

Preliminary Report of Service Disruption on 4 January 2017

1. Introduction

On 4 January 2017, a UPS power outage happened at one data center, in which a RADIUS server was down, causing service disruption of CMHK network partially. This preliminary report provides a description of events that led to the occurrence of service disruption, the remedial actions taken and the improvement measures to be taken.

2. Service Disruption on 4 January 2017

2.1 Events Leading to the Occurrence of the Outage

On 4 January 2017 at around 11:30am, one of the UPS at one data center was failed, which caused some equipment down without power supply. This affected some website applications and one RADIUS server, for user accounting purpose, which caused some mobile data service interruption.

After trouble shooting, CMHK engineers started to bypass RADIUS server at 12:15pm, from which network service was restored progressively. The network data and voice traffic was mostly back to normal level at 1:45pm.

During RADIUS server problem between 11:30am and 12:15pm, high load occurred in some core network nodes (PCRF, HLR, MSC) due to high volume of network attach and call re-attempts. This resulted in network congestion, affecting network data and voice services.

At 12:35pm, power supply to affected equipment was resumed.

2.2 Event History Log

Time	Event Description
Around 11:30am	<ul style="list-style-type: none">● Network alarm alerts was received.● Found newly setup mobile data service and VoLTE call failed.
11:35am	<ul style="list-style-type: none">● On-site engineer reported one UPS at one data center was down, and 2 MCCB were tripped including the AC Main MCCB of UPS (200A) and one output MCCB (63A).● Conducted network investigation, and decided to bypass RADIUS server query during mobile data service setup.
12:15pm	<ul style="list-style-type: none">● Started configuration of PGW nodes to bypass RADIUS server query.● Mobile data and voice service was started to resume gradually.● UPS vendor support arrived at data center, and started trouble-shooting of the power failure.
12:35pm	<ul style="list-style-type: none">● Vendor engineer bypassed the UPS to building power, and power supply to affected equipment was resumed.● Engineers started to resume website applications, which were not affecting the mobile network services.
12:40pm	<ul style="list-style-type: none">● Confirmed mobile data and VoLTE call OK.● Informed OFCA that the network service started resume gradually.
Around 1:45pm	<ul style="list-style-type: none">● The network data and voice traffic was mostly back to normal level.

2.3 Remedial Actions taken

At 12:15pm, engineers started system configuration of PGW nodes to bypass RADIUS server query. The network service was then restored progressively. The network data and voice traffic was mostly back to

normal level at 1:45pm.

Regarding the UPS outage, vendor engineer arrived on site at 12:15pm. Vendor engineer bypassed the UPS to building power, and power supply to affected equipment was resumed at 12:35pm. Engineers started to resume website applications, which were not affecting the mobile network services. Website applications were resumed after 10:30pm.

2.4 Root cause analysis

One of the UPS at one data center was failed, which caused some equipment down without power supply. One of the failed equipment was RADIUS server which was used for user accounting purpose of mobile data service. This resulted in some mobile data service setup failure.

During RADIUS server problem between 11:30am and 12:15pm, high load occurred in some core network nodes (PCRF, HLR, MSC) due to high volume of network attach and call re-attempts. This resulted in network congestion, affecting network data and voice services.

Regarding the UPS outage, it was preliminarily suspected that a short circuit in one data server generated high backward current to an output feed of UPS, which caused control board failure in UPS & related MCCB tripped at 11:23am. This caused some equipment down without power supply. The detailed root cause analysis of UPS outage needed to wait for vendor investigation report.

2.5 Number of affected customers

The outage affected some mobile data service and voice calls. Based on traffic statistics, data and voice traffic volume during the incident period was decreased by 41.2% and 10.5% respectively, as compared with previous traffic load in the same period on Wednesday.

4. Communication with the Public

CMHK had communicated with customers, local media, and the general public about the service disruption via the following channels on the day of the incident.

1. Retail, Corporate Sales and Hotline staff
2. Facebook
3. Media

4.1 Retail, Corporate Sales and Hotline staff

Frontline staffs were briefed about the incident for handling related enquiries from customers on 4 Jan. We had immediately adjusted manpower in Customer Services Hotline center to answer customers' enquires.

4.2 Facebook

Messages and announcements were posted in CMHK official Facebook during and after the incident, informing customers of the network service disruption and service recovery status.

4.3 Media

CMHK had kept following up with the media and immediately responded to their queries during and after the incident.

5. Improvement Measures

- The dual power feeds of RADIUS server had already been separately connected to two UPS sources at the night of 4-Jan.
- Site resiliency has already been planned for RADIUS server, and will be implemented by mid 2017.

China Mobile Hong Kong Co. Ltd.

Date: 9-Jan-2017