BACH KHOA UNIVERSITY

FACULTY OF COMPUTER SCIENCE & ENGINEERING

Assignment 02 Report

COMPUTER NETWORKS 1 – SEMESTER 171

Group members

Contents

In order to make BKU a modern, friendly and energy-saving university, CSE Faculty has been requested to research and build a monitoring system with camera and many other devices (measuring humidity, temperature and light in classes). This system is implemented in buildings at H6 (Binh Duong – Di An). For this system to work efficiently, our faculty need to design new network in these buildings.

Scope of work

In this assignment, we're requested to design the network for a monitoring system with camera and many other devices, which will be implemented in buildings at H6 (Binh Duong – Di An).

H6 consists of these kinds of areas:

- Room with big area – over 60m^2
- Lobbies
- Theory classrooms
- Practice classrooms
- Other rooms

In this assignment, we will assume that the system will be implemented at 3 floors, each floor has 1 room with big area, 1 theory classroom, 1 practice classroom & 1 lobby.

Information required

- Physical design
- Network topology
- Logical diagram
- List of devices
- Total estimated budget

Requirement analysist

Bandwidth calculation

- Room with big area:

  If we have 6 light sensors & 6 temperature sensors, then there'll be 12 sensors.

  Data collection occurs on both sensors every minute, and the data size is 32 Kb for each factor, so every minute the collected data size will be:

  12 * 32 = 384 Kb

  The collected data size in 5 minutes will be:

  384 * 5 = 1920 Kb

  Since that amount of data will be sent to the server, the bandwidth used for transferring it will be:

  1920 Kbps = 1.875 Mbps

- Theory classroom:

  If we have 3 light sensors & 3 temperature sensors, then there'll be 6 sensors.

  Data collection occurs on both sensors every minute, and the data size is 32 Kb for each factor, so every minute the collected data size will be:

  6 * 32 = 192 Kb

  The collected data size in 5 minutes will be:

  192 * 5 = 960 Kb

  Since that amount of data will be sent to the server, the bandwidth used for transferring it will be:

  960 Kbps = 0.9375 Mbps

- Practice classroom:

  If we have 3 light sensors & 3 temperature sensors, then there'll be 6 sensors.

  Data collection occurs on both sensors every minute, and the data size is 32 Kb for each factor, so every minute the collected data size will be:

  6 * 32 = 192 Kb

  The collected data size in 5 minutes will be:

  192 * 5 = 960 Kb

  Since that amount of data will be sent to the server, the bandwidth used for transferring it will be:

  960 Kbps = 0.9375 Mbps

- Lobby cameras:

  The camera will monitor 24/7, and store data on server with network speed 1MB/s, or we can say it its 8Mbps.

  So, if we have 4 cameras per lobby, then the bandwidth used for transferring data from them will be:

  8 * 4 = 32 Mbps

- To summarize the estimated bandwidth, we will have the following table for a floor:

Room with big area	Theory classroom	Practice classroom	Lobby cameras	**Total**
1.875 Mbps	0.9375 Mbps	0.9375 Mbps	32 Mbps	**35.75 Mbps**

Therefore, the total estimated bandwidth used for transferring data of 3 floors will be

35.75 * 3 = 107.25 Mbps

Storage capacity calculation

- From the total estimated bandwidth above, we can calculate the size of the data arrived at the server every second, which is:

  107.25 Mb or **13.40625 MB**

  The stored data size in 1 day will be:

  13.40625 * 86400 = 1158300 MB = 1131.15234375 GB = 1.10464096069 TB

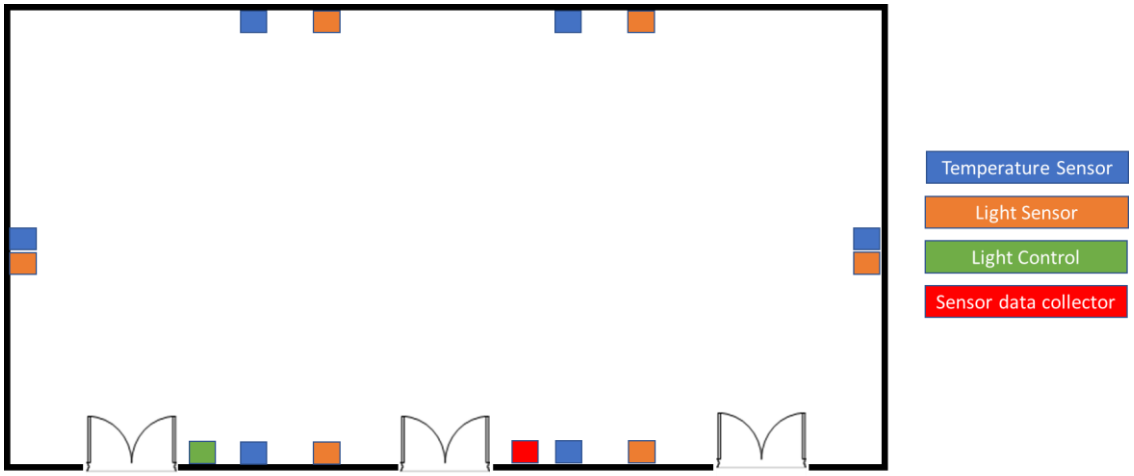
  The stored data size in one month (assuming that there're 31 days):

  1.10464096069 * 31 = 34.2438697815 TB

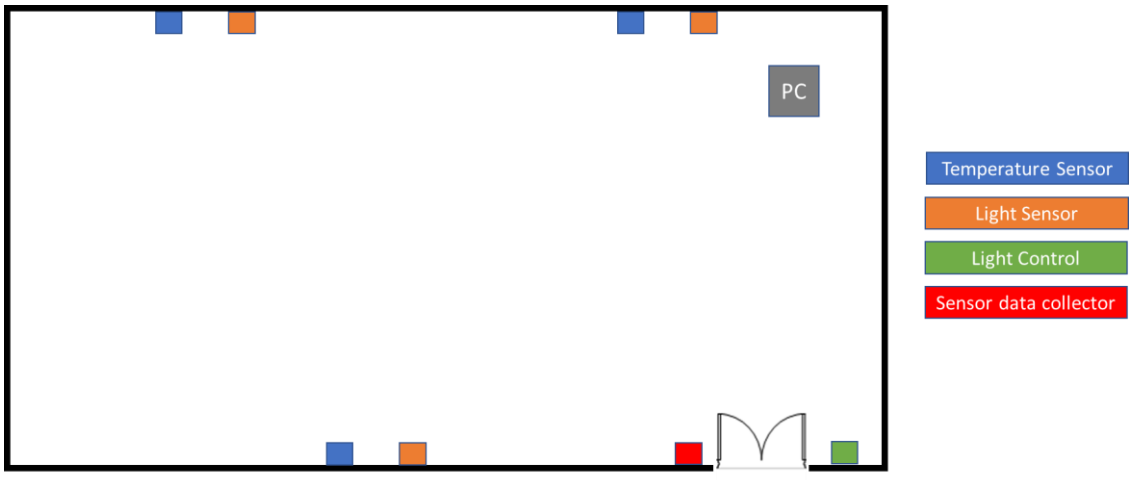
  34.2438697815 TB will be the Maximum Stored Data Size in a month. To make economical use of storage capacity, this data will be deleted monthly.

Physical Design

Room with big area

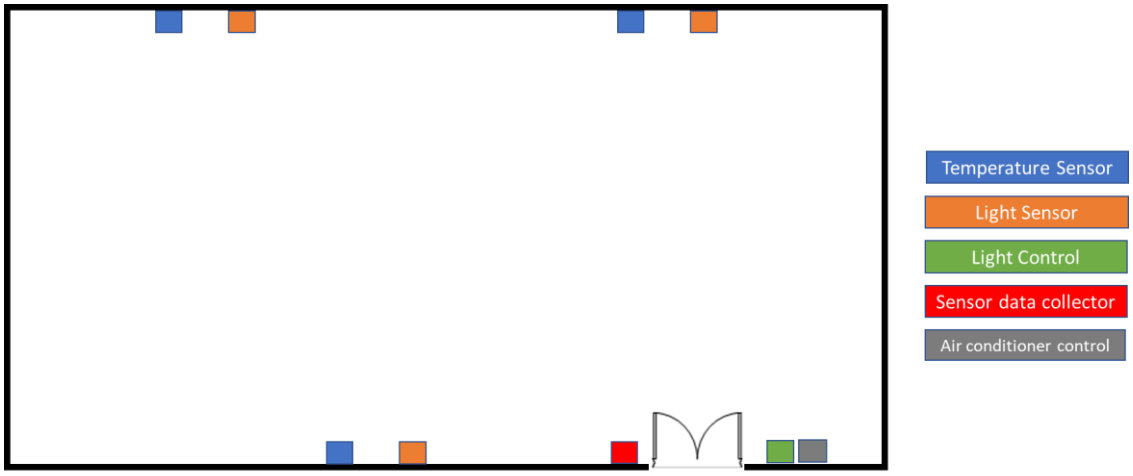


Theory classroom

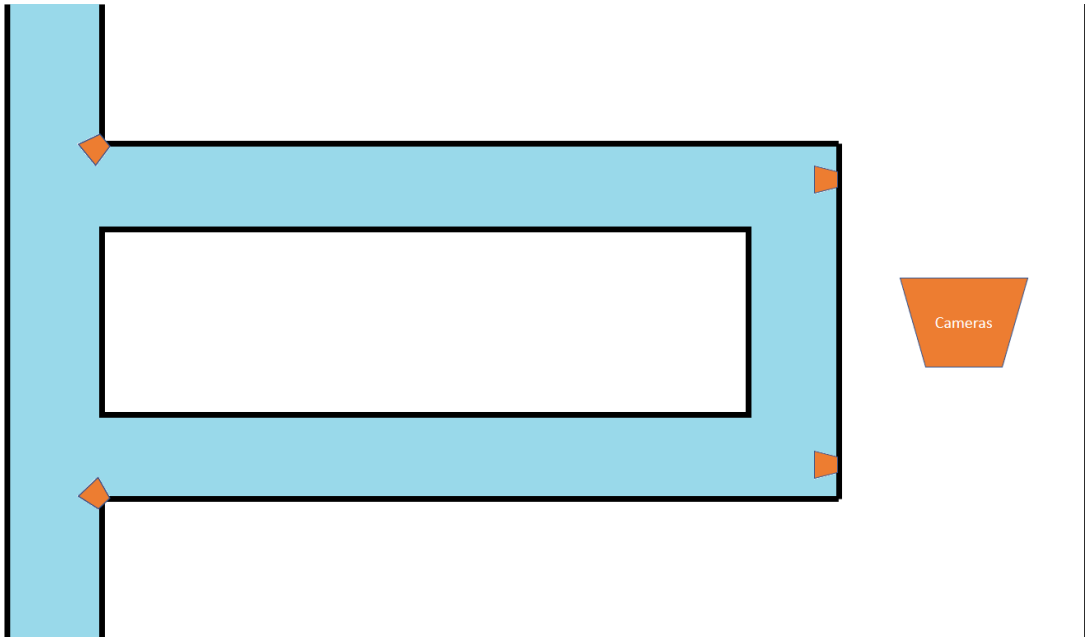


Physical Design

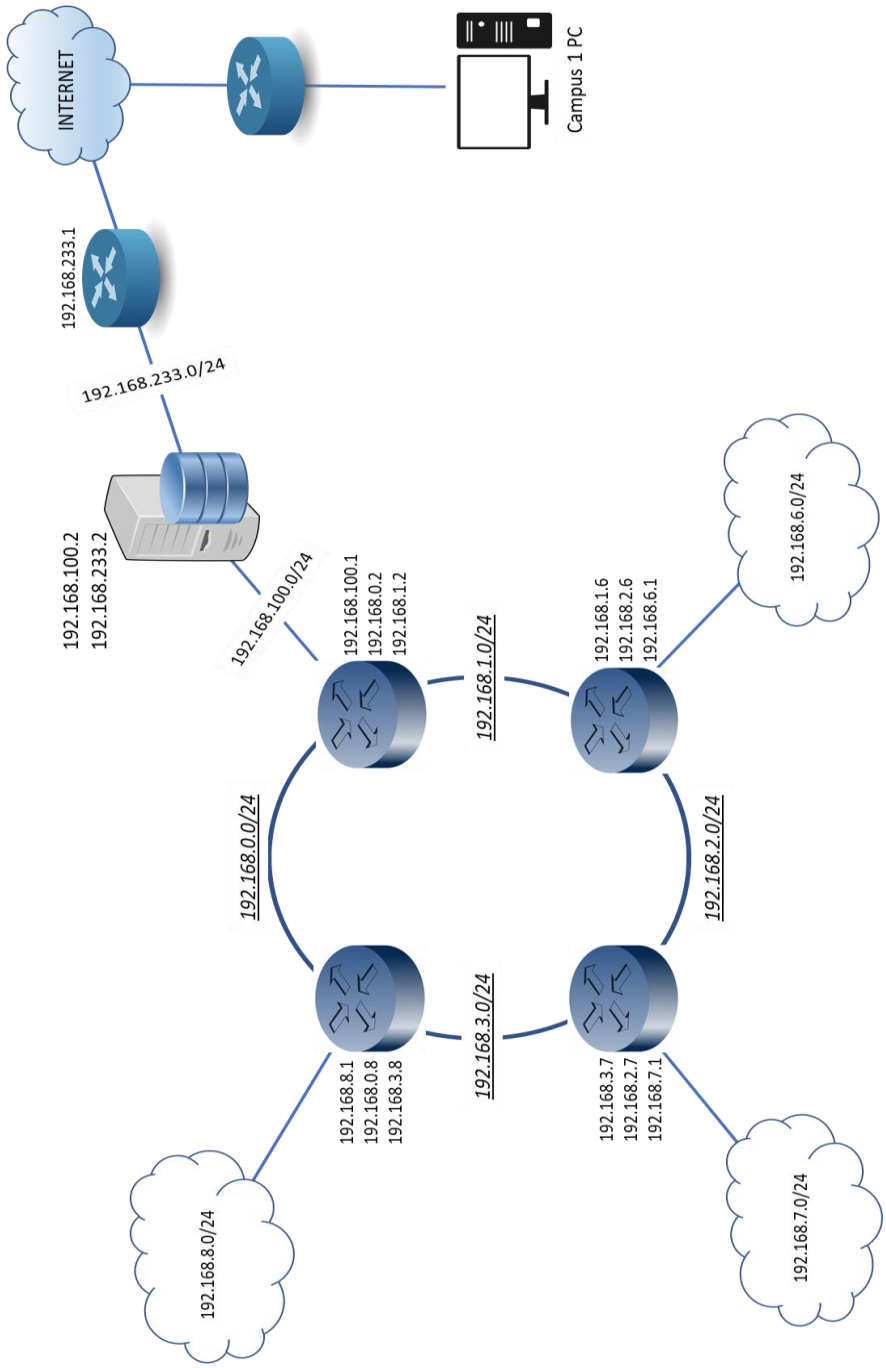
Practice classroom



Lobby cameras

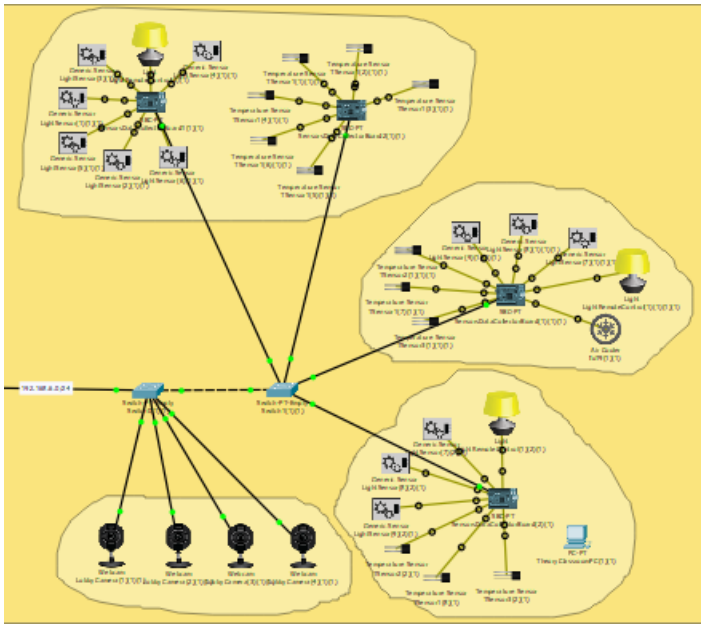


Logical Network Diagram & VLAN Addresses

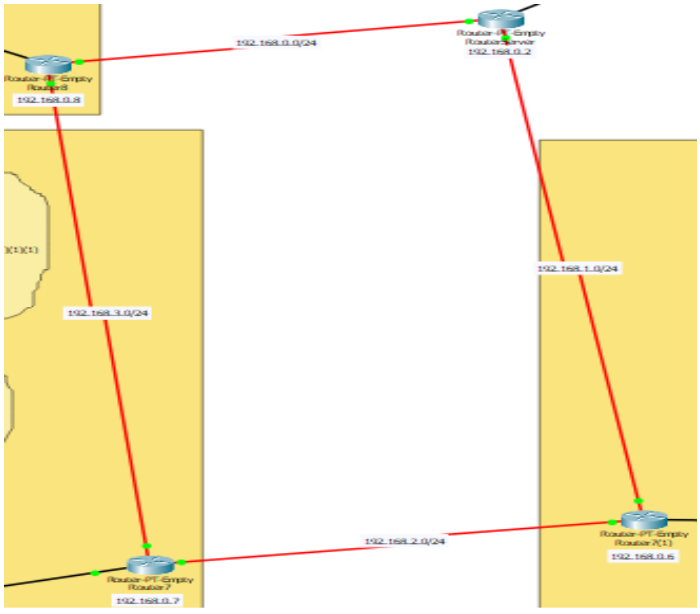


Network Topology

The topology for the network of a floor would be STAR topology



While the topology for the network of outer routers of all floors would be RING topology



List of equipment and total budget

Item	Model	Amount	Unit cost	Total cost
Router	Cisco 2501	4	$34.95	$139.80
	Cisco RV082 Dual WAN VPN Router	1	$94.99	$94.99
Switch	Cisco WS-C2960PD-8TT-L 2960 8-PORT Catalyst 10/100 Switch	6	$284.32	$ 1705.92
	CISCO SYSTEMS 5-Port Ethernet Switch (SG110D05NA)	2	$24.00	$48.00
Server	Supermicro SuperChassis CSE-836TQ-R710B	1	$1,299.99	$1,299.99
Hard Drives	Western Digital 3.5" Red WD30EFRX 3TB 5400RPM SATA3 64M Cache NAS Desktop HDD	14	$120.00	$1680.00
Camera	Hikvision DS-2CD2142FWD-I 4MP POE IR WDR Fixed Dome Network Camera 2.8mm lens	12	$83.99	$1007.88
Light Sensors	Dusk To Dawn Photocell Automatic Light Control Sensor	36	$4.19	$150.84

List of equipment and total budget

	Switch DC 12V/24V/36V/48V			
Temperature Sensors	Mini F Digital LCD Thermometer Temperature Meter Gauge Sensor Indoor Outdoor US	36	$7.98	$287.28
IOT Boards	STM32F107 STM32F107VCT6 Development Board Ethernet RC522 IOT Multiple Interfaces	12	$37.89	$ 454.68
LAN cable	CAT6 1000FT UTP High Speed Ethernet Network LAN Cable Grey - Bulk Pull Box	1	$44.99	$44.99
LAN connector	100 Pcs CAT6 Plug EZ RJ45 Network Cable Modular 8P8C Connector End Pass Through	100	$1.095	$10.95
Serial Cable	10 Foot DB15 15 Pin Serial Port Cable Male / Male	4	$10.99	$43.96
TOTAL	**$6969.28 = 158,325,000VND** (currency exchange rate applied on 2017/12/28)			

Pros & Cons

Pros:

- Scalability: with 4 big routers (3 floors and server router) set up by the RING topology, should there be a new router added to the Ring, the administrator just has to reconnect the cables and reconfigure the routing table, without having to pay for the replacement of any other devices.

- Performance: with the whole system being wired, the probability of data loss is considerably low, as there's no obstacles or difficulties in the connectivity like wireless networks.

- Security: with the whole system being wired and completely separated from public network (used by everyone to get on the Internet), there's hardly anyway an attacker can gain access to the system (even if it has some vulnerabilities). Man-In-The-Middle is nearly impossible.

Cons:

- Availability: With 4 big routers (3 floors and server router) set up by the RING topology, should a router fail, some other routers lying before it in the traffic flow will be unable to connect to the server.

- Performance: A packet might have to travel through many routers to reach its destination. This may result in overall degraded performance if any router's performance is degraded.

- Storage capacity: the amount of data generated after a day is very large, so the storage capacity is still limited and the data has to be deleted after a short time (only a month), which might be inefficient if some investigations demanded for data of a longer time before.

Group Assessment

Member / Task		
Requirement analysist		
Physical design		
Logical Diagram and VLAN addresses		
Network topology		
List of equipment and total budget		
Pros & Cons		
TOTAL PERCENT	%	%