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Netcamps

Design, configuration and documentation of the exemplary computer network for a campus of dormitories

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1 Document description

This document provides an extended description for the NetCamps project that was implemented during the 'Metodyki Projektów Teleinformatycznych' summer course at AGH University of Krakow 2023/2024. Its summarized version can be found in the main github repository located in NetCamps Repo. If the document reader desires to contact the product authors in terms of any NetCamps-related topics, it is welcome to do this github channel.

2 Abbreviations

This section contains a list of common abbreviations presented in the document content

- **OSI/ISO** – The OSI (Open Systems Interconnection) model is a conceptual framework for network protocol design.
- **OSPF** – Open Shortest Path First - is a routing protocol used in computer networks to determine the most efficient path for data packets to travel from a source to a destination.
- **IP** – IP, or Internet Protocol, is a fundamental protocol that forms the basis of communication on the Internet
- **VLAN** – A Virtual Local Area Network, is a network segmentation technique that allows the creation of logically isolated networks within a physical network
- **DHCP** – Dynamic Host Configuration Protocol, is a network protocol used to automatically assign IP addresses and other network configuration information to devices on a network

3 Preface

This comprehensive guide has been crafted to provide you with in-depth insights into the features, functionalities, and optimal usage of NetCamps product. Whether you are a new user exploring the capabilities of NetCamps or a seasoned professional seeking detailed reference material, this documentation is designed to cater to the needs of potential user.

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4 Overview

This section provides a brief overview of the NetCamps product portfolio and potential audience for this document.

4.1 Introduction

Building, designing, and testing complex computer networks come with a unique set of challenges due to the scale, complexity, and dynamic nature of large-scale networks. Successfully addressing these challenges requires a combination of expertise, careful planning, and the adoption of appropriate technologies and best practices in network design and management. These needs could be addressed by the NetCamps product portfolio in a following way:

- Providing an exemplary topology, configuration and documentation for the campus computer network along with the used tools
- Being a source for business use cases occuring during similar projects and its technical solutions
- Presenting detailed and structured list of costs related with building campus computer network
- Delivering educational or instructional materials regarding networking and telecommunication areas

4.2 Audience

The documentation for NetCamps is designed to cater to a diverse audience with varying levels of expertise and responsibilities. Potential audiences for this documentation include potential customers, training departments, project managers or compliance officers. By addressing the needs of this diverse audience, the documentation aims to provide comprehensive support and guidance to ensure a successful experience with NetCamps.

5 Supported use cases

This section provides reader with the description of NetCamps supported use cases.

5.1 Layer 3 (OSI/ISO) connectivity between campus network end-devices

Layer 3 connectivty is a common requirement from the potential customers of network design and configuration solution providers, the demand can be defined as follows:

> ***As a user, I want to be able to communicate with another campus network device directly after connecting to the internal network***

For this reason, the network has been configured with the OSPF protocol. Open Shortest Path First (OSPF) is a routing protocol used in computer networks to help routers dynamically exchange information about network topology. It is an interior gateway protocol (IGP) designed to efficiently determine the best path for routing packets within an autonomous system, typically a single organization's network. OSPF uses a link-state routing algorithm, where routers exchange information about the state of their links with neighboring routers, allowing each router to build a detailed and up-to-date map of the network.

What's more, NetCamps product also predicted the neccesity of introducing DHCP server that provides connected end-devices with the IP address, and allows them to communicate directly with each other right after connecting PC to the internal network. Dynamic Host Configuration Protocol (DHCP) is a network management protocol used to automatically assign and configure IP addresses to devices within a network. It eliminates the need for manual IP address assignment, making it more efficient to manage a large number of devices on a network.

5.2 Link Redundancy and VLAN subnetting configuration

Providing VLAN subnetting and link redundancy, might be a key part of client requirements for a better performance of campus network

> ***As a user, I want to be able to communicate with another campus network device despite the fact of backbone link failure***

Link redundancy is crucial in campus networks to ensure high availability, reliability, and fault tolerance. Campus networks typically connect various buildings, departments, and users within an organization's physical location. Redundant links help mitigate the impact of link failures, improving the overall performance and resilience of the network.

> ***As a user, I want to secure selected switchports from communicating with devices by assigning them VLAN not supported on trunk link***

When it comes to assigning VLAN to the unused one, this security measure helps mitigate potential VLAN hopping attacks where an unauthorized user attempts to gain access to traffic in a VLAN other than their own. By assigning switch ports to the top unused VLAN, you create an isolated VLAN that is not in active use, reducing the risk of unauthorized access and potential security breaches. Because of that, given scenario presents two relevant simulations of securing the switch port by assigning it to and unused VLAN and link redundancy scenario which relies on deleting redundant links in the backbone part of the network.

6 Topology design

6.1 Network equipment

7 Configuration analysis

8 Cost analysis

9 Summary

9.1 Summary

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