



EEL 4744C: μ P Apps

EEL 4744 Menu

- XMEGA Event System



See docs/examples on web-site:
doc8331 (Sec 6) , doc8071

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EEL 4744 XMEGA Event System


- An **event** is a change in a peripheral's state
 - > An event usually corresponds to a peripheral's interrupt condition
- Event system
 - > Enables direct peripheral-to-peripheral communication and signaling
 - > Allows change in one peripheral's state to **automatically** trigger actions in other peripherals
 - > Allows for autonomous peripheral control and interaction **without** the use of interrupts, CPU, or DMA controller resources

See doc8331, Sec 6.2

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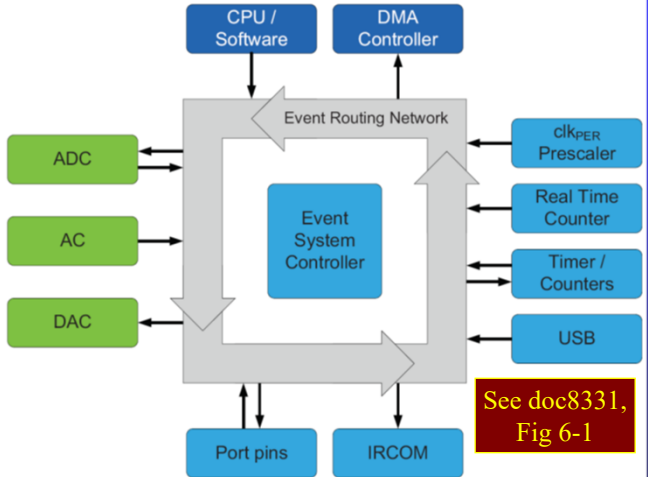


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Event System


Connects Peripherals

- 8 software-configurable MUXes control how events are routed and used



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Events

- **Event**: An indication that a change of state within a peripheral has occurred
- Two types of events
 - > **Signal events**: indicate a change in state
 - > **Data events**: indicate a change in state **and** info about the event [not used in our course]
- **Event generator**: Peripheral that originates the event
 - > A peripheral can have several event sources
 - Ex: A timer can have a compare match or a timer overflow; an ADC can have a result available
- **Event user**: Peripheral that uses the event
- **Event action**: Action triggered by event

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Example of Event Source Generator, User, and Action

Timer/Counter

Compare Match

Over-/Underflow

Error

Event Source

See doc8331,
Fig 6-2

➔

Event Routing
Network

ADC

Channel Sweep


Single Conversion

Event Action

- For example, a timer overflow can trigger an ADC single channel conversion

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Signaling and Data Events

- A **signaling event** does **not contain any information** apart from the indication of a change in a peripheral
 - > Most peripherals can only generate and use signaling events
 - > Unless otherwise stated, all occurrences of the word “event” are to be understood as meaning signaling events
- **Data events** differ from signaling events in that they **contain information** that event users can decode to decide event actions based on the receiver information
 - > Event users that can utilize data events can also use signaling events
 - > **Not used in our course**

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EEL 4744 Peripheral Clock and Software Events

- Each event channel includes a peripheral clock prescaler with a range from 1 (no prescaling) to 32,768
 - > This enables configurable periodic event generation based on the peripheral clock
 - It is possible to periodically trigger events in a peripheral or to periodically trigger synchronized events in several peripherals
 - Since each event channel include a prescaler, different peripherals can receive triggers with different intervals

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EEL 4744 Software Events

- Events can be generated from software by writing the **DATA** and **STROBE** registers
 - > The DATA register must be written first, since writing the STROBE register triggers the operation
 - The DATA and STROBE registers contain one bit for each event channel
 - Bit n corresponds to event channel n
 - It is possible to generate events on several channels at the same time by writing to several bit locations at once
 - > Software-generated events last for one clock cycle and will overwrite events from other event generators on that event channel during that clock cycle

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Event Routing Network

- The event routing network routes the events between peripherals
 - > It consists of eight multiplexers (CHnMUX), which can each be configured to route any event source to any event users
 - > The output from a multiplexer is referred to as an event channel
 - > For each peripheral, it is selectable if and how incoming events should trigger event actions
 - > Details on configurations can be found in the datasheet for each peripheral

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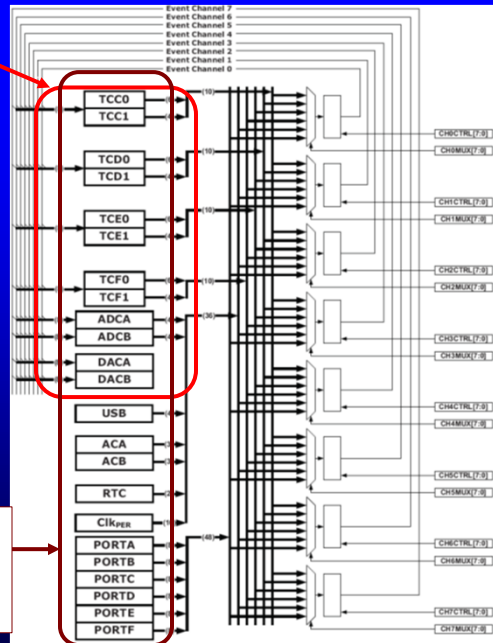
Event Routing Network

See doc8331, Fig 6-3

Event actions

- See [Figure 6-3](#) in [doc 8331](#) (link)
- Eight multiplexers means that it is possible to route up to eight events at the same time
- It is also possible to route one event through several multiplexers

Event sources (& TCs)



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EEL 4744 CHnMUX- Event Channel n MUX Register

↓


- These bits select the event **source** according to [Table 6-3](#)
- This table is valid for all XMEGA devices regardless of whether the peripheral is present or not
- Selecting event sources from peripherals that are not present will give the same result as when this register is 0
- When this register is zero, no events are routed through

`EVSYS_CHnMUX, n=0..7`

	7	6	5	4	3	2	1	0	
	CHnMUX[7:0]								CHnMUX
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W
Initial Value	0	0	0	0	0	0	0	0	0

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EEL 4744 Event Action


- The event source can trigger **actions** of the following peripherals (see the top left side of [Figure 6-3 in doc 8331](#) [items circled in red a few pages back in this lecture])

> See sections on each of below for how to set up the event action

- TCC0, TCC1, TCD0, TCD1, TCE0, TCE1, TCF0, TCF1
 - See Fig 14-3
 - See Section 14.12.1 CTRLA – Control register A
 - See Section 14.12.4 CTRLD – Control register D
- ADCA, ADCB
 - See Section 28.16.4 EVCTRL – Event Control register
- DACA, DACB
 - See Section 29.10.4 EVCTRL – Event Control register

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See doc8331:
Sec 13.7

Port Event


- Port pins can generate an event when there is a change on the pin
- The sense configurations decide the conditions for each pin to generate events
- Event generation requires the presence of a peripheral clock, and asynchronous event generation is not possible
- For edge sensing, the changed pin value must be sampled once by the peripheral clock for an event to be generated
- For level sensing, a low-level pin value will not generate events, and a high-level pin value will continuously generate events
- For events to be generated on a low level, the pin configuration must be set to inverted I/O

Sense settings	Signal Event	Data Event
Rising Edge	Rising Edge	Pin value
Falling edge	Falling Edge	Pin value
Both edges	Any edge	Pin value
Low level	Pin Value	Pin value

doc8331:
Table 13-4

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Manual Event Generation (by software) [not used in our course]

- Software can generate events, i.e., **manual** event generation
- Generated events are injected directly in the event channels
- The event channel does not need to have an event source associated with it to use the manual event generation
- If an event source is associated with the event channel, the manually generated event has priority and will override the peripheral event
- Event generation is trigger by a write to the **STOBE** register
- For **signaling** events, only the STROBE is needed
 - > Ex: If write a 0x05 (0000 0101) to the STROBE register, it will simultaneously signal events on channels 2 and 0
- For **data** events, both STROBE and DATA are needed and STROBE must be written after DATA [not used in our course]

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More on XMEGA Event System


See doc8071 (Event System)

- See the XMEGA Event Systems data sheet, [doc8071](#)
 - > For examples, see section 4 (§ 4)
 - Ex in § 4.2: Configure a sweep of the four channels of ADCA on an overflow of TCC0, using event channel 0
 - Configure TCC0 with the desired frequency and period
 - Select the TCC0 overflow event as an event source for event channel 0
 - Configure ADCA for a four-channel sweep
 - Configure ADCA to start sweep on event, using event channel 0

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The End!

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