language for Describing Stakeholders' Semantics and Concerns
- Component Specification Language related to Accountability
- Language for Variation Points Modeling
- Framework Development

Light Weight Ontology and Heavy Weight Ontology for describing Semantics and Concerns

- to remove GAPS



Component Specifications

- For Accountability and Evolvability

