## ECE6343 : Embedded System Design

# POSIX Threads on Visual Studio 2010

## Introduction to PThreads Library & Multi-threaded Application Development

**Objective : This hand-out will familiarize students with POSIX Library and its integration with Visual Studio 2010. Students will learn, how to integrate pThread library into Visual Studip Workspaces/Solutions**

Learning outcomes are :

1. Integration of pThread Library in Visual Studio 2010
2. Development of multi-threaded applications on Windows Platform

## 1 Integration of Pthreads Library in Visual Studio Project

Below are the steps for integration of Pthreads Library into Visual Studio 2010 Solution

1. You may download the Pthreads for Win 32 from the web page :
http://sources.redhat.com/pthreads-win32/

It includes both source code and a binary version. (**Required files for Pthreads Library are also included in Assignment#3** )

2. In Visual Studio, Create new project of type **Win32 Console Project** .

3. Copy the following files of Pthreads Library to the folder of created project. Also include these files into project

**pthread.h**
**sched.h**
**semaphore.h**
**pthreadVC.dll**
**pthreadVC.lib**

4. Add the **pthreadVC.lib** library in the linker options of the project as shown below:

Project → Project_Properties... → Configuration Properties → Linker → Command Line → Addition Options

Click OK and save the settings .

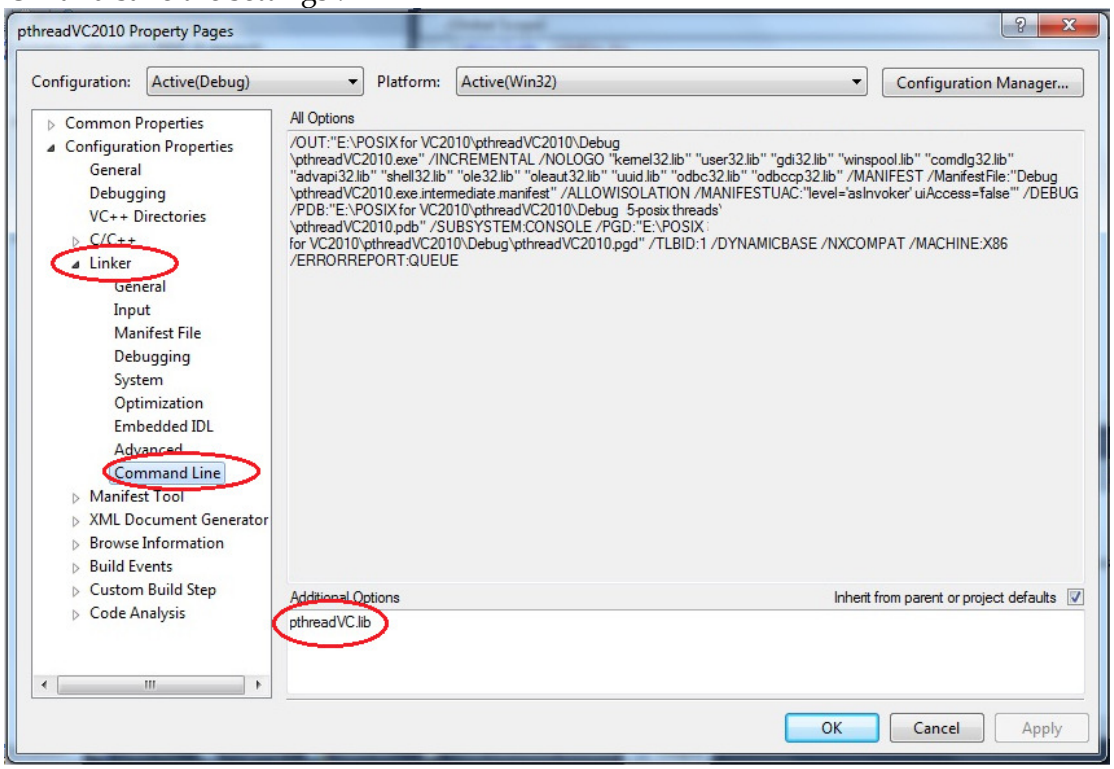


**Figure 1. Visual Studio 2010 Properties Window**

## 2 Hello World Program using Pthreads

Compile and run the following example program as demo application using Pthreads.

```
/*
 * main.c
 *  Created on: Dec 06, 2014
 *      Author: mTahir
 */

#include <pthread.h>
#include <stdio.h>

#define NUM_THREADS     5
```

```
void *PrintHello(void *threadid)
{
   long tid;
   tid = (long)threadid;
   printf("Hello World! It's me, thread #%ld!\n", tid);
   pthread_exit(NULL);
}

int main (int argc, char *argv[])
{
   pthread_t threads[NUM_THREADS];

   int rc;
   long t;

   for(t=0; t<NUM_THREADS; t++){
      printf("In main: creating thread %ld\n", t);
      rc = pthread_create(&threads[t], NULL, PrintHello, (void *)t);
      if (rc){
         printf("ERROR code from pthread_create() is %d\n",rc);
         exit(-1);
      }
   }

   /* Last thing that main() should do */
   pthread_exit(NULL);
}
```

Compile and run the following example program as demo application using Pthreads.

## 3 Pthreads Applications : Practice Problems

1. Implement dot product using multiple threads and mutex
2. Implement Producer , Consumer Problem using pthread library and semaphores
3. Implement Reader , Writer Problem using pthread library and semaphores/mutex
4. Implement matrix multiplication using multiple threads in pthread library and mutexes