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# Oracle Enterprise Manager Grid Control 11g Release 1 Security Deployment – Best Practices

## Introduction

The dynamic and complex nature of today's IT environments, the potential fallout of security breaches in terms of the financial implications and loss of goodwill coupled with stringent regulatory requirements make security a critical area of consideration for both business and IT managers. Whilst security considerations are important for standalone applications, the introduction of distributed system management applications can make it yet more challenging. Further, while standardized security best practices are available for databases and application servers, there aren't any standardized security benchmarks specifically for system management products.

This document presents best practices for managing the security of Oracle Enterprise Manager Grid Control deployments. The recommendations in this document are based on our experience with both customer deployments and Oracle's own internal usage of Oracle Enterprise Manager. Some of the recommendations are based on the CIS (Center for Internet Security) Benchmark.

The diagram below presents a schematic of Oracle Enterprise Manager architecture.

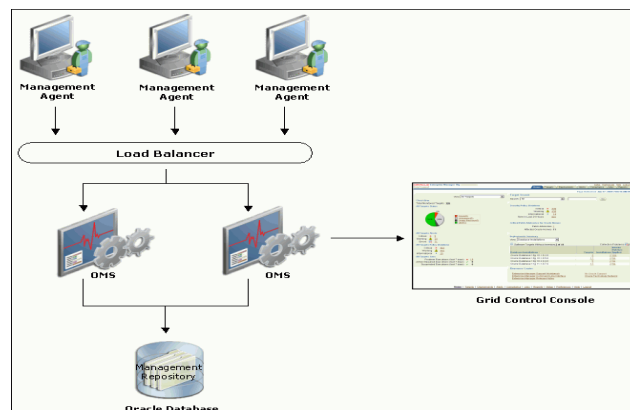


Figure 1 – Oracle Enterprise Manager Grid Control Architecture

The best practices presented in this document are divided in 7 categories based on the major components of Oracle Enterprise Manager architecture The categories are

1. Securing the Oracle Management Repository (OMR)
2. Securing the Oracle Management Service (OMS)
3. Securing the Oracle Management Agents(OMA)
4. Securing the communication between Enterprise Manager Components
5. Grid Control User Authentication
6. Grid Control Privilege/Role Management
7. Preferred Credentials and Target Access
8. Encryption/Decryption
9. Auditing

## Securing the OMR

Securing your Oracle Enterprise Manager (EM) deployment involves securing all layers of the stack starting with the underlying operating system (OS) on which the OMS and Repository reside all the way up to the EM components themselves. Since the Oracle Management Repository resides within an Oracle database, a number of the best practices for securing the Oracle database itself are applicable to securing the Repository as well. For best practices on Oracle database security, please refer to the Oracle Database Security Checklist available at the following location –

<http://www.oracle.com/technetwork/database/security/twp-security-checklist-database-1-132870.pdf>

The above document also covers certain Operating System level steps that need to be performed to secure the database. Additionally, we offer the following recommendations specially to further secure the Repository

1. Audit all SYS (SYS is the username for the account that owns the schema) operations at the database level.
  - a. Set AUDIT\_SYS\_OPERATIONS to TRUE
  - b. Use syslog audit trail to minimize the risk that a privileged user, such as a database administrator, can modify or delete audit records stored in an operation system trail if the database version of Repository is 10gR2 or after
    - i. For 10gR2 DB, please refer to the doc to obtain more information about syslog audit trail:

[http://download.oracle.com/docs/cd/B19306\\_01/network.102/b14266/auditing.htm#CEGJJHJH](http://download.oracle.com/docs/cd/B19306_01/network.102/b14266/auditing.htm#CEGJJHJH)

- ii. For 11g DB, set AUDIT\_SYS\_LEVEL initialization parameter appropriately to use syslog audit trail. Please refer to the following to obtain details:

[http://download.oracle.com/docs/cd/B28359\\_01/network.111/b28531/auditing.htm#CEGBIJD](http://download.oracle.com/docs/cd/B28359_01/network.111/b28531/auditing.htm#CEGBIJD)

- 2. Special privileges should be revoked from the PUBLIC profile that all database users are granted by default. Revoke the following from PUBLIC (please see the Oracle Database Security Checklist document referenced above for more details on these privileges)
  - a. EXECUTE on UTL\_FILE
  - b. EXECUTE on UTL\_TCP
  - c. EXECUTE on UTL\_HTTP
  - d. EXECUTE on UTL\_SMTP
  - e. SELECT with GRANT OPTION with ALL\_TABLES
  - f. SELECT with GRANT OPTION with ALL\_TAB\_PRIVS
  - g. EXECUTE with GRANT OPTION on DBMS\_JOB
  - h. EXECUTE with GRANT OPTION on DBMS\_SCHEDULER
- 3. Restrict network access to the host on which the Repository resides.
  - a. Put the repository behind a firewall

- b. Check Network IP Address: The Listener should be configured to accept requests only from OMS nodes by adding the following parameters into \$TNS\_ADMIN/protocol.ora file
  - iii. tcp.validnode\_checking =YES
  - iv. tcp.excluded\_nodes = (list of IP addresses)
  - v. tcp.invited\_nodes = (list of IP addresses)

The first parameter turns on the feature whereas the latter parameters respectively deny and allow specific client IP addresses from making connections to the Oracle listener.

Please refer to the guideline of Secure the Network Connection for more information:

[http://download.oracle.com/docs/cd/B28359\\_01/network.111/b28531/guidelines.htm#CHDJFEFF](http://download.oracle.com/docs/cd/B28359_01/network.111/b28531/guidelines.htm#CHDJFEFF)

- 4. Enable Connection Rate Limiter feature of Oracle listener for OMR to reduce Denial-of-Service attacks on the listener. Please refer to the following link for detailed information:

<http://www.oracle.com/technetwork/database/enterprise-edition/oraclenetservices-connectionratelim-133050.pdf>

## Securing the OMS

The OMS runs on top of the Oracle WebLogic Application Server. Most best practices for securing the Oracle WebLogic Server are applicable for securing the OMS as well. Security aspects that are unique to OMS are presented in this document.

Please refer to the following documentation for securing the Oracle WebLogic Server.

[http://download.oracle.com/docs/cd/E12839\\_01/web.1111/e13705/practices.htm#1134009](http://download.oracle.com/docs/cd/E12839_01/web.1111/e13705/practices.htm#1134009)

Here are the additional recommendations that we offer to secure OMSs:

1. Harden all Oracle homes of all the OMS installations
  - a. Restrict OS access by supporting only indirect or impersonation-based access to these Oracle homes by using utilities such as sudo or PowerBroker.
  - b. Consider protecting the software running in these Oracle homes through protecting the host using a firewall
2. Make sure that all the Oracle homes are patched up to the latest CPU (Critical Patch Update) level. Setup your My Oracle Support credentials to detect new Security Alerts and CPUs. EM will download new Security Alerts and CPUs automatically and place them in the Patch Cache. Security Alerts and CPUs that are downloaded but not yet applied will trigger EM Alerts. Look specifically for alerts related to OMS. This recommendation is also applicable for securing the Repository and the Agents.
3. Change all the passwords used during the installation, for example, SYS, SYSMAN and My Oracle Support credential's password. For SYSMAN password change, please refer to Securing the Repository Section 2.b
4. Harden the OMS machines themselves by removing all unsecure services such as rsh, rlogin, telnet, and rexec on Linux platform (For the list of unsecure services and how to remove them on different platforms, please refer to CIS benchmarks at [www.cisecurity.org](http://www.cisecurity.org) ). This recommendation is also applicable to the machine that hosts the Repository. We also recommend that you stop non-essential services, this minimizes the 'attack footprint' of the host but reduces resource consumption by services that are not required, freeing up system resources to deliver the best performance from the OMS.
5. Put OMSs behind firewall to restrict network access. Please refer to Chapter 19 of Advanced Installation and Configuration Guide for detailed information of firewall setup.

## Securing the OMA

1. Install the agents via Grid Control's Agent Deploy which uses the secure SSH protocol.
2. To protect against the possibility of users installing unauthorized agents, use one-time registration passwords that have a reasonable expiry date instead of persistent registration passwords.
3. Install the latest CPUs. For more details on this, please see recommendation #2 in the Securing the OMS section above.
4. Install the agent as a separate user from OMS installation and support only impersonation based access to this account such as sudo or PowerBroker post installation.

## Securing the communication between Enterprise Manager Components

1. All OMSs should run in "secure-lock" mode. "secure-lock" mode means that the communication can be only through HTTPS port (HTTP port is locked).
  - a. This ensures that the OMS-Agent communication is always encrypted and mutually authenticated. All requests from un-secure agents are rejected by the OMS. Similarly, any un-secure request from the OMS is rejected by the agent. This helps safe-guard the management system from any malicious 'man-in-the-middle' attack happening from within the infrastructure. Brand new EM Grid Control (EMGC) 11g Release 1 installations are secure locked by default. In cases where you upgrade your installation to EMGC 11 Release 1, if the pre-upgrade environment is secured, the upgrade retains the secure but does not secure-lock OMS. If the pre-upgrade environment is already secure-locked,the upgrade retains the secure-lock mode between OMS and Agent.



To check the status if OMS is run in secure mode, run the following command:

```
emctl status oms -details
```

Run the following command to check if the agent is run in secure mode:

```
emctl status agent -secure
```

To secure lock the communication between OMS and agent run the command:

```
emctl secure lock [-upload]
```

Note that once OMSs are running in secure-lock mode, unsecure agents are not be able to upload any data to the OMSs.

- b. This also ensures the console access from browser is secure over SSL/TSL. Brand new EM Grid Control (EMGC) 11g Release 1 installations are secure locked by default. In cases the pre-upgrade environment is not secure-locked, after you upgrade your installation to EMGC 11g Release 1, you need to run the following command to secure-lock the console access:

```
emctl secure lock [-console]
```

- c. Please configure OMS and agents to support only TLS v1 protocol, which is the successor of SSL v3, for the communication.
  - i. Please follow the following steps to configure OMS for TLS v1 protocol only
    1. Stop the OMS by entering the following command:

```
emctl stop oms
```
    2. Enter the following command:

```
emctl secure oms -protocol TLSv1
```
    3. Append `-Dweblogic.security.SSL.protocolVersion=TLS1` to `JAVA_OPTIONS` in `Domain_Home/bin/startEMServer.sh`. If this property already exists, update the value to `TLS1`.

4. Restart the OMS with the following command:  
*emctl start oms*
- ii. To configure an agent to support only TLS v1 protocol while the agent listens as a server, please update the following entry in `$AGENT_HOME/sysman/config/emd.properties` file as
  1. `allowTLSOnly=true`
- d. Please enable the strong cipher suites for the communication between OMS and agent.
  - i. By default, if not specified, the following cipher suites will be allowed for the communication
    1. `SSL_RSA_WITH_RC4_128_MD5`
    2. `SSL_RSA_WITH_RC4_128_SHA`
    3. `SSL_RSA_WITH_3DES_EDE_CBC_SHA`
  - ii. You can edit the parameter in `SSLCipherSuites` `$AGENT_HOME/sysman/configure/emd.properties` to configure the strong cipher suites to be used for agent SSL/TLS communication. The following are supported strong cipher suites.
    1. `SSL_RSA_WITH_AES_128_CBC_SHA`
    2. `SSL_RSA_WITH_AES_256_CBC_SHA`
    3. `SSL_DH_anon_WITH_3DEC_EDE_CBC_SHA`
    4. `SSL_DH_anon_WITH_RC4_128_MD5`
    5. `SSL_DH_anon_WITH_DES_CBC_SHA`
    6. `SSL_RSA_WITH_RC4_128_MD5`
    7. `SSL_RSA_WITH_RC4_128_SHA`
    8. `SSL_RSA_WITH_3DES_EDE_CBC_SHA`
  - iii. To restrict the strong cipher suites used by OMS, please edit `SSLCipherSuite` parameter in `$INSTANCE_HOME/WebTierIH1/config/OHS/ohs1/httpd_em.conf` and `ssl.conf` files with the appropriate values. Here are the default values:
    1. `SSL_RSA_WITH_RC4_128_MD5`

2. SSL\_RSA\_WITH\_RC4\_128\_SHA
  3. SSL\_RSA\_WITH\_3DES\_EDE\_CBC\_SHA
  4. SSL\_RSA\_WITH\_DES\_CBC\_SHA
  5. TLS\_RSA\_WITH\_AES\_128\_CBC\_SHA
  6. TLS\_RSA\_WITH\_AES\_256\_CBC\_SHA
2. Use a certificate from well-known Certificate Authority (CA) to secure OMS-Agent communication and console access to take advantage of the well-known trusted certificates with different expiry and key size. Please refer to Section “Configuring Third Party Certificates” in Chapter 2 of Administrator’s Guide for detailed information.
  3. Enable Advanced Security Option (ASO) between OMS and Repository. ASO ensures that the data between OMS and Repository is secure both from confidentiality and integrity standpoints.
    - a. Issue command “emctl set property –name <Property Name> -value <Value>” to set the following properties with the values
      - i. oracle.sysman.emRep.dbConn.enableEncryption=true
      - ii. oracle.net.encryption\_client=REQUESTED
      - iii. oracle.net.encryption\_types\_client={DES40C}
      - iv. oracle.net.crypto\_checksum\_client=REQUESTED
      - v. oracle.net.crypto\_checksum\_types\_client={MD5}
    - b. Add the following to the Repository Oracle home, for example TNS\_ADMIN/sqlnet.ora
      - i. SQLNET.ENCRYPTION\_SERVER = REQUESTED

Please refer to the following link to obtain detailed information about the parameters listed above.

[http://download.oracle.com/docs/cd/B28359\\_01/network.111/b28530/asoappa.htm#i634533](http://download.oracle.com/docs/cd/B28359_01/network.111/b28530/asoappa.htm#i634533)

## Grid Control User Authentication

1. Oracle Enterprise Manager Authentication

- a. Use Oracle Single Sign-on (SSO) or Enterprise User Security (EUS) based authentication to take advantage of centralized identity management across the enterprise

Please refer to the following links for detailed information about how to configure SSO and EUS with EM authentication respectively.

[http://download.oracle.com/docs/cd/E11857\\_01/em.111/e16790/security3.htm#BABFIACG](http://download.oracle.com/docs/cd/E11857_01/em.111/e16790/security3.htm#BABFIACG)

[http://download.oracle.com/docs/cd/E11857\\_01/em.111/e16790/security3.htm#BABCEGII](http://download.oracle.com/docs/cd/E11857_01/em.111/e16790/security3.htm#BABCEGII)

2. Disable SYSMAN logging into console. SYSMAN is the schema owner and is hence more privileged than EM Super Administrators. SYSMAN should be treated as the schema owner instead as an EM Super user. Create a separate super administrator and prevent SYSMAN from logging into console by executing the following SQL statement on the Repository:

```
UPDATE MGMT_CREATED_USERS  
SET SYSTEM_USER='-1'  
WHERE user_name='SYSMAN'
```

After disabling SYSMAN from logging into console, you can enable it by executing:

```
UPDATE MGMT_CREATED_USERS  
SET SYSTEM_USER='1'  
WHERE user_name='SYSMAN'
```

3. Reduce the number of Super users. EM Super Administrators have FULL privileges on targets/reports/templates/jobs and these are the only users who can create other users and Super Administrators, and grant/revoke privileges to/from other users. So Super user privilege should be granted with caution. Using the

following query to get the list of super users:

```
SELECT grantee FROM MGMT_PRIV_GRANTS WHERE PRIV_NAME =  
'SUPER_USER'
```

5. Use password profiles to enforce the password control of EM Administrators while Repository-based authentication is used:
  - a. There is an out-of-box password profile MGMT\_ADMIN\_USER\_PROFILE with the following parameter settings for EM Administrators:
    - i. FAILED\_LOGIN\_ATTEMPTS=10
    - ii. PASSWORD\_LIFE\_TIME=180
    - iii. PASSWORD\_REUSE\_TIME=UNLIMITED
    - iv. PASSWORD\_REUSE\_MAX=UNLIMITED
    - v. PASSWORD\_LOCK\_TIME=1
    - vi. PASSWORD\_GRACE\_TIME=7
    - vii. PASSWORD\_VERIFY\_FUNCTION=MGMT\_PASS\_VERIFY  
Y

The out-of-box password verification function MGMT\_PASS\_VERIFY will ensure that the password cannot be same as username, its minimum length is 8, and it must have at least one alphabet, digit and punctuation character.

You can create customized password profiles with different values to meet your special requirements, for example, a new password verification function to meet a stricter password complexity requirement.

6. Change SYSMAN and MGMT\_VIEW users' password on a regular basis.

- a. The following command helps you change the SYSMAN password.

```
emctl config oms -change_repos_pwd [-change_in_db] [-old_pwd  
<old_pwd> [-new_pwd <new_pwd> [-use_sys_pwd [-sys_pwd  
<sys_pwd>]]]
```

Parameter `change_in_db` controls if the password in Repository will be changed. Without this parameter, the command only updates SYSMAN password in OMS's credential store.

In a single OMS instance environment, run the following command to change SYSMAN password in both Repository and OMS configuration file. You will be prompted for the old and new SYSMAN passwords.

```
emctl config oms -change_repos_pwd -change_in_db
```

In multiple OMS instances environment, run the command above at least at one OMS instance and run the following command at all other OMS instances to just update the SYSMAN password in OMS's configuration file.

```
emctl config oms -change_repos_pwd
```

You are prompted for old and new SYSMAN passwords.

- b. Use the following command to change MGMT\_VIEW's password

```
emctl config oms -change_view_user_pwd [-sysman_pwd  
<sysman_pwd>][-user_pwd <user_pwd>][-auto_generate]
```

In multiple OMS instance environment, you only need to run the command at one OMS instance.

Please note that if "-auto\_generate" is chosen, a random password will be generated for MGMT\_VIEW and no one knows the password.

- c. To avoid the service interruption due to the lockout of internal users: SYSMAN and MGMT\_VIEW, out-of-box both users are associated with MGMT\_INTERNAL\_USER\_PROFILE, whose password parameters are all set to UNLIMITED. In addition, to avoid sessions hanging or taking a

long time due to resource consumption limit,  
MGMT\_INTERNAL\_USER\_PROFILE's kernel parameters are set to  
default, which is unlimited as well.

## Grid Control Privilege/Role Management

1. Grant roles to users instead of granting privileges to enable Role Based Access Control (RBAC). Managing role grants is simpler than managing privilege grants. Create Meaningful roles and only grant roles instead of privileges
2. Use Privilege Propagation Group to simplify the privilege assignment, revocation, and administration along with group management.
3. Follow the Principle of Least Privilege to grant only the minimum set of privileges a user needs for carrying out his/her responsibilities by granting the fine-grained privileges/roles only when needed.
4. Monitor the privileges grants on a regular basis and also keep track of which users are exercised what privileges by enabling audit.
  - a. Grant role
  - b. Grant target privilege
  - c. Revoke role
  - d. Revoke target privilege
  - e. Grant system privilege
  - f. Revoke system privilege
  - g. Grant job privilege
  - h. Revoke job privilege

## Preferred Credentials and Target Access

1. Use privilege delegation utilities such as sudo or PowerBroker to access targets, run jobs and collect user-defined metrics.

2. Do not set preferred credentials for group/common accounts, e.g., SYSMAN. If preferred credentials are set for common accounts, then the accountability of the use of these credentials is lost. The following SQL statement can be used to report the list of users who have the preferred credentials set:

```
SELECT t.target_name,tc.user_name,tc.credential_set_name  
FROM MGMT_TARGET_CREDENTIALS tc, MGMT_TARGETS t  
WHERE tc.target_guid=t.target_guid
```

3. Take advantage of the benefits such as centralized identity storage and administration brought by LDAP,RADIUS or Kerberos authentication for host target access via Pluggable Authentication Module(PAM). Note 422073.1 shows how to configure Agent for PAM and LDAP.

## Encryption/Decryption

1. Secure the encryption key: Encryption key is the master key that is used to encrypt/decrypt sensitive data, such as passwords and preferred credentials, which is stored in the Repository. The key itself is originally stored in the Repository and it is removed automatically from the Repository once the installation is done. And it only needs to be in the Repository when the Repository is upgraded. By storing the key separately from EM schema, we ensure that the sensitive data such as Preferred Credentials in the Repository remain inaccessible to the schema owner and other SYSDBA users (Privileged users who can perform maintenance tasks on the database) in the Repository. Moreover, keeping the key from EM schema will ensure that sensitive data remain inaccessible while Repository backups are accessed. Further, the EM schema owner should not have access to the OMS/Repository Oracle homes. Follow the process outlined below to secure the encryption key:
  - a. Backup the encryption key to a file by running the following command and keep the encryption file on a separate machine securely. If the encryption key is lost or corrupted, the encrypted data in the repository is unusable.



```
emctl config emkey -copy_to_file_from_credstore -emkey_file  
emkey.ora
```

2. While emkey is required to be existing in the Repository for some operations, if the operation does not automatically copy the emkey back to Repository (or remove it from the Repository afterwards), please copy it back to the Repository and after the operation remove it from the Repository by following the procedure below:

- a. Copy the encryption key back into the Repository by using the following command:

```
emctl config emkey -copy_to_repos
```

You will be prompted for SYSMAN password.

- b. Remove the key from the Repository once the operation is done.

```
emctl config emkey -remove_from_repos
```

You will be prompted for SYSMAN password.

## Auditing

2. Enable audit for all security critical operations by issuing the following EMCLI verb:

```
emcli enable_audit
```

Please note that you have to restart OMSs if your GC is 10g Release 5. For 11g Release 1, restarting is not needed.

3. To enable audit for a subset of audited operations, please use the following EMCLI verb:

```
emcli update_audit_settings -audit_switch="ENABLE/DISABLE" -  
operations_to_enable="name of the operations to enable, for all operations use  
ALL" -operations_to_disable="name of the operations to disable, for all operations  
use ALL"
```

Please refer to section “Setting up for Auditing System for Enterprise Manager” in Chapter 2 of Administrator’s Guide for the list of operations that are audited by Enterprise Manager.

The following command will show you the list of operations that can be audited by Enterprise Manager

```
emcli show_operations_list
```

And the following command will only enable Enterprise Manager to audit user login and logoff operations in Grid Control.

```
emcli update_audit_settings --audit_switch="ENABLE" --  
operations_to_enable="LOGIN;LOGOUT"
```

4. Once audit is enabled, the audit records are kept in MGMT\$AUDITLOG table in the Repository. Please use GUI tool in Grid control to monitor audit data. Here are the steps to monitor audit data in Grid Control:
  - a. Login in to Grid Control as a Super Administrator
  - b. Go to “Setup”
  - c. Click Tab “Management Services and Repository”
  - d. Scroll down the page to “Audit” section and click the link “Audit Data” then you will be directed to the page to monitor audit data.
5. Configure the externalization service via EMCLI verb `update_audit_settings` to externalize the audit data from the Repository to an external file system on a regular basis. Please also make sure there is enough space in the directory for the audit log files

```
emcli update_audit_settings -file_prefix=<file_prefix> -
directory_name=<directory_name> -file_size = <file size> -
data_retention_period=<period in days>
```

- *file\_prefix*: The prefix of the file which contains the audit data.
- *directory\_name*: The name of the database directory that is mapped to the OS directory.
- *file\_size*: The size of the file the data is written to.
- *data\_retention\_period*: The period for which the audit data is to be retained inside the repository.

The following example shows that the audit data will be retained in the Repository for 60 days and once expurged the data will be stored in the OS directory that corresponds to database directory EM\_DIR with filenames prefixed with emgc\_audit, and the file size will be 1M bytes each..

```
emcli update_audit_setting      -directory="EM_DIR"
                                -file_prefix="emgc_audit"
                                -file_size="1000000"
                                -data_retention_period="60"
```

6. Achieve Separation of Duties by restricting the access to the directory where the externalized audit data is stored; No EM users should have access to the externalized audit data.

Please refer to the Chapter 2 of Administrator's Guide for more information about Oracle Enterprise Manager Auditing.

[http://download.oracle.com/docs/cd/E11857\\_01/em.111/e16790/security3.htm#insertedID8](http://download.oracle.com/docs/cd/E11857_01/em.111/e16790/security3.htm#insertedID8)

## Conclusion

It is difficult to overstate the importance of security. This is particularly true for EM given its wide-reaching nature. Oracle Enterprise Manager provides a robust set of security features and capabilities starting with secure framework level communication to a secure user model. Wherever possible, we attempt to incorporate best practices learned in the field into the product itself. The rich set of target security policies shipped out-of-box are an example of this effort. Yet, the entire system is as vulnerable as its weakest link. The

best practices presented above are designed to help you systematically enhance the overall security of your EM deployments. We encourage you to take advantage of these recommendations to make your EM Deployments robust from a security standpoint.



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