# UTML

## Unified Transaction Modeling Language


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# The Problem

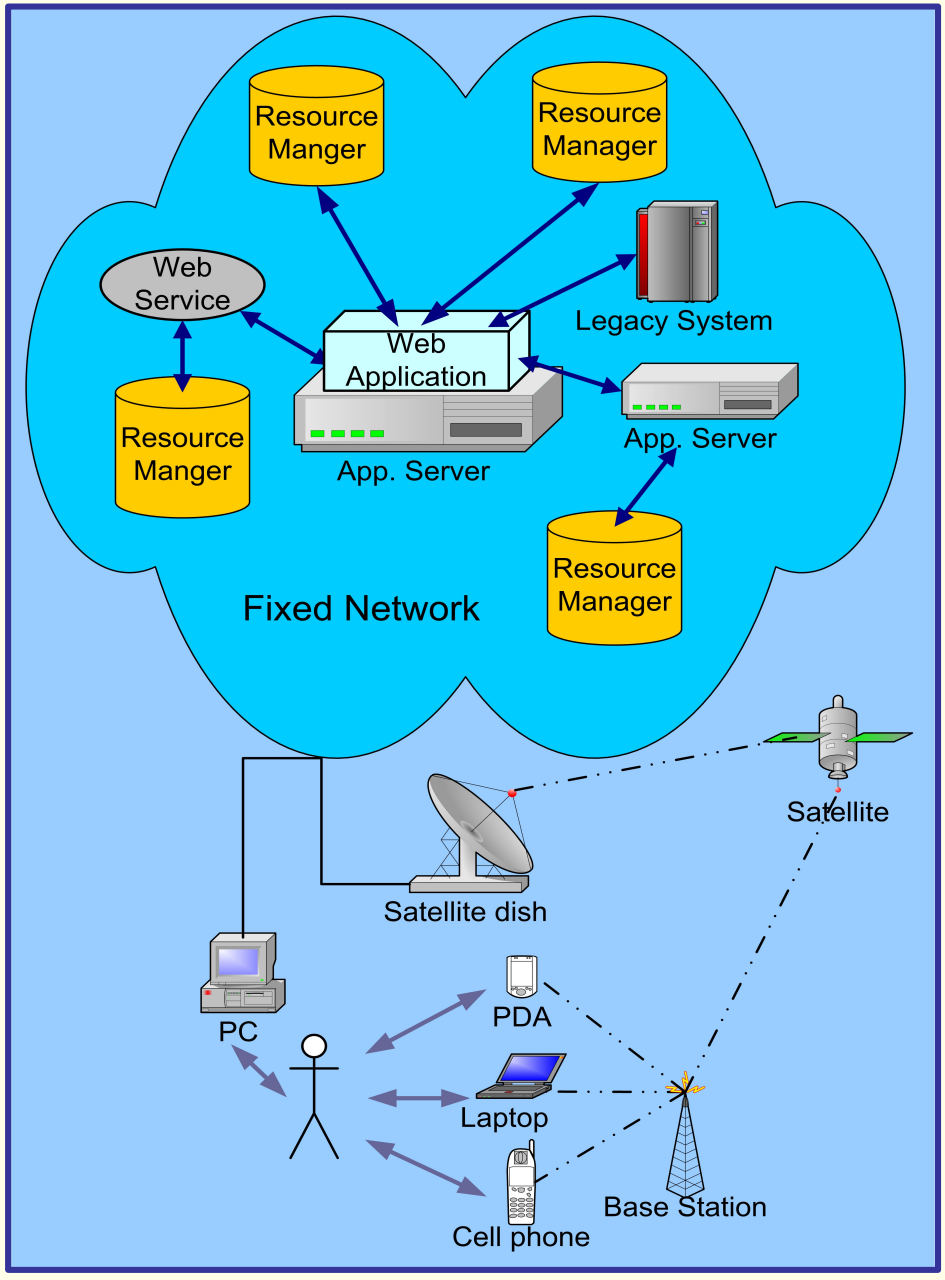
## Web Applications' Complexity

- 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 For UTML And Methodology

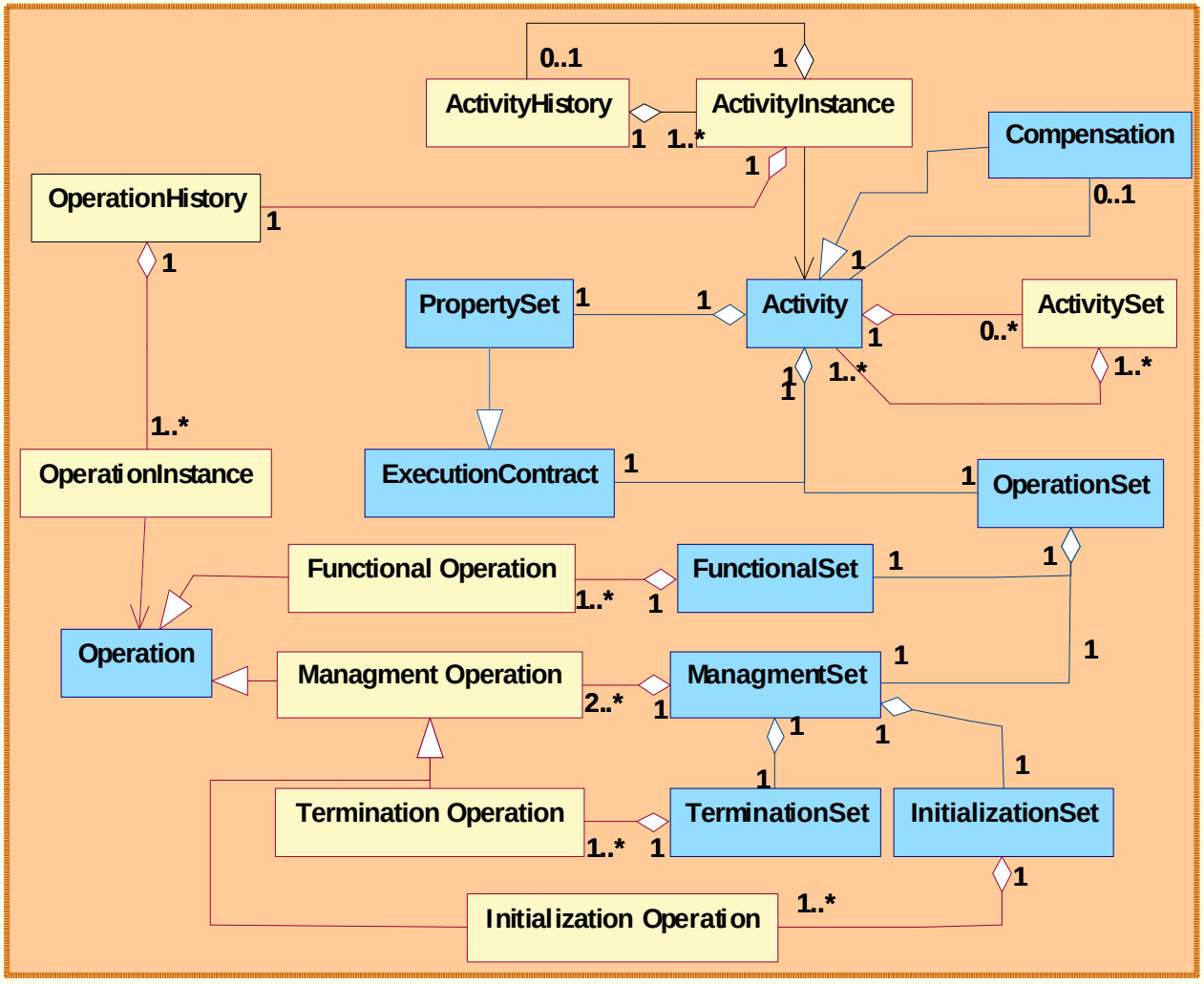
## Objectives Set For UTML

- Description of both **static structure** and **execution flow** of transactions
- Modeling of transactions including most of 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 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



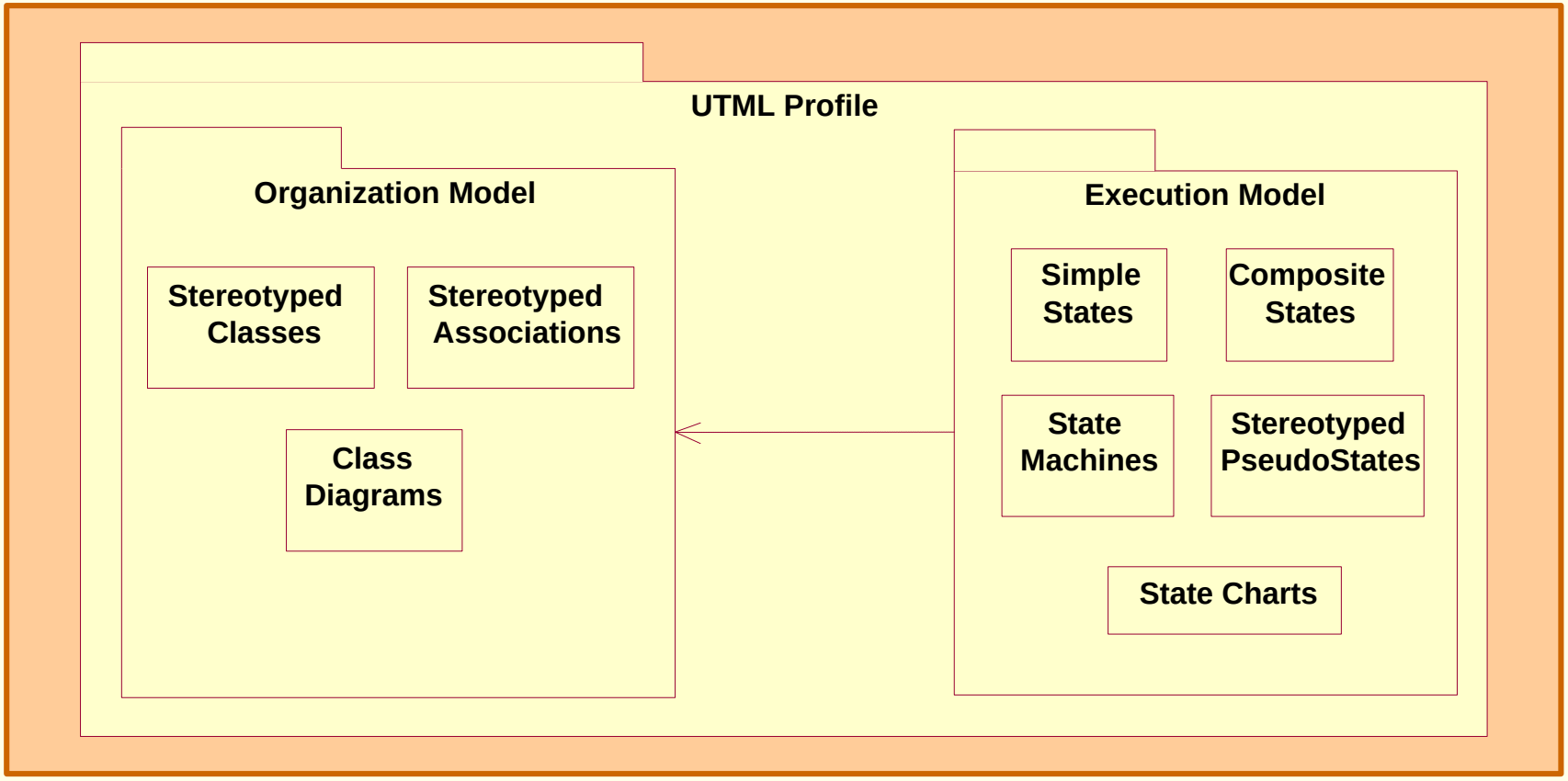

## Characteristics

- **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 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

- It has the ability to:
  - Describe transactions in a **high level and declarative way**
  - Support design in both **top-down** and **bottom-up** approach
  - Model **weak transactions** – weaker than ACID
  - Describe transactions conforming to the most of known transaction models
  - Incorporate **different 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)

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