ProfiTel IP

Technical description

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1. INTRODUCTION

IP and Ethernet is already de-facto standard communication platform for Internet, office networks and process control applications. Due to the widespread acceptance and the great advantage of having one common platform for all services; analog systems like video and telephony are also rapidly moving towards IP.
The reasons for implementing IP-telephony are quite obvious:

- **ECONOMY**
  - All phone calls within the local area network are free of charge
  - The existing Ethernet infrastructure can be used, no separate cabling is necessary for the phone system
  - Gatekeeper supports existing technologies ex. existing analogue phones.

- **FLEXIBILITY**
  - A new telephone can be connected to any available network port
  - Telephone can support IP camera or remote IO
  - Telephone is a part of the IP net (Hiper ring, Spanning Tree and Rapid Spanning Tree)

- **SAFETY**
  - Automatic remote testing of telephones
  - High performance, easy to handle error monitoring
  - Remote management & configuration with Software Configurator
  - Redundant IP backbone reduces downtime if IP net fails

- **RELIABILITY**
  - Continuous automatic tests and automatic warning of errors
  - No public network is needed for internal call
  - Fiber optic connection of the phones
  - Connected to and part of redundant IP backbone

ProfiTel IP is a complete IP based telephone system for use in harsh environment. The system covers both standard functionality and special safety features needed in an emergency system. ProfiTel IP is based on a close cooperation with Aastra which ensures a "Future Proof" system. Profitek is Norway's leading provider of emergency telephone systems for traffic applications with experience from development, integration and installation since 1990. Among these are the worlds longest road tunnel (24Km) and the worlds longest sub sea road tunnel (7Km).

Profitek AASTRA

Figure 1: The concept

2. TECHNICAL DESCRIPTION

2.1. GENERAL INFORMATION

ProfiTel IP can be used in a variety of applications according to customer requirements. Typical use is as Emergency "Hotline" Telephone, Industrial Telephone, Public Announcement (PA) System and Calling System. With integrated switch (option NET) can Profitel IP be used as connection point for PC, PLC, video over IP and other IP-based equipment. The integrated switch supports fiber optic redundant ring as network topology.
Main system components are:

- Telephone Units
- Operators Consoles
- Gatekeeper/Gateway
- Remote Maintenance Station (PC)
- ProfiTel software package
- External amplifier/loudspeaker (Option)
- External beacon/sounder (Option)
- Local Area Network (Separate or included in ProfiTel IP NET)

Figure 2: ProfiTel IP

2.2. MAIN FEATURES

The system covers the same functionality as an “office” telephone system in addition to the industry specific features made especially for ProfiTel IP.

- Call operator/emergency destination.
- Call other telephones
- Call groups
- Announcing single phone/groups
- Queuing
- Call logging
- Telephone directory
- Historical data
- Voice recording
- Automatic testing of telephone and Gatekeeper
- Fault monitoring and alerting
- Fully featured remote configuration tools
- Audio output for PA

2.3. OPERATION

ProfiTel IP	ProfiTel IP Hotline	ProfiTel IP Hotkey	ProfiTel IP Hands free	ProfiTel IP Hands Free Hotkey
Keypad	*Automatic call*	*Push-buttons*	*Keypad*	*Push-buttons*
Handset	*Handset*	*Handset*	*Hands free*	*Hands free*

Table 1 : Different ways of operation

2.4. TELEPHONE UNIT

ProfiTel IP is a rugged weatherproof IP telephone unit designed for harsh environment.
ProfiTel IP telephones can be connected to any type of Ethernet switch with sufficient quality.
Standard Ethernet connection is copper cable (Cat 5E or better)
ProfiTel IP NET has integrated Industrial Ethernet Switch with fiber optic backbone ports (HiPER Ring).
ProfiTel IP phones can optional be delivered with an internal fiber to copper converter/switch with 3 free 10/100 Mb/s ports.
All types can be delivered with or without keypad (hotline) as hands free telephone and optionally with customer specified operation (push buttons). Configuration of the telephone is software based and can be done using PC (laptop or maintenance station).

- Weatherproof IP65 (water, humidity, dust)
- 24VDC
- Manageable
- Redundant HIPER ring with MultiMode fiber (Option NET-M)
- Redundant HIPER ring with SingleMode fiber (Option NET-S)
- HIPER Ring compatible with Hirschmann Rail, MICE and MACH 3000 series
- Ruggedized construction
- Upgradeable platform
- Modular; phone is mounted on fascia
- External beacon & hooter (option)
- External PA loudspeaker (option)
- Automatic test (option)

Figure 3 : ProfiTel IP stations

2.5.OPERATORS CONSOLE

ProfiTel IP offers several levels of features for the operators.
Basic operator a digital Office 45 provides the basic operator functionality.
Advanced operator PC operator Office 1560 uses either Office 45 (digital AD2) or Office 35IP (IP connection) as voice media and the Office 1560 software for call controll.

2.5.1. BASIC OPERATOR CONSOLE

The Basic Operators Console is an Office type telephone with extended display connected directly to AD2 port at Gatekeeper.
Operator can be supported by OIP. OIP provides an intuitive graphical user interface (GUI) with history and call history.
(OIP) is Java based for installation on PC with any type of operating system.
Headset, wireless headset and call recording are available as options.

Figure 4 : ProfiTel IP Basic Operators Console

2.5.2. ADVANCED OPERATOR CONSOLE

The advanced operator PC operator Office 1560 uses either Office 45 (digital AD2) or Office 35IP (IP connection) as voice media and the Office 1560 software for call control.
Office 1560 provides an intuitive graphical user interface (GUI). Multiple layers of real time busy indications for the selected users.
Features like: Brake into conversations, take over call, conference calls, queuing with time in queue, free to pick calls in the queue, park calls, transfer calls, Operator statistics fields, call history (incoming and outgoing calls), and user friendly and highly configurable GUI.
Office 1560 is supported trough OIP.. (OIP) is Java based for installation on PC with any type of operating system.
Headset, wireless headset and call recording are available as options.

Figure 5 : ProfiTel IP Advanced Operators Console

2.6.PROFITEL IP GATEKEEPERS

The combined Gatekeeper and Gateway is based on the latest generation industrial IP PBX platform. The Gatekeeper is 19" rack mount.
ProfiTel IP Gatekeepers are modular systems supporting:
ISDN BRI, ISDN PRI, IP, Analog lines, and digital lines.
ProfiTel IP Gatekeeper supports and connects to existing technologies, analogue and ISDN.
ProfiTel IP Gatekeeper connects direct to public net or to existing PBX on site.
All interfaces can be combined within the same chassis making the system easy to adapt to different environment and requirements.
Size of the gatekeeper/gateway is determined by the number of users and.

Following versions available:

ProfiTel IP Gatekeeper	Max. attached IP Phones	Default ports
ProfiTel IP Gatekeeper 10	*10 IP telephones*	*1 x 10BT[2]* *1 x 10/100BTX[2]* *3 x ISDN BRI/S0* *3 x Analog Line* *4 x AD2[1]*
ProfiTel IP Gatekeeper 20	*20 IP telephones*	*1 x 10BT[2]* *1 x 10/100BTX[2]* *3 x ISDN BRI/S0* *3 x Analog Line* *4 x AD2[1]*
ProfiTel IP Gatekeeper 50	*50 IP telephones*	*1 x 10BT[2]2 x 10/100BTX[2]* *3 x ISDN BRI/S0* *3 x Analog Line* *4 x AD2[1]*
ProfiTel IP Gatekeeper 100	*100 IP telephones*	*3 x 10/100BTX[2]* *1 x AD2[1]*
ProfiTel IP Gatekeeper 200	*200 IP telephones*	*4 x 10/100BTX[2]* *1 x AD2[1]*
ProfiTel IP Gatekeeper 300	*300 IP telephones*	*5 x 10/100BTX[2]* *1 x AD2[1]*
ProfiTel IP Gatekeeper 400	*400 IP telephones*	*5 x 10/100BTX[2]* *1 x AD2[1]*

[1] *For Basic Operators Console etc*
[2] *Ports must be connected to LAN*

Table 2 : ProfiTel IP Gatekeeper/Gateway configuration

2.6.1. GATEKEEPER FUNCTIONALITY

Configuration and administration all phones.
Call control all telephone calls IP or non IP internal and external
Controlling and monitoring telephone numbers & names to IP-addresses
Administrative tasks like admission control, call filters, etc
User group management (PA, group calls)
Test & alarm handling
SNMP Management & Configuration

2.6.2. Gateway functionality

Transformation of the PCM voice signals into IP packages and reverse
Coding and decoding of the voice signals in accordance with G.711 and G.729 with selectable frame length
Echo compensation and volume control
Control of the bandwidth of the voice channels.

Figure 6 : ProfiTel IP Gateway/Gatekeeper

2.7. SOFTWARE CONFIGURATION TOOLS

The SW Configuration Tools are Windows applications to be installed on a PC.
The applications are used for configuration and monitoring of ProfiTel IP Gatekeeper and telephones and main features are:

- ❑ Setup and configuration of Gatekeepers
- ❑ Setup and configuration of IP telephones
- ❑ Remote control Virtual Display of IP telephones
- ❑ IP address configuration, configuration of DHCP/DNS
- ❑ Alarm handling and report server software
- ❑ Automatic acoustic test software
- ❑ Alarm receiving client software

2.7.1. PROFITEL IP SOFTWARE PACKAGE

ProfiTel IP Gatekeepers are delivered with the following licensed single user software:

AIMS	Gatekeeper configuration tool
Configurator	Telephone configuration tool
PAN Server	ProfiTel Alarm Notification Server
PAN Client	ProfiTel Alarm Notification Client

Optional software

PAT	ProfiTel Acoustic Test

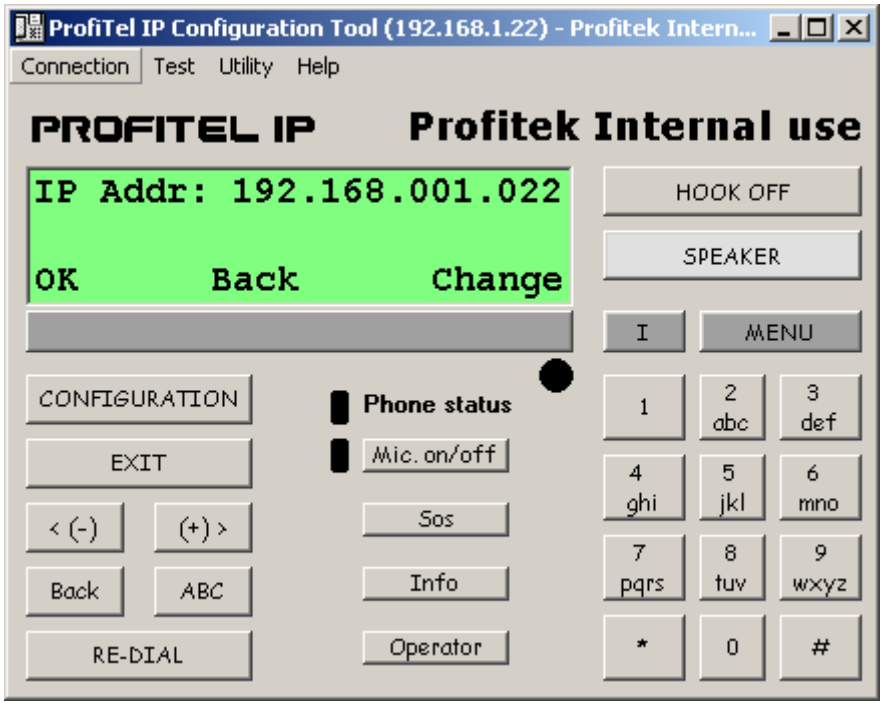

Figure 7 : ProfiTel IP Configurator tool screenshot

2.8. LOCAL AREA NETWORK

IP Telephony is using a limited amount of bandwidth, only approximately 100Kbps pr. active conversation in uncompressed mode.
It is real a time application and recommended maximum jitter should be less than 150mS.
Telephones in a safety system are not allowed to be out of operation (same as a process control LAN) and due to this there are certain requirements to the Local Area Network:

- A properly designed switched network with sufficient bandwidth
- Control and knowledge of the network load
- A properly designed cabling infrastructure
- Quality of Service (QoS)
- We recommend industrial Ethernet type of LAN equipment in a redundant topology to reduce downtime in the Ethernet back bone
- UPS and over voltage protection

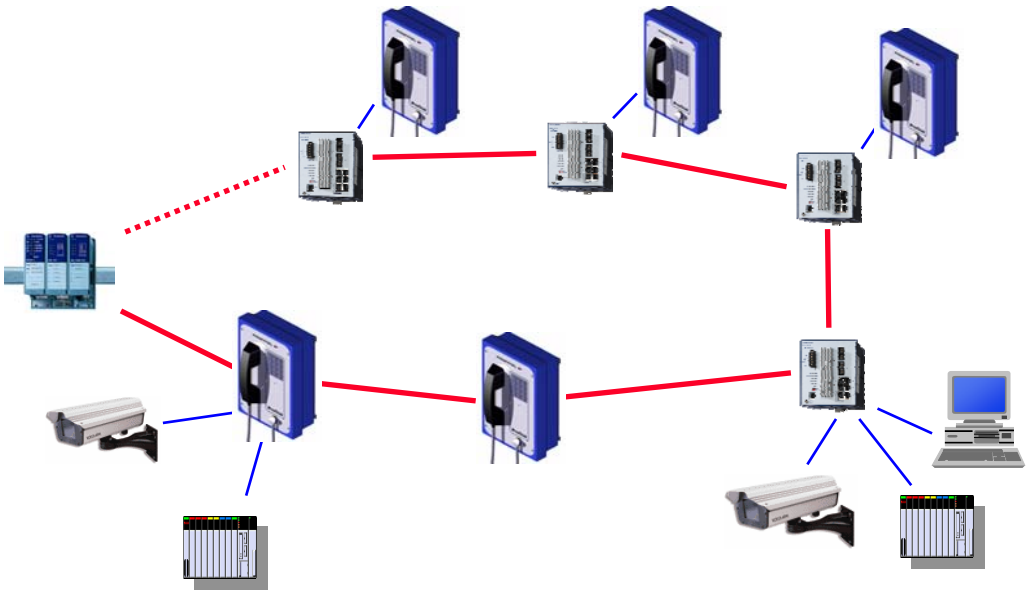

Figure 8 : ProfiTel IP in a HIPER ring topology

3. OPTIONS

3.1. OPTION NET

The telephone with integrated switch (ProfiTel IP NET) has two 10/100 port for users and two fiber optic ports for integration into redundant backbone. Additional equipment can be connected by simply adding an external switch ex from Rail or MICE series of industrial Ethernet switches. The NET Option is compatible with Hirschmann HIPER Ring. The ring ports can be MultiMode or SingleMode fiber.
The switch supports QoS and is manageable with WEB, SNMP and OPC.
The switch also supports Spanning Tree and Rapid Spanning Tree
Installation is simplified with auto polarity, auto negotiate and auto crossing.

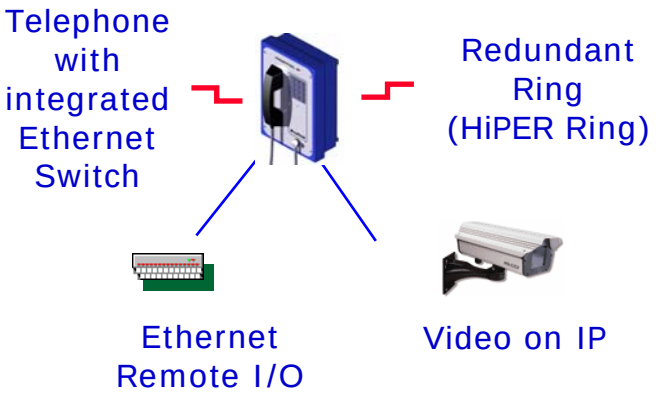

Figure 9 : ProfiTel IP with integrated switch (option NET)

Feature	Profitel IP NET - M	Profitel IP NET - S
Ports	*2x10/100BTX* *2x100BFX MultiMode (HiPER Ring)*	*2x10/100BTX* *2x100BFX SingleMode (HiPER Ring)*
	Auto Polarity *Auto Negotiate* *Auto Crossing*	
QoS	*Priority according to IEEE 802.1D/p*	
Management	*SNMP* *WEB* *OPC* *Serial Interface* *DHCP/BootP Client* *DHCP Option 82* *Autoconfig Adapter (ACA)*	
Redundancy	*HiPER Ring* *Rapid Spanning Tree Protocol (RSTP)* *Connection for redundant power supply*	

Table 3 : Technical data for Integrated switch (Profitel IP NET)

3.2. OPTION FIBER CONVERTER/SWITCH

The telephone with integrated fiber converter/switch has four 10/100 port for users and tone fiber optic ports for integration into fiber connection to a fiber switch in the backbone. Additional equipment can be connected by simply connect to the three free 10/100 ports in the converter/switch.
Fiber port: Multimode fiber 50/125µm or 62.5/125µm
Installation is simplified with auto polarity, auto negotiate and auto crossing.

3.3.OPTION PA/BEACON/SOUNDER

The option is integrated in the telephone unit with output for 2 wire audio and relay for switching of power to external beacon and sounder. The audio signal can feed a separate amplifier or an outdoor loudspeaker with integrated amplifier. Amplifier, loudspeaker, beacon and sounder are not part of the option but can be ordered as separate items.

3.4. OPTION ACOUSTIC TEST

The ProfiTel IP self test software is developed for automatic acoustic testing of the telephones, gateway and physical lines.
This is a highly important issue when the ProfiTel IP is being used as an emergency telephone system. These telephones are often located in remote areas with limited access and **must** be in working order when needed.
The test is acoustic and confirms proper functionality of the audible signal path including the handset. The test is performed automatically from a PC running the Test software/hardware (PAT) and generates alarm messages to control center and/or qualified personnel. All events like alarms and changes of status are stored in a historical database.

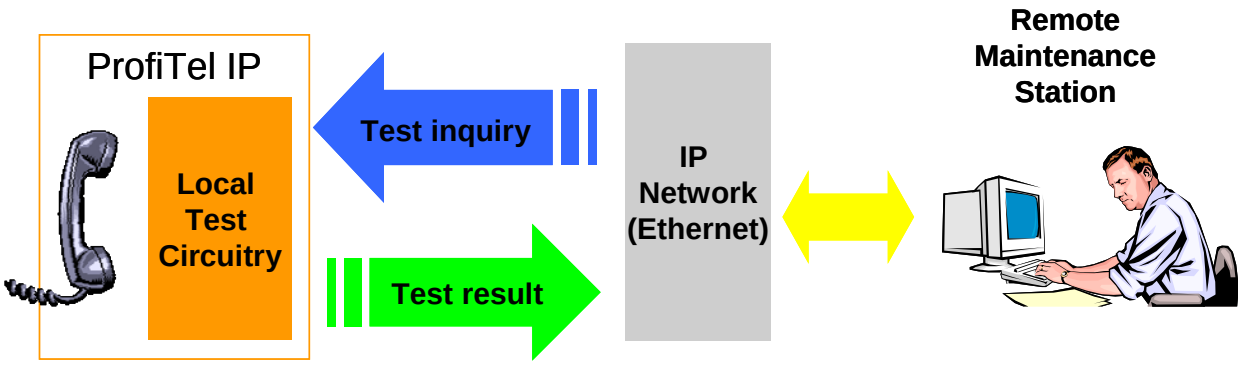

Figure 10 : Test sequence

4. TECHNICAL DATA

4.1. CODEC

Codec	Bandwidth voice	Effective bandwidth (without IP header compression) in relation to the frame length			Speech quality
		10 ms	20 ms	30 ms	
G.711	*64 kbit/s*	*111 kbit/s*	*90 kbit/s*	*80 kbit/s*	*max. 4.5 MOS*
G.729	*8 kbit/s*	*55 kbit/s*	*32 kbit/s*	*24 kbit/s*	*max. 4 MOS*
G.711 is uncompressed, has small delay values (provided a small frame length has been set) and a high speech quality (the MOS scale ranges from 1 to 5). This codec should be given priority whenever there is sufficient bandwidth available. If the bandwidth is limited, G.729 is used to advantage					

Table 4 : Codec and compression

4.2.STANDARDS

	ProfiTel IP	**ProfiTel IP with NET Option**	**Gateway/gatekeeper**
Signal Conversion	*H.323 (LAN)*	*H.323 (LAN)*	*H.323 (LAN)* *Q.931 (PBX)* *SIP*
Compression	*G.711, G.723, G.729*	*G.711, G.723, G.729*	*G.711, G.723, G.729*
Network	*IEEE 802.3* *10BaseT* *100BaseTx*	*IEEE 802.3* *10BaseT* *100BaseTX* *100BaseFx* *IEEE 802.1D* *IEEE 802.1p/Q*	*IEEE 802.3* *10BaseT* *100BaseTx* *IEEE 802.1 p/Q*
Management		*WEB, SNMP, OPC*	*SNMP, OPC*
Redundancy		*HiPER Ring* *RSTP* *Spanning Tree*	
Shock		*IEC 60068-2-27*	
Vibration		*IEC 60068-2-6*	
Free fall		*IEC 60068-2-32*	
EMC	*EN 55022 Class B* *EN 55024* *EN 61000-3-2* *EN 61000-3-3*	*EN 55022 Class A* *FCC CFR47 Part 15* *EN 61000-4-2* *EN 61000-4-3* *EN 61000-4-4* *EN 61000-4-5* *EN 61000-4-6*	*EN 55022 Class B* *EN 55024* *EN 61000-3-2* *EN 61000-3-3*
Safety	*IEC/EN 60950*		
Cabling infrastructure	*EN 50173*		

Table 5 : Standards

ProfiTel IP web: www.profitel-ip.com

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