UTML

Unified Transaction Modeling Language

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VLDB 2002
Hong Kong, China

The Problem

Web Applications' Complexity

Web applications exhibit **complex transactional behavior:**

- **Hierarchical structure** of transactions satisfying user (sub) goals
- **Multiple resource managers**, with **diverse semantics** and characteristics, are accessed in the scope of the same transaction
- **Pre-existing logic** is utilized (e.g. Legacy Systems, Web Services)
- **Not all** user activities are strict ACID transactions

Navigation actions may mislead user regarding transaction status

Ubiquity Issues

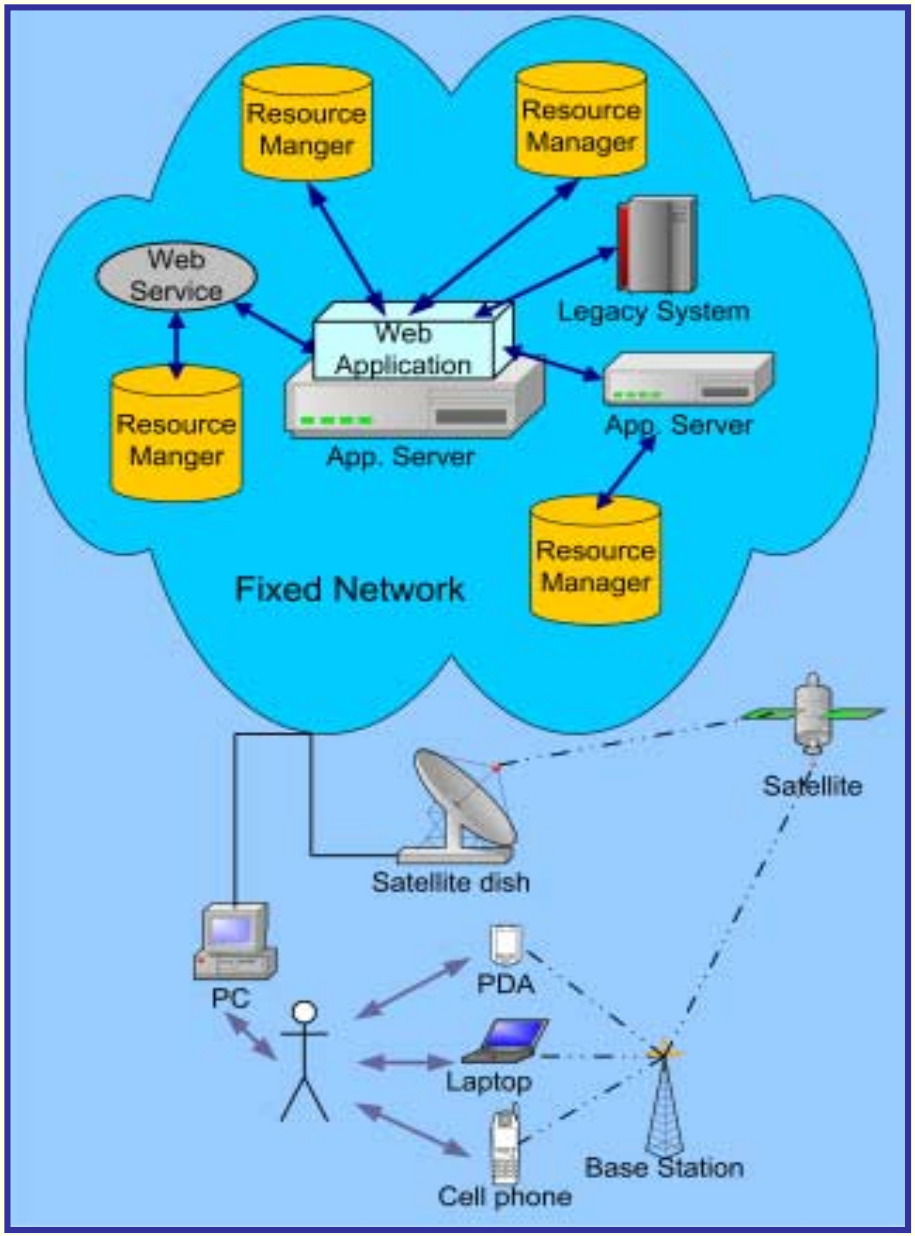
Ubiquity introduces new issues:

- Implementers "would like" application to be **written once** independently of **delivery channel, device,** etc.
- **Asynchronous transaction execution** is needed; how is it supported? What's now the application's behavior?

Design and **documentation** for such applications is important. No such mechanisms exist.

A modeling language for analyzing, designing and documenting their transactional behavior would be valuable

An Execution Environment



Characteristics

A single access point of the application

Multiple Resources with diverse semantics and interfaces

Use of pre-existing logic
(legacy systems, web services, etc.)

Ubiquity
The same application logic is delivered
through different channels
at different devices
in different user profiles

Our Goal

Design the transactional properties of the application logic in advance

Enable the design of web applications in **both top-down** and **bottom-up** fashion

Document the application behavior enabling easy derivations of new implementations (or transformations) for new devices, user profiles, etc.

Objectives And Methodology

Objectives Set For UTML

Description of both **static structure** and **execution flow** of transactions

Modeling of transactions including most of the known transaction models

Extensibility for designing new transaction models according to the application's requirements

Description of **diverse decomposition semantics** and **behavior** into **the same** structured transaction

Support for **weak transactions** (weaker than ACID)

Description of **long-lived transactions**

Provision for modeling **asynchronous** execution of transactions

Followed Methodology

Built **on top of UML**

Use of UML class diagrams for modeling the **static structure** of transactions and UML state charts for modeling their **dynamic behavior**

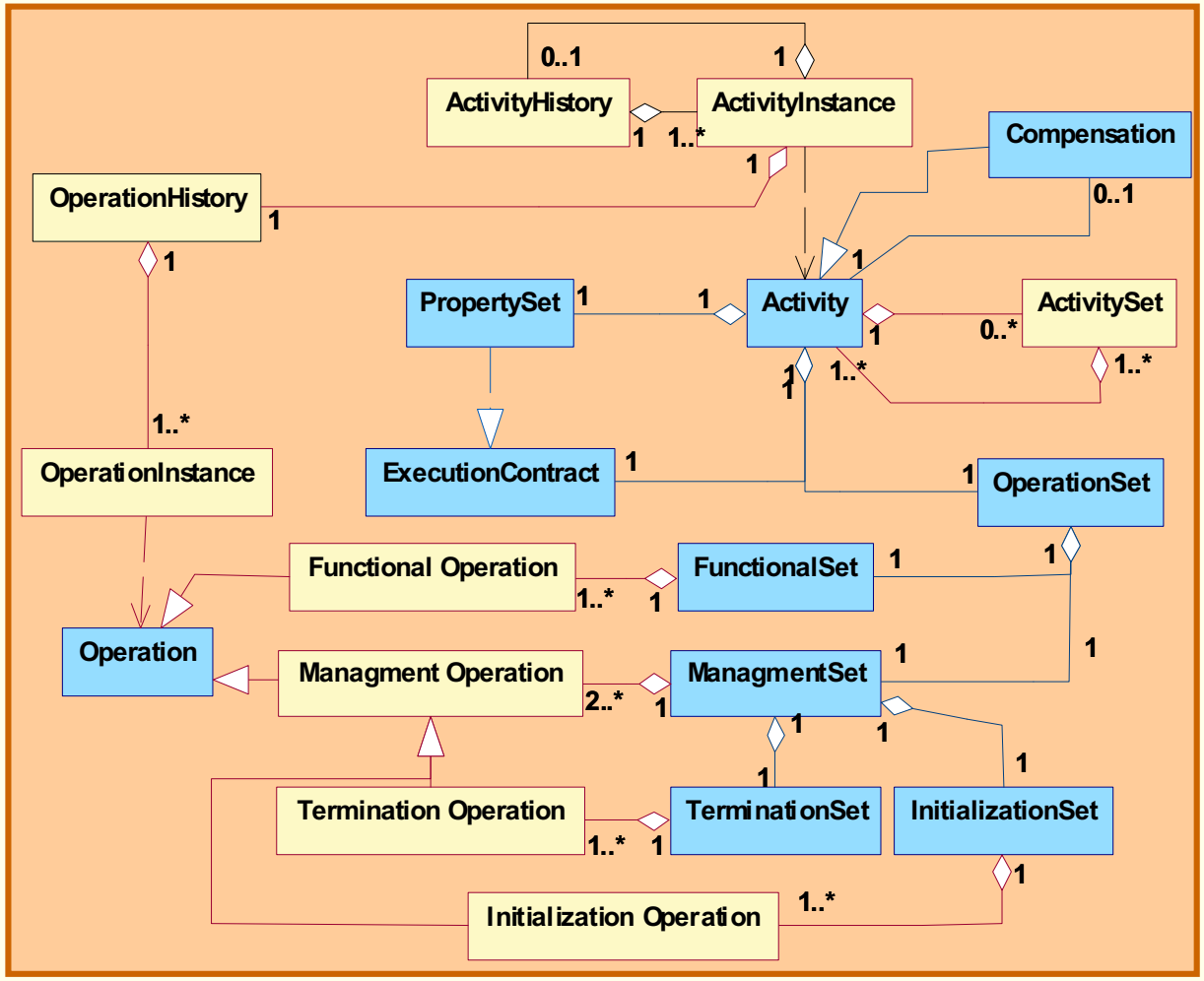
Provide a **flexible and extensible meta-model** capable to describe transactions following most of the known transaction models

Give appropriate **well-formedness** rules to formalize and automate the transaction modeling process

Provide **a complete notation system** to visualize the transaction modeling process

Provide **Documentation** for the designed applications in appropriate format; Important for different implementations of the same applications

The UTML Transaction Meta-Model



Characteristics

Activities and **Operations** as main modeling concepts

Distinction between **management** and **logic** of activities

Definition of **execution contracts** (subsets of ACID) for activities

Separate modeling of activity **decomposition semantics**

Modeling of **Compensations**

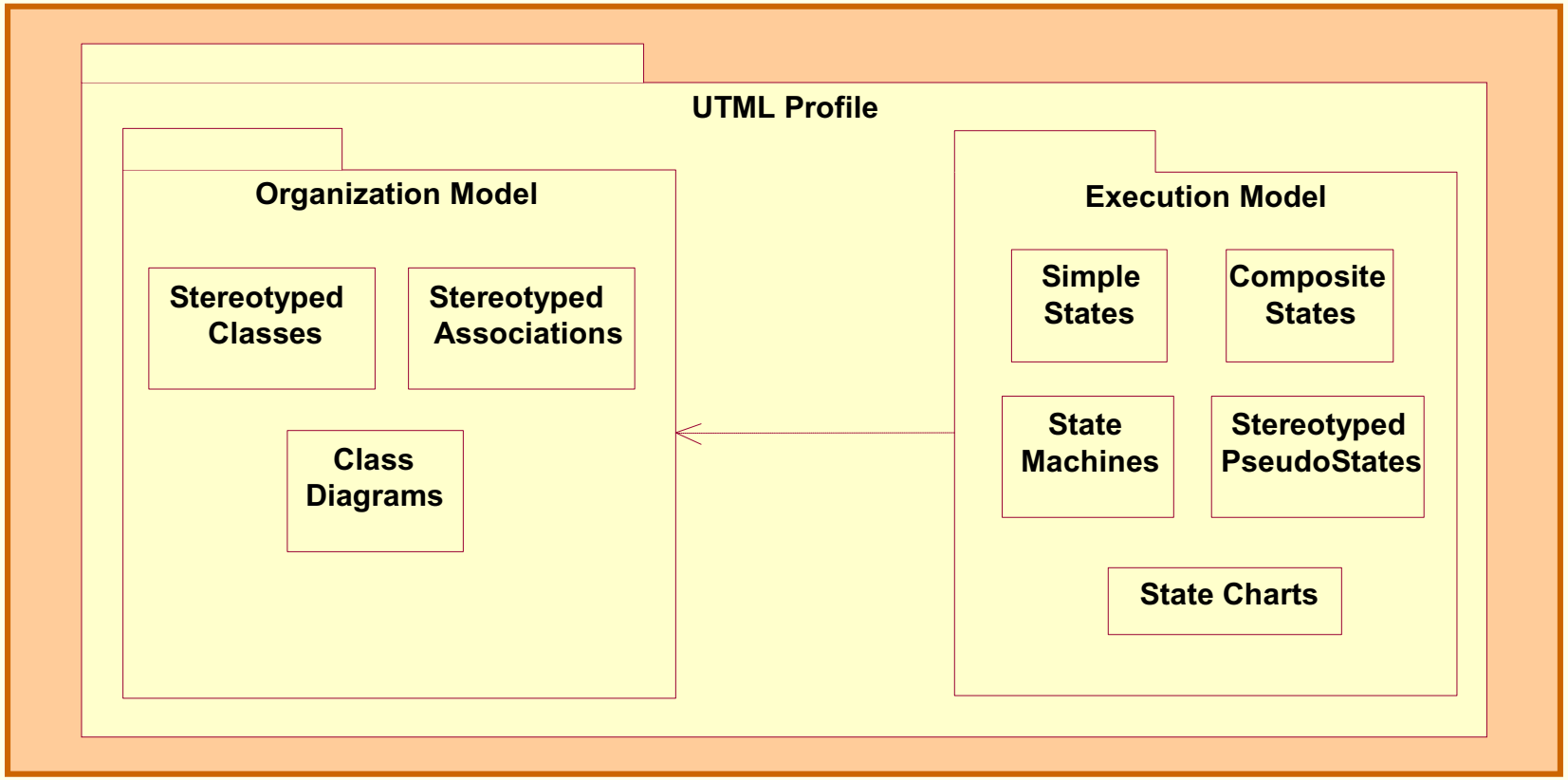
Well-Formedness rules are used to formalize the user-defined models

Extensibility Mechanism

1st Part: Definition of **new management operations** for the custom model

2nd Part: Definition of appropriate **well-formedness** rules formalizing a model's behavior

The UTML Notation System



Formalization

Also, **Well-Formedness Rules** may be attached on activities formalizing their **behavior** and **co-ordination** with parent/sub activities
(2nd part of meta-model's **extensibility mechanism)**

Conclusions And Future Work

Conclusions

UTML has the ability to:

- Describe transactions in a **high level and declarative way**
- Support design in both **top-down** and **bottom-up** fashion
- Model **weak transactions** – weaker than ACID
- Describe transactions conforming to the most of the known transaction models
- Incorporate **diverse semantics** and **behaviors into the same** structured transaction
- Describe transaction models **from scratch** by using its **extensibility mechanism** (management operations & well-formedness rules)
- Model the **execution flow** of transactions, defining a primitive **user navigation model**

Future Work

Better **formalization** of UTML

Extension to directions of:

- Describing **asynchronous execution of transactions** (replication, allotment, virtual executions, synchronization), enabling the design of mobile applications
- Modeling **data flow dependencies** between transaction and **compensation strategies**
- Modeling **persistent activities** (recoverability of activities; not only databases)

A work financed by the **EU Project: U**biquitous **W**eb **A**pplications (IST-2000-25131) www.uwaproject.org