Portal Implementation Case Study: BAE SYSTEMS SDE

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INTRODUCTION
This paper gives performance statistics and architectural details for the implementation of BAE Systems Shared Data Environment (SDE) Portal.

It is a companion component of the Portal Sizing Kit available for download from PortalCenter. For a more in-depth description of some of the topics and metrics reported in this document, please read Portal Implementation Case Study: My Oracle which can be found on portalcenter.oracle.com

More in-depth performance reports like this will be delivered as part of the Portal Sizing Kit.

About BAE Systems
BAE Systems is a systems company innovating for a safer world and delivering total solutions to customer requirements, from the outermost reaches of space to the depths of the oceans. BAE Systems has international markets around the globe producing annual sales of some £12 billion. Including joint ventures, BAE Systems employs world-wide more than 90,000 people, committed to delivering outstanding capability to customers through the quality technology, the robust processes and the innovation of its people.

BAE Systems prime contracting capability combines key in-depth skills in systems, defence and aerospace, enabling it to manage the most complex high-level systems tasks and provide total solutions - a one-stop shop capability and service provision.

BAE Systems designs, manufactures, and supports military aircraft, surface ships, submarines, space systems, radar, avionics, C4ISR, electronic systems, guided weapons and a range of other defence products, many of these with international partners. Key skills include systems integration, complex software and hardware development and advanced manufacturing.

BAE Systems has a major presence internationally, particularly in Europe and the United States as well as in the Middle East, Asia Pacific and Australia. The company has a full in-service support and logistics organisation so that it can work with customers both in specifying solutions to their needs, and offering the management and operation of their facilities, as well as training, repair and overhaul of products and the provision of professional logistic support.
What is SDE?

BAE Systems Naval Ships Shared Data Environment (SDE) Portal is used by their user community as their Common Desktop Environment. It is used as a central repository of information from a multitude of sources, Portal itself being one of them, and for a large majority of BAE Systems Naval Ships users it is the single point of truth for reporting purposes i.e. Project milestone reporting.

To access a large number of BAE Systems Naval Ships applications you must be within the portal environment and it is BAE Systems Naval Ships intention that OID will provide the authentication method for the majority of BAE Systems Naval Ships applications, including 3rd Party Apps.

This portal provides BAE Systems Naval Ships employees with a personalized, single entry point to essential information. The site is to store and retrieve content relevant to users’ jobs. This includes HTML and Word documents, meeting notes, presentations, drafts for review, viewlets and zip files. Each employee has an account that offers a private storage area that they can use to store their own content or to share it with specific users, groups or public users.

BAE Systems Naval Ships originally started this project some four years ago with Oracle WebDB. Since then SDE has been through two major upgrades currently taking advantage of the enterprise class features in OracleAS Portal 9.0.2.6. The system currently has in excess of 7,000 registered users and an unspecified number of public users.

There are two SDE instances running on the hardware described in this paper, the primary instance has 10,380 unique portal pages and the secondary instance has 1,994 unique portal pages.

Figure 1: View of SDE’s Default Home Page
Goals for SDE

- Exploit emerging web technologies, requiring no client software (except for MS Word etc) to allow people to collaborate and share information between departments, customers and stakeholders in real time, effectively on a project.
- Provide real-time reporting
- Ensure that the information displayed to the user is specific to their role or task.

SDE enhances project, team and personal productivity for all the project stakeholders. The capabilities are summarized below

Enabling Enterprise Effectiveness

The following capabilities are provided through the Project Portal

Directory Services

Enables project members to keep their personal details up to date and provides dynamic organizational and search capabilities

News Archive

Provides a single source for project news and a news archive. Users can publish items in any project folders that they have privileges to use (see Team Folders). The folder owner approves items in order for them to be displayed to the rest of the community.

Forums

Forums cover the gamut of serious, social, and team communications and technology topics. Originally BAE took advantage of the OTN Discussion Forums and Oracle Portal Online portlets that were delivered as part of the Oracle Consulting Portal Accelerator offering. Though these have served them well they are hoping to move to an Oracle Collaboration Suite NNTP server based solution in the future.

Links to other Application tools and Portals

There are links to other major applications used by the project along with documentation and guidelines. Selected real time data from some applications and databases e.g. the project control system is exposed through portlets.

Workflow

Enables automation of certified processes and delivers tasks directly to the actionable individuals. Change control, issue management and the review and approval process are all available in the Project portal.

Enabling Team Effectiveness

The following team specific capabilities are provided

Team Folders

Each team has a defined team folder within SDE. The folder owner can control team privileges as well as create subject sub-folders and delegate ownership of those to other members of the team. Relevant project information including
documents, presentations and links to applications can be published in these folders.

**Collaboration**

Individuals can open a real-time window to their e-mail, tasks and appointments. They can arrange meetings, invite others and check participant availability. Built in ‘presence awareness’ highlights which users are currently online so that other users can instigate on-line chat sessions, meetings and voice and video conferencing with them.

**Team Pages**

Team Pages provide a gateway to a specific team’s area of the SDE. They include team folders, roles and goals, organisation, project performance, issues, risks and policies.

BAE Systems Naval Ships also refer to them as the team market stalls on which important documents are published, often alongside related information to provide context e.g. publishing a deliverable alongside links to an issues register, action list and work package specification. Access to the rest of the team and other stakeholders is controlled using security on the page or at the item level and document versions are maintained in a document management system.

Team news, discussion forums and messages from the team leader are all posted in real-time and can give the team a greater sense of purpose and participation.

**Enabling Personal Effectiveness**

**Interest lists**

Enables rapid access to frequently used folders within the SDE. Any folder visited within the SDE can be added to a favourites list. In this way, commonly used areas or areas of interest, may be rapidly accessed.

**Saved Searches**

Enables rapid access to frequently used searches of the SDE. Any search of the SDE may be saved and added to a personal search list. In this way, personal folder searches may be rapidly repeated e.g. all “best practice” documents that have been published. Provides individuals with their own content area within SDE, enabling them to publish and share information with colleagues and to save shortcuts (URLs) for frequently used capabilities and information within SDE. e.g. a shortcut to the area of the Product that an individual Design Engineer is working within or a shortcut to a frequently used discussion forum, process, procedure or function.

**Personal portals**

These pages provide a personalized view for each member. The pages are created from a custom template and the member can add, customize or hide portlets to suit their needs.
INFRAREDSTRUCTURE OVERVIEW

Figure 2 shows the SDE Architecture.

![SDE Architecture Diagram]

Figure 2: SDE Architecture

Portal Middle Tier

The Middle-tier servers contain the components that handle the page generation and content from local and remote providers. The portal middle-tier consists of these elements:

- Oracle HTTP Server
- Mod_PLSQL 9.0.2.6
- OC4J 9.0.2
- Parallel Page Engine (PPE) 9.0.2.6
- Portal Cache
- Oracle9iAS Web Cache

The middle tier and its operation are described in detail in the white paper "Tips and Techniques for Deploying a Scalable Portal", available for download from portalcenter.oracle.com.

### MidTier Machine Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>Sun v480</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of CPUs</td>
<td>2</td>
</tr>
<tr>
<td>CPU Speed</td>
<td>900Mhz</td>
</tr>
<tr>
<td>Total Physical RAM</td>
<td>16 Gb</td>
</tr>
</tbody>
</table>
**Oracle9iAS Web Cache**

Oracle9iAS Web Cache is a powerful state-of-the-art in-memory cache solution, offering throughput rates of several thousand requests per second. Oracle9iAS Web Cache offers intelligent caching, page assembly and compression features which distinguish it from any other Web caching solution on the market. Unlike legacy proxy servers which cache only static objects, Oracle9iAS Web Cache accelerates the delivery of both static and dynamic Web content. Oracle9iAS Web Cache acts as the initial point of contact in any web request, if the content being requested is stored in it’s cache and is valid, then Oracle9iAS Web Cache will respond with the content without troubling the remaining parts of the Oracle9iAS Portal architecture.

**Oracle HTTP Server**

The middle tier includes an Oracle HTTP listener that handles all the incoming HTTP requests to the portal. If the incoming request asks to display a portal page, the listener hands the request to OC4J running the Parallel Page Engine (PPE). The PPE splits up all the portlet requests that make up the page and sends them off in parallel to wherever the portlets are served from. If the request asks to execute a database portlet or a PL/SQL procedure, the listener hands it to mod_plsql to communicate to the database. As each of the requests come back, the Parallel Page Engine reassembles the page and returns it to the user. If one of the portlets is too slow in returning, the Parallel Page Engine returns the rest of the page once the timeout duration specified in the provider has elapsed.

**Portal Cache**

The Portal Cache is the persistence component of the SDE caching armory and is a key component in supporting very high request rates. The Portal Cache uses the file system on the middle-tier to store fully assembled pages as well as page definitions and rendered content from individual portlets. Retrieving content from the cache is much faster than having the database and providers regenerate it and the parallel page engine re-assembles it into pages for every request. So if the page definition hasn’t changed from the last time the user requested it, then the cached information will be served up very quickly. Furthermore, if the portlet content hasn’t changed from the last time the user requested it, the Portal Cache serves up the already assembled page.

The Portal Cache entries can be configured on a page-by-page, or portlet-by-portlet basis to check if a refresh is required (Validation-based Caching) or to refresh periodically (Expiry-based Caching). SDE uses Page Definition Only (Validation based) caching. This means that the page definition will be cached, but the content will not unless explicitly instructed to do so by the folder owner.

**SSO Server**

The SSO Server uses the core security and authentication features of Oracle9iAS 9.0.2. This means we use the SSO Server to pass the initial authentication requests for logging in to Oracle Internet Directory (OID) and to manage retrieval of usernames and passwords for external applications that may be stored in the SSO schema.

Upon initial authentication the username and password submitted by the user are passed to the OID instance for an LDAP authentication. The clear text password entered by the user is run through a one-way encryption and the encrypted string is compared against that retained in the OID repository. If a match is made then OID will return an authenticated token and the SSO may commence the login
process. The SSO Server has a set of tables that it uses to manage users and passwords for external applications outside of the Oracle environment. The SSO Server and OID schemas are contained in the same database as the portal repository.

**OC4J**

OC4J is an application server with containers that offer a very lightweight, easy to use, high performance J2EE environment. OC4J is integrated in JDeveloper and the Oracle Application Server. The containers in OC4J enable users to run their J2EE-based applications entirely in the standard Java Development Kit (JDK) executing on the Java Virtual Machine (JVM). The J2EE facilities provided by the OC4J include an Enterprise JavaBeans (EJB) container, a Java Servlet container, and a JavaServer Pages Translator and runtime (OJSP). In the context of Oracle Portal OC4J is the execution container for the Parallel Page Engine (PPE).

The PPE is a servlet, which runs in the middle tier, that builds portal pages for display

**SDE Repository Server**

<table>
<thead>
<tr>
<th>DB Machine Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Model</strong></td>
</tr>
<tr>
<td><strong>Number of CPUs</strong></td>
</tr>
<tr>
<td><strong>CPU Speed</strong></td>
</tr>
<tr>
<td><strong>Total Physical RAM</strong></td>
</tr>
<tr>
<td><strong>Database Size</strong></td>
</tr>
<tr>
<td><strong>SGA</strong></td>
</tr>
<tr>
<td><strong>Database Version</strong></td>
</tr>
<tr>
<td><strong>Disk Configuration</strong></td>
</tr>
</tbody>
</table>

The SDE repository has been successfully upgraded from 3.0.9 to 9.0.2.6 as part of the ongoing project lifecycle.

Further detailed information on the upgrade process can be obtained from portalcenter.oracle.com/upgrades

No major tuning exercise has been undertaken for the repository server with most default settings being retained. It should be noted that this server is not only running the portal and infrastructure repositories, there are two more separate Oracle Database instances running on the same hardware.

**Reliability and Availability**

Oracle Enterprise Manager is used to monitor the system and issue alerts when anything goes wrong. In addition, other utilities are used to check on system status.

It is proposed that SDE use Real Application Clusters (RAC) from the Oracle9i database. RAC is the evolution of the Oracle Parallel Server (OPS), offering the failover and load-balancing benefits of OPS with considerably less administrative complexity. This implementation of RAC will occur in the second half of 2004
Performance logging is switched on throughout the whole SDE architecture; mod_plsql, PPE, OC4J, Web Cache and DB logging are all utilized to give the fullest picture possible of the health of systems.

The data from these logs is then uploaded into an Oracle9i database for analysis. The steps for this are documented in the technote ‘Performance Monitoring with mod_plsql in Oracle9iAS Portal Release 2’ and an overview of the types of reports available can be found in the technote ‘Object Access Reporting from the Performance Logs in Oracle9iAS Portal’

The outcome of the logs and some examples of the data they provide are shown later in this paper.

The performance logs are analyzed to check for poorly performing pages, portlets and providers, however there is also a failsafe monitoring system in place utilizing the monitoring capabilities of Oracle Enterprise Manager.

Configuration Settings

The configuration of the components within Oracle9iAS for SDE are left at the defaults they ship with, however some components are either shut down or removed for security purposes whilst others are tuned for performance reasons.

You can read more about these configurations options in the Oracle9i Application Server Performance Guide on OTN

The only configuration change on the mid-tier for SDE is within mod_plsql (dads.conf)

- DAD level NLS_LANG is configured to match the database NLS_LANG, avoiding unnecessary/unsupported requirements to have charset conversions for response being fetched through mod_plsql

  - PlsqlNLSLanguage AMERICAN_AMERICA.UTF8

Database TNS Listener is configured for DEDICATED connections. MTS mode has additional overheads which we wish to avoid. If your portal has Multi-Threaded Server (MTS) enabled MTS, you should try running without it to see if a performance improvement is achieved. Typically there is little need to use MTS with the connection pooling and reuse model of mod_plsql, which you can read more about in the Oracle9iAS Portal Architecture whitepaper on PortalCenter.

You can read more about these TCP/IP and SQL*Net settings in the TechTip “Tuning Oracle Net Services to optimize modPLSQL Database access times” on PortalCenter
PERFORMANCE LOGGING ANALYSIS

Through using the performance logging features of `mod_plsql` and the PPE it is possible to obtain detailed log entries that may be analyzed.

For a full description of how to implement this logging service, please see the technote "Performance Monitoring with `mod_plsql` in Oracle9iAS Portal", which is available on Portal Center.

![Unique Logins per Day](image)

Figure 3: Unique logins per day

The chart in Figure 3 indicates the quantity of unique successful logins over a 7 day period. A successful login is composed of one or more successful calls to `wwptl_login.login_url` and `wwsso_app_admin.ls_login`, terminated by a successful call to `wwsec_app_priv.process_signon`. Success is defined as returning an HTTP status code of less than 400. Since the number of calls to the first two functions can vary, the time reported is a weighted sum based on the frequency of the 3 calls over the time period specified. If your system is properly configured, the average value should be 1.6-1.8 seconds.

SDE saw some 1800 unique logins on 26th Nov.

For an explanation of this process please refer to "Design Considerations for a Performant Portal", available for download from portalcenter.oracle.com.
Figure 4: Unique Logins

The chart in Figure 4 drills down further on the unique login data to show the unique successful logins for a given hour.

The drilldown data is taken from the heaviest day in the sample week, and the graph shows that peak login occurs between 10am and 11am.
Figure 5: Maximum Concurrent Sessions by Day

As can be seen from the chart in Figure 5 whilst concurrent sessions follows the same pattern as unique logins for 26th Nov, it does not follow for 28th Nov which had similar unique sessions to 26th but proportionally lower logins during that day. Perhaps a greater proportion of public users were accessing content that day.
As can be seen from the chart in Figure 6 total page views in a seven day period follows the working week closely. Monday thru Thursday providing steady page viewing figures around the 16,000 mark with Friday substantially less and Saturday/Sunday with little or no access.
Figure 7: Page views per hour & CPU load

The Page View chart in Figure 7 gives an insight to the loading that the SDE machines are under during a 24 hour period.

The chart shows three elements here:

- Unique Page View count in each hour
- CPU utilization for SDE mid-tier
- CPU utilization for the SDE repository server

The graph shows that there is a distinct capacity for increased load on the SDE middle-tier server. Even at peak page load (~2000 page views) around 10am the middle-tier server never exceeded 50% utilization. The repository server utilization is similarly reasonably loaded compared to the to the page viewing figures.
CPU Utilization for a 24-hour period

Figure 8: Page CPU Utilization

The CPU chart is generated from data generated by the SAR utility which generates system utilization statistics. In its simplest form this can show simple percentage utilization for each CPU in a given machine.

Here we can see the load that machines are under during a 24 hour period.
Figure 9: Top ten pages on SDE

The chart in Figure 9 shows that there are a large number of SDE users viewing the home page. The very similar page view numbers for the next eight pages fit with the classic portal navigation model. This model follows a ‘landing pad’ approach where all users hit a single page and then navigate off to a page specific to them. Caching the Home page in its entirety and reducing the customization options available on the home page will ensure that a cache hit is obtained whenever possible. Subsequent pages navigated to by the user may then be more customizable as it is likely to receive fewer requests than the main landing pad page.
Top Twenty Portlets & Response Time

The chart in Figure 10 shows the 20 most popular portlets in SDE. Note the huge difference between request count for the search portlet and the average response time. This portlet would be the first on a list for tuning, assuming that it hadn’t already been done and the duration of searches were simply proportional to the amount of content being searched.
Figure 11: Response times

The chart in Figure 11 shows the average response times for a ‘hit’ on the middle-tier server. A ‘hit’ is different from a page request in Portal terms. A page request is defined as the unique URL that initiates a page generation or cache load, this page request may result in any number of ‘hits’ for subsequent subordinate content e.g. images, css, JavaScript files etc. The ‘hit’ to page ratio can be obtained by dividing the hit count for a period by the page req count for that same period. In this case SDE has a hit/page ratio of ~11.5 this is below the average, but is likely down to low use of graphics and aesthetic elements within the page.

The average response time for SDE over the seven day period is between 0.6 and 1.8 seconds.
CONCLUSION

SDE provides all shared processes, application tools, and hosts all of the information required to support BAE Systems development programme throughout its lifecycle.

An SDE by nature needs to support the dynamic behaviour of the project enabling project stakeholders to rapidly share information and collaborate as a community.

SDE achieves this goal through the use of OracleAS Portal

'BAE Systems Naval Ships is the Prime Contractor, and will launch and deliver, the whole class of the new Type 45 Destroyer for the Royal Navy. As the programme gathers pace the company is looking at introducing the Shared Data Environment to other programmes. Major future programmes for BAE Systems include work on the new Aircraft Carrier.

By encouraging newer and more effective ways of sharing information and working together BAE Systems Naval Ships can continue to increase focus on areas such as Prime Contracting, systems integration and project management. As such, BAE Systems Naval Ships is paving the way for the defence industry to meet the challenges of the 21st century.'

OracleAS Portal provides the technology, scalability and performance to help BAE Systems achieve their vision.