INTERNATIONAL CIVIL AVIATION ORGANIZATION

VOICE OVER INTERNET PROTOCOL (VOIP) AND ANALOG VOICE INTERFACE CONTROL DOCUMENT FOR THE ASIA-PACIFIC COMMON AERONAUTICAL VIRTUAL PRIVATE NETWORK

VERSION 1.0

EXECUTIVE SUMMARY

Under the guidance of the International Civil Aviation Organization (ICAO) a number of States/Administrations in the Asia/Pacific region have created a data and voice communications network to allow for the exchange of air traffic control information. This network is delivered by the Service Provider.

This Interface Control Document (ICD) defines the Voice over Internet Protocol (VoIP) service and Analog Voice service interfaces between the Service Provider and each of the States/Administrations.

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1.0 Purpose and Scope

This Interface Control Document (ICD) defines the interface between the Service Provider and each of the States/Administrations of the Voice over Internet Protocol (VoIP) service and Analog Voice service for Ground to Ground voice communications and forms part of the Specification for the Asia-Pacific Common aeRonautical Virtual Private Network (CRV).

The purpose of this ICD is to clearly communicate all possible voice inputs and outputs with the CRV. This ICD helps understanding and is to ensure compatibility between system, sub-systems and components. This ICD only addresses the first four layers of the OSI model, that being the Physical, Data Link, Network and Transport layers and Analog Voice interfaces. Information specific analog switching system is outside the scope of this ICD.

The intended audience of this ICD is the Service Provider, States/Administrations and the Operations Group (OG).

2.0 System Overview

The CRV is to consist of a network which facilitates telecommunications between the States/Administrations.

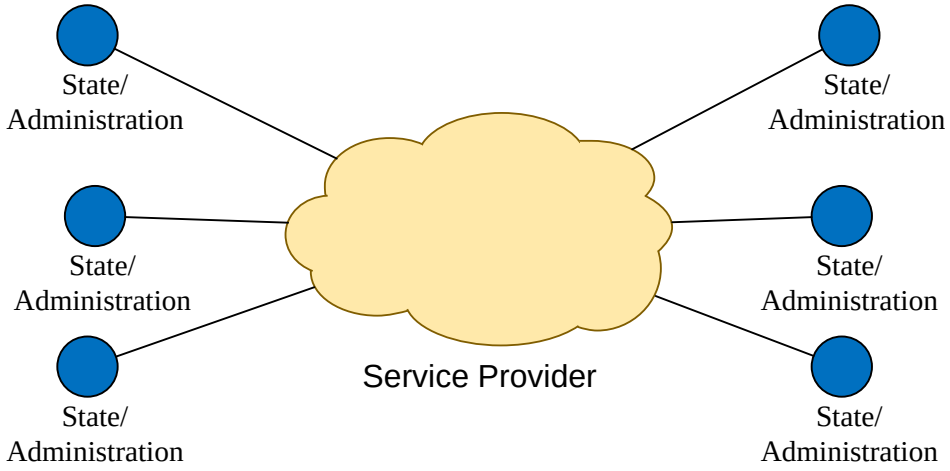

Figure 1: High level system overview

The various VoIP and Analog Voice interfaces have not been shown on this diagram, as they will be detailed below.

3.0 Interface Locations

The Service Provider will place a Network Interface Device (NID) into the State/Administration's premises, as shown in Figure 2.

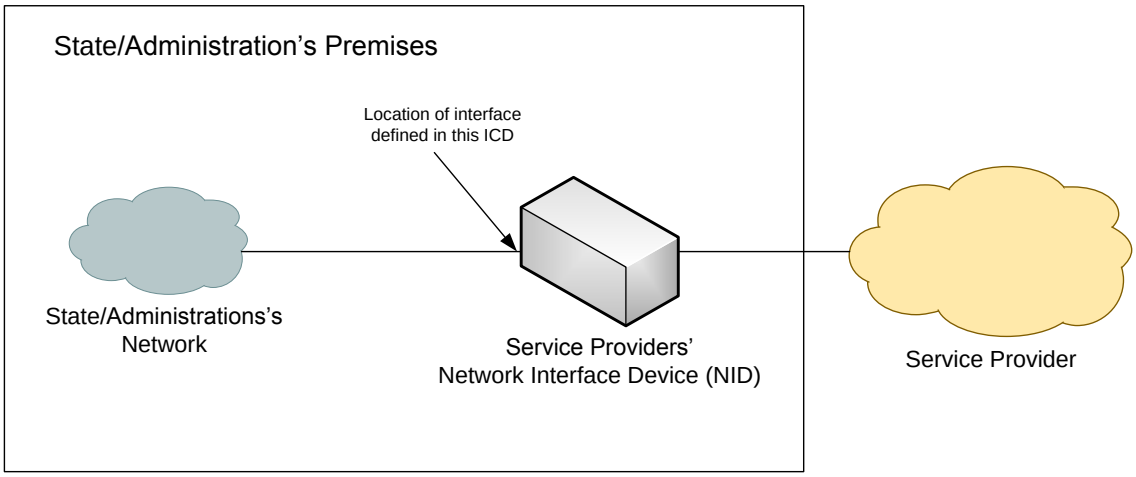

Figure 2: Location of Interface

The interface point defined in this ICD is the customer facing socket on the Service Providers' Network Interface Device (NID).

The OG maintains a list of State/Administrations which have a connection to the Service Provider and the street address of each location.

4.0 Interface Types

Several VoIP and Analog Voice interfaces are available. These are diagrammed below.

4.1.1 Voice over Internet Protocol

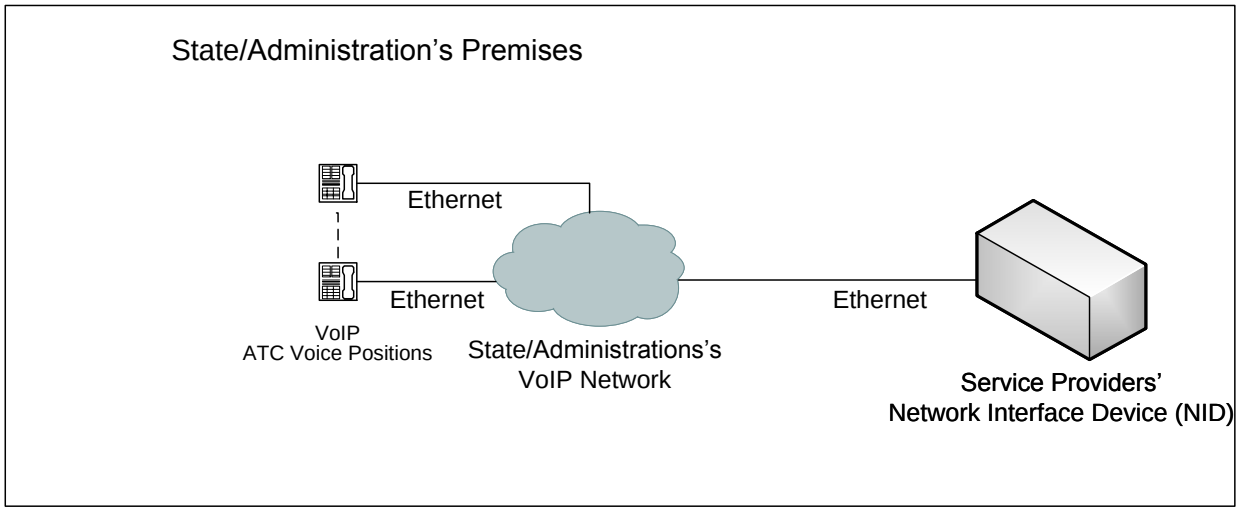

Figure 3: Voice over Internet Protocol Interface

4.1.2 VoIP Gateway

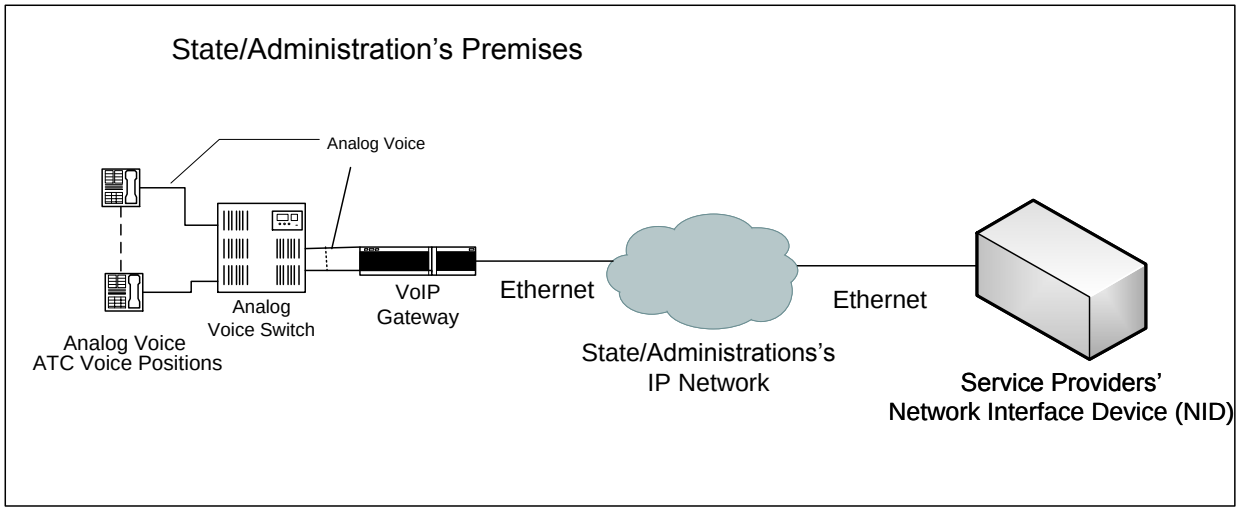

Figure 4: VoIP Gateway Interface

4.1.3 Analog Voice

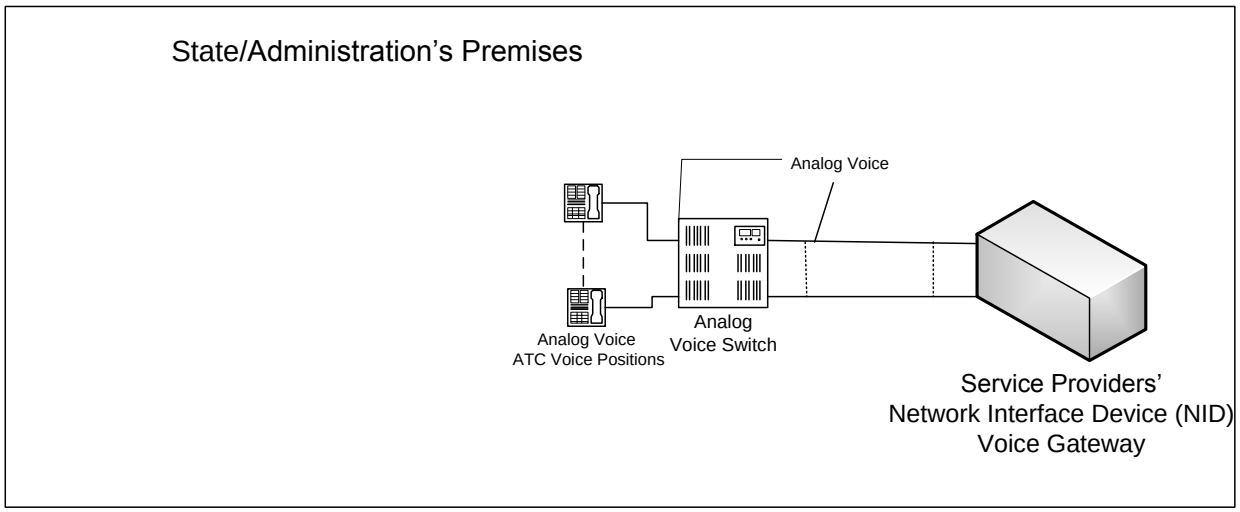

Figure 5: Analog Voice Interface

4.1.4 Redundant Analog Voice

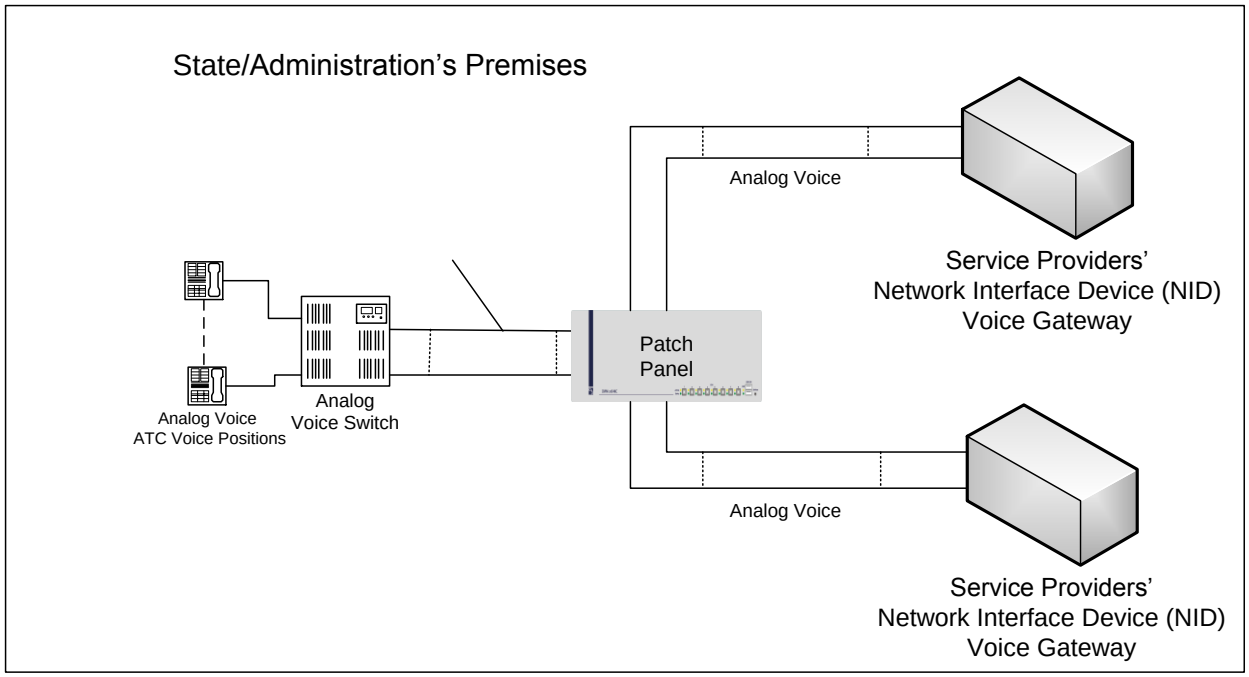

Figure 6: Redundant Analog Voice Interface

5.0 VoIP Interface Controls

5.1 Introduction

The CRV Ethernet interfaces are summarised in Table 1. These interfaces may be used for VoIP or VoIP Gateway Interface types.

Table 1: VoIP Interface Definitions

Interface Type	Version	Interface Type	Paragraph Reference
Ethernet-single	1	Single Ethernet connection with no redundancy	5.2
Ethernet-multi	1	Two or more Ethernet connections which failover	5.3

5.2 Interface: Ethernet-single

This interface type is for a State/Administration that has only a single connection to the Service Provider.

5.2.1 Physical layer

Each local access interface is presented via a standard RJ45 (female) Ethernet (IEEE 802.3) socket.

This Ethernet port is an IEC 60603-7 8P8C modular connector as shown in Figure 7.

The Ethernet port shall support cable terminations as specified by EIA/TIA 568A.

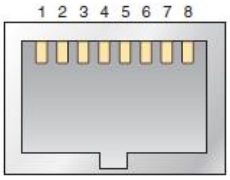

Figure 7 : 8P8C modular socket

For cases where both the Service Provider equipment and the State/Administration equipment can operate at 1Gbps, then:

- electrical signaling shall meet the 1000BASE-T standard, as defined by IEEE 802.ab;
- the Service Provider equipment and the State/Administration equipment shall use auto negotiation for speed and duplex.

For all other instances, then:

- electrical signaling shall meet the 100BASE-TX, as defined by IEEE 802.3u; and
- the Service Provider equipment and the State/Administration equipment shall both be statically set to 100 Mbps/Full-Duplex, so as to avoid speed/duplex negotiation mismatch and compatibility issues.

5.2.2 Data link layer

The data link protocol is IEEE-802.3 Ethernet (MAC and 802.2 LLC) and ARP in compliance with:

RFC 826 An Ethernet Address Resolution Protocol, November 1982.

5.2.3 Network layer

The Network layer will use Internet Protocol version 4 in compliance with:

RFC 791 Internet Protocol, September 1981, and
RFC 792 Internet Control Message Protocol, September 1981, as updated by RFCs 950, 4884, and 6633, and
RFC 796 Address Mappings, September 1981, and
RFC 894 Standard for the Transmission of IP Datagrams over Ethernet Networks, April 1984.

The OG maintains the CRV IP Address and Routing Plan. This Plan contains a list of all the subnets used by the network.

The State/Administration shall make an IP address on its connecting equipment responsive to ICMP echo (PING) packets to assist in maintenance and fault finding.

The Service Provider shall make an IP address on its connecting equipment responsive to ICMP echo (PING) packets to assist in maintenance and fault finding.

Note that while IPv4 is used in the initial implementation, IPv6 will be supported in the future.

5.2.4 Transport Layer

The Transport layer may use TCP and/or UDP in compliance with:

RFC 793 Transmission Control Protocol, September 1981, as updated by RFC 3168, and
RFC 768 User Datagram Protocol, August 1980.

5.2.5 Upper Layers

The Session, Presentation, and Application layers are combined in the TCP/IP model and will use SIP, SDP, and RTP in compliance with:

RFC 3261 SIP: Session Initiation Protocol, June 2002, and
RFC 3550 RTP: A Transport Protocol for Real-Time Applications, July 2003, and
RFC 3551 RTP Profile for Audio and Video Conferences with Minimal Control, July 2003, and
RFC 3665 Session Initiation Protocol (SIP) Basic Call Flow Examples, December 2003, and
RFC 3666 Session Initiation Protocol (SIP) Public Switched Telephone Network (PSTN) Call Flows, December 2003, and
RFC 4566 SDP: Session Description Protocol, July 2006.

The CRV OG maintains a SIP Dial Plan. The initial SIP Dial Plan is presented below (see 7.0).

5.2.6 Quality of Service Markings

The OG maintains the CRV Quality of Service Plan for the CRV. Packets traversing this interface shall comply with this plan.

5.3 Interface: Ethernet-multi

This interface type is for a State/Administration that has more than one connection to the Service Provider.

5.3.1 Physical layer

This is identical to the Ethernet-single interface (see 5.2.1).

5.3.2 Data link layer

This is identical to the Ethernet-single interface (see 5.2.2).

5.3.3 Network layer

This is identical to the Ethernet-single interface (see 5.2.3).

5.3.4 Transport Layer

The Transport layer may use TCP and/or UDP in compliance with:

RFC 793 Transmission Control Protocol, September 1981, as updated by RFC 3168, and
RFC 768 User Datagram Protocol, August 1980, and
RFC 2439 BGP Route Flap Damping, November 1998, and
RFC 4271 A Border Gateway Protocol 4 (BGP-4), January 2001, as updated by RFC 6286, and
RFC 6286 Autonomous-System-Wide Unique BGP Identifier for BGP-4, June 2011.

Border Gateway Protocol version 4 (BGP-4) shall be used to exchange routing information between the Service Provider and the State/Administration. The BGP implementation shall use the BGP peers, Autonomous System (AS) numbers and route preference details contained in the CRV IP Address and Routing Plan.

A password shall be used to secure BGP sessions and enable Message Digest 5 authentication on the TCP/IP connections between BGP peers. BGP route filters should be used so that only authorized subnets are accepted by the BGP peers.

5.3.5 Upper Layers

The Session, Presentation, and Application layers are combined in the TCP/IP model and will use SIP, SDP, and RTP in compliance with:

RFC 3261 SIP: Session Initiation Protocol, June 2002, and
RFC 3550 RTP: A Transport Protocol for Real-Time Applications, July 2003, and
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RFC 4566 SDP: Session Description Protocol, July 2006.

The CRV OG maintains a SIP Dial Plan. The initial SIP Dial Plan is presented below (see 7.0).

5.3.6 Quality of Service Markings

This is identical to the Ethernet-single interface (see 5.2.6).

6.0 Analog Voice Interface Controls

6.1 Introduction

The CRV Analog Voice interfaces are summarised in Table 2. These interfaces may be used for Analog Voice Interface types, either single or redundant with an A/B Switch.

Table 2: Analog Voice Interface Definitions

Interface Type	Interface Type	Paragraph Reference
E&M Type I	2 or 4 wire audio with E and M signals	6.2
E&M Type V	2 or 4 wire audio with E and M signals	6.3
FXS	Foreign eXchange Station	6.4
FXO	Foreign eXchange Office	6.5

6.2 Interface: E&M Type I

This is the most common E&M interface in North America.

Type I uses two leads for supervisor signaling: E, and M.
During inactivity, the E-lead is open and the M-lead is connected to the ground.
The PBX (that acts as trunk circuit side) connects the M-lead to the battery in order to indicate the off-hook condition.
The Cisco router/gateway (signaling unit) connects the E-lead to the ground in order to indicate the off-hook condition.

Each local access interface is presented via a standard RJ48S (female) socket.

This E&M port is an IEC 60603-7 8P8C modular connector as shown in Figure 7.

The E&M port supports 2 or 4 wire audio.

6.3 Interface: E&M Type V

Type V is symmetrical and allows two signaling nodes to be connected back-to-back. This is the most common interface type used outside of North America.

Type V uses two leads for supervisor signaling: E, and M.
During inactivity the E-lead and M-lead are open.
The PBX (that acts as trunk circuit side) connects the M-lead to the ground in order to indicate the off-hook condition.
The Cisco router / gateway (signaling unit) connects the E-lead to the ground in order to indicate off-hook condition.

Each local access interface is presented via a standard RJ48S (female) socket.

This E&M port is an IEC 60603-7 8P8C modular connector as shown in Figure 7.

The E&M port supports 2 or 4 wire audio.

6.4 Interface: FXS

A Foreign eXchange Station interface is the port that provides dial tone and ring voltage. Historically, it is the jack in the wall into which you would plug an analog telephone. An FXS interface would connect to an FXO interface on the CRV Voice Gateway. Because the FXS interface is "facing" a station or telephone, the interface is not used to dial digits. When the FXS interface detects a ground start or loop start condition, as configured, it should provide dial tone and, possibly, collect digits. When an FXS interface is used to place a call, it provides ring voltage to alert the station.

FXO/FXS circuits use standard telephone wiring with RJ-11 connectors.

6.5 Interface: FXO

A Foreign eXchange Office interface is the interface "facing" the office. Historically, it is the plug on the analog telephone or the plug(s) on your analog phone system. An FXO interface connects to an FXS interface on the CRV Voice Gateway. When placing a call, the FXO interface closes the loop to the FXS interface, receives dial tone, and provides digits, like dialing from aa analog telephone.

FXO/FXS circuits use standard telephone wiring with RJ-11 connectors.

7.0 Dial Plan

In compliance with ICAO 9804, an initial dial plan was developed using an 8 digit numbering plan consisting of the following:

- 1-3 digits for the Country Code/Area Identifier (AA) – E.164
- 4-2 digits for the ANSP Centre code (CC) – ANSP provided
- 3 digits for the operator position (OO) – ANSP provided

The initial dial plan includes Airservices Australia, Airways New Zealand, Fiji Airports and USA FAA and joining CRV members would be added in a similar fashion.

ANSP	Operator Position	AA	CC	OO
Airservices Australia				
	Brisbane - Coral	61	400	001
	Brisbane - Lord Howe	61	400	002
	Brisbane - Nauru	61	400	003
Papua New Guinea (via Australia)	Brisbane - PNG	675	121	01
Airways New Zealand				
	Auckland	64	202	001
	Auckland	64	202	002
Fiji Airports				
	Nadi-CWP 1	679	44	001
	Nadi -CWP 2	679	44	002
USA FAA				
	Oakland D5 (80)	1	5170	080
	Oakland D9 (83)	1	5170	083
	Oakland D3 (84)	1	5170	084
	Oakland D6 (86)	1	5170	086

APPENDIX A - ACRONYMS

A.0 Acronyms

This appendix defines the acronyms used in this document.

BGP	Border Gateway Protocol
ICAO	International Civil Aviation Organization
ICD	Interface Control Document
ICMP	Internet Control Message Protocol
ISO	International Organization for Standardization
IP	Internet Protocol
ITU	International Telecommunications Union
ITU-T	ITU Telecommunications Sector
OSI	Open Systems Interconnection
QOS	Quality of Service
TBD	to be Determined
TCP	Transmission Control Protocol