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Secrecy, Accuracy and Testing of the Chosen Electronic Voting System   ***Part 6***
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Part 6

e-Voting Best Practice: Council of Europe Recommendation

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6.1 Introduction (*Part 6*)

This part reports the Commission's work in evaluating the implementation of electronic voting in Ireland against emerging international best practice in the field of e-voting, specifically, the legal and operational standards and technical requirements for e-voting contained in Recommendation Rec(2004)11 of the Committee of Ministers of the Council of Europe ("the Recommendation") agreed in September 2004.

Context of Evaluation

The Commission is required by its terms of reference to carry out a comparative assessment of the secrecy and accuracy of the chosen electronic system and the existing paper system of voting as described in *Part 5*.

It is a primary objective of the Recommendation that "e-voting shall be as reliable and secure as elections and referendums which do not involve the use of electronic means" and it thus appears to the Commission that the Recommendation is a useful benchmark by which to evaluate the proposed migration from paper to electronic voting methods in Ireland. Furthermore, and although the Recommendation is broadly based in terms of the democratic principles underpinning elections that are conducted by electronic means, its specific objective of ensuring the reliability and security of such elections corresponds very closely with the Commission's mandate in relation to the secrecy and accuracy of the chosen system.

Therefore, in the interests of completeness and in order to place its work on the chosen system in the context of current e-voting developments, the Commission has evaluated the implementation of e-voting in Ireland with respect to the Recommendation. However it was not considered appropriate to use the Recommendation as the *de facto* measure of how the chosen system compares with the paper system for the following reasons:

• the Recommendation has no formal legal status and is non-binding on member states;
• the Recommendation post-dates to the adoption of the chosen system for use in Ireland (but recommends that member states already using e-voting should comply with its provisions);
• in addition to technical requirements for voting systems, the Recommendation refers to legal and operational standards, some of which lie beyond the scope of the chosen system;
• the Recommendation also refers to a range of options for the conduct of e-elections that is wider than the voting and counting aspects implemented in Ireland using the chosen system.

As the scope of the Recommendation is thus wider than that of the chosen system, the Commission's evaluation accordingly relates to the wider implementation of e-voting in Ireland and not only to assessing the chosen system as a replacement for the paper system. This evaluation is accordingly presented separately from the comparative assessment of the chosen system and the paper system in *Part 5*.

Although it is not binding, the Recommendation, described by the Council of Europe as "the first international legal text on e-voting", is nonetheless a valid (and currently the only) internationally agreed point of reference in terms of emerging e-voting standards and the general requirements for implementing e-voting systems.

The Council of Europe Recommendation

The Council of Europe is an international organisation based in Strasbourg, consisting of 46 European member states based on the principle of the rule of law and the guarantee of fundamental human rights and freedoms to their citizens. The Council of Europe was responsible in 1950 for the European Convention on Human Rights, a charter which serves as the basis for the European Court of Human Rights. The Committee of Ministers is the Council of Europe's decision-making body comprising the Foreign Affairs Ministers of all the member states, or their permanent diplomatic representatives in Strasbourg.

Adopted by the Committee of Ministers on 30 September 2004, the Recommendation sets out a blueprint for governments currently using, or planning to use, electronic voting for elections and referendums. It is based on experience gathered by the Council of Europe through pilot projects in several member states, as well as knowledge from legal and technical experts from nearly all 46 member states of the Council of Europe. Member states are to keep under review their policy and experience of e-voting and report within two years to the Council of Europe Secretariat.

The Recommendation incorporates guidance on how to design, implement, operate and supervise e-voting systems to ensure that they are as reliable and secure as traditional paper-based methods. It emphasises the need for new voting methods to meet the democratic principles of universal and equal suffrage, as well as for free and secret ballots, and for electronic systems to be robust, transparent and accessible. In addition to the core e-voting functions of vote recording and vote counting, the Recommendation also addresses related issues such as registration and authentication of voters, notification of elections, nomination of candidates and provision of information to voters.

In general terms, it recommends that:

- e-voting shall respect all the principles of democratic elections and shall be as reliable and secure as elections which do not use electronic means;

- the interconnection between the legal, operational and technical aspects of e-voting set out in the Recommendation must be taken into account when applying the Recommendation;

- while they are not required to change their voting procedures, member states should consider reviewing their relevant domestic legislation in the light of the Recommendation;

- member states should keep under review their policy and experience of e-voting and report thereon within two years to the Council of Europe Secretariat.

Specifically, the Recommendation calls on the governments of member states to ensure that their e-voting systems meet the standards and requirements set out in three appendices to the Recommendation and relating to legal, operational and technical aspects of e-voting.

The full text of the Recommendation, including the appendices relating to legal standards, operational standards and technical requirements is set out in *Appendix 6*.

6.2 Approach to Evaluation

This section describes the structure of the Recommendation and the approach taken by the Commission in evaluating the compliance of e-voting in Ireland with the standards and requirements of the Recommendation.

Structure of the Recommendation

The legal and operational standards and technical requirements of the Recommendation comprise 112 individually numbered measures, together with an additional (unnumbered) general technical requirement, making 113 in total. These measures are categorised as follows:

- Legal Standards (35 measures)
  - Principles (Universal Suffrage, Equal Suffrage, Free Suffrage, Secret Suffrage)
  - Procedural Safeguards (Transparency, Verifiability, Accountability, Reliability, Security)

- Operational Standards (25 measures)
  - Notification
  - Voters
  - Candidates
  - Voting
  - Results
  - Audit

- Technical Requirements (53 measures)
  - General
  - Accessibility
  - Interoperability
  - Systems operation
  - Security (General, Pre-voting, Voting, Post-voting)
  - Audit (General, Recording, Monitoring, Verifiability, Other)
  - Certification

Evaluation Criteria

Compliance with the measures of the Recommendation is evaluated on the basis of a six-point scale according to the following criteria:

Excellent	The implementation of e-voting in Ireland perfectly complies with the standard or requirement
Very Good	The implementation of e-voting in Ireland meets the standard or requirement almost completely
Good	The implementation of e-voting in Ireland generally meets the standard or requirement

Fair   The implementation of e-voting in Ireland meets the standard or requirement but incompletely

Poor   The implementation of e-voting in Ireland only minimally addresses the standard or requirement and nearly fails to meet it

Fail   The implementation of e-voting in Ireland completely fails to meet the standard or requirement

N/A   The standard or requirement is not applicable to the implementation of e-voting in Ireland (for reasons set out in *section 6.3*)

The results of the Commission's evaluation on this basis are summarised in *section 6.3*.

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6.3 Evaluation of Compliance

The Commission's evaluation of compliance with the Recommendation is summarised in this section with reference to each individually numbered measure of the Recommendation as set out in *Appendix 6*.

Non-Applicable Measures

In addition to measures relating to the electronic processes for vote recording and vote counting, the Recommendation also includes measures relating to other electoral procedures that may be conducted electronically, such as notification of elections, nomination of candidates, registration and authentication of voters and provision of information to voters. Although these are relevant to e-voting generally, they are, in effect, optional for implementation by member states and are not an integral part of the Irish implementation of electronic voting using the chosen system. These measures have been excluded from the Commission's evaluation.

Additionally, some of the measures relate to alternative "channels" or methods of voting (such as remote on-line voting via the internet), while others envisage different types of channel being available in parallel. Neither remote voting nor voting by different channels (other than in the case of postal voters as described in *Part 5*) is envisaged by the Irish implementation. These measures have also been excluded from the Commission's evaluation.

A further particular class of measure concerning audit has also been excluded. While the principal audit measures of the Recommendation have been included for evaluation, a number of measures relate to consequential matters which assume the existence of levels or types of audit information that are not present in the Irish implementation of e-voting using the chosen system.

The following measures of the Recommendation, comprising 27 in total, have accordingly been excluded from the Commission's evaluation of e-voting in Ireland in the specific context of the chosen system:

- electronic registration and identification of voters (**Nos. 2**, **39**, **40**, **41**, **78**, **86**, **88**, **94**);
- electronic nomination and notification of candidates (**Nos. 42**, **43**, **49**, **82**, **87**);
- remote and multi-channel e-voting (**Nos. 4**, **6**, **44**, **45**, **50**, **51**);
- inapplicable audit measures (**Nos. 60**, **105**, **106**, **110**);
- electronic notification and timetabling at elections (**Nos. 36**, **37**);
- use of election mark-up language (**Nos. 67**, **68**).

Summary of Compliance (Applicable Measures)

With 27 of the original 113 measures of the Recommendation being deemed not applicable for the purposes of the Commission's evaluation, the compliance levels in respect of the remaining 86 measures are set out below according to the evaluation criteria outlined in *section 6.2*. For the purposes of this summary (and in the subsequent analysis of the results of the evaluation) these remaining 86 measures are regarded as comprising 100% of the applicable measures evaluated by the Commission.

Summary of Compliance Levels

Compliance Level	Frequency	%
Excellent	10	12
Very Good	18	21
Good	14	16
Fair	17	20
Poor	12	14
Fail	15	17
Total	86	100

It is important to note that no conclusion can be drawn simply on the basis of the number, or percentage, of measures in respect of which the implementation of e-voting in Ireland is recorded here as being compliant or non-compliant with the Recommendation or otherwise. Each individual measure has its own particular significance and value within the wider context of the chosen system as a whole and the arrangements for its deployment and the overall levels of compliance must be considered in light of this. The Commission has also taken account of this in recording its observations on e-voting best practice in *section 6.4* below.

Areas of Compliance (48%)

The level of compliance was evaluated as "excellent" in respect of 10 measures, "very good" in respect of 18 measures and "good" in respect of 14 measures. The implementation of e-voting in Ireland is accordingly deemed to be compliant with the Recommendation in the following respects (relevant measures have been grouped together and summarised for the purposes of description):

Legal Standards
- Voter anonymity and secrecy of the voting process (*Nos. 16, 17*, *18*, *19*)
- Segregation of voter authentication data from vote data (*No. 35*)
- Clarity and ease of use; avoidance of manipulative influence (*Nos. 1*, *5*, *7*, *9*, *11*, *12*, *14*)
- Opportunities for voter familiarisation (*No. 22*)
- Facilitation of partial or complete re-run of election and possibility for re-counts (*Nos. 26, 27*)
- Disclosure of components for verification purposes (*No. 24*)
- Prevention of precipitate or unintentional voting (*No. 10*)

Operational Standards
- Voter guidance and orientation on voting process (*Nos. 38*, *46*, *47*, *48*)
- Removal of voter preferences from display once vote is cast (*No. 52*)
- Preservation of secrecy during handling of votes prior to counting (*Nos. 53, 54*)
- Recording of count results and facilitation of observation (*Nos. 55*, *56*, *57*)

Technical Requirements
- Assessment and management of risks (*Additional Technical Requirement[70]*)
- Presentation of voting options to voter (*No. 65*)

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[70] See additional (unnumbered) general technical requirement between Nos. 60 and 61.

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- Contingency and backup arrangements (***Nos. 70***, ***71***)
- Data availability and avoidance of permanent data loss (***Nos. 77***, ***99***)
- Ballot authenticity and validity, voter anonymity, vote recording (***Nos. 90, 91, 93***, ***95***, ***96***)
- Accurate counting of votes and reproducible counting process (***No. 98***)
- Recording of audit data sufficient to observe and confirm processes comply with law (***Nos. 103***, ***104***)
- Ability to participate in development of international e-voting standards (***No. 112***)

Areas for Improvement (21%)

The level of compliance was evaluated as "fair" in respect of 17 measures. It is suggested that further work will be required in order for the implementation of e-voting in Ireland to be compliant with the Recommendation in the following respects (relevant measures have been grouped together and summarised for the purposes of description):

Legal Standards
- Measures to ensure availability of services and to avoid malfunction or attack (***No. 30***)
- Reliable incorporation of postal (paper) votes in the count (***No. 8***)
- Information measures to ensure voters understand and have confidence in system (***Nos. 20***, ***21***)
- Facilitation of disabled voters (***No. 3***)
- Access and staffing controls (***Nos. 32, 33***)

Operational Standards
- Votes affected by any irregularity to be recorded as such (***No. 58***)

Technical Requirements
- Procedures to check, approve and monitor correct operation and adequate backup (***Nos. 72***, ***73***)
- Secure storage of equipment and data; incident reporting and disaster recovery (***Nos. 75***, ***76***)
- Provision and independent assessment of time-marked audit and observation data (***Nos. 84***, ***85***)
- Sufficiency of means to prevent modification of votes during voting (***No. 92***)
- Self checking for correctness and availability (***No. 79***)
- Controls on access to services (***No. 80***)

Areas of non-Compliance (31%)

The level of compliance was evaluated as "poor" in respect of 12 measures and "fail" in respect of 15 measures. The implementation of e-voting in Ireland is accordingly deemed to be non-compliant with the Recommendation in the following respects (relevant measures have been grouped together and summarised for the purposes of description):

Legal Standards (Principles):
- Allowing voters to record null or blank votes (***No. 13***)
- Prevention of changing of votes once cast (***No. 15***)

Legal Standards (Procedural Safeguards):
- Independent verification of correct equipment functioning and security measures (***No. 25***)

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- Reliability and security; encryption of votes (***Nos. 28***, ***34***)
- Adequate testing before use to ensure genuineness and correct operation (***No. 31***)
- Transparency of processes (***No. 23***)
- Avoidance of fraud or interruption affecting system while in use (***No. 29***)

Operational Standards:
- General requirement for e-voting system to be auditable (***No. 59***)

Technical Requirements:
- Security (General): protection of authentication data; event recording for observation (***Nos. 81***, ***83***)
- Security (Voting): integrity and authentication of data (***Nos. 89***, ***97***)
- Control procedures on technical operations and equipment changes (***No. 74***)
- Certification processes for testing and certification of components (***No. 111***)
- Implementation of end-to-end audit features to facilitate oversight and verification[71] (***Nos. 100***, ***101***, ***102***, ***107***, ***108***, ***109***)
- User involvement in design and compatibility with technologies for the disabled (***Nos. 62***, ***64***)
- Accessibility of services to all voters and provision of alternative voting methods (***Nos. 61***, ***63***)
- Component interoperability, publication of software lists, updated protection software (***Nos. 66***, ***69***)

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[71] Audit: it should be noted that the Recommendation does not require voter verifiable audit or a paper trail.

6.4 Observations on e-Voting Best Practice

This section sets out the Commission's observations arising from its evaluation of the implementation of e-voting in Ireland using the chosen system, having regard to the Recommendation Rec(2004)11 of the Committee of Ministers of the Council of Europe agreed in September 2004.

While a number of recommended measures were deemed not to be applicable for the purposes of its evaluation, the Commission notes that the implementation of e-voting in Ireland using the chosen system is compliant in many areas with the Recommendation and can, with some further work, achieve improved compliance in other areas. However, the evaluation has also identified areas of non-compliance under all three categories of measure contained in the Recommendation, namely, legal standards, operational standards and technical requirements.

The areas of compliance highlighted by the Commission's evaluation include the following features of the chosen system and the arrangements for its deployment:

- preservation of voter anonymity and secrecy of the ballot during voting and counting stages;
- ballot authenticity and accurate recording of votes cast;
- availability and avoidance of permanent loss of data;
- contingency and backup arrangements;
- ease of use for voters and optimal presentation of voting options;
- recording and observation of counting process;
- facilitation of partial or complete re-run of whole election or counting process;
- voter guidance and orientation and opportunity for familiarisation;
- assessment and management of risks.

The Commission recognises that these are important and materially significant features of the overall implementation of e-voting in Ireland involving the chosen system.

The areas of non-compliance, or in need of improvement, as highlighted by the Commission's evaluation are consistent with those areas for improvement already highlighted in the Commission's work as reported in *Parts 3*, *4* and *5*, including as regards the following:

- the need for independent verification, testing and certification of the chosen system;
- security measures within and around the system;
- procedural controls and staffing requirements;
- data security and the use of encryption.

The following issues concerning the chosen system and the arrangements for its deployment which previously emerged peripherally in the Commission's work have also been brought more to the forefront by the evaluation:

- implementation and facilitation of independent observation and audit;
- accessibility and provision of alternative voting methods for disabled persons;
- allowing null or blank votes.

Arising from the Commission's work in *Parts 3, 4* and *5* in relation to technical, operational and comparative aspects of the chosen system and the arrangements for its deployment, the further work that would be necessary in order to meet the standards and requirements of emerging international best practice on e-voting as represented by the Recommendation would include:

- the modification and further analysis of the hardware and software of the chosen system followed by independent testing and certification;
- the review and enhancement of the operational procedures for its deployment and use.

Amendment of the electoral law would also be required in order to comply fully with certain aspects of the Recommendation.

While the Recommendation affords prominence to the issues of secrecy and accuracy ("security and reliability") falling within the scope of the Commission's work, it is also a useful indicator of the broader range of considerations on which the introduction of any e-voting system should be based. These include considerations of cost, speed, accessibility, diversity of voting methods, enhanced voter participation and independent verification. Where possible and where relevant to its terms of reference, the Commission has acknowledged these considerations in its comparative assessment of the chosen system and the paper system in *Part 5* and (as regards issues not specifically relating to secrecy and accuracy) in *Appendix 5A*.

In view of the constraints identified by the Commission in *section 6.1* concerning the full application of the Recommendation to the implementation of e-voting in Ireland, the Commission's evaluation must be viewed as merely a first step in identifying and highlighting, with regard to emerging best practice, areas for improvement in the deployment of the chosen system and in signposting the future direction of e-voting in Ireland.