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Exploitation and Dissemination Plans

Alberto Mozo, Bruno ; Ordozgoiti, Enrique Fernández, Sandra Gomez, Alex Martínez, Alex Mara, Bo Zhu, Stanislav Vakarov, Daniele Apiletti, Elena Baralis, et al.

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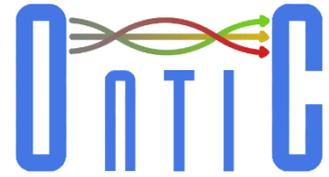
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Exploitation and Dissemination Plans

**ONTIC Project
(GA number 619633)**

**Deliverable D6.4
Dissemination Level: PUBLIC**

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1. Acronyms and Definitions

Acronyms

Table 1: Acronyms

Acronym	Defined as
IEEE	Institute of Electrical and Electronics Engineers
IoT	Internet of Things
IPR	Intellectual Property Rights
ACM	Association for Computing Machinery
ONTIC	Online Network Traffic Characterization
TMA	Traffic Monitoring and Analysis
BigDAP	Big Data Applications and Principles
CNSM	Conference on Network and System management
NOMS	Network Operations and Management Symposium
AIMS	Autonomous Infrastructure, Management and Security
QoS	Quality of Service
ISP	Internet Service Provider
OSS	Operating Service Support
KPI	Key Performance Indicator
CAPEX	CAPital EXpenditures
OPEX	OPerating EXpense



2. Executive Summary

This deliverable presents plans on exploitation and dissemination activities. These include scientific papers, journals and conferences of interest, IPR, press releases, and a list of relevant industrial associations that are interested in the project activities and outcomes. Both future and current to-date activities are presented, targeting different scientific communities, students, stakeholders and decision makers.

ONTIC dissemination and exploitation plans aim at ensuring that all relevant stakeholders, decision makers, and communities are informed about project activities and outcomes. ONTIC dissemination consists of activities of project promotion as a whole, and dissemination of specific and innovative results (e.g., scientific papers).

3. Dissemination Plan

During the first year, ONTIC have to focus on spreading the project ideas and use case scenarios through publishing news on different project/platform websites, forums, etc. Specifically, the main dissemination goal is to create a group of followers (network providers, network operators, manufacturers, end-users) eager to use our results for their own network management and operation activities, services and deployment. A secondary goal is to collect experiences and lessons learned from use case scenarios similar to the ones that will be addressed in ONTIC.

To this end, the dissemination plan of the academic partners of the ONTIC project consists of the following activities.

- Publishing premier high-quality papers in major international conferences and journals in the area of networking, security, and autonomic systems, big data, data mining, data analysis, parallel processing and closely related fields, to promote new ideas and concepts stemming from project activities and outcomes.
- Gaining significant skills in the area of big data computing, data mining and analysis, machine learning, autonomous systems, network traffic analysis, and distributed computing. Such skills and knowledge will lead to new courses to be held to undergraduate, graduate and PhD students, summer schools, seminars and informal presentations to research partners.
- Dissemination of results and prototypal implementations to partner companies for possible industrial exploitation.

3.1 Logo and acronym

To clearly identify the project in all dissemination activities, the acronym is used as a reference. Also, a logo has been designed.

The acronym is taken directly from the project's full name, Online Network Traffic Characterization.

The logo went through a couple of iterations before settling on the final version. At first, the letters were of a bright red color (Figure 1).



Figure 1. First version of the ONTIC logo

This was changed to a muted blue color because of the associations red has with concepts like ‘stopping’, ‘wrong’ or ‘failure’ (Figure 2).

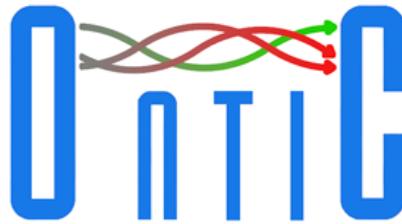


Figure 2. Second version of the ONTIC logo

For the last iteration of the logo the arrows at the top were changed to stray from the notion that there are right or wrong kinds of traffic, which the older logos seemed to suggest, rather than just different kinds of traffic that can be classified (Figure 3).

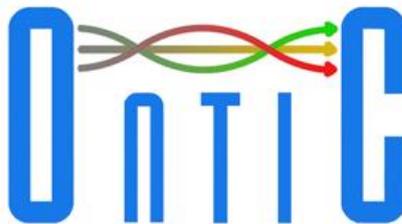


Figure 3. Final version of the ONTIC logo

In the words of one of the designers: *‘The purpose of our logo lies on the target we want to achieve. At first Internet traffic, represented by the three arrows, is a mixture of unknown information that apparently looks like any other Internet traffic flow previously recorded. As the flow goes through the ONTIC’s logo, Internet flows start to show some differences which means that our main target is being fulfilled: Internet flows do not look the same anymore and, in addition, they do not look like a mixture of unknown information. Instead of having three crossed arrows, after the process the arrows are now perfectly separated and classified.’*

3.2 Project presentations

Project presentations, including press releases, announcements, and factsheets, will be presented in this section.

This activity has the twofold objective of developing contacts in the research community involved in activities within the scope of the project, namely academics and data scientists working on traffic characterization, and reaching a wider audience potentially interested in applying the outcomes of the project to other contexts.

To this end, the Universidad Politécnica de Madrid (UPM), as project coordinator, has made a press release available at www.upm.es that will be also included in the UPM newsletter “e-Politécnica Investigación e Innovación” (e-Politecnica Research and Innovation) at www.upm.es/institucional/UPM/CanalUPM/epolitecnica_inv and in the UPM Magazine at www.upm.es/institucional/UPM/CanalUPM/Revista. Besides, the UPM Communication Office will give it adequate visibility on social media by using official UPM accounts on Facebook, Twitter, Google Plus, Flickr, and Wordpress. Finally, this press release will be published by a national news agency specializing on scientific information named SINC (www.agenciasinc.es) and on Alpha Galileo, an international news resource focused on international research organizations and media at www.alphagalileo.org.

Also, a factsheet (ONTIC Deliverable D6.1) presenting the main motivations behind the project has been produced and is available for download at <http://ict-ontic.eu/index.php/deliverables/66-d6-1>.

ADAPTIT has produced the following public announcement text:

“ADAPTIT SA participates in European Union’s Seventh Framework Program Online Network Traffic Characterization (ONTIC) project <http://ict-ontic.eu/>. ONTIC is a multinational collaboration with participants from the academia (Universidad Politecnica De Madrid Spain, Politecnico Di Torino Italy, Centre National De La Recherche Scientifique France) as well as leading corporations (EMC Spain, Ericsson SA Spain, Sistemas Avanzados De Tecnologia SA Spain). The ONTIC project is a three year effort aiming to design, develop and evaluate a novel architecture of massively-scalable online & offline techniques able to characterize network traffic data, identifying traffic pattern evolutions, and proactively detect anomalies in real time at very high network speeds. ONTIC will integrate these techniques into an autonomous network traffic characterization platform, to be used as cornerstone of a new generation of scalable and proactive network management and analysis applications.

ADAPTIT was established in 2005 specializing in the design of application delivery network infrastructure and performance management. Amongst its key areas of specialization lays the design of integrated application delivery network infrastructure and performance management solutions, which provide to service providers and enterprises the ability of mapping the relationships between application network requirements and user perceived application performance, as a means to achieve optimized end user experience. ADAPTIT’s participation in the ONTIC project is part of its continuing R&D efforts to improve its ability to discover, map, monitor & correlate the relationships between application performance, network and IT infrastructure components performance and end user experience.

A brief description of the ONTIC project is included in the attached fact sheet while more detailed information about the ONTIC project is available at <http://www.ict-ontic.eu/>”

In January 2015 this announcement is going to be distributed by a targeted e-mail campaign as well as through the publications of Ethos Media corporation. Ethos Media’s publications are read by decision makers in Greece and other south east European countries (<http://www.ethosmedia.eu/en/company.html>)

ADAPTIT’s announcement is available at:

http://www.adaptit.gr/index.php?&show_news_record=1&news_id=15&lang_id=de

Adaptit also plans to present the ONTIC project to visitors in its stand at the Mobile World Congress in Barcelona, Spain, in February 2015.

In addition, last October 2014, UPM submitted the ONTIC project to Madrid I+D (R+D) prizes 2014 in the category of European R+D Collaborative Projects, details are available at www.madrimasd.org/quesmadrimasd/premios-madrimasd.

Polito has published a press release specifically for the ONTIC project on the December 8th 2014 edition of a leading Italian business newspaper, Il Sole 24 Ore, (www.ilsole24ore.it), which is the most widespread newspaper among decision makers and business people in Italy. The full page of the newspaper which includes the press release is available on the official ONTIC website as a PDF file. Future plans are to evaluate the outcomes of this press release and include the possibility of a new press release with updated results of the project.

Finally, a Twitter account has been created and regularly updated in order to reach a wider public and let followers of the project stay up to date. It is available at <http://twitter.com/ONTICProject> (user @ONTICProject).

3.3 The ONTIC portal and other websites

The ONTIC public portal (<http://ict-ontic.eu>) offers an extensive compilation of relevant information for project members, partners, reviewers (European Commission) and anybody else interested in the ongoing research carried out at the ONTIC project. A detailed description of this portal can be found in the ONTIC deliverable D6.2. at <http://ict-ontic.eu/index.php/deliverables/79-d6-2-website-user-manual>.

As a key aspect, the ONTIC portal contains links to the main communication channels for dissemination and feedback. This website, publicly accessible at <http://ict-ontic.eu/>, describes the main goals of the ONTIC project. It also features a collaborative tool for the consortium members. The portal is based on Joomla v.3.2.3, an open source CMS tool.

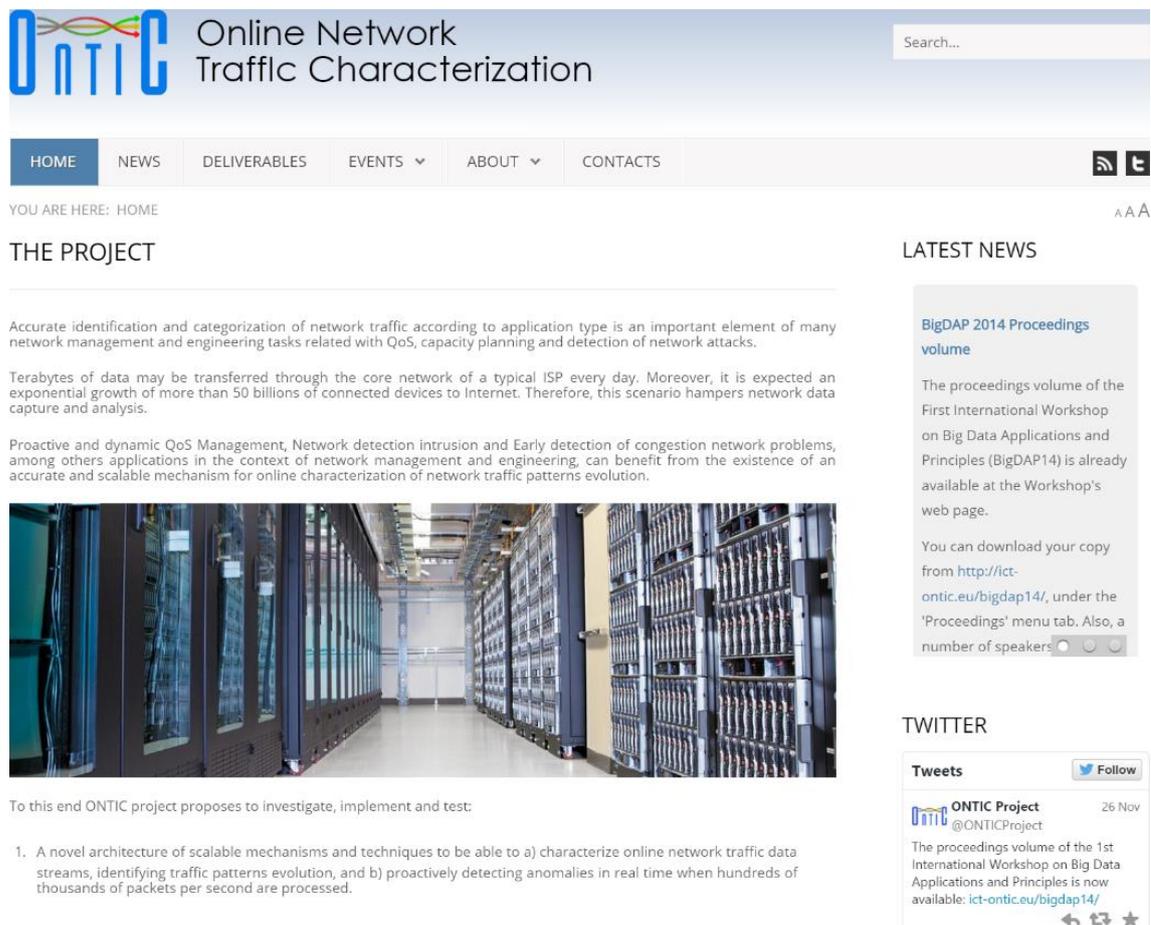


Figure 4. ONTIC website home page

When the portal is accessed, users will first find a homepage with some information about the project and the main menu. This menu is structured in five basic sections (see Figure 4. ONTIC website home page):

1. Home
2. News
3. Deliverables
4. About
5. Contacts

This model optimizes content location and enhances user experience.



The News branch contains all the information available so far about events, papers and dissemination activities. This section will be continuously updated as the project evolves to show the latest information.

Besides the official project portal, partners also published news pages on their own websites and most partners will do so during the project lifetime to post updates on their activities:

- CNRS
<https://www.laas.fr/public/fr/contrats-sara>
- Polito
<http://dbdmg.polito.it/wordpress/ontic/>
- SATEC
http://www.satec.es/es-ES/PrensayEventos/Paginas/SATEC_BIGDAP2014.aspx

Adaptit plans to put the previously-described public announcement text in the news section of its front page in its website www.adaptit.gr.

3.4 Conferences, workshops and journals

Specifically addressing scientific dissemination, the following list presents a subset of conferences and journals where the partners aim to publish their work:

- IEEE/ACM Transactions on Networking
- IEEE Transactions on Network and Service Management
- IEEE Transactions on Knowledge and Data Engineering
- IEEE BIGDATA conference
- ACM Transactions on Knowledge Discovery
- Journal of Network and Systems Management
- Journal of Information Science
- International Journal of Intelligent Systems
- Knowledge Based Systems
- International Journal of Network Management
- ACM Symposium on information, computer and communication security
- TMA workshop (Traffic Monitoring and Analysis)
- AIMS (IFIP Conference on Autonomous Infrastructure, Management and Security)
- NOMS (Network Operations and Management Symposium)
- CNSM (Conference on Network and System management)
- BigDAP workshop (Big Data Applications and Principles)

Any other conference, workshop, journal, special issue and magazine related with big data, data mining, network traffic analysis may be a proper venue to disseminate ONTIC results. To ensure high-quality dissemination, ISI-indexed journals with a significant impact factor in the field will be selected. As a baseline, only peer-reviewed venues will be considered for scientific dissemination.

Currently published conference papers are listed below:

- A Survey on feature selection and reduction for network traffic characterization, B. Zhu and A. Mozo (First International Workshop in Big Data Applications and Principles, BIGDAP 2014, September, 2014, Madrid, Spain)

- A Telecom Analytics Framework for Dynamic Quality of Service Management, Guadamillas, M.A. López, N. Maravitsas, A. Mozo and F. Pulvirenti, (First International Workshop in Big Data Applications and Principles, BIGDAP 2014, September, 2014, Madrid, Spain)
- A. Bascuñana, F. Castro, D. Espadas, P. Sánchez, M.A. Monjas. (2014) “Adaptive Quality of Experience (AQoE) control for Telecom Networks”. Proceedings First international Workshop, BigDAP 14. Madrid, Spain, September 11-12 2014.
- P. Owezarski, "Unsupervised Classification and Characterization of Honeypot Attacks", International Conference on Network and System Management (CNSM'2014), Rio de Janeiro, Brazil, November 17-21, 2014
- P. Owezarski, P. Casas, J. Mazel, "Unsupervised detection of network attacks in the dark", 1st international workshop on big data applications and principles (BigDAP'2014), Madrid, Spain, September 11-12, 2014
- Misleading generalized itemset mining in the cloud. Elena Baralis, Luca Cagliero, Tania Cerquitelli, Silvia Chiusano, Paolo Garza, Luigi Grimaudo, Fabio Pulvirenti. IEEE ISPA 2014, Milan, Italy, 26-27-28 August 2014
- MGI-Cloud: discovery of misleading generalized itemsets. Elena Baralis, Luca Cagliero, Tania Cerquitelli, Silvia Chiusano, Paolo Garza, Luigi Grimaudo, Fabio Pulvirenti. SEBD 2014, Castellammare di Stabia, Italy, 16-17-18 June 2014
- Network traffic analysis by means of Misleading Generalized itemsets. Daniele Apiletti, Elena Baralis, Luca Cagliero, Tania Cerquitelli, Silvia Chiusano, Paolo Garza, Luigi Grimaudo, Fabio Pulvirenti, BigDap 2014, Madrid, Spain

3.5 Open source releases

The software developed within ONTIC will be released as open source as much as possible to foster dissemination.

The ONTIC project has contacted Yahoo! Research Labs in order to collaborate with them with the goal of incorporating some of the online algorithms that are going to be designed and implemented in WP4 into the SAMOA framework. UPM has held conversations with Gianmarco De Francisci Morales, at the time a Research Scientist at Yahoo Research Labs, on July 2014 regarding a possible collaboration on the Apache SAMOA framework. The Apache SAMOA framework is a library of online machine learning algorithms running on the Apache S4, Apache Storm and Apache Samza distributed platforms. SAMOA is the evolution of the well-known machine-learning framework MOA (Massive Online Analysis), and is intended for the world of high performance distributed computing. Originally developed by Yahoo Labs, SAMOA is now an Apache Project. Today, Gianmarco is working on Apache SAMOA for the Apache Software Foundation. Apache SAMOA representatives showed interest mainly in the inclusion of anomaly detection algorithms in their framework, but UPM thinks ONTIC could contribute with other kind of online machine algorithms as well (e.g. clustering, classification and prediction). In fact, UPM has started working on online clustering and prediction on WP4, so we will try to contribute to SAMOA along those lines. It's stated in the DoW document that our results would be integrated in a public framework. Therefore, this contact with the Apache SAMOA project is the first step in relation to the integration of results in an open source framework.

Additional venues to release open source code developed within the context of the project will be considered, such as well-known leading machine learning for distributed computing frameworks as Mahout (<http://mahout.apache.org/>) and MLib (<http://spark.apache.org/mlib/>).

3.6 BigDAP workshop

This section presents the BigDAP 2014 workshop, which was a major dissemination event of ONTIC project activities. A complete description of this workshop can be found in deliverable D6.8 (Big Data Analytics Workshop #1) at <http://ict-ontic.eu/index.php/deliverables/78-d6-8-first-international-workshop-on-big-data-applications-and-principles>.

BigDAP was an international workshop conceived to allow for the dissemination of the activities carried out in the ONTIC project, as well as the achieved results. In addition, BigDAP was organized in order to increase public awareness of the project, to encourage new research activities in its areas of interest and to provide a networking space for academic institutions and members of the industry.

In this regard, BigDAP was a perfect opportunity for the exchange of ideas, information, experiences and contacts which certainly fueled the advancement of the ONTIC project in the academic, industrial and scientific areas. In order to achieve this, BigDAP was structured in two blocks: the scientific/academic track and the industrial track. By means of this, a valuable combination of knowledge was conveyed to both the audience and the participants.

All BigDAP scientific presentations were compiled into a proceedings volume published in Open Access mode and were made publicly available at BigDAP 2014 website (<http://ict-ontic.eu/bigdap14/>), under the 'Proceedings' tab, or from the following link: http://ict-ontic.eu/bigdap14/bigdap14_PROCEEDINGS.pdf

In order to attain a good level of visibility, a name and a logo were carefully conceived (Figure 5). BigDAP is a combination of the terms "Big Data" and "Dap", which aims to represent the significant advances that often stem from research in this area in recent years.

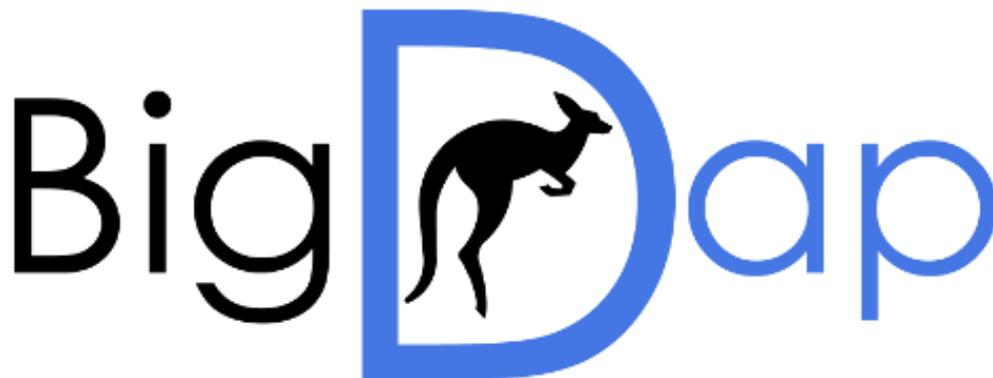


Figure 5. BigDAP workshop logo

The logo is meant to get the spirit of the workshop. The kangaroo represents the great leap forward that, as previously mentioned, comes from research in the field of Big Data.

The intended audience of the workshop can be grouped as follows:

- Industrial sector: professionals involved in R&D&I activities.
- Enterprise sector: representatives of SMEs and large corporations interested in improving their organizational structures leveraging novel technologies.
- Professors and researchers whose research interests are focused on the activities carried out at ONTIC.
- PhD students who are working on a thesis related to the activities carried out at ONTIC.



- Students enrolled in programs related to the activities carried out at ONTIC, or with the intention of developing their career in a related area.

Two main tracks were selected in order to gather both perspectives industrial and academics, namely:

- Academic track: this track consisted of a series of invited talks and peer-reviewed scientific contributions. The invited talks were delivered by world-class academic and scientific experts who work on fields related to the topics of the workshop. All of the scientific contributions have been papers sent to the workshop via the submission process, which were formally peer-reviewed by the Programme Committee.
- Industrial track: this track featured invited talks by representatives of major corporations with an R&D department focused on areas related to the topics of the workshop. Their contributions helped understand the implications of real-world applications of these techniques and how they are trying to adopt and incorporate new developments programs in their R&D departments to be ready to the challenge of Big Data.

The calendar for the event is defined in the following table:

Table 2. Workshop dates

Important Dates	
July 31, 2014	Deadline for paper submission (closing at 23:59h, CET)
August 1, 2014	Deadline for paper submission (closing at 23:59h, CET) (EXTENDED)
August 10, 2014	Notification of paper acceptance or rejection
August 20, 2014	Early registration
September 3, 2014	Final version of the paper for the proceedings
September 8, 2014	Late registration

A website was built and put online to cover the necessities of participants, attendees, and everyone interested in the workshop. This website is integrated in the ONTIC project portal, and can be accessed through the "Events" menu as seen in Figure 6. BigDAP workshop website.



ONTIC Online Network Traffic Characterization

HOME NEWS DELIVERABLES **EVENTS** ABOUT CONTACTS

YOU ARE HERE: HOME

THE PROJECT

Accurate identification and categorization of network traffic according to application type is an important element of many network management and engineering tasks related with QoS, capacity planning and detection of network attacks.

Tera-bytes of data may be transferred through the core network of a typical ISP every day. Moreover, it is expected an exponential growth of more than 50 billions of connected devices to Internet. Therefore, this scenario hampers network data capture and analysis.

Proactive and dynamic QoS Management, Network detection intrusion and Early detection of congestion network problems, among others applications in the context of network management and engineering, can benefit from the existence of an accurate and scalable mechanism for online characterization of network traffic patterns evolution.

To this end ONTIC project proposes to investigate, implement and test:

1. A novel architecture of scalable mechanisms and techniques to be able to a) characterize online network traffic data streams, identifying traffic patterns evolution, and to proactively detecting anomalies in real time when hundreds of thousands of packets per second are processed.
2. A completely new set of scalable offline data mining mechanisms and techniques to characterize network traffic, applying a big data analytics approach and using distributed computation paradigms in the cloud on extremely large network traffic summary datasets consisting on billions of records.

ONTIC project will integrate offline and online mechanisms and techniques into an autonomous network traffic characterization system to be used as cornerstone of a new generation of scalable and proactive network management and engineering applications.

Additionally, ONTIC project will generate a petabyte size dataset composed of real network traffic summaries obtained during several months from a set of data flows (1.5 Gbps on average) that cross the core network of a medium size ISP that participates in the ONTIC consortium. The contents of this dataset will be anonymized and made publicly available at the end of the project to foster new research initiatives in the field of big data analytics.

Finally, ONTIC will lead the dissemination and adoption of project outcomes to other application domains (e.g. bioinformatics, medicine, physics, social sciences, and finances). Then, ONTIC will generate an open source scalable offline/online analytics framework to be used by developers in other application domains.

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ONTIC is co-funded by the European Commission under the SEVENTH FRAMEWORK PROGRAMME

Figure 6. BigDAP workshop website

The BigDAP website offers an extensive compilation of all information on the workshop. In the manner of the ONTIC portal, the workshop website contains links to the communication channels for diffusion and feedback.

The website can also be accessed at <http://ict-ontic.eu/BigDAP14> as shown in Figure 7: BigDAP web page.



Figure 7: BigDAP web page

To promote the dissemination of the workshop, several different channels were used:

- Via email, using international email distribution lists from academic fields related to Computer Science in Europe.
- Several Calls for Papers were sent using international distribution email lists and personally sent to institutions, organizations and contacts by each of the members of the consortium and both of the workshop committees. The template used for this Call for Papers can be found at Annex A.1 of this document. Some of the email distribution lists used to disseminate BIGDAP are: PROLE, DISTJISBD, JCSD, TYPES-ANNOUNCE, CFP, BIG-DATA and MMB.
- Via email, sent by the Programme and Organization Committee members to personal contacts in academic and industrial fields.
- Using web pages and other internal dissemination means from each of the consortium partners in their respective universities.
- The visibility and the publicity to the event were promoted before, during and after the completion of the event from the Universidad Politécnica de Madrid, at the ETSISI, website (URL: <http://www.etsisi.upm.es/>). Results derived from the workshop were published on the ETSISI website at http://www.etsisi.upm.es/noticia_destacada/celebraci%C3%B3n_del_1st_international_workshop_big_data_applications_and_principles, see Figure 5 as relevant news, valuing how the development and visibility of the event benefits the University, with emphasis on the association with the ONTIC Project and funding by the European Commission under the SEVENTH FRAMEWORK PROGRAMME.
- Via the ONTIC Project webpages, using the Event and News sections.
- Via twitter, using the official ONTIC Project twitter.



Additionally, a poster to promote the event was designed by members of the Organizing Committee. This poster was distributed via email for its dissemination by consortium members, published on the website and shown in screens strategically placed throughout UPM Campus Sur. The poster can be seen in [Error! No se encuentra el origen de la referencia..](#)

International Workshop on Big Data Applications and Principles
 Madrid, 11-12 of September 2014

Salón de Grados
 Building IV, second floor
 ETSISI-UPM

  @ONTICProject
<http://ict-ontic.eu/bigdap14/>

Big Data in Data Mining
 NoSQL/NewSQL Machine Learning
 Security & Privacy Parallel & Distributed Computing
 Data Management

Grants for students & ECTS credits
 more info:
grants@ict-ontic.eu

Sponsored by:

BigDap

Figure 8: BigDAP'14 poster



3.7 Other activities

This section presents other dissemination activities of the partners.

Adaptit has already unofficially introduced the work of ONTIC to First Data Greece (a subsidiary of First Data) and plans a formal meeting within Q1 2015 to present and discuss potential applications deriving from the work of ONTIC (https://www.firstdata.com/en_gr/home.html)

Furthermore within Q1 2015 Adaptit plans a formal meeting and discussion with Cosmote Group a mobile operator in Greece, Albania and Romania that is part of Deutsche Telekom group (www.cosmote.gr).

Ericsson presented ONTIC activities at the following events:

1. Ericsson Data Research Days

September 9th. Presentation and Poster.

- Presentation: “Big data analytics for network optimization - Ontic FP7 Project” (Patricia Sánchez, Fabian Castro)
- Internal Ericsson event with employees from all around the world (200 in Kista visiting the event (Oceania) ~140 via webcast over the day)
- Profile: IT, Marketing or Sales, Product management, Research, Design/Syst mgmt.

2. Madrid R&D Innovation Days

November 11th and 12th. Presentation.

- Presentation: “Improving Network Control by using real-time analytics” (Alejandro Bascuñana, Fabian Castro)
- People from Ericsson R&D and visitors from other Ericsson sites and 64 external guests.

More than 700 people visited the event, Marketing/Sales, Product management, Design/Systems management.

EMC presented ONTIC activities during the internal Big Data workshop (1 day, 19th of November) as part of an initiative inside the company to make all workers (professional services, sales, presales) aware about what Big Data means, the capabilities and experience around this new area, and where the ONTIC project was presented and explained.

- Date: 19th of November
- Place: Madrid offices (EMC)
- Speaker: Fernando Arias (ONTIC project)
- Context: Big data awareness initiative inside EMC
- Attendees: Global Professional Services, presales and sales (EMC Spain) (> 40 people)

UPM presented ONTIC activities at the following events:

- Seminar on Machine Learning algorithms applied to network traffic classification (2015), included in the Master Of Computer Sciences and Technologies taught at UPM (November 2014)
- Lecture on Machine Learning algorithms applied to Telecom scenarios in the subject “State of the Art in Computer Sciences and Technologies”, taught in the Master Of Computer Sciences and Technologies at UPM (December 2014).



Polito held a seminar on ONTIC technologies in the undergraduate course of “Database Management Systems” for the Computer Engineering students at Politecnico di Torino, on Friday, November 21, 2014, room 8C, Corso Duca degli Abruzzi 24, Torino, Italy. Daniele Apiletti and Luigi Grimaudo, from the Database and Data Mining group lead by prof. Elena Baralis, presented recent advances in Big Data technologies related to ONTIC activities. The audience included approximately 200 students enrolled for the course.

Furthermore, prof. Elena Baralis introduced ONTIC activities into her PhD course at the Dipartimento di Automatica e Informatica, Politecnico di Torino, held from mid-September to mid-October (10 lessons overall). ONTIC concepts and research activities were spread across different lessons covering clustering techniques, classification models and correlation analysis by means of association rule mining. The audience included approximately 20 students.

Polito plans to iterate on these activities in the next year, updating the contents and improving the dissemination based on the feedbacks of the audience.



4. Exploitation plan

4.1 Ericsson

4.1.1 IPR identification, protection and mediation

Below a list of the patent applications filed by members of the consortium as project foreground can be found:

Table 3. Patent applications

Applicant	Slogan	Filling Date	Filling Reference
LM Ericsson	Congestion Mitigation by Offloading to non-3GPP Networks	2014-09-25	PCT/EP2014/070566

4.1.2 Market potential for targeted technologies

The ONTIC project addresses the challenging Big Data market. This market is **moving quickly from the hype to reality**, growing 6 times faster than the rest of the ICT industry [1]. Another figure that can help to illustrate this trend is provided by IDC (2013) [2]. IDC foresees that Big Data market will amount to \$32.4 billion in 2017. But Big Data is not only about making different things with more data, but also about **cost savings**. When analyzing specific vertical industries, a good example can be health care. By using Big Data, McKinsey estimates a potential value in US Health Care of \$300 billion in annual savings (12% of total US health care cost) [3]. In a similar way, ONTIC will provide its main contributions to Communication Service Providers (CSP) [4], by developing technologies and scenarios that will help them to save on their OPEX and CAPEX.

In the **Telecom market case**, networks are already moving an incredible and increasing amount of data [5]. Figure 9 shows Ericsson's growth prediction in mobile data traffic for the period between 2013 and 2019. In this time it is foreseen that there will be a spectacular growth in the total volume of data moved both in fixed and mobile scenarios. Raw figures suggest a scenario of around 18ExaBytes per month in 2019, 10 times more than the data travelling around on 2013. This huge amount of data going through networks will pose tremendous challenges and will require network providers to deploy network and control management procedures. It is clear that by 2019 networks will have to provide the needed infrastructure to move such a huge amount of data by improving the network control optimizing OPEX and CAPEX.

ERICSSON MOBILITY REPORT

Global mobile traffic (monthly ExaBytes)

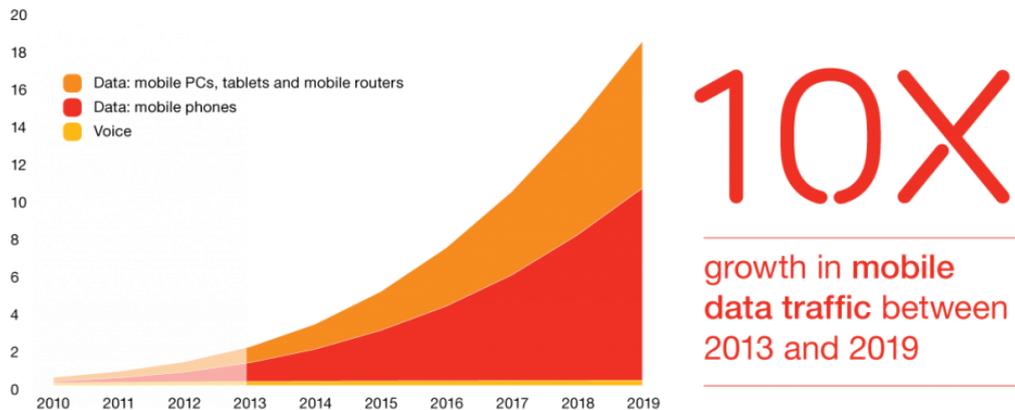


Figure 9: Global Mobile Traffic (monthly ExaBytes)

Related to the investments plans, and as can be seen in Figure 10, 64% of organizations in general have invested in Big Data Technologies in 2013 and, what is more critical, the power of data has not been developed to its full potential. Forrester Research estimated in 2011 that organizations are utilizing less than 5% of their available data [6]. So there are a big field to deal with, and the technologies and scenarios proposed by ONTIC addresses key aspects of the Big Data development.

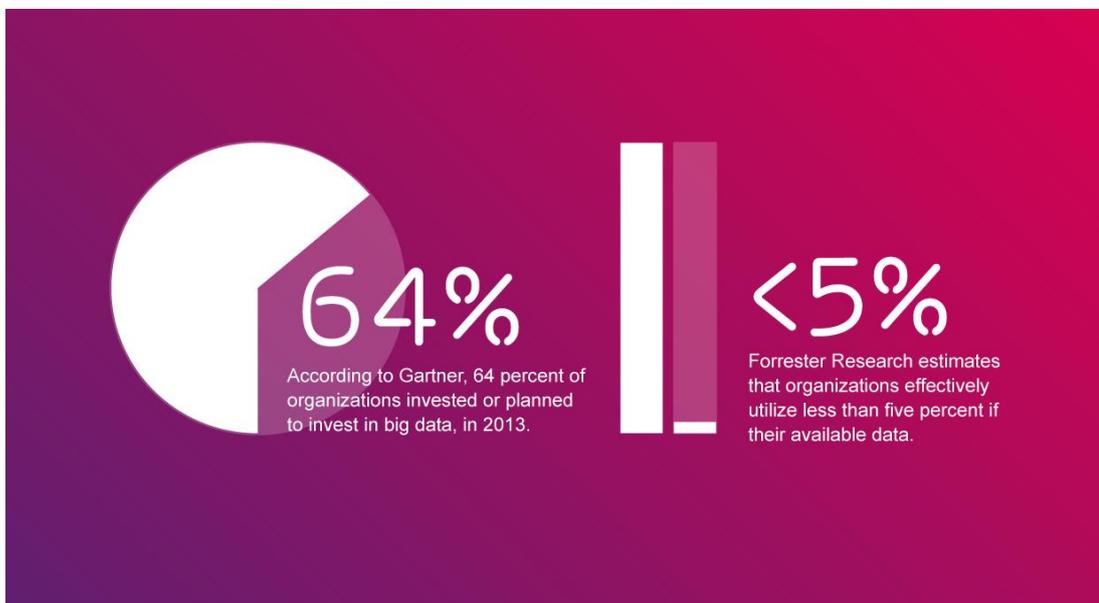


Figure 10: Big Data Market

Two of the use cases addressed by ONTIC provide ways to improve the customer experience by acquiring a deeper understanding of the user needs and by providing a set of actuations on the network side. This is the case for both the QoS and the congestion detection scenarios. Figure 11 illustrates the importance that network performance issues have for the perception of

network quality. **CSPs need to understand their user's needs** in order to plan, manage and optimize the use of their networks. This analysis can be done both in an offline and in an online way by using the proper big data algorithms. But big data algorithms alone do not provide more knowledge about the real user needs. The definition of proper scenarios to apply these algorithms is needed. Here is where ONTIC provides a **refined view of proposed scenarios**. Scenarios originally proposed on the DoW will be refined along the duration of the project to finally provide a vision **as close as possible to the market needs**. With this approach it is assured that the vision originally provided in the DoW about the different scenarios will be aligned with the market needs, and therefore the outputs of the project will be aligned with these needs.

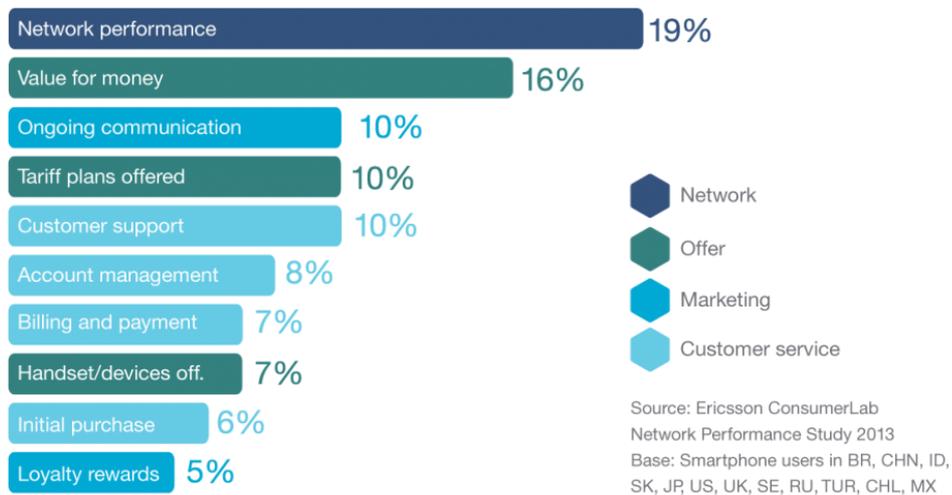


Figure 11: Network Performance Study 2013

In the virtuous circle already explained in D5.1 and shown in Figure 12, the nodes that will be part of the whole value chain that will enable this vision and that will be developed along the project length can be seen.

The Ericsson team involved in the ONTIC activities is focused on the development of the so called **Policy Governance Function (PGF)**. This module will be **responsible for adapting the predictions coming from the analytics module** (the module where the developed big data algorithms will be applied to make predictions) to policies and rules that later on will be enforced in the network side to control the network parameters and therefore to alleviate congestion and QoE degradation scenarios.

As said before, network automation will be a key feature in a near future, and is in the top of the CSPs agenda. This type of functions will be the ones that will enable it.

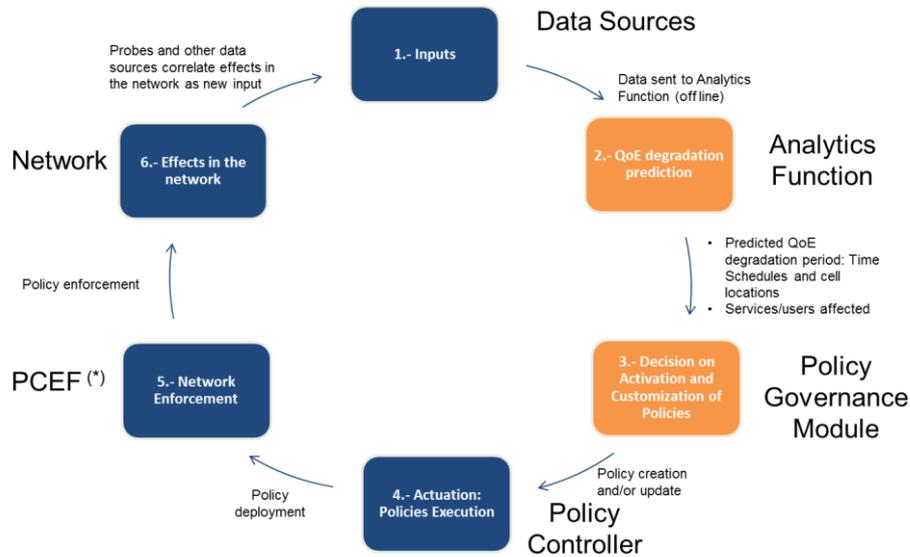


Figure 12: The expanded analytics virtuous circle

For the development of the user story related to QoS and congestion control scenarios, the **chosen service has been video (Streaming, on demand, etc)**. Today the access to video services dominates the traffic and without any doubt will dominate network traffic in the following years. This can be checked in the Ericsson Mobility Report November 2014 [7] . CSPs will need to manage the quality of this service, as it will be one of the most valuable ones for customers according to the usage level that is foreseen for the following years.

Data Traffic – Application

in Other | Encrypted | Software download and update | Social networking | Web Browsing | Audio | Video | File sharing

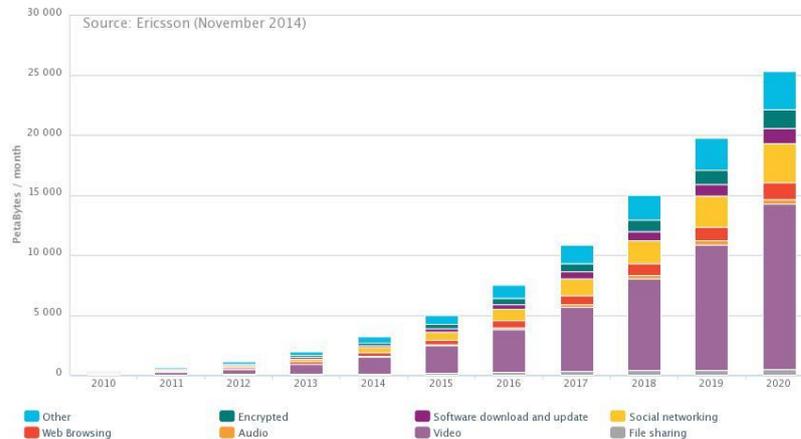


Figure 13: Forecast Data traffic Split on Applications [8]

The proposed technological development will lead to a reduction of CAPEX and OPEX, and therefore to a churn reduction. These two indicators will improve the margin in the CSP side by lowering the cost and improving the revenues.



4.1.3 Possible practical and legal hurdles in QoE scenario

To address the goals proposed in the use cases, CSPs have to deal with **large volumes of information** generated both **internally and externally** to the networks. In addition to that, as the aim of the ONTIC scenarios is to provide users with the **best Quality of Experience in limited resources environments**, an accurate knowledge of the user profiles will help to optimize the use of the resources, and therefore to improve the QoE delivered to users.

Big Data technologies will help operators to:

- 1) **Analyze:** Carry out a detailed profiling of users and services
- 2) **Actuate:** Perform actuations in the network to optimize network parameters so that the best QoE can be offered with the available resources.

Because of the sensitive nature of the data being handled (people, legal companies, etc.) the project **will face several practical and legal hurdles that must be solved** on the way from an idea to the implementation.

This section will review the main issues identified along this first year work.

By processing the output coming from the offline profiling phase, CSPs will be able to make better decisions about the actions to be taken on these services (priority level, cut/allow the services, etc) in QoE degradation scenarios, just to maximize the overall user experience in an environment of such limited resources.

Both the analysis and actuation phases will be carried out by using **online and offline big data tools:**

1. **The Offline analysis** will analyze the user's behavior, providing more information about the service preferences, preferred time of day, day of the week, etc.
2. **The Online analysis** will help to identify both QoE degradation situations and affected users. This online analysis will trigger the set of actions that, based on the user's profiles provided by the offline analysis, will help operators to offer the best user experience in such resource limited scenario.

Online and offline analysis will lead to several issues that must be solved in the following phases of the project:

- **Issue 1 (new contractual relationship with customers):** This new way of managing the service priorities can generate new types of contractual relationship. To the traditional gold, silver and bronze categories, contracts based on specific service usage could be added, for example contracts related to the use of music services such as Spotify, or video like Youtube, etc. This new way of managing QoE can lead to a new relationship with customers.
- **Issue 2 (processing huge amounts of information coming from CSPs scenarios):** Huge volumes of information generated both internally and externally to the network are available to make predictions. Because the network changes at a very high rate, extracting conclusions and making predictions nearly in real time is an important requirement for this type of problem. Not only the actions must be taken in the right time slot, which is usually short, but actions that are valid in a fraction of the slot might no longer be valid in the following one. Therefore, quick decisions about how to actuate are key in these scenarios.
- **Issue 3 (Profiling and privacy):** Making proper user and service profiling is the way to know users' preferences better, and therefore a way to provide them with enough QoE in service degradation scenarios. But to better know the user profiles, there is a need to track users' activities, and this information should be protected using encryption, securing the communications, etc.

- **Issue 4 (Access to both internal and external information):** The information required to make predictions and customize policies comes not only from the Network environment but also from external data sources. Information related to the weather, programmed events, and other relevant data sources will be used to make better predictions. Therefore, a special protection should be enforced over sensitive user information.
- **Issue 5 (Need of historical information):** To make better predictions about cell status, user groups, provided services, etc. there is a need for historical information just to let systems learn from past situations and apply it to future ones.
- **Issue 6 (Cell mixing prediction / mobile networks case):** To apply the right policies and make the right decisions about how to actuate in the network it is necessary to have not only user profiling but also predictions about the type of users that will be present in a cell.
- **Issue 7 (Policies optimization).** Analytics can be used not only to extract profiles or help to make decisions on how to actuate, but also to make a better policy composition that later on helps to alleviate the service degradation situations better.

4.1.4 Market insights

The ICT market is becoming more and more automated. Today we have experts managing our networks and providing the intelligence to it. In addition to that, CSPs have powerful tools that help to monitor the network/user/services status and are able to implement the policies and commands already set-up by them. It can be said that today CSPs manage an incredible complexity in the networks, but it's still manageable with the help of such powerful systems and tools. However, how about the future? It can be seen that from today to the year 2020 and beyond there will be an explosion of data circulating through the networks and connected devices. With this scenario in the landscape and taking into account the growing number of Big Data tools available in the market and in the research arena for the analysis (both online and offline) of such huge volume of data, it is easy to infer that the future of network control and optimization will be based on them.

We are speaking about the networked society, with 50 billion connected devices, a world where everything that can be connected will be connected, with an incredible growing level of heterogeneity in the networks, more applications, more services, more smart devices, Internet of Things, growing user heterogeneity, etc.

In addition to that, CSPs will face a growing level of pressure when speaking about OPEX and CAPEX.

With this landscape in mind it is clear that the use cases proposed in ONTIC address the following stage in the network evolution introducing real-time intelligence in the network side enabling smarter network control.

4.1.5 Market entry strategies and market demands.

ICT industry is the natural target market for the ONTIC research and development activities. If we put the focus on the Telecom Market, it can be seen that it is strongly based on standards. Thanks to this fact, the mobile market is approaching to 8 billion subscribers worldwide and plans to have around 9.2 billion subscribers by the end of 2019 [9] (Figure 14). Standards make the technology available worldwide and ease interoperability. Due to this fact, it is clear that standardization activities must be one of the core focuses of the project for it to successfully reach the telecom market. These ONTIC standardization activities will be described more in detail in D5.7. But, just to clarify this exploitation section, Standardization activities are key to approach the Telecom market.

Subscriptions – All Device Types

in LAM | NAM | APAC | CEMA | WE

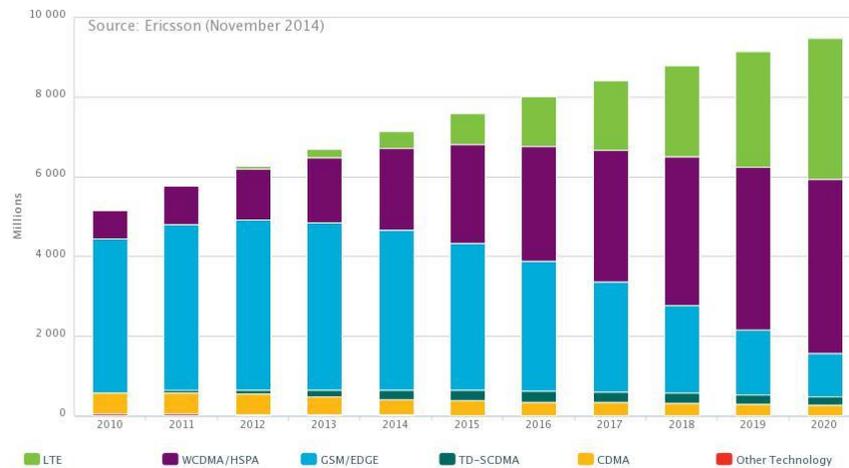


Figure 14: Forecast Subscriptions split on technology type [10]

As explained in the Ericsson Mobility Report November 2014 [11] “Consumers are embracing online video services that provide access to an ever increasing source of content and they expect video to play smoothly and to look great on their mobile devices.” Therefore, technologies as the ones developed in the ONTIC project can contribute to the launch of video services improving the quality of experience of users.

4.1.6 Plans for the following year

In the following years of the project a more detailed analysis about the market potential for Big Data will be carried out. Technologies applied to the Quality of Experience cases, including both QoS and congestion control scenarios, and will deliver reports making visible performance benchmarking against current technologies.

This is, and will be, without any doubt an expansion area within the Telecom business. Networks will become more and more automated and therefore more intelligent and efficient. Big Data tools will make network resource optimization and planning of network deployments possible.

In this way, Ericsson is already providing the Telecom market with tools that could be potential receivers of the Big Data technology developed in the project. As will be explained later on the document, Ericsson product managers have to evaluate the proposed technologies and try to select those that fulfill the market and product needs the best. This means that the adoption of the provided technologies delivered by ONTIC is not assured, but that could be analyzed by potential receivers within Ericsson. On the other hand this will not be the only way out for the technologies developed within the project. Open source communities and 3rd party licensing could be the other exploitation alternatives, which will be reviewed later on.

There is a set of Ericsson products that could be the potential receivers of the technologies developed within the project. The Ericsson team participating in ONTIC are in contact with the people in charge of these products, organizing workshops and providing them ways to evaluate the developed technologies, just to explain to them the main features that ONTIC add to the current State of the Art.



The products that could be potential receivers of the ONTIC developments could be grouped into three categories:

- Analytic products
- OSS/BSS Tools
- Policy controllers and Traffic Detection

Analytics products

Within this category there are two targeted products: Ericsson Expert Analytics (EEA) [12] and User Profile Gateway (UPG) [13]. These products allow operators to work with data coming from both networks and the environment and to aggregate and consolidate them.

Operations Support Systems (OSS)/ Business Support Systems (BSS) Tools [14]

OSS tools are responsible for managing, tuning, planning and optimizing the network adapting network parameters to the quick rate of network change. BSS systems are the tools that manage the customer satisfaction rate, apply the tariff plans and manage customer satisfaction tools.

Policy controllers and Traffic Detection

This product category could benefit from the developments of the Policy Governance function and related modules. In this case we are speaking about Service-Aware Policy Controller SAPC [15] (enhanced 3GPP PCRF), and also the Ericsson DPI product, the Service Aware Support Node (SASN) [16], in everything related to traffic analysis and classification.

To sum up, the three Ericsson product categories that could be potential receivers of the research activities done in ONTIC are related to the analytics part: EEA, UPG and OSS/BSS tools.

4.2 SATEC

Besides the market potential in the ICT area, it is important to highlight the real growth of big data in broad and diverse sectors. Many large companies have been working to develop the concept of Big Data as core business strategies that are creating trends and technological solutions such as [17]:

- Data Discovery in the public administration, e.g. for discovering citizen behavior patterns (administration, elections, security, etc.).
- Solutions to ensure data quality and avoid errors in large corporate databases (customers, products, business, etc).
- Continuous/real-time processing of big data, because the markets require managers to make quick decisions with a high degree of accuracy.
- Secure access to confidential information, implying both network security and protection of private information.
- Information management for Machine to Machine or Internet of Things (IoT) scenarios, which usually require to manage a lot of information continuously.
- Etc.

In this context, the need for real-time, continuous, distributed big data processing can be a common demand of different customers and solutions. In this regard, the ONTIC project could generate the basis for the development of specific platforms for this type of processing and implement them in a variety of markets and solutions.



SATEC focus their plans for next year in the transfer of research results in the field of security (traffic anomaly and intrusion) to market solutions. To do this, SATEC works on the design and development of a computing architecture with distributed, scalable and online capabilities.

Therefore one of the objectives will be to work on this type of solution for handling big data online, distributed and scalable Big Data computing architecture to be generalized and developed as an industrial product, and therefore used for different kinds of applications, customers and markets.

In any case the work at this stage will be directed by use case #1 (anomaly detection) as a basis for development and testing. Therefore, SATEC will try to bring the results to potential customers in the telecommunications sector.

4.2.1 Market identification

The exploitation strategy has been defined as focused on the following ONTIC outcomes:

- ONTS (ONTIC Network Traffic dataset) which will contain network packets crossing a real ISP (SATEC-Interhost) and summary records (statistical information of each packet). All this data will be stored in the ONTIC Big Data platform and may be used outside ONTIC project for both research activities and application testing, for example.
- The ONTIC framework, a specific implementation of a Big Data architecture (hardware and software) for Network Traffic Summary Dataset. It can be offered to different stakeholders in order to use the dataset and as an open framework to develop new research and support the development and deployment of new products.
- Prototype for the Network Anomaly Detection Use Case, which will be used as a proof of concept and which can be exploited as the core of an industrial product for anomaly detection in data networks.
- Prototype for the Dynamic QoS management Use Case, which will be used as a proof of concept and which can be exploited as the core of an industrial product for Quality of Service/Quality of Experience in data networks.
- Prototype for the Proactive Congestion Detection and Control Systems Use Case, which will be used as a proof of concept and which can be exploited as the core of an industrial product for Congestion Detection and Control in data networks.

All the outcomes cited above are oriented to the data network market but, beyond these specific results, the core of the knowledge (for example algorithms, and architectures for real time Big Data processing) and the expertise acquired in this project will enable partners to design and develop new solutions in which scalability, accuracy and, in some cases, real-time response are a must.

Therefore, these new solutions and products will be able to be oriented not only to the data network domain, but also to a wide range of markets such as:

- Bank and finance:
 - Real-time analysis of financial transactions
 - Real-time analysis of stock exchange transactions
 - Data security.
 - Fraud control



- Health:
 - Continuous and massive analysis of electronic medical records for the early detection of pandemics, rare diseases, etc.
- Government:
 - Fight against fraud based on the analysis of the issue of digital invoices and statement associated taxes (VAT).
 - Smart Cities: Online processing of data captured by multiple sensors deployed in smart cities.

4.2.2 Interested companies and user groups

SATEC has contacted and has attended meetings (in which presentations about Big Data solutions were explained) with following potential customers:

- Ministerio de Industria Turismo y Comercio de España (Spanish Ministry of Industry) to analyze solutions for a Big Data system oriented to supporting the industrial aid granting process .
- R-cable (Spanish cable network operator): solutions for real-time log files analysis.
- Agencia Tributaria/Ministerio de Economía y Hacienda de España (Spanish Ministry of Finance): analyzing an online Big Data application to make the cross check between electronic invoices and Vat statement (fraud detection and prevention).
- Muscat Municipality (Sultanate of Oman): they are looking for a new big data-based solution for the continuous processing of the data captured from sensors deployed in the city.
- BBVA: Heterogeneous data analysis of corporate training systems.

4.3 EMC

One of the main goals for EMC Spain in the ONTIC project is to gain knowledge and experience in the big data world, as this is one of the priorities our company has had in the last years, and will continue to make efforts and investments in the coming years. EMC is built as a federation of companies. One of them is Pivotal Software, which is focused on providing solutions for big data analytics, and the ONTIC project is a great opportunity for EMC Spain to show our capabilities and experience to our customers and to help them deal with the complexity of Big Data solutions.

From our experience, one of the keys to success in this is trying to convince our customers that big data can be a way to improve their business, taking advantage of all kind of information sources they have in order to exploit the information in a different way. As customers usually are very reluctant to invest in new technologies if they don't see a real advantage and profit in it, the best way to get their attention is to give them real examples of what Big Data can do in a real scenario.

And the first step we need to accomplish for this is to convince our sales/presales force that big data is a reality that we are ready to address, and that we have the skills, knowledge and experience to tell our customers how they can use Big Data in their business. And this is not an easy trip. Sales/presales teams will need to be trained and updated on the progresses of ONTIC, so that they can comfortably get the message and the results of the project across to our customers, and try to establish a link with them based on our real experience in this venture.

The second initiative we plan to develop in the coming years has to do with the Professional Services organization itself. As big data is one of the focuses of the company, a big transformation is taking place in the professional services department, as a new Big Data discipline is created

across EMEA to drive the change and lead all the opportunities around big data. The ONTIC project can be one of the references to be used across all the countries in EMEA to leverage the experience and results of the project for our customers.

4.4 Adaptit

ADAPTIT is interested in ONTIC project results from the viewpoint of a solution provider. In particular, ADAPTIT is interested in the design and deployment of the Big Data architecture for traffic characterization and the analytics for extracting network and application performance insights and metrics.

ADAPTIT is committed to capitalising on the experience gained from its involvement in the project and on the collaboration with the other partners of the consortium. Specifically, the exploitation of project results is seen in two directions, discussed below.

Strengthen the company's position in the market: The participation of ADAPTIT in ONTIC will be exploited as a competitive advantage of the company for strengthening its position as a provider of infrastructure and performance management solutions. The company will gain a significant know-how in offering Big Data solutions and analytics for performance management, which constitute areas of primary concern to the company. Relevant external dissemination activities have already been commenced, while pre-sales/sales teams have been working on enhancing the company's 'know-how' message.

Utilise the gained know-how and experience into service offerings: Based on the acquired knowledge, ADAPTIT plans to further develop their Big Data analytics portfolio for infrastructure and performance management. Big Data-as-a-service is considered as a promising sales form. A presales/sales team will be formed for undertaking direct customer contacts, presentations and pilot projects, targeting at current and prospect customers in the EMEA region. The strategy is to pursue FOA (First Office Application) for exhibiting the benefits of the proposed services, with ADAPTIT undertaking the cost of the pilot project. To this direction ADAPTIT has already made contacts with First Data Hellas, who have shown interest in analysing usage data from cloud resources, while meetings with Cosmote Greece and Vodafone Italia are in the agenda within H1 of 2015.

In addition, collaboration with other partners in the consortium will be sought for jointly exploiting the produced results.

4.5 UPM

As an academic institution, UPM focuses on non-profit exploitation activities. In accordance with this profile, these consist primarily in leveraging the ONTIC platform and the knowledge and experience acquired from it in future R&D projects. Specifically, the knowledge obtained in the ONTIC project has been exploited during the first year through the dissemination activities previously described in section 3.

UPM created the Centre for Support for Technological Innovation (CAIT - its initials in Spanish) in 2010 with the fundamental objective of promoting the exploitation of the results of R&D activities as well as serving as a stimulus to the innovation process in the business ecosystem close to the UPM. In this context, CAIT will explore options to secure IP generated within the project and launch and incubate spin-offs or license the IP, all with the ultimate goal of introducing innovative services and/or products into the market.

Additionally, the UPM team has started to explore the dissemination of ONTIC results by contributing to an open source framework for scalable online and offline analytics (subsection 3.5 ONTIC). As previously commented, the aim is to include some ONTIC algorithms in a framework



that can be used in other application domains (e.g. bioinformatics, social sciences, financial, etc.).

4.6 CNRS

CNRS-LAAS is an academic partner. As such, its dissemination and exploitation plan includes:

- Publishing premier high quality papers in major top conferences and journals in the area of networking, security, and autonomic systems to promote our new disruptive ideas and concepts.
- Gaining significant skills in the area of big data computing, data mining, machine learning, autonomous system, and actual traffic and illegitimate network activities. Such skills and knowledge will lead to new courses to be held to PhD students thanks to summer schools, or to undergraduate students of engineering schools.
- Finding new research directions and prospecting for new academic and industrial partners for future research projects based on skills and results gained in ONTIC.
- Disseminate our upcoming results and prototype implementation to company for possible industrial exploitation. At CNRS, this work is triggered by the researchers. CNRS has some offices in French regions for "promoting" results to industrial companies, i.e. if a researcher has a good algorithm with a demo or a prototype, and finds a company that wants to make an industrial product out of it, the lawyers of these regional valorization offices are in charge of negotiating the technology transfer from public research to industry, the related intellectual property, and the related royalties.

4.7 POLITO

POLITO exploitation plans are to allow the technology and competence transfer to industry, by using ONTIC outcomes to increase awareness among industry and professionals. Furthermore Polito plans to contribute with publications of the scientific results in journals such as IEEE Transactions On Knowledge and Data Engineering and ACM Transactions on Knowledge Discovery, and specific purpose conferences such as IEEE BIG DATA, then use ONTIC as base platform for research on novel Big Data algorithms and data mining techniques in H2020 or national projects (e.g., PRIN), and let students exploit ONTIC activities for completing their Degree Final Project.



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