

JSP 602 Instruction	1029	Applicability	Infrastructure, Network/Communications
Configuration Identity	Version: 01.02 Amended: 2009-03-02 Reviewed: 2006-06-28	Epoch Applicability	2005 - 2009

JSP 602: 1029 - Voice Interchange

Outline

Description: Voice Interchange covers the services and standards necessary to connect differing voice communication systems. It covers which methods of voice coding are allowed at system boundaries, such that voice communication occurs in an intelligible fashion. It also covers additional signaling to ensure timely communication. This policy covers all forms of voice communication between both open and secure systems in all environments from benign (strategic) to harsh (tactical).

Reasons for Implementation: In order for voice communication to occur, where voice communications systems have differing internal methods of encoding voice, the method of voice encoding needs to be changed at the system interconnection point. The process (either transcoding or tandem coding) is likely to introduce some degradation in speech quality (intelligibility and latency). In order to minimise this degradation, it is desirable to minimise the number of transcodings/tandem codings.

Due to bandwidth limitations, it is desirable that some voice calls are given precedence over others. This may allow important and highly time critical calls to override existing, but lower importance calls.

Issues: The method of speech coding within each communications system is not proscribed by this policy. It also does not cover end-to-end encrypted voice where the method of voice coding is specific to that equipment. The implementation of this policy does not preclude the inclusion of other voice codings by a system, provided that one or more of the codings mandated by this policy is provided.

Not all communications systems provide the means to signal the priority of a call. Where this interworking occurs, a default priority level should be assumed by the system implementing precedence and pre-emption.

Guidance: This policy is outside the scope of the e-GIF. This policy is consistent with the NC3TA for circuit switched voice policy. The NC3TA does not address policy for VoIP.

DFN IPT is the mandatory provider of voice services within the strategic domain.

Policy

Strategic

1029.01: Circuit switched networks (Secure, Insecure and Mixed)

1029.01.01 All systems and/or projects providing voice interchange circuits shall, where they have the ability to accept/provide more than one coding, as a minimum accept/provide the following encoding standard in addition to its own native encoding standards:

1029.01.01.01 A-law - as defined in ITU-T G.711:1988 Pulse code modulation of voice frequencies

1029.01.02 It is highly desirable that such systems providing a transit capability should also allow any voice coding to be 'tunneled' through where possible.

1029.02: Voice Performance

1029.02.01 The basic voice performance of a system shall meet the following requirements for quality, intelligibility, speaker recognition and communicability prior to any transcoding. It is important to strive for minimum voice intelligibility/quality loss.

1029.02.01.01 Voice Quality - MOS rating: The MOS rating shall equal or exceed that of the strategic reference system (see comment)

Comment: Voice quality as measured by the MOS is more important in the strategic environment and less so in the tactical environment. It is usually employed when the intelligibility of the system is already high. The MOS is a standard subjective test that provides a numerical measure (range 1 to 5) of the distortion of human voice.

1029.02.01.02 Voice Intelligibility - DRT (ANSI S3.2-1989) The DRT score shall equal or exceed that of the strategic reference system (see comment)

Comment: The DRT is a standard test that measures (range 0% to 100%) how easy it is to discriminate between similar sounds over communications systems; that is it measures the intelligibility of speech.

1029.02.01.03 Speaker Recognition - The speaker recognition performance shall equal or exceed that of the strategic reference system (see comment)

Comment: This is an important mechanism used to authenticate a caller and is particularly useful in the Tactical domain. Whilst there are currently no standards or metrics for speaker recognition ad-hoc comparisons with the appropriate reference system may be used.

1029.02.01.04 Voice communicability ITU-T G.114: - The voice communicability score shall equal or exceed that of the strategic reference system (see comment)

Comment: The ITU recommendation G.114 states that delays introduced into conversations of up to 150 milliseconds are considered to be acceptable and no delay may be more than 400 milliseconds. Delays of 150 to 400 milliseconds are considered usable. Half-duplex voice communications (where only one party can speak at a time and the word 'over' is used to pass control between speakers) can tolerate significantly longer delays.

Strategic (continued)

Comment: Speech tests such as the MOS or DRT require the use of human subjects to act as talkers and listeners. Such tests can be used to produce a quantitative measure of voice communications system performance, but the variability introduced by the subjects must be carefully controlled. Consequently, the most reliable results are obtained when a new system is compared against a known reference circuit, rather than an absolute value (e.g. a DRT score of 75%, or a MOS score of 3.0). The Strategic reference system is defined as follows: A-Law 64 bit/s PCM, (ITU-T G711)

1029.03: Voice Encoding - Vocoders on Circuit-Switched Networks

1029.03.01 All systems and/or projects providing voice interchange circuits must accept/provide voice coding to one or more of the following standards.

1029.03.01.01 CVSD - STANAG 4380:1995 - Technical standards for analogue-digital conversion of voice signals-16 kbps CVSD (See also STANAG 4206-4213, 4249 and 4290)

1029.03.01.02 MELP - NATO STANAG 4591 - Mixed-Excitation Linear Predictive Coding Standard

Used by NATO specifically for interoperation between voice coders. MELP provides 1.2 Kbit to 2.4 Kbit encoding.

1029.03.01.03 A-law - as defined in ITU-T G.711:1988 Pulse code modulation of voice frequencies

An international standard defined by ITU-T that is mandated by STANAG 4578 and TacISDN.

Comment: G.711, CVSD and MELP are the main vocoders used for interoperability between voice networks.

1029.04: Voice Encoding - Vocoders on Packet-Switched Networks

1029.04.01 All systems and/or projects providing voice interchange circuits must accept/provide voice coding to one or more of the following standards.

1029.04.01.01 LD-CELP as defined in: G.728 (1992) Coding of speech at 16 kbit/s using LD-CELP

1029.04.01.02 CS-CELP as defined in: ITU-T G.729 - CELP and CS-CELP

These are international standards for voice encoding.

1029.05: Priority, Precedence and Pre-emption Line Busy

1029.05.01 All systems and/or projects providing voice interchange circuits must accept/provide voice coding to one or more of the following standard:

1029.05.01.01 ITU-T I.252 - Call Offering supplementary services

An international standard that defines subscriber controlled voice connection services such as call forwarding and deflection that can be employed if a subscriber already making or taking a call when another call arrives for them.

Strategic (continued)

1029.06: Channel Overload

1029.06.01 All systems and/or projects providing voice interchange circuits must accept/provide voice coding to one or more of the following standards.

1029.06.01.01 ITU-T I.255.3 - MLPP (1990)(MLPP)

An international standard that defines telephone exchange controlled prioritization, precedence and pre-emption services.

1029.07: Interoperation

1029.07.01 All systems and/or projects providing voice interchange circuits must accept/provide voice coding to one or more of the following standards.

1029.07.01.01 TacISDN

Covers mapping from 5-level prioritisation to 3-level and recognition of call priority during call setup.

1029.07.01.02 STANAG 4578 ed.2 - EDSTG (Draft)

Covers mapping from 5-level prioritisation to 3-level and recognition of call priority during call setup.

Comment: STANAG 4578 states that if a change of voice coding is required between systems then voice will be converted from the source's local vocoder to an intermediate form and then to the destinations local vocoder. This intermediate form is likely to be G.711 or 13/16 bit linear PCM.

1029.07.01.03 STANAG 4208:1993 - NATO multi-channel tactical digital gateway- (2nd Ed.) signaling standards (referenced by 4578)

Defines a digital gateway between two tactical systems (providing 16 Kbit channels) and covers voice interchange issues.

Comment: It is important to limit the number of voice re-encodings in order to preserve quality and minimize latency. In order to avoid unnecessary coding changes, the tunneling method of speech carriage is desirable. Where a network is capable of acting as a transit network between two compatible networks (i.e. they use the same speech coding method) then if possible the speech information should be carried transparently through the transit system. This may be by tunneling a lower rate speech coding through a higher rate channel in the transit system (e.g. 16kbit/s CVSD through a 64kbit/s ISDN channel)

Deployed

1029.08: Voice Performance

1029.08.01 The basic voice performance of a system shall meet the following requirements for quality, intelligibility, speaker recognition and communicability prior to any transcoding. It is important to strive for minimum voice intelligibility/quality loss.

1029.08.01.01 Voice Quality - MOS rating: The MOS rating shall equal or exceed that of the deployed reference system (see comment)

Deployed (continued)

1029.08.01.02 Voice Intelligibility - DRT (ANSI S3.2-1989) The DRT score shall equal or exceed that of the deployed reference system (see comment)

1029.08.01.03 Speaker Recognition - The speaker recognition performance shall equal or exceed that of the deployed reference system (see comment)

1029.08.01.04 Voice communicability ITU-T G.114: - The voice communicability score shall equal or exceed that of the deployed reference system (see comment)

Comment: See comments in 'Strategic' section. The Deployed reference system is defined as follows: CVSD 16 kbit/s (STANAG 4206)

1029.09: Voice Encoding - Vocoders on Circuit-Switched Networks

As for Strategic domain.

1029.10: Voice Encoding - Vocoders on Packet-Switched Networks

As for Strategic domain.

1029.11: Priority, Precedence and Pre-emption Line Busy

As for Strategic domain.

Tactical

1029.12: Voice Performance

1029.12.01 The basic voice performance of a system shall meet the following requirements for quality, intelligibility, speaker recognition and communicability prior to any transcoding. It is important to strive for minimum voice intelligibility/quality loss.

1029.12.01.01 Voice Quality - MOS rating: The MOS rating shall equal or exceed that of the tactical reference system (see comment)

1029.12.01.02 Voice Intelligibility - DRT (ANSI S3.2-1989) The DRT score shall equal or exceed that of the tactical reference system (see comment)

1029.12.01.03 Speaker Recognition - The speaker recognition performance shall equal or exceed that of the tactical reference system (see comment)

1029.12.01.04 Voice communicability ITU-T G.114: - The voice communicability score shall equal or exceed that of the tactical reference system (see comment)

Comment: See comments in 'Strategic' section. The Tactical reference system is defined as follows: MELPe at 1.2 or 2.4 kbits/s as appropriate (STANAG 4591).

1029.13: Voice Encoding - Vocoders on Circuit-Switched Networks

1029.13.01 All systems and/or projects providing voice interchange circuits must accept/provide voice coding to one or more of the following standards.

1029.13.01.01 CVSD - STANAG 4380:1995 - Technical standards for analogue-digital conversion of voice signals-16 kbps CVSD (See also STANAG 4206-4213,

Tactical (continued)

4249 and 4290)

1029.13.01.02 MELP - NATO STANAG 4591 - Mixed-Excitation Linear Predictive Coding Standard

1029.13.01.03 LPC-10 - STANAG 4198:1984 ed.1, Linear Predictive Coding at 2400 b/s - (specifically for use over Link16)

1029.14: Voice Encoding - Vocoders on Packet-Switched Networks

As for Strategic domain.

1029.15: Priority, Precedence and Pre-emption Line Busy

As for Strategic domain.

Remote

1029.16: Voice Performance

1029.16.01 The basic voice performance of a system shall meet the following requirements for quality, intelligibility, speaker recognition and communicability prior to any transcoding. It is important to strive for minimum voice intelligibility/quality loss.

1029.16.01.01 Voice Quality - MOS rating: The MOS rating shall equal or exceed that of the strategic reference system (see comment)

1029.16.01.02 Voice Intelligibility - DRT (ANSI S3.2-1989) The DRT score shall equal or exceed that of the strategic reference system (see comment)

1029.16.01.03 Speaker Recognition - The speaker recognition performance shall equal or exceed that of the strategic reference system (see comment)

1029.16.01.04 Voice communicability ITU-T G.114: - The voice communicability score shall equal or exceed that of the strategic reference system (see comment); where Half Duplex Voice is used, delays of several seconds shall be permitted.

Comment: The ITU recommendation G.114 states that delays introduced into conversations of up to 150 milliseconds are considered to be acceptable and no delay may be more than 400 milliseconds. Delays of 150 to 400 milliseconds are considered usable. Half-duplex voice communications (where only one party can speak at a time and the word 'over' is used to pass control between speakers) can tolerate significantly longer delays.

Comment: See comments in 'Strategic' section.

1029.17: Voice Encoding - Vocoders for Mobile Telephones

1029.17.01 All systems and/or projects providing voice interchange circuits for mobile telephones shall accept/provide voice coding as a minimum to the following standard:

1029.17.01.01 GSM

International standards for mobile communications

Remote (continued)

1029.18: Voice Encoding - Vocoders for Civilian Telephones

1029.18.01 All systems and/or projects providing voice interchange circuits for civilian telephones shall accept/provide voice coding as a minimum to the following standard:

1029.18.01.01 A-law - as defined in ITU-T G.711:1988 Pulse code modulation of voice frequencies

An international standard defined by ITU-T.

1029.19: Priority, Precedence and Pre-emption Line Busy

1029.19.01 No capability is mandated for remote users (see comment).

Comment: It is recommended that all incoming and outgoing calls should default to 'Routine' priority.

Responsibility for Implementing the Policy

Implementation of this policy shall be the responsibility of all MOD Projects (and their suppliers) that provide voice services within the GII.

Procedure

Within the Strategic, Deployed and Remote domains the principal provider of voice services is the DFN IPT. All projects requiring voice services within these domains must contact the DFN IPT [contact details TBA].

Relevant Links

JSP602: 1026 Telephones.

ITU-T standards can be obtained (subscription required) from the ITU web site here. (<http://www.itu.int/ITU-T/index.html>)

A glossary of terms and abbreviations used within this document is available here.

Instructions on how to read a JSP602 leaflet are available here.

Compliance

Stage	Compliance Requirements
Initial Gate/DP1	MOD Projects shall submit a formal declaration that they have read and understood the policy and sought guidance from the SME(s).
Main Gate/DP2	MOD Projects shall reference in their SRD (and MODAF technical views) the specific policy elements contained within this leaflet that are applicable to the infrastructure they are procuring or updating.
Release Authority/DP5	MOD Projects (supported by their equipment suppliers) shall provide evidence of their compliance with the elements of this policy defined within the SRD (and MODAF technical views). Evidence of conformance with standards shall be presented; sources of evidence may include: conformance/compliance certificates provided by equipment suppliers (e.g. under type approval or other assessment regimes), demonstrations, inspection, analysis, tests carried out by suppliers (e.g. Factory Acceptance Tests) and tests carried out at Defence Test and Reference Facilities.