International Civil Aviation Organization

Twelfth Meeting of the Common aeRonautical Virtual Private Network Operations Group (CRV OG/12)

Denarau Island, Fiji, 23-26 January 2024

Agenda Item 8: CRV Operational performance report - CRV Bandwidth Utilization Rate

MONITORING AND ANALYZING CRV NETWORK TRAFFIC IN HONG KONG, CHINA

(Presented by Hong Kong, China)

SUMMARY

Hong Kong, China has been actively supporting the CRV implementation and various ICAO initiatives in the region relying on CRV as communication infrastructure, such as SWIM, ATFM and surveillance data sharing. With increasing applications riding on CRV, it is increasingly important to take steps in monitoring and analyzing CRV bandwidth utilization. This paper introduces the CRV network traffic capturing equipment deployed in Hong Kong, China, and presents the insights and analysis derived from the captured network traffic.

1. INTRODUCTION

1.1 During the ACSICG/10 in May 2023 and previous CRV OG meetings, there was a recognized need to review and analyze the bandwidth usage of CRV in each State/Administration. Such analysis is crucial for proactive planning of upgrades and accommodating future applications, ensuring necessary actions will be taken timely.

1.2 Hong Kong, China plays an active role in CRV implementation and various ICAO initiatives, including SWIM, ATFM and surveillance data sharing, which use CRV as communication infrastructure. With increasing number of applications, it is of growing significance to monitor and analyze CRV network traffic. Hong Kong, China has taken proactive steps to capture and analyze CRV network traffic.

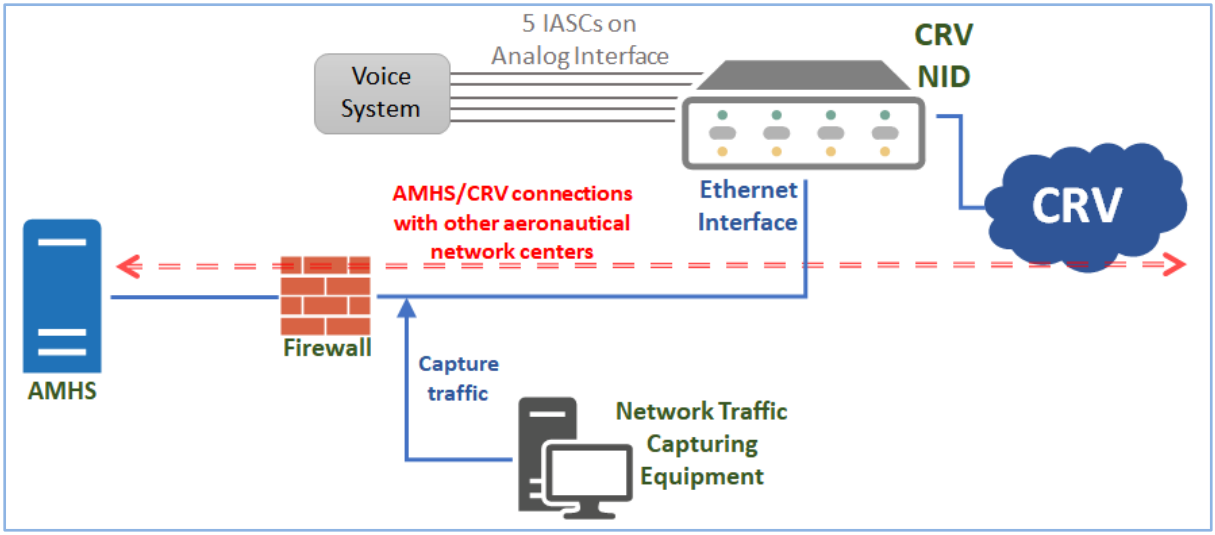
2. DISCUSSION

Current CRV Implementation Status in Hong Kong

2.1 Presently, in Hong Kong, there are two CRV 2Mbps connections (active and standby) established for the exchange of ATS messages with overseas aeronautical network centers, along with five Inter Area Speech Circuits (IASCs) with ATC centers. The five IASCs utilize five voice ports on the Network Interface Device (NID), each consuming 112kbps of bandwidth with the highest Quality of Service (QoS) class (Gold) allocation. Consequently, 560kbps of bandwidth is allocated to voice communication, while the remaining 1,440kbps is dedicated to AMHS/CRV. Currently, Hong Kong has AMHS/CRV connections with various aeronautical network centers, including Bangkok, Beijing, Fukuoka, and Manila.

CRV Network Traffic Capturing Equipment

2.2 In January 2024, Hong Kong implemented a CRV network traffic capturing equipment. This equipment, accompanied by the widely-used software Wireshark, captures all incoming and outgoing traffic of the AMHS. The network traffic for voice communication is not captured as it is assumed that these channels are always utilizing the entirety of the allocated bandwidth for real-time voice communication. The diagram below illustrates the setup.



2.3 To conduct an initial analysis, network traffic between 8 and 14 January 2024 was captured. Additionally, the average inbound and outbound traffic in kbps over a 1-minute interval was selected for analysis due to two main reasons. Firstly, a 1-minute interval aligns with the timestamp resolution of the ICAO AFTN flight plan. Secondly, the time-sensitive application AIDC in Hong Kong allows for a delay tolerance of up to 1.5 minutes. If the AIDC messages, transmitted via AMHS/CRV, cannot be delivered to other centers within this time frame, aircraft hand-over will resort to voice communication. Therefore, a 1-minute interval is crucial for meaningful analysis in Hong Kong.

2.4 The captured traffic in Wireshark pcapng format amounts to approximately 200 megabytes per day. Following post-processing of the data files to generate statistical information for analysis, findings are summarized in the ensuing paragraphs.

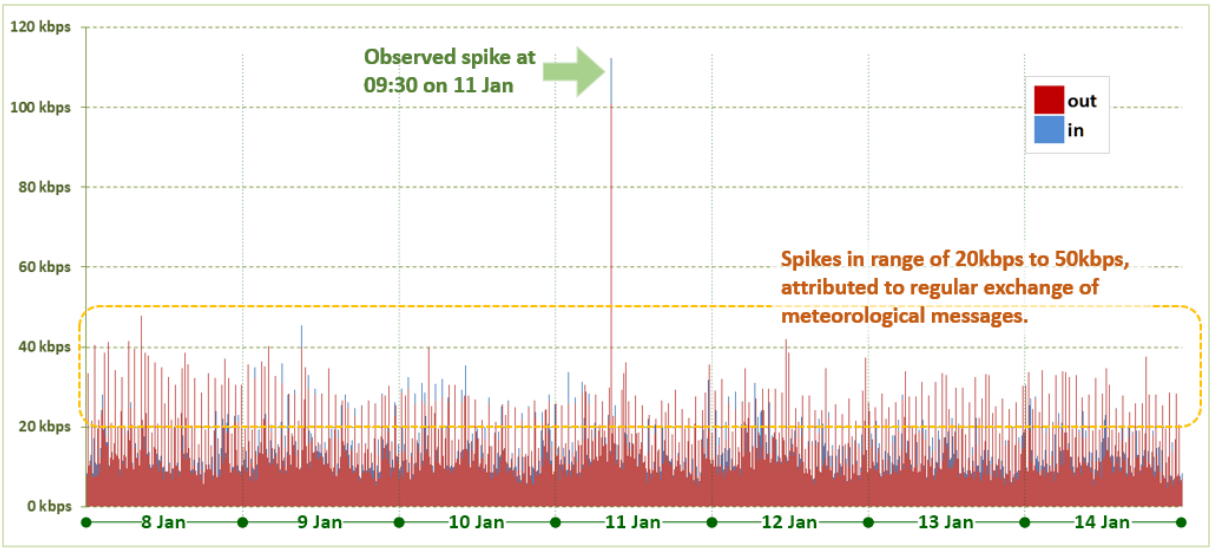


Figure 1. Average inbound and outbound traffic in kbps over 1-minute interval between 8 and 14 January 2024

Finding and Initial Analysis

2.5 At 09:30 on 11 January, a significant spike in traffic was observed. Upon investigation, it was revealed that Manila center had transmitted approximately 750 IA5-Text messages to Hong Kong in this minute, out of which around 700 were Non-Delivery Reports (NDR). Subsequently, Hong Kong promptly relayed the majority of these messages to other centers, leading to a spike in both inbound and outbound traffic, peaking at approximately 120kbps.

2.6 In addition, during this period, 5% of the traffic experienced fluctuations ranging between 20kbps and 50kbps, typically occurring at hh:05. Further analysis revealed that these spikes were primarily associated with the exchange of meteorological messages in both TAC and IWXXM formats. Each ANSP follows its own schedule to dispatch such messages at hh:05 hourly with reference to APAC ROBEX handbook. For instance, at hh:05, Hong Kong received these meteorological messages from the centers of Beijing, Bangkok and Fukuoka, providing insight into the observed traffic spikes.

2.7 Furthermore, 95% of network usage remained below 20kbps and was confirmed to be normal day-to-day operational message exchange between centers.

2.8 A total of over 500K messages were transmitted and received during this period. The findings pertaining to IA5-Text and IWXXM messages are presented in the following table:

	IA5-Text	IWXXM
Number of messages in percentage	95%	5%
Average bytes transmitted for the message (including TCP and AMHS overheads)	1.7K bytes	4.1K bytes

Way Forward

2.9 The statistical data provided above indicates that bandwidth utilization in Hong Kong is relatively low. Even with the planned implementation of Hochiminh's and Macao's AMHS/CRV, the anticipated increase in bandwidth usage is expected to be minimal. Moreover, the size of IWXXM files exchanged with Hong Kong is also not significantly high enough to warrant immediate attention. Therefore, given the current bandwidth allocation of 1,440kbps for AMHS/CRV, there is no immediate need to upgrade bandwidth capacity, assuming no significant changes in bandwidth usage patterns in the near future.

2.10 It is important to note that the captured traffic represents only a brief period. Hong Kong, China will continue to maintain the capturing equipment setup to monitor CRV network traffic and conduct further analysis, particularly as more high-volume applications are gradually brought into CRV.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the initiative by Hong Kong China to deploy equipment to capture CRV network traffic and conduct analysis;

b) encourage States/Administration using CRV to share their experience in conducting similar CRV network traffic monitoring and analysis; and

c) discuss any relevant matter as appropriate.

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