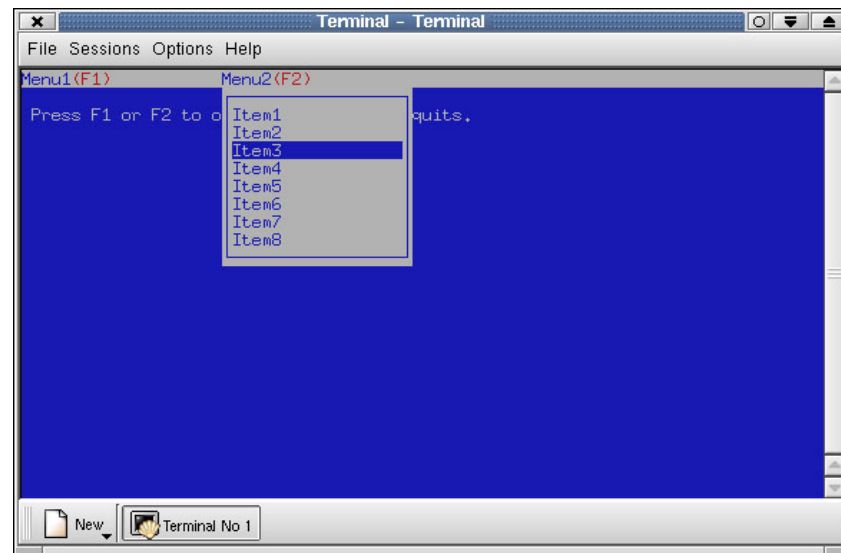
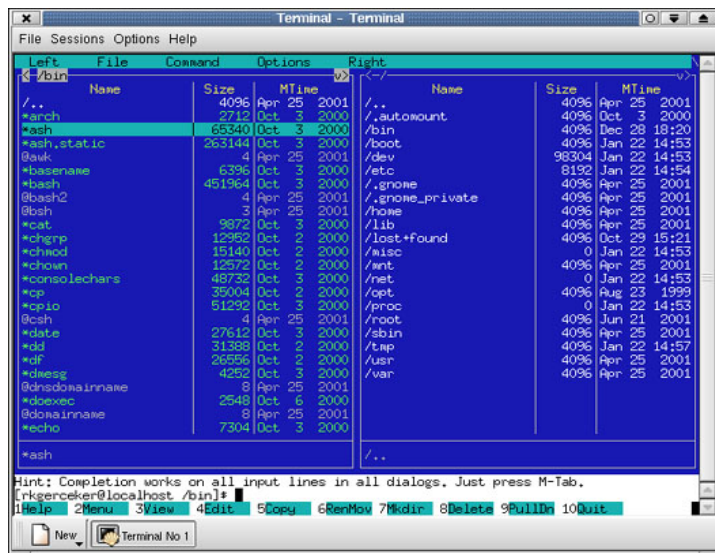


NCURSES

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들어가기 앞서 ^[1]

- NCURSES 란?
 - Curses 는 "cursor optimization" 을 재미스럽게 발음한 것
 - Curses 라이브러리는 상당히 유연하고 효율적인 API(Application Programing Interface) 를 제공한다.
 - 커서를 움직이거나, 윈도우를 생성하고, 색깔을 만들고, 마우스 관련 함수를 제공한다.
- NCURSES 기능
 - Ncurses 는 터미널 기능의 wrapper 생성이 가능
 - 텍스트 모드에서 UI를 구현할 수 있는 프레임워크를 제공한다.
 - 윈도우 등을 만들 수 있는 함수를 제공하며, 보다 확장된 라이브러리는 패널, 메뉴, 폼 등 기본적인 curses 라이브러리로부터 확장성을 제공한다.



프로그래밍 환경설정 (1)

- NCURSES

- URL

- www.gnu.org/software/ncurses/ncurses.html

- 배포 버전 (Release version)

- ncurses 6.2, released February 12, 2020

Release Notes

These notes are for *NCURSES* 6.2, released **February 12, 2020**.

This release is designed to be source-compatible with *NCURSES* 5.0 through 6.1; providing extensions to the application binary interface (ABI). Although the source can still be configured to support the *NCURSES* 5 ABI, the reason for the release is to reflect improvements to the *NCURSES* 6 ABI and the supporting utility programs.

There are, of course, numerous other improvements, listed in this announcement.

The most [important bug-fixes/improvements](#) dealt with user-defined capabilities in terminal descriptions. The release notes also mention some other bug-fixes, but are focused on new features and improvements to existing features since *NCURSES* 6.1 release.

- 다운로드 방법

- Ftp 를 사용하여 다운로드 가능
 - wget 를 사용하여 다운로드하는 방법을 선택

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[Interesting bug-fixes](#)

[Configuration changes](#)

[Major changes](#)

[Configuration options](#)

[Portability](#)

[Features of *NCURSES*](#)

[Applications using *NCURSES*](#)

[Development activities](#)

[Related resources](#)

[Other resources](#)

[OLDER RELEASES](#)

www.gnu.org/software/ncurses/ncurses.html

<https://invisible-island.net/ncurses/>

Overview

The *NCURSES* (new curses) library is a free software emulation of curses in System V Release 4.0 (SVr4), and more. It uses terminfo format, supports pads and color and multiple highlights and forms characters and function-key mapping, and has all the other SVr4-curses enhancements over BSD curses. SVr4 curses became the basis of X/Open Curses.

In mid-June 1995, the maintainer of 4.4BSD curses declared that he considered 4.4BSD curses obsolete, and encouraged the keepers of *UNIX* releases such as BSD/OS, FreeBSD and NetBSD to switch over to *NCURSES*.

Since 1995, *NCURSES* has been ported to many systems:

- It is used in almost every system based on the Linux kernel (aside from some embedded applications).
- It is used as the system curses library on OpenBSD, FreeBSD and MacOS.
- It is used in environments such as Cygwin and MinGW. The first of these was EMX on OS/2 Warp.
- It is used (though usually not as the *system* curses) on all of the vendor *UNIX* systems, e.g., AIX, HP-UX, IRIX64, SCO, Solaris, Tru64.
- It should work readily on any ANSI/POSIX-conforming *UNIX*.

The distribution includes the library and support utilities, including

- [captoinfo](#), a termcap conversion tool
- [clear](#), utility for clearing the screen
- [infocmp](#), the terminfo decompiler
- [tabs](#), set tabs on a terminal
- [tic](#), the terminfo compiler
- [toe](#), list (table of) terminfo entries
- [tput](#), utility for retrieving terminal capabilities in shell scripts
- [tset](#), to initialize the terminal

Full manual pages are provided for the library and tools.

The *NCURSES* distribution is available at *NCURSES*' [homepage](#):

<ftp://ftp.invisible-island.net/ncurses/> or
<https://invisible-mirror.net/archives/ncurses/> .

It is also available via anonymous FTP at the GNU distribution site

<ftp://ftp.gnu.org/gnu/ncurses/> .

Release Notes

프로그래밍 환경설정 [2]

- **NCURSES 다운로드**

- 아래의 명령문을 사용하여 다운로드를 수행한다.

- `wget https://ftp.gnu.org/pub/gnu/ncurses/ncurses-6.2.tar.gz -P ~/Downloads`

```
iodo@iodo-lab: ~$ wget https://ftp.gnu.org/pub/gnu/ncurses/ncurses-6.2.tar.gz -P ~/Downloads
--2020-04-26 16:48:31-- https://ftp.gnu.org/pub/gnu/ncurses/ncurses-6.2.tar.gz
Resolving ftp.gnu.org (ftp.gnu.org)... 209.51.188.20, 2001:470:142:3::b
Connecting to ftp.gnu.org (ftp.gnu.org)|209.51.188.20|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 3425862 (3.3M) [application/x-gzip]
Saving to: '/home/iodo/Downloads/ncurses-6.2.tar.gz'
```

```
ncurses-6.2.tar.gz      100%[=====>]  3.27M  839KB/s  in 4.0s
```

```
2020-04-26 16:48:36 (839 KB/s) - '/home/iodo/Downloads/ncurses-6.2.tar.gz' saved [3425862/3425862]
```

```
iodo@iodo-lab: ~$ ls ./Downloads
```

```
ncurses-6.2.tar.gz
```

```
iodo@iodo-lab: ~$
```

- **다운로드 파일 "ncurses-6.2.tar.gz" 압축을 해제한다.**

```
iodo@iodo-lab: ~$ cd Downloads
```

```
iodo@iodo-lab: ~/Downloads$ tar xzfv ncurses-6.2.tar.gz
```

```
ncurses-6.2/
```

```
ncurses-6.2/aclocal.m4
```

```
...
```

```
ncurses-6.2/Ada95/samples/tour.adb
```

```
iodo@iodo-lab: ~/Downloads$
```

프로그래밍 환경설정 [3]

- **NCURSES** 설정
 - 디렉터리 "ncurses-6.2" 로 이동 후 환경을 설정한다.
 - 설치 시 make 가 필요
 - 설치가 안되어 있는 경우 "sudo apt install make" 사용하여 설치한다.
 - ./configure

```
iodo@iodo-lab: ~/Downloads$ ls
ncurses-6.2  ncurses-6.2.tar.gz
iodo@iodo-lab: ~/Downloads$ cd ncurses-6.2/
iodo@iodo-lab: ~/Downloads/ncurses-6.2$ ./configure
checking for egrep... grep -E
Configuring NCURSES 6.2 ABI 6 (Sun Apr 26 17:00:05 KST 2020)
checking for package version... 6.2
...
creating headers.sh
```

** Configuration summary for NCURSES 6.2 20200212:

extended funcs: yes
xterm terminfo: xterm-new

bin	directory: /opt/ncurses/bin
lib	directory: /opt/ncurses/lib
include	directory: /opt/ncurses/include/ncurses
man	directory: /opt/ncurses/share/man
terminfo	directory: /opt/ncurses/share/terminfo

프로그래밍 환경설정 [4]

- **NCURSES 빌드**
 - make 를 사용하여 빌드하고
 - make install 을 사용하여 인스톨을 수행한다. (with sudo)

```
iodo@iodo-lab: ~/Downloads/ncurses-6.2$ make
cd man && make DESTDIR="" RPATH_LIST="/usr/lib" all
make[1]: Entering directory '/home/iodo/Downloads/ncurses-6.2/man'
/bin/sh ./MKterminfo.sh ./terminfo.head ../include/Caps ../include/Caps-ncurses ./terminfo.tail >terminfo.5
make[1]: Leaving directory '/home/iodo/Downloads/ncurses-6.2/man'
cd include && make DESTDIR="" RPATH_LIST="/usr/lib" all
...
compiling demo (obj_s)
/usr/bin/g++ -o demo ../objects/demo.o -L../lib -lncurses++ -L../lib -lform -lmenu -lpanel -lncurses -lutil -DHAVE_CONFIG_H -I../c++ -I. -I../include -D_DEFAULT_SOURCE -D_XOPEN_SOURCE=600 -D_NDEBUG -O2
make[1]: Leaving directory '/home/iodo/Downloads/ncurses-6.2/c++'
iodo@iodo-lab: ~/Downloads/ncurses-6.2$ sudo make install
[sudo] password for iodo:
cd man && make DESTDIR="" RPATH_LIST="/usr/lib" install
make[1]: Entering directory '/home/iodo/Downloads/ncurses-6.2/man'
/bin/sh ../edit_man.sh normal installing /usr/share/man . terminfo.5 *-config.1 /*.[0-9]*
installing /usr/share/man/man5/terminfo.5.gz
installing /usr/share/man/man1/ncurses6-config.1.gz
...
installing ./curses.h in /usr/include
installing ./cursesw.h in /usr/include
installing ./cursslk.h in /usr/include
installing etip.h in /usr/include
make[1]: Leaving directory '/home/iodo/Downloads/ncurses-6.2/c++'
```

- **NCURSES 설치 확인**
 - “ls -la /opt/ncurses” 명령을 사용하여 설치를 확인

```
iodo@iodo-lab:~$ ls -la /opt/ncurses
total 24
drwxr-xr-x 6 root root 4096 Apr 26 17:13 .
drwxr-xr-x 3 root root 4096 Apr 26 17:13 ..
drwxr-xr-x 2 root root 4096 Apr 26 17:20 bin
drwxr-xr-x 3 root root 4096 Apr 26 17:13 include
drwxr-xr-x 2 root root 4096 Apr 26 17:20 lib
drwxr-xr-x 5 root root 4096 Apr 26 17:14 share
iodo@iodo-lab:~$
```

Simple Example ⁽¹⁻¹⁾

- HelloWorld: hello.cpp

```
#include <ncurses.h>

int main()
{
    initscr();
    printw("Hello World !!!");
    refresh();
    getch();
    endwin();
    return 0;
}
```

- #include <ncurses.h>

- ncurses 라이브러리를 사용하는 C/C++ 프로그램들의 컴파일을 위해 <ncurses.h> 헤더파일을 포함하여야 한다.

- Initscr()

- ncurses 를 이용해서 스크린 처리를 하기 위해서는 initscr() 함수를 반드시 먼저 호출하여 터미널을 초기화하여야 한다. Initscr() 함수는 'stdscr' 이라 일컫는 기본 윈도우를 생성한다.

- printw()

- 함수 printw 는 stdscr 인 기본 윈도우 내에 (y, x) 위치에 문자열을 출력한다. 프로그램에서는 커서 위치가 0, 0 이기 때문에 현재 윈도우의 좌상단에 문자열을 출력한다.

Simple Example ⁽¹⁻²⁾

- HelloWorld: hello.cpp
 - refresh()
 - 함수 printf 는 기본 윈도우에 문자열을 쓰고, 화면에 출력은 하지 않는다. 즉 윈도우 버퍼에 데이터를 쓰기만 함을 의미한다.
 - 윈도우의 버퍼의 내용을 화면에 출력하기 위해서는 refresh() 함수를 호출여야 한다.
 - endwin()
 - 최종 ncurses 모드를 종료하여야 한다. 이를 생략하면 프로그램 종료 후 터미널이 비정상적으로 동작할 수 있다.
 - 함수 endwin() 는 ncurses 에 의해 점유되었던 메모리의 해제 후, 터미널을 일반 모드로 변경한다.
- 컴파일
 - 컴파일을 위한 일반적인 명령문은 아래와 같다.

```
g++ -o hello hello.cpp -lncurses
```

- 보다 상세한 컴파일 환경을 소개한다.

Compiling ^[1]

- 현재 개발환경 하의 운영체제
 - 명령문 : `cat /etc/lsb-release`

```
iodo@iodo-lab:~$ cat /etc/lsb-release
DISTRIB_ID=Ubuntu
DISTRIB_RELEASE=18.04
DISTRIB_CODENAME=bionic
DISTRIB_DESCRIPTION="Ubuntu 18.04.4 LTS"
iodo@iodo-lab:~$
```

- 현재 g++ 버전
 - `g++ --version`

```
iodo@iodo-lab:~$ g++ --version
g++ (Ubuntu 7.5.0-3ubuntu1~18.04) 7.5.0
Copyright (C) 2017 Free Software Foundation, Inc.
This is free software; see the source for copying conditions. There is NO
Warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.
```

- 우분투 18.04에서 기본 제공되는 g++ (버전 7.5.0)은 기본적으로 C++14 (C++11 호환)
- 특정 C++ 버전을 사용하기 위해서는
 - 옵션 `-std` 를 설정
 - C++11 : `-std=c++11` C++17 : `-std=c++17` (c++1z)

```
g++ -o hello hello.cpp -lncurses -std=c++11
```

Compiling [2]

- 현재 컴파일에 사용하는 g++ 옵션리스트를 확인

– g++ -o hello hello.cpp -lncurses -v

```
iodo@iodo-lab: ~/C++/ncurses/Hello$ g++ -o hello hello.cpp -lncurses -v
```

```
Using built-in specs.
```

```
COLLECT_GCC=g++
```

```
...
```

```
GNU C++14 (Ubuntu 7.5.0-3ubuntu1~18.04) version 7.5.0 (x86_64-linux-gnu)
```

```
compiled by GNU C version 7.5.0, GMP version 6.1.2, MPFR version 4.0.1, MPC version 1.1.0, isl version isl-0.19-GMP
```

```
...
```

```
GCC heuristics: --param ggc-min-expand=100 --param ggc-min-heapsize=131072
```

```
Compiler executable checksum: 3eb3dc290cd5714c3e1c3ae751116f07
```

```
COLLECT_GCC_OPTIONS='-o' 'hello' '-v' '-shared-libgcc' '-mtune=generic' '-march=x86-64'
```

– g++ -o hello hello.cpp -lncurses -std=c++11 -v

```
iodo@iodo-lab: ~/C++/ncurses/Hello$ g++ -o hello hello.cpp -lncurses -std=c++11 -v
```

```
Using built-in specs.
```

```
COLLECT_GCC=g++
```

```
...
```

```
GNU C++11 (Ubuntu 7.5.0-3ubuntu1~18.04) version 7.5.0 (x86_64-linux-gnu)
```

```
compiled by GNU C version 7.5.0, GMP version 6.1.2, MPFR version 4.0.1, MPC version 1.1.0, isl version isl-0.19-GMP
```

```
...
```

```
COLLECT_GCC_OPTIONS='-o' 'hello' '-std=c++11' '-v' '-shared-libgcc' '-mtune=generic' '-march=x86-64'
```

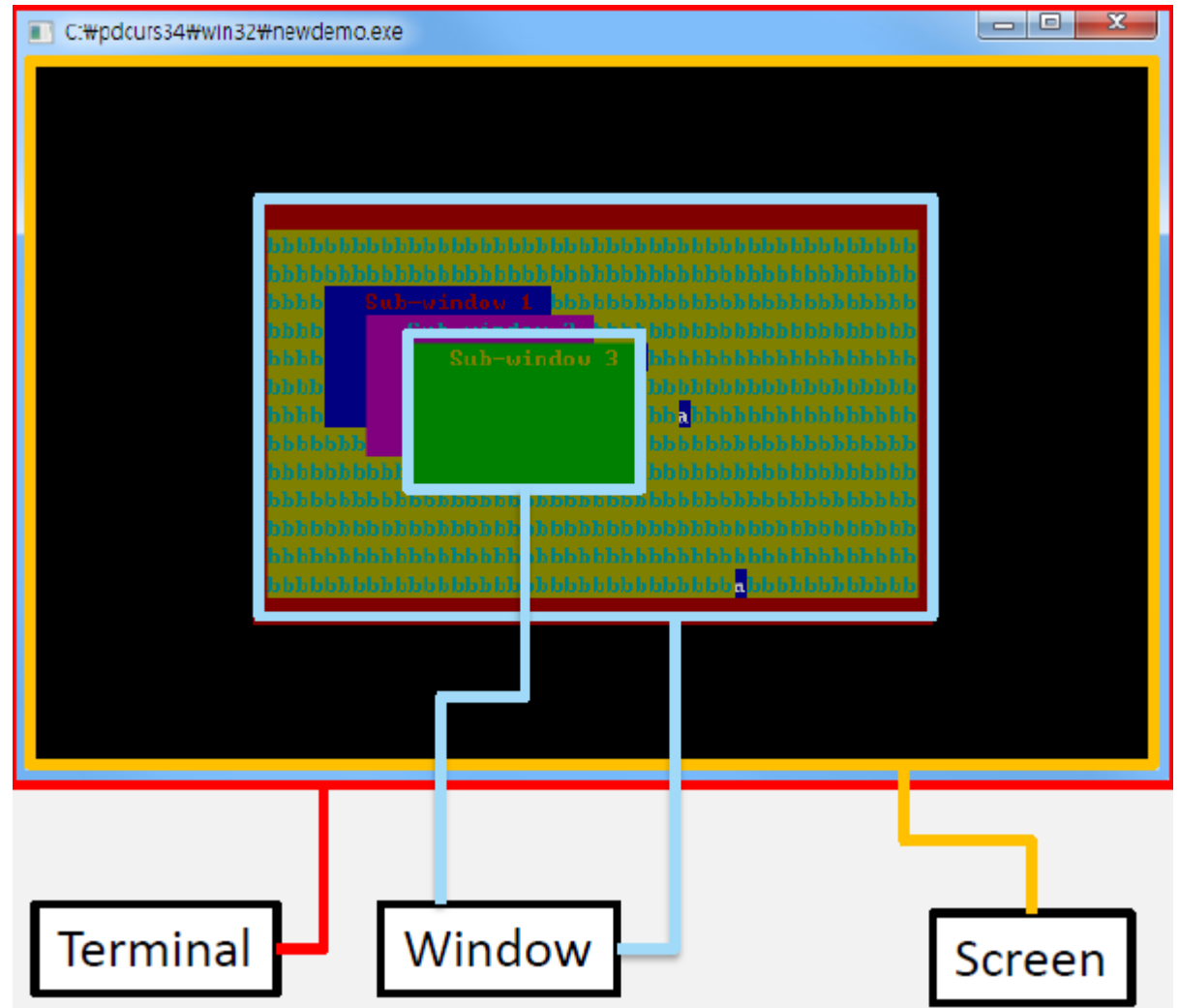
```
as -v --64 -o /tmp/cctSKSTu.o /tmp/cctrr4B4.s
```

```
...
```

- 우리는 디폴트인 C++14 버전으로 컴파일한다.

Terminal, Screen, Window

- NCURSES 에서의
터미널, 스크린 , 윈도우
- 터미널(Terminal)
 - 콘솔 실행 화면
- 스크린(Screen)
 - 프로그램 내 보여지는 화면
- 윈도우(Window)
 - ncurses mode 후 스크린에 생성되어
출력될 화면
 - 스크린 내에 포함



Simple Window ⁽¹⁾

- Example
 - simplewin.cpp

```
#include <ncurses.h>

int main()
{
    initscr(); // Curses 모드시작
    start_color(); // Color 사용선언
    init_pair(1, COLOR_RED, COLOR_WHITE); // 색attribute 설정
    attron(COLOR_PAIR(1)); // Attribute 적용
    printw("Hello world"); // Hello world 출력
    attroff(COLOR_PAIR(1)); // Attribute 해제
    refresh(); // 실제 스크린에 출력
    getch(); // 사용자입력대기
    endwin(); // Curses 모드종료

    return 0;
}
```



Simple Window [2]

- Example
 - simplewin.cpp

```
#include <ncurses.h>

int main()
{
    initscr(); // Curses 모드시작
    start_color(); // Color 사용선언
    init_pair(1, COLOR_RED, COLOR_WHITE); // 색attribute 설정
    attron(COLOR_PAIR(1)); // Attribute 적용
    printw("Hello world"); // Hello world 출력
    attroff(COLOR_PAIR(1)); // Attribute 해제
    refresh(); // 실제 스크린에 출력
    getch(); // 사용자입력대기
    endwin(); // Curses 모드종료

    return 0;
}
```

- start_color()
 - ncurses에 color attribute 사용 선언
- init_pair()
 - 한쌍의 색 속성을 설정
 - 인자 (숫자, 폰트색, 폰트배경색)
 - ex) init_pair(1, COLOR_RED, COLOR_WHITE);
 - 1번 팔레트
 - 폰트 색상: 빨간색, 폰트 배경 색상: 흰색
 - 반환값
 - 성공 시 0, 실패 시 -1
- attron()
 - 적용할 속성 설정
 - ex) attron(COLOR_PAIR(1))
 - 1번 팔레트 사용
 - 반환값
 - 성공 시 0, 실패 시 -1

Using NCURSES Manual

- NCURSES Manual
 - man 사용

```
iodo@iodo-lab: ~/C++/ncurses/Window$ man initscr
```

```
iodo@iodo-lab: ~/C++/ncurses/Window
File Edit View Search Terminal Help
initscr(3NCURSES)                                initscr(3NCURSES)

NAME
    initscr, newterm, endwin, isendwin, set_term, delscreen - curses screen initialization and
    manipulation routines

SYNOPSIS
    #include <curses.h>

    WINDOW *initscr(void);
    int endwin(void);
    bool isendwin(void);
    SCREEN *newterm(const char *type, FILE *outfd, FILE *infd);
    SCREEN *set_term(SCREEN *new);
    void delscreen(SCREEN* sp);

DESCRIPTION
    initscr
    initscr is normally the first curses routine to call when initializing a program. A few special
    routines sometimes need to be called before it; these are slk_init(3X), filter, ripoffline, use_env.
    For multiple-terminal applications, newterm may be called before initscr.

    The initscr code determines the terminal type and initializes all curses data structures. initscr
    also causes the first call to refresh(3X) to clear the screen. If errors occur, initscr writes an
    appropriate error message to standard error and exits; otherwise, a pointer is returned to stdscr.

    newterm

Manual page initscr(3ncurses) line 1 (press h for help or q to quit)
```

Simple Window with border ⁽³⁾

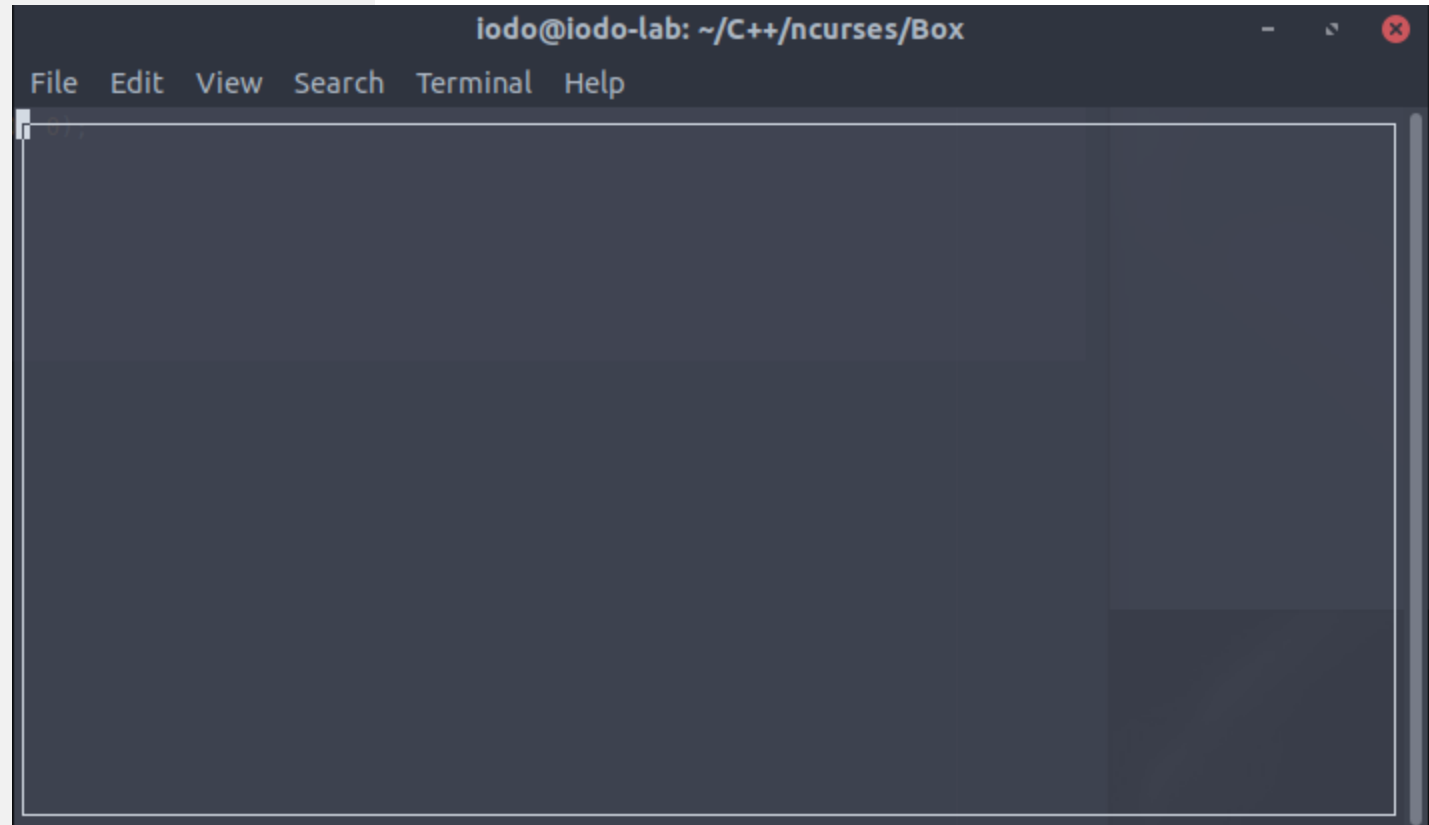
- Example
 - borderwin.cpp

```
#include <ncurses.h>
```

```
int main()
{
    initscr();
    box(stdscr, 0, 0); // 윈도우의 경계를 표현한다.
    refresh();

    getch();
    endwin();

    return 0;
}
```



Simple multi Window with border [3]

- Example
 - multiwin.cpp

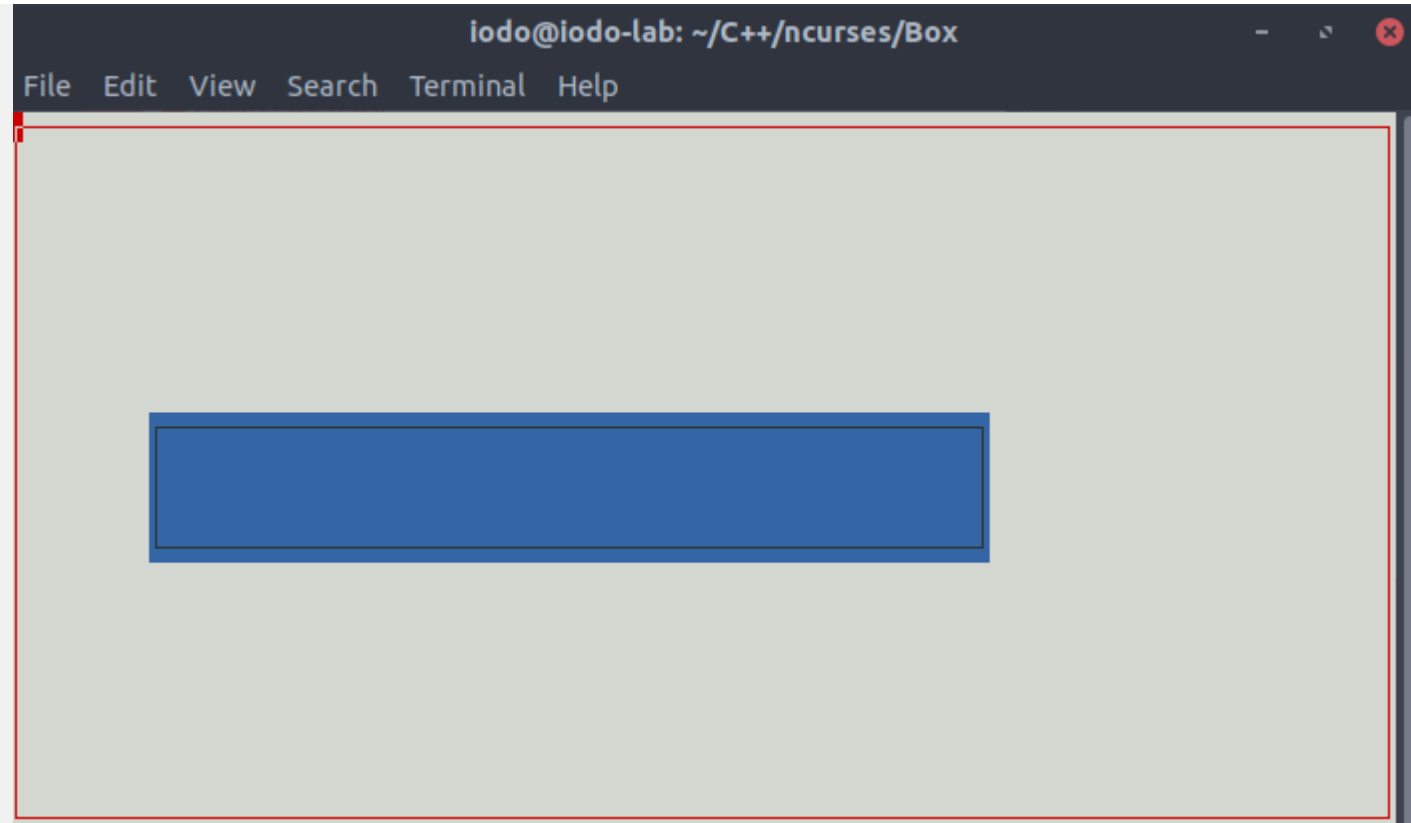
```
#include <ncurses.h>

int main()
{
    initscr();
    start_color();
    init_pair(1, COLOR_RED, COLOR_WHITE);
    box(stdscr, 0, 0);
    attron(COLOR_PAIR(1));
    wbkgd(stdscr, COLOR_PAIR(1)); //윈도우 백그라운드 컬러

    // 기본 윈도우 내의 서브윈도우 생성
    WINDOW *win = subwin(stdscr, 5, 60, 10, 10);
    init_pair(2, COLOR_BLACK, COLOR_BLUE); //윈도우 백그라운드 컬러
    box(win, 0, 0);
    attron(COLOR_PAIR(2));
    wbkgd(win, COLOR_PAIR(2));
    refresh();

    getch();
    delwin(win);
    endwin();

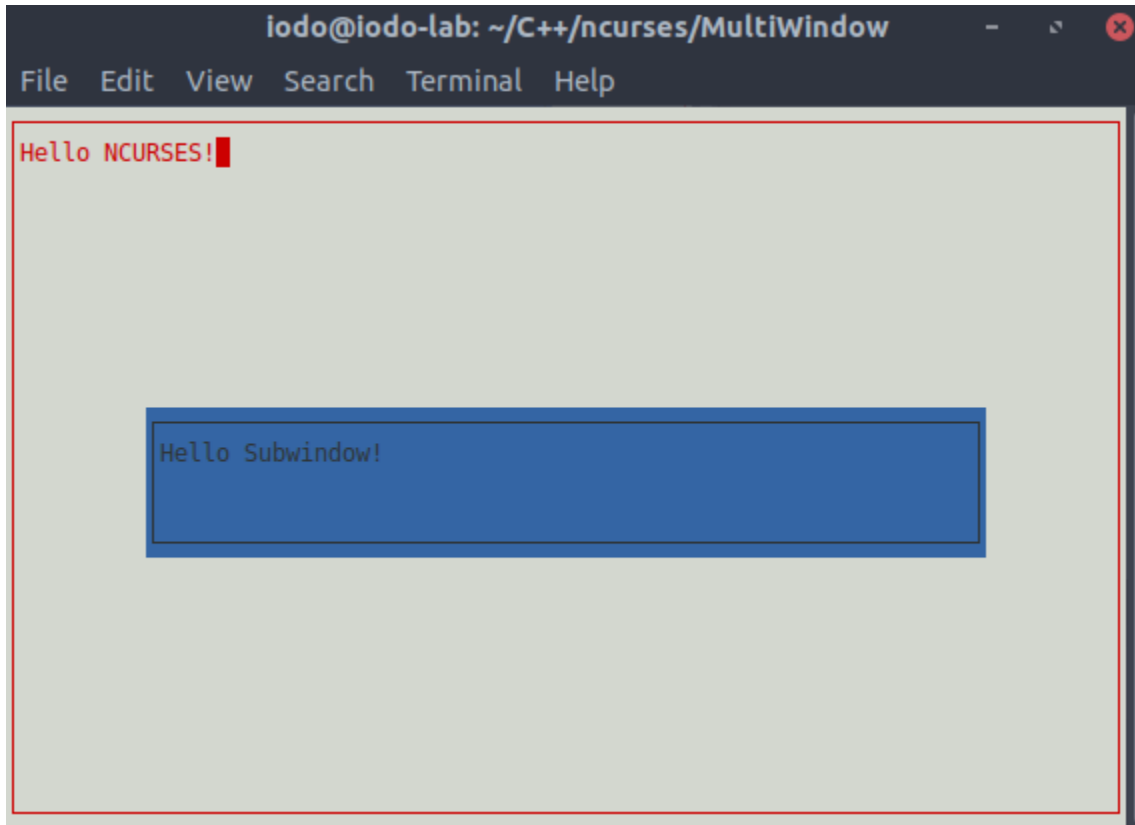
    return 0;
}
```



LAB (1)

- LAB

- 각각의 윈도우 상에 특정 문자열을 출력
- 출력결과



- References

- NCURSES Programming HOWTO
 - <http://tldp.org/HOWTO/NCURSES-Programming-HOWTO/index.html>
- NCURSES Programming HOWTO (한글번역)
 - <https://wiki.kldp.org/wiki.php/NCURSES-Programming-HOWTO>
- man 활용