

Supplementary agreement for start-up operations

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Voice over IP

Voice over IP – general description

The transmission of voice over a data network based on internet protocol (IP) offers the following additional benefit:

Considerable decrease in costs

- WAN - decrease in costs (avoiding of provider-fees)
- Better utilization of the existing transmission capacity of the data network
- Port prices lower than with traditional telephony

Operative improvement

- Unitary network for all applications
- Joint installation for data and voice
- Better operation surfaces possible

Business-Tool-Integration

- Integration of voice messages, e-mail and fax
- Possibility to offer new services
- Open for the development of new services

Voice over IP – Technical requirements

Several technical parameters shall be met before implementation. The following demands describe the technical prerequisites which a “telephony grade” data network has to fulfil in order to provide an optimal voice service.

Voice data transmission constitutes a very sensitive and time-critical application. In order to be able to operate such applications at their best, it is necessary to implement “Quality of Service” (QoS) in the data network.

The internet technology is based on the transmission of data packets. In practice the treatment of these data packets in the individual nodes (routers/switch) is effected however without the possibility for an allocation of priorities, it is a so-called “best effort”-service which delivers the data packets as fast as possible using the least effort.

If the internet technology shall serve as a basis for professional networks, certain guarantees have to be possible with regard to the quality of transmission. This demand gains even more importance the more time-critical data packets are transmitted (e.g. for the transmission of audio/video).

High quality of performance must be ensured over all facilities up to the end user (end to end QoS). That will enable to prioritize critical services vis-à-vis less important services in order to guarantee optimal voice quality.

Delays (end to end delay) within the network are tolerable with the transmission of data, with the transmission of voice however this is the case only to a very limited extent (recommendation ITU-G.114). It is therefore important to analyse in detail the transmission ways with too long delays and to eliminate their cause.

Jitter (delay variation) basically exists with every transmission and is compensated by the balance buffers (“jitter buffers”) on the IP terminals. If the jitter peak values are exceeded (dependent on the IP terminals), this has a negative effect on the voice quality.

Bottlenecks of the data bandwidth in the LAN/WAN area shall be furnished with appropriate “quality of service” (QoS) measures in order to provide a faultless voice quality.

Relevant guidelines

ITU-T describes a service with QoS-parameters.

IETF (RFC 2212) on the contrary only considers a few technical (measurable) parameters as QoS-parameters:

- **Data throughput:** data throughput means the data transfer rate actually achieved with the transmission.
- **Packet delay:** packet delay means the total delay with the transmission from the sender to the recipient.
- **Jitter (Packet Delay Variation):** Jitter means the time variance of several successive data packets.
- **Packet Loss Rate:** Packet loss rate means the relation of the packets rejected to the total number of data packets sent per time unit.

How can I find out whether my existing data network allows VoIP?

CANCOM offers you several possibilities to determine the VoIP-suitability of your existing data network.

- By means of the undermentioned „Requirements for the successful implementation of VoIP“, you can determine the VoIP-suitability of your data network by your own network-specialists and you undertake to properly provide the data network before implementation. Possibly necessary additional services due to requirements not met before implementation shall be charged at actual expenses on material and work time on the basis of confirmed performance records (material- and hour evidence).
- You choose the service package „VoIP Readiness Check“ and network specialists of CANCOM will examine your network with regard to VoIP-suitability. The result of the “VoIP Readiness Check” is a simple statement whether your existing network is suitable for VoIP or not. (Details see in chapter “VoIP Readiness Check”).
- You choose the Professional Services package „VoIP Network Analysis“. This includes a detailed as is/target investigation of your existing data network together with a detailed catalogue of measures and recommendations for the implementation of VoIP (details see in chapter “VoIP Network Analysis”).

Requirements for the successful implementation of VoIP

- The necessary bandwidth depends on several factors:
- Sample Time
- Transmission protocol
- Semi-/Full- Duplex
- VAD
- Number of simultaneous calls
- Used compression-codes

The exact bandwidth may be deduced from the factors above. As a rule the following may be assumed:

Transmission protocol

- G.711 (compression-code) – approx.90Kbit/s per call
- G.729 (compression-code) – approx.30Kbit/s per call
- FAX (T.38) – approx.90Kbit/s per call

Transmission protocol

- G.711 (compression-code) – approx.100Kbit/s per call
- G.729 (compression-code) – approx.40Kbit/s per call
- FAX (T.38) – approx.100Kbit/s per call

The following steps are necessary for the determination of the total data bandwidth

- Determination of the required minimum data bandwidth for data
- Determination of time-critical protocols and their demands for bandwidths
- Determination of the calls made simultaneously between the defined sites

Maximum values of transmission criteria

- End-to-End-Delay up to 150ms (according to ITU-G.114)
- Jitter up to 30ms (individually depending on the terminal)
- Packet loss of up to 1% (individually depending on the terminal)

Network-requirements LAN (Switch resp. OSI Layer 2)

Adherence to maximum values of transmission criteria. Within the network broadcast messages must be limited „locally“ by virtual networks (VLANs) in order to prevent a so-called “flooding” in the net (i.e. no disturbance of voice transmission by unnecessarily numerous routine messages). Inter VLAN routing between Voice VLAN and Data VLAN for the management and possibly for CTI control must however be guaranteed. This Inter VLAN-connection may either be provided for by existing WAN routers or by a Core Switch (layer 2 AND layer 3).

A further requirement is the working and cross-linked LAN cabling/infrastructure:

- The required number of network connections and IP-addresses must be given.

Requirements for the LAN-Switch

- Ethernet : IEEE 802.3 (CSMA/CD)
- QoS performance requests:
- IEEE802.1q (VLAN cut-off of broadcast domains)
- IEEE802.1p (Layer 2 prioritization)
- all ports used for VoIP must be adjusted to Full Duplex

Network requirements WAN (router resp. OSI layer 3)

The WAN may not exceed the peak values of the transmission criteria (end-to-end delay, jitter, packet loss), in order to facilitate a sufficient voice quality according to standard G.107 (definition of voice quality). Therefore appropriate QoS measures have to be implemented in the network.

The data network shall be dimensioned according to the necessary minimum data bandwidth in relation to the number of calls transmitted simultaneously.

Requirements for cross-linked sites

A transparent IP connection between the sites is generally assumed. Note:

- Firewall: NAT and PAT are not supported
- Routing protocol: „Packet- Loadsharing“ is not supported

Installation requirements for IP instruments and IP gateways:

In order to guarantee a timely installation without additional cost and time expenses, we ask you to consider the following requirements:

- The required number of 10/100 Mbit/s Switch-ports must be available.
- Ethernet patch cables must be available in the required number and length.
- TCP/IP network protocol has to be implemented.

Power supply

- At least 1 230V~ power outlet per IP phone must be available if no inline power switches (PoE) are provided for remote supply.
- +PoE-capable switches must support Standard IEEE802.3af

Videoconference

Videoconference – general description

In order to be able to really use the surplus value of videoconferences, a few technical parameters need to be considered before implementation. The following demands describe the technical requirements which a data network shall meet in order to provide a guaranteed and optimal videoconference service.

Videoconference transmission is a very sensitive and time-critical application. In order to be able to operate such applications at their best, it is necessary to implement “Quality of Service” (QoS) in the data network.

High quality of service shall be ensured over all facilities up to the individual end user (end to end QoS). That enables to prioritize critical services vis-à-vis less important services, in order to guarantee an optimal audio/video quality.

It is therefore important to analyse in detail transmission ways with too long delays and to remove their cause.

Jitter (delay variation) basically exists with every transmission and is compensated by the balance buffers (“jitter buffers”) on the terminals. If the jitter peak values are exceeded (dependent on the terminals), this has a negative effect on the audio/video quality.

Bottlenecks of the data bandwidth in the LAN/WAN area shall be furnished with appropriate “Quality of Service” (QoS) measures in order to guarantee a faultless voice quality.

How can I find out whether my existing data network is suitable for videoconference?

CANCOM offers you the possibility to determine the videoconference suitability of your existing data network.

- By means of the undermentioned „Requirements for the successful implementation of videoconference solutions“, you can determine the suitability of your data network by your own network-specialists and you undertake to properly provide the data network before implementation. Possibly necessary additional services due to requirements not met before implementation shall be charged at actual expenses on material and work time on the basis of confirmed performance records (material- and hour evidence).
- You choose the service package „Videoconference Readiness Check“ and network specialists of CANCOM will examine your network with regard to the suitability. The result of the “Videoconference Readiness Check” is a (simple) statement whether your existing network suitable or not. (Details see in chapter “Video conference Readiness Check”).

Requirements for a successful implementation of videoconference solutions

The exact bandwidth may be deduced from the factors „Definition, frame rate & call rate“ below. As a rule the following may be assumed:

Optimal Definition Profile: Setting Normal

This setting for videoconference solutions is adopted in typical office rooms where lighting is average.

Optimal Definition Profile: Setting Medium

This setting is adopted for videoconference solutions in well illuminated meeting rooms and saves on average 25% of the bandwidth which is required with the setting Normal.

Optimal Definition Profile: Setting High

This setting for videoconference solutions is adopted in meeting rooms especially designed (optimal lighting conditions) for video meetings and saves on average 50% of the bandwidth which is required with the setting Normal.

Typical resolutions used for different optimal definition profiles, call rates and frame rates								
Frame rate	Optimal Definition Profile	Call rate						
		256 kbps	768 kbps	1152 kbps	1472 kbps	2560 kbps	4 Mbps	6 Mbps
30 fps	Normal	512×288	1024×576	1280×720	1280×720	1920×1080	1920×1080	1920×1080
	Medium	640×360	1280×720	1280×720	1280×720	1920×1080	1920×1080	1920×1080
	High	768×448	1280×720	1280×720	1920×1080	1920×1080	1920×1080	1920×1080
60 fps	Normal	256×144	512×288	768×448	1024×576	1280×720	1280×720	1920×1080
	Medium	256×144	768×448	1024×576	1024×576	1280×720	1920×1080	1920×1080
	High	512×288	1024×576	1280×720	1280×720	1920×1080	1920×1080	1920×1080

Network requirements LAN

Adherence to maximum values of transmission criteria.

Within the network broadcast messages must be limited „locally“ by virtual networks (VLANs) in order to prevent a so-called “flooding” in the net (i.e. no disturbance of voice/video transmission by unnecessarily numerous routine messages). Inter VLAN routing between Voice/Video VLAN and Data VLAN for the management and possibly for CTI control must however be guaranteed. This Inter VLAN-connection may either be provided for by existing WAN routers or by a Core Switch (layer 2 AND layer 3).

A further requirement is the working and cross-linked LAN cabling/infrastructure:

- Network pins and IP-addresses must be given in the required number.

Requirements for the LAN-Switch

- Ethernet : IEEE 802.3 (CSMA/CD)
- QoS performance requirements
- IEEE802.1q (VLAN cut-off of broadcast domains)
- IEEE802.1p (layer 2 prioritization)

Network requirements WAN

WAN may not exceed the peak values of the transmission criteria (end-to-end delay, jitter, packet loss), in order to facilitate a sufficient voice quality according to Standard G.107 (definition of voice quality). Therefore appropriate QoS measures shall be implemented in the network.

The data network shall be dimensioned pursuant to the necessary minimum data bandwidth, relating to the number of the videoconferences to be transmitted simultaneously.

Requirements for cross-linked sites

A transparent IP connection between the sites is generally required.

Note:

- Firewall: NAT and PAT are not supported
- Routing protocol: „Packet- Loadsharing“ is not supported

Videoconference Readiness Check

Why “Videoconference Readiness Check”?

Not every data network is suitable for a video transmission. A high quality video communication requires a specifically prepared data network!

Whether your data network is suitable for video transmission may be determined by the „Videoconference Readiness Check“ by CANCOM. With this test it is not necessary to transmit special and confidential information to CANCOM via the network.

CANCOM needs the customer’s support with the performance of this test (e.g. availability of checkpoints, Ethernet ports, IP-addresses, preliminary installation of the test software). You will receive a detailed description of the necessary preparations after ordering.

The result of the „Videoconference Readiness Check“ constitutes a basic statement whether your existing network is suitable or not.

Scope of service „Videoconference Readiness Check“

This innovative service helps to evaluate the voice/video quality resp. the quality of service mechanisms within an existing network.

We examine your data network in all areas of quality (QoS) and especially pay attention to the following parameters:

- Bandwidth
- Jitter
- Packet loss
- Delay

Result of the Videoconference Readiness Check

- Clarification of technical issues by means of the „Checklist“ provided by CANCOM
- Determination of the audio/video suitability of your data network (statement: YES / NO)
- Protocolary illustration: Result/analyses/documentation

Videoconference - Room requirements

The following room requirements must be given for a faultless operation of the video-conference resolution.

- optimal room size per video solution between 10 and 25m²
- table position & chair position must be chosen suitable for a life-size display
- the room may not reverberate, great importance needs to be attached to appropriate acoustics and the necessary adaptations
- no bright light in camera direction
- neutral background (no pure white) which is looked at through the camera by the counterpart including e.g. location statement and company logo
- no windows in the background
- no door in the background
- camera position with 2 monitors must either be between these two or slightly above them
- monitors should be at table level

Microsoft Lync requirements for the implementation (provision by the customer)

Network requirements General

Beside the bandwidth also other factors of the network such as e.g., latency, jitter or packet loss are decisive for the quality of the transmitted voice. These values can be scaled in a network (e.g., with a “VoIP Readiness Check”).

Details under: <http://technet.microsoft.com/en-us/library/gg425841.aspx>

Quality of Service (QoS)

No QoS mechanisms are required by Microsoft for the use within the LAN. With WAN connections, especially if bandwidths are short, it is necessary to implement QoS. The Microsoft Lync server therefore supports DiffServ. Voice- (Expedited Forwarding) and video packages (class 3) are then treated with preference appropriately. With regard to the VPN-connections it is important in this context to consider the priority between standard internet traffic and the VPN-tunnel.

Details under: <http://technet.microsoft.com/en-us/library/gg405409.aspx>

Bandwidths and network requirements for voice, video and application sharing

Below are listed the bandwidth areas per communication and communication type. For a stable operation these have to be made available by Lync in the network.

Details under: <http://technet.microsoft.com/en-us/library/jj688118.aspx>

Bandwidths Voice

The Lync server by default applies a specific “RTAudio” codec for Lync-to-Lync calls which behaves differently according to the quality of the line connection and which accordingly requires variable bandwidths. Additionally also other codecs are employed as illustrated in the following table.

Audio codec	Scenarios	Audio payload bitrate (KBPS)	Bandwidth audio payload and IP header only (Kbps)	Bandwidth audio payload, IP header, UDP, RTP and SRTP (Kbps)	Bandwidth audio payload, IP header, UDP, RTP, SRTP and forward error correction (Kbps)
RTAudio Wideband	Peer-to-peer	29.0	45.0	57.0	86.0
RTAudio Narrowband	Peer-to-peer, PSTN	11.Aug	27.Aug	39.8	51.6
G.722	Conferencing	64.0	80.0	95.6	159.6
G.722 Stereo	Peer-to-peer, Conferencing	128.0	144.0	159.6	223.6
G.711	PSTN	64.0	80.0	92.0	156.0
Siren	Conferencing	16.0	32.0	47.6	63.6

Bandwidths video

A separate codec is equally being applied by the Lync in the video area. Compression of the data is again dependent on the available bandwidth.

Video codec	Resolution and aspect ratio	Maximum video payload bitrate (Kbps)	Minimum video payload bitrate (Kbps)
H.264	320x180 (16:9) 212x160 (4:3)	250	15
H.264/RTVideo	424x240 (16:9)) 320x240 (4:3)	350	100
H.264	480x270 (16:9) 424x320 (4:3)	450	200
H.264/RTVideo	640x360 (16:9) 640x480 (4:3)	800	300
H.264	848x480 (16:9)	1500	400
H.264	960x540 (16:9)	2000	500
H.264/RTVideo	1280x720 (16:9)	2500	700
H.264	1920x1080 (16:9)	4000	1500

H.264/RTVideo	960x144 (20:3)	500	15
H.264	1280x192 (20:3)	1000	250
H.264	1920x288 (20:3)	2000	500

Bandwidths Application Sharing

Modality	Average bandwidth (Kbps)	Maximum bandwidth (Kbps)
Application sharing using Remote Desktop Protocol (RDP)	434 Kbps sent per sharer	938 Kbps sent per sharer
Application sharing using Compatibility Conferencing service	713 Kbps sent per sharer 552 Kbps received per viewer	566 Kbps sent per sharer 730 Kbps received per sharer

Server Hardware

Recommended Hardware for Front End Servers, Back End Servers, Standard Edition Servers, and Persistent Chat Store and Persistent Chat Compliance Store (Back End Server Roles for Persistent Chat Server)

Hardware component	Recommended
CPU	64-bit dual processor, hex-core, 2.26 gigahertz (GHz) or higher Intel Itanium processors are not supported for Lync Server server roles.
Memory	32 Gigabytes (GB)
Disk	<ul style="list-style-type: none"> <input type="checkbox"/> 8 or more 10,000 RPM hard disk drives with at least 72 GB free disk space. Two of the disks should use RAID 1, and six should use RAID 10. - OR - <input type="checkbox"/> Solid state drives (SSDs) which provide performance similar to 8 10,000-RPM mechanical disk drives.
Network	<ul style="list-style-type: none"> <input type="checkbox"/> 1 dual-port network adapter, 1 Gbps or higher (2 recommended, which requires teaming with a single MAC address and single IP address)

Recommended Hardware for Edge Servers, Standalone Mediation Servers and Directors

Hardware component	Recommended
CPU	<ul style="list-style-type: none"> <input type="checkbox"/> 64-bit dual processor, quad-core, 2.0 gigahertz (GHz) or higher - <input type="checkbox"/> 64-bit 4-way processor, dual-core, 2.0 GHz or higher Intel Itanium processors are not supported for Lync Server server roles.
Memory	16 Gigabytes (GB)
Disk	<ul style="list-style-type: none"> <input type="checkbox"/> 4 or more 10,000 RPM hard disk drives with at least 72 GB free disk space The disks should be in a 2x RAID 1 configuration. - OR - <input type="checkbox"/> Solid state drives (SSDs) which provide performance similar to 4 10,000-RPM mechanical disk drives.
Network	<ul style="list-style-type: none"> <input type="checkbox"/> 1 dual-port network adapter, 1 Gbps or higher (2 recommended, which requires teaming with a single MAC address and single IP address). 2 network interfaces are required on Edge Servers.

Details under: <http://technet.microsoft.com/en-us/library/gg398835.aspx>

Virtualization

Lync server 2013 supports the Hyper-V platform as well as virtualization environments which are supported by the Windows server virtualization validation program.

Component	Recommendation
Server	Enterprise-grade server, with a minimum of two CPU sockets
CPU	Enterprise-class CPU which can support at least 24 virtual cores.
Network adapter	Two or more 1GbE or 10 GbE adapters. For best performance, we recommend using Windows Server 2012 R2 on a host server that supports Single Root I/O Virtualization (SR-IOV).
Storage	Two or more serial advanced technology attachment (SATA) or serial attached SCSI (SAS) hard disk drive, 10k rpm or higher direct attach storage (DAS), or equivalent storage. RAID 1 or equivalent SSD.
Memory	<u>At least 32 GB. Each host server should have 4 GB for the host, as well as enough memory to support each virtual server it will run, according to the amount of memory required by each server role as listed in Server Hardware Platforms.</u>

Operating system

The performance on virtualized servers requires Windows Server 2012 or Windows Server 2008 R2.

Details under: <http://technet.microsoft.com/en-us/library/gg412883.aspx>

Active Directory

All domains in which Lync Server is being provided, shall be upgraded to a domain function level of Windows Server 2012, Windows Server 2008 R2, Windows Server 2008 or at least Windows Server 2003.

The overall structure in which the Lync Server is being allocated, shall be upgraded to an overall structure function level of Windows Server 2012, Windows Server 2008 R2, Windows Server 2008 or at least Windows Server 2003.

In each domain in which Lync Server-computers or –users are being allocated, a global catalogue has been prepared.

Certificates

Lync Server 2013 requires a Public Key Infrastructure (PKI) for the support of TLS- (Transport Layer Security) and MTLs-connections (Mutual TLS). External certificates are required for Edge-servers and for the Reverse Proxy.

Details see: <http://technet.microsoft.com/de-de/library/gg398066.aspx>

DNS and Loadbalancer

For the allocation of the Lync server you have to establish DNS-inputs (Domain Name System) which allow the determination of clients and servers and which support the automatic client registration.

Details see: <http://technet.microsoft.com/de-DE/library/gg398386.aspx>

For High Availability Deployments a hardware-loadbalancer is required additionally.

Details see: <http://technet.microsoft.com/en-us/library/gg615011.aspx>

Firewall

Lync requires appropriate Firewall-Port clearings.

Details under: <http://technet.microsoft.com/en-us/library/gg398798.aspx>

Microsoft Exchange

Lync supports a series of features in connection with Microsoft Exchange.

Details under: <http://technet.microsoft.com/en-us/library/jj688094.aspx>

Client

Recommended Hardware for Lync 2013 and the Online-conference-Add-In for Lync 2013

System component	Mindestanforderung Minimum requirement
Computer/Processor	Intel Pentium 4, AMD Athlon 64 or equivalent
User memory	2 GB RAM
Data and VoIP	Processor with at least 1,6 GHz. Recommended are 2,0 GHz (32 Bit or 64 Bit).
Video	<u>Further information is available under video requirements for Lync Client</u>
Display Definition	1024 x 768 required
Graphics hardware	<ul style="list-style-type: none"> <input type="checkbox"/> Support for Microsoft DirectX 9-API <input type="checkbox"/> 128 MB Graphics memory (minimum) Recommended are 256 MB Graphics memory <input type="checkbox"/> WDDM-Drivers (Windows Display Driver Model) <input type="checkbox"/> Pixel Shader 2.0-Hardware <input type="checkbox"/> 32 Bit per Pixel
Voice	<p>Microphone and loudspeaker, Headset with microphone or comparable equipment. Recommended equipment:</p> <p><u>Phones with the Logo "Optimized for Microsoft Lync"</u> <u>(under http://go.microsoft.com/fwlink/?linkid=208938&clcid=0x407 you will find a list with phones and equipment which are suitable for Microsoft Lync)</u></p> <ul style="list-style-type: none"> <input type="checkbox"/> Phones which Lync Phone Edition is performed on
Video source	USB 2.0-Videocamera or Polycom CX5000 HD-Device (RoundTable-Device)

2013 Software demands for Lync 2013 and the Online-conference Add-In for Lync 2013

System component	Mindestanforderung Minimum requirement
Windows-Operating system	Windows 8 Windows 7-operating system Windows Server 2008 R2 including latest Service Pack
Installation and Updates	Administrator rights and -authorizations
Browser	Windows Internet Explorer 10-Internetbrowser Windows Internet Explorer 9-Internetbrowser Windows Internet Explorer 8-Internetbrowser Windows Internet Explorer 7-Internetbrowser Webbrowser Mozilla Firefox
Microsoft Office-Integration	All integration functions: <ul style="list-style-type: none"> <input type="checkbox"/> Outlook 2013-Client for Messaging and Cooperation <input type="checkbox"/> Outlook 2010-Client for Messaging and Cooperation
Microsoft Exchange-Integration	All integration functions: <ul style="list-style-type: none"> <input type="checkbox"/> Microsoft Exchange Server 2013 <input type="checkbox"/> Microsoft Exchange Server 2010

Requirements and preparation works for performance of telecommunication facilities

The stated installation and start-up costs shall apply subject to the fact that all works may be performed by the CANCOM customer service during normal working hours and without interruption.

All necessary additional services caused by performance interruptions on the side of the customer (e.g. shutdown of power supply, structural impediments by other professionals, incomplete requirements or preparation works for start-up and installation or such not met in time before installation start), or services not included in the service specifications, shall be charged according to actual expenses on material and work time on the basis of confirmed performance records (material and hour evidence).

An appropriate, lockable room shall be made available for delivery and storage of the telecommunication system and the system components. In case of unsuccessful delivery attempts caused by the principal, every repeated delivery attempt shall be with costs.

New registrations resp. notifications of a change for line accesses with the respective provider shall be made by the principal. Deadline coordination with the providers for the start-up of the telecommunication system shall be made by CANCOM. CANCOM shall however not be liable for the observance of deadlines by the providers.

In order to be able to guarantee a professional installation and start-up in due time without additional cost- and time expenses, we ask you to observe the following requirements and to have the appropriate items below accomplished on time.

Compatibility

The components/systems subject to the offer may be applied with existing systems or migrated to following technologies insofar as this is possible on the basis of the product

policy of the respective producer (e.g. up- and downward compatibility of products or product lines, mutual support of products or product lines). We explicitly point out that CANCOM has not executed an inspection with regard to possible compatibility problems and that therefore no compatibility commitment is given by CANCOM. Possible additional costs for migrations which may be required due to the product policy of a producer shall therefore not be part of the offer and shall not be borne by CANCOM.

Programming of the basic functions and the internal phone numbers

The programming of the basic functions of the telecommunication system and the internal phone numbers (direct dial numbers) shall be performed using the completely filled-in data collection list provided by the principal 1 week before installation start at the latest. The template for the data collection list is provided by CANCOM.

Recording of the central quick dialling targets

The recording of the central quick dialling targets shall be performed once-only using the Excel-file provided by the principal 1 week before installation start at the latest.

Recording of „Text before Answering“ and „Music on Hold“

The recording of acoustic information (e.g. „Text before answering“, „Music on Hold“) shall be performed once-only using the sound carriers (MP3 resp. WAV file or Audio-CD) provided by the principal as per installation start. Other sound carriers shall require a separate agreement.

Setting up of the required line system

The required piping- and structural system, the required wiring system, the main distributor as well as possibly necessary intermediate distribution frames and the (switch) outlets for the terminals shall not be subject of this offer, but shall be established resp. adapted by the customer according to the technical requirements of the telecommunication system resp. according to applicable rules and technically acknowledged standards (amongst others overvoltage protection, grounding, maximum pipeline lengths).

- The wiring of all workplaces with terminals (digital and analogue telephone sets, cordless phones, fax machines, answering machines, modem, cordless sender etc.) up to the system control center must be given and interconnected (CAT5 cable resp. Twisted Pair cable 2x2x0,5 resp 4x0,5).
- All outlets (preferably RJ45 system) for the terminals must be installed, connected and labelled in conformity with the distributor inscription.
- With regard to structured wiring the patch fields as well as the patch cables shall be made available for all analogue and digital subscriber terminals fully installed, connected by wire and labelled.

- Lan cabling: network access / one IP-address per control center, TCP/IP network protocol.
- A fully executed cable- and distributor plan shall be available before installation start.
- A dust-free room shall be provided for the system control center (temperature: +5°C up to +40°C, atmospheric moisture: 5% up to 85%). A triple outlet (230V~), secured by a separate current circuit as well as a non-fused earthing (16 mm²-ground wire connected directly with the potentiality equalizing bar) according to the ÖVE-Rules (Austrian Association for electrical Engineering) must be given with the customer.

Any and all stated works need to be completed by the agreed installation start at the latest. Possibly necessary additional services of the contractor caused by incomplete or unprofessional performance (amongst others according to applicable rules and acknowledged technical standards for amongst others overvoltage protection, grounding, maximum line pipeline lengths), shall be charged according to actual expenses on material and work time on the basis of confirmed performance records (material- and hour evidence).

System dimensions All-over-IP communication system:

System	Small / Medium	Small / Medium Rack installation	Business
Height	360 mm	65 mm	85 mm
Width	294 mm	483 mm	481 mm
Depth	65 mm	294 mm	380 mm
Weight*	2,4 kg	2,5 kg	6,9 kg

Indication of weight without net cable, extension cards, packaging

Application of VoIP

In order to be able to provide an impeccable functionality and high voice quality, a LAN/WAN network adapted properly for VoIP is required. You will find the technical requirements in the chapter “Requirements for a successful implementation of VoIP”.

We recommend the „VoIP Readiness Check“ described in the chapter above in order to ensure whether the requirements for the network are actually met in practice.

Network requirements which are not met lead to additional expenses for problem analysis and ex post establishment of the respective requirements with the implementation of VoIP. These additional expenses shall be invoiced according to actual expenses.

If power outlets are needed for the operation of VoIP terminals, these must be given before installation of the terminals (not the case with Power over Ethernet). With the use of the VoIP instruments-switches for the power-on of the PCs attention shall be paid to the fact that the LAN cables are easily accessible.

Remote maintenance access with SIP provider connection

In order to be able to guarantee remote maintenance of your Unified Communications system (hard- and software) and to foreground the security concerns of your company, the remote maintenance access should ideally be performed via your IP-network per VPN Client.

An unrestricted access to all system components via the VPN Client shall be guaranteed to enable our technical staff to perform remote maintenance of these for maintenance- and repair purposes.

The VPN access must be possible without Token and individual authentication, but the access may only allow an approach to your network from the CANCOM address area 194.187.92.0/25. CANCOM guarantees by the secured remote maintenance that only authorized users (customer service technicians) gain access to the remotely maintained system components (hard- and software).

We ask you to transfer to us the respective VPN Client software as well as the respective configuration file resp. to hand it over to our customer service technician who puts into operation the Unified Communications systems (hard- and software).

If remote maintenance access is not possible via VPN access, our customer service technician must be allowed access to a computer within your network which is always online. It has to be possible for our customer service technician to reach all system components for maintenance- and repair purposes from this specific computer with the appropriate remote maintenance tools. Furthermore it shall be allowed to CANCOM to install the remote maintenance tools on this specific computer.

Connection of alternative service providers to the telecommunication system

The connection of alternative providers (in lieu of or additionally to Telekom Austria) shall require written form.

In this context we state the following:

- The connection to alternative providers shall be established up to a clear mechanical and/or electrical interface (KE-, NT-, DEG-interface).
- An impeccable functionality of charge metering resp. of least cost routing is only guaranteed if the provider delivers these functions in the same quality and according to the same standard as TA (Telekom Austria).
- If the provider changes fee- and/or time zones, a respective re-programming of the telecommunication system is required. CANCOM shall be commissioned with such re-programming separately.

- In some cases the connection of a provider will require a modification of hard- resp. software within the telecommunication system resp. in the call data processing. A re-programming of call data processing from pulse recording to time recording will require a larger expense of time.
- The principal undertakes to procure with the provider all relevant data and to transfer them to CANCOM. These are: dial chart, connection type, dial procedure and type of fee information.

All additional expenses necessary with the connection of alternative providers (system adaptations, system programmings, adaptations of hard- and software, changes of call data recording, etc.) shall be charged according to actual expenses on material and work time on the basis of confirmed performance records (material and hour evidence).

Connection of ISDN GSM-gateways to the telecommunication system

Before start-up the following measures shall without fail be taken by the principal in case of connection of an ISDN GSM-gateway to the telecommunication system:

- Determination of the site for optimal reception (this may be read off the field stress display of any GSM-mobile phone).
- On site a 230V-outlet must exist for each GSM- gateway module.
- A two-part screened line shall be established from the system center to the location of each GSM-gateway module. For the purpose of synchronisation an additional two-part screened line shall be established between network terminator of the provider (NT) and each GSM-gateway module. If several GSM-gateway modules are activated, the synchronisation line may be continued from module to module. All facilities dispose of a RJ45 loading system.
- The location for the GSM-gateway modules shall for radio-communication reasons be chosen in the way that a minimum space of 3m is maintained between the individual modules as well as to the telephone center and the next telephone set.
- (A) SIM-card(s) issued by the network provider must exist and be fully functional, in particular:
 - the SIM-card must be cleared by the provider
 - all kinds of call diversions as well as the mailbox function must be deactivated

We point out that the use of GSM-gateways is often contractually prohibited by the providers. We cannot preclude that your provider contract may equally provide such an exclusion of the use of GSM-gateways. We therefore recommend examining your provider contracts as to whether you are entitled to use GSM-gateways. Please refer to your provider for more information.

Start-up and implementation of server-client applications

With regard to server-client applications the implementation shall cover installation and the functionality test on the server of the application software included in the scope of delivery and performance as well as the installation and functionality test of the application software on a client (reference-client). The implementation of application software on further clients, according to the software licenses granted in the scope of delivery and performance, shall be made by the network adviser of the principal. If the principal wishes an installation of software applications on more clients to be performed by the customer service of CANCOM, this shall require a separate agreement. Necessary work time for this installation shall be invoiced on the basis of confirmed performance records.

Configuration of the communication system

The system shall be configured once by the customer service technician in accordance with the data disclosed by the principal and the functions agreed in the scope of delivery and performance. Later configuration modifications shall be invoiced according to actual expenses on material and work time on the basis of confirmed performance records (material and hour evidence).

The labelling of the devices is performed with the standard functions. Individual inscriptions shall be optional or shall be performed by the customer.

Connection of the telecommunication system to EDP-facilities

With regard to the connection of the telecommunication system to data processing facilities the implementation of the applications shall be made by the CANCOM customer service exclusively together with an employee of the principal authorized by the principal and closely familiar with the configuration and handling of the data processing facilities (administrator or network adviser).

Before implementation of the applications the principal undertakes to establish the requirements specified by CANCOM as well as a ready-to-operate EDP-system in accordance with the hard- and software requirements stated in the offer or in the attached data sheets.

Appropriate measures for safety and restoration of the data shall be taken by the principal before each service performance.

The connection of the telecommunication system to transmission facilities resp. communication systems not delivered by CANCOM (e.g. LAN, Router) shall be made according to current standards. Expenses for the performance of configuration works in the course of possible compatibility problems resp. additional functionality tests due to that shall be invoiced to the principal according to actual expenses on material and work time.

Expenses for performance interruptions caused by the customer shall be invoiced by the contractor separately. (e.g. power shut-off, structural impediments by other professionals).

Viruses / Trojans / Worms on application servers/ Hackers

Any application server may be attacked!

Due to the fact that our customers usually already dispose of anti-virus solutions instituted in the company, it is within their responsibility to install and also to maintain anti-virus software on the application servers.

Because our applications partly make high demands on the respective system resources we ask for your understanding that we cannot test every anti-virus software in joint operation with the respective application and recommend a defined product per application.

CANCOM disposes of an extensive portfolio of scalable solutions in the area of security and anti virus and will be pleased to advise you on appropriate protection measures.

If other security/anti-virus solutions are installed on the application servers, we cannot guarantee safe operation.

Telecommunication systems may be targets of criminals (hackers) in the same way as EDP-systems, particularly if the function "transit traffic" is activated (office-office connection), VoIP telephony, the service feature DISA (Direct Inward System Access), the power-on of voice-mail systems and GSM-gateways as well as the operation of the system within a telecommunication system network.

It has already happened and may happen again that these persons enter the telecommunication system over existing voice gateways or the internet and thereby cause damages (e.g. unlawfully make phone calls at the expense of the plant operator). The degree of damage caused for your company may be considerable already within a short period of time.

The only possibility to prevent such harassments to a maximum is to deactivate the functions mentioned above, to change passwords regularly and to always operate all telecommunication components behind a firewall and to configure this firewall appropriately safe. Of course there are security solutions which make attacks difficult, but they cannot entirely exclude them. If you still want to operate these functions, clearing shall be made at your own risk.

The program „SamWin“, delivered by us, as of version 4.x disposes of the possibilities of charge metering and will trigger an alarm if the fee threshold is exceeded. As a matter of form, we however wish to point out that these programs may be bypassed at any time. If though you wish to get an all-over charge-metering, this may only be realised by your telecommunication provider who records all calls.

We advise you to contact your telecommunication provider in order to clarify with him how and under which circumstances he will inform you on a supposed misuse.

Additional information is available for you under <https://www.cancom.at/it-security>.

Call data recording

The charge metering offered optionally may only record the incurred fees by approximation. With regard to a reimbursement of fees CANCOM shall not be liable for a possible loss of profit.