Technological Foundations of Electronic Governance

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Contents

Technological Foundations

The basic techniques that are available: (i) to enable better domain understanding and, (ii) for building reliable software solutions peculiar to electronic governance.

Two such foundational techniques are considered:

- Formal Engineering Technique
- Semantic Techniques

“Formal Techniques” here captures both formal and semantic techniques

Formal Technique 1

A Formal Technique is a notation with a mathematical semantics.

Semantics is a precise explanation of how such notations should be interpreted, usually expressed in algebra, logic or set theory.

A formal notation is typically associated with a method which describes how it should be applied to the description or analysis of computing systems.

Formal techniques are usually supported by tools such as model checkers, type checkers and theorem provers.

Formal techniques are used for specifying, developing and verifying systems properties.

Semantic Techniques

They provide explicit meanings for information.

Meanings are expressed using ontologies:

- simple lists or controlled terminologies
- thesaurus
- taxonomy
- conceptual models
- logical theory

Electronic Governance

Government is an institution of the state responsible for:

- public services and infrastructure (common good)
- rule making, implementation and adjudication
- maintenance of social order and security

We capture these three activities as Governance.

Strategic and transformational application of ICT to governance processes is electronic governance.

E-Governance Domain 1

Electronic governance is different from the domain of e-business:

"*public and private management are fundamentally alike in all unimportant respects …"*

"…. what is important is addressing the differences that exists in the important aspects" Wallace Sayre

For example, major differences exist in:
- specificity of government tasks
- role of normative law
- special significance of knowledge

E-Governance Domain 2

Characterized by two categories of domain-specific features :

Regulatory perspective

1) Privacy protection (R1)
2) Eligibility criteria (R2)
3) Identity management (R3)
4) Anonymity protection (R4)
5) Accessibility support (R5)
6) Conformance to standards (R6)

Organizational perspective

1) Collaboration (O1)
2) IT Function (O2)
3) Administrative services (O3)
4) Knowledge (O4)

Technical Implications 1

Regulatory and organizational issues lead to a set of technical requirements:

1) Interoperability of Government IT Ecosystem (T1)
2) Rapid development of Electronic Public Service and Public Management Information Systems (EPS/PMIS) (T2)
3) Adaptability or evolvability of EPS/PMIS (T3)
4) Rigorous contract specification (T4)
5) Specification of security properties (T5)
6) Verifiability of security properties (T6)
7) Verifiability of conformance to standards (T7)
8) Knowledge Management (T8)

Application Scenarios

Application scenarios for formal techniques in the domain:

1) Formal domain description
2) Formal Systems specification
3) Specification-based testing
4) Behavioral specification
5) Formal verification
6) Generating implementations from specifications

7) Ontologies as domain model
8) Ontology-based requirements specification
9) Semantic components description
10) Ontology-based policies and business rules

Scenarios versus Challenges

No	Scenario	Challenge
S1	Formal domain description	O1
S2	Formal systems specification	O2, R1, R4
S3	Specification-based testing	O2, R1, R4
S4	Behavioral Specification	O2, R1, R4
S5	Formal verification	R1, R4
S6	Generating from formal specifications	O2
S7	Ontology as a domain object model	O1
S8	Ontology based specification	R1, R4
S9	Semantic components description	O2
S10	Ontology as Policies and business rules	R1-R5, O4

Scenarios and Technical Challenges

No	Scenario	Challenge
S1	Formal Domain description	T1
S2	Formal systems specification	T4, T5
S3	Specification-based testing	T4, T6
S4	Behavioral Specification	T4, T5
S5	Formal verification	T6
S6	Generating implementations from formal specifications	T2
S7	Ontology as a domain object model	T1,
S8	Ontology based requirement specification	T5
S9	Semantic components description	T2
S10	Ontology as Policies and business rules	T3, T7, T8

Workshop Overview

Additional 4 papers to be will be presented in this session by:

1) Formal Support for e-Government Systems Design with Transparency Consideration, Xiaoyi Chen et; al

2) Formal threat descriptions for enhancing government risk assessment, Andreas Ekerhart et. al.

3) Automatic Generation of e-Government forms from semantic descriptions, Bernd Stadhofer et. al.

4) Semantic Framework for e-Government, Charles Chrichton et. al.

Workshop Paper 2

1) Explores abstractions and concepts such as transparency independently of any existing technological solution.

2) Paper provides better understanding of administrative transparency through formal models

Workshop Paper 3

1) Presents an ontology for threat definition as a formal model of threats, vulnerabilities, controls, and safeguards to enable threat identification and response

2) Paper also describes automatic updating and reconfiguration of software infrastructure to mitigate effects and impose best practices

Workshop Paper 4

1) Paper shows how an ontology for specific public services can be used as the basis for automatic generation of web forms

2) The work also shows how it is possible to automatically associate data with computable representation of its semantics, enabling the availability of data semantics in advance of its acquisition and use

Workshop Paper 5

1) Paper explains how a practical, semantic framework can be defined in terms of: terminology services, metadata registries, and model repositories.

2) Presents a collection of defined terms, structured in a way that suits many applications.

3) Presents a collection of ‘metadata elements’ - templates for recorded data, explained partly by reference to the controlled terminology, and organized in terms of equivalence, specialization and versioning.

4) Demonstrates the use of formal models, ontologies, and metamodels describing components, processes, and information artifacts, such as database schemas, service descriptions, forms, queries, and reports.

Presentation of Workshop Papers 2 to 5