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1394 OpenHCI DMA Overview

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Agenda

- Terminology
- Packet Descriptors
- Common Registers
- Other DMA

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Terminology

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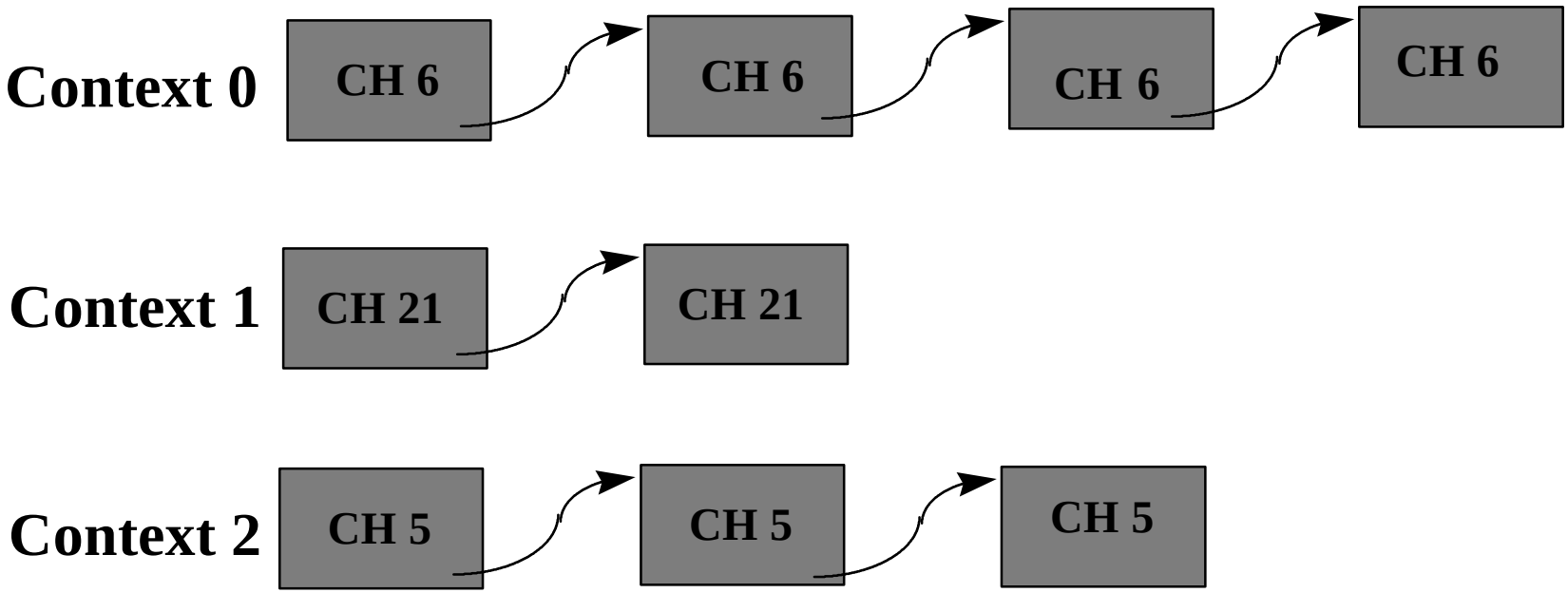
Terminology

- quadlet - 32-bit word (four bytes)
- Numbers use Verilog notation
  - (number of bits)'(base)(digits)
  - 10'h3FF = 10'b11_1111_1111 = 1023

Terminology cont.

- **DMA Controller - mechanism used in support of a specific DMA function.**
- **DMA Context - a distinct logical data stream.**
- **DMA Descriptor - a data structure used to describe buffers and buffer list control.**
- **DMA Context Program - a list of DMA descriptors**

Example: Isochronous Transmit



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DMA Functions

- Asynchronous Transmit (AT)
- Asynchronous Receive (AR)
- Isochronous Transmit (IT)
- Isochronous Receive (IR)
- Self-ID
- Physical

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Common DMA Mechanism

- Used by 4 DMA functions
  - Asynchronous Transmit (AT)
  - Asynchronous Receive (AR)
  - Isochronous Transmit (IT)
  - Isochronous Receive (IR)

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Packet Descriptors

Transmit Packet Descriptors

Packet Header **Packet Data**

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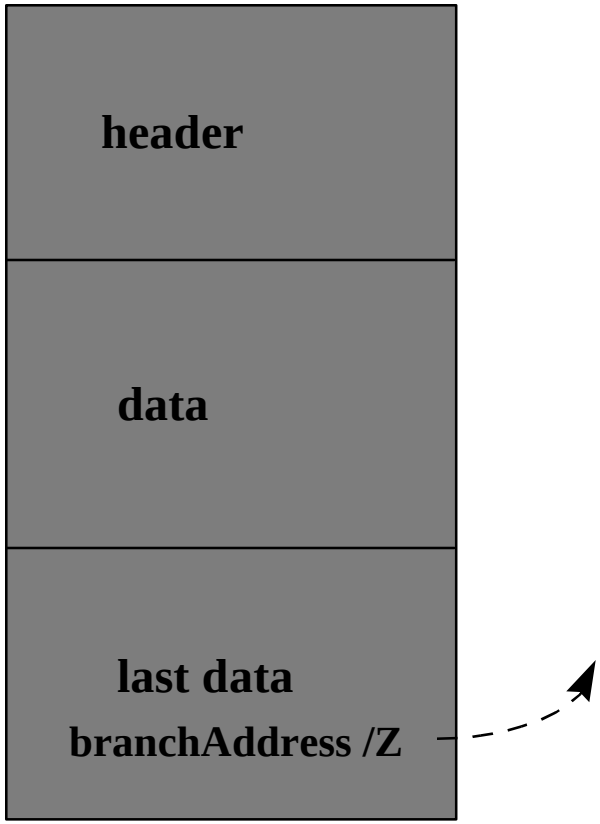
Descriptor Block



- **Must be <u>contiguous</u> in host memory.**

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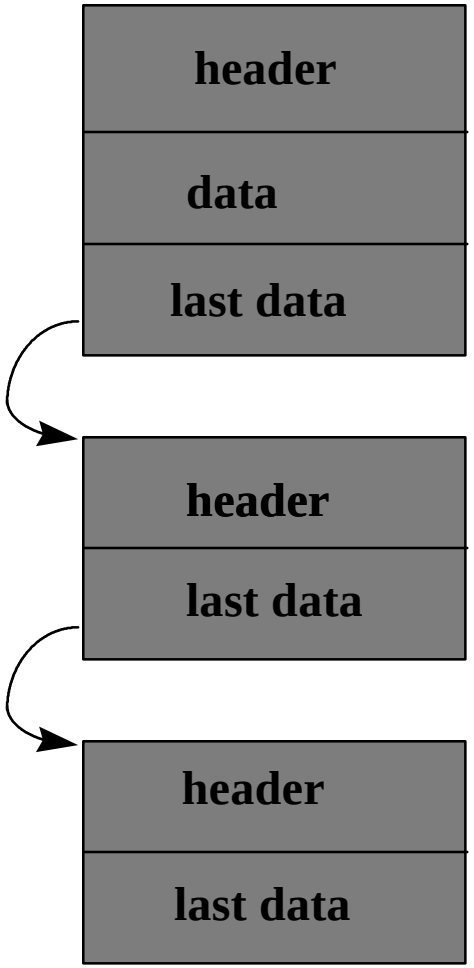
Context Program



- **A list of Descriptor Blocks.**

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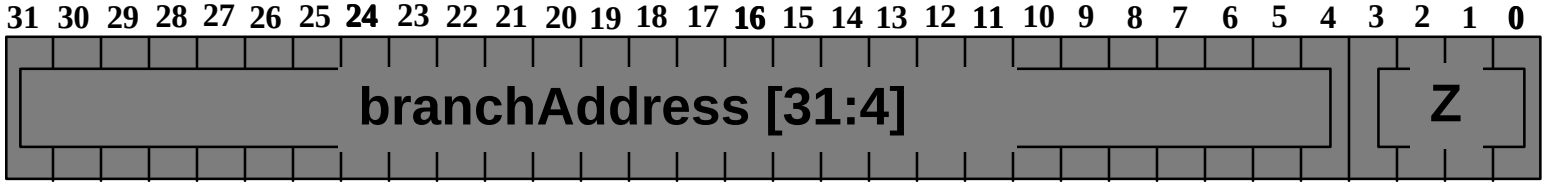
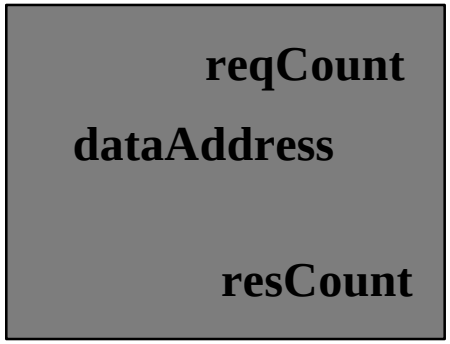
"Z"

- **The last descriptor in a descriptor block points to the next descriptor block.**
- **It also includes the Z value**
  - **The number of contiguous 16-byte descriptor components in the next descriptor block.**
  - **Used for prefetch.**



Receive Descriptors

- **Used to specify a receive buffer**



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Two Receive Modes

- **Packet-per-Buffer (IR only)**
- **Buffer Fill (AR & IR)**

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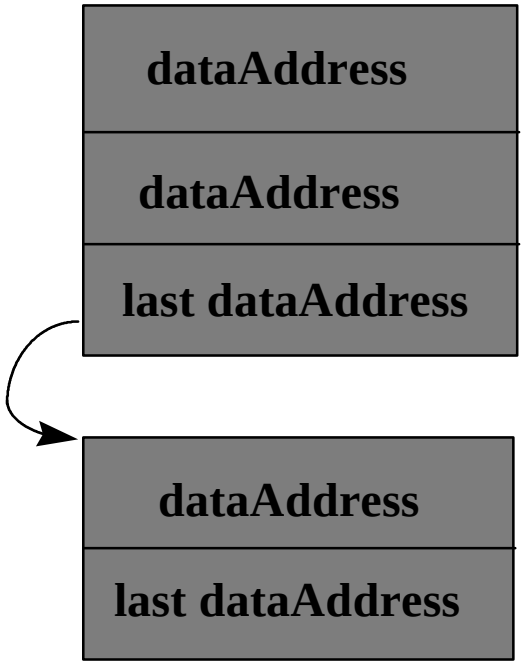
Packet-per-Buffer



- Each descriptor block receives one packet.
- At end of packet IR controller goes to next descriptor block.

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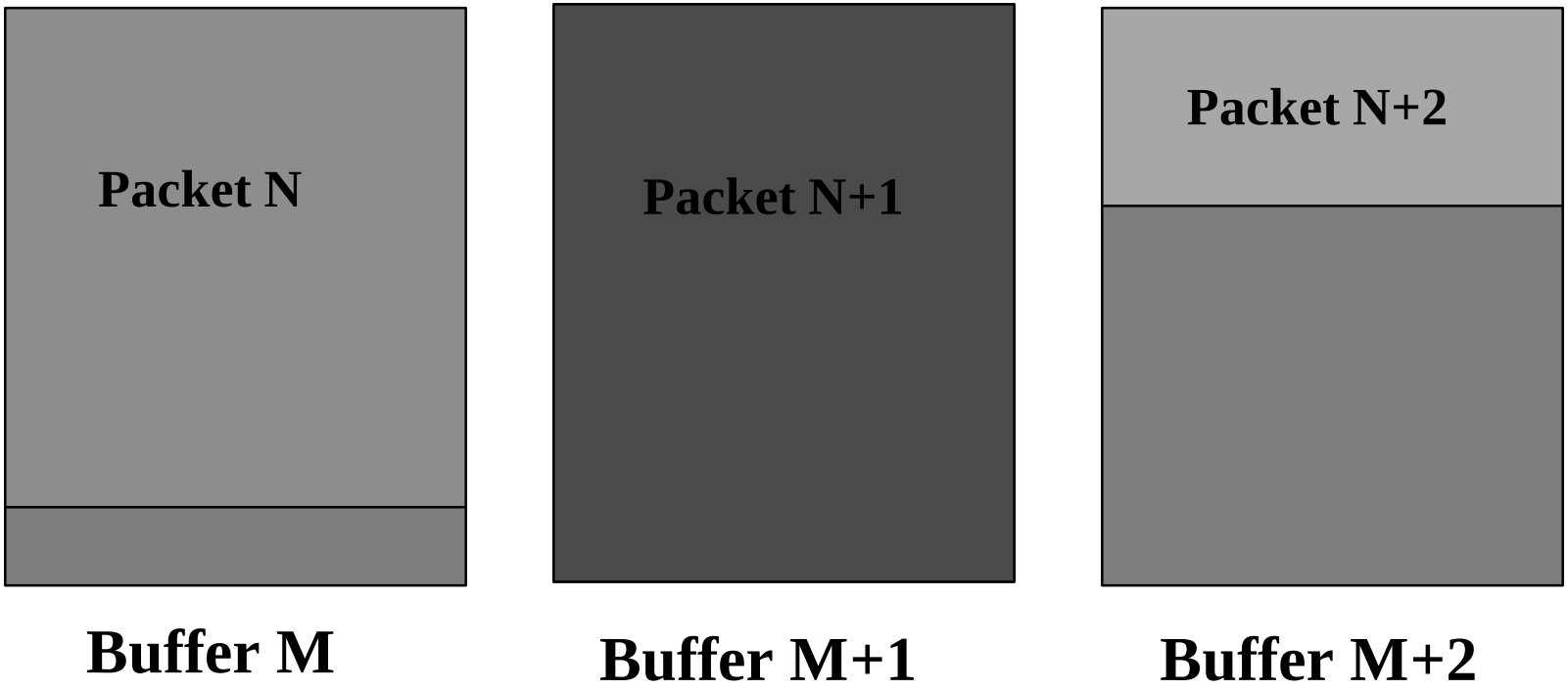
Packet Per Buffer cont.



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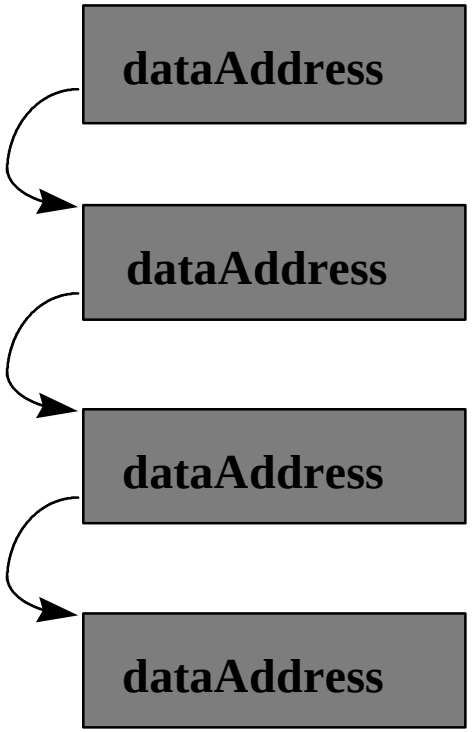
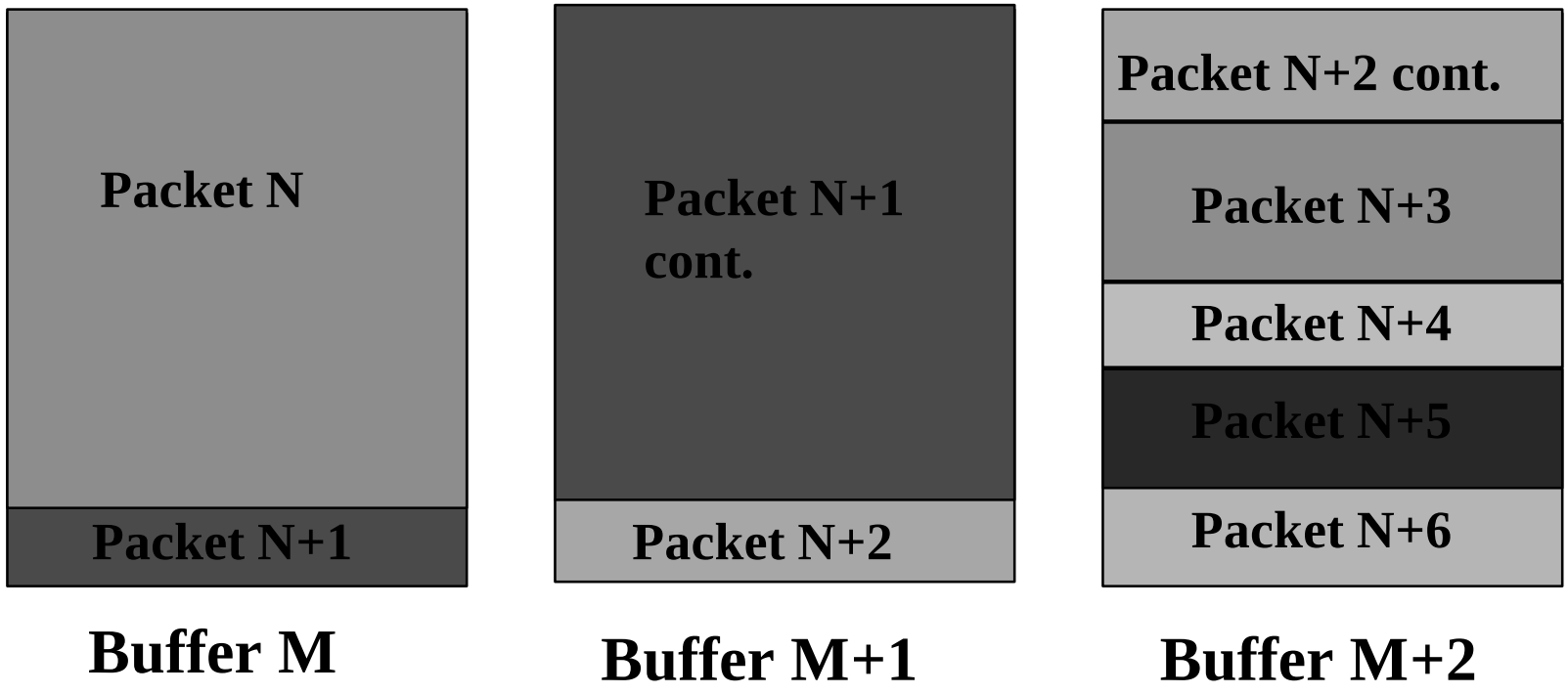
Buffer Fill



- Each descriptor block
  - consists of one command descriptor
  - specifies one buffer
- Each buffer is filled before advancing to the next descriptor block.

Buffer Fill cont.

- Each buffer may receive multiple packets



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Common Context Registers

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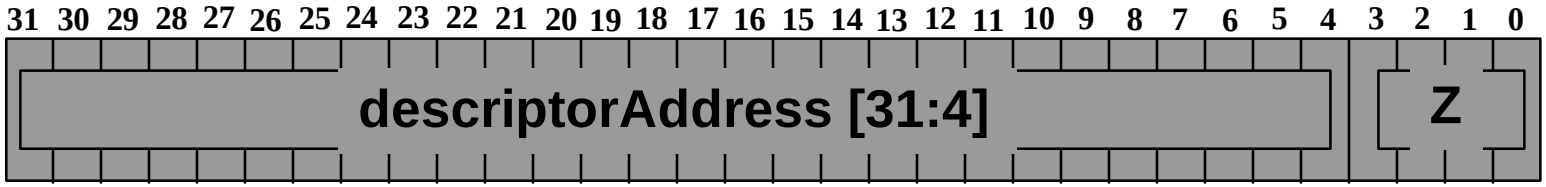
Common Context Registers

- CommandPtr
- ContextControl

CommandPtr

- Points to first descriptor block



- descriptorAddress - address of 16-byte aligned descriptor block.
- Z - number of contiguous 16-byte descriptor components (for prefetch)

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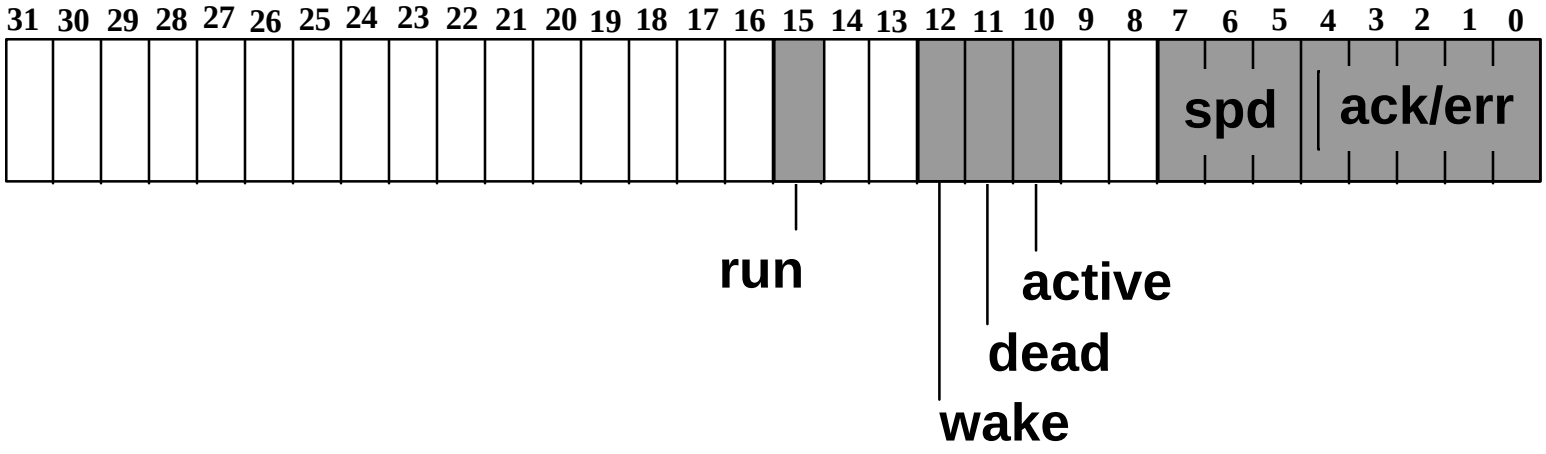
ContextControl

- Register used to control the running of the context.
- Different for each controller, but all share some common elements.



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ContextControl bit definitions

- run - used to enable processing for the context.
- wake - used to resume processing for the context.
- active - read only. HW indication that context descriptors are being processed.
- dead - fatal context error. Does not affect any other context.

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ContextControl field definitions

- spd - 1394 transmission speed
- ack/error code - packet transfer status

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ContextControl ack/error codes

- ack_complete
- ack_pending
- ack_busy_X
- ack_busy_A
- ack_busy_B
- evt_tcode_err
- evt_short_packet
- evt_long_packet
- evt_missing_ack
- evt_underrun
- evt_overrun

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ContextControl ack/error codes cont.

- evt_descriptor_read
- evt_data_read
- evt_data_write
- evt_bus_reset
- evt_timeout
- evt_unknown
- evt_flushed

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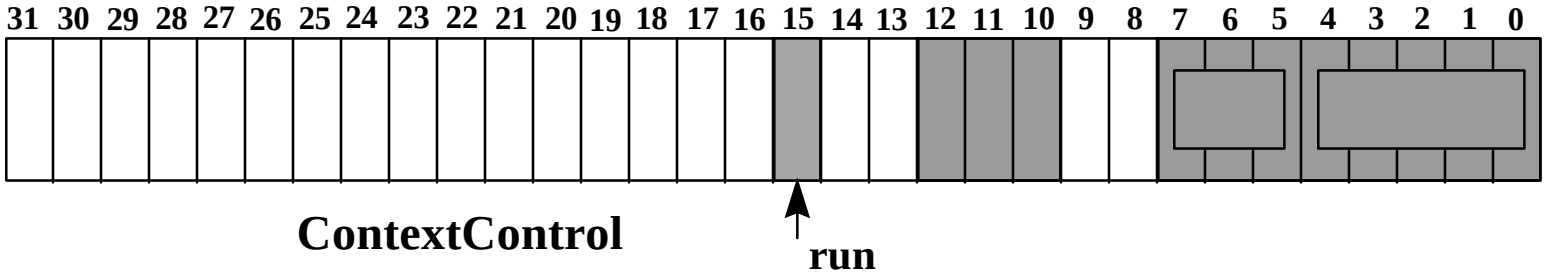
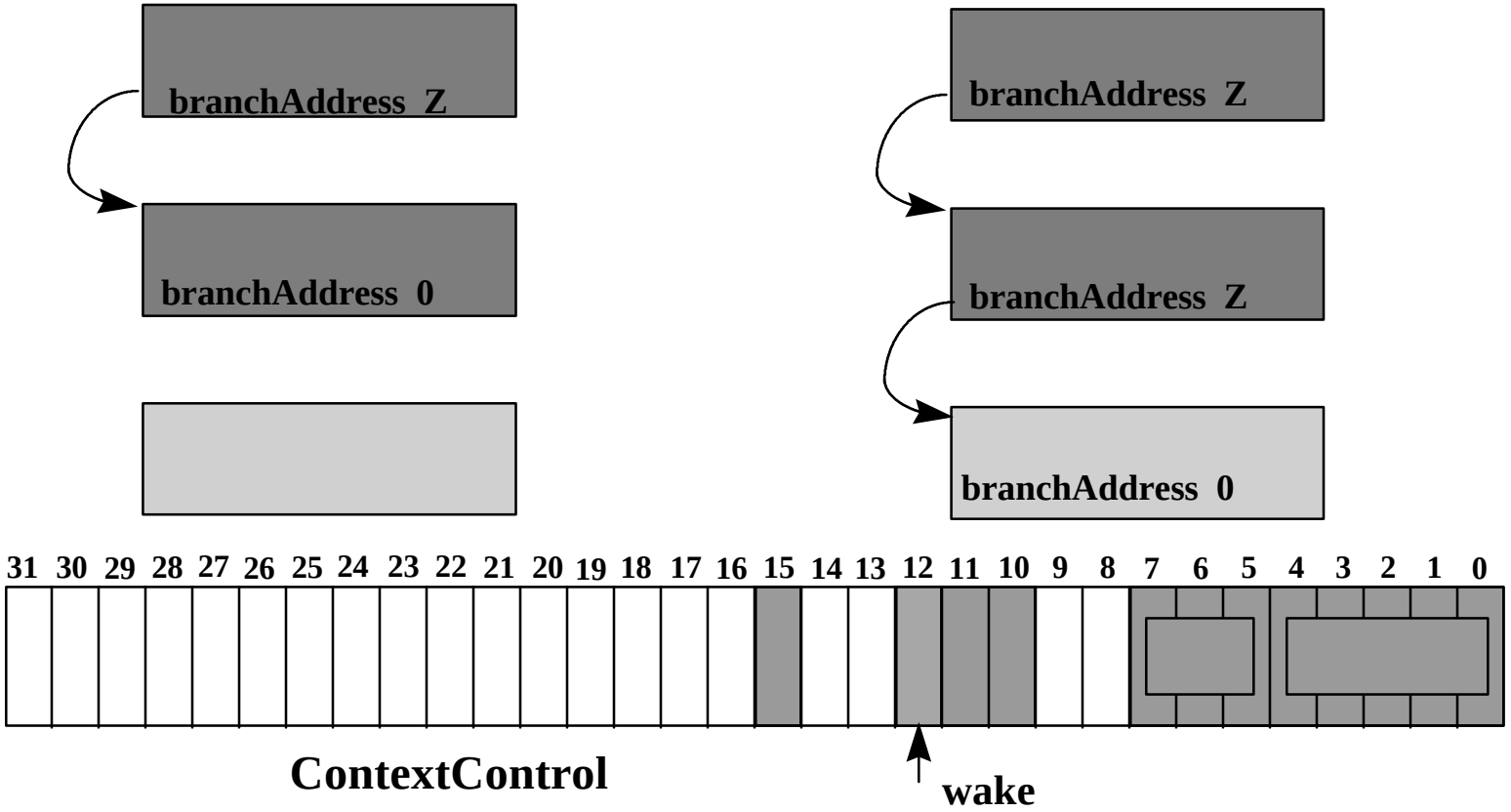
Starting a context

- initialize CommandPtr.*descriptorAddress* and CommandPtr.*Z*
- set ContextControl.*run* to enable the context
- must not be set if ContextControl.*active* is not 0

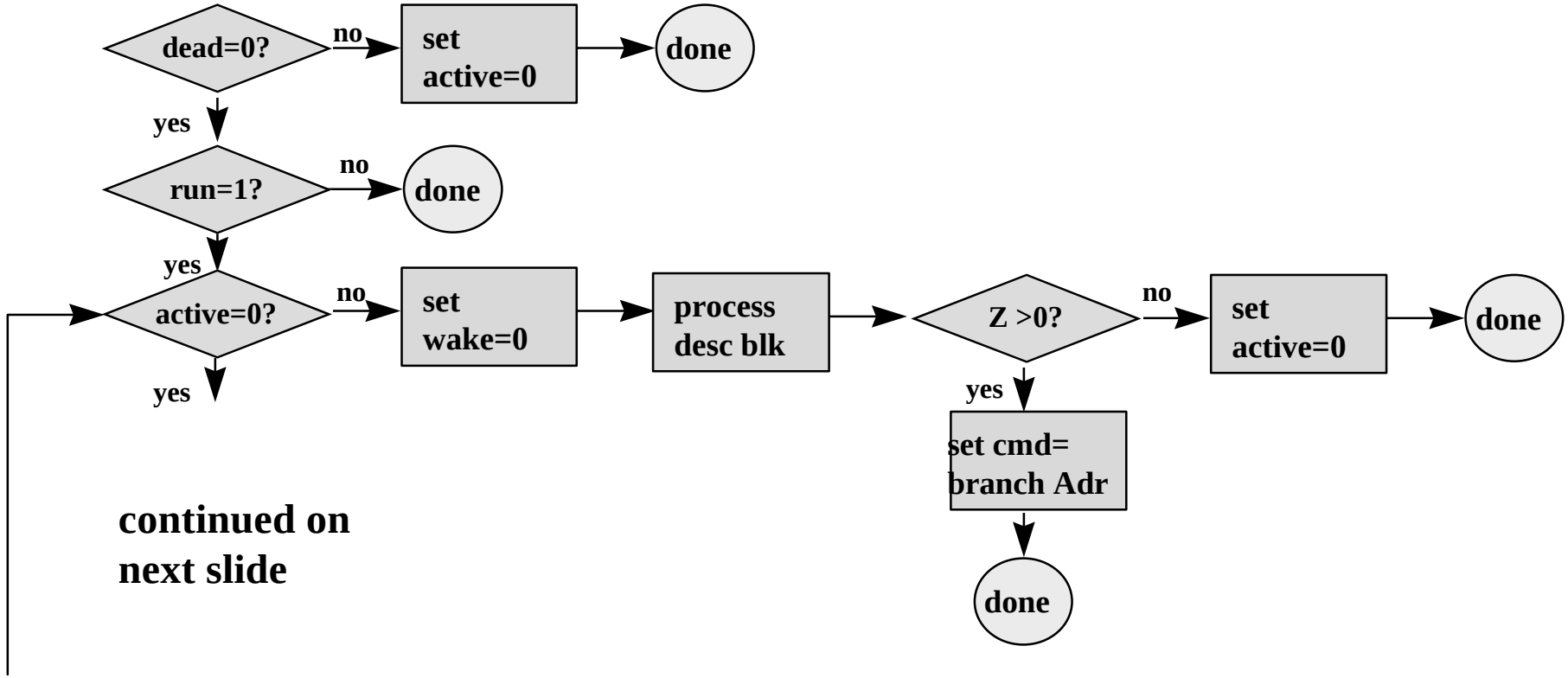


Appending to a Context Program - SW

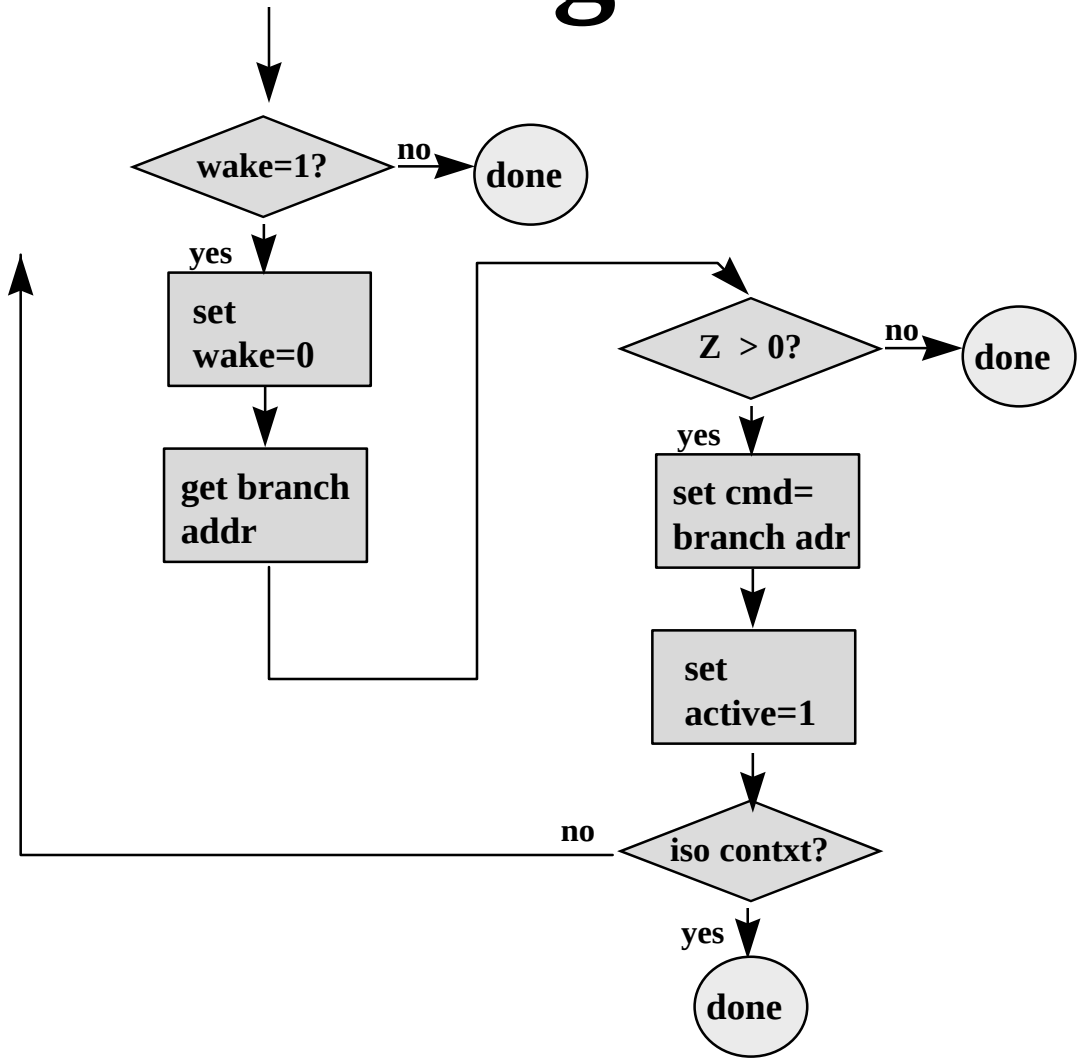
- Add descriptor block to end
- set ContextControl.*wake* bit



Appending to a Context Program - HW



Appending to a Context Program - HW cont.



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Stopping a context

- **Clear ContextControl.*run***
- **When ContextControl.*active* is 0, the context has stopped.**
- **Cannot necessarily reset ContextControl.*run* again without resetting CommandPtr.**

Reading CommandPtr

- **Must only be read when ContextControl.*active* is 0**
- **If read after context has run**
  - **CommandPtr.*descriptorAddress* points to the next descriptor to be processed.**
  - **or if the context is dead, it points to a descriptor in the descriptor block in which the unrecoverable_error occurred.**
- **If written then read before ContextControl.*run* is set, the read value is what was written.**

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Other DMA

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Self-ID

- Handles Self-ID packets that arrive during the self-ID phase of bus initialization.
- Context has two Self-ID specific registers
- Packets received in Buffer Fill mode

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Physical Requests

- Not Context/Descriptor driven.


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