JT (Jersey) Ltd
PO Box 53, No 1 The Forum,
Grenville Street, St Helier,
Jersey JE4 8PB
Company Number 83487

JT (Guernsey) Ltd
24 High Street,
St Peter Port,
Guernsey GY1 2JU
Company Number 39971

JT Incident of July 12th, 2020
Final Reason for Outage (RFO) report

Introduction

This document describes the incident that occurred on JT's network from Sunday July 12th at approximately 19:00 BST. Services (fixed line and mobile voice) started to restore step by step from July 12th at 23:34 BST.

This incident is the most critical JT has ever experienced and is exceptional due to both its size and its duration. This document provides a summary of JT's findings regarding the incident and faithfully represents our understanding after consultation with all internal and external parties involved. We believe it accurately explains the sequence of events that led to this service incident. The majority of services to JT's Channel Islands customers were fully recovered by 3am on July 13th, with some minor remaining mobile issues finally resolved at noon on July 17th. JT's International services were fully recovered by 5pm on July 14th.

Description of the impact

Most of JT's services were impacted (mobile voice and data for JT subscribers in the Channel Islands or roaming abroad, fixed voice and data for JT subscribers in the Channel Islands, JT internal corporate services, IoT, FPS and bulk messaging services for international customers and internal communication). The table below shows the duration of the outage for those different services:

Service	Time to partial recovery HR:MM	Time to full recovery HH:MM
FTTP Voice	02:49	04:46
FTTP Broadband	Straight to full	05:57
Guernsey Broadband	Straight to full	05:57
CI Mobile Voice / SMS	02:49	04:46
CI Mobile Data	Straight to full	05:57
CI Private Circuit	05:57	21:00
INT IoT	05:57	42.12
INT Roaming	05:57	42:12
INT FPS	05:57	28:49
INT Bulk Messaging	05:57	TBC
JT internal communication services – Voice	Straight to full	04 :46
JT internal communication services – Data	Straight to full	05 :57

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Description of the cause

In common with most telecommunication operators, JT's services rely on a fully resilient IP (Internet Protocol) network. JT operates a network composed of around 100 IP routers provided by Cisco and configured to a Cisco approved design. Those routers are connected to two clock sources (NTP "Network Time Protocol" servers - managed as primary and secondary for resilience) through the IP network.

On July 12th at 18:55 BST, one of the two NTP servers generated a wrong date (actually "27/11/2000"). Because the source clock was available from a service point of view, the routers which had this source as their primary did not switch to the secondary clock source and instead started to propagate this incorrect time stamp to JT's other network routers.

From a synchronisation point of view, the IP routers are designed to be resilient to either a wrong date/timestamp or even a total absence of a clock signal as they all have a local clock to which they can switch.

In order to exchange routing information between each other, IP routers use a protocol called IS-IS (IS-IS: Intermediate Systems to Intermediate Systems, protocol designed by IETF: Internet Engineering Task Force). This protocol is implemented on all our routers. In order to secure the IS-IS protocol each router will authenticate with its neighbour using a locally stored password.

The underlying reason why this incorrect date/time stamp had such a dramatic effect on the routers is explained by an unexpected interplay whereby the local password can only be considered valid by the IP router from an explicit configured date in the router of July 1st 2012 (which we believe to be the date that our first Cisco IP routers were deployed). As the date transmitted (27/11/2000) was earlier than the password validity start date (01/07/2012) the router stopped working as it no longer had a valid password to communicate with its neighbours.

On July 12th at 18:55 BST, 15 (of our 100) routers received the wrong date and isolated themselves from the rest of the network. By doing so, they made 35 other routers unreachable. Thus, having lost around half of all the network the inherent resilience and redundancy of the network design was lost, and the network failed resulting in the consequences described above for end user services.

Amongst those impacted routers, two routers terminate our submarine cable connections to the UK (London), and one router terminates our submarine cable connection to France (Paris). Also, amongst those impacted routers were the 4 routers which are used as gateways to our geo-redundant mobile network core systems located in Jersey and Guernsey.

In order to restore service, our engineers had to physically attend the multiple sites where the routers are located. We needed to manually change the time on each effected router to replace the incorrect date. This took considerable time especially to reach the routers located outside of the Channel Islands. Our last router in Paris was corrected on July 13th at 16:00 BST.

Once the time had been updated on the isolated routers, most of the Channel Islands services were restored. However, as noted above, it took up to a further 36 hours for all international located devices to reconnect. This can be explained by the sudden return of connectivity generating a spike of activity to some of our and our partners' platforms. Those platforms, even though largely over

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dimensioned, were not sized to recover from a full outage. Some of our telco partners also interpreted these spikes as abnormal and suspicious behaviour and automatically shut down the links to JT as a precaution.

On July 15th, in parallel to finalise full recovery of our services, we started working actively with CISCO to disable the time-based password mechanism related to the IS-IS feature. A JT Cisco jointly designed Method of Procedure was implemented during a maintenance window the night of July 16th and was successfully completed at 5am on July 17th. Following this change, we are now confident our network is no longer vulnerable to the propagation of a wrong time/date stamp through our servers and a repeat of the incident is therefore impossible.

Why did one of our clocks send an incorrect date?

Based on our investigations, the cause is a hardware failure in the NTP server which caused a card to reset back to its original factory parameters.

We have investigated other possible causes which have been eliminated:

- The malfunctioning clock (NTP server) was in one of our access restricted data centres and does not have any external connection method or interface that would have allowed a malicious intervention (i.e. we do not believe that this could have been a cyber-attack).

- The clock (NTP server) gets it accurate time from a GPS signal. We have looked at the possibility of a GPS malicious spoofing. This has been eliminated as there are other network elements which use the same GPS signal which remained in full sync with the right date.

Why was there limited customer communication during the outage?

The incident caused us to lose access to all our corporate services meaning that we could not reach our customer databases or use our email services from the Channel Islands. Some JT personnel located outside the borders of the Channel Islands had access to emails but not to our central databases or to the Business Continuity team who were working on the resolution in our offices.

It was around 23:30 BST on July 12th that communication between JT locations started to resume. We chose to prioritise restoring services and monitoring to prevent any recurrence over customer communication in the hours immediately following the service incident. The need for more robust customer communications during service incidents forms one of many learnings for JT following this incident.

Next steps

The faulty NTP server providing the erroneous clock has been decommissioned and at the time of writing we are currently operating with just one NTP Server. A new server will be installed this week to ensure we quickly return to a redundant clock (NTP Server) source.

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Conclusion

We understand and apologise for the impact this outage has had on all our customers. Whilst the cause of the outage was a sequence of events that was almost impossible to foresee, we recognise that we have much to learn from both the failures and successes of how we recovered the situation. Clearly our number one focus is on network resilience and reliability witnessed by the fact that we have never had such a largely impacting outage since our foundation in 1888. We will re-double our efforts to ensure that such an event never happens again during our lifetimes. We will also document all the learnings about how we can respond more quickly, restore services faster and provide better support and communication to our customers throughout any future incidents.

Thank you very much for your patience, support and understanding.

Thierry

Thierry Berthouloux
Chief Technology & Information Officer
E: thierry.berthouloux@jtglobal.com