JSR-331
Constraint Programming API

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Constraint Programming - CP

- Constraint Programming (CP) is a proven optimization technology
- CP Solvers provide powerful tools to model and efficiently solve constrained satisfaction and optimization problems
- Today CP is used by real-world business applications in such areas as scheduling, planning, configuration, resource allocation, and real-time decision support
- However, the absence of standards still limits the acceptance of CP by the business world
JSR-331 – Java Specification Request

- Java Constraint Programming API under the Java Community Process (JCP)  
  [www.jcp.org](http://www.jcp.org)
- JSR-331 covers key concepts and design decisions related to the standard representation and resolution of constraint satisfaction and optimization problems
- Utilizes de-facto standardized design decisions from multiple CP solvers
CP Standardization Perspective

- **Top-Down View**
  - **Business World**
  - **CP Interface**
- **Bottom-Up View**
  - **CP World**

**Standard is Oriented to Business App Developers** while allowing CP Vendors to provide implementations.
Key Objectives

- Make CP more accessible for business application developers:
  - Java Developers through API
  - Business Analysts through integration with Business Rules
- Allow a business application developer to easily switch between different implementation solvers without any changes in the application code
- Assist CP vendors in creating practical and efficient JSR-331 implementations
Community Input

- Constructive critique and contribution:
  - From CP vendors
    - Choco, IBM/ILOG, G12, JaCoP, Gecode, Constrainer
  - From CP experts
  - From Association for Constraint Programming (ACP)
- Important feedback from users who started to use preliminary JSR-331 releases
JSR-331 Architecture

Diagram:
- CP Interface
  - implements
  - Common Implementation
    - CP Solver Independent
      - Implements
      - Library of Constraints
      - Library of Search Strategies
    - JSR-331 Implementation(s)
      - CP Solver Dependent
      - TCK
      - Technology Compatibility Kit
        - Compatibility Tests
        - Library of CSPs

Arrows indicate relationships and dependencies between components.
Current State

- JCP Phase: Proposed Final Draft
- Detailed Documentation
  - Specification (Description and Javadoc)
  - User Manual
  - Many practical examples that can be tested
- Technology Compatibility Kit
  - Common Denominator - JUnit tests that all solvers should satisfy
  - A set of working well-known constraint satisfaction and optimization problems
Working JSR-331 Implementations

- From the very beginning we developed in parallel:
  - Specification
  - Implementations with examples and User Documentation

- Today we have:
  - Three tested working implementations using: **Choco™** or **JaCoP™** or **Constrainer™**
  - A new 4th (!) implementation based on **JSetL™**
  - All underlying CP solvers are open sourced
Integration with Modern Business Decision Management Systems

- Incorporations of Constraint Solvers with other BDMS components including:
  - Business Rules
  - Predictive Analytics
  - Complex Event Processing

- Use popular Business Rules interfaces to describe complex decisions with optimization components
  - orientation to Business Analysts instead of software gurus only