Telephony Capture Service

User Manual

Version



**Document Modification History**

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| 1.0.0 | R Monk | 2017-01-03 | Original Release |
| 1.0.1 | R Monk | 2017-01-25 | Review Modifications  Context Diagram |
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| 1.0.3 | R.Monk | 2017-01-28 | pg1 permanently listens on 5432, pg2 on 5433 |

Table of Contents

1 Introduction 4

1.1 Purpose 4

1.2 Scope 4

1.3 Document Location 4

1.4 Document Status 4

1.5 Acronyms Definitions 4

1.6 Reference and Related Documents 4

1.7 Open Issues 4

2 Preliminaries 5

2.1 User Characteristics 5

2.2 Preparing the Environment 5

2.2.1 Software Platform 5

2.2.2 Configuring the TCS 5

2.2.2.1 Volume Environment Variables 5

2.2.2.2 Application Environment Variables 6

2.2.2.3 Barman Configuration 6

2.3 TCS Version Numbers 7

2.4 TCSPROJ 7

3 TCS Operating Environments 8

3.1 Common Containers 8

3.2 Development Environment 8

3.3 QA Environment 9

3.4 Production Environment 10

4 Use Cases 11

4.1 Launching The TCS For The First Time 11

4.1.1 Mainstream TCS 11

4.1.2 TMS Simulator 11

4.1.3 PBX Simulator 11

4.1.4 Mangle 12

4.2 TCS Health Monitoring 12

4.2.1 Kitematic 12

4.2.2 RabbitMQ Management Console 13

4.2.3 Docker Logs 14

4.3 Changing TCS Version 14

4.4 Postgres Management 15

4.4.1 Rollback Recovery 15

4.4.2 Offline Recovery 16

5 Command Line Tools 17

# Introduction

## Purpose

The purpose of this document is to provide instructions for how to carry out the various TCS use cases.

## Scope

This manual details how to start, stop, upgrade, and monitor the performance of the TCS. And because the TCS has the further responsibility to install and otherwise exploit a new server database, it also includes instructions for how to restore the database from a backup set.

This document does not include:

* Instructions to carry out the various admin management functions associated with running a Linux installation.
* Instructions for installing git, docker, docker-compose, Kitematic.
* Instructions for how to modify the TCS database version, the queuing service version, nor the custom TCS software itself. There is a separate manual for such material, namely the [TCS Development Manual](TCS%20Developer%20Manual.docx).

## Document Location

This document is found in the ‘docs’ folder of the TCS GitHub repository:

<https://github.com/ccbcadmin/telephony-capture-service.git>

## Document Status

This document must be kept current and released concurrently with each software release.

## Acronyms Definitions

The reader is referred to the [TCS Software Requirements Document](TCS Software Requirements Document.docx)

## Reference and Related Documents

* [TCS Software Requirements Document](TCS Software Requirements Document.docx)
* [TCS Developer Manual](TCS Developer Manual.docx)

## Open Issues

* Add datastores for rabbitmq, pg1 / pg2, barman, and Jenkins to the various diagrams.
* The discussion on the 3 TCS operating environments possibly should be moved to the TCS Developer Manual.

# Preliminaries

## User Characteristics

It is assumed that the user is generally familiar with Linux command line utilities and is able to navigate the Linux directory structure.

Beyond that having some further familiarity of any or all of the following is an advantage:

|  |  |
| --- | --- |
| [Git](https://git-scm.com/documentation) | Used to manage TCS versions. |
| [docker](https://docs.docker.com/) | docker and a closely aligned product, docker-compose, are heavily exploited by the TCS. However, as far as this manual is concerned, docker’s capabilities have been largely captured in scripts, aliases, and functions. |
| [Postgres](https://www.postgresql.org/docs/9.6/static/index.html) | The more that the user knows about Postgres the better, nevertheless, the TCS user can effectively use the TCS without Postgres knowledge. |
| [barman](http://www.pgbarman.org/) | Barman is an open source product designed to manage Postgres backups and Postgres Write Ahead Logs. Working knowledge of barman is useful, but not essential. |

## Preparing the Environment

### Software Platform

The assumed platform is the following:

* Ubuntu 16.04.1
* Docker 1.13.0
* Docker-compose 1.9.0
* Kitematic 0.13.0 or later
* Git 2.7.4 or later

### Configuring the TCS

#### Volume Environment Variables

This section details the environment variables that inform Docker of volume settings. These are defined in the file ~/tcs/.env.

**BARMAN\_HOME**

Defines the location where Barman will maintain Postgres backups and WAL files.

**SMDR\_DATA\_PROD**

At various points the TCS requires access to a repository of files containing SMDR messages. SMDR\_DATA\_PROD defines that location for the Production environment. One of the folders belonging to this repository, smdr-data-001, is special in that it is used by the TCS to record all SMDR messages received from the PBX.

**SMDR\_DATA\_DEV**

This variable is exactly analogous to SMDR\_DATA\_PROD, but this time for the Development environment (this variable need not be set in the Production environment).

**SMDR\_DATA\_DEV**

This variable is exactly analogous to SMDR\_DATA\_PROD, but this time for the QA environment (this variable need not be set in the Production environment).

#### Application Environment Variables

This section details the environment variables that inform Docker of TCS-specific volume settings. These are defined in the file ~/tcs/env\_PROD/.env

**BACKUP\_SCHEDULE**

The backup schedule defines a typical cron-like string pattern (e.g. ‘\* \* 2 \* \* 1’ triggers a backup at 2:00am every Monday. Further documentation can be found here: <https://www.npmjs.com/package/node-schedule>

**DB\_QUEUE**=PROD\_DB\_QUEUE

Identifies the RabbitMQ queue for the initial capture of SMDR records destined for the database. This value must not be changed.

**DATABASE**=prod

Identifies the Postgres database that records Production database activity. This value must not be changed.

**MANGLE\_SOURCE\_DIRECTORY**=/smdr-data/smdr-data-002

The tool Mangle reads files from this directory.

**MANGLE\_TARGET\_DIRECTORY**=/smdr-data/smdr-data-003

The tool Mangle outputs files to this directory.

**PBX\_SIMULATOR\_TRANSMIT\_INTERVAL**=1000

During a period of pre-operations, the PBX Simulator will be useful for acceptance testing. This variable allows the user to define a fixed period between transmissions of test SMDR messages sent by the PBX Simulator to the TCS.

**PBX\_SIMULATOR\_SOURCE\_DIRECTORY**=/smdr-data/smdr-data-002

The directory from which the PBX-simulator expects to find smdr-files.

**TCS\_PORT**=3456

The port number on which the TCS is listening for connect attempts.

**TMS\_ACTIVE**=1

As long as the TMS is required, TMS\_ACTIVE should be set to 1. Should the day come when the TMS is no longer needed, then it should be set to 0.

**TMS\_HOST**=192.168.99.100

The host IP address where the TMS is running (note: during development, this variable will often have the same value as DOCKER\_MACHINE\_IP).

**TMS\_PORT**=6543

The port number on which the TMS is listening.

**TMS\_QUEUE**=PROD\_TMS\_QUEUE

Identifies the RabbitMQ queue for the initial capture of data being routed to the TMS. This value must not be changed.

#### Barman Configuration

Barman configuration settings are documented [here](http://docs.pgbarman.org/release/2.1/). Changes can be made by modifying the file ~/tcs/env\_PROD/barman.conf. Once this file has been modified in order to have the changes actually applied, the barman container will need to be restarted (this can be done through Kitematic).

Note that Barman does not actually trigger backup production; this is done by TCS custom software and the backup schedule is defined by the environment variable **BACKUP\_SCHEDULE** discussed in section 2.2.2.2

## TCS Version Numbers

TCS Version numbers are of the form: vX.Y, where v is a literal ‘v’ and both X and Y are non-negative integers (e.g. “v3.2” meaning version 3.2).

## TCSPROJ

All TCS activity is launched from the folder ~/tcs. Once there, the following command must be executed:

**$ source scripts/project [tcs\_version]**

Where tcs\_version is optionally provided; if omitted, the TCS Version remains unmodified.

In order to expedite this process, it is recommended to define the following function in the .bashrc file:

**tcsproj () { cd ~/tcs; source scripts/project; }**

Thereafter, the user can conveniently prepare for TCS commanding with the following:

**$ tcsproj [TCS Version]**

# TCS Operating Environments

The TCS software supports 3 different operating environments: Development, QA, and Production. These environments can co-exist, although the most typical usage would be for only one environment to be active at any given time (e.g. the Development environment is typically used by off-site personnel, whereas the Production environment runs exclusively on-site). This section discusses each of the environments in more detail.

## Common Containers

Practical considerations mandate that the queuing service container, rabbitmq, and the database container, pg1, not be replicated in each environment for those situations where the environments are coincidently active. Nevertheless, it is prudent to isolate the environments to the maximum extent possible. This section discusses how this is achieved.

Each TCS operating environment requires 2 queues (one for SMDR message flow to the database and the other for the flow of data destined for the TMS), for a total of 6. All queues are independent and isolated from each other.

* DEV\_TMS\_QUEUE
* DEV\_DB\_QUEUE
* QA\_TMS\_QUEUE
* QA\_DB\_QUEUE
* PROD\_TMS\_QUEUE
* PROD\_DB\_QUEUE

Similarly, Postgres instances are configured to isolate the 3 environments using the Postgres ‘database’ concept (e.g. a Postgres instance can simultaneously support multiple databases). The 3 Postgres databases are ‘dev’, ‘qa’, and ‘prod’.

## Development Environment

The Development Environment is discussed in the TCS Developer Manual.

## QA Environment

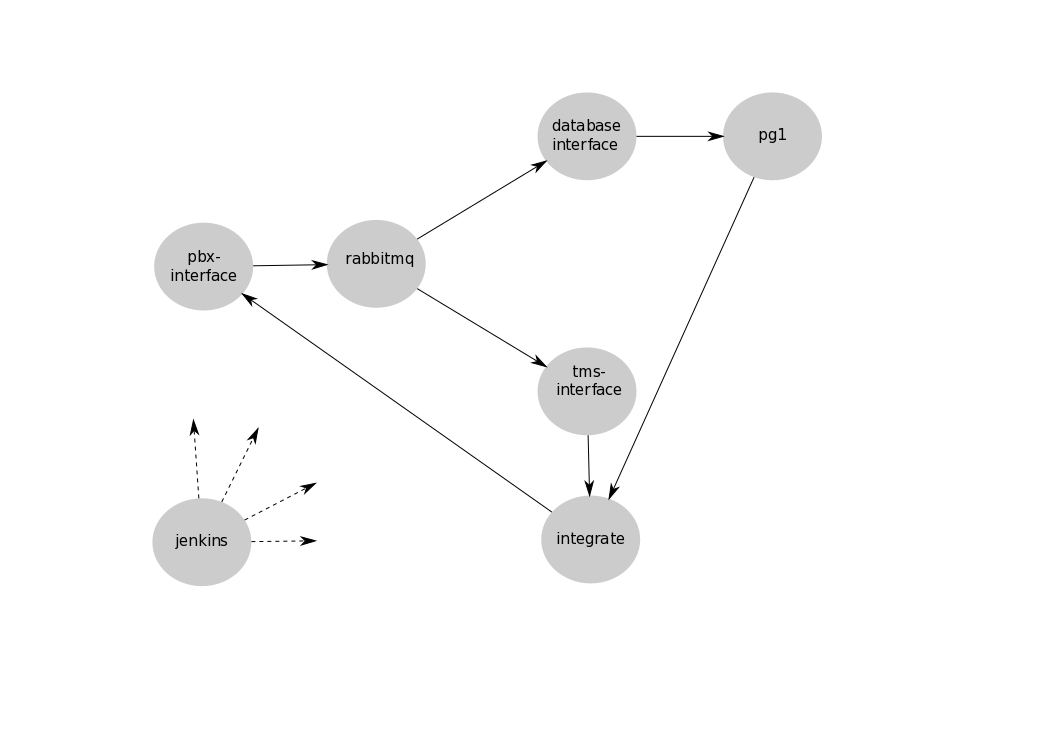


Figure : TCS QA Operating Environment

A successful run of the TCS software in the QA Environment assures that TCS software is fit for purpose. The usual workflow is that Development announces the availability of a new software release and the customer takes delivery of the software using features that are discussed later in this document. Part of the delivery effort is to first ensure that the new software actually performs correctly in the QA environment. A few observations:

* jenkins orchestrates the activities of the other containers (jenkins can start, shutdown, pause, and restart containers).
* A new QA-specific container, integrate, is used as a vehicle to execute a number of test routines. Although integrate is quite flexible, its responsibilities come down to some combination of the following:
  1. Send something to pbx-interface;
  2. Verify messaging coming from tms-interface; and / or
  3. Verify that the content of the database is as expected.
* jenkins monitors the output of integrate and if all tests succeed, then the new software is declared fit for purchase.

## Production Environment

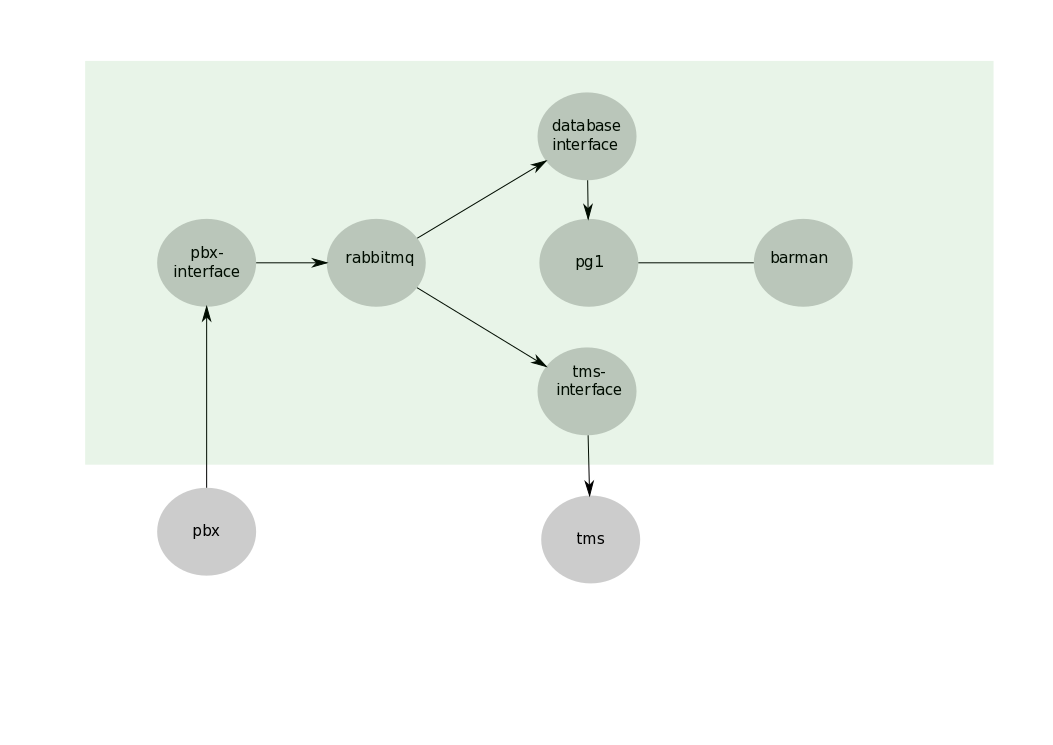


Figure : TCS Production Operating Environment

The production environment ingests data from the actual PBX via pbx-interface which in turn passes the data on to two distinct RabbitMQ queues. The pbx-interface has one other important responsibility: it records to the file system a copy of all incoming SMDR records to the directory smdr-data-001 – this is relative to the SMDR-DATA-PROD volume setting discussed in section 2.2.2.1.

Two other containers draw data from the queues; these are database-interface and tms-interface. database-interface inserts all incoming SMDR records into the Postgres pg1. Meanwhile, the tms-interface directs all data that it pulls from its queue to the TMS.

Last but not least, the barman container provides the following services:

* In real-time, it receives and logs a database replication stream from pg1.
* It triggers pg1 backups according to a user-defined schedule.
* It purges backups according to a user-defined purge policy.

# Use Cases

## Launching The TCS For The First Time

### Mainstream TCS

It is assumed that the TCS environment variables have been configured correctly – see Section 2). In the following, it is assumed that the first install is version 1.0 (v1.0).

**$ cd ~**

**$ git clone https://github.com/ccbcadmin/telephony-capture-service tcs 1**

**$ tcsproj v1.0**

**$ tcs 3**

1. Clones the tcs GitHub repository into the tcs folder.
2. Selects the v1.0 version of the software.
3. This command creates the following common TCS containers (the first three are common to all three operating environments).

* pg1
* rabbitmq
* barman

It then creates the following Production containers:

* prod-pbx-interface
* prod-tms-interface
* prod-database-interface

### TMS Simulator

During system / acceptance testing it will be necessary to have a sink for data destined for the TMS (otherwise the TMS queue would grow without limit if there is an input PBX source).  This is the purpose of the TMS Simulator. It can be brought up as follows:

**$ tms-simulator**

The corresponding container name will be shown as prod-pbx-simulator by Kitematic.

### PBX Simulator

The PBX Simulator is to be used for two quite different purposes:

* During pre-operational phases of the project, it will be desirable to be able to send the TCS an artificial stream of SMDR messages.
* During the initial startup of the TCS (to an operational state), it will be necessary to inject the set of historical SMDR messages through the TCS. This simulator will be used for this purpose.

This stream is created by executing the following command:

**$ pbx-simulator source-directory**

***source-directory*** *must exist within the volume defined by the environment variable SMDR\_DATA\_PROD. See section 2.2.2.1 for more details.*

The corresponding container name will be shown as prod-pbx-simulator by Kitematic.

### Mangle

This tool takes as input a folder containing one or more raw SMDR files and randomizes the last 4 digits of all unknown phone numbers and records the resulting transformed records into files to be found in the output folder.

**$ mangle source-directory target-directory**

or as an example:

**$ mangle smdr-data-002 smdr-data-003**

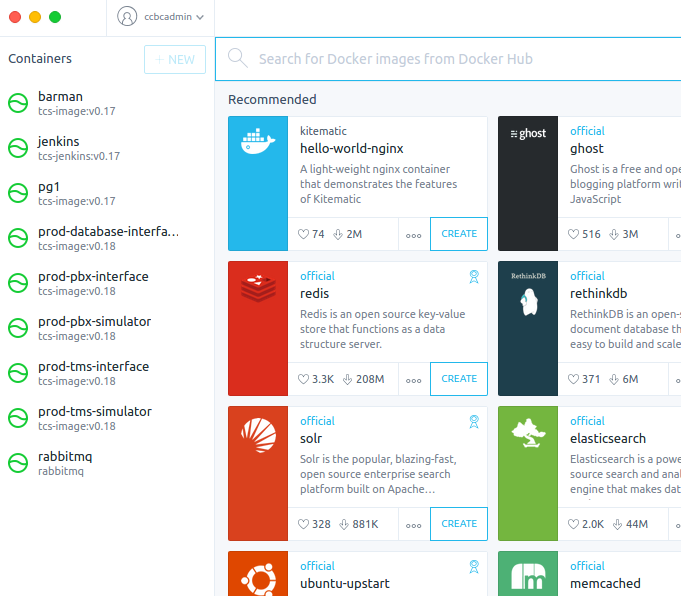
***source-directory*** *and* ***target-directory*** *must exist within the volume defined by the environment variable SMDR\_DATA\_PROD. See section 2.2.2.1 for more details.*

## TCS Health Monitoring

This section provides information for how to monitor and otherwise check that the TCS is performing properly.

### Kitematic

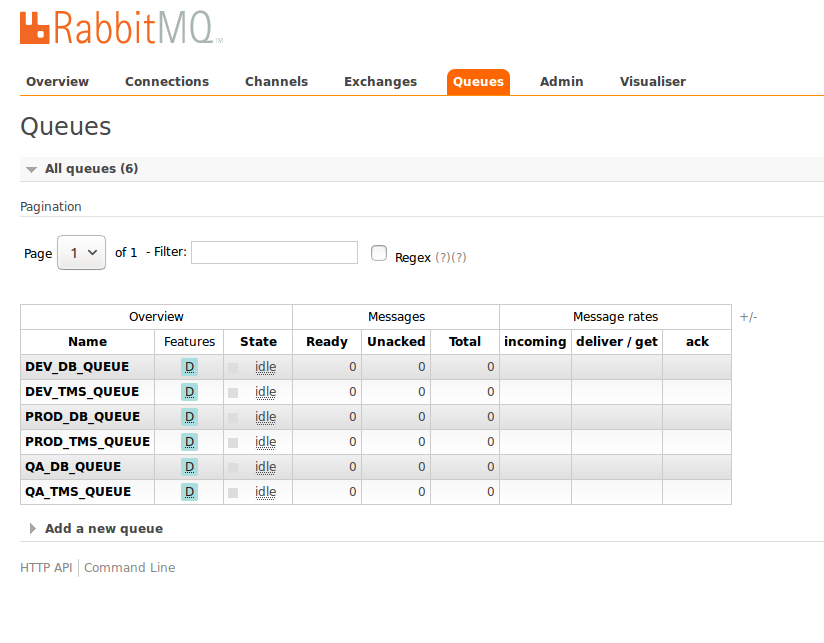
Kitematic is ideal for providing a visual confirmation that all the TCS containers are running (Kitematic also provides a means to Stop, Start, and Restart individual services).



### RabbitMQ Management Console

Provides a wealth of information about the internal state of RabbitMQ. The most important one in this context is the ability to view how many messages are in the queues (nominally the queue size should be more or less 0 if everything is working properly). Note: the user name / password is ‘guest’/’guest’.

ToDo: change defaults.



### Docker Logs

The various log files produced by the TCS containers can be retrieved by using the **$ docker logs** command. Its usage is available as follows:

**$ docker logs –-help**

A particular usage is the following (all the log entries produced by the pbx-interface container prefixed with timestamps):

**$ docker logs –t pbx-interface**

## Changing TCS Version

Assume that v1.3 is currently running. The following commanding switches the TCS to version v1.4.

*Before proceeding, the TCS environment variables should be reviewed. Environment variables can be added and / or modified from one version to the next.*

**$ tcsproj v1.4 1**

**$ tcs down 2**

**$ tcs 3**

1. Change the version. This command triggers the following actions:
   1. A Git pull request to GitHub to ensure that the local Git repository is up-to-date;
   2. A Git checkout to branch v1.4.
   3. The new version number is recorded locally.
2. Shuts down all containers.
3. Triggers a pull from the Docker Hub to download version v1.4 of the TCS image. Once complete, then the TCS containers startup.

## Postgres Management

The TCS runs with 2 Postgres containers, pg1 and pg2, however, only pg1 is required to be permanently available. This section provides the following:

* Instructions to do a rollback recovery to pg1.
* Instructions to do a offline recovery to pg2. Once the offline recovery is complete, the user is able to investigate the state of the database at some previous point in time without disturbing the TCS.

The following table that summarizes valid Postgres container states.

|  |  |  |
| --- | --- | --- |
| **Postgres Container** | **Docker State** | **Listening Port** |
| pg1 | running | 5432 |
| pg2 | running | 5433 |
| pg2 | stopped | - |
| pg2 | gone | - |

It is completely valid for pg2 to not be running in the sense of a Docker container running. In fact, pg2 may not even exist (gone) in the Docker sense.

Whatever the state of pg2, it does not interfere or otherwise impact other TCS functionality.

### Rollback Recovery

Rollback recovery is a database recovery to pg1. Once the recovery is complete, normal TCS operations are restored. Data loss is likely.

Before proceeding, the user will need the following:

* The user will need to be aware of which backups are available. The list of available backup\_ids is provided by executing the following command:

**$ list-backups**

The barman backup\_id must be the latest backup taken BEFORE the target time.

* If the rollback is to be up to a specific time, then the target time is required and is expressed in ISO format, e.g. “2016-12-15T12:00:00”. Target time is optional.

Armed with this information, the user can now proceed with the recovery:

**$ pg-rollback-recovery backup\_id [target\_time]**

### Offline Recovery

There may come a time when it would be useful to investigate the state of the database at some point in the past. Offline recovery is very similar to a rollback recovery except that the target of the recovery is the pg2 container.

The consequence of an investigation of the state of the offline database could be, for example, a need to recover a table that should not have been deleted. Such actions are quite doable, nevertheless, the details are outside the scope of this manual. The reader is advised to refer to one of the many excellent Postgres references, starting with the online [Postgres documentation](https://www.postgresql.org/docs/9.6/static/index.html) itself.

Carrying out a offline recovery is very similar to a rollback recovery. Please refer to the previous section for instructions on how to identify the appropriate backup\_id and target time (the latter is optional).

The user can now proceed with the recovery as follows:

**$ pg-offline-recovery backup\_id [target\_time]**

# Command Line Tools

The following command line tools are not essential to run or administer the TCS, nevertheless, they will likely prove to be useful.

**$ barman-exec**

Opens an interactive shell to the barman container. This allows full access to the barman command line interpreter.

**$ pg1-exec**

Opens an interactive shell to the pg1 container.

**$ pg2-exec**

Opens an interactive shell to the pg2 container.

**$ psql1**Attempts to open an interactive [psql](http://postgresguide.com/utilities/psql.html) terminal to the pg1 container.

If not successful in opening an interactive terminal, the command will terminate as follows:

1. If the pg1 container exists: pg1 STOPPED
2. If the pg1 container does not exist: pg1 GONE

**$ psql2**

See the discussion for the $ psql1 command.

**$ tcs [down]**

This command allows the user to either start or remove the TCS containers that are required to support the current environment.