The TDD technique applied to a real project: a DB-2-DB replicator

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Outline

- What is MIP?
- The Gateway
- The TDD technique and the iterative process
- Continuous Integration
- The RUP process
- Measurements from the project
- Conclusions

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What is MIP?

- MIP stands for "Multilateral Interoperability Programme".

- The aim of the MIP is to achieve international interoperability of Command and Control Information Systems (C2IS) at all levels.

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The MIP Concepts

- Common Interface: The Exchange Data Model
- Exchange Mechanism: How the information exchange takes place
- Interoperability

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Exchange Mechanism

- The Message Exchange Mechanism (MEM) consists of a suite of formatted messages in compliance with AdatP-3 Part 1 plus instructions for their use.

- The Data Exchange Mechanism (DEM) is an automatic data push mechanism that co-exists with the MEM.

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Interoperability

- The MIP specifications are powerful interoperability tools.

- The Baseline 2 is a product of the MIP Block 2. It has been officially released at the end of 2006.

- The Baseline 3 is a product of the MIP Block 3. It has been release on March 2009.

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The Gateway

- The Gateway is a software component used to map the MIP Block 2 concepts to the MIP Block 3 concepts and vice versa.

- The mapping between the two blocks consists of several rules.

- Each rule is related to a DB structure change or to a Business Rule change.

- Oracle Golden Gate^{TM} is the COTS used to implement the rules.

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The TDD technique and the iterative process

- The Functional Requirements of the Gateway consist of a set of Mapping Rules between the C2IEDM and JC3IEDM DB schemas.

- Each Rule is:

  - **self-consistent** and **complete** (relative to the portion of data schema to which it refers)
  - **independent** from the other rules
  - **uniquely identified**
  - identified by a **priority**

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The TDD technique and the iterative process: the Backlog

- The "*Requirements Analysis and Specification*" Process spans over the whole Life Cycle and the **Customer is involved**

- It produces and maintains the **Backlog**, from which well defined Rules, ordered by Priority, are submitted to the development team iteration by iteration
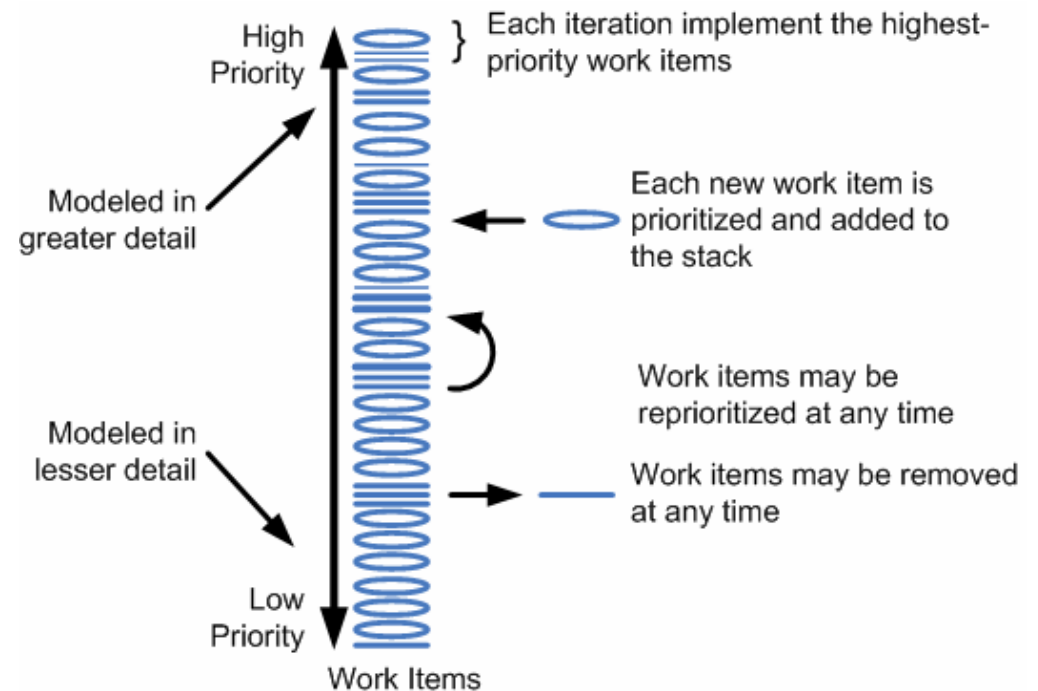
The TDD technique and the iterative process: Iterative Development

- ● **The Iterative Development Process is organized in a SCRUM-like manner**
  - ● The scope of an Iteration (Sprint) is to define the set of Rules that could be implemented in the next iteration with the agreement of the Customer (Sprint Planning)
  - ● The rules are popped from the backlog according to their priority
  - ● The status of the development is revised and validated with the Customer (Sprint Review) at the end of each iteration.

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The TDD technique and the iterative process: Test Driven Development

- ## The TDD is a rigorous development process, where:

  - N Functional Test Cases are defined for each Rule (with $N > 1$)

  - The Test Cases are created **before** the Rule implementation

  - A Rule is considered "**completed**" when all the associated Test Cases are successfully executed

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The TDD technique and the iterative process: the Backlog Item representation

- Work Item "Mapping Rule"

Test Automation

- ## JUnit

  - ### Test Code is implemented using JUnit

  - ### Each Test Case stimulates the Gateway, by means of one or more INSERT statement into the source DB, and reads the results, by one or more SELECT on the destination DB after the replication.

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Continuous Integration is a software development practice where members of a team integrate their work frequently, usually each person integrates at least daily - leading to multiple integrations per day. Each integration is verified by an automated build (including test) to detect integration errors as quickly as possible

Martin Fowler

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- ## Daily Build – Each night CI server builds
  - ### Check-out code from the SVN repository
  - ### Build and deploy the SW into the target test bed
  - ### Run the integration tests
  - ### Check replication and test case correctness

- ## Build Result
  - ### Each build sends a detailed report to PM, TL
  - ### All developers are notified if there was a broken build

- ## Acceptance Test
  - ### Test Suite is part of the acceptance test during Sprint Review.

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- Dashboard server CI

- Detailed Information about failures

Test Result

140 failures (+140)

1.418 tests (±0)
Took 3 hr 57 min.

All Failed Tests

Test Name	Duration	Age
>>> test.gwfinal.attivita.GH6.CtgtdetAuthTestCase_S1018_974.test_CAUTH	0.422	1
>>> test.gwfinal.attivita.GH6.CtgtdetAuthTestCase_S1018_974.testCreatorId	0.046	1
>>> test.gwfinal.attivita.GH6.CtgtdetAuthTestCase_S1018_974.testID	0.016	1
>>> test.gwfinal.attivita.GH6.CtgtdetItemTestCase_S1018_975.test_CITEM	0.0	1

Regression

test.gwfinal.attivita.GH6.CtgtdetAuthTestCase_S1018_974.test_CAUTH (from test.AllTests)

Failing for the past 1 build (Since #469)
Took 0,42 sec.

Error Message

Listener refused the connection with the following error:
ORA-12518, TNS:listener could not hand off client connection
The Connection descriptor used by the client was:
172.16.7.81:1521:ORCL

Stacktrace

java.sql.SQLException: Listener refused the connection with the following error:
ORA-12518, TNS:listener could not hand off client connection
The Connection descriptor used by the client was:
172.16.7.81:1521:ORCL

```
        at oracle.jdbc.driver.DatabaseError.throwSqlException(DatabaseError.java:112)
        at oracle.jdbc.driver.DatabaseError.throwSqlException(DatabaseError.java:261)
        at oracle.jdbc.driver.T4CConnection.logon(T4CConnection.java:387)
        at oracle.jdbc.driver.PhysicalConnection.<init>(PhysicalConnection.java:414)
        at oracle.jdbc.driver.T4CConnection.<init>(T4CConnection.java:165)
        at oracle.jdbc.driver.T4CDriverExtension.getConnection(T4CDriverExtension.java:35)
        at oracle.jdbc.driver.OracleDriver.connect(OracleDriver.java:801)
        at java.sql.DriverManager.getConnection(DriverManager.java:582)
        at java.sql.DriverManager.getConnection(DriverManager.java:154)
        at test.common.AbsTestCase.getConnection(AbsTestCase.java:515)
        at test.common.AbsTestCase.getGh6Connection(AbsTestCase.java:490)
        at test.gwfinal.attivita.GH6.CtgtdetAuthTestCase_S1018_974.test_CAUTH(CtgtdetAuthTestCase_S1018_974.java:38)
```

**Standard Output**

CfeatStatTestCase_S1018_573.test_CFEATSTAT()

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The TDD technique and the iterative process: Work Flow of the "Mapping Rule"

Draft

⬇

Defined

⬇

→ **Description**, Size, N Test Cases, etc.   **PM**

→ **Technical Solution**   **TL**

Analyzed

⬇

In Progress

⬇

→ **Implementation and Test**   **Team**

Completed

⬇

→ **Validation**   **Sprint Review**

Closed

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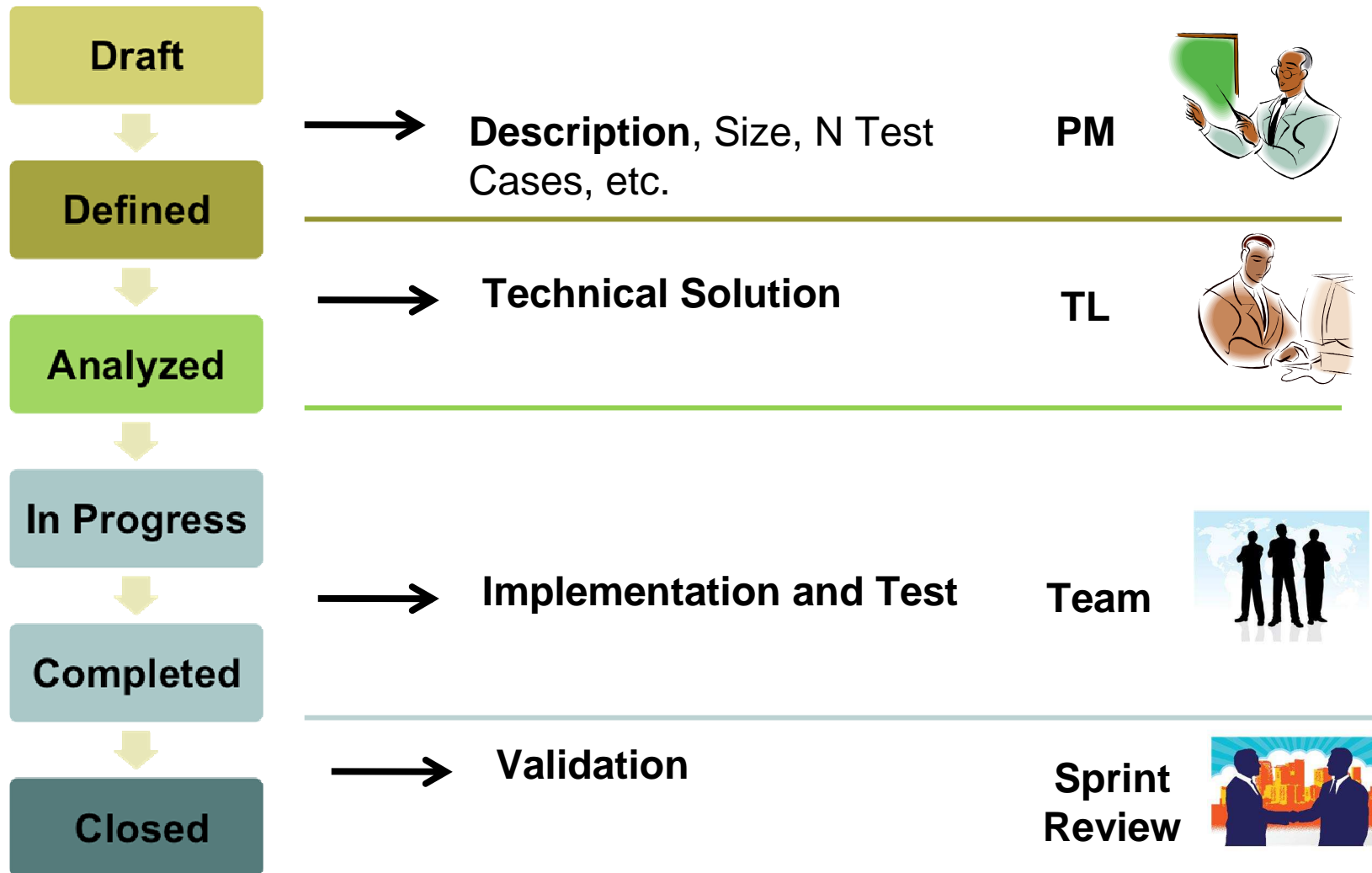
Iteration (Sprint) framework

Planning (1/2g)

- Owner :PM
- W.I. allocated to the Iteration on the basis of Priority and Size
- Usage of metrics from previous Iterations
- Team involvement

Development (4gg)

- Owner: TL, Team
- Execution of the TDD process
- Continuous Integration

Review (1/2g)

- Owner: PM
- Verification of the nightly build from Continuous Integration
- Closure of the Completed W.I.
- Metrics updating
- Internal Tag on SVN

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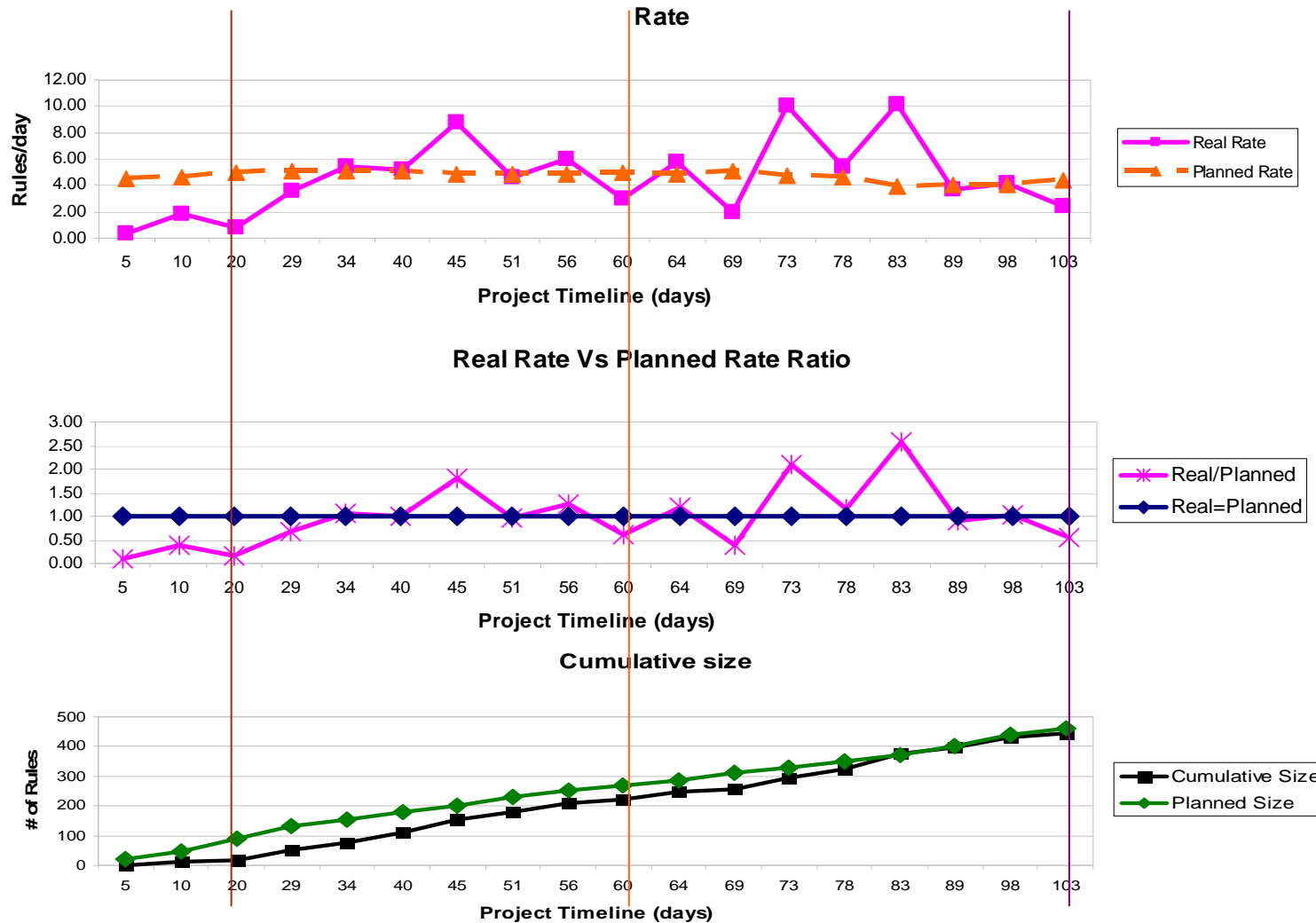Tecnologie nelle Reti e nei Sistemi T.R.S. S.p.A.

The RUP process

- The Rational Unified Process (RUP) is an iterative software development process framework

- It consists of four phases: the inception, the elaboration, the construction and the transition.

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Measurements from the project

Rate

Real Rate
Planned Rate

Real Rate Vs Planned Rate Ratio

Real/Planned
Real=Planned

Cumulative size

Cumulative Size
Planned Size

End of the Inception   **End of the Elaboration**   **End of the Construction**

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Conclusions

- The TDD process gives more control on the project: in any phase we know where we are and where we are going to

- Every team component knows what are its own responsibilities

- The Customer knows what is the project situation and he/she is part of the development process

- Low defects: about 40 on about 450 mapping rules (less than 10%).

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Questions?

Thank you very much

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