

# International Technology Transfer : An insight into the cooperation between a multi-national and two African Universities

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**Abstract** — Cooperation and linkages between corporate organisations is a well -established practice in the developed countries of Europe and the USA. The motivation is usually that of mutual benefits to both organisations. The Universities benefit from increased funding and staff motivation and the corporate organisation benefits from potential increased earnings and competitiveness from new developments and innovations arising from academic research efforts. Cooperation between large corporate organisations and small academic institutions in developing countries in a high technology field is a far less common occurrence. The paper will describe one of such co -operations involving CISCO Systems an international computer networking organisation based in the USA and two Universities in Southern Africa namely the Universities of Zimbabwe, and the Polytechnic of Namibia (being re -named Namibia University of Applied Science & Technolog). It will highlight the process involved in establishing the projects, the training process, the challenges and the positive outcomes that resulted from the project. It will also show the benefits of the project within a national context in particular gender sensitivity and promotion of information and communication technology in Zimbabwe and Namibia.

**Index Terms** . Cisco Network Academies, Computer Networking, International Co -operation

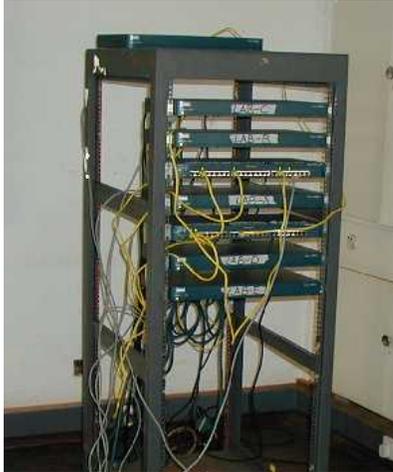
## FIRST INSTITUTION: UNIVERSITY OF ZIMBABWE

The ACADEMY at the University of Zimbabwe was set up after initial contacts with the International Telecommunications Union who with CISCO were working together to increase Information and Communication Technology (ICT) in the developing world, the Africa Region being included in their programmes. Following a successful application and proposals by Chairman of Department Dr E Chikuni, the Zimbabwe Regional Academy was set up. Two instructors: Emanuel Rashayi, Engelbert Takawira Kapuya were sent to PE Technikon, in Port Elizabeth, South Africa to undergo CCNA instructor course training. Currently the instructors are certified to teach CCNA 1-4. Cisco Systems’ partner ITU sponsored the training. Cisco also donated the lab bundle to use in CCNA courses. Table I shows the details of the equipment, which was donated by Cisco.

TABLE I:CISCO LAB BUNDLE DETAILS

Part number	Description	Qty
CISCO2620	10/100 Ethernet Router w/2 WIC Slots & 1 Network Module Slot	4
CISCO2621	Dual 10/100 Ethernet Router with 2 WIC S	2
WS-C2924-XL-EN	rw-port 10/100 Switch (Enterprise Edition)	3
WIC-1T=	1-Port Serial WAN Interface Card	12
CAB-AC	Power Supplies	9
CAB-V35FC	V.35 Cable, DCE, 10 Feet	4
CAB-V35MT	V.35 Cable, DTE, 10 Feet	4

The picture below shows the lab bundle mounted to a rack. Its movable. Students can move it to wherever they would want to use it.



**Picture 1**

The Cisco Networking Academy currently uses departmental computers situated in the Computer Lab. The currently networked machines total 15. These machines run windows 2000, and only authorized users can log on. The department has two powerful workgroup servers, which are for staff and students. Cisco Course materials are loaded on the servers and only authorized users can access them. The department also has a website, which is still under development. This can be found on the following URL:

<http://www.uz.ac.zw/engineering/electrical/>

### C. Campus wide Area Network

The University of Zimbabwe upgraded the Internet link to 1.5Mbps. This has significantly improved the Internet services. The upgrade was done on the fiber link between UZ and telecommunications organisation, the PTC. The demand on campus, however, far outweighs the supply. The University of Zimbabwe is still in the process of trying to get an upgrade of about 6Mbps. The limitation at the moment is what the provider can give in terms of the bandwidth.

## II. ENROLLMENT & CLASSES

Since its inception the University of Zimbabwe Academy has seen an increasing number of student enrolment. Currently the enrolment stand at 88. We receive enquiries on the Cisco Program everyday. Most of students on the Cisco Academy program are students from the department doing their Bsc Honours degree. Ours students do the program for free. Students from other departments have shown interest in the program. We actually enrolled one class with students from the Computer Science department (*see Picture 2*). These students only pay for consumables e.g. UTP cable, cost of producing certificates of course completion.

### A. Fees

The course fees for the professionals is shown on the table below

**TABLE 2: CCNA COURSE FEE STRUCTURE**

Target Population	Cost Per Semester	Cost for Sem 1-4 (local currency)	Cost for Sem 1-4 (USD)
Students	<b>Free*</b>	<b>Free*</b>	<b>Free*</b> only pay for consumables
Women	<b>Z\$120,000</b>	<b>Z\$480,000</b>	<b>US\$582</b>
Professionals	<b>Z\$150,000</b>	<b>Z\$600,000</b>	<b>US\$728</b>
Unemployed	<b>Z\$120,000</b>	<b>Z\$480,000</b>	<b>US\$582</b>

### B. Classes

Between February and October 2003 the Academy has created the following classes

**TABLE 3: CCNA CLASSES**

<i>CLASS</i>	<i>Size</i>	<i>Class</i>	<i>SIZE</i>
UZ0301	26	UZ0305 CCNA 2	16
UZ0301 CCNA 2	22	UZ0306 CCNA 3	19
UZ0303	16	UZ0307 CCNA 4	19
UZ0304 CCNA 1	49		

### C. Performance

The Academy has witnessed high pass rates in the CCNA course. Most students score above 90 % at first attempt

### III. LOCAL ACADEMIES

As a Regional Academy, we have an obligation to initiate the starting up of Local Academies. By the end of 2004 there will be two local academies in operation (Africa University & University of Applied Science and Technology).

### IV. SUCCESSES

Since its inception the Academy has registered a lot of successes in achieving its objectives. The Academy, the first of its kind in Zimbabwe has managed to spread its presence across the country. Now we receive a lot of enquiries about the program everyday, and some from corporates have even gone to an extent of requesting special classes for them.

#### A. Academy

- Through course fees, the Academy has managed to buy additional equipment, and will continue to do so. Students from Industry have also managed to spread the word about our existence at their work places. Some companies like the Electricity Utility ZESA have already placed students for enrolment next year. Another success of the Academy is high pass rate in the entire course. This can be seen through the gradebooks on the Cisco Networking Academy Management system (CNAMS).

We are also in the process of integrating the Cisco Networking Academy Program into our degree program and its proving to be a success.

#### B. Instructors

The instructors have managed to demonstrate expertise in the course, and have used the best lesson plans as evidenced by the high pass rate in all the academy classes. Students have come to the instructors asking for solutions to problems at their workplaces and have provided them with solutions and it has worked for them .We have managed to the keep the lab bundle up and running without any problem. In addition to the CISCO duties the instructors do network administration for the students computer lab. Our lab is always up and running all the time, including the servers. We have managed to maintain high standards in skills exams

#### C. Students



Figure2



Figure 3

Some students have managed to secure employment using the Academy's certificates of course completion. The student: One student who is currently doing CCNA4 got a job with a Major Internet Service Provider before he had even completed the certification exam. Several have greatly improved their chances for promotion. The students come from a broad spectrum of Zimbabwe Industry including Banks, Insurance Companies, Manufacturers as well as government departments. In spite of this there still some challenges, shortage of computers, the need to encourage more females. Our vision is to proceed to higher network training standards

## SECOND INSTITUTION: POLYTECHNIC OF NAMIBIA

Polytechnic of Namibia (PON) became CCNA Regional Academy in 2000 and started teaching in the academic year 2001. Instructor training initially involved two academic staff who were sent to University of Central England, Birmingham, UK. Further training was organised at PON's premises in subsequent years so that by now nine members of the IT department are involved in teaching CCNA, five of which are fully certified.

PON became CCNP Local Academy at the end of 2002 and started teaching in the academic year 2003. Currently CCNP instructor training is not yet completed; two academic staff are certified to teach CCNP 1 and 2.

Cisco Systems, Inc. donated the CCNA equipment bundle, the far more expensive CCNP lab equipment was bought with own funds. A generous donation from the German development organisation GTZ allowed us to further upgrade the networking laboratory to the extent that PON today accommodates one of the most sophisticated networking laboratories in Southern Africa.

### (A) Lab bundles

Table 1 shows a list of equipment currently deployed in the networking laboratory (excluding crimping, punching, and testing tools):

<i>Equipment type</i>	<i>Description</i>	<i>Qty</i>	<i>Equipment Type</i>	<i>Description</i>	<i>Qty</i>
Router	Cisco 2514	1	Switch	Catalyst 1912	1
Router	Cisco 2501	4	Switch	Catalyst 1924	1
Router	Cisco 2610	1	Switch	Catalyst 2912	1
Router	Cisco 2620	6	Switch	Catalyst 2950	6
Router	Cisco 2621	3	Switch	Catalyst 3550	3
Interface card	Smart Serial 2 slots	9	Interface module	1000BASE-T	6
Interface card	Serial 1 slot	2	Hub	SureCom 16-port, Rack-mountable	2
Interface card	ISDN S/T	4	Traffic Simulator	Adtran Atlas 550, CCNP specification	2
Network Module	ISDN PRI	1	Modem	External 56K	14
Network Module	4-Port Ethernet	1	Cabling	Smart Serial, female	16
Network Module	8-Port Serial	1	Cabling	Smart Serial, male	17
Network Module	1-Port Gigabit Ethernet	1	Cabling	Serial, female	9
Network Module	16-Port Smart Serial	1	Cabling	Serial, male	8
Transceiver	AUI port	6		Catalyst 1912	1

The equipment is housed in two racks, accessible from a dedicated networking laboratory with triple network cabling on each of the 17 workstations. This allows for simultaneous access of in-band (console) and out-of-band (Ethernet) equipment ports and, alternatively, Intra- and Internet. All racks and raceways have been installed by students and graduates.

Picture 1(attached): The PON networking rack and raceways.



## (B) Departmental Computers

PON, IT dept has over 200 laboratory computers, 17 of which are dedicated to practical computer networking courses. 10 servers support the department infrastructure, including a full SAP system, a 2-TB NAS unit, and the departmental web site ([QD HGX SRO:WHFKQLF LV](#)).

## C) Campus wide network

PON has a 768 Kbps Internet link which is to be upgraded soon.

## Enrollment and Classes

In Namibia as well as in Zimbabwe the demand for CCNA education outweighs the supply by far. While PON would principally be in a position to split the available equipment to populate a second laboratory with it, it was opted to keep all routers and switches in one venue to allow for more complex experiment settings and a better students-per-equipment ratio. Besides CCNA and CCNP we teach the B.Tech course Practical Network Security in this lab.

CCNA, modules 1-4, is compulsory for students that pursue the National Diploma: Information Systems Administration. CCNP and Network Security (theory and practical) together form 6 modules that are elective subjects for all B.Tech:IT Specialisations. Four of these six modules are compulsory for students that want to specialise in Computer Networking.

We also educate professionals at our premises. Participating companies have been: Telecom Namibia, Namibian Government, Nampower, Namwater, PC Centre, Africa Online, Iway, Comparex, and many more. For the fee structure see table 2:

<i>Target Population</i>	<i>Cost per semester</i>	<i>Cost for Sem 1 -4 (local currency)</i>	<i>Cost for Sem 1 -4 (US\$)</i>
Students	Free (normal course fee)	Free (normal course fee)	Free (normal course fee)
Staff	Free	Free	Free
Professionals	N\$ 3,000	N\$ 12,000	US\$ 1,846

The US\$ is currently very weak in relation to the Namibia Dollar; under normal circumstances the US\$ fee is much lower.

## Classes and Performance:

At any given time, approximately 70 students are enrolled in one of the four CCNA modules. This number is expected to rise significantly in 2004. Overall pass rate is around 70%.

## 3)Local Academies

Namibia is sparsely populated, and the infrastructure is highly centralised. Nowhere outside Windhoek is there a considerable demand for technology. It is for these reasons that the CNAP roll-out to Local Academies has not yet taken off. In 2004 University of Namibia is scheduled to become our first Local Academy.

## 4)Successes

Since 2001, a substantial amount of money and work hours have been invested in laboratory equipment and staff training for teaching various Cisco computer networking courses at Polytechnic of Namibia. A recent study<sup>1</sup> has concluded that this was effort well made: Polytechnic of Namibia has become the leading computer networking educator in the country. Relations to local industry have improved significantly, a panel of well-trained academics has been created, and students have been provided with relevant knowledge and skills to an extent that future potential employers are wrestling about them. All graduates of CNAP are employed in above-average positions.

This in turn convinced students from other areas of specialisation to enrol in CCNA for non-degree purposes, to also gain the advantage on the job market that a CCNA certification entails.

## 5)Challenges

Due to the demand on the local job market Polytechnic of Namibia strives to further extend its offerings in computer networking education. Our main challenge is currently that no lecturer exclusively teaches Networking, therefore no lecturer can devote all work time to the development of the laboratory, the curricula, and own subject expertise. As Computer Networking as an IT subject expands at an enormous pace, academic staff can hardly stay up-to-date with current developments. To become, and stay, involved in research is harder to achieve than almost anywhere else in the IT field.

A second serious challenge is the purchase price of additional equipment. While all CNAP bundle items can be obtained from Cisco Systems, Inc. at generously reduced prices, modules that are not part of the official specification and machines from different vendors are extremely expensive. No major investment can be made from the IT department's yearly budget without assistance from donors or government.

## 6)Gender Initiative

Our Cisco Academy has no gender initiative in place. While we have a number of female students their proportions do not make up 30%. On a departmental level, however, we do almost achieve gender equality - our female students prefer to specialise in Business Computing and Software Engineering.

## 7)Future Plans

PON Regional Cisco Academy plans to elevate most instructors to the level of a CCNP within the next two years. Once this is achieved, two major outcomes shall be focused on: the creation of a workshop where industry technicians and academic staff together prepare for the Cisco Certified Internetworking Engineer (CCIE) certification, and the creation of a research team that investigates emerging network technologies in our laboratory environment. This will involve further upgrades of our lab.

## 8)Graduate estimate for 2003

PON has an output of approximately 25 fully trained CCNA graduates per year. This includes students, staff, and members from the public.

## 9)Conclusion

The Cisco Networking Academy Program has given educational institutions in Southern Africa a kick-start in teaching Computer Networking by providing a high-level, up-to-date curriculum for free, complete with hands-on exercises, exam suggestions, equipment specification and an overall quality management plan that includes guidelines for lecturer's education. This lead to standardized, good-quality teaching which was a positive experience for students and staff alike.

Technology transfer to developing countries faces many challenges, though, many of which originate in a permanent lack of monetary resources. Over and above initial education and equipment sponsoring, long-lasting support relations are necessary to sustain this initiative.

## **ACKNOWLEDGEMENT**

We wish to thank the CISCO organisation for donating the equipment referred to in this paper.