



## STM32MP15 clock tree



# STM32MP15 clock tree

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All the peripherals receive one or several clocks that are generated via [RCC internal peripheral](#). RCC relies on several clocks sources (LSI, LSE, HSI, HSE, CSI) and four PLL in order to provide adequate input frequencies to all the peripherals. The clock tree covers all the system clock distribution aspects, from the clock sources to the consumer peripherals (internal and external), except clock gating management that is locally controlled by each peripheral driver.

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## 1 Overview

The clock tree is managed via [RCC internal peripheral](#) hardware block and it is configured at different steps from the Cortex-A7:

- When the device is **reset**, all RCC registers take their reset values: the four PLL are disabled and most of the clock source selectors are pointing to the HSI.
- The ROM Code configures the minimum clock tree needed to boot on the selected boot device.
- The **FSBL** (Cf. [Boot chains overview](#)) completely configures the clock tree as expected, all the way up to Linux, thanks to the configuration given in the [device tree](#).
  - U-Boot SPL (basic boot chain) binding is available in `doc/device-tree-bindings/clock/st,stm32mp1.txt`
  - TF-A (trusted boot chain) binding follows the same syntax as U-Boot SPL



- **Linux** is responsible for the clock tree at runtime and it may partly modify it thanks to information taken from the device tree:
  - Linux binding is available in [Documentation/devicetree/bindings/clock/clock-bindings.txt](#) (and surrounding files): 'fixed-clock' compatible, 'clocks' and 'assigned-clocks' properties are important concepts to understand the management of clocks providers/consumers.

Notice that [STM32Cube](#) (running on the Cortex-M4) does not control the clock tree setup so the configuration applied by the Cortex-A7 must provide suitable clocks to Cortex-M4, like it is explained in [resource manager](#) description. One exception to this rule is the [engineering boot](#), allowing to directly load (and debug) the Cortex-M4 whereas the Cortex-A7 execution is stalled in the ROM code.

## 2 How to build a clock tree?

Building a clock tree is quite complex as it needs to take into account the constraints set by each internal and external peripheral, including external clock sources.

We encourage the use of [STM32CubeMX](#) to build the clock tree, and avoid having to know all internal peripherals details: the tool allows to select the peripherals that will be present on the board, fix the clock sources frequencies and automatically find an optimized clock tree. It is then able to generate the device tree that is directly consumed by the boot chain and Linux.

## 3 ST boards clock tree

### 3.1 For ecosystem release v1.1.0 <sup>▲</sup>

#### 3.1.1 STM32MP157C-EV1 case

This chapter shows the boot time clock tree set by the FSBL on [STM32MP157C-EV1](#) evaluation board. Linux eventual runtime modifications are not covered here.

##### 3.1.1.1 Clock tree

The following table shows what [STM32MP157C-EV1](#) clock tree looks like, as a result of the [boot chain](#) execution with the device tree built with [STM32CubeMX](#).

Component Comment	Parent	Frequency	Used?	
LSI	N.A.	0.032000 MHz	yes	Mandatory for IWDG, DAC
DAC	LSI	0.032000 MHz	yes	
RNG1 be as low as possible	LSI	0.032000 MHz	yes	Input frequency should
RNG2 be as low as possible	LSI	0.032000 MHz	yes	Input frequency should
IWDG1	LSI	0.032000 MHz	yes	



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IWDG2	LSI	0.032000	MHz	yes	
LSE	N.A.	0.032768	MHz	yes	Mandatory for DTS
RTC	LSE	0.032768	MHz	yes	
TAMP	LSE	0.032768	MHz	yes	
CEC	LSE	0.032768	MHz	yes	
LPTIM4	LSE	0.032768	MHz	yes	
LPTIM5	LSE	0.032768	MHz	yes	
HSI	N.A.	64.000000	MHz	yes	
SPI4	HSI	64.000000	MHz	no	
SPI5	HSI	64.000000	MHz	no	
SPI6	HSI	64.000000	MHz	yes	
I2C4	HSI	64.000000	MHz	yes	PMIC
I2C6	HSI	64.000000	MHz	no	
I2C1	HSI	64.000000	MHz	no	
I2C2	HSI	64.000000	MHz	yes	Rpi and peripherals
I2C3	HSI	64.000000	MHz	no	
I2C5	HSI	64.000000	MHz	yes	Rpi
USART1	HSI	64.000000	MHz	yes	
USART2	HSI	64.000000	MHz	no	
USART3	HSI	64.000000	MHz	yes	Rpi
UART4	HSI	64.000000	MHz	yes	Linux console
UART5	HSI	64.000000	MHz	no	
USART6	HSI	64.000000	MHz	no	
UART7	HSI	64.000000	MHz	no	
UART8	HSI	64.000000	MHz	no	
MC01	HSI	64.000000	MHz	no	Available so can be used
HSE	N.A.	24.000000	MHz	yes	
DSIPLL	HSE	125.000000	MHz	no	DSI DPHY PLL
DSIBL	DSIPLL	125.000000	MHz	no	DSI lanebyte clock
RTCDIV	HSE	1.000000	MHz	yes	Only used when RTC
source is HSE					
ck_per	HSE	24.000000	MHz	yes	
ADC	ck_per	24.000000	MHz	yes	Can use internal divider
to be < 40MHz					
PLL1	HSE	1300.000000	MHz	yes	
PLL1P	PLL1	650.000000	MHz	yes	
MPUDIV	PLL1P	325.000000	MHz	yes	
Cortex-A7	PLL1P	650.000000	MHz	yes	
MC02	Cortex-A7	650.000000	MHz	no	Available so can be used
PLL2	HSE	1066.000000	MHz	yes	
PLL2P	PLL2	266.500000	MHz	yes	
AXI	PLL2P	266.500000	MHz	yes	< 266MHz
FMC	AXI	266.500000	MHz	yes	NAND flash
QSPI	AXI	266.500000	MHz	yes	NOR flash
SYSRAM	AXI	266.500000	MHz	yes	
ROM	AXI	266.500000	MHz	yes	
AHB5	AXI	266.500000	MHz	yes	< 266MHz
CRYP1	AHB5	266.500000	MHz	yes	
HASH1	AHB5	266.500000	MHz	yes	
GPI0Z	AHB5	266.500000	MHz	yes	
BKPSRAM	AHB5	266.500000	MHz	yes	
AHB6	AXI	266.500000	MHz	yes	< 266MHz
CRC1	AHB6	266.500000	MHz	yes	
MDMA	AHB6	266.500000	MHz	yes	
USBH	AHB6	266.500000	MHz	yes	USB Host
APB4	AHB6	133.250000	MHz	yes	
APB5	AHB6	66.625000	MHz	yes	
BSEC	APB5	66.625000	MHz	yes	< 67MHz
ETZPC	APB5	66.625000	MHz	yes	
TZC	APB5	66.625000	MHz	yes	
DBGAPB	AXI	133.250000	MHz	yes	JTAG & Coresight
DBGMCU	DBGAPB	66.625000	MHz	yes	
STM	DBGAPB	66.625000	MHz	yes	
PLL2Q	PLL2	533.000000	MHz	yes	
GPU	PLL2Q	533.000000	MHz	yes	< 533MHz
PLL2R	PLL2	533.000000	MHz	yes	
DDR	PLL2R	533.000000	MHz	yes	< 533MHz



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PLL3	HSE	417.755859 MHz	yes	
PLL3P	PLL3P	208.877930 MHz	yes	
MLAHB	PLL3P	208.877930 MHz	yes	< 209MHz
Cortex-M4	MLAHB	208.877930 MHz	yes	
SRAM1	MLAHB	208.877930 MHz	yes	
SRAM2	MLAHB	208.877930 MHz	yes	
SRAM3	MLAHB	208.877930 MHz	yes	
RETRAM	MLAHB	208.877930 MHz	yes	
AHB1	MLAHB	208.877930 MHz	yes	< 209MHz
AHB2	MLAHB	208.877930 MHz	yes	< 209MHz
DMA1	AHB2	208.877930 MHz	yes	
DMA2	AHB2	208.877930 MHz	yes	
DMAMUX	AHB2	208.877930 MHz	yes	
APB1	MLAHB	104.438965 MHz	yes	
LPTIM1	APB1	104.438965 MHz	yes	
WWDG	APB1	104.438965 MHz	yes	
APB2	MLAHB	104.438965 MHz	yes	
TIM2	MLAHB	208.877930 MHz	yes	TIM Group 1
TIM3	MLAHB	208.877930 MHz	yes	TIM Group 1
TIM4	MLAHB	208.877930 MHz	yes	TIM Group 1
TIM5	MLAHB	208.877930 MHz	yes	TIM Group 1
TIM6	MLAHB	208.877930 MHz	yes	TIM Group 1
TIM7	MLAHB	208.877930 MHz	yes	TIM Group 1
TIM12	MLAHB	208.877930 MHz	yes	TIM Group 1
TIM13	MLAHB	208.877930 MHz	yes	TIM Group 1
TIM14	MLAHB	208.877930 MHz	yes	TIM Group 1
TIM1	MLAHB	208.877930 MHz	yes	TIM Group 2
TIM8	MLAHB	208.877930 MHz	yes	TIM Group 2
TIM15	MLAHB	208.877930 MHz	yes	TIM Group 2
TIM16	MLAHB	208.877930 MHz	yes	TIM Group 2
TIM17	MLAHB	208.877930 MHz	yes	TIM Group 2
APB3	MLAHB	104.438965 MHz	yes	
LPTIM2	APB3	104.438965 MHz	yes	
LPTIM3	APB3	104.438965 MHz	yes	
SYSCFG	APB3	104.438965 MHz	yes	
VREFBUF	APB3	104.438965 MHz	yes	
DTS	APB3	104.438965 MHz	yes	
HDP	APB3	104.438965 MHz	yes	
AHB3	MLAHB	208.877930 MHz	yes	< 209MHz
CRC2	AHB3	208.877930 MHz	yes	
CRYP2	AHB3	208.877930 MHz	yes	
HASH2	AHB3	208.877930 MHz	yes	
DCMI	AHB3	208.877930 MHz	yes	Camera
IPCC	AHB3	208.877930 MHz	yes	Mailbox
AHB4	MLAHB	208.877930 MHz	yes	< 209MHz
PWR	AHB4	208.877930 MHz	yes	
RCC	AHB4	208.877930 MHz	yes	
GPIOA-K	AHB4	208.877930 MHz	yes	
EXTI	AHB4	208.877930 MHz	yes	
PLL3Q	PLL3	24.573874 MHz	yes	
SPI1	PLL3Q	24.573874 MHz	no	
SPI2	PLL3Q	24.573874 MHz	no	
SPI3	PLL3Q	24.573874 MHz	no	
DFSDM	PLL3Q	24.573874 MHz	yes	Digital micro
SAI1	PLL3Q	24.573874 MHz	no	
SAI2	PLL3Q	24.573874 MHz	yes	AudCodec 48kHz (use
PLL3R for 44.1kHz)				
SAI3	PLL3Q	24.573874 MHz	no	
SAI4	PLL3Q	24.573874 MHz	yes	SPDIF TX 48kHz (use
PLL3R for 44.1kHz)				
PLL3R	PLL3	11.290699 MHz	yes	
PLL4	HSE	594.000000 MHz	yes	
PLL4P	PLL4	99.000000 MHz	yes	
SDMMC1	PLL4P	99.000000 MHz	yes	μSD card
SDMMC2	PLL4P	99.000000 MHz	yes	eMMC
SDMMC3	PLL4P	99.000000 MHz	yes	
SPDIF	PLL4P	99.000000 MHz	yes	SPDIF RX



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PLL4Q	PLL4	74.250000 MHz	yes		
LCD	PLL4Q	74.250000 MHz	yes		LTDC & DSI display pixel
clock					
PLL4R	PLL4	74.250000 MHz	yes		
FDCAN	PLL4R	74.250000 MHz	yes		Should be as high as
possible and < 100MHz					
STGEN	HSE	24.000000 MHz	yes		
USBPHYC	HSE	24.000000 MHz	yes		USB PHY Ctrl for USB
Host and OTG					
USBPLL	USBPHYC	48.000000 MHz	yes		
USB0	USBPLL	48.000000 MHz	yes		USB OTG
CSI	N.A.	4.000000 MHz	yes		Mandatory for IO
compensation					
ETH	N.A.	0.000000 MHz	no		ETH clocked by RGMII PHY
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### 3.1.1.2 Device tree

Here are the corresponding device tree `gcc_clk` sub node properties consumed by the first stage boot loader (FSBL) to configure the clock tree above:

```

st,clksrc = <
    CLK_MPU_PLL1P
    CLK_AXI_PLL2P
    CLK_MCU_PLL3P
    CLK_PLL12_HSE
    CLK_PLL3_HSE
    CLK_PLL4_HSE
    CLK_RTC_LSE
    CLK_MCO1_DISABLED
    CLK_MCO2_DISABLED
>;

st,clkdiv = <
    1 /*MPU*/
    0 /*AXI*/
    0 /*MCU*/
    1 /*APB1*/
    1 /*APB2*/
    1 /*APB3*/
    1 /*APB4*/
    2 /*APB5*/
    23 /*RTC*/
    0 /*MCO1*/
    0 /*MCO2*/
>;

st,pkcs = <
    CLK_CKPER_HSE
    CLK_FMC_ACLK
    CLK_QSPI_ACLK
    CLK_ETH_DISABLED
    CLK_SDMMC12_PLL4P
    CLK_DSI_DSIPLL
    CLK_STGEN_HSE
    CLK_USBPHY_HSE
    CLK_SPI2S1_PLL3Q
    CLK_SPI2S23_PLL3Q
    CLK_SPI45_HSI
    CLK_SPI6_HSI
    CLK_I2C46_HSI
    CLK_SDMMC3_PLL4P
    CLK_USB0_USBPHY

```



```

CLK_ADC_CKPER
CLK_CEC_LSE
CLK_I2C12_HSI
CLK_I2C35_HSI
CLK_UART1_HSI
CLK_UART24_HSI
CLK_UART35_HSI
CLK_UART6_HSI
CLK_UART78_HSI
CLK_SPDIF_PLL4P
CLK_FDCAN_PLL4R
CLK_SAI1_PLL3Q
CLK_SAI2_PLL3Q
CLK_SAI3_PLL3Q
CLK_SAI4_PLL3Q
CLK_RNG1_LSI
CLK_RNG2_LSI
CLK_LPTIM1_PCLK1
CLK_LPTIM23_PCLK3
CLK_LPTIM45_LSE

>;

/* VCO = 1300.0 MHz => P = 650 (CPU) */
pll1: st,pll@0 {
    cfg = < 2 80 0 0 0 PQR(1,0,0) >;
    frac = < 0x800 >;
    u-boot,dm-pre-reloc;
};

/* VCO = 1066.0 MHz => P = 266 (AXI), Q = 533 (GPU), R = 533 (DDR) */
pll2: st,pll@1 {
    cfg = < 2 65 1 0 0 PQR(1,1,1) >;
    frac = < 0x1400 >;
    u-boot,dm-pre-reloc;
};

/* VCO = 417.8 MHz => P = 209, Q = 25, R = 11 */
pll3: st,pll@2 {
    cfg = < 1 33 1 16 36 PQR(1,1,1) >;
    frac = < 0x1a04 >;
    u-boot,dm-pre-reloc;
};

/* VCO = 594.0 MHz => P = 99, Q = 74, R = 74 */
pll4: st,pll@3 {
    cfg = < 3 98 5 7 7 PQR(1,1,1) >;
    u-boot,dm-pre-reloc;
};

```

### 3.1.2 STM32MP157C-DK2 case

This chapter shows the boot time clock tree set by the FSBL on STM32MP157C-DK2 DISCO board. Linux eventual runtime modifications are not covered here.

#### 3.1.2.1 Clock tree

The following table shows what STM32MP157C-DK2 clock tree looks like, as a result of the boot chain execution with the device tree built with STM32CubeMX.

Component Comment	Parent	Frequency	Used?
LSI	N.A.	0.032000 MHz	yes   Mandatory for IWDG, DAC



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DAC	LSI	0.032000 MHz	no	
RNG1	LSI	0.032000 MHz	yes	Input frequency should
be as low as possible				
RNG2	LSI	0.032000 MHz	yes	Input frequency should
be as low as possible				
IWDG1	LSI	0.032000 MHz	yes	
IWDG2	LSI	0.032000 MHz	yes	
LSE	N.A.	0.032768 MHz	yes	Mandatory for DTS
RTC	LSE	0.032768 MHz	yes	
TAMP	LSE	0.032768 MHz	yes	
CEC	LSE	0.032768 MHz	yes	
LPTIM4	LSE	0.032768 MHz	yes	
LPTIM5	LSE	0.032768 MHz	yes	
HSI	N.A.	64.000000 MHz	yes	
SPI4	HSI	64.000000 MHz	yes	Arduino
SPI5	HSI	64.000000 MHz	yes	Rpi
SPI6	HSI	64.000000 MHz	no	
I2C4	HSI	64.000000 MHz	yes	PMIC
I2C6	HSI	64.000000 MHz	no	
I2C1	HSI	64.000000 MHz	yes	Rpi and peripherals
I2C2	HSI	64.000000 MHz	no	
I2C3	HSI	64.000000 MHz	no	
I2C5	HSI	64.000000 MHz	yes	Rpi and Arduino
USART1	HSI	64.000000 MHz	no	
USART2	HSI	64.000000 MHz	yes	Bluetooth
USART3	HSI	64.000000 MHz	yes	Rpi
UART4	HSI	64.000000 MHz	yes	Linux console
UART5	HSI	64.000000 MHz	no	
USART6	HSI	64.000000 MHz	no	
UART7	HSI	64.000000 MHz	yes	Arduino
UART8	HSI	64.000000 MHz	no	
MC01	HSI	64.000000 MHz	no	Available so can be used
HSE	N.A.	24.000000 MHz	yes	
DSIPLL	HSE	125.000000 MHz	no	DSI DPHY PLL
DSIBL	DSIPLL	125.000000 MHz	no	DSI lanebyte clock
RTCDIV	HSE	1.000000 MHz	yes	Only used when RTC
source is HSE				
ck_per	HSE	24.000000 MHz	yes	
ADC	ck_per	24.000000 MHz	yes	Can use internal divider
to be < 40MHz				
PLL1	HSE	1300.000000 MHz	yes	
PLL1P	PLL1	650.000000 MHz	yes	
MPUDIV	PLL1P	325.000000 MHz	yes	
Cortex-A7	PLL1P	650.000000 MHz	yes	
MC02	Cortex-A7	650.000000 MHz	no	Available so can be used
PLL2	HSE	1066.000000 MHz	yes	
PLL2P	PLL2	266.500000 MHz	yes	
AXI	PLL2P	266.500000 MHz	yes	< 266MHz
FMC	AXI	266.500000 MHz	no	
QSPI	AXI	266.500000 MHz	no	
SYSRAM	AXI	266.500000 MHz	yes	
ROM	AXI	266.500000 MHz	yes	
AHB5	AXI	266.500000 MHz	yes	< 266MHz
CRYP1	AHB5	266.500000 MHz	yes	
HASH1	AHB5	266.500000 MHz	yes	
GPI0Z	AHB5	266.500000 MHz	yes	
BKPSRAM	AHB5	266.500000 MHz	yes	
AHB6	AXI	266.500000 MHz	yes	< 266MHz
CRC1	AHB6	266.500000 MHz	yes	
MDMA	AHB6	266.500000 MHz	yes	
USBH	AHB6	266.500000 MHz	yes	USB Host
APB4	AHB6	133.250000 MHz	yes	
APB5	AHB6	66.625000 MHz	yes	
BSEC	APB5	66.625000 MHz	yes	< 67MHz
ETZPC	APB5	66.625000 MHz	yes	
TZC	APB5	66.625000 MHz	yes	
DBGAPB	AXI	133.250000 MHz	yes	JTAG & Coresight





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DBGMCU	DBGAPB	66.625000	MHz	yes	
STM	DBGAPB	66.625000	MHz	no	
PLL2Q	PLL2	533.000000	MHz	yes	
GPU	PLL2Q	533.000000	MHz	yes	< 533MHz
PLL2R	PLL2	533.000000	MHz	yes	
DDR	PLL2R	533.000000	MHz	yes	< 533MHz
PLL3	HSE	417.755859	MHz	yes	
PLL3P	PLL3	208.877930	MHz	yes	
MLAHB	PLL3P	208.877930	MHz	yes	< 209MHz
Cortex-M4	MLAHB	208.877930	MHz	yes	
SRAM1	MLAHB	208.877930	MHz	yes	
SRAM2	MLAHB	208.877930	MHz	yes	
SRAM3	MLAHB	208.877930	MHz	yes	
RETRAM	MLAHB	208.877930	MHz	yes	
AHB1	MLAHB	208.877930	MHz	yes	< 209MHz
AHB2	MLAHB	208.877930	MHz	yes	< 209MHz
DMA1	AHB2	208.877930	MHz	yes	
DMA2	AHB2	208.877930	MHz	yes	
DMAMUX	AHB2	208.877930	MHz	yes	
APB1	MLAHB	104.438965	MHz	yes	
LPTIM1	APB1	104.438965	MHz	yes	
WWDG	APB1	104.438965	MHz	yes	
APB2	MLAHB	104.438965	MHz	yes	
TIM2	MLAHB	208.877930	MHz	yes	TIM Group 1
TIM3	MLAHB	208.877930	MHz	yes	TIM Group 1
TIM4	MLAHB	208.877930	MHz	yes	TIM Group 1
TIM5	MLAHB	208.877930	MHz	yes	TIM Group 1
TIM6	MLAHB	208.877930	MHz	yes	TIM Group 1
TIM7	MLAHB	208.877930	MHz	yes	TIM Group 1
TIM12	MLAHB	208.877930	MHz	yes	TIM Group 1
TIM13	MLAHB	208.877930	MHz	yes	TIM Group 1
TIM14	MLAHB	208.877930	MHz	yes	TIM Group 1
TIM1	MLAHB	208.877930	MHz	yes	TIM Group 2
TIM8	MLAHB	208.877930	MHz	yes	TIM Group 2
TIM15	MLAHB	208.877930	MHz	yes	TIM Group 2
TIM16	MLAHB	208.877930	MHz	yes	TIM Group 2
TIM17	MLAHB	208.877930	MHz	yes	TIM Group 2
APB3	MLAHB	104.438965	MHz	yes	
LPTIM2	APB3	104.438965	MHz	yes	
LPTIM3	APB3	104.438965	MHz	yes	
SYSCFG	APB3	104.438965	MHz	yes	
VREFBUF	APB3	104.438965	MHz	yes	
DTS	APB3	104.438965	MHz	yes	
HDP	APB3	104.438965	MHz	no	
AHB3	MLAHB	208.877930	MHz	yes	< 209MHz
CRC2	AHB3	208.877930	MHz	yes	
CRYP2	AHB3	208.877930	MHz	yes	
HASH2	AHB3	208.877930	MHz	yes	
DCMI	AHB3	208.877930	MHz	no	
IPCC	AHB3	208.877930	MHz	yes	Mailbox
AHB4	MLAHB	208.877930	MHz	yes	< 209MHz
PWR	AHB4	208.877930	MHz	yes	
RCC	AHB4	208.877930	MHz	yes	
GPIOA-K	AHB4	208.877930	MHz	yes	
EXTI	AHB4	208.877930	MHz	yes	
PLL3Q	PLL3	24.573874	MHz	yes	
SPI1	PLL3Q	24.573874	MHz	yes	SPI2S1 for BT PCM
SPI2	PLL3Q	24.573874	MHz	yes	SPI2S2 for HDMI
SPI3	PLL3Q	24.573874	MHz	no	
DFSDM	PLL3Q	24.573874	MHz	no	
SAI1	PLL3Q	24.573874	MHz	no	
SAI2	PLL3Q	24.573874	MHz	yes	AudCodec 48kHz (use
PLL3R for 44.1kHz)					
SAI3	PLL3Q	24.573874	MHz	no	
SAI4	PLL3Q	24.573874	MHz	no	
PLL3R	PLL3	11.290699	MHz	yes	
PLL4	HSE	594.000000	MHz	yes	



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PLL4P	PLL4	99.000000 MHz	yes	
SDMMC1	PLL4P	99.000000 MHz	yes	μSD card
SDMMC2	PLL4P	99.000000 MHz	yes	Wifi
SDMMC3	PLL4P	99.000000 MHz	yes	Rpi
SPDIF	PLL4P	99.000000 MHz	no	
PLL4Q	PLL4	74.250000 MHz	yes	
LCD	PLL4Q	74.250000 MHz	yes	LTDC & DSI display pixel
clock				
PLL4R	PLL4	74.250000 MHz	yes	
FDCAN	PLL4R	74.250000 MHz	no	
STGEN	HSE	24.000000 MHz	yes	
USBPHYC	HSE	24.000000 MHz	yes	USB PHY Ctrl for USB
Host and OTG				
USBPLL	USBPHYC	48.000000 MHz	yes	
USB0	USBPLL	48.000000 MHz	yes	USB OTG
CSI	N.A.	4.000000 MHz	yes	Mandatory for IO
compensation				
ETH	N.A.	0.000000 MHz	no	ETH clocked by RGMII PHY
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-----				

### 3.1.2.2 Device tree

Here are the corresponding device tree `rcclk` sub node properties consumed by the first stage boot loader (FSBL) to configure the clock tree above:

```

st,clksrc = <
    CLK_MPU_PLL1P
    CLK_AXI_PLL2P
    CLK_MCU_PLL3P
    CLK_PLL12_HSE
    CLK_PLL3_HSE
    CLK_PLL4_HSE
    CLK_RTC_LSE
    CLK_MCO1_DISABLED
    CLK_MCO2_DISABLED
>;

st,clkdiv = <
    1 /*MPU*/
    0 /*AXI*/
    0 /*MCU*/
    1 /*APB1*/
    1 /*APB2*/
    1 /*APB3*/
    1 /*APB4*/
    2 /*APB5*/
    23 /*RTC*/
    0 /*MCO1*/
    0 /*MCO2*/
>;

st,pkcs = <
    CLK_CKPER_HSE
    CLK_FMC_ACLK
    CLK_QSPI_ACLK
    CLK_ETH_DISABLED
    CLK_SDMMC12_PLL4P
    CLK_DSI_DSIPLL
    CLK_STGEN_HSE
    CLK_USBPHY_HSE
    CLK_SPI2S1_PLL3Q
    CLK_SPI2S23_PLL3Q
    CLK_SPI45_HSI

```

```

    CLK_SPI6_HSI
    CLK_I2C46_HSI
    CLK_SDMMC3_PLL4P
    CLK_USB0_USBPHY
    CLK_ADC_CKPER
    CLK_CEC_LSE
    CLK_I2C12_HSI
    CLK_I2C35_HSI
    CLK_UART1_HSI
    CLK_UART24_HSI
    CLK_UART35_HSI
    CLK_UART6_HSI
    CLK_UART78_HSI
    CLK_SPDIF_PLL4P
    CLK_FDCAN_PLL4R
    CLK_SAI1_PLL3Q
    CLK_SAI2_PLL3Q
    CLK_SAI3_PLL3Q
    CLK_SAI4_PLL3Q
    CLK_RNG1_LSI
    CLK_RNG2_LSI
    CLK_LPTIM1_PCLK1
    CLK_LPTIM23_PCLK3
    CLK_LPTIM45_LSE
  >;

  /* VCO = 1300.0 MHz => P = 650 (CPU) */
  pll1: st,pll@0 {
    cfg = < 2 80 0 0 0 PQR(1,0,0) >;
    frac = < 0x800 >;
    u-boot,dm-pre-reloc;
  };

  /* VCO = 1066.0 MHz => P = 266 (AXI), Q = 533 (GPU), R = 533 (DDR) */
  pll2: st,pll@1 {
    cfg = < 2 65 1 0 0 PQR(1,1,1) >;
    frac = < 0x1400 >;
    u-boot,dm-pre-reloc;
  };

  /* VCO = 417.8 MHz => P = 209, Q = 25, R = 11 */
  pll3: st,pll@2 {
    cfg = < 1 33 1 16 36 PQR(1,1,1) >;
    frac = < 0x1a04 >;
    u-boot,dm-pre-reloc;
  };

  /* VCO = 594.0 MHz => P = 99, Q = 74, R = 74 */
  pll4: st,pll@3 {
    cfg = < 3 98 5 7 7 PQR(1,1,1) >;
    u-boot,dm-pre-reloc;
  };

```

## 3.2 For ecosystem release v1.0.0 <sup>▲</sup>

### 3.2.1 STM32MP157C-EV1 case

This chapter shows the boot time clock tree set by the FSBL on STM32MP157C-EV1 evaluation board. Linux eventual runtime modifications are not covered here.



3.2.1.1 Clock tree

The following table shows what STM32MP157C-EV1 clock tree looks like, as a result of the boot chain execution with the device tree built with STM32CubeMX.

Component Comment	Parent	Frequency	Used?	
LSI	N.A.	0.032000 MHz	yes	Mandatory for IWDG, DAC
DAC	LSI	0.032000 MHz	yes	
RNG1	LSI	0.032000 MHz	yes	Input frequency should
be as low as possible				
RNG2	LSI	0.032000 MHz	yes	Input frequency should
be as low as possible				
IWDG1	LSI	0.032000 MHz	yes	
IWDG2	LSI	0.032000 MHz	yes	
LSE	N.A.	0.032768 MHz	yes	Mandatory for DTS
RTC	LSE	0.032768 MHz	yes	
TAMP	LSE	0.032768 MHz	yes	
CEC	LSE	0.032768 MHz	yes	
LPTIM4	LSE	0.032768 MHz	yes	
LPTIM5	LSE	0.032768 MHz	yes	
HSI	N.A.	64.000000 MHz	yes	
SPI4	HSI	64.000000 MHz	no	
SPI5	HSI	64.000000 MHz	no	
SPI6	HSI	64.000000 MHz	yes	
I2C4	HSI	64.000000 MHz	yes	PMIC
I2C6	HSI	64.000000 MHz	no	
I2C1	HSI	64.000000 MHz	no	
I2C2	HSI	64.000000 MHz	yes	Rpi and peripherals
I2C3	HSI	64.000000 MHz	no	
I2C5	HSI	64.000000 MHz	yes	Rpi
USART1	HSI	64.000000 MHz	yes	
USART2	HSI	64.000000 MHz	no	
USART3	HSI	64.000000 MHz	yes	Rpi
UART4	HSI	64.000000 MHz	yes	Linux console
UART5	HSI	64.000000 MHz	no	
USART6	HSI	64.000000 MHz	no	
UART7	HSI	64.000000 MHz	no	
UART8	HSI	64.000000 MHz	no	
MC01	HSI	64.000000 MHz	no	Available so can be used
HSE	N.A.	24.000000 MHz	yes	
DSIPLL	HSE	125.000000 MHz	no	DSI DPHY PLL
DSIBL	DSIPLL	125.000000 MHz	no	DSI lanebyte clock
RTCDIV	HSE	1.000000 MHz	yes	Only used when RTC
source is HSE				
ck_per	HSE	24.000000 MHz	yes	
ADC	ck_per	24.000000 MHz	yes	Can use internal divider
to be < 40MHz				
PLL1	HSE	1300.000000 MHz	yes	
PLL1P	PLL1	650.000000 MHz	yes	
MPUDIV	PLL1P	325.000000 MHz	yes	
Cortex-A7	PLL1P	650.000000 MHz	yes	
MC02	Cortex-A7	650.000000 MHz	no	Available so can be used
PLL2	HSE	1066.000000 MHz	yes	
PLL2P	PLL2	266.500000 MHz	yes	
AXI	PLL2P	266.500000 MHz	yes	< 266MHz
FMC	AXI	266.500000 MHz	yes	NAND flash
QSPI	AXI	266.500000 MHz	yes	NOR flash
SYSRAM	AXI	266.500000 MHz	yes	
ROM	AXI	266.500000 MHz	yes	
AHB5	AXI	266.500000 MHz	yes	< 266MHz
CRYP1	AHB5	266.500000 MHz	yes	
HASH1	AHB5	266.500000 MHz	yes	



STM32MP15 clock tree

GPI0Z	AHB5	266.500000	MHz	yes	
BKPSRAM	AHB5	266.500000	MHz	yes	
AHB6	AXI	266.500000	MHz	yes	< 266MHz
CRC1	AHB6	266.500000	MHz	yes	
MDMA	AHB6	266.500000	MHz	yes	
USBH	AHB6	266.500000	MHz	yes	USB Host
APB4	AHB6	133.250000	MHz	yes	
APB5	AHB6	66.625000	MHz	yes	
BSEC	APB5	66.625000	MHz	yes	< 67MHz
ETZPC	APB5	66.625000	MHz	yes	
TZC	APB5	66.625000	MHz	yes	
DBGAPB	AXI	133.250000	MHz	yes	JTAG & Coresight
DBGMCU	DBGAPB	66.625000	MHz	yes	
STM	DBGAPB	66.625000	MHz	yes	
PLL2Q	PLL2	533.000000	MHz	yes	
GPU	PLL2Q	533.000000	MHz	yes	< 533MHz
PLL2R	PLL2	533.000000	MHz	yes	
DDR	PLL2R	533.000000	MHz	yes	< 533MHz
PLL3	HSE	417.755859	MHz	yes	
PLL3P	PLL3	208.877930	MHz	yes	
MLAHB	PLL3P	208.877930	MHz	yes	< 209MHz
Cortex-M4	MLAHB	208.877930	MHz	yes	
SRAM1	MLAHB	208.877930	MHz	yes	
SRAM2	MLAHB	208.877930	MHz	yes	
SRAM3	MLAHB	208.877930	MHz	yes	
RETRAM	MLAHB	208.877930	MHz	yes	
AHB1	MLAHB	208.877930	MHz	yes	< 209MHz
AHB2	MLAHB	208.877930	MHz	yes	< 209MHz
DMA1	AHB2	208.877930	MHz	yes	
DMA2	AHB2	208.877930	MHz	yes	
DMAMUX	AHB2	208.877930	MHz	yes	
APB1	MLAHB	104.438965	MHz	yes	
LPTIM1	APB1	104.438965	MHz	yes	
WWDG	APB1	104.438965	MHz	yes	
APB2	MLAHB	104.438965	MHz	yes	
TIM2	MLAHB	208.877930	MHz	yes	TIM Group 1
TIM3	MLAHB	208.877930	MHz	yes	TIM Group 1
TIM4	MLAHB	208.877930	MHz	yes	TIM Group 1
TIM5	MLAHB	208.877930	MHz	yes	TIM Group 1
TIM6	MLAHB	208.877930	MHz	yes	TIM Group 1
TIM7	MLAHB	208.877930	MHz	yes	TIM Group 1
TIM12	MLAHB	208.877930	MHz	yes	TIM Group 1
TIM13	MLAHB	208.877930	MHz	yes	TIM Group 1
TIM14	MLAHB	208.877930	MHz	yes	TIM Group 1
TIM1	MLAHB	208.877930	MHz	yes	TIM Group 2
TIM8	MLAHB	208.877930	MHz	yes	TIM Group 2
TIM15	MLAHB	208.877930	MHz	yes	TIM Group 2
TIM16	MLAHB	208.877930	MHz	yes	TIM Group 2
TIM17	MLAHB	208.877930	MHz	yes	TIM Group 2
APB3	MLAHB	104.438965	MHz	yes	
LPTIM2	APB3	104.438965	MHz	yes	
LPTIM3	APB3	104.438965	MHz	yes	
SYSCFG	APB3	104.438965	MHz	yes	
VREFBUF	APB3	104.438965	MHz	yes	
DTS	APB3	104.438965	MHz	yes	
HDP	APB3	104.438965	MHz	yes	
AHB3	MLAHB	208.877930	MHz	yes	< 209MHz
CRC2	AHB3	208.877930	MHz	yes	
CRYP2	AHB3	208.877930	MHz	yes	
HASH2	AHB3	208.877930	MHz	yes	
DCMI	AHB3	208.877930	MHz	yes	Camera
IPCC	AHB3	208.877930	MHz	yes	Mailbox
AHB4	MLAHB	208.877930	MHz	yes	< 209MHz
PWR	AHB4	208.877930	MHz	yes	
RCC	AHB4	208.877930	MHz	yes	
GPIOA-K	AHB4	208.877930	MHz	yes	
EXTI	AHB4	208.877930	MHz	yes	



## STM32MP15 clock tree

PLL3Q	PLL3	24.573874 MHz	yes	
SPI1	PLL3Q	24.573874 MHz	no	
SPI2	PLL3Q	24.573874 MHz	no	
SPI3	PLL3Q	24.573874 MHz	no	
DFSDM	PLL3Q	24.573874 MHz	yes	Digital micro
SAI1	PLL3Q	24.573874 MHz	no	
SAI2	PLL3Q	24.573874 MHz	yes	AudCodec 48kHz (use
PLL3R for 44.1kHz)				
SAI3	PLL3Q	24.573874 MHz	no	
SAI4	PLL3Q	24.573874 MHz	yes	SPDIF TX 48kHz (use
PLL3R for 44.1kHz)				
PLL3R	PLL3	11.290699 MHz	yes	
PLL4	HSE	594.000000 MHz	yes	
PLL4P	PLL4	99.000000 MHz	yes	
SDMMC1	PLL4P	99.000000 MHz	yes	μSD card
SDMMC2	PLL4P	99.000000 MHz	yes	eMMC
SDMMC3	PLL4P	99.000000 MHz	yes	
SPDIF	PLL4P	99.000000 MHz	yes	SPDIF RX
PLL4Q	PLL4	74.250000 MHz	yes	
LCD	PLL4Q	74.250000 MHz	yes	LTDC & DSI display pixel
clock				
FDCAN	PLL4Q	74.250000 MHz	yes	Should be as high as
possible and < 100MHz				
PLL4R	PLL4	74.250000 MHz	yes	
STGEN	HSE	24.000000 MHz	yes	
USBPHYC	HSE	24.000000 MHz	yes	USB PHY Ctrl for USB
Host and OTG				
USBPLL	USBPHYC	48.000000 MHz	yes	
USB0	USBPLL	48.000000 MHz	yes	USB OTG
CSI	N.A.	4.000000 MHz	yes	Mandatory for IO
compensation				
ETH	N.A.	0.000000 MHz	no	ETH clocked by RGMII PHY

### 3.2.1.2 Device tree

Here are the corresponding device tree `gcc_clk` sub node properties consumed by the first stage boot loader (FSBL) to configure the clock tree above:

```

st,clksrc = <
    CLK_MPU_PLL1P
    CLK_AXI_PLL2P
    CLK_MCU_PLL3P
    CLK_PLL12_HSE
    CLK_PLL3_HSE
    CLK_PLL4_HSE
    CLK_RTC_LSE
    CLK_MCO1_DISABLED
    CLK_MCO2_DISABLED
>;

st,clkdiv = <
    1 /*MPU*/
    0 /*AXI*/
    0 /*MCU*/
    1 /*APB1*/
    1 /*APB2*/
    1 /*APB3*/
    1 /*APB4*/
    2 /*APB5*/
    23 /*RTC*/
    0 /*MCO1*/
    0 /*MCO2*/

```



## STM32MP15 clock tree

```
>;
st,pkcs = <
  CLK_CKPER_HSE
  CLK_FMC_ACLK
  CLK_QSPI_ACLK
  CLK_ETH_DISABLED
  CLK_SDMMC12_PLL4P
  CLK_DSI_DSIPLL
  CLK_STGEN_HSE
  CLK_USBPHY_HSE
  CLK_SPI2S1_PLL3Q
  CLK_SPI2S23_PLL3Q
  CLK_SPI45_HSI
  CLK_SPI6_HSI
  CLK_I2C46_HSI
  CLK_SDMMC3_PLL4P
  CLK_USB0_USBPHY
  CLK_ADC_CKPER
  CLK_CEC_LSE
  CLK_I2C12_HSI
  CLK_I2C35_HSI
  CLK_UART1_HSI
  CLK_UART24_HSI
  CLK_UART35_HSI
  CLK_UART6_HSI
  CLK_UART78_HSI
  CLK_SPDIF_PLL4P
  CLK_FDCAN_PLL4Q
  CLK_SAI1_PLL3Q
  CLK_SAI2_PLL3Q
  CLK_SAI3_PLL3Q
  CLK_SAI4_PLL3Q
  CLK_RNG1_LSI
  CLK_RNG2_LSI
  CLK_LPTIM1_PCLK1
  CLK_LPTIM23_PCLK3
  CLK_LPTIM45_LSE
>;

/* VCO = 1300.0 MHz => P = 650 (CPU) */
pll1: st,pll@0 {
  cfg = < 2 80 0 0 0 PQR(1,0,0) >;
  frac = < 0x800 >;
  u-boot,dm-pre-reloc;
};

/* VCO = 1066.0 MHz => P = 266 (AXI), Q = 533 (GPU), R = 533 (DDR) */
pll2: st,pll@1 {
  cfg = < 2 65 1 0 0 PQR(1,1,1) >;
  frac = < 0x1400 >;
  u-boot,dm-pre-reloc;
};

/* VCO = 417.8 MHz => P = 209, Q = 25, R = 11 */
pll3: st,pll@2 {
  cfg = < 1 33 1 16 36 PQR(1,1,1) >;
  frac = < 0x1a04 >;
  u-boot,dm-pre-reloc;
};

/* VCO = 594.0 MHz => P = 99, Q = 74, R = 74 */
pll4: st,pll@3 {
  cfg = < 3 98 5 7 7 PQR(1,1,1) >;
  u-boot,dm-pre-reloc;
};
```



### 3.2.2 STM32MP157C-DK2 case

This chapter shows the boot time clock tree set by the FSBL on STM32MP157C-DK2 DISCO board. Linux eventual runtime modifications are not covered here.

#### 3.2.2.1 Clock tree

The following table shows what STM32MP157C-DK2 clock tree looks like, as a result of the boot chain execution with the device tree built with STM32CubeMX.

Component Comment	Parent	Frequency	Used?	
LSI	N.A.	0.032000 MHz	yes	Mandatory for IWDG, DAC
DAC	LSI	0.032000 MHz	no	
RNG1	LSI	0.032000 MHz	yes	Input frequency should
be as low as possible				
RNG2	LSI	0.032000 MHz	yes	Input frequency should
be as low as possible				
IWDG1	LSI	0.032000 MHz	yes	
IWDG2	LSI	0.032000 MHz	yes	
LSE	N.A.	0.032768 MHz	yes	Mandatory for DTS
RTC	LSE	0.032768 MHz	yes	
TAMP	LSE	0.032768 MHz	yes	
CEC	LSE	0.032768 MHz	yes	
LPTIM4	LSE	0.032768 MHz	yes	
LPTIM5	LSE	0.032768 MHz	yes	
HSI	N.A.	64.000000 MHz	yes	
SPI4	HSI	64.000000 MHz	yes	Arduino
SPI5	HSI	64.000000 MHz	yes	Rpi
SPI6	HSI	64.000000 MHz	no	
I2C4	HSI	64.000000 MHz	yes	PMIC
I2C6	HSI	64.000000 MHz	no	
I2C1	HSI	64.000000 MHz	yes	Rpi and peripherals
I2C2	HSI	64.000000 MHz	no	
I2C3	HSI	64.000000 MHz	no	
I2C5	HSI	64.000000 MHz	yes	Rpi and Arduino
USART1	HSI	64.000000 MHz	no	
USART2	HSI	64.000000 MHz	yes	Bluetooth
USART3	HSI	64.000000 MHz	yes	Rpi
UART4	HSI	64.000000 MHz	yes	Linux console
UART5	HSI	64.000000 MHz	no	
USART6	HSI	64.000000 MHz	no	
UART7	HSI	64.000000 MHz	yes	Arduino
UART8	HSI	64.000000 MHz	no	
MC01	HSI	64.000000 MHz	no	Available so can be used
HSE	N.A.	24.000000 MHz	yes	
DSIPLL	HSE	125.000000 MHz	no	DSI DPHY PLL
DSIBL	DSIPLL	125.000000 MHz	no	DSI lanebyte clock
RTCDIV	HSE	1.000000 MHz	yes	Only used when RTC
source is HSE				
ck_per	HSE	24.000000 MHz	yes	
ADC	ck_per	24.000000 MHz	yes	Can use internal divider
to be < 40MHz				
PLL1	HSE	1300.000000 MHz	yes	
PLL1P	PLL1	650.000000 MHz	yes	
MPUDIV	PLL1P	325.000000 MHz	yes	
Cortex-A7	PLL1P	650.000000 MHz	yes	
MC02	Cortex-A7	650.000000 MHz	no	Available so can be used
PLL2	HSE	1066.000000 MHz	yes	
PLL2P	PLL2	266.500000 MHz	yes	
AXI	PLL2P	266.500000 MHz	yes	< 266MHz
FMC	AXI	266.500000 MHz	no	





STM32MP15 clock tree

QSPI	AXI	266.500000	MHz	no	
SYSRAM	AXI	266.500000	MHz	yes	
ROM	AXI	266.500000	MHz	yes	
AHB5	AXI	266.500000	MHz	yes	< 266MHz
CRYP1	AHB5	266.500000	MHz	yes	
HASH1	AHB5	266.500000	MHz	yes	
GPIOZ	AHB5	266.500000	MHz	yes	
BKPSRAM	AHB5	266.500000	MHz	yes	
AHB6	AXI	266.500000	MHz	yes	< 266MHz
CRC1	AHB6	266.500000	MHz	yes	
MDMA	AHB6	266.500000	MHz	yes	
USBH	AHB6	266.500000	MHz	yes	USB Host
APB4	AHB6	133.250000	MHz	yes	
APB5	AHB6	66.625000	MHz	yes	
BSEC	APB5	66.625000	MHz	yes	< 67MHz
ETZPC	APB5	66.625000	MHz	yes	
TZC	APB5	66.625000	MHz	yes	
DBGAPB	AXI	133.250000	MHz	yes	JTAG & Coresight
DBGAPB	DBGAPB	66.625000	MHz	yes	
STM	DBGAPB	66.625000	MHz	no	
PLL2Q	PLL2	533.000000	MHz	yes	
GPU	PLL2Q	533.000000	MHz	yes	< 533MHz
PLL2R	PLL2	533.000000	MHz	yes	
DDR	PLL2R	533.000000	MHz	yes	< 533MHz
PLL3	HSE	417.755859	MHz	yes	
PLL3P	PLL3	208.877930	MHz	yes	
MLAHB	PLL3P	208.877930	MHz	yes	< 209MHz
Cortex-M4	MLAHB	208.877930	MHz	yes	
SRAM1	MLAHB	208.877930	MHz	yes	
SRAM2	MLAHB	208.877930	MHz	yes	
SRAM3	MLAHB	208.877930	MHz	yes	
RETRAM	MLAHB	208.877930	MHz	yes	
AHB1	MLAHB	208.877930	MHz	yes	< 209MHz
AHB2	MLAHB	208.877930	MHz	yes	< 209MHz
DMA1	AHB2	208.877930	MHz	yes	
DMA2	AHB2	208.877930	MHz	yes	
DMAMUX	AHB2	208.877930	MHz	yes	
APB1	MLAHB	104.438965	MHz	yes	
LPTIM1	APB1	104.438965	MHz	yes	
WWDG	APB1	104.438965	MHz	yes	
APB2	MLAHB	104.438965	MHz	yes	
TIM2	MLAHB	208.877930	MHz	yes	TIM Group 1
TIM3	MLAHB	208.877930	MHz	yes	TIM Group 1
TIM4	MLAHB	208.877930	MHz	yes	TIM Group 1
TIM5	MLAHB	208.877930	MHz	yes	TIM Group 1
TIM6	MLAHB	208.877930	MHz	yes	TIM Group 1
TIM7	MLAHB	208.877930	MHz	yes	TIM Group 1
TIM12	MLAHB	208.877930	MHz	yes	TIM Group 1
TIM13	MLAHB	208.877930	MHz	yes	TIM Group 1
TIM14	MLAHB	208.877930	MHz	yes	TIM Group 1
TIM1	MLAHB	208.877930	MHz	yes	TIM Group 2
TIM8	MLAHB	208.877930	MHz	yes	TIM Group 2
TIM15	MLAHB	208.877930	MHz	yes	TIM Group 2
TIM16	MLAHB	208.877930	MHz	yes	TIM Group 2
TIM17	MLAHB	208.877930	MHz	yes	TIM Group 2
APB3	MLAHB	104.438965	MHz	yes	
LPTIM2	APB3	104.438965	MHz	yes	
LPTIM3	APB3	104.438965	MHz	yes	
SYSCFG	APB3	104.438965	MHz	yes	
VREFBUF	APB3	104.438965	MHz	yes	
DTS	APB3	104.438965	MHz	yes	
HDP	APB3	104.438965	MHz	no	
AHB3	MLAHB	208.877930	MHz	yes	< 209MHz
CRC2	AHB3	208.877930	MHz	yes	
CRYP2	AHB3	208.877930	MHz	yes	
HASH2	AHB3	208.877930	MHz	yes	
DCMI	AHB3	208.877930	MHz	no	



## STM32MP15 clock tree

IPCC	AHB3	208.877930 MHz	yes	Mailbox
AHB4	MLAHB	208.877930 MHz	yes	< 209MHz
PWR	AHB4	208.877930 MHz	yes	
RCC	AHB4	208.877930 MHz	yes	
GPIOA-K	AHB4	208.877930 MHz	yes	
EXTI	AHB4	208.877930 MHz	yes	
PLL3Q	PLL3	24.573874 MHz	yes	
SPI1	PLL3Q	24.573874 MHz	yes	SPI2S1 for BT PCM
SPI2	PLL3Q	24.573874 MHz	yes	SPI2S2 for HDMI
SPI3	PLL3Q	24.573874 MHz	no	
DFSDM	PLL3Q	24.573874 MHz	no	
SAI1	PLL3Q	24.573874 MHz	no	
SAI2	PLL3Q	24.573874 MHz	yes	AudCodec 48kHz (use
PLL3R for 44.1kHz)				
SAI3	PLL3Q	24.573874 MHz	no	
SAI4	PLL3Q	24.573874 MHz	no	
PLL3R	PLL3	11.290699 MHz	yes	
PLL4	HSE	594.000000 MHz	yes	
PLL4P	PLL4	99.000000 MHz	yes	
SDMMC1	PLL4P	99.000000 MHz	yes	µSD card
SDMMC2	PLL4P	99.000000 MHz	yes	Wifi
SDMMC3	PLL4P	99.000000 MHz	yes	Rpi
SPDIF	PLL4P	99.000000 MHz	no	
PLL4Q	PLL4	74.250000 MHz	yes	
LCD	PLL4Q	74.250000 MHz	yes	LTDC & DSI display pixel
clock				
FDCAN	PLL4Q	74.250000 MHz	yes	Should be as high as
possible and < 100MHz				
PLL4R	PLL4	74.250000 MHz	yes	
STGEN	HSE	24.000000 MHz	yes	
USBPHYC	HSE	24.000000 MHz	yes	USB PHY Ctrl for USB
Host and OTG				
USBPLL	USBPHYC	48.000000 MHz	yes	
USB0	USBPLL	48.000000 MHz	yes	USB OTG
CSI	N.A.	4.000000 MHz	yes	Mandatory for IO
compensation				
ETH	N.A.	0.000000 MHz	no	ETH clocked by RGMII PHY

### 3.2.2.2 Device tree

Here are the corresponding device tree `rcc_clk` sub node properties consumed by the first stage boot loader (FSBL) to configure the clock tree above:

```

st,clksrc = <
    CLK_MPU_PLL1P
    CLK_AXI_PLL2P
    CLK_MCU_PLL3P
    CLK_PLL12_HSE
    CLK_PLL3_HSE
    CLK_PLL4_HSE
    CLK_RTC_LSE
    CLK_MCO1_DISABLED
    CLK_MCO2_DISABLED
>;

st,clkdiv = <
    1 /*MPU*/
    0 /*AXI*/
    0 /*MCU*/
    1 /*APB1*/
    1 /*APB2*/
    1 /*APB3*/

```



## STM32MP15 clock tree

```
1 /*APB4*/
2 /*APB5*/
23 /*RTC*/
0 /*MCO1*/
0 /*MCO2*/

>;

st,pkcs = <
CLK_CKPER_HSE
CLK_FMC_ACLK
CLK_QSPI_ACLK
CLK_ETH_DISABLED
CLK_SDMMC12_PLL4P
CLK_DSI_DSIPLL
CLK_STGEN_HSE
CLK_USBPHY_HSE
CLK_SPI2S1_PLL3Q
CLK_SPI2S23_PLL3Q
CLK_SPI45_HSI
CLK_SPI6_HSI
CLK_I2C46_HSI
CLK_SDMMC3_PLL4P
CLK_USB0_USBPHY
CLK_ADC_CKPER
CLK_CEC_LSE
CLK_I2C12_HSI
CLK_I2C35_HSI
CLK_UART1_HSI
CLK_UART24_HSI
CLK_UART35_HSI
CLK_UART6_HSI
CLK_UART78_HSI
CLK_SPDIF_PLL4P
CLK_FDCAN_PLL4Q
CLK_SAI1_PLL3Q
CLK_SAI2_PLL3Q
CLK_SAI3_PLL3Q
CLK_SAI4_PLL3Q
CLK_RNG1_LSI
CLK_RNG2_LSI
CLK_LPTIM1_PCLK1
CLK_LPTIM23_PCLK3
CLK_LPTIM45_LSE

>;

/* VCO = 1300.0 MHz => P = 650 (CPU) */
pll1: st,pll@0 {
    cfg = < 2 80 0 0 0 PQR(1,0,0) >;
    frac = < 0x800 >;
    u-boot,dm-pre-reloc;
};

/* VCO = 1066.0 MHz => P = 266 (AXI), Q = 533 (GPU), R = 533 (DDR) */
pll2: st,pll@1 {
    cfg = < 2 65 1 0 0 PQR(1,1,1) >;
    frac = < 0x1400 >;
    u-boot,dm-pre-reloc;
};

/* VCO = 417.8 MHz => P = 209, Q = 25, R = 11 */
pll3: st,pll@2 {
    cfg = < 1 33 1 16 36 PQR(1,1,1) >;
    frac = < 0x1a04 >;
    u-boot,dm-pre-reloc;
};
```



## STM32MP15 clock tree

```
/* VC0 = 594.0 MHz => P = 99, Q = 74, R = 74 */  
pll4: st,pll@3 {  
    cfg = < 3 98 5 7 7 PQR(1,1,1) >;  
    u-boot,dm-pre-reloc;  
};
```

Reset and Clock Control

Low Speed Internal oscillator (STM32 clock source)

Low Speed External oscillator (STM32 clock source)

High Speed Internal oscillator (STM32 clock source) or High Speed Synchronous Serial Interface (MIPI<sup>®</sup> Alliance standard)

High Speed External oscillator (STM32 clock source)

Multi Speed Internal oscillator (STM32 clock source)

First Stage Boot Loader

Das U-Boot -- the Universal Boot Loader (see [U-Boot\\_overview](#))

Secondary Program Loader, *Also known as **U-Boot SPL***

Read Only Memory

Independent Watchdog

Digital-to-analog converter (Electronic circuit that converts a binary number into a continuously varying value.)

Device Tree Source (in software context) or Digital Temperature Sensor (in peripheral context)

Real Time Clock

Tamper

Consumer Electronics Control (HDMI standard)

Power Management Integrated Circuit

Display Serial Interface (MIPI<sup>®</sup> Alliance standard)

Analog-to-digital converter. The process of converting a sampled analog signal to a digital code that represents the amplitude of the original signal sample.

USB Host (STM32 specific)

Boot and Security and OTP control

Extended TrustZone Protection Controller

TrustZone address space Controller for DDR

debug and test protocol, named from the Joint Test Action Group that developed it

System Trace Module

Graphics Processing Units

Doubledata rate (memory domain)

System Configuration

voltage reference buffer (STM32 specific)

Hardware Debug Port



## STM32MP15 clock tree

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Digital Camera Memory Interface

Inter-Processor Communication Controller

External Interrupt

Digital Filter for Sigma-Delta Modulator

Transmit

former spelling for e•MMC ('e' in italic)

Receive

LCD TFT Display Controller (STM32 specific)

System Time Generator

USB On-The-Go (Capability/type of USB port, acting primarily as USB device, to also act as USB host. Also known as USB OTG.)

input/output

Ethernet

Microprocessor Unit

Microcontroller Unit (MCUs have internal flash memory and are intended to operate with a minimum amount of external support ICs. They commonly are a self-contained, system-on-chip (SoC) designs.)

Central processing unit

Discovery kit

BlueTooth

High-Definition Multimedia Interface (HDMI standard)