Internet-Enabled Calibration: A Future of Calibration?

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ABSTRACT

Calibration of measuring instruments provides the confidence in measurements. It is the obligation of every laboratory to have its measuring equipment calibrated in regular intervals. This obligation means that the laboratory must send its equipment to the calibration laboratory every year or two depending on the calibration intervals. During this time the equipment is not available and this presents a financial burden to the laboratory of the customer. Since many of the modern instruments include some communication interfaces, it was made possible to create an Internet-enabled calibration system. This term encompasses a wide range of possible applications and services. The Internet-enabled calibrations must address several problems not present in standard calibrations, including security issues, since the equipment is not always under direct control of the calibration laboratory personnel who will sign the calibration certificate. As the traceability and integrity of the calibration process directly depends on the measured data, the reliable and secure remote control and monitoring of instruments must be a crucial aspect of Internet-enabled calibration technologies.

Keywords: Architectural Features, Client-Server, Computer-Aided Technology, Internet-Based Technology, Web-Based Applications

INTRODUCTION

Today, calibration and testing of measuring instruments is an important part of metrology activities. All the laboratory instruments require recalibration in regular time intervals. Traditionally, instruments are transported from the customer to the calibration laboratory which implies a downtime for every particular instrument under calibration. There is also a danger that instruments will be damaged during transportation. The development of automated measurement procedures, evolution of the computer networks and growing number of quality standards in the industrial and research fields in recent years has led to the realization of Internet-enabled calibration systems, specifically for industrial applications. Also, Internet-enabled metrology is a wider concept that covers the use of communication systems to provide convenient access to a range of measurement and calibration services. On the other hand, calibration, including any kind of remote calibration process must adhere to the recommendations specified in standard ISO/IEC 17025 (International Organization for Standardization, 2008).

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According to Dudley (2005) these services usually include some of the following:

- Remote control and monitoring of measuring equipment (instruments and standards),
- Traceable measurements that are performed at a customer location but controlled remotely by the calibration facility (this covers the term Internet-enabled calibration and/or testing),
- Access to measurement and calibration history and other related data of each instrument and standard,
- Access to libraries of testing and metrology software or algorithms.

Remote calibration can be the best choice for the calibration of low-cost instruments as their calibration is quite expensive when compared with the instrument cost. The Internet-enabled calibration system must include some kind of travelling standard (or transfer standard) that must be transported from the calibration laboratory to the customer laboratory. This transfer standard, as important part of any Internet-enabled calibration have to be robust and error prone, and yet simple for operation by the customer laboratory staff. The remote testing and calibration of measuring instruments is still not fully exploited, mainly due to the security issues, which are associated with the operations outside of a calibration laboratory, primarily since the installation of the equipment including transfer standard should be done by the customer staff, and not by the calibration laboratory personnel who will sign the calibration certificate. This implies that the reliable remote control and monitoring of instruments is a crucial aspect of Internet-enabled calibration procedure. This paper presents overview of existing Internet calibration technologies, and addresses the issues that needs to be solved in the future, especially in order that Internet-enabled calibrations are in accordance with the ISO/IEC 17025 standard. Also, the realization of Internet-enabled calibration system in Primary electromagnetic laboratory of Croatia is described briefly.

INTERNET ENABLED CALIBRATIONS IN COMPARISON TO THE CLASSIC CALIBRATION PROCESS

Last few years, the measurement community is exploring the possibilities of remote measurement and Internet-enabled calibrations of different quantities, instruments, sensors, meters and devices. For example Espina (1999) investigated the possibility to remotely calibrate gas flow meters, while Amicone et al. (2008) investigated the remote calibration of electrical energy meters. Today, the data communications can be done in fast and secure way, causing new services and products almost on a daily base. Some of these services include exchange of text messages in real time, audio and video conferencing, and lately, services for business cooperation and decision making, IP telephony, etc. In the last few years there have been several different investigations in order to use these new communication possibilities for monitoring and calibration services. Several different terms emerged in recent years such as Internet-enabled measurement, remote measurement which stand for the procedure of remote control and/or monitoring of different instruments with the means of some kind of computers and communication networks. These terms must be differentiated from the term Internet enabled calibration or remote calibration, which stands for the calibration of equipment on remote location by the calibration laboratory using the transfer standard as a calibration standard. The usual calibration procedure is presented in Figure 1. The customer sends his equipment (Device Under Test, DUT) to the calibration laboratory (usually National Metrology Institute, NMI), where it is calibrated against equipment with higher accuracy or reference standards.

Internet enabled calibration can be seen in Figure 2. Here, the transfer standard is travelling from the calibration laboratory to the customer. The travelling standard can also have computer or microcontroller attached to it. The equipment that needs to be calibrated must also
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