FINAL INTERNAL AUDIT REPORT

IT Availability and Capacity (IA 13 519/F)

Andrew Wolstenholme, Chief Executive

Audit Conclusion: Audit Closed

23 February 2015

<table>
<thead>
<tr>
<th>Issue categories</th>
<th>Agreed actions</th>
<th>Satisfactorily addressed</th>
<th>Partially addressed</th>
<th>No longer applicable</th>
<th>Not addressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Priority 1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Priority 2</td>
<td>10</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Priority 3</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
CONTENTS

EXECUTIVE SUMMARY ........................................................................................................ 3
STATUS OF AGREED ACTIONS ...................................................................................... 5
APPENDIX 1 – DISTRIBUTION LIST ................................................................................. 12
EXECUTIVE SUMMARY

Objective

The objective of this audit was to provide assurance over the effectiveness of controls designed and implemented to ensure adequate maintenance of service availability, efficient management of resources, and optimisation of system performance.

Scope

The audit focused on IT processes, procedures and controls implemented to manage IT availability and capacity in Crossrail, including those that have been put in place to:

- Assess the current capacity, availability, and performance to meet business requirements, priorities and objectives;
- Analyse the business impact of unavailable critical systems and resources to ensure adequate management of the relevant risks and resilience of the critical assets;
- Adequately plan for new or changed services and adjust the performance and capacity plans and targets as appropriate;
- Monitor, measure, analyse, and report the existing availability and capacity; and
- Investigate and address availability, capacity, and performance issues, including those relevant to the complexity of the service infrastructure (ie number of items and connections required to provide service), hardware age and single points of failure.

The review of IT availability and capacity focused on four critical applications, i.e. Enterprise Bridge (eB), ProjectWise, SharePoint, and Microsoft Exchange. The processes, procedures and controls specific to the availability and capacity management of Crossrail SAP systems and other non-hosted applications have been excluded from the scope of this audit.

Summary of findings

Our Interim Audit Report dated 13 June 2014 entitled ‘IT Availability and Capacity’ identified five priority 2 issues, as follows:

- Crossrail IT had not established a process to translate Crossrail business plans into measurable and detailed inputs for the IT capacity plans developed and managed by Fujitsu;
- Crossrail’s arrangements for IT service performance reporting could have been improved;
• Crossrail and Fujitsu monitored the IT services passively so issues were not identified before they had a major impact on users. We also noted that default rules and alerts still remained to be used within Fujitsu’s primary monitoring tool;

• Fujitsu had not produced a separate Availability Management Plan as required by the EAI contract; and

• The programme to incorporate thirteen contractors’ remote sites into the corporate network did not cover their resilience.

One priority 3 issue was also raised.

We have performed a follow up review and confirmed that management has implemented all the agreed management actions in respect of these findings. This audit is closed.
**STATUS OF AGREED ACTIONS**

<table>
<thead>
<tr>
<th>Ref</th>
<th>Agreed action</th>
<th>Owner and due date</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Priority 2 actions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Crossrail IT will undertake a detailed analysis of the current usage of key core systems and how that relates to the various contract types such as Civil Works, Rail Systems Installation and station fit out. It is expected that patterns will be identified, which will then be applied to forecasted work held in the programme’s master control schedule. A series of interviews will be held with key business stakeholders, including the programme planning team, delivery teams, and support functions seeking forecasts for how this usage will continue until the end of the project. Crossrail IT will also work alongside the Operations and Technical Information departments to identify options for information hand over at the end of the programme, and the impact those options will have on application usage and capacity. This work will culminate in an application and capacity roadmap report</td>
<td>Duncan Evans 30 September 2014</td>
<td>Satisfactorily addressed. Crossrail IT has undertaken a detailed analysis of the key core systems’ utilisation and their relationship to the various contract types, identifying the relevant patterns and forecasting their future utilisation. The application and capacity roadmap, along with the recommended future IT activities, has been approved by the IT Director.</td>
</tr>
<tr>
<td>Ref</td>
<td>Agreed action</td>
<td>Owner and due date</td>
<td>Status</td>
</tr>
<tr>
<td>-----</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-------------------------------------</td>
<td>-------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>submitted to and approved by the IT Director by the end of September 2014. The report will provide forecasted capacity by application and recommended future IT activities required to support that change.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>To complete the definitions of all service measures and establish required service targets for the 14 reported measures.</td>
<td>Gary Leach 31 July 2014</td>
<td>Satisfactorily addressed. An agreement on the service measures and service targets has been reached and contract changes have been raised to formally implement the resulting changes.</td>
</tr>
<tr>
<td>3.</td>
<td>To develop a new set of performance measures to assess more effectively the performance of Crossrail’s key applications – eB, SharePoint, ProjectWise, covering availability and capacity measures. This work will focus on using existing tools and capabilities to achieve the improvement, rather than looking at investments in new products. The timescales associated with the delivery of the Crossrail project, versus the benefits that might accrue, makes this a more practical approach. We will also look to cover the effectiveness of the capacity planning.</td>
<td>Alistair Goodall 31 July 2014</td>
<td>Satisfactorily addressed. Management has performed a review of, and identified, the measures to be used to review the performance of Crossrail's key applications, including the use of a benchmark measure for the end user experience and monitoring performance at a detailed server level. The actual data against the forecasted capacity is reported by Fujitsu in their capacity reports.</td>
</tr>
<tr>
<td>Ref</td>
<td>Agreed action</td>
<td>Owner and due date</td>
<td>Status</td>
</tr>
<tr>
<td>-----</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-----------------------------------------</td>
<td>---------------------------------------------</td>
</tr>
<tr>
<td>4.</td>
<td>Fujitsu are establishing an Operational Bridge on the Crossrail account with the express purpose of monitoring the enterprise management systems in a more proactive fashion. The initial operating capability is in place, and full operating Capability will be reached by the end of June. This new capability has the potential to improve overall monitoring of services and to develop more detailed reporting.</td>
<td>Gary Leach 31 July 2014</td>
<td>Satisfactorily addressed. An Operational Bridge on the Crossrail account has been implemented by Fujitsu to monitor Crossrail's core infrastructure components.</td>
</tr>
<tr>
<td>5.</td>
<td>Since the audit, it has been agreed that Fujitsu will now include the threshold values and any proposed changes in the Quarterly Capacity plan and this process will allow Crossrail to review and accept them on a frequent basis.</td>
<td>Gary Leach Completed</td>
<td>Satisfactorily addressed. This action was completed before the issuing of the Interim Audit Report.</td>
</tr>
<tr>
<td>6.</td>
<td>Fujitsu, Crossrail's current service provider, are continuing to refine and develop the reporting of capacity. At the time of the Audit the greatest focus was in the area of storage because of previous issues in that area. Subsequently the reporting has become more widely based.</td>
<td>Andrew Turner Completed</td>
<td>Satisfactorily addressed. This action was completed before the issuing of the Interim Audit Report.</td>
</tr>
</tbody>
</table>
The following changes are some examples of changes that have already been made:

- A technical dashboard has been set up to provide a clear RAG status along with 30 60 and 90 days predictions
- Network WAN utilisation of the 4 main links with forecast is now included
- Weekly SAN CPU utilisation is monitored
- Monthly CPU statistics are included in the capacity report
- Monthly server memory and CPU usage is being reported (Windows 2003 and Windows 2008)
- WAN health and status is being reported
- Exchange database utilisation is being forecast

7. The following list of items represents enhancements currently being worked on for introduction to the reporting over the next four months.

- Reviewing various storage reports at

<table>
<thead>
<tr>
<th>Ref</th>
<th>Agreed action</th>
<th>Owner and due date</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Gary Leach 31 August 2014</td>
<td>Satisfactorily addressed. The enhancements noted in the action have been adequately addressed.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Owner and due date</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Satisfactorily addressed. The enhancements noted in the action have been adequately addressed.</td>
<td></td>
</tr>
<tr>
<td>Ref</td>
<td>Agreed action</td>
</tr>
<tr>
<td>-----</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
|     | an operational level including snapshot usage, aggregate forecasts based on variations of periodic usage  
    - Capturing new project requirements for CPU, Memory and SAN usage  
    - Improving the accuracy of network reporting  
    - SQL forecasting and recommendations utilising a new operational report which will integrate with a process for maintaining database thresholds  
    - SQL, Wintel and SMS process to carry out the recommendations within the weekly SQL reports  
    - Integration of Crossrail forecasts into the quarterly capacity plan                                                                                                                                                                                                                          | Gary Leach  
    31 August 2014                                                                                                           | Satisfactorily addressed.  
    An availability plan has been developed by Fujitsu and shared with Crossrail management.                                                                                                                                         |
| 8.  | Fujitsu will develop and publish a separate Availability plan.                                                                                                                                                                                                                        | Chris Waters  
    30 June 2014                                                                                                           | Satisfactorily addressed.  
    Fujitsu have completed a review of remote connectivity to Crossrail’s sites.                                                                                                           |
| 9.  | Crossrail’s service partner Fujitsu, is in the final stages of implementing dedicated Crossrail network links to thirteen key                                                                                                                                                        |                            |                                                  |
construction sites. This is a project that was approved in 2013 in order to improve network reliability and to reduce the dependency on contractor-provided networks, which have not always been reliable and resilient.

We will take further action to improve resilience by asking Fujitsu to conduct an initial review of remote connectivity to our sites. This review will not only include WAN to remote sites, but also the technologies Crossrail is employing to enable access from remote sites including Citrix Access Gateway (CAG) and VPN. This initial review is likely to identify a series of high level potential changes to improve both resilience and functionality. Once complete, Fujitsu will liaise with Chris Waters, Crossrail’s Head of Technology, and jointly they will identify those items which merit further exploration with a view to implementation.

Once the improvement recommendations have been finalised, the changes that have been identified will need to be priced and approved. If the benefits justify the cost then an implementation plan will be submitted a proposal for a WAN Resilience Project.

<table>
<thead>
<tr>
<th>Ref</th>
<th>Agreed action</th>
<th>Owner and due date</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>construction sites. This is a project that was approved in 2013 in order to improve network reliability and to reduce the dependency on contractor-provided networks, which have not always been reliable and resilient. We will take further action to improve resilience by asking Fujitsu to conduct an initial review of remote connectivity to our sites. This review will not only include WAN to remote sites, but also the technologies Crossrail is employing to enable access from remote sites including Citrix Access Gateway (CAG) and VPN. This initial review is likely to identify a series of high level potential changes to improve both resilience and functionality. Once complete, Fujitsu will liaise with Chris Waters, Crossrail’s Head of Technology, and jointly they will identify those items which merit further exploration with a view to implementation.</td>
<td>Chris Waters 31 December 2014</td>
<td>Satisfactorily addressed. Crossrail management has reviewed the above proposal and concluded that its implementation would not be ‘value for money’.</td>
</tr>
<tr>
<td>Ref</td>
<td>Agreed action</td>
<td>Owner and due date</td>
<td>Status</td>
</tr>
<tr>
<td>-----</td>
<td>---------------</td>
<td>--------------------</td>
<td>--------</td>
</tr>
<tr>
<td></td>
<td>developed and executed.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Priority 3 actions**

11. We will carry out a review of the processes, controls and documentation associated with the requirements for each of Crossrail’s key applications. This work will cover existing applications, as well as the processes for designing and implementing new applications. The first phase of the analysis will concentrate on the top 5 most critical applications, based on usage or importance to Crossrail. This list will contain eB and SharePoint. The recommendations from this review will be prioritised and any necessary changes to processes and documentation will be amended accordingly. Any issues that are identified in relation to potential future capacity constraints will have action plans assigned to them. Once this first phase of work has been completed we will review the applicability of the changes to other applications, which may lead to a second phase of work.

Alistair Goodall  
30 September 2014

**Satisfactorily addressed.**

Crossrail IT management has implemented an ongoing process for review of the processes, controls and documentation relevant for IT availability and capacity planning for Crossrail’s key applications.
APPENDIX 1 – Distribution list

This report was sent to Andrew Wolstenholme, Chief Executive, by Clive Walker, Director of Internal Audit, and copied to:

Andrew Turner  Interim IT Director
David Allen  Finance Director
Gary Leech  Head of IT Services & Technical Infrastructure
Duncan Evans  Head of Business Systems and Planning
Alistair Goodall  Head of Application Support and Planning
Chris Waters  Head of Technology
Simon Gill  IT Services Manager
Mark Cone  Delivery Executive, Fujitsu
David Evans  Service Management Operations Manager, Fujitsu
Simon Wright  Programme Director
Dave Allen  Finance Director
Robert Flanagan  Finance Operations Director
Rob Halstead  Head of Risk Management
Richard Brown  Audit Manager
Nigel Blore  Head of Group Insurance, TfL
Andrea Clarke  Director of Legal, TfL
Andrew Pollins  Interim Chief Finance Officer, TfL
Steve Allen  MD, Finance, TfL
Howard Carter  General Counsel, TfL
Robert Brent  KPMG