Dec 13th, 2005

ORACLE 10g Job Scheduler

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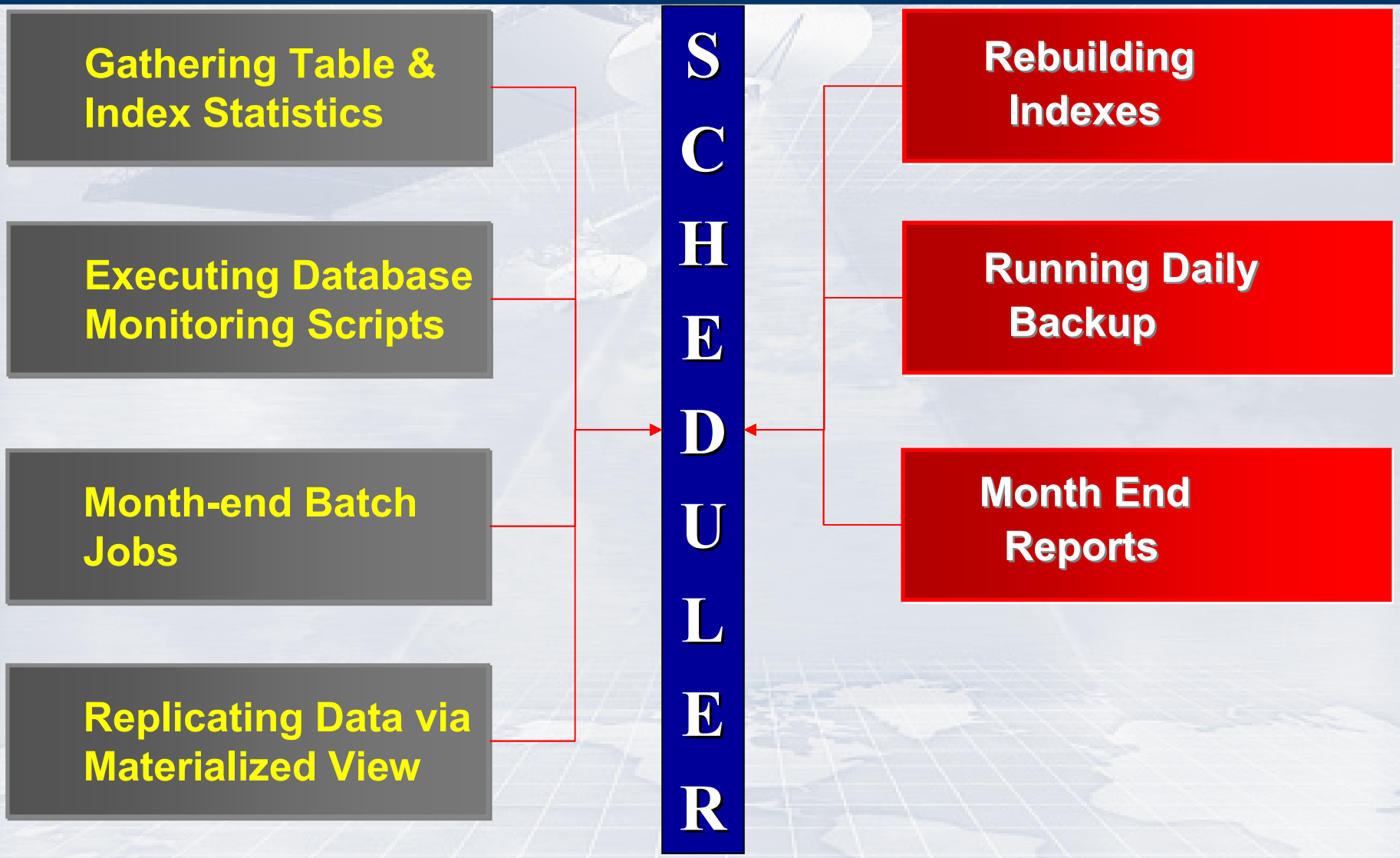
Principal Consultant

DATA SOFTECH INC.
Complete Database Solution Provider

AGENDA

- Why we need Scheduler
- Oracle Scheduler Solutions
- Benefit of Oracle 10g Scheduler
- Scheduler Components
- Scheduler Architecture
- Scheduler Privileges
- Questions and Answers

Why we need Scheduler



Available Oracle Scheduler Solutions

DBMS_JOB PL/SQL API

- Time-Based

DBMS_SCHEDULER PL/SQL API

- Time-Based
- Event-Based
- Dependency-Based
- Prioritize Jobs

Enterprise Mgr. GUI

Oracle 10g Scheduler Features

- Graphical User Interface using EM
- Minimize Development Time
- Create a library of reusable objects shared among users
- Platform independent
- Move from one system to another using expdp/impdp utility
- Maintain a Log of when the Job was last run
- Support for all Time Zone
- No Extra Licensing Cost
- Execute Jobs based on Time, Event or dependency
- Prioritize Jobs
- Allocate Resource to the Jobs

ORACLE Enterprise Manager 10g
Database Control

Database Instance: indydb

Home | Performance | Administration | Maintenance

The Administration tab displays links that allow you to administer database objects and initiate database operations inside an Oracle database. The Maintenance tab displays links the flow of data between or outside Oracle databases.

Database Administration

Storage
- Control Files
- Tablespaces
- Datafiles
- Rollback Segments
- Redo Log Groups
- Archive Logs

Database Configuration
- Memory Parameters
- Undo Management
- All Initialization Parameters

Database Scheduler
- Jobs
- Schedules
- Programs
- Job Classes
- Windows
- Window Groups
- Global Attributes

Statistics Management
- Manage Optimizer Statistics

Change Database
- Make Tablespace Locally Managed

Resource Manager
- Monitors
- Consumer Groups
- Plans

Policies
- Policy Library
- Policy Violations

Schema

Database Objects
- Tables
- Indexes
- Views
- Synonyms
- Sequences
- Database Links
- Directory Objects
- Reorganize Objects

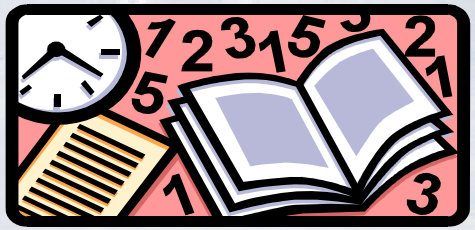
Programs
- Packages
- Package Bodies
- Procedures
- Functions
- Triggers
- Java Classes
- Java Sources

XML Database
- Configuration
- Resources
- Access Control Lists
- XML Schemas
- XMLType Tables
- XMLType Views

Scheduler Basic Components

PROGRAM

WHAT



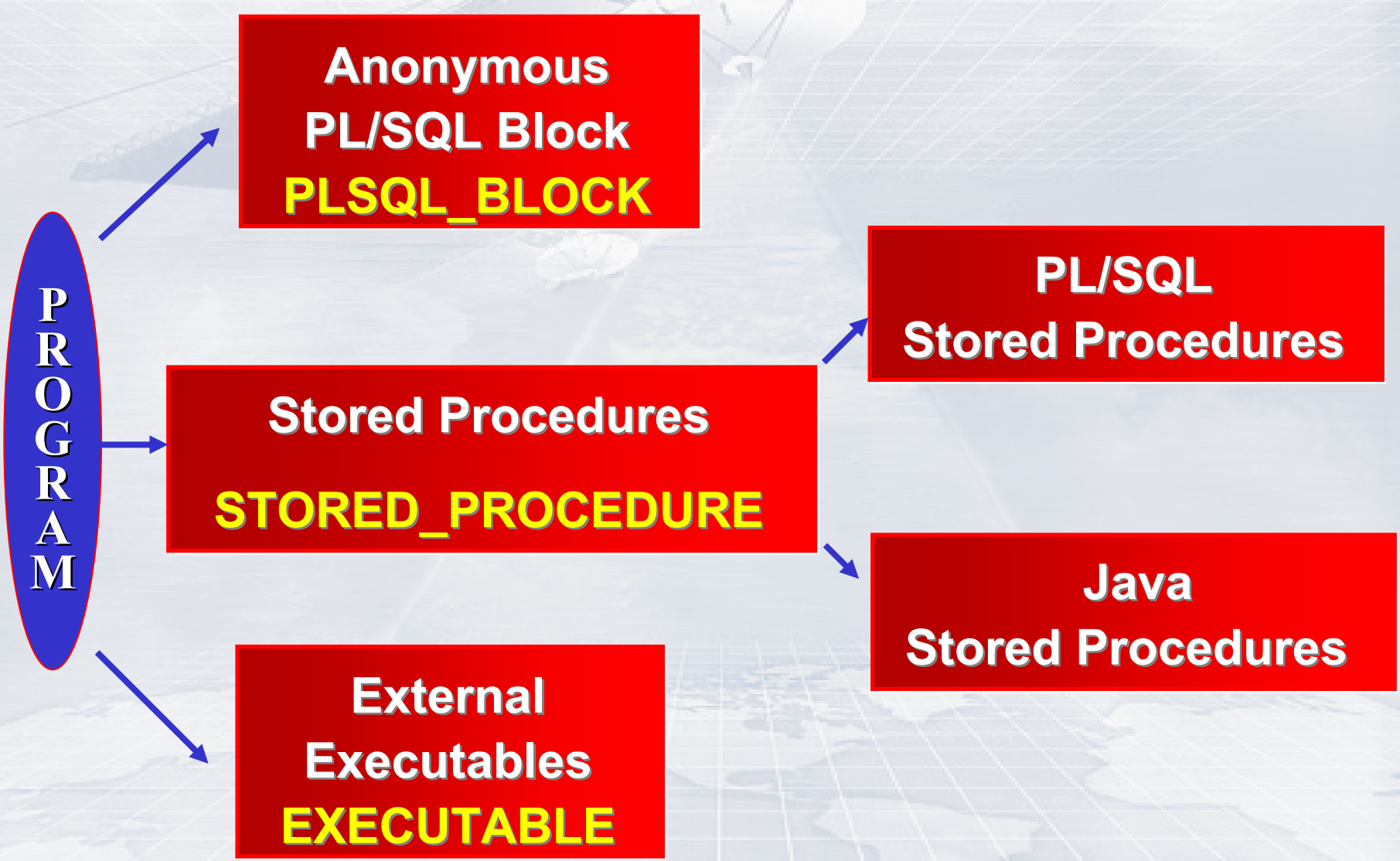
JOB

WHAT
WHEN

SCHEDULE

WHEN
HOW OFTEN

PROGRAM(1)



PROGRAM(2)

- It is metadata about WHAT will be run by the Scheduler.
  - ✓ Program Name
  - ✓ Type of Program
  - ✓ Program Argument – Optional
- Reusable database objects
- Shared with other users
- Program should be ENABLED to execute it. By Default it is created as DISABLED
- You need `CREATE JOB` privilege to create a program in your own schema.
- `CREATE ANY JOB` privilege can create a program in any schema.

ORACLE Enterprise Manager 10g
Database Control

Database Instance: indydb

Home | Performance | Administration | Maintenance

ORACLE Enterprise Manager 10g
Database Control

Setup | Preferences | Help | Logout

Database

Database Instance: indydb > Scheduler Programs

Logged in As SYS

Scheduler Programs

Following are the programs that define what are to be executed in the jobs.

Create

View | Edit | Delete | Create Like | Go

Select	Name	Schema	Enabled	Type	Description
◉	ABC	SYS		PLSQL_BLOCK	This is test Job
○	APPLY_PROGRAM	DMSYS	✓	STORED_PROCEDURE	Used for applying a mining model using JDM API
○	AUTO_SPACE_ADVISOR_PROG	SYS	✓	STORED_PROCEDURE	auto space advisor maintenance program
○	BUILD_PROGRAM	DMSYS	✓	STORED_PROCEDURE	Used for building a mining model using JDM API
○	EXPLAIN_PROGRAM	DMSYS	✓	STORED_PROCEDURE	Used for explain using JDM API
○	EXPORT_PROGRAM	DMSYS	✓	STORED_PROCEDURE	Used for exporting a mining model using JDM API
○	GATHER_STATS_PROG	SYS	✓	STORED_PROCEDURE	Oracle defined automatic optimizer statistics collection program
○	IMPORT_PROGRAM	DMSYS	✓	STORED_PROCEDURE	Used for importing a mining model using JDM API
○	PREDICT_PROGRAM	DMSYS	✓	STORED_PROCEDURE	Used for predict using JDM API
○	PURGE_LOG_PROG	SYS	✓	STORED_PROCEDURE	purge log program
○	SQL_APPLY_PROGRAM	DMSYS	✓	STORED_PROCEDURE	Used for applying a mining model using JDM API
○	TEST_PROGRAM	DMSYS	✓	STORED_PROCEDURE	Used for testing a mining model using JDM API
○	XFORM_PROGRAM	DMSYS	✓	STORED_PROCEDURE	Used for transformation using JDM API

View | Edit | Delete | Create Like | Go

Related Links

Chains
Jobs
Windows
Global Attributes
Schedules
Job Classes
Window Groups

Database | Setup | Preferences | Help | Logout

About Oracle Enterprise Manager 10g Database Control

ıbase. The Maintenance tab displays links

Database Scheduler

Jobs
Schedules
Programs
Job Classes
Windows
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Global Attributes

Resource Manager

Monitors
Consumer Groups
Plans

XML Database

Configuration
Resources
Access Control Lists
XML Schemas
XMLType Tables
XMLType Views

ORACLE Enterprise Manager 10g
Database Control

Setup Preferences Help Logout
Database

Database Instance: indydb > Scheduler Programs > Create Program

Logged in As SYS

Create Program

Show SQL Cancel OK

* Name LoadFileData

Schema HR

Enabled Yes No

Description Loading Data From Text File

Type EXECUTABLE

* Executable Name /export/home/oracle/Load_File_data.ksh

Include full path

```
BEGIN
DBMS_SCHEDULER.CREATE_PROGRAM(
program_name=>'HR.LoadFileData',
program_action=>'/export/home/oracle/Load_File_data.ksh',
program_type=>'EXECUTABLE',
number_of_arguments=>0,
comments=>'Loading Data From Text File',
enabled=>FALSE);
END;
```

Arguments

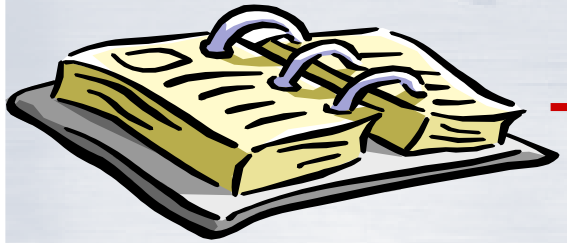
Select	Name	Order	Data Type	Default	IN/OUT

Add Another Row

Database | Setup | Preferences | Help | Logout

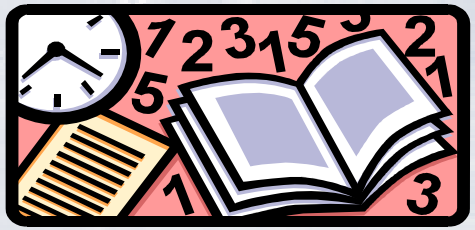
Show SQL Cancel OK

Scheduler Basic Components



PROGRAM

WHAT



JOB

WHAT
WHEN

SCHEDULE

WHEN
HOW OFTEN

SCHEDULE (1)

SCHEDULE

- EVENT Based
  - START TIME
  - END TIME
- DATE/TIME Based
  - One Time Job
    - Execute TIME
  - Repeat Job
    - START TIME
    - Repeat Intervals
    - END TIME

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SCHEDULE – Repeat Interval (1)

SCHEDULE REPEAT INTERVAL

- **PL/SQL Expression**
  - **Use PL/SQL Function e.g SYSDATE + 1**
- **Calendaring Expression**

SCHEDULE – Repeat Interval (2)

CALENDERING EXPRESSION

FREQUENCY

- YEARLY
- MONTHLY
- WEEKLY
- DAILY
- HOURLY
- MINUTELY
- SECONDLY

→

INTERVAL

[1 – 999]

→

SPECIFIERS

- BYMONTH
- BYWEEKNO
- BYYEARDAY
- BYDATE
- BYMONTHDAY
- BYDAY
- BYHOUR
- BYMINUTE
- BYSECOND
- BYSETPOS

SCHEDULE – Repeat Interval (3)

	PL/SQL EXPRESSION	CALENDERING EXPRESSION
START DATE	DATE when the JOB will be executed FIRST Time	DATE When the Schedule become VALID
NEXT RUN DATE	Not-FIXED and depend on START TIME	FIXED, Always RUN at the specified TIME

Calendering Expression - Examples

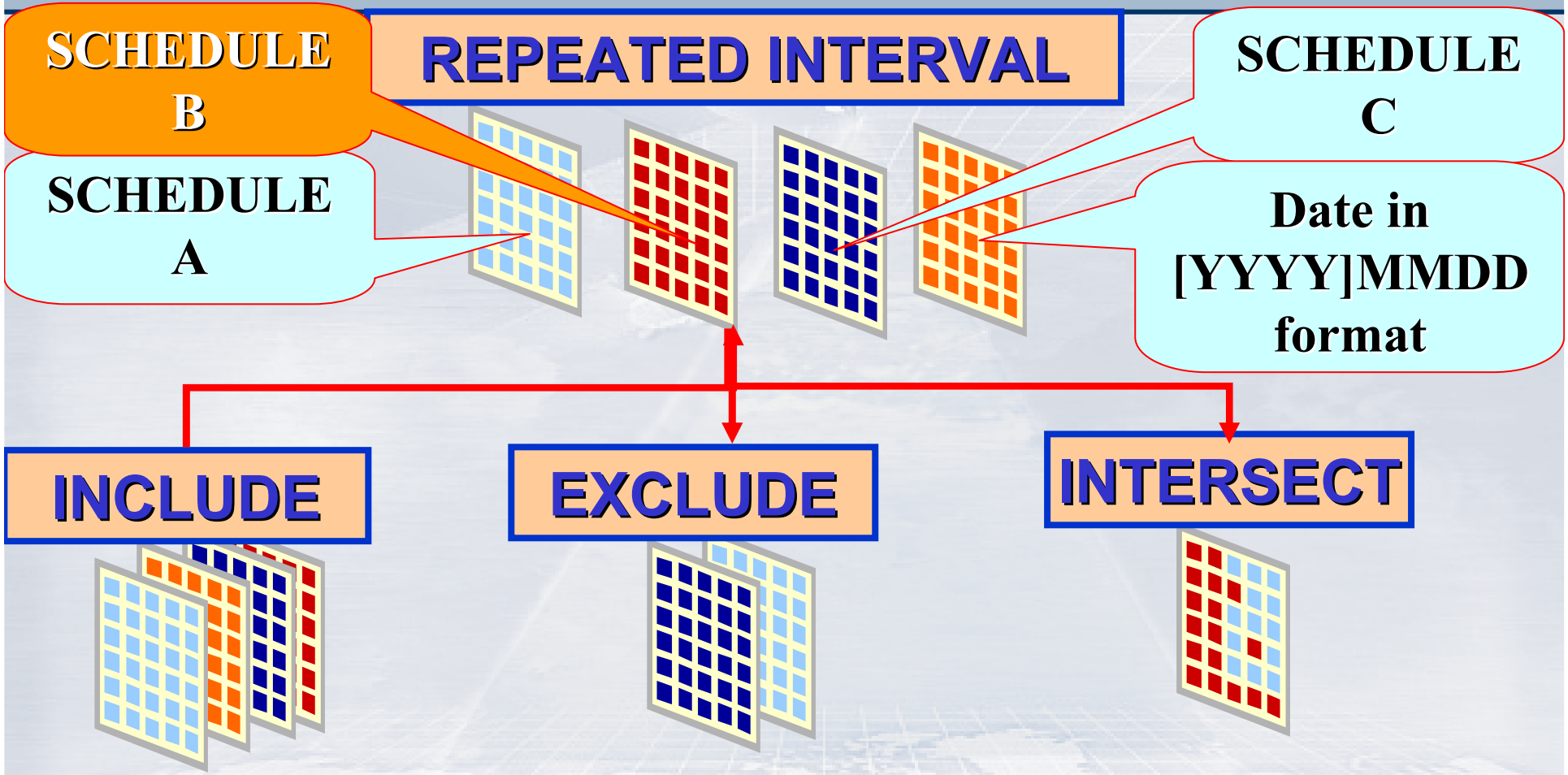
Repeat interval=> ‘FREQ=HOURLY;
INTERVAL=1;
BYHOUR=8;’

Repeat interval=> ‘FREQ=MONTHLY;
BYDAY=1MON;
BYHOUR=8;’

Repeat interval=> ‘FREQ=MONTHLY; BYDAY=SAT,SUN;
BYSETPOS=1;’

Repeat interval=> ‘FREQ=MONTHLY; interval=3;
BYDAY= MON,TUE,WED,THU,FRI
BYSETPOS=-1’

Complex Schedules



e.g Schedule A, 0101, 0507, 0209
Schedule A, Jan 01, May 7, Feb 9

No Year means Dates are included for every year

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Complex Schedules - INCLUDE

New Year Day

DBMS_SCHEDULER.CREATE_SCHEDULE('NYDay',

FREQ=MONTHLY; BYMONTH=JAN; BYMONTHDAY=1')

Memorial Day

DBMS_SCHEDULER.CREATE_SCHEDULE('MemDay',

FREQ=MONTHLY; BYMONTH=MAY; BYDAY=1MON')

Independence Day

DBMS_SCHEDULER.CREATE_SCHEDULE('IndDay',

FREQ=MONTHLY; BYMONTH=JUL; BYMONTHDAY=4')

ThanksGiving Day

…

DBMS_SCHEDULER.CREATE_SCHEDULE('Comp_Holidays',

'INCLUDE=NYDay, MemDay, IndDay, THKDay, XMasDay')

Complex Schedules - EXCLUDE

New Year Day

```
DBMS_SCHEDULER.CREATE_SCHEDULE( 'NYDay',
        FREQ=MONTHLY; BYMONTH=JAN; BYMONTHDAY=1')
```

Memorial Day

```
DBMS_SCHEDULER.CREATE_SCHEDULE( 'MemDay',
        FREQ=MONTHLY; BYMONTH=MAY; BYDAY=1MON')
```

```
DBMS_SCHEDULER.CREATE_SCHEDULE( 'Comp_Holidays',
        'INCLUDE=NYDay, MemDay, IndDay, THKDay, XMasDay')
```

Last Working Day of the Month

```
DBMS_SCHEDULER.CREATE_SCHEDULE( 'MyRpt',
        FREQ=MONTHLY;  BYDAY= MON, TUE, WED, THU, FRI;
        EXCLUDE=Comp_Holidays; BYSETPOS=-1')
```

Complex Schedules - INTERSECT

Common Holidays

DBMS_SCHEDULER.CREATE_SCHEDULE('CommDays',

FREQ=INTERSECT=Comp_Holidays, Bank_Holidays, School_Holidays, Fed_Holidays)

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Database Control

Database Instance: indydb

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ORACLE Enterprise Manager 10g
Database Control

Setup Preferences Help Logout
Database

Database Instance: indydb > Scheduler Schedules

Logged in As SYS

Scheduler Schedules

Page Refreshed **Nov 29, 2005 7:43:35 PM** Refresh

Create

Edit View Delete Create Like

Select	Name	Owner	Start Date	End Date	Description
⊙	DAILY_PURGE_SCHEDULE	SYS			

Related Links

Chains
Jobs
Windows
Global Attributes
Programs
Job Classes
Window Groups

Database | Setup | Preferences | Help | Logout

About Oracle Enterprise Manager 10g Database Control

ORACLE Enterprise Manager 10g
Database Control

Setup Preferences Help Logout

Database

Database Instance: indydb > Scheduler Schedules > Create Schedule

Create Schedule

Logged in As SYS

Show SQL Cancel OK

* Name DAILY_LOAD

* Owner SYS

Description This is test to run da

```
BEGIN
sys.dbms_scheduler.create_schedule(
repeat_interval => 'FREQ=DAILY;BYHOUR=8;BYMINUTE=40;BYSECOND=0',
start_date => systimestamp at time zone 'US/Eastern',
comments => 'This is test to run daily at 8:40 am EST',
schedule_name => '"SYS"."DAILY_LOAD"');
END;
```

Schedule

Time Zone US/Eastern

Schedule Type Standard
- Standard
- Event

Repeating

Repeat By D
- Do N
- By S
- By M
- By Hours
- By Days
- By Weeks
- By Months
- By Years

Interval (Days) 1

Time 8 40 00 AM PM

Available to Start

- Immediately
- Later

Date Nov 30, 2005
(example: Nov 30, 2005)

Not Available After

- No End Date
- Specified End Date

Date Nov 30, 2005
(example: Nov 30, 2005)

ORACLE Enterprise Manager 10g
Database Control

Setup Preferences Help Logout

Database

Database Instance: indydb > Scheduler Schedules > Create Schedule

Create Schedule

Logged in As SYS

Show SQL Cancel OK

* Name DAILY_LOAD

* Owner SYS

Description Test to Run Job

```
BEGIN
sys.dbms_scheduler.create_schedule(
repeat_interval => 'FREQ=WEEKLY;BYDAY=MON;BYHOUR=8;BYMINUTE=40;BYSECOND=0',
start_date => systimestamp at time zone 'US/Eastern',
comments => 'Test to Run Job Weekly on Monday at 8:40 am EST',
schedule_name => '"SYS"."DAILY_LOAD"');
END;
```

Schedule

Time Zone US/Eastern

Schedule Type Standard

Repeating

Repeat By Wee

Interval (Weeks) 1

Days of Week ☑ Monday ☐ Tuesday ☐ Wednesday ☐ Thursday ☐ Friday ☐ Saturday ☐ Sunday

Time 8 40 00 ◉ AM ○ PM

Available to Start

◉ Immediately
○ Later

Date Nov 30, 2005
(example: Nov 30, 2005)

Not Available After

◉ No End Date
○ Specified End Date

Date Nov 30, 2005
(example: Nov 30, 2005)

ORACLE Enterprise Manager 10g
Database Control

Setup Preferences Help Logout

Database

Database Instance: indydb > Scheduler Schedules > Create Schedule

Create Schedule

Logged in As SYS

Show SQL Cancel OK

```
BEGIN
sys.dbms_scheduler.create_schedule(
repeat_interval => 'FREQ=MONTHLY;BYMONTHDAY=-1;BYHOUR=8;BYMINUTE=40;BYSECOND=0',
start_date => systimestamp at time zone 'US/Eastern',
comments => 'Test to Run Job on Last day of Month at 8:40 am EST',
schedule_name => '"SYS"."DAILY_LOAD"');
END;
```

* Name DAILY_LOAD
* Owner SYS
Description Test to Run

Schedule

Time Zone US/Eastern
Schedule Type Standard

Repeating

Repeat By Months
Interval (Months) 1
Days of Month

1 8 15 22 23 24 25 26 27 28 29 30 31 LAST

TIP In months with no 29th, 30th, or 31st of the month, those dates are treated as LAST

Time 8 40 00 AM PM

Available to Start

Immediately
Later
Date Nov 30, 2005
(example: Nov 30, 2005)

Not Available After

No End Date
Specified End Date
Date Nov 30, 2005
(example: Nov 30, 2005)

ORACLE Enterprise Manager 10g
Database Control

Setup Preferences Help Logout

Database

Database Instance: indydb > Scheduler Schedules > Create Schedule

Create Schedule

Logged in As SYS

Show SQL Cancel OK

* Name DAILY_LOAD

* Owner SYS

Description Test to Run Jo

Schedule

Time Zone US/Eastern

Schedule Type Standard

Repeating

Repeat By Years

Interval (Years) 1

Days of the Year

Month		
January		
February	LAST	
Select a month		

TIP If LAST is specified for the month of February, this will be treated as the 29th in leap years and 28th otherwise

Time 8 40 00 AM PM

Available to Start

Immediately

Later

Date Nov 30, 2005

(example: Nov 30, 2005)

Not Available After

No End Date

Specified End Date

Date Nov 30, 2005

(example: Nov 30, 2005)

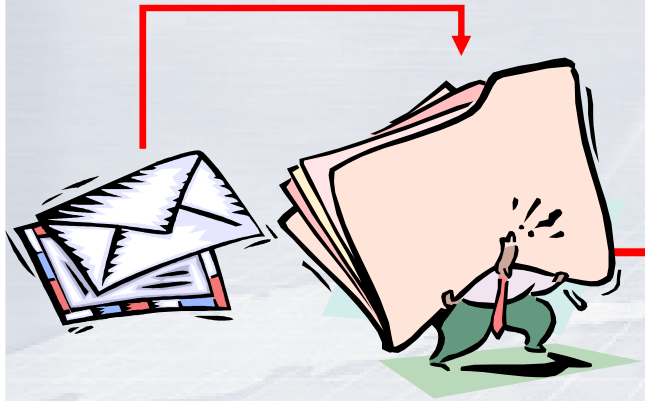
```
BEGIN
sys.dbms_scheduler.create_schedule(
repeat_interval => 'FREQ=YEARLY;BYYEARDAY=1,-307;BYHOUR=8;BYMINUTE=40;BYSECOND=0',
start_date => systimestamp at time zone 'US/Eastern',
comments => 'Test to Run Job on Jan1 and Feb Last day at 8:40 am EST',
schedule_name => '"SYS"."DAILY_LOAD"');
END;
```

Event-Based Scheduling

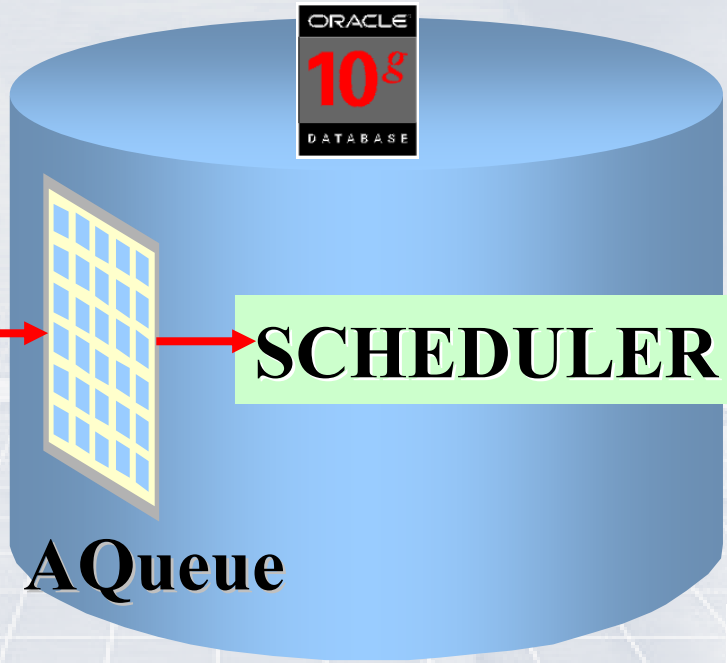
User or Application Generated Events

Scheduler Generated Events

Your Application Can Raise Events to Notify the Scheduler to start a Job



Event Raised



AQueue

SCHEDULER

JOB

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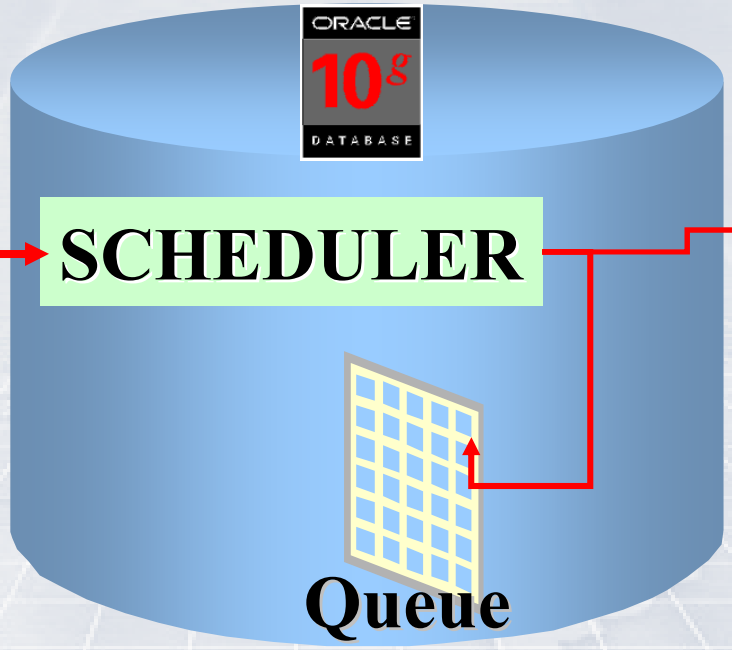
Event-Based Scheduling

User or Application Generated Events

Scheduler Generated Events

Scheduler Raise Events to notify the Application about the change in State of Job in `SYS.SCHEDULER$_EVENT_QUEUE`

JOB



Job or App

Scheduler Generated Events

- Scheduler Raise the events by enqueuing them into default event queue SYS.SCHEDULER$_EVENT_QUEUE
- Use DBMS_AQ.DEQUEUE to dequeue the message
- By Default, Scheduler automatically expire/delete all events raised in SYS.SCHEDULER$_EVENT_QUEUE every 24 Hours

Events Raised by Scheduler

- JOB_START
- JOB_STOPPED
- JOB_SUCCEEDED
- JOB_COMPLETED
- JOB_BROKEN
- JOB_FAILED
- JOB_OVER_MAX_DUR
- JOB_SCH_LIM_REACHED

ORACLE Enterprise Manager 10g
Database Control

Setup Preferences Help Logout
Database

Database Instance: indydb > Scheduler Schedules > Create Schedule

Logged in As SYS

Create Schedule

Show SQL Cancel OK

* Name USER_EVENT_BASED
* Owner SYS
Description Demo for User Generated Ev

```
BEGIN
sys.dbms_scheduler.create_event_schedule(
event_condition => 'tab.user_data.event_name =''User_generated_event1''',
queue_spec => 'INDY.EVENT_QUEUE',
start_date => systimestamp at time zone 'US/Eastern',
comments => 'Demo for User Generated Event Based schedule',
schedule_name => '"SYS"."USER_EVENT_BASED"');
END;
```

Schedule

Time Zone US/Eastern

Schedule Type Event

Event Parameters

* Queue Name INDY.EVENT_QUEUE Change Queue
* Agent Name
* Condition

tab.user_data.event_name ='User_generated_event1'

Available to Start

Immediately
Later

Date Dec 1, 2005
(example: Dec 1, 2005)

Time 2 20 00 AM P

Not Available After

No End Date
Specified End Date

Date Dec 1, 2005

Search and Select: Queue

Cancel Select

Search

Search for Queue Go

	SYS.AQ_EVENT_TABLE_Q
	SYS.AQ_SRVNTFN_TABLE_Q
	SYSTEM.DEF$_AQCALL
	SYSTEM.DEF$_AQERROR
	INDY.EVENT_QUEUE
	SYSMAN.MGMT_NOTIFY_Q
	IX.ORDERS_QUEUE
	SYS.SCHEDULER$_EVENT_QUEUE
	SYS.SCHEDULER$_JOBQ
	IX.STREAMS_QUEUE
	SYS.SYS$SERVICE_METRICS
	WMSYS.WM$EVENT_QUEUE

Cancel Select

ORACLE Enterprise Manager 10g
Database Control

Setup Preferences Help Logout
Database

Database Instance: indydb > Scheduler Schedules

Logged in As SYS

Confirmation

Schedule INDY.USER_EVENT_BASED has been created successfully

Scheduler Schedules

Page Refreshed **Dec 1, 2005 2:39:27 PM** Refresh

Create

Edit View Delete Create Like

Select	Name	Owner	Start Date	End Date	Description
◉	DAILY_PURGE_SCHEDULE	SYS			
○	USER_EVENT_BASED	INDY	Dec 1, 2005 2:39:26 PM -05:00		Demo for User Generated Event Based schedule

Related Links

Chains
Jobs
Windows
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Job Classes
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Database | Setup | Preferences | Help | Logout

About Oracle Enterprise Manager 10g Database Control

ORACLE Enterprise Manager 10g
Database Control

Setup Preferences Help Logout
Database

Database Instance: indydb > Scheduler Jobs > Create Job

Logged in As SYS

Create Job

Show SQL Cancel OK

General | Schedule Options

* Name USER_GENERATED_EVENT_BASED

* Owner SYS

Enabled Yes No

Description This is Demo for User Eve

Logging Level Log job runs only (RUNS)
Specify logging requirements for the job

Job Class DEFAULT_JOB_CLASS

Auto Drop FALSE
Specify whether the job should be droppe

Restartable FALSE
Specify whether the job can be restarted

```
BEGIN
sys.dbms_scheduler.create_job(
job_name => '"SYS"."USER_GENERATED_EVENT_BASED_JOB"',
job_type => 'EXECUTABLE',
job_action => '/export/home/oracle/JOB/load_data.sh',
start_date => systimestamp at time zone 'US/Eastern',
job_class => 'DEFAULT_JOB_CLASS',
comments => 'This is Demo for User Event Based Job',
auto_drop => FALSE,
enabled => TRUE);
END;
```

Command

Select the command type for the job, then enter the command requirements.

Command Type **Executable** Change Command Type

Executable Name /export/home/oracle/JOB/load_data.sh
Include full path

Arguments

Provide the argument values of the job.

Select	Order	Value
	No item found.	

Add Another Row

General | Schedule Options

ORACLE Enterprise Manager 10g
Database Control

Database Instance: indydb > Scheduler Jobs > Create Job Logged in As SYS

Create Job

Show SQL Cancel OK

General | Schedule Options

* Name: Schedule_based_event_job
* Owner: indy
Enabled: Yes No
Description: This is Schedule Event Demo
Logging Level: Log job runs only (RUNS)
Specify logging requirements for the job
Job Class: DEFAULT_JOB_CLASS
Auto Drop: FALSE
Specify whether the job should be dropped afte
Restartable: FALSE
Specify whether the job can be restarted manu

```
BEGIN
sys.dbms_scheduler.create_job(
job_name => '"INDY"."SCHEDULE_BASED_EVENT_JOB"',
job_type => 'PLSQL_BLOCK',
job_action => 'begin
   Null;
end;',
repeat_interval => 'FREQ=MINUTELY',
start_date => systimestamp at time zone 'US/Eastern',
job_class => 'DEFAULT_JOB_CLASS',
comments => 'This is Schedule Event Demo',
auto_drop => FALSE,
enabled => TRUE);
END;
```

Command

Select the command type for the job, then enter the command requirements.

Command Type **PL/SQL Block** Change Command Type

PL/SQL

```
begin
   Null;
end;
```

General | Schedule Options

Database | Setup | Preferences | Help | Logout

ORACLE Enterprise Manager 10g
Database Control

Setup Preferences Help

Database Instance: indydb > Scheduler Jobs

Logged in

Confirmation

Job INDY.SCHEDULE_BASED_EVENT_JOB has been created successfully

Scheduler Jobs

Page Refreshed Dec 1, 2005 3:05:26 PM

All | Running | History

View Job Definition | Edit Job Definition | Delete | Run Now | Create

Select	Name	Owner	Scheduled Date	Last Run Date	Last Run Status	Enabled	Job Class
◉	AUTO_SPACE_ADVISOR_JOB	SYS	MAINTENANCE_WINDOW_GROUP	Nov 30, 2005 10:00:02 PM -05:00	SCHEDULED	✓	AUTO_TASKS_JOB_CLASS
○	USER_GENERATED_EVENT_BASED_JOB	SYS	N/A	Dec 1, 2005 2:53:00 PM -05:00	FAILED		DEFAULT_JOB_CLASS
○	PURGE_LOG	SYS	Dec 2, 2005 3:00:00 AM -08:00	Dec 1, 2005 3:00:00 AM -08:00	SCHEDULED	✓	DEFAULT_JOB_CLASS
○	SCHEDULE_BASED_EVENT_JOB	INDY	Dec 1, 2005 3:06:24 PM -05:00	Dec 1, 2005 3:05:25 PM -05:00	SCHEDULED	✓	DEFAULT_JOB_CLASS
○	USER_GENERATED_EVENT_BASED_JOB	INDY		Dec 1, 2005 2:54:13 PM -05:00	SCHEDULED	✓	DEFAULT_JOB_CLASS
○	HIRE						LASS

All | Running | History

Related Links

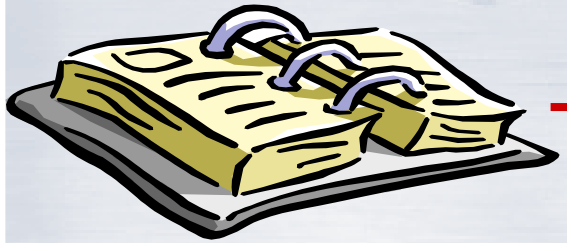
Chains
Programs
Windows

```
begin
DBMS_SCHEDULER.set_attribute(
    name      => 'SCHEDULE_BASED_EVENT_JOB',
    attribute => 'raise_events',
    value     => DBMS_SCHEDULER.job_succeeded);
END;
/
```

Events Raised by Scheduler

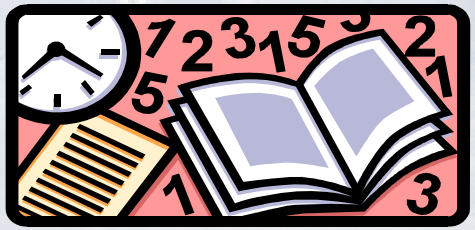
- JOB_START
- JOB_STOPPED
- JOB_SUCCEEDED
- JOB_COMPLETED
- JOB_BROKEN
- JOB_FAILED
- JOB_OVER_MAX_DUR
- JOB_SCH_LIM_REACHED

Scheduler Basic Components



PROGRAM

WHAT



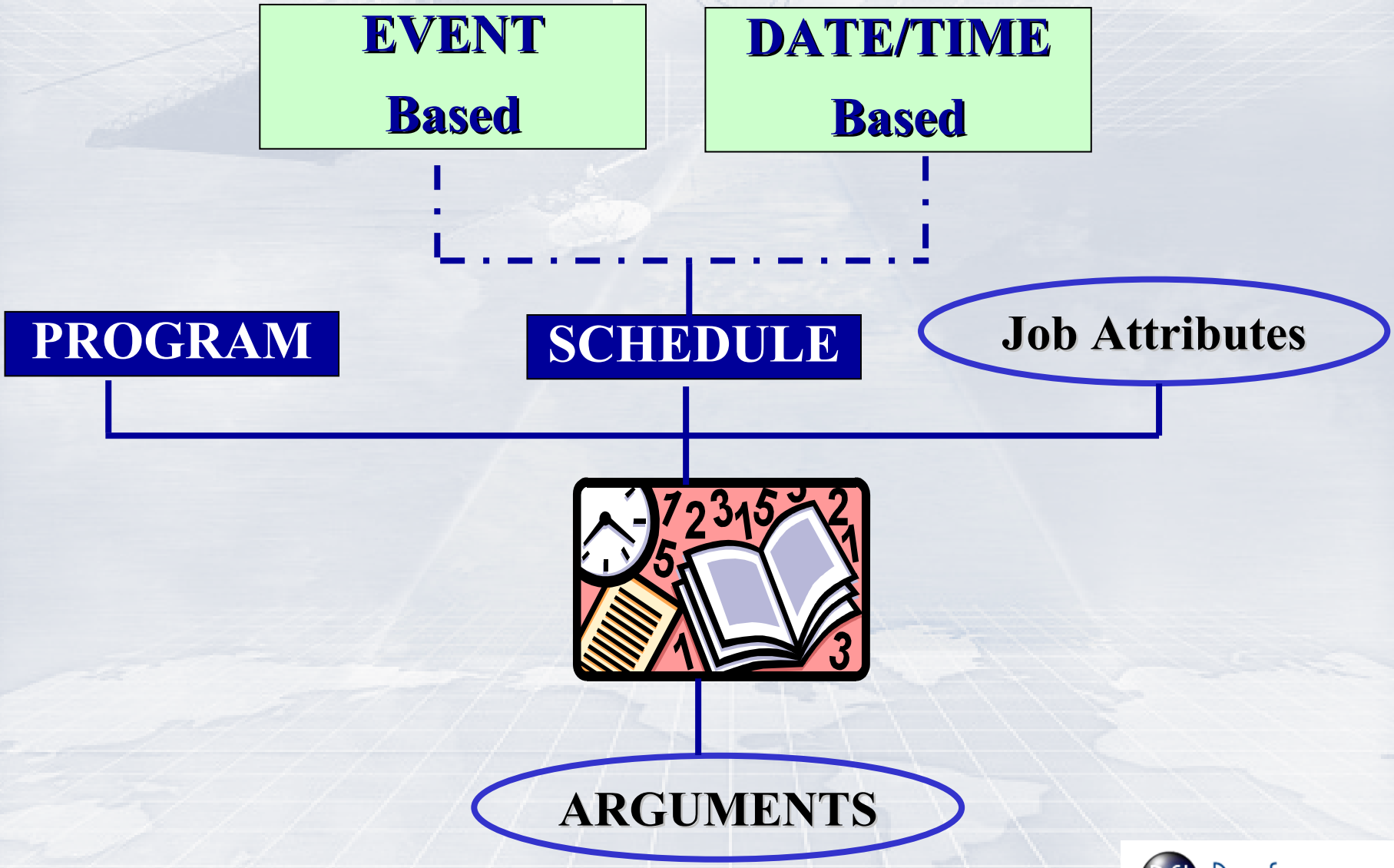
JOB

WHAT
WHEN

SCHEDULE

WHEN
HOW OFTEN

JOB(1)



Creating JOB(2)

- Job is a combination of Program and Scheduling data
- Job can be Created by any of the following methods :
  - ✓ Using Saved PROGRAM and Saved SCHEDULE
  - ✓ Using Saved PROGRAM and by specifying Schedule directly
  - ✓ Specifying the Task directly and using Saved SCHEDULE
  - ✓ Specifying both Task as well as Schedule in-line using DBMS_SCHEDULER

ORACLE Enterprise Manager 10g
Database Control

Database Instance: indydb

Home | Performance | Administration | Maintenance

The Administration tab displays links that allow you to administer database objects and initiate database operations inside an Oracle database. The Maintenance tab displays links the flow of data between or outside Oracle databases.

Database Administration

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- Reorganize Objects

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- XMLType Views

ORACLE Enterprise Manager 10g
Database Control

Setup Preferences Help Logout
Database

Database Instance: indydb > Scheduler Jobs

Logged in As SYS

Scheduler Jobs

Page Refreshed **Nov 29, 2005 2:02:27 PM** Refresh

Create

All | Running | History

View Job Definition | Edit Job Definition | Delete | Run Now | Create Like

Select	Name	Owner	Scheduled Date	Last Run Date	Last Run Status	Enabled	J
◉	AUTO_SPACE_ADVISOR_JOB	SYS	MAINTENANCE_WINDOW_GROUP	Nov 28, 2005 10:00:01 PM -05:00	SCHEDULED	✓	A
○	PURGE_LOG	SYS	Nov 30, 2005 3:00:00 AM -08:00	Nov 29, 2005 3:00:00 AM -08:00	SCHEDULED	✓	D
○	HIRE	SCOTT	Nov 29, 2005 2:07:14 PM -05:00	Nov 29, 2005 2:02:14 PM -05:00	SCHEDULED	✓	D
○	HIRE	INDY	Nov 29, 2005 2:07:14 PM -05:00	Nov 29, 2005 2:02:14 PM -05:00	SCHEDULED	✓	D

All | Running | History

Related Links

Chains
Programs
Windows
Global Attributes
Schedules
Job Classes
Window Groups

Database | Setup | Preferences | Help | Logout

About Oracle Enterprise Manager 10g Database Control

ORACLE Enterprise Manager 10g
Database Control

Setup Preferences Help Logout

Database

Database Instance: indydb > Scheduler Jobs > Create J

Logged in As SYS

Create Job

Show SQL Cancel OK

General Schedule Options

* Name Job_Using_EXE

* Owner SYS

Enabled Yes No

Description This is Test Job

Logging Level Log job runs only (RUNS)

Log everything (FULL)
Log job runs only (RUNS)
No logging (OFF)

Job Class Create Job Class

Auto Drop FALSE

Specify whether the job should be dropped after completion

Restartable FALSE

Specify whether the job can be restarted manually or in the event of failure

Command

Select the command type for the job, then enter the command requirements.

Command Type **Executable** Change Command Type

Executable Name /export/Load_File_Data.ksh

Include full path

Arguments

Provide the argument values of the job.

Select	Order	Value
	No item found.	

Add Another Row

General Schedule Options

Select Command Option

Choose an existing program or specify an in-line program for execution.
Program offers code re-usability and performance benefits over an in-line program.

Cancel OK

- Program Name — Create Program
- PL/SQL
- Stored Procedure
- Executable
- Chain — Create Chain

Cancel OK

ORACLE Enterprise Manager 10g
Database Control

Setup | Preferences | Help | Logout

Database

Database Instance: indydb > Scheduler Jobs > Create Job

Create Job

Logged in As SYS

Show SQL | Cancel | OK

General | **Schedule** | Options

Schedule Type: Use Pre-defined Window

- Standard
- Use Pre-defined Schedule
- Standard Using PL/SQL for repeated interval
- Use Pre-defined Window
- Event

Time Zone: US/Eastern

Repeating

Repeat: Do Not Repeat

- Do Not Repeat
- By Seconds
- By Minutes
- By Hours
- By Days
- By Weeks
- By Months
- By Years

Start

- (•) Immediately
- ( ) Later

Date: Nov 29, 2005

(example: Nov 29, 2005)

Time: 2 : 05 : 00 ( ) AM (•) PM

General | **Schedule** | Options

Database | Setup | Preferences | Help | Logout

Show SQL | Cancel | OK

ORACLE Enterprise Manager 10g
Database Control

Setup Preferences Help Logout
Database

Database Instance: indydb > Scheduler Jobs > Create Job

Logged in As SYS

Create Job

Show SQL Cancel OK

General Schedule Options

Priority Medium
Sets the level of control for the allocation of resources for concurrent jobs within the Job Class

Schedule Limit (minutes)
Time after which a job that has not been run on the scheduled time will be rescheduled. Only valid for repeating jobs

Maximum Runs
Maximum number of consecutive times this job is allowed to run after which its state will be changed to 'COMPLETED'

Maximum Failures
Number of times a job can fail on consecutive scheduled runs before it is automatically disabled

Job Weight
Job which include parallel queries should set this to the number of parallel slaves they expect to spawn

Instance Stickiness TRUE
For use in RAC. If TRUE, Scheduler runs the job on the instance with the lightest load.
If FALSE, the Scheduler chooses the first available instance on which to schedule the job

General Schedule Options

Database | Setup | Preferences | Help | Logout

Show SQL Cancel OK

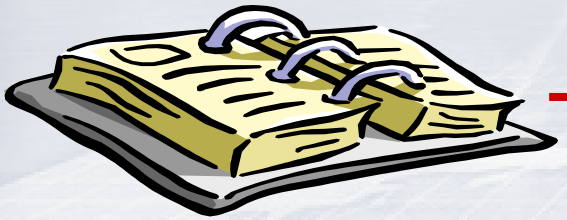
Creating JOB(3)

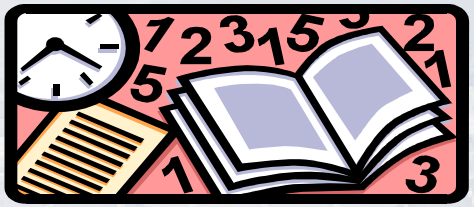
- You need the following Privileges
  - ✓ CREATE JOB – To create the Job in your schema
  - ✓ CREATE ANY JOB – To create job in any schema except SYS
  - ✓ CREATE EXTERNAL JOB – To create job to execute program external to the database

Advanced Scheduler Components

RESOURCE CONSUMER GROUP

RESOURCE PLAN





PROGRAM

JOB

SCHEDULE

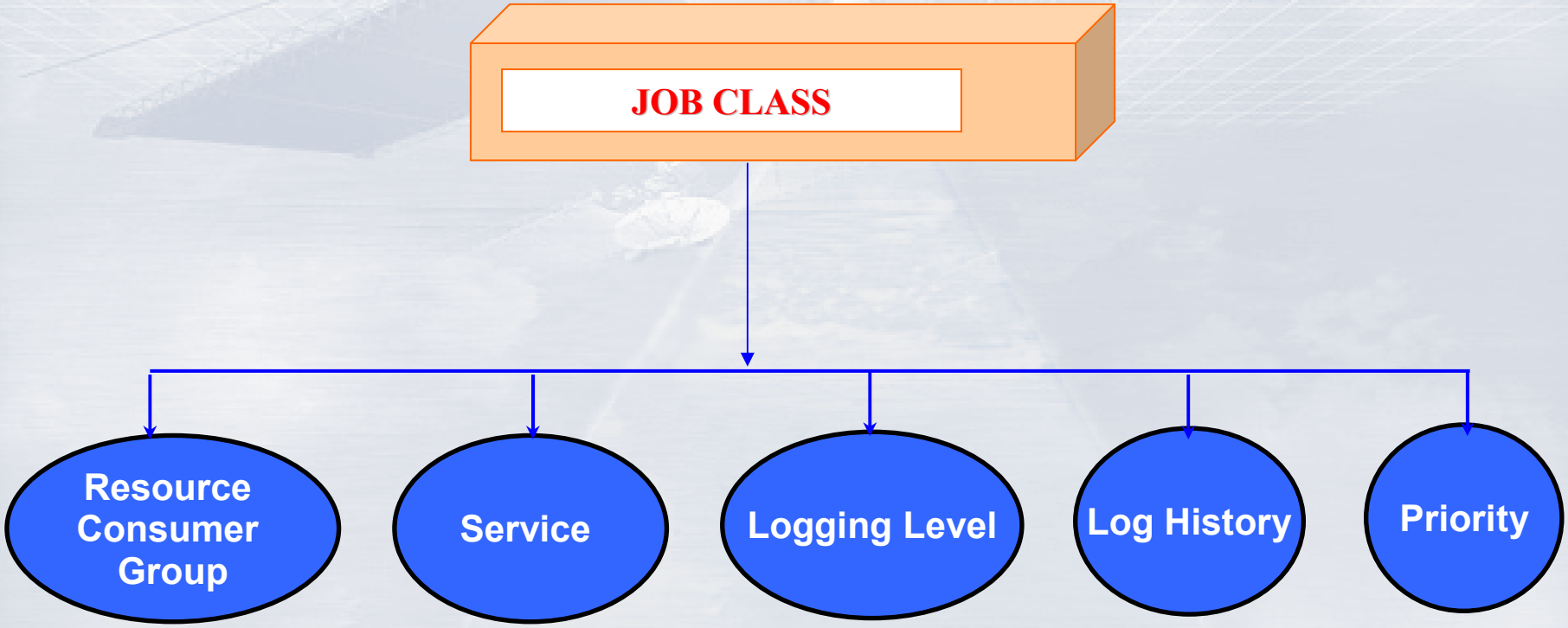
WHAT

WHAT
WHEN

WHEN
HOW OFTEN

JOB CLASS [1]

- It categorize the Jobs that share common Resource usage requirements and other Characteristics.
- Assign a set of attributes like Logging level to pass it to member Job(s)
- Set Service affinity for member jobs so as to decide which instance in RAC can run member jobs
- Sets Resource Allocation to member Job(s)
- Prioritize the Jobs [1-5] within a Job class. It is possible only if Resource manager is enabled.
- A Job can be member of exactly one Job class
- Dropping a Job class assigned to some Job(s) will disable the Job and assign DEFAULT_JOB_CLASS
- A class always belongs to the `SYS` schema.
- Creating a class requires the `MANAGE SCHEDULER` privilege.


JOB CLASS
Resource Consumer Group
Service
Logging Level
Log History
Priority

JOB CLASS [2]

JOB CLASS

- Report1 (2)
- Report2 (1)

Apps Job

- Backup (3)
- Statistics (1)

Admin Jobs

Misc Jobs (5)

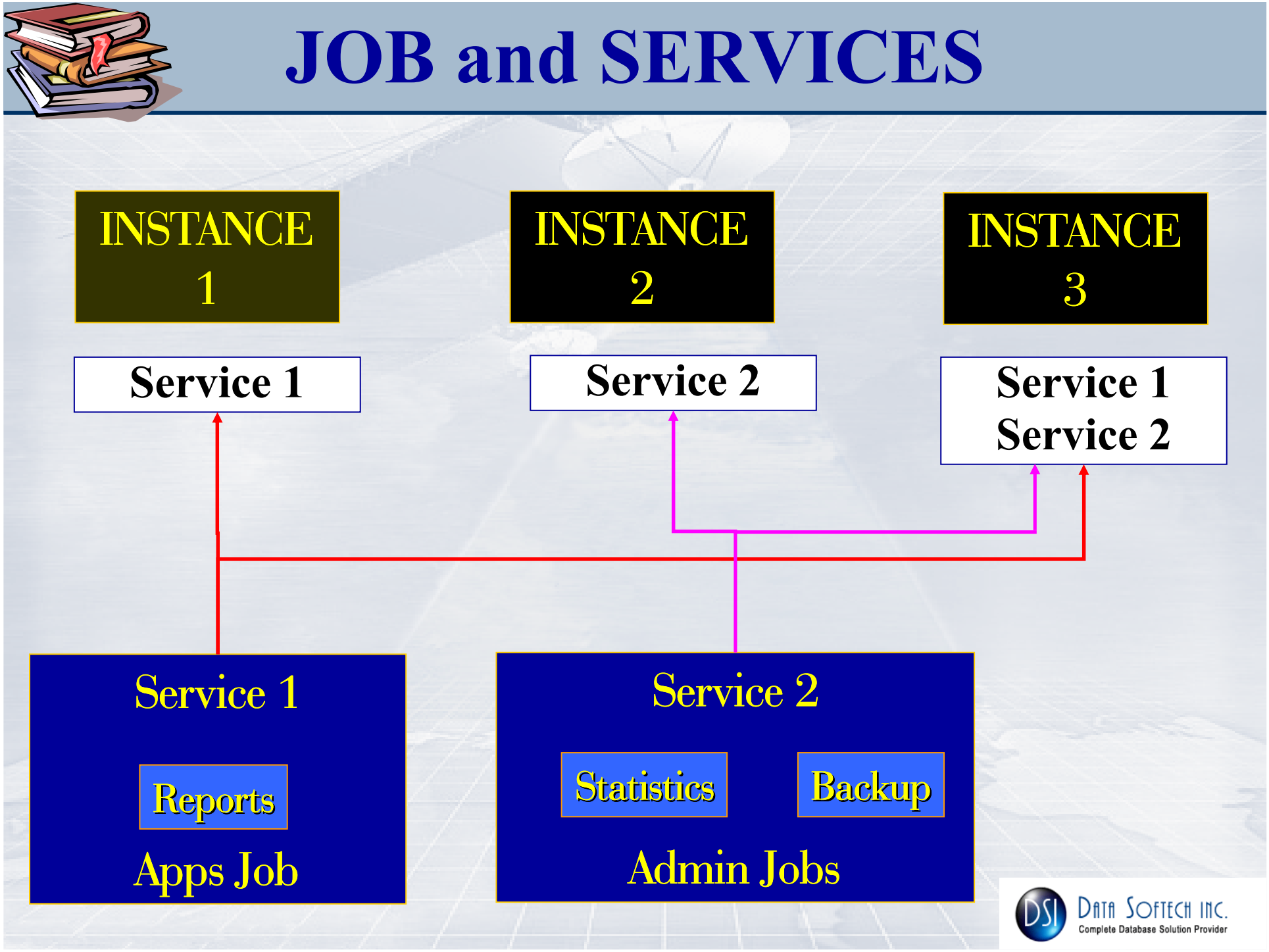
Daytime_Res_Plan

Apps_Jobs => 55
DBA_Jobs => 15
Misc_Jobs => 30

Night_Res_Plan

Apps_Jobs => 25
DBA_Jobs => 55
Misc_Jobs => 20

JOB and SERVICES



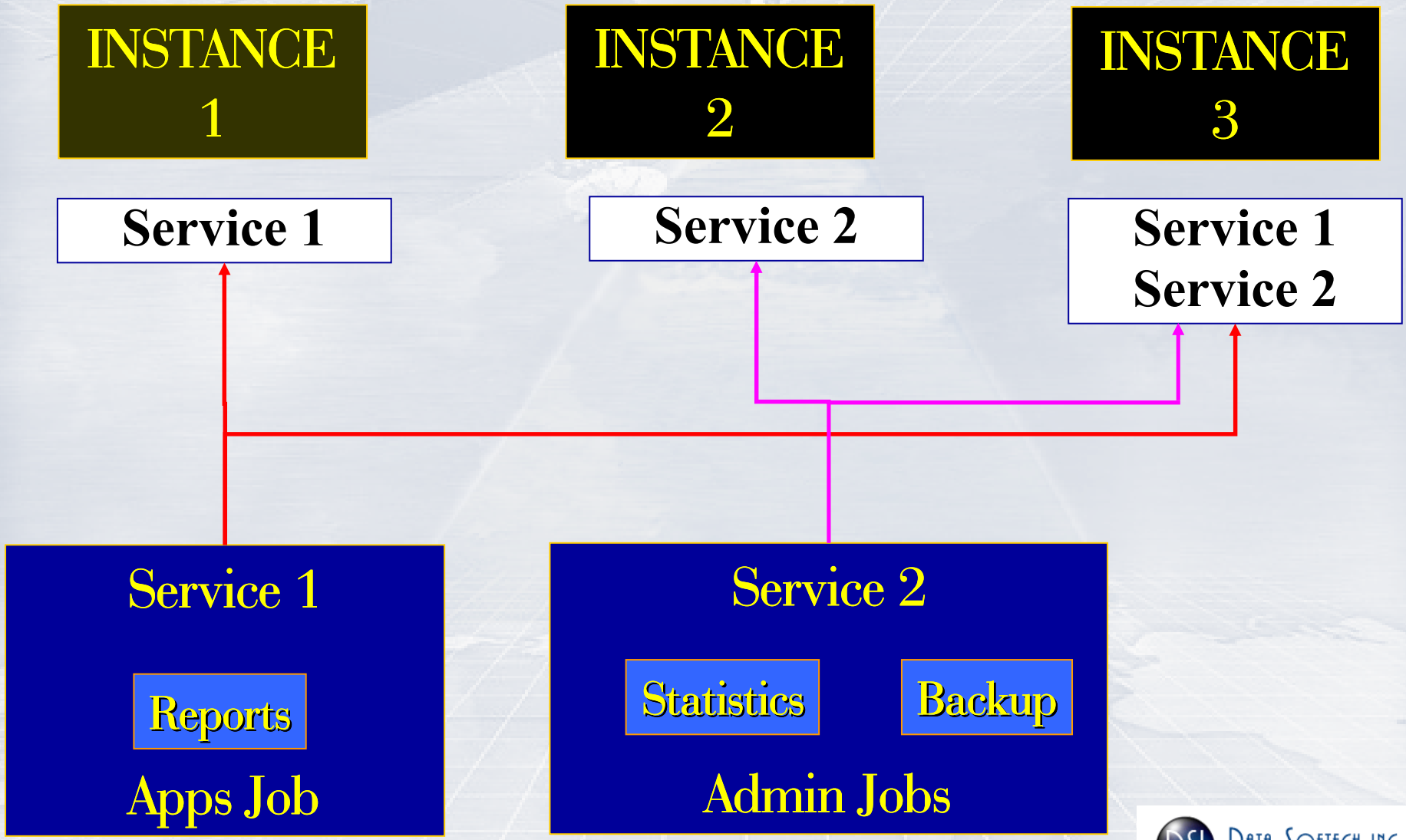
LGS
MAIL

Instance	Not Used	Preferred	Available
LGS1	○	●	○
LGS2	○	●	○
LGS3	○	●	○

Add Remove

● None ○ Basic ○ Preconnect

Cancel Help « Back Next »



ORACLE Enterprise Manager 10g
Database Control

Database Instance: indydb

Home | Performance | Administration | Maintenance

The Administration tab displays links that allow you to administer database objects and initiate database operations inside an Oracle database. The Maintenance tab displays links the flow of data between or outside Oracle databases.

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ORACLE Enterprise Manager 10g
Database Control

Setup Preferences Help Logout
Database

Database Instance: indydb > Scheduler Job Classes

Logged in As SYS

Scheduler Job Classes

Page Refreshed **Dec 1, 2005 3:20:20 PM** Refresh

A job class defines the resource consumer group in which a job will run. Using a resource plan in a window, a DBA can allocate resources among different resource groups and between different job classes.

Create

Edit View Delete Create Like

Select	Name	Logging Level	Log Retention Period (Days)	Resource Consumer Group	Service Name	Description
◉	DEFAULT_JOB_CLASS	RUNS				This is the default job class.
○	AUTO_TASKS_JOB_CLASS	RUNS		AUTO_TASK_CONSUMER_GROUP		System maintenance job class

Related Links

Chains
Programs
Windows
Global Attributes
Schedules
Jobs
Window Groups

Database | Setup | Preferences | Help | Logout

About Oracle Enterprise Manager 10g Database Control

```
BEGIN
sys.dbms_scheduler.create_job_class(
logging_level => DBMS_SCHEDULER.LOGGING_RUNS,
log_history => 20,
resource_consumer_group => 'DEFAULT_CONSUMER_GROUP',
comments => 'This is Demo for JobClass',
job_class_name => 'DEMO_JOB_CLASS');
END;
```

Setup Preferences Help Logout

Database

Logged in As SYS

Show SQL Cancel OK

* Name: Demo_Job_class

Description: This is Demo for JobClass

Logging Level: Log job runs only (RUNS)

Log Retention Period (Days): 20

Resource Consumer Group: DEFAULT_CONSUMER_GROUP

Service Name:

Database | Setup | Preferences | Help | Logout

Show SQL Cancel OK

About Oracle Enterprise Manager 10g Database Control

ORACLE Enterprise Manager 10g
Database Control

Setup Preferences Help Logout
Database

Database Instance: indydb > Scheduler Jobs > Create Job

Logged in As SYS

Create Job

Show SQL Cancel OK

General | Schedule | Options

* Name JOB_FORJOBCLASS
* Owner SYS
Enabled ◉ Yes ○ No
Description This is Demo Job Using JobClas
Logging Level Log job runs only (RUNS)
Specify logging requirements for the job
Job Class DEMO_JOB_CLASS
Auto Drop FALSE
Specify whether the job should be dropped after co
Restartable FALSE
Specify whether the job can be restarted manually

```
BEGIN
sys.dbms_scheduler.create_job(
job_name => '"SYS"."JOB_FORJOBCLASS"',
job_type => 'PLSQL_BLOCK',
job_action => 'begin
   -- Insert PL/SQL code here
end;',
start_date => systimestamp at time zone 'US/Eastern',
job_class => 'DEMO_JOB_CLASS',
comments => 'This is Demo Job Using JobClass',
auto_drop => FALSE,
enabled => TRUE);
END;
```

Command

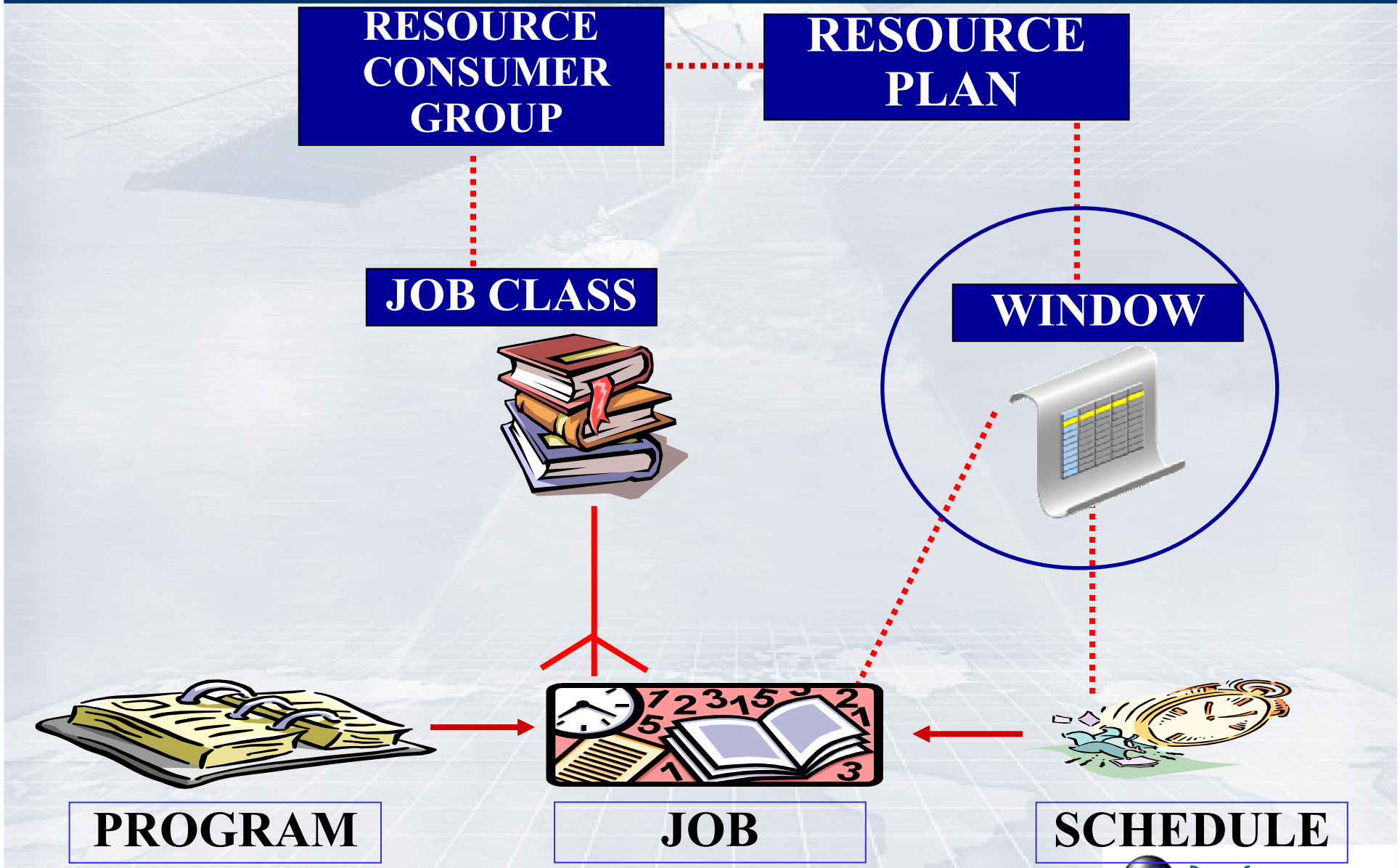
Select the command type for the job, then enter the command requirements.

Command Type **PL/SQL Block** Change Command Type

PL/SQL

```
begin
  -- Insert PL/SQL code here
end;
```

Advanced Scheduler Components



Window [1]

- It can be used to Control process, when several jobs are scheduled in the same time period
- It is represented by an interval of time showing start and end e.g. 9pm to 11pm
- Created in SYS schema
- Need MANAGE SCHEDULER privilege to create it
- Only one window can be in effect any any given time.
- Specify Window in Scheduler section of CREATE JOB
- If Window is OPEN and you configure new JOB A to run in this window, then it will be executed next time window is OPEN

Window w.r.t Resource Plan

Jobs
JOB 1
JOB 2
JOB 3
JOB 4

Consumer Group
RCG_1=>Job 1, Job 2
Df_CG=>Job 3, Job 4

Resource Plan
Apps_Plan
Admin_Plan

RCG_1 =>30%
Df_CG =>70%

RCG_1 =>70%
Df_CG =>30%

Day_Window →8am – 5pm Use APPS_PLAN	Night_Window →5pm – 7am Use ADMIN_PLAN
JOB 1 – Use 30% Resources	JOB 1 – Use 70% Resources
JOB 2 – Use 30% Resources	JOB 2 – Use 70% Resources
JOB 3 – Use 70% Resources	JOB 3 – Use 30% Resources
JOB 4– Use 70% Resources	JOB 4– Use 30% Resources

Window w.r.t Job Priority

- Priority are defined from 1-5 with 1 as highest and 3 as default priority
-
```
BEGIN
    DBMS_SCHEDULER.SET_ATTRIBUTE (
    name => 'job3',
    attribute => 'job_priority',
    value => 2);
END;
```
- Priority are based on Resource Plan. E.g. Apps Job has more priority during Daytime Window
- Within Job Class, Jobs get priority based on Priority Value. E.g Backup Job has more priority over Stats Job

Overlapping Window

W1 →3 – 8am
Use RPT_PLAN

W2_Window →7am – 5pm
Use APPS_PLAN

W3_Window →4pm – 3am
Use ADMIN_PLAN

3am 9 am 3 pm 9 pm 3am

- Priority are defined on Window Level as HIGH or LOW
- If two Window Overlap, then the Window with HIGH Priority open First
- If two Overlapping Window has Same priority, then the window which is Active remains open

ORACLE Enterprise Manager 10g
Database Control

Database Instance: indydb

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The Administration tab displays links that allow you to administer database objects and initiate database operations inside an Oracle database. The Maintenance tab displays links the flow of data between or outside Oracle databases.

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ORACLE Enterprise Manager 10g
Database Control

Setup Preferences Help Logout
Database

Database Instance: indydb > Scheduler Windows

Logged in As SYS

Scheduler Windows

Following are the system windows that specify resource usage limits based on time-duration windows.

Create

View Edit Delete Create Like Go

Select	Name	Resource Plan	Enabled	Next Open Date	End Date	Duration (min)	Active	Description
◉	WEEKNIGHT_WINDOW		✓	Dec 1, 2005 10:00:00 PM		480	FALSE	Weeknight window for maintenance task
○	WEEKEND_WINDOW		✓	Dec 3, 2005 12:00:00 AM		2880	FALSE	Weekend window for maintenance task

Related Links

Chains
Jobs
Window Groups
Global Attributes
Programs
Job Classes
Schedules

Database | Setup | Preferences | Help | Logout

About Oracle Enterprise Manager 10g Database Control

ORACLE Enterprise Manager 10g
Database Control

Setup Preferences Help Logout
Database

Database Instance: indydb > Scheduler Windows > Create Window

Logged in As SYS

Create Window

Show SQL Cancel OK

* Name Demo_Window

Resource Plan INTERNAL_PLAN View Resource Plan Create Resource Plan

Priority Low High

Description This Is demo for Window

```
BEGIN
DBMS_SCHEDULER.CREATE_WINDOW(
window_name=>'Demo_Window',
resource_plan=>'INTERNAL_PLAN',
start_date=>systimestamp at time zone 'US/Eastern',
duration=>numtodsinterval(60, 'minute'),
repeat_interval=>null,
end_date=>null,
window_priority=>'LOW',
comments=>'This Is demo for Window');
END;
```

Schedule

Use a calendar

Use an existing schedule

Time Zone US/Eastern

Repeating

Repeat Do Not Repeat

Start

Immediately

Later

Date Dec 1, 2005

(example: Dec 1, 2005)

Time 3 30 00 AM PM

Duration

Duration 1 Hours 0 Minutes

Show SQL Cancel OK

Database | Setup | Preferences | Help | Logout

About Oracle Enterprise Manager 10g Database Control

ORACLE Enterprise Manager 10g
Database Control

Setup Preferences Help Logout
Database

Database Instance: indydb > Scheduler Jobs > Create Job

Logged in As SYS

Create Job

Show SQL Cancel OK

General | Schedule | Options

Schedule Type Standard

- Standard
- Use Pre-defined Schedule
- Standard Using PL/SQL for repeated interval
- Use Pre-defined Window
- Event

Time Zone

Repeati

Repeat Do Not Repeat

Start

- (•) Immediately
- ( ) Later

Date Dec 1, 2005
(example: Dec 1, 2005)

Time 3 35 00 ( ) AM (•) PM

General | Schedule | Options

Show SQL Cancel OK

ORACLE Enterprise Manager 10g
Database Control

Setup | Preferences | Help | Logout

Database

Database Instance: indydb > Scheduler Jobs > Create Job

Logged in As SY

Create Job

Show SQL | Cancel | OK

General | **Schedule** | Options

Schedule Type: Use Pre-defined Window

Select a window or a window group. You

Window: SYS.DEMO_WINDOW

☐ Stop on Window Close

If checked, the job will be stopped if the associate

Name **DEMO_WINDOW**
Resource Plan **INTERNAL_PLAN**
Enabled **TRUE**
Priority **LOW**
Description **This Is demo for W**

Schedule

Repeat **Do Not Repeat**
Duration (min) **1 hour(s) 0 minute(s)**
Start Date **Dec 1, 2005 3:37:04 PM US/**

General | **Schedule** | Options

```
BEGIN
sys.dbms_scheduler.create_job(
job_name => '"SYS"."JOB_USING_WINDOW"',
job_type => 'PLSQL_BLOCK',
job_action => 'begin
   -- Insert PL/SQL code here
end;',
schedule_
job_class
comments
auto_drop
enabled =
sys.dbms_
attribute
sys.dbms_
END;
```

Search and Select: Window and Window Groups

Cancel | Select

Search

Object Name | Go

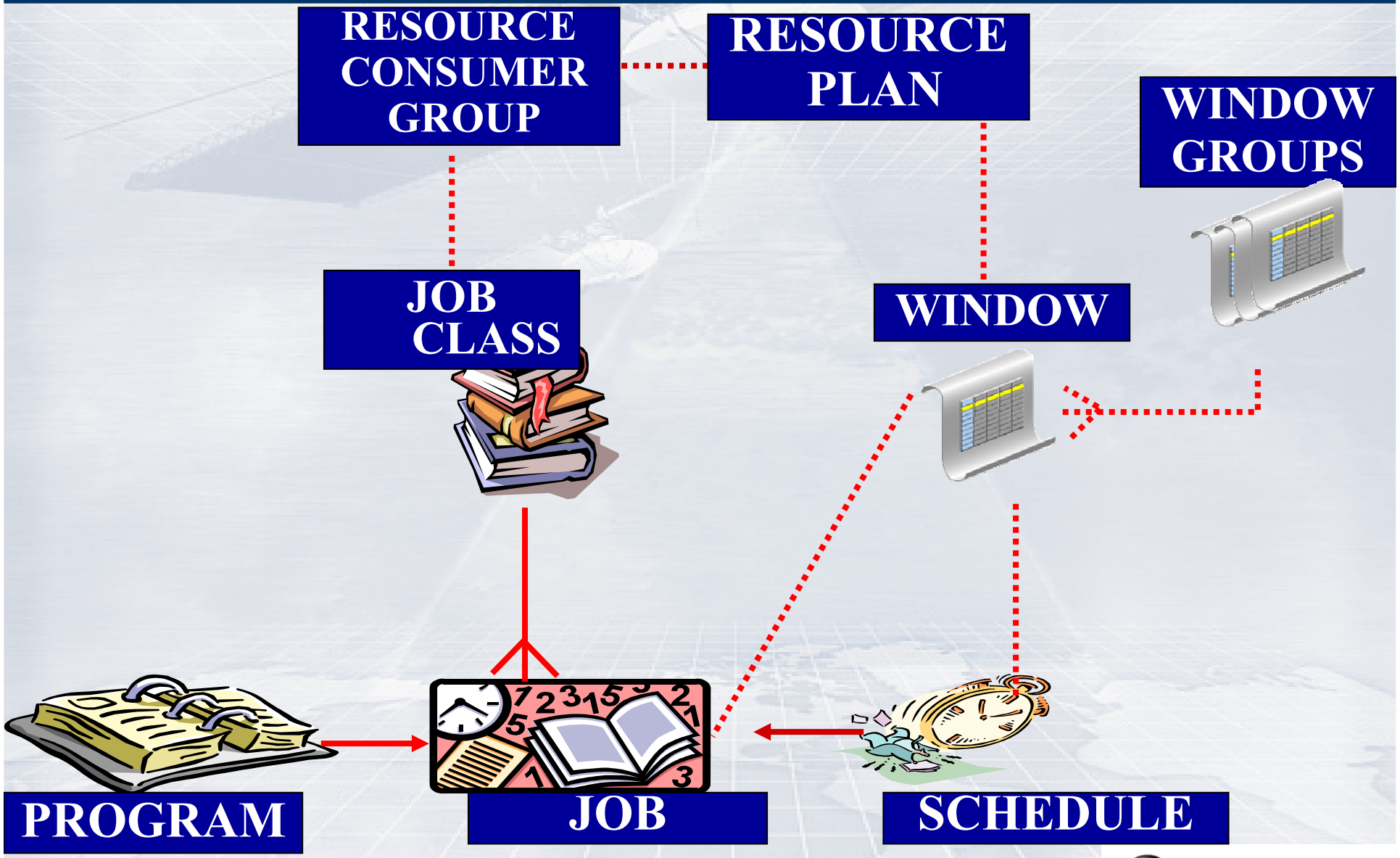
Results

Select	Name	Type
◉	DEMO_WINDOW	Window
○	MAINTENANCE_WINDOW_GROUP	Window Group
○	WEEKEND_WINDOW	Window
○	WEEKNIGHT_WINDOW	Window

Cancel | Select

Database | Setup | Preferences | Help | Logout

Advanced Scheduler Components



Window Groups

W1_Window

Holiday_Window

Night_WG

W2_Window

W3_Window

Day_WG

Window Groups

- A window group is a named collection of windows.
- Creating window groups requires the `MANAGE SCHEDULER` system privilege.
- Window groups are created in the `SYS` schema.

ORACLE Enterprise Manager 10g
Database Control

Database Instance: indydb

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ORACLE Enterprise Manager 10g
Database Control

Setup | Preferences | Help | Logout

Database

Database Instance: indydb > Scheduler Window Groups

Logged in As SYS

Scheduler Window Groups

Create

View | Edit | Delete | Create Like | Go

Select	Name	Enabled	Number of Members
⊙	MAINTENANCE_WINDOW_GROUP	✓	2

Related Links

Chains
Jobs
Windows
Global Attributes
Programs
Job Classes
Schedules

Database | Setup | Preferences | Help | Logout

About Oracle Enterprise Manager 10g Database Control

ORACLE Enterp
Database Control

```
BEGIN
DBMS_SCHEDULER.CREATE_WINDOW_GROUP(
group_name=>'Demo_Window_grp',
window_list=>'DEMO_WINDOW,WEEKEND_WINDOW,WEEKNIGHT_WINDOW');
END;
```

Database Instance: in

SYS

Create Windo

Show SQL | Cancel | OK

* Name Demo_Window_grp

Members

Add/Remove Windows

Name	Resource Plan	Enabled	Next Open Date	End Date	Duration (min)	Description

Database | Setup | Preferences | Help | Logout

Show SQL | Cancel | OK

About Oracle Enterprise Manager 10g Database Control

ORACLE Enterprise Manager 10g
Database Control

Database Instance: indydb > Scheduler Jobs > Create Job

Create Job

General | **Schedule** | Options

Schedule Type: Use Pre-defined Window

Select a window or a window group. You can run the job in multiple windows by grouping the windows in a window group.

Window [ ] View Details Create Window

☐ Stop on Window Close

If checked, the job will be stopped if the associated window closes

General | **Schedule** | Options

About Oracle Enterprise Manager 10g Database Control

Search and Select: Window and Window Groups

Cancel Select

Search

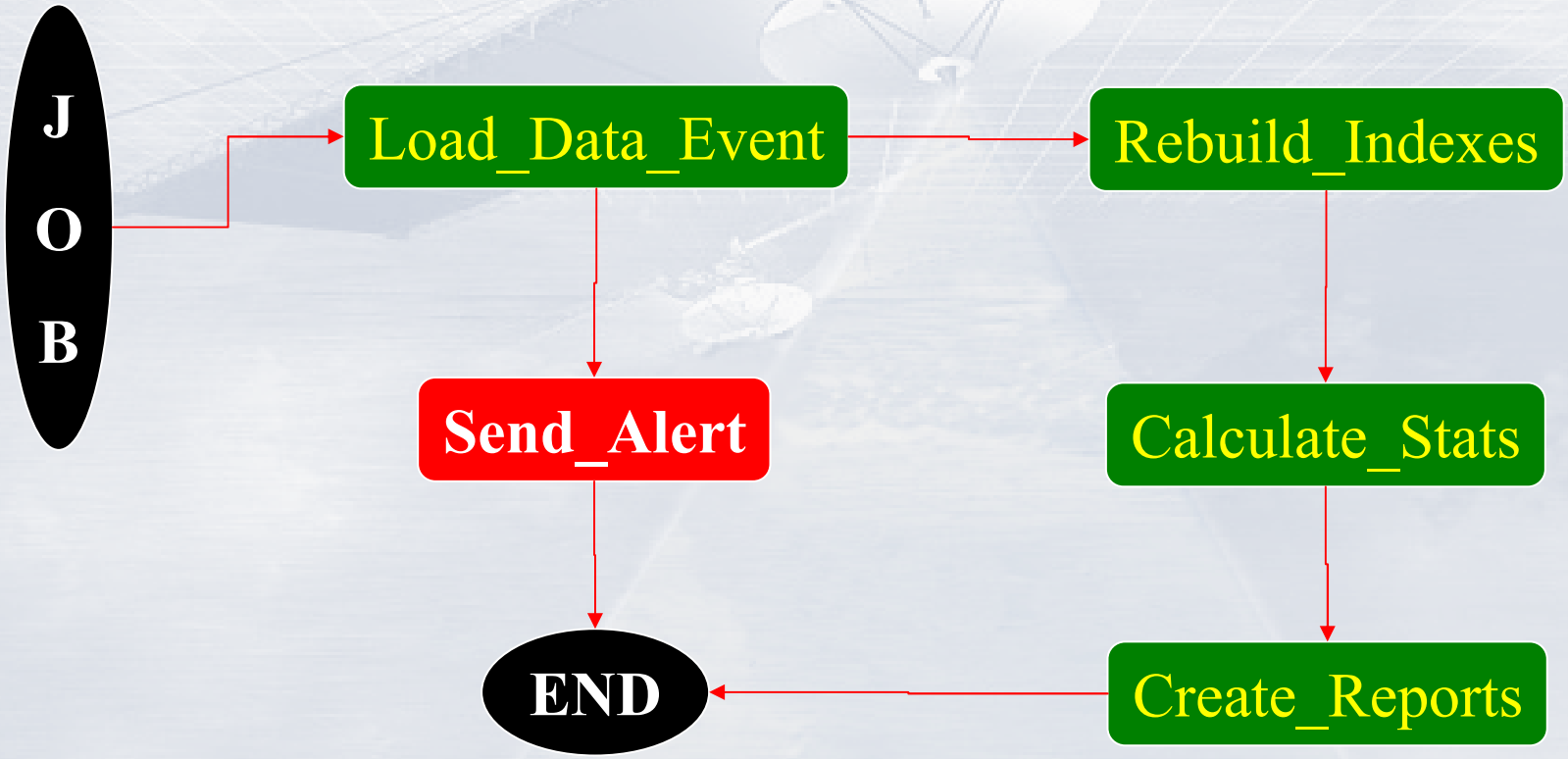
Object Name [ ] Go

Results

Select	Name	Type
◉	DEMO_WINDOW	Window
○	MAINTENANCE_WINDOW_GROUP	Window Group
○	WEEKEND_WINDOW	Window
○	WEEKNIGHT_WINDOW	Window

Cancel Select

Job Chain



Job Chain

- A chain is a collection of programs that are linked together for a combined objective.
- Each Program within a chain of interdependent programs is referred to as a step. Execution of each step may or may not be dependent on Previous step.
- Each step can point to one of the following:
  - ✓ A program
  - ✓ Another chain (a nested chain)
  - ✓ An event
- Multiple steps in the chain can invoke the same program or nested chain.

Creating Job Chains

1. Create a Chain Object
2.
3.
4.
5.

```
BEGIN
        DBMS_SCHEDULER.CREATE_CHAIN (
        chain_name          => 'CHAIN_DEMO',
        rule_set_name       => NULL,
         evaluation_interval => NULL,
        comments            => 'This is DEMO Chain');
END;
```

Creating Job Chains

1. Create a Chain Object
2. Define Steps in the Chain
3.
4.
5.

```
BEGIN
        DBMS_SCHEDULER.DEFINE_CHAIN_EVENT_STEP (
        chain_name          =>  'CHAIN_DEMO',
        step_name           =>  LOAD_DATA_EVENT,
        event_schedule_name  =>  'my_event1'); OR
                program_name  =>  'my_program1');
END;
```

Creating Job Chains

1. Create a Chain Object
2. Define Steps in the Chain
3. Add Rules
4.
5.

```
BEGIN
        DBMS_SCHEDULER.DEFINE_CHAIN_RULE (
        chain_name        => 'CHAIN_DEMO',
        Condition                 =>'TRUE',
        Action                    =>'START LOAD_DATA_EVENT',
        Rule_name                 =>'CRULE_1',
        comments          => 'This is First Step Rule');
END;
```

```
        Condition                 =>'Load_Data_event COMPLETED",
        Action                    =>'START Rebuild_Indexes',
        Rule_name                 =>'CRULE_2',
```

Creating Job Chains

1. Create a Chain Object
2. Define Steps in the Chain
3. Add Rules
4. Enable the Chain
5.

```
BEGIN
        DBMS_SCHEDULER.ENABLE (
        chain_name        => 'CHAIN_DEMO',
END;
```

Creating Job Chains

1. Create a Chain Object
2. Define Steps in the Chain
3. Add Rules
4. Enable the Chain
5. Create the Job to refer the Chain

```
BEGIN
        DBMS_SCHEDULER.CREATE_JOB (
        Job_name      => 'Job_Chain_1',
        Job_type            => 'CHAIN',
        Job_Action          => 'CHAIN_DEMO',
        Repeat_interval=>'freq=hourly',
        Enabled => 'TRUE'      );
END;
```

Create Chain

Show SQL | Cancel | OK

* Name: BULK_LOAD_DATA

* Owner: HR

Enabled: ○ Yes ◉ No

Description: Load data from file and run reports

Steps

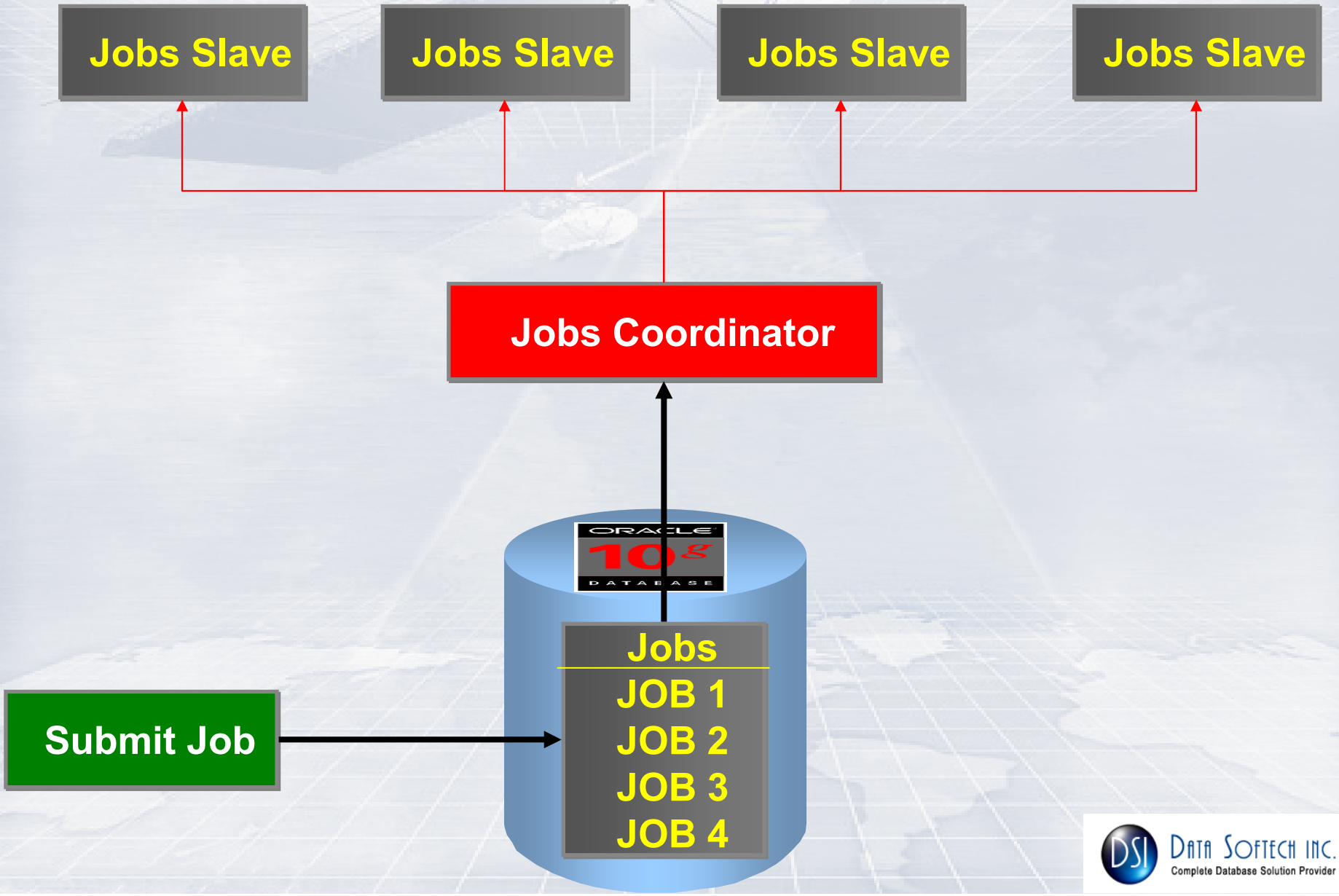
Delete

Select	Step Name	Type	Object Name
◉	load_data_evt	EVENT_SCHEDULE	HR.FILE_ARRIVAL_EVENT
○	do_bulk_load	PROGRAM	HR.LOAD_DATA_PROG
○	rebuild_indx	PROGRAM	HR.REBUILD_INDEXES
○	run_reports	SUBCHAIN	HR.GEN_REPORTS
○	stop_when_disk_full_evt	EVENT_SCHEDULE	HR.DISK_FULL_EVT_SCHED

Add 5 Steps

Rules

Scheduler Architecture



Job Coordinator

- Controls and spawns the job slaves
- Queries the job table and put them into memory cache on regular basis.
- Takes jobs from the memory cache and passes them to job slaves for execution
- Cleans up the job slave pool when slaves are no longer needed
- Goes to sleep when no jobs are scheduled
- Wakes up when a job needs executing or a new job is created

Job Slaves

When a job is done, the job slaves:

- Update Job table with the status of Job like COMPLETED
- Insert an entry into the job log table
- Update the run count
- Clean up and then look for new work (if none, they go to sleep)

<u>Controlling Job slaves</u>

- Use the default Oracle database control mechanisms
- Set the Scheduler attribute `max_job_slave_processes` to the desired value

Data Dictionary Views

```
[DBA | ALL | USER]_SCHEDULER_JOBS
[DBA | ALL | USER]_SCHEDULER_JOB_ARGS
[DBA | ALL | USER]_SCHEDULER_RUNNING_JOBS
[DBA | ALL | USER]_SCHEDULER_JOB_LOG
[DBA | ALL | USER]_SCHEDULER_JOB_RUN_DETAILS
[DBA | ALL | USER]_SCHEDULER_PROGRAMS
[DBA | ALL | USER]_SCHEDULER_PROGRAM_ARGS
```

Scheduler Privileges- System Level

Privilege	Description
CREATE JOB	Create,Alter,Delete own Jobs,Schedules and Programs
CREATE ANY JOB	Create,Alter,Delete any Jobs,Schedules and Programs
EXECUTE ANY PROGRAM	Execute Program of other Schema in own program
EXECUTE ANY CLASS	Execute Jobs in Job classes of other Schemas
MANAGE SCHEDULER	Contains all Admin privileges required by Scheduler

Scheduler Privileges- New Role

SCHEDULER_ADMIN ROLE
CREATE JOB
CREATE ANY JOB
CREATE EXTERNAL JOB
EXECUTE ANY PROGRAM
EXECUTE ANY CLASS
MANAGE SCHEDULER

Q&A

QUESTIONS
ANSWERS

DSI Data Softech Inc.
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