CONVINcE

D6.1.2

Standardization Report #2

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1 EXECUTIVE SUMMARY

In the first year of CONVINcE project we identified the relevant standardization bodies and followed those working groups that are relevant for the project. In the second and third year of the project relevant forums to which the project partners followed and contributed on were 3GPP, MPEG, IETF and W3C in these there are small numbers of working groups that concentrate on energy aspects. Harmonic, Ericsson and Sony Mobile have related standardization activities that have been started already prior to CONVINcE but the results support the work carried out in CONVINcE project. Ericsson and Sony Mobile have within the project initiated a joint contribution activity to the 3GPP standardization on Network assistance for DASH, which so far has resulted in more than 20 documents submitted to the SA WG4 group. Technically it has resulted in the agreement within 3GPP to start a work item for specifying the collaborative architecture solution, which has been developed within CONVINcE WP4. Harmonic created an initiative in MPEG to form a group on Network Distributed Video Coding. The group focused its attention on Guided transcoding Use-cases. The goal is to show evidence of gains in terms of bandwidth or CPU usage which also means gain in power consumption.

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2 DOCUMENT HISTORY AND ABBREVIATIONS

2.1 Document history

Version	Date	Description of the modifications
0.1	01.01.2017	First version of the report
0.2	19.01.2017	Added BTH input and input from Harmonic
0.3	17.02.2017	Added input from CEA and Sony and cleaned up
0.4	10.03.2017	Minor updates and fixes
0.5	10.03.2017	Updates from Harmonic
0.6	10.03.2017	Fixed a paper reference
0.7	10.03.2017	TOC and Footers fixed
0.8	13.03.2017	Review done by IMT
1.0	30.03.2017	First release
1.1	30.04.2017	Additional comments addressed
1.2	17.05.2017	IRTF contribution added
1.3	31.05.2017	Addressed comments regarding CEA contributions

2.2 Abbreviations

3GPP	3rd generation partnership project
6lo	IPv6 over Networks of Resource-constrained Nodes
AVC	Advanced Video Coding
CDN	Content Delivery Networks
CoRE	Constrained RESTful Environments
CPU	Central Processing Unit
GESI	Global e-Sustainability Initiative
HEVC	High Efficiency Video Coding
ICE	Interactive Connectivity Establishment
IETF	Internet Engineering Task-Force
IPv6	Internet Protocol version 6
IRTF	Internet Research Task-Force
MIB	Management Information Base
MMUSIC	Multiparty Multimedia Session Control
MPEG	Moving Picture Experts Group
NFV	Network Functions Virtualization
Netvc	Internet Video Codec

SDN	Software Defined Networking
TCGCC	Technical Committee on Green Communications and Computing
W3C	World Wide Web Consortium
WebRTC	Web Real-Time Communications
WG	Working Group

3 INTRODUCTION

Standardization efforts are an integral part of the commercialization strategy for the project. Without standards to back up the developed technology, any commercialization efforts run an increased risk of marginalization due to lack of market wide adoption. The standardization efforts began early in the project with the identification of expected outcomes and organizations, which potentially are important to protect in standards form, both to secure a preference of using our developed solutions and to avoid being superseded by competing solutions. The bulk work though was done closer to the end of the project when technically sound results have been reached that can be presented to the organizations responsible of defining the area.

This report is structured in to following two parts where in the first part of the report the relevant forums (chapter 4) to follow are identified and then the second part (chapter 5) of the report discusses the individual contributions and participation to these relevant forums.

3.1 Scope of the report

This report aims to collect the contributions made by the project partners helping us to identify at the end of the project the impact created in the standardization bodies. Also, we have identified some standardization actions in this report that are done by the partners outside CONVINcE project. During the second and third year of the project some of the project results were disseminated in to relevant standardization bodies and in this document, we are identifying the major achievements of the project.

4 ORGANIZATIONS TARGETED AND MONITORED

At the beginning of the project, the standardization task has concentrated on identifying few key standardization bodies where the results from the CONVINcE project may be relevant. This list of organizations was updated during second and third year as the results became more ready to be introduced as contributions to relevant standards.

4.1 Relevant Standardization Bodies

In the project, we have studied the related standardization bodies to follow up and contribute to.

- 3GPP: 3rd generation partnership project
- IETF and IRTF: Networking protocols and routing,
- MPEG: Standards for coded representation of digital audio, video and related data,
- W3C: Application layer protocols and web services.

3GPP

3rd generation partnership project (3GPP – www.3GPP.org) standardization organization is responsible of a set of global mobile communication standards. Particularly the WCDMA and LTE standards have been defined within 3GPP, and currently also a next generation standard targeted to meet IMT requirements for 5G that is being defined by 3GPP.

The standardization in 3GPP is conducted within different working groups (WGs), where each group is responsible for a specific area of the communication standard.

One of the working groups is the WG4 group within the service and system aspects area. SA WG4 (a.k.a SA4) group deals with the specifications for speech, audio, video, and multimedia codecs, in both circuit-switched and packet-switched environments. Other topics within the mandate of SA WG4 are quality evaluation, end-to-end performance, and interoperability aspects with existing mobile and fixed networks. The work conducted by WG4 has been identified as the most relevant for the CONVINcE project.

IETF & IRTF

In the IETF the most relevant working groups are the ones considering multimedia and transport networking aspects. These groups are CoRE, ICE, mmusic, 6lo, and netvc. Mmusic and netvc are working groups that concentrate on the encoding and transport aspects of various media. ICE working group was split out from the MMUSIC working group in autumn 2015 as the interactive connectivity establishment procedure was identified to be useful in several use cases still the focus from CONVINcE is to follow how to save battery while keeping the reachability on the devices.

6lo is working on the routing aspect of power constrained devices which could be also of interest of CONVINcE project. CoRE working group is working on more lightweight application protocols for constrained devices that are designed to be low power and equipped with small batteries or even using energy harvesting. Techniques studied and standardized in CoRE for power saving are useful in the context of CONVINcE

IRTF is the research branch of the IETF and it looks more in to the future developments of networking protocols. Work that could be interesting from the CONVINcE perspective is the work carried out in Thing-to-Thing research group and Network Function Virtualization research group. The difference from regular IETF is that IRTF doesn't create industry standards rather aims explore technologies in the field and requirements for them.

MPEG

The Moving Picture Experts Group (MPEG) is a working group of authorities that was formed by ISO and IEC to set standards for audio and video compression and transmission It was established in 1988 by the initiative of Hiroshi Yasuda (Nippon Telegraph and Telephone) and Leonardo Chiariglione.

In MPEG the relevant work items that the project followed are:

- Green Metadata where metadata are added to the video to help the terminal to decrease its consumption,

Network Distributed Video Coding giving support for transcoding.

W3C

In the W3C the identified groups are WebRTC and WoT. WebRTC is considering future developments of Web based communication protocols where energy aspects could be considered. In the WoT the goal is to accelerate the adoption of Web technologies as a basis for enabling services for the combination of the Internet of Things with rich descriptions of things and the context in which they are used.

4.2 Relevant Industry alliances

Relevant industry alliances that could be in the scope of CONVINcE project is GESI. GESI is a leading source of impartial information, resources and best practices for achieving integrated social and environmental sustainability through ICT. GESI partners use their collective knowledge and experience to identify opportunities and develop solutions for improving energy and resource efficiency, reducing carbon emissions and footprints, ensuring sustainable practices in the supply chain, encouraging access to sustainable technologies, and supporting ICT-enabled transformation across all industries and sectors around the globe. Ericsson who is part of the CONVINcE project is also one of the founding members of GESI.

It was also envisaged that CONVINcE becomes a member of TCGCC (IEEE Technical Committee on Green Communications and Computing). The goal of TCGCC, is to provide a platform for its members, and the whole research, development, standardization, and service community of energy- and/or resource- efficient and/or environment-sustainable communications, computing, and relevant systems. This committee not only addresses greening communications, computing, and relevant systems but also investigate using communications, computing, and relevant systems to achieve green objectives for the sustainable world. CONVINcE joined TCGCC on February 2016, IMT being the contact point for the project.

Green Touch organization was also considered. However, it appeared that it stopped working in 2015. Two Green Touch tools (GWATT and Flexible Power Model) were evaluated by CEA to check if they could be used by CONVINcE. The result was disappointing: "The results are hypothetical. There is little relationship with real-world phenomena, and the analysis is very coarse-level".

4.3 Partners' relevant Standardization actions outside CONVINcE

Harmonic reported to CONVINcE partners the work done on Green Metadata[1] and more generally progress of this Working Group that Harmonic is chairing. The work done by Harmonic is funded by a national French project (Green Video). First version of the standard was published in July 2015[2] with reference "ISO/IEC 23001-11"

Ericsson (Ari Keränen) has been co-chairing the IETF mmusic WG at IETF that is related to the work done in CONVINcE and that could be a possible dissemination of project results during the second and third year of the project. In this working group, various media transport aspects are discussed and the focus of Ericsson has been the Interactive Connectivity Establishment and enhancements on the protocol. In battery powered devices, the existence of address translators is an issue and sending keep-alive messages should be done as seldom as possible with still maintaining the reachability.

[1] For more information on Green video, please see : http://online.qmags.com/MM0115?sessionID=4D9E3762BEFB2C86014AA8D0C&cid=3204101&eid=19247#pg1&mode2 , pages 80 -87.

[2] See http://www.iso.org/iso/home/store/catalogue_tc/catalogue_detail.htm?csnumber=66065

5 CONTRIBUTIONS TO RELEVANT STANDARDS

In this section, we list the contributions that were made and finished during the project and their respective forums. Between the project partners there have been number of discussion on possible additional contributions towards the identified forums but those we have not listed as there is no confirmed contribution date yet.

5.1 3GPP Contribution on DASH from Sony Mobile and Ericsson

In January 2016 a new study item on Server and Network Assisted DASH for 3GPP Multimedia Services was started in 3GPP SA4. Sony Mobile and Ericsson have jointly contributed to this study item, with the target to introduce the collaborative architecture solutions that have been reported within CONVINcE WP4. More than 10 joint technical contributions presenting the concept of collaborative architecture as well as simulation and test results, by Ericsson and Sony Mobile have been submitted to the 3GPP SA4 meetings during the 2016 study item phase. The concept is within 3GPP sometimes referred to as "Network Assistance for DASH".

Further, Sony Mobile and Ericsson have jointly collaborated in the process of establishing a 3GPP SA4 work item on the Server and Network Assisted DASH, and particularly to bring the CONVINcE WP4 concept of collaborative architectures into the scope of such work item. Sony Mobile and Ericsson jointly submitted work item proposal documents to two consecutive meetings of the SA4 group, and in October 2016 the new work item was finally approved. The 3GPP work item will be run during 2017, starting January 2017 with target to be finalized in September 2017.

5.2 MPEG Contribution on Network Distributed Video Coding from Harmonic

A specific Adhoc group was created at MPEG meeting #114 in San Diego (February 2016) on Harmonic's initiative. It oversees establishing requirements for Network-distributed video coding. Mandates were very broad and the Adhoc group focused its attention on Guided transcoding Use-cases. The goal is to show evidence of gains in terms of bandwidth or CPU usage which also means gain in power consumption and thus is relevant to CONVINcE activities. It should not only address Future Video Coding but should also deal with legacy codecs (AVC, HEVC).

Guided transcoding approach consists in storing in the CDN a single representation of a video and to transcode in the edge the video to the format requested by the terminal (see Figure 1).

An output document of requirements on this topic has been drafted during meeting #114 and a call for proposal is planned for July 2017, with responses in October 2017.

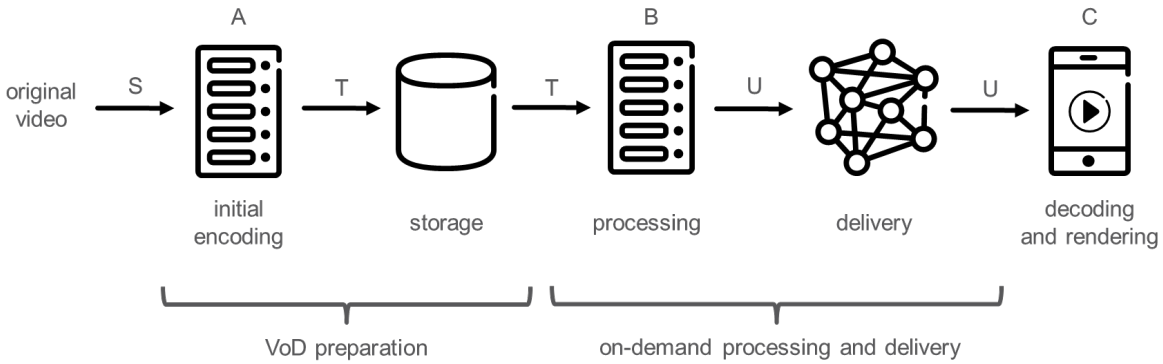

Figure 1: Guided transcoding

5.3 IEEE Contribution on SDN/NFV from BTH

BTH has been invited and accordingly joined the IEEE Standardization Group IEEE P1916.1 – Standard for Software Defined Networking and Network Function Virtualization Performance. This standard provides a framework to build and to operate SDN/NFV service delivery infrastructure that satisfies performance expectations of network operators, service/content providers, and end users. This standard specifies performance framework including characteristics, metrics, requirements, models, and use-cases for Software Defined Networking and Network Function Virtualization (SDN/NFV).

5.4 IETF Contribution on power consumption in smartphones from CEA

In June 2016, in collaboration with UO, Telhoc and LU, CEA published the IETF draft "YANG Model of Battery MIB (draft-petrescu-battery-mib-yang-00.txt)". In this draft, we describe a YANG data model for battery monitoring. The model is based on the Battery-MIB module definition that was elaborated in RFC7577. The main task of this module is to provide information about the battery in use and raise notifications about its status.

Moreover, in CEA, we run several experimentations to measure the power consumption in smartphones when IPv4 and IPv6 addresses are used, respectively. In these experimentations, we used Greenspector probe and a USIM card (i.e. able to connect to both of IPv4 and IPv6 network) from Orange. We find out that IPv6 consumes at max 5% more than IPv4 for a video streaming application. These measurement are relevant to CONVINcE and especially to Task 4.2 where energy saving mechanisms are developed. In fact, we can imagine a use case scenario where the smartphone selects the IP version to be used based on its battery status. For instance, it can decide to use IPv4 for a given video streaming application as its battery status indicates a low level. We gathered all these measurement in an informative IETF draft "Power Consumption of IPv6 vs IPv4 in Smartphone (draft-petrescu-v6ops-ipv6-power-ipv4-00.txt)". This document has been co-authored with Greenspector and submitted in March 2017.

5.5 IETF Contribution on lowering power consumption of DASH video streaming in wirelss networks using fountain and networking with DASH streaming

TelHoc is preparing a submission to IRTF relating to the use of fountain coding and networking in wireless networks, especially WiFi networks, to increase capacity and lower power consumption over high packet loss channels. Fountain coding and networking achieves capacity that is closer to the Shannon limit of a wireless channel by removing the need to transmit packets in sequence; only the correct number of packets needs to be received.

TelHoc's contribution relates to how fountain and network coding can used and implemented with DASH streams. By a having a HTTP server in an Access Point (AP), or somewhere in the access network close to the access point, operating as intermediate point between the client and the content, it is possible to fountain/network encode DASH chunks before they are sent to the client. This server first downloads the DASH chunk, and then encodes the chunk and sends it to the client that decodes it. On a client terminal, another HTTP proxy is running, where a client directs its requests. Rather than requesting content from the content server, the client application requests them from the local proxy running on the terminal. The only difference in the application is that the URL has the IP address/DNS entry of the terminal, meaning no changes is needed in existing applications to support this. This proxy then redirects the URL request to the HTTP server in the AP. The proxy then decodes the fountain/network chunks before passing them to the application. The proxy can either be hosted as a separate process or service, or as a library for application developers to embed in new video players.

6 PARTICIPATION TO THE RELEVANT STANDARDIZATION EVENTS

In following table we will list the forums where CONVINcE partners physically attendant during the project.

	Standardization organization	Location	Date	Involved Partners	Activities in working groups/tasks
(1)	MPEG	Strasbourg	October 2014	TVN	Green Metadata
(2)	MPEG	Geneva	February 2015	TVN	Green Metadata
(3)	MPEG	Warsaw	June 2015	TVN	Green Metadata
(4)	MPEG	Geneva	October 2015	TVN	Green Metadata
(5)	MPEG	San Diego	February 2016	TVN	Green Metadata Guided transcoding
(6)	MPEG	Geneva	May 2016	TVN	Green Metadata Guided transcoding
(7)	MPEG	Chengdu	October 2016	TVN	Green Metadata Guided transcoding
(8)	MPEG	Geneva	January 2017	TVN	Green Metadata Guided transcoding
(10)	91st IETF	Honolulu	November 2014	Ericsson	MMUSIC & CoRE & ROLL
(11)	92nd IETF	Dallas	March 2015	Ericsson	MMUSIC & CoRE & ROLL
(12)	93rd IETF	Prague	July 2015	Ericsson	MMUSIC & CoRE & ROLL
(13)	94th IETF	Yokohama	November 2015	Ericsson	ICE & CoRE & ROLL
(14)	95th IETF	Buenos Aires	April 2016	Ericsson	ICE & CoRE & ROLL
(15)	96th IETF	Berlin	July 2016	Ericsson	ICE & CoRE & ROLL
(16)	97th IETF	Seoul	November 2016	Ericsson	ICE & CoRE & ROLL

7 CONCLUSIONS

During the execution of the project, direct contributions in four areas were made to the standards, as listed in the section 5, on 3GPP, IETF and MPEG. Some more possible contributions were identified as stated in section 5 towards IEEE, 3GPP, IETF and W3C related to different application protocol stack and API optimizations. CONVINcE project partners will continue to work further by following up the work done by the relevant standardization bodies and bringing the results that could contribute to the work carried out by these organizations. As the CONVINcE project has defined new concepts on how to enhance the power savings on the terminals and networks it is natural that some results are still pending for dissemination to relevant standards even after the project finishes.