Tools For Embedded System Development - A Survey
Draft

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Overview

- Motivation
- Tools covered
- Approach
- Tool diagrams
- Future work

Motivation

- MoDES meeting in October 2006: Survey started
  - On embedded development tools
  - Design methods
  - Interest for MoDES members
- Interest: a toolchain for embedded development
- $\longrightarrow$ Effort to support full embedded development cycle
- $\longrightarrow$ A bird's-eye-view on existing tools
- $\longrightarrow$ Support selection of tools for a toolchain

Finding Tools

- Start out with a large list
  - ARTIST2 Roadmap
  - Report from TUM on CASE tools (embedded)
  - YAHODA project from Masaryk University
  - Tools used at AAU
- Disregard unavailable
  - OSS/Research: no homepage with download
  - Commercial: no eval. download and no way to buy
  - Internal projects
- Web link from literature / Web search

Tool List

- 1^{st} iteration
  - Include tools known to authors
- Subsequent iterations
  - Input from other parties
  - Evaluation of tools

Extract From Current List

94 tools and technologies

Product	**Provider**	**Available**
Bandera Bogor		Y
IF	Verimag	Y
IFx	Verimag	Y
PHAVer		Y
Matlab/Simulink + StateFlow		Y
dSpace		Y
SCADE	Esterel	Y
ETAS/ASCET-SD	Etas	Y
SystemBuild / MATRIXx	Wind River	Y
Scilab	Inria	Y
Modelica	Modelica	Y
StatemateMagnum	Telelogic	Y
Rhapsody	Telelogic	Y
...	...	...

Diagram Layout

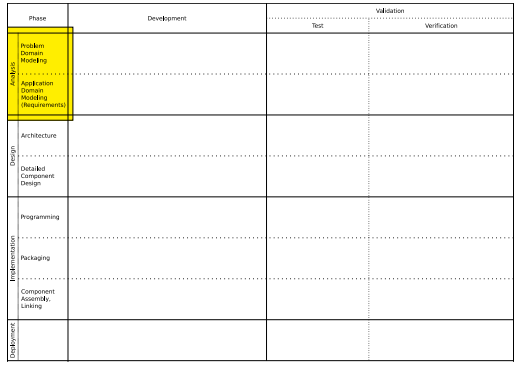
Phase		Development	Validation	
			Test	Verification
Analysis	Problem Domain Modeling			
	Application Domain Modeling (Requirements)			
Design	Architecture			
	Detailed Component Design			
Implementation	Programming			
	Packaging			
	Component Assembly, Linking			
Deployment				

Figure: Diagram structure for classifying embedded development tools

Diagram Structure

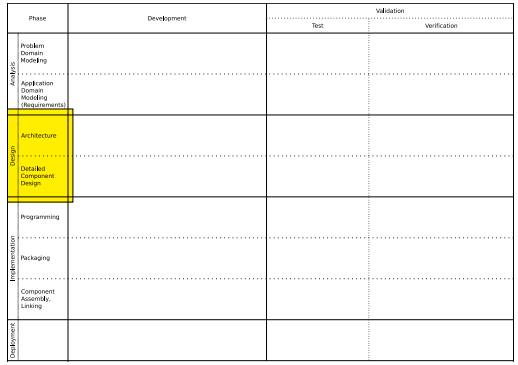
- Provide an overview of tools
- Classical development phases (Y-axis)
  - Analysis
  - Design
  - Implementation
  - Deployment
- Development activities (X-axis)
  - Development
  - Validation
    - Testing
    - Verification

Diagram Structure: Y-Axis - Analysis



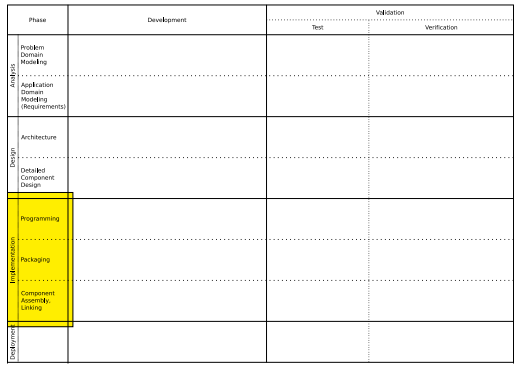
- Analysis phase
  - Problem Domain Modeling
    - Environment
  - Application Domain Modeling
    - Requirements to the system operating in the environment

Diagram Structure: Y-Axis - Design



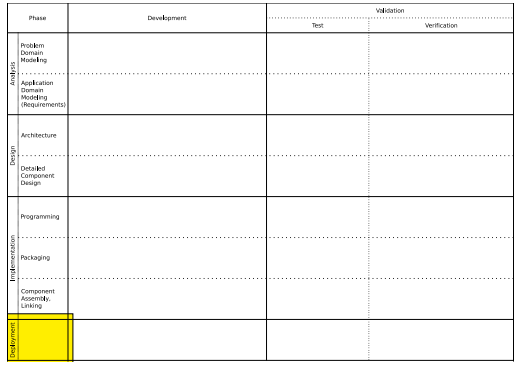
- Design phase
  - Architecture Design
    - Component diagram
  - Detailed Component Design
    - Component specifications

Diagram Structure: Y-Axis - Implementation



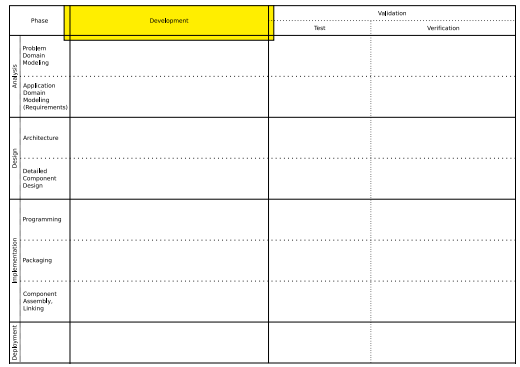
- Implementation phase
  - Programming
    - Concrete interpretation of design model
  - Packaging
    - Compiling
    - Prepared for distribution
  - Component Assembly and Linking
    - Adaptation to resources provided by platform

Diagram Structure: Y-Axis - Deployment



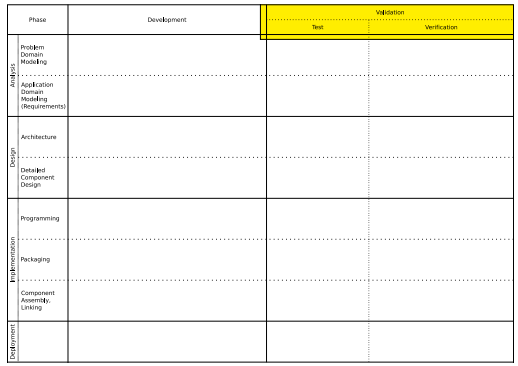
- Deployment phase
  - System is loaded to intended platform
  - RTOS, Embedded Java enabled platform, etc.

Diagram Structure: X-Axis - Development



- Development Activities
  - From analysis to deployment
  - Abstract to concrete
  - Stepwise refinement

Diagram Structure: X-Axis - Validation



- Validation Activities
  - Testing
    - Simulation
    - Test case generation
    - Running tests
  - Verification
    - Models
    - Program

Diagram

Currently only a limited number of tools

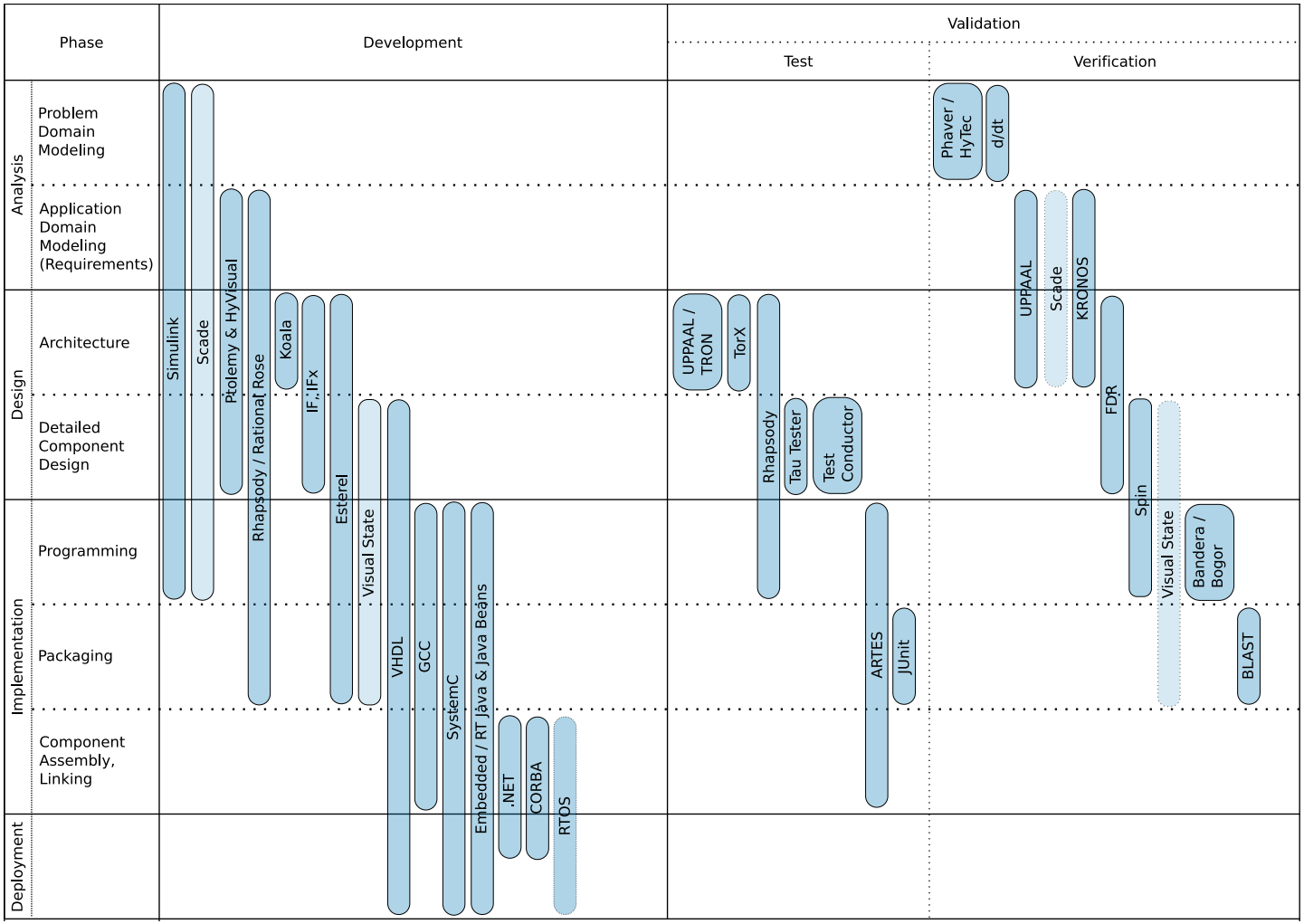


Figure: Embedded system development tools diagram

Toolchain Example

One example

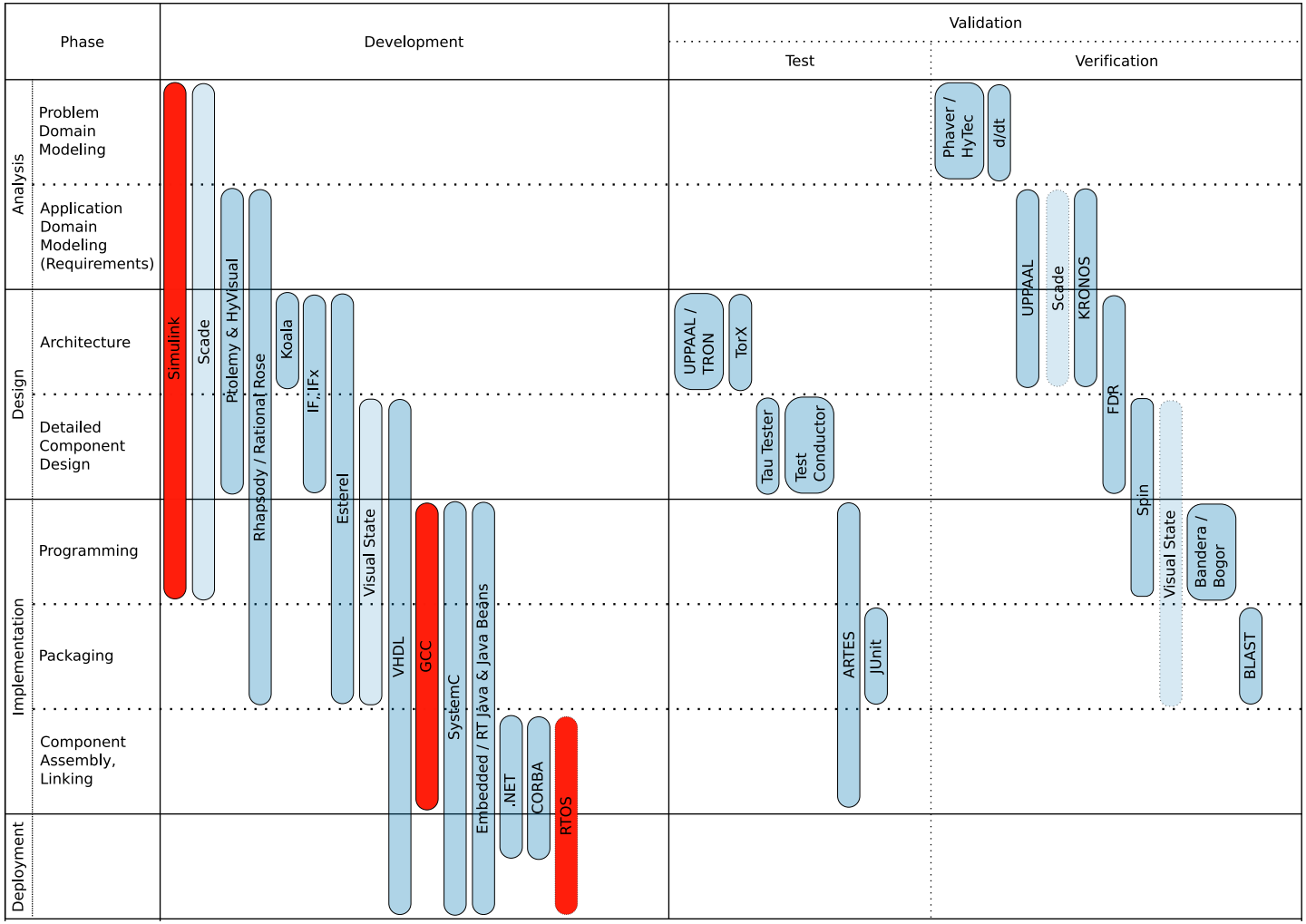


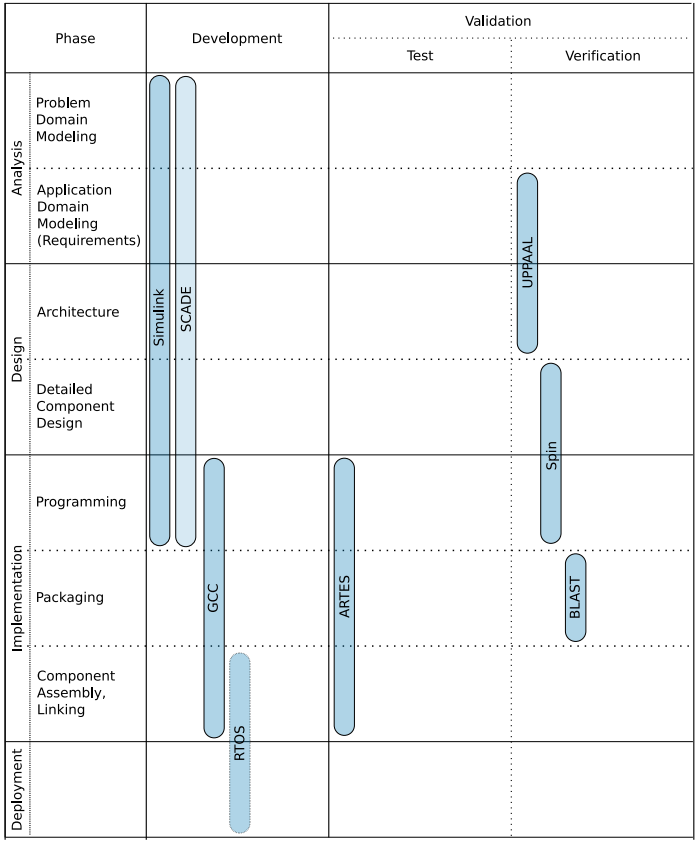
Figure: A development toolchain, covering all phases

Toolchain Candidates

Development:
- Simulink or SCADE
- GCC
- RTOS

Verification:
- UPPAAL, Spin, BLAST

Test:
- ARTES

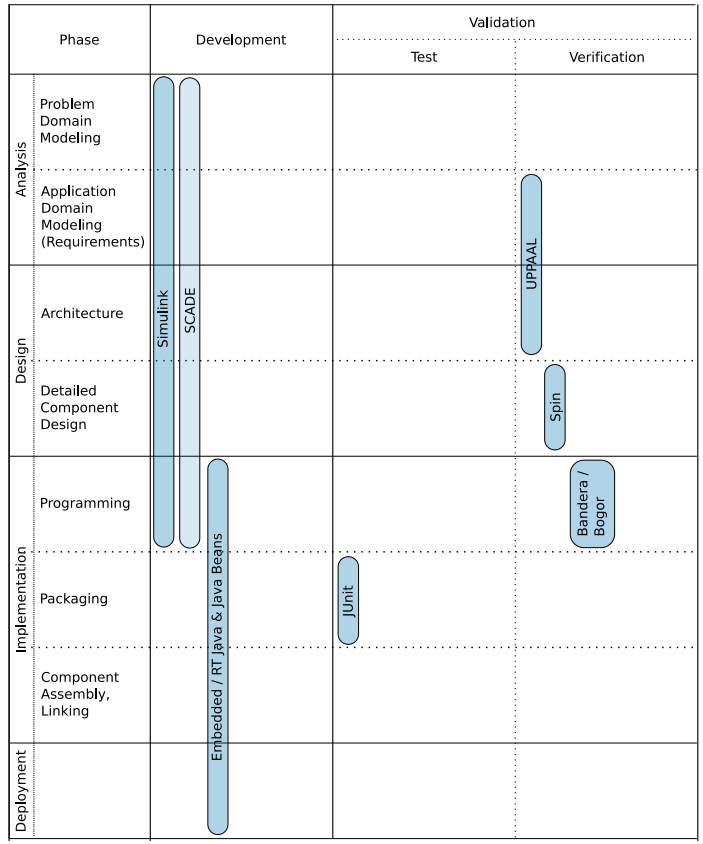


Toolchain Candidates For Java

Development:
Simulink or SCADE
Embedded or RT-Java enabled platform

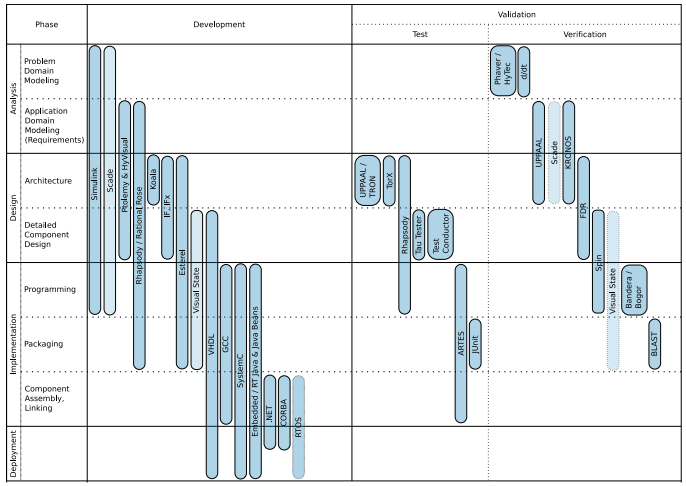
Verification:
UPPAAL, Spin, Bandera/Bogor

Test:
JUnit



Toolchain Diagram - Conclusion

- Cover all phases
- Cover all activities
- Approach does not (yet) address
  - Modeling formalisms used
  - Input/output format compatibility
  - Accessing internal representations
- Plans for a reasonable coverage of these issues



Future Work

- Expand list of tools
- Include more tools from the list
- Address shortcomings?
  - Document modeling formalism
  - Document Input/output format
  - (Internal model representation)
- Feedback requested
  - Missing tools from the list
  - Classification of tools
- Considering web based collaboration
  - An interactive website
    - For sharing results
    - For classification and tool addition?

Please give us **your** favourite chain!

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