

To plot a graph in a Linux environment using C, use a library like **GNUplot** (via system calls or piping) or a graphics library like **SDL** or **OpenGL** for more control. The program flow for using **GNUplot** with C is widely used for plotting.

Program Flow for Plotting with C and GNUplot

1. Set up the environment:

- Ensure GNUplot is installed (sudo apt install gnuplot on Debian/Ubuntu).
- Include necessary C headers (stdio.h for file operations or stdlib.h for system calls).

2. Prepare data:

- Generate or collect data points to plot (e.g., x-y coordinates).
- Write data to a file (e.g., data.txt) or pass it directly to GNUplot via a pipe.

3. Interface with GNUplot:

- Use popen() to open a pipe to GNUplot and send plotting commands.
- Alternatively, write a GNUplot script to a file and invoke it via system().

4. Send GNUplot commands:

- Specify plot type (e.g., plot, splot), data source, and styling (e.g., lines, points).
- Configure axes, labels, and title if needed.

5. Execute and display:

- GNUplot renders the plot in a window (e.g., X11 or Qt terminal) or saves it to a file (e.g., PNG, PDF).
- Close the pipe or terminate the GNUplot process.

6. Clean up:

- Close files or pipes.
- Handle errors if GNUplot fails to execute.

Simple Example: Plotting a Sine Wave

This C program generates sine wave data, writes it to a file, and uses GNUplot to plot it via a pipe.

```
#include <stdio.h>
#include <math.h>
```

```
int main() {
    // Step 1: Open a pipe to GNUplot
```

```

FILE *gp = popen("gnuplot -persist", "w");
if (!gp) {
    fprintf(stderr, "Error opening GNUplot\n");
    return 1;
}

// Step 2: Generate and write data to a file
FILE *data = fopen("data.txt", "w");
if (!data) {
    fprintf(stderr, "Error opening data file\n");
    pclose(gp);
    return 1;
}

// Generate sine wave data (x, sin(x))
for (double x = 0; x <= 10; x += 0.1) {
    fprintf(data, "%f %f\n", x, sin(x));
}
fclose(data);

// Step 3: Send GNUplot commands
fprintf(gp, "set title 'Sine Wave'\n");           // Set title
fprintf(gp, "set xlabel 'x'\n");                 // X-axis label
fprintf(gp, "set ylabel 'sin(x)'\n");            // Y-axis label
fprintf(gp, "plot 'data.txt' with lines title 'sin(x)'\n"); // Plot command

// Step 4: Flush and close GNUplot
fflush(gp);
pclose(gp);

return 0;
}

```

How to Compile and Run

1. Install GNUplot:

```
sudo apt update
```

2. sudo apt install gnuplot

3. Compile the C program:

```
gcc -o sine_plot sine_plot.c -lm
```

(The -lm flag links the math library for sin().)

4. **Run the program:**bash

```
./sine_plot
```

This opens a GnuPlot window displaying a sine wave from $x = 0$ to $x = 10$

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