Smarter Balanced Reporting
Runbook, Deployment, Administration
AWS Version

Prepared for:

by:

Revision History

Revision Description	Author/Modifier	Date
Initial Release (DRAFT)	Anna Grebneva (Amplify)	2014.07.09
Added Test Score Batcher	Doris Ip (Amplify)	2014.11.03
Added AWS	Clinton Wolfe	2015.05.08
Added Dependencies	Anna Grebneva	2015.07.15

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1 Summary

This document is for System Administrators who will be operating the System. It contains instructions on how to install, scale, and maintain the Smarter Balanced Data Warehouse and Reporting instance.

2 Data Capacity Planning Assumptions

1. Smarter Balanced Reporting Database Storage:
    a. Student Registration: 0.5kb per student.
    b. Student Assessments: 2kb per assessment and 0.5kb per student.
    c. Allocate similar size to the whole postgresql database for postgresql point in time recovery.
    d. Keep disk usage less than 50% to help Database Administrators to perform postgres vacuum operations efficiently.
2. PDF file Storage:
   The Smarter web application will pre-generate grayscale PDF's, and color PDF's will be generated when a user requests. Therefore, it is good practice to estimate disk space for 100% disk storage for grayscale PDF's files and 50% disk storage for color PDF's.
    a. color - 85kb/assessment outcome.
    b. grayscale - 75kb/assessment outcome.
3. Historical Assessment Archive:
    a. 50 mb assessment csv for 100k per assessment.
4. Individual Item Response (a.k.a. Item-Level) Data Storage:
    a. Average size of file after compression is 200kb.
    b. A student generates around 5 item-level files per school year.
    c. SBAC requires storing of 10 years of student item level xml raw data.
5. HTTP Pickup Zone Storage:
    a. [PLACEHOLDER: performance and load testing scheduled as part of M6].
    b. Database for pickup zone operation.
6. Landing Zone Storage:
    a. 0.5kb per student per assessment.
7. Loader Database Storage:
    a. [PLACEHOLDER: performance and load testing scheduled as part of M6].

3 Hardware Minimum Requirements

The number of instances required for each machine type is correlated to three independent criterias: the number of tenants/states in the system, the number of users accessing the system, and the number of students in the tenant/state.

Table 1 - Sample configuration for data warehouse and reporting for 1 tenant containing 2M students and 100K users.

Application	Avg Usage (3% user concurrency) instances	Peak Usage (10% user concurrency) instances	Cores (vCPU per instance)	Memory (GB per instance)	AWS instance type	non-OS portion Storage (GB)
reporting-web (main web application server)[2]	9	30	4	8	m3.large	
load balancers[2]	2	2	2	2	ELB	
db-master[1]	1	1	8	64	r3.2xlarge	1000
reporting-db-slave (replicas for web front end)[2]	2	7	8	64	r3.2xlarge	1000
extracts-db-slave (replicas for extraction)[2]	1	3	8	64	r3.2xlarge	1000
reporting-db-pool[2]	2	3	4	8	m3.xlarge	
memcache[3]	2	2	8	64	m3.2xlarge	
reporting-rabbit-services[2]	2	2	4	8	m3.xlarge	
reporting-worker-pdf[3]	2	2	8	64	r3.2xlarge	
reporting-generator-pdf[1]	1	1	2	8	m3.large	
reporting-rabbit-extract[2]	2	2	4	8	m3.xlarge	
reporting-worker-extract[2]	2	7	8	32	m3.2xlarge	
reporting-cache-warmer[1]	1	1	2	8	m3.xlarge	

lz (landing zone)[1]	2	2	4	8	m3.xlarge	50
hpz-web (https pickup zone web app)[5]	3	9	4	8	m3.xlarge	
hpz-db[5]	1	1	4	8	m3.2xlarge	10
udl (universal data loader)[3]	2	2	4	8	m3.2xlarge	
udl-rabbit[1]	2	2	4	8	m3.xlarge	
udl-db[1]	1	1	8	32	m3.2xlarge	1000
migrate-rabbit					m3.xlarge	
udl-db (loader database)	1	1	8	32	m3.2xlarge	1000
migrate-db (database staging)[1]	1	1	8	32	m3.2xlarge	1000
gluster-server[3]					m3.medium	26480[4]
tsb-web (Test Score Batch web server)[3]	2	3	4	8	m3.xlarge	
tsb-rabbit[3]	2	3	4	8	m3.xlarge	
tsb-worker[3]	4	4	8	64	m3.xlarge	
tsb-trigger[1]	1	1	4	8	m3.large	
tsb-db	1	1	8	32	m3.2xlarge	
file-grabber	1	1	2	8	m3.large	
file-trigger	1	1	2	8	m3.large	
stats-db	1	1	8	32	m3.2xlarge	

[1] The number of instances for this machine type is proportional to every Tenant/State.

[2] The number of instances for this machine type is proportional to every 100,000 Users.
[3] The number of instances for this machine type is proportional to every 2,000,000 Students.
[4] The number of storage for this is proportional to 10 years of item level data storage plus 1 year of pdf.
[5] The number of storage for this is proportional to every 100,000 Users.

4 Required Infrastructure Components

In addition to the components provided, several infrastructure components are required to successfully deploy Smarter Reporting Live. These components are not included and may be implemented as the operator sees fit.

Access Control and Secrets Management

- Previous deployments have used IAM users, or AWS-SAML integration, to control access to the AWS console.
- Secrets, such as SSL keys, were stored on S3 buckets unique to each application. IAM instance profiles were used to bind each application type to a list of S3 buckets it may access.
- SSH keys were baked into the AMIs that were used.

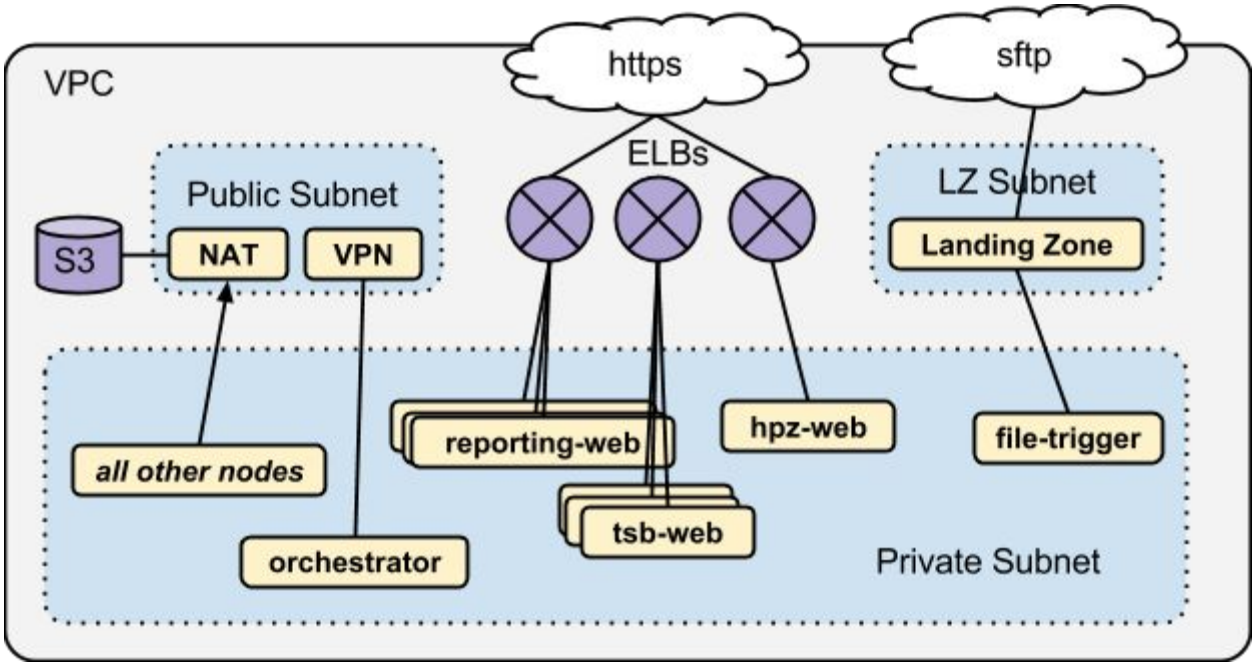
Monitoring and Logging

- Metrics were collected using sensu and stored using graphite/carbon.
- Sensu was configured to send alert triggers to pagerduty.
- Many metrics are still collected through indirect means.
- Log aggregation was performed using rsyslog to send logs to logstash, then indexed using ElasticSearch and queried using Kibana.

Automation

- Some mechanism to create and configure the nodes will be needed.
- Ansible was used to perform single-node configuration.
- Mass spinup of nodes was implemented in python/boto.
- Previous deployments did not implement auto-scaling.

Network Configuration



Subnet Configuration

The basic configuration consists of three subnets. Similar to a traditional AWS layout, it includes a public subnet (which contains an Internet gateway and nodes with public IP addresses) and a private subnet. The private subnet contains nearly all nodes, including web servers, database servers, workers, rabbitMQ servers, and other utility machines. The special LZ subnet contains the landing zone node which is exposed to the public on port 22.

Security Group Configuration

In all subnets, each host class was restricted to accept only those incoming connection ports that were required for it to operate. These assignments were handled through automation; details are available upon request.

Other Needs

- NTP service
- A private YUM repo
    - s3iam yum plugin, with repo in S3, worked well.
- Low-volume outbound email (for internal alerts) - SES was previously used.

5 Software Requirements

The system has been tested with servers running on CentOS 6.5. A brief summary of software requirements for each machine type is listed in the table below. Please refer to the other sections of this document for more details.

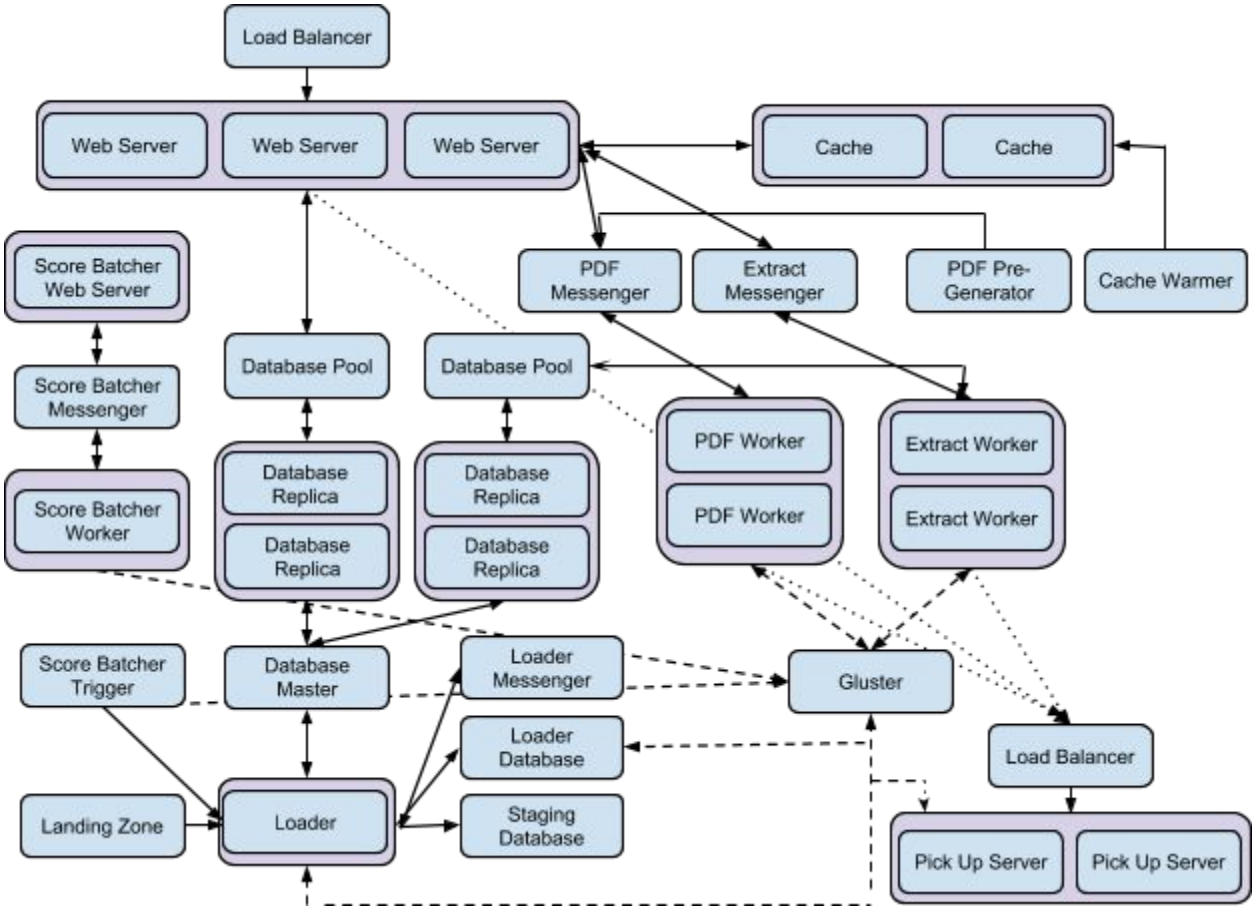
Table 2 - Machine Types with their software requirements

Machine	External Software (Available from Linux distributors)	Software provided by Amplify
web servers	httpd xmlsec1 xmlsec1-openssl-devel	python3-3 python3-mod_wsgi smarter
http landing zone	httpd mod_xsendfile xmlsec1-openssl-devel xmlsec1 glusterfs glusterfs-fuse fuse-encfs	python3-mod_wsgi3-3 hpz
http landing zone database	postgresql92 postgresql92-libs postgresql92-server postgresql92-contrib	
load balancers		
database masters	postgresql92 postgresql92-libs postgresql92-server postgresql92-contrib repmgr	
database replicas for web reporting	postgresql92 postgresql92-libs postgresql92-server postgresql92-contrib repmgr xmlsec1 xmlsec1-openssl-devel	python3-3 python3-mod_wsgi smarter
database replicas for extraction	postgresql92 postgresql92-libs postgresql92-server postgresql92-contrib repmgr	
db pool with failover for web front end	pgpool-II	
db pool without failover for bulk extract	pgpool-II	

cache	memcached	
pdf messenger	rabbitmq-server	
pdf workers	glusterfs glusterfs-fuse fuse-encfs urw-fonts	wkhtmltox-0.12.1-1.x86_64 pdfunite
pdf generator	httpd xmlsec1 xmlsec1-openssl-devel	python3-3 python3-mod_wsgi smarter
extract messaging	rabbitmq-server	
extract worker	glusterfs glusterfs-fuse fuse-encfs xmlsec1 xmlsec1-openssl-devel	python3-3 python3-mod_wsgi smarter
cache warmer	httpd xmlsec1 xmlsec1-openssl-devel	python3-3 python3-mod_wsgi smarter
landing zone		python3-3 edsftp
loader	glusterfs glusterfs-fuse fuse-encfs	python3-3 edudl
loader messenger	rabbitmq-server	
loader database	postgresql92 postgresql92-libs postgresql92-server postgresql92-contrib glusterfs glusterfs-fuse fuse-encfs	
migrator	xmlsec1 xmlsec1-openssl-devel rabbitmq-server	python3-3 python3-mod_wsgi smarter
database staging	postgresql92 postgresql92-libs postgresql92-server postgresql92-contrib	
gluster (storage)	glusterfs-geo-replication glusterfs	

	glusterfs-server glusterfs-fuse	
score batcher web server	httpd xmlsec1 xmlsec1-openssl-devel	python3-3 python3-mod_wsgi smarter_score_batcher
score batcher messenger	rabbitmq-server	
score batcher worker	glusterfs glusterfs-fuse fuse-encfs xmlsec1 xmlsec1-openssl-devel	python3-3 python3-mod_wsgi smarter_score_batcher
score batcher trigger	glusterfs glusterfs-fuse fuse-encfs xmlsec1 xmlsec1-openssl-devel	python3-3 python3-mod_wsgi smarter_score_batcher

The following diagram illustrates the architecture of, and relationships between the components listed above:



5.1 Service Dependencies

The following table outlines dependencies between software components. The dependencies are to be available during the service startup. Any changes to dependencies may require service restart.

Application	Dependencies
reporting-web	reporting-db-pool reporting-rabbit-services reporting-rabbit-extract hpz-web memcache

load balancers	reporting-web hpz-web tsb-web
db-master	
reporting-db-slave	db-master
extracts-db-slave	db-master
extract-db-pool	extracts-db-slave
reporting-db-pool	reporting-db-slave
memcache	
reporting-rabbit-services	
reporting-worker-pdf	reporting-rabbit-services reporting-web reporting load balancer gluster-service
reporting-generator-pdf	reporting-rabbit-services stats-db
reporting-rabbit-extract	
reporting-worker-extract	reporting-rabbit-extract extract-db-pool gluster-service
reporting-cache-warmer	memcache stats-db reporting-db-pool
lz	
hpz-web	hpz-db gluster-service
hpz-db	
udl	udl-rabbit udl-db migrate-db stats-db db-master gluster-service

udl-rabbit	
udl-db	
migrate (lives on db-master)	migrate-rabbit migrate-db stats-db db-master reporting-db-pool reporting-db-slave
migrate-rabbit	
migrate-db	
gluster-service	
tsb-web	tsb-rabbit
tsb-rabbit	
tsb-worker	tsb-rabbit tsb-db gluster-service
tsb-trigger	tsb-db gluster-service tsb-rabbit
tsb-db	
file-grabber	lz gluster-service
file-trigger	udl udl-rabbit gluster-service
stats-db	

Service Shutdown/Startup Order

Services must be restarted in the order provided below. Reverse the order for startup procedure.

file-grabber
file-trigger
lz

reporting-web
hpz-web
tsb-web
reporting-cache-warmer
reporting-generator-pdf
reporting-worker-pdf
reporting-worker-extract
tsb-worker
tsb-trigger
udl
migrate-rabbit
udl-rabbit
tsb-rabbit
reporting-rabbit-services
reporting-rabbit-extract
reporting-db-pool
extract-db-pool
reporting-db-slave
extracts-db-slave
db-master
udl-db
hpz-db
tsb-db
migrate-db
stats-db
memcached
gluster-server

5 Planning for Availability

The reporting application is designed for high availability and each installation can be setup to provide the service with minimal interruption.

The following architectural diagram is a sample configuration intended to minimize administrative involvement to failover process.

Table 1. Sample Configuration for Smarter Balanced Reporting

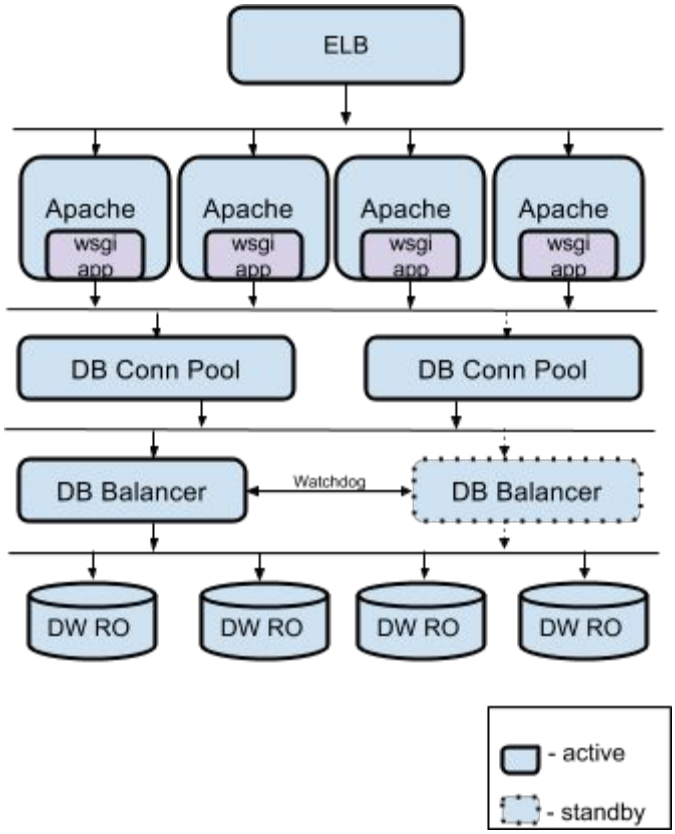
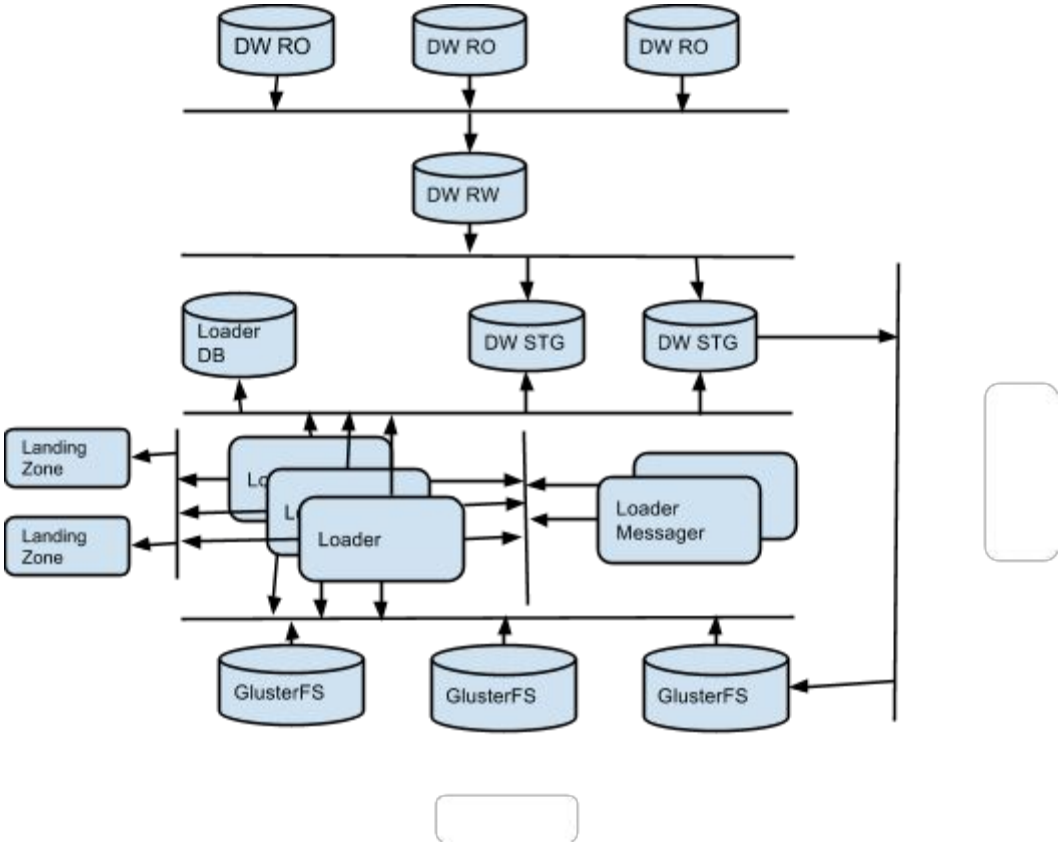


Table 2. Sample Configuration for Smarter Data Loader



- Apache
  All web servers are registered to ELB. When a web server goes down, ELB will not route a request. When a web server comes back online, ELB will resume routing a request.

- DB Connection Pool
  - PgPool-II
    The version of PgPool-II must be 3.3 or greater. PgPool-II uses “watchdog” to monitor each other. An active PgPool-II server uses virtual IP addresses to receive all database requests and forward to specific PostgreSQL servers by roundrobin. Standby PgPool-II becomes active and takes over the virtual IP when an active PgPool-II goes down.

- Memcached:
  - Memcached supports clustering. By setting up clustering, it provides load balancing and redundancy. Configuration guidance can be found in the following external documentation:
    https://code.google.com/p/memcached/wiki/NewConfiguringServer

- PostgresQL 9.2
  - The Smarter Balanced Data Warehouse uses multiple read-only replication databases to provide redundancy. The failover for database is via PgPool in previous sections.
  - The data loader can be configured with multiple staging databases to parallelize data injection. This also provides failover for the data loading pipeline when a subset of the staging database is not in available.

- Data Loader
  - The data loader can be configured with multiple processing servers to process the data loading job in parallel. This provides redundancy and load balancing in the data loading process.

- Data Loader Messenger
  - The data loader can be configured with RabbitMQ clustering to provide redundancy and failover and load balancing for the data loading process.

- Landing Zone:
  - No provision for redundancy is provided.

6 Archival, Backup and Recovery

1. Backup and restore PostgreSQL (**manual process**).
   Use the PostgreSQL master database to backup the database.
   Depending on the size of the database, it may take several hours.
   1. Stop EdMigrate service:
      `/etc/init.d/edmigrate-conductor stop`
   2. Extract PostgreSQL data (please refer to the man for pg_dump):
      `pg_dump -f /path/to/backup.sql.gz -Z 9 -U edware -W edware`
   3. Resume Edmigrate serivce:
      `/etc/init.d/edmigrate-conductor start`

   Encrypt & Upload to S3:
   1. Create a Python script to automatically encrypt and then upload **backup.sql.gz** to S3, into it's respective folder, as follows:
      a. S3 bucket: **srl-backups-pg**
      b. GPG encrypt the **backup.sql.gz** file to its respectable filename, as below.
      c. Hourly/Daily/Monthly folders: Python script should detect the time of execution and name the encrypted file like this:
         i. srl-backups-pg/hourly/backup.1400.sql.tar.gz.gpg (2:00pm backup).

ii. srl-backups-pg/daily/backup.28.sql.tar.gz.gpg (28th of the month backup).
iii. srl-backups-pg/monthly/backup.05-May.sql.tar.gz.gpg (monthly backup for May).
iv. Cleanup: Python script should delete the 2 local files to save space:
    1. **backup.28.sql.tar.gz.gpg**
    2. **backup.sql.tar.gz**

To restore the Smarter Balanced Reporting System database:

1. Download the latest backup file from S3.
2. Run the Python script to decrypt the backup file.
3. Stop the EdMigrate service:
   `/etc/init.d/edmigrate-conductor stop`
4. Restore PostgreSQL data (please refer to the man for pg_restore.)
   `pg_restore -U edware -W -d edware /path/to/backup.sql.gz`
5. Resume the Edmigrate service:
   `/etc/init.d/edmigrate-conductor start`

2. Please check http://www.slideshare.net/InesSombra/data-antipatterns-nycdevops for more information on the following process:
    a. Provisioning enough disk space for database backup.
    b. Proper backup schedule for full backup and incremental backup, see https://wiki.postgresql.org/wiki/Incrementally_Updated_Backups, http://stackoverflow.com/questions/5529603/best-method-for-postgres-incremental-backup and http://www.postgresql.org/docs/9.2/static/continuous-archiving.html for good incremental backup for PostgresQL.
    c. Set up good backup retention time.
    d. Periodically practice restore database backups to detect corrupted backup files.
    e. Always test the restored backup with smarter app to make sure the restoration from backup is proper.
    f. Set up recovery protocols, plans, and practice disaster recovery.
3. Historical Assessments archive:
    a. Periodically backup history assessment files in landing zone history to tapes/optical media/amazon Glacier.
4. Item-Level raw data:
    a. We suggest setting up rsync and a redundant item level storage cluster as a backup plan due to the number of files and size of data.
    b. Periodically backup item-level files to tape/optical media/amazon glacier.

c. Item level data file may be updated/modified, so it is advisable to plan incremental backup on whole file repository periodically. Make sure the gap for missed item-level raw data is as minimal as possible
d. Tar may not be usable in backup item-level data. See: http://serverfault.com/questions/329273/store-and-backup-200-million-small-files

7 Installation & Configurations

7.1 Reporting Web Servers

Reporting Web Servers are responsible for running the Smarter Balanced Reporting Web Application. This application is written in Python, and runs on Apache using WSGI.

7.1.1 Installation

The following table lists the RPMs that must be installed on reporting-web servers.

Package	Tested Version	RPM Name	Description
Python	3.3.0*	python3	Python 3 RPM is generally not available from Linux distributions, hence Amplify has supplied a customized Python 3 RPM
Apache	2.2.15	httpd	Apache hosts Smarter Web Application. It can be installed from the standard distributed RPM. We highly recommend using customized configuration. Apache should run on worker MPM mode.
WSGI	3.4*	python3-mod_wsgi	WSGI defines a simple and universal interface between web servers and web applications or frameworks for Python. This is a customized RPM supplied by Amplify.
Smarter	TBD*	smarter	Amplify's Smarter Web Application
XMLSec	1.2.20	xmlsec1 xmlsec1-openssl-devel	XMLSec can be installed from standard distributed RPM. It is used for verification of SAML Responses.

* Provided by Amplify.

7.1.2 Apache Configuration

7.1.2.1 MPM Mode

The nature of the application is CPU intensive, and requires Apache to run in worker MPM (Multi-Processing Module) mode.

Modify **/etc/sysconfig/httpd** to set Apache to use worker MPM mode.

```
# Configuration file for the httpd service.
HTTPD=/usr/sbin/httpd.worker
```

7.1.2.2 Configuration Files to Add

See Appendix A for the details of the contents of these files. All paths are under **/etc/httpd**.
The Reporting Web Server requires:

- conf/httpd.conf
- conf.d/edware_mpm_worker.conf
- conf.d/rewrite_reporting_https.conf
- conf.d/rewrite_reporting_slash.conf
- conf.d/ssl_main_server.conf
- conf.d/wsgi_edware.conf

7.1.2.3 Configuration Files to Remove

These files are included with the stock RPMs, and should be removed:

- conf.d/ssl.conf
- conf.d/welcome.conf

7.1.3 Smarter Application

Smarter is the main web application. It provides HTML, CSV and PDF data access to end users. The application runs on Apache web server via WSGI with Python Pyramid Framework.

The Smarter RPM, provided by Amplify, packages an entire Python 3.3 virtual environment and all Python dependencies used by the application. The Smarter RPM installs the virtual environment in **/opt/virtualenv/smarter**. A utility packaged within the RPM is provided to generate the **.ini** configuration file for the Smarter Web Application. The generation of the **.ini** file is the administrator's/operator's responsibility.

7.1.3.1 Generating smarter.ini

Smarter needs to read an **.ini** configuration upon start-up. The default location of this file is **/opt/edware/conf/smarter.ini**, and the configuration of the path is specified in **/opt/edware/smarter/smarter.wsgi**.

Each environment is unique, hence, the configuration of each configuration is unique. The operator must generate the **.ini** file for each server/environment. Within the directory, **/opt/edware/conf/**, a **settings.yaml** file exists that defines the default and environment specific key/value pairs of the configuration. For permanent changes to the configuration of an environment, changes should be made in **/opt/edware/conf/settings.yaml**.

Here are the steps to generate the **.ini** file for the "**uat**" environment:

```
shell>  . /opt/virtualenv/smarter/bin/activate
(virtualenv)  cd /opt/edware/conf
(virtualenv)  python generate_ini.py -e uat
(virtualenv)  mv uat.ini smarter.ini
```

7.1.3.2 Configuration File for Authentication between OpenAM SAML and Smarter

The Smarter Web Application needs to verify the authentication with OpenAM SAML by IDP Metadata XML file. This metadata file doesn't come with the RPM. The operator must generate and reference the path of this file inside smarter.ini. By default, Smarter expects this file to be located in **/opt/edware/conf/idp_metadata.xml.**

7.1.3.3 Adding Custom Metadata Configuration

Every tenant/state has the option to insert custom metadata into their production database's **custom_metadata** table. This table has three columns:

Column Name	Description	Example Value
state_code	The state code of a particular tenant.	NC
asmt_subject	The subject for a particular assessment	Math
asmt_custom_metadata	A JSON formatted string that contains the minimum cell size, and colors used for assessment representation within reports.	{"min_cell_size":30, "colors":[{"text_color":"#ffffff","bg_color":"#DD514C","start_gradient_bg_color":"#EE5F5B","end_gradient_bg_color":"#C43C35"}, {"text_color":"#000","bg_color":"#e4c904","start_gradient_bg_color":"#e3c703","end_gradient_bg_color":"#eed909"}, {"text_color":"#ffffff","bg_color":"#6aa506","start_gradient_bg_color":"#3d9913","end_gradient_bg_color":"#65b92c"}, {"text_color":"#ffffff","bg_color":"#237ccb","start_gradient_bg_color":"#2078ca","end_gradient_bg_color":"#3a98d1"}]}

The insertion of custom metadata is optional, as default values will be used instead.

7.1.3.4 Configuring syslog

A optional rsyslog configuration file, **/etc/rsyslog.d/wgen.conf**, can be created by an operator. All regular files in the /etc/rsyslog.d directory are included as additional rsyslog server settings for **/etc/rsyslogd.conf**. If syslog local facilities are not specified, they are sent to the syslog message facility.

```
$FileCreateMode 0644
local0.* /opt/edware/log/audit.log
local1.* /opt/edware/log/smarter.log
local2.* /opt/edware/log/security_event.log
```

7.1.3.5 Creating a Database Schema for Production Database

You must manually create an empty schema for the production database. A script is provided to perform this task. This step requires that the Database Master is installed and configured first.

```
shell>  . /opt/virtualenv/smarter/bin/activate
(virtualenv)  cd
/opt/virtualenv/smarter/lib/python3.3/site-packages/edschema-0.1-py3.3.egg/edschema
(virtualenv) python metadata_generator.py -s edware -d edware -m edware --host
[dbMastHostName] -p [password]
```

Note: The command is in the format of:

```
python metadata_generator.py -s [schemaName] -d [databaseName] -m edware --host
[dbMastHostName] -p [password]
```

7.2 Load Balancer

Load Balancers are used to load balance traffic to web servers. In AWS, Elastic Load Balancers are used for this purpose.

7.3 PDF Messenger [Ansible name: reporting-rabbit-services]

PDF Messenger hosts the broker for PDF tasks that are requested by the Smarter Web Application. We have chosen to use RabbitMQ as the message broker. RabbitMQ, written in Erlang, implements the Advanced Message Queuing Protocol (AMQP) standard.

7.3.1 Installation

The following table lists the RPMs that must be installed on the PDF Messenger server.

Package	Tested Version	RPM Name	Description

RabbitMQ	2.6.1	rabbitmq-server	RabbitMQ RPM is available from Extra Packages for Enterprise Linux (EPEL)

7.3.2 Configuration

RabbitMQ

The RabbitMQ RPM comes with default built-in configurations which are sufficient for running the service effectively. We recommend using RabbitMQ cluster to prevent a single point of failure. Please see http://www.rabbitmq.com/clustering.html for more details.

The main configuration file for RabbitMQ is located in **/etc/rabbitmq/rabbitmq.config**. Please refer to http://www.rabbitmq.com/configure.html for more details.

Please remember that any configurations set here (such as user name, passwords, etc.) needs to be reflected back in your **smarter.ini** file in your web server, pdf worker, and pdf generator machines.

Adding a New User

A user needs to be created to authenticate with applications with RabbitMQ. To add a new user, execute the commands below with root access, please refer to **smarter.ini** for the user name and password. We default to the user **'edware'** and password **'edware1234'**.

```
shell>  rabbitmqctl add_user <user> <password>
```

Adding a New vhost

A new virtual host needs to be added so that PDF Generator has a separation with other applications that may utilize the same broker. By default, Smarter Web Applications expects this virtual host to be named **services**. To add a new virtual host, execute the following command below with root access:

```
shell> rabbitmqctl add_vhost services
```

Granting User Permission

The user that you have created above needs to have permission to your virtualhost. To grant permission, execute the following command below, replacing <user> with the one with proper permission:

```
shell> rabbitmqctl set_permissions -p services <user> ".*" ".*" ".*"
```

Enabling SSL (Optional)

If you decide to run RabbitMQ on SSL, you will need to enable Celery on SSL in your PDF Worker (as described later).

Generate self signed certificate and key with OpenSSL

You will need to generate the certificate with the following commands:

```
shell> cd ~/
shell> mkdir testca
shell> mkdir certs private
shell> chmod 700 private
shell> echo 01 > serial
shell> touch index.txt
shell> vi testca/openssl.cnf
        [ ca ]
        default_ca = testca
        [ testca ]
        dir = .
        certificate = $dir/cacert.pem
        database = $dir/index.txt
        new_certs_dir = $dir/certs
        private_key = $dir/private/cakey.pem
        serial = $dir/serial
        default_crl_days = 7
        default_days = 365
        default_md = sha1
        policy = testca_policy
        x509_extensions = certificate_extensions
        [ testca_policy ]
        commonName = supplied
        stateOrProvinceName = optional
        countryName = optional
        emailAddress = optional
        organizationName = optional
        organizationalUnitName = optional
        [ certificate_extensions ]
        basicConstraints = CA:false
        [ req ]
        default_bits = 2048
        default_keyfile = ./private/cakey.pem
        default_md = sha1
        prompt = yes
        distinguished_name = root_ca_distinguished_name
        x509_extensions = root_ca_extensions
        [ root_ca_distinguished_name ]
        commonName = hostname
        [ root_ca_extensions ]
        basicConstraints = CA:true
        keyUsage = keyCertSign, cRLSign
        [ client_ca_extensions ]
        basicConstraints = CA:false
        keyUsage = digitalSignature
        extendedKeyUsage = 1.3.6.1.5.5.7.3.2
        [ server_ca_extensions ]
        basicConstraints = CA:false
        keyUsage = keyEncipherment
        extendedKeyUsage = 1.3.6.1.5.5.7.3.1
```

Generate self-signed CA

You will need to generate a self-signed certificate authority with the following command:

```
shell> openssl req -x509 -config openssl.cnf -newkey rsa:2048 -days 365 -out cacert.pem
-outform PEM -subj /CN=MyTestCA/ -nodes
```

Generate Server Certificate

You will need to generate a server certificate with the following commands:

```
shell>  cd ~/
shell>  mkdir server
shell>  cd server
shell>  openssl genrsa -out key.pem 2048
shell>  openssl req -new -key key.pem -out req.pem -outform PEM -subj /CN=$(hostname)/O=server/
-nodes
shell>  cd ../testca
shell>  openssl ca -config openssl.cnf -in ../server/req.pem -out ../server/cert.pem -notext
-batch -extensions server_ca_extensions
```

Generate Client Certificate

You will need to generate a client certificate, which be installed by clients such as PDF Worker:

```
shell>  cd ~/
shell>  mkdir client
shell>  cd client
shell>  openssl genrsa -out key.pem 2048
shell>  openssl req -new -key key.pem -out req.pem -outform PEM -subj /CN=$(hostname)/O=client/
-nodes
shell>  cd ../testca
shell>  openssl ca -config openssl.cnf -in ../client/req.pem -out ../client/cert.pem -notext
-batch -extensions client_ca_extensions
```

Configure and Enable SSL on RabbitMQ

1. Update /etc/rabbitmq/rabbitmq.config:

```
[
        {rabbit, [
                {tcp_listeners, []},
                {ssl_listeners, [5671]},
                {ssl_options, [{cacertfile,"/etc/rabbitmq/testca/cacert.pem"},
                               {certfile,"/etc/rabbitmq/server/cert.pem"},
                               {keyfile,"/etc/rabbitmq/server/key.pem"},
                               {verify,verify_peer},
                               {fail_if_no_peer_cert,false}]}
]}]
```

2. Restart the rabbitmq server:

```
/etc/rc.d/init.d/rabbitmq-server restart
```

3. Configure the Firewall, change **/etc/sysconfig/iptables**, add the following lines before the REJECT rules:

```
-A INPUT -p tcp -m state --state NEW -m tcp --dport 5671 -j ACCEPT
```

```
-A INPUT -p tcp -m state --state NEW -m tcp --dport 15672 -j ACCEPT
```

7.4 PDF Worker [Ansible name: reporting-worker-pdf]

PDF Worker is responsible for producing PDF versions of reports. The worker picks up messages/tasks from the PDF Messenger via RabbitMQ. PDF Worker is written using a Python framework, Celery. Celery is an asynchronous task queue/job queue based on distributed message passing. PDFs are stored on a volume on glusterFS encrypted with EncFS.

7.4.1 Installation

PDF Messenger, internally known as celeryd-services, is packaged inside the Smarter RPM, hence, the prerequisites for Smarter is also required in PDF Worker servers.

The following table lists the RPMs that must be installed on PDF Worker servers:

Package	Tested Version	RPM Name	Description
Python	3.3	python3-3.3.0	Python 3 RPM is generally not available from Linux distributions, hence Amplify has supplied a customized Python 3 RPM
WSGI	3.4	python3-mod_wsgi	WSGI defines a simple and universal interface between web servers and web applications or frameworks for Python. This is a customized RPM supplied by Amplify.
Smarter	TBD	smarter	Amplify's Smarter Web Application
XMLSec	1.2.16	xmlsec1 xmlsec1-openssl-devel	XMLSec can be installed from standard distributed RPM. It is used for verification of SAML Responses.
wkhtmltopdf	0.12.1	wkhtmltox	A third party utility for PDF generation of reports using webkit rendering engine and Qt.
PDFUnite	0.26.1	pdfunite	A third party utility for merging PDFs. Amplify provides a customized RPM for PDFUnite.
urw-fonts	2.4	urw-fonts	Free versions of 35 standard PostScript fonts.

			This RPM is readily available from Linux Distributions.
PDF Fonts	<placeholder>	<placeholder>	Fonts for other languages are required so that PDFs are generated properly for such languages.
glusterfs	3.3.1	glusterfs	We suggest installing a newer version of the RPM from GlusterFS' site other than the RPM from Linux distributors. See below for more details.
glusterfs-fuse	3.3.1	glusterfs-fuse	It provides support to FUSE based clients. We suggest installing a newer version of the RPM from GlusterFS' site other than the RPM from Linux distributors. See below for more details.
encfs	1.7.4	fuse-encfs	encFS client to encrypt a volume This RPM is readily available from Linux Distributions. Not Required for AWS

Installing GlusterFS

GlusterFS is a clustered file-system capable of scaling to several petabytes. As noted above, we recommend installing a newer version of the glusterfs RPM directly from GlusterFS' website.

Setting up yum repo configuration for GlusterFS

Please execute the following command:

```
shell> wget -P /etc/yum.repos.d
http://download.gluster.org/pub/gluster/glusterfs/LATEST/EPEL.repo/glusterfs-epel.repo
```

7.3.2 Configuration

7.3.2.1 GlusterFS

At this step, it's expected that you have a gluster that is ready to be mounted. You will need to configure PDF worker servers to automount the gluster.

Automount the Gluster

Modify **/etc/fstab** to automount when the OS boots up.

```
glusterServer.example.net:/gv0   /mnt/gluster    glusterfs    defaults     1 2
```

There is a network timing issue with automount when the OS boots up. To work around this issue, use **rc.local** to mount GlusterFS. Append the following line to **/etc/rc.d/rc.local**:

```
mount -a
```

7.3.2.3 celeryd-services

Similar to the Smarter Web Application, PDF Workers read the same **.ini** file (located in /opt/edware/conf/smarter.ini). Please refer here to generate the **.ini** file.

Changing Celery process' user/group (Optional)

If you need to run the celery process with a different user or group other than the default, you will need to modify **/opt/edware/conf/celeryd-services.conf**.

You'll need to modify the values for CELERYD_USER and/or CELERYD_GROUP.

Changing PDF Worker's Celery Configuration (Optional)

In **/opt/edware/conf/smarter.ini**, the following configurations are relevant and most likely needs to be changed in PDF Worker:

Configuration Name	Description	Example Value
services.celery.BROKER_URL	The Broker URL that PDF Worker will bind to	`amqp://edware:edware1234@pdfMessengerHost/services`

Enabling SSL (Optional)

This section is required only if you've enabled SSL on your PDF Messenger.

Copy Client Certificates

Copy the client certificates and **testca** generated from here and place the CA to **/opt/edware/conf/testca** and certificates to **/opt/edware/conf/client**.

Configure Celery to use SSL

1. Update broker URL to RabbitMQ with the SSL port number:

```
services.celery.BROKER_URL = amqp://user:pwd@broker:5671/services
```

2. Add the following lines into **smarter.ini**:

```
services.celery.BROKER_USE_SSL = {'ca_certs': '/opt/edware/conf/testca/cacert.pem', 'keyfile':
'/opt/edware/conf/client/key.pem', 'certfile': '/opt/edware/conf/client/cert.pem', 'cert_reqs':
True }
```

3. Restart celeryd:

```
shell> /etc/init.d/celeryd-services restart
```

7.4 PDF Pre-Generator [Ansible name: reporting-generator-pdf]

PDF Pre-Generator is used to pre-generate PDFs when new data batches are loaded into the system. This mechanism is done via a cron job that is scheduled to run and check the database for newly ingested data. We can consider this mechanism as a backend Smarter Web Application. Its sole responsibility is to trigger PDF pregeneration on a scheduled basis.

PDF Generator needs to write and update the **edware_stats** database, therefore the database connection must be directly to the database master. We recommend this database to be on the Loader Database server.

7.4.1 Installation

Please refer to here for installing PDF Pre-Generator server. The install is almost identical to installing and configuring web servers, except that wsgi needs to be configured to be single process. This is described in the configuration section.

7.4.2 Configuration

7.4.2.1 smarter

Generating Smarter.ini

Similarly, PDF Generator needs to read from the **.ini** file. Please refer to here for generating this file.

Note: In **settings.yaml**, you can check if there exists a section dedicated to this server type. To generate the **.ini** for PDF Generator, you can/should set the environment value as '**uat.pdf_generator**'.
ex. `python generate_ini.py -e uat.pdf_generator`

Configurations specific to PDF Generator in Smarter.ini

Configuration	Description	Example Value
cache.session.expire	The special pdf generation batch user's session expiration in seconds. This should be set to the value that you expect the duration of the PDFs to be generated for the current batch of data.	300000
batch.user.session.timeout	The special pdf generation batch user's cookie expiration in seconds. This should align with the session expiration.	300000
trigger.pdf.enable	Enable pdf pre-generation	True
trigger.pdf.schedule.cron.hour	The hour in which to schedule pdf-generation	20
trigger.pdf.schedule.cron.minute	The minute in which to schedule pdf-generation	15

7.4.2.2 WSGI

The configuration for wsgi is almost identical to the configuration of wsgi in web servers. Please refer to that section for the configuration needed. The only configuration difference is described below.

Configuration for Smarter application specific WSGI configuration

Modify **/etc/httpd/conf.d/wsgi_edware.conf** to add the WSGI configuration for PDF Pre-Generator. The notable difference compared to web server is that we're running on a single process.

```
WSGIApplicationGroup %{GLOBAL}
WSGIPassAuthorization On
WSGIDaemonProcess pyramid user=apache group=apache processes=1 threads=30
python-path=/opt/virtualenv/lib/python3.3/site-packages
WSGIScriptAlias / /opt/edware/smarter/smarter.wsgi
WSGIImportScript /opt/edware/smarter/smarter.wsgi process-group=pyramid
application-group=%{GLOBAL}
WSGISocketPrefix run/wsgi
<Directory /opt/virtualenv>
   WSGIProcessGroup pyramid
   Order allow,deny
   Allow from all
```

```
</Directory>
WSGIPythonPath /opt/virtualenv/lib/python3.3/site-packages
```

7.5 Extract Messenger [Ansible name: reporting-rabbit-extract]

Extract Messenger hosts a message system between Smarter Web Application and Extract Worker. It uses RabbitMQ as its message broker and extract tasks are sent from Web Servers and are received by Extract Workers. The installation and configuration is very similar to PDF Messenger.

7.5.1 Installation

Please refer to the installation of RabbitMQ from here.

Note: The only configuration difference is that the name of the virtual host for extracts should be different than the one defined for PDF Messenger. By default, we expect and recommend the virtual host for Extract Messenger to be named, **edextract**.

7.5.2 Configuration

Please refer to the configuration of RabbitMQ from here.

7.6 Extract Worker [Ansible name: reporting-worker-extract]

Extract worker is responsible for receiving extract tasks from the queue and generating bulk raw extracts in CSV format. The installation and configuration is very similar to PDF Worker.

There are a few key differences for Extract Worker:

- Celery service name is **celeryd-edextract**.
- Celery configuration file is **celeryd-edextract.conf**.
- Mount EncFS to **/opt/edware/extraction** (be sure to mount it as celery user).
- **extract.celery.BROKER_URL** is the broker URL used by Extract Worker.

7.6.1 Installation

Please refer to the installation of Extract Worker from here.

Note: Please remember the notable installation differences between PDF and Extract Worker, namely, the celery service.

7.6.2 Configuration

Please refer to the configuration of Extract Worker from here.

Note: Please remember the notable configuration differences between PDF and Extract Worker, namely, the celeryd configuration file, the EncFS mount point, and the broker URL configuration in smarter.ini.

7.7 Cache [Ansible name: memcached]

The Smarter Web Application uses cache servers to persist data for reports and user sessions for some configurable amount of duration. It uses memcached, an in-memory key-value store for small chunks of arbitrary data (strings, objects).

7.7.1 Installation

The following table lists the RPMs that must be installed on cache servers.

Package	Tested Version	RPM Name	Description
memcached	1.4.4	memcached	Available on standard Linux Distributions

7.7.2 Configuration

memcached

The standard install of memcached should be sufficient.

Main configuration for memcached

Modify **/etc/sysconfig/memcached** for main configuration for memcached:

```
PORT="11211"
USER="memcached"
MAXCONN="1024"
CACHESIZE="64"
OPTIONS=""
```

Please update MAXCOMM and CACHESIZE based on your memchaced server configuration.

7.8 Cache Warmer [ansible name: reporting-cache-warmer]

The Cache Warmer re-populates memcached used by the Application Server for results of popular data requests. The Cache Warmer is triggered on a schedule. The data requests are configurable for the types of demographics filters to apply to the data requests.

Similar to PDF Pre-Generator, Cache Warmer is considered as an offline Smarter Web Application. It's a dedicated server used to handle the flushing and re-caching of reports data when new data has been ingested into the system.

7.8.1 Installation

Please refer to the installation guide from here. The install is almost identical to installing and configuring web servers, except that the wsgi needs to be configured to be a single process. This is described in configuration section.

7.8.2 Configuration

WSGI

The configuration for wsgi is almost identical to the configuration of wsgi in web servers. Please refer to that section for the configurations needed. The only configuration difference is described below.

Configuration for Smarter application specific WSGI configuration

Modify **/etc/httpd/conf.d/wsgi_edware.conf** to add WSGI configuration for the Cache Warmer. The notable difference compared to web server is that we're running on a single process.

```
WSGIApplicationGroup %{GLOBAL}
WSGIPassAuthorization On
WSGIDaemonProcess pyramid user=apache group=apache processes=1 threads=30
python-path=/opt/virtualenv/lib/python3.3/site-packages
WSGIScriptAlias / /opt/edware/smarter/smarter.wsgi
WSGIImportScript /opt/edware/smarter/smarter.wsgi process-group=pyramid
application-group=%{GLOBAL}
WSGISocketPrefix run/wsgi
<Directory /opt/virtualenv>
  WSGIProcessGroup pyramid
  Order allow,deny
  Allow from all
</Directory>
WSGIPythonPath /opt/virtualenv/lib/python3.3/site-packages
```

smarter

Generating Smarter.ini

Similarly, Cache Warmer needs to read from **.ini** file. Please refer to here for generating this file.

Note: In settings.yaml, you should check if there exists a section dedicated to this server type. To generate **.ini** for Cache Warmer, you can/should set the environment value as 'uat.cache. ex. python generate_ini.py -e uat.cache

Configurations specific to Cache Warmer in Smarter.ini

Configuration	Description	Example Value
trigger.recache.enable	Enable cache warmer	True

trigger.recache.schedule.cron.hour	The hour in which to schedule cache warmer	20
trigger.recache.schedule.cron.minute	The minute in which to schedule cache warmer	15

Configuration for Demographics Filters

Cache Warmer re-caches comparing populations reports, and the demographic filters for the report configuration. The state and district comparing populations reports are both candidates for caching, the configuration file contains state and district specific sections.

Modify **/opt/edware/conf/comparing_populations_precache_filters.json** to configure filters specific to your tenant/state. You can override a particular tenant's configuration by adding a section in the JSON file by prepending the tenant name in front of state or district.

Ex. The following configuration has 2 filters for State View, 1 filter for District View, and overwrites ES tenant State View with a different filter.

```
{"state":
      [{"grade: ["3"], "dmgPrgIep": ["Y"]},
      {"grade": ["4"]}],
 "district": [{"grade": ["5"]}],
 "ES.state": [{"grade": ["6"]}]}
```

7.9 Database Master [ansible name: db-master]

Database Master server is used for storing all reporting data. Database Master allows insert/update/delete/select queries. Master sends replication data to one or more standby servers.

In order to protect PII, database data should be encrypted. Please see the Encrypting section to prepare to encrypt your data in PostgreSQL.

7.9.1 Installation

The following lists the RPM required by Database Master

Package	Tested Version	RPM Name	Description
Database	9.2.8	postgresql postgresql92-server postgresql92-libs postgresql92-contrib postgresql92-devel	These RPMs are available from most Linux distributions

Replication Manager	2.0	repmgr	RPM is available from most Linux distributions.

7.9.2 Configuration

postgres

Configuring postgres master

1. If this is the first time you install postgres, run:
   ```
   shell> service postgresql-92 initdb
   ```
2. We need to set up an archive directory for the WAL log for replication, and put the right archive directory into archive_command options. For example in the runbook we have **/var/lib/pgsql/9.2/archive** as archive directory.
3. Generate an ssh key pair on master. Executing the following commands as the **`postgres`** user. (repmgr program will copy the database with rsync and ssh for user postgres, so we need to set up ssh login with password between master and slave servers).
   ```
   shell> ssh-keygen
   Generating public/private rsa key pair.
   Enter file in which to save the key (/var/lib/pgsql/.ssh/id_rsa):
   Created directory '/var/lib/pgsql/.ssh'.
   Enter passphrase (empty for no passphrase):
   Enter same passphrase again:
   Your identification has been saved in /var/lib/pgsql/.ssh/id_rsa.
   Your public key has been saved in /var/lib/pgsql/.ssh/id_rsa.pub.
   The key fingerprint is:
   58:66:3b:d1:97:f4:b9:fc:1f:66:dc:28:3f:8f:bf:8f postgres@dbpgdw0.qa.dum.edwdc.net
   The key's randomart image is:
   +--[ RSA 2048]----+
   |             .    |
   |         . . o . |
   |        = . o o  |
   |       = o . . . |
   |      . S     o  |
   |         .    .o.|
   |            . .=o|
   |             o+oo|
   |              E=B|
   +-----------------+
   ```
4. Distribute public key to postgresql database replica servers:
   Append generated public key(**`/var/lib/pgsql/.ssh/id_rsa.pub`**) to replica servers (**`/var/lib/pgsql/.ssh/authorized_keys`**).
5. Modify **`/var/lib/pgsql/9.2/data/postgresql.conf`**
   Update the following options. Keep the other options untouched.

Configuration	Description	Example Value
listen_addresses	address for postgres server, we use all IP on the server. so '*'	'*'

shared_buffers	This depends on your server memory. See postgres manual for details.	8192MB
work_mem	work_mem for each connection,	100MB
log_filename	file name for log file	'postgresql-%a.log'
log_truncate_on_rotation		on
log_rotation_size		0
log_timezone	Time Zone for log file. We use 'UTC'	'UTC'
timezone	Time Zone	'UTC'
wal_level	We are doing replication. So host_standbay	hot_standby
checkpoint_segments		30
archive_mode	We need to run replication. so we set it on	on
max_wal_senders	number of processes to send WAL log to remote	10
wal_keep_segments	WAL files that are kept under pg_xlog before it is archived.	5000
hot_standby		on
ssl	enable ssl	on
archive_command	command to be executed by celery to move WAL log to archive directory. We prefer keep pg_xlog small and move compress WAL log to archive and delete the original WAL log under pg_xlog	'gzip -9 < %p > /var/lib/pgsql/9.2/archive/%f && rm %p'

6. Update **`/var/lib/pgsql/9.2/data/pg_hba.conf`**, add the following lines into pg_hba.conf, keeping the original pg_hba.conf content:

```
local   all             all                                     peer
# IPv4 local connections:
hostssl    all             all             127.0.0.1/32            trust
# Replication:
hostssl    replication     all             ###.###.###.###/#          trust
hostssl    all             all             ###.###.###.###/#              md5
# IPv6 local connections:
hostssl    all             all             ::1/128                 ident
```

###.###.###.### is your postgresql slave server IP/network.

7. Create the **edware** user and database at the psql prompt:

```
CREATE DATABASE edware with encoding 'UTF-8';
```

```
CREATE DATABASE edware_stats with encoding 'UTF-8';
CREATE USER edware WITH PASSWORD 'edware2013';
GRANT ALL PRIVILEGES ON DATABASE edware to edware;
GRANT ALL PRIVILEGES ON DATABASE edware_stats to edware;
```

8. Create **/var/lib/pgsql/repmgr.conf**:

Configuration	Description	Example Value
cluster	group of cluster name. Use the same name for all servers.	edware_pg_cluster
node	node number must be unique for each servers.	1
node_name	value must be its own server hostname	fully qualified domain name of the machine
conninfo	repmgr to connect to PostgreSQL server, host value must be its server host name, and the proper user name and database name for replicated database	'host=<my_FQDN_.com> user=repmgr dbname=edware'
pg_bindir	path to pgsql installation	/usr/pgsql-9.2/bin

9. Create the **repmgr** user for PostgreSQL at the psql prompt:
   ```
   CREATE ROLE repmgr SUPERUSER LOGIN;
   ```
10. Register **repmgr**:
    ```
    PATH=$PATH:/usr/pgsql-9.2/bin repmgr -f /var/lib/pgsql/repmgr.conf master register
    ```
11. Restart PostgreSQL.

7.10 Database Replica

Database Replica servers are responsible for replicating data from the Database Master. The server is a read-only server, therefore, only SELECT queries can be executed.

In order to protect PII, database data should be encrypted. Please see the Encrypting section to prepare to encrypt your data in PostgreSQL.

In Smarter Balanced Reporting, we allocated ⅓ of the replica servers for data extract use and ⅔ replica servers for web frontend reporting. The data extraction replica server doesn't require smarter to be installed.

7.10.1 Installation

The following lists the RPMs required by Database Replica for web frontend reporting:

Package	Tested Version	RPM Name	Description

Database	9.2.8	postgresql postgresql92-server postgresql92-libs postgresql92-contrib postgresql92-devel	These RPMs are available from most Linux distributions.
Replication Manager	2.0	repmgr	RPM is available from most Linux distributions.
smarter	<TBD>	smarter	An Amplify supplied RPM. edmigrate-celerdy is package within smarter RPM.

The following lists the RPMs required by the Database Replica for extract:

Package	Tested Version	RPM Name	Description
Database	9.2.8	postgresql postgresql92-server postgresql92-libs postgresql92-contrib postgresql92-devel	These RPMs are available from most Linux distributions.
Replication Manager	2.0	repmgr	RPM is available from most Linux distributions.

7.10.2 Configuration

postrgres

1. Generate an ssh key pair on all slave servers. Executing commands must be the **`postgres`** user. (The repmgr program will copy the database with rsync and ssh for the postgres user, so we need to set up ssh login with password between the master and slave servers).

```
shell> ssh-keygen
Generating public/private rsa key pair.
Enter file in which to save the key (/var/lib/pgsql/.ssh/id_rsa):
Created directory '/var/lib/pgsql/.ssh'.
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /var/lib/pgsql/.ssh/id_rsa.
Your public key has been saved in /var/lib/pgsql/.ssh/id_rsa.pub.
The key fingerprint is:
58:66:3b:d1:97:f4:b9:fc:1f:66:dc:28:3f:8f:bf:8f postgres@dbpgdw0.qa.dum.edwdc.net
The key's randomart image is:
+--[ RSA 2048]----+
|            .    |
|         . . o . |
|        = . o o  |
|       = o . . . |
```

```
|      . S     o  |
|         .    .o.|
|           . .=o|
|            o+oo|
|              E=B|
+-----------------+
```

2. Copy the public key to the postgresql Master Server:
   Append the generated public key (**/var/lib/pgsql/.ssh/id_rsa.pub**) to the Master Server (**/var/lib/pgsql/.ssh/authorized_keys**).
3. Stop PostgreSQL.
4. Make sure the data directory is empty. Delete all files and directories:
   ```
   cd /var/lib/pgsql/9.2/data
   rm -rf *
   ```
5. Clone the master database:
   a. This must be the **postgres** user. To execute, replace **master.server.com** to your master database' fully qualified domain name:
   ```
   shell> su - postgres
   shell> PATH=$PATH:/usr/pgsql-9.2/bin repmgr -D
   /var/lib/pgsql/9.2/data -d edware -p 5432 -R postgres --verbose
   standby clone master.server.com
   ```
6. After the clone, modify **recovery.conf**. To add the following two lines, you need to change the archive path to what you have on your replica server:
   ```
   restore_command = 'gunzip < /var/lib/pgsql/9.2/archive/%f.gz > %p'
   archive_cleanup_command = 'pg_archivecleanup /var/lib/pgsql/9.2/archive %r'
   ```
7. After the clone, if there are files under the archive directory in the master database - **scp** them under the **postgres** user to the replicated servers. Here is an example copy from master to slave replica's archive directory:
   ```
   shell> scp * postgres@[fqdn of replica]:/var/lib/pgsql/9.2/archive/
   ```
8. Update **pg_hba.conf**, make sure the following line is in **pg_hba.conf**:
   ```
   host all all 127.0.0.1/32 trust
   ```
9. Start the slave database after modifying **postgresql.conf**.
10. Create **/var/lib/pgsql/repmgr.conf**:

Configuration	Description	Example Value
cluster	group of cluster name. Use the same name for all servers.	edware_pg_cluster
node	node number must be unique for each servers.	1
node_name	value must be its own server hostname	fully qualified domain name of the machine
conninfo	repmgr to connect to PostgreSQL server, host value must be its server host name, and the proper user name and database name for replicated database	'host=<my_FQDN_.com> user=repmgr dbname=edware'

pg_bindir	path to pgsql installation	/usr/pgsql-9.2/bin

11. Make sure **/var/log/repmgrd** and **/var/run/repmgrd** exist and are owned by the **postgres** user.
12. Register **repmgr** for **postgres** use:
    ```
    PATH=$PATH:/usr/pgsql-9.2/bin repmgr -f /var/lib/pgsql/repmgr.conf standby register
    ```
13. Start replication:
    a. If using **repmgr 1.2** then ***sudo*** as **postgres**:
       ```
       PATH=$PATH:/usr/pgsql-9.2/bin repmgrd -f /var/lib/pgsql/repmgrdx.conf
       ```
    b. Add **repmgrd**:
       ```
       chkconfig --add repmgrd
       ```
    c. If using **repmgr** - then run as ***root***:
       ```
       service repmgrd start
       ```
14. Grant privilege to **repmgr_edware_pg_cluster** to the **edware** user:
    ```
    shell> su - postgres
    shell> psql -d edware
    edware=# grant usage on schema repmgr_edware_pg_cluster to edware;
    edware=# set search_path to repmgr_edware_pg_cluster;
    edware=# GRANT ALL PRIVILEGES ON TABLE repl_monitor to edware;
    edware=# GRANT ALL PRIVILEGES ON TABLE repl_nodes to edware;
    edware=# GRANT ALL PRIVILEGES ON TABLE repl_status to edware;
    ```

celeryd-edmigrate

celeryd-edmigrate is a service used for our migration process. The role of replicas in the migration process is known as a player. We only need to enable **celeryd-edmigrate** for Database replicas that are used for the Smarter Balanced Reporting Web Front End.

Configure iptables for celeryd-edmigrated

1. Reset **iptables** rules.
   shell> `service iptables stop`
2. Create the minimum **iptables** rules:
   shell> `/sbin/iptables -A INPUT -m state --state RELATED,ESTABLISHED -j ACCEPT`
   shell> `/sbin/iptables -A INPUT -p tcp --dport 22 -j ACCEPT`
   shell> `/sbin/iptables -A INPUT -p tcp --dport 5432 -j ACCEPT`
   shell> `/sbin/iptables -P INPUT DROP`
3. Create new user-defined custom chain "**EDMIGRATE_PGSQL**":
   shell> `/sbin/iptables -N EDMIGRATE_PGSQL`
4. Create a new rule for the chain:
   shell> `/sbin/iptables -A EDMIGRATE_PGSQL -p tcp -d 127.0.0.1 --dport 5432 -j ACCEPT`
   shell> `/sbin/iptables -A EDMIGRATE_PGSQL -p tcp --dport 5432 -j REJECT`

5. Save the **iptables** rules. Caution: when you execute the following command - it will overwrite any existing **iptables** saved settings.
   shell> `service iptables save`
   or
   shell> `iptables-save > /etc/sysconfig/iptables`

Configure sudoers for celeryd-edmigrate

1. Run ***visudo***:
   shell> `visudo`
2. Add the following lines. Caution: the second line is a single line:

```
Defaults:celery !requiretty
celery ALL=NOPASSWD: /sbin/iptables -t filter -I INPUT -j EDMIGRATE_PGSQL,
/sbin/iptables -t filter -D INPUT -j EDMIGRATE_PGSQL, /sbin/iptables -t filter -I
OUTPUT -j EDMIGRATE_PGSQL, /sbin/iptables -t filter -D OUTPUT -j EDMIGRATE_PGSQL,
/sbin/iptables-save
```

Configure Player

1. Register the **celery** task:
   shell> `chkconfig --add celeryd-edmigrate`
2. Start the service:
   shell> `service celeryd-edmigrate start`
3. Stop the service:
   shell> `service celeryd-edmigrate stop`

7.11 Database Load Balancer

PgBouncer is a lightweight connection pooler for PostgreSQL. The Smarter web application uses **PgBouncer** in order to handle massive database connections by web service requests efficiently.

7.11.1 Installation

The following lists the RPMs required by the Database Load Balancer:

Package	Tested Version	RPM Name	Description
Database Middleware	1.5.4	pgbouncer	RPM is available from most Linux distributions.

7.11.2 Configuration

1. Edit **`/etc/pgbouncer/pgbouncer.ini.`** Modify the following options and keep the others unchanged:

```
[databases]
* = host=dwrouter1.qa.dum.edwdc.net port=9999 user=edware password=edware2013 pool_size=450
connect_query='select 1'

[pgbouncer]
```

```
logfile = /var/log/pgbouncer/pgbouncer.log
pidfile = /var/run/pgbouncer/pgbouncer.pid
listen_addr = *
listen_port = 6432
auth_type = md5
auth_file = /etc/pgbouncer/userlist.txt
admin_users = user2, postgres
stats_users = stats, postgres
pool_mode = session
server_reset_query = DISCARD ALL
ignore_startup_parameters = client_min_messages
max_client_conn = 500
default_pool_size = 100
reserve_pool_size = 10
log_connections = 0
log_disconnections = 0
log_pooler_errors = 1
query_timeout = 180
```

2. Create **`/etc/pgbouncer/userlist.txt`**
   PgBouncer requires its own userlist file. The client authenticates with PgBouncer service first, this is independent of the PostgreSQL Database Authentication. The authentication file contains pairs of double-quote enclosed username and passwords that a client application uses to access PgBouncer. The location of **`userlist.txt`** is specified at **`auth_file`** in **`/etc/pgbouncer/pgbouncer.ini`**.
   a.
   ```
   "postgres" "md5cf8e80c6852c634a6e00613455d34189"
   "edware" "md50927d04170fc5ebc2a14e662d5425c9c"
   ```
   b. Encrypting the password
      The authentication file takes both clear text passwords and MD5-encrypted passwords by settings in pgbouncer.ini (**`auth_type`**). For security reasons, we strongly encourage to use of MD5-encrypted passwords.
      i. How to generate MD5-encrypted password
         From PostgreSQL Query Prompt
         ```
         select 'md5' || md5 ('edware2013' || 'edware');
         ```
         Copy the resulting string into the userlist.txt file:
         ```
         “edware" "md5d305b538896b9a9ea5086cc126bcc09f"
         ```
3. Log file
   The location of log file can be specified in pgbouncer.ini (**`logfile`**).

7.12 Database Pool [ansible name: reporting-db-pgpool]

Pgpool-II is a middleware that works between PostgreSQL servers and PostgreSQL database client. Pgpool-II is mainly used by Smarter to load balance the distribution of SELECT queries among multiple servers, thus improving the system’s overall throughput.

In Smarter Balanced Reporting. We have two sets of Database Pool. One set of Database Pool is for Smarter Balanced Reporting Web Front End. Another set of Database Pool is for Smarter Balanced Bulk Extract and Bulk Printing.

7.12.1 Installation

The following lists the RPMs required by Database Pool

Package	Tested Version	RPM Name	Description
Database	9.2.8	postgresql92-server postgresql92-libs postgresql92	RPM for postgres user for pgpool
Database Middleware	3.3.1	pgpool-II	RPM is available from most Linux distributions.

7.12.2 Configuration

pgpool for Smarter Balanced Reporting web frontend

1. Make sure postgres user exists
2. Make sure firewall is opened for port 9999 for pgpool.
3. Disable postgresql server running
   ```
   shell> service postgresql-9.2 stop
   ```
4. Make sure /var/run/pgpool is owned by postgres user
5. Edit **`/etc/pgpool-II/pool_hba.conf,`** Add following to allow access to pgpool.
   ```
   host all all ###.###.###.###/## trust
   host replication all ###.###.###.###/## trust
   host all all 127.0.0.1/32 trust
   ```
   ###.###.###.### is your pgbouncer server IP/network.
6. Edit **`/etc/pgpool-II/pcp.conf`**
   Configuration for pcp.conf user. We need to use pcp_attach_node command to recover pg_pool connection during edmigrate.
   a. `generate md5 password`
      ```
      # USERID:MD5PASSWD
      postgres:{the md5 passphrase from postgres}
      ```
7. Edit **`/etc/pgpool-II/pgpool.conf`**
   Main configuration file for Pgpool-II. Default configurations that comes with the RPM is almost sufficient for Smarter. There are few changes need in the file.
   a. Updating pgpool.conf, keep other options unchanged.
      Assuming load balancing 2 servers
      ```
      port = 9999
      listen_addresses = '*'
      backend_hostname0 = 'dbpgdwr0s0.qa.dum.edwdc.net'
      backend_port0 = 5432
      backend_weight0 = 1
      backend_data_directory0 = '/mnt/san-postgres/9.2/data'
      backend_flag0 = 'ALLOW_TO_FAILOVER'
      backend_hostname1 = 'dbpgdwr0s1.qa.dum.edwdc.net'
      backend_port1 = 5432
      backend_weight1 = 1
      backend_data_directory1 = '/mnt/san-postgres/9.2/data'
      backend_flag1 = 'ALLOW_TO_FAILOVER'
      ```

```
load_balance_mode = on
replication_mode = off
```

b. Update pgpool.conf to add failover_command for edmigrate, if the slaves that pgpool points doesn't need edmigrate. then no need for this step and step 8.

```
failover_command = '/usr/local/bin/pgpool_failover.sh %d %h %p'
```

8. Create **/usr/local/bin/pgpool_failover.sh** script by copying following text

```
#!/bin/bash
node_id=$1
host_name=$2
port=$3
pcp_user=postgres  # replace this with your pcp.conf user name if
necessary
pcp_pass=postgres  # replace this with your pcp.conf password if
necessary
pcp_host=localhost
pcp_port=9898     # replace this with your pcp.conf pgpool.conf pcp port
if necessary
attach_timeout=100
pgpool_status_file=/var/log/pgpool-II/pgpool_status # replace with your
pgpool_status file location

# command to check pgpool parent is running or not
COMMAND_PS="ps -C pgpool|wc -l"
# command to check failover host name
COMMAND_TEST="nc -w 1 $host_name $port"
# command to reattach node to pgpool. change port number and user name,
password
COMMAND_ATTACH="/usr/bin/pcp_attach_node $attach_timeout localhost
$pcp_port $pcp_user $pcp_pass $node_id"

wait_for_host_to_recover() {
    eval $COMMAND_TEST
    while [ $? -ne 0 ]; do
       PARENT=`eval $COMMAND_PS`
       if [ $PARENT -eq "1" ]; then

          rm $pgpool_status_file
          exit
       fi
       eval $COMMAND_TEST
    done
    eval $COMMAND_ATTACH
}

wait_for_host_to_recover &
```

9. Logfile

create /var/log/pgpool if it doesn't exist, and change ownership to postgres.postgres

a. /var/log/pgpool.log
b. /var/log/pgpool/pgpool_status.

pgpool for Extracts

1. Make sure postgres user exists
2. Make sure firewall is opened for port 9999

3. Disable postgresql server running
   ```
   shell> service postgresql-9.2 stop
   ```
4. Make sure /var/run/pgpool is owned by postgres user
5. Edit **/etc/pgpool-II/pool_hba.conf,** Add following to allow access to pgpool.
   ```
   host all all ###.###.###.###/## trust
   host replication all ###.###.###.###/## trust
   host all all 127.0.0.1/32 trust
   ```
   ###.###.###.### is your pgbouncer server IP/network.
6. Edit **/etc/pgpool-II/pgpool.conf**
   Main configuration file for Pgpool-II. Default configurations that comes with RPM is almost sufficient for Smarter. There are few changes need in the file.
   a. Updating pgpool.conf
      Assuming load balancing 2 servers
      ```
      port = 9999
      listen_addresses = '*'
      backend_hostname0 = 'dbpgdwr0s2.qa.dum.edwdc.net'
      backend_port0 = 5432
      backend_weight0 = 1
      backend_data_directory0 = '/mnt/san-postgres/9.2/data'
      backend_flag0 = 'ALLOW_TO_FAILOVER'
      backend_hostname1 = 'dbpgdwr0s3.qa.dum.edwdc.net'
      backend_port1 = 5432
      backend_weight1 = 1
      backend_data_directory1 = '/mnt/san-postgres/9.2/data'
      backend_flag1 = 'ALLOW_TO_FAILOVER'
      load_balance_mode = on
      replication_mode = off
      ```

5. Logfile
   create /var/log/pgpool if it doesn't exist, and change ownership to postgres.postgres
   a. /var/log/pgpool.log
   b. /var/log/pgpool/pgpool_status.

7.13 Smoke test for smarter functioning

After setting up above software, there is a smoke test to test the whole system is functioning correctly.

1. open a browser
2. pick a web server for smarter. for example: web1.example.com
3. type following url into browser tab: http://web1.example.com/services/heartbeat
4. if it shows 200 Ok. Then the whole Smarter Balanced Reporting is running correctly now. If not. you need to troubleshooting the whole chain of reporting.

7.14 Landing Zone

Landing Zone is a tenant-based drop-off zone for incoming batched data files. Files are dropped into its dedicated tenant space, and are transferred to the Loader server for processing. A File Watcher sits on this machine and watches for newly arrived files

7.14.1 Installation

The following lists the RPMs required by Landing Zone

Package	Tested Version	RPM Name	Description
Python	3.3	python3-3.3.0	Python 3 RPM is generally not available from Linux distributions, hence Amplify has supplied a customized Python 3 RPM
EdSFTP	TBD	edsftp	Amplify's EdSFTP RPM for Landing Zone server.
smarter		smarter	to generate ini file

7.14.2 Configuration

edsftp

EdSFTP is a RPM supplied by Amplify that contains scripts for setting up the Landing Zone server for tenants.

Configuring chroot

1. Add the following section in **/etc/ssh/sshd_config**. Make sure the content is placed at the very bottom of the file.

```
Match Group edwaredataadmin
  X11Forwarding no
  AllowTcpForwarding no
  ForceCommand internal-sftp
  ChrootDirectory /sftp/%h
```

2. Replace existing system override in **/etc/ssh/sshd_config**

```
override default of no subsystems
#Subsystem      sftp    /usr/libexec/openssh/sftp-server
Subsystem       sftp    internal-sftp
```

3. Restart sshd service

```
shell> service sshd restart
```

Generating Smarter .ini file

EdSFTP also reads its configuration from the **.ini** file. You can find the instructions of how to generate the **.ini** file from here.

Creating Groups for SFTP users

By default, all the users will belong to the group: **edwaredataadmin**. If you want to change the group that the SFTP users belong to, you can modify **/opt/edware/conf/smarter.ini** and change the value for **sftp.group**
To create the group, you will need to execute the following commands,

```
shell> source /opt/virtualenv/edsftp/bin/activate
(virtualenv) cd /opt/virtualenv/edsftp
(virtualenv) exit --init
```

Creating Tenant Accounts

For each tenant, you will need to set up an account. Each tenant may have more than one SFTP user if required.

```
# adding tenant “ca”
(virtualenv) sftp_driver.py -s -t ca
# adding user “ca_user1”
(virtualenv) sftp_driver.py -a -u ca_user1 -t ca -r sftparrivals
# set password for the user
(virtualenv) passwd ca_user1
```

You can test whether SFTP works with jailroot for the above user

```
Shell> sftp ca_user1@landingZoneServer
ftp> cd /
ftp> cd file_drop
ftp> put </path/to/test/file/to/be/sftped>
ftp> cd /etc   # access will be restricted
```

Starting EdSFTP watcher service

On the Landing Zone machine, you will need to run the SFTP watcher service to monitor incoming files that are being dropped off.

The following instructions requires the Loader server to be installed and configured (udl2 user must be created in Loader machine). Please proceed if that is completed.

As root user,

1. start service
   `service edsftp-watcher start`
2. Verify the service is running

```
ps -ef | grep sftp_driver
```

7.15 Loader

The Data Loader is responsible for processing newly arrived data and loading it into a Staging database.

The Loader has the ability to call a callback URL for notification purposes. Please make sure that the server is able to make outgoing HTTP and/or HTTPS calls to such URLs (port 80 and 443).

7.15.1 Installation

The following lists the RPMs required by Loader

Package	Tested Version	RPM Name	Description
Python	3.3	python3-3.3.0	Python 3 RPM is generally not available from Linux distributions, hence Amplify has supplied a customized Python 3 RPM
EdUDL	TBD	edudl2	Amplify's RPM for Data Loader
smarter	TBD	smarter	Amplify's RPM for Smarter. We currently need this installed in the Loader for logging purposes.

7.15.2 Configuration

celeryd-udl2

Generate udl2_conf.ini

This configuration file is needed and read by **celeryd-udl2**.

```
shell>  . /opt/virtualenv/udl2/bin/activate
(virtualenv) /opt/edware/conf
(virtualenv) python generate_ini.py -i udl2_conf.yaml -o /opt/edware/conf/ud2_conf.ini
```

This file contains configurations for tenants that are supported, the UDL database, the Staging and Production Database servers.

Generate smarter.ini

Currently, we require smarter.ini for configuring logging in the Loader machine.

Please follow the instructions from here.

Initialize the UDL2 database

You will need to manually initialize the Loader Database schema:

```
shell>  . /opt/virtualenv/udl2/bin/activate
(virtualenv) cd /opt/virtualenv/udl2
(virtualenv) python -m edudl2.database.database --action setup
```

Ensure GPG keys are copied to /opt/edware/keys

Please make sure that the encryption keys are copied to **/opt/edware/keys**

Mount Work Zones directories from Gluster

On every Loader server, please mount the gluster as the **root** user. Make sure the id of **udl2** user and group are the same across the central UDL DB and the pipeline machines (use group id 501 and user id of 502):

```
usermod -G fuse udl2
chown -R udl2.udl2 /opt/edware
```

To mount encrypted zones from gluster as the **udl2** user, execute the following:

```
encfs /mnt/gluster/udl/zones /opt/edware/zones -o umask='007'
```

Ensure Outgoing HTTP and HTTPs ports are opened

Loader makes GET requests to a configurable URL specified in the data files for notifications. Please make sure ahead of time that the URLs are reachable.

Start edudl2-file-grabber and edudl2-trigger service to watch for incoming files being copied to work zone

Note: If multiple Loader servers exist, only one instance needs to be running the **edudl2-file-grabber** and **edudl2-trigger** services.

edudl2-file-grabber is to move files (except **.partial** file extension) from the Landing Zone to the Loader by rsync for the **edudl2-trigger** service.

To start **edudl2-file-grabber**:

```
service edudl2-file-grabber start
```

edudl2-trigger is used to monitor and watch for files that have arrived in the Loader machine and triggering the Loader to process the new data file.

To start **edudl2-trigger**:

```
service edudl2-trigger start
```

The logs can be found based on the logging configs defined in **/opt/edware/conf/smarter.ini**.

7.16 Loader Messenger

Loader Messenger hosts the broker for the Loader tasks that are requested by Data Loader. We have chosen to use RabbitMQ as the message broker. RabbitMQ, written in Erlang, implements the Advanced Message Queuing Protocol (AMQP) standard.

7.16.1 Installation

Please refer to the installation of RabbitMQ from here.

Note: By default, we expect and recommend the virtual host for Loader Messenger to be named, **edudl**. Please make the appropriate configuration changes.

7.16.2 Configuration

Please refer to the configuration of RabbitMQ from here.

7.17 Loader Database

The Loader Data hosts an internal centralized database used for temporary storage used by the Loader. When data files get dropped off in the Landing Zone, the data gets transformed and is temporarily stored in the Staging Database waiting to be migrated. The Loader Database is shared amongst all tenants.

In order to protect PII, all database data should be encrypted. Please see the Encrypting section to prepare to encrypt your data in PostgreSQL.

7.17.1 Installation

The following lists the RPMs required by Loader Database

Package	Tested Version	RPM Name	Description
Database	9.2.8	postgresql postgresql92-server postgresql92-libs postgresql92-contrib postgresql92-devel	RPMs for postgres are readily available from Linux distributions
glusterfs	3.3.1	glusterfs	We suggest installing a newer version of the RPM from GlusterFS' site other than the RPM from Linux distributors.

			See below for more details.
glusterfs-fuse	3.3.1	glusterfs-fuse	It provides support to FUSE based clients. We suggest installing a newer version of the RPM from GlusterFS' site other than the RPM from Linux distributors. See below for more details.
encfs	1.7.4	fuse-encfs	encFS client to encrypt a volume This RPM is readily available from Linux Distributions.

7.17.2 Configuration

postgres

Allow username/password based Authentication

Update **/var/lib/pgsql/9.2/data/pg_hba.conf:**

```
host all all ###.###.###.###/## trust
host replication all ###.###.###.###/## trust
```

###.###.###.### is your postgresql server IP/network

Allow client configuration

Update **/var/lib/pgsql/9.2/data/postgresql.conf**:

```
listen_addresses =  '*'# what IP address(es) to listen on;
port = 5432
max_connections = 100
```

Restart PostgreSQL after this configuration change:

```
shell> service postgresql-9.2 restart
```

Create Database User

We recommend creating a dedicated user for database operations.

```
shell>  sudo -u postgres createuser -s -e -E -d -P  udl2
```

Create UDL database

You will need to create a database to host the data and grant the above created user permission to the database. We recommend that you name this database, udl2:

```
shell> su - postgres
shell> createdb -e -E utf-8 -O udl2 -W udl2
```

Create udl2 User and Group

The creation of the udl2 user and group is required for the Loader Database to change the files in the GlusterFS as the same user being used in the Loader. We recommend using 501 id for group and 501 id for the user, though you just need to make sure it's consistent with the user created in the Loader server(s).

To add the group and user, please execute the following commands:

```
groupadd udl2 -f -g 501
useradd udl2 -g udl2 -u 501
```

Prepare Work Zone Directory

Incoming files into the Landing Zone are copied over to an encrypted volume sitting on a gluster. You will set this up following the steps below:

1. Mount gluster onto Loader Database server

   ```
   mkdir /mnt/gluster
   mount -t glusterfs <glusterServer>:/gv0 /mnt/gluster
   ```

2. Mount work zone directory from gluster (this is needed for Foreign Data Wrapper to locate the same path for zones folder as defined in INI). Please execute the following commands as root:

   ```
   usermod -G fuse udl2
   echo "user_allow_other" | sudo tee -a /etc/fuse.conf
   usermod -G udl2 postgres
   mkdir /mnt/gluster/udl/zones /opt/edware/zones
   chown -R udl2.udl2 /mnt/gluster/udl/zones/ /opt/edware/zones/
   service postgresql-9.2 restart
   ```

3. As udl2 user, mount the encfs root:

   ```
   encfs /mnt/gluster/udl/zones /opt/edware/zones -o allow_other -o umask='007'
   ```

4. Create udl arrivals directories under the encfs root /opt/edware/zones
   ```
   mkdir -p /opt/edware/zones/landing/arrivals
   mkdir -p /opt/edware/zones/landing/work
   mkdir -p /opt/edware/zones/landing/history
   ```
5. as udl2 user, generate ssh key pair if one does not exist.
   Alternatively, you can specify the file location of a private key in **udl2_rsync.args.private_key**.
6. Copy “udl2” user public key to LZ server “root” authorized_keys (/root/.ssh/authorized_keys)
7. Try to ssh to LZ server without password as root user.

7.18 Database Staging

The Database Staging machine hosts a staging database for each tenant. The staging database gets populated by the Loader, and contains the data delta only (data since the last migration from staging to production database).

In order to protect PII, all database data should be encrypted. Please see the Encrypting section to prepare to encrypt your data in PostgreSQL.

7.18.1 Installation

The following lists the RPMs required by Database Staging

Package	Tested Version	RPM Name	Description
Database	9.2.8	postgresql postgresql92-server postgresql92-libs postgresql92-contrib postgresql92-devel	RPMs for postgres are readily available from Linux distributions

7.18.2 Configuration

postgres
Allow username/password based Authentication
Update **`/var/lib/pgsql/9.2/data/pg_hba.conf`**:

```
host all all ###.###.###.###/## trust
host replication all ###.###.###.###/## trust
```

###.###.###.### is your postgresql server IP/network.

Allow client configuration

Update **/var/lib/pgsql/9.2/data/postgresql.conf**:

```
listen_addresses =  '*'# what IP address(es) to listen on;
port = 5432
max_connections = 100
```

Restart PostgreSQL after this configuration change:

```
shell> service postgresql-9.2 restart
```

Create Database User

We recommend creating a dedicated user for database operations. We recommend creating a user named **edware**:

```
shell>  sudo -u postgres createuser -e -E -d -P  edware
```

Create the edware database

You will need to create a database to host the data and grant the above created user permission to the database. We recommend that you name this database **edware**:

```
shell> su - postgres
shell> createdb -e -E utf-8 -O edware -W edware
```

You can validate that the user has access by running the following commands:

```
shell> su - postgres
shell> psql -U edware -W
postgres#> \l
postgres#> \du
```

7.19 Gluster (Storage)

GlusterFS is a distributed file system capable of scaling to several petabytes and handling thousands of clients. We use GlusterFS to store a large number of files including PDFs, CSVs, and landing zone files.

The installation and configuration for GlusterFS is relatively standard, but we have listed our installation recommendation below.

7.19.1 Installation

The following lists the recommended RPMs required by the Gluster machine.

Note: Even though Linux distributors provide an RPM for GlusterFS server, Amplify suggests to use a newer version of the RPM directly from the GlusterFS site.

You will need to set up the **yum** repo configuration for GlusterFS:

```
wget -P /etc/yum.repos.d
http://download.gluster.org/pub/gluster/glusterfs/LATEST/EPEL.repo/glusterfs-epel.repo
```

Package	Tested Version	RPM Name	Description
glusterfs	3.3.1	glusterfs-geo-replication glusterfs glusterfs-server glusterfs-fuse	RPMs for GlusterFS server

7.20 Migrator

Migration is a batch process to move records from the Staging Database (pre-prod) to Database Master (prod). The process is designed to provide minimal interruption to user reporting.

It's designed to have two roles - a conductor and player(s). The conductor orchestrates the process of removing players from the Database Pool such that they can sync with the latest data to be migrated.

7.20.1 Installation

EdMigrate is part of the smarter package. Installing the Smarter RPM is required. Also:

Package	Tested Version	RPM Name	Description
RabbitMQ	2.6.1	rabbitmq-server	RabbitMQ RPM is available from Extra Packages for Enterprise Linux (EPEL)

7.20.2 Configuration

RabbitMQ

Please refer to this section in RabbitMQ configuration. For the virtual host name, we recommend that you name it '**edmigrate**'.

edmigrate

Setting up the .ini file

The **.ini** file from Smarter will be used. Please see here for more details.

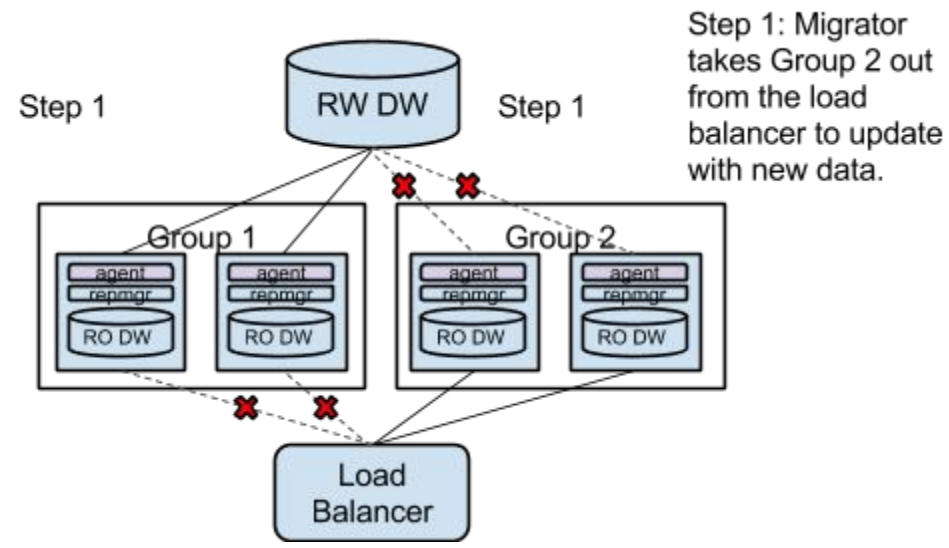
Configuration Name	Description	Example Value
migrate.broadcast.queue	Name of Queue used by Celery from the Conductor to the Players	edmigrate_players
migrate.celery.BROKER_URL	URL of the Message Queue server used by celery	amqp://edware:edware1234@edwappsrv1.poc.dum.edwdc.net/edmigrate
migrate.celery.CELERYBEAT_SCHEDULE	celery task scheduling	[{'seconds': 100, 'task': 'task.edmigrate.master.prepare_edware_data_refresh', 'schedule': 'timedelta', 'name': 'prepare-migration'}, {'seconds': 200, 'task': 'task.edmigrate.master.start_edware_data_refresh', 'schedule': 'timedelta', 'name': 'start-migration'}]
migrate.celery.CELERY_QUEUES	Celery queue used by EdMigrate	[{'exchange': 'fanout', 'key': 'edmigrate_players', 'durable': False, 'name': 'edmigrate_players'}]
migrate.celery.CELERY_RESULT_BACKEND	Type of Queue server	amqp
migrate.celery.CELERY_ROUTES	name of celery route for EdMigrate	[{'edmigrate.tasks.player': {'queue': 'edmigrate_players'}}]
migrate.conductor.enable	Set to True if the server is conductor	True
migrate.conductor.find_player.timeout	How long in second the conductor waits to find the players	5
migrate.conductor.schedule.cron.day	How often conductor runs	*/1
migrate.iptables.chain	Name of chain to use for iptable	EDMIGRATE_PGSQL
migrate.iptables.command	path to iptables	/sbin/iptables
migrate.iptables.mock	for testing purpose, mock iptable for the players	False
migrate.iptables.sudo	path to sudo	/usr/bin/sudo
migrate.master.hostname	hostname of PostgreSQL master server	edwdbsrv1.poc.dum.edwdc.net
migrate.pgpool.hostname	hostname of PgPool server	edwdbsrv4.poc.dum.edwdc.net
migrate.replication_monitor.admin.apply_lag_tolerance	replication tolerance	100
migrate.replication_monitor.admin.check_interval		1000
migrate.replication_monitor.admin.replication_lag_tolerance	replication tolerance	100
migrate.replication_monitor.admin.time_lag_tolerance	replication tolerance	100

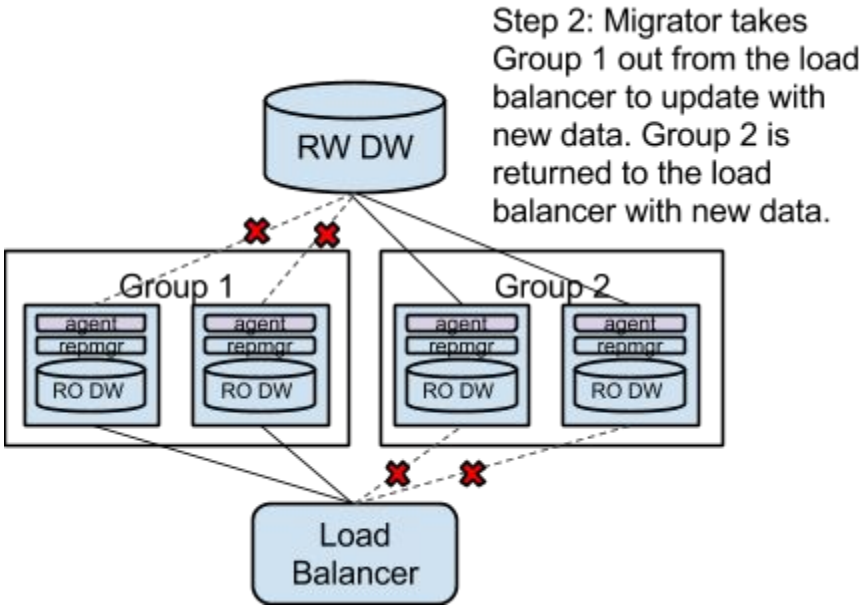
migrate.replication_monitor.apply_lag_tolerance	replication tolerance	100
migrate.replication_monitor.monitor_timeout	replication tolerance	28800
migrate.replication_monitor.replication_lag_tolerance	replication tolerance	100
migrate.replication_monitor.time_lag_tolerance	replication tolerance	100
migrate.timeout		5
migrate_dest.db.[tenant].schema_name	schema name production server	edware_prod
migrate_dest.db.[tenant].url	production PostgreSQL server	postgresql+psycopg2://edware:edware2013@localhost:5432/edware
migrate_source.db.[tenant].url	pre-production PostgreSQL server	postgresql+psycopg2://edware:edware2013@localhost:5432/edware
edware_stats.db.schema_name	The schema name of the stats database server	edware_stats
edware_stats.db.url	the database url of the stats database server	postgresql+psycopg2://edware:edware2013@localhost:5432/edware_stats

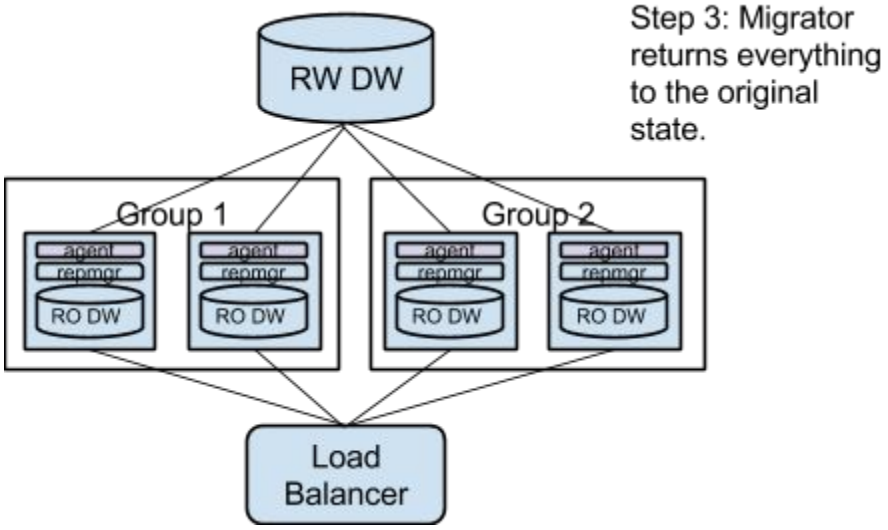
Configure Conductor

1. Register startup service
   shell> `chkconfig --add edmigrate-conductor`
2. Start service
   shell> `service edmigrate-conductor start`
3. Stop service
   shell> `service edmigrate-conductor stop`

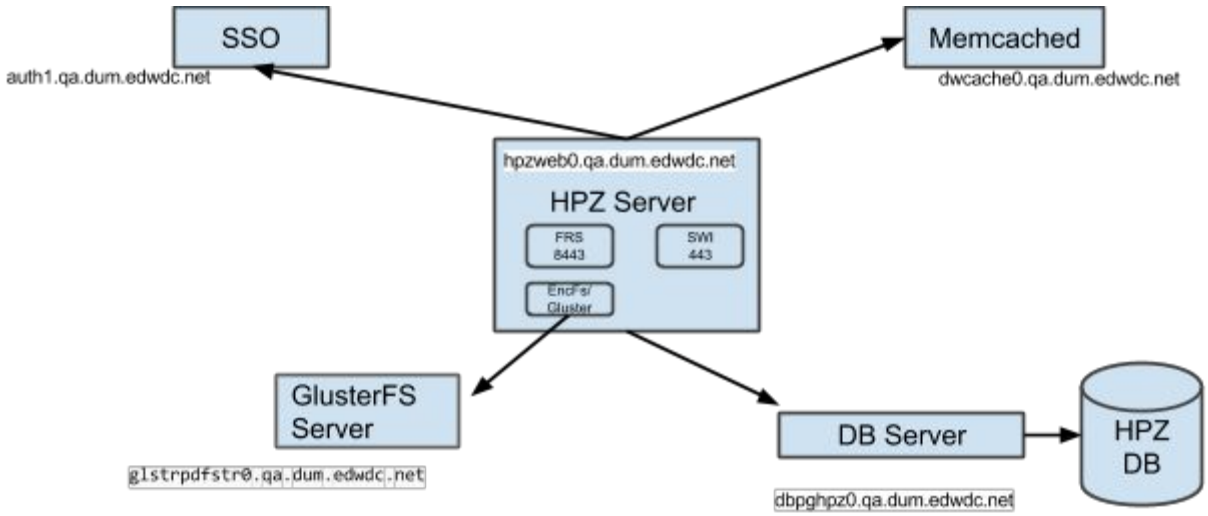
Diagrams to illustrate migration process


Step 1
RW DW
Step 1
Step 1: Migrator takes Group 2 out from the load balancer to update with new data.
Group 1
Group 2
agent
repmgr
RO DW
Load Balancer


RW DW
Step 2: Migrator takes Group 1 out from the load balancer to update with new data. Group 2 is returned to the load balancer with new data.
Group 1
Group 2
agent
repmgr
RO DW
Load Balancer



7.21 HTTPS Pickup Zone Web Server



7.21.1 Installation

The following RPMs are required for installing **hpz-web**:

Package	Tested Version	RPM Name	Description

apache module	0.12	mod_xsendfile	RPMs for apache server to process X-SENDFILE headers
xmlsec1	1.2.16	xmlsec1 xmlsec1-openssl	RPMs for XML security
encfs	1.7.4	fuse-encfs	RPMS for encrypt/decrypt hpz data on glusterfs
fuse	2.8.3	fuse fuse-libs	RPMs for fuse file system interface to be used by encfs and glusterfs
gluster	3.3.1	glusterfs glusterfs-fuse	RPMs for hpz to use gluster file server
mod_wsgi	3.4.0	python3-mod_wsgi	RPMs for apache server uses Python wsgi server
python	3.3.0	python3-3.3.0 python3-libs python3-psycopg2	RPMs for python runtime
postgresql	9.2.8	postgresql92 postgresql92-libs	RPMs for hpz server to contact its working database
hpz	0.1	hpz	RPM for http pickup zone

7.21.2 hpz-web Configuration

7.21.2.1 Configure apache

1. Update the apache config file **/etc/sysconfig/httpd**:

Configuration Name	Description	Example Value
HTTPD	*Configuration file for the httpd service.*	`/usr/sbin/httpd.worker`

Using Appendix A, add:

- conf/httpd.conf
- conf.d/ssl_on.conf
- conf.d/xsendfile.conf
- conf.d/wsgi_frs.conf
- conf.d/wsgi_swi.conf

Remove:

- conf.d/ssl.conf
- conf.d/welcome.conf

7.21.2.2 glusterfs

Configure glusterfs

1. Mount **glusterfs** as root:
   ```
   shell> mount -t glusterfs  glstrpdfstr0.qa.dum.edwdc.net:/gv0
   /mnt/gluster
   ```
2. Create the hpz uploads directory:
   ```
   shell> cd /mnt/gluster
   shell> mkdir hpz
   shell> cd hpz
   shell> mkdir uploads
   ```
3. Make the **apache** user owner of the **hpz** directory:
   ```
   shell> cd /mnt/gluster/
   shell> chown -R apache:apache hpz
   ```

7.21.2.3 encfs

Configure encfs

1. Create **/opt/edware/hpz/uploads**, and ensure it is owned by **apache**:
   ```
   shell> mkdir /opt/edware/hpz/uploads
   shell> chown apache.apache /opt/edware/hpz/uploads
   ```
2. Make the **apache** user a member of the **fuse** group:
   ```
   shell> usermod -G fuse apache
   ```
3. Mount **encfs** as the **apache** user, and give a password for **encfs**:
   ```
   shell> sudo su -s /bin/sh apache -c "encfs
   /mnt/gluster/hpz/uploads /opt/edware/hpz/uploads"
   ```

7.21.2.4 Application Configuration

Generate the .ini file:

```
$ cd /opt/edware/conf
$ source /opt/virtualenv/hpz/bin/activate
$ python generate_ini.py -e qa -o /opt/edware/conf/hpz.ini
```

Install the IDP Metadata File

1. Grab the IDP's metadata file from the OpenAM server in your installation for example https://auth1.qa.dum.edwdc.net/openam/saml2/jsp/exportmetadata.jsp?entityid=https://auth1.qa.dum.edwdc.net/openam and save it as **/opt/edware/conf/idp_metadata.xml**.

You can adjust **hpz**'s number of connections by changing the following options in:

- /opt/edware/conf/hpz.ini
- /etc/httpd/conf.d/wsgi_frs.conf

- /etc/httpd/conf.d/wsgi_swi.conf

hpz.ini

Configuration Name	Description	Example Value
hpz.db_pool_size	For optimal configuration, the pool_size should be equal to number of threads	5

wsgi_swi.conf

Configuration Name	Description	Example Value
WSGIDaemonProcess	number of process and threads for external facing endpoint	swi user=apache group=apache processes=2 threads=30 python-path=/opt/virtualenv/hpz/lib/python3.3/site-packages
MaxClients	must be at least as large as ThreadsPerChild	90

wsgi_frs.conf

Configuration Name	Description	Example Value
WSGIDaemonProcess	number of process and threads used by internal facing endpoint	frs user=apache group=apache processes=2 threads=30 python-path=/opt/virtualenv/hpz/lib/python3.3/site-packages
MaxClients	must be at least as large as ThreadsPerChild	90

7.22.2 hpz-db installation

The following RPMs are required for installing the **hpz** database server:

Package	Tested Version	RPM Name	Description

postgresql	9.2.8	postgresql92 postgresql92-libs postgresql92-server postgresql92-contrib postgresql92-devel	RPMS for hpz database to keep track of files.

7.22.2 hpz-db Configuration

Configure Postgresql

1. Update the config file: **/var/lib/pgsql/9.2/data/postgresql.conf**:

Configuration Name	Description	Example Value
listen_address		'*'
shared_buffers		8192MB
work_mem		100MB
log_filename		'postgresql-%a.log'
log_truncate_on_rotation		on
log_rotation_size		0
log_timezone		'UTC'
max_connections	max number of db connections for postgres server	100
timezone		'UTC'

2. Update **/var/lib/pgsql/9.2/data/pg_hba.conf**:

```
local   all             all                                     peer
# IPv4 local connections:
hostssl    all             all             127.0.0.1/32            trust
# Replication:
hostssl    replication     all             10.0.0.0/8          trust
hostssl    all             all             10.0.0.0/8              md5
# IPv6 local connections:
hostssl    all             all             ::1/128                 ident
```

   ###.###.###.### is your postgresql slave server IP/network.

3. Start the Postgres Database:

```
shell> services postgresql-9.2 start
```

4. If postgresql was not used, initialize postgres:

```
shell> services postgresql-9.2 initdb
```

5. If the HPZ database is not created yet, create the HPZ Database:
```
shell> su - postgres
shell> psql
psql> CREATE DATABASE hpz
```

6. If the HPZ user is not created yet, create the DB user:
```
psql> CREATE USER hpz WITH PASSWORD 'hpz2015';
psql> GRANT ALL PRIVILEGES ON DATABASE hpz to hpz;
```

7. Teardown any old HPZ Schemas:
```
shell> python3.3 -m hpz.database.metadata_generator --metadata
hpz -a teardown -s hpz -d hpz --host=dbpghpz0.qa.dum.edwdc.net:5432
-u hpz -p hpz2014
```

8. Initialize the HPZ Schema:
```
shell> python3.3 -m hpz.database.metadata_generator --metadata
hpz -s hpz -d hpz --host=dbpghpz0.qa.dum.edwdc.net:5432 -u hpz -p
hpz2014
```

Smoke Test For HPZ

1. Register a file:
   a. `curl -X PUT -H "Content-Type: application/json" -d '{"uid":"shall"}' https://hpzweb0.qa.dum.edwdc.net:8443/registration -k`
   b. Capture the registration id and download url from the response.
2. Copy a file to HPZ:
   a. `curl -X POST -H "File-Name: test.txt" -F "file=@<Path to file>" https://hpzweb0.qa.dum.edwdc.net:8443/files/<registration id> -k`
3. Download the file from HPZ:
   a. Use the download url captured in the first step to login as shall and download the test.txt file.

7.22.3 Heartbeat

HPZ provides a heartbeat service to monitor service health.

URL: **http[s]://hostname/services/heartbeat**

Response:
200 - OK

500 - Database connection is down and/or Disk is not writable for 1024 bytes (disk maybe full).

7.23 Score Batcher Web Server

Score Batcher Web Servers are responsible for running the Web Application for handling XMLs for Score Batching.

7.23.1 Installation

The following table lists the RPMs that must be installed on web servers:

Package	Tested Version	RPM Name	Description
Python	3.3	python3	Python 3 RPM is generally not available from Linux distributions, hence Amplify has supplied a customized Python 3 RPM
Apache	2.2.15	httpd	Apache hosts Smarter Score Batcher Web Application. It can be installed from the standard distributed RPM. We highly recommend using customized configuration. Apache should run on worker MPM mode.
WSGI	3.4	python3-mod_wsgi	WSGI defines a simple and universal interface between web servers and web applications or frameworks for Python. This is a customized RPM supplied by Amplify.
Smarter_score_batcher	TBD	smarter_score_batcher	Amplify's Smarter Score Batcher Web Application
XMLSec	1.2.16	xmlsec1 xmlsec1-openssl-devel	XMLSec can be installed from standard distributed RPM. It is used for verification of SAML Responses.

7.22.2 Configuration

7.23.2.1 Apache Configuration

Using Appendix A, add:

- conf/httpd.conf
- conf.d/wsgi_tsb.conf
- conf.d/ssl_main_server.conf
- conf.d/rewrite_tsb.conf

Remove:

- conf.d/welcome.conf
- conf.d/ssl.conf

7.23.2.2 Application Configuration

Score Batcher Web Server uses an **.ini** file to configure the application. The path of this file is **/opt/edware/conf/smarter_score_batcher.ini** This is a manual process to generate this file, and the steps to generate this file is similar to Smarter Reporting Web Server's **.ini** file.

smarter_score_batcher.ini

Configuration Name	Description	Example Value
smarter_score_batcher.metadata.performance	Location of performance xml metadata	/opt/edware/resources/meta/performance
smarter_score_batcher.metadata.static	Location of static metadata	/opt/edware/resources/meta/static

7.24 Score Batcher Messenger

Score Batcher Messenger is a message system between the Smarter Score Batcher Web Application and Score Batcher Worker. It uses RabbitMQ as its message broker and score batcher tasks are sent from Web Servers and are received by Score Batcher Workers. The installation and configuration is very similar to PDF Messenger.

7.24.1 Installation

Please refer to the installation of RabbitMQ from here.

Note: The only configuration difference is that the name of the virtual host for score batcher should be different than the one defined for PDF Messenger. By default, we expect and recommend that the virtual host for Score Batcher Messenger should be named '**smarter_score_batcher**'.

7.24.2 Configuration

Please refer to the configuration of RabbitMQ from here.

7.25 Score Batcher Worker

The Score Batcher worker is responsible for receiving score batcher tasks from the queue and saving raw XML to storage, and generating item level files, and landing zone format CSV/JSON files. The installation and configuration is very similar to PDF Worker.

There are a few key differences for Score Batcher Worker:

- The Celery service name is **celeryd-smarter_score_batcher**.
- The Celery configuration file is **celeryd-smarter_score_batcher.conf**.

- Mount EncFS to **/opt/edware/item_level**, **/opt/edware/raw_data** and **/opt/edware/tsb** (be sure to mount it as the **celery** user.)
- **smarter_score_batcher.celery.BROKER_URL** is the broker URL used by the Test Score Batcher Worker.

7.25.1 Installation

Please refer to the installation of Score Batcher Worker from here.

Note: Please remember the notable installation differences between PDF and Score Batcher Worker, namely, the celery service.

7.25.2 Configuration

Please refer to the configuration of Score Batcher Worker from here.

Note: Please remember the notable configuration differences between PDF and Test Score Batcher Worker, namely, the **celeryd** configuration file, the EncFS mount point, and the broker URL configuration in **smarter_score_batcher.ini**.

Custom XML Metadata Directory Structure

Score Batcher Worker relies on static custom metadata files that describe assessments. These files must be manually placed in the directories specified in the **.ini** file. These files can be stored on a gluster volume and all the workers can access these files over the network.

Performance metadata XML must be placed in the following directory structure:
<smarter_score_batcher.metadata.performance>/<year>/<assessment type>/<grade>/<subject>.xml

Static Metadata will be used to merge with Custom XML Metadata. Static Metadata should be placed in the following directory structure,
<smarter_score_batcher.metadata.static>/<subject>.json

Here is a sample format:

```
{
    "Content": "assessment",
    "Identification": {
        "Subject": "ELA"
    },
    "PerformanceLevels": {
        "Level1": {
            "Name": "Level 1"
        },
        "Level2": {
            "Name": "Level 2"
        },
        "Level3": {
            "Name": "Level 3"
        },
        "Level4": {
```

```
            "Name": "Level 4"
        }
    },
    "Claims": {
        "Claim1": {
            "Name": "Reading",
            "Mapping": "myClaim1"
        },
        "Claim2": {
            "Name": "Writing",
            "Mapping": "Claim2Writing"
        },
        "Claim3": {
            "Name": "Listening",
            "Mapping": "Claim3Listening"
        },
        "Claim4": {
            "Name": "Research & Inquiry",
            "Mapping": "Claim4ReadingResearch and Inquiry"
        }
    },
    "ClaimsPerformanceLevel": {
        "Level1": {
            "Name": "Below Standard"
        },
        "Level2": {
            "Name": "At/Near Standard"
        },
        "Level3": {
            "Name": "Above Standard"
        }
    }
}
```

Score Batcher also provides default metadata files as fallback for performance metadata. The default metadata files have similar structure as static metadata files, and are mutually exclusive with performance metadata. When Score Batcher runs, it first tries to get performance metadata; if no such data is available, it looks for default metadata as a last resort before raising an error. Usually default metadata files should be transparent to an operator, but in case that providing performance metadata is impossible while still needing to provide additional information to static metadata, one can place default metadata files under <smarter_score_batcher.metadata.default>/<assessment type>/<subject>.json.

To create default metadata, follow the below steps. In this example we use “**Interim Assessment Blocks**” as assessment type and “**Math**” as subject. Please replace the variables enclosed by `<`, `>` with values that are specific to your environment.

1. Modify the **.ini** file and modify <smarter_score_batcher.metadata.default> to the location where default metadata should be located.

2. Change current work directory to <smarter_score_batcher.metadata.default> using the command line:

```
$ cd <smarter_score_batch.metadata.default>
```

3. Execute below command to make a directory with the name of corresponding assessment type:

```
$ mkdir interim\ assessment\ blocks & cd interim\ assessment\ blocks & touch MATH.default_asmt_metadata.json
```

4. Paste below sample JSON file into `MATH.default_asmt_metadata.json`:

```
{
    "Content": "assessment",
    "Identification": {
        "Subject": "Math",
        "Period": "" },
    "PerformanceLevels": {
        "Level1": {
            "Name": "",
            "CutPoint": "" },
        "Level2": {
            "Name": "",
            "CutPoint": "" },
        "Level3": {
            "Name": "",
            "CutPoint": "" },
        "Level4": {
            "Name": "",
            "CutPoint": "" },
        "Level5": {
            "Name": "",
            "CutPoint": "" }
    },
    "Overall": {
        "MaxScore": 0,
        "MinScore": 0 },
    "Claims": {
        "Claim1": {
            "Name": "",
            "Mapping": "",
            "MinScore": 0,
            "MaxScore": 0 },
        "Claim2": {
            "Name": "",
            "Mapping": "",
            "MinScore": 0,
            "MaxScore": 0 },
        "Claim3": {
            "Name": "",
            "Mapping": "",
            "MinScore": 0,
            "MaxScore": 0 },
        "Claim4": {
            "Name": "",
            "Mapping": "",
            "MinScore": 0,
```

```
            "MaxScore": 0 }},
        "ClaimsPerformanceLevel": {
            "Level1": {
                "Name": "" },
            "Level2": {
                "Name": "" },
            "Level3": {
                "Name": "" }
        }
    }
```

Claim Name Mapping
Claims.Claim1.Mapping key is used as Claim alias name.
e.g.

```
<Score measureOf="myClaim1" measureLabel="ScaleScore" value="1285" standardError="13" />
<Score measureOf="myClaim1" measureLabel="PerformanceLevel" value="1" />
```

In this example, myClaim1 is used to identify as the Claim1 entry.

If no claim name mapping exists, Score Batcher will map “Claim1” from the value of the first Score element whose *measureLabel* attribute is “*ScaleScore*” and *measureOf* attribute is not “Overall”. All other claims are left with empty value in this case.

7.26 Score Batcher Trigger

Score Batcher Trigger is responsible for encrypting and archiving CSV and JSON files into a batch to be consumed by the Loader . The installation and configuration is very similar to Score Batcher Worker.

7.26.1 Installation

Please refer to the installation of Score Batcher Trigger from here.

7.26.2 Configuration

Please refer to the configuration of Score Batcher Trigger from here.

Score Batcher Trigger needs to have the following settings enabled in its **smarter_score_batcher.ini**:

Configuration Name	Description	Example Value
trigger.assessment.enable	Enabling the worker to batch up CSV and JSON files to be sent to Loader	true
trigger.assessment.schedule.cron.[minute|day]	Cron scheduling of how frequent to batch up the files.	*/5

7.26 Score Batcher Database Server

Score Batcher Database Server is a temporary storage that saves assessment information in received XML. This information will be processed by Score Batcher Trigger and then archived and encrypted into a batch.

7.26.1 Installation

Database installation is the same as installing . See 7.9 Database Master for detail.

7.26.2 Installation Creating a Database Schema

You must manually create an empty schema for **smarter score batcher**. A script is provided to perform this task. This step requires that Database is installed and configured first.

```
shell>  . /opt/virtualenv/smarter_score_batcher/bin/activate
(virtualenv)  cd
/opt/virtualenv/smarter_score_batcher/lib/python3.3/site-packages/smarter_score_batcher
-0.1-py3.3.egg/smarter_score_batcher/database
(virtualenv) python metadat.py -s edware -d edware -u edware --host
[dbMastHostName] -p [password]
```

Note: The command is in the format of:

```
python metadata_generator.py -s [schemaName] -d [databaseName] -u [userName] --host
[dbMastHostName] -p [password]
```

7.26.3 Configuration

Once the database is ready, one needs to update the database connection configuration in **smarter_score_batcher.ini** on each smarter score batcher worker server. Update the below two directives with the actual values of database connection:

```
smarter_score_batcher.db.schema_name = edware_tsb
smarter_score_batcher.db.url =
postgresql+psycopg2://edware:edware2013@localhost:5432/edware
```

8 Starting Applications

The relevant services for each machine type are listed below. You can use the commands below to start and/or stop the services.

Type	Component	Command
Web Servers	Smarter	/etc/init.d/httpd [start|stop]

HTTPS Pickup Zone Servers	https pickup zone server	/etc/init.d/httpd [start|stop]
HTTPS Pickup Zone Servers	encfs	sudo su -s /bin/sh apache -c "encfs /mnt/gluster/hpz/uploads /opt/edware/hpz/uploads"
PDF Messenger	RabbitMQ	/etc/init.d/rabbitmq-server [start|stop]
PDF Worker	celeryd-services	/etc/init.d/celeryd-services [start|stop]
PDF Pre-Generator	Smarter	/etc/init.d/httpd [start|stop]
Extract Messenger	RabbitMQ	/etc/init.d/rabbitmq-server [start|stop]
Extract Worker	celeryd-edextract	/etc/init.d/celeryd-services [start|stop]
Cache	memcached	/etc/init.d/memcached [start|stop]
Cache Warmer	Smarter	/etc/init.d/httpd [start|stop]
Database Master	PostgreSQL	/etc/init.d/postgres-9.2 [start|stop]
Database Replica	PostgreSQL	/etc/init.d/postgres-9.2 [start|stop]
Database Load Balancer	PgBouncer	/etc/init.d/pgbouncer [start|stop]
Database Pool	Pgpool-II	/etc/init.d/pgpool [start|stop]
Landing Zone	edsftp-watcher	service edsftp-watcher [start|stop]
Loader	edudl2-trigger	service edudl2-trigger start
Loader	edudl2-file-grabber	service edudl2-file-grabber [start|stop]
Loader	edudl	service celeryd-edudl [start|stop]
Loader Messenger	RabbitMQ	/etc/init.d/rabbitmq-server [start|stop]
Loader Database	PostgreSQL	/etc/init.d/postgres-9.2 [start|stop]
Migrator	Conductor	/etc/init.d/edmigrate-conductor [start|stop]

Migrator	Player	/etc/init.d/celeryd-edmigrate [start|stop]
Database Staging	PostgreSQL	/etc/init.d/postgres-9.2 [start|stop]
GlusterFS	glusterfsd	service glusterd [start|stop]
Score Batcher Web Server	smarter_score_batcher	/etc/init.d/httpd [start|stop]
Score Batcher Messenger	RabbitMQ	/etc/init.d/rabbitmq-server [start|stop]
Score Batcher Worker	celeryd-smarter_score_batcher	/etc/init.d/celeryd-smarter_score_batcher [start|stop]
Score Batcher Trigger	celeryd-smarter_score_batcher	/etc/init.d/celeryd-smarter_score_batcher [start|stop]

9 Logging & Monitoring

9.1 Web Server

Apache

The Apache server provides very comprehensive and flexible logging capabilities.

Log File	Description
/var/log/httpd/access_log	Refer to access_log for requests being served by Apache
/var/log/httpd/error_log	Refer to error_log for any errors that surface up to Apache

Smarter

Smarter has three log files - **`smarter.log`**, **`audit.log`** and **`security_event.log`**. Smarter utilizes the syslog service for logging and uses the local syslog facilities. By default, **`local0`** is used by audit.log, **`local1`** is used by smarter.log, and **`local2`** is used by audit.log. Using syslog facilities, log levels can be changed inside the **.ini** file. The location of the log files is managed by rsyslogd.

Log File	Description
/opt/edware/log/smarter.log	This log contains application level logging.
/opt/edware/log/audit.log	This log contains information on reports being accessed.
/opt/edware/log/security_event.log	This log contains information on security events in the system related to login, logout, forbidden access, and SAML2 responses.

9.2 HTTP Pickup Server

Apache

Log File Directory	Description
/var/log/httpd/access.log	The log contains information for http pickup server' access records
/var/log/httpd/error.log	The log contains information for errors in hpz wsgi server.

HPZ

Log File Directory	Description
/var/log/hpz/log	The log contains information on hpz working status and errors.

9.3 PDF Messenger [Ansible name: reporting-rabbit-services]

RabbitMQ

Log File Directory	Description
/var/log/rabbitmq/	All RabbitMQ logging are saved into this directory

9.4 PDF Worker [Ansible name: reporting-worker-pdf]

celeryd-services

Log File	Description
/var/log/celery-services/default_worker.log	Logs for PDF Worker tasks
/var/log/celery-services/batch_worker.log	Logs for PDF Pre-Generator tasks
/var/log/celery-services/health_check_worker.log	Logs for health check worker. This worker dequeues from our health check queue.

9.5 PDF Pre-Generator [Ansible name: reporting-generator-pdf]

Smarter

Log File	Description
/opt/edware/log/smarter.log	This log contains application level logging.

9.6 Extract Messenger [Ansible name: reporting-rabbit-extract]

RabbitMQ

Log File Directory	Description
/var/log/rabbitmq/	All RabbitMQ logging are saved into this directory

9.7 Extract Worker [Ansible name: reporting-worker-extract]

celeryd-edextract

Log File	Description
/var/log/celery-edextract/extract_sync_worker.log	Logs for synchronous extraction requests.
/var/log/celery-edextract/extract_worker.log	Logs for asynchronous extraction requests.
/var/log/celery-edextract/extract_archive_worker.log	Logs for archiving step of extracting requests

9.8 Cache [Ansible name: memcached]

memcached

Log File	Description
/var/log/memcached.log	Logs related to memcached. By default, logging is disabled

9.9 Cache Warmer [ansible name: reporting-cache-warmer]

Smarter

Log File	Description
/opt/edware/log/smarter.log	This log contains application level logging.

9.10 Database Master

PostgreSQL

Log File	Description
/var/log/postgres/postgres.log	PostgreSQL application level logs

9.11 Database Replica

PostgreSQL

Log File	Description
/var/log/postgres/postgres.log	PostgreSQL application level logs

9.12 Database Load Balancer

PgBouncer

Log File	Description
/var/log/pgbouncer/pgbouncer.log	Logging of PgBouncer status

9.13 Database Pool

Pgpool-II

Log File	Description
/var/log/pgpool.log	Logging of Pgpool
/var/log/pgpool/pgpool_status	Logging of Pgpool status

9.14 Landing Zone

edsftp-watcher

Log File	Description
/opt/edware/log/smarter.log	This log contains application level logging.

9.15 Loader

edudl2-trigger
edudl2-file-grabber

Log File	Description
/opt/edware/log/smarter.log	This log contains application level logging.

edudl

Log File	Description
/var/log/celeryd-udl2/udl2_worker.log	Logging of edudl service

9.16 Loader Messenger

RabbitMQ

Log File Directory	Description
/var/log/rabbitmq/	All RabbitMQ logging are saved into this directory

9.17 Loader Database

PostgreSQL

Log File	Description
/var/log/postgres/postgres.log	PostgreSQL application level logs

9.18 Database Staging

PostgreSQL

Log File	Description
/var/log/postgres/postgres.log	PostgreSQL application level logs

9.19 Migrator

Log File	Description
/opt/edware/log/smarter.log	This log contains application level logging.

9.20 Score Batcher Web Server

Log File	Description
/opt/edware/log/smarter.log	This log contains application level logging.

9.21 Score Batcher Messenger

Log File	Description
/var/log/rabbitmq/	All RabbitMQ Logs are saved in this directory.

9.22 Score Batcher Worker

Log File	Description
/var/log/celery-smarter_score_batcher/smarter_score_batcher_sync_worker.log	This log is for the workers handing synchronous requests.
/var/log/celery-smarter_score_batcher/smarter_score_batcher_async_worker.log	This log is for the workers handling asynchronous requests.

10 Troubleshooting

How do I know if the smarter web application is up and running?

When Smarter is up and running, you can navigate to /services/heartbeat endpoint and make sure a 200 OK is returned.

Ex. http://[hostname]/services/heartbeat

A 200 OK is returned only if smarter is able to connect to all the databases that are configured in smarter.ini and that it's heartbeat task is processed in the queue.

How do I tell if memcached is up and running?

```
telnet [server] 11211
stats items
```

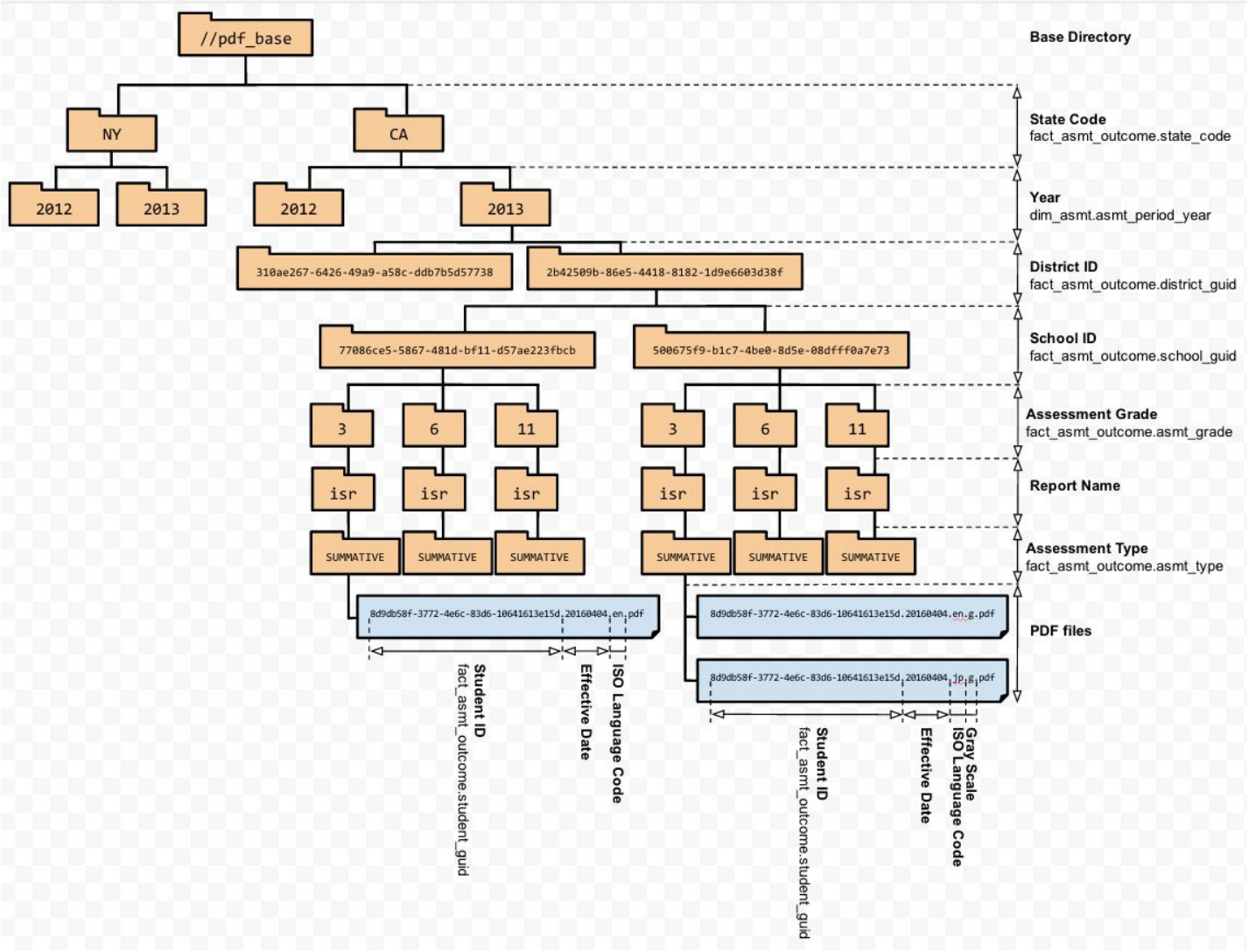
How do I clear the contents in memcache?

The quickest way is to restart memcached service on cache server.

A bad PDF was generated. How do I remove it?

Login as celery user and then change to the **/opt/edware/pdf** directory. Find the PDF and delete it.

The diagram below describes the directory structure in which PDFs are stored.



How do I delete all the PDF files?

The quickest way to delete all the PDF files is to delete the directory directory within the volume.

```
rm -rf /export/brick1/vdb1/smarter/[dir]
```

Important Warning: You will see a "**`/export/brick1/vdb1/smarter/.encfs6.xml`**" file. **DO NOT DELETE THE FILE. It contains EncFS information. Deleting this file causes PDF files to become unrecoverable by EncFS.**

How do I clear all queues in RabbitMQ?

Restarting RabbitMQ does not clear all queues. Executing the following commands will clear all the queues.

```
rabbitmqctl stop_app
rabbitmqctl reset
rabbitmqctl start_app
```

How do I monitor Celery Tasks?

Flower is a real-time web based monitor and administration tool for Celery. It provides graphs and statistics on task details, as well as remote control. An important note is that Celery Flower runs on Python 2.7 (Reference: https://github.com/mher/flower).

How do I list the queues or users configured in RabbitMQ?

To get the list of users, you can execute the following as root user:

```
rabbitmqctl list_users
```

To get the list of queues, you can execute the following as the root user:

```
rabbitmqctl list_queues [-p vhostpath]
```

11 Maintenance

11.1 Cache

Clearing Cache

Cache can be flushed only by a user with super admin rights. Using a Rest Client (ex. Chrome Advanced Rest Client), the super admin user can send REST API calls to interface with the cache services.

To delete all data in memcached:
Send a `DELETE` request to `http://[hostname]/services/flush/all`

To delete sessions in memcached:
Send a `DELETE` request to `http://[hostname]/services/flush/session`

To delete reports data in memcached:
Send a `DELETE` request to `http://[hostname]/services/flush/data`

11.2 Database

Cleanup Maintenance [Database, Repmgr and pg_xlogs]

Vacuum and Analyze

Vacuum can be performed on the Loader Database, Staging Database and Production Database Master to compact and release space back to the OS. The frequency of doing this can be different for each database.

Example of Running vacuum on Loader Database:

Determine DB size

> psql -h localhost -U udl2 -d udl2 -c "select pg_size_pretty(pg_database_size('udl2'))"

Run vacuum command while udl is running. This frees up space of the deleted records, but will not release space to OS. This command is non-blocking

> **psql -h localhost -U udl2 -d udl2 -c "VACUUM (VERBOSE, ANALYZE)"**

Run vacuum command while udl2 is not running. This command blocks the database but releases the space to OS and is more efficient than previous

> **psql -h localhost -U udl2 -d udl2 -c "VACUUM (VERBOSE, FULL)"**

http://www.postgresql.org/docs/9.2/static/sql-vacuum.html

http://www.postgresql.org/docs/9.2/static/sql-analyze.html

Transaction log Cleanup

Transaction logs under pg_xlog can be archived continuously by the following settings:

```
# To prevent the primary server from removing the WAL segments required for
# the standby server before shipping them, set the minimum number of segments
# retained in the pg_xlog directory. At least wal_keep_segments should be
# larger than the number of segments generated between the beginning of
# online-backup and the startup of streaming replication. If you enable WAL
# archiving to an archive directory accessible from the standby, this may
# not be necessary.
wal_keep_segments = 32

# Enable WAL archiving on the primary to an archive directory accessible from
# the standby. If wal_keep_segments is a high enough number to retain the WAL
# segments required for the standby server, this is not necessary.
archive_mode    = on
archive_command = 'gzip -9 < %p > /mnt/server/archivedir/%f && rm %p'
```

The archive file path should be accessible to the master and the slaves for recovery. In this case we can keep the value of **wal_keep_segments** to minimal such as **32**.

We also need to set up recovery.conf to enable postgres recover from gzipped archive wal files.

In recovery.conf:

```
restore_command = 'gunzip < /mnt/server/archivedir/%f > %p'
archive_cleanup_command = 'pg_archivecleanup /mnt/server/archivedir %r'
```

http://www.mkyong.com/database/postgresql-point-in-time-recovery-incremental-backup/
http://wiki.postgresql.org/wiki/Streaming_Replication

11.3 HTTP Pickup Zone

Cleanup Maintenance

HPZ will store files internally for the number of days listed on '/opt/edware/conf/hpz.ini' by 'hpz.record_expiration' . You can also cleanup manually via the pickup_zone_cleanup.py script:

Cleanup via script

Requirement

1. Make sure pickup_zone_cleanup.py is installed on the hpz server.

2. The user that the script runs as needs to be able to delete both entries in HPZ's internal database and the files in HPZ's filesystem.
3. Python and SQLAlchemy are installed.

Usage

Parameter	Description	Required ?
-c, --config	The local path to HPZ's config file. If not provided, will default to /opt/edware/conf/hpz.ini	No
-e, --expiration	Files (and their related metadata) older than the number of days passed in (as an integer) will be removed	Yes

For example, when HPZ's config file is located at "/the/path/to/my/file.ini" and all files older than a week that HPZ is storing should be removed:

```
python pickup_zone_cleanup.py -c "/the/path/to/my/file.ini" -e 7
```

HPZ is meant to be used with extract files that can take a lot time to generate. As a general rule, expiration values should be in the range of 3 to 10 days. Anything less, end users may not always be able to receive the file that they requested. Anything more, large files may be hanging around long after they've been used.

The clean up script can be triggered via **crond**.

Clean up manually

1. Check the download url that corresponds to that file.
2. The url contains an id that corresponds to that file.
3. The format of the url is <hpz host>/download/<file id>.
4. On the machine that is running HPZ, navigate to the location where HPZ stores files. (Refer to HPZ's config file if uncertain where HPZ stores them). Remove the file that has the same name as the file id.

Appendix A: Apache Configuration Files

conf/httpd.conf

```
ServerTokens Prod
ServerRoot "/etc/httpd"
PidFile run/httpd.pid
Timeout 120
KeepAlive Off
MaxKeepAliveRequests 100
```

```
KeepAliveTimeout 15
Listen 80

LoadModule authz_host_module modules/mod_authz_host.so
LoadModule log_config_module modules/mod_log_config.so
LoadModule logio_module modules/mod_logio.so
LoadModule env_module modules/mod_env.so
LoadModule deflate_module modules/mod_deflate.so
LoadModule headers_module modules/mod_headers.so
LoadModule mime_module modules/mod_mime.so
LoadModule status_module modules/mod_status.so
LoadModule vhost_alias_module modules/mod_vhost_alias.so
LoadModule dir_module modules/mod_dir.so
LoadModule alias_module modules/mod_alias.so
LoadModule setenvif_module modules/mod_setenvif.so
LoadModule rewrite_module modules/mod_rewrite.so
Include conf.d/*.conf
User apache
Group apache
ServerAdmin root@localhost
UseCanonicalName Off
TypesConfig /etc/mime.types
DefaultType text/plain
<IfModule mod_mime_magic.c>
    MIMEMagicFile conf/magic
</IfModule>
HostnameLookups Off
ErrorLog logs/error_log
LogLevel warn
LogFormat "%h %l %u %t \"%r\" %>s %b %>D \"%{Referer}i\" \"%{User-Agent}i\""
combined_with_duration
LogFormat "%h %l %u %t \"%r\" %>s %b \"%{Referer}i\" \"%{User-Agent}i\"" combined
LogFormat "%h %l %u %t \"%r\" %>s %b" common
LogFormat "%{Referer}i -> %U" referer
LogFormat "%{User-agent}i" agent
CustomLog logs/access_log combined env=!dontlog
ServerSignature Off
AddDefaultCharset UTF-8
AddType application/x-compress .Z
AddType application/x-gzip .gz .tgz
AddType application/x-x509-ca-cert .crt
AddType application/x-pkcs7-crl    .crl
AddHandler type-map var
BrowserMatch "Mozilla/2" nokeepalive
BrowserMatch "MSIE 4\.0b2;" nokeepalive downgrade-1.0 force-response-1.0
BrowserMatch "RealPlayer 4\.0" force-response-1.0
BrowserMatch "Java/1\.0" force-response-1.0
BrowserMatch "JDK/1\.0" force-response-1.0
BrowserMatch "Microsoft Data Access Internet Publishing Provider" redirect-carefully
BrowserMatch "MS FrontPage" redirect-carefully
BrowserMatch "^WebDrive" redirect-carefully
BrowserMatch "^WebDAVFS/1.[0123]" redirect-carefully
BrowserMatch "^gnome-vfs/1.0" redirect-carefully
BrowserMatch "^XML Spy" redirect-carefully
BrowserMatch "^Dreamweaver-WebDAV-SCM1" redirect-carefully
```

conf.d/edware_worker_mpm.conf

```
<IfModule worker.c>
    ThreadLimit         120
    StartServers        1
    ServerLimit         4
    MaxClients          120
    MinSpareThreads     30
    MaxSpareThreads     120
    ThreadsPerChild     30
    MaxRequestsPerChild  0
    MaxMemFree          256
</IfModule>
```

conf.d/rewrite_reporting_https.conf

```
RewriteEngine On
RewriteCond %{HTTP:X-Forwarded-Proto} !https
RewriteCond %{HTTP_USER_AGENT} !^ELB-HealthChecker
RewriteRule (.*) https://reporting.smarterbalanced.org%{REQUEST_URI} [L,R=301]
```

conf.d/rewrite_reporting_slash.conf

```
RewriteEngine on
RewriteRule ^/$ https://%{HTTP_HOST}/assets/public/landing.html
```

conf.d/rewrite_tsb.conf

```
RewriteEngine On
RewriteCond %{HTTP:X-Forwarded-Proto} !https
RewriteCond %{HTTP_USER_AGENT} !^ELB-HealthChecker
RewriteRule (.*) https://reportingintake.smarterbalanced.org%{REQUEST_URI} [L,R=301]
```

conf.d/ssl_main_server.conf

```
LoadModule ssl_module modules/mod_ssl.so
Listen 443
SSLEngine on
SSLCertificateFile /etc/pki/tls/certs/{{ ssl_key_name }}.crt
SSLCertificateKeyFile /etc/pki/tls/private/{{ ssl_key_name }}.key
SSLProtocol All -SSLv2 -SSLv3
```

```
SSLCipherSuite
ECDHE-RSA-AES128-GCM-SHA256:ECDHE-ECDSA-AES128-GCM-SHA256:ECDHE-RSA-AES256-GCM-SHA38
4:ECDHE-ECDSA-AES256-GCM-SHA384:DHE-RSA-AES128-GCM-SHA256:DHE
-DSS-AES128-GCM-SHA256:kEDH+AESGCM:ECDHE-RSA-AES128-SHA256:ECDHE-ECDSA-AES128-SHA256
:ECDHE-RSA-AES128-SHA:ECDHE-ECDSA-AES128-SHA:ECDHE-RSA-AES256-SHA384:ECDHE-E
CDSA-AES256-SHA384:ECDHE-RSA-AES256-SHA:ECDHE-ECDSA-AES256-SHA:DHE-RSA-AES128-SHA256
:DHE-RSA-AES128-SHA:DHE-DSS-AES128-SHA256:DHE-RSA-AES256-SHA256:DHE-DSS-AES2
56-SHA:DHE-RSA-AES256-SHA:!aNULL:!eNULL:!EXPORT:!DES:!RC4:!3DES:!MD5:!PSK
SSLSessionCache none
```

conf.d/ssl_on.conf

```
LoadModule ssl_module modules/mod_ssl.so
SSLSessionCache none
```

conf.d/wsgi_edware.conf

```
WSGIApplicationGroup %{GLOBAL}
WSGIPassAuthorization On
WSGIDaemonProcess pyramid user=apache group=apache processes=4 threads=30
python-path=/opt/virtualenv/smarter/lib/python3.3/site-packages
WSGIScriptAlias / /opt/edware/smarter/smarter.wsgi
WSGIImportScript /opt/edware/smarter/smarter.wsgi process-group=pyramid
application-group=%{GLOBAL}
WSGISocketPrefix run/wsgi
<Directory /opt/virtualenv/smarter>
   WSGIProcessGroup pyramid
   Order allow,deny
   Allow from all
</Directory>
WSGIPythonPath /opt/virtualenv/smarter/lib/python3.3/site-packages
```

conf.d/wsgi_frs.conf

```
WSGISocketPrefix run/wsgi
WSGIPythonPath /opt/virtualenv/hpz/lib/python3.3/site-packages
WSGIDaemonProcess frs user=apache group=apache processes=2 threads=30
python-path=/opt/virtualenv/hpz/lib/python3.3/site-packages
  XSendFile on
  <Directory "/opt/edware">
    XSendFile on
    XSendFilePath /opt/edware
  </Directory>

NameVirtualHost *:443
<VirtualHost *:443>
```

```
    WSGIApplicationGroup %{GLOBAL}
    WSGIPassAuthorization On
    WSGIScriptAlias / /opt/edware/hpz/frs.wsgi
    WSGIImportScript /opt/edware/hpz/frs.wsgi process-group=frs
application-group=%{GLOBAL}

    RewriteEngine On
    RewriteCond %{HTTP:X-Forwarded-Proto} !https
    RewriteCond %{HTTP_USER_AGENT} !^ELB-HealthChecker
    RewriteRule (.*) https://reportdownload.smarterbalanced.org%{REQUEST_URI}
[L,R=301]

    SSLEngine on
    SSLCertificateFile /etc/pki/tls/certs/{{ ssl_key_name }}.crt
    SSLCertificateKeyFile /etc/pki/tls/private/{{ ssl_key_name }}.key
    SSLProtocol All -SSLv2 -SSLv3
    SSLCipherSuite
ECDHE-RSA-AES128-GCM-SHA256:ECDHE-ECDSA-AES128-GCM-SHA256:ECDHE-RSA-AES256-GCM-SHA38
4:ECDHE-ECDSA-AES256-GCM-SHA384:DHE-RSA-AES128-GCM-SHA256
:DHE-DSS-AES128-GCM-SHA256:kEDH+AESGCM:ECDHE-RSA-AES128-SHA256:ECDHE-ECDSA-AES128-SH
A256:ECDHE-RSA-AES128-SHA:ECDHE-ECDSA-AES128-SHA:ECDHE-RSA-AES256-SHA384:ECD
HE-ECDSA-AES256-SHA384:ECDHE-RSA-AES256-SHA:ECDHE-ECDSA-AES256-SHA:DHE-RSA-AES128-SH
A256:DHE-RSA-AES128-SHA:DHE-DSS-AES128-SHA256:DHE-RSA-AES256-SHA256:DHE-DSS-
AES256-SHA:DHE-RSA-AES256-SHA:!aNULL:!eNULL:!EXPORT:!DES:!RC4:!3DES:!MD5:!PSK

    <LocationMatch ^/registration>
      Order Allow,Deny
      Deny from all
    </LocationMatch>
    <LocationMatch ^/files/(.*)>
      Order Allow,Deny
      Deny from all
    </LocationMatch>

    <Directory /opt/virtualenv/hpz>
      WSGIProcessGroup frs
      Order allow,deny
      Allow from all
    </Directory>
    LogLevel info

</VirtualHost>
Listen 443
```

conf.d/wsgi_swi.conf

```
WSGISocketPrefix run/wsgi
WSGIPythonPath /opt/virtualenv/hpz/lib/python3.3/site-packages
WSGIDaemonProcess swi user=apache group=apache processes=2 threads=30
python-path=/opt/virtualenv/hpz/lib/python3.3/site-packages

<VirtualHost *:8443>
  WSGIApplicationGroup %{GLOBAL}
  WSGIPassAuthorization On
  WSGIScriptAlias / /opt/edware/hpz/swi.wsgi
```

```
  WSGIImportScript /opt/edware/hpz/swi.wsgi process-group=swi
application-group=%{GLOBAL}

  SSLEngine on
  SSLCertificateFile /etc/pki/tls/certs/{{ ssl_key_name }}.crt
  SSLCertificateKeyFile /etc/pki/tls/private/{{ ssl_key_name }}.key
  SSLProtocol All -SSLv2 -SSLv3
  SSLCipherSuite
ECDHE-RSA-AES128-GCM-SHA256:ECDHE-ECDSA-AES128-GCM-SHA256:ECDHE-RSA-AES256-GCM-SHA38
4:ECDHE-ECDSA-AES256-GCM-SHA384:DHE-RSA-AES128-GCM-SHA256:D
HE-DSS-AES128-GCM-SHA256:kEDH+AESGCM:ECDHE-RSA-AES128-SHA256:ECDHE-ECDSA-AES128-SHA2
56:ECDHE-RSA-AES128-SHA:ECDHE-ECDSA-AES128-SHA:ECDHE-RSA-AES256-SHA384:ECDHE
-ECDSA-AES256-SHA384:ECDHE-RSA-AES256-SHA:ECDHE-ECDSA-AES256-SHA:DHE-RSA-AES128-SHA2
56:DHE-RSA-AES128-SHA:DHE-DSS-AES128-SHA256:DHE-RSA-AES256-SHA256:DHE-DSS-AE
S256-SHA:DHE-RSA-AES256-SHA:!aNULL:!eNULL:!EXPORT:!DES:!RC4:!3DES:!MD5:!PSK

  <LocationMatch ^/download/(.*)>
    Order Allow,Deny
    Deny from all
  </LocationMatch>
  <Directory /opt/virtualenv/hpz>
    WSGIProcessGroup swi
    Order allow,deny
    Allow from all
  </Directory>
</VirtualHost>

Listen 8443
```

conf.d/wsgi_tsb.conf

```
WSGIApplicationGroup %{GLOBAL}
WSGIPassAuthorization On
WSGIDaemonProcess pyramid user=apache group=apache processes=2 threads=30
python-path=/opt/virtualenv/smarter_score_batcher/lib/python3.3/site-packages
WSGIScriptAlias / /opt/edware/smarter_score_batcher/smarter_score_batcher.wsgi
WSGIImportScript /opt/edware/smarter_score_batcher/smarter_score_batcher.wsgi
process-group=pyramid application-group=%{GLOBAL}
WSGISocketPrefix run/wsgi
<Directory /opt/virtualenv/smarter_score_batcher>
   WSGIProcessGroup pyramid
   Order allow,deny
   Allow from all
</Directory>
WSGIPythonPath /opt/virtualenv/smarter_score_batcher/lib/python3.3/site-packages
```

conf.d/xsendfile.conf

```
LoadModule      xsendfile_module        modules/mod_xsendfile.so
```

Appendix B: Service Provider Metadata

```
<?xml version='1.0' encoding='UTF-8'?>
<ns0:EntityDescriptor xmlns:ns0="urn:oasis:names:tc:SAML:2.0:metadata"
xmlns:ns1="http://www.w3.org/2000/09/xmldsig#" entityID="{{ ENTITY_NAME }}">
    <ns0:SPSSODescriptor AuthnRequestsSigned="false" WantAssertionsSigned="true"
protocolSupportEnumeration="urn:oasis:names:tc:SAML:2.0:protocol">
        <ns0:KeyDescriptor use="signing">
            <ns1:KeyInfo>
                <ns1:X509Data>
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    </ns0:SPSSODescriptor>
</ns0:EntityDescriptor>
```

please update {{ ENTITY_NAME }} and {{ HOST_NAME }}. {{ ENTITY_NAME }} can be any name, but it must be unique in SSO name entries.