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3RD GENERATION PARTNERSHIP PROJECT 2 "3GPP2"

# cdma2000 Multimedia Services Evaluation Methodology: Software Tools

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## INFORMATIVE REFERENCES

[1] 3GPP2 C.R1008, cdma2000 Multimedia Services Evaluation Methodology

# CONTENTS

# LIST OF FIGURES

# 1 INTRODUCTION

This technical report explains how to use C.R1009 software tools, which are supplemental to this technical report.

# 2 DEFINITIONS, SYMBOLS AND ABBREVATIONS

This section contains definitions, symbols and abbreviations that are used throughout the document.

## 2.1 Definitions

**multimedia**: a combination of multiple media elements used in a service to enrich the user experience.

## 2.2 Symbols and Abbreviations

| | |
|---|---|
| 3GPP2 | Third Generation Partnership Project 2 |
| BCMCS | Broadcast-Multicast Services |
| DLL | Dynamic Link Library |
| DRC | Data Rate Control |
| EVRC | Enhanced Variable Rate Codec |
| FER | Frame Error Rate |
| FL | Forward Link |
| HRPD | High Rate Packet Data |
| IP | Internet Protocol |
| ITU | International Telecommunications Union |
| LSB | Least Significant Bit |
| MAC | Medium Access Control |
| MPEG | Motion Picture Expert Group |
| MTU | Maximum Transmission Unit |
| NCIM | Network Client Interface Module |
| NB | Narrow Band |
| PDU | Packet Data Unit |

| | | |
|---|---|---|
| RL | Reverse Link |
| RTP | Real-time Transport Protocol |
| S/W | Software |
| TTI | Transmission Time Interval |
| UDP | User Datagram Protocol |
| VoIP | Voice over Internet Protocol |

# 3 SIMULATION METHODOLOGY FOR MULTIMEDIA SERVICES: SOFTWARE TOOLS

## 3.1 General Description

This software distribution is in long filename format and will need to be initially downloaded onto a PC-Windows® platform, and the appropriate portions subsequently transferred to an appropriate platform for processing, depending on the software distribution contents. If the distribution is downloaded as compressed files from an ftp site, a free 13.2 MB space will be required: 2.2 MB for the compressed files and 11 MB for the uncompressed distribution directory. The utilization of this software database is described in the parent referenced document [1].

## 3.2 Simulation Methodology for Multimedia Services Software Distribution

The Software Distribution supporting the simulation methodology for multimedia services is contained in the compressed files accompanying this textual cover. The folder rtpsim contains source files. The channel model source files are located in the folder Channel.

# 4 RTPSIM SOFTWARE USAGE

C.R1009 software tools presented in this technical report includes a module called RTPsim. The flowchart of RTPsim is shown in Figures 1 and 2.

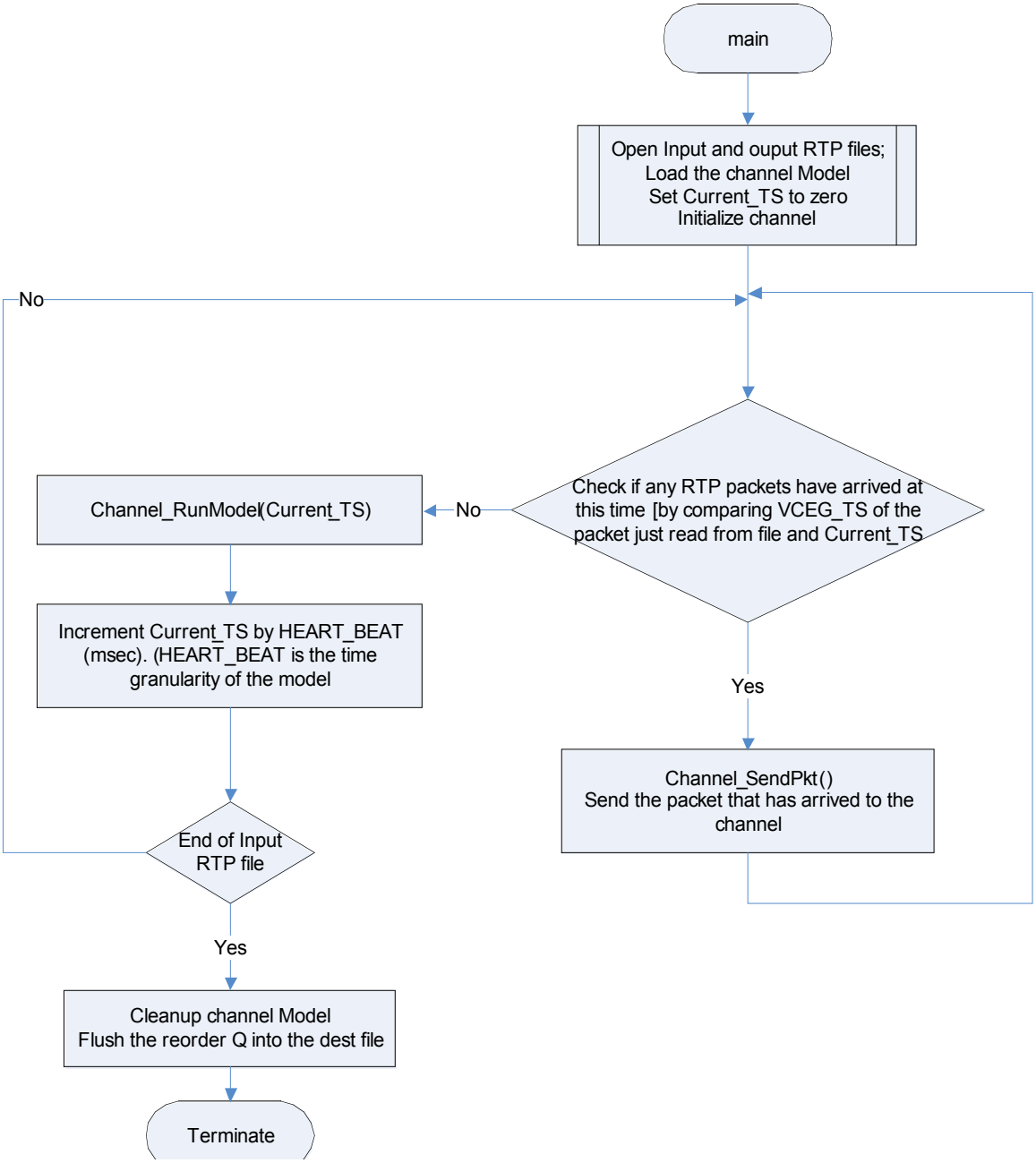


**Figure 1 RTPsim functional flowchart**

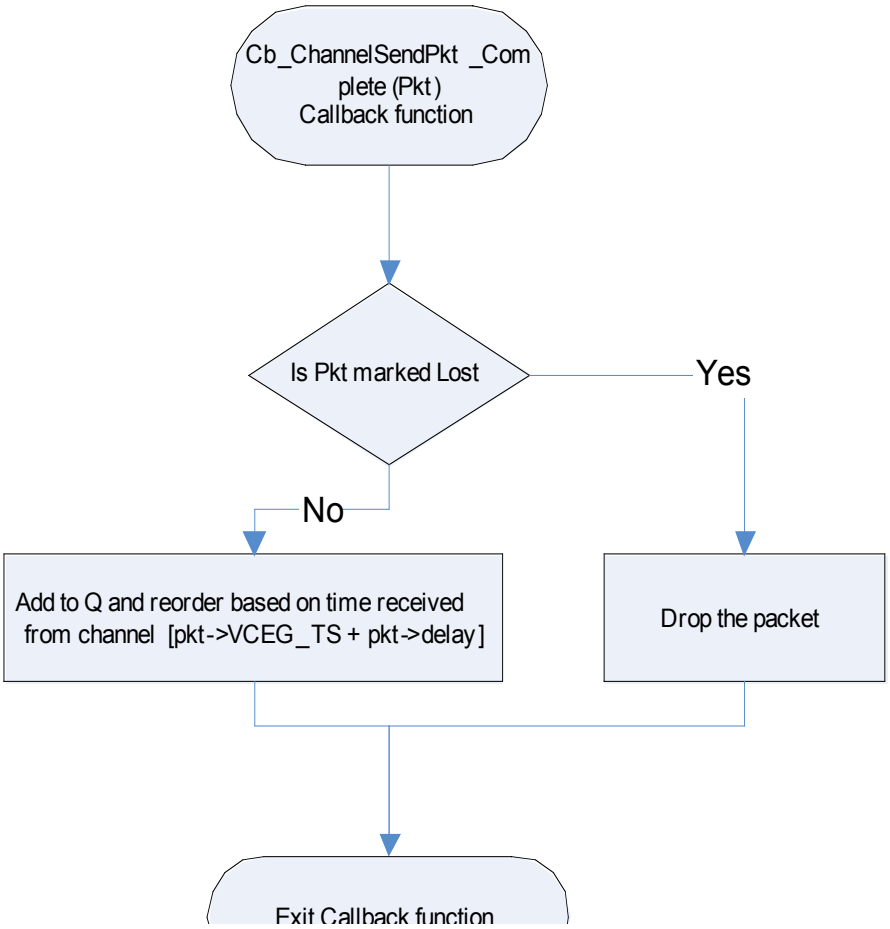


**Figure 2 Channel_SendPkt ( )**

RTPsim software can be run using 2 following commands as follows:

## 4.1 Separated channel model dynamic link library

DLL is built using Visual Studio .NET [Visual C++ 6 and 7] only. The software usage is as follows:

RTPsim.exe <Input File> <Output File> <Configuration File> <ChannelModel.dll>

Example of usage is as follows:

RTPsim.exe video_input.rtp video_output.rtp config.cfg channel.dll

Default DLL files (<ChannelModel.dll>) are channel_HRPDRL_video.dll, channel_HRPDFL_video.dll, DedicatedChannel.dll and Channel_HRPD_voip.dll for HRPD Reverse Link, Forward Link, Dedicated Channel and HRPD VoIP channels. The DLL file for each channel model is located in the folder RTPsim/bin.

## 4.2 Integrated channel model library

This section describes how to build RTPsim from command line, e.g., for Cygwin, Linux, and Unix. RTPsim executable containing static library is built using "make <ChannelModelName>" from command line where <ChannelModelName> can be one of the following: "HRPD_voip", "HRPDFL_video", "DedicatedChannel" or "HRPDRL_video". "make all" will build all the channel models. Software usage is as follows:

RTPsim.exe <Input File> <Output File> <Configuration File>

Example of usage is as follows:

RTPsim.exe video_input.rtp video_output.rtp config.cfg

For both usages (DLL and Static library), the formats of the input file, the output file and the configuration file are provided in [1]. Log file defined in config.cfg captures per packet diagnostic information. Statistics file defined in config.cfg captures statistics such as:

1. total number of RTP packets,
2. number of lost RTP packets,
3. total number of bytes successfully transmitted,
4. total number of lost bytes,
5. total number of MAC packets,
6. number of lost MAC packet,
7. average channel delay (average of delay suffered by each RTP packet),
8. average channel throughput (application data + RoHC compressed IP/UDP/RTP headers), and
9. effective channel throughput (application data + IP/UDP/RTP headers).

Note: not all the statistics are captured for all channel models.

# 5 CHANNEL MODELS

## 5.1 HRPD Video

### 5.1.1 Reverse Link

Token bucket parameters and probability models are provided inside the channel model source codes. Example of a configuration file for HRPD video reverse link is shown below.

```
LogFile              = "log.txt"       # Log File
StatFile             = "stat.dat"       # Statistics File
LossDelayProfile     = "hrpd.out"    # Unused
ErrorFreeRTP         = 0                    # Number of error-free RTP packets
MaxE2EDelay          = 1000               # in msec & the value should be greater
than 0; drop packet in the channel if delayed more than this value
HeaderSize           = 28            # IP + UDP Header size in bytes
RoHCOffset           = 36            # reduction in header size due to RoHC in bytes
```

### 5.1.2 Forward Link

Example of a configuration file for HRPD video forward link is shown below. The DRC trace files are located in rtpsim/Traces/HRPD/HRPD_FL [1].

```
LogFile              = "log.txt"       # Log File
StatFile             = "stat.dat"      # Statistics File
LossDelayProfile     = "DRCtrace.dat"        # DRC trace File
ErrorFreeRTP         = 0               # Number of error-free RTP packets
MaxE2EDelay          = 1000          # in msec & the value should be greater than
0; drop packet in the channel if delayed more than this value
HeaderSize           = 28            # IP + UDP Header size in bytes
RoHCOffset           = 36            # reduction in header size due to RoHC in bytes
```

## 5.2 Dedicated Channel

Example of a configuration file for dedicated channel for video is shown below. The error mask files are located in rtpsim/Traces/DedicatedChannel [1].

```
LogFile              = "log.txt"              # Log File
StatFile             = "stat.dat"              # Statistics File
LossDelayProfile     = “FER1_CM0_g6_AS1.rev" # Error mask
RandomSeed           = 0                      # Random Seed
ErrorFreeRTP         = 0                      # Number of error-free RTP packets
MaxE2EDelay          = 1000                   # in msec & the value should be greater
than 0; drop packet in the channel if delayed more than this value
HeaderSize           = 28                     # IP + UDP Header size in bytes
RoHCOffset           = 36                     # reduction in header size due to RoHC
in bytes
PDUSize              = 160                    # PDU size in Bytes
SlotTTI              = 20                     # Slot duration
```

## 5.3 BCMCS

Basic BCMCS SiNR traces for channel model A are included in sinr/ModelA, and the traces for channel model D are included in sinr/ModelD. Also, sinr/ contains “data_rate_set.txt” which contains information needed to post-process SiNR traces. This information is listed below.

- DRC to rate map
- DRC to number of required slots map
- DRC to SiNR threshold map
- DRC to Doppler backoff map

Procedures to generate error traces using SiNR traces are described in Section 6.3 of [1].

## 5.4 HRPD VoIP

Followings are the steps to perform VoIP evaluation for the separated channel model case of section 3.1.

```
Preprocess_speech_trace.exe <Input delay profile (provided in the package under
directory rtpsim/Traces/HRPD/HRPD_VoIP)> <hrpd.out>
RTPpacketizer_EVRC <EVRC encoded file> <EVRC RTP packet file>
RTPsim.exe <input speech RTP packet file> <output speech RTP packet file>
<speech.cfg> <channel_HRPD_voip.dll>
NCIM.exe < output speech RTP packet file > <output decoded speech file>
```

For the integrated channel model case of section 3.2, following are the steps to perform VoIP evaluation.

```
Preprocess_speech_trace.exe <Input delay profile (provided in the package under
directory rtpsim/Traces/HRPD/HRPD_VoIP)> <hrpd.out>
RTPpacketizer_EVRC <EVRC encoded file> <EVRC RTP packet file>
RTPsim_HRPD_voip.exe <input speech RTP packet file> <output speech RTP packet
file> <speech.cfg>
NCIM.exe < output speech RTP packet file > <output decoded speech file>
```

Example *speech.cfg*

```
LogFile              = "log.txt"       # Log File
StatFile             = "stat.dat"       # Statistics File
```

```
LossDelayProfile        = "hrpd.out"    # contains delay and loss statistics
ErrorFreeRTP            = 0                     # Number of error-free RTP packets
MaxE2EDelay             = 1000                  # in msec & the value should be greater
than 0; drop packet in the channel if delayed more than this value
HeaderSize              = 28            # IP + UDP Header size in bytes
RoHCOffset              = 36            # reduction in header size due to RoHC in bytes
```