FINAL DECISION OF
THE COMMUNICATIONS AUTHORITY

INVESTIGATION INTO THE DISRUPTION OF THE TELECOMMUNICATIONS SERVICES OF HUTCHISON TELEPHONE COMPANY LIMITED ON 29 JUNE 2012

Telecommunications Licensee Investigated:	Hutchison Telephone Company Limited ("HTCL")
Issue:	There was a disruption of the 3G mobile data service of HTCL on 29 June 2012
Relevant Instruments:	General Condition ("GC") 5.1 of HTCL's Unified Carrier Licence No. 004
Decision:	No breach of GC 5.1 of HTCL's Unified Carrier Licence No. 004
Sanction	N/A
Case Reference:	LM T61/12 in OFCA/R/R/134/2 C

BACKGROUND

At around 12:00 noon on 29 June 2012, the Office of the Communications Authority ("OFCA") received reports from the public about disruption of the 3G mobile data service of HTCL at various locations. OFCA immediately contacted HTCL to check out the position. After confirming with HTCL of the service disruption, OFCA activated the Emergency Response System[1] and kept in close contact with HTCL to monitor the situation.

[1] Emergency Reporting System is the communication arrangement for maintaining contacts among OFCA and all the major public telecommunications network service operators when there is a risk of possible network congestion problem or network outage which may affect the general public.

THE SERVICE DISRUPTION

2. According to HTCL, at 11:05 am on 29 June 2012, its network operations centre ("NOC") was alerted by system alarms that one of the Internet Protocol ("IP") network routing components, namely the Authentication Authorization and Accounting server ("AAA server"), was abnormal. The AAA server is mainly responsible for (a) IP address assignment of new mobile data connections and (b) IP-MSISDN mapping[2] to other platforms in its 3G network. Owing to the malfunction of the AAA server, users of HTCL's 3G mobile service requesting new data connections (i.e. internet access) during the period of 11:00 am – 1:15 pm on 29 June 2012 had difficulties in getting IP addresses and were unable to access to HTCL's 3G mobile data service. Services for those 3G users who had been connected with HTCL's service platform before 11:00 am were not affected because the IP addresses had already been assigned.

3. According to HTCL, the incident had affected around 40,000 to 50,000 of its 3G users. HTCL emphasized that the disruption only affected 3G mobile data service and, throughout the whole disruption period, the mobile voice service and short message service ("SMS") of HTCL remained normal and no user of 2G and 4G services was affected.

4. HTCL claimed that, after the problem was confirmed to be caused by a software bug in the AAA server at around 12:45 pm, it took immediate action to bypass the AAA server and enable the Gateway GPRS Support Node ("GGSN") to take up the duty of IP address assignment for 3G mobile data service. HTCL also claimed that it had successfully managed to complete the bypassing process within 30 minutes, upon which the 3G mobile data service started to resume normal operation progressively from 1:15 pm, and was fully restored at 2:00 pm on 29 June 2012.

THE INVESTIGATION

5. As the service disruption had affected 40,000 to 50,000 users of HTCL's 3G mobile data service for over two hours, OFCA decided to conduct an investigation into the incident to –

[2] The AAA server maintains a table mapping of allocated IP address to the established Mobile Subscriber Integrated Services Digital Network Number ("MSISDN").

(a) examine whether HTCL was in breach of GC 5.1 of its Unified Carrier Licence which specifies that –

> *"5.1 The licensee shall, subject to Schedule 1 to this licence and any special conditions of this licence relating to the provision of the service, at all times during the validity period of this licence operate, maintain and provide a good, efficient and continuous service in a manner satisfactory to the Authority…"*; and

(b) review the actions taken by HTCL in handling the incident (including the communication with OFCA, customers and the media, and the efficiency of service restoration etc.) to examine whether there are any areas requiring HTCL to make improvements.

6. In the course of OFCA's investigation, HTCL has as per OFCA's request submitted a preliminary report[3] on the incident on 4 July 2012 and a full report[4] on 17 July 2012. OFCA has carefully examined the reports. As part of the investigation, OFCA has also examined the 51 consumer complaints it has received concerning the disruption of HTCL's 3G mobile data service. Most of the complaints were about dissatisfaction of the service disruption and the difficulties in reaching HTCL's customer hotline during the period of service disruption. OFCA has not received any complaint against HTCL from the media.

7. OFCA completed its investigation and submitted its findings to the Communications Authority ("CA") on 8 September 2012. Having considered the findings of OFCA, the CA issued its Provisional Decision to HTCL on 10 September 2012 and invited it to make representations within 14 days. HTCL submitted its representations to OFCA on 25 September 2012.

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[3] The preliminary report of HTCL may be downloaded from OFCA's website at http://www.ofca.gov.hk/filemanager/ofca/common/Industry/telecom/fbs/outage/htcl_report_201207.pdf.

[4] The full report of HTCL may be downloaded from OFCA's website at http://www.ofca.gov.hk/filemanager/ofca/common/Industry/telecom/fbs/outage/htcl_full_report_20120717.pdf.

Issues Examined During the Investigation

The Cause of the Incident and the Adequacy of HTCL's Preventive Measures

8. The incident was caused by a software bug in the AAA server. The problematic software held up the resources of the AAA server and reduced the number of unallocated IP addresses in the pool for assignment. As a result, no IP address was available for assignment to 3G users who requested new data connections (i.e. internet access) during the period 11:00 am – 1:15 pm on 29 June 2012, effectively cutting off users' access to HTCL's 3G mobile data service. As the faulty AAA server was only used for the provision of data service of HTCL's 3G network, other services of HTCL including 3G voice service and SMS, all 2G services and 4G services etc remained normal and unaffected.

9. HTCL reported that both the software and hardware of the AAA server were supplied by Nokia Siemens Network Limited ("NSN"), a reputable telecommunications equipment vendor. Before the AAA server was put into service, HTCL had conducted extensive functional test and system stress/load test (over 300 tests under the testing period of four weeks) to verify the stability of the equipment and its compatibility with the system. HTCL emphasized that, according to NSN, the problem was caused by a software bug which had never shown up in Hong Kong or in any where else in the world before. The software was developed by NSN. The service disruption was thus caused by circumstances beyond HTCL's control.

10. HTCL claimed that it had diligently endeavoured its best to ensure the stability and reliability of the AAA server after it had been put into service. There are regular preventive maintenance and health checking procedures in place for the AAA server. HTCL has paid close attention to ensuring that the software of the AAA server is up-to-date. The most recent major upgrade of the software of the AAA server took place in April 2010. The existing software is working within the normal product life cycle of the software product developed by NSN for carrier-grade AAA server[5].

11. HTCL submitted that, as the software bug in question has not surfaced before, NSN is now working very hard to develop a permanent solution to the problem. In the interim, to prevent the faulty AAA server

[5] The normal software upgrading cycle for NSN's carrier-grade AAA server is 2.5 – 3 years.

from affecting the provision of 3G mobile data service, HTCL has activated the backup solution by bypassing the AAA server and would continue to let the GGSN take up the duty of assigning IP addresses to users of 3G mobile data service. In addition, to guard against similar incident from occurring again in future, HTCL submitted that it –

(a) has developed a system to closely monitor the number of IP addresses assigned on a continuous basis. The system will also have a set of recovery procedures to clean up the IP addresses improperly held up;

(b) has made preparations to carry out the necessary acceptance and loading tests once the permanent solution to eliminate the software bug of the AAA server is delivered by NSN. The target is to complete all relevant tests by the end of August 2012;

(c) will work with NSN to conduct a full review of its network architecture to examine whether there is any abnormality in respect of the IP network components;

(d) will setup a communication channel with NSN to closely monitor the problems of AAA server reported by mobile operators in other places of the world on a regular basis; and

(e) will review its crisis management procedures regularly to improve its ability to respond to critical network incidents.

OFCA's Assessment

12. OFCA recognizes that it is not uncommon for software bugs to exist in a computer programme. As a user of the AAA server supplied by NSN, OFCA considers that HTCL has acted reasonably to ensure that the equipment had been fully tested before it was put into service. Besides, HTCL has strived to ensure that the AAA server is up-to-date and there are also regular maintenance and health checking procedures in place to ensure the proper functioning of the AAA server (including carrying out housekeeping procedures for the AAA server everyday and performing health checking bi-hourly by executing a set of automatic software scripts and manual checking procedures). As the problematic software was developed

by NSN and HTCL is just a user of the software, OFCA agrees that the service disruption was caused by circumstances beyond HTCL's control.

13. OFCA also notes that HTCL has made resilience provision for the AAA server in the network design by commissioning a pair of front end servers and a pair of back end servers in operation to safeguard against single point of failure. HTCL has also formulated in advance a backup arrangement (i.e. to arrange the GGSN to take up the duty of IP address assignment) which could be triggered readily in case there are problems with the AAA server.

14. Although HTCL has implemented the above safeguarding measures, the incident still occurred. As explained by HTCL, the incident was caused by a rare software bug, a risk which was beyond predictable even by HTCL's vendor. According to NSN, the bug could not have been discovered in the acceptance and loading tests because it was not loading related and it has never surfaced before. The risk posed by the software bug is not predictable and NSN is still making effort to develop a permanent solution to fix the problem.

15. In conclusion, having examined the cause of the incident and the preventive measures taken by HTCL, OFCA accepts that the service disruption was due to circumstances beyond HTCL's control. OFCA is also satisfied that HTCL has taken reasonable preventive measures to ensure the healthiness and stability of its AAA server.

Time and Actions Taken by HTCL to Restore Services

16. HTCL submitted that, as soon as it was alerted by the system alarms that the AAA server was abnormal at 11:05 am on 29 June 2012, its engineers immediately started working and requested its vendor (i.e. NSN) to provide emergency support. HTCL reported that it had worked closely with NSN throughout the service disruption and had made efforts to resolve the problem by carrying out a series of emergency checking and troubleshooting procedures, including –

- checking the memory usage, processing loading, physical interfaces status, database usage of the AAA server;

- checking the healthiness of the other mobile network elements to

ensure that they were functioning well and would not affect the 3G mobile data service;

- capturing the signalling messages in/out the AAA server and analyzing the message content; and

- conducting call tests with system debugging function to isolate the root cause of the problem.

17. At around 12:45 pm on 29 June 2012 (i.e. 1 hour 40 minutes after the problem was noticed), after confirming that the problem was caused by a software bug in the AAA server, HTCL immediately decided to activate the backup arrangement to bypass the AAA server. The implementation of the bypass was completed at around 1:15 pm (i.e. within 30 minutes). HTCL reported that it had been very efficient in mobilizing its staff to carry out the restoration works to shorten the duration of the service disruption.

OFCA's Assessment

18. OFCA notes that, once HTCL was alerted to the disruption of its 3G mobile data services, it had escalated the matter to NSN, its vendor, in the first instance and had been working closely with NSN to trace the root cause of the problem. Although HTCL (and NSN) had taken approximately 1 hour 40 minutes to identify the root cause of the problem, having regard to the fact that there were many other IP components in the system (any one of which might be the cause of the service disruption) and HTCL had to carry out various checking procedures and tests (as listed out in paragraph15 above) to identify the source of the problem, OFCA considers that the time taken by HTCL to identify the root cause of the problem is acceptable.

19. OFCA also notes that, after the root cause of the problem was identified, HTCL had taken a decisive move to bypass the AAA server and had managed to complete the bypass process within a short timeframe (i.e. 30 minutes). The affected 3G mobile data service was resumed progressively from 1:15 pm and was fully recovered at 2:00 pm on 29 June 2012. OFCA notes that HTCL was able to complete the bypass process within a short period of time because it had put in place in advance the backup arrangement, which had enabled HTCL to effectively shorten the restoration time and minimize the impact on customers as and when problems occur.

20. Overall speaking, OFCA considers that the time and actions taken by HTCL to restore the affected 3G mobile data service are acceptable.

HTCL's Communication with OFCA over the Service Disruption

21. According to the "Guidelines for Cable-based External Fixed Telecommunications Network Services Operators and Internet Service Providers for Reporting Network and Service Outages" (the "Guidelines") issued on 19 July 2011, a network operator is required to report to OFCA in the event of network or service outage. The Guidelines also specify that in the event of any degradation of internet access services or failure of critical components (e.g. authentication servers) affecting or potentially affecting 10,000 or more users for more than 45 minutes, the network operator concerned should report the outage to OFCA within one hour from the happening of the outage if the outage occurs on weekdays during the period from 8:30 am to 1:00 am of the next day.

22. The malfunction of HTCL's AAA server on 29 June 2012, a weekday, had led to around 40,000 to 50,000 customers having difficulty in using HTCL's 3G mobile data service for over two hours. Pursuant to the Guidelines, HTCL should notify OFCA about the incident by 12:05 pm. According to the records of OFCA, HTCL notified OFCA of the incident at 12:00 noon.

23. After identifying the root cause of the problem, at 1:00 pm, HTCL also took the initiative to inform OFCA that the disruption was caused by a problem occurred in the process of IP address assignment to 3G mobile data service, and confirmed that voice and SMS services were unaffected.

OFCA's Assessment

24. HTCL had notified OFCA of the incident within the timeframe stipulated in the Guidelines and had kept OFCA updated of the progress of its restoration works from time to time during the service disruption. As HTCL had complied with the requirements stipulated in the Guidelines and had been cooperative and responsive to OFCA's enquiries throughout the service disruption, OFCA considers that the manner in which HTCL handled its communication with OFCA throughout the service disruption satisfactory.

HTCL's Communication with Customers and the Media

25. HTCL submitted that it had communicated with its customers about the service disruption through the following channels on 29 June 2012 –

(a) at 1:30 pm, HTCL issued a statement (in both Chinese and English) to frontline staff notifying them of the incident to enable them to answer customer inquiries with updated information. The same statement was also issued to the media;

(b) at 2:00 pm, HTCL posted a message about the service disruption on HTCL's customer service page on the Facebook and on HTCL's website (i.e. www.three.com.hk);

(c) at 2:30 pm, HTCL issued the second statement advising the public that the affected service had resumed normal operation at 2:00 pm, and apologized for the service disruption; and

(d) at 7:00 pm, HTCL issued the third statement which provided the details on the number of customer enquiries/complaints received and clarified that the incident only affected 3G mobile data service.

26. HTCL also submitted that it had sent text messages and the second statement by email to the corporate customers who had enquired about the incident.

OFCA's Assessment

27. OFCA observed that HTCL notified the public by posting a message about the service disruption on HTCL's customer service page on the Facebook and on HTCL's website at 2:00 pm (i.e. almost three hours after the service disruption occurred). During the period between 11:05 am – 2:00 pm, as no information about the service disruption was released by HTCL to the public, the affected customers did not know what had happened with HTCL's 3G mobile data service and when the service would resume normal. Some HTCL's customers had tried to call HTCL's hotline during

the period but could not get in touch with any HTCL staff. OFCA considers that if HTCL had notified the customers and the media earlier (e.g. shortly after the time when it notified OFCA at 12:00 noon), its service users would have been more timely and effectively advised of the service disruption.

28. Overall speaking, OFCA is of the view that the arrangement made by HTCL in notifying its customers and the media of the service disruption was only marginally satisfactory. OFCA considers that there is scope for HTCL to improve and streamline its internal procedures to ensure more timely dissemination of information to the customers and media in the event of service disruption.

CONCLUSION

29. After examining the facts of the case and the representations of HTCL, OFTA considers that HTCL has –

(a) taken reasonable preventive measures to ensure the healthiness and stability of the AAA server and put in place proper redundancy arrangement. The service disruption was caused by circumstances beyond the control of HTCL;

(b) taken expeditious actions to identify the cause of the problem and has restored the affected service within an acceptable timeframe;

(c) reported the service disruption to OFCA within the timeframe stipulated in the Guidelines and cooperated with OFCA during the service disruption period; and

(d) notified its customers and the media of the service disruption within an acceptable timeframe, albeit marginally only.

30. In conclusion, OFCA considers that there has been no breach of HTCL of GC 5.1 of its Unified Carrier Licence No. 004, which requires it to provide a good, efficient and continuous service in a manner satisfactory to the CA.

IMPROVEMENT MEASURES

31. Notwithstanding the finding of no breach by HTCL of GC 5.1 of its Unified Carrier Licence No. 004, OFCA would urge HTCL to conduct the technical review of the AAA server as a matter of top priority with a view to identifying a permanent solution to the problem so as to avoid similar incident from occurring in future. OFCA also considers that HTCL should review its internal procedures to ensure more timely dissemination of information to its customers and the media in the event of service disruption.

The Communications Authority
October 2012