Appendix

EXAMPLE MULTIMEDIA DOCUMENTS

This appendix contains storyboards, partial order diagrams, and sample PMSL and PMFF source for the multimedia documents used in examples and experiments in this dissertation. The first two documents he designed were `paris.pmsl` and `military.pmsl`. As the project progressed, both Caro and the dissertation author made many revisions to these documents. A description of them is included here to give the reader of the dissertation a more concrete notion of how PMSL documents are constructed.

A.1 The paris.pmsl document: a travelogue of Paris

The `paris.pmsl` document is divided into three parts. The first part is illustrated in Figure A.1, and consists of a sequence of images of a globe, that slowly zoom in to the continent of Europe, then the country of France, and finally the city of Paris. Meanwhile, synchronized with this sequence, the listener hears the French National Anthem. In later versions of the document (not illustrated here) there are additional images of the city of Paris presented in parallel with the sequence of globe and map images.

The second part of the document are illustrated in the top row of Figure A.2. In the second part, the narrator provides an overview of three sites that will be described in the travelogue: Notre Dame Cathedral, the Louvre Pyramid, and the Eiffel Tower. This narration is synchronized with subtitles for the hearing

impaired. While this narration is proceeding, images of these three sites are being presented in parallel; this provides an example of partial order, since the exact order in which the images appear is not important, as long as each image is on the screen before it is mentioned in the audio. As each site is mentioned, an arrow pointing to the location of that site on the map is synchronized with the audio. At the end of this part, a continue button is presented; the user must click on this button before the presentation proceeds. During this pause, portions of the next part of the document can be pre-fetched, up to the amount that is allocated in the transport layer receive buffer.

The third part of the document is illustrated in the bottom two rows of Figure A.2. The third part presents a sequence of images of the three featured sites, with an audio narration track synchronized with subtitles. (In later versions of the document, there are several side images presented in parallel with the main image; this increases the parallelism in the document and provides more opportunity for partial order transport to provide benefit.) After each of these segments, a continue button is presented. The document then concludes with an additional image of the Eiffel Tower, accompanied by an invitation to come a “see Paris for yourself.”

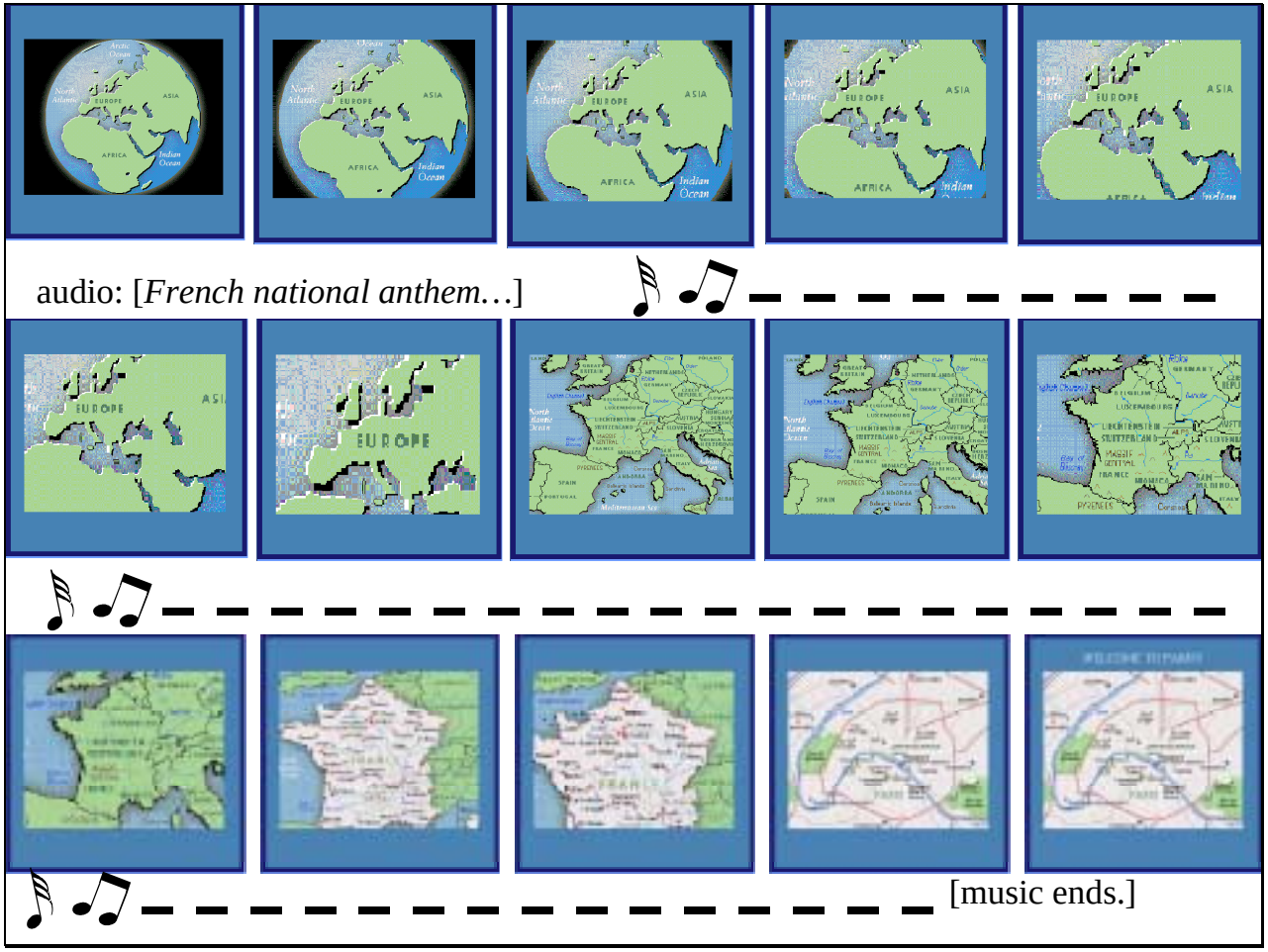

Figure A.1 paris.pmsl: storyboard (part 1)

Figure A.2 paris.pmsl: storyboard (part 2)

A.2 military.pmsl: a briefing on Gulf War weapons systems

The `military.pmsl` document is similar in structure to the paris.pmsl document; we therefore present only a portion of the storyboard for this document. As illustrated in Figure A.3, this document begins with a description of two major groups of weapons systems used in the Gulf War: ground systems, and aircraft systems. The ground systems are in the top box, while aircraft systems are in the bottom box.

An example of partial order in this document occurs in the initial painting of the screen: the initial frame contains several images, each of which can be presented in parallel. Coarse-grained synchronization is also illustrated: as each system is mentioned, the box surrounding that particular system is highlighted.

Figure A.3 military.pmsl: partial storyboard.

A.3 Listing of example PMSL source: paris.pmsl

```
# PARIS DEMO PMSL FILE

COLORDEF     "Red"        red
COLORDEF        "SteelBlue"      steelblue
COLORDEF        "MidnightBlue"   midnightblue
COLORDEF     "White"         white

FONTDEF      "-adobe-times-medium-r-normal--24-240-75-75-p-124-iso8859-1"
       times24

FONTDEF      "-adobe-times-medium-r-normal-*-14-*-*-*-*-*-*-*" times14

PENDEF BkgndPen
       FOREGROUND steelblue
       LINEWIDTH 500

PENDEF BrdPen
       FOREGROUND midnightblue
       LINEWIDTH 30

PENDEF TitlePen
       FOREGROUND white
       FONT times24

PENDEF ArrowPen
       FOREGROUND red

       LINEWIDTH 8

PENDEF CaptionPen
       FOREGROUND white
       FONT times14

PENDEF ContBtnPen
       FOREGROUND midnightblue
       LINEWIDTH 3

TXTFORMATDEF TitleForm
       TOP 40
       LEFT 0
       RIGHT 500
       JUST C
       SPACE 1

TXTFORMATDEF ContTxtForm
       TOP 462
       LEFT 360
       RIGHT 460
       JUST C
       SPACE 1

#Background
ELEMENT      background:
             border.                          RELIABLE
       PEN BkgndPen
         BOX 0 0 500 500
```

```
#Border color
ELEMENT      border:
             anthem,
             globe1.                          RELIABLE
       PEN BrdPen
         BOX 0 0 500 500

ELEMENT      anthem:
             welcomeTitle,
             welcomeAu.                UNRELIABLE
         AUDIO "v0.32/paris/anthem.au"

ELEMENT      globe1:
             pauseGlobe1.              RELIABLE
         IMAGE GIF 38 80 "v0.32/paris/globe.gif"

ELEMENT      pauseGlobe1:
             globe2.                          RELIABLE
       PAUSE 50

ELEMENT globe2:
             eraseGlobe1,
             pauseGlobe2.              RELIABLE
         IMAGE GIF 38 80 "v0.32/paris/globe2.gif"

ELEMENT eraseGlobe1:
             globe3.                          RELIABLE
       ERASE globe1

ELEMENT pauseGlobe2:
             globe3.                          RELIABLE
         PAUSE 50

ELEMENT         globe3: eraseGlobe2, pauseGlobe3.           RELIABLE
         IMAGE GIF 38 80 "v0.32/paris/globe3.gif"

ELEMENT         eraseGlobe2: globe4.          RELIABLE
         ERASE globe2

ELEMENT         pauseGlobe3: globe4.          RELIABLE
         PAUSE 50

ELEMENT         globe4: eraseGlobe3, pauseGlobe4.           RELIABLE
         IMAGE GIF 38 80 "v0.32/paris/globe4.gif"

ELEMENT         eraseGlobe3: globe5.          RELIABLE
         ERASE globe3

ELEMENT         pauseGlobe4: globe5.          RELIABLE
         PAUSE 50

ELEMENT         globe5: eraseGlobe4, pauseGlobe5.           RELIABLE
         IMAGE GIF 38 80 "v0.32/paris/globe5.gif"

ELEMENT         eraseGlobe4: globe6.          RELIABLE
         ERASE globe4

ELEMENT         pauseGlobe5: globe6.          RELIABLE
         PAUSE 50

ELEMENT         globe6: eraseGlobe5, pauseGlobe6.           RELIABLE
         IMAGE GIF 38 80 "v0.32/paris/globe6.gif"
```

```
ELEMENT         eraseGlobe5: globe7.          RELIABLE
        ERASE globe5

ELEMENT         pauseGlobe6: globe7.          RELIABLE
        PAUSE 50

ELEMENT         globe7: eraseGlobe6, pauseGlobe7.            RELIABLE
        IMAGE GIF 38 80 "v0.32/paris/globe7.gif"

 ELEMENT        eraseGlobe6: europe2.       RELIABLE
        ERASE globe6

ELEMENT         pauseGlobe7: europe2.          RELIABLE
        PAUSE 50

# There is no europe1
ELEMENT         europe2: eraseGlobe7, pauseEurope2.    RELIABLE
        IMAGE GIF 38 80 "v0.32/paris/europe2.gif"

ELEMENT         eraseGlobe7: europe3.          RELIABLE
        ERASE globe7

ELEMENT         pauseEurope2: europe3.          RELIABLE
        PAUSE 50

ELEMENT         europe3: eraseEurope2, pauseEurope3.        RELIABLE
        IMAGE GIF 38 80 "v0.32/paris/europe3.gif"

ELEMENT         eraseEurope2: europe4.          RELIABLE
        ERASE europe2

ELEMENT         pauseEurope3: europe4.          RELIABLE
        PAUSE 50

ELEMENT         europe4: eraseEurope3, pauseEurope4.        RELIABLE
        IMAGE GIF 38 80 "v0.32/paris/europe4.gif"

ELEMENT         eraseEurope3: europe5.          RELIABLE
        ERASE europe3

ELEMENT         pauseEurope4: europe5.          RELIABLE
        PAUSE 50

ELEMENT         europe5: eraseEurope4, pauseEurope5.            RELIABLE
        IMAGE GIF 38 80 "v0.32/paris/europe5.gif"

ELEMENT         eraseEurope4: france2.          RELIABLE
        ERASE europe4

ELEMENT         pauseEurope5: france2.          RELIABLE
        PAUSE 50

# there is no france1
ELEMENT         france2: eraseEurope5, pauseFrance2.    RELIABLE
        IMAGE GIF 38 80 "v0.32/paris/france2.gif"

ELEMENT         eraseEurope5: france3.          RELIABLE
        ERASE europe5

ELEMENT         pauseFrance2: france3.          RELIABLE
        PAUSE 50
```

```
ELEMENT         france3: eraseFrance2, pauseFrance3.            RELIABLE
        IMAGE GIF 38 80 "v0.32/paris/france3.gif"

ELEMENT         eraseFrance2: paris.          RELIABLE
        ERASE france2

ELEMENT         pauseFrance3: paris.          RELIABLE
        PAUSE 50

ELEMENT         paris: welcomeTitle, welcomeAu.            RELIABLE
        IMAGE GIF 38 80 "v0.32/paris/paris.gif"

ELEMENT         welcomeTitle: eraseFrance3.            RELIABLE
       PEN TitlePen
       TEXT TXTFORMAT TitleForm
       "WELCOME TO PARIS!!"

ELEMENT         welcomeAu: eraseFrance3.          UNRELIABLE
        AUDIO "v0.32/paris/welcome.au"

ELEMENT         eraseFrance3: introTxt.          RELIABLE
        ERASE france3

ELEMENT         introTxt: smallSite1, smallSite2, smallSite3, introAu.
         RELIABLE
       PEN CaptionPen
        TEXT TOP 420 LEFT 38 RIGHT 462 JUST L SPACE 1
 "As you can see on the map, there are many sites in Paris to visit ... some
of "
       "which are more popular than others.  On this brief tour you will see
three "
       "of the most popular sites."

ELEMENT         smallSite1: arrow1.            RELIABLE
        IMAGE GIF 20 80  "v0.32/paris/site5_small.gif"

ELEMENT         smallSite2: site2Au.            RELIABLE
        IMAGE GIF 317 80 "v0.32/paris/site4_small.gif"

ELEMENT         smallSite3: site3Au.            RELIABLE
        IMAGE GIF 47 294 "v0.32/paris/tower_a_small.gif"

ELEMENT         introAu: arrow1.        UNRELIABLE
        AUDIO "v0.32/paris/tour_sites.au"

ELEMENT         arrow1: site1Au.         RELIABLE
       PEN ArrowPen
        LINE 250 250 170 180

ELEMENT         site1Au: arrow2.        UNRELIABLE
        AUDIO "v0.32/paris/tour_site#1.au"

ELEMENT         arrow2: site2Au.         RELIABLE
       PEN ArrowPen
        LINE 275 272 333 184

ELEMENT         site2Au: arrow3.        UNRELIABLE
        AUDIO "v0.32/paris/tour_site#2.au"

ELEMENT         arrow3: site3Au.         RELIABLE
       PEN ArrowPen
```

```
        LINE 181 278 105 303

ELEMENT site3Au:
             introContTxt,
             introContBtn.              UNRELIABLE
        AUDIO "v0.32/paris/tour_site#3.au"

ELEMENT      introContTxt:
             eraseIntroContTxt,
             eraseIntroTxt,
             eraseWelcomeTitle,
             eraseParis,
             eraseSmallSite1,
             eraseSmallSite2,
             eraseSmallSite3,
             eraseArrow1,
             eraseArrow2,
             eraseArrow3. RELIABLE
       PEN CaptionPen
        TEXT TXTFORMAT ContTxtForm
       "CONTINUE"

ELEMENT      introContBtn:
             eraseIntroContTxt,
             eraseIntroTxt,
             eraseWelcomeTitle,
             eraseParis,
             eraseSmallSite1,
             eraseSmallSite2,
             eraseSmallSite3,
             eraseArrow1,
             eraseArrow2,
             eraseArrow3. RELIABLE
       PEN ContBtnPen
        HOTSPOT 360 455 460 480 CONTINUE

ELEMENT eraseIntroContTxt:
             luvTitle, luvFrameAu, luv, flag.              RELIABLE
        ERASE introContTxt

ELEMENT eraseIntroTxt:
             luvTitle, luvFrameAu, luv, flag.              RELIABLE
        ERASE introTxt

ELEMENT         eraseWelcomeTitle:luvTitle, luvFrameAu, luv, flag. RELIABLE
        ERASE welcomeTitle

ELEMENT         eraseParis:luvTitle, luvFrameAu, luv, flag. RELIABLE
        ERASE paris

ELEMENT             eraseSmallSite1:luvTitle, luvFrameAu, luv, flag.
       RELIABLE
       ERASE smallSite1

ELEMENT             eraseSmallSite2:luvTitle, luvFrameAu, luv, flag.
       RELIABLE
       ERASE smallSite2

ELEMENT             eraseSmallSite3:luvTitle, luvFrameAu, luv, flag.
       RELIABLE
       ERASE smallSite3
```

```
ELEMENT             eraseArrow1:luvTitle, luvFrameAu, luv, flag.   RELIABLE
       ERASE arrow1

ELEMENT         eraseArrow2:luvTitle, luvFrameAu, luv, flag.  RELIABLE
        ERASE arrow2

ELEMENT         eraseArrow3:luvTitle, luvFrameAu, luv, flag.   RELIABLE
        ERASE arrow3

ELEMENT      luvTitle:
             luvTxt1.                   RELIABLE
       PEN TitlePen
       TEXT TXTFORMAT TitleForm
        "I. M. Pei's Louvre Pyramid"

ELEMENT luv:
             luvTxt1.                   RELIABLE
        IMAGE GIF 24 80 "v0.32/paris/site5.gif"

ELEMENT flag:
             luvContTxt,
             luvContBtn.                UNRELIABLE
        IMAGE GIF 390 25 "v0.32/paris/frenchflag.gif"

ELEMENT luvFrameAu:
              luvTxt1.                  UNRELIABLE
        AUDIO "v0.32/paris/frame.au"

ELEMENT luvTxt1:
             luvAu1.                           RELIABLE
       PEN CaptionPen
       TEXT TOP 415 LEFT 25 RIGHT 475 JUST L SPACE 1
       "Chinese-born American architect I. M. Pei designed this controversial
glass "
       "pyramid (completed in 1989) at the entrance to the Louvre, a museum
in Paris, "
       "France.  Noted for his unique arrangements of geometric shapes, "
       "Pei also earned "
       "a reputation for his creative use of space, surfaces, and materials.
"

ELEMENT luvAu1:
             pauseLuv1.                 UNRELIABLE
        AUDIO "v0.32/paris/louvre1.au"

ELEMENT pauseLuv1:
             eraseLuvTxt1.              RELIABLE
        PAUSE 2000

ELEMENT eraseLuvTxt1:
             luvTxt2.                   RELIABLE
        ERASE luvTxt1

ELEMENT luvTxt2:
             luvAu2.                           RELIABLE
       PEN CaptionPen
       TEXT TOP 415 LEFT 25 RIGHT 475 JUST L SPACE 1
       "One of the foremost architects of the 20th century, "
       "Pei has designed important "
       "public and corporate buildings throughout the world and has worked
with urban "
       "renewal. "
```

```
ELEMENT luvAu2:
             luvContTxt,
             luvContBtn.                UNRELIABLE
        AUDIO "v0.32/paris/louvre2.au"

ELEMENT luvContTxt:
             eraseLuvTxt2,
             eraseLuvTitle,
             eraseLuv,
             eraseLuvContTxt,
             eraseFlag.                 RELIABLE
       PEN CaptionPen
        TEXT TXTFORMAT ContTxtForm
       "CONTINUE"

ELEMENT luvContBtn:
             eraseLuvTxt2,
             eraseLuvTitle,
             eraseLuv,
             eraseLuvContTxt,
             eraseFlag.                 RELIABLE
       PEN ContBtnPen
        HOTSPOT 360 455 460 480 CONTINUE

ELEMENT eraseLuvTxt2:
             notreTitle, notreTxt1, notreFrameAu,
             notre.                     RELIABLE
        ERASE luvTxt2

ELEMENT eraseLuvTitle:
             notreTitle, notreTxt1, notreFrameAu,
             notre.                     RELIABLE
        ERASE luvTitle

ELEMENT eraseLuv:
             notreTitle, notreTxt1, notreFrameAu,
             notre.                     RELIABLE
        ERASE luv

ELEMENT eraseLuvContTxt:
             notreTitle, notreTxt1, notreFrameAu,
             notre.                     RELIABLE
        ERASE luvContTxt

ELEMENT eraseFlag:
             notreTitle, notreTxt1, notreFrameAu,
             notre.                     RELIABLE
        ERASE flag

ELEMENT notreTitle:
             notreAu1.                  RELIABLE
       PEN TitlePen
       TEXT TXTFORMAT TitleForm
       "Notre Dame Cathedral"

ELEMENT notre:
             notreAu1.                  RELIABLE
        IMAGE GIF 25 80 "v0.32/paris/site4.gif"

ELEMENT notreFrameAu:
             notreAu1.                  UNRELIABLE
```

```
        AUDIO "v0.32/paris/frame.au"

ELEMENT notreTxt1:
             notreAu1.                  RELIABLE
       PEN CaptionPen
       TEXT TOP 425 LEFT 25 RIGHT 475 JUST L SPACE 1
       "Notre Dame Cathedral was begun in 1163 and completed for the most
part in "
       "1250.  It is one of the best-known Gothic cathedrals in the world.
The view "
       "here is of the south side, overlooking the Seine River, displaying
the "
       "dramatic "
       "flying buttresses and one of the famous rose windows."

ELEMENT notreAu1:
             pauseNotre.                UNRELIABLE
        AUDIO "v0.32/paris/cathedral_a.au"

ELEMENT pauseNotre:
             eraseNotreTxt1.                  RELIABLE
        PAUSE 2000

ELEMENT eraseNotreTxt1:
             notreTxt2.                 RELIABLE
        ERASE notreTxt1

ELEMENT notreTxt2:
             notreAu2.                  RELIABLE
       PEN CaptionPen
       TEXT TOP 425 LEFT 25 RIGHT 475 JUST L SPACE 1
       "Although Notre Dame is considered a Gothic structure, it incorporates
"
       "remnants "
       "of the earlier Romanesque style. "

ELEMENT notreAu2:
             notreContTxt,
             notreContBtn.              UNRELIABLE
        AUDIO "v0.32/paris/cathedral_b.au"

ELEMENT notreContTxt:
             eraseNotreTxt2,
             eraseNotreTitle,
             eraseNotre,
             eraseNotreContTxt.       RELIABLE
       PEN CaptionPen
        TEXT TXTFORMAT ContTxtForm
       "CONTINUE"

ELEMENT notreContBtn:
             eraseNotreTxt2,
             eraseNotreTitle,
             eraseNotre,
             eraseNotreContTxt.       RELIABLE
       PEN ContBtnPen
        HOTSPOT 360 455 460 480 CONTINUE

ELEMENT eraseNotreTxt2:
             eiffelTitle, eiffelFrameAu, eiffelTxt1,
             eiffel.                    RELIABLE
       ERASE notreTxt2
```

```
ELEMENT      eraseNotreTitle:
             eiffelTitle, eiffelFrameAu, eiffelTxt1,
             eiffel.                    RELIABLE
        ERASE notreTitle

ELEMENT      eraseNotre:
             eiffelTitle, eiffelFrameAu, eiffelTxt1,
             eiffel.                    RELIABLE
        ERASE notre

ELEMENT eraseNotreContTxt:
             eiffelTitle, eiffelFrameAu, eiffelTxt1,
             eiffel.                    RELIABLE
        ERASE notreContTxt

ELEMENT      eiffelTitle:
             eiffelAu1.          RELIABLE
       PEN TitlePen
       TEXT TXTFORMAT TitleForm
       "Eiffel Tower"

ELEMENT eiffel:
             eiffelAu1.          RELIABLE
        IMAGE GIF 150 80 "v0.32/paris/tower_a.gif"

ELEMENT      eiffelFrameAu:
             eiffelAu1.          UNRELIABLE
        AUDIO "v0.32/paris/frame.au"

ELEMENT eiffelTxt1:
             eiffelAu1.          RELIABLE
       PEN CaptionPen
       TEXT TOP 405 LEFT 25 RIGHT 475 JUST L SPACE 1
       "The Eiffel Tower, rising in the twilight sky above Paris, "
       "was built for the World's "
       "Fair in 1889.  French engineer Alexandre Gustave Eiffel "
       "designed it as a cross-braced latticed girder with minimum wind
resistance."

ELEMENT      eiffelAu1:
             pauseEiffel.        UNRELIABLE
        AUDIO "v0.32/paris/eiffel_a.au"

ELEMENT pauseEiffel:
             eraseEiffelTxt1.        RELIABLE
        PAUSE 2000

ELEMENT      eraseEiffelTxt1:
             eiffelTxt2.         RELIABLE
        ERASE eiffelTxt1

ELEMENT eiffelTxt2:
             eiffelAu2.          RELIABLE
       PEN CaptionPen
        TEXT TOP 405 LEFT 25 RIGHT 475 JUST L SPACE 1
       "Constructed from over 6300 metric tons (7000 tons) of highest quality
wrought "
       "iron, the Eiffel Tower is a masterpiece of wrought-iron technology."

ELEMENT      eiffelAu2:
             eiffelContTxt,
```

```
            eiffelContBtn.             UNRELIABLE
        AUDIO "v0.32/paris/eiffel_b.au"

ELEMENT     eiffelContTxt:
            eraseEiffelTxt2,
            eraseEiffelTitle,
            eraseEiffel,
            eraseEiffelContTxt.        RELIABLE
      PEN CaptionPen
        TEXT TXTFORMAT ContTxtForm
      "CONTINUE"

ELEMENT     eiffelContBtn:
            eraseEiffelTxt2,
            eraseEiffelTitle,
            eraseEiffel,
            eraseEiffelContTxt.              RELIABLE
      PEN ContBtnPen
        HOTSPOT 360 455 460 480 CONTINUE

ELEMENT     eraseEiffelTxt2:
            endImg, endAu.                           RELIABLE
        ERASE eiffelTxt2

ELEMENT eraseEiffelTitle:
            endImg, endAu.                           RELIABLE
        ERASE eiffelTitle

ELEMENT eraseEiffel:
            endImg, endAu.                           RELIABLE
        ERASE eiffel

ELEMENT eraseEiffelContTxt:
            endImg, endAu.                           RELIABLE
        ERASE eiffelContTxt

ELEMENT endImg:
            pauseEnd1.                 RELIABLE
        IMAGE GIF 20 80 "v0.32/paris/tower_c.gif"

ELEMENT endAu                    UNRELIABLE
        AUDIO "v0.32/paris/end.au"

ELEMENT pauseEnd1:
            endBox1.      RELIABLE
        PAUSE 7000

ELEMENT endBox1:
            pauseEnd2.      RELIABLE
      PEN BrdPen
        BOX 25 25 475 475

ELEMENT pauseEnd2:
            endBox2.      RELIABLE
        PAUSE 50

ELEMENT endBox2:
            pauseEnd3.      RELIABLE
      PEN BrdPen
        BOX 50 50 450 450

ELEMENT pauseEnd3:
```

```
            endBox3.      RELIABLE
        PAUSE 50

ELEMENT endBox3:
            pauseEnd4.      RELIABLE
       PEN BrdPen
        BOX 60 60 440 440

ELEMENT pauseEnd4:
            endBox4.      RELIABLE
        PAUSE 50

ELEMENT endBox4:
            pauseEnd5.      RELIABLE
       PEN BrdPen
        BOX 70 70 430 430

ELEMENT      pauseEnd5:
            endBox5.      RELIABLE
        PAUSE 50

ELEMENT endBox5:
            pauseEnd6.      RELIABLE
       PEN BrdPen
        BOX 80 80 420 420

ELEMENT pauseEnd6:
            endBox6.      RELIABLE
        PAUSE 50

ELEMENT      endBox6:
            pauseEnd7.      RELIABLE
       PEN BrdPen
        BOX 90 90 410 410

ELEMENT pauseEnd7:
            endBox7.      RELIABLE
        PAUSE 50

ELEMENT endBox7:
            pauseEnd8.      RELIABLE
       PEN BrdPen
        BOX 100 100 400 400

ELEMENT pauseEnd8:
            endBox8.      RELIABLE
        PAUSE 50

ELEMENT endBox8:
            pauseEnd9.      RELIABLE
       PEN BrdPen
        BOX 110 110 390 390

ELEMENT pauseEnd9:
            endBox9.      RELIABLE
        PAUSE 50

ELEMENT endBox9:
            pauseEnd10.      RELIABLE
       PEN BrdPen
        BOX 120 120 380 380
```

```
ELEMENT pauseEnd10:
             endBox10.      RELIABLE
        PAUSE 50

ELEMENT endBox10:
             pauseEnd11.      RELIABLE
       PEN BrdPen
        BOX 130 130 370 370

ELEMENT pauseEnd11:
             endBox11.      RELIABLE
        PAUSE 50

ELEMENT endBox11:
             pauseEnd12.      RELIABLE
       PEN BrdPen
        BOX 140 140 360 360

ELEMENT pauseEnd12:
             endBox12.      RELIABLE
        PAUSE 50

ELEMENT endBox12:
             pauseEnd13.      RELIABLE
       PEN BrdPen
        BOX 150 150 350 350

ELEMENT pauseEnd13:
             endBox13.      RELIABLE
        PAUSE 50

ELEMENT endBox13:
             pauseEnd14.      RELIABLE
       PEN BrdPen
        BOX 160 160 340 340

ELEMENT pauseEnd14:
             endBox14.      RELIABLE
        PAUSE 50

ELEMENT endBox14:
             pauseEnd15.      RELIABLE
       PEN BrdPen
        BOX 170 170 330 330

ELEMENT pauseEnd15:
             endBox15.      RELIABLE
        PAUSE 50

ELEMENT endBox15:
             pauseEnd16.      RELIABLE
       PEN BrdPen
        BOX 180 180 320 320

ELEMENT pauseEnd16:
             endBox16.      RELIABLE
        PAUSE 50

ELEMENT endBox16:
             pauseEnd17.      RELIABLE
       PEN BrdPen
        BOX 190 190 310 310
```

```
ELEMENT pauseEnd17:
             endBox17.      RELIABLE
        PAUSE 50

ELEMENT endBox17:
             pauseEnd18.      RELIABLE
       PEN BrdPen
        BOX 200 200  300 300

ELEMENT pauseEnd18:
             endBox18.      RELIABLE
        PAUSE 50

ELEMENT endBox18:
             pauseEnd19.      RELIABLE
       PEN BrdPen
        BOX 210 210 290 290

ELEMENT pauseEnd19:
             endBox19.      RELIABLE
        PAUSE 50

ELEMENT endBox19:
             pauseEnd20.      RELIABLE
       PEN BrdPen
        BOX 220 220 280 280

ELEMENT pauseEnd20:
             endBox20.      RELIABLE
        PAUSE 50

ELEMENT endBox20:
             pauseEnd21.      RELIABLE
       PEN BrdPen
        BOX 230 230 270 270

ELEMENT pauseEnd21:
             endBox21.      RELIABLE
        PAUSE 50

ELEMENT endBox21:
             pauseEnd22.      RELIABLE
       PEN BrdPen
       BOX 240 240 260 260

ELEMENT pauseEnd22:
             endBox22.      RELIABLE
        PAUSE 50

ELEMENT endBox22           RELIABLE
       PEN BrdPen
        BOX 249 249 251 251
```

A.4 Excerpts from sample file paris.pmff

Because the `paris.pmff` file corresponding to the paris.pmsl file is lengthy, we only show sample excerpts from this file.

```
# This file was automatically generated using version
# pconrad/v0.32.07a of ptpc.
# Manual editing not recommended.
#
# Created: Fri Jun 11 05:28:27 1999
# Source: "paris.pmsl"
#
#
#
# Optimized for bitrate 128 Kbps with 80 Kbps for audio
#  assuming UTL mech T2 with header length 52 datalink header 8
#
#
#
# Service Profile:
627 168
0 1 63
0 1 51
0 1 56
0 1 48
0 1 7
0 1 6
0 1 7
0 2 8 9
1 2 48 49
```

[… many additional lines of service profile deleted]

```
0 1 161
0 1 162
0 1 163
0 1 164
0 1 165
0 1 166
0 1 167
0 0
#
# Elements:
0 0 0 48 pen 0 / 5 ContBtnPen fg "MidnightBlue" lw 3 ft 0
1 0 0 90 pen 1 / 5 CaptionPen fg "White" lw -1 ft "-adobe-times-medium-r-
normal-*-14-*-*-*-*-*-*-*"
2 0 0 37 pen 2 / 5 ArrowPen fg "Red" lw 8 ft 0
3 0 0 99 pen 3 / 5 TitlePen fg "White" lw -1 ft "-adobe-times-medium-r-
normal--24-240-75-75-p-124-iso8859-1"
4 0 0 45 pen 4 / 5 BrdPen fg "MidnightBlue" lw 30 ft 0
5 0 0 45 pen 5 / 5 BkgndPen fg "SteelBlue" lw 500 ft 0
6 0 0 46 blok 0 / 161 background draw box 5 0 0 500 500
7 0 0 42 blok 1 / 161 border draw box 4 0 0 500 500
9 1 13 40 cell 3 / 161 globe1 draw image gif 38 80 0 "v0.32/paris/globe.gif"
8 1 320 25 cell 2 / 161 anthem audio 32 "v0.32/paris/anthem.au"
8 1 320 25 cell 2 / 161 anthem audio 352
8 1 320 25 cell 2 / 161 anthem audio 672
9 1 192 40 cell 3 / 161 globe1 draw image gif 38 80 13
```

```
8 1 320 25 cell 2 / 161 anthem audio 992
8 1 320 25 cell 2 / 161 anthem audio 1312
8 1 320 25 cell 2 / 161 anthem audio 1632
8 1 320 25 cell 2 / 161 anthem audio 1952
9 1 10 40 cell 3 / 161 globe1 draw image gif 38 80 205
8 1 320 25 cell 2 / 161 anthem audio 2272
8 1 320 25 cell 2 / 161 anthem audio 2592
9 1 511 40 cell 3 / 161 globe1 draw image gif 38 80 215
8 1 320 25 cell 2 / 161 anthem audio 2912
8 1 320 25 cell 2 / 161 anthem audio 3232
8 1 320 25 cell 2 / 161 anthem audio 3552
8 1 320 25 cell 2 / 161 anthem audio 3872
8 1 320 25 cell 2 / 161 anthem audio 4192
8 1 320 25 cell 2 / 161 anthem audio 4512
8 1 320 25 cell 2 / 161 anthem audio 4832
8 1 320 25 cell 2 / 161 anthem audio 5152
8 1 320 25 cell 2 / 161 anthem audio 5472
9 1 510 40 cell 3 / 161 globe1 draw image gif 38 80 726
8 1 320 25 cell 2 / 161 anthem audio 5792
```

…[many additional lines of pmff output deleted]

```
158 0 0 48 blok 152 / 161 endBox18 draw box 4 210 210 80 80
159 0 0 34 blok 153 / 161 pauseEnd19 pause 50
160 0 0 48 blok 154 / 161 endBox19 draw box 4 220 220 60 60
161 0 0 34 blok 155 / 161 pauseEnd20 pause 50
162 0 0 48 blok 156 / 161 endBox20 draw box 4 230 230 40 40
163 0 0 34 blok 157 / 161 pauseEnd21 pause 50
164 0 0 48 blok 158 / 161 endBox21 draw box 4 240 240 20 20
165 0 0 34 blok 159 / 161 pauseEnd22 pause 50
166 0 0 46 blok 160 / 161 endBox22 draw box 4 249 249 2 2
167 0 0 25 blok 161 / 161 $FIN$ null
```

A.5 Description of PMTP output

For each line in the PMFF file (except for the service profile and comments), exactly one PMTP message is sent from server to client. The first number on the line of PMTP output is the element number, followed by a flag indicating whether this is the last cell in the stream for a particular element. The third number indicates the length of the data in the trailer, which is either read from the file named on the first line associated with an element (for audio and image data), or is read from the data inline in the PMFF file (for text data). The fourth number is the length of the PMTP header that makes up the remainder of the line in the PMFF file. The server forms a PMTP packet by stripping off these first four numbers, and placing the header and trailer into a message, and sending it to the client.