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Technical Report

Corporate Networks (NGCN);
Next Generation Corporate Networks (NGCN) - General

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Foreword

This Technical Report (TR) has been produced by ECMA on behalf of its members and those of the European Telecommunications Standards Institute (ETSI).

Introduction

The present document is the first of a series of Ecma publications that explore IP-based enterprise communication involving Corporate telecommunication Networks (CNs) (also known as enterprise networks) and in particular Next Generation Corporate Networks (NGCN). The series particularly focuses on inter-domain communication, including communication between parts of the same enterprise, between enterprises and between enterprises and carriers. The present provides general information on the subject, defines some architectural concepts, identifies various communication scenarios, and provides a framework in support of other publications that provide greater detail on particular topics.

The present document is based upon the practical experience of Ecma member companies and the results of their active and continuous participation in the work of ISO/IEC JTC1, ITU-T, ETSI, IETF and other international and national standardization bodies. It represents a pragmatic and widely based consensus. In particular, Ecma acknowledges valuable input from experts in ETSI TISPAN.

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1 Scope

The present document is part of a series of publications that provides an overview of IP-based enterprise communication involving Corporate telecommunication Networks (CNs) (also known as enterprise networks) and in particular Next Generation Corporate Networks (NGCN). The series particularly focuses on session level communication based on the Session Initiation Protocol (SIP) [i.6], with an emphasis on inter-domain communication. This includes communication between parts of the same enterprise (on dedicated infrastructures and/or hosted), between enterprises and between enterprises and public networks. Key technical issues are investigated, current standardization work and gaps in this area are identified and a number of requirements are stated.

The present document provides general information on the subject, defines some architectural concepts, identifies various communication scenarios, and provides a framework in support of other publications that provide greater detail on particular topics. At the time of publication of the present document, one further document in the series has been published, on the subject of identification and routing [i.3].

The scope of the present document is limited to communications with a real-time element, including voice, video, real-time text and instant messaging.

Further details on mobility in an NGCN environment are to be found in ECMA TR/92 [i.2].

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific.

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2.1 Normative references

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2.2 Informative references

The following referenced documents are not essential to the use of the present document but they assist the user with regard to a particular subject area. For non-specific references, the latest version of the referenced document (including any amendments) applies.

[i.1] ECMA-269: "Services for Computer Supported Telecommunications Applications (CSTA) Phase III".

[i.2] ECMA TR/92: "Corporate Telecommunication Networks - Mobility for Enterprise Communication".

[i.3] ECMA TR/96: "Next Generation Corporate Networks (NGCN) - Identification and Routing".

[i.4] ITU-T Recommendation H.248: "Gateway control protocol".

[i.5] ITU-T Recommendation H.323: "Packet-based multimedia communications systems".

[i.6] IETF RFC 3261: "SIP: Session Initiation Protocol".

[i.7] IETF RFC 3550: "RTP: A Transport Protocol for Real-Time Applications".

[i.8] IETF RFC 4566: "SDP: Session Description Protocol".

[i.9] SIP Forum sf-adopted-twg-IP-PBX-SP-Interop-sibley-sipconnect: "IP-PBX / Service Provider Interoperability - SIPConnect 1.0 Technical Recommendation".

[i.10] ETSI EG 201 017: "Corporate Telecommunication Networks (CN); Standardization plan".

[i.11] ETSI TR 180 000: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); NGN Terminology".

[i.12] IEEE 802.1x: "Port Based Network Access Control".

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3 Definitions

For the purposes of the present document the following definitions apply:

3.1 Corporate telecommunication Network (CN) (EG 201 017)

Telecommunication network serving a corporation, i.e. a single organization, an extended enterprise, or an industry application group as defined by the International Chamber of Commerce (ICC).

NOTE: Sets of equipment [Customer Premises Equipment (CPE) and/or Customer Premises Networks (CPN)] are typically located at geographically dispersed locations and are interconnected to provide networking services to a defined group of users. A CN can employ connection-oriented and connectionless technology.

3.2 Domain

Session level capabilities within a single administrative area.

NOTE: A domain may or may not correspond to a DNS domain.

3.3 Enterprise network

A CN comprising session level capabilities and optionally application layer capabilities hosted on one or more infrastructures.

NOTE: Infrastructures can include the enterprise's own infrastructure (dedicated NGCN), the infrastructure of one or more hosting NGNs, the infrastructure of one or more hosting NGCNs or any combination of these.

3.4 Home server

For a given user, as identified by a SIP address of record, the SIP intermediary that contains registrar and proxy functionality in support of that user.

NOTE: It is therefore the SIP intermediary with which the user's UAs register.

3.5 Transport service provider (TSP)

A business or organization separate from an enterprise that provides services for transporting data based on the use of IP at the network layer, thereby allowing the enterprise to communicate with entities outside the enterprise or with geographically dispersed parts of the enterprise.

NOTE 1: Communication can but need not be via the public Internet.

NOTE 2: A TSP should not intervene above the transport layer. This does not preclude a business or organization that acts as a TSP also acting as the provider of higher level services, e.g. as an SSP.

3.6 Medium

A given type of payload transported between session users (e.g. audio, video, text), separate from any signalling used for session establishment.

3.7 Next Generation CN (NGCN)

That part of an enterprise network that is not based on public network infrastructure, that is designed to take advantage of emerging IP-based communications solutions and that can have its own applications and service provisioning.

NOTE: An NGCN can be an entire enterprise network if none of that network is based on public network infrastructure.

3.8 Next Generation Network (NGN)

The definition in [i.11] applies.

NOTE: This defines an NGN as follows: "A Next Generation Network is a packet-based network able to provide services including Telecommunication Services and able to make use of multiple broadband, QoS-enabled transport technologies and in which service-related functions are independent from underlying transport-related technologies. It offers unrestricted access by users to different service providers. It supports generalized mobility which will allow consistent and ubiquitous provision of services to users." It also goes on to list some fundamental aspects that characterize NGN.

3.9 Private network traffic

Signalling for session level communications that is handled according to rules specific to an enterprise network.

3.10 Public network traffic

Signalling for session level communications that is handled according to rules for public networks.

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3.11 Roaming

The use of session capabilities of a visited domain to allow a user to access session level services at his home domain.

NOTE 1: This usually requires a roaming agreement between the operators of the domains concerned.

NOTE 2: This definition of roaming reflects the concept of roaming as found in mobile telephone networks, for example. It does not encompass certain other common uses of the term, e.g. concerning transport service provision.

3.12 Roaming hub

A network or other entity with which an enterprise domain has a roaming agreement, allowing enterprise users to visit other domains that have a roaming agreement with the roaming hub but not directly with the enterprise domain.

3.13 Session service provider (SSP)

A business or organization separate from an enterprise that provides communication capabilities at the session layer using SIP and thereby allows the enterprise to communicate using SIP with entities outside the enterprise or with geographically dispersed parts of the enterprise.

3.14 SIP intermediary

Any intermediate entity involved either actively or passively in SIP signalling between two UAs, including but not limited to proxies, Back-to-Back User Agents (B2BUAs), Application Layer Gateways (ALGs) and Session Border Controllers (SBCs).

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4 Abbreviations

ALG	Application Layer Gateway
B2BUA	Back-to-Back User Agent
CN	Corporate telecommunication Network
DNS	Domain Name System
IP	Internet Protocol
IPPBX	IP Private Branch eXchange
IPSEC	Internet Protocol Security
ISDN	Integrated Services Digital Network
LAN	Local Area Network
NAT	Network Address Translator
NGCN	Next Generation Corporate Network
NGN	Next Generation Network
PNP	Private Numbering Plan
PSTN	Public Switched Telephone Network
QoS	Quality of Service
RTP	Real Time Protocol
SBC	Session Border Controller
SDP	Session Description Protocol
SIP	Session Initiation Protocol
SRTP	Secure Real Time Protocol
SSP	Session Service Provider
TLS	Transport Layer Security
TSP	Transport Service Provider
UA	User Agent
UAC	User Agent Client
UAS	User Agent Server
URI	Universal Resource Identifier
VPN	Virtual Private Network

WAN	Wide Area Network

5 Background

Many enterprises and other organizations require their own telecommunications capabilities to support their own internal communications as well as supporting communications with the outside world. This avoids incurring unnecessary charges and provides added value in terms of services and features available, integration with other enterprise applications, etc. These capabilities are provided through enterprise telecommunication networks (or corporate telecommunication networks, CN, or simply enterprise networks). Many administrations do not apply the same licensing conditions or regulation to enterprise networks and their internal traffic as they do to public networks and their public network traffic. Many public networks also offer optional services to corporate customers, such as hosted (Centrex) services and the leasing and maintenance of customer premises equipment.

There has been a major evolution in enterprise telecommunications during the last few years. Prior to that, enterprise network were based on 64 kbit/s circuit-switched technology, which had synergy with corresponding technology deployed in public Integrated Services Digital Networks (ISDN) and traditional analogue services. Those enterprise networks primarily delivered a voice or telephony service to their users, although in principle they were capable of other services too, including video and various types of data service. For communication outside the enterprise, enterprise networks were able to interwork with public ISDNs across standardized interfaces (at the T-Reference Point). The T reference point formed the demarcation point between standards and regulations applicable to public networks and standards and regulations applicable to enterprise networks and their PBXs.

With the advent of technologies for transmitting voice and other real-time media over the Internet Protocol (IP) (e.g. based on Real Time Protocol (RTP) [i.7]) and corresponding new signalling protocols (e.g. H.323 [i.5], the Session Initiation Protocol (SIP) [i.6]), there was potential for providing telephony and other real-time person-to-person services in the public Internet. Moreover, such services also became possible in the IP-based "intranets" already deployed in enterprises for data services such as corporate email, file transfer, corporate web services and access to the world wide web. Enterprises saw advantages such as savings on infrastructure costs (e.g. one wire to the desk) and the introduction of innovative services that exploited the convergence of real-time and data communication. The traditional PBX (Private Branch Exchange) was replaced by or evolved to an "IP-PBX" or "soft switch" that supported IP connectivity to the desktop and IP connectivity between nodes. Direct IP-based transmission of multimedia between endpoints meant that switching capabilities were no longer required, except gateways for interworking with "legacy" circuit-switched networks and media servers for conference bridging, announcements, etc. The "IP-PBX" or "soft switch" was just required to handle signalling.

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IP-based enterprise networks are continuing to evolve, to support additional services, improved security, improved Quality of Service (QoS), etc. Moreover, SIP has become the dominant signalling protocol. An enterprise network that fully embraces IP technology and uses SIP as the signalling protocol is referred to here as a Next Generation CN (NGCN). An NGCN could still contain some components that are not based on IP (e.g. traditional PISN components) or that use signalling other than SIP (e.g. H.323 [i.5], H.248 [i.4]), but it would also include SIP components and be able to interface externally using SIP.

Until recently, NGCNs generally fell back to legacy circuit-switched techniques for standardized communication outside the enterprise, e.g. using public ISDN or circuit-switching over leased lines. Gateways provided the necessary interworking of signalling and media. This was sometimes the case also for communication between different parts of the same enterprise.

We are now witnessing a period when NGCNs are extending IP-based communication externally by interfacing to public IP-based networks. This permits IP-based communication between:

- enterprise users supported by different NGCNs (i.e. different enterprises);
- enterprise users supported by different parts of the same NGCN at geographically dispersed locations (different sites);
- enterprise users supported by NGCN and users supported by hosted enterprise services provided on public network infrastructure;
- enterprise users supported by NGCNs and individual users of public networks (fixed or mobile); and
- enterprise users supported by an NGCN and users of legacy networks via a gateway outside the NGCN.

Enterprise users in this context includes users of terminals based on IP and SIP and also users of legacy terminals connected via gateways and other legacy equipment such as PBXs.

With this the NGCN no longer needs gateways to external legacy networks (except where required by existing investment or economic considerations) and can enjoy the benefits of end-to-end IP-based communication with appropriately equipped communication partners.

The public Internet is one example of a public IP-based network that an NGCN can use for external communications. This can be used for direct connection between two enterprises, between two parts of the same enterprise (e.g. between the main office and a branch or home office), or between an enterprise and a public telecommunications network. In addition, some public network providers are starting to offer public IP-based networks that offer improvements compared with the public Internet (e.g. in terms of QoS, security, mobility, applications, etc.) and are even basing their entire telephony capabilities (including emulation of the PSTN/ISDN) on IP-based technology. These value added public IP-based networks are collectively known as Next Generation Networks (NGN).

At present there are no defined standards for direct connection between enterprises. For connection between an enterprise and a public network, various public network providers are offering their own specifications, based on SIP, and there are some standardization activities, but these are at risk of being mutually incompatible. The present document analyses enterprise requirements for IP- and SIP-based interworking with other networks, with a view to influencing standardization and regulation. It also discusses communication between different parts of an enterprise, including parts supported by enterprise infrastructure and parts supported through hosting on other network infrastructures, including that of an NGN.

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6 General concepts

6.1 Basic communication architecture

Communication networks in general and NGCNs in particular can be viewed as providing capabilities at three levels, as shown in Figure 1:

- transport;
- session;
- application.

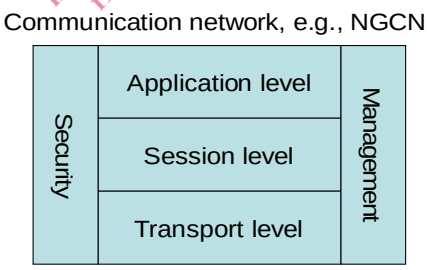

Figure 1: Basic communication architecture

Capabilities at the transport level provide basic IP connectivity between physical items of equipment, such as servers, PCs, phones, PDAs, etc., including connectivity to the outside world such as the public Internet and NGNs. This can be used to transport signalling, media and other data. IP connectivity can be based on IP version 4 or version 6 and can operate over different infrastructures (e.g. fixed or wireless, LAN or WAN) with different security mechanisms (e.g. IEEE 802.1x [i.12], WiFi security). Capabilities present at the transport level include but are not limited to routing, switching, firewall, network address translation (NAT), quality of service (QoS) provision, security, etc. Connectivity may be limited to enterprise employees or may be extended to guests.

The session level provides capabilities in support of user-to-user communication, generally with a real-time element. Communications can use a variety of media, including audio, video, real-time text, messaging, fax, etc., or a combination of these. Within an NGCN (and likewise within an NGN) SIP signalling is assumed for establishment of

communications. Users are not necessarily human users - in some cases automata (applications) can take the role of users.

For the purposes of the present document, the application level comprises applications that have some relevance to communication, as provided by the session level. This includes:

- applications that enhance communication capabilities in some way, e.g. advanced conferencing, presence;
- applications that use communication capabilities, e.g. a business process application that uses communication capabilities for communicating with customers, suppliers, partners, etc.

The present document focuses on the session level, but also includes some discussion on the application level. The transport level is mentioned only to the extent of how it impacts the session level, e.g. providing connectivity between session level entities, the impact of NATs and firewalls.

Each level has its own security and management considerations and capabilities. In addition, security and management have to be co-ordinated across all three levels, NGCN-wide.

The broad architectural framework described above can be realized in a number of ways. One example utilizes the IP Multimedia Subsystem (IMS) specified by 3GPP, in which case the IMS layer corresponds to the session level described above. The IMS layer runs on top of a transport layer and provides support to a service/applications layer. The IMS layer itself comprises a number of functional components and inter-relationships. The present document makes no assumptions regarding the use of IMS or any other architecture (beyond the framework described above and the session level architecture described in clause 6.2) in NGCNs.

The three level architecture is applicable also to communication between networks. Two networks can each provide functionality at each of the three levels, and interworking can take place potentially at all three levels, as shown in Figure 2. Interworking does not need to occur right up to the application layer. For example, if applications are local to the two networks, interworking could be just at the transport and session levels. If there is no real-time communication session involved (e.g. data communication such as email or web, which is outside the scope of the present document), interworking would be only at the transport level.

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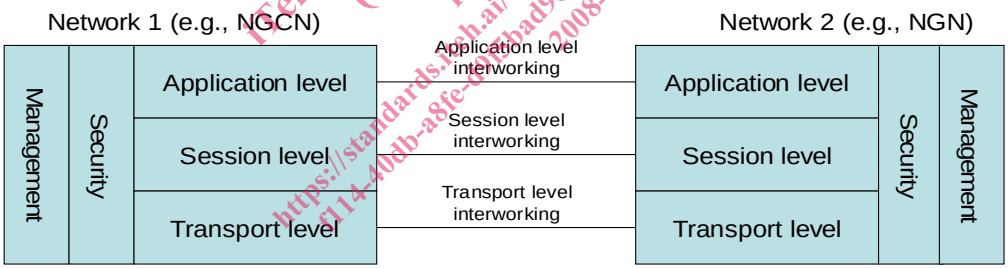

Figure 2: Overall architecture for inter-network operation

Similar principles can be extended to multiple networks in series, where intermediate networks might not be involved at the higher levels. Figure 3 shows an example where networks 1 and 4 communicate up to the application level, with network 2 involved only at the transport level (e.g. a transport service provider, TSP) and network 3 involved only up to the session level (management and security omitted for clarity).

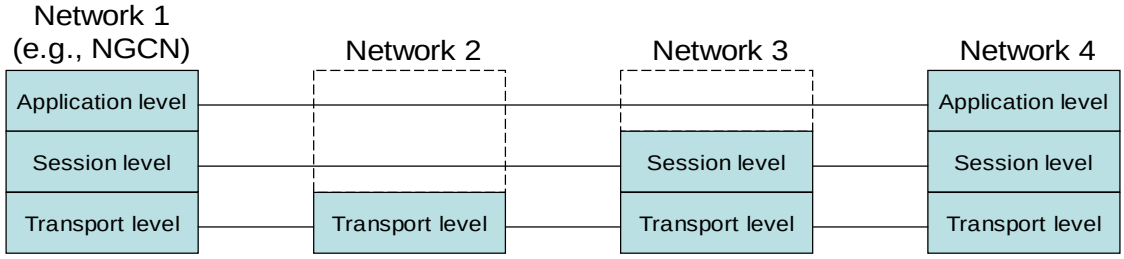

Figure 3: Example of operation through multiple networks (management and security omitted for clarity)