Clock System

- Xmega has many possible clock sources:
  - 32MHz runtime calibrated oscillator
  - 2MHz runtime calibrated oscillator
  - 32.768kHz runtime calibrated oscillator
  - 32kHz ultra low power oscillator
  - External clock source
  - External quartz crystal 0.4-16MHz

- Peripherical clocks can run at 2-4x CPU clock
- Directly after reset, CPU starts up with the internal 2Hmz clock
- System clock can be changed on-the-fly safely.
- Each oscillator has a ”ready” flag to indicate that its ready.
Clock System

Setup for clocks: https://morf.lv/configuring-xmega-system-clock

```c
void setUp32MhzInternalOsc() {
    OSC_CTRL |= OSC_RC32MEN_bm; // Setup 32Mhz crystal
    while (!(OSC_STATUS & OSC_RC32MRDY_bm));
    CCP = CCP_IOREG_gc; // Trigger protection mechanism
    CLK_CTRL = CLK_SCLKSEL_RC32M_gc; // Enable internal 32Mhz crystal
}

void setUp16MhzExternalOsc() {
    PORTD_DIR = 0x01;
    // 16 MHz external crystal
    OSC_XOSCCTRL = OSC_FRQRANGE_12TO16_gc | OSC_XOSCSEL_XTAL_16KCLK_gc;
    // Enable external oscillator
    OSC_CTRL |= OSC_XOSCEN_bm;
    // Wait for clock stabilization
    while (!(OSC_STATUS & OSC_XOSCRDY_bm));
    // Selects clock system as external clock
    // through change protection mechanism
    CCP = CCP_IOREG_gc;
    CLK_CTRL = CLK_SCLKSEL_XOSC_gc;
}
```
Clock System

- Here’s how to quickly and easily get your Atmel AVR XMEGA running at a very stable 32MHz without a crystal. This will enable both the 32Khz and 32MHz internal oscillators, using the 32KHz oscillator for DFLL calibration and switch the XMEGA to the 32MHz clock. I’ve used the USART at 115,200 on a few projects with this configuration and it’s been very stable.

```c
// Configure clock to 32MHz
OSC_CTRL |= OSC_RC32MEN_bm | OSC_RC32KEN_bm;  /* Enable the internal 32 MHz & 32 KHz oscillators */
while (!(OSC.STATUS & OSC_RC32KRDY_bm)); /* Wait for 32 Khz oscillator to stabilize */
while (!(OSC.STATUS & OSC_RC32MRDY_bm)); /* Wait for 32 MHz oscillator to stabilize */
DFLLRC32M_CTRL = DFLL_ENABLE_bm; /* Enable DFLL - defaults to calibrate against internal 32 Khz clock */
CCP = CCP_IOREG_gc; /* Disable register security for clock update */
CLK_CTRL = CLK_SCLKSEL_RC32M_gc; /* Switch to 32 MHz clock */
OSC_CTRL &= ~OSC_RC2MEN_bm; /* Disable 2Mhz oscillator */
```
For further tutorials of XMEGA we will use PLL as system clock source and 2MHz internal oscillator as PLL clock source. The function for configuring system clock is as shown below.

```c
void clock_init() {
    OSC_PLLCTRL = OSC_PLLFAC3_bm; // select internal 2MHz oscillator as PLL clock source, PLL multiplication factor as 8
    OSC_CTRL = OSC_PLLEN_bm; // enable PLL
    while (!(OSC_STATUS & OSC_PLLRDY_bm)); // wait until PLL is locked to desired frequency and ready to use
    CCP = 0xd8; // write Configuration Change Protection register
    CLK_CTRL = CLK_SCLKSEL2_bm; // select PLL as system clock source
    CCP = 0xd8; // write Configuration Change Protection register
    CLK_PSCTRL = CLK_PSADIV0_bm; // select Prescaler A as 2, Prescaler B and Prescaler C as 1, Clksys = 16 MHz, Clkper4 = Clkper2 = Clkper = 8 MHz
    CLK_RTCCTRL = CLK_RTCEN_bm; // enable RTC clock source as 1KHz from 32KHz ULP internal oscillator
}
```