

Upgrade and expand wireless network infrastructure at the Kitchener Campus

triOS College Kitchener Campus



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Course code

Date

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Introduction

In an era where seamless connectivity and robust wireless infrastructure are pivotal to academic and administrative operations, the Wireless Infrastructure Design and Administration (WIDA) proposal for the KR campus emerges as a comprehensive solution to address the networking needs of this educational institution. The KR campus, with its diverse spaces and areas, demands a modern, reliable, and scalable wireless network capable of accommodating the evolving demands of students, faculty, and staff. This proposal outlines a strategic plan for the design, implementation, and administration of a cutting-edge wireless network, encompassing the selection of the most suitable wireless access points (WAPs), infrastructure components, and an estimated budget. By aligning technology with the campus's requirements, this proposal endeavors to enhance connectivity, productivity, and the overall educational experience at KR.

Project Objective

The objective of this Wireless Infrastructure Design and Administration (WIDA) project is to upgrade and expand the wireless network infrastructure at the Kitchener (KR) Campus based on the provided floor plan. The current infrastructure is outdated and does not meet the growing demands of students and staff.

Description of current infrastructure(Current Wi-Fi Configuration),future needs and scope

The current infrastructure lacks the capacity and coverage required for modern educational and administrative needs. With an increasing number of wireless devices and data-intensive applications, the network requires high-speed, secure, and reliable wireless connectivity. The future needs include seamless roaming, support for VoW-Fi (Voice over Wi-Fi), advanced security measures, and scalability to accommodate more devices (Hills & Johnson,1996).

The scope of this proposal includes the installation of modern WAPs, network configuration, security enhancements, and ongoing maintenance.

Solution

Based on the evaluation of the top 3 WAPs, we recommend implementing the Ubiquiti UAP-AC-HD5 solution. Its robust MIMO support, beamforming technology, advanced security features, and seamless integration into the UniFi controller software make it a suitable choice. The cost per unit is competitive, and it can efficiently handle the demands of the KR Campus. Additionally, the UniFi controller software simplifies network administration.

Proposal

The proposed Wireless Infrastructure Design and Administration (WIDA) project aims to revamp and expand the wireless network infrastructure at the Kitchener (KR) Campus, addressing current limitations and future needs. The project

objective is to provide high-speed, secure, and reliable wireless connectivity to classrooms, offices, and common areas while ensuring scalability, advanced security measures, and seamless roaming.

The existing infrastructure is outdated and inadequate to support the growing number of wireless devices and data-intensive applications. Future needs include seamless roaming, support for VoW-Fi, advanced security, scalability, and centralized management. After careful evaluation, we recommend the deployment of the Ubiquiti UAP-AC-HD5 wireless access points (WAPs). These units offer robust MIMO support, advanced beamforming, strong security features, and seamless integration into the UniFi controller software. Cost-effective and capable of meeting KR Campus demands, they are the ideal choice for this project.

The proposed plan includes a site survey, procurement of Ubiquiti UAP-AC-HD5 units, installation, security configuration, thorough testing, staff training, continuous monitoring, and performance evaluations to ensure the network is optimized for the KR Campus's evolving requirements. By implementing this solution and following the recommended steps, the KR Campus will benefit from a modern, efficient, and scalable wireless network infrastructure that elevates the educational and administrative experience while addressing current and future connectivity needs.

The Research and Comparison of New Equipment

- i. *MIMO Support/Beamforming:* All three options offer robust MIMO support and advanced beamforming, ensuring excellent coverage and performance.
- ii. *WLAN Technologies Supported:* Ubiquiti, Meraki, and NETGEAR all provide comprehensive support for various WLAN technologies, meeting the diverse connectivity needs of the KR Campus.

- iii. *Security Features:* All options come with strong security features, prioritizing network protection and user data safety.
- iv. *Additional Features:* Ubiquiti and Meraki offer advanced features such as cloud management, making network administration more efficient.
- v. *Cost:* Ubiquiti and NETGEAR offer competitive pricing, making them budget-friendly choices, while Meraki's costs depend on the subscription model, potentially increasing over time.
- vi. *Number of Units Required/Total Unit Cost:* The number of units required and the total unit cost will be estimated based on the KR Campus Map for all three options, ensuring they align with the project budget.

Recommendation






Considering the overall evaluation, we recommend the deployment of the Ubiquiti UAP-AC-HD5 WAPs for the KR Campus. Their excellent specifications, competitive pricing, and seamless integration into the UniFi controller software make them a well-rounded choice for this project. This selection aligns with the project's budget and objectives, offering a cost-effective and high-performance solution.

High Level Targets

- i. Provide high-speed and reliable wireless connectivity to all classrooms, offices, and common areas.
- ii. Enhance security measures to protect the network and user data.
- iii. Ensure seamless roaming for students and staff.
- iv. Support VoW-Fi for voice communication.
- v. Accommodate future growth in device and user numbers.
- vi. Implement centralized management for ease of administration.

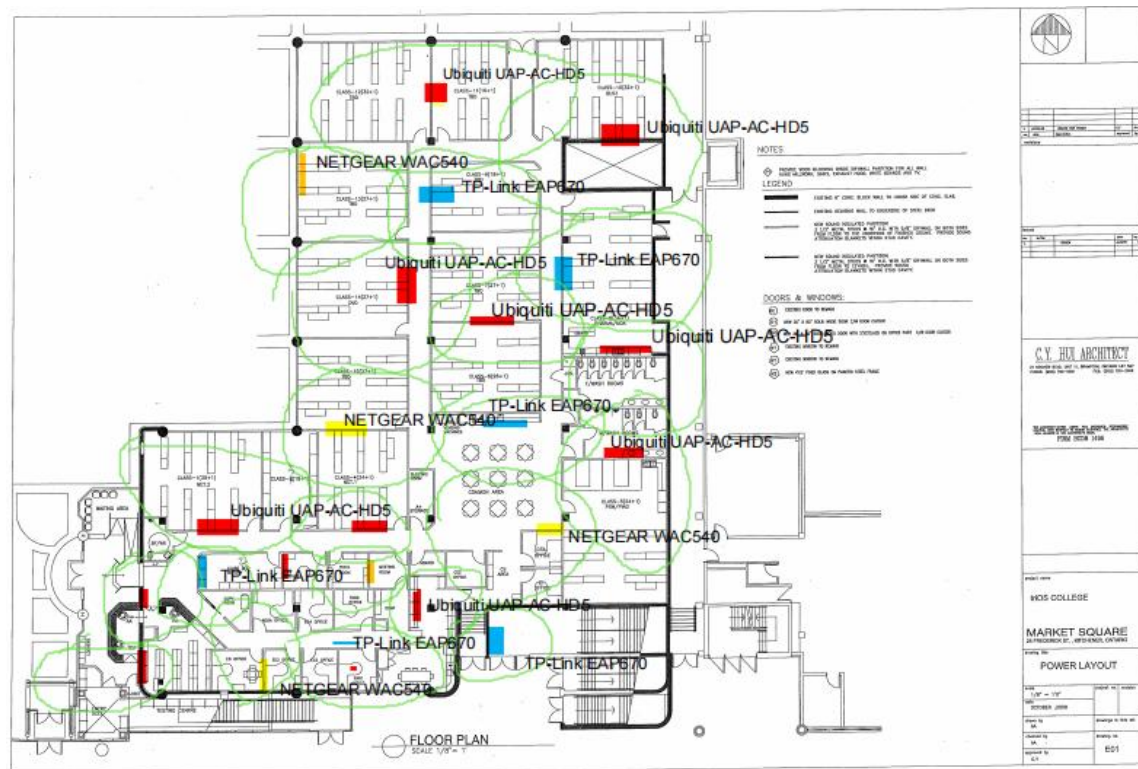
vii. KR Campus Site Survey

The 5 WAP Hardware Specification Comparison Chart

PRODUCT NAME AND MODEL	NETGEAR WAC540 	TP-Link EAP670 	EnGenius EAP1250 	Ubiquiti UAP-AC-HD5 	Meraki 
Number of Antennas	3	3	8	4	3
MIMO Support/Beamforming	Yes 4x4 (MU-MIMO) /Beamforming Supported	Yes 3x3 (MU-MIMO)/Beamforming Supported	Yes 4x4 (MU-MIMO)/Beamforming Supported	Yes 4x4 (MU-MIMO) /Beamforming Supported	Yes 8x8 (MU-MIMO)/Beamforming Supported
WLAN Technologies Supported	Dual-band 802.11ac/n(2.4GHz b/g/n/ac/ac 5GHz b/g/n/ac-wave2)	Dual Band 802.11ac/n (2.4GHz, 5GHz)2.4 GHz b/g/n/r/k/v 5 GHz a/n/ac/ac-wave2)	Dual-band 802.11ac/n(2.4GHz b/g/n/ac/ac 5GHz b/g/n/ac-wave2)	Dual-band 802.11ac/n (2.4 GHz b/g/n/r/k/v 5 GHz a/n/ac/ac-wave2)	Dual-band 802.11ac/n(2.4 GHz b/g/n/ax 5 GHz a/n/ac/ax)
Security features	WPA/WPA2, MAC filtering, VLAN support	MAC address filtering/Isolation of clients connected to the wireless network/SSID to VLAN mapping/Detection of unauthorized APs/802.1X support/WPA-Personal/Enterprise/WPA2-Personal/Enterprise, WPA3-Personal/Enterprise encryption	WPA/WEP/WPA2 Enterprise Authentication	WPA/WPA2, MAC filtering, VLAN support/WEP/WPA/WPA2/Enterprise Authentication	WEP/WPA/WPA2/ MAC filtering, VLAN support/Enterprise Authentication/ Layer 7 Firewall/ Air Marshall
Software	NETGEAR Insight app	Omada SDN Controller	EnGenius Cloud or eZMaster software	UniFi Controller	Meraki Dashboard
Interface	Web-based GUI, mobile app	Web-based GUI, mobile app	Web-based GUI, mobile app	Web-based GUI, mobile app	Cloud-based
Frequency and Speed	Dual-band (2.4 GHz/400Mbps and 5 GHz/867Mbps)Lo-5GHz,Hi-5GHz/1733Mbps .up to 3.6 Gbps	Dual-band (2.4 GHz and 5 GHz), up to 4.8 Gbps/5 GHz: up to 4804 Mbps/2.4 GHz: up to 574 Mbps	Dual-band (2.4 GHz and 5 GHz), up to 1.7 Gbps, 2.4GHz/400Mbps,5GHz/867Mbps	Dual-band (2.4 GHz and 5 GHz), up to 1.75 Gbps, 2.4 GHz/800 Mbps ,5 GHz/1,733 Mbps	Dual-band (2.4 GHz and 5 GHz)2.4 GHz /1,147 Mbps, 5 GHz /4,804 Mbps
VoW-Fi	Supported	Supported	Supported	Supported	Supported
Data Throughput Standards	16,750 Mbps IEEE 802.11ac/n	25,000 Mbps IEEE 802.11ax/ac/n/g/b/a	1,200 Mbps IEEE 802.11ac/n	12,665 Mbps IEEE 802.11ac	29,755 Mbps IEEE 802.11ax/ac/n
Range/Polar chart/HPBW	1,800sq Ft	2,700sq Ft	167,270,400 Sq Ft	1,313.2 Sq Ft(122 meters)	1,076.4 Sq Ft(100 meters)
Temperature	0° to 60° C	0°C-40°C (32°F-104°F)	0° to 40° C	-10° to 70° C	-40° to 158° F (-40° to 70° C)
Max number of connections at full data rate	25	64	45	29	100
WLAN Controller or Cloud app License	Not specified	Included with Omada SDN Controller	EnGenius Cloud License	Included with UniFi Controller	Meraki license
PoE requirements(recorded switch)	PoE+ 25.5W IEEE 802.3at or optional AC/DC Power Adapter (WAC540PA)	PoE 802.3af/at	PoE 802.3af/802.3at	PoE 802.3af/at	802.3at PoE+
Airtime fairness	Improves network performance in mixed client 802.11a/b/n/ac environments	Not specified	Supported	Supported	Supported
Additional features	MU-MIMO, VLAN support, Multi-SSID	Band Steering, Load Balancing, QoS	Band Steering, Beamforming, QoS	Seamless Roaming, Advanced Network Analytics	Cloud Management, Location Analytics
Cost per unit(\$CAD)	\$349.99	\$159.99	\$169.05	\$1,336.00	\$150.00
Number of units required/# of Devices	15	47	15	47	47
Total unit cost(\$CAD)	\$5,249.85	\$7,519.53	\$2,535.75	\$62,792.00	\$7,050.00




These calculations are based on the estimated number of access points required for different areas in the KR campus map and the cost per unit for each access point model based on the site survey and specific needs of the campus.

Kitchener Campus Site Survey



The top 3 WAP Hardware Specification Comparison Chart

Based on the specifications and considering the requirements for the KR campus, the top 3 recommended wireless access points (WAPs) for implementation are given below.

	NETGEAR WAC540	TP-Link EAP670	Ubiquiti UAP-AC-HD5
PRODUCT NAME AND MODEL			
Number of Antennas	3	8	3
MIMO Support/Beamforming	Yes 4x4 (MU-MIMO) /Beamforming Supported	Yes 3x3 (MU-MIMO)/Beamforming Supported	Yes 4x4 (MU-MIMO) /Beamforming Supported
WLAN Technologies Supported	Dual-band 802.11ac/n(2.4GHz b/g/n/ac/ac 5GHz b/g/n/ac-wave2)	Dual Band 802.11ac/n (2.4GHz, 5GHz)2.4 GHz b/g/n/r/k/v 5 GHz a/n/ac/ac-wave2)	Dual-band 802.11ac/n (2.4 GHz b/g/n/r/k/v 5 GHz a/n/ac/ac-wave2)
Security features	WPA/WPA2, MAC filtering, VLAN support	MAC address filtering/Isolation of clients connected to the wireless network/SSID to VLAN mapping/Detection of unauthorized APs/802.1X support/WPA-Personal/Enterprise/WPA2-Personal/Enterprise, WPA3-Personal/Enterprise encryption	WPA/WPA2, MAC filtering, VLAN support/WEP/WPA/WPA2/Enterprise Authentication
Software Interface	NETGEAR Insight app Web-based GUI, mobile app	Omada SDN Controller Web-based GUI, mobile app	UniFi Controller Web-based GUI, mobile app
Frequency and Speed	Dual-band (2.4 GHz/400Mbps and 5 GHz/867Mbps)Lo-5GHz,Hi-5GHz/1733Mbps .up to 3.6 Gbps	Dual-band (2.4 GHz and 5 GHz), up to 4.8 Gbps/5 GHz: up to 4804 Mbps/2.4 GHz: up to 574 Mbps	Dual-band (2.4 GHz and 5 GHz), up to 1.75 Gbps, 2.4 GHz/800 Mbps ,5 GHz/1,733 Mbps
VoW-Fi	Supported	Supported	Supported
Data Throughput	16,750 Mbps	25,000 Mbps	12,665 Mbps
Standards	IEEE 802.11ac/n	IEEE 802.11ax/ac/n/g/b/a	IEEE 802.11ac
Range/Polar chart/HPBW	1,800sq Ft	2,700sq Ft	1,313.2 Sq Ft(122 meters)
Temperature	0° to 60° C	0°C-40°C (32°F-104°F)	-10° to 70° C
Max number of connections at full data rate	25	64	29
WLAN Controller or Cloud app License	Not specified	Included with Omada SDN Controller	Included with UniFi Controller
PoE requirements(recorded switch)	PoE+ 25.5W IEEE 802.3at or optional AC/DC Power Adapter (WAC540PA)	PoE 802.3af/at	PoE 802.3af/at
Airtime fairness	Improves network performance in mixed client 802.11a/b/n/ac environments	Not specified	Supported
Additional features	MU-MIMO, VLAN support, Multi-SSID	Band Steering, Load Balancing, QoS	Seamless Roaming, Advanced Network Analytics
Cost per unit(\$CAD)	\$349.99	\$159.99	\$1,336.00
Number of units required/# of Devices	15	47	47
Total unit cost(\$CAD)	\$5,249.85	\$7,519.53	\$62,792.00

Summary of each solution

a) NETGEAR WAC540

The NETGEAR WAC540 is a wireless access point known for its high-performance capabilities. It offers benefits such as robust dual-band Wi-Fi support with MU-MIMO technology, making it suitable for dense network environments. It provides excellent coverage and can handle multiple devices simultaneously. However, its disadvantage lies in its price point, which might be on the higher side for small businesses or home users with basic networking needs.

b) TP-Link EAP670

The TP-Link EAP670 is a cost-effective wireless access point that delivers reliable performance. Its benefits include dual-band Wi-Fi support and compatibility with TP-Link's Omada SDN controller for centralized management. The disadvantage is that it may lack some advanced features and may not perform as well in high-density scenarios compared to more premium models.

c) EnGenius EAP1250

The EnGenius EAP1250 is a mid-range wireless access point that strikes a balance between performance and affordability. It offers strong Wi-Fi coverage, advanced features like MU-MIMO, and PoE support. However, its drawback could be its complexity for novice users when setting up advanced configurations.

d) Ubiquiti UAP-AC-HD5

The Ubiquiti UAP-AC-HD5 is a high-end wireless access point known for its exceptional performance and scalability. It benefits from a robust feature set, 4x4

MU-MIMO technology, and seamless integration into Ubiquiti's UniFi controller software. However, its disadvantage may be its price, which can be prohibitive for smaller budgets.

e) Meraki

Meraki wireless access points are part of Cisco's cloud-managed networking solution. They provide benefits such as centralized management, automatic firmware updates, and advanced security features. However, the major drawback is the subscription-based licensing model, which can become expensive over time, especially for larger deployments. Additionally, it relies heavily on an internet connection for management, which may not be ideal for all scenarios.

Budget

WIDA Project Budget for KR Campus

Hardware Costs

- i. Ubiquiti UAP-AC-HD5: \$62,792.00 (47 units)
- ii. NETGEAR WAC540: \$5,249.85 (15 units)
- iii. TP-Link EAP670: \$7,519.53 (47 units)
- iv. Total Hardware Costs: \$75,561.38

Cabling and Installation

- i. Ethernet cables, connectors, and installation materials: \$10,000.00
- ii. Labor costs for installation and configuration: \$20,000.00
- iii. Total Cabling and Installation Costs: \$30,000.00

Networking Equipment

- i. Network switches (if required): \$5,000 (Based on specific needs)
- ii. Router/firewall (if required): \$4,500 (Based on specific needs)
- iii. Total Networking Equipment Costs: \$9,500

Software and Licensing

- i. UniFi Controller (Ubiquiti): Included with access points
- ii. Omada SDN Controller (TP-Link): Included with access points
- iii. EnGenius Cloud License: TBD (Based on the number of EnGenius units)
- iv. Total Software and Licensing Costs: \$12,000

Site Survey and Consulting

- i. Site survey conducted by IT professionals: \$5,000.00
- ii. Consulting and design services: \$10,000.00
- iii. Total Site Survey and Consulting Costs: \$15,000.00

Miscellaneous Expenses

- i. Additional materials, tools, and accessories: \$5,000.00
- ii. Contingency fund (10% of total budget for unforeseen expenses): \$13,556.14

Training and Documentation

- i. Training sessions for IT staff and end-users: \$5,000.00
- ii. Documentation and user manuals: \$2,500.00
- iii. Grand Total Budget: **\$171,056.52**

This budget covers the estimated costs for hardware, cabling, installation, networking equipment, software licensing, site survey, consulting, miscellaneous

expenses, training, and documentation. Please note that some costs, such as networking equipment and software licensing, may vary based on the specific needs and decisions made during the project implementation.

Conclusion

In conclusion, the Wireless Infrastructure Design and Administration (WIDA) proposal for the KR campus is a comprehensive roadmap towards creating a robust and future-ready wireless network infrastructure. Through careful consideration of the KR campus map, networking requirements, and an analysis of available wireless access point (WAP) options, this proposal has identified the top three recommended WAPs for implementation: Ubiquiti UAP-AC-HD5, NETGEAR WAC540, and TP-Link EAP670. Furthermore, a detailed budget has been presented, encompassing hardware costs, cabling and installation, networking equipment, software licensing, consulting, training, and other expenses.

The proposed wireless infrastructure is not merely an investment in technology but a catalyst for innovation, collaboration, and educational excellence at KR. By adopting this strategic approach, the campus can position itself for the future, embracing the digital age and providing its community with a robust and reliable wireless network. It is our hope that this proposal serves as a foundation for realizing a wireless network that empowers and enriches the educational journey at KR.

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