

**REVIEW OF SELECTED TELECOMMUNICATION
ISSUES AND USE OF VOICE OVER INTERNET
PROTOCOL TECHNOLOGIES IN THE UNITED
NATIONS SYSTEM ORGANIZATIONS**

Prepared by

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Joint Inspection Unit

Geneva 2007



United Nations

JIU/NOTE/2007/2

Original: ENGLISH

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GE.07-02627

EXECUTIVE SUMMARY

Review of selected telecommunication issues and use of Voice over Internet Protocol technologies in the United Nations system organizations

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The objective of this review is to identify the opportunities for, and determine the feasibility of, using new telecommunication technologies based on Voice over Internet Protocol (VoIP) in the United Nations system organizations, with a view to reducing costs and improving services. The review also analyses the coordination of telecommunication services and equipment procurement among United Nations system organizations.

Main findings and conclusions

- Telephony services are mission critical to any organization and are a principal means of communication. In many duty stations, the current systems providing telephony services to the United Nations system organizations have reached their end-of-life, and need to be replaced with modern, reliable and cost-effective telephony systems at the most opportune time.
- VoIP is a new technology that breaks down voice signals into digital packets that can be sent using standard Internet protocol (IP) over the Internet or through any other IP-based network. There is significant use of this technology on private premises, in particular to replace old private branch exchanges (PBXs). The most notable difference between the traditional telephony network, public switched telephone network (PSTN), and VoIP is in the transmission method. VoIP uses packets instead of the dedicated circuit used by PSTN, which, in certain cases, can increase efficiency because other information can be transmitted at the same time.
- Benefits of VoIP for business include savings on long-distance calls, since long-distance calls can be placed over the Internet. VoIP also allows users to streamline their network requirements from two networks (one for telephone and one for data) into one single network, and thus saves on capital investment and maintenance costs. VoIP provides new presence-enabled services and functionalities, such as advanced conferencing and unified e-mail/voicemail messaging supported by an online computer contact list, thus enhancing the productivity and efficiency of the communication system. VoIP could also act as an effective supplementary means for voice telecommunication in remote regions.
- Possible disadvantages that may be encountered with VoIP include transmission-related voice quality (loss of or delayed packets), security risks, power outages, etc., but the recent evolution and improvements in VoIP technologies and equipment have succeeded in solving these problems in a satisfactory manner.
- As VoIP-based technology has now already become stable and reliable, some organizations have deployed IP telephony both when replacing current systems at end-of-life and in new construction installations. The Inspectors recommend that United Nations system organizations should implement VoIP technologies in new telecommunication projects, whenever these projects are aimed at replacing end-of-life telephone systems, constructing new buildings, renovating current buildings or renting new offices.

- Attention must also be paid to national laws and regulations, since some countries impose restrictions on certain uses of VoIP. The United Nations system organizations need to negotiate with host countries before implementing VoIP technologies.
- Meanwhile, increased competition in telecommunications markets has dramatically brought down the rates charged by service providers. Many of them are, in fact, increasingly combining voice and data traffic and carrying it over IP-based networks, including their dedicated virtual private networks (VPN). In many cases, the resultant savings are passed along to users.
- Taking into consideration the advantages brought by VoIP technologies, the strong competition in the telecommunications market, and the limited procurement cooperation between the United Nations system organizations on telecommunications, the Inspectors recommend that joint negotiations and procurement activities on telecommunication services and equipment should be further pursued, in order to accumulate sizeable volumes and strengthen their bargaining power vis-à-vis potential service/equipment providers.
- Many United Nations system organizations are aware of the advantages of VoIP technologies and also its related risks and challenges, such as the quality of service, security risks, and lack of budgetary and trained staffing resources, etc. Thus, the Inspectors recommend that the United Nations system organizations should make evaluations on an on-going basis, and prepare an implementation plan for the use of various voice technologies, including VoIP, which should include a detailed business case description, the amount of investment required, expected returns, a risk management strategy and a contingency plan, in order to enable the organizations to make the best use of this new technology while keeping the related risks under control.

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ABBREVIATIONS

CEB	United Nations System Chief Executives Board for Coordination
CMP	Capital Master Plan
CTBTO	Comprehensive Nuclear-Test-Ban Treaty Organization
DPKO	Department of Peacekeeping Operations, United Nations
ECA	United Nations Economic Commission for Africa
ECLAC	United Nations Economic Commission for Latin America and the Caribbean
ERP	Enterprise Resources Planning
ESCAP	United Nations Economic and Social Commission for Asia and the Pacific
ESCWA	United Nations Economic and Social Commission for Western Asia
FAO	Food and Agriculture Organization of the United Nations
IAEA	International Atomic Energy Agency
ICAO	International Civil Aviation Organization
ICC	The United Nations International Computing Centre (ICC)
ICRC	International Committee of the Red Cross
ICT	Information and Communication Technologies
ICTS	Information and Communication Technology Service (UNOG)
IFAD	International Fund for Agricultural Development
IFC	International Finance Corporation
ILO	International Labour Organization
IMF	International Monetary Fund
IMO	International Maritime Organization
IP	Internet Protocol
IPT	Internet-Protocol Telephony
ITAG	Inter-Agency Telecommunications Advisory Group
ITSD	Information and Technologies Services Division, United Nations
ITU	International Telecommunication Union
ITU-D	Telecommunication Development Bureau, ITU
JIU	Joint Inspection Unit of the United Nations system
LCR	Least Cost Routing
MAC	Move, Add, Change
MPLS	Multi Protocol Label Switching
PBX	Private Branch Exchange
PSTN	Public Switched Telephone Network
UNAIDS	Joint United Nations Programme on HIV/AIDS
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFPA	United Nations Population Fund
UNHCR	Office of the United Nations High Commissioner for Refugees
UNICEF	United Nations Children's Fund
UNIDO	United Nations Industrial Development Organization
UNIFEM	United Nations Development Fund for Women
UNODC	United Nations Office on Drugs and Crime
UNOG	United Nations Office at Geneva
UNON	United Nations Office at Nairobi
UNOPS	United Nations Office for Project Services
UNRWA	United Nations Relief and Works Agency for Palestine Refugees in the Near East
UNV	United Nations Volunteers
UNWTO	World Tourism Organization of the United Nations
UPS	Uninterruptible Power Supply

UPU	Universal Postal Union
VoIP	Voice over Internet Protocol, also called IPT
VPN	Virtual Private Network
VSAT	Very Small Aperture Terminal
WFP	World Food Programme
WHO	World Health Organization
WIPO	World Intellectual Property Organization
WMO	World Meteorological Organization
WTO	World Trade Organization

I. INTRODUCTION

1. As part of its programme of work for 2006, the Joint Inspection Unit (JIU) conducted a review of selected telecommunications issues and uses of Voice over Internet Protocol (VoIP) technologies in United Nations system organizations.

2. The objective of the review is to identify the opportunities for, and determine the feasibility of, using new telecommunication technologies based on VoIP in the United Nations system organizations, with a view to reducing costs and improving services. The review also analyses the coordination of telecommunication services and equipment procurement between the United Nations system organizations. In many cases, joint and coordinated telecommunication procurement/standardization could provide economies of scale and minimize costs and risks of interoperability. It could also help to attain more preferential offers from telecommunications service providers and equipment manufacturers, resulting in cheaper running costs and budget savings over the medium and long-term with assured quality of service.

3. The review covers the telecommunication operations and practice of most of the participating organizations of JIU; the use of new telecommunication technologies, especially VoIP technologies; and the procurement of telecommunication services and equipment.

4. Telephony is an important tool in any organization. The Inspectors note that the current systems providing telephony services to the United Nations in many duty stations, including the United Nations Headquarters complex (installed in 1986), United Nations Office at Nairobi (UNON), United Nations Office on Drugs and Crime (UNODC), the United Nations Economic Commission for Latin America and the Caribbean (ECLAC), the United Nations Economic and Social Commission for Western Asia (ESCWA), and the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP), have reached their end-of-life and need to be replaced with a modern, reliable and cost-effective telephony system at the most opportune time. Other organizations in the United Nations system are also facing the same situation. In addition, to run a reliable and quality telephony service, including voice, videoconference, cable, fax, etc., requires substantial, continuous capital investment and operational support costs, in addition to the costs charged by telecommunications companies for actual call duration. For the United Nations Headquarters complex alone, a total of US\$ 8.55 million is incurred annually for telephony-related costs, including technical support staffing costs (US\$ 0.7 million), capital investments (US\$ 4.7 million) and non-staff operating costs (US\$ 3.15 million). It is against this background of “time for change” that the Inspectors carried out this review.

Methodology

5. In accordance with the internal standards and guidelines of JIU and its internal working procedures, the methodology followed in preparing this note included a detailed desk review, questionnaires, interviews and in-depth analysis.

6. Detailed questionnaires were sent to all participating organizations. On the basis of the responses received, the Inspectors conducted interviews with officials of the participating organizations, and also sought the views of many well-known experts in the field as well as the views of a number of other international organizations, including the International Committee of the Red Cross (ICRC), which implemented VoIP at its headquarters premises in 2005. The Inspectors also consulted some members of the Inter-Agency Telecommunications Advisory Group (ITAG) of the Information and Communication Technologies (ICT) Network under the

United Nations System Chief Executives Board for Coordination (CEB), which has been following the subject matter.

7. Comments from the participating organizations on the draft note have been sought and taken into account in finalizing the note.

8. In accordance with article 11.2 of the JIU statute, this note has been finalized after consultation among the Inspectors so as to test its conclusions and recommendations against the collective wisdom of the Unit.

9. This note is intended for all United Nations system organizations and requests actions from their executive heads. To facilitate the handling of the note and the implementation of its recommendations and the monitoring thereof, annex VII contains a table indicating those recommendations relevant for each organization.

10. The Inspectors wish to express their appreciation to all who assisted them in the preparation of this note, and particularly to those who participated in the interviews and so willingly shared their knowledge and expertise.

II. CONVERGENCE OF TELEPHONY NETWORKS WITH DATA NETWORKS AND THE EMERGENCE OF VOICE OVER INTERNET PROTOCOL TECHNOLOGIES

11. Voice over Internet protocol (VoIP), also called Internet protocol (IP) telephony, Internet telephony, broadband telephony, broadband phone and voice over broadband, is a technology that breaks down voice signals into digital packets that can be sent using standard Internet protocol over the Internet or through any other IP-based network. Its use is widespread for backbone (wholesale) transmission of voice traffic by telecommunications operators. There is also significant use on private premises, in particular to replace old private branch exchanges (PBXs).

12. According to “The Essential Report on IP Telephony”,¹ “telephony networks have in the course of time undergone major evolutionary changes, driven essentially by technological progress in various fields (switching, transmission, access and maintenance). The latest such change is digitization of their transport technology, which has had a considerable integrating influence. Still, the end purpose of a telephone network was always associated with the provision of a universal communication service with a certain quality. This has several implications for the technologies used and the mode of interconnection between subnetworks”.

13. This report points out that “every telephone operator throughout the world operates a subnetwork of the global telephone network. In order to provide a universal communication service to all of their respective subscribers, they have an obligation to interconnect their networks and to agree on a single and coherent system for designating their subscribers.”²

14. The traditional technology used for the purposes of transporting voice within telephony networks is known as circuit switching. A resource (circuit) must be reserved for a call from the time of its dialling to its conclusion. The public switched telephone network (PSTN) connects all circuit-switched telephone networks worldwide, as the Internet connects all the world’s public IP-based packet-switched networks. After more than 100 years’ evolution, PSTN has evolved from fixed-line based analogue to mostly digital networks, and also includes mobile communication networks.³

15. As a result of the progress made in the field of information technology during recent years, the deployment of data networks, especially the Internet, has experienced a boom following the widespread introduction of computers into private sector companies, governments, universities and households.

16. Nowadays, the boundary between circuit-switching telephony networks and data networks has blurred. As pointed out by a document issued by the Telecommunication Development Bureau, International Telecommunication Union (ITU-D) in 2001,⁴ “The situation today is one in which the interconnection of personal computers to the Internet is for the most part via the global telephone network, and this is true for both developed countries and developing countries. The parallel evolutions led to the establishment of two types of network, each optimised for transporting the predominant type of information for which it was

¹ Published in 2003 by the group of experts on IP telephony, established by the director of the Telecommunication Development Bureau, International Telecommunication Union (ITU-D).

² Ibid.

³ The description of PSTN is taken from Internet sources (<http://en.wikipedia.org> and www.answers.com).

⁴ Published in October 2001, entitled IP Telephony Group of Experts – Technical aspects.

designed (voice speech for the telephony network and all types of data for data networks). Today, the use of the telephony network for accessing the Internet, and the possibility of carrying voice over an IP-type packet network, leads to the possibility of convergence between these two types of networks.”

17. A notable difference between PSTN and VoIP is in the transmission method. PSTN uses a dedicated circuit to ensure continuity and real-time transmission for every call, but this limits its potential use for other purposes while the voice communication is taking place. On the other hand, VoIP uses “data packets” instead of a dedicated circuit, which, in certain cases, can increase efficiency because other information can be transmitted at the same time. However, voice packets sent through IP could be lost or delayed at any point in the network, and between VoIP users if the network is highly congested due to limited bandwidth. This may cause a problem of voice dropout, which is an unacceptable quality problem in voice communication. However, progress in technology in recent years has improved the reliability and voice quality of VoIP during the packet transmission process, supported by increased investment to expand bandwidth.

18. In view of this drastic evolution in telecommunication technologies, which brings voice communication together with data transmission into an interlinked network, the Inspectors are of the opinion that more economies and efficiencies could be achieved by better coordination between the United Nations system organizations regarding telecommunications procurement and the implementation of new telecommunication technologies, under appropriate circumstances. Use of the new technologies would reduce redundancy through running a converged network enabled by VoIP, instead of the current two parallel networks for telephony and data.

19. The Inspectors are aware that many peacekeeping missions of the United Nations are using satellite technologies, such as Very Small Aperture Terminal (VSAT), for communication purposes. Due to the temporary and emergency nature of these missions, secure quality of service may be the primary concern in applying these technologies rather than economic savings. Thus, the use and means of telecommunication by peacekeeping missions may be different from those of a normally established office. The Inspectors only consider in this note the needs and use of telecommunications by established offices in the United Nations system organizations. However, they note the potential for cost savings through the use of VoIP-enabled VSAT networks, such as the World Food Programme (WFP) has achieved.

III. ADVANTAGES AND POSSIBLE DISADVANTAGES OF VOICE OVER INTERNET PROTOCOL TECHNOLOGIES

20. The Inspectors would like to draw attention to the advantages of VoIP technologies and the possible disadvantages inherent in their use, before going into further detail about how these advanced technologies should be used in telecommunication operations by the United Nations system organizations.

21. One potential benefit of VoIP for business is savings on traditional long-distance calls. These savings can result either from implementing a private international voice network using VoIP, or from negotiating with operators, who themselves have implemented such networks and can be induced to pass along the resultant cost savings. In the case of implementing a private international voice network using VoIP, the potential benefits for long-distance charges should be carefully compared to the connection, maintenance and investment costs, such as investment in bandwidth/network infrastructure. In some circumstances, the overall related costs to ensure the same quality to run VoIP to an external destination may exceed the savings from the long-distance charges .

22. VoIP may also allow users to streamline their network requirements. As stated before, in the past an office needed two networks: one for telephones and one for computers. VoIP will allow both voice and data to run on one network. Obviously, having one single integrated network results in cheaper installation and maintenance costs. In fact, many organizations have now integrated their telephony function and information network function into one infrastructure function. However, for security reasons, the organization will still need to keep a separate and smaller communication network to have a back-up system for emergency contact and communication, in case voice communications are disrupted in the IP network if there is a power outage, or if the IP network fails for some other reason (see paragraphs 26 and 27 below). As VoIP-based technology has now become stable and reliable, some organizations have deployed IP telephony while replacing current systems at end-of-life and in new construction installations. These same advantages are foreseen as realizable in the United Nations Capital Master Plan (CMP) and new buildings construction/rental in UNON, the United Nations Office at Geneva (UNOG) and the United Nations Economic Commission for Africa (ECA), based on documentation provided to the Inspectors by the United Nations Information and Technologies Services Division (ITSD). To install one converged network in any new building (newly constructed, renovated or rented), instead of installing two separate networks, will provide savings to the United Nations organizations not only in terms of capital investment, but also in ongoing maintenance costs.

23. Cost saving is not the only benefit of VoIP. It can provide more functions than the traditional PSTN telephony system, such as advanced conferencing and unified e-mail/voice mail messaging (instant messaging) supported by an online computer contact list. These functionalities, especially the presence-enabled technologies such as instant messaging, would definitely increase the productivity of an organization since information could be accessed and treated by the conversing partners (the speaker and his/her target audience) in a more economic, effective, efficient and timely manner on this unified communication platform.

24. Due to the use of IP, a VoIP phone number, unlike regular telephone numbers, is completely portable. Most commonly referred to as a virtual number, it can work anywhere there is a broadband Internet connection. As a result, an IP-based internal telecommunication network (private network) can be configured using a web interface, which can be managed by a network administrator online instead of on-site, thus the related “move, add, change” (MAC) process caused by staff moving to other locations is made much easier and cheaper. This

portability is a very attractive solution to the United Nations Secretariat in its phased headquarters building renovation project, the Capital Master Plan, as the complex will not be vacated completely during the renovation, but instead will be renovated top down (10 floors at a time), with the remaining areas of the complex occupied and requiring telephone services.

25. For some remote regions in the world, the connection between telephony networks is very unstable, while the connection via Internet is much more stable and resilient due to the possibility of connecting through various routes in the network, without incurring additional costs. This phenomenon indicates that VoIP could even act as an effective supplementary means for voice telecommunication to these remote regions, and may offer better connection quality compared to PSTN networks. UNODC has demonstrated this advantage to the Inspectors in the execution of their pilot VoIP project in some field offices.

26. Besides these distinct advantages offered by VoIP, it may also have some disadvantages, if it is not properly managed. The fact that VoIP is using IP to send packets via networks means all the limitations of the Internet are inherent in VoIP applications. In recent years the most common problem has been transmission-related voice quality. IP-based packets may not arrive at their destination in a consistent time and ensured manner - some packets arrive faster or slower than others, some are even lost during the process. These problems cause voice conversations to experience gaps, not be smooth or even to be incomprehensible. However, the recent evolution and improvements in VoIP technologies and equipment have succeeded in solving these problems in a satisfactory manner, especially the establishment of specific quality of service protocols and buffers to monitor packet transmission in addition to the increased bandwidth of the network which reduces possible congestion.

27. Other disadvantages can still persist. For example, power outages may make VoIP applications unavailable, since the Internet connection is established only when the system is on, while for a PSTN connection, there is an external separate power supply to the network, independent of the users. However, this power outage risk could be managed with the use of uninterruptible power supply (UPS).

28. VoIP networks also suffer similar security problems to normal digital networks, and could be subject to electronic virus attacks. With a well-defined security strategy, security measures and firewalls, this kind of risk could be contained at a level acceptable to the organizations, similar to those applied to other mission-critical information systems/applications, such as enterprise resources planning (ERP), the Internet, intranets, e-mail, etc.

29. The nature of IP makes it difficult to locate network users geographically. Emergency calls, therefore, cannot easily be routed to a nearby call centre, nor can they be placed on some VoIP systems. Thus, keeping a limited traditional telephone system should be considered for emergency contact purposes and also in case of a serious information system breakdown.

30. Attention must also be paid to national laws and regulations. Some countries have imposed legal restrictions on the commercial use of VoIP by unauthorized telecommunications service providers, and the United Nations system organizations may need to negotiate with the competent national authorities before implementing VoIP in these countries. In principle, the Inspectors are of the view that the internal implementation of VoIP by the United Nations system organizations should be exempt from this kind of legal restriction according to the Convention on the Privileges and Immunities of the United Nations adopted by the General Assembly in 1946, and the standard host country agreements signed by many host governments. However, the Inspectors are aware that some governments are reluctant to approve VoIP applications by VSAT or other methods for the international telephone service,

as this service is still regarded by them as a protected sector, a money earner for the government and the local economy. It may need negotiations with certain governments to secure the legal conditions for the applicability of VoIP for the United Nations organizations. The experience of WFP during the introduction of VoIP in its regional offices proves that, with very few exceptions, the United Nations organizations can succeed in getting consent from most governments on the use of VoIP, after laborious negotiations.

31. In conclusion, in the view of the Inspectors, the use of VoIP could realize the transmission of voice communication over data networks in a reliable, economic, efficient and effective manner, resulting in important cost savings and productivity gains. This is subject to special efforts and measures being deployed relating to quality of service, investment in infrastructure and security-related issues.

32. The Inspectors note that the World Health Organization (WHO) has replaced end-of-life telephony services with VoIP, in its Regional Office for the Western Pacific. In the case of new offices/services, WHO is using IP telephony in its newly established Global Service Centre in Kuala Lumpur. The implementation of the following recommendation would provide United Nations system organizations with effective means to realize sizeable economic savings on capital investment and maintenance costs, and to achieve productivity gains through a converged network based on VoIP.

Recommendation 1

The executive heads of those United Nations system organizations which have not yet done so, should implement VoIP technologies in new telecommunication projects, whenever these projects are aimed at replacing end-of-life telephone systems, constructing new buildings, renovating current buildings or renting new offices.

IV. COMPETITION AMONG TELECOMMUNICATIONS COMPANIES AND OPPORTUNITIES FOR THE UNITED NATIONS

33. During this review, the Inspectors note that in recent years, the global telecommunications market has undisputedly moved towards greater liberalization and increased competition.

34. A report, published by the Federal Communications Commission of the United States in 1999, entitled “Connecting the globe, a regulator’s guide to building a global information community”, gave a very informative description of competition in the world market and its impacts.⁵

“The benefits of introducing competition in telecommunications markets are apparent in all segments of the telecommunications market. For instance, competition in the United States and many other countries in long distance and international telecommunications services have led to a dramatic decline in consumer rates for these services, as well as a dramatic increase in demand and a substantial increase in investment.

The 1997 WTO Agreement on Basic Telecommunications Services ushered in a new era for telecommunications competition in many countries of the world. As part of that agreement, 72 countries have made commitments to open their telecommunications markets to foreign suppliers of basic telecommunications services. As these countries implement their commitments, dramatic change has occurred in their markets. In many countries, there are several new providers of international and domestic telecommunications services, and prices are dramatically lower. As a result, increased competition has led to lower international settlement rates in many countries which, in turn, has led to lower calling prices for consumers. Lower calling prices means that people can afford to make more calls, more often, creating closer ties between family and friends in different countries and strengthening business relationships”.

35. The Inspectors note that many international telecommunications companies/service providers have, in fact, already applied VoIP on their dedicated virtual private networks (VPN) with enhanced quality of service, such as the multi protocol label switching (MPLS). They are increasingly combining voice and data traffic and carrying it over IP-based networks. Thus, traditional voice calls made by their customers could also be routed by VoIP without any, or only a minor, deterioration of voice quality felt at the user’s end. This has allowed telecommunications companies/service providers to take advantage of the potential savings brought by the use of VoIP. In many cases, the resultant savings are passed along to users.

36. On the user’s side, a technology called least cost routing (LCR)⁶ has been widely applied by users to take advantages of competitive offers from various telecommunication service providers.

37. The compound effect of the dedicated and across-the-board use of VoIP by major international telecommunications companies and the application of LCR by end users, have resulted in very attractive voice communication rates for organizations based in major cities in

⁵ Federal Communications Commission, “Connecting the globe, a regulator’s guide to building a global information community”, Washington, June 1999.

⁶ LCR is a feature of a telephone system that automatically connects an outgoing telephone call with the telephone service that costs the least to that location at that time of day.

developed countries, such as New York, Vienna, Paris, Rome, London and Geneva, many of which are the key duty stations of the United Nations system organizations.

38. Due to the very competitive nature of the telecommunications market, voice communication rates are heavily influenced by negotiations between telecommunications companies and customers. The size of the customer and the volume of their telecommunications have a crucial impact in fixing the rates.

39. Joint negotiations between the United Nations system organizations and telecommunications providers could result in making available preferential commercial rates and solutions, and avoid unnecessary technological investment and its associated costs.

40. Considering the current worldwide presence of United Nations system organizations, and their increasingly expanding field operations, it is the view of the Inspectors that the United Nations system organizations have not yet fully exploited the cost saving potential offered through joint negotiations.

V. REVIEW OF CURRENT TELECOMMUNICATIONS PRACTICES IN THE UNITED NATIONS SYSTEM ORGANIZATIONS

41. The Inspectors note that the telecommunications practices of the United Nations system organizations differ from each other in many aspects, which is to a certain extent natural due to their different types of activities, size, organizational structure, location and operating environment/history. Different considerations and constraints may have been taken into consideration when they made decisions on the use of different technologies in the telecommunications field (see annexes I to VI for details).

42. The Inspectors are encouraged to note that most of the organizations have taken advantage of the many new competitive commercial offers and technologies available. Annexes I and II show that various actions were taken by United Nations system organizations in 2004 and 2005 to lower telecommunication costs. Many also started using VoIP technologies, especially those United Nations system organizations with worldwide coverage and/or a high number of staff concentrated in a single duty station, such as the United Nations Headquarters complex in New York, WFP, the International Labour Organization (ILO), the Food and Agriculture Organization of the United Nations (FAO), the United Nations Children's Fund (UNICEF), the United Nations Development Programme (UNDP), WHO, the International Atomic Energy Agency (IAEA), the Office of the United Nations High Commissioner for Refugees (UNHCR) and UNODC. Many have also established commercial negotiation strategies and/or joint procurement.

43. It is worthwhile mentioning the ongoing VoIP implementation project being undertaken in the United Nations Headquarters complex in New York. Starting in June 2006 and covering an 18-month period, the current telephone system is being migrated to IP telephony through a series of phases including planning, pilot testing, ordering of equipment, implementation of support services, network assessment, remedial action (if needed), training of operational staff, installation, test and activation of the new VoIP system, training staff on using the new equipment, and cutover to the new VoIP system. The financial analysis prepared by the Information and Technologies Services Division (ITSD) shows that the project will achieve accumulated financial benefits at a net present value of US\$ 44.44 million over a ten-year period, while the initial cost of this project is US\$ 6.69 million. The recurrent cost per year for this project will be US\$ 2.69 million. The net present value of these costs is US\$ 31.26 million.⁷

44. After considering some of the critical risks compared to the benefits stated above, including the risk of cost overruns, the risk of delays to the implementation schedule and the risk of not being able to realize some of the benefits associated with the project, the risk-adjusted benefits value is US\$ 42.22 million. The risk adjusted cost value is US\$ 32.19 million. The risk-adjusted return on investment of this project is calculated at 31 per cent.

45. This project clearly shows the high potential savings, benefits and return on investment brought by VoIP. The Inspectors would recommend that United Nations system organizations should consider the possibility of using VoIP, especially for any planned end-of-life replacement of current telephony systems, and/or construction/rent of new buildings, and to consult with ITSD if necessary.

⁷ Documentation and calculations provided to the Inspectors by ITSD.

46. The Inspectors also reviewed the joint procurement of telecommunications equipment and services (see annex II), which shows that some progress has been achieved in recent years. For example, the United Nations Secretariat has already standardized the use of VoIP technologies, completed the associated procurement action and put in place a long-term system contract with one leading provider of this type of technology. This contract incorporates the highest levels of discount offered by this company, and is open for use by any organization within the United Nations system. The United Nations Secretariat also recently took part in a cooperative procurement initiative led by the World Bank for the provision of telecommunications services, which resulted in pricing that will generate significant savings to the organization. However, there is room for improvement across the United Nations system in this area. Much could be achieved if this kind of joint activity could be extended at least to those organizations located in the same duty station. The Inspectors could not attain accurate global statistics of call-minutes per year incurred by all United Nations system organizations, but data provided by the Information and Communication Technology Service (ICTS), UNOG, shows that in 2006 alone, the organizations served by ICTS/UNOG incurred in total 5.24 million call-minutes for national fixed-line calls, and 3.45 million call-minutes for international fixed-line calls. If this volume of call-minutes could be combined with the volumes of other United Nations system organizations based in Geneva, their bargaining power could be significantly enhanced. The Inspectors welcome a recent initiative by three Rome-based United Nations organizations, whereby WFP, the International Fund for Agricultural Development (IFAD) and FAO have started joint approaches to link all three headquarters offices using common data and telephony services. The plan also includes integrated VoIP capabilities, and is expected to substantially reduce costs and improve service reliability for all three organizations.

47. The following recommendation would ensure United Nations system organizations get better value for money and achieve better quality of service through joint procurement on telecommunication services and equipment.

Recommendation 2

The executive heads of those United Nations system organizations, which have not yet done so, should pursue joint procurement of telecommunication services and equipment, especially for those organizations which are in the same duty station.

48. The Inspectors note that the following factors have been selected by different United Nations system organizations as the perceived advantages for the use of VoIP for internal (on premises, PBX replacement) and external (off-site) communication, namely: functionalities (e.g., voice mail, e-mail), cost savings, mobile (portable), synergies with ICT investment, a supplementary means for voice telecommunication and others, such as web conferencing, etc. (for details, please see annexes III and IV.) The perceived disadvantages for the use of VoIP for internal and external communications include: security concerns, technical limitations, the lack of qualified/trained staff, budgetary constraints, questions of quality of service and legal concerns. Other concerns voiced were that it is not a priority issue, prefer not to take the lead in this area, the current PBX is still within its useful life, and other, such as lack of staffing resources, etc. (for details, please see annexes V and VI.)

49. The Inspectors are encouraged to note that many United Nations system organizations are aware both of the advantages that VoIP technologies could bring to their operations, and also of the possible risks and challenges that would have to be overcome. Only with full awareness and knowledge can management make sound decisions. On this matter, the Inspectors are pleased to note that UNICEF issued an administrative instruction on the organization's VoIP implementation policy in December 2002, which is the first one in the United Nations system. In addition, UNICEF's ICT biennium budget guidelines strongly recommend the use of VoIP in country offices.

50. Considering the advantages and disadvantages of the use of VoIP, the Inspectors would propose continuous evaluations, and a gradual implementation, of this technology, whenever appropriate: first, the use of VoIP in internal communication, such as the replacing of legacy PBX with IP-based PBX whenever the former is at the end of its life cycle, or using an IP-based PBX for any new office premises. After technical support staff and users become familiar with the new system, then the application to external use can be rolled out with a carefully prepared feasibility study and implementation plan, including a detailed business case description, the level of investment required and expected returns, a risk management strategy and contingency plan, etc.

51. The following recommendation would enhance the management efficiency of the United Nations system organizations through a continuous evaluation and gradual implementation strategy, making the best use of this new technology while keeping the related risks under control.

Recommendation 3

The executive heads of those United Nations system organizations which have not yet done so, should make evaluations on an on-going basis and prepare an implementation plan for the use of various voice technologies, including VoIP, which should include a detailed business case description, amount of investment required and expected returns, a risk management strategy and a contingency plan.

Annex I: Actions taken to lower telecommunication costs through commercial negotiation and implementation of new technologies (2004 - 2005)

Organization	Negotiated mobile voice rates	Negotiated fixed voice rates	Negotiated Internet connectivity rates	Installed VoIP equipment for PBX	Use of VoIP for international calls	Others/Comments
FAO	√	√	√		√	√ (Some VoIP installations in country offices and Voice over Frame Relay between its headquarters and Accra office)
IAEA	√	√	√	√	√	
ICAO	√	√	√			√ (Change of service provider in ICAO Lima office)
ILO	√	√	√			√ (Use pc-to-pc Skype for communication between headquarters and field)
IMO		√	√			
ITU	√	√	√			
United Nations		√		√ (for OHCHR new office and New York complex)		√ (International communication between United Nations offices are carried on data links with a fixed price per month regardless of number of calls)
UNDP	√	√	√	√	√	
UNFPA	√		√			
UNHCR	√	√	√	√	√	√ (CMN/EMC project)
UNICEF	√	√	√		√	As of October 2007, UNICEF has 148 locations worldwide using VoIP.
UNIDO*		√				
UNODC	√	√	√	√	√	√ (VoIP to many field offices)
UNRWA			√			
UNWTO	√	√				
UPU		√	√			√ (Limited use of Skype)
WFP	√	√	√	√	√	√ (Create worldwide private VoIP-enabled VSAT network between 175 sites)
WHO	√	√	√	√		√ (VoIP between WHO offices through established wide area network and between PBXs in Geneva over the metropolitan area network)

WIPO	√	√				
WMO	√	√				

Source: Responses from United Nations system organizations to the JIU questionnaire.

* UNOV manages telephony services on behalf of UNODC, UNIDO, as well as CTBTO jointly.

**Annex II: Actions taken to lower telecommunication costs
through joint procurement on telecommunication (2004 - 2005)**

Organization	Joint procurement on both telecommunication services and equipment	Joint procurement only on telecommunication services	Joint procurement only on telecommunication equipment
FAO	No	SITA long-haul communications under United Nations long term agreement, mobile phone service with WFP, IFAD	No
IAEA	No	UNODC	No
ICAO	No	No	No
ILO	No	No	No
IMO	No	No	No
ITU	No	No	No
United Nations	System contracts, such as Global Cisco equipment and services, Motorola radios and SITA for communications	Consortium headed by the World Bank for long distance and ISDN services	No
UNDP	UNICEF, WHO, OCHA, WFP	UNFPA, UNOPS, UNIFEM	No
UNFPA	No	No	No
UNODC	CTBTO and UNIDO	IAEA	No
UNHCR	An inter-agency request for proposal (RFP) for high frequency (HF) and very high frequency (VHF) equipment with WFP and UNICEF launched and led to an inter-agency United Nations long-term agreement.	FAO, Global Fund to Fight Aids, Tuberculosis and Malaria, ICAO, ICC, IFC, IMF, UNICEF, UNDP, UNESCO, United Nations, UNOG, UNFPA, UNAIDS, UNV, World Bank, WFP, WHO, WIPO, WTO	No
UNICEF	No	No	No
UNIDO	UNOV/UNODC	No	No
UNRWA	No	No	No
UNWTO	No	No	No
UPU	No	No	No
WFP	FAO, UNICEF (Satphones, PBX, GSM service)	All agencies - SITA under United Nations long-term agreement	UNHCR, United Nations DPKO, UNICEF (HF and VHF radio)

WHO	Inter-agency VSAT Request for Proposal (UNDP, UNICEF, WFP, OCHA, DPKO, WHO)	Mobile phone services (UNOG, WHO) and satellite services (UNICEF, WHO)	No
WIPO	No	WHO, UNOG	No
WMO	No	No	No

Source: Responses from United Nations system organizations to the JIU questionnaire.

Note: SITA is a not-for-profit cooperative, which provides network and communications solutions via its air transport industry-related network/communications infrastructure/facilities to international organizations and companies.

Annex III: Advantages perceived for the use of VoIP in internal (on premises) communications

Advantages perceived for use of VoIP in internal (on premises) communications	Organizations
Functionalities (e.g., voice mail, e-mail)	United Nations, UNHCR, UNODC, UNDP, UNFPA, ITU, ICAO, IMO, WMO
Cost savings	ILO, UNODC, UNDP, ITU, ICAO, IAEA, IMO, UNWTO
Mobile	United Nations, UNHCR, UNODC, UNDP, UNFPA, ITU, ICAO, IAEA, IMO
Synergies with ICT investment	United Nations, UNHCR, UNDP, ITU, ICAO
Others	IAEA (lack of telephone wires to office floor), ITU (video and audio conferencing, alarm notification), United Nations (should move to a single vendor IPT solution to address the consistency problem in current PBX's platforms), WHO (web conferencing), ILO (avoid hacking), WFP (VoIP between sites)

Source: Responses from United Nations system organizations to the JIU questionnaire.

Annex IV: Advantages perceived for the use of VoIP in external (off-site) communications

Advantages perceived for use of VoIP in external communications	Organizations
Functionalities (e.g., voice mail, e-mail)	UNHCR, UNODC, UNFPA, ITU, ICAO, IMO, UPU
Cost savings	WFP, ILO, WHO, UNHCR, UNODC, UNIDO, UNDP, UNFPA, UNRWA, ITU, ICAO, IAEA, IMO, UPU, UNWTO, UNICEF
Mobile	FAO, UNODC, UNDP, ITU, ICAO, IMO, UPU
Synergies with ICT investment	WFP, UNHCR, ITU, ICAO
A supplementary means for voice telecommunication	WFP, FAO, UNHCR, UNODC, UNIDO, UNDP, UNRWA
Others	ILO (avoid hacking), UNICEF (reach difficult locations and achieve better quality to locations with poor infrastructure)

Source: Responses from United Nations system organizations to the JIU questionnaire.

**Annex V: Disadvantages perceived for use of VoIP
in internal (on premises) communications**

Disadvantages perceived for use of VoIP in internal communications	Organizations
Security concerns	ITU, IAEA, IMO, WIPO
Technical limitations	WFP, ITU, IAEA, IMO, UNICEF
Lack of qualified/trained staff	WFP, UNRWA, WIPO
Budgetary constraints	WFP, UNRWA, ITU, IMO, WIPO, UNICEF
Questions of quality of service	ITU, UNICEF
Not a priority issue	FAO, UNIDO, UNRWA
The current PBX is still within its useful life	WFP, FAO, UNRWA, IAEA, WIPO, UNICEF
Other	UNRWA (lack of staffing resources), IAEA (power supply needed), FAO (no certification of LAN suitability for VoIP)

Source: Responses from United Nations system organizations to the JIU questionnaire.

**Annex VI: Disadvantages perceived for use of VoIP
in external (off-site) communications**

Disadvantages perceived for use of VoIP in external communications	Organizations
Security concerns	ITU
Technical limitations	WIPO
Lack of qualified/trained staff	FAO, ITU, WIPO
Budgetary constraints	ITU, WIPO
Questions of quality of service	FAO, UNHCR, ITU
Legal concerns	ITU
Not a priority issue	FAO, UNHCR
Prefer not to take lead in this area	FAO
Other	UNHCR (no business case), United Nations (the United Nations private network is in place to support data and voice today at a fixed monthly cost)

Source: Responses from United Nations system organizations to the JIU questionnaire.

ANNEX VII
Overview on action to be taken by participating organizations on JIU recommendations
JIU/NOTE/2007/2

		Intended impact	United Nations its funds and programmes											Specialized agencies and IAEA												
			United Nations ^{1,2}	UNCTAD	UNODC	UNEP	UN-HABITAT	UNHCR	UNRWA	UNDP	UNFPA	UNICEF	WFP	ILO	FAO	UNESCO	ICAO	WHO	UPU	ITU	WMO	IMO	WIPO	UNIDO	UNWTO	IAEA
Note	For action		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
	For information		<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Recommendation 1		f	E					E		E			E		E	E		E	E	E	E	E		E		
Recommendation 2		f	E					E		E	E		E		E	E		E	E	E	E			E		
Recommendation 3		g	E					E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	

Legend: **L:** Recommendation for decision by legislative organ
E: Recommendation for action by executive head
☐ : Recommendation does not require action by this organization

Intended impact: **a:** enhanced accountability **b:** dissemination of best practices **c:** enhanced coordination and cooperation **d:** enhanced controls and compliance
e: enhanced effectiveness **f:** significant financial savings **g:** enhanced efficiency **o:** other

Note:

- Covers all entities listed in ST/SGB/2002/11 other than UNCTAD, UNODC, UNEP, UN-HABITAT, UNHCR, and UNRWA.
- United Nations Headquarters in New York have taken some actions as required in the three recommendations but these recommendations still apply, where feasible, to all its Offices away from Headquarters (OAH)