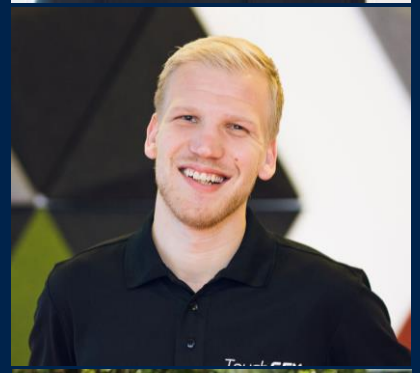
life.augmented

Rapid Graphic Prototyping with TouchGFX and STM32 Discovery Platforms

Mike Hartmann

Jesper Hedegaard



Emil Petersen

Romain Dieleman

life.augmented

Agenda

- STM32 Graphics Portfolio
- STM32 Graphics Ecosystem
- Intro to Embedded Graphics
- TouchGFX Introduction
- Hands-on with TouchGFX
- Wrap-up

life.augmented

Accelerating the HMI of Things

Enabling high-end user experience in embedded devices

Smarter and richer devices requiring Advanced Graphical User Interfaces

life.augmented

What to consider when designing platform with graphics

- What are the tasks of the system
  - System complexity impacts the solution required
  - Acceleration, memory and overall architecture
- Display
  - Size/Resolution and Color Depth
  - Interface (MIPI DSI, LCD-TFT, SPI, parallel 8080/6800)
- Development Resources
  - Graphic Designers
  - Firmware Engineers
  - Hardware Engineers

life.augmented

What to consider when designing platform with graphics

- What are the tasks of the system
  - System complexity impacts the solution required
  - Acceleration, memory and overall architecture
- Display
  - Size/Resolution and Color Depth
  - Interface (MIPI DSI, LCD-TFT, SPI, parallel 8080/6800)
- Development Resources
  - Graphic Designers
  - Firmware Engineers
  - Hardware Engineers

Small SPI Display showing Sensor Data

I need a basic STM32 MCU and a few engineers

life.augmented

What to consider when designing platform with graphics

- What are the tasks of the system
  - System complexity impacts the solution required
  - Acceleration, memory and overall architecture
- Display
  - Size/Resolution and Color Depth
  - Interface (MIPI DSI, LCD-TFT, SPI, parallel 8080/6800)
- Development Resources
  - Graphic Designers
  - Firmware Engineers
  - Hardware Engineers

Medium DSI LCD with menus and connectivity

I need a high performance STM32 MCU with graphics capability and a full engineering team

life.augmented

What to consider when designing platform with graphics

- What are the tasks of the system
  - System complexity impacts the solution required
  - Acceleration, memory and overall architecture
- Display
  - Size/Resolution and Color Depth
  - Interface (MIPI DSI, LCD-TFT, SPI, parallel 8080/6800)
- Development Resources
  - Graphic Designers
  - Firmware Engineers
  - Hardware Engineers

10” TFT LCD with 3D menus, cloud connectivity, and real-time control

I need a STM32MP1 running Linux, a full team, and maybe a ST Partner

life.augmented

STM32 MCU and MPU Roadmap

MPU							**STM32MP1** 4158 CoreMark 800 MHz Cortex -A7 209 MHz Cortex -M4
High Perf MCUs			**STM32F2** 398 CoreMark 120 MHz		**STM32F4** 608 CoreMark 180 MHz	**STM32H7** 3224 CoreMark 240 MHz Cortex -M4 480 MHz Cortex -M7	**STM32F7** 1082 CoreMark 216 MHz
Mainstream MCUs	**STM32F0** 106 CoreMark 48 MHz	**STM32G0** 142 CoreMark 64 MHz	**STM32F1** 177 CoreMark 72 MHz		**STM32F3** 245 CoreMark 72 MHz	**STM32G4** 550 CoreMark 170 MHz	
Ultra-low Power MCUs		**STM32L0** 75 CoreMark 32 MHz	**STM32L1** 93 CoreMark 32 MHz	**STM32L5** 424 CoreMark 110 MHz	**STM32L4** 273 CoreMark 80 MHz	**STM32L4+** 409 CoreMark 120 MHz	
Wireless MCUs					**STM32WL** 161 CoreMark 48 MHz	**STM32WB** 216 CoreMark 64 MHz	
Arm® Cortex® core	M0	M0+	M3	M33	M4	M7	Dual A7 + M4

LONGEVITY 10 YEARS COMMITMENT

Optimized for mixed-signal applications

Cortex-M0+ Radio co-processor

life.augmented

STM32 Devices with Graphics Acceleration

MPU							STM32**MP1** 4158 CoreMark 800 MHz Cortex -A7 209 MHz Cortex -M4
High Perf MCUs			STM32**F2** 398 CoreMark 120 MHz		STM32**F4** 608 CoreMark 180 MHz	STM32**H7** 3224 CoreMark 240 MHz Cortex -M4 480 MHz Cortex -M7	STM32**F7** 1082 CoreMark 216 MHz
Mainstream MCUs	STM32**F0** 106 CoreMark 48 MHz	STM32**G0** 142 CoreMark 64 MHz	STM32**F1** 177 CoreMark 72 MHz		STM32**F3** 245 CoreMark 72 MHz	STM32**G4** 550 CoreMark 170 MHz	
Ultra-low Power MCUs		STM32**L0** 75 CoreMark 32 MHz	STM32**L1** 93 CoreMark 32 MHz	STM32**L5** 424 CoreMark 110 MHz	STM32**L4** 273 CoreMark 80 MHz	STM32**L4+** 409 CoreMark 120 MHz	
Wireless MCUs					STM32**WL** 161 CoreMark 48 MHz	STM32**WB** 216 CoreMark 64 MHz	
Arm® Cortex® core	M0	M0+	M3	M33	M4	M7	Dual A7 + M4

LONGEVITY 10 YEARS COMMITMENT

● Optimized for mixed-signal applications

● Cortex-M0+ Radio co-processor

life.augmented

STM32 Devices with Graphics Acceleration

MPU							STM32**MP1** 4158 CoreMark 800 MHz Cortex -A7 209 MHz Cortex -M4
High Perf MCUs			STM32**F2** 398 CoreMark 120 MHz		STM32**F4** 608 CoreMark 180 MHz	STM32**H7** 3224 CoreMark 240 MHz Cortex -M4 480 MHz Cortex -M7	STM32**F7** 1082 CoreMark 216 MHz
Mainstream MCUs	STM32**F0** 106 CoreMark 48 MHz	STM32**G0** 142 CoreMark 64 MHz	STM32**F1** 177 CoreMark 72 MHz		STM32**F3** 245 CoreMark 72 MHz	STM32**G4** 550 CoreMark 170 MHz	
Ultra-low Power MCUs		STM32**L0** 75 CoreMark 32 MHz	STM32**L1** 93 CoreMark 32 MHz	STM32**L5** 424 CoreMark 110 MHz	STM32**L4** 273 CoreMark 80 MHz	STM32**L4+** 409 CoreMark 120 MHz	
Wireless MCUs					STM32**WL** 161 CoreMark 48 MHz	STM32**WB** 216 CoreMark 64 MHz	
Arm® Cortex® core	M0	M0+	M3	M33	M4	M7	Dual A7 + M4

LONGEVITY 10 YEARS COMMITMENT

● Optimized for mixed-signal applications

● Cortex-M0+ Radio co-processor

life.augmented

Advanced HMI with graphics and video on top of real time applications

HD video decode
with Dual Arm Cortex-A7 @ 800 MHz

Better user experience
powered by advanced OpenGL 3D GPU

Wide range of partners ready to support you on many topics:
Graphics, HW & SW Services…

Seamless and flexible combination of audio and real time processing
with Cortex-A + Cortex-M architecture

life.augmented

STM32 MCU and MPU Roadmap

MPU							STM32**MP1** 4158 CoreMark 800 MHz Cortex -A7 209 MHz Cortex -M4
High Perf MCUs			STM32**F2** 398 CoreMark 120 MHz		STM32**F4** 608 CoreMark 180 MHz	STM32**H7** 3224 CoreMark 240 MHz Cortex -M4 480 MHz Cortex -M7	STM32**F7** 1082 CoreMark 216 MHz
Mainstream MCUs	STM32**F0** 106 CoreMark 48 MHz	STM32**G0** 142 CoreMark 64 MHz	STM32**F1** 177 CoreMark 72 MHz		STM32**F3** 245 CoreMark 72 MHz	STM32**G4** 550 CoreMark 170 MHz	
Ultra-low Power MCUs		STM32**L0** 75 CoreMark 32 MHz	STM32**L1** 93 CoreMark 32 MHz	STM32**L5** 424 CoreMark 110 MHz	STM32**L4** 273 CoreMark 80 MHz	STM32**L4+** 409 CoreMark 120 MHz	
Wireless MCUs					STM32**WL** 161 CoreMark 48 MHz	STM32**WB** 216 CoreMark 64 MHz	
Arm® Cortex® core	M0	M0+	M3	M33	M4	M7	Dual A7 + M4

LONGEVITY 10 YEARS COMMITMENT

Optimized for mixed-signal applications

Cortex-M0+ Radio co-processor

life.augmented

Other STM32 Options for Graphics

- STM32G0
  - Cost optimized solution supporting SPI displays

MPU							STM32MP1 4158 CoreMark 800 MHz Cortex -A7 209 MHz Cortex -M4
High Perf MCUs			STM32F2 398 CoreMark 120 MHz		STM32F4 608 CoreMark 180 MHz	STM32H7 3224 CoreMark 240 MHz Cortex -M4 480 MHz Cortex -M7	STM32F7 1082 CoreMark 216 MHz
Mainstream MCUs	STM32F0 106 CoreMark 48 MHz	STM32G0 142 CoreMark 64 MHz	STM32F1 177 CoreMark 72 MHz		STM32F3 245 CoreMark 72 MHz	STM32G4 550 CoreMark 170 MHz	
Ultra-low Power MCUs		STM32L0 75 CoreMark 32 MHz	STM32L1 93 CoreMark 32 MHz	STM32L5 424 CoreMark 110 MHz	STM32L4 273 CoreMark 80 MHz	STM32L4+ 409 CoreMark 120 MHz	
Wireless MCUs					STM32WL 161 CoreMark 48 MHz	STM32WB 216 CoreMark 64 MHz	
Arm® Cortex® core	M0	M0+	M3	M33	M4	M7	Dual A7 + M4

LONGEVITY 10 YEARS COMMITMENT

Optimized for mixed-signal applications

Cortex-M0+ Radio co-processor

life.augmented

Other STM32 Options for Graphics

- STM32F4 Access and Foundation Lines
  - Cost optimized options supporting SPI or 8080/6800 interfaces displays

MPU							STM32MP1 4158 CoreMark 800 MHz Cortex -A7 209 MHz Cortex -M4
High Perf MCUs			STM32F2 398 CoreMark 120 MHz		STM32F4 608 CoreMark 180 MHz	STM32H7 3224 CoreMark 240 MHz Cortex -M4 480 MHz Cortex -M7	STM32F7 1082 CoreMark 216 MHz
Mainstream MCUs	STM32F0 106 CoreMark 48 MHz	STM32G0 142 CoreMark 64 MHz	STM32F3 177 CoreMark 72 MHz		STM32G0 245 CoreMark 72 MHz	STM32G4 550 CoreMark 170 MHz	
Ultra-low Power MCUs		STM32L0 75 CoreMark 32 MHz	STM32L1 93 CoreMark 32 MHz	STM32L5 424 CoreMark 110 MHz	STM32L4 273 CoreMark 80 MHz	STM32L4+ 409 CoreMark 120 MHz	
Wireless MCUs					STM32WL 161 CoreMark 48 MHz	STM32WB 216 CoreMark 64 MHz	
Arm® Cortex® core	M0	M0+	M3	M33	M4	M7	Dual A7 + M4

LONGEVITY 10 YEARS COMMITMENT

Optimized for mixed-signal applications

Cortex-M0+ Radio co-processor

life.augmented

Other STM32 Options for Graphics

MPU							STM32**MP1** 4158 CoreMark 800 MHz Cortex -A7 209 MHz Cortex -M4
High Perf MCUs			STM32**F2** 398 CoreMark 120 MHz		STM32**F4** 608 CoreMark 180 MHz	STM32**H7** 3224 CoreMark 240 MHz Cortex -M4 480 MHz Cortex -M7	STM32**F7** 1082 CoreMark 216 MHz
Mainstream MCUs	STM32**F0** 106 CoreMark 48 MHz	STM32**G0** 142 CoreMark 64 MHz	STM32**F1** 177 CoreMark 72 MHz		STM32**F3** 245 CoreMark 72 MHz	STM32**G4** 550 CoreMark 170 MHz	
Ultra-low Power MCUs	STM32**L0** 75 CoreMark 32 MHz	STM32**L1** 93 CoreMark 32 MHz	STM32**L5** 424 CoreMark 110 MHz		STM32**L4** 273 CoreMark 80 MHz	STM32**L4+** 409 CoreMark 120 MHz	
Wireless MCUs					STM32**WL** 161 CoreMark 48 MHz	STM32**WB** 216 CoreMark 64 MHz	
Arm® Cortex® core	M0	M0+	M3	M33	M4	M7	Dual A7 + M4

- STM32WL and STM32WB
  - Great options for SPI display with SubGHz or BLE/Zigbee/Thread connectivity

LONGEVITY 10 YRS COMMITMENT

Optimized for mixed-signal applications

Cortex-M0+ Radio co-processor

life.augmented

STM32 Devices with Graphics Acceleration

MPU							STM32**MP1** 4158 CoreMark 800 MHz Cortex -A7 209 MHz Cortex -M4
High Perf MCUs			STM32**F2** 398 CoreMark 120 MHz		STM32**F4** 608 CoreMark 180 MHz	STM32**H7** 3224 CoreMark 240 MHz Cortex -M4 480 MHz Cortex -M7	STM32**F7** 1082 CoreMark 216 MHz
Mainstream MCUs	STM32**F0** 106 CoreMark 48 MHz	STM32**G0** 142 CoreMark 64 MHz	STM32**F1** 177 CoreMark 72 MHz		STM32**F3** 245 CoreMark 72 MHz	STM32**G4** 550 CoreMark 170 MHz	
Ultra-low Power MCUs		STM32**L0** 75 CoreMark 32 MHz	STM32**L1** 93 CoreMark 32 MHz	STM32**L5** 424 CoreMark 110 MHz	STM32**L4** 273 CoreMark 80 MHz	STM32**L4+** 409 CoreMark 120 MHz	
Wireless MCUs					STM32**WL** 161 CoreMark 48 MHz	STM32**WB** 216 CoreMark 64 MHz	
Arm® Cortex® core	M0	M0+	M3	M33	M4	M7	Dual A7 + M4

LONGEVITY 10 YEARS COMMITMENT

● Optimized for mixed-signal applications

● Cortex-M0+ Radio co-processor

life.augmented

Latest STM32 MCUs with Advanced Graphics

Cost Optimized – Feature Enhanced!

STM32H72x
STM32H73x

High Performance
- Cortex® M7 at 550MHz

Advanced Graphics Features
- Chrom-ART™
- TFT controller

External Memory Options
- Dual Octo-SPI with XiP
- Flexible Memory Controller

STM32H7Ax
STM32H7Bx

BoM Optimized with 1.4MB Internal RAM
- Supports 480x320 24bit without external RAM

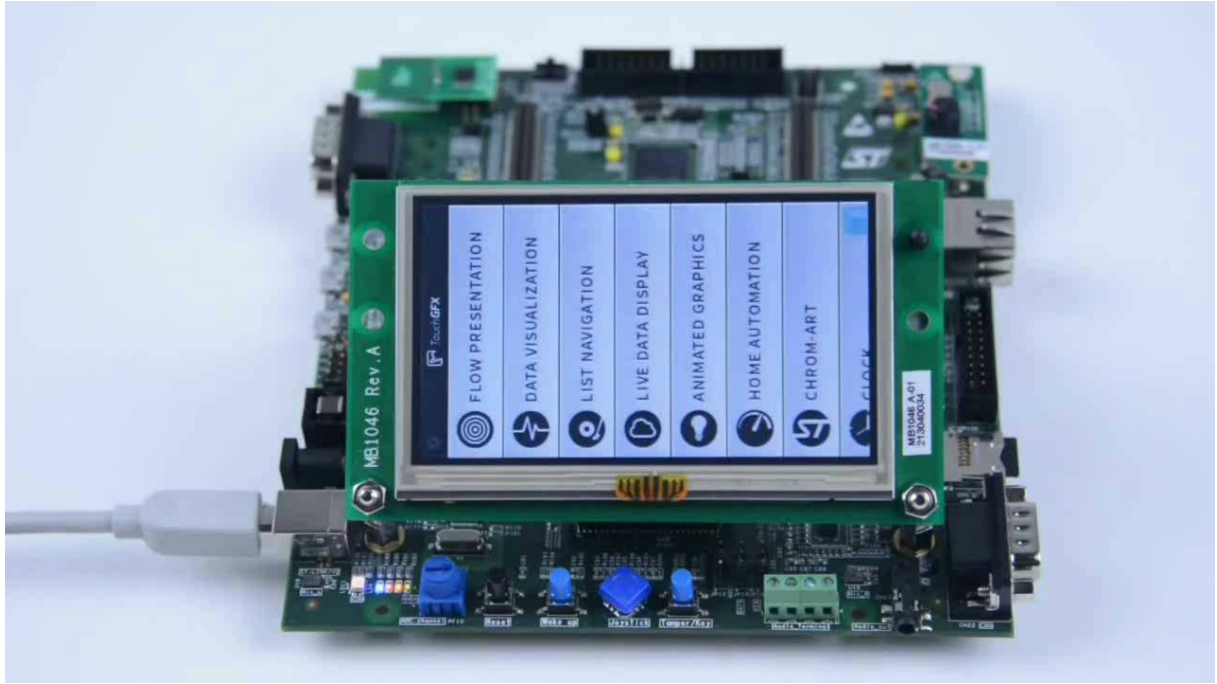
Advanced Graphics Features
- Chrom-ART™
- JPEG Codec
- TFT controller
- Chrom-GRC™

Large choice of packages
- QFP, BGA and CSP
- Graphics support starting from QFP 64 pins

life.augmented

STM32 MCU Graphics Optimizations

- Chrom-ART Accelerator
  - Direct Memory Access, reducing CPU usage
  - Alpha Blending



- Hardware JPEG Codec
  - Accelerated JPEG Decode for Videos

- Chrom-GRC
  - Optimized memory usage for non-rectangular LCDs

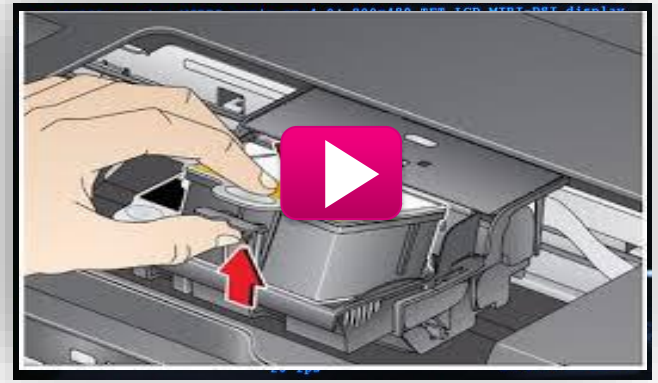
life.augmented

STM32 MCU Graphics Optimizations

- Chrom-ART Accelerator
  - Direct Memory Access, reducing CPU usage
  - Alpha Blending

- Hardware JPEG Codec
  - Accelerated JPEG Decode for Videos

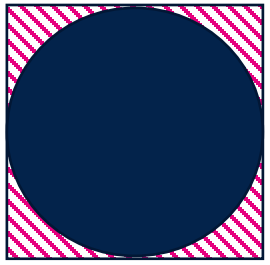
- Chrom-GRC
  - Optimized memory usage for non-rectangular LCDs



life.augmented

STM32 MCU Graphics Optimizations

- Chrom-ART Accelerator
  - Direct Memory Access, reducing CPU usage
  - Alpha Blending
- Hardware JPEG Codec
  - Accelerated JPEG Decode for Videos
- Chrom-GRC
  - Optimized memory usage for non-rectangular LCDs



Saved Memory

- **For 360x360 round display**
  - @16bpp **~205kBytes** (vs 253kBytes)
  - @24bpp **~307kBytes** (vs 380kBytes)
- **For 400x400 round display**
  - @16bpp: **250kBytes** (vs 312kBytes)
  - @24bpp: **372kBytes** (vs 469kBytes)

Free Graphics Framework and Tools

TouchGFX – Unbeatable GUI performance on STM32

Maximum Performance

The TouchGFX technology enables you to achieve the highest level of smartphone GUI performance on STM32 devices

Create Anything

The structure and flexibility of TouchGFX gives the Developer control to easily create unique UI designs

Easy to Use

TouchGFX combines a WYSIWYG designer, auto code generation and a PC simulator with the efficiency and flexibility of the C++ language

life.augmented

TouchGFX

Extended Graphics Ecosystem

Advanced graphics services and support – ST approved

- Extended Support
- Porting
- Application Development
- Onsite Development
- Training
- Hardware Development
- Full Turnkey Solutions
- Electronic Manufacturing
- User Experience
- Graphic Design

BRESSLERGROUP
edt
EKTOS
EMBEDDED PARTNERS
EMG SOFT
itk ENGINEERING
iWave Embedding Intelligence
Mjølner INFORMATICS
PsiControl
SDATAWAY
泰辑科技 Taiji Software
SIANA SYSTEMS

STM32 Partner Graphics Software Options

Advanced graphics software ported for STM32 hardware

Embedded Wizard

SEGGER

MICROEJ®

Qt

KORU

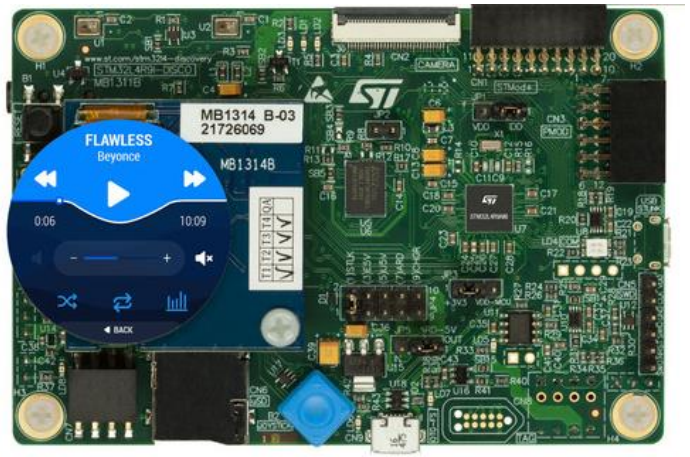
Crank software inc.

life.augmented

Latest Graphic Hardware Platforms

STM32H7B3I-DK

STM32L4R9I-DISCO



STM32H735G-DK

X-NUCLEO-GFX01M1

life.augmented

Hands-on Requirements
STM32H7B3I-DK

STM32H7B3I-DK

life.augmented

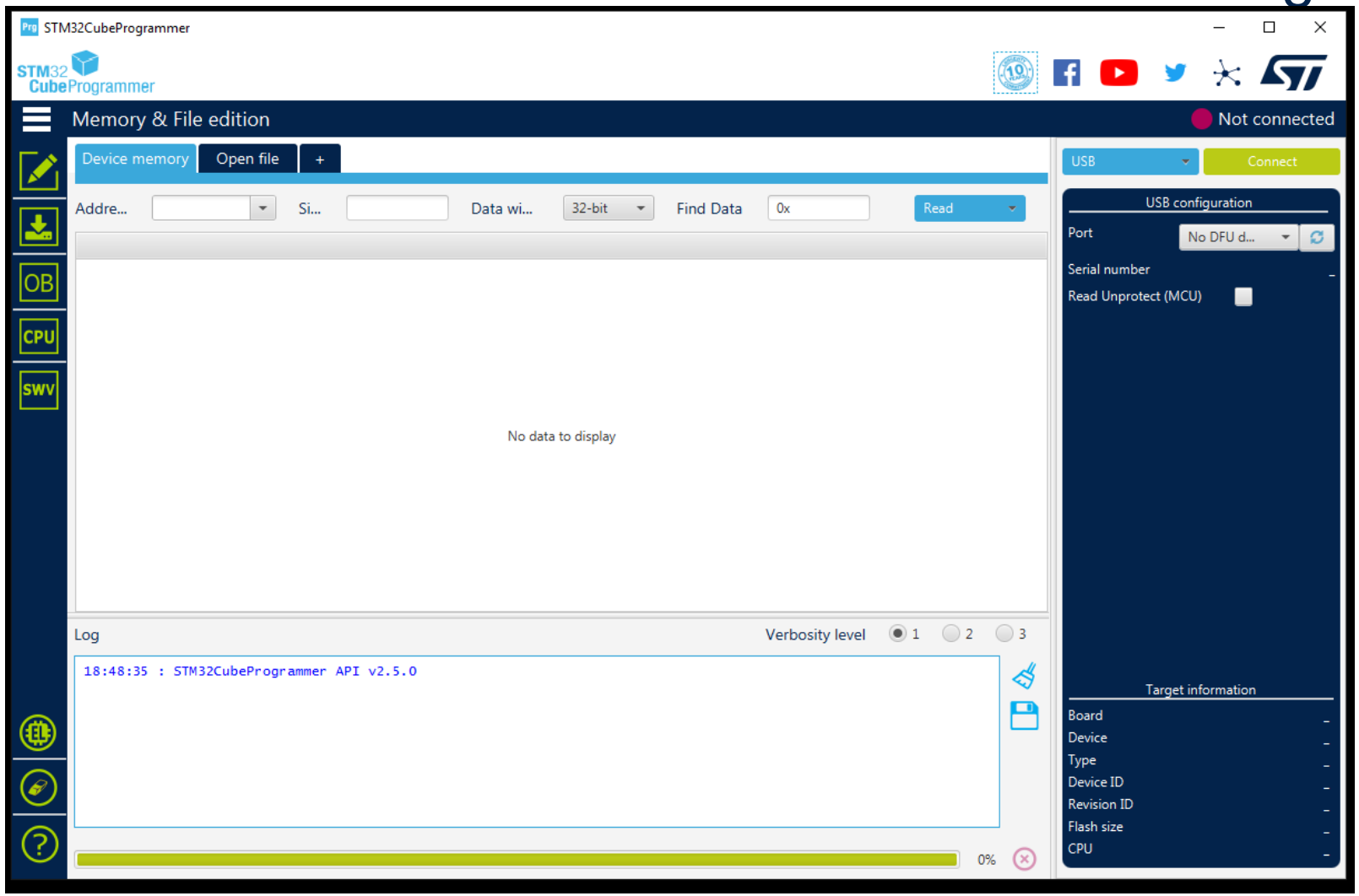
Hands-on Requirements

TouchGFX Designer 4.15.0

Search for “X-Cube-TouchGFX” on ST.com
Follow readme.txt to install TouchGFX Designer

Hands-on Requirements

STM32CubeProgrammer 2.5.0



Search for “STM32CubeProg” on ST.com
Select version 2.5.0

Hands-on Requirements

Any Text Editor

Notepad++

GNU Emacs

life.augmented

Agenda

- ✓ STM32 Graphics Portfolio
- ✓ STM32 Graphics Ecosystem
- Intro to Embedded Graphics
- TouchGFX Introduction
- Hands-on with TouchGFX
- Wrap-up

life.augmented

Thank you

life.augmented