



ENOVIA SmarTeam

SmarTeam - Multi-site Administration Guide

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Chapter 1: Introduction

Overview

This guide outlines the various administrative procedures required to successfully setup, customize and maintain a SmarTeam – Multi-site system in a corporate environment.

Note: All the documentation mentioned in this document, unless specified otherwise, is available on the SmarTeam Documentation CD.

Required Oracle Knowledge

Because SmarTeam – Multi-site installation and maintenance is complex, a specialist with extensive knowledge of different aspects of Oracle (Replication, Backup & Recovery, Tuning) is required during installation. Periodic follow-up visits are necessary as well.

Terminology

The following terminology is specific to SmarTeam – Multi-site.

Table 1: Terminology

Term	Description
Conflict	A request that conflicts with an earlier transaction, mostly based on the asynchronous nature of the replication.
Data	Physical files (drawings, documents) associated with a specific metadata record.
Distribution	The process/ability to store data in different sites and enable sites to reference the data in its original location.
ID Range	A range of reserved numbers assigned to each object as an internal ID on each site. Since all internal IDs have to be unique, each site is assigned with a predefined pool of IDs to enable this uniqueness.
Metadata	Database records that represent a certain object/part number.
Oracle Master Database (OMD)	A designation assigned to a database (in a given site) that identifies it as a database that can replicate its data to other sites.
Ownership	The designation that identifies who can modify a given set of data. In SmarTeam – Multi-site, the ownership tag assigned to SmarTeam objects identifies the site that can control the data (for changes). This is essential for data integrity.
Parallel Vault	A general description for Work Vaults that is located in the same Vault Group.
Primary Identifier	The combination of attributes that define a unique object and revisions in the SmarTeam database.
Replication	The process of synchronizing and copying data from site to site.
Site	A physical location/facility of the company where all users are connected to a local database server.
Site ID	Unique identifier to distinguish one site from another. Also used as a prefix for an object primary ID, such as Part number, to avoid duplications across sites for newly created objects. The prefix is added to the given ID using the mask designated to it.
Coordinated Universal Time / Global Time Convention (UTC/GTC)	A high-precision, world-accepted time standard, which divides up time into days, hours, minutes, and seconds. Local time is calculated by using UTC as the basis, adding / subtracting to take time-zones into effect, and offsetting the calculation (typically +1) for daylight savings, if relevant.

Table 1: Terminology

Vault Configuration	<p>A specific setup defined by users consisting of work vaults and mirrored vaults from different sites. This is beneficial for users who log in to a database from different locations and want to access the nearest available vaults for accessing files, a location that can vary with a roaming user. This solution is also useful for SmarTeam – Web Editor users.</p> <p>In the login screen, besides typing the username and password, the user should also select the Vault Configuration/Site to be used in this session.</p>
Vault Group	<p>If a specific vault is designated for project X on site A, and users from site B want to check in a file, they need a local work vault of the same type. This vault should have mirrored vaults on all other sites to provide local access for users working on that site. All vaults that correspond with the original work vault, (consisting of mirrored vaults and corresponding work vaults on other sites), are called Vault Group.</p> <p>A Vault Group is used in the Vault Maintenance utility for designating a project or specific file type to this group, thus users from different sites can locate their files in local vaults, which are then replicated to their corresponding mirror vaults on other sites.</p>
Vault Site	<p>A Vault Site is used to direct users to either a working vault or a mirrored vault, depending on which site has placed the required file in the vault, and if that file was replicated to the site where the user is working. There are two vault sites in each site. One site includes all working vaults, and the second site includes all mirrored vaults. On any lifecycle operation the user is directed to the specific vault site that includes the vault containing the files to be checked in or checked out. A cross reference of Vault Site and Vault Group always directs a user to the closest vault that is required for a specific operation.</p>
Work/Mirror Vault	<p>For each given vault, whether assigned to a specific project or file type in the Vault Maintenance utility, there is a mirrored vault on all other sites. All new files are checked into Work Vaults and copied to all other mirrored vaults. The original vaults to which users check in files are called Work Vaults. Vaults that have copies of the files, from which remote users can check out files, are called Mirrored Vaults.</p>

Related Documentation

The following documents are referred to in this guide. All of these documents are available on the SmarTeam Directory CD.

Document	Remarks
SmarTeam – Multi-site Installation Guide	Describes the procedures for installing Multi-site.
SmarTeam – Multi-site Online Help	Provides the online help application for Multi-site.
SmarTeam Hardware and Software Requirements	Details the minimum hardware and software required for Multi-site.
SmarTeam Procedure for Upgrading to V5R20	Describes upgrade procedures between SmarTeam versions.

The following Oracle Documentation is referred to in this document.

Document	Remarks
Oracle Replication Administration Course Parts	
MetaLink: Initial Steps (setup, security etc): Note: 117434.1;	
MetaLink: Troubleshooting: Note: 1035874.6; Note: 122039.1; Note: 121716.1	
MetaLink: Backup & Recovery in Distributed Environment: Note: 31061.1	
Oracle Backup & Recovery Handbook, ISBN 0-07-882389-7	
Oracle Tuning, ISBN 0-07-881181-3	

Internet Site

You are highly recommended to frequently visit our website for the latest updates and plug-in products, including the latest Service Packs, Program Directory (Release Notes), Hotfixes and Technical Support at <http://www.3ds.com/support/>.

Chapter 2: Checklist

[SmarTeam – Multi-site Checklist](#) includes setting up Multi-site for database replication and Vault replication.

SmarTeam – Multi-site Checklist

This checklist provides a detailed list of all the steps that need to be performed and the order in which they should be performed to successfully setup SmarTeam – Multi-site.

*Requirement: M = Mandatory, O = Optional

	Item	M/O*	Reference
Stage 1: Pre-Setup			
<input type="checkbox"/>	Install SmarTeam – Foundation	M	SmarTeam – Foundation Installation Guide
<input type="checkbox"/>	Install SmarTeam – Editor (includes SmarTeam Multi-site client software)	M	SmarTeam – Editor Installation Guide
<input type="checkbox"/>	Install Multi-site Admin (includes the required components and administrative tools to configure the distributed environment on the SmarTeam – Multi-site server)	M	SmarTeam – Multi-site Installation Guide
Stage 2: Setup			
	Database Replication		
<input type="checkbox"/>	Configure Oracle databases	M	Oracle Configuration Requirements
<input type="checkbox"/>	Prepare SmarTeam Primary Site	M	SmarTeam Primary Site Preparation
<input type="checkbox"/>	Set up the Data Model Designer (DMD)	M	Multi-site Data Model Wizard
<input type="checkbox"/>	Set up the DB Site Manager utility	M	DB Site Manager Utility
<input type="checkbox"/>	Update the database through a simulated system	O	Updating the Database through a Simulated System
	Vault Replication		
<input type="checkbox"/>	Set up the Data Model Designer (DMD) for Vault replication	M	SmarTeam – Foundation Administration Guide
<input type="checkbox"/>	Set up Vault Sites	M	SmarTeam – Foundation Administration Guide
<input type="checkbox"/>	Configure Vaults for a Site	M	SmarTeam – Foundation Administration Guide

	Item	M/O*	Reference
<input type="checkbox"/>	Set up Vault Groups Replication	M	SmarTeam – Foundation Administration Guide
<input type="checkbox"/>	Run SmarTeam Data Model Designer (DMD) for both Multi-site and Vault Replication	M	SmarTeam – Editor Online Help
<input type="checkbox"/>	Install and configure RepliWeb or DFS (mandatory for Vault replication)	O	RepliWeb Installation and Configuration Guide OR DFS Installation and Configuration Guide

Chapter 3: Concepts

General Concepts

ENOVIA SmarTeam provides the SmarTeam – Multi-site product, which enables large and small organizations to work simultaneously on local and remote locations on all data, without compromising data integrity. Data changes performed at one site are replicated and applied to all other sites while preserving data integrity.

SmarTeam – Multi-site provides:

- Transparent information flow between remote locations while ensuring access to the same data at all sites.
- Propagation of data modification to all sites.
- Asynchronous methodology, which ensures that users can continue working on each site even when there is no connection between sites. In this case, data is periodically replicated between sites according to the administrator configuration. Transactions are logged at each site and implemented at the remote site(s) upon replication.

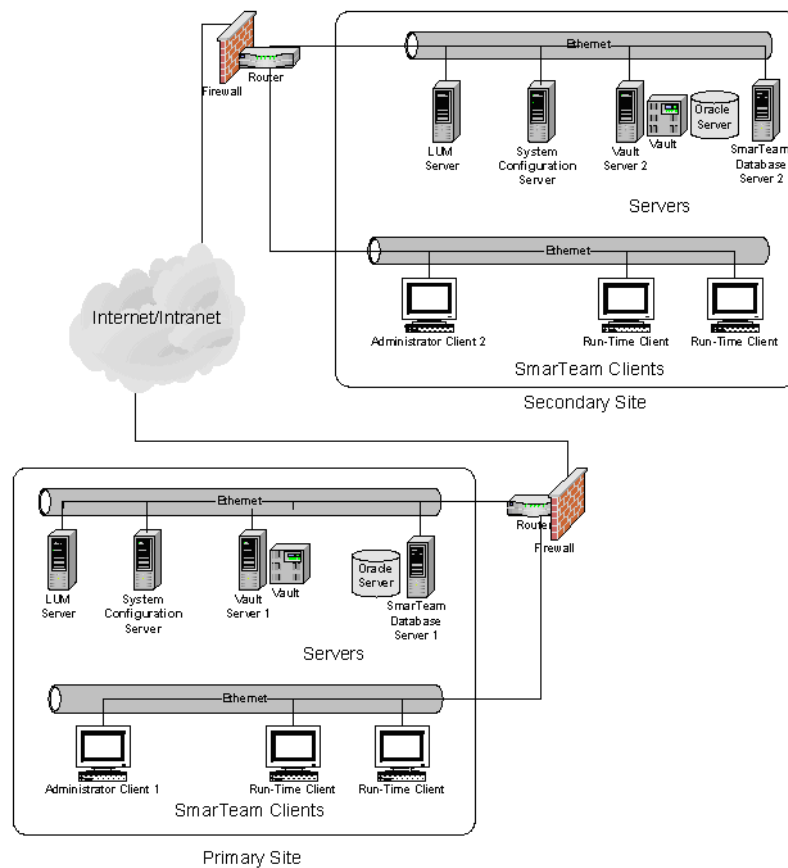
SmarTeam – Multi-site is based on the following integrated functionality:

- Standard Oracle replication technology, which provides database replication, Vault replication in addition to conflict resolution, prevents users from different sites from performing lifecycle operations on objects that are not owned by their site.
- SmarTeam – Editor functionality, which is responsible for handling ownership, and object ID allocation.

Note: Synchronous database replication, which requires all sites to be connected at all times, is not a recommended environment for SmarTeam – Editor, as it involves On-Line Transaction Processing (OLTP), where a large amount of data is constantly written to the database.

The SmarTeam – Multi-site system contains a primary master SmarTeam database with associated file storage vaults. Those file storage vaults are connected to multiple, remote secondary SmarTeam databases and vaults. Initially the secondary databases and vaults are replicated from the primary units and, thereafter, synchronization between primary and secondary units is maintained by an ongoing periodic replication mechanism, which is handled by SmarTeam – Multi-site software.

The following diagram shows a typical Multi-site system:



Primary Site

The Primary Site contains the following components:

- **SmarTeam Database Server 1:** This server contains the SmarTeam database that is replicated on the Secondary Site of SmarTeam – Multi-site.
- **Vault Server 1:** This is the Vault Server for the Primary Site. This Vault is replicated from the Vault on the Secondary Site in SmarTeam – Multi-site.
- **System Configuration Server 1:** Contains the set parameters for the Primary Site.
- **LUM Server:** Contains the following items:
 - All SmarTeam – Multi-site site licenses
 - All SmarTeam products licenses that run on the Primary Site
- **Administrator Client 1:** The Administrator Client manages the Multi-site software and performs upgrades on all sites. The Administrator Client also manages the Oracle installation on the server. The Administrator Client contains the following software:
 - Oracle Import/Export
 - DB Site Manager
 - MultisiteDataModelWizard
 - SmartDBRepairing Utility (recommended but not mandatory)
 - Run-Time Client: The basic SmarTeam – Editor client

For additional information, see [Initializing a Primary Site](#).

Secondary Site

The Secondary Site contains the following components:

- **SmarTeam Database Server 2:** This server contains the SmarTeam database that is replicated from the Primary Site by SmarTeam – Multi-site.
- **Vault Server 2:** This is the Vault Server for the Secondary Site. This Vault is replicated from the Vault on the Primary Site in the SmarTeam – Multi-site.
- **System Configuration Server 2:** Contains the set parameters for the Secondary Site.
- **LUM Server:** Contains all licenses for SmarTeam products running on the Secondary Site. (recommended but not mandatory).
- **Administrator Client 2:** Manages both, the Multi-site software and the Oracle installation. The Administrator Client contains the following software:
 - Oracle Import/Export
 - DB Site Manager (recommended but not mandatory)
 - SmartDBRepairing Utility (recommended but not mandatory)
 - Run-Time Client: The basic SmarTeam – Editor client

For additional information, see [Configuring a Secondary Site](#).

Database Replication Concepts

Database Security

Similar to the Oracle Replication security model, SmarTeam – Multi-site Database Replication is based on two users:

- **DBA user:** SYSTEM by default
- **Replication DBA user:** called the Replication Administrator

Replication Administrator

The Replication Administrator has extended database privileges so the password should be handled carefully. Every operation connected with Database Replication should be handled using this user-name only. This means you must log in to an application, such as Oracle Enterprise Manager or SQL*Plus, as a Replication Administrator user only and then push Replication jobs.

IMPORTANT! Do not select either SYSTEM or SYS Oracle users to be the Replication Administrator. This may weaken your overall security.

Username and Passwords

- System database administrator users should have the same username and password at all sites.
- A Replication Administrator user should be created at every participating site. Users at all sites should have the same username, but may have different passwords.

- SmarTeam – Editor users should have the same username and password at all sites.

This example shows how to set up usernames and passwords for Site 1 and Site 2.

User	Site 1		Site 2	
	Username	Password	Username	Password
System DBA user	<i>SYSTEM</i>	<i>manager</i>	<i>SYSTEM</i>	<i>manager</i>
Replication Administrator	<i>REPADMIN</i>	<i>repadmin1</i>	<i>REPADMIN</i>	<i>repadmin2</i>
SmarTeam – Editor user	<i>SMARTEAM</i>	<i>smarteam</i>	<i>SMARTEAM</i>	<i>smarteam</i>

Understanding Sequences in SmarTeam – Multi-site

When working in a SmarTeam - Multi-site environment, the sequence pattern, defined by means of the Sequence Designer, should be identical on the primary and secondary sites. Sequences operate the same way using SmarTeam – Multi-site and SmarTeam – Editor with the following exceptions:

When an object is added to a site, a mask value unique to the site is allocated to the object from a mask pool on the site. The concept of independent pools of mask values on each site is preferable in a distributed environment where network disruption can occur, preventing access to a central mask pool.

A Site prefix is added to the object name to ensure the object is unique in the entire SmarTeam – Multi-site system. For example: US-Project-0001 and UK-Project-0001

To enable the user to easily distinguish objects created on different sites, the Site prefix is added to the object name, which is a part of the object's primary identifier. The Site prefix appears as part of SmarTeam Sequences (Masks).

Assigning the Site prefix to sequences is a two-stage operation:

- 1 The object identifier mask is expanded to include a placeholder for a Site prefix as part of setting up the Primary Site in the SmarTeam – Multi-site environment. When an object is created at the Primary Site, the Primary Site identifier is automatically inserted in the Site prefix placeholder of the object identifier mask.
- 2 When a new Secondary Site is added to the environment, the expanded object identifier mask is copied from the Primary Site to the new Secondary Site. Whenever an object is created at that Site, the Site prefix of that Secondary Site is automatically inserted in the Site prefix placeholder of the object identifier mask.

After any modification of the sequence in the primary site, you must check all secondary sites to verify that the sequence value is set. For example, the sequence pattern on the primary site may be changed from a.9 to aa.9 and the sequence value is set to blank. In the secondary site, the pattern is changed, but the sequence value is not set to blank. In this case, the sequence value on the secondary site has to be overwritten manually.

The Site prefix assignment is accessed from the Multi-site DMD application. For more information about selecting this option, see [Setting Multi-site Options](#).

For more information about SmarTeam sequences, see the SmarTeam – Editor Administration Guide.

Site Info Profile Card Tab

The Site Info Profile Card tab enables the user to identify the Site-related properties of an object on its profile card, including following properties:

- Site at which the object is created
- Site where the object is modified
- Site to which the object belongs

The Site Info Profile Card setup is an option of the Multi-site DMD application. For more information about performing the setup, see [Launching the Multi-site Data Model Wizard](#).

SmarTeam Preferences

SmarTeam preferences can be set only at the Primary Site. The preferences are saved at the Primary Site in an xml file, which should be distributed by the administrator to Secondary Sites.

After any change in preferences on the Primary Site's configuration server, updated xml files should be distributed by the administrator to the corresponding folder of all Secondary Sites configuration servers.

The updated xml files to be distributed are located on the configuration server in the following folder:

`<SmarTeam>\ConfigurationSettings\Data\Domain`

Example: (C:\Program Files\SmarTeam\ConfigurationSettings\Data\Domain)

These files should be duplicated to the Secondary Site configuration server directory:

`<SmarTeam>\ConfigurationSettings\Data\Domain`

Note: RepliWeb® can be used to automatically perform the distribution of xml files for any change in preferences. For more information, see the RepliWeb® Installation Guide.

Ranges

A unique object ID is allocated every time a SmarTeam object is created. Because sites can be disconnected, source maintenance for single object IDs can be challenging. To support site independence and guarantee object ID uniqueness, SmarTeam – Multi-site divides global object ID space into object ID pools, or ranges. Every range contains 2^{26} object IDs, totaling 16 ranges.

Note: This allocation sets a clear limitation on the entire system and SmarTeam – Multi-site cannot have more than 16 sites.

When the Range is full and a user tries to add an object, an error message appears, such as Err No. 23008 **Object ID is out of range of local site**. The necessary response is to assign a new range in the DB Site Manager utility.

To identify in which site an object is created in a revision-managed class, find the range that includes the object ID. The TDM_SITE_ID of the range is the Site at which the object is created. For an object in the non-revision managed class, see the TDM_SITE_ID of the object (the TDM_SITE_ID is a reference class to the TDM_DB_SITE).

Timestamp and Timezone

Timestamp information is used when creating or modifying SmarTeam objects.

Multi-site uses the timestamp mechanism as follows:

Timestamps of objects created or modified on different sites must be coordinated according to their respective timezones. The Multi-site Administrator defines a site timezone when it creates a site (see [Setting Primary Site Parameters](#)). With this information, SmarTeam – Multi-site automatically compensates for a difference in timezones between sites. Timezone information includes an adjustment for daylight savings time.

To perform this procedure, enable the **Timestamps calculated relative to database server time** option in the SmarTeam – Editor Administrator options.

Conflict Prevention in SmarTeam – Multi-site

In asynchronous replication, which is used by SmarTeam – Multi-site, the Insert and Update database commands are validated only against local data, without considering parallel actions in remote sites. This can result in two types of modification conflicts:

- Database conflicts
- SmarTeam – Editor logical conflicts

Database Conflicts

Due to the asynchronous operation of SmarTeam – Multi-site, a built-in locking mechanism is required to prevent database conflicts. The locking mechanism, called object ownership, is described in [Object Ownership – Preventing Parallel Changes](#).

Example:

Two users check out the same SmarTeam object at the same time from two different sites and both perform changes on the object. When the object is a file-managed object, which refers to a file such as a drawing or a document, a parallel change creates two different branches for the same object. When users on different sites modify the same object, a conflict arises when the data is replicated.

SmarTeam – Editor Logical Conflicts

There are other types of conflicts that cannot be prevented by object ownership, such as changes made to object data in the SmarTeam – Editor without considering the restrictions of the Multi-site environment.

Example 1:

A Primary ID, such as a part number, is changed in such a way that site-naming conventions are contradicted.

Example 2:

An object in one site is deleted and, in parallel, a link between the same object and another object in another site is created, resulting in a dangling link that is connected to only one object.

Editor Logical Conflicts cannot be resolved automatically and require administrator intervention. The administrator can find all logical conflicts by using the Retrieve Logical Conflicts option in the SmarTeam DB Site Manager utility. For further information, see [Logical Conflicts](#).

Object Ownership – Preventing Parallel Changes

To prevent database conflicts, Object Ownership is included in the SmarTeam – Multi-site solution.

At any time only one site can own a SmarTeam object. Each SmarTeam object has a designation indicating the site that owns it. A user can only perform a Check Out or New Release lifecycle operation on a given SmarTeam object from a site that owns the data. If an object is not owned by the local site, the user is prevented from performing the operation.

Taking Ownership

Authorized users can take ownership of an object at any time while performing lifecycle operations. The preference that controls this option can be set automatically or the user can be prompted to take ownership of the object.

To complete the operation of taking ownership, the local database must exchange information online with the owner's database. If the connection is not established, the user is not allowed to complete the operation.

Because of the inherent delay in the replication process, there is generally a delay between the time an object at a remote site becomes available for taking ownership to the time that the local site is informed of the object's availability.

There are certain circumstances in which a remote object is not available for ownership. In those cases a message is sent detailing the reason, which is described in [Ownership Determination Delayed or Refused](#).

Ownership Determination Delayed or Refused

This section describes cases where ownership cannot be established, even when a connection exists between the sites:

- The status of the object is New at the remote site. If you want to take ownership of the object, you must check in the object and wait for replication.
- The object or one of its revisions is checked out at a remote site. The object and all its revisions have to be checked in at the remote site before you can take ownership.
- You cannot initiate a lifecycle operation on an Assembly object and then propagate the operation to all Assembly components if one of the components is checked out at a different site.
- The object was updated at a remote site and replication has not occurred yet.
- The object is not owned by the remote site. A third site may have already taken ownership and replication has not occurred yet.

In all these cases, the user receives a message to wait for the next replication. The object's status is updated by information provided by the replication so the user is able to re-evaluate the operation.

Vault Replication Concepts

This section is described in detail in the Foundation Administration Guide. For more information, see the Foundation Administration Guide, which is available on the SmarTeam Documentation CD.

Chapter 4: Database Replication

Preparing Databases

Before setting up the SmarTeam – Multi-site installation, you must first configure Oracle and prepare the SmarTeam Primary Site.

Oracle Configuration Requirements

- The Oracle configuration requirements in this section should be applied to Oracle installations at all clients and servers participating in the SmarTeam – Multi-site system (Primary and Secondary Sites) unless specified otherwise.

Note: To access your Oracle installation through a firewall, see Setting up an Oracle Server for a Secure Environment in the Oracle 10g Installation Guide.

Configuration requirements should be performed in the following order:

- 1 [Setting Oracle Connection Parameters](#)
- 2 [Installing Network Client](#)
- 3 [Configuring Oracle Administrator Client](#)
- 4 [Creating an Oracle Instance](#)
- 5 [Setting Up Oracle Sites for Communication](#)
- 6 [Recompiling Internal Oracle Objects](#)
- 7 [Creating an Oracle SmarTeam Database Schema](#)

Setting Oracle Connection Parameters

Note: The explanation in this section applies to Oracle 10g if not stated otherwise.

Set the sqlnet.ora parameters at all clients and servers at:

<Oracle-Home>\Network\Admin

For example: D:\Oracle\product\10.2.0\Client_1\Network\Admin refers to the following table:

sqlnet.ora Parameter	Set to:
SQNET.AUTHENTICATION_SERVICES	Disable by <ul style="list-style-type: none"> • Adding remark (#) sign at beginning of line. Or • Set parameter to NONE
NAMES.DEFAULT_DOMAIN	Disable by adding remark (#) sign at beginning of line. Note: If this parameter is not present in the file, then it is not required.

Installing Network Client

It is recommended to perform a separate Network Client installation for each site participating in the SmarTeam – Multi-site installation. Thus, all clients connected to a certain site use the network client installation for that site.

Configuring Oracle Administrator Client

Install the Oracle database utilities (Export/Import) at the Administrator Client station for each site.

Creating an Oracle Instance

The purpose of this section is to highlight required steps for creating or modifying an Oracle database instance to enable it to support SmarTeam – Multi-site functionality. See the Oracle Installation Guide for SmarTeam Implementers (Version 10g).

Oracle Database Feature

When creating an Oracle instance or when using the Oracle Database Configuration Assistant on an existing database, do the following:

- 1 Install Oracle JServer (optional), which is a default database feature for Oracle 10g. This feature enables Multi-site Auto-Repairing capability (see [Recovery from a Downed Network](#)).

Note: Oracle Advanced Replication is a standard feature of the Oracle Enterprise Edition. It is recommended to install the Oracle JServer.

- 2 Set the Global Database Name.

The Global Database Name of an Oracle instance on a server is a site-meaningful name, usually the format name.domain, which is unique on a Multi-site system where:

- name: A site-specific name, clearly designating its role in the Multi-site system by location or function, such as BOSTON or HQ.
- domain: Similar to a URL designator, which provides additional, auxiliary information about the site, designating the role of the site in the enterprise, such as Development or Production departments. For example: DEVELOPMENT.COMPANY_NAME.COM

Example: BOSTON.DEVELOPMENT.COMPANY_NAME.COM.

Note: A supplied database name can only contain the following characters: A-Z, 0-9, '_', '#', '\$', '.', and @ characters.

- 3** If you want to change the Character set, click **Change Character Set**.

Note: For information about selecting a suitable character set for the SmarTeam – Multi-site system, see [Database Character Sets](#).

- 4** Set the Init*.ora parameters:

Set Init*.ora parameters in the database init*.ora configuration file at <Oracle_Home>\ADMIN\<SID>\PFILE, according to the following table:

Note: If any of these parameters are not present in the init*.ora configuration file, you should add them manually.

Init*.ora Parameter	Set to:
job_queue_processes	I+3, where I is the number of sites in the Multi-site system. Example: For 3 Sites, job_queue_processes = 6
open_links	4+2*I, where I is the number of sites in the Multi-site system. Example: For 3 Sites, open_links = 10
REPLICATION_DEPENDENCY_TRACKING (important for backup and recovery)	TRUE
java_pool_size	Not less than 20MB (required by Java Server option)
shared_pool_size	Not less than 100MB

Setting Up Oracle Sites for Communication

Oracle Database Names

The following names are used in connection with Oracle databases:

- **tnsNames Alias** (also known as the Service Name): Is an alias of a server, which allows a client to connect to the database on the server. It is defined by a record in a tnsnames.ora file located in <Oracle_Home> \ NETWORK \ ADMIN directory at every client and server, where the server acts as a client. To identify the tnsNames Alias of a server, use the Net Configuration Assistant utility from the Oracle Start menu.
- **Database Service Name (SID)**: Is a name that connects an Oracle Database to an Oracle listener. To identify the Database Service Name use the Net Configuration Assistant utility on the server. To identify the Database Service Name from the Oracle Start menu use the Service Name field of the appropriate database alias.
- **Global Database Name**: Is the name of the Oracle instance, (see [Creating an Oracle Instance](#)). To identify the Global Database Name, open SQL Plus, connect to the database under DBA user authority (SYS or SYSTEM) and issue the following command:

```
select * from global_name;
```

The Global Name appears.

Coordinating Oracle Database Names

To ensure that Oracle works in the Multi-site environment:

- The tnsNames Alias of a server, as it appears at each client and server, must be identical to the Global Database Name on that server.
- The database Global Database Name must be the same as Database Service Name.

Changing the tnsNames Alias

If the tnsNames Alias (Service Name) is different from the Global Database Name, use the Net Configuration Assistant utility on the client or server from the Oracle Start menu and rename the tnsNames Alias to the Global Database Name.

Changing the Global Database Name

If the Global Database Name is not the same as Database Service Name:

- Rename the Global Name to conform with the Database Service Name in SQL Plus as follows:

```
alter database rename global_name to name.your_company;
```

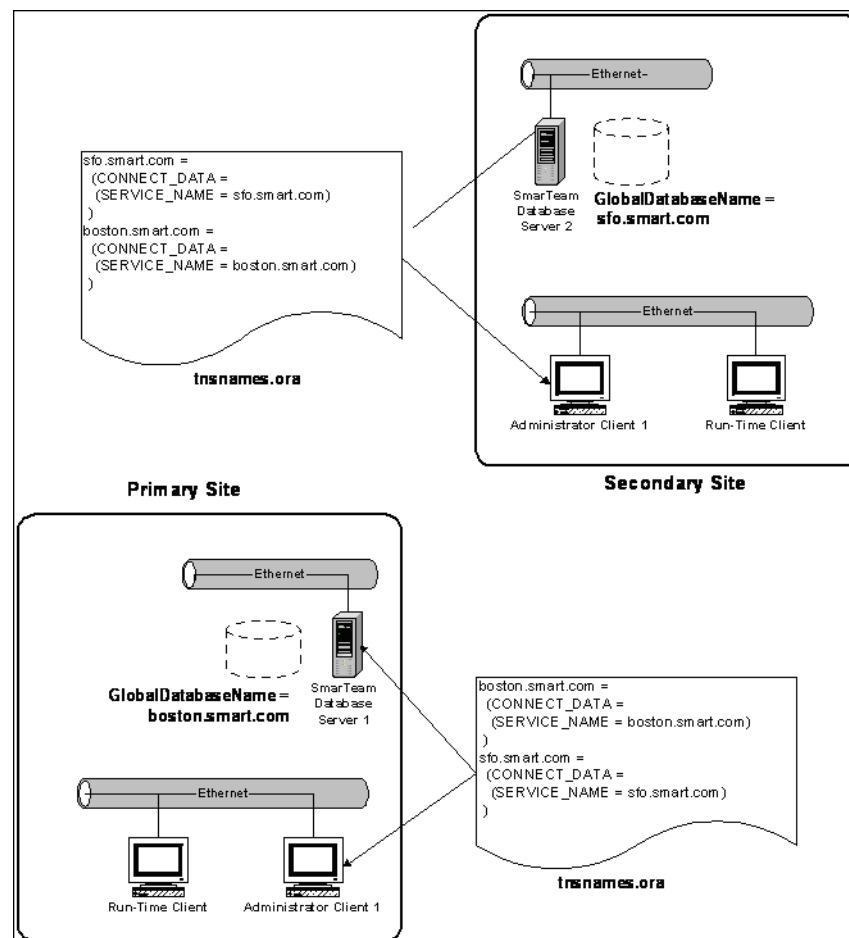
Where

name.your_company uniquely identifies the site, such as, HQ. smarteam.com

- Check the Global Database Name again. If it is unchanged, use the command:

```
update global_name set global_name='name.your_company';  
commit;
```

The following figure shows how the tnsnames.ora files should appear for a typical Multi-site installation.



Recompiling Internal Oracle Objects

After an Oracle installation, there may be invalid packages in the SYS database schema. For SmarTeam – Editor users, this can result in an unsuccessful SmarTeam – Multi-site implementation. This is especially true if the Oracle Intermedia component is installed.

This section describes how to recompile internal Oracle objects, such as packages.

- 1 Run the script `Package_repair.sql` located on the

<SmarTeam – Multi-site CD-ROM>\Kits\Script directory in SQL Plus under SYS authority.

If you receive error messages during script execution, such as ORA-00942, or ORA-01031, you must reconnect to SQL*Plus as the Oracle user whose name appears in the error message as the owner of the bad object.

For example, if you receive an error when running the script:

```
ALTER Package CTXSYS.[ObjectName] COMPILE BODY;
```

Reconnect as the CTXSYS user and run the script again.

- 2 Repeat [Step 1](#) until no error messages appear.

If you continue to receive error messages that are unrelated to authentication errors, use the Oracle Enterprise Manager to identify and correct the problems.

Creating an Oracle SmarTeam Database Schema

A SmarTeam database on Oracle is an Oracle database schema, which contains basic SmarTeam objects such as tables, indexes, packages and triggers. This section explains how to create, or select an existing Oracle SmarTeam database for the Oracle Instance you have created. See [Creating an Oracle Instance](#).

Single SmarTeam Database in an Oracle Instance

In general, an Oracle Instance could contain several SmarTeam databases. However, a SmarTeam database participating in a SmarTeam – Multi-site environment, should be the only database in an Oracle Instance.

Database Privileges for SmarTeam Database Schema

A SmarTeam database can be created either by the Enterprise Manager application or manually in SQL*Plus. SmarTeam requires the following minimal system privileges to be granted to the SmarTeam database schema:

- a** CONNECT
- b** RESOURCE
- c** CREATE VIEW

Note: A database administrator may consider it too risky to grant the RESOURCE privilege to a regular database user. Instead, the database administrator can grant quotas on certain tablespaces according to the organization's security rules. In any event, in a SmarTeam – Multi-site environment the database administrator should grant a quota on the SMARTEAM user's tablespace and on the SYSTEM and TEMP tablespaces.

If a SmarTeam database user has been created in advance and contains SmarTeam data, you can continue using it in a Multi-site environment.

Note: It is highly recommended not to grant database administrator privileges to a SmarTeam Database schema or to choose a built-in Oracle DBA user, SYS or SYSTEM, to be the SmarTeam Database schema.

Database Character Sets

The Oracle database maintains and represents all its text data according to the character set defined when the database is created.

The following attributes are defined in the database settings and are equivalent to NLS_LANG in the registry of the database server:

- NLS_LANGUAGE
- NLS_TERRITORY
- NLS_CHARACTERSET

Where:

NLS_LANG=<NLS_LANGUAGE>'_'<NLS_TERRITORY>.<NLS_CHARACTERSET>

Character Sets and Code Groups

Character sets are divided between three basic and separate code groups. The following are alternatives for selecting a character set for databases participating in a SmarTeam – Multi-site system:

- Western
- Middle Eastern
- Far Eastern

Only Database/Sites with character sets from the same code group are permitted to participate in the Multi-Site system. Therefore, it is highly recommended to use the same character set for all sites in a SmarTeam – Multi-site system.

Choosing a Code Group

Databases/Sites with character sets from different code groups, such as French and Japanese, cannot participate together in an Oracle Multi-Master Replication or in a SmarTeam – Multi-Site system.

For example, if an American company wants to open sites in the US, Japan and Europe, it will have to sacrifice the convenience of one set of users. All users will work in either the Western group or the Far Eastern group, which means that one group will be unable to work in its native language. One language that can link all users is English, which exists in any code group.

Choosing a Character Set

Within a code group, you still have flexibility in choosing a character set. You can select a wider character set to cover more cases or a narrow character set. If you use two narrow character sets in the same code group, problems can occur.

For example, data in French is entered into a European site working with the WE8ISO8859P1 character set and these changes are replicated to an American site working with US7ASCII. Since US7ASCII doesn't recognize languages other than English it translates special French characters into question marks (?). As a result, data is different at two sites and true replication has not been achieved. One solution to this problem is to use a single, wider character set.

Oracle Database Asynchronous Replication

SmarTeam – Multi-site operates in an asynchronous replication environment, where data is periodically replicated between sites. The system administrator can configure the frequency of replications. Transactions are logged at each site and implemented at the remote site(s) upon replication.

DML (Data Manipulation Language)

Transactions are performed locally, but because validation is not performed against remote databases, the same data may be changed in more than one location. When replication occurs, this may cause conflicts that must be resolved. Major benefits of asynchronous replication include performance and site independence. The Oracle database alone cannot resolve all conflict, and special mechanisms need to be included to support this environment in an OLTP (On-Line Transaction Processing) database.

Note: Synchronous database replication, which requires all sites to be connected at all times, is not a recommended environment for SmarTeam – Editor, as it is an OLTP type where a large amount of data is constantly written to the database.

Conflict Resolution

Oracle replication technology is used to replicate all changes made to the database since the last replication to all other sites. To avoid conflicts, a special mechanism is used to prevent users from different sites from performing any lifecycle operations or update operations on objects that are not owned by their site. For more information about Ownership, see [Object Ownership – Preventing Parallel Changes](#).

Oracle Selective Replication

Due to existing Oracle limitations, the SmarTeam – Multi-site database replication does not allow selectivity. That means you can only replicate all changes.

SmarTeam Primary Site Preparation

In this section, prepare the SmarTeam database that serves as your Primary database under the Oracle Instance you previously created (see [Creating an Oracle Instance](#)). You can use a SmarTeam database that already exists under Oracle or other database systems, or you can create a new SmarTeam database directly in Oracle.

SmarTeam – Multi-site Licenses

The following applications must have access to a SmarTeam – Multi-site licenses (administration purposes only):

- DB Site Manager
- DataModelPropagator
- Data model change utilities, such as the DataModelDesigner and its application family

All Multi-site licenses are located at the LUM server at the Primary Site. A license is required for both Database Replication and for Vault Replication.

Note: To avoid delays in license allocation over the WAN for SmarTeam products such as the SmarTeam – Editor when used on a Secondary Site, it is recommended to install a separate LUM server at each Secondary Site.

SmarTeam – Multi-site System Configuration Environment

System Configuration in the SmarTeam – Multi-site environment enables synchronization between sites.

If the administrator makes any change in system configuration at the Primary Site, the administrator can also apply the same changes at all Secondary Sites according to customer needs.

However, if synchronized, the following entries must be applied to the local site parameters.

Level	File	Parameter	Action
Domain	legacypreferences	Database Connection String	After Copying the files, use Data-baseConnectionManager. This should be done in any case.
System	legacypreferences	Defaul Vault (vault_Replication.VaultCon-figuration)	After Copying the files, use ST-ED= > Option s=>Default Vault. This should be done in any case.

Default	smarteam.std.nls.config	NLS Folder	After Copying the files, manually change this parameter to appropriate value. This should be done only if relevant.
Default	legacypreferences	VaultWorkDirPrefix	After Copying the files, manually change this parameter to (Example: <This Computer>\SmTemp) appropriate value. This should be done only if relevant.

SmarTeam – Multi-site Software Executable Files

The following SmarTeam – Multi-site software are executable files:

- DB Site Manager: Used in the installation of the SmarTeam – Multi-site system to set up the Primary and Secondary Sites
- Multi-site Data Model Wizard: Used in the installation of the SmarTeam – Multi-site system to prepare a Data Model for replication
- Data Model Propagator: Used subsequent to installation of the SmarTeam – Multi-site system to propagate changes in the Data Model from Primary to Secondary sites
- Multi-site Data Model: A DLL that the Data Model Propagator and the SmarTeam DMD use in the Multi-site environment

Preparing the Primary SmarTeam Databases

The steps detailed in this section should be performed in the following order:

- 1 [Creating a SmarTeam Database](#)
- 2 [Backing Up the SmarTeam Database](#)
- 3 [Fixing Database Indices](#)
- 4 [Checking Index Field Length](#)
- 5 [Correcting Database Anomalies](#)
- 6 [Registering the SmarTeam Database](#)
- 7 [Applying the Multi-site Data Model Wizard to the SmarTeam Database](#)

Creating a SmarTeam Database

To create the SmarTeam database, do one of the following:

- Create a new SmarTeam database using the SmarTeam DMD at
<SmarTeam>\bin\SmartDataModelDesigner.exe
- OR**
- If you already have an existing SmarTeam database, do one of the following
 - Import a previously exported database to an existing Oracle SmarTeam database using Oracle Import/Export tools.
- OR**

- Copy an existing SmarTeam database from an existing source database using the SmartDBExplorer. Create an alias or use an existing alias for the source database and copy from source alias to alias that you have previously defined.

Backing Up the SmarTeam Database

Using the Oracle Export utility, perform a backup of your SmarTeam database.

Fixing Database Indices

To fix database indices:

- 1 Run the SmartDbRepairing utility at <SmarTeam>\bin\SmartDbRepairing.exe.
- 2 Select **IndicesValidation** to check indices and null values in the database. If a problem is detected, click **IndicesRepairing** to fix all indices.

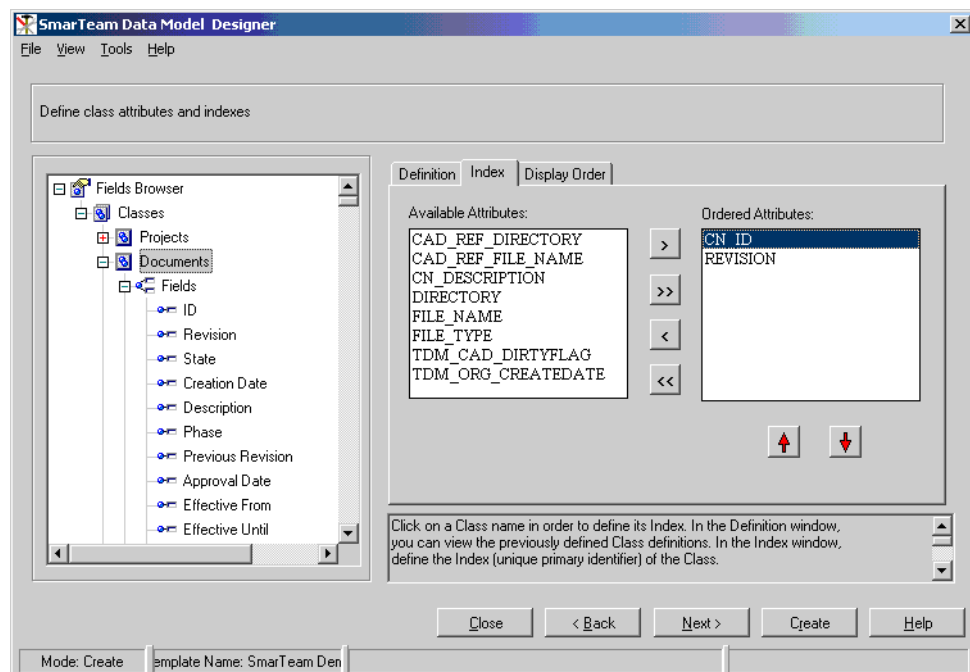
For more information, see the SmartDBRepairing User Guide.

Checking Index Field Length

The replication process requires each superclass in the model to have at least one character attribute of 20 bytes or more.

To verify that the index field length for your SmarTeam database is correct:

- 1 Run the SmarTeam DMD for your SmarTeam database using <SmarTeam>\bin\SmartDataModelDesigner.exe.
- 2 Select the Index tab for each superclass of the database model.



- 3 Check all superclasses of the model and ensure that at least one of the attributes in the Ordered Attributes list has a size of 20 characters or more.

Correcting Database Anomalies

Truncate Field Name Length

Use the SmartDBRepairing utility to automatically correct any field names that are more than 28 characters.

SmarTeam – Multi-site allows a maximum length of 28 characters for all names in a Oracle table participating in database replication. For example, any existing SmarTeam databases that contain column names exceeding 28 characters are truncated to 28 characters using SmartDBRepairing.

- Run the SmartDbRepairing utility at <SmarTeam>\bin\SmartDbRepairing.exe.

Note: Since the SmartDBRepairing utility truncates field names to 28 characters, any existing SmarTeam scripts that use attributes, which represent Oracle table fields, must be changed to reflect the new truncated field names. The new field names are listed in the report produced by the DB Site Manager application.

Cleaning up Leaf Classes

To clean up leaf classes:

- 1 Use the SmartDBRepairing utility to automatically delete all records in leaf classes that do not have a corresponding record in their respective super-classes.
- 2 Run the SmartDbRepairing utility at <SmarTeam>\bin\SmartDbRepairing.exe.

For more information, see the SmartDBRepairing User Guide.

Registering the SmarTeam Database

In this section, register the SmarTeam database at the Primary site.

IMPORTANT! Database Registration should be performed in the order specified in this document. You should never perform Database Registration after initiating the Primary Site.

The following are two cases when you must register the SmarTeam database:

Note: For all other cases you can skip this section.

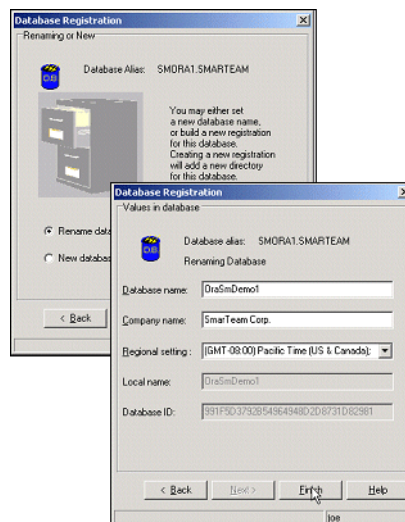
- The SmarTeam Database ID is not unique. For example, if you copied the database.
- You want to change the database name, which appears on the windows, to a site-specific name.

To register the SmarTeam database, follow the instructions in Chapter 6 System Administration Functions of the SmarTeam – Editor Administration Guide. In addition, perform the following action for SmarTeam – Multi-site:

Note: The default for the New Database Registration option is disabled.

- When you set the database parameters, verify that the Regional setting is correct.

SmarTeam regional settings determine correct conflict resolution between sites.



Applying the Multi-site Data Model Wizard to the SmarTeam Database

In this section, use the Multi-site Data Model Wizard to perform actions on the SmarTeam database. For detailed information about using the Multi-site Data Model Wizard application, see [Launching the Multi-site Data Model Wizard](#).

Note: These operations can also be performed by a SmarTeam DMD, but not as simply.

IMPORTANT! Before updating the SmarTeam Data Model, it is highly recommended to perform a backup operation of the SmarTeam database.

Adding Replication Mechanisms

Using the Multi-site Data Model Wizard, add the following replication mechanisms, according to [Selecting Data Model Mechanisms](#):

- Distributed: Mechanism for replicating a database to all sites
- Vault Replication: Mechanism for replicating a vault to all sites

These mechanisms are independent; you can add either one without the other.

Note: These mechanisms may already be present if you are working with an existing database.

Setting Multi-site Options

Using the Multi-site Data Model Wizard, set the following Multi-site options according to the procedure [To set Multi-site options](#):

- Add site information to Profile Card
- Add Site prefix to masks

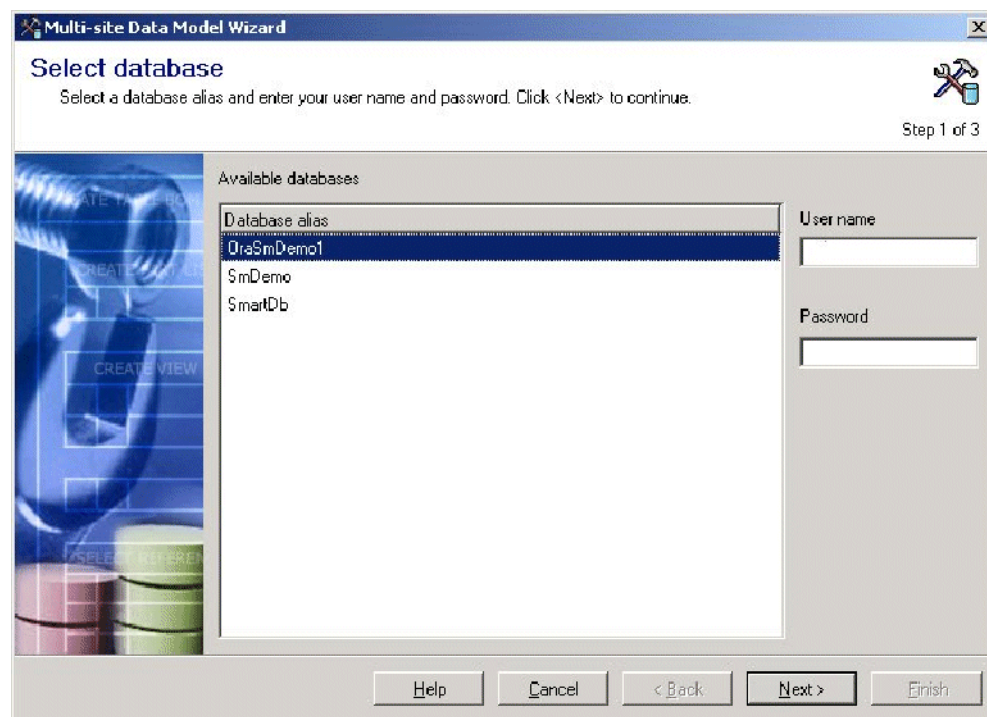
Multi-site Data Model Wizard

The Multi-site Data Model Wizard utility enables you to add or remove Multi-site data model mechanisms and change Multi-site options without using the generic SmarTeam – DataModelDesigner application.

Launching the Multi-site Data Model Wizard

To launch the Multi-site Data Model Wizard:

- 1 Double click the MultisiteDataModelWizard.exe file located in the <SmarTeam>\Bin directory to launch the Multi-site Data Model Wizard utility. It shows a list of available databases and options.



- 2 Click **Next** until you reach the end of the Wizard and then click **Finish**.

Selecting the Database to Upgrade

To select the database you want to upgrade:

- 1 Select the name of the SmarTeam database to which you want to add the mechanisms.
- 2 Type the username and password of the SmarTeam System Administrator for the selected SmarTeam database.
- 3 Click **Next** to select a data model mechanism.

A SmarTeam message window appears prompting you to perform a backup operation of the destination database.
- 4 If you have already performed a backup, click **Yes** to proceed to the next step, otherwise click **Cancel** to abort the Multi-site Data Model Wizard and perform a backup operation of the

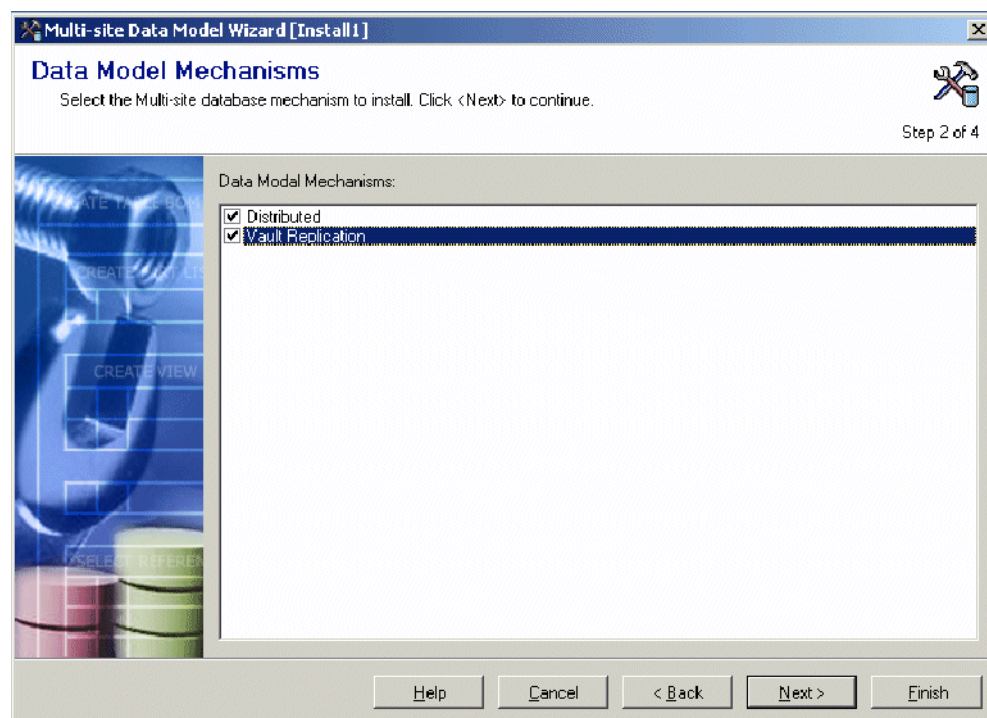
selected database. After backing up the selected database, run the Multi-site Data Model Wizard again to perform the required database changes.

Selecting Data Model Mechanisms

This section describes how to add the following Multi-site data model mechanisms:

- Distributed mechanism responsible for the database replication
- Vault Replication

The Data Model Mechanisms window appears, showing the available Data Model replication mechanisms to install.



Setting Multi-site Options

To set Multi-site options:

- 1 Select the following relevant options:
 - Add site information to the Profile Card
 - Add Site prefix to masks
- 2 Click **Next** until you reach the end of the Wizard.
- 3 Click **Finish** to start updating the selected database with the selected mechanism(s) and option(s).

The Multi-site Data Model Wizard upgrades and displays all changes to the selected database.

Note: This process requires a few minutes, depending on the size of the selected database.

At the end of the process, a SmarTeam information message appears, confirming that the database was successfully updated.

- 4 Click **OK** to continue.

In the Multi-site Data Model Wizard, if necessary, use the scroll bar to view the changes made to the selected database. This completes upgrading the selected database with Multi-site functionality.

- 5 Click **Close** to exit the Multi-site Data Model Wizard.

DB Site Manager Utility

Setting Up Sites: Basic Functionality

The DB Site Manager utility is launched by double-clicking on the DbSiteManager.exe file, which is located in the <SmarTeam>\Bin directory.

The DB Site Manager is used to set up and initialize the Primary Site and supports the following:

- [Registering the Replication Administrator](#)
- [Setting Primary Site Parameters](#)
- [Setting SmarTeam Internals](#)

SmarTeam Administration Utilities

The following table shows on which Primary site various SmarTeam administration utilities can be run.

Table 1: SmarTeam Administration Utilities

Utility

DefaultValues.exe

FlowChartDesigner.exe

FormDesigner.exe

MenuEditor.exe

ScriptMaintenance.exe

SequenceDesigner.exe

SmartBomAdministrationWizard.exe

SmartDataModelDesigner.exe

SmartDbRepairing.exe

SmarTeam.Std.Application.FormDesigner.exe

SmartFDAJobServer.exe

SmartOperationDependenciesManager.exe

The DB Site Manager is also used to add Secondary Sites and supports the following:

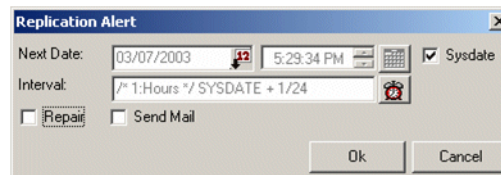
- [Adding a Secondary Site](#)
- [Exporting a Primary Site](#)
- [Building a Secondary Site](#)
- [Creating Links – Scheduling the Replication Process](#)
- [Adding a Site as an Oracle Master Database](#)

Setting Up Sites: Extended Functionality

The extended functionality of the DB Site Manager becomes available if you launch the application with the ADMIN option: DB Site Manager /ADMIN.

Replication Alert Dialog Box

- From ADMIN mode of the DB Site Manager, right click on the site.
The Replication Alert dialog box appears.



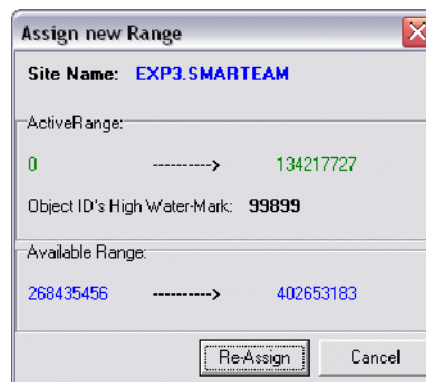
The options are:

- **Repair:** Select this option to enable Replication Alert and change the status of the broken jobs to normal
- **Send Mail:** Select this option to send mail to the administrator whenever a broken job is discovered
- **Interval:** Complete this field to show elapsed time between checking Oracle job states
- **Next Date:** Complete this field to show starting date for enabling Replication Alert (by default, current time)

SmarTeam – Multi-site provides sufficient auto-repair capability to reduce maintenance time, but it is unable to completely eradicate this problem.

Allocating New Ranges

To assign a new range to a site, select the target site on the DB Site Manager Replication tree and right click. For more information, see [Ranges](#).



Logical Conflicts

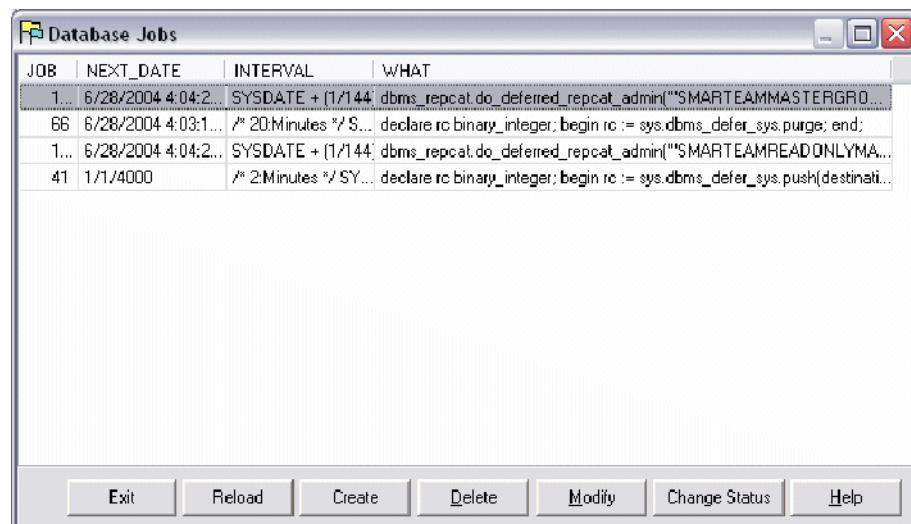
To obtain logical conflicts for a site, select the site icon on the DB Site Manager replication tree, right click and select **Retrieve logical conflicts**.

Managing Jobs

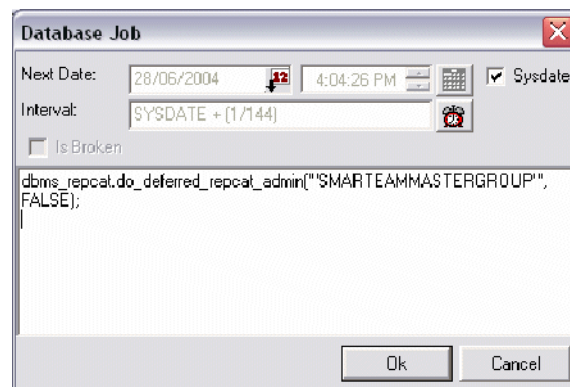
The DB Site Manager provides fast access to Multi-site related Oracle jobs (as an alternative of using Oracle Tools). You can change job scheduling parameters and change job status from NORMAL to BROKEN and vice-versa.

To modify a property for a job:

- 1 Select the site on the DB Site Manager Replication tree. Right click and select **Manage Jobs**. The Database Jobs window appears.

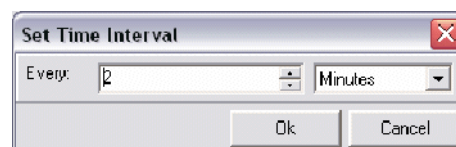


- 2 Select the job and click **Modify**. The Database Job window appears.



- 3 To change the job's scheduling interval properties, click the alarm button on the Database Job window.

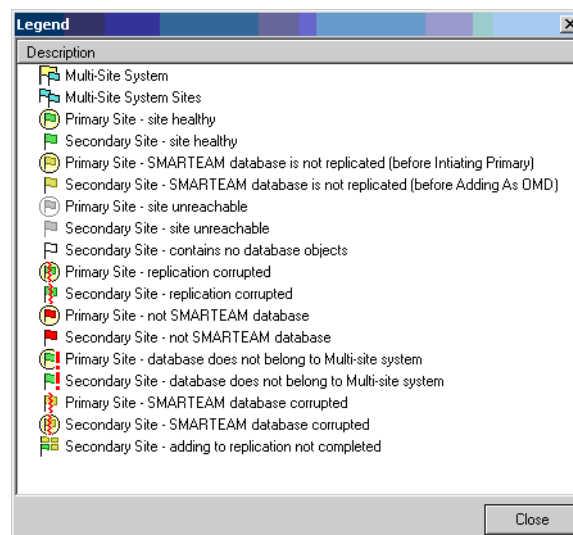
The Set Time Interval dialog box appears.



- 4 Change the interval and click **Ok**.

DBSite Manager Replication Model Legend

From the DB Site Manager main menu, select the Legend, which supports the following list of all symbols representing different states of the SmarTeam – Multi-site system and its components:



Separate Scripts

From the main menu in DB Site Manager ADMIN mode, select **Separate Scripts**. Its components are designed solely for SmarTeam support usage. Do not use any of these options without consulting SmarTeam support.

Initializing a Primary Site

In this section, initialize the database at the Primary Site for replication from the DB Site Manager by doing the following:

- 1 [Registering the Replication Administrator](#)
- 2 [Setting Primary Site Parameters](#)
- 3 [Setting SmarTeam Internals](#)

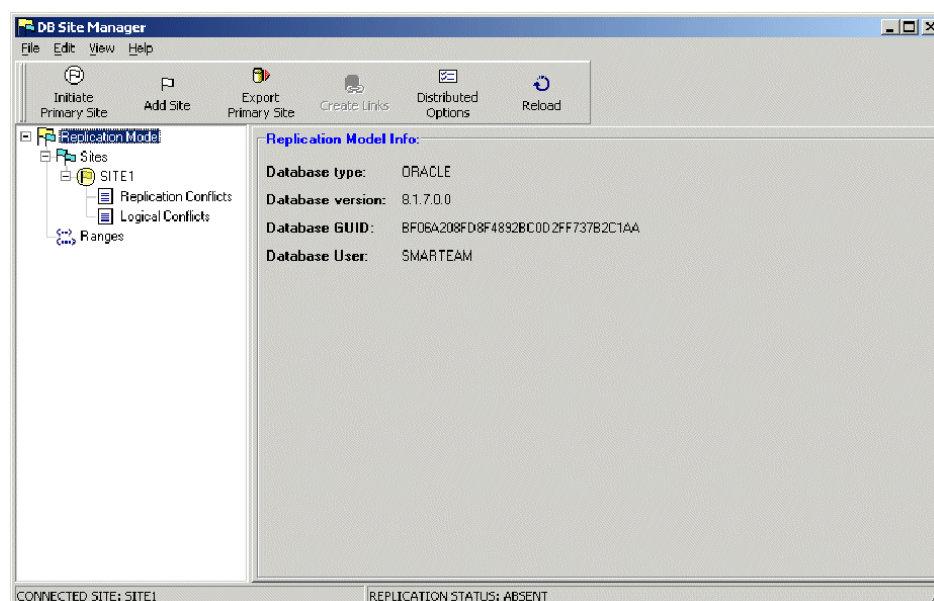
IMPORTANT! It is highly recommended to perform a backup operation on the selected database before initializing the Primary Site. Starting from this point, the Oracle export/import utilities are not applicable; use the regular cold backup procedure instead.

Registering the Replication Administrator

In this section, create a Replication Administrator in the Oracle Instance, which contains the SmarTeam Database. The Replication Administrator is an Oracle user (RepAdmin), who supports the replication process. To define a RepAdmin User, you must access the Oracle Instance with database administrator privileges.

To register a Replication Administrator:

- 1 Launch the DB Site Manager application at the Administrator Client on the Primary Site at <SmarTeam>\bin\DBSiteManager.exe.
- 2 If you have copied the SmarTeam database from another Oracle database, an error message may appear regarding information in the SmarTeam internal tables. Click **Ok** to fix the errors automatically.
- 3 Log in as the SmarTeam System Administrator.
- 4 From the DB Site Manager window, click **Initiate Primary Site**.



- 5 From the Select SysAdmin for [Database Name] dialog box, type the username and password for an Oracle User that has database administrator privileges and click **Ok**.

The **SYSTEM** user, which appears on the field, is the default database administrator user. The SYSTEM default password is **manager**.

Note: If the Oracle User you have selected does not have database administrator privileges or the password is incorrect, an error message appears and you need to type different information.



- 6 Register an Oracle Replication Administrator (RepAdmin) user by selecting one of the following options:

- [Using an existing RepAdmin user](#)
- [Defining an existing Oracle user to be a RepAdmin user](#)
- [Defining a new Oracle user to be RepAdmin user](#) (recommended)

The Initiate Primary Site window appears. See [Setting Primary Site Parameters](#).

Using an existing RepAdmin user

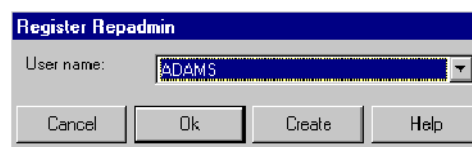
To register a RepAdmin user using an existing user:

- Select one of the following options:
 - If a RepAdmin User has already been defined, the Select SysAdmin for [Database Name] dialog box appears showing the **SMREPADMIN** username (see [Step 5](#)). Type the required password for the RepAdmin user and click **Ok**.

OR

- If a RepAdmin user has not been defined, a dialog box appears, prompting you to define a RepAdmin user. Click **OK**.

The Register Repadmin dialog box appears.



Do one of the following:

- From the drop-down list, select an existing RepAdmin user and click **Ok**.

OR

- Select **Create** to create a new RepAdmin user.

The Create Database User dialog box appears (recommended). See [Defining a new Oracle user to be RepAdmin user](#).

Defining an existing Oracle user to be a RepAdmin user

To define an existing user to be a RepAdmin user:

- 1 From the drop-down list on the Register Repadmin dialog box, select an existing RepAdmin user and click **Ok**.

The Select RepAdmin window appears showing the user you selected (see [Step 5](#)).

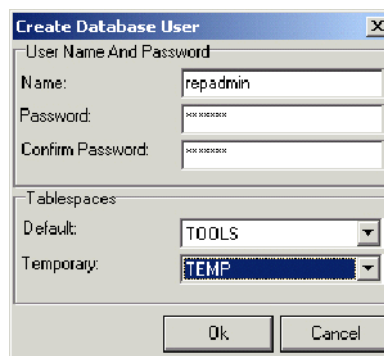
- 2 Type the required password for the RepAdmin user and click **Ok**.

Defining a new Oracle user to be RepAdmin user

To define a new user to be a RepAdmin user:

- 1 From the Register Repadmin dialog box, select **Create**.

The Create Database User dialog box appears.

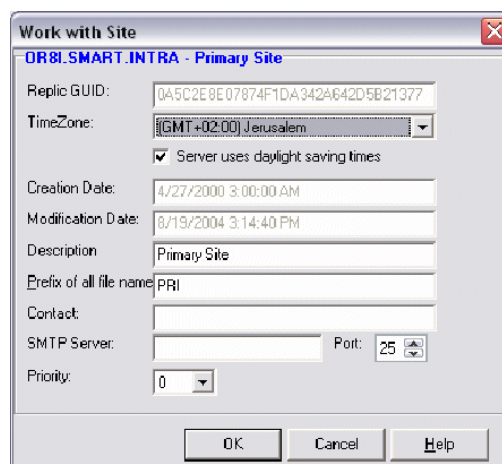


The 'Create Database User' dialog box is shown. It has a title bar with a close button. The 'User Name And Password' section contains three fields: 'Name' with the value 'repadmin', 'Password' with a masked input (new password), and 'Confirm Password' with a masked input (new password). The 'Tablespaces' section contains two dropdown menus: 'Default' set to 'TOOLS' and 'Temporary' set to 'TEMP'. At the bottom are 'Ok' and 'Cancel' buttons.

- 2 Type the required username and password information in the appropriate fields.
- 3 Select the appropriate values from the drop-down lists for the following Tablespaces fields:
 - **Default:** Possible value: TOOLS (do not select SYSTEM)
 - **Temporary:** Possible value: TEMP
- 4 Click **Ok** to save.

Setting Primary Site Parameters

- 1 From the Initiate Primary Site window, complete the following fields:



The 'Work with Site' dialog box is shown for 'OR81.SMART.INTRA - Primary Site'. It contains several fields: 'Replic GUID' (0A5C2E8E07874F1DA342A642D5B21377), 'TimeZone' (GMT+02:00 Jerusalem), a checked checkbox for 'Server uses daylight saving times', 'Creation Date' (4/27/2000 3:00:00 AM), 'Modification Date' (8/19/2004 3:14:40 PM), 'Description' (Primary Site), 'Prefix of all file name' (PRI), 'Contact' (empty), 'SMTP Server' (empty), 'Port' (25), and 'Priority' (0). At the bottom are 'OK', 'Cancel', and 'Help' buttons.

- **TimeZone:** Select the applicable Timezone for your location from the drop-down list.
- **Server uses daylight saving times:** Select this option if the Automatically adjust clock for daylight saving changes setting on the site's database server is enabled. This synchronizes the system time between the SmarTeam client and the SmarTeam database on the server. The operating system Automatically adjust clock for daylight saving changes setting should be set according to the particular operating system.
- **Description:** Type a description of Primary Site, such as Primary Site.
- **Prefix of all file names:** Type a free text prefix for the location of the Primary Site. The prefix is added to an object's identity field to identify where the object was created. The recommended prefix consists of two characters although a maximum of three characters is supported. Example: NY is the prefix for New York, LA is the prefix for Los Angeles.

The following three fields are important to use with SmarTeam – Multi-site scheduled links auto-repairing capabilities. See [Recovery from a Downed Network](#).

- **Contact:** Type a suitable contact name in valid email format. For example: name@company.com. (This field is optional.)
- **SMTP Server:** SMTP Server address. Type your email server IP address. (This field is optional.)
- **Port:** Port of the SMTP Server. Default is 25
- **Priority:** This property defines the Site conflict resolution priority. The lower the number, the higher the priority where the priority values are between 0-15. The default priority for the Primary Site is 0, the highest priority. For more details, see the Methodology Guide.

- 2 Click **Finish** to commence the process to initiate the Primary Site. This process may take some time, depending on the size of the selected database.

After the site has been successfully initiated, a SmarTeam information window notifies you that the Primary Site [Name] has been successfully initiated.

The Primary Site Icon changes to green and yellow indicating **Site healthy**.

Setting SmarTeam Internals

Setting Timestamp Policy

From Tools > Administrator Options in the General Options menu of the SmarTeam – Editor, select **Time Stamps calculated relative to database server time**.

File Naming Configuration

To configure the Administrative Tools settings:

- 1 From the SmarTeam – Editor main menu, select Tools > Administrator Option.
- 2 Click **Lifecycle Options** to show the Lifecycle Options window.
- 3 From the Lifecycle Options window, click the Into Vault tab.
- 4 Deselect **Retain original file name on first check in**.

For more information, see [File Naming Configuration](#).

Configuring a Secondary Site

This section explains how to configure a Secondary Site in the SmarTeam – Multi-site system by doing the following:

- 1 [Adding a Secondary Site](#)
- 2 [Exporting a Primary Site](#)
- 3 [Building a Secondary Site](#)
- 4 [Creating Links – Scheduling the Replication Process](#)
- 5 [Adding a Site as an Oracle Master Database](#)

IMPORTANT! It is highly recommended to perform the procedures of this section with a Secondary Site computer located in the same LAN as the Primary Site, subsequently returning the computer to its actual location. The reason is that the Add as OMD stage is performed by Oracle as two-phase commit, which is bandwidth-dependent.

Note: Check that the Oracle Instance that is to be used at the Secondary Site is configured as described in [Oracle Configuration Requirements](#).

Adding a Secondary Site

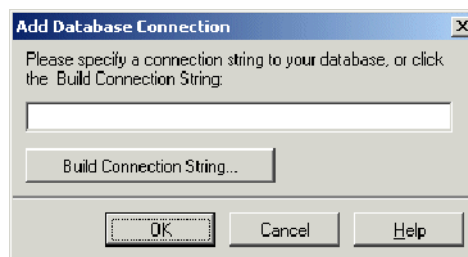
To add a Secondary Site:

- 1 Create an Oracle SmarTeam database user on the Secondary Site with the same name and password as the SmarTeam user on the Primary Site. For example, if you created an Oracle SmarTeam database user SMARTEAM with password smarteam at the Primary Site, you have to create an Oracle SmarTeam database user SMARTEAM with password smarteam at all Secondary Sites. See [Usernames and Passwords](#).

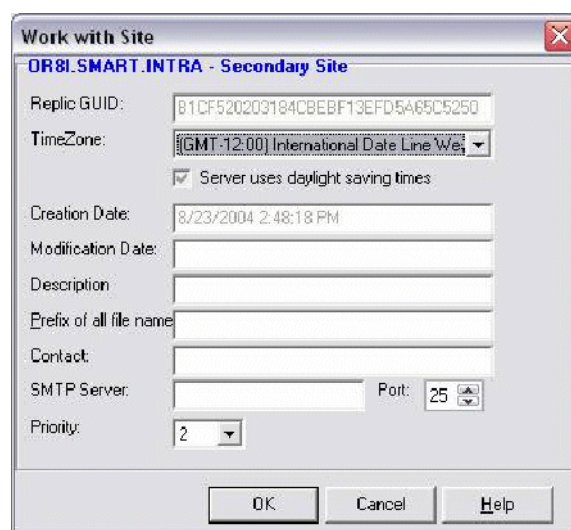
Also, the Oracle SmarTeam database users at all sites should have the default tablespace with the same name. Grant this user the same privileges as those available at the Primary Site, such as CONNECT, and RESOURCE roles and CREATE VIEW system privilege.

Note: At this stage do not create or import any object(s) into this SmarTeam schema! The SmarTeam schema at the Secondary Site must be empty when you add it to the SmarTeam – Multi-site system.

- 2 Create a tnsNames Service Name, which appears in the tnsnames.ora files for the Secondary Site at the Primary Site and all previously created Secondary Sites. Similarly, create a tnsNames Service Name for the new Secondary Site at the Administrative Clients, using the Net Configuration Assistant (see [Setting Up Oracle Sites for Communication](#)).
- 3 Run the DB Site Manager at the Administrator Client of the Primary Site.
- 4 From the DB Site Manager toolbar, click **Add Site**.
The SmarTeam Add Database Connection window appears.



- 5 From the Add Database Connection window connect to the Oracle database you want to use as the Secondary Site, as described in the SmarTeam – Editor documentation.
- 6 Complete the following fields in the New Site window:
 - TimeZone: Expand the dropdown list and select the applicable timezone for your location.



- Server uses daylight saving times: Select this option if the **Automatically adjust clock for daylight saving changes** setting on the site's database server is enabled. This synchronizes the system time between the SmarTeam client and the SmarTeam database on the server. The operating system **Automatically adjust clock for daylight saving changes** setting should be set according to the particular operating system.
- Description: Type free text description of Primary Site, for example, **Primary Site**.
- Prefix: Type a free text prefix for the location of the Secondary Site. The prefix is added to an object's CN_ID field to identify where the object is created. Two characters are recommended; three characters are the maximum. For example: NY for New York, LA for Los Angeles (This field is only applicable if you have performed the steps in [Initializing a Primary Site](#).)

The following fields are important for use with the SmarTeam – Multi-site scheduled links auto-repairing capabilities (see [Recovery from a Downed Network](#)):

- Contact: Type a suitable contact name in valid email format. (This field is optional.)

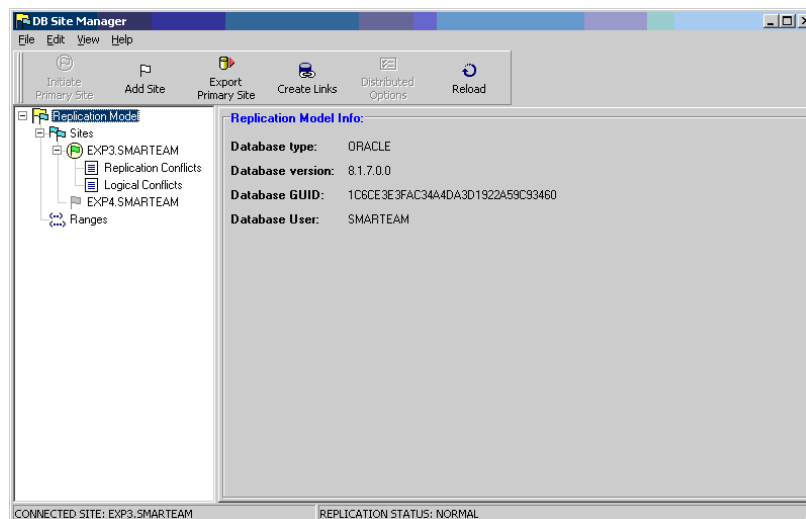
For example: name@company.com

- SMTP Server: SMTP Server address. Type your email server IP address. (This field is optional.)

- Port: Port of the SMTP Server. Default is 25.
- Priority: This property defines Site conflict resolution priority. The lower the number, the higher the priority. Default for the Secondary Site is the next available value, where the values are between 0–15.

7 Click **OK** to save your entries and exit the SiteEdit window.

The site name appears in the Replication Model tree of the DB Site Manager window. The gray flag without a background indicates that the site is a Secondary Site and that the database is accessible but not yet configured to participate in the replication environment.



8 If applicable, repeat the above steps to add additional Secondary sites.

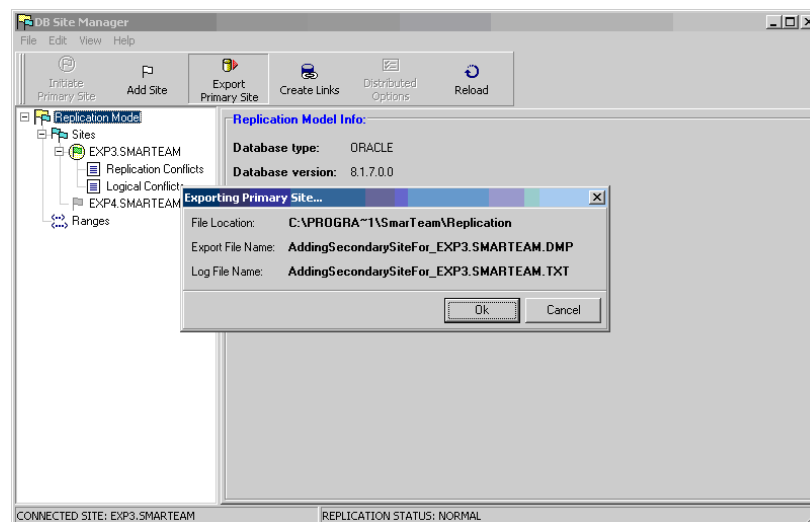
Exporting a Primary Site

In this section, the SmarTeam data of the Primary Site database is transferred to the Secondary Site database.

To export data from a Primary Site to a Secondary Site:

- 1 From the Administrator Client of the Primary Site, click the Export Primary Site toolbar button to export the SmarTeam Schema of the Primary Site.

The Exporting Primary Site window appears.



- 2 From the Exporting Primary Site window, click **Ok** to create an export file.
The resulting export filename is AddSecondarySiteFor_PrimarySiteName.dmp and it is located in <SmarTeam>\Replication folder. A success window appears.
- 3 Send the export file created in [Step 2](#) from the Primary Site to the Secondary Site Admin Console folder <SmarTeam>\Replication, for example, by ftp.

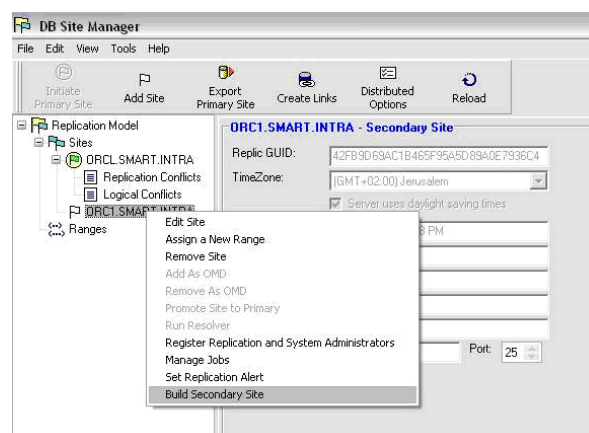
Note: The Build Secondary Site, which uses the Oracle Import Utility, can now work locally on the Secondary Site instead of operating over the network. This significantly improves the performance of the Build Secondary Site operation.

Building a Secondary Site

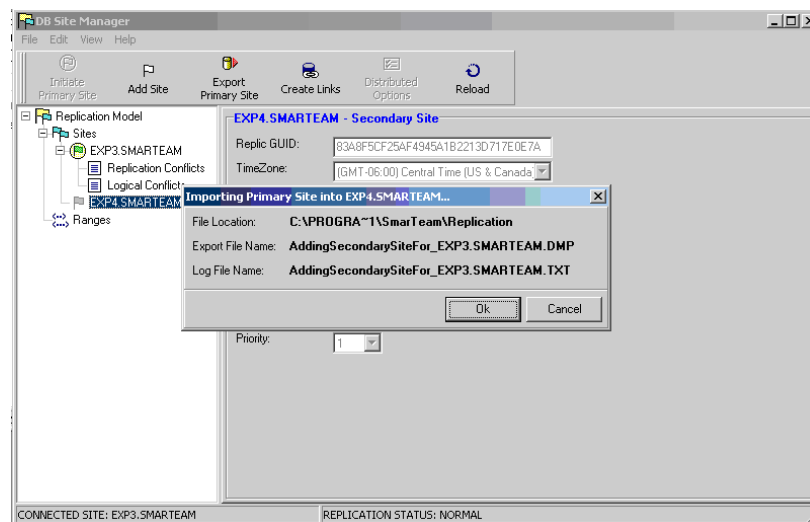
After data is exported from the Primary Site (see [Exporting a Primary Site](#)), it is imported to the Secondary Site.

To import data to the Secondary Site:

- 1 From the Administrator Client of the Secondary Site, open the DB Site Manager at the Primary Site.
- 2 Right-click on the target Secondary Site icon in the Replication Model tree, and select **Build Secondary Site**.



- From the Importing Primary Site window, click **Ok** to import the file that was exported from the Primary site.



Creating Links – Scheduling the Replication Process

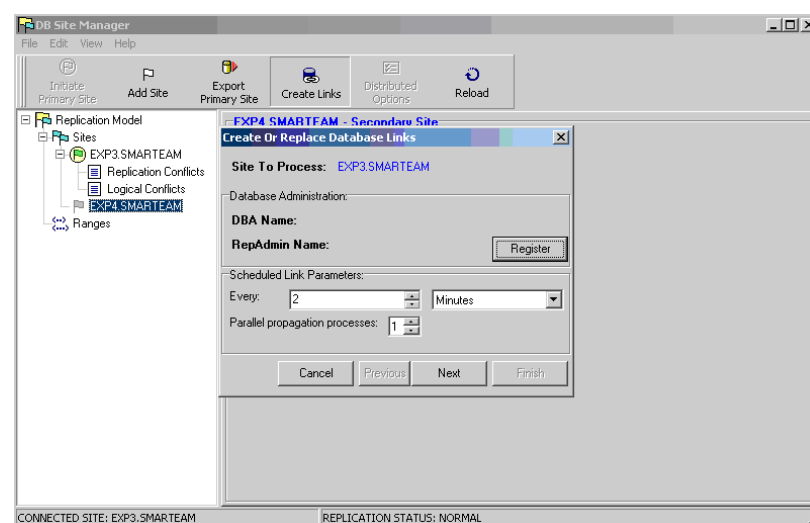
In this section, the CreateLinks Wizard, which loops through the Secondary Sites and creates or replaces previously defined links between the databases in the SmarTeam – Multi-site system, is activated. The purpose of these links is to coordinate and schedule the replication process; adding the Secondary Site is now handled.

To create links between databases in the SmarTeam – Multi-site system:

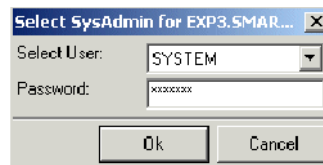
Note: It is assumed that the DB Site Manager is running on the Administrator Client of the Primary Site.

- From the DB Site Manager toolbar, click **Create Links**.

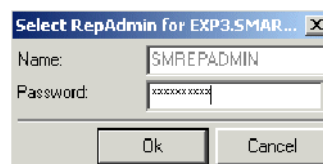
The Create or Replace Database Links dialog box for the Primary Site appears. The Primary site appears in the Site to Process title bar.



- 2 Click **Register**.
- 3 In the SelectSysAdmin registration dialog box for the site, type the username and password for the Site System Administrator, which also appears in [Registering the Replication Administrator](#).



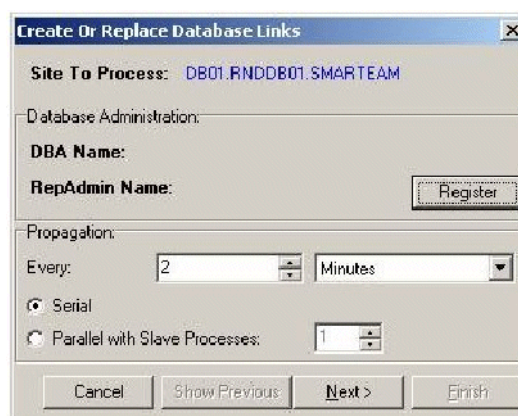
- 4 Click **Ok**.
- 5 In the SelectRepAdmin for [Database Name] dialog box, type the username and password for the Site Replication Administrator, which also appears in [Registering the Replication Administrator](#).



Note: If a Replication Administrator has not yet been created for the site, a SmarTeam warning message appears prompting you to define a Replication Administrator before proceeding.

- 6 Click **Ok**.

The Create or Replace Database Links dialog box now appears showing the Site to Process, the DBA Name, the RepAdminName in blue text.



- 7 In the Every field of the Propagation area, type the appropriate values for the replication interval. These values indicate the intervals at which other sites should replicate changes to the Site To Process.

For example, if the replication interval is 15 minutes, all sites replicate to the site that appears in the Site to Process title bar, every 15 minutes.

- 8 From the Propagation area, select a propagation type, such as Serial or Parallel with Slave Process.

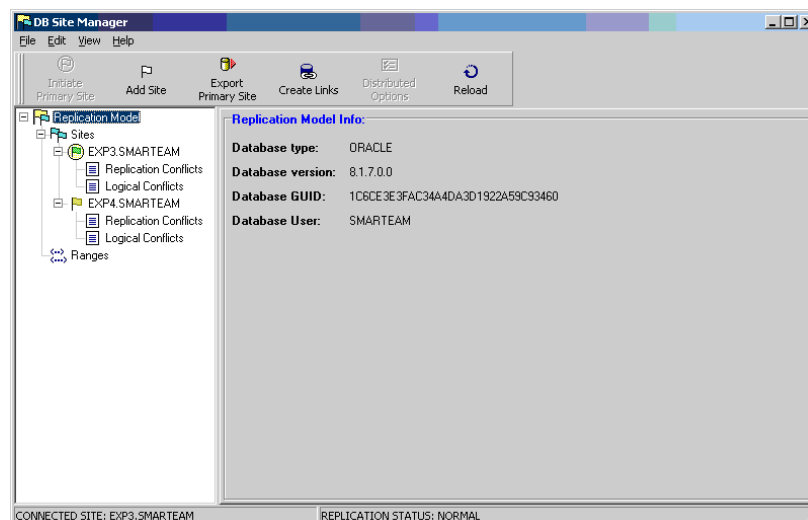
Note: Oracle highly recommends using the parallel propagation type with at least one slave process. (In multi-process systems, the following coarse formula for a number of slave processes can be used: Slave Processes = number of CPUs - 1.) This type of propagation provides much better performance than the serial propagation, which can cause a bottleneck in a busy system. However, Oracle reported Bug 4775068 – **Deferred transactions not applied in the correct order when using parallel propagation**, which indicates parallel propagation can cause errors, such as Ordering and No data found, even in a system consisting of two sites. This bug is fixed in following versions:

- Oracle 10.2 - 10.2.0.3
- Oracle 11g (Future version)

After evaluating the experiences of many customers using Multi-site, it is clear that this bug causes problems very rarely. Therefore, the potential risk of using parallel propagation with bug 4775068 can be much lower than the risk of overflowing queues when using the serial propagation option. In the Create or Replace Database Links dialog box, the serial propagation type is the default for Oracle servers with bug 4775068. If you select the parallel propagation type, the following message appears:

Note: It is not recommended that you use the parallel propagation on this Oracle server. Select **Yes** to use parallel propagation or **No** to use serial propagation.

- 9 Click **Next** to continue to the first Secondary Site.
- 10 Click **Register** to register a Replication and System Administrators for the Secondary site, (see [Registering the Replication Administrator](#)).
- 11 Click **OK** to save your entries and return to the Create or Replace Database Links dialog box.
- 12 Type additional Propagation Parameters as you did in [Step 7](#) – [Step 8](#).
- 13 Repeat the above steps for each Secondary Site displayed by the Wizard.
- 14 Click **Finish** to save your entries and return to the DB Site Manager window.



In the DB Site Manager window, the added Secondary Site name appears in the Replication Model tree. A green flag indicates that the site is a Primary Site. A yellow flag at the Secondary Site indicates that the database is accessible and is configured to participate in the replication environment.

Adding a Site as an Oracle Master Database

To enable replication for the Secondary Site, you need to define the Secondary Site as an Oracle Master Database (OMD).

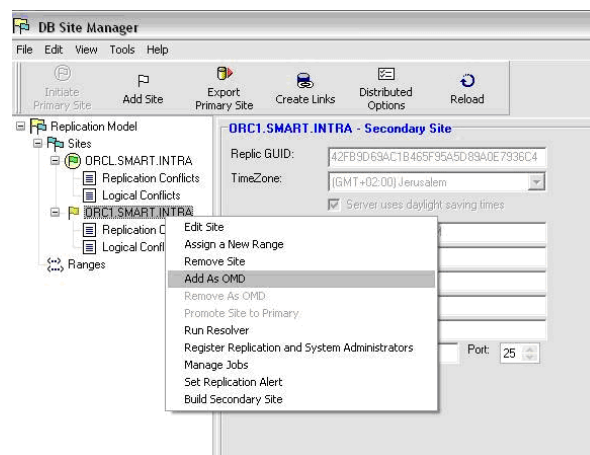
To monitor and troubleshoot the OMD process, see [Monitoring the Add to OMD Process](#).

To add a site as an OMD:

- 1 As a preliminary step, perform the procedure in [Recompiling Internal Oracle Objects](#).
- 2 From the Administrator Client at the Primary Site, run the DB Site Manager.
- 3 From the DB Site Manager, select and highlight the Secondary Site that you want to add as an OMD and right click.

A popup menu appears.

- 4 From the popup menu, select Add as OMD to add the selected site as an OMD.



Note: If you receive an error message regarding invalid objects, run the scripts described in [Recompiling Internal Oracle Objects](#) to clear the invalid objects and proceed to the next step.

A SmarTeam warning message appears, recommending you perform a backup of the Secondary Site (destination) database before continuing. Using Oracle export/import utilities is not considered an effective backup procedure. Use full cold backup instead.

- 5 Do one of the following:
 - Click **Yes** to save your entries and exit the DB Site Manager utility to perform a backup operation for the destination database. After performing the backup operation, return to this process.

OR

- Click **No** to continue without performing a backup operation. (In this case, it is assumed that a backup operation was already performed, as recommended.)

The Primary Site SelectSysAdmin registration window appears. See [Step 2](#).

- 6 From the SelectSysAdmin registration window, type the username and password for the Primary Site System Administrator, which appears in the [Registering the Replication Administrator](#).
- 7 Click **Ok**.
- 8 From the SelectRepAdmin for [Database Name] window, type the username and password for the Primary Site Replication Administrator, which appears in the [Registering the Replication Administrator](#).
- 9 Click **OK**.

Note: Add as OMD functions in a two-phase commit mode and may take considerable time to complete (from 20 minutes to eight hours), depending on your network bandwidth.

At the end of the process, a SmarTeam information window appears notifying you that the selected database was successfully added as an OMD to the DB Site Manager.

- 10 Click **Ok** to return to the DB Site Manager window.

In the DB Site Manager window, the Primary Site and Secondary Site you have defined appear in the Replication Model tree.

A green flag with a background appears next to the Primary Site, indicating that the site is connected and operating properly.

A green flag displays next to the Secondary Site, indicating that the site is a Secondary Site and that it is connected and operating properly.

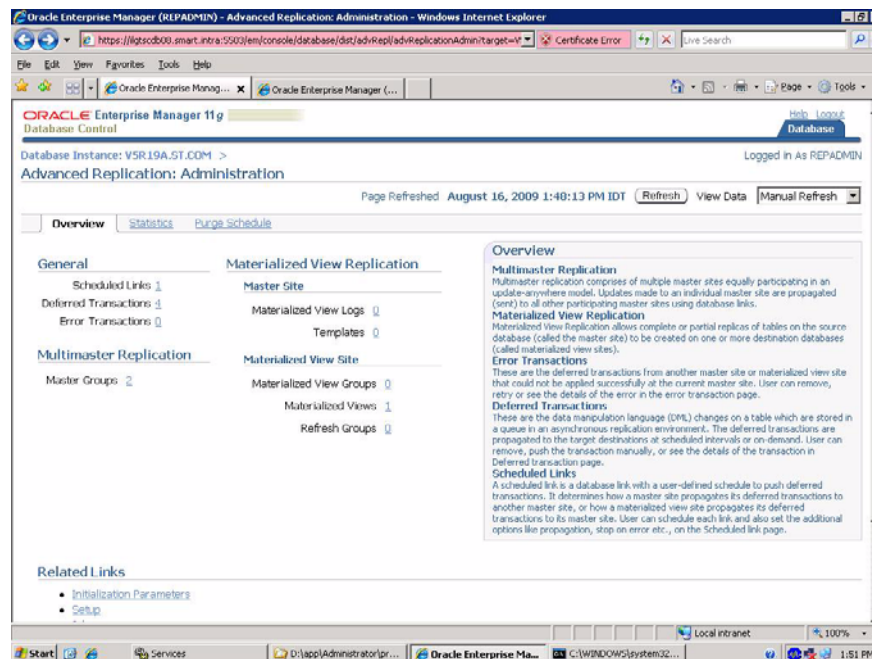
- 11 Repeat this procedure to add additional Secondary Sites.

Monitoring the Add to OMD Process

To monitor the Add as OMD process, check the rate of administration requests in the Oracle system. To observe the rate of administration requests, select the Secondary Site from the Replication Administrator Authority.

Monitoring with Oracle Enterprise Manager Database Control

- 1 Launch Oracle Enterprise Manager Database Control and log in as the **RepAdmin user**.
- 2 Navigate to Data Movement > Advanced Replication > Management.



- 3 Click on **Master Groups** to determine if the **Administrative Request** counter is steadily decreasing. If so, the operation is proceeding normally.

Note: The process has failed if the status assigned to any administrative requests is ERROR. For more information, see [Troubleshooting the Add as OMD Process](#). If required, restore from a backup and repeat the process or, contact SmarTeam support.

Troubleshooting the Add as OMD Process

Issue: Oracle Does Not Process Admin Requests

Indication

If the process is taking too long to execute, the most common cause is incorrect handling of administrative requests by Oracle (internal Oracle Replication API calls). This problem is detected through monitoring, as described in [Monitoring with Oracle Enterprise Manager Database Control](#).

When Oracle does not handle administrative requests, such as calls from the Replication APIs, properly the entire system may be hung. There is no automated solution for this problem in the current version SmarTeam – Multi-site.

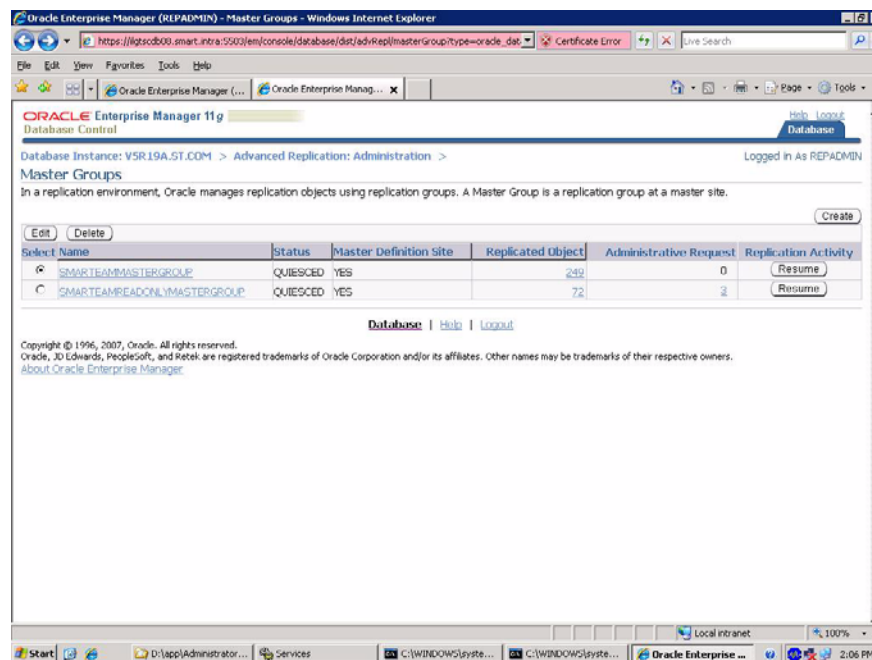
Resolution

To correct the problem of incorrect handling of administrative requests by Oracle, use the **Apply** action.

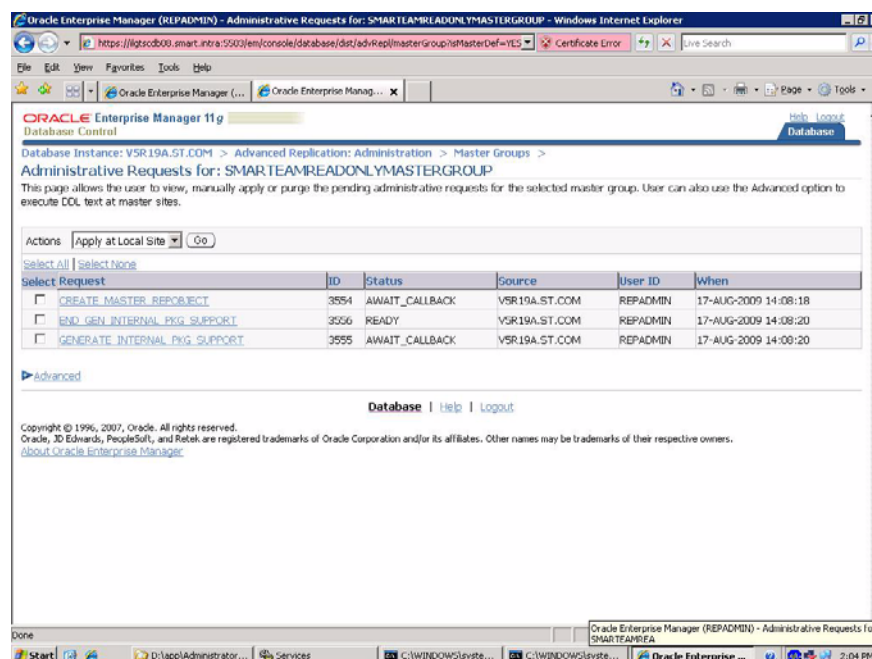
IMPORTANT! Before performing the **Apply** action, check whether all requests have **READY** status. If any requests have a status other than **READY**, wait until all requests have **READY** status.

To correct incorrect handling of administrative requests by Oracle using Apply action:

- 1 In Oracle Enterprise Manager Database Control, go to Data Movement > Advanced Replication > Management. Click on **Master Groups**.



- 2 For each master group that has administrative requests, click on the **Administrative Request** counter.



- 3 Only if all administrative requests are in **READY** status, click **Apply** action.

- 4 After all administrative requests are applied at the Secondary Site(s), check the Primary Site, (see [Monitoring the Add to OMD Process](#)).

If there is a single administrative request with **READY** status with no change in its state for 20–30 minutes, perform the **Apply Administrative Requests** on the Primary Site (see [Step 3](#)).

Issue: Failure of Add as OMD Due to Oracle Failure

Indication

An error message that indicates a critical Oracle problem that is causing the Add as OMD procedure to fail, such as a site that is down, network disruption, or Oracle internal errors.

Resolution

- If a site is down, or there are Oracle internal errors, restart the site.
- If there are networking problems, restore the normal networking.
- Last resolution effort: Re-launch DB Site Manager and repeat the Add as OMD operation.

DB Site Manager Features

Some of the features of DB Site Manager software that support Database Replication, include:

- [Object ID Allocation between Sites](#)
- [Site Ownership Transfer](#)

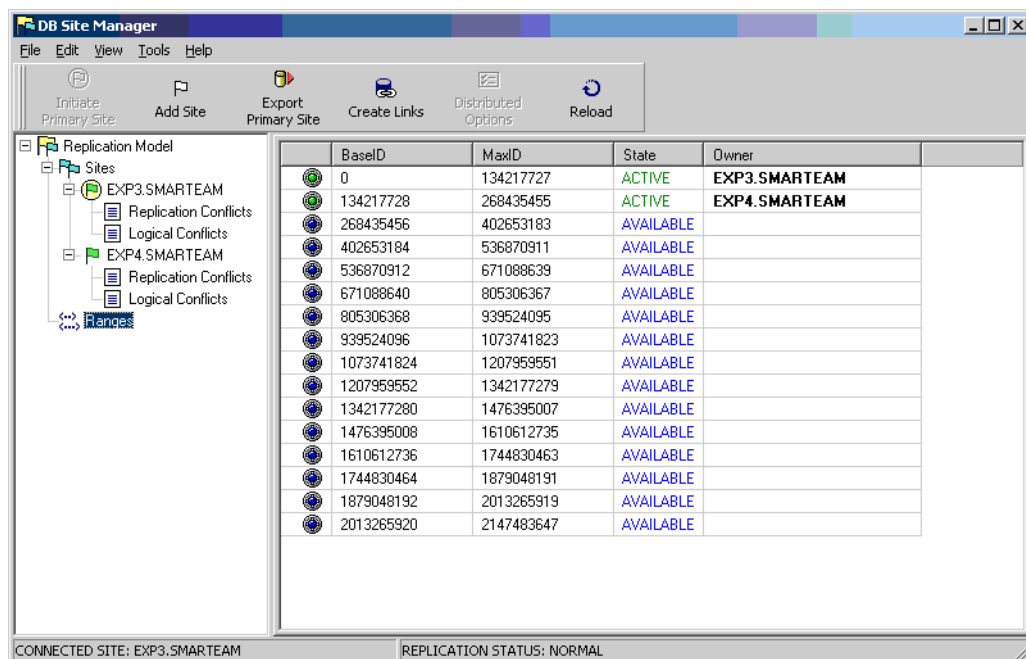
Object ID Allocation between Sites

From the DB Site Manager, you can view the allocation of Object Identifiers between Primary and Secondary sites.

To view Object ID Allocation between Sites:

- From the Replication Model tree, click **Ranges** to view a list of Object ID ranges used for a Primary Site and for each additional Secondary Site.

Also, a list of available ranges are displayed, which can be added to a configured site.



Site Ownership Transfer

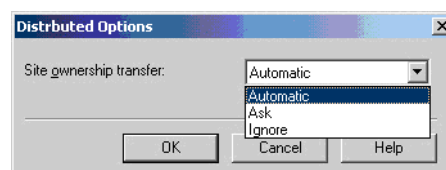
From the Distributed Options window of the DB Site Manager you can set the **Site ownership transfer** mode when performing lifecycle operations. This mode controls how ownership is transferred between users on different sites in a Multi-site system. See [Object Ownership – Preventing Parallel Changes](#).

Note: When updating ownership transfer by selecting **Ask** via a Profile Card, the behavior of internal objects, such as Users, and Specification Links, is not confirmed.

To set Site ownership transfer mode:

- 1 From the DB Manager toolbar, click **Distributed Options**.

The Distributed Options window appears.



- 2 Select one of the following options from the dropdown list:
 - Automatic: Enables automatic ownership transfer without being prompted
 - Ask: Asks the user to transfer ownership to him
 - Ignore: Ownership is not granted

Updating the Database through a Simulated System

Introduction

Using a simulated system for data model changes in the SmarTeam – Multi-site environment enables you to save time and minimize potential risk of network failure. The general concept of the following procedures is to position all SmarTeam – Multi-site system sites in the same LAN, thus improving overall performance.

Using the WAN for data model changes in the SmarTeam – Multi-site environment is a time-consuming procedure and is liable to halt due to network failures. The procedure requires constant communication between the Primary Site and Secondary Site and such as the overall time of the data model change can be significant.

Consequently, the following procedures are recommended and describe how to set up a simulated system to improve the performance of the data model change in a SmarTeam – Multi-site environment.

The Typical WAN Update

The SmarTeam – Multi-site systems are deployed over the distributed network. While this line is perfectly fit for regular data exchange between sites, it is hardly suitable for an operation requiring two-phase commit.

Updating through the Simulated System Process

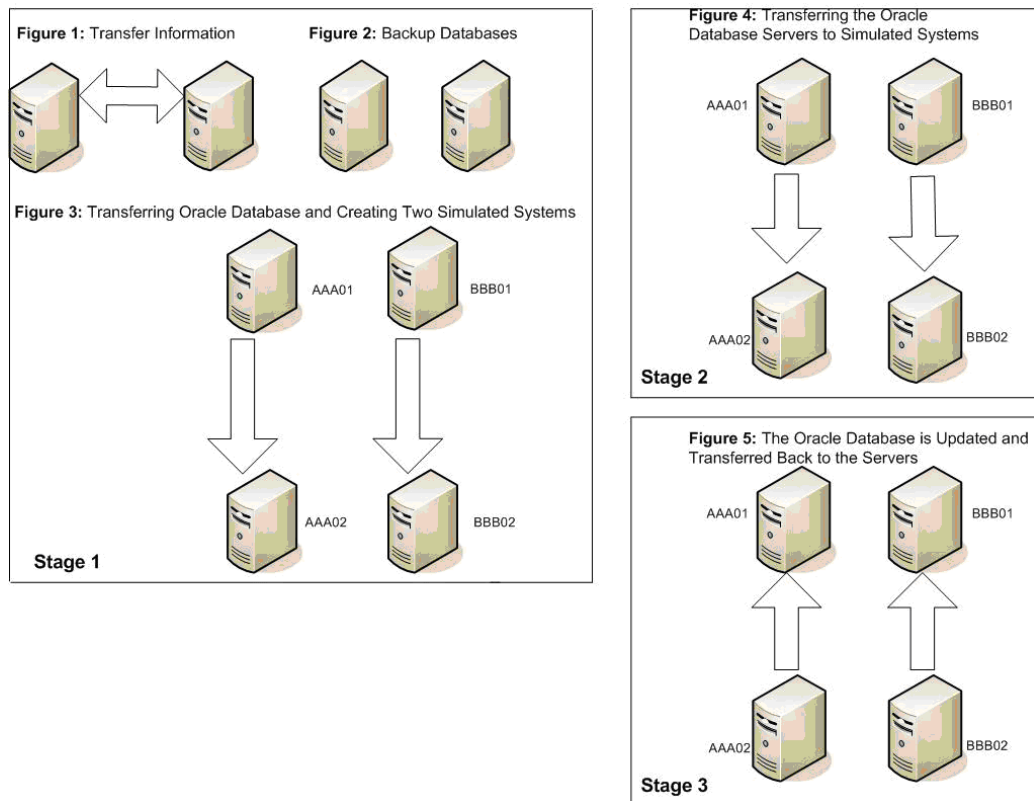
Updating the Oracle database in a SmarTeam – Multi-site simulated environment is a three-step process:

- 1 Similar Oracle database servers located in different locations are backed up. Each server then creates a simulated system.
- 2 The Oracle database is then transferred from the server to the simulated system and updated with any changes or software.
- 3 The simulated system then transfers the updated Oracle database back to the server.

General vs. Partial Process

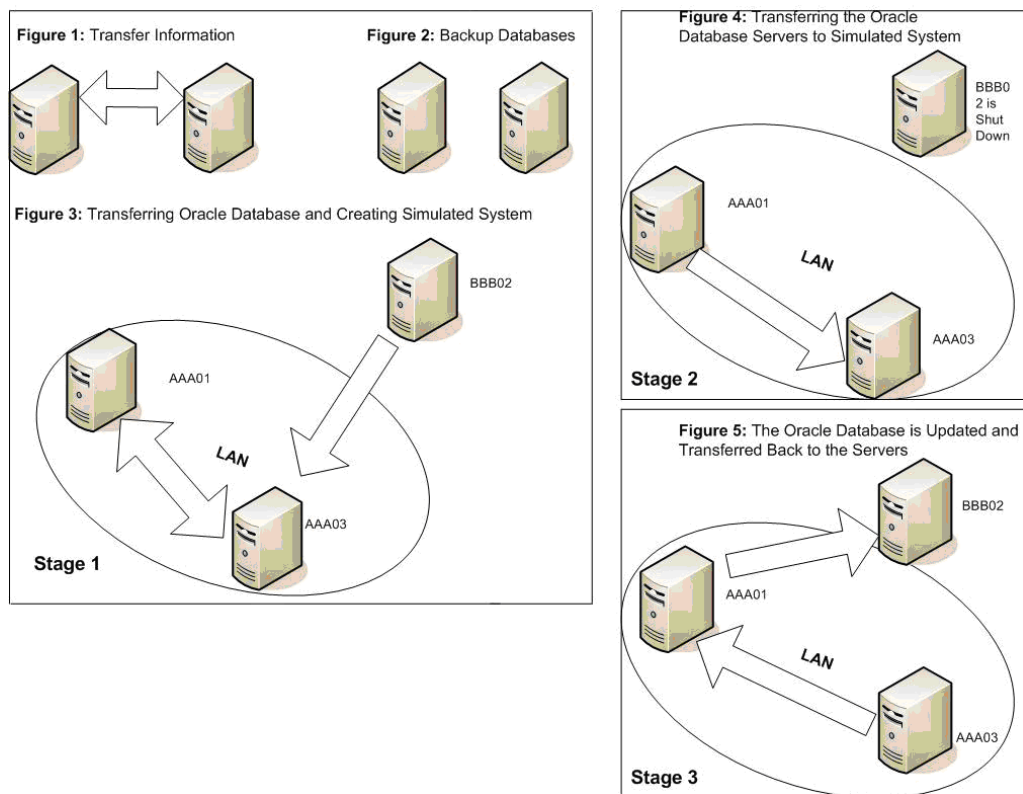
The SmarTeam – Multi-site Administration uses two different simulated systems to back up, update and restore Oracle databases and other software.

- The General process establishes a parallel simulated system for each individual Oracle database server that needs to be updated.



The General Process is divided into the following stages:

- 1 Two Oracle Database Servers located in different locations on a WAN, using similar databases, are backed up. Each server then creates a simulated system.
- 2 The Oracle Database is transferred from the servers to the simulated systems.
- 3 The Oracle Database is then updated and transferred back to the servers.
 - The Partial process establishes one parallel simulated system for updating the database.



The Partial Process is divided into the following stages:

- 1 The two Oracle Database Servers located in different locations on a WAN, using similar databases, are backed up. One server (BBB02) transfers its complete database to the first server (AAA01). The first server then creates a simulated system (AAA03).
- 2 The Oracle Database from the server (BBB02) is transferred to the simulated system (AAA03), which is in the same LAN as AAA01.
- 3 The Oracle Database is then updated and transferred back from the simulated system to the original server (BBB02).

Oracle Net Configuration

Oracle uses service names to identify remote connections. The details of these service names are contained in files that are distributed to the host in the network. When a service name is called it is recognized, and checked by the Oracle Net configuration, known as `tnsnames.ora`, which determines which parameters are used.

Configuration and Parameter Files

The following configuration and parameter files are used for recognition purposes in the Oracle database.

- `tnsnames.ora`
- `listener.ora`
- `sqlnet.ora`
- `init*.ora`

■ spfile*.ora

tnsname.ora Configuration File:

In the simulated system process SmarTeam uses the tnsnames configuration file, located at:
C:\oracle\product\10.2.0\client_1\NETWORK\ADMIN\tnsnames.ora.

The following Oracle format for the network configuration is an example of tnsnames.

```
tnsnames.ora Network Configuration File: C:\oracle\product\10.2.0\client_1\NETWORK\ADMIN\tnsnames.ora
Generated by Oracle configuration tools.

AA =
  (DESCRIPTION =
    (ADDRESS_LIST =
      (ADDRESS = (PROTOCOL = TCP)(HOST = AAA01)(PORT = 1521))
    )
    (CONNECT_DATA =
      (SERVICE_NAME = AAA)
    )
  )
)

BB =
  (DESCRIPTION =
    (ADDRESS_LIST =
      (ADDRESS = (PROTOCOL = TCP)(HOST = BBB02)(PORT = 1521))
    )
    (CONNECT_DATA =
      (SERVICE_NAME = BBB)
    )
  )
)
```

Listener Configuration File:

Following the specific Oracle format for the network configuration, the Listener.ora file needs to be configured.

The following is an example of the Oracle format for the Listener.ora configuration:

```
# listener.ora Network Configuration File: C:\oracle\product\10.2.0\db_1\network\admin\listener.ora
# Generated by Oracle configuration tools.

SID_LIST_LISTENER =
  (SID_LIST =
    (SID_DESC =
      (SID_NAME = PLSExtProc)
      (ORACLE_HOME = C:\oracle\product\10.2.0\db_1)
      (PROGRAM = extproc)
    )
    (SID_DESC =
      (SID_NAME = AAA)
      (ORACLE_HOME = C:\oracle\product\10.2.0\db_1)
    )
  )

LISTENER =
  (DESCRIPTION_LIST =
    (DESCRIPTION =
      (ADDRESS = (PROTOCOL = TCP)(HOST = AAA01)(PORT = 1521))
    )
  )
)
```

Admin Configuration File:

To ensure that the simulated Oracle database server communicates with the original Oracle database server, the following specific Oracle instance format, located at
oracle\ora10.2.0\NETWORK\admin, must be used:

```
Computer Name: AAA03
Oracle Home: D:\Oracle\Ora10.2.0
Instance Name: BBB
Instance Data files: D:\Oracle\Oradata\BBB\
Instance Admin: D:\Oracle\Admin\BBB\
Instance SPFILE: D:\Oracle\Ora10.2.0\database\spfileBBB.ora

INSNAMES & LISTENER.ORA & SQLNET.ORA: D:\Oracle\Ora10.2.0\Network\Admin

Starting up the instance (in command prompt): ORADIM -NEW -SID BBB -password man
```

Chapter 5: Backup and Recovery

General

This chapter describes the backup and recovery strategy for the SmarTeam – Multi-site system.

IMPORTANT! This document assumes an Oracle database administrator will be responsible for maintaining the system along with the IT group. Failure to use a professional Oracle database administrator may result in severe data losses and stoppages.

Failure and Recovery Scenarios

This section presents scenarios describing various types of failures that can occur in the SmarTeam – Multi-site system and the corresponding methods of recovery.

General Recovery Procedure for Database Failure

In case one of the sites crashes it can be recovered by a regular Oracle procedure.

Scheduled links at ALL sites should be checked and repaired.

IMPORTANT! Oracle export/import are utilities, providing so-called logical backup. An export/import procedure cannot be considered as a backup method in the replication environment.

Scenario 1: Site Database Instance Failure

Failure Description:

Database Site crashes (instance only).

Recovery Procedure Description:

- 1 The person responsible for system maintenance must be alerted immediately.
- 2 The instance should be restarted. If this is a cluster, the database should still be available and the failed instance should be started up.
- 3 Scheduled links between sites should be checked and fixed.

Scenario 2: Site Hardware Failure

Failure Description:

Database Site crashes (hardware failure, for example, hard disk failure).

Recovery Procedure Description:

- 1 The person responsible for the system maintenance must be alerted immediately.
- 2 The failed hardware should be replaced.
- 3 Database Recovery steps:
 - a Take the latest cold and hot backup.
 - b Take all relevant archive logs.
 - c Recover database to the point of failure.
 - d Start up the database.
- 4 Scheduled links between sites should be checked and fixed.

Scenario 3: Lost Site

Failure Description:

Database Site is totally lost along with all its backups.

Recovery Procedure Description:

- 1 The person responsible for the system maintenance must be alerted immediately.
- 2 From the DB Site Manager:
 - Right click the Lost Site.
 - Select Lost Site>Force Remove As OMD (Mark as Lost Site).
- 3 A new computer should be set up and installed as soon as possible:
 - New hardware should be delivered, assuming that an appropriate service agreement with the hardware supplier exists.
 - Software should be installed.
 - Oracle should be installed and database with the same name as the lost site should be created, all according to the SmarTeam – Multi-site documentation.
- 4 The entire system should be stopped for maintenance (all sites). It is possible that the system will be available in read-only mode.
- 5 The Lost Site should be added the same way a new site is added, via the DB Site Manager as follows:
 - Export Primary Site
 - Rebuild Lost Site:
 - Right click Lost Site
 - Select Lost Site > Rebuild Lost Site...
 - Create links

- Add a site as an OMD

Scenario 4: SmarTeam Service Failure

Failure Description:

One of the followings cases:

- 1 A SmarTeam service crashes (Software: Workflow Server, Vault Server, and Configuration Services).
- 2 A computer with SmarTeam services crashes.

Recovery Description:

There is absolutely no threat to any kind of data; the only loss is data availability. No data recovery is required. Case 1 requires re-starting services, while Case 2 may require setting up a new computer.

Scenario 5: Network Failure

Failure Description:

Network failure, completely isolating one of the sites.

The problem may become apparent only when communication is restored and the accumulated transactions are pushed back and forth. This may cause system overload, and serious performance degradation.

Recovery Procedure Description:

- 1 This kind of failure must be monitored. An automated monitoring system is recommended.
- 2 On network recovery, scheduled links should be checked and repaired. It is recommended to use the SmarTeam – Multi-site scheduled links auto-recovery feature. See [Recovery from a Downed Network](#).
- 3 It is necessary to control the process of Oracle databases pushing transactions. If any database is stuck, a database administrator may need to restart it using the **Shutdown Abort** command.

Data Integrity

This section describes the type of degradation of data integrity, including data loss or data inconsistency that can be expected in the SmarTeam – Multi-site system when either the database server or the vault storage crashes.

The database and files belong to the different sub-systems and cannot both be handled in the framework of the same UNITS-OF-WORK transactions. Consequently, the automatic recovery can operate differently on each type of data. It is possible that the metadata is saved in the database, while the vault file is lost. Alternatively, it is possible that the file is saved on the file storage while the database crashes and rolls back the latest transaction resulting in lost metadata. Nothing can be done to automatically recover from a loss of metadata, known as transactional failure; to recover, you need to repeat the roll-back database operations utilizing existing data.

Recommendations

Hardware

It is recommended to use network storage systems as a base for both database data files and vault data files.

Oracle Database Backup Procedure

The following is the backup procedure for Oracle databases in the SmarTeam – Multi-site environment.

- 1 Cold backup of all databases should be done simultaneously, stopping replication and pushing all remaining transactions forward.

In a simultaneous cold backup the databases are taken down in about the same time, after first performing the following steps:

- The replication between sites should be stopped – no transactions should be processed to any of the databases.
- All existing transactions in the replication transaction log should be pushed to their destinations.

This is important from the consistency point of view as well, as to avoid accumulation of transactions at different sites in the time of backup and their subsequent massive replication.

- 2 ARCHIVELOG mode at all sites.
- 3 Hot backup if necessary, similar to the single-database approach.
- 4 It is desirable to push transactions before taking cold backup.

Example of Simultaneous Backups:

A SmarTeam – Multi-site system is deployed in all possible parts of the world. The best time for the global backup is Sunday morning. The following table shows the site location and backup times for different sites:

Table 1:

Site Location	Local Backup Time
Europe	Sunday morning 9:00 AM
US East Coast	Sunday about 2:00 AM
US West Coast	Saturday 11:00 PM
Far East	Sunday evening

Chapter 6: Maintenance

Synchronizing Site Server Time

It is required that database servers in the SmarTeam – Multi-site system be time-synchronized with each other. This is done by synchronizing the servers with a standard international time, such as GMT. For example, a server in New York has a local time of 15:32, while a server in Los Angeles has a local time of 12:32.

You can synchronize your server with the international standard time, for example, by using the NET TIME command or through a time server system.

Run Resolver

There are circumstances in SmarTeam where an object is deleted without also deleting the link to this deleted object. Run Resolver, which is a function of the DB Site Manager, checks the system and removes these ghost links.

Database Conflicts Resolution

Database conflicts are resolved automatically without logging any entries.

Logical conflicts are logged in the Logical Conflict log area in the DB Site Manager utility. If you find entries in this log, you should resolve them as soon as possible. If you neglect to deal with them quickly enough, there may be difficulties in restoring old information. You can deal with such entries by locating the object and finding out what caused the conflict. You may decide to keep the current value, but if you choose to revert to the old value, you will be able to find all the necessary details in the log. Once you have decided on your course of action, update the object with the records, as applicable.

Promote Site to Primary

Any site can be taken offline for maintenance, upgrade or any other type of construction work. If this happens to the Primary Site, it is not possible to perform administration tasks on the Multi-site environment. This also occurs if the customer decides to close the branch where Primary Site is located.

To resolve all these issues, a selected site can become the Primary Site by going through a Promote to Primary procedure, which may take a long time to complete. This procedure initiates communication with the Primary Site, exchanging information required to demote the Primary and promote the Secondary Site to a primary status.

Therefore, the following occurs: the larger the data module, the more information it holds, the narrower the bandwidth, and the more time it requires to complete this procedure.

Since the primary database has to be an active participant in this scenario, it has to be maintained even more carefully than other sites.

For further information, see the Oracle Backup and Recovery Guide.

Remove as OMD

Remove as OMD is a DB Site Manager function, which removes the site from the Oracle replication process, so the site is no longer an Oracle Master database.

The database link to this site is removed in the Oracle Enterprise Manager.

In DB Site Manager the site appears with a yellow flag to indicate that the database is not replicated.

Remove Site

Remove Site is a DB Site Manager function, which changes ownership of objects to another site.

The site must first be removed as an Oracle Master Database, using the function Remove as OMD.

All the objects that belong to the removed site are assigned to another site, which you select. After the site is removed, the range is unavailable for future use.

Recovery from a Downed Network

A network failure can cause Oracle database replication to halt. After several attempts to restart the replication job, Oracle marks the replication job to the remote site as broken and will not try again to internally restart the replication.

The Replication Alert feature, provided by SmarTeam – Multi-site, periodically checks the Oracle state of replication jobs and marks any broken jobs it finds as normal. This causes Oracle to continue trying to perform the replication job. For this feature to operate, a JAVA Server must be installed on the Oracle server.

Replication Alert also enables the SmarTeam – Multi-site administrator to be notified about broken jobs. Repeated notifications about broken jobs indicate possible network failure. An administrator email address should be designated for each site to ensure receipt of these messages.

For the exact procedure, see [Replication Alert Dialog Box](#).

Chapter 7: Troubleshooting

Changing the Data Model Stage Failure

The data model change stage in the Multi-site environment requires uninterrupted communication between all sites. This communication is referred to as a two-phase commit, which guarantees that a transaction is valid at all sites by the time it commits or rolls back. For more information about the SmarTeam Data Model Designer see the SmarTeam – Editor Online Help and the SmarTeam Procedure for Upgrading to V5R20.

If during the first stage, there is a network failure, the only solution is to restore the entire Multi-site system from the backup and start the procedure again from the beginning.

Propagation Stage Failure

There are two advantages of Propagation:

- It is less vulnerable to network failure
- It is easily recoverable

The Propagation stage requires communication between both, the Secondary target site and the Primary site.

If during the Propagation process, the Secondary site fails, do the following:

- 1 Restore the Secondary site from the previous backup.
- 2 Update the SmarTeam internal data information by clicking **Tools**, and revert to needsgen to start the Propagation process again.

Complete Propagation Stage Failure

The Complete Propagation procedure in the Multi-site environment requires uninterrupted communication between all sites. This procedure is recoverable in the case of DataModelPropagator failure.

Note: Do not backup the system after the Propagation of all Secondary Sites and before the Complete Propagation stage starts.

Most failures at the Complete Propagation stage occur because of the following:

- A bad network connection may cause an Oracle two-phase commit procedure to abort
- The Oracle Replication procedure may cause database locks and even deadlocks, resulting in the abortion of the Complete Propagation procedure

In addition, the following non-Oracle related issues may cause Complete Propagation stage process failure:

- For some reason, one of the SmarTeam – Multi-site system sites fails
- Human error – one of the servers accidentally disconnected from the network

Recovery Procedure

In any case of failure of the Complete Propagation stage, perform the following recovery procedure:

- 1 Connect to all sites by Oracle Enterprise Manager Console as an Oracle Replication Administrator user and check for error entries in Administrative requests window of both Replication Master Groups.
- 2 If error entries are found on either Primary or Secondary Sites from the Administrative Requests window, delete all entries.
- 3 If there are no error entries on the Primary Site of the Administrative Requests window, but there are entries on the Secondary Site with the ready status, then click **Apply** at the Secondary Site.
- 4 Restart the Data Model Propagator and run Complete Propagation again. The environment is cleaned up and the procedure is restarted from the latest healthy point.

Note: You can observe the progress of the Clean Up procedure in a Data Model Propagator log file.

The last step in the recovery process is the Finish the Data Model Upgrade Procedure. For more information, see the SmarTeam Procedure for Upgrading to V5R20.

Multi-site and SmarTeam – Full-text Search Contention

When Multi-site and SmarTeam – Full-text Search (FTS) work together, one of the mechanisms may stop working, because they both share the same pool of Oracle database jobs. If the number of jobs used by FTS and Multi-site together exceeds the parameter `JOB_QUEUE_PROCESSES`, some of the jobs cease to work. The issue is resolved by increasing the value of `JOB_QUEUE_PROCESSES` to its maximum limit of 36.

You can estimate the number of jobs that can operate simultaneously on your system as follows:

Multi-site related jobs = $3 + i$ (where i is the number of sites in the Multi-site system)

FTS related jobs = 1 job per table involved

Chapter 8: Best Practice

This section provides best practice and recommendations based on experience and information gathered from customers who have been working on previous SmarTeam – Multi-site versions.

MultiSite WorkFlow Limitations

Because of the ownership policy and the need to synchronize between sites, certain limitations occur when working with SmarTeam – WorkFlow in a SmarTeam – Multi-site environment.

WorkFlow Server Required

Each site in the SmarTeam – Multi-site environment must have at least one FlowServer. Each site must ensure that the **Use SmartFlow Server** preference is set.

Changing a Flowchart at a Remote Site

A user working in the FlowChartDesigner at one site on a Flowchart that is created at another site does not have permission to perform any changes on the Flowchart unless ownership permission is specifically granted by the creator's site.

Flow Process Actions Performed only on Creator Site

The Flow Process actions:

- Changing the Flowchart for a Flow Process
- Attaching objects to the Flow Process at the Start Node
- Sending the Flow Process from the Start Node must be performed on the site that created the Flow Process

Ownership for Revision-Managed Objects

When a revision-managed object has a private revision (Checked Out or New) the following limitations occur:

- The object can only be attached to a Flow Process (at any Node) at the site that owns the object.
- When a Flow Server sends a Flow Process with an attached object to the End Node, the Flow Server may need to take ownership of the object but the Flow Server may be prevented from doing so due to the ownership policy.

Recommendation: Before sending a Flow Process with an attached revision-managed object to the End Node, verify that the object has no private revisions.

Minimizing Cross Site Effects

Creation and modification of data in SmarTeam – Editor results in Insert (new records) and Update type transactions in the database. These are the transaction types that must be replicated across sites.

The Scope of a Change

In some PDM implementations, users may check out a complete document or BOM tree (structure) so that only they have access to it, although they are planning on changing only a small portion of the tree.

Such a methodology results in redundant operations, decreased efficiency, and confusion to other team members who cannot get an accurate picture of the changes and their implications. This applies to a single site scenario, but the problems are compounded when working with distributed teams.

In the SmarTeam – Multi-site scenario, performance implications for redundant lifecycle operations are more critical. In addition, as sites are designated with ranges of internal IDs, they are consistently assigned to objects that are not applied, such as Check Out lifecycle operations that overwrite the previous revision. It is strongly recommended that lifecycle operations be performed on the actual objects that need to be modified.

Replication Intervals

In an asynchronous replication environment, the replication can be set to occur at intervals. Replicating data places a certain amount of overhead on the network. Network traffic implications are dependent on the number of transactions performed in the local and remote databases. Oracle uses minimal-communications technology by only sending changes. Therefore replication in most cases can be performed rather often. SmarTeam – Multi-site assumes replication intervals to be 2 minutes as a default (excellent communication), while 15-20 minutes is a normal variant. Setting replication intervals to hours or days may cause the accumulation of large transactional data volumes, so the replication process may take a long time, causing locks, deadlocks and finally data loss.

Site-Specific Projects

In a scenario where each site is working on its own set of data, replication is performed for the purpose of overall company centralization of data, Parts are reused and standard component definition is shared, it is sufficient and cost effective to replicate once a day, overnight when the network is used the least.

Cross-Site Projects

In cases when users from different sites need to work in collaboration as if they are sitting in the same room, and are often working on the same project-related data, replication may need to take place at shorter intervals. These intervals have to be defined and fine tuned according to the bandwidth in place, which is also used by other critical enterprise systems, whether replication is done asynchronously or synchronously, and the amount of data replicated.

One scenario is rather dangerous for the SmarTeam – Multi-site system. A large amount of imported objects generate megabytes of data to be replicated through a WAN, decreasing overall performance and increasing risk of failure. This is relevant for any kind of data bulk loaded into the SmarTeam database.

Defining Queries and Views

SmarTeam – Editor queries and views are site specific. Tables defining these actions are not replicated across sites. Consequently, usage of projections that are query-based (for Reference-to-Class fields) is not available. For extreme situations where this functionality is required, it can be handled through customization by SmarTeam consultants.

Using API

Part of the primary key of a given object is the site to which it belongs. Some API calls, such as `ISmObjectStore.RetrieveObjectByPrimaryIdentity`, try to identify an object by providing its primary key. If a written script omits the site from the primary key and two objects fit the rest of the criteria, in the case of COM API an exception is raised, while the procedural API generates an `ERR_DUP` error.

It is strongly recommended to follow the methodology of naming conventions described in [Understanding Sequences in SmarTeam – Multi-site](#) and to include the site ID on API-based scripts and utilities.

Database and Vault Replication

This section describes aspects relevant to database and vault replication.

Accessing Data

Due to the nature of asynchronous replication, it is possible to find a record in the database pointing to a file that cannot be accessed because file replication has not yet been carried out.

Depending on the frequency of replications and the extent of collaborative work performed within an organization, a linkage between the two replication types should be established.

Performing Vault Replication before database replication does not solve the described problem. Performing database replication before Vault Replication provides users with access to new files with new database entries. During the short period of time it takes for the Vault Replication to complete after database replication is performed, a new file may not be accessible.

Choosing a Vault Configuration during Login

In a vault-replicated environment, when you log in to the SmarTeam – Editor you need to choose the vault configuration that SmarTeam – Editor is to use. Select the vault configuration that is closest to your site.

Preferences

The following preference for Vault Replication is available:

- Copy the file from a remote vault to a local vault when the file does not exist in the local vault.

If you need a file in a remote site and the requested file is not located in the mirror vault of the remote site, then SmarTeam Vault Server copies the file from the remote site to the mirror vault at the local site. This preference is relevant only if the SmarTeam Vault Server on the local site has permission in the vault on the remote site.

Hooks

The following hooks for Vault Replication are available

- File Exists on Local Mirror

When SmarTeam – Editor looks for a local file, this script hook is called:

- Before Hook: Called before it checks if the local file is present
- After Hook: Called after it finds that the local file is not present

This hook can be used when the local Vault Server does not have permission to copy a file from the remote server and the preference described in [Preferences](#) does not apply. In that case, use the After Hook to copy the requested file.

- Saving RedLine

When you save a RedLine file, this hook is called. In the script attached to the hook you can copy the saved version of the RedLine file to all sites to ensure that a user working on another site has the latest version of the RedLine file available.

Distributing NLS Data to Sites

Each site can be configured to work in any of the supported languages. You have two options for distributing NLS data files to multiple sites:

- Copy NLS data files manually from Site A to Site B
- Set up a replication job that utilizes Multi-site's replication capabilities to replicate NLS data files to other sites