

## DUA Metrics

### Status of this Memo

This memo provides information for the Internet community. It does not specify an Internet standard. Distribution of this memo is unlimited.

### Abstract

This RFC is being distributed to members of the Internet community in order to solicit their reactions to the proposals contained in it. While the issues discussed may not be directly relevant to the research problems of the Internet, they may be interesting to a number of researchers and implementers.

This document defines a set of criteria by which a DUA implementation, or more precisely a Directory user interface, may be judged. Particular issues covered include terminal requirements; style of interface; target user; default object classes and attribute types; use of DAP; error handling. The focus of the note is on "white pages" DUAs: this is a reflection of the current information base. Nevertheless much of the document will be applicable to DUAs developed for other types of Directory usage.

Please send comments to the author or to the discussion group <osi-ds@CS.UCL.AC.UK>.

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## 1. Overview

The purpose of this document is to define some metrics by which DUA products can be measured. It should be first be noted that the use of the term "DUA" is rather misleading. There is an assumption here that the DUA is implemented correctly and is able to "talk" valid X.500 protocol: this is a sine qua non. Instead, this document seeks to draw out the characteristics of Directory user interfaces. However, the term DUA is persisted with as it is used by most people when referring to Directory user interfaces. The format of these DUA metrics is essentially a questionnaire which extracts a detailed description of a user interface. DUAs come in very different forms. Many make use of windowing environments, offering a "high-tech" view of the Directory, while others are designed to work in a terminal environment. Some interfaces offer extensive control over the Directory, and thus may be well-suited to Directory managers, while others are aimed more at the novice user. Some interfaces are configurable to allow searches for any attribute in any part of the DIT, while others lack this generality but are focussed on handling the most typical queries well. In many aspects, it is almost impossible to say that one DUA is better than other from looking at the responses to question in this document. A flexible management tool will be better for management than a DUA aimed at servicing simple look-ups, and vice-versa. Furthermore, in other areas, there are several radically different approaches to a problem, but it is not as yet clear whether one approach is better than another. One example of this is the extent to which a DUA provides an abstraction of the underlying DIT hierarchy, either emphasising the world as a tree or trying to conceal this from the user.

However, other aspects, such as whether the DUA can actually find the entries required, and if so, how quickly, can be directly measured in some way. Throughout this document, some of the questions posed are annotated with a square-bracketed points score and an explanation as to how the points should be allocated. For example, a question might be appended with "[2 if yes]", indicating score 2 points for an affirmative answer to that question. These points scores should be

collated in Table 1 at the end of the document, and this table constitutes a measure of the DUA. The metrics are on a section by section basis, which should help the reader who is seeking, for example, a DUA with good management capabilities which runs on a wide variety of platforms, to focus on the critical aspects of a DUA for the particular requirement.

## 2. General Information

This section contains general information about the implementation under discussion.

1. Name of the implementation .....
2. Version number of the DUA described in this document .....
3. Are further versions planned? [3 if yes] .....
4. Name and address of supplier or person to contact .....  
.....  
.....  
.....  
.....
5. Describe the hardware and software platforms on which the DUA will run. Some DUAs are split into a user interface part, and a DUA server part, communicating by means of a protocol. If the DUA is of the type where the DUA protocol machinery and user agent are implemented in a single process, complete only the user interface section, and indicate "n/a" for the DUA server and communications protocol questions.
  - (a) User interface part [1 per platform, up to a maximum of 4]
    - i. Hardware (If appropriate, can summarise as, for example,
    - ii. O/S (state version if critical)
      - A. UNIX (be sure to indicate which flavour - e.g., SYSV, BSD, SUNOS, etc) .....  
.....
      - B. VMS) .....
      - C. MS-DOS .....

- D. MS-Windows .....
- E. Macintosh .....
- F. Other) .....
- (b) DUA server part (or n/a) .....
  - i. Hardware (If appropriate, can summarise as, for example, "generic UNIX platform", or "386 PC") .....
  - ii. O/S (state version if critical)
    - A. UNIX (be sure to indicate which flavour - e.g., SYSV, BSD, SUNOS, etc) .....
    - B. VMS) .....
    - C. MS-DOS .....
    - D. Macintosh .....
    - E. Other) .....
  - iii. How does the user interface communicate with the DUA server?
    - A. Directory Assistance Service, as described in RFC1202 .....
    - B. DIXIE protocol, as described in RFC1249 .....
    - C. LDAP protocol, as described in Internet Draft OSI-DS 26 .....
    - D. Other .....
- (c) Name any other software required to run the DUA which is not supplied with the operating system or with the DUA software itself. Examples might include X.500 DAP libraries, or communications software .....
- 6. Is the software free? If the DUA needs other packages, are these also freely available? [3 if completely free] .....

### 3. Conformance to OSI Standards

#### 3.1 Directory protocols

7. Please list all conformance testing work applied to the DUA implementation (here the term DUA is used correctly in the sense of the DUA protocol machinery) [2 if any conformance work has been done] .....

#### 3.2 Protocol stacks

For the next two questions, [2 per stack supported for up to 4 stacks]

8. Which of the following transport and network layer protocols does the DUA support:
- (a) TP.x over CONS (state transport class) .....
  - (b) TP.4 over CLNS .....
9. Does the DUA support other transport and "network" layer protocols?
- (a) TP.x over RFC1006 over TCP/IP (state transport class) .....
  - (b) TP.x over X.25(1980) (state transport class) .....
  - (c) State any other options supported. ....
10. Does the DUA also run over any lightweight stack? If so, describe it with reference to the OSI seven layer model [3] .....

#### 3.3 Schema

11. Does the DUA support the full schema in X.520 and X.521 (y/n)? (Omissions should be described in response to a later question) [2 for full schema support] .....

#### 3.4 DIT structure

12. Does the DUA only follow object class hierarchies which conform to the suggested DIT structure in X.521?.....

#### 4. Conformance to Research Community Standards

The COSINE and Internet Directory Pilots have agreed a set of extensions to the standard, which make for a more cohesive pilot. This section is about conformance to these extensions.

13. Does the DUA fully support RFC1274, "The COSINE and Internet X.500 Schema" (y/n)? (Omissions should be described in response to a later question) [2 for full support] .....
14. Can the DUA handle referrals whose network addresses conform to RFC1277, "Encoding Network Addresses to support operation over non-OSI lower layers"? [2 if yes] .....
15. Does the DUA handle the Distinguished Name string syntax described in OSI-DS 23, "A String Representation of Distinguished Names" [2 if yes] .....  
.....
16. Does the DUA use the user-friendly naming query resolution described in OSI-DS 24, "Using the OSI Directory to achieve User Friendly Naming" [2 if yes] .....
17. Does the DUA make use of the Quality of Service schema extensions described in OSI-DS 15, "Handling QOS (Quality of service) in the Directory" [2 if yes] .....

#### 5. The General Style of the DUA

18. Is this a "white pages" interface, designed to give access to information about people within organisations? If not, state the types of information at which this interface is targetted .....  
.....
19. If this is a white pages DUA, who is it principally designed to serve? Indicate more than one of the following categories if appropriate (but please do not fill in so many categories as to hide due emphasis): [mark allocated should be the highest for any single classification]
  - (a) The ordinary user, who has no understanding of X.500, the hierarchical DIT, the state of advancement of the pilot, etc. [10] .....
  - (b) A secretary who wants to do telephone or room number look-ups within their department or organisation [8] .....
  - (c) A computer-literate user, who habitually uses a wide-range of

- network services [6] .....
- (d) An organisation's (or department's) data manager [4] .....
- (e) A Directory system manager [2] .....
20. Which best describes the use the DUA makes of the user's terminal?
- (a) Scrolling, line-mode interface .....
- (b) Full screen, "vt100" style interface .....
- (c) X-Windows .....
- (d) MS-Windows .....
- (e) Macintosh .....
- (f) Other .....
21. Does the DUA tend to emphasise or de-emphasise the DIT hierarchy?  
.....
22. Describe the interface in your own terms (up to about 50 words)  
.....  
.....  
.....  
.....  
.....  
.....

## 6. Schema

### 6.1 Object Classes and Attribute Types

Some DUAs are tightly focussed on answering particular queries: for example, white pages look-ups for information about people. Others offer more general capabilities. Please answer this question accordingly.

23. If the DUA has a tight focus, state:

- (a) The target object classes .....
- (b) The default attribute types .....

- (c) Other attribute types which may be configured. This might be answered as, for example, "all barring photo and audio", or as a list of supported attribute types .....

24. If the DUA has more general capabilities, state:

- (a) State any object classes in X.521 which cannot be searched for .....
- (b) State any object classes in RFC1274 which cannot be searched for.....
- (c) State any attributes in X.521 which cannot be displayed.....
- (d) State any attributes in RFC1274 which cannot be displayed....

## 6.2 DIT structure

25. DUAs often have a default object class hierarchy (e.g., it might assume countries at the root of the DIT, organisations immediately under countries, and people somewhere under organisations. Describe the type of hierarchy which the DUA most closely accords to:

- (a) Rigid .....
- (b) Rigid, but several hierarchies supported .....
- (c) Default hierarchy offered, but many hierarchies are supported .....
- (d) Default hierarchy offered, but DUA fully flexible .....
- (e) No default hierarchy, DUA fully flexible .....

26. If a default hierarchy is offered, please describe it .....

27. State any hierarchies, which are valid according to X.521's suggested DIT structure, but which cannot be queried (exclude hierarchies which cannot be queried because the DUA does not query for entries of particular object classes) .....



.....

## 7. Entering queries

The term "querying" is used here as a generic term for finding an entry, whether it be as a simple look-up, or the prelude to a modification operation.

### 28. Which best describes the query entry style?

- (a) Form filling (user responds to a set of prompts) .....
  - i. Query specified first, then resolved .....
  - ii. Query entry and resolution mixed .....
  - iii. Both modes possible .....
- (b) Queries entered as "user-friendly names" .....
- (c) Querying is by "navigating" around the DIT, the user searching and selecting .....
- (d) Other (please describe) .....  
.....

## 8. Strategy for locating entries

A number of strategies are employed by DUAs to find the entry the user is looking for. These have implications for user-friendliness and performance. For example, an interface which makes extensive use of search operations may be excellent at finding entries, but at the cost of being intolerably slow.

### 29. Which of the following strategies most closely accords with the behaviour of the DUA?

- (a) The DUA always uses search operations to find entries .....
- (b) The DUA offers users a list of entries, and invites the user to select from the list .....
- (c) The DUA only tries read operations (i.e., the DN must be exactly right) .....
- (d) The DUA tries read operations first, then searches for something similar if no entry can be found .....

- (e) The DUA tries read operations first, then offers a list of possible entries if no entry can be found .....
  - (f) User explicitly controls the X.500 operation which is invoked
  - (g) Other. Please describe.....
30. Does the DUA allow a user to "list" (either by the list operation or by a single level search operation) all the child entries of a node (notwithstanding administrative limits)? .....
31. Does the DUA follow aliases? .....  
If so, does it do so:
- (a) Always? .....
  - (b) Optionally? .....
32. Will the DUA optionally follow links to other entries by using attributes such as seeAlso and roleOccupant with a DN syntax? ..

## 9. Displaying results

33. Are the strings used to describe attribute types freely and independently configurable? [2] .....
34. Name any attribute types where the attribute values may be presented in local formats? (For example, it may be possible to configure the display of telephone numbers so that local numbers are shown as extensions, rather than with the full international dialling code.) [1 per attribute, up to a maximum of 4] .....
35. Does the DUA allow for the display of more than one result at a time (showing attribute values other than the name of the entry)? If so, how many entries may be displayed in response to a single query? [2 if feature provided] .....
36. Does the DUA support the notion of a quick synopsis, where a small core of attributes is retrieved initially, and a larger set is returned if required? [2 if yes] .....
37. What does the DUA do with attribute types it doesn't support in its sub-schema, but which have a standard syntax? .....

38. What does the DUA do with attributes which have are not in its sub-schema, and which have a non-standard syntax?

- (a) Ignore them? .....
- (b) Tell user, but don't display? .....
- (c) Display hex BER encoded value? .....
- (d) Display in some other format? .....

#### 10. Association Handling

This section is concerned with how a DUA handles its association with the Directory.

39. How/where is the access point to the Directory configured? If more than one method, indicate which ways are possible. [1 per method, up to maximum of 3]

- (a) In a system-wide tailor file .....
- (b) In a per user tailor file .....
- (c) As a run-time command line argument .....
- (d) Other. Please describe .....

40. Does the DUA allow for automatic connection to a back-up DSA if the access point DSA is unavailable? [2 if yes] .....

41. Can the DUA keep connections open to more than one DSA at a time? [1 if yes] .....

42. Does the DUA keep an idle connection open to the DSA(s). If not, describe the timeout strategy. [1 if yes] .....

43. Does the DUA handle referrals automatically? [2 if yes] .....  
If not: does the DUA handle referrals at all? [1 if yes] .....

44. Does the DUA make use of asynchronous operations?

- (a) Does the DUA bind asynchronously? [2 if yes].....
- (b) Are the operations handled asynchronously? .....

If so, is this true for:

- i. All operations? [2 if yes] .....
  - ii. Some operations? [1 if yes] .....
45. Does the DUA use size and time limits by default? [2 if no limits, or limits may be over-ridden] If so: .....
- (a) What size limit is used? .....
  - (b) What time limit is used? .....
  - (c) Are these limits overridable? .....

#### 11. Suitability for management

This section is intended to establish the range of operations supported by the DUA and, in particular, whether it is suitable for management tasks.

46. Is it possible to invoke all the operations in the Directory Abstract Service? If not, say which operations it does use [2 if all] .....
47. Is the user given full control over the service controls? If not, say which may be controlled, or none at all [2 if full, 1 if some control] .....
48. Is it possible to manage system attributes with the DUA? If so, indicate which DSA implementations for which this DUA provides management capabilities. ....
- (a) Knowledge [1].....
  - (b) Replication information [1] .....
  - (c) Other .....
49. Access control notwithstanding, does the DUA allow the following?
- (a) Attribute management [2 for all below, 1 for some]
    - i. Addition .....
    - ii. Modification .....

- iii. Deletion .....
- (b) Entry management [2 for all below, 1 for some]
  - i. Addition .....
  - ii. Modification .....
  - iii. Deletion .....
  - iv. Renaming .....

## 12. Query Resolution

This section discusses the process of query resolution. While two DUAs may both be able to resolve a query using the same information, one may do so much more quickly than the other. Some DUAs may be more "economic" in their use of DAP operations to achieve the same results. Some DUAs may find the correct results even when the users' input corresponds rather weakly to Directory names. Three aspects of query resolution are measured:

- o Does the DUA actually find the required entry?
- o If the required entry is found, how many entries were returned as well?
- o How "expensive" was the query in terms of underlying X.500 operations, whether the query was resolved successfully or not?

The following set of queries might all conceivably be resolved such that the author's Directory entry be found. The queries are split into 2 groups: the first group SHOULD pose no difficulties for a reasonable DUA; the second group are more problematic. In each case, award [2] marks if the query found the author's entry successfully. The expensiveness of each query should be measured using the following formula, which introduces the notion of SearchStones! The SearchStone rating is calculated by adding together the total operations used in attempting to resolve a query, weighted thus:

- o Bind [5]
- o Read operation [1]
- o List operation [2]
- o Search single level for countries, organisations or localities [3]

- o Search single level for organisational units, people or roles [3]
- o Search subtree [5]

Note: The single level searches have been separated into two categories in acknowledgement that certain types of search are much more likely to span multiple DSAs than others. The weightings are the same for the moment because of the pervasiveness of the Quipu implementation, which replicates all sibling entries in a single DSA, whatever the level in the DIT.

The notion of SearchStones merits some further explanation and the statement of some caveats.

The idea is to give some broad brush view of the work being undertaken by a DUA to retrieve an entry. There will be some correspondence between a low SearchStone rating and a DUA responding quickly, and vice-versa, although this correlation is not consistent, for reasons given below. It would be desirable to be able to have some timing information for the resolution of queries, but such results would only be meaningful if the tests were for target entries widely distributed throughout the DIT. Maybe this is something for the future? In the meantime it is worth noting some of the factors which militate against simple minded interpretation of the SearchStones.

- o The DIT is not uniform, with the depth varying considerably
- o While the DIT is currently mastered mostly by DSAs of a single implementation, this will be decreasingly the case, and other DSAs may have very different performance profiles.
- o Different directory domains are already adopting different strategies on information replication with profound performance implications.
- o No weighting is given to different search filters, or to boolean combinations of filters.

While acknowledging the difficulty of the exercise, there are counter arguments:

- o Some DUAs are better than others at finding the required results
- o Some DUAs will get the required results more quickly than most
- o DUA designers have to build DUAs in the knowledge that the DIT is heterogeneous with respect to DSA implementation and DIT structure

One possible way forward would be to refine the test queries such that they better represented the diversity of the DIT. However, as a first step, the tests are restricted to queries which could reasonably be constructed as searches for the author's entry. The author's entry is held in part of the DIT which is representative of much of the current DIT. It is suggested that in order to normalise the tests as much as possible, that testing be performed by connecting to the target DSA directly. The DSA's name is "cn=Vicuna, c=GB", and the addresses of the DSA may be found in the presentation address attribute for that entry. Note that the SearchStone rating should be shown even for queries which cannot be resolved.

First, the straightforward queries:

50. NAME=Paul Barker, OU=Computer Science, O=University College London, C=GB

51. NAME=Paul Barker, OU=Computer Science, O=UCL, C=GB

52. NAME=Barker, OU=Computer, O=UCL, C=GB

53. NAME=Barker, O=UCL, C=GB

54. NAME=p barker, O=university college, C=GB

55. NAME=paul b, OU=cs, O=university college, C=GB

More difficult queries:

56. NAME=p b, O=university college, C=uk

57. NAME=Paul Barker, OU=Computer Networking, O=london college, C=GB

58. NAME=Paul Baker (sic), OU=cs, O=ucl, C=Britain

59. NAME=p baker (sic), O=UCL, C=England

60. NAME=Paul Barker, OU=Directories, O=london, C=United Kingdom

Other general questions:

61. Will the DUA attempt a query of the form "Find all the Smiths in Britain"? .....

If so, does it do it by:

(a) A single query under the country node? .....

- (b) Multiple queries under all organisation nodes? .....
62. Does the DUA allow "hands-off" querying whereby the details of a query may be entered in one go, and the DUA attempts to resolve the query without any further user intervention? .....
13. International Languages
63. Does the DUA offer multi-lingual support. If so: .....
- (a) State which languages are already supported [1 per language up to a maximum of 3] .....
64. Can the DUA handle national language characters not found in PrintableString? [2 if yes] .....
14. User Friendliness
65. Is run-time help available? [2 if yes] .....  
If so:
- (a) Is context-sensitive help available? [1 if yes] .....
- (b) How many screens/windows? .....
- (c) How many bytes of help information? [2 if more than 5 Kbytes of text, 1 if more than 3 Kbytes] .....
66. Are the error messages terse renderings of the X.500 service errors, or user-friendly!? As an example, provide the error message displayed to the user if an administrative limit is exceeded. [2 if user-orientated, 1 if administrator-orientated, 0 if no message at all] .....  
.....  
.....
67. If modify operations are provided, is there support for editing the attributes correctly with the appropriate syntax (e.g., does the DUA guide the user that addresses are of up to 6 lines of up to 30 characters; what support is given for entering distinguished names) [2 for postal address support, 2 for DN support, 1 for any other support] .....
68. Is the user allowed to see what sort of entries are in the Directory if they are unable to find the entry they are looking for? [1 if yes] .....



69. Does the DUA allow automatic following of attributes with DN values, such as seeAlso and roleOccupant? [1 if yes].....

15. Operational Use

The DUA exists. But is there any evidence to suggest that it is a usable tool?

70. Is this DUA widely in use? [5 if used by more than 20 orgs, 3 if by more than 10 orgs, 2 if by more than 5 orgs, 1 if used operationally to provide a service anywhere] .....
- (a) Is this DUA in use anywhere in the COSINE/Internet Pilot? ..
- (b) Is this DUA in use in any other major pilot? .....
- (c) Is this DUA in use anywhere else operationally? .....
71. Has this DUA been assessed by groups outside of the software developers or providers? .....
72. If so, are the assessments public? Please provide copies of these assessments if they are available .....

Section		Points			
No.	Description	Maximum	Scored		
2	Gen_Info	10	...	n/a	
3	Conf_to_OSI	15	...	n/a	
4	Comm_stds	10	...	n/a	
5	Gen_Style	10	...	n/a	
9	Disp_Res	10	...	n/a	
10	Assoc_hand.	15	...	n/a	
11	Man_cap	10	...	n/a	
12	Query res			Search Stones	No. of other entries found
	Q._50	2	...	...	:_....._.....
	Q._51	2	...	...	:_....._.....
	Q._52	2	...	...	:_....._.....
	Q._53	2	...	...	:_....._.....
	Q._54	2	...	...	:_....._.....

Section		Points			
No.	Description	Maximum	Scored		
	Q._55	2	....	....	:_....._
	Q._56	2	....	....	:_....._
	Q._57	2	....	....	:_....._
	Q._58	2	....	....	:_....._
	Q._59	2	....	....	:_....._
	Q._60	2	....	....	:_....._
_13_	Int_Lang	5	....	n/a	
14	User-fr				
	Query DUA	10	....	n/a	
	Modify_DUA	15	....	n/a	
_15_	Op_use	5	....	n/a	

Table 1: DUA Metrics

## 16. Security Considerations

Security issues are not discussed in this memo.

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