

COST
Domain Committee
"Information and Communication Technologies"

COST Action (IC0703)
Start Date (13.03.2008)

*Data Traffic Monitoring and Analysis:
Theory, techniques, tools and applications for the
future Internet*

**MONITORING
PROGRESS REPORT**

***Reporting Period: from 08.05.2010
to 02.05.2011***

This Report is presented to the relevant Domain Committee.
It contains three parts:

- I. Management Report prepared by the COST Office/Grant Holder***
- II. Scientific Report prepared by the Chair of the Management Committee of the Action***
- III. Previous versions of the Scientific Report; i.e., part II of past reporting periods***

The report is a "cumulative" report, i.e. it is updated annually and covers the entire period of the Action.

Confidentiality: the documents will be made available to the public via the COST Action web page except for chapter *II.D. Self evaluation*.

Based on the monitoring results, the COST Office will decide on the following year's budget allocation.

Executive summary (max.250 words):

The TMA Action is now going to end its third reporting period. The TMA community is now established and well recognized in the European scene. Several Early Stage Researchers (ESR) are enthusiastic contributors to the Action, taking initiative to launch bi-lateral collaborations and STSMs.

The Action has suffered a suspension of budget-consuming activities (STSMs and meetings) for four months between July and October 2010, due the delay in the grant assignment procedure by the COST Office. This was the primary cause for the drop in the number of STMS application and grants.

The COST Action has established a link to one EU FP7 project (DEMONS). A second PhD school is being organized for the next reporting period.

The third TMA Workshop was held in Vienna, Austria on 27 April 2011, co-located with European Wireless conference, and attracted about 55 participants with 14 papers presented plus a Poster session.

A plan is being developed for continuing the TMA Workshop series beyond the termination of the Action, and to promote it further as a prominent European-based venue for scientific dissemination and a reference point for the regional research community.

I. Management Report prepared by the COST Office/Grant Holder

I.A. COST Action Fact Sheet

- **COST Action IC0703 – Data Traffic Monitoring and Analysis (TMA Action)**
- **Domain Information and Communication Technologies**

- **Action details:**

CSO Approval: (16/11/2007)

End date: (12/03/2012)

Entry into force: ((17/12/2007)

Extension: (day/month/year)

- **Objectives** (from DB as in About COST)

The main objective of the Action is to increase the quality and the impact of European research in the field of Traffic Monitoring and Analysis (TMA). Modern packet networks are highly complex and ever-evolving objects. Understanding, developing and managing such environment is difficult and expensive in practice. Traffic Monitoring and Analysis (TMA) has always been seen as a key methodology to understand telecommunication technology and operation, and the complexity of the Internet has attracted many researchers to face traffic measurements since the pioneering times. The recent advances in the field of TMA suggest that evolved TMA-based techniques can play a key role in the operation of real networks. Today, the lack of insight and early recognition of emerging risks and/or performance issues can expose the network infrastructure to stability and security problems. TMA is therefore the basis for prevention and response in network security, as typically the detection of attacks and intrusions requires the analysis of detailed traffic records, e.g. packet traces. This Action will coordinate both Research Groups and Network Operators active in the field of TMA, promoting the development of novel techniques and focusing the research efforts towards commonly recognized problems, thus driving the research towards real-world applications. It will foster the adoption of common monitoring tools and analysis platforms, so as to catalyze the emergence of a European de-facto standard for traffic monitoring, ultimately increasing the impact of European research in the field.

- **Parties:** list of countries and date of acceptance

Austria 03/03/2008	Israel 07/02/2008
Belgium 17/12/2007	Italy 12/03/2008
Bulgaria 21/08/2008	Lithuania
Croatia 16/10/2009	Netherlands 29/01/2008
Cyprus 11/03/2009	Norway 17/12/2007
Denmark 07/02/2008	Poland 10/01/2008
Finland 07/02/2008	Portugal 05/06/2008
France 17/01/2008	Serbia 27/03/2010
Germany 17/12/2007	Spain 09/01/2008
Greece 17/12/2007	Sweden 15/02/2008
Hungary 31/03/2008	Switzerland 15/02/2008
Ireland 01/02/2008	United Kingdom 17/12/2007

Intentions to accept: none

- **Other participants:**

*Institute of Control Sciences of Russian Academy of Sciences, Russian Federation
University of Montenegro, Faculty of Electrical Engineering, Montenegro*

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- **Action Web site :** <http://www.tma-portal.eu>
- **Grant Holder Representative:** Alessandro D'Alconzo, dalconzo@ftw.at
- **Working Groups** (*list of WGs and names and affiliations of participants*)

Although WG were foreseen at the start of the Action, the current organization does not revolve around WG. Instead, the TMA Action has Special Interest Groups (SIG)S, i.e. small groups of institutes interested to a specific topic, coordinated by the SIG leader (usually the initiator) and with a less formal and more dynamic organization.

I.B. Management Committee member list

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I.C. Overview activities and expenditure

(year) Budget

2010-2011

Total Action Budget: 93,800.00

Remaining Action Commitments* (estimated costs):

- Expected budget for remaining travel claims of the 7th MC meeting and 3rd TMA Workshop on 27-28th May 2011, in Vienna 22,000.00
- Budget for 3 STSMs already granted but not yet finished/paid 6,698.00
- Budget for one more expected STSM 2.000.00
- Planned budget for 2nd TMA Training school "Bridging the gap between theory and practice in network monitoring and analysis" (Napoli, 6-10th June 2011) increased by unused budget. 17,300.00
- Support for TMA website and portal development 2,000.00
- Secretarial support for Action year 2008-2009 (14.2% of all costs) 11,700.00

Total

61,698.00

Meetings

Meeting Type	Date		Place		Cost	Total
	From	To				
Cancelled MC meeting	09/20	09/21	Zagreb	Croatia	1,318.46	
6 th MC and technical meeting	01/20	01/21	Zagreb	Croatia	24,824.3	
						26,142.76

STSM

Beneficiary	Date		Place		Cost	Total
	From	To	From	To		
Dr Tobias Hossfeld	10/15	11/15	University of Würzburg, Germany	FTW, Austria	1,924.00	
Mr Felipe Mata Marcos	11/15	02/28	UAM, Spain	University of Amsterdam, Netherlands	3,000.00	
Mr Andreas Berger	01/10	01/15	FTW, Austria	NEC Laboratories, Germany	950.00	
						5,874.00

Action Total : 32,016.76

Estimated costs are indicated by an asterisk (*) in the "Remaining Action Commitments" field of the document. All other figures refer to actual costs.

Final costs will appear in the Final Financial Report (due by end of July).

II. Scientific Report

In this third year the set of TMA participants have formed a “community” which is now consolidated. Through the considerable number of research collaborations, regular participation to the meetings and use of the portal and mailing list, the “community culture” has been established. Thanks to that, it can be expected that series of TMA Workshops which will be continued also beyond the closing of the Action in 2012, thus offering a well recognized European-based dissemination forum and point of contact between academics involved in this field.

It should be noted that the activities of the Actions were completely suspended for four months, from July to October 2010, due to a considerable delay in the procedure for grant assignment by the COST Office. This caused the suspension of all new STSM applications for the granting period, and the cancellation of one MC meeting in Zagreb --- which was initially planned for September 2010 and then postponed to January 2011.

A natural consequence of the suspension is that the total volume of STSM has decreased compared to the average of past years. Notably, all granted STSM involve Early Stage Researchers.

The third edition of the TMA workshop took place in Vienna, on 27 April 2011, co-located with 17th European Wireless Conference. The figures are in line with past editions the following: 30 submissions, 14 accepted papers (10 full and 4 short) and about 55 participants, with increased participation from outside Europe. Such figures are extremely successful for a young one-day single-track workshop. The workshop proceedings have been published by Springer-Verlag in the LNCS series. The workshop hosted a special poster session organized by the EU FP7 project DEMONS on the topics of secure inter-domain monitoring.

*In the reporting period the Action members have organized a Special Issue of the International Journal on Network Management (Wiley) on “**Traffic Monitoring and Network Measurements: from Theory to Practice**” that was published in September 2010.*

Finally, a PhD summer school is being organized for up to 30 trainees. The school will be held in Napoli at the beginning of June 2011. It will be a one-week program involving also laboratories and a panel with network operators.

II.A. Innovative networking

The number of STSM grants, the activity and discussion at the meetings and the number of joint scientific publications are clear indicators that the Action was successful in promoting research collaborations between its members.

A link with the FP7-IP project DEMONS, which had been launched by the initiative of some prominent Action members, has been established in the form of a special poster session hosted by the TMA 2011 Workshop and is expected to be strengthened in the forthcoming reporting period.

The Action has established good links with the international community revolving around the PAM conference (Passive and Active Measurements): co-location between TMA Workshop and PAM conference took place in 2010 and is expected to be iterated in 2012.

II.B. Inter-disciplinary networking

The development of inter-disciplinary networking was not among the primary objectives of the TMA Action in this reporting period.

II.C. New networking

During the reporting period the Action has acquired two additional members: Lithuania and Montenegro. The total number of participant countries is now 24, plus 2 non-COST institutions.

Several countries have multiple research groups involved in the Action. The current list of research groups involved in the Action activities accounts c.ca 55 research groups (see <http://www.tma-portal.eu/cost-tma-action/groups/>), each with at least one active individual following the Action activities. In all technical meetings the number of participants was approximately 40-50. The number of subscribers to the TMA mailing list amounts to c.ca 250.

Early Stage researches are remarkably active in the TMA Action: almost all STSMs granted so far had an Early Stage Researcher (ESR) as applicant.

ESRs account for about one-third of active MC delegates and approximately 50% of participants to the last two meetings in Zagreb and Vienna.

Publications: the number of joint publications, some of which stemmed from STSM, amounts to roughly 50 (see <http://www.tma-portal.eu/cost-tma-action/joint-publications/>).

II.D. Self evaluation

Overall the reporting period the outcome of the Action is very positive, considered that all activities involving budget spending were completely suspended for four months due to the grant delay by the COST Office.

The TMA Action community is now consolidated and is likely to remain active also beyond the conclusion of the Action. The success of the TMA workshop had an important role in this process.

The TMA Action continues to register enthusiastic participation by young researchers, mostly PhD students and post-docs, who have been taking autonomous initiatives to initiate new bilateral collaborations and organize STSMs.

In a few cases STSMs were granted also to MS students which are considering to start a PhD for making a research-oriented thesis abroad. In this sense, the TMA Action is promoting the ingress of young people into the research track.

The TMA Portal is being used as a support tool inside the Action. Its content is slowly growing. The forum discussions were not particularly active and people tend to prefer off-line communications to discuss technical issue.

Besides the mentioned grant delay, the high management and administration overhead pending on the Chair and on the Secretary continues to represent a serious problem. Compared to the previous reporting period, which had already suffered from the introduction of eCost, the actual overhead was further amplified by the latest change in the procedures introduced by the new version of the Vademecum. The management, coordination and steering of the Action activities is requiring higher-than-ever efforts by the Chair and by the Secretary.

It is highly desirable that steps are taken by the COST Office to revise certain procedures in the direction of their simplification.

III. Previous scientific report(s)

II. Scientific Report (2009 – 2010)

In this second year the set of TMA participants have formed a “community” which is now consolidating. Through the considerable number of research collaborations, regular participation to the meetings and use of the portal and mailing list, the “community culture” has grown considerably. The TMA Action starts to be recognized also outside Europe and the success of the second TMA workshop edition has contributed to this goal.

Second, a considerable share of the Action resources were again used to establish a network of bilateral collaborations between the research groups, most prominently by supporting several STSMs for Early Stage researchers – 17 STSMs were granted as of April 2010, with a few more expected until June 2010¹.

Contrary to the success of bilateral collaborations, multi-party research collaborations have not produced the expected results: it appears that the efforts required to coordinate multiparty activities and some specific obstacles, e.g. in sharing traces or proprietary tools, make it difficult to run such multi-lateral collaborations without dedicated support.

Two TMA workshops took place in the reporting period. The 1st TMA workshop was held in Aachen, Germany, on 11 May 2009, co-located with IEEE/IFIP Networking’09 conference. The 2nd TMA Workshop was held in Zurich on 7 April 2011 co-located with PAM 2010. The figures were similar for both editions: 34-35 submissions, 14-15 accepted papers and over 70 participants, with increased participation from outside Europe in the second edition. Such figures are extremely successful for a young one-day single-track workshop! The workshop proceedings have been published by Springer-Verlag in the LNCS series.

A journal special issue on “Traffic Monitoring and Network Measurements: from Theory to Practice” was organized for the International Journal of Network Management. Publication is expected in August 2010, with five accepted papers out of 18 submissions.

A PhD school on the topic of Anomaly Detection was organized in collaboration with EuroNF Network-of-Excellence. Held in Torino in February 2010, it had 44 participants selected among 55 applications and 5 trainees, with an intensive one-week program involving also practical laboratories and final exams. The organizational efforts were considerable, due to the number of participants and the laboratories

II.A. Innovative networking

The number of STSM grants, the activity and discussion on the mailing lists and the number of joint scientific publications are clear indicators that an interesting volume of work is being done between the TMA members. A novel Special Interest Group (SIG) on Quality of Experience (QoE) was started, which follows the SIG on Anomaly Detection, Traffic Classification and Bandwidth Estimation.

Projects: at least one FP7-IP project proposal (DEMONS) was prepared resulting from contacts gained during the TMA Action activities. DEMONS was accepted and will start on September 2010.

II.B. Inter-disciplinary networking

¹ The current reporting period (from 27/04/2009 to 07/05/2010) spans over two partial financial years. Indeed, out of the 17 STSMs, 5 were granted during the last two months of the first financial year, whereas the remaining 12 have been granted during the initial ten months of the second financial year.

The development of inter-disciplinary networking was not among the primary objectives of the TMA Action in this second year, which has been mostly dedicated to consolidating the Action community from inside. However, the QoE SIG launched in the second year has the potential to develop more inter-disciplinary work, e.g. involving psychologists.

II.C. New networking

One new COST party joined the Action in Q1-2010: Serbia (Prof. Prof. Miroslav POPOVIC, and Dr. Ilija BASICEVIC). The total number of participant countries is now 23.

One participant is from a non-COST country: Dr. Natalia Markovich from the Institute of Control Sciences of Russian Academy of Sciences - (Russian Federation). She participated actively to the technical meeting and in one STSM.

Several countries have more than two research groups involved in the Action. The current list of research groups involved in the Action activities accounts c.ca 50 research groups (see <http://www.tma-portal.eu/cost-tma-action/groups/>), each with at least one active individual following the Action activities. In all technical meeting the number of participants was approximately 40-50. The number of subscribers to the Action website amounts to over 140.

Early Stage researches are remarkably active in the TMA Action. 16 out of the 17 STSMs granted so far had an Early Stage researcher as applicant.

The collaborative initiatives that have been recently started (e.g. SIG on QoE) are driven by young post-doc. Early Stage researchers account for about one-third of active MC delegates and approximately 60% of participants to the last two technical meetings in Barcelona and Zurich.

Female participation: one third of participating parties (7 out of 23) have one female MC delegate/substitute. About one sixth (2 out 17) STSM had a female applicant.

Publications: the number of joint publications, some of which stemmed from STSM, amounts to roughly 20 (see <http://www.tma-portal.eu/cost-tma-action/joint-publications/>).

The TMA Portal (www.tma-portal.eu) is meant to serve as a primary outreach tool, among other functions. The portal was empowered and incrementally evolved during the second reporting period. Its content is still in a growing phase.

II.D. Self evaluation

Overall this second year of the TMA Action lifetime can be considered positive.

The TMA Action community is being consolidated and is now a recognizable entity also from outside Europe. The success of both workshop editions --- indicated by the number and quality of the submitted contributions and number of registered participants --- had an important role in this process.

The TMA Action continues to register enthusiastic participation by several young researchers, mostly PhD students and post-docs, who have been taking autonomous initiatives to launch new bilateral collaborations and STSMs.

Almost all the 17 STSMs were granted to Early Stage researchers, with a few more expected in the remaining part of the financial period, about half of them lasting as long as 1-2 months. These are important indications of the Action's capability to gain lively involvement by Early Stage researchers.

In a few cases STSMs were granted also to MS students which are considering to start a PhD for making a research-oriented thesis abroad. In this sense, the TMA Action is promoting the ingress of young people into the research track.

The TMA Portal is being used as a support tool inside the Action. Its content is slowly growing. The forum discussions were not particularly active and people tend to prefer off-line communications to discuss technical issues.

The main difficulty encountered during this second year was the high management and administration overhead pending on the Chair and on the Secretary. The management, coordination and steering of the Action activities is still requiring higher-than-expected efforts by the Chair. The management overhead was greatly amplified by the shift to the new e-Cost system: many problems were encountered by the people during the procedures and all of them required a lot of attention by the Grant Holder, particularly the Secretary, and in some cases by the Chair.

II. Scientific Report (2008-2009)

In this first year most of the efforts have been dedicated to build up the TMA community. The set of research groups and individuals involved in the TMA Action did not come together from any previous common activity (e.g. NoE), and very few of them had already collaboration links in place. Therefore the community building process had to start more or less "from scratch".

This process has been implemented by several means.

First, the MC spent efforts to build a strong "community culture", by promoting the active participation on the general mailing list and website, by the use of a well-recognizable logo in any activity (e.g. workshop, portal) and more recently by launching the TMA portal as a community platform.

Second, a considerable share of the Action resources were invested in establishing a network of bilateral collaborations between the research groups, most prominently by supporting several STSMs for Early Stage researchers --- more than 10 were granted as of April 2009, with a few more expected until June 2009.

Third, multi-party research collaborations are being initiated on two important research topics, namely Anomaly Detection and Traffic Classification, with concrete results expected in the next reporting period.

It should be considered that in practice the Action activities have been initiated with the first technical meeting in Samos, Greece on September 2008, therefore only seven months ago.

Despite such a relatively short time frame, there are clear indications that the community-building process is being successful, and that the TMA Action is starting to acquire visibility and recognition also outside the scope of COST Countries.

For instance, the organization of the 1st TMA workshop organized by the Action --- to be held in Aachen, Germany, on 11 May 2009 --- has received c.ca 35 paper submissions (of which 15 were accepted) and c.ca 60 prospective participants have already registered as of today: these are extremely good figures for a one-day first-edition workshop! The workshop proceedings will be published by Springer-Verlag in the LNCS series. Moreover, the option of holding the next Workshop jointly with PAM 2010 is now being considered, which would further increase the International visibility of the TMA Action.

II.A. Innovative networking

The Action is contributing to raise awareness among its members about the problems affecting research in the TMA field, particularly regarding the lack of cross-validation of the proposed analysis algorithms (e.g. for Anomaly Detection and Traffic Classification). Some collaborative activities within the Action to respond to such need have started since the first technical meeting in September 2008, some of which supported explicitly by STSM. The first concrete results are expected to appear at the beginning of the next reporting period. However, the number of STSM grants and the activity/discussion on the mailing list are clear indicators that an interesting volume of work is being done.

Projects: at least one NoE proposal and one STREP proposal for FP7 Call 5 are being prepared which result from contacts gained during the TMA Action activities.

II.B. Inter-disciplinary networking

Generally speaking, the topic of TMA has a strong intrinsic potential for multi-disciplinary impact. On the scientific side, several methodologies and conceptual tools are being imported from diverse scientific fields (economy, signal processing, statistics among others) and applied to TMA problems. Also, technology developed for TMA (e.g. large-scale data collection and mining) has the potential to be used in other application areas. Furthermore, there are serious socio-economic aspects relevant to TMA that are expected to play a major role in the Future Internet, e.g. privacy and network neutrality.

Having said that, the development of inter-disciplinary networking was not among the primary objectives of the TMA Action in this first year, which has been mostly dedicated to consolidating the Action community from inside.

It is planned to focus more on multi-disciplinary work in the following year. The launch of TMA portal, which is currently in roll-out phase, is expected to serve well this goal, by providing a reference entry point to the TMA field also to scientific communities in other fields.

II.C. New networking

Two new COST parties joined the Action in Q1-2009: Cyprus (Dr. Costandinos Mavromoustakis) and Croatia (Prof. Maja Matijasevic). The total number of participant countries is now 22.

One participant is from a non-COST country: Dr. Natalia Markovich from the Institute of Control Sciences of Russian Academy of Sciences - (Russian Federation). She participated actively to the technical meeting and is expected to contribute to the Training Schools to be organized in the next year within her area of expertise (advanced statistics).

Several countries have more than two research groups involved in the Action. The current list of research groups involved in the Action activities accounts c.ca 50 research groups (see <http://www.cost-tma.eu/participants>), each with at least one active individual following the Action activities. In the last technical meeting (Samos, 22-23 September 2008) the number of participants was approximately 40-45. The number of subscribers to the Action website amounts to over 100.

Early Stage researches are remarkably active in the TMA Action. All 10 STSM granted so far had an Early Stage researcher as applicant. The collaborative initiatives that have been recently started (on Anomaly Detection and Traffic Classification) are driven and participated by PhD students or young post-doc. Early Stage researchers account for about one-third of active MC delegates and approximately 60% of participants to the last technical meeting in Samos.

Female participation: one third of participating parties (7 out of 22) have one female MC delegate/substitute. The primary workshop Program Chair and the WG1 leader are female. One fifth (2 out of 10) STSM had a female applicant.

Publications: several joint collaborations have started between Action participants since the first technical meeting in September 2008, including those fostered by STSMs. Joint publications, and in general papers from within the Action, are currently being worked on, with the first ones going to be presented at the next TMA workshop and a few others still under submission at other international conferences (e.g. Globecom). As of today it is too early to provide a representative outlook on published joint works, a complete list and consolidated figures will be presented in the next-year report.

The TMA Portal (www.tma-portal.eu) is meant to serve as a primary outreach tool, among other functions. The portal was developed and put online in the second part of the reporting period. As of today it contains some initial content (e.g. state-of-art overview of selected research topics) and is now entering the "adoption" phase where the community members are called to populate it with content about their research fields. A dedicated section of the portal will progressively replace the website that has been used in the first part of the Action (www.cost-tma.eu), while the technical discussions will be moved from the mailing list to the forum section.

The Chair has presented the TMA Action at the 1st European Workshop on Mechanisms for the

Future Internet, 10-11 July 2008, Salzburg, Austria.

Projects: at least one NoE proposal and one STREP proposal for FP7 Call 5 are being prepared resulting from contacts established during the TMA Action activities.

II.D. Self evaluation

Overall this first year of the TMA Action lifetime can be considered definitely positive.

The TMA Action community has been successfully built and is starting to be a recognizable entity also from outside. The success of the first workshop organization --- indicated by the number and quality of the submitted contributions and number of registered participants --- marks an important milestone of this process, which is also very promising about the potential to consolidate the visibility of the TMA Action in the future years.

The TMA Action has registered enthusiastic participation by several young researchers, mostly PhD students and post-docs, who have been taking autonomous initiatives to launch new bilateral collaborations, STSMs and more recently also a couple of multi-party joint activities. As many as 10 STSMs were granted to Early Stage researchers, with a few more expected in the remaining part of the financial period, about half of them lasting as long as 1-2 months. These are important indications of the Action's capability to gain lively involvement by Early Stage researchers.

More recently the initial version of the TMA Portal was put online, offering among other features like: a wiki-like section for the collective production of overview and state-of-art of various research topics in the TMA area, technical forums, support for collaborations and dissemination activities. As with any community platform, the process of being adopted and enriched by the community requires some time. The TMA portal is still in its infancy: although some initial content is already available therein, it will take some time before reaching the "critical mass" --- in terms of content and usage --- that is required to mark it as a truly central tool in the research community. We expect to reach this point in the second half of the next reporting period.

The main difficulty encountered during this first year is ultimately due to the large size of the Action itself, in terms of involved individuals and research groups. The management, coordination and steering of the Action activities required higher-than-expected efforts by the Chair and by the Secretary. Also, the initial design and development of the TMA portal turned out to be more complex task than originally planned --- which was too much optimistic and failed to anticipate several challenging aspects of the system --- and therefore took longer than expected.

The promotion of new EC project proposals in FP7 and other national projects was not so high in this first year. Indeed, the focus was rather on establishing new links between the Action participants and seed novel collaborations. It is planned in the next reporting period to capitalize on such collaborations and put more emphasis on joint proposal preparation.

III. Previous scientific report(s)

NA