USB Type-C ENGINEERING CHANGE NOTICE

Title: Exit from Attached.SRC State
Applied to: USB Type-C Specification Release 1.2

Brief description of the functional changes proposed:

Currently, there is no text in the spec which explicitly states what the maximum allowed timing is for a source to detect the CC pin has been removed (SRC.Open) before it exits Attached.SRC and disables VBUS and VCONN. This can potentially cause a problem with certain source implementations which choose to de-bounce the CC pin. There is implicit text which states that a port which supports the Error Recovery state will enter this state after the monitored CC pin is in the Open state for a minimum of tErrorRecovery = 25ms. This effectively places an upper bound on the time duration which the source may de-bounce the CC pin. As such, the spec should clarify this maximum limit and also add text encouraging the source implementation to detect CC removal as quickly as possible.

Benefits as a result of the proposed changes:

Provides clarification where there previously was none. Provides guidance to implement CC removal detection as fast as possible while putting a maximum time limit, which will help manufactures pass compliance and also ensure that devices which support the Error Recovery state get the expected response from a source.

An assessment of the impact to the existing revision and systems that currently conform to the USB specification:

There may be some cases where existing sources implement a de-bounce when detecting CC is SRC.Open. If this was mistakenly implemented to be longer than 25ms, then these sources will fail compliance.

An analysis of the hardware implications:

No impact since CC already has de-bounce circuitry

An analysis of the software implications:

SW will now be able to reliably force the Error Recovery state on the sink side for >= 25ms and know that the source will detect CC Open

An analysis of the compliance testing implications:

To test this in compliance, we could force the CC pin into the open state for a max of 25ms and then re-connect Rd and ensure that the source disables VBUS and VCONN (if applicable)

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Actual Change Requested

(a). Section 4.5.2.2.8.2, Exiting from Attached.SRC State, Page 146

From Text:

A Source shall transition to Unattached.SRC when the SRC.Open state is detected on the monitored CC pin.

When the SRC.Open state is detected on the monitored CC pin, a DRP shall transition to Unattached.SNK unless it strongly prefers the Source role. In that case, it shall transition to TryWait.SNK. This transition to TryWait.SNK is needed so that two devices that both prefer the Source role do not loop endlessly between Source and Sink. In other words, a DRP that would enter Try.SRC from AttachWait.SNK shall enter TryWait.SNK for a Sink detach from Attached.SRC.

A port shall cease to supply VBUS within tVBUSOFF of exiting Attached.SRC.

A port that is supplying VCONN shall cease to supply it within tVCONNOFF of exiting Attached.SRC, unless it is exiting as a result of a *USB PD* PR_Swap.

After a *USB PD* PR_Swap is accepted (i.e., either an Accept message is received or acknowledged), a DRP shall transition directly to the Attached.SNK state (i.e., remove Rp from CC, assert Rd on CC and stop supplying VBUS) and maintain its current data role, connection and VCONN supply state.

To Text:

A Source shall transition to Unattached.SRC when the SRC.Open state is detected on the monitored CC pin. The Source shall detect the SRC.Open state within tSRCDisconnect, but should detect it as quickly as possible.

When the SRC.Open state is detected on the monitored CC pin, a DRP shall transition to Unattached.SNK unless it strongly prefers the Source role. In that case, it shall transition to TryWait.SNK. This transition to TryWait.SNK is needed so that two devices that both prefer the Source role do not loop endlessly between Source and Sink. In other words, a DRP that would enter Try.SRC from AttachWait.SNK shall enter TryWait.SNK for a Sink detach from Attached.SRC.

A port shall cease to supply VBUS within tVBUSOFF of exiting Attached.SRC.

A port that is supplying VCONN shall cease to supply it within tVCONNOFF of exiting Attached.SRC, unless it is exiting as a result of a *USB PD* PR_Swap.

After a *USB PD* PR_Swap is accepted (i.e., either an Accept message is received or acknowledged), a DRP shall transition directly to the Attached.SNK state (i.e., remove Rp

from CC, assert Rd on CC and stop supplying VBUS) and maintain its current data role, connection and VCONN supply state.

Actual Change Requested

(b). Section 4.5.2.2.7.2, Exiting from AttachWait.SRC State, Page 144

From Text:

The port shall transition to Attached.SRC when VBUS is at vSafe0V and the SRC.Rd state is detected on exactly one of the CC1 or CC2 pins for at least tCCDebounce.
If the port supports Audio Adapter Accessory Mode, it shall transition to AudioAccessory when the SRC.Ra state is detected on both the CC1 and CC2 pins for at least tCCDebounce.

If the port supports Debug Accessory Mode, it shall transition to UnorientedDebugAccessory.SRC when the SRC.Rd state is detected on both the CC1 and CC2 pins for at least tCCDebounce.

A Source shall transition to Unattached.SRC and a DRP to Unattached.SNK when the SRC.Open state is detected on both the CC1 and CC2 pins.

A Source shall transition to Unattached.SRC and a DRP to Unattached.SNK when the SRC.Open state is detected on either the CC1 or CC2 pin and the other CC pin is SRC.Ra.

A DRP that strongly prefers the Sink role may optionally transition to Try.SNK instead of Attached.SRC when VBUS is at vSafe0V and the SRC.Rd state is detected on exactly one of the CC1 or CC2 pins for at least tCCDebounce.

To Text:

The port shall transition to Attached.SRC when VBUS is at vSafe0V and the SRC.Rd state is detected on exactly one of the CC1 or CC2 pins for at least tCCDebounce.
If the port supports Audio Adapter Accessory Mode, it shall transition to AudioAccessory when the SRC.Ra state is detected on both the CC1 and CC2 pins for at least tCCDebounce.

If the port supports Debug Accessory Mode, it shall transition to UnorientedDebugAccessory.SRC when the SRC.Rd state is detected on both the CC1 and CC2 pins for at least tCCDebounce.

A Source shall transition to Unattached.SRC and a DRP to Unattached.SNK when the SRC.Open state is detected on both the CC1 and CC2 pins. The Source shall detect the SRC.Open state within tSRCDisconnect, but should detect it as quickly as possible.

A Source shall transition to Unattached.SRC and a DRP to Unattached.SNK when the SRC.Open state is detected on either the CC1 or CC2 pin and the other CC pin is

SRC.Ra. The Source shall detect the SRC.Open state within tSRCDisconnect, but should detect it as quickly as possible.

A DRP that strongly prefers the Sink role may optionally transition to Try.SNK instead of Attached.SRC when VBUS is at vSafe0V and the SRC.Rd state is detected on exactly one of the CC1 or CC2 pins for at least tCCDebounce.

Actual Change Requested

(c). Section 4.5.2.2.1, Disabled State, Page 140

From Text:

This state appears in Figure 4-12, Figure 4-13, Figure 4-14, Figure 4-15, Figure 4-16 and Figure 4-17.

The Disabled state is where the port prevents connection from occurring by removing all terminations from the CC pins.

The port should transition to the Disabled state from any other state when directed.

A port may choose not to support the Disabled state. If the Disabled state is not supported, the port shall be directed to either the Unattached.SNK or Unattached.SRC states after power-on.

To Text:

This state appears in Figure 4-12, Figure 4-13, Figure 4-14, Figure 4-15, Figure 4-16 and Figure 4-17.

The Disabled state is where the port prevents connection from occurring by removing all terminations from the CC pins.

The port should transition to the Disabled state from any other state when directed. When the port transitions to the Disabled state from Attached.SNK, it shall keep all terminations on the CC pins removed for a minimum of tErrorRecovery.

A port may choose not to support the Disabled state. If the Disabled state is not supported, the port shall be directed to either the Unattached.SNK or Unattached.SRC states after power-on.

(d). Section 4.11.2, Timing Parameters, Table 4-22, Page 181

From Text:

Table 4-22 CC Timing

	Minimum	Maximum	Description
tCCDebounce	100 ms	200 ms	Time a port shall wait before it can determine it is attached
tPDDebounce	10 ms	20 ms	Time a port shall wait before it can determine

			it is either detached or there has been a change in USB Type-C current due to the potential for *USB PD* BMC signaling on CC as described in the state definitions. The exit condition for the Attached.SRC state may not apply this timer.
tErrorRecovery	25 ms		Time a self-powered port shall remain in the ErrorRecovery state.

To Text:

Table 4-22 CC Timing

	Minimum	**Maximum**	**Description**
tCCDebounce	100 ms	200 ms	Time a port shall wait before it can determine it is attached
tPDDebounce	10 ms	20 ms	Time a port shall wait before it can determine it is either detached or there has been a change in USB Type-C current due to the potential for *USB PD* BMC signaling on CC as described in the state definitions. ~~The exit condition for the Attached.SRC state may not apply this timer.~~
tErrorRecovery	25 ms		Time a self-powered port shall remain in the ErrorRecovery state.
tSRCDisconnect	0ms	20 ms	Time a Source shall detect the SRC.open state. The source should detect the SRC.open state as quickly as practical.