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The accuracy of SysTick depends on the accuracy of the clock. We use the PLL to derive a bus clock based on the 16 MHz crystal, the time measured or generated using SysTick will be very accurate. More specifically, the accuracy of the NX5032GA crystal on the LaunchPad board is ±50 parts per million (PPM), which translates to 0.005%, which is about ±5 seconds per day. One could spend more money on the crystal and improve the accuracy by a factor of 10. Not only are crystals accurate, they are stable. The NX5032GA crystal will vary only ±150 PPM as temperature varies from -40 to +150 °C. Crystals are more stable than they are accurate, typically varying by less than 5 PPM per year.

Help

Program 10.2 shows a simple function to implement time delays based on SysTick. The **RELOAD** register is set to the number of bus cycles one wishes to wait. If the PLL function of Program 10.1 has been executed, then the units of this delay will be 12.5 ns. Writing to **CURRENT** will clear the counter and will clear the count flag (bit 16) of the **CTRL** register. After SysTick has been decremented **delay** times, the count flag will be set and the **while** loop will terminate. Since SysTick is only 24 bits, the maximum time one can wait with **SysTick_Wait** is 2^{24}*12.5ns, which is about 200 ms. To provide for longer delays, the function **SysTick_Wait10ms** calls the function **SysTick_Wait** repeatedly. Notice that 800,000*12.5ns is 10ms.

```
#define NVIC_ST_CTRL_R      (*((volatile unsigned long *)0xE000E010))
#define NVIC_ST_RELOAD_R    (*((volatile unsigned long *)0xE000E014))
#define NVIC_ST_CURRENT_R   (*((volatile unsigned long *)0xE000E018))
void SysTick_Init(void){
  NVIC_ST_CTRL_R = 0;               // disable SysTick during setup
  NVIC_ST_CTRL_R = 0x00000005;      // enable SysTick with core clock
}
// The delay parameter is in units of the 80 MHz core clock. (12.5 ns)
void SysTick_Wait(unsigned long delay){
  NVIC_ST_RELOAD_R = delay-1;  // number of counts to wait
  NVIC_ST_CURRENT_R = 0;       // any value written to CURRENT clears
  while((NVIC_ST_CTRL_R&0x00010000)==0){ // wait for count flag
  }
}
// 800000*12.5ns equals 10ms
void SysTick_Wait10ms(unsigned long delay){
  unsigned long i;
  for(i=0; i<delay; i++){
    SysTick_Wait(800000);  // wait 10ms
  }
}
```

Program 10.2. Use of SysTick to delay for a specified amount of time (C10_SysTick_Wait).

CHECKPOINT 10.2

What is the longest time one could wait using SysTick_Wait10ms?

Hide Answer

The maximum delay is 2^{32} * 10ms, which is about 500 days.

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