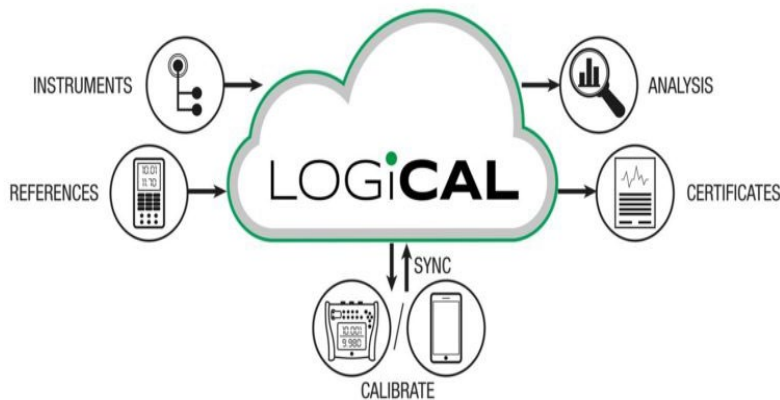


Beamex LOGiCAL — Automatic generation and signing of Digital Calibration Certificates

1. Introduction

Beamex LOGiCAL is a subscription-based calibration software using cloud technology. Being cloud-based, you can access it anywhere you have an internet connection.



LOGiCAL features a web service communication technology that allows you to communicate wirelessly with mobile phones or tablets having the Beamex mobile calibration application installed. You can also communicate with Beamex documenting calibrators for a fully paperless calibration process.

Calibrating with LOGiCAL on a day-to-day basis can be described in five easy steps:



Once you have added your instruments and references to the LOGiCAL database, you can synchronize calibration work to a Beamex calibrator or to phone/tablet with the free Beamex bMobile application. Once you are done with the calibration, you can synchronize the calibration results back to LOGiCAL to review them or to generate certificates.

The certificates are however generated from raw data each time they are generated, to be sure that the certificates are unmanipulated they must be stored as signed digital calibration certificates.

2. Project goals

The main goal is to **design and implement** a DCC software module that can be used in Beamex Logical Sync. This software module must automatically create a DCC when receiving results from Beamex MC6 or bMobile. When a DCC is created it should automatically be sent to stamping server where it is signed and returned to Logical Sync Result Queue. The DCC must be in standardized* XML format as defined by PTB.

The result data received from MC6 (or bMobile) is defined in protocol buffer files. The first stage is to transform the .proto data to JSON and then to XML.

- Units in the DCC must be created according to D-SI standard. Research how e.g., error units “% of Span” and “% of Reading” can be shown.
- Resolution for numerical values must be preserved in DCC -> Research best way to do this.
* This will be an exception to the standard DCC.
- Note: There is currently no Certificate number included in results received from Beamex mobile devices, but the certificate number must be added before DCC is signed -> may require some changes to Logical Sync? Solution: In first development stage the data can be retrieved from the Logical Database instead from Mobile device:

```
{  
    "id": [UUID],  
    "result": [JSON OBJECT],  
    "customCertificateId": [string]  
}
```

The final DCC software module should have support for:

- Transmitters / Indicators (priority 1)
- Switches (priority 2)
- Weighing instruments (priority 3, not even supported in Logical yet)

When we have this support, we can test the DCC software module in the Logical Sync cloud service.

3. Technologies

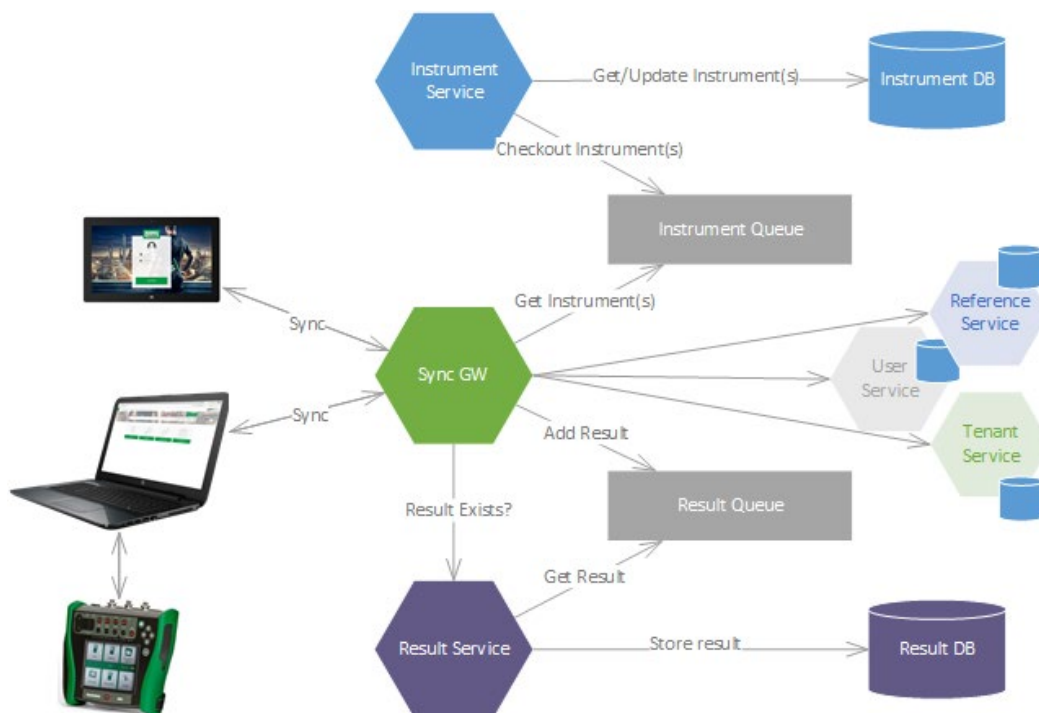
The DCC software module must be implemented with:

- Microsoft .Net framework and C#
- Preferably with .Net Core 3.1 or .Net 5

Other:

- .Proto-files (Protocol Buffers)
<https://developers.google.com/protocol-buffers>
- Use e.g. gRPC to create JSON based on a proto file.
<https://grpc.io/>
- Create DCC (xml) from JSON. The DCCs will be represented in XML, and digitally signed using standard XML tools and methods.

Basic Logical Sync architecture:



4. Requirements for the students

Students should preferably have:

- Knowledge how to use Microsoft Visual Studio and C#
- Experience with JSON and XML
- Basic knowledge about computer security and cryptographic signing
- Preferably basic knowledge about measurement and metrology
- Basic knowledge about Azure

The group members should have their own laptops or other computers, suitable for Microsoft Visual Studio development.

5. Legal Issues

Intellectual Property Rights (IPR):

Intellectual Property Rights will be handled in a separate agreement if Aalto accepts this project proposal.

Non-disclosure agreement (NDA):

Signing an NDA with Beamex is required.

6. Client representatives

Kennet Riska, kennet.riska@beamex.com, +358-505330482

Sami Koskinen, sami.koskinen@beamex.com +358-405470788

7. Additional information

Beamex is a **technology and service company** that develops, manufactures, and markets high-quality calibration equipment, software, systems and services for the calibration and maintenance of process instruments.

<https://www.beamex.com/>