Grant agreement for: Collaborative project*

Annex I - "Description of Work"

Project acronym: ARTIST

Project full title: " Advanced software-based seRvice provisioning and migraTIon of legacy Software "

Grant agreement no: 317859

Version date:

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A1:
Project summary

Project Number [1]	317859	Project Acronym [2]	ARTIST

One form per project

General information

Project title [3]	Advanced software-based seRvice provisioning and migraTIon of legacy Software		
Starting date [4]	01/10/2012		
Duration in months [5]	36		
Call (part) identifier [6]	FP7-ICT-2011-8		
Activity code(s) most relevant to your topic [7]	:		
Free keywords [8]	modernisation, evolution, legacy, reverse engineering, software transformations, metamodeling, cloud business model, migration assessment, cloud requirements, MDRE, SOA, SOAML, feasibility analysis		

Abstract [9]

Successful software has to evolve to keep it compatible and up to date. Up to 90% of software cost is spent on maintenance and of this 75% is spent on the development of new features for staying competitive. The industry progresses through periods of incremental development interlaced with true paradigm shifts.
We are currently experiencing one of these paradigm shifts, as remarked by the European Commission: “The speed of change in Internet technologies continues to be impressive. Software is becoming more and more pervasive: it runs on the devices that we use every day ...[opening] a new world of possible applications”
cf. Cloud computing, Internet of Services and Advanced Software Engineering, European Union, 2011 (doi:10.2759/47598).
Accordingly, more and more traditional software vendors notice the need to transform their current business and technology model in order to remain competitive. Software-as-a-Service (SaaS) is seen as the most promising way to achieve this change. However, this transition from Software-off-the-shelf (often residing as legacy applications) to SaaS is a tremendous challenge comprising business, application and technical issues.
Having an automated, vendor, technology and hardware independent way to migrate an application would permit the software to evolve easily even in case of transition to new paradigms.
ARTIST proposes a software migration approach covering the premigration and postmigration phases.
The premigration phase analyzes the technical and non-technical consequences of migrations, supporting the decision-making process on how a migration should be done. The migration phase itself is based on Model Driven Engineering techniques to automate the reverse engineering of the legacy applications to platform independent models. These models are the input for the forward engineering process to generate and deploy modernized applications and to support future migrations. In the postmigration phase, the modernized applications are certified with respect to the stated goals of the premigration phase.
ARTIST will reduce the risk, time and cost of migrating legacy software. It will lower the barriers for companies (with existing software) wanting to take advantage of the latest technologies and business models, particularly when considering the current benefits of Cloud Computing and SaaS.

A2:
List of Beneficiaries

Project Number [1]	317859	Project Acronym [2]	ARTIST

List of Beneficiaries

No	Name	Short name	Country	Project entry month [10]	Project exit month
1	ATOS SPAIN SA	ATOS	Spain	1	36
2	FUNDACION TECNALIA RESEARCH & INNOVATION	TECNALIA	Spain	1	36
3	INSTITUT NATIONAL DE RECHERCHE EN INFORMATIQUE ET EN AUTOMATIQUE	INRIA	France	1	36
4	FRAUNHOFER-GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V	Fraunhofer	Germany	1	36
5	TECHNISCHE UNIVERSITAET WIEN	TUWIEN	Austria	1	36
6	ENGINEERING - INGEGNERIA INFORMATICA SPA	ENG	Italy	1	36
7	INSTITUTE OF COMMUNICATION AND COMPUTER SYSTEMS	ICCS	Greece	1	36
8	SPARXSYSTEMS SOFTWARE GMBH	SPARX	Austria	1	36
9	ATHENS TECHNOLOGY CENTER SA	ATC	Greece	1	36
10	SPIKES	SPIKES	Belgium	1	36

A3:
Budget Breakdown

Project Number [1]	317859	Project Acronym [2]	ARTIST

One Form per Project

Participant number in this project [11]	Participant short name	Fund. % [12]	Ind. costs [13]	Estimated eligible costs (whole duration of the project)					Requested EU contribution
				RTD / Innovation (A)	Demonstration (B)	Management (C)	Other (D)	Total A+B+C+D	
1	ATOS	50.0	A	997,308.00	0.00	259,249.00	190,187.00	1,446,744.00	948,090.00
2	TECNALIA	75.0	A	1,163,986.00	0.00	16,290.00	64,028.00	1,244,304.00	953,307.00
3	INRIA	75.0	S	604,875.00	0.00	14,924.00	24,849.00	644,648.00	493,429.00
4	Fraunhofer	75.0	A	938,171.00	0.00	18,330.00	67,988.00	1,024,489.00	789,946.00
5	TUWIEN	75.0	T	882,398.00	0.00	16,924.00	56,268.00	955,590.00	734,990.00
6	ENG	50.0	A	1,444,160.00	0.00	16,540.00	72,240.00	1,532,940.00	810,860.00
7	ICCS	75.0	T	912,000.00	0.00	18,600.00	68,000.00	998,600.00	770,600.00
8	SPARX	75.0	S	391,200.00	0.00	3,000.00	31,200.00	425,400.00	327,600.00
9	ATC	75.0	A	205,000.00	0.00	9,500.00	160,500.00	375,000.00	323,750.00
10	SPIKES	75.0	T	966,760.00	0.00	22,412.00	53,651.00	1,042,823.00	801,133.00
Total				8,505,858.00	0.00	395,769.00	788,911.00	9,690,538.00	6,953,705.00

Note that the budget mentioned in this table is the total budget requested by the Beneficiary and associated Third Parties.

*** The following funding schemes are distinguished**

Collaborative Project (if a distinction is made in the call please state which type of Collaborative project is referred to: (i) Small of medium-scale focused research project, (ii) Large-scale integrating project, (iii) Project targeted to special groups such as SMEs and other smaller actors), Network of Excellence, Coordination Action, Support Action.

1. Project number

The project number has been assigned by the Commission as the unique identifier for your project, and it cannot be changed. The project number **should appear on each page of the grant agreement preparation documents** to prevent errors during its handling.

2. Project acronym

Use the project acronym as indicated in the submitted proposal. It cannot be changed, unless agreed during the negotiations. The same acronym **should appear on each page of the grant agreement preparation documents** to prevent errors during its handling.

3. Project title

Use the title (preferably no longer than 200 characters) as indicated in the submitted proposal. Minor corrections are possible if agreed during the preparation of the grant agreement.

4. Starting date

Unless a specific (fixed) starting date is duly justified and agreed upon during the preparation of the Grant Agreement, the project will start on the first day of the month following the entry into force of the Grant Agreement (NB : entry into force = signature by the Commission). Please note that if a fixed starting date is used, you will be required to provide a detailed justification on a separate note.

5. Duration

Insert the duration of the project in full months.

6. Call (part) identifier

The Call (part) identifier is the reference number given in the call or part of the call you were addressing, as indicated in the publication of the call in the Official Journal of the European Union. You have to use the identifier given by the Commission in the letter inviting to prepare the grant agreement.

7. Activity code

Select the activity code from the drop-down menu.

8. Free keywords

Use the free keywords from your original proposal; changes and additions are possible.

9. Abstract

10. The month at which the participant joined the consortium, month 1 marking the start date of the project, and all other start dates being relative to this start date.

11. The number allocated by the Consortium to the participant for this project.

12. Include the funding % for RTD/Innovation – either 50% or 75%

13. Indirect cost model

A: Actual Costs
S: Actual Costs Simplified Method
T: Transitional Flat rate
F :Flat Rate

Workplan Tables

Project number

317859

Project title

ARTIST—Advanced software-based seRvice provisioning and migraTIon of legacy Software

Call (part) identifier

FP7-ICT-2011-8

Funding scheme

Collaborative project

WT1
List of work packages

Project Number [1]	317859	Project Acronym [2]	ARTIST

LIST OF WORK PACKAGES (WP)

WP Number [53]	WP Title	Type of activity [54]	Lead beneficiary number [55]	Person-months [56]	Start month [57]	End month [58]
WP 1	Project Management	MGT	1	44.00	1	36
WP 2	Scientific and Technical Coordination	RTD	2	13.00	1	36
WP 3	Business Requirements and exploitation	OTHER	1	44.00	1	36
WP 4	Dissemination and Communication	OTHER	9	48.00	1	36
WP 5	Modernization assessment	RTD	2	74.00	1	30
WP 6	Modernisation Blueprint, methodology and integration	RTD	7	97.00	1	33
WP 7	Meta-modelling for target definition and cloud delivery	RTD	7	110.00	1	30
WP 8	Legacy Product Analysis by Reverse Engineering	RTD	3	131.00	1	30
WP 9	New software generation by forward engineering	RTD	5	174.00	1	30
WP 10	Common migration artefacts provisioning and management	RTD	4	85.00	1	36
WP 11	Migrated product testing, validation and certification	RTD	5	78.00	1	30
WP 12	Use cases development	RTD	6	105.00	1	33
WP 13	Use cases assessment report	RTD	10	41.00	1	36
			Total	1,044.00		

WT2:
List of Deliverables

Project Number [1]	317859	Project Acronym [2]	ARTIST

List of Deliverables - to be submitted for review to EC

Delive-rable Number [61]	Deliverable Title	WP number [53]	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D1.1	D1.1 Project Management Manual and Quality Plan	1	1	2.00	R	CO	1
D1.2	D1.2 Risk assessment and contingency plan	1	1	2.00	R	CO	3
D1.3.1	D1.3.1 Interim Management Report M6	1	1	4.00	R	CO	6
D1.3.2	D1.3.2 Project Management Report M12	1	1	9.00	R	CO	12
D1.3.3	D1.3.3 Interim Management report M18	1	1	4.00	R	CO	18
D1.3.4	D1.3.4 Project Management Report M24	1	1	9.00	R	CO	24
D1.3.5	D1.3.5 Interim Management Report M30	1	1	4.00	R	CO	30
D1.3.6	D1.3.6 Project Management Report M36	1	1	10.00	R	CO	36
D2.1	D2.1 Plan for standardization	2	2	3.00	R	PU	6
D2.2.1	D2.2.1 Standardization report and follow-up roadmap M18	2	2	5.00	R	PU	18
D2.2.2	D2.2.2 Standardization report and follow-up roadmap M36	2	2	5.00	R	PU	36
D3.1	D3.1 Initial market watch and requirements	3	9	10.00	R	CO	6

WT2:
List of Deliverables

Delive-rable Number [61]	Deliverable Title	WP number [53]	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D3.2	D3.2 ARTIST Business Scenarios	3	1	10.00	R	CO	12
D3.3	D3.3 Initial exploitation plan	3	1	12.00	R	CO	24
D3.4	D3.4 Final exploitation plan	3	1	12.00	R	CO	36
D4.1	D4.1 Initial publication material	4	9	2.00	O	PU	2
D4.2	D4.2 Dissemination strategy	4	9	3.00	R	PU	3
D4.3.1	D4.3.1 Dissemination Report M12	4	9	9.00	R	PU	12
D4.3.2	D4.3.2 Dissemination Report M24	4	9	9.00	R	PU	24
D4.3.3	D4.3.3 Dissemination Report M36	4	9	9.00	R	PU	36
D4.4	D4.4 Collaboration Plan	4	9	16.00	R	PU	6
D5.1.1	D5.1.1 Specification of the Business and Technical Modernization assessment in ARTIST M12	5	2	6.00	R	CO	12
D5.1.2	D5.1.2 Specification of the business and technical modernization assessment in ARTIST M24	5	2	4.00	R	CO	24
D5.1.3	D5.1.3 Specification of the business and technical modernization assessment in ARTIST M30	5	2	4.00	R	CO	30

WT2:
List of Deliverables

Delive-rable Number [61]	Deliverable Title	WP number [53]	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D5.2.1	D5.2.1 Business and Technical Modernization assessment tool M12	5	2	9.00	P	PU	12
D5.2.2	D5.2.2 Business and Technical Modernization assessment tool M24	5	2	9.00	P	PU	24
D5.2.3	D5.2.2 Business and Technical Modernization assessment tool M30	5	2	6.00	P	PU	30
D5.3.1	D5.3.1 Technical feasibility tools M12	5	1	6.00	P	PU	12
D5.3.2	D5.3.2 Technical feasibility tools M24	5	1	6.00	P	PU	24
D5.3.3	D5.3.3 Technical feasibility tools M30	5	1	4.00	P	PU	30
D5.4.1	D5.4.1 Business feasibility tool M12	5	6	7.00	P	PU	12
D5.4.2	D5.4.2 Business feasibility tool M24	5	6	8.00	P	PU	24
D5.4.3	D5.4.3 Business feasibility tool M30	5	6	5.00	P	PU	30
D6.1	D6.1 Analysis of current migration approaches	6	7	3.00	R	PU	4
D6.2.1	D6.2.1 ARTIST Methodology M12	6	2	16.00	R	CO	12
D6.2.2	D6.2.2 ARTIST Methodology M24	6	2	10.00	R	CO	24
D6.2.3	D6.2.3 ARTIST Methodology M30	6	2	5.00	R	CO	30

WT2:
List of Deliverables

Delive-rable Number [61]	Deliverable Title	WP number [53]	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D6.3.1	D6.3.1 ARTIST methodology process framework M12	6	7	13.00	P	PU	12
D6.3.2	D6.3.2 ARTIST methodology process framework M24	6	7	12.00	P	PU	24
D6.3.3	D6.3.3 ARTIST methodology process framework M30	6	7	8.00	P	PU	30
D6.4.1	D6.4.1 ARTIST integrated architecture M15	6	1	14.00	R	PU	15
D6.4.2	D6.4.2 ARTIST integrated architecture M33	6	1	16.00	P	PU	33
D7.1	D7.1 Definition and extension of performance stereotypes M18	7	7	14.00	R	PU	18
D7.2	D7.2 PaaS/IaaS metamodelling requiremente and SOTA	7	7	4.00	R	PU	4
D7.2.1	D7.2.1 PaaS/Iaas metamodelling framework and tools M12	7	6	20.00	P	PU	12
D7.2.2	D7.2.2 PaaS/Iaas metamodelling framework and tools M24	7	6	20.00	P	PU	24
D7.2.3	D7.2.3 PaaS/Iaas metamodelling framework and tools M30	7	6	21.00	P	PU	30
D7.3	D7.3 Analysis and incorporation of third party offerings	7	10	9.00	R	PU	18

WT2:
List of Deliverables

Delive-rable Number [61]	Deliverable Title	WP number [53]	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D7.4	D7.4 Classification methods and tools M30	7	7	22.00	P	PU	30
D8.1	D8.1 Taxonomy of legacy artefacts M12	8	3	5.00	R	PU	12
D8.2	D8.2 Methodology and techniques for model discovery M18	8	3	12.00	R	PU	18
D8.2.1	D8.2.1 Components for Model Discovery from Legacy Technologies M12	8	3	18.00	P	PU	12
D8.2.2	D8.2.2 Components for Model Discovery from Legacy Technologies M24	8	3	18.00	P	PU	24
D8.2.3	D8.2.3 Components for Model Discovery from Legacy Technologies M30	8	3	20.00	P	PU	30
D8.3	D8.3 Methodology and techniques for model understanding M18	8	3	10.00	R	PU	18
D8.3.1	D8.3.1 Mechanisms for Viewpoint Definition and View Extraction from Models of Legacy Artifacts M12	8	5	16.00	P	PU	12
D8.3.2	D8.3.2 Mechanisms for Viewpoint Definition and	8	5	16.00	P	PU	24

WT2:
List of Deliverables

Delive-rable Number [61]	Deliverable Title	WP number [53]	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
	View Extraction from Models of Legacy Artifacts M24						
D8.3.3	D8.3.3 Mechanisms for Viewpoint Definition and View Extraction from Models of Legacy Artifacts M30	8	5	16.00	P	PU	30
D9.1	D9.1 State of the art in modelling languages and model transformation techniques	9	5	6.00	R	PU	6
D9.2	D9.2 Modelling language and editor for defining target specifications	9	5	18.00	P	PU	12
D9.3	D9.3 Migration rules formalized as generic model transformations M24	9	5	40.00	P	PU	24
D9.4	D9.4 Collection of optimization patterns M24	9	5	10.00	R	PU	24
D9.5	D9.5 Model-to-code transformations for specific cloud infrastructures	9	5	20.00	P	PU	24
D9.6	D9.6 Automated deployment strategies M30	9	1	40.00	P	PU	30
D9.7	D9.7 Integrated environment for maintaining/ developing forward engineering process M30	9	5	40.00	P	PU	30

WT2:
List of Deliverables

Delive-rable Number [61]	Deliverable Title	WP number [53]	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D10.1	D10.1 Repository requirements	10	4	2.00	R	PU	4
D10.2	D10.2 Technical and information architecture of the repositories M12	10	4	3.00	R	PU	12
D10.3.1	D10.3.1 Repository prototype M18	10	4	10.00	P	PU	18
D10.3.2	D10.3.2 Repository prototype M30	10	4	15.00	P	PU	30
D10.4.1	D10.4.1 Methodology and techniques for artefact evolution support M18	10	4	10.00	P	PU	18
D10.4.2	D10.4.2 Methodology and techniques for artefact evolution support M36	10	4	10.00	P	PU	36
D10.5.1	D10.5.1 Inventory of common general-purpose artefacts M24	10	1	20.00	P	PU	24
D10.5.2	D10.5.2 Inventory of common general-purpose artefacts M30	10	1	15.00	P	PU	30
D11.1	D11.1 Methodology and techniques for deriving test cases from models M30	11	5	13.00	P	PU	30
D11.2	D11.2 Methodology and architecture for end-user	11	5	10.00	P	PU	24

WT2:
List of Deliverables

Delive-rable Number [61]	Deliverable Title	WP number [53]	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
	based testing M24						
D11.3.1	D11.3.1 Methodology and Environment for evaluating migration success M8	11	5	5.00	R	PU	8
D11.3.2	D11.3.2 Methodology and Environment for evaluating migration success M30	11	5	12.00	P	PU	30
D11.4.1	D11.4.1 ARTIST SbSp certification model M6	11	2	3.00	R	CO	6
D11.4.2	D11.4.2 ARTIST SbSp certification model M24	11	2	20.00	P	CO	24
D11.4.3	D11.4.3 ARTIST SbSp certification model M30	11	2	10.00	P	CO	30
D11.5	D11.5 Migration support for test cases	11	5	5.00	R	PU	12
D12.1	D12.1 Use cases definition and migration architecture	12	6	6.00	R	PU	12
D12.2	D12.2 Use cases migration roadmaps M24	12	2	15.00	R	PU	24
D12.3.1	D12.3.1 Deployed use cases M24	12	9	42.00	P	CO	24
D12.3.2	D12.3.2 Deployed use cases M33	12	9	42.00	P	CO	33
D13.1	D13.1 Use case evaluation methodology	13	10	11.00	R	PU	12

WT2:
List of Deliverables

Delive-rable Number [61]	Deliverable Title	WP number [53]	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D13.2.1	D13.2.1 Use case assessment report M24	13	9	15.00	R	PU	24
D13.2.2	D13.2.2 Use case assessment report M36	13	9	15.00	R	PU	36
			Total	1,044.00			

WT3:
Work package description

Project Number [1]	317859	Project Acronym [2]	ARTIST

One form per Work Package

Work package number [53]	WP1	Type of activity [54]	MGT
Work package title	Project Management		
Start month	1		
End month	36		
Lead beneficiary number [55]	1		

Objectives

This WP carries out the effective management and coordination tasks required for a successful project implementation to realize the planned achievements and deliverables of the project, according to objectives and contractual arrangements. The key objectives are:
• To ensure a timely financial monitoring and control of the overall project according to terms and conditions of the contract.
• Management and reviews of all project tasks for successful achievement of the project with reference to the technical and research objectives in terms of concept definition, design, performances, timely delivery and validation.
• Setup and maintain the information and communication flow among partners

Description of work and role of partners

Task 1.1: Overall management of the Consortium (M1-M36/Leader: ATOS)
This task is responsible for the overall direction and major decisions affecting the project
This includes following actions:
• Be the official liaison with EC, covering for any contractual matters, review meetings, submission of deliverables, etc.
• Plan the overall management of the Project
• Project control through regular peer reviews and project milestones control
• Follow up and monitor the contractual achievements of partners commitments according to the Description of Work and other terms and conditions of Contract
• Give or recall necessary instructions to partners in order to ensure a proper and timely implementation of the Contract; regular reports on functioning of lower-level management, highlighting any problem areas
• Organization and coordination of meetings (general meetings, review meetings etc, support to Technical Coordinator for technical meetings) producing minutes
• Maintain management records for the project
• Establish the Quality Plan and ensure it is followed
• Ensure that deliveries are provided in a timely way according to contractual specifications
• Major decisions on termination or refocusing Activities/WPs
• Action against partners in default
• Continuous risk assessment; reports on current and anticipated future risks
• Establish communication and information tools and guidelines for the partners of the Project

Task 1.2: Financial management (M1-M36/Leader: ATOS)
• Overall financial control of the project, for transferring sums to partners in accordance with the overall budget, and for keeping records to the standard required
• Define and up-date the Budget flow of the project
• Monitor and control the budget on a regular basis, maintaining financial records for the project
• Report the budget expenses status as per contractual terms and/or on request of the E.C.
• Supply the necessary documents for supporting the contractual payments (follow up and reporting)
• Coordinate annual financial reporting

WT3:
Work package description

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	ATOS	36.00
2	TECNALIA	1.00
3	INRIA	1.00
4	Fraunhofer	1.00
5	TUWIEN	1.00
6	ENG	1.00
7	ICCS	1.00
8	SPARX	0.00
9	ATC	1.00
10	SPIKES	1.00
	Total	44.00

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D1.1	D1.1 Project Management Manual and Quality Plan	1	2.00	R	CO	1
D1.2	D1.2 Risk assessment and contingency plan	1	2.00	R	CO	3
D1.3.1	D1.3.1 Interim Management Report M6	1	4.00	R	CO	6
D1.3.2	D1.3.2 Project Management Report M12	1	9.00	R	CO	12
D1.3.3	D1.3.3 Interim Management report M18	1	4.00	R	CO	18
D1.3.4	D1.3.4 Project Management Report M24	1	9.00	R	CO	24
D1.3.5	D1.3.5 Interim Management Report M30	1	4.00	R	CO	30
D1.3.6	D1.3.6 Project Management Report M36	1	10.00	R	CO	36
		Total	44.00			

Description of deliverables

D1.1) D1.1 Project Management Manual and Quality Plan: This document will specify the management procedures to follow during the project execution; define communication guidelines and tools, set up conflict resolution procedures, provide project templates for documents (deliverables, presentations, roadmaps, agendas, minutes etc) and outline the methods and process for ensuring the quality of the deliveries. Common language will be established and the basic structure of the project will be set up. [month 1]

D1.2) D1.2 Risk assessment and contingency plan: This document will identify potential project risks and the associated contingency actions in case of occurrence as well as clearly assign risk owners for each identified risk. Further follow-up on risk and contingencies will be provided through Project Management Reports. [month 3]

D1.3.1) D1.3.1 Interim Management Report M6: This deliverable will briefly report the overall progress of project activity from M1 to M6. It includes the overall status of the work done in the reported period as well as at work package level, assessing progress versus the plan. Deviations, risks, problems and contingency actions will be also reported. Adjustments in the project implementation or relevant technical or scientific decisions will be also reflected here. [month 6]

D1.3.2) D1.3.2 Project Management Report M12: This deliverable will report the overall progress of project activity from M1 to M12. It includes the overall status of the work done in the reported period as well as at work package level, assessing progress versus the plan. Deviations, risks, problems and contingency actions will be also reported, as well as any responses to review recommendations from period reviews. It includes the administrative and financial reporting of the overall project in the corresponding period. These deliverables will also show the scientific progress versus the project objectives and indicators and the original state of the art. They will describe how the research is carrying out in the project and the methodology followed to synchronize the research and technical activities with other dimensions of the project (exploitation, standardization, collaboration, dissemination, etc). Adjustments in the project implementation or relevant technical or scientific decisions will be also reflected here. [month 12]

D1.3.3) D1.3.3 Interim Management report M18: This deliverable will briefly report the overall progress of project activity from M13 to M18. It includes the overall status of the work done in the reported period as well as at work package level, assessing progress versus the plan. Deviations, risks, problems and contingency actions will be also reported. Adjustments in the project implementation or relevant technical or scientific decisions will be also reflected here. [month 18]

D1.3.4) D1.3.4 Project Management Report M24: This deliverable will report the overall progress of project activity from M13 to M24. It includes the overall status of the work done in the reported period as well as at work package level, assessing progress versus the plan. Deviations, risks, problems and contingency actions will be also reported, as well as any responses to review recommendations from period reviews. It includes the administrative and financial reporting of the overall project in the corresponding period. These deliverables will also show the scientific progress versus the project objectives and indicators and the original state of the art. They will describe how the research is carrying out in the project and the methodology followed to synchronize the research and technical activities with other dimensions of the project (exploitation, standardization, collaboration, dissemination, etc). Adjustments in the project implementation or relevant technical or scientific decisions will be also reflected here. [month 24]

D1.3.5) D1.3.5 Interim Management Report M30: This deliverable will briefly report the overall progress of project activity from M25 to M20. It includes the overall status of the work done in the reported period as well as at work package level, assessing progress versus the plan. Deviations, risks, problems and contingency actions will be also reported. Adjustments in the project implementation or relevant technical or scientific decisions will be also reflected here. [month 30]

D1.3.6) D1.3.6 Project Management Report M36: This deliverable will report the overall progress of project activity from M25 to M36. It includes the overall status of the work done in the reported period as well as at work package level, assessing progress versus the plan. Deviations, risks, problems and contingency actions will be also reported, as well as any responses to review recommendations from period reviews. It includes the administrative and financial reporting of the overall project in the corresponding period. These deliverables will also show the scientific progress versus the project objectives and indicators and the original state of the art. They will describe how the research is carrying out in the project and the methodology followed to synchronize the research and technical activities with other dimensions of the project (exploitation, standardization, collaboration, dissemination, etc). Adjustments in the project implementation or relevant technical or scientific decisions will be also reflected here. [month 36]

WT3:
Work package description

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
MS1	Project plan	1	3	Plans for dissemination, collaboration, risk and assestment
MS2	Project definition and baseline	1	4	Plans for Project Management, web page, collaborative tools setting up, SOTA, requirements
MS3	Project design	2	6	Documents with the detailed designs of technical WPs.
MS4	First prototyping and starting pilots	2	12	First releases of the different methodology, roadmap and tools of ARTIST solution. Definition of pilots and setting-up
MS5	Second prototyping and first pilots	2	18	Second releases of the different methodology, roadmap and tools of ARTIST solution.
MS6	Third prototyping and second pilots	2	24	Third releases of the different methodology, roadmap and tools of ARTIST solution. First implementation of pilots. First exploitation plan
MS7	Final prototyping	1	30	Final releases of the different methodology, roadmap and tools of ARTIST solution
MS8	Final pilots	6	33	Final pilot implementation based on final version of solution
MS9	Validation and benchmarking of the results	6	36	Reports assessing the benchmark by means of the project measures of success. Last version of the overall solution validated and verified. Final exploitation plan

WT3:
Work package description

Project Number [1]	317859	Project Acronym [2]	ARTIST

One form per Work Package

Work package number [53]	WP2	Type of activity [54]	RTD
Work package title	Scientific and Technical Coordination		
Start month	1		
End month	36		
Lead beneficiary number [55]	2		

Objectives

This work package includes the technical project coordination, concretely,
• Provide the global scientific direction for the project
• Perform the project-wide coordination of the technical and scientific activities
• Ensure the appropriate level of scientific cooperation in the project
• Follow, contribute to, promote and ensure usage of the corresponding relevant standards (e.g. OMG and others).

Description of work and role of partners

Task 2.1: Technical management (M1-M36/Leader: TECNALIA)
Technical Coordinator is responsible for the detailed planning and monitoring of individual activities, as well as risk management at a technical level (assessment of options) and support the Project Manager in management of quality assurance of processes and deliverables.
• Define and implement a detailed technical project control plan for all technical aspects and related documentation
• Follow up technical actions and control action items list
• Set-up, prepare and co-ordinate technical progress meetings and reviews
• Control all the contractual technical documentation before Project Manager delivery to the E.C Officer
• Validate the technical project performance of partners and deliveries
• Continuously refine the scientific objectives for the project with respect to its scientific contributions and the world-wide progress of relevant state of the art.
• Ensuring the harmonization of short-term research objectives and long-term visions for the project's scientific development.
• The monitoring and assessment of scientific progress and fulfilment of the project's scientific objectives. This activity will be reported in the Project Management Reports.
• Coordination, planning, management, and control of project-wide technical activities, including coordinating (in time and scope) the technical work between work packages (cross-WP coordination). Tools include roadmapping and cross WP mapping of tasks.
• Define IPR guidelines in coordination with Exploitation Manager to ensure that third party software is registered, potential license conflicts or constraints on foreground are analyzed, and open issues are adequately resolved.
• Management of a regularly updated IPR register.
The result of this task will be include in the deliverable D0.2vx Project management Report

Task 2.2: Standardization (M1-M36/Leader: TECNALIA)
This task will ensure that the project work uses and is in line with the relevant standards, as well as identify appropriate sections of the research that are brought into the standardization process fostering dialogues with relevant bodies through meeting attendance and also preparing appropriate contributions, based on the work performed within each work package.
Activities in the task will contribute towards generating or contributing to representative standards and proposing and promoting them to the appropriate standardization bodies. The task involves identifying the relevant standardization bodies and standardization projects, European and international. TECNALIA, an active research member with in-depth knowledge and experiences in initiating, driving and finalising standardization task forces,

will lead this task taking advantage of its situation and its knowledge in OMG's procedures to promote the extension of relevant Standards (such as SOAML and CloudML) with the work performed in ARTIST.
Various standards and specifications issued or in progress by working groups of the following standardization bodies will be likely used within the ARTIST project. Any progress related to these standards that are achieved throughout the project's effort and with the agreement of all the relevant consortium members will be contributed to the respective standardization bodies. In what follows we present an indicative list of related standards and specifications by relevant standardization bodies. A more exhaustive list is expected to be produced while the technical achievements of the project emerge:
• Object Management Group (OMG)
• Architecture Driven Modernization (ADM) Task Force.
• ETSI TR 102 997 (Standardization requirements for Cloud Services) - ETSI European Telecommunications Standards Institute.
• OCCI-Open Cloud Computing Interface (Open Grid Forum).
• SaaS Quality Seal –(EuroCloud)
• SOAML- Service oriented architecture Modeling Language, and CloudML standards (OMG-Object Management Group).
• SMART- The Service-Oriented Migration and Reuse Technique (SEI –Software Engineering Institute)

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	ATOS	1.00
2	TECNALIA	9.00
3	INRIA	1.00
4	Fraunhofer	0.00
5	TUWIEN	1.00
6	ENG	1.00
7	ICCS	0.00
8	SPARX	0.00
9	ATC	0.00
10	SPIKES	0.00
	Total	13.00

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D2.1	D2.1 Plan for standardization	2	3.00	R	PU	6
D2.2.1	D2.2.1 Standardization report and follow-up roadmap M18	2	5.00	R	PU	18
D2.2.2	D2.2.2 Standardization report and follow-up roadmap M36	2	5.00	R	PU	36
		Total	13.00			

Description of deliverables

WT3:
Work package description

D2.1) D2.1 Plan for standardization: Standardization activities planning, including an initial analysis of the selected standardization bodies and institutions [month 6]

D2.2.1) D2.2.1 Standardization report and follow-up roadmap M18: This report will document al the standardization activities performed in the project from the begining to the M18 [month 18]

D2.2.2) D2.2.2 Standardization report and follow-up roadmap M36: This report will document al the standardization activities performed in the project during the whole duration [month 36]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead beneficiary number	Delivery date from Annex I [60]	Comments
MS3	Project design	2	6	Documents with the detailed designs of technical WPs.
MS5	Second prototyping and first pilots	2	18	Second releases of the different methodology, roadmap and tools of ARTIST solution.
MS9	Validation and benchmarking of the results	6	36	Reports assessing the benchmark by means of the project measures of success. Last version of the overall solution validated and verified. Final exploitation plan

WT3:
Work package description

Project Number [1]	317859	Project Acronym [2]	ARTIST

One form per Work Package

Work package number [53]	WP3	Type of activity [54]	OTHER
Work package title	Business Requirements and exploitation		
Start month	1		
End month	36		
Lead beneficiary number [55]	1		

Objectives

The overall goal of this work package is to address the future uptake and sustainability of project results by analysing the current market, providing requirements according to existing needs and developing a strategy for exploiting those results.
• To assist and complement the technical development with the business perspective particularly, relating to future uptake and sustainability
• To study the external context for ARTIST results, to provide input and requirements relating to market needs and trends and to define the market context for exploitation.
• To confirm and further analyse the ARTIST value proposition, value chain, business models and deployment models for the optimal exploitation of results.
• To develop joint and individual exploitations plans for the uptake of project results.

Description of work and role of partners

Task 3.1: Market Watch (M1-M6/Leader: ATC)
This task will determine the market context for ARTIST results, updating the partner's present market knowledge. A detailed study will quantify the size of the market, determine trends in the market and identify key competitors and substitutes from research and industry, based on the specific results ARTIST will produce. It use a variety of analytical tools as necessary (e.g. critical success factor analysis, Porter's five forces, blind spot analysis, power/influence matrix, Political, Economic, Social, and Technological analysis (PEST) and SWOT analyses) to structure data from primary and secondary sources, as deemed necessary (analyst reports, interviews, annual company reports, questionnaires, research papers etc.)
This task will form an initial report in M6, which will be used to guide the project development. Following publication of the deliverable this task will continue with constant monitoring of the market and be reported in other deliverables of this workpackage.

Task 3.2: Analysis of business scenarios (M7-M12/Leader: ATOS)
This task will examine the internal features of the project in order to determine the possible routes towards the future exploitation of results, and then combine this with market analysis to determine the optimal routes. This task entails value chain analysis, core competence analysis, scenario analysis and business modeling. The project has an initial understanding of the ARTIST value chain and potential business models, as discussed in section 3, but these will need further analysis as the results materialize.
The output of this task will be the business scenarios deliverable in M12, which will define the most promising business model(s) for exploitation and will provide the project with a clear direction from the business perspective, with new requirements and considerations. It will also impact IPR considerations and help orient the dissemination strategy.

Task 3.3: Exploitation (M13-M36/Leader: ATOS)
This task follows from the business scenarios deliverable by exploring the possibilities of a business plan for a consortium-based exploitation under various governance models. Whilst task 3.2 is an exercise to find the ideal or most promising delivery and exploitation, task 3.3 is very much a practical exercise to provide details on how that exploitation can be brought about. As such it is focused on the specific consortium members, their interests, their constraints and their plans to implement ARTIST results.

The output of this task will be two reports, at M24 and M36. The first will define the initial business plan for the exploitation and the intentions and actions the partners intend to carry out during the final period. The second will present the final business plan, the progress of each partner and their plans for the future

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	ATOS	20.00
2	TECNALIA	3.00
3	INRIA	1.00
4	Fraunhofer	1.00
5	TUWIEN	1.00
6	ENG	4.00
7	ICCS	1.00
8	SPARX	3.00
9	ATC	7.00
10	SPIKES	3.00
	Total	44.00

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D3.1	D3.1 Initial market watch and requirements	9	10.00	R	CO	6
D3.2	D3.2 ARTIST Business Scenarios	1	10.00	R	CO	12
D3.3	D3.3 Initial exploitation plan	1	12.00	R	CO	24
D3.4	D3.4 Final exploitation plan	1	12.00	R	CO	36
		Total	44.00			

Description of deliverables

D3.1) D3.1 Initial market watch and requirements: This document presents the initial findings from the market analysis task. It will identify important trends and requirements from the market which will need to be reflected in the technical development and will feed into the business scenarios document. As part of the market analysis this deliverable will include the definition of the end product, the projects positioning in the market, a SWOT analysis. It will also include preliminary exploitation intentions of the partners. [month 6]

D3.2) D3.2 ARTIST Business Scenarios: This document will explore the potential implementation routes for the ARTIST results, describing the value chain, deployment options, delivery options, and above all, potential business models for the exploitation of results The deliverable will also update the exploitation intentions. [month 12]

D3.3) D3.3 Initial exploitation plan: This deliverable will describe the initial business plan. In addition each partner will elaborate a statement of their interests in exploitation and plan actions to explore and develop those interests during the final project period. [month 24]

WT3:
Work package description

D3.4) D3.4 Final exploitation plan: This deliverable will provide the final business plan for ARTIST. All partners will describe their intentions for future exploitation, detail their plans to achieve this and report progress on planned actions during the previous period. [month 36]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
MS3	Project design	2	6	Documents with the detailed designs of technical WPs.
MS4	First prototyping and starting pilots	2	12	First releases of the different methodology, roadmap and tools of ARTIST solution. Definition of pilots and setting-up
MS6	Third prototyping and second pilots	2	24	Third releases of the different methodology, roadmap and tools of ARTIST solution. First implementation of pilots. First exploitation plan
MS9	Validation and benchmarking of the results	6	36	Reports assessing the benchmark by means of the project measures of success. Last version of the overall solution validated and verified. Final exploitation plan

WT3:
Work package description

Project Number [1]	317859	Project Acronym [2]	ARTIST

One form per Work Package

Work package number [53]	WP4	Type of activity [54]	OTHER
Work package title	Dissemination and Communication		
Start month	1		
End month	36		
Lead beneficiary number [55]	9		

Objectives

The main focus of this work package is to maximize the impact of the project, to ensure proper dissemination and communication of the project results and subsequently to raise awareness to the scientific, industrial, and general public communities.
The objectives are:
- To widely disseminate the project concept, developments and findings to identified stakeholders (i.e. industry, academia, Public Authorities) using effective communication means and strategies.
- To ensure that all the relevant communities will be reached out to in an interactive way, integrating their feedback at key timestamps of the project: namely specification requirements, market analysis, design, development and evaluation periods, as well as during exploitation tasks.
- To create and publish scientific contributions valuable for the research community.
- To participate in appropriate European and worldwide events (workshops, seminars, conferences, etc.) targeted at industry and academia with the ultimate goal not only to showcase ARTIST results and subsequently to prepare the way for a successful commercial exploitation of the project outcomes, but also to create an ARTIST community mobilizing its members whenever it is needed (requirements definition process, evaluation period, etc.).
- Support the liaison and co-operation activities with the other ICT projects under the WP2011/2012 Objective "Cloud Computing, Internet of Services and Advanced Software Engineering" as well as with other Frameworks (i.e. ITEA2, ARTEMIS) in the relevant scientific area of ARTIST.

Description of work and role of partners

This WP deals with the dissemination and communication activities required to make the relevant target users and markets aware of the results produced by the project developments.

Dissemination activities will commence even before the preliminary results are available. They will start with monitoring of literature, resources and events in the area of migrating legacy software systems into different target frameworks, notably SOA and Cloud based environments, both in the academia and industry. Furthermore, a meticulous dissemination plan will be prepared describing dissemination goals, identified scientific communities and targeted groups, dissemination channels and individual approach for particular partners. This plan will define KPIs for dissemination which will be monitored on a monthly basis and used to steer efforts and actions to maximum effect. The compilation of the dissemination plan is considered a highlighted task for the ARTIST set up, as it will emphasis on the means that will be utilized in mobilizing all the relevant stakeholders during the evaluation of the case studies.
Towards the second half of the project, dissemination will also increasingly target professionals and events in the target sectors, via workshops and conferences, periodical publications, associations, software trade events, exhibitions and with increasing use of social media (MoDELS, ECMDA-FA, SoSyM, etc.). The project dissemination activities will be supported by a project web site and a flow of relevant project information.

The Certification models have proved to be a necessity from Public Authorities. Workshops with Member States Public Authorities near the end of the project to present the SbSp Certification model will be part of the dissemination activities as well.

Task 4.1: Elaboration of a dissemination plan (M1-M3/Leader: ATC)

WT3:
Work package description

During the first three months of the WP, coordinator (ATC) in collaboration with the rest of the partners will elaborate a dissemination plan where dissemination activities at all levels will be defined in detail. The main elements of this dissemination plan will be: Firstly the strategy, with a detailed description of stakeholders, project milestones and results to disseminate and optimal means of dissemination; Secondly a breakdown of tasks, assigned partner responsible for them, stakeholder or public addressed by the task, timing of the action and expected outcome; And thirdly monitoring of KPIs and frequent adjustments to the plan in agreement with project, technical and exploitation managers. Every six months the dissemination plan will be formally updated according to project's partial developments and outcome.

Task 4.2: Dissemination activities and spread of knowledge (M1-M36/Leader: ATC)
Following the ARTIST dissemination strategy defined in Task 4.1, the project will have strong and partly novel, dissemination actions. These actions will commence as soon as preliminary results are available and will last until the end of project's lifetime.
Further details of dissemination activities and specifics (e.g. acknowledged conferences, journals and workshops for future contribution) to be addressed in section 3.2.2 "Dissemination of results and technology transfer".

Task 4.3: Communication activities (M1-M36/Leader:ATC)
With the purpose to establish good foundations for a communication mindset in ARTIST, a set of diverse communication activities will be achieved from the very beginning of the project. The dissemination strategy will be supported by communication tools such as following examples listed below:
- Press Releases. The project will produce two press releases: one at the beginning of the project to promote the project objectives and expected benefits for the software community and users willing to migrating to cloud their applications; and a second one, at the end of the project to elaborate the conclusions of the achieved results and fostering the adoption of project outcomes. These PR will be issued in English and the four more languages from the project (Spanish, French, German, Greek, Italian, Dutch) and distributed to local press and local MEPs (Member of European Parliament) in each of the represented countries in the project. Partners involved in the production of these PRs will be: ATOS, ATC, Fraunhofer, INRIA, ENG, SPIKES and TECNALIA. These partners will ensure proper coverage by local press of the PR.
- Project factsheet. This factsheet must be prepared before the project starting date (end of July), so it is not included as a formal deliverable. The factsheet will be produced following the template provided by EC.
- Web site: a fancy, useful and always updated web site will be issued at very beginning in the project. The domain www.artist-project.eu will be bought for the project duration and 2 years beyond at minimal. It will follow the guidelines provided by the EC about required functionality and content.
Section 3.2.2 describes in details several other progressive communication tasks that will be considered by the ARTIST consortium during projects lifecycle

Task 4.4: Collaboration with relevant EC funded projects (M1-M36/Leader: ATC)
ARTIST is open to collaborate with other EC funded projects on technical topics that are of joint interest. A special focus will be on establishing a good collaboration with the other projects running under Objective 1.2 of the ICT programme on software and services. Several projects under Objective 1.2 deliver open source software, and ARTIST will actively seek collaboration with other projects with the aim to enhance the best practices in open source development methodologies and to promote better the joint open source software results of Objective 1.2 towards a wider community of open source developers.
ARTIST consortium acknowledges and will adopt the guidelines provided by EC about collaboration with other projects, focusing on the basic principles that ensure the creation of a successful framework of collaboration activities. To this end, all partners will contribute and especially the ones who actually carry out the technical work, the collaboration will not only be addressed at a management level but at a technical as well and ARTIST will aim co-operation activities with other EC funded projects in Objective 1.2.
A detailed description of the collaboration activities can only be compiled when intensive bilateral and multilateral discussions between projects are organized beforehand. These discussions will lead to agreements and synchronization only if ARTIST consortium will define early in the project: a) all the ARTIST's technologies that can be shared with external parties, b) an availability timeplan for those and c) the research, technological and business areas that can have synergies to exploit, can complement to and join forces to reach the target audience.

Diverse collaboration activities will be addressed in the context of the project, such as, joint publications, organization of joint event or workshops, collaboration with Working Groups (CWG), etc.

Additionally ARTIST will explore possibilities of other joint activities in for example dissemination, training and cooperation with related communities with the other running projects of Objective 1.2 of the ICT programme. This matter will be first discussed in the context of the Internet of Services Collaboration event in October 2012.

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	ATOS	7.00
2	TECNALIA	4.00
3	INRIA	1.00
4	Fraunhofer	4.00
5	TUWIEN	6.00
6	ENG	2.00
7	ICCS	6.00
8	SPARX	1.00
9	ATC	16.00
10	SPIKES	1.00
	Total	48.00

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D4.1	D4.1 Initial publication material	9	2.00	O	PU	2
D4.2	D4.2 Dissemination strategy	9	3.00	R	PU	3
D4.3.1	D4.3.1 Dissemination Report M12	9	9.00	R	PU	12
D4.3.2	D4.3.2 Dissemination Report M24	9	9.00	R	PU	24
D4.3.3	D4.3.3 Dissemination Report M36	9	9.00	R	PU	36
D4.4	D4.4 Collaboration Plan	9	16.00	R	PU	6
		Total	48.00			

Description of deliverables

D4.1) D4.1 Initial publication material: This deliverable will focus on the publication of the initial set of materials that will define and promote project's identity. It will include the creation of a project logo, a project factsheet, an MS PowerPoint presentation providing a general description of ARTIST, project's official web site and templates for the official documents to be developed within the project. An initial Press Release will be also issued in diverse languages and promoted in different countries. [month 2]

D4.2) D4.2 Dissemination strategy: This deliverable will detail the plan for the project dissemination strategy to be adopted throughout the project lifetime. The release of the respective report is considered one of the key milestones of the project. [month 3]

D4.3.1) D4.3.1 Dissemination Report M12: Report of the dissemination, collaboration and communication activities followed during the reporting periods as well as the results from these activities and will update project's dissemination plan respectively. Towards project end, this deliverable will be updated on a constant basis to be concluded in the final plan for the dissemination and use of knowledge, as per the FP7 reporting guidelines. [month 12]

D4.3.2) D4.3.2 Dissemination Report M24: Report of the dissemination, collaboration and communication activities followed during the reporting periods as well as the results from these activities and will update project's dissemination plan respectively. [month 24]

D4.3.3) D4.3.3 Dissemination Report M36: Report of the dissemination, collaboration and communication activities followed during the reporting periods as well as the results from these activities and will update project's dissemination plan respectively. [month 36]

D4.4) D4.4 Collaboration Plan: The specific plan for collaboration, including the specific working groups this project will participate to will be detailed in the deliverable "Collaboration Plan" due at M6. The collaboration activities and revision of the plan will be reported in the due Dissemination Reports by period. [month 6]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
MS1	Project plan	1	3	Plans for dissemination, collaboration, risk and assestment
MS3	Project design	2	6	Documents with the detailed designs of technical WPs.
MS4	First prototyping and starting pilots	2	12	First releases of the different methodology, roadmap and tools of ARTIST solution. Definition of pilots and setting-up
MS6	Third prototyping and second pilots	2	24	Third releases of the different methodology, roadmap and tools of ARTIST solution. First implementation of pilots. First exploitation plan
MS9	Validation and benchmarking of the results	6	36	Reports assessing the benchmark by means of the project measures of success. Last version of the overall solution validated and verified. Final exploitation plan

WT3:
Work package description

Project Number [1]	317859	Project Acronym [2]	ARTIST

One form per Work Package

Work package number [53]	WP5	Type of activity [54]	RTD
Work package title	Modernization assessment		
Start month	1		
End month	30		
Lead beneficiary number [55]	2		

Objectives

The main objective of this WP is to provide a set of methods and tools that will support companies on the assessment for the modernization of their software towards a Cloud delivery model, sustaining them on the migration strategy and providing the required tools to analyse the impact of the potential transformation of the software in the company.
The modernization of the software and its delivery will be analyzed under two different, but interrelated, dimensions: one focusing on Technology (architecture, performance, reliability, data schema, and so on) and another one on Organisational & Business aspects (pricing model, market addressed, organisational processes, etc). The business model offered by the organization (based on the delivery of software artefacts) will change from a product to a service.
After the assessment, the assessed organizations will be able to visualize a maturity map where the position of their current business service is showed, as well as the position (in terms of technology modernization and business model changes) to be located once the migration takes place.
In addition, the modernization assessment will support the analysis of such initial and desired situations through a set of impact assessment tools. The main purpose of these tools is to establish a collection of objective measurable metrics and indicators on which to estimate the feasibility of the migration. Furthermore, the figures will be presented in measurement units and concepts easily shared, recognised and acknowledged by stakeholders.
Summarizing, the main objectives of this WP are:
• To define and implement a method for characterising the technical and business dimensions of the current legacy application, in particular those concerns related with its modernisation towards a selected target
• To establish a set of common metrics and indicators that characterise relevant technical aspects of the legacy application and the business model before and after the migration takes place.
• To develop a set of tools that will automatically evaluate the figures related to the modernization processes such as: resources and effort required, impact in the company processes, estimated ROI and payback, operational risks.

Description of work and role of partners

Task 5.1: Study of available benchmarking models, tools and techniques that analyse the maturity of an application (M1-M4/Leader: TECNALIA)
This task will focus on the study of existing benchmarking models, best practices, tools and techniques that analyse the different aspects that characterize the maturity of an application, be it cloud or not. To do so, a technology watch will be established, in order to be always updated on the latest trends, best and worst practices and therefore catalogue them in technology, technical and business issues and extract from the possible metrics, indicators and the range values. As a result an analysis of current approaches for measurement of application maturity will be obtained.

Task 5.2: Business and Technical Modernization Assessment (M5-M30/Leader: TECNALIA)
This task will focus on the characterization of the metrics and indicators (metrics weighed and combined) of the business and technical dimension of the legacy application and the company, such as the pricing model, the targeted market, the product sustainability, SLAs, legal issues, metrics that describe the legacy application source code and data schema complexity, compliance with baseline legacy technologies, gap estimation between legacy and target baseline, etc. This assessment requires artefacts such as source code

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Work package description

and architecture, development process, GUI, source environment and desired environment, source and target infrastructure, covered and uncovered non-functional requirements.
This task also includes the development of a supporting software application for the migration assessment where the initial and the final desired situation of the application are rendered from a set of metrics and indicators values. This tool will be provided both as-a-service and as-a-good.

Task 5.3: Technical Feasibility Tool (M5-M30/Leader: ATOS)
The main objective of this task is the development of a supporting tool that
1) analyse how coupled and complex (i.e. McCabe's complexity degree) the legacy source code is
2) analyse the legacy data schema and sources
3) create high level models of the legacy source code
4) based on the desired target cloud platform, provide an estimation of the work (effort) that would be needed to transform it to that target platform

Task 5.4: Business Feasibility Tools (M5-M30/Leader: ENG)
The goal of this task is to develop a set of tools that will aid the management level take the decision whether to tackle the migration to SOA and/or Cloud based on objective economic parameters. In order to do so, in this task ARTIST will develop a cost-benefit analysis tool (including ROI and Payback) that will cover the specific issues related to this shift of business model, as well as means to calculate the impact and implications of changing business models in a company that is already sustainable.

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	ATOS	15.00
2	TECNALIA	34.00
3	INRIA	0.00
4	Fraunhofer	0.00
5	TUWIEN	0.00
6	ENG	25.00
7	ICCS	0.00
8	SPARX	0.00
9	ATC	0.00
10	SPIKES	0.00
	Total	74.00

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D5.1.1	D5.1.1 Specification of the Business and Technical Modernization assessment in ARTIST M12	2	6.00	R	CO	12
D5.1.2	D5.1.2 Specification of the business and technical modernization assessment in ARTIST M24	2	4.00	R	CO	24

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List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D5.1.3	D5.1.3 Specification of the business and technical modernization assessment in ARTIST M30	2	4.00	R	CO	30
D5.2.1	D5.2.1 Business and Technical Modernization assessment tool M12	2	9.00	P	PU	12
D5.2.2	D5.2.2 Business and Technical Modernization assessment tool M24	2	9.00	P	PU	24
D5.2.3	D5.2.2 Business and Technical Modernization assessment tool M30	2	6.00	P	PU	30
D5.3.1	D5.3.1 Technical feasibility tools M12	1	6.00	P	PU	12
D5.3.2	D5.3.2 Technical feasibility tools M24	1	6.00	P	PU	24
D5.3.3	D5.3.3 Technical feasibility tools M30	1	4.00	P	PU	30
D5.4.1	D5.4.1 Business feasibility tool M12	6	7.00	P	PU	12
D5.4.2	D5.4.2 Business feasibility tool M24	6	8.00	P	PU	24
D5.4.3	D5.4.3 Business feasibility tool M30	6	5.00	P	PU	30
		Total	74.00			

Description of deliverables

D5.1.1) D5.1.1 Specification of the Business and Technical Modernization assessment in ARTIST M12: This deliverable will include the definition of the ARTIST modernization assessment including how to perform and what to measure. All the metrics and indicators will be defined for both business and technical dimensions, and the process on how to perform the assessment will be also defined [month 12]

D5.1.2) D5.1.2 Specification of the business and technical modernization assessment in ARTIST M24: Updating of the specification of the business and technical modernization assessment in ARTIST at M24 [month 24]

D5.1.3) D5.1.3 Specification of the business and technical modernization assessment in ARTIST M30: Final version of the specification of the business and technical modernization assessment in ARTIST at M30 [month 30]

D5.2.1) D5.2.1 Business and Technical Modernization assessment tool M12: The ARTIST assessment tool will provide an automatic way for performing the assessment, providing as a result the initial and the desired situations for the application. This deliverable will include a design document. [month 12]

D5.2.2) D5.2.2 Business and Technical Modernization assessment tool M24: New iteration of the assessment tool development [month 24]

D5.2.3) D5.2.2 Business and Technical Modernization assessment tool M30: Final prototype of the assessment tool [month 30]

D5.3.1) D5.3.1 Technical feasibility tools M12: These tools will analyse the complexity and coupling of the source code of the legacy product, its data schema and sources, and will create high level abstract models out of the legacy source code that address the concerns related to its migration into the desired target cloud platform, providing an estimation of the work (effort) that would be needed to transform the legacy product into that target platform. [month 12]

D5.3.2) D5.3.2 Technical feasibility tools M24: New iteration of technical feasibility tools development [month 24]

D5.3.3) D5.3.3 Technical feasibility tools M30: Final prototype of the technical feasibility tools [month 30]

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D5.4.1) D5.4.1 Business feasibility tool M12: This deliverable will include a cost-benefit analysis tool (including ROI and Payback) that will cover the specific issues related to the shift of business model, and the impact on the business processes of the company [month 12]

D5.4.2) D5.4.2 Business feasibility tool M24: New iteration of the business feasibility tool development [month 24]

D5.4.3) D5.4.3 Business feasibility tool M30: Final prototype of business feasibility tool [month 30]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
MS4	First prototyping and starting pilots	2	12	First releases of the different methodology, roadmap and tools of ARTIST solution. Definition of pilots and setting-up
MS5	Second prototyping and first pilots	2	18	Second releases of the different methodology, roadmap and tools of ARTIST solution.
MS6	Third prototyping and second pilots	2	24	Third releases of the different methodology, roadmap and tools of ARTIST solution. First implementation of pilots. First exploitation plan
MS7	Final prototyping	1	30	Final releases of the different methodology, roadmap and tools of ARTIST solution

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Project Number [1]	317859	Project Acronym [2]	ARTIST

One form per Work Package

Work package number [53]	WP6	Type of activity [54]	RTD
Work package title	Modernisation Blueprint, methodology and integration		
Start month	1		
End month	33		
Lead beneficiary number [55]	7		

Objectives

This WP aims to define the roadmap (methodology, steps, timing, guidelines, etc) ARTIST users should follow to perform the migration of their legacy products. In case of a viable migration, the concrete steps, from the analysis of the legacy product to the processing of new software components ready for deployment, need to be defined. Unlike current existing migration approaches, in case of migrating to a service based software approach, both architecture and organizational and business model modernization need to be considered. WP6 will receive the input from WP5 regarding the characterization of different “situations” where an application can be as an “initial situation” and as a “final situation”.
Not all companies own the same maturity at technology and/or organizational & business level, whereby a common framework for migrating into the cloud paradigm need to be established. Upon the definition of the common phases of the ARTIST methodology, a set of supporting tools (handbooks, guidelines, tools) will be developed.
Since this WP will define the ARTIST migration methodology and will acquire a comprehensive overall vision of the ARTIST migration techniques and tools, this WP will also provide the integrated ARTIST conceptual architecture, upon the baseline of Eclipse platform, constituted as a suite of Eclipse-based technologies and plug-ins.
The objectives of this WP are:
• Definition of a generic process in order to migrate the legacy application to the target framework
• Creation of the suitable supporting material (like handbook and tools)
• Integrate the ARTIST conceptual architecture

Description of work and role of partners

Task 6.1: Definition of roadmap components (basic steps for migrating documentation, code, etc.) (M1-M3/Leader: ICCS)
This task will identify and analyze the different needed components to define a generic roadmap for software migration into a cloud environment. Therefore, several topics and matters will be considered both at technical and at business level.
Besides, different existing migration approaches will be analyzed (Amazon Migration strategy, SMART, IBM SOMA, REMICS …) and extended in order to make ARTIST approach to SOA and Cloud compliant. These components will constitute the main building blocks for the ARTIST methodology. Moreover, one of the baselines for this definition of migration roadmap components and methodology phases will be the OMG Architecture Driven Modernisation (ADM).

Task 6.2: ARTIST Methodology definition phase (M1-M30/Leader: TECNALIA)
The ARTIST Methodology will be defined and developed in this task. Even if not all companies have the same maturity at technology or organizational & business level and therefore a “one size fits all” approach or a “big bang approach” cannot be suggested, every application when migrated to cloud faces similar challenges on architectures, SLAs requirements, security requirements, scalability requirements, change in the organizational & business processes, etc. Taking this into account the lifecycle of the methodology including its phases, purpose, activities to be performed, inputs, outputs, tools or techniques suited for each phase, and templates, will be developed.

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Task 6.3: ARTIST methodology supporting material (handbook, tools (such as EPF based process tool)) (M1-M33/Leader: ICCS)
This task will provide developers with a methodology process framework tool. This tool, based on EPF (Eclipse Process Framework) and standards such as SPEM2.0, will guide ARTIST users in the migration process; by suggesting them the steps to be executed each time, as well as the inputs, outputs, roles expected in that task and templates or tools suggested. Whenever a step is finalized and marked as such, the tool will advance to the next step, following always the same procedure. This tool could be understood as a BPM one, integrated in the ARTIST tool chain.
Additionally, ARTIST will provide the scientific community with a handbook on the application of the methodology and a cookbook with the lessons learned by ARTIST partners.

Task 6.4: ARTIST Integrated Conceptual Architecture (M1-M30 /Leader: ATOS)
This task will define the integrated ARTIST conceptual architecture, aiming at providing a comprehensive and integrated functional description of the ARTIST technical framework, constituted by the ARTIST techniques, tools and artefacts required to instantiate the ARTIST migration methodology and processes. The purpose of this integrated conceptual architecture is to ensure a seamlessly conceptual integration between the different ARTIST techniques and tools, in particular guaranteeing the reifying of ARTIST migration methodology. This task will focus on the alignment of tool interfaces, tool extensions, artefacts exchange and sharing, identification of functional gaps, etc.

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	ATOS	21.00
2	TECNALIA	23.00
3	INRIA	2.00
4	Fraunhofer	10.00
5	TUWIEN	0.00
6	ENG	0.00
7	ICCS	35.00
8	SPARX	0.00
9	ATC	0.00
10	SPIKES	6.00
	Total	97.00

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D6.1	D6.1 Analysis of current migration approaches	7	3.00	R	PU	4
D6.2.1	D6.2.1 ARTIST Methodology M12	2	16.00	R	CO	12
D6.2.2	D6.2.2 ARTIST Methodology M24	2	10.00	R	CO	24
D6.2.3	D6.2.3 ARTIST Methodology M30	2	5.00	R	CO	30

WT3:
Work package description

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D6.3.1	D6.3.1 ARTIST methodology process framework M12	7	13.00	P	PU	12
D6.3.2	D6.3.2 ARTIST methodology process framework M24	7	12.00	P	PU	24
D6.3.3	D6.3.3 ARTIST methodology process framework M30	7	8.00	P	PU	30
D6.4.1	D6.4.1 ARTIST integrated architecture M15	1	14.00	R	PU	15
D6.4.2	D6.4.2 ARTIST integrated architecture M33	1	16.00	P	PU	33
		Total	97.00			

Description of deliverables

D6.1) D6.1 Analysis of current migration approaches: This deliverable will include an analysis of the current approaches for software modernization and the specification of the building blocks of the ARTIST methodology components [month 4]

D6.2.1) D6.2.1 ARTIST Methodology M12: ARTIST methodology will be defined, including phases, purpose, inputs and outputs of its phase, etc. This deliverable will also include the handbook on the ARTIST application of the methodology and a cookbook with the lessons learned. Severak version of the methodology will be provided by feedback from the every development and assessment phase. [month 12]

D6.2.2) D6.2.2 ARTIST Methodology M24: Third version of ARTIST methodology [month 24]

D6.2.3) D6.2.3 ARTIST Methodology M30: Final version of ARTIST methodology [month 30]

D6.3.1) D6.3.1 ARTIST methodology process framework M12: This tool, based on EPF (Eclipse Process Framework) and standards such as SPEM2.0 will provide an automatic way for supporting the deployment of the ARTIST methodology, guiding the developers in the process [month 12]

D6.3.2) D6.3.2 ARTIST methodology process framework M24: Third version of methodology process framework [month 24]

D6.3.3) D6.3.3 ARTIST methodology process framework M30: Final version of methodology process framework [month 30]

D6.4.1) D6.4.1 ARTIST integrated architecture M15: This deliverable will be the functional description and conceptual architecture of all the results obtained in ARTIST; and the integrated framework of the outcomes achieved in the other technical workpackages while on the other hand. [month 15]

D6.4.2) D6.4.2 ARTIST integrated architecture M33: Final version of the conceptual architecture and integrated framework of ARTIST results. [month 33]

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Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
MS2	Project definition and baseline	1	4	Plans for Project Management, web page, collaborative tools setting up, SOTA, requirements
MS4	First prototyping and starting pilots	2	12	First releases of the different methodology, roadmap and tools of ARTIST solution. Definition of pilots and setting-up
MS6	Third prototyping and second pilots	2	24	Third releases of the different methodology, roadmap and tools of ARTIST solution. First implementation of pilots. First exploitation plan
MS7	Final prototyping	1	30	Final releases of the different methodology, roadmap and tools of ARTIST solution
MS8	Final pilots	6	33	Final pilot implementation based on final version of solution

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Work package description

Project Number [1]	317859	Project Acronym [2]	ARTIST

One form per Work Package

Work package number [53]	WP7	Type of activity [54]	RTD
Work package title	Meta-modelling for target definition and cloud delivery		
Start month	1		
End month	30		
Lead beneficiary number [55]	7		

Objectives

The main objective of this WP is to provide and/or extend existing meta-models for the modelling of the target infrastructures in which the legacy applications will be deployed. Through the implemented support, all the relevant information needed for migration and deployment will be included, in order to identify whether the target environments are suitable for a specific legacy application based on its requirements. Even if the migrated product can be deployed within compatible Cloud providers, each provider offers specific features and resources, and requires particular deployment artefacts that specify the actual delivery.
The purpose is to model any relevant feature of the target environments, including common Cloud offering features and resources, but also other concerns like security capabilities, performance issues, etc.
The main objectives are:
• To analyze existing meta-modelling approaches and compare them with the required modelling needs, gap analysis and selection of a baseline meta-modelling approach;
• Extend existing meta-modelling approaches and knowledge for describing Cloud and SOA infrastructures, their features, resources, particular offerings and deployment facilities
• Extend these meta-models exploiting existing knowledge regarding performance requirements of most prominent application types
• To analyze major cloud infrastructures, both at Infrastructure (IaaS) and Platform level (PaaS), in order to identify common features as well as differences (either in term of semantic of the functionality offered and in performance); Categorize providers with respect to their specific capabilities in these types
• Identify whether a specific provider is suited for hosting the legacy application
• Exploit any advances in Cloud and Platform offerings, that can ease the migration process through readymade, pluggable components or functionalities

Description of work and role of partners

Task 7.1: Definition of performance stereotypes (M1-M18/Leader: ICCS)
This task has the aim to identify the basic performance stereotypes of applications and the features of the Cloud/SOA infrastructures that may host them, or the ways the latter access and use the resources, in order to come up with a limited number of categories in which the applications may later be classified. The main goal of this process is to have these categories of well-known behaviour, in which the applications will be classified (in Task 7.4) and for which the ratings of the IaaS/PaaS providers will be obtained (in Task 7.2). In order to do so, this task will take under consideration existing benchmarking approaches and categorization, identify and possibly extend the most prominent with regard to service oriented aspects of the transformed legacy applications. The overall information may also be useful for the cloud deployment selection taking place in WP9.

Task 7.2: IaaS and PaaS characteristics and metamodelling (M1-M30 /Leader: ENG)
This task will focus on identifying and incorporating into our meta-models the key characteristics of IaaS and PaaS providers that are of interest for the legacy applications. These include the performance of these entities concerning the stereotypes derived from the previous task, along with any other features that can or must be used by the cloud migrated version of the legacy application. Moreover, this can be combined with the target framework derived from the Forward Engineering phase in order to identify if a specific IaaS or PaaS provider is capable of hosting the legacy application. Additionally, this task adds an uniform metamodel specification of:
• Cloud offering resources and features.
• Cloud platform delivery specifications and artefacts.

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Those extensions provide common and universal models to specify offered resources and features, delivery specification and artefacts regardless particular Cloud provider infrastructures.

Task 7.3: Integration with 3rd party components, services and cloud delivery platform (M1-M18/Leader: SPIKES)
This task will focus on the reusability of 3rd party components and services that are offered over the Internet as a service and can reduce the cost for the migration of the legacy application. It will utilize information derived from the Reverse and Forward Engineering phase, and the delta produced from them regarding the new functionalities that are needed to be supported by the legacy applications due to the change in the environment (from dedicated internal resources to shared virtualized ones). This may refer to specific services that are available for monitoring, accounting etc., or more specific products like distributed and scalable databases as a service, clusters as a service etc. Existing offerings will be taken under consideration and inclusion in the cloud deployed version of the application will be performed (for example by implementation of necessary bridges or interfaces).

Task 7.4: Classification of transformed legacy components to the performance stereotypes (M12-M30/Leader: ICCS)
This task will focus on the classification and identification of the transformed, service oriented versions of the legacy application components (as these are produced from WP9) to the performance stereotypes defined in T7.1 This classification will be based on Artificial Intelligence techniques for automating the process and will be made feasible through the development of a suitable tool. By combining the information produced from this task and the PaaS/IaaS ratings on the performance stereotypes developed in T7.2, the deployment process (taking place in WP9) may result to optimal selection of the target infrastructure/platform

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	ATOS	6.00
2	TECNALIA	6.00
3	INRIA	8.00
4	Fraunhofer	6.00
5	TUWIEN	12.00
6	ENG	24.00
7	ICCS	33.00
8	SPARX	6.00
9	ATC	0.00
10	SPIKES	9.00
	Total	110.00

List of deliverables

Deliverable Number [61]	Deliverable Title	Lead beneficiary number	Estimated indicative person-months	Nature [62]	Dissemination level [63]	Delivery date [64]
D7.1	D7.1 Definition and extension of performance stereotypes M18	7	14.00	R	PU	18
D7.2	D7.2 PaaS/IaaS metamodelling requiremente and SOTA	7	4.00	R	PU	4

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D7.2.1	D7.2.1 PaaS/Iaas metamodelling framework and tools M12	6	20.00	P	PU	12
D7.2.2	D7.2.2 PaaS/Iaas metamodelling framework and tools M24	6	20.00	P	PU	24
D7.2.3	D7.2.3 PaaS/Iaas metamodelling framework and tools M30	6	21.00	P	PU	30
D7.3	D7.3 Analysis and incorporation of third party offerings	10	9.00	R	PU	18
D7.4	D7.4 Classification methods and tools M30	7	22.00	P	PU	30
		Total	110.00			

Description of deliverables

D7.1) D7.1 Definition and extension of performance stereotypes M18: Based on D7.2 and with regard to existing performance stereotypes and it is desrcibed how to extend them in order to include the specificities of legacy applications and cloud environments. [month 18]

D7.2) D7.2 PaaS/IaaS metamodelling requiremente and SOTA: This report will aim at identifying the specific metamodelling requirements of the ARTIST project and analyze existing approaches to the problem [month 4]

D7.2.1) D7.2.1 PaaS/Iaas metamodelling framework and tools M12: This report will be twofold: • aiming at validating the benchmarking of selected PaaS/IaaS and the initial validation of stereotypes (in M12 and 24 versions) • creating the complete metamodelling usage framework for describing IaaS/PaaS providers and incorporating them in the ARTIST platform (all versions) [month 12]

D7.2.2) D7.2.2 PaaS/Iaas metamodelling framework and tools M24: Updated version of the metamodelling framework and tools [month 24]

D7.2.3) D7.2.3 PaaS/Iaas metamodelling framework and tools M30: Final version of the metamodelling framework and tools [month 30]

D7.3) D7.3 Analysis and incorporation of third party offerings: This deliverable will include an analysis of service offerings that may be used by legacy applications for specific purposes and the necessary tools to include them in the cloud deployable version of the application. [month 18]

D7.4) D7.4 Classification methods and tools M30: This deliverable will report the related work in the respective field and the detailed methods used in the ARTIST project for extending the state of the art. It will also provide the tools to characterize the legacy application components to the predefined stereotypes [month 30]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
MS2	Project definition and baseline	1	4	Plans for Project Management, web page, collaborative tools setting up, SOTA, requirements

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Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
MS4	First prototyping and starting pilots	2	12	First releases of the different methodology, roadmap and tools of ARTIST solution. Definition of pilots and setting-up
MS5	Second prototyping and first pilots	2	18	Second releases of the different methodology, roadmap and tools of ARTIST solution.
MS6	Third prototyping and second pilots	2	24	Third releases of the different methodology, roadmap and tools of ARTIST solution. First implementation of pilots. First exploitation plan
MS7	Final prototyping	1	30	Final releases of the different methodology, roadmap and tools of ARTIST solution

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Project Number [1]	317859	Project Acronym [2]	ARTIST

One form per Work Package

Work package number [53]	WP8	Type of activity [54]	RTD
Work package title	Legacy Product Analysis by Reverse Engineering		
Start month	1		
End month	30		
Lead beneficiary number [55]	3		

Objectives

WP8 addresses the whole process of discovering all the relevant information out of the different software artefacts composing the legacy systems to be treated within the ARTIST framework, and representing this information in an understandable and reusable way for the remainder of the ARTIST process. A model-based approach will be followed in all the steps of this process. To this intent, already existing components provided by the open source Eclipse-MDT MoDisco project are going to be reused, customized and extended according to the ARTIST context. Various metamodels produced in ARTIST are also going to be considered here.
In short, this reverse engineering phase involves:
• Identifying and classifying the main different "families" (i.e.; natures) of legacy artefacts, according to the legacy systems they are part of, to be treated following the ARTIST approach;
• Defining the appropriate methodology and underlying techniques for model discovery & understanding from considered legacy systems, favouring the reusability of the specified components;
• Building the tool support for applying this methodology and concretely using these techniques, to be delivered and integrated as part of the ARTIST overall framework.
Within the ARTIST overall approach (following the previous "Assessment" phase), this "Reverse Engineering" phase precedes the next "Forward Engineering" phase, both being part of the global "Technical & Business Analysis" phase.

Description of work and role of partners

Task 8.1: Classification of legacy artefacts (M1-M12/Leader: INRIA)
The objective of this task is twofold. Firstly, it consists in identifying more precisely the different natures of legacy artefacts to be considered in a Reverse Engineering process (focusing on the types of legacy system addressed by ARTIST), e.g.; source code, configuration files, data files, documentation, existing models, etc. Secondly, based on this, a taxonomy is going to be proposed highlighting the main different types of legacy artefacts according to their corresponding characteristic and properties. Such a nature-based classification is very useful for guiding the design and implementation of model discovery technologies, as performed in Task 8.2.

Task 8.2: Model discovery from legacy artefacts (M1-M30/Leader: INRIA)
The objective of this task is to provide the required support in terms of methodology and tooling for performing the raw information extraction from the different legacy artefacts to be treated within the ARTIST framework. The defined methodology is going to take into account the classification realized in Task 8.1. The required model-based techniques for representing all the necessary low-level information as complete models are going to be specified within this context, and the corresponding tooling developed accordingly. Thus, components allowing the generation of such initial models from legacy systems relying on the Java and C# technologies are going to be implemented as part of this task. The obtained models can conform to either technology-specific (e.g.; Java, C#) or generic (e.g.; OMG KDM, etc) metamodels, according to the requirements of Task 8.3 for exploiting these initial models as inputs to the next step of the process.

Task 8.3: Model understanding from discovered models (M6-M30/Leader: TUWIEN)
The objective of this task is to provide the required support in terms of methodology and tooling for performing the information selection, and its efficient expression, from the initial models of legacy systems as produced thanks to Task 8.2. A general methodology is going to be defined for determining the relevant viewpoints/views to be extracted out of these previously discovered models. The required model-based techniques for

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representing this higher-level information as understandable views on the legacy systems are going to be specified within this context, and the corresponding tooling developed accordingly. Thus, components facilitating the building of different views are going to be implemented as part of this task (supporting both modular extension and new view generation by adaptation): e.g.; views emphasizing on SOA/Cloud-specific concerns, security properties, J2EE information, GUI items, views describing architecture and/or data using UML, or other metamodels developed in the context of ARTIST

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	ATOS	24.00
2	TECNALIA	15.00
3	INRIA	32.00
4	Fraunhofer	12.00
5	TUWIEN	20.00
6	ENG	0.00
7	ICCS	0.00
8	SPARX	16.00
9	ATC	0.00
10	SPIKES	12.00
	Total	131.00

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D8.1	D8.1 Taxonomy of legacy artefacts M12	3	5.00	R	PU	12
D8.2	D8.2 Methodology and techniques for model discovery M18	3	12.00	R	PU	18
D8.2.1	D8.2.1 Components for Model Discovery from Legacy Technologies M12	3	18.00	P	PU	12
D8.2.2	D8.2.2 Components for Model Discovery from Legacy Technologies M24	3	18.00	P	PU	24
D8.2.3	D8.2.3 Components for Model Discovery from Legacy Technologies M30	3	20.00	P	PU	30
D8.3	D8.3 Methodology and techniques for model understanding M18	3	10.00	R	PU	18
D8.3.1	D8.3.1 Mechanisms for Viewpoint Definition and View Extraction from Models of Legacy Artifacts M12	5	16.00	P	PU	12

WT3:
Work package description

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D8.3.2	D8.3.2 Mechanisms for Viewpoint Definition and View Extraction from Models of Legacy Artifacts M24	5	16.00	P	PU	24
D8.3.3	D8.3.3 Mechanisms for Viewpoint Definition and View Extraction from Models of Legacy Artifacts M30	5	16.00	P	PU	30
		Total	131.00			

Description of deliverables

D8.1) D8.1 Taxonomy of legacy artefacts M12: A detailed classification of the main different natures of legacy artefacts according to their corresponding characteristic and specific properties. To be then used as a base to guide the design and implementation of the Model Discovery technologies (cf. D8.2.x). [month 12]

D8.2) D8.2 Methodology and techniques for model discovery M18: Detailed specification of the global methodology and underlying model-based techniques to be considered for discovering complete low-level models out of legacy software artefacts. To be then used as a base for implementing such a dedicated support for the Java & C# technologies (cf. D8.2.x) [month 18]

D8.2.1) D8.2.1 Components for Model Discovery from Legacy Technologies M12: Concrete tool support allowing the generation of complete low-level models out of Java & C# legacy source artefacts, following the global methodology and recommendations as provided in D8.1 & D8.2. Produced models to be then used as inputs to the Model Understanding technologies (cf. D8.3.x). [month 12]

D8.2.2) D8.2.2 Components for Model Discovery from Legacy Technologies M24: New version of Java and C# technology discovery components [month 24]

D8.2.3) D8.2.3 Components for Model Discovery from Legacy Technologies M30: Final version of Java and C# technology discovery components [month 30]

D8.3) D8.3 Methodology and techniques for model understanding M18: Detailed specification of the global methodology and underlying model-based techniques to be considered for better understanding complex models, with a focus on models of legacy software artefacts. To be then used as a base for implementing a dedicated support for viewpoint definition and corresponding view extraction (cf. D8.3.x). [month 18]

D8.3.1) D8.3.1 Mechanisms for Viewpoint Definition and View Extraction from Models of Legacy Artifacts M12: Generic tool support allowing both the definition of viewpoints and the representation of the corresponding views from any kind of complex model (following the global methodology and recommendations as provided in D8.3), and additional tool support targeting specifically the definition of the project's required viewpoints and the representation of the corresponding views from the complex models (of legacy software artefacts) produced thanks to the technologies developed in D8.2. [month 12]

D8.3.2) D8.3.2 Mechanisms for Viewpoint Definition and View Extraction from Models of Legacy Artifacts M24: Updated version of viewpoint/view definition mechanism at M24 [month 24]

D8.3.3) D8.3.3 Mechanisms for Viewpoint Definition and View Extraction from Models of Legacy Artifacts M30: Final version of viewpoint/view definition mechanism at M30 [month 30]

WT3:
Work package description

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
MS4	First prototyping and starting pilots	2	12	First releases of the different methodology, roadmap and tools of ARTIST solution. Definition of pilots and setting-up
MS5	Second prototyping and first pilots	2	18	Second releases of the different methodology, roadmap and tools of ARTIST solution.
MS6	Third prototyping and second pilots	2	24	Third releases of the different methodology, roadmap and tools of ARTIST solution. First implementation of pilots. First exploitation plan
MS7	Final prototyping	1	30	Final releases of the different methodology, roadmap and tools of ARTIST solution

WT3:
Work package description

Project Number [1]	317859	Project Acronym [2]	ARTIST

One form per Work Package

Work package number [53]	WP9	Type of activity [54]	RTD
Work package title	New software generation by forward engineering		
Start month	1		
End month	30		
Lead beneficiary number [55]	5		

Objectives

This WP focuses on the establishment of forward engineering techniques to migrate and to deploy the models produced in the reverse engineering process (cf. WP 8) to new platforms by the extensive application of model transformations. The forward engineering phase is divided into the following steps for which dedicated support is developed in this WP:
1. Specification of the requirements for the target system
2. Generation (including optimization) of the target system from the legacy application models
3. Deployment of the target system to the target platform by model-to-text (M2T) technologies.
In particular, the modernization engineer should be enabled to provide a model-based specification of the target system to select a concrete configuration out of different possibilities. The target system specification is the input to configure model transformations for producing the actual target system. One important aspect is the optimization of the target system in order to realize the modernization goals. Therefore, additional transformations are needed to optimize the generated target system by using optimization patterns which should be derived from reference projects, e.g., the use cases defined in WP12. By this, we aim to establish a collection of optimization patterns tailored to migrating legacy applications to the Cloud. The optimization patterns have to be generalized and formalized in terms of model transformations. Deployment artefacts for Cloud target infrastructures can be created using Forward Engineering (FE) transformation techniques, in particular using M2T technologies. Finally, transformations needed for establishing the transition from the legacy system to the initial target system, its optimization by using static optimization patterns for the design artefacts as well as by using dynamic deployment space exploration, have to be integrated in a coherent tooling to allow modernization engineers to developing new forward engineering processes as well as to adapting existing ones.
Furthermore, a special focus is put on how to realize the goals of the software modernization in terms of non-functional requirements such as performance. For this, not only a fixed deployment strategy given by the modernization engineer should be followed, but means for exploring the deployment space are especially needed for Cloud infrastructures. In order to allow for such support, the deployment process should be also automated by using model-based techniques and the execution of the deployed software has to be monitored in order to get the necessary feedback to evaluate different deployment strategies

Description of work and role of partners

Task 9.1: Target specification: expression of the requirements (M1-M12/Leader: TUWIEN)
This task comprises the establishment of a modelling language to describe the target specification, in particular aligned and extending SOA/Cloud meta-models provided by WP7. This modelling language should allow the selection of different architectural patterns, design alternatives, different platform providers, and finally, deployment strategies including also runtime re-configuration possibilities. However, we do not aim for creating a completely new modelling language. The goal is to reuse existing modelling language standards such as feature models with necessary extensions.

Task 9.2: Model transformation: rules to build the models of the target software and data. (M2- M24/Leader: TUWIEN)
In this task, transformations have to be established which allow to move from the legacy models (conforming to legacy architectures and languages) to the new target platform including also a switch in the modelling language (such as switching to UML, CloudML, SoaML). Transformations are developed for the software specifications (design and deployment artefacts) as well as for runtime artefacts, such as data stored in databases, to

provide a systematic migration approach. While this task will provision of generic-purpose and parameterisable (template-based) M2M transformations, more specific and case based transformations will be provided by WP12.

Task 9.3: Optimization patterns expressed as transformations. (M8-M24/Leader: TUWIEN)
Having achieved a transition from the legacy system to the new platform, the next step is to reason about optimization rules to exploit modern features of the target platform. Therefore, our aim is to collect optimization patterns dedicated to the Cloud infrastructures and SOA-based systems which are derived from the use cases of WP12. From these use cases, we plan to extract reusable optimization patterns which should be generalized and formalized as model transformations.

Task 9.4: Target generation: production of the software components out of the obtained models. (M8-M25/Leader: TUWIEN)
Having platform independent models at hand, specific model-to-code transformations are needed to deploy the models to concrete Cloud and SOA providers. By these model-to-code transformations, technological heterogeneities should be resolved between different platform providers, notably allowing to switch between different Cloud providers. However, the goal is not to redevelop code generators for general purpose languages such as Java or C#, but to reuse and extend existing generators for Cloud/SOA infrastructures.

Task 9.5: Deployment patterns expressed as transformations. (M12-M30/Leader: ATOS)
In order to support dynamic deployment space exploration, deployment patterns have to be implemented as model transformations to automatically deploy the generated code and populate the target system, i.e., the initialization of the existing data extracted from the legacy model. This feature, of course, alleviates the burden of the modernization engineer to deploy the system artefacts manually, but also opens the door for automatically exploring different deployment possibilities. Thus, flexible deployment patterns have to be formalized in this task as automatically executable model transformations. M2T deployment patterns also create required deployment artefacts and bundle containers out of the migrated product and associated target models describing requested deployment resources and features.

Task 9.6 Migration techniques and tools. (M18-M30/Leader: TUWIEN)
Finally, tool support has to be established to allow for adapting existing forward engineering processes as well as for developing new ones for supporting the migration of other kinds of legacy applications. For offering an easy-to-use environment, we plan to integrate the established transformations in the MOMOCS transformation environment

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	ATOS	24.00
2	TECNALIA	15.00
3	INRIA	6.00
4	Fraunhofer	6.00
5	TUWIEN	41.00
6	ENG	29.00
7	ICCS	18.00
8	SPARX	27.00
9	ATC	0.00
10	SPIKES	8.00
	Total	174.00

WT3:
Work package description

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D9.1	D9.1 State of the art in modelling languages and model transformation techniques	5	6.00	R	PU	6
D9.2	D9.2 Modelling language and editor for defining target specifications	5	18.00	P	PU	12
D9.3	D9.3 Migration rules formalized as generic model transformations M24	5	40.00	P	PU	24
D9.4	D9.4 Collection of optimization patterns M24	5	10.00	R	PU	24
D9.5	D9.5 Model-to-code transformations for specific cloud infrastructures	5	20.00	P	PU	24
D9.6	D9.6 Automated deployment strategies M30	1	40.00	P	PU	30
D9.7	D9.7 Integrated environment for maintaining/developing forward engineering process M30	5	40.00	P	PU	30
		Total	174.00			

Description of deliverables

D9.1) D9.1 State of the art in modelling languages and model transformation techniques: This deliverable is a report on the state-of-the-art in model transformation engineering w.r.t. generality and customizability of transformations. It will also comprise a collection and comparison of currently available modelling languages for Cloud/SOA infrastructures and is the basis for the selection of modelling languages used in ARTIST. [month 6]

D9.2) D9.2 Modelling language and editor for defining target specifications: This deliverable is the tool support for the selected modelling languages to specify the target applications [month 12]

D9.3) D9.3 Migration rules formalized as generic model transformations M24: This deliverable comprises a set of automatically executable model transformations which implement the migration rules needed for the forward engineering process [month 24]

D9.4) D9.4 Collection of optimization patterns M24: This deliverable is a report on optimization patterns explored in the ARTIST case studies while migrating the legacy applications to Cloud/SOA infrastructures [month 24]

D9.5) D9.5 Model-to-code transformations for specific cloud infrastructures: This deliverable comprises a set of code generation templates which are tailored to specific Cloud infrastructures [month 24]

D9.6) D9.6 Automated deployment strategies M30: This deliverable comprises automatically executable transformations needed for deploying the modernized applications in specific Cloud infrastructures [month 30]

D9.7) D9.7 Integrated environment for maintaining/developing forward engineering process M30: This deliverable is represented by an integrated environment allowing the user to maintain and develop forward engineering processes by following guidelines how to successfully achieve these kinds of tasks [month 30]

WT3:
Work package description

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
MS3	Project design	2	6	Documents with the detailed designs of technical WPs.
MS4	First prototyping and starting pilots	2	12	First releases of the different methodology, roadmap and tools of ARTIST solution. Definition of pilots and setting-up
MS6	Third prototyping and second pilots	2	24	Third releases of the different methodology, roadmap and tools of ARTIST solution. First implementation of pilots. First exploitation plan
MS7	Final prototyping	1	30	Final releases of the different methodology, roadmap and tools of ARTIST solution

WT3:
Work package description

Project Number [1]	317859	Project Acronym [2]	ARTIST

One form per Work Package

Work package number [53]	WP10	Type of activity [54]	RTD
Work package title	Common migration artefacts provisioning and management		
Start month	1		
End month	36		
Lead beneficiary number [55]	4		

Objectives

The main objective of this work package is to provide the ARTIST repository infrastructure for storing and retrieving the artefacts relevant for the migration process seamlessly integrated with the ARTIST tooling, as well as to populate it with reusable general purpose artefacts required during the ARTIST migration methodology. The repository is a key part of ARTIST that acts as knowledge base in several instantiations of the ARTIST methodology.

It is extremely important for the quick uptake of ARTIST results by the community, that ARTIST offers a comprehensive tooling suite, comprising not only a bunch of techniques and tools, but also a seamlessly integrated repository populated with those generic and technology-dependent artefacts that are required to apply ARTIST on real life migration scenarios. Otherwise, ARTIST use cases and other potential communities will need to provide in advance these artefacts before applying ARTIST tools to their migration projects. Examples of required generic and technology specific artefacts are: metamodels for popular technologies such as J2EE and .NET, including metamodels for frameworks such as Swing/SWT/GWT, M2M transformations supporting RE and FE techniques, both generic (copy transformations, extracting classes, interfaces, boundary interfaces, components, patterns, etc) and technology specific (extracting EJB, Swing composites, etc), M2T transformations (Java and .NET code generation, deployment descriptors generation, etc)

The repository is also responsible for managing artefacts produced in other WPs such as general meta-models (WP7), models recovered by the reverse engineering steps in WP8 and WP12, models developed by the forward engineering steps in WP9, and transformations implementing the migration between these two kinds of models (WP9). Managing here means storage and retrieval of the versioned artefacts themselves along with their metadata, as well as recording the relationships and interdependencies between these artefacts and providing access control for the repository content.
Based on the different nature of the managed artefacts two views of the repository will be produced:
• A private repository view will integrate the repository into a development environment like e.g. Eclipse to provide developers access to all repository data and services.
• A web based public repository view will make selected reusable artefacts such as the meta models developed in WP7 that are independent of specific applications available to the developer community and a wider public

By storing this information in the repository and by making it available the reverse engineering step has to be done only once. The information in repository is to be (re)used after the initial migration.
The software lifecycle does not stop with the deployment of the migrated system. Changes in requirements, business strategy and runtime behaviour are important influences for the continued operation of a product. They necessitate changes in the software which have to be tracked in the repository. The repository will enable the subsequent evolution of the migrated system by providing suitable support to adapt the requirements, models and other artefacts of the system.
The repository will provide suitable interfaces to allow for integration with the other ARTIST framework components, as well as with other common software development environments.
The main objectives of this work package are:
• Providing an artefact repository infrastructure to support the ARTIST migration approach
• Providing a marketplace like web based public view to select content of the artefact repository that offers features like comments, tagging and rating facilities to promote the reuse of generic artefacts produced in ARTIST that are of common interest.
• Augmenting the repository with functionalities for product evolution

• Creating the needed application independent reusable artefacts not produced in other work packages
• Collecting common general-purpose artefacts produced in other technical WPs and create artefacts required by the ARTIST use cases that are not provisioned by other technical WPs

Description of work and role of partners

Task 10.1: Developing a repository for migration artefacts (M1-M30/Leader: Fraunhofer)
This task will create the repository for storing and provisioning migration artefacts. The artefacts comprise among others the source code, documentation and reverse engineered models of the legacy software system, as well as meta-models and transformations. In addition to the artefacts the repository will store the relationship between the artefacts and provide a way to visualize and query the resulting relationship graph. This will improve system understanding by providing a “knowledge inventory” and improve further migration and modernization efforts. The repository will offer access control to protect the intellectual property potentially contained in some artefacts. This task will also create appropriate interfaces to integrate the repository into existing software development environments. A prototypical implementation for Eclipse will be provided.

Task 10.2: Developing a public repository view for common migration artefacts (M12-M30/Leader: Fraunhofer)
This task will make potentially reusable artefacts stored in the repository available to the software development community via a marketplace like web interface. These reusable artefacts comprise among others the meta-models developed in WP7 and general purpose M2M, M2T transformations. This web interface will give interested parties the opportunity to browse, search, tag, comment and rate the available artefacts. The public repository web site is an important means to promote knowledge about the reusable artefacts to the public and supports artefact reuse by collecting feedback, and experiences about their application in different contexts.

Task 10.3: Develop evolution functionality (M6-M30/Leader: Fraunhofer)
This task will develop methods and tools for further changing and improving a system after migration. After the migration the repository contains the generated models of the system. With this information this task will provide a tool to analyse how future changes to the requirements impact the system on this abstract level. This includes providing a method for versioning the information in the repository and relating it to the other artefacts. Lastly, this task will provide a way to encapsulate changes to different parts of the system as so called feature sets. This information will provide developers with more knowledge about how and why different parts of the system have been changed during the implementation of requested features.

Task 10.4: Provisioning of general purpose artefacts (M12-M30/Leader: ATOS)
This task will create common general-purpose artefacts required by the ARTIST use cases during the adoption of ARTIST migration methodology and not provisioned by other technical WPs. Those artefacts and their corresponding meta-data will populate the ARTIST repository. Some of those artefacts such as the meta-models required to model legacy applications and target environments (e.g. Cloud, SOA) will be provided by WP7, WP8 and WP9. Generic parametrizable model-to-model (M2M) and model-to-text (M2T) transformations will be implemented by WP8 and WP9, but this task focuses on implementing those common artefacts shared between the ARTIST use cases, particularly M2M transformations required during reverse engineering understanding phase and the forward engineering M2M transformation phase

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	ATOS	20.00
2	TECNALIA	0.00
3	INRIA	7.00
4	Fraunhofer	33.00
5	TUWIEN	0.00
6	ENG	15.00
7	ICCS	0.00

WT3:
Work package description

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
8	SPARX	0.00
9	ATC	0.00
10	SPIKES	10.00
	Total	85.00

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D10.1	D10.1 Repository requirements	4	2.00	R	PU	4
D10.2	D10.2 Technical and information architecture of the repositories M12	4	3.00	R	PU	12
D10.3.1	D10.3.1 Repository prototype M18	4	10.00	P	PU	18
D10.3.2	D10.3.2 Repository prototype M30	4	15.00	P	PU	30
D10.4.1	D10.4.1 Methodology and techniques for artefact evolution support M18	4	10.00	P	PU	18
D10.4.2	D10.4.2 Methodology and techniques for artefact evolution support M36	4	10.00	P	PU	36
D10.5.1	D10.5.1 Inventory of common general-purpose artefacts M24	1	20.00	P	PU	24
D10.5.2	D10.5.2 Inventory of common general-purpose artefacts M30	1	15.00	P	PU	30
		Total	85.00			

Description of deliverables

D10.1) D10.1 Repository requirements: This report will document the requirements for an artefact repository in the ARTIST context covering integration with other tools, types of data to store, required metadata to track and required retrieval and search functionality [month 4]

D10.2) D10.2 Technical and information architecture of the repositories M12: This report describes the architecture of the private repository including the information architecture and the architecture of the public repository web interface [month 12]

D10.3.1) D10.3.1 Repository prototype M18: This deliverable is a working prototype that comprises the second iteration of the internal repository including the first iteration of the public repository web interface as described in D10.2 as well as developer documentation [month 18]

D10.3.2) D10.3.2 Repository prototype M30: Final version of the repository and the public repository web interface including the finished user documentation [month 30]

D10.4.1) D10.4.1 Methodology and techniques for artefact evolution support M18: This report describes the techniques and tool support for artefact evolution support as well as the methodology how to use these techniques [month 18]

WT3:
Work package description

D10.4.2) D10.4.2 Methodology and techniques for artefact evolution support M36: This report describes the techniques and tool support for artefact evolution support as well as the methodology how to use these techniques [month 36]

D10.5.1) D10.5.1 Inventory of common general-purpose artefacts M24: This report provides an inventory of all potentially reusable artefacts produced in ARTIST and identifies missing artefacts. The artefacts themselves are published in the public repository [month 24]

D10.5.2) D10.5.2 Inventory of common general-purpose artefacts M30: Final provisioning of artefacts into the ARTIST public repository at M30 [month 30]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
MS2	Project definition and baseline	1	4	Plans for Project Management, web page, collaborative tools setting up, SOTA, requirements
MS4	First prototyping and starting pilots	2	12	First releases of the different methodology, roadmap and tools of ARTIST solution. Definition of pilots and setting-up
MS5	Second prototyping and first pilots	2	18	Second releases of the different methodology, roadmap and tools of ARTIST solution.
MS6	Third prototyping and second pilots	2	24	Third releases of the different methodology, roadmap and tools of ARTIST solution. First implementation of pilots. First exploitation plan
MS7	Final prototyping	1	30	Final releases of the different methodology, roadmap and tools of ARTIST solution

WT3:
Work package description

Project Number [1]	317859	Project Acronym [2]	ARTIST

One form per Work Package

Work package number [53]	WP11	Type of activity [54]	RTD
Work package title	Migrated product testing, validation and certification		
Start month	1		
End month	30		
Lead beneficiary number [55]	5		

Objectives

This WP focuses on the post-migration phase, namely on the quality of the modernized software has to be evaluated with respect to two major aspects:
1. The behavioural equivalence between the legacy software and the modernized software has to be shown.
2. Non-functional requirements have to be evaluated for the modernized software in order to ensure that the goals of the migration have been actually achieved.
For tackling the first aspect, i.e., to show the behavioural equivalence, we plan to employ regression tests. In case regression tests are already available for the legacy application, these tests have to be migrated to the modernized software which leads again to another migration project. Therefore, we aim to provide also support to migrate test cases from legacy systems to the modernized system. In case no or insufficient regression tests are available for the legacy system, means are needed to derive regression tests for the legacy system as well as for the modernized system. Thus, we aim at deriving tests from the reverse engineered models for the legacy system as well as for the modernized system. Finally, not only test cases based behavioural equivalence testing should be provided, but also end-user based testing is aimed to complement the test cases based approach. By running the legacy application and the modernized system in parallel, the answers from both systems to user requests can be compared.
For validating the second aspect, i.e., the realization of the non-functional requirement goals, we aim at providing support to derive model-based reports which build on existing well-established metrics for measuring non-functional requirements. By extracting primitive metrics from the systems as models, we build the basis for tools which calculate more advanced metrics by combining the basic metrics. Again, the derivation of advanced metrics is formalized as model transformations. Finally, having the reports as models allows reusing model-based tools for analyzing and visualizing the results.
Another aspect covered in this WP is the development of a certification model. This model will at least contain fundamental roles, activities, and artefacts that are necessary for Service based Software providers under the cloud delivery model. It will be based on already existing maturity models as far as they are applicable and comprehensive in the context of SaaS and cloud and extended in topics not covered by the current ones.

Description of work and role of partners

Task 11.1: Testing methods & tools for verifying behavioural equivalence – test cases based approach (M1-M30/ Leader: TUWIEN)
This task comprises the establishment of migration means to transform test cases for the legacy system into test cases for the modernized system. Furthermore, we aim in this task to produce new test cases by deriving from the model-based representation of the software new test cases in order to validate the behavioural equivalence also for systems where no or only insufficient test cases are available.

Task 11.2: Testing methods & tools for verifying behavioural equivalence – end-user based approach (M3-M24/ Leader: TUWIEN)
This task comprises the establishment of an architecture which allows to run the legacy system and the new system in parallel and to distribute user requests to both systems. Furthermore, a controlling system is needed that monitors if there is a deviation of the answers from the new system w.r.t. the legacy application.

Task 11.3: Testing methods & tools for verifying non-functional requirements (M6-M30/ Leader: TUWIEN)

WT3:
Work package description

For validating that the goals of the modernization process have been realized, methods and tools have to be established which allow to reason about non-functional requirements as well. Based on well-established metrics, we aim to provide extractor tools which are able to compute the metrics for the legacy application (this support is also needed for analysing the legacy application – cf. WP8) as well as for the modernized application. Having this raw data at hand, again transformations are envisioned that are able to (1) combine basic metrics into more complex ones and (2) to visualize the metrics within appropriate diagrams or other visualization techniques.

Task 11.4: SbSp (Service based Software providers) certification model. (M1-M30/ Leader: TECNALIA)
This task will deal with the definition of the certification structure and content. On the one hand, how the content of the model will be structured need to be set (Process Areas, levels, goals, best practices…) and on the other hand the content has to be developed and structured under that model. The content of the SbSp certification model will include information and content coming from existing certification models and new aspects and concepts not covered by the existing certification models. Along with the certification model (in terms of content) a certification process will be also developed. Different phases on how the certification will be implemented will be developed. In order to facilitate the implementation of such a certification process, supporting tools (automatic questionnaires, templates, etc) will be developed

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	ATOS	0.00
2	TECNALIA	24.00
3	INRIA	3.00
4	Fraunhofer	0.00
5	TUWIEN	39.00
6	ENG	0.00
7	ICCS	12.00
8	SPARX	0.00
9	ATC	0.00
10	SPIKES	0.00
	Total	78.00

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D11.1	D11.1 Methodology and techniques for deriving test cases from models M30	5	13.00	P	PU	30
D11.2	D11.2 Methodology and architecture for end-user based testing M24	5	10.00	P	PU	24
D11.3.1	D11.3.1 Methodology and Environment for evaluating migration success M8	5	5.00	R	PU	8

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D11.3.2	D11.3.2 Methodology and Environment for evaluating migration success M30	5	12.00	P	PU	30
D11.4.1	D11.4.1 ARTIST SbSp certification model M6	2	3.00	R	CO	6
D11.4.2	D11.4.2 ARTIST SbSp certification model M24	2	20.00	P	CO	24
D11.4.3	D11.4.3 ARTIST SbSp certification model M30	2	10.00	P	CO	30
D11.5	D11.5 Migration support for test cases	5	5.00	R	PU	12
		Total	78.00			

Description of deliverables

D11.1) D11.1 Methodology and techniques for deriving test cases from models M30: This deliverable includes on the one hand a state-of-the-art survey how to derive test cases from models and on the other hand, based on this survey, an appropriate methodology is developed to derive equivalent test cases from models for the legacy application as well as for the modernized application. [month 30]

D11.2) D11.2 Methodology and architecture for end-user based testing M24: In this deliverable, a methodology and an abstract as well as concrete architecture for the ARTIST use cases is developed which allows to run the legacy application and the modernized application in parallel to reason about behavioural equivalence [month 24]

D11.3.1) D11.3.1 Methodology and Environment for evaluating migration success M8: This deliverable comprises a methodology and an environment for reasoning about the goals of the migration, namely if they are fulfilled or not. Special attention has to be paid to the non-functional requirements which should be easily computable and comparable in the resulting environment [month 8]

D11.3.2) D11.3.2 Methodology and Environment for evaluating migration success M30: The methodology and environment for measure the success of the migration at M30 [month 30]

D11.4.1) D11.4.1 ARTIST SbSp certification model M6: This deliverable will include the definition of the requirements and structure for the whole definition of the Service based Software providers' certification model [month 6]

D11.4.2) D11.4.2 ARTIST SbSp certification model M24: This deliverable will include the development of the certification implementation process for the whole definition of the Service based Software providers' certification model [month 24]

D11.4.3) D11.4.3 ARTIST SbSp certification model M30: This deliverable will include the integrated version of the certification implementation process and tools for the whole definition of the Service based Software providers' certification model [month 30]

D11.5) D11.5 Migration support for test cases: This deliverable will comprise transformations for migrating test cases from the legacy applications to the modernized applications [month 12]

WT3:
Work package description

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
MS2	Project definition and baseline	1	4	Plans for Project Management, web page, collaborative tools setting up, SOTA, requirements
MS3	Project design	2	6	Documents with the detailed designs of technical WPs.
MS4	First prototyping and starting pilots	2	12	First releases of the different methodology, roadmap and tools of ARTIST solution. Definition of pilots and setting-up
MS6	Third prototyping and second pilots	2	24	Third releases of the different methodology, roadmap and tools of ARTIST solution. First implementation of pilots. First exploitation plan
MS7	Final prototyping	1	30	Final releases of the different methodology, roadmap and tools of ARTIST solution

WT3:
Work package description

Project Number [1]	317859	Project Acronym [2]	ARTIST

One form per Work Package

Work package number [53]	WP12	Type of activity [54]	RTD
Work package title	Use cases development		
Start month	1		
End month	33		
Lead beneficiary number [55]	6		

Objectives

The objective of this work package is to specify the requirements for the four pilots case studies of industrial interest covering a broad spectrum of domains and to apply the ARTIST's methodology and tools to their migration, certification and deployment into a cloud infrastructure. Scenarios shall be developed to adhere to real-world situations, and to address outstanding industrial problems and needs related to their application domain.
In particular the scenarios will serve to provide early test beds and benchmarks for the technology developed, resulting in rapid feedback for steering the research direction. To achieve this, the project includes continuous and intense synchronization between the scenarios activity and the focus activities, with the scenarios activity covering the whole project duration.
Summarizing objectives of WP12 are:
• to define real industrial use case scenarios to ensure that WP5-11 deliver practical results.
• to generate detailed requirements to the other three technical work packages WP5-11.
• to apply ARTIST results to the defined use cases

Description of work and role of partners

Task 12.1: Use Cases Definition (M1-M6/Leader: SPIKES)
The owners of use cases will contribute to a document that specifies the migration scenarios. The scenarios will describe the business and technological domains of the case study owners as well as the development processes relevant to each case study. The scenarios will detail the work products and the functionalities required of the ARTIST technologies, methodologies and components, and provide the basis for the requirements specification to be produced in Task 12.2. Moreover, this task elicits the migration use case requirements that will influence the technical challenges addressed by other WPs.

Task 12.2: Use case migration Architecture (M6-M12/Leader: ENG)
The objective of this task is to define an initial architecture for the reference scenarios. This provides the starting point for exposing the scenarios to the ARTIST methodology once it is provided by work package WP6, and ensures that the initial migration assessment provides both feedback to the definition of the methodology from the beginning on, and serves as an early test bed for the methodology being defined.

Task 12.3: Use cases migration roadmaps (M9-M33/Leader: TECNALIA)
The objective of this task is to define the roadmaps for implementing the migration of the reference scenarios.

Task 12.4: Migration and deployment of use cases (M9-M33/Leader: ATC)
The objective of this task is to develop the software artefacts implementing the use cases defined by T12.1. The development will be realised by applying the ARTIST tools in its different versions as being provided by work packages WP9 to the reference scenario

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	ATOS	24.00

WT3:
Work package description

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
2	TECNALIA	6.00
3	INRIA	1.00
4	Fraunhofer	1.00
5	TUWIEN	2.00
6	ENG	29.00
7	ICCS	0.00
8	SPARX	0.00
9	ATC	22.00
10	SPIKES	20.00
	Total	105.00

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D12.1	D12.1 Use cases definition and migration architecture	6	6.00	R	PU	12
D12.2	D12.2 Use cases migration roadmaps M24	2	15.00	R	PU	24
D12.3.1	D12.3.1 Deployed use cases M24	9	42.00	P	CO	24
D12.3.2	D12.3.2 Deployed use cases M33	9	42.00	P	CO	33
		Total	105.00			

Description of deliverables

D12.1) D12.1 Use cases definition and migration architecture: A report describing the migration scenarios and their migration requirements, which will be used in the project. Each scenario will be described in term of its business and technological domains and its development processes. The report will detail the work products and the functionalities required of the ARTIST technologies, methodologies and components. The report is also describing the initial architecture of each reference scenario. [month 12]

D12.2) D12.2 Use cases migration roadmaps M24: A report describing for each use case the migration roadmaps distilled by applying the blueprints and methodology defined by WP6. The report is the basis for the assessment within WP13 of the ARTIST methodology [month 24]

D12.3.1) D12.3.1 Deployed use cases M24: The set of software artefacts (migrated applications) obtained by applying, by means of the ARTIST toolset, the migration roadmaps defined by deliverable D12.3. Each software artefact will be described by accompanying reports. Both the artefacts and the reports are the basis for the assessment within WP13 of the ARTIST toolset. [month 24]

D12.3.2) D12.3.2 Deployed use cases M33: Final version of use cases development and deployment at M33 [month 33]

WT3:
Work package description

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead beneficiary number	Delivery date from Annex I [60]	Comments
MS4	First prototyping and starting pilots	2	12	First releases of the different methodology, roadmap and tools of ARTIST solution. Definition of pilots and setting-up
MS6	Third prototyping and second pilots	2	24	Third releases of the different methodology, roadmap and tools of ARTIST solution. First implementation of pilots. First exploitation plan
MS8	Final pilots	6	33	Final pilot implementation based on final version of solution

WT3:
Work package description

Project Number [1]	317859	Project Acronym [2]	ARTIST

One form per Work Package

Work package number [53]	WP13	Type of activity [54]	RTD
Work package title	Use cases assessment report		
Start month	1		
End month	36		
Lead beneficiary number [55]	10		

Objectives

This WP focuses on assessing and evaluating the ARTIST approach and technologies in the different use cases developed in WP12. We will define a common evaluation methodology together with the stakeholders, and define quantitative and qualitative criteria that can provide actionable feedback to the joint teams realizing the use cases. The intent of the assessments is to align the use case developments and their expected outcomes with business opportunities, exploitability, costs and savings, and evolving future market insights and predictions explored in WP3. Since the objective of these assessments is supportive rather than punitive in nature, the focus will be on early and ongoing evaluation in all stages of use case development, rather than post factum scoring. Outcomes and deliverables should be consensual, clear, concise and actionable to ensure uptake and follow through in the projects developments.
Summarizing the main objectives for this WP are:
• To define a common evaluation methodology
• To define criteria that allows to provide actionable feedback for the uses cases.
• To align the use case developments and the expected results with the results of the WP3.

Description of work and role of partners

Task 13.1: Overall use case evaluation methodology (M1-M6/Leader: SPIKES)
This task is responsible for defining the evaluation approach that will be applied to the different developments in the use cases of the project. In order to assure consensus and uptake of the evaluation findings and results objective common criteria and approach needs to clearly be defined up-front and agreed by the different stakeholders involved in the cases. The method can include both objective measurable results on the artefacts used in the use-cases, but can also involve more projective measurements as an outcome of workshops or qualitative assessments based on interviews or scenario walkthroughs. The methodology should focus on actionable outcomes that can have a positive contribution to ongoing developments of both the technical artefacts as well as the expected impact and exploitation opportunities of the results. The methodology should be common to the different use cases to facilitate its use as an instrument of improvement. The method will favour concise and pointed feedback over the production of elaborate documents. The method will favour cooperative, explorative and participatory assessment rather than mere review of intermediate deliverables.

Task 13.2: Use case assessment and monitoring (M7-M36/Leader: ATC)
This task entails the monitoring and assessment of the various use cases in the project. These evaluations will be conducted in line with the methodology agreed by all involved parties in T13.1. The evaluations will be conducted by multidisciplinary teams from business and RTD providers from the different use cases. In order to ensure actionable feedback, the assessments will start early and iterate in line with the major milestones of the project. The success of the assessments should be measured in terms of the positive impact they have on the evolution of the project, in terms of business case development, technological developments or exploitation opportunities of the use case

WT3:
Work package description

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	ATOS	6.00
2	TECNALIA	6.00
3	INRIA	1.00
4	Fraunhofer	1.00
5	TUWIEN	1.00
6	ENG	6.00
7	ICCS	2.00
8	SPARX	0.00
9	ATC	8.00
10	SPIKES	10.00
	Total	41.00

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D13.1	D13.1 Use case evaluation methodology	10	11.00	R	PU	12
D13.2.1	D13.2.1 Use case assessment report M24	9	15.00	R	PU	24
D13.2.2	D13.2.2 Use case assessment report M36	9	15.00	R	PU	36
		Total	41.00			

Description of deliverables

D13.1) D13.1 Use case evaluation methodology: This document will describe the evaluation methodology that will be used by the consortium the support the various use cases. It will describe the scope, the procedure, the involved parties and instruments used in the assessments. It will typify and define the form and formats of the outcomes of an assessment, as well as the expected scope of impacts and opportunities to engage on findings produced. [month 12]

D13.2.1) D13.2.1 Use case assessment report M24: The use case assessment report following each evaluation entails a document describing the evaluation as conducted, describing participation, activities undertaken, materials examined and assumptions made specifically in the evaluation; and a presentation of concise and actionable outcomes of the evaluation undertaken, including observations, recommendations and planned actions by the different stakeholders. [month 24]

D13.2.2) D13.2.2 Use case assessment report M36: Final eveluation report of ARTIST use cases on basis to the final research results of the technical WPs. [month 36]

WT3:
Work package description

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
MS4	First prototyping and starting pilots	2	12	First releases of the different methodology, roadmap and tools of ARTIST solution. Definition of pilots and setting-up
MS6	Third prototyping and second pilots	2	24	Third releases of the different methodology, roadmap and tools of ARTIST solution. First implementation of pilots. First exploitation plan
MS9	Validation and benchmarking of the results	6	36	Reports assessing the benchmark by means of the project measures of success. Last version of the overall solution validated and verified. Final exploitation plan

WT4:
List of Milestones

Project Number [1]	317859	Project Acronym [2]	ARTIST

List and Schedule of Milestones

Milestone number [59]	Milestone name	WP number [53]	Lead beneficiary number	Delivery date from Annex I [60]	Comments
MS1	Project plan	WP1, WP4	1	3	Plans for dissemination, collaboration, risk and assestment
MS2	Project definition and baseline	WP1, WP6, WP7, WP10, WP11	1	4	Plans for Project Management, web page, collaborative tools setting up, SOTA, requirements
MS3	Project design	WP1, WP2, WP3, WP4, WP9, WP11	2	6	Documents with the detailed designs of technical WPs.
MS4	First prototyping and starting pilots	WP1, WP3, WP4, WP5, WP6, WP7, WP8, WP9, WP10, WP11, WP12, WP13	2	12	First releases of the different methodology, roadmap and tools of ARTIST solution. Definition of pilots and setting-up
MS5	Second prototyping and first pilots	WP1, WP2, WP5, WP7, WP8, WP10	2	18	Second releases of the different methodology, roadmap and tools of ARTIST solution.
MS6	Third prototyping and second pilots	WP1, WP3, WP4, WP5, WP6, WP7, WP8, WP9, WP10, WP11, WP12, WP13	2	24	Third releases of the different methodology, roadmap and tools of ARTIST solution. First implementation of pilots. First exploitation plan
MS7	Final prototyping	WP1, WP5, WP6, WP7, WP8, WP9, WP10, WP11	1	30	Final releases of the different methodology, roadmap and tools of ARTIST solution
MS8	Final pilots	WP1, WP6, WP12	6	33	Final pilot implementation based on final version of solution
MS9	Validation and benchmarking of the results	WP1, WP2, WP3, WP4, WP13	6	36	Reports assessing the benchmark by means of the project measures of success. Last version of the overall solution validated and verified. Final exploitation plan

WT5:
Tentative schedule of Project Reviews

Project Number [1]	317859	Project Acronym [2]	ARTIST

Tentative schedule of Project Reviews

Review number [65]	Tentative timing	Planned venue of review	Comments, if any
RV 1	12	Brussels	Review of the milestones M1, M2, M3 and M4 that are about set up of the project, technical design of WPs, first prototype and definition of pilots
RV 2	24	Brussels	Review of M5 and M6 that are about the second and third prototype and first and second pilots implementation respectively.
RV 3	36	Brussels	Review of milestones M7, M8 and M9 that are about the final prototype, the final pilots and the validation and benchmarking of the technology developed

WT6:
Project Effort by Beneficiary and Work Package

Project Number [1]	317859	Project Acronym [2]	ARTIST

Indicative efforts (man-months) per Beneficiary per Work Package

Beneficiary number and short-name	WP 1	WP 2	WP 3	WP 4	WP 5	WP 6	WP 7	WP 8	WP 9	WP 10	WP 11	WP 12	WP 13	Total per Beneficiary
1 - ATOS	36.00	1.00	20.00	7.00	15.00	21.00	6.00	24.00	24.00	20.00	0.00	24.00	6.00	204.00
2 - TECNALIA	1.00	9.00	3.00	4.00	34.00	23.00	6.00	15.00	15.00	0.00	24.00	6.00	6.00	146.00
3 - INRIA	1.00	1.00	1.00	1.00	0.00	2.00	8.00	32.00	6.00	7.00	3.00	1.00	1.00	64.00
4 - Fraunhofer	1.00	0.00	1.00	4.00	0.00	10.00	6.00	12.00	6.00	33.00	0.00	1.00	1.00	75.00
5 - TUWIEN	1.00	1.00	1.00	6.00	0.00	0.00	12.00	20.00	41.00	0.00	39.00	2.00	1.00	124.00
6 - ENG	1.00	1.00	4.00	2.00	25.00	0.00	24.00	0.00	29.00	15.00	0.00	29.00	6.00	136.00
7 - ICCS	1.00	0.00	1.00	6.00	0.00	35.00	33.00	0.00	18.00	0.00	12.00	0.00	2.00	108.00
8 - SPARX	0.00	0.00	3.00	1.00	0.00	0.00	6.00	16.00	27.00	0.00	0.00	0.00	0.00	53.00
9 - ATC	1.00	0.00	7.00	16.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22.00	8.00	54.00
10 - SPIKES	1.00	0.00	3.00	1.00	0.00	6.00	9.00	12.00	8.00	10.00	0.00	20.00	10.00	80.00
Total	44.00	13.00	44.00	48.00	74.00	97.00	110.00	131.00	174.00	85.00	78.00	105.00	41.00	1,044.00

WT7:
Project Effort by Activity type per Beneficiary

Project Number [1]	317859	Project Acronym [2]	ARTIST

Indicative efforts per Activity Type per Beneficiary

Activity type	Part. 1 ATOS	Part. 2 TECNALI	Part. 3 INRIA	Part. 4 Fraunho	Part. 5 TUWIEN	Part. 6 ENG	Part. 7 ICCS	Part. 8 SPARX	Part. 9 ATC	Part. 10 SPIKES	Total
1. RTD/Innovation activities											
WP 2	1.00	9.00	1.00	0.00	1.00	1.00	0.00	0.00	0.00	0.00	13.00
WP 5	15.00	34.00	0.00	0.00	0.00	25.00	0.00	0.00	0.00	0.00	74.00
WP 6	21.00	23.00	2.00	10.00	0.00	0.00	35.00	0.00	0.00	6.00	97.00
WP 7	6.00	6.00	8.00	6.00	12.00	24.00	33.00	6.00	0.00	9.00	110.00
WP 8	24.00	15.00	32.00	12.00	20.00	0.00	0.00	16.00	0.00	12.00	131.00
WP 9	24.00	15.00	6.00	6.00	41.00	29.00	18.00	27.00	0.00	8.00	174.00
WP 10	20.00	0.00	7.00	33.00	0.00	15.00	0.00	0.00	0.00	10.00	85.00
WP 11	0.00	24.00	3.00	0.00	39.00	0.00	12.00	0.00	0.00	0.00	78.00
WP 12	24.00	6.00	1.00	1.00	2.00	29.00	0.00	0.00	22.00	20.00	105.00
WP 13	6.00	6.00	1.00	1.00	1.00	6.00	2.00	0.00	8.00	10.00	41.00
Total Research	141.00	138.00	61.00	69.00	116.00	129.00	100.00	49.00	30.00	75.00	908.00
2. Demonstration activities											
Total Demo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3. Consortium Management activities											
WP 1	36.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	44.00
Total Management	36.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	44.00
4. Other activities											
WP 3	20.00	3.00	1.00	1.00	1.00	4.00	1.00	3.00	7.00	3.00	44.00

WT7:
Project Effort by Activity type per Beneficiary

4. Other activities											
WP 4	7.00	4.00	1.00	4.00	6.00	2.00	6.00	1.00	16.00	1.00	48.00
Total other	27.00	7.00	2.00	5.00	7.00	6.00	7.00	4.00	23.00	4.00	92.00
Total	204.00	146.00	64.00	75.00	124.00	136.00	108.00	53.00	54.00	80.00	1,044.00

WT8:
Project Effort and costs

Project Number [1]	317859	Project Acronym [2]	ARTIST

Project efforts and costs

Beneficiary number	Beneficiary short name	Estimated eligible costs (whole duration of the project)						Requested EU contribution (€)
		Effort (PM)	Personnel costs (€)	Subcontracting (€)	Other Direct costs (€)	Indirect costs OR lump sum, flat-rate or scale-of-unit (€)	Total costs	
1	ATOS	204.00	1,101,600.00	5,000.00	35,000.00	305,144.00	1,446,744.00	948,090.00
2	TECNALIA	146.00	691,602.00	5,000.00	29,000.00	518,702.00	1,244,304.00	953,307.00
3	INRIA	64.00	308,121.00	2,500.00	39,000.00	295,027.00	644,648.00	493,429.00
4	Fraunhofer	75.00	588,697.00	5,000.00	29,000.00	401,792.00	1,024,489.00	789,946.00
5	TUWIEN	124.00	552,120.00	5,000.00	42,000.00	356,470.00	955,590.00	734,990.00
6	ENG	136.00	889,440.00	2,500.00	29,000.00	612,000.00	1,532,940.00	810,860.00
7	ICCS	108.00	594,000.00	5,000.00	27,000.00	372,600.00	998,600.00	770,600.00
8	SPARX	53.00	344,500.00	0.00	12,000.00	68,900.00	425,400.00	327,600.00
9	ATC	54.00	270,000.00	0.00	24,000.00	81,000.00	375,000.00	323,750.00
10	SPIKES	80.00	630,640.00	5,000.00	18,000.00	389,183.00	1,042,823.00	801,133.00
	Total	1,044.00	5,970,720.00	35,000.00	284,000.00	3,400,818.00	9,690,538.00	6,953,705.00

1. Project number

The project number has been assigned by the Commission as the unique identifier for your project. It cannot be changed. The project number **should appear on each page of the grant agreement preparation documents (part A and part B)** to prevent errors during its handling.

2. Project acronym

Use the project acronym as given in the submitted proposal. It cannot be changed unless agreed so during the negotiations. The same acronym **should appear on each page of the grant agreement preparation documents (part A and part B)** to prevent errors during its handling.

53. Work Package number

Work package number: WP1, WP2, WP3, ..., WPn

54. Type of activity

For all FP7 projects each work package must relate to one (and only one) of the following possible types of activity (only if applicable for the chosen funding scheme – must correspond to the GPF Form Ax.v):

• **RTD/INNO =** Research and technological development including scientific coordination - applicable for Collaborative Projects and Networks of Excellence

• **DEM =** Demonstration - applicable for collaborative projects and Research for the Benefit of Specific Groups

• **MGT =** Management of the consortium - applicable for all funding schemes

• **OTHER =** Other specific activities, applicable for all funding schemes

• **COORD =** Coordination activities – applicable only for CAs

• **SUPP =** Support activities – applicable only for SAs

55. Lead beneficiary number

Number of the beneficiary leading the work in this work package.

56. Person-months per work package

The total number of person-months allocated to each work package.

57. Start month

Relative start date for the work in the specific work packages, month 1 marking the start date of the project, and all other start dates being relative to this start date.

58. End month

Relative end date, month 1 marking the start date of the project, and all end dates being relative to this start date.

59. Milestone number

Milestone number:MS1, MS2, …, MSn

60. Delivery date for Milestone

Month in which the milestone will be achieved. Month 1 marking the start date of the project, and all delivery dates being relative to this start date.

61. Deliverable number

Deliverable numbers in order of delivery dates: D1 – Dn

62. Nature

Please indicate the nature of the deliverable using one of the following codes

R = Report, **P** = Prototype, **D** = Demonstrator, **O** = Other

63. Dissemination level

Please indicate the dissemination level using one of the following codes:

• **PU =** Public

• **PP =** Restricted to other programme participants (including the Commission Services)

• **RE =** Restricted to a group specified by the consortium (including the Commission Services)

• **CO =** Confidential, only for members of the consortium (including the Commission Services)

• **Restreint UE =** Classified with the classification level "Restreint UE" according to Commission Decision 2001/844 and amendments

• **Confidentiel UE =** Classified with the mention of the classification level "Confidentiel UE" according to Commission Decision 2001/844 and amendments

• **Secret UE =** Classified with the mention of the classification level "Secret UE" according to Commission Decision 2001/844 and amendments

64. Delivery date for Deliverable

Month in which the deliverables will be available. Month 1 marking the start date of the project, and all delivery dates being relative to this start date

65. Review number

Review number: RV1, RV2, ..., RVn

66. Tentative timing of reviews

Month after which the review will take place. Month 1 marking the start date of the project, and all delivery dates being relative to this start date.

67. Person-months per Deliverable

The total number of person-month allocated to each deliverable.

PART B

COLLABORATIVE PROJECT

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DEFINITIONS AND COMMON TERMS USED IN THIS PROPOSAL

Legacy application or legacy software

Legacy software is an existing software product developed compliant to the specifications of the source framework, while the target software system is a software product, compliant to the specifications of the target framework and resulted as outcome of a migration process.

We assume our legacy software (regardless if it is already running on a production framework or not) was produced in the context of a **source framework** different from the **target framework** subject of migration. By framework we refer, in general, to the complete software infrastructure required to produce and execute a software system, including software development and execution environments (SDKs, Application Containers, data storage, etc.), software specifications and languages, etc. By software, we refer to the complete software sources, not exclusively code, but also data schemas, data sources, artefacts, documentation, etc.

ARTIST definition and vision for Software Migration, Transformation, Modernisation, and Evolution

Software migration implies that the source (legacy) and target frameworks are different in some essential aspects, which impede the legacy system to be executed on the target framework without accomplishing important changes on the legacy software system. Therefore, this framework mismatching requires applying transformations on the legacy software.

A particular case of software migration is **software modernization** (or **evolutionary software**), where the target software framework has been specified (and created) time after the source software framework was, whereby target specification can be considered much more modern that source specification. In the other way around, source software framework can be considered obsolete.

In ARTIST, **we address software migration in general, but also software modernization in particular**. For example, depending on the nature of the legacy software product in particular, the migration to the Cloud can be considered as modernization or just migration. In other words, ARTIST addresses in general software migration, regardless the business reasons behind that migration need. That is, in ARTIST legacy software is not necessarily obsolete.

Multi tenancy

It refers to a principle in software architecture where a single instance of the software runs on a single infrastructure, serving multiple client organizations (tenants) and supporting a high consolidation of the resources. Multitenancy is contrasted with a multi-instance architecture where separate software instances (or hardware systems) are set up for different client organizations.

There are 3 different levels for creating a multi-tenant environment depending on the types of resources shared among the different tenants:

- Hardware consolidation level
- Application consolidation level

- DDBB consolidation level

Pay back

The length of time required to recover the cost of an investment.

Acronyms

- NPV: Net Present Value
- ROI: Return on Investment
- MDRE: Model-Driven Reverse Engineering
- MDE: Model-Driven Engineering
- SOA: Software Oriented Architecture
- OS: Open Source
- UML: Unified Modelling Language
- SysML: Systems Modelling Language
- SoaML: Service oriented architecture Modelling Language
- SPEM2.0: Software & Systems Process Engineering Metamodel
- MARTE: Modelling and Analysis of Real-Time and Embedded Systems
- OMG: Object Management Group
- ETSI: European Telecommunications Standards Institute
- BPM: Business Process Modelling
- SaaS: Software as a Service

B1. CONCEPT AND OBJECTIVES, PROGRESS BEYOND STATE-OF-THE-ART, S/T METHODOLOGY AND WORK PLAN

B1.1 Concept and project objective(s)

B 1.1.1 ARTIST Concept and Motivation

"*The speed of change in Internet technologies continues to be impressive. In the last couple of years the availability of devices and tools to access software-based services has increased dramatically. Also, the number and the quality of those services have improved.*" [1]

New developments in the way services can be delivered over the internet have opened up tremendous business opportunities to software companies. The Internet got faster and more reliable so that data is transferred quicker and more reliably among customers and providers. This has made it possible to offer even basic IT appliances such as servers for storage or computing clusters as a service, i.e. providers provide the hardware and infrastructure and clients provide the data. The decoupling of responsibilities accelerates the development of new service platforms and software products.

Since the rate of innovation is accelerating, **software products in the age of the Internet have to evolve constantly**. Consider how within the space of just five years innovations such as cloud computing, smartphones and social networks have totally transformed the way we work together. Innovations in the technological space affect the systems that the software has to support or needs to adapt to. Innovations in the business space also affect the licensing and usage model. Software products have to be improved with regard to these new circumstances but without disrupting the business continuity of existing customers.

Challenges in software modernization

However, managing software modernization is still a significant challenge in today's software life cycle. This challenge is usually considered as inevitable, unpredictable, costly, technically difficult, time-and resource-consuming, and poorly supported by tools and techniques or formalisms. The complete lifecycle of software, from requirements to run-time and delivery has to be re-adapted to the new technological and business conditions, requirements and challenges, since there is an increasing need for tools/means to support software evolution and adaptation as a key value for next generation service based software modernization.

The first challenge that companies face is **the decision whether to migrate their existing products or to start from scratch**. Questions such as cost and effort of the migration, impact of new business models in the company or return of the investment need to be answered before tackling the actual modernization. If the estimates they obtain suit their expectations and they finally decide on the migration to a service-based software, reusing as much as possible from the old one, they will face further challenges and difficulties, not only in with respect to the usage of new technologies, or architecture but also with respect to assumptions that companies usually take for granted and afterwards are no longer valid.

The software evolution process is becoming more and more difficult, boundless and unpredictable as many new factors have to be considered: hardware evolution, new (non-) functional requirements, current and future business models, etc. As result, **the estimation of the impact and effort required to implement the modernization of a system is difficult and uncertain**. Tools and processes are needed to estimate the costs, resources and the

financial, technical and cultural feasibility of the system modernization are required. Moreover, the new set of (non-) functional requirements such as security, privacy, reliability, availability, application monitoring, automatic billing mechanisms, dynamic upgrades during execution for ensuring business continuity or the possibility of accessing the same application on different devices need to be covered.

Another changing dimension in software development is time-to-market. Google famously releases many products as beta versions, and users overwhelmingly accept unfinished and in-development projects, provided the core benefits are good and reliable. This shift in user attitude, the often low barriers to competition, and rapid adoption cycles mean that first-mover advantage is very high in the software industry. Consequently, **time-to-market is now, more than ever, critical and therefore the software development cycles need to change**, from requirements to provision, from migration to new developments, from maintenance to evolution to new technologies still on the periphery, such as multicore processing[2]. The software development and provision lifecycle needs to address the evolution of a software product over time.

Software is no longer sold as a package but rather as a service and this requires new capabilities in the software, such as the ability to support multi-tenancy or providing monitoring and billing. This leads to at times profound changes in the company, such as pricing models, business models or changes in the business processes as emphasis switches from making sales at a point in time to serving customers over time.

Current development frameworks focus mainly on the development of new applications but they do not support the needs for an automatic transformation of existing applications into service-based ones, considering current constraints like multi-tenancy or future ones like parallel programming. **A complete approach is needed that aids companies in the process of bringing their applications into the Internet of Services, taking into account the implications of current architectures and forecasting the implications of future ones**.

The points above present current challenges from the software providers' perspective. But, how about the end users? There are always customers that do not trust the Internet as a whole: they do not have trust in having their data "somewhere in the cloud", on the continuity of businesses that offer their products as services or the quality of the offered service. A certification model needs to be created in order to generate trust in service consumers, considering existing laws and policy frameworks that need to be absolutely fulfilled.

At present there is no automatic and vendor and technology independent way to migrate an application as a whole to a services approach, (almost) ready to be placed anywhere, and so independent from hardware that the software can evolve easily. This requires the development of a new approach for migration, reengineering, maintenance and evolution. This is the mission of ARTIST.

B1.1.2 S&T Objectives

The main scientific and technological (S&T) objective of the ARTIST project is:

To prepare, support and increase the competitiveness of the European Software and Services Industry in a global Cloud and SaaS business environment, ARTIST **will develop a set of methods, tools and techniques that facilitate the transformation and modernization of legacy software assets and businesses**. The project will create **tools to assess, plan, design, implement, and validate an automated evolution of legacy software, sold as a good, to SaaS and to the cloud computing delivery model**. By focusing on reusability during this transition, the methods and tools will be generic enough to cover future shifting efforts, e.g. deployment to future platform delivery paradigms.

This S&T objective can be broken down into smaller scientific and technological (S&T) objectives, which are explained in the following table:

- **S&T Objective 1:** Develop a **benchmarking tool to assess the maturity of the technology and the business model of a given software product**, including auditing the technology limitations that constraints the value of the product in terms of technical performance, features, interoperability, associated costs, and deployment options.
- **S&T Objective 2**: Develop a **set of tools** that will enable companies to precisely and accurately **evaluate the feasibility, costs, implications and benefits of migrating from legacy to target frameworks and platforms**, including non-technical changes, especially where a change in business model (such as SaaS deployment) is planned.
- **S&T Objective 3:** Specify**,** develop and test a **(tool-supported) customizable methodology to guide companies** through a stepwise procedure, supported by a body of reusable components metamodelled (potentially 3rd party or open source), **to migrate legacy software to a target framework or platform** taking into account new attributes made available through that migration:
  - **S&T Objective 3.1:** Generate upon a generic ARTIST **roadmap for migration projects**, a specific one, fit-for-purpose migration task-decomposed roadmap for individual migration projects;
  - **S&T Objective 3.2:** Specifically, ARTIST will **enable the migration to a service oriented and to a cloud computing platform,** which will take into account key concerns such as SOA, security, multitenancy, parallelism, scalability and elasticity, performance, reliability, portability, vendor independency, SLAs, QoS, interfaces with databases, and provision model. This could be performed by extending or adapting existing related methodologies (e.g.; cf. OMG ADM standards) in order to address notably Cloud specific features;
  - **S&T Objective 3.3**: Support for **efficiently handling huge volumes of information** coming from the legacy software artefacts. This will be realized by working on globally improvement of scalability of the current modelling techniques (e.g.; model transformation, model querying, etc);
  - **S&T Objective 3.4:** Support for **tackling the potential heterogeneity** of the legacy software systems to be treated by the developed approach. This will be realized by working on both 1) reusing and/or designing lower level technology-specific metamodels and 2) reusing and/or extending higher level generic metamodels such as OMG standards for instance;
  - **S&T Objective 3.5:** Support for **managing the understandability and evolvability** of legacy software systems, by providing the relevant views on them at different level of complexity and abstraction, as required during both the Reverse Engineering and Forward Engineering phases. This will be realized by improving the current modelling techniques (statically or dynamically);
  - **S&T Objective 3.6**: Specific support for **dealing with service-based (or Cloud) software patterns and model deployment** both considering behavioural and non-behavioural (structural) aspects, performance, security, business, etc. This will be realized notably by defining a set of reusable dedicated model transformations;
  - **S&T Objective 3.7**: Support for reusing already developed software transformation artefacts (i.e.; metamodels, transformations, specifications, domain models, etc.) within the context of other applications of the ARTIST methodology. This will be realized by providing an ARTIST **repository** allowing both storing and efficiently retrieving all these relevant modelling artefacts.
- **S&T Objective 4:** Develop a **practical method to transform the current business structures** based on the Software as a product business model towards a sustainable service-based software business one, considering the dependencies between the technological and business actions that must be taken.
- **S&T Objective 5:** Create a **multilevel testing and validation framework**, for continuous online validation of the application's behaviour, based on the dynamic event-based changes of a service enabled application
- **S&T Objective 6: Enhance and extend existing certification models for service based application providers**, particularly with a focus on migrated systems, regardless of whether they are provisioned as a service or not, . This certification model will be offered as a service (CaaS = Certification as a Service).

The activities required to achieve these objectives are split up into different tasks and work packages in this proposal as shown in the following table:

Table 1. S&T Objective mapped to its corresponding section in the proposal and work packages that address it

Obj	Related SoTA section	Work Package and Tasks
1	1.2.1. Migration to SOA and Cloud Methodologies, Strategies, and Tools	WP5 – Modernization Assessment (T5.1,T5.2)
2	1.2.7. Business Models and Sustainability 1.2.9. Non – Functional Requirements in Cloud – based applications	WP5 – Modernization Assessment (T5.3,T5.4)
3	1.2.1. Migration to SOA and Cloud Methodologies, Strategies, and Tools 1.2.3. Service Engineering and Specific Modelling languages for SOA and Cloud: SOAML and PIM4Cloud	WP6 – Modernization Blueprint, methodology and integration (T6.1, T6.2,T6.3,T6.4)
3.1	1.2.1. Migration to SOA and Cloud Methodologies, Strategies, and Tools 1.2.3. Service Engineering and Specific Modelling languages for SOA and Cloud: SOAML and PIM4Cloud	WP6 – Modernization Blueprint, methodology and integration (T6.1) WP12 – Use Cases development (T12.2,T12.3)
3.2	1.2.1. Migration to SOA and Cloud Methodologies, Strategies, and Tools 1.2.3. Service Engineering and Specific Modelling languages for SOA and Cloud: SOAML and PIM4Cloud 1.2.8. Cloud Interoperability (data and code related) 1.2.9. Non – Functional Requirements in Cloud – based applications	WP7 – Meta-modelling for target definition and Cloud Delivery (T7.1,T7.2, T7.3) WP9 – New Software generation by Forward Engineering (T9.1)
3.3	1.2.2. (Model-Driven Reverse) Engineering and Modernization 1.2.3. Service Engineering and Specific	WP8 – Legacy Product Analysis by Reverse Engineering (T8.1,T8.2,T8.3) WP7 – Meta-modelling for target definition and

Obj	Related SoTA section	Work Package and Tasks
	Modelling languages for SOA and Cloud: SOAML and PIM4Cloud	Cloud Delivery (T7.1,T7.2, T7.3)
3.4	1.2.2. (Model-Driven Reverse) Engineering and Modernization 1.2.3. Service Engineering and Specific Modelling languages for SOA and Cloud: SOAML and PIM4Cloud	WP8 – Legacy Product Analysis by Reverse Engineering (T8.1,T8.2,T8.3)
3.5	1.2.3. Service Engineering and Specific Modelling languages for SOA and Cloud: SOAML and PIM4Cloud	WP8 – Legacy Product Analysis by Reverse Engineering (T8.1,T8.2,T8.3) WP10 – Common migration artefacts provisioning and management (T10.3)
3.6	1.2.4.Performance Modelling of source applications and target environments 1.2.8. Cloud Interoperability (data and code related) 1.2.9. Non – Functional Requirements in Cloud – based applications	WP9 – New Software generation by forward Engineering (T9.2,T9.3,T9.4,T9.5,T9.6)
3.7	1.2.3-(Model-Driven Reverse) Engineering and Modernization	WP10 – Common migration artefacts provisioning and management (T10.1,T10.2,T10.4)
4	1.2.1. Migration to SOA and Cloud Methodologies, Strategies, and Tools 1.2.7. Business models and sustainability	WP5 – Modernization Assessment (T5.2, T5.4)
5	1.2.5. Service based Software Quality Assurance	WP11 – Migrated product testing, validation and certification (T11.1,T11.2,T11.3)
6	1.2.6. Certification Models and Services 1.2.1. Migration to SOA and Cloud Methodologies, Strategies, and Tools	WP11 – Migrated product testing, validation and certification (T11.4)

The achievement of ARTIST scientific and technical objectives will be measured against an initial **set of verifiable indicators**. The envisaged type of indicators and selected examples are summarized in the following table. Please note that these indicators will be refined and updated in the course of the project in order to reflect the detailed needs and environment of the project.

Table 2. ARTIST performance indicators

Obj.	Measurability and verifiability	Success Criteria and When (Milestone)
1	The tools will be applied in the use cases and feedback recorded and reported.	**Reduction of 15% of time required to establish the "migration process"** through the ARTIST migration maturity benchmarking tool. *Milestone 7 (Month 30)*
2	The accuracy and usefulness of the assessment tools will be measured qualitatively through the feedback of the end users and quantitatively through the accurate prediction of migration metrics in the use cases.	**As a minimum, the following migration metrics** will be defined: - Associated costs of the migration - Estimated benefits (cost saving &/or revenue growth) - ROI and NPV of the migration - Payback period of the migration - Technical feasibility of the migration

Obj.	Measurability and verifiability	Success Criteria and When (Milestone)
		including: deployment options, estimated performance, required technical skills. **Correctness degree less than 20%** (error margin) of the results offered by the assessment tools: Comparison between the results given by the tools and the real numbers obtained during and after the execution of the use case. *Milestone 7 (Month 30)*
3	The methods and tools will be applied in 4 use cases and the successful migration will consequently be demonstrated. As metrics will be measured in each case the overall performance can be quantified, usability (ease of use) of the approach, satisfaction degree.	**Satisfaction** considered several aspects (usefulness of the approach, overall performance, interoperability, functional aspects, suitability for each specific use case and technology) recorded from end users will be of **at least 90%.** *Milestone 7 (Month 30)*
3.1	The generic migration roadmap will be instantiated into the 4 use cases, generating specific blueprints for each scenario. The adequacy of the roadmap for each specific scenario will be evaluated mainly through the delta between the generic nature of it and the specific add-ons that are required for each use case.	The needs of adaptation of the generic migration roadmap to the specific instantiated ones will be less than **30% of add-ons in each use case.** *Milestone 1 (Month 3) and Milestone 9 (Month 36)*
3.2	The ARTIST methodology will consider cloud computing non-functional requirements such as security, multitenancy, scalability, performance, QoS, and so on. The completeness of the topics tackled will be measured against the requirements of the clouds environments selected for each of the 4 use cases. Test cases will also include the validation of specific features such as performance improvement with the use of elastic resources.	The ARTIST methodology **will cover the 90% of the requirements** regarding cloud aspects coming from the specific use cases. *Milestone 5 (Month 18) and Milestone 7 (Month 30)*
3.3	The methodology and tooling will be applied on real industrial use cases covering large legacy systems. This will imply the creation and handling of large and complex models, which will allow demonstration of the scalability of the proposed framework.	**Use case components will be successfully categorized to the developed stereotype models in the 90%** of the **examined cases.** External services must be integrated in at least one of the use cases, in order to demonstrate the added value and alleviation of migration effort. *Milestone 5 (Month 18) and Milestone 7 (Month 30)*
3.4	The same methods and tools will be applied on two different types of software environments, i.e.; Java (2 use cases) and .NET (2 use cases). This will	At **least 2 different cloud providers and two software environments** (.NET and Java) will be supported by ARTIST framework.

Obj.	Measurability and verifiability	Success Criteria and When (Milestone)
	demonstrate the capability of the proposed framework to manage heterogeneity. Furthermore, different providers may be considered for deployment.	*Milestone 7 (Month 30)*
3.5	The methodology and tooling will be applied in its entirety on several legacy systems coming from different application domains. The evaluation of the modernized systems (e.g., in terms of bug frequency, quality attributes based on metrics) and feedback from developers gained from expert interviews will allow measuring the degree of understandability and evolution readiness provided by the proposed framework. Furthermore, the evaluation of obtained results using the metrics defined in WP4 and feedback from WP 12 will contribute also to measuring the degree of successfulness of the proposed solution.	The ARTIST solution will be applied on 4 different use cases implemented using 2 different legacy technologies (Java & .NET) in order to ensure the **generality/universality of the developed solution**. Also, the produced systems will be tested according to the initial legacy systems in order to ensure the **validity of the process results** (notably attested by a dedicated certification, cf. S&T Objective 6). *Milestone 7 (Month 30)*
3.6	Model transformations defined for supporting behavioural and no behavioural aspects will be evaluated to accomplish at least the needs of the use cases. For at least one use case the existence and deployment of more than one version will be pursued and the toggling between them based on different usage patterns.	At least transformations for the four use cases will be developed and rigorously tested (cf. S&T Objective 5). At least for one Cloud infrastructure, different usage patterns will be developed which allow for rapid change of deployment strategies. *Milestone 6 (Month 24) and Milestone 7 (Month 30)*
3.7	The methods and tools will be applied in the use cases and the successful use of the repository will consequently be demonstrated. By developing modernization support for real industrial use cases comprising different kinds of legacy systems and target platforms, we are able to evaluate the reuse potential of concrete artefacts and the ability of the repository to discover and exploit this potential established in one use case for the other use cases.	The repository tracks among other meta-data which models are reused and where. This makes it possible to define and evaluate reuse metrics that measure the reuse potential of artefacts and ensures the **effectiveness of reuse support** of the repository and the connected tools. *Milestone 7 (Month 30)*
4	The ARTIST methods and tools will support the transformation of business structures towards sustainable business models. The completeness of the ARTIST approach will be evaluated by measuring the number of Cloud based business models analysed and included	**At least 4 cloud-based business** models will be included in the ARTIST solution. **Reduction of 20% of time** required to introduce innovative cloud based business models in the organization.

Obj.	Measurability and verifiability	Success Criteria and When (Milestone)
	in the ARTIST solution. Furthermore through the implementation of the use cases the reduction of time in the inclusion of innovative business models by following the ARTIST solution will be also measured.	*Milestone 7 (Month 30)*
5	Transform the existing test cases for the legacy application use cases in order to be used for the SOA based approach and enrich them with more specific test cases that target distributed service environments. Compare the results between the original legacy system and migrated application for consistency. Create events that would disrupt the service behaviour and observe the launching of the testing and validation case and the final outcome of this process.	At least for the 4 use cases of ARTIST, migration support of test cases will be developed. **Reduction of 20% of time** required to compare the legacy system and the migrated system w.r.t. behavioural equivalence and migration goals. *Milestone 7 (Month 30)*
6	A certification model gains value when different certification authorities support it in order to increase its application. The ARTIST certification model will measure this impact by means of number of Public Authorities and certification bodies that have shown interest.	At least **1 public authority and or 1 certification body** will have to have interest on supporting the ARTIST certification model. *Milestone 7 (Month 30)*

B1.1.3 Challenges

The following section presents the different challenges ARTIST will face. They have been grouped into different categories to facilitate their understanding

Table 3.ARTIST Challenges

Type of Challenge	Challenge
Overall project challenge	To **ensure minimum effort for the developer** of legacy applications during the migration of the latter in SOA/Cloud environments and to identify a priori whether the migration is affordable by the owner of the software application or not To **enhance reusability of model driven approaches** and ensure that the final result will be equivalent in terms of functionality and improved in terms of elasticity and behaviour in cloud based environments, despite the fact that legacy applications were initially designed for dedicated, proprietary systems To **cope with the existence of different administrative domains and multitenancy aspects** and a very dynamic environment, in which assigned resources, software or external API versions may be changed continuously and unexpectedly.
Migration of Legacy systems to	With respect to software migration, the complete lifecycle of software, from requirements to run-time and delivery has to be re-adapted to the new technological and business conditions, needs and challenges, increasing the need of advanced **means**

Type of Challenge	Challenge
service-based software	**to support the software evolution and adaptation as a key value for next generation service based software modernization**. Furthermore, companies have to face the decision whether to migrate their existing products or to start from scratch, considering cost and effort of the migration, impact of the new business model in the company or return of the investment. ARTIST will overcome this challenge by **providing a migration assessment phase** to support this decision making. Once the migration has started, the software evolution process itself is a complex and unpredictable process as many new factors have to be considered: hardware evolution, new (non-) functional requirements, current and future business models, etc. ARTIST project will tackle this by developing a **new approach for migration reengineering, maintenance and evolution of service based software**.
Certification models	One of the major problems that new service based software providers have to face is the reluctance of their customers to consume new software offered as a service. These providers need to demonstrate to their consumers that the service they deliver is of good quality, secure, load-balanced, etc. On the other hand, service consumers need to be sure that the SaaS applications they use and consume reach the minimum level of quality. To overcome these challenges, ARTIST **certification model** will extend existing models to cover cloud and SaaS characteristics, with the final objective of fostering mainstream adoption of the cloud model both from the consumer side and from the provider side
Reverse Engineering	Reverse engineering is a historically complex and hard domain to address. When it comes to applying MDE techniques to elaborate on concrete solutions in this area, several interesting challenges are thus raised. The main one concerns the **general improvement of the MDE/MDRE techniques' scalability**, especially during the model loading/unloading and querying phases. Also, to tackle the **heterogeneity of legacy software artefacts, generic mechanisms for (semi-)automated model discovery and advanced model extension** have to be developed accordingly. Finally, to deal with the inherent **complexity of the legacy systems, traceability** has to be ensured at each step of the overall process via notably advanced model linking mechanisms. This way, a detailed understanding of such complex systems could be performed based on the definition of multiple interrelated views.
Forward Engineering	One of the major challenges is to cope with **changing requirements of forward engineering** processes. The reasons for this are twofold. First, no explicit descriptions for target platforms are available. Second, techniques are missing to configure and maintain model transformations. Other challenges are specific to the area of migrating legacy applications to the Cloud. Currently, there are no best practices or patterns on how to achieve such transformations in an appropriate way. This is even more aggravated by the fact that forward engineering techniques are completely separated from deployment space exploration techniques. To tackle these challenges, ARTIST will establish **modelling languages for explicitly defining target platforms as well as techniques for configuring and maintaining model transformations** by explicit variations points. Furthermore, re-occurring optimization patterns for migrating legacy applications to the Cloud will be collected and model-to-text transformations will be combined with automated deployment space exploration techniques.
Migrated product testing and validation	Creation of a **multi-level framework** that will continuously validate the transformed legacy application, by applying suitable simulation and validation strategies, in both testing and production-time operation. Take events and change of conditions under consideration for triggering validation and

Type of Challenge	Challenge
	testing in the multirole environment, in order to ensure a continuous functionality assurance.
Business Models	Predict the **impact of switching** to a service based software delivered as cloud on a company's existing **business models**. Assess how existing business models influence the strategies and processes for development and migration to the cloud. Research how business models trigger technological decisions, e.g. choice of the appropriate infrastructure platform.
Software Evolution	**Changes** in requirements, business strategy and runtime behaviour influence the continued **operation of certain software after migration**. Therefore it is necessary to track changes in the repository and determine their impact. The **ARTIST repository** will have to integrate new models and changes to the existing models. Other challenges of software evolution addressed in ARTIST will be the integration and analysis of data from various sources in a repository and the contribution of tools as building blocks of a common software evolution platform.
Non-functional requirements integration	To ensure that the cloud-enabled legacy application behaves in the same or enhanced way as the legacy system and is able to exploit the elasticity of resources offered by the Cloud platforms. To overcome this challenge ARTIST solution will **analyze the runtime execution of the legacy system and use the information in the reverse engineering** step and to generate optimal solutions in the forward engineering. Another challenge to be tackled by ARTIST regarding non-functional requirements will be the improvement of the front-end of automatically generated target systems by enhancing the accessibility of applications for people with special needs which is especially required for Web applications
Service & Cloud Modelling	ARTIST will need to develop or extend **modelling languages** (such as SOAML) in order to specify models for the infrastructures in which the legacy applications will be deployed. This extension will include aspects and concepts to enrich the modelisation of the service to be deployed in a cloud infrastructure.

B1.1.4 Approach

The ARTIST approach focuses on Legacy Applications. Through the usage and extension of MDE approaches ARTIST will ease the migration of legacy applications to new computing paradigms like service oriented architectures and cloud solutions.

The term "Legacy" in ARTIST includes any existing software product already developed and compliant with the specifications of the initial usage and intentions. The **main characteristics and trends of Legacy Applications** are:

- **Usage of dedicated and isolated infrastructures**, and usually quite focused on privacy and security (information is hardly shared)
- Extreme value for the companies that have developed them in terms of investment and produced/expected revenue
- Very **sensitive with regard to reliability** and **performance** issues
- **Proprietary and expensive systems**, for each client a separate (and potentially specific) process of installation and configuration is followed
- **Vendor and technology lock-in**, for maintaining client base

Main **problems of current implementations of Legacy Applications** are the following:

- **Inability to handle workload peaks**: due to the dedicated and isolated form of the infrastructures mentioned above, peaks in workload have either to be foreseen during the initial design of the infrastructure or met afterwards through the extension of the latter or not met at all. In any case, the lack of elasticity hinders the optimization of resource management and cost
- Very **significant investments** must be made in order to obtain and use one, thus not directly targeting at SMEs or start-up companies. A company must be well established and of substantial size in order to decide to utilize a Legacy Application and to be sure of the ROI. Thus the **client base** of such applications is usually **thin**
- **Excessive cost of maintaining huge legacy applications**, usually deployed in big companies
- **Inability to take advantage of offerings available on the Internet**, mainly through PaaS or IaaS providers
- **Inability to merge/utilize new IT paradigms and** evolve in order to exploit advancements like 3rd party offerings over the Internet
- **Lack of scalability** with regard to demand/users due to the monolithic form in which they were designed and implemented
- **Continuous attention and effort in** each **individual installation** for a customer, thus leaving little room for focus on optimizing the main offering. The main effort is mainly towards creating and maintaining the production chain.

On the other hand, there are significant **opportunities for the Legacy Applications** in the current IT domain. These mainly include:

- **Usage of cloud platforms in order to gain from their offered services.** This may range from the domain of SaaS and up to PaaS and IaaS. This way, a direct reduction of cost may be achieved, both in terms of software produced and resources utilized. Furthermore, due to the increased scalability, dynamic adaptation to demand and produced revenue maximization may be achieved.
- **Availability of Legacy Applications through usage of service oriented implementations**. By following the SOA approach, they may be offered as services over the Internet, combined with 3rd party services, thus adding more value for the end customer. Furthermore, through the multi-tenancy usage of such applications, costs will be minimized, the client base will become wider and the concept of separate implementations for each individual customer will disappear.

However, in this **effort to transform**/adapt the Legacy Applications to new software paradigms, a number of **significant hurdles** must be overcome:

- **Examination of the trade-off between the costs and benefits from transforming/migrating** an existing application. For this, an extensive qualitative and quantitative analysis must be made, that will take all factors under consideration and decide whether the newly transformed service will have a successful ROI. This cost/benefit analysis should take under consideration technical and business aspects and evaluate in business terms the technical improvements.

- **The source (legacy) and target software are different**, which impede the legacy system to be executed on the target framework without accomplishing **important changes** and transforming it from a monolithic to a SOA-based environment.
- Investigation of **the parallelism capabilitie**s of the existing application, the possibility to exploit them and what additions/alterations must be performed for this to happen.
- Extensive **modelling of the application with regard to performance issues** and with respect to the different platforms of execution and their policies must be performed, in order to achieve a transformation that can have elastic properties, can meet varying demands and may have an optimized performance
- **Distributed execution** means remote access to resources such as processing and storage, together with a **fragmented deployment** of the application components. Thus the need to model and study the performance of different deployments or possibly different structures of the application exists, in order to fully exploit the capabilities of Cloud environments and mitigate their weaknesses.
- The **existence of different administrative domains** inserts new requirements for management and accounting capabilities. Furthermore, the multi-tenancy aspects raise different needs for privacy and security concerns, with regard to the individual per client installation.
- **Measurements and assessment of value versus cost** must be studied explicitly, especially with regard to performance.
- **Testing and validation of the produced software must be based on an entirely different basis due to the dynamicity of the environment**, the multiple level of information and the service oriented and distributed version of the transformed application. This process must be continuous and adaptable, with an ability to identify alterations in the collaborating parties and re-validate the final product so that Quality of Service is assured in this multilevel environment.
- Software providers must **deal with** the **mistrust of the users** of their application about the new adopted paradigm and delivery model over the Internet.

In the context of the **ARTIST project** we intend to develop the tools and methods to overcome these obstacles and reduce the costs and risks associated with the migration of Legacy Applications to new IT paradigms like SOA-based technologies and Cloud platforms. In order to do so we will first assess, plan, design, then perform and finally validate and verify the **migration** of **legacy software systems** into **different target framework(s),** but with the same or enhanced functionalities and behaviour**. In detail the major goals** are to

- Develop an innovative **and combined technical and business analysis on the maturity and prospect of the legacy application**. The major target of this process is to identify in advance the perspectives of the migration and pre-evaluate the performance and business benefits with relation to the cost of the process. For the first time, the **business value will be directly attached to the technical performance**.
- Provide a **large scale model-based approach for representing the source and target applications** and infrastructures/platforms:
    - **Automatic or semi-automatic analysis of the software artefacts** (i.e.; source code, configuration files, models, documentation, etc) composing the legacy application and extraction of corresponding models (e.g.; technology-specific models for Java and .NET, technology-independent models such as OMG KDM ones, higher-level models such as OMG UML ones, etc), in a reverse engineering process that has the aim to extract all necessary and reusable

information from the source legacy application and to highlight its overall architecture and content
    - **Model-driven approach for encapsulating the parameters of the application for migration to a SOA/Cloud based environment,** thus building the target form of the legacy software through forward engineering, by **taking under consideration the new requirements** that emerge from the specificities of this new ecosystem, **like** notably **security and multi-tenancy** issues.
    - **Model-driven transformation** from the source application to the target one, together with identification of the lacking functionality, exploration of 3rd party offerings for compensating the latter and concretization of the missing parts that need to be implemented from scratch, thus **minimizing the effort needed and exploring different capabilities of integration**.
    - **Definition and/or extension of advanced PaaS/IaaS metamodels**, taking into consideration the **specific requirements of the legacy applications** in terms of service offerings, capabilities and infrastructure performance
- Create a **unified performance modelling framework** that will create:
    - Models that are used to **exploit/expose the parallelism of the application** and can lead to a **scalable transformation** of the monolithic implementation or improvement of the underlying design.
    - Definition of **performance models** (using dedicated metamodels and/or UML profiles) for the various types of applications that can serve as a bridge between the target software and the target infrastructures. Through automated mechanisms, both of them will be compared against these models in order to choose the proper target infrastructure for each deployment, but also exploit pre-existing knowledge regarding the varying behaviour. For this reason, profiling tools will be offered for performing this matching even for unknown applications.
- **Identify dynamic deployment methodologies**. For each legacy application, different possibilities of the target software, based on different policies, performance optimizations or security and business issues will be created. Through the creation of multiple versions of the same software and the identification of different deployment patterns we will be able to achieve the optimal target setup (either in terms of software version or infrastructure conditions). For this reason, models that describe different usage patterns and interactions between the distributed components and the infrastructures will be created and used through the application lifecycle and especially during the deployment selection.
- **Enforce reusability of the (modelling) artefacts produced during the migration process through the usage of a repository**. Every kind of artefacts produced in the previous phases (such as models, metamodels, UML profiles, transformations, XML files, documentation, etc.) will be committed in a repository with their related metadata in order to be available for the future. This may affect the evolution capabilities of the legacy software itself, by identifying the necessary delta needed in order to achieve the upgrade to a new version. Thus minimal changes may be achieved and much faster update process. Moreover, these artefacts will be available for every other legacy application that needs to go over the same process, so that duplication of effort is avoided for the same types of transformations or additions.
- Implement an innovative and **thorough testing and continuous validation process, that will span across all layers of the multilevel ecosystem**, taking into consideration the specificities of the environment, like the incorporation of 3rd party

APIs or components (e.g. monitoring/accounting from the PaaS/IaaS provider) or the possibility for continuous evolution of the software and its subcomponents. For this reason, a three step approach will be followed, starting with the offline testing of the overall system, continuing with a runtime online validation each time an event alters the system (e.g. updated version of a component, external API etc.) and completing with a detailed error tracing mechanism.
- Enhance, enforce and promote the usage of an **integrated certification model for Cloud application providers**. Therefore, an application certified under this model will **ensure that the highest exigencies in terms of business, operation and service continuity** are met.

The overall phases of the ARTIST approach are depicted in Figure 1.

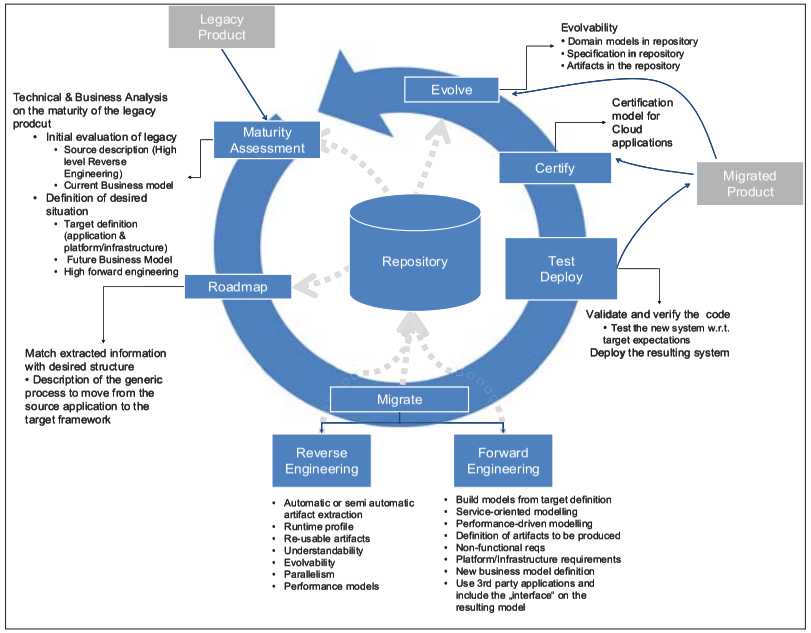


Figure 1. Approach of ARTIST solution

B1.1.5 Industrial Use Cases

A total of 4 industrial use cases (IUC) will benchmark the ARTIST results and its S&T objectives ST1-ST6.

IUC1-ATOS: DEWS in the cloud

DEWS stands for Distant Early Warning System. It is a generic system that can be applied in a varied range of geographical locations and to different types of risks; in particular, DEWS FP7 R&I project focuses on tsunamis. The DEWS system receives relevant information from

distributed multi-sensor networks, processes it and supports operators (using a graphical console, the Command and Control User Interface, CCUI) in order to decide whether an early warning must be issued.

The DEWS operational environment scenario in the Indian Ocean region consists of four warning systems. DEWS have three DEWS National Centres (NC's), in Indonesia, Sri Lanka and Thailand and one DEWS Wide Area Centre (WAC) running in Indonesia.

The DEWS CCUI is an Eclipse RCP[3] developed in Java using the Eclipse Standard Widget Toolkit, SWT[4]. Additionally, the CCUI requires local binary geo-spatial information and persistence storage for user profiles. As another desktop Eclipse application, DEWS CCUI requires a local desktop installation that implies that the number of possible CCUI installations and DEWS operators are limited by the available hardware infrastructure and the installation help desk support. Other technical limitations of an Eclipse-based approach are: complex and costly evolutionary maintenance, high computational workload in local workstations, constrained hardware compatibility, etc. Current DEWS CCUI restrictions described above can be alleviated by migrating the CCUI legacy system to a Cloud environment, where CCUI is hosted as a Webtop RIA application, accessible through standard compatible Web browsers, leveraging on Cloud features such as multi-tenancy, resource elasticity and massive computational workload. The DEWS use case is planning to first explore the feasibility and cost-effectiveness of the migration of part of the DEWS CCUI console to the Cloud, including required binary geo-spatial information and data schemas migration, and then to perform the migration. In particular, we explore the technical migration of Eclipse RCP SWT/JFace widgets into Google Web Toolkit (GWT) widgets based RIA Webtop applications

IUC2-ENGINEERING e-Gov Scenario

The e-Gov scenario proposed by ENG aims to assess how the ARTIST framework can ease the re-engineering of J2EE eGov applications to be ported to cloud computing environment. In particular we will take into account eGov applications based on the SPCoop infrastructure.

The SPCoop infrastructure allows to set up an actual backbone for the interchange of data and services between the different Italian public administrations. The SPCoop approach guarantees the minimal economical and organisational impact on the technological choices already made by the different public entities.

SPCoop lets its users have a unified view (independent from the provisioning channel) of all services of Italian public administrations both central and local. It defines a shared model for on-line interaction that saves the specificity of service provider and, at the same time, assures uniform interaction and identification of both service provider and service consumer (more in general of all actors participating in a interaction).

Sample SPCoop-based applications include: Land registration, Federated taxation management, Drug reimbursements management, Public administrations registration, Work marketplace, Car tax management, Fuel price monitoring.

Both SPCoop and eGov applications are implemented in the Java language and are compliant with the J2EE specifications. Most of the implementations are based on the following open source products: JBoss Application Server (http://www.jboss.com), Axis Web Services Engine (http://ws.apache.org/axis), jUDDI - UDDI Web Service Directory

(http://ws.apache.org/juddi), Log4j - Logging Service (http://logging/apache.org/log4j/docs), WSS4J – WS-Security Implementation (http://ws.apache.org/wss4j), PostgreSQL Database Management System (http://www.postgresql.org).

The main motivation for the transitioning to cloud computing environment resides on the possibility to benefit from economies of scale: the rationale behind the adoption of the cloud computing paradigm is the possibility to offer the services common to all SPCoop-based eGov applications (a.k.a Services for the Interoperability, Cooperation and Access Control - SICA) as a platform for the development of new applications.

In the eGov domain although the economic benefits have been already positively evaluated, key concerns about the security are still impeding the adoption of the cloud-based solution. Solutions developed by the ARTIST research project could contribute to the removal of such resistance.

IUC3-ATC-NEWESASSET

News as an *Asset* (**NEWSASSET**) is an end-to end multimedia cross-channel solution for evolving News Agencies, Broadcasters and Publishers. It constitutes an innovative management solution for handling large volumes of information in the following forms (Text, Picture, Graphics, Audio, Video, Stories, etc), offering a complete and secure electronic environment for storage, management and delivery of sensitive information in the news production environment. The functional and efficient means of management for the distribution of content that NEWSASSET offers streamlines the internal operations and organization of news enterprises with absolute security and reliability.

The major objective of NEWSASSET is to support companies to the effect of producing, storing, organizing and handling all documents, utilized both internally and in company transactions with external associates, such as customers, suppliers, branches or citizens, other services, etc. It has been built to meet the needs of today's news agency's to help create, manage and distribute breaking news quickly and efficiently to a wide array of customers through diverse and varied means of delivery. NEWSASSET is developed and based on known and accepted International Standards such as: IPTC (International Press Telecommunication Council), ANPA (American Newspaper Publishers Association), NewsML etc., allowing to automatically download any news in any format, from a large number of external sources utilizing such standards (i.e. REUTERS, Associated Press, etc). It is worth to be noted at this point that the particular standards are fully compatible with the corresponding ISO and CCITT standards of the specific domain.

Being a commercial product marketed by ATC, the adaptation of ARTIST's approach (ARTIST cycle of progress) will be a natural evolution of NEWSASSET, as it will reduce the risks and costs associated with its migration to innovative technologies, namely SOA-based infrastructures and Cloud platforms. The realization of a NEWSASSET version based on ARTIST's targeted technologies will not only support company's efforts to expand its customer base in the media environment while differentiating from the competition, but to penetrate in new markets and broadening its target customer groups as well.

It is envisioned that NEWSASSET will strongly benefit from ARTIST's offerings at both technical and business scales. Indicative examples are: i) storage of potentially huge quantities of data without exploding their storage costs, ii) stable environment that will guarantee an efficient operation of NEWSASSET even when sudden events which may peak

the user demand occur, iii) search and access quickly and efficiently huge amounts of relevant data that could potentially be distributed widely around the globe, iv) fundamental security policies will be applied and privacy protection will be assured for both the information that is conveyed among the different stakeholders and the identity of the stakeholders itself, v) faster, easier, scalable and less costly installations to customers that cannot invest great funds for migrating to a new system. Note that in the current economic crisis period this involves the majority of the media organizations, vi) refinements and improvements of ATC's technical and business know-how obtained by the challenges met through the project towards media and other application deployments.

IUC4-SPIKES-Line of Business (LOB)

This use case focuses on the application of the ARTIST tool chain and Methodology to assist in the partial modernization of existing Line-Of-Business (LOB) applications by extending them through Software-as-a-Service (SaaS) service extensions. This use case demonstrates the value of the ARTIST research assets in scenarios where full migration is not a priority.

Spikes UbiSoN is a real-time context aware social messaging solution. The context can consist of state changes in applications or devices, which the system through rules maps into events in a social space. As a simple example, an account manager gets assigned a portfolio in a legacy CRM system, and as a result, the manager social graph in the company's choice of social networking system is updated to "follow" those accounts. For this to work UbiSoN needs relevant functional models of the legacy systems as well as the social target system, and a generated set of virtual event sensors on the legacy application.

This use case makes use of the same model driven techniques and tools as the other cases in the project. What is specific to this case is that models derived by the ARTIST software are in this case not used to migrate the application completely to a new platform, but to discover relevant domain models and mappings, and likewise, the generated code is not a pure transformation of the legacy code base onto the new cloud platform, but an observation and extension module onto the legacy platform that allows UbiSoN to interact with the system. This mixed approach offers the choice of maximizing return on investment by preserving legacy assets while at the same time bringing future extensibility and value to both service provider and client.

B1.1.6 Relevance to the topics addressed by the call

ARTIST is a proposal for a Large - scale Integrating Projects (IP) addressing the challenge "**Pervasive and Trusted Network and Service Infrastructures**" and focusing on the objective "**Cloud Computing, Internet of Services and Advanced Software Engineering"** (ICT-20011.1.2). The following Table explains how the objectives as stated in the ICT Work Programme 2011-12 are addressed by ARTIST. ARTIST's contributions to each of these target outcomes are described in the second column.

Table 4.Relevance to the topics addressed by the call

ICT Work Programme Objective	ARTIST Contribution
Service engineering principles, methods and tools supporting development for the Internet of Services,	**Through the usage and extension of MDA approaches ARTIST will ease the migration of legacy applications to new computing paradigms like service oriented architectures and cloud solutions**. ARTIST will provide a complete solution with methods, principles and tools supporting the adaptation of legacy applications to the Future Internet, and preparing

ICT Work Programme Objective	ARTIST Contribution
including languages and tools to model parallelism	them for being offered as SaaS over the Internet. The methods and tools provided will cover the migration cycle from the very beginning, including an assessment phase (in order to analyse the technical and financial feasibility of the migration) to the final step of evolution and guarantee of quality measures in such migration process, including a Service based Software Providers Certification model.
Massive scalability, self-management, verification, validation and fault localisation for software-based services.	**ARTIST aims at identifying and implementing the framework for ensuring that the cloud-migrated legacy application will have the same behaviour as the original version through its testing and validation framework**. This framework will extend the initial test cases of the application and will enrich them with specific ones related to the dynamic cloud environments and the distributed service oriented components, through a continuous and event-based management process. Enhanced logging abilities will also be pursued in order to achieve efficient traceability of fault origin and localisation for the migrated software-based services.
Methods and tools to manage life cycle of secure and resilient Internet-scale applications from requirements to run-time and their adaptive evolution over time	Through the usage of the **ARTIST Forward Engineering tools, the new requirements that arise from the change of environment of the application execution will be dealt with, through addition of necessary features or components**. ARTIST will also develop methods and tools for further changing and improving a system after migration. After the migration, the generated models of the system will be used along with a tool to analyse how future changes to the requirements impact the system on this abstract level. This will also enable the identification of changes for extending the feature set offered by the application.
Advanced engineering for software, architectures and front ends spanning across all abstraction levels	ARTIST will provide tools for a **Reverse Engineering process that will extract all the necessary information from the original legacy application and will produce the models** of the latter. Furthermore, through the Forward Engineering techniques and tools, the project will produce the final models of the service oriented application, at different levels of abstractness, complexity and concerns, in order for this to be able to be deployed in a target cloud environment. Through this process, differentiations and optimization of the application structure will be achieved, in order to fully exploit the capabilities of the new computing paradigm.
Quality measure and assurance techniques which adapt to changing requirements and *contexts, to flexibly deal with the complexity and openness of the Future Internet*	The testing and validation phase that is envisioned to be created in the ARTIST project will support **tools for continuous quality assurance of the transformed service oriented application**, taking under consideration the specificities of the new environment, like continuous changes and upgrades in the individual components or external entities with which these may communicate (like Cloud provider's auditing and management consoles etc.). Through an event-based approach, each time such a change occurs, the validation process will be initialized. Furthermore, through this transformation of the legacy application to a modular service oriented approach, each component may be updated or adapted to meet newly expressed requirements or business goals.
Management of non-functional requirements typical of Internet-scale applications, like concurrency levels	ARTIST will support **non-functional requirements through the meta-modelling** approaches that will be followed in order **to characterize IaaS and PaaS providers**. These meta-models will be populated with concrete values for the providers and enriched with performance stereotypes that will declare their capabilities with regard to the specific features. Furthermore,

ICT Work Programme Objective	ARTIST Contribution
which will be orders of magnitude larger than in today's applications, huge data stores and guaranteed performance over time	due to the incorporation of forward engineering techniques, multiple deployment versions and usage patterns identification, the runtime optimization of application performance will be guaranteed and adapted to the dynamic execution parameters of distributed applications running over virtualized resources. Multitenancy aspects will also be dealt with, in order to shift the usage of legacy applications from dedicated instances to the pay-per-use multitenant business model.
Tools and methods for community-based and open source software development, composition and life cycle management	The majority of the tools and methods created or extended under the ARTIST project will be open source contributions to well-known frameworks like Eclipse. Furthermore, the model transformations, the meta-models and **every product that may be reusable will be included in the public artefact repository** to promote the exploitation of artefacts produced in ARTIST that are of common interest.

B1.2 Progress beyond the state of the art

B1.2.1 Migration to SOA and Cloud Methodologies, Strategies and Tools

Transforming legacy applications to services allows systems to remain mostly invariable while exposing functionalities to a large number of customers through well-defined service interfaces. Khadka et al [5] identify in their systematic literature (SLR) review some common phases out of three evaluation frameworks: 1) Butterfly[6], 2) ADM [7], 3) Reinassance Method [8]. These phases called Evolution planning and Evolution Implementation and management include tasks such as understanding the legacy and target system, feasibility analysis and migration implementation. In this SLR they have analysed 121 distinct approaches from 2000 to 2010 but none of them include all phases and tasks, necessary for a correct migration and of course, none of them include issues related to business aspects.

With respect to the methods and techniques used, the SLR shows that Reverse Engineering is the most common approach to understand the legacy system, while the most common way to migrate the current business functions is by using wrappers, which may be relatively straightforward but in the long term not efficient. Characteristics such as platform, language, architecture and the target SOA or cloud environment play an important role in this complicated task. In the event of migrating to Cloud, these characteristics need to be summed up to others such as automatic scalability and elasticity, multi-tenancy, security and other non-functional requirements. The Service – Oriented Migration and Reuse Technique (SMART)[9] is one of the most widely used strategies to migrate to SOA. SMART process, developed by SEI at Carnegie Mellon University, helps organizations to make initial decisions about the feasibility of reusing legacy components as services within a SOA environment. SMART considers the specific interactions that will be required by the target SOA environment and any changes that must be made to the legacy components. To achieve this, SMART gathers information about legacy components, the target SOA environment, and candidate services to produce 1) a preliminary analysis of the viability of migrating legacy components to services, 2) an analysis of the migration strategies available, and 3) preliminary estimates of the costs and risks involved in the migration. SMART is vendor and tool independent, and provides a clear roadmap of the steps to consider in the migration. Furthermore, this approach does not address important issues on a formal basis like QoS, security, scalability, multi-tenancy and it does not provide a complete solution execution for migrating legacy software.

Tool vendors and cloud providers such as IBM [10], Oracle[11], Microsoft [12], SAP [13] and Amazon [14] have also defined their own migration strategies to SOA and Cloud locked to their own products (i.e. Oracle, SAP, Amazon, IBM) or relying heavily on the use of XML technology (Microsoft), limiting in this case scaling possibilities, However, **most of these methods proposed by vendors lack of a holistic method to prepare companies to a SOA or cloud migration**, where both requirements of current legacy systems and business needs and licensing issues have to be taken into account to achieve a successful migration. Among the abovementioned strategies, only Amazon treats partially this but the high level in which some issues are treated make hard the applicability of their method.

The European FP7 project REMICS, is also developing a methodology for the reuse and migration of legacy software to cloud, centred mainly on the technical aspect and nothing at all on the business aspect. While it is still under development, the methodology stops once the application is deployed on a cloud provider and does not cover, therefore, the maintenance and evolution of the application to future technological paradigms. Furthermore, the methodology is primarily focused on cloud and relies on the provider for aspects like multitenancy, security, scalability, monitoring and billing, which provokes the application not being, for instance, scalable.

B1.2.1.1 Technical Limitations

Current open migration methodologies to service based software and especially that provided as a service leave aside important aspects that need to be considered in loosely coupled architectures. These aspects, identified by Orue-Echevarria et al[15] include new requirements, functional and non-functional, that arise in such contexts. Especially critical are, in the case of service based software that is to be provisioned as a service, non-functional requirements such as configurability, multitenancy (and variability in multitenancy), security and authorization, scalability, monitoring and billing. Legal concerns such as where the application data is located are obviated in these approaches.

Proprietary initiatives like the ones expressed above (e.g. IBM, Microsoft) treat partly some of these new requirements but only if the software is migrated with their own tools or to their own platforms, which means a high dependency on their tool suites. Some of these new requirements that these initiatives do cover include multitenancy and security but other aspects (e.g. scalability, monitoring, billing) are being forgotten. Developing loosely coupled systems and moreover, migrating to a loose coupled system provisioned as cloud requires the use of several methods, techniques and a combination of both.

As shown previously, there are some partial contributions in several areas, but they abandon the process as soon as the code is deployed on a cloud infrastructure, leaving important decisions to the cloud provider (i.e. REMICS) while they should be decided at the application level, or they only focus on the migration to a service oriented architecture (i.e. SMART) or are proprietary (i.e. IBM, Amazon). Thus, **none of the current solutions provide an appropriate methodology, strategy and vendor - independent tools focusing on the migration and evolution of loosely coupled systems provisioned as a service**.

Additionally, **none of the methods described above treat the business model requirements**, essential to the cloud computing delivery model or legal and trust aspects.

B.1.2.1.2 Innovation of ARTIST

The main innovation of ARTIST relies on the integration of business aspects and technical aspects in the whole migration process, preparing the software also for the evolution to newer paradigms.

The main innovations can be recalled as:

- A first step to **assess the feasibility to migrate** the current system, so that decision makers in the companies can decide, based on objective indicators, the suitability and feasibility of the migration. These assessment tools include:
  - A Benchmarking tool to analyse where the application to be migrated stands currently in terms of architecture and business models and where the application is aimed to be.
  - Based on this leap (the current situation as-is, and the desired future situation to-be), a gap analysis is performed and indicators will be obtained. These indicators will include a Cost-Benefit Analysis (including ROI and Payback), Impact of what this shift of business model implies in the company (in terms of processes, additional costs, personnel, new aspects that need to be considered, …), and an estimation of the effort needed to change to the new delivery model (based on some indicators obtained from high level reverse and forward engineering activities). These data will analyse the feasibility of the migration and management can take their decisions based on objective indicators.
- A **customized roadmap on how to tackle the migration** for that specific application and desired target platform, as well as the degree of achievement available at all times for the developers executing the migration activities. This specific roadmap allows firstly evaluating and secondly determining how to efficiently implement and run the actual process;
- A **generic approach (i.e.; a methodology and supporting tools and framework)**, covering all migration phases, that is applicable on any kind of migration scenario involving a switch of paradigm during the process, compared to usual approaches considering only specific targets or certain phases;

The achieved **solution will be Open Source, thus avoiding vendor-lock-in** problems, and based on standards such as SoaML, or other UML profiles. This solution will be as much automated as possible, even though, a full degree of automation is hard to predict at this stage.

The migrated product will also avoid cloud platform vendor lock-in constraints, in the sense that since different target cloud platforms are modelled within ARTIST, the product can be ported from one provider to another one with little effort and (semi) automatically.

B1.2.2 (Model-Driven) Reverse Engineering and Modernization

Reverse engineering is almost as old as computer science itself. Initially targeting hardware analysis[16], reverse engineering problems quickly evolved to principally focus on software analysis[17], following software's spectacular advent during the 80s-90s. Real-world software systems require continuous change and enhancement to satisfy new user requirements and expectations, to adapt to new and emerging business models and organizations, to adhere to changing legislation, to cope with technology innovation and to preserve the system structure from deteriorating[18]. Reverse engineering, as an evolution of software maintenance, is considered the key technology to deal with all these scenarios.

In the 90s, object-oriented technologies used to be considered as the reference solution for implementing reverse engineering approaches[19]. Several proposals and tools in that area, e.g.; aimed at "program comprehension"[20], appeared around at that time. Thus, different works have been realized in order to study the extraction of relevant information from existing source code or software components in general[21], from relational databases[22] [23], from compiled code or binaries files[24], etc.

However, since the beginning of the 2000s, the Model Driven Engineering (MDE) paradigm[25], as introducing higher abstraction capabilities, has raised a considerable interest. This has largely facilitated the development of more elaborated reverse engineering solutions dealing with more and more complex problems. Application of MDE techniques in reverse engineering is commonly referred to as Model Driven Reverse Engineering (MDRE)[26], and is usually employed as part of broader general "software evolution" solutions [27] [28].

At the conceptual level, MDRE relies on the use of a set of models to represent the legacy system and a set of transformations[29] [30] that transform the extracted models into comprehensive views of the system appropriate for each user profile. Transformation technologies involve both model-to-model transformations (e.g.; Eclipse ATL[31]) and model-to-text transformations (e.g.; Eclipse Acceleo[32]) technologies, with the corresponding standardization initiatives leaded by the Object Management Group (OMG) (respectively QVT (OMG) Spec[33] and MOFM2T (OMG) Spec[34]). The models can be generic (i.e. a kind of abstract reference "model"[35]) or specific for a given technology, some examples are: migration from COBOL to Java[36], migration from standard Java to SOA[37], reverse engineering from "4th generation" applications[38], graphical interface reuse[39], metric computation[40] [41], extraction of dynamic views from Java applications[42], etc.

The importance of (model driven) reverse engineering has also been officially recognized by the Object management Group (OMG), the well-known worldwide consortium aiming at setting modelling standards in the software engineering area. The dedicated Architecture Driven Modernization (ADM) initiative[43] has been started as a direct answer to this need, has then emerged as a key player in the reverse engineering world and is now leading the standardization activities around this topic. More particularly, ADM already proposes several standard metamodels to be used as pivots by market actors: the Knowledge Discovery Metamodel (KDM), the Software Metrics Metamodel (SMM), the Generic Abstract Syntax Tree Metamodel (GASTM), etc.

Within this global context, the Eclipse Modelling-MDT MoDisco project[44] [45] is providing the first generic and extensible open source framework fully dedicated to the elaboration of (model driven) reverse engineering solutions. Initiated during the MODELPLEX European project[46], it now notably makes available official reference implementations of several standards from the OGM ADM Task Force, such as the ones just mentioned before.

Over time software systems are subject to various changes from a variety of sources. These changes in general lead to a deterioration of software quality and structure and an increase in complexity due to additional features added (Lehman et al. 1997). The aim of Software Evolution is to provide tools, methods and processes that support or ideally make obsolete software maintenance. Existing approaches for maintenance and evolution of software systems that were developed are for example object-oriented Programming, generative programming[47], design patterns, frame based software engineering[48], aspect oriented programming, software product lines, Model driven software development and architectures (MDSD and MDA) as well as domain specific languages (DSL). **The MDA approach**

promotes a clean separation of abstraction levels via the separation in platform independent and platform dependent models and of concerns by the use of models and views for the different aspects of a system. While these features are likely to improve evolution of software this is still a topic of ongoing research

B1.2.2.1 Technical Limitations

Nevertheless, based on the experience of concretely applying MDRE on numerous real projects, we believe there are still some important problems to be tackled before MDRE becomes mainstream. They concern notably the *software paradigm shift* that has to be more and more frequently observed during reverse engineering or modernization scenarios. In particular, there are several challenges that every complex migration project needs to face:

- **Efficiency concerns.** Legacy systems are usually huge and complex systems. *Scalability* of MDRE techniques must be improved to be able to load/query/transform the big models that must be generated and handled to represent the legacy applications.
- **Cost of adapting existing solutions to the project specific needs.** Most MDRE solutions are technologically-dependent, meaning that they only target a very concrete legacy technology. We must advance in the development of generic MDRE solutions that, even if they still keep a technology-dependent subsystem, are largely reusable in various contexts.
- **Avoid losing information.** To ensure the quality of the modernized system, and validate that it behaves in the same way as the old one, is very important to be able to trace back all components and migration decisions to the part of the legacy system that originated them. Full life-cycle traceability is a missing component in all MDRE solutions at the moment.
- **Comprehension of the system.** The goal of reverse engineering is not only to represent the legacy system in a different technical space (i.e. in a model form) but to facilitate the understanding of that system by its users/developers. This requires going beyond providing a simple low-level representation of the system, and trying to derive (in a semi-automatic way) higher abstract views of it with the most relevant information. The objective is also to be able to create useful views of the system depending on the role of the user examining it.

Even though there are already other projects (e.g. European projects such as MOMOCS[49] or REMICS[50]) that have worked on improving the overall migration experience (respectively focusing on the reengineering and Cloud modelling parts), and tools (mainly limited to specific reverse engineering scenarios and concrete technologies) that have provided interesting advances in the MDRE domain, the previously mentioned issues remain opened.

These limitations are especially relevant nowadays, given the disruptive change that Cloud Computing is introducing in all kinds of organizations. Current approaches are unable to fully address the particularities of this new “Internet of Services”, preventing many companies that would like to move to the Cloud to do it with full guarantees.

Some of the challenges in software maintenance and evolution stated by Mens[51] have not sufficiently been addressed in context of the MDA approach. Among them are support for model evolution, provision of a common software platform as a basis for effective research, increasing managerial awareness for the necessity and benefits of software evolution and the

integration of data from various sources to form a body of knowledge that supports system comprehension.

B1.2.2.2 Innovation of ARTIST

The objective of ARTIST is to contribute to the community such a complete modernization methodology, as well as a corresponding concrete framework to effectively deploy it on real use cases. The base of the approach is to represent the legacy artefacts and their useful content as models, so that they can then be efficiently transformed into several different views facilitating the legacy systems assessment, comprehension and migration. In addition to that generic and extensible base, the provision of dedicated extensions addressing the specificities of the “Internet of Services” or Cloud is also a fundamental contribution to be made by ARTIST. Thus, we believe that such a use of models provides the relevant capabilities to stay ready for the future, by allowing capitalizing on the actual knowledge of the applications at a technology- or paradigm- independent level. As stated before, **there is no industrial-level complete methodology to be used a solid basis in order to design and build solutions potentially addressing any kind of reverse engineering scenario from different types of legacy systems** as ARTIST intends to do.

According to the present situation, the three main innovations brought by ARTIST from the MDRE side are the following ones:

- A **generic approach** (i.e.; a methodology and supporting framework) that is applicable on any kind of migration scenario involving a switch of paradigm during the process, compared to usual approaches considering only specific targets;
- A **strong support for the business assessment**, technical analysis and migration roadmap planning that allow firstly evaluating and secondly determining how to efficiently implement and run the actual process;

The ARTIST project will improve MDA software evolution in various ways:

- The **repository stores and relates information from various sources** and makes it accessibly to developers and development tools;
- The **repository will store model changes as deltas** which makes it possible to track model evolution and to evaluate model changes for e.g. data migrations;
- **Certification and the inclusion of business aspects** will raise the awareness of managers towards migration and evolution costs and potentials.

B.1.2.3 Service Engineering and Specific Modelling languages for SOA and Cloud

Service Engineering can be seen on the technical and on the business level. In the latter context Service Engineering describes development of service offerings in a systematic and structured way. This method describes a service offering along four dimensions: potential to offer the service, processes needed to offer the service, products offered and the market environment[52]. Special attention is paid to design the service in a way that is attractive to customers. Service Engineering is relevant for the definition of viable Software as a Service business models.

On the technical level Service Engineering deals with the development of software services and their interactions in a Service Oriented Architecture (SOA). There are a number of methodologies that have emerged from industry as listed by Van Den Heuvel[53]. Among them

are the Service-Oriented Modelling Framework[54] which provides a methodology, a modelling language and patterns for enterprise and application architectures, Service-Oriented Architectures (SOA) and Cloud Computing. However some of these assets are proprietary and not publicly available.

In research there are approaches such as the Service Development Lifecycle Methodology (SDLM) the EU-funded projects Service Centric System Engineering (SeCSE)[55], SOA4ALL[56] and COMBINE[57] (COMponent-Based INteroperable Enterprise System Development) or ModelWare[58]. Other approaches to SOA architectures are Federal Enterprise Architecture (FEA)[59] and the Open-Group Architecture Framework (TOGAF)[60]. The FP7 SHAPE[61] project (Semantically-enabled heterogeneous service architecture and platforms) has produced a methodological framework to develop service based enterprise systems. Additionally, SHAPE delivered as major outcome the standard **SoaML [62] which aims to provide explicit modelling for services in software and system modelling**. The standard aims not only to improve the communication among software developers, but also to enable the automatic processing of the models in order to generate the platform specific assets necessary to implement those services.

As an evolution of SoaML, and pushed by the technological revolution on the cloud side, PIM4Cloud[63] is being developed as one of the activities of the REMICS project[64]. PIM4**Cloud intends to extend SoaML metamodel** and addresses three issues related to deploying an application on the Cloud: modelling the technical architecture of the application, modelling deployment of this technical architecture on public and private cloud computing platforms and modelling physical infrastructure used in conjunction with cloud computing platform. PIM4Cloud is recommended to describe the positioning of those components and services throughout the Cloud environment The final goal is to issue an OMG Request for Proposal for PIM4Cloud with the objectives of 1) Focusing on modelling deployment of applications & services on cloud for portability, interoperability and reuse, 2) Addressing deployment to Cloud Platforms at the Infrastructure and Service level, 3) creating a Deployment model to specify infrastructure and QoS and SLA properties for analysis

B1.2.3.1 Technical Limitations

The existing approaches offer comprehensive methodologies to scope and develop software services and address the need to align business processes and organisation with a services based IT infrastructure, some issues like performance profiles and support for performance optimization at deployment time are not covered systematically.

SoaML was conceived under the SOA paradigm and currently it is oriented to the modelling of services and components in a Service Oriented Architecture, but it does not address specific aspects related to the SaaS paradigm (horizontal multitenancy, scalability, monitoring needs, security, self-deployment…).

Furthermore, currently SoaML does not address the following issues:

- **Security is not addressed** at PIM Level
- **Quality of Service** at PIM Level

Regarding PIM4Cloud, it currently does not address the following issues:

- **PaaS**. PIM4Cloud does not model PaaS. The justification provided is because of the immaturity of current existing PaaS
- **Mapping to existing platforms and languages for services specification** and execution

B.1.2.3.2 Innovation of ARTIST

ARTIST will **extend SoaML metamodel** and profile including SaaS specific characteristics of services such as:

- Scalability and multitenancy at service level
- Security aspects
- QoS aspects

At the same time ARTIST project intends to **collaborate with the REMICS project and their activities regarding the PIM4Cloud metamodel** in order to apply and extend (if necessary) the specification of the deployment model of service based software into the cloud.

B1.2.4 Performance modelling of source applications and target environments

The issue of performance modelling of applications and environments is a complex process, containing a variety of actors and parameters that influence this process. Application execution parameters[65] for example, may influence the need for resources depending on the internal code structure, or specific characteristics of the execution. Furthermore, **the performance of virtualized, multitenant infrastructures is questionable**, given that the way the coexisting applications are allocated to the available resources interfere with each other depends on various parameters, like the provider's scheduling policies, the types of the applications, the complementarity of the resource usage etc.

B1.2.4.1 Technical Limitations

What is done at the moment is that for each application that is going to be deployed or transformed into a service oriented version, extensive sampling or benchmarking is performed in order to extract models that depict the variation in performance and correlate it with various parameters (like application or hardware ones). **There is no generic way of identifying with very little information the type of an application to existing well known forms** like benchmarks[66].

Another issue is that for monolithic applications, the performance of the software was measured on an end to end basis, given that the notion of components was limited. With a transformation to a service oriented version, the different components and the way they are connected may influence performance significantly[67]. With this approach, there is the potential to discover bottlenecks or different setups of the final application that will benefit the way these are deployed and operate.

Furthermore, one fact for example of service oriented platforms is that their internal infrastructures are hidden from the outside world. Thus very little information is available regarding their capabilities, the true performance of the available hardware or the fluctuation of this performance. For example, the interference of collocated VMs or in general computational tasks on the same physical node may be extremely severe or negligible, depending on the types of these tasks and their characteristics and whether the provider takes

these issues under consideration[68]. In addition the difference in the performance of similar resources of the same infrastructure provider is not negligible as dictated in the article referenced[69]. Existing infrastructure offerings do not take actual performance of their infrastructures into consideration, when offering SLAs to the end customers. Providers such as Amazon or Flexiscale for example simply provide access to predefined instances, with configurable number of cores and/or RAM size. However, this is not sufficient guarantees that the application will behave as desired, given the interference from concurrently running applications. Thus an independent, external high level view of the quality of their infrastructures needs to be taken under consideration, in order to identify critical fluctuations in this QoS or specific inefficiencies in the internal infrastructure (like limited storage I/O or networking capabilities). Existing **attempts for measuring IaaS/PaaS providers performance** exist[7071], however t**hey are not incorporated in an overall framework**, by identifying in what category an application belongs and choosing therefore the most suitable provider.

On the other hand, IaaS and PaaS providers have recognized the need to start offering specific capabilities in their infrastructures or platforms, with regard to specific types of applications. Such offerings for example may be Hadoop as a Service[72], Cluster as a Service[73]

Thus, when a legacy application is identified as a specific type that can be included in these offerings, it will be most beneficial to choose the specific provider, taking under consideration that the configuration of this offering will be optimized for these types, in relation to the common infrastructures offered to the general public or generic applications.

For all these factors to be taken under consideration automatically and in a machine understandable way, according **metamodels must be created for both software and infrastructures, clearly depicting the performance characteristics** of both, in an attempt to optimize the deployment process. Existing standards (like PMML[74]) may aid for example for application characteristics, but they must be extended based on the stereotypes and in order to include infrastructure capabilities also.

B1.2.4.2 Innovation of ARTIST

In the context of ARTIST, it is envisioned to create the framework for:

- Analyzing the **performance characteristics of the transformed application and identifying potential bottlenecks** derived from the SOA-based design, altering and optimizing the latter in order to achieve significant improvements from using elastic infrastructures.
- **Defining and describing concrete and generic performance models (stereotypes)** that **capture the behaviour** of software with regard to the usage of the underlying hardware, the patterns of access and usage
- **Mapping the software components to these stereotypes** through supporting tools that will be able to extract the type of the software, **thus** directly **predicting their behaviour** to a variety of hardware. For this, knowledge-based approaches will be combined with Artificial Intelligence agents that will perform this mapping in an automated fashion
- **Mapping the target deployment facilities capabilities** with regard **to the performance stereotypes and time** (in case of variation of these capabilities), making it feasible to choose the fittest environment for the specific characteristics of the transformed legacy application

- Enabling the **multi-modal construction of services, optimizing their behaviour with regard to parameters of usage**. This is based on the sound assumption that different patterns of usage may require different design considerations/transformations in the SOA level (e.g. addition of acceleration or load aggregation components).

By taking under consideration the aforementioned factors ARTIST will be able to optimize the way the applications are deployed (based on the expected usage), choose the necessary and fittest infrastructures but also ensure that the performance of the final version of the legacy application abides by the standards set by the owner.

B.1.2.5 Service – based Software Quality Assurance

After migrating software to a new platform, **the quality of the resulting software system has to be evaluated**. Two major concerns have to be considered in this post-migration phase. First, the functional equivalence between the legacy software and the migrated software has to be proven. Second, non-functional requirements have to be evaluated for the migrated software in order to ensure that the goals of the migration have been actually achieved. Especially the first concern is considered to be the most costly step in migration projects[75] . In order to prove at least in a certain way the equivalence between the legacy software and migrated software, additional functionality should be introduced after the equivalence has been verified[76]. Normally, regression tests are used to show the equivalences. Here two scenarios are possible: (1) regression tests are available and (2) no or insufficient regression tests are available for the legacy system. In the first case, the regression tests have to be migrated as well to the new target platform and in the second case, regression tests have to be derived for the legacy system before it can be successfully migrated.

B1.2.5.1 Technical Limitations

Current approaches for software migration mention the necessity of post-migration testing for determining the functional equivalence between the legacy system and the new system as well as the non-functional requirements. However, as reported in the paper related to Approach for Post-Migration Testing of Web Applications[77], only little support is provided by current approaches. **There is neither methodological nor tool support to automate post-migration testing**. Only some specific approaches have been proposed[78] for deriving artificial regression test for software migration (based on white-box testing) as well as using the real end-users to test the migrated system (based on black-box testing) by running the legacy system and the migrated system in parallel. Request from users are distributed to the legacy system and simultaneously sent to the migrated system. Then, results generated by both systems are then compared, and mismatches due to migration problems can be easily detected. Besides finding the right set of test cases, testing in modern infrastructures such as the Cloud is considered to be a major challenge[79]. Especially, testing non-functional requirements seems to be dependent on the actual resources available in the Cloud infrastructure. Thus, **dedicated simulation processes are needed to identify if** certain **requirements** such as performance **are successfully realized**.

B1.2.5.2 Innovation of ARTIST

One of the objectives of ARTIST is to **establish a comprehensive post-migration testing approach for ensuring the quality of the migrated software**. First, means to migrate test cases from the legacy system to the modernized system have to be provided. Second, if no test

cases exist, ARTIST will aim to provide means to generate artificial test cases from models (applicable on the legacy system and on the migrated system) as well as using real end-users as tester by running both systems in parallel. Third, an intensive evaluation of non-functional properties should be enabled to allow for an exact measurement of the benefits of the migration. This last point has to be aligned with the first phases of the migration, i.e., the goals formulated for the migration have to be validated in the post-migration phase. To summarize, a methodology covering different possibilities for post-migration testing as well as dedicated tool support is needed to reduce the high costs of testing the migrated system. Because this phase is considered to be up to 80% of the total time spent for migration legacy systems, ARTIST partners see a huge economic potential in providing dedicated support for this phase which is currently mostly overlooked by existing approaches.

B.1.2.6 Quality Models, Frameworks and Services

Certification and Process Improvement models such as CMMI, ISO or ITIL are widely applied nowadays all over the world. Companies that commit to these models have a competitive advantage compared to those that do not and thus do not apply systematic procedures in their daily tasks.

CMMI for Services (CMMI-SVC) [80] extends the coverage of the CMMI Product Suite to cover the establishment, management, and delivery of services. The model focuses on service provider processes and integrates bodies of knowledge that are essential for successful service delivery, such as incidence management, service continuity, delivery or management, on top of others essential to the business such as project management.

Information Technology Infrastructure Library (ITIL)[81] [82] is a public framework that describes Best Practice in IT service management. It provides a framework for the governance of IT, and focuses on the continual measurement and improvement of the quality of IT service delivered, from both a business and a customer perspective. ITIL describes a wide number of management proceedings to get a good quality-cost relationship in operations related to IT. These proceedings are independent from suppliers and have been developed as guides for the development of the IT infrastructure. ITIL was the baseline for defining the ISO 20.000 Standard[83] , which is considered the first international standard for the administration of the IT Services.

The European Cloud Platform, **EuroCloud**, is developing a certification model called **Star Audit** [84]. Requirements for this model have been obtained from different stakeholders such as the German Government, ISO, KPMG, Cloud Security Alliance (CSA) or ENISA's Cloud Computing Report. EuroCloud has divided its model in three levels, categorized as stars, similar to the classification of hotels worldwide, being these: 3* Trusted Cloud, 4* Trusted Cloud Advanced, 5* Trusted Cloud High Available. Some of the aspects analysed in this certification model include Compliance Conformity (Order Processing, Data Protection Regulations, Book Keeping Regulations, Data Export Regulations), Data Center Infrastructure Capabilities, Maturity of Operational Processes, SLA Fulfilment Capabilities and Scalability and Interoperability.

B1.2.6.1 Technical Limitations

ITIL deals with service management and delivery, SOA with service technology but it is not clear how ITIL supports the transition of organisations from classical product to SOA based service business. Despite the common goals and guiding principles of ITIL and SOA, there is a chasm in many organizations between these two efforts. This is because some of the fundamental problems that have produced inefficient IT operations and unresponsive business

applications also are conspiring to derail many ITIL and SOA initiatives. The most significant obstacle is the psychological distance and structural barriers between the IT operations and software-development teams[85].

CMMI-SVC was released in early 2009 and its applicability is still being proven. Basically it is more generic than ITIL, which directly focuses on IT-Services.

Star Audit by EuroCloud is still at its definition phase, and currently it is very focused on the infrastructure part of the Cloud Computing paradigm, rather than on the services to be provided on top of the Cloud infrastructure.

All above listed certification models or quality frameworks are designed for a dedicated business and the related organisational units of an enterprise (Software development, System development Service development, Service Management, IT Integrations...). All of them have business models as a fundament without really naming them. For organisations in transformation, especially from product to service business none of them is really helpful by looking at the dependencies on the business model, the technology and the organisational structure. Most methods have their roots in software as a product in the conventional sense, directly addressing the needs of patented software business models (before the advent of open source software). These methods were oriented to a product lifecycle involving a development phase followed by a service phase.

B1.2.6.2 Innovation of ARTIST

The certification model to be developed in ARTIST **will focus on organisations that develop and offer or consume software based services** using methodologies and business models that are connected the Future Internet. Certification is a way to ensure that "standard-based" products are implemented. The advantages afforded by a certification are usually fairly obvious: quality products, competitive markets with more choices, commodity pricing, and less opportunity to become "locked in" to a particular vendor. Moreover, a certification program based on well understood and sound principles will be acceptable and credible to its community of users.

The certification model to be developed will at least contain fundamental roles, activities, and artefacts that are necessary for cloud providers (mainly SaaS but also PaaS). It will be based on already existing maturity and certification models as far as they are applicable and comprehensive in the context of cloud certification and extended in topics not covered by the current ones. A starting point is the one developed by Eurocloud and for that, several liaison activities will be planned (WP3). ARTIST's certification model will analyse different aspects from three points of view: 1) the organizational approach (processes, products, financial aspects, and service continuity), 2) the service offered approach (security, administration, support, QoS, SLA, service operational maturity) and 3) the application approach (functionality, usability, maintenance).

Within each component the company will score a level of maturity beyond a pass/fail that comprises coverage, depth, documentation, and tools. And, of course, the report will include recommendations for improvement and scaling up the maturity ladder.

With such a **specific, cloud-centric, verifiable and accountable program**, the consumer of these on-demand services will know whether a company that is offering a service can or cannot meet their expectations.

B1.2.7 Business Models and Sustainability

In the most basic definition, business models describe how a company creates value. Apart from this very basic definition, the opinions divert on what the exact components of a business model are and how to design and to describe them.

In his thesis "*The Business Model Ontology - a proposition in a design science approach*"[86] Alexander Osterwalder gives four main areas of a business model: product, customer interface, infrastructure management and financial aspects. The product area describes what a company is offering, either now or in the future. Without something that can be of value to potential customers it is very difficult to define a business model. The second main area, the customer interface, describes the audience that is targeted with the product, how the distribution channel to reach this audience works and what the relation to the customer is, either direct or indirect via external partners. The third main area, infrastructure management, deals with the organizational aspects of creating the value, i.e. the product and the services, and comprises how the value is created for the customer and what resources and activities are required for it, describes the ability to create the value via a repeatable process and determines if partnerships are required if more expertise is needed to create the envisioned value. The fourth main area, financial aspects, comprises the cost structure and the revenue model. The cost structure summarizes all the expenses needed to create the value as they appear in the business model. The revenue model describes how the income is generated by selling the products or the services.

This model is a generic model that is applicable to different kinds of companies and businesses. The generation of a specific model is guided by the elaboration of each of the main areas.

B1.2.7.1 Technical Limitations

The above definition is generic and targets physical goods as well as virtual goods. The current vendors of cloud-based software systems keep the details of their business models private. It is an open question how a successful business model for a new service can be created or how a given business model for a legacy system can be transformed to one that is suitable for the cloud. An additional challenge in this regard lies in the **definition of value chains and revenue-sharing models in distributed service landscapes**. First steps are being done in this direction via studies with IT service providers[87].

B1.2.7.2 Innovation of ARTIST

ARTIST will use commonly accepted definitions of the components of a business model and use them to define templates that can be used for cloud products. In addition, ARTIST will **examine the business models of legacy software systems and examine which parts can be adapted to a cloud-based distribution** and which parts have to be redefined. This will ensure the business sustainability of the providing company.

B.1.2.8 Cloud Interoperability (data and code related)

The IEEE Glossary[88] defines the term "interoperability" as the ability of two or more systems (1) to exchange information and (2) to use the exchanged information. Under the term "system", different types are subsumed from the hardware level such as *computer systems*, e.g., PC and Mac, to software level such as *operating systems*, e.g., Windows and Linux,

programming platforms, e.g., .Net and Java, and *software applications*, e.g., Word and OpenOffice. As for traditional systems, interoperability becomes also an important topic in the context of Cloud computing on all levels of the Cloud stack, i.e., IaaS, PaaS, and SaaS, as mentioned in several publications[89] [90] [91]. First, interoperability is needed to combine different Cloud infrastructures to realize one single application or to integrate several different applications running on different cloud infrastructures. The latter scenario is also referred as federated Clouds[92]. In particular, integration allows exploiting the advantages of different Cloud infrastructures. Second, besides assembling the best mixture of Cloud infrastructures, also economic benefits may be raised by migrating applications quickly to the "best" Cloud infrastructure provider. This aspect is also strongly interconnected with the problem of Cloud provider lock-in of programs and data which has been explored as a major issue, e.g., when providers have to close their business. To summarize, the two main interoperability scenarios for Cloud computing are *integration* and *migration*. Both scenarios have in common that ***heterogeneities* between the different systems have to be resolved before interoperability may be achieved** [93] [94].

Establishing interoperability between heterogeneous systems has a long tradition in diverse fields of computer science and a multitude of concepts, techniques, and tools have been established in the last decades[95]. For loosely coupled systems, *bus* or *network-based architectures* have been established where different systems are connected by a communication channel. If a stronger kind of integration is needed, *virtualization* in different forms is one key technique to abstract from hardware and operation systems which is heavily employed for Cloud computing[96]. Virtualization is not only specific to programs, but is also employed to integrate and federate data by providing a "virtual" schema to access several different "local" schemas in a unified way[97] .

Not surprisingly, virtualization is also one of the key concepts in Cloud computing, especially on the lower levels of the Cloud stack. An example scenario is virtual machine migration for load balancing; a technique evolved from process migration techniques[98]. If no heterogeneities between Cloud providers exist, such techniques are efficient to migrate even running systems from one provide to another. However, currently there exist a huge bunch of heterogeneities between different Cloud infrastructures. To tackle these heterogeneity issues, standardization efforts are currently on-going in research projects, industry consortiums, and standardization organizations, mostly focusing on the lower levels of the Cloud stack. For instance, the European Desktop Grid Initiative (EDGI)[99] (EU FP7) aims at developing a consolidated middleware for deploying applications requiring an extremely large number of CPUs and cores. While EDGI is only concerned with the IaaS level, the Cloud4Soa project[100] (EU FP7) also aims at providing interoperability between different PaaS providers by using SOA and lightweight Semantic Web technologies. Besides research projects, there are also industry consortiums working on standardizing interactions between Cloud environments by developing cloud management use cases, architectures and interactions such as the Open Cloud Standards Incubator[101], a working group formed by the Distributed Management Task Force (DMTF) or the Open Cloud Consortium (OCC)[102]. Finally, also standardization organizations are currently starting to consider Cloud infrastructures such as the NIST Working Definition of Cloud Computing[103], the Object Management Group[104], and OASIS[105].

Finally, the willingness of SMEs in the field of Cloud computing for having open standards is reflected by the **Open Cloud Manifesto**[106] which states several principles for establishing interoperable Cloud infrastructures. However, the big players in the field of Cloud computing (such as Google, Microsoft, and Amazon) have still not signed the manifesto which shows that a complete standardization seems to be hardly achieved.

B1.2.8.1 Technical Limitations

To summarize, there are currently several efforts to establish interoperability between Cloud infrastructures. Software stacks have improved interoperability among platforms, but the APIs for Cloud Computing itself are still proprietary or have not enough been the subject of active standardization, yet. Thus, customers cannot easily migrate their data and programs from one provider to another. Customer lock-in seems to be attractive to Cloud providers, thus it is questionable of a complete standardization is achievable in reality. Nevertheless, on the lower levels of the Cloud stack, there are several efforts to develop standards such as unified APIs and virtual machines. However, to the best of our knowledge, at the higher level, i.e., frameworks used on the platform level to program the actual application logic, there are only few attempts for providing interoperability in terms of migration from one Cloud provider to another. In particular, a comprehensive approach would be needed for migrating programs as well as data. Finally, currently **there are no formalized platform models for specific Cloud providers** aggravating the comparison and interoperability between them.

B1.2.8.2 Innovation of ARTIST

One of the objectives of ARTIST is to establish a **comprehensive approach for providing interoperability between different PaaS providers**. In particular, we aim for model-driven interoperability [107] for realizing the following five goals. First, applications residing in the Cloud should be reverse engineered into models by reusing the aforementioned software modernization approach for legacy applications. Second, having these models at hand, they can be deployed to other PaaS providers by using forward engineering. Third, having a common modelling language for the applications, such as the established UML or the upcoming PIM4Cloud standard, as well as having a pivot metamodel for PaaS providers, the interoperability problem is reduced in terms of number of bridges between PaaS providers from nXn to n. Fourth, not only a common modelling language for programs, but also for data is provided which allows complete migrations from one PaaS provider to another. Fifth, not only migration shall be tackled but also integration of different Cloud infrastructures by providing dedicated integration templates which are instantiated in forward engineering tasks. By this, the software developer should have more freedom of choosing a well-suited mixture of cloud infrastructures without writing boilerplate code for their integration. For this, we plan to build our approach on top of results of the Cloud4SOA project which seems to be an appropriate target platform for code generation. This should show that our approach is orthogonal to emerging approaches and is a step towards further raising the level of abstraction for interoperability issues in the Cloud.

B1.2.9 Non – Functional Requirements in Cloud – based applications

When addressing the major challenge of software migration, modernization, and re-engineering, improving the legacy software's accessibility is of paramount importance and especially if delivered as a service over the Internet. During the past years, it has been observed a tremendous growth of the information, knowledge, and services that are, often even exclusively, available through digital technology. These technologies have been a key enabler for progress and welfare of the European information society both in work life and leisure time. However, more than 15 % of the population of the European Union[108] are, due to disabilities of various kinds, increasingly missing out on the social and economic benefits that this technology is providing for society.

The European Commission is well aware of this severe problem and, therefore, committed itself to encourage a European-wide adoption of accessibility standards for digital technology[109]. More recently, the European Commission further established the e-Inclusion initiative, which aims to achieve that "*no one is left behind in enjoying the benefits of ICT*"[110]. One important step towards this honourable and ambitious goal is the adoption of global web accessibility standards. To this end, the world-wide web consortium (W3C) published, in the course of the Web Accessibility Initiative (WAI)[111], several recommendations and guidelines for realizing accessible Web applications as well as authoring tools. Accessibility, however, is an essential aspect that must be considered when modernizing and re-engineering legacy systems to shift rich-client user interfaces into the cloud; because modern software must be usable by everyone such that "no one is left behind".

Legal aspects of software mostly concern the handling of sensitive data. Up to now that data has usually been stored on a medium that is under the control of the user of a software product or the company running it on-premise, meaning hard drives or storage systems. It was the user's or the service administrators' responsibility to set up proper safety measures to prevent unauthorized data access or data theft. This includes testing software packages for malicious behaviour and keeping them up-to-date in regard to security fixes.

Software that is running in the cloud is not an exempted from these rules in any way. Cloud services do order data processing, i.e. they store and process data on behalf of a customer. The EC has issued the directive 2002/58 [112], *"Directive concerning the processing of personal data and the protection of privacy in the electronic communications sector"*, that specifies the rules for handling of sensitive and personal data. The directive addresses security concerns regarding the confidentiality of communications, the handling of traffic data, i.e. data that is only temporarily stored for faster transmission, as well as location and related traffic data. The directive dictates that "the provider of a publicly available electronic communications service must take appropriate technical and organisational measures to safeguard security of its services, [...]". It also rules that providers have to inform customers of potential risks in regard to the usage of the service and possible counter-measures.

These aspects address the secure operation of software services in the cloud. The ISO/IEC 15408 [113] defines a framework for the definition, choice of implementation and evaluation of security functional and assurance requirements. The requirements are usually defined by the users of a product, the vendor can choose to implement them and evaluation of compliance is done by independent testing facilities. The three aspects are compiled in a document detailing the Protection Profile of the product. Protection Profiles exist for several crucial IT components, such as firewalls, operating systems or smart cards.

Other standards, such as ISO/IEC 27000 or the German “IT-Grundschutzhandbuch”[114], supplement the common criteria by adding requirements for interoperation, system management or user training. It is as of yet unclear how the standards handle the operational aspects of cloud services, meaning the handling of failures in the operational value chain of infrastructure, platform and software provider, each of which can be a different entity for a given product.

Data security and operational safety are the two top challenges to consider when migrating a software as a service to the cloud. They have to be addressed during development and monitored/audited during operation. This is the case of security considered among one of the major barrier to a faster and widespread adoption of the cloud computing deployment scheme of applications[115]

Although cloud computing shares a set of IT security risks (e.g. data segregation and privacy, privileged user access) with any externally provided service[116], it also poses new specific **security issues** [117] [118] [119]:

- unexpected side channels (passively observe information) and covert channels (actively sending data): e.g. an attacker virtual machine (VM) deployed on the same physical machine of a targeted virtual machine could construct a side channel and detect activity patterns of the target;
- reputation fate-sharing: sharing of physical equipment means that the seizing of an equipment to properly conduct forensics on a single application can disrupt the other users sharing the very same equipment;
- more complicated computing ecosystems potentially enabled by cloud computing (e.g. an end user relying on a SaaS provider relying on a PaaS provider that in turn relies on a IaaS provider) means the increase of attack surface (e.g. one of the cloud provider in the ecosystem could sell confidential information about its customers);
- perception of cloud computing as an always-available service could lead to inadequate security good practices (e.g. data backups across multiple cloud providers).

As a consequence organisation adopting cloud-based service have to assess [120]: *(i)* security, privacy and regulatory compliance risks, *(ii)* identify use cases that are inappropriate for cloud computing, *(iii)* identify use cases that pose an acceptable level of risks for services delivered on cloud, *(iv)* implement compensating security controls. The fulfilment of security requirements by means of security controls cannot be an afterthought in the process of software development[121]. Various software development methodologies have been proposed to ensure that security is woven into the software and tested and measured thorough the development life cycle[122].

The Microsoft's Security Development Lifecycle (SDL) is a software development security assurance process consisting of security practices grouped by seven phases: training, requirements, design, implementation, verification, release, and response[123].

The purpose of the NIST Secure Development Life Cycle Software is to assist agencies in building security into their IT development processes[124]. The NIST's report recommends that "*consideration must be given not only to integrating security into the SDLC for new systems and the integration of systems, but also to the overhaul, upgrade, or migration of systems to address technology advancement*". One of the reasons why security is neglected during the design and development of software systems is the lack of security knowledge by software engineer and developers [125].

Security Patterns are a conceptual approach aimed to bring to software engineers and developers the security experts' knowledge about how to solve recurrent security problems arising during software development [126]. Security Patterns specific for specific technologies have been developed as well [127].

A source code refactoring (i.e. a transformation of the code of an application that does not change the behaviour of the application) can be seen as a sort of transformation patterns since it describes both a recurrent problem and a solution. Maruyama [128]introduces a set of refactoring increasing the security level of existing code.

B.1.2.9.1 Technical Limitations

Although the need for Security Patterns for cloud computing has started to be recognised in recent years [129]**a catalogue of security patterns for cloud-based applications is still lacking**. Moreover the assessment of the impact of refactoring on the security properties and other non-functional requirements of a given program has still received little attention[130].

B.1.2.9.2 Innovation of ARTIST

The contribution of ARTIST with respect to Non-Functional Requirements will consist of:

- **A library of Cloud Security Patterns** (i.e. Security Patterns for applications deployed within Cloud Environments), fulfilling different legal frameworks (EC Directives on Privacy, Data Confidentiality and Security).
- Techniques for the **discovery and display of Security Patterns** from legacy applications starting from the analysis of source code and execution traces.
- A library of model transformations aimed to preserve across migration the security properties of a legacy application by **mapping** the security patterns matched by a legacy application with the **Cloud Computing Security Patterns**.
- Techniques to assess the **impact of refactoring** due to migration on the security properties of a legacy application.
- Elaboration of means for migrating, modernizing, and re-engineering legacy software, also the incorporation and compliance to **accessibility standards into the software to be modernized** is, conforming to the aims of the European Commission: accessibility is foreseen as an integral part in the redefinition of the complete software development and provision lifecycle.

Altogether the above will contribute to make secure the ARTIST modernisation blueprint and methodology.

B.1.2.10 Patent search results

Not applicable in the context of this project as the main results will be based on methods, rules and tools not patentable according to EPC[131] (European Patent Convention).

B.1.2.11 Summary of the state-of-the-art, contributions and innovations planned in ARTIST

Table 5. Summary of the State of the art and ARTIST innovation

Summary of ARTIST innovations		
Key area	**Baseline**	**ARTIST innovation**
Migration to SOA and Cloud methodologies, Strategies and Tools	Existing migration approaches and methodologies are tool vendors and cloud providers' dependent, or do not take into account aspects as scalability QoS, security. None of these methodologies treat the business model requirements.	ARTIST relies on the **integration of business and technical aspects** in the whole migration process. The achieved solution will be **Open Source and based on standards** such as SOAML or other UML profile models, thus avoiding tool vendors and cloud providers constraints.

Summary of ARTIST innovations		
		Exploitation Potential *Increase Innovation*
(Model-Driven) Reverse Engineering and Modernization	MDRE relies on the use of a set of models to represent the legacy system and a set of transformations that transform the extracted models into comprehensive views of the system appropriate for each user profile. There are several challenges as: Efficiency concerns, cost of adapting existing solutions to the project specific needs, avoid losing information, and comprehension of the system.	ARTIST approach is focused on the representation of the legacy artefacts and their useful content as models, so that they can then be efficiently transformed into several different views facilitating the legacy systems assessment, comprehension and migration. In addition to that generic and extensible base, the provision of **dedicated extensions addressing the specificities of the "Internet of Services" or Cloud** is also a fundamental contribution. *Advance over the State of the Art*
Service Engineering and Specific Modelling languages for SOA and Cloud: SOAML and PIM4Cloud	SOAML is oriented to the modelling of services and components in a Service Oriented Architecture, but it does not address specific aspects related to the SaaS paradigm. PIM4Cloud (one of the major outputs of REMICS) intends to extend SoaML metamodel and addresses issues related to deploying an application on the Cloud. PIM4Cloud currently does not address: PaaS and mapping to existing platforms and languages for services specification and execution	ARTIST will **extend SoaML metamodel** and profile including SaaS specific characteristics of services such as: Scalability and multitenancy at service level, security and QoS. ARTIST will **collaborate with** REMICS project and their activities regarding PIM4Cloud **metamodel**. *Advance over the State of the Art* *Standardization Potential*
Performance modelling of source applications and target environments, Techniques and Tools	The issue of performance modelling of applications and environments is a complex process, containing a variety of actors and parameters that influence this process. Furthermore, the performance of virtualized, multitenant infrastructures is questionable, given that the way the coexisting applications are allocated to the available resources interfere with each other depends on various parameters. The performance of the monolithic applications was measured on an end to end basis, given that the notion of components was limited. With a transformation to a service oriented version, the different components and the way they are connected may influence performance significantly.	ARTIST will create a framework for: • Analysing **performance characteristics** and potential bottlenecks • Defining **concrete and generic stereotypes** (performance models) and mapping the software components to these stereotypes with supporting tools • Enabling **multi-modal construction of services**, optimizing their behaviour respect the parameters of usage *Increase Innovation* *Exploitation Potential*
Service –	Current approaches for software	ARTIST will develop a methodology

Summary of ARTIST innovations		
based Software Quality Assurance	migration mention the necessity of post-migration testing for determining the functional equivalence between the legacy system and the new system as well as the non-functional requirements, but only little support is provided by current approaches.	covering different possibilities for **post-migration testing**. A dedicated tool support is also needed to reduce the high costs of testing the migrated system: migration test cases, generation of artificial test cases from models as well as using real end-users as tester by running both legacy and migrated systems, an intensive evaluation of non-functional properties. *Advance over the State of the Art* *Exploitation Potential*
Certification Models and Services	Certification and Process Improvement models such as CMMI, ISO or ITIL are widely applied in industry. These certification models or quality frameworks are designed for a dedicated business and the related organisational units of an enterprise For organisations in transformation, especially from product to service business none of them is really helpful by looking at the dependencies on the business model, the technology and the organisational structure.	ARTIST will **develop a certification model** focused on an organisation that develops and offers or consumes software based services using methodologies and business models that are connected to the Future Internet. This certification model will analyse aspects related to: the organisation, the service offered and the application offered. I*ncrease Innovation* *Exploitation Potential*
Business Models and Sustainability	Although, a generic model for different kinds of companies and businesses are defined in the thesis "*The Business Model Ontology - a proposition in a design science approach*" by Alexander Osterwalder, it is still an open issue how a successful business model for a new service can be created or how a given business model for a legacy system should be transformed to one that is suitable for the cloud.	ARTIST will define guidelines and templates based on accepted definitions of the components of a business model. In order to ensure the business sustainability, ARTIST will analyse which parts of the legacy product can be **adapted to a cloud– based delivery model**. *Advance over the State of the Art*
Cloud Interoperability (data and code related)	There are currently several efforts to establish interoperability between Cloud infrastructures. Software stacks have improved interoperability among platforms, but the APIs for Cloud Computing itself are still proprietary or have not enough been the subject of active standardization, yet. Nevertheless, on the lower levels of the Cloud stack, there are several efforts to develop standards such as unified APIs and virtual machines.	ARTIST will establish a comprehensive approach for providing **interoperability between different PaaS** providers based on a Model-driven interoperability solution. *Increase Innovation* *Exploitation Potential*
Non – Functional Requirements	Two main aspects are reflected: 1) Accessibility is an important aspect	ARTIST will provide: • **Cloud Security patterns**:

Summary of ARTIST innovations		
in Cloud – based applications	for European Commission that encourages to adopt the accessibility standards for digital technology. 2) Data security and operational safety are the two top challenges to consider when migrating software as a service to the cloud. The organisations adopting cloud have to assess: security, privacy and regulatory compliance risks, identify use cases that are inappropriate for cloud computing, identify use cases that pose an acceptable level of risks for services delivered on cloud, implement compensating security controls.	Library, techniques for discovery. • Incorporation and **compliance to accessibility standards** into the software to be modernized. • **A library of model transformations** for preserving across migration the security properties. All these aspects among others will contribute to make secure the ARTIST blueprint and methodology. *Advance over the State of the Art* *Exploitation Potential*

B.1.2.12 Previous and on-going European research projects related to ARTIST

Following Table shows a brief list of European projects that are most related to ARTIST topics. Other projects also related to ARTIST are specified in Annex A.

Table 6. Previous and Ongoing Projects related to ARTIST

Project	Relevant Results	Relation to, and difference with ARTIST	Partners
MODELPLEX [132] (FP6-IST-034081)	The goal of MODELPLEX is to develop an open solution for complex systems engineering improving quality and productivity exploiting advances in model-driven development; to lead its industrialization; and to ensure its successful adoption by the industry.	MODELPLEX focuses on proposing a model driven approach to elaborate on new complex software systems, where software architecture developments are built from a top-down approach (from model to code). It is more focused on the use of model driven techniques for new system development than on reverse engineering and evolution of legacy systems. However, **some MDE techniques initiated as part of MODELPLEX can be reused and extended/improved** for the purpose of ARTIST.	TECNALIA, INRIA
REMICS [133] (FP7-IST-257793)	The goal of REMICS is to develop advanced model driven methodology and tools for REuse and Migration of legacy applications to Interoperable Cloud Services. Service Cloud paradigm stands for	The methodology stops once the application is deployed on a cloud provider and does not cover, therefore, the **maintenance and evolution of the application to future technological paradigms**. Furthermore, the methodology is primarily focused on cloud and relies on the provider for aspects like multitenancy, security,	TECNALIA

Project	Relevant Results	Relation to, and difference with ARTIST	Partners
	combination of cloud computing and Service Oriented Architecture (SOA) for development of Software as Service systems. To support the migration, REMICS will enhance the OMG Architecture Driven Modernization (ADM) methodology with specific methods, meta-models and tool support, including knowledge discovery, patterns and transformations for SOA and Cloud Computing, Model Driven Interoperability (MDI), Models@Runtime, Model Checking and Model-based Testing (MBT).	scalability, monitoring and billing, which can imply the application not to be necessarily scalable. Additionally, REMICS does not cover the planning and assessment aspects of the legacy system evolution process, neither the business specificities the legacy system is actually addressing	
Cloud4SOA 134 (FP7-IST-257953)	Cloud4SOA focuses on resolving the semantic interoperability issues that exist in current Clouds platforms and infrastructures and on introducing a user-centric approach for applications which are built upon and deployed using Cloud resources.	Cloud4SOA addresses the semantic interoperability between competitive PaaS offerings, supporting the discovery of offerings based on the semantic profiles that describe applications to be delivered, their deployment, governance and monitoring and their migration from one PaaS offering to another compatible one. However, Cloud4SOA constraints application migration from one PaaS offering to another one to those technically compatible wrt the application development technology. In other words, **Cloud4SOA does not modernise applications to be inter-Cloud compatible**.	ATOS
mOSAIC	Development of an open source API and platform for multiple clouds, implementing a multi-agent brokering mechanism and facilitating competition between Cloud providers.	mOSAIC plans to release a second version of their Cloud Interoperability API early next year. ARTIST will study its usability and its suitability to **avoid vendor-lock in and application interoperability** with other cloud vendors. However ARTIST will not advance the state of the art in this concern.	TECNALIA

B.1.2.13 Indicators

Target Outcome (Obj. 1.2)	Project Level		Collaboration activities (if any of these expected to come out of the collaboration workpackage)	
	Target	Achieved	Target	Achieved
Cloud Computing	2. Contribution to standards: extension of fUML, SoaML, PIM4Cloud, all from OMG3. 3. Peer reviewed articles (3) 7. Press releases (2)		Workshops co-organized: 3 (location to be defined, total attendees of 100)	
Internet of Services	N/A		N/A	
Advanced Software Engineering	5. Whitepapers (2) 4. Open Source Repository: http://www.artist-project.eu/repository, size: provided by ARTIST partners (approx. 100 of artefacts) and by the ARTIST community (around 100 to 1000 new artefacts added every year), nature of users: any Software Developer (legacy or not legacy applications) for any technology (in particular the initial support is for Java and .NET), nature of community users 1.Trademark (1,SbSp certification) 3. Peer reviewed articles (6)		3. Peer reviewed articles: joint papers or articles with other IoS projects (2)	

More specific indicators about dissemination and collaboration are described in section 3.2.2.

Impact (Obj. 1.2)	Project Level	
	Target	Achieved
European Interoperable Clouds	Creation and/or extension of existing metamodels for the modelling of PaaS/IaaS providers, ensuring the interoperability and portability of applications among clouds.	
Platforms for easy and controlled development and deployment	Creation of a tool, model transformations and patterns to develop and deploy applications easily on different cloud providers	
Lower barriers	Increase awareness on the need to develop and deploy applications with quality and certified under a certification model in order to lower barriers in the adoption of cloud solutions.	
Efficient implementation on massively parallel architectures	Definition of performance stereotypes for target Cloud infrastructures. Classification and ranking matching Cloud offerings for delivery on massively parallel infrastructures	
Easier evolution of legacy software	Reduction of 15% of time required to establish the migration process of legacy software.	
Fast innovation cycles	Reduction of 20% of time required to introduce innovative cloud based business models.	
Strengthened industry in Europe for software – based services	Development of open source tools and methods which will provide affordable means to migrate to cloud for European companies (especially SMEs).	

B1.3 S/T Methodology and associated work plan

The methodology shows how the project plans to reach its objectives by performing the identified tasks. The objectives are threefold:

- Develop a new set of methods, tools and techniques that facilitate the transformation and modernization of legacy software assets and businesses by letting companies assess, plan, design, implement, and validate an automated evolution of legacy software to SaaS and to the cloud computing delivery model.
- Additionally, by focusing on reusability during this transformation, these methods and tools will be generic enough to cover future shifting efforts, e.g. deployment to future platform delivery paradigms.
- Develop a certification model from the provider's perspective.

We should not forget the need to create guidelines to transform the business structure towards the Cloud delivery model, taking into account the change from a product-oriented company to a service-oriented company, supporting the change from a license model to pay-per-use, give support to a bigger number of customers, etc. All the three objectives will take this into account.

These aspects will run in parallel, and will be validated by piloting. Following the iterative and incremental cycle of Plan-Do-Check-Act in software process improvement activities, the project will identify the requirements, provide the methodology and tools according to these requirements, validate the results and finalize the deliverables. The approach will be iterative, which allows reflection and optimal planning.

As Cloud Computing is an evolving hot topic, new researches and innovations from external communities will be properly incorporated to ARTIST outcomes. On the other hand, the creation of technological assets by means of defined use case scenarios and pilots, will allow validating concepts against the state of the art, methodologies, technologies, business analysis, and applications. Research and development activities in the project will follow an iterative and incremental approach divided into three phases and has therefore several project milestones in each of the phases.

- **Phase 1 – *Initial development (includes Milestones M1, M2, M3, M4)***: In the first phase of the project (from Month 1 to Month 12), the ARTIST consortium will work towards designing and harmonising initial versions of methodologies for transformation of legacy applications to a cloud delivery approach. The results will be based on existing state of the art results from completed and ongoing FP6 and FP7 projects. The consortium will also strive to define precisely the actual industrial use cases and the requirements for the ARTIST architecture.
- **Phase 2 – *Improvements and extensions (includes Milestones M5, M5, M7)*:** In the second phase of the project (from Month 13 to Month 30) the consortium will improve the methods and tools, and will support them with the ARTIST platform. The proof- of-concepts for these methods will be shown in the industrial use cases. Two iterations are planned in this timeframe
- **Phase 3 – *Finalization (includes Milestones M8, M9)***: In the third phase of the project (from Month 31 to Month 36) the consortium plans to finalize and integrate the technical results of ARTIST, provide final validation and benchmarking reports from the industrial use cases and final management reporting.

B1.3.1 Overall strategy and general description

- **Activity 1: Management, Awareness and Sustainability (led by ATOS)**: This activity will focus on the management of the project (WP1, WP2), on the awareness of the results (WP4 - Dissemination) and on the sustainability of project results after project completion (WP3 - Business requirements and Exploitation).

- **Activity 2: Technical definition and Implementation (led by TECNALIA)**: All the technical work packages are included in this activity. These WPs will focus on research, development and implementation of the different methodologies, technologies and tools. WP6 will define the overall ARTIST methodology and conceptual architecture, while the rest of the technical WPs will focus on specific research topics to implement such as the methodology and conceptual architecture (WP5, WP7, WP8, WP9, WP11). In order to support the re-utilisation of the artefacts and models developed during the migration, WP10 will implement a common migration artefacts repository.

- **Activity 3: Validation (led by ENG)**: This activity will focus on the validation of the ARTIST results through four industrial use cases. These uses cases will be developed in WP12 and monitored in WP13.

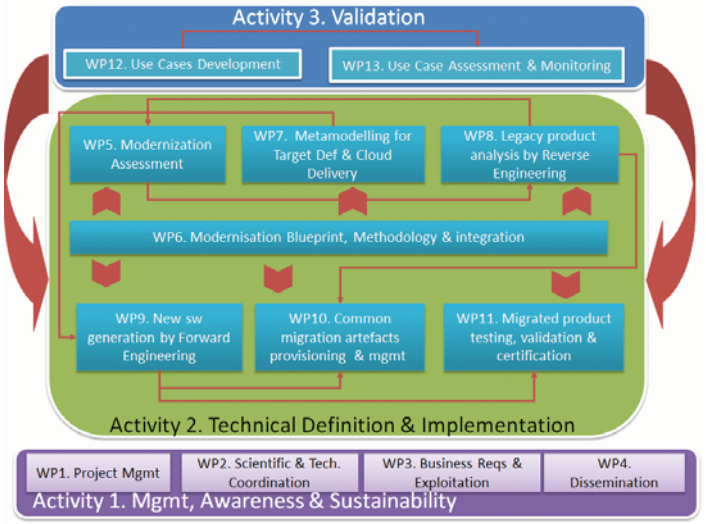


Figure 2. Overall Strategy

B1.3.1.1Risk Management

Risk Management will be adopted to manage project issues and conflicts. The challenging mission of ARTIST project is to provide a new approach for migration, reengineering, maintenance and evolution of legacy software into the Cloud Computing paradigm.

Thus, the main risk is failing in achieving the expected impact. This may emerge from mainly two sources:

- not achieving the technical results,
- not being able to create sufficient impact, based on technical results.

ARTIST risk management is focused on monitoring both issues, taking a proactive attitude. This means advanced risk identification, definition of proactive measures and monitoring potential background reasons causing risk. Next table below shows the initial high level identification of ARTIST risks. During the initial start-up of the project, a further risk assessment will be conducted to identify risks associated with both the business and technical aspect of the research. The General Assembly, the Executive Board, the Project Coordinator, the Scientific Coordinator and work package leaders as well as other key players (i.e. Exploitation Manager) will be involved in the assessment. This will establish a central risk register included in the document "*D1.2 Risk assessment and contingency plan*"

The table below describes several initial risks identified for the ARTIST project, their possible consequences, as well as the way the project plans to deal with these risks.

Table 7. Risk Identification

Risk ID	Type	Risk Description	Contingency Plan
1	Exploitation	The certification model does not create enough impact in the Member States Public Authorities. The project will not achieve the planned impact and subsequent exploitation.	A specific task in WP4 is created to take care of the collaboration with public authorities in this area. Collaboration with EuroCloud of the certification model is also foreseen in WP4. This will ensure the dissemination and impact creation.
2	Exploitation	Partners do not agree in the licensing model for the final results of ARTIST. The project will not achieve the planned impact and subsequent exploitation.	Detail licensing issues in the Consortium Agreement before the beginning of the project. Initial versions of its licensing model already addressed in Section 3 of this proposal
3	Technical	Not all the aspects to be considered in a migration can be converted into measurable metrics.	Tasks to define the metrics have been included. Tools to convert technical and business related aspects into metrics have been envisioned.
4	Technical	The developed ARTIST migration roadmap, forward engineering and reverse engineering techniques are not generic enough to be applicable to cover the major number of migration approaches.	The ARTIST use cases have been selected for being heterogeneous enough and covering the major technologies and business migration approaches. Adapting the generic roadmap and other techniques to the specific use cases will ensure the generality needed to support the major migration types within industry. Additionally, they will be released in the ARTIST repository for public consultation
5	Technical	Incomplete understanding of use cases requirements which will cause an unsatisfactory definition of business challenges and consequently	The project is based on a tight feedback look between the case providers and the RTD activities. Within RTD activities, the outcome is developed in increments, and work packages

Risk ID	Type	Risk Description	Contingency Plan
		danger of misfit of the solution to the users' problem	include activities to assess progress and results to draw indications for problem recovery The case studies run in parallel with RTD activities to allow for continuous assessment of the results.
6	Technical	Lacking of consensus on the technological approach between competences. The development work could be delayed and lead to inconsistencies and integration problems	A task within WP6 is set up to define the ARTIST conceptual architecture that integrates ARTIST methodology, tools, techniques, plug-ins, etc. A conflict resolution procedure among partners has also been already defined (cf section 2.1.2 – Decision procedures and conflict resolution) and it will be further detailed in the CA
7	Exploitation	The project results do not achieve sufficient industrial relevance The project will not achieve the planned impact and subsequent exploitation.	The included industrial end-users support the direction of the project to industrially relevant results. The included software and service providers are interested in gaining new business based on the results and thus direct the project to impact creation.
8	Exploitation	The dissemination of the project results is not sufficient to create impact. The project will not achieve the planned impact and subsequent exploitation.	A specific WP is created to take care of the dissemination (WP4) and impact creation actions (WP3 and the standardization task in WP2)

Table 8. Risk categorization

Criticality				
	L			5, 6, 7, 8
	M		1, 2	3
	H	4		
		H	M	L
		Probability		

B1.3.2 Timing of work packages and their components

List of work packages, work packages descriptions, list of deliverables and milestones are included in the Part A of this project. Also the allocation of effort and costs tables is included there. This document refers to that document.

From the formal list of deliverables, it is highlighted below which deliverables are management documents. All of them are led by ATOS as Project Coordinator.

Del num	Deliverable description	WP num	Nature	Delivery date
D1.1	Project Management Manual and Quality Plan	WP1	R	M1

Del num	Deliverable description	WP num	Nature	Delivery date
D1.2	Risk assessment and contingency plan	WP1	R	M3
D1.3.1	Interim project management Report	WP1	R	M6
D1.3.2	Project management Report	WP1	R	M12
D1.3.3	Interim project management Report	WP1	R	M18
D1.3.4	Project management Report	WP1	R	M24
D1.3.5	Interim project management Report	WP1	R	M30
D1.3.6	Project management Report	WP1	R	M36

Additionally to the formal deliverables, the consortium will produce some internal documentation that will support the elaboration of the formal deliverables. Here below the list of these working documents and relative information about them:

Table 9 List of working documents for internal use

WD num	WD description	WP num	Leader	Nature	Delivery date
WD5.1	Analysis of current approaches for measurement of application maturity	WP5	TECNALIA	R	M4
WD5.2	Business and Technical Modernization assessment tool	WP5	TECNALIA	P	M18
WD5.3	Technical Feasibility tools	WP5	ATOS	P	M18
WD5.4	Business feasibility tools	WP5	ENG	P	M18
WD6.2	ARTIST Methodology	WP6	TECNALIA	R	M18
WD6.3	ARTIST Methodology Process Framework	WP6	ICCS	P	M18
WD6.4.a WD6.4.b	ARTIST Integrated Architecture	WP6	ATOS	P	M21 M27
WD7.1	Definition and extension of performance stereotypes	WP7	ICCS	R	M6
WD7.2	PaaS/IaaS Metamodelling Framework and Tools	WP7	ICCS	P	M18
WD7.4	Classification methods and tools	WP7	ICCS	P	M18

WD num	WD description	WP num	Leader	Nature	Delivery date
WD8.1	Taxonomy of legacy artefacts	WP8	INRIA	R	M3
WD8.2.a	Methodology and techniques for Model Discovery	WP8	INRIA	R	M6
WD8.2.b	Components for Model Discovery from Legacy Technologies	WP8	INRIA	P	M18
WD8.3.a	Methodology and techniques for Model Understanding	WP8	INRIA	R	M6
WD8.3.b	Mechanisms for Viewpoint Definition and View Extraction from Models of Legacy Artifacts	WP8	TUWIEN	P	M18
WD9.3	Migration rules formalized as generic model transformations	WP9	TUWIEN	P	M12
WD9.4	Collection of optimization patterns	WP9	TUWIEN	R	M12
WD9.6	Automated deployment strategies	WP9	TUWIEN	P	M18
WD9.7	Integrated environment for maintaining/developing forward engineering process	WP9	ATOS	P	M18
WD10.2	Technical and information architecture of the repositories	WP10	Fraunhofer	R	M6
WD10.3.a WD10.3.b	Repository prototype	WP10	Fraunhofer	P	M12 M24
WD10.5.a	Inventory of common general-purpose artefacts	WP10	ATOS	P	M18
WD11.1	Methodology and techniques for deriving test cases from models	WP11	TUWIEN	R	M4
WD11.2	Methodology and architecture for end-user based testing	WP11	TUWIEN	R	M6
WD11.4	ARTIST SbSp certification model	WP11	TECNALIA	R	M18
WD12.2.a WD12.2.b	Use cases migration roadmaps	WP12	TECNALIA	R	M18 M33
WD12.3.a	Deployed use cases M18	WP12	ATC	P	M18
WD13.2.a	Use case assessment report	WP13	ATC	R	M18

Figure 3 shows a complete Gantt chart for the project, presenting tasks, main dependencies and their duration.

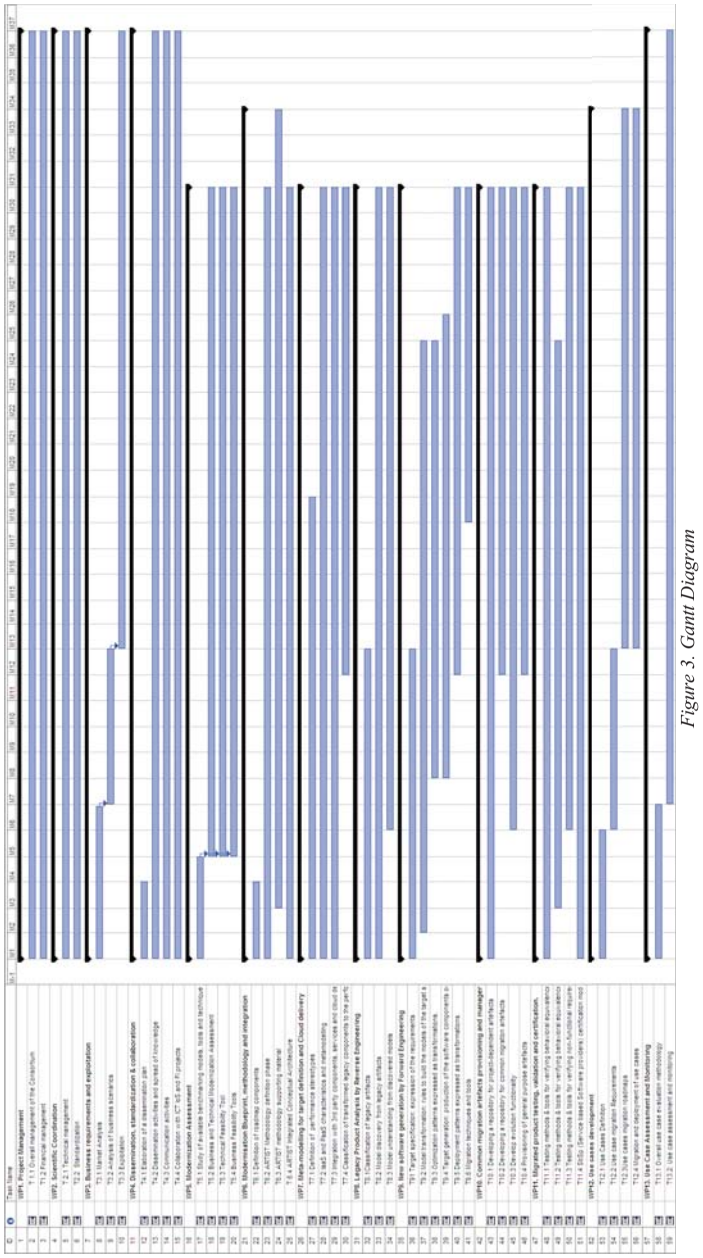


Figure 3. Gantt Diagram

B1.3.3 Project flow

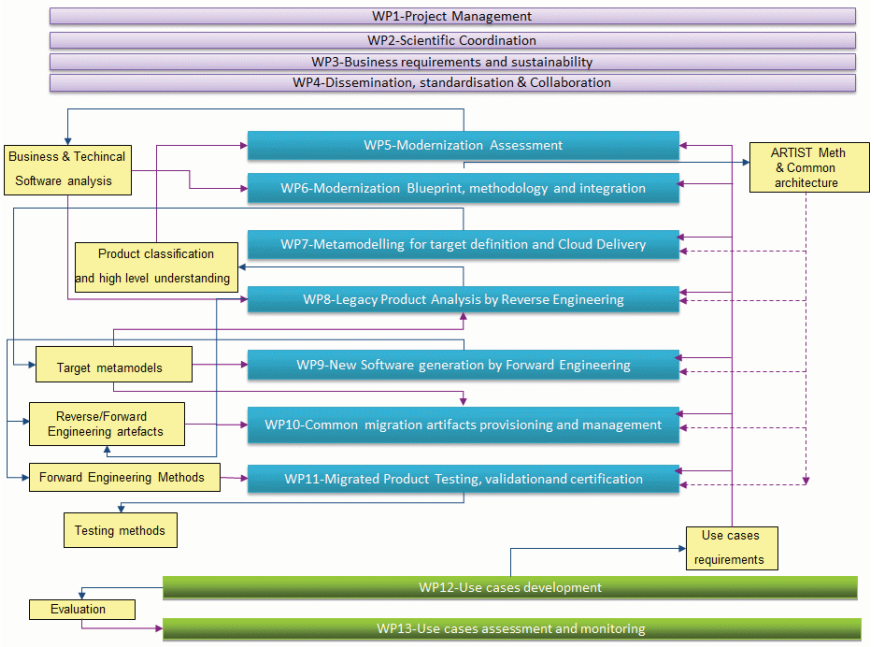


Figure 4.WP Dependencies

Figure 4 shows the dependencies among the work packages. There are a number of global work packages (W1-WP4) that influence and are influenced by the other technical, demonstration and evaluation work packages. While WP1 coordinates the overall project work, WP3 exploits the business potential benefits of ARTIST results obtained from the technical work packages (WP5-WP11) and validation (WP12) and evaluation (WP13), whereas WP4 disseminates and standardise the techniques developed by the technical work packages (WP5-WP11). All technical work packages will be driven by the stakeholders' requirements elicited by WP12.

More concrete dependencies are identified between technical, demonstration and evaluation work packages. WP5 preliminary technical assessment requires some FE techniques developed in WP8, in particular for legacy product classification and high level understanding. WP6 ARTIST methodology and roadmap to apply to concrete migration projects depends on the business and technical migration assessment results obtained in WP5. WP7 defines extensions to SOA/Cloud meta-models, whereby is only influenced by the project baseline (meta-modelling) and stakeholders' requirements. WP8 provides a generic tooling independent from any other technical work package, but aligned with the project baseline. However, WP8 considers the preliminary technical assessment produced by WP5, the methodological approach defined in WP6 and the target meta-modelling from WP7. WP9 depends on the SOA/Cloud meta-modelling developed in WP7. Besides, WP9 techniques depend on the models of the legacy product obtained by applying WP8 RE techniques, but WP9 techniques do not directly depend on RE techniques developed by WP8. WP10 repository, (including its storage information model and the provisioning of the migration artefacts) depends on the baseline in which meta-models (WP7), RE techniques (WP7) and FF techniques (WP9) artefacts are specified and produced. WP11 testing methods depend on the FF techniques (WP9) in order to produce deployable and testable models.

WP12, use cases (validation), depends on the complete set of techniques and tools developed by the technical work packages (WP5-WP11), whereby they have not been specifically rendered in the picture. WP13 evaluates the ARTIST project results through the WP12 use cases (validation).

B2. IMPLEMENTATION

B 2.1 Management structure and procedures

The management of a complex construct such as an Integrated Project requires a very efficient and well-structured project organization. Of particular importance are the clear distribution of responsibilities and the flow of information, both for controlling the project and reporting on its progress. A clear conflict management process is required to ensure fast and acceptable conflict resolution, whilst reducing the risks of escalating disputes. A thorough assessment and analysis of potential risks is also important to prepare recovery actions if required. The ARTIST organization is designed to meet the objectives of all its stakeholders including the European Commission (as funding body), the contributing industrial and academic partners and their research staff, as well as the European innovation and research base. Its primary goal is to respond to the needs of the Integrated Project efficiently and flexibly. All bodies and roles participating in this project can be divided into two different categories:

Table 10.Management roles

Category	Responsibility	Roles & Bodies
General Management	Overall direction and major decisions of the project; communication, control and corrections of the decisions. Overall control project expenditure, cost report collection, check & payment. Overall control of the quality in deliveries and execution process	- General Manager (GM) - Project Manager (PM) - Executive Board (EB) - General Assembly (GA) - IPR Board (IPRB)
Operations	Coordination of operational effort on scientific, technical and business related basis, responsible for scientific, technical and business decisions.	- Scientific & Technical Manager (STM) - Exploitation Manager (EM) - Dissemination Manager (DM) - Work Package Leader (WPL) - Technical Board (TB)

ARTIST implements an organizational structure where the responsibilities and interaction flows are distributed vertically and horizontally (see following figure):

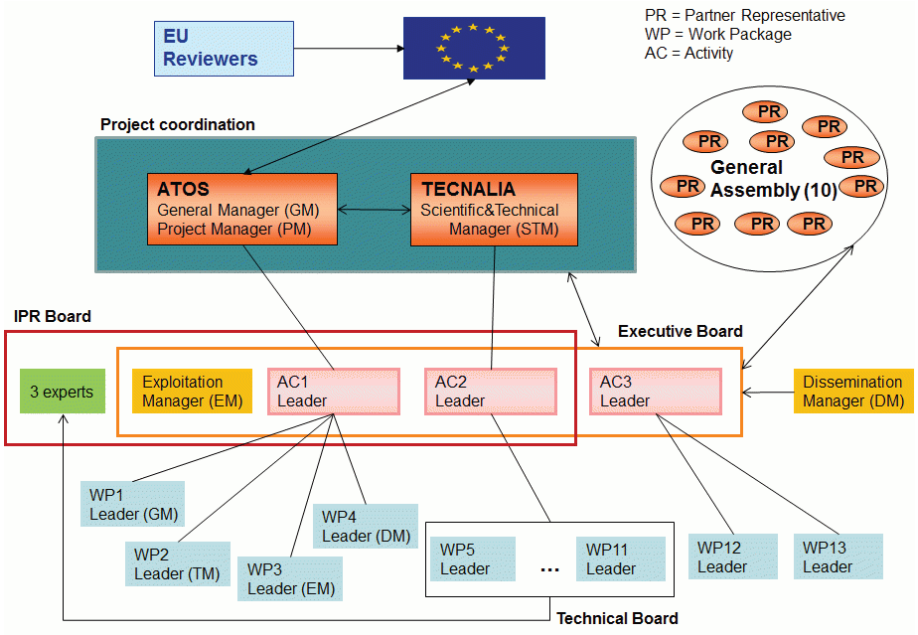


Figure 5 .ARTIST Project Structure

The project management structure is divided into Activities, each of which is made up of work packages where the actual management, research and development will be carried out. The double arrows represent a bidirectional communication between the two entities they join (e.g. General Assembly and Executive Board need each other for communicating and taking decisions). The single arrows indicate the direction of the communication or reporting (the 3 experts of the IPR Board come from the technical WP leaders). And the simple line labels a role (e.g. Dissemination Manager is the leader of WP4).

B 2.1.1 Project profiles and bodies

Table 11. Project profiles and roles for General Management

Profile	Key person (CVs in section 2.2)	Role	Typical tasks
General manager (GM): Senior Project Manager of the Coordinating Organization	Clara Pezuela, ATOS	Intermediary between the contractors and the Commission. Leader of Activity 1 and chairman of the General Assembly and Executive Board.	Submission of deliverables and project interface to the Commission. Continuous follow up of the project status and check project progress against planned schedule (including budget, effort), milestones are met and deliverables properly produced. Agenda, minutes and chair of General Assembly and Executive Board. Work in close cooperation with Project Manager. Organisation of information flow through the different bodies.
Project Manager (PM): Project Manager of the Coordinating Organization	Malena Donato, ATOS	Assistance to GM	Appointed by and reports to the General Manager, assists the GM in the day-to-day tasks and is responsible for quality assurance and financial management in the project. Withholding pre-financing (advance payment) and transferring sums allocated among the contractor as per budget agreed in the Executive Board; keep related records identifying what portion of the Commission payments has been allocated/paid to the contractors

Table 12.Project profiles and roles for Operational Management

Profile	Key person (CVs in section 2.2)	Role	Typical tasks
Scientific & Technical Manager (STM)	Leire Orue-Echevarria, TECNALIA	Leader of the scientific and technical activities of the project Apart from leading Activity 2 (Technical Definition and Implementation), she is the chair of the Technical Board	Review the scientific and technical strategy for ARTIST Check scientific and technical objectives progress against schedule Agenda, minutes, chair of the Technical Board, decision follow-up; Identify trends and technologies that could be of interest to the project Generate a technical assessment of completed and running activities

Profile	Key person (CVs in section 2.2)	Role	Typical tasks
			Scientific & technical risk management
Exploitation manager (EM)	Daniel Field, ATOS	Leader of the exploitation activities of the project Apart from leading WP3, he is the chairman of the IPR Board described hereafter.	Review the exploitation strategy for ARTIST Check business objectives progress against schedule Agenda, minutes, chair of the IPR Board, decision follow-up; Identify trends and technologies that could be of interest to the project Generate a business assessment of completed and running activities Business risk management
Dissemination manager (DM)	Ilias Spais , ATC	Leader of the dissemination activities of the project (WP4)	Review the dissemination strategy for ARTIST in close cooperation with Exploitation Manager Check dissemination objectives progress against schedule Support the exploitation strategy by required dissemination means and actions.
Activity Leader (AL)	Activity 1: Clara Pezuela, ATOS Activity 2: Leire Orue-Echevarría, TECNALIA Activity 3: Domenico Presenza, ENG	Leader of the scientific, technical and/or business/management issues in a given Activity	Definition and follow-up of Activity progress and objectives Follow-up of WPs within the Activity Transmission of documents/information to relevant WP Leaders Report to General Manager and Scientific and Technical Coordinator
Work Package Leader (WPL)	WP1: Clara Pezuela, ATOS WP2: Leire Orue-Echevarría, TECNALIA WP3: Daniel Field, ATOS WP4: Ilias Spais, ATC WP5: Juncal Alonso, TECNALIA WP6: Konstantinos Tserpes, ICCS WP7: George Kousiouris, ICCS WP8: Hugo Bruneliere, INRIA WP9: Manuel Wimmer, TUWIEN WP10: Oliver Strauβ, Fraunhofer WP11: Philip Langer, TUWIEN WP12: Domenico Presenza, ENG	Leader of a given Work Package.	Responsible for the timely and effective execution of the WP work. Transmission of any document or information to the contractors concerned or to the Activity Leader and Scientific & Technical Manager.

Profile	Key person (CVs in section 2.2)	Role	Typical tasks
	WP13: Peter Stuer, SPIKES		

Table 13: Management boards

Composition	Partners involved	Responsibilities	Meeting frequency
Executive Board (EB): Activity Leaders, General Manager, Scientific & Technical Manager, Exploitation Manager)	ATOS, TECNALIA, ENG	Setting objectives based on strategy and strategy implementation Resolving inter-partner issues and ensuring cross activity integration Overseeing the promotion of gender equality in the project Coordination at Consortium Level of technical activities of the project Coordination of the overall legal, contractual, ethical, financial and administrative management Take major decisions. Some of these might be subject to further approval from the General Assembly	It will meet at least once every three months (ordinary) and on any Executive Board member's request (extraordinary). Monthly teleconferences are also foreseen.
Technical Board (TB): All the technical WP leaders and the Scientific & Technical Manager	TECNALIA, ICCS, TUWIEN, INRIA, Fraunhofer		It will meet at least once every three months and on Scientific & Technical Manager's request
General Assembly (GA): One representative of each contractor (10 in total)	ATOS, TECNALIA, INRIA, Fraunhofer, TUWIEN, SPARKX, ICCS, ATC, ENG, SPIKES	Follow-up of the project and take the corresponding decisions	At least twice every year (ordinary) and upon Executive Board request.
IPR Board (IPRB): No more than three experts with IPR background recruited from the Technical Board partners and the Technical and Exploitation Managers	ATOS + TECNALIA + 3 experts to be selected	Assesses information on background / foreground IPR and ownership and determines access rights and use of project results; provides recommendation to the Executive Board on IPR issues	At least once every year and upon the Executive Board request.

The details about responsibilities of different boards and roles are fully detailed in the Consortium Agreement.

B 2.1.2 Decision procedures and conflict resolution

In general, individual WPs will follow the instructions from the project management boards and leaders. Most conflicts will be solved bilaterally. In the exceptional case that conflicts cannot be solved at a WP level, the Activity Leader may be called by the respective WP-Leader and asked to solve the conflict. It is expected that the Activity-leader will properly consult the relevant WPs before making any decision and ensure that a lightweight approach is used to conflict resolution. The goal and thus the metric for the co-ordinating persons is always to improve the overall functioning of the IP as an integrated project and to improve the quality, consistency and impact of the project results. If the Activity Leader cannot solve a conflict it must be brought forward to the Executive Board for decision. If the Executive Board is unable to provide an acceptable decision, the case must be brought to the General Assembly. The General Assembly will make a final decision, if necessary, through weighted voting by project share. This decision will then be binding on all partners and other management bodies.

B2.1.3 Risks and Contingency

In large, complex and relatively long projects where many partners are involved it is unavoidable that problems occur from time to time. It is of paramount importance that potential risks are clearly identified and assessed, and that the project prepares for recovery actions if required. Section 1 already mentions some specific technical and business risks, but in this section other risks from the management point of view are also addressed:

Table 14: Risks and contingency plans

Risk type	Categorization	Effect	Contingency plans
Partner problems (e.g. underperforming partner; a key partner leaves the project; disagreement between partners). *Operational risk*	Low	Possible delay in workplan	WP leaders monitor progress (including potential partner conflicts) at WP level and communicate difficulties to Activity leaders. Any problems which cannot be solved bilaterally, are referred to Activity leader level and then to Executive Board. The Consortium Agreement will also provide a framework for underperforming partners and conflict resolution procedures. The consortium is of sufficient strength and diversity for partners to replace if required. Reassignment of responsibilities to other partners.
Partner heterogeneity. The different organizational and national cultures cause collaboration problems or conflicts in the project consortium. *Operational risk*	Low	Bad project progress as time is used on conflicts, poor results and low impact and exploitation	Project management procedures and working practices are defined in the beginning of the project. The project aims in openness and motivation of all the partners. Special commitment is expected from work package leaders. Also informal methods are used to create a communal and motivating spirit in the project. This is especially needed in the project start-up.
The	Low	Bad project	The coordination of the project is

Risk type	Categorization	Effect	Contingency plans
coordination of the project fails. *Operational risk*		progress, poor results and low impact and exploitation.	performed by an experienced project manager senior. The project will establish the proper mechanisms for ensuring the quality of the results, the cooperation among the partners and the monitoring of the work. The coordinator will be assisted by a project manager and by the Scientific & Technical coordinator. ATOS has proven expertise and it is borne out by success project management in the past.
Expertise risks (e.g. a key person with a specific expertise leaves the project). *Operational risk*	Medium	Possible delay in workplan	Proper documentation through project reporting and deliverables can mitigate this risk, although depending on the profile and the moment in the project, work may need to be rescheduled in order to bring a new person up to speed. Clear communication channels in the project allow partners to inform the coordinator promptly of this risk
Project execution risks (e.g. key milestones or critical deliverables are delayed). *Operational risk*	Low	Possible delay in workplan. If a critical milestone, potential failure of project	This risk is reduced by the expertise of the partners (both technical and management experience) that will allow the identification of planning drifts. Workpackage roadmaps and the Detailed Activities Plan are key management elements for this risk.
Technological risks (e.g. key technologies or components are not available at the expected time; development takes longer than expected; wrong technology based is selected) *Operational, Strategic.*	Medium	Possible delay in workplan. If a key technology, possible failure of the project, or less than optimal results.	This risk is reduced by tight project reporting at WP, Activity level and to the Technical Board and Executive Board in order to react and re-plan as such issues arise. However, it should not be forgotten that all IPs such as ARTIST exist to take technological risks. Where problems arise they will be identified and solutions found or plans altered appropriately.
Project objectives lose relevance. *Strategic*	Low	Project results are less relevant than expected, lack of sustainability	Technical and Executive Board periodically reviews the progress in the field. The consortium changes the work plan, if necessary.

Risks with a high probability and a severe impact are handled with particular caution during the project. The following measures are foreseen:

- For risks of medium to high probability and severe impact, they will be flagged throughout the execution of the project as “risky items”. This ensures that all levels of the project take special care of those items.
- For risks with low probability or low impact, and for ones that cannot be foreseen at this stage, the Project Management Team will ensure early identification, and that necessary countermeasures are taken.

B2.1.4 Monitoring and reporting

The project management approach proposed for ARTIST provides mechanisms to identify and resolve potential risks. The Project Management Team continuously controls the project plan with its milestones and critical paths. Monthly audio-conferences of the Executive Board are foreseen, which allows Activity Leaders to flag problems and discuss as they arise. In addition there are reports every six months (M6, M12, M18, M24, M30 and M36), which ensures that the management is aware of potential problems and can initiate countermeasures long before a problem becomes too critical. The tight controls both at work package level (Work Package Leader) and at IP management level (Project Management Team and Executive Board) ensure that solutions will be available in time.

Additionally an internal detailed project plan will be produced at the beginning of the project and updated always it would be required. The work will be broken down into atomic tasks that will be monitored by Project Manager and Scientific &Technical Coordinator ensuring the fulfilment of the deadlines and the delivery of the proper results in concrete and small slots of time. If an adjustment or correction in the plan is required, the detailed plan will be updated accordingly. The most appropriate tool will be selected for implementing this detailed plan.

B2.1.5 Communication strategy

The organization of the project into activities and work packages is designed in order to carry out the work and produce early results in the most effective manner. Work packages and Activities have regular planned teleconferences and meetings; the Activity leaders meet periodically to check progress, cross activity meetings and working groups will be planned as needed according to the work plan.

The project will put in place communication mechanisms supporting this project structure including but not limited to: project intranet for document repository, organization of meetings, effort reporting, address book of partners, assignment of document reviewers etc.; teleconference rooms with web support; and collaboration tools such as wikis, blogs and forges.

B2.1.6 Management of resources and payment rules on performed work

In the Consortium Agreement the conditions on payment procedures and resource re-allocation, in case it becomes necessary, are laid out. The distribution of pre-financing (of the EU advance payment) will be done according to the conditions set out in the contract and detailed in the Consortium Agreement. As an indicative rule all partners receive an initial advance of 30% of the EU advance payment (80% of their assigned budget of the first 18 month period). During the following semesters the IP Coordinator will control the payment of the remaining budget according to reported work and invoices. Work reporting and payment

of performed work will be done on a yearly basis. Payments will only be done if the committed work has been performed; otherwise payments may be delayed until the work has been delivered. If a partner is not able to deliver the work, the IP Coordinator may re-allocate the assigned tasks to other partners who offer to complete the work. This procedure, which complies with well-established and proven procedures in previous projects, ensures a high degree of security and flexibility, and will help to assure that work will be delivered according to plan even if a partner may fail to perform the assigned work.

B 2.2 Beneficiaries

B2.2.1 ATOS SPAIN SA (ATOS)

Description of the organization
Atos (http://atos.net) is an international company focused on Services for Information Technologies (IT) and currently it employs 78,500 people. In July 2011, Atos acquired Siemens IT Solutions and Services (the Siemens IT division), which has turned out in the incorporation of 28,000 new employees to Atos' team. Atos' headquarters are located in Paris, with presence in 42 countries around the world. Atos business is turning client vision into results through the application of consulting, systems integration and managed operations. The company has a wide experience in finance sector, public administration, energy, telecommunications, transport and logistics, health and manufacturing industry, always taking care of the support to SMEs, human resources development and environment protection. Atos is the fifth company in the world for IT consulting sector and the first one in Europe, according to its business volume. The company quotes in the Eurolist market, in Paris, and it carries out its activity through the brands Atos, Atos Consulting & Technology Services, Atos Worldline and Atos WorldGrid.

The Research and Innovation group (http://www.atosresearch.eu/), as part of Atos Spain, concentrates on the realisation of international projects, combining the most up-to-date technological developments (in areas such as cloud, smart objects, services, etc.) with a high awareness of the human factors (education sciences, disability-related issues, etc.). For this reason, this multi-disciplinary and multicultural team is composed of experts in different knowledge areas, who apply all their knowledge to the achievement of the most balanced solutions.

The Service Engineering & IT Platforms (SEIP) Lab focuses its research in Cloud Computing, Service and Software Engineering and Open Source technologies. It investigates advanced capabilities of Cloud Infrastructures, Software tools and Open Source communities as well as new tools and techniques for advances PaaS and SaaS. The SEIP Lab is under the Information Technologies sector that fosters the adoption of Lab technologies and research towards the software industry and other business units at ATOS.

Expertise provided and main tasks assigned
ATOS provides a long expertise in large projects management (OPTIMIS, BeinGRID, ORCHESTRA, DEWS, SOA4ALL, etc) and technical participation in European projects since more than 20 years ago. The research and innovation group at ATOS brings deep expertise in service engineering and cloud computing domains backed up by experience in projects such as Secse, SOA4ALL, COIN, Optimis, Cloud4SOA, SmartLM, iCargo as well as national research projects. Additionally, this group provides also expertise in modelling tools and languages gained thanks to projects such as MOMOCS. ATOS researchers are also well

skilled in agile software development methodologies and complex software integration processes. Finally, we also highlight the business approach we can bring to the project with experts in marketing and business models in technology domain.

ATOS will mainly participate in the project as Project Coordinator, Exploitation Manager and one of the industrial scenarios. We will contribute many technical tasks in the different technical work packages providing the above mentioned expertise across them.

Key personnel
Clara Pezuela. She has a degree in Computer Science by the Universidad Politécnica of Madrid. She has 12 years experience in R&D projects development and management. Currently, she is the Head of IT sector at Research and Innovation group in Atos. Her main responsibilities now are the management of research projects and teams, the preparation of new research proposals and the commercialization of research assets in Atos business units. She is skilled in open business models and innovation processes, collaborative development environments, service and software engineering. She is the executive chair of INES platform and member of the Steering Committee. Her current research interests are modernization of software towards cloud, improvement of software development process and fostering of open source development. She applies for the project her expertise in managing previous R&D projects such as B-MAN, SmartEc or Vulcano. She has been Exploitation Manager from projects such as QualiPSo or ALERT.

Jesús Gorroñogoitia. He has a degree in Theoretical Physics from the Universidad Complutense de Madrid (UCM), also complementing his studies with a Master in Condensed Matter and Statistics Physics by UNED (Madrid). He has been working in diverse ICT companies as Software Analyst and Architect for 14 years. In Atos Research & Innovation (ARI) he is working as Software Architect on the Service Engineering & IT Platforms Lab, in fields such as Service Oriented Computing (SOC), Model Driven Development (MDD) and Semantics. Jesús has been Technical Director of EC FP6 SeCSE project, member of the Architecture Board of EC FP7 NEXOF-RA project and leader of the Service Construction WP of EC FP7 IP SOA4ALL project. Currently he is working on other FP7 projects such as Khresmoi and Cloud4SOA.

Daniel FIELD: BSc (Hons) in Chemistry and Management (Imperial College London, Tanaka Business School (United Kingdom) 2004). Since joining ATOS in 2007, he has worked on market and business analysis in a number of projects, and managed exploitation in several large projects, including COIN (2008-2012) and Aladdin (2009-2012). He currently leads the team of business analysts within Atos' cloud research unit and oversees the exploitation strategy and participation in FP7 projects Cloud4SOA, Optimis, BonFIRE and SESERV, among others. Daniel has worked on both the theoretical and practical sides of business analysis for several years, including a thesis on the impact of European Union enlargement on business strategy (2004), several project-related whitepapers and a recently presented new approach to value chain analysis based on experience in collaborative projects (2011). He recently chaired a cross-project working group on exploitation within the software and services community.

B2.2.2 TECNALIA Research & Innovation (TECNALIA)

Description of the organization
Fundación TECNALIA Research & Innovation (www.tecnalia.com) is a private, non profit, research organisation resulting from the merger (1st January 2011) of eight research centers:

Cidemco, European Software Institute, EUropean Virtual Engineering, Fatronik, Inasmet, Labein, Leia and Robotiker. With registration F-69 in the Register of Foundations of the Basque Country, TECNALIA is the leading private and independent research and technology organisation in Spain and the fifth largest in Europe, employing 1,445 people (164 PhDs) and with expected income of 131 Million € in 2011.

TECNALIA operates in the following market sectors: Industry and Transport, ICT, Sustainable Development, Innovation Systems and Health and Quality of Life.

TECNALIA is very active in FP7, participating up to June-2011 in 214 projects and coordinating 47 of them. TECNALIA has a strong market orientation aiming at achieving major impacts in economic terms, by means of innovation and technological development.

The current proposal will be carried out by the Software Systems Engineering unit of the European Software Institute division. This unit is focused on embedded systems development processes and tools, effective engineering of SoA solutions, simulation and ICT support tools, model-driven design and reuse through software product-line approach, dynamic reconfiguration and interoperability, embedded architectures and middleware for autonomous and cooperative agents, among others. This Unit has more than 15 years experience applying the above Technologies in industry.

Expertise provided and main tasks assigned
The main areas of competences in the Software Systems Engineering Unit related to this project are:

- Process Improvement: Model-based Improvement: Techniques and methodologies to improve software processes with reference a models of good practices
- IT Services & Architecture
- Transition to SOA and Cloud: Reengineering legacy systems (monolithic) to SOA to deploy services in the cloud. This includes services (SaaS) and platforms (PaaS) (eg with ADM - Architecture driven modernization). Service Specification Language (SoaML). Impact on the business model.
- Automation tools and processes to increase productivity in the development of systems., understanding automation as a guided process, supported by tools.

TECNALIA will lead the technical & scientific coordination of the project and will actively participate in leading WP4 and the standardization task as contributors of previous standards such as SoaML, CloudML and SPEM2.0; and working mainly in WP5, WP6, WP7, WP8 and WP10.

Key personnel
Leire Orue-Echevarria graduated as Computer Engineer (BSc) from the University of Deusto (Bilbao, Spain) and Politecnico di Milano (Milan, Italy) in 1998. After her graduation, she began her Ph.D in Computer Science at the Deusto University reaching the DEA degree. She is currently achieving an Executive Master's degree in Business Administration (MBA with an extension in PMBOK) by the University of Barcelona (expected 2012). Additionally, she is certified in models like CMMI (SEI), methodologies like RUP (IBM) or standards like ITIL. Her professional experience ranges from different sectors and covering the whole software lifecycle. She started working at Labein, a Basque research center, where she programmed an intelligent tutoring system. In 2001 she moved to Germany where she worked in a German-Spanish company whose focus was Software Quality with a special stress on safety critical systems and led several big sized testing teams in Germany, Austria and Spain.

In 2002 she was appointed as the person responsible of the R&D Department of the Spanish branch. Her main tasks there were to define the research strategy of the company but also lead research projects and workpackages at regional, national and European level (i.e. ITEA2 Moose and FP5 eXPERT). In 2004 she moved to Bilbomática, a software engineering and consultancy company, where she acted as project manager and had the European Comission (DG-JLS and other European Agencies created under the umbrella of the EC) as major customer. In Bilbomática she led in-shore and off-shore teams (in India). Additionally, she was responsible for all R&D Projects at European level within in the company and led several improvements initiatives within the company (adoption of UML, systematic testing, and CMMI). Leire started working at TECNALIA (former European Software Institute) in 2008 where she has acted as senior CMMI consultant, Project Leader of R&D projects of projects at regional, national and European level, coordinating several of them (i.e. mCloud). In December 2011 she was appointed as leader of the development of TECNALIA's Product "Migration to Cloud". Her current research areas are transition to cloud computing, that is, migration of legacy software to cloud, business models, and Service Engineering.

Juncal Alonso is a R&D Engineer working at Software System Engineering projects area of TECNALIA. She has two year experience as ICT consultant for private Telecommunication Companies. After this, she joined ESI in 2007. Her area of research includes information systems for interoperability and collaboration, business process management, new organizational forms and Future Internet applications in the Web.

B2.2.3 AtlanMod (INRIA)

Description of the organization
INRIA, the French national institute for research in computer science and control, operating under the joint authority of the Ministries of Research and of Industry, is dedicated to fundamental and applied research in information and communication science and technology (ICST). Throughout its eight research centers, INRIA has a workforce of 4 100 (3 150 of whom are scientists from INRIA or from INRIA's partner organizations such as CNRS (the French National Center for Scientific Research), universities and leading engineering schools) divided in about 200 project-teams for a global annual budget of 217 million Euros.

Closely combining scientific excellence with technology transfer, INRIA develops many partnerships with industry and fosters technology transfer and entrepreneurship in the field of ICST. INRIA asserts its presence in the international research by notably contributing to the development of the European Research Area through its implication in EUREKA and participation in the FP7; INRIA being indeed involved in more than 100 selected proposals. In the ICT theme of the Cooperation program, INRIA is partner in 65 selected proposals.

Expertise provided and main tasks assigned
The AtlanMod group, based in Nantes, is a joint research team between INRIA, Ecole des Mines de Nantes (EMN) and the Nantes Atlantic Computer Science Laboratory (LINA). It is the result of a long term experience and research expertise in Model Driven Engineering (MDE), which has led to the creation of recognized international conferences (such as MODELS or ICMT) and to the participation in many collaborative projects, notably European ones (MODELWARE, MODELPLEX, CESAR, OPEES). Specialized in advanced MDE and its concrete applications, the team activity is highly visible in terms of research results, contributions to open source communities (via the Eclipse Foundation), but also technology transfers and industrial collaborations.

Within ARTIST, AtlanMod is going to bring is scientific expertise on MDE in general (modeling core principles and techniques, e.g.; model transformation), and on (model driven) reverse engineering in particular via notably their past and present experience around the Eclipse-MDT MoDisco project (http://eclipse.org/MoDisco/).

Key personnel
Jordi Cabot is currently leading the AtlanMod research team. Previously, he has been a post-doctoral fellow at the University of Toronto, a senior lecturer at the UOC (Open University of Catalonia) and a visiting scholar at the Politecnico di Milano. He received the BSc and PhD degrees in Computer Science from the Technical University of Catalonia. His research interests currently include conceptual modeling, model-driven and web engineering, formal verification and social aspects of software engineering. He has written more than 70 publications in international journals and conferences in the area. Apart from his scientific publications, he writes and blogs about all these topics in his Modeling Languages portal (http://modeling-languages.com). He is a member of the IEEE and the ACM.

Hugo Bruneliere is an R&D engineer working in the field of Modeling (MDE) for the AtlanMod team with focuses on (model driven) reverse engineering, tool interoperability (based on model transformation) and global model management. He has notably been working as the responsible for the INRIA coordination on the MODELPLEX (MODELling solution for comPLEX software systems) IST European project. Since several years, he is active in the Eclipse community as the leader of the MDT-MoDisco project, a committer on the EMFT-EMF Facet project, a user of EMF, M2M-ATL & other Eclipse Modeling projects, as well as a regular speaker at the Eclipse Community major events. He has also published and presented more than 15 papers in international journals, conferences and workshops.

B2.2.4 Fraunhofer IAO, Stuttgart (Fraunhofer)

Description of the organization
Fraunhofer Gesellschaft is Europe's largest application-oriented research organization. The Fraunhofer Institute for Industrial Engineering IAO specialises in the integrated planning, design and optimisation of innovative products, processes and structures. Under consideration of human factors, organisational aspects, technological solutions and the environment, Fraunhofer IAO explores and evaluates new concepts of technology management, work organisation and work design, especially in the area of development of advanced information and communication systems. Fraunhofer IAO supports its customers in optimising their software development processes, in introducing new technologies and development methods as well as in the conceptual design, the evaluation and the implementation of complex software systems. Fraunhofer IAO coordinates the regional Competence Center Electronic Commerce (ECC) Stuttgart-Heilbronn within the national e-commerce network NEG. The objective of the ECC is to inform SMEs in industry, commerce and trade about the possibilities and opportunities of electronic commerce in a vendor-independent manner.

Expertise provided and main tasks assigned
Fraunhofer IAO leads the creation of the knowledge repository and the reuse and evolution activities in WP9. Fraunhofer IAO has more than twenty years of experience with document management systems and has consulted companies from all sectors (manufacturing sector, public sector, banks, insurance companies etc.) on suitable repository software for document management in more than 200 industrial projects. In these projects it has developed a structured approach for assessing document structures and document workflow to define

repository requirements that will be applied in Artist to source code documents and the software engineering workflows.

In the field of software reuse Fraunhofer IAO participated in various national level projects concerned with repositories (KosPuD: software component metadata specification, search and retrieval; Cocktail: creation of a mash-up service repository) as well as organizational aspects (PROMT: integration of reuse in the software development process, incentive systems; ReqMan: reuse oriented requirements engineering). Additionally, Fraunhofer IAO is involved in German research initiative THESEUS, where it contributes to the use case scenario TEXO that addresses service marketplaces and the creation and integration of added value services as well as the development of USDL (Unified Service Description Language). For the European Commission Fraunhofer IAO developed the eBSN eBusiness Solutions Guide which is an online tool that provides the possibility to enter and search for software and services offered in all EU-countries. In the ITEA project LOMS Fraunhofer IAO has worked on Service-Oriented Architectures for mobile services. In the German DOMUS, Fraunhofer IAO developed and MDA based system for the domain- and architecture-independent development of mobile applications. The design and implementation of the reuse repositories and reuse support will make use of these experiences.

Fraunhofer IAO is a very active member of the German Cloud Computing community (national projects CloudWerker, SkIDenity and Seraphim) and is speaker of the Fraunhofer Cloud Alliance which is a cooperation of eight Fraunhofer Institutes to bundle and exchange competences in the field of cloud computing. In the European project EGEE, Fraunhofer IAO has contributed to the definition of a European grid infrastructure. On the national level Fraunhofer IAO was involved in the projects MediGrid, Services@MediGrid, PartnerGrid and the Fraunhofer Resource Grid, where it contributed to the Grid Resource Definition Language and developed reusable security components.

Key personnel
Dipl.-Phys. Jürgen Falkner is head of the Competence Team Software Technology at the Fraunhofer Institute for Industrial Engineering (IAO) and speaker of the Fraunhofer-Alliance Cloud Computing. His main areas of work are Cloud and Grid Computing, Service Oriented Architectures and Software as a Service as well as IT Security. He specializes in the systematic engineering and operation of IT services for distributed systems, the design of customized business models for services and applications in distributed IT environments as well as in IT security and incident response. Jürgen Falkner is also member of an expert group on Cloud Computing consulting the European Commission.

Dipl.-Phys. MS Oliver Strauß received his diploma in physics from the University of Stuttgart in 2000 and a Master of Science degree in physics from the University of Massachusetts USA in 1998. At the Fraunhofer IAO he has worked on projects concerned with MDA (DOMUS) requirements management and reuse (ReqMan), Grid Computing (EGEE, MediGrid, PartnerGrid and Services@MediGrid) and Cloud Computing (CloudWerker).

Erik Hebisch received his diploma in computer science from the University of Koblenz-Landau in 2009. At the Fraunhofer IAO he has worked on projects concerning software development processes for multicore architectures, portal development and cloud computing.

B2.2.5 Technische Universität Wien (TUWIEN)

Description of the organization
The Business Informatics Group (BIG) at TUWIEN focuses its teaching and research activities in the areas of data engineering, Web engineering, model engineering, and process engineering. One of the many efforts of the group, which will be valuable for the project is their book on object-oriented modelling with UML 2 ("UML@Work", publisher dpunkt.verlag). The most valuable contribution for the proposed project is expected to origin from the experiences gained during the FIT-IT funded project ModelCVS "A Semantic Infrastructure for Model-based Tool Integration" where model-based reverse/forward engineering has been extensively researched. Additionally findings from the finished FIT-IT funded project AMOR "Adaptable Model Versioning" and from the ongoing WWTF funded project FAME "Formalizing and Managing Evolution in Model-Driven Engineering" with respect to tackling evolution problems will be very valuable. Finally the FWF funded project TROPIC "Transformations by Petrinets in Color" contributes valuable knowledge about mapping and transforming between heterogeneous modeling languages.

Expertise provided and main tasks assigned
Members of BIG at TUWIEN have experience in national and international projects as well as a long tradition in collaborating with industry partners and other universities. Projects at national level include Gulliver (partner: Siemens Austria Division PSE TN, funding: Siemens, 09/99-07/01), WIT (funding: Fforte programme (bmbwk and esf), 01/03-12/07), ebTransfer (funding bmw, 01/07-11/07), BSopt (partners: MediaPrint GmbH, Paradigma GmbH, funding: FIT-IT Semantic Systems, 04/08-03/10).

Projects at the international level include: Resource-Based Agents for Distributed Object-Oriented Databases (partner: University of Southampton, funding: UK The British Council in Austria, 01/99-08/99), TRACK and TRADE (partner: Deutsches Zentrum für Luft- und Raumfahrt, Emphasis Telematics, Geomatics, GreenWay Systeme, Research Academic Computer Technology Institute, Talent S. A., TU Wien, WIGeoGIS, funding: EU FP6, 10/06-09/08).

Key personnel
o.Univ.-Prof. Mag. Dipl.-Ing. Dr. Gerti Kappel is a full professor and the head of the BIG at TUWIEN. 2003-2007 she was also head of the Women's Postgraduate College for Internet Technologies (WIT). Prior to that, she was a full professor at Johannes Kepler University. Her current research interests include OO modeling, model-driven development and web engineering. She has been involved in various national and international projects which resulted in more than 100 internationally renowned publications.

Dr. Manuel Wimmer is a senior researcher at BIG. He has done his PhD in the ModelCVS project establishing model-based tool integration by using semantic technologies. His research interests comprise web engineering, reverse engineering, and model-driven engineering, in particular how model transformations can be combined with semantic technologies to leverage information integration.

Dr. Philip Langer is a senior researcher at BIG. He has done his PhD in the AMOR project developing an adaptable model versioning framework based on EMF technology. His research focus is model-driven engineering, in particular model versioning, model transformation, and model testing and debugging.

B2.2.6 Engineering Ingegneria Informatica S.p.A. (ENG)

Description of the organization
Engineering Group is Italy's largest systems integration group and a leader in the provision of complete IT services and consultancy. Engineering Group has about 6500 employees and 35 branch offices, throughout Italy, in Belgium, and (outside the EU) in Brazil. The Engineering Group operates through seven business units: Finance, Central Government, Local Government and Healthcare, Oil Transportation and Services, Utility, Industry and Telecom, supported by an SAP transverse skills centre and by its Central Office for Research & Innovation, with researchers active in Italian and EU projects. Engineering was one of the first Italian companies to adopt the Quality standard ISO 9001 in the early 1990s. Since 1996 the company has adopted NATO standard AQAP 2110/160 certification. And recently the production units have been certified CMMI® level 3. The Pont Saint Martin Service Centre (PSM) provides to more than 100 Italian and international customers, 40.000 workplaces, 1000 remote connections, 10.000 electronic mail boxes and about 7000 SAP users. The R&D Department is organised to work in strict cooperation with business divisions in order to facilitate knowledge and technology transfer. The Engineering R&D lab is involved in the NESSI and NEM ETPs.

Expertise provided and main tasks assigned
The Engineering R&D Lab is brings expertise in service engineering and cloud computing domain (EU projects SLA@SOI, QualiPSO, VENUS-C, VISION-Cloud, Passive, TEFIS, ERINA4Africa, ERINA+, ARISTOTELE, D4ScienceEcosystem) as well as in ICT security (EU projects: ASSERT4SOA, MASTER, SERENITY, ESFORCE).

ENG will participate in the project as coordinator of the development of all industrial scenarios, and particularly it will be responsible for their own industrial scenario from the eGov domain. ENG will lead other tasks in diverse technical work packages (T4.4 and T6.2) as well.

The main technical contributions from ENG will be to WP4 (focus on organisational/business impact of modernisation of an application), WP6 (meta-modelling and characterisation of IaaS and PaaS), WP8 (transformations preserving non-functional properties of applications), WP9 (focus on requirements and architecture of the repository).

Key personnel
Paolo Fabriani received his University Degree in Computer Science in July 2000 at University of Rome "La Sapienza". Since 2001 he has been involved in different research projects (ArchWare, ECOLNET, Diligent). Recently, he led the Engineering team in ETICS/ETICS2 and D4Science projects. He is currenly responsible for the design and implementation of the accounting and billing system in VENUS-C project.

Domenico Presenza. He got his University Degree in Computer Science in April 1989 at University of Pisa. From 1989 to 1992 he has been working in the R&D Laboratory of Engineering S.p.A as researcher. In 1992 he joined Finsiel S.p.A. as researcher and where he held different positions. In particular, he has participated in different national research projects as team member. In July 2000 he joined again Engineering S.p.A. His main competencies concern Security Engineering, Knowledge Representation, Distributed Computing, Multi-Agent Systems, Security Visualisation. During his professional life, Domenico Presenza has been author of different scientific publications presented at international conferences. He has been Project Director of the SERENITY integrated project

from January 2006 to June 2009. Currently he leads the ICT Security Unit at the Engineering R&D Lab. In the context of the ASSERT4SOA IST Project (257351) he leads the development of a security ontology for certification of security properties web-services.

B2.2.7 Institute of Communication and Computer Systems (ICCS)

Description of the organization
The **National Technical University of Athens-NTUA** (www.ntua.gr) is the oldest and most prestigious technical university in Greece. It was founded in 1837 and has since been contributing to the progress of the engineering science in Greece, through the education of young engineers and its multi-faceted research and development activities. The University comprises nine departments, each one covering a different aspect of the engineering field. The School of Electrical and Computer Engineering of the National Technical University of Athens is well known in Greece and abroad for the research achievements of its faculty members and the good reputation of its students and alumni. The field of Electrical and Computer Engineering (ECE) spans a wide range of subject areas, like computer science, telecommunications, electronics, automatic control and electric power.

The **Institute of Communication and Computer Systems-ICCS** (www.iccs.ntua.gr) is a research organisation associated with the School of ECE and has about 40 laboratories and research units presently active which are established by the implementation of several structural programmes such as Mediterranean Integrated Programme on Informatics of European Community (MIP-Informatics), Public Investment and Special Development Programmes of the Ministry of Education as well as European Programs as TIDE, AIM, RACE, STRIDE, Telematics, ESPRIT, eTEN, ICT, etc.

Our **Distributed, Knowledge and Media Systems Group-DKMS** (www.grid.ece.ntua.gr), administratively falls under the Telecom Lab of ICCS and its research activities focus mainly on:

- Advanced Distributed Computing, dealing with topics such as Service Oriented Architectures, Cloud Computing and Internet of Things. Work includes Distributed Computing, SOA systems and architectures, Model Driven Engineering, Data Aggregation, Policy-driven systems, QoS and Trust issues in Service Provisioning Systems, SLA Lifecycle Management (provisioning, negotiation, enforcement, etc). Related Projects to which our group has been involved: OPTIMIS (FP7), VISION Cloud (FP7), 4CaaSt (FP7), IRMOS (FP7), BEinGRID (FP6), NextGRID (FP6), Akogrimo (FP6), CHALLENGERS (FP6), GRIA (FP5), GridLAB (FP5), etc
- Knowledge, Media & Digital Art, dealing with topics such as Knowledge Representation and Domain Modelling, Artificial Intelligence and Decision Support Systems, Clustering and Pattern Identification, Data Mining and Database Integration, Computer Vision and Advanced Multimedia Applications. Related Projects: ANSWER (FP7), SCOVIS (FP7), POLYMNIA (FP6), FIDIS (FP6), SemVeillance (nationally funded), etc.

Expertise provided and main tasks assigned
In the framework of ARTIST, ICCS / NTUA will focus on defining the methodology and generic roadmap (WP5) for the migration process of legacy applications to SOA based, Cloud enabled versions. Furthermore we will be involved in the modeling approaches (WP6) for target platforms and infrastructures, investigation and definition of performance stereotypes and the incorporation of these aspects during the deployment process. Our role will also

involve the investigation of different deployment versions of the software based on the application's characteristics and usage patterns (WP8) as well as continuous and event-based testing and validation in the context of WP10.

Key Personnel
Dr. Andreas Menychtas graduated from the School of Electrical and Computer Engineering, National Technical University of Athens (NTUA) in 2004. In 2009, he received his Ph.D. in area of Distributed Computing from the School of Electrical and Computer Engineering of the National Technical University of Athens. He worked in the private sector as computer and network engineer and has been involved in several EU and National funded projects such as GRIA, NextGRID, EGEE, IRMOS, HellasGRID and GRID-APP. His research interests include Distributed Systems, Web Services, Object Oriented Programming, Service Oriented Architectures, Security and Information Engineering. Currently, he works as research engineer in the Institute of Communication and Computer Systems (ICCS) of National Technical University of Athens.

George Kousiouris received his Msc in Electrical and Computer Engineering from the University of Patras, Greece in 2005. He is currently pursuing his Phd in Grid Computing at the Telecommunications Laboratory of the Dept. of Electrical and Computer Engineering of the National Technical University of Athens and is a researcher for the Institute of Communication and Computer Systems (ICCS), where he has participated in the EU funded projects OPTIMIS, IRMOS and BEinGRID and the National project GRID-APP. In the past he has worked for private telecommunications companies. His interests are mainly computational intelligence, model driven engineering, optimization and service oriented architectures.

B2.2.8 Sparx Systems Software GmbH - Central Europe (SPARX)

Description of the organization
Sparx Systems was founded in 1996 in Australia. To support the European customers in their language and time zone, Sparx Systems Central Europe was founded as an independent sister company in 2004. Sparx Systems is the developer of the modeling tool Enterprise Architect. To date 250000 licences have been sold worldwide to all top 500 companies. Enterprise Architect comes with a range of technologies and an extension mechanism. Many technologies like UML 2.x, BPMN, SysML, SoaML, etc. are provided out-of-the-box. Based on a profile mechanism, existing technologies may be extended and new one can be made. Enterprise Architect may be used for any kind of conceptual modelling as well as for code generation, reverse engineering of existing code and round-trip engineering. Based on templates and plug-in mechanism, many features of Enterprise Architect may be adopted and extended.
We as Sparx Systems Central Europe mainly support our customers with courses in conceptual modelling, introduction of modelling approaches, and adapting of Enterprise Architect.

Expertise provided and main tasks assigned
Members of Sparx System Central Europe have contributed to various external and internal research projects:

- Deutsche Post – Architecture of mobile Application for 42.000 devices based on Windows Mobile and Motorola HC 700, 2006 - now.
- SEZ – Worldwide solution for service staff with SQL Server replication, 2003 – 2004.

- SIEMENS MED – Architecture consulting for the worldwide Metamodel in EA, 2008.
- mobil-data – Product architecture for JAVA and .NET for all mobile business applications, 2004 – now.
- Bank Austria – Web architecture for Asset Management, 2007-2008.
- Otto Versand – Integration of EA to codeBeamer for improvement of their process landscape, 2008.

And more than 400 days training and consulting at customer site per Year.

Sparx Systems was the industrial partner in the national research project AMOR (Adaptable Model Versioning).

Key personnel
***Hans Bartmann*:** Is the Business Manager of SparxSystems Software GmbH, located in Vienna.His role in this project is legal and organisational stuff.

Dr. Horst Kargl: keeps oneself busy with OO programming and modelling since 2000. Before he changed to Sparx Systems Central Europe in 2008, he was a research assistant at the TUWIEN. His PhD thesis was about a semi-automatic integration of modeling languages. His research focus is on conceptual modeling, software architecture, code generation as well as adapting and extending of Enterprise Architect. As a senior consultant and trainer, he supports customer in questions regarding conceptual modeling and Enterprise Architect. He is often involved in industrial and scientific projects.

***Roman Bretz*:** Senior Consultant and Product Manager of AMUSE (Advanced Modeling UML Simulation and Execution) Since 1994 experience as software developer. Between 2005 and 2010 worked as software architect and system engineer at high budget, multi-supplier, time critical projects in the healthcare industry. Over 6 years modeling experience in UML and SysML using different platforms (Enterprise Architect, Together Architect, Rational Rose). He studied Mathematics and Computer Science in Novosibirsk, Russia, 1991-1994. He studied Computer Sciences at the Friedrich-Alexander-University in Erlangen, Germany 1996-2001.

B2.2.9 ATC (ATC)

Description of the organization
Founded in 1987, ATC is an ICT SME offering solutions and services targeting specific sectors incl. the Media, Banking and Retail Sectors, Utilities and Public Sector Organizations as well as horizontal solutions focusing on Content Management, Web Applications, Human Capital Resource Management and eLearning, and Mobile Applications. The activities of the company span several countries in the EU, Eastern Europe and CIS countries, as well as the Balkans. ATC provides the Media Sector with consulting and media – specific solutions as an active and leading supplier of newsroom, editorial and archive specific editorial solutions with a particular emphasis on News and Press Agencies and Publishing organizations. ATC's customers include major newspapers in Greece, Cyprus and Romania and the National News Agencies in Greece, Portugal, Poland, Russia as well as the Western Balkans. The initial engine of the Suite was developed in a Greek State R&D Project (in 1996), whereas new collaboration enabling versions with strong search capabilities are currently being researched in EU Projects. In recent years, ATC has also been investing in mobile technologies. Having acquired ISO 9001 certification since 2000, the company provides a broad spectrum of value-added products and services such as consulting, customer training, installation and maintenance, warranty and post-warranty services, SLA projects, project management, and

professional support. Central to the Company's strategy is the conduction of vivid Research and Development, focusing both in improving current Products and Solutions, as well as in exploring new technologies for future growth. All ATC own products and services are based on early prototypes and/or "proof of concept" obtained through R&D Projects, whether funded by the Company, the Greek State or the Commission.

Expertise provided and main tasks assigned
ATC has long standing experience in software and service engineering with respect to the migration of research results into business and industrial case studies. The company has been heavily involved in relevant past EC-funded research and commercial projects for the integration of software solutions in many fields and application sectors, including the development of end-to-end multimedia cross-channel solutions for an evolving News Agency, archiving and searching infrastructures, service registries and web content management and delivery toolkits. ATC has also coordinated user interface implementation tasks, as well as it has successfully undertaken the role of the dissemination and exploitation leader in a number of EC-funded projects. ATC brings in the project the extensive expertise in the media domain to contribute to the Legacy application of ARTIST technologies in a real critical business environment. It will also participate in the evaluation and marketplace development activities, the provisioning of ARTIST-oriented use cases, and the dissemination and collaboration activities.

Key personnel
Dr Nikos Sarris is a Senior IT Consultant in the ATC Consulting Department. He has received his PhD from the Aristotle University of Thessaloniki and his Master of Engineering degree from the University of Manchester Institute of Science and Technology. He has worked as a Researcher for the Aristotle University of Thessaloniki and the Informatics and Telematics Institute, where he participated in several national and European projects. His research interests include 3D model-based image and video processing, multimedia coding and analysis, and semantic-based knowledge extraction. He is the co-editor of a book in 3D modelling and animation and has authored numerous publications for international journals and conferences. Dr Sarris represented ATC in the MESH IP as the technical director and has been the coordinator of the SYNC3 and PAPYRUS STREP projects.

Dr Ilias Spais is working as an IT consultant in the Consulting Department. He received the diploma in Electrical and Computer Engineering from the University of Patras in 2000, and the PhD degree in Analysis, Design and Development of Processes, Systems and Computer Engineering from the National Technical University of Athens (NTUA) in 2006. He has been involved in several research projects in the context of the IST framework as a research associate and senior developer of the Telecommunications Laboratory of NTUA. His research interests include natural language processing, speech recognition and synthesis, digital management and presentation of cultural content, distributed information in SOA-based systems and multimedia e-learning platforms. He is currently involved in the field of business applications, user requirements capture, specifications analysis, dissemination and exploitation activities and project management in European and National R&D projects. Dr. Spais is a member of the Technical Chamber of Greece.

B2.2.10 SPIKES (SPIKES)

Description of the organization
Spikes is a System Integration and Software Solutions SME (>40 FTE) located in Antwerp, Belgium. Since its foundation in 2002, Spikes has focused on translating leading edge

advances in ICT into business benefits for its customers. Spikes customers are typically large, well known brands in the Financial Services, Retail, Logistics, HR, Utilities and Security domains as well as the public sector. Spikes software solutions specializes in middle-office solutions, and has a strong market presence in decision support, workflow, document management and collaboration solutions. The current business model is a Software + Services approach, where revenue is derived from both software licensing of Spikes products and accelerators.

Spikes Research is a division of Spikes dedicated to strategic, non-incremental innovation for the company. The research division targets technological gaps in topics that are in a pre-competitive stage of invention/development, or where market solutions are significantly qualitatively underperforming.

Expertise provided and main tasks assigned
Spikes is recognized as one of the leading ICT research intensive SME's of the Flanders region, both by public authorities as well as industry associations. We bring to the project a team that combines an academic research track record combined with extensive commercial experience and a dedicated SME perspective. We will provide ARTIST with relevant commercial and research experience in the domains of declarative model based integration and collaboration, and service architectures. The main technical tasks taken up by the team will focus on three specific areas:

- Realization of a specific use case based on ARTIST methodology and tooling in the area of legacy software modernization by model extraction and subsequent cloud based service extension, widening applicability of ARTIST's results to partial migration and modernization scenarios.
- Specific expertise in model extraction from .NET software artifacts and generation of event driven service interaction
- Leading the continuous evaluation for all use cases with a focus on relevance and exploitability of the results

Besides these Spikes will contribute its commercial expertise to the project in terms of business requirements and ecosystem sustainability of the results, and broaden dissemination to an industrial audience.

Key personnel
Peter Stuer is the director of the Spikes Research division. He holds a master's degree in computer science with a specialization in Artificial Intelligence He joined Spikes in 2004, and has been involved in the architecture of key Spikes product line in decision support, driven methodological transitions and has lead very large scale integration projects for Spikes' service customers. Since founding Spikes Research as a dedicated division in 2008, he has been focusing on strategic technical innovation and collaborating with European partners in open innovation, shared research initiatives. Peter was/is the lead on projects (ITEA2 – ITEI) on Ubiquitous Innovation system support, (ITEA2 – GUARANTEE) targeting extended home wellness and safety systems and (FP7 – eBest) providing a Social Ecosystem Innovation solution. Before joining Spikes, Peter Stuer was involved as a technical lead and architect in multiple European projects in FP4 & FP5

Peter Plessers received his PhD in Computer Science in 2006 with a treatise in "Web Based Ontology Evolution" after being a researcher in the Web Information Systems engineering group of the Vrije Universiteit Brussel for four years. He joined Spikes in 2007 as a software architect. He currently leads Spikes efforts on Collaboration Platforms and Security solutions.

His research focus is on flexible collaboration systems, advanced document management solutions and model configuration in product lines.

Bram Pellens received his PhD in Computer Science in 2007 with a treatise titled "A Conceptual Modeling Approach for Behaviour in Virtual Environments using A Graphical Notation and Generative Design Patterns". After a Postdoc at the Vrije Universiteit Brussel he joined Spikes Research in 2010 were he is currently lead researcher on Realtime Context Aware Systems.

B 2.3 Consortium as a whole

B2.3.1 Consortium composition leading criteria

The ARTIST consortium has been selected in order to conform to the following criteria:

- Adequate level of manageability.
- Balanced consortium between industry, academia and SMEs and complementarities of scientific and technical expertise.
- Trans-national approach.

Adequate level of manageability

The first criterion is satisfied:

- By choosing a Coordinator with comprehensive experience in managing large industrial research projects and by defining a suitable management strategy, as described in section 2.1.
- By bringing together a critical mass of partners that know each other and have already collaborated in the past and are fitted to the assigned tasks to assure project results.
- By defining three levels of responsibilities for all involved partners: Management, Executive Board, and General Assembly (described in detail in section 2.1).

ATOS has applied its methodology for large project management during its long history as a European leader in system integration, consulting and facilities management. The capacity to steer efficiently from the smallest internet Web page to the whole software system of the Olympic Games is reflected in every single project in which ATOS has been involved. This ability has transformed this company into the European leader and the world key player that it is today. Some examples of large projects coordinated by ATOS are:

- EU projects with more than 13 partners => ELEGI, TRUSTCOM, ORCHESTRA, PROMINENCE, SOA4ALL, OPTIMIS, BonFire
- The largest EU project in FP6 IST with 97 partners => BEinGRID
- Olympic Games, a complex mix of process, people, and technology with huge number of partners and suppliers.

Balanced consortium

The ARTIST Consortium is a well-balanced team that contains leading European players, combining business know-how and deep technical insights. This ensures that the partners are well positioned to cooperate and collaborate to respond to the global technological challenge.

Highly skilled ARTIST partners each of them contributing with their specific expertise and know-how to the joint research and development activities will drive improvement of scientific and technological cooperation for mutual benefit.

This consortium has the right balance between academia and industry of all sizes in order to achieve cutting-edge research results in the field of Software and Service Engineering and Cloud Computing. It involves renowned universities (TUWIEN, ICCS/NTUA) together with international recognized research institutes (TECNALIA, FRAUNHOFER IAO, INRIA), powerful multinationals (ATOS, ENG) and specialized SMEs (ATC, SPIKES, SPARX). In addition, SPARX is a known software tool vendor for software modelling. All together provide the necessary equilibrium between research interests and industrial significance necessary to achieve ground-breaking results driven by its applicability to real cases.

As depicted in the figure below, each partner brings along a specific area of expertise covering all necessary technology and business-oriented layers that altogether are essential for building up ARTIST.

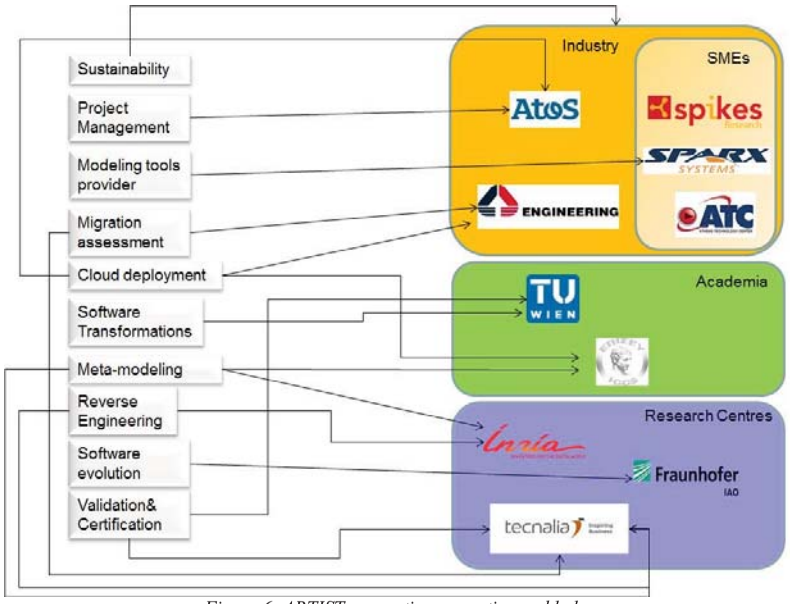


Figure 6. ARTIST consortium expertise and balance

Technological contributions are very convincing, grouping together partners have a proven track record in participating in relevant European and National projects such as MOMOCS, REMICS, ModelPLex, Cloud4SOA, OPTIMIS. There is an excellent complementary background among the different partners, which is also manifested in the leadership of the different work packages and activities.

Industry is very well represented in the consortium, involving: large IT providers and software integrators (ATOS, ENG); SMEs specialized in software development for diverse application domains (ATC, SPIKES); and a software tool vendor for software modelling (SPARX).

In order to achieve the major impact from ARTIST execution, all partners have a huge potential for deployment, exploitation and sustainability of project results and they are committed to leverage on their existing channels and tools to help in shaping, promoting and marketing ARTIST results.

Trans-national approach

ARTIST is composed by 10 partners from 7 European countries, representing North and South Europe, assuring the trans-European dimension. Their distribution is plotted on the following map.

Figure 7. Trans-European consortium

B2.3.2 Partner descriptions and roles

The following table provides further details on the specific expertise and contributions of each partner.

Table 15. Expertise and contribution provided by each ARTIST partner

Partner / country	Type (Expertise)	Primary contribution to ARTIST and relevant expertise
P1 ATOS (Spain)	Industry (IT Provider)	Project Coordinator and involvement in ARTIST Scientific and Technical Coordination (extensive experience managing large projects; including IPs such as BEinGRID, SOA4ALL, OPTIMIS, TRUSTCOM, ELEGI and ORCHESTRA). ATOS will also provide the Exploitation Manager leading the sustainability and business model of the project. Significant contributions to WP6, WP8, WP9 and WP10. Other contributions to WP4, WP5 and WP7. Responsible of one of the industrial use cases to assess and validate the project results.
P2 TECNALIA	Research Centre	Scientific and Technical Coordinator. Expertise in coordinating IP's (both technically and financially acquired in the OPENCOSS IP) and

Partner / country	Type (Expertise)	Primary contribution to ARTIST and relevant expertise
(Spain)	(Technology provider)	STREP's (i.e. EnerSIP). TECNALIA, and especially the Business Unit Software and Systems Engineering (former European Software Institute) has been and are contributors of OMG standards like SoaML, CloudML, and SPEM2.0 to be used within ARTIST, as well as other standards. As for the technical work, TECNALIA will focus on the development of the migration roadmap and methodology supported by the tools to be developed under Forward and Reverse Engineering. Expertise in this field acquired through projects like ModelPlex, ModelWare and REMICS.
P3 INRIA (France)	Research Centre (Technology provider)	INRIA is leading WP8 and all the WP tasks. They also contribute to other technical work packages and in the demonstration work packages. They will disseminate the project results through publications and events. Additionally, INRIA will contribute to the standardization task and will engage open source communities around software development (e.g.; the Eclipse Foundation via the MoDisco project)
P4 Fraunhofer (Germany)	Research Centre (Technology provider)	Fraunhofer IAO is leading WP10, leading most of the WP tasks. They also contribute to other technical work packages and in the demonstration work packages. They will disseminate the project results through publications and events
P5 TUWIEN (Austria)	University (Technology provider)	TUWIEN is leading WP9 and WP11, leading most of the WP tasks. They also contribute to other technical work packages and in the demonstration work packages. They will disseminate the project results through publications and events.
P6 ENG (Italy)	Industry (IT Provider)	ENG will lead the AC3 Demonstration and will be responsible for the proper development of all industrial scenarios, and as well as responsible for their own industrial scenario. They will lead the WP12 Use cases development and other tasks in diverse technical work packages (T5.4 and T7.2). Significant contributions to WP5, WP7, WP9, WP10. As industrial partner they will have a significant role in the definition of the exploitation strategy and they will contribute in the dissemination of project results.
P7 ICCS (Greece)	University (Technology provider)	ICCS will lead WP6 and WP7 and several tasks in these WPs. They will also participate in other technical work packages and in the dissemination of project results through publications and events.
P8 SPARX (Austria)	SME (Software tools provider)	SPARX will contribute in those work packages where their software tools may contribute to the development of the different assets of the project, as well as in those where some research can be injected in their future tools. They are a key element in the exploitation strategy of the project since they can drive the project results into their tools and software tools market. SPARX will lead T9.1 in WP9.
P9 ATC (Greece)	SME (IT provider)	ATC is the Dissemination Manager of the project and leading the corresponding work package, WP4 Dissemination. They will also lead the Collaboration task. They act as deputy exploitation manager leading the market analysis and contributing to exploitation strategy from the perspective of SMEs.

Partner / country	Type (Expertise)	Primary contribution to ARTIST and relevant expertise
		They are also responsible for one of the industrial scenarios by migrating one of the assets of the company (WP12 and WP13)
P10 SPIKES (Belgium)	SME (IT Provider)	SPIKES is leading WP13 and it is responsible of one of the industrial scenarios for a SME. They will actively participate in diverse technical work packages, leading also T7.3 in WP7. As their industrial scenario is developed in .NET, they will provide the expertise in this language to be applied in modelling and transformation models. SPIKES will also contribute in disseminating the project in SME forums and in the definition of the exploitation strategy from SME perspective.

B 2.4 Resources to be committed

The project will mobilise resources across the entire consortium to establish the joint programme of research necessary to carry out the project activities, its dissemination and exploitation. At the same time, resources also will be mobilised in support of an effective project management infrastructure. Funding will also be allocated to specific initiatives such as the publication of technical reports, special journal issues, and standardisation activities as well as marketing and IPR exploitation.

The total **budget** of ARTIST project is **9.690.538€.** Of this amount, the **requested EC contribution** is **6.953.705€ (71%).** As such the consortium members have made a commitment to contribute approximately one third of the project costs from their own resources, including personnel costs and access to existing infrastructures. Each participating partner has gained top level management approval for this commitment and consequently we can guarantee that the necessary resources will be released to the project to complement the requested EC contribution. Additionally, the consortium partners have made a commitment related to the time and expertise of the senior and junior personnel who will actively work on the project.

B 2.4.1 Allocation over project activities

The allocation of the project resources per activities is provided below.

Table 16. Effort distribution (per type of activity)

Activity type	Effort (p/m)	%
RTD	908	87,0%
Other	92	8,8%
Management	44	4,2%
Total	1044	100,00%

Table 17. Effort distribution (per project activity)

Activity name	Effort (p/m)	%
Activity 1: Project Management, Awareness, IPR management and exploitation	149	14,3%

Activity 2 : Technical definition and implementation	749	71,7%
Activity 3: Validation	146	14,0%
Total	1044	100,00%

Table 18. Effort distribution (per project work package)

Work Package	Effort (p/m)	%
WP1 Project Management	44	4,2
WP2 Scientific & Technical coordination	13	1,2
WP3 Business requirements and sustainability	44	4,2
WP4 Dissemination	48	4,6
WP5 Modernization assessment	74	7,1
WP6 Modernisation blueprint and methodology	97	9,3
WP7 Metamodeling for target definition and cloud delivery	110	10,5
WP8 Legacy product analysis by reverse engineering	131	12,5
WP9 New software generation by Forward Engineering	174	16,7
WP10 Common migration artefacts provisioning and management	85	8,1
WP11 Migrated product testing and validation	78	7,5
WP12 Use cases development	105	10,1
WP13 Use Case assessment and monitoring	41	3,9
Total	1044	100

Table 19. Budget and funding distribution (per type of activity)

Activity type	Budget Cost (€)	%	Funding (€)	%
RTD	8.505.858	87,77%	5.769.025	82,96%
Other	788.910	8,14%	788.910	11,35%
Management	395.768	4,08%	395.769	5,69%
Total	9.690.538	100,00%	6.953.705	100,00%

B2.4.2 Allocation per partner

The allocation of the project budget and effort per partner is provided below.

Table 20. Budget/funding distribution per partner

Partner	Costs	Cost %	Funding	Funding %
ATOS	1.446.744 €	14,93%	948.090 €	13,64%
TECNALIA	1.244.304 €	12,84%	953.307 €	13,71%
INRIA	644.648 €	6,65%	493.429 €	7,10%

Fraunhofer1	1.024.489 €	10,57%	789.946 €	11,35%
TUWIEN	955.590 €	9,86%	734.990 €	10,57%
ENG	1.532.940 €	15,82%	810.860 €	11,66%
ICCS	998.600 €	10,31%	770.600 €	11,08%
SPARX	425.400 €	4,39%	327.600 €	4,71%
ATC	375.000 €	3,87%	323.750 €	4,66%
SPIKES	1.042.823 €	10,76%	801.133 €	11,52%
TOTAL	9.690.538 €	100,00%	6.953.705 €	100,00%

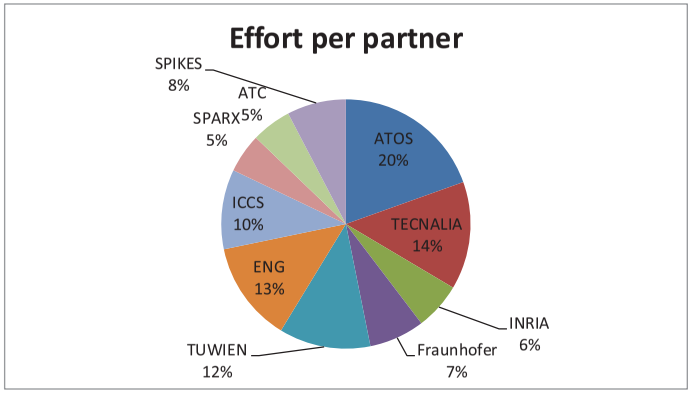


Figure 8. Effort distribution per partner

B2.4.3 Allocation over cost categories

The project's administrative allocation of resources is shown below.

Table 21. Budget distribution (per cost category)

Cost Category	Budget (€)	%
Personnel	5.970.121	61,61%
Overhead on personnel	3.400.816	35,09%
Consumables	5.000	0,05%
Equipment	30.000	0,31%
Audit Certificates	35.000	0,36%
Travels	249.000	2,57%
Subcontracts	0	0,00%

[1] the indicated effort per person month for a scientist contains 80 hours of effort for student assistants

Total	**9.690.538**	100,00%

The major cost item in the project resources is the personnel costs. All partners have committed appropriate personnel resources from existing staff as well as additional staff to be recruited to undertake the project. Other costs, including equipment, consumables, travel and subcontracting are further detailed in the following subsections. No major equipment costs are included except for servers for the development and testing environments. Travel and subsistence costs are included by all partners to ensure that the project results are effectively disseminated in major international forums to have maximal impact. The travel and subsistence costs will also facilitate travel to project meetings and workshops as well as meetings with the EC and other bodies. We will attempt to minimise travel by making use of online communication tools as well as telephone conferences. However, physical plenary meetings will take place at regular intervals to monitor the progress of the project and work-package teams will meet physically in working meetings to undertake technical work as appropriate.

Consumables: Consumable costs include:

– ATC (5.000 euros): ARTIST will focus on the production of the appropriate hands-on promotional marketing material consisting of project's results and benefits, namely leaflets, posters, brochures, USB sticks, etc. to be used in the different dissemination and networking events to be attended all through the project

Equipment: Equipment costs (30.000 €) include:

– ATOS (5.000 €): servers for development, integration and pilot development.
– TUWIEN (15.000 €) and INRIA (10.000 €): Servers for the development environment.

Travel: Travel costs in the project are 249.000 €. They have been based on the basis of a specific number of trips per partner and a base cost of 1.000 € per trip. We have classified the trips into three categories depending on the nature: project meetings (RTD), review meetings (MGT) and conferences attendance (OTH).

Table 22. Travel Budget Distribution

	ATOS	TECNALIA	INRIA	Fraunhofer	TUWIEN	ENG	ICCS	SPARX	ATC	SPIKES
Project meetings	20	20	20	20	20	20	20	9	10	13
Review meetings	6	3	3	3	3	3	3	3	3	3
Diss Events	4	6	6	6	4	6	4		6	2
Total cost in travels	29K	29K	29K	29K	27K	29K	27K	12K	19K	19K

Other costs

Effort in WP3 Business requirements and sustainability – 377.305 Euros
Effort in WP4 Dissemination (including Collaboration) – 411.606 Euros
788.911 Euros in total

Subcontracting

Subcontracting only will be required for audit certificates, thus all partners who will require audit certificates have been assigned subcontracting budget in the Management category to subcontract the certification of their financial statements (when there has been an accumulated funding claim of 375,000 Euros).

- Average audit certificate budget (number of certificates indicated per each partner):
  - 2500 Euros per certificate: ATOS (2), TECNALIA (2), Fraunhofer (2), INRIA (1), TUWIEN (2), ICCS (2), SPIKES (2)
- No certificates are needed for ATC and SPARX as their total funding request is under 375,000 €.
- ENG will need only one audit certificate at the end of the project since they applied for Certificate for Methodology (COM) and EU approved it.

B2.4.4 Allocation per countries

The ARTIST consortium is well balanced according to Budget and Funding distribution between countries. As shown in figures below the budget/funding allocated in Spain is a bit higher since both Project ad Technical coordinators come from there (ATOS, TECNALIA). It might be also seen that there is a balance among the rest of the participating countries allocating similar percentages.

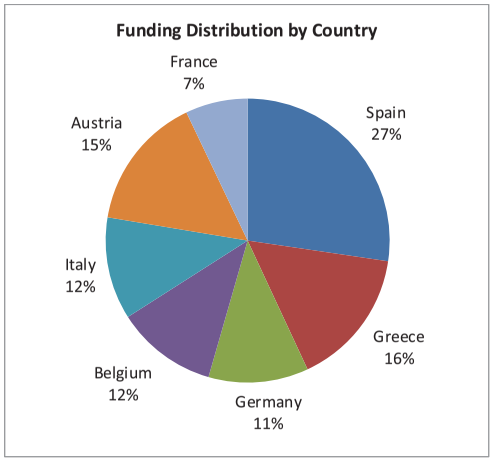


Figure 9. Funding distribution (per country)

B3. IMPACT

B 3.1 Strategic impact

B3.1.1 Expected impacts listed in the work programme

ARTIST will combat the depreciation of software assets by freeing them from the constraints of the original programming model and permitting them to be used in accordance with current (and future) best practice, including cost reduction, performance enhancement and allowing their use with new business and deployment models. The following major impact expected from the work programme is indeed the central objective of ARTIST:

> ***"Easier evolution of legacy software over time, thanks to innovative methods and tools managing the complete lifecycle of software from requirements to run-time."***

The way ARTIST will produce this impact is through allowing software vendors and users of OS software **to migrate the legacy software to a new software paradigm in an automated, facile and cost effective way**. This means that legacy software can be transformed so that it receives the benefits of that software paradigm such as performance enhancement, cost effectiveness or interoperability. Clear examples of desirable target paradigms are present today in the form of cloud computing and mobile computing. The project sets out to make this transformation easy and effectively covers the entire lifecycle as new requirements and design principles are captured during the migration process. When, in the future, the new software in turn becomes outdated and uneconomical, it can be migrated once again to the new paradigm of the day.

The following table shows the expected impact according to the Work Programme and how ARTIST will contribute to each of them. As can be seen, the impact of ARTIST is highly aligned with the expected impact of the call as described in the Work Programme. This shows that ARTIST shares the vision of the Internet of Services and offers a compatible approach beyond the specifically targeted area of the work programme.

Table 23. ARTIST contribution w.r.t. Expected Impact from the Work Programme

Expected Impact	ARTIST Contribution
Emergence of European interoperable clouds contributing to an internal market of services in the EU whilst providing very significant business opportunities to SME's; improved trust in cloud-based applications and storage for citizens and business.	ARTIST's approach will overcome the challenges of market confidence and market transparency, through developing a specific **SbSp (Service based Software providers) certification model** which will guarantee the capabilities (not only technical but also organizational, economic, etc) of service providers. Through enabling the migration process, numerous applications that could be considered obsolete will be 'recycled' as Cloud services. This is particularly important to SME consumers, due to the **low capital requirements of cloud vis-à-vis software acquisition**.

Expected Impact	ARTIST Contribution
Availability of platforms for easy and controlled development and deployment of value-added services through innovative service front-ends.	ARTIST promotes a different model-driven paradigm for user-assisting semi-automatic development and deployment of service based Rich Internet Applications (RIAs) fully integrated with one of the leading open source software development IDE[2]. ARTIST paradigm fosters the provisioning and delivery of value-added services from the massive stock of legacy applications. For the deployment process, the ARTIST tools will take under consideration numerous factors like the actual Quality of Service, performance, etc offered by the different IaaS/PaaS providers with regard to different application types, thus leading to an improved selection process.
Lower barriers for service providers and users to develop, select, combine and use value-added services through significant advances in cloud computing technologies and standardised and open interfaces	As a cheaper **alternative to developing software from scratch**, ARTIST will lower the barrier for providers as the massive stock of existing proprietary legacy applications and 'obsolete' open source software can be **'recycled' into modern RIA and Web services**. In particular, Cloud delivery is dramatically simplified by the provisioning of standardized meta-modelling techniques that describes Cloud offerings, allowing the specification of target delivery requirements. The ease with which new state of the art will be integrated into existing applications will **increase the rate of innovation** by providers with benefits for users, providers and technology developers.
Efficient implementation of mainstream software applications on massively parallel architectures	ARTIST is an enabler of this implementation because it will dramatically reduce the cost of exploiting the benefits provided by these architectures. In particular, **ARTIST will permit specifying performance requirements for target Cloud infrastructures** and classify and rank matching Cloud offerings for delivery on massively parallel infrastructures.
Easier evolution of legacy software over time, thanks to innovative methods and tools managing the complete lifecycle of software from requirements to run-time.	This is the **main objective** of the ARTIST project as discussed above. ARTIST will develop a set of generic methods, tools and techniques that facilitate the transformation and modernization of legacy software assets and businesses. The project will **build tools to assess, plan, design, implement, and validate an automated evolution of legacy software** to SOA and to the cloud computing delivery model. Thus, the complete lifecycle of software will be considered.
Fast innovation cycles in service industry, e.g. through the use of Open Source development model	ARTIST will accelerate the innovation of the sector because the **cost of technology adoption will be reduced**. Thus the barriers for new technology will be reduced, the uptake will be greater, and more organisations will benefit from the innovation. This causes positive feedback: **a more receptive market makes investment more favourable and more investment funds more innovation**. ARTIST itself is planning a rapid innovation cycle, exploiting open source development. The project will treat the use cases as innovation cycles, improving the product each time and is examining the best way open source can be used to accelerate

[2] Eclipse IDE: http://www.eclipse.org

Expected Impact	ARTIST Contribution
A strengthened industry in Europe for software-based services offering a large choice of services satisfying key societal and economical needs, with reinforced capabilities to engineer and produce software solutions and on-line services	ARTIST will level the playing field for companies with existing products who until now cannot afford to migrate to cloud. With the high number of SMEs (for whom this is an acute problem) in Europe relative to other world regions, ARTIST strengthens the European software industry. **Increased innovation will cascade down to the users of technology** – essentially most of the economy.

B3.1.1.1 Bringing about the impact

We proceed to describe how this impact will realised, in particular how the easier evolution of legacy software will lead to fast innovation cycles and a strengthened industry. We do this through explaining the creation of value through easier migrations, and how this affects the competitiveness, actions and incentives of the main stakeholders, such as software providers, users, investors and other ICT stakeholders. Effectively impact is driven by this business case for adoption of ARTIST by these stakeholders.

The cost for migrating existing legacy applications is an issue for both large and small companies. It is discouraging for SMEs that cannot afford to reinvest new funds in migrating existing applications. At the same time, large companies often use very large and complex legacy applications, and the disruption and difficulty of the migration is a hurdle to carrying out a migration. Thus, **SMEs take advantage of ARTIST technologies to realize otherwise cost-prohibitive migrations, whilst large companies which have the available funds, may see the reduction in complexity and time as the major benefit**. By lowering the barriers for providers (in cost and time) to migrate to the cutting edge of software development, the **risk of such a migration is reduced**. The incumbent industry is consequently strengthened against the threat of start-ups which have been founded on the risky calculation that the emerging technology model will succeed. This is **particularly relevant in Europe** where the venture capitalist-funded technology booms are slower and more conservative than, for example, Silicon Valley. Easy, cheap and controlled development and deployment of legacy systems in current software paradigms, such as SOA, cloud infrastructure and SaaS models will lead to faster innovation cycles as businesses with a strong product can **focus more on innovation** and reinforcement of the core product capabilities and performance, **and less on maintenance** and interoperability with what else is occurring in the market. By extending, perhaps indefinitely, the lifecycle of European mainstream software applications, ARTIST will satisfy a key societal and economical need of **balancing software continuity with optimal performance and cost**. The increased stability of the software industry has societal and economic benefits for employees and customers **and provides a healthy alternative to short-lived boom and bust software innovators**. We have tried to estimate the magnitude of this problem. Whilst in general there is a lack of empirical studies of software maintenance costs [135]a detailed study in 2003 [136]has identified that up to 90% of software cost relates to its maintenance following implementation. In the context of all enterprise ICT costs this is some 55%. [137] This would appear to be on the rise, from 50-60% estimated by various sources between 1979 and 1990[138], rising to 90% in later studies [139]. In absolute figures **Annual software maintenance cost in USA has been estimated to be more than $70 billion[140]**. For large consumers of ICT spending is a major cost. When an urgent and major upgrade is required, as seen by the Y2K bug, we see this rise further, For example the US federal government and Nokia Inc. spent about $8.38 billion and $90 million, respectively, on this problem. A significant portion of the maintenance cost is used to upgrade the features of the software in order to stay competitive in the market. One study estimated this was as high as

75% of cost[141]. **This is clearly an issue which ARTIST tackles**. By being able to migrate to the state of the art automatically, the requirement of software vendors to chase the state of the art through work-arounds and enhancements is significantly reduced. With these orders of magnitude in mind, in the following discussion we show **how** ARTIST will enable software vendors to keep their products closer to the cutting edge. As an example we focus on a pure cost/performance basis. However the same concept is true for other attributes of software, such as agility and functionality.

We consider that at any point in time the state of the art model for software provision provides an optimal value for performance per unit cost. This is shown by the dashed line in the graph on the right (Figure 10). Of course this is a simplification as different performance requirements have different cost structures, but for the purpose of demonstration we assume this has an optimum that is acknowledged by the software creator. The performance per unit cost is ever increasing as new networking capabilities, virtualization, multitenancy and cloud, etc. are developed. When software is developed it is done so using the state of the art. We assume that once software is developed it cannot take full advantage of future changes without some investment, that is, its performance per unit cost is fixed. This is shown by the rectangles, showing successive versions of the product which are released over time.

The software creator will see that **at any point in time there are benefits to migrating to the current state of the art.** This is indicated on the graph at time *t* as the **performance gap** between the performance of the software when it was developed and SOTA at the present time, *t*. However there is also an investment associated with this migration. This investment must be evaluated in terms of net present value (cost/benefit analysis), in terms of risk (will the current state of the art be stable, widely adopted and supported in the future?) and in terms of opportunity cost (could the developers' time better be spent on new features or other products?). **At some point in time, the performance gap between the software and the SOTA is great enough that the migration becomes economically viable,** albeit with a risk associated.

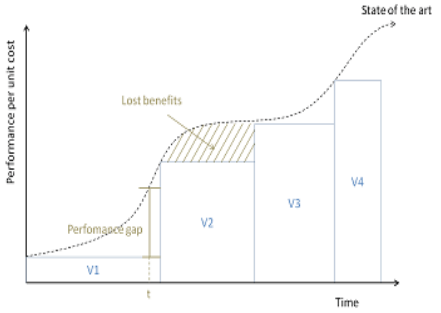


Figure 10 The performance gap between legacy software and the state of the art

Because of the delay between making this investment and upgrading to the SOTA, the software creator has lost benefits equal to the area between the curve and the performance / cost of the product version. These lost benefits represent the difference between the theoretical maximum performance and the actual performance. These depend on the performance gap and the time. Competitors may have released products in the meantime which are more efficient. These lost benefits are shown on the graph above for one of the software versions. We now look at the way that ARTIST will provide the desired impact through the reduced cost (and also consequently investment risk and opportunity cost) on software creators.

In the graph on the right (Figure 11) we see that with reduced investment cost and complexity, the tipping point for implementing the software migration to the next version comes much sooner. The number of releases increases rapidly as **with ARTIST the economics dictate more frequent migrations**. The total sum of the lost benefits (ie the total area between the curve and the software performance) is much lower. Effectively, **with ARTIST the software follows the SOTA much more closely.**

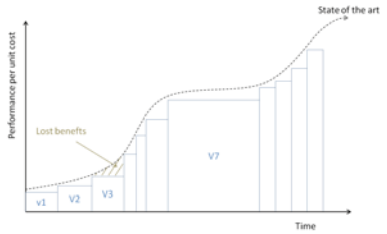


Figure 11. With ARTIST there will be more frequent migrations and so software will closer follow the SOTA and there will be less lost benefits.

If the software creator was using the software in-house, their costs would be much lower than their competitors not using the ARTIST migration tools. If they were selling the software, their product would be much more competitive than their rival's software purely on the grounds of running costs. As a consequence, **ARTIST is able to improve the software industry competitiveness**.

And this competitiveness is far from merely on a cost basis. An agile software creator, which can quickly roll out new versions to respond to demand (new features, new compatibility, new usage patterns, new business models) will be considerably more competitive than the competitor who cannot afford to migrate as frequently, as shown in Figure 12, where the infrequent migrations (dark grey) are superimposed on top of the more frequent migrations (light grey). The visible light grey areas are the competitive advantage that the ARTIST adopter receives.

This improved competitiveness is the business case for software creators to use ARTIST results for the migration of their software.

In the above example we detail the impact of a single client over time. We have seen that **ARTIST effectively reduces the threshold at which a software owner migrates to the latest paradigm**. In doing so, they have more agile, better performing software at lower cost. Considering the wider impact, based on multiple users, we can consider the following impact on industry and its stakeholders:

ISVs: As it becomes easier for ISVs to migrate their assets, those **assets become more valuable and have an extended lifetime**. This in turn incentivizes the ISVs to **invest more in innovation**. Because the functionalities of the asset will be easily migrated, the ISV can invest in further functionalities even when a migration in the near future is foreseen. This means that software will not become neglected as developers look to the next

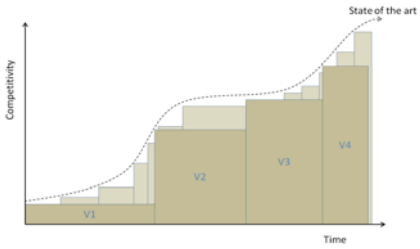


Figure 12 Competitive advantage provided by ARTIST

product version, but rather continue improving the existing version.

The reduction of the technical limitations of the obsolete programming model of the legacy applications could be a reality for software developers thanks to ARTIST. Besides, the exploitation of the new features, either with regard to infrastructure benefits (elasticity) or software maintenance (component-based software is easier to manage than monolithic ones, and updating specific components only is much cheaper than updating the entire application).

In the specific case where the ISVs are shifting to a new business model such as software-as-a-service, ARTIST will allow the industry to take advantage of multiple benefits of this model, including growth of the customer base and lowered costs. At present **SaaS is becoming more prevalent and we foresee ARTIST accelerating the migration**, with benefits to users, providers and the whole ecosystem.

Investors: By adopting ARTIST solution, investors may conserve their investment – value created now will be conserved as it can be transferred to future migrations. This counters the risk that software developed today using the state of the art is obsolete in the near future. Consequently the risk of the investment is reduced, so **ARTIST should increase the flow of venture capital into the software and services industry**, providing innovation and employment for Europe.

Technology providers: As stated above, ARTIST will accelerate the shift to SaaS and to Cloud. This will increase the demand for infrastructure providers, increasing the market size and consequently the attractiveness of the sector. This will lead to greater investment in capacity and perhaps encourage the emergence of new providers. Along with cloud computing this will also increase demands on the network infrastructure and spur development, investment and job creation. On the flip side, with the increase in cloud there will be a decrease in hardware requirements of users, as they consume the resources remotely.

Software users: For the user, many of the benefits will be indirect. There will be more SaaS providers, and **software will be more advanced and at lower cost** (as development costs decrease). This will be very positive for these stakeholders, but at the same time subtle – they will not directly use ARTIST. Perhaps a more direct impact, particularly for corporate purchasers, will be **increased business continuity** of the applications they use. There will be a reduced risk that the software provider discontinues a product or does not provide updated features as the technology evolves – as ARTIST lowers the threshold for the software provider to make these investments.

Consultants: ARTIST opens up consultancy to two new areas. Firstly an increased need for consultants to help with the migration process itself and the related areas such as cloud and SaaS specific changes. Secondly, as the economics of migrations change, this will impact technology strategies in the ways described above. Consultants will be able to advice on when to migrate, how to incorporate migration into the development process and how to shift from short software lifetimes to potentially indefinite lifetimes.

Open source community: Essentially anyone can take an Open Source product (license terms dependent) and make it a SaaS business or *cloudify* it. This will lead to **user-driven innovation** and drive a shift from amateur Open Source projects to commercial quality products. By 'recycling' older Open Source projects, a large amount of innovation will be brought back into mainstream products.

The potential market size for ARTIST is very large. Having identified above the magnitude of the problem and how ARTIST will address it, we need to consider the number of actors involved and the costs of the migration. We know that about 70% or more of the still active business applications are written in COBOL (Giga Information Group) and there are at least 200 billion lines of COBOL-code still existing in mainframe computers alone (Gartner Group[142]). The cost of manual migrations has been estimated by Gartner to cost $6 - $26 per line of code and is accomplished at a rate of 160 lines per day[143]. With a system of 1 million lines, this implies a cost of $6-$26 million and 28 man-years of labour. When the systems become even larger, a manual migration becomes impracticably large. A source [144] has estimated existing manual migrations at a rate of $1-$4 per line, giving an equivalent cost of $1-$4 million, estimated to take just 9-18 months. However these systems have a series of drawbacks as discussed in the SOTA of this proposal. With ARTIST we anticipate that not only will these obstacles be overcome, but the cost will be reduced further. Based on the expectations listed in the S&T objectives 3.2 and 5, (90% automation, 20% reduction in time wrt to SOTA) the project output would put the same migration at a cost and time of:

Table 24. Manual cost vs. ARTIST cost

Process	Manual time	Manual cost	ARTIST time	ARTIST cost
Convert 1,000,000 lines of code manually	28 man-years With team of 10 = 33 months	$4-26 million	-	-
Convert 90% automatically & 20% faster than SOTA	-	-	= 80% * 9-18 months = 7-15 months	@2$/line = $1,800,000
Convert 10% manually	-	-	100,000/160/365*12 = 20 MM With a team of 10 = 2 MM	100,000* 6-26$ = 600,000-2,600,000
Total	33 months	4-26$M	9-17 months	2.4 – 4.4 $M

ARTIST gains = 50%-72% in time and 1.6-23.6M$ cheaper.

B3.1.1.2 Motivation for a European based approach

A European approach is required for two main reasons. Firstly, ARTIST has the potential to make the European software industry more competitive and innovative. However to achieve maximum potential, it needs to have wide take up. This will not happen by tying the results to a single nation state or partner. SMEs in Europe are increasingly acting in a pan-European ecosystem and so it is beneficial for companies when their international partners also to boost their innovation. Secondly, in order for the ARTIST results to be widely applicable to the

whole Europe, the degree of heterogeneity present in Europe must be taken into account. This covers issues such as standards (including de facto ones), but also skills, perspectives, habits and customs. This is particularly acute in the business analysis tools of ARTIST, where regional differences, laws and requirements need to be taken into account.

B3.1.1.3 National and international research

As a proposal which straddles the fields of legacy computing, MDD techniques and cloud computing, ARTIST will work accordingly with initiatives in these fields at national and European level. This includes working with the ongoing analysis on the *"Opportunities For European Cloud Computing Beyond 2010"*[145] in where a European Expert Group provides a set of recommendations towards European research and development communities and bodies. ARTIST project will take into consideration relevant research topics, opportunities and threats exposed by diverse Groups of Experts and initiatives such as: NESSI, the **Future Internet Assembly, Euro Cloud, ETSI, NIST**, etc. The PPP (**Public Private Partnership** is a major initiative seeking to radically change the way that the ICT is consumed and used in the future Internet. The partners have strong links with this and will work closely with them to align impact and to collaborate at a technical level. Another initiative is **INES, the Spanish Technological Platform for Software and Services**, which strategic agenda includes SaaS, SOA and cloud as present and future technologies to foster the industry competiveness in different sector markets. **ARTIST has been granted a label from this platform as strategic project** for the implementation of its research agenda.

B 3.2 Plan for the use and dissemination of foreground

B3.2.1 Exploitation of project results

The **value proposition** of ARTIST is to **reduce the cost and complexity** of software migration. The **business case** for adopting ARTIST by customers is that through this, the risk associated with decisions to produce, for example, a cloud version, SaaS version or mobile version, of a product is lowered **and so companies can be more innovative**. Companies exploit the latest technology to reduce costs or increase performance or functionality. Investment in new features for old products is a better investment because that investment is conserved and carried forth into new products. Adopting ARTIST will lead to lowered costs, improved performance, greater customer satisfaction, more innovation and greater competitiveness. As described at length above. The tentative **value chain** for ARTIST is shown below. The results of some activities provide input for future iterations (arrows). The essence of the chain is described below.

The key value activities with barriers to competition (ie which are difficult for competitors to replicate) are the transformation algorithms, the artefact library, the metric database and the results library. As a consequence the **business model**, or sustainability model, of ARTIST will be based on these. These give the exploiting organisation a strategic position from which they can defend any competitor which establishes a similar service. Consequently, one potential **business model** is based on the **traditional service model**, whereby the analysis and the migration are offered as **consultancy services.** This exploitation route would imply a business being developed to offer these services. The implication on IPR would be to control the access to the results and to the algorithms. The other promising business model, which is inherently more innovative, is **to open the migration process as a self-service tool**, with ARTIST generating revenues through the provision of the artefacts and results libraries. The

implication is that **an Open Source implementation could potentiate the model** by **increasing throughput** and consequently the collection of results.

The following of a general Open Source approach has been clear for all partners from the beginning of the project, always ensuring the feasibility of the exploitation intentions of all of them. This OS approach will be implemented in the project fostering the development of OS code and engaging related OS communities. Following actions will be achieved to foster an open source development process:

- Use of collaborative development environments for project's developers
  - OS forges (SVN, Bug tracker)
  - Communication tools (mailing lists, chat, wiki, blog)
- Reuse whenever possible existing open source code from previous OS projects e.g. MoDisco)
- Open the project results as soon as possible to other OS developers. This implies:
  - Providing complete documentation for every item to open
  - Promoting the Repository (artefacts) and Software tools through our web site
  - Allowing early download and feedback (foro, mail). The external OS developers' community is not only useful for evolving the project results (and ensuring the project sustainability), but also as extra-testers of our results providing valuable feedback and preparing them for further adoption.
  - Allowing external contributions as soon as the project development cycles and timeline would allow it.
- Distribution of some project results under OS licenses. Many of the project results will be delivered under OS model. Others will be restricted to partners for commercial reasons. An initial analysis of the pre-existing OS components/background has been done and all of them are under non-restrictive licenses, so they can be reused. The establishment of the licenses for project results will be always compatible with partners' exploitation interests, although the business interest of partners involved is to keep the OS model as open as possible.

On the other hand, the engagement of the existing OS communities from the beginning of the project is essential to ensure the long term sustainability of ARTIST assets. The concrete strategy will be set up in the Dissemination Plan and first exploitation deliverables (the approaching to OS communities covers this two angles: how to communicate them what we are doing and how can they adopt project results), but it can be already stated that an initial selection of main related OS communities will be done at the beginning of the project. Afterwards a concrete strategy with any of them will be established with some indicators that will measure the degree of engagement and impact of ARTIST in those communities. A key aspect for success in approaching to OS communities is to be able to provide them valuable results that they can adopt, evolve and maintain in the future by themselves. This implies to elaborate a clear governance mechanism to deliver project's results and collect contributions from these communities. ARTIST will capitalize the partners' liaison with OS communities and centers, such as:

- Eclipse-MDT MoDisco (INRIA)
- ENG, ATOS, INRIA and Tecnalia are Eclipse Foundation members
- OW2 (ENG)
- National OS competence centers (ATOS-Tecnalia in Spain, ENG in Italy)
- BerliOS, Sourceforge (ATOS, ENG)

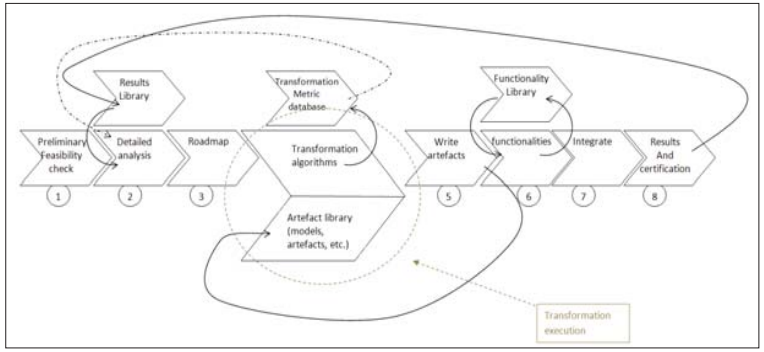


Figure 13. ARTIST Value Chain

The above picture shows the following steps: ❶Preliminary feasibility analysis defining scope and expectations, taking into account maturity, architecture and business aspects; ❷ Run detailed analysis (using metrics, incorporating historical data); ❸ Generate migration blueprint; ❹ Execute transformation (automated) based on automated scripts, artefact, model library etc. Provides data used in future analyses; ❺ Write missing artefacts (which go into library for future use). Missing artefacts are required prior to apply modifications on the legacy application (transformations). ❻ Add new functionalities, from library or new (self-feeding). After incorporating new functionality the deployment bundle is created and deployed (once the target has been selected); ❼Integrate, verify and validate the automated and manual pieces in its behavioural and non-functional aspects; ❽ Validation and certification of the migrated software.

In either of these cases the impact on Europe's software market will be delivered through widespread uptake. To exploit the technology the following process will be followed:

1. Confirmation of the value chain and possible business scenarios
2. Market analysis to confirm assumptions and initial findings regarding the demand for this tool.
3. Development of a business plan for the exploitation of the results and elaboration of individual plans for complementary exploitation according to the partner context.

This is described in greater detail in the corresponding work package description. In addition we consider that **some value activities could be exploited during the project lifetime**. For example, some elements of the feasibility analysis could be released as a self-test tool. This could be **made available through the project website** for use by potential clients. Doing so would provide a valuable source of contacts and market data from the clients who would drive future work and exploitation. Likewise, analysis of the nontechnical changes that accompany a migration to cloud or SaaS could be commercialized as a service independently from the progress in the automated migration of the software itself. ARTIST plans a proactive approach to exploitation and will develop both the technology and the exploitation plan in tandem. These high aspirations for exploitation are justified because roles of the value chain are currently covered by consortium partners.

Table 25. Partners' value chain positions

Position	Partner
Provision of the migration feasibility analysis (software, business case)	TECNALIA, ENG, ATOS
Consultancy in the application of the migration roadmap/methodology	TECNALIA, ICCS, ATOS, Fraunhofer, INRIA
Support in the migration process	INRIA, TUWIEN, SPARX, TECNALIA, ICCS, ATOS
Development of new artefacts	ATOS, TUWIEN, INRIA, ENG, ICCS
Maintenance of the repository/library	Fraunhofer, INRIA
Develop new functionality domain-oriented	ATOS, ENG, ATC, SPIKES
Integration of ARTIST functionality	ATOS, ENG, Fraunhofer
Validation/certification process	TECNALIA, ICCS

In the case of the modelling tool provider we have in the consortia (SPARX), despite their tools are being commercial, the artefacts they will develop in the scope of the project will not be useful only for their own tools but also for third parties, as they will be delivered under Open Source. This will be possible thanks to the use of XML Metadata Interchange (XMI), the standard of Object Management Group (OMG) used for interchange of software development tools. The entry and exit points of the artefacts developed by SPARX in the project are XMI. Thus, the interchange with other modelling tools is a main focus in our mindset. The format is open, neutral and allows interchange of elements based on meta-metamodels of the Meta-Object-Facility (MOF). Using XMI allows interchange of any Metadata as long as they can be represented by MOF. Some modelling tools supporting XMI that can be benefit from the project would be: Altova UModel, ArgoUML, ARIS Toolset, Artisan Studio, Astah, BOUML, Eclipse Process Framework Composer, Sparx Systems Enterprise Architect, Innovator, iteraplan, MagicDraw, Modelio, Pentaho, Sybase PowerDesigner, Rational System Architect, SAP BI, StarUML, Umbrello, UML2 Project (Eclipse MDT), Visual Paradigm.

The following table describes the high-level exploitable results of ARTIST that can be identified at the proposal stage. The results will be evaluated and refined during the course of the project based on the findings of the ARTIST business requirements and sustainability work package. The exploitation team will extend and fine-tune the results table and develop a sound exploitation strategy for ARTIST.

Table 26 ARTIST exploitable results

Result	Description	Type
ARTIST modernization assessment	This result will be composed of the required methods to perform the modernization assessment (assessment process and method, metrics and indicators to be measured) as well as the supporting tools: Business and Technical Modernization assessment tool (to perform the assessment semi-automatically), Technical Feasibility tool (to analysis the complexity of the modernization regarding technology shifts needed), Business Feasibility tool (to perform a cost-benefit analysis on the modernization process).	Methods and software
ARTIST methodology	The ARTIST methodology will comprise all the phases needed to perform the modernization. It will define the lifecycle of the migration process including its phases, purpose, activities to be performed, inputs, outputs, tools or techniques suited for each phase, and templates to use. The ARTIST methodology will be	Methods

Result	Description	Type
	supported by a handbook and a Methodology Process Framework in order to guide developers in the process of applying the ARTIST methodology in their specific environment.	
ARTIST software analysis	Reverse Engineering approach for the analysis and understanding of legacy application architecture and technology baseline from its source code and data schemas	Methods and software
PaaS/IaaS Metamodeling Framework and Tools	Meta-modelling techniques supporting the specification of Cloud target delivery requirements	Software
Set of transformations to cloud	Forward Engineering transformation techniques supporting the adaptation of legacy application models into a target Cloud infrastructures also described by similar meta-modeling technologies.	Software transformation
ARTIST Repository	A repository of reusable MDE artefacts required along with the entire ARTIST migration roadmap, intended to leverage on previous similar migration results.	Software
ARTIST artefacts	A particular reusable required input by a MDE migration task within the ARTIST migration process (as described in the ARTIST methodology)	Software
Validation environment and certification model	The SbSp (Service based Software provider) certification model will define a structured quality framework for service based modernized applications as well as a certification process and its supporting tools (automatic questionnaires, templates, etc).	Method and software
ARTIST pilots	Real life scenarios that evaluate and showcase ARTIST methodology and tooling support for legacy application migration	Software and case studies

All partners are committed to the exploitation of the project results. Commercial organisations intend to improve their products and services, and to launch new products. The academic organisations look to apply their existing research into new challenges and to further develop them, which will feed into teaching and further research.

Table 27. Partners' exploitation plans

Partner	Exploitation Interests
ATOS	ATOS manages the ICT of many large clients who employ legacy systems. However the maintenance of these is a low profit activity – it is a utility service. The real profit is made when we incorporate new capabilities which actually propel the clients forward. With ARTIST we can modernise the legacy systems, reducing the costs, allowing our consultants to focus on building value for the client.
TECNALIA	Software modernization is a key theme within TECNALIA research. ARTIST results will feed into on-going efforts. In particular, the certification model, assessment and modernization methodologies are of special interest and are expected to be commercialised.
INRIA	ARTIST results will significantly improve MDE techniques, especially wrt the complex problem of reverse engineering. The results will be reused and extended after the end of the project, probably applying them to different domains than reverse engineering.
Fraunhofer	Development particularly of the ARTIST methodology, the MDE approach and the repository reuse concepts and advance Fraunhofer IAO' competences. IAO will utilize its connections to local SMEs to facilitate knowledge transfer of the ARTIST results to the industry. Concepts will be included in courses taught by

Partner	Exploitation Interests
	FHG at the University of Stuttgart. The repository could be used for storing software engineering information complementary to cloud computing which would be very beneficial especially for research into multicore software engineering.
TUWIEN	Several adaptations of the current content of courses provided by BIG at TUWien are planned as well as the provision of new lecture material. The Web Engineering course offered to more than 200 students will be updated with new insights on Cloud computing which is especially an important topic for modern Web application development. The Model Engineering course offered to more than 150 students will be updated with forward engineering techniques as well as model-based testing approaches. Participating in the ARTIST project is highly valuable for other international and national projects which are currently running and planned in the area of model-driven engineering. The modernization aspects fit well with the research line of current projects dealing with the systematic evolution of software system such as the FAME and AMOR projects.
ENG	Public administrations represent the 38,5% of our client base. The application of ARTIST to the 'cloudification' of e-Gov applications is of major interest as this will be a major business line in the coming years. We anticipate provisioning the SPCoop platform as a service (PaaS), and the ARTIST methodology for the Italian public sector.
ICCS	The area of legacy application migration on Clouds will be important to the Institute's effort to promote technology within the Greek industry, which is part of a larger effort to promote Internet and new technologies among business users. We will strengthen our advisory role towards companies that are looking to alter their current legacy systems and transport them on Cloud infrastructures.
SPARX	With ARTIST we will gain the necessary knowledge in the emerging domain of Cloud Computing. This will help us to support our customers with new modelling languages and methodologies to design the transfer from legacy systems into the Cloud. In addition to new modelling approaches and methods, we will provide concrete tools, which support reverse engineering to creating technology independent models of legacy systems, which include their structure and behaviour as a basis for cloud forward engineering. In addition to this we will use the gained knowledge in other domains to better support the reverse engineering and forward generation of code.
ATC	Through the migration, ATC will offer new features of NewsAsset and refine the business models. These innovations will be available to new and existing ATC customers and will assist the company's efforts to expand its customer base, while differentiating from the competition in what is a highly competitive market.
SPIKES	A large part of Spikes' revenue is derived from developing and supporting on premise line-of-business solutions. We expect a transition to SaaS solutions as a consequence of technology push and macro-economic incentives. ARTIST technology will allow us to develop new products and services in a SaaS environment, while integrating with our own as well as other's legacy product-line solutions without prohibitive cost or complexity. This will allow the business to transition a market shift to SaaS and Cloud models. Specifically, we plan to initially target ARTIST methodology and tools to enable two horizontal SaaS offerings, Spikes BrightLine and Spikes UbiSoN, using model extraction and code generation to produce the integration layers between the legacy and the new service functionalities.

B3.2.2 Dissemination of results and technology transfer

A dissemination plan will be drawn up early in the project (M3). It will analyse in detail the mentioned stakeholders, available communication channels and key project events and results around which to base dissemination. It will establish key performance indicators for the dissemination and plan concrete dissemination actions, which will be assigned to partners. The dissemination plan will be the basis for all the dissemination activities and periodically revised according to ARTIST's developments and achievements.

ARTIST has identified the initial stakeholders to communicate the results of the project to. The dissemination is split into dissemination to the scientific community (Cloud, SaaS, Software engineering, researchers), where the **focus is on transferring knowledge and tools** into the scientific domain, so that they can be used in complementary research fields; and dissemination to the commercial community (ISVs, Investors, Technology providers, Users, Consultants, Open source community, etc.), where the **focus is on informing potential clients of the ARTIST capabilities**. We will build interest in the project to complement the exploitation plan, garner feedback from the market and identify potential partners and users.

Scientific dissemination will include an emphasis on conferences, scientific workshops, academic papers and scientific magazines (online and print). The main messages include the approach taken, the results gained, the innovation and processes. The intention is to spread widespread knowledge of the project and to foster feedback on complementary approaches.

Commercial dissemination will focus on typically shorter and more generic communication items (web coverage, flyers, press releases, whitepapers, exhibition stands, magazines and websites focused on software developers, etc.) The key messages revolve around what ARTIST will be able to do, what benefits it will confer, the conditions under which it can be used and how and when users can become involved. **The intention is to prepare the market, identify potential collaborators and users and to gather feedback.**

ARTIST will adhere to the EU's guide to successful communications3 in order to be able to disseminate project results in the best possible way. In order to raise public participation and awareness The ARTIST consortium will launch the following initiatives:

Creation, elaboration and provisioning of dissemination material
In order to reinforce the project brand, a first set of materials will be c and published regarding the project identity. This will include the creation of a project logo, a project factsheet, press release, a slide presentation and templates for the official documents to be developed within the project. On a second step, the consortium will focus on the production of the appropriate marketing material consisting of project's results and benefits, namely leaflets, posters and brochures to be used in the different dissemination and networking events to be attended all through the project.

Traditional dissemination activities
The project team will give special attention to dissemination using various forms and mechanisms that will raise stakeholder's awareness over the ARTIST project. Furthermore,

[3] "Guide to successful communications http://ec.europa.eu/research/science-society/science-communication/index_en.htm, Last accessed 5th of December 2011"

an effective dissemination is the basis for the creation of a critical mass that will assure the engagement of a sufficient number of participants during the evaluation phases of the project.

To this end, the dissemination activities will be affected as follows:

Presentation of the project and its results as they become available at thematic events, workshops and conferences in all the scientific domains and relevant fields of ARTIST; **Participation in related events** organized by the European Commission; Publishing the technical and methodological results of the project in established industrial and academic magazines / journals; **Setting up and maintaining project's web portal**. The portal will operate as a non-stop-shop for those that are interested in getting aware of the proposed solution and it will provide access to internal and external sources. Potentially we are looking at incorporating the preliminary feasibility check tools as a free tool for users, in collaboration with exploitation; **Appropriate feedback to standardization bodies** where this is feasible; **Media relations**, including press campaigns to promote core project's periods like specification's definition and pilot execution by mobilizing the targeting communities, utilization of TV Broadcasting Networks in several countries that ATC is making use of in order to get feedback from potential customers, etc; **Production of Wikipedia** entries and in other online information repositories as appropriate. (Note that Wikipedia as a generalisation no longer permits projects to have their own page, however appropriate contributions to topical pages has previously been a very successful dissemination tactic);

The consortium will focus on **organising a workshop** on the specific scientific areas that ARTIST addresses. The workshop could be a satellite event to one of the most well-known and relevant to the context of ARTIST conferences. ARTIST consortium is envisioning the event as a major final dissemination activity that will address a broader range of stakeholders, including other projects, potential project's technology, users from industry or academia and that will expose project's successful outcome.

Some indicative venues (conferences and journals) that have been identified (by topic) as useful for ARTIST dissemination are the following: (full details given in Annex B).

Software Engineering (or its Model Driven Engineering & Reverse Engineering sub-domains): MoDELS; ECMDA-FA; IEEE Transactions; ACM Transactions; SoSyM; TOOLS; ICMT; EclipseCon; EclipseCon Europe; ICSEASE; CSMR; ICWE; ICSSEA 2012 (24th International Conference on SOFTWARE & SYSTEMS ENGINEERING and their APPLICATIONS)

Cloud, Service-oriented Architectures, SaaS, Internet of Services, Business Models: WWW conference; ICSOC; SericeWave; IEEE; ACM communications, Cloud Expo; ICSOFT; ACM transactions

Certification and Quality Frameworks: SEPG Europe and SEPG – Latin America

The above mentioned publications and events will be revised when the dissemination plan is elaborated (M3).

Social Networks profile management and internet dissemination activities

During this subtask the project team will exploit the power of social networks and available internet tools in order to enable a more active dissemination towards the community. The ultimate goal is to create an ARTIST social community that will be flexible enough to engage

its members during all project's noted periods (definition of requirements and specifications, architectural design, development and evaluation). This is particularly important when considering the Open Source community. A prolonged and interactive communication campaign is necessary, and technical staff from the project will be recruited to actively engage with the identified community according to dissemination and exploitation objectives.

Specifically:

- ARTIST will count with profiles in **professional social networks** such as LinkedIn, Twitter and Facebook. These will be used as direct communication channels with other professionals from relevant fields of action. Regularly updates with the events, news or state of the project will be published in the networks increasing the impact of ARTIST. An initial set of profiles will be created during the first months of the project and will be updated by all the partners on a regular basis. Previous experience has shown LinkedIn as a good way to communicate events and publications, for example.
- ARTIST will identify the most appropriate social network communities that already exist in the framework of migrating Legacy Applications to new IT paradigms, namely the SOA-based environments and Cloud technologies. These communities will be approached in order to attract its members and subsequently enrich the ARTIST community. This activity will **engage in relevant forums and with key bloggers**. Previous experience has shown that guest blogging or involving interested bloggers to act as ambassadors has been a successful approach.

Progress in dissemination will be monitored through the use of **key performance indicators** (KPIs) which will cover all forms of dissemination and in particular emphasize the results gained rather than the quantity produced. Constant monitoring of the KPIs will allow the dissemination manager, project coordinator and exploitation manager to modify the strategy and incorporate feedback into the project.

The dissemination strategy will be designed as a forerunner activity to results commercialisation, regarded as a two-way dynamic and interactive process, which should be continuous and evolving. Dissemination will be effected at both the consortium level and the partners' level.

In order for the dissemination strategy to be effective and provide tangible results, key performance indicators must be the outcome of a well-structured methodology which will be applied early in the project (M3) and will focus on the following :

- Define the objectives of the dissemination actions
- Define what will be disseminated; the dissemination "products"
- Identify the target groups for dissemination
- Establish the appropriate source for the dissemination activities (in terms of roles and responsibilities)
- Raise public awareness about the project achievements through the most suitable means for communicating with the respective target groups

KPIs will cover website statistics, event participation and quantity of publications. Beyond merely registering the quantity of activities, the KPIs will expressly **measure the dissemination value** of actions. For example, the number of "reads" of online materials, the number of queries and comments received, number of citations and back links. **These KPIs will be used to steer dissemination to the most valuable activities.**

The following table describes KPIs initially defined by the ARTIST consortium. Deliverable D4.2 "Dissemination strategy" (M3) will provide an update based on the previous actions mentioned.

Table 28. Dissemination KPIs

Dissemination channels	KPI	Success indicator
Website	Number of unique visitors and no. no. of visits each reporting period Average time on site statistics	According to our experience in previous research projects, an average of 1500 visits per year would be a positive result, with at least 40% of users spending more than 2 minutes on the site
ARTIST Community	ARTIST presence in Social Media Number of existing social media communities relevant to ARTIST identified Flow of communication, number of posts	ARTIST in Facebook, Twitter, LinkedIn At least 10 social communities will be mobilized for ARTIST's activities Continuous information contribution during the project's life cycle
Brochures	Number of leaflets / brochures produced	Preparation and distribution of three (3) different brochures during the project's life cycle
Conference / Journal publications	Number of publications	The ARTIST consortium will aim at releasing at least 7 journal and 20 conference publications
Project presentations	Number of events participated Number of attendees (registered / estimated)	It is foreseen to present ARTIST in at least 3 major events. The average number of targeted attendees per event is estimated at least at 100
Project posters	Number of posters	The ARTIST consortium aims at publishing 1 to 2 posters during the project's life cycle
Press releases	Number of press releases	At least 3 press releases during the project's life cycle
Project showcases	Number of different demonstration videos produced	At least 4 videos during the project's life cycle
Newsletters	Number of newsletters	The ARTIST consortium aims at producing and distributing several different newsletter issues (~4) during the project's life cycle

Specific dissemination plans will be drawn up at the beginning of the project and revised periodically. The above mentioned publications and events will be revised when the plan is elaborated. The table contains individual partners' plans to contribute to project dissemination.

Table 29. Partners' specific dissemination assets and intentions

Partner	Dissemination plan
ATOS	ATOS chairs the **INES technological platform** through which around 400 SMEs, academy and large industry organisations can be reached regularly. ATOS manages the **IT-Tude industrial community** which links research projects to industrial

Partner	Dissemination plan
	players. Furthermore Atos has a wide internal communication network (reaching 80,000 employees and many more clients and collaborators) and much experience in project dissemination.
TECNALIA	Through participation in competitiveness clusters and **OSS communities** such as the Spanish MORFEO[146] community, TECNALIA has strong links to specific stakeholder networks. TECNALIA is also keen to work with several **standardisation bodies:** OMG, promoters of SoaML and CloudML, and ETSI, OCCI or EuroCloud are initially identified. Internal dissemination channels within TECNALIA will also be used. (Yammer, the TECNALIA Express website, internal blogs and the external www.softwarecommunity.eu blog).
INRIA	INRIA is keen on producing **research papers and presentations** at the main **conferences and journals** of both the MDE and Reverse Engineering domains, or Software Engineering in general. INRIA will promote the contribution as **open source** of the developed software components using **Eclipse-MDT MoDisco** as the hosting project.
Fraunhofer	Fraunhofer IAO coordinates the regional **Competence Center Electronic Commerce** (ECC) Stuttgart-Heilbronn within the national e-commerce network NEG, thus having a **direct link to Germany's SMEs**, who generate high demand for secure cloud computing solutions. Fraunhofer IAO will also include ARTIST results in courses at the University of Stuttgart, in **academic papers** and events at Fraunhofer like the **yearly Stuttgart Software Technology Forum**.
TUWIEN	TUWien will disseminate the project results by publishing papers collaboratively with the ARTIST consortium in the following research communities: MDE, reverse engineering, Cloud computing, and Web Engineering. Furthermore, presentations of ARTIST prototypes are planned at conferences dealing with software engineering in general to reach a broader research community and to transfer the project results also to other fields of research. Finally, the ARTIST prototypes will be published and maintained as open source projects for ensuring sustainability of the project results.
ENG	Engineering will contribute with joint papers with other academic and industrial partners. Engineering will also disseminate the project's results at conferences and performing demonstrations at public events (e.g. the Forum of Italian Public Administrations http://portal.forumpa.it/). Moreover Engineering will also exploit its liaisons in the Italian eGov market to present the project's results to key stakeholders and decision makers in Italian Public Administrations
ICCS	ICCS /NTUA has extensive internal and external **communication networks** (internal web site, external webs like the **National Documentation Centre of Greece** (www.ekt.gr), presentations and flyers to according events organized by our institution, like **seminars, workshops and lectures)**. They anticipate generating many **scientific papers**, particularly for the Software Engineering, IEEE Transactions on (www.computer.org/tse/); Services Computing, IEEE Transactions on (www.computer.org/tsc/); and Future Generation Computer Systems, Elsevier Press (www.elsevier.com/locate/future). Finally ICCS/NTUA is eager to join **collaborative activities** between EU funded projects in the scope of dissemination and training.
SPARX	Sparx Systems is a global player in the modeling domain. Over 250.000 users over the world use our modeling tool Enterprise Architect. Top 500 companies in Europe profit from Enterprise Architect and from our trainings and consulting services. We share our experience and new technologies on several Internet forum-platforms like LinkedIn but also in our internal platform with hundreds of registered users. We regularly publish articles in different print medias e.g. Object Spectrum. In addition

Partner	Dissemination plan
	to this we are present on several conferences like OOP, BASTA, Embedded World. ARTIST will help us to extend our portfolio in the area of Cloud Computing. We will use all above named opportunities for sharing our ARTIST experience and new open source tools in order to promote the ARTIST technologies on the one hand and to address new customer groups on the other hand.
ATC	ATC brings the **SME perspective** to the project and will ensure that SMEs get appropriate attention and through the most suitable channels. As dissemination manager, ATC will oversee the **planning, execution, monitoring and reporting** of project dissemination.
SPIKES	Spikes Research is recognized as a leading innovative SME in the Flanders area of Belgium. As a result Spikes is often invited to speak at industry focussed conferences and gatherings targeting a wide variety of businesses. At these events we often promote results from our research projects to demonstrate our vision and roadmaps. We fully expect ARTIST to be featured prominently in those presentations, as it is very core to the business evolution of Spikes, and the European B2B ICT Software and Services market as a whole. We also plan to participate and present on-going results in EC hosted events as well as joint research platform working groups.

B3.2.3 Standardization Activities

Standards in the area of ARTIST need to be monitored in order to identify contributions from project. Such monitoring is done by participating in working groups developing new standards, and contributions are provided by suggesting, commenting or ballots on new work. The project will monitor the relevant standardisation bodies and standardisation projects, European and international, taking part as appropriate. Examples are different WG in OCCI, ETSI and OMG and in particular ETSI TR 102 997 and the OMGs group on Claims/Evidence/Arguments, where project partners are already members and can make contributions. Relevant standards and recommendations will be defined and, if appropriate, these will be proposed, with possible contributions to the standardisation bodies. TECNALIA, SPARX and TUWIEN will be leading these efforts, thanks to the experience acquired as contributors of standards such as service and cloud – related standards like SoaML, PIM4Cloud, fUML- but also as contributors of other Standards.

The next table presents each Key Technology used, provided and addressed within ARTIST, each tangible outcome stemming from them, an initial list of potential standards that will be considered or used and finally, to which standards and how the ARTIST consortium will contribute to. The planned contributions are still at a very high level but they do reflect the main shortcomings of each of the identified standards under the scope of ARTIST and where partners have expertise.

Key Technology	Tangible Outcome	Standards to be considered and used	Contribution to Standards - How?
Modernization Assessment Tools (WP5)	Framework analyzing transformation feasibility and providing generalized metrics and indicators	Based on Software Process Improvement methods (PDCA, IDEAL)	

Key Technology	Tangible Outcome	Standards to be considered and used	Contribution to Standards - How?
Migration Process (WP6)	Migration methodology, tool and templates (based on Eclipse Process Framework)	SPEM2.0	
Performance Stereotypes / Classification Mechanisms (WP7)	Generic classification methods mapping any application to performance stereotypes	SPEC, PMML	
Categorization and Metamodelling of Cloud environments (WP7)	Generalized metamodels and initial concretization for cloud providers and toolkits	SPEC, PIM4Cloud	PIM4Cloud 1) mapping to existing platforms and languages for services specs and execs 2) Inclusion of PaaS metamodels To be considered and analysed: OCCI 1) GFD.184 – OCCI Infrastructure (v1.1)
Reverse Engineering Tools (WP8)	Tools generating reusable models from the legacy code	KDM, ASTM, SMM, UML2, SoaML	
Forward Engineering Tools (WP9)	Tools generating service-based application description and geometry	QVT MOFM2T ATL, SoaML, fUML, EMF	SoaML Extensions on • Security issues • Multitenancy • QoS At PIM Level, creating metamodels or modelling stereotypes to cover them. **MEF**: contributing the ideas of EMF profiles. **fUML**: defining the operational semantics of further UML diagrams like state machines
Deployment Optimization	Mechanisms providing deployment patterns for	UML2, MARTE	

Key Technology	Tangible Outcome	Standards to be considered and used	Contribution to Standards - How?
(WP9)	improved performance		
Artefacts repository (WP10)	Repository of artefacts, indexing and discovery functionalities	Reusable Asset Specification (RAS), RDF/S	
Validation and Testing Tools (WP11)	Model-based tools for performing analysis and visualization of test outcomes	ITIL, EuroCloud StarAudit, UML testing profile (UTP)	

ARTIST partners will send the major contribution, known as RFP, to the identified standardization bodies, mainly OMG, on Milestone M6 (Month 30), after the final versions of the whole solution have been released and are stable. However, periodical contacts will be made to the different standardization bodies in order to align common interests and to cause the major possible impact. The recurring contacts as well as the request for contribution will be sent to the OMG through Sparx.

B3.2.4 Management of knowledge and intellectual property

All the partners are familiar with open source licenses and open document licenses, including the benefits and caveats of an open approach. The consortium is in favour of open innovation models and committed to sharing results where appropriate.

The project consortium will manage IPR according to the consortium agreement to be signed in the negotiation phase. This will cover the issue such as use of foreground and background to ensure fair and open access to results and required components during the project and for exploitation.

The licenses of documents will be decided according to the deliverable or document content and purpose. **By default an open access is preferred** as this allows maximum use of the content, for example the **creative commons** set of licenses are widely used and suitable. Where IPR needs to be protected, or for security or commercial confidentiality it is necessary to withhold information for the public, this will be managed with confidential deliverables, and where specific conferences require ownership of copyright, this will be managed on a case by case basis.

In order to protect IPR from accidental exposure, here will be a **publications policy** stated in the consortium agreement which will give partners a time window in which to object to publications. In order to expedite the publication of news and information, publications containing previously published material, those related to open source components and those containing information already in the public domain will be exempt from the approvals process.

As stated above, the consortium is familiar with and **supports the open source licensing of software** where appropriate. The consortium is likewise committed to exploitation and aware

that for this to be viable, the licensing schemas must support the exploitation model. Consequently the project will endeavour to publish software as open source except where for business requirements tighter controls on IPR are needed. This may be for security, privacy or competitiveness reasons. The exploitation model for the project will be developed early so that pending licensing decisions do not hold back technical development. As the licenses of background and third party software can have implications on the licensing options and use of the foreground, **all pre-existing software used in the project will be carefully registered** and potential conflicts and limitations identified and resolved prior to integration. Finally, in order to maximize the exploitation of the project a dual licensing schema may be adopted, for example permitting research use of certain components whilst prohibiting commercial use during a certain period of time, thus protecting commercial exploitation without inhibiting research.

All IPR rules will be detailed in the consortium agreement and described in the management deliverables.

B4. GENDER ASPECTS

The EU has established objectives about the relationship between women and research:

- Research by women
- Research for women
- Research about women (not relevant to ARTIST)

ARTIST addresses these as follows and this is further detailed thereafter:

- Research for women: Concerning the social impact of the project in gender issues, the ARTIST methods promote the equal opportunity policy at the company level (all companies can join and use the solutions, provided that they are regularly established and correctly operating). In this sense sex is absolutely not relevant, since it ensures large visibility to all the subjects that qualify themselves in terms of good offer, flexibility, reputation and so on.
- Research by women: Concerning the gender in research (women within the research team of this project), the ICT field is traditionally woman-intensive, as it requires intellectual rather than physical attitude however there is a well-known ‘gender-gap’ in the IT field. Indeed a rough analysis of the gender divide in the ARTIST consortium members and employees confirms this issue. However, the project itself is gender neutral since there is nothing specific which either promotes or denies inclusion. However, ARTIST intends to recognize and not deny these situations by taking affirmative action to promote the recognition of any gender inequalities found and take the following affirmative primary actions as identified below. Moreover, in the case of ARTIST, the Project Coordinator, the Assistant to the Project Coordinator, and the Scientific Coordinator will be women. Additionally, at least one Work Package leader (WP4) will be a woman.
- Management: The Management allocate a specific monitoring which will include the monitoring of any gender/ethical issues
- Over-viewing project results to assess and resolve discriminatory aspects:
  - Escalating to the Project Management Board where necessary to identify potential gender issues for redress by management.
  - Providing a short ‘equal opportunities policy section’ to the project procedures and Consortium agreement for implementation by the entire partnership.

- Impact: The Discussion, Dissemination and Exploitation work package will endeavour to assess and take specific actions within these subtasks to promote the project across the gender divide.

It is anticipated that with these activities in mind this will help the project and not detract from European and the partners aim to encourage women's participation and in technical fields.

Partners will perform reasonable effort to integrate female participants in this project, and prefer females with comparable skills to ensure sure a good but competent mix. Unfortunately, even though commercial and R&D companies are largely male, the relevant partners have committed to take specific effort to include female ICT staff where possible.

ANNEX A PREVIOUS AND ON-GOING EUROPEAN RESEARCH PROJECTS

Project	Relevant Results	Relation to, and difference with ARTIST	Partners
COIN [147] (FP7-IST- 216256)	The mission of the COIN IP is to study, design, develop and prototype an open, self-adaptive, generic ICT integrated solution. Among other issues, COIN explores and studies the development of new Business Models for SaaS, like the SaaS-Utility concept.	Regarding SaaS Business Ecosystem, COIN (Collaboration and Interoperability for Networked Enterprises) project, explores and studies the development of new business models for SaaS. Based on these results, activities to be done in the ARTIST project will **contribute to research in the evolving development of SaaS business models**, like the SaaS-Utility concept.	TECNALIA, ATOS
MOMO148CS (FP6-IST-034466)	MOMOCS provides a methodology and related tools for fast reengineering of complex systems and study how a complex system can be modernised focusing on the software. MOMOCS propose a holistic modernization process for complex software systems called XIRUP (eXtreme end-User dRiven Process). Additionally, MOMOCS offers a complete tools suite supporting for Forward Engineering modernisation of complex systems.	MOMOCS focus on FE M2M techniques supporting the modernisation of complex systems, addressing the XIRUP methodology. MOMOCS does not offer tooling support for the preliminary evaluation (assessment) and understanding, using reverse engineering techniques**. MOMOCS does not provide any particular support for migration to SOA and Cloud paradigms**. MOMOCS offers generic user-assisting modelling and M2M transformation facilities for Forward engineering and a repository for XIRUP artefacts produced and consumed within the XIRUP process, featured with semantic searching.	ATOS
IRMOS (FP7-IST-)	The goal of IRMOS was to design and implement a PaaS/IaaS solution for enabling soft real time applications to be executed on virtualized service oriented infrastructures with performance guarantees.	The relevant to ARTIST part of IRMOS is the modelling of the applications by the developer, through the usage of an Eclipse/Papyrus extension and UML, in order to describe them towards the platform of execution. Furthermore, optimization approaches were followed in order to identify the resources that these applications needed when executed on cloud platforms. However the project did not go as far as **investigating potentially multiple versions of the same software, adjustable to specific usage or deployment solutions**. Furthermore, it did not take modelling aspects of IaaS	ICCS

Project	Relevant Results	Relation to, and difference with ARTIST	Partners
		providers under consideration and just provided storage, network and CPU resources in the standard way of modern Clouds.	
OPTIMIS (FP7-IST-257115)	The main goal of the OPTIMIS Programming Model (PM) is providing a methodology to define and implement a service for achieving an optimal deployment and execution in the Cloud Infrastructure.	With relation to ARTIST, OPTIMIS PM is mainly intended for newly developed applications and not for transformation of legacy systems existing code. Furthermore, **only Java is supported** in this process. However the parallelization features of the PM are interesting and may also be considered for usage inside ARTIST.	ATOS, ICCS
VISION Cloud (FP7-IST-)	VISION Cloud aims at combining all types of metadata and information characterizing different parts / "elements" of the system (data objects, resources, services, requirements) into a Unified Model, which will allow for optimum decision making, data movement, as well as resource and service management, also leading to enhanced Quality of Service.	With relation to ARTIST, the VISION unified model can be a starting point for the richness of information that is needed from a modelling point of view. However, in VISION this model is not extended in order to cover IaaS providers abilities with regard to specific performance aspects. Furthermore, it is not **used during runtime as part of an intelligent mechanism** that may correlate the infrastructure models with the usage and the application models, like it is envisioned to be performed in ARTIST.	ICCS
SERENITY (FP6-IST-027587)	The primary goal of SERENITY IP proposal is to enhance security and dependability for Ambient Intelligence (AmI) ecosystems by capturing security expertise and making it available for automated processing. Technically, SERENITY is based on (i) the enhanced notions of S&D Patterns and Integration Schemes, and (ii) the support for run-time pro-active and reactive monitoring of requirements. SERENITY focuses on five key areas to provide security and dependability mechanisms: (i) Organization & Business, (ii) Workflow & Services, and (iii) Network & Devices	The ARTIST security preserving transformations may be informed by SERENITY S&D Patterns. Moreover **Organisational & Business S&D Patterns** will be used as basis for the assessment of the impact of the modernization on the organisation.	ENG, ATOS

Project	Relevant Results	Relation to, and difference with ARTIST	Partners
	levels, (iv) provision of integrated solutions for these mechanisms and (v) support for run-time monitoring.		
MASTER (FP7-IST-216917)	MASTER aims at providing methodologies and infrastructure that facilitate the monitoring, enforcement, and audit of quantifiable indicators on the security of business processes, and that provide manageable assurance of the security levels, trust levels and regulatory compliance of highly dynamic service-oriented architecture in centralised, distributed (multi-domain), and outsourcing contexts. To this extents MASTER identifies new innovation components in terms of key assurance indicators, key security indicators, protection and regulatory models and security model transformation coupled with the methodological and verification tools for the analysis and assessment of business processes.	The MASTER concepts of Key **Assurance Indicator** and Key Security Indicators may inform the ARTIST migration assessment. Moreover the MASTER's analysis and assessment of the business processes may inform the ARTIST legacy product analysis exploiting execution traces.	ATOS, ENG
ASSERT4SOA (FP7 IST-257351)	ASSERT4SOA will fill this gap by producing novel techniques and tools – fully integrated within the SOA lifecycle – for expressing, assessing and certifying security properties for complex service-oriented applications, composed of distributed software services that may dynamically be selected, assembled and replaced, and running within complex and continuously evolving software ecosystems. ASSERT4SOA has 3 main objectives: 1) to develop methods and tools to support certification of SOA based software by providing abstract models	The ASSERT4SOA abstract models may inform the **meta-modelling and characterisation of IaaS and PaaS.** Moreover the ASSERT4SOA Security Ontology may inform the requirements and architecture of the ARTIST repository.	ENG

Project	Relevant Results	Relation to, and difference with ARTIST	Partners
	for these systems that capture their peculiarities and the security properties they satisfy ; 2) to develop schemes for expressing certification claims in the SOA lifecycle and mechanisms for handling them; 3) to provide mechanisms and tools enabling to reason about ASSERTs (Advanced Security Service cERTificates) in order to assess the trustworthiness of service based systems at runtime.		

ANNEX B IDENTIFIED DISSEMINATION CONFERENCES

Details of the conferences mentioned in Section 3.2.2.

a. Software Engineering (or its Model Driven Engineering & Reverse Engineering sub-domains)

MoDELS - International Conference on Model Driven Engineering Languages and Systems
ECMDA-FA – European Conference on Model Driven Architecture – Foundations and Applications
IEEE Transactions on Software Engineering
ACM Transactions on Software Engineering and Methodology
SoSyM - Springer Journal on Software and Systems Modelling
TOOLS - International Conference on Objects, Models, Components and Patterns
ICMT - International Conference on Model Transformation
EclipseCon (Main annual Eclipse conference)
EclipseCon Europe (formerly named Eclipse Summit Europe)
ICSE – International Conference on Software Engineering
ASE – International Conference on Automated Software Engineering
CSMR – International Conference on Software Maintenance and Reverse Engineering
ICWE – International Conference on Web Engineering
Elsevier Journal of Systems and Software
Elsevier Information and Software Technology

b. Cloud, Service-oriented Architectures, SaaS, Internet of Services, Business Models

World Wide Web Conference
International Conference on Service Oriented Computing (ICSOC)
ServiceWave
IEEE Internet Computing
Communications of the ACM
ACM International Conference on Computing Frontiers
Cloud Expo computing
ICSOFT (International Conference on software paradigm trends)
ACM Transactions on Internet Technology
ACM Transactions on Information Systems

c. Certification and Quality Frameworks

SEPG - Europe – Software and Systems Process Management (series of conferences)
SEPG - Latin America– Software and Systems Process Management (series of conferences)

ANNEX C INDUSTRIAL USE CASES

1 ATOS USE CASE: DEWS IN THE CLOUD

1.1. Business context of company

Atos is an International Information Technology Services company that serving a global client base, it delivers hi-tech transactional services, consulting and technology services, systems integration and managed services. Atos focuses on business technology that powers progress and helps organizations to create their firm of the future. Atos Research & Innovation (ARI) is the research, development and innovation hub of ATOS (www.atosresearch.eu).

DEWS was originated from an European project (www.dews-online.org) that finalized on June 2010 and it is one of the main innovative assets of ARI. The solution was recently installed at the Badan Meteorologi, Klimatologi dan Geofisika (BMKG), the Indonesian tsunami early warning centre in Jakarta to be used as an additional system for early detection of tsunamis in the Indian Ocean area. DEWS is a clear example that the technology transfer is feasible from an R&D project to a real deployment scenario. Besides DEWS represents the compromise of ATOS in contributing with innovative technology for society wellness and safety. The migration of DEWS will empower the current solution by providing a more flexible way of deployment for ATOS and of use for the users (operators in tsunamis centres). The use case development in the project will also show an example of ARTIST application to be replicated in other legacy systems existing in the company.

Currently the number of users utilizing the DEWS console is limited due to the fact that only a proof of concept has been implemented in Indonesian National Centre.

1.2. Functional description of legacy application

DEWS stands for Distant Early Warning System. It is a generic system that can be applied in a varied range of geographical locations (in situ or remotely) and to different types of risks (earthquakes, tsunamis, forest fires, floods, etc.). In particular, DEWS project focused on tsunamis.

DEWS is based on service-oriented architecture (SOA). The system receives relevant information from distributed multi-sensor networks, processes it and supports operators (using a graphical console, the Command and Control User Interface, CCUI) in order to decide whether an early warning must be issued. In the event of an early warning, the system is able to integrate relevant information packages on the fly, and distribute them to a multiplicity of actors dealing with crisis management and emergency activities.

The CCUI console, an Eclipse RCP application developed with SWT/JFace, is the point of access to the system for the operator. The CCUI offers different perspectives that meaningfully show and encapsulate all functionality associated with the comprehensive tasks fulfilled by the operator on duty.

The perspectives (Eclipse perspectives/views) of the CCUI are:

- Administration Perspective: it enables the management of the users of the system and information logistics (persons, institutions, preferred language for messages, preferred dissemination channels, etc.).
- Monitoring Perspective: it enables operators to monitor running events

- Forecasting Perspective: it enables operators to combine actual current data with the results of previously obtained simulations.
- Message Composition Perspective: it enables operators to prepare and send warning messages.
- Dissemination Perspective: it enables operators to observe and monitor all messages delivered to the specific user groups

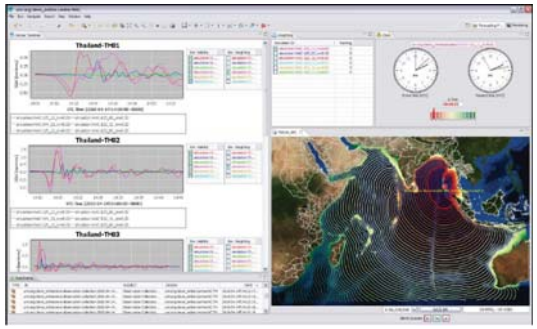


Figure 14. CCUI Eclipse RCP screenshot

The DEWS operational environment scenario in the Indian Ocean region for the demonstration and utilisation of the distant early warning functionality consists of four warning systems. Three of them are operating on the national level and one on the international level. All systems might have their own individual and independent sensor system platform. DEWS Wide Area Centre is able to connect to different DEWS National Centres in order to send and receive information to and from them. DEWS have three DEWS National Centres (NC's), in Indonesia, Sri Lanka and Thailand and one DEWS Wide Area Centre (WAC) running in Indonesia.

Figure 15. Indian ocean DEWS scenario

1.3. Motivation for the use case

DEWS CCUI is an Eclipse RCP (http://www.eclipse.org/home/categories/rcp.php) developed in Java using the Eclipse Standard Widget Toolkit, SWT (http://eclipse.org/swt/) and the UI toolkit JFace (http://wiki.eclipse.org/index.php/JFace). Additionally, CCUI requires local binary geo-spatial information and persistence storage for user profiles, currently in Postgresql. As another desktop Eclipse application, DEWS CCUI requires a local desktop installation, attending to release specific installation requirements and instructions that need to be fulfilled. That implies that the number of possible CCUI installations and DEWS operators are limited by the available hardware infrastructure and the installation help desk support. Besides, evolutionary maintenance is complex and costly, since new releases of CCUI should be installed in all existing instances in order to ensure a homogenous operation among coordinated DEWS National Centres. Moreover, current computational workload in the CCUI must be assumed by the workstation hardware where the CCUI console is installed. Other limitations of the current DEWS architecture with regards to the CCUI console is the impossibility of running CCUI in devices other than dedicated workstations, limiting the mobile access of operators outside the DEWS National Centre premises.

1.4. Expected impact

Current DEWS CCUI restrictions described above can be alleviated by migrating the CCUI legacy system to a Cloud environment, where CCUI is hosted as a Webtop RIA application, accessible through standard compatible Web browsers. In this way, multiple CCUI instances are accessible by DEWS operators. Even multi-tenancy is supported for the different DEWS National Centres. DEWS operators always get access to the latest CCUI release, whereby maintenance is simplified dramatically. CCUI compatible devices are enlarged by far, since most of browse compatible devices with suitable displays are compatible. Even though, for devices with not compatible devices (i.e. devices with lower screen capabilities) specific CCUI views can be provided by adaptation. Hardware restrictions imposed to the legacy CCUI workstations are also alleviated, since the computational work load can be managed by the Cloud IaaS infrastructure, thanks to Cloud elasticity capability.

ARTIST use case is planning to explore the feasibility and cost-effectiveness and accomplish the migration of part of the DEWS CCUI console to the Cloud, including required binary geo-spatial information and data schemas migration. In particular, we explore the technical migration of Eclipse RCP SWT/JFace widgets into Google Web Toolkit (GWT) widgets which can be automatically compile as AJAX Web applications and deployed within the selected Cloud PaaS offering.

The main expected business impact of this migration is that a Cloud-based DEWS CCUI will simplify the technical restrictions and cost for the adoption of DEWS on different National Centres, even including the number of DEWS CCUI installations and operators. Moreover, CCUI consoles will be accessible by mobile devices, including laptops, tablets and other handheld devices. This has a huge potential impact to embrace a higher number of potential risk management participants.

Technically, this use case will allow assessing the feasibility and benefits of MDE base migration approaches in other similar (in technology and complexity) migration projects.

1.5. Expected results from ARTIST

The migration of DEWS CCUI to the Cloud requires of ARTIST tools support for different phases of the migration, including methodologies and tools for preliminary assessment,

methodological roadmap, RE model extraction and understanding techniques for Eclipse Java SWT/JFace, Cloud target modeling specification, FF model transformation techniques (from Java SWT/JFace to Java GWT) and data schemas, FF code generation techniques (for GWT code), FF deployment techniques (for PaaS offerings), testing techniques, repository of reusable artifacts, etc.

2 ENGINEERING USE CASE: E-GOV SCENARIO

2.1 Business context of company

The e-Gov scenario proposed by ENG aims to assess how the ARTIST framework can ease the re-engineering of J2EE eGov applications to be ported to cloud computing environment. Sample eGov applications include:

- Land register
- Federated taxation management
- Drug reimbursements management
- Public administrations register
- Work marketplace
- Car tax
- Fuel price monitor
- Statistical services support

The Public System for Cooperation (SPCoop) lets its users to have a unified view (independent from the provisioning channel) of all services of public administrations both central and local. It defines a shared model for on-line interaction that saves the specificity of service provider and, at the same time, assures uniform interaction and identification of both service provider and service consumer (more in general of all actors participating in a interaction).

The variety of architectural solutions for cooperation of (software) applications already deployed at the national level required to define a unified infrastructure aimed to preserve both the autonomy in decision making of public administrations and interoperability among systems providing integrated services to users. In fact, the interoperability between public administrations cannot rely on homogenous and shared standards requiring to identify in advance the services and data that each administration may decide to put on-line.

Since the interchange of data and services between administrations takes place between peers,. the objective of SPCoop is to allow the integration of processes and data from different public administrations. In order to achieve such an objective SPCoop defines both how data can be identified and accessed by software services.

SPCoop defines the technological infrastructure for the interface used by the different systems/organisations to publish and the exchange their data and services. The SPCoop infrastructure (whose main technological pillars are the Domain Gateways and the e-Gov Envelope) allows to set up an actual backbone for the interchange of data and services between the different public administrations. The SPCoop approach guarantees the minimal economical and organisational impact on the technological choices already made by the different public entities.

The Services for Interoperability, Cooperation and Access Control (SICA) are shared infrastructural resources, made available by the SPCoop framework, that are strategic to enable the smooth coordination and collaboration between the different public administrations interacting in a complex and dynamic environment. Coordination and collaboration represent,

in turn, the pre-condition enabling the effective implementation of the e-Governement within the (Italian) country.

2.2 Functional description of legacy application

The J2EE being considered operate in the context of the Public System for Connectivity (SPC) infrastructure.

The SPC infrastructure has a three layer architecture:

1. Connectivity infrastructure providing both wired and wireless data transport services, Voice-over—IP (VoIP) and security with guaranteed quality of services (QoS).
2. Services:
   - Interoperability services;
   - Collaboration and support services (e.g. electronic mail and PEC, housing and hosting, web sites management)
   - Services for cooperation between software applications (i.e. SPCoop services): enabling the development and operation of cooperating software applications
3. Cooperating software applications providing to users (both citizens and enterprises) the result of cross administration eGov processes

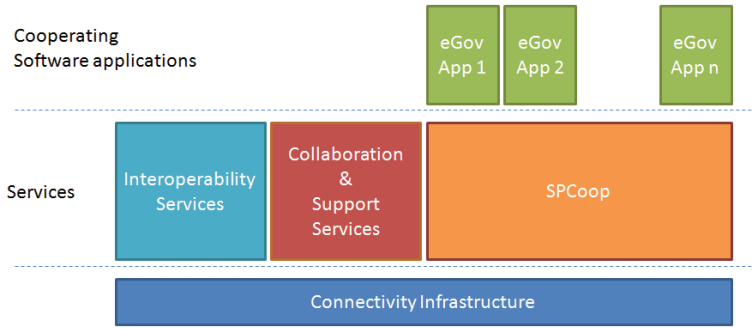


Figure 16. SPC Layers

Domain Gateway and e-Gov Envelope

All software services (provided by a Domain or by a Cooperation Domain via its coordinator) are published by means of a Domain Gateway (PDD - Porta di Dominio). Actually it is a platform that makes available the interfaces of the software services. It is not mandatory that all software components implementing a software service are hosted within the same PDD, as a matter of fact very often it conveniently acts as a proxy and dispatcher towards other back-end platforms hosting the implementation of services.

The software protocol enabling the remote call of software services is an extension of the SOAP standard aimed to assure end-to-end security, reliability of transmission and traceability of all communications. E-Gov Envelop is the name given to the extension of SOAP designed for the purposes of SPCoop. It mandates the use of a tailored header, processed by the Domain Gateways, able to carry all information required to provide the above properties (i.e. security, reliability and traceability) transparently to the software applications making use of the gateways. The following picture sketches the provisioning and use of software services via the Domain Gateways.

Services for Interoperability, Cooperation and Access Control (SICA)

The cooperation model fostered by SPCoop is centred around the concept of Service Agreement. The objective of the Services for the Interoperability, Cooperation and Access Control (SICA) is to enable the management of all the aspects of a Service Agreement by providing all the functionalities required for this purpose.

SICA is an aggregation of software components comprising:

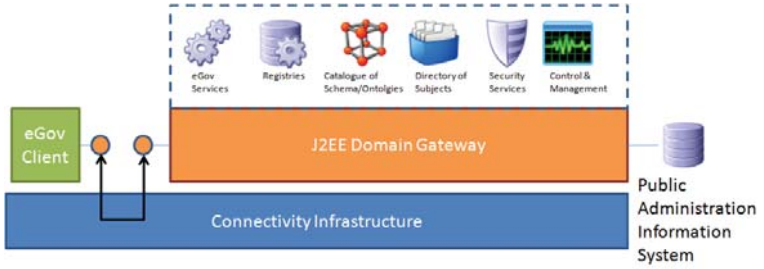
- SICA Registries for the publishing, retrieval, update and removal of Service Agreements;
- SICA catalogue of Schemas and Ontologies for reasoning about the semantic of the services and the information they produce/consume. It is used for the selection of the candidate services best fitting required service levels.
- Directory of Subjects service for the management of the index book of all the operators and users of the Public Administration.
- SICA Security Services (e.g. XML Firewall)
- Control and Management Services to monitor fulfilment of Service Agreement (Control) and counteract in case of violation of Service Agreement (Management).

Current deployment platform

Both SPCoop and eGov applications are implemented in the Java language and are compliant with the J2EE specifications. Most of the implementations are based on the following open source products:

- JBoss Application Server http://www.jboss.com
- Axis Web Services Engine http://ws.apache.org/axis
- jUDDI - UDDI Web Service Directory http://ws.apache.org/juddi
- Log4j - Logging Service http://logging/apache.org/log4j/docs
- WSS4J – WS-Security Implementation http://ws.apache.org/wss4j
- PostgreSQL Database Management System http://www.postgresql.org

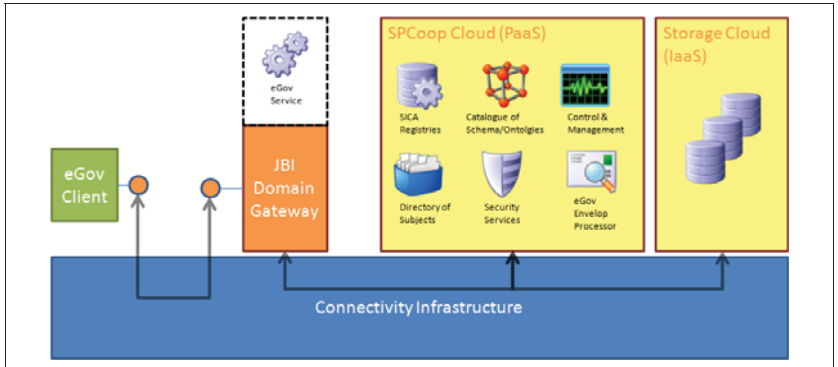
Figure 17. Current (J2EE) SPCoop application



2.3 Expected impact

The main motivation for the transitioning to cloud computing environment reside on the possibility to benefit from economies of scale.

The rationale behind the adoption of the cloud computing paradigm the possibility to offer the services common to all eGov applications as a platform for the development of new applications as sketched in the following picture:



Envisaged (cloud) architecture for SPCoop apllications

Figure 18. Envisaged architecture for SPC Applications

2.4 Expected results from ARTIST

The proposed eGov scenario expects to benefit of tools and methods reducing costs and risks of the migration.

3 ATC USE CASE: NEWSASSET

3.1 Business context of company

Founded in 1987, ATC (www.atc.gr) is an Information Technology Company offering solutions and services targeting specific sectors incl. the Media, Banking and Retail Sectors, Utilities and Public Sector Organisations as well as horizontal solutions focusing on Content Management, Web Applications, Human Capital Resource Management and eLearning, and Mobile Applications. The activities of the Company span among several countries in EU, Eastern Europe and CIS countries, as well as the Balkans.

ATC provides the Media Sector with consulting and media – specific solutions as an active and leading supplier of newsroom, editorial and archive specific editorial solutions with a particular emphasis on News and Press Agencies and Publishing organisations. ATC's customers include major newspapers in Greece, Cyprus and Romania and the National News Agencies in Greece, Portugal, Poland, Russia as well as the Western Balkans. The initial engine of the Suite was developed in a Greek State R&D Project (in 1996), whereas new collaboration enabling versions with strong search capabilities are currently being researched in EU Projects.

3.2 Functional description of legacy application

The legacy application that we propose to migrate through ARTIST is called NEWSASSET and is being marketed by ATC with success both inside and outside Greece with the major clients being the National News Agencies of Greece, Portugal, Poland and Russia.

NEWSASSET is an innovative suite of media asset management solutions for News Agencies, Broadcasters and Publishers. It is available in three editions **Publishing**, **Agency** and **Broadcast,** each one of them providing specialized modules /functionalities targeted to the different media sectors.

In ARTIST we foresee the migration of either one or both the Publishing and Agency edition.

- **Publishing Edition**
  NEWSASSET Publishing Edition is an integrated and secure Editorial & Archiving System for news content management (texts, images, graphics, video, audio) which completely automates the workflow of newspapers and magazines; starting from editorial planning & content gathering and leading to archiving, final layout & cross publishing to multiple channels. The design of **NEWSASSET** ensures modularity and parameterization, allowing the easy and fast adjustment to meet the requirements and needs of all News Organizations regardless of size and capacity, from big publishing houses to smaller newspapers and magazines.

- **Agency Edition**
  NEWSASSET Agency Edition is a modular, configurable, all-in-one multimedia solution for News Agencies. It has been built to meet the needs of an evolving News Agency to help plan, create, manage and distribute breaking news quickly and efficiently to a wide array of customers through multiple delivery channels. It delivers the core functionality required for event management & editorial planning, content creation & aggregation, production monitoring, archiving, and distribution/ publishing through multiple channels.

- **General Functionalities**

  - **News Wires Management**: reception of unlimited number of news wires in various formats, automatic sorting & archiving, providing immediate access to all (authorized) users of the system in real time.
  - Advanced built-in **RTF text Editor** used for the creation and/or editing of text news items. Both RTF και Plain Text formats are supported.
  - **Spell checking** available in multiple languages (text and basic metadata fields).
  - Integration with **MS Word** or **OpenOffice**.
  - **Archiving**: **NEWSASSET** is a robust asset management system safely storing and managing infinite amount of text, image, graphic, audio, video files and multimedia stories.
  - **Identification & Categorization** of all supported news items with multiple identifiers, unlimited keywords, IPTC metadata etc.
  - **Searching:** powerful searching mechanisms for supporting advanced search queries with multiple parameters such as date, subject, keyword, author, provider etc, including full text search and a flexible & smart query builder.
  - **Multi-lingual** user interface: already supports Greek, English, Russian, Polish, Portuguese and Arabic. Easily expandable to other languages.
  - Functionalities for organizing work and research (additionally) in customizable **filters supporting also user-defined notifications (alerts)**.
  - Archive of **deleted documents**: Storing of deleted text items with retrieval and content copying capabilities (for the administrator) which could be used in case of accidental erasure of text items.
  - **Sending**: dynamic sending or exporting of assets by Web, Satellite, FTP, Email, Web Services, etc
  - **Thesaurus**: Build-in keyword based thesaurus based on the **ISO-2788 prototype**
  - **Statistics**: per role/ user/ department for Document Hold Period, Created Documents, Stored (Dispatched) Documents and Document Traffic etc

3.3 Motivation for the use case

Migration to Cloud based technologies is a natural evolution of NEWSASSET for the following main reasons:

1. As an application it is very much connected to potentially huge quantities of data (current and archived multimedia news content that would be extremely valuable to news agencies if they could keep accessible without exploding their storage costs)
2. It is critical to have very quick, stable and guaranteed response to sudden events which may peak the user demand (during crisis situations like natural disasters the availability of news content from major providers should not be affected by huge internet traffic, or local extreme conditions)
3. Such an application can benefit greatly from the potential to access seamlessly huge amounts of relevant data that could potentially be distributed widely around the globe (e.g. for being able to cluster similar news content originating from other sources)

3.4 Expected impact

A cloud-based version of NEWSASSET would be extremely valuable to ATC both for technical and business reasons:

1. Client installations will be much easier and faster to deploy which would make it possible even to prepare demo installations that would attract customer interest in a much more effective way
2. Installations will be easily scalable with changing customer needs (e.g. more or less content, faster or slower access to the content, etc)
3. Smaller (less costly) installations will be made possible by offering NEWSASSET 'as a service' to customers that cannot invest great funds for migrating to a new system. Note that in the current economic crisis period this involves the majority of the media organisations.

3.5 Expected results from ARTIST

For us whatever tools and methods are offered to help in the migration process will be extremely valuable. The current application is structured in a very modular way which could make migration possible in a more automated way. But some discussion needs to take place to be able to envision together the necessary process.

4 SPIKES USE CASE: LINE OF BUSINESS (LOB)

4.1 Business context of company

Spikes

Spikes is a System Integration and Software Solutions SME (>40 FTE) located in Antwerp, Belgium. Since its foundation in 2002, Spikes has focused on translating leading edge advances in ICT into business benefits for its customers. Spikes customers are typically large, well known brands in the Financial Services, Retail, Logistics, HR, Utilities and Security domains as well as the public sector. Spikes software solutions specializes in middle-office solutions, and has a strong market presence in decision support, workflow, document management and collaboration solutions. Spikes services concentrate of large scale integration and SOA solutions.

Spikes Research

Spikes Research is a division of Spikes dedicated to strategic, non-incremental innovation for the company. The research divisions targets technological gaps in topics that are in a pre-competitive stage of invention/development, or where market solutions are significantly qualitatively underperforming. We are recognized by IWT as one of the most successful research SME's in Flanders and selected to deliver experience reports at (International) events on research organization in SME's. Since it was officially launched in 2008, Spikes Research has participated in 3 European projects, ITEI and GUARANTEE, both ITEA2 (Eureka) projects, and eBest directly under FP7. Spikes Research team members have been active in many European projects for previous employers, and have experience in the European Research arena since FP4. We are fully in compliance with the Unique Registration Facility (PIC: 992598091, LEAR: Peter Stuer) and comfortable with the use of EPSS for proposals.

In our own country Spikes Research, even though relatively young, is recognized as one of the most active research intensive SME's in ICT and has been invited and recommended by the local Public Authority to present on innovation in SME's at hosted events.

4.2 Functional description of legacy application

For this ARTIST use case we will not focus will on the use of the same ARTIST toolset and methodology to aid in SaaS extensions/partial modernizations to legacy software assets. We will use the Spikes UbiSon SaaS offering as a test case for the project.

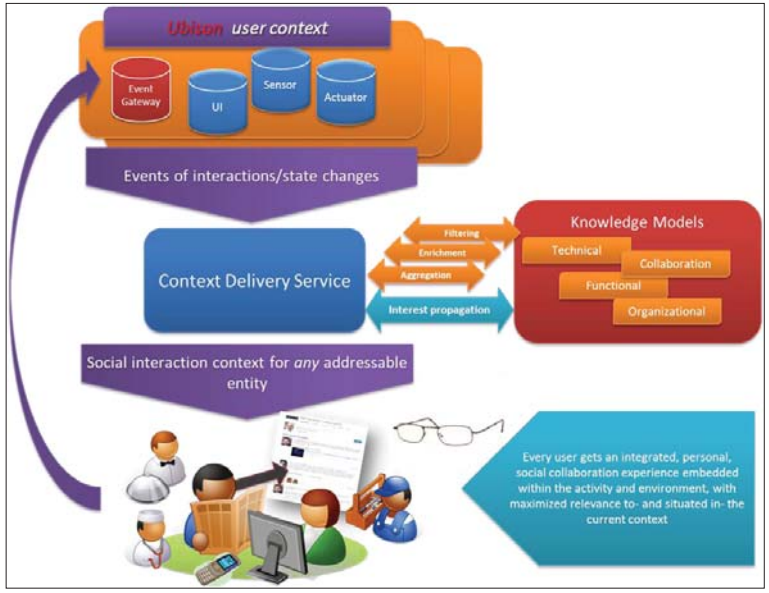


Figure 19. Spikes UbiSoN service overview

Spikes UbiSoN, short for Ubiquitous Social Network, is a social collaboration enablement facility targeting environments that have a rich real time context. This context can be both a digital context, including data and activities occurring in existing applications, or a physical environment such as the one found in the Internet of Things. UbiSoN is aimed primarily at closed user groups, such as an enterprise environment, in which identity exists beyond the explicit interactions inside the social platform. It is conceived as an open extension and augmentation to a pre-existing environment, rather than a host platform onto which "apps" have to be (re-)build. UbiSoN itself is offered through a SaaS platform, but does not require that the environment into which it is an extension is itself a SaaS or "Cloud" environment. Examples of applications are enterprise systems, where it supports a social collaboration fabric of knowledge workers across multiple Line of Business (LoB) applications, Sensor rich Smart Home environments in wellness/healthcare where it supports a social fabric for home care (in tandem with Spikes BrightLine, a smart social messaging solution). Spikes UbiSoN clients include PC as well as mobile (Android, WP7, IoS) platform support. UbiSoN can be used as a complete social layer solution or can be positioned as an intelligent activity stream generator for 3rd party social networking platforms. The UbiSoN service will have a limited roll-out in Q2-Q3/2012, with full commercial release in Q4/2012

As noted before, UbiSon assumes its users are already active in a rich application environment. If we would expect the user to explicitly "duplicate "activities just for the sake of sharing or collaborating, we would burden rather than support, and would de-facto miss out on most activities. Take as an example a typical enterprise LoB application such as a Customer Relations Management (CRM). System. If an account manager gets assigned to a group of customers, it would be reasonable to assume that she would be interested in relevant

updates on those customers through the UbiSoN fabric, rather than have to manually "friend" those customers in UbiSoN or 3rd party Social Networks.

We do not assume legacy applications in the UbiSoN context are (re-)written specifically for the platform. We need a way to efficiently integrate those legacy systems into the UbiSoN context environment. The tools and methods developed in the ARTIST project will support the modeling, transformation, extension and integration of such a legacy line-of-business platforms to enable SaaS services such as UbiSoN to add value to these legacy systems.

The initial proposed approach of the case is to make use of models and model mappings to significantly reduce the cost, and as such widen the application potential, of the system.

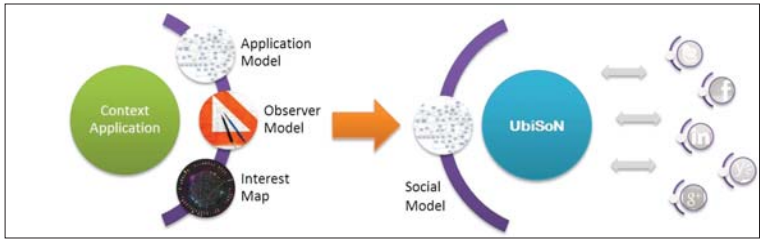


Figure 20: Specific ARTIST software models in UbiSoN legacy modernization

We focus on 3 models and 1 map:

- An application model, including the structural elements of an application such as entities and the relationships between them as well as an agentive model describing the interactions with and transformations on the structural model. This is the same type of models used in functional analysis and application architecture, and one that in ARTIST would not differ from those needed to assist e.g. in application to SaaS migration
- An observational activity model describing how events resulting from interactions inside the context application can be observed and linked. This model will assist the technical "integrator" for a new platform type in configuring or generating the "adapter" for the application so that at run time the activity streams for the application can be generated and made available to the UbiSoN service.
- A social model, a specific application model describing this time not the "context" application but the social platform application itself. This will allow the social platform itself to evolve its capabilities over time, or make it possible to adapt the ARTIST toolset and methodology to different social collaboration environments beyond the default UbiSoN social facilities.
- The interest map describing how events in the context application are mapped onto social operations of the social environment.

The legacy systems onto which we can offer the Spikes UbiSoN service can be categorized on a granular level according to the potential for integration they expose.

- Can they be modelled at the relevant functional level? A human targeted solution such as UbiSoN needs to clearly distil higher level functional models from low level technical models, since the users will preferably collaborate in the "Domain of Discourse" rather than a fine-grained technical entity / transaction space.
- Are they observable? Legacy applications most often do not expose clean functional external eventing api, but sometimes other observational methods can be employed to "sense" state changes and transactions from implicit artefacts (database, network, UI, …). Bringing these techniques (through layered models?) into a shared toolbox with (partial) applications described in a common observational activity model could be of great benefit.
- Can we derive a differentiated audience model? Are actions in the applications of interest to other users? Is there potential for a shared interest model? Do events have significance outside of the application context? Are there different user classes? Are there differentiated relations between entities or transactions on the system and particular user/groups?

Depending on these categorizations the potential and feasibility for a UbiSoN extension can be estimated.

4.3 Motivation for the use case

As a European B2B company Spikes offers its clients vertical solutions that most often involve a mix of licensed products and accelerators, bespoke development and integration. We believe that several trends will challenge this most typical European B2B ICT business model including:

Cloud technologies, in particular SaaS: A traditional System Integrator relies for a large part of its revenues from an asset on the delivery of development and integration services to one or a small group of customers at a time. These projects are executed in close collaboration with the client's business divisions for functional aspects, and IT departments for non-functional issues, and rely on joint expertise and collaboration between the client and the provider in both aspects. Cloud technologies have the potential to disrupt the amount of knowledge in the IT departments for supporting on-premise complex solutions. This potentially creates a cascading network effect whereby non-SaaS offerings could be marginalized for new projects, and forced more into end-of-life maintenance models for legacy. Spikes believes that as such the "SaaS'-iffcation' of new project development has very high significance to the company's future. Spikes research has already begun to investigate these issues, and has built experimental platforms as SaaS services with the potential to add new functionality to legacy Line-Of-Business solutions. Two services are under development, Spikes UbiSoN for adding social collaboration environments in a legacy LoB environment, and Spikes BrightLine, a real-time context aware smart messaging service.

Another part of the motivation is coming from market pull. RFP's and client requests now routinely include the question "why not IaaS/PaaS/SaaS?" for any extension and modernization projects. Clients clearly understand the promise and potential of this approach, so the market is really there, but for the service provider there are also significant challenges.

SaaS has a strong potential to lower provisioning costs, but in order to reap the benefits in depth we need a far deeper understanding of the applications and an attention to granularity and consumption of resources that we generally do not have in a typical legacy model. A typical example is storage: A quick and dirty "throw it all on EC2" approach to legacy

migration most often does not survive the initial back of the envelop viability exercise, as it is quickly discovered that simply for relational storage alone this would be prohibitively expensive. Yet, the finer models of an application, in terms of which entities/functionalities of an application are multitenant capable or require which needs do not exist as we are used to measuring by the dedicated blade and TB of storage for a complete application, not by cycle and MB per functional transaction needed to balance the SaaS books. Partial or gradual modernization seems to hit the sweet spot of keeping hard to "cloud" parts of a legacy operational, while at the same time allowing new investments in partial migrations and functional extensions to benefit from SaaS. The enabler for all these scenarios will be the modeling and transformation support ARTIST tooling and methods will offer to open up and "de-monolitize" the "closed" legacy platforms of yesterday for todays future.

4.4 Expected impact

ARTIST addresses key issues for Spikes as it touches on both the approach and the technicalities involved in gradual modernization of legacy applications. Investment in B2B in very few cases involves true "green-field" developments, and even in those cases, the new system has to interoperate in the context of substantial legacy systems. SaaS is attractive to customers because it shares many properties with "off-the-shelf" IT products. The risk of development is more with the supplier, both through a shift in who invests in upfront development costs, as well as in the expectations for a flexible engagement along the lines of a pay-per-use model. Service suppliers that can offer a clear approach and effective tool chain based on ARTIST results will have a strong competitive advantage in the SaaS modernization arena.

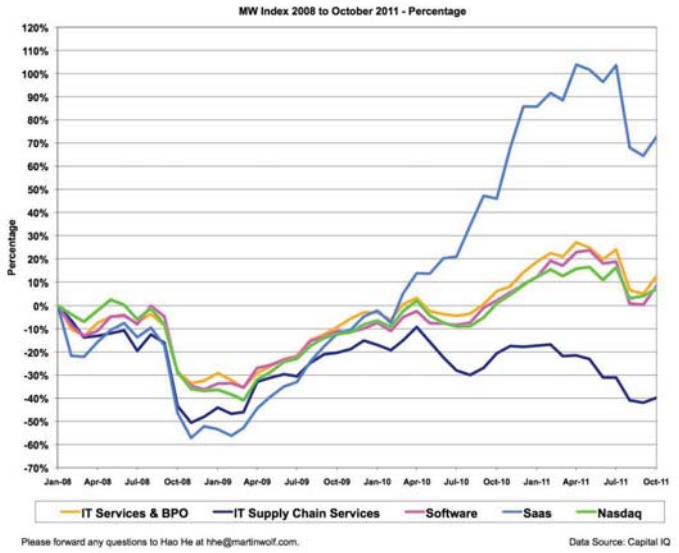


Figure 21: Martin Wolf M&A Advisors, Market Worth index evolution 2008-2011

Valuation of SaaS companies is rapidly outstripping those of legacy software businesses. While this is of course not direct "evidence" of performance, it does give a strong signal as to where to find the most potential for growth, and as such cannot be ignored by smart companies and business ecosystems. We expect ARTIST results to have a critical impact on future business potential for Spikes and similar European B2B ICT software and services companies, as it allows them to de-polarize the worlds of "legacy" customers and new "cloud" futures.

Moving the existing strong client base across this chasm while at the same time broadening and updating in key future plays will be of utmost importance for continued growth of the business.

4.5 Expected results from ARTIST

The tools we would expect from ARTIST focus on modelling tools.

- For the legacy applications for which the UbiSoN service would be an augmentation and that also provide the context, we would point the ARTIST toolset at an existing legacy application, and have it open an ARTIST workbench that supports an information architect to efficiently produce the models and maps described above. The toolbox would be more than a simple editor, but potentially also derive partial or precursor models though inspection and reverse engineering. As an added bonus, in an ideal world, it would also aid in the construction of the event adaptors and activity links, potentially even go as far as partial code-generation for the adapters.

- For the UbiSoN service itself, and potentially other SaaS offerings that are currently bulk provided on a "legacy" in house or hosted infrastructure, it could be an added bonus to have the ARTIST toolset assist in having a functional model on the one hand, derived from the service api, and relate that to a cost model on a per transaction basis for a given PaaS, hopefully again with the aid of inspection tools that can relate resource type usage to functional transactions. This type of tool could be a mix of static and dynamic observation and modeling techniques.
- Thirdly, apart from the direct technical toolbox, we would expect ARTIST to come up with guidance on the approaches to SaaS style modernization and extension. Defining the issues and steps, and providing a project team with an outlined methodology to approach such potential projects.

We do not expect "turn key" ready results, but rather a joint derived understanding and proof-of-concept prototype style of results for the jointly develop technology and methodology.

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