Recent Software Developments – The view of the weighing industry

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1. Introduction

Daily life for both citizens and businesses is at a point of transition in the early part of the 21st Century. We have all become used to the great changes bought by the Internet, but now this is developing to new levels with the influence of cloud technologies and the "internet of things" and the increasing focus on "big data" It appears to be almost a daily occurrence that new technologies and products are bought onto the market that will affect us all in yet undiscovered ways.

Weighing and measuring technologies are just one aspect of these developments, perhaps most obviously being seen in the development of smart utility meters, but affect all type of weighing and measuring equipment. This essay expounds the view of CECIP, the European Association of Manufacturers and Suppliers of weighing instruments. It looks to consider these potential changes in technology and how they could be addressed in the context of European Legal metrology.

2. The economic driver and the effect of software developments

One of the most important notions to understand is that the developing technologies such as the cloud and the growth of big data are facilitating the rapid changes that we see in the weighing instrument market. They are not necessarily driving the changes. This is being done by the increasingly gloabilised market place, ever-increasing drive for efficiency and rapidly developing consumer demand; products are being loaded on to ships in India and the transaction take place in the Netherlands, automatic weighing instruments in Indonesia are monitored and controlled from the UK.

The significance of this is that the changes and developments are likely to continue independently of any legal metrology frameworks. External forces are driving them. The frameworks we develop must recognise this and must not seek to halt or prevent the changes instead they must regulate the development for the benefit of all stakeholders.

Historically trade took place in the local environment with simple equipment, people would buy and sell at the local market place and later on in local shops and stores. The effect of this that the legislative requirements that regulated this trade reflected not only the technology but also the economic and political environment in which it operated. The earliest known uniform systems of weights and measures have been created at some time in the 4th and 3rd millennia BC in Egypt, Mesopotamia and the Indus Valley [1].

As the geographical spread of trade increased from local to regional and eventually national levels the pressure to have more consistent legal requirements became more and more urgent. The Magna Carta in Britain (1216) stipulated that "there shall be one unit of measure throughout the realm". The French Revolution recognized the need for a national weights and measures system [2] and it was also about the same time that Thomas Jefferson presented a "Plan for Establishing Uniformity in the Coinage, Weights, and Measures of the United States" [3].

The next major challenge in the development of legal metrology has been caused by the development of international trade; it has become increasingly important that there is not just consistent measure across but also between nations states. This has perhaps reached the greatest challenge with the European Single market in which 28 separate nations are trying to harmonize their requirements in a whole range of areas, not just legal metrology.

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One of the effects of the increasing international trade and the advancing software technologies is the development of new type of weighing and instruments that have different elements in different geographical locations as demanded by the customer and the market place. Instruments that use the cloud for data storage and running applications and others that make use of smart phones for weighing indicators are just some of the products that are available today.

The challenge that all stakeholders in the market place now face is how to regulate these new software environments. The legislation for weighing instruments has historically been based on the notion of a single item, a shop scale or a weighbridge for example, that was in one location and could be easily regulated. Future regulation must be based around that fact that different elements of a weighing instrument can easily be based in different member states and outside the EU. Future legal frameworks must reconcile this, the rapidly changing technology and the powerful economic drivers that combine to create this challenge.

3. The present legal framework

The present legal system for non-automatic weighing instruments is the Directive 2014/31 [4] and for automatic weighing instruments 2014/32 [5]. These offer some limited and general regulatory requirements for software.

The essential requirements relating to software for the purposes of the Directive 2014/32 are:

7.6 When a measuring instrument has associated software, which provides other functions besides the measuring function, the software that is critical for the metrological characteristics shall be identifiable and shall not be inadmissibly influenced by the associated software.
8.1 The metrological characteristics of a measuring instrument shall not be influenced in any inadmissible way by the connection to it of another device, by any feature of the connected device itself or by any remote device that communicates with the measuring instrument.
8.3 Software that is critical for metrological characteristics shall be identified as such and shall be secured. The measuring instrument shall easily provide software identification. Evidence of an intervention shall be available for a reasonable period of time.
8.4 Measurement data, software that is critical for measurement characteristics and metrologically important parameters stored or transmitted shall be adequately protected against accidental or intentional corruption
10.1 Indication of the result shall be by means of a display or hard copy.

The essential requirements relating to software for the purposes of the Directive 2014/31 are:

8.3 Digital electronic devices shall always exercise adequate control of the correct operation of the measuring process, of the indicating device, and of all data storage and data transfer.
8.4. When external equipment is connected to an electronic instrument through an appropriate interface the metrological qualities of the instrument shall not be adversely influenced.
8.5. The instruments shall have no characteristics likely to facilitate fraudulent use, whereas possibilities for unintentional misuse shall be minimal. Components that may not be dismantled or adjusted by the user shall be secured against such actions.

These gaps have been filled in by some of the relevant guides produced by WELMEC. The Guide 2.3 (3) [6] relates to the examination of software for non-automatic weighing instruments and the Guide 7.2 (6) [7] applies to software used in those instruments covered by the Directive 2014/32

The present legal requirements and guides have their roots in previous technologies when the majority of software on weighing instruments would have been embedded. These regulations do not easily manage instruments when different elements may be in disparate locations and the onerous legal difficulties that arise when the different elements of an instrument may not all be in one country.

4. Risk assessment and the role of WELMEC WG7

What we must consider is how can this matter be addressed for the future. CECIP have been actively involved in all of the work of WELMEC WG7 on software and the present project that is being undertaken at on risk assessment. This proposal is based on the concepts of ISO 27005 [8] and ISO 15408 [9].These standards define risk as a "combination of the consequences that would follow from the occurrence of an unwanted event and the likelihood of the occurrence of the event". The standard also creates the risk evaluation criteria as "legal and regulatory requirements, and contractual obligations".

4.1 The defining of assets

The risk assessment process behind the standard can be divided into three separate stages. The first is to identify the assets and security properties of the software. The assets are those tangible elements of the software that will ensure the essential requirements of the Directive are met.

If we look for example at the essential requirement 7.6 of the Directive 2014/32.

When a measuring instrument has associated software, which provides other functions besides the measuring function, the software that is critical for the metrological characteristics shall be identifiable and shall not be inadmissibly influenced by the associated software.

The assets would be such things as the identification of the legally relevant software and the inadmissibility of that software to be influenced by other software. Associated with the assets would be the security properties that would enable the asset to be realised. In the example above these would be the availability and integrity of the software identifier and the prevention of the ability to influence legally relevant software.

4.2 The defining of attack vectors

Once the assets have been defined, the next part of the process is to define those things that could be threats to the assets and the consequences of such threats. These are what are referred to as attack vectors, in one example considered this would be an attacker retrieving the administration pass word by trying all of the 6 digit combinations, or the attacker retrieving the administration password and replacing all of the legally relevant software.

4.3 Vulnerability analysis

The third stage is to affect a "vulnerability analysis" once the attack vectors have been defined. This would be estimated in relation to each attack vector. In the project being by considered by WG7 there are five categories to which points can be assigned to each attack vector.

- Elapsed time in which the attach could take place (1–19points)
- Expertise (0–8 points)
- Knowledge of the Target of Evaluation (0–11 points)
- Window of Opportunity (0–10 points)
- Equipment (0–9points)

When the attack proballities are then added for each attack vector a total value as to the probability of the software of the instrument being attacked can be calculated.

5. The view of CECIP

5.1 Advantages

It is the view of CECIP that this system has many advantages to all stakeholders involved in the production and analysis of software for legal metrology.

It would be a reproducible and transparent evaluation scheme that would tend to be independent of the actual evaluator. This is very important for manufacturers of weighing software, as it would begin the process of creating a consistency between different notified bodies. There would move towards producing the same risk evaluation for the same piece of software regardless of which notified body was use.

It is likely that a manufacturer would only need to define common attack vectors for a particular instrument once only. This would be advantageous in producing an effective and efficient system for gaining appropriate approvals across Europe and bring benefits not only to manufacturers and notified bodies, but also the market surveillance authorities and ultimately consumers.

5.1 Concerns

Whilst being supportive of the development of the risk assessment being developed by WG7 and enthusiastic about reaching a successful conclusion CECIP has one major concern regarding potential evaluations. The vulnerability analysis must include some element of attacker motivation. The present analysis appears sufficiently sophisticated to analyse an appropriate risk once an attacker has decided to attack the instrument but does not attempt to analyse the likelihood of the instrument being attacked in the first place.

There would be concern the attack vectors are based on theoretical analysis only and the risk analysis must consider actual attacks that have occurred in the market place. This would give a much clearer view of attacker motivation.

Under certain circumstances it could be acceptable to consider risks that have not been revealed in the market place and would therefore be consider as theoretical. The analysis of such risks must not be based on technical possibility alone but must consider the potential advantages to an attacker, financial or otherwise. This will enable a more accurate risk of attacker motivation to be defined and much more sophisticated analysis of risk to be achieved for different types of instruments. The output of the analysis must be sufficiently subtle to distinguish between the motivation to attack, for example electricity meter and the motivation to attack a weighbridge. The motivations to attack these instruments are not the same.

If these matters can be resolved it is likely that an agreed, consistent and transparent risk assessment can take be developed which would enable manufacturers, notified bodies and market surveillance authorities to work together much more consistently not only for their own benefit but also for the benefit of consumers in the European Market.

6. Conclusion

The increasing globalization of world trade will lead to an inevitable increase in the use of software technologies to increase the efficiency of transactions and meet consumer demands.

The present legal framework is based on previous technologies and is not compatible with the technologies demanded by the present market place.

Risk assessment is seen by CECIP as a practical and sensible way to introduce consistency and transparency into the approval of software used in weighing and measuring instruments.

The present project being undertaken by WELMEC WG7 may offer a potential solution for the risk assessment of the software used in weighing and measuring instruments.

The risk assessment process must consider the risk of an attack-taking place if it is to be accepted by CECIP

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