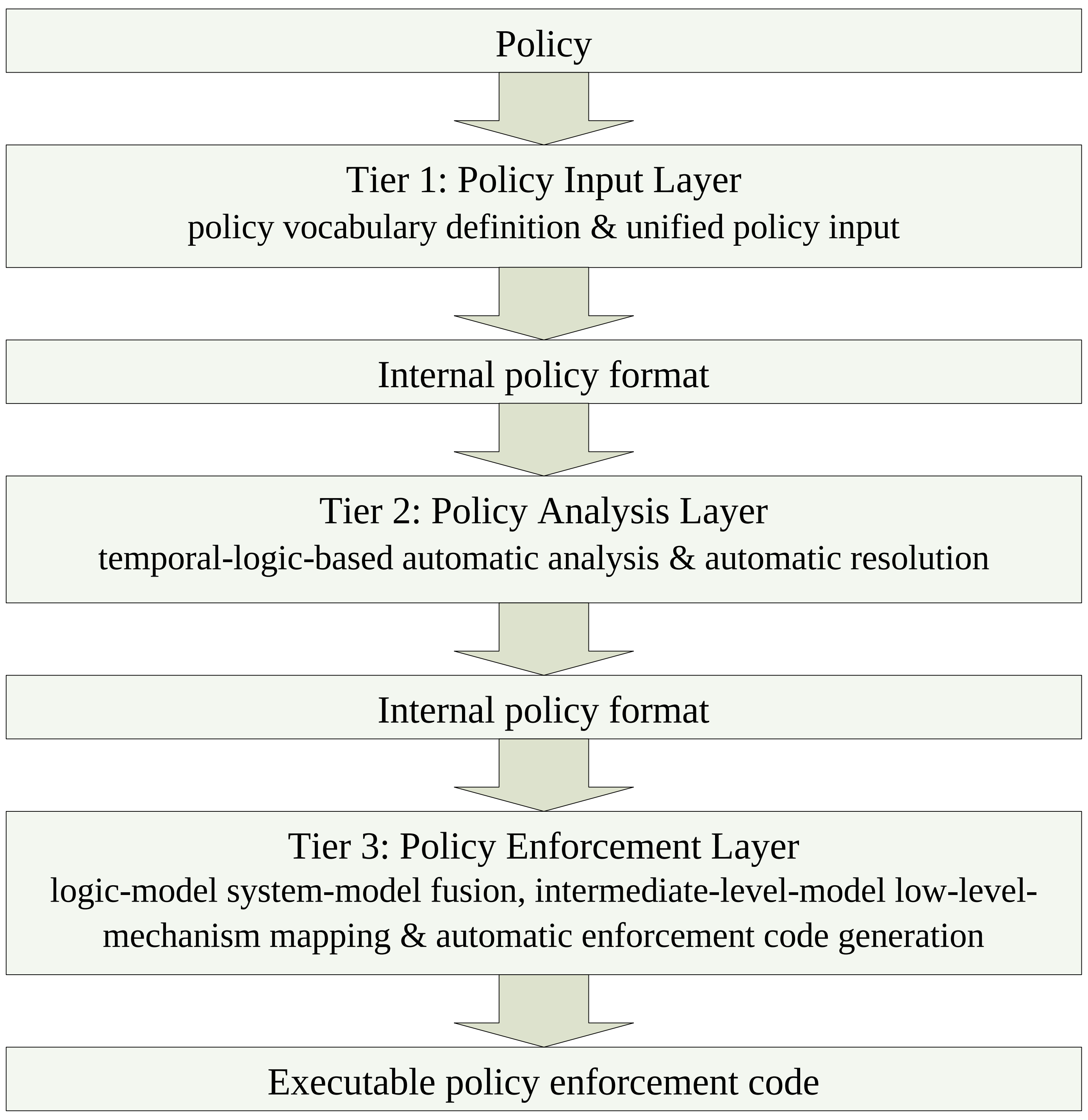
42 : ___ ___ ___

A Policy Management Framework for Integrated Network and System Management

Zhengping Wu
Department of Computer Science and Engineering, University of Bridgeport, Bridgeport, CT

Introduction

With more and more system and network management tasks spanning over multiple domains, integrated control and management become more and more challenging. This research provides an architectural innovation for policy-based management for effective and efficient network and system control. It targets obligation, authorization and configuration policies used in multi-domain environments. Figure 1 illustrates the three-tier architecture proposed in this research.



Policy

Tier 1: Policy Input Layer
policy vocabulary definition & unified policy input

Internal policy format

Tier 2: Policy Analysis Layer
temporal-logic-based automatic analysis & automatic resolution

Internal policy format

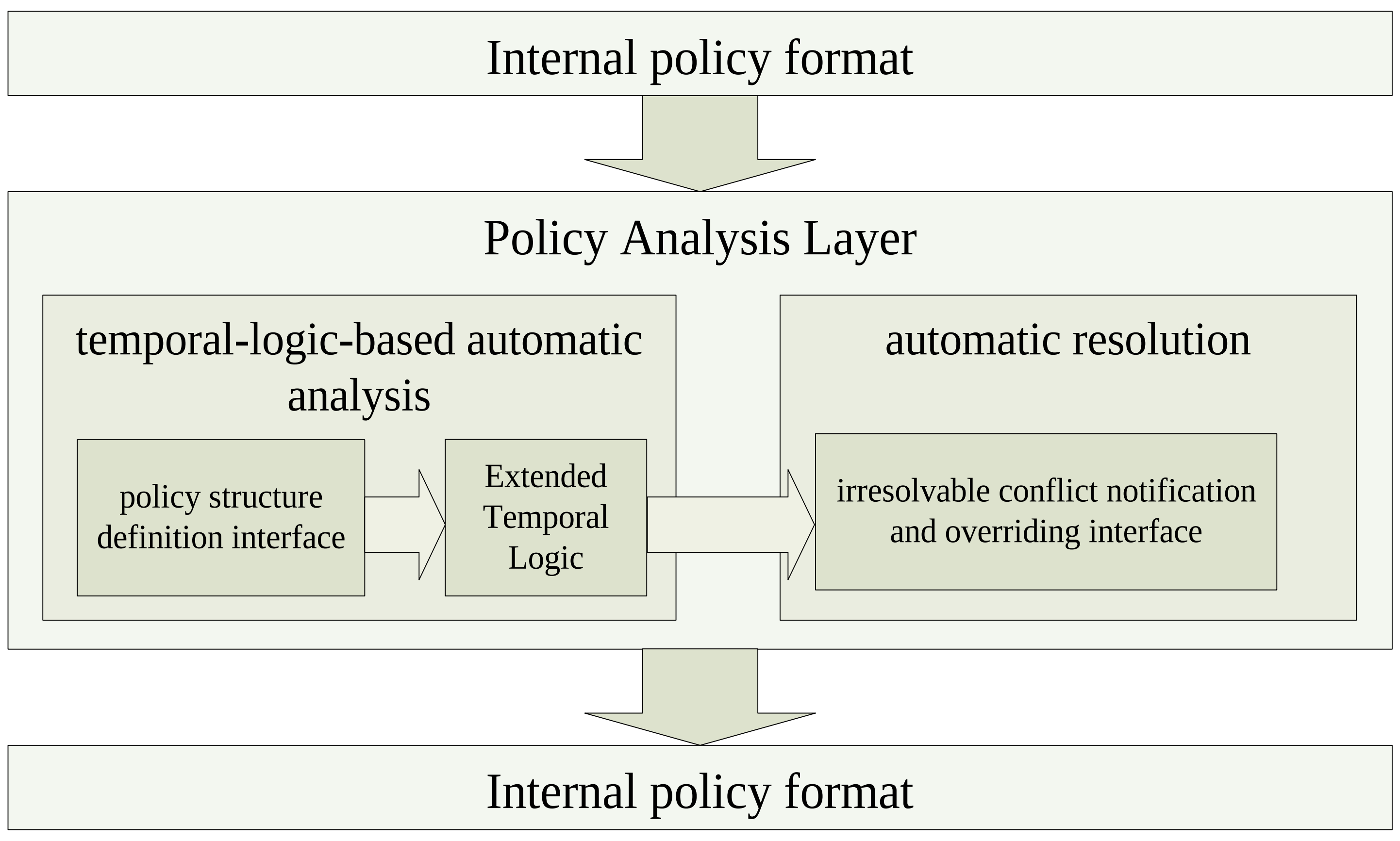
Tier 3: Policy Enforcement Layer
logic-model system-model fusion, intermediate-level-model low-level-mechanism mapping & automatic enforcement code generation

Executable policy enforcement code

Figure 1. Three-tier architecture for policy management framework

Policy Analysis

Since applicable policies or policy sets from different domains or be defined for different purposes are dynamic, and different domains have their own policy formats and structures, a unified policy model is introduced in policy analysis layer to detect and resolve conflicts in policies. There are four major components in this unified policy model: subject, object, action, and context. Policy modeling is the first step in this policy analysis layer, which figures out these different components from a policy set. A logic that can accommodate dynamic contexts called Extended Temporal Logic (ETL) is then used to represent and analyze policy sets. A policy structure definition interface is provided to allow users to identify four major components required in the unified policy model if the policy analysis layer cannot finish the component identification process automatically or the result is incorrect. The complete structure is illustrated in Figure 3.



Internal policy format

Policy Analysis Layer

temporal-logic-based automatic analysis

policy structure definition interface

Extended Temporal Logic

automatic resolution

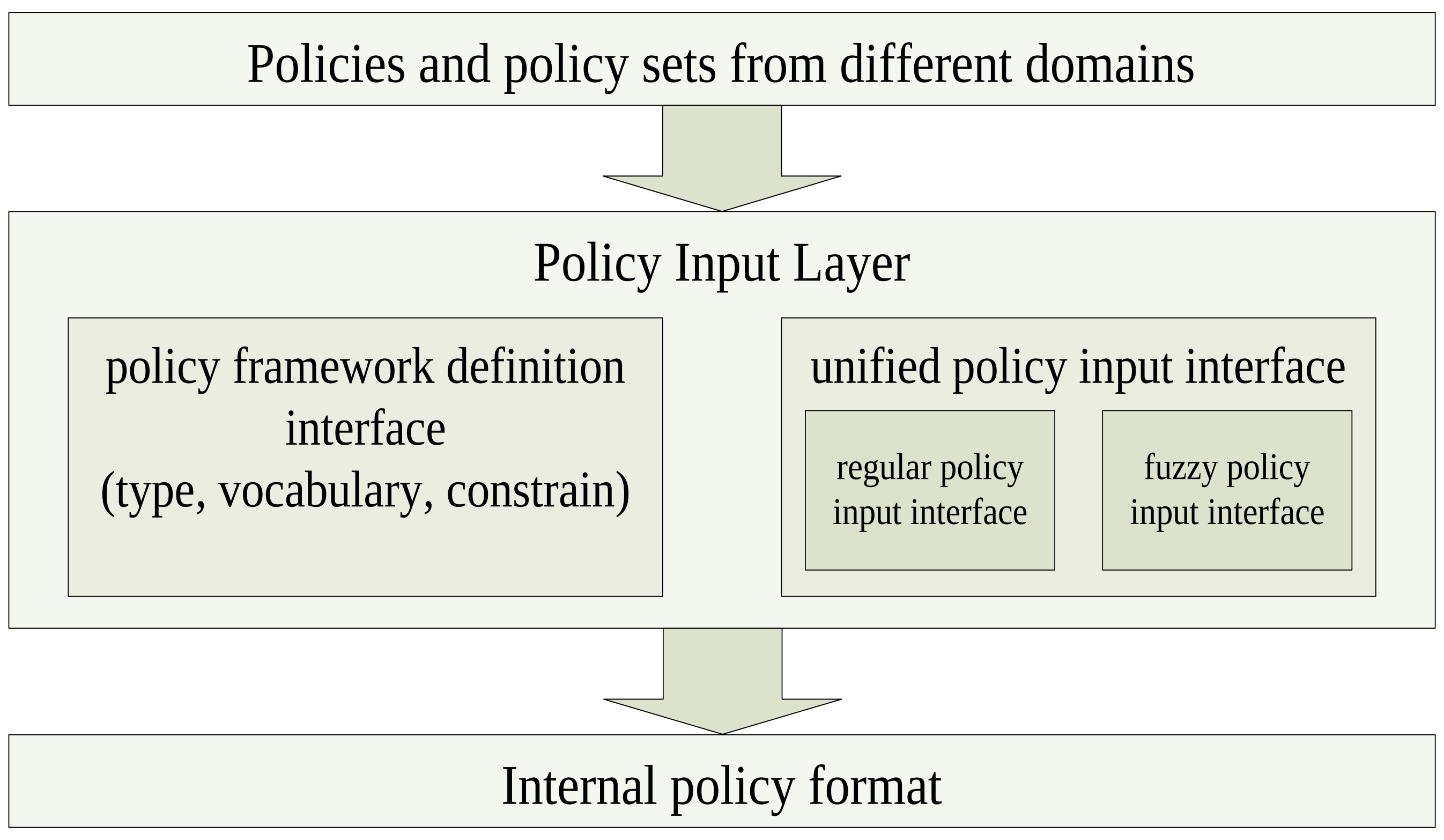
irresolvable conflict notification and overriding interface

Internal policy format

Figure 3. The structure of policy analysis layer

Policy Input

To accommodate different types of policies used by different administrative domains, policy input layer provides flexible policy framework definition and policy rule input interfaces for users. A user can define the framework of one policy set specifying type, vocabulary and constrains first. Then the system automatically generates an interface for defining the policy instances (concrete policy rules) of the policy set. The structure of the policy input layer is illustrated in figure 2.



Policies and policy sets from different domains

Policy Input Layer

policy framework definition interface
(type, vocabulary, constrain)

unified policy input interface

regular policy input interface

fuzzy policy input interface

Internal policy format

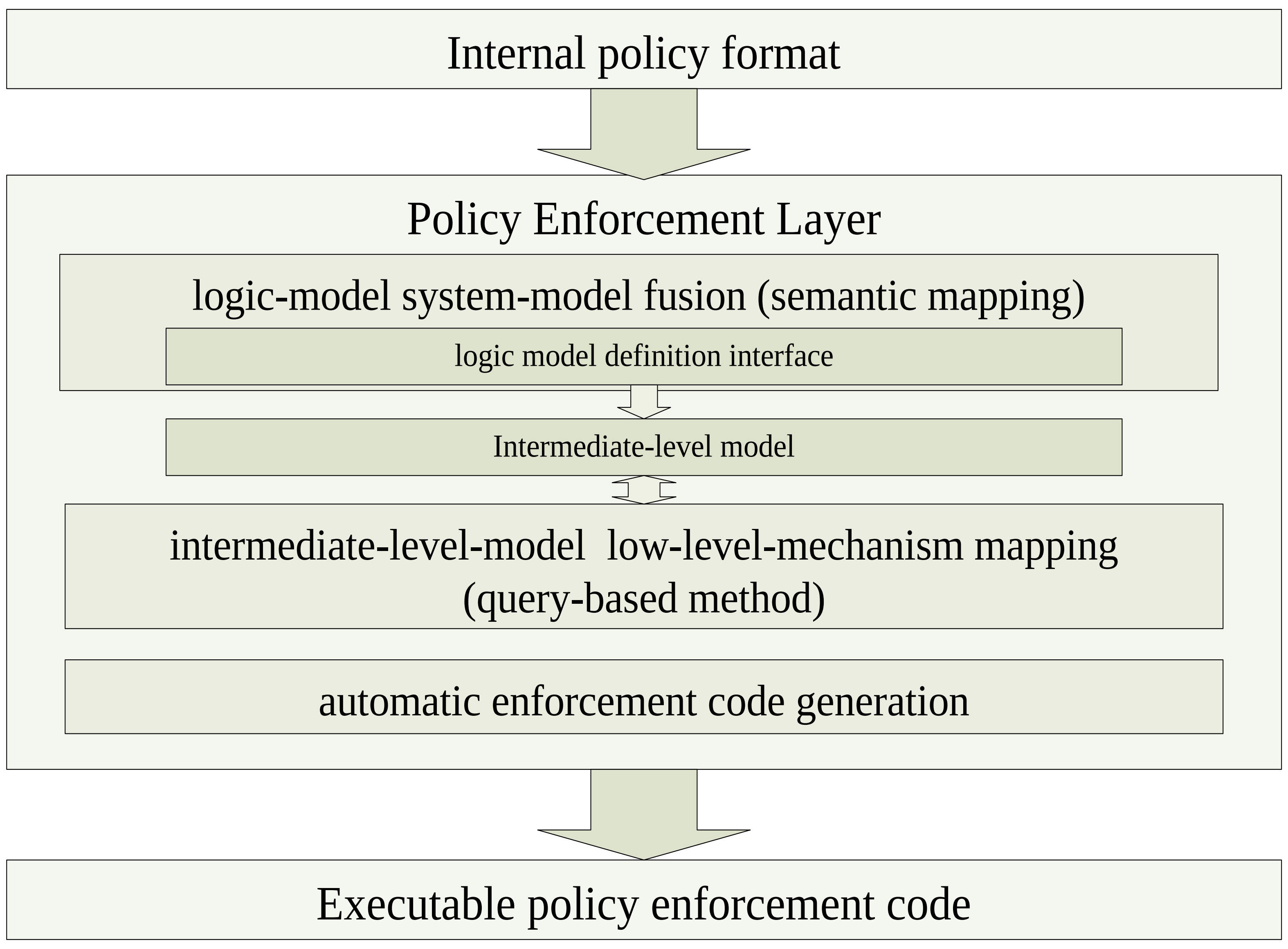
Figure 2. The structure of policy input layer

Conclusion

A new architectural design of policy management for cross-domain integrated network and system management is discussed in this poster. The new policy management framework can also generate partial enforcement code.

Policy Enforcement

In policy enforcement layer, an interface to input the formal logic or mathematical model for management requirements is also provided. This model is derived from business logic or collaboration agreements for a specific cross-domain task. This model is also in the format of ontology. Then a mapping is performed between the logic or mathematical model and the system model of the policy language to form an intermediate-level model. Partial enforcement code is generated following these two mappings then. Detailed structure is illustrated in Figure 4.



Internal policy format

Policy Enforcement Layer

logic-model system-model fusion (semantic mapping)

logic model definition interface

Intermediate-level model

intermediate-level-model low-level-mechanism mapping
(query-based method)

automatic enforcement code generation

Executable policy enforcement code

Figure 4. The structure of policy enforcement layer