

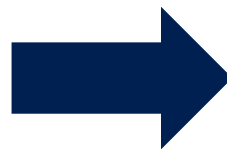
使用STM32 设计HMI-综述

介绍使用STM32提供的硬件资源和软件资源开发人机交互界面HMI的方法



越来越多的应用需要图形界面

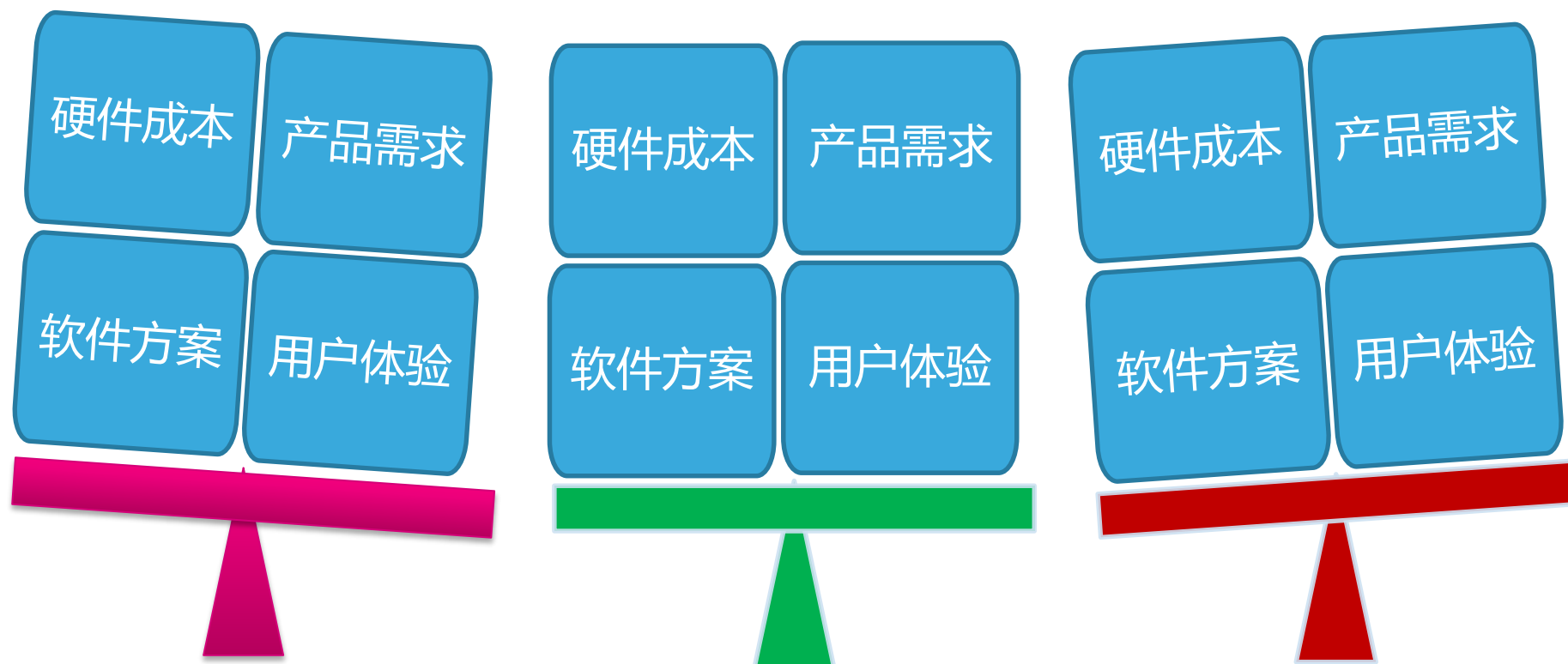
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图形显示是应用的一部分

图形增强了应用的使用感受

选择合适的界面方案是平衡的艺术



配置不足

用户体验的风险
产品面世时间的风险

合适的配置

最佳平衡

过量配置

BOM成本风险
功耗风险

智能家居应用



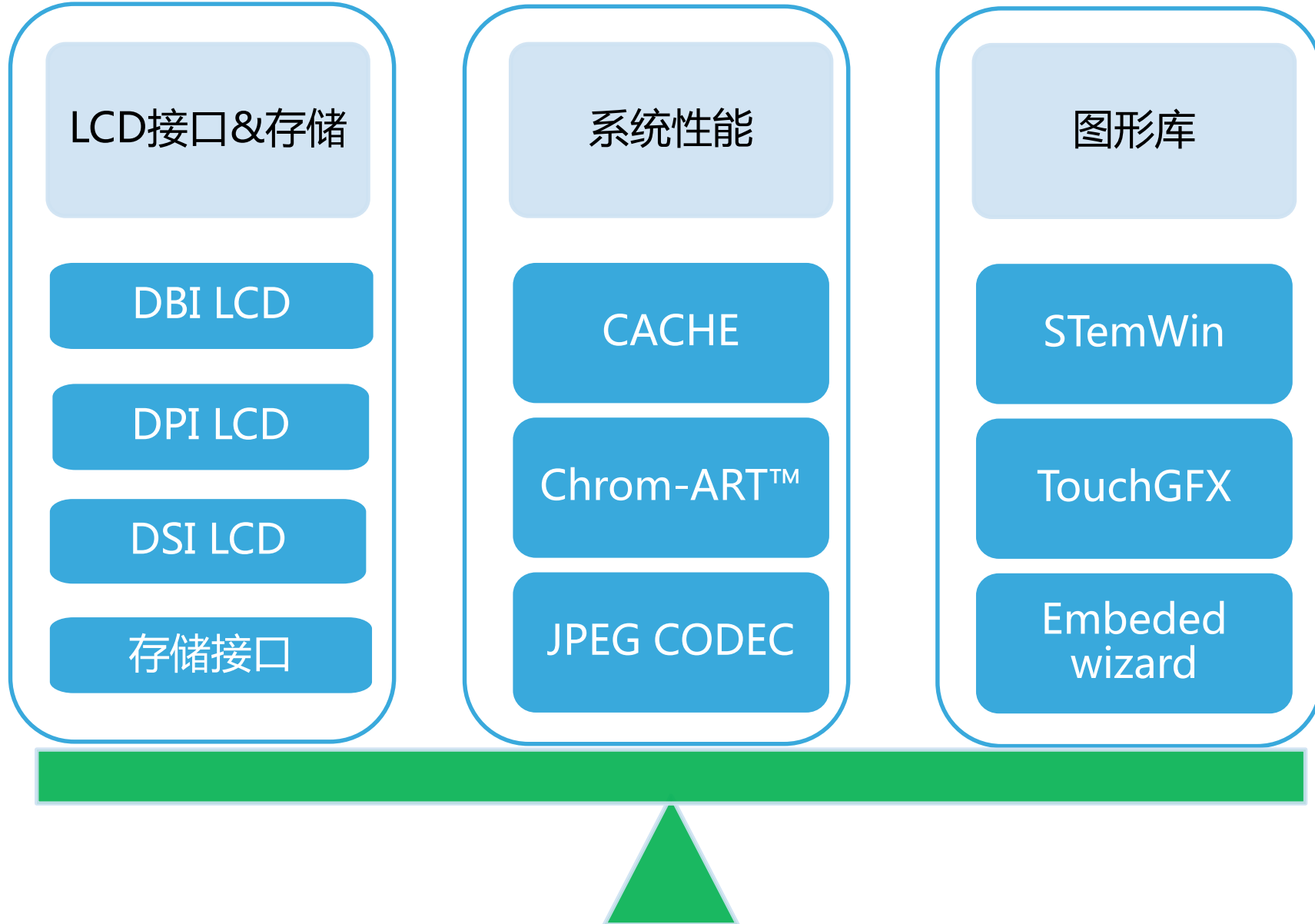




STM32GUI方案可以做到软件和
硬件的平衡

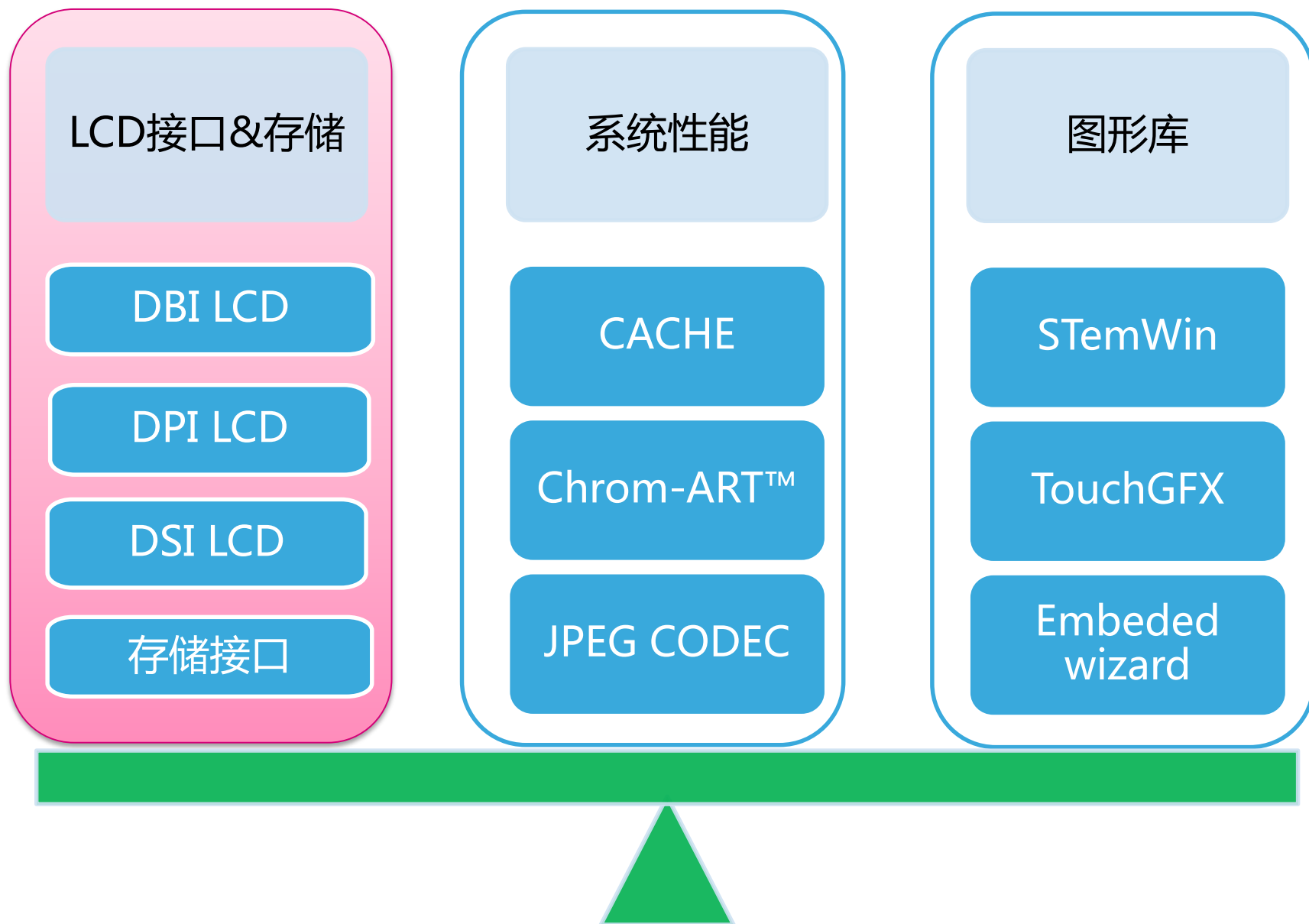
STM32GUI方案可以做到软件和硬件的平衡

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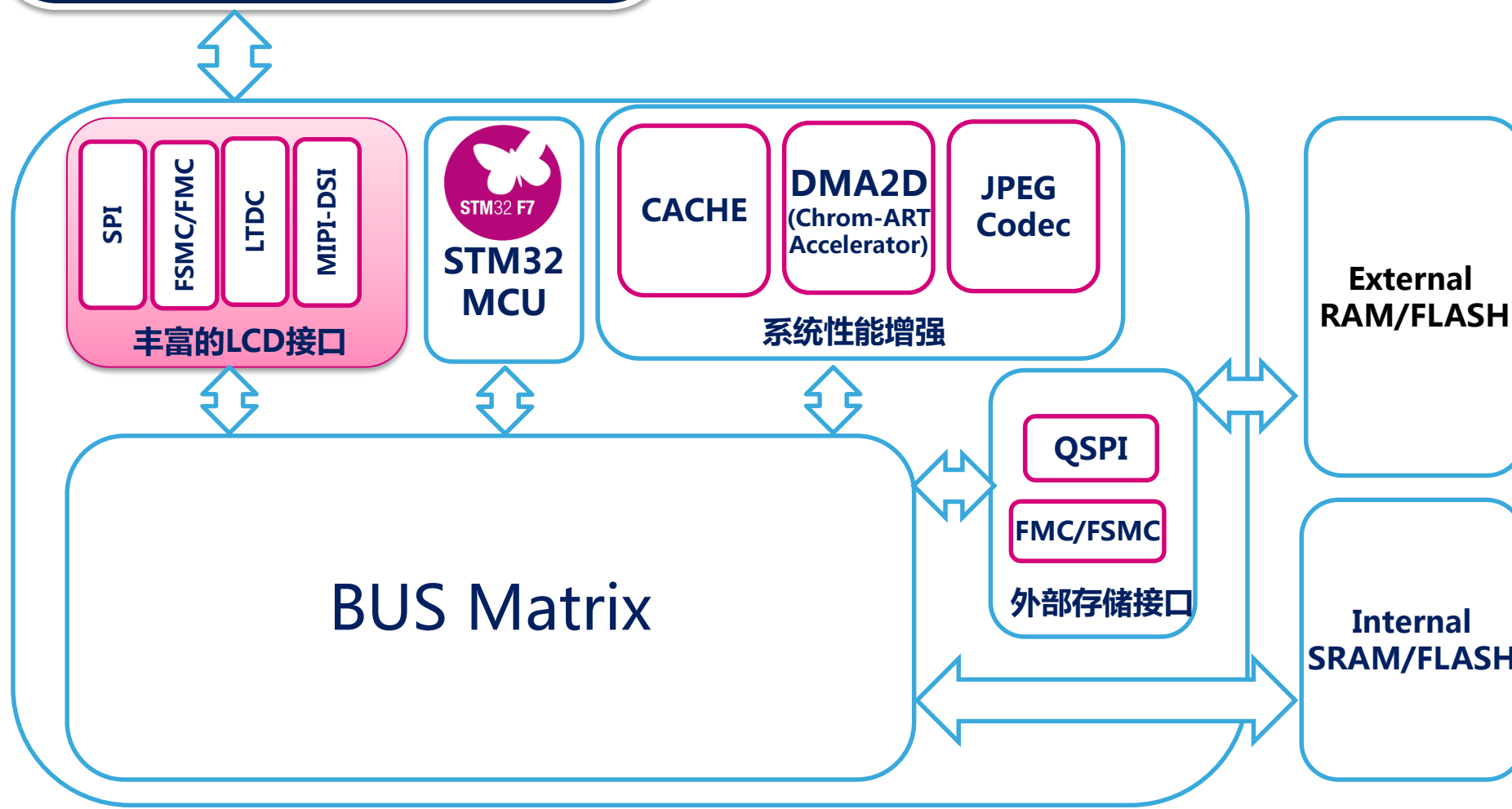
STM32GUI方案可以做到软件和硬件的平衡

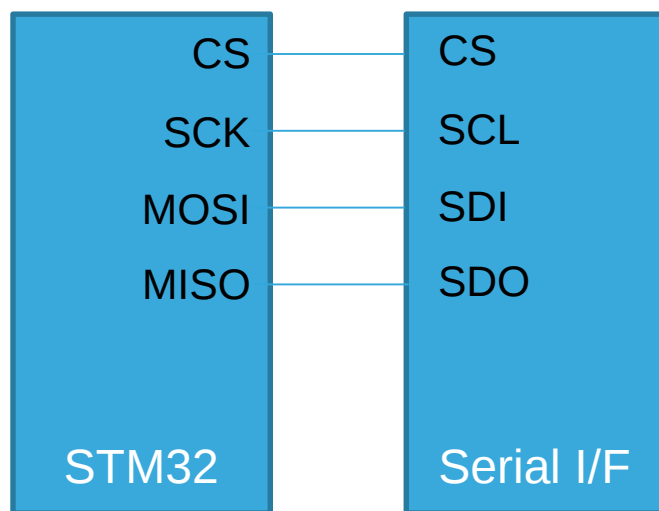
8



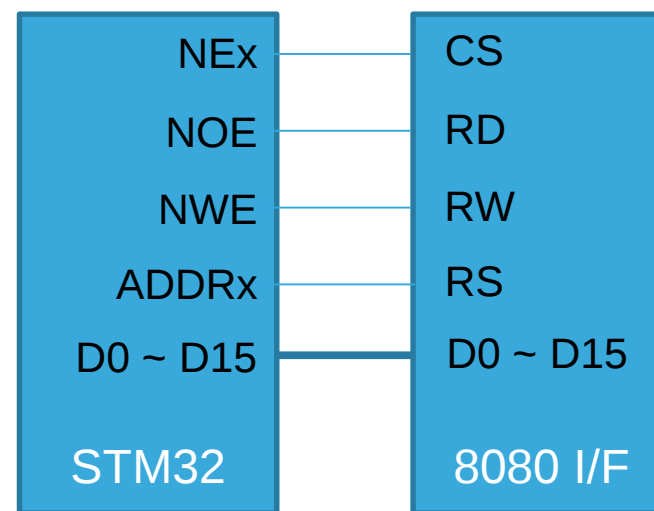


完备的LCD外设接口

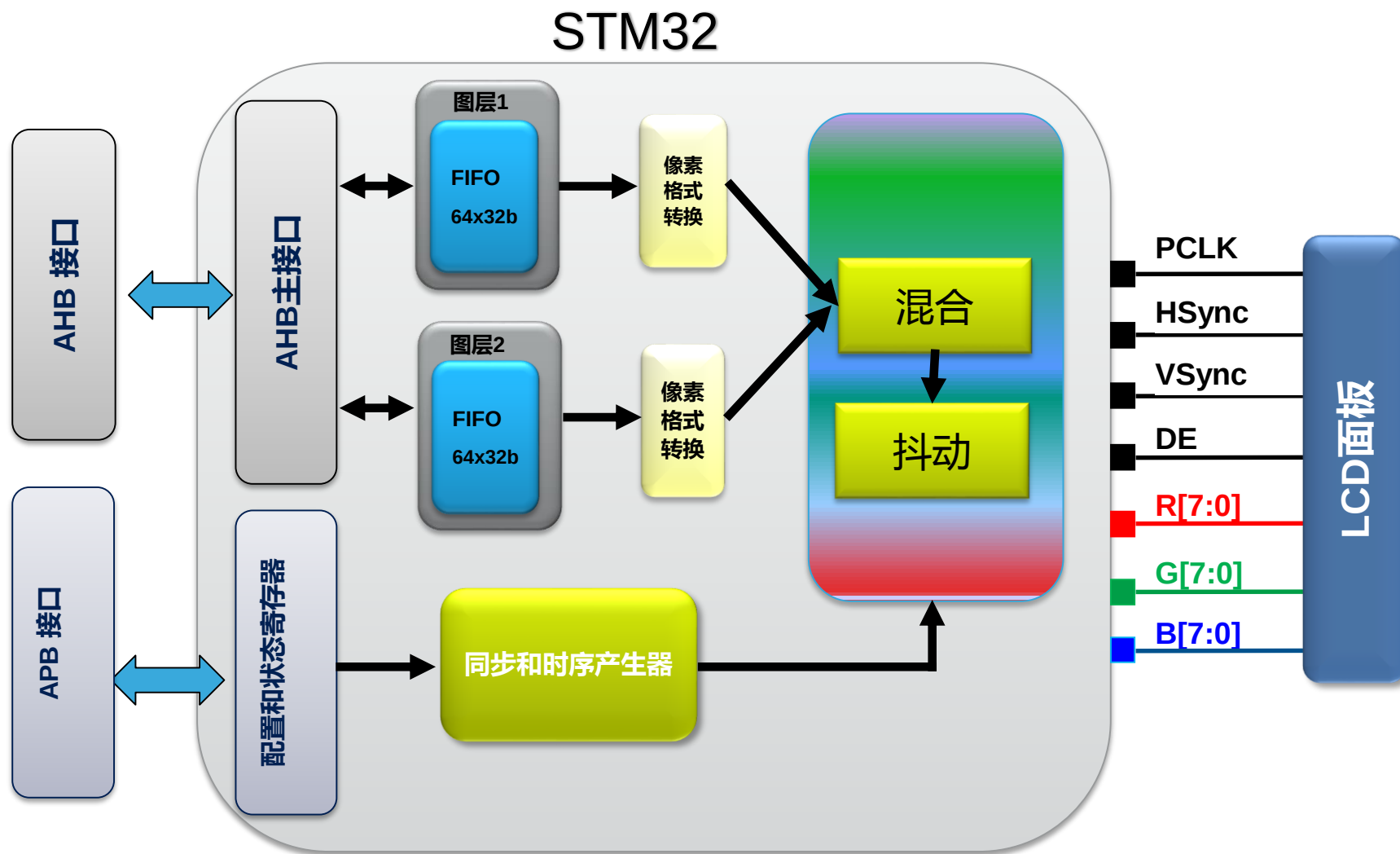


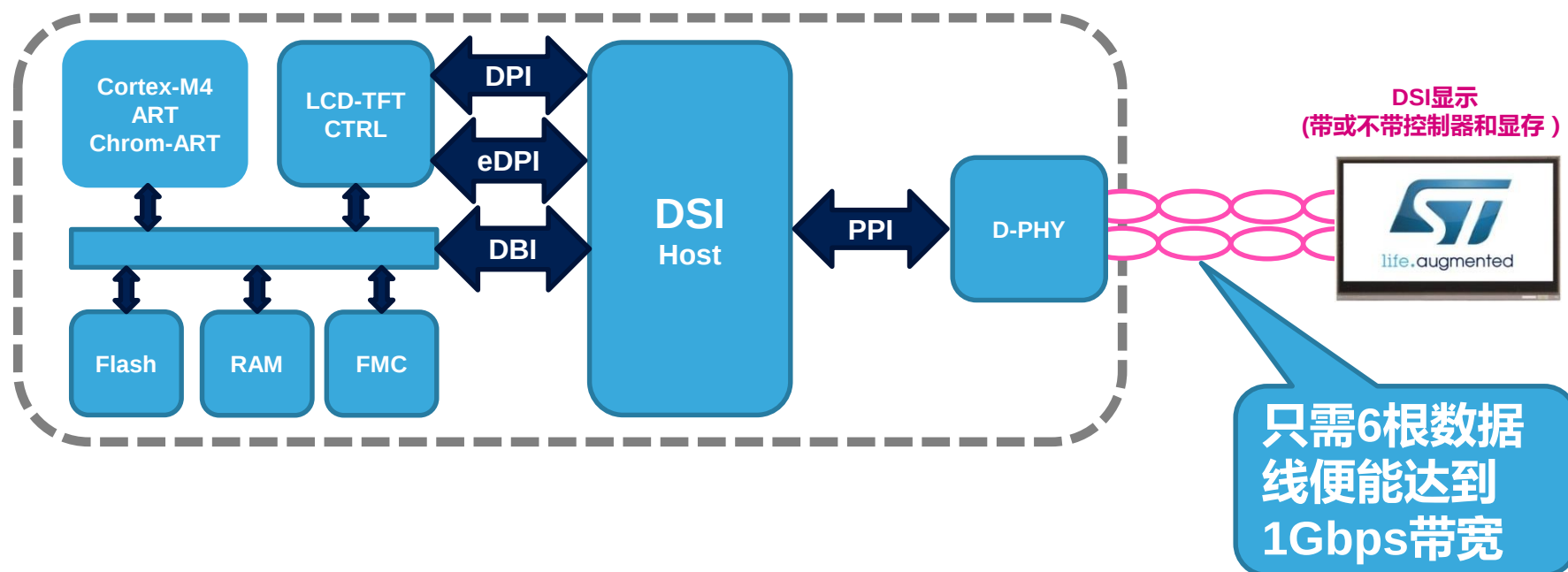


SPI



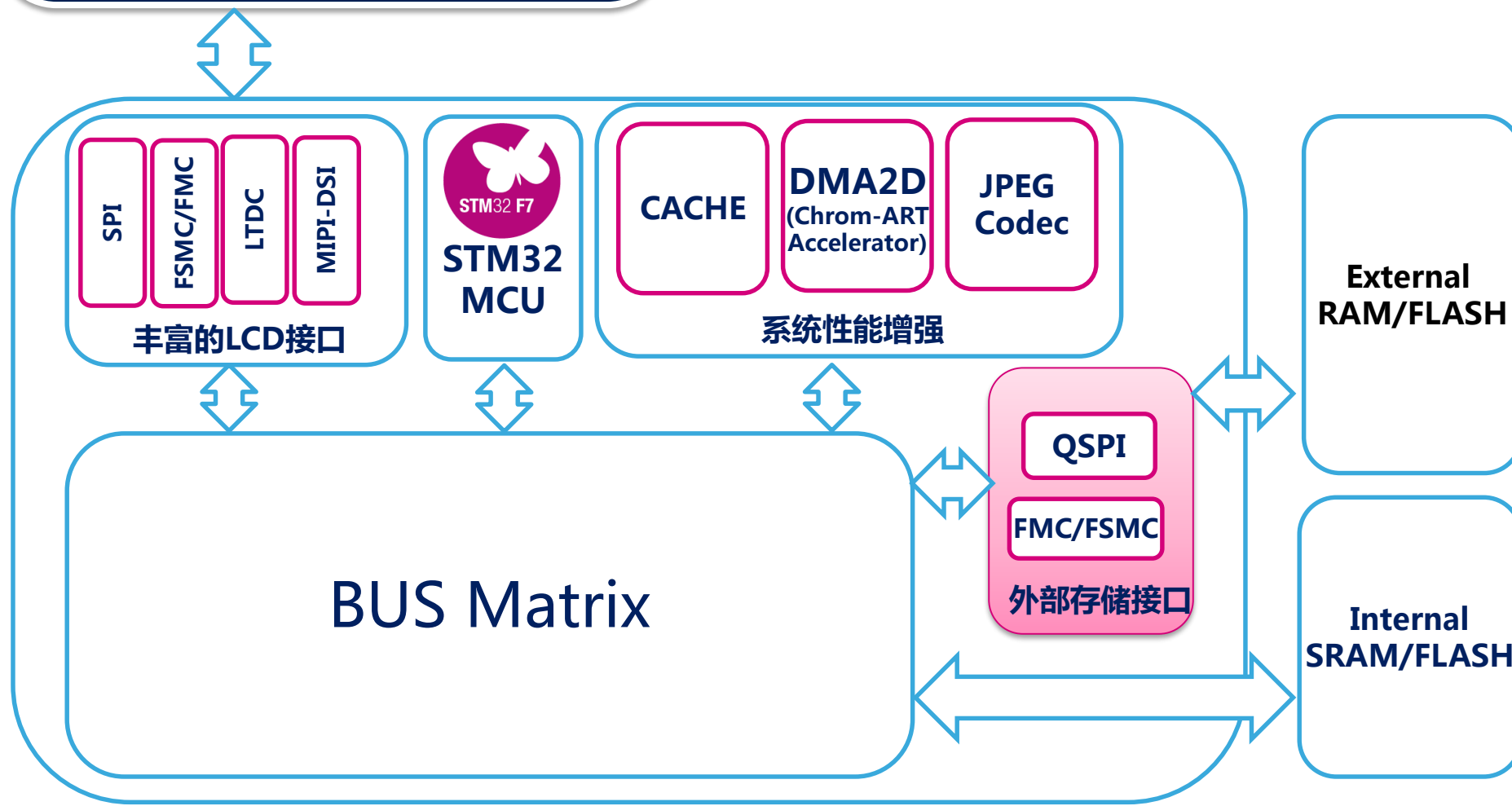
FSMC/FMC







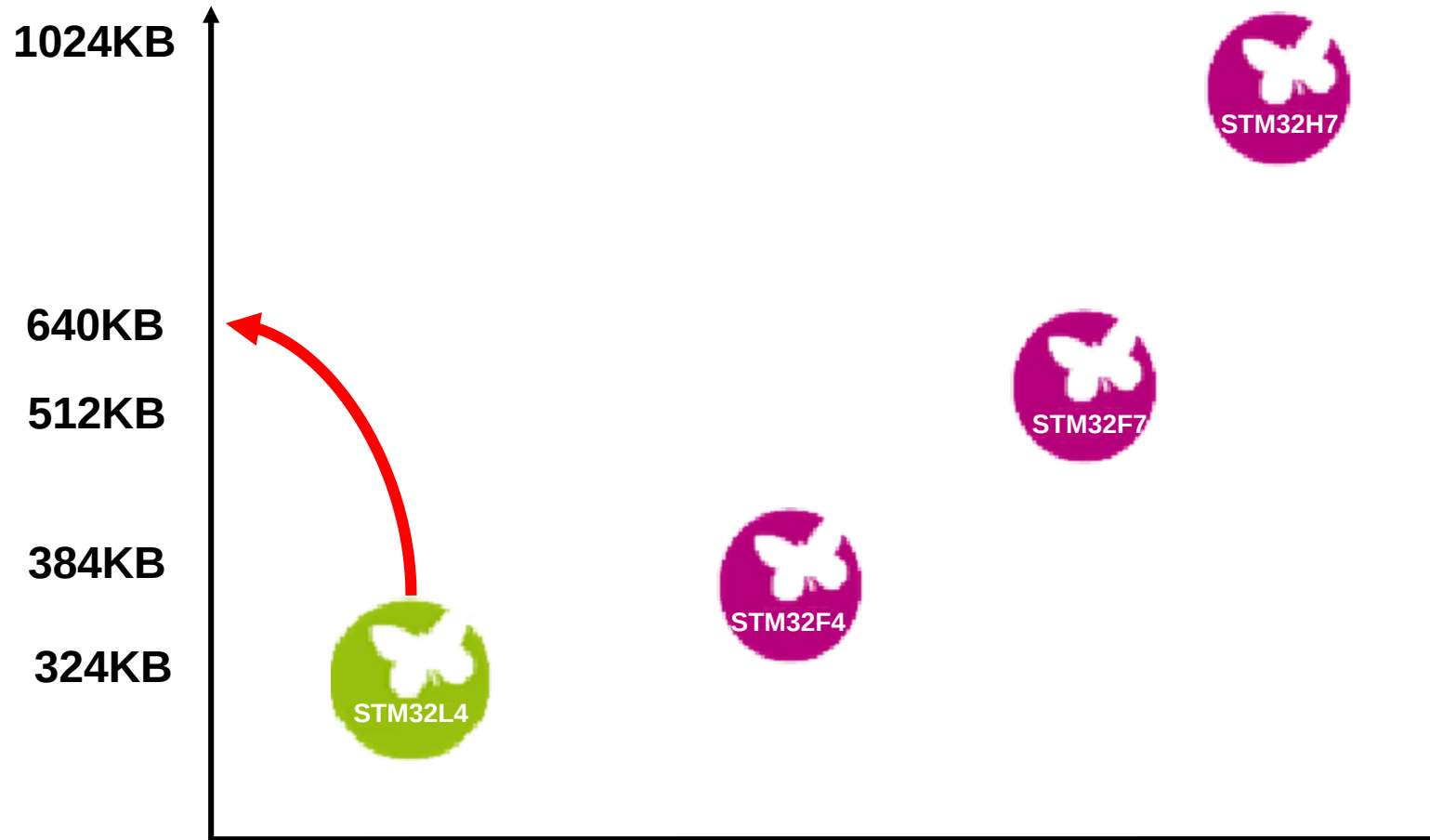
灵活的存储扩展接口



日益增强的内存配置

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- RAM

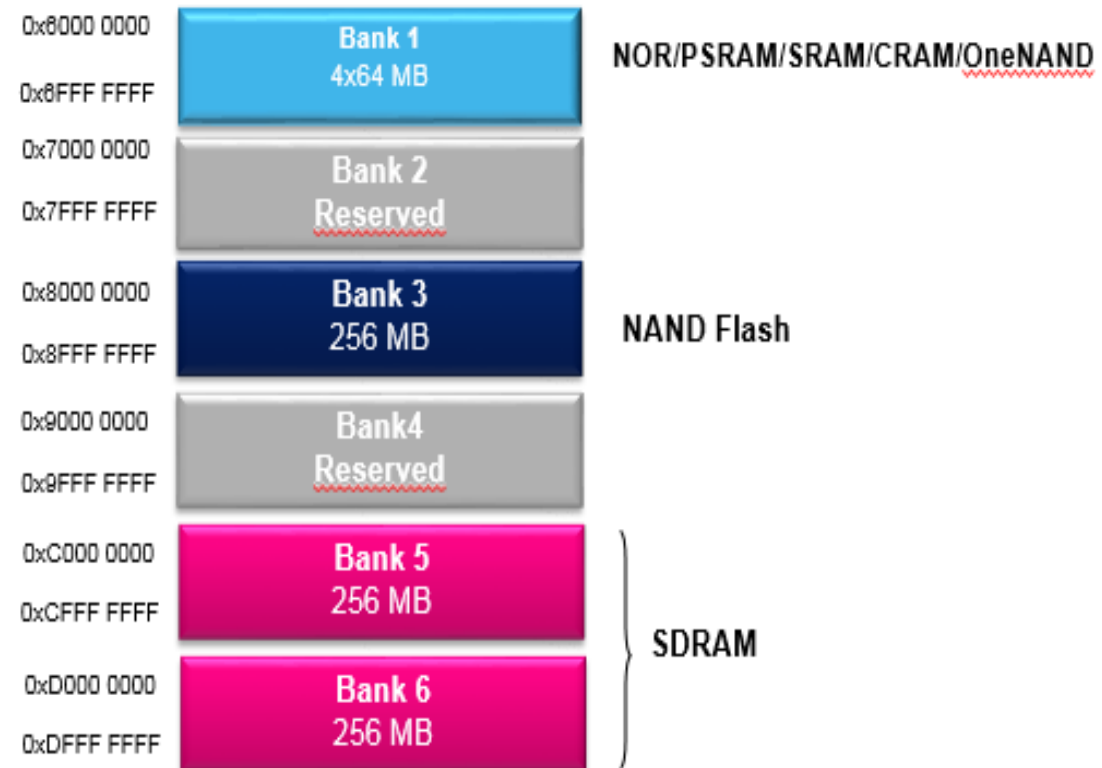


STM32存储扩展接口-FMC/FSMC

- FMC/FSMC管理1GB空间，拥有4个Bank连接外部存储器
 - 每个Bank有独立的片选信号
 - 每个Bank有独立的时序配置
 - FMC比FSMC多了对于SDRAM的支持
- 同步批量传输访问最高频率可达 $216\text{MHz}/2(f_{\text{CLK}} = \text{HCLK} / 2)$

- 支持的存储器类型

- 静态存储支持
 - SRAM
 - PSRAM
 - NOR/ONENAND
 - ROM
- LCD接口
 - 支持8080和6800模式
- NANDFlash和16位PCCard
 - NAND Flash具有硬件ECC
- SDRAM支持(FSMC除外)
- MCP支持(Norflash+PSRAM)



众多的产品型号

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Ultra Low Power

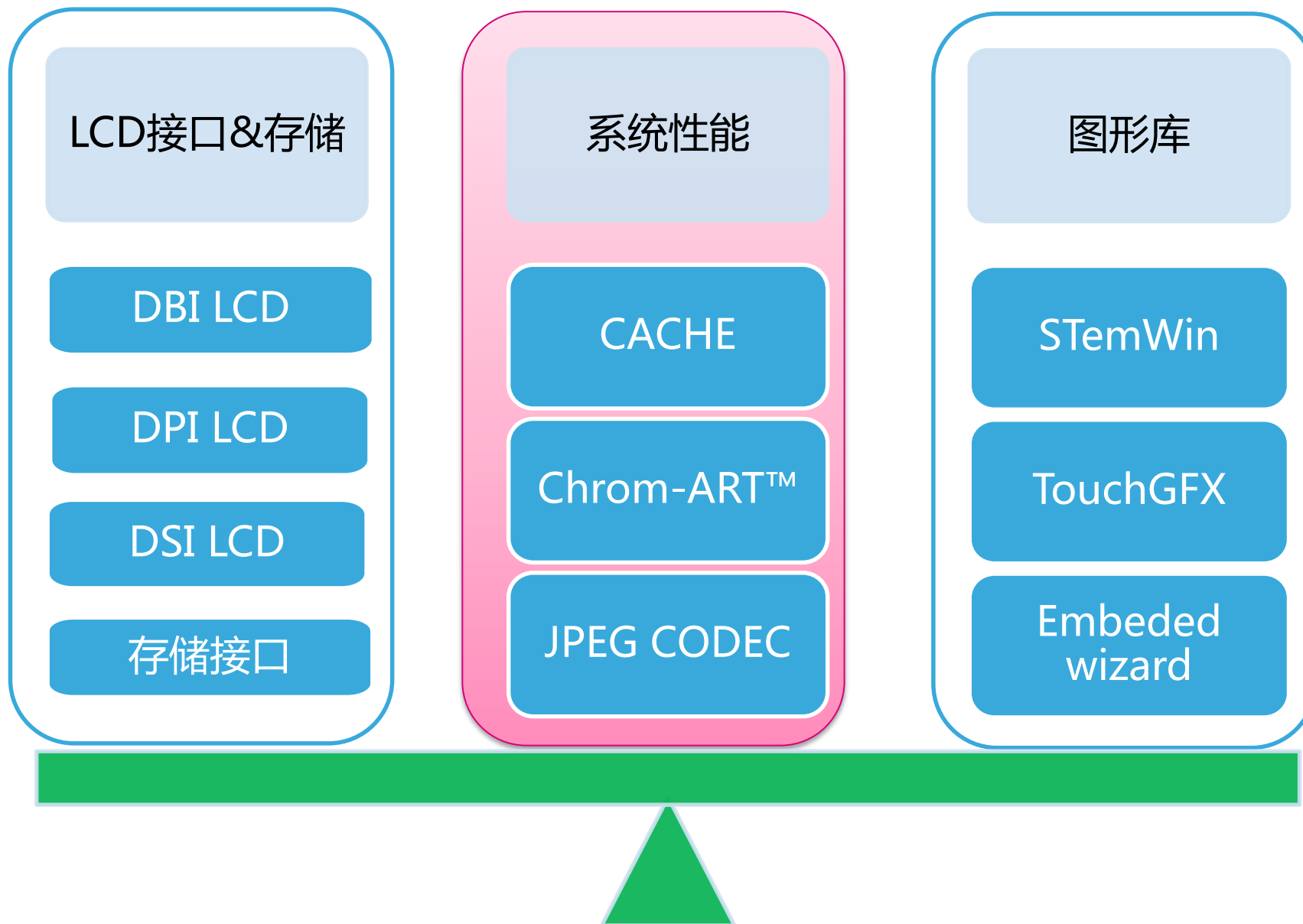
Mainstream

High Performance

SPI + FSMC + TFT + DSI									F469	F769	
SPI + FSMC + TFT									F429 / F439	F746 / F756	
SPI + FSMC			Many		Many	Some	All	F412	All	All	All
SPI	All	All	All	All	All	All	All	All	All	All	All
Family	L0	L1	L4	F0	F1	F3	F2	F4 (Dyn. Eff.)	F4 (HighPerf)	F7	H7
DMIPS	26	33	100	38	61	90	150		225	462	856
MHz	32	32	80	48	72	72	120	Up to 100	Up to 180	216	400
RAM	2~20	4~80	2~320	4~32	4~96	64~128	16~80	256	32~384	256~512	1024

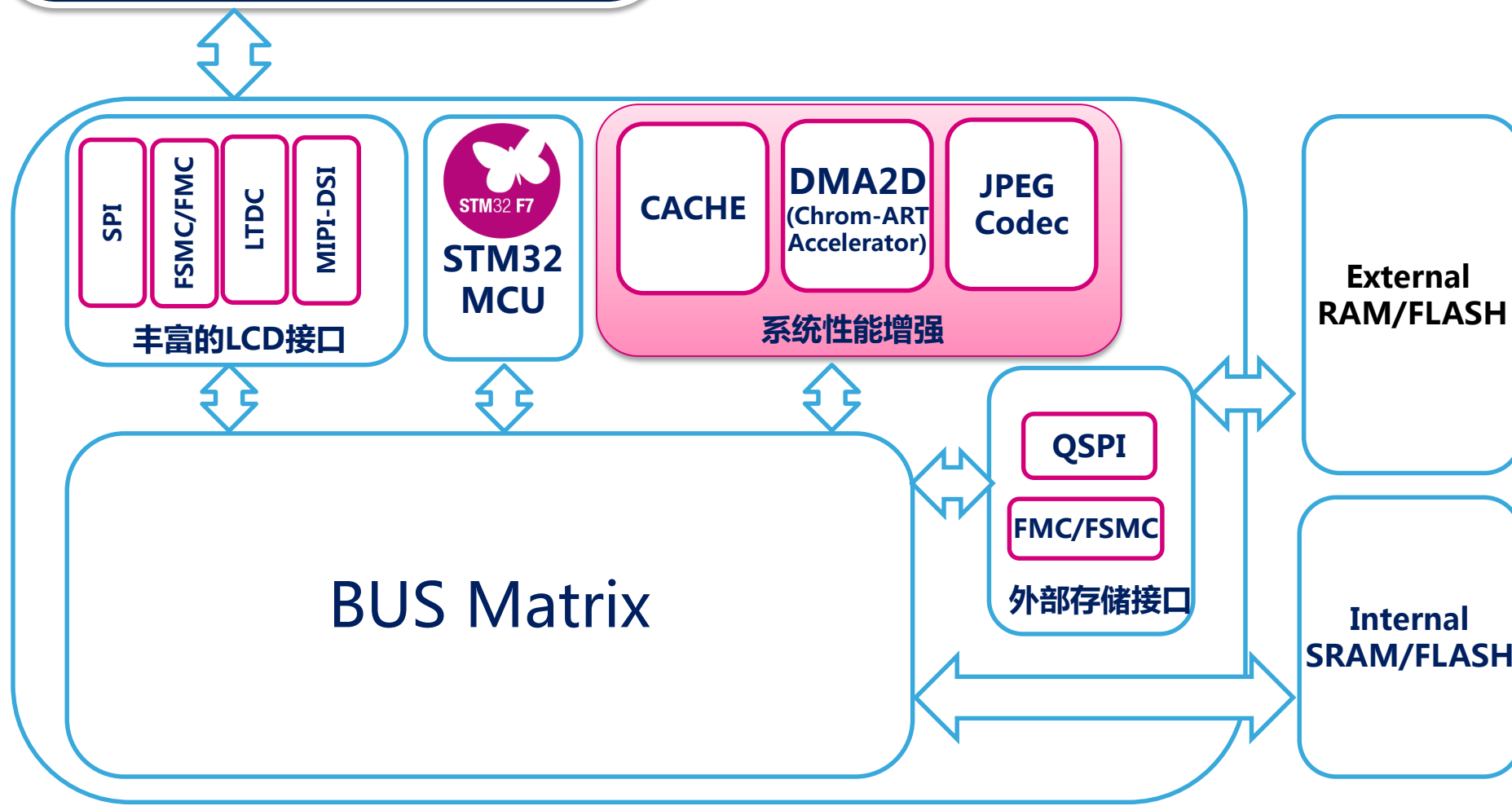
STM32GUI方案可以做到软件和硬件的平衡

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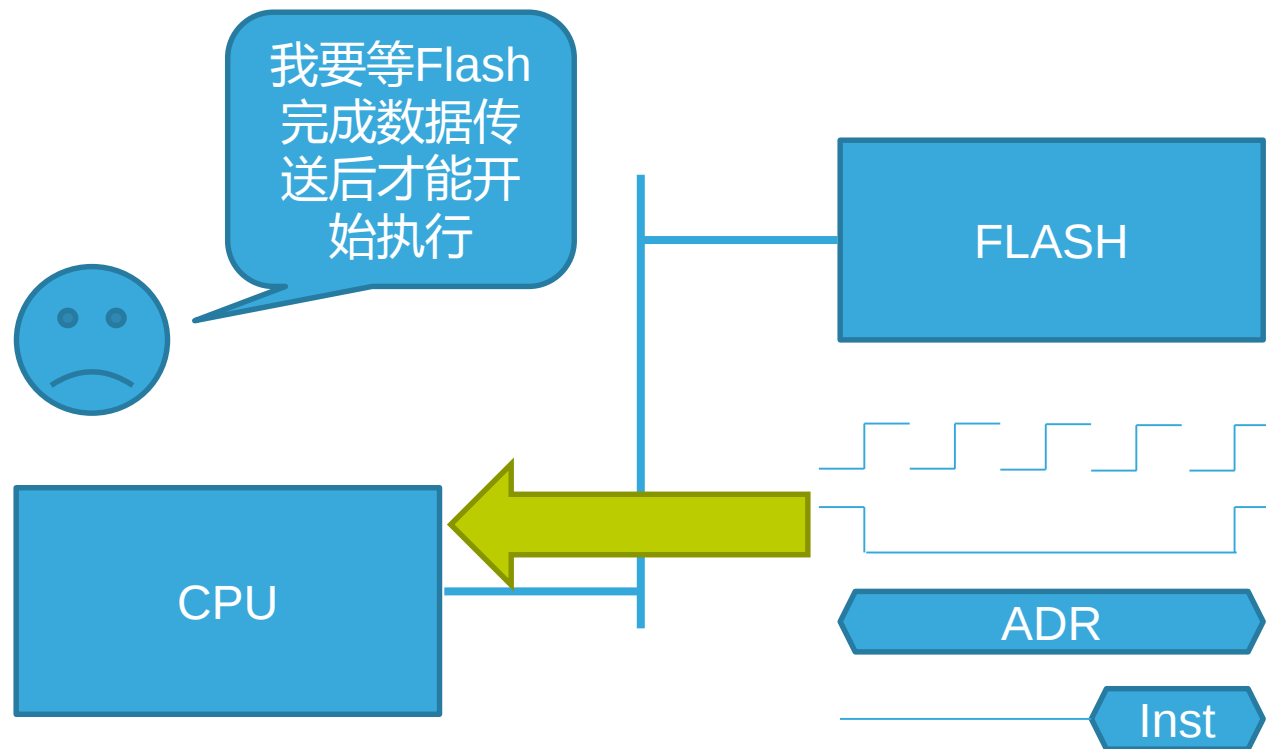
增强系统图像处理性能的硬件模块



- STM32F769提供了更大的缓存
 - 16KB指令Cache + 16KB数据Cache
- 缩短内核获取指令和数据的时间
 - 外部存储器效果显著
 - Nor Flash
 - QSPI Flash
 - SRAM
 - SDRAM
- CoreMark跑分实测
 - 开启和关闭Cache对CoreMark测试影响显著

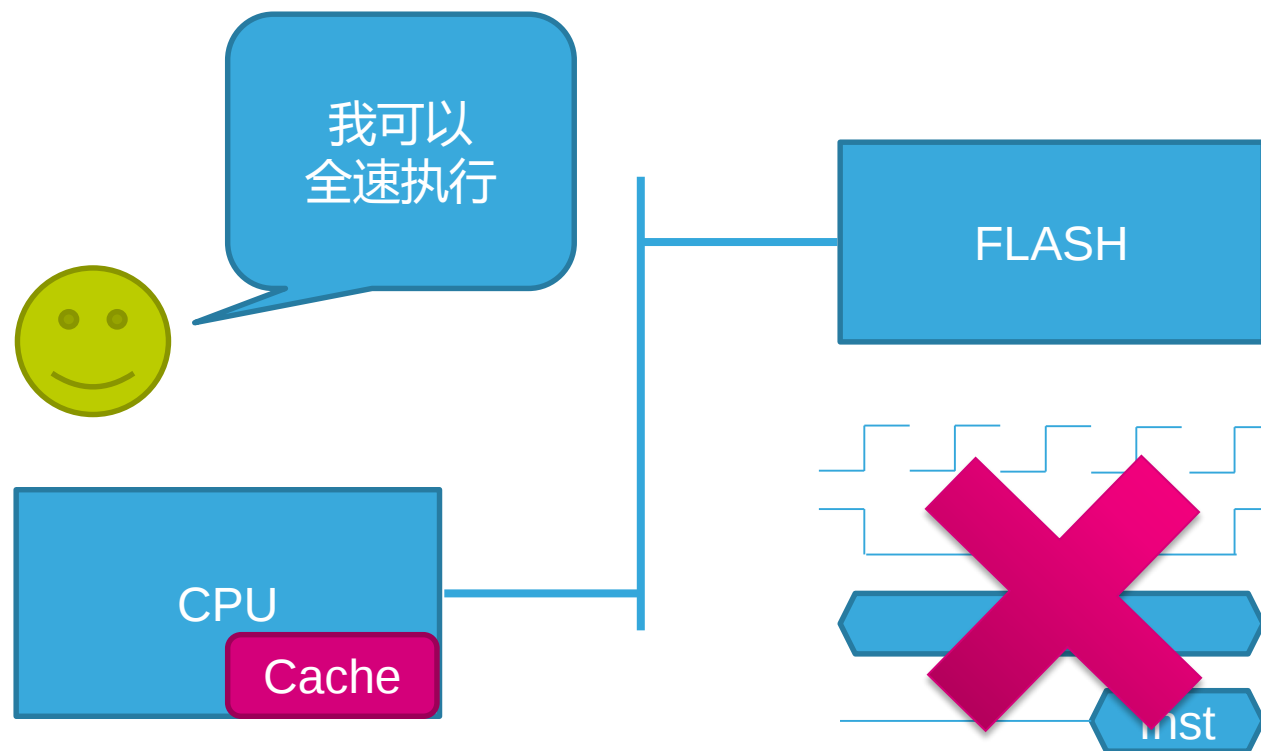
通常CPU需要等待Flash准备数据

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Cache减少CPU等待瓶颈

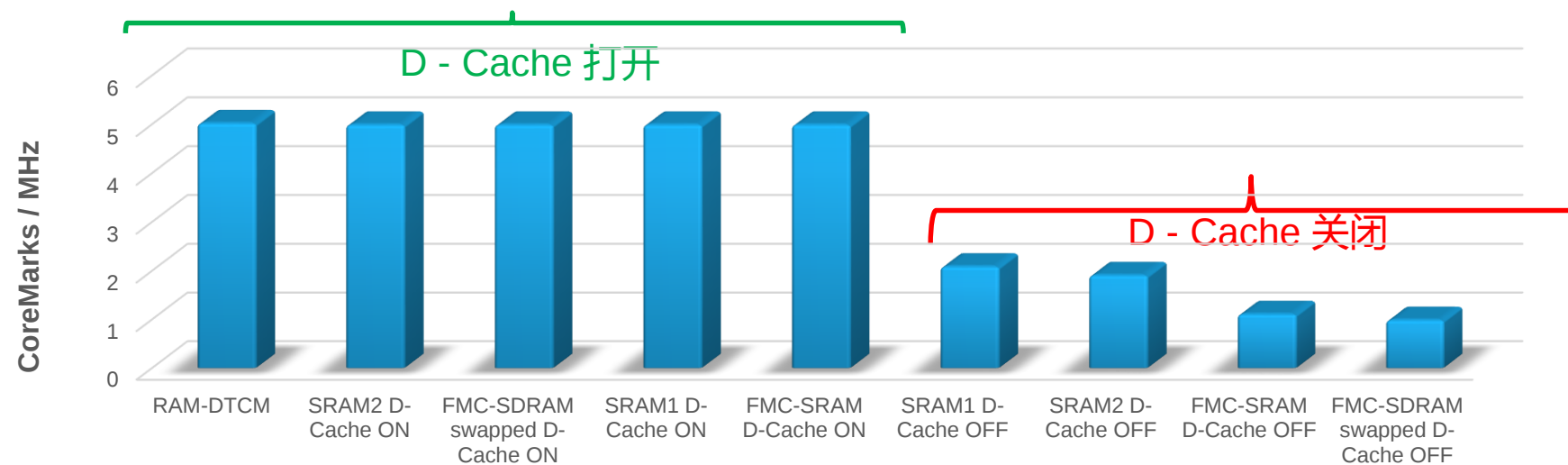
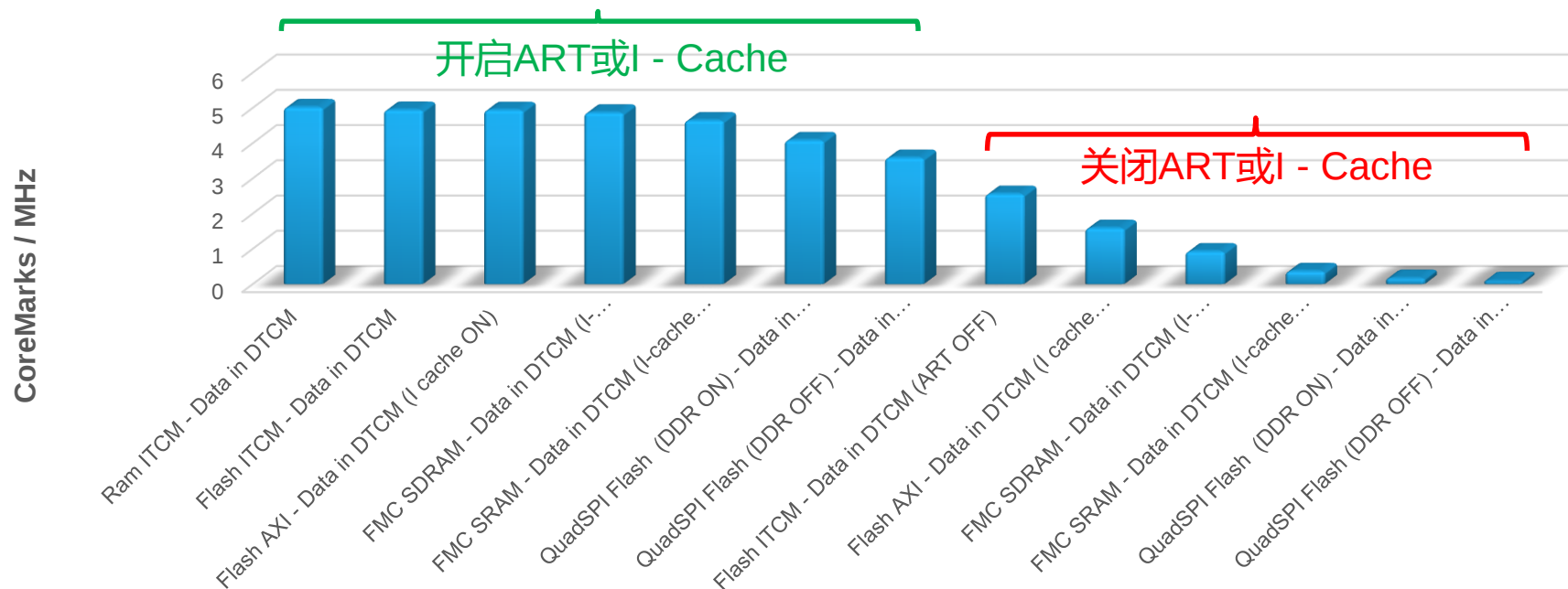
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数据指令存在于Cache中，
无需访问Flash

系统性能增强-CACHE

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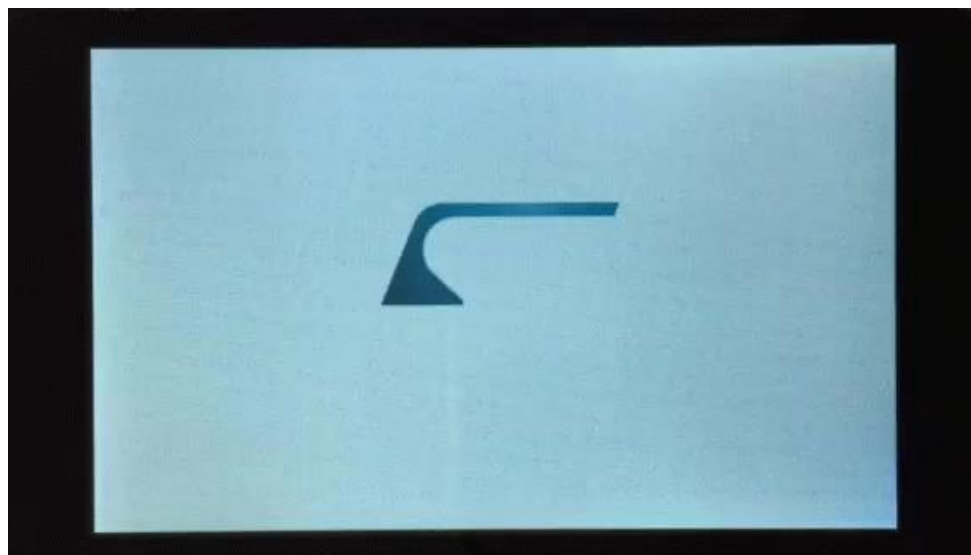
视频演示 – 打开Cache后GIF播放更流畅

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- Cache开启

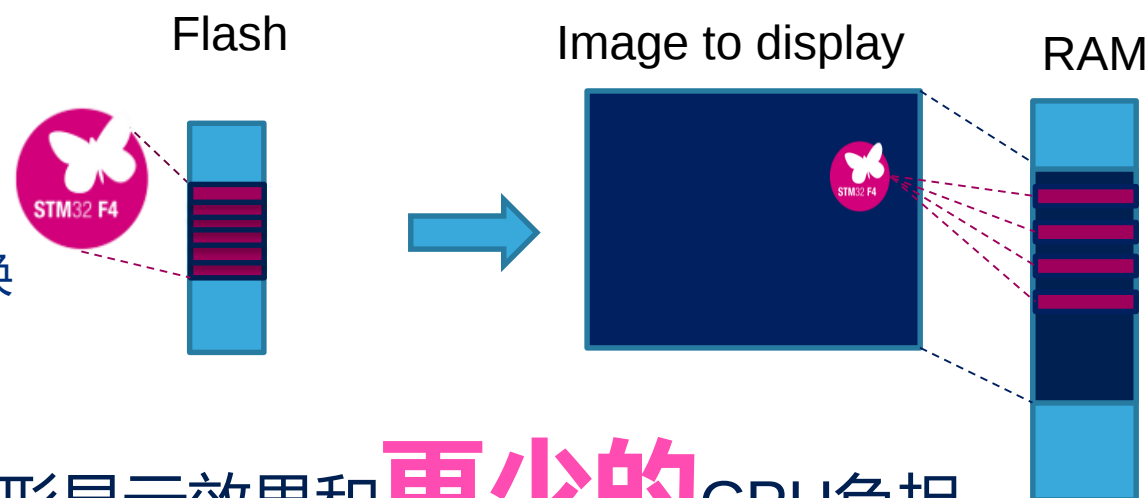


- Cache关闭



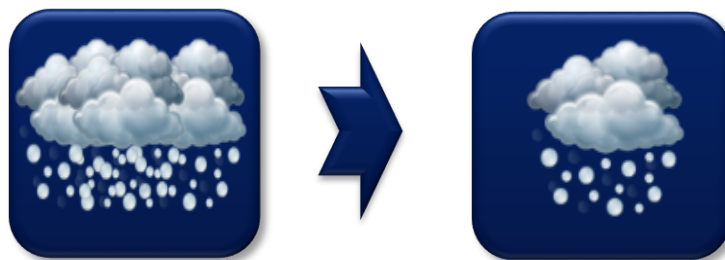
- 主要功能

- 像素填充
- 像素拷贝
- 像素格式转换
- 画面合成



更好的图形显示效果和**更少的**CPU负担

- 使用一个MCU就能做到高级的GUI显示效果和实时处理的能力



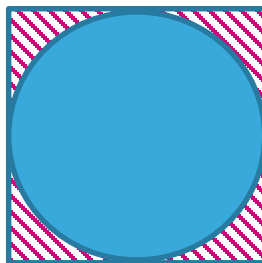
演示视频 – Chorm-ART显著降低CPU负载

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Chrom-GRC

- (G)raphic (R)essources (C)utter 应用于非矩形显示
→减少20%显存占用



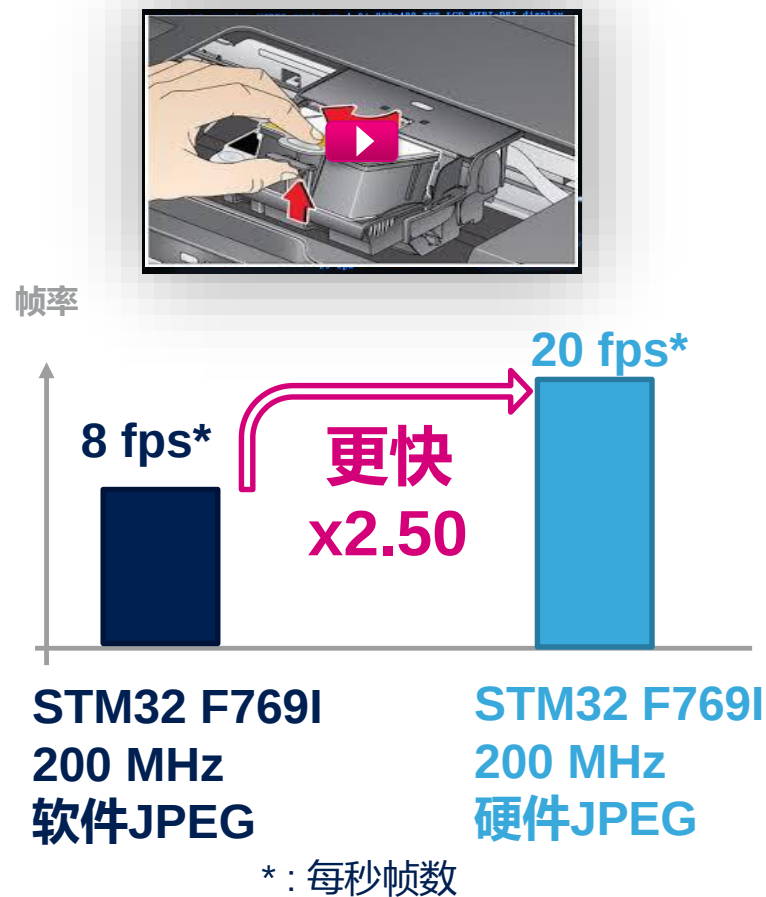
 节省的内存

- **360x360圆形显示**
 - @16bpp ~**205kBytes** (vs.253kBytes)
 - @24bpp ~**307kBytes** (vs.380kBytes)
- **400x400圆形显示**
 - @16bpp: **250kBytes** (vs.312kBytes)
 - @24bpp: **372kBytes** (vs.469kBytes)

系统性能增强-硬件JPEG编解码器

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- 简单快速的硬件JPEG压缩/解压缩
 - 降低CPU在处理JPEG数据时的负载
- 全面管理JPEG文件头
 - 不需要CPU进行干预
- 支持Motion JPEG视频
 - 动画显示厂家LOGO或商标增强用户体验
 - 产品可以嵌入动画教程



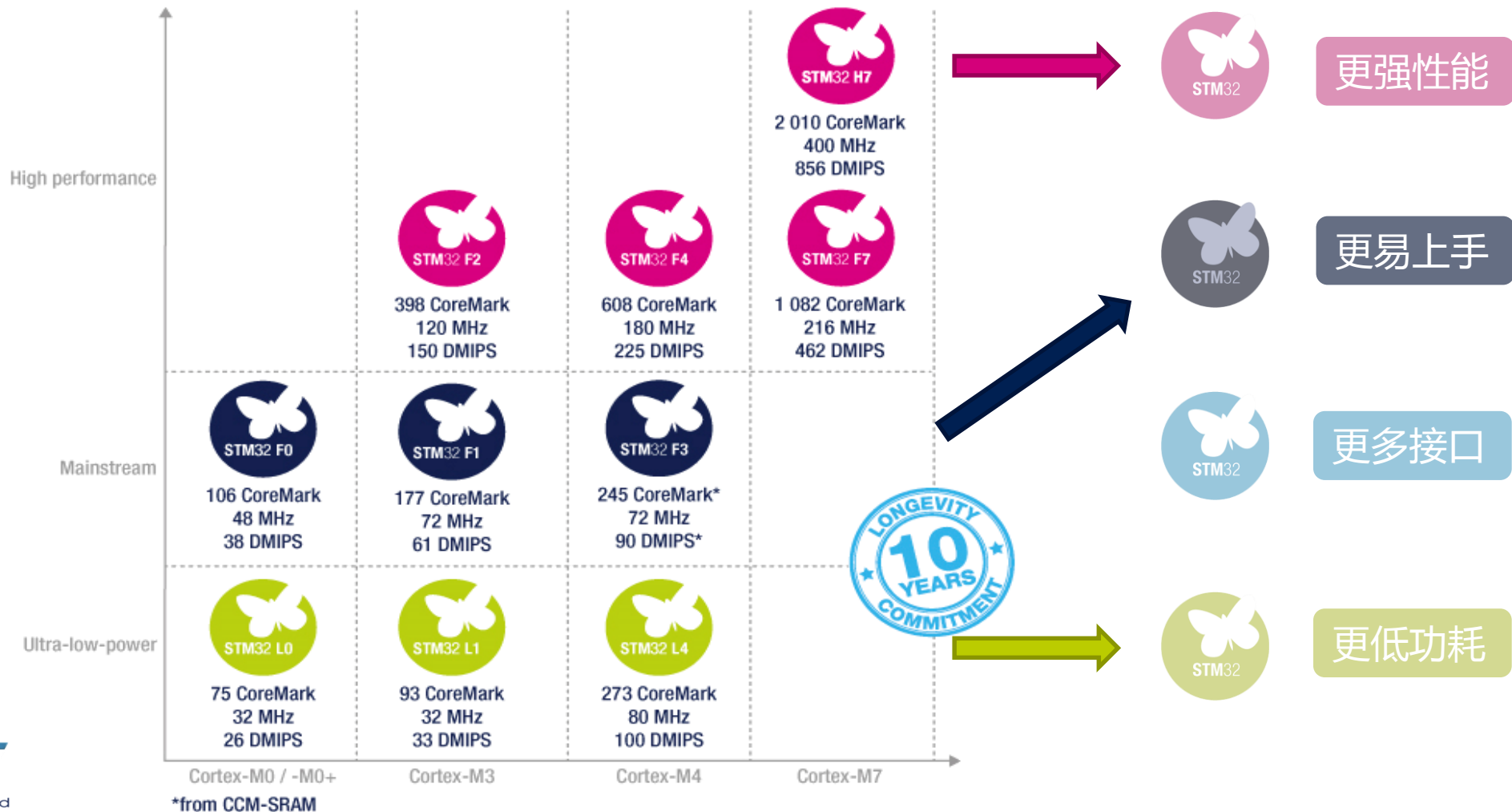
视频演示 – JPEG编解码器

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提供超级平台化GUI方案

To be continued...



Series	Core	Frequency	Graphic IPs	Display IF	Resolutions
STM32F1	Cortex-M3	72 MHz	-	8080/6800 parallel IF	CGA/QVGA
STM32F2	Cortex-M3	120 MHz	-	8080/6800 parallel IF	CGA/QVGA
STM32L49x	Cortex-M4	80 MHz	Chrom-ART	8080/6800 parallel IF	QVGA/WQVGA
STM32L4Rx	Cortex-M4	120 MHz	Chrom-ART Chrom-GRC	8080/6800 parallel IF LCD TFT controller MIPI-DSI	WQVGA
STM32F4 Access and Foundation lines	Cortex-M4	100 to 180MHz	-	8080/6800 parallel IF	QVGA/WQVGA
STM32F4 advanced lines	Cortex-M4	180 MHz	Chrom-ART	8080/6800 parallel IF LCD TFT controller MIPI-DSI	Up to XGA
STM32F7	Cortex-M7	216 MHz	Chrom-ART HW Jpeg	8080/6800 parallel IF LCD TFT controller MIPI-DSI	Up to XGA
STM32H74x	Cortex-M7	400 MHz	Chrom-ART HW Jpeg	8080/6800 parallel IF LCD TFT controller MIPI-DSI	Up to XGA

谢谢！

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更多信息请访问我们的官方网站

www.st.com/stm32

www.stmcu.com.cn

www.stmcu.org