

Data exchange with robots and sensors: achievements and prospects of the Animal Data Exchange initiative

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Abstract

In response to the growing difficulties met in data exchange between breeding organizations and on farm robots and / or sensors, a collaborative initiative has been launched by some manufacturers and some milk recording organizations: Animal Data Exchange (ADE). The rationale and the different phases as well as the main achievements are reviewed. The ADE architecture based on a client server approach using web services as well as its specifications in compliance with state of art standards such as “http”, “Extensible Markup Language (XML)” and “SOAP” are detailed. The first provisional results of the ongoing field tests in three countries are given as well as the next steps to set up a full operational system.

Key words: data exchange standard, farm equipment, information system

Introduction

In the mid of the nineties, the International Standard Organization, established a standard for data exchange with stationary equipment.

This standard consists in several parts:

- Standard for the syntax (Animal data interchange syntax - ADIS - ISO 11 787)
- Standard for data dictionary (Agricultural data element dictionary – ADED - ISO 11 788 - 1)
- Data dictionary for dairy framing (ISO 11 788 - 2)

The major manufacturers implemented partly this standard often known as ‘Taurus’. In some countries these standards are also widely used for any type of data exchange in livestock farming.

More recently an improvement of these standards, the ISO 17 532, was published to enlarge specifications to a protocol for automatic and interactive data exchange between machines with corresponding software at process level or management programs at all organizational levels of the production of animal products. At the moment, this standard is little implemented for dairy cattle.

For dairy cattle, the ISO standards are aging, are not widely implemented, and there implementations may differ upon the countries and the manufacturers. ISO decided to discard the working group responsible for maintenance of the standard.

In the meantime, needs for data exchange were increasing as fast as the development of on farm automatic device such as milking robot, feeding equipment and miscellaneous sensors. The needs were also changing. That is not only to retrieve data from an equipment for milk recording once a month, but to feed the equipment with data which may facilitate its operating

or / and the works of the farmers. The need of a permanent, automatic and in real time data transmissions has also arisen.

Information and communication technologies became more and more standardized and available in an animal production context.

Animal data exchange – ADE

The 2012 ICAR guideline included a first version of a data dictionary for data exchange with milking and feeding equipment. Although a data dictionary is a prerequisite to facilitate data exchange, it is not sufficient to facilitate data transmission. It was decided, to complete these recommendations by any issue which should be addressed to facilitate in practical data transmission and to prove the concept through pilot implementations.

These specifications which were designed in close cooperation with manufacturers of farm equipment has been called ‘Animal data exchange – ADE’. The purpose is to provide manufacturers and breeders organizations with standards which allow:

- To address data exchanges in relation with any livestock process: milking, feeding, animal traceability, animal reproduction...
- Permanent data exchange
- Data exchange from equipment to breeder organizations and from breeder organizations to equipment

This standard is also:

- In accordance with the state of art of information and communication technologies available in an animal production context
- Scalable according the business needs
- Easy and costless to implement and to maintain
- Compatible as much as possible the existing data dictionary
- Based on a modular to re uses as much as possible aggregated data
- Based as much as possible the existing standard whatever their origin (ISO, W3C, UNCEFACT...) as long as they are relevant, of quality, widely implemented and regularly maintained

Main features of the specifications of ADE

General

Data exchange takes place between an information system which may be operated by a breeder organization and an equipment which is a complex set including sensors, data base, controlled devices and different sort of software. The exchange concerns a subset of data common, to the information system and to the equipment. The equipment is the client which sends a request to the information system which is the server which sends back a response through an Application Programming Interface (API) based on web service standards. The data flow can be either from the equipment to the information system or from the information system to the equipment.

Prior to any exchange, an interchange agreement should be passed between the owner of the equipment and the service provider in order to define the provided service(s), the service levels, the user identification, the location of the service as Internet URL, the type of identifier used for the animals and for the farms, the code lists depending upon the country and the responsibilities to handle the errors. The recommendations for the interchange agreement are out of the specifications of ADE.

Business requirements

The business requirement specification encompasses:

- Descriptions of business interactions between equipment and information systems based on a use case approach
- A data dictionary in compliance with the ISO standard ISO 11 788 – 1 which describes all data elements in a unique way and identifies them by a data dictionary number.
- Code lists for data elements

ADE encompasses also specifications for:

- User authentication
- Error description
- Common frameworks to structure requests and responses

Technical mapping

The technical mapping may be done according two types of standards:

- The ISO standard 11 787 (ADIS)
- The Extensible Markup Language (XML) of the World Wide Web consortium (W3C)

The XML mapping encompasses:

- Files containing the XML schemas for the request and the responses which specifies data in detail: name, type ('time', 'text'...), minimum or maximum values, code list, optional or mandatory....
- Files containing interface specifications in compliance with the W3C standard “Web service specification language – WSDL”

These schemas are in compliance with the UNCEFACT recommendations and reuse as much as possible the UNCEFACT core component library.

The transmission is based on Internet standards:

- transport protocol: TCP / IP
- communication protocol: http or https

State of progress

The current version of the ADE standard (v 1.7), which is in compliance with the recommendations which were published by ICAR in 2012 for data transmission encompasses

1. A data dictionary consisting in about 100 data elements as well as 15 code lists
2. Two messages:
 - from the information system to the equipment in order to initialize or update the equipment data base
 - from the equipment to the information system in order to transmit milking results

The technical mapping is available according either ADIS or XML.

The interfaces taking into account the two messages are available in a file in compliance with the WSDL standards. These files may be download from the ICAR web site in order to be processed directly by xml processors either by the client, the equipment, by the server, the information system.

At the moment, only breeder organizations and manufacturers participating in the pilot phase may access to these files. In addition, ICAR is providing a unique test plat form both the

manufacturers and the breeder organizations. Shortly, the standard will be implemented for a limited number of farmers in France, Germany and in the Netherlands in order to prove the concept.

Perspectives of development

By the beginning of 2015, the objective is to establish a fully operational standard which provide the stakeholders, manufacturers, famers, breeder organizations and consultant with identified benefits and which should be open to any breeder organization or manufacturer.

The current specifications will be included with in addition and at least the transmission of milk analysis to the equipment for analyzer calibration.

This operational standard should be based sound organization, which remains to be designed, which must:

- Operate a maintenance process in cooperation with manufacturers to deliver a new release every year
- To be reactive in case of unforeseen problem
- Provide the users with an appropriate support
- Provide an appropriate environment to distribute the files containing the XML schemas, the WSDL and the code lists
- Be funded in permanent according transparent and well accepted principles.

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