



# Supervisor's statement of a final thesis

**Student:** David Mládek  
**Supervisor:** Ing. Tomáš Pajurek  
**Thesis title:** Security aspects of software development in the Microsoft Azure cloud  
**Branch of the study:** Computer Security and Information technology

**Date:** 10. 6. 2019

<i>Evaluation criterion:</i>	<i>The evaluation scale: 1 to 4.</i>
<b>1. Fulfilment of the assignment</b>	<b><u>1 = assignment fulfilled,</u> 2 = assignment fulfilled with minor objections, 3 = assignment fulfilled with major objections, 4 = assignment not fulfilled</b>
<i>Criteria description:</i> Assess whether the submitted FT defines the objectives sufficiently and in line with the assignment; whether the objectives are formulated correctly and fulfilled sufficiently. In the comment, specify the points of the assignment that have not been met, assess the severity, impact, and, if appropriate, also the cause of the deficiencies. If the assignment differs substantially from the standards for the FT or if the student has developed the FT beyond the assignment, describe the way it got reflected on the quality of the assignment's fulfilment and the way it affected your final evaluation.	
<i>Comments:</i> All parts of the assignment were fulfilled in larger extend than expected. Although the topic of cloud and security is very broad, student did not deviated from the intended direction of the thesis which was security in context of cloud developers. Student clearly delimited out-of-scope topics. Networking, virtual machines and other infrastructure-as-a-service topics were appropriately described only into the level of detail necessary to examine main subject of the thesis and out-of-scope topics are clearly stated.	
<i>Evaluation criterion:</i>	<i>The evaluation scale: 0 to 100 points (grade A to F).</i>
<b>2. Main written part</b>	<b>99 (A)</b>
<i>Criteria description:</i> Evaluate whether the extent of the FT is adequate to its content and scope: are all the parts of the FT contentful and necessary? Next, consider whether the submitted FT is actually correct – are there factual errors or inaccuracies? Evaluate the logical structure of the FT, the thematic flow between chapters and whether the text is comprehensible to the reader. Assess whether the formal notations in the FT are used correctly. Assess the typographic and language aspects of the FT, follow the Dean's Directive No. 26/2017, Art. 3. Evaluate whether the relevant sources are properly used, quoted and cited. Verify that all quotes are properly distinguished from the results achieved in the FT, thus, that the citation ethics has not been violated and that the citations are complete and in accordance with citation practices and standards. Finally, evaluate whether the software and other copyrighted works have been used in accordance with their license terms.	
<i>Comments:</i> Written part has 55 content pages and is organized into four chapters starting from more generic topics and ending with solutions specific to Microsoft Azure. There is also an appendix with additional 13 pages containing examples of various API calls and code snippets.  In the thesis, various relevant sources are synthesized (official Azure documentation for developers, architectural-level whitepapers and guidelines as well as books considered to be classical for such topic). Despite that the thesis is focused on specific modern technology, it identifies underlying general principles and makes use of number of high-quality publications.  Some parts of the thesis are going very deep into the topic. Student utilized the ongoing effort of Microsoft in open-source are and aspects that were not apparent from the documentation were examined directly in the source code of relevant C# SDKs. On pages 46 and 47, even the aspects of heterogeneous distributed systems are taken into an account.  The thesis is written in very good English. Only small amount of typos or formatting errors were found (most significant one is incorrectly rendered link on page 6).	
<i>Evaluation criterion:</i>	<i>The evaluation scale: 0 to 100 points (grade A to F).</i>
<b>3. Non-written part, attachments</b>	<b>95 (A)</b>
<i>Criteria description:</i> Depending on the nature of the FT, comment on the non-written part of the thesis. For example: SW work – the overall quality of the program. Is the technology used (from the development to deployment) suitable and adequate? HW – functional sample. Evaluate the technology and tools used. Research and experimental work – repeatability of the experiment.	

*Comments:*

Non-written part of the thesis contains several C# projects demonstrating topics discussed in the written part. These projects are also accompanied by PowerShell scripts that can be used to deploy Azure resources necessary for running the examples. Therefore, reproduction of experiments is very straightforward.

Both C# and PowerShell code is written for cutting-edge .NET Core runtime and ASP.NET Core web framework and therefore can be run on Linux as well as on Windows.

C# source code comply with almost all widely accepted conventions except letter casing for project and namespace names where 'lisp-case' is used instead of 'PascalCase'. Architecture of example projects is too simple in some cases. For example, in 'data-protection' project (web application) there is business and infrastructure logic placed in directly in the view class - it is clear that this project would benefit from at least one more abstraction layer.

*Evaluation criterion:*

*The evaluation scale: 0 to 100 points (grade A to F).*

**4. Evaluation of results, publication outputs and awards**

98 (A)

*Criteria description:*

Depending on the nature of the thesis, estimate whether the thesis results could be deployed in practice; alternatively, evaluate whether the results of the FT extend the already published/known results or whether they bring in completely new findings.

*Comments:*

The thesis can serve as a very good introduction for developers interested in learning security best-practices in cloud environment. The thesis itself contains large amount of useful information (including working examples) as well as references to other relevant resources. Unlike a lot of other Azure-specific resources, the thesis puts the information into broader context and examines other cases than just those on happy-path.

The section 4.3 provides in-depth overview of secret handling methods including their critical evaluation and recommendations for generic cloud environment. According to my knowledge, such overview is currently not available elsewhere.

*Evaluation criterion:*

*The evaluation scale: 1 to 5.*

**5. Activity and self-reliance of the student**

5a:  
**1 = excellent activity,**  
2 = very good activity,  
3 = average activity,  
4 = weaker, but still sufficient activity,  
5 = insufficient activity  
5b:  
1 = excellent self-reliance,  
**2 = very good self-reliance,**  
3 = average self-reliance,  
4 = weaker, but still sufficient self-reliance,  
5 = insufficient self-reliance.

*Criteria description:*

From your experience with the course of the work on the thesis and its outcome, review the student's activity while working on the thesis, his/her punctuality when meeting the deadlines and whether he/she consulted you as he/she went along and also, whether he/she was well prepared for these consultations (5a). Assess the student's ability to develop independent creative work (5b).

*Comments:*

Student was very active and continually proposed direction of the thesis by himself.

*Evaluation criterion:*

*The evaluation scale: 0 to 100 points (grade A to F).*

**6. The overall evaluation**

99 (A)

*Criteria description:*

Summarize which of the aspects of the FT affected your grading process the most. The overall grade does not need to be an arithmetic mean (or other value) calculated from the evaluation in the previous criteria. Generally, a well-fulfilled assignment is assessed by grade A.

*Comments:*

Student did a great job. The thesis is excellent content-wise as well as formally. Topics are examined thoroughly and it can be seen the student gained deep understanding of the principles of cloud security and cloud in general. Attached C# and PowerShell examples that are demonstrating several most complex topics appearing in the thesis, are fully working and overcome many Azure-specific issues caused mainly by lacking or inaccurate official documentation. I am assigning grade A.

Signature of the supervisor: