Lincoln Public Schools

ROBERT FORD
DIRECTOR OF TECHNOLOGY

Memorandum **May 30, 2013**

To: Superintendent Becky McFall
From: Rob Ford

Subject: Network Improvement Recommendation

On May 9th, I shared with you an initial assessment of the Lincoln and Hanscom campus networks. I identified three primary problems that were impeding the use of technology to improve student learning - inadequate wireless access points, internal network bottlenecks and bandwidth constraints, and a flat network design. In the long-term, a regular maintenance and equipment replacement plan, staff training, and proactive monitoring and analysis will be critical to addressing these issues, but there are some actions, detailed below, that will make an immediate and meaningful impact on teaching and learning.

Network Core and Fiber Replacement

In order to address the critical bottlenecks and bandwidth constraints, we are proposing replacing the network core on each campus, including the core switches and firewalls. This will dramatically increase our switching performance and will allow us to connect all edge switches and servers at either 1Gbps or 10Gbps. We are also recommending replacing the fiberoptic cabling linking the Lincoln MDF to the Smith, Brooks 1, and Brooks 2 IDF closets with new cabling that can support 10Gbps connection speeds. While the cabling between the two Hanscom schools also warrants replacement, we are not recommending doing so at this time, given that it will have to be removed and replaced again within the next year during the upcoming building project.

Wireless Access Point Replacement/Deployment

Over the long-term, the district needs to move towards one wireless access point per typical classroom to meet the demands of both today's educational activities and future demands such as the upcoming PARCC assessment. As a first step towards this goal we are proposing replacing all wireless access points and increasing the number of access points overall. This model will place one wireless access point in every 1:1 classroom and one per every two classrooms elsewhere in the district. Overall this will increase the number of access points on the Lincoln campus from 20 to 38 and on the Hanscom campus from 20 to 42. We also recommend replacing the edge switches where the access points connect to the network in order to remove critical bottlenecks.

Implement a New Network Design including a Public Wireless network

Replacing the equipment detailed above will afford us an opportunity to build a new network VLAN and routing scheme. This will also allow us to better manage our network using Quality of Service (QoS) techniques and will introduce a greater level of security by

appropriately segmenting the network. As part of this work we will also introduce a public wireless network that will allow us to isolate "untrusted" devices from our core academic and administrative functions. We will also be able to implement more robust security and authentication protocols.

All of the recommended changes above will lead to improved network performance and reliability and help build faculty confidence in the use of technology. This is critical in addressing the concerns of the faculty, who in large numbers report that the network is unreliable, has a negative impact on teaching, or has made them less likely to use technology in the classroom. By building a solid network base, it will establish a foundation to support any project that utilizes technology in the district.

All of the equipment identified above, including switches and wireless access points, will be transferable to any new buildings that may be built. Although both the fiber and copper cabling infrastructure at the Hanscom schools is inadequate, we are not recommending new cabling at these schools given the imminent building projects.

Attached to this memo is a detailed cost estimate for this work. If you have any questions, please do not hesitate to contact me.

Network Improvement Cost Estimate

Edge switch, access point, and firewall licensing info below is presented with two options for terms - three or five years.

Lincoln Campus

Item	Equipment Cost	Licensing 3-Year Cost	Licensing 5-Year Cost
Core Switch: 1 x HP E5406 zl switch with 24-Port Gig-T Module, redundant power supply, and 10GB expansion module	$8,457.00	N/A	N/A
Core Fiberoptic Transceivers: 1 x 1GB SFP, 4 x 10GB SFP+	$4,679	N/A	N/A
Firewall: Meraki MX400	$7,895.00	$16,700.00	$23,400.00
Wireless Access Points: 34 x Meraki MR16 and 4 x Meraki MR24	$18,463.58	$8,474.00	$12,844.00
Edge Switches: 5 x Meraki MS42-P PoE and 3 x Meraki MS42	$21,882.15	$2,376.00	$3,600.00
Edge Fiberoptic Transceivers: 1 x 1GB SFP, 4 x 10GB SFP+, and 3 Twinax 10GB SFP cables	$3,356.09	N/A	N/A
Replacement Fiber: 3 x 12-strand plenum-rated 10GB OM3 Fiber terminated with SC connectors	$2,550	N/A	N/A
TOTAL	**$67,282.82**	**$27,550.00**	**$39,844.00**

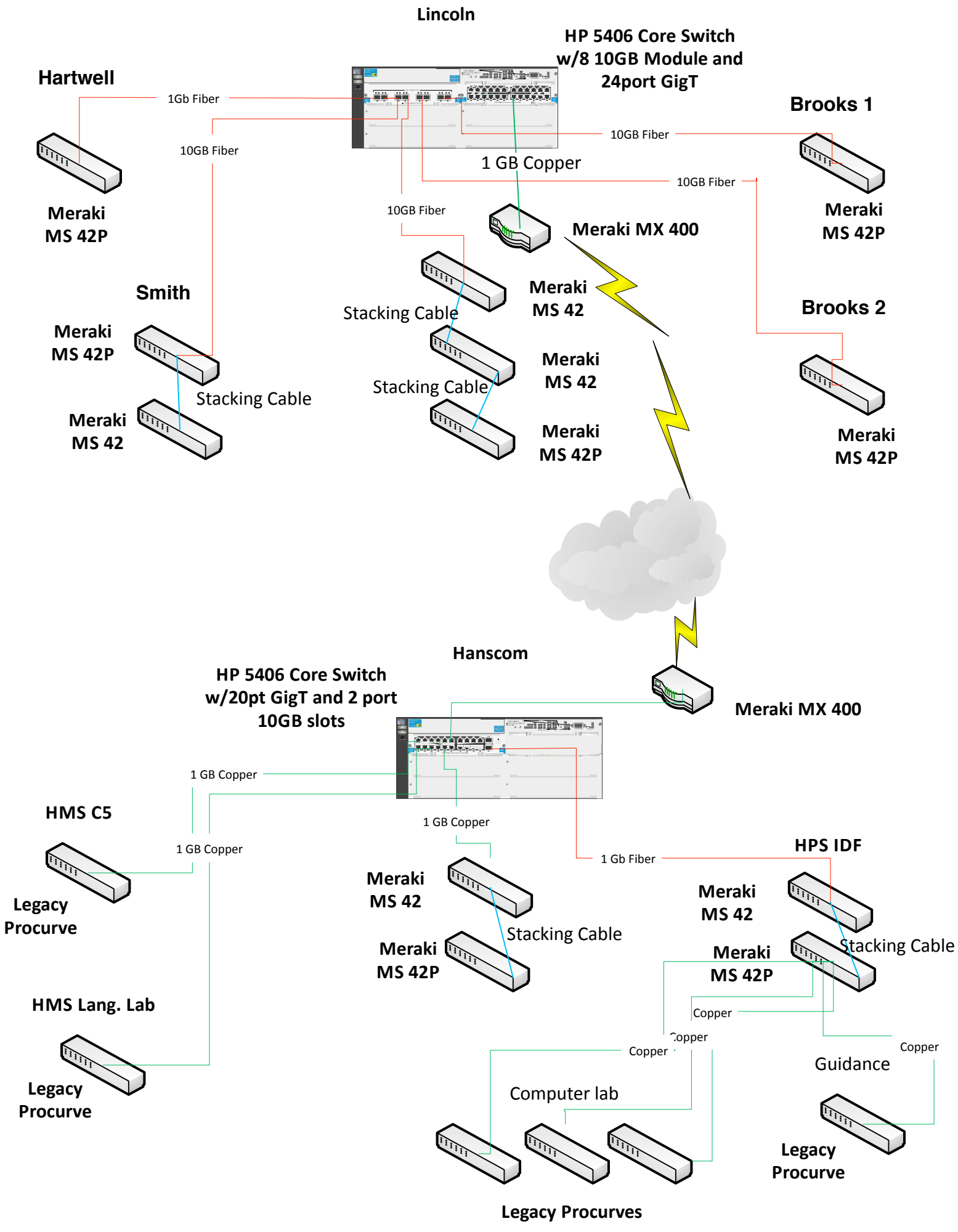
Total Lincoln Campus (w/ 3 year licensing option): $ 94,832.82
Total Lincoln Campus (w/ 5 year licensing option): $107,126.82

Hanscom Campus

Item	Equipment Cost	Licensing 3-Year Cost	Licensing 5-Year Cost
Core Switch: 1 x HP E5406 zl switch with 20-Port Gig and 2 10 GB expansion module, and redundant power supply	$5,425.00	N/A	N/A
Core Fiberoptic Transceiver: 1 x 1GB SFP	$330	N/A	N/A
Firewall: Meraki MX400	$7,895.00	$16,700.00	$23,400.00
Wireless Access Points: 36 x Meraki MR16 and 6 x Meraki MR24	$21,002.52	$9,366.00	$14,196.00
Edge Switches: 2 x Meraki MS42-P PoE and 2 x Meraki MS42	$10,636.70	$1,188.00	$1,800.00
Edge Fiberoptic Transceivers: 1 x 1GB SFP, and 2 Twinax 10GB SFP cables	$470.00	N/A	N/A
TOTAL	**$45,759.22**	**$27,254**	**$39,396**

Total Hanscom Campus (w/ 3 year licensing option): $ 73,013.22
Total Hanscom Campus (w/ 5 year licensing option): $ 85,155.22

TOTAL (w/ 3 year licensing option): $167,846.04
TOTAL (w/ 5 year licensing option): $192,282.04


Lincoln
HP 5406 Core Switch w/8 10GB Module and 24port GigT
Hartwell
1Gb Fiber
10GB Fiber
Meraki MS 42P
Brooks 1
10GB Fiber
Meraki MS 42P
1 GB Copper
10GB Fiber
10GB Fiber
Meraki MX 400
Meraki MS 42
Smith
Meraki MS 42P
Stacking Cable
Meraki MS 42
Stacking Cable
Meraki MS 42
Stacking Cable
Meraki MS 42P
Brooks 2
Meraki MS 42P
Hanscom
HP 5406 Core Switch w/20pt GigT and 2 port 10GB slots
Meraki MX 400
1 GB Copper
1 GB Copper
HMS C5
1 GB Copper
1 Gb Fiber
HPS IDF
Meraki MS 42
Stacking Cable
Legacy Procurve
Meraki MS 42
Stacking Cable
Meraki MS 42P
Meraki MS 42P
Copper
HMS Lang. Lab
Copper
Copper
Guidance
Computer lab
Legacy Procurve
Legacy Procurve
Legacy Procurves