

# Entity-Control-Boundary: Architectural Patterns in Computer-Aided Timetable Construction System RUT-K



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D.IOD 24 Entwicklung Client/Server

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# Outline of the Talk

## RUT-K

- Task and Requirements of Train Schedule Management
- “Big Picture” of Structure of RUT-K Software
- Demonstration of RUT-K presenting
  - Construction
  - Visualization
  - Interaction
- Behind the Curtains: Use Cases, Business Rules and Interaction
- Conclusion
  - Further technical Challenges in RUT-K

# The Art of Train Scheduling

## RUT-K

### Goals in Train Scheduling are

- Correct Travelling Times
- Schedules without conflicting Train Paths

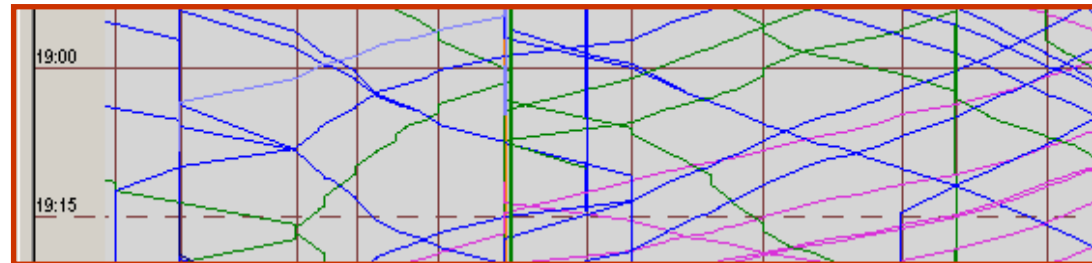
### Task of DB-Netz AG is Scheduling

- for 40000 trains/day
- on 35000 km lines of tracks

### Requirements for RUT-K were

- GUI for Visualization and User Interaction
- Detailed Calculation of Running Times, Times of Usage, Conflicts
- Multi-User Access
  - 7 regional Business Units
  - ~ 50 Users/Unit

### RUT-K: Interactive Timetable-Construction



### RUT-K “office”

- **Client Application**
  - Visual Works 7.4.1
  - “Very Fat Client”
- **Server**
  - Oracle 9 Database
  - Smalltalk Servers

### RUT-K “mobile”

- Personal Oracle on Notebook
- Connect to Server-DB to
  - Load/Download from/to Server

# Acting Parts of the Software

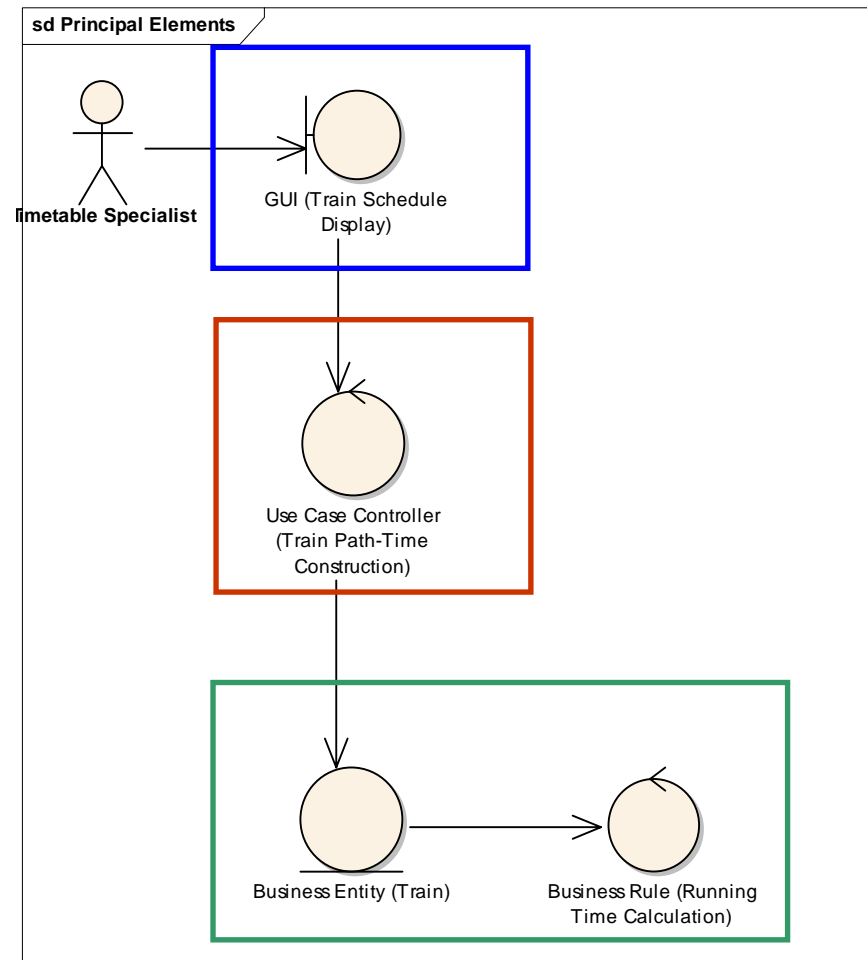
RUT-K

## Basic Acting Parts of Software

- Boundary Elements
  - GUI
  - Interfaces to other systems
  - ...
  
- Controlling Elements
  - For Use-Cases
  - For Business Rules
  
- Entities
  - of Business Domain

## Interaction of these Elements

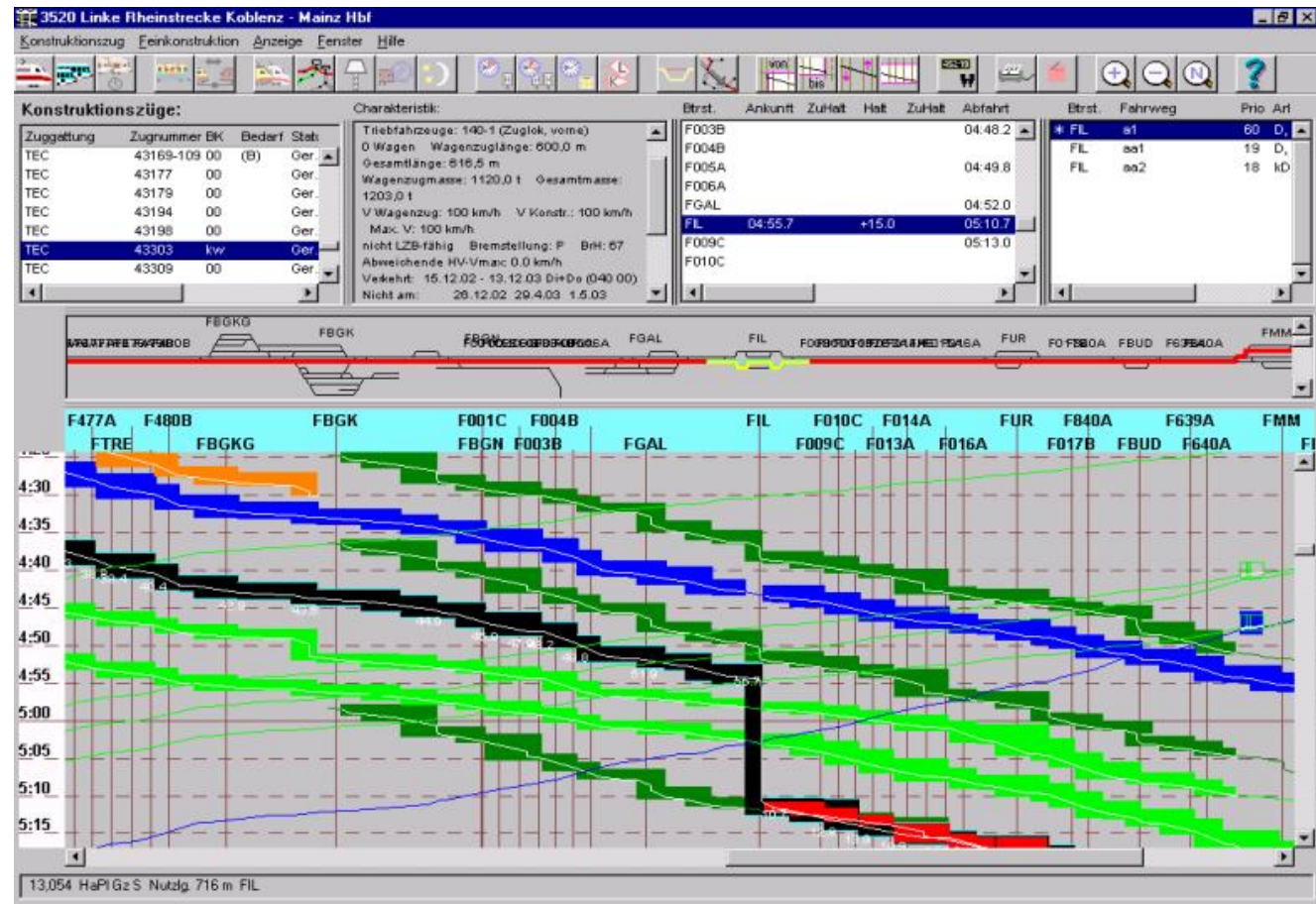
- By Calls
- ...



# Demonstration of RUT-K Application

## RUT-K

- Timetable Construction



# Architectural Elements in RUT-K

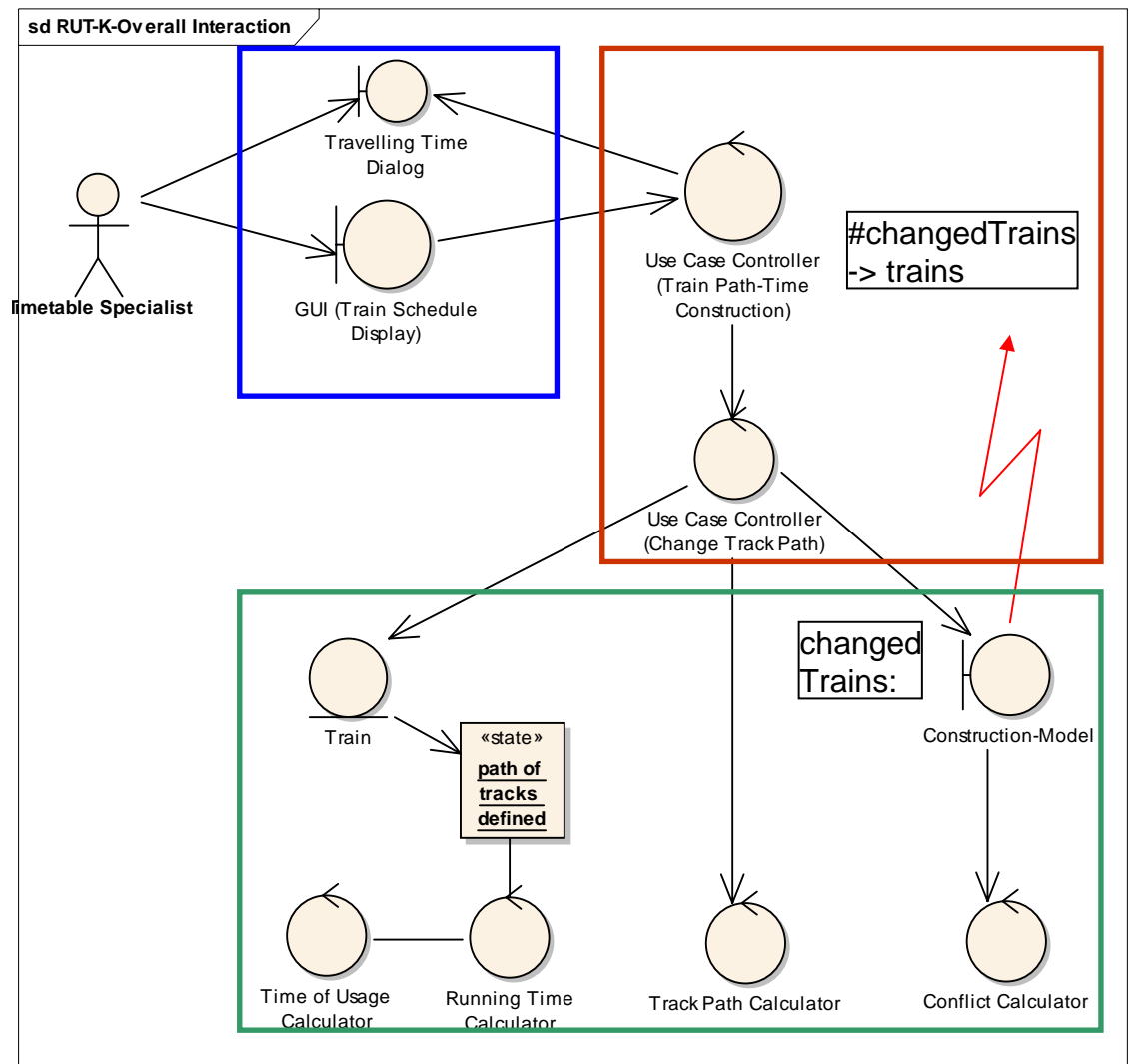
## RUT-K

### UCC-Layer

- Interleaving of Use Cases
  - Several Running Use Case Controllers
  - Subscription to Business-Events
  - Decision of UCCs on Event-Reaction

### Business Layer

- Domain Model-Object
  - Boundary for Subscription of UCCs to Business-Events
  - Registry of Business Objects



## Other important Aspects

### RUT-K

#### ■ Access to Database

- Boundary for Access to Persistence Framework
- Data Management: Load/Unload
- Controller to Register Loaded Business Objekts

#### ■ Control of Multi-User-Access

- Locking of Business Entities, Refresh

#### ■ Transactions on Events

- Accumulate Events until Use Case Action has stopped
- reduce Number of Updates of GUI in complex transactions



RUT-K

**Thank You!**

**Thanks to all the People who contributed to RUT-K**