



Case Request On-line

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B.Sc. Project

Bachelor of Science in Computer Science

December 2014



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B.Sc. Project of 12 ECTS credits submitted to the School of Computer Science
at Reykjavík University in partial fulfillment of
the requirements for the degree of
Bachelor of Science in Computer Science

December 2014

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Abstract

This report covers in detail a B.Sc. project at Reykjavík University in fall 2014. This project is conducted in a collaboration with a software company named Annata. Annata develops resource management solutions for various fields within the automotive industry. The goal of this project is to develop an extension for Annata IDMS, which allows individuals to book service appointments themselves on-line for their vehicle.

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1 Introduction

When the time comes to service or repair your car, wouldn't it be convenient to book an appointment on-line at a workshop instead of making a phone call at a given hour and to be put on hold waiting for your request to be handled?

This is what customers have to do, make a phone call to the workshop and arrange an appointment. Customers call in and explain the problem while an employee fills in the service request form manually. We propose a more comfortable way with a on-line fill in form for the customer to use. The customer can make his own reservation at any suitable hour and replaces an employee answering phone and scheduling time. This employee could be moved to other beneficial projects for customer services or other departments of the company. This on-line fill is presented as an excellent add-on to existing resource.

This report covers a project conducted in collaboration with Annata, a software company specializing in management solutions for importers, dealerships and manufacturing ². Annata's main product is Annata Dynamics IDMS (Importer Dealership Management Solution), from now on referred to as Annata IDMS. Annata IDMS offers an option to request servicing of vehicles and other devices and is performed through a form called Case Request. The software does not offer any solutions for creating such requests from an external source such as a website, desktop or mobile applications. This project is meant as an extension to Annata IDMS and provides a solution to this problem with a website as an external source. The name of the project is Case Request On-line. This is a B.Sc project in Computer Science at Reykjavík University in fall 2014.

This report will cover in detail the Case Request On-line solution. Background information about Annata and their main product as well as other components used in the project can be found in Section 2. The Case Request form in Annata IDMS will be introduced in Section 3 and the Case Request On-line solution in Section 4. The design and development of the system will be discussed in Section 5. The security of the system and suggested improvements are discussed in Section 6. Other suggested future work is discussed in Section 7. If the readers wants informations about project planning, risk assessment and project progress it can be found in separate reports (verkskipulag, áhættugreining and framvinduylit).

² <http://www.annata.is/Solutions/DMS/>

2 Background

In this section the history of Annata and its products will be briefly reviewed, along with background information about the main components of the IDMS system.

2.1 Annata

Annata is a software company founded in 2001, their main focus is on gathering expertise in Axapta which later became Microsoft Dynamics AX ³ (clarification and further discussions on Microsoft Dynamics AX can be found in Section 2.3). Annata has since its establishment been building their software solutions on the Dynamics AX platform. Annata is a multinational company with headquarters in Reykjavík, Iceland ⁴. The main focus at Annata is to deliver complete resource management solutions for importers, dealerships and manufacturing.

2.2 IDMS

The main product that Annata produces is Annata Dynamics IDMS (Importer Dealership Management Solution) which is an add-on for Microsoft Dynamics AX. The product combines all their solutions into a single software. Annata IDMS provides a wide range of solutions mainly for automotive, equipment, rent and fleet industries as well as for manufacturing ⁵ as can be seen in Figure 1.



Figure 1: Annata IDMS

³ <http://www.annata.is/About/Milestones/>

⁴ <http://www.annata.is/About/Worldwide/>

⁵ <http://www.annata.co.uk/About/Annata/>

2.3 Dynamic AX

Microsoft Dynamics AX is an enterprise resource management and planning solution software ⁶. The software is built on over 20 years of experience in business applications [2]. It was originally developed by the Danish company Damgaard Data under the name Axapta. In 2000 Damgaard merged with Navision A/S which was finally purchased in 2002 by Microsoft ⁷. After the acquisition by Microsoft Axapta became Microsoft Dynamics AX.

2.4 Azure

Azure is a collection of cloud based solutions offered by Microsoft ⁸. Among solutions offered is Azure Service Bus which is a communication scheme with authentication and is easily integrated to Microsoft products such as Dynamics AX. The Azure Service Bus is a subscription cloud based service which makes it adopted to networking system without additional infrastructure.

3 Case Request

Annata IDMS contains support for case management which keeps track of all requested and ongoing maintenance, services or repair of devices. Within the case management there is a request form for such services, namely Case Request. The Case Request form claims information about the customer and its device and the type of service requested. After the application the Case Request needs to be approved by a personnel which assigns an appointment and other resources. When all steps are fulfilled the Case Request becomes a specific real case and will be launched. The approval of a Case Request and later steps are not addressed in this project. The Case Request form can be seen in Figure 10.

⁶ <http://www.microsoft.com/en-us/dynamics/erp-ax-overview.aspx>

⁷ <http://www.damgaard.com/SitePages/History.aspx>

⁸ <http://azure.microsoft.com/en-us/>

Create case request (1)

Create case request

Contact information *

Request number: CR000260

Customer name: [text box]

Contact: [text box]

Telephone: [text box]

E-mail: [text box]

Service region: [dropdown]

Address: [text box]

Delivery address: [dropdown]

Other

Source: Service [dropdown]

Replacement device: ☐

Device information *

Registration number: [text box]

Model year: 0

Usage: [text box]

Location: [text box]

Brand number: [dropdown]

Class number: [dropdown]

Model number: [dropdown]

Description

Subject: [text box]

Comments: [text area]

Planning

Select	Type	Name	Estimated hours
<input type="checkbox"/>	BodyShop	Small body repairs	8,00
<input type="checkbox"/>	BrakeRepair	Brake Repair	2,00
<input type="checkbox"/>	Breakdown	Pre-Inspection due to a breakdown	4,00
<input type="checkbox"/>	Inspection	Service inspection	6,00
<input type="checkbox"/>	OilChange	Oil and filter change	0,50

Estimated hours: [text box]

Start: 08:00:00

End: [text box]

Replacement device: ☐

OK Cancel

Figure 2: Case Request in Annata IDMS

The Case Request form has four main sections of required information. First there is a request of general information about the customer and contact information. Annata IDMS has a global address book so a customer information can be automatically filled in if the customer has previously been inserted to the database.⁹ The customer can choose preferred service region and choose if he wants a replacement device or not. The second section is a collection of information about the device, registration number, device brand et cetera. In the third section the employee writes down customers information and wishes about the problem and desired service. The fourth and final section has a list of standard service types and estimated time for those services. The employee can fill in the customers preferred date of service.

The process of creating a Case Request using Annata IDMS is dependent on an employee to extract information from a client calling in.

⁹ For security reasons the global address book is not inserted to the Case Request On-line

4 Case Request On-line

The Case Request On-line solution essentially extends the Annata IDMS Case Request form explained in Section 3 to an external source. In this project the outside source is a website. The solution allows customers to create their own Case Request on-line when needed. This can be convenient for both the customer and the servicing company. The on-line solution contains all the input fields as in the original Case Request.

Benefits of the on-line form are for example resources from answering phones and manually creating Case Requests. For the customer there are also many benefits, the customer could have a breakdown in a region that he/her is not familiar with. The customer could that do a web search for a dealer of the device brand. If the dealer would be running the case request on-line solution the customer could choose the service region, specify the problem and desired service date.

4.1 Functionality

The functionality of the Case Request On-line solution is limited to the form in Annata IDMS. In the demonstration website the four sections of the form are split into separate pages. When the form has been successfully filled in the customer can submit the request and will receive confirmation that it has been successfully conducted. The on-line form and the four sections will now be further demonstrated.

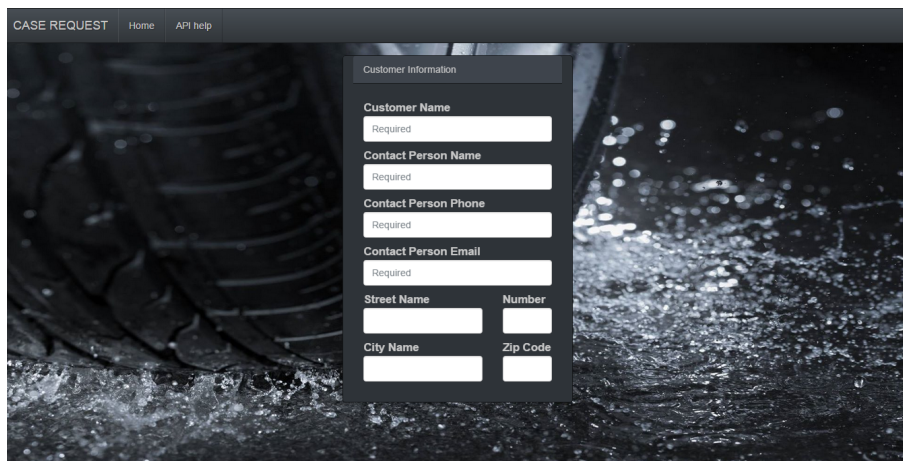
The image shows a web form titled "CASE REQUEST" with navigation links "Home" and "API help". The main section is "Customer Information". It contains several input fields, each with a "Required" label. The fields are: "Customer Name", "Contact Person Name", "Contact Person Phone", and "Contact Person Email". Below these are four smaller fields: "Street Name", "Number", "City Name", and "Zip Code". The form is set against a dark, abstract background.

Figure 3: Contact Information

The first section can be seen in Figure 3. This page gathers information about the customer, required fields are customers name, contact persons name, phone and e-mail ad-

dress and physical address. When all required fields have been filled an option to progress to the next page will appear.

CASE REQUEST Home API help

Device Information

Registration Number
Required

Brand

Class

Model

Model Year

Usage

Back

Figure 4: Device Information

The second section which can be seen in Figure 4 gathers information about the device which the customer desires to be serviced. Registration number, brand, class and model are all required fields in this form. Additional optional fields are model year and usage.

CASE REQUEST Home API help

Service Types

Select	Type	Name	Hours
<input type="checkbox"/>	BodyShop	Small body repairs	8
<input type="checkbox"/>	BrakeRepair	Brake Repair	2
<input type="checkbox"/>	Breakdown	Pre-Inspection due to a breakdown	4
<input type="checkbox"/>	Inspection	Service inspection	6
<input type="checkbox"/>	OilChange	Oil and filter change	0.5
<input type="checkbox"/>	TireChange	Tire change	0.5
<input type="checkbox"/>	Washing	Full vehicle cleaning	4

Estimated Hours

Back

Figure 5: Service Types

The third section can be seen in Figure 5. This page offers the customer to choose common services provided by the company from a list. When a certain service is chosen the form calculates the estimated hours of service. The customer is required to choose at least one option from the list to progress further.

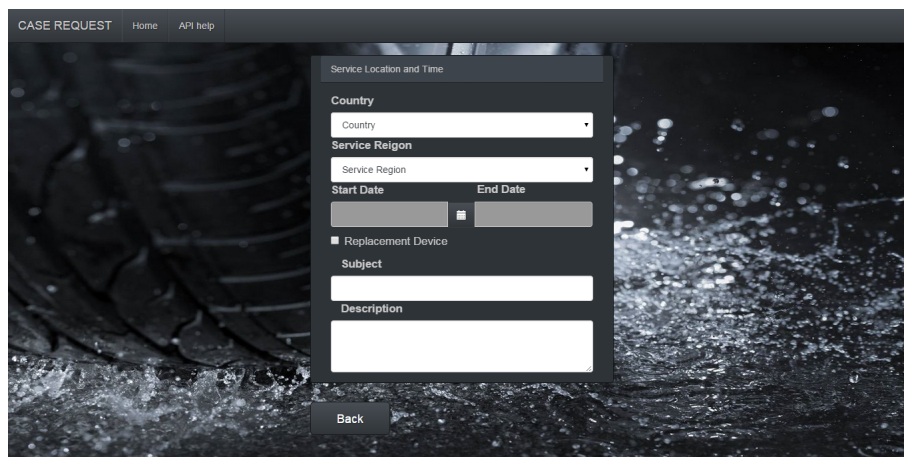
The screenshot shows a web application interface with a dark background featuring a tire tread. At the top, there is a navigation bar with the text 'CASE REQUEST' and links for 'Home' and 'API help'. A modal form titled 'Service Location and Time' is displayed in the center. The form contains several input fields: a 'Country' dropdown menu, a 'Service Region' dropdown menu, 'Start Date' and 'End Date' date pickers, a checkbox labeled 'Replacement Device', a 'Subject' text input field, and a 'Description' text area. A 'Back' button is located at the bottom of the form.

Figure 6: Service Location and Time

The fourth and last section can be seen in Figure 6. Here the customer chooses preferred service region. The customer can also choose a desired date of service as well as whether he wants a replacement device. There is a field which the customer can write a further description of the problem and favoured services. The required field is the service region, other fields are optional. A submission button appears when the form has been filled.

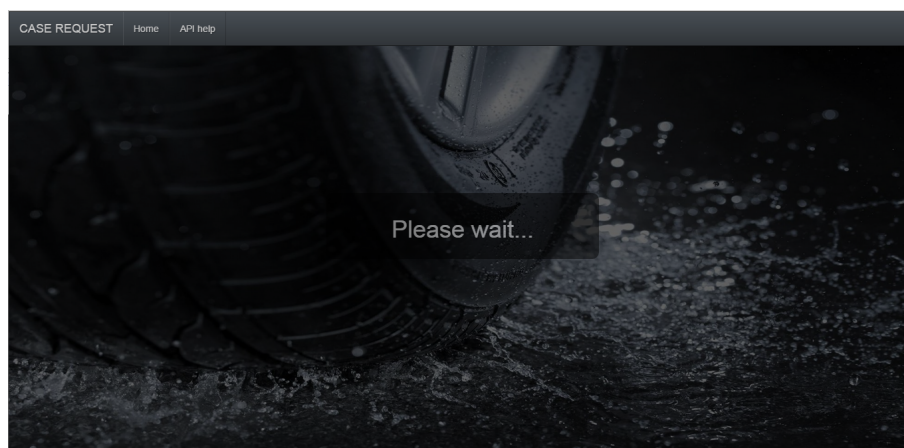


Figure 7: Processing Request

After the customer has submitted the request the form will be posted to the companies servers and the customer asked to wait as shown in Figure 7.

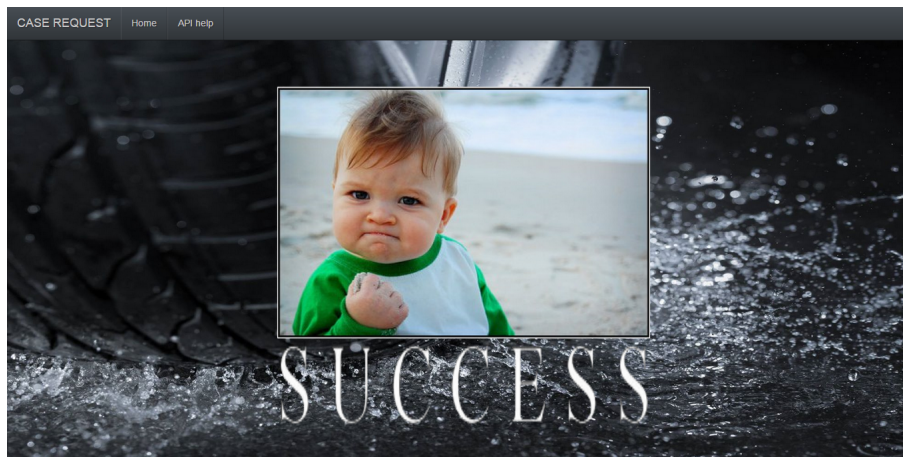


Figure 8: Submission Confirmed

When the form has been successfully submitted the customer will get a confirmation that his request was received and he will be contacted when the request has been processed.

5 Design and Development

One of the challenges in this project was to find a way to extend the Case Request form to a outside source. Our solution is to use Microsoft Azure Service Bus. The service bus provides secure end to end communication. To enable outside operations in Annata IDMS Case Request custom services are used. Those services are registered as inbound ports in Annata IDMS allowing only the service bus to utilize those services. On the outside of Annata IDMS a MVC.NET API is used to communicate with the service bus and encapsulate the functionality.

5.1 Project Planning

The agile software development framework Scrum was used to plan and manage the project Case Request On-line. The estimated time for the project was 740 hours which ended up being 733. For further informations about project planning, risk assessment and project progress refer to the separate reports (verkskipulag, áhættugreining and framvinduylit).

5.2 Overview architecture

The top level architecture of the system can be seen in Figure 9. The customer can use any web enabled device such as a personal computer and enter a website that offers the Case Request On-line solution. The website utilizes the Case Request On-line API which is connected to the Annata IDMS services using the Azure Service Bus. The services enable the website to read and write information to Annata IDMS server.

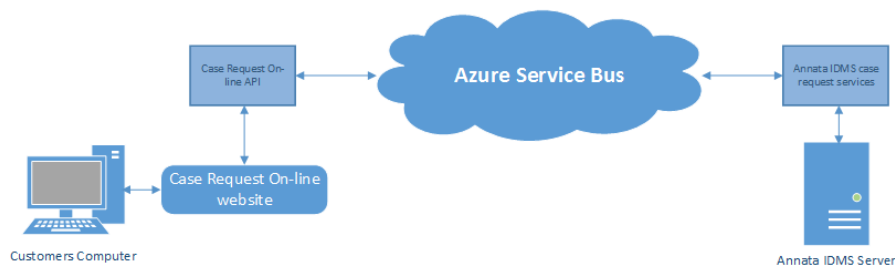


Figure 9: Top level architecture

5.3 Programming languages and developing environments

To be able to extend the Case Request form to an on-line source, custom services are made in Annata IDMS. Custom AX development is done with the MorphX IDE and the programming language X++. The API which utilizes the service are written in C#. The demonstration website is written in HTML and jQuery. Both the web server and the website are developed in Visual Studio. Source control for the code is managed using Microsoft Team Foundation Server.

5.4 Annata IDMS Services

The system needs to allow a trusted outside source to read and write information to the Annata IDMS server. This is done by creating Dynamics AX services. The first step is to create an entity class. Entity classes declare the data members which will be accessible by the service. The service gets a data attribute which gives the service an external name. The entity class also has get and set methods for all the variables as well as specifying which field and which table in Annata IDMS the data member belongs to. A service class is then created and linked to the entity class. The service class contains methods to manipulate the variables declared in the entity class. In this project the most common methods were database queries and creation of new table entries.

5.5 Communication

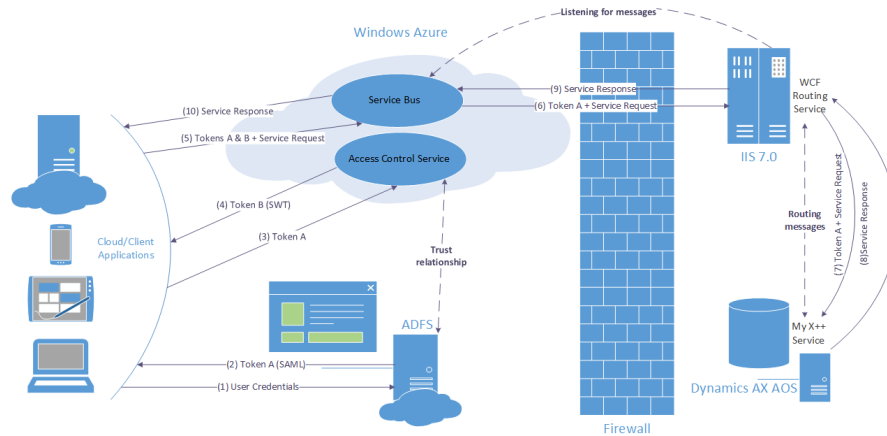


Figure 10: Microsoft Azure Service Bus [1]

As previously mentioned the communication scheme used in the project is Microsoft Azure Service Bus. Figure 10 shows how the service bus enables client applications to communicate with Dynamics AX server behind a firewall.

1. When a customer enters the client website it sends information to the ADSF (Active Directory Federation Services) server to confirm that this user is trusted.
2. ADFS server sends a SAML (Security Assertion Markup Language) token to the client. The client can use the token to verify that it is a trusted user.
3. The website sends the SAML token to ACS (Access Control Service) in the Microsoft Azure cloud. There is a trust relationship between the ADFS server and the access control in Azure Service Bus.
4. If the token is valid, the access control in the service bus sends the client a SWT token (Simple Web Token).
5. Now the client sends both the SAML and SWT tokens to initialize secure connection with the Microsoft Azure Service Bus. The client also sends a service request.
6. The Windows Azure Service Bus can now send the SAML token and the service request from the client to the WCF (Windows Communication Foundation) routing service through the company firewall. The WCF has been listening for requests from the Microsoft Azure Service (WCF server are usually placed within a companies server mainframe).

7. WCF routing service can now forward the service request and SAML token to the Dynamics AX server.
8. Microsoft Dynamics AX sends a response to the service request back to the WCF routing service.
9. WCF routing service forwards the response through the firewall to the Microsoft Azure Service bus.
10. The Microsoft Azure Service Bus then forwards the response to the client.

5.6 Service API

The API protocol handles requests from the web page by sending JSON (JavaScript Object Notation) or XML (EXtensible Markup Language) to and from the web server. In Case Request On-line are used JSON to send message between the client and the server. The reason that JSON is chosen over XML is because it has lower overhead and therefore contains smaller message going over the wire and is more cost-efficient. The reason API is chosen to handle the request is because it makes the web server more versatile and supports more applications than only this web page.

6 Security

The purpose of Case Request On-line is to simplify customers process of booking a service appointment for a device. No authentication is needed in convenience for the customer, not having to log in to the web page with a user name and password. The demonstration website uses a global authentication token and should for safety reasons not be deployed as it is. The Case Request On-line is meant to be adopted by some pre-existing system, at which point security concerns need to be addressed and this section will discuss these security issues and possible solutions.

6.1 User Authentication

The first issue that comes to mind is that the customer is never authenticated. That means that anyone could enter the website and make bogus request. Even on a small scale such fake requests are harmful to companies, both time and effort is used to process these. This can also be problem in the traditional way that someone calls in a fake request.

6.2 Denial of Service (DoS)

DoS attacks are done by flooding servers with bogus request. This can be done by writing a software which sends thousands of requests each second and from many computers simultaneously. There is no way to protect the web server from DoS attacks since there is no way for the web server to distinguish between actual client request or a fake one. From the server point of view, there may be many actual clients sending requests at the same time. Since the server will treat every request as a real one it quickly allocates all its resources preventing it from providing further services. In the Case Request On-line system there is no way to distinguish between real or fake requests.

6.3 Possible Solutions

The demonstration website in the Case Request On-line is not the ideal way of using the system, it is a proof of concept. Ideally a company would embed the solution to a pre-existing system and introduce a login for the Case Request form. This would help authenticating the customer. The website should also track how many submissions are sent from a particular IP-address in a given time interval. By limiting the submissions of a IP-address the website can help prevent DoS attacks.

7 Future Work

The basic operation for Case Request On-line has been completed. It is extremely important that the correct security measures are enforced when the solution is adopted. There are also some functionality which might be beneficial to add to the system in future iterations, most noticeably localization. Annata IDMS is used all around the world and does indeed have localization options. Localization in Case Request On-line was originally part of the project scope but due to insufficient time it was delayed to later versions. Annata IDMS has a label services which is most likely the best way to solve the localization issue. This was partially implemented in the project but was left out of the final product due to its unfinished state.

The Case Request On-line is meant to be easily integrated into pre-existing solutions of companies using Annata IDMS. This was done by implementing an API for Case Request On-line. The services needed to uses the API could be automatically included in future versions of Annata IDMS. This makes it easier for developer to utilize the solution. To

make integration even simpler a standard website with an admin panel allowing administrators to easily change the layout and style of the site as well as uploading company logos and images.

Cloud based solution is another option which might be a convenient option for some companies. Customer would be redirected to this central cloud based website. The site would automatically load assets and other data from the companies Annata Dynamics IDMS servers. This would make it very easy for companies to adopt the Case Request On-line.

Adding a login to the Case Request On-line could also be beneficial. For first time users the procedure of such a solution will take more time due to account creation. When the customer has an account information it can be queried from the companies database automatically filling certain parts of the Case Request form. This also add a layer of security by authenticating the customer.

The ultimate on-line appointment booking service would give the customer a confirmation with concrete date of service, time of service and cost upon completion of filling the form. This is not possible in Case Request. But Case Requests can be accepted and at that point they can be assigned time and other resources. This would be very beneficial for both company and customer. This would require optimization algorithms for scheduling and assigning resources.

8 Conclusions

The goal of this B.Sc. project was to design and implement an extension to the Case Request form in the Annata IDMS software to a web servers. This was done by developing custom Microsoft Dynamics AX services. These services were then made accessible from a outside source by registering the service to a inbound port. An API was then developed to utilize these services. Although the the API was used to create a demonstration website in the project it could also be used to develop desktop or mobile applications. The communication between the service in Annata IDMS and the API is done via Microsoft Azure Service Bus.

The final product is a fully functional Case Request On-line as well as a demonstration website. The services used to implement the project are ready to be used for real applications.

Finally we would like to thank Annata for the cooperation and opportunity to work on this project.

References

- [1] Figure. Microsoft Azure Service Bus diagram, downloaded 12.12.14 from:
<http://technet.microsoft.com/en-us/library/dn720290.aspx>.
- [2] Lars Dragheim Olsen Arthur Greef, Michael Fruergaard Pontoppidan and experts from the Microsoft Dynamics AX team. *Inside Dynamics AX 4.0*. Microsoft Press, 2006.



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