SANTANDER RFP

# Solution Design

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# Introduction

The purpose of this document is to provide a high-level description of the solution delivered for Santander Bank's messaging integration with Infobip's platform.

mGate is Infobip's proprietary database integration layer used by banks and other large enterprises around the globe that provides fully automated messaging capabilities. After integrating via mGate, clients can use the full scope of features available through the Infobip communication platform: 2FA, 2-way messaging, bulk SMS, mobile number validation, Omni channel communication and detailed reporting and statistics.. It is designed to handle large volumes of consistent, real-time traffic. It is recognized globally for the following main strong points:

**Security** – uncompromising data integrity is our fundamental business premise as we serve clients that require the absolute highest security standards available, which include VPN, SSL, firewalls, and message encryption. In addition, our system redundancy warrants complete business continuity.

**Reliability** – with more than 400 operator partnerships around the globe, and more than 300 direct connections, Infobip's infrastructure ensures one of the best deliverability rates in the industry.

**Performance** – fully programmable, mGate is built to support the throughput of even the most demanding clients who must process millions of messages within hours.

**Flexibility** – even though mostly utilized in the financial sector, mGate is highly customizable to any industry and for any use case. We will help you optimize your mobile communication based on your specific needs.

**Scalability** – mGate is tailored to meet your need for advanced communication solutions. Connected to the Infobip platform, it is the foundation for any of your Omni channel communication strategies.

- # System Architecture

Santander is connected with Infobip's platform through VPN connection.

Integration method used is SMTP. Additionally, Portal access is available to Santander. Portal can be used for both ad hoc message sending and reporting purposes and is accessed via secure HTTPS. Note that Portal access is not via VPN.

To provide Santander with maximum flexibility of the solution and in order to minimize any changes required to Santander systems, the solution proposed is mGate hosted in Infobip environment.

The high level architecture diagram given in Figure 1 below, provides an overview of the mGate product within the Business Messaging ecosystem.

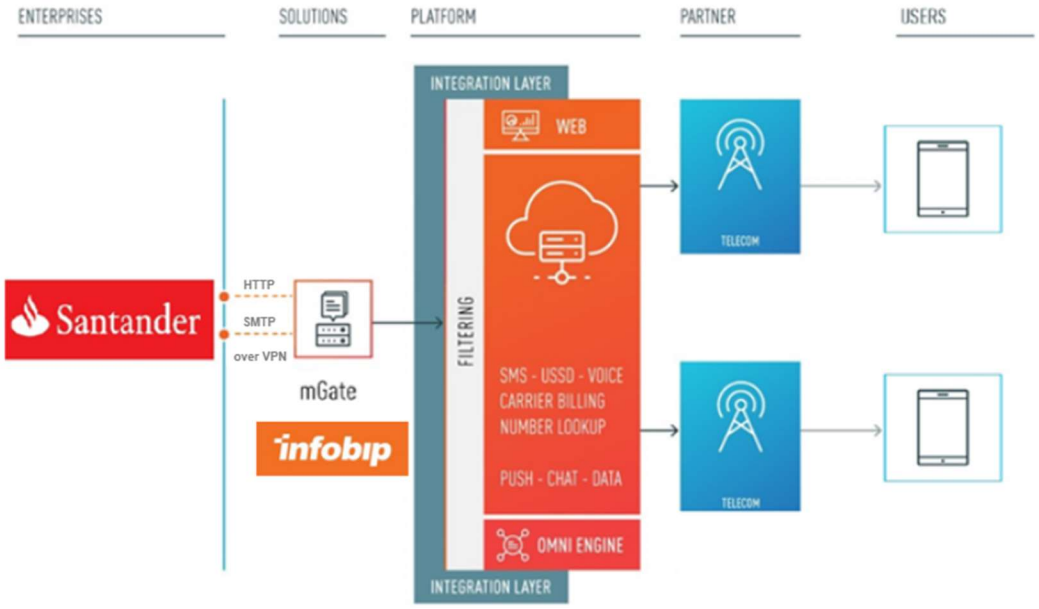


***Figure 1*** High level diagram

- # SMTP Integration

Infobip has setup an SMTP server on the same virtual machine as mGate in the Infobip environment.

Santander is sending messages (a CSV file as a message attachment) to Infobip's platform by using SMTP protocol. SMTP server credentials were provided by Santander.

The message file sent as an attachment is a CSV file. Template name is the last element of the filename, using an underscore as the delimiter.

The content of the CSV file is described in section 3.2 The assumption is made that these files would be generated using automated processes within Santander to ensure the quality of the overall service. Inconsistent file structures or poor data quality have a direct impact on the effectiveness of the solution to successfully deliver SMS to Santander customers.

During the solution setup phase, template records were established to define the delivery window to be used for each template. This will be the template referenced by the CSV filename.

- Template information

Template names contained in the csv file name is used as the key for information about delivery time windows and message validity.

Besides desired delivery days and time all template entries should specify a validity. The validity defines how long the mobile networks will continue to try to deliver the message to a temporarily unavailable handset. From a business perspective, this should reflect the length of time the message itself remains relevant to the customer.

For troubleshooting purposes last 5 modifications of template information will be stored on Infobip side.

- CSV file

This data file contains all necessary information about recipients, senders and the message text to be sent. Additionally, it contains the fourth column that can be ignored. Delimiter used is a semi-colon ‘;’. Where the delimiter occurs within the message text, the message text will be enclosed in double quotes "Example''. Inside message text pipe delimiter ‘|’ is used to indicate new line character.

Each line of the csv file represents a new message.

First column is the recipients’ phone number, which uniquely identifies a subscription in a GSM/UMTS mobile network. Numbers are quoted in international format and are prefixed with ’+’.

Second column is a sender, used to deliver the message. All senders used must be pre-registered with Infobip to ensure effective white listing.

Third column is the message text to be sent. The text of the message will use UTF-8 encoding. The maximum length of a single SMS is 160 characters where the messages are encoded in GSM7 character encoding. Where Unicode is used, for example to send some special characters, the maximum length of a single SMS is 70 characters. Note that the list of characters to be supported include some Unicode.

Values supported are: 0123456789abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWX YZ áéíóú?! ¡@ € # + - / * ñÑ £ _ '"() []:.;, Ç% & | = $ <> .

Example of CSV file content:

+34639460001;FROMFZ01;MESSAGE TEXT 1;PIOL_BKS0152100/S05qRDLTt15E
+34639460002;FROMFZ02;MESSAGE 2 TEXT;PIOL_BKS0152100/S05qRDLTt15E
+34639460003;FROMFZ03;MESSAGE TEXT 3;PIOL_BKS0152100/S05qRDLTt15E
+34639460004;FROMFZ04;"MESSAGE TEXT;4“;PIOL_BKS0152100/S05qRDLt15E

Besides file content, the filename is processed to identify which delivery window to apply to the submissions from that file. Last 10 characters of the csv filename are used as the delivery template name. Template name is in format of 10-digit number.

Example of CSV filename:

SantanderUK_0000521_SANTANDER_PRUEBA_0_B1_1111111111.csv

In the example given, 1111111111 is the template name.

- # Message Processing flow

This paragraph describes the message processing flow that has been implemented.

Santander system sends files that contain information about the messages that need to be processed as an email with an attachment by connecting to SMTP server setup within the Infobip environment. Protocol used to transfer files is SMTP via a VPN.

The first step is the verification that all necessary information has been received by SMTP server. The email message received must contain a single csv file as an attachment and must use the previously agreed naming policy.

Each new attachment is then moved to an incoming directory on mGate. Task is scheduled every 15 minutes to check for unprocessed files in the incoming directory. If a file remains unprocessed for over an hour, which would indicate processing issues, an alert is triggered to Infobip Support.

All messages received by the SMTP server that do not include a csv file are discarded. Daily task is scheduled to count the number of received messages and processed files. In event of a mismatch in numbers, an alert is triggered to Infobip Support.

Messages that have attachment, but attachment’s file name is not in line with the naming policy, attached file is rejected, moved to ‘Rejected’ folder on mGate and an email described in section 5.3 is sent to email addresses defined by Santander.

Message in csv file is rejected any of the four criteria apply.

- Fields are not in the predefined order
- Mobile Number (MSISDN) is in a none valid format for all entries

- A senderID (Alphatag) is in none of the agreed Alphanumeric/numeric formats
- A message text field is empty

Note the distinction between the validation of the mobile numbers, sender ID and message text validation criteria.

Message batch processing consists of the following steps:

### o Delivery window definition

The last element of the CSV file name will be used to check the delivery template information to find the corresponding delivery window and validity period to be used. If the corresponding line cannot be found, the file will be rejected.

### o SantanderUK_*_*_*_*_*_templatename.csv processing

The csv file is processed line by line. Each line represents one message.
The delivery template name used is associated with each message record created as a reference value to be included within reporting.

### o Message sending

The last step in file processing is the message submission process. If all steps described above are executed successfully, the system proceeds with message submission. The template name taken from csv file name is added as data payload entry, thereby making this information available within the delivery reports over Portal.

Messages are submitted to the Infobip platform over SMPP connection, which is an asynchronous connection. In case of mGate connection issues with the core platform, core platform may not provide a timely response upon message submission and those messages would have irregular status on mGate.
An hourly job is scheduled on mGate which checks the database for messages with irregular statuses. In case of irregular message status on mGate, which might indicate possible communication disruption between mGate and Infobip platform, an email would be sent to Infobip Support for additional investigation.

Volume estimates provided are:

- Up to 10,000 messages (rows) per CSV
- Approx. 4000 files per day
- Platform to be scaled to 40,000,000 messages a day

No information is available on peak throughput requirements. The deployed hardware is scaled to deliver file processing throughput of 300 to 500 messages per second.

### o CSV file retention policy

All the csv files received from Santander are archived for 7 days on mGate.
Successfully processed files are saved in *'Processed'* folder and rejected files are saved in *'Rejected'* folder.

- Reporting
  - CSV File Processing Report

Processing reports are created and saved on mGate. These reports are filed in two folders.

- "Processed" folder - After files are successfully uploaded and processed by the Infobip Platform, they will be visible in this folder.
- "Rejected" folder - If the file has an incorrect structure or format the Infobip platform will automatically move all files into this folder.

The scenarios that would lead to a batch file being rejected are described in section 4 above.

Example file processing and delivery reports are provided below. The file names are:

- Processed file report (*PR-20180611-074125*)

PR-20180611-07412
5.txt

  - Message Delivery Reporting

Once a file has been processed and the SMS submitted, the platform will then make available message delivery information. This information is available via Portal.

  - Email notifications

Email notifications are configured for the following situations:

1. Email will be sent if a file has been successfully processed and moved to the "Processed" folder.
   Email will contain the name of the file that has been successfully processed.
   Examples of the email content are:
   *Subject: <SERVICE>: File named <Filename> has been processed*
   *Body:*
   *File named <Filename> has been successfully processed and moved to the "Processed" folder.*
   *The subject line will begin with the service name e.g. LIVE or TEST.*

2. Email will be sent if a file has been rejected and moved to the "Rejected" folder. Email will contain the name of the file being rejected.
   Examples of the email content are:
   *Subject: <SERVICE>: File named <Filename> has been rejected*
   *Body:*
   *File named <Filename> has been rejected and moved to the "Rejected" folder.*

3. Email will be sent every day with the file processing summary.

Example of the email can be seen below:

*Subject: <SERVICE>: Daily summary*
*Body:*
*Daily summary can be found in the file attached.*

*Email attachment example can be seen below.*

```
TemplateID;FileName;Status;StatusReason;SuccessfulCount;FailedCount;FailedLines
5612310100;SantanderUK_SMS_SANTANDER_PRUEBA_0_B1_5612310100.csv;PROCESSED;successfully processed;2;0;0
5712310100;SantanderUK_SMS_SANTANDER_PRUEBA_0_B1_5712310100.csv;PROCESSED;successfully processed;25;0;0
5812310100;SantanderUK_SMS_SANTANDER_PRUEBA_0_B1_5812310100.csv;PROCESSED;successfully processed;23;0;0
```

SERVICE will identity whether the report relates to the TEST or LIVE service.

The summary report will list, per file received:

- TemplateID
- FileName
- Status
- StatusReason
- SuccessfulCount – number of rows successfully processed
- FailedCount – number of rows failed within the file
- FailedLines – the line number of the failed rows

4. Bi-weekly and monthly summary reports are also generated.

- Report is sent as a CSV attachment to the email
- Each summary contains a number of processed and rejected files, as well as the number of rejected lines per template broken down by template
- The content of both reports will be consistently formatted as - TemplateID;ProcessedFiles;RejectedFiles;RejectedLines
- The bi-weekly summary report is generated on the 1st of the month and will then be followed by 1 or 2 additional summaries every 2 weeks during that month
- The monthly summary report will be generated on the 1st of the month

Email notifications informing on file processing status (points 1 and 2) are sent out following file processing. SMS notification is set as a failover channel for email notifications for both rejected and processed files, so that the information on the processing is sent near real-time. In case of an issue with connection to the Exchange server used for sending email notifications, connection timeout is triggered, and notification is sent over SMS to a fixed distribution list.

Email notifications are sent to a fixed distribution list, as defined by Santander. Each report has a distinct distribution list.

Changes to the distribution lists will be possible on request to Infobip as a P3 support ticket logged via email only. Email confirmation is required that Infobip have written confirmation of the requested change.

- Portal

Infobip has provided Santander with numerous different forms of reports and logs. These are available 24x7 via the Infobip's Portal.

Both SMTP and HTTPS messages flows are visible within the portal. All dashboards are updated automatically to provide real time information on the Santander's account activity.

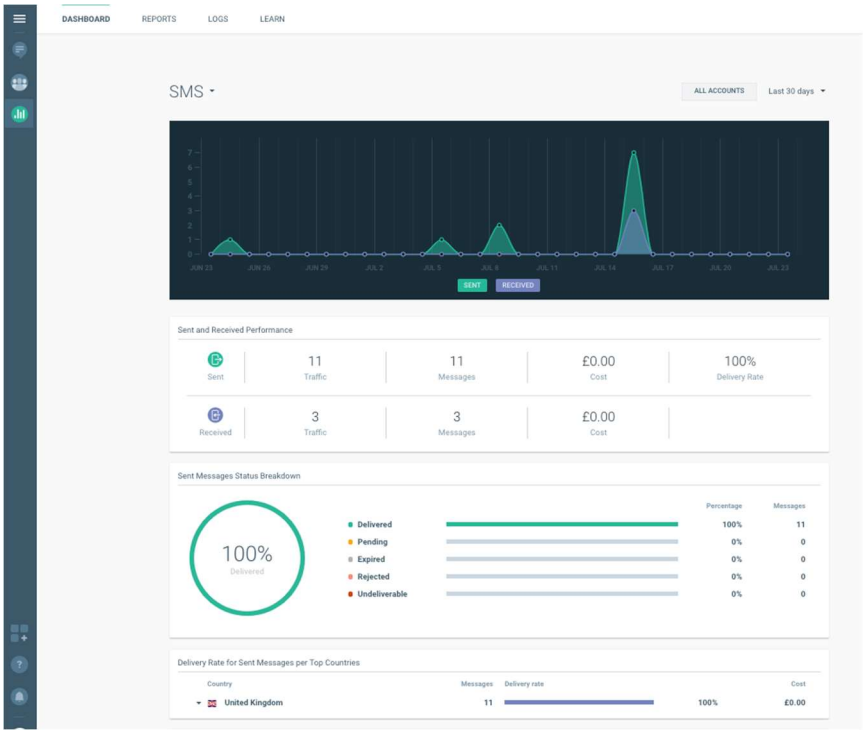


***Figure 2*** Dashboard

- 5.4.1 Detailed reports

Detailed reports can be created based on the messages processed by Infobip, Reports are derived based on channel which will be SMS, account/user and a customizable time frame. The reports can be run on an ad hoc basis, or they can be automated. Scheduled to run at defined intervals, emails are sent to the specified email address(es) for that report to advise of its availability and provide access to the report data. All such automated reporting can be setup directly within the Portal. These reports create the following information in either XLSX or CSV.

- Account
- User
- SenderID/Alphatag
- MSISDN
- MessageID
- Send at (message forwarded to network)
- Country of MSISDN
- Mobile Network of MSISDN
- Message Status

- Reason for Message Status
- Delivery Report Timestamp
- Total Message Count
- Data Payload

- 5.4.2 Logs

Logs functionality is provided and allows for a quick search functionality for granular checks on a specific message status. Logs can be searched by:

- Accounts and users
- Channels
- Statuses
- Filter by: to, from, message ID or campaign name
- Date with scheduling options

- # Controls

This paragraph describes the controls that are currently in place – as seen in the image below. Please note that VM performance is monitored at all times.

Controls listed under letters A and B display possible risks on Santander side, while controls listed under letters C to J present controls on Infobip side.

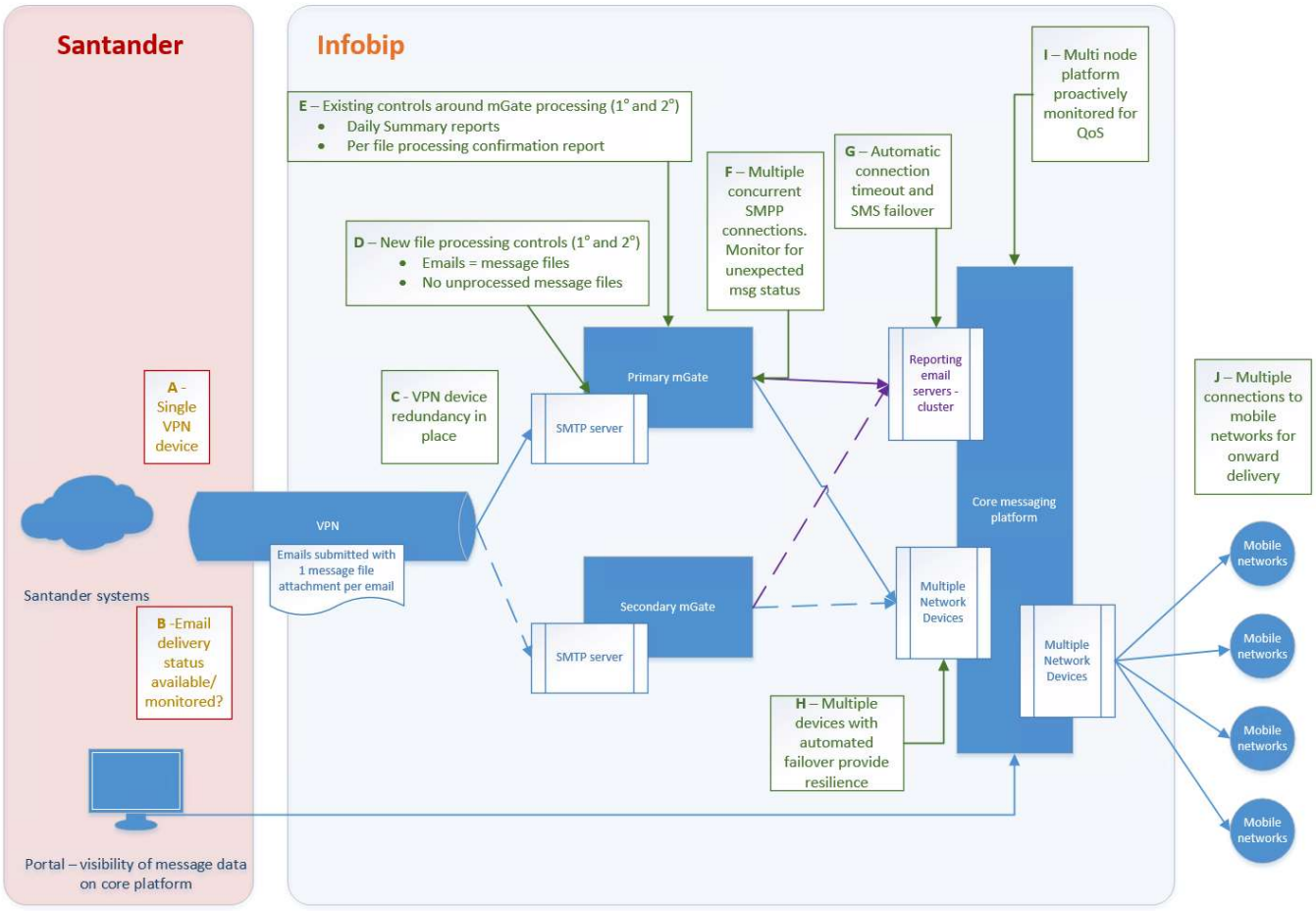


FIGURE 3 CONTROL SCHEME

Control listed under letter C is connectivity control on Infobip side which is ensured by VPN device redundancy. In the event of an issue with the primary VPN device, the connection will automatically fail over to the secondary device. Alerts would be raised within the Infobip infrastructure team for further investigation.

Controls listed under letter D are file processing level controls and ensure monitoring of the incoming files. First control compares numbers of received emails and files, while the second reports on unprocessed files.

- First control is set up as a daily task scheduled to count the number of received messages and processed files. In event of a mismatch in numbers, an alert is triggered to Infobip Support.
- Second control is set up as a task which is scheduled every 15 minutes to check for unprocessed files in the incoming directory. If a file remains unprocessed for over an hour, which would indicate processing issues, an alert is triggered to Infobip Support.

Controls listed under letter E are file processing level controls to report on file processing. First of the two is a daily summary report, as defined in section 5.3, which is sent for validation to a predefined Santander mailing group. Second control is a notification of each file successfully processed or rejected, as defined in the same section.

Control listed under letter F is a message processing level control, which also serves as a connectivity control between mGate and core messaging platform. An hourly job is scheduled on mGate which checks the database for messages with irregular statuses. In case of irregular message status on mGate, which might indicate possible communication disruption between mGate and Infobip platform, an email would be sent to Infobip Support for additional investigation and, if needed, message resubmission from mGate to Infobip platform by Infobip support.

Controls listed under letter G include a reporting level control. mGate processing notifications are sent over Exchange server. In event of connectivity issues between mGate and Exchange server, the connection would be automatically reset and that notification would be sent using an alternative channel, SMS, to a predefined list provided by Santander, ensuring the timely delivery of this information to Santander.

Control listed under letter H is integration level control on core messaging platform. Redundant network devices and application servers have a minimum of two instances hosted in different datacentres, ensure resilience within the Infobip core platform. All instances are monitored at all times.

Control listed under letter I is a QoS level control on core messaging platform. The core platform architecture is redundant and easily scalable. Platform is monitored 24/7 by dedicated teams, ensuring QoS is achieved and additional nodes are deployed when needed. All nodes are monitored at all times.

Control listed under letter J is operator connection control on core messaging platform. Multiple connections are in place to all the main operators. Each connection is monitored by dedicated teams, and appropriate re-routeing actions are performed when needed.

- # Detailed application level architecture

In order to support ongoing testing activity, a separate test environment is available.
Note that this has been provisioned as a separate mGate instance. Files are submitted via a second IP address on the one VPN in place between Infobip and Santander.

Message visibility within the reports on Portal is managed using defined user credentials. Credentials may be defined on either the live service or the test service.
This will ensure segregation of test data from live.

- ## Dedicated test environment

The test environment is a single instance of the Santander custom file processing solution and is not subject to live service SLAs. File processing alerts and automated end of day reports are in place. As can be seen from the architecture diagram below, the test environment will submit messages to the mobile networks for onward delivery to handsets. Messages delivered via the test environment will be charged at the standard Santander message rate at the time of submission.

The test environment can be configured not to submit messages to the mobile network for delivery. Please contact your account manager to request this setup change.

The loopback test sender ID of IB-10001 can be used at any time. Messages submitted using the sender ID of IB-10001 will not be delivered to handsets and can therefore be used to prevent specific message from delivering.

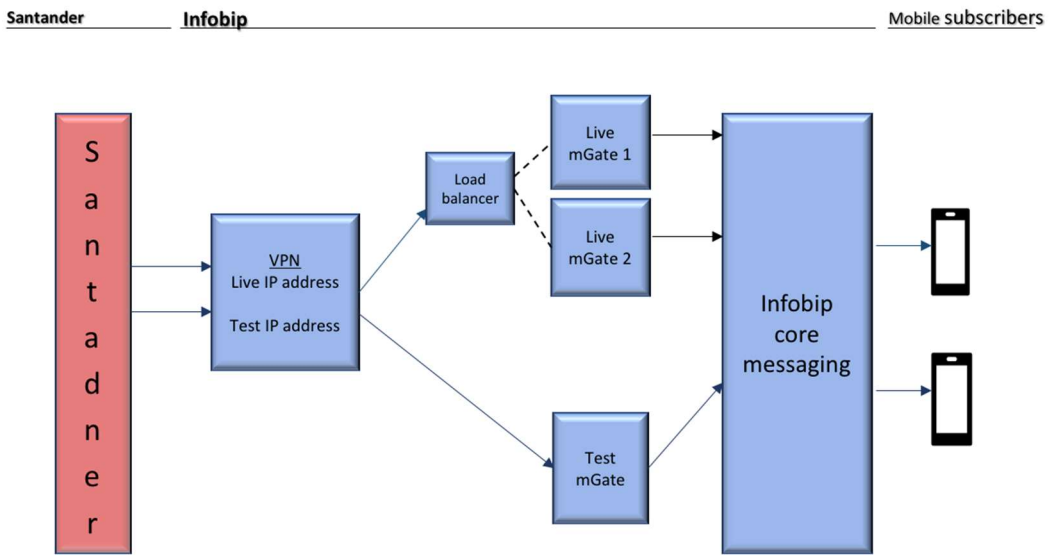


***Figure 2*** *Application level architecture detailing test VM*

- Out of Scope

Features and functionality out of scope for this document are:

- Portal access via VPN. Portal access uses HTTPS as standard
- Alternative solution designs using alternative communication protocols and designs to limit Infobip customization requirements.
- Process report file delivery to SFTP server setup on Santander side