USB Type-C ENGINEERING CHANGE NOTICE

Title: Clarification of USB4 Cable Speed for supported optional TBT3 Active Retimer Cables
Applied to: USB Type-C Specification Release 2.3, Oct 2023

Brief description of the functional changes proposed:
The USB Type-C spec optionally allows for Thunderbolt 3 active retimer cables designed late in the Thunderbolt 3 era to support USB4. These cables must support Rounded clock rate operation, and the USB Type-C spec defines how to identify such cables based on the Thunderbolt 3 DiscoverMode response for SVID 0x8087. An example of such a cable is described in F.2.2 and Tables F-5, F-6, and F-7. The optional flow requires that the DFP use EnterMode for Thunderbolt 3 to cable's SOP' and SOP", before using EnterUSB for USB4 to SOP. Make clear that for the speed of such active cables is to be determined from the Thunderbolt 3 DiscoverMode response, as that may override the USB 3.2 Gen 2 speed marked in the Active Cable VDO.

Benefits as a result of the proposed changes:
More clarity on what cable speed to regard Thunderbolt 3 active retimer cables for the purposes of filling out the EnterUSB message for DFPs that optionally implement support for such cables in USB4 mode.

An assessment of the impact to the existing revision and systems that currently conform to the USB specification:
Should be minimal. Affects only a subset of DFPs that support the optional cable, and just makes it clear what the logical CableSpeed would be if this cable is supported in USB4 mode.

An analysis of the hardware implications:
None.

An analysis of the software implications:
None.

An analysis of the compliance testing implications:
Not sure if compliance tests for function with this optional cable.

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Actual Change Requested

(1). Section 5.4.3.2.1 Discovering Passive Cables

To Text:

If the USB Signaling field [B2…0] in the Passive Cable VDO response is 010b (USB 3.2 Gen2) but the DFP is capable of USB4 Gen3 or higher operation, then the DFP shall use the USB PD Alternate Mode process to determine if the cable also can be identified as a TBT3 Gen3 cable. Refer to Section 5.4.3.2.3 for TBT3 cable discovery process. If the Cable Speed field of the Discover Modes VDO response is set to 011b, then the USB4 discovery process is complete and USB4 operation up to as high as ~~Gen3~~Gen4 is supported using the TBT3 passive cable (see Table F-11).

(b). Section 5.4.3.2.2 Discovering Active Cables

To Text:

The USB PD specification defines the Active Cable VDO responses to the Discover Identity Command sent by the DFP to a USB4-compatible active cable.

If the USB Signaling Support field [B2…0] in the Active Cable VDO 1 response is 011b (USB4 Gen3), the USB4 discovery process is complete and USB4 operation up to as high as Gen3 is supported. If the USB Signaling Support field [B2…0] in the Active Cable VDO 1 response is 100b (USB4 Gen4), the USB4 discovery process is complete and USB4 operation up to as high as Gen4 is supported.

Optionally, discovery and use of existing TBT3 active cables that indicate support for rounded data rate operation is allowed if the active cable isn't explicitly identified as USB4-compatible. If the USB Highest Speed field [B2…0] in the Active Cable VDO 1 response is 010b (USB 3.2 Gen2) but the DFP is capable of USB4 Gen3 or higher operation, then the DFP shall use the USB PD Alternate Mode process to determine if the cable also can be identified as a TBT3 active cable with rounded data rate operation support. Refer to Section 5.4.3.2.3 for TBT3 cable discovery process. If the TBT_Rounded_Support field of the Discover Modes VDO response is set to 01b, and the Cable Speed field of the Discover Modes VDO response is set to 011b, then the USB4 discovery process is complete and USB4 operation up to as high as Gen3 is supported using the TBT3 active re-timer cable (see Table F-11).

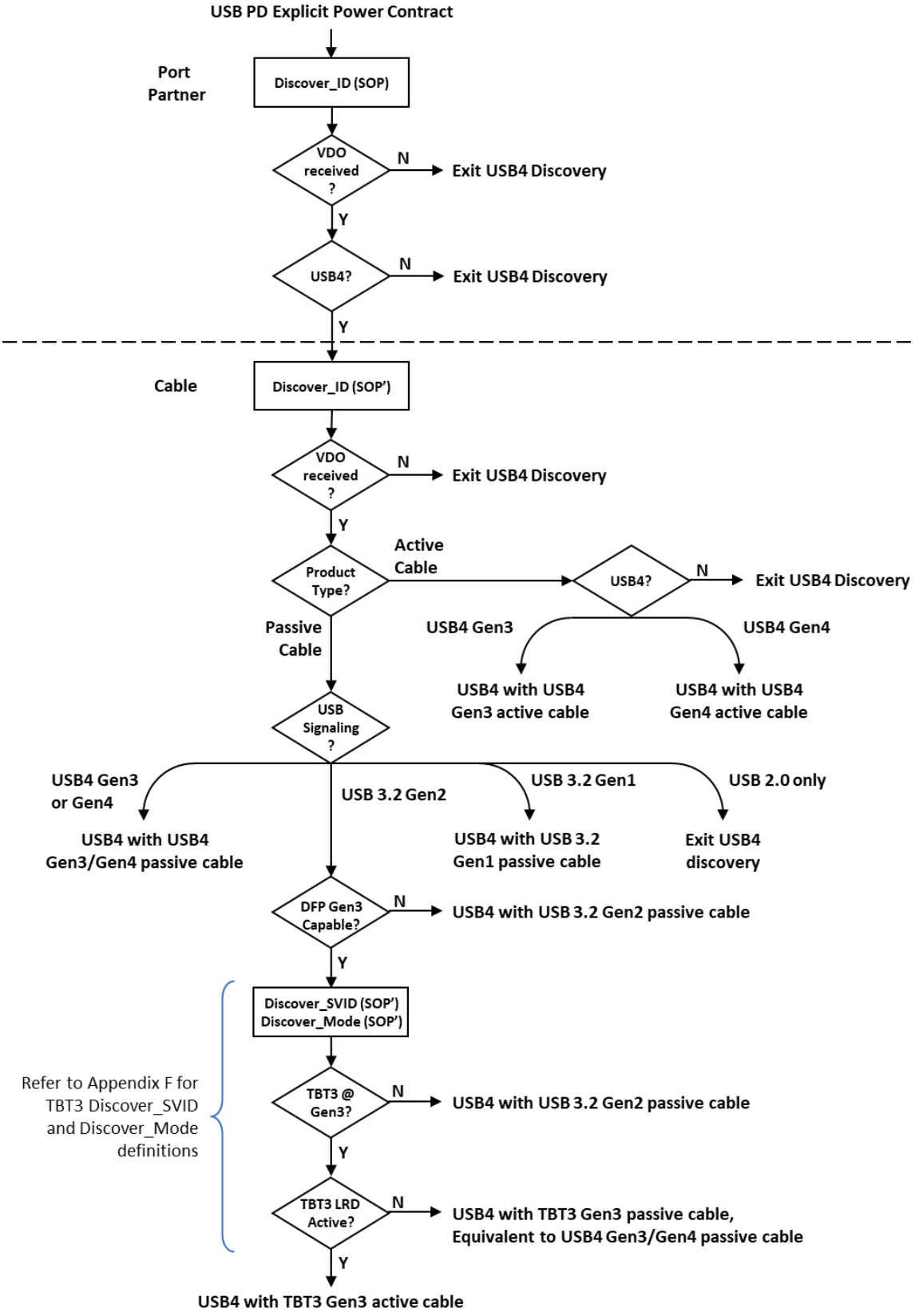
(c). Section 5.4.3.2.3 Process for Discovering Thunderbolt 3 Cables

To Text:

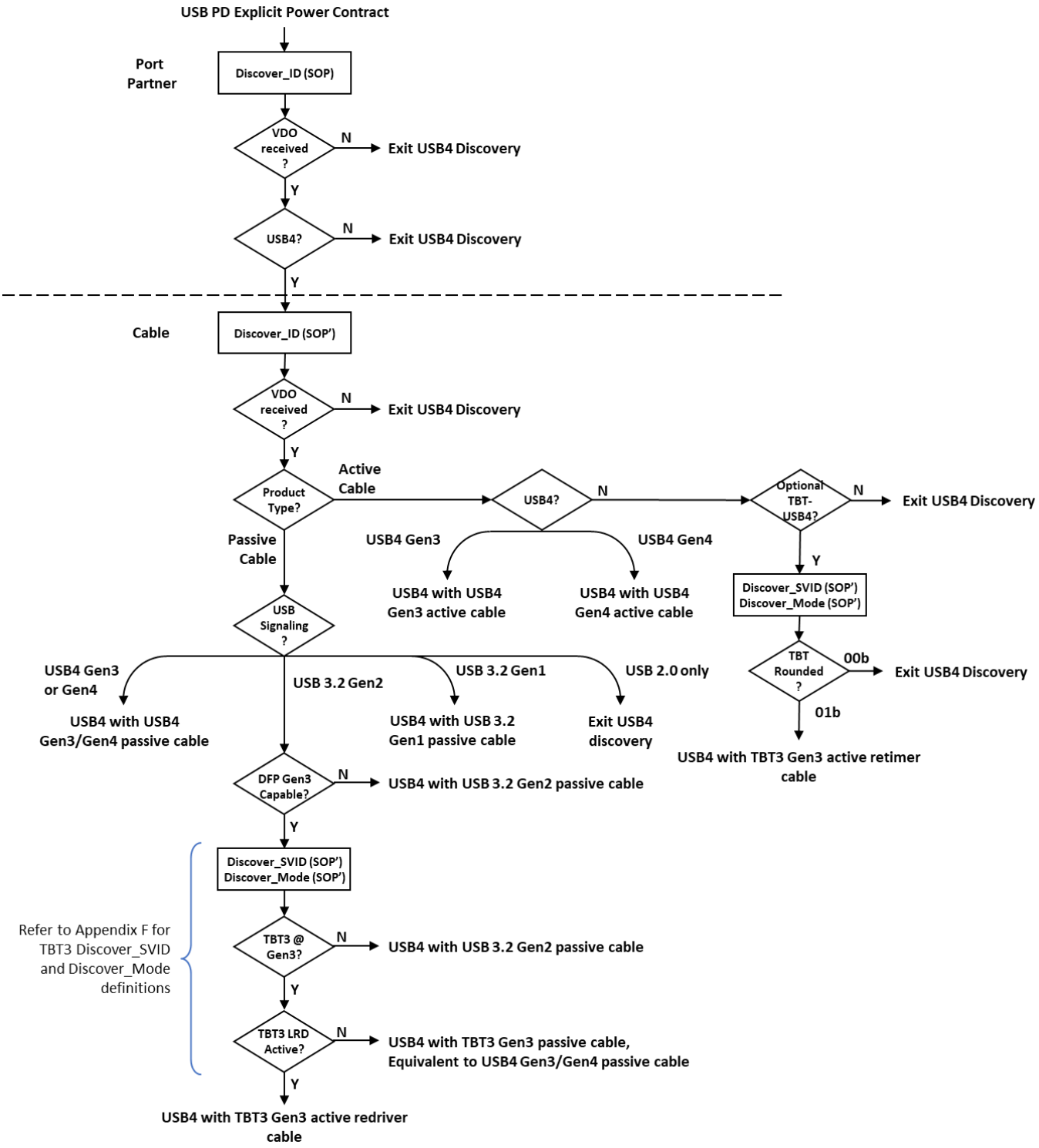
5. If this discovery is part of the USB4-compatible active cable discovery process, from the cable's Discover Modes VDO responses (see Section F.2.6), extract the value in the TBT_Rounded_Support Field and extract the value in the Cable Speed field to complete the process. [Note: discovery and use of USB4-compatible TBT3 active cables is an optional feature that also would require use of USB PD Enter Mode command to enable the cable for USB4 operation.].

(d). Figure 5-1 USB4 Discovery and Entry Flow Model

From:


USB PD Explicit Power Contract
Port Partner
Discover_ID (SOP)
VDO received ?
N
Exit USB4 Discovery
Y
USB4?
N
Exit USB4 Discovery
Y
Cable
Discover_ID (SOP')
VDO received ?
N
Exit USB4 Discovery
Y
Product Type?
Active Cable
USB4?
N
Exit USB4 Discovery
USB4 Gen3
USB4 Gen4
USB4 with USB4 Gen3 active cable
USB4 with USB4 Gen4 active cable
Passive Cable
USB Signaling ?
USB4 Gen3 or Gen4
USB4 with USB4 Gen3/Gen4 passive cable
USB 3.2 Gen2
USB 3.2 Gen1
USB4 with USB 3.2 Gen1 passive cable
USB 2.0 only
Exit USB4 discovery
DFP Gen3 Capable?
N
USB4 with USB 3.2 Gen2 passive cable
Y
Discover_SVID (SOP')
Discover_Mode (SOP')
Refer to Appendix F for TBT3 Discover_SVID and Discover_Mode definitions
TBT3 @ Gen3?
N
USB4 with USB 3.2 Gen2 passive cable
Y
TBT3 LRD Active?
N
USB4 with TBT3 Gen3 passive cable, Equivalent to USB4 Gen3/Gen4 passive cable
Y
USB4 with TBT3 Gen3 active cable

To:


USB PD Explicit Power Contract
Port Partner
Discover_ID (SOP)
VDO received ?
N
Exit USB4 Discovery
Y
USB4?
N
Exit USB4 Discovery
Y
Cable
Discover_ID (SOP')
VDO received ?
N
Exit USB4 Discovery
Y
Product Type?
Active Cable
USB4?
N
Optional TBT-USB4?
N
Exit USB4 Discovery
Y
Passive Cable
USB4 Gen3
USB4 Gen4
USB4 with USB4 Gen3 active cable
USB4 with USB4 Gen4 active cable
Discover_SVID (SOP') Discover_Mode (SOP')
USB Signaling ?
TBT Rounded ?
00b
Exit USB4 Discovery
01b
USB4 with TBT3 Gen3 active retimer cable
USB4 Gen3 or Gen4
USB 3.2 Gen2
USB 3.2 Gen1
USB 2.0 only
USB4 with USB4 Gen3/Gen4 passive cable
USB4 with USB 3.2 Gen1 passive cable
Exit USB4 discovery
DFP Gen3 Capable?
N
USB4 with USB 3.2 Gen2 passive cable
Y
Discover_SVID (SOP') Discover_Mode (SOP')
Refer to Appendix F for TBT3 Discover_SVID and Discover_Mode definitions
TBT3 @ Gen3?
N
USB4 with USB 3.2 Gen2 passive cable
Y
TBT3 LRD Active?
N
USB4 with TBT3 Gen3 passive cable, Equivalent to USB4 Gen3/Gen4 passive cable
Y
USB4 with TBT3 Gen3 active redriver cable