



# *openETCS* itea2 Review

## WP7 – Toolchain Development

supported by:



Federal Ministry  
of Education  
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Région de  
Bruxelles-  
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openETCS@ITEA2 Project

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Michael Jastram

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Paris, July 3rd 2013

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# The Big Picture



**WP7  
Toolchain**

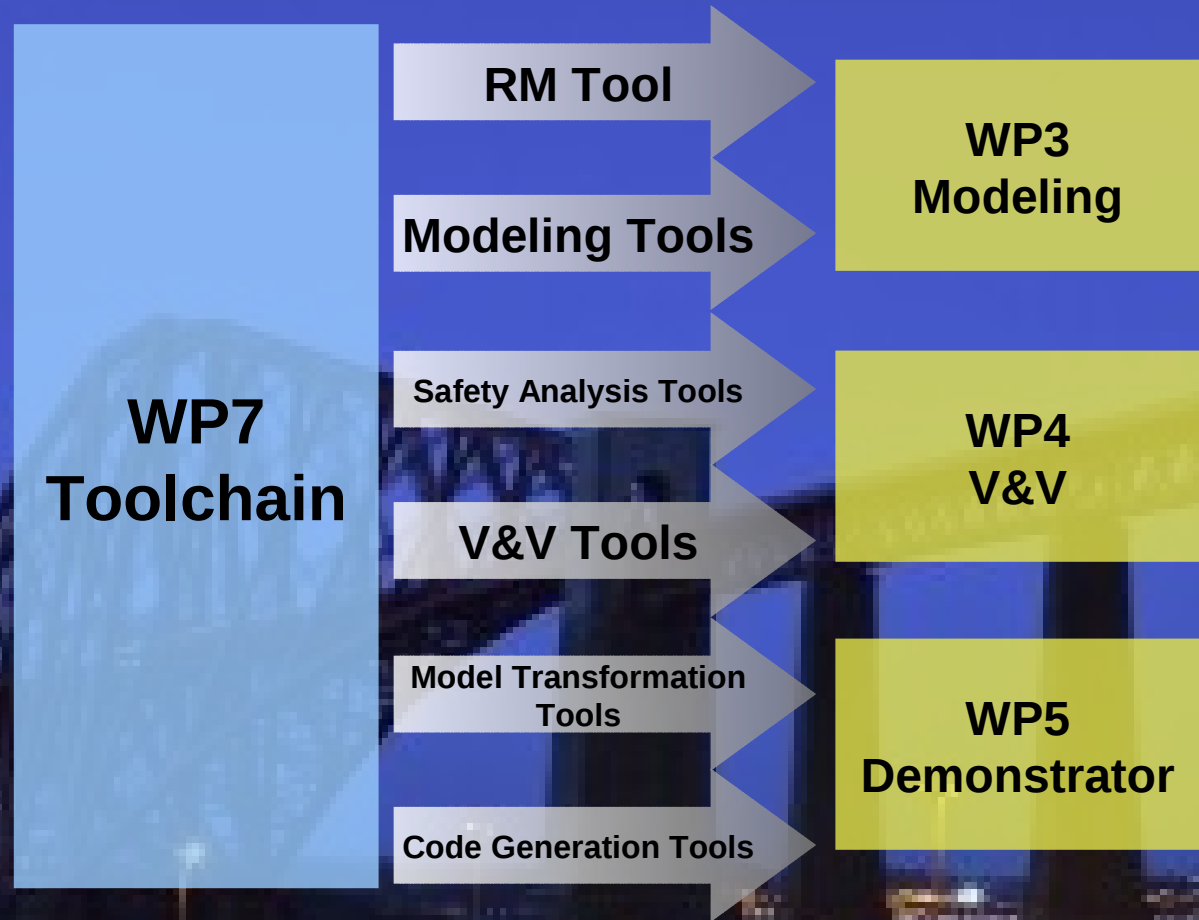
# The Big Picture

**WP7  
Toolchain**

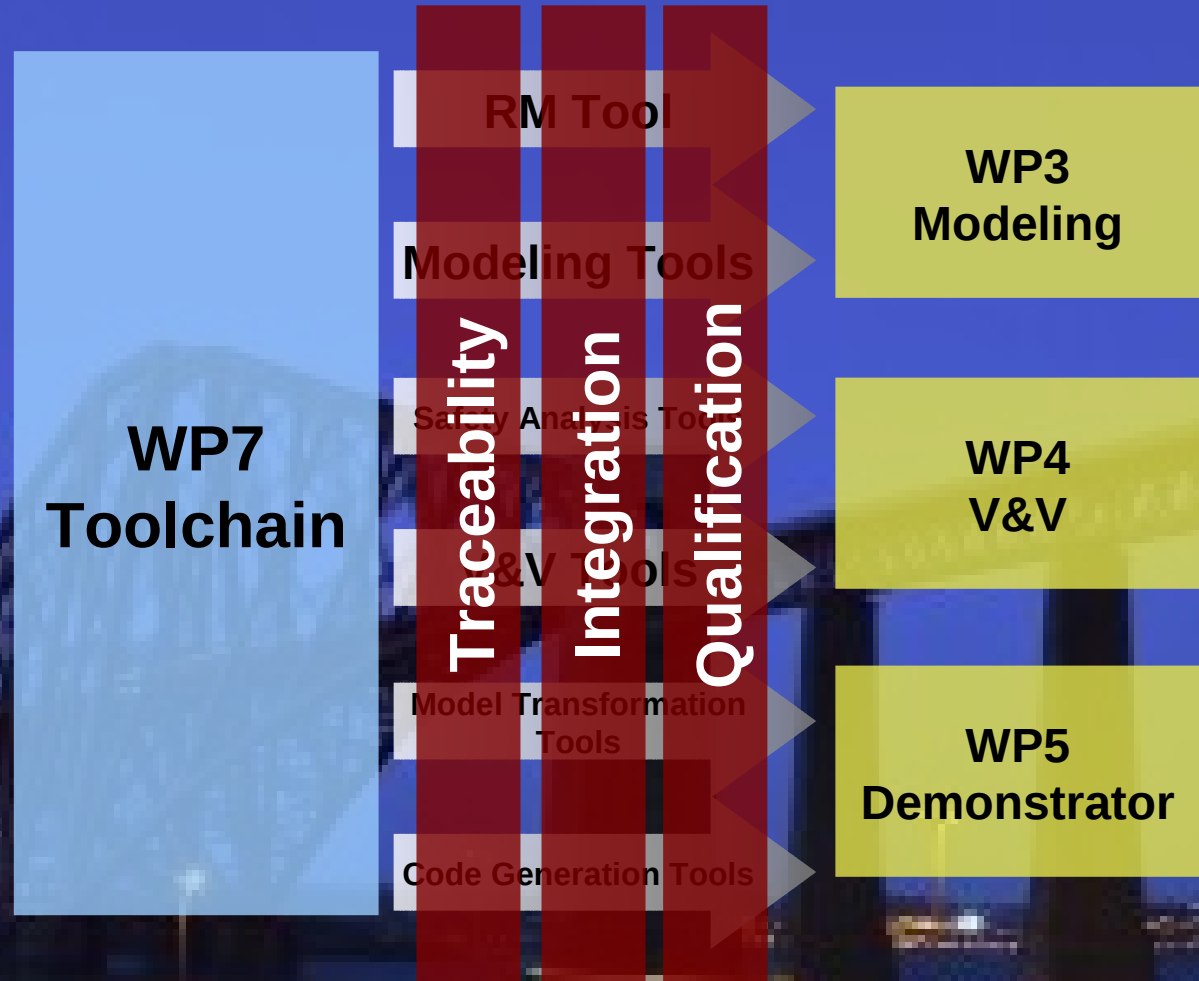
**Modeling Tools**

**WP3  
Modeling**

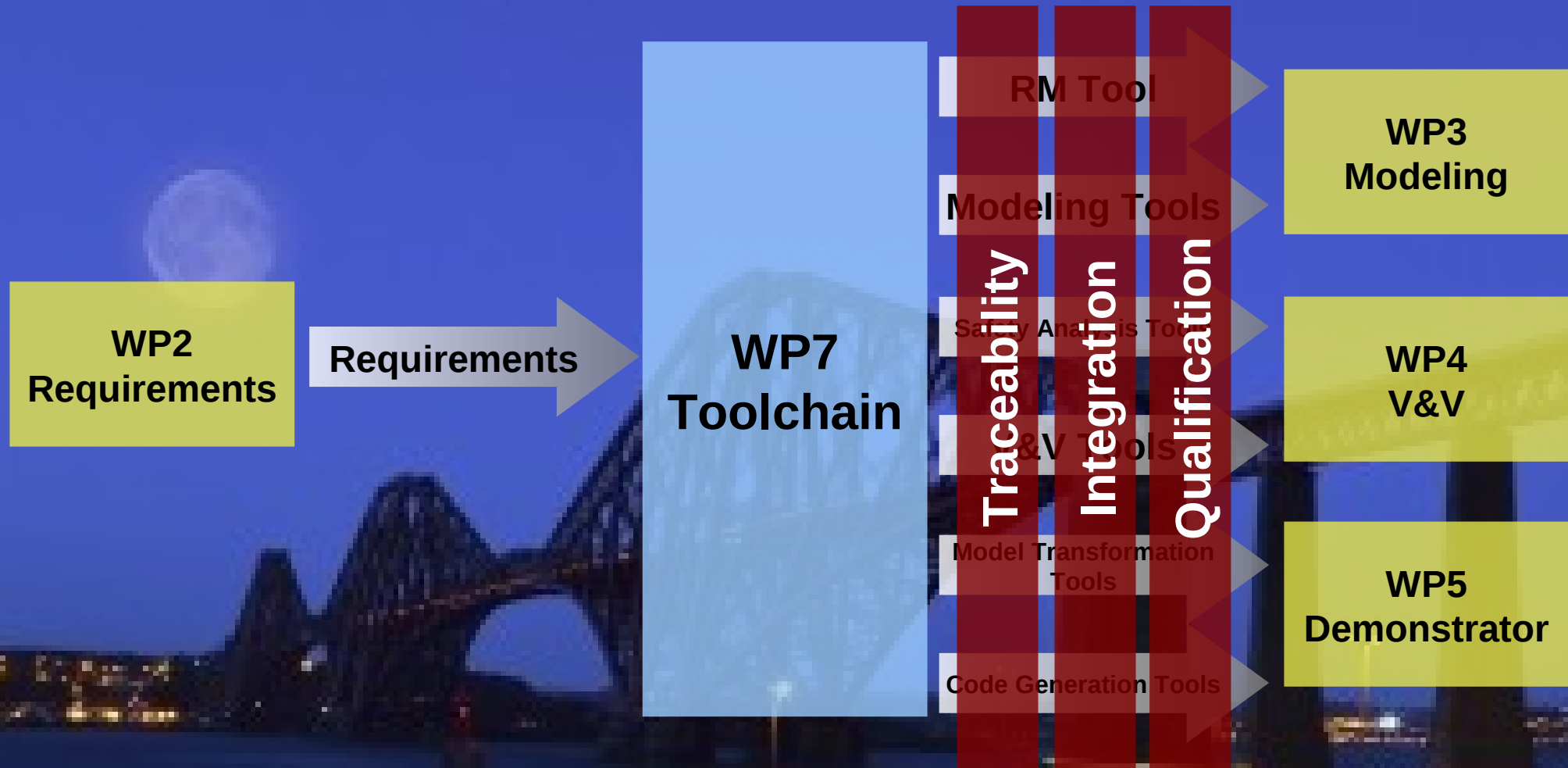
# The Big Picture



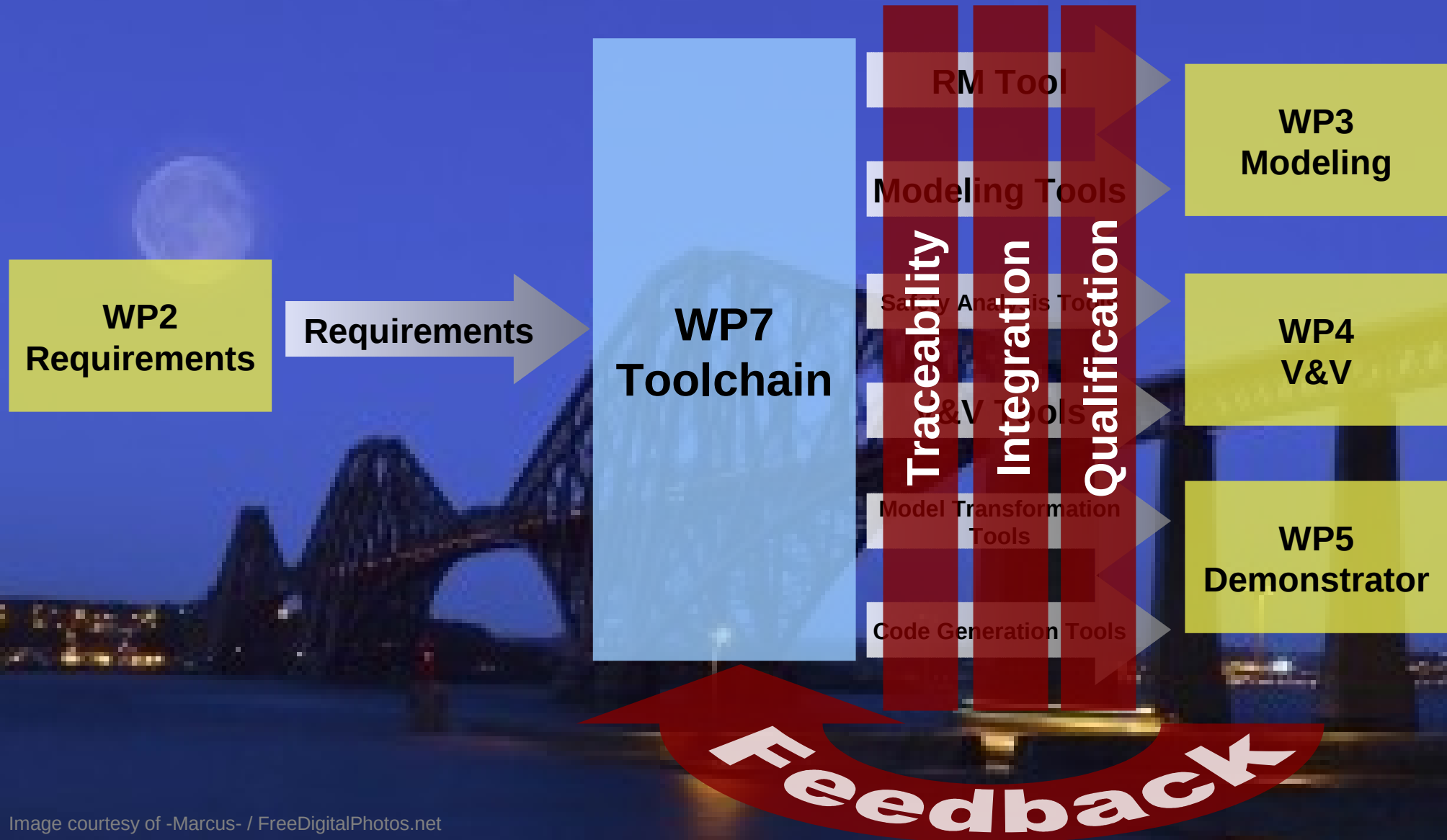
# The Big Picture



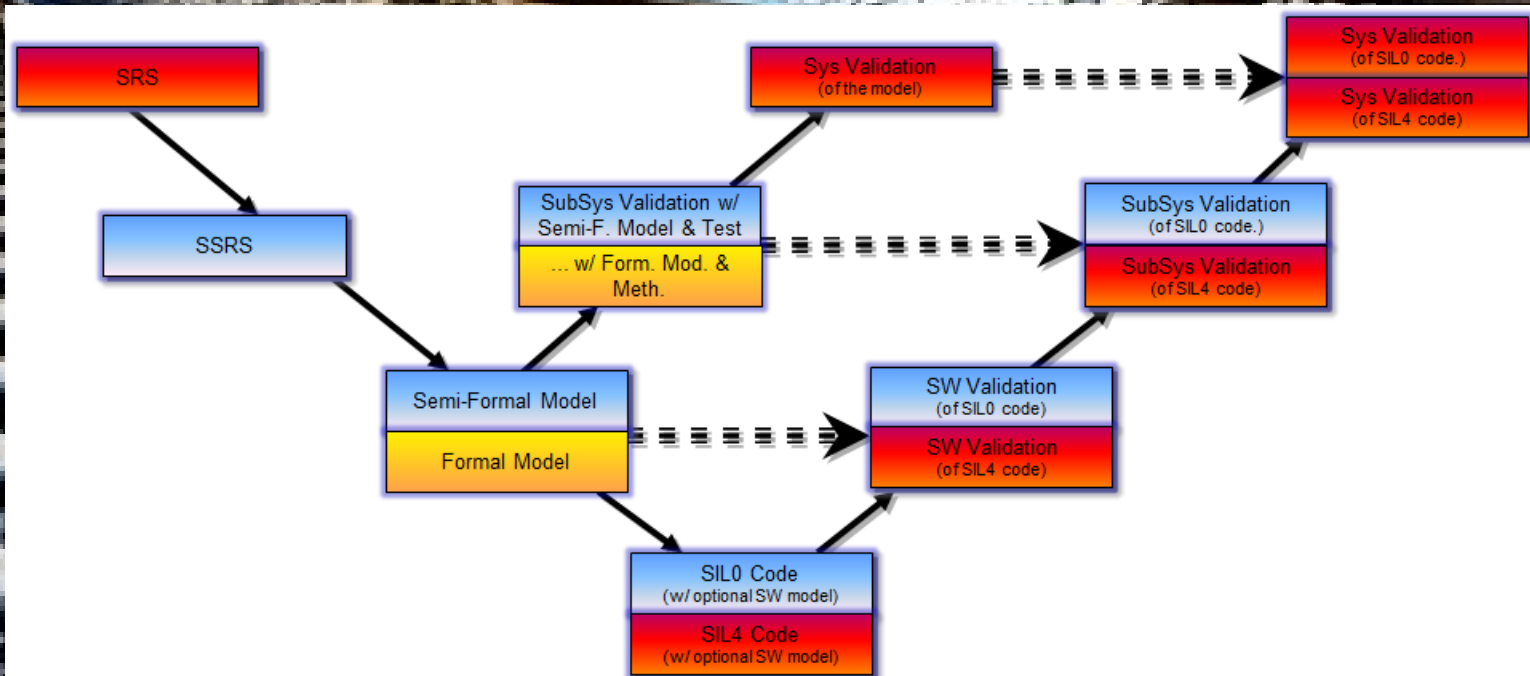
# The Big Picture



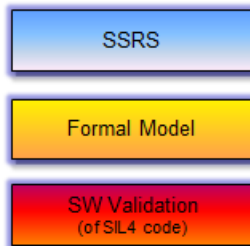
# The Big Picture



# An Integrated Tool Chain



Source: <https://github.com/openETCS/requirements/tree/master/D2.6-9>



Task is part of the project

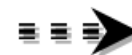
Task is part of the project but will  
done on a sample

Task is not part of the project

Note: Verification tasks between items that are part of the project  
are also part of the projects. They are not represented here  
to avoid cluttering of the drawing.



Normal process



Is used by



# Workpackage Structure



## WP7 Toolchain

Michael Jastram / Formal Mind

### T7.1 Primary Toolchain

Marielle Petit-Doche / Systere

### T7.2 Secondary Toolchain

Marielle Petit-Doche / Systere

### T7.3 Toolchain Development

Jan Peleska & Cécile Braunstein  
University Bremen

### T7.4 Ecosystem

Jonas Helming / EclipseSource

# Timeline

Today

2012

2013

2014

Q3

Q4

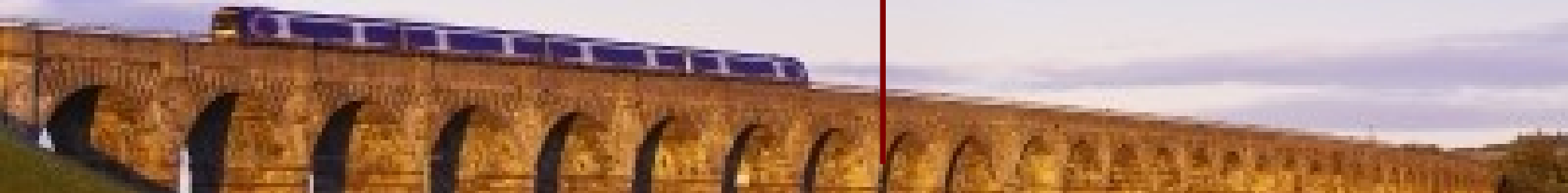
Q1

Q2

Q3

Q4

Q1



# Timeline

OpenETCS  
Kick-Off

WP7: Tooling

WP3: Modeling

Split of WP3

**Today**

**2012**

**2013**

**2014**

**Q3**

**Q4**

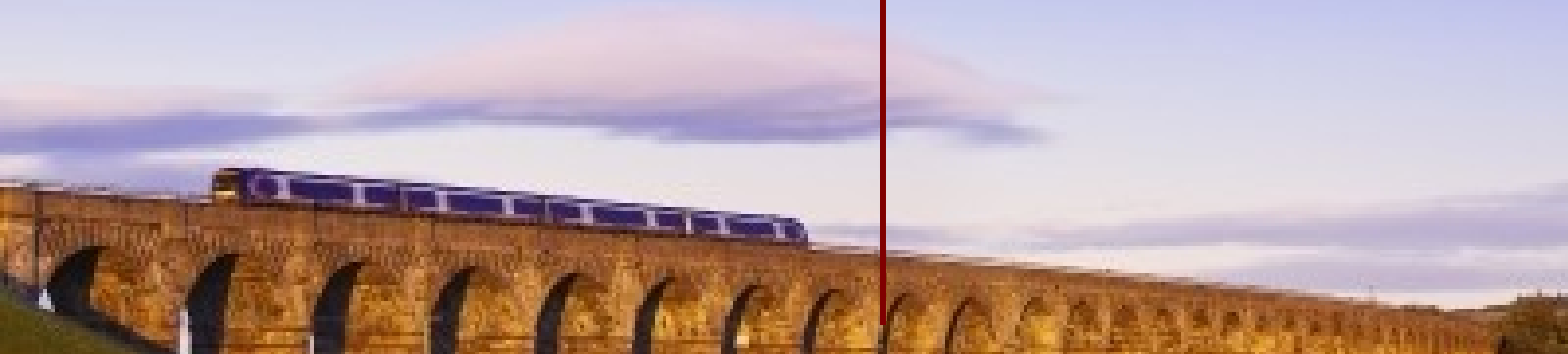
**Q1**

**Q2**

**Q3**

**Q4**

**Q1**



# Timeline

OpenETCS  
Kick-Off

WP7: Tooling

WP3: Modeling

Split of WP3

Today

2012

2013

2014

Q3

Q4

Q1

Q2

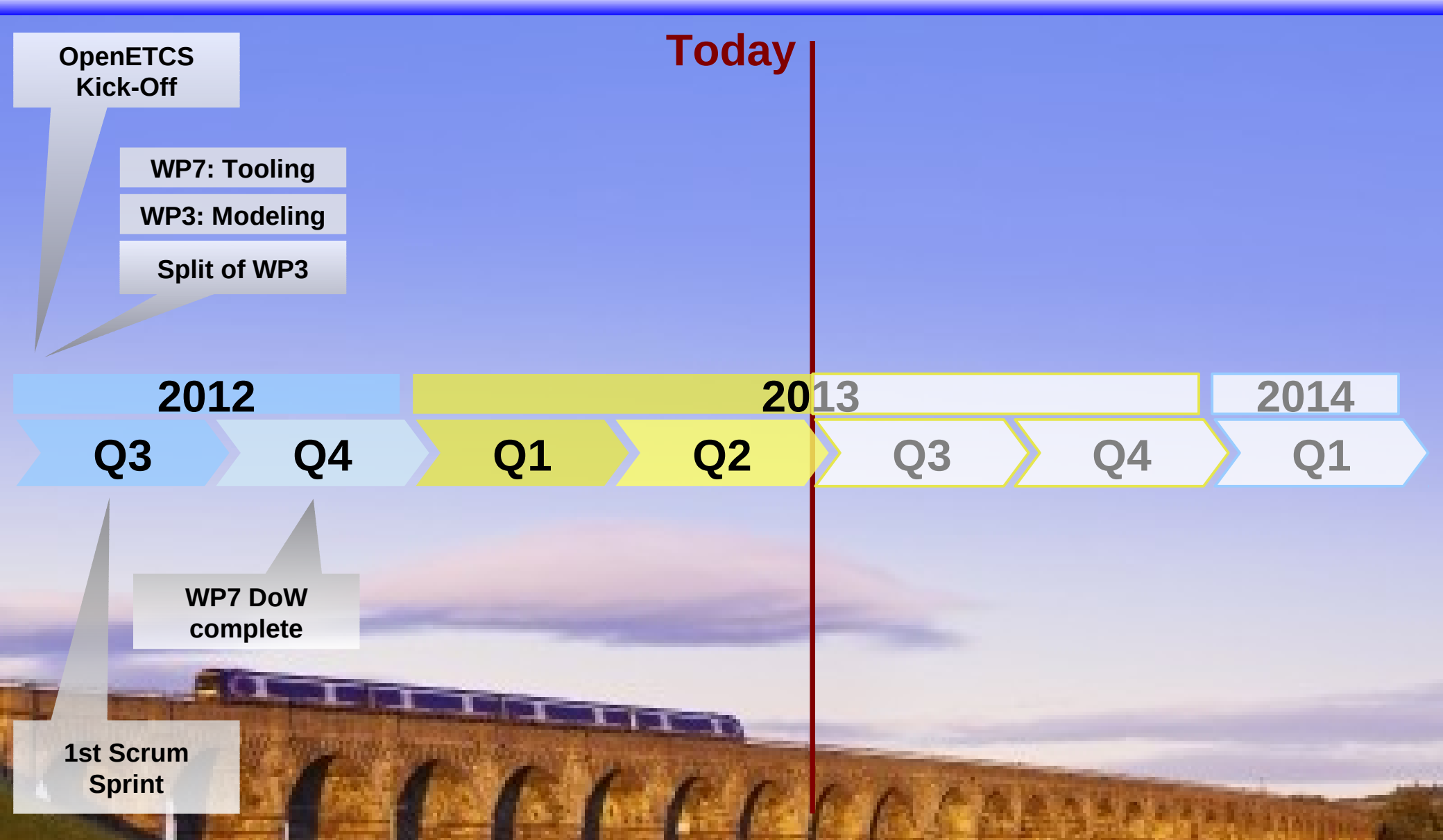
Q3

Q4

Q1

WP7 DoW  
complete

1st Scrum  
Sprint



# Timeline

OpenETCS  
Kick-Off

WP7: Tooling

WP3: Modeling

Split of WP3

First benchmark  
started

12 benchmarks  
underway

**Today**

**2012**

**2013**

**2014**

**Q3**

**Q4**

**Q1**

**Q2**

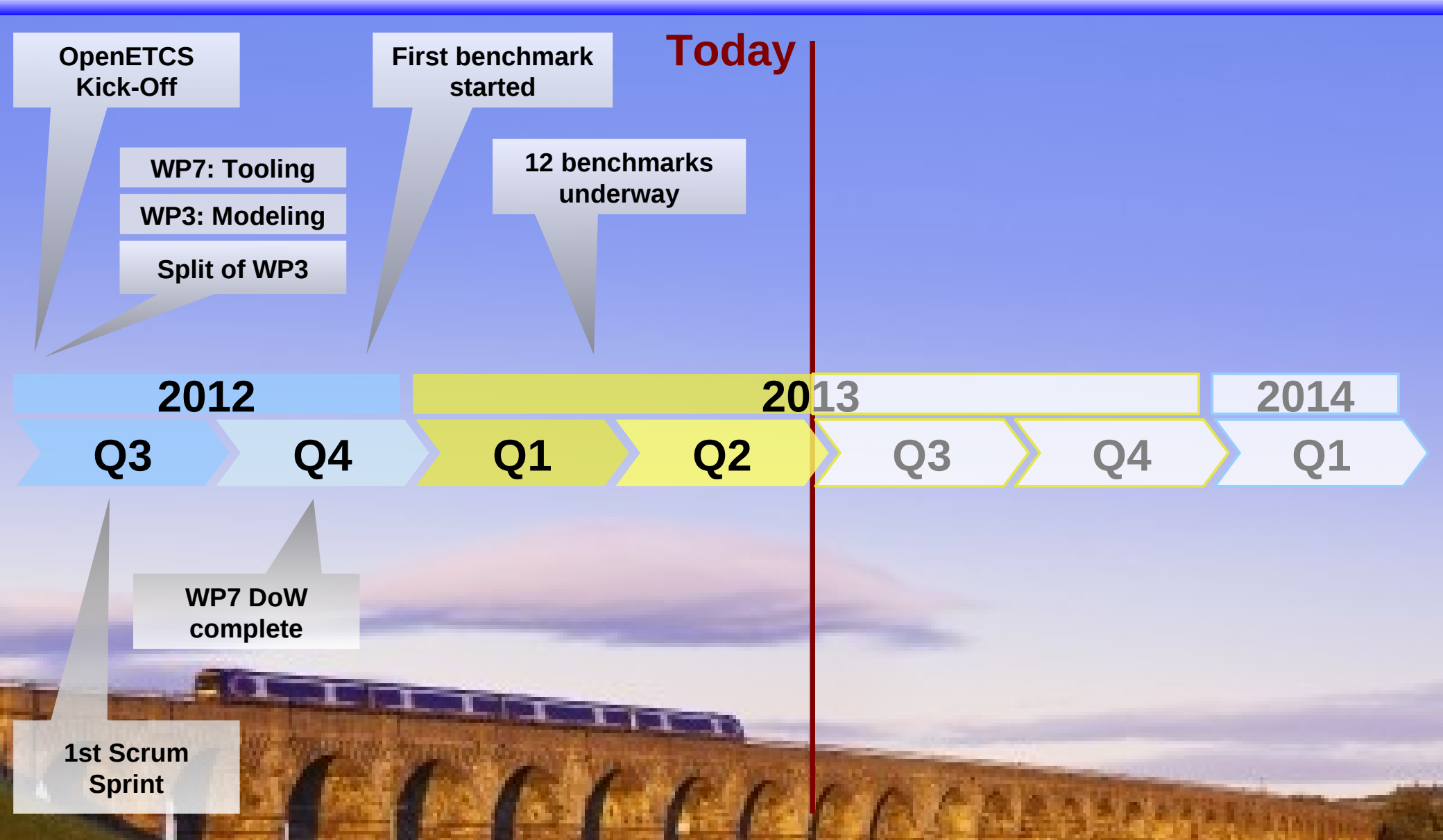
**Q3**

**Q4**

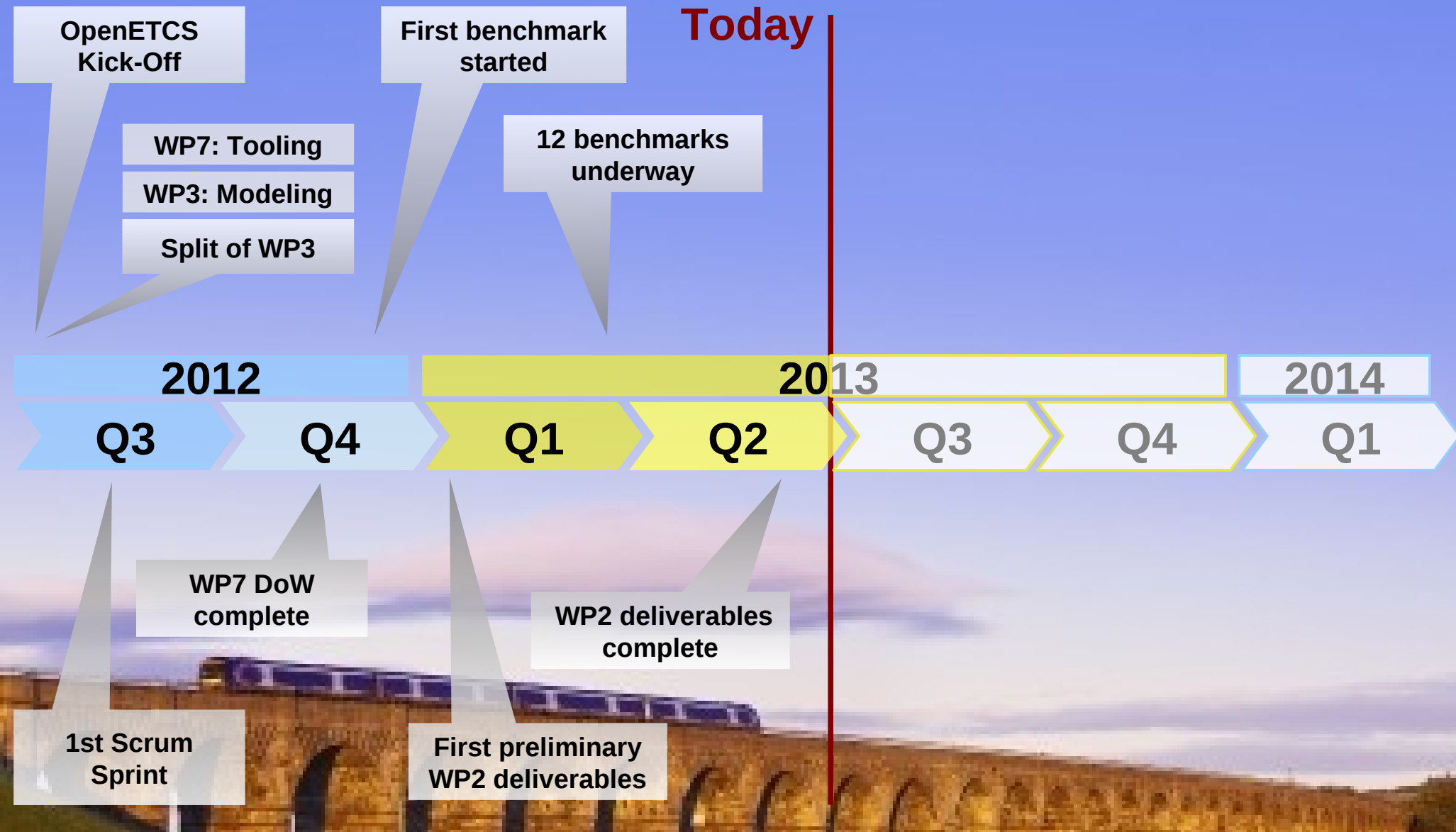
**Q1**

WP7 DoW  
complete

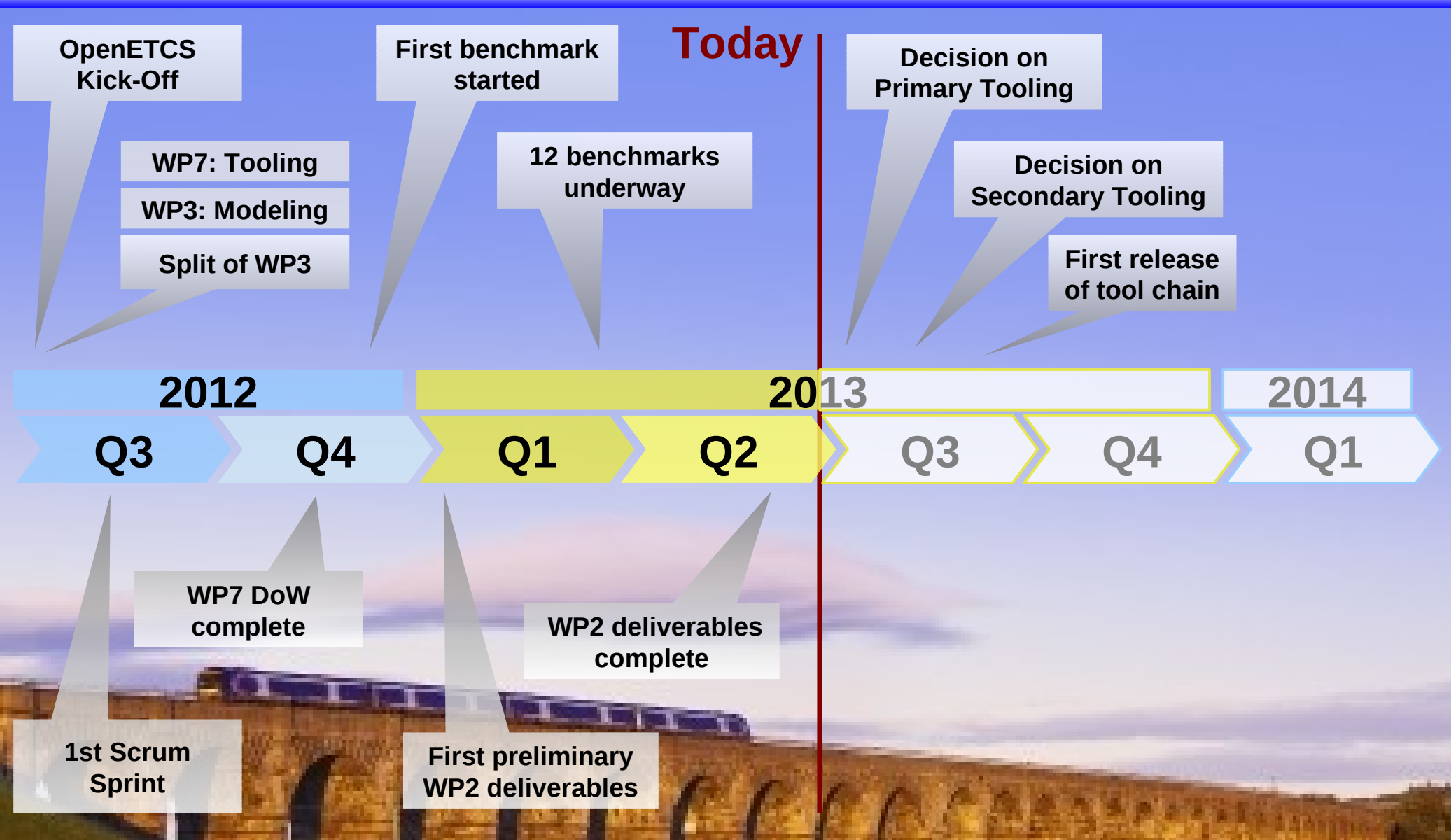
1st Scrum  
Sprint



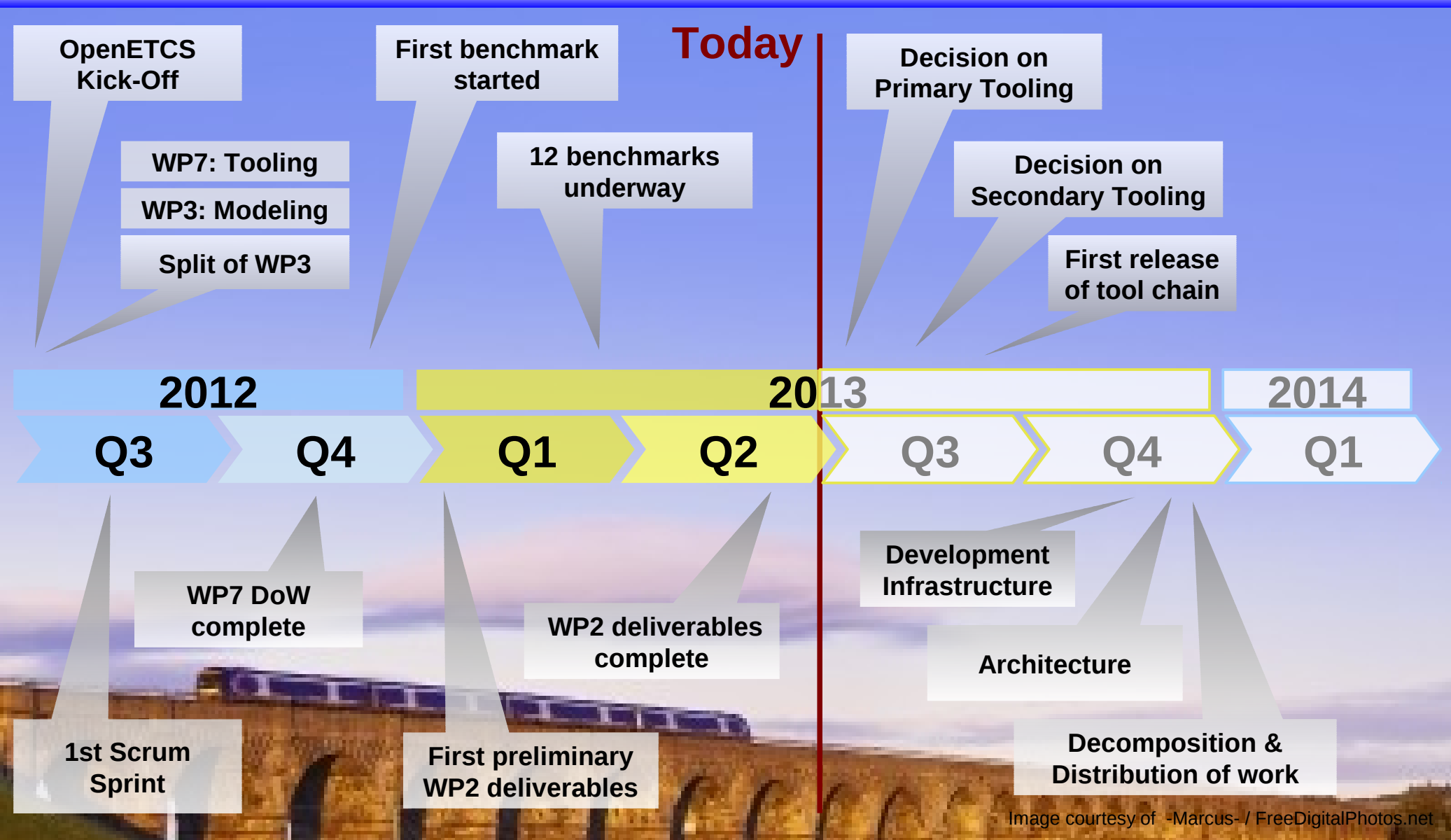
# Timeline



# Timeline

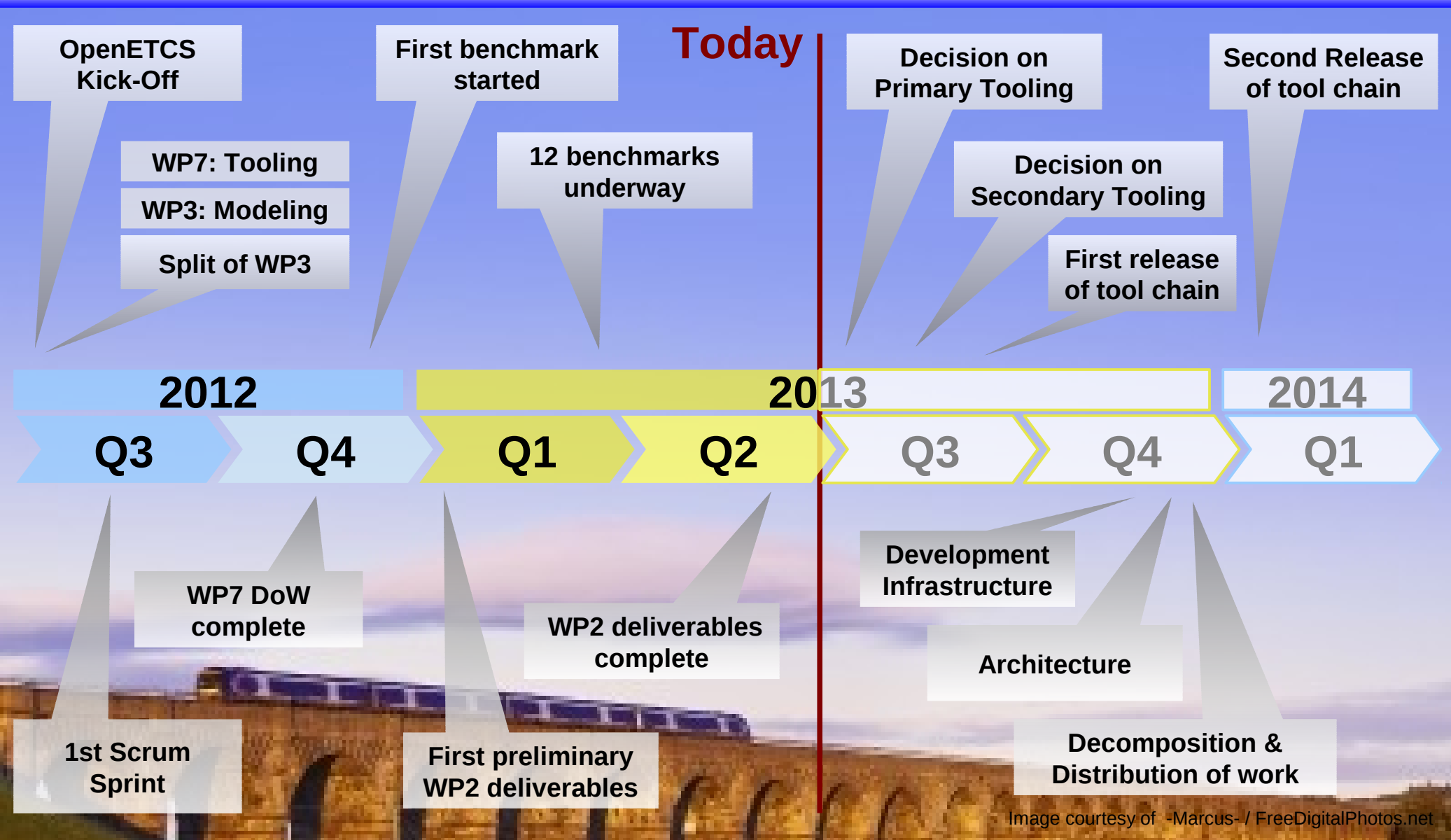


# Timeline

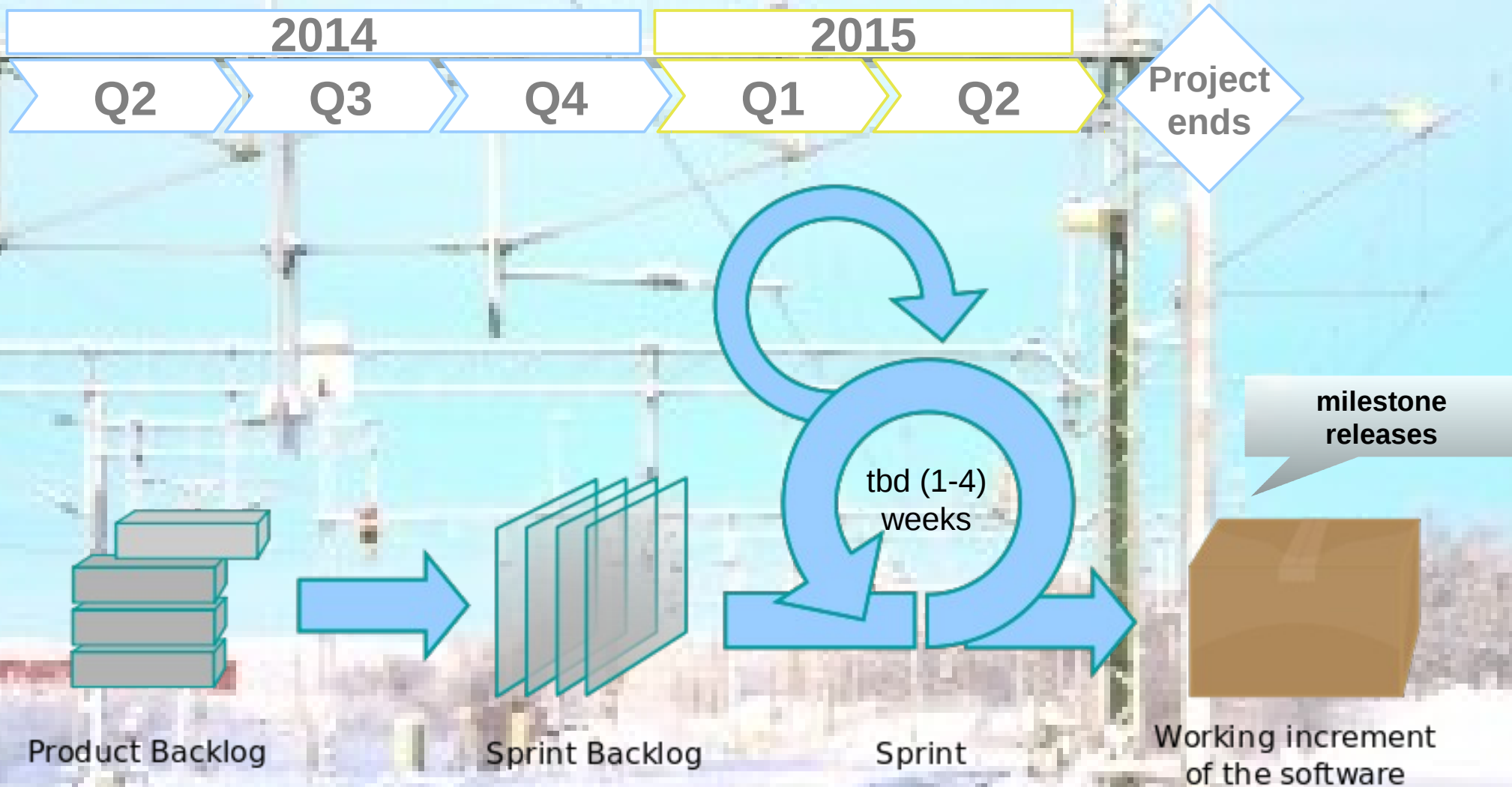




# Timeline



# 2014 – 2015: Regular releases



# No deliverables yet, but...

WP7 Objectives		
Date	Type of stone <sup>5</sup> /deliverable	Description
T0+13	D7.1 (Systerel)	Report on the final choice(s) for the primary tool chain (means of description, tool and platform)
T0+15	D7.2 (Systerel)	Report on all aspects of secondary tooling (results of T7.2)
T0+16	D7.4 (Uni-Bremen)	Tool chain first release
T0+19	D7.3 (Uni Bremen)	Tool chain qualification process description
T0+26		Regular releases according to Scrum Process
T0+36	D7.5 (Eclipse Source)	Ecosystem Artefacts: Proposed Terms of use, Proposed Committer Agreements, Proposed IP Policy, Proposed Development Process Description, Development Process Guidelines, Infrastructure Documentation, Infrastructure Template, Evolution Report of previous Deliverables

Source: [https://github.com/openETCS/management/blob/master/FPP/11025\\_openETCS\\_FPP\\_Annex\\_v301.pdf](https://github.com/openETCS/management/blob/master/FPP/11025_openETCS_FPP_Annex_v301.pdf)

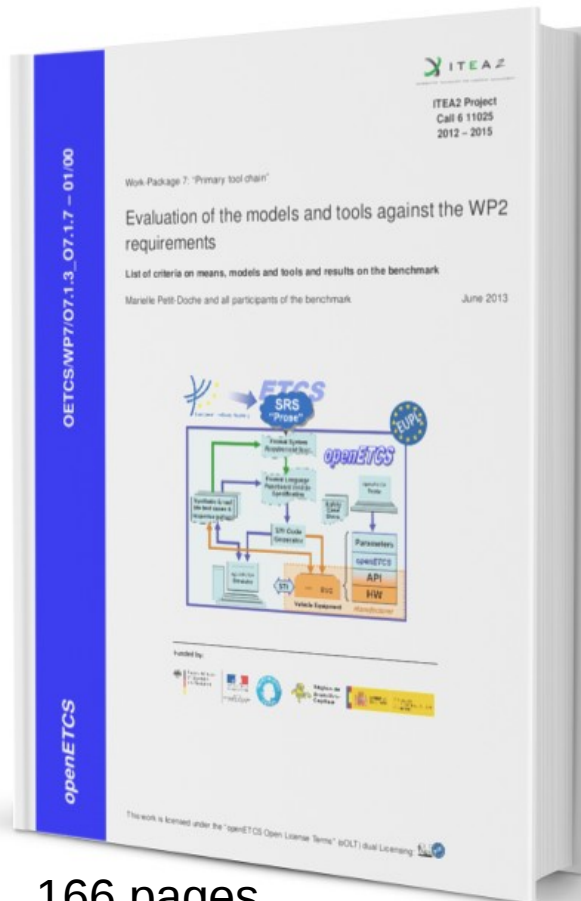


## ... but concrete results (primary tools)

Formalism / Tool	Status
SCADE 6.3.1	Done
ERTMSFormalSpecs	Done
CORE Workstation 5.1	<b>Stopped</b>
Event-B / Rodin 2.7 with ProR, ProB or AnimB and toolkit of provers (AtelierB, SMT,...)	Done
ClassicalB / AtelierB 4.0.2	Done
Why3 0.80	<b>Stopped</b>
GNATprove	Done
SysML/EA, RT-Tester	Done
GOPRR (GOPRR) meta meta model / MetaEdit+	Done
SysML / Papyrus	Done
SystemC	Done
UPPAAL	<b>Moved</b>
Petri Nets / Design/CPN	Done

# Result: O7.1.3 – O7.1.7

[https://github.com/openETCS/toolchain/blob/master/T7.1/O7.1.3\\_O7.1.7/Evaluation\\_against\\_WP2.pdf](https://github.com/openETCS/toolchain/blob/master/T7.1/O7.1.3_O7.1.7/Evaluation_against_WP2.pdf)



166 pages

OETCS/WP7/O7.1.3\_O7.1.7 – 01/00

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	Author	Assessor 1	Assessor 2	Total
Defensive programming	0	0	0	0
Fault detection & diagnostic	0	0	0	0
Error detecting code	0	0	0	0
Failure assertion programming	2	2	2	6
Diverse programming	0	0	0	0
Memorising executed cases	0	0	0	0
Software error effect analysis	2	0	0	2
Fully defined interface	3	3	3	9
Modelling	3	3	2	8
Structured methodology	3	2	3	8

## D.7 Software code generation

This section discusses the usage of the approach for software code generation. It can be skipped depending the results of [L.8](#).

Which criteria for software design and implementation are covered by the methodology (see ENS0128 table A.4) :

	Author	Assessor 1	Assessor 2
Formal methods	0	0	0
Modeling	1	2	0
Modular approach (mandatory)	2	2	0
Components	1	1	0
Design and coding standards (mandatory)	0	0	0
Strongly typed programming language	3	3	0

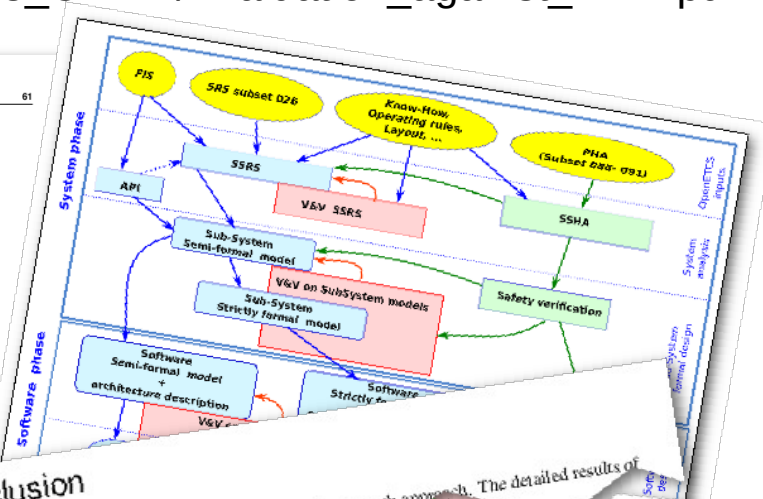
## D.8 Main usage of the tool

This section discusses the main usage of the tool.

Which task are covered by the tool ?

	Author	Assessor 1	Assessor 2
Modelling support	3	3	3
Automatic translation	1	1	0
Code Generation	0	0	0
Model verification	0	0	0
Test generation	2	2	1
Simulation, execution, debugging	0	0	0
Formal proof	0	0	0

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## 3 Conclusion

This conclusion give a sum up of the evaluation results for each approach. The detailed results of each approach are given in the appendix.

### 3.1 Main usage of the approach

This section discusses the main usage of the approach. According to the figure [11](#) for which phases do you recommend the approach (give a note from 0 to 3) :

	GOPR	ERTMS Formal Specs	SysML with Papyrus	SysML with EA	SCADE	EventB	Classical B	System C	Petri Nets	GNAT prove
System Analysis	5	1	7	9	3	9	4	2	6(9)	2 (3)
Sub-system Formal design	9	9	6	7	9	9	5	5	6(9)	3 (4)
Software design	9	9	6	7	9	9	9	9	6(9)	6(9)
Software code generation	9	9	6	7	9	9	9	9	2 (3)	6(9)

## ... but concrete results (secondary tools)

Formalism / Tool	Model transformation	Requirement management	Validation	Verification	Safety Analysis
AtelierB			X	X	
SCADE Suite	X	X	X	X	
UPPAAL			X	X	
Rodin + pluggins (ProR, ProB, SMT solvers, IUML,...)	X	X	X	X	X
CPN-Tools & SPENAT			X	X	X
Goal Structuring Notation (GSN)		X			X
MaTeLo (Model Based Testing tool based on Markov Chains)		X	X		
Safety Architect (System Safety Analysis tool)					X
RT-tester			X	X	
Eclipse ProR		X			
Fiacre and Tina, model-checking toolbox for Time Petri Nets				X	
SPARK Ada					

# Thanks to the team

## **Task Leader 7.1 and 7.2**

Marielle Petit-Doche / Systereel

## **Task Leader 7.3**

Jan Peleska & Cécile Braunstein  
University of Bremen

## **Task Leader 7.4**

Jonas Helming / Eclipse Source

## **Thanks**

to the openETCS WP7 Team

