

B Hand-in 6 - SRS of FarmCom

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D E P A R T M E N T O F E N G I N E E R I N G , A A R H U S U N I V E R S I T Y

V E R S I O N 4

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Revision

Revision	Date	Change description	Creator
1	2017-03-09	First draft	LHN, MK, BS
2	2017-03-09	Changes from meeting with customer	LHN, MK, BS
3	2017-03-09	Final hand-in revision	LHN, MK, BS
4	2017-03-09	Revision from review and instructors	LHN, MK, BS

Contents

The contents of this appendix follow the table of contents provided on page 3.

Glossary

CC	Costumer
Delegator	Sub-component(s) inside FarmCom Server Platform which is responsible for delegate a request to the right FarmCom Server instance.
FarmCom Gateway	Component physically placed at a farm managing incoming requests and outgoing responses.
FarmCom Server Platform	Main system platform component, which may consist of multiple FarmCom Server instances, Delegators, Database etc.
FarmCom Server	Sub-component placed within the FarmCom Server Platform. Responsible for providing main functionality of the FarmCom Server Platform.
Farmer	Primary user of the system, e.g. farm's owner or farm's worker.
farmId	Unique, human readable, farm identifier.
farm uid	Unique farm identifier.
Loadbalancer	Sub-component inside FarmCom Server Platform which is responsible for navigating incoming requests to delegator and managing which FarmCom Server a FarmCom Gateway should connect to.
serviceId	Unique, human readable, service identifier.
service uid	Unique service identifier.
Kept-alive connection	A type of connection, which allows to send and receive multiple requests through the same communication channel, instead of opening a new connection for every single request/response.
Cloud platform	A network of servers providing multiple remote services to the user such as possibility to deploy your app, security services, etc.
Azure platform	Microsoft cloud platform provider

B.1 Introduction

This paper is based on the hand-in 6 in the TISPIT course. The paper is a requirement specification made in cooperation with Mjølner Informatics A/S [10]. The specification will be based on the SL-07 template made by Søren Lauesen, DTU [16]. This paper will start with a description of the elicitation process, followed by the background and high level demands, which will provide all necessary background information and purpose of the system. Afterwards functional requirements will be described as task descriptions, along with a description of data to be stored in the system. Technical IT-architecture will be presented, and non-functional requirement will be stated, divided into different categories.

B.2 Elicitation process

At first, the project timeplan was created. The group defined the dates for meetings with the customer, and deadlines for deliveries.

The elicitation process were made by three meetings with Torben Frost-Thorsen from Mjølner. Each one has lasted one hour. The meetings were split into three topics:

1. Initial meeting - including goal and domain level requirements. Furthermore we did a stakeholder analysis and discussed the timeframe for this project along with a matching of expectations.
2. Second meeting - including review of the first document draft, and discussion on new requirements. Product and design level requirements were discussed.
3. Last meeting - including a review of the whole SRS, and final comments from the customer.

The time plan for the project can be found in appendix A on page 18.

During the periods between the meetings, the group has been working on the SRS, so it was continuously improved, and kept up to date.

All deliverables have been submitted to Torben 48 hours in advance of our meetings, so that the customer had a chance to acknowledge with the document, and prepare for the upcoming meeting.

B.3 Acknowledgements

In cohesion with Mjølner it is agreed that the customer will be anonymous (named CC from now on), and the product name will be a made up name: FarmCom, in respect to the real customer.

The group would like to thank Torben and Mjølner for a good cooperation and dialogue throughout the process.

B.4 Background and Supplier Guide

B.4.1 Background and vision

FarmCom is a solution designed to extend an existing, currently functioning system, that enables farmers to access a series of services such as a surveillance of their animals, or monitoring farm information such as a temperature, or a number of animals of particular species. These functionalities are now currently available only inside the farm's internal network. This means that the farmer is able to use farm's services as long as he is connected to the farm's internal network. This is shown in fig. 3 on the next page

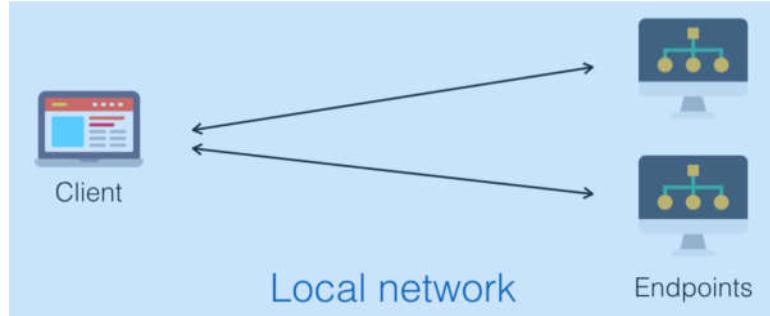


Figure 3: The current system

However, there is a need for enabling the access to all the services from external networks. Wherefore, the customer expects that the supplier will deliver a COTS system that extends the functionality of existing system and enables the access to the services outside of the farm. Simplified, the overall purpose of the system is to forward a HTTP request from the user's browser all the way to the specific farm's endpoint and return the response back to the browser.

The theoretical solution to this issue might be to just open the port, which enables access to needed services to the outside world, but the CC does not like this solution because it would require massive amount of manual settings on every single farm, and it would be hard to maintain, and control in the future.

As a result, the conceptual model of the solution has been created.

The FarmCom system will be divided into two main components:

- FarmCom Gateway - Hardware infrastructure deployed on every farm's internal network, with suitable software installed. The FarmCom Gateway, being inside the internal network will have access to all of the internal services (endpoints) and will forward this access to external entities through programmatic interface. The responsibility of the FarmCom Gateway is to connect to the FarmCom Server and keep the connection alive.
- FarmCom System - As a second component of the system there will be external server provided. The server will be responsible for managing persistent data, and monitoring of FarmCom Gateways states. It will be able to communicate with the FarmCom Gateways through programmatic interface, with use of the previously established, kept alive connection.

The implementation of the system is shown in fig. 4 on the following page.

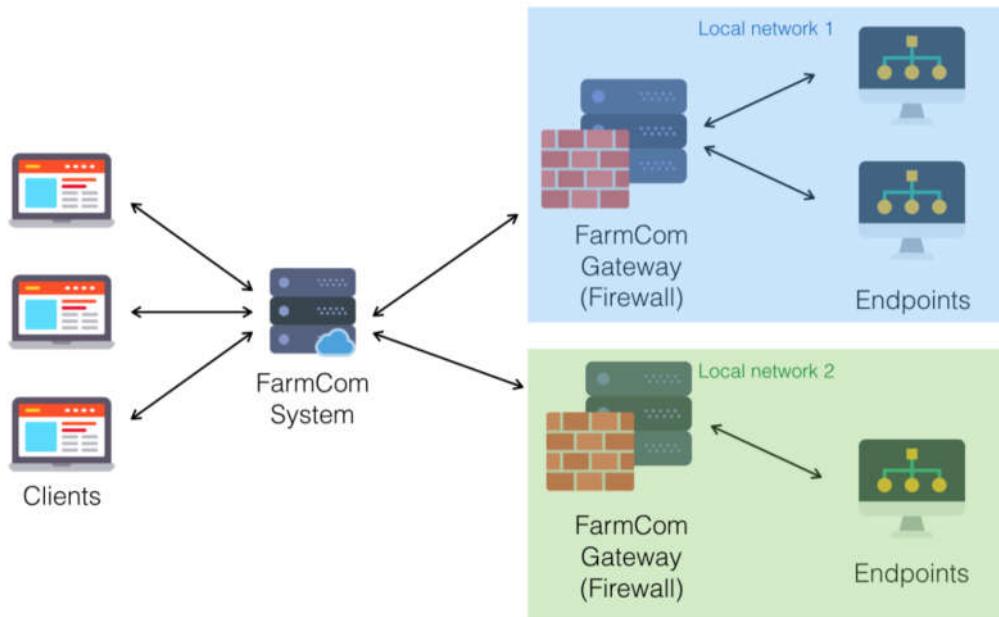


Figure 4: The new system

B.4.2 Supplier guide

The document is divided into multiple chapters. Each chapter refers to a specific type of requirements, and all the requirement regarding this type are presented in the this chapter.

B.4.2.1 Requirement prioritisation

All requirements in this document are considered high priority by the costumer, unless otherwise stated. High priority requirements are expected to be fulfilled in the final delivery. Low priority requirements are labelled with "[Low priority]", and they may be delivered with further system's extensions.

B.4.2.2 Reading guide

Throughout the document, two different methods of requirements specification are being used.

Non-functional requirements are specified in the standard form providing requirement unique identifier, and requirement detailed description.

Functional requirements are specified in the form of the 'Task Description' tables. The table comprises of 3 columns:

- No. - Defining the normal order of tasks execution
- Subtasks and variants - Describing customer demand
- Example solution

B.5 High-level demands

This chapter will specify the business goals and how they're met through the requirements.

B.5.1 Business goals

The business goals are stated in the table, where for each goal there is stated the stakeholder and how the proposed solution is supposed to be established. Furthermore the related requirements are stated, with the unique id from this document, and the deadline to fulfil the goal. All the business goals are stated in table 13

Goal	Stakeholder	Large scale solution	Related requirements	require- ments	Deadline
Keep good relationship with the customer (CC)	Mjølner	Deliver a product that meets Mjølner's standards and customer requirements.	Comply all requirements in this document	-	-
Allow farmers to access data outside their farm	CC	Deliver a solution that provides access to the existing system outside of the local network	Comply all requirements in this document	-	-

Table 13
Business Goals

B.5.2 Early proof of concept

This section is written to clarify the high-risk areas in the process, so Mjølner and the CC will be able to align expectations in the project's initial phase.

High-risk areas for early proof of concept	Example of proof
The user experience should be the same as the system without FarmCom (Installation and UI)	A prototype of the FarmCom implemented so the user can use the current system, but also outside the farm.
Fair response times (all requirements in appendix B.13 on page 48)	Setup a test environment to simulate the implemented system.
Abstract installation	Installation with no requirements for a specific router on the local network.

Table 14
Example of proof

B.5.3 Selection criteria

This solution will be chosen by the customer if the following criterias are met:

1. The solution provides business values (based on the business goals, appendix B.5.1 on page 25)
2. The risk. Based on time needed to create the proof of concept, appendix B.5.2 on page 25.
3. Delivery time.
4. The price. Including new equipment, services and data storage.

B.6 Initial requirements

To be able to understand the tasks the system needs to perform some requirements need to be defined in advance. In this chapter there will be provided requirements relevant for further system's description.

B.6.1 URL-pattern

Req. Id	Requirement
URL-1	<p>The URL pattern enabling user to access the services from an external network shall be structured as follows:</p> <p>{farmName}-{serviceName}.{systemDomain}.com,</p> <p>where:</p> <p>{farmName} - unique farm identifier</p> <p>{serviceName} - unique, in regard to every farm's internal networks services set, service identifier</p> <p>{systemDomain} - defined by CC's web domain</p>

Table 15
URL-Pattern requirements

B.6.2 Farm uid and id

Single server platform shall be used to cooperate with multiple, independent farms. As a result, the solution to distinguish different farms is needed.

Req. Id	Requirement
FR-1	Every farm shall have an unique identifier (uid), enabling unique distinction of the farm.
FR-2	Every farm shall have an unique human readable farmId, directly related to the uid, used as a farmName URL element (related to URL-1).

Table 16
Farm-id requirements

The unique identifier from FR-1, will in this paper be referred to as **farm uid**. The farm id from FR-2, also used as the farm name in the URL, will in this paper be referred to as **farmId**.

B.6.3 Service endpoints id and uid

Every farm can have registered multiple services, which shall be unique in terms of specific farm.

Req. Id	Requirement
SER-1	Every service endpoint shall have unique identifier (uid), enabling unique distinction of the service on the farm internal network.
SER-2	Every service endpoint shall have unique, in terms of specific farm internal network, human readable serviceId, directly related to the uid, used as a serviceName URL element.

Table 17
Service-id requirements

The unique service identifier from SER-1 will in this paper be referred to as **service uid**. The service id in SER-2, will in this paper be referred to as **serviceId**.

B.7 Tasks to support

This chapter specifies all user tasks to be supported by the system. Each task is divided into subtasks. Subtasks are optional, and numbered for traceability purposes, but do not have to be carried out in the given sequence. A subtask can also be repeated during the same task.

B.7.1 Work area 1: Farm access

This work area comprises the following tasks: Establishing connection between the FarmCom Gateways and FarmCom Server, and accessing farm network outside of the local network.

User profile: Farmer, Wants to get access to the farm's data from outside the local network.

Environment: Outside the local farm network, with access to the Internet.

FA-1: Establish connection between FarmCom Gateways and FarmCom Server

The task describes establishment of connection between FarmCom Gateway and FarmCom Server.

Start: When FarmCom Gateway is turned on and connected to the Internet.

End: When FarmCom Gateway is turned off.

Users: None

No.	Subtasks and variants	Example solutions
1	FarmCom Gateway establishes kept-alive connection to FarmCom Server, providing its farm uid, and farmId.	FarmCom Gateway sends initial request to establish connection with the FarmCom Server.
1p	Problem: FarmCom Server is turned off.	FarmCom Gateway retries to establish connection to the FarmCom Server every 5 seconds as described in Subtask 1.
2a	FarmCom Server does not recognise provided uid.	
2a.1	Provided farmId is available.	FarmCom Server registers the farm with provided data.
2a.p	Problem: Provided farmId is already used in the system by another farm.	The connection is rejected with suitable error message.
2b	FarmCom Server recognises provided farm uid.	FarmCom Gateway keeps the same farm name as before.
2b.1	Provided farmId matches provided farm uid.	FarmCom Server accepts the connection.
2b.1.1	Provided farmId does not match provided uid.	
2b.1.p	Problem: Provided farmId is already used by another farm.	FarmCom Server rejects the connection with suitable error message.
2b.2	Provided farmId is available.	FarmCom Server changes farmId associated with provided uid.

3	FarmCom Server accepts the connection with the FarmCom Gateway.	
3p	Problem: Connection to FarmCom Server lost.	FarmCom Gateways retry to establish connection to another instance of the FarmCom Server after 5 seconds.
3q	Problem: FarmCom Server gets overloaded.	The new instance of the FarmCom Server is brought to life, and the connection is redirected to new instance [Low priority].
4	FarmCom Gateway sends information about running services to the FarmCom Server	
5	FarmCom Server registers information about running services	FarmCom Server stores information about running services in cache memory.
6	FarmCom Gateway and FarmCom Server establish a kept-alive connection for each of the enabled services.	FarmCom Server sends instruction to the FarmCom Gateway for establishing communication channel for every service
7	Redistribution of workload on FarmCom Servers.	During the night, all the FarmCom Gateways reconnect (subtask 1) to the FarmCom Server, which results in redistribution of the workload on each FarmCom Server [Low priority].

Table 18
Establish connection between FarmCom Gateways and FarmCom Server.

FA-2: Accessing farm network from outside the local network

This task describes how a farmer accesses services from outside the local network.

Start: Farmer wants to get access to services from outside the local network.

End: Farmer have finished using the services.

Users: Farmer

No.	Subtasks and variants	Example solutions
1	Request of a service on a local farm through the web browser from external network.	Opens a browser and types URL in the form of URL-form as defined in requirement URL-1.
2	LoadBalancer redirects request to specific FarmCom System.	
3	FarmCom System checks in memory registry to which FarmCom Server instance the farm with provided farmId is connected.	
3p	Problem: Specified Farm name does not exist.	Error message is displayed to the user.
4	FarmCom System redirects the request to specific instance of the FarmCom Server	
5	FarmCom Server redirects request to FarmCom Gateway	Based on farmId and uid FarmCom Server determines FarmCom Gateway IP address and forwards the request.
6	FarmCom Gateway calls the specified endpoint inside farm's internal network.	-
6p	Problem: Service is temporarily unavailable on the local network.	Error message is displayed to the user.
7	FarmCom Gateway returns response to the FarmCom Server.	-
8	FarmCom Server return response to the user's web browser.	Response is shown in the farmers browser. -

Table 19
Accessing farm network from outside the local network

B.7.2 Work area 2: Farm administration

This work area comprises the following tasks: registering new services, removing currently registered service, changing farmId, changing serviceId and changing connected server instance.

User profile: Farmer, Wants to add, remove or rename service on the local network.

Environment: Local farm network.

FAd-1: Registrering new services

The system provides access to services inside farms local network. The customer expects the system to enable the farmer with possibility to add new services to his own network, which should be accessible via. the system.

Start: Farmer have a new service which should be added to the system.

End: Service is added to the system.

Users: Farmer

No.	Subtasks and variants	Example solutions
1	Adding a new service to the local network.	-
2	The local IP-address of the service is registered to the FarmCom Gateway and provides it with a serviceId.	The serviceId and local service IP-address is stored in FarmCom Gateway's local database in relation to a generated uid.
2p	ServiceId is already registered to another service.	Error message is shown to the user.
3	FarmCom Gateway notifies FarmCom Server about a newly added service.	FarmCom Server saves information about the new service in its memory.
4	New kept-alive connection is established between FarmCom Server and FarmCom Gateway reserved for data exchange with the new service	FarmCom Server unstructs the Gateway how to open the connection for new service.

Table 20
Registrering new services

FAd-2: Removing currently registered service

The customer expects the system to enable the farmer to remove a currently existing service from his own local network.

Start: Farmer wants to remove a service from the local network.

End: Service is removed.

Users: Farmer

No.	Subtasks and variants	Example solutions
1	Remove a service from the local network.	-
2	The FarmCom Gateway deletes the service from its memory.	-
2p	Problem: The service could not be found by FarmCom Gateway.	Error message is shown to user.
3	The FarmCom Gateway notifies the FarmCom Server about the removed service.	-
4	The FarmCom Server closes the connection and removes the service information from internal memory.	-

Table 21
Removing currently registered service

FAd-3: Changing serviceId

The customer expects the system to enable the farmer to rename a currently existing service on his own local network.

Start: Farmer wants to change a serviceId from the local network.

End: Service name is changed.

Users: Farmer

No.	Subtasks and variants	Example solutions
1	ServiceId is changed on the local network.	-
2	The FarmCom Gateway changes the serviceId to the name provided by farmer.	-
2p	Problem: ServiceId already exist.	Error message is shown to the user.
2q	Problem: The service could not be found by FarmCom Gateway.	Error message is shown to the user.
3	The FarmCom Gateway notifies FarmCom Server that the serviceId has changed.	FarmCom Server updates serviceId in memory.

Table 22
Changing serviceId

FAd-4: Changing farmId

The customer expects the system to enable the farmer to rename farmId while FarmCom Gateway is connected to FarmCom Server.

Start: Farmer wants to change the farmId while FarmCom Gateway is connected to FarmCom Server.

End: FarmId has been changed.

Users: Farmer

No.	Subtasks and variants	Example solutions
1	FarmId is changed on the FarmCom Gateway.	-
2	The FarmCom Gateway notifies FarmCom Server about the change of farmId.	-
2p	Provided farmId is already used by another farm.	An error message is shown.
3	The FarmCom Server updates farmId in local memory.	-
4	The FarmCom Server notified the FarmCom Gateway about successful farmId update.	-
5	FarmId is changed in the FarmCom Gateway local database.	-

Table 23
Changing farmId

FAd-5: Changing connected server platform instance

There may exist multiple, independent FarmCom Server Platform instances with different IP addresses. The system shall enable farmer to determine to which FarmCom Server Platform instance the farm should connect, while system running.

The customer expects the system to enable the farmer to change the FarmCom Server Platform instance during system's operation.

Start: Farmer wants to change a destined FarmCom Server Platform instance from the local network.

End: Server platform to which the farm is connected is changed.

Users: Farmer

No.	Subtasks and variants	Example solutions
1	The IP address of the destined FarmCom Server Platform instance, is changed.	-
2	The FarmCom Gateway closes the connection with the current FarmCom Server Platform instance.	-
3	The current FarmCom Server Platform removes the service data associated with the farm.	-
4	The FarmCom Gateway establishes connection with new FarmCom Server Platform instance as described in B.7.1	-
4p	The FarmCom Server Platform has not been found under the provided IP address	The error message is shown to the user

Table 24
Changing FarmCom Server Platform instance

The below task descriptions describe how the farmer can enable and disable specific services to manage interdependently the accessibility to different services. Furthermore the farmer should be able to enable/disable the connection between the FarmCom Gateway and the FarmCom Server.

FAd-6: Disable service

The farmer wants to disable service being accessible from outside the local network.

Start: Farmer wants to disable a service.

End: Service is disabled

Users: Farmer

No.	Subtasks and variants	Example solutions
1	Disable service on the local network.	-
2	The FarmCom Gateway registers the service being disabled.	A "flag" is set in the local database of the FarmCom Gateway.
3	The FarmCom Gateway notifies FarmCom Server that the service is disabled and closes the kept-alive connection.	The FarmCom Server removes the service from local memory.

Table 25
Disable service

FAd-7: Enable service

The farmer wants to enable a service to be accessible from outside the local network.

Start: Farmer wants to enable a service.

End: Service is enabled

Users: Farmer

No.	Subtasks and variants	Example solutions
1	The service is enabled on the local network.	-
2	The FarmCom Gateway registers the service being enabled.	A "flag" is set in the local database of the FarmCom Gateway.
3	The FarmCom Gateway notifies FarmCom Server that the service is enabled and opens a new kept-alive connection.	The FarmCom Server adds the service to local memory.

Table 26
Enable service

FAd-8: Disable connection to FarmCom Server

The farmer wants to disable the connection from the FarmCom Gateway to the FarmCom Server.

Start: Farmer wants to disable the connection to the FarmCom Server.

End: Connection is disabled

Users: Farmer

No.	Subtasks and variants	Example solutions
1	The connection to FarmCom Server is disabled on the local network.	-
2	The FarmCom Gateway registers the disablement.	A "flag" is set in the local database of the FarmCom Gateway.
3	The FarmCom Gateway notifies FarmCom Server that the connection is disabled.	The FarmCom Server disconnects from the FarmCom Gateway, and all enabled services in the FarmCom Gateway are removed from FarmCom Server's local memory.

Table 27
Disable connection to FarmCom Server

FAd-9: Enable connection to FarmCom Server

The farmer wants to enable the connection from the FarmCom Gateway to the FarmCom Server.

Start: Farmer wants to enable the connection to the FarmCom Server.

End: Connection is enabled and open.

Users: Farmer

No.	Subtasks and variants	Example solutions
1	The connection to the FarmCom Server on the local network is enabled.	-
2	The FarmCom Gateway enables the connection.	A "flag" is set in the local database of the FarmCom Gateway.
3	The FarmCom Gateway opens a new kept-alive connection to the FarmCom Server.	The FarmCom Server adds the connection to local memory.
4	FarmCom Gateway sends information about running services to the FarmCom Server	
5	FarmCom Server registers information about running services	FarmCom Server stores information about running services in cache memory.
6	FarmCom Gateway and FarmCom Server establish a kept-alive connection for each of the enabled services.	FarmCom Server sends instruction to the FarmCom Gateway for establishing communication channel for every service

Table 28
Enable connection to FarmCom Server

B.8 Data to record

This chapter describes which data shall be recorded by the system. There are multiple memory structures used for storage of the different types of data.

Note: this chapter specifies the minimum required data to be stored. Additional data is allowed to be stored.

B.8.1 FarmCom Gateway data storage

The FarmCom Gateway shall hold information about:

No.	Fields and relationships	Example solution
1	Farm uid: The FarmCom Gateway shall store information about its unique identifier (uid).	-
2	Farm id: The FarmCom Gateway shall store information about its unique farmId.	-
3	IP-Address: The FarmCom Gateway shall store information about the FarmCom Server Platform IP address.	-
4	Services: The FarmCom Gateway shall store information about registered services.	-
4.1	Services: The FarmCom Gateway shall store information about registered services unique id (uid).	-
4.2	Services: The FarmCom Gateway shall store information about registered services serviceId.	-
4.3	Services: Endpoint: The FarmCom Gateway shall store information about registered services endpoint address.	-
4.4	Services: Enabled: The FarmCom Gateway shall store information about whether the service is enabled or disabled.	-
5	Enabled: The FarmCom Gateway shall store information whether the FarmCom Gateway should be accessible from outside the local network.	-

Table 29
FarmCom Gateway data storage

B.8.2 FarmCom Server data storage

The FarmCom Server shall fulfil the following requirements.

Req. Id	Requirement
DTR-1	The FarmCom Server data storage shall be divided into two separate data structures
DTR-1.1	The FarmCom Server shall provide persistent data structure in the form of database.
DTR-1.2	The FarmCom Server shall provide common information for every FarmCom Server instance cache memory data structure, shared between all instances.

Table 30
FarmCom Server data storage

The FarmCom Server shall store information about:

No.	Fields and relationships	Example solution
1	Farm uid: The FarmCom Server shall store registered farm uid in persistent data structure.	-
2	FarmId: The FarmCom Server shall store registered farmId in persistent data structure.	-
3	Relationship between FarmCom Server instance, and connected farmId: The FarmCom Server shall store information about which farm is connected to which specific FarmCom Server instance in the cache memory data structure.	-
4	ServiceIds: The FarmCom Server shall store information about enabled services in the FarmCom Gateways.	-

Table 31
FarmCom Server data storage

B.9 Other functional requirements

This chapter specifies other functional requirements which are not stated in Chapter B.7.

B.9.0.1 Monitoring

The task description below shows the example usage of the monitoring system.

Monitoring

In order to provide easy support in case of the problems with operation of the system it is prominent to deliver reliable monitoring system. The system should provide statistical, and support data.

Start: Farmer encounters a problem with the system.

End: The support provided the farmer with the solution to the problem.

Users: Farmer, Support team

No.	Monitoring requirements	Example solutions
1	A problem with the system is encountered.	The telephone, or email support center is provided to the customer.
2	Event is registered, and all the necessary information about the problem: - type of problem - date of occurrence - farmid	-
3	The event is checked by farmId or unique farm id the connection between the farm, and the FarmCom Server.	-
4	Workload of specific instance of the FarmCom Server, to which the farm is connected is checked	-
5	Login into the monitoring system.	-
6	Check the workload of specific FarmCom Gateway.	-
7	The connection between different components of the system (for specific components description see section B.10.2): - Load Balancer - Delegator - Delegator - FarmCom Server - FarmCom Server - FarmCom Gateway - FarmCom Gateway - Service endpoint - Service endpoint - FarmCom Gateway - FarmCom Gateway - FarmCom Server - FarmCom Server - Web Browser	-
8	Identify problem.	Support person provides the solution to the farmer.

8p	Problem could not be identified.	Support person redirects the issue to the developer according to description in appendix B.9.0.2 on page 44
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Table 32
Monitoring

The monitoring system provides two support views, showing statistical data concerning the use of the system from two different perspectives:

- From the perspective of the farm (FarmCom Gateway),
- From the perspective of the FarmCom Server

For specific components description see section B.10.2.

Monitoring - farm view - MFV

No.	Monitoring requirements	Example solution
1	The monitoring system should provide following information:	-
1.1	How many services are currently running on specific farm.	-
1.2	How long have the currently running services been connected to the FarmCom Server.	-
1.3	How many requests are made through specific FarmCom Gateway.	-
1.3.1	Per day.	-
1.3.2	Per hour.	-
1.4	How much data was transmitted through a specific FarmCom Gateway.	-

Table 33
Monitoring - farm view

Monitoring - server view - MSV

No.	Monitoring requirements	Example solution
1	The monitoring system should provide following information:	-
1.1	How many FarmCom Server instances are currently running.	-
1.2	How many FarmCom Gateways are connected to the whole platform, and to every instance of the FarmCom Server.	-
1.2	How long have the currently running FarmCom Server instances been running.	-
1.4	How many requests are made through specific instance of FarmCom Server.	-
1.4.1	Per day.	-
1.4.2	Per hour.	-
1.5	How much data was transmitted through a specific instance FarmCom Server.	-

Table 34
Monitoring - server view

Furthermore, the support team shall not only be able to view data with use of the monitoring system, but also be able to manage the system's properties such as registered farms.

Monitoring - other requirements - MON

No.	Monitoring requirements	Example solution
1	The monitoring system should be accessible from a web page by an authorised supporter.	-
2	The monitoring system shall enable deletion of specific farms data from the system.	-
2.1	farmId	-
2.2	farm uid	-

Table 35
Monitoring - other requirements

B.9.0.2 Logging

Logging

A logging mechanism is needed in order to trace errors and exceptions generated by the system. It shall serve as a second level of support after the monitoring functionality. The logs trace shall be accessible from the FarmCom Server, and should hold events generated by the FarmCom Server itself as well as for each connected FarmCom Gateway.

No.	Logging requirements	Example solutions
1	The logging system shall only be accessible for authenticated developers.	-
2	Logging should hold:	-
2.1	For every log entry: - FarmId - Farm uid - External farm IP address - Severity level - Type of entry (error, debug, info etc) - Timestamp	-
2.2	Any errors generated by the system including error message.	-
2.3	Any exceptions thrown by the system including stacktraces.	-
3	Log messages shall be possible to be filtered by: - FarmId - Farm uid - External farm IP address - Severity levels - Type of entry (error, debug, info etc) - Time period	-
4	Logging shall show request time between each of the following components (for specific components description see section B.10.2): - Delegator and the endpoint - Server and the endpoint - FarmCom Gateway and the endpoint	-

Table 36
Logging

B.10 Technical IT-architecture

The technical IT architecture of designed system can be viewed on fig. 5.

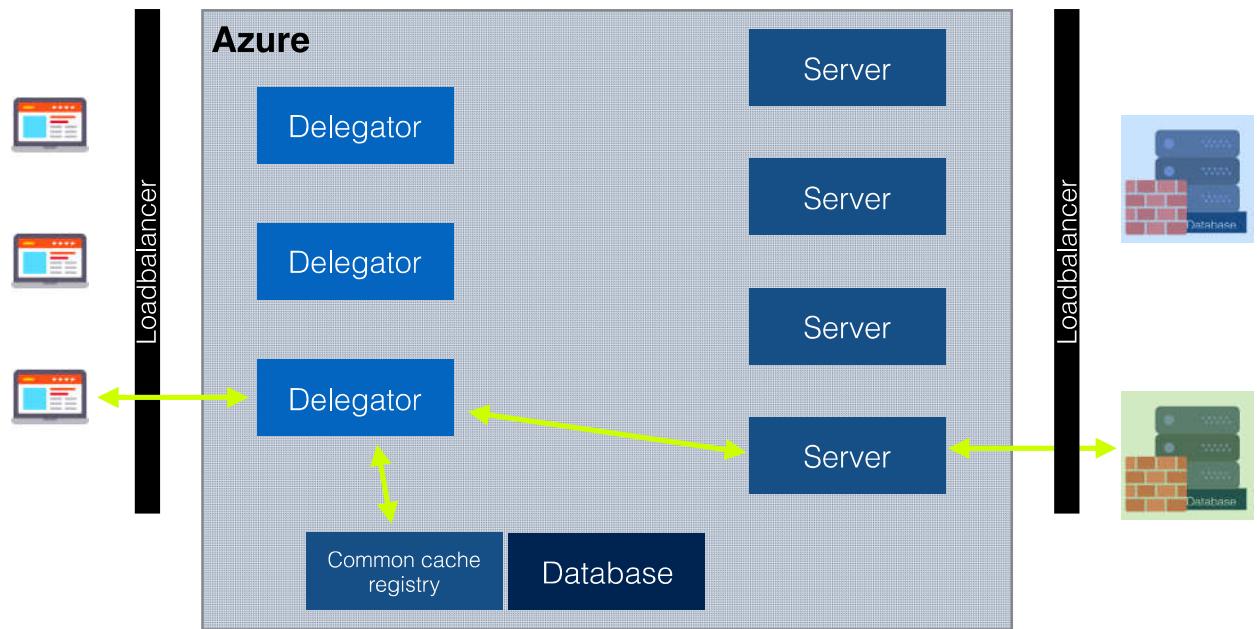


Figure 5: Technical architecture

The text description of the system's technical architecture will be provided in a way of describing the way of a request through the system.

The user's interaction with the system begins with use of a web browser by invoking desired service with URL, specifying the farm and the service. The request is then forwarded to the FarmCom Server on the Azure Platform. The whole platform is scalable, which means there may exist multiple instances of the FarmCom Server. Primarily, the request goes through the Loadbalancer which redirects the request to one of the Delegators, based on their traffic load. The delegators check which farm, the request refers to, and then finds out which instance of the FarmCom Server this specific farm is connected to. This is found in the common cache registry.

Then, the request is forwarded to this specific instance of the FarmCom Server. FarmCom Server verifies that the requested service is available on the farm, and based on the given farmId forwards the request to the FarmCom Gateway on farms internal network. The FarmCom Gateway invokes specific service, and returns the response to the FarmCom Server. There is also loadbalancer between the FarmCom Gateway and the FarmCom Server. This can be the same one as the one between the Web and the Delegators. It is used during establishing initial connection. The FarmCom Gateway sends the request for establishing connection, and then the loadbalancer redirects this request to one of multiple instances of the FarmCom Server based on their workload. There is persistent database common for all FarmCom Server instances. Moreover, every FarmCom Gateway has its own local database, where it stores for instance the address of the FarmCom Server Platform, or information about registered services.

B.10.1 Use of existing hardware and software

Existing system comprises of the FarmCom Server, which provides user with access to the services via HTTP/HTTPS communication protocol inside the farm's internal network. In addition to that there are mobile, and web client applications with user interfaces provided.

Therefore, FarmCom system shall not provide its own services or client applications, but enable user to access current ones outside of the internal network.

B.10.2 New hardware and software

Req. Id	Requirement
INF-1	The system shall provide following components:
INF-1.1	The FarmCom Gateway - component installed on farm's internal network responsible for establishing, and keeping alive the connection between the FarmCom Gateway and FarmCom Server, managing services, and playing role of middleware between the FarmCom Server and the specific service endpoint inside farm's internal network.
INF-1.2	FarmCom Gateway Local Database.
INF-1.3	FarmCom Server.
INF-1.4	FarmCom Delegator - component responsible for routing incoming connections to the correct FarmCom Server instance.
INF-1.5	LoadBalancer - component responsible for routing incoming connections to the specific FarmCom Delegator based on the overload of the system.
INF-1.6	FarmCom Server Database - used for storage of persistent data.
INF-1.7	FarmCom Server Cache Memory Registry - common for all FarmCom Server instances memory structure, used for storage of cache data.

Table 37
New hardware and software

B.11 Integration with external systems

The FarmCom system is supposed to enable access to the services available to the user, through the system currently provided inside the farm's internal network. Therefore, the integration with the farms internal services shall be provided.

Req. Id	Requirements
EI-1	The system shall provide the integration with the farms' current services through the programmatic interface between the FarmCom Gateway and internal services.
EI-2	The system shall store information which farm is connected to which FarmCom Server instance in FarmCom Server Cache Memory Registry.
EI-3	The FarmCom Server shall store information about running services in FarmCom Server Cache Memory Registry.

Table 38
Integration with external systems

B.12 Security

Req. Id	Requirement
SCR-1-1	To ensure secure transfer of data between FarmCom Server and FarmCom Gateway the encrypted transport protocol over TCP protocol shall be used.
SCR-1-2	The data transfer between the FarmCom Gateway and Internal Farm's endpoints shall be carried out with use of HTTP/HTTPS protocol.
SCR-1-3	To ensure secure transfer of data between web browser and FarmCom Server the HTTPS connection protocol shall be used.

Table 39
Security

B.13 Usability

Referring to the bibliography position [11] the ranges of modern system's response times are considered as follows:

1. **0.1** second is about the limit for having the user feel that the system is reacting instantaneously, meaning that no special feedback is necessary except to display the result.
2. **1.0** second is about the limit for the user's flow of thought to stay uninterrupted, even though the user will notice the delay. Normally, no special feedback is necessary during delays of more than 0.1 but less than 1.0 second, but the user does lose the feeling of operating directly on the data.
3. **10 seconds** is about the limit for keeping the user's attention focused on the dialogue. For longer delays, users will want to perform other tasks while waiting for the computer to finish, so they should be given feedback indicating when the computer expects to be done. Feedback during the delay is especially important if the response time is likely to be highly variable, since users will then not know what to expect [11].

Therefore, the following usability requirements have been defined:

Req. Id	Requirement
USR-1	The system response time measured, as the time since calling the service by the user till providing the user with the response shall be less than 1.0 second for every service.
USR-1.1	The time measured as the time since the FarmCom Server receives the call till it communicates with the FarmCom Gateway shall be less than 0.05 second.
USR-1.2	The time measured as the time since the FarmCom Gateway receives the response data from internal service until it provides the data to the FarmCom Server shall be less than 0.05 second.
USR-1.3	The time measured as the time since the FarmCom Server receives the response data from FarmCom Gateway until it provides the data to the user shall be less than 0.05 second.

Table 40
Usability requirements

B.14 Other requirements

Req. Id	Requirement
OR-1	The FarmCom Server shall be deployable on Microsoft Azure cloud platform.
OR-2	The FarmCom Server shall be designed to enable server scaling according to the network traffic.

Table 41
Other requirements

B.15 The customers deliverable

Req. Id	Requirement
DL-1	The programmatic script shall be provided enabling automatic system deployment and configuration on Azure [9] Platform.

Table 42
The customers deliverable

B.16 Operation, support and maintenance

Having provided the solution to the customer, it is also very prominent to provide system's support through the period of its operation. As a result the requirements regarding this issue have been defined.

Req. Id	Requirement
MR-1	The customer shall be provided with the 24/7 e-mail support contact system.
MR-2	The customer shall be able to purchase the concrete amount of the providers work force hours for the cost stated in MR-2.1.
MR-2.1	The cost of 1 working hour of software developer is 150\$.
MR-3	The customer shall be provided with the response confirming registration of the error, and approximate time needed for its solution during 48 hours since email report.
MR-4	All the high priority errors shall be resolved during 5 working days (only monday-friday included).
MR-5	All the low priority errors shall be resolved during 15 working days (only monday-friday included) since their registration.

Table 43
Operation, support and maintenance