Sangfor aCloud Best Practice for SAP Business One

This paper mainly describes:

- How to set up virtual environment of SAP system on SANGFOR aCloud
- How to completely migrate SAP service system on a physical host (or virtual machine (VM)) to SANGFOR aCloud through migration function
Table of Content

1. Background .......................................................................................................................... 1

2. Deployment Schemes ......................................................................................................... 2
   2.1 Environmental Preparations ......................................................................................... 2
   2.2 Installation of Operating System .................................................................................. 2
   2.3 Installation of SQL ......................................................................................................... 3
   2.4 Installation of SAP Business One .................................................................................. 4
   2.5 Deployment of Service Migration .................................................................................. 4

3. Functions of SANGFOR aCloud ......................................................................................... 4
   3.1 Compute Virtualization (aSV) ...................................................................................... 5
   3.2 Storage Virtualization (aSAN) ..................................................................................... 6
   3.3 Networking Virtualization (aNET) ................................................................................ 8
   3.4 Security Virtualization (aSEC) .................................................................................... 9
   3.5 Cloud Management Platform (aCMP) .......................................................................... 11
   3.6 Backup of Disaster Recovery ....................................................................................... 11
   3.7 Application references ................................................................................................. 13

4. Best Practice of SAP Business One ..................................................................................... 14
   4.1 Best Practice of VM Configuration .............................................................................. 14
      4.1.1 VM System Configuration ..................................................................................... 14
      4.1.2 VM vCPU Configuration ...................................................................................... 15
      4.1.3 VM Memory Configuration ................................................................................... 15
      4.1.4 VM Disk Configuration ....................................................................................... 15
   4.2 Performance Optimization of SQL Server (SAP) .......................................................... 18
      4.2.1 Maximum and Minimum Memory Limit Configurations ........................................ 18
      4.2.2 Data File Configuration ........................................................................................ 18
      4.2.3 Confirmation of Large-Page/Huge-Page Configuration ........................................... 19
      4.2.4 Configuration of Cost Threshold for Parallelism ................................................... 20
      4.2.5 Configuration of Max Degree of Parallelism (MAXDOP) ....................................... 20
   4.3 SQL Server AlwaysOn .................................................................................................... 21
1. Background

SANGFOR aCloud (Sangfor Enterprise Cloud) is a new generation of cloud IT architecture. It is built on the innovative hyper-converged technology. It has complete IT infrastructure service capabilities and O&M management service capabilities. Moreover, it can carry mission-critical enterprise service applications such as core database, ERP, financial system, and production system.

This paper mainly describes:
- How to set up virtual environment of SAP system on the SANGFOR aCloud, or
- How to completely migrate SAP service system on a physical host (or virtual machine (VM)) to SANGFOR aCloud through migration function.

SANGFOR aCloud has the following advantages: easy operation, no influence on previous services and host disc files, and rollback after failed operation. Meanwhile, it provides basic hardware and database configurations required for the SAP service to offer auto scaling function. In addition to this, SANGFOR aCloud provides a series of advantages for SAP users, including:

a. 1-click quick clone of SAP VMs to rationally utilize storage capacity
b. Low-latency operation against I/O localization of index and database files
c. Infrastructure integration, eliminating the vertical shaft of underutilized applications, and integrating several workloads into a single platform
d. Complete VM-level data protection, automatic backup and disaster recovery solution
e. Easy operation. No CPU, memory, disk and other complicated hardware configurations, nor mapping relationship configuration between RAID and LUN
2. Deployment Schemes

2.1 Environmental Preparations

Hyper-converged server, database installation software, SAP business one installation software.

2.2 Installation of Operating System

The steps are as follows:

- Log in to SANGFOR aCloud
- Build a new VM
- Configure vCPU quantity, memory and disk size in accordance with service demands

For specific configuration, refer to the following:

**SAP Business One Server**

<table>
<thead>
<tr>
<th>Hardware Configuration</th>
<th>Minimum Configuration</th>
<th>Recommended Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processor (vCpu)</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>Memory</td>
<td>32 GB</td>
<td>64 GB</td>
</tr>
<tr>
<td>Disk</td>
<td>80 GB</td>
<td>500G</td>
</tr>
<tr>
<td>CD-ROM drive</td>
<td>None.</td>
<td>None.</td>
</tr>
<tr>
<td>Monitor</td>
<td>None.</td>
<td>None.</td>
</tr>
<tr>
<td>Network adapter</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

**SAP Business One Database Server**

<table>
<thead>
<tr>
<th>Hardware Configuration</th>
<th>Minimum Configuration</th>
<th>Recommended Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processor (vCpu)</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>Memory</td>
<td>64 GB</td>
<td>128 GB</td>
</tr>
<tr>
<td>Disk</td>
<td>See 4.1.3.</td>
<td>See 4.1.3.</td>
</tr>
<tr>
<td>CD-ROM drive</td>
<td>None.</td>
<td>None.</td>
</tr>
<tr>
<td>Monitor</td>
<td>None.</td>
<td>None.</td>
</tr>
<tr>
<td>Network adapter</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
SAP Business One Client (Generally local PC, without a concern)

<table>
<thead>
<tr>
<th>Hardware Configuration</th>
<th>Minimum Configuration</th>
<th>Recommended Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processor (vCpu)</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Memory</td>
<td>4 GB</td>
<td>8 GB</td>
</tr>
<tr>
<td>Disk</td>
<td>80 GB</td>
<td>80 GB</td>
</tr>
<tr>
<td>CD-ROM drive</td>
<td>None.</td>
<td>None.</td>
</tr>
<tr>
<td>Monitor</td>
<td>None.</td>
<td>None.</td>
</tr>
<tr>
<td>Network adapter</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

After creating the VM successfully, install the operating system (OS). Click the installation system to select the ISO image of the system to be installed. The OS edition selected should be relatively stable and of high market share to guarantee the application service quality. It is recommended to install the 64-bit OS above Microsoft Windows server 2008 and corresponding system patches.

### 2.3 Installation of SQL

After installing the OS, perform the following steps:

- Configure the VM network
- Upload the database installation software for database installation

The OS edition selected should be relatively stable and of high market share to guarantee the application service quality. It is recommended to install Microsoft SQL Server 2008, Microsoft SQL Server 2008 R2, or Microsoft SQL Server 2012 (the database system installed must be matched with the OS) and corresponding system patches. The specific configuration refers to the following:

<table>
<thead>
<tr>
<th>SQL Server Edition (*)</th>
<th>Support or Not</th>
<th>Recommend or Not (*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SQL Server 2000</td>
<td>√</td>
<td>×</td>
</tr>
<tr>
<td>SQL Server 2005</td>
<td>√</td>
<td>×</td>
</tr>
<tr>
<td>SQL Server 2008 (*)</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>SQL Server 2012 (*)</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>SQL Server 2014</td>
<td>√</td>
<td>×</td>
</tr>
<tr>
<td>SQL Server 2016</td>
<td>√</td>
<td>×</td>
</tr>
</tbody>
</table>

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Note: The database is to be authorized by the Enterprise Core Edition. Otherwise the use of number of CPU cores is limited to result in incapability to enhance the performance.

### 2.4 Installation of SAP Business One

After completing Steps 2.2 and 2.3, perform the following steps:

- Determine that the patches of the OS and database system installed are also installed
- Install the SAP Business One.

See the related documents for detailed installation process.

### 2.5 Deployment of Service Migration

See the related documents for details.

### 3. Functions of SANGFOR aCloud

The SANGFOR aCloud provides a hyper-converged infrastructure for virtualization and cloud environment. In a set of x86 servers, it integrates compute virtualization (aSV), storage virtualization (aSAN), networking virtualization (aNET), security virtualization (aSEC) and cloud management platform (aCMP). The SANGFOR aCloud can greatly enhance the performance of the corporate network size, and let the network deployment and equipment O&M be more convenient. Moreover, it has a complete disaster recovery solution to let the service data be more secure.

- **aSV**: It virtualizes a server into multiple VMs to carry different services, improving the resource utilization and reliability.

- **aSAN**: It virtualizes the solid state disk (SSD) and hard disk drive (HDD) in the server into the shared storage with large capacity and high performance, and offers it to the VM.

- **aNET**: It realizes a network topology of "what you draw is what you get" to let the network O&M be easy, and provides a 2-4-layer firewall for each VM.
aSEC: It can virtualize traditional network security equipment hardware (such as AD/AF/SSL), and provide more secure and reliable service assurance.

aCMP: The cloud management platform realizes multi-tenant, process, self-service and other advanced functions of cloud computing to meet the needs of private cloud construction.

### 3.1 Compute Virtualization (aSV)

The Sangfor server virtualization technology abstracts the physical (hardware) resource of the server into logical resource to let one server turn into several and even hundreds of mutually isolated virtual machines. These servers are not limited by the definition in the physical hardware any more. Moreover, the technology lets CPU, memory, disk, I/O and other hardware turn into "resource pool" that can be dynamically managed, and supports such operations as hot add and hot migration of server and storage.

aSV cluster can add the physical host installed with the aSV system into the same management platform in a centralized manner. When any one of hardware, storage and network of the host fails, HA mechanism will automatically recover the VMs (including virtual network equipment) to other hosts for running. In addition to this, the SANGFOR aCloud provides a complete disaster recovery solution to guarantee the service continuity.

After the cluster resource scheduling is enabled, the system intelligently schedules the running position of the VM to ensure sustainable and stable operation of the service according to the resource load of each host.

After the dynamic resource add is enabled, the system will automatically evaluate the VM performance. When the VM performance is insufficient for a long time, the system automatically adds the CPU and memory resource (DRS, dynamic resource scheduling) for the VM to ensure sustainable and efficient operation of the service.
It is necessary to purchase abundant servers, storages, switch routes and other devices for the traditional data center (DC). They have the following shortcomings: complicated architecture, troublesome deployment, and extremely high hardware cost. After using the enterprise-class cloud software, the customers only need standard x86 server and switch to realize all functions of the traditional DC.

The traditional IT O&M takes charge of server O&M, storage O&M, networking O&M, and security O&M. It has the following shortcomings: complicated O&M, and people consumption. Using SANGFOR aCloud only needs few O&M engineer to manage all resources through the visual unified interface.

3.2 Storage Virtualization (aSAN)

The Sangfor virtual storage (called aSAN for short) is a product developed based on distributed file system to face the trend of storage virtualization. It virtualizes the SSD and HDD in the server into the shared storage with large capacity and high performance and offers it to the VM. The network-based distributed storage is used for such operations as storage, management, and read-write of the VM by "storage pooling" the space of all hard disk storages of the VMP. When any host fails, other hosts can continually access the VM files on this storage to guarantee that the VM can be recovered for running, as shown in the following figure:
aSAN is a new generation of product in the hyper-converged solutions, specially designed for the cloud computing environment and facing to the integrated market application. Such storage technologies as converged distributed cache, SSD cache acceleration, global server load balance, and multi-factor data protection can meet the demands of mission-critical service to guarantee efficient and stable operation of the customers' services.

The Sangfor hyper-converged infrastructure supports the iSCSI storage and FC storage provided by the third-party storage vendors as the shared storage, or selects the virtual storage function provided in the product.

**Cache - Read Cache**

The read cache, located in the VS client, can provide higher performance. The read cache will cache the data often read to the SSD in blocks of 4 KB~64 KB. It will be read directly from the SSD in the next time. During read operation, if the data to be read is cached on the SSD, it is called as hit. If not, it will be read from the HDD on the bottom layer. It is called as no hit. The
proportion of hit IO and all IOs is the hit ratio. The hit radio greatly affects the performance of reading the IOPS. The higher the hit radio is, the higher the IOPS performance is, as shown in the following figure:

3.3 Networking Virtualization (aNET)

The network topology of "what you draw is what you get" is used for the networking virtualization to intuitively present the connection relation between virtual network and network equipment in the virtual network. Dragging the mouse cursor simply can quickly set up the virtual network.

**Node Type:**

Physical port: Connect the virtual network to the physical network through physical port.

Virtual switch: Use for layer-2 connection and forwarding between nodes in the virtual network.

Virtual router: Use for layer-3 routing between nodes in the virtual network.

Virtual network equipment: including security protection (vAF), Internet access behavior management (vIAM) and application delivery (vAD) devices of the virtual network. Before adding such type of virtual network equipment, first import the device template. (Note: The use of this function needs to be authorized.)

VM: The virtual network is used to provide services in the end. The VM is to generate value. In the "VM" page, perform the following steps:

- Manage the VM
- Install the OS
- Deploy the service
- Add it into the network topology

Connection: Connect the virtual network equipment to the VM.

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3.4 Security Virtualization (aSEC)

As the leader of security products, Sangfor virtualizes the traditional security equipment hardware (such as IAM/AD/NGAF/SSL VPN). It provides an all-round multi-level security scheme from platform security, network security to data security to guarantee the service and data security of the customers.
vAF comprises the NFV function of the Sangfor Next-Generation Application Firewall (NGAF). The Sangfor NGAF provides L2-L7 secure, visual comprehensive protection. It effectively identifies the content risks from the network layer and application layer through bidirectional detection of network traffic. It provides stronger security protection capability than that of traditional firewall, IPS, WAF and other security equipment deployed simultaneously to resist the application layer attack with wider source, easier operation and more obvious harm.

vAD comprises the NFV function of Sangfor application delivery. The Sangfor application delivery is an upgrade of the traditional load-balanced product. It integrates the server, link, data center load balance, and application performance optimization function in one. It is a perfect choice to build a high-reliability and efficient service architecture.

vIAM comprises the NFV function of Sangfor Internet Access management. The Sangfor Internet access management can effectively manage the network. It comprises such core functions as user authentication, traffic control, application block, and Internet access behavior audit.
3.5 Cloud Management Platform (aCMP)

The Sangfor cloud management platform (aCMP) can manage the cluster cross the domain, and provide the heterogeneous management support to the VMware data center. It can divide the resource pool managed into several logical available zones. It configures the authorization of grading administrator to define the approval process and accounting. Moreover, because the network management and network security between tenants are enhanced, the tenants can configure the firewall in own zone.

3.6 Backup of Disaster Recovery

The SANGFOR aCloud has a complete disaster recovery (DR) function, and supports local and remote backup. The 1-click backup or recovery can be realized, with easy operation.
It can realize second-level backup locally, and has low requirements of backup storage. The common iSCSI and FC storages can support it. 1-click operation is supported for quick recovery in case of any failure to the service. The system starts within 2~5min. The remote backup function of the DR can realize second-level RPO and minute-level RTO to increase a protection line for the customers' data security, and improve the system reliability and continuity. The backup recovery process is as follows:
Snapshot can save the status of memory and disk file of the VM at a certain time point as an image. This image is combined with the original disk image. The status that the VM created the snapshot at that time can be recovered at any time later through this image.

Clone can create a new VM based on the existing one to realize the backup of existing VM. The new VM is identical to the original one, but independent of the original one.

3.7 Application references

The SANGFOR aCloud conducts special thorough optimization to the core services in the industry. At present, thousands of customers have deployed SAP, Kingdee ERPs, HIS, SQL Server, Oracle Database, and even Oracle RAC.
4. Best Practice of SAP Business One

This chapter describes the items of the SANGFOR aCloud that can be optimized against the practice of SAP Business One, such as system optimization, VM CPU, memory, storage and database. Note that numerous configurations and optimization take place at the levels of database and OS, rather than SANGFOR aCloud platform.

4.1 Best Practice of VM Configuration

4.1.1 VM System Configuration

The distributed storage module (aSAN) of SANGFOR aCloud has split-brain arbitration mechanism. To guarantee the platform stability, it is suggested to provide at least 3 servers in the cluster, and configure each server in the same manner. The RAID card supports non-raid and jbod. To use the aSAN, the cache disk and data disk must be configured into non-raid or jbod mode. For the distributed storage, more than or equal to 2 SSDs are used as the cache disks, and the SATA or SAS is as the data disk. It is recommended that the number rate of data disk and cache disk should be greater than or equal to 3:1. The vs architecture of SANGFOR aCloud can achieve the IO read-write performance of the SSD under the use of non-SSD storage. It is not suggested to configure full-SSD storage disk unless specifically requested.

The performance optimization tool of the platform is a management program, installed in the VM OS (Guest OS). It has the following effects:

- Provide the virtio drive required for virtualization of such IOs as network adapter and disk.
- Report such running status information as IP address of the VM, and real-time CPU/memory/IO of the OS to the platform.

The antivirus software will create problems against some functions of SQL Server. The exclusion function of the antivirus software is used to exclude the database file beyond the scanning range. The following file types are to be excluded: *.mdf, *.ndf, *.ldf, and *.bak.
4.1.2 VM vCPU Configuration

For the VM resources run by the SAP, the vCPU quantity is greater than the CPU configuration of the physical database server that is using currently, but less than 32 cores. Moreover, the NUMA is enabled. After the NUMA is enabled by the vCPU, pay attention to the relationship between vCPU quantity configuration and physical CPU quantity of the server. The server used is aServer2100 or above. Eight is taken as the boundary for the binding between vCPU and physical CPU. When the vCPU quantity is less than or equal to 8, the VM will not be transmitted to the physical CPU from the vCPU configuration, namely, 1*8 and 2*4 in the physical CPU are bond to 1 physical CPU. For the VM GUEST machine system, they are CPU configuration of 1*8. Therefore, when a SAP database server is created, the number of vCPU cores is recommended as 16 or 24.

4.1.3 VM Memory Configuration

VM memory size can be equivalent to the memory configuration of the physical database server that is using currently. Each vCPU should have a memory of at least 4GB, namely, 16*4=64GB. Meanwhile, enabling the huge page memory can increase the hit ratio of the TLB. The locked memory page is enabled after the VM is installed. The Windows policy will determine which account can have access to the process to retain the data in the physical memory, preventing the system from paging the data into the virtual memory of the disk. It can improve the database usability. The operations are as follows:

- Enable the "locked memory page" with system login account: Enabling mode "run" -->> "Enter gedit.msc" -->> "Computer configuration" -->> "Security setting" -->> "Local policy" -->> "Allocation of user rights" -->> "Locked memory page" -->> "Add current login user". (Run gpupdate and restart SQL Server service after adding.)

4.1.4 VM Disk Configuration

Divide the OS, SQL Server installation software as well as common tools software, Tempdb, database transaction log file, database data file, and database backup file in an independent

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disk respectively. Enable the "dynamic allocation of disk" of the disk where the database file is located.

This function can dynamically allocate the storage space according to the data occupation, improving the storage resource utilization while enhancing the performance.

From the angle of SQL Server, splitting the data file into several files and allocating them to different virtual disks can allocate I/O to multiple virtual disks to greatly utilize their I/O performance. Moreover, each file has a set of b-tree organizations and own growth space. Each file will be allocated with a thread for individual management, greatly enhancing the read-write performance of the data file:

<table>
<thead>
<tr>
<th>Classification of Database File</th>
<th>Database File Name</th>
<th>Database File Group</th>
<th>Disk Size</th>
<th>Storage Type</th>
<th>File System</th>
<th>Allocation Unit Size</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATA</td>
<td>Data1.mdf</td>
<td>PRIMARY</td>
<td>80GB</td>
<td>Asan</td>
<td>NTFS</td>
<td>64K</td>
<td>Store the data file of the user database, and adopt preallocated mode for the disk.</td>
</tr>
<tr>
<td></td>
<td>Data2.ndf</td>
<td>PRIMARY</td>
<td>80GB</td>
<td>Asan</td>
<td>NTFS</td>
<td>64K</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Data9.ndf</td>
<td>PRIMARY</td>
<td>80GB</td>
<td>Asan</td>
<td>NTFS</td>
<td>64K</td>
<td></td>
</tr>
<tr>
<td>LOG</td>
<td>Log1.ldf</td>
<td>None by default</td>
<td>100GB</td>
<td>Asan</td>
<td>NTFS</td>
<td>64K</td>
<td>Store the transaction log file of the user database, and adopt preallocated mode for the disk.</td>
</tr>
<tr>
<td></td>
<td>Log2.ldf</td>
<td>None by default</td>
<td>100GB</td>
<td>Asan</td>
<td>NTFS</td>
<td>64K</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Log6.ldf</td>
<td>None by default</td>
<td>100GB</td>
<td>Asan</td>
<td>NTFS</td>
<td>64K</td>
<td></td>
</tr>
<tr>
<td>Tempdb</td>
<td>Tempdb1.mdf</td>
<td>PRIMARY</td>
<td>20G</td>
<td>Asan</td>
<td>NTFS</td>
<td>64K</td>
<td>Store the data file and transaction log file of the system database tempdb.</td>
</tr>
<tr>
<td></td>
<td>Tempdb2.ndf</td>
<td>PRIMARY</td>
<td>20G</td>
<td>Asan</td>
<td>NTFS</td>
<td>64K</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tempdb8.ndf</td>
<td>PRIMARY</td>
<td>20G</td>
<td>Asan</td>
<td>NTFS</td>
<td>64K</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tempdblog1.ldf</td>
<td>None by default</td>
<td>100G</td>
<td>Asan</td>
<td>NTFS</td>
<td>64K</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tempdblog2.ldf</td>
<td>None by default</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Space allocation of data disk and log disk: The data file and log file must be placed in different disks independently. The total size of the log disk is suggested to be about 20%
larger than that of the data disk, mainly allowing for the mode of write data of SQL Server. Firstly, the data is written to the log file, and then written to the data file from the log file again. Moreover, the data synchronization is conducted between primary and auxiliary nodes through transaction log under AlwaysOn. Therefore, the log will increase greatly. It is suggested that the log disk should be 20% larger than the data disk for easy maintenance.

- Quantity allocation of data disk and log disk: Multiple data files can enhance the performance, but multiple log files basically have no enhancement. It is related to the writing mode of log sequence of SQL Server. Therefore, for easy maintenance, the several quantity allocations of data disk and log disk are recommended as follows: [9*data disks, 6*log disks], and [12*data disks, 6*log disks].

- TempDB: Almost all of relational databases will have a temporary data file or temporary database. It is called as TempDB on SQL Server. TempDB is used as an internal storage to store the following items:
  a) Sort, collection and other larger query statements
  b) Big-data type parameters
  c) XML or big-data type variables
  d) Datasets that are analyzed by the execution plan and subject to SPOOL operation
  e) Static cursor and key-value cursor
  f) Intermediate data in the INSTEAD OF trigger

Therefore, TempDB will generate abundant I/Os during use of SQL Server. It is necessary to independently create a disk for TempDB. Generally, the instance catalog is set to the designated on-disk catalog during database installation.

- Precautions for disk formatting: The basic unit of the data storage of SQL Server is an 8 KB page. Even if you only need to read a record, SQL Server still will read the whole page where the record is located. During allocation of data page, continuous 8 pages form an extend for unified allocation management. SQL Server enterprise edition has a pre-read mechanism. When a page is read, the adjacent pages will also be read to the memory simultaneously. If the next data that does not to be accessed is exactly on the adjacent page read just now, it can greatly benefit from the pre-read. The organizational structure and pre-read mechanism in the reference extend can format the disk into a 64 KB cluster.

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When an 8 KB page is read, the actual disk is read for 64K. Because the cluster is a continuous sector, the influence of such excess part read on the performance basically can be ignored. Therefore, formatting the disk partitioning (data, file and Tempdb) specifically used for SQL Server storage into a 64 KB cluster can save the space and enhance the performance.

### 4.2 Performance Optimization of SQL Server (SAP)

According to the verification result of Microsoft server virtualization, please install 64-bit database editions of Windows Server 2008 or above. In this way, SQL can effectively use the memory of greater than 2GB.

#### 4.2.1 Maximum and Minimum Memory Limit Configurations

In the aspect of memory configuration, VM memory = Maximum configured memory of SQLServer + Stack + System memory + VM cost + Other application memories. SQL Server will cache abundant data pages, and other information, including execution plan of stored procedure and security content of specific user. Because of relatively high memory consumption, it is not recommended to install additional production application services on the database server. It is suggested that the VM memory should be greater than 64G, 90% of VM memory should be allocated to SQL Server, and 10% be left for the system itself.

#### 4.2.2 Data File Configuration

It is necessary to configure Tempdb data file as follows:

- Set the recovery mode of Tempdb database as SIMPLE (SIMPLE by default). In SIMPLE mode, the system can automatically recover the log space to minimize the demands on log space.
- Divide Tempdb database into 8 data files (Total quantity of data file of Tempdb database = Quantity of CPU logical processor). Each data file has the same size, and is allocated in different disks.
Set tempdb size as 10% of the maximum instance database. Operations to add the data file are as follows:
- Divide the DATA file of the service database into more than 8 data files in the same way.
- Allocate them in different disks, as shown in the following figure:

Theoretically, the data file and log file of the database should be stored in the disk with quicker speed, such as RAID 1 disk. However, vs architecture of SANGFOR aCloud can achieve the IO read-write performance of the SSD, so you should not pay attention to it.

4.2.3 Confirmation of Large-Page/Huge-Page Configuration

Windows Large-Page/Huge-Page allocations used by SQL Server can enhance the performance. It is very suitable for the scenario of hyper-converged SQL Server deployment. Because SQL Server deployment on the hyper convergence is implemented on an independent VM, the preemption of other applications will not be happened. Mentioned in Chapter 4.1.3, Large-Page can reduce the entrance of TLB, increase the hit ratio of TLB cache, and enhance SQL Server performance greatly. SQL Server service startup account of the current system should have the authorization to lock the memory page to enable Large-Page/Huge-Page. See Chapter 4.1.3 for the operation methods. The effectiveness of Large-Page can be inquired in the SQL Server query:

```sql
SELECT large_page_allocations_kb, locked_page_allocations_kb
FROM sys.dm_os_process_memory;
```

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4.2.4 Configuration of Cost Threshold for Parallelism

The cost threshold for parallelism configured here is the threshold to designate SQL Server to create and run the parallel query plan. Only when the estimated cost of serial plan to run the same query is higher than the value set in the "cost threshold for parallelism", SQL Server can create and run the parallel plan of this query. The cost refers to the estimated time (s) spending on running the serial plan in the specific hardware configuration. The default value is 5. Any value among 0-32767 can be set. It is necessary to assess this value configuration in two scenarios:

- **OLTP scenario:** Generally, the serial plan cost is significantly larger than the parallel plan cost only under larger query throughput. At this time, the parallel plan is significant. Under smaller query throughput in OLTP scenario, the parallel plan is similar to a low-efficiency index for query, and its cost is significantly larger than that of serial plan. Therefore, it is suggested to increase the threshold to 20 in OLTP scenario.
- **OLAP scenario:** A larger query throughput is involved in some ERP report service query, or application scenario of data warehouse. At this time, the advantages of the parallel plan are embodied. Under this scenario, it is suggested to configure the value among 0~5, or keep the default value as 5.

4.2.5 Configuration of Max Degree of Parallelism (MAXDOP)

MAXDOP configuration option is used to limit the number of processors used during execution of parallel plan. SQL Server will implement the parallel execution plan for the query, index data definition language operation, static and keyset-driven cursor filling. In addition to query and index operations, this option also controls the parallelism of DBCCHECKTABLE, DBCCCHECKDB and DBCCCHECKFILEGROUP.

MAXDOP option can be set as the value among 0-32767. The designated value represents the maximum number of processor cores used to designate the single query. The default value is 0. Under the default value of 0, SQL Server can use 64 available processors at most. If the designated value is larger than the number of available processors, setting the actual available...
quantity of processor as 1 can cancel to generate the parallel plan. When the server only has one processor, the value of MAXDOP option will be ignored.

The best practices of MAXDOP option configuration can refer to the following items:

- When vCPU of the VM configuration is greater than 8, MAXDOP=8
- When vCPU of the VM configuration is less than or equal to 8, MAXDOP=vCPU quantity
- If the VM enables numa, and is configured by 2*N, then MAXDOP=N, namely, when vCPU has 16 cores, set it as 8; when vCPU has 16 cores, set it as 12
- In principle, MAXDOP configuration size cannot be greater than the CPU quantity of the physical server, even if the server CPU enables the hyper-threading

## 4.3 SQL Server AlwaysOn

As a comprehensive high availability and disaster recovery (HADR) solution of Microsoft new generation database, SQL Server AlwaysOn cluster is widely applied in the business database field. SANGFOR aCloud platform optimizes the deployment and performance of SQL Server AlwaysOn cluster, supports to deploy SQL Server AlwaysOn cluster in a guide type, provides database-level and instance-level HA of the cluster, and supports multi-node load balance and failover features. Meanwhile, it has such virtualization platform features as failure HA to improve the high availability of SQL Server AlwaysOn cluster.

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