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| **Oracle Database Server and 32-bit Operating System Memory Limitations (Doc ID 269495.1)** | [To Bottom](https://support.oracle.com/epmos/faces/SearchDocDisplay?_adf.ctrl-state=vh4o2hh13_4&_afrLoop=320759508287128%20\o%20To%20Bottom) |  |
| **In this Document**   |  |  | | --- | --- | |  | [Goal](https://support.oracle.com/epmos/faces/SearchDocDisplay?_adf.ctrl-state=vh4o2hh13_4&_afrLoop=320759508287128%20\l%20GOAL) | |  | [Solution](https://support.oracle.com/epmos/faces/SearchDocDisplay?_adf.ctrl-state=vh4o2hh13_4&_afrLoop=320759508287128%20\l%20FIX) |  |  |  | | --- | --- | |  | [References](https://support.oracle.com/epmos/faces/SearchDocDisplay?_adf.ctrl-state=vh4o2hh13_4&_afrLoop=320759508287128%20\l%20REF) |     **APPLIES TO:**  Oracle Database - Enterprise Edition - Version 10.1.0.2 to 11.2.0.3 [Release 10.1 to 11.2]  Linux x86  z\*OBSOLETE: Microsoft Windows 2000  Microsoft Windows (32-bit)  z\*OBSOLETE: Microsoft Windows XP  z\*OBSOLETE: Microsoft Windows Server 2003  \*\*\*Checked for relevance on 06-Aug-2016\*\*\*  **GOAL**  Often the questions of the limitations imposed by the Oracle database arise.  The Oracle database imposes some limits and one can find these limits in the Oracle documentation  for the specific release, book Oracle Database® Reference Appendix A Database Limits.  Refer also to [Note 336186.1](https://support.oracle.com/epmos/faces/DocumentDisplay?parent=DOCUMENT&sourceId=269495.1&id=336186.1) - Database Limits   However, often the Oracle database is additionally restricted by some OS level restrictions, which  applies also to the Oracle software, since it generally operates at the next level and uses OS APIs to  complete operations, such as disk and memory management. The purpose of this document is to discuss  the memory limitations imposed by the 32-bit architectures  **SOLUTION**  Most of the problems appearing here are related to the 32-bit architectures. The most common 32-bit  processors used today are the Intel x86 based systems, running MS Windows or Linux operating  systems. Also most of the RISC vendors offers 32-bit architectures, but since Oracle 9i database and  above, Oracle tends to offer only 64-bit software for these platforms (see [Note:149914.1](https://support.oracle.com/epmos/faces/DocumentDisplay?parent=DOCUMENT&sourceId=269495.1&id=149914.1)).    Memory limitations of the 32-bit architectures.  The problem appears, because the 32-bit architectures are generally able to address only  231=4Gb of address space per process. In addition to that, part of that address space will normally be  reserved for kernel purposes, so the process itself is able to operate with even less than 4Gb of  memory. Such amount of memory sounded reasonably high several years ago, but today, the systems  often require significantly more. The good news is, that the hardware and OS vendors offers different  mechanisms for overcoming that limitation and addressing significantly more space, but these  mechanisms needs the administrators to be aware of that, needs some configuration, have some  limitations, and sometimes they introduces new APIs for the memory management, so not all the  applications (and respectively all the versions of the Oracle Database) can transparently use them.   Microsoft Windows  On this platform the Oracle Database Server is implemented as a single service and the background and  the server processes are implemented as threads in this service. Hence the total amount of memory  addressed by this service (and respectively used by Oracle) could not be more than 4Gb. In addition,  Windows reserves 2Gb of that space for kernel needs, so all the Oracle structures (SGA and the total  amount of PGAs) cannot be more than 2Gb in size. The following ways to overcome that limitation on  Windows exists  4GT-tuning feature  The 4GT-tuning feature simply reduces the kernel mode partition to 1GB, so 3Gb of space  can be used by Oracle. However, the total amount of memory addressed by the service is still 4Gb.  Physical Address Extension (PAE)  PAE is a method to access memory above 4 GB. PAE maps up to 64 GB of physical memory into a  32-bit (4 GB) virtual address space using either 4-kB or 2-MB pages. The page directories and the page  tables are extended from 4 byte to 8 byte formats, allowing the extension of the base addresses of page  tables and page frames to 24 bits (from 20 bits). More details about PAE can be found at the Microsoft  Knowledge Base article Q268363. Instructions on how to use PAE with Oracle 10g/11g can be found at  your Windows specific documentation, book Oracle® Database Platform Guide  NOTE:  On a computer that is running Windows Server 2003, Enterprise Edition or Windows Server 2003,  Datacenter Edition, the PAE specification is automatically turned on if the computer is configured to use  hot-add memory devices. Therefore, you do not have to use the /PAE switch on a system that is configured  to use hot-add memory devices. In all other cases, you must use the /PAE switch in the Boot.ini file.  For additional information, please refer also to    Oracle® Database Platform Guide    11g Release 2 (11.2) for Microsoft Windows     Part Number E10845-07     Section: Oracle Database Scalability on Windows <http://docs.oracle.com/cd/E11882_01/win.112/e10845/architec.htm#i1005805>Linux  Since this is mainly hardware problem, Linux also faces similar problems as Windows,  because it runs on the same 32-bit Intel processors. Also, Linux uses same methods (especially PAE)  for extending the memory, which can be addressed.  **REFERENCES**  [NOTE:1036312.6](https://support.oracle.com/epmos/faces/DocumentDisplay?parent=DOCUMENT&sourceId=269495.1&id=1036312.6) - Utilizing Up to 3GB Virtual Memory on Windows [NOTE:149914.1](https://support.oracle.com/epmos/faces/DocumentDisplay?parent=DOCUMENT&sourceId=269495.1&id=149914.1) - Oracle's 9i Platform Strategy Advisory [NOTE:156797.1](https://support.oracle.com/epmos/faces/DocumentDisplay?parent=DOCUMENT&sourceId=269495.1&id=156797.1) - What Is The Maximum Memory (RAM) Size Oracle Can Use on MS Windows 2000 [NOTE:260152.1](https://support.oracle.com/epmos/faces/DocumentDisplay?parent=DOCUMENT&sourceId=269495.1&id=260152.1) - Linux Big SGA, Large Memory, VLM - White Paper NOTE:336186.1 - Database Limits [NOTE:46001.1](https://support.oracle.com/epmos/faces/DocumentDisplay?parent=DOCUMENT&sourceId=269495.1&id=46001.1) - Oracle Database and the Windows NT memory architecture, Technical Bulletin | | |