

COST Action IC1402
(Action 17/12/2014– Action 16/12/2018)

Runtime Verification beyond Monitoring
(ARVI)

PROGRESS REPORT AT MONTH 24

This report is submitted by the MC Chair on behalf of the Management Committee.

Confidentiality: This report, other than section II.D, is non-confidential. Section II.D is confidential to the Management Committee and the COST Association (including the Committee of Senior Officials, Scientific Committee and Administration).

Executive summary of the Progress Report:

(max.500 words) (to be completed by Action Chair describing the Action's progress with achieving the Action MoU objectives and generating outputs and impacts – see Annex 1 definitions)

Runtime verification (RV) is a computing analysis paradigm based on observing a system at runtime to check its expected behavior and emerged in recent years as a practical application of formal verification. Despite the potential of the new verification technique and the individual success of European teams, the research in RV is fragmented and still not widely used in several application domains. The main goal is to overcome the fragmentation of RV research by (1) the design of common input formats for tool cooperation and comparison; (2) the evaluation of different tools, building a growing sets benchmarks and running tool competitions; and (3) by designing a road-map and grand challenges extracted from application domains.

The action is structured into four working groups (WGs). In WG1, core runtime verification techniques are revisited and shaped to provide a coherent approach to the field of runtime verification. Within the report period, the working group has started the activity of compiling an RV tutorial volume giving a common introduction. In WG2, two RV competitions have been performed and the third is under preparation. To this end, the topics of common benchmarks, standardization, and tool interoperability have been addressed. Challenging computational domains are considered in WG3. There has been intensive discussions on distributed RV techniques, runtime enforcement, the combination of static analysis with RV, most of them having resulted in international research publications. WG4 focusses on the application of RV techniques in different (industrial) domains. Several speakers from industry could be invited to the meeting reporting on their respective challenges. Possible application scenarios will find their way into the aforementioned tutorial volume.

The action organized one summer school at the Madrid meeting, in which both Action partners as well as international researchers provided a thorough introduction to field of RV to more than 50 (mostly) PhD students.



The action supported 7 STMSs to foster the collaboration. For most actions, research publications have emerged witnessing the success of the mission.

In total, members of the action have jointly published 9 papers in scientific events and/or journals.



I. Progress Report
I.A. COST Action Profile

Objective/ Aim

Runtime verification (RV) is a computing analysis paradigm based on observing a system at runtime to check its expected behavior. RV has emerged in recent years as a practical application of formal verification, and a less ad-hoc approach to conventional testing by building monitors from formal specifications. There is a great potential applicability of RV beyond software reliability, if one allows monitors to interact back with the observed system, and generalizes to new domains beyond computers programs (like hardware, devices, cloud computing and even human centric systems). Given the European leadership in computer based industries, novel applications of RV to these areas can have an enormous impact in terms of the new class of designs enabled and their reliability and cost effectiveness. This Action aims to build expertise by putting together active researchers in different aspects of runtime verification, and meeting with experts from potential application disciplines. The main goal is to overcome the fragmentation of RV research by (1) the design of common input formats for tool cooperation and comparison; (2) the evaluation of different tools, building a growing sets benchmarks and running tool competitions; and (3) by designing a road-map and grand challenges extracted from application domains.

Details

MoU:	oc-2013-2-16896	Start of Action:	17/12/2014
CSO approval date:	15/05/2014	End of Action:	16/12/2018

COST Member Countries and Cooperating State having accepted the MoU

Copy section from Action fact sheet here

Intentions to Accept the MoU

0

Other participants:

Institution Name	Country
Copy from Action page on COST website	

Contacts

Chair/ Vice Chair

Position	Name	Contact details	Country	Date of PhD:	Gender
Chair:	Martin Leucker	University of Lubeck, Ratzeburger Allee 160, 23562 Lubeck, Germany leucker@isp.uni-luebeck.de / +4515005551	DE	2002	M
Vice Chair:	Volker Stolz	Bergen University College, Postbox 7030, 5020 Bergen, Norway vsto@hvl.no / +47 55 58 75 86	NO	2016	M

Working Group Leaders

WG#	WG Title	WG Leader	Country	Date of PhD:	Gender	Number of participants
1	Core runtime verification	Ylies Falcone, Ezio Bartocci	FR, AT	2009, 2009	M,M	12
2	Standardization, benchmarks, tool interoperability	Giles Reger	UK	2014	M	12
3	Challenging computational domains	César Sánchez, Gerardo Schneider	ES,SE	2007, 2002	M,M	12
4	Application areas (outside “pure” software reliability)	Christian Colombo	MT	2013	M	15

Other positions if applicable (STSM Coordinator, WG Vice Leader, Task Force Leader...)

Position	Name	Country	Date of PhD:	Gender
STSM committee	Tarmo Uustalu	EE	1998	M
STSM committee	César Sánchez	ES	2007	M
STSM committee	Martin Steffen	NO	1998	M

Action website: <https://www.cost-arvi.eu>

I.B. Progress with MoU objectives and deliverables and additional outputs

MoU objectives

MoU objective	Achieved Yes/ Partially/ No	Evidence of (partial) achievement including hyperlink to enable assessment of the achievement ¹ . Justification if full achievement is not foreseen
<i>The main objective of the Action is to consolidate a network of runtime verification experts and practitioners in application domains, so that they jointly find new principles for reliable system engineering using monitoring as a building block.</i>		<ul style="list-style-type: none"> Partially achieved, by organisation of summer school and preparation of LNCS tutorial volume.
the development of a common infrastructure that enables the development of a collection of runtime verification problems and benchmarks for the comparison of algorithms and tools, and to increase their collaboration		<ul style="list-style-type: none"> Infrastructure developed through RV competition Over all iterations the competition has compared 14 RV tools on over 100 problems See publications See https://www.cost-arvi.eu/?page_id=654
the development and sharing of current challenges in runtime verification and monitoring		<ul style="list-style-type: none"> Development through RV competition Sharing via ongoing development of online repository (not yet live – will be made live within the next two months)
the development of an interaction between the runtime verification community of experts at large with practitioners from application domains that could benefit from this technology, and influence its developments		<ul style="list-style-type: none"> talks by industry experts: A.Weiss/Accemic (hardware), N.Bayer (finance), M.Sachenbacher (e-mobility) Discussions with people from medical domain, especially at the medical cyber physical systems workshop organized by Ezio Bartocci and Martin Leucker
education of young researchers and potential users of monitoring technologies		<ul style="list-style-type: none"> summer school
coordination of European research on monitoring,		<ul style="list-style-type: none"> H2020 project COEMS since Nov. 2016 (https://www.coems.eu) Tutorial volume

¹ The links to the outputs and deliverables will be used by the Action Rapporteur in assessing the progress.

runtime verification and its applications		
---	--	--

MoU deliverables

MoU deliverable	Level of progress ¹	Evidence of (partial) delivery achievement including hyperlink to enable assessment of the delivery ¹ . Justification if full achievement is not foreseen
-none defined-		

Co-authored publications and FP7/ H2020 proposals

The co-authored publications and FP7/ H2020 proposals/ projects resulting from the Action are listed on the page following the “Additional outputs and achievements” section

Additional outputs and achievements

Please describe any other outputs and achievements that have resulted or are in progress, focusing in particular on those that contribute to the COST mission of “COST enables break-through scientific developments leading to new concepts and products and thereby contributes to strengthen Europe’s research and innovation capacities.”
Please describe any additional outputs and achievements from the Action

Co-authored publications and FP7/ H2020 proposals

Co-authored publications

Enter in the table below only publications on the topic of the Action, co-authored by at least two Action participants from two different countries participating in the Action and for which the Action networking added value. A maximum of ten publications may be entered. If the Action has more than ten such publications the Core Group should select the ten most significant ones to include in the table below.

NO.	Bibliographic data (including: Title, Authors, Title of the periodical or the series, Issue number or volume, Publisher, Year of publication, Relevant pages)	Main author	Number of authors	Action participants listed among the authors (Name, country and role ²)	WGs involved in publication	Date of submission (must be after Action start date)	Expected date of publication (if not already published)	Persistent link to publicly available version of the paper (if available) or the abstract	Is/Will open access ³ provided to this publication?	Is/ will COST be cited/ acknowledged in the publication?	Are/ will COST funds (be) implicated in this publication	Relevance to H2020 Societal Challenges ⁴ ?	Is it peer-reviewed?	Was the added value of the Action Networking necessary for the publication	Impact Factor (if applicable)
1	"Information flow analysis for Go", Eric Bodden, Ka I Pun, Martin Steffen, Volker Stolz, Anna-Katharina Wickert, in Proc. ISoLA'16, LNCS 9952, Springer, 2016	Stolz	5	Volker Stolz (NO, Vice Chair), Eric Bodden (DE, MC Member), Martin Steffen (NO, MC Member)		May 2016		http://dx.doi.org/10.1007/978-3-319-47166-2_30	no	yes			yes	yes	
2	Organising LTL Monitors over Distributed Systems with a Global Clock, Christian Colombo and Ylies Falcone, in Formal Methods in System Design, 49(1-2): 109-158, Springer, 2016	Colombo	2	Christian Colombo (MT, MC Member), Ylies Falcone (FR, MC Member)	1	April 2015		http://dx.doi.org/10.1007/s10703-016-0251-x	no	yes	yes		yes	yes	
3	First International Summer School on Runtime Verification As Part of the ArVi COST Action 1402	Colombo	2	Christian Colombo (MT, MC Member), Ylies Falcone (FR, MC Member)	1,4	August 2016		http://dx.doi.org/10.1007%2F978-3-319-46982-9_2	no	yes	yes		yes	yes	
4	An Automata-Based Approach to Evolving Privacy Policies for Social Networks	Raul Pardo	4	Raul Pardo (SE, Substitute member), Christian Colombo (MT, MC Member), Gordon Pace (MT, MC Member), Gerardo Schneider	4	April 2016		http://dx.doi.org/10.1007%2F978-3-319-46982-9_18	no	yes	yes		yes	yes	

² MC Member/ MC Substitute/ MC Observer/ WG Member/ Training School Trainee/ STSM Recipient/ Other Action Participant

³ Open Access is defined as free of charge access for anyone via Internet. Please answer "yes" if the open access to the publication is already established and also if the embargo period for open access is not yet over but you intend to establish open access afterwards.

⁴ H2020 Societal Challenges are "Health, demographic change and wellbeing"; "Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the Bioeconomy"; "Secure, clean and efficient energy"; "Smart, green and integrated transport"; "Climate action, environment, resource efficiency and raw materials"; "Europe in a changing world - inclusive, innovative and reflective societies"; "Secure societies - protecting freedom and security of Europe and its citizens"

				(SE, MC Member)													
5		Raúl Pardo	4	Raúl Pardo (SE), Ivana Kellyérová (SE), César Sánchez (SP, MC Member), and Gerardo Schneider (SE, MC Member)	4	June 2016	2016	http://dx.doi.org/10.1109/TIME.2016.15		yes	yes		yes	yes			
		Raúl Pardo, Ivana Kellyérová, César Sánchez, and Gerardo Schneider. Specification of Evolving Privacy Policies for Online Social Networks. In 23rd International Symposium on Temporal Representation and Reasoning (TIME'16). IEEE CPS, 2016.															
6		Shaun Azzopardi, Gordon J. Pace, Fernando Schapachnik, and Gerardo Schneider. Contract Automata: An Operational View of Contracts Between Interactive Parties. Artificial Intelligence and Law, 24(3):203-243, September 2016.	4	Shaun Azzopardi (MT), Gordon J. Pace (MT, MC Member), Fernando Schapachnik (Argentina), and Gerardo Schneider (SE, MC Member)	4	February 2016		http://dx.doi.org/10.1007/s10506-016-9185-2		yes	yes		yes	yes			
		Shaun Azzopardi, Gordon J. Pace, Fernando Schapachnik, and Gerardo Schneider. Contract Automata: An Operational View of Contracts Between Interactive Parties. Artificial Intelligence and Law, 24(3):203-243, September 2016.															
7		Gordon Pace, Raúl Pardo, and Gerardo Schneider. On the Runtime Enforcement of Evolving Privacy Policies in Online Social Networks. In 7th International Symposium on Leveraging Applications of Formal Methods, Verification and Validation - ISoLA'16 (2); Track: Runtime Verification and Enforcement, the (industrial) application perspective, volume 9953 of LNCS, pages 407-412. Springer, 10-14 October 2016.	3	Raúl Pardo (SE), Gordon Pace (MT, MC Member), Gerardo Schneider (SE, MC Member)	4	March 2016		http://dx.doi.org/10.1007/978-3-319-47169-3_33		yes	yes		yes	yes			
		Gordon Pace, Raúl Pardo, and Gerardo Schneider. On the Runtime Enforcement of Evolving Privacy Policies in Online Social Networks. In 7th International Symposium on Leveraging Applications of Formal Methods, Verification and Validation - ISoLA'16 (2); Track: Runtime Verification and Enforcement, the (industrial) application perspective, volume 9953 of LNCS, pages 407-412. Springer, 10-14 October 2016.															
8		Enforcement of (Timed) Properties with Uncontrollable Events. M. Renard, Y. Falcone, A. Rollet, S. Pinisetty, T. Jérón, H. Marchand. In 12th International Colloquium on Theoretical Aspects of Computing ICTAC 2015, Cali, Colombia, volume 9399 of Lecture Notes in Computer Science, p. 542-560, Springer.	6	Yliès Falcone (FR,MC), Antoine Rollet (FR,MC)		June 2015		http://www.labri.fr/perso/rollet/divers/ictac15.pdf	no	no	no	no	yes	Yes			
		Enforcement of (Timed) Properties with Uncontrollable Events. M. Renard, Y. Falcone, A. Rollet, S. Pinisetty, T. Jérón, H. Marchand. In 12th International Colloquium on Theoretical Aspects of Computing ICTAC 2015, Cali, Colombia, volume 9399 of Lecture Notes in Computer Science, p. 542-560, Springer.															
9		Verifying Concurrent Programs Using Contracts. R.F. Dias, C. Ferreira, J. Fiedor, J. Lourenco, A. Smrcka, D.G. Sousa, T. Vojnar. Under review at ICST 2017, a technical report is available.	7	R.F. Dias (PT), C. Ferreira (PT), J. Fiedor (CZ), J. Lourenco (PT, MC member), A. Smrcka (CZ), D.G. Sousa (PT), T. Vojnar	1	October 2016	2017	http://www.fit.vutbr.cz/~vojnar/Publications/tr-contracts-16.pdf	yes	yes (so far no acknowledgement is present in the version submitted for review)	no	no	yes	yes			
		Verifying Concurrent Programs Using Contracts. R.F. Dias, C. Ferreira, J. Fiedor, J. Lourenco, A. Smrcka, D.G. Sousa, T. Vojnar. Under review at ICST 2017, a technical report is available.															

I.C. Networking

<p>Added value of the Networking</p> <p>Please describe here the added value of the networking, highlighting in particular anything that would not have happened without the Action networking.</p> <p>The action has brought together researchers from both academia and industry together with practitioners in particular focus areas such as financial transactions, privacy and medical devices. In some specific cases, we have now establish collaboration between researchers who have not been working together before. This collaboration has not only been useful to identify the challenges in applying runtime verification in the particular domain – with particular relevance to the work of WG3 and WG4 – but also had the expected side effect of co-authored papers. Without the action this would not have been possible.</p>
<p>Extent of the networking</p> <p>Describe the extent of the networking among the participants in the Action. Were all participants integrated into the networking equally? Were those targeted by COST policies on Inclusiveness Target Countries (ITCs), Early Career Investigators (ECIs)/ Young Researchers, and gender balance fully integrated into the Action networking?</p>

I.D. Impacts

The impacts that have resulted, or might result from the Action are described in the following table.

Description of the impact	Type of impacts ⁵	Timing of impacts ⁶
Enter one impact per line, and specify the type and timing of the impact.		

I.E Dissemination and exploitation of Action results

Describe the Action’s dissemination and exploitation approach as well as all activities undertaken to ensure dissemination and exploitation of Action results and the effectiveness of these activities.			
Add description here			
Item/ activity	Target audience	Result	Hyperlink
Workshop on the application of RV in the processing of financial transactions	Researchers and practitioners from the field	Well attended by COST participants and a number of challenges have been identified.	https://www.cost-arvi.eu/?page_id=166
Various talks focusing on	Researchers and practitioners from	Well attended by COST participants and	

⁵ Scientific/ technological, Economic, Societal

⁶ Achieved/ Foreseen within 2 years/ Foreseen 2-5 years/ Foreseen 5-10 years/ Foreseen 10+ years

areas such as RV of medical devices, Li-ion batteries, multicore processors	the respective fields	a number of challenges have been identified.	
Discussion panel	Runtime verification researchers and practitioners	A number of important points have been raised	

I.F. Action success(es)

COST regularly communicates the successes of Actions. At this point in time what aspect(s) (outcomes and/ or impacts, rather than activities) of this Action is/ are the most suitable for communication?

Description of the success story	Dimension of the success
	<ul style="list-style-type: none"> ■ Breakthrough: scientific, technological or socioeconomic ■ Policy implementation (specify which policy) ■ Capacity building

II. Management Report

II.A. Overview of expenditure

Insert below in the yellow cells the summary of figures from the Yearly Financial Reports (YFRs) of completed Grant Periods and an IFR of any incomplete Grant Period – the Totals (non-yellow cells) will automatically sum.

	Grant Period 1	Grant Period 2	Grant Period 3	Total
GP start	01/03/2015	01/09/2015	01/05/2016	
GP end	31/08/2015	30/04/2016	30/04/2017	
Grant Holder Institution	ISP, University of Lübeck, DE	ISP, University of Lübeck, DE	ISP, University of Lübeck, DE	
Meetings	23.174,59 EUR	63.464,63 EUR	40.763,94 EUR	127.403,16 EUR
Training Schools	0,00 EUR	0,00 EUR	21.064,04 EUR	21.064,04 EUR
STSMs	1.702,00 EUR	3.910,00 EUR	3.300,00 EUR	8.912,00 EUR
Dissemination	71,51 EUR	0,00 EUR	0,00 EUR	71,51 EUR
OERSA	0,00 EUR	0,00 EUR	0,00 EUR	0,00 EUR
Total Scientific Expenditure	24.948,10 EUR	67.374,63 EUR	65.127,98 EUR	157.450,71 EUR
FSAC	3.742,22 EUR	10.106,19 EUR	9.769,20 EUR	23.617,61 EUR
TOTAL	28.690,32 EUR	77.480,82 EUR	74.897,18 EUR	181.068,32 EUR

¹ OERSA = Other Expenses Related to Scientific Expenditure (e.g. bank charges)

² FSAC = Amount received by Grant Holder for Financial Scientific and Administrative Coordination

II.B. Budget and Participation management

II.B.1 Budget spent in relation to individuals/ institutions outside participating COST countries

STSMs from or to institutions from countries other than Participating COST countries

The table below describes the added value STSMs to approved institutions in IPC or NNC or Specific Organisations and any STSMs from an approved institution in an NNC to a participating COST country.

Grantee		Host		Date	Topic and value added to the Action
Institution	Country	Institution	Country		
Add home institution and country		Add host institution and country		Date	Describe topic of the STSM and the added value to the Action
Add home institution and country		Add host institution and country		Date	Describe topic of the STSM and the added value to the Action
Add home institution and country		Add host institution and country		Date	Describe topic of the STSM and the added value to the Action

Invited Speakers

The table below highlights the added value of Invited Speakers from COST countries that have not accepted the MoU and/ or non-participating NNC, IPC or Specific Organisations whose participation at a meeting or Training School was reimbursed by the Action.

Participant name	Institution	Country	Event date	Topic and added value to the Action
Add	Add	Add	Add	Describe the speaker's topic and the added value to the Action
Add	Add	Add	Add	Describe the speaker's topic and the added value to the Action
Add	Add	Add	Add	Describe the speaker's topic and the added value to the Action

Dissemination meetings

The table below highlights the added value of Dissemination Meetings financed from Action funds.

Participant name	Role	Country	Date	Location	Topic and added value to the Action
Add	Add	Add	Add	Add	Describe the speaker's topic and the added value to the Action

II.C. Participants

Management Committee		
Name	Country	Email address
Dr Ezio Bartocci	AT	ezio.bartocci@tuwien.ac.at
Dr Dejan Nickovic	AT	dejan.nickovic@ait.ac.at
Prof Tomas Vojnar	CZ	vojnar@fit.vutbr.cz
Dr Jan Kofroň	CZ	jan.kofron@d3s.mff.cuni.cz

Prof Bernd Finkbeiner	DE	finkbeiner@cs.uni-saarland.de
Dr Juan Manuel Crespo	DE	jm Crespo@gmail.com
Dr Brian Nielsen	DK	bnielsen@cs.aau.dk
Dr Cesar Sanchez	ES	cesar.sanchez@imdea.org
Dr Juan Tapiador	ES	jestevez@inf.uc3m.es
Dr Tarmo Uustalu	EE	tarmo@cs.ioc.ee
Dr Ylies Falcone	FR	ylies.falcone@imag.fr
Dr Antoine Rollet	FR	antoine.rollet@labri.fr
Dr Giles Reger	UK	giles.reger@manchester.ac.uk
Prof Nobuko Yoshida	UK	yoshida@doc.ic.ac.uk
Prof Petros Stefanias	EL	petros@math.ntua.gr
Prof Athanasios Kakarountas	EL	kakarountas@ieee.org
Prof Leonardo Mariani	IT	mariani@disco.unimib.it
Prof Ferruccio Damiani	IT	damiani@di.unito.it
Prof Shmuel Tyszberowicz	IL	tyshbe@tau.ac.il
Prof Doron Peled	IL	doron.peled@gmail.com
Dr Brian Lee	IE	blee@ait.ie
Dr Runar Unnthorsson	IS	runson@hi.is
Dr Marcel Kyas	IS	marcel@ru.is
Dr Jun Pang	LU	jun.pang@uni.lu
Dr Moussa Ouedraogo	LU	moussa.ouedraogo@list.lu
Prof Rimantas Seinauskas	LT	rimantas.seinauskas@ktu.lt
Prof Boro Jakimovski	MK	boro.jakimovski@finki.ukim.mk
Prof Gordon Pace	MT	gordon.pace@um.edu.mt
Dr Christian Colombo	MT	christian.colombo@um.edu.mt
Prof Volker Stolz	NO	stolz@ifi.uio.no
Dr Martin Steffen	NO	msteffen@ifi.uio.no
Dr Jorge A. Pérez	NL	japerezp@gmail.com
Prof Marieke Huisman	NL	m.huisman@utwente.nl
Prof José Rufino	PT	jm Rufino@ciencias.ulisboa.pt
Prof João Lourenço	PT	joao.lourenco@fct.unl.pt
Prof Gerardo Schneider	SE	gerardo@cse.gu.se
Prof Natasha Sharygina	CH	natasha.sharygina@usi.ch
Dr Dmitriy Traytel	CH	traytel@inf.ethz.ch
Prof Zoran Budimac	RS	zjb@dmi.uns.ac.rs

II.D. Specific matters

This section is confidential to the Management Committee, and the COST Association (Administration, Scientific Committee and Committee of Senior Officials); and is not included in the version of the report that is made publicly available.

The Action encountered the following particular difficulties in the implementation of the Action (e.g. imbalances of participation across the Working Groups, inactive country representatives).
<ul style="list-style-type: none">• Inactive country: DK. Action taken: MC member informed and will suggest a 2nd national MC member• Interested members from RO not becoming part of the Action; no progress/answer from NCP• eCOST system allows no delegation by Chair
The MC did not accept the pending intentions to accept the MoU shown in Section I.A for the following reason.
n/a

Annex 1

Definitions:

COST Action Challenge (main aim)	“The research question addressed by the COST Action targeting scientific, technological, and / or socioeconomic problems”
COST Action Innovation	“The creation and / or development of new or improved concepts, products, processes, services, and / or technologies that are made available to markets, governments and society”
COST Action objectives	“COST Action objectives are the results that an Action needs to achieve in order to respond to meet its challenge. These are SMART (Specific, Measurable, Achievable, Relevant, Timely) and twofold: research coordination objectives and capacity building objectives.”
COST Action research coordination objectives	“Achieving these objectives turns COST Actions from initially scattered teams into one transnational team and leverages the existing funded research. These objectives entail the distribution of tasks, sharing of knowledge and know-how, and the creation of synergies among Action participants to achieve specific outputs.”
COST Action capacity building objectives	“Achieving these objectives entail building critical mass to drive scientific progress, thereby strengthening the European Research Area. They can be achieved by the delivery of specific outputs and / or through network features or types and levels of participation.”
COST Action networking activities	“any activities organised by the COST Action (whether or not directly funded by COST) in order to achieve research coordination and capacity building objectives.”
COST Action networking tools	“instruments through which eligible activities can be funded”
COST Action outputs	“direct results from the COST Action activities. These can be codified knowledge, tacit knowledge, technology, and societal applications.”
COST Action impact	“the short- to long-term scientific, technological, and / or socioeconomic changes produced by a COST Action, directly or indirectly, intended or unintended.”
COST Action deliverable	“a distinct, expected and tangible output of the Action, meaningful in terms of the Action’s overall objectives such as a report, a document, a technical diagram, a software etc. Action deliverables are used to measure its progress and success.”
COST Action milestones	“Control points in the Action that help to chart progress. They are also needed at intermediary points so that, if problems have arisen, corrective measures can be taken. A milestone may be a critical decision point in the Action where, for example, the MC must decide which of several technologies to adopt for further development (e.g. core group and MC meetings, mid-term reviews)”
Inclusiveness Target Country (ITC):	Current COST Member Countries targeted by the COST inclusiveness Policy (“Inclusiveness Target Countries” (ITC)): EU 13 (Bulgaria, Cyprus, Czech Republic, Estonia, Croatia, Hungary, Lithuania, Latvia, Malta, Poland, Romania, Slovenia, Slovakia), EU candidate countries (the former Yugoslav Republic of Macedonia, Montenegro, Republic of Serbia, Turkey) and potential EU candidate countries (Bosnia and Herzegovina). In addition, to comply with the EC criteria for ‘Spreading Excellence and Widening Participation’, Portugal and Luxemburg are included.