Telelogic

Automated Test: from Generation to Execution

Putting you ahead

for advanced software

development

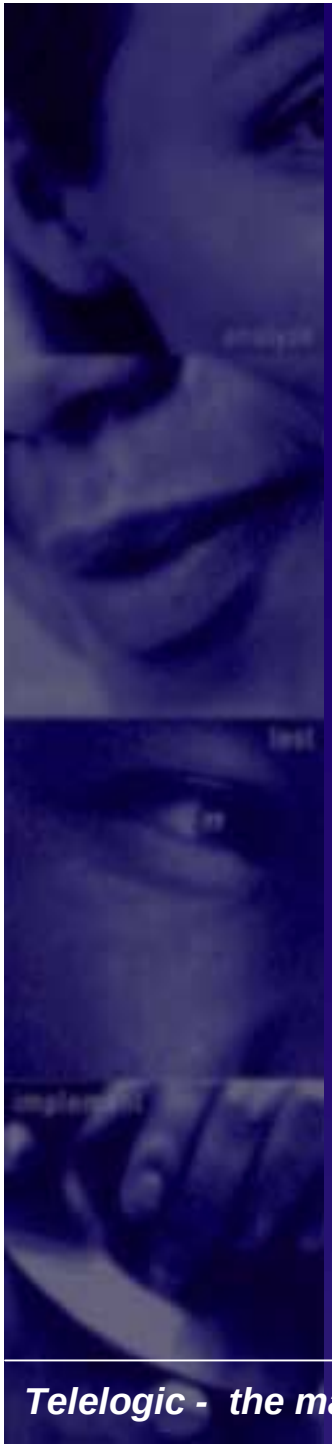
Telelogic

- a stable history and an exciting future

- Founded 1983
- Listed 1999

- Revenue 1999 $37M (318 MSEK)
- Growth 78%
- 600 employees

Global business - local presence



Successful customers around the world

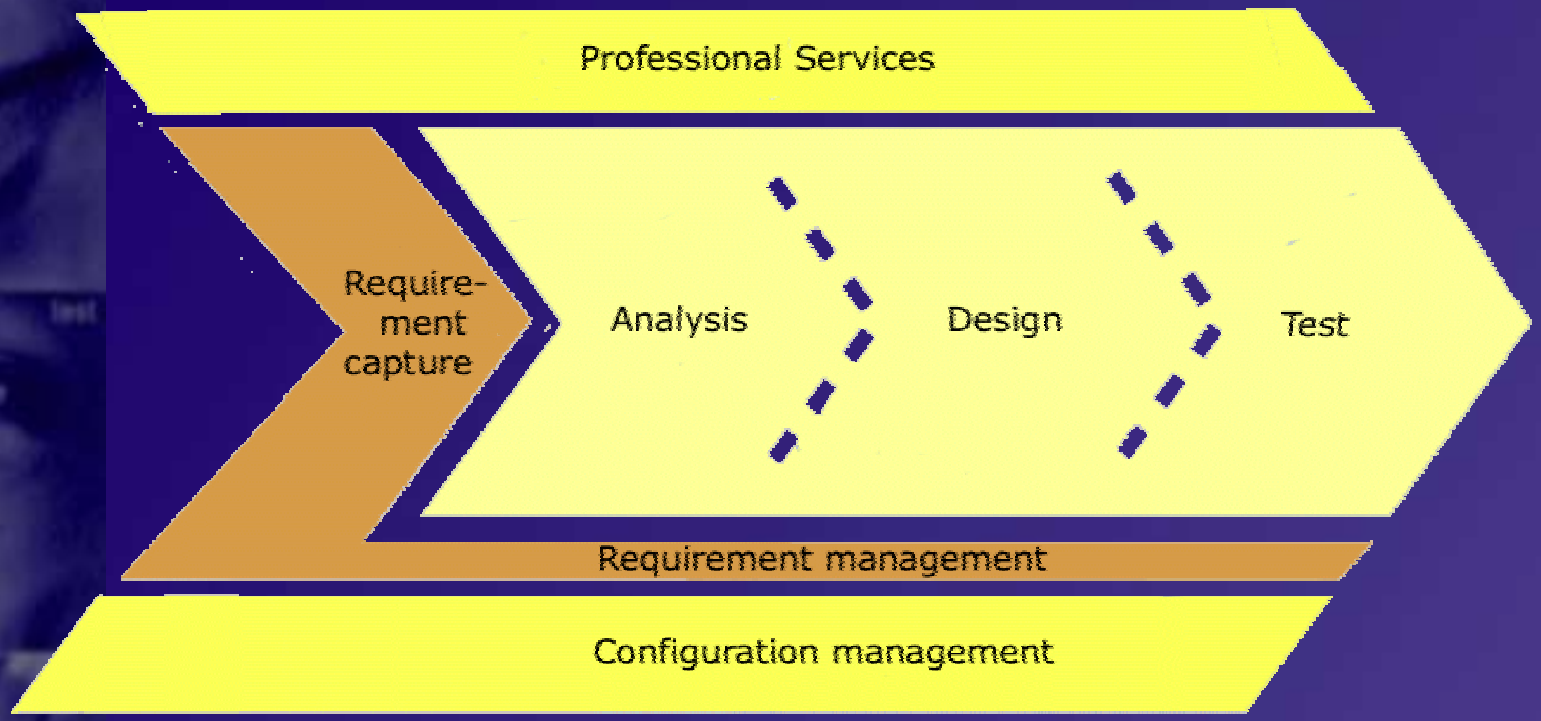
- Alcatel
- Bosch
- Cisco
- Ericsson
- Fujitsu
- Lucent Technologies
- Motorola
- NEC
- Nokia
- Nortel Networks
- Siemens
- Telcordia

- Airbus
- Allied Signal
- Boeing
- Eurocopter
- Honeywell
- Lockheed-Martin
- Matra Marconi Space
- NASA
- Raytheon
- Rockwell Collins
- United Space Alliance

- Alpine
- Opel/GM
- Blaupunkt
- BMW
- DaimlerChrysler
- Volvo
- Volkswagen

- Deutsche Bahn
- Agribank
- Thomas Cook

Telelogic
- Process & tools match -



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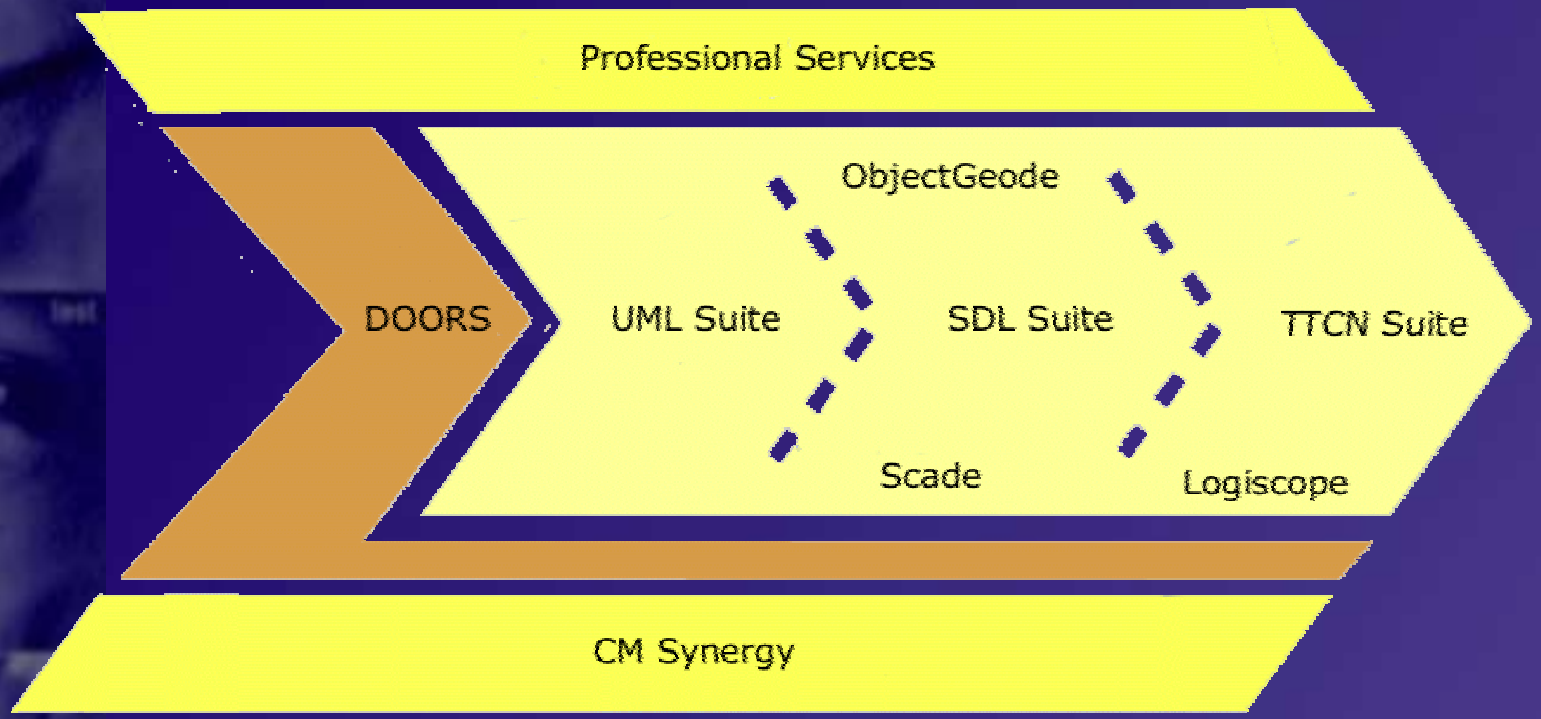
- Process & tools match -



Telelogic

The Telelogic mission

”To help our customers
become leaders in product reliability and time-to-market
by providing complete state-of-the-art solutions
for real-time software development”

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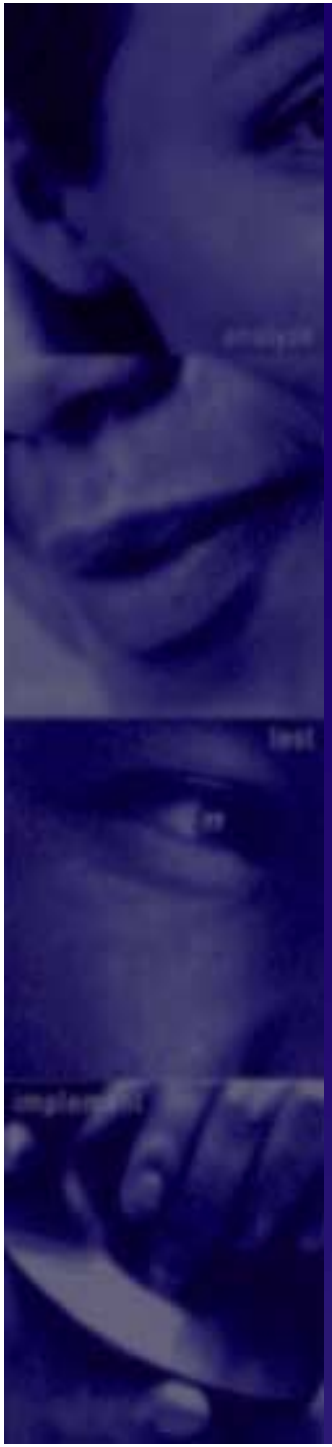

Automated Test

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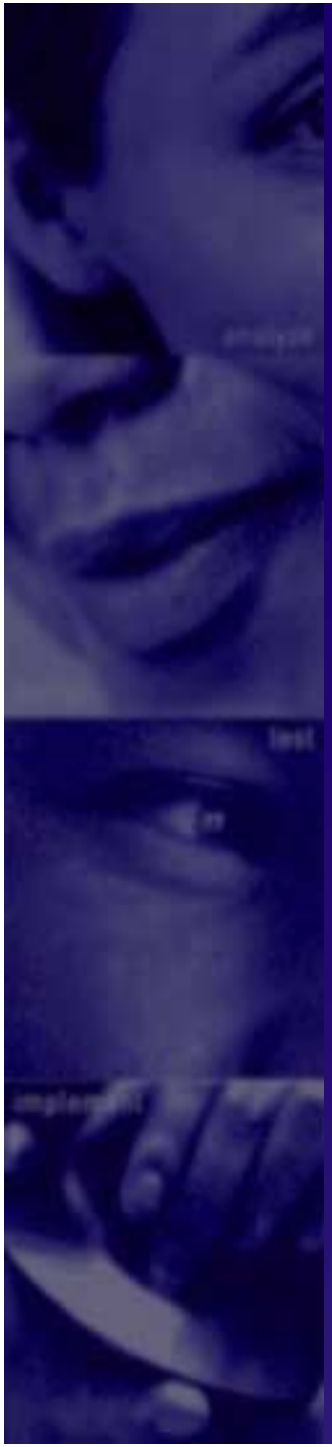
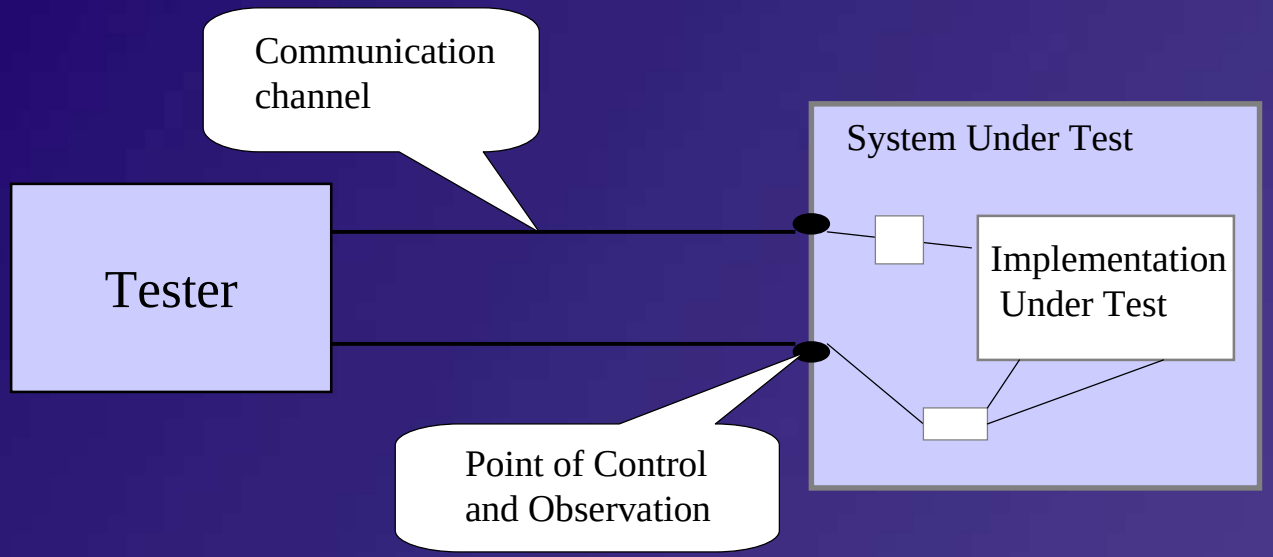


System Test

- Black Box testing
- Message based communication



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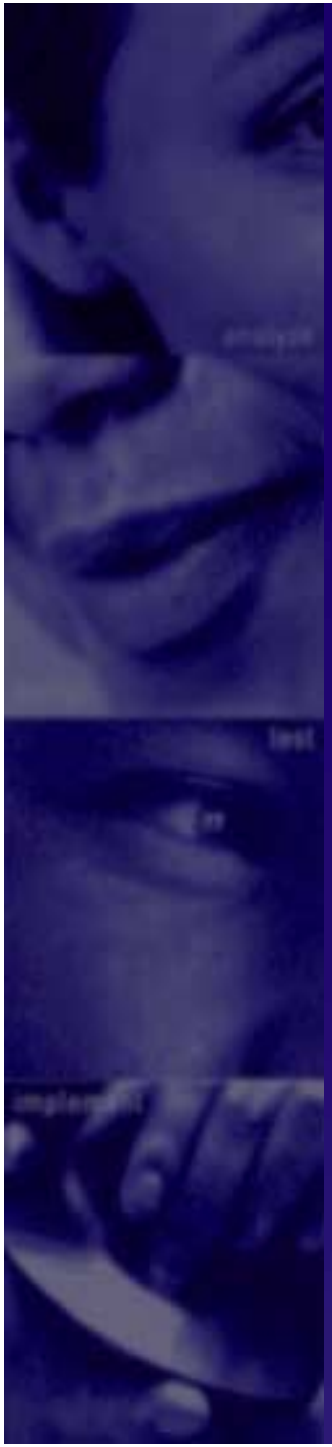

What is Automated Test ?

Automated Test Execution

Control	Automated Stimulation	Automated Stimulation	Automated Interactive Test
Observation	Manual Results Analysis	Post Mortem Automated Analysis	

Automated Test Generation (ATG)

Control	Inputs Sequence	Inputs Sequence	Input-Output Tree
Observation		Required Ouputs Sequence	

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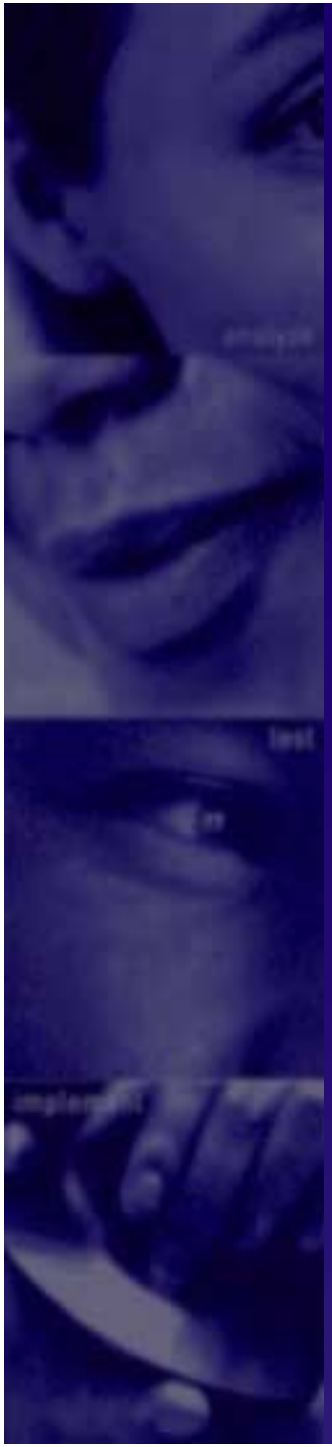
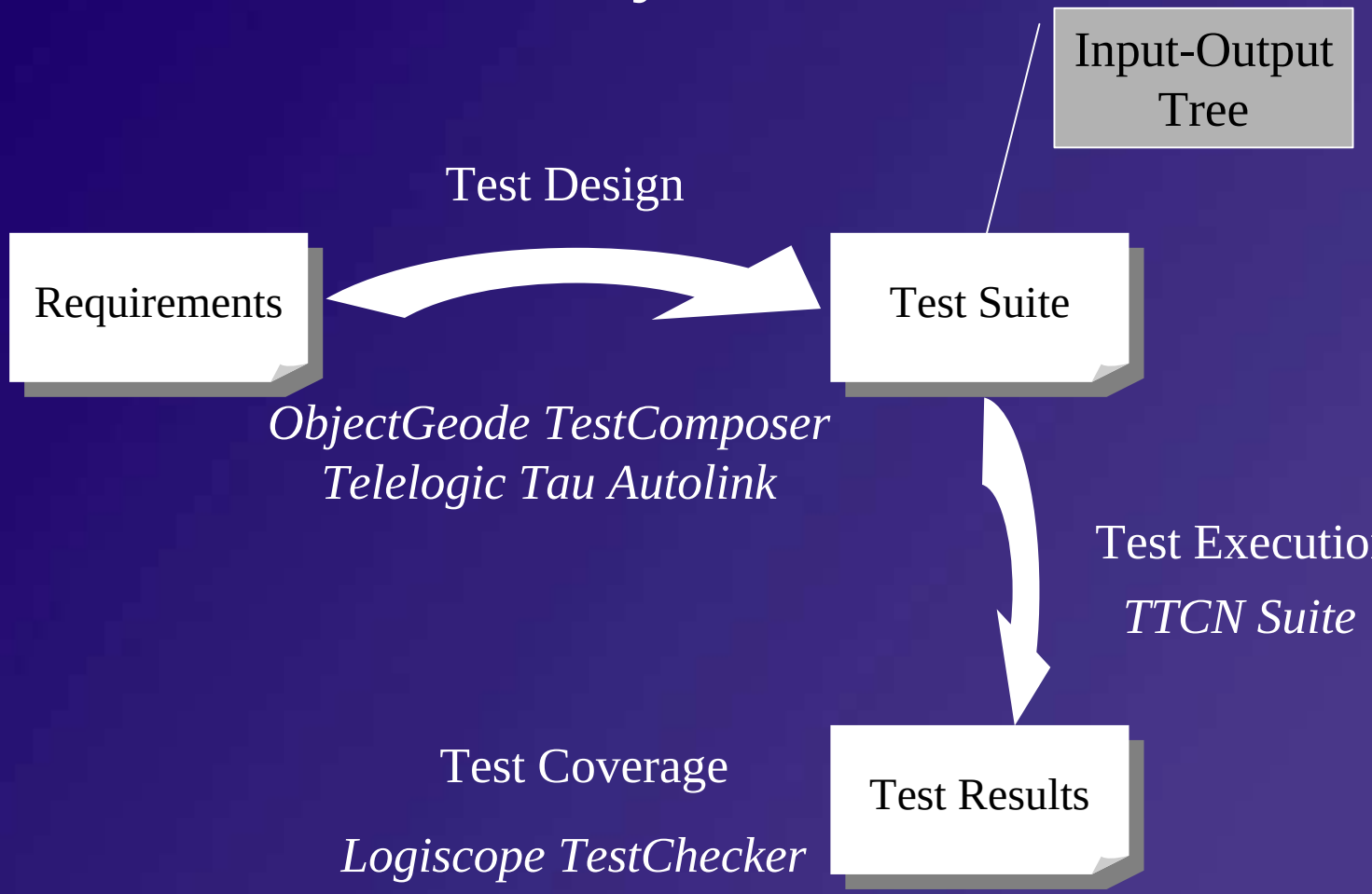


Test Life Cycle



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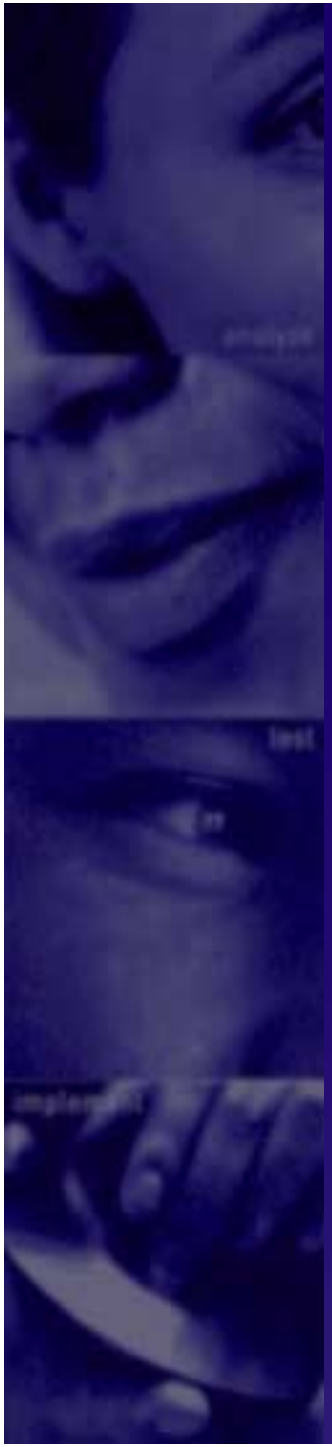

Customers Profiles

- Test Specification Institute
- Test Department
- Design Team

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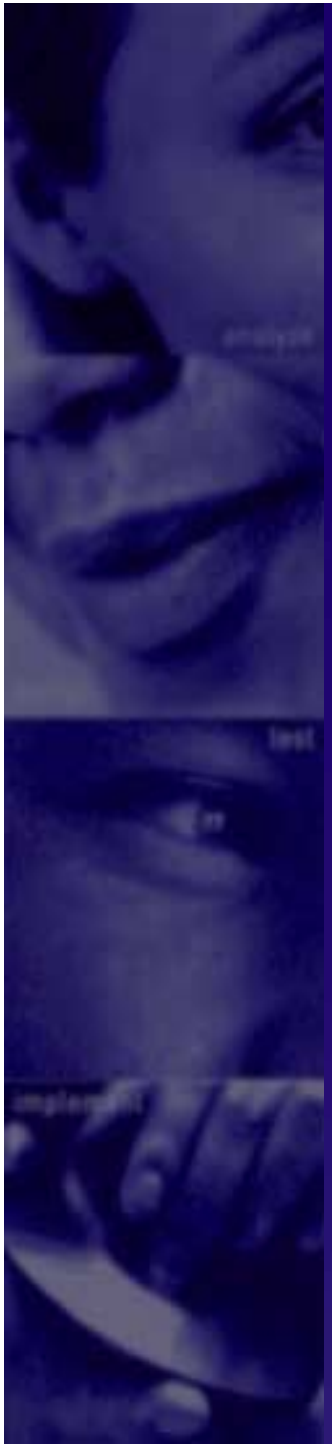

Test Specification Institute

- Mission
  - Design a Test Suite for Standardization
- Keywords
  - Conformance Testing, Abstract Test Suite, Standards
- Needs
  - Standard Test Language
  - Requirements to Specification to Test automation
  - Light Test Management
- Typical examples
  - ETSI, NTT Docomo

Test Life Cycle

- Define Test Architecture
- Simulate SDL-> MSC Test Purposes
- Run SDL/MSC -> TTCN
- Post-process TTCN
- Deliver TTCN Test Suite

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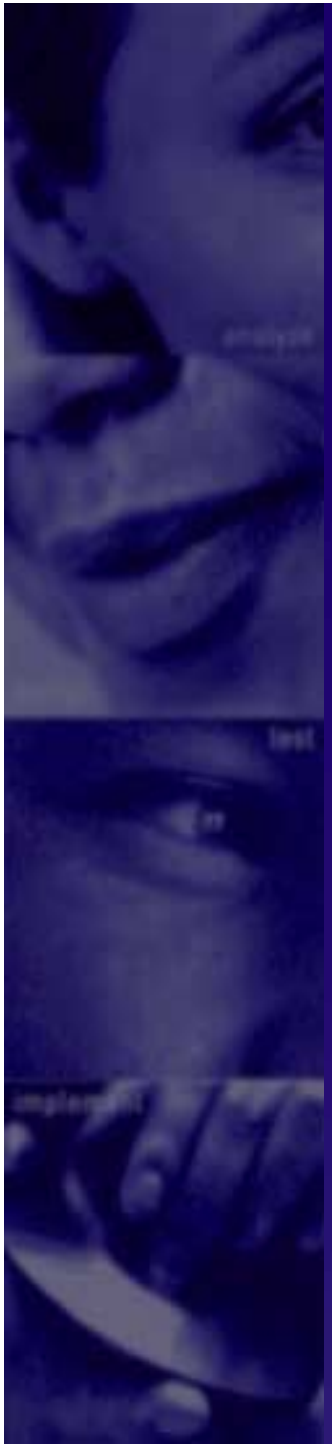

Typical example

ETSI: HIPERLAN/2

- Entry point:
  - SDL specification (20 KLOC),
  - set of partial MSC, textual specification
- Output:
  - TTCN Test Suite
- Tool:
  - ObjectGeode TestComposer

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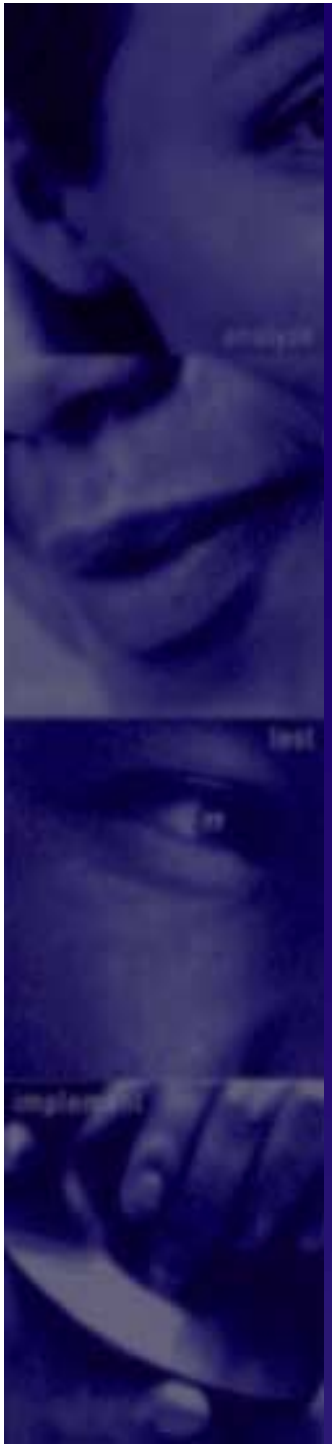

Results and Conclusion

- Results:
  - Generation of 200 Test Cases
  - Estimation of effort: 20% less than classical development (SDL+TTCN)
- Industrial SDL vs Requirements SDL
  - Requires complete, simulation-ready SDL
- TTCN produced
  - Good handling of complex behaviors
  - Need for parameterized constraints, concurrent TTCN
  - Need for wildcards generation

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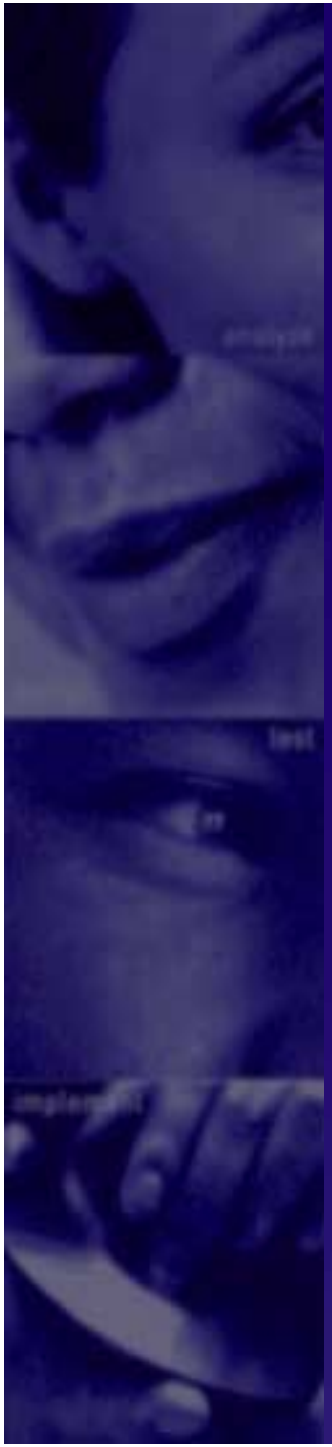
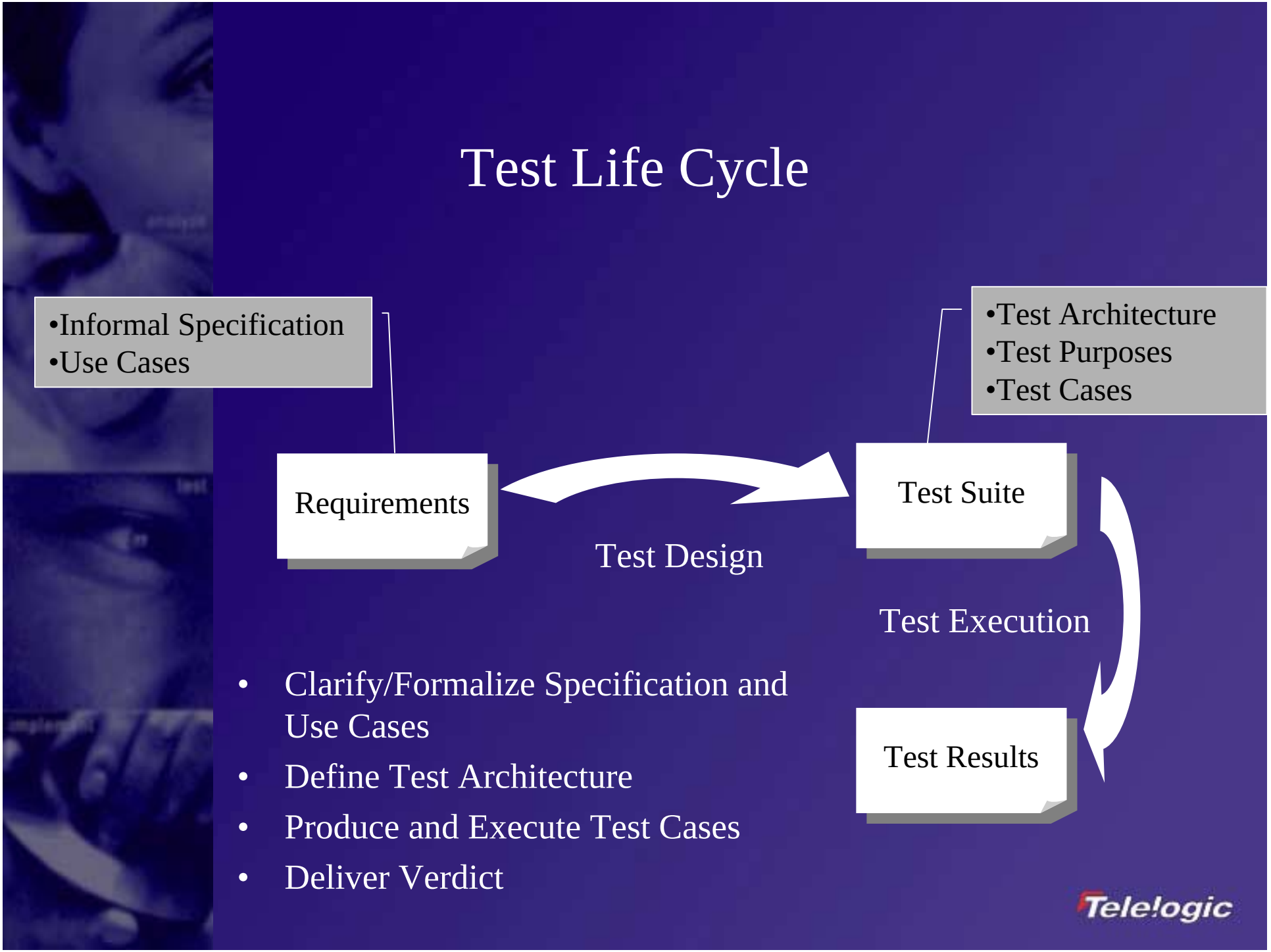


Validation Department

- Mission
  - Validation of systems developed in other departments
- Keywords
  - Validation, System Test, Target Test Execution, Test Management
- Needs
  - Formalization for inter-department communication
  - Automated Test execution
  - Test life-cycle management
- Typical examples
  - Most of System Engineering companies

Test Life Cycle



- Clarify/Formalize Specification and Use Cases
- Define Test Architecture
- Produce and Execute Test Cases
- Deliver Verdict

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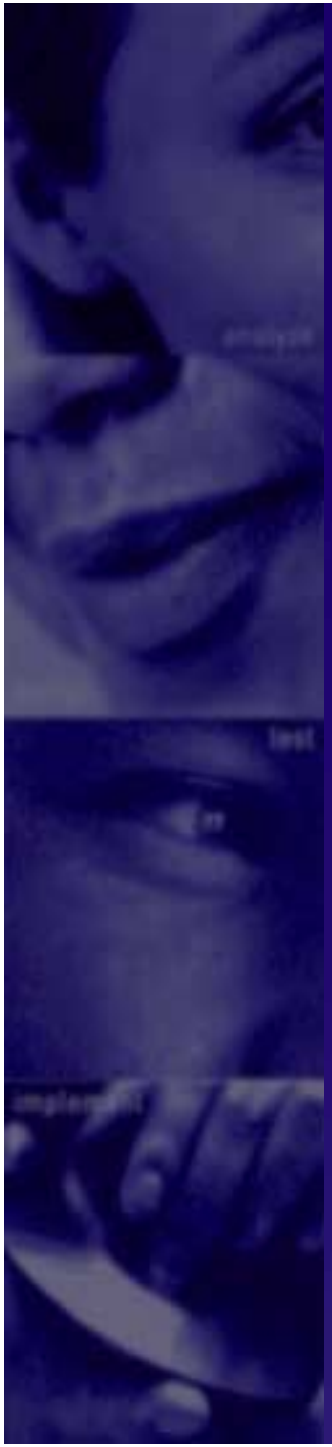
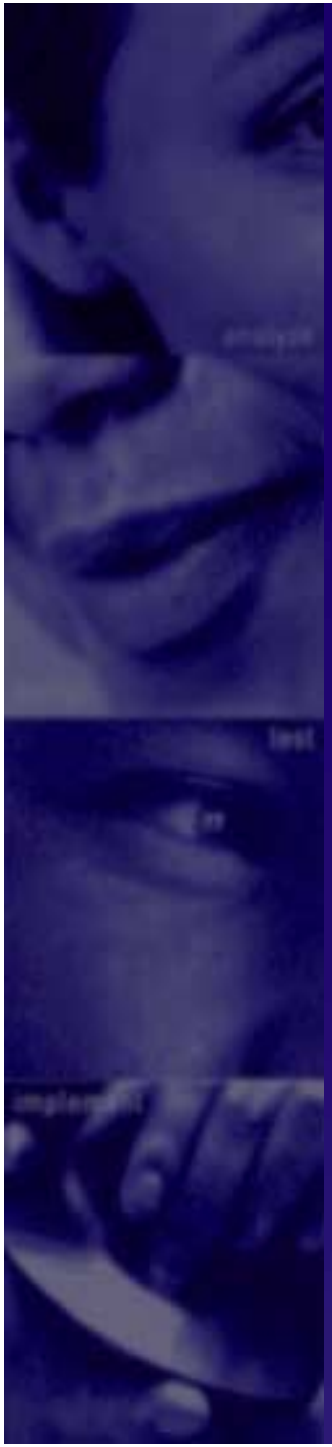


Alcatel Example

- Validation of a part of GSM protocol
  - Evaluation of Automated Test Generation on a real-size project
  - Comparison to hand-written tests
  - Test Execution on Alcatel's proprietary test platform
- Starting point: ETSI Standard for the CCBS part
- Outputs:
  - SDL Specification, MSC Test Purposes, Test Cases
  - Test Suite execution
- Tools:
  - ObjectGeode TestComposer



Results and Conclusion

- ATG is useful and needed for automating Conformance Testing

- Special requirements for the SDL model:
  - Early definition of Test Architecture
  - Messages and data handling
    - Handling and visualization of huge messages description
  - SDL model for reference and ATG
    - Useful for documentation and understanding by simulation
    - Not to be detailed down to design model

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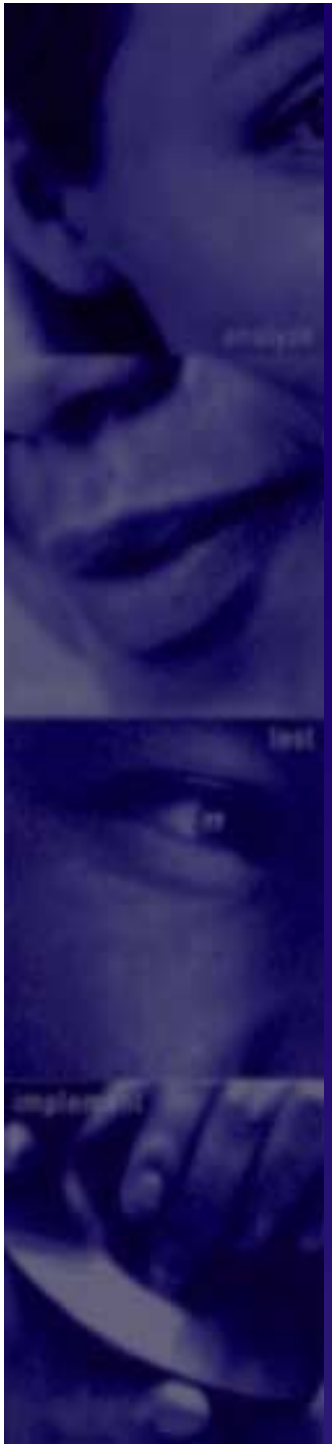

Development Team

- Mission
  - Develop and Test a System’s part
- Keywords
  - Module and Integration Testing, Test Execution, Test Coverage Assessment
- Needs
  - Host/Target test execution environment
  - Facilities to handle data and types
- Typical examples
  - Most of System Engineering companies

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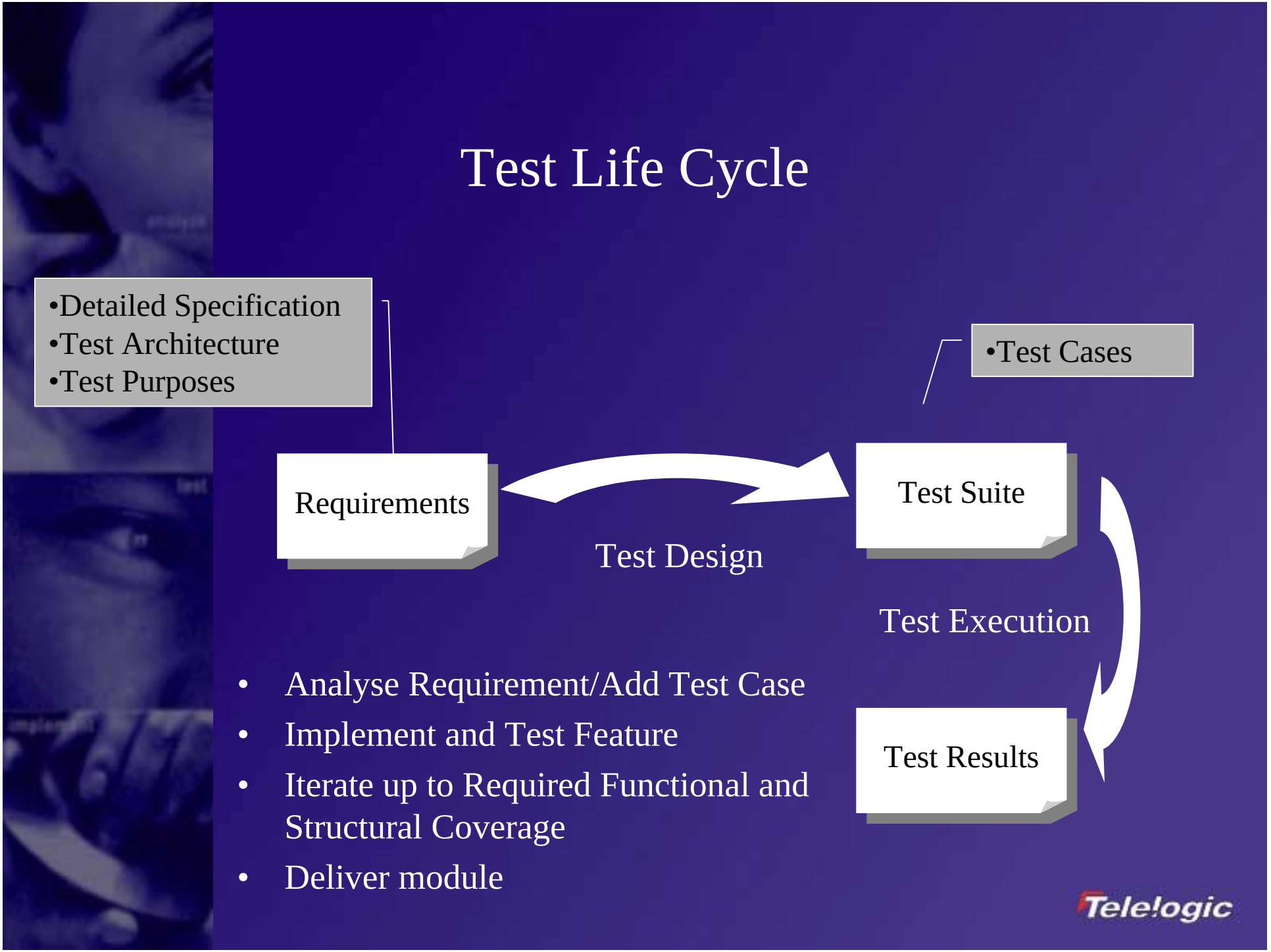
Test Life Cycle



- Analyse Requirement/Add Test Case
- Implement and Test Feature
- Iterate up to Required Functional and Structural Coverage
- Deliver module

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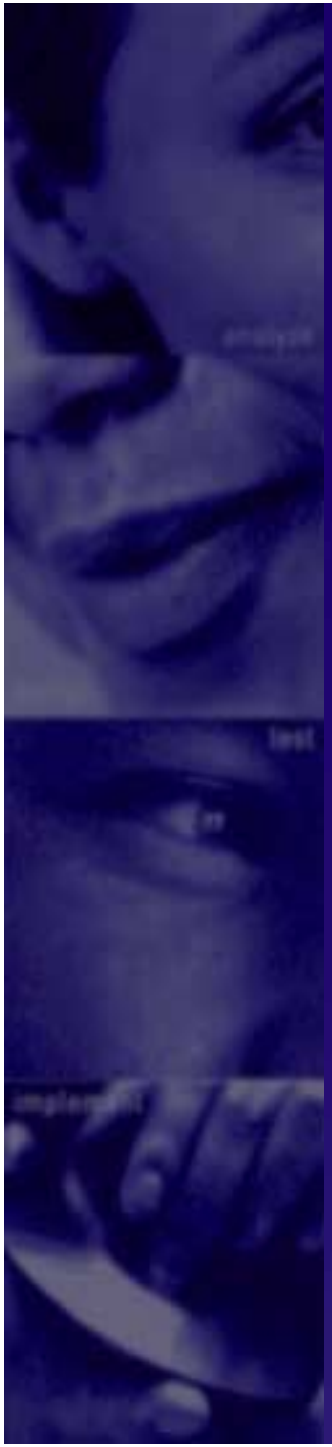
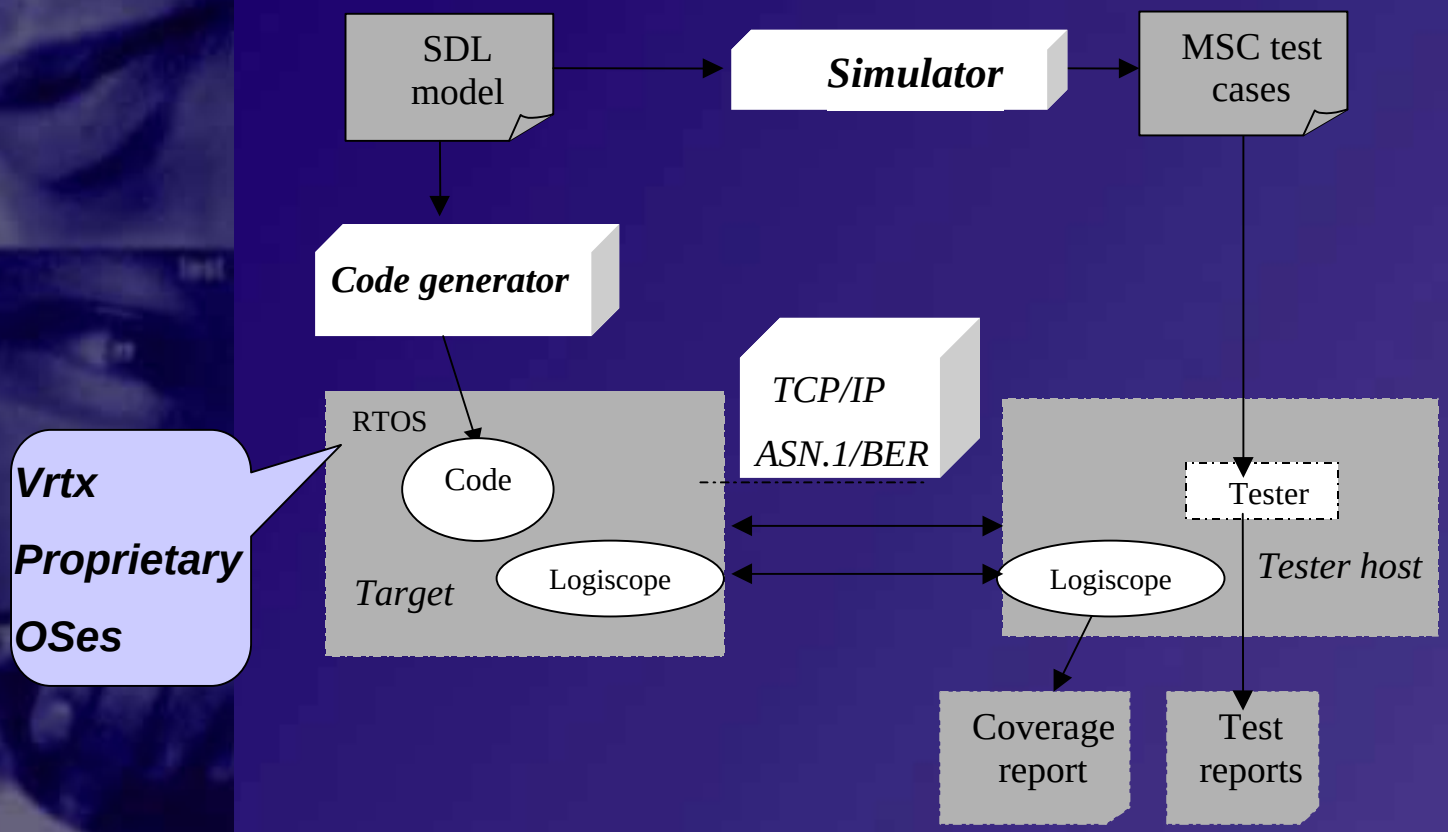


Honeywell Avionics example

- CMU on-board software
- Principal challenges
  - 100,000 lines of SDL + 30,000 lines of C code
  - Code generation and Test Execution
  - Certification for DO-178B Level C compliance
- Tools:
  - ObjectGeode TestComposer
  - Logiscope TestChecker
  - Attol System Test

Honeywell test process



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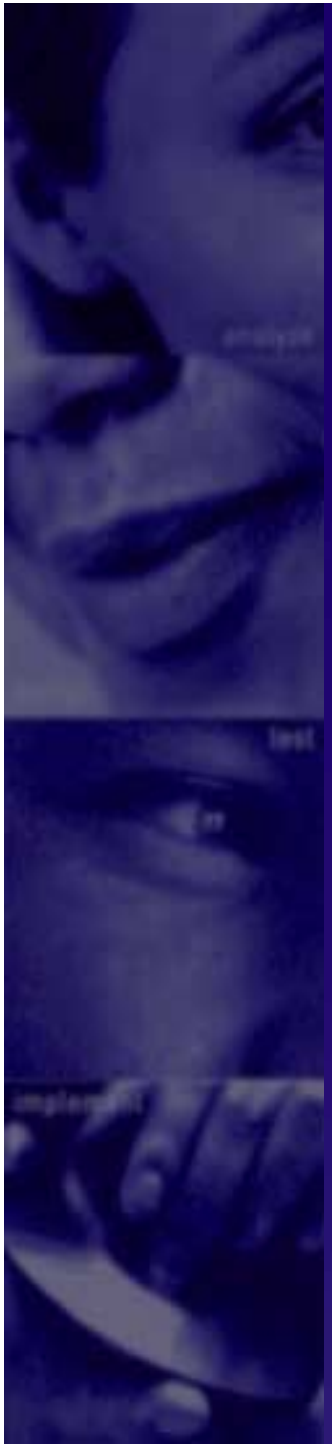

Results and Conclusion

- Results:
  - Development of 1000+ MSC test cases by simulation (on-going)
  - Test Execution on three different RTOS
  - MSC language very helpful to visualize and understand Test Cases
- Additional needs
  - Easy switch between test architectures
  - Test Version and Configuration management

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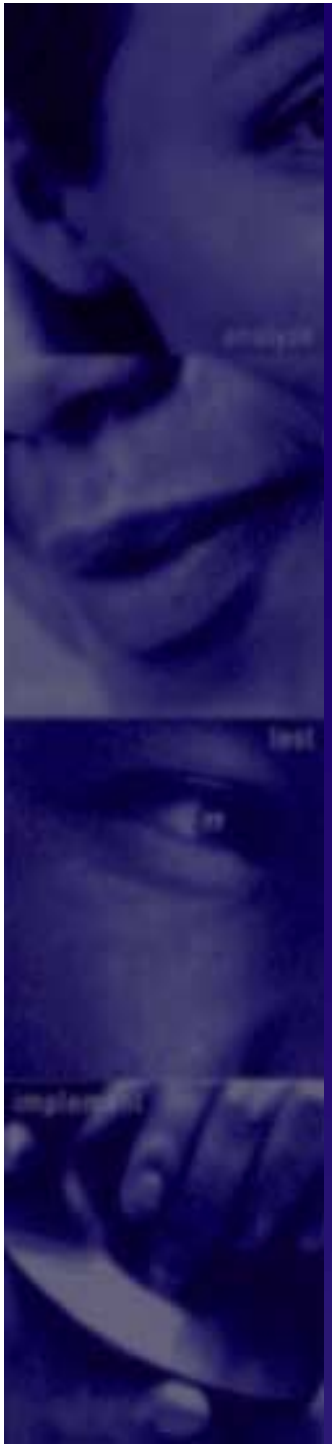

General Conclusions

- ATG is needed and good for
  - Automatic (re)production of Test Cases
  - Handling of Complex Behaviours
  - Integration of Requirements Tracking and Configuration Management
- ATG requires and facilitates Automated Test Execution
- ATG requires a shift of efforts to specification design
- TTCN is suited for complex tests of distributed systems
- MSC is well suited for simpler (sequential) tests

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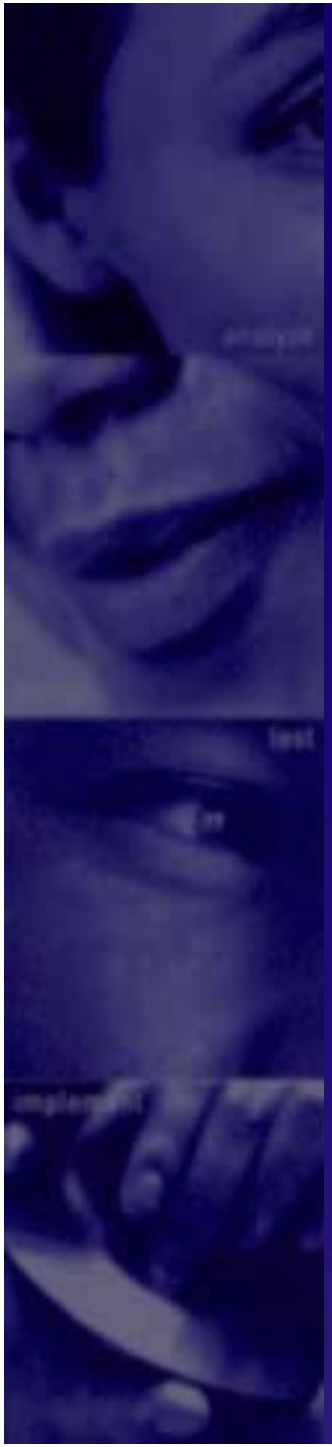

Improvement points

- Handling of complex data (edition, visualisation)
- Generation of wildcards (symbolic handling of data)
- Generation of Concurrent Test (Concurrent TTCN)
- Definition of a Generic Process and Methodology

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