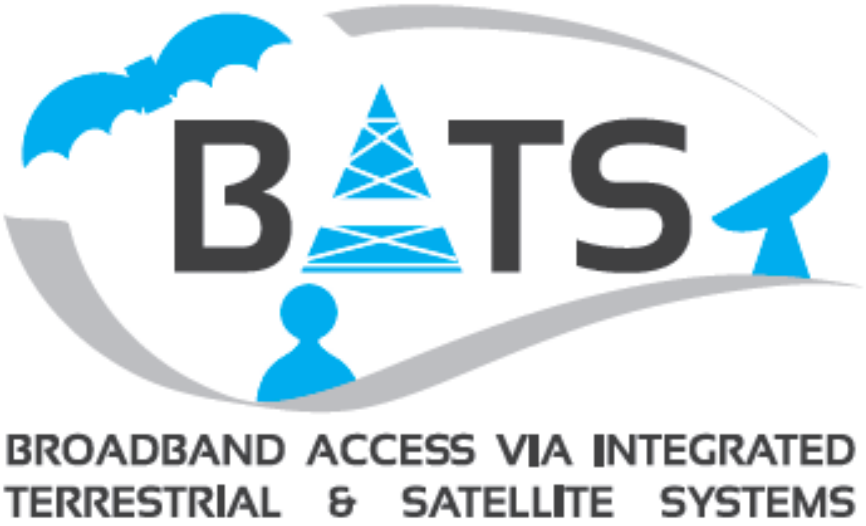

D8.2.3

Report on the promotion of BATS standardisation activities

Instrument	Collaborative Project
Topic	ICT-2011.1.1
Project Title	Broadband Access via Integrated Terrestrial & Satellite Systems
Project Number	317533
Project Acronym	BATS
Contractual Delivery Date	M39
Actual Delivery Date	18/12/2015
Contributing WP	WP8.2
Project Start Date	01/10/2012
Project Duration	39 months
Dissemination Level	PU
Editor	TAS-F
Contributors	AVA, CAL, OAF

Document History			
Version	Date	Modifications	Source
0.0	16/11/15	Creation	TAS-F
0.1	09/12/15	Addition of sections	CAL
0.4	16/12/15	Addition of sections	One Access, TASF
1.0	18/12/15	After QA review	AVA

Table of Contents

List of Tables

List of Acronyms

BATS	Broadband Access via Integrated Terrestrial & Satellite Systems
ETSI	European Telecommunications Standards Institute
EU	European Union
IETF	Internet Engineering Task Force
GHG	GreenHouse Gas
ITU	International Telecommunications Union
LCA	Life Cycle Analysis
Mbps	Megabit (1 million bits) per second
MPTCP	Multi Path Transport Control Protocol
SCN WG	Satellite Communication and Navigation Working Group
SES	Satellite Earth Stations and Systems
SG5	ITU-T Study Group 5 Environment & Climate Change

Executive Summary

This deliverable reports about the promotion of BATS standardisation activities carried out in the BATS project in the context of ETSI, IETF and ITU-T and BB Forum.

It describes the reports, standards, technologies and methods that have been developed by the BATS project and promoted in standardisation organisations gathering organisations beyond the satellite community.

The main concepts developed in the BATS project and promoted at various standards bodies are as follows:

- TCP Initial spreading;
- Multipath TCP;
- Traffic classification with multipath TCP;
- Energy efficiency and lifecycle assessment of greenhouse gas emissions for hybrid and satellite only broadband access networks.

1 Introduction

This deliverable reports on the promotion of BATS standardisation activities carried out in the BATS project in the context of ETSI, IETF and ITU-T.

The primary project focus in this has been the definition of a hybrid satellite with terrestrial network for the delivery of broadband access, and the development of technologies/methods enabling this system concept.

As part of the BATS project several standards/technologies and methods have been developed and promoted in organisations or groups of organisations beyond the satellite community.

The different standards/technologies/methods are described in chapter 2 together with the activities in the international standardisation organisations. Chapter 3 summarises this work.

2 Promotion of Standardisation activities

2.1 European Technical Standards Institute (ETSI)

2.1.1 Context

Improving the Energy Efficiency of satellite-based systems is important if they are to complete with terrestrial based systems in the fulfilment of the EU Digital Agenda 2020 targets which state that 100% of EU homes and businesses must be able to receive 30 Mbps broadband by 2020. This will not be economically possible without using satellite-based systems.

It is equally important to demonstrate that the GreenHouse Gas (GHG) emissions of a satellite based system over the full life cycle (LCA) are comparable with those from terrestrial technologies. BATS has demonstrated that a hybrid satellite/terrestrial system can have lower GHG emissions than a satellite-only system, and this will be reinforced by the ETSI standards in this area.

2.1.2 Promoted techniques/technologies

The completion of Technical Reports in ETSI SES/SCN (Technical Committee on Satellite Earth Stations and Systems / Working Group on Satellite Communications and Navigation) on Energy Efficiency and on the Full Life Cycle Analysis of a Satellite Broadband Network has proved very useful. This was the first time that such an Energy Efficiency analysis had been carried out for a Satellite Network, which allows comparison on an equal basis with terrestrial technologies. It was also the first time that a full life cycle analysis had been carried out on any network technology within the scope of ETSI, and so will lead the way for similar analyses to be carried out on terrestrial network technologies.

This will establish the role of satellite networks as a mainstream technology in broadband service provision. The need to include satellite networks has also been recognised in Phase 2 of EU Mandate M/264 “ICT to enable efficient energy use in fixed and mobile information and communication networks” currently being worked on by ETSI, and satellite experts will now take part in this work for the first time.

In addition, the work on ETSI has influenced work in ITU (see later) and thus ensured that the results will be applicable globally.

2.2 Internet Engineering Task Force (IETF)

2.2.1 Context

The mission of the IETF is to make the Internet work better by producing high quality, relevant technical documents that influence the way people design, use, and manage the Internet.

2.2.2 Promoted techniques/technologies

Multi Path TCP protocol

The OneAccess standardisation activity on MP-TCP with its partner Orange consisted of following-up in the IETF and BBF (Broadband Forum) bodies by making more contributions, complemented by visiting Communication Service Providers and Satellite Service Providers in Europe, Asia and North America to promote the MP-TCP protocol at a rate of three to four per month.

The feedback has been good from these service providers being impatient to actually test, and in some case deploy, a product. OneAccess has built an evaluation system completed with home-developed test tools allowing measurement of different use cases while varying the bandwidth values and the applications transported. This evaluation system is expected to be deployed at the rate of one or two units per month in Q1 2016 until the end of the year. This evaluation system has already raised significant improvements to be made and also identified unseen market opportunity such Hybrid MPLS.

TAS also initiated contact with UCL (Université catholique de Louvain, Belgium) that is in charge of the reference open-source MPTCP stack implementation to include satellite segment consideration.

Initial spreading TCP protocol

The promotion of the Initial Spreading is done in three main areas:

1. The ICCRG (Internet Congestion Control Research Group) and TCPm (TCP Maintenance and Minor Extensions Working Group) chairs proposed that TAS enlarge the scope of the Initial Spreading work to include all pacing techniques. This Internet Draft will be used as a recommendation on these techniques that let us standardize Initial Spreading in a second step. TAS will initiate this Internet Draft including Initial Spreading technique, with possible support from Google;
2. Following discussions with Google transport and QUIC (Quick UDP Internet Connections) teams in the 94th IETF meeting in Yokohama, large scale testing using QUIC framework is planned to be made using satellite operator networks. A first phase of evaluation will occur before any TCP connections start-up phase optimizations. It has to be mentioned that Google shows great interest for these set of techniques and they already foresees to use Initial Spreading in their servers (in fact the combination of larger Initial Window and pacing during the first Round Trip Time);
3. Follow-up of the Initial Spreading study is on-going in the frame of a CNES R&T study to enlarge the applicability of the technique and to improve not only short TCP connections but also longer ones.

2.3 International Telecommunication Union (ITU)

2.3.1 Context

The ITU is part of the United Nations organisation. Its membership is open to all countries and organisations within countries. It has three sectors:

- **ITU-T** : Telecommunications Standards;
- **ITU-R** : Radio-communications; and
- **ITU-D** : Development.

2.3.2 Promoted techniques/technologies

BATS primarily promoted the hybrid (satellite/terrestrial) broadband access network concept within ITU-T Study Group 5 (SG5) “Environment and Climate Change”. Within SG5, BATS raised awareness about the potential of satellite broadband networks to provide broadband services in rural areas, particularly in developing countries, and to highlight the value of satellite networks in adaptation to climate change. Work has gone on in the following areas:

- Q18/5 “Methodologies for the assessment of environmental impact of ICT”. This is important because it standardises the methodology to be used for assessing the environmental impact of ICTs. This is applicable to the GHG assessment of ICTs including BATS technology and its possible alternatives. Recommendations concerning the methodology have been made in close co-operation with ETSI but these standards will apply globally not just within Europe.
- Q14/5 ”Setting up a low-cost sustainable telecommunication infrastructure for rural communications in developing countries”. This is making recommendations on best practices for deploying broadband communications in developing countries, considering issues such as cost, coverage and resilience. It provides possible routes to commercial exploitation of BATS technology.
- Q15/5 “ICTs and adaptation to the effects of climate change”. Satellite communications provide an important means of gathering data concerning climate change and providing communications concerning adaptation to citizens over telecommunications networks. BATS hybrid satellite technology has a role to play by bringing internet services to enable better adaptation to climate change to populations in rural areas and best practices using hybrid satellite to have been contributed to Q15/5. A particular feature of the use of BATS for climate change adaption is the additional resilience which comes from the use of two or more access networks in parallel.

To promote BATS hybrid satellite technologies and align them with world standards, three work items have been established in ITU-T SG5 these are:

- Q18/5 Supplement to ITU-T L.1410 "Assessment of GHG emissions from satellite-based services". This will allow satellite-based systems to be assessed on an equal basis with terrestrial network technologies.
- Q14/5 Supplement on setting up a low cost sustainable telecommunications network for rural communications in developing countries using hybrid-terrestrial satellite systems”. This will facilitate the deployment of satellite-based systems to fulfil the requirements for low cost telecommunications networks in rural areas.
- Q15/5 BATS has already contributed to Recommendation L.1502 “Adapting information and communication technology infrastructure to the effects of climate change” with reference to the resilience and coverage of hybrid satellite systems. A Supplement will now be developed specifically to cover best practises in hybrid satellite-based systems, which will promote BATS technologies.

2.4 Broadband Forum (BBF)

2.4.1 Context

The BBF is the central organization driving broadband access via wireline and wireless solutions. Its aim being to empoweri converged packet networks worldwide to better meet the needs of vendors, service providers and their customers. BBF develops multi-service broadband packet networking specifications addressing interoperability, architecture and management. It forges technical specifications, share best practices and generally drives the broadband market.

As a BBF member, OneAccess contributed in 2014 and 2015 to the WT348 technical committee[1] to propose an MP-TCP standard based method against two other solutions. The proposition has been endorsed by major Communication Service Providers looking for a non-proprietary solution that really cumulates the links bandwidth and adapts to the links' characteristics variations. A confirmation of this proposition as a standard is expected for Q2 2016.

2.4.2 Promoted techniques & technologies

There are different technical approaches to link bonding and BATS focused initially on User Experience with a Multi Path TCP protocol-based solution complemented by major innovations on Link Estimation, Traffic Classification and Traffic distribution domains.

OneAccess is actively promoting those techniques towards its service provider market.

MP-TCP is receiving strong support from the community against the two alternatives: Huaweï link-bonding and 3GPP IFOM. Compared to the first, MP-TCP is based on IETF RFC6824 and, as a consequence not proprietary and already stable. It is also superior on the second one by actually cumulating the bandwidth.

Link Estimation

The BATS Link Estimation is a vendor agnostic non-invasive solution that is different from the modem polling mechanisms by measuring the WAN link characteristics, providing end-to-end link bandwidth, latency and loss, i.e. from server to client. Those two characteristics are superior as they do not generate extra traffic and integrate possible bottlenecks located outside the WAN link itself. Being protocol agnostic, the traffic classification based on object size technology separates short-lived interactive traffic against file transfer/streaming traffic, even if encrypted.

Traffic distribution

The Packet Selection Based on Object Length (Psbol) traffic distribution is another concept claimed by OneAccess and has revolutionized this segment that is currently exclusively combining Policy-Based Routing to statically separate customer-specific critical and non-critical applications. Describing those applications is likely to be inaccurate (for example because of encryption), requires significant effort, and the result is that none of those applications can use more than its link's bandwidth, and both of links are used even when one of them is dramatically more expensive than other.

[1] https://www.broadband-forum.org/technical/technicalwip.php

Psbol traffic distribution is a unique proposition, the optimization of the user experience by using the currently lowest latency link for the short objects and currently highest bandwidth for long objects is logically understood by the market and it is expected that standard tests will appear to qualify the benefits. The enhancements produced thanks to the Field Test, such as combining with Weighted Round Robin the two links with the highest bandwidth and therefore allowing the total available bandwidth to be equal to the cumulative bandwidth demonstrates how correct is the approach and its flexibility and efficiency to address even more use cases.

Those technologies are promoted to the Communication Service Providers; from incumbent ones to virtual network operators, to Managed Service Providers serving a Cloud-based service, to OEM partners as well as to enterprises.

2.5 International Standards Organisation (ISO)

2.5.1 Context

BATS needed to track the work of ISO TC204 and the related European Committee for Standardization (CEN) TC278. These groups are working on standards relating to intelligent transport systems, including “v2x” communications. ISO TC 204 WG16 has developed the CALM concept of open communications so that vehicles are always best connected, by making an intelligent routing selection over the mobile networks that are available at the time that a communication must be made. This approach has been adopted by ETSI ITS and CEN TC278. In particular CEN TC278 WG16 (jointly with ISO TC204 WG18) was developing a method to encode the application requirements as meta-data to allow the intelligent routing engine to make informed decisions as to which of the available networks to use. It appeared that the approach of including or deriving metadata on the application requirements might be a useful method to enable BATS to make wise routing decisions.

2.5.2 Promoted techniques/technologies

Actually, BATS evaluated the methods developed in ISO/CEN context in view of possible re use.

Following an initial analysis the concept was presented at the BATS GA. However, the meeting decided that this approach would not be pursued by BATS, because it required the applications to be programmed to present their communications QoS requirements: it was considered that it was not practical to expect application developers to include communication requirements metadata

3 Conclusions

A variety of Standards, technologies, methods developed and assessed during the BATS have been promoted in international standardisation organisations/fora gathering organisations beyond satellite communication community.

Table 3-1: List of Standards, technologies, methods developed in BATS.

Standards, technologies, methods developed in BATS	**Promotion towards International standardisation fora/organisations**	**Promoters from BATS project**
Initial spreading TCP protocol	IETF	TAS-F
Multi Path TCP protocol applicability to hybrid networks	IETF	OneAccess, TAS-F
Energy Efficiency and Carbon emission assessment method	ETSI	CAL
Multi Path TCP protocol-based solution complemented by major innovations on Link Estimation, Traffic Classification and Traffic distribution domains	Broadband Forum	OneAccess
Hybrid (satellite/terrestrial) broadband access network concept to provide broadband services in rural areas, particularly in developing countries, and to highlight the value of satellite networks in adaptation to climate change	ITU-T Study Group 5 (SG5) “Environment and Climate Change”	CAL
Method to encode the application requirements as meta-data to allow the intelligent routing engine to make informed decisions as to which of the available networks to use	ISO and CEN	CAL

This effort will results in the medium term in increased interoperability of satellite systems with terrestrial networks.