
RESEARCH EXHIBITION IN MATHEMATICS & COMPUTER SCIENCES

REMACS 5.0



CS240 - BACHELOR OF INFORMATION TECHNOLOGY [HONS.]
CS248 - BACHELOR OF SCIENCES [HONS.]
MANAGEMENT IN MATHEMATICS
CS251 - BACHELOR OF COMPUTER SCIENCE [HONS]
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DATA COMMUNICATION & NETWORKING

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Universiti Teknologi MARA Perlis Branch

**Research Exhibition in Mathematics and Computer Sciences
(REMACS 5.0)**

Research Exhibition in Mathematics and Computer Sciences (REMACS 5.0)

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Preface

It is with great pleasure that we present this extended abstract book, titled "The 5th Research Exhibition in Mathematics and Computer Sciences (REMACS 5.0)". This book is a collection of research work in the fields of Computer Science and Mathematics, contributed by the final year students from Universiti Teknologi MARA, Perlis Branch. The aim of this book is to showcase the diversity and depth of research in these two interrelated fields.

Mathematics and Computer Science are two fields that have seen tremendous growth and advancement in recent years. With the rise of new technologies and the increasing demand for data-driven solutions, researchers in these fields have been working hard to develop new theories, algorithms, and models that can help solve some of the most pressing problems of our time. This book is a testament to their hard work and dedication.

The abstracts in this book cover a wide range of topics, including algebra, analysis, logic, computer architecture, algorithms, artificial intelligence, machine learning, computer network, netcentric computing and many more. The work presented here is both theoretical and practical, and has the potential to impact many areas of society, from finance and healthcare to education and security.

We hope that this book will serve as a valuable resource for future students in the fields of Mathematics and Computer Science. We also hope that it will inspire more students to pursue innovative and groundbreaking research in these two fields. Finally, we would like to express our gratitude to all the contributors for their hard work and dedication, without which this book would not have been possible.



RESEARCH EXHIBITION IN MATHEMATICS & COMPUTER SCIENCES
REMACS 5.0

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EVENT SCHEDULE

8:00 – 8:30 am

- Registration

8:00 am – 12:00 pm

- FYP Project Presentation

12:00 - 2:00pm

- Lunch Break

2:15 – 2:35 pm

- National & Wawasan Setia Anthems
- Doa Recitation

2:35 – 2:45 pm

- Welcoming Address by Director of REMACS 5.0

2:45 – 2:55 pm

- Officiating & Closing Remarks from Rector of UiTM Perlis

2:55 – 3:00 pm

- REMACS 5.0 Montage

3:00 – 4:00 pm

- Awarding of Winners:
 - Best Poster
 - Best Project Award
- Photo Session
- End of Ceremony

Dress Code: Formal / Corporate

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EXTENDED ABSTRACTS

RESEARCH EXHIBITION IN MATHEMATICS & COMPUTER SCIENCES
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NETWORK AUTOMATIONS ON ACCESS CONTROL LIST (ACL) FOR MULTIVENDOR DEVICES USING ANSIBLE AND NAPALM IN GNS3

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Abstract

Access control list (ACL) are crucial for network security in complex and dynamic networks. In the context of network systems, ACL is the list of permission associated to a certain network. In addition, the incorporation of ACL with automations will help the network management in terms of reducing the number of alerts. Additionally, the performance of the entire network will be impacted by the lack of trained network engineers and administrators in network-based enterprises. ACL is one of the security automations mechanisms that consist of programmed detections, investigation, mitigations and prevention. Automation thus uses machine-based security operations to lessen the risk of human interactions. ACL are typically manually configured and analysed. Furthermore, redundancies are a regular problem with ACL rules, which is in conflict with the ideas of network automation. In this project, a set of ACL scripts and playbooks for basic network configurations are presented. These solutions help network engineers update ACLs and configurations automatically. Additionally, these automation scripts used NAPALM and Ansible for advanced settings for multivendor devices in GNS3. This automated ACL constructions underwent functional testing. The success rate of pushed configurations in network devices using NAPALM Python scripts and Ansible playbooks is the main focus of this project because it is its main objective. With the exception of some NAPALM configurations that cannot be deployed to certain Cisco and Juniper routers owing to device limitations, NAPALM and Ansible have been successfully linked to deploy configurations to these routers. Nevertheless, by combining NAPALM with Ansible, network engineers can lessen the chance of human error, which is helpful in situations with several vendors. The use of Jinja2 can improve the effectiveness of integrations between NAPALM and Ansible for future research.

Keywords: NAPALM, Ansible, GNS3, Cisco, Juniper, ACL

1. Introduction

The work focuses on developing ACL automation for multivendor devices in GNS3 by using Ansible and NAPALM with a combination of two vendors which is Cisco and Juniper devices. In relation, Python3, YAML and INI used to develop the project. This research will study how to automate basic network configuration by integrating napalm-ansible modules. Next, configuring, modifying and verifying the existence of ACL rules using NAPALM. The scope of this project is to develop methods of the ACL automation scripts using NAPALM and Ansible. And to evaluate the automated ACL scripts using functionality and verification.

2. Methodology

Methodology used in this project is Automation testing life cycle (ATLC). ATLC is used with a structured sequence of testing procedures that can include all stages of the testing life cycle as well as additional phases for test preparation and automation deployment. This ATLC involves several major phases which are listed such as Initial phase, planning phase, Systems Requirement Analysis phase, Design, and development phase, Testing phase and Documentation. This paper implemented network automation using NAPALM and Ansible to configure ACL and advanced configuration for multivendor network devices in the GNS3 environment.

3. Results and Discussion

This project presents a set of ACL python3 scripts and basic network configuration playbooks for network automation, which were tested and analysed. It focuses on the success rate of pushed configurations in network devices using NAPALM python's scripts and Ansible playbooks. Based on the test scenario, this automation script can compare the configurations to eliminate redundant ACL rules, validating the existence of ACL rules, pushing configurations, gathering device and host information for ansible inventory, and pushing configurations. Since it features self-configuration and error correction capabilities. Compared to conventional methods of setting and analysing, it is more precise, has a lower mistake rate, requires less human energy, reduces costs, and shortens analysis time. This demonstrates that autonomous configuration systems can replace conventional network configuration methods. In conclusion, it can be stated that a network automation utilizing NAPALM and Ansible in ACL can assist network administrators in configuring network devices in terms of discarding ACL redundancies, modifying ACL rules, committing ACL configurations, basic network configuration, and reverting to previous configurations for corrective actions.

4. Novelty of Research / Product

Numerous studies, particularly those aimed at network engineers, have studied network automation. According to Mohd Faris Mohd Fuzi and Khairunnisa Abdullah (2021), they have developed network automations for the EIGRP Network. Next, previous research about the Access Control List focused on how to ensure the verification of ACL rules and effectively check whether ACL policy meets the expected ACL security baseline requirements (Chen et al., 2020). There is also a study on implementing network automations that don't have vendor constraints by using NAPALM (IEEE Communications Society et al., 2019). Besides that, there is research on ACL that highlights how to efficiently update your ACL and prevent significant service downtime (Tian et al., 2019). This project focuses on NAPALM and Ansible integration for multivendor networks. In addition, ACL verification ensures that the rules are accurate and eliminates redundancies. In addition, this project enhanced the correctness of ACL rule verifications and the efficiency of auditing. Moreover, since modifying ACL settings is error-prone, a single ACL misconfiguration can result in service failures. This project has additional capabilities to rollback to previous configurations.

5. Conclusion

In conclusion, it can be stated that a network automation utilizing NAPALM and Ansible in ACL can assist network administrators in configuring network devices in terms of discarding ACL redundancies, modifying ACL rules, committing ACL configurations, basic network configuration, and reverting to previous configurations for corrective actions.

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