A Study on the ROI of Access Node Switching

by

Ms. Jittinun Sitthipaet

A Final Report of the Six-Credit Course
IC 6997 and IC 6999 E-Commerce Practicum

Submitted in Partial Fulfillment
of the Requirements for the Degree of
Master of Science
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Project Title	A Study on ROI of Access Node Switching
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Academic Year	November 2003

The Graduate School of Assumption University has approved this final report of the six-credit course, IC 6997 and IC 6999 E-Commerce Practicum, submitted in partial fulfillment of the requirements for the degree of Master of Science in Internet and E-Commerce Technology.

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November 2003

ABSTRACT

The Communication Authority of Thailand (CAT) is the first telecommunication company that provides service in International Telephone. As International Telephone traffic volume continues to grow and the demand for more professional knowledge, technologies and other services is increasing, the telecommunication network is becoming more and more complex. Therefore this project is to develop the high quality product and network solutions for International Telephone System.

The Digital Switching System (Access Node Switching) has all the functions necessary for public switching such as: numbering, routing, charging, alarms handling, line measurements, coin box, etc. ANS is based on a small versatile autonomous exchanges supporting any mix of ordinary analogue subscribers and Euro-ISDN subscribers (PRA and BRA) expandable in small steps. "Access Node Switching" which is the one of a major product in providing easy operation and maintenance, Advanced Capabilities and high performance. However the numerical data takes from all real sources and make data nearly real data for easier to understand.

The new proposed Information System will be consisted of ANS which is flexible switching product covering a wide range of modern telecommunication for rural, sub-urban and overlay network.

However, in the future Access Node Switching will be provided a range of supplementary services to PSTN and ISDN subscribers. These services will offer revenue potential for network operators through the generation of extra call traffic as well as charging for the use of these services and reduce the network cost and also mention closely to protect CAT benefits since high volume of service is provided.

ACKNOWLEDGEMENTS

Several people have made contributions to this project. The writer would like to acknowledge their efforts and thank them for their contributions.

She would like to thank Dr.Settapong Malisuwan, her project advisor, for my valuable suggestions and advice given in to preparation of this project.

She extends her sincere thanks to Dr. Pipat Prommee; Engineer, Mr. Teerapong Prapitpaisarn; Network Engineer, and other people in Follow - up and Analysis Department, International Telephone Division, CAT (Communication Authority of Thailand) Mr. Anusit Yossakdacharoen; Network Consultant of 3COM (Thailand) Co., Ltd., for their timely assistance and information provided to her while carrying out the data collection required for her project.

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I. INTRODUCTION

With various rapidly technological advancements in Thailand, Telecommunication becomes more readily available domestically and internationally covering all regions of Thailand and other parts of the world. In addition, Digital Switching System has all the functions necessary with high efficiency for public switching such as numbering, routing, charging alarms handling, line measurements, coin box, etc. ANS is a flexible public switching product covering a wide range of modern telecommunication Technology. This project aims to present a brief technical description of the ANS product, describing the low cost of investment and low operational costs assure a short time to revenue.

Information in this document begins with ANS generic system overview including the main features and the benefits of the ANS product. After a brief overview of concept, the Proposed System introduces the overall structures and performance characteristics of the Access Node Switching and then review the ANS management system and Cost effective opportunity for small operators which is concerning with the advantages and effectiveness of Access Node Switching and revenue-generating business service management.

The rest of this project is the Project Implementation, which describes a part of ROI solution and concerns with a cost-effective that is offering a high value for money. Moreover, a brief summary of decreasing of Interconnection charge as well.

1.1 Background of the Project

This project will describe the Return on Investment(ROI), Network Configuration of ANS. In this project, 2 sets of Access Node Switching are adopted and developed to ensure the service for satisfying the customer's needed.

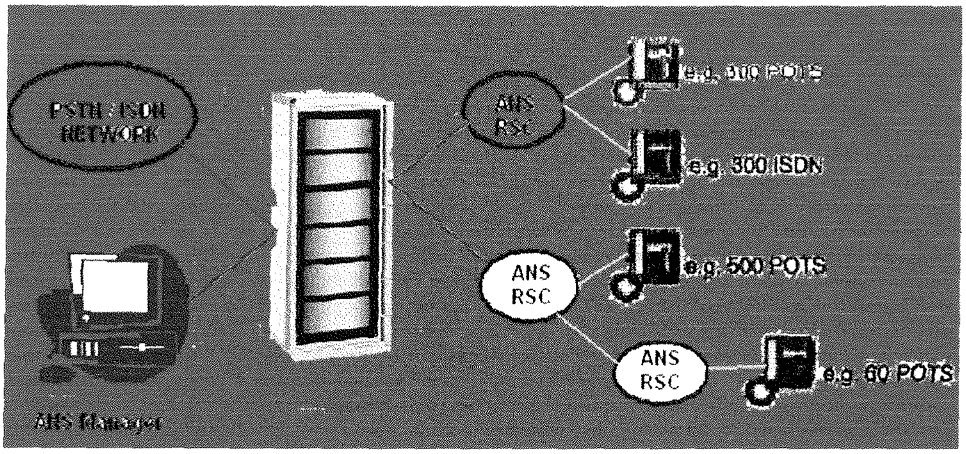


Figure1.1 Access Node Switching Configuration as V5.2 interface towards RSC.

As Figure1.1, Access Node Switching will be shown that ANS can be used stand-alone switch, supporting both direct connections PSTN and ISDN subscribers as well as V5.2 connections to subscribers connected via ANS/RSC (Access Node Switching/Remote Subscriber Concentrators).

1.2 Objectives of the Project

(1) To define and introduce the overall performances and the capabilities of Access Node Switching (ANS) for offering a high quality service.

(2) To study how Access Node Switching (ANS) can reduce an operational costs based on comprehensive centralized management, smaller equipment footprint, least cost routing and lower transport costs.

(3) To study how Access Node Switching (ANS) can expand the International Telephone service caused of the lower price to increase more sale volumes to satisfy the customer's needed.

(4) To calculate and analyze how ANS can reduce the cost of International call of the users and increase the high revenue and seek for opportunities of The Communication Authority of Thailand (Based on payment).

1.2 Scope of the Project

This term project will cover:

(1) Overview to Access Node Switching

(a) Work Flow Architecture

(b) Network Configuration

(2) Whole sale cost calculation based on 1 month (Monthly collectible)

(3) Access Node Switching (ANS) configurations includes:

(a) Charging Fees

(b) Statistics of calling

(c) Basic ISDN services

(d) Call Management Services

(e) Network Traffic Management

1.4 Deliverables

(1) Final report in details covering the scope mentioned earlier.

(2) Telecommunication System, Internet Technology (IT) and Computer Networking will be shown the concepts in the report being applied.

1.5 Project Plan

Table 1.1. Research in Access Node Switching.

	Year 2003						
No.	**Job Title**	**July**	**Aug**	**Sep**	**Oct**	**Nov**	**Oct**
1.	Proposal Submission	*					
2.	Research and Analysis	*	*				
3.	Researching Report and Measurement Traffic		*				
4.	Configuration and Networking Planning			*			
5.	Compare Call complete before and after use Tandem				*		
6.	Report Submission (End of Project)					*	
7.	Review & Defense						*

Detail in Project Plan:

Mon. Oct. 20, 2003 Last day to request & submit project IEC

(After checking grammar and format)

Sun. Oct 16, 2003 Present Project IEC

II. THE EXISTING SYSTEM

2.1 Background of the Organization

CAT's Organizations Structure

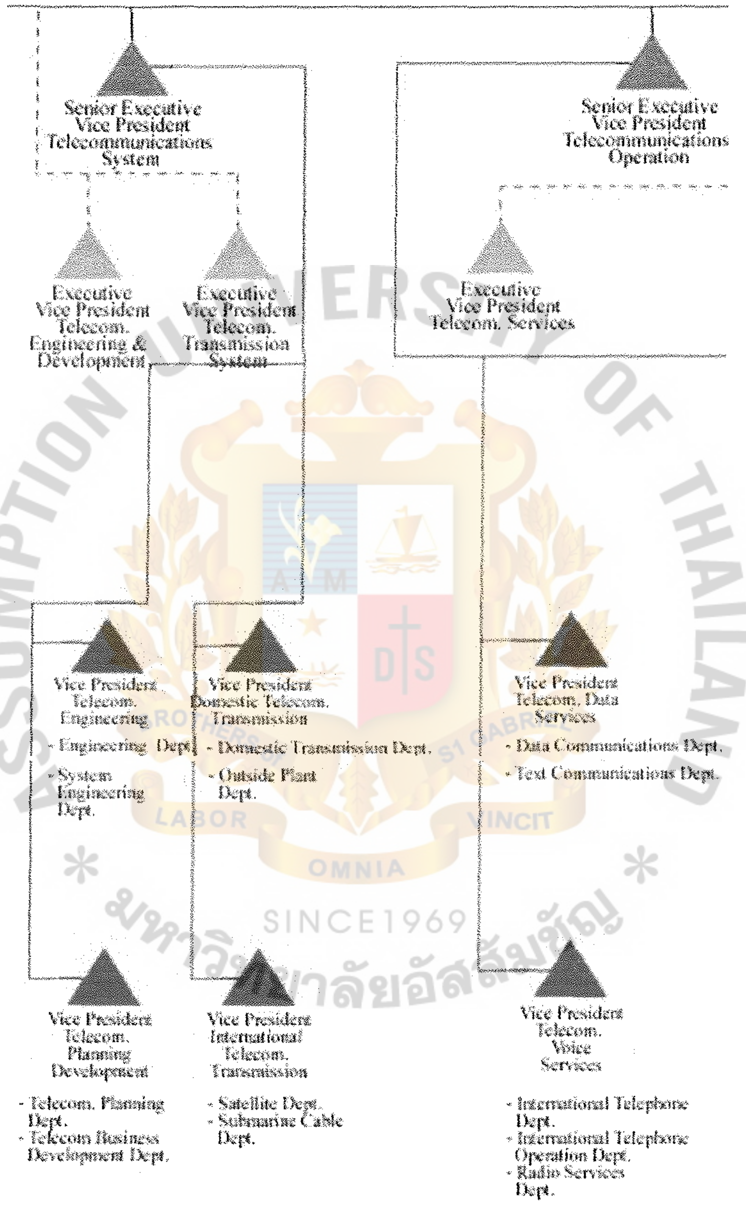


Figure1.2 CAT's Organization Structure.

CAT's History

CAT was established on the 25th February 1977 by the provision of the Communications Authority of Thailand Act B.E. 2519. CAT bears an essential responsibility for Thailand's postal and telecommunications systems for the benefit of the country and the public.

CAT's Business Activities

As the main communications Hub of the nation, CAT plays an important role in developing and applying the most advanced technology for both postal and telecommunications systems, constructing both optical fiber submarine cable and satellite networks, investing in Intelligent Network of ATM switching system in order to effectively provide a variety of multimedia telecommunications services. CAT ranks among the leading telecommunications service providers in Southeast Asia region.

CAT's Objectives

(1) To enhance and offer high quality service and seek for opportunities in providing other related business.

(2) To apply advanced technology in operational and service development.

(3) To prepare for the privatization in the aspect of business management and financial independence.

CAT's Vision

Post: To become Thailand's postal business leader in providing international standard services to obtain highest customer satisfaction.

Telecommunications: To provide world standard telecommunications services in order to obtain highest customer satisfaction.

CAT's Intention

For long-term success, CAT determines to create high service standard and performance by effective cooperation, readiness and creativity. This strong intention will generate the growth of our organization for business profit and social value.

CAT's Policy

To successfully reach an excellent performance, enhanced policies in services, marketing, finance, investment human resources development, administration and management, advance technology and welfare have been adopted, while focusing on standard business management for competition in the market. It aims to ensure customer satisfaction and to lay a firm basis for continuous self-development and to take care of our personal staff.

CAT's Mission

To bear an essential responsibility for Thailand's postal and telecommunications and other related business by providing high quality services with reasonable rates for the great benefit of the public.

CAT's Service for Oversea Call

001 Automatic Direct Call service (ISD) direct calls to anywhere in the world by pressing 001.

100 Operator Assisted Call Dial 100 to CAT's operator who will assist you in making a call to every country in the world.

International Prepaid Calling Card – THAICARD is the first international prepaid calling card in Thailand Users could make a call from Thailand to Overseas, in the meanwhile, from Overseas to Thailand and to Others Countries. It's a convenient way without any surcharge from any touch-tone phone in Thailand or mobile phone or from local public phones or disconnected-line phones.

International Toll Free Service (ITFS) Ideal for hotels, travel agencies, airlines,

exporters, or international companies who wish to facilitate their customers in making a free connection.

PhoneNET CARD To facilitate international call service user on Internet protocol with Phone Net card: Phone-to-Phone (Phone to Phone: It's economic international calling card via CAT's Internet network. The service is now available for 88 countries around the world).

DATEL Data communications and facsimile service through Front End network. CAT will provide the network and assign special numbers to facilitate international reception and transmission of communication faster, clearer and more economical.

Thailand Direct

Direct line to Thailand from any type of telephone worldwide. With the help of a Thai operator and service charge billed to called party in Thailand, this service helps solve language barrier and voice.

Home Country Direct

International Call from Thailand connected through each country's operator to facilitate foreign businessmen and tourists in Thailand calling home

eFONE

It will be low-cost international calls, using Internet Protocol Network to reduce charges by 20-30%. Nowadays, it's available to 109 countries over the world.

2.2 Current Problems and Area for Improvement

With various rapid technological advancements, the customer's needs and market competition, the telecommunication industry has been developing very fast. Following these rapid changes, a telecom field has entered into a new era. With the monopoly status of the dominant telecom service provider concluded, lots of operators came in to being. More and more networks are built or are being built, including PSTN, Data Network and etc. As a result, a heterogeneous environment of multi-operators and based on multi-networks has formed, and has brought certain complexity for internetworking. One of the important questions raised today is how to interconnect all these networks.

Access Node Switching System is responsible for operating under practically any environmental condition. ANS can help the wholesales to support a wide range of services including a small-scale operator services system. ANS also help to support a wide range inter exchange signaling protocol which has a flexible housing system including the cabinets for indoor exchange office building as well as roadside cabinet with built-in power and emergency batteries. ANSs are installed in many places within Thailand and at the present every switching is connected directly to the ITSC (International Telephone Switching Center) in Figure 1.1.

Access Node Switch has many trunks, and no lines, which concentrate traffic by connecting access nodes to ANS TransLocal so fast and effectively. This multi-functional use, the flexible switch eliminates the need for each and office switch to store multitudes of routing information provides faster call transfer, and result in low cost (cost saving) as well as gaining regulatory access charge revenues. They also combine and transit both local and long distance services, allowing the customers to arrange and develop their switch equipment in cost-effective manner, whether these needs are basic long distance, wholesale long distance, international long distance, or a variety of other service options.

2.3 Existing Switching System

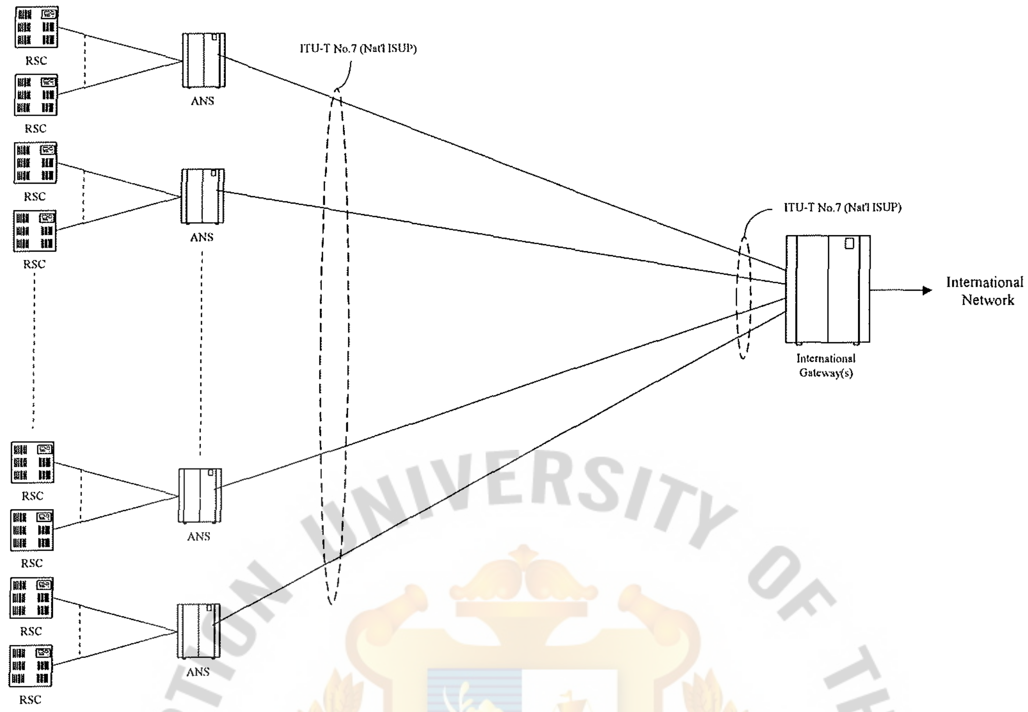
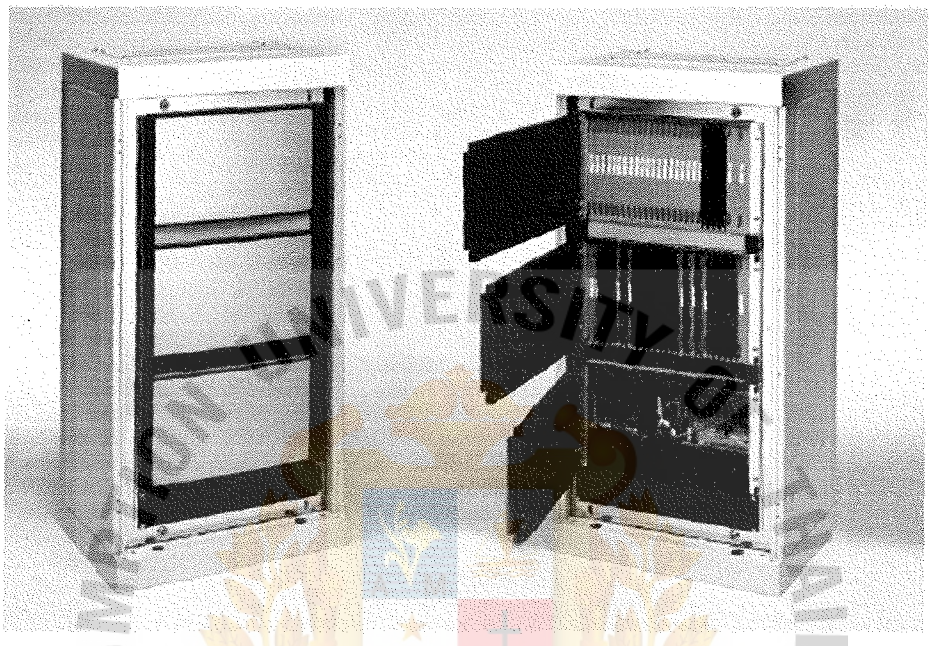


Figure1.3 The Network Configuration.

All Access Node Switching (ANSs) are connected directly to the International Telephone Switching Center (ITSC). Deploying various transmission technologies, Local extends the reach of the network to areas where conventional copper wire based transmission is financially and physically impossible. And the customer payment behavior will be monitored closely to protect CAT benefits since the return of investment is provided. These proposed is "Access node Switching" for the Communication Authority of Thailand as well.

III. THE PROPOSED SYSTEM

ACCESS NODE SWITCHING



ANS generic system overview
Main features and benefits of the ANS product family
ANS TransLocal
ANS Local
ANS RSC
ANS Manager

3.1 Technical description of the ANS product family

Access Node Switching (ANS) generic product overview: presents a brief the technical description of the ANS product family, describing the main features and benefits of the following products:

(1) ANS TransLocal – compact transit switch

(2) ANS Local – compact local switch

(3) ANS RSC – Remote subscriber Concentrator

(4) ANS Manager – management system for the ANS

The ANS product family offers a variety of compact telecom solutions for operators and Internet Service Provider (ISPs) seeking switching and IP solutions specialized for high Functionality networks with low subscriber density.

Offering a full range of telephony services and a capacity of up to 10,000 subscribers, the ANS presents a flexible and cost-effective switch especially well suited for small and medium-sized networks. The ANS switch supports a range of different signaling protocols and can be fully integrated into any existing of future network, including AXE and ENGINE networks. More than 1,000 ANS systems have been purchased and installed in more than 60 countries worldwide.

3.1.1 Target audience

ANS is intended for both internal and external use, targeting commercial and technical specialists concerned with public network and service development and management.

3.2 Unique selling points

The ANS is compact switch for small and medium-sized fixed networks and has proven to be a very cost-effective and flexible component in a wide variety of solutions. The full functionality of the ANS combined with the relatively low price and low operational costs ensure a high value for the money and provide an option for networks, where other larger systems may not initially be financially viable. In the following unique selling points of the ANS are described in more detail.

Fast deployment

Fast time to customer is ensured by the very short implementation time of the ANS (Delivery: 4–6 weeks. Installation and implementation: 1–2 weeks. Full operator training: 3weeks).

Short time to revenue

The ANS is a cost-effective switch that offers high value for money. Fast deployment combined with low cost of investment and low operational costs assure a short time to revenue.

User -friendly

The ANS Manager means easy operation and maintenance. One example of the user-friendliness of the ANS is a customer that purchased an ANS switch and attended the 3 weeks ANS Operation and Maintenance course. Within 2 weeks, the company installed the ANS themselves and obtained internetworking approvals towards 5 other operators.

Flexible platform

The ANS is based on a highly modular and flexible platform with no fixed hardware positions, which makes it easy for operators to gradually expand and add more functionality as the demand increase (pay-as-you-grow). New services are easily added by downloading new software modules. The flexibility of this platform also makes it possible to base both switching and access on the same platform (ANS for switching and ANS RSC for access).

Compact with low power consumption

The ANS is physically impact. A complete ANS switch with 88 PCMs, power and cooling into just three 19" (48 cm) subracks with a power consumption of only 225W. The smallest ANS cabinet has a footprint of only 0.4 by 0.6 square metres and a height of 1.2metres.

Common management system

The ANS product family has it owns operation and maintenance system, the ANS Manager, which assures user-friendly O&M. The flexibility of the ANS manager also makes it possible for the operators to integrate O&M in a mixed ANS/AXE network or in any higher level management system.

Full functionality switching

The ANS TransLocal can be applied as a combined local, transit and international switch, and provides an option for networks where other larger systems may not initially be financially viable. The ANS also allows the operators to establish a POP/POI in any location as the ANS gateway functionality supports multiple national and international network signaling protocols (ISUP, IISUP, TUP, ITUP and R2) TransLocal can also be applied as Service Switching Point (SSP) in an Intelligent Network (IN).

IN functionality

Applying the ANS TransLocal as Service Switching Point (SSP) in an Intelligent Network enables the operators to provide IN service such as: Virtual Private Network functionality (VPN), IN Access screening, number portability and Prepaid Calling card.

Quick line expansion

ANS Local is ideal for quick line expansion with the support of V5.2 interfaces for remote access nodes.

Concentrating traffic with V5.2interface

Using the V5.2 interface in the ANS, the operator is able to concentrate traffic by connecting V5.2 access nodes to ANS TransLocal (e.g. ANS RSCs).

Marketing adaptation

Fast deployment in new markets is ensured by using the built-in ISUP screening mask, which provides easy adaptation of national ISUP variants.

Applications for bridging voice and IP

The ANS can be used as protocol converter, providing an opportunity for ISPs to become operators and improve their revenue by expanding into new service areas. The ANS is also part of solutions that provide VoIP and ToIP.

Cabinets

The ANS cabinets do not take up much space. The smallest indoor cabinet is only 1.20 meters high with a footprint of 0.4 x 0.6 meters and houses 3 x 19" ETSI subracks. Both indoor and outdoor cabinets are available so that the ANS can operate under practically any environmental condition.

3.3 ANS product overview

The following chapters describe the multiple network functionality of the ANS. In short, the ANS provides a compact, high performance and cost-effective switch designed for relatively low traffic capacities-ideal for small and medium-sized networks where a larger system may not initially be financially viable.The ANS provides a variety of solutions ranging from traditional circuit switching to convergence of data and voice. Adding IP applications to the ANS, protocol conversion, and Internet, as well as voice-over-IP(VoIP) and telephony-over-IP (ToIP) services.

3.3.1 ANS TransLocal

The flexibility of the ANS enables it to fill in a range of network functions. New and emerging operators will find that the ANS offers an ideal platform for breaking into the market for telecommunication services, while established operators will see a way to extend their service offerings to new or more remote parts of their networks.

Network functionality

ANS TransLocal can be applied as a Point of Presence (POP) and Point of Interconnect (POI) on new markets, as a combined local, transit and international switch, and as a Service Switching Point (SSP) in an Intelligent Network(IN).

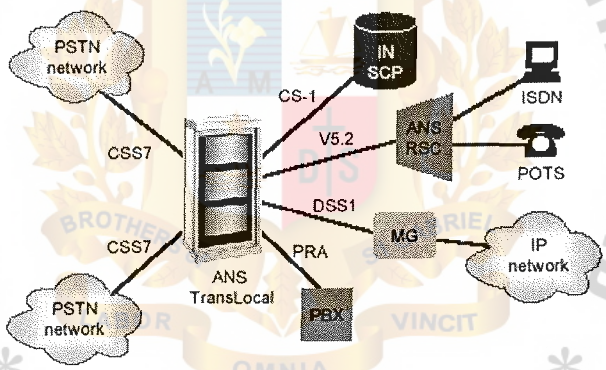


Figure1.4 Functional overview as ANS TransLocal.

ANS TransLocal can also function as V5.2 interface, concentrating traffic by connecting to access nodes to ANS TransLocal. Furthermore, it has gateway functionality with multiple national and international network signaling protocols (ISUPv.2, ISUPv.3, TUP, R2).

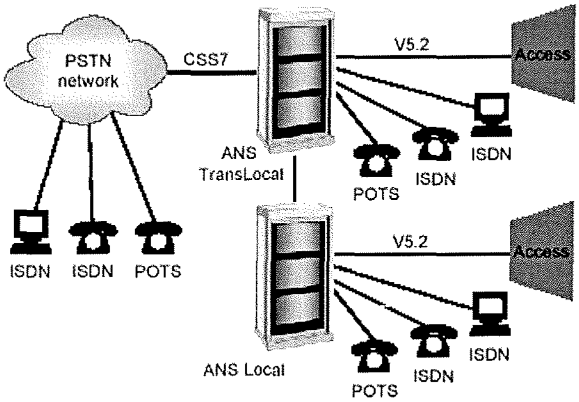


Figure1.5 ANS TransLocal as (POP) and (POI).

IN functionality

ANS TransLocal can provide Service Switching Point (SSP) functionality based on the TSI CS1 specification. The Service Switching functionality enables ANS TransLocal to work as Service Switching Point (SSP) node in an Intelligent Network and hereby allows new end-user services to be quickly introduced into a network.

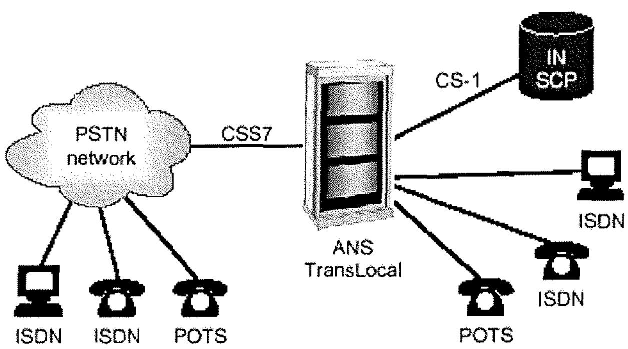


Figure1.6 ANS as Service Switching Point (SSP) in an Intelligent Network (IN).

Applying the ANS as Service Switching Point (SSP) is an Intelligent Network (IN) enables the operators to provide IN services such as: Virtual Private Network functionality (VPN), IN access screening, number portability and Prepaid Calling Card. Virtual Private Network services allow the operator to create a private network from the service perspective while using the resources of the public network.

Benefits

ANS TransLocal enables the operator to offer a wide range of service offerings including: Ordinary telephony services – POTS and ISDN.

(1) -Ordinary telephony services – POTS and ISDN

(2) PBX access – DSS1/PRA and CAS

(3) Access screening and routing

(4) Number portability

(5) Address analysis including A- and B-number conversion

(6) IN services

(7) Integrated Voice Announcement Unit for delivering pre-recorded announcements

(8) Charging and accounting of all local/transit calls and service

(9) AOC99 Advice of Charge. ETSI charging in multi-carrier environment including ISUPv.3.

3.3.2 ANS Local - compact local switch

Flexible local switch

ANS Local is designed for quick and cost-effective line expansion in areas with low subscriber density, providing full analog and digital telephony services in any environment. By deploying various transmission technologies (e.g. fiber, radio or satellite), ANS Local extends the reach of the network to areas where conventional copper wire based transmission is financially or physically impossible.

Network functionality

ANS Local can be used as a stand-alone public switch, supporting direct connections to PSTN and ISDN subscribers. It can also be applied as a V5.2 interface, concentrating traffic via ANS RSC remote subscriber concentrators. By deploying various transmission technologies (such as fiber, radio or satellite), ANS Local extends the reach of the network to areas where conventional copper-wire-based transmission is financially or Physically impossible.

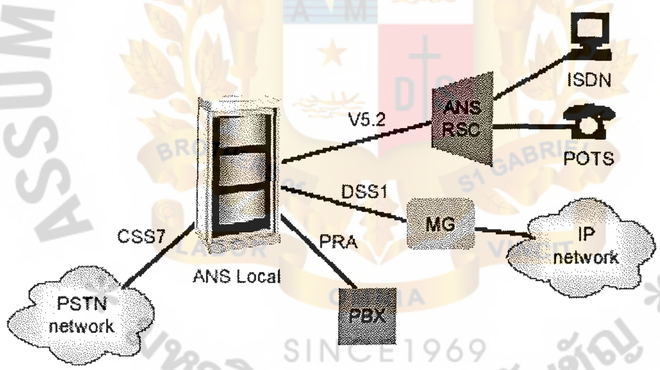


Figure1.7 Functional overview of ANS TransLocal.

Supports a wide range of signaling protocols

Although developed for low subscriber density (ranging from 30 to 10,000 PSTN/ISDN lines), ANS Local can be integrated in local, domestic and international public switching networks as it supports a wide range of inter-exchange signaling protocols (such as ISUPv.2, ISUPv.3, TUP, R2).

Benefits

ANS Local enables the operator to offer a wide range of service offerings including:

(1) Ordinary telephony services – POTS and ISDN.

(2) PBX access – DSS1/PRA and CAS.

(3) Access screening and routing.

(4) Number portability.

(5) Address analysis including A- and B-number conversion.

(6) Integrated Voice Announcement Unit for delivering pre-recorded announcements.

(7) Charging and accounting of all local/transit calls and services.

(8) AOC99 Advice of Charge. ETSI charging in multi-carrier environment including ISUPv.3

Upgrade path

Cost-effective opportunity for small operators

Local is based on a highly modular and flexible platform, which makes it easy for operators to gradually add more functionality as the demand increases. With the 'pay as you grow' concept, the operator has the opportunity to upgrade to an ANS TransLocal switch and thereby obtain full transit functionality, international gateway functionality and IN services.

3.3.3 ANS RSC

ANS RSC is a Remote Subscriber Concentrator and an integrated V5.2 access solution for generic narrowband access. It is relevant for operators who wish to access subscribers in remote areas, connect subscribers directly, and fully utilize the potential of the ANS Local and ANS TransLocal.

Network functionality

Designed to provide cost-optimized line extension, ANS RSC is a suitable for small scale as well as large-scale access deployment. It is possible to interconnect several ANS RSCs to extend the reach of the network even further.

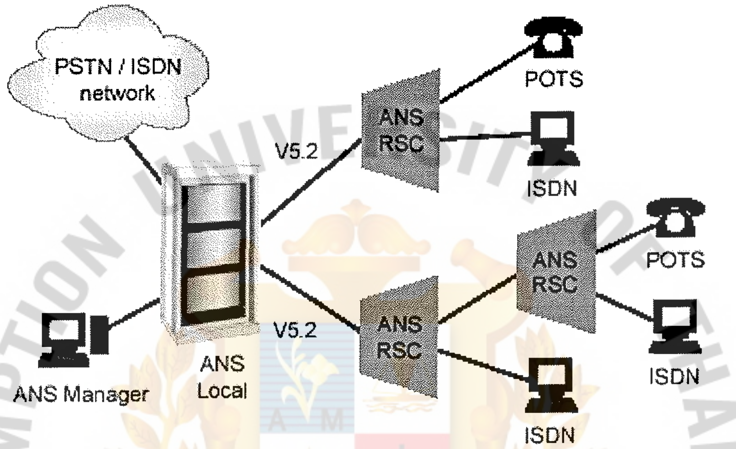


Figure1.8 ANS RSC for V5.2 access.

(ANS RSC = Remote subscriber Concentrator)

V5.2protocol

ANS RSC uses the standard ETSI V5.2 protocol as network interface. As transmission between the nodes, both optical and electrical E1 as well as HDSL, SDH and other transmission technologies are available.

ANS RSC 500 and RSC 120

ANS RSC is available in two models: RSC 500 for large nodes and RSC 120 for small nodes. ANS RSC 500 serves as a large V5.2 access node grooming PSTN, ISDN and leased line services into single-service aggregate lines.

ANS RSC 120 is extremely compact and fits into just one 19" subrack. It is designed to provide a highly cost-effective solution as a remote access node for the subscriber segment below 270 lines, and deployment at both switch and customer premises is possible. All interface units; power supplies etc. are interchangeable with the RSC 500.

Upgrade path

ANS RSC is built on the same HW and SW platform as the rest of the ANS product family. The common platform of the ANS product family makes it possible to upgrade the ANS RSC by converting it to an ANS Local or TransLocal switch.

IP Solution providing Telephony over IP

The ANS can also be part of broadband access solutions by connecting to the Telephony Access Gateway (TAG). The Telephony Access Gateway is an IP subscriber access product relevant for operators and multi-service providers seeking a Telephony over IP (ToIP) solution with standard V5.2 interconnect.

The Telephony Access Gateway solution supports full quality of speech and almost all existing subscriber services, which is a major advantage compared to most other VoIP solutions available today.

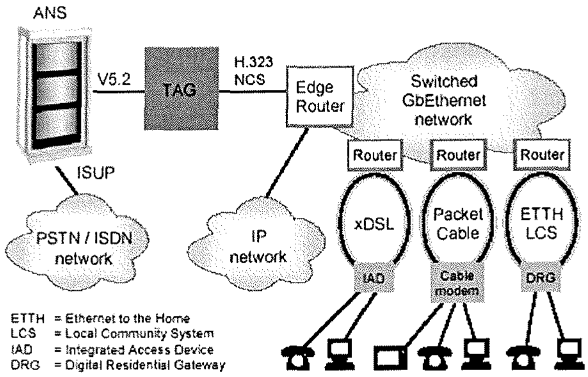


Figure1.9 ANS connected to (TAG) in Telephony over IP solution.

Network functionality

The Telephony Access Gateway uses the standard ETSI V5.2 protocol as interconnection towards switching systems that support V5.2 interconnect (e.g. Engine Integral, ANS etc.) The main benefit if the V5.2 interconnect is that the control of the subscriber data is handled by either an ANS or another switch or telephony server in the overlaying network, as illustrated above.

The protocol must commonly used for subscriber equipment in cable networks and switched Ethernet are supported by the Telephony Access Gateway. The protocols include NCS for cable networks and H.323for switched Ethernet.

Benefits

The ToIP solution provides the operators with the following functionality for IP connected subscribers:

(1) Class-5 subscriber supplementary services

(2) IN services

(3) Lawful interception

(4) Common provisioning system and billing system for IP subscribers and traditional subscribers

(5) Full DOCSIS support for cable networks

Solution components

The Telephony Access Gateway design is based on anew type of IP network architecture that divides the traditional switching functionality into three parts:

(1) Media Gateway Controller (MGC)

(2) Signaling Gateway (SG)

(3) Media Gateway (MG) (AXC 811 Multi-Service Access Platform)

The Telephony Access Gateway is compact and fits into only four standard 19" subracks.

3.4 IP Solution providing protocol conversion

Bcsidcs bcing a stand-alone switch, the ANS has proven a cost-effective and flexible component in solutions for convergence of data and voice. Combining the ANS with a media gateway (IP router), basic protocol conversion from CSS7 to DSS1, the protocol mainly used by Internet Access servers and IP telephony servers. Adding VoIP gateway, IP services such as VoIP can be offered to the subscribers.

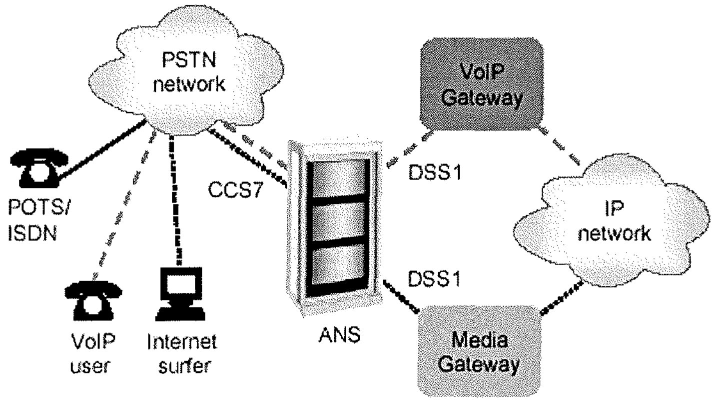


Figure1.10 ANS as protocol converter in IP convergence solution.

Target customers

This IP application is mainly targeted at Internet Service Providers (ISPS) who plan to expand their business and become operators.

Internet Service Providers generally do not receive any payment for the traffic they generate. By becoming licensed operators, ISPs will be able to reduce or eliminate transmission fees and begin capturing interconnect fees for the calls which are routed through the network.

Benefits

ISPs becoming operators will gain new business opportunities including:

(1) Retail and Internet access

(2) Wholesale Internet access to ISPs

(3) Reduced congestion on telephony networks by off-loading Internet dial-up calls onto an IP network

(4) Improved revenue from expansion into new service areas such as: Voice over IP (VoIP), Virtual Private Networks (VPN), Prepaid Internet access, e-Commerce, and WAP services.

Another opportunity is the improvement of revenue streams by expanding into new service areas such as:

(1) Voice over IP (VOIP)

(2) Virtual Private Networks (VPN)

(3) Prepaid Internet access

(4) e-Commerce

(5) WAP services

Solution components

This IP application combines the following products:

(1) ANS TransLocal or ANS Local switch

(2) Media gateway: AXC 811 Multi-Service Access Platform

(3) Voice OVER IP gateway: AXI 511

(4) Common management platform

3.5 New Applications

The latest ANS releases introduce a variety of new applications that enable the operator to offer more services to the subscribers and reduce the operational costs by making operation and management of the ANS easier.

ANS Call Server

Integrates access screening, routing, and number portability onto an SQL platform. It enables routing and access screening in a complete ANS network and includes features such as lease cost routing, A-number validation, authentication, number portability, While List, Black List, and more.

AOC99

Advice of Change for ETSI charging in multi-carrier environment (includes ISUPv.3).

RTViewer

A user-friendly graphical user interface for conversion and display of Call Data Records (CDRs).

SNMP interface (SNMP trap reception and trap relay)

SNMP interface for common fault management. The SNMP trap reception and trap relay application enables the ANS Manager to forward alarm messages to a higher-level SNMP fault management system and interface to non-ANS network clients.

MPA Browser

Integrated protocol analyzer that collects and interprets CSS7/ETSI (protocol signaling) data from remote network elements.

Capacity and performance

The following chapters present an overview of the ANS in more technical detail, starting with capacity and performance.

System capacity

The ANS core switch unit (CSB080) has a capacity of 2640 x 64 kbit/s channels, non-blocking. This corresponds to a maximum ANS configuration of 88 x E1 trunk interfaces.

Transit calls

The 2640 channels handled by the non-blocking ANS core switch allow for 1320 simultaneous connections (i.e. 1320 incoming connections and 1320 outgoing connections), corresponding to 44 "incoming" E1 trunk connections and 44 "outgoing" E1 trunk connections. (These figures also apply for local calls from ANS RSCs).

Local calls

In an ANS solution with 8 x E1 trunk interfaces it is possible to connect either 1290 POTS subscribers or 602 ISDN BA subscribers or a combination of the two. In this case a traffic load of approx. 0.15E at a GoS (blocking probability) of 0.1% is provided per subscriber.

The limitation of 8 x E1 systems plus the 1290 POTS subscribers or 602 ISDN subscribers is a physical limit determined by the number of interface subracks handled by the ANS and is not a limitation due to the ANS core switch unit.

As an example, and ANS in a configuration with 1320 directly connected POTS subscribers is able to provide 660 simultaneous local calls (i.e. 660 subscribers calling 660 subscribers, all connected to the same ANS).

If all 8 x E1 trunk interfaces are occupied by either incoming or outgoing calls, this ANS configuration can handle 240 incoming/outgoing trunk calls plus 540 simultaneous local calls.

Total number of subscribers

It is possible to create up to 10,000 subscribers in the ANS. The 10,000 subscribers include both directly connected subscribers and subscribers connected via remote V5.2 access nodes.

Call handling capacity

The call handling capacity of an ANS equipped with 4 DSU668 units is given in the table below.

Table1.2 The call handling capacity of an ANS equipped with 4 DSU668 units.

Type of call	**Capacity in BHC**[1]
Transit ISUP/ISUP (En-block)	68,000
Transit ISUP/ISUP with 2nd dial tone Number Validation evaluation	28,000[2]
Transit ISUP/ISUP with Intelligent Routing	64,000[3]
Transit ISUP/ISUP with EtsiCharging	53,000
Local PRA/PRA (Overlap)	13,000
Local BA/BA (Overlap)	13,000
Local PSTN/PSTN (Overlap)	13,000

The call handling values shown in the table above are mutually exclusive and are valid under the following conditions:

(1) The ANS performs charging and transmission of charge telegrams to the ANS Manager. Handling of additional signaling information may reduce the call handling performance.

(2) Partial debiting is not enabled.

(3) DSU668 redundancy can freely be enabled/disabled.

(4) No down line load of programs, dump/reload of system data, DSS1 screening activation/deactivation or trace of internal signaling is performed during busy hour.

(5) A simple protocol screening, causing additional signaling on ISUP, may be performed. More complicated screening may reduce performance.

(6) Trunk statistics can freely be enabled/disabled.

(7) No supplementary services are used.

(8) For a vast majority of the handled calls, address analysis is performed for numbers with known length.

(9) An average of two ring back indication tones is required per local or outgoing call.

Signaling links and destination point codes

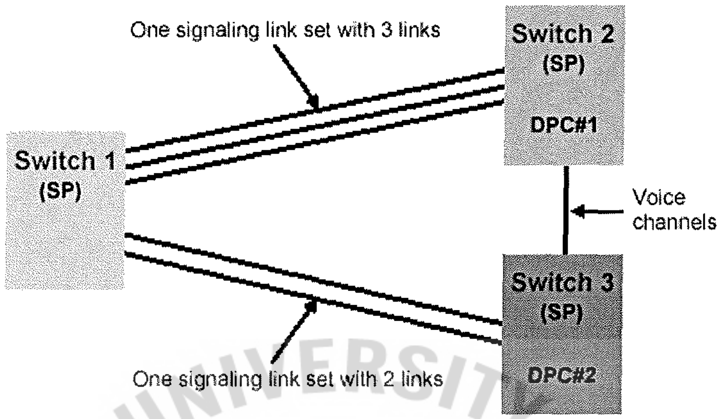


Figure1.11 Link sets and destination point codes (DPC).

Signaling links

The signaling network consists of signaling points (SP) connected by signaling links. A signaling link is a PCM system with CCS7 connection between two signaling points. A link set is a number of signaling links between two signaling points. Up to 45 link sets can be defined in an ANS with up to 8 links in a link set. Each link set must have a unique destination and a unique code in order to identify the link. The link code (SLC) must be the same in both ends of the cable.

Since the transmission capacity of CCS7 is very high, not all switches in a network need to be interconnected with signaling links. In the illustration above, Switch 2 and Switch 3 have no direct signaling link between them, but both of them have direct links to Switch 1. Signaling between Switch 2 and Switch 3 can then be routed via Switch 1.

Destination point codes

The ANS can be a Signaling Transfer Point (STP) in a CCS7 signaling network and can handle up to 512 destination point codes (DPC).

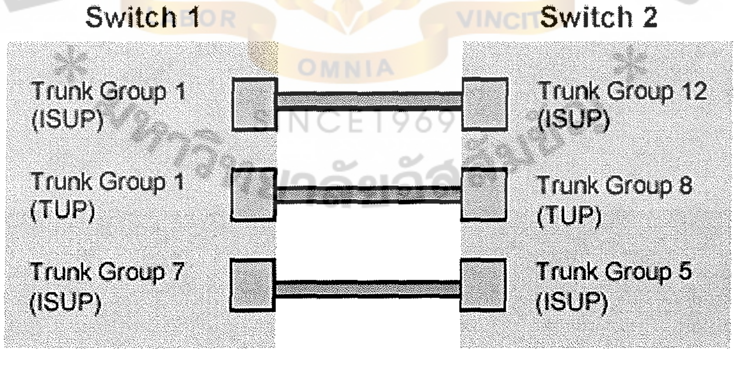
Trunk groups

A trunk group is a number of trunk lines towards a specific signaling point, as illustrated below. A trunk line is a 64 kbit equivalent speech channel, and every PCM connection can contain up to 31 trunk lines (30 of them are used for speech and one for signaling). Trunk lines within the same destination and the same user part (e.g. ISUP, TUP) can be handled in trunk groups.

The maximum number of trunk lines is 2640 channels (88 x 2 Mbit/s PCM systems).

The maximum number of trunk groups is 250 trunk groups per signaling system.

The trunk groups are user part specific, which means that the same number can easily be used for trunk groups with different user parts. In this way, Trunk Group 1 can be used for both TUP and ISUP between two switches.



Trunk groups

Figure1.12 Trunk groups.

3.6 Architecture

The variety of ANS products is a result of the different hardware and software packets loaded and installed onto the configuration from the management system.

The ANS consists of one common section subrack and up to four interface subracks. Each subrack is equipped with a local power converter for general DC supply and for line feeding and ringing voltage. The mechanical concept is based on 19" subracks for rack mounting. Each subrack is designed to comply with EMC requirements. Almost all cables are rear mounted.

The common section subrack is dedicated to the common functions such as the main processor units, circuit and packet switches, system handling unit and up to 4 interface handling units (one for each interface subrack).

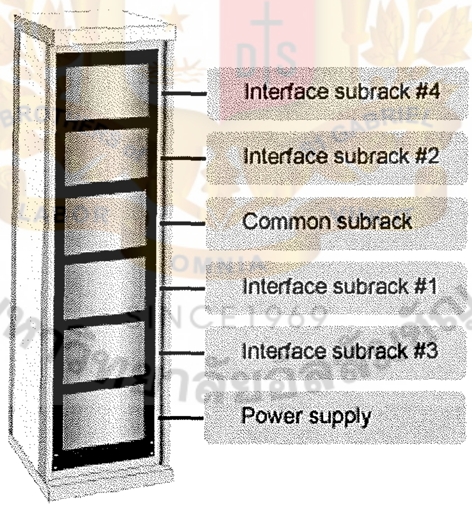


Figure1.13 ANS architecture.

The interface subracks are used for the interface connections. All hardware interface positions can be equipped with a mixture of subscriber line interfaces and 2 Mbit/s network interfaces.

This gives a variety of configuration possibilities and covers any solution from an isolated local exchange with 1320 analog POTS interfaces for ordinary telephones to a pure PCM transit switch for up to 88 x 2 Mbit/s PCM systems. With the addition of remote subscriber stages (e.g. ANS RSCs), one ANS can handle up to 10,000 subscriber channels.

Hardware

This chapter presents an overview of different types of hardware modules used in the ANS. In the following, the core section, control section and interface section will be described. The core and control sections are part of the common subrack, and the interface section is part of the interface subrack.

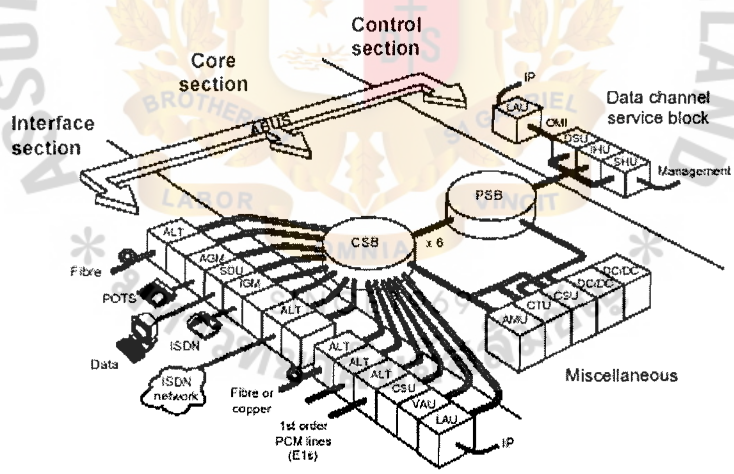


Figure1.14 ANS generic system platform.

Core section - part of common subrack

The following sections describe the hardware parts of the core section shown in the illustration above.

Circuit Switch Block (CSB)

The CSB is a single board, two-way, non-blocking digital switch. It is capable of switching 96 first order PCM highways corresponding to 3072 channels, 64 kbit/s equivalents. 8 of the 96 systems are reserved for internal connection in the system, leaving the remaining 88 systems available for external interfaces.

All types of interface hardware installed in the interface section subracks must be connected to the CSB in the common section by one internal 2 Mbit/s PCM highway. This connection is obtained by a number of standard cables, each with the capacity to connect 9 PCM highways.

The system platform itself handles switch settings on the basis of signals received via an asynchronous control bus (ABUS).

Packet Switch Block (PSB)

The PSB is a single board packet switch unit. PSB signaling is employed whenever a signal has to be sent from one hardware unit to another, such as between an ALT unit and a corresponding processor board or to and from the subscriber modules.

Clock and Tone Unit (CTU)

The CTU performs the master clock function in the ANS. The tones are configurable by MML-commands and transmitted to the CSB via specific channels of the internal PCM highway, connecting the CTU with the CSB.

Analog Measurement Unit (AMU)

The AMU is a test and control unit performing a range of functions, e.g. analog subscriber line measurement, test of codec, supervision of fuses, supply voltage, ringing voltage, and external alarm input/output.

Central Signaling processing Unit (CSU762)

The CSU handles all the tone signaling such as the DTMF receivers for subscriber push-button dialing, the MFC and DTMF receivers and transmitters for CAS inter-register signaling and multi-party connection circuits.

DC/DC Converter (PSU097)

The common section has a single or duplicated DC/DC converter system. The DC/DC converters are connected in parallel, supplying local -5V, +5V and +12V.

Control section - part of common subrack

The following sections describe the hardware parts of the control section shown in the illustration above.

Data channel Service Block (DSU668)

The DSU668 is a 32 bit RSIC processor unit with 64 Mbyte Flash memory for program storage of the different ANS application software blocks such as CCS7 level 4 functions (TUP, MTP, ISUP etc.), ISDN, analog call handling, O&M functions, etc. It has 28 Mbyte of RAM for data.

Data Service Unit (DSU560)

The DSU560 is a general microprocessor unit serving as the System Handling Unit (SHU) and Interface Handling Unit (IHU) of the ANS, taking care of the following functions:

(1) SHU: the unit is the general interface to the system hardware placed in the common section subrack. The SHU holds the vital element data in a battery powered RAM-chip.

(2) IHU: the unit is the general interface to the hardware in the interface section subrack and is controlled by the SHU.

LAN Access Unit (LAU)

The LAU unit is an Ethernet interface that provides the ANS with a LAN interface using the TCP/IP or UDP (User Datagram Protocol) networking protocols. The recommended management connection is ISUP over IP signaling.

Interface section - part of interface subrack

The following sections describe the hardware parts of the interface section shown in the illustration above.

Analogue Group Module (AGM415)

The AGM415 provides a line interface for analogue two-wire subscriber lines (POTS) including a number of features: resistive voltage feed of subscriber line, line current limitations for both differential and common mode, complex input impedance, hybrid function, CODEC functions with O&M programmable gain, on/off hook detection, ring trip detection, detector for pulse dialing, hookflash detection, ringing, tip-ring polarity reversal, line disconnect (end-of-dialing signal), metering pulses (12 or 16 kHz) and over-voltage protection.

The AGM415 unit can work both as master and slave. In order to have a whole group two units are needed. The unit inserted in the master position will act as master and the unit inserted in the slave position will act as a slave. Each unit controls 15 subscribers.

ISDN Group Module (IGMM441 / IGMS442)

The IGMM441 and IGMS442 are digital line cards that terminate ISDN Basic Rate Access U-interfaces. The 2BlQ line code is used.

One IGM ISDN group module consists of the IGMM441 working as master and the IGMS442 working as slave. Each IGM ISDN group module terminates 14 U-interfaces connected to 2048 Mbit/s internal circuit switch connections. Each U-interface is provided with two B-channels and one D- channel (2B+D) with a total transfer rate of 144 kbit/s (2 x 64 + 16) including the EOC-channel for operation and maintenance.

Autonomous Line Termination unit (ALT400)

The ALT400 is a 4 x 2 Mbit/s (El) interface with a similar functionality as the ALT949.

Autonomous Line Termination unit (ALT949)

ALT949 is providing a 2 Mbit/s electrical interface (El). This is a first order PCM termination unit terminating a G.703 interface. The ALT949 is able to terminate the CCS7 link. When using ALT949 for CCS7 it is possible to select a timeslot different from 16 for signaling.

Autonomous Line Termination unit (ALT202 / ALT204)

The ALT202 is an optical link that carries 4 x 2 Mbit/s bit-streams, which are multiplexed/demultiplexed on the ALT202 board. ALT949 is used as slave for this card.

The ALT204 is a long-haul version of the ALT202 unit. ALT204 provides a 10 dB higher optical output than the ALT202, thus providing an optical power budget of 30 dB.

Central Signaling processing Unit (CSU962)

Optional. The CSU handles all the tone signaling such as the DTMF receivers for subscriber push-button dialing, the MFC and DTMF receivers and transmitters for CAS inter-register signaling and multi-party connection circuits.

Voice Announcement Unit (VAU220)

The VAU220 is a voice announcement unit supporting 30 PCM channels for voice. On each channel, playback of any pre-recorded announcement can start at any time.

LAN Access Unit (LAU)

The LAU unit is an Ethernet interface that provides the ANS with a LAN interface using the TCP/IP or UDP (User Datagram Protocol) networking protocols. The recommended management connection is ISUP over IP signaling.

DC/DC Converter (PSU099)

The interface section has a single or duplicated DC/DC converter system. The DC/DC converters are connected in parallel, supplying local -5V, +5V and +12V.

A built in digital ringing generator (DRG) supplies the ringing voltage for analogue subscribers. The generator works on basis of clock signals received from the CTU.

Software

Generally, the ANS software can be divided into two types of software:

(1) Firmware residentially programmed in EPROMs

(2) RAM located application software, which may be down-line loaded from the management system to central or peripheral processor units.

The ANS software consists of:

(1) Operation and Maintenance block (OAM)

Handles the system restart, operation and maintenance of all HW blocks, down-line load of programs, alarms, supervision of environment, traces facilities, statistics, dump and reload of exchange data.

(2) User functional block (US)

The user functional block handles protocols towards the subscribers.

(3) Supplementary Services functional block (SUS)

This functional block is used for services such as diversion services, hotline and user-to-user signaling (ISDN).

(4) Network functional block (NET)

This functional block handles the network interfaces by use of signaling protocols towards the PSTN and ISDN.

(5) Call control functional block (CC)

The following functions are implemented in the CC: call set-up and control of circuit switched calls, call set-up and control of packet switched calls, charging and generation of charge telegrams, address analysis and routing.

(6) Call associated signaling functional block (CAS)

(7) Intelligent Network application protocol (IN)

Contains the IN triggers and the INAP (Intelligent Network Application Protocol)

Protocols

Below is an overview of the protocols available in the ANS.

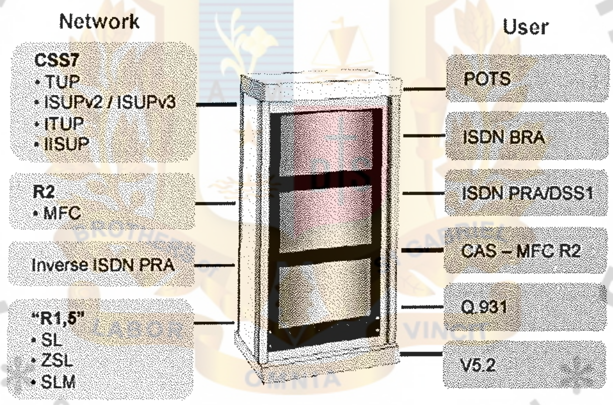


Figure1.15 Overview of the protocols available in the ANS.

3.7 Operating transaction

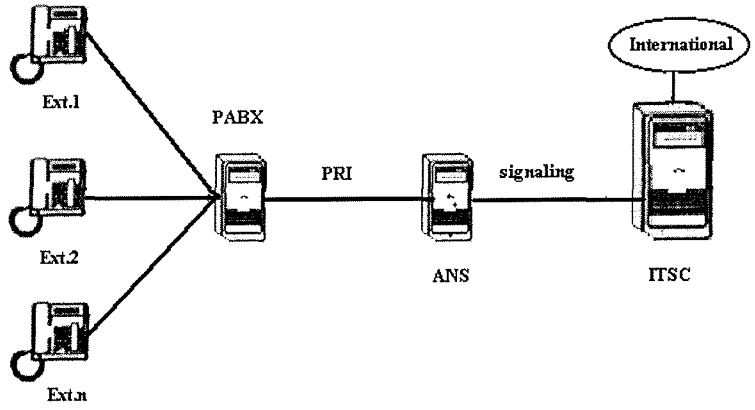


Figure1.16 Connection Model between CAT and Subscriber(PABX).

As Figure1.16, it demonstrates the connection in business model who offers the subscriber to distribute the International connection service as well.

However from the architectural structure of the system, it works similarly with DATEL service but using PRI as the main of the connection in order to support a high volume of the traffic of Overseas Telephone Service.

3.8 Cost and Benefit Analysis

Table1.3 ISD Cost Calculation.

ISD COST

Accounting Rate			Minute	Interconnection charge	Cost
AUSTRALIA	USA	New Zealand			
10.08			153,205.98	6.00	2,463,552.16
	7.98		6,590.68	6.00	92,137.71
		7.14	7,131..17	6.00	93,703.57
		Total	166,927.83	Total	2,649,393.44

Table1.4 Whole Sale Cost Calculation based on 1 month.

Whole Sale Cost Calculation based on 1 month

Accounting Rate			Minute	Implementation Cost IPLC	Estimate cost of Whole Sell
AUSTRALIA	USA	New Zealand			
10.08			153,205.98	55,000.00	1,599,316.28
	7.98		6,590.68		52,593.63
		7.14	7,131..17		50,916.55
		Total	166,927.83	Total	1,702,826.46

Standard Rate	**Reduce Rate**
24.00	**20.00**

As Table1.4, it analyzes to Wholesale Cost Calculation based on 1 month. The revenue of Overseas Telephone Service, we can calculate from accounting rate (outgoing cost based on different rate of each country) and call duration without interconnection charge which will be calculated by following equation.

(10.08 * 153,205.98) + 55000 = 1,599,316,28

(7.98 * 6,590.68) = 52,593.63

(7.14 * 7,131.17) = 50,916.55

Total Cost = 1,702,826.46

10.08, 7.98, 7.14 are accounting rate (paid for each destination)

153,205.98, 6,590.68, 7,131.17 are number of minutes using

55,000 is implementation cost (IPLC): paid once for setting up

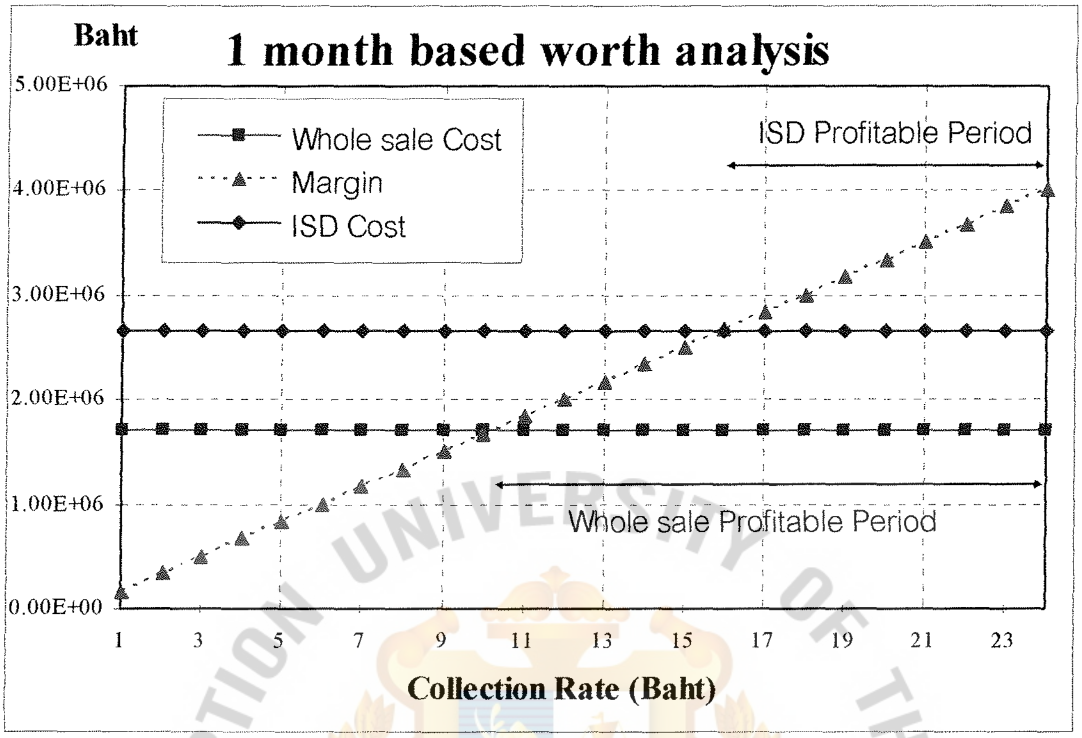


Figure 1.17 Payment based on 1 month (worth analysis).

As Figure 1.17, In case you want to make an oversea call, each country will use a different service rate that depends on rate for OVERSEAS CALL. It shows that the profitable period will be commenced since 16 baht which we can call "Margin Cost".

And the payment fee for this service will be collected as monthly. Customer Payment Behavior will be monitored closely to protect CAT benefits since high volume service is provided. From the previous reason it is difficult in presentation all details because the objective of this project is to increase higher revenue and evade to lose debt and waste the time for managing the billing as well.

IV. CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

The convergence of voice and data in today's communications network has the potential to change the fundamental way that the world communicates. The demand for the inter-working of the telecommunication is rising. Through the use of all this technology, CAT had built the flexible public switching product covering a wide range of modern telecommunication for rural, sub-urban and overlay network so called "Access Node Switching". This trend has made the system an extremely complicated one. So, to provide reliable service to the subscribers, the telecom service providers of the world require a switching system that can provide lots of services together with high reliability and strong interconnection capability with low cost of investment. Access Node Switching having many good advantages of advanced technology, high stability, adaptability and revenue, can meet all the demands, of the most complicated international telephone services all over the world.

4.2 Recommendations

Spearheading Our Future Success

We believe that our Access Node switch is specifically designed for the next-generation of a wide range of services requiring increased reliability, performance, scalability, interoperability and flexibility. Our strategy is to offer the revenue potential fro network operates through the generation of extra-call traffic as well as charging for the use of these services. We believe that we have an early mover advantage in this network performance. Digital switching systems can use fiber optic or digital wireless transmission, which enables developing countries to easily and rapidly deploy telecommunications services to consumers within months rather than years.

Leveraging Our Proprietary Technology

ANS is based on our proprietary operating system software, which provides high performance, reliability and functionality. We believe the development of comparable systems that would require too much cost and take several years to complete and also reduce or eliminate the transmission fees and begin capturing interconnect fees for the calls which are routed through the network as well.

Solidly Positioned for Success

We are entering 2003 with a clear identity and direction in the fields of data and voice communications. We believe that ANS can enhance the value of any organization and also specifically designed increased reliability, in addition to offer a wide variety of services, and expand those services that prove the profitable and also expand the business area and test the market without committing to a large investment.

APPENDIX A

SUPPLEMENTARY SERVICES OF ACCESS NODE SWITCHING

Supplementary services

TableA.1. Supplementary services.

Service	POTS / V5.2	ISDN BRA / V5.2	ISDN PRA				
			ETSI V2	TR87	VN4/VN4	ITSVSN 300102	ETSI inverse PRA
Abbreviated Dialing (AD)	☺						
Advice of Charge at call set-up time (AOC-S)		☺	☺	☺		☺	
Advice of Charge during call (AOC-D)		☺	☺	☺	☺	☺	
Advice of Charge at the end of the call (AOC-E)		☺	☺	☺		☺	
Alarm Call Service (ACS)	☺	☺					
Call Deflection (CD)		☺	☺				
Call Forwarding busy (CFB)	☺	☺	☺	☺	☺	☺	
Call Forwarding no reply (CFNR)	☺	☺	☺	☺	☺	☺	
Call Forwarding unconditional (CFU)	☺	☺	☺	☺		☺	
Call Hold (CH)	☺	☺	☺				
Call Transfer (CT)	☺	☺					
Call Waiting (CW)	☺	☺	☺				
Calling Line Identification Presentation (CLIP)	☺	☺	☺	☺	☺	☺	☺
Calling Line Identification Restriction (CLIR)	☺	☺	☺	☺	☺	☺	☺
Closed User Group (CUG)	☺	☺	☺	☺		☺	
Change of Keyword	☺	☺*					
Completion of Calls to busy subscriber (CCBS)	☺	☺	☺				
Conference Call (CONF)	☺	☺*					
Connected Line identification Presentation (COLP)		☺	☺	☺		☺	☺
Connected Line identification Restriction (COLR)		☺	☺	☺		☺	☺
Direct Dialing In (DDI)		☺	☺	☺	☺	☺	
Equal Access (EA)	☺	☺*	☺				
Fixed Destination Call (FDC)	☺	☺					
Incoming Call Barring (ICB)	☺	☺	☺	☺		☺	
Last Number Repetition (LNR)	☺	☺					
Line Hunting (LH)	☺	☺					
Malicious Call Identification (MCI)	☺	☺	☺	☺	☺	☺	
Multiple Subscriber Number (MSN)	☺	☺	☺				
Number Completion and Screening		☺					
Outgoing Call Barring (OCB)	☺	☺	☺	☺	☺	☺	
Printed Record of Charge (PRC)	☺	☺					
PRIO				☺		☺	
Private Numbering Plan (PNP)	☺	☺					
Service Intercept (SVI)	☺	☺	☺				
Sub-addressing (SUB)		☺	☺	☺	☺	☺	☺
Terminal Portability (TP)		☺			☺		
Three Party Conference (3PTY)	☺	☺	☺				
Trunk Hunting (TH)		☺	☺				
User to User Signaling (UUS)		☺	☺	☺		☺	☺

* = depending on End-User Terminal

APPENDIX B

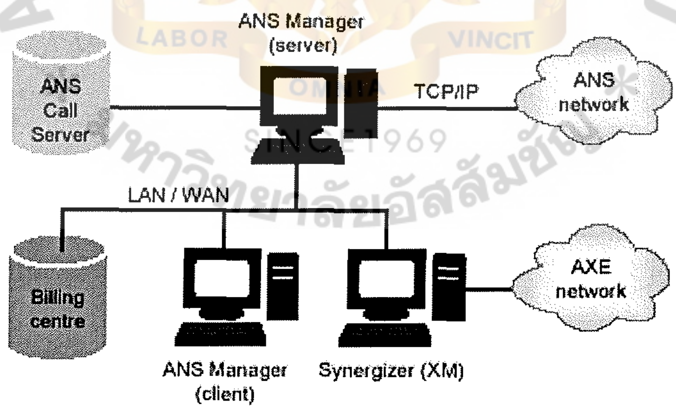
ACCESS NODE SWITCHING

ANS Management

The ANS product family has its own operation and maintenance system - the ANS Manager. The ANS Manager efficiently configures, controls, and maintains the elements in an ANS network and enables the operator to control a number of network elements through one single management system and to utilize multiple linked workstations to distribute O&M functions in a network.

The ANS Manager supports centralized as well as decentralized (DCN) operation and maintenance procedures. It is built on the Microsoft Windows 2000 platform. The ANS Manager is based on a client server principle, and clients can either be locally connected or connected via LAN/WAN.

The ANS Manager can interface with the Ericsson management system Synergizer (XM), enabling O&M integration for mixed ANS/AXE networks and making it possible to manage the ANS/AXE network from one centralized location.



FigureB.1. ANS Manager in integrated ANS/AXE network.

ANS Manager

The ANS Manager must be connected to the ANS, and only the ANS Manager is capable of operating and maintaining the ANS. This is typically done via standard TCP/IP LAN interface.

The ANS Manager enables the operator to:

(1) Control a number of network elements through one single management system.

(2) Utilize multiple, linked work stations to distribute O&M functions in a network.

(3) Create individual applications via the open Application Programming Interface (API).

(4) Provide a centralized, distributed and/or local management solution.

(5) Handle new customized applications and maintain new, remote nodes as the ANS network grows.

(6) Interface the ANS Manager with the Ericsson management system called Synergizer (XM), providing O&M integration for mixed ANS /AXE networks.

(7) Provide fault management and integration with different management systemsusing the SNMP management or BNSI interface.

Applications to the ANS Manager

The following applications can be added to the ANS Manager:

(1) RTViewer: A user-friendly graphical user interface for conversion and display of Call Data Records (CDRs). The RTViewer is a mediation device between the ANS Manager and the billing system, which makes it easy to view and interpret charging records by converting them into a graphical user interface.

(2) MPA Browser: Integrated protocol analyzer that collects and interprets protocol signaling from remote network elements

(3) SNMP interface: SNMP interface for common fault management. The SNMP trap reception and trap relay application enables the ANS Manager to forward alarm messages to a higher-level SNMP fault management system and interface to non-ANS network clients.

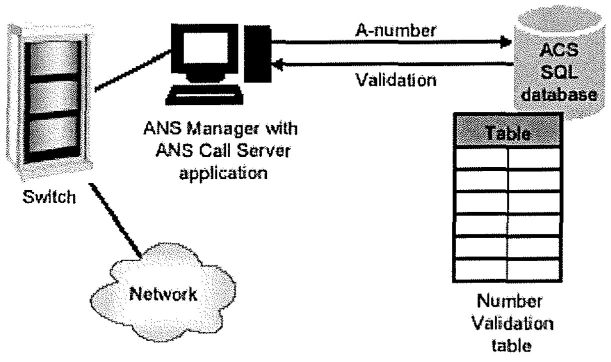
(4) Subscriber Manager: Application that allows a person with little or no knowledge of programming to easily connect subscribers and change supplementary services etc.

ANS Call Server

The ANS Call Server (ACS) enables routing and access screening and includes features such as least cost routing, A-number validation, authentication, number portability and more. It integrates Intelligent Routing and Number Validation onto an SQL platform. The ANS Call Server is an application that is added to the ANS Manager.

Number Validation

The Number Validation works as follows: the screening request is sent to a dedicated ANS Manager along with the A-subscriber identity data (e.g. A-number), using the ANS Call Server, which contains a Number Validation table for a positive identification. This is done before finishing the call set-up. The Number Validation table can be updated locally or through a normal LAN/WAN network.

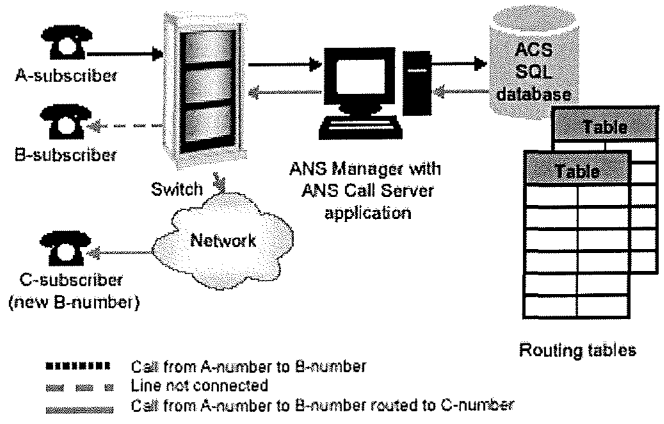


FigureB.2. Number Validation using the ANS Call Server (ACS).

The ACS Number Validation application can be used together with the VPN functionality.

Intelligent Routing

The Intelligent Routing functionality contains two main functions; access check of the A-number and additional routing by changing the B-number of a call. The access check verifies that the A-number is present in the access table before access to the switch is granted. When access is granted, the B-number is changed according to information stored in a system of tables. The parameters that are taken into consideration are A-number, B-number, route origin, combined service identifier (CSI), the price level of the A-subscriber, the date and the time. The new B -number can be a completely new B-number or a prefix added to the old original B-number.



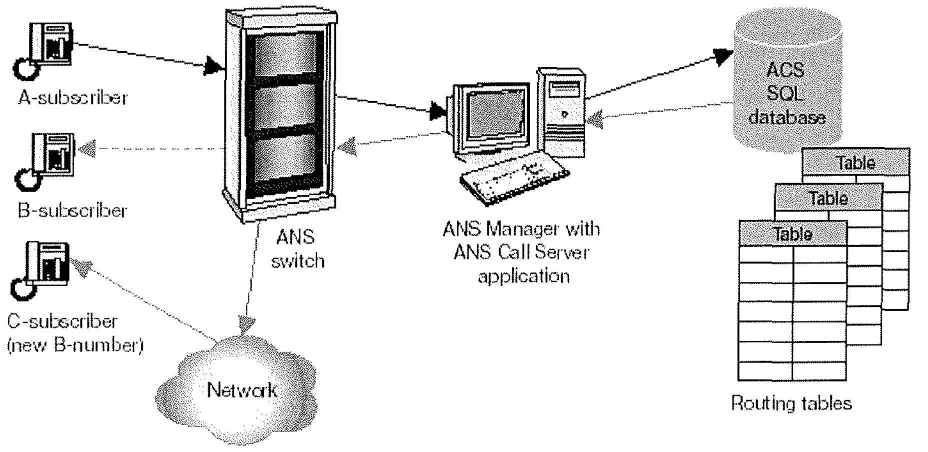
FigureB.3. Intelligent Routing using the ANS Call Server (ACS).

Operating environment

The ANS equipment works under the following environmental conditions.

TableB.1. Working of ANS equipment.

Temperature	-5° to +45° Celsius
Humidity	20 to 80% RH
Power Supply	Input voltage: -48 V (range -38 to -75 V) Optional: 220V/-48 AC/DC converter Optional: battery back-up
During operation	Indoor cabinet: ETS 300-019-1-3.2 Outdoor cabinet: ETS 300-019-1-4 class 4.1 E
During transportation	ETS 300-019-1-2 class 2.3
During Storage	ETS 300-019-1-1 class 1.2



FigureB.4. ACS for Number Validation and Intelligent Routing.

ANS Call Server for Number Validation and Intelligent Routing

The ANS Call Server enables routing and access screening and includes features such as least cost routing, A-number validation, authentication, number portability and more. It integrates Intelligent Routing and Number Validation into an SQL platform. The ANS Call Server is an application that is added to the ANS Manager.

Intelligent Routing and Number Validation

The ANS Call Server is suitable for small as well as large networks and enables the operator to optimize profitability by offering features such as:

(1) Least cost routing

(2) Time-dependent routing

(3) Number portability

(4) White List/Black List

(5) Voice Messages

Advantages of the ANS Call Sever

Apart from the Intelligent Routing and Number Validation functionality, The ANS Call Server (ACS) includes the following additional features:

(1) SQL platform for the handling of routing and access screen data.

(2) High response speed due to indexed searches (Typically it takes 100 million seconds to search through a database of 1 million entries).

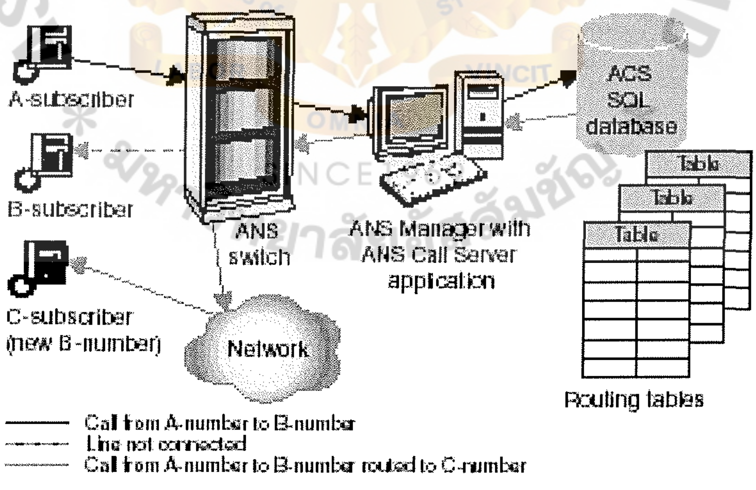
(3) Statistics record of call frequency and average answering time.

(4) CONFIGURATION Manager with a graphical user interface.

Features of the ANS Call Server

Intelligent Routing

Intelligent Routing provides operators with the flexibility to control access to their networks and to optimize routing within their networks based on selected criteria in each call (origin, time of day, service level requirement and etc,).



FigureB.5. Intelligent Routing and B-number conversion.

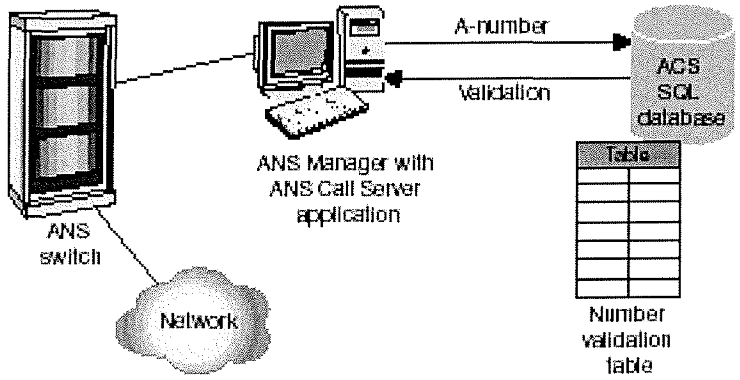
Before access to the switch and the Intelligent Routing functionality is granted, access screening verifies that the A-number is present in the access table. When access is granted, the B-number may be changed according to information entered into a system of routing tables in the database. Some or all of the following parameters can be taken into consideration for each subscriber, the date, and the time. The new B-number can be a completely different B-number or a prefix added to the original B-number.

Examples of routing by B-number conversion

The advantage of this service is that operators now have the power to optimize the routing of calls in their networks based on any of the criteria listed above. Time-dependent routing, least cost routing and number portability are excellent ways of optimizing profitability by using lower cost networks at certain period of time. Another example of time dependent routing is maintaining in a worldwide 24-hour hotline with a limited number of service centers places in various times zones. In this way, an incoming night call in one country might be forwarded to the nearest open service center located on a different continent in a different time zone.

Number Validation

Number Validation means access screening via a database of a subscriber A-numbers that have been authorized ad users of a specific service. When a subscriber attempts to make a call using a special service or network with access limits, the subscriber's A-number is checked against the database. These calls are usually identification (CLI). Number Validation is completed before call setup is finished and only calls made from authorized A-numbers are granted access. An incoming call is accepted only if its a-number is contained in the Number Validation table – the so –called "White List Table". However, if the Number Validation acts as Black List, then the call will be accepted if its a-Number is **not** contained in the Number Validation table.



FigureB.6. Number Validation.

Examples of the use of Number Validation

Number Validation allows operators to restrict access e.g. for carrier pre-selection or other selected route origins. In combination with the ANS voice announcement unit (VAU), the Number Validation also offers the possibility to se a voice message to advertise for a service or a pre-selected carrier on a call-by-call basis, e.g. when a non-subscriber attempts to place a call or use a service.

System Overview

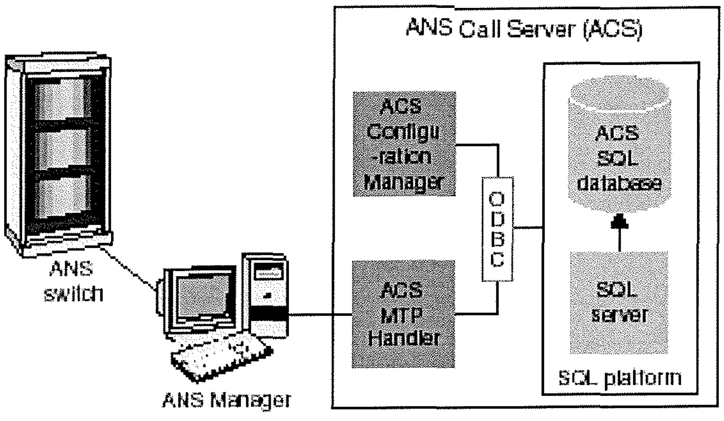
Components of the ANS Call Server

The ANS Call Server (ACS) consists of the following three elements:

(1) ACS SQL database

(2) ACS MTP Handler

(3) ACS Configuration Manager



FigureB.7. Technical overview of the ANS Call Server.

In order to operate the ANS Call Server, two additional elements are required:

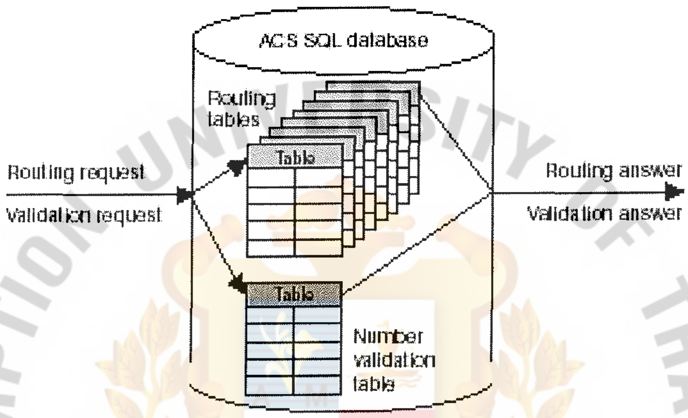
(1) a compatible SQL server including full administrative rights

(2) a compatible ODBC driver. The ODBC – Open Database Connectivity – is an interface to the ACS SQL database needed by both the ACS MTP Handler and the ACS Configuration Manager

The ANS Call Server SQL database: The ANS Call Server (ACS) integrates Intelligent Routing and Number Validation onto the SQL platform. The SQL platform consists of an SQL server and the ANS Call Server SQL database. The ACS SQL database consists of SQL table and stored procedures – the tables contain all the Intelligent Routing data and Validation numbers, and the stored procedures implement requests and relationships between the data. The database also has the means to record statistics of the requests (call frequency and average response time).

How the ANS SQL database

Every time a request is received by the database, a main process decides whether it is and Intelligent Routing or a Number Validation request. If an Intelligent Routing request arrives, the Intelligent Routing tables are looked-up according to the input information contained in the request, and an Intelligent answer is issued.



FigurcB.8. ACS SQL database.

Through the open SQL interface, the operators can even provides their own maintenance tools to change the data. This could be a web portal that can be operated by the users.

Operation and maintenance

The ANS Manager is the communication basis for the entire ANS Call Server. When the ANS switch issues routing or access screening requests, the ANS Manager provides access to the network elements and interfaces them to the ACS MTP Handler. The ACS answers (routing or access screening responses) are sent from the ACS MTP Handler to the ANS Manager that forwards them to the ANS switch.

In case the connection between the ANS switch and the ANS Manager is lost, a primary and a secondary ANS Manager can be set up so that alternative management links automatically keep the connection. In case the MTP connection to one or both ANS Manager is lost, an alarm is issued.

System overview, continued

ACS MTP Handler

The ACS MTP Handler (Message Transfer Part handler) receives the ACS requests from the ANS Manager and forwards them to the ACS SQL database via the ODBL interface. When the database answers, the ACS MTP Handler sends the response back to the ANS Manager.

ACS Configuration Manager

The ACS Configuration Manager provides a Windows graphical user interface which makes it easy to maintain the ACS SQL database. The ACS Configuration Manager includes the following functions:

(1) Management of the database (add and delete data)

(2) Search in the database (via queries)

(3) Test the database functionally (by executing stored procedures)

(4) File transfer operations (e.g. data transfer via text files)

(5) Display of statistics recorded in the database

Requirements

SQL Server requirements

A compatible SQL server including full administrative rights is required to run the ANS Call Server. The SQL server can be shared by several ANS Manager via a LAN connection.

Recommended SQL server size:

The minimum platform for running both the SQL database and the ANS Manager is a server PC with 500 MHz and 256 Mb RAM. However, the size of the PC depends on the number of subscribers (this example will handle approx. 100,000 subscribers).

Integrated platforms

The ANS Call Server is integrated with two SQL platforms: Microsoft SQL Server 7.0/2000 and Sybase Adaptive Sever Anywhere 6.0.

The ANS Call Server works on a Windows NT/2000 (both Microsoft and Sybase distributions). The Microsoft SQL server distribution is able to run on a Windows 2000 platform.

Migration to the ANS Call Server

It is possible to keep data from existing Intelligent. Routing and Number Validation applications, when migrating to the ANS Call Server. The existing data can be converted by exporting and importing them into the ANS call Server.

APPENDIX C

DATA DICTIONARY

DATA DICTIONARY

ANS RSC

ANS RSC is characterized by using the standard ETSI V5.2 protocol as network interface.

Access Node

A connecting point for a data transport or data-packet network. Access nodes usually reside in a central office environment or are a part of a leased space agreement. Connections to access nodes are provided by local carrier loops. Access devices at the end of the customer loop are generally provided by the data-network service provider or by the customer.

Area Code

An area code is a three-digit code that designates a toll center in the North American Numbering Plan. To call outside of your toll center, you first dial 1, then the area code for the toll center or "area" you wish to call.

Completed Call

A call that is connected to its destination. When someone calls a number and someone picks up the end, the call is completed. You would think that a call would be completed when the people were finished talking, but in regard to call routing and switching, that is not the case.

Connection Oriented

A protocol model of interconnection that has three phases: connection, transfers of data, and disconnect. Some connection-oriented protocols are X.25, TCP, and a regular telephone call. Many protocols are a mixture of connection/connectionless, such as ATM, TCP/IP, and frame relay.

Country Code

A code used in international dialing for countries that are not a part of the North American Number Plan (NANP). To dial international long distance from the United States, dial : 011 + country code + city code + number.

For a listing of country codes

To dial the United States from another country that is a part of the NANP, simply dial the area code the same way you would call long distance to another state. To call the United States from another country that is not a part of the NANP, consult, your long distance company. The United States has a different country code/access code for almost every country that is not a part of the NANP.

IEEE (Institute of Electrical and Electronics Engineers)

A professional organization whose activities include the development of telecommunications and networking standards. IEEE LAN standards, such as the Ethernet 802 family, are the predominantly implemented LAN standards today.

Integrated Services Digital Network (ISDN)

ISDN is a service that first evolved in 1979. It brings the features of PBX systems and high-speed data-transfer capability to the telephone network. The only thing that makes ISDN complicated is the many available features. The two kinds of ISDN lines are *Primary Rate Interface (PRI)* and *Basic Rate Interface (BRI)*. Two types of channels are contained within an ISDN circuit. The B (bearer) channel carries the customer's communications, and a D (data) channel provides control and signaling for the B channels. The *BRI (Basic Rate Interface)* ISDN line has two B channels and one D channel. A PRI has 23 B channels and one D channel.

International Gateways

International telecommunications are done through gateway central offices. Gateway central offices (class 5 central offices) connect communications to other countries. The gateway does the translation from T1 to E1, T3 to E3, and vice versa.

ISUP (Kilobits per Second)

ISUP is the ISDN user part of No.7 signaling system. It defines necessary signaling message, function and procedure of voice service and non-voice service control. (such as circuit switched data communication). ISUP can complete all functions of TUP and DUP, and can realize wide range of ISDN services. It is used widely.

Kbps (Kilobits per Second)

A reference to how fast data is being transferred on a communications path.

Lost Call

A call that did not complete or was blocked because of a lack of switching facilities. Lost Call is different from Attempt Call.

Network

A group of devices that communicates back and forth using a set of rules or a set of protocols (called a *protocol stack* in data communications). The medium that the devices communicate through can be copper wire (UTP), fiber optic, coax, fiber optic, air/vacuum (radio), or light (infrared).

Switching Center

Another name for a telecommunications company's central office. A location for switching equipment/electronics and transport equipment/electronics.

Telecommunications

To exchange information across a distance.

Terminal

1. A closure where a telephone cable is terminated. It is usually a green box if it terminates buried cable or silver box if pole mounted.

2. A video I/O device with a keyboard that is used to enter and retrieve information (data) from computers.

Traffic

A measure of the amount of call attempts and active calls on a telephone switch. Traffic is measured in centum call seconds (*CCS*, one phone call for one second) or Erlangs. Many larger PBX (*Private Branch Exchange*) telephone systems and central office switches now have *CTI (Computer Telephony Integration*) applications that will calculate traffic, CPU % utilization, busy hours, and other useful information.

APPENDIX D

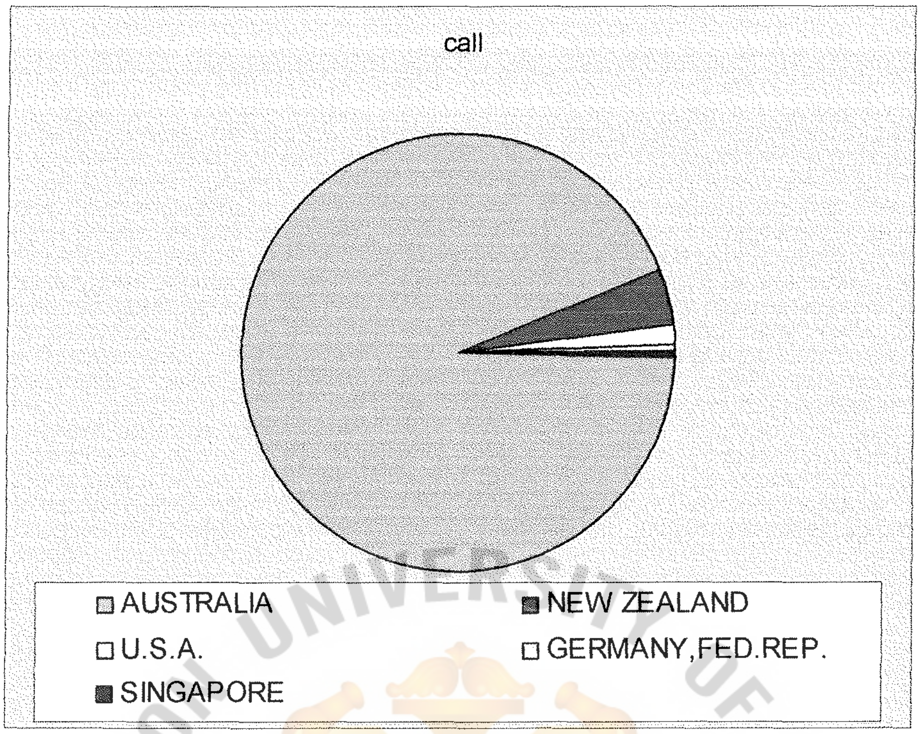
NUMERICAL DATA OF ACCESS NODE SWITCHING

TableD.1. Incoming and Outgoing Traffic example in International Telephone Switching Center including detail in number of call.

country	Call	Min	%
AUSTRALIA	*92080*	*153205.98*	*85.644*
AUSTRIA	5	8.32	0.005
BAHRAIN	1	0.15	0.000
BELGIUM	2	4.83	0.003
BOTSWANA	1	1.12	0.001
BRAZIL	2	28.68	0.016
BRUNEI	16	17.22	0.010
CANADA	107	807.95	0.452
CHINA,PEO.REP.OF	83	307.24	0.172
COSTA RICA	4	12.3	0.007
CYPRUS	8	29.16	0.016
FIJI	200	295.69	0.165
FRANCE	6	46.36	0.026
FRENCH POLYNESIA	2	1.8	0.001
GAMBIA	3	16.2	0.009
GERMANY,FED.REP.	***603***	***1758.86***	***0.983***
GHANA	48	226.47	0.127
HAITI	2	17.56	0.010
HAWAII	2	1.39	0.001
HONG KONG	236	695.32	0.389
HUNGARY	9	39.05	0.022
INDIA	152	618.32	0.346
INDONESIA	31	100.23	0.056
IODC	1	1.77	0.001
IRELAND,REP.OF	13	77.59	0.043
ITALY	2	1.7	0.001
ITFS	38	202.42	0.113
JAMAICA	7	81.07	0.045
JAPAN	281	824.97	0.461
KOREA,DEM.REP.OF	1	3.15	0.002
KOREA,REP.OF	5	7.63	0.004
KUWAIT	1	1.02	0.001
KYRGYZSTAN	4	3.5	0.002
LUXEMBOURG	1	0.67	0.000
MEXICO	1	0.73	0.000
MOROCCO	4	3.14	0.002
MYANMAR	6	33.71	0.019
NETHERLANDS	113	396.05	0.221
NEW ZEALAND	*4273*	*7131.17*	*3.986*
NEW ZEALAND-CLEA	166	307.01	0.172
OMAN	8	27.05	0.015
PAKISTAN	12	46.51	0.026
PAPUA NEW GUINEA	107	441.06	0.247

TableD.1. Incoming and Outgoing Traffic example in International Telephone Switching Center including detail in number of call (Continued).

Country	Call	Min	%
RUSSIA	19	62.5	0.035
SAUDI ARABIA	2	3.65	0.002
SEYCHELLES	1	10.07	0.006
SINGAPORE	***558***	***1100.76***	***0.615***
SOLOMON IS.	3	8.01	0.004
SOUTH AFRICA,REP	247	454.58	0.254
SRI LANKA	10	48.28	0.027
SURINAME	5	2.77	0.002
SWEDEN	8	67.14	0.038
SWITZERLAND	6	32.87	0.018
TAIWAN	73	276.8	0.155
TOGO,REP.OF	8	61.89	0.035
TUVALU	1	0.45	0.000
U.A.E.	84	263.14	0.147
U.K.	245	933.35	0.522
U.S.A.	*1240*	*6590.68*	*3.684*
UZBEKISTAN	3	13.3	0.007
VANUATU	27	71.1	0.040
VIETNAM,SOC.REP.	1	0.92	0.001
WESTERN SAMOA	78	210.23	0.118
	Total Min.	178887.94	



FigureD.1. The countries which have more calls duration.

As Table 1.6, it is an incoming and Outgoing Traffic example in International Telephone Switching Center including detail in number of call of each country which is indicating the statistics in call, minutes and also in percentage as the consequences of calling in each country. For example, the statistic of calling in AUSTRALIA is the highest frequency of using second is New Zealand, third is U.S.A and so on. For analyzing the table, we can describe that we have a good chance to increase more and more the business opportunities of International Telephone Service by offering a higher quality of services as well as is rather higher cost than using Access Node Switching. The previous strategies may get the same as the effectiveness requires several complex procedures and takes a long implementation time.

BLIOGRAPHY

1. Elahi, Ata. Competition International Telecommnication: Delmar Thomson Learning, 2001.

2. Forouzan, Behrouz A. Data Communications and Networking, 2nd Edition. Singapore: A Division of the McGraw-Hill Companies, 1998.

3. Retske, Gene. A Guide to Competitive International Telecommunications. NY: CMP Books, 2002.

4. Clayton, Jade. McGraw-Hill Illustrated Telecom Dictionary, 4th Edition. NY: A Division of the McGraw-Hill Companies, 2001.