



D7.4 Dissemination and Communication Report III

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

Executive summary

This report summarizes the communication and dissemination activities performed under SONATA WP7 during the last six months of the SONATA project, from the 1st July 2017 to the 31st December 2017.

The report starts with the presentation of the communication and dissemination plan designed and agreed by the consortium at the beginning of this period. This plan, defined channel by channel, also includes the analysis of the performance of each of these channels during the previous year. This analysis was done at the beginning of this last period in order to identify potential weaknesses and strengths and adjust the Y3 plan.

We then detail how the plan was executed by the consortium and the main results and achievements during this period.

Before finishing with conclusions, the comparison of these results with the KPIs that the project committed to reach according to the document of work, provide a clear indication about the success of SONATA's communication and dissemination plan, not just during this last six months but during the whole life time of the project.

We compare our results with the KPIs that the project committed to reach according to the description of work, which indicates the success of SONATA's communication and dissemination, not just during this last six months but during the whole life time of the project.

As some of the project's main and concrete successes in relation to communication and dissemination we can highlight our contribution to OSM RELEASE 3, which incorporates SONATA's emulator with our service validation tool planned for inclusion in the next release; the Best Demo Paper Award received at the IEEE NetSoft 2017; our high involvement in relation to 5G PPP collaboration, with one of our pilots integrating results from two different projects; or our leadership in the Software Networks WG.

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1. Introduction

1.1 Deliverable purpose

This report summarizes the communication and dissemination activities performed under SONATA WP7 during the last six months of the SONATA project, from the 1st July 2017 to the 31st December 2017.

1.2 Document organization

The deliverable is organized in the following manner:

- Section 1 (this section) is an introduction to the deliverable.
- Section 2 presents the SONATA's communication and dissemination plan drafted by the consortium at the beginning of this last period.
- Section 3 provides information about how the communication and dissemination plan described in section 2 has been executed during the last six months of life of the project. Detailed information is provided channel by channel.
- Section 4 is a scores table of all the KPIs defined for SONATA related to communication and dissemination.
- Section 5 provides conclusions.

1.3 List of acronyms

Acronym	Definition
3G	"3rd Generation" Networks
3GPP	3G Partnership Project
5G	"5th Generation" Networks
5G PPP	The 5G Infrastructure Public Private Partnership
ANIMA	Autonomic Networking Integrated Model and Approach
API	Application Programming Interface
CDN	Content Delivery Network
DevOps	Development & Operations
DoW	Description of Work
DX.Y	Deliverable #.# (e.g. D7.1)
EC	European Commission
ETSI	European Telecommunications Standards Institute
EUCNC	European Conference on Networks and Communications
EVE	Evolution and Ecosystem
FIC	Cape Verde International Fair
ICIN	Innovations in Cloud, Internet and Networks

ICT	Information and Communication Technologies
IEEE	Institute of Electrical and Electronics Engineers
IETF	Internet Engineering Task Force
IFA	Interfaces and Architecture
IFIP	International Federation for Information Processing
IM	Integrated Network Management
IoT	Internet of Things
IRTF	Internet Research Task Force
ISG	Industry Specification Group
ITP	Institute of Telecommunications Professionals
ITU	International Telecommunication Union
ITU-T	ITU Telecommunication Standardization Sector
ITU-T IMT2020	ITU-T International Mobile Telecommunication system for 2020 and beyond
JSAC	IEEE Journal on Selected Areas in Communications
KPI	Key Performance Indicator
MX	Month # (e.g. M2)
MANO	Management and Orchestration
MEC	Mobile Edge Computing
MEF	Metro Ethernet Forum
NetSoft	Network Softwarisation
NFV	Network Function Virtualisation
NFVRG	Network Function Virtualization Research Group
NGP	Next Generation Protocols
NS	Network Service
NSD	Network Service Descriptor
NoF	Network of the Future
NOMS	Network Operations and Management Symposium
OS	Open Source
OSG	Open Source Group
OSM	Open Source MANO
OSS	Operations Support System
PoP	Point of Presence
PoC	Proof of Concept
PPP	Public Private Partnership

QX	Quarter # (e.g. Q2)
R&D	Research and Development
R&I	Research and Innovation
REL	Reliability
RG	Research Group
SDK	Service Development Kit
SDN	Software-Defined Networks
SDO	Standards Development Organization
SEC	Security
SG	Study Group
SEO	Search Engine Optimisation
SOFTNETWORKING	Software Defined Networking and Network Functions Virtualization
TMF	TM Forum
TNSM	Transactions on Network and Service Management
ToR	Terms of Reference
TST	TeSTing, experimentation and open source
VIM	Virtual Infrastructure Manager
VNF	Virtual Network Function
WG	Working Group
WPX	Work Package # (e.g. WP5)
YX	Year # (e.g. Y2)
ZSM	Zero-touch Service Management
ZTNSM	Zero-Touch Network Service Management

Table 1: List of Acronyms

2. Y3 SONATA communication and dissemination plan

SONATA's communication and dissemination plan for Y3 was defined during the first months of this period and agreed upon by all partners at the plenary meeting that took place from the 19th to the 21st of September in Ghent (Belgium).

The first step was to analyse the performance of the project in relation to communication and dissemination activities during the previous year. The main goal was to identify potential areas that might require more focus during these last six months of the project, according to the results achieved in Y2.

Taking into account the conclusions of this analysis and also the activities and the KPIs that we had previously committed to, we defined our general marketing strategy for year three that

was executed by all partners with very little deviations, most of them justified and always made in order to increase the impact of the project.

2.1 Y2 performance analysis

Year two was an intensive and successful year for SONATA from the point of view of communication and dissemination.

A thorough communication and dissemination plan was defined and approved by all partners at the beginning of the period, aimed at ensuring wide impact of the SONATA outcomes in the most relevant communities.

The execution of the plan was also brilliant. The presence of the project on the Internet and social media channels was impressive in year two, as well as the participation of partner members in events and conferences. The intense project activity in relation to publications, our main communication/dissemination channel in Y1, was not just repeated but improved in Y2. The strong involvement of some of the SONATA partners in open source activities, in standardisation bodies and in 5G PPP collaboration was also a key point to create significant and targeted impact related to the SONATA technical topics.

The comparison of the Y2 results with the activities and the KPIs the consortium committed to reach at the beginning of the project, gave a clear idea of the success of the defined communication and dissemination plan. For more information, we encourage the reader to have a look at SONATA deliverable *D7.3 Dissemination and Communication Report II* [1]. We provide below a summary of the performance for each of the main channels for the reader's benefit though.

2.1.1 Website

The project website [2] always held a major role in the SONATA dissemination and communication plan.

In Y2, the structure of the page was fully renovated, the use of the blog and the news section was highly improved, and fresh and valuable content was constantly provided. The statistics for year two show the effectiveness of the activities carried out during the period:

- More than 7,000 sessions (141% of the expected ones during the lifetime of the project), with average session duration of over three and a half minutes and almost 4 pages per session
- Over 4,000 users
- More than 27, 000 page views
- Growth of more than 386% in the number of page views, 262% in the number of sessions, and 239% in the number of users, compared to Y1

2.1.2 Partners websites

11 out of the 15 partners that constitute the consortium presented and executed a plan to disseminate the project results using their organisational channels.

2.1.3 Social media

In year two, the project improved its presence on social media platforms in terms of number of channels (with presence in Twitter, LinkedIn, YouTube and Research gate now, the last three opened in year two), but also in proactivity and quality of the content provided.

Twitter was the star with almost 7,000 profile visits, more than 79,000 impressions, 475 tweets published, 229 followers and a contribution of more than 50% to the traffic generated to the project website through social media acquisition channels.

2.1.4 Newsletter

The project newsletter was launched in year two with two issues published to announce the software releases.

2.1.5 Supporting materials

A project brochure (a triptych) was created in Y2. 2,000 units were printed and it is also available on-line.

2.1.6 Publications

If good in year one, the project activity regarding publications in year two was even better, surpassing initial expectations.

2.1.7 Events

The project achieved the objective of keeping the previous year's rhythm regarding events, with the participation in a total of 15 events/workshops, more than in Y1. Events to highlight were SDN World Congress 2016, Softnetworking 2017 and EuCNC 2017.

Since the beginning of Y2, the project performed a total of five software demonstrations in different venues.

2.1.8 Collaboration

2.1.7.1 Standards bodies organizations

As planned at the beginning of year two, the project contributed to the set of identified target bodies (ETSI NFV, IETF and ITU-T) while monitoring others (MEF, TMF and 3GPP) for potential opportunities.

2.1.7.2 Open Source communities

The project activity in relation to open source communities was important mainly because of its high engagement with one of the most relevant open source communities for the project: OSM.

2.1.7.3 5G PPP collaboration

➤ **5G PPP Working Groups (WG)**

SONATA had an active participation in four 5G PPP WGs:

- Software Networks

- Architecture
- Security
- Network Management

➤ **5G PPP Projects**

We identified four projects addressing goals aligned with SONATA's and started collaborations with them. Those projects were: 5G Exchange, VirtuWind, Selfnet and Charisma.

2.1.9 Other press and media channels

The consortium published two press releases, each of them corresponding to the delivery of one of the project's major software releases in M13 and M20.

Our proactive content marketing strategy has also facilitated the promotion and spread of the project results in other press and media channels such as Mirantis or Topical blog, for example.

All SONATA communication activity was also echoed by the 5G PPP through their main communication and dissemination channels, namely its website, its LinkedIn group and its Twitter account.

2.2 Y3 Action plan

Taking into consideration the diagnostic of the situation, our goals, our target market and the activities and KPIs we committed to achieve at the beginning of the project, the consortium decided to follow the action plan that is detailed per channel in the following sections.

2.2.1 Website

Both the current website [2] structure and the content had the desired quality and performance. No major upgrades were required, we only needed to keep feeding it with new and fresh content as we successfully did during the previous year. We planned to do this mainly through:

- Announcing blog posts, news, deliverables, project presentations, publications, etc.
- The "Software" section, with information regarding new releases, technical documentation, guides of installation, demonstrations, etc.

2.2.1.1 Blog

The partners' commitment in year two in relation to the blog [3] was great and the results were excellent. We only needed to keep executing the time plan previously agreed upon and shown in Figure 1:

Year 3	July 2017 SYNELIXIS THALES	August 2017 NEC	September 2017 UCL ubiwhere <small>SUITE THE FUTURE</small>	October 2017 <i>Telefonica</i>
	November 2017 Atos	December 2017 BT		

Figure 1: SONATA Blog Post Calendar for Y3

2.2.1.2 News

The same happened with the website's "News" section [4]. We all agreed on keeping the same strategy as in year two, reflecting events regarding the following list in the news section:

- Deliverables
- Software releases
- Blog posts
- Newsletters
- New videos in our YouTube Channel
- Project publications
- Project presentations
- Participation in events, meetings, workshops, etc.
- Project meetings
- Website updates (mainly related to new software releases)
- Any other topic of interest for our audience

2.2.2 Partners websites

All partners had committed to update their individual plans in relation to the dissemination of SONATA's results using their own organisations' channels. Partners that did not contribute much in this sense in the previous year were encouraged to do it during the last months of the project when the results are more solid and "saleable". The goal was clear, to achieve the KPIs shown in Figure 2:

Project updates on partners' websites: <ul style="list-style-type: none"> • ≈15 (all) partners posting to company related portal • ≥ 2 post/partner
--

Figure 2: KPI related to SONATA promotion by partner

2.2.3 Social media

We all agreed that no new social media channels were required. In year three, we planned to keep the use we made of them in year two and provide the kind of content that our audience demanded according to the statistics extracted: the one directly generated by the project.

As in year two, the channels and their suggested use were the items shown in Table 2:

Channel	Use purpose	Frequency of use
Twitter [5]	<ul style="list-style-type: none"> • Content Marketing (own and third-parties content) • Project news 	2-3 posts/working day
LinkedIn [6]	<ul style="list-style-type: none"> • Blog posts • Deliverables • Publications • Project presentations • Software release announcements • Participation in events 	On demand
ResearchGate [7]	<ul style="list-style-type: none"> • Blog posts • Deliverables • Publications • Project presentations • Software release announcements • Participation in events 	On demand
YouTube [8]	<ul style="list-style-type: none"> • Video marketing • Project videos collection: <ul style="list-style-type: none"> ▪ Installation videos ▪ Demos ▪ Tutorials ▪ Presentation in events ▪ Etc. 	On demand

Table 2: SONATA's social media channels and use

2.2.4 Newsletter

The consortium agreed to keep the newsletters channel [9] for making important announcements of the project, for example, the delivery of new software releases.

This was the initial calendar proposed:

- M25: Year two summary
- M26: Final qualified version announcement
- M30: Year three summary
- Any other exceptional event that might happen

2.2.5 Supporting materials

Pilots and demonstrations of the project results were the main focus during the remaining months of the project. In relation to marketing material, the most interesting thing to do was then to create supporting material for each of the events where the consortium was planning a demonstration. Additionally, the nice project triptych created in year two was planned to be distributed in all those events.



Figure 3: Picture taken at the NOF (Network of the Future) event in London

2.2.6 Publications

As mentioned earlier, publications were one of the main channels used by the consortium to disseminate the project results during its first two years of life. The consortium activity here was intense, so our goal for these last months of the project was to keep this track and continue with the job started in Y1.

2.2.7 Events/demos

Together with publications, participation in different events was a channel that the consortium used the most in the previous years, with presence in a total of 23 events, more than expected for the whole life of the project. The goal for this period was to keep this good performance, now focusing our participation on demonstrations of the project results, pilots, and more practical developers-oriented sessions, with the “final” release of SONATA platform almost available.

2.2.8 Collaboration

Collaboration with standards bodies, open source communities and other 5G PPP projects were some of the basic pillars of the project’s impact strategy. The plan defined to promote that collaboration was drafted as follows.

[2.2.8.1 Standards organisations](#)

Given the nature of standardization activities, the planned contributions to standardization bodies during these last months followed the same guidelines as the ones identified when the project started. We had to make a few small adjustments to these guidelines to take the changes in the target SDO landscape into account. The main target bodies we planned to consider were ETSI NFV, IETF and ITU-T, but we also needed to monitor others just in case of potential opportunities.

[2.2.8.2 Open source communities](#)

At this stage of the project, our collaboration strategy was focused mainly on OSM, due to the synergies with SONATA and the relationship established, especially during the previous year.

[2.2.8.3 5G PPP Collaboration](#)

- **5G PPP Working Groups:** In year three, SONATA planned to keep its active collaboration in the Software Networks, Architecture, Security and Network Management WGs as in year two.
- **5G PPP Projects:** During the last months of life of the project, we planned to improve collaboration with 5G Exchange, Selfnet, VirtuWind and Charisma. In addition, we planned to open discussions with some new phase II projects in order to promote and encourage the re-use of SONATA results.

2.2.9 Other press and media channels

As planned in year two, the consortium was committed to create a press release for the announcement of the delivery of the final release in M26, according to the DoW. As this meant to launch a marketing campaign in July/August, we decided to postpone this action until September/October, after the summer break, so the impact of the action could be maximized.

As in the previous year, all project's announcements/outcomes/publications were planned to be also echoed using all the existing channels provided by the 5G PPP.

Our content marketing strategy would also facilitate the promotion and spread of the project results in other press and media channels as in year two.

2.3 Control mechanisms

The table of KPIs (Table 3) for each of the outreach activities on which we had also based our communication and dissemination plan was again the anchor to determine the progress of our plan in year three. As in year two, in each of the plenary meetings, we intended to hold a session to analyse our communication/dissemination performance in relation to the KPI table. During the session, and based on the analysis, we would agree upon and adopt the appropriate corrective measures when required.

Outreach Activity	KPIs
Web Campaign	
Project Website	≥ 5000 visits
Social Media Campaign	≥ 2 social media channels used regularly, including Twitter and LinkedIn
Project updates on partners' websites	= 15 (all) partners posting to company related portal ≥ 2 posts/partner
Press and Media Channels	
External Media Channels	≥ 5 external media channels covering the telecom sector
Project Press Release	≥ 100 downloads via website ≥ 5 external media covered
Online publishing, blogs, online magazines and newspapers	≥ 20 publications
Project Newsletters	≥ 100 recipients per 2 issues each period ≥ 50 people reported back/asked
Demonstrations	
Demonstrations	≥ 10 demonstrations online and face to face ≥ 50 organisations
Tutorials and developer advocacy	≥ 10 sessions ≥ 100 attendees
Events, Workshops and Conferences	
Presentations	≥ 10 presentations and ≥ 50 organisations
Organization and/or attendance to conferences/workshops/events	≥ 8 events ≥ 300 participants
Publications	
Open Access publications	≥ 10 publications
Reports and other Documents (public)	≥ 20 public documents (including deliverables)
Whitepapers	≥ 2 whitepapers
Collaboration	
Contribution to Standards	≥ 2 working groups – active collaboration
Involvement in Open Source communities	≥ 2 communities (OpenStack, OpenNVF, etc)
Organization of 5G PPP cluster activities with other projects	≥ 4 projects
Material (Online and Printed)	
Project Flyer, Booklet, Poster, etc.	≥ 1000 recipients (online +printed) ≥ 10 events distributed ≥ 2 posters, multiple events

Table 3: Communication activities and KPIs

3. Y3 communication and dissemination plan execution and results

This section is devoted to showing how the consortium executed the communication and dissemination plan defined at the beginning of the period and presented in section 2. Here we detail the main results and achievements of the project during the last six months, channel by channel, including statistics wherever possible.

3.1 Website

3.1.1 Upgrades

In this section, we describe the main activity performed in Y3 in relation to the SONATA's website:

JULY 2017

- 1) Announcement using the carousel on the homepage of the website: IEEE NetSoft best demo award 2017 for SONATA's demonstration "A Flexible Multi-PoP Infrastructure Emulator for carrier grade MANO systems" (Figure 4).

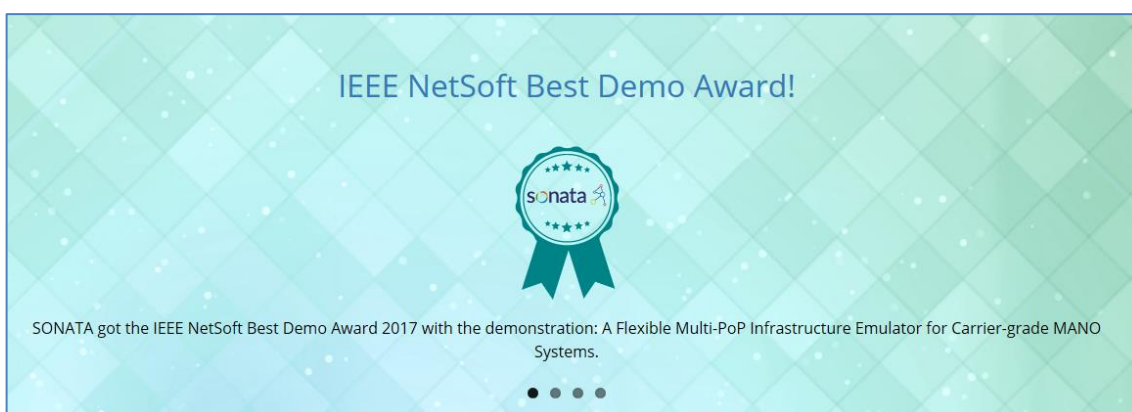


Figure 4: Home page carousel - IEEE NetSoft best demo award 2017

SEPTEMBER 2017

- 2) New video on the SONATA's website homepage with information on preliminary achievements and next steps of the project (Figure 5).



Figure 5: Video shot from EUCNC2017

- 3) SONATA 3.0 release announcements using the carousel on the homepage of the SONATA webpage (Figures 6 and 7).

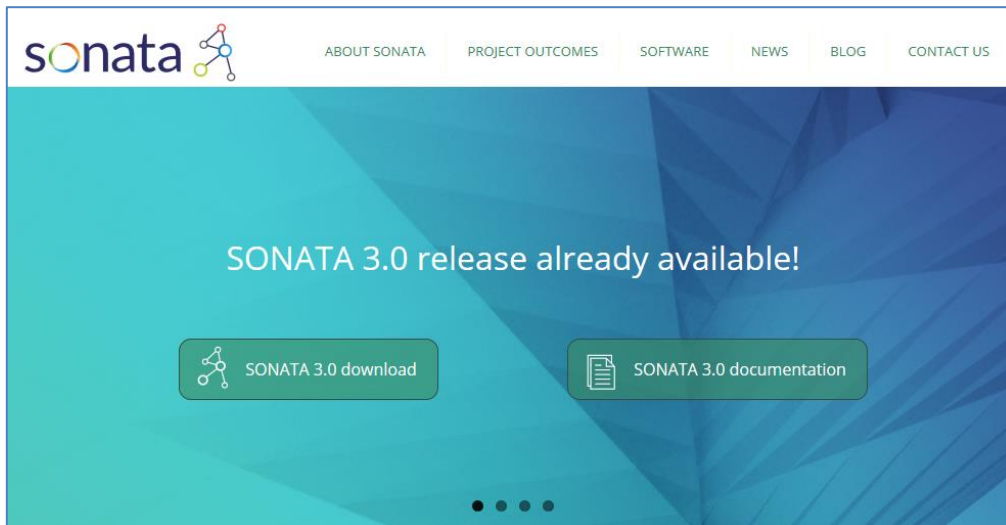


Figure 6: Home page carousel – SONATA 3.0 release



Figure 7: Home page carousel – SONATA 3.0 release II

- 4) New structure for the “Software” section (Figure 8).

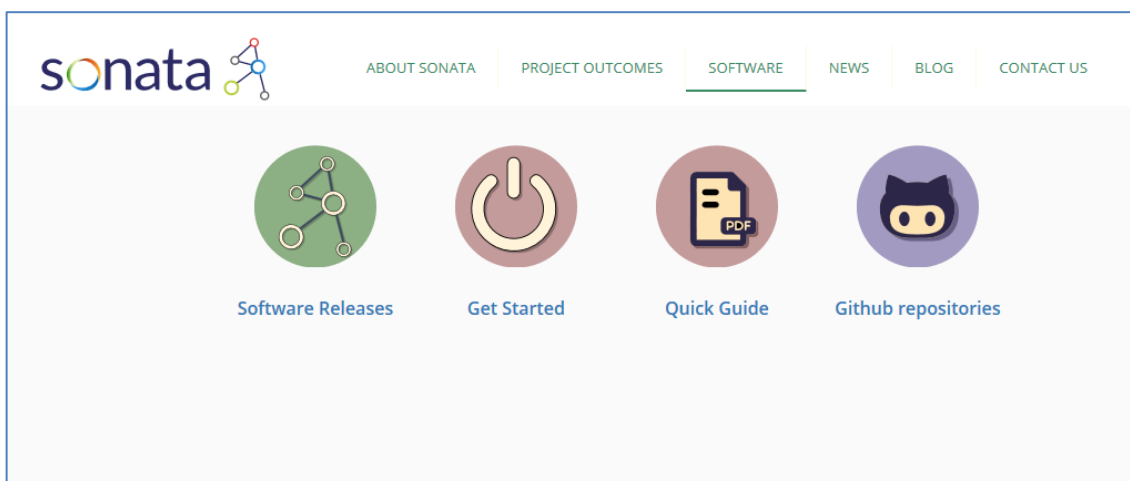


Figure 8: Software section new look&feel

- 5) Updated information about SONATA software releases (Figure 9).

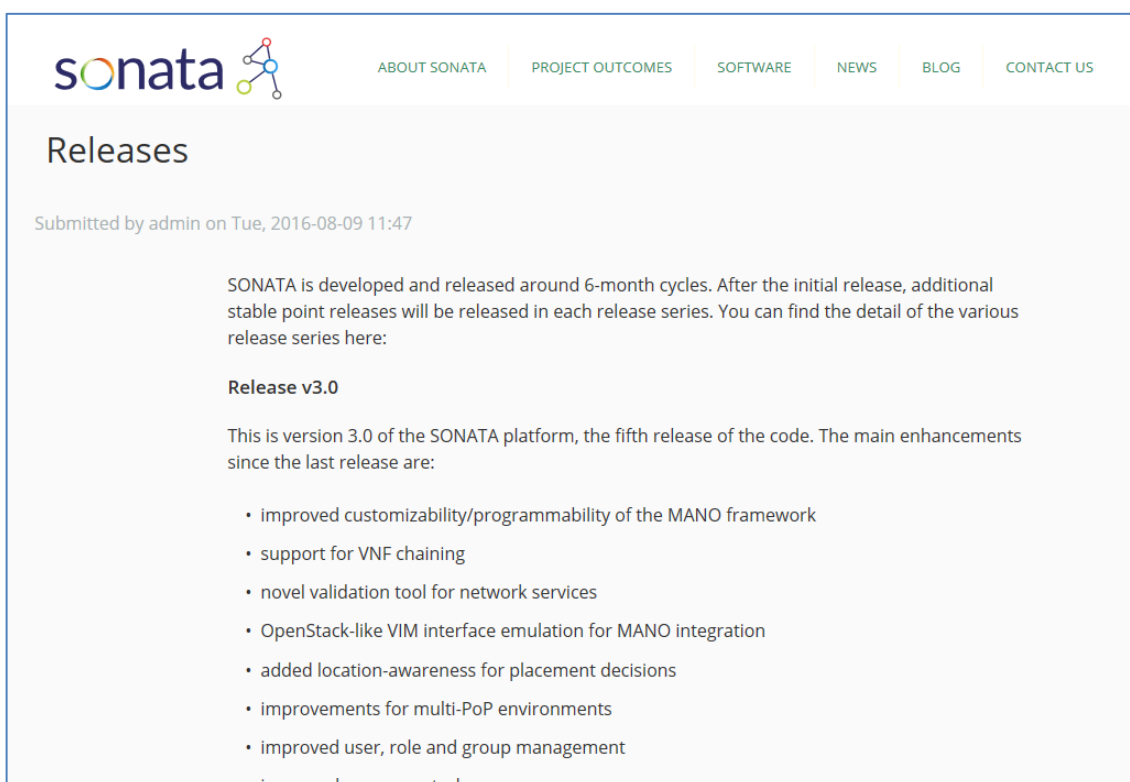


Figure 9: Software releases information on the web page

- 6) Link to the SONATA 3.0 quick guide (Figure 10).

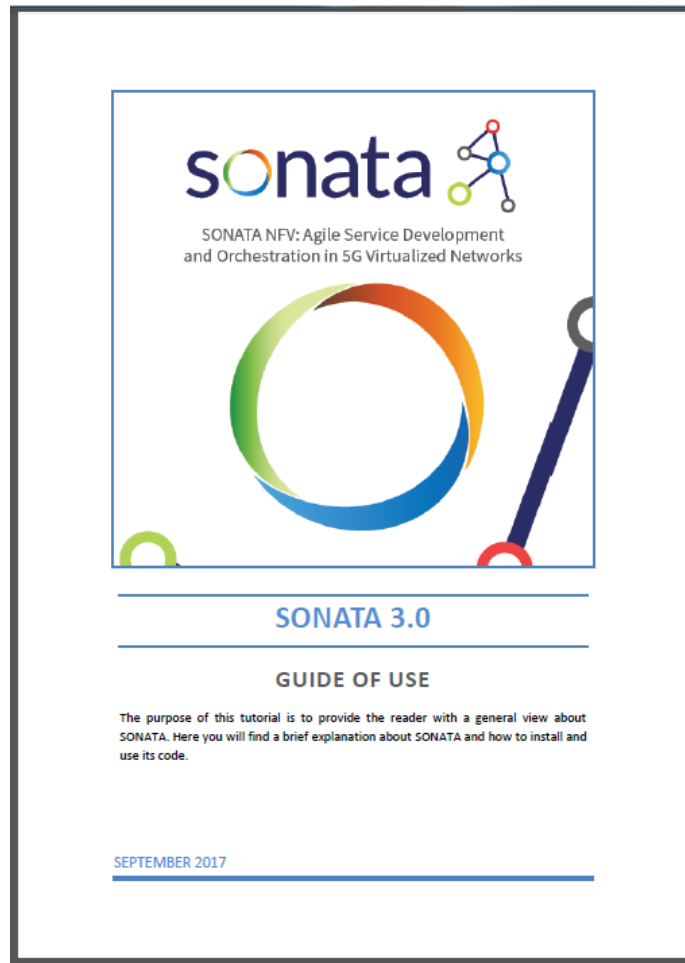


Figure 10: SONATA 3.0 Guide of use

- 7) Link to the GitHub landing page specially created for release SONATA 3.0 to facilitate its use and uptake (Figure 11).

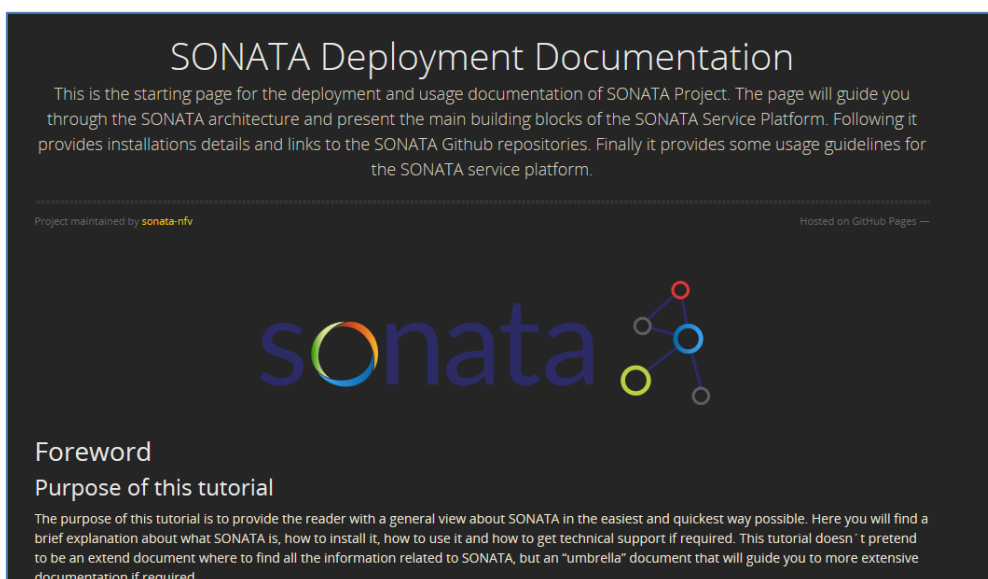


Figure 11: SONATA 3.0 GitHub landing page

OCTOBER 2017

- 8) Announcement of SONATA's participation at the SDN NFV World Congress (Figure 12).



Figure 12: Home page carousel – SONATA at the SDN NFV World Congress

- 9) Announcement of SONATA's agenda for the Berlin 5G Week (Figure 13).



Figure 13: Home page carousel – SONATA agenda for the Berlin 5G Week

NOVEMBER 2017

- 10) Announcement of SONATA's participation at the Cape Verde International Fair (Figure 14).



Figure 14: Home page carousel – SONATA at the FIC2017

DECEMBER 2017

- 11) At the time of this report is being written, the consortium is working on the creation of a new section on the SONATA website to provide information about the pilots implemented by the project. This section complements the existing information related to the use cases from which requirements were extracted at the beginning of the project.

3.1.2 News section

As indicated in our Communication and Dissemination Plan, one of our purposes for year three was to keep the activity initiated in year two to make the best use possible of the “News” section of the project website (Figure 15).

During this last 6-month period, we have published 29 news posts, resulting in a total of 76 during the lifetime of the project.

To read the news published by the project, please visit the project news posts section [4].

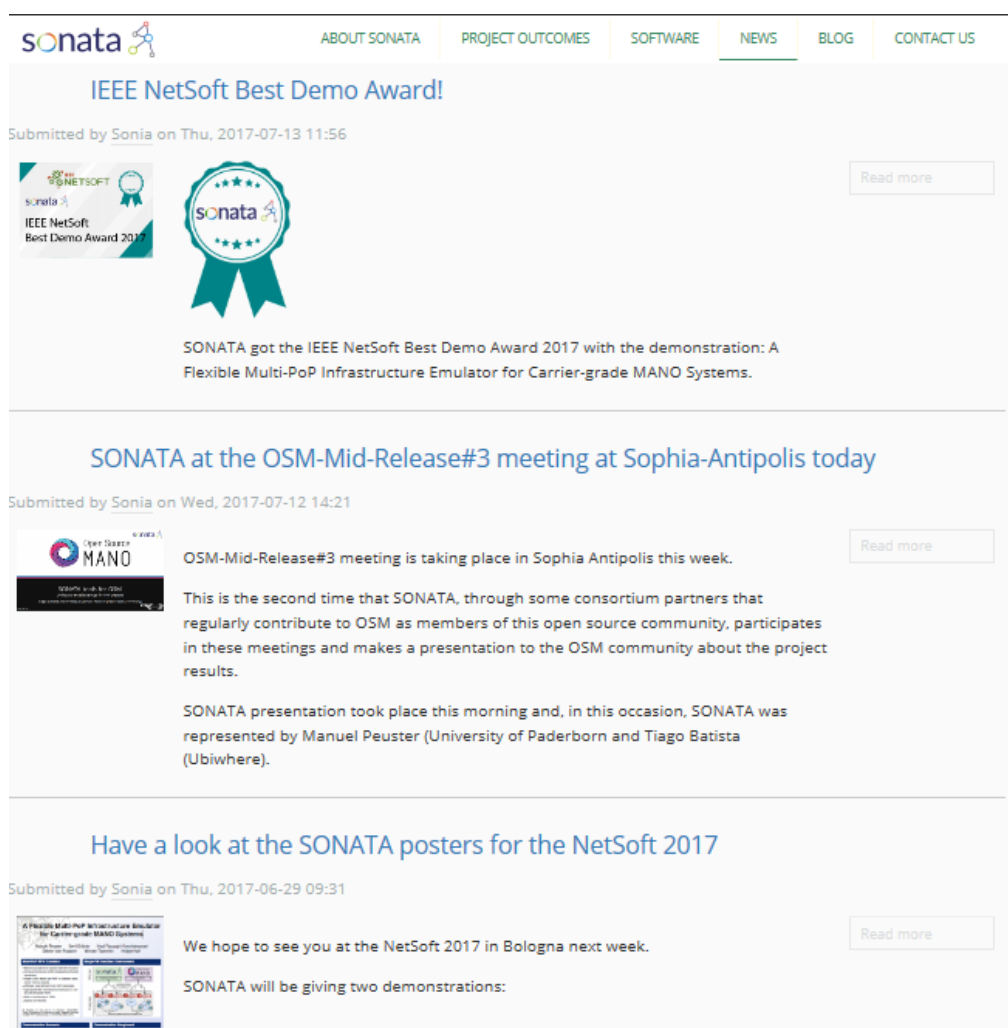


Figure 15: SONATA website news section

3.1.3 Blog

In line with our plans, these are the blog posts published by the project during the third year of the project:

July 2017



Addressing Network and Service Monitoring Challenges in the 5G Landscape

By Synelixis

Network Service Adaptation

By Thales

August 2017



SONATA Self-Service

By NEC

September 2017



Network Service Validation in SONATA

By Ubiwhere

October 2017



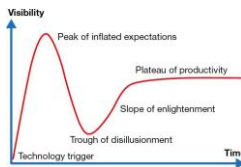
5G Service Platform to Service Platform Interworking

By University College of London

Zero-Touch Network Service Management (ZTNSM)

By Telefonica

November 2017



Today's Software Networks Challenge

By Atos

December 2017



SONATA and OSM, an Example of Cooperation Among Open Source Projects

By BT

To read the content of these blog posts, we encourage the reader to visit our blog [3].

3.1.4 Other publications on the website

News and blog posts have not been the only content provided by the project using the SONATA's website. We detail below all the documents uploaded to the project's website during these last six months:

- Deliverables: 4 (all public reports corresponding to this period, all marked with the tag "To be approved by the European Commission")
- Presentations: 7
- Press releases: 1
- Newsletters: 2
- Marketing material: 3 demonstration posters

3.1.5 Website statistics

In this section, we provide some of the main metrics related to the performance of the project website during year three and its comparison with the previous ones. Note: Statistics were collected on December 14, 2017.

General overview

As shown in Figure 16, during the time period of July 1, 2017 to December 14, 2017, we have seen:

- 4,107 sessions, with average session duration of 3:03 minutes, and 3.07 pages per session.
- 2,543 users, of which 59.7% are new visitors, and 40.3% returning visitors.
- 12,589 page views.

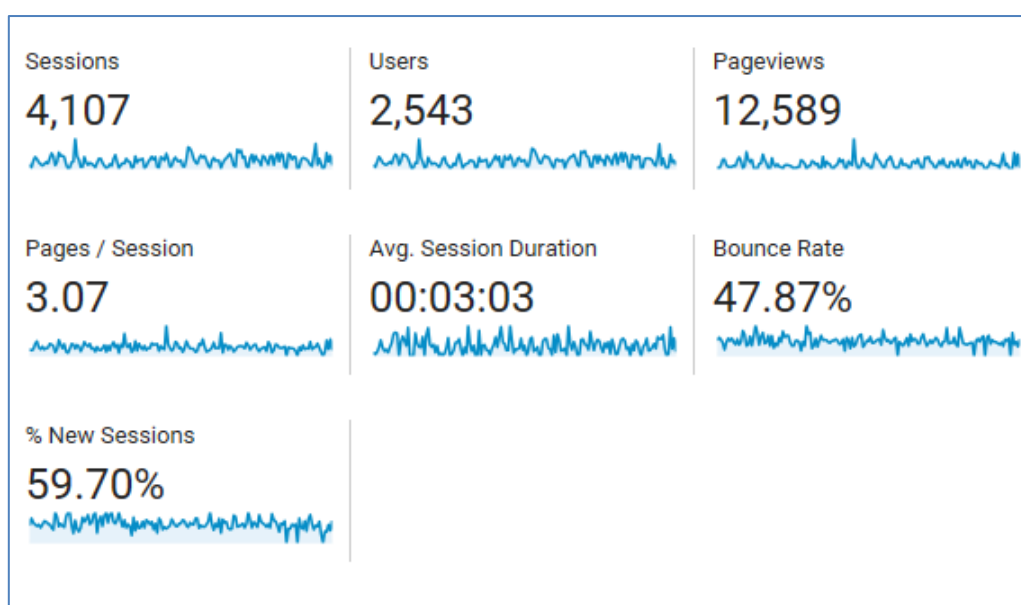


Figure 16: SONATA website main statistics

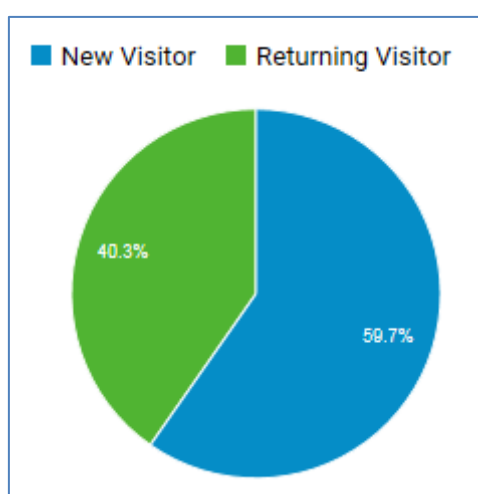


Figure 17: New visitors vs. returning visitors

If we compare the data with the corresponding period in year 2, we see that the number of sessions in Y3 is higher than in Y2 by almost 30%. We also observe an increase in the number of users (by 35%), the number of new sessions (by almost 3%) and reduced the bounced rate (by -4.11%). This means, if the performance of the website in Y2 was fantastic, it was even better in Y3.

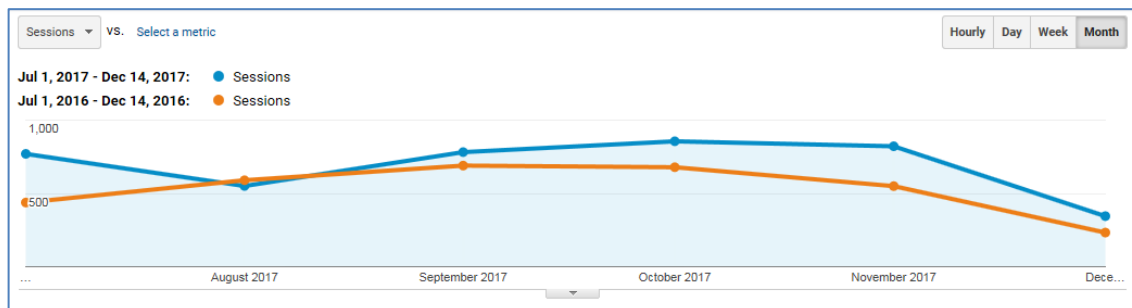


Figure 18: Sessions/month (Y3 vs. Y2)

As in Y2, the majority of users were from Spain, the United States, and Germany, followed by the United Kingdom, Greece and India (Figure 19).

Country	Sessions	% Sessions
1. Spain	694	16.90%
2. United States	458	11.15%
3. Germany	358	8.72%
4. United Kingdom	286	6.96%
5. Greece	241	5.87%
6. India	241	5.87%
7. France	201	4.89%
8. Italy	197	4.80%
9. Belgium	128	3.12%
10. Portugal	122	2.97%

Figure 19: SONATA website users' main locations

And, as shown in the map in Figure 20, SONATA website received visitors from the five continents again.

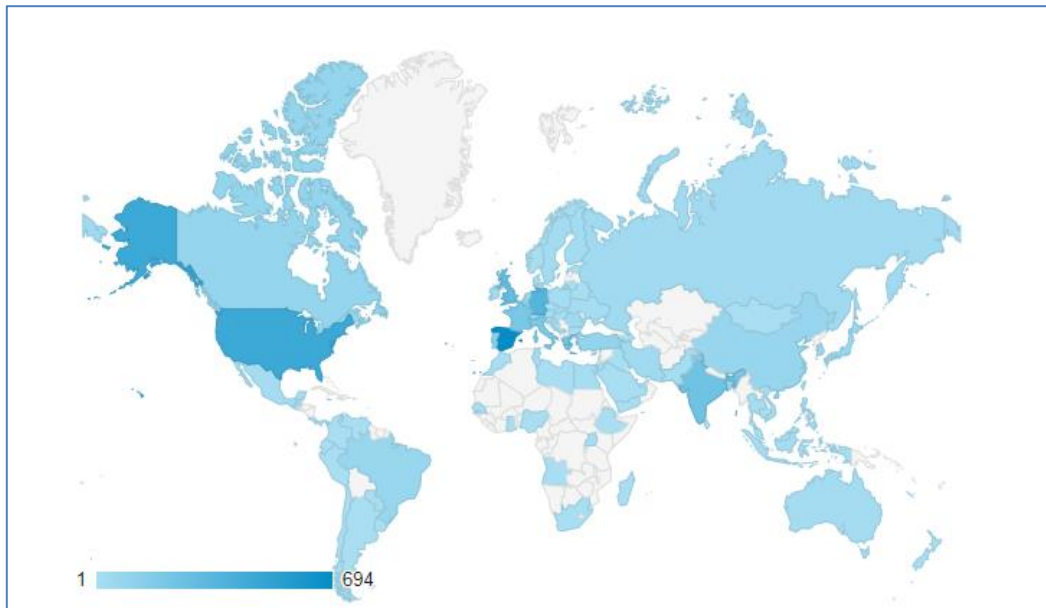


Figure 20: SONATA website sessions by country

In relation to the acquisition channels, as illustrated in Figure 21, most of the entries were via organic search and direct access, with 45.2% and 37.5% of the sessions respectively. This means that the SEO (Search Engine Optimisation) and promotion of the website worked very well as in Y2.

We also see an increase in the contribution of the social media platforms (mainly through Twitter and LinkedIn), from 6.6% to 12.7%. This means that the promotion efforts using social media channels were even more successful during these last months of life of the project. Moreover, it was the channel with the lowest bounce rate.

Referrals have been another important acquisition channel for the project, generating 4.5% of the sessions in this last period. It is important to highlight that 34.24% of the traffic generated by this channel came from Mailchimp, the tool the project used to generate its newsletter, which indicates that the project newsletter worked really well. As an interesting fact, we can state that the partners' websites that generated the most traffic for SONATA were Ubiwhere's (6%) followed by Telefonica's (3.8%).

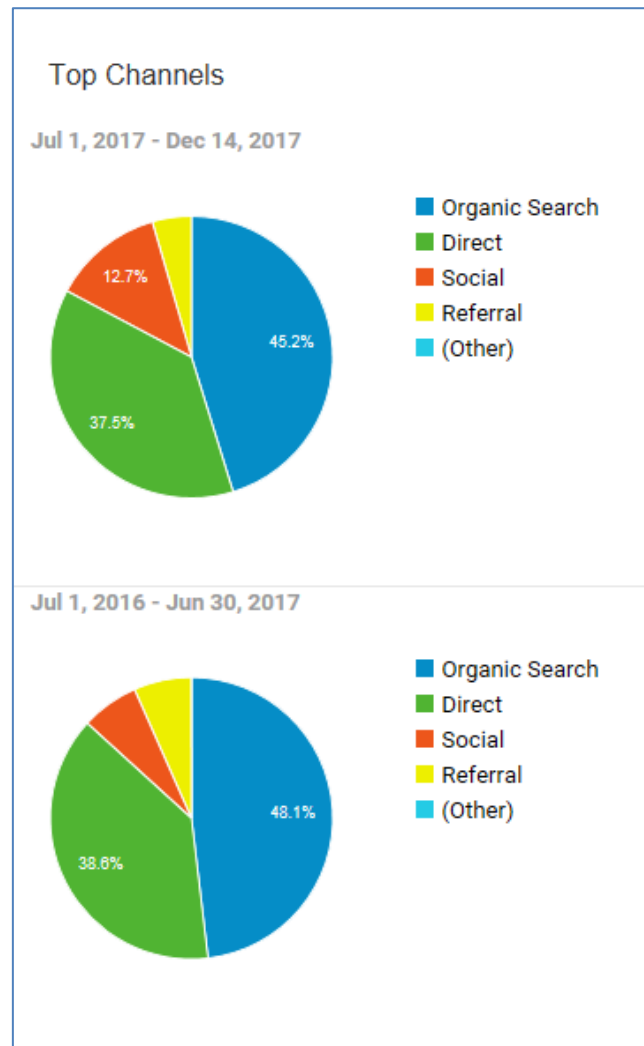


Figure 21: SONATA website top channels (Y3 vs. Y2)

As in year two, the project blog contributed to the good performance of the SONATA website, with an example shown in Figure 22. In this figure, we appreciate how a blog post publication and corresponding promotion results in an increase in the traffic in the website.

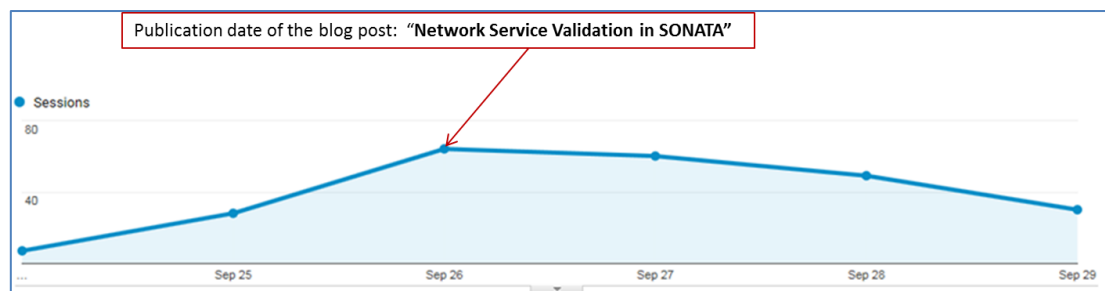


Figure 22: Effect of a blog post publication on the traffic to the SONATA website

3.2 Partners websites

In D7.3, the dissemination and communication report corresponding to year 2, we presented in detail the promotion plans designed individually by each partner to promote SONATA using

their organisation's own channels. Below, we present a summary of the new activities that took place in these last six months of life of the project.

[ALTICE LABS](#)

As we will explain in more detail later in this document, Altice Labs promoted SONATA at the Cabo Verde International Fair in Mindelo, in November 2017. This activity was promoted using the usual SONATA channels (News, Website, Twitter, LinkedIn, YouTube) but also Altice Labs own channels as show in the Figure 23.



Figure 23: Cabo Verde International Fair on the Altice Group's Intranet




[NOKIA](#)

Recently, the organisation published a blog post (Figure 24) on Bell-Labs site talking about their participation in the 5G PPP initiative where SONATA was mentioned [10].

A&A Cloudband 5G-PPP

DECEMBER 12, 2017

#5g

Nokia has been engaged in the 5G PPP initiative (5G Infrastructure Private-Public Partnership, part of the EU Horizon 2020 Research and Innovation program) across many different programs. The first wave of innovation projects, Phase 1, were aimed at increasing wireless capacity, saving energy, connecting all people and things, decreasing latency, and improving reliability.

The Nokia Applications and Analytics business has been a partner in three of the Phase 1 projects: Sonata, Cognet, and SuperFluidity, which are all in the domains Cloudband is leading within Nokia. Bell Labs is also a partner in Cognet and SuperFluidity.

These projects began in July 2015 and with their official conclusion, there have been several tangible accomplishments:

- The Sonata project has implemented a Service Orchestration system in-line with the ETSI NFV MANO stack NFVO.
- The Cognet project is promoting Machine Learning for improvement of 5G Network Management
- The SuperFluidity project aims to implement on-the-fly service creation for rapid service deployment.

Nokia CloudBand is adopting aspects of each of these projects in its product roadmap.

For more details visit:

- **Sonata:** <https://5g-ppp.eu/sonata/>, <http://www.sonata-nfv.eu/>
- **Cognet:** <https://5g-ppp.eu/cognet/>, <http://www.cognet.5g-ppp.eu/>
- **Superfluidity:** <https://5g-ppp.eu/superfluidity/>, <http://superfluidity.eu/>

Figure 24: Nokia's blog post on Bell-Labs website

UPB

UPB promoted SONATA-related news and updates through the new Twitter account (@CN_UPB) of their Computer Networks research group [11] (Figure 25).



Figure 25: Example of tweet about SONATA by @CN_UPB

UCL

UCL published an updated list of 5G consolidated achievements and results (5G Integrated Components & Testbed, Monitoring, Slice Controller, Virtual Network Platform) where SONATA is mentioned [12], as shown in Figure 26.

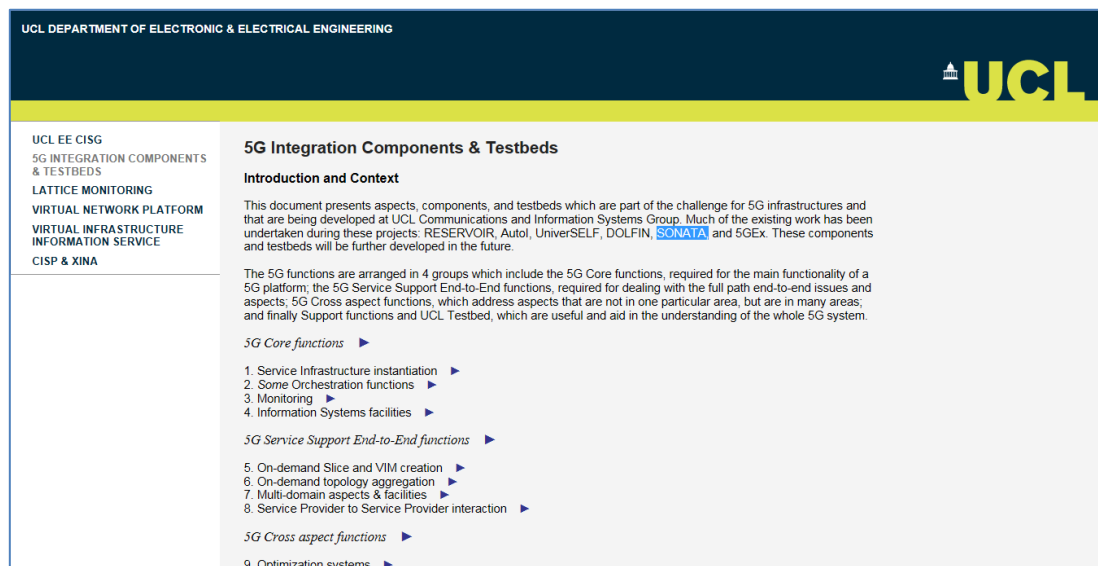


Figure 26: UCL Department of Electronic & electrical engineering website

OPTARE

The SONATA release 3.0 was published promoted via:

- The news section on the Optare's website [13].

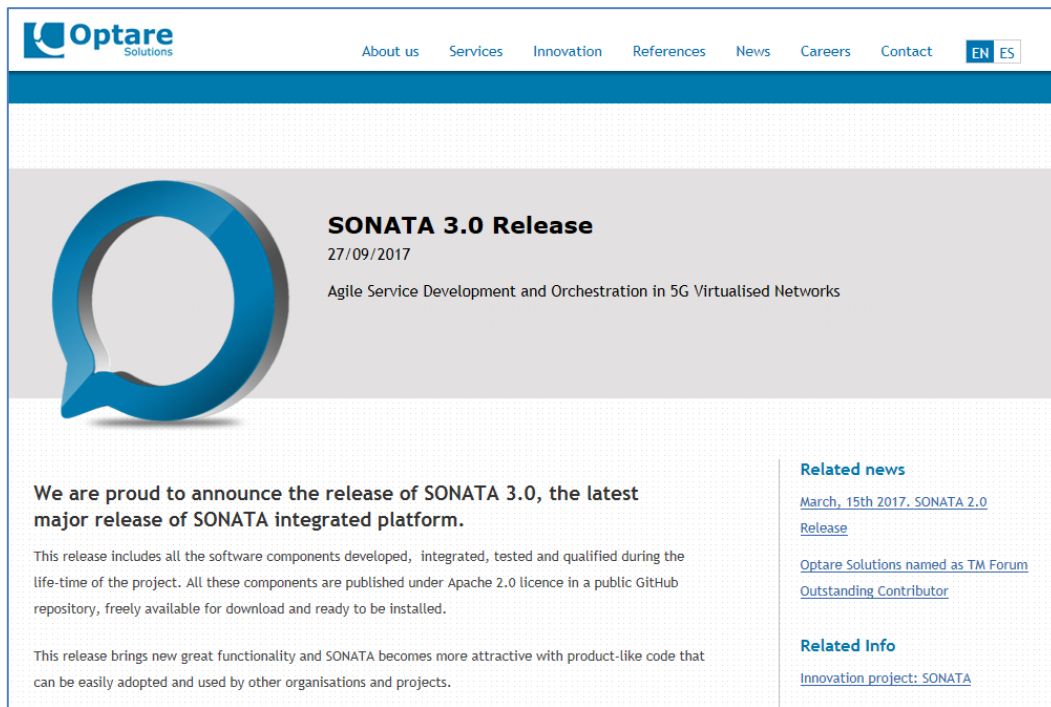


Figure 27: SONATA 3.0 on Optare's website

- The organisation's official Twitter account [14].

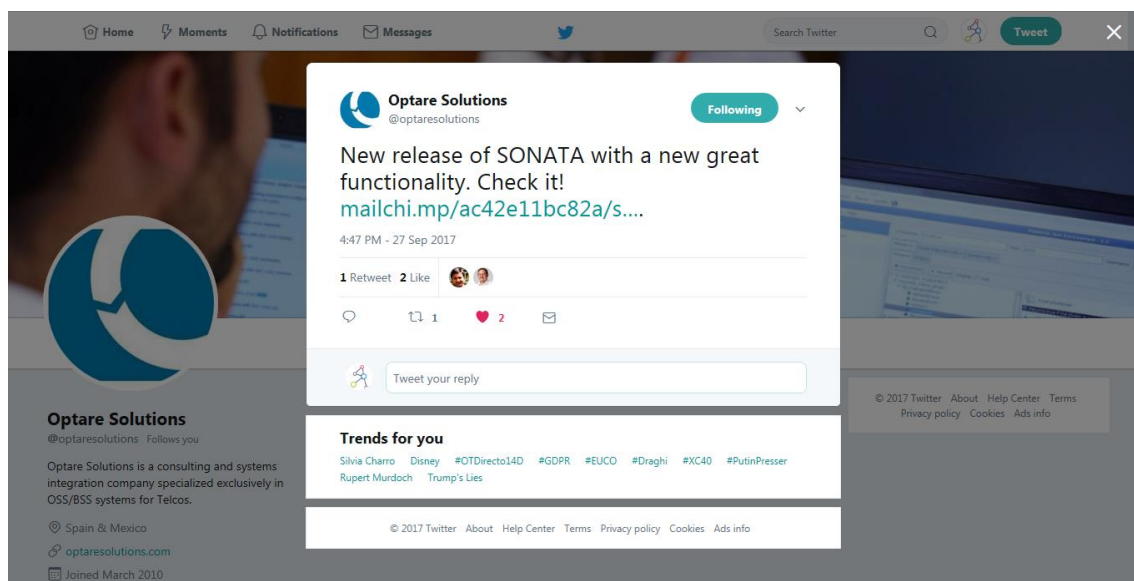


Figure 28: SONATA 3.0 on Optare's Twitter account

I2CAT

I2CAT promoted SONATA news by re-tweeting SONATA related news via i2CAT's official Twitter channel [15] (Figure 29). I2CAT's main contact person for SONATA also promoted SONATA-related news on his personal Twitter and LinkedIn accounts by re-tweeting and re-posting, respectively.



Figure 29: SONATA 3.0 on i2CAT's Twitter account

SYN

Synelixis follows SONATA in social media and regularly disseminated results and news in its Twitter [16] and Facebook [17] accounts (Figure 30).



Figure 30: Example of tweet about SONATA by Synelixis

BT

A summary of concluding projects is made in an internal newsletter about all of BT's collaborative research activity. SONATA will be included.

UBIWHERE

SONATA had a booth at Ubiwhere's new offices inauguration day [18], where all Ubiwhere's close partners and Portugal national relevant figures were invited. The Portugal's European Commissioner Carlos Moedas also attended the event.

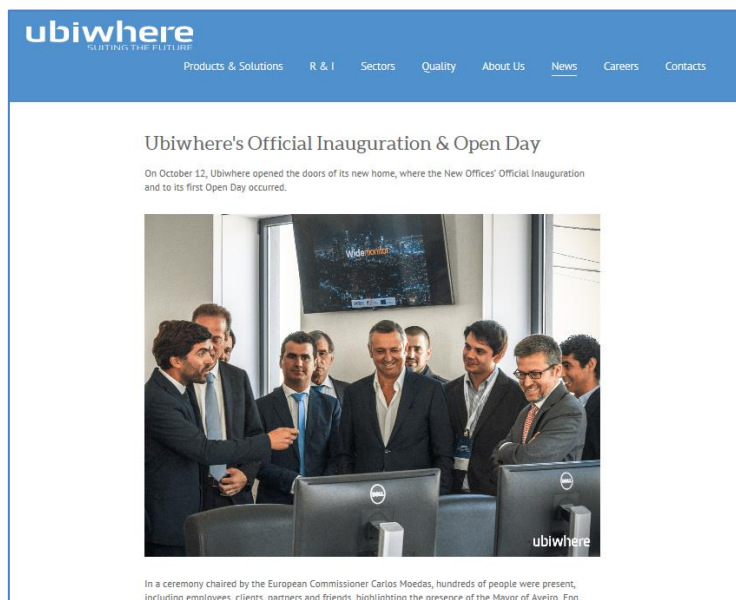


Figure 31: Ubiwhere's official inauguration day news on the organisation website

SONATA's new software releases has been also promoted on Ubiwhere's news page [19] (Figure 32).

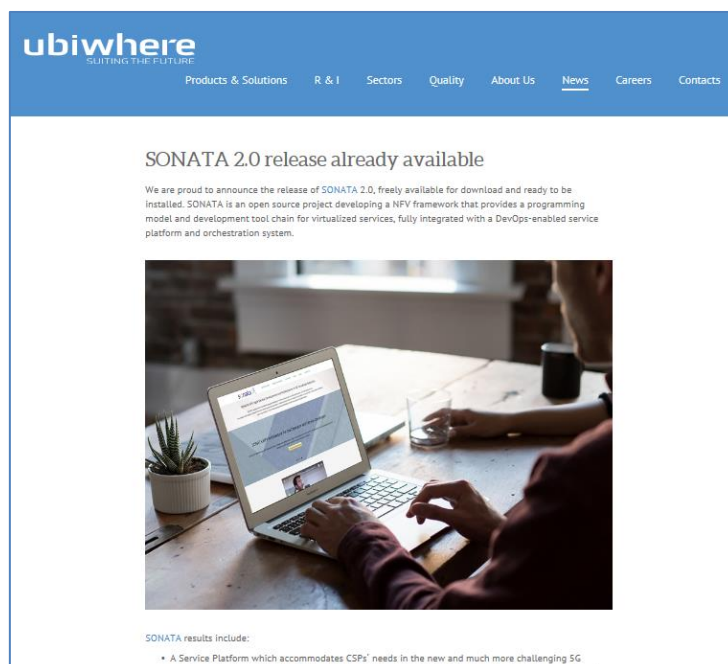


Figure 32: SONATA releases on Ubiwhere's website

3.3 Social Media

3.3.1 Twitter

As in previous years, The SONATA Twitter [5] account has been one of the main social media channels used by the project to promote its results in Y3.

We have already shown the efficiency of the social media channels as traffic generator to the SONATA website, Twitter in particular, with 52.58% of the social media contribution (shown in Figure 33), slightly higher than its contribution in Y2 (52.3%).

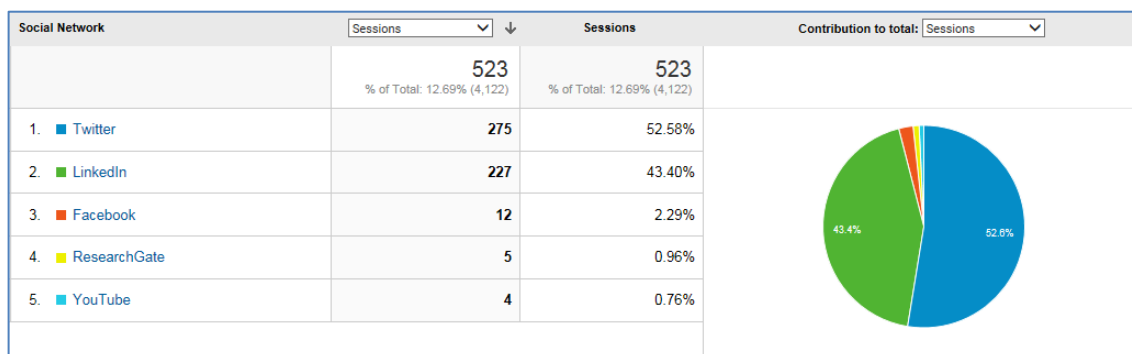


Figure 33: Social media channels contribution to the website traffic

The statistics below show the proactive manner in which this channel has been used during the last six months of the project, as well as its acceptance by the SONATA project followers. Note: Data extracted on December 14, 2017.

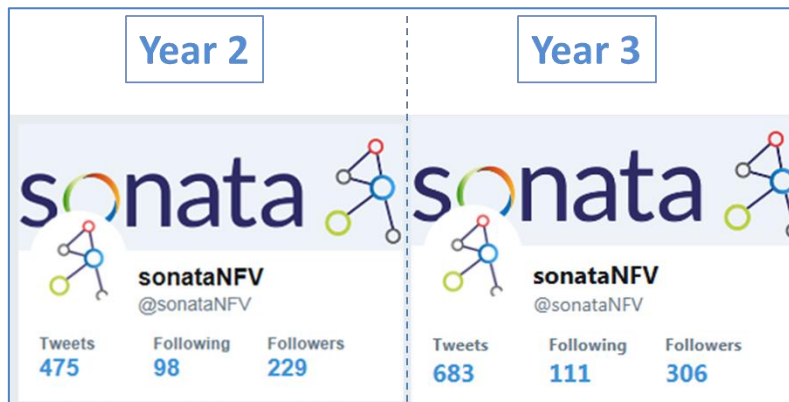


Figure 34: SONATA's Twitter account

As shown in Figure 34, since its launch, SONATA's Twitter account has published 683 tweets and reached 306 followers. Keeping in mind the same statistics from the previous years (Y1: 38 tweets and 86 followers, Y2: 475 tweets and 229 followers), we can clearly say that we have achieved the main goal of this channel according to the Y3 plan, which, as described in Section 2, was to keep as active as in year two.

Table 4 presents more detailed information per month and its comparison with the previous year.

	Tweets*	Impressions	Profile Visits	Mentions	New followers
Y2 Monthly Average	22	6,604	579	12	12
Y3 Monthly Average	25	10,018	724	24	12
July	23	7,876	536	24	9
August	27	9,207	427	13	6
September	21	9,873	619	18	21
October	36	18,300	696	47	16
November	26	8,122	319	7	3
December (first half)	8	8,301	873	14	7
Total Half 1 Y3	141	51,806	3,470	130	62
Total Y3 (extrapolation)	264	120,216	8,688	288	144
Total Y2	263	79,245	6,946	141	146

Table 4: SONATA Twitter statistics per month in Y3 (and comparison with Y2)

*Retweets not included.

Note the number of profile visits received (3,470) and the number of impressions achieved (more than 120,000). The activity in October, the month in which we promoted SONATA 3.0 release, deserves also a special mention. Summarizing, we can say that the analytics corresponding to the last six months of the project are impressive, even much better than in year two. Please, compare monthly averages and/or total year performances.

One of the main conclusions that we extracted from the year two analytics was that the kind of information that our followers wanted us to provide through this channel was content directly related to the project: announcement of launch of software releases, information about our blog posts, SONATA participation in events, publication of videos in our YouTube channel, etc. As a consequence, although we tried that the content provided through the SONATA's Twitter account in this period was as varied as in year two, we focused on providing more information about the project as our followers were demanding.

Figure 35 below shows the top six tweets of this period as well as information about the interest generated in our audience attending the number of impressions, engagements and engagement rate. Again, apart from one of them on 5G, most of them provide information about the project. It is important to highlight that three of them talk about our collaboration with OSM, which we understand is an activity appreciated by our followers.






 <p>sonataNFV @sonataNFV Did you miss @5GPPP @sonataNFV participation at the #SDN #NFW #WorldCongress 2017? Presentations and videos of the sessions available here: http://www.sonata-nfv.eu/content/sonata-material-sdn-nfv-world-congress-available ... pic.twitter.com/qzltwm9hmf</p>	<p>Impressions 1,636</p> <p>Total engagements 37</p> <p>Likes 9</p> <p>Link clicks 9</p> <p>Retweets 8</p> <p>Detail expands 5</p> <p>Profile clicks 4</p> <p>Media engagements 2</p>
<p>sonataNFV @sonataNFV What's so good about 5G? https://inform.tmforum.org/internet-of-everything/2017/08/whats-good-5g/ ... via @TMFInform</p>	<p>Impressions 1,592</p> <p>Total engagements 18</p> <p>Link clicks 10</p> <p>Retweets 3</p> <p>Profile clicks 3</p> <p>Likes 2</p>
 <p>sonataNFV @sonataNFV @sonataNFV at the @OpenSourceMANO mid-release3 meeting http://www.sonata-nfv.eu/content/sonata-osm-mid-release3-meeting-sophia-antipolis-today ... @map_nw @baitas pic.twitter.com/U8KibyQNB1</p>	<p>Impressions 1,517</p> <p>Total engagements 35</p> <p>Link clicks 11</p> <p>Profile clicks 8</p> <p>Retweets 7</p> <p>Likes 5</p> <p>Media engagements 4</p>
 <p>sonataNFV @sonataNFV Award to Manuel Peuster @map_nw for the @5GPPP @sonataNFV emulator contribution @OpenSourceMANO release 3! http://www.sonata-nfv.eu/newsroom pic.twitter.com/9Xnv3sHdyi</p>	<p>Impressions 1,394</p> <p>Total engagements 40</p> <p>Media engagements 11</p> <p>Likes 9</p> <p>Profile clicks 8</p> <p>Retweets 6</p> <p>Link clicks 6</p>
 <p>sonataNFV @sonataNFV M. Peuster @map_nw presenting a paper on #NFW profiling at the #Berlin5GWeek @5GPPP @sonataNFV @5Gtango pic.twitter.com/YAJOkVfcHN</p>	<p>Impressions 1,355</p> <p>Total engagements 56</p> <p>Media engagements 18</p> <p>Likes 14</p> <p>Retweets 8</p> <p>Link clicks 8</p> <p>Hashtag clicks 3</p> <p>Detail expands 3</p> <p>Profile clicks 2</p>
 <p>sonataNFV @sonataNFV Don't miss our blog post "@5GPPP @sonataNFV and @OpenSourceMANO , an example of cooperation among open source projects": http://www.sonata-nfv.eu/content/sonata-and-osm-example-cooperation-among-open-source-projects ... pic.twitter.com/UTUJBK2GGs</p>	<p>Impressions 1,321</p> <p>Total engagements 51</p> <p>Link clicks 23</p> <p>Likes 10</p> <p>Retweets 9</p> <p>Detail expands 5</p> <p>Media engagements 3</p> <p>Profile clicks 1</p>

Figure 35: SONATA top blog posts

The map in Figure 36, shows the location of our Twitter followers across the globe. As in year two, most of them are mainly from Spain (16.4%) and the United Kingdom and the United States (10.7%), but this time we can see a considerable increase of users from Germany (12.5%).

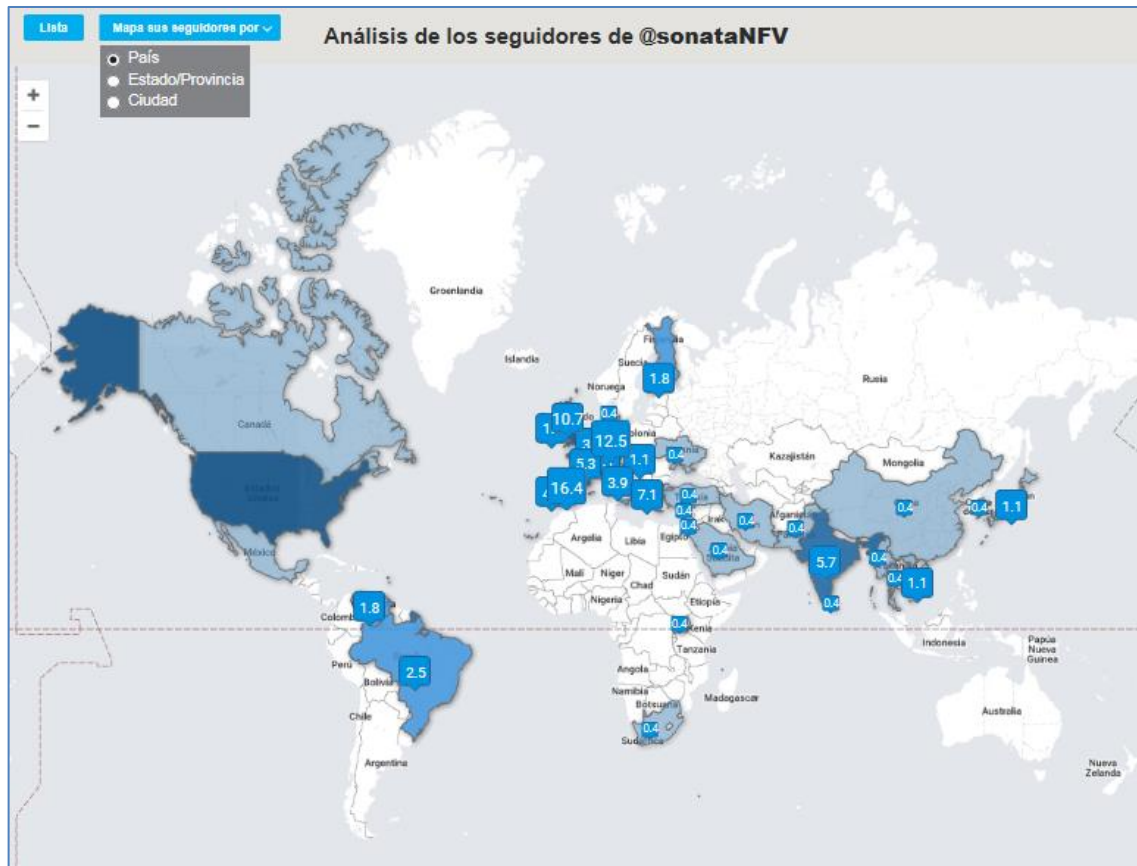


Figure 36: SONATA's Twitter followers' location

3.3.2 LinkedIn

SONATA LinkedIn account [6] was opened in Y2 by the project with the intention of increasing our presence on social media and providing more visibility of the main announcements of the project, especially our blog posts.

In these last six months we have published a total of 8 articles (corresponding to our blog posts) and other 28 more general posts.

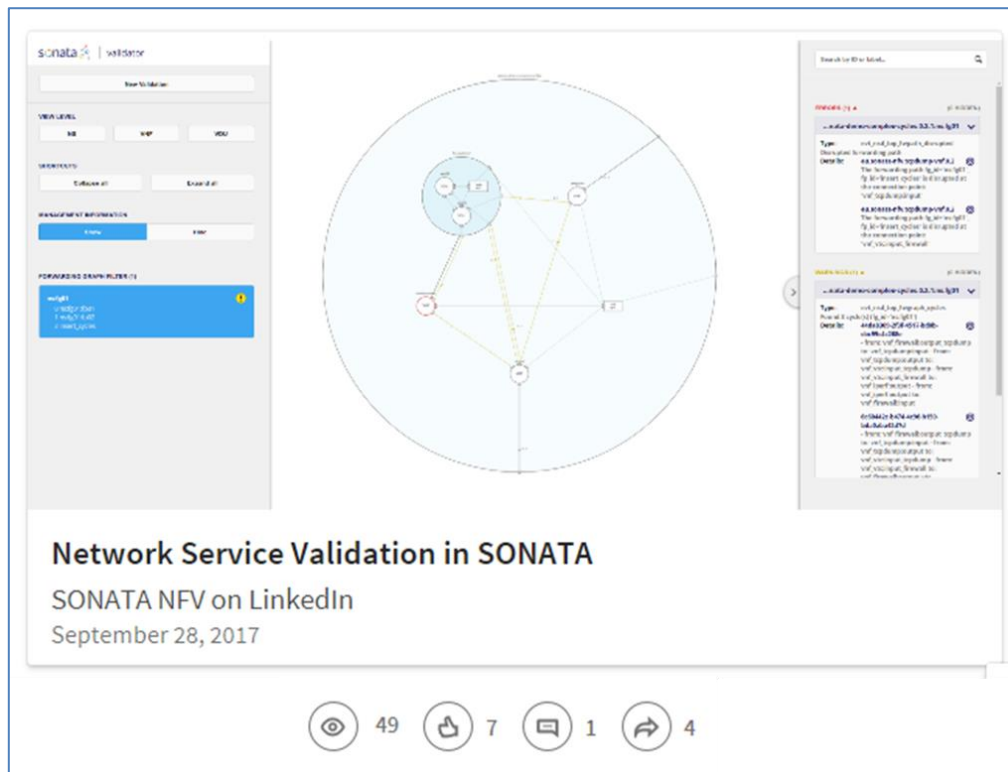


Figure 37: SONATA LinkedIn top article

As stated in year two, it is not possible to ascertain the real impact of the project activities in LinkedIn due to the limitation in the analytics engine provided by LinkedIn for non-premium accounts. What we can say is that, in the last six months, we have gained 19 followers, finishing the project with a total of 99. Another important fact is that LinkedIn has contributed more than 43% to the traffic redirected to our website through our social media channels, being the second one after Twitter.

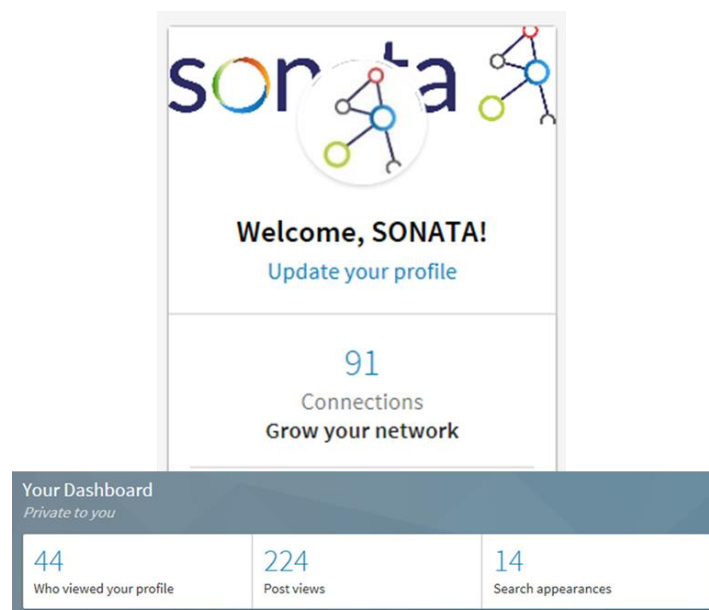


Figure 38: SONATA LinkedIn analytics

As in year two, SONATA also contributed content to the 5G PPP LinkedIn Group [20], with 37 out of a total of 57, 65%.

3.3.3 ResearchGate

ResearchGate [7] is another social media channel we started using in Y2 to disseminate the project activities and scientific papers among the research community.

There has been reasonable interest of academic community in the SONATA project as shown by the statistics below achieved at the end of the project:

- Recommendations 8
- References in Scientific Publications 14
- Followers 27
- Collaborators 12
- Reads 306

The community showed special interest in the publications and deliverables of the SONATA project. The most viewed post during the life time of the project was the article “DevOps for network function virtualisation: an architectural approach” (Figure 39).

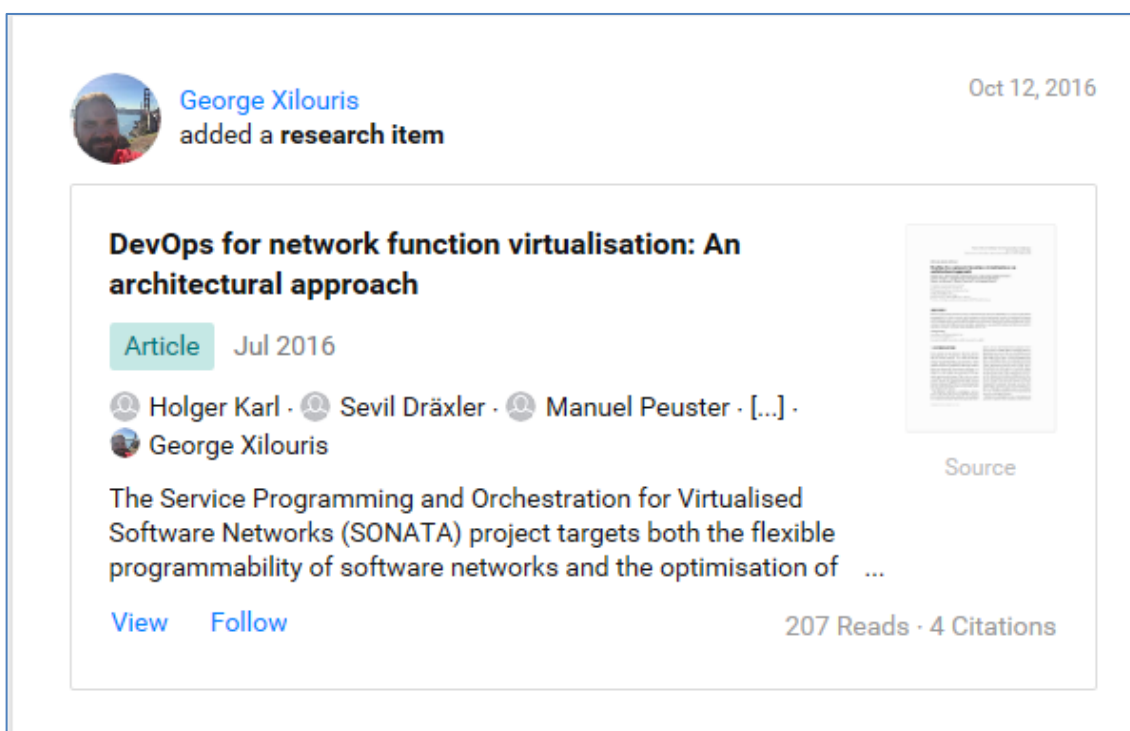


Figure 39: Top viewed post on SONATA ResearchGate space

3.3.4 YouTube

SONATA YouTube channel [8] was inaugurated in year 2 with the main goal of centralising all videos generated by the project, and to boost our video marketing strategy.

Table 5 below shows the main statistics at the end of the project and in its comparison with Y2, which shows the high activity of this channel during the last six months of the project.

	Y2	Y3
Number of subscribers	23	33
Number of views	306	1,255
Uploaded public videos	10	20
Liked videos	4	8

Table 5: SONATA YouTube channel Twitter statistics (Y2 vs. Y3)

Figure 40 shows the main statistics achieved at the end of the project, including watch time and average view duration.

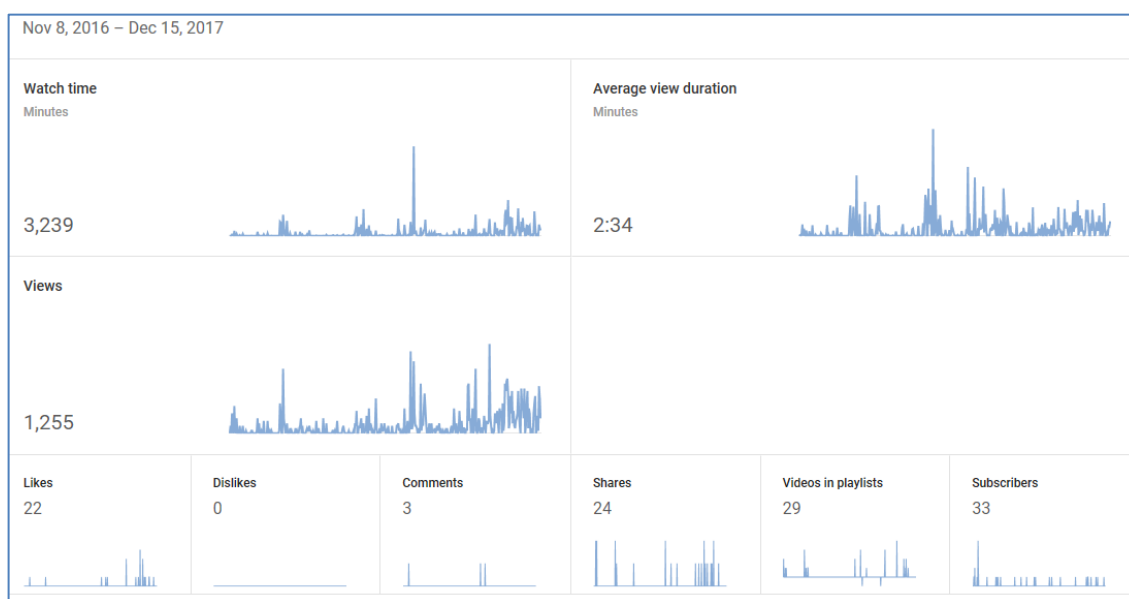


Figure 40: SONATA YouTube channel analytics

Next you can see a ranking with the top-10 videos and the main statistics related to each of them in Figure 41.

Top 10 Videos <small>Browse all content</small>					
Video	↓ Watch time (minutes)	↓ Views	↓ Likes	↓ Comments	
Demo: A Flexible Multi-PoP Infrastructure E...	625 19%	254 20%	3	1	
SONATA Modular Architecture SDN World...	525 16%	82 6.5%	0	0	
SONATA "son-emu" demonstration (Y1)	465 14%	149 12%	1	1	
SONATA SDK: Rapid prototyping of networ...	377 12%	109 8.7%	2	0	
Network Service Deployment in the SONAT...	226 7.0%	68 5.4%	3	0	
SONATA overview: NFV enabled Service PL...	191 5.9%	49 3.9%	0	0	
SONATA Emulator to OSM Integration Tec...	175 5.4%	66 5.3%	1	0	
SONATA "son-emu" installation	124 3.8%	125 10%	0	0	
The SONATA Gatekeeper: A Mediated Appr...	111 3.4%	26 2.1%	0	0	
SONATA BSS	57 1.8%	43 3.4%	2	1	

Figure 41: SONATA YouTube channel Top 10 videos

It is important to highlight that with the demonstration corresponding to the top one video, “A Flexible Multi-PoP Infrastructure Emulator for Carrier-grade MANO Systems”, SONATA got the IEEE NetSoft Best Demo Award 2017.

Figure 42 and 43 show other analytics regarding geography and the sources of traffic.

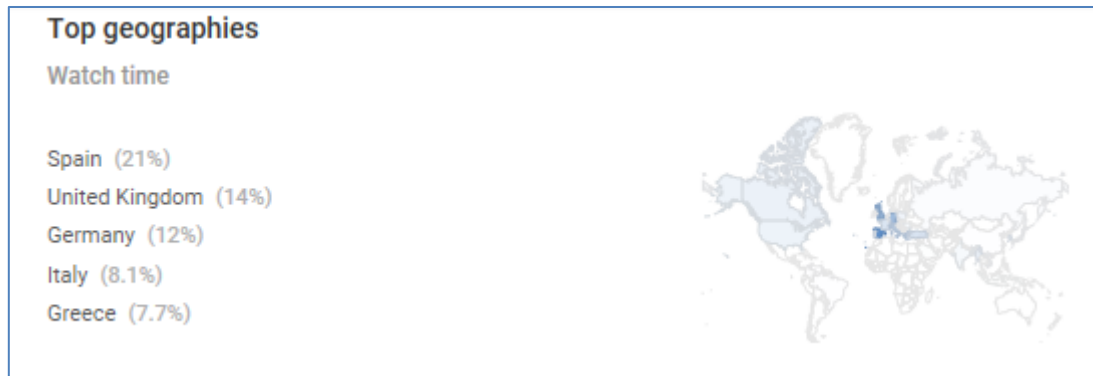


Figure 42: SONATA YouTube channel demography analytics

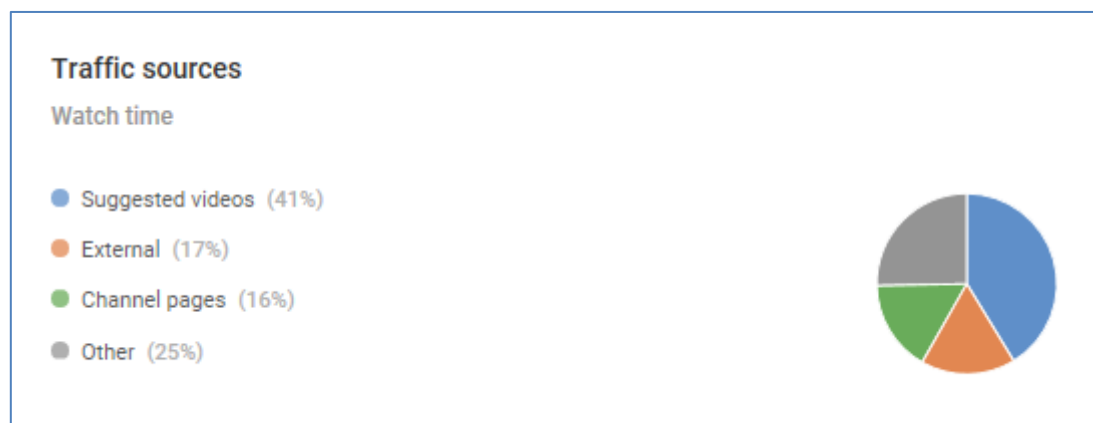


Figure 43: SONATA YouTube channel demography analytics

3.4 Newsletters

According to our plan, the project had committed to send three newsletters in Y3. The first newsletter of the period (shown in Figure 44) was launched in July 2017, coinciding with the project’s second anniversary, as a summary of the main achievements of the project during the previous year.

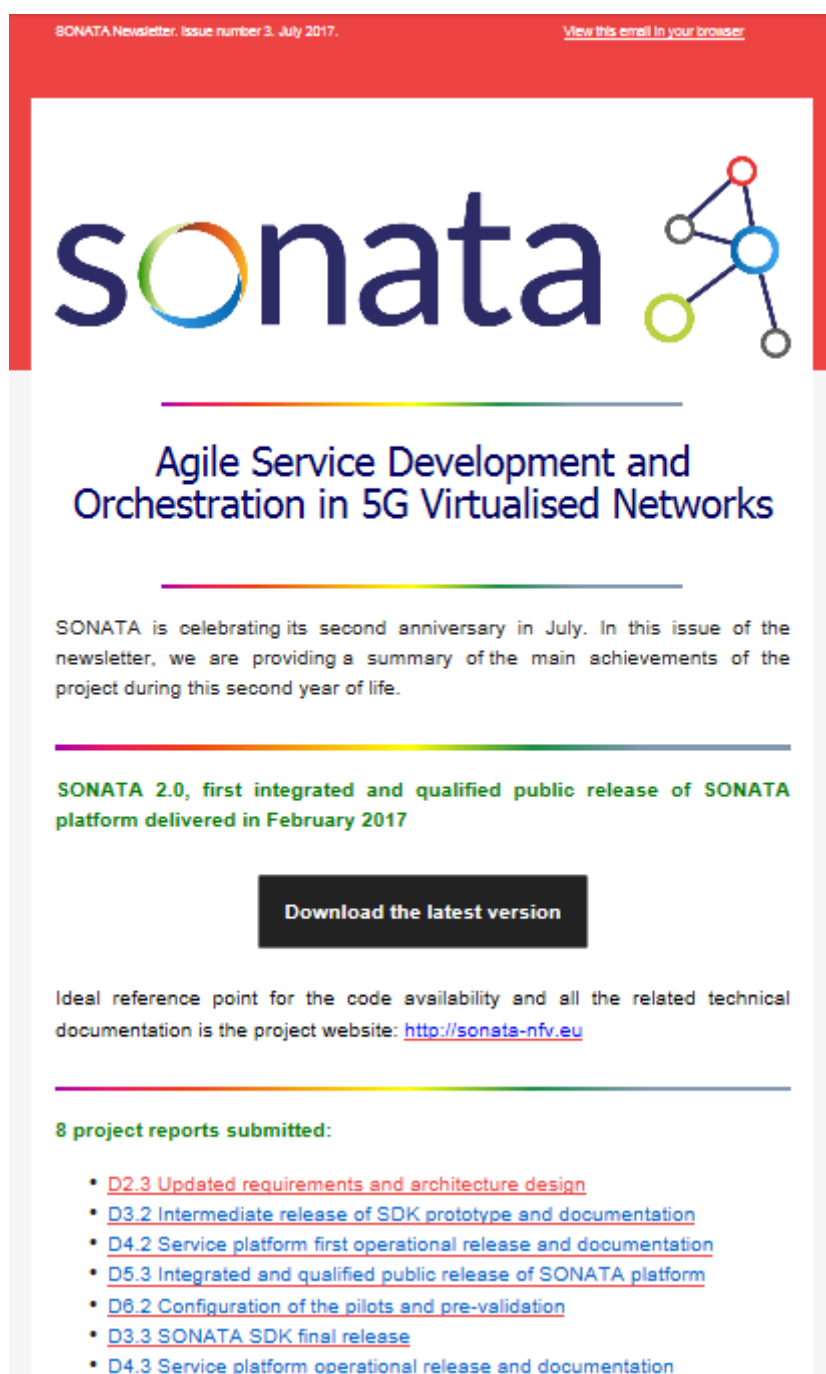


Figure 44: SONATA Newsletter issue number 3

The second newsletter of year three, the issue number 4, shown in Figure 45, coincided with the communication of SONATA 3.0, the software release delivered in August 2017 which marketing campaign took place in September 2017.

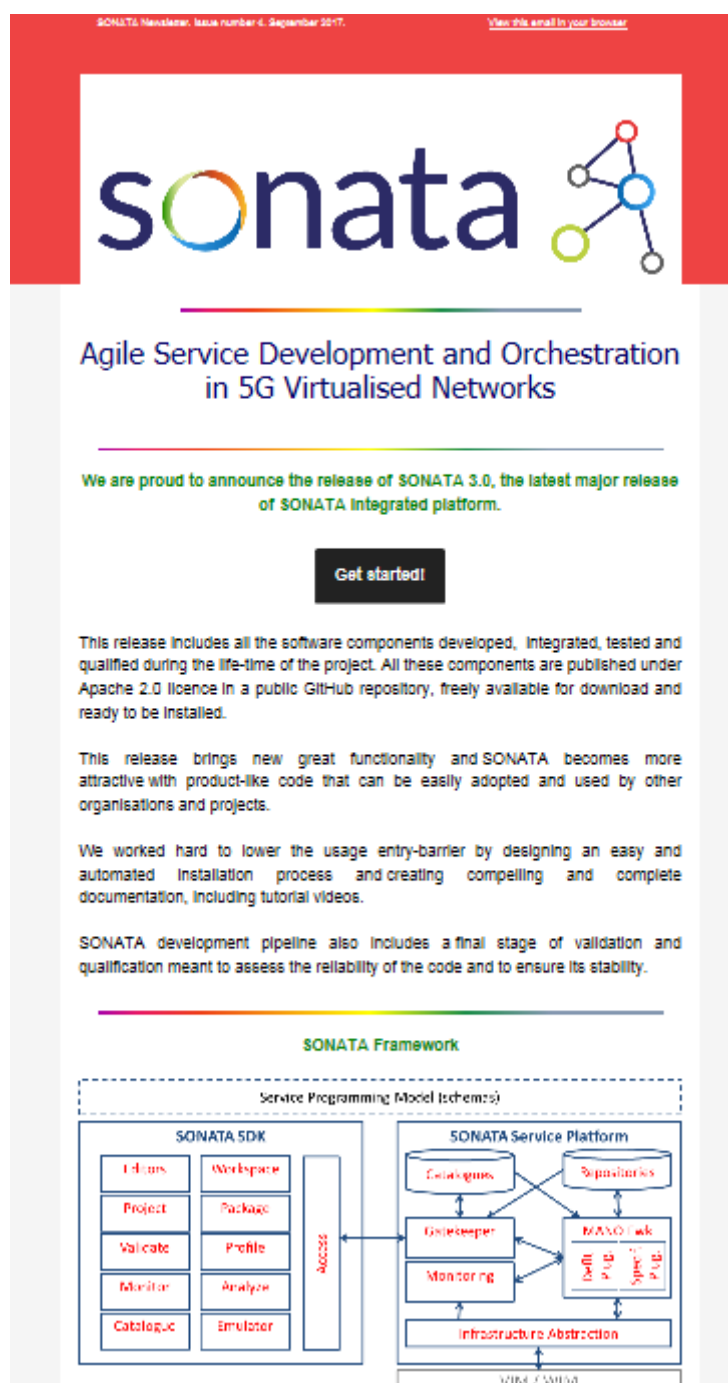


Figure 45: SONATA Newsletter issue number 4

At the end of the project, another issue will be sent summarizing the achievements reached by the project during its lifetime. Due to the Christmas break, and in order to maximise impact, this newsletter will be published early in January 2018.

All SONATA newsletters are available on the project website [9].

3.5 Supporting materials

The project triptych (shown in Figure 46) created in Y2, which was printed in 2,000 copies, has been also used in Y3 and distributed in events, conferences, workshops, etc.

SONATA addresses the significant challenges associated with the development and deployment of the complex services envisioned for 5G networks, targeting both the flexible programmability of software networks and the optimization of their deployments.

Core Objectives

- Reduce time-to-market of networked services**
SONATA offers a valuable SDK for service developers to easily create and deploy networked services on top of telecom operators' resources. It also promotes a DevOps model to integrate service development and management operations of virtual network functions.
- Optimize resources utilization and reduce costs of service deployment and operation**
SONATA Service Platform orchestrates and maps complex services to connectivity, computing and storage resources and automatically re-configures running services.
- Accelerate industry adoption of software networks**
SONATA supports the full lifecycle of a service and allows NFV integration and interoperability with already existing network management systems.

SONATA's channels

- sonatanfv@gmail.com
- www.sonata-nfv.eu
- @sonatanfv
- SONATA NFV
- SONATA NFV
- H2020 SONATA
- sonata-nfv

Partners: AT&S, NEC, Altice Labs, THALES, Telefonica, NOKIA, UNIVERSITÄT PADERBORN, UCL, imec, Optare, SYNELIXIS, BT, ubiwhere, izcat.

SONATA is an EU Horizon 2020 funded project part of the 5G PPP initiative.

Key features

- First integrated approach in the NFV landscape that includes service composition, testing and orchestration.
- Invaluable tools to support developers in the creation and testing of services.
- Flexible architecture and modular design.
- Openness and multi-vendor compatibility.
- Customization opportunities depending on customer's needs, existing assets or future requirements.
- DevOps model for Telecom that enables the agile management of the full service lifecycle, increasing productivity and time-to-market.
- Multi-organizational by design enabling network operators the creation of an ecosystem with external and internal developers improving collaboration and a more competitive offering.

Architecture

The architecture shows the SONATA SDK (Editor, Packaging/Testing Tools, Packaging Tool, Private Catalogues) interacting with the SONATA Service Platform (Platform Catalogue, Extended MANO Framework, Repositories, Gatekeeper, Public Catalogues). The platform is supported by an Infrastructure Adapter (NF, VIM/WIM, Infrastructure, NF) and OSS and GUI.

Milestones

- December 2016: First SONATA architecture
- July 2016: First integrated MANO prototype
- February 2017: First qualified SONATA release
- July 2017: Updated SONATA release

Open Source

SONATA is an open source project. Its source code is published under Apache v2.0 licence, in a public GitHub repository, freely available for download and ready to be installed with full rights for adoption, modification and distribution. The project follows the best practices of open source software development, quality assurance and testing in order to produce high quality code.

Current code release and related technical documentation is available on the project website: www.sonata-nfv.eu

Figure 46: SONATA project brochure (tritych)

Apart from that, and according to the plan agreed upon at the beginning of this period, the project created some demo posters that were shown at the main events where the project gave demonstrations.

The NetSoft 2017, the third IEEE conference on network softwarisation that took place in Bologna (Italy) on July 3-7, 2017 was one of these events. There the project gave two demonstrations and presented posters for each of them (shown in Figures 47 and 48).

A Flexible Multi-PoP Infrastructure Emulator for Carrier-grade MANO Systems

Manuel Peuster Sevil Dräxler Hadi Razzaghi Kouchaksaraei
Steven Van Rossem Wouter Tavernier Holger Karl

Multi-PoP NFVI Emulator

- Mininet/Containter-based network emulation
- Compute Instances (VNFs) deployed as Docker containers
- Single SDN switch per PoP to abstract data-center-internal details
- Arbitrary user-defined multi-PoP topologies
- OpenStack-like northbound Interfaces to control the emulated PoPs
- Built-In monitoring of VNFs
- Apache 2.0 license

M. Peuster, H. Karl and S. V. Rossem: *MediCINE: Rapid Prototyping of Production-Ready Network Services in Multi-PoP Environments*, in IEEE NFV-SDN, 2016.

Single-VM Sandbox Environment

Demonstration Scenario

Demonstration Storyboard

1. Define topology and start emulation
2. Connect emulated PoPs as VIMs to OSM or SONATA
3. Define vCDN service using OpenStack HEAT templates, OSM or SONATA descriptors
4. On-board and instantiate vCDN service using OSM or SONATA MANO systems
5. Stream a video through the deployed service
6. Monitor service components using the emulator's monitoring functionalities

Give it a try!

<https://goo.gl/ardJDs>

Who are we?

Atos NEC

THALES | Orange | NOKIA

ARM | UCL

UTMTC | ETSI | 3GPP

sonata

SONATA NFV: Agile Service Development and Orchestration in 5G Virtualized Networks

<http://sonata-nfv.eu>

<https://github.com/sonata-nfv>

<https://twitter.com/sonataNFV>

<https://www.linkedin.com/company/sonata-nfv>

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<http://www.upl.de/cn/>

imec

UNIVERSITY

SONATA

Figure 47: A Flexible Multi-PoP Infrastructure Emulator for Carrier-grade MANO Systems demo poster

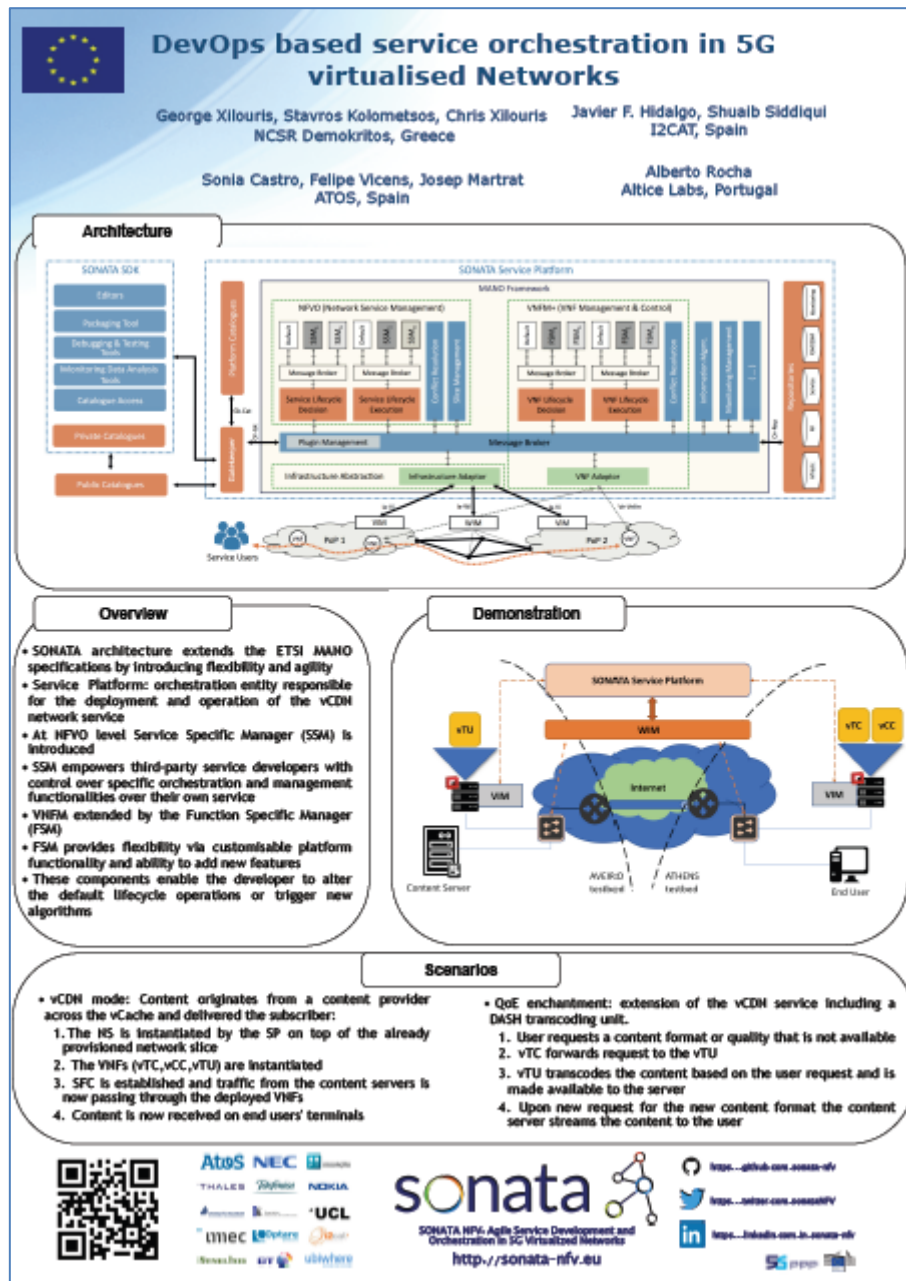


Figure 48: DevOps based service orchestration in 5G virtualised Networks demo poster

Another event for which an additional demo poster was created was the Network of the Future (NoF 2017) conference that took place in London on November 22-24, 2017.

SONATA participated in the Demo & Poster Session on day 3, where some of our partners presented the demo "Service orchestration leveraging software networks and DevOps in 5G" (corresponding poster shown in Figure 49).

3.6.1 Conference Publications

Title	Authors	Conference Proceedings	Publication Date	Status	Links and Additional Notes
Slicing in Network and Service	A. Galis	ICIN 2019 Paris 7-9 May 2017	May 2017	Expert Panel Presentation	http://2017.icin-conference.org/program.html
Towards 5G Slice Networking – Key Issues and Challenges	A. Galis	IFIP/IEEE International Symposium on Integrated Network Management (IM) Lisbon 8-12 May 2017	May 2017	Expert Panel Presentation	http://im2017.ieee-im.org/panels
The Open Way towards the Software Network	D. Lopez	TNC17, Linz	Jun. 2017	Invited talk	https://tnc17.geant.org/core/user/login
5G Architecture View Points	A. Galis	ITU-T IMT-2020 5G Workshop Geneva 11th July 2017	Jul. 2017	Invited Keynote Presentation	http://www.itu.int/en/ITU-T/Workshops-and-Seminars/201707/Pages/Programme.aspx
Moving Frontiers in Network Softwarization	A. Galis	IEEE NetSoft 2017 Bologna, 3-7 July 2017	Jul. 2017	Distinguished Expert Panel	http://sites.ieee.org/netsoft/panel/
Genome Centric Networking: a network function virtualization solution for genomic applications	M. Femminella G. Reali D. Valocchi	IEEE NetSoft 2017 Bologna, 3-7 July 2017	Jul. 2017	Presented	http://sites.ieee.org/netsoft/program/
A Flexible Multi-PoP Infrastructure Emulator for Carrier-grade MANO Systems	M. Peuster S. Dräxler H. Razzaghi S. Van Rossem W. Tavernier H. Karl	IEEE Netsoft 2017 Bologna, 3-7 July 2017 (DEMO track)	Jul. 2017	Presented Best Demo Award	http://sites.ieee.org/netsoft/

Title	Authors	Conference Proceedings	Publication Date	Status	Links and Additional Notes
A Network Service Development Kit Supporting the End-to-End Lifecycle of NFV-based Telecom Services	S. Van Rossem M. Peuster, L. Conceicao H. Razzaghi R. Kouchaksaraei W. Tavernier D. Colle M. Pickavet P. Demeester	IEEE NFV-SDN '17	Nov. 2017	Accepted Demo Paper	http://nfvsdn2017.ieee-nfvsdn.org/
Profile Your Chains, Not Functions: Automated Network Service Profiling in DevOps Environments	M. Peuster H. Karl	IEEE NFV-SDN'17	Nov. 2017	Full Paper Presented	http://nfvsdn2017.ieee-nfvsdn.org
Service Orchestration leveraging software networks and DevOps in 5G	G. Xilouris P. Eardley S. Kolometsos M. Kourtis F. Vicens C. Xilouris D. Valocchi A. Rocha L. Conceição J. Fernandez S. Siddiqui A. Zaalouk T. Soenen	Network of the Future	Nov. 2017	Presented, poster paper	https://nof17.lip6.fr/program.php

Title	Authors	Conference Proceedings	Publication Date	Status	Links and Additional Notes
	J. Martrat				
Making DevOps Possible in Telco Networks	D. Lopez	8 th FUSECO Forum, Berlin	Nov. 2017	Invited talk	http://www.fuseco-forum.org/ http://www.berlin5gweek.org/
Joint Orchestration of Cloud-Based Microservices and Virtual Network Functions	H. Razzaghi H. Karl	The Ninth International Conference on Cloud Computing, GRIDs, and Virtualization CLOUD COMPUTING 2018	Feb. 2018	Accepted, poster paper	
Insights from SONATA: Implementing and Integrating a Microservice-based NFV Service Platform with a DevOps Methodology	T. Soenen S. Van Rossem W. Tavernier F. Vicens D. Valocchi P. Trakadas P. Karkazis G. Xilouris P. Eardley S. Kolometsos M. Kourtis D. Guija S. Siddiqui P. Hasselmeyer J. Bonnet	IEEE/IFIP Network Operations and Management Symposium (NOMS), Experience Session	Apr. 2018	Accepted Paper	http://noms2018.ieee-noms.org/content/call-experience-session-papers
Let the state follow its flows: An SDN-based flow handover	M. Peuster H. Kuettner	IEEE Netsoft 2018	-	Submitted, Under Review	http://netsoft2018.ieee-netsoft.org

Title	Authors	Conference Proceedings	Publication Date	Status	Links and Additional Notes
protocol to support state migration	H. Karl				
Generating Resource and Performance Models for Service Function Chains: The Video Streaming Case	S. Dräxler M. Peuster M. Illian H. Karl	IEEE NetSoft 2018	-	Submitted, Under Review	http://netsoft2018.ieee-netsoft.org
Scaling and Placing Bidirectional Services with Stateful Virtual and Physical Network Functions	S. Dräxler S. Schneider H. Karl	IEEE NetSoft 2018	-	Submitted, Under Review	http://netsoft2018.ieee-netsoft.org

Table 6: Conference Publications

3.6.2 Journal Publications

Title	Authors	Journal	Publication Date	Status	Links and Additional Notes
5G PPP Phase1 Security Landscape	S. Siddiqui D. Lopez and others	5G PPP Security WG	Jul. 2017	Published	http://www.sonata-nfv.eu/content/5g-ppp-security-whitepaper-released
SONATA: Agile Service Development and Orchestration in 5G Virtualised Networks	J. Martrat S. Castro J. Bonnet G. Xilouris P. Eardley W. Tavernier S. Mendes	European 5G Annual Journal: Second Edition	Sep. 2017	Published	https://bscw.5g-ppp.eu/pub/bscw.cgi/d200818/Euro%205G%20Annual%20Journal%202017.pdf
Network Functions Virtualisation: A Carrier's Perspective on State-of-Play & Future Challenges	P. Veitch P. Willis P. Eardley	ITP Journal	Dec. 2017	Invited paper To be published	https://www.theitp.org/knowledge_hub/journal_archives
NFV and SDN - Key Technology Enablers for 5G Networks	Z. Yousaf M. Bredel S. Schaller F. Schneider	IEEE JSAC - Special issue on Emerging Technologies in Software-	Q1 2018	Under review	http://www.comsoc.org/jsac

Title	Authors	Journal	Publication Date	Status	Links and Additional Notes
		driven Communicati on			
Optimization Enablers in Cloud Networks with Slices	Z. Xu W. Liang A. Galis Y. Ma Q. Xia W. Xu	IEEE JSAC	Q1 2018	Under review	http://www.comsoc.org/jsac
JASPER: Joint Optimization of Scaling, Placement, and Routing of Virtual Network Services	S. Dräxler H. Karl Z. A. Mann	IEEE Transactions on Network and Service Management (IEEE TNSM)	-	Under review	https://www.comsoc.org/tnsm

Table 7: Journal Publications

3.6.3 (Pre) Standards Publications

Title	Authors	SDO	Publication Date	Status	Links and Additional Notes
Network Slicing Terms and Systems	A. Galis	IETF 99	Jul. 2017	Presented	https://datatracker.ietf.org/meeting/99/materials
Network Slicing - Revised Problem Statement	A. Galis S. Kuklinski J. Dong L. Geng K. Makhijani H. Flinck R. Ravindran L. M. C. Murillo S. Bryant P. Martinez-Julia S. Hares C. J. B. Cano	IETF	Jul. 2017	Draft	draft-galis-netslices-revised-problem-statement-01
Network Slicing Architecture	K. Makhijani J. Qin R. Ravindran L. Geng L. Qiang S. Peng X. de Foy A. Rahman A. Galis X. de Foy	IETF	Jul. 2017	Draft	draft-geng-netslices-architecture-02

Title	Authors	SDO	Publication Date	Status	Links and Additional Notes
	S. Kuklinski				
Network Slicing Use Cases: Network Customization and Differentiated Services	K. Makhijani J. Qin R. Ravindran L. Geng L. Qiang S. Peng X. de Foy A. Rahman A. Galis	IETF	Jul. 2017	Draft	draft-netslices-usecases-01
Gap Analysis for Transport Network Slicing	L. Qiang P. Martinez-Julia L. Geng J. Dong K. Makhijani A. Galis S. Hares S. Kuklinski	IETF	Jul. 2017	Draft	draft-qiang-netslices-gap-analysis-01
Problem Statement of Supervised Heterogeneous Network Slicing	L. Geng L. Wang S. Kuklinski L. Qiang S. Matsushima	IETF100	Oct. 2017	Draft 01	https://tools.ietf.org/html/draft-geng-coms-problem-statement-01

Title	Authors	SDO	Publication Date	Status	Links and Additional Notes
	A. Galis L. Contreras				
Interconnecting (or Stitching) Network Slice Subnets	X. de Foy A. Rahman A. Galis K. Makhijani L. Qiang	IETF100	Oct. 2017	Draft 01	https://tools.ietf.org/html/draft-defoy-coms-subnet-interconnection-01
Network Slicing Supported by Dynamic VIM Instantiation	S. Clayman D. Valocchi F. Tusa A. Galis	IETF100	Nov. 2017	Presentation at NFVRG	https://datatracker.ietf.org/meeting/100/materials/slides-100-nfvrg-3-network-slicing-support-by-dynamic-vim-instantiation/
Technology Independent Information Model for Network Slicing	L. Qiang A. Galis L. Geng K. Makhijani P. Martinez H. Flinck X. de Foy A. Rahman	IETF100	Nov. 2017	Draft 01	https://datatracker.ietf.org/doc/draft-qiang-coms-netslicing-information-model
Network Slicing Use Cases	K. Makhijani J. Qin	IETF100	Nov. 2017	Draft 02	https://datatracker.ietf.org/doc/draft-netslices-usecases/

Title	Authors	SDO	Publication Date	Status	Links and Additional Notes
	R. Ravindran L. Qiang S. Peng L. Geng X. de Foy A. Rahman A. Galis G. Fioccola H. Flinck L. Contreras				
Autonomic Slice Networking	A. Galis K. Makhijani D. Yu B. Liu	IETF100	Nov. 2017	Draft 03	https://www.ietf.org/internet-drafts/draft-galis-anima-autonomic-slice-networking-03.txt

Table 8: Standards Publications

3.6.4 Book Publications

In year 3, the consortium also participated in the edition of a chapter of the book “5G Networks: an European Vision” whose name will be “DevOps for 5G Network Function Virtualization”. The book is still to be published.

Title	Authors	Submission date	Publication Date	Status	Links and Additional Notes
5G Networks: an European Vision, Chapter: DevOps for 5G Network Function Virtualization	A. Galis D. Valocchi S. Clayman G. Xilouris H. Karl S. Castro J. Martrat J. Bonnet	July 2017	Q4 2017	Not yet	Under review

Table 9: Book Publications

3.7 Events and demos

The project has achieved and even surpassed the objective of keeping the previous years' rhythm regarding events, with the participation in a total of 12 events/workshops in only 6 months, same as in the whole year two.

The table below provide more information about this activity. In section 3.7.2 we provide more detailed information about the most relevant events for the project in Y3.

3.7.1 Events tracking

Event	Date	Location	Audience profile	Partners representatives	Consortium activity	Additional information
IEEE NetSoft 2017	Jul 2017	Bologna, Italy	Research Industry	M. Peuster S. Kolometsos	<ul style="list-style-type: none"> Project Demo "A flexible multi-PoP infrastructure emulator for carrier-grade MANO Systems" + Poster + video. Best Demo paper award! Project Demo "DevOps based service orchestration in 5G virtualized Networks + Poster 	http://sites.ieee.org/netsoft/demos/
Lipari Summer School on Network programmability: Emerging methodologies, technologies, and applications	Jul 2017	Lipari (Aeolian islands), Italy	PhD students and young researchers involved in networking research both from computer science and	H. Karl	Material largely based on SONATA; Testbed demo; Material online https://uni-paderborn.sciebo.de/index.php/s/EBxhuCoCtaBGK4J	https://netprog.liparischool.it http://www.sonata-nfv.eu/content/lipari-summer-school-network-programmability-

Event	Date	Location	Audience profile	Partners representatives	Consortium activity	Additional information
			communications communities			emerging-methodologies-technologies-and http://www.sonata-nfv.eu/content/lipari-summer-school-material
OSM-Mid-Release#3 Meeting	Jul. 2017	Sophia Antipolis, France	OSM community	M. Peuster T. Batista	Presented SONATA tools for OSM	
IEEE 5G SUMMIT	Jul. 2017	Thessaloniki, Greece	5G Project partners	A. Voulkidis	Project presentation File:IEEE 5G Summit July2017 Greece_s yn.pdf	http://www.5gsummit.org/greece/
OSM-Release#4 Meeting	Oct. 2017	Madrid, Spain	OSM community	M. Peuster F. Vicens	Work and discussion on SONATA emulator and validator; received outstanding contributor award	
SDN NFV World Congress	Oct. 2017	The Hague, Netherlands	Research Industry	J. Martrat G. Xilouris E. Otoakhi	Project Presentations: <ul style="list-style-type: none"> SONATA approach towards DevOps in 5G Networks (Josep Martart) SONATA NS development and deployment workflows (Georgios Xilouris) 	https://www.layer123.com/sdn-agenda-day3/#Forum-6 http://www.sonata-nfv.eu/content/sonata-will-be-sdn-nfv-world-congress-presenting-sonata-30

Event	Date	Location	Audience profile	Partners representatives	Consortium activity	Additional information
					<ul style="list-style-type: none"> Virtual CDN Implementation (Eugene Otoakhia) 	http://www.sonata-nfv.eu/content/sonata-material-sdn-nfv-world-congress-available
IEEE NFV-SDN 2017	Nov. 2017	Berlin, Germany	Research Industry	G. Xilouris S. Clayman H. Razzaghi M. Pesteur	<ul style="list-style-type: none"> Co-organisation of the workshop "Fourth Workshop on Network Function Virtualization and Programmable Networks". Endorsement of the "Third IEEE International Workshop on Orchestration for Software Defined Infrastructures" workshop. Presentation of the Demo Paper "A Network Service Development Kit Supporting the End-to-End Lifecycle of NFV-based Telecom Services" Presentation of the Paper "Profile Your Chains, Not Functions: Automated Network Service Profiling in DevOps" 	http://www.sonata-nfv.eu/content/sonata-and-berlin-5g-week

Event	Date	Location	Audience profile	Partners representatives	Consortium activity	Additional information
					Environments”.	
8th FOKUS-FUSECO Forum 2017	Nov. 2017	Berlin, Germany	Research Industry	D. Lopez A. Galis	<ul style="list-style-type: none"> • Presentation: “Making DevOps Possible in Telco Networks” • Session and Panel: “Operator 5G Use Case Visions and Global 5G Standardization” 	http://www.sonata-nfv.eu/content/sonata-and-berlin-5g-week
XXIst Edition of FIC- Cape Verde International Fair	Nov. 2017	Mindelo, Cape Verde	Research Industry	A. Rocha	Presentation of the European project “SONATA 5G NFV”	http://www.sonata-nfv.eu/content/sonata-xxist-edition-fic-cape-verde-international-fair http://www.sonata-nfv.eu/content/material-sonata-participation-xxist-edition-fic-available
Network of the Future (NoF) conference	Nov. 2017	London, UK	Research Industry	G. Xilouris P. Eardley	SONATA demo: Service orchestration leveraging software networks and DevOps in 5G	http://www.sonata-nfv.eu/content/sonata-nof-2017-london http://www.sonata-nfv.eu/content/sonata-poster-service-orchestration-leveraging-software-networks-and-devops-5g

Event	Date	Location	Audience profile	Partners representatives	Consortium activity	Additional information
BMBF ancillary research 5G	Dec. 2017	Remote presentation	Research	M. Peuster	SONATA/5GTANGO presentation	
NFV#20-F2F	Dec. 2017	Sophia Antipolis, France	ETSI Community	T. Batista	Participation in the event with special focus on SONATA Validator	

Table 10: Y2 Events Reporting

3.7.2 Additional information about the most relevant events of Y3

3.7.2.1 IEEE NetSoft 2017

Bologna hosted the third edition of the flagship conference of the IEEE SDN initiative from the 3rd to the 7th of July 2017.

This timely flagship conference of IEEE SDN tried to shed light on the fundamental technology components and systems for SDN-NFV infrastructures, clouds-edges and any sort of network services in order to fully exploit its potential for the efficiently handling of heterogeneous resources across wired and wireless networks and data center domains and for easy and fast deployment of new ICT services. The IEEE NetSoft brought together academia and industry to jointly review and ponder maturing developments related to all aspects of Softwarization, and its first exploitation with the 5G.

SONATA participated at the NetSoft 2017 leading two out of the ten demos that took place during the conference as shown in Figure 50.

D1: A Flexible Multi-PoP Infrastructure Emulator for Carrier-grade MANO Systems Authors – Manuel Peuster (Paderborn University), Sevil Draxler (Paderborn University, Germany), Hadi Razzaghi Kouchaksarai (Paderborn University, Germany), Steven v. Rossem (Ghent University, Belgium) Wouter Tavernier (Ghent University, Belgium), and Holger Karl (Paderborn University, Germany)
D2: An Interactive Intent-based Negotiation Scheme for Application-Centric Networks Authors – Antonio Marsico (FBK CREATE-NET, Italy), Michele Santuari (FBK CREATE-NET, Italy), Marco Savi (FBK CREATE-NET, Italy), Domenico Siracusa (FBK CREATE-NET, Italy), Abdul Ghafoor (RISE ICT/Acreo, Sweden), Stephane Junique (RISE ICT/Acreo, Sweden), Pontus Sköldström (RISE ICT/Acreo, Sweden)
D3: End-to-End Management of IoT Applications Authors – Hamzeh Khazaei (University of Toronto, Canada), Hadi Bannazadeh (University of Toronto, Canada), Alberto Leon-Garcia (University of Toronto, Canada)
D4: Mimicking a Compute Domain Orchestrator with the ONOS SDN Controller Authors – Gabriele Castellano (Politecnico di Torino, Italy), Ivano Cerrato (Politecnico di Torino, Italy), Fulvio Rizzo (Politecnico di Torino, Italy), Davide Pezzolla (Politecnico di Torino, Italy), Antonio Manzolini (TIM, Italy)
D5: RAN slicing for multi-tenancy support in a WLAN scenario Authors – Katerina Koutlia (Universitat Politècnica de Catalunya, Spain), Anna Umbert (Universitat Politècnica de Catalunya, Spain), Sergio Garcia (Universitat Politècnica de Catalunya, Spain), Ferran Casadevall (Universitat Politècnica de Catalunya, Spain)
D6: Telecom Microservices Orchestration Authors – Duc-Hung LUONG (Nokia Bell Labs, France), Huu-Trung THIEU (Nokia Bell Labs, France), Abdelkader OUTTAGARTS (Nokia Bell Labs, France), Bruno MONGAZON-CAZAVET (Nokia Bell Labs, France)
D7: Traffic Monitoring and DDoS Detection using Stateful SDN Authors – Filippo Rebecchi (Thales Communications & Security, France), Julien Boite (Thales Communications & Security, France), Pierre-Alexis Nardin (Thales Communications & Security, France), Mathieu Bouet (Thales Communications & Security, France), Vania Conan (Thales Communications & Security, France)
D8: Wi-Balance SDN-based load-balancing in Enterprise WLANs Authors – Estefania Coronado (University of Castilla-La Mancha, Spain), Jose Villalon (University of Castilla-La Mancha, Spain), Antonio Garrido (University of Castilla-La Mancha, Spain)
D9: DevOps based service orchestration in 5G virtualised Networks Authors – George Xilouris (NCSR Demokritos, Greece), Stavros Kolometsos (NCSR Demokritos, Greece), Chris Xilouris (NCSR Demokritos, Greece), Javier F. Hidalgo (I2CAT, Spain), Shuaib Siddiqui (I2CAT, Spain), Alberto Rocha (Altice Labs, Portugal), Sonia Castro (ATOS, Spain), Felipe Vicens (ATOS, Spain), Josep Martrat (ATOS, Spain)
D10: Multi-domain Service Orchestration with X-MANO Authors – Giovanni Baggio (FBK CREATE-NET, Italy), Antonio Francescon (FBK CREATE-NET, Italy), Riccardo Fedrizzi (FBK CREATE-NET, Italy)

Figure 50: Demonstrations at the NetSoft 2017

As previously commented, posters were created for both demonstrations. Those posters can be found on the SONATA website, within the “Marketing material” section in the “Project Outcomes” label [11].

We highlight again that with the first demonstration, A Flexible Multi-PoP Infrastructure Emulator for Carrier-grade MANO Systems, SONATA got the IEEE NetSoft Best Demo Award 2017.

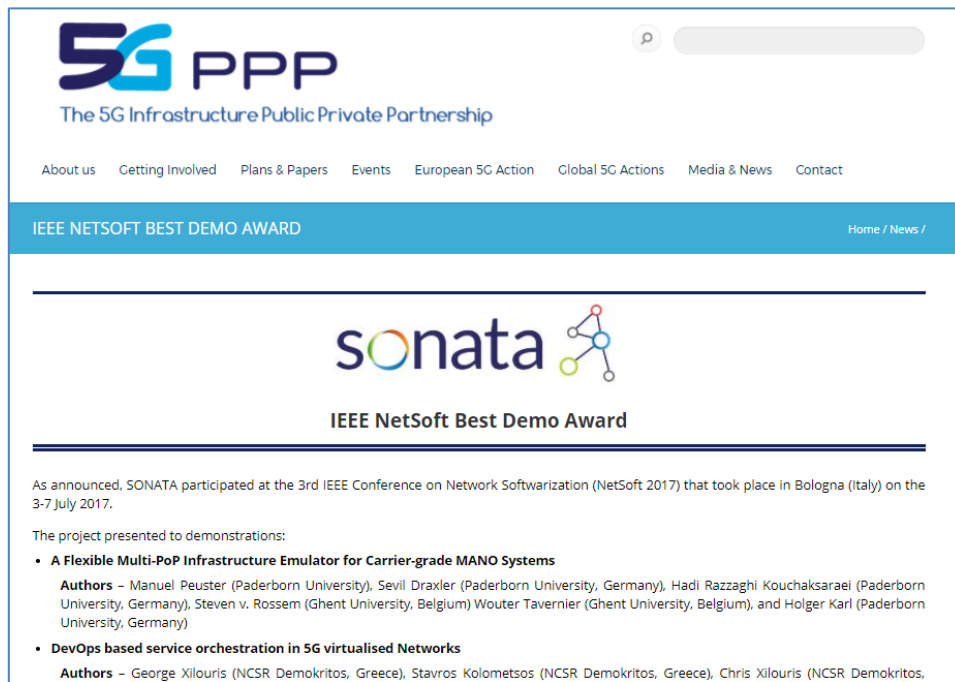


Figure 51: IEEE NetSoft Best Demo Award 2017 for SONATA demonstration on the 5G PPP website

A video of this demo can be also found on the project YouTube channel [22].

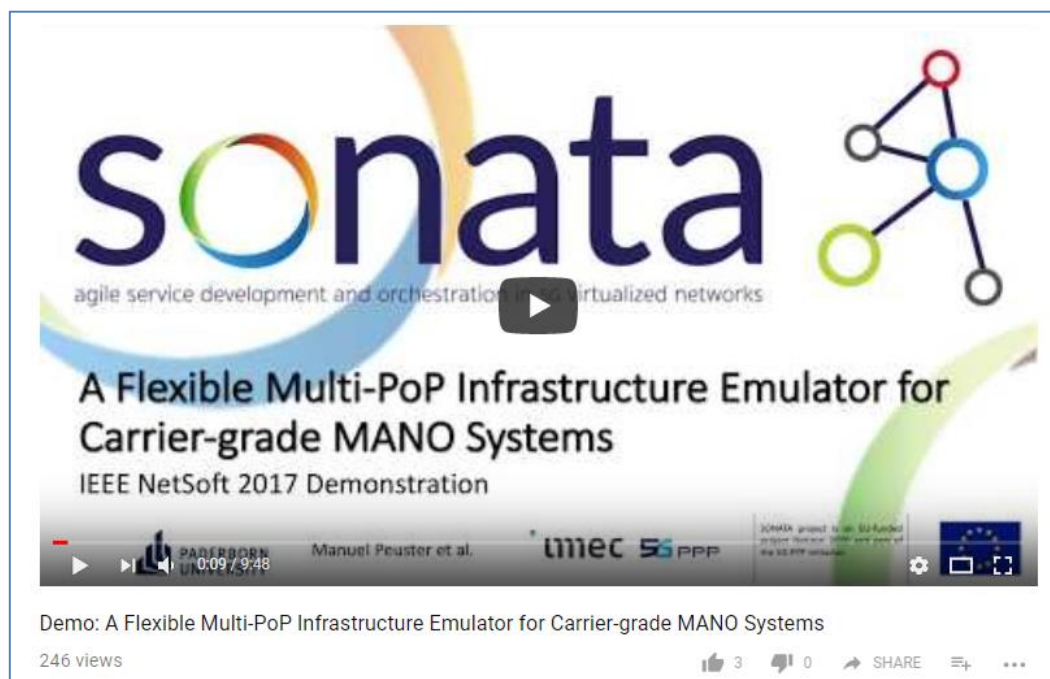


Figure 52: IEEE NetSoft SONATA demonstration on the SONATA YouTube channel

3.7.2.2 SDN NFV World Congress 2017

Another of the major events for SONATA during this last period was the SDN NFV World Congress 2017.

Established in 2012, SDN NFV World Congress creates the principal market focus for network innovation, and has grown to become the world's largest meeting place for carrier Network Transformation industry leaders. The SDN NFV World Congress is the industry leading debating forum and showcase for the rapidly growing and massively influential, Software-Defined networking and Network Functions Virtualization industries.

In year two, SONATA was at the SDN NFV World Congress with a workshop session to announce SONATA 1.0, the first software release of the project. This year, we were there again but this time with SONATA 3.0, the latest software release of the project delivered in the weeks before this event.

This year, we gave two presentations on the 12th of October:

SONATA approach towards DevOps in 5G Networks

Josep Martrat | Project Co-ordinator | SONATA

Telecom Market Manager | ATOS

SONATA NS development and deployment workflows

Georgios Xilouris | Research Fellow | NCSR Demokritos

In addition to this, one of our partner members, Eugene Otoakhia from BT, made a presentation **on Virtual CDN Implementation** on the same day. This presentation also included some notions about SONATA and the pilots being developed by the project.

These project presentations are available on the project website, in the project presentations section [23].

Videos of the sessions were also recorded and are available in the SONATA YouTube channel [8].

The whole agenda of day three can be found at [24].



Figure 53: SONATA participation at the SDN NFV World Congress 2017

3.7.2.3 Berlin 5G Week the IEEE NFV-SDN event

The Berlin 5G week took place from the 6th to the 10th of November 2017. This year's edition joined three of the most solid events related to software-based networks and 5G technologies: 3rd IEEE NFV-SDN Conference, Industrial IoT Forum and the 8th FOKUS FUSECO FORUM.

The globally most discussed 5G hot topics, such as software-defined networks, network virtualization, network slicing for 5G verticals, Industrial Internet/IoT, 5G multi-access network support, and 5G testbeds and most recent technology PoCs, were touched there.



Figure 54: Berlin 5G Week

SONATA project and its partner members had an active participation there, in both the 3rd IEEE NFV-SDN Conference and the 8th FOKUS FUSECO FORUM. Below we summarize our participation in each of the events:

The 3rd IEEE NFV-SDN Conference

- Co-organisation of the workshop "Fourth Workshop on Network Function Virtualization and Programmable Networks".
- Endorsement of the "Third IEEE International Workshop on Orchestration for Software Defined Infrastructures" workshop.
- Presentation of the Demo Paper "A Network Service Development Kit Supporting the End-to-End Lifecycle of NFV-based Telecom Services"
- Presentation of the Paper "Profile Your Chains, Not Functions: Automated Network Service Profiling in DevOps Environments".

The 8th FOKUS FUSECO FORUM

- Presentation on "Making DevOps Possible in Telco Networks.
- Session and panel on "Operator 5G Use Case Visions and Global 5G Standardization".

More information about these activities can be found on SONATA website [25].

3.7.2.4 XX1st Edition of FIC – Cape Verde International Fair

SONATA participated in the XX1st Edition of FIC - Cape Verde International Fair, this year under the slogan "Cape Verde, the Hub for Western Africa".



Figure 55: FIC 2017 event

Held in the City of Mindelo - São Vicente Island, from November 15 to 19, the FIC 2017 was the reference event for all sectors in Cape Verde. During 5 days, the country brought together exporters, importers, resellers, distributors and service providers from and to Cape Verde with the purpose of promoting business, knowledge transfer and business partnerships.

Our partner member, Altice Labs, was in charge of presenting the European project “SONATA” this time. Altice Labs was kindly invited to participate by the local incumbent operator CVT [26] and was integrated in the “Open Idea” stand dedicated to Innovation.

The Altice labs team made several presentations about SONATA and its results, as well as some live demonstrations. Presentation and video of the session are publicly available at the following links respectively [27] [28].

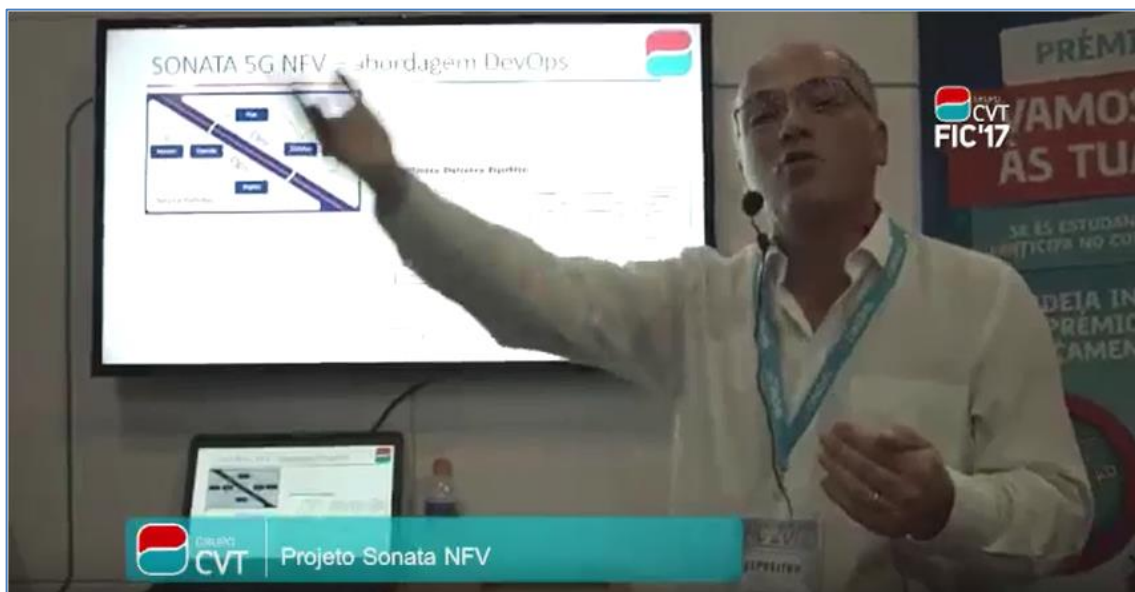


Figure 56: Alberto Rocha (Altice Labs) presenting at FIC 2017

3.7.2.5 The Network of the Future conference-NoF 2017

The Network of the Future (NoF) conference is a premier annual conference that covers advances in the area of Future Internet design, with emphasis on enabling technologies, architectures and services. The conference aims at providing a forum for researchers, students and professionals to exchange ideas, share their experiences, and discuss their research results around a single-track of technical sessions and a series of tutorials and workshops.

This year, NoF took place in the historical Strand campus of the King's College, in the heart of London, from the 22nd to the 24th of November.

SONATA participated in the Demo & Poster Session on day three, where our partner members NCSR and BT presented the SONATA demo "Service orchestration leveraging software networks and DevOps in 5G".

Poster of the session can be found in the "PROJECT OUTCOMES" section of this website [29].



Figure 57: Pictures taken at the NoF 2017

3.8 Collaboration

Activities regarding collaboration in relation to standards, open source communities and the 5G PPP will be extensively covered in deliverable D7.8, as they constitute one of the main exploitation pillars of the project.

As D7.8 will be a confidential report, just available for members of the consortium (including the Commission Services), we summarised here the main information provided in D7.8.

3.8.1 Standards bodies organizations

As planned, the project identified three main standardization targets (ETSI NFV, IETF and ITU-T) and has focused its contributions on them during this period. It has been during these last months when the work in these contributions has translated in final results, as well as in mature drafts that the contributing partners plan to continue as part of their exploitation activities. In addition, the project has been instrumental in the establishment of a new initiative within ETSI (the ZSM ISG) and has kept interacting with two other standards organizations: the TMForum and MEF.

Within ETSI NFV, the project has focused its contributions in areas related to security, monitoring, and the application of the NFV concepts to support network slicing. It has interacted with the SEC and EVE WGs, dedicated to security and the evolution of the NFV technology respectively. The SONATA results on DevOps were contributed as well to the REL WG (on reliability), together with matters related to billing and the verification of cloud

nativeness in the EVE WG. Finally, SONATA has contributed to the ongoing discussions on multi-domain aspects in all the ETSI NFV working groups.

The contributions to ITU-T have been concentrated on IMT2020 and related to the interests of this group: all 5G non-radio network segments as far as overall 5G architecture, network softwarization, integrated network management, fixed mobile convergence is concerned.

In the case of the IETF (and its research branch, the IRTF), the SONATA partners have contributed and made the case for Internet Drafts on different aspects of network slicing, including the autonomic management of the slices, and the components required to support DevOps in NFV environments.

Furthermore, SONATA facilitated the discussions that concluded in the approval by ETSI of a new ISG, called ZSM (Zero-touch Service Management). The project hosted the workshop (organized by TID in Madrid, in September 2017) that defined the later approved Terms of Reference for the ETSI ZSM ISG. Several of the concepts on service development and continuous integration developed in SONATA are included in the plans of the ISG, as result of the project partners' contributions during these initial discussions. This new forum constitutes another essential path for further exploitation of SONATA results.

Finally, the project has kept open discussions with:

- TMForum, on the development of their *Open APIs*, and how their strategy around their *OSS of the Future* could be supported by the SONATA results on service development, deployment, and monitoring.
- MEF, on the evolution of their network service orchestration framework, and how they could benefit from some of the SONATA approaches to these matters.

We can conclude that SONATA contributions to SDOs have achieved a significant impact.

3.8.2 Open Source communities: OSM

As planned, during these six last months of the project, our collaboration strategy has been focused mainly on OSM, due to the synergies with SONATA and the relationship established specially during the previous years.

In year three, SONATA has kept participating in the OSM meetings and discussing the main areas where SONATA could potentially contribute to OSM.

Our participation in these meetings has been very fruitful so far: OSM just launched Release THREE, which reaches a high level of maturity both in the supported features and in the robustness of the code. It includes SONATA's emulator, *son-emu*, as part of the DevOps environment, with our service validation tool planned for inclusion in the next release.

SONATA is also playing a central role in a whitepaper that OSM is writing about "Experience with NFV architecture, interfaces and information models", currently in draft version. This document captures some of the points that have been learnt from implementing the NFV architecture, interfaces and information models. The aim is that ETSI NFV ISG considers them as it develops its next iteration of the NFV standards. The development of the SONATA Pilots has helped us explore some of the issues that the OSM community is facing and we are leading this OSM-related activity to publish the whitepaper.

3.8.3 5G PPP Collaboration

3.8.3.1 5G PPP Working Groups

As planned, during this period SONATA keep its active role in the following WGs:

Software Networks

SONATA has been co-leading the Software Networks working group during the whole 5G PPP Phase 1.

During this last period of the project, it was of the utmost importance to consolidate the mature results of Phase 1 projects so that the results can be reused and adopted by the projects in 5G PPP Phase 2. Thus, SONATA collected – with the support of other projects – the list of well documented, tested and available assets, considering also the associated license and ownership. This helps to guarantee the future evolution of existing outcomes.

In addition, SONATA co-organized the group workshop at EUCNC 2017 conference at Oulu. We presented an overview of the SN WG white paper produced in early 2017 to which SONATA contributed some chapters on network programmability and existing Open Source initiatives in the NFV/SDN arena. The main objective of the workshop was two-fold. On one hand, to present the Phase 1 results and to continue with technical discussions trying to address the existing gaps when addressing SDN/NFV topic as a whole. On the other hand, to present the technical focus of Phase 2 projects.

As a follow-on activity, SONATA has been organizing regular teleconferences in which the new projects have been presenting the initial architecture designs.

Finally, SONATA prepared the new WG Terms of Reference (ToR) to officially incorporate these new projects. We called and organized the necessary elections for the new WG chairs as the mandate expired in fall 2017. SONATA is supporting new projects so that there is a smooth transition.

Architecture

The contributions of SONATA to the Architecture working group of the 5G PPP initiative have continued from the previous year. Represented by UCL and UPB, SONATA has contributed to various aspects of this working group's whitepaper in Version 2. Our editorial responsibilities included overall co-editor of the Section 2 "Overall Architecture" and significant impact on Section 5 "Softwarization and 5G Service Management and Orchestration", including contributions focused on the main areas of interest for SONATA:

- 5G Network softwarisation and programmability.
- 5G Network slicing lifecycle Management.
- 5G Recursive approaches.
- 5G Service management and DevOps
- Impact on Standardization

At the time of this writing, the second version of the white paper is nearing completion and currently undergoes internal review; it is expected to be released in December 2017. An early version of this white paper was issued in July 2017 for public consultation [30].

[Network Management](#)

The contributions of SONATA to the Cognitive Network Management Working Group of the 5G PPP initiative have continued from the previous year. Represented by UCL, SONATA has contributed to various aspects of this Working Group's whitepaper [31].

We have participated in multiple editorial telephone conferences. Our editorial responsibilities included contributions focused on the main areas of interest for SONATA:

- New Requirements for Network Management based on 5G
- 5G Service & Network Management and Orchestration
- Cognitive Network Management for 5G : NFV, SDN, Network Slicing

[Security](#)

SONATA was involved in the Security WG and continued to participate in the WG during these last six months. As the 5G PPP Phase 1 projects are nearing the finish line, as part of the SEC WG activity, SONATA will present the security-related achievements in the WG.

[3.8.3.2 5G PPP Projects](#)

We list below the projects with which SONATA has actively collaborated, as well as the activities that took place in this regard and the main conclusions.

[5G Exchange \[32\]](#)

Similarly, in year 2 we had identified the need for further investigating the technical differences and similarities of hierarchical orchestration in SONATA and 5G Exchange (5GEx). In a special task force formed for this purpose, we have analyzed and compare the approaches taken towards cross-domain hierarchical network service management and orchestration.

As a conclusion we can say that both projects consider a north-south interface for the hierarchical interactions. In 5GEx the north-bound orchestrator uses resource control interfaces from subordinate domains, similar to the infrastructure view that SONATA's north-bound service platform can receive from the south-bound service platform in a hierarchical relationship. Despite the differences in the main focus of the projects, 5GEx and SONATA approaches to hierarchical orchestration are very well aligned and interoperable. This has been shown by a proof-of-concept implementation of multi-domain, hierarchical management and orchestration using 5GEx and SONATA. The reader is referenced to SONATA D6.3, published on SONATA website (Deliverables Section) [33][22], for further details about this PoC.

[SELFNET \[34\]](#)

The SELFNET project's main objective is to design and implement an autonomic-based control loop. This loop leverages on virtualized (NFV-based) and/or programmable (SDN-based) sensors that provide information about the network and enables the operational management layers to derive network symptoms, diagnose their cause, define a tactic to mitigate the problem and apply specific action(s) through virtualized and/or programmable actuators. On the other hand, the SONATA project aims to optimize and accelerate the virtualized networks design and deployment through a DevOps model approach.

Putting both projects in perspective, it is easy to conclude that they complement each other: SONATA enhances SELFNET by providing automated testing and deployment techniques, whereas SELFNET enhances SONATA through autonomic-based management procedures to optimize the end-to-end service delivery.

The two SONATA components we thought could be reused by SELFNET are the SONATA's Emulator (from SONATA's SDK) and SONATA's Gatekeeper. However, the integration effort that would be required to accommodate these components in the SELFNET pilots was found to be significant, to an amount that neither project could now spend. This extension may be considered by 5GTANGO [35] and SLICENET [36] projects, which can be considered as extensions of SONATA and SELFNET, respectively.

[CHARISMA \[37\]](#)

The initial collaboration effort and ideas between SONATA and CHARISMA projects were reported in D7.7. The main topics of mutual interest were:

1. NFV Orchestrator: As perceived in initial discussion on this topic, due to the lack of available effort required for re-usage of NFVOs in the projects (i.e., SONATA's Platform in CHARISMA or TeNOR orchestrator in SONATA), the idea was not further pursued.
2. SONATA SDK: The idea of reutilizing SONATA's SDK in CHARISMA was further discussed. Although, effort for implementation and demonstration were not available, a software architecture-level blue-print was produced. Two additional components would be needed: a CHARISMA Translator to translate the SONATA-based descriptors into CHARISMA descriptors, and a client to use CHARISMA Control, Management and Orchestration API to onboard the descriptors in CHARISMA platform.
3. CHARISMA Open Access Manager: The relevant component in CHARISMA Open Access Manager to be re-utilized in SONATA Platform is the Slice Manager. Although SONATA already perceives a Slice Manager plugin in its MANO architecture, for the CHARISMA Slice manager to be adopted, a lot of effort would be required. Similar to other topics, the discussion and conclusion of mutual interest was limited to an architecture level exercise.

[VirtuWind \[38\]](#)

As reported in the previous communication and dissemination report (D7.3), VirtuWind and SONATA held a workshop to elaborate the similarities and possible collaborations. A number of complementarities and synergies were identified between the two projects. After a few more discussion rounds, we came to the conclusion that the dynamicity and DevOps methodology enabled by SONATA do not help the main aim of the VirtuWind project, which operates in a rather conservative and static environment. Similarly, the additions developed in the VirtuWind project, specifically those related to quality-of-service guarantees, were not integrated into the SONATA platform due to time and effort constraints.

3.9 Other press and media channels

As agreed during the definition of the communication and dissemination plan for year 3, the consortium created a press release with the delivery of the last major software release of the

project: SONATA 3.0. As planned, once approved by each individual organization in the consortium, this press release was promoted through different channels: the project's channels, the partner's individual channels, and also the 5G PPP channels. The goal was to reach the widest coverage possible. The press releases are also available on the project website for reading/downloading at any time [39].

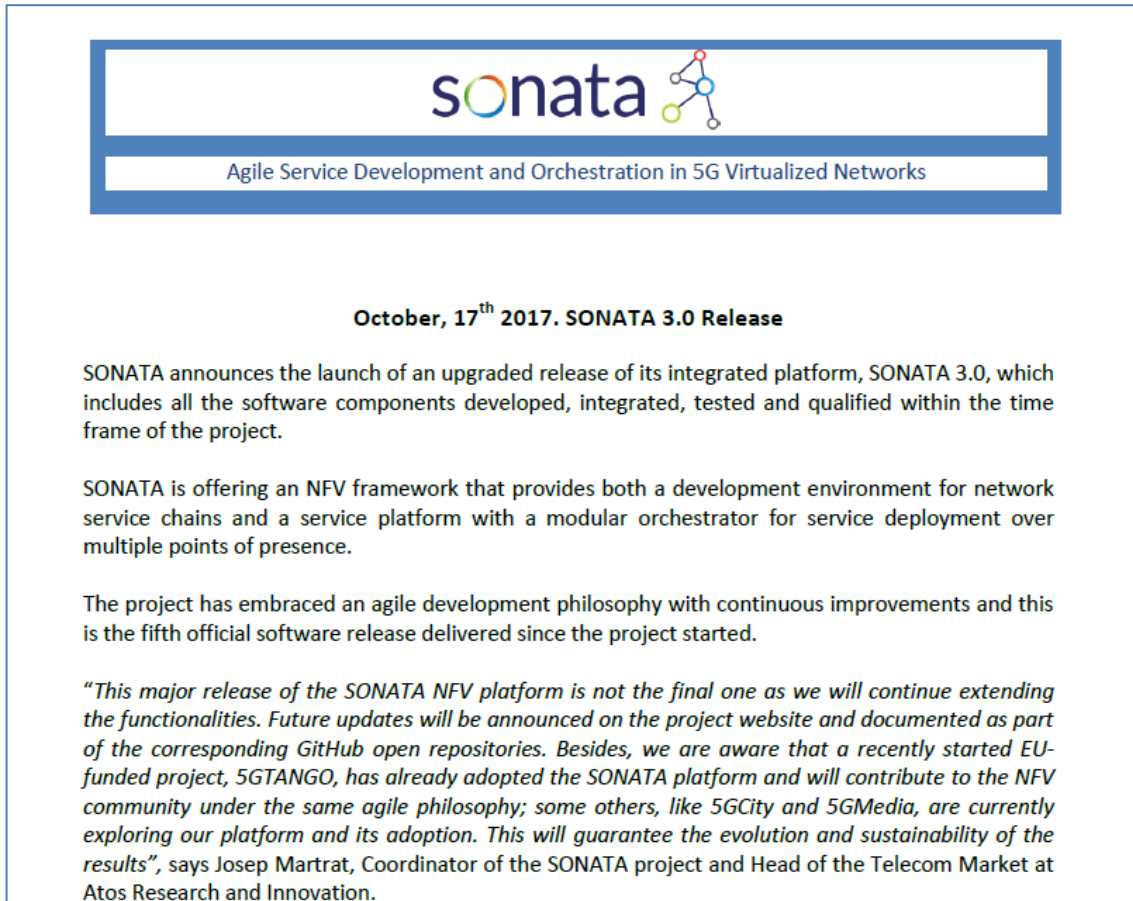


Figure 58: SONATA press release issue 3

As in previous years, all SONATA communication activity has been reported and echoed by the 5G PPP through its main communication and dissemination channels, namely its website, its LinkedIn group and its Twitter account. It is fair to mention some examples of SONATA's contribution to the content provided by the 5G PPP through these channels:

- 32 out of the 158 news articles published through the 5G PPP website since its launch have been generated by SONATA project, this means more than 20% of them.
- The same can be said if we take SONATA's contributions to the 5G PPP LinkedIn group into account, adding up to 40 posts out of a total of 122 published, which means almost 33%.
- Our contribution to the 5G PPP Twitter account, although more difficult to quantify, has been also high.



Figure 59: Example of SONATA contribution to the 5G PPP website news

Our strong communication/dissemination effort within the 5G PPP community has yielded its fruit and we can claim that even some 5G PPP phase II projects are thinking of reusing SONATA results to start building on top. As an example, we can mention 5GCity [40], which is considering SONATA as the orchestrator to be used by the project as mentioned in their presentation video [41] (represented in Figures 60 and 61).

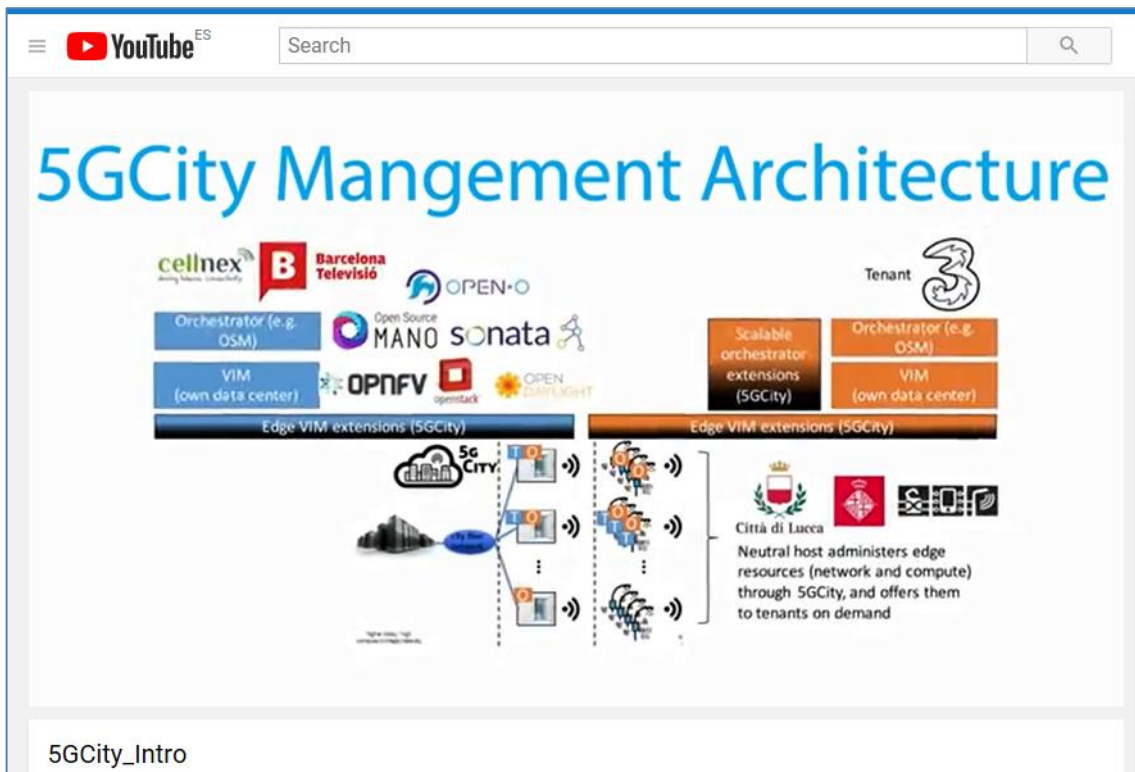


Figure 60: SONATA in 5GCity project presentation video

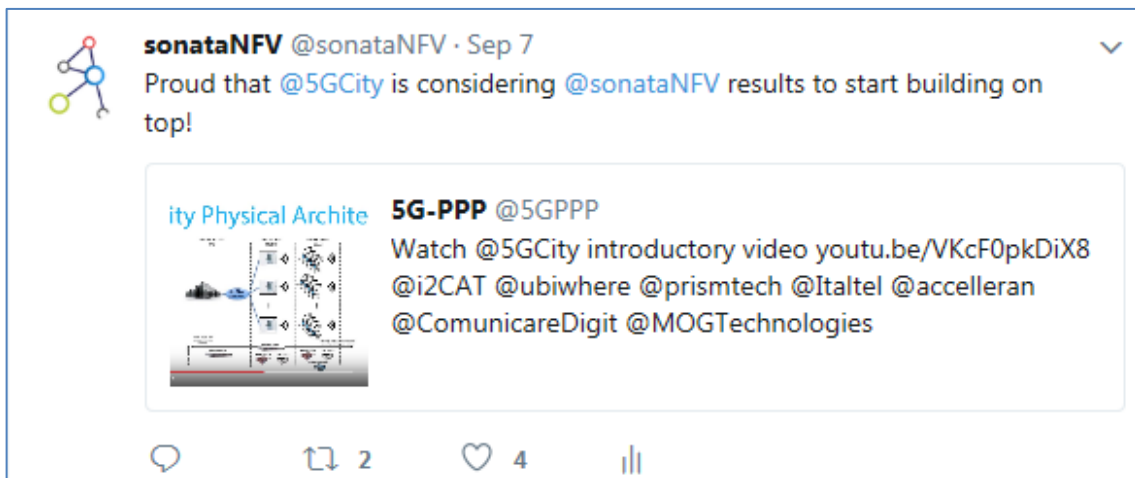


Figure 61: SONATA / 5GCity joint communication

Another fact that deserves to be mentioned, is our close relationship with OSM. As described in the section related to “Collaboration”, contributing to OSM was one of our main goals during this period. This collaboration has gone beyond technical discussions and both open source projects have joined forces many times to create impact and give the maximum visibility possible to the work we were doing. The following figures are just an example of that.

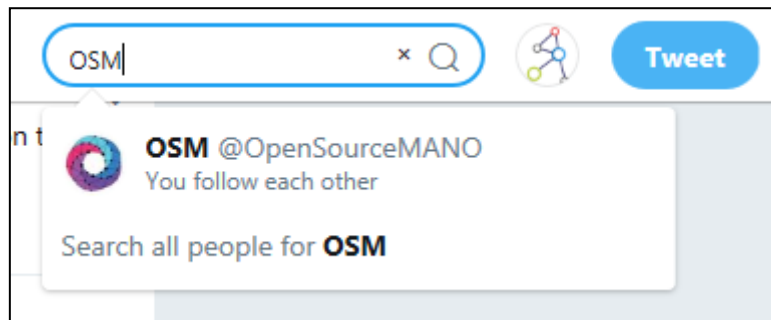


Figure 62: SONATA and OSM follow each other in Twitter



Figure 63: Communications related to OSM award for the SONATA emulator contribution



Figure 64: SONATA/OSM communications regarding the SDN NFV World Congress 2017

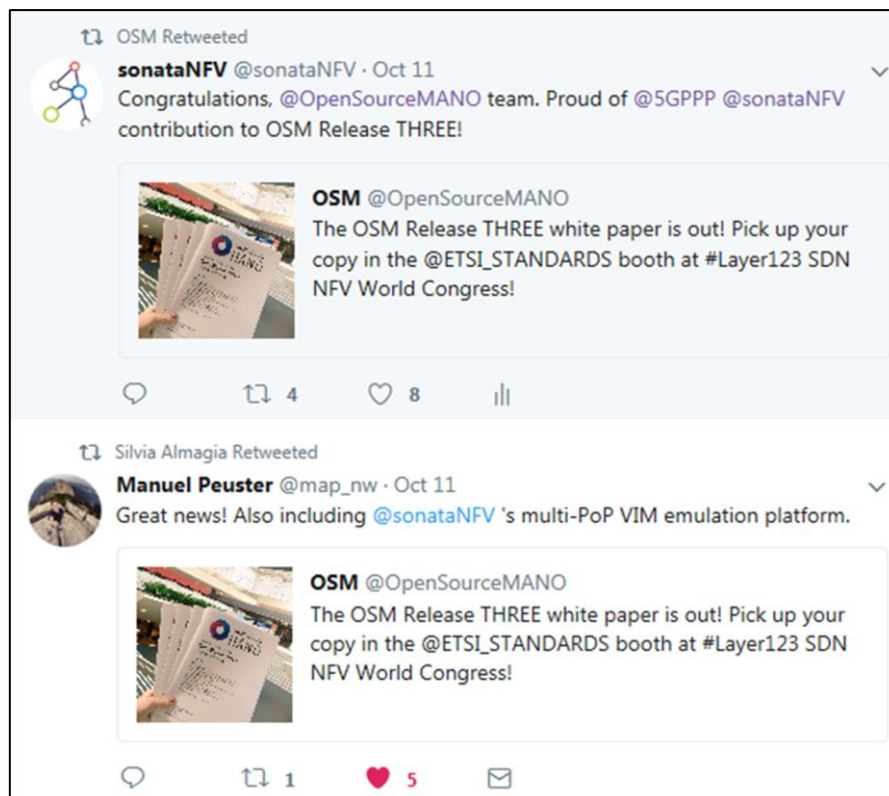


Figure 65: Communications related to SONATA contributions to OSM Release THREE

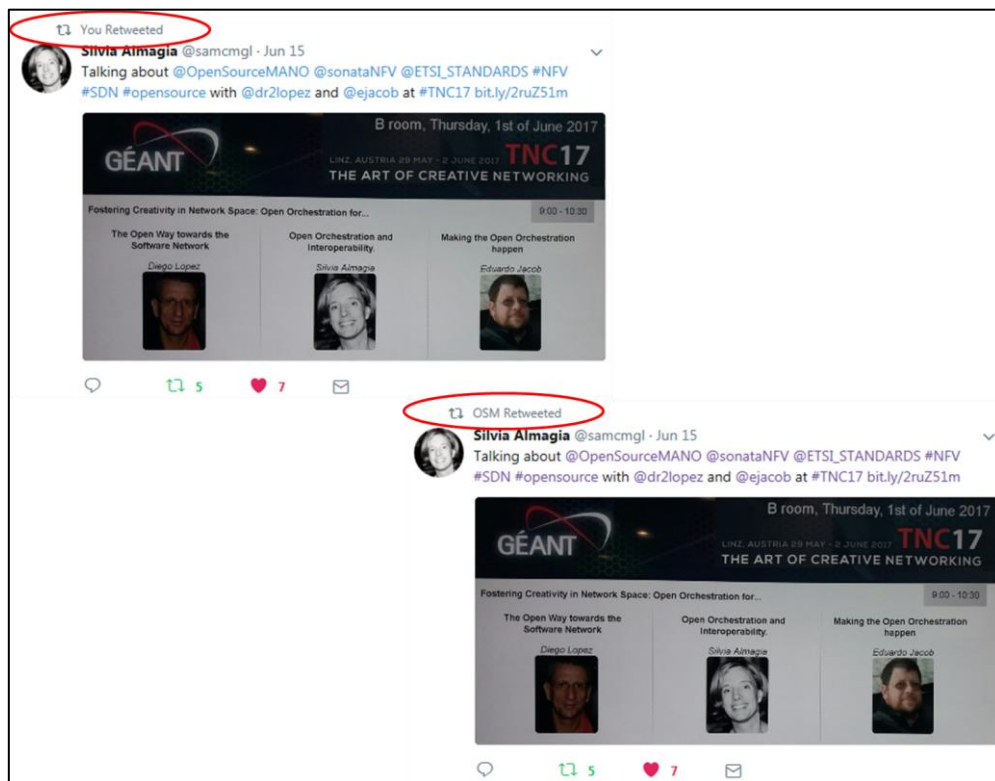


Figure 66: SONATA/OSM joint communication example

Our proactive content marketing strategy has also facilitated the promotion and spread of the project results in other press and media channels.

“Essentials” [42], which claim publishing hand-picked high-quality links carefully selected by top trusted experts in their industry, is an example of that as shown in the following figures.

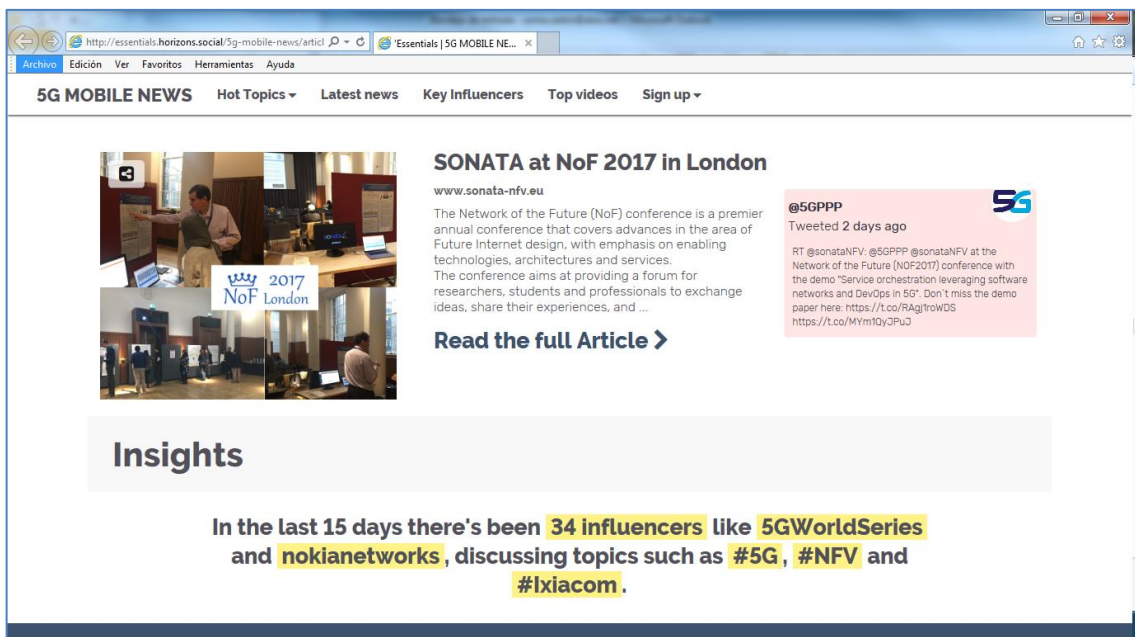


Figure 67: SONATA on Essentials webpage [43]

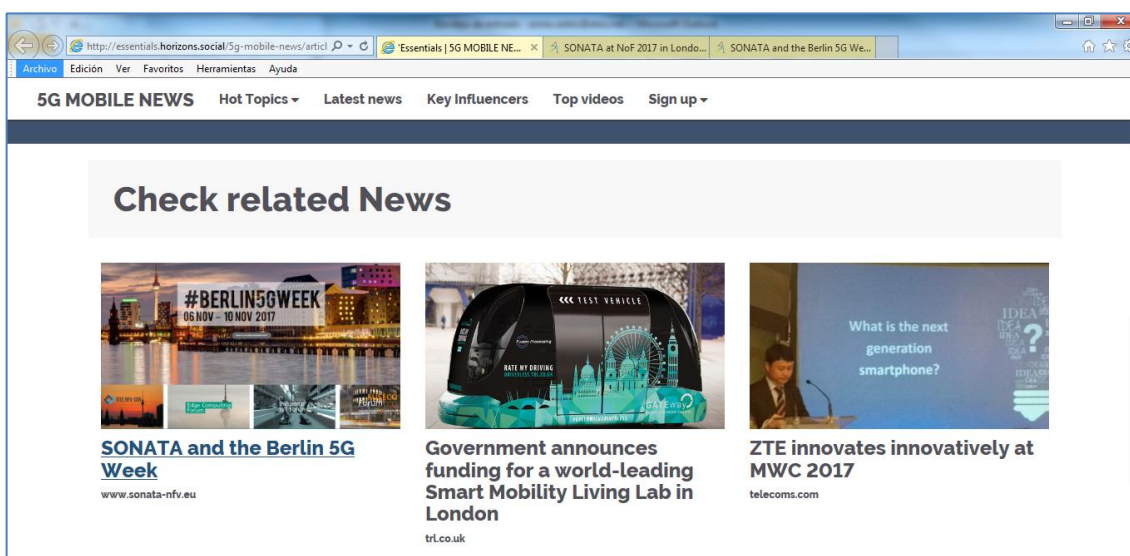


Figure 68: Other of SONATA on Essencials webpage [43]

3.10 SONATA 3.0 marketing campaign

SONATA 3.0 was officially the last major release of SONATA integrated platform delivered during the life-time of the project. For that reason, a strong marketing campaign was designed and executed in order to give the project results the maximum dissemination possible. This campaign extended for more than a month.

Figure 69 shows the marketing plan designed and executed to create impact. The bubbles show only some of the activities developed as part of each action. All of them were disseminated through the different channels used by the project and the 5G PPP, namely the websites and the Twitter, LinkedIn and ResearchGate accounts.

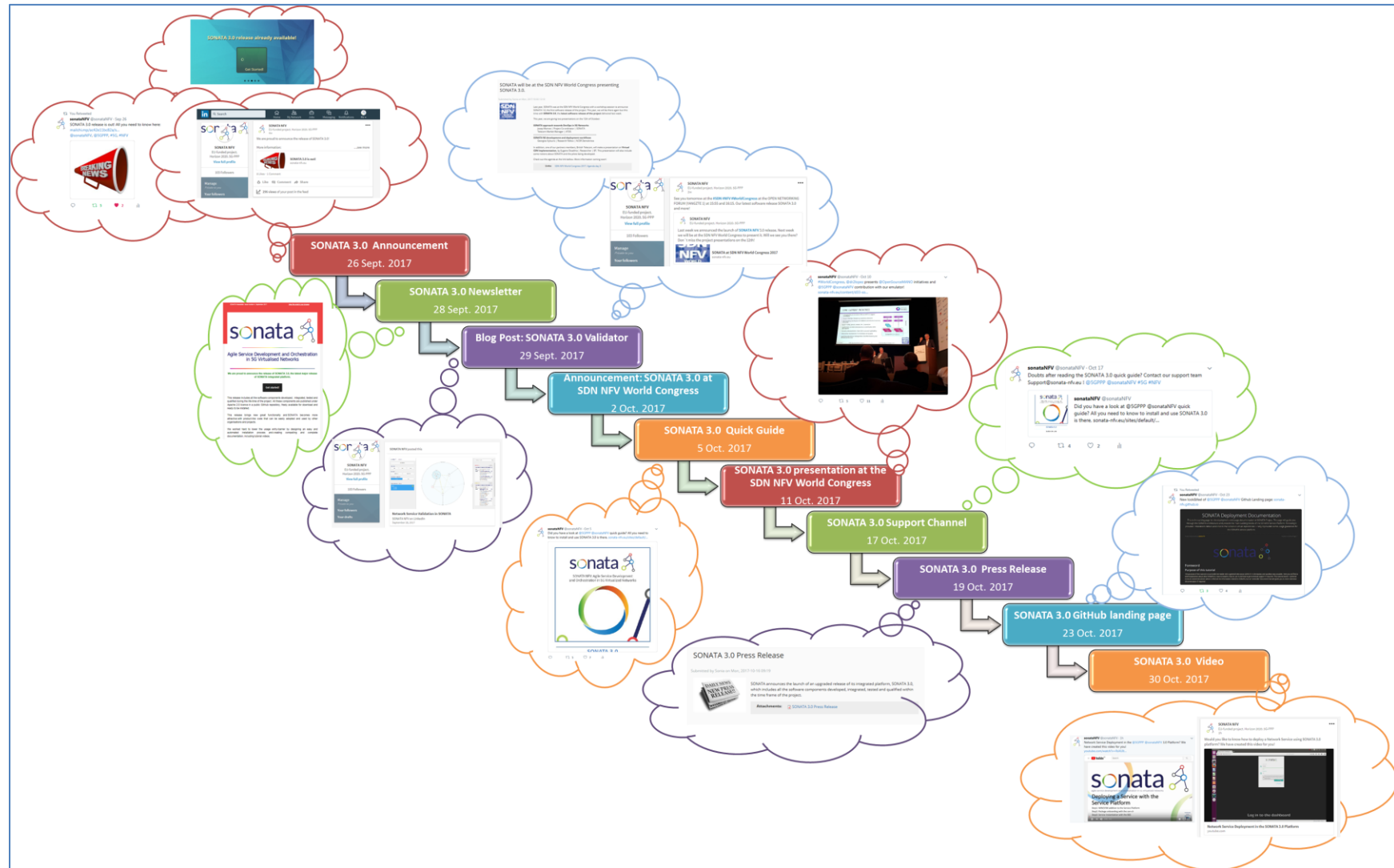


Figure 69: SONATA 3.0 Communication Plan

4. KPIs

The following tables show the KPIs for each of the outreach activities that have been a part of our communication and dissemination plan. Achievements of the project are also reflected in order to facilitate the overall progress of the whole plan.




Outreach Activity	KPIs	Achievements at end of the project	Status
Web Campaign			
Project Website	≥ 5000 visits	13,806 visits, more than 276% of the expected ones. Important to highlight also the number of users from the 5 continents (8,071), pageviews (47,646), the viewed pages by session (3.45) and its average duration (3:14 minutes).	
Social Media Campaign	≥ 2 social media channels used regularly, including Twitter and LinkedIn	Twitter, LinkedIn, Researchgate and YouTube have been the social media channels regularly used by the project. The intense activity has been highly demonstrated previously in this document. See twitter analytics as example here: 683 tweets/ 306 followers/ more than 10,400 visits/ more than 131,000 impressions.	
Project updates on partners' websites	= 15 (all) partners posting to company related portal	Most partners have used their channels to promote SONATA, not only the organisation website, but also their social media channels. Most of them have published more than 2 posts.	
	≥ 2 posts/partner		

Table 11: KPIs and project achievements: web and social media



Outreach Activity	KPIs	Achievements at end of the project	Status
Press and Media Channels			
External Media Channels	≥ 5 external media channels covering the telecom sector	Our proactive content marketing strategy has facilitated the promotion of SONATA in different media channels, specially within the 5G PPP and the OSM communities. CVT Group, Essentials 5G Mobile News, Mirantis, Topical blog, Cloud Expo Euro website etc. are just some examples of our presence in external other media channels.	
Project Press Release	≥ 100 downloads via website	2 press releases has been published by the project so far, both promoted through different channels apart from the internal ones. Due to the diversity of channels used, It is difficult to estimate the number of downloads, but we foresee that the expected KPI has been surpassed by far.	
	≥ 5 external media covered		

Table 12: KPIs and project achievements: press and media channels



Outreach Activity	KPIs	Achievements at end of the project	Status
Press and Media Channels			
Online publishing, blogs, online magazines and newspapers	≥ 20 publications	The project had published total of 20 blog posts during its 30 months of life. Those posts are being echoed through different channels internally and externaly to the project. The project has also contributed the three editions of the 5G journal promoted by the 5G PPP and worked on a chapter of a book on 5G currently under review.	
Project Newsletters	≥ 100 recipients per 2 issues each period	Since its launch in year two, the project has published 4 newsletters, two per period as committed. A final newsletter will be published in January as a summary of the main achievements of the project. All newsletters reach all the consortium members, who have also shared them through their own networks. The newsletters have been also distributed within the whole 5G PPP community. However, the communication/ dissemination activity of the project has been so intense and used so different channels to spread its message that it is difficult to predict the number of contact received directly because the newsletters.	
	≥ 50 people reported back/asked		

Table 13: KPIs and project achievements: press and media channels II


Outreach Activity	KPIs	Achievements at end of the project	Status
Demonstrations			
Demonstrations	≥ 10 demonstrations online and face to face	<p>Demonstrations started in Y2, once the software release SONATA 1.0 was available. Since then, and specially in the last period with the implementation of the pilots, the project has not only gave face to face demonstrations in some of the most relevant events, such as the IEEE NetSoft 2017, IEEE NFV-SDN 2017, NOF 2017 for example, but also recorded quite a few demonstrations that are available in SONATA YouTube channel. Important to highlight that our demo ""A flexible multi-PoP infrastructure emulator for carrier-grade MANO Systems" received the IEEE NetSoft 2017 best demo paper award and has had more that 250 views in the project YouTube channel in only 5 months.</p>	
	≥ 50 organsiations		

Table 14: KPIs and project achievements: demonstrations


Outreach Activity	KPIs	Achievements at end of the project	Status
Tutorials and developer advocacy	≥ 10 sessions	Instead of creating a new open source community from scratches in the overcrowded MANO field and competing against communities with more resources, the consortium focused on influencing the key open source communities for the project and promoting collaboration. Apart from organising and participating in some sessions specially oriented to developers, as for example, the sofnetworking 2017 or the tutorials at the summer schools in Karlstad and Lipari, the SONATA consortium worked hard in order to provide all the elements needed to help potential adopters and developers to fully use and adapt the SONATA results. These are some of the project's activities in line with its open source strategy: product-like code with great functionality, compatibility with other open source communities like OSM, validation/qualification process to ensure the reliability and stability of the code, automatic and asy-to-use installation process, complete and compelling documentation regarding the installation and the purpose and use of each of the SONATA components, quick guide about how to install and use the code, tutorial videos on the SONATA youtube channel, and processes for requesting technical support, receiving external feedback, for accepting external contributions, and for external bug reporting.	
	≥ 100 attendees		

Table 15: KPIs and project achievements: tutorials and developers advocacy




Outreach Activity	KPIs	Achievements at end of the project	Status
Events, Workshops and Conferences			
Presentations	≥ 10 presentations and ≥ 50 organisations	SONATA partners have been present in more than 30 industry events, international conferences, academic and industry workshops, summers schools, etc. during its lifetime. In all of them, the project members have been actively involved via coordination / management activities, presentations, panels, etc...	
Organization and/or attendance to conferences/workshops/events	≥ 8 events		
	≥ 300 participants		
Publications			
Open Access publications	≥ 10 publications	Publications has been one of our main communication/dissemination tools, almost achieving the committed KPIs in the first year of the project. In Y2 ann Y3, our activity in relation to publication was been even better so we can claim that we have clearly achieved our objectives in relation to publications.	
Reports and other Documents (public)	≥ 20 public documents (including deliverables)		
Whitepapers	≥ 2 whitepapers		

Table 16: KPIs and project achievements: events and publications





Outreach Activity	KPIs	Achievements at end of the project	Status
Collaboration			
Contribution to Standards	≥ 2 working groups – active collaboration	SONATA is already active in several working groups. ETSI NFV, ITU, IRFT/IEFT deserve special mention.	
Involvement in Open Source communities	≥ 2 communities (OpenStack, OpenNVF, etc)	Although the main focus for SONATA has been OSM, where the project has got great achievements, Tacker has been also in our radar since the project started.	
Organization of 5G PPP cluster activities with other projects	≥ 4 projects	SONATA has collaborated with the following 4 phase 1 5G PPP projects: 5GEx, VirtuWind, SELFNET and CHARISMA.	
Material (Online and Printed)			
Project Flyer, Booklet, Poster, etc.	≥ 1000 recipients (online +printed)	The project brochure (a triptych) created in Y2 was printed (2,000 units) and made also available on the project's website. It has been distributed in every event where we have participated.	
	≥ 10 events distributed	4 posters have been created also created and presented in several venues, such us the at the ETSI conference in Sophia Antipolis in April 2016, EUCNC event in Athens in June 2016, the IEEE NetSoft in Bologna in July 2017 or the NoF2017 in London in November 2017.	
	≥ 2 posters, multiple events		

Table 17: KPIs and project achievements: collaboration and marketing material

As it can be concluded from the tables above, SONATA communication and dissemination plan has worked very well, much better than expected in most of the areas.

5. Conclusions

This deliverable has described the communication and dissemination plan designed by the SONATA consortium at the beginning of the third year of the project, its execution, and its main results and achievements during this period.

The comparison of our results with the KPIs that the project committed to reach according to the description of work, indicates the success of SONATA's communication and dissemination, not just during this last six months but during the whole life time of the project.

Publications have been one of our main communication/dissemination channels since the project started, improving the activity period by period.

During these two and a half years, SONATA has been represented in more than 30 events, international conferences and workshops, leaving tracks on different countries all over the world. The Best Demo Paper Award 2017 that the SONATA demonstration "A Flexible Multi-PoP Infrastructure Emulator for Carrier-grade MANO Systems" received at the IEEE NetSoft is well indicator of the quality of our engagement and participation at these events.

The presence of the project on the Internet and social media channels has been impressive, especially from year two, being one of the most active H2020 phase 1 projects, if we have into account our contributions to the 5G PPP social media channels.

The strong involvement of SONATA partners in open source, standardisation, and 5G PPP collaboration activities has also been a key point to create significant, repeated and targeted impact related to the SONATA technical topics.

In relation to open source communities, we are proud of our contribution to OSM RELEASE 3, which incorporates SONATA's emulator, as part of the DevOps environment, with our service validation tool planned for inclusion in the next release.

We can also conclude that SONATA contributions to SDOs have achieved a significant impact in ETSI NFV, IETF and ITU-T. In addition, the project has been instrumental in the establishment of a new initiative within ETSI, the ZSM ISG.

Regarding 5G PPP collaboration, we can claim our leadership in the Software Networks WG and that the one of our pilots incorporates the orchestrators from SONATA and 5G Exchange, which is a unique example of close integration of the results from two H2020 projects.

The achievements of the project during the 30 months of its work plan show the good performance of the project in relation to communication and dissemination activities for our target audience. We can conclude that the general purpose of SONATA's communication and dissemination plan, aimed at ensuring wide impact of SONATA outcomes in the most relevant communities, has been accomplished with success.

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Note: the following URLs were captured in December 2017, the publication date of this deliverable, and may be outdated at time of reading.

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