

## Thomas Penny

**From:** Jenkins Gareth GI  
**Sent:** 08 March 2010 09:54  
**To:** charles.mclachlan [REDACTED] GRO  
**Cc:** Thomas Penny  
**Subject:** Horizon Architecture Diagrams

**Attachments:** Horizon Arch Overview.doc



Charles,

As discussed, on Friday, I've extracted some high level Architecture diagrams and also a summary of the message flows for processing Debit Card transactions.



Horizon Arch  
Overview.doc (859..

Hopefully it is the sort of thing you were after and they make some sort of sense. I'm happy to talk you through them.

Regards

Gareth

Gareth Jenkins  
Distinguished Engineer  
Applications Architect  
Royal Mail Group Account

**FUJITSU**  
Lovelace Road, Bracknell, Berkshire, RG12 8SN

Tel: [REDACTED] GRO [REDACTED] Internal: [REDACTED] GRO  
(Note new external number -  
old number will not work after 31/12/2009)  
Mobile: [REDACTED] GRO [REDACTED] Internal: [REDACTED] GRO  
email: [REDACTED]  
Web: <http://uk.fujitsu.com>

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# Horizon Architecture Diagrams

Ref: g:\gij\documents\poa\horizon\other\9c07.west byfleet\horizon arch overview.doc  
Author: Gareth I Jenkins  
Date: 08/03/2010 09:41:00

## 1. Introduction

The purpose of this note is to pull together some high level architectural diagrams of the Horizon System.

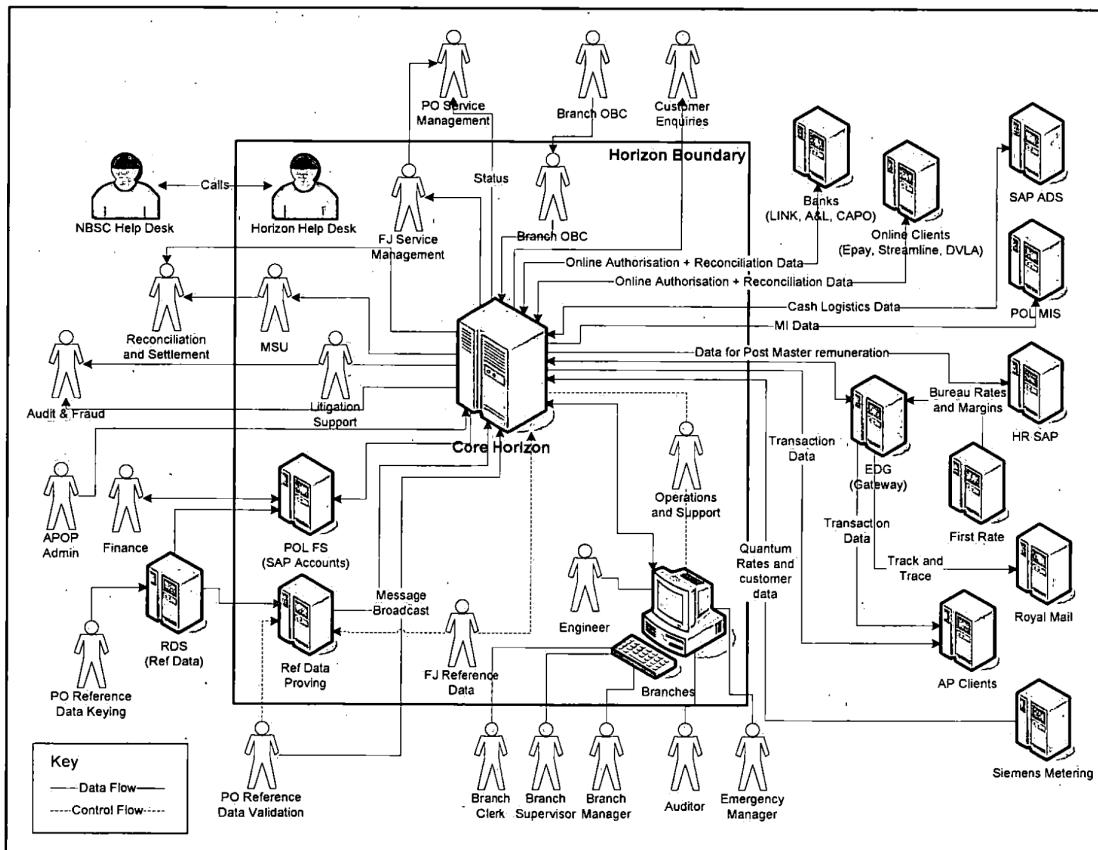
It is based on extracts from informal document TD/ARC/039 v0.2 and NB/IFS/004 v 4.3, neither of which is in an approved state.

This is intended to provide a summary for Prof Charles McLachlan an Expert Witness for the Defence in the case Regina v Seema Misra.

## 2. Overall Context

### 2.1 IT Context and Users

The diagram below shows the wider context of the Horizon Architecture and the users:



There are four main areas within the Horizon Architecture:

1. POL-FS – financial accounting system based on SAP

2. Reference Data Proving – environment in which changes to reference data are proved before releasing into live (reference data controls things such as which products are sold, their price and where in the menu hierarchy they are displayed).
3. Branches – the branches themselves
4. Core Horizon – the central systems that support Horizon

Core Horizon communicates with the following systems:

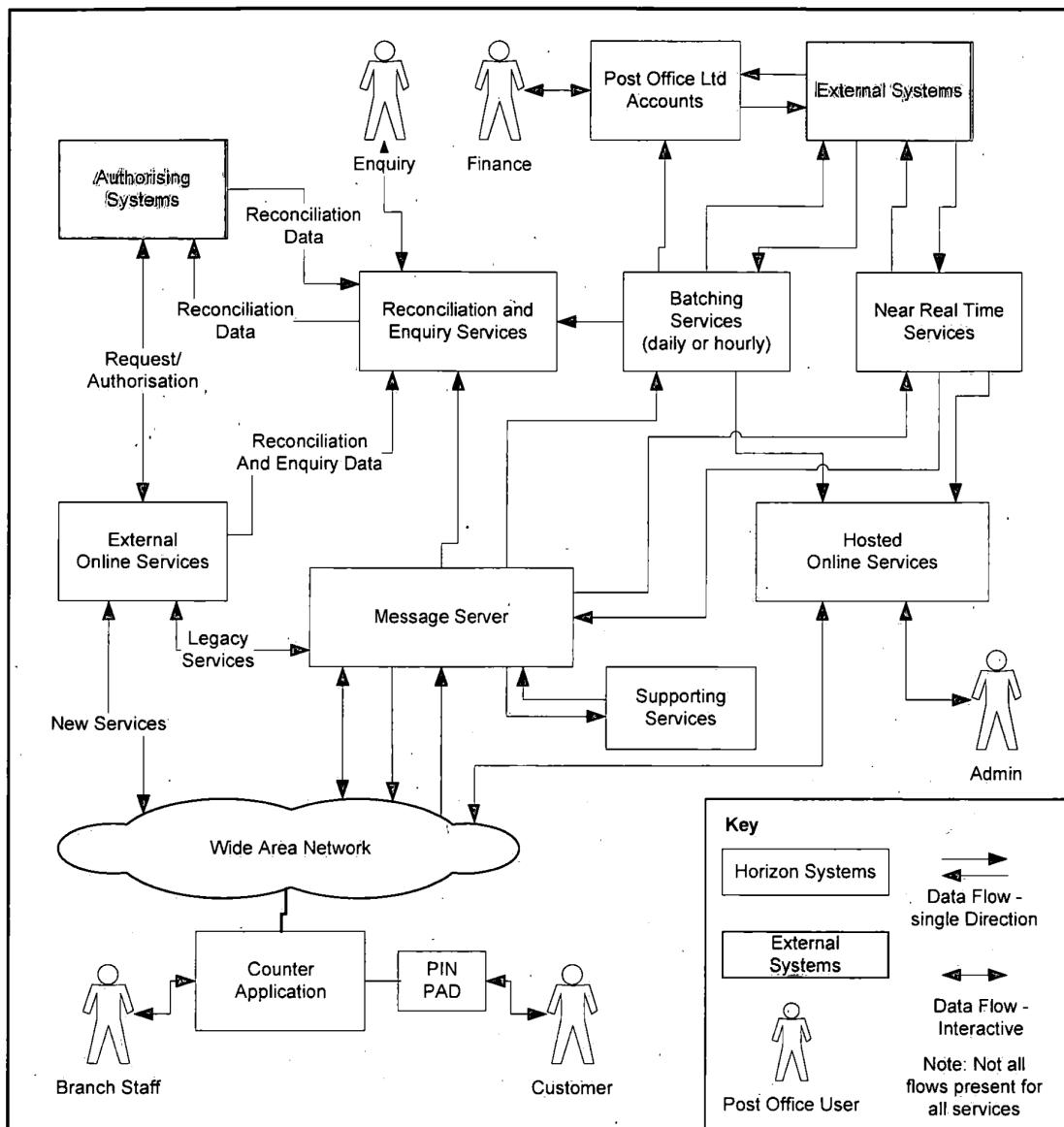
- Banks (LINK, A&L, CAPO) for online authorisation of banking transactions and transaction data used for reconciliation.
- Online Clients (e-pay, Streamline, DVLA) for online authorisation of transactions and (for e-pay and Streamline) data used for reconciliation.
- SAP ADS – A Post Office system that handles cash and Foreign Currency logistics. Data includes cash on hand statements from each branch, planned orders, replenishment deliveries and delivery/collection data.
- HR SAP – A SAP system that handles remuneration to the branch franchisees and “multiples” such as Tesco.
- POL MIS – An Oracle based system to provide MI reporting to Post Office.
- First Rate – Provides bureau rate information. It is also passed all bureau transactions to allow First Rate to undertake MI.
- Siemens Metering – Provides Rates and Customer data for Quantum gas pre-payment card.
- AP Clients – Transaction information for Clients where payment information is collected by Post Office.
- Royal Mail and Parcel Force Worldwide – track and trace information for parcels and letters taken in a branch.
- RDS – Post Office system that provides reference data

### **3. Logical Architecture**

This section describes the logical architecture to provide an introduction to the Horizon solution. It is split into two areas: Business Applications and physical structure

#### **3.1 Business Applications**

The diagram below shows a simplified view of the business applications for Horizon.



The key systems are described below:

#	Name	Description
1	Counter Application	The counter application is used by branch staff to sell products and to perform back office functions. Business data held in the counter in a Riposte messaging system – all counters in a branch have a copy of the complete data.
2	PIN Pad	Allows customers to input smart card and PIN for banking and DCS transactions.
3	Message Server	Handles messaging to/from Branches for batch data transfers using Riposte (specialist messaging system from Escher Group). Also handles online authorisations for legacy services (Banking, DCS, ETU) – new services connect directly via SOAP.

4	External Services	Online	<p>Provides online authentication for counter transactions where a third party owns the system that authorises the transactions. Specific services supported are:</p> <ul style="list-style-type: none"> <li>• DCS for debit card and credit card authorisations</li> <li>• Banking for deposits, withdraws and balance enquiries</li> <li>• ETU to allow electronic top-ups for mobile phones</li> <li>• DVLA for authorising car tax</li> </ul>
5	Hosted Services	Online	<p>Provides online authentication for counter transactions where the authorisation or information system is hosted by Horizon. Specific services supported are:</p> <ul style="list-style-type: none"> <li>• APOP databases - e.g. Postal orders</li> <li>• PAF to allow lookup of Postal Addresses</li> <li>• </li> </ul>
6	Reconciliation and Enquiry Services		<p>Provides Reconciliation and enquiry services for online authorisations. The specific systems are:</p> <ul style="list-style-type: none"> <li>• DRS (data reconciliation service) to reconcile individual transactions for the DCS, ETU and Banking services.</li> <li>• TES (transaction enquiry service) to allow Post Office to query transactions status for banking (only)</li> <li>• DWH (data warehouse) contains banking, ETU and DCS data for SLT calculations.</li> <li>• APS (automated payment system) which reconciles transactions between itself and TPS (transaction processing system).</li> </ul>
7	Batching Services		<p>Batches up data from branches to send to external systems – either all transactions or in summarised form. Also receives batch data from external systems for distribution to branches. The systems that pass data to external systems are:</p> <ul style="list-style-type: none"> <li>• TPS (transaction processing system) – provides daily data to other systems including POL-FS, POL-MIS and HR SAP. Also provides a feed to First rate for Bureau transactions.</li> <li>• APS (automated payment system) – provides daily data to AP clients (British Gas, BT etc).</li> <li>• LFS (logistic feeder service) – provides data on pouch collections and receipts at branches to SAP ADS on an hourly basis. Also nightly data on cash held in branches.</li> </ul> <p>The systems that receive data from external systems are:</p> <ul style="list-style-type: none"> <li>• APS – receives customer and tariff data for Quantum and Water Card service once per day.</li> <li>• LFS – receives planned order data (once per day) and pouch contents information (potentially hourly).</li> <li>• RDMC – receives Rates and Margins data for Bureau service</li> </ul>
8	Near Real Time Services		<p>Transfers data in near real time to or from external systems. The systems are:</p> <ul style="list-style-type: none"> <li>• APS – receives emergency customer data from Quantum for immediate distribution to the branches.</li> <li>• Track and Trace – provides data on parcels etc received by branches to Royal Mail and Parcel Force Worldwide</li> </ul>

9	Support Services	Supports the business systems with reference data, security and SLT monitoring. The systems are: <ul style="list-style-type: none"> <li>• RDMC and RDDS – reference data management and distribution systems.</li> <li>• KMA – key management system for branch security keys</li> <li>• OMDB – provides SLT monitoring for outbound data distribution. Also monitors branch connectivity.</li> <li>• DWH – SLT reporting for data file deliveries (inbound and outbound).</li> </ul>
10	PO Ltd Accounts	An SAP system (called POL FS) that holds the accounts for Post Office Ltd.. This has lots of input and output feeds to external systems.

#### 4. Application Architecture

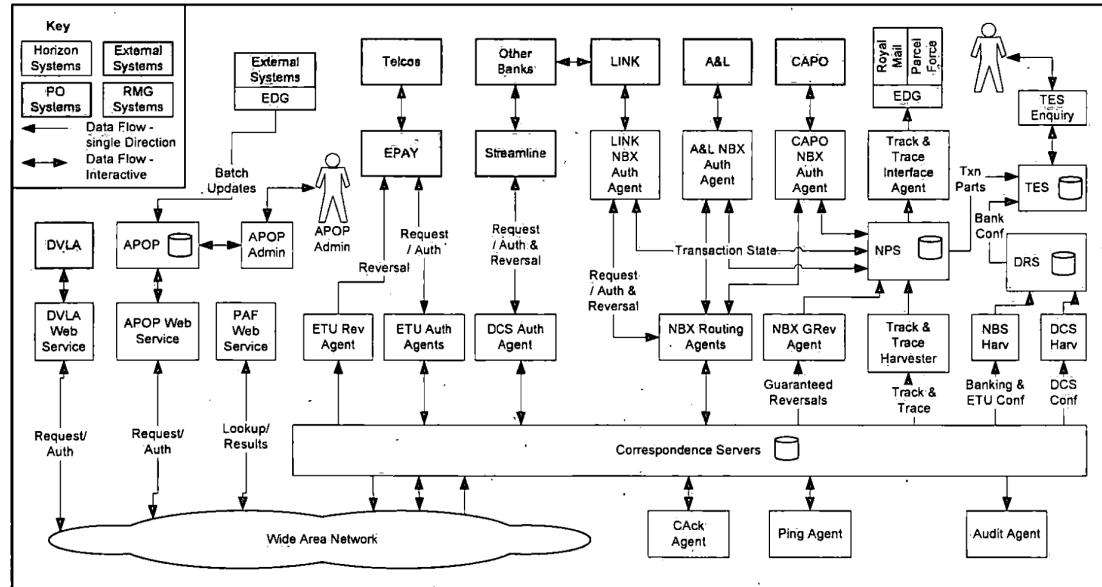
The application architecture has been split into a number of areas to allow the solution to be described as follows:

- Online and Near Real Time systems in the data centre. APOP Admin is included in this section for convenience.
- Batch systems in the data centre that handle the main business data and POL-FS.
- Supporting systems for reference data, SLT measurement Branch Monitoring and Key Management.
- Counter

This approach allows an understanding of all the elements that make up the different service. However some components do appear in multiple areas as a result.

##### 4.1 Online and Near Real Time

The picture below shows the systems and flows within the data centre for online and near real time services. The batch aspects of the APOP service have also been included for convenience.



The components and their role are described in the table:

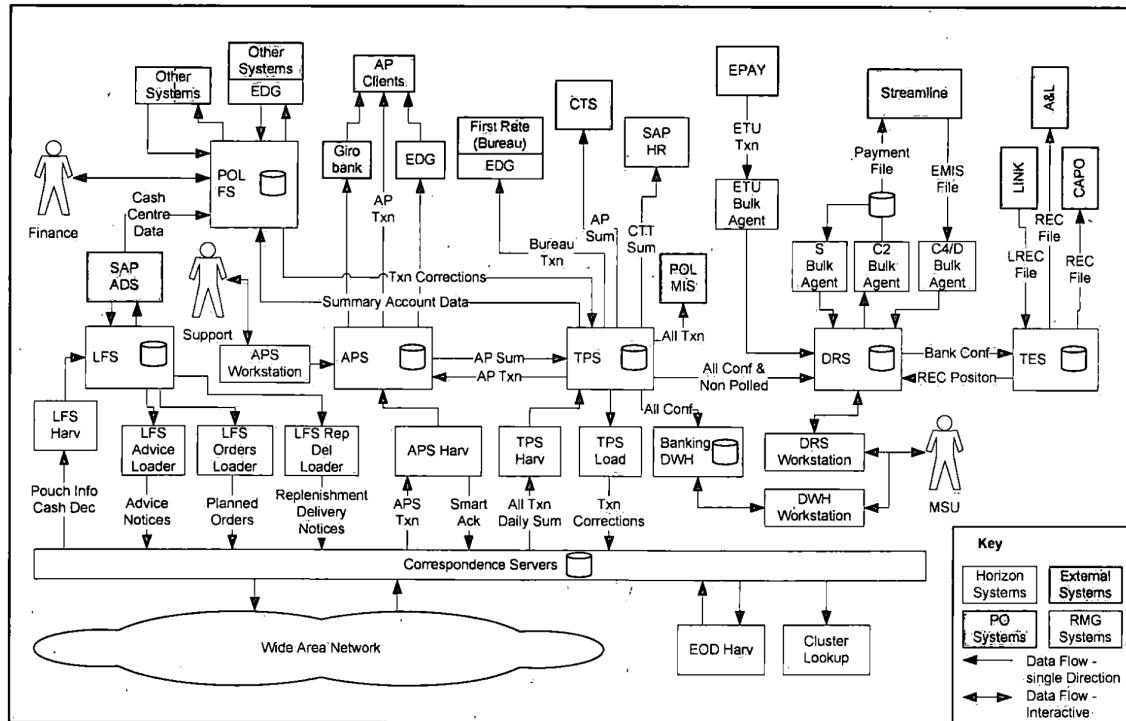
#	Name	Function

1	Correspondence Servers	Messaging Servers that pass messages to/from the branches. Data is held either as messages with a given expiry period or as "persistent objects" which are retained until updated or deleted. For performance reasons, the branch estate is split into 4 "clusters" each handling round 3,500 branches.
2	Ping Agent Central Acknowledgement Agent (CAck)	The Ping Agent responds to application level pings from the counter via the correspondence servers.  The CAck agent is used for recording receipt of messages at the data centre (mainly used for SLT monitoring). It is also used to acknowledges requests from the counter Smart Cache used to police use of Smart card charging (see security).
3	Audit Agent	Writes to text files all messages written or received by the correspondence servers for audit.
4	DVLA Web Service	Allows branches to authorise car tax in an online transaction to DVLA. Interface between the counter and data centre is SOAP.
5	APOP Web Service APOP Database APOP Admin	A hosted online service that handles electronic vouchers.  Requests/Authorisations from the counter are handled using SOAP to a Web Service.  Batch updates to the database arrive via the EDG and are controlled by a Maestro schedule.  A web based admin service allows Post Office staff to update individual records.
6	PAF Web Service	Allows branches to look up postcodes and addresses. Interface between the counter and data centre is SOAP.
7	ETU Auth Agent ETU Rev Agent	Handles requests for authorisations to top up mobile phones. Requests are received from a counter via the correspondence servers and the authorisations written back the same way.  A separate agent handles reversals to e-pay.
8	DCS Auth Agent	Handles requests for authorisations for Debit and Credit Cards and also reversals. Requests are received from a counter via the correspondence servers and the authorisations written back the same way.
9	NBX Routing Agent NBX GRev Agent LINK NBX Auth Agent A&L NBX Auth Agent CAPO NBX Auth Agent NPS Database	Handles online authorisation requests for banking transactions. Requests are received via the correspondence server in the routing agent which routes the request to the LINK, A&L or CAPO authorisation agent (as required). The authorisation agents hold state and audit data in the NPS database.  Reversals are handled both via the routing/auth agents and also via a guaranteed route into the NPS. These reversals are then processed by the relevant auth agents.

10	Track & Trace Harvester Track & Trace Interface Agent NPS Database	Track and trace data from the branches are processed in near real time, with data passed to Royal Mail and Parcel Force via EDG. The NPS database is used as a staging post to screen duplicates.
11	NBS Harvester DCS Harvester DRS Database TES Database TES Enquiry	DRS handles reconciliation for banking, ETU and DCS. The confirmations generated by the counters are harvested in near real time to ensure the reconciliation position is up to date. There are two harvesters – one for NBS and ETU and one for DCS.  The banking confirmations, together with transaction parts from NPS are passed to TES. An enquiry service is provided to allow Post Office staff to query the status of transactions.  DRS and TES are also involved in the batch flows and there is a workstation to support reconciliation updates (see next section).

#### 4.2 Batch and POL FS

The picture below shows the systems and flows within the data centre for the main batch flows. The POL FS system is included for convenience.



The components and their role are described in the table:

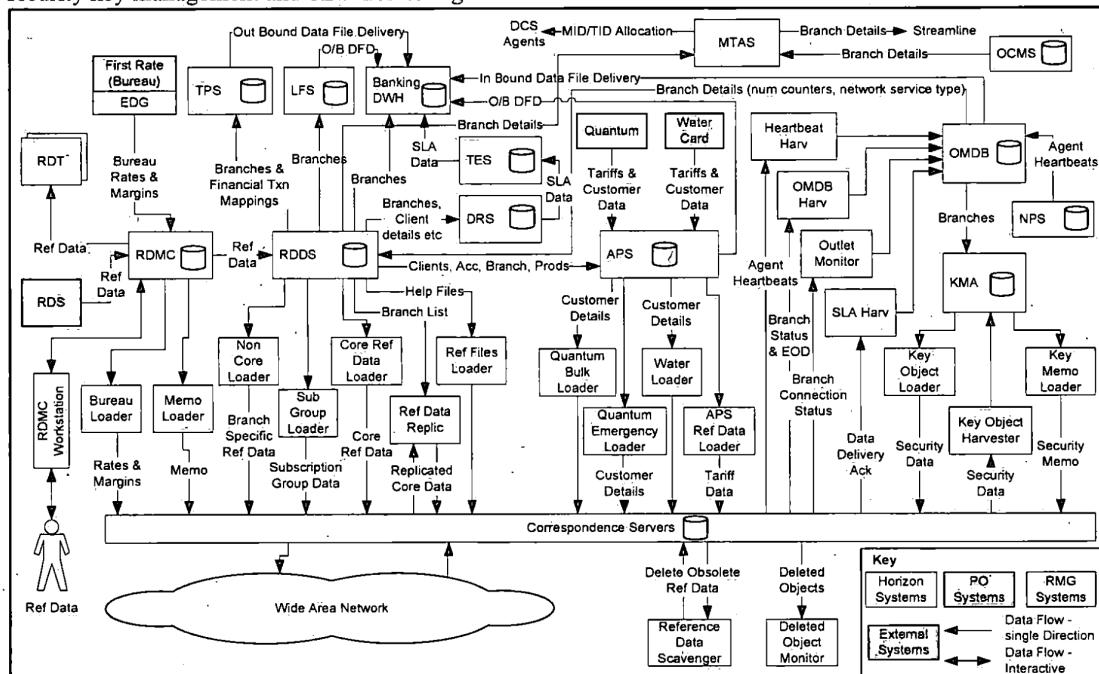
#	Name	Function
1	Correspondence Servers	Messaging Servers that pass messages to/from the branches. Data is held either as messages with a given expiry period or as "persistent objects" which are retained until updated or deleted. For performance reasons, the branch estate is split into 4 "clusters" each handling round 3,500 branches.
2	EOD Harvester	The End of Day Harvester ensures that there is a consistent set of data from the branch for the APS and TPS harvesters to use.
3	Cluster Lookup	Cluster lookup is a generic service that tells other agents in which correspondence server cluster a particular branch resides and which branches are within a particular cluster.
4	LFS Harvester LFS Advice Notice Loader LFS Planned Orders Loader LFS Replenishment Delivery Notice Loader LFS Database	LFS passes data between the counters and Post Office's SAP ADS system for cash and currency handling. The database is used as a staging post to screen duplicates. Pouch Information (both collections and delivers for all pouches – not just cash and Foreign Currency), and Cash Declarations are passed to SAP ADS. Advice notices, planned orders and replenishment delivery notices are received from SAP ADS. Note that advice notices have never been used.
5	APS Harvester APS Database APS Workstation	APS passes Automated Payment transactions to Clients – either directly, via Girobank or via the EDG.  The harvester reads all APS transactions from the correspondence server to put into the database which then splits them by client. The database also provides a summary by client which is passed to Post Office Ltd's CTS process via the TPS database as well as checking that all AP transactions were also harvested into TPS.  The harvesting agent also acknowledges smart transactions to allow the counter smart cache to operate (see security).  The APS workstation is used to allow new clients to be added to the solution.

6	TPS Harvester TPS Loader	<p>TPS takes all transactions from the counters and then passes them directly in either full or summary form to a number of other systems:</p> <ul style="list-style-type: none"> <li>AP Transactions passed to APS to allow reconciliation between APS and TPS.</li> <li>Bureau Transactions are passed to First rate via the EDG gateway. Horizon is responsible for delivery of files into Huthwaite, but not for putting data onto EDG itself.</li> <li>AP Summaries are sent to CTS to allow Post Office to settle with their clients. Also Transaction Corrections and Error files.</li> <li>Summaries are sent to HR SAP to allow remuneration to the branch franchisee for the transactions they have done. This data is provided monthly, with TPS keeping a running total.</li> <li>Nearly all transactions are sent to POL MIS (some – e.g. balancing transactions) are suppressed.</li> <li>All confirmations (Banking, ETU, DCS) are sent to DRS for reconciliation.</li> <li>All confirmations are sent to the banking data warehouse for SLT calculations.</li> <li>A summary position of the transactions traded that day is sent to POL FS.</li> </ul> <p>There are also transactions corrections received from POL-FS that are fed to the counters via TPS.</p>
7	Banking DWH	Provides SLT calculations for banking. MSU are also able to query the history (91 days) for ad-hoc reports via a workstation.
8	DRS Database ETU Bulk Agent S Bulk Agent C2 Bulk Agent C4/D Bulk Agent DRS Workstation TES Database	<p>DRS reconciles transactions for Banking, ETU and DCS with the clients.</p> <p>For ETU a payment file is received from e-pay and processed via the ETU bulk agent.</p> <p>For DCS a payment file is passed to Streamline via the C2 bulk agent. Once acknowledgement is received from Streamline that this has been received the S bulk agent puts the transactions back into DRS. Once Streamline have processed the payment file, they produce an EMIS file of the status for all transactions (i.e. whether settled or not) and this is loaded into DRS via the C4/D bulk agent.</p> <p>TES produces a banking reconciliation (REC) file for A&amp;L and CAPO and receives one from LINK. All transactions are passed to DRS for reconciliation.</p> <p>For DRS there is also a workstation to allow MSU staff to update the reconciliation states of transactions.</p>
9	POL FS	An SAP system that provides the accounts for the Post Office. As well as the data from the branches it has a number of feeds to/from other systems.

10	APS FTMS TIP FTMS GP FTMS NBX Connect:Direct Gateway DCSM	<p>These components are responsible for file transfer to/from remote systems. For clarity they are not shown on the diagram.</p> <p>APS FTMS is responsible for file transfers to/from APS Clients.</p> <p>TIP FTMS is responsible for file transfers to/from Post Office systems</p> <p>EDG FTMS is responsible for file transfers to/from other systems via the EDG.</p> <p>GP FTMS is responsible for file transfers to other Fujitsu sites.</p> <p>NBX: Connect:Direct Gateway is responsible for file transfers to the banks.</p> <p>DCSM is responsible for file transfers to/from e-pay and Streamline.</p>
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#### 4.3 Supporting Systems

The picture below shows the supporting systems and flows within the data centre that cover reference data, security key management and SLT monitoring.



#	Name	Function
1	Correspondence Servers	Messaging Servers that pass messages to/from the branches. Data is held either as messages with a given expiry period or as "persistent objects" which are retained until updated or deleted. for performance reasons, the branch estate is split into 4 "clusters" each handling round 3,500 branches.
2	RDMC Database RDDS Database Bureau Loader Subscription Group Loader Non.Core Loader Core Ref Data	<p>The reference data system is responsible for ensuring that reference data is delivered to counters and is house kept appropriately. The RDMC database receives reference data changes from Post Office's RDS system and then they are normally validated on the RDT rig (see infrastructure) by the Reference data team.</p> <p>Once the reference data is validated it is released via the RDMC workstation onto the RDDS database to allow it to be loaded into the correspondence servers.</p> <p>Loading takes place in several ways depending on its type:</p>

	<p>Loader</p> <p>Ref Files Loader</p> <p>Ref Data Replicator</p> <p>Non DB Ref Loader</p> <p>Ref Data Scavenger</p> <p>Deleted Object Monitor</p> <p>RDT Rig</p> <p>RDMC Workstation</p>	<ul style="list-style-type: none"> <li>Non Core (branch specific) is loaded directly into the branch.</li> <li>Core (delivered to all branches) is loaded into a “dummy group” in the correspondence server. This is then copied to the branches through the reference data replicator agent.</li> <li>Subscription Group data (which is written once each correspondence server cluster but can be read by all branches) is loaded through either the Subscription group loader or the Core Ref Data Loader depending on the data type.</li> <li>Help text (which also uses subscription groups) is loaded via the RDMC workstation into RDMC. Once released into RDDS it is loaded via the file loader.</li> <li>Other reference data that doesn't have an automated route is loaded via the RDMC workstation in a similar way to the help text.</li> <li>Bureau rate and margins data are received from First Rate and loaded via RDMC via a subscription group. RDDS is not used to minimise delays in processing the data.</li> </ul> <p>There are also two agents that are responsible for housekeeping – Scavenger deletes superseded or obsolete reference data and deleted object monitor checks that this deletion has occurred correctly (since the correspondence servers are distributed then deletions can take place at different times on different nodes, potentially causing issues).</p> <p>Messages for counters (memos) are loaded via the RDMC workstation into the RDMC database. These are then loaded into the correspondence servers.</p> <p>Branch information also flows from RDDS to the other databases to ensure there is a consistent view of which branches are open and shut as well as required reference data.</p>
3	Banking DWH	Used for measurement of file delivery to clients and data delivery to branches. Also produces some banking reports
4	<p>APS Database</p> <p>Quantum Bulk Loader</p> <p>Quantum Emergency Loader</p> <p>Water Card Loader</p> <p>APS Ref Data Loader</p> <p>APS Ref Data Replicator</p>	<p>For pre-payment Gas (Quantum) and Water Card customer and tariff information is loaded into the correspondence servers as core reference data.</p> <p>For Quantum, customer information is targeted at a specific branch. This is either done overnight (bulk) or during the day (emergency).</p> <p>For Water Card customer information is sent to all branches and is only updated overnight.</p>
5	<p>OMDB Database</p> <p>Heartbeat Harvester</p> <p>OMDB Harvester</p> <p>Outlet Monitor</p> <p>SLA Harvester</p>	<p>The OMDB database collects status information for the branches and data centre agents. This is then used to trigger alerts etc (see systems management)</p> <p>The following information is collected about the branches:</p> <ul style="list-style-type: none"> <li>Branch Status (WAN and LAN connection status generated by the gateway PC).</li> <li>End of Day Markers (EOD)</li> <li>Connection Status to the correspondence servers (when the branch last</li> </ul>

	SMDB Database (not shown)	<p>connected)</p> <ul style="list-style-type: none"> <li>• Acknowledgements of data delivery to the branch (for SLT measurement).</li> </ul> <p>OMDB also collects information on agent heartbeats to monitor the agents either directly from NPS (for the banking authorisation agents) or via the correspondence servers for the other agents.</p> <p>The branch SLT information is sent to the DWH.</p> <p>Most of the data on the OMDB is replicated to a separate SMDB (Service Management Database) that is sited within a DMZ. This allows support and operations staff access to that data from the Fujitsu Services intranet.</p>
6	<p>KMA Database</p> <p>Key Object Loader</p> <p>Key Object Harvester</p> <p>Key Memo Loader</p>	<p>KMA manages the cryptography keys needed in the solution (see security). For asynchronous functions data is transferred to/from the counters (and other servers) via the correspondence servers (loader and harvester).</p> <p>For some operations branch staff need to be involved and they are informed through memos (memo loader)</p>
7	MTAS OCMS Database	MTAS (MID/TID Allocation Service) is responsible for allocating MID (Merchant ID) to branches and TID (terminal ID) to counters. It takes feeds from RDDS and OCMS (database that handles opening of new branches) to determine branch status and then feeds data to Streamline on what has been allocated and to the DCS agents so that MID/TID can be added to each transaction sent to Streamline.

## 5. DCS

### 5.1 DCS RAC Model

Figure 1 - RAC Model and Data Flows for DCS Transactions presents the RAC Model for DCS, showing the message flow, including the ICC interaction on the PIN Pad. Swipe card Transactions follow the same flows upwards through the message store layer, though the content of the message will be different.

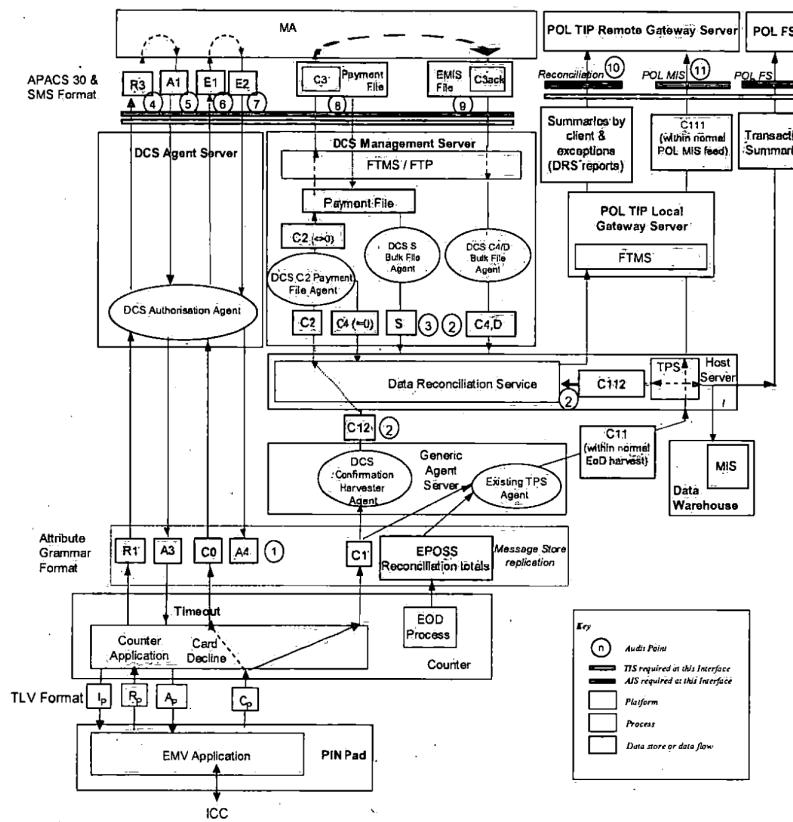


Figure 1 - RAC Model and Data Flows for DCS Transactions