

**Agricultural Research Center
Central Laboratory of Agricultural Expert Systems
RADCON Project, UTF/EGY/021**

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Table of Contents

1. Overview.....	4
2. Dokki Campus Network Infrastructure.....	6
2.1 Design Description.....	6
2.2 Design Layout.....	7
2.3 Core Switch Specifications.....	8
2.4 Edge Switches Specifications.....	9
2.5 Server.....	11
3. Giza Campus Network Infrastructure.....	12
3.1 Design Description.....	12
3.2 Design Layout	14
3.3 Core Switch Specifications.....	16
3.4 Edge Switches Specifications.....	17
3.5 Server.....	17
4. Kafr El-Sheikh Network Infrastructure.....	17
4.1 Design Description.....	17
4.2 Design Layout	18
4.3 Network Devices Specifications.....	21
5. Wide Area Network Infrastructure.....	23
5.1 Design Description.....	23
5.2 Design Layout	23
5.3 Routers Specifications.....	24
6. Network Security Infrastructure.....	24
6.1 Security System for Dokki Campus Network.....	24
6.2 Security System for Giza Campus Network.....	27
7. Current Status of RADCON's Equipment.....	27
7.1 Status of Distributed equipment.....	28
7.2 Ongoing Activities for the purchase of remaining equipment.....	31
8. Dokki and Giza Campuses Network Configuration Design.....	31
9. Recommendations for Improving the current Infrastructure.....	33

List of Figures and Tables

Figure 1: ARC Structure.....	4
Table 1: The locations of Dokki campus network.....	6
Figure 2: Network Layout for Dokki Campus.....	8
Table 2: List of edge switches in Dokki campus network.....	9
Table 3: The locations of Giza campus network.....	13
Figure 3: Network Layout for Giza Campus.....	14
Table 4: List of edge switches in Giza campus network.....	17
Table 5: List of Sites in Sakha Campus Network.....	18
Figure 4: Sakha Research Stations Schematic Diagram.....	19
Figure 5: Network Layout for Sakha Campus Network.....	20
Table 6: Switches Specifications.....	21
Table 7: Router & DSL Specifications.....	22
Table 8: Outdoor Wireless Bridge Specifications.....	22
Figure 6: ARC WAN Layout.....	23
Figure 7: CLAES Network Layout before installing Security Devices.....	25
Table 9: List of distributed devices on ADs and ECs.....	28
Figure 8: Security Layout for Dokki/Giza Campus Network.....	28
Figure 9: VLAN Configuration Design in Dokki Campus Network.....	32
Figure 10: VLAN Configuration Design in Giza Campus Network.....	32

1. Overview

The Agricultural Research Center (ARC) is a large research center that spread over all Governorates in Egypt and represented by 16 Research Institutes, 9 Central Laboratories, 31 Specialized Research Stations (SRS), 8 Regional Research Stations (RRS), 97 Extension Centers (EC), Agricultural Experiments, 26 Agricultural Directorates (AD), Egyptian National Agricultural Library (ENAL), and Central Administration for Research Stations. During the year 2001, the number of ARC researchers have been reached to 4300, which means that thousand of theses have been created and a need for a methodology for publishing the research activities should be adopted, therefore, ARC has begun to establish its physical network infrastructure by the beginning of 2001 through an agricultural information system project, before this date there were some individual entities that established its network infrastructure such as Central Laboratory for Agricultural Expert Systems (CLAES), ENAL, Agricultural Genetic Engineering Research Institute (AGERI), and Central Laboratory for Agricultural Climate (CLAC). This document will describe the current status of infrastructure of ARC network, which are used by RADCON information system.

ARC network includes two main campuses network; one is located in Dokki region, while the other is located in Giza region. Also, a new campus network for Sakha research stations has been established and it will be connected to ARC network. Moreover, the other remote sites are connected to ARC network through different communication means. Figure 1 depicts the overall structure of ARC enterprise network

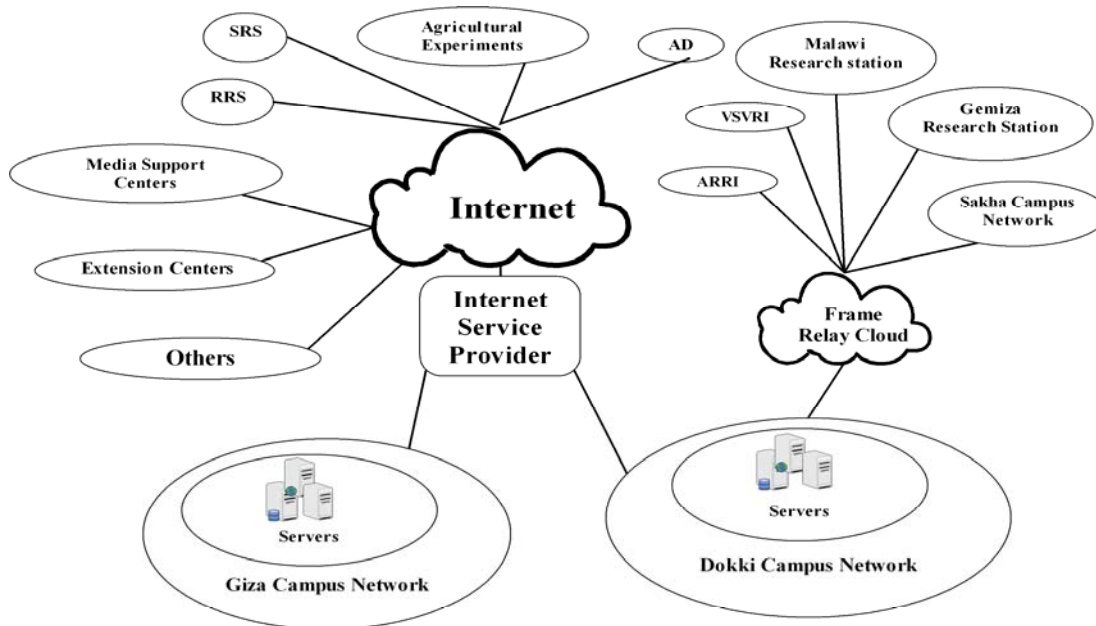


Figure 1: ARC Structure

Dokki campus network consists of 6 research institutes, 4 central laboratories, ENAL, Electronic Documentation and Information Central Administration (EDICA), Union of Producers and Exporters of Horticultural Crops (UPEHC), and, Ministry headquarter

building, moreover, there are 5 remote locations: Animal Reproduction Research Institutes (ARRI), Veterinary Serum and Vaccine (VSVRI), 3 research stations: Malawi, Gemiza, and Sakha. There are three intensive sites in Dokki campus network, which are:

- **Central Laboratory for Agricultural Expert Systems**

CLAES is the focal node for all sites in Dokki region and it includes servers that host the information systems of NARIMS, VERCON, and RADCON and addition to other services such as CLAES web site, mail server and DNS server.

- **Egyptian National Agricultural Library**

It plays an important role in the whole ARC network as it provide publications subscriptions services for all other nodes, it hosts its web site and mail server.

- **Central Laboratory for Agricultural Climate**

CLAC has its own LAN and Web, and Mail Servers.

A Giza campus site consists of 8 research institutes, 4 central laboratories, the ARC administration building, Central Administration for Research Stations (CARS), and Central Administration for Seeds. There are three intensive sites in Dokki campus network, which are:

- **Sugar Crops Research Institute**

SCRI is the focal node for all sites in Giza region and it includes servers that host the ARC mail, and DNS servers

- **Agricultural Genetic Engineering Research Institute**

AGERI has its own LAN that connected to Internet through FRCU in addition to their connection with Giza campus network; they have their own web server.

- **Administration Unit for Insurance and Pension**

This unit is connected to National Organization for Pension and Insurance (NOPI) to provide insurance services for the ARC's staff in finishing their needs without going to the NIPO.

Sakha encompasses the largest research stations in Egypt. It consists of more than 20 buildings that represent different kinds of specialized research stations: crops, horticulture, and animal and one regional research station. Sakha network includes two campus connected to each other and the two campuses connected to ARC network.

RADCON Project has assigned another entities called others in figure1 that has been participated in the activities of the project to be connected to RADCON information system through the ARC enterprise network, they are: 46 poor villages that are connected to RADCON server through dialup connections, 8 faculties of agriculture belongs to 7 universities and 3 non-governmental organizations (NGO). Those entities are connected to RADCON by using Dialup/ADSL connections.

2. Dokki Campus Network Infrastructure

2.1 Design Description

Dokki campus network consists of two layers: core and access. Core layer consists of one core switch: Alcatel Omni Core 5052, this switch has 20 ports 10/100 Mbps, 12 ports 1000 Base -SX and 4 ports 1000 Base -LX. Access layer consists of twelve locations that are connected through Gigabit Ethernet with optical fiber cables.

Table 1 contains a list of sites in Dokki region. An assumption to consider the node that have more than 50 users and its own servers by heavy users while the other nodes which have less than 50 users is called by ordinary nodes. As indicated in tables 1 we have three heavy nodes in addition to the focal node, and 15 ordinary nodes.

Table 1: The locations of Dokki campus network

No.	Site Name	No. of Users	Comment
1	CLAES	90	Focal Node
2	CLAC	60	Heavy Node
3	Central Agricultural Pesticides Laboratory (CAPL)	10	Ordinary Node
4	Central Laboratory of Residue Analysis of Pesticides & Heavy Metal in Food	5	Ordinary Node
5	Plant Protection Research Institute (PPRI)	24	Ordinary Node
6	Animal Production Research Institute (APRI)	21	Ordinary Node
7	Animal Health Research Institute (AHRI)	24	Ordinary Node
8	Vegetable Department of Horticultural Research Institute (HRI)	12	Ordinary Node
9	Agricultural Economics Research Institute (AERI)	7	Ordinary Node
10	Agricultural Engineering Research Institute (AENRI)	21	Ordinary Node
11	Animal Reproduction Research Institute ¹ (ARRI)	5	Ordinary Node
12	Veterinary Serum and Vaccine Research Institute ¹ (VSVRI)	5	Ordinary Node
13	Sakha Research Station ¹	115	Heavy Node
14	Gemiza Research Station ¹	8	Ordinary Node
15	Malawi Research Station ¹	8	Ordinary Node
16	ENAL	90	Heavy Node
17	EDICA	5	Ordinary Node
18	UPEHC	6	Ordinary Node
19	Ministry Headquarter Building ²	4	Ordinary Node
20	Potato Brown Rot Project (PBRP)	21	Ordinary Node
	Total	542	

¹ An upgrade for the connections of these links is in progress and currently they are not working

² The board of edge switch was burnt and the repairing process is still running

2.2 Design Layout

Figure 2 illustrates the layout of Dokki campus network, 14 sites are connected to the focal node through 8 cores fiber optic cables with 1 Gbps data rate, those sites is far from the focal node about 1 Km and 5 remote sites (VSVRI in Abaasia, ARRI in Harm, Sakha, Gemiza, Malawi) are connected by using Frame Relay technology

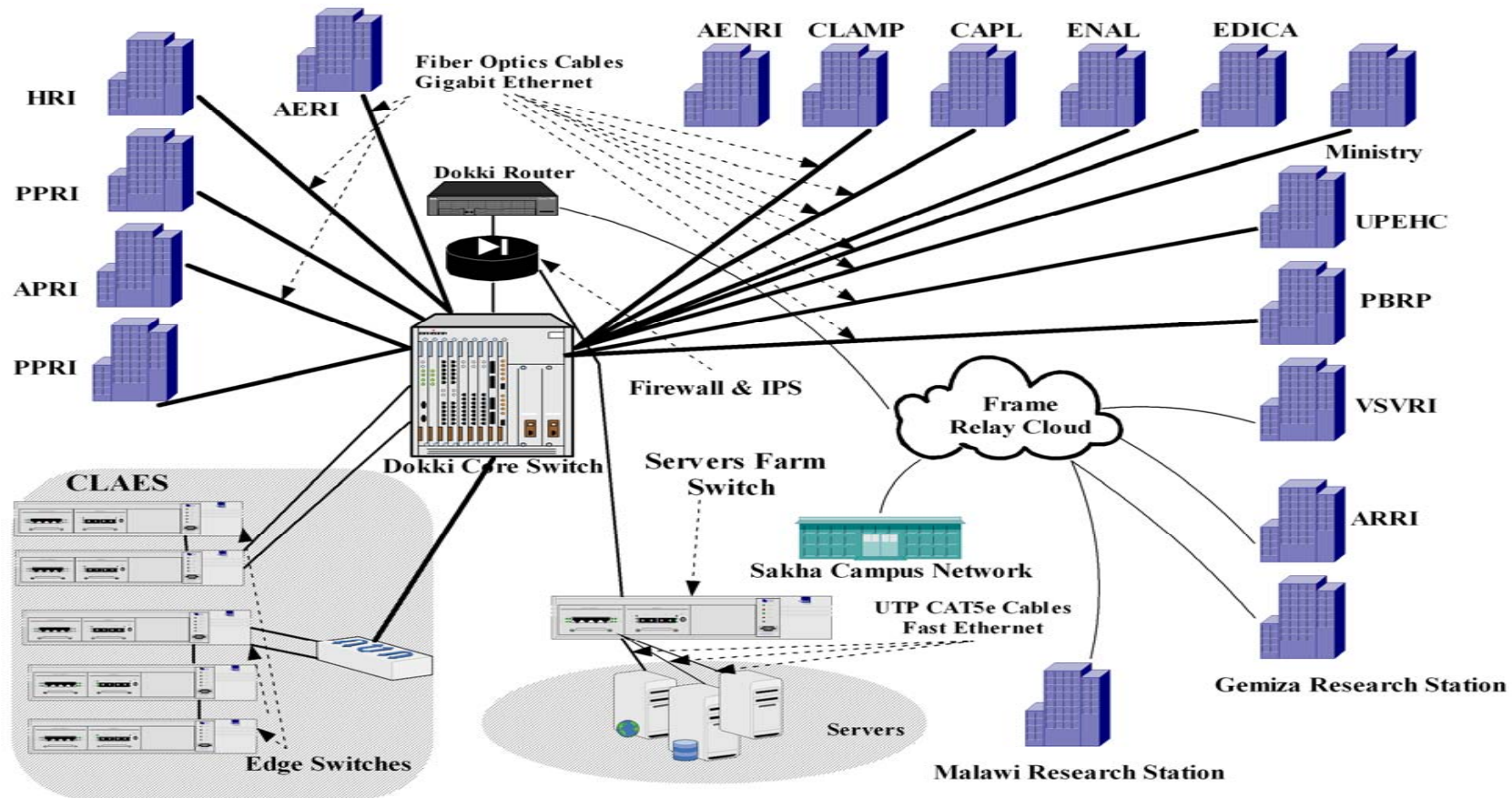


Figure 2: Network Layout for Dokki Campus

2.3 Core Switch Specifications

Location

CLAES

Physical Features

- Model Type: Alcatel, OmniCore 5052
- Supports up to 14 modules, and 3 power supplies
- It includes the following modules:
 - o 2 Enterprise Management Modules, the first operates as a primary module and equipped in slot number 2 with 16 MB Flash Memory, 256 MB DRAM, 2 serial ports, and one PCMCIA Flash card. The second as a secondary module for redundancy and equipped in slot number 1.
 - o Two modules: 6-port, 1000Base – SX, it is used to connect sites which have distances less than 500 meters
 - o Two module: 4-port (2 ports are active and 2 ports are used for redundancy), 1000Base –LX, it is used to connect sites which have distances more than 500 meters
 - o One Module: 20-Port, it was firstly used to connect Servers

Performance Features

- Back plane: 52 Gbps
- Forwarding Rate: 37 Million Packet /sec
- Blocking:

Routing Features

- IPv4 and IPv6
- RIPv1 and RIPv2
- OSPF
- BGPv4
- Static Routes

Switching Features

- It is capable of learning 64,000 addresses per gigabit port or per group of ten Fast OmniCore routing switch supports bridging as defined in the IEEE 802.1d standard and Fast STP (FSTP) as defined in the IEEE 802.1w standard.
- OmniCore port trunking allows four ports of the same type and configuration to be combined to form Ethernet ports
- The a single logical trunk. Up to four trunk groupings can be created in a single OmniCore chassis.
- The OmniCore routing switch supports 512 VLANs based on port, protocol, MAC, IEEE 802.1Q tag, or Layer 3 address.

Network Management

- Supports SNMPv1
- Four groups of RMON (statistics, history, alarms, and events), and wire-speed port mirroring to aid in troubleshooting the network.

- Routing switch configuration and management can occur through the following mechanisms: Telnet, Java-based GUI with Track View management, a Command Line Interface (CLI), and HP Open View.
- All switch management is completely tied to SNMP since the switch uses public and private MIBs for management.

2.4 Edge Switches Specifications

There are three types that are used and distributed in Dokki sites and distributed as in table 2

Table 2: List of edge switches in Dokki campus network

Edge Switches Type	Sites	
	Name	Quantity
Alcatel, OminSwitch, 6024	CLAES	1
	CLAC	1
	CAPL	1
	APRI	1
	AHRI	1
	HRI	1
	AERI	1
	AENRI	1
	Ministry Building	1
	CLAM	1
3 COM 3300	CLAES	4
	ENAL	3
3 COM 4228G	PBRP	1
	PPRI	1
	UPEHC	1
3 COM 4200 28	EDICA	1
3 COM 3226 Ports	CLAES	1
3 COM 3900	ENAL	1
Cisco Catalyst 2950G	Sakha	1
	Gemiza	1
	Malawi	1
	VSVRI	1
	ARRI	1

Specifications of Alcatel, OminSwitch, 6024

- Access Method: CSMA/CD
- Standard Conformance: IEEE 802.3, IEEE 802.3u
- Number of Ports: 24 -port 10/100 Mbps, 2 –port 1000 –BaseX
- Switching Method: Store and Forward
- Supports port trunking up to 5 trunks/switch with 12 trunks for the entire stack, each trunk contains 2~4 ports.
- Backplane: 8.8 Gbps per switch
- Supports Telnet, SNMP/RMON and Web-based interface

- Four-group RMON including Statistics, History, Alarms and Events
- VLAN support for up to 256 groups, port-based or with 802.1Q VLAN tagging

Specifications of 3 COM 3300

- Access Method: CSMA/CD
- Policy enforcement with Fast IP, IGMP snooping, IEEE 802.1D (incorporating 802.1p prioritization), and IEEE 802.1Q standards based VLANs
- Number of Ports: 24 -port 10/100 Mbps
- Web-based monitoring and control system and embedded Remote Monitoring (RMON).
- Part Number: 3C16985B

Specifications of 3 COM 4200 28

- Access Method: CSMA/CD
- Standard Conformance: IEEE 802.1D (STP), IEEE 802.1p (CoS), IEEE 802.1Q (VLANs), IEEE 802.1w (RSTP), IEEE 802.1X (Network Log-in), IEEE 802.3i (10BASE-T), IEEE 802.3ab (1000BASE-T), IEEE 802.3ad (Link Aggregation), IEEE 802.3u (Fast Ethernet), IEEE 802.3x (Flow control), IEEE 802.3z (Gigabit Ethernet)
- Number of Ports: 24 -port 10/100 Mbps, 2 –port 10/100/1000 Base –T, and 2 –port 1000 –BaseX
- Switching Method: Store and Forward
- Backplane: 12.8 Gbps per switch
- Supports web-based management; command line interface (CLI); serial connector ((9-pin D-type)); Telnet; SNMP v1; works with 3Com management applications, including 3Com Network Supervisor, 3Com Network Director, and 3Com Enterprise Management Suite
- Four-group RMON including Statistics, History, Alarms and Events
- Forwarding Rate: 9.5 Million Packets /sec
- VLAN support for up to 60 groups with 802.1Q VLAN tagging
- Part Number: 3C17304A

Specifications of 3 COM 3900

- Access Method: CSMA/CD
- Standard Conformance: IEEE 802.1d Spanning Tree Bridge, IEEE 802.3 Ethernet, IEEE 802.3u 100 Mbps, and IEEE 802.3x Flow Control.
- Number of Ports: 36 -port 10/100 Mbps, and 1 port 1000 –BaseX
- Web-based monitoring and control system, and embedded Remote Monitoring (RMON).
- Forwarding Rate: 9.8 Million Packets /sec
- Part Number: 3C39036

Specifications of Cisco Catalyst 2950G

- Access Method: CSMA/CD

- Standard Conformance: IEEE 802.1x, IEEE 802.1w, IEEE 802.1s, IEEE 802.3x full duplex on 10BASE-T, 100BASE-TX, and 1000BASE-T ports, IEEE 802.1D Spanning-Tree Protocol, IEEE 802.1p class-of-service (CoS) prioritization, IEEE 802.1Q VLAN, IEEE 802.3 10BASE-T, IEEE 802.3u 100BASE-TX, IEEE 802.3ab 1000BASE-T, IEEE 802.3ad, IEEE 802.3z 1000BASE-X.
- Number of Ports: 24 10/100 ports + two 1000BASE-X ports, Enhanced Image software installed
- Switching Method: Store and Forward
- Backplane: 12.8 Gbps per switch
- Manageable through CiscoWorks network management software on a per-port and per-switch basis, providing a common management interface for Cisco routers, switches, and hubs. SNMP v1, v2, and v3 and Telnet interface support delivers comprehensive in-band management, and a CLI-based management console provides detailed out-of-band management. Cisco Discovery Protocol Versions 1 and 2 enable a CiscoWorks network management station to automatically discover the switch in a network topology.
- An embedded Remote Monitoring (RMON) software agent supports four RMON groups (history, statistics, alarms, and events) for enhanced traffic management, monitoring, and analysis.
- Forwarding Rate: 6.6 Million Packets /sec
- A SPAN port monitors traffic of a single port from a single network analyzer

Specifications of 3 COM 3226

- Access Method: CSMA/CD
- Standard Conformance: IEEE 802.1p (CoS), IEEE 802.1Q (VLANs), IEEE 802.1w (RSTP), IEEE 802.1X (Security), IEEE 802.3ab (Copper Gigabit), IEEE 802.3ad (Link Aggregation), IEEE 802.3i (10BASE-T), IEEE 802.3u (Fast Ethernet), IEEE 802.3x (Flow Control), IEEE 802.3z (Fiber Gigabit)
- Switching Method: Store and Forward
- Number of Ports: 24 10/100 ports
- Supports web-based management; command line interface (CLI); serial connector ((9-pin D-type)); Telnet; SNMP v1; works with 3Com management applications, including 3Com Network Supervisor, 3Com Network Director, and 3Com Enterprise Management Suite
- Backplane: 12.8 Gbps per switch
- Four-group RMON including Statistics, History, Alarms and Events
- Forwarding Rate: 6.6 Million Packets /sec
- Part Number: 3CR17500-91

2.5 Servers

RADCON/VERCON Servers

- Quantity: 3
- Dell, Power Edge 2800 – Xeon 3.2 GHz/1MB
- Memory: 2 GB DDR
- Two Hard Drives: 36 GB SCSI Ultra320 (15000 rpm)

- Three Hard Drives: 73 GB SCSI Ultra320 (10000 rpm)
- Optical Drive: 24 x CDROM
- Monitor: 17" TCO99 Flat Panel
- UPS: APC Back-UPS RS1000VA

Mail Server

- Dell, Power Edge1600
- Processor: 2.4 GHz – Xeon
- Memory: 512 GB
- HDD: 2 x 80 GB

NARIMS Server

- Dell, Power Edge 1800
- Processor: Intel Xeon 3.2 GHz
- Memory: 2GB
- HDD: 3 x 72 GB SCSI Ultra3

CLAES web Servers

- Quantity: 2
- Dell, Power Edge 1500, Dual Processors, Xeon 1 GHz (PIII), 512 Kb Cache Memory
- The memory has been upgraded to 1 GB to one of them and the other is 512 MB
- Two Hard Drives: 36 GB SCSI Ultra320 (15000 rpm)
- UPS: 1200 VA

3. Giza Campus Network Infrastructure

3.1 Design Description

Giza campus network consists of two layers: core and access. Core layer consists of one core switch: Alcatel Omni Core 5052, this switch has 20 ports 10/100 Mbps, 12 ports 1000 Base -SX and 2 ports 1000 Base –LX. Access layer consists of twelve locations that are connected through Gigabit Ethernet with optical fiber cables. Table 3 contains a list of sites in Giza region.

Table 3: The locations of Giza campus network

No.	Site Name	No. of Users	Comment
1	Sugar Crops Research Institute (SCRI)	20	Focal Node
2	Plant Pathology Research Institute (PPathRI)³	30	Ordinary Node
3	Cotton Research Institute (CRI)⁴	40	Ordinary Node
4	Agricultural Genetic Engineering Research Institute (AGERI)	4	Ordinary Node
5	Gene Bank⁵	14	Ordinary Node
6	Field Crops Research Institute (FCRI)⁶	41	Ordinary Node
7	Food Technology Research Institute (FTRI)	4	Ordinary Node
8	Soil, Water, and Environment Research Institute (SWERI)	10	Ordinary Node
9	Agricultural Extension & Rural Development (AERDRI)⁷	9	Ordinary Node
10	Horticultural Research Institute (HRI)	4	Ordinary Node
11	Central Laboratory of Design and Statistical Analysis Research (CLDSAR)	14	Ordinary Node
12	Central Laboratory of Weed Control⁸	6	Ordinary Node
13	Central Laboratory of Palm Research⁹	13	Ordinary Node
14	Central Laboratory of Food and Feed	2	Ordinary Node
15	ARC Administration Building¹⁰	9	Ordinary Node
16	Central Administration for Research Stations	10	Ordinary Node
17	Central Administrations for Seeds¹¹	7	Ordinary Node
18	Insurance and Pension Unit	5	Ordinary Node
19	Engineering Administration Unit	3	Ordinary Node
20	Silk Department (belonged to PPRI)¹²	2	Ordinary Node
21	Biological Control (belonged to PPRI)¹³	10	Ordinary Node
	Total	240	

³ This site consists of two buildings, one is shared with CRI while the other is only occupied by PpathRI's staff.

⁴ This site consists of three buildings connected to each other through fiber optics cables

⁵ This site is connected to core switch through AGERI

⁶ This site consists of two building, one represents the technical office while the other represents the main building

⁷ This site is connected to core switch through SWERI

⁸ This site is connected to core switch through Central Administration for Research Stations

⁹ This site is connected to core switch through CLDSLAR

¹⁰ This site is connected to core switch by 100 Mbps fiber optics cables because there are no additional free Gigabit ports in the core switch.

¹¹ This site is connected to core switch through AERDRI

¹² This site is a department of PPRI

¹³ This site is connected through Silk dept.

3.2 Design Layout

Figure 2 illustrates the layout of Giza campus network, 14 sites are connected to the focal node through 8 cores fiber optic cables with 1 Gbps data rate, those sites is far from the focal node about 1 Km and 5 remote sites (VSVRI in Abaasia, ARRI in Harm, Sakha, Gemiza, Malawi) are connected by using Frame Relay technology.

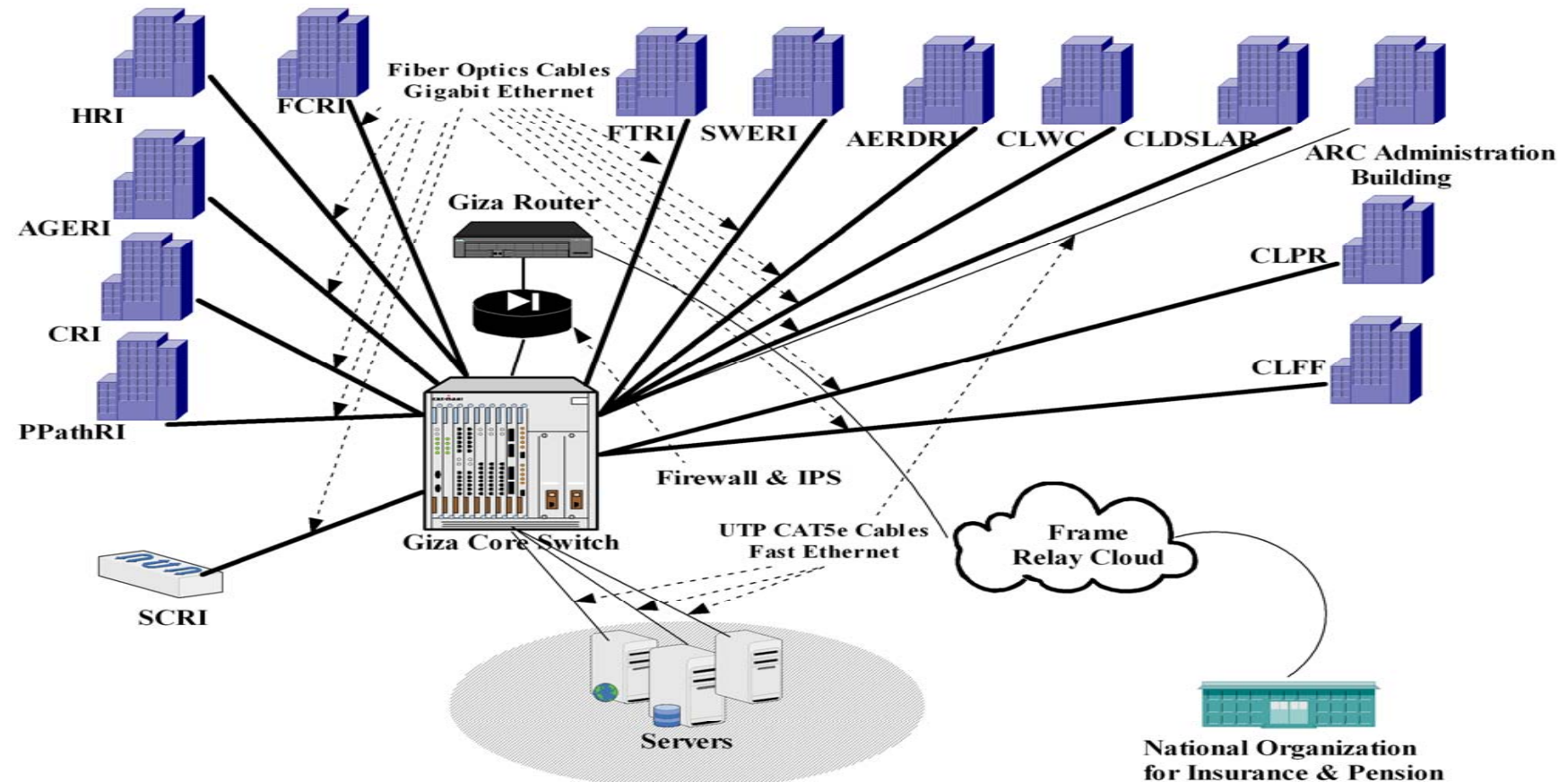


Figure 3: Network Layout for Giza Campus

3.3 Core Switch Specifications

Location

SCRI

Physical Features

- Model Type: Alcatel, OmniCore 5052
- Supports up to 14 modules, and 3 power supplies
- It includes the following modules:
 - o 2 Enterprise Management Modules, the first operates as a primary module and equipped in slot number 2 with 16 MB Flash Memory, 256 MB DRAM, 2 serial ports, and one PCMCIA Flash card. The second as a secondary module for redundancy and equipped in slot number 1.
 - o Two modules: 6-port, 1000Base – SX, it is used to connect sites which have distances less than 500 meters
 - o Two module: 2-port (1 port are active and 1 port is used for redundancy), 1000Base –LX, it is used to connect sites which have distances more than 500 meters
 - o One Module: 20-Port, it was firstly used to connect Servers

Performance Features

- Back plane: 52 Gbps
- Forwarding Rate: 37 Million Packet /sec
- Blocking:

Routing Features

- IPv4 and IPv6
- RIPv1 and RIPv2
- OSPF
- BGPv4
- Static Routes

Switching Features

- It is capable of learning 64,000 addresses per gigabit port or per group of ten Fast OmniCore routing switch supports bridging as defined in the IEEE 802.1d standard and Fast STP (FSTP) as defined in the IEEE 802.1w standard.
- OmniCore port trunking allows four ports of the same type and configuration to be combined to form Ethernet ports
- The a single logical trunk. Up to four trunk groupings can be created in a single OmniCore chassis.
- The OmniCore routing switch supports 512 VLANs based on port, protocol, MAC, IEEE 802.1Q tag, or Layer 3 address.

Network Management

- Supports SNMPv1
- Four groups of RMON (statistics, history, alarms, and events), and wire-speed port mirroring to aid in troubleshooting the network.
- Routing switch configuration and management can occur through the following mechanisms: Telnet, Java-based GUI with Track View management, a Command Line Interface (CLI), and HP Open View.

- All switch management is completely tied to SNMP since the switch uses public and private MIBs for management.

3.4 Edge Switches Specifications

There are three types that are used and distributed in Dokki sites and distributed as in table 4

Table 4: List of edge switches in Giza campus network

Edge Switches Type	Sites	
	Name	Quantity
Alcatel, OminSwitch, 6024	SCRI	1
	Silk Department	1
	Biological Control Department	1
	SWERI	1
	FTRI	1
	CLFF	1
	AGERI	1
	Administration Building	1
	FCRI	1
3 COM 4228G	CLWC	1
	CLPR	1
Cisco Catalyst 2950G	Central Administration for Research Stations	1
	AERDRI	1
	CRI	3
	CLDSAR	1
	PpathRI (new building)	1

The specifications of Alcatel, Omni Switch, 6024, 3 COM 4228G, and Cisco Catalyst 2950G are mentioned in section 2.4.

3.5 Servers

Mail, DNS, Web Servers

Quantity: 3

Model: Compaq Server, Proliant ML – 530,

Processor: Dual 1 GHz Xeon,

Memory: 512 MB ECC Memory,

HDD: 3 x 36.4 SCSI HDD 10K RPM, with RAID Controller,

Tape Drive,

Dual Power Supply

4. Kafr El-Sheikh Network Infrastructure

4.1 Design Description

The project aims at establishing a network infrastructure for the agricultural researcher stations (ARS) in Kafr El-sheikh Governorate. The network infrastructure will be designed using the latest technology in order to facilitate the best researching environment to the agricultural researchers.

The ARS campus in Kafr-Elshiekh consists of 19 buildings: Grains, Rice, Library of Rice, Fish wealth, Enhancement, Scientific Library, Cotton, sugar, crops, Vaccination, Soil, Weeds, Regional Stations, Agricultural Experiments, Agricultural Economics, Management of Soil and Water, Protection and station Management. The total number of network outlets is 115 and the distribution of these outlets over the sites as indicated in table 5. Figure 4 is a schematic diagram for the sites in Sakha research stations

Table 5: List of Sites in Sakha Campus Network

Building Number	Building Name	Total
1	Central Library	4
2	Cotton Research Institute	3
3	Sugar Research Institute	2
4	Agricultural Rural	2
5	Agriculture Enhancement	2
6	Aquaculture	2
7	Agriculture Technology	4
9''	Rice	24
10	Grains	16
11	Weeds	4
12	Regional Station	2
13	Agricultural Experiments	2
14	Agricultural Economics	4
15	Management of Soil and Water (OSOM)	4
16	Plant Protection	5
17	Soil	11
18	Vaccination	20
19	Wheat Diseases	4
	Total	115

4.2 Design Layout

Figure 5 indicates the implemented solution for providing the connectivity among buildings.

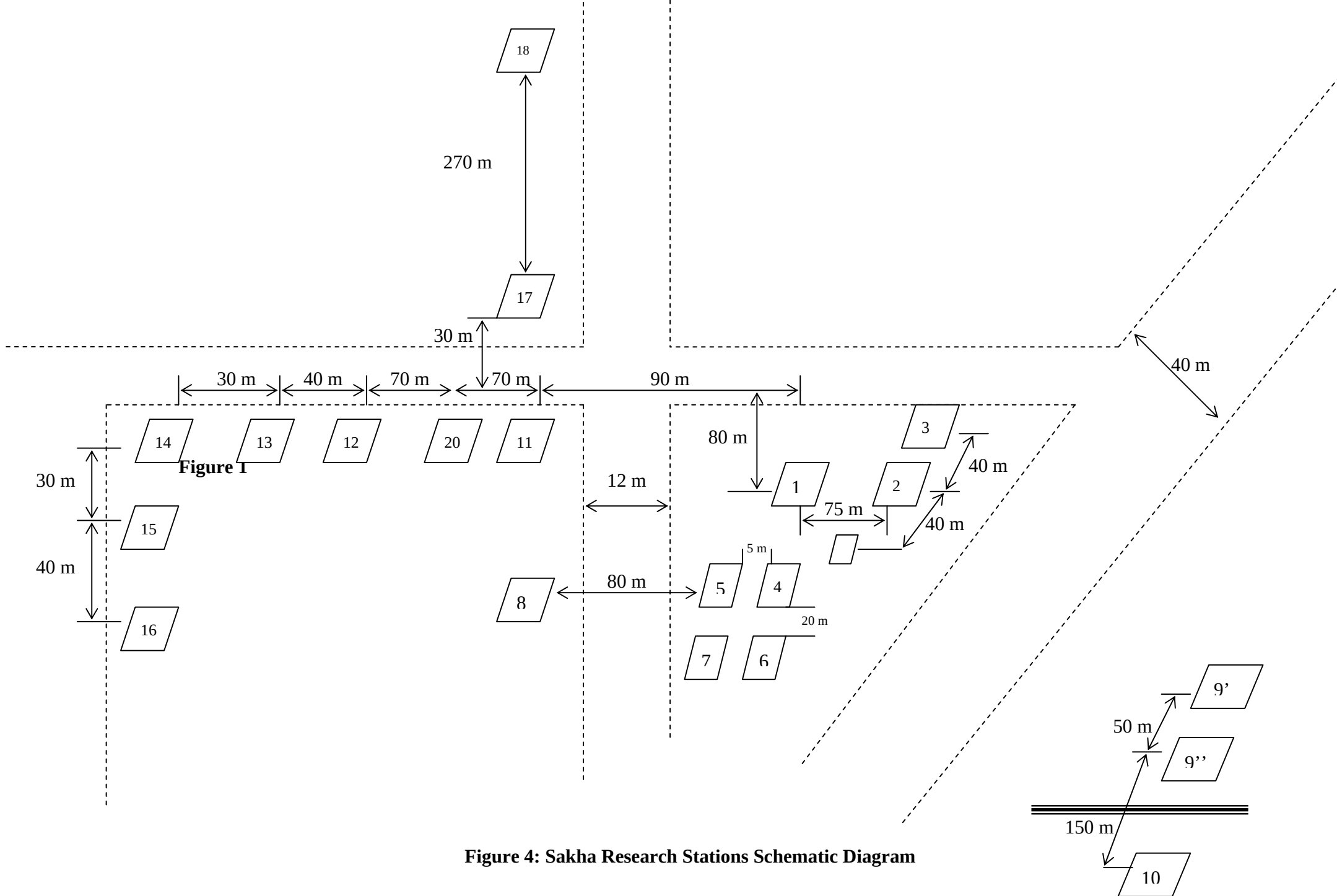


Figure 4: Sakha Research Stations Schematic Diagram

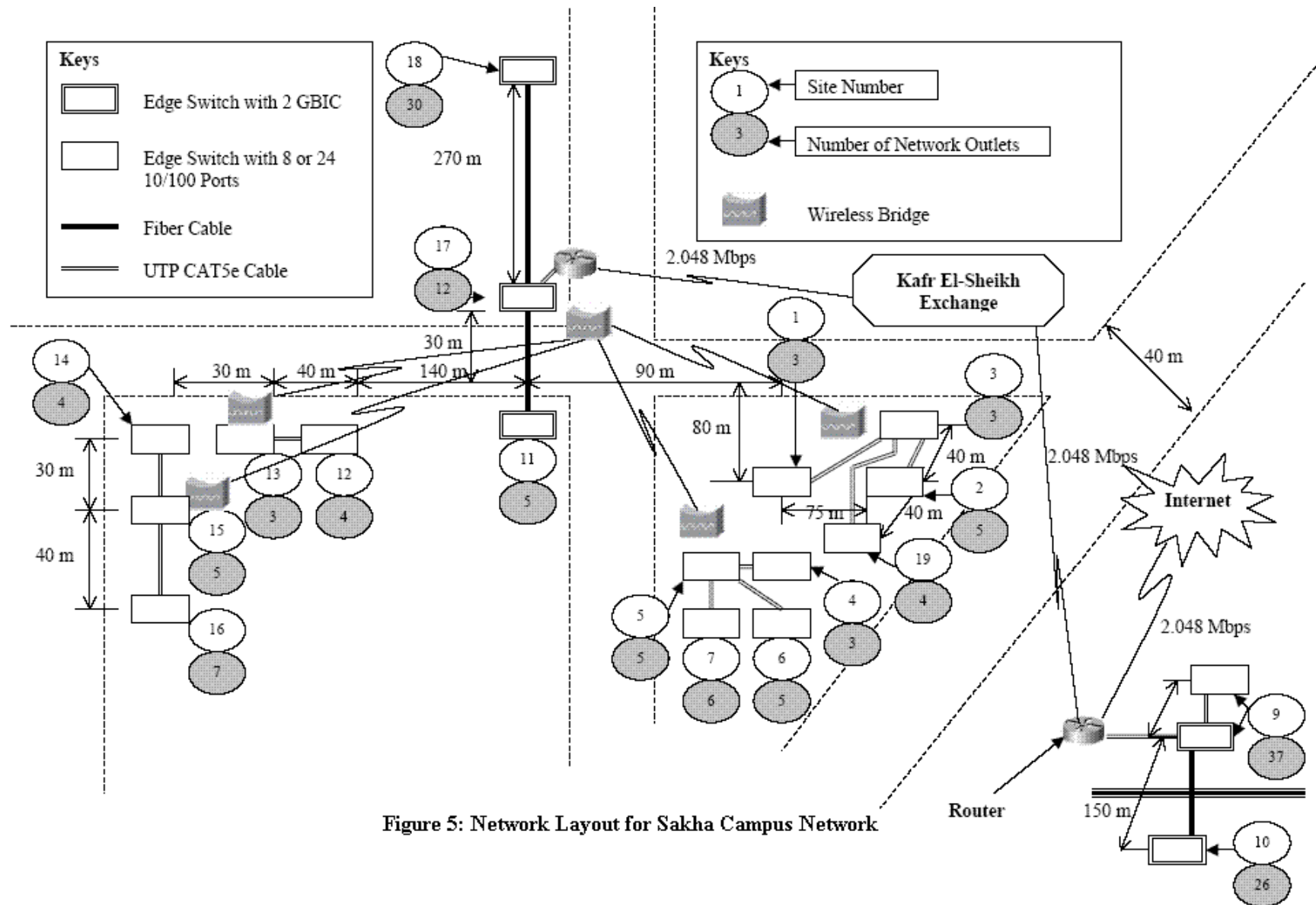


Figure 5: Network Layout for Sakha Campus Network

4.3 Network Devices Specifications

Table 6: Switches Specifications

No.	Specifications	Qty
1	Ports: 24 auto sensing between 10 and 100 Mbps, 2 auto sensing between 10,100 Mbps and 1000 Mbps, 2 GBIC. Forwarding Rate: 6 million packet per second or more Switching technique: store and forward or equivalent The switch should support at least the following protocols: IEEE 802.3z 1000Base-SX/LX/TX IEEE 802.1p IEEE 802.1Q IEEE 802.1D Media interface: RJ45 for 26 ports Management: can be managed through CLI or HTTP Power supply requirements: 220VAC, 50Hz. All the manuals, console cable, power cable and any other needed accessories and software should be included.	5
	Uplink: multi mode Gigabit port (50 µm)	6
2	Ports: 24 auto sensing between 10 and 100 Mbps. Switching technique: store and forward or equivalent The switch should be compliant with IEEE 802.3 standard Media interface: RJ45 Management: can be managed through CLI or HTTP Power supply requirements: 220VAC, 50Hz.	8
3	Ports: 8 auto sensing between 10 and 100 Mbps. Switching technique: store and forward or equivalent The switch should be compliant with IEEE 802.3 standard Media interface: RJ45 Power supply requirements: 220VAC, 50Hz.	7

Table 7: Router & DSL Specifications

No.	Description	Qty
1	LAN Ports: one auto sense Ethernet port 10/100 Mbps WAN ports: one Synch port, speeds up to 2 Mbps DRAM: sufficient for the required configuration Flash RAM: sufficient for router software with the required configuration The WAN link should include different protocols: PPP, and Frame Relay. Router should include IP routing protocols RIP, OSPF, and Static routing. Router should include NAT Router should be managed via SNMP protocol. Router should be supplied with the latest version of router All the manuals, console cable, power cable and any other needed accessories and software should be included.	1
2	WIC with one Synch port, speeds up to 2 Mbps to be installed in Cisco 1751	1
3	xDSL equipment Line rate up to 2.048 Mbps It should be equipped with V.35 interface capable to transfer data rate up to 2.048Mbps & the appropriate V.35 adaptor. It should supports transmission of virtually all protocols, including IP, PPP and frame relay. Endpoint should be capable to transport data over a 2-wire or 4-wire up to 3 Km.	2

Table 8: Outdoor Wireless Bridge Specifications

No.	Description	Qty
1	Ports: 1 RJ45 10/100 Mbps Compliant with IEEE 802.3 standard Standards: IEEE 802.11b, IEEE802.11g and Wi-Fi Certified Data Rate: 54 Mbps in 2.4 GHz band It must support DHCP Remote Management: HTTP, SNMP and Telnet Transmit Power: at least 100 mW Antenna Type: outdoor Power Supply: 220 V/ 50 Hz All the manuals, console cables, power cables, mounting kit and any other needed accessories and Software should be included.	5
2	Type: Directional or Omni or sector Antenna according to site survey to achieve the best performance Gain: at least 9dbi	5
3	All the manuals, Antenna cables, power cable and any other needed accessories and software should be included.	Survey

5. Wide Area Network Infrastructure

5.1 Design Description

The different entities of RADCON participant are connected to RADCON server by using Internet infrastructure. Dokki and Giza campus networks are connected to each other through the Internet Service Provider (ISP). Some research stations, VSVRI, and ARRI are connected to Dokki campus through frame relay cloud. 46 poor villages, 8 faculties of agriculture belong to 7 universities and 3 non-governmental organizations (NGO) are connected by Dialup/ADSL services. Moreover, there are unknown Internet users from different countries.

5.2 Design Layout

Figure 6 indicates the overall design for ARC network

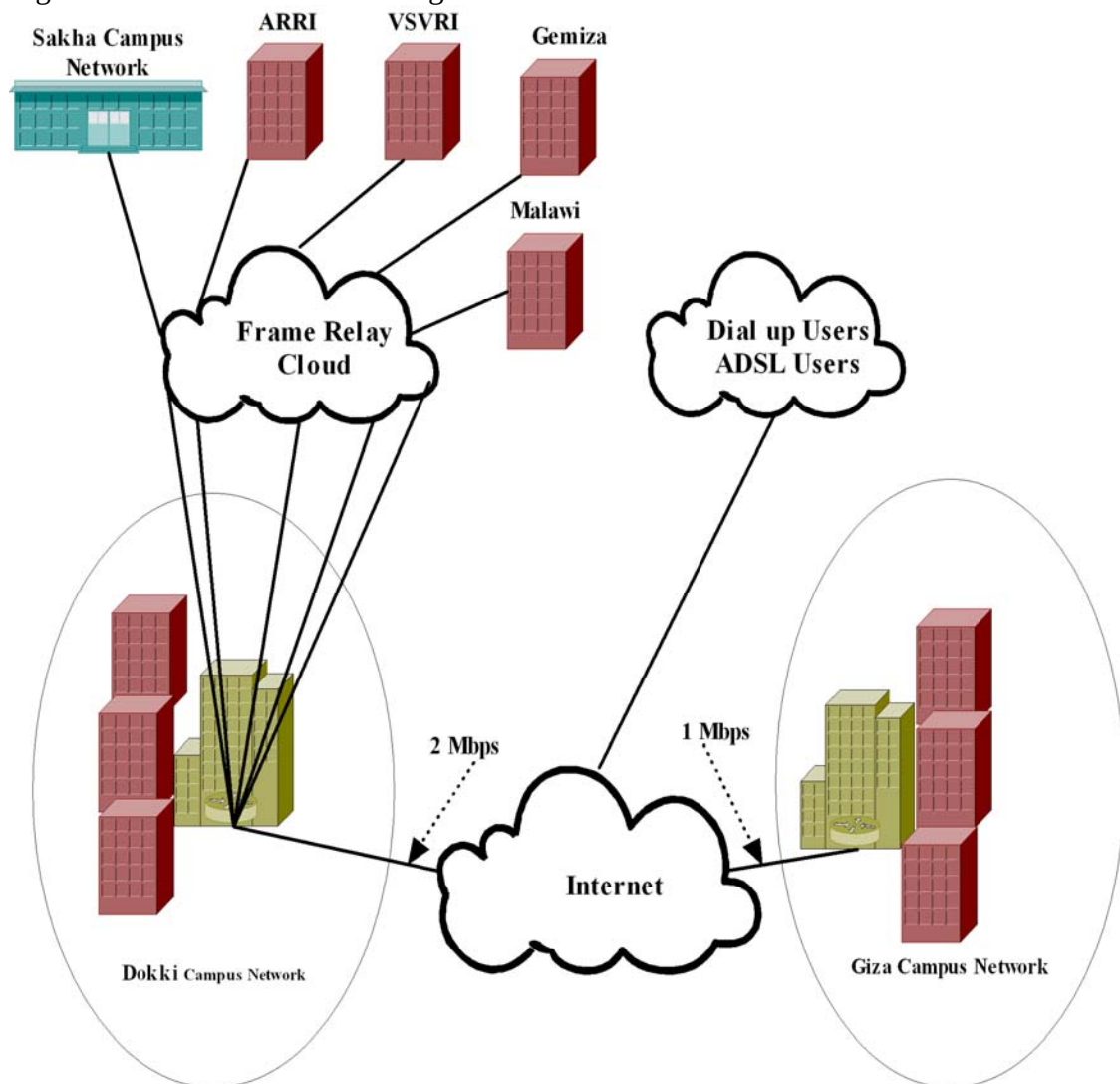


Figure 6: ARC WAN Layout

5.3 Routers Specifications

Main Router

Locations: CLAES for Dokki Campus Network, SCRI for Giza Campus Network

- Model Type: Cisco router 3640
- Processor Type: 100-MHz IDT R4700 RISC
- DRAM: 64 MB
- Flash RAM: 16 MB
- One 10/100BaseTX Fast Ethernet port (RJ45)
- Two WIC with 2 synchronous ports supports up to 2048 Kbps
- Performance: 20-70 K Packets/Sec

Edge Router

Locations: Sakha, Gemiza, Malawi, VSVRI, and ARRI

- Model Type: Cisco router 1751
- Processor Type: Motorola MPC860T PowerQUICC at 48 MHz
- DRAM: 32 MB
- Flash RAM: 16 MB
- One 10/100BaseTX Fast Ethernet port (RJ45)
- One WIC with 1 synchronous port supports up to 2048 Kbps

6. Network Security Infrastructure

The main goal of the installed network security system is to protect the entire network nodes of ARC especially that host the RADCON Information System including: databases, web front/back end server, and backup server in addition to clients from internet attacks such as worms, viruses, and backdoors by defining a security policy for ARC Network, This security policy will be based in identifying the weakness and vulnerabilities in the currently used operating systems, applications, firmware of routers, switches, and so on. Our required security system based on hardware equipment to guarantee the maximum performance and it includes Firewall equipment, Intrusion Prevention System equipment and a switch that support traffic mirroring to isolate the servers in a standalone farm, in addition to a Security Management Software to analyze the collected network events and configure the required security policy The purpose of the Firewall is to act as the first guard or defense against the network attacks that filters the information coming through the Internet connection into private network and allows and denies the traffic according to the required configuration. The purpose of the Intrusion Prevention System is to detect attacks, both known and unknown, and prevents the attack from being successful. It can operate in two modes inline mode in which, the device inspects the packets in real time and take the action at the real time and the other mode is mirroring mode which detect the attack then block it through the firewall or by alerting the administrator to configure another security rules

6.1 Security System for Dokki Campus Network

6.1.1 Design Description

CLAES is the focal node uses a Gigabit Ethernet technology; there is an OmniCore 5052 Alcatel core switch connecting the sites in Dokki zone through 8 cores optical fiber cable for each site, the same model is implemented in Giza campus network.

CLAES has the following Operating Systems and Applications:

- Servers: MS Windows 2000 Advanced Server, MS Windows 2003 Enterprise
- Clients: MS Windows 2000/XP Professional
- Mail Server: MS Exchange Server 2000 Enterprise Edition
- DBMS: MS SQL Server 2000
- MS Office 2000/XP/2003 Professional
- MS Visual Studio 6.0/Net
- McAfee Active Virus Defense

Figure 7 shows CLAES network before installing security devices indicating the location of the servers and clients in addition to the distribution of switches. Number of users in CLAES is approximately 90 users and number of users in Institutes, Laboratories, and stations that connected to the existing core switch in CLAES is approximately 548 users (including CLAES). RADCON information systems installed in RADCON servers should be accessed by internal users in CLAES and the other sites in Dokki region, also these information systems should be accessed from the most of Governorates in Egypt through the Internet free numbers. The installed network security system will protect RADCON servers in addition to the entire network devices of CLAES such as databases, web server, and mail server also clients from external Internet attacks by defining a security approach for CLAES Network.

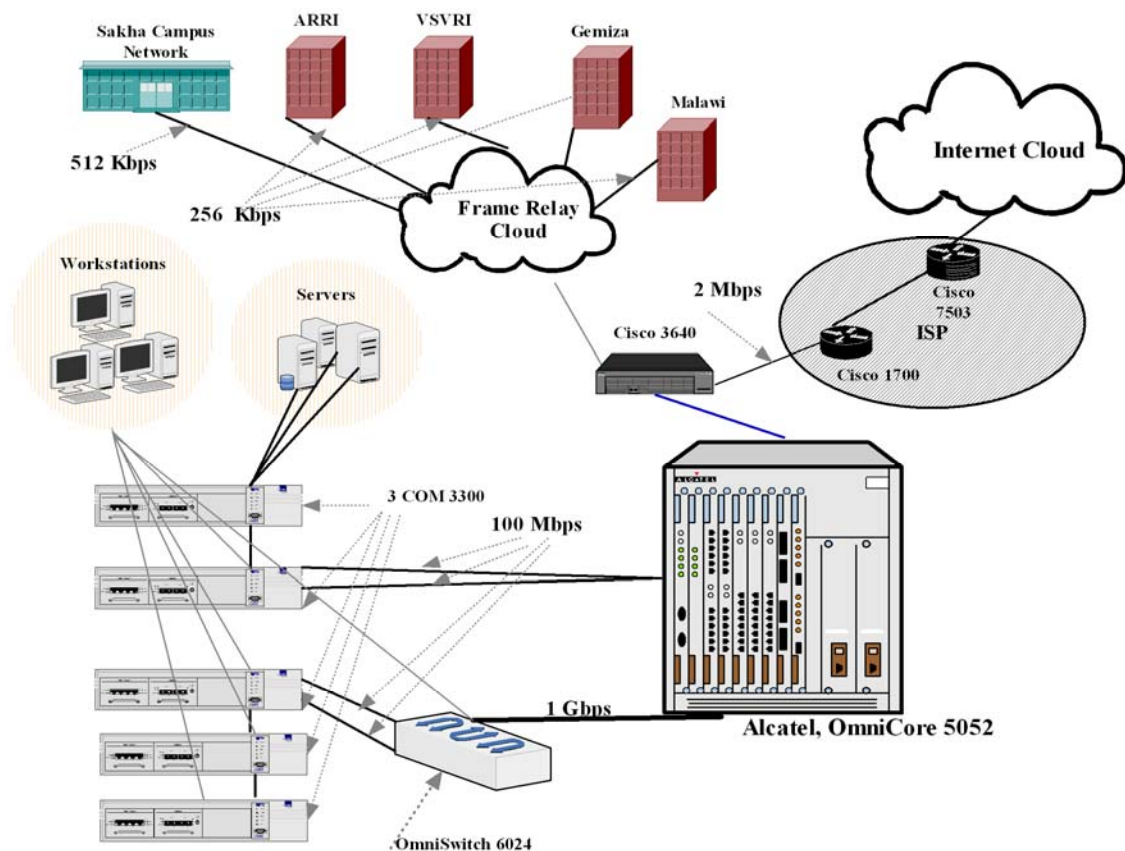


Figure 7: CLAES Network Layout before Installing Security Devices

6.1.2 Design Layout

As indicated in figure 8 the design of security system is based on isolating servers in separate zone and filtering traffic to and from them. Filtering traffic coming to the inside network.

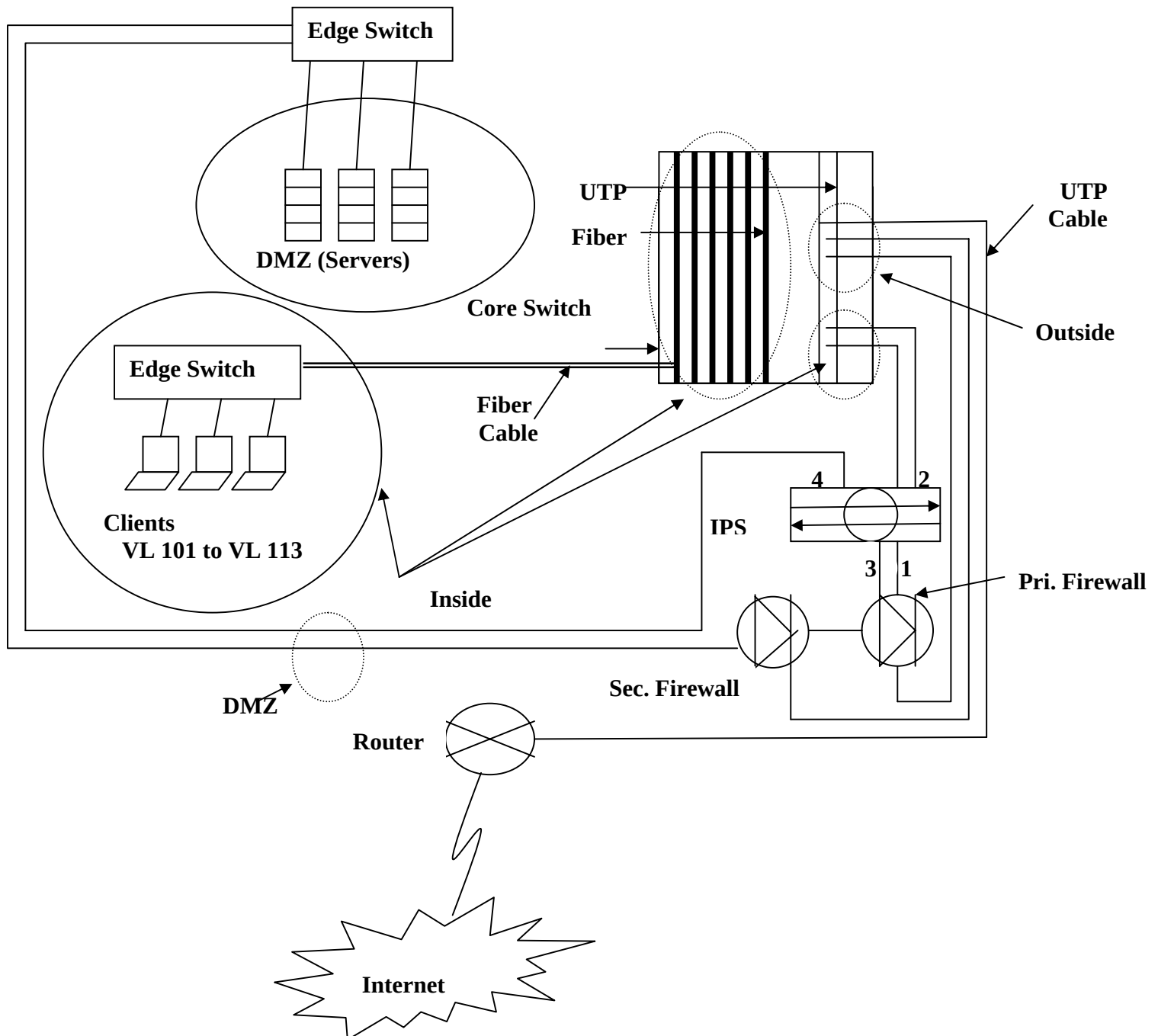


Figure 8: Security Layout for Dokki/Giza Campus Network

6.1.3 Security Devices Specifications

Firewall Device

1. Model: Cisco PIX 525
2. It supports Stateful inspection IP packets filter, which maintains complete session state, each time a TCP/UDP connection is established
3. It supports NAT and PAT
4. It supports IKE, and IPsec VPN to ensure data privacy/integrity and strong authentication to remote networks and remote users over the Internet also it should support 56-bit DES, 168-bit 3DES, and up to 256-bit AES data encryption to ensure data privacy
4. Protection against common attacks as denial of service, IP spoofing, and others.
5. It support 4 Demilitarizes Zones (DMZ)
6. Throughput is 300 Mbps, and support up to 200,000 concurrent sessions.

Intrusion Prevention System (IPS) Device

1. Model: Cisco IPS 4240
2. it supports attacking prevention by using signature detection
3. Notification for administrator by different means like email, alarm to management station, and log the events
4. It has the ability to detect false alarms
5. It has the ability to detect backdoor intrusion such as Trojan or worm.
6. It has the ability to prevent intrusion through many methods such as TCP reset and signaling firewall.
7. It supports automatic and secure update

Security Management Software

1. It has the ability to manage the last mentioned security equipment
2. Displays and analyze enterprise security events
3. The facility to generate reports easily
4. Secure configuration of remote firewalls and routers
5. Real-time activity monitoring

6.2 Security System for Giza Campus Network

The same model has been implemented in Giza campus network with the same type of devices

7. Current Status of RADCON's Equipment

The distributed devices and software until Jan. 15, 2007 are: 197 computers, 100 printers, 32 data projector, 8 Laptop Dell Latitude 610D, 1 copier, 15 USB Pocket HDD 5 GB, 4 External HDD 200 GB, Cisco PIX 525 firewall appliance, Cisco IPS 4240 appliance, 4 Wireless Access Points, Microsoft Development Network (MSDN) software, and, Macromedia Dream weaver Package.

7.1 Status of Distributed Equipment

7.1.1 Extension Centres and Agricultural Directorates

Table 9: List of distributed devices on ADs and ECs

No.	Agriculture Directorate	Distributed Equipment	Extension Centers	Distributed Equipment
1	El-Gharbia	1 PC, 1 Printer	10	10 PCs, 10 Printers
2	El-Sharkia	1 PC, 1 Printer	9	9 PCs, 9 Printers
3	El-Fayoum	1 PC, 1 Printer	0	0
4	Dakahlia	1 PC, 1 Printer	6	6 PCs, 6 Printers
5	El-Menoufia	1 PC, 1 Printer	5	5 PCs, 5 Printers
6	Matrouh	1 PC, 1 Printer	1	1 PCs, 1 Printers
7	Kafr-Elshiekh	1 PC	2	2 PCs, 12 Projectors
8	Bany Swief	1 PC, 1 Printer	5	5 PCs, 5 Printers
9	Asyut	0	11	3 PCs, 3 Printers, 11 Projectors
10	North Sina	1 PC, 1 Printer	3	3 PCs, 3 Printers
11	El-Menia	1 PC, 1 Printer	3	3 PCs, 3 Printers
12	Sohag	1 PC, 1 Printer	2	2 PCs, 2 Printers
13	Domiat	1 PC, 1 Printer	4	4 PCs, 4 Printers
14	Kena	1 PC, 1 Printer	3	3 PCs, 3 Printers
15	El-Kaliobia	1 PC	4	4 PCs, 4 Printers
16	El-Wady El-Gadid	1 PC	1	1 PC
17	El-Behira	0	4	4 Projectors
18	Ismailia	None	2	2 PC
19	Noubaria	None	3	3 Projectors
SUM	16	15 PCs, 11 Printers	86	63 PCs, 59 Printers, 30 Projectors

7.1.2 SRS (26 Computers, 18 Printers)

1. Ganoub El-Tahrir (Horticulture): 1 PC, 1 Printer
2. Borg El-Arab: 1 PC, 1 Printer
3. Tag-El-Ezz: 1 PC, 1 Printer
4. Mehalt Mousa (Animal Production): 1 PC, 1 Printer
5. Sakha (Field Crops): 1 PC
6. Gemiza (Animal Production): 1 PC, 1 Printer
7. Gemiza (Field Crops): 1 PC, 1 Printer
8. Ismailia: 1 PC, 1 Printer
9. Seds (Horticulture): 1 PC, 1 Printer
10. Seds (Field Crops): 1 PC, 1 Printer
11. Matrouh (Field Crops): 1 PC, 1 Printer
12. North Sina: 1 PC, 1 Printer
13. Malawi (Animal Production): 1 PC, 1 Printer
14. Malawi (Field Crops): 1 PC, 1 Printer
15. Seds (Animal Production): 1 PC, 1 Printer
16. Al-Serw (Field Crops): 1 PC, 1 Printer

17. Al-Serw (Animal Production): 1 PC, 1 Printer
18. Bahteem (Field Crops): 1 PC, 1 Printer
19. El-Mataana (Field Crops): 1 PC, 1 Printer
20. El-Wadi El-Gdid, El-Kharga (Field Crops): 1 PC
21. Sakha (Animal Production): 1 PC
22. El-Fayoum (Animal Production): 1 PC
23. El-Sabbha (Animal Production): 1 PC
24. Kafr El-Hamam (Animal Production): 1 PC
25. Anshas (Animal Production): 1 PC
26. Toshki: 1 PC

7.1.3 RRS (1 Computer)

Sakha, Kafr El-Sheikh

7.1.4 Media Support Center (4 Computers, 1 Printers)

Menia, Malawi: 1 PC, 1 Printer

Dekernes: 2 PCs

Ismailia: 1 PC

7.1.5 ICD Unit (3 Computers, 2 Printers)

3 Computers, 2 Printers

7.1.6 Research Institutes (7 Computers, 5 Printers)

Field Crops: 1 PC, 1 Printer

Plant Protection: 1 PC, 1 Printer

Animal Production: 1 PC, 1 Printer

Horticulture: 1 PC, 1 Printer

Plant Pathology: 1 PC, 1 Printer

Agricultural Extension & Rural Development: 1 PC

Soil, Water, and Environment: 1 PC

7.1.7 Universities, Faculties of Agriculture (14 Computers, 3 Printers)

Alexandria: 2 PCs, 1 Printer

Asyut: 2 PCs, 1 Printer

Kafr El-Sheikh: 2 PCs, 1 Printer

Suez Canal, Ismailia: 2 PCs

El-Arish: 2 PCs

El-Behaira: 2 PCs

El-Mansoura: 2 PCs

7.1.8 Rice Training Center

1 PC, 1 Printer

7.1.9 Villages (39 Computers)

Asyut (13 Computers)

1. Sarwah, Manfalout

2. Nazlet Raneh, Manfalut
3. Nazlet Farag, Dierout
4. Kom Boha, Manfalout
5. Gahdam, Manfalout
6. Gazeret Baheeg, Abnoub
7. Der Show, Abnoub
8. Dakran, Abou Teeg
9. Bani Shaaran, Manfalout
10. Bani Saleh, Akosiah
11. Al-Ghareeb, Sahel Seleem
12. Al-Ansar, Al-kosiah
13. Abouh Khors, Abouh Teeg

Kafr-Elsiekh (13 Computers)

1. Tiba
2. Miniat Kalien, Kalien
3. Menshat AlShazlie, Kalien
4. Kafr Al-Taifa
5. Kafr Al-Masharkah
6. Kafr Al-Manshi
7. Halies
8. Boreed, Sedi Salem
9. Zedan, Al-Hamoul
10. Al-Masry, Sedi Salem
11. Al-Etehad
12. Al-Banah, Al-Hamoul
13. Ezbet Amr, Motobas

Noubria Region (4 Computers)

1. Al-Adl, Abou Al-Matameer
2. Abou Al-Nour, Abou Al-Matameer
3. Saad Zaghloul, Abou Al-Matameer
4. Taha Hussien, Abou Al-Matameer

Dakahlia (2 Computers)

1. Al Koma, Dekernis
2. Al Kebab Al Soughra

El-Bhaira (7 Computers)

1. Abou Kabareh, Abou Homos
2. Menshat Amer, Kafr Al-Dawar
3. Kafr Wl-Wak, Hosh Esa
4. Nobar, Abou Al-Matameer
5. Al-Hamraa, Wadi Al-Natroon
6. Beni Salamah, Wadi Al-Natroon
7. Manshaet Ragab, Damnhour

7.1.10 CLAES

1. 24 PCs and 2 Projectors
2. Cisco PIX 525 firewall appliance
3. Cisco IPS 4240 appliance
4. 15 USB Pocket HDD, 5 GB
5. 4 External HDD, 200 GB
6. 8 Laptop, Dell, Latitude 610D
7. 4 Wireless Access Points, Cisco Aironet 1121
8. Digital Copier, Xerox
9. Microsoft Development Network (MSDN) software
10. Macromedia, Dream weaver, software

7.2 Ongoing Activities for the purchase of remaining equipment

No.	PC	Printer	Projector	Camcorder (Media Center)	Digital Camera	ADSL Connectivity
Required	35	78	82	2	114	89
P.O has been sent to Vendor	35	78	40	2	44	0
Still in progress	0	0	42	0	70	89

8. Dokki and Giza Campuses Network Configuration Design

Each site in Dokki and Giza campus networks is configured in VLAN to isolate the traffic generated by each site to not impact the other. VLAN is based on IP configuration. OSPF is used as a dynamic routing protocol among different VLANs. Figures 9, 10 indicate the IP distributions on Dokki and Giza campuses networks.

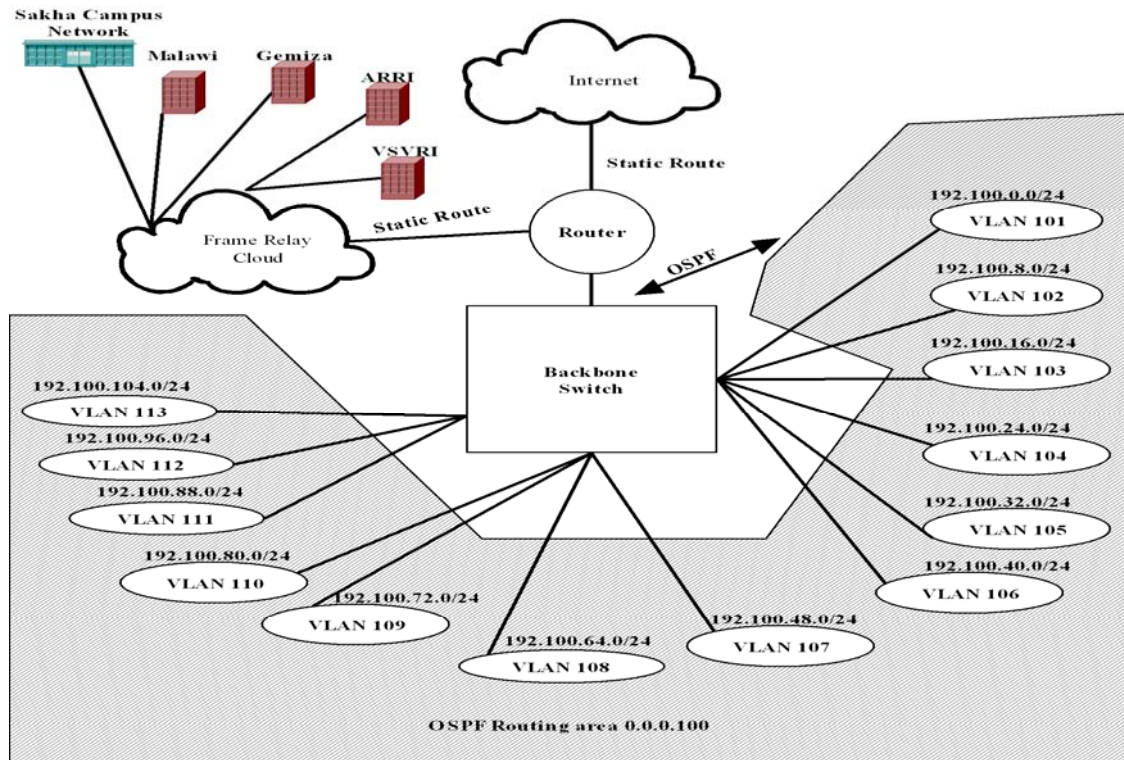


Figure 9: VLAN Configuration Design in Dokki Campus Network

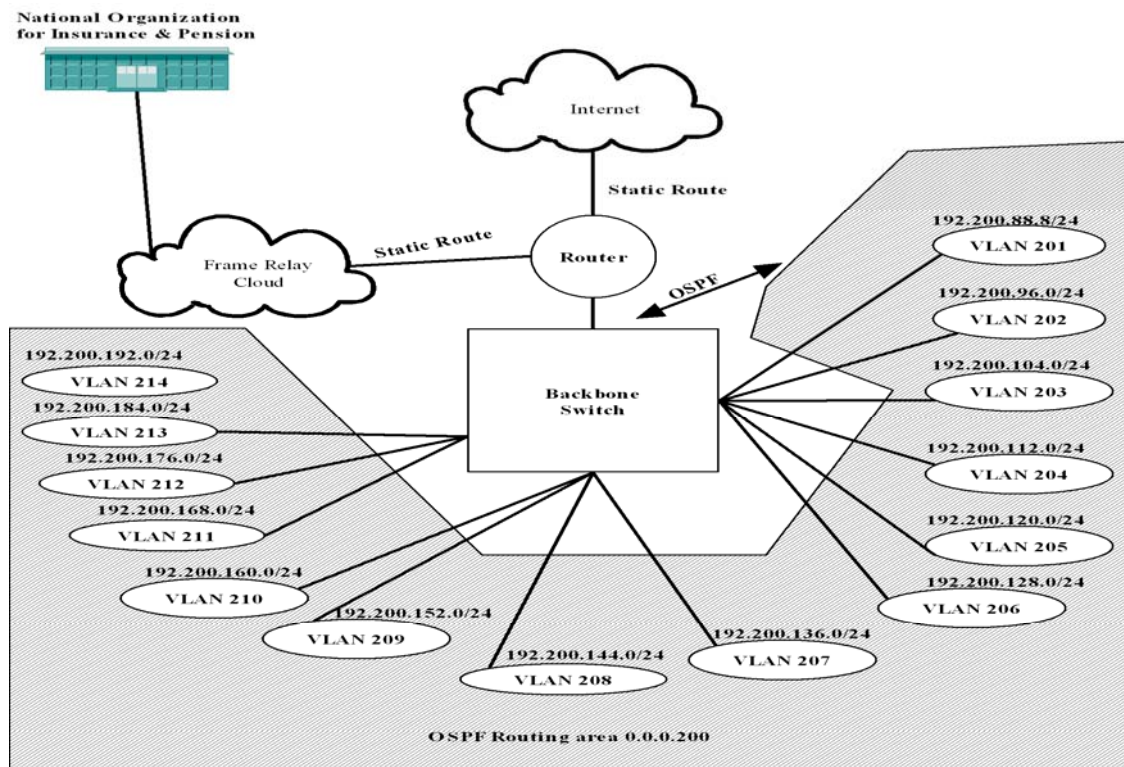


Figure 10: VLAN Configuration Design in Giza Campus Network

9. Conclude Remarks

This document explains the ARC network elements in detail including design description, layout and specifications for the current situation. The most important results are:

- The infrastructure of Dokki and Giza campus networks is based on Gigabit Ethernet that runs over fiber optics cables. This infrastructure allows several types of network traffic to be applied.
- The existing types of traffic on ARC network are non-real time applications such as FTP, HTTP and database applications traffic which have no deadline on delivery of packets.
- The Internet connection speed for is 2 Mbps for Dokki campus and 1 Mbps for Giza campus and the chart for the aggregated traffic for both of them indicates that these connections are congested and there is a vital need to upgrade those links.
- There is a tendency to apply both Voice over IP (VoIP) and Video Conferencing (VC) on ARC network to avail voice conversations and remote meetings/training among different participants within ARC network. VoIP and VC are real time applications therefore they have restrictions especially on the allowed delay, jitter and packet loss to work with the required level of quality.

From the previous mentioned points, we conclude that there is an extremely need to accomplish these tasks:

- **Report on ARC Network Performance Evaluation:** although the installed switches, routers, firewall, and IPS have some embedded and/or external software tools for management such as SNMP, Telnet, and RMON, there is no a complete traffic characteristic report for each user in ARC network, and the mount of traffic consumed by each type of application (Database, HTTP, FTP) is not known. There is a need to prepare performance report to assess the status of current elements and the measurement hardware and/or software tools to fully monitor the existing network.
- **Report on deployment of VoIP on ARC network:** this report will study the impact of applying voice traffic on the current situation from the performance point view, a comparative analysis for different VoIP solutions, and recommendation for the optimal solution for implementing VoIP.
- **Report on Deployment of VC on ARC network:** this report will study the impact of applying video/audio applications traffic on the current situation from the performance point view, the recommended solution for implementing VC.