

From Code to Models: Past, Present and Future of MDE Adoption in Telefónica

TELEFÓNICA I+D
Berlin, 12th June 2008



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01 Introduction (I)

Changes in the telecommunication industry

Past:

- Huge barriers to competition, state-owned companies, monopoly.
- Business centred on network operation,
- Voice & bandwidth provision.

Present / Future:

- Barriers removed, open & competitive environment.
- Next Generation Networks (NGNs).
- Service & content provision.



01 Introduction (II)

Challenges and how to deal with them

Challenges:

- Improve Time-To-Market (TTM), Time-To-Connect (TTC), customer satisfaction.
- Reduce TCO: Operating Expenses (OPEX), development costs.

How to Address them:

- Adoption of new and improved processes and technologies / tools.
 - In all the steps of the provisioning chain: development, deployment, etc.
 - Efficient & scalable solutions with strong backing from the industry.

01 Introduction (III)

Case study presented

Use of Models and Model-driven approaches in:

- Development of automated equipment configuration systems.

What we will present:

- A review of Telefónica's experience in the field in the last decade.
- Different levels of success obtained and lessons learned.
- Plans and challenges for the immediate future.

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02 First Failed Attempts at Modelling (I)

Back in 1999, the arrival of ADSL to Spain

- The Asymmetric Digital Subscriber Line revolutionizes Internet.
 - Real broadband, explosion in number of users, new services.
 - Many equipment vendors, heterogeneous configuration interfaces.
- In early 2000 it was evident that we needed:
 - A unified configuration interface, for end users and operators.
 - A new methodology for quick development of new tools.

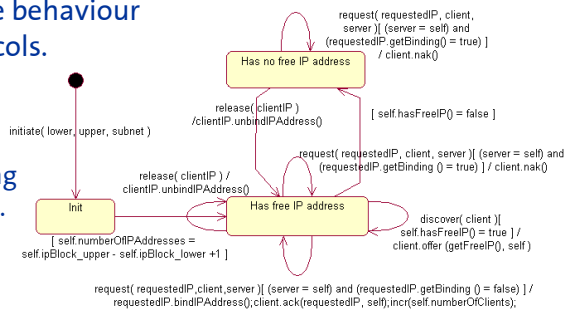


02 First Failed Attempts at Modelling (II)

Experiences with UML 1.1

- UML 1.1 (released around 1997) seemed a good idea:
 - It was, at last, a standard modelling language.
 - Some teams had started to use it in the analysis phase.
 - The plan was to use a more ambitious model-driven approach.
- Focus on modelling the behaviour of configuration protocols.

- Interaction use cases (sequence diagrams).
- Full protocol modelling (statechart diagrams).



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02 First Failed Attempts at Modelling (III)

Causes of the failure

- Too much time spent modelling with no measurable benefit.
 - Lack of experience with UML in the team.
 - Notational complexities of the language.
 - Absence of code generation tools.
- Inability to maintain the models in synch with the code:
 - Code was manually edited.
 - No Roundtrip Engineering and/or Traceability support.
 - Updating the models was, thus, seen as a waste of resources.
- Finally, an OOD approach was used and models were dropped.

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03 A Past Success Based on a DSL Approach (I)

Why the need for a new approach

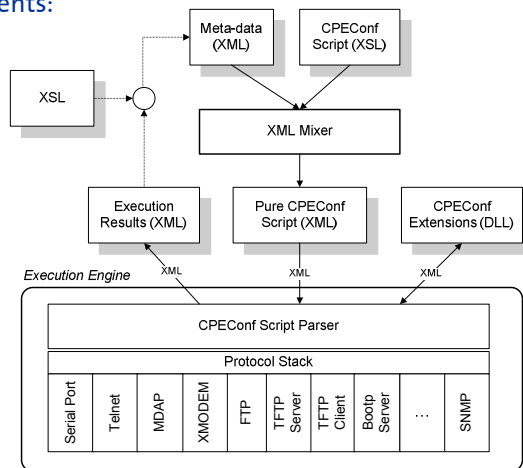
- Existing framework and reusable assets, but:
 - Development of the systems was still complex and error prone.
 - The highly-skilled engineers needed were scarce and costly.
 - Systems developed with untrained staff had too many defects.
 - More testing iterations, missed deadlines, loss of business / credibility.
 - Difficult to extend the systems to deal with new protocols / devices.
- Around 2003 the need for a new approach was clear.
 - To reduce the training process for new engineers.
 - To minimize the number of defects discovered in late phases.
 - To cope with the ever-growing number of protocols and devices.

03 A Past Success Based on a DSL Approach (II)

High-level architecture of the DSL-based solution

- Solution based on a textual DSL with the following requirements:

- Management of meta-data.
- Simple flow control (XSLT).
- Easy to extend with support for new protocols.
- Interpreted language.
- Extensible with code for specific tasks (DLL).
- Reuse existing assets.



03 A Past Success Based on a DSL Approach (III)

Productivity improvement metrics with CPEConf

	With DSL	Without DSL	Comparison
Lines of code (configuration code only)	2.000	30.000	15 times less
Critical bugs (configuration related)	Less than 5	10 to 20	2 - 4 times less
Effort (in person-months, whole project)	15	25	down to 60%
Development cost (in 2008 K€, whole project)	110	230	down to 50%
Time-To-Market (in months)	3.5	5	down to 70%
Time-To-Connect	--	--	No effect
Operating Expenses	--	--	Marginal gain
Total lines of code produced (2003-2008)	250.000	≈ 3.75 Mloc	--

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04 Current Work on MDE and Domain-Specific Modelling (I)

Reasons for the new change

- The CPEConf DSL approach had some weaknesses:
 - Configuration scripts were still vendor-specific as CLIs differ.
 - The language was not adequate for domain (non-technical) experts.
 - OPEX was not significantly reduced, neither was TTC.
- The Model-driven world had evolved greatly since our last try:
 - UML2 released around 2004.
 - Multiple new tools and IDEs available.
 - Strong Open Source activity in the field.

04 Current Work on MDE and Domain-Specific Modelling (II)

Objectives

- Migration to a remote “zero touch” configuration system.
 - Which can really improve OPEX and TTC.
- Industrial support to new configuration standards.
 - Commitment to promote DSL Forum’s TR-069 family.
- Common tool for all roles in the service development process.
 - Streamlining the process, models (not text) as specifications.
- Reuse and build on top of existing assets.

MODELPLEX IST FP6 (started in 2006)
Telefónica is Industrial Partner
Case Study: CPE Conf & Mgmt System

MODELPLEX



Information Society
Technologies

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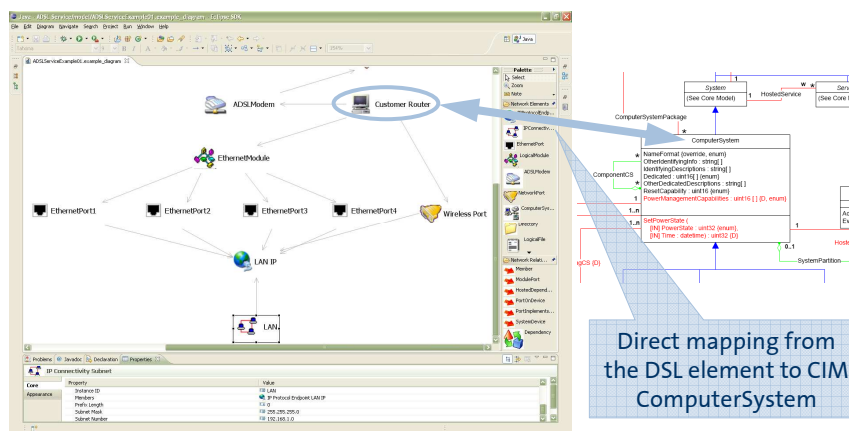
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04 Current Work on MDE and Domain-Specific Modelling (III)

First implementation of a DSM tool

- First prototype of DSM tool using the EMF/GMF framework.
- Direct mapping of concepts in the meta-model (CIM).



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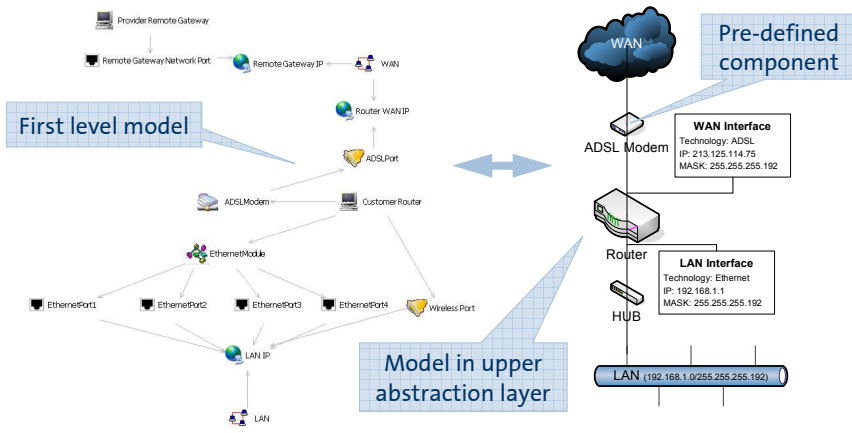
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04 Current Work on MDE and Domain-Specific Modelling (IV)

Work in progress

- Implementation of abstraction layers in the DSM tool.
- Creation of a library of pre-defined components (models).



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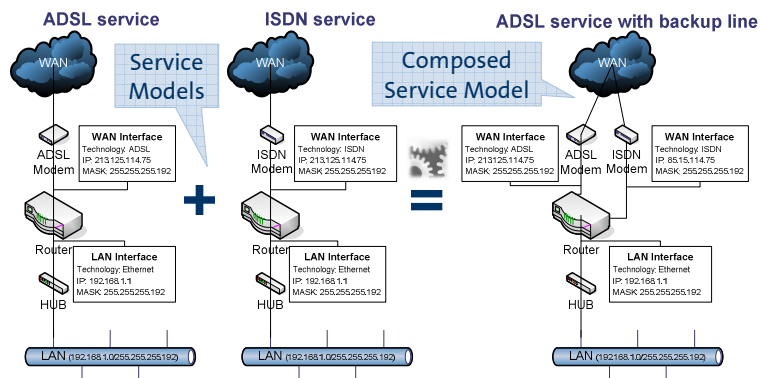
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04 Current Work on MDE and Domain-Specific Modelling (V)

Work in progress (cont.)

- DSM composability (service composability):
 - Model composition (using Reuseware Composition Framework).
 - Combine two or more network services into a unique scenario.



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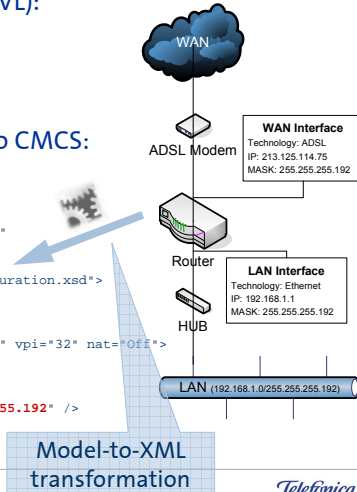
04 Current Work on MDE and Domain-Specific Modelling (VI)

Work in progress (cont.)

■ Generation of device configuration specifications.

- Verification of the DSM (using OCL / EVL):
 - Consistency of network parameters.
- M2M transformation (using ATL).
- Output file (XML) can be directly fed to CMCS:
 - Automatic device configuration.

```
<?xml version="1.0" encoding="utf-8" ?>
<Configuration xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:xsd="http://www.w3.org/2001/XMLSchema"
  xmlns="http://www.tid.es/ACS/Configuration/"
  xsi:schemaLocation="http://www.tid.es/ACS/Configuration/ configuration.xsd">
  <Priority>Normal</Priority>
  <Commands>
    <SetWan interface="Primary" mode="Static" state="On" vci="8" vpi="32" nat="Off">
      <StaticWan ip="213.125.114.75" mask="255.255.255.192"
        gateway="213.125.114.66" />
    </SetWan>
    <SetLan mode="Static" gateway="192.168.1.1" mask="255.255.255.192" />
    <SetWireless channel="3" state="Off" SSIDVisible="No" />
  </Commands>
</Configuration>
```



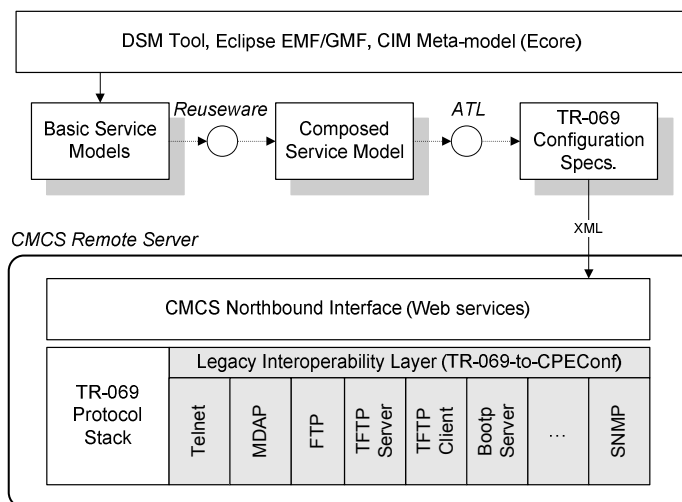
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04 Current Work on MDE and Domain-Specific Modelling (VII)

High-level architecture of the DSM approach



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05 Challenges on the Road to MDE Adoption (I)

Organizational challenges

- Reuse and integrate existing assets into the new paradigm.
 - “Evolution and not revolution”.
 - Reverse engineering / model understanding can help.
 - A DSM approach allows companies to better reuse assets.
 - Building new tools and abstractions on top of available frameworks.
- Training of the technical staff in MDE technologies.
 - Well-trained professionals in MDE are difficult to find and costly.
 - Creation of special cross-organizational teams can be a solution.
 - A DSM approach can be, again, adequate.
 - But may hit organizational barriers in highly hierarchical companies.

05 Challenges on the Road to MDE Adoption (II)

Technological challenges

- Maturity of MDE technologies.
 - Open challenges in traceability and roundtrip engineering.
 - Many tools are still university and research projects, not products.
 - Companies need products with strong support.
 - Lack of integrated tool suites (Eclipse shows good promise).
- UML is too general purpose and complex.
 - Profiles can mitigate this, but also add to the notational complexity.
 - Code generation has to be very specifically tailored.
 - Great effort needed to compose M2T transformations for new domains.
- Again, DSM approaches seem the best option for us right now.

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06 Conclusions

- As technologies evolve, businesses have to move faster:
 - In the telecommunications domain this trend is even clearer.
 - Quick modernization of key systems and processes is necessary.
 - This has to be done in a cost-effective and progressive way.
- Can MDE help a company like Telefónica address these challenges more effectively?
 - In our opinion, the answer to the question is “definitely yes”.
 - But some challenges lie ahead on the road.
 - Final conclusions from MODELPLEX project will be available in two years time (early 2010).



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