LDOS

Leonard's Demo Operating System

The easiest way to code a trackmo for your Amiga

INTRODUCTION

LDOS is a framework to easily build Amiga multi-part demos. You can chain several amiga executable effects. LDOS is managing memory allocation, floppy disk loading, data depacking and image disk creation. LDOS also includes an HDD loader to run your demo from harddisk. LDOS toolchain is running on Windows platform.

CREDITS

- LDOS is written by Arnaud Carré aka Leonard/Oxygene (@leonard_coder)
- ARJ depackers by Mr Ni! / TOS-crew
- Light Speed Player by Leonard/Oxygene (https://github.com/arnaud-carre/LSPlayer)
- This doc by Soundy (https://www.pouet.net/user.php?who=13965)

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FILES TYPES

Here's a summary of the different files types you're going to deal with:

- `.asm` ⇒ your assembly source code
- `.bin` ⇒ output of the assembler/linker. These files are generated by `m.cmd` and are used by LDOS to create an ADF file.
- `.cfg` ⇒ Compiler & linker configuration file
- `.cmd` ⇒ Windows Batch File, similar to the good old `.bat`
- `.lsmusic & .lsbank` ⇒ LSP music player native files formats (see https://github.com/arnaud-carre/LSPlayer)
- `.s` ⇒ same as .asm

GETTING THE FILES YOU NEED

You already have coded some effects, maybe you also have a music and you want to make a Trackmo? Easy!

1. Grab LDOS's latest version here: https://github.com/arnaud-carre/ldos
2. In folder `LDOS/demo/` you will find a suggested folder organization:

- demo/
    - build.cmd
    - parcade.mod
    - script.txt
    - greetings/
        - greetings.asm
        - m.cmd
        - run.cmd
        - script.txt
        - vc.cfg
    - sprites_loader/
        - sprite.asm
        - m.cmd
        - run.cmd
        - script.txt
        - vc.cfg

Here's an explanation of the above file organization, remember this is just a **suggestion**:

- **demo**: Global folder that contains the whole demo, and specific files to build the full demo:
    - **build.cmd**: used to build the full demo (described below)
    - **parcade.mod**: just the music for your demo (can be several)
    - **script.txt**: same as for single fx, but this one is bigger: it lists all the .bin of all your FX, and the music (see below for more explanations about script.txt)
- **greetings**, **sprite_loader**, …: Folders containing your various FX. Each is composed of:
    - source and data files
    - **m.cmd**: builds and links your code. The output is a "`.bin`" file.
    - **run.cmd**: creates a `.ADF` out of the `.bin` and launches WinUAE.
    - **script.txt**: the list of files to include in the ADF file for this FX (more details about script.txt below).
    - **vc.cfg**: you need it in every FX folder. It contains the arguments (parameters) for the assembler and the linker (vasm, vlink). You can use the one provided here: `LDOS\demo\greetings\vc.cfg` .

Note: If you check m.cmd, you will notice that optimizations are off: "`-O0`". This is the default configuration to rebuild LDOS as a library. Now, for your FX, feel free to enable optimizations and use "`-O2`", no problem.

SCRIPT.TXT

This is a text file containing the names of all the files to include in your Trackmo (basically, the list of files to copy to the ADF disk). 1 file path per line, as easy as that.

- FX Development use case:
    - You need to build an ADF containing only FX1 to test it? Just type a single line in script.txt:

      ```
      FX1.bin
      ```

      See demo file `LDOS\demo\greetings\script.txt` for example.

Wonder what a `.bin` is? It's generated by build.cmd, described later.

- Maybe you want to test FX1, but at the end of FX1 you coded a transition to FX2. Wanna test it? Just add FX2.bin in your script. Now your script file in the FX1 folder contains 2 lines:

  ```
  FX1.bin

  FX2.bin
  ```

- Building the whole trackmo use case:

  Now you want to generate an ADF that contains your whole demo. Here's the script.txt you need:

  ```
  music.lsbank

  music.lsmusic

  ../FX1/FX1.bin

  ../FX2/FX2.bin
  ```

  See demo file `LDOS\demo\script.txt` for example.

  The 2 first lines are the files generated by LSP when processing your .MOD music file. This processing is handled in build.cmd (described below). Putting the music first guarantees the music is loaded before anything else and we are sure it can start with the first FX. Then comes the list of FX binaries to add to the trackmo.

- Note about musics: LSP requires 2 files: a `.lsbank` and a `.lsmusic` file for each music. You always have to put both files one after another in your script.txt.

BUILD.CMD

This is a text file containing the instructions to compile your full demo and make an ADF:

See demo file `LDOS\demo\build.cmd` for example:

1. calls `m.cmd` for each of the FX of the demo to generate a .bin for each of them
2. converts the music to the LSP format
3. generates the ADF from all the .bin and music files according to `script.txt`
4. invokes WinUAE

API DOCUMENTATION

All the available functions are listed in "`../../ldos/kernel.inc`", and guess what, your code must `include "../../ldos/kernel.inc"`

Then, all functions are invoked the same way:

```
move.l  (LDOS_BASE).w,a6
jsr FUNCTION(a6)
```

For example:

```
move.l  (LDOS_BASE).w,a6
jsr LDOS_PRELOAD_NEXT_FX(a6)
```

Note that `../../ldos/kernel.inc` already provides a basic documentation for the API, below is some extra info for the functions that need more details:

- **LDOS_PRELOAD_NEXT_FX** : load & depack the next file in `script.txt`. Usually used by a FX to pre-load the next FX. Once the current FX ends (using RTS) the next one is executed immediately.
    - Note #1: If the next file in `script.txt` is not a .bin, but a music or a data file, then this file will be loaded.
    - Note #2: If you don't pre-load, next FX will be loaded & depacked when the previous one ends. So preload is not compulsory, it just avoids a blank screen in your demo while next FX loads (the music keeps on playing though).
- **LDOS_MUSIC_START**: Will start playing the latest loaded music.2 ways to load a

music:
    - Either the music files are the 2 first files in script.txt and the music will be ready to play when your first FX starts (see `LDOS\demo\script.txt` for an example).
    - Either the music is NOT at the beginning of script.txt, and it needs to be preloaded using **LDOS_PRELOAD_NEXT_FX**. This method is generally used when you have several musics in a single demo.
- **LDOS_MUSIC_GET_TICK**: Get LSP music frame tick. Use this counter if you want to sync gfx with music (output: `d0.l` = music frame tick). The return value is actually the CIA counter ticks, and it totally depends on the music's tempo. There is no trivial way to convert the tick counter into patter/pos/row in the original .MOD file.
- **LDOS_MUSIC_GET_SEQ_POS**: Returns the current MOD music sequence position (output: `d0.w` = music sequence position). Basically, this number increases every time a new pattern starts. Note this is not the pattern number, but the index in the pattern sequence. In other words, if your song plays 4 times pattern 0, LDOS_MUSIC_GET_SEQ_POS will return 1,2,3,4 and not 0,0,0,0.
- **LDOS_MUSIC_STOP**: Stops the current music and frees the associated RAM.
- **LDOS_PERSISTENT_CHIP_ALLOC**: Allows FX to allocate memory that will not be erased when your FX ends (see *"How do I allocate RAM in my FX?"* in the Q&A section below*).*

2 DISKS DEMOS

Here's how to handle multiple disks demos.

- First, you need 2 script.txt files in your demo/ folder: one for each disk, listing which .bin and which musics go to which disk.
- Then, here's how you check for disk swap:

```
.retry:
move.l     (LDOS_BASE).w,a6
move.w     #5*50,d0 ; wait 5 seconds in case of HDD version
jsr        LDOS_IS_DISK2_INSERTED(a6)
cmp.b      #$ff,d0
bne.b      .retry
; success
move.l     (LDOS_BASE).w,a6
```

```
jsr         LDOS_PRELOAD_NEXT_FX(a6)
```

DEBUGGING

LDOS crash screens will give you an explanation of why it crashed. But you can use this feature to implement your own assert/error system. To see examples, look for "`trap #0`" instructions in LDOS source files. For example:

```
InvalidParam:
      move.w      d0,-(a7)          ; push param to display on stack
      movea.l     a7,a1
      lea         .txt(pc),a0       ; error message
      trap        #0                ; assert
.txt:
      dc.b        'D0.W = %w Invalid param!',0
      even
```

Another example:

```
mallocError:
      lea         .txt(pc),a0             ; error string
      pea         fastMemTable(pc)        ; 2nd displayed argument
      pea         chipMemTable(pc)        ; 1st displayed argument
      movea.l     a7,a1
      trap        #0                      ; assert
.txt:
      dc.b        'MALLOC ERROR!',10      ; ",10" goes to the next line
      dc.b        'Chip Table: $%l',10    ; %l ⇒ chipMemTable(pc)
      dc.b        'Fake Table: $%l',10    ; %l ⇒ fastMemTable(pc)
      dc.b        0                       ; classic 0 terminated string
```

```
even                                    ; better safe than sorry ;)
```

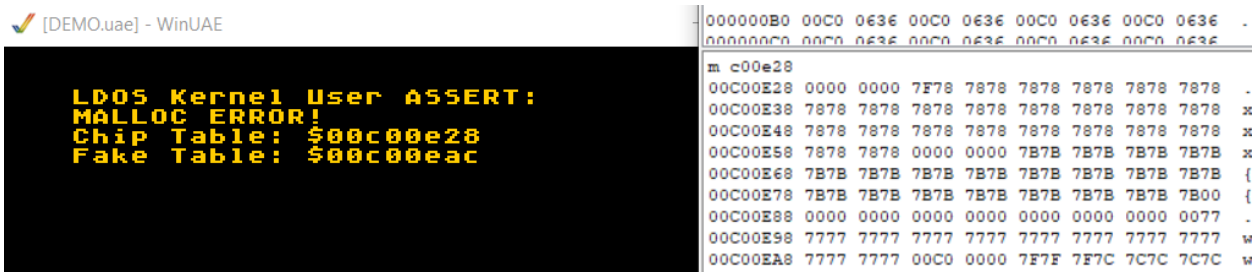
Q&A

- ***How do I allocate RAM in my FX?***
    - The best way is to use BSS sections. DATA sections are fine too, but obviously make your .bin files bigger than a BSS. LDOS will allocate your sections for you when your FX starts and free them when your FX ends.
    - You may want to allocate buffers in a FX that will be used by other FX. In that case, see: `LDOS_PERSISTENT_CHIP_ALLOC / LDOS_PERSISTENT_CHIP_GET / LDOS_PERSISTENT_CHIP_TRASH`

  Be aware that allocating persistent RAM may lead to memory fragmentation. To avoid this, alloc your persistent RAM as early as possible in your demo. Don't hesitate to start your demo (in script.txt) with a tiny .bin that does nothing but allocates the shared RAM. This was used for example in "The Nature Of Magic" by NGC : Persistent CHIP RAM is allocated at the beginning of the demo to store a default copperlist installed at the end of each FX. This way, the background color is kept between 2 screens.

- ***I ran out of RAM, how can I investigate it?***

  The "`MALLOC ERROR!`" screen gives you the "Chip Table" and "Fake Table" addresses that can be investigated in your debugger: Each table starts with the address of the RAM buffer (4 bytes), then the 128 following bytes give the status of each 4KB page within the buffer. 0 means the page is free, so by checking the tables, you can know if you ran out of free or fake memory. For example, here's a rather full CHIPmem table (starts at address 0, then all pages are allocated):



You can also use http://deadliners.net/LDOSRAM/ :just copy the text from

WinUAE's debugger at the memory table's address (the right side of the above image), paste it in LDOSRAM, and it will tell you what takes how much RAM.

Also, when you build your FX, LDOS will give you precious information about the CHIP and FAKE RAM taken by your FX:

```
[0]:$000000 [Raw] Packing    292->   292 (100%) Chip:  0KiB Fake:  0KiB  (boot.bin)
[0]:$000124 [Raw] Packing   9454->  7046 ( 74%) Chip:  0KiB Fake: 10KiB  (kernel.bin)
[0]:$001caa [Exe] Packing  53636-> 20108 ( 37%) Chip:188KiB Fake: 44KiB  (streamers.bin)
```

As usual, always prefer BSS to DATA sections when possible.

- ***What if I want to play a music while another one is loading?***

  Imagine you want to load your main music while a loading/intro music is playing. Unfortunately, LDOS supports only a single music at a time. The trick is to hide your loading music and the LSP player within your loading/intro FX (.bin): Include your intro music as incbin in your intro fx (.bin), and play it using LSP replay routine (include LSP source code in your intro's source code and compile it with your fx in the same .bin). While your intro is playing, you can load your main music using script.txt.