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# 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.

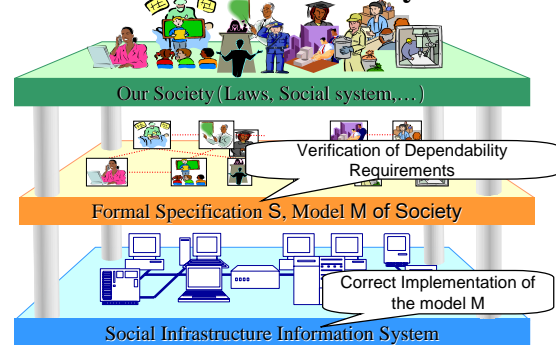


## Dependability Requirements of e-Society( Prof. Katayama’s Definition)

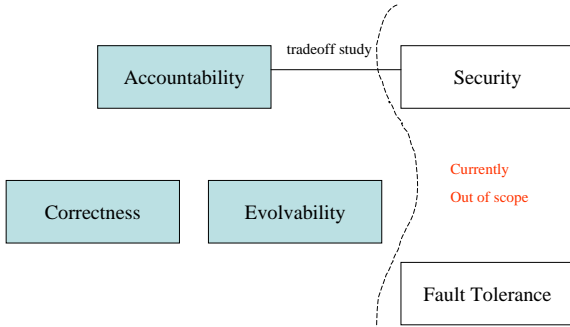
- 1. Correctness**  
Are the functions correct? (“Is my tax correctly calculated?”)  
Are they consistent with laws?
- 2. Accountability**  
Is the information system built to be able to answer questions about it?  
“Why my tax is correct?”
- 3. Security**  
No illegal data access, Privacy protected...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



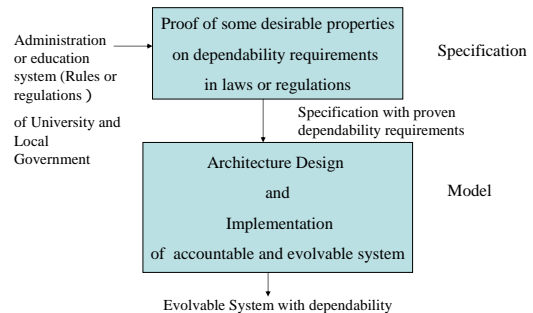
## Model Driven Approach to Realize Dependable e-Society



## 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

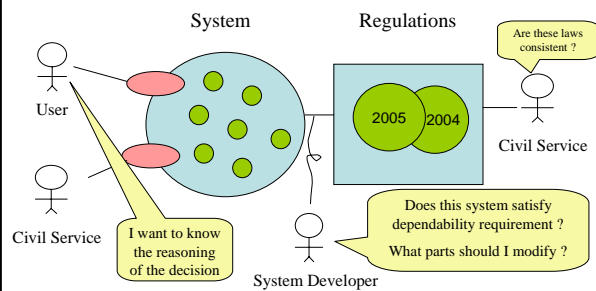
## Topics of Today (Preliminary Consideration)

- 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**
    - **Concerns to the System**
- special thanks to Mr. Kumagai.  
This definition was obtained from the discussion with him

## Stakeholders of Information System



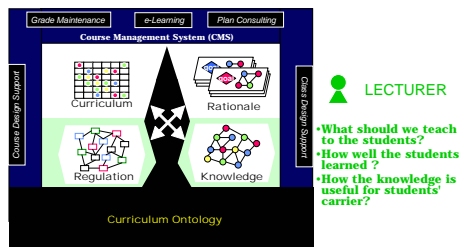
### Ontology-aware Course Consulting System (Prof. Ikeda)

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**

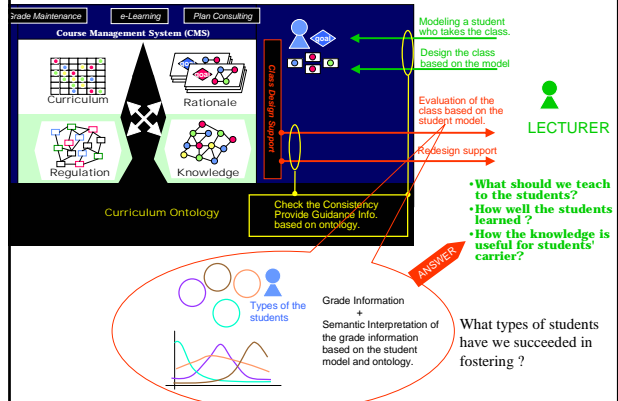
- How the change of regulation effects on the students' plan
- How the course design matches with students' needs
- How well the course works?



**LECTURER**

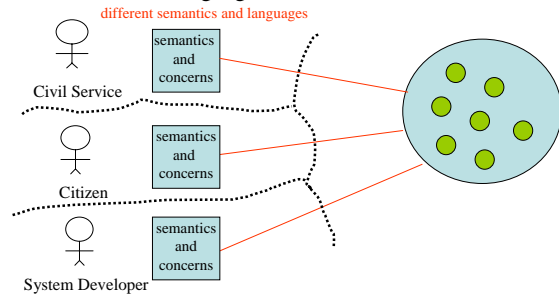
- What should we teach to the students?
- How well the students learned ?
- How the knowledge is useful for students' carrier?

### Ontology-aware Course Consulting System (Prof. Ikeda)



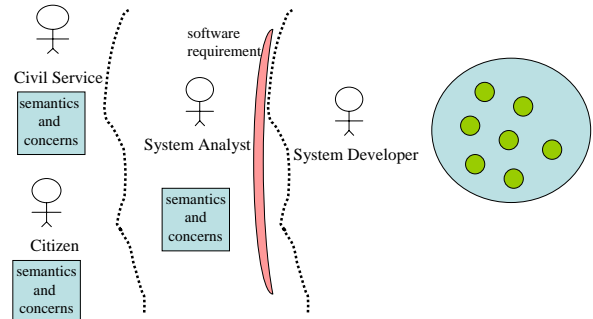
## Our Definition of Accountability

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



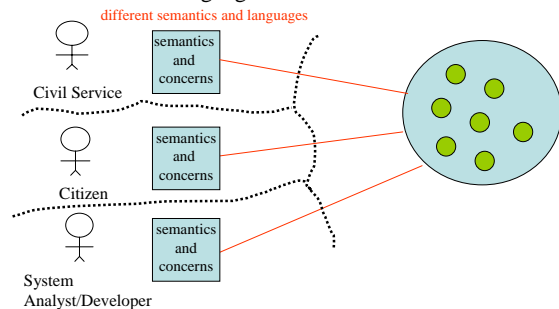
## Software Engineering Approach

Translation and loss of accessibleness



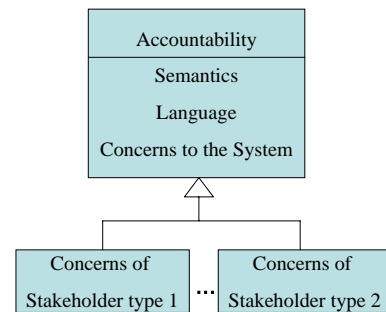
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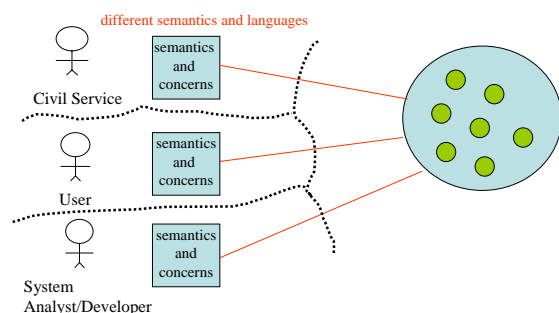
## Accountability

- 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

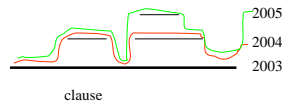
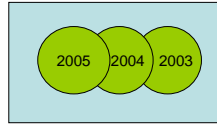


## Candidates for the Implementation

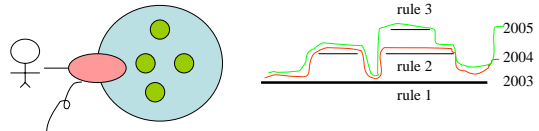
- Evolution related issues
  - Applying **Product Line Technology** following Gomaa's PLUS method
  - **Variation points modeling** on version of regulations
- Accountability related issues
  - **Component Design** based on accountability
  - **Framework Design** based on execution order of components

## Structure and Type of Regulations

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



## Variation Points Modeling

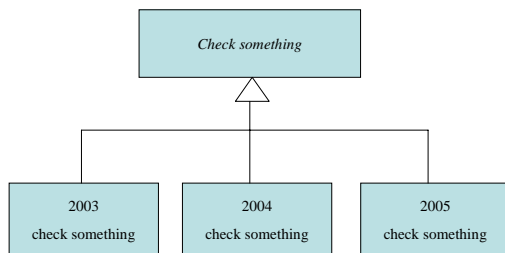


**Usecase Name:** Explain Something  
**Reuse Category:** Kernel  
**Description**

- 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)



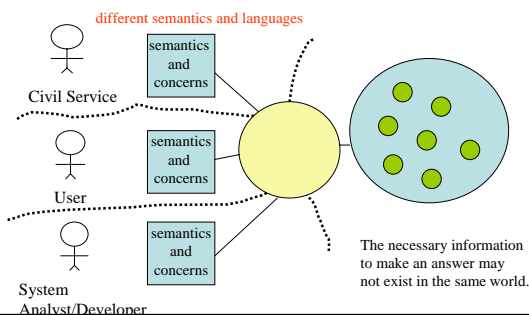
- **Dynamic Binding** to the corresponding component
- **Component specification** considering the proper units for accounting

## 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

