REPORT
On the possible update of the Council of Europe Recommendation Rec(2004)11 on legal, operational and technical standards for e-voting

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Acronyms and Abbreviations

CNIL	La Commission Nationale de l'Informatique et des Libertés (France)
CoE	Council of Europe
DDOS	Distributed denial of service (attack)
E2E	End-to-End
ECI	European Citizens' Initiative
EFFI	Electronic Frontier Finland
ICT	Information and Communication Technology
IDEA	International Institute for Democracy and Electoral Assistance
IFES	International Foundation for Electoral Studies
NVT	New voting technology/ies
OAS	Organisation of American States
ODIHR	Office for Democratic Institutions and Human Rights
OSCE	Organization for Security and Co-operation in Europe
Rec(2004)11	Recommendation of the Committee of Ministers to member states on legal, operational and technical standards for e-voting was adopted by the Committee of Ministers on 30 September 2004
U.S. EAC	United States Election Assistance Commission
VVPAT	Voter verified paper audit trail
VVSG	Voluntary Voting System Guidelines (U.S.)
ZKP	Zero-Knowledge Proofs

Executive Summary

The Recommendation of the Committee of Ministers to member States on legal, operational and technical standards for e-voting was adopted on 30 September 2004. It became rapidly a reference for Council of Europe States that introduce or envisage introducing e-voting. Being the only international instrument to legally regulate e-voting, the Recommendation has also been referenced by other organisations and countries outside the region.

In the light of e-voting practical experiences, it was rapidly felt that the Recommendation needed some adjustments. Two sets of Guidelines were adopted offering practical tools to facilitate the implementation of the recommendations on certification and transparency. Further reflection and experiences brought experts to the conclusion that a formal update is needed which allows for a thorough rethink and redesign of the Recommendation in the light of today's understanding of e-voting.

The main arguments in favour of an update include lessons learned by experimenting with e-voting or by observing it, critical assessments of the Recommendation as well as technology developments. After considering the implications of a non-update, we recommend a revision in line with the needs resulting from the e-voting development since 2004. The revision must ensure that the Recommendation is up-to-date, balanced and responsive to ongoing developments. A revised Recommendation would allow the Council of Europe to maintain its position as a recognised and cutting-edge actor in the field of e-voting.

1. INTRODUCTION

In a follow-up to the fourth biennial meeting of the Council of Europe (CoE) to review Recommendation Rec(2004)11 on legal, operational and technical standards for e-voting, hereafter referred to as the Recommendation or as Rec(2004)11, which took place in July 2012 in Bregenz as well as to a Ministers' Deputies Rapporteur Group on Democracy meeting of 4 July 2013, the Division of Electoral Assistance and Census at the Directorate of Democracy of the Council of Europe mandated the present report.

The mandate specifies that the report shall comprise "*a factual analysis of the current implementation by the Council of Europe member States of the Committee of Ministers Rec(2004)11 on legal, operational and technical standards of e-voting and a proposal for a possible update of the recommendation in the light of individual countries' practical experience, technological advances and emergence of new concepts since the adoption of the instrument*".

In accordance with the mandate, we identified three questions to examine, the second one being the central question: How has Rec(2004)11 been developed and implemented so far? Has an update become necessary following practical experience, technological advances and emergence of new concepts? How to proceed with a possible update? The main purpose of the report is to assess the need for updating the Recommendation. This will contribute to the Council of Europe planning in this field.

In preparing the report we considered the following information: the follow-up work to Rec(2004)11 of the Council of Europe, the evaluation of e-voting experiences in CoE countries, the regulatory work in the field of e-voting by other organizations, academic research and industry reports. After a short historical reminder, we review the implementation of the Recommendation by member States and its referencing by other organizations (chapter 2). A number of reasons for an update are identified in this chapter already. Next (chapter 3) we discuss update proposals. They originate, among others, from critical assessments of the Recommendation and technology developments. The purpose of a possible update and the necessary expertise to conduct it are also briefly discussed. We also reflect (chapter 4) on the implications of a non-update, before finishing (chapter 5) by presenting some recommendations on how to tackle the updating of Rec(2004)11.

2. REC(2004)11

2.1 Introduction

2.1.1 Rationale and objectives

Rec(2004)11 is addressed to the CoE member States. The Committee of Ministers also took note of the Explanatory Memorandum thereto[1] presented by the Multidisciplinary Ad Hoc Group of Specialists on legal, operational and technical standards for e-enabled voting, the ad-hoc group which compiled both documents.

1

https://wcd.coe.int/ViewDoc.jsp?Ref=CM/Del/Dec%282004%29898/1.5b&Language=lanEnglish&Ver=original&Site=COE&BackColorInternet=DBDCF2&BackColorIntranet=FDC864&BackColorLogged=FDC864

E-voting is defined in the Recommendation as an e-election or e-referendum that involves the use of electronic means at least in the casting of the vote. It will be used in the same sense in this document, covering both e-voting in controlled (e.g. voting machines in polling stations) and in uncontrolled environments (e.g. internet voting from a private computer).

The rationale for introducing Rec(2004)11 can be summarized as follows: "*(i) apply the principles of democratic elections to e-voting, (ii) provide member states with a comprehensive checklist for all stages of the electoral process, (iii) set minimum standards for remote and non-remote e-voting and (iv) promote and ensure interoperability of e-voting systems*" (Remmert, 2006). Minimum standards were expected to be used as benchmarks by countries helping them to create a sound legal basis for e-voting. Rec(2004)11 was expected to be followed by the ICT industry.

Considering the historical development of e-voting which in Europe started already in the sixties it can be inferred that Rec(2004)11 was prompted by increasing awareness of the necessity to legally regulate the use of e-voting. The adoption of common standards at the international level was considered key to guaranteeing the respect of all the principles of democratic elections and referendums when using e-voting (Remmert, 2004: 13).

There existed few examples of e-voting legislation at the time. One example was the Swiss Federal Ordinance on Political Rights, articles 27*a* ff. which had been introduced in September 2002 to regulate the use of internet and SMS voting[2]. Several provisions in the Recommendation are very similar to art. 27*a* ff. of the Ordinance. The adoption of the Recommendation was also preceded by a European Commission for Democracy through Law, alias Venice Commission, report (2004) on distant voting and internet voting.

Rec(2004)11 is a pioneer effort which attempts to apply a finite but not consolidated number of legal requirements for democratic elections, dispatched in a set of international instruments only some of which are mentioned at the beginning of the Recommendation, to an indefinite number of voting solutions that (only) share one common characteristic: the use of electronics in casting the vote.

The CoE Recommendation is the first and so far only international instrument to legally regulate e-voting. Other organisations have developed other e-voting related instruments (see point 2.4). This body of knowledge is often referred to as emerging standards for electronic voting.

2.1.2 Structure and content

The Recommendation contains five recommendations (i. to v.) and some definitions. The five recommendations refer to and are followed by the Appendices I to III. The appendices contain the legal (I) and operational standards (II) and the technical requirements (III). The list of standards and requirements is considered to be non-exhaustive. The explanatory memorandum is not part of the Recommendation strictly speaking. However it provides valuable information and an insight into the historical context.

The starting point for the Rec(2004)11 is the observation that "*member states are already using, or considering using e-voting for a number of purposes*" and that "*only those e-voting systems which are secure, reliable, efficient, technically robust, open to independent verifica-*

[2] Ordonnance sur les droits politiques (RS 161.11), Available: http://www.admin.ch/opc/fr/classified-compilation/19780105/201206010000/161.11.pdf [29 Nov 2013]

tion and easily accessible to voters will build the public confidence which is a pre-requisite for holding e-voting".

The recommendations to member states are three: (i) e-voting shall respect all the principles of democratic elections and referendums and be as reliable and secure as democratic elections and referendums which do not involve the use of electronic means; (ii) the interconnection between the legal, operational and technical aspects of e-voting, as set out in the Appendices, has to be taken into account when applying the Recommendation and (iii) member states should consider reviewing their relevant domestic legislation in the light of this Recommendation and within the limits stated by recommendation iv.

The request for a review meeting two years after the adoption is made "*in order to provide the Council of Europe with a basis for possible further action on e-voting*" (v). For the purpose of the review it is recommended that member states keep under review their policy on, and experience of e-voting, and in particular the implementation of the provisions of this Recommendation; and report to the Secretariat the results of their reviews.

The Recommendation is neutral with respect to the introduction of e-voting. It does not recommend member states to introduce e-voting, although it recognises that "*as new information and communication technologies are increasingly being used in day-to-day life, member states need to take account of these developments in their democratic practice*". And it also expects e-voting to increase participation, improve access for disabled citizens or those residing or staying abroad, reduce overall costs over time, deliver voting results reliably and more quickly, provide the electorate with a better service, etc.

2.2 Follow-up and development

2.2.1 Biennial meetings

The Council of Europe has convened four biennial expert meetings so far: in 2006, 2008, 2010 and 2012. Member States have reported on their policy on, and experience of, e-voting. The meetings have provided a platform for considering developments in the field of e-voting at the European level.

The first review meeting in 2006 reconfirmed that the Recommendation was accepted by member States as a valid benchmark by which to assess and evaluate e-voting systems. Participants agreed that further research and attention should be dedicated to the issues of accreditation and certification of e-voting systems and to the development of guidelines on the observation of e-enabled elections.

That same year the CoE (2006b) organized a conference in Estonia on lessons learned and future challenges. The issue of verification by the voter of the e-voting results was qualified as a crucial question and legal problem.

At the second review meeting in 2008 member states agreed that the Recommendation on e-voting was still accurate and useful. However, the experts felt that in the light of experiences and developments in the field of e-voting it was useful to develop some additional comments to certain parts of the Recommendation, such as certification and observation.

Consequently, two sets of new guidelines were approved at the third review meeting in 2010 : one on transparency of e-enabled elections and the other on certification of e-voting systems (CoE, 2011a and 2011b). Prepared by the Secretariat with input from representa-

tives of interested member states and academic experts, the texts were endorsed by the participants as providing a common reference. It was stressed that they needed to be viewed as work in progress since the practical experiences in the field of e-voting were in constant evolution. In addition, a practical guide on the introduction of e-voting prepared by the Secretariat was also endorsed. "Guidelines" are defined as documents aiming at streamlining particular processes according to a set routine, but without being mandatory (see Appendix 1 in both documents).

Participants at the forth review meeting in 2012 expressed concerns that "*bearing in mind the practical experience, technological advances and emergence of new concepts since the adoption... the Recommendation adopted in 2004 does not comprehensively address a number of significant issues and contains some ambiguities in its provisions and in the explanatory memorandum…(T)he Recommendation would benefit from a clearer distinction between provisions relating to non-remote machine voting in polling stations and to remote e-voting over the internet. Participants also pointed to some tension in the Recommendation between recommendations of a high-level and those that address issues in great detail...(T)he representatives of Member States present at the review meeting ... agreed to recommend that (the Recommendation) should be formally updated*" (CoE, 2012).

Under the high patronage of the CoE, biennial academic conferences were held since 2004 in Bregenz, Austria that presented an interdisciplinary approach to e-voting developments worldwide. European experiences have been extensively discussed. The conference proceedings[3] give a good overview on the fast development of e-voting in the past years.

The 2008 conference highlighted several issues considered new in comparison to traditional voting including observation of voting and counting through a computer, the guarantee of a transparent election when people vote on a machine, the security and the legal aspects. Certification and transparency were two other topics. The highly interdisciplinary needs when dealing with e-voting were underlined.

So-called end-to-end (or E2E) verifiable schemes were presented in 2010. Specific sessions were dedicated to certification of e-voting systems and to E2E verifiability.

The 2012 conference dealt with "*challenges to electronic voting: transparency, trust and voter education*". Verification was discussed in depth, from different perspectives and as applied in different contexts such as in Norway. Auditing and testing of e-voting systems was another topic. For the first time, the CoE biennial review meeting was organised back to back with the Bregenz conference.

From our point of view, these multiple developments show the need for common references and the fact that the Recommendation timely responded to it, rapidly becoming a reference in the e-voting regulation field. They also show that in the light of experiences, practitioners felt rapidly the need to adjust the Recommendation. Efforts were initially directed into completing it by adding two sets of Guidelines. Further reflection and new developments have brought experts to the conclusion that a formal update is needed which allows for a thorough rethink and redesign of the Recommendation to reflect today's understanding of e-voting.

[3] http://www.e-voting.cc/en/publications/proceedings/ [29 Nov 2013]

2.2.2 Guidelines on certification

One of the first questions when introducing e-voting is how to make sure that prescribed requirements and standards are effectively implemented. The guidelines on certification aim at providing a practical tool to facilitate the implementation of the 2004 Recommendation, in particular paragraphs 111 and 112 which recommend member states to introduce certification processes that allow for any IT component to be tested and certified as being in conformity with the technical requirements described. The term certification as used in the guidelines means "*a process of confirmation that an e-voting system is in compliance with prescribed requirements and standards and that it at least includes provisions to ascertain the correct functioning of the system*" (CoE, 2011a).

The core challenge is mentioned in guideline §3 : "*Member states should ascertain that all technical requirements fully reflect the relevant legal and democratic principles*". The text focuses on two issues: (i) making sure that (ii) all technical requirements fully reflect the law. In other words it focuses on certification (making sure) of the full compliance (all technical requirements fully reflect the law). A third important point is implied in order for full compliance to make sense: all pertinent legal requirements must be respected.

This poses the question of the exhaustivity of the international principles on democratic elections mentioned in the Recommendation. Indeed it is important when certifying to have a complete list of requirements against which to check the conformity of a given system. There will always be room for interpretation of Rec(2004)11 and for more detailed regulation at the national level. But the list itself, in this case, of international principles on democratic elections applicable to voting systems, needs to be exhaustive.

Peruse and re-use of certification is foreseen (guideline §10). It will help countries and industries to certify and to do it possibly at reasonable costs. To be seriously taken into account, the concepts of peruse and re-use in a given country of a certification obtained in another country imply that the certification indicates compliance with a, possibly exhaustive, list of international requirements for democratic elections applicable to voting systems, contained preferably in one international instrument (such as the Recommendation) previously approved by the given country's responsible authority (the Government for Rec(2004)11). Thus, with respect to certification, it's important to have a complete and coherent list of standards. As mentioned above, the Recommendation does not contain such a list.

2.2.3 Guidelines on transparency

Even in countries where the public trusts the electoral system and its administration, the introduction of e-voting has proved challenging. So, in addition to the fundamental issue of the trustworthiness of the e-voting solution itself, one important question relates to additional measures to foster trust and confidence.

The guidelines on transparency (CoE, 2011b) aim at providing a practical tool to facilitate the implementation especially of recommendations 20 to 23 which invite member states to ensure the transparency of their voting system. Transparency is defined in the guidelines as "*the concept of determining how and why information is conveyed through various means*".

The guidelines on transparency introduce new concepts which reflect practical experiences. One is "*the use of a second medium to store the vote to improve transparency*" (§13 applicable to e-voting in polling stations) and the related "*mandatory count of the second medium in a statistically meaningful number of randomly selected polling stations*" (§14) and specific

"*rules dealing with discrepancies between the mandatory count of the second medium and the official electronic results*" (§15). However, the use of a second medium to store the vote is not simply a way to ensure transparency as it affects the organisation of the voting.

Another new concept is introduced in §16 which requires countries to "*gain experience in providing mechanisms that allow voters to check whether their vote was counted as intended*". Also the concept of "*chain of trust in e-enabled elections*" is introduced according to which voters should be able to verify if their vote was *cast as intended, recorded as cast and counted as recorded*. This introduces a new possibility for the voter to *prove* that their *own single vote* was cast as intended, recorded as cast and counted as recorded. This possibility does not exist in other, non-electronic, voting systems in relation to a specific vote.

Such concepts, although inspired by traditional voting, are new. They are specific to e-voting and appear today as necessary to ensure that the public can place the same trust in e-voting as in other non electronic voting systems.

Norway considered the ability to independently *verify* that the system accurately reflects the will of the voters in the results that it produces as an important feature for Internet voting system. Accordingly, and in addition to transparency measures such as publication of documents and of source code, Norway introduced new mechanisms in its internet voting solution. The most discussed are software independent E2E verification that includes Zero-Knowledge Proofs (ZKP) for the final cleansing and mixing stages and the so-called return codes, whose purpose is to allow individual verifiability that the Internet voting system has received the vote as cast by the voter from the voting client (Barrat et al., 2012a). These are new technical possibilities mainly based on cryptography. Discussion on their merits and development is ongoing.

As usual with experimenting, practice has so far preceded regulation. However we are now at a point where there exists a certain consensus on their use and they are being introduced in a number of countries[4]. Such new concepts and mechanisms being legally relevant, they need to be defined and their use regulated by law. So far no legal basis exists at the CoE level. The general requirements of transparency in the Recommendation and Guidelines do not regulate the implementation, control, etc. of such mechanisms.

As research on the compatibility of return codes used in Norway with Rec(2004)11 shows, a literal interpretation of the Recommendation may suggest the conclusion that return codes contradict its requirements. A more subtle interpretation, however, concluded that return codes may meet the Council of Europe's recommendations (Barrat, Goldsmith, 2012b).

When considering regulation of such new mechanisms, their impact on the whole system of democratic elections and referendums as well as the way to deal with complaints need to be considered. Whether and to what extent such regulation can be introduced in the Recommendation itself should be explored. The Recommendation could be the right instrument to introduce minimum standards to provide guidance to member states.

[4] E.g. Estonia and several Swiss cantons.

2.3 Implementation

2.3.1 By countries

The recommendation recommends the governments two things: to comply with its requirements and to consider reviewing domestic legislation in the light of the Recommendation.

It can be safely said that all CoE countries that conduct or envisage conducting e-voting look towards the Recommendation for guidance at least at the implementation level, if not at the regulatory level. In particular internet voting systems were either conceived or updated by incorporating the CoE Recommendation (U.S. EAC, 2011). This was the case in Estonia, Finland, the Netherlands and Switzerland. Presumably this is also the case for more recent e-voting developments in the Czech Republic, the Republic of Moldova, the Netherlands, Romania and Spain as the (CoE, 2012) report suggests.

Compliance with Rec(2004)11 and adjustment of national legislation in the light of the Recommendation to regulate e-voting has been monitored by the administrations themselves, by OSCE/ODIHR or by researchers. Below we'll present some examples.

Norway is so far the only country to have given Rec(2004)11 legal status by incorporating its recommendations (with few exceptions) into the regulatory framework of both 2011 and 2013 internet voting trials (Norway, 2011 and 2013). The Regulations laid down by the Norwegian Ministry of Local Government and Regional Development Relating to Trial Electronic Voting at the 2011 municipal and county council elections stipulate that the Council of Europe's Rec(2004)11 relating to legal, operational and technical standards for e-enabled voting shall form the basis of these trials, unless otherwise specified in these Regulations and in the Election Act. However some of the recommendations were excluded and Norway also introduced verification mechanisms which are not dealt with in the Rec(2004)11 such as return codes.

Norway has offered good examples of e-voting transparency during the 2011 and 2013 trials. In addition to publishing several documents and the source code, the Ministry of Local Government has held international conferences with the participation of international electoral experts interested in e-voting. This has allowed for an open discussion of the Norwegian e-voting solution in the light of emerging international standards on e-voting.

The Norwegian system has also been specifically evaluated for its conformity to Rec(2004)11 by independent researchers (Barrat and Goldsmith, 2012b). The evaluation concludes that "*(a)s a package, the Council of Europe Recommendations represents a very comprehensive and detailed set of standards for the conduct of electronic voting. For the Norwegian Internet voting system to fully comply with 85 of the 102 relevant recommendations and only be non-compliant with three recommendations, is a significant achievement given the exacting nature of the Council of Europe Recommendations*". The evaluation also provides a critical feedback on the Rec(2004)11 itself that we will consider below.

Belgium Federal and Regional Administrations commissioned a thorough study on e-voting (BeVoting, 2007). Rec(2004)11 is largely referenced in the study and serves as the main benchmark for evaluating e-voting (first part of the study) as well as for proposing a set of technical requirements for a new e-voting system in Belgium (second part of the study).

In Estonia the Recommendation has been considered by the judge when examining the right to change the e-vote and more generally the constitutionality of e-voting. The Estonian Na-

tional Court considered the right to change the e-vote as a precondition of constitutionality of e-voting, without which the principle of free voting cannot be guaranteed by remote Internet voting. The Court then explained that the right to change the e-vote is in accordance with the CoE Recommendation (Madise and Vinkel, 2011).

Finland's use of voting machines in polling stations has been monitored in the light of Rec(2004)11 by both Electronic Frontier Finland (Electronic Frontier Finland, 2009) - a Finnish non-profit - and the Council of Europe, Congress of Local and Regional Authorities (Whitmore, 2008).

France's e-voting from an uncontrolled environment must comply with the National Commission on Informatics and Liberties (CNIL) recommendations (CNIL, 2010). The structure of the CNIL 2010 recommendations differs from Rec(2004)11. However there are many commonalities. CNIL points out that compared to 2003 (first edition of the recommendations), when e-voting was at its very beginning, e-voting from controlled and uncontrolled environments has moved and expanded so fast that the recommendations needed to be amended and a second edition issued in 2010.

The implementation of electronic voting in Ireland was evaluated against emerging international standards on e-voting, specifically, the legal and operational standards and technical requirements for e-voting contained in Rec(2004)11 (Commission on Electronic Voting, 2004). This despite the fact that Rec(2004)11 post-dated to the adoption of the Irish e-voting system.

Swiss federal legislation on e-voting from uncontrolled environments introduced in 2002 and Rec(2004)11 present many commonalities (Conseil fédéral, 2013.) in their content. The Federal Ordinance has been recently modified to reflect lessons learned during the past ten years[5]. According to official explanations the provisions of the Ordinance have been reduced to the essential. More detailed technical requirements have been integrated in a new Technical Regulation issued by the Federal Chancellery, the Federal Government's entity responsible for political rights at the federal level. This will allows for speedy and flexible amendments of the Technical Regulation to reflect technology developments. The main new concept - E2E verifiability - is regulated in the Ordinance (approved by the Government). The Law on political rights (approved by Parliament) will presumably be modified if and when e-voting is generalized and liberalized, which is not yet the case.

OSCE/ODIHR has monitored the use of e-voting or new voting technologies (NVT) in elections in different CoE countries. Its reports provide valuable information on the implementation of the Recommendation as well as on the legal framework for e-voting in the countries. ODIHR often interprets and gives substance to high-level recommendations. E.g. when, based on the broad recommendations 107 and 108, it recommended Belgium to introduce legislation on voter verified paper audit trail (VVPAT) or an equivalent verification procedure (OSCE/ODIHR, 2007, Belgium).

ODIHR'S recommendation to France (2012) that the authorities consider the use of a verifiable internet voting scheme or an equally reliable mechanism for voters to check whether or not their votes were cast as intended reflects recent technical developments. However such recommendation is not backed by Rec(2004)11 as it stands today but only by the Guidelines on transparency. Rec(2004)11 has to be amended accordingly to fulfill its role as the legal benchmark for such a recommendation.

[5] The new version is expected to enter into force on 1 January 2014. The proposed new version is available at: http://www.admin.ch/ch/f/gg/pc/ind2013.html#ChF [29 Nov 2013]

ODIHR regularly recommends that legal provisions with regards to all stages of internet voting are further detailed and consolidated in the national law (see 2011/2012 reports on Estonia, Norway, Switzerland and France). An updated Rec(2004)11 would help national governments and legislators with this task.

In some cases, the same recommendation is implemented in opposing ways by different countries in accordance with their own specificities. This is the case with "secrecy and freedom of the vote" (recommendations 9 to 19). Norway and Estonia have introduced multiple voting, or a right to change the e-vote for internet voters alone (although this literally contradicts recommendation 5) as well as a precedence of paper ballots over electronic ballots. France and Switzerland do not allow multiple voting and assign the same value to a validly issued ballot, be it on paper or electronic. Norway and Estonia use this means to offer the voter a way to get around voting coercion and vote buying. France's and Switzerland's point of view is that internet voting is just another form of distant voting from an uncontrolled environment, and that coercion will not be addressed differently for internet voting than for postal voting. Whether remote voting from uncontrolled environments is acceptable when considering the possibility of coercion, and, if yes, under which conditions, this is decided elsewhere (e.g. Venice Commission opinions). ODIHR encourages France and Switzerland to introduce multiple voting but says nothing on the impact this would have on the system as a whole given the inequality it will create with other channels and the fact that not all voters have access to internet voting (due to a step-by-step approach in e-voting introduction, at least in Switzerland, which in turn is considered to be a good practice by ODIHR).

The last example illustrates several things. First, the need to take into account the whole electoral system of a country. Secondly, some issues are strictly related to e-voting while others, such as multiple voting, even if they are introduced in an e-voting context, are a matter of public policy not of voting technology. Their introduction affects the whole system. Thirdly, the importance of having an exhaustive list of requirements that reflect international standards for democratic elections and that apply to all voting channels and to all CoE member countries. We will add a fourth point: issues such as secrecy and freedom cannot be examined the same way whether we consider e-voting in controlled or in uncontrolled environments. The distinction between these two categories has to be taken into account.

Austria used the Recommendation to evaluate and certify an Internet voting system used in a pilot for student council elections. Rec(2004)11 was used as a baseline for the project, with additional requirements created by Austria's Parliament. The Austrian experience provided valuable feedback for an update of the Recommendations as we will see below (see 3.1.1).

Outside the CoE region, the Recommendation is referenced in particular when considering introduction of e-voting regulation or standards. A recently published research study commissioned by Elections Canada (Schwartz and Grice, 2013) considers the work done by CoE in this field as the most extensive while creating a legal framework for a new technology. It recommends election officials in Canada to consider referencing the Rec(2004)11 check-list.

The US Electoral Assistance Commission has also referenced the Recommendation in an effort to locate standards and requirements on internet voting utilized elsewhere in the world which include voting specific functionality, accessibility and security requirements (U.S. EAC, 2011).

2.3.2 By industry

Scytl, a European internet voting solutions and service provider, has published its evaluation of the compatibility of its solution with Rec(2004)11 in December 2004. More specifically, Scytl has evaluated the compliance of "Pnyx" with security standards 77 to 99 and with standards 100 to 110 on audit . For each standard a brief explanation of compliance is provided by Scytl.

There exist other examples of self-measurement of compliance with Rec(2004)11 by providers of e-voting solutions, be they private firms or public administrations. To ensure implementation of Rec(2004)11 it is important that certification (and other types of controls) of e-voting systems towards the Recommendation are conducted by an independent and competent body.

2.4 Regulations and guidelines by other organizations

The emerging international electoral standards on e-voting are struggling to catch up with the introduction of technology into the voting and counting process (Barrat and Goldsmith, 2012b). Several organisations have produced guidelines on e-voting introduction and observation. Organisations such as the OSCE/ODIHR (2013), the Organization of American States (2010), the Carter Center (2012) and the National Democratic Institute for International Affairs (Pran and Merloe, 2008) have approached the issue of standards for electronic voting and counting technologies from the perspective of election observers. A document from IFES (Goldsmith, 2011) is interesting from a regulatory point of view as it presents a comprehensive overview of international electoral standards and a step-by-step approach to the introduction of e-voting, including legal considerations.

As discussed at the fourth review meeting of Rec(2004)11, the implementation of the European Citizens' Initiative (ECI) in all EU Member States from 1 April 2012 produced a lively debate about new forms of e-participation. This happened for example in Austria where the parties represented in parliament discussed a far-reaching "democracy package". Furthermore, the regulatory framework for the ECI (European Union, 2011a and 2011b) provides an interesting example of a legal regulation completed by technical specifications, including references to technical standards developed by other organisations such as the ISO 27000 family of norms. The regulation applies to e-collecting systems but presents an approach which is interesting from the standpoint of regulating e-voting systems as well.

The recently published ODIHR (2013) Handbook for the observation of new voting technologies crystallises current know-how on the issue and offers a detailed method for observing and evaluating e-voting. According to the Handbook, ODIHR's assessment of NVT is based on OSCE commitments for democratic elections and on Rec(2004)11 and its additional developments. Given the high-level nature of OSCE commitments, Rec(2004)11 would be the right regulatory instrument provided it is updated to reflect recent developments and lessons learned, including by observing e-voting. The ODIHR and other organisations' contributions on e-voting are a good starting point when considering an update of the Recommendation.

3. FIRST OPTION: UPDATE OF REC(2004) 11

3.1 Background

3.1.1 Critical assessments and proposals for update

We already identified the need to update the Recommendation in the light of its application. Below we will present some critical assessments of Rec(2004)11 and concrete proposals for update.

Jones 2004

Jones (2004) compares the Recommendation to the U.S. non-binding voluntary federal voting systems standards (Voluntary Voting System Guidelines or VVSG). As "*nothing prevents states from writing them into law...if a sufficient number do so, the nonbinding nature of these standards could change without the cooperation of their authors*".

Jones conducts a detailed review of the Recommendation which, in addition to many useful ideas, according to him "*suffers from some serious deficiencies, mostly in the appendices that contain the actual standards*". Each critique is accompanied with proposals for solution and advice on how to improve the recommendation.

The requirement that e-voting should be as secure as non-electronic voting systems is problematic for Jones because there exist no widely accepted metrics for this. In addition, the risks that e-enabled elections face are different from those encountered by traditional voting methods (Jones calls them "retail fraud" for non-e-voting and "wholesale fraud" for e-voting referring to the impact that fraud may have on the results). This flaws the comparison between the two. In our view this is the most important critique he makes and it needs to be addressed in a future update (the other ones being more easily implementable/answerable).

After discussing voting absolute or relative privacy he concludes that "*The choice between these two models of voter privacy should be viewed as a matter of public policy, not of voting technology. Technological arguments that purport to show that a given technology for conditional privacy is strong enough to be trustworthy should be taken as arguments to change the law to permit a conditional model, not as arguments for the use of technology offering conditional privacy in jurisdictions where the law calls for absolute privacy*". We couldn't agree more with this conclusion as it also supports what we said before with respect to multiple voting. However Jones does not follow his own advice when he recommends the introduction of multiple voting to deal with coercion without mentioning that this is a broader issue of remote voting from uncontrolled environments policy and that the introduction of multiple internet voting affects other voting channels.

Another important point is his critique on the use of terms such as verification and verifiability in the Recommendation. Any future update should pay attention to terms and to the specific meaning of the same term when used in different contexts (e.g. electoral law, software development or systems' control). Even for terms that are used in one context alone (legal terms such as vote secrecy), attention should be paid to distinguish between different ways to implement the same term in different countries, as the discussion about absolute and relative or conditional secrecy shows.

McGaley, Gibson 2006

McGaley and Gibson present a critical analysis of Rec(2004)11 (McGaley and Gibson, 2006). They do not consider the merits of the standards included in the Recommendation. They use engineering requirements and reverse engineering techniques to show that standards are expressed in a poor way. The same techniques are then used to make a first, simple, restructuring of the Recommendation.

They highlight that the Recommendation as it stands makes certification against standards difficult. The use of engineering techniques is interesting given the challenge of regulating a domain at the cross-roads of law and technology. Their advice is to start by stating more explicitly the requirements that the standards should meet, then to re-write the standards in order to better meet these requirements. With respect to the management and maintenance of these standards, they recommend the CoE to broaden the membership to include experts in technology, science, engineering and mathematics.

Several "original flaws" (in the view of a software engineer) of Rec(2004)11 are discussed: consistency, completeness and scope, over specification, under specification, redundancy and repetition, maintainability and extensibility. A first-step restructuring, rooting out the identified original flaws is proposed with operational standards and technical requirements (appendixes II and III of the recommendation) grouped in a logical manner under each of the five rights identified in appendix I (legal standards) of the Recommendation. The restructuring required several decisions to be made such as splitting, merging, rephrasing, contradicting, adding and excluding individual recommendations.

Their aim is to show that the Recommendation as it stands is flawed according to standard software engineering practices. They fear this "*could lead to "bad" systems being certified and "good" systems failing*". They conclude that a "*broadly applicable instrument would be genuinely useful both to governments procuring e-voting systems, and to vendors developing and maintaining such systems*". They also recommend that "*the successful development of standards for e-voting systems will require the input of experts in technology, science, engineering and mathematics*".

Ehringfeld et al. 2010

Ehringfeld et al. (2010) question the possibility for the 2004 Recommendation to handle sufficiently real-world attacks against elections using e-voting. Edwards Deming's Plan-Do-Check-Act Cycle is employed to improve upon Rec(2004)11.

Under this perspective the Recommendation is considered (as being or ought be) specific enough as to provide detailed solutions to deal with specific threats such as skilled, creative, personally motivated and appropriately equipped students planning and executing attacks such as distributed denial of service attacks (DDOS), phishing with mock e-voting system, vote flipping video, vote buying campaign and unknown social engineering attack.

For each of these attacks, countermeasures are explained and put in relation with Rec(2004)11 recommendations. Identified gaps in the Recommendation are analyzed and conclusions drawn. The authors propose that Rec(2004)11 be further improved by explicitly pointing out the necessity of implementing adequate countermeasures to different types of attacks and that the development of a special security strategy to deal with attacks that target voters' acceptance of e-voting should be recommended in Rec(2004)11. Finally awareness programmes, trained staff, and well-designed processes are considered necessary to deal with social engineering and this could be included in the recommendation.

Barrat, Goldsmith 2012

While studying the compliance of the Norwegian internet voting system with international standards, Barrat and Goldsmith (2012b) encountered some difficulties in applying the requirements of Rec(2004)11. This prompted them to present a critical assessment of the Recommendation. Their arguments can be summarized as follows:

- the Recommendation does not build on existing public international law, such as the European Convention on Human Rights and its protocols or the Venice Commission decisions;
- it says little on the legal basis, trying, on the contrary, to cover every possible situation in a technologically neutral way;
- the Recommendation aims at designing standards applicable to all circumstances, to different voting channels and different stages of the electoral process whose common point is that they rely on IT. But such a broad scope is problematic when it comes to their implementation;
- the Recommendation ignores the fact that trade-offs between standards are sometimes necessary in electronic voting, such as the need for secret voting against the need for transparency, and the need to be able to audit the function of the voting system. The need to comply with the Recommendation as a whole is problematic;
- a number of standards may appear to be overlapping or redundant;
- vague wording makes the enforcement of the Recommendation more difficult than it should be. Interpretation is sometime needed;
- in some cases, the wording appears too detailed;
- mixing different issues of reliability and security in one recommendation is problematic;
- the recommendations are technically neutral in their wording, but not in their consequences when attempting to comply.

The authors affirm that compared to 2004, our knowledge has importantly increased, especially with respect to internet voting. The e-voting environment along with the way in which we interact with it has changed significantly too, thus implying that an update of Rec(2004)11 is necessary.

It may seem contradictory that some authors argue for an exhaustive list of requirements to help vendors to build "good" systems as well as certification authorities to examine them (McGaley, Gibson) while others are concerned about the ambition of the Recommendation to exhaustively regulate technical aspects of e-voting (Barrat, Goldsmith) which are too rigid when one thinks of the need for compromise. In our view this apparent contradiction stems from the lack of completeness and the lack of consistency of the recommendations. The following two points must be observed in a future update. First, the Rec(2004)11 must be as high level as to be applicable everywhere in the region. It should include all legal principles (European common heritage) for democratic elections applicable to all voting channels. Second, the Recommendation should present a complete and consistent set of standards.

Other work

Important work has been realized on the technical aspects of e-voting such as e-voting protocols, e-voting control and certification or e-voting increased transparency through cryptographic solutions. The consideration of such work in the light of Rec(2004)11 goes beyond the scope of this report. However these developments and their significance for the Recommendation need to be studied in view of the updating work.

As early as 2004 Jones mentioned in its critique to Rec(2004)11 the existence of experimental e-voting systems "*that prove to the voter, in the privacy of the voting booth, that the receipt contains their vote, but they do not provide, to the voter, sufficient information to prove to anyone else how they voted, using that receipt*". Such research is ongoing. The results are published in the specialized literature. Proceedings of periodical conferences such as Bregenz EVOTE, EVT/Wote[6], and Vote-ID[7] give a good overview of such developments.

Participants at the Dagstuhl Conference on Frontiers of E-Voting in 2007 adopted the "Dagstuhl Accord[8]" which argues in favour of the development of E2E voting systems which "*allow each voter to ensure that his or her vote cast in the booth is recorded correctly. They then allow anyone to verify that all such recorded votes are included in the final tally correctly. ...Typically through use of encryption, these systems can also provide privacy of votes. They do this without introducing any danger of "improper influence" of voters, as in vote buying and coercion. Moreover, such systems offer all these properties without relying on trust in particular persons, manual processes, devices, or software*".

Following Norway, Estonia has declared introducing an E2E verifiable internet system for the October 2013 municipal elections. Switzerland has recently modified legislation to allow for second generation systems offering E2E verifiability to be developed already in 2014. Belgium has taken a similar approach by introducing VVPAT. The Recommendation could be updated to provide basic requirements for such new verifiability concepts.

Another interesting development from a regulatory point of view is work on certification, including formal certification of e-voting systems. Contributions in this area (e.g. Volkamer, 2009) need to be considered.

3.1.2 Other lessons learned

Netherlands discontinued all forms of e-voting because, beyond the technical considerations and problems of radiation of voting machines, "*the embedding of the voting machines within the legal framework was very weak*" (Loeber, 2008). Another lesson from the Netherlands is that technical choices made in the past to embed basic principles of elections need to be periodically reconsidered. This is valid for e-voting regulation in general in our view.

National courts have played an important role in clarifying conditions for e-voting use, especially in Germany and Austria. The German Constitutional Court demanded verifiability for electronic voting in its voting computer decision of 3 March 2009. Jurisprudence, especially of higher Courts, and its implications at the regulatory level need to be carefully considered while updating of the Recommendation.

[6] https://www.usenix.org/conference/evtwote13
[7] http://www.voteid13.org/
[8] http://www.dagstuhlaccord.org/index.php . The signatories include renowened technical specialists of e-voting such as Chaum, Kutylowski, Rivest, Ryan etc.

A U.S. report (CALTECH/MIT 2012) provides an insight on lessons learned with e-voting in the U.S. since 2000. The report considers (federal) voting system standards as being useful for examining the basic functionality, usability, reliability, and elementary security aspects of voting machines. The report however notes that several conflicts have become apparent in recent years regarding voting systems standards in the U.S. such as "*a desire for high integrity in voting systems, versus the fact that testing and certification cannot ensure secure voting systems... security is a negative quality. You can test that a voting machine weighs at most 80 pounds, but you cannot test that a voting machine is "secure"...Even the best-tested equipment can be misused to yield invalid election outcomes; post-election audits are capable of detecting and correcting such problems*". The report concludes that "*while (standards) may have helped ensure that voting systems meet some basic requirements, the difficulty, cost, and time involved in having voting systems certified have certainly also made life difficult for new voting system vendors and election officials*". This is the reason why the report recommends a switch from certification to auditing. Similar arguments are heard in Europe as well where the cost-efficiency of certification has been questioned and individual and universal verifiability is seen as offering better guarantees while at the same time being less costly than certification.

3.2 Purpose of the update

3.2.1 Meet stakeholders' needs

We already identified several arguments in favour of an update of Rec(2004)11. Behind each argument there is at least one stakeholder with a direct interest in the update. It's necessary to clearly identify them.

Stakeholders include member States' governments as well as national legislators. Industry is very much interested in working with up-to-date standards and in building systems that can be certified and used. The control and certifying authorities as well. Research has an interest. Finally the major stakeholder, the voter, has a clear interest that all voting systems, including e-enabled ones, respect the principles of democratic elections.

Among the voters, some categories may have an increased interest in e-voting and in the fact that it becomes a sustainable solution. These include the visually impaired, people with reduced mobility, expatriates, people on mission abroad (military) etc. Their needs have to be identified and dealt.

As already seen, needs and expectations may vary in time due to a number of factors, including social and technological developments. As a result, needs cannot be satisfied once and for all. Periodic updates of the Recommendation are necessary.

3.2.2 Address weaknesses

What should the update address? We would say that first of all it should address the so-called congenital weaknesses, taking into account critical assessments and proposals. Secondly, it should examine and reflect recent developments and new concepts and ideas, be they technological, legal or social, in the CoE countries. Thirdly, it should benefit from experiences, and where existing, guidelines on e-voting from implementing bodies, observers, researchers etc. in the CoE region and elsewhere. Fourthly it should take into account les-

sons learned by countries outside the CoE region. And an update should of course produce a document that can be easily used by the different stakeholders.

3.3 Expertise required

3.3.1 Combined expertise

As already mentioned, the multi-disciplinary nature of e-voting requires combined expertise from different areas. Recent developments have provided enough evidence that the involvement of ICT experts in particular is needed.

A report of the Dutch Government to the Parliament (CoE, 2012) underscored the lessons learnt from the abolition of e-voting in 2006 and observed that sets of election criteria cannot be static and rather need to be repeatedly updated. These specifications, it was proposed, should be developed largely by independent experts.

3.3.2 Role of periodical review meetings

The biennial review cycle of Rec(2004)11 is meant for recommendations and updates to be discussed in detail. However, the bulk of the work needs to be conducted by experts who will most probably meet more frequently (physically or virtually). Work done by the experts must be presented to and validated by member States' representatives at biennial meetings.

Biennial review meetings are important and fulfil their mandate as long as they have an active role in the updating of the Recommendation. If no update is proposed, if there is no follow-up on countries' experiences and lessons learnt the Recommendation will gradually become obsolete and biennial meetings would lose their substance.

4. SECOND OPTION: NO UPDATE OF REC(2004) 11

4.1 Alternative standards?

We will not speculate on the theoretical possibility for other organisations to provide legal standards on e-voting. So far, we have seen that organisations involved with e-voting have been focusing on formalizing procedures (e-voting introduction, observation and so on) and on identifying good practices. Formalized procedures and methodologies have been domain specific (directed to election officials, observers and so on) and do not aim at providing the regulatory framework for e-voting. They need to be taken into account when updating the Recommendation but they are not equivalent to it (e.g. in their respective scopes) and no substitute to it. The main reason being that no other institution has a mandate equivalent to the CoE in this area, at least in Europe.

CoE's mandate in the voting area derives from its purpose to safeguard "*spiritual and moral values which are the common heritage of their peoples and the true source of individual freedom, political liberty and the rule of law, principles which form the basis of all genuine democracy*" (CoE, 1949). Indeed the aim of the CoE as laid out in article 1 of its Statute is "*to achieve a greater unity between its members for the purpose of safeguarding and realising ... principles which are their common heritage...This aim shall be pursued...by agreements and*

common action in ...legal and administrative matters". Article 15 of the CoE Statue foresees that action may take the form of recommendations to the governments of members.

4.2 Council of Europe's expertise

As mentioned in the previous chapters CoE's Recommendation is largely referenced and CoE's expertise in this area is recognised.

The participants at the fourth review meeting "*concurred that a decision to update the Recommendation would be decisive in the deliberation as to whether the Council of Europe wishes to remain or not a widely recognised and cutting-edge actor in the field of e-voting, being the only entity capable of setting international standards in this significant aspect of democratic governance, i.e. in an area of core competence of the Organisation. Indeed, the continuation of standard-setting work in the field of e-voting would be fully in line with the Council of Europe's 'Strategy on Internet Governance 2012-2015' (doc. CM(2011)175 final, adopted by the Committee of Ministers in March 2012, reference to e-voting in paragraph 13.c)*" (CoE, 2012).

Ultimately the question is not whether or not to update the Recommendation. The true question for the CoE is whether it wishes to continue work in this field or not. If the CoE wishes to maintain its position as a reference in this area, the above mentioned evidence provides a solid foundation for a decision to update the Recommendation.

5. RECOMMENDATIONS

The questions we asked at the beginning were: How has Rec(2004)11 been implemented so far? Has un update become necessary? How to proceed with the necessary update? The three questions have been answered throughout the report. Below we will further develop some recommendations on how to tackle the updating work.

Implementation?

If we compare Rec(2004)11 to the U.S. VVSG (U.S. EAC 2005) it's clear that their structure and language is very different. Both are voluntary guidelines. However, if adopted, VVSG provide a check-list ready for use by authorities, vendors, certifying bodies, etc., while Rec(2004)11 was intended to provide guidance, although some parts of it are too detailed for such a purpose.

So the first question before undertaking a thorough update of the Recommendation should be to decide what kind of document we want? In the light of experiences made and lessons learned so far it can be assumed that a readily implementable (by authorities as well as by industry) check-list will receive greater attention. This decision will influence the structure, content and wording of the entire Recommendation.

The level of detail of the Recommendation needs special attention. It should include all international standards for democratic elections applicable to all voting systems, while leaving individual countries the necessary room for implementing their own electoral specificities, of course in accordance with the broader international standards. The check-list should be comprehensive and coherent to facilitate implementation and control, but must be limited to what is strictly necessary to ensure compliance of e-voting with international standards for democratic elections. Countries have of course the possibility to do more and to do bet-

ter. By comparaison, in a federal context such approach would be characterized "as centralized as necessary, as decentralized as possible". The aim is to keep costs, for example for system certification towards the requirements of the Recommendation, as low as possible.

Another prior determination would be to clearly distinguish between e-voting in controlled and e-voting in uncontrolled environments. Requirements and standards in the Recommendation should clearly indicate to which of the two types of e-voting they apply.

Update?

Experiences, technical developments, academic reviews, all indicate that an update of the Recommendation is currently necessary. The major challenge is to identify a comprehensive set of international requirements for democratic elections applicable to all voting channels and to map it with specific requirements for e-voting in controlled and in uncontrolled environments.

A management and maintenance policy for the Recommendation is needed. Experts from different disciplines such as law, engineering, mathematics etc. must be involved in the maintenance work. Their proposals should be validated by member States' representatives before being presented to the Committee of Ministers with the request to formally update the Recommendation.

There may be a risk that the update of the Recommendation is seen as an opportunity to re-open Pandora’s box in the sense of re-discussing everything. An update being a further development of issues that factually command an update, it does not challenge the fundamentals. It is up to the body responsible for mandating the update to define such fundamentals and accordingly delimitate the scope of the update of Rec(2004)11.

How to proceed with the update?

If work in 2004 started from a theoretical perspective, updating work in 2014 definitely has to start by considering practical needs of administrations, voters, industry and other stakeholders.

The initial enthusiasm for e-voting from 2004 has given way to more lucidity and maturity in the consideration of risks and opportunities. Today's understanding of IT and e-voting should be duly taken into account in the updating process.

At the end of the day, ensuring verifiable e-voting requires not just state-of-the-art technical solutions but first and foremost state-of-the-art legal regulations to support them and this is the primary reason for, and ultimate goal of, an update.

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