Getting to Know the Easy-to-Use FreeMASTER Runtime Debugging Tool – Now Part of MCUXpresso SDK

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SECURE CONNECTIONS
FOR A SMARTER WORLD

AGENDA

- FreeMASTER and MCUXpresso overview
- Where to find examples in MCUXpresso SDK
- Example walk through
  – Using FreeMASTER to view/control an application with no modifications
  – MCUXpresso SDK FreeMASTER examples
  – Exchanging data with another application (Excel)
- Introduction to other capabilities
- Q & A

FREEMASTER PURPOSE AND ORIGINS

- From beginnings in 2000, initially used for real-time variable monitoring
- Evolution has continued, with extension of connection interface options
  - UART, CAN, BDM/PD-BDM and JTAG/SWD (debug channels), or custom
- Four aspects
  - Connect: …to the board over UART, CAN, BDM, JTAG/SWD or custom interface
  - Monitor: read and variables in run time
  - Control: write variables and send commands
  - Share: …access to control and display variables. HTML/Javascript pages, Matlab, Excel, etc.
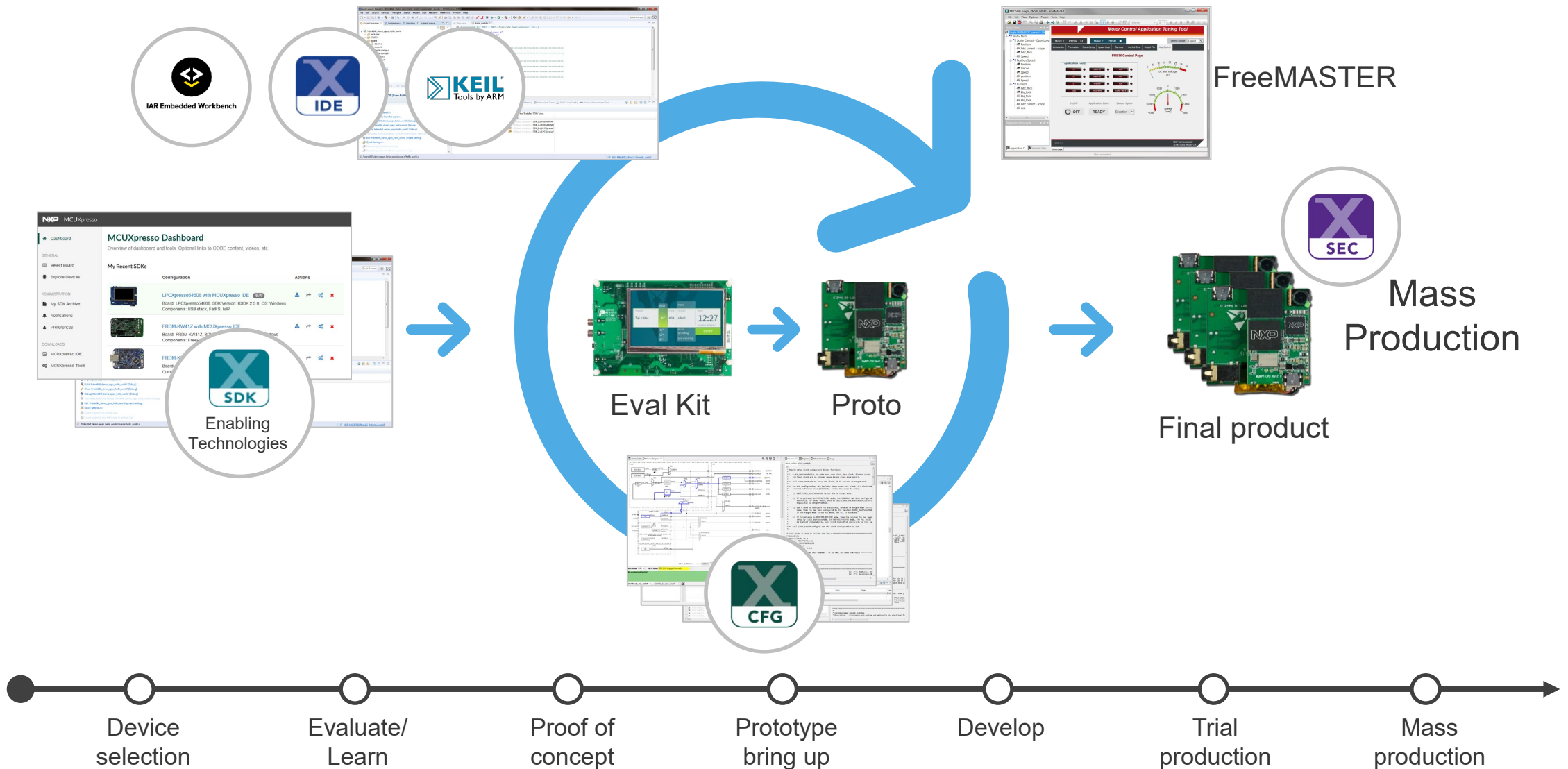
WHY IS FREEMASTER USED?

- Debug and tune at run time, changing algorithm parameters while code is running
- System dynamics can be monitored/controlled
- Enables UI concepts to be easily prototyped
- Linking to custom frameworks using ActiveX for logging, modelling and analysis
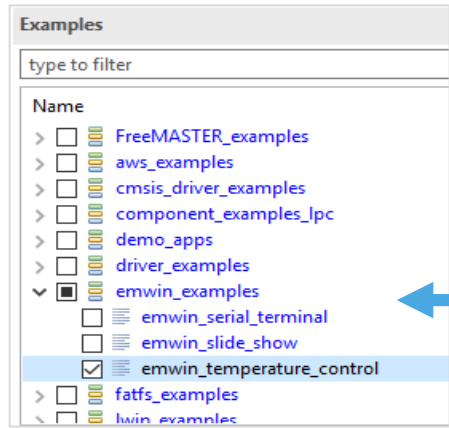 - E.g. Matlab, Excel, etc.

THE MCUXPRESSO ECOSYSTEM

> **Core Technologies from NXP**
> - MCUXpresso IDE
> - MCUXpresso SDK
> - MCUXpresso Config Tools
> - MCUXpresso Secure Provisioning Tool

> **Enabling Software Technologies**
> - Run time software libraries and middleware
> - Enable customers to focus on differentiation
> - From NXP and partners

> **Enabling Tools Technologies**
> - Partner IDEs
> - Debug Probes
> - Development Boards
> - From NXP and partners → **FreeMASTER**

STREAMLINED MCUXPRESSO DEVELOPMENT FLOW

FreeMASTER

Enabling Technologies

Eval Kit

Proto

Final product

Mass Production

Device selection — Evaluate/ Learn — Proof of concept — Prototype bring up — Develop — Trial production — Mass production
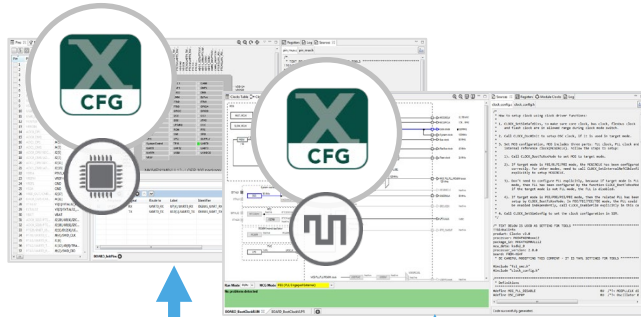
EVALUATION TO PROOF-OF-CONCEPT ON NXP EVALUATION BOARDS

Import/clone one of a large range of SDK examples
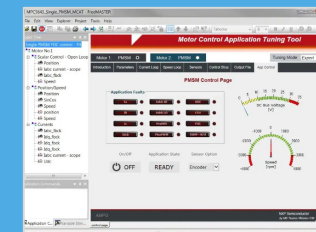
Easy selection from with MCUXpresso IDE

Modify pin/clock settings for your application

Simple, push button updates into IDE project

FreeMASTER:

Visualize data in real time

Implement debug control interfaces

Or use MCUXpresso IDE new project wizard and peripheral config tool to select and configure drivers and middleware

NXP FREEMASTER
ADVANCED DATA VISUALIZATION AND CONTROL

- Enables runtime configuration & tuning of embedded software applications

- Enable HTML/JScript, Excel, Matlab or other scriptable framework to add MCU hardware to a control loop

- Used as UI for NXP's Motor Control, Touch Sensing and Wireless Charging stacks

    - Also available for any custom application

MCU Memory Access

Communication DLL Library

Connect over UART, USB-CDC or CAN

Direct memory access using j-Link, CMSIS-DAP or P&E

Share any connection over the internet
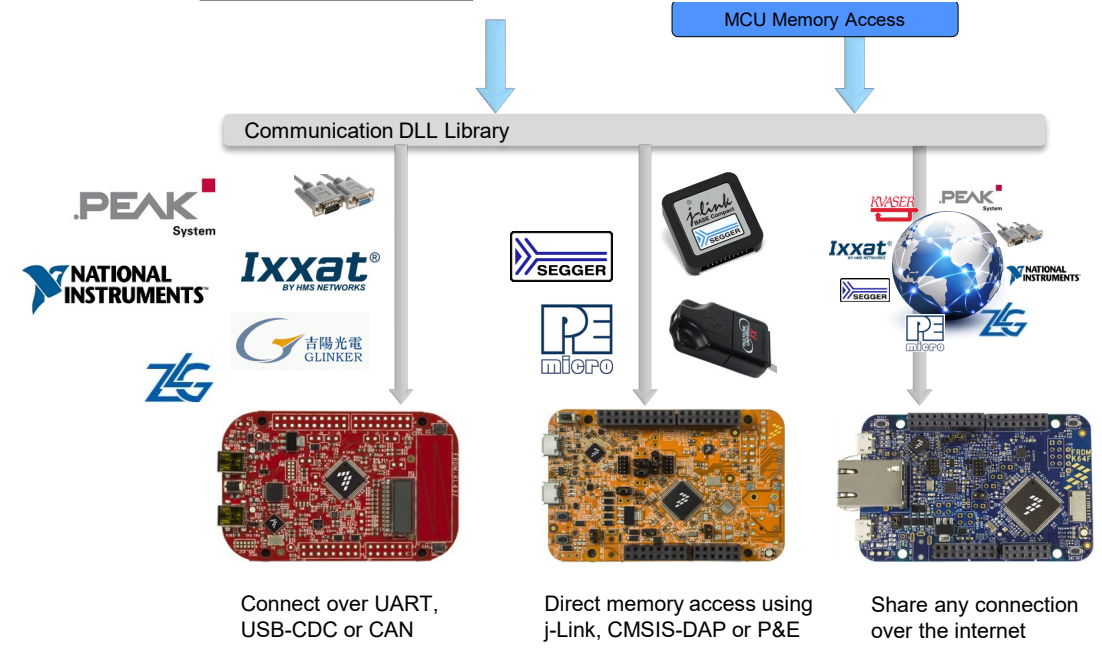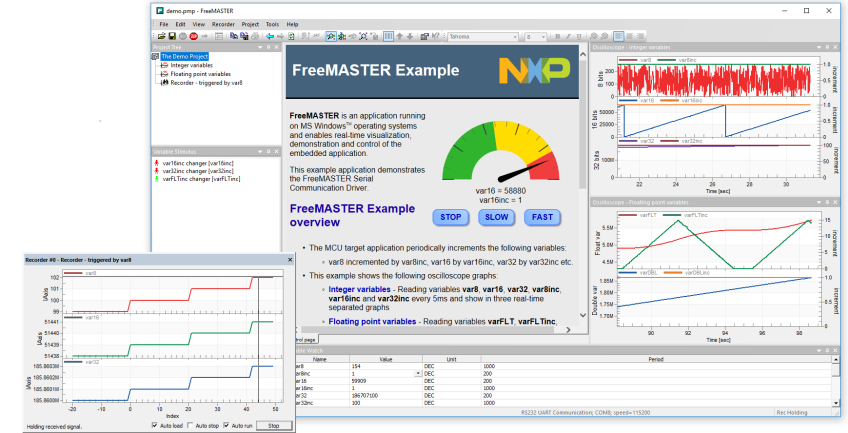
SELECTING FREEMASTER AS AN OPTION IN MCUXPRESSO SDK BUILDER

- Available for all supported toolchains
  - MCUXpresso IDE
  - Arm Keil uVision
  - IAR EWARM
  - GCC w/ cmake
- FreeMASTER is also included in the SDK packages that can be installed directly from MCUXpresso IDE
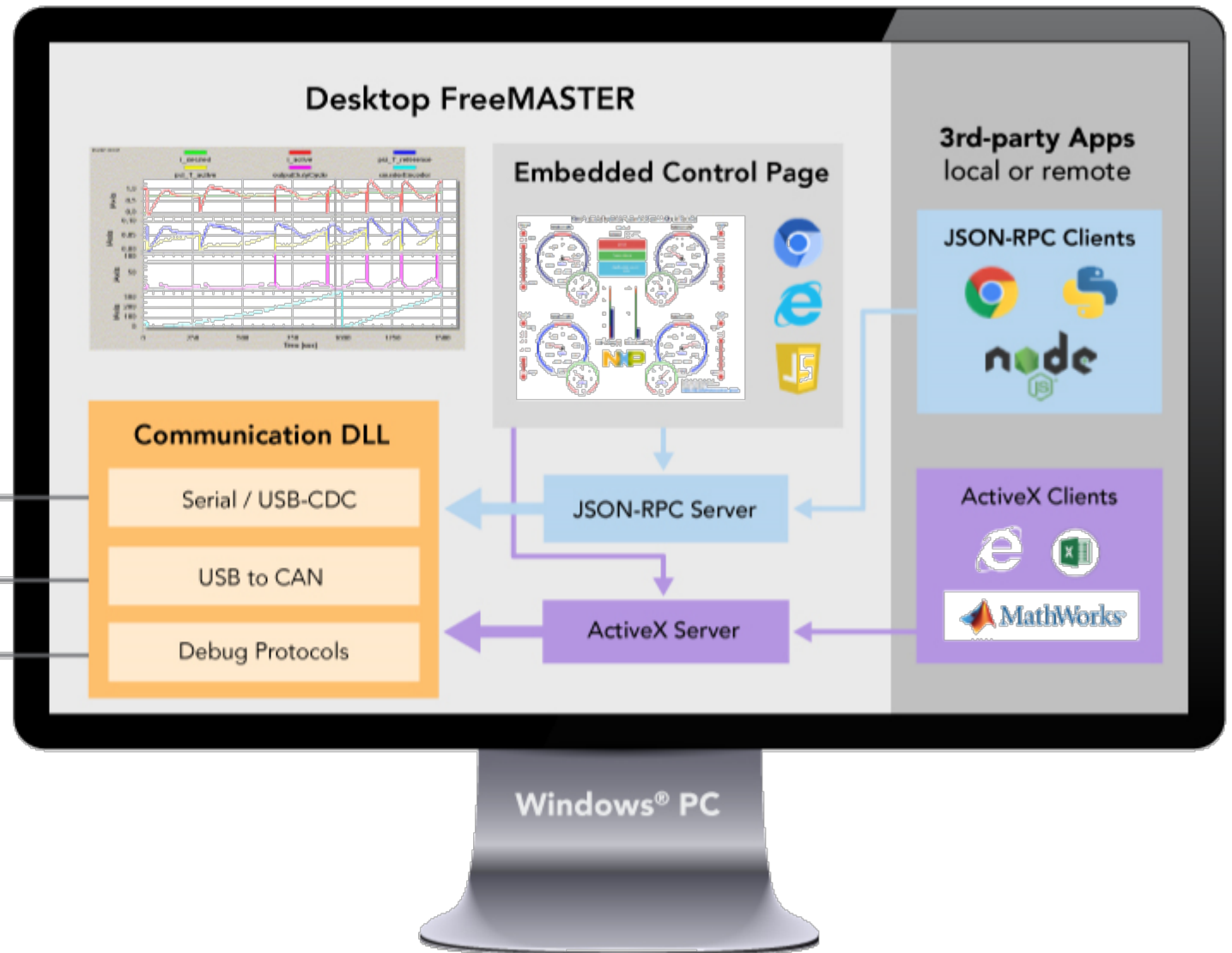
ADDING FREEMASTER TO A PROJECT (IN MCUXPRESSO IDE)
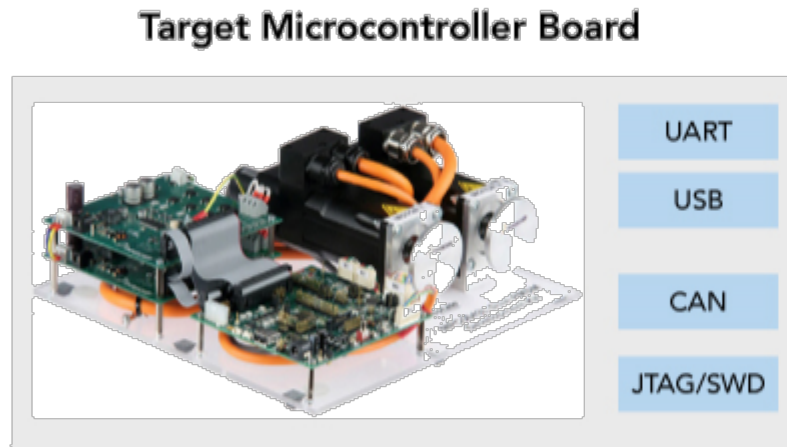
- For New Projects, select FreeMASTER as a middleware option
- For an existing project, right click on project then select Manage SDK components

- Select FreeMASTER from Middleware
- Configure freemaster_cfg.h for project needs
  (in the source directory with main project)

FREEMASTER 3.0

Target Microcontroller Board

UART

USB

CAN

JTAG/SWD

Desktop FreeMASTER

Embedded Control Page

3rd-party Apps
local or remote

JSON-RPC Clients

Communication DLL

Serial / USB-CDC

USB to CAN

Debug Protocols

JSON-RPC Server

ActiveX Clients

ActiveX Server

MathWorks

Windows® PC

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FREEMASTER LITE

- FreeMASTER core without user interface, to be used with other applications
  - Runs "invisibly" on PC connected to target
- Supports JSON-RPC with third-party applications
- For example, demos seen today could be seen (HTML page with gauge/buttons) on a standalone browser
  - Not variables, graphs, recorder

FREEMASTER LITE

Target Microcontroller Board

UART
USB
CAN
JTAG

FreeMASTER Lite Service

Embedded Control Page

Communication DLL
- Serial / USB-CDC
- USB to CAN
- Debug Protocols

JSON-RPC Server

Web Server

retrieved pages

3rd-party Apps
local or remote

JSON-RPC Clients
node

Web Browser
Control page

Windows® /
Linux® PC
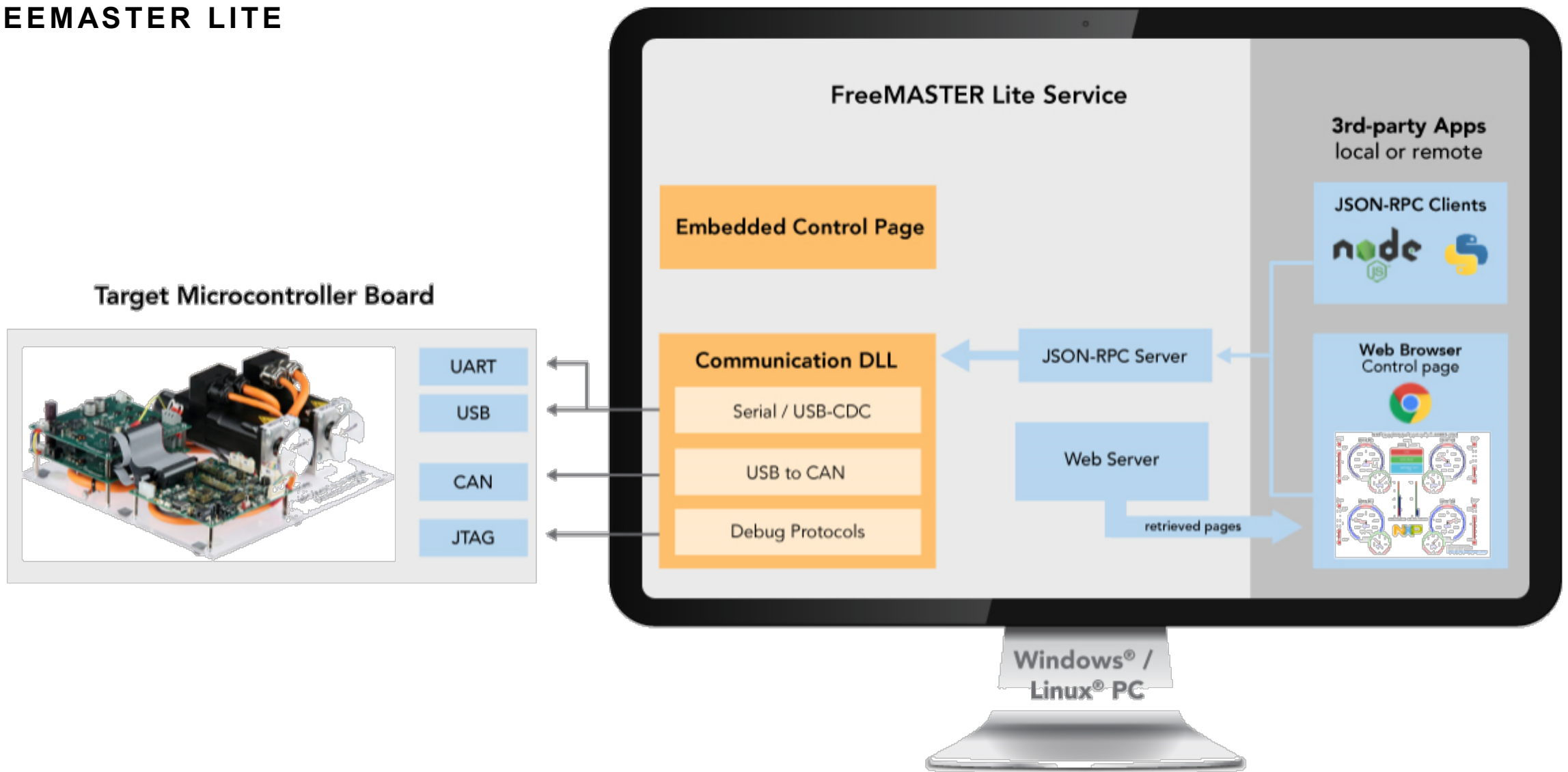
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MCUXPRESSO SOFTWARE AND TOOLS
ADDITIONAL WEB RESOURCES

MCUXpresso Software and Tools Overview Page:
https://www.nxp.com/mcuxpresso

MCUXpresso Software and Tools Community Site:
https://community.nxp.com/community/mcuxpresso

IDE	SDK	CFG	SEC	FreeMASTER
Website / Community	Website / Community	Website / Community	Website / Community	Website / Community

FreeMASTER Support devices

Supported Devices Tab (FreeMASTER landing page)

Why?

To build a robust community of support for FreeMASTER with idea share.

How to participate?

1. **Submit your idea** through June 19, 2020 to the NXP Community, request your board of choice (one of the following: i.MX RT1020 EVK , LPC55S28 development board and S32K144EVB), available on first come, first served basis until quantities are depleted.

2. Once you've created your code example, **post a brief description and a screenshot of your dashboard along with a ZIPped code** to *the* original blog comment thread.

Click here for complete details!

HOW TO CONTROL AND VISUALIZE DATA FROM YOUR EMBEDDED APPLICATION WITH FREEMASTER | A FOUR-PART WEBINAR SERIES

- **Part 1: Today**
  Get to Know the Easy-to-Use FreeMASTER Runtime Debugging Tool – Now Part of MCUXpresso SDK

- Part 2: Thursday, April 30 | 10 AM CDT | Register Here >>
  Tips for Enhancing Embedded Applications with FreeMASTER UI from Various Development Environments like S32DS and Matlab/Simulink

- Part 3: Tuesday, May 5 | 10 AM CDT | Register Here >>
  Introduction to FreeMASTER Dashboard Coding Using HTML, JavaScript, ActiveX and JSON-RPC

- Part 4: Tuesday, May 12 | 10 AM CDT | Register Here >>
  Getting Started with FreeMASTER Lite and JSON-RPC Protocol: From Scripting to Visual Dashboards with Python and JavaScript

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