



## VOIP Telephony for NONESCOST Communication System

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### Abstract

This study aimed to implement the “VOIP telephony for NONESCOST communication system”. The main objective of this study is to implement the VOIP telephone system to NONESCOST using open source software, to evaluate the efficiency of the implemented VOIP Telephone System of NONESCOST, and to evaluate the cost-efficiency of the VOIP Telephone System of NONESCOST. A Performance and Pilot testing was used as a research design for conducting study on comparing the Performance of existing devices which is the basic telephone provided by the local service provider. To achieve the objectives of this study, the researcher used a self-made questionnaire and was validated using criteria developed for evaluating survey questionnaire by Carter V. Good and Douglas B. Scates. The respondents of the self-made questionnaire are the five (5) offices that was deployed of the VOIP Phones with 25 items question and five-level Likert scale. A data was gathered and tabulated to get the weighted mean. The result was very relevant that implies that the implementation of VOIP- PBX for NONESCOST communication system contributes a big impact in terms of simplification of their communication system.

**Keywords:** VOIP Telephony, Open-source Software, IP Phones, PBX

### Introduction

The Northern Negros State College of Science and Technology is the only state college in Northern Negros and the only science and technology state college in the Province of Negros Occidental was once the Old Sagay Barangay High School that started to operate in 1970. As the college still continue to grow communication system is very essential in its day to day operations.

Communication is vital within the educational system. The VOIP Telephony based on Internet Protocol (IP), are finally bringing voice into a network, just like all the other applications that you have been using for several years, such as email, databases, and instant messaging applications. Today, many PBX manufacturers have migrated into IP communications and are now using protocols that can communicate and integrate with other existing applications that are widely available online.

VOIP-PBX is a PBX phone system that uses IP (Internet Protocol) data networks to manage call switching, route call and handle other messaging features. VOIP-PBX technology includes advanced communication features, like videoconferencing and voicemail to email, but also provides scalability as it has the capability to connect to the old and traditional Public Switched Telephone Service (PSTN) lines so there is no need to change service providers

These new PBXs technology are referred to as VOIP-PBXs, because they use IP (Internet Protocol) for their signaling. Additionally, Asterisk based VOIP-PBXs are becoming more available and changing forever the traditional type of PBX and considered to be high-class PBX replacement.

The Asterisk has started its eleventh year according to research. And as an open source PBX software and has captured the dominate position of PBX software in the market. It has proved itself to be efficient, cost effective and stable, and something that the industry giants are having to compete with when it comes to their communication system. More companies now are exploring an IP solution for their next PBX telephone system.

VOIP-PBX telephone system consists of one or more IP- Telephones, and VOIP-PBX server and an optional VOIP gateway or asterisk card is used to connect to existing PSTN lines. The VOIP-PBX server functions in a similar manner as a hosted server, but resides in most cases on- premise/on-site: connecting SIP clients, being either soft phone for desktop pc or mobile phones or hardware-based IP- Phones. The IP-PBX server establishes a directory of registered IP-Phones and their corresponding SIP addresses and connects internal network (LAN) call or routes outgoing calls either to a VOIP gateway or a VOIP service provider.

### Objectives of the Study

This study aims to implement the VOIP technology as

NONESCOST communication system to reduced telephone expenses and have a unified communication system for the entire school and external campuses. Specifically, it aimed to achieve the following:

1. To implement the VOIP telephone system to NONESCOST using open source software.
2. To evaluate the efficiency of the implemented VOIP Telephone System of NONESCOST.
3. To evaluate the cost-efficiency of the VOIP Telephone System of NONESCOST.

## Literature Review

When it comes to meeting the communicational needs of thousands of people, network solutions become imperative, especially when those people are students. With an overwhelming number of people on the same network at the same time, it can be difficult to maintain a working and stable connection. Students need to be able to access all system functions at all times. Finding out that the system is down right before the deadline to submit a paper to a professor, can cause internal panic and unnecessary stress. Traditionally, communications offerings were built around Centrex and/or PBXs, however, unable to satisfy the requirements of vast number of students on a college campus, institutions are turning to IP communications. Universities are making these changes in order to lower costs, integrate new technology, and provide innovative services for students. These changes are influenced by a list of functionality options, such as internal network solutions, service continuity, network convergence, streamlined operations, and unified messaging solution.

It is vital for universities to have strong campus network solutions. Voice applications function over broadband IP networks, delivering the service to analog and/or digital handsets through integrated access devices. By searching and using phone system services in NJ, universities can have access to functions, such as dial tone, call waiting, find-me/follow-me, and unified messaging. In a hosted platform, call control intelligence resides in the network, enabling service delivery and on-net calling across locations.

Network solutions available for campuses are Centrex line replacement, PBX replacement, access channel consolidation, premises network convergence, and private voice networking. If there are any complications in the Centrex line or PBX, the hired phone system's service people will replace and attend to anything needing repair. Campus voice and data

networks constantly need to integrate applications and equipment to meet the development of new services. Phone system companies that run on open networking standards, enable universities to integrate rapidly with IP applications, allowing them to consolidate voice and data networks. In the long-term, this can save universities a great deal of money.

Online communication services can make your phone network easier to use with a number of integration options. It is important to have procedures in place that make certain the phones systems are always working properly, and if a problem does arise, maintenance procedures are performed. Service continuity involves guaranteeing that the phone system functions are working continually and on all systems and platforms. Network convergence involves consolidating all telephone, video, and data communication services into one network. This allows phone companies to deliver better services for lower prices, giving consumers a wider range of services. For reliable online communication services, search phone system services in NJ.

### On-Campus: Converting Legacy Phone Systems to VOIP

As legacy phone systems reach their end-of-life stage, colleges and universities around the country continue to make the switch to VoIP. This decision to switch varies from campus to campus, but an overwhelming number of institutions have similar reasons for doing so:

- "One of the drivers for moving to a more modern, IP- based voice communication system is moving from multiple separate network infrastructures to just one...The older solutions we are operating are part of legacy telephony and while they have provided good service, they are reaching the end of their life in terms of hardware and software." – University of Pennsylvania
- "Not only will the conversion mean cost savings for the University, the VoIP technology includes the capability to move phones without having to coordinate with an outside vendor." – University of North Carolina at Chapel Hill
- "CSUSB and Palm Desert Campus will be undergoing a major upgrade to the campus Voice over IP (VoIP) system upgrade. The project will upgrade the aging telephone system that the campus has been using since 2007, standardize voice systems on the two campuses, and will include new features to unify communications throughout the academic year." – California State University San Bernardino
- "Both the cost of wiring and maintaining a traditional PABX has historically been cost

prohibitive for schools. With heightened security risks, increasing demands from parents to communicate with teachers and the need to improve productivity, the model of limited voice capability in schools is rapidly becoming a thing of the past. As most schools adopt local area network (LAN) networks, the opportunity arises for schools to address these demands with VoIP.” – Bialik College

- “By moving voice services to the data network, Notre Dame eliminates a separate, managed voice infrastructure and dramatically reduces the cost of telephone moves, adds and changes.”- University of Notre Dame
- “The existing voice communication infrastructure, originally installed in 1996, is outdated and expensive to maintain. It also lacks the capabilities of the current generation voice technology systems that the University needs to handle our advanced communication requirements.” – University of Virginia
- Our legacy system had the typical problem of parts only being available aftermarket. Also, we were running two systems simultaneously that did not allow for us to move forward without a longer-than- desired roll out. The whole system conversion was a financial decision, but we knew that [VoIP] offered more functionality.” – Casper College

The majority of higher education campuses have implemented strong networks that host a growing number of services for faculty and students, such as email integration, web conferencing, instant messaging, and more. The need to continually maintain and upgrade this infrastructure is taken into consideration when contemplating the implementation any new type of technology. Making the switch to VoIP is becoming necessary for universities due to the legacy phone systems not being manufactured anymore. As time passes, obtaining replacement parts for these obsolete systems becomes more difficult, if not impossible. While this is the driving force behind the need to *get rid* of an old system, the main motives for adopting VoIP are cost savings and advanced feature-sets.

### **Additional Perks of VoIP**

A survey by ACUTA found that the most frequently cited benefits of the VoIP network included improved end-user features, according to 46% of the users; cost savings, cited by 31%; and overall network efficiency, cited by 23%. VoIP systems provide an opportunity for campuses to eliminate PBX systems, in part or altogether. This allows them to advance into full-featured phone services on existing network infrastructure, which streamlines maintenance and reduces operational costs. By migrating phone service to the data networks that colleges and universities

already maintain, institutions can take fuller advantage of that infrastructure while ensuring the reliability of those networks, which benefits all of the IP services. Although traditional phone networks provide a level of reliability that IP networks have been hard- pressed to equal, the rich feature sets, along with its affordability, present an ever-more compelling argument for VoIP on campuses.

Campuses can benefit from free nationwide long-distance calls (a must-have for college students and faculty), as well as additional features such as mobility, email integration, call queues, conferencing, and more. VoIP also allows an institution to integrate phone service into its emergency notification plan, along with other network resources such as e-mail, text messaging, networked signs, and alarms. Also worth noting is that cell networks are often overloaded in emergency situations, and a VoIP phone system provides an institution with additional capacity (or bandwidth) to make and receive calls even if cell service is disrupted – a must-have for campus-wide emergency situations.

### **Future of VoIP**

As data networks become increasingly reliable and high-speed networks approach ubiquity, the move toward VoIP will continue, with more and more institutions finding that the switch makes sense financially and technologically. VoIP will likely see greater integration with customer relationship management (CRM) software, and voice calling in apps will become mainstream. VoIP is part of the much larger trend of Unified Communications (UC), which promises expanded feature sets and increased effectiveness of business communications in the coming years.

Whether it’s an international student needing to call home or faculty members with a campus-wide emergency on their hands, instant communication among staff, students, and parents on campuses is vital. VoIP technology has quickly become the most flexible, affordable, and integrative option for guaranteeing effective communication for educational institutions across the country.

### **Macau University of Science and Technology implements first campus IP telephony system using cisco technology**

April 4, 2002 - The Macau University of Science and Technology has chosen Cisco Systems, the worldwide leader in networking for the Internet, for a new

campus-wide IP telephony network becoming the first education institute in Macau to implement such a system. The new network will combine all of the University's telephone and data traffic on to a single robust system capable of handling all data, voice and video communications.

Installed in only two weeks after equipment delivery, the network combines IP telephony traffic of more than 150 Cisco IP Phones located across the University's new Taipa campus. The system is expected to provide the University with significant savings from simplified wiring and long term maintenance cost reductions.

The IP telephony network forms the first phase of an ongoing IT infrastructure programme for expanding the network at the University. The new network was constructed by Cisco's systems integrator Getronics and will eventually encompass a full 802.11 wireless deployment allowing users to access the network from any location on campus without the hassle of wires.

"In October, the University moved to its new permanent campus in Taipa where we wanted to employ a network that would be highly scalable, easy to maintain and ready for future deployment of multi-media applications. For those reasons, we knew we wanted an IP telephony system as opposed to the traditional circuit-based system," said Professor Zhou Li-gao, Rector of the Macau University of Science and Technology. "In just two weeks, the network was installed, in line with the schedule for our newly built campus. We are delighted with the state-of-the-art IP telephony system provided by Cisco."

The network is based on a 3-layer architecture around a Gigabit Ethernet backbone. It offers a feature-rich, cost-efficient IP telephony solution based on Cisco's Architecture for Voice, Video and Integrated Data (AVVID). "More than 1,300 students attend the Macau University of Science and Technology, and we are happy that they and their faculties can now enjoy the benefits of a complete IP telephony system," said Frankie Sum, Managing Director, Cisco Systems Hong Kong. "IP telephony is rapidly becoming the norm for such institutions due to the benefits of converged data, voice, and video networking. By combining different types of traffic on a single network connection, the University will significantly lower the maintenance cost of its integrated network with phones that enable enhanced services and efficiency."

Sum said that Cisco views the school's new network as a sign of a broader trend toward installing IP telephony systems in the tertiary educational sector as opposed to

private branch exchange (PBX) circuit-based systems. "Last July, the Baptist University of Hong Kong completed a similar such network, the largest operating in the territory," he said.

The Macau University of Science and Technology is a privately held tertiary education institution established in 2000. The University offers a variety of professional diploma, undergraduate and postgraduate programmes through its four faculties of Information Technology, Management and Administration, Law, and Chinese Medicine.

### VOIP and Higher Education

VoIP allows users to make and receive phone calls using a high speed Internet connection, as opposed to a traditional phone line. In doing so, the telephony service typically offers users a number of features, plans, and services traditional lines cannot account for. While some service options are limited (VoIP-to-VoIP calls), others offer full range (VoIP-to- local, long distance, or mobile number). Though VoIP offers service plans in both residential and business industries, the service can also be utilized and implemented in other fields. For example, users can look to the field of education, or more specifically, college education.

Communication is vital within the educational system. Within education, VoIP can be applied to help better interaction, as well as advance course infrastructure and lead to new applications/opportunities. Aside from feature and service, all users need to enact VoIP features is: a VoIP package (service, and hardware/software), as well as a high speed internet connection. Once these necessities are accounted for, users can begin utilize the full range of services.

In regards to education, VoIP offers a number of features that are aimed at simplifying communication. While higher education allots for more independence, it also requires extensive communication between students and professors. In response to this, VoIP features are able to connect students and professors through a number of ways including: phone calls, video calls, messages, and even fax. Aside from providing this thorough interconnectivity, VoIP services can be used to implement news methods of teaching. VoIP can be used to better education in a number of ways including:

**Distance Learning Course:** While online classes are becoming increasingly popular with colleges, they can be further supplemented with VoIP services and



technology. VoIP can be introduced into an academic program to designate classes for students who may not be able to attend classes. Students that may be geographically, economically, physically, or otherwise disadvantaged can now attain the same academic career as students who are able to be present in the classroom.

VoIP offers advanced video calling features that enable students to contact their professor(s) remotely. With that, there are a number of providers that offer free PC-to-PC voice and video calls. In doing so, academics can utilize this free service to deliver lesson plans to students via web connection. This would allow the same student-teacher interaction, without the classroom. Additionally, teachers could also use this function as a tutoring tool. If a student needed extra help, but office/classroom hours couldn't accommodate them, users could turn to this service for extra help. Aside from teachers, students could use VoIP to communicate with one another for group projects, or to compare notes with one another.

Another circumstance that could benefit from distance learning courses is natural disasters. In the event of a natural disaster, students/professors may not be able to meet back on campus due to damages sustained. Now, professors could offer the alternative of connecting via internet connection. All this would require was a web connection. Students would not have to wait for the campus to reopen. Instead, they could meet digitally.

**In the Classroom:** VoIP can be used for classes that physically meet in the classroom as well. Students can use VoIP services to collaborate outside of the classroom. For example, students can work on a group project through a conference call or video call. Additionally, students can also work with other students outside the school, town, state, and even country. Professors can use VoIP to connect to other points all over the world to reinforce or implement their lesson plans. Aside from this, having a phone in the classroom allows for greater security measures. Generally all VoIP providers include the [e911](#) (enhanced 911) service, which connects callers to the closest PSAP (public safety answering point), which is the emergency service dispatch center that responds to 911 calls. While this method is appealing, it is not without flaws. Many schools are weary of installing VoIP because it is hard to keep a current list of where each IP phone is located—this information is necessary for e911 services. While the phones have the mobility to move to any network switch port, and log on automatically, there is nothing that automatically registers current location. As a result of this, some

school councils (Texas A&M University) do not allow VoIP in residencies. Despite this potential disadvantage, VoIP phones also allow administration to more readily and easily contact professors and students in the case of an emergency.

**Amongst Faculty:** Aside from re-appropriating the student- teacher relationship, VoIP can also simplify communications amongst staff. School administrators now have the tools to contact staff directly using VoIP calling and/or messaging as opposed to intercom systems.

**Student Body:** Many schools see VoIP as a viable way to get around tricky communications obstacles. For example, Bowdoin College in Maine has actively sought to extend their college private-network phone features to student cell phones. Here, the school has made a deal with mobile provider to apply cell towers all over campus. This will allow for four bar reception all over. With this, everyone will have wireless handsets that can tie into the cellular or campus VoIP network, which will allow students to make 4 digit calls on campus. Aside from applications, VoIP offers schools tremendous cost efficiency—schools are able to take advantage of VoIP data circuits to reduce reoccurring charges associated with traditional landlines.

VoIP is able to offer a number of positives in regards to education; however, it is not without its disadvantages. Aside from vulnerable network security, converging voice and data networks allows for more physical security vulnerability over the voice network. There are also many other factors that should be addressed regarding VoIP and education. Many VoIP providers offer their services as standalone service; however, many of them allow for the service to supplement another service. Therefore, VoIP can be used in addition to whatever phone systems are in already being used at a university/school.

As stated above there are many more advantages and disadvantages to using VoIP in education. While higher education offers a number of tradeoffs in service, VoIP allows for a number of implementations that are not possible with traditional landline services.

## Methodology

This section discusses the research designs and methodologies that will be used in the implementation of VOIP Telephony for NONESCOST Communication System.

## Research Design

The researchers used Performance and Pilot testing as a research design. Performance and Pilot testing is used for conducting study on comparing the Performance of existing devices which is the basic telephone provided by the local service provider. Pilot testing sees if the prototype is working in industrial scale.

## Local of the Study

The location of the study will be the Northern Negros State College of Science and Technology, Old Sagay campus. The beneficiary of the project will be the offices wherein they don't have their own telephone connections such as Office of the Vice-President for Academic Affairs, Office of the Vice-President for Administration and Finance, Registrar's Office, Cashier's Office, and Graduate School Office.

## Respondents of the Study

The respondent of the study were the Offices of NONESCOST. This study will use purposive sampling or these respondents were purposely selected since they were the direct users of the VOIP Telephony System.

## Research Instrument

To achieve the objectives of this study, the researchers used a self-made questionnaire and was validated using criteria developed for evaluating survey questionnaire by Carter V. Good and Douglas B. Scates.

The observation and interview was conducted on-site by the researchers at the NONESCOST. The self-made questionnaire consist of 25 items using a five-point scale where 5 as the highest and 1 as the lowest.

## Data Gathering Procedure

The researchers prepared a questionnaire that aimed to draw out proper responses on the objectives of this study. It was presented to research adviser and a panel to ensure the validity of the responses it would elicit.

## Results

This section presents the results, analyses and interpretation of data. The data gathered are presented in textual and tabular forms with the aid of statistical

treatment for the analysis and interpretation purposes. The presentation of data is sequenced according to the order of research questions.

Table 1. *Data Analysis and Interpretation*

	Criteria	Total Mean Score
1	Lower cost of Implementation than other VOIP systems	3.60
2	Maintenance costs savings	3.60
3	Cheap phone call rate	3.80
4	Simplify management of the network	4.00
5	Simplify communications in the school	3.60
6	Enhance flexible working	3.60
7	Increase competitiveness	4.00
8	Increase productivity	4.00
9	Improve customer service	3.20
10	Communication within the school	3.40
11	Communication with other School's locations (local)	4.00
12	Communication outside the School (national calls)	3.40
13	Make phone calls abroad	3.00
14	Communication while being away from the office	4.00
15	Have videoconferences	3.40
16	Moving to another office in the building is easier	4.00
17	Relocation to other School locations is easier	4.00
18	Telephone bills are cheaper	4.00
19	The network is easily administered	3.60
20	There is a reduction in network costs	4.20
21	VoIP phones enable me to accomplish tasks more quickly	3.60
22	VoIP phones can significantly increase the quality of output on my job	3.40
23	VoIP phones can significantly improve customer service	3.60
24	Conversations using VoIP within the company network are safe	4.20
25	VoIP phones allow making special phone calls (police, ambulance...)	3.80
	Grand Mean	3.72
	Interpretation	Very Relevant

Table 1 shows the result of the survey conducted to the five (5) respondents which are the end-user of the VOIP Telephone with the interpretation of "Very Relevant" rating with the mean score of 3.72.

The result implies that the implementation of VOIP-PBX for NONESCOST communication system contributes a big impact in terms of simplification of their communication system. The implementation of VOIP-PBX will also reduced their telephone expenses as they can install unlimited local numbers without additional expenses on their monthly telephone bills.

## Conclusion

Based on the summary of findings, the following are concluded: (1) The VOIP Telephone system was



successfully implemented in NONESCOST. (2) The VOIP Telephone system is more efficient to used compare to the ordinary telephone service. (3) The VOIP Telephone system for NONESCOST will reduce its expenses on communication system.

Furthermore, the School may use the VOIP Telephone System because it is relevant to its day-to-day operations. It is also recommended to add more phone to other offices since this technology has no limit on local telephone connections. The school may also implement this VOIP-PBX to its satellite campuses for unified communication system using the internet.

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