The Framework Programme for Research & Innovation
Innovation actions (IA)

Project Title:

FORTIKA - Cyber Security Accelerator for trusted SMEs IT Ecosystems

This project has received funding from the European Union's Horizon 2020 Research and innovation programme under Grant Agreement n°740690

FORTIKA White Paper #1

Edge Acceleration and Cyber-security for SMEs: The FORTIKA perspective

Responsible partner: FINT

Contributing partners: CERTH-ITI & TEIC

Topics addressed

i. Introduction & overall info for the project
ii. What is Edge Acceleration?
iii. How this technology applies to the Cyber Security domain
iv. How we used the acceleration technology in FORTIKA
v. What does the FORTIKA acceleration technology offer to SMEs? Why is FORTIKA so distinctive?

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i. Introduction

Information Technologies are rapidly evolving. They are incorporated into everyday practice in companies of any size in all business sectors. It is difficult to imagine a company that does not use the internet in this day and age. As technology evolves, more and more of company information assets are ported to cyberspace. Operating in a cyber-world means that every company is exposed to cyber threats. As technology evolves, the threats increase in number and become more intelligent, sophisticated and novel. Cyberattacks are the fastest growing crime [1]. Cyber threats comprise a major risk for businesses. It is proven that the vulnerability of a company is inversely proportional to its size. SMEs are typically poorly prepared to defend themselves, their digital assets and their client's data and privacy against cyber threats compared to large enterprises.

The EU funded project FORTIKA

FORTIKA is an EU funded project under Horizon 2020 program. The project started on the 1st of June 2017 and will end in May 2020. Sixteen partners from nine countries participate in the

project, among them three Universities, two Research Institutes, six IT companies and five companies as end users.

The vision of FORTIKA is to develop and test a new technology to minimise the exposure of small and medium sized businesses to cyber security risks and threats. This will help them successfully respond to cyber security incidents, while relieving them from all unnecessary and costly efforts of identifying, acquiring and using the appropriate cyber security solutions.

As the cyber-threats become more sophisticated with time, it is required to deploy advanced and effective countermeasures.

The FORTIKA approach is to engage **artificial intelligence algorithms** that watch the company network, identify the threats and initiate the countermeasures. All this functionality represents very heavy computational tasks that need to be executed fast, close to real time. Further, FORTIKA's ambition is to offer such functionality through a small, affordable device called the "FORTIKA Gateway".

Our approach towards this vision is to adopt a new hardware-based technology known as "**Edge Acceleration**".

ii. What is Edge Acceleration?

Edge Acceleration is Edge Computing (i.e. computing done at or near the source of the data) utilising hardware acceleration paradigms, such as GPU, ASIC and FPGA. This boosted Edge computing not only enjoys the benefits of reduced latency and increased privacy and security levels (no need to transfer, process and/or store data to remote datacenters) of conventional Edge Computing but also reaps the benefits of hardware acceleration in terms of computing speed and/or lower energy consumption. The GPU (Graphics Processing Unit) computing paradigm focuses on offloading the data computation to the graphics cards processing units. The Application Specific Integrated Circuit (ASIC) paradigm employs the use of an Integrated Circuit (IC) designed to process only one specific application; in contrast, the Field Programmable Gate Array (FPGA) paradigm builds on the concept of (re)programmable hardware meaning that it can be used for more than one application. Each of these three paradigms have their own benefits and drawbacks, for example, GPU is well suited for processing data in parallel, however when synchronisation is needed the complexity of the solution and energy consumption increases significantly. ASIC is the fastest solution, but is designed and implemented to perform only one specific task, if you want to change the application even by a bit (e.g. add a new feature) you have to design and build a new ASIC unit. On the other hand, the FPGA is ideal for low energy solutions that deal with stream processing problems and whenever pipelining can be applied on large datasets, not to mention its reprogrammability feature, i.e. change applications on the fly; the catch here is that FPGA programming is not so straightforward (compared to modern SW programming) as you **need to be aware of HW specific details.**

iii. How this technology applies to the Cyber Security domain

In the cyber security domain, the use of encryption for protecting sensitive data and the utilisation of heavyweight analytics for detecting malicious patterns and events is standard practice. As these solutions are computationally and energy expensive the options are two, namely to use Cloud based solutions (meaning you also have to transfer the necessary data to the cloud and wait for the processing results) or, especially if there are privacy/security concerns for the use of remote solutions, to invest in expensive HW equipment (e.g. High-end Servers) for the ability to run and take advantage of these solutions locally. Edge acceleration makes its case for the second option by enabling for a low cost, low energy consumption and

computing efficient solution that can be deployed locally and be used for hosting the "computationally expensive" cybersecurity-oriented algorithms.

iv. How we used the acceleration technology in FORTIKA

In the context of FORTIKA, we provide a FORTIKA Gateway (F-GW) unit (see **Figure 1**) that not only provides conventional GW functionalities (e.g., routing) but also FPGA based hardware acceleration capabilities; in other words, it allows the deployment of sophisticated cybersecurity services by enabling them to offload their computationally expensive tasks (e.g., analysis algorithms) to the FPGA component of the GW. We utilise the FPGA computing paradigm because it achieves outstanding computing and energy performance when compared to the CPU or even GPU computing paradigms, especially for on-stream processing problems and whenever pipelining can be applied on large data sets [2]. For example, Microsoft has reported that equipping 1632 of their servers with FPGA accelerators not only doubled the ranking throughput of their Bing search engine but also improved the energy efficiency by 77% [3]. As **Figure 2** depicts, the cybersecurity solutions (bundles in FORTIKA terminology) are hosted in a Cloud based Marketplace. An SME can install the F-GW in their premises (e.g. in-line with their Internet router) and use the Marketplace dashboard to deploy any of the offered cyber-security solutions to the F-GW. The FPGA portion of the cyber security solution (e.g. encryption algorithm) is deployed in the FPGA component, enabling hardware acceleration of the solution (e.g. encryption of data), while at the same time assuring a low energy footprint.

Figure 1. FORTIKA GW unit

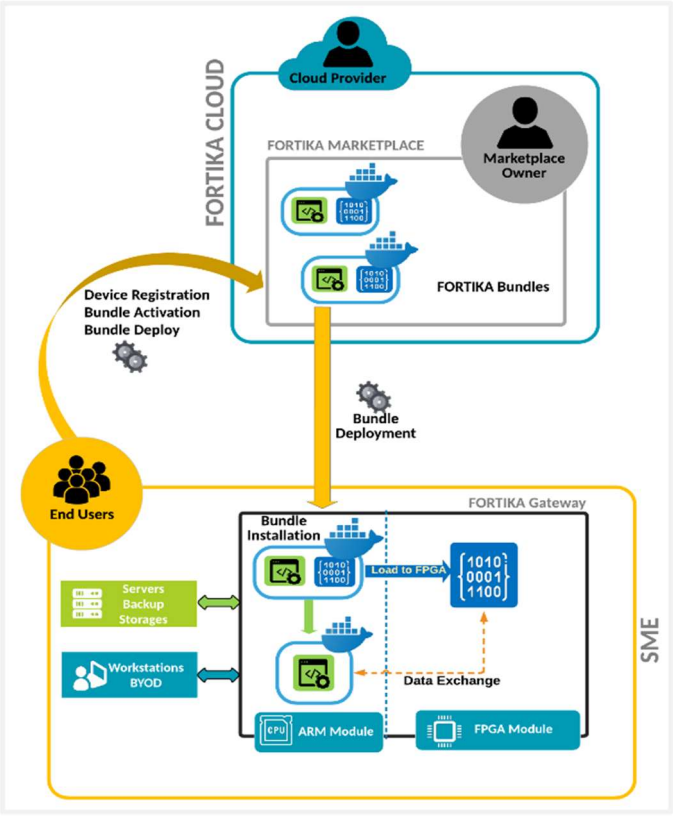

Figure 2. Deployment of bundle to FORTIKA GW

v. What does the FORTIKA acceleration technology offer to SMEs? Why is FORTIKA so distinctive?

FORTIKA enables an on-premise alternative to the cloud-based cybersecurity solutions for SMEs, enabling them at the same time to reap the benefits of low cost, low energy consumption and efficient computing of FPGA based edge acceleration.

vi. References – Sources for further reading

[1] The Cost of Cybercrime, Accenture, 2019, https://www.accenture.com

[2] FPGAs for Software Programmers, Dirk Koch, Frank Hannig, Daniel Ziener, Springer International Publishing, 2016

[3] A. Putnam, A. M. Caulfield, E. S. Chung, D. Chiou, K. Constantinides, J. Demme, H. Esmaeilzadeh, J. Fowers, G. P. Gopal, J. Gray, M. Haselman, S. Hauck, S. Heil, A. Hormati, J.-Y. Kim, S. Lanka, J. Larus, E. Peterson, S. Pope, A. Smith, J. Thong, P. Y. Xiao, and D. Burger. A reconfigurable fabric for accelerating large-scale datacenter service. In Proceedings of the ACM/IEEE 41st International Symposium on Computer Architecture (ISCA), pages 13–24. IEEE, 2014.