The X Font Service Protocol

X Consortium Standard

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X Version 11, Release 7.7

Version 2.0

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!

" # #

$

% &"( )

* #+ #,

+

-

+ +

. /

"

+

"01 +23"4561 !+ 627! 1 85+ !+9 4!"02:" 45665 "; 23 5 ;
<! 1) 61++ 26 != >!1 ! >: ! ? @:" 2" >!=!"1 "2 "01
45665 "!1+ 23 =16 05 "5@!>!"; 3!" 1++ 326 5 56"! :>56
:6 2+1 5 2 ! 36! ?1=1 " ! 2 171 " +05>> "01)
2 +26"!:= @1 >!5@>1 326 5 ; >5!= 5=5?1+ 26 2"016 >!5@!>!
"; 401"016 ! 5 5 "!2 23 2 "65 " "26" 26 2"0164!+1
56!+! ? 362= 2:" 23 26 ! 2 1 "!2 4!"0 "01 +23"4561 26
"01 :+1 26 2"016 15>! ?+ ! "01 +23"4561

1$)

+ A)

Table of Contents

! H
5 = H
3 + P
" -! P
1 P
Q
" Q
6 B &(
1 HI
1 HC
1 H(
" H(
6 B HG
1 (P
1 (J
5 (G
6 (G
5 + > (G
@ ! + ('

Introduction

"
) 4 + &[1] =
$
") 3
+
) : *
B , $
* ,

) 3+ "3"
+
D $
"

@)
!

3 A $ B
A
A

1 B
$ "
*
, A B
+

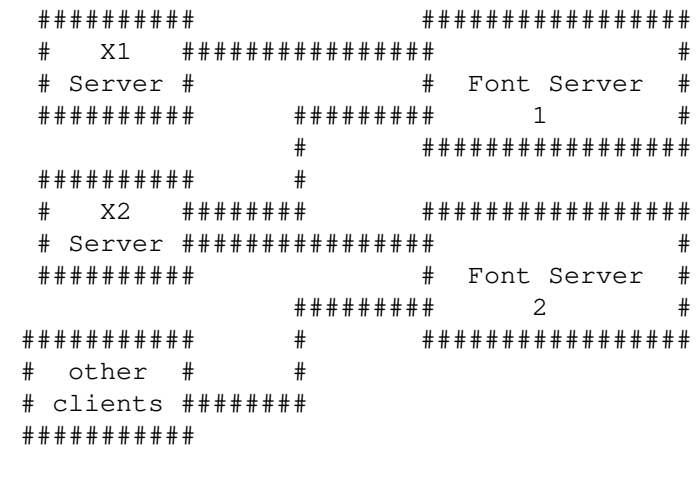
3 D
) * 1 56"
=1 " 32 "+ 5 >! 5"!2 32 "+,
) B
+) 3 +
B

Architectural Model

! # # # #
!
$)

") 3 + B)
"
5)
3 C & 5) 4 +
* ,

[1] &! " # " 2 ?



3 C&/ 3 +

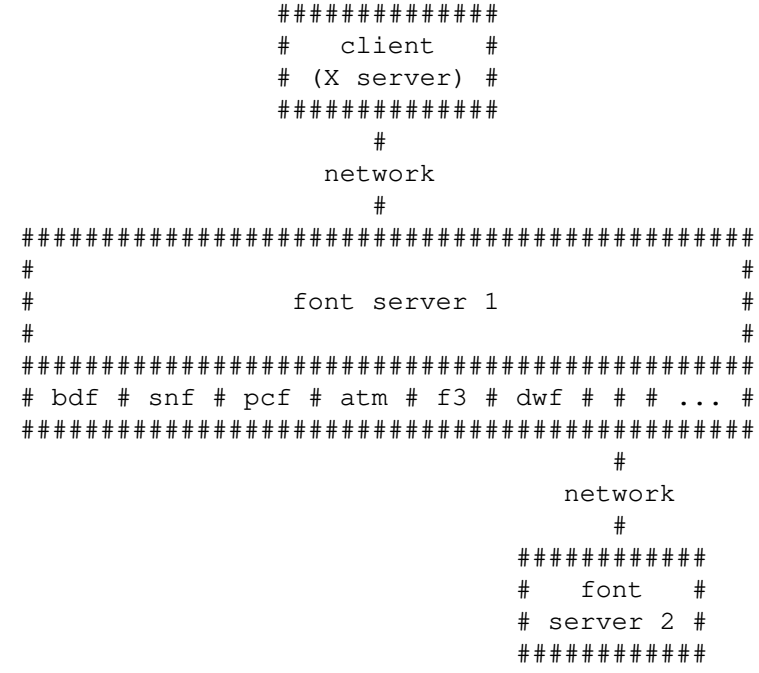
B - -
* " -! 1 C ,

3 B
" B)

3 +

)4 + 1$ $

5 *
,
+ (
3 CC



3 CC/4 3 3

C 1 1B

" # #

5)

A *
D ,
" A
*) ,

! B $
5 *
. ,)

Font Server Naming

3 $
* 1 56"=1 " 32 "+, 0

+
3
)

TCP/IP Names

" $ " -! /

```
<TCP name>  ::=  "tcp/" <hostname>":" <ipportnumber> ["/" <cataloguelist>]
```

E F * $,
* &G HI I C&C, " E F
" E F
B 3 $ /

```
tcp/expo.lcs.mit.edu:8012/available+special
tcp/18.30.0.212:7890
```

DECnet Names

" $ 1 /

```
<DECnet name>  ::=  "decnet/" <nodename> "::font$" <objname>
                    ["/" <cataloguelist>]
```

E F * +67 2 ,
1 * ((JI, " E . F
1 . " E F
B 3 $ /

```
DECNET/SRVNOD::FONT$DEFAULT/AVAILABLE
decnet/44.70::font$other
```

Protocol

" B - -
+ C) 4 +
K&L/

M /32 "!

M5 A /= $4

M+
/

+ * @;"1 26
16 =+@,
$ 4

M" # / # / 56 G/ G

M / N =
= $4 = $ O

M /
K &/ 56 G C/ 56 G L

5 $ #>!+" #
/ >!+" 56 G

Data Types

") 3 + /

ACCESSCONTEXT: ID

" 5 B
5 $
"
A "

!

+
* $) , B
2
* $,

AccessContexts * CreateAC)
* SetAuthorization) #
#

ALTERNATESERVER: [name: STRING8,
subset: BOOL]

" 5=1 !+2 GGP' &
+ H
" +:@+1"

"

AUTH: [name: STRING8,
data: LISTofBYTE]

" A
! A
5 B

BITMAPFORMAT:

CARD32 containing the following fields defined by the
sets of values given further below
[
byte-order-msb: 1 bit,
bit-order-msb: 1 bit,
image-rect: 2 bits { Min,
MaxWidth,
Max },
zero-pad: 4 bits,
scanline-pad: 2 bits { ScanlinePad8,
ScanlinePad16,
ScanlinePad32,
ScanlinePad64 },
zero-pad: 2 bits,
scanline-unit: 2 bits { ScanlineUnit8,
ScanlineUnit16,
ScanlineUnit32,
ScanlineUnit64 },
zero-pad: 2 bits,
zero-pad: 16 bits,
]

"
QueryXBitmaps8 QueryXBitmaps16 B

! @;"1 26 16 =+@ *& EE I, = + @
2 > +
@

! @!" 26 16 =+@ *& EE &,
= + @
2 >
+ @

" !=5?1 61 " $
! /

```
ImageRectMin          (0 << 2)
ImageRectMaxWidth     (1 << 2)
ImageRectMax          (2 << 2)
```

3 $) 056! 32
)32 "! 32 !=5?1 61 "
/

ImageRectMin – "
$ "
" /

```
left:     XCHARINFO.LBEARING
right:    XCHARINFO.RBEARING
top:      XCHARINFO.ASCENT
bottom:   XCHARINFO.DESCENT
```

ImageRectMaxWidth – "
D
* I , $
* , 5
A "
! 6 =$ A ! 6 =
" /

```
left:          min (XFONTINFO.MIN-BOUNDS.LBEARING, 0)
right:         max (XFONTINFO.MAX-BOUNDS.RBEARING,
                    XFONTINFO.MAX-BOUNDS.WIDTH)
top:                XCHARINFO.ASCENT
bottom:             XCHARINFO.DESCENT
```

! 6 =$ " $
* , $
* ,
A $ =$4 5 A
"
*
, "
/

```
left:          min (XFONTINFO.MIN-BOUNDS.LBEARING, 0)
right:         max (XFONTINFO.MAX-BOUNDS.RBEARING,
                    XFONTINFO.MAX-BOUNDS.WIDTH)
top:           max (XFONTINFO.FONT-ASCENT,
```

```
                    XFONTINFO.MAX-BOUNDS.ASCENT)
bottom:       max (XFONTINFO.FONT-DESCENT,
                    XFONTINFO.MAX-BOUNDS.DESCENT)
```

" + 5 >! 1 5 *G &Q HC
Q(, !
/

```
ScanlinePad8          (0 << 8)
ScanlinePad16         (1 << 8)
ScanlinePad32         (2 << 8)
ScanlinePad64         (3 << 8)
```

" + 5 >! 1 : !" *G &Q HC
Q(, "
B + 5
>! 1 5 ! /

```
ScanlineUnit8          (0 << 12)
ScanlineUnit16         (1 << 12)
ScanlineUnit32         (2 << 12)
ScanlineUnit64         (3 << 12)
```

@!"=5 326=5" 56 HC 5
A

: @!"=5 326=5" 3

@!"=5 326=5"=5+</ 56 HC

" @!"=5 326=5"/

```
ByteOrderMask          (1 << 0)
BitOrderMask           (1 << 1)
ImageRectMask          (1 << 2)
ScanlinePadMask        (1 << 3)
ScanlineUnitMask       (1 << 4)
```

: B A 3

@22>/ 56 G

"
/

```
False              0
True               1
```

@;"1/ G

"
$

56 G/ G

56 &Q/ &Q

56 HC/ HC

" "

056C@/ K & C/ 56 G L

"
C $* @;"1& @;"1C
, * @;"1& @;"1C
, "
G "
@;"1&

171 "=5+</ 56 HC

" $ D * D ,
1

"
* 1)"1 +!2 2 2 1 A
SetEventMask GetEventMask B ,/

```
CatalogueListChangeMask          (1 << 0)
FontListChangeMask               (1 << 1)
```

```
! CatalogueListChangeMask
CatalogueListNotify     !     FontListChangeMask
                              FontListNotify
```

1$
"
$ 5
A ! SetEventMask B
$ * , 171 "
=5+< * 1)"1 +!2 2 2 1
SetEventMask B , EventMask "
56 HC

32 "! / !

" B OpenBitmapFont

! / 56 HC

" HC H
& * & CRC' &, !
. !
S
32 "! 5 1++ 2
"1)"

5 ! A

! "G/ G

! "&Q/ &Q

! "HC/ HC

" "

```
OFFSET32:      [  position:     CARD32,
                  length:       CARD32 ]
```

"

```
PROPINFO:     [ offsets:          LISTofPROPOFFSET,
                data:             LISTofBYTE ]
```

"
+

" HC

```
PROPOFFSET:     [ name:           OFFSET32,
                  value:          OFFSET32,
                  type:           CARD8,
                  zero-pad3:      BYTE, BYTE, BYTE ]
```

"

" 5=1 *
A ,
62 ! 32 5"5 "
75>:1 "; 1
/

```
String          0
Unsigned        1
Signed          2
```

/

" "
62 ! 32 5"5
75>:1 2+!"!2 *
A , $ 75>:1 >1 ?"0 * A ,

" HC 56 HC
75>:1 2+!"!2 *75>:1 >1 ?"0 A ,

" HC
! "HC 75>:1 2+!"!2 *75>:1 >1 ?"0
A , " A HC

65 ?1/ K $ / 056C@ L

" 5
=! 056 B =5) 056 !
=5) 056 =! 056
=! 056 D)32 "! 32 056 65 ?1 =!
056 =5) 056 D)32 "! 32 056
65 ?1 =5) 056

```
RESOLUTION:      [ x-resolution:          CARD16,
                   y-resolution:          CARD16,
                   decipoint-size:        CARD16 ]
```

" A
") 61+2>:"!2 ;
61+2>:"!2 $
A " 1 ! 2! " +!T1 A
A

+"6! ?G/ >!+" 56 G

" &
!+2 GGP' & 5 # # B 056C@
@;"1& A @;"1C # #

"!=1+"5= / 56 HC

"
!

) 056! 32/ K / ! "&Q / ! "&Q / ! "&Q
/ 56 &Q L

" $ A
* ,
"

$ * $
3 H & #@ 3 C &#
KCL,

" >@156! ?
$

" 6@156! ? *
, $

" 4! "0 *
, $
* # #, "

A

" 5+ 1 " * ,
$

" 1+ 1 " * ,
$

" 5""6!@:"1+
!
A

" $
$ " $
6@156! ? >@156! ? $ 5+ 1 " U 1+ 1 "
$

```
XFONTINFO:      [ flags:                CARD32,
                  drawing-direction:    { LeftToRight, RightToLeft }
                  char-range:           RANGE,
                  default-char:         CHAR2B,
                  min-bounds:           XCHARINFO,
                  max-bounds:           XCHARINFO,
                  font-ascent:          INT16,
                  font-descent:         INT16,
                  properties:           PROPINFO ]
```

"

" 3>5?+ A
* A ,/

```
AllCharactersExist      (1 << 0)
InkInside               (1 << 1)
HorizontalOverlap       (1 << 2)
```

/

5 1$

!
056 65 ?1 !

! !

! $
D

D !
$

0 A 2

! $ *
$,

*
, !

$

" 654! ? !61 "!2
* #> "6 #,
*#6 "> #, !
/

```
LeftToRight            0
RightToLeft            1
```

" 056 65 ?1 =! 056 056 65 ?1 =5) 056

5 *
=! 056 =5) 056 B , B

" 135:>" 056
6 B
$ A
A

" =! @2: + =5) @2: +
$ $
* $,

" 32 "5+ 1 " 32 " 1+ 1 "
D
"
!

" 62 16"!1+

" HC

Requests

" B
7 .
B

1 B B
& + B
B
+
B B 1 B
(/

```
major-opcode:          CARD8
minor-opcode:          CARD8
length:                CARD16
```

" =5V26 2 2 1 B $
! =5V26 2 2 1 B =! 26
2 2 1 G B 2 =! 26 2 2 1
$ B " >1 ?"0
(
! *>1 ?"0 &, W
(B :
B A

! B >
! * ,
B 5 ! *
, B !
! $ B QueryEx-
tension B $ Request
! B =5V26 2 2 1 =! 26
2 2 1 Request 5
B ! B

B =5V26 2 2 1 I &CJ 1$
B =5V26 2 2 1 &CG CPP
5 =! 26 2 2 1 $ B
I CPP

1 G /

```
type:                  CARD8 value of 0
data-or-unused:        CARD8
sequence-number:       CARD16
length:                CARD32
```

" "; 1 A " 5"5 26 : :+1
* + P C B , "
&Q B B
+1X:1 1 :=@16 " >1 ?"0
(
! >1 ?"0
*>1 ?"0 C, W (

6 B $/

```
RequestName
    arg1:  type1
    arg2:  type2
    ...
    argN:  typeN
      =>
   result1:  type1
    result2:  type2
    ...
    resultM:  typeM

Errors:  kind1, kind2 ..., kindK

Description
```

! B #YF# !
B #YF# #YFU# !
A $ 5 B
F#

"
/

```
  open connection
    byte-order:                          BYTE
    client-major-protocol-version:       CARD16
    client-minor-protocol-version:       CARD16
    authorization-protocols:             LISTofAUTH
```

" @;"1 26 16 B
&Q HC " &IC *5+ !!
Z@D, S
&P(*5+ !! Z D,
!

" >!1 "=5V26 62"2 2> 716+!2 >!1 "=! 26
62"2 2> 716+!2
!
"
. C I

" 5:"026!T5"!2 62"2 2>+

"
$ A

```
    =>
    status:                          { Success, Continue,
                                       Busy, Denied }
    server-major-protocol-version:   CARD16
    server-minor-protocol-version:   CARD16
```

```
alternate-servers-hint:          LISTofALTERNATESERVER
authorization-index:             CARD8
authorization-data:              LISTofBYTE
```

" +16716 =5V26 62"2 2> 716+!2 +16716 =! 26
62"2 2> 716+!2
$!

! B
D 2
B
D ! D

" 5>"16 5"1 +16716+ 0! "
*
,
.

" +"5":+ .
!
/

```
Success          0
Continue         1
Busy             2
Denied           3
```

! +"5":+ . D A
! +"5":+ @
*
, ! 5:"026!T5"!2 ! 1) A
A

2 5:"026!T5"!2 ! 1) $ *
&, 5:"026!T5"!2 62"2 2>+
!
A
" 5:"026!T5"!2 5"5 A
*
,

! +"5":+ + 2
+"5":+ $ A *
B ,/

```
->
more-authorization-data:   STRING8
=>
status:                    { Success, Continue,
```

Busy, Denied }
more-authorization-data: LISTofBYTE

" +"5":+ "
* +"5":+ + ,
. * +"5":+ @ ,

2 +"5":+ + 5
$ A
/

=>
remaining-length: CARD32
maximum-request-length: CARD16
release-number: CARD32
vendor: STRING8

" 61=5! ! ? >1 ?"0 (
" =5)!=:= 61X:1+" >1 ?"0
B A (
(I'Q 6 B
> " 71 26
" 61>15+1 :=@16

5 $
B /

NoOp

1 / 5

" B !
KeepAlive

ListExtensions

YF

/ >!+" +"6! ?G

1 / 5

" B $
1$
!+2 GGP' &

QueryExtension

/ +"6! ?G

YF

/ @22>

/ 56 &Q

/ 56 &Q

/ 56 G

/ 56 G

/ 56 G

/ 56 G

1 / Alloc

" B $
5=1 * !+2 GGP' &,
.
! 61+1 " " =5V26 716+!2
=! 26 716+!2 .
S =5V26 2
2 1 $ B S 3!6+" 171 "
$ A
$ S :=@16 171 "+
S 3!6+" 16626
$ A
$ S :=@16 16626+
$

2 61+1 " 3
A

" "
B B
$ SetEventMask request
to express interest in any of $ D 2
Request

ListCatalogues

/ +"6! ?G

/ 56 HC

YFU

/ 56 HC

/ >!+" +"6! ?G

1 / Alloc

" B =5) 5=1+
* , 5""16
! * !+2 GGP' &, Z[D
* JJ, S ZWD * PC,
A S

" 5=1+
!+2 GGP' & $

! 5""16 A =5) 5=1+ B A
A "
A

+
ListCatalogues B " B
S

"

" 61 >!1+ 32>>24! ? 0! "

B !
A A

SetCatalogues

/ >!+" +"6! ?G

1 / Alloc , Name

" B
"

ListFonts , ListFontsWithXInfo , OpenBitmapFont
B "
!+2 GGP' & 5 A D

! Name
B

GetCatalogues

YF

/ >!+" +"6! ?G

1 / Alloc

" B *
!+2 GGP' &, "
ListFonts ListFontsWithXInfo
OpenBitmapFont 5 A D

$

SetEventMask

/ 56 G

/ 171 "=5+<

1 / EventMask , Request

" B $
1)"1 +!2 2 2 1 * A ,
1 $
* , $
$ B B

" SetEventMask A
+

! 1)"1 +!2 2 2 1 $
QueryExtension A Request !
171 "=5+<
$ * , EventMask
B

GetEventMask

/ 56 G

YF

/ 171 "=5+<

1 / Request

" B $
1)"1 +!2 2 2 1 * A ,

! 1)"1 +!2 2 2 1 $
QueryExtension A Request

CreateAC

/ 5 1++ 2 "1)"

/ >!+" 5:"0

YF

/ N + O

/ 56 G

/ >!+" @;"1

1 / IDChoice

" B AccessContext .
A 4 AccessCon-
text SetAuthorization B

! +"5":+ . D A
5 AccessContext .
! 5:"026!T5"!2 ! 1) A A
5:"026!T5"!2 5"5

2 5:"026!T5"!2 ! 1) $ *
&, 5:"026!T5"!2 62"2 2>+
!
A " 5:
"026!T5"!2 5"5 A
*

,

! +"5":+ $
B
" +"5":+
+

```
->
more-authorization-data:          STRING8
=>
status:                           { Success, Continue, Denied }
more-authorization-data:          LISTofBYTE
```

2 +"5":+ +
B

! 5 K& CRC' &L
$!

FreeAC

/ 5 1++ 2 "1)"

1 / AccessContext , Alloc

" B 5
$! 5 Access-
Context * SetAuthorization B , Se-
tAuthorization AccessContext
2
5 "
5 B CreateAC B

! 5 D A
CreateAC , an AccessContext

SetAuthorization

/ 5 1++ 2 "1)"

1 / AccessContext

" B AccessContext B
B * $ QueryXInfo QueryXExtents8 QueryXExtents16

QueryXBitmaps8 QueryXBitmaps16 CloseFont
AccessContext OpenBitmapFont #, #
5 5 AccessContext

! 5 AccessCon-
text CreateAC AccessContext

SetResolution

/ >!+" 61+2>:"!2

1 / Resolution Alloc

" B
A B
" 61+2>:"!2 \)
61+2>:"!2 \;)>3

! A 61+2>:"!2 +
2
61+2>:"!2 + A

! 61+2>:"!2 A 6

GetResolution

YF

/ >!+" 61+2>:"!2

1 / Alloc

" B !
SetResolution

ListFonts

/ +"6! ?G

/ 56 HC

YFU

/ 56 HC

/ >!+" +"6! ?G

1 / Alloc

" B =5) 5=1+
5""16)
> 3 KHL ! *
!+2 GGP' &, Z[D * JJ,
S ZWD * PC, A
S
" 5=1+ !+2 GGP' &
$ 3 B
)>3

! 5""16 A =5) 5=1+ B A
A "
A

+ List-
Fonts B " B S

"

" 61 >!1+ 32>>24! ? 0! "

B !
A A

ListFontsWithXInfo

/ +"6! ?G

/ +"6! ?G

/ +"6! ?G

/ 56 HC

YFU

/ 56 HC

/)32 "! 32

/ +"6! ?G

1 / Alloc

" B ListFonts $

3
A 5=1 ! 32

" 61 >!1+ 32>>24! ? 0! "

B !
A

! 5""16 A =5) 5=1+ B A
A 5=1 ! 32
" A

OpenBitmapFont

/ 32 "!

/ +"6! ?G

/ @!"=5 326=5"=5+<

/ @!"=5 326=5"

YF

/ 32 "!

/ @22>

/ @22>

1 / IDChoice Name Format AccessContext Alloc

" B
5""16
ListFonts . ! Name
2

"
D AccessContext * SetAutho-
rization B ,
5
AccessContext SetAutho-
rization AccessContext FreeAC + B
QueryXInfo QueryXExtents8 QueryXExtents16 QueryXBitmaps8
QueryXBitmaps16 CloseFont B 32 "!
Open-
BitmapFont B

!
* ,
2"016!
" 2"016! 75>!
2"016! / "
2"016! 32 "! 2 2"0
16! 75>! 3 2"016!
B OpenBitmapFont B

! 2"016! 2"016! 75>!
3

" 326=5"=5+< 326=5"0! "
B GetXBitmaps8 GetXBitmaps16

B +

! 5 05@>1 " *
,
AccessContexts
D "
! 5 05@>1
3 AccessContext .

"
ListFonts B
" B *
,
ListFonts OpenBitmapFont

! 32 "! K& CRC' &L
IDChoice !
5""16 Name
!
AccessContext ! 326=5"=5+<
326=5"0! "
326=5"=5+< Format

QueryXInfo

/ 32 "!

YF

/)32 "! 32

1 / Font Alloc

" B
32 "!

! 32 "! Font

QueryXExtents8

/ 32 "!

/ @22>

/ +"6! ?G

YF

/ >!+") 056! 32

1 / Font Range Alloc

" B B QueryXExtents16 $
&

QueryXExtents16

/ 32 "!

/ @22>

/ >!+" 056C@

YF

/ >!+") 056! 32

1 / Font Range Alloc

" B $
32 "! 65 ?1
056+

! 65 ?1 " 056+
$
! 056+ D
)32 "! 32 056 65 ?1 =5) 056
! 056+
D)32 "! 32 056 65 ?1 !
6 2
056+
$

! 65 ?1 3 056+
$! 056+ A
A $

" $ *
,
5
A
A 5 A
A B

! 32 "! Font
! 65 ?1 " 056+
Range

QueryXBitmaps8

/ 32 "!

/ @22>

/ +"6! ?G

/ @!"=5 326=5"

YFU

/ 56 HC

/ >!+" 233+1"HC

/ >!+" @;"1

1 / Font Range Format Alloc

" B B QueryXBitmaps16 $
&

QueryXBitmaps16

/ 32 "!

/ @22>

/ >!+" 056C@

/ @!"=5 326=5"

YFU

/ 56 HC

/ >!+" 233+1"HC

/ >!+" @;"1

1 / Font Range Format Alloc

" B
32 "! 65 ?1
056+

! 65 ?1 " 056+

! 056+ D
)32 "! 32 056 65 ?1 =5) 056
! 056+
D)32 "! 32 056 65 ?1 !
6 2
056+

! 65 ?1 3 056+
! 056+ A
A

! 6
2
056+

"
!

"

5

3 D
$
326=5"!=5?1 61 " 4
$

1 A

326=5"+ 5 >! 1 5 "
B 326=5"+ 5 >! 1 : !" "
$
326=5"@!"26
16 =+@ "
326=5"@;"1 26
16 =+@ 3

"
@!"=5 + !

* , !
A
1
326=5"+ 5 >! 1 : !"

" 233+1"+

1
A @!"=5 +
* ,

" 61 >!1+ 32>>24! ? 0! "

B !
A A

! 32 "! 3
! 65 ?1 " 056+
6 ! 326=5" 3

CloseFont

/ 32 "!

1 / Font Alloc

" B 32 "!
"
"
32 "! B OpenBitmapFont
B

! 32 "! Font

"close connection"

4 CloseFont
!

Errors

5 &Q /

/ 56 G &

/ 56 G

/ 56 &Q

/ 56 HC

/ "!=1+"5=

/ 56 G

/ 56 G

/ 56 &Q

" "; 1 " 16626 2 1
I &CJ $
&CG CPP " +1X:1 1 :=@16
&Q B B
" >1 ?"0 (
(" "!=1+"5=
" =5V26 2 2 1 =! 26 2 2 1 *A B ,
B " 5"5 26 : :+1
&Q ! >1 ?"0
*>1 ?"0 (, W ($

" /

Request

/ 56 &Q

" B
. B $
B QueryExtension $

Format

/ 56 &Q

/ @!"=5 326=5"

" @!"=5 326=5"
OpenBitmapFont QueryXBitmaps8 QueryXBitmaps16
B " $

Font

/ 56 &Q

/ 32 "!

" 32 "!
QueryXInfo QueryXExtents8 QueryXExtents16 QueryXBitmaps8
QueryXBitmaps16 CloseFont B "
$

Range

/ 56 &Q

/ 65 ?1

" 65 ?1 QueryXExtents8
QueryXExtents16 QueryXBitmaps8 QueryXBitmaps16 B
" $

EventMask

/ 56 &Q

/ 171 "=5+<

" 171 "=5+< SetEvent-
Mask B " $

AccessContext

/ 56 &Q

/ 5 1++ 2 "1)" AccessContext

" 5 1++ 2 "1)" FreeAC
SetAuthorization B OpenBitmapFont B
A ! 5
1++ 2 "1)" B $!
5 1++ 2 "1)" $

IDChoice

/ 56 &Q

/ !

" 5 1++
2 "1)" CreateAC B 32 "!
OpenBitmapFont B "
$

Name

/ 56 &Q

" OpenBitmapFont B SetCat-
alogues B

Resolution

/ 56 &Q)

/ 56 &Q ;

/ 56 &Q A

" 61+2>:"!2
SetResolution B "
5"5 26 : :+1 $

Alloc

/ 56 &Q

" B
* ,

Length

/ 56 &Q

/ 56 HC

" B
*=5)!=:= 61X:1+">1 ?"0 W (, "
$

Implementation

/ 56 &Q

" B
:

5 $

Events

1 B D
$ 1
&C /

/ 56 G C

/ 56 G

/ 56 &Q

/ 56 HC

/ "!=1+"5=

" "; 1 C " 171 " 2 1
I &CJ &CG CPP
$ " +1X:1 1 :=@16 &Q
B B "
>1 ?"0 (
H " "!=1+"5=
! >1 ?"0
*>1 ?"0 H, W (

1 $/

```
EventName
        arg1: type1
        ...
        argN: typeN

         Description
```

! $

") 3 + /

KeepAlive

" *

, B B * NoOp #, #

CatalogueListNotify

/ @22>

/ @22>

" Cata-
logueListChangeMask
" 5 1 "
3
" 1>1"1 " $
3

FontListNotify

/ @22>

/ @22>

" FontListChangeMask

" 5 1

"

3 " 1>1"1 "

$

3

5 $

Protocol Encoding

$ #]$# $ * &Q, 5
6 B
$/

Name
count *contents* *name*
...
count *contents* *name*

2: "
2 "1 "+ + (
5=1

2 . *
B ,
. " $
= .
2 "1 "+ $ #>!+" #

: * , 2 "1 "+
5=1 # # T * A ,
2 "1 "+ 5=1 #A # " $ * ,
/

```
pad(e) = (4 - (e mod 4)) mod 4
```

Data Types

```
ACCESSCONTEXT

4 CARD32 access context with at least one of the following bits set:

#x1fffffff

but none of the following bits set:

#xe0000000                zero


ALTERNATESERVER
```

```
1     BOOL              subset
1     n                 length of name
n     STRING8           name
p                       unused, p=pad(n+2)

AUTH

2     n                 length of name
2     d                 length of data
n     STRING8           name
p                       unused, p=pad(n)
d     STRING8           data
q                       unused, q=pad(d)


BITMAPFORMAT

4 CARD32 value, union of the following bits:
     #x00000001          ByteOrderMSB
     #x00000002          BitOrderMSB
     #x00000000          ImageRectMin
     #x00000004          ImageRectMaxWidth
     #x00000008          ImageRectMax
     #x00000000          ScanlinePad8
     #x00000100          ScanlinePad16
     #x00000200          ScanlinePad32
     #x00000300          ScanlinePad64
     #x00000000          ScanlineUnit8
     #x00001000          ScanlineUnit16
     #x00002000          ScanlineUnit32
     #x00003000          ScanlineUnit64

except for the following bits which must be zero:

     #xffffccf0          zero

and the following of which at most one bit may be set:

     #x0000000c at most one bit can be set


BITMAPFORMATMASK

4 CARD32 value, mask of the following bits:

     #x00000001          ByteOrderMask
     #x00000002          BitOrderMask
     #x00000004          ImageRectMask
     #x00000008          ScanlinePadMask
     #x00000010          ScanlineUnitMask

except for the following bits which must be zero:

     #xffffffe0          zero
```

```
BOOL

1    BOOL       boolean, one of the following values:
0    False
1    True

BYTE
1    BYTE       unsigned byte of data

CARD8
1    CARD8       8-bit unsigned integer

CARD16
2    CARD16      16-bit unsigned integer

CARD32
4    CARD32      32-bit unsigned integer

CHAR2B
1    CARD8       byte1
1    CARD8       byte2

EVENTMASK
4    CARD32 event mask
     for core events, this is union of the following bits:

     #00000001   CatalogueListChangeMask
     #00000002   FontListChangeMask

but none of the following bits set:

     #fffffffc

extensions define their own sets of bits

FONTID

4 CARD32 font identifier with at least one of
the following bits set:

     #x1fffffff

but none of the following bits set:

     #xe0000000   zero

INT8
1    INT8         8-bit signed integer

INT16
2    INT16         16-bit signed integer

INT32
```

```
4    INT32          32-bit signed integer

OFFSET32
4    CARD32          position (or integer value)
4    CARD32          length

PROPINFO
4    n                number of PROPOFFSET components
4    m                number of bytes of property data
20*n PROPOFFSET        property offsets into data block
m    LISTofBYTE        property data block

PROPOFFSET
8    OFFSET32         name in data block
8    OFFSET32         value in data block

1 CARD8 type, one of the following values:
0    String
1    Unsigned
2    Signed
3    zero

RANGE
2    CHAR2B                minimum character code
2    CHAR2B          maximum character code

RESOLUTION
2    CARD16 x resolution in pixels per inch
2    CARD16 y resolution in pixels per inch
2    CARD16 point size in decipoints

STRNAME
1    n length of name
n    STRING8 name

STRING8
n    LISTofBYTE         array of 8-bit character values

TIMESTAMP
4    CARD32          milliseconds since server time origin

XCHARINFO
2    INT16          left bearing
2    INT16          right bearing
2    INT16          width
2    INT16          ascent
2    INT16          descent
2    CARD16          attributes

XFONTINFO
4 CARD32 flags, union of the following bits:
     #x00000001         AllCharactersExist
     #x00000002         InkInside
     #x00000004         HorizontalOverlap
```

```
but none of the following bits set:

     #xfffffff8         zero
4    RANGE              range of characters in font
1    CARD8              drawing direction
     0             LeftToRight
     1             RightToLeft
1                       unused
2    CHAR2B             default character
12   XCHARINFO          minimum bounds
12   XCHARINFO          maximum bounds
2    INT16              font ascent
2    INT16              font descent
n    PROPINFO           property data
```

Requests

```
1     BYTE                   byteorder, one of the values:
      #x42                   MostSignificant Byte first
      #x6c                   LeastSignificant Byte first
1     CARD8                  numberof auth in auth-data
2     2                      client-major-protocol-version
2     0                      client-minor-protocol-version
2     a/4 lengthof           auth-data
a     LISTofAUTH             auth-data
=>
2     CARD16                 status
0                            Success
1                            Continue
2                            Busy
3                            Denied
2     2                      major version
2     0                      version
1     CARD8                  numberof alternate-servers-hint
1     CARD8                  authorization-index
2     a/4                    lengthof alternate-servers-hint
2     (d+q)/4                lengthof authorization-data
a     LISTofALTERNATESERVER  alternate-servers-hint
d     LISTofBYTE             authorization-data
q                            unused, q=pad(d)
```

```
! +"5":+   @                                !
+"5":+            $
                        "
           +              +"5":+   @
          /


->
4     1+(d+q)/4              length
```

```
d     LISTofBYTE              more-authorization-data
q                             unused, q=pad(d)
=>
4     2+(d+q)/4               length
2     CARD16                  status
        0                     Success
      1                       Continue
      2                       Busy
      3                       Denied
      2                       unused
d     LISTofBYTE              more-authorization-data
q                             unused, q=pad(d)
```

4 +"5":+ +
/

```
4     3+(v+w)/4               length of rest of data
2     CARD16                  maximum-request-length
2     v                       length of vendor string
4     CARD32                  release-number
v     STRING8                 vendor-string
w                             unused, w=pad(v)
```

2
B /

NoOp

```
1   0                         major-opcode
1                             unused
2   1                         length
```

ListExtensions

```
1   1                         major-opcode
1                             unused
2   1                         length
=>
1   0                         type reply
1   CARD8                     numberof names
2   CARD16                    sequence-number
4   2+(n+p)/4                 length
n   LISTofSTRNAME             names
p                             unused, p=pad(n)
```

QueryExtension

```
1   2                         major-opcode
1   n                         length of name
2   1+(n+p)/4                 length
n   STRING8                   name
p                             unused, p=pad(n)
=>
1   0                         type reply
1   BOOL                      present
2   CARD16                    sequence-number
```

```
4   5                       length
2   CARD16                  major-version
2   CARD16                  minor-version
1   CARD8                   major-opcode
1   CARD8                   first-event
1   CARD8                   number-events
1   CARD8                   first-error
1   CARD8                   number-errors
3                           unused
```

ListCatalogues

```
1   3                       major-opcode
1                           unused
2   3+(n+p)/4               length
4   CARD32                  max-names
2   n                       length of pattern
2                           unused
n   STRING8                 pattern
p                           unused, p=pad(n)
=>+
1   0                       type reply
1                           unused
2   CARD16                  sequence-number
4   4+(n+p)/4               length
4   CARD32                  replies-following-hint
4   CARD32                  numberof catalogue-names
n   LISTofSTRNAME           catalogue-names
p                           unused, p=pad(n)
```

SetCatalogues

```
1   4                       major-opcode
1   CARD8                   numberof catalogue-names
2   1+(n+p)/4               length
n   LISTofSTRNAME           catalogue-names
p                           unused, p=pad(n)
```

GetCatalogues

```
1   5                       major-opcode
1                           unused
2   1                       length
=>
1   0                       type reply
1   CARD8                   numberof catalogue-names
2   CARD16                  sequence-number
4   2+(n+p)/4               length
n   LISTofSTRNAME           catalogue-names
p                           unused, p=pad(n)
```

SetEventMask

```
1   6                       major-opcode
1   CARD8                   extension-opcode
2   2                       length
4   EVENTMASK               event-mask
```

GetEventMask

```
1   7                       major-opcode
1   CARD8                   extension-opcode
2   1                       length
=>
1   0                       type reply
1                           unused
2   CARD16                  sequence-number
4   3                       length
4   EVENTMASK               event-mask
```

CreateAC

```
1   8                       major-opcode
1   CARD8                   numberof authorization-protocols
2   2+a/4                   length
4   ACCESSCONTEXT           ac
a   LISTofAUTH              authorization-protocols
=>
1   0                       type reply
1   CARD8                   authorization-index
2   CARD16                  sequence-number
4   3+(d+q)/4               length
2   CARD16                  status
    0 Success
    1 Continue
    2 Busy
    3 Denied
2                           unused
d   LISTofBYTE              authorization-data
q                           unused, q=pad(d)
```

! +"5":+ $

"

+ @ B

```
->
4   1+(d+q)/4               length
d   LISTofBYTE              more-authorization-data
q                           unused, q=pad(d)
=>
4   2+(d+q)/4               length
2   CARD16                  status
    0 Success
    1 Continue
    2 Busy
    3 Denied
2                           unused
d   LISTofBYTE              authorization-data
q                           unused, q=pad(d)
```

FreeAC

```
1   9                       major-opcode
```

```
1                           unused
2   2                       length
4   ACCESSCONTEXT           ac
```

SetAuthorization

```
1   10                      major-opcode
1                           unused
2   2                       length
4   ACCESSCONTEXT           ac
```

SetResolution

```
1   11                      major-opcode
1   n                       number of resolutions
2   1+(6*n+p)/4             length
6*n LISTofRESOLUTION        resolutions
p   p=pad(6*n)
```

GetResolution

```
1   12                      major-opcode
1                           unused
2   1                       length
=>
1   0                       type reply
1   n                       number of resolutions
2   CARD16                  sequence-number
4   2+(6*n+p)/4             length
6*n LISTofRESOLUTION        resolutions
p   p=pad(6*n)
```

ListFonts

```
1   13                      major-opcode
1                           unused
2   3+(n+p)/4               length
4   CARD32                  max-names
2   n                       length of pattern
2                           unused
n   STRING8                 pattern
p                           unused, p=pad(n)
=>+
1   0                       type reply
1                           unused
2   CARD16                  sequence-number
4   4+(n+p)/4               length
4   CARD32                  replies-following-hint
4   CARD32                  numberof font-names
n   LISTofSTRNAME           font-names
p                           unused, p=pad(n)
```

ListFontsWithXInfo

```
1   14                      major-opcode
1                           unused
2   3+(n+p)/4               length
4   CARD32                  max-names
2   n                       length of pattern
```

```
2                               unused
n   STRING8                     pattern
p                               unused, p=pad(n)
=>+(except for last in series)
1   0                           type reply
1   n                           length of name
2   CARD16                      sequence-number
4   3+(n+p+f)/4                 length
4   CARD32                      replies-hint
f   XFONTINFO                   fontinfo
n   STRING8                     name
p                               unused, p=pad(n)
=>(last in series)
1   0                           type reply
1   0                           last-reply indicator
2   CARD16                      sequence-number
4   2                           reply length
```

OpenBitmapFont

```
1   15                          major-opcode
1                               unused
2   4+(n+p)/4                   length
4   FONTID                      fontid
4   BITMAPFORMATMASK            format-mask
4   BITMAPFORMAT                format
n   STRNAME                     pattern
p                               unused, p=pad(n)
=>
1   0                           type reply
1   BOOL                        otherid-valid
2   CARD16                      sequence-number
4   4                           length
4   FONTID                      otherid
1   BOOL                        cachable
3                               unused
```

QueryXInfo

```
1   16                          major-opcode
1                               unused
2   2                           length
4   FONTID                      fontid
=>
1   0                           type reply
1                               unused
2   CARD16                      sequence-number
4   2+f/4                       length
f   XFONTINFO                   fontinfo
p                               unused, p=pad(f)
```

QueryXExtents8

```
1   17                          major-opcode
1   BOOL                        range
2   3+(n+p)/4                   length
4   FONTID                      fontid
```

```
4   n                       number chars entries
n   STRING8                 chars
p                           unused, p=pad(n)
=>
1   0                       type reply
1                           unused
2   CARD16                  sequence-number
4   3+3*n                   length
4   n                       number of extents
12*n LISTofXCHARINFO        extents
```

QueryXExtents16

```
1   18                      major-opcode
1   BOOL                    range
2   3+(2*n+p)/4             length
4   FONTID                  fontid
4   n                       number chars entries
2*n                         LISTofCHAR2B chars
p                           unused, p=pad(2*n)
=>
1   0                       type reply
1                           unused
2   CARD16                  sequence-number
4   3+3*n                   length
4   n                       number of extents
12*n LISTofXCHARINFO        extents
```

QueryXBitmaps8

```
1   19                      major-opcode
1   BOOL                    range
2   4+(n+p)/4               length
4   FONTID                  fontid
4   BITMAPFORMAT            format
4   n                       number of chars entries
n   STRING8                 chars
p                           unused, p=pad(n)
=>+
1   0                       type reply
1                           unused
2   CARD16                  sequence-number
4   5+2*n+(m+p)/4           length
4   CARD32                  replies-following-hint
4   n                       number of offsets
4   m                       number of bytes of glyph images
8*n LISTofOFFSET32          offsets
m   LISTofBYTE              glyphimages
p                           unused, p=pad(m)
```

QueryXBitmaps16

```
1   20                      major-opcode
1   BOOL                    range
2   4+(2*n+p)/4             length
4   FONTID                  fontid
4   BITMAPFORMAT            format
```

```
4   n                       number of chars entries
2*n LISTofCHAR2B            chars
p                           unused, p=pad(2*n)
=>
1   0                       type reply
1                           unused
2   CARD16                  sequence-number
4   5+2*n+(m+p)/4           length
4   CARD32                  replies-following-hint
4   n                       number of offsets
4   m                       number of bytes of glyph images
8*n LISTofOFFSET32          offsets
m   LISTofBYTE              glyphimages
p                           unused, p=pad(m)
```

CloseFont

```
1   21                      major-opcode
1                           unused
2   2                       length
4   FONTID                  fontid
```

Errors

Request

```
1   1                       type error
1   0                       Request
2   CARD16                  sequence-number
4   4                       length
4   TIMESTAMP               timestamp
1   CARD8                   major-opcode
1   CARD8                   minor-opcode
2                           unused
```

Format

```
1   1                       type error
1   1                       Format
2   CARD16                  sequence-number
4   5                       length
4   TIMESTAMP               timestamp
1   CARD8                   major-opcode
1   CARD8                   minor-opcode
2                           unused
4   BITMAPFORMAT            bad-format
```

Font

```
1   1                       type error
1   2                       Font
2   CARD16                  sequence-number
4   5                       length
4   TIMESTAMP               timestamp
1   CARD8                   major-opcode
```

```
1   CARD8                   minor-opcode
2                           unused
4   FONTID bad-fontid
```

Range

```
1   1                       type error
1   3                       Range
2   CARD16                  sequence-number
4   5                       length
4   TIMESTAMP               timestamp
1   CARD8                   major-opcode
1   CARD8                   minor-opcode
2                           unused
4   RANGE                   bad-range
```

EventMask

```
1   1                       type error
1   4                       EventMask
2   CARD16                  sequence-number
4   5                       length
4   TIMESTAMP               timestamp
1   CARD8                   major-opcode
1   CARD8                   minor-opcode
2                           unused
4   EVENTMASK               event-mask
```

AccessContext

```
1   1                       type error
1   5                       AccessContext
2   CARD16                  sequence-number
4   5                       length
4   TIMESTAMP               timestamp
1   CARD8                   major-opcode
1   CARD8                   minor-opcode
2                           unused
4   ACCESSCONTEXT           access context
```

IDChoice

```
1   1                       type error
1   6                       IDChoice
2   CARD16                  sequence-number
4   5                       length
4   TIMESTAMP               timestamp
1   CARD8                   major-opcode
1   CARD8                   minor-opcode
2                           unused
4   FONTID                  bad-fontid
```

Name

```
1   1                       type error
1   7                       Name
2   CARD16                  sequence-number
4   4                       length
4   TIMESTAMP               timestamp
```

```
1   CARD8                   major-opcode
1   CARD8                   minor-opcode
2                           unused
```

Resolution

```
1   1                       type error
1   8                       Resolution
2   CARD16                  sequence-number
4   5                       length
4   TIMESTAMP               timestamp
1   CARD8                   major-opcode
1   CARD8                   minor-opcode
6   RESOLUTION              resolution
```

Alloc

```
1   1                       type error
1   9                       Alloc
2   CARD16                  sequence-number
4   4                       length
4   TIMESTAMP               timestamp
1   CARD8                   major-opcode
1   CARD8                   minor-opcode
2                           unused
```

Length

```
1   1                       type error
1   10                      Length
2   CARD16                  sequence-number
4   5                       length
4   TIMESTAMP               timestamp
1   CARD8                   major-opcode
1   CARD8                   minor-opcode
2                           unused
4   CARD32                  bad-length
```

Implementation

```
1   1                       type error
1   11                      Implementation
2   CARD16                  sequence-number
4   4                       length
4   TIMESTAMP               timestamp
1   CARD8                   major-opcode
1   CARD8                   minor-opcode
2                           unused
```

Events

KeepAlive

```
1   2                       type event
1   0                       event KeepAlive
2   CARD16                  sequence-number
```

```
4   3                       length
4   TIMESTAMP               timestamp

CatalogueListNotify
1   2                       type event
1   1                       event CatalogueListNotify
2   CARD16                  sequence-number
4   4                       length
4   TIMESTAMP               timestamp
1   BOOL                    added
1   BOOL                    deleted
2                           unused

FontListNotify
1   2                       type event
1   2                       event FontListNotify
2   CARD16                  sequence-number
4   4                       length
4   TIMESTAMP               timestamp
1   BOOL                    added
1   BOOL                    deleted
2                           unused
```

Acknowledgements

" $
=!") 5

" V 3 <
@ + + @ V 3
5$
+ ? C 3
>

References

5))

! " # $ % 6 4 +

*& # ' ( ) *+*

! , + ! -) (, . % +/

A. Suggested Licensing Policies

" A

3

/

M "
5 $ 3

M
"

M "
A * < + 6 ,

M+ :
5 5 $
"
*
,

M =
1
4 A
5 $

! *
,

B. Implementation Suggestions

3 B
/

M"
5

M2
$
+

M2

M! *
,
*) D 1 2 613:+1) ,