

Final Incident Report

RITS and FSS Incident – 12 October 2022

1. Executive Summary

On Wednesday 12 October 2022, at around 19:00 the Reserve Bank of Australia (RBA) experienced a major system incident which impacted the Fast Settlement Service (FSS) and the Low Value Clearing and Settlement Services (LVCS and LVSS). The root cause was an operational error during a planned change which applied an incorrect setting to the software that manages the RBA's virtual servers. This took a number of production and non-production servers out of service.

As a result of the incident:

- settlement notifications that are normally sent to NPP participants by the FSS immediately following settlement of those transactions, were either delayed or not sent between 19:13 and 23:45. Settlement services for the FSS were recovered by 23:45 and full redundancy was restored by the afternoon of Saturday, 15 October. The impact on FSS processing was initially believed to be limited. Settlement requests continued to be received and settled but participants were not receiving settlement notifications in a timely way. This resulted in timeouts and prevented the completion of payments by participants. The full extent of this issue became clear at around 23:15. Recovery actions were undertaken and the FSS service was restored at 23:45. Transactions that had not been fully processed during the incident had to be reconciled and reprocessed by participants and this took a number of days for some institutions, with the bulk of the recovery work completed by Monday 17 October. Around 500,000 NPP unique payments (17 per cent of the daily average volume for a Wednesday)¹ sent by the public were delayed by at least 4 hours, with some delayed by more than five days.
- the Reserve Bank Information Transfer System (RITS) was unable to send and receive LVSS files between 19:05 on 12 October and 00:54 on 13 October.² This prevented members from submitting LVSS File Settlement Instructions (FSIs) to RITS through the normal channel. FSIs could be submitted manually through the RITS User Interface but there was limited use of this option. RITS opened 30 minutes earlier the following day as a precautionary measure following the disruption to services. Most members had submitted all of their remaining FSIs by the 10:45 multilateral run on 13 October.
- the LVCS was unable to exchange clearing files on behalf of participants between 19:05 on 12 October and 00:30 on 13 October.

The RBA acknowledges the seriousness of this incident and sincerely apologises to industry participants and their customers for the widespread repercussions it caused. This incident report for

¹ This is the number of unique payments settled during the incident. It differs from the volume estimate reported in the RBA's interim report which was the total number of payments initiated in the period and included some automatic retries of the same payment where the original had failed.

² Some minor revisions to the times quoted in the interim report have since been made following more detailed investigation.

our members sets out the results of our review and the subset of actions relevant to industry participants that we will undertake to prevent similar disruptions occurring in future.

2. Incident Root Cause

RITS and FSS have a high degree of technical redundancy, including appropriate automatic failover of components. Multiple instances of critical components, including infrastructure, network, database and application technologies, exist at each of the RBA's two operational sites. Data from the active site is synchronously replicated to the systems at the alternate site to ensure that transactional information is protected in the event of a failure. Data is also replicated to a third-site data bunker.

On 12 October at around 19:00, an operational error occurred during a planned Bank wide change using the software that provisions the RBA's virtual servers. This error triggered a process that disrupted a significant number of servers in a random pattern over a period of approximately 25 minutes. The scale of servers affected was caused by a failure to comply with the RBA's Technology Change Management policy and control gaps associated with the virtual server solution design contributed to the rapid propagation of the error. The incident affected multiple systems across the RBA.

While the strong redundancy features of RITS and FSS enabled parts of the system to continue operating normally, some services became unavailable and the resilience of the system was severely degraded. The scale and haphazard pattern of disruption significantly complicated the incident response.

3. Impact to RITS Members and RITS Services

The incident prevented FSS from sending out notifications of successful settlement, which caused widespread disruption to NPP payment processing and had severe repercussions for members, including significant inconvenience and delays to customers. Normal processing of low value clearing and settlement files was also delayed but the member and customer impact was not as great. Industry stakeholders were required to attend incident calls through to the early hours of Thursday morning. Large scale reconciliations and replays of impacted transactions took a number of days for some institutions to resolve. The incident also generated extensive enquiries and media coverage.

Despite the extent of servers affected, and the significant impact on the FSS and LVSS, the timing of the incident meant that all other settlement services had already finished for the day which greatly reduced the overall impact of the incident on members.

3.1 FSS

Settlement unavailable from 19:13 to 23:45

The FSS settles transactions submitted via the NPP feeder system on an RTGS basis.

Between 19:00 and 19:15, a large number of FSS servers were progressively taken offline. This resulted in three of the four FSS technology stacks becoming unavailable including six of the eight FSS payment gateways (PAGs). Despite this, the FSS continued to settle transactions through the infrastructure that remained intact. Initial indications during the incident were that FSS was operating normally, albeit with reduced capacity and resiliency. A series of duplicate settlement requests were received from

participants early in the incident which were thought to be automatic retries or replays of incomplete transactions. The speed of settlement notifications being sent to participants was also slow which was assumed to be due to reduced processing capacity.

At around 20:33 the RBA was advised by NPPA that some aborted transactions were occurring, but internal monitoring suggested that the number and extent of aborts was reasonably low and likely due to decreased processing capacity of the FSS. Given the uncertainties around how systems were behaving and the severely reduced redundancy, the remediation team initially sought to preserve processing through the surviving PAGs and associated components by minimising configuration changes and restarts. At 21:20 NPPA advised the RBA that there had been 408,000 aborted transactions in the previous two hours and system recovery teams then directed all of their attention to investigating. A conservative recovery approach that didn't require shutting down the surviving gateway was attempted but was not successful in restoring services.

At 23:15, the NPP Incident Response Group (NPP IRG) meeting was convened, which made it clear that the disruption to NPP processing was widespread with a far greater percentage of transactions aborting. The remediation team restarted the problematic component around 23:45 and the FSS immediately began successfully processing incoming and outgoing messages. From this point all settlement notifications were successfully sent out within the allowable response times.

Once the FSS had been restored to normal processing, participants were required to work through the backlog of aborted transactions which were in an unknown settlement state for both inbound and outbound transactions (around 500,000). NPPA arranged a number of meetings with all NPP direct participants over the next couple of days to co-ordinate the reconciliation and recovery effort. This involved originating participants replaying transactions from the initial clearing request within the 48 hour duplicate checking window. Some participants were able to complete this task quickly by using automated processes while others manually reconciled their transactions between their back office and the RBA FSS settlement report. Around 500,000 unique NPP payments sent by the public (excluding retry attempts) were delayed by at least 4 hours, with some delayed by more than five days.

Full redundancy for the FSS was restored by the afternoon of Saturday, 15 October.

3.2 Low-Value Settlement Service

Normal file processing unavailable from 19:05 to 00:54

The LVSS is used to submit settlement instructions to RITS for interbank obligations arising from cheques, direct entry and retail card payments (other than Mastercard and eftpos scheme transactions). RITS settles these obligations in five intraday settlement runs occurring between 10:45 and 21:15, or at 9:00 on the next business day.

From around 19:00 when the incident commenced, a large number of servers related to the LVSS were progressively taken offline. At around 19:05, the LVSS became unavailable to send or receive files. Members had already submitted their FSIs for the 19:15 multilateral settlement run, which settled successfully in RITS. However, by this time the LVSS was unable to send the associated settlement response files to members.

At around 21:06, the LVSS connection to RITS was restored but the component used to transfer files to and from members remained unavailable. This meant members were unable to submit FSIs for the 21:15 multilateral settlement run through the normal channel, but were able to manually enter these

through the RITS User Interface. The RITS Evening Session was extended by 30 minutes to 22:30 to allow members time to do this. There was limited use of this option, but three members were able to submit manual FSIs for settlement before the 22:30 cut-off.

LVSS inbound file transfers were restored at around 00:14 and outbound file transfers at around 00:54 on 13 October. Settlement response files for the manual FSIs and the earlier 19:15 multilateral run were sent to members from 00:54.

As a precautionary measure, RITS was opened 30 minutes early on 13 October. Most members submitted the last of their remaining FSIs by the 10:45 multilateral run.

3.3 Low-Value Clearing Service

File processing unavailable from 19:05 to 00:30

The LVCS facilitates bilateral file transfers between low value clearing system participants using SWIFT FileAct and the industry Community of Interest Network (COIN). Most low value clearing exchanges do not use the LVCS and instead use the COIN to directly exchange files.

As with the LVSS, from around 19:05, the LVCS was unavailable to send or receive clearing files.

RITS members were unable to exchange clearing files through the LVCS for the last two direct entry exchanges of the day (around 20:45 and 22:30). The LVCS was restored at 00:30 on 13 October.

Members liaised bilaterally to arrange for clearing files to be resent where necessary, and most reported the backlog was cleared on 13 October. Depending on the approach taken by members, there may have been a delay of up to one day for some customer payments unable to be cleared through the LVCS. An issue occurred with one member processing a file twice which resulted in duplicate postings to customers and required reversing.

3.4 Overnight processing

Overnight processing of member reports was largely unaffected, although the FSS end-of-day reports sent in the early hours of 13 October were delayed by around 50 minutes. While systems were not yet at full capacity there was a similar delay to statements being sent on the evening of 13 October. Normal processing speed resumed on 14 October.

4. Industry Communication

The RBA uses a crisis communication service hosted outside the RBA that facilitates the mass broadcast of SMS and email. This is a highly available service which is separate from other technology services to ensure the RBA can continue to communicate with industry stakeholders in the event of a large scale incident such as this one. The crisis communication service was available throughout the incident and was used to communicate with RITS and FSS contacts, NPPA, the NPP IRG, and AusPayNet and its Crisis Management Team (CMT).

The first NPPA IRG meeting was called at 22:51 on 12 October and convened at 23:15. A total of 5 meetings occurred over 3 days. The AusPayNet Member Incident Plan (MIP) was invoked and the first meeting occurred at 09:30 on 13 October. The RITS Help Desk also took a large number of phone calls from members during the course of the incident and over the following day.

Throughout the incident the RBA sent multiple external updates to RITS and FSS contacts to provide information and updates regarding the incident progress. A record of the timing of communications is detailed in Appendix 1.

The incident attracted extensive media interest and there were numerous enquiries from media outlets and members of the public. The RBA issued a message on Twitter and a media release on Thursday, 13 October: <https://www.rba.gov.au/media-releases/2022/mr-22-34.html>.

5. Actions

The RBA has identified a comprehensive set of action items arising from the incident. A subset of these relevant to industry participants is reproduced below. Some of the action items involve detailed reviews of RBA systems as well as RBA and industry contingency arrangements, and are therefore expected to generate additional action items.

5.1 Incident cause and recovery

1. Undertake a review of the governance and control arrangements relevant to the incident, including other contributing factors

The RBA aims to have a strong change control environment for its systems and takes incidents of this nature very seriously. The error related to an incorrect configuration change. The scale of servers affected was caused by a failure to comply with the Bank's Technology Change Management policy. Control gaps associated with the virtual server solution design contributed to the rapid propagation of the error. A number of actions have already been taken to address this. Furthermore, the RBA will undertake a comprehensive review of the governance and control arrangements relevant to the incident, including broader potential contributing factors.

2. Investigate improvements to broaden monitoring of end-to-end message flow for FSS

There is a gap in the RBA's ability to rapidly monitor and assess the business impact of FSS incidents on the broader NPP ecosystem. While settlement of FSS transactions was confirmed to be uninterrupted, there was no available internal option to check the end to end flows as part of the business impact assessment to identify settlement aborts. It also took the RBA too long to determine the extent of settlement aborts occurring. The RBA will investigate, and where necessary implement, improvements to its monitoring that could have detected this and discuss options with NPPA as to whether its participant communication options can assist.

There is also a potential gap in centralised monitoring of settlement aborts and timeouts. Unlike clearing message aborts, SWIFT (and therefore NPPA) does not currently have centralised alerting in place for settlement aborts, or the associated NPP payment message timeouts, that can be monitored by SWIFT or NPPA (aborts are sent to both sender and receiver). The RBA will seek guidance from NPPA and SWIFT about whether additional centralised alerting, or any potential alternatives, should be considered.

3. Review system RBA recovery procedures for FSS

The NPP disruption could potentially have been resolved earlier if the RBA had taken more timely assertive actions to restart a component responsible for FSS settlements notifications. On this

occasion, observing the principle of “first do no harm” likely prolonged the recovery time. If better information on the severity of the impact had been known, a more positive approach to system recovery may have been adopted earlier. This could have included self-suspension of the FSS PAGs to halt NPP payments, which would have reduced the need to manage aborts and orchestrate subsequent retries and manual reconciliation. Given the information available at the time, it remains an open question whether a different course of action should have been taken. The RBA will review and where necessary update its internal contingency procedures based on the experience gained from this incident.

5.2 Industry communication and coordination

4. Review clarity of RBA notifications and updates to Members about RBA system issues

The communications sent out by the RBA for the FSS may not have been sufficiently clear and could have been interpreted by NPP participants as meaning that the RBA was aware of the delays to the settlement notifications and working on the remediation. The RBA will review the language and content of its external notifications and make changes where necessary.

5. Discuss procedures on the timing of industry incident meetings with NPPA and AusPayNet

Holding industry-wide meetings with participants earlier would have provided business impact information and allowed for more effective decision making. This includes NPPA convening an NPPA IRG and RBA working with AusPayNet to convene a separate meeting with their participants for the LVSS and LVCS. There was also some confusion in relation to who could call an industry NPPA IRG which may have contributed to the delay.³ The RBA will discuss this bilaterally with NPPA and AusPayNet.

6. Review and clarify communication roles between RBA and NPPA

The communication procedures between the RBA and NPPA could have been clearer, particularly in relation to how an incident is handled when occurring outside of business hours. Greater clarification around roles and responsibilities in relation to media responses and press releases may have resulted in more timely communications. The RBA will seek to work with NPPA to review and clarify the communication procedures.

5.3 Industry procedures

7. Seek guidance from NPPA about industry capability to replay NPP payments at scale

The NPP design in relation to settlement aborts requires participants to replay the clearing request. The NPP procedures stipulate that participants must have the capability to this, and participants that did were able to relatively quickly complete their payments. The remediation took longer for participants that could not replay or do so at scale. The RBA will seek guidance from NPPA about whether measures to improve industry capability to replay payments at scale should be considered.

³ The RBA-NPPA Operational and Contingency Procedures allocate responsibility to NPPA for the notification and escalation of FSS Incidents and BI Incidents to the NPP IRG and for convening the IRG as required. However, in practice either NPPA or RBA can request the convening of the NPPA IRG.

APPENDIX 1. Summary of Action Items

The RBA will seek to address these actions as a matter of urgency. The timeframes for each are currently being assessed. We will communicate relevant updates to Members through the existing channels, including the regular RITS User Group Forum meetings.

Item	Action
1	Undertake a review of the governance and control arrangements relevant to the incident, including other contributing factors
2	Investigate improvements to broaden monitoring of end-to-end message flow for FSS
3	Review system RBA recovery procedures for FSS
4	Review clarity of RBA notifications and updates to Members about RBA system issues
5	Discuss procedures on the timing of industry incident meetings with NPPA and AusPayNet
6	Review and clarify communication roles between RBA and NPPA
7	Seek guidance from NPPA about industry capability to replay NPP payments at scale

APPENDIX 2. Sequence of Events

Event Time	Service/Component	Event Description
Wednesday, 12 October 2022		
19:00		Issue identified.
19:05		Incident bridge convened.
19:23	FSS	FSS automatically attempts to self-suspend the PAGs. This action failed.
19:25		Confirmation that servers for multiple services are affected.
19:28	NPPA	First phone call to NPPA to advise incident impacting processing, but FSS still settling transactions.
19:30	External Communication	RBA Update: The RBA is currently investigating an issue with the Fast Settlement Service. Settlement processing is not currently impacted, however, delays maybe be encountered. A further update will be provided in approximately 30 minutes.
19:31	FSS/RITS	Confirmation that three stacks for the FSS are down and the LVSS/LVCS is unavailable.
19:37	RITS	Confirmation that 19:15 multilateral settlement completed successfully but settlement response files unable to be sent.
19:50	External Communication	RBA Update: The RBA is currently investigating an issue which is impacting the Low Value Clearing and Settlement Services. LVSS response files have not been sent from 19:15MR. A further update will be provided in approximately 30 minutes.
20:01	RITS	Recovery priority is RITS LVSS/LVCS given analysis at the time was that FSS was continuing to operate.
20:05	External Communication	RBA Update: The RBA is currently investigating an issue with the Fast Settlement Service. Settlement processing is not currently impacted, however, delays maybe be encountered. A further update will be provided in approximately 30 minutes.
20:20	External Communication	RBA Update: The RBA is currently investigating an issue which is impacting the Low Value Clearing and Settlement Services. Currently, RITS is unable to receive FSIs for settlement. A further update will be provided in approximately 30 minutes.
20:33	NPPA	RBA Update: RBA calls NPPA to advise no change in impact to FSS. NPPA informs that some participants are timing out/aborted without receiving Settlement Notification.
20:42	FSS	Internal checks confirm that FSS is healthy with multiple participants settling transactions.
21:00	External Communication	RBA Update: The RBA is currently investigating an issue with the Fast Settlement Service. Settlement processing is not currently impacted, however, delays maybe be encountered. A further update will be provided in approximately 30 minutes.
21:05	External Communication	RBA Update: The RBA is continuing investigations of the issue which is impacting the Low Value Clearing and Settlement Services. Members can manually enter files in RITS. Please contact the RITS Help Desk if you need assistance with this. A further update will be provided in approximately 30 minutes.

Event Time	Service/Component	Event Description
21:27	NPPA	NPPA advises there have been 400,000 aborted NPP transactions in past 2 hours.
21:46	FSS	RBA identifies an issue which may be causing the aborts.
21:48	RITS	RBA agrees to extend the RITS Evening and Reports sessions by 30 minutes to 22:30 to facilitate manual file entry into RITS.
22:05	External Communication	RITS Evening Session has been extended by 30 minutes to 22:30 to allow members to submit manual FSI's to RITS for settlement.
22:33	FSS	Confirmed that RITS allocation transfers have settled.
22:45	SWIFT	SWIFT join the RBA PS systems incident bridge to help troubleshoot.
22:51	NPPA	RBA requests NPPA to convene Incident Response Group (IRG).
23:00	External Communication	RBA Update: The RBA is continuing investigations of the issue with the Fast Settlement Service. Participants may be observing message aborts. FSS EOD Allocation Transfers settled in RITS shortly after 22:30. NPP will be raising an IRG at 23:15.
23:15	External Communication	RITS has now closed for the day. We will advise when our systems are available for files for the Low Value Clearing and Settlement Services to be submitted.
23:15	NPPA	IRG meeting held.
23:47	FSS	FSS is restored (one stack out of four). A restart of an FSS component is conducted while IRG is ongoing and this restores services. SWIFT and NPP participants confirm on call that aborts have stopped.
Thursday, 13 October 2022		
00:11	RITS	LVSS recovered for incoming files to RITS.
00:30	NPPA	IRG meeting held.
02:30	External Communication	RBA Update: The issue impacting the RITS Low Value Clearing Service (LVCS) and Low Value Settlements Service (LVSS) has now been resolved. Any file transfers received in RITS with a value date of 12 October will be rejected. Discussions will be held with AusPayNet in the morning about convening an Industry call to discuss the current status and any further actions. The RBA will be opening RITS 30 minutes earlier at 07:00 to facilitate the resolution of any residual issues.

Event Time	Service/Component	Event Description
02:45	External Communication	<p>RBA Update: The RBA experienced an issue which impacted the Fast Settlement Service from 19:21 to 23:47 on Wednesday 12 October.</p> <p>Settlement processing was impacted during this period with participants reporting a high percentage of timeouts or aborts. The RBA completed remedial activity at 23:47 which resolved the timeout/abort issues. The FSS is now processing all transactions successfully, but is operating on reduced resiliency.</p> <p>Further updates will be provided at the NPPA IRG, scheduled at 10:00am.</p>
07:00	RITS	RITS opened 30 minutes earlier without issue.
07:45	External Communication	The RBA has opened RITS successfully at 07:00 with no issues encountered.
08:04	AusPayNet	RBA contacts APN to request the convening of an Industry call.
08:09	RBA	The RBA posts a message on Twitter.
09:30	AusPayNet	AusPayNet Industry call convened to discuss impacts to low-value participants and agree next steps.
10:00	NPPA	NPPA Operations Managers meeting reconvened to discuss the status of participants and to commence the process of replaying the backlog of transactions.
15:00	AusPayNet	AusPayNet Industry call convened as a follow up to earlier call to check status on backlog of low value files.
16:00	NPPA	NPPA Operations Managers meeting reconvened for as status update on progress replaying the backlog of transactions.
17:15	RBA	The RBA issues a media release.
Saturday, 15 October 2022		
17:02	External Communication	<p>RBA Update: The RBA has completed all remedial activities for the Fast Settlement Service (FSS) and it is now operating with full resiliency. The FSS continues to process transactions successfully.</p> <p>This is the final update.</p>

APPENDIX 3. Record of communications

Timeline	Electronic External Notifications			Teleconference Meetings		Phone Communication	
	SMS/Email	Twitter	Press Release	NPP (IRG)	AusPayNet (CMT)	NPPA	AusPayNet
Wednesday, 12 October 2022							
	FSS	LVCS/LVSS					
19:00	19:30	19:50				19:28	
20:00	20:05	20:20				20:33, 20:37	
21:00	21:00	21:05				21:19, 21:44	
22:00		22:05				22:45	
23:00	23:00	23:15		23:15			
Thursday, 13 October 2022							
00:00				00:30			
01:00							
02:00	02:45	02:30					
07:00		07:45					
08:00			08:09				08:00
09:00					09:30		
10:00				10:00			
11:00							
12:00							
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14:00							
15:00					15:00		
16:00				16:00			
17:00			17:16	17:15			