# SONG: Half Life 2 Deathmatch Network Traffic Trace Files

Lawrence Stewart, Philip Branch
CAIA Technical Report  060406D
Swinburne University of Technology
Melbourne, Australia
lastewart@swin.edu.au, pbranch@swin.edu.au

*Abstract-***This technical report describes the conditions under which network traffic was generated and captured for a range of traffic traces available on the SONG database. In this case the traffic traces concern network traffic generated by the Half Life 2 Deathmatch game running on a central server with between two and nine players and two different maps. This dataset is made publicly available as part of the SONG database project of the Smart Internet CRC (http://caia.swin.edu.au/sitcrc/song) to assist researchers in accessing databases of network game traffic generated under known conditions. This report and the SONG website should be referenced in any work which uses any of the corresponding dump files.**

*Keywords-* **Traffic trace, Smart Internet CRC**

## I. INTRODUCTION

SONG (Simulating Online Network Games) is a sub-project of the Smart Networks Stream 4, itself a project of the Smart Internet CRC. More information the CRC and the Smart Networks Projects can be found here [1, 2]. The goal of this project is to develop a publicly available library of network traffic traces and simulation models that can be used to augment existing IP network engineering tools and to demonstrate any new models developed to assist in the design of networks to carry game traffic.

This document describes the conditions under which the corresponding network traces were both generated and captures. This information should be considered when analysing any statistical results generated from the trace file as well as when comparing the properties of data from two different trace files.

## II. TRAFFIC CAPTURE SCENARIO

This report deals with traffic captured during networked sessions of the Half Life 2 Deathmatch game [3]. The report is relevant to numerous trace files available on the SONG website and describes the game scenarios, number of players and network configuration under which the trace files were captured.

### A. Game Details

Half Life 2 Deathmatch is a client-server based game with client software running on standard PCs. Player actions are transmitted from the client to the server. The server constructs a game state for distribution to all players based on these actions. The game state is then distributed to all players. The game state may be different for players to limit the possibility of cheating, particularly wall-hacks.

For all trace files described in this report the game was played across a switched Ethernet LAN.

### B. Server configuration

The server configuration for this series of trials is described in the following table.

Table 1. Server configuration

| IP address | 136.186.229.146 |
|---|---|
| CPU | Intel Celeron 2.8GHz (8kb L1 cache, 128kb L2 cache) |
| RAM | 1GB PC3200 DDR RAM (2 x 512MB in dual channel configuration) |
| Motherboard | ASUS P4-P800VM |
| Onboard NIC | Intel 82801BA (D865) Pro/100 VE |
| Onboard Video | Intel 82865G (865G GMCH) SVGA controller (reported by FreeBSD dmesg) |
| HDD | Seagate ST380011A/8.01 80GB PATA UDMA100 |
| OS | FreeBSD 5.4-RELEASE |

| OS KERNEL CONFIG | Kernel config file: GENERIC+ALTQ |
|---|---|
| | Commented the line: cpu I486_CPU |
| | Commented the line: cpu I586_CPU |
| | Added the line: options ALTQ |
| | Added the line: options ALTQ_CBQ |
| | Added the line: options ALTQ_PRIQ |
| | Added the line: options ALTQ_HFSC |
| OS CONFIG PARAMETERS | Relevant sysctl variable/value pairs: |
| | kern.clockrate = { hz = 1000, tick = 1000, profhz = 1024, stathz = 128 } |
| RELEVANT HALF LIFE 2 DEATHMATCH CONFIG PARAMETERS | 'Half-Life 2 Deathmatch' version 11 |
| | 'Base Source Shared Materials' version 7 |
| | 'Base Source Shared Models' version 3 |
| | 'Base Source Shared Sounds' version 3 |
| | 'Source Dedicated Server Linux' version 51 |
| | sv_minrate 3000 |
| | sv_maxrate 20000 |
| | decalfrequency 60 |
| | sv_maxupdaterate 100 |
| | sv_minupdaterate 30 |
| | sv_lan 0 |

| Main->Options->Keyboard->Advanced->Console (~) | On |
|---|---|
| Main->Options->Audio->Speaker Config | 2 speakers |
| Main->Options->Audio->Sound Quality | High |
| Main->Options->Audio->Captioning | No captions |
| Main->Options->Video->Aspect Ratio | 4:3 |
| Main->Options->Video->Display Mode | Fullscreen |
| Main->Options->Video->Advanced->Model Details | Low |
| Main->Options->Video->Advanced->Texture Detail | Low |
| Main->Options->Video->Advanced->Shader Detail | Low |
| Main->Options->Video->Advanced->Water Detail | Simple reflections |
| Main->Options->Video->Advanced->Shadow Detail | Low |
| Main->Options->Video->Advanced->Antialiasing Mode | None |
| Main->Options->Video->Advanced->Filtering Mode | Bilinear |
| Main->Options->Video->Advanced->Wait For Vertical Sync | Disabled |
| Main->Options->Video->Advanced->High Dynamic Range | None |
| Main->Options->Voice->Enable Voice In The Game | Off |

## C. Client configuration

There were nine different client machines involved in the trials. Each trial used between two and nine clients. The IP addresses of the clients and the client machine configuration (hardware and operating system) and Half Life 2 Deathmatch configuration is described in each table

The last two entries in the table describe the Half Life 2 Deathmatch configuration used by the client. This differed between clients. However, the following Half Life 2 Deathmatch configuration was common to all clients.

Table 2. Half Life 2 Deathmatch common configuration

| Steam Setting->Internet | LAN/T1 >1M |
|---|---|
| Multiplayer Decal Limit | 200 |
| Main->Options->Multiplayer->Advanced->Automatically Switch To Picked Up Weapon If More Powerful | Yes |
| Main->Options->Multiplayer->Advanced->Centre Player Names | Yes |
| Main->Options->Multiplayer->Advanced->Auto Health | Yes |
| Main->Options->Multiplayer->Advanced->Show A Progress Bar When Diffusing C4 | Yes |
| Main->Options->Keyboard->Advanced->Fast Weapon Switch | On |

Table 3. Client 1 configuration

| IP address | 136.186.229.70 |
|---|---|
| CPU | Intel Celeron 2.4GHz (8kb L1 cache, 128kb L2 cache) |
| RAM | 512MB DDR RAM (2 x 256MB in dual channel configuration) |
| Motherboard | ASUS P4-P800VM |
| Onboard NIC | Intel 82801BA (D865) Pro/100 VE |
| Onboard Video | Sparkle Nvidia GeForce 6600 256MB AGP 8x graphics card (BIOS revision 5.43.02.46T5DH) |
| HDD | Western Digital WD400JB 40GB PATA UDMA100 |
| OS | MS Windows XP Professional SP2 + all critical security patches as at 09/01/2006 |
| Other | NVIDIA DRIVER: 81.98_forceware_winxp2k_english_whql.exe |
| Video Rendering Mode | DirectX 8.0 |
| Resolution | 800x600 |

Table 4. Client 2 configuration

| IP address | 136.186.229.71 |
|---|---|
| CPU | Intel Celeron 2.8GHz (8kb L1 cache, 128kb L2 cache) |
| RAM | 1GB DDR RAM (2 x 512MB in dual channel configuration) |
| Motherboard | ASUS P4-P800VM |
| Onboard NIC | Intel 82801BA (D865) Pro/100 VE |
| Onboard Video | Sparkle Nvidia GeForce 6600 256MB AGP 8x graphics card (BIOS revision 5.43.02.46T5DH) |
| HDD | Seagate ST380011A/8.01 80GB PATA UDMA100 |
| OS | MS Windows XP Professional SP2 + all critical security patches as at 09/01/2006 |
| Other | NVIDIA DRIVER: 81.98_forceware_winxp2k_english_whql.exe |
| Video Rendering Mode | DirectX 8.0 |
| Resolution | 640x480 |

Table 5. Client 3 configuration

| IP address | 136.186.229.72 |
|---|---|
| Specs same as 136.186.229.71 | |
| Video Rendering Mode | DirectX 8.0 |
| Resolution | 800x600 |

Table 6. Client 4 configuration

| IP address | 136.186.229.73 |
|---|---|
| Specs same as 136.186.229.71 except for NVIDIA driver version. 78.01_winxp2k_english_whql.exe | |
| Video Rendering Mode | DirectX 8.0 |
| Resolution | 800x600 |

Table 7. Client 5 configuration

| IP address | 136.186.229.74 |
|---|---|
| Specs same as 136.186.229.71 except for NVIDIA driver version. 7.1.8.9 (from device manager -> display adapter -> driver tab) | |
| Video Rendering Mode | DirectX 8.0 |
| Resolution | 800x600 |

Table 8. Client 6 configuration

| IP address | 136.186.229.75 |
|---|---|
| Specs same as 136.186.229.71 | |
| Video Rendering Mode | DirectX 8.0 |
| Resolution | 800x600 |

Table 9. Client 7 configuration

| IP address | 136.186.229.92 |
|---|---|
| CPU | Intel P4 3.0GHz |
| RAM | 512MB DDR RAM (1x512MB) |
| Motherboard | Gigabyte GA81865 GM-775 |
| Onboard NIC | Marvel Yukon Gigabit Ethernet 10/100/1000 |
| Onboard Video | Sparkle Nvidia GeForce 6600 256MB AGP 8x graphics card (BIOS revision 5.43.02.46T5DH) |
| HDD | Seagate ST380817AS 80GB SATA150 |
| OS | MS Windows XP Professional SP2 + all critical security patches as at 09/01/2006 |
| Other | NVIDIA DRIVER: 7.7.7.7 |
| Video Rendering Mode | DirectX 8.0 |
| Resolution | 1024x768 |

Table 10. Client 8 configuration

| IP address | 136.186.229.126 |
|---|---|
| CPU | Intel Celeron 2.4GHz (8kb L1 cache, 128kb L2 cache) |
| RAM | 1.25 GB DDR RAM |
| Motherboard | ASUS P4-P800VM |
| Onboard NIC | Intel 82801BA (D865) Pro/100 VE |
| Onboard Video | Sparkle Nvidia GeForce 6600 256MB AGP 8x graphics card (BIOS revision 5.43.02.46T5DH) |
| HDD | Western Digital WD400JB 40GB PATA UDMA100 |
| OS | MS Windows XP Professional SP2 + all critical security patches as at 22/06/2005 |
| Other | NVIDIA DRIVER: 7.1.8.4 (from device manager -> display adapter -> driver tab) |
| Video Rendering Mode | DirectX 8.0 |
| Resolution | 800x600 |

Table 11. Client 9 configuration

| IP address | 136.186.229.138 |
|---|---|
| CPU | Intel Celeron 2.4GHz (8kb L1 cache, 128kb L2 cache) |
| RAM | 512 MB DDR RAM   (2 x 256MB in dual channel) |
| Motherboard | ASUS P4-P800VM |
| Onboard NIC | Intel 82801BA (D865) Pro/100 VE |
| Onboard Video | Sparkle Nvidia GeForce 6600 256MB AGP 8x graphics card (BIOS revision 5.43.02.46T5DH) |
| HDD | Western Digital WD400JB 40GB PATA UDMA100 |
| OS | MS Windows XP Professional SP2 + all critical security patches as at 09/01/2006 |
| Other | NVIDIA DRIVER:  7.7.7.2 |
| Video Rendering Mode | DirectX 8.0 |
| Resolution | 800x600 |

All Half Life 2 Deathmatch client software was patched to the latest version as at January 31st, 2006.

### D.  Network configuration

The Half Life 2 Deathmatch clients were attached to the central server via the CAIA LAN running at 100 Mbps. The traffic capturing was done on a bridge machine sitting between the Half Life 2 Deathmatch dedicated server and the CAIA LAN. The traffic was captured using **tcpdump** [4] to obtain a raw packet trace of all LAN traffic during each experiment.

The accuracy of the timestamps generated by tcpdump on the traffic capturing machine is documented in [5].

## III.  NETWORK TRACES

This section describes the different Half Life 2 Deathmatch traffic traces that are available on the SONG databse. All traces can be found under the hierarchy **SONG – traffic traces Half Life 2 Deathmatch.** The naming convention used for the tcpdump files described in this report is as follows:

```
hl2dm_<trialdate>_<run#>_<mapname>_<numplayers>.dmp
hl2dm_<trialdate>_<run#>_<mapname>_<numplayers>_frag
ment.dmp.
```

The naming convention used for the Half Life 2 Deathmatch log files described in this report is as follows: `<logfilename>-<date>_<time>_<pid>_<udpport>.log`

Traffic was captured on the game server machine using the following configuration:

- **tcpdump** has been configured to capture the first 100 bytes of each packet. This 100 bytes is made up of:
  - 14 bytes – Ethernet frame header
  - 20 bytes – IP header
  - 8 bytes – UDP header
  - 58 bytes – first part of the UDP payload

The data collected has not been anonymised.

The tcpdump files that end in extension "_fragment.dmp" are for general consumption and are provided as a cut down sample of the full tcpdump files. The fragment files contain only packet header information for 5000*number_of_participating_clients packets. The packets are obtained from an offset of 10000 packets into the original full trace to ensure only active game traffic makes up the sample.

For example, the sample file for the `hl2dm_150206_1_overwatch_9.dmp` full trace is named `hl2dm_150206_1_overwatch_9_fragment.dmp` and contains 9*5000 = 45000 packet headers, for the packets numbered 10000 to 54999 (inclusive) in the full trace file.

### A.  Game Trials

Table 12. Trial 1

| Number of clients | 2 |
|---|---|
| Game length | 20 mins |
| Full Tcpdump file | hl2dm_030206_1_overwatch_2.dmp |
| Full Tcpdump MD5 | f8633ea46a6654a0cfb9e0df8c5f4e29 |
| Sample Tcpdump file | hl2dm_030206_1_overwatch_2_fragment.dmp |
| Sample Tcpdump MD5 | 23874b5414aa793485120a0a6d84fc96 |
| Log file | server-030206_1714_49592_27015.log |

Table 13. Trial 2

| Number of clients | 3 |
|---|---|
| Game length | 20 mins |
| Full Tcpdump file | hl2dm_030206_1_overwatch_3.dmp |
| Full Tcpdump MD5 | 10184d9794ab386b8f57d4cd4a5a5a04 |
| Sample Tcpdump file | hl2dm_030206_1_overwatch_3_fragment.dmp |
| Sample Tcpdump MD5 | 8c26305b59ccad992f0ec346ebd51f51 |
| Log file | server-030206_1752_50004_27015.log |

Table 14. Trial 3

| Number of clients | 4 |
|---|---|
| Game length | 20 mins |
| Full Tcpdump file | hl2dm_030206_1_overwatch_4.dmp |
| Full Tcpdump MD5 | 844373f8025fd39102584e56115efce9 |
| Sample Tcpdump file | hl2dm_030206_1_overwatch_4_fragment.dmp |
| Sample Tcpdump MD5 | c2a88fac4428bdf0ba8e1b6b6680b937 |
| Log file | server-030206_1839_50464_27015.log |

Table 15. Trial 4

| Number of clients | 5 |
|---|---|
| Game length | 20 mins |
| Full Tcpdump file | hl2dm_060206_1_overwatch_5.dmp |
| Full Tcpdump MD5 | dbd34485c5536c15e06eae90e6b68c9b |
| Sample Tcpdump file | hl2dm_060206_1_overwatch_5_fragment.dmp |
| Sample Tcpdump MD5 | 74c4858ed5f5a84f7c8008f4ed65ef8b |
| Log file | server-060206_1804_61184_27015.log |
| NB: Client 136.186.229.74 crashed out of the game and reconnected about 2/3rds of the way through the 20 mins | |

Table 16. Trial 5

| Number of clients | 7 |
|---|---|
| Game length | 20 mins |
| Full Tcpdump file | hl2dm_090206_1_overwatch_7.dmp |
| Full Tcpdump MD5 | 73231122cc4d16d25a3fbcb06c46bc3a |
| Sample Tcpdump file | hl2dm_090206_1_overwatch_7_fragment.dmp |
| Sample Tcpdump MD5 | d17e484c70faf63f80ed5a18508f8958 |
| Log file | server-090206_1615_84619_27015.log |
| NB: Client 136.186.229.74 crashed out of the game and reconnected about 1/2 way through the 20 mins | |

Table 17. Trial 6

| Number of clients | 6 |
|---|---|
| Game length | 20 mins |
| Full Tcpdump file | hl2dm_090206_1_overwatch_6.dmp |
| Full Tcpdump MD5 | 43f3f556fa8709c836c13f3d8209acd1 |
| Sample Tcpdump file | hl2dm_090206_1_overwatch_6_fragment.dmp |
| Sample Tcpdump MD5 | 327dc73054d8f6a4586246ac13a2de7b |
| Log file | server-090206_1749_86452_27015.log |

Table 18. Trial 7

| Number of clients | 5 |
|---|---|
| Game length | 20 mins |
| Full Tcpdump file | hl2dm_130206_1_resistance_5.dmp |
| Full Tcpdump MD5 | 96b47aee3e7a57d43c3915e084227a24 |
| Sample Tcpdump file | hl2dm_130206_1_resistance_5_fragment.dmp |
| Sample Tcpdump MD5 | 24adaac0703417c2632a10ca36e93658 |
| Log file | server-130206_1550_1597_27015.log |

Table 19. Trial 8

| Number of clients | 9 |
|---|---|
| Game length | 20 mins |
| Full Tcpdump file | hl2dm_150206_1_overwatch_9.dmp |
| Full Tcpdump MD5 | 79be64b4c27783a92d6a6c5176a3bd4a |
| Sample Tcpdump file | hl2dm_150206_1_overwatch_9_fragment.dmp |
| Sample Tcpdump MD5 | 41824859b366a0ed8b0e2e2b07150038 |
| Log file | server-150206_1801_8980_27015.log |

Table 20. Trial 9

| Number of clients | 8 |
|---|---|
| Game length | 20 mins |
| Full Tcpdump file | hl2dm_160206_1_overwatch_8.dmp |
| Full Tcpdump MD5 | 3a95eb712f78f61d4800fdda1184ceae |
| Sample Tcpdump file | hl2dm_160206_1_overwatch_8_fragment.dmp |
| Sample Tcpdump MD5 | 294a57a6208da59a2ddd95dbc491349c |
| Log file | server-160206_1832_13078_27015.log |

Table 21. Trial 10

| Number of clients | 6 |
|---|---|
| Game length | 20 mins |
| Full Tcpdump file | hl2dm_170206_1_resistance_6.dmp |
| Full Tcpdump MD5 | 1b2c42b5cf90eabb9f4efd2fed9c5437 |
| Sample Tcpdump file | hl2dm_170206_1_resistance_6_fragment.dmp |
| Sample Tcpdump MD5 | 5b8a71915d6797eaf73c396a4fdcc3a0 |
| Log file | server-170206_1459_15971_27015.log |

HOW TO CITE

This section provides examples of how to cite any tracefiles or their related technical reports obtained from the online SONG database.

L. Stewart, P. Branch, "HLCS, Map: dedust, 5 players, 13Jan2006", Centre for Advanced Internet Architectures SONG Database, http://caia.swin.edu.au/sitcrc, hlcs_130106_1_dedust_5_fragment.tar.gz, April 4th, 2006.

L. Stewart, P. Branch, "Quake3, Map: caialab3, 8 players, 10Jan2006", Centre for Advanced Internet Architectures SONG Database, http://caia.swin.edu.au/sitcrc, quake3_100106_1_caialab3_8_fragment.tar.gz, April 4th, 2006.

L. Stewart, P. Branch, "HL2DM, Map: overwatch, 3 players, 3Feb2006", Centre for Advanced Internet Architectures SONG Database, http://caia.swin.edu.au/sitcrc, hl2dm_030206_1_overwatch_3_fragment.tar.gz, April 4th, 2006.

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[3] "HALF – LIFE 2", 2006, http://half-life2.com/

[4] "TCPDump/libpcap", 2006, http://www.tcpdump.org

[5] L. Stewart, "Evaluation of the CAIA GENIUS Bridge's Timestamping Accuracy", CAIA Technical Report 060413A, April 2006, http://caia.swin.edu.au/reports/060413A/CAIA-TR-060413A.pdf