R&I

Cybersecurity technology radar

1st Report

December 2018

Abstract

We present in this report a visualisation of EC supported activities in the area of Cybersecurity and Privacy that allows possible exploiters of the outputs of these projects to understand their status.

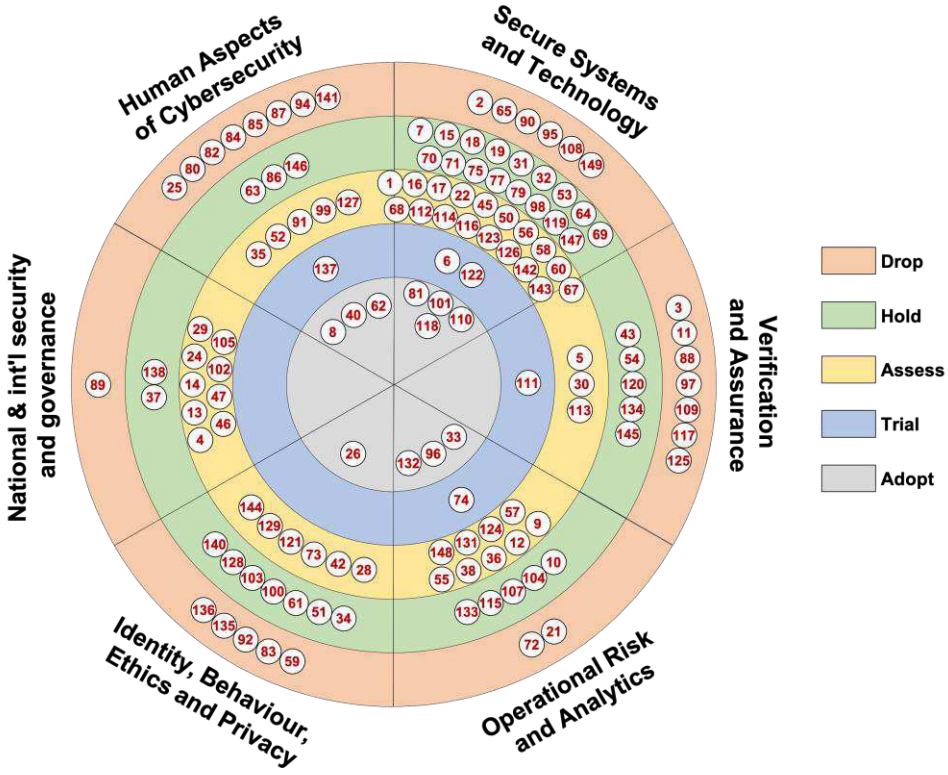
Disclaimer

The work described in this document has been conducted within the project cyberwatching.eu. This project has received funding from the European Union's Horizon 2020 (H2020) research and innovation programme under the Grant Agreement no 740129. This document does not represent the opinion of the European Union, and the European Union is not responsible for any use that might be made of its content.

Executive Summary

The European Commission has launched 25 calls which were either explicitly supporting projects in the domain of Cybersecurity and privacy or from which projects in this area were supported. As such it is important that we consider what the outputs of these projects have been and where the products they have created have gone in terms of exploitation either by the projects themselves or by others who may reuse their outputs.

Utilising the fairly well known "Technology Radar" methodology the Cyberwatching.eu project used its previously published Cybersecurity taxonomy and a schema that describes guidance on whether a user should invest themselves in the outputs of a project, to produce the radar visualisation as below.



Overall, we can see from this that there is still an imbalance in the domains within which projects have been supported by the EC, with a concentration in the Secure Systems and Technology segment. This is possibly not surprising, as this is still what the majority would consider in need of further development in the area of CS&P.

Unfortunately, another equally important segment, yet not nearly as high profile is one of the most lowly represented: Verification and Assurance. As such, supporting this more explicitly in a future funding round could be necessary.

Analysing the status within the rings, we can see that there are a significant number of projects that are currently at the point of assessment (yellow ring), again led by Secure Systems and Technology though this is the most populated ring for nearly all sectors. A possible concern is that there are no products or outputs in two of the sectors, National and

International Security & Governance and Verification & Assurance where all of the activities are either relatively new or have already completed.

Overall, we consider this first version of the Technology Radar as a working document, which will develop with further releases, integrating product trajectories in future versions.

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1 Introduction

A large number of substantial investments have been made by both national governments and the European Commission to support co-ordinated programmes of research and innovation projects within the broad domain of cybersecurity and privacy. Since some of these programmes have now completed and as the European Commission has transitioned from Framework 7 to Horizon 2020, it is important that we are able to evaluate the impact that these programmes have had, and more specifically, how ready the outputs are for utilisation by persons from outside the developing community. As such, in an area such as Cybersecurity it is essential that we are able to consider and present to stakeholders in these enterprises (potential users of the technologies, processes and policies developed) the outputs from the projects alongside a systematic method of the evaluation of the outputs, with commentary on how easy these outputs are to use both generally and more importantly, outside of the team that originally developed them.

The method chosen to present the evaluations of the project outputs has been determined to be a type of technology radar, as pioneered by ThoughtWorks[1]. This methodology allows not only the subdivision of the items classified to be segmented depending on specific criteria, but also their radial distance from the centre allows a second classification to be presented simultaneously. Through the use of colour for the points rather than the rings within the radar we are able to support a third dimension of assessment for featured project outputs, which future versions of the Cyberwatching.EU Cybersecurity R&I technology Radar will exploit.

As this is the first Cyberwatching.eu Cybersecurity Technology Radar report (with future versions published at M36 and M48 of the project), we will be concentrating at this point on the projects supported by the European Commission. Projects supported through national governments will appear in future releases of the technology radar. Since this is the first edition of the technology radar, this release will not include illustration of trajectory of products and outcomes. These result in a track being established for a particular item within the radar, which can then be used to identify trends and predict the next position of an item in the short to medium term. This track and prediction indicate which tools, productions or services are becoming mature, commercially viable etc. This information will appear for the first time in the next edition.

Following this section, we first describe the assessment methodology used to understand the current status of the projects. This is especially important as it would not be feasible within the confines of this first edition of the radar to ask assessed projects to self-evaluate, or for us to personally walk them through in a more hands-on approach. We then describe the segmentation radially into the different sectors of the cyberwatching.eu taxonomy that was introduced previously in deliverable D2.1. Next, we explain the meaning for the different radial bands which assess project output suitability for external usage. For this first edition, we are utilising the current status of the project itself and then if necessary, the time since or towards project completion as the key assessment within this edition of the Radar. In future editions we will utilise the output from the assessment methodology of the

[1] https://www.thoughtworks.com/radar

Market and technology Readiness Levels as described within the Cyberwatching.eu deliverable D2.3.

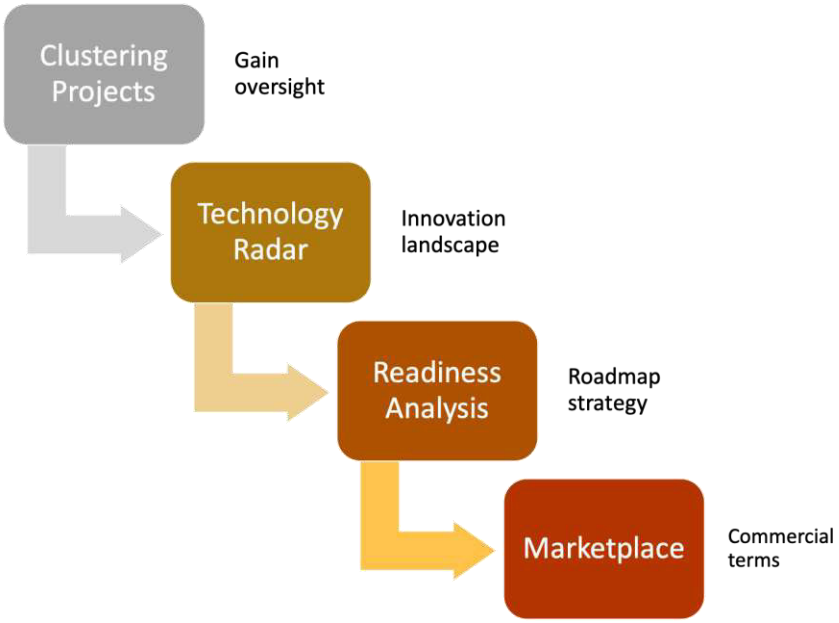

Figure 1: How WP2 tasks feed into each other and, ultimately, into WP4's marketplace

We then present all of the projects that have been assessed within this edition of the radar, which is followed by the radar presentation itself.

The document concludes with a discussion about an overall larger pan-project conclusions that this visualisation is able to give us. It also identifies the impact of the findings in the broader scope of the project and in particular on the promotion of projects through the SME end-user club and Marketplace.

2 Methodology

The Technology Radar as a tool requires a descriptive taxonomy of general areas within a specific domain, and a schema that describes the relationship between the object and its position within the domain sector and the distance from the centre for the visualisation that is used.

In the following sections both of these are described, starting with the taxonomy of domains and then the actual schema and application of the Technology Radar to the cybersecurity domain.

2.1 Sectors

Within the Cyberwatching Technology Radar there are six sectors as described by the six L2 categories of the Cyberwatching taxonomy of R&I in cybersecurity and privacy. These are summarised below for completeness of this deliverable –the full definition and description are found in deliverable D2.1.

2.1.1 Level 1 Taxonomy

The first sub division of the cybersecurity and privacy landscape is done at the highest level possible into three categories;

- ***Foundational technical methods & risk management for trustworthy systems in cybersecurity and privacy*** – The development of technologies that are directly associated with cybersecurity capabilities or features and methods by which the confidence in the technical capabilities of a system may be validated.
- ***Applications and user-oriented services to support cybersecurity and privacy*** – Specific capabilities or services which directly interact with system users and are developed with capabilities that are directly about how to improve the inherent capabilities and user experiences of cybersecurity and privacy in consumed services.
- **Policy, governance, ethics, trust, and usability, human aspects of cyber security & privacy** – Aspects of cyber security that are overwhelmingly driven by the human interaction, understanding and dependency on how secure systems are or have been designed to be.

From these three top-level categories we then subdivide into the next level for the taxonomy.

2.1.2 Level 2 Taxonomy

The six sub domains listed below are intended to describe a specific sub area within cybersecurity research and innovation. The individual sectors are listed below along with their parent Level 1 categories.

- ***Foundational technical methods & risk management for trustworthy systems in cybersecurity and privacy***
  - **Operational risk, management and analytics**: Understanding the risk and harm resulting from cyberattacks, and how it propagates across and between organisations. Work focuses on creating situational awareness through aiming for a complete understanding of scenario and risk management; metrics and models for

security postures; and analytics for predicting risk, prioritising responses and supporting security operations.

- **Verification and assurance**: Two disciplines that help establish how much confidence you can have in a system, both in terms of security and the privacy of all stakeholder groups who act with or in a system. Assurance focuses on managing risks related to the use, processing, storage, and transmission of information, whereas formal verification seeks to build a mathematical model of a digital system and then try to prove whether it is 'correct', often helping to find subtle flaws.

- ***Applications and user-oriented services to support cybersecurity and privacy***
  - **Secure systems and technology**: How security can be built into technology from the design stage including cloud computing security, cryptography, trusted platforms, wireless security, mobile security and secure coding paradigms.
  - **Identity, behaviour, ethics and Privacy**: Bringing diverse perspectives and interpretations to questions such as: Who are you online, how do you communicate, and what can (or should) you do? This also connects to the ongoing activities on Privacy launched through directives and regulations over the past year.
- **Policy, governance, ethics, trust, and usability, human aspects of cyber security & privacy**
  - **National and international security, privacy and governance**: looking at politics, international relations, defence, policy and governance issues: how do countries and communities interact with (and through) technology, and how might this change in different contexts?
  - **Human aspects of cyber security**: Understanding the ways humans interact with (and through) digital systems – whether to understand and design for target users, or to understand how adversaries operate and can exploit the systems. This includes aspects like usability, trust, collaborative practices, social embeddedness, nationhood, cultural diversity, impact on economy, and the relationship between microsocial interactions and global structures.

2.2 Technology Radar rings

Categorising data blips into sectors/segments (see section 2.1 for more detail) provides a *static* grouping of European and national cybersecurity for easy and swift drill-down into the data.

Assessing cybersecurity projects according to maturity allows the reader to make an informed decision as to where and when the project in question should be closer examined, or not examined at all.

This section describes this Technology Radar's *rings* and the state of maturity they capture for every project included in section 4.

2.2.1 Underlying concepts

As any visualisation technique, this Technology Radar relies on applying a number of design principles to the data in order to provide an intuitive reader experience. Combined with an

easy to understand way of charging values with expressive yet generic semantics, the results allow for swift conveying on large amounts of information.

Software Development Lifecycle as project maturity metaphor.

The Software Development Life Cycle (SDLC) is a well-known concept capturing the life cycle of any software project, from idea to 'sunsetting', i.e. the discontinuation or retiring a solution, a service, a library, basically any piece of software. The SDLC is comparable to many different concepts; for example, the progression through the SDLC is closely resembling the ascension through the Technology Readiness Levels (TRL) that are ubiquitous in the technology and engineering sectors. (With the exception that TRLs do not capture the concept of sunsetting a piece of software.)

Therefore, mapping the Technology Radar's *rings*, or states to the SDLC, software, or knowledge in this deliverable's context, would undergo the following sequence of assessment:

Assess → Trial → Adopt → Hold → Drop

Figure 2: Maturity progression of cybersecurity projects

The semantics of these terms are described in section 2.2.2.

Proximity to radar's centre reflects readiness for adoption.

A straight mapping of the project maturity on the rings of the radar would be counter-intuitive to the visual message of the radar where the very centre of the radar requires the most attention, the outermost ring the least attention. By contrast, the level of attention to the software maturity levels peaks with "Adopt", and dropping to lower levels at either side of it – not dissimilar to the bell curve:

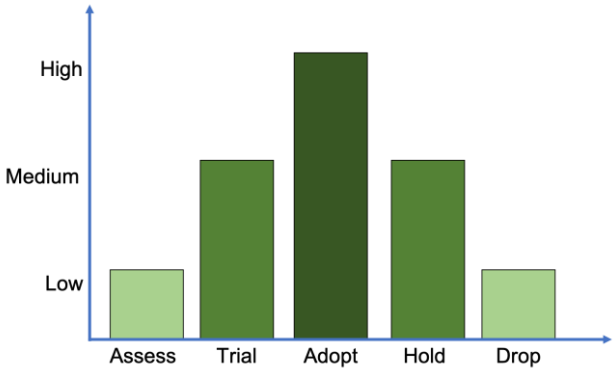

Figure 3: Attention level required for software project maturity levels

Consequently, projects will progress through the radar not in a linear succession from outermost rings towards the centre. Instead, they will "enter" the radar in the middle, gravitate to the centre (the bull's eye), then jump to the outermost rings for gradually dropping out of scope of the radar altogether:

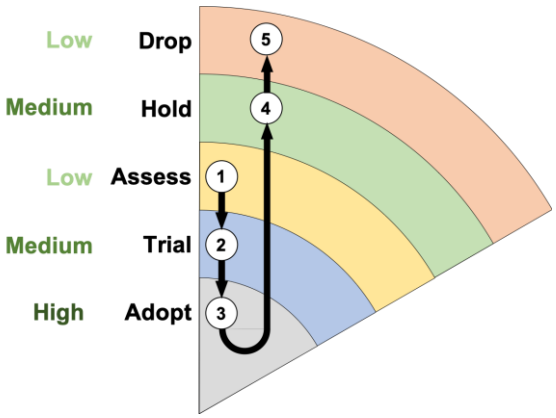

Figure 4: Mechanics of the technology radar

2.2.2 Project maturity: The rings of the radar

The rather generic terms that qualify the rings of the radar need to be further contextualised towards the overall purpose of the radar. In *this* instalment of the Technology Radar report, the focus lies on the introduction of the radar, how it works, and what kind of insights it may deliver.

This first Technology Radar focuses on project maturity based on its contractual timeline, relative to the point in time the report was created. It assumes that projects generally progress satisfactorily towards their goals and outcomes – it relies on this being ensured by the funding programme's own checks and balances. In the case of EU H2020, these are the regular project reviews, and the selection of expert reviewers for the project by the Commission.

This Technology Radar report addresses the following question, therefore: "Given the current landscape and oversight of projects addressing various aspects of cybersecurity, at which point in time should I start tracking their results and reports?"

1. Assess

Technical criterion: Project is running, and has **more than 6 months to go.**

The project is still running, and has still a considerable amount of time to further mature their results and outputs, yet needs to think about how it will play out the final stretch of project lifetime.

Recommendation: Study the project's high-level description and designated outputs, and compare with your own strategy and needs. If there is a match, put the project on a personal/specific short-list for further check-up later.

2. Trial

Technical criterion: Project is running, but has **less than 6 months to go.**

The project is now seriously busy finalising its planned outputs. That might be a piece of software, an innovative algorithm, or a study whose results may impact your own work. Some of the planned work might have been dropped in order to reach the stated goal for more important outputs.

Recommendation: Check back regularly with the project (either actively or passively) to see how the output you are interested in is progressing. Refine your shortlist based on the results of that exercise; expect your shortlist getting smaller unless there are new projects in the pipeline that stock it up again. For those you consider specifically mature, you should consider first practical trials of integrating the output into your portfolio – not to accomplish it straight away, but to anticipate the level of "integration pain" you may experience later.

3. Adopt

Technical criterion: The project finished **less than 1 year ago.**

The project has finished and published its results and outputs. However, intended follow-on activities may have not yet ramped up, or in case of open source software the intended community around it has not yet formed and you are not prepared to be a first mover in that space. In any case, project outputs are usually considered stable and the focus of uptake into production. There may be further changes to it, especially with active communities supporting it, but expect at least a temporary significant drop in speed of change in this timeframe.

Recommendation: For projects that stayed on your shortlist unto this stage, this is the time to start serious integration trials with stable versions of the output. In case of study results, or non-IT related outputs, the expected integration pain may affect your overall business strategy and cause changes in operations and processes, rather than technical integration challenges that present themselves with IT integrations.

4. Hold

Technical criterion: The project finished **1 – 2 years ago.**

If you haven't already decided to integrate the project's outputs into your own business, or more neutrally, operations at large, projects in this "stage" may still have value to you, but you need to understand the how the then published outputs have fared until now and may fare in the future.

Project results in the IT sector, and especially in the currently very dynamic cybersecurity domain age very quickly, as competition is fierce, and many outputs are superseded by technical innovation, or other projects simply having been faster or more efficient in their execution.

Recommendation: Look out for the support infrastructure and community for the outputs of that project. Is alive and active? Is it expanding or contracting? As far as concepts and new knowledge is concerned, how well are outputs from about 2 years ago still valid? Be very sure about the impact and skills required when deciding to integrate outputs of that age.

5. Drop

Technical criterion: The project finished **more than 2 years ago.**

The project has seen its sunset quite a while ago. At this point in time, you will know whether its outputs have succeeded or not. If it did, then it is usually disassociated from the original project and has formed a life and purpose of its own, and you can focus on the software, hardware, knowledge, or insight itself.

As far as tracking and collecting project related information, it is safe to consign it to the long-term archives.

Recommendation: For all intents and purposes, projects at this stage are safe to discard from your attention.

3 The analysed projects

In order to obtain a first representative sample of projects to be assessed in this Technology Radar, we collected projects funded in 25 calls across the EU's major recent research and innovation programmes, i.e. FP7 and H2020, that address cybersecurity in their DoAs. These calls are, in alphabetical order:

- DRS-17-2014
- DS-02-2016
- ECSEL-2016-2-IA-two-stage
- EE-13-2014
- EINFRA-22-2016
- ERC-CoG-2014
- FCT-09-2015
- FP7-PEOPLE-2011-IOF
- H2020-SMEINST-1-2016-2017
- ICT-06-2016
- ICT-10-2016
- ICT-12-2015
- ICT-2009.1.4
- ICT-2013.6.1
- ICT-32-2014
- ICT-37-2014-1
- INNOSUP-02-2016
- MSCA-ITN-2014-ETN
- PEOPLE-2007-4-3.IRG
- SEC-2011.2.5-1
- SEC-2011.6.1-5
- SEC-2011.6.5-2
- SEC-2012.2.3-1
- SiS-2009-1.1.2.1
- SSH-2009-3.2.1

For the purpose of this technology radar, from the total of 149 projects (see Appendix 1), 15 project were considered out of scope since they incorporate other projects' cybersecurity outcomes rather than offer research and innovation as a project goal in its own right. The remaining 134 EC-funded projects are included in this radar, and are also part of the observatory, which contains a further 85 nationally-funded projects. .

In this deliverable, only EC funded cybersecurity projects have been analysed.

The process of selecting and filtering EC funded projects was a four-step process:

1. Collection of key project data, such as start and end date, budget, call, project type (Research & Innovation Action, Innovation Action, Coordination & Support Action, etc.) coordinator, and high-level project descriptions.
2. Assessment of whether each project in fact does address aspects of cybersecurity directly or merely acts as a consumer of outputs of cybersecurity tools and knowledge. Projects of the latter categorisation were discarded from further analysis, in total 15 projects of the 149 originally collected. 134 projects remained.
3. Grouped projects according to the cyberwatching cybersecurity research taxonomy level 1 domains (see Cyberwatching.eu deliverable D2.1 for details)
4. Clustered projects in our research taxonomy level 2 (and as summarised in section 2.1 earlier in this deliverable)

Once this final list of 134 projects was determined, we applied the methodology described above, arriving at the results provided in section 4 below.

4 The Autumn 2018 Technology Radar

We now present the results of the Radar analysis, initially on a sector by sector basis and then finally bringing them all together to also see the shape of the overall landscape.

4.1 Results by sector

4.1.1 Secure Systems and Technology

# projects	Assess	Trial	Adopt	Hold	Drop
47	18	2	4	17	6

Table 1: "Secure Systems and Technology" overview

"Secure systems and technology" is understandably the most popular area within the cybersecurity and privacy ecosystem, since it is what most would consider the front line in protecting resources, to develop new technological solutions to what can be a technology driven problem.

This includes a large number of projects that have recently started and a smaller number that are more mature within the software development lifecycle. Indeed, these are all at the Trial or Adopt stage. There are also a large number of projects that have already come to the end of their development lifecycle having ended already. In some cases, the technologies implemented are likely to have been superseded by outputs from more latterly funded activities.

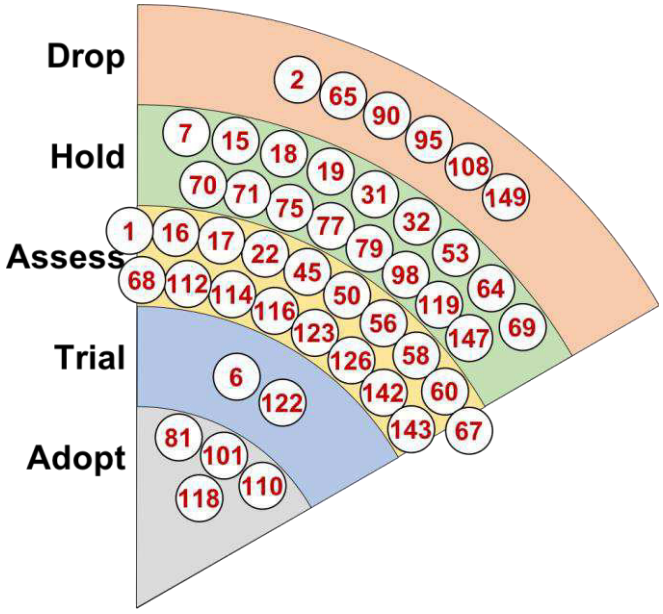

Figure 5: "Secure Systems and Technology" radar

#	EC Project name	Start date	End date	Assess	Trial	Adopt	Hold	Drop
1	AARC2	May 2017	Apr 2019	X				
2	ABC4Trust (F)	Nov 2010	Feb 2015					X
6	ARIES	Sep 2016	Feb 2019		X			
7	ARMOUR (F)	Feb 2016	Jan 2018				X	
15	CHOReVOLUTION (F)	Jan 2015	Dec 2017				X	
16	CIPSEC	May 2016	Apr 2019	X				
17	CITADEL	Jun 2016	May 2019	X				
18	CLARUS (F)	Jan 2015	Dec 2017				X	
19	CloudSocket (F)	Jan 2015	Dec 2017				X	
22	COEMS	Nov 2016	Oct 2019	X				
31	CyberWiz (F)	Sep 2015	Aug 2017				X	
32	CYCLONE (F)	Jan 2015	Dec 2017				X	
45	ENCASE	Jan 2016	Dec 2019	X				
50	FutureTrust	Jun 2016	May 2019	X				
53	HEAT (F)	Jan 2015	Dec 2017				X	
56	HIPS	Oct 2014	Sep 2019	X				
58	KONFIDO	Nov 2016	Oct 2019	X				
60	LIGHTest	Sep 2016	Aug 2019	X				
64	MAS2TERING (F)	Sep 2014	Aug 2017				X	
65	MATTHEW (F)	Nov 2013	Oct 2016					X
67	mF2C	Jan 2017	Dec 2019	X				
68	MH-MD	Nov 2016	Oct 2019	X				
69	MIKELANGELO (F)	Jan 2015	Dec 2017				X	
70	MITIGATE (F)	Sep 2015	Feb 2018				X	
71	MUSA (F)	Jan 2015	Dec 2017				X	
75	OCTAVE (F)	Jun 2015	Jul 2017				X	
77	OPERANDO (F)	May 2015	Apr 2018				X	

#	EC Project name	Start date	End date	Assess	Trial	Adopt	Hold	Drop
79	PaaSword (F)	Jan 2015	Dec 2017				X	
81	PANORAMIX (F)	Sep 2015	Aug 2018			X		
90	PreserviX	May 2015	Oct 2015					X
95	PRISM CODE	Nov 2012	Oct 2016					X
98	PRIVACY FLAG	May 2015	Apr 2018				X	
101	ProBOS	Oct 2016	Sep 2018			X		
108	RESPECT	Feb 2012	May 2015					X
110	SafeCloud	Sep 2015	Aug 2018			X		
112	SAFERtec	Jan 2017	Dec 2019	X				
114	SAURON	May 2017	Apr 2019	X				
116	SCOTT	May 2017	Jun 2020	X				
118	SecIoT	Sep 2017	Aug 2018			X		
119	SERECA	Mar 2015	Feb 2018				X	
122	SHIELD	Sep 2016	Feb 2019		X			
123	SISSDEN	May 2016	Apr 2019	X				
126	SODA	Jan 2017	Dec 2019	X				
142	UNICORN	Jan 2017	Dec 2019	X				
143	VESSEDIA	Jan 2017	Dec 2019	X				
147	WITDOM	Jan 2015	Dec 2017				X	
149	SAWSOC	Jan 2014	Dec 2016					X

Table 2: "Secure systems and Technology" details.
(F) indicates projects having ended at the time of writing.

4.1.2 Verification and Assurance

# projects	Assess	Trial	Adopt	Hold	Drop
16	2	2	0	5	7

Table 3: "Verification and Assurance" overview

This area is significantly smaller in terms of population than nearly every other sector. It is also one where the majority of the projects assessed have already ended. A small number of projects have started but are still very early in their development lifecycles. As such and understanding the importance of this area, it would appear that this is an area ripe for further support, and also where there may be gaps in the future that will need filling.

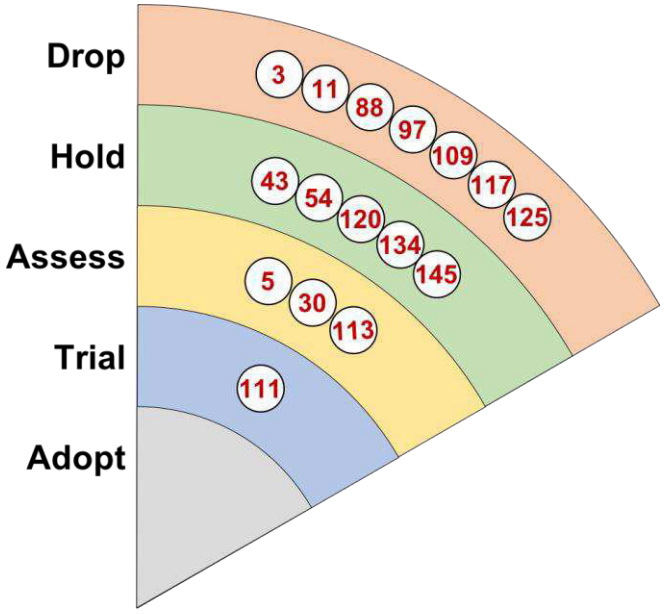

Figure 6: "Verification and Assurance" radar

#	EC Project name	Start date	End date	Assess	Trial	Adopt	Hold	Drop
3	ADDPRIV (F)	Feb 2011	Mar 2014					X
5	ANASTACIA	Jan 2017	Dec 2019	X				
11	BIOSEC (F)	Mar 2009	Feb 2012					X
30	CYBECO	May 2017	Apr 2019	X				
43	ECRYPT-CSA (F)	Mar 2015	Feb 2018				X	
54	HECTOR (F)	Mar 2015	Feb 2018				X	
88	PRECIOSA	Mar 2008	Aug 2010					X
97	PRISMS	Feb 2012	Jul 2015					X
109	REVEN-X1	Jul 2015	Dec 2015					X
111	SAFEcrypto	Jan 2015	Dec 2018		X			
113	SAINT	Mar 2017	Feb 2021	X				
117	SCR	Jul 2016	Dec 2016					X
120	SHARCS	Jan 2015	Dec 2017				X	
125	SocialPrivacy	Sep 2012	Aug 2015					X
134	SUPERCLOUD	Feb 2015	Jan 2018				X	
145	VisiOn	Jul 2015	Jun 2017				X	

Table 4: "Verification and Assurance" details.
(F) indicates projects having ended at the time of writing.

4.1.3 Operational Risk, Management and Analytics

# projects	Assess	Trial	Adopt	Hold	Drop
20	9	1	3	5	2

Table 5: "Operational Risk, Management and Analytics" overview

From the current distribution of projects within this sector we can see that there have been recent funding decisions made to support projects in this area at a much larger scale than those projects that went before in this sector. There are a small number of mature project outputs that we consider sit well within the adopt domain. There has also been previous support in this area which has come to an end, the outputs of which in the Hold domain would need careful investigation due to a no longer being actively developed due to project closure.

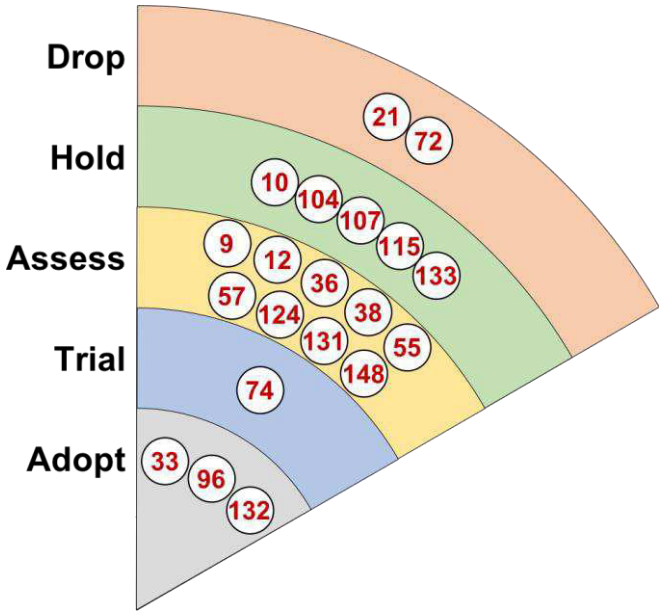

Figure 7: "Operational Risk, Management and Analytics" radar

#	EC Project name	Start date	End date	Assess	Trial	Adopt	Hold	Drop
9	ATENA	May 2016	Apr 2019	X				
10	BEACON (F)	Feb 2015	Jul 2017				X	
12	C3ISP	Oct 2016	Sep 2019	X				
21	COCKPITCI (F)	Jan 2012	Dec 2014					X
33	CYRail (F)	Oct 2016	Sep 2018			X		
36	DEFENDER	May 2017	Apr 2020	X				
38	DiSIEM	Sep 2016	Aug 2019	X				
55	HERMENEUT	May 2017	Apr 2019	X				
57	IMPACT	Feb 2015	Jan 2021	X				
72	NECOMA (F)	Jun 2013	Mar 2016					X
74	OCGN	May 2017	Nov 2018		X			
96	PRISMACLOUD	Feb 2015	Jul 2018			X		
104	RAPID	Jan 2015	Dec 2017				X	
107	REDSENTRY	Jul 2017	Dec 2017				X	
115	SCISSOR	Jan 2015	Dec 2017				X	
124	SMESEC	Jun 2017	May 2020	X				
131	STOP-IT	Jun 2017	May 2021	X				
132	STORM	Mar 2015	Aug 2018			X		
133	SUNFISH	Jan 2015	Dec 2017				X	
148	FENTEC	Jan 2018	Dec 2020	X				

Table 6: "Operational Risk, Management and Analytics" details.
(F) indicates projects having ended at the time of writing.

4.1.4 Identity, Behaviour, Ethics and Privacy

# projects	Assess	Trial	Adopt	Hold	Drop
19	6		1	7	5

Table 7: "Identity, Behaviour, Ethics and Privacy" overview

This sector is another that is significantly under populated when compared to others. It also has a large proportion of its projects either recently underway and therefore with immature outputs or that have already completed and therefore will not be developed further or have even been superseded already. From the distribution within the sector it is clear though that in the past this has been strongly supported but then left for a while and has become important again, most likely in response to the general increase in importance in personal privacy.

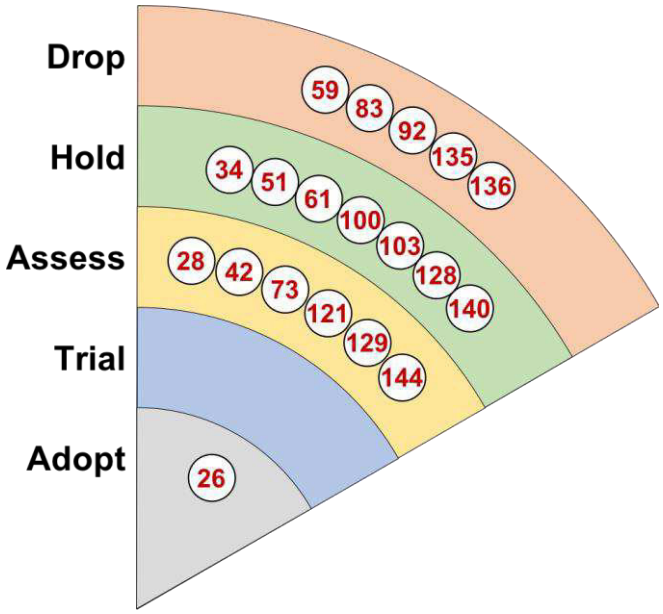

Figure 8: "Identity, Behaviour, Ethics and Privacy" radar

#	EC Project name	Start date	End date	Assess	Trial	Adopt	Hold	Drop
26	CREDENTIAL (F)	Oct 2015	Sep 2018			X		
28	CryptoCloud	Jun 2014	May 2019	X				
34	DAPPER (F)	Apr 2014	Mar 2018				X	
42	e-Sides	Jan 2017	Dec 2019	X				
51	GenoPri (F)	May 2016	Apr 2018				X	
59	LAST (F)	Oct 2009	Sep 2014					X
61	LV-Pri20 (F)	Jun 2015	Jun 2017				X	
73	NeCS	Sep 2015	Aug 2019	X				
83	PASS (F)	Dec 2008	Nov 2012					X

#	EC Project name	Start date	End date	Assess	Trial	Adopt	Hold	Drop
92	PrimeLife	Mar 2008	Jun 2011					X
100	PRIVACY4FORENSICS	Feb 2015	Mar 2018				X	
103	Ps2Share	Jan 2017	Dec 2017				X	
121	SHiELD	Jan 2017	Dec 2019	X				
128	SpeechXRays	May 2015	Apr 2018				X	
129	SPOOC	Sep 2015	Aug 2020	X				
135	SurPRISE	Feb 2012	Jan 2015					X
136	SysSec	Sep 2010	Nov 2014					X
140	TYPES	May 2015	Oct 2017				X	
144	VIRT-EU	Jan 2017	Dec 2019	X				

Table 8: "Identity, Behaviour, Ethics and Privacy" details.
(F) indicates projects having ended at the time of writing.

4.1.5 National & international Security, Privacy and Governance

# projects	Assess	Trial	Adopt	Hold	Drop
12	9			2	1

Table 9: "National & international Security, Privacy and Governance" overview

The smallest sector by far this is a domain where there is basically little or no previous work in this area with only three projects previously supported. A new set of projects have now been supported which are all very new. They are all so early in their project lifecycle that they are all only classified as being projects to assess their outputs.

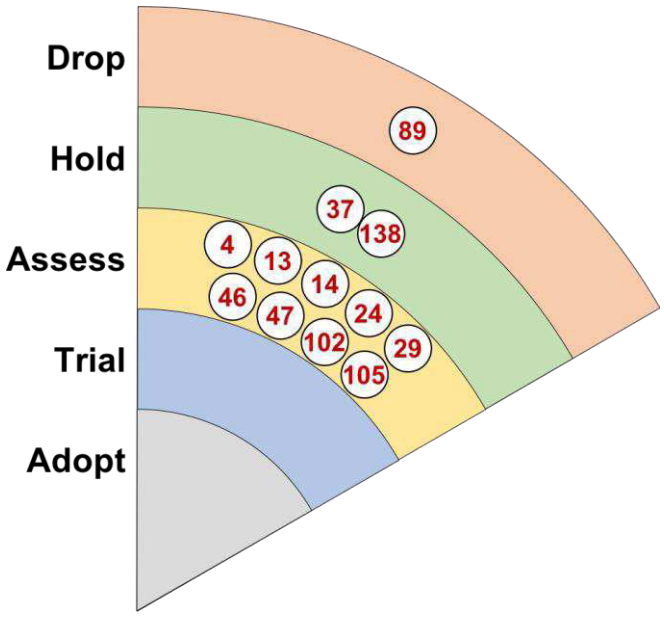

Figure 9: "National & international Security, Privacy and Governance" radar

#	EC Project name	Start date	End date	Assess	Trial	Adopt	Hold	Drop
4	AEGIS	May 2017	Apr 2019	X				
13	CANVAS	Sep 2016	Aug 2019	X				
14	certMILS	Jan 2017	Dec 2020	X				
24	COMPACT	May 2017	Oct 2019	X				
29	CS-AWARE	Sep 2017	Aug 2020	X				
37	DISCOVERY (F)	Jan 2016	Dec 2017				X	
46	EU-SEC	Jan 2017	Dec 2019	X				
47	EUNITY	Jun 2017	May 2019	X				
89	PRESCIENT	Jan 2010	Mar 2013					X
102	PROTECTIVE	Sep 2016	Aug 2019	X				
105	REASSURE	Jan 2017	Dec 2019	X				
138	TREDISEC	Apr 2015	Mar 2018				X	

Table 10: "National & international Security, Privacy and Governance" details.
(F) indicates projects having ended at the time of writing.

4.1.6 Human Aspects of Cybersecurity

# projects	Assess	Trial	Adopt	Hold	Drop
20	5	1	3	3	8

Table 11: "Human Aspects of Cybersecurity" overview

This sector has a significant percentage of projects which have ended, mostly such a long time ago that their outputs have been most likely superseded. There are a small number of projects whose outputs are mature and still supported and therefore should be adopted. As per most other sectors, there are also a reasonable number of projects that have been recently supported and therefore should be assessed to understand their current level of development as well as overall the level of support any project is able to give to those externally who may use it.

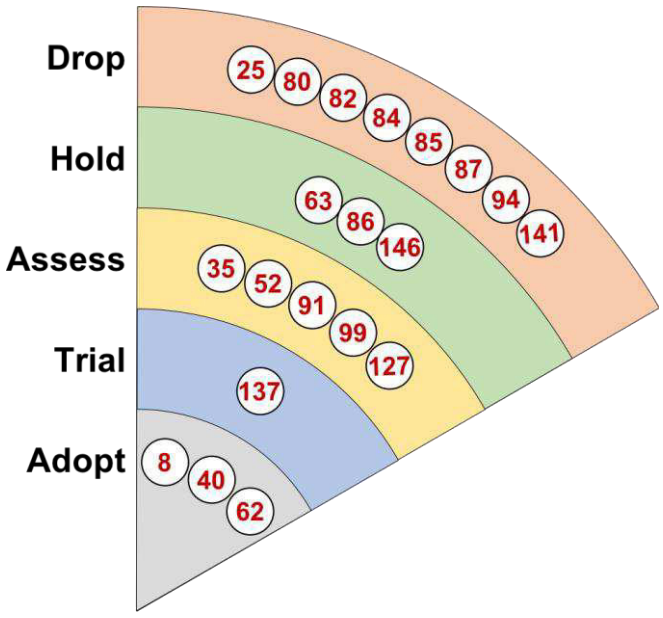

Figure 10: "Human Aspects of Cybersecurity" radar

#	EC Project name	Start date	End date	Assess	Trial	Adopt	Hold	Drop
8	ASAP (F)	Oct 2012	Sep 2018			X		
25	CONSENT (F)	May 2010	Apr 2013					X
35	DECODE	Dec 2016	Nov 2019	X				
40	DOGANA (F)	Sep 2015	Aug 2018			X		
52	GHOST	May 2017	Apr 2020	X				
62	MAMI (F)	Jan 2016	Jun 2018			X		
63	MAPPING (F)	Mar 2014	Feb 2018				X	
80	PACT (F)	Feb 2012	Jan 2015					X
82	PARIS (F)	Jan 2013	Feb 2016					X
84	PATS (F)	Aug 2009	Mar 2012					X
85	PICOS (F)	Feb 2008	Jun 2011					X
86	PQCRYPTO (F)	Mar 2015	Feb 2018				X	
87	PRACTIS (F)	Jan 2010	Mar 2013					X
91	PrEstoCloud	Jan 2017	Dec 2019	X				
94	PRISM	Mar 2008	May 2010					X
99	Privacy.Us	Dec 2015	Nov 2019	X				
127	SPECIAL	Jan 2017	Dec 2019	X				
137	TOREADOR	Jan 2016	Dec 2018		X			
141	U2PIA	Nov 2016	Mar 2017					X
146	WISER	Jun 2015	Nov 2017				X	

Table 12: "Human Aspects of Cybersecurity" details.
(F) indicates projects having ended at the time of writing.

4.2 The Autumn 2018 Technology Radar

Segment	Assess	Trial	Adopt	Hold	Drop	Total
Secure Systems and Technology	18	2	4	17	6	47
Verification and Assurance	2	2	0	5	7	16
Operational Risk, Management and Analytics	9	1	3	5	2	20
Identity, Behaviour, Ethics and Privacy	6	0	1	7	5	19
National & international Security, Privacy and Governance	9	0	0	2	1	12
Human Aspects of Cybersecurity	5	1	3	3	8	20
	49	6	11	39	29	134

Table 13: Autumn 2018 Technology Radar overview

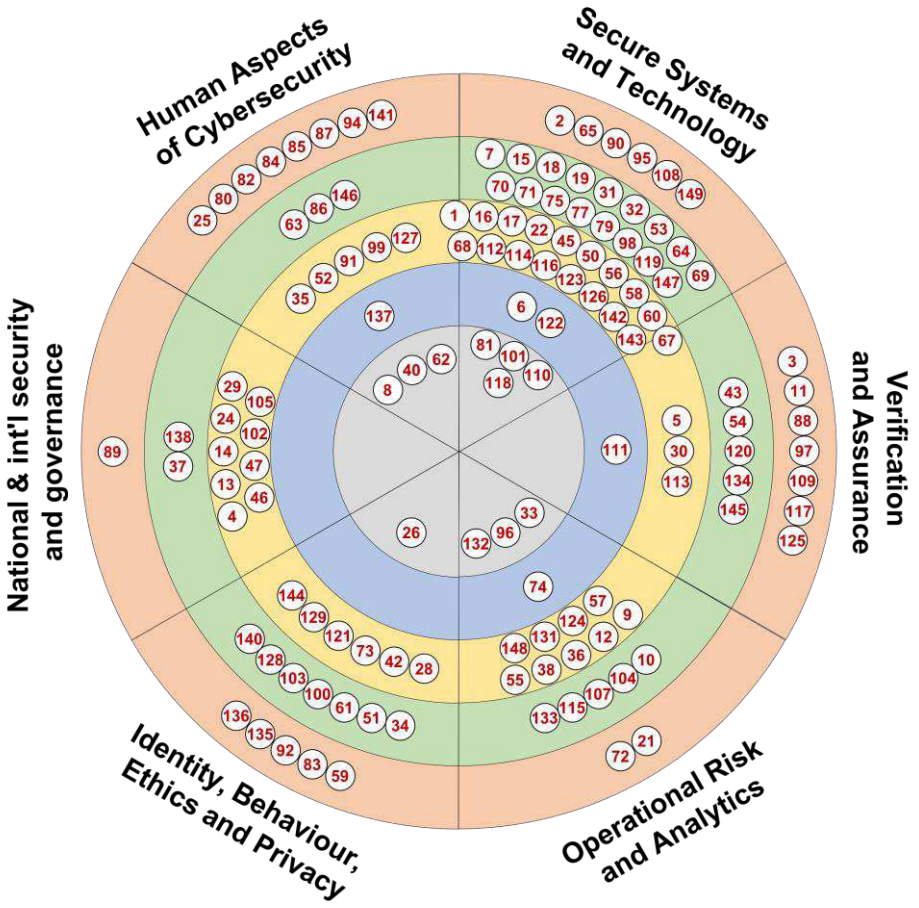

Figure 11: The Autumn 2018 Technology Radar, showing L2 taxonomy sectors, with analysed projects distributed radially into bands depending on their maturity level.

5 Commentary & next steps

Looking at the full radar it is clear that we are at a point where we have a significant growth in the number of activities that are occurring, as shown by the large number of projects that sit within Assess. It is also clear that there have been different parts of the cybersecurity research ecosystem that have been supported previously at different times, and at different levels. We would expect over the next months that we will both grow the number of products that are within the Trial and Adopt rings.

The next version of the Technology Radar report will include the utilisation of the MTRL assessment methodology described in deliverable D2.3 on these projects which will allow us to introduce a third dimension in this which is readiness for market. We will have to consider whether we represent this using the allocation to rings and colours to describe project age. Overall having a multi-dimensional visualisation where all of this is bought together will allow the community to better understand where they are and where other sit within the ecosystem.

The analysis of the 134 projects is also very important in the broader scope of the cyberwatching.eu project and in particular already introducing project results and services into the SME end-user club and marketplace. Projects categorised under Trial will be considered and contacted to provide results to the SME end-user club for potential validating and testing of results. Projects categorised under Adopt will be contacted and invited to publish their results on the actual marketplace where cyberwatching.eu can facilitate them in reaching potential adopters.

6 Appendix 1: EC funded projects reference

The following projects were included and analysed in this deliverable, in alphabetical order:

Project	Call	Type	Start	End
AARC2	EINFRA-22-2016	RIA	May 2017	Apr 2019
ABC4Trust	ICT-2009.1.4	CP	Nov 2010	Feb 2015
ADDPRIV (F)	SEC-2010.6.5-2	CP	Feb 2011	Mar 2014
AEGIS	DS-05-2016	CSA	May 2017	Apr 2019
ANASTACIA	DS-01-2016	RIA	Jan 2017	Dec 2019
ARIES	FCT-09-2015	RIA	Sep 2016	Feb 2019
ARMOUR (F)	ICT-12-2015	RIA	Feb 2016	Jan 2018
ASAP (F)	ERC-AG-PE6	ERC-AG	Oct 2012	Sep 2018
ATENA	DS-03-2015	IA	May 2016	Apr 2019
BEACON (F)	ICT-07-2014	RIA	Feb 2015	Jul 2017
BIOSEC (F)	FP7-PEOPLE-IOF-2008	MC-IOF	Mar 2009	Feb 2012
C3ISP	DS-04-2015	IA	Oct 2016	Sep 2019
CANVAS	DS-07-2015	CSA	Sep 2016	Aug 2019
certMILS	DS-01-2016	IA	Jan 2017	Dec 2020
CHOReVOLUTION (F)	ICT-09-2014	RIA	Jan 2015	Dec 2017
CIPSEC	DS-03-2015	IA	May 2016	Apr 2019
CITADEL	DS-03-2015	IA	Jun 2016	May 2019
CLARUS (F)	ICT-07-2014	RIA	Jan 2015	Dec 2017
CloudSocket (F)	ICT-07-2014	RIA	Jan 2015	Dec 2017
CloudTeams (F)	ICT-07-2014	IA	Mar 2015	Feb 2017
COCKPITCI (F)	SEC-2011.2.5-1	CP-FP	Jan 2012	Dec 2014
COEMS	ICT-10-2016	RIA	Nov 2016	Oct 2019
COLA	ICT-06-2016	IA	Jan 2017	Jun 2019
COMPACT	DS-02-2016	IA	May 2017	Oct 2019
CONSENT (F)	SSH-2009-3.2.1.	CP-FP	May 2010	Apr 2013
CREDENTIAL (F)	DS-02-2014	IA	Oct 2015	Sep 2018
CROSSMINER	ICT-10-2016	RIA	Jan 2017	Dec 2019

Project	Call	Type	Start	End
CryptoCloud	ERC-AG-PE6	ERC-AG	Jun 2014	May 2019
CS-AWARE	DS-02-2016	IA	Sep 2017	Aug 2020
CYBECO	DS-04-2016	RIA	May 2017	Apr 2019
CyberWiz (F)	DRS-17-2014	SME-2	Sep 2015	Aug 2017
CYCLONE (F)	ICT-07-2014	IA	Jan 2015	Dec 2017
CYRail (F)	S2R-OC-IP2-01-2015	Shift2Rail-RIA	Oct 2016	Sep 2018
DAPPER (F)	FP7-PEOPLE-2013-CIG	MC-CIG	Apr 2014	Mar 2018
DECODE	ICT-12-2016	RIA	Dec 2016	Nov 2019
DEFENDER	CIP-01-2016-2017	IA	May 2017	Apr 2020
DISCOVERY (F)	ICT-38-2015	CSA	Jan 2016	Dec 2017
DiSIEM	DS-04-2015	IA	Sep 2016	Aug 2019
DITAS	ICT-06-2016	RIA	Jan 2017	Dec 2019
DOGANA (F)	DS-06-2014	IA	Sep 2015	Aug 2018
DSSC	MSCA-COFUND-2016	MSCA-COFUND-DP	May 2017	Apr 2022
e-Sides	ICT-18-2016	CSA	Jan 2017	Dec 2019
ECRYPT-CSA (F)	ICT-32-2014	CSA	Mar 2015	Feb 2018
ECRYPT-NET	MSCA-ITN-2014-ETN	MSCA-ITN-ETN	Mar 2015	Feb 2019
ENCASE	MSCA-RISE-2015	MSCA-RISE	Jan 2016	Dec 2019
EU-SEC	DS-01-2016	IA	Jan 2017	Dec 2019
EUNITY	DS-05-2016	CSA	Jun 2017	May 2019
FIDELITY (F)	SEC-2011.3.4-1	CP-IP	Feb 2012	Jan 2016
FORTIKA	DS-02-2016	IA	Jun 2017	May 2020
FutureTrust	DS-05-2015	IA	Jun 2016	May 2019
GenoPri (F)	MSCA-IF-2015-EF	MSCA-IF-EF-ST - Standard EF	May 2016	Apr 2018
GHOST	DS-02-2016	IA	May 2017	Apr 2020
HEAT (F)	ICT-32-2014	RIA	Jan 2015	Dec 2017
HECTOR (F)	ICT-32-2014	RIA	Mar 2015	Feb 2018
HERMENEUT	DS-04-2016	RIA	May 2017	Apr 2019
HIPS	ERC-CG-2013-PE6	ERC-CG	Oct 2014	Sep 2019
IMPACT	ERC-2013-SyG	ERC-SyG	Feb 2015	Jan 2021

Project	Call	Type	Start	End
KONFIDO	DS-03-2016	RIA	Nov 2016	Oct 2019
LAST (F)	ERC-SG-PE6	ERC-SG - ERC Starting Grant	Oct 2009	Sep 2014
LIGHTest	DS-05-2015	IA	Sep 2016	Aug 2019
LV-Pri20 (F)	MSCA-IF-2014-EF	MSCA-IF-EF-CAR	Jun 2015	Jun 2017
MAMI (F)	ICT-12-2015	RIA	Jan 2016	Jun 2018
MAPPING (F)	SiS.2013.1.2-1	CSA-SA	Mar 2014	Feb 2018
MAS2TERING (F)	ICT-2013.6.1	CP	Sep 2014	Aug 2017
MATTHEW (F)	ICT-2013.1.5	CP	Nov 2013	Oct 2016
MELODIC	ICT-06-2016	RIA	Dec 2016	Nov 2019
mF2C	ICT-06-2016	RIA	Jan 2017	Dec 2019
MH-MD	ICT-18-2016	RIA	Nov 2016	Oct 2019
MIKELANGELO (F)	ICT-07-2014	RIA	Jan 2015	Dec 2017
MITIGATE (F)	DS-06-2014	IA	Sep 2015	Feb 2018
MUSA (F)	ICT-07-2014	RIA	Jan 2015	Dec 2017
NECOMA (F)	ICT-2013.10.1	CP	Jun 2013	Mar 2016
NeCS	MSCA-ITN-2015-ETN	MSCA-ITN-ETN	Sep 2015	Aug 2019
OCGN	MSCA-IF-2015-EF	MSCA-IF-EF-ST	May 2017	Nov 2018
OCTAVE (F)	DS-02-2014	IA	Jun 2015	Jul 2017
OPENREQ	ICT-10-2016	RIA	Jan 2017	Dec 2019
OPERANDO (F)	DS-01-2014	IA	May 2015	Apr 2018
P5 (F)	SEC-2012.2.3-1	CP-FP	Aug 2013	Oct 2016
PaaSword (F)	ICT-07-2014	RIA	Jan 2015	Dec 2017
PACT (F)	SEC-2011.6.5-2	CP-FP	Feb 2012	Jan 2015
PANORAMIX (F)	DS-01-2014	IA	Sep 2015	Aug 2018
PARIS (F)	SEC-2012.6.1-2	CP-FP	Jan 2013	Feb 2016
PASS (F)	PEOPLE-2007-4-3.IRG	MC-IRG	Dec 2008	Nov 2012
PATS (F)	SiS-2008-1.2.2.1	CSA-SA	Aug 2009	Mar 2012
PICOS (F)	ICT-2007.1.4	CP	Feb 2008	Jun 2011
PQCRYPTO (F)	ICT-32-2014	RIA	Mar 2015	Feb 2018
PRACTIS (F)	SiS-2009-1.1.2.1	CP-FP	Jan 2010	Mar 2013

Project	Call	Type	Start	End
PRECIOSA	ICT-2007.6.2	CP	Mar 2008	Aug 2010
PRESCIENT	SiS-2009-1.1.2.1	CP-FP	Jan 2010	Mar 2013
PreserviX	ICT-37-2014-1	SME-1	May 2015	Oct 2015
PrEstoCloud	ICT-06-2016	RIA	Jan 2017	Dec 2019
PrimeLife	ICT-2007.1.4	CP	Mar 2008	Jun 2011
PRIPARE	ICT-2013.1.5	CSA	Oct 2013	Sep 2015
PRISM	ICT-2007.1.4	CP	Mar 2008	May 2010
PRISM CODE	FP7-PEOPLE-2012-CIG	MC-CIG	Nov 2012	Oct 2016
PRISMACLOUD	ICT-32-2014	RIA	Feb 2015	Jul 2018
PRISMS	SEC-2011.6.5-2	CP-FP	Feb 2012	Jul 2015
PRIVACY FLAG	DS-01-2014	IA	May 2015	Apr 2018
Privacy.Us	MSCA-ITN-2015-ETN	MSCA-ITN-ETN	Dec 2015	Nov 2019
PRIVACY4FORENSICS	FP7-PEOPLE-2013-IIF	MC-IIF	Feb 2015	Mar 2018
ProBOS	SMEInst-13-2016-2017	SME-2	Oct 2016	Sep 2018
PROTECTIVE	DS-04-2015	IA	Sep 2016	Aug 2019
Ps2Share	ICT-35-2016	RIA	Jan 2017	Dec 2017
RAPID	ICT-07-2014	RIA	Jan 2015	Dec 2017
REASSURE	DS-01-2016	RIA	Jan 2017	Dec 2019
ReCRED	DS-02-2014	IA	May 2015	Apr 2018
REDSENTRY	H2020-SMEINST-1-2016-2017	SME-1	Jul 2017	Dec 2017
RESPECT	SEC-2011.6.1-5	CP-FP	Feb 2012	May 2015
REVEN-X1	ICT-37-2015-1	SME-1	Jul 2015	Dec 2015
SafeCloud	DS-01-2014	IA	Sep 2015	Aug 2018
SAFEcrypto	ICT-32-2014	RIA	Jan 2015	Dec 2018
SAFERtec	DS-01-2016	RIA	Jan 2017	Dec 2019
SAINT	DS-04-2016	RIA	Mar 2017	Feb 2021
SAURON	CIP-01-2016-2017	IA	May 2017	Apr 2019
SCISSOR	ICT-32-2014	RIA	Jan 2015	Dec 2017
SCOTT	ECSEL-2016-2-IA-two-stage	IA	May 2017	Jun 2020

Project	Call	Type	Start	End
SCR	SMEInst-13-2016-2017	SME-1	Jul 2016	Dec 2016
SecIoT	INNOSUP-02-2016	CSA	Sep 2017	Aug 2018
SERECA	ICT-07-2014	RIA	Mar 2015	Feb 2018
SHARCS	ICT-32-2014	RIA	Jan 2015	Dec 2017
SHiELD	DS-03-2016	RIA	Jan 2017	Dec 2019
SHIELD	DS-04-2015	IA	Sep 2016	Feb 2019
SISSDEN	DS-04-2015	IA	May 2016	Apr 2019
SMESEC	DS-02-2016	IA	Jun 2017	May 2020
SocialPrivacy	FP7-PEOPLE-2011-IOF	MC-IOF	Sep 2012	Aug 2015
SODA	ICT-18-2016	RIA	Jan 2017	Dec 2019
SPECIAL	ICT-18-2016	RIA	Jan 2017	Dec 2019
SpeechXRays	DS-02-2014	IA	May 2015	Apr 2018
SPOOC	ERC-CoG-2014	ERC-COG	Sep 2015	Aug 2020
STAMP	ICT-10-2016	RIA	Dec 2016	Nov 2019
STOP-IT	CIP-01-2016-2017	IA	Jun 2017	May 2021
STORM	EE-13-2014	RIA	Mar 2015	Aug 2018
SUNFISH	ICT-07-2014	RIA	Jan 2015	Dec 2017
SUPERCLOUD	ICT-07-2014	RIA	Feb 2015	Jan 2018
SurPRISE	SEC-2011.6.5-2	CP-FP	Feb 2012	Jan 2015
SysSec	ICT-2009.1.4	NoE	Sep 2010	Nov 2014
TOREADOR	ICT-16-2015	RIA	Jan 2016	Dec 2018
TREDISEC	ICT-32-2014	RIA	Apr 2015	Mar 2018
TRUESSEC.EU	DS-01-2016	CSA	Jan 2017	Dec 2018
TYPES	DS-01-2014	IA	May 2015	Oct 2017
U2PIA	SMEInst-13-2016-2017	SME-1	Nov 2016	Mar 2017
UNICORN	ICT-06-2016	IA	Jan 2017	Dec 2019
VESSEDIA	DS-01-2016	RIA	Jan 2017	Dec 2019
VIRT-EU	ICT-35-2016	RIA	Jan 2017	Dec 2019
VisiOn	DS-01-2014		Jul 2015	Jun 2017
WISER	DS-06-2014	IA	Jun 2015	Nov 2017

Project	Call	Type	Start	End
WITDOM	ICT-32-2014	RIA	Jan 2015	Dec 2017
FENTEC	H2020-DS-LEIT-2017	RIA	Jan 2018	Dec 2020
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