EVIDEN

Identity and Access Management

DirX Directory

Disc Dimensioning Guide

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Preface

This manual provides information how to calculate and dimension disc space for your data for the DirX Directory Service (DirX).

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- Chapter 3 defines the terms for dimensioning disc space.
- Chapter 4 provides an overview on DBAM storage model and terminology.
- Chapter 5 provides an overview on DBAM configuration tools and their defaults.
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DirX Directory Documentation Set

DirX Directory provides a powerful set of documentation that helps you configure your directory server and its applications.

The DirX Directory document set consists of the following manuals:

- *DirX Directory Introduction*. Use this book to obtain a description of the concepts of DirX Directory.
- *DirX Directory Administration Guide*. Use this book to understand the basic DirX Directory administration tasks and how to perform them with the DirX Directory administration tools.
- *DirX Directory Administration Reference*. Use this book to obtain reference information about DirX Directory administration tools and their command syntax, configuration files, environment variables and file locations of the DirX Directory installation.
- *DirX Directory Syntaxes and Attributes*. Use this book to obtain reference information about DirX Directory syntaxes and attributes.
- *DirX Directory LDAP Extended Operations*. Use this book to obtain reference information about DirX Directory LDAP Extended Operations.
- *DirX Directory External Authentication*. Use this book to obtain reference information about external authentication.
- *DirX Directory Supervisor*. Use this book to obtain reference information about the DirX Directory supervisor.
- *DirX Directory Plugins for Nagios*. Use this book to obtain reference information about DirX Directory plugins for Nagios.
- *DirX Directory Disc Dimensioning Guide*. Use this book to understand how to calculate and organize necessary disc space for initial database configuration and enhancing existing configurations.
- *DirX Directory Guide for CSP Administrators*. Use this book to obtain information about installing, configuring and managing DirX Directory in the context of a Certificate Provisioning Service operating in accordance with regulations like the German “Signaturgesetz”.
- *DirX Directory Release Notes*. Use this book to install DirX Directory and to understand the features and limitations of the current release.

Notation Conventions

Boldface type
In command syntax, bold words and characters represent commands or keywords that must be entered exactly as shown.

In examples, bold words and characters represent user input.

Italic type
In command syntax, italic words and characters represent placeholders for information that you must supply.

[ ]
In command syntax, square braces enclose optional items.

{ }
In command syntax, braces enclose a list from which you must choose one item.

In Tcl syntax, you must actually type in the braces, which will appear in boldface type.

|
In command syntax, the vertical bar separates items in a list of choices.

...
In command syntax, ellipses indicate that the previous item can be repeated.

install_path
The exact name of the root of the directory where DirX Identity programs and files are installed. The default installation directory is *userID_home_directory**/DirX Identity* on UNIX systems and **C:\Program Files\DirX\Identity** on Windows systems. During installation the installation directory can be specified. In this manual, the installation-specific portion of pathnames is represented by the notation *install_path*.

1. Introduction

The DirX Directory documentation gives numerous information about the DBAM database, the storage model and the available configuration tools. However DirX Directory administrators additionally need some rules in order to be able to plan how much disc space will be necessary to store the whole information necessary to fulfill the performance requirements of their systems. They will also need some hints for the use of the numerous configuration parameters available for the database.

The purpose of this document and of the provided spreadsheet is to allow a first planning of the disc space needed.

Tuning of disc space and performance is an additional task necessary for every project.

Basically the place needed on the disk depends on several factors like:

- Number and type of directory entries
- Number of attributes of the entries
- Size needed by most of the entries
- Number of indexed attributes
- Type of indexes created
- Properties of the attribute values

2. References

DirX Directory Administration Guide

1. Chapter 1.4 The DBAM Database
2. Chapter 2.6 The DBAM Storage Model
3. Chapter 2.7 DBAM Configuration Tools

DirX Directory Administration Reference

4. Chapter 1.9 dbamconfig
5. Chapter 1.10 dbamboot

3. Definitions

a. Real Object: Basic set of information pertaining to one entry

b. Cluster: defines the size of a set of contiguous blocks (of fixed size) in the logical device for Indexes AVIDX (see chapter 5). The minimum size of such a cluster is not directly configurable and depends on the DirX Directory version. This size is of 32 MB for versions up to DirX Directory Extranet Edition V2.0B respectively and
may be reduced to 8 MB for subsequent versions.

c. Additionally for DirX Directory, the maximum size of a cluster is 128 MB.
The purpose of clusters is to force a certain locality of related data.

d. Density of Attribute Values in a DIT: In a directory tree, there are attributes where the value can be the same for many entries and other attributes where the value can be different for any entry. For instance consider these 2 extremes: a Boolean attribute will have only two values and an attribute like the Common Name (which is often quite unique defined) will tend to have as much values as the number of entries in the database (assuming a single valued attribute). If N is the member of entries, the possible number of existing values for single valued attributes will vary between 2 and N. For all attributes, there will be an average value between 2 and N. The density D is this average value, expressed as a percentage of N.

4. DBAM Storage Model and Terminology

The DBAM storage Model is described in [2]. This model supports two device types, the Directory Data Device and the Transaction Device

a. The Directory data device stores different types of data. It can be one or maximal 6 different raw devices. It is important to understand which data are stored in the different parts of the data device and how these data subsets are called in the configuration tools
    i. Real directory object data (called REAL): complete set of Information about one directory entry. These data subset is stored in blocks of fixed size.
    ii. Pseudo object data (called PSEUDO): references to REAL used by DBAM. These data subset is stored in blocks of fixed size.
    iii. Attribute Value Index Data (called AVIDX): standard Indexes (see chapter 6). These data subset is stored in blocks of fixed size.
    iv. Bit String Data (called BITSTR): References to subordinates. These data subset is stored in blocks of variable size.
    v. Tree data (called TREE): hierarchical relationships between entries. These data subset is stored in blocks of variable size.
    vi. General data (called GENERAL): other data. These data subset is stored in blocks of variable size.
b. The Transaction device only contains transaction logs and is always a separate raw device

5. DBAM Tools: Overview on Configuration Options

a. **dbamconfig**

The **dbamconfig** tool (see [4]) allows to configure profiles defining how these data are located on the disc and how much disc space is allocated to each data type.

For the default profile, a directory data device uses only one raw device and contains 3 logical devices

- The first logical device contains GENERAL | BITSTR | PSEUDO | TREE and gets 20% of the raw device space
- The second logical device contains REAL and gets 40% of the raw device space
- The third logical device contains AVIDX and gets 40% of the raw device space

b. **dbamboot**

The **dbamboot** tool (see [5])

- initializes/resets the database
- defines which DBAM profile will be used
- defines the fixed blocked size for REAL data. The value can be 1KB (default), 4KB, 16 KB or 64KB.
- defines the maximum number of attributes that can be indexed
- (default is 20). With this number and a check of the available disc space for AVIDX, the system will compute the optimal cluster size for this data type. The minimum size of a cluster is 8 MB, the maximum size is 128 MB for DirX Directory.
- based on the available disc space, dbamboot displays a raw information telling how many entries can be created, how many attribute types can be indexed, how many attribute index entries can be created, which AVIDX cluster size was selected, and how many index cluster can be used. (The number of entries is determined upon the size for the REAL logical device and the chosen block size. The AVIDX size and the number of indexed attribute types will determine the used cluster size. If instead the logical device size is insufficient and even choosing the minimal cluster size, it is not possible to satisfy the administrator's request, then a warning is displayed telling the maximal number of attributes affordable.)

6. Indexes

DirX Directory allows creating the following attribute indexes:

- INITIAL (also used for equality) / FINAL
- PRESENCE
- CONTAINS
- APPROXIMATE (phonetic match)

a. INITIAL / FINAL

   This index will be created with the **dirxadm** command:

   db attrconfig *attr-type(s)* **-index TRUE** ,

   or

   import_dbconfig *file-name*

   where the file *file-name* contains

   dn: cn=dbconfig
   attributeIndex: (*oid* **NAME** *attr-type* **INDEX INITIAL FINAL OPTREAD true)**
   ...

   For all attributes with string syntax, an INITIAL and FINAL index will be created.

   For all attributes that do not have string syntax only an INITIAL index just supporting equality match will be created.

b. PRESENCE

   This index will be created with the **dirxadm** command:

   db attrconfig *attr-type(s)* **-index TRUE ANY** ,

   or

   import_dbconfig *file-name*

   where the file *file-name* contains

   dn: cn=dbconfig
   attributeIndex: (*oid* **NAME** *attr-type* **NAME *attr-type* INDEX INITIAL FINAL PRESENT OPTREAD true)**
   ...

c. CONTAINS

   This index will be created with the **dirxadm** command:

db attrconfig *attr-type(s)* **-index TRUE CONTAINS** ,

or

import_dbconfig *file-name*

where the file *file-name* contains

dn: cn=dbconfig
attributeIndex: (*oid* **NAME** *attr-type* **INDEX INITIAL FINAL CONTAINS OPTREAD true)**
...

d. APPROXIMATE

This index will be created with the **dirxadm** command:

db attrconfig *attr-type(s)* **-index TRUE APPROXIMATE** ,

or

import_dbconfig *file-name*

where the file *file-name* contains

dn: cn=dbconfig
attributeIndex: (*oid* **NAME** *attr-type* **INDEX INITIAL FINAL CONTAINS APPROXIMATE OPTREAD true)**
...

See the **dirxadm db attrconfig** operation in the *Administration Reference* for a complete description of the operation.

7. Dimensioning Rules

a. Real Objects

The Fixed Block size for Real Objects can be configured with **dbamboot** to1 KB (default), 4 KB, 16 KB or 64 KB

The value to take here depends on how much memory is needed for 80 or 90% of the entries. An entry with about 10 standard attributes like password, telephone number, postal address will fit into 1 KB block. If many entries have space consuming attributes like certificates or photos, a bigger value should be taken. Note that for the entries that do not fit in one block, the system will have to create overflow blocks, which have consequences on the performance.

Choose the one, which allows to confine and to contain the information of an entire entry for at least 80 % of all entries.

This will so lead to the ideal situation of having to handle overflow records only for 20 % of all entries.

If N is the number of entries and K the configured block size in KB, the size of the REAL logical device will be

$$REAL = \mathrm{Re} = N \cdot K \text{ [KB] or } \mathrm{Re} = \mathrm{int}\left(\frac{N \cdot K}{1024^2} + 1\right) \text{ [GB]}$$

where

N = number of objects/ entries in the directory

K = said basic size of the Real Object in KB.

b. GENERAL | BITSTR | PSEUDO | TREE

The following values can be deduced from the size of the Real Objects (REAL) logical device, i.e.:

$$TREE = 0.1 \cdot \mathrm{Re}$$
$$PSEUDO = 0.1 \cdot \mathrm{Re}$$
$$BITSTR = 0.1 \cdot \mathrm{Re}$$
$$GENERAL = 0.2 \cdot \mathrm{Re}$$

Therefore, the size of this logical device will be:

$$\mathrm{Re}st = TREE + PSEUDO + BITSTR + GENERAL = 0.5 \cdot \mathrm{Re}$$

c. Indexes

Setting:

I = Number of indexed attributes
D = Density of indexes attribute values
Cl = cluster size in MB

The size of the AVIDX logical device will be in GB

$$AVIDX = \text{int}\left[I \cdot 5 \cdot \text{int}\left(\frac{D \cdot N}{6400 \cdot Cl} + 1 \right) \cdot \frac{Cl}{1024} + 1 \right]$$

This rule implicitly takes in account that all possible indexes, including CONTAINS (i.e.: INITIAL, FINAL, CONTAINS, ANY (presence) and APPROXIMATE (phonetic match)) will be created for all indexed attributes.

d. Transaction Log

A minimum size of 256 MB is required. For best performance consider:

TRANSLog = 2 times DBAM cache size and 4 GB behind.

8. Dimensioning Spread Sheet

The following spreadsheet allows entering different values for

- N : number of entries
- K : configured block size for REAL
- I : Number of indexed attributes
- D : Density of indexed attribute values
- Cl : cluster size

and computes the size of the REAL, AVIDX, Rest (TREE/ PSEUDO/ GENERAL) and the TRANSlog logical devices:

dimensioningSpreadsheet.xlsx

9. Working Area

For the building and rebuilding of attributes' indexes a working area under the control of the normal file system will be required.

The size of such an area should be oriented to the size of the AVIDX logical device (i.e. to be safe this working area should be foreseen with the same size as the AVIDX logical device).

This working area will, at directory installation, be assumed to be per default at: "$DIRX_INST_PATH/Tmp".

It can however be redirected at loading time, via **dirxload** assigning another path to the **dirxload**-parameter: **-t**.

Wanting on the other side to force a post indexing procedure (e.g. for the re-building of indexes) to use an alternative area, this can be achieved assigning a corresponding path to the environment variable: "$DIRX_DSA_TMP" prior starting the DSA.

10. DBAM Tools: Getting Information on the Disk Space in Use

The following tools will allow on one side to check after termination of the initial installation and configuration, that everything corresponds to the requirements and on another side to check, having later on to extend the number of indexed attributes, that the available logical device space is effectively able to bear the extensions.

a. **dbamconfig**

   dbamconfig (see [4]), beyond the ability to create profiles, allows also displaying how your DBAM Profiles are configured, it means how much place you reserved on the disc for the different dada types:

   dbamconfig -s -l –P*profile_name*

+It does not show how much place of these reserved disc parts is used. To see it use the following tool

1. **dbamdevinfo**

dbamdevinfo gives information on how much of the reserved space is in use and the fragmentation on each logical device.

+ Here an example:

+

```
DBAM Tools: Getting Information on the Disk Space in Use
The following tools will allow on one side to check after termination
of the initial installation and configuration, that everything
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b.  dbamdevinfo
dbamdevinfo gives information on how much of the reserved space is in
use and the fragmentation on each logical device.
```

```
Here an example:
DSA profile:               profile, ID=1
Real object block size:    1 KB
AVIDX cluster size:        8 MB
Maximum number of indices: 80

Logical device:  GENERAL | BITSTR | PSEUDO | TREE
    In use:          0.22 % (     1.793 MB of  818.997 MB)
    Fragmentation:   0.00 %
Logical device:  REAL
    In use:          0.06 % (     1.008 MB of    1.600 GB)
    Fragmentation:   0.00 %
Logical device:  AVIDX
    In use:          0.05 % (     0.766 MB of    1.600 GB)
    Fragmentation:   0.00 %


Attribute index specific device info:
    Attr id  LDAP name         Index type  Size
    0        objectClass       INITIAL        0.016 MB (   1 cluster)
    3        cn                INITIAL        0.172 MB (   1 cluster)
    3        cn                FINAL          0.172 MB (   1 cluster)
    4        sn                INITIAL        0.172 MB (   1 cluster)
    4        sn                FINAL          0.172 MB (   1 cluster)
    13       o                 INITIAL        0.016 MB (   1 cluster)
    13       o                 FINAL          0.016 MB (   1 cluster)
    15       ou                INITIAL        0.016 MB (   1 cluster)
    15       ou                FINAL          0.016 MB (   1 cluster)

    Number of indices: 9      (maximum 80)
    Cluster usage:     4.41 % (9 of 204)
```

11. Extending the Directory Database

If the size of the database is approaching in one or more directory logical devices the initially foreseen size limit, or more attribute types must be indexed than predefined, then the directory database must be resized as follows:

- Calculate, with the above described method, the new needed logical device size(s)
- Stop the DirX Directory service.
- Perform a backup of the database via:
  dirxbackup -S -v *backup_file_name*
- Enlarge the respective concerned logical device(s) (for example replace the disk with a larger one or add another one or a partition and create a corresponding larger logical one by means of the operating system features)
- Create a new profile with:
  dbamconfig -c -P *new_profile_name* **-D** ... (using the new logical devices)
- Perform again the basic initialization with the new profile through:
  dbamboot -P *new_profile name* **-a** *new_number_of_indexed_attributes*

It is important that even after the resizing that the cluster size remains the same as before. Now, when the new AVIDX size has been calculated as described above this should normally lead to the satisfaction of this requirement.
It can in some cases however happen that a discrepancy is discovered. In this case the cluster size can be adjusted varying the *new_number_of_indexed_attributes*. Increasing it will reduce the cluster size and vice versa.
If the adjustment can only be achieved through a reduction of the *new_number_of_indexed_attributes* below the real needed number of such attributes, then the AVIDX size is still too small and will have to be further enlarged. After that, the procedure can be resumed with the reconfiguration via **dbamconfig** as just described. (See also the information about the **AVIDX** device below for details.)

- Restore the directory database with:
  dirxbackup -R -v *backup_file_name*
- Delete the old profile with:
  dbamconfig -d -P *profile_name*
- Start the DirX Directory service.

When increasing the DBAM devices the following rules apply:

- Profile compatibilty:

  The new profile must be compatible with the old profile. That is:

  - You can only enlarge the device sizes.

- You must specify the devices as you had specified them in the old profile, for example you cannot modify the combination of **GENERAL**, **BITSTR**, **PSEUDO**, and **TREE** devices.

Perform the command
dirxbackup –Ti [*archive_name*]
to display the profile information of your backup.

- **REAL** device:

  See the **dbamconfig** command reference page in the *DirX Directory Administration Reference* for the maximum **REAL** device size.

  If you are uncertain about the applied real object block size you can find it in the file **schema***PID***.txt** where *PID* is the process id of the DSA process. The DSA process writes basic settings to this file at start-up time. It is located in the directory *install_path***/server/log**.

  Here is an example how the real block size is written to this file:

```
DBAM data:

...
Real object block size :    1 KB
```

  In this example with a real block size of 1 KB you can increase the **REAL** device size to a maximum value of 512GB.

- **AVIDX** device:

  The maximum size for increasing the **AVIDX** device depends on the applied AVI cluster size of the old database. **dbamboot** has calculated the appropriate cluster size when initializing the database. When you enlarge the **AVIDX** device size it must fit to the cluster size of the old profile.

  The following table lists the maximum values in relationship to the cluster size of the old database:

Cluster Size	Maximum Device Size
8 MB	26 GB
32 MB	102 GB
128 MB	409 GB

  Like the real block size you find the AVI cluster size in the file **schema***PID***.txt**. (See information above for details.)

  Here is an example how the AVI cluster size is written to this file:

```
DBAM data:

Number of AVI types    :   20
Number of AVI cluster  :  151
AVI cluster size       :  128 MB
Real object block size :    1 KB
```

In this example with a AVI cluster size of 128 MB you can increase the **AVIDX** device size to a maximum valueof 409GB.

- **GENERAL**, **BITSTR**, **PSEUDO**, **TREE** device:

  See the **dbamconfig** command reference page in the *DirX Directory Administration Reference* for maximum device sizes.

Example

The AVIDX device has a size of 1GB and all clusters are allocated. **dbamdevinfo** reports the following output for the AVIDX device:

```
Attribute index specific device info:
    Attr id  LDAP name         Index type  Size
    0        objectClass       INITIAL       0.031 MB (   1 cluster)
    3        cn                INITIAL     253.766 MB (  33 cluster)
    3        cn                FINAL       331.859 MB (  42 cluster)
    4        sn                INITIAL     206.891 MB (  26 cluster)
    4        sn                FINAL       168.000 MB (  21 cluster)
    13       o                 INITIAL       0.016 MB (   1 cluster)
    13       o                 FINAL         0.016 MB (   1 cluster)
    15       ou                INITIAL       0.016 MB (   1 cluster)
    15       ou                FINAL         0.016 MB (   1 cluster)

    Number of indices: 9      (maximum 80)
    Cluster usage:     100 %  (127 of 127)
```

To enlarge the AVIDX device perform the following steps :

- Stop the DirX Directory service
- Save the database with **dirxbackup**:
  `dirxbackup -S -v ArchiveDB`
- Increase the AVIDX device for example to 6GB.
- Create a new enlarged profile:

```
dbamconfig -c -D D:\RawDevices\DB,REAL=16GB,AVIDX=6GB
-T D:\RawDevices\Translog
-Pprofile2
```

- Initialize the new enlarged profile:
  dbamboot -Pprofile2
- Restore the database with **dirxbackup**:
  dirxbackup -R ArchiveDB
- Delete the profile:
  dbamconfig -d -Pprofile1
- Start the DirX Directory service.

dbamdevinfo now reports the new free cluster:

```
Attribute index specific device info:
    Attr id  LDAP name         Index type  Size
    0        objectClass       INITIAL       0.031 MB (   1 cluster)
    3        cn                INITIAL     253.766 MB (  33 cluster)
    3        cn                FINAL       331.859 MB (  42 cluster)
    4        sn                INITIAL     206.891 MB (  26 cluster)
    4        sn                FINAL       168.000 MB (  21 cluster)
    13       o                 INITIAL       0.016 MB (   1 cluster)
    13       o                 FINAL         0.016 MB (   1 cluster)
    15       ou                INITIAL       0.016 MB (   1 cluster)
    15       ou                FINAL         0.016 MB (   1 cluster)

    Number of indices: 9        (maximum 80)
    Cluster usage:     16.56 %  (127 of 767)
```

DirX Product Suite

The DirX product suite provides the basis for fully integrated identity and access management; it includes the following products, which can be ordered separately.

DirX Identity

DirX Identity provides a comprehensive, process-driven, customizable, cloud-enabled, scalable, and highly available identity management solution for businesses and organizations. It provides overarching, risk-based identity and access governance functionality seamlessly integrated with automated provisioning. Functionality includes lifecycle management for users and roles, cross-platform and rule-based real-time provisioning, web-based self-service functions for users, delegated administration, request workflows, access certification, password management, metadirectory as well as auditing and reporting functionality.

DirX Directory

DirX Directory provides a standards-compliant, high-performance, highly available, highly reliable, highly scalable, and secure LDAP and X.500 Directory Server and LDAP Proxy with very high linear scalability. DirX Directory can serve as an identity store for employees, customers, partners, subscribers, and other IoT entities. It can also serve as a provisioning, access management and metadirectory repository, to provide a single point of access to the information within disparate and heterogeneous directories available in an enterprise network or cloud environment for user management and provisioning.

DirX Access

DirX Access is a comprehensive, cloud-ready, scalable, and highly available access management solution providing policy- and risk-based authentication, authorization based on XACML and federation for Web applications and services. DirX Access delivers single sign-on, versatile authentication including FIDO, identity federation based on SAML, OAuth and OpenID Connect, just-in-time provisioning, entitlement management and policy enforcement for applications and services in the cloud or on-premises.

DirX Audit

DirX Audit provides auditors, security compliance officers and audit administrators with analytical insight and transparency for identity and access. Based on historical identity data and recorded events from the identity and access management processes, DirX Audit allows answering the “what, when, where, who and why” questions of user access and entitlements. DirX Audit features historical views and reports on identity data, a graphical dashboard with drill-down into individual events, an analysis view for filtering, evaluating, correlating, and reviewing of identity-related events and job management for report generation.

For more information: support.dirx.solutions/about

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