



MetaCase

Choosing the Best Level of Abstraction for Your Domain-Specific Language

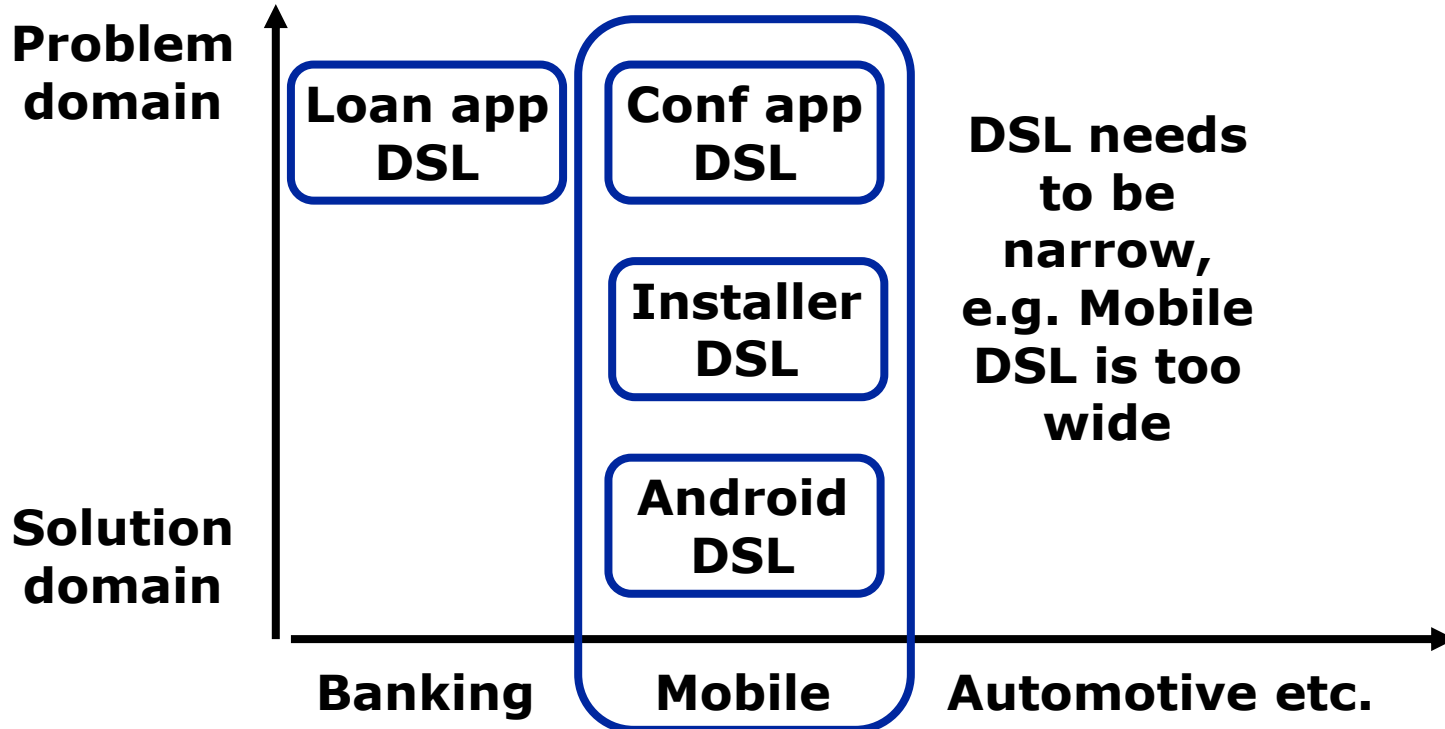
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Some (repeated) definitions

- General-Purpose / Domain-Specific
- External / Embedded / Internal Languages
- Problem Domain / Solution Domain
- Graphical / text / matrix / table / maps etc. as concrete syntax
- Static / behavior
- Turing complete / in-complete
- Domain knowledge as first class citizen / naming convention

(Your) area of interest = domain



Where at the main benefits?

- More empirical research is needed, but studies show improvements in:
 - Productivity
 - Quality
 - Process
 - Maintenance tasks
 - Understanding and communication
 - Easier introduction of new developers etc.
- While time-to-market is often the most significant improvement, many industry cases shows 5-10x (**500-1000%**) productivity improvements (see references)

Industry experiences



Elektrobit

"The setup effort to create the languages was a couple of weeks and provided more than **ten times faster speed**"



"The quality of the generated code is clearly better, simply because the modeling language **rules out errors**"



"The DSML solution makes development **significantly faster** and easier than the old manual coding practices"

Controlled empirical studies

Panasonic

- Built the same system twice: 425% faster
- Built code generator for a second platform: a fraction of time



- Lab study: 6 engineers develop typical features: > 750% faster
- Built the same system twice: 900% faster



- Built the same production system in parallel
- Built several similar systems: Break Even Point = 3,14

Standard pages and connectors are available through the icon bar

On-site tool configuration facilities

Code generators and Work flow automations

Concepts browser

Detailed view

Visual modeling workspace

Zoom and other view modifiers

The screenshot shows a software development environment for user interface design. It features a top toolbar with icons for file operations and a menu bar. On the left, there is a 'Concepts browser' showing a tree view of project elements like 'Start', 'Menu', and 'Confirmation'. Below it is a 'Detailed view' showing a 'Property Value' table. The main workspace is a 'Visual modeling workspace' containing a complex flowchart of UI screens and their transitions. At the bottom, there are 'Zoom and other view modifiers' including a grid, zoom in/out buttons, and a refresh button.

設定(1/3)

音設定 ネットワーク設定

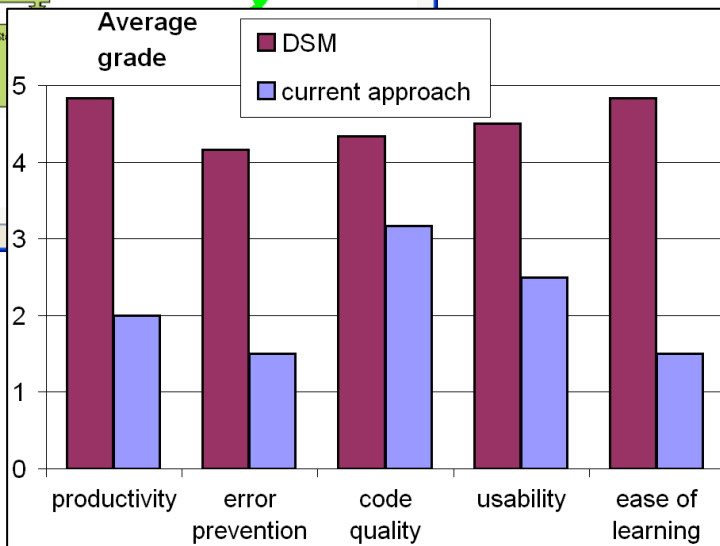
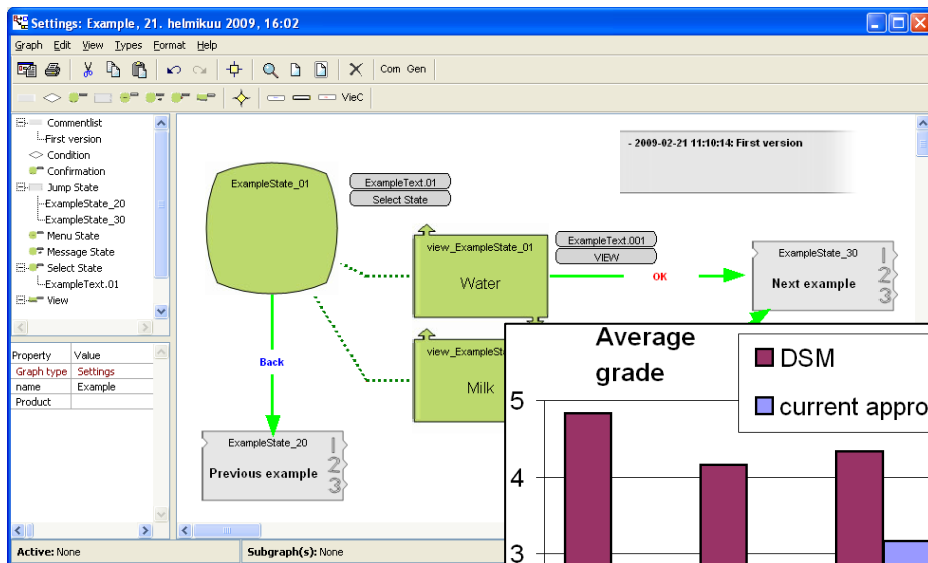
画面設定 センターサーバ接続設定

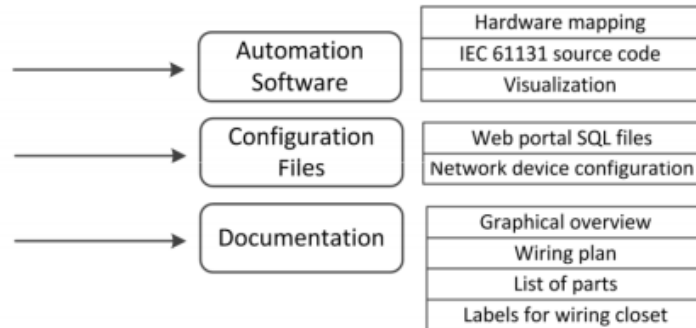
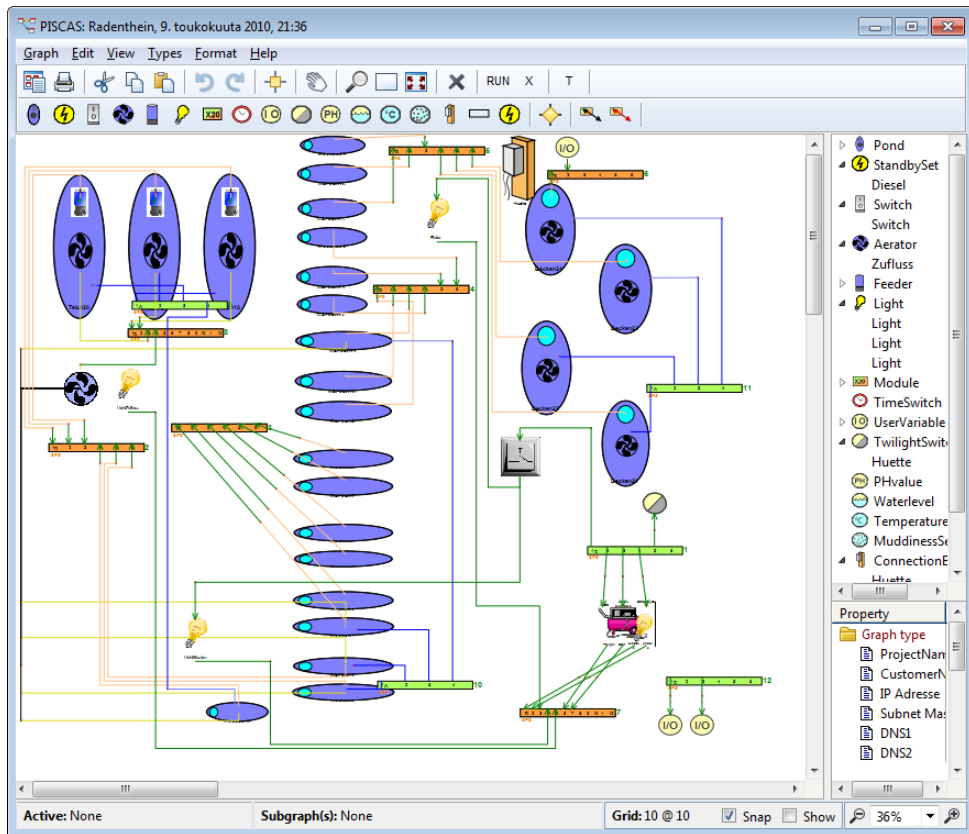
前ページ 次ページ 戻る

Embedded controller

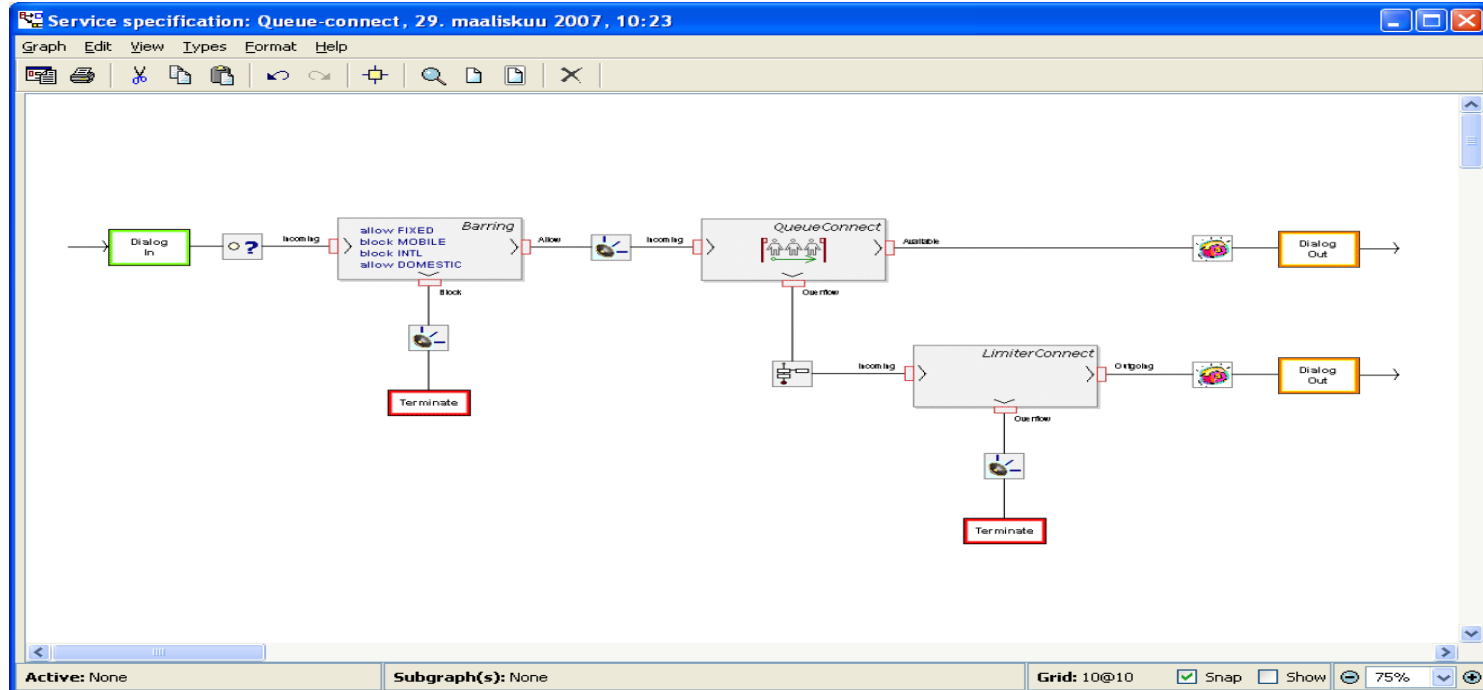
Microcontroller

The top image is a screenshot of the 'User-Interface Design' software showing a flowchart of UI screens. A white arrow points from this flowchart to a screenshot of a menu screen titled '設定(1/3)' (Settings 1/3). The menu screen contains buttons for '音設定' (Sound Settings), 'ネットワーク設定' (Network Settings), '画面設定' (Screen Settings), 'センターサーバ接続設定' (Center Server Connection Settings), '前ページ' (Previous Page), '次ページ' (Next Page), and '戻る' (Back). Below the menu screen are two circular images: 'Embedded controller' showing a small white device with a screen, and 'Microcontroller' showing a small green printed circuit board (PCB) component.

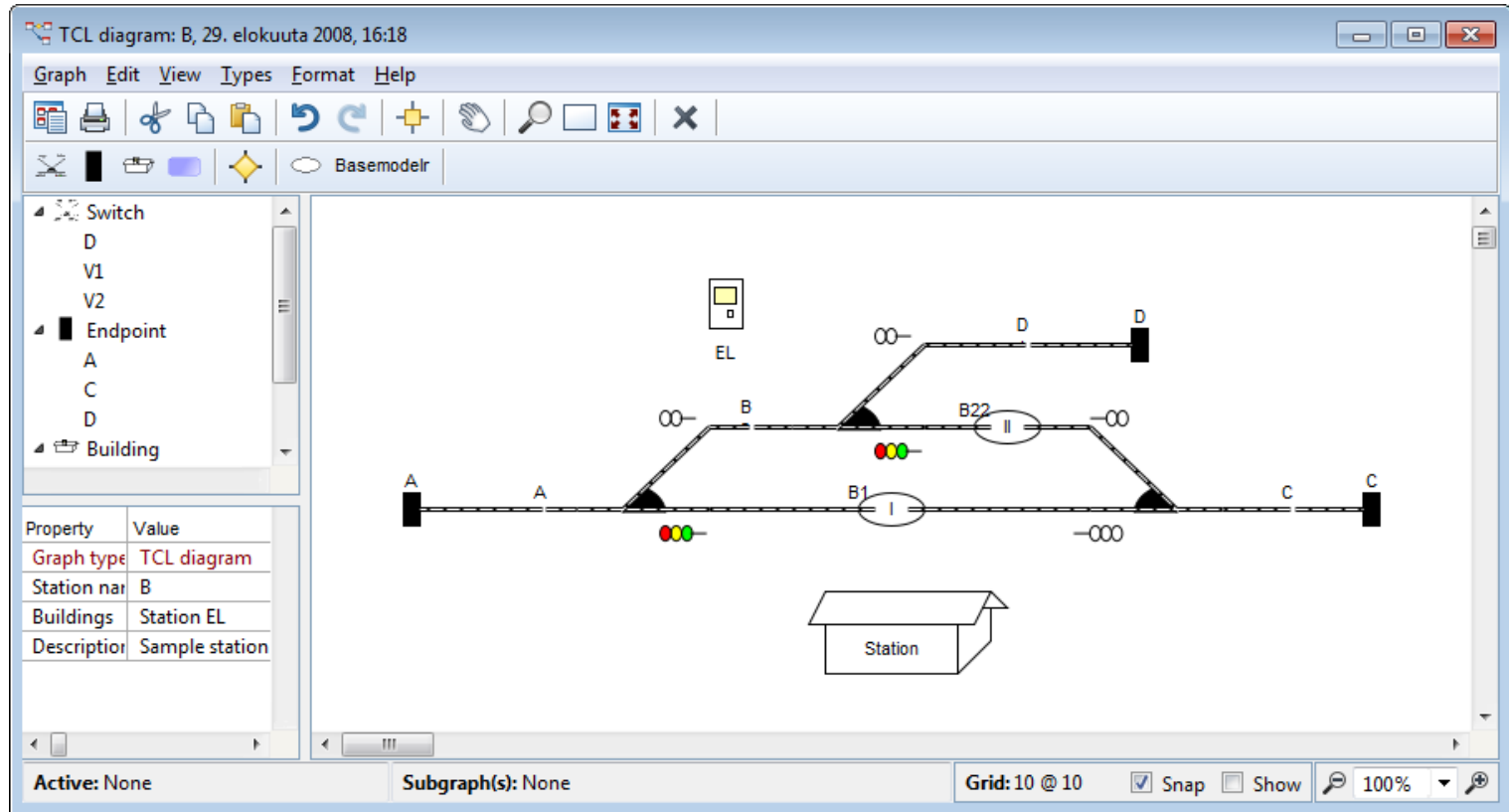




Telecom services

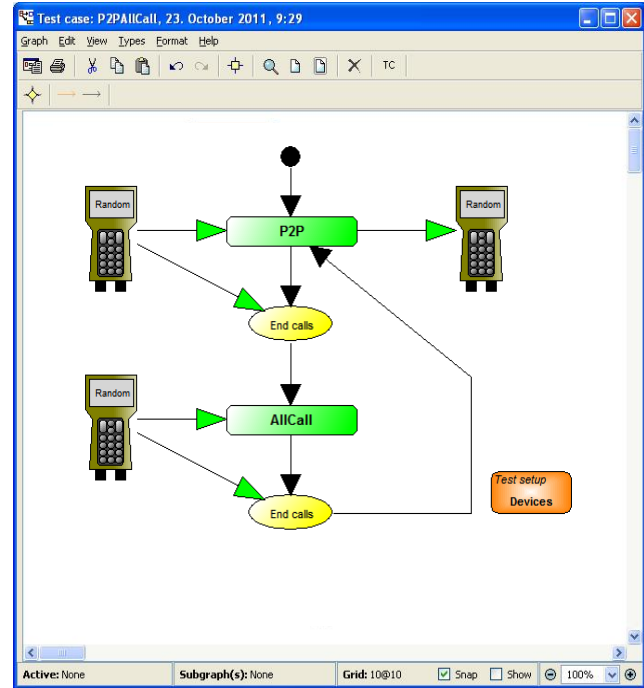
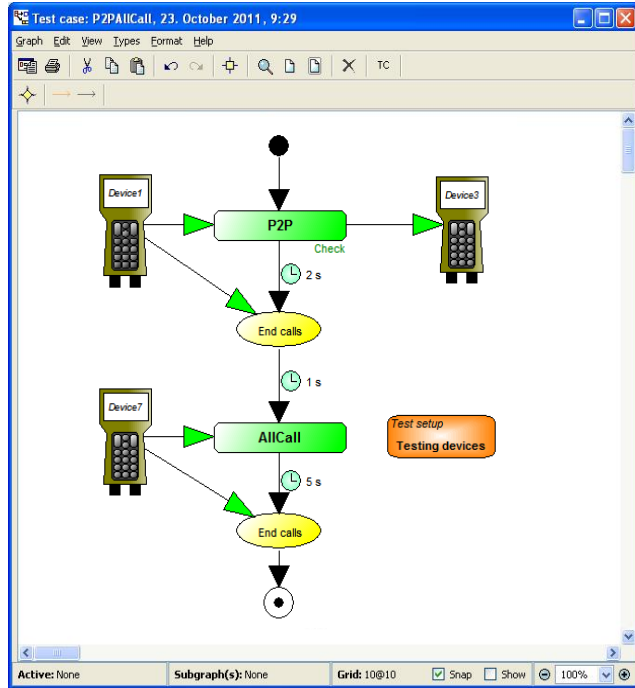


Railway interlocking

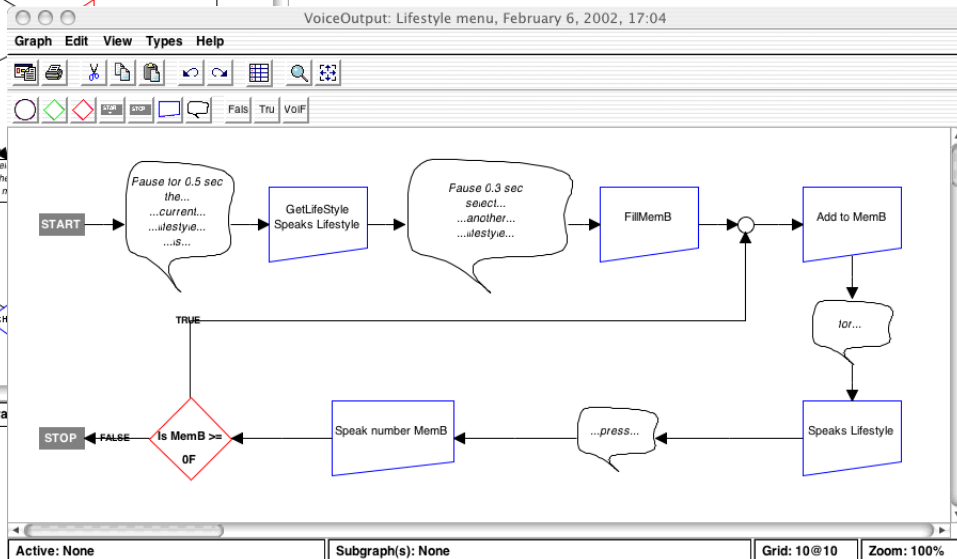
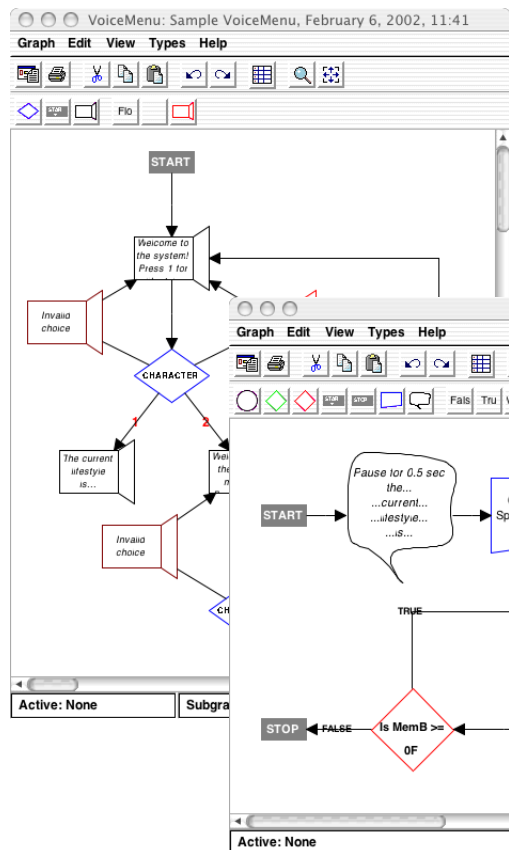


Radio network testing

- Modeling test cases/test logic and generating test data

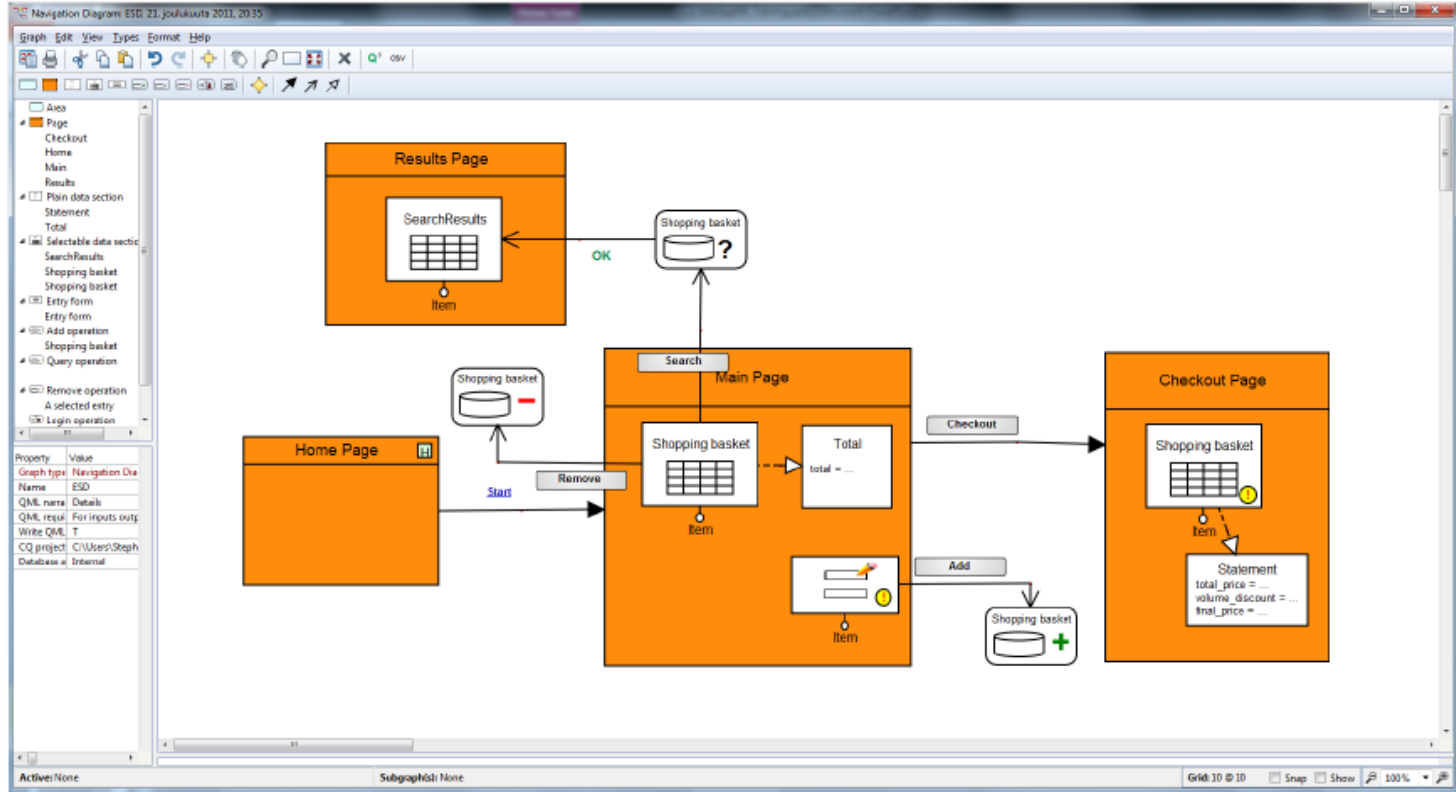


Voice control



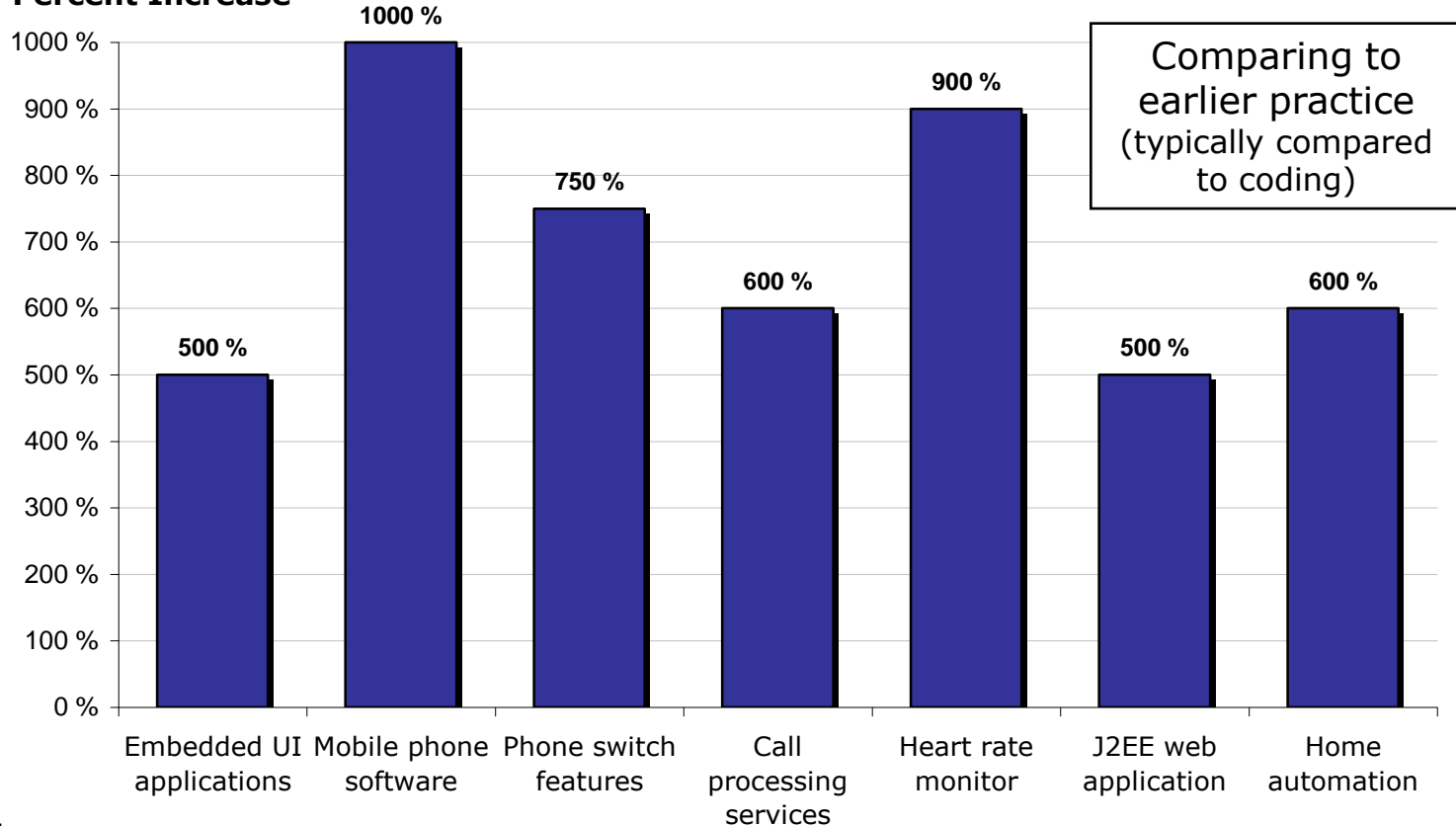
```
Report Output: Sample VoiceMenu: VoiceMenu
File Edit Help
Goto 3_266
3_450
Speak 0x01 5 (Pause for 0.5 sec)
Speak 0x02 5 (the...)
Speak 0x03 5 (...current...)
Speak 0x04 5 (...lifestyle...)
Speak 0x05 5 (...is...)
GetLifeStyle
Speaks Lifestyle
Speak 0x06 5 (Pause 0.3 sec)
Speak 0x07 5 (select...)
Speak 0x08 5 (...another...)
Speak 0x04 5 (...lifestyle...)
FillMemB 00
3_844
Add to MemB 01
Speak 0x09 5 (for...)
Speaks Lifestyle
Speak (...press...)
Speak number MemB
Is MemB >= OF
IFNot
Goto3_844
3_468
Speak 0x15 10 (Welcome to the other menu)
Speak 0x16 12 (Press 1 for the main menu)
Clear Menu Buffer
```

Web app testing



Productivity increase measured

Percent Increase



Analysis of the cases indicates

- DSL should raise the level of abstraction above the code
- DSL is not using necessarily linear text representation
 - Domain and problem solving dictates
 - Maps, diagrams, matrixes, tables etc.
- DSL focus on narrow domain
 - Exclude outside as much as possible
- DSL for other than producing the code
 - Higher abstraction is not applicable only for producing the code but can also be used for testing, deployment, interaction design, localization etc.

Tooling

- Some sort of tooling is always used, but big differences on tools, see
 - series of Language Workbench Comparison, LWC 2011-2013
 - Comparison reports, e.g. tinyurl.com/gerard12: Language implementation (Eclipse GMF 25 days vs. MetaEdit+ 0.5 days)
- Language creation is the first task but also other issues need to be handled, like
 - integrating multiple languages
 - sharing languages
 - maintaining languages
 - updating specifications made with earlier version of language
 - collaboration, like multiple language engineers

Summary

- Raise the abstraction as high as possible:
ideally 1:1 to problem domain
- Exclude outside as much as you can
- Refine languages as needed (keep it flexible)
- Use tools that support “agile” language definition
 - And allow also models to automatically update to new language version



MetaCase

**Thank You!
Questions?**

To see various cases, examples, and download
MetaEdit+ tool, visit <http://www.metacase.com>

References

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- Safa, L., The Making Of User-Interface Designer, A Proprietary DSM Tool, Procs of 7th DSM Workshop (2007)
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