Preface

Rules have a history from the early days of computer science, including computational models, compiler technology, artificial intelligence, databases, and logic programming. They included backward chaining rules (or derivation rules), forward chaining rules (or production rules), Event-Condition-Action Rules (or reaction rules) while many researchers also consider integrity constraints to be rules as well.

The history of rule-based programming and rule-based systems started in the 1960s and 1970s with theorem proving, parsing, AI reasoning, and Prolog, a logical and a declarative programming language. During that time, a number of other rule languages were created. Between the 1970s and 1990s, rule languages were used mainly in academia in artificial intelligence applications, notably expert systems, and logic programming. However, since the late 1990s, many practical applications of rules in various problem domains have been developed.

Rules became increasingly important in business modeling and requirements engineering, and as a high level programming paradigm especially in the engineering of e-business applications and Semantic Web applications. In each of these fields different rule languages and tools are being used. Rules are used in applications to model and manage some parts of the application business logic. They are best used in applications with dynamic business logic (e.g., applications) where changes in the business logic are frequent and they need to be immediately reflected in the application behavior such as insurance (insurance rating), financial services (loans, claims routing and management, fraud detection), government (tax calculations), telecom customers (care and billing), and electronic commerce (personalizing the user’s experience, recommender systems, and auctions). Moreover, rules have continued to play an important role in AI shells for knowledge-based systems and in intelligent agents, today both needing a Web interchange format, and such XML/RDF-standardized rules are now also usable for the declarative specification of Web services.

A number of companies became involved in rule engines design and production (IBM, ILOG, Fair Isaac, HP and others). Later open source projects appeared (e.g., JBoss Drools and Jena Rules) and other software vendors (e.g., Oracle, TIBCO and SAP) started building their own tools for developing rule-based systems. In the last decade appeared standardization efforts pioneered by the Rule Markup Initiative (RuleML), and continued by various parties including the W3C Working Group on Rule Interchange Format (RIF).

This handbook aims to provide a comprehensive state-of-the-art of rule languages, methodologies for modeling, designing, and implementing rules, rule interoperability/interchange, and rule-based applications. The target readers are practitioners dealing with concrete problems, researchers looking for challenging research topics, and users and managers willing to advance their current business practices and software solutions. The book helps researchers to learn more about the current state of the art in the area.
In addition, the book fills a gap in the literature by relating the rule applications to Model Driven Architecture and ontology development on the Semantic Web. It gives an overview of the major issues researchers, developers, and users of rule-based systems may face while researching, developing, and using rule-based systems. This topics are related to: (a) business rules’ representation methods; (b) rule history and lifecycle management; (c) rule types and forms of reasoning; (d) rule verbalization, visualization, and documentation; (e) interoperability with external (data) sources; (f) testing and debugging tools; and (g) authoring environments (IDE vs. Browser vs. Custom). The developers will accommodate rule languages and methodologies to designing and building rule-based applications. The users and managers will learn more about rule-based systems, so that choosing solutions may become easier.

**ORGANIZATION AND STRUCTURE**

The handbook features chapters authored by 54 leading experts offering an in-depth description of key terms and concepts related to rule technologies, issues and trends in business rules’ management, and rule modeling and rule interoperability technologies in modern organizations worldwide. The handbook contains 27 peer-reviewed contributions organized into three main sections.

Section I covers the topics of rule languages and rule engines. Particularly, this explores various rule formalisms (such as description logic and logic programming), domain specific rule languages, various aspects of rule-based reasoning, modular rule languages, graphical notations for rule languages, and the rule languages for the Web.

Section II is devoted to standards, methodologies, and tools for rules and rule-based systems. This includes topics such as agile development of rule systems, verification and debugging principles used in rule bases, development of Web applications, services, and rule usage in agent-oriented systems.

Finally, Section III looks into rule applications, which spans across various application domains such as business process management, high-level agent architectures, service-oriented systems, ontology-driven applications, policy and rule languages, rules and model-driven software development techniques, and tools for rule mining and modeling.

The handbook contains many practical examples, case studies, and references to external sources containing many useful tools, systems, and engines, which allow the readers to experiment with the presented research results and potentially use them in their current research and practice.

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