AN14402

使用MCU-Link和LinkServer并行烧写多个目标器件

第1.0版 — 2024年10月18日   应用笔记

文档信息

信息	内容
关键词	AN14402、MCU-Link、LinkServer，烧写多个目标器件
摘要	本文介绍了如何在Windows操作系统环境下并行烧写多个目标器件，从而简化任务并节省时间。

1   概述

一次对多个目标器件进行烧写通常是一项复杂且耗时的任务。本应用笔记介绍了如何使用低成本的MCU-Link和LinkServer调试方案，在Windows平台上对多个目标器件并行烧写，从而简化调试过程并节省时间。

2   系统架构

假设需要同时对三个目标器件进行烧写。

图1所示为并行烧录多个目标器件的系统架构图。每个目标器件都需要搭配一个MCU-Link。

MCU-Link是一款功能强大且经济高效的调试探头，可以无缝地与MCUXpresso-IDE配合使用。MCUXpresso for Visual Studio Code与支持CMSIS-DAP协议的第三方IDE兼容。MCU-Link还包含USB转UART的桥接功能（VCOM），可在目标MCU和主机之间实现串行连接。

在本系统中，主机上的LinkServer可以同时连接三个MCU-Link。LinkServer作为一款GDB服务器管理工具软件，不仅能够启动和管理恩智浦的调试探头，而且具备命令行方式的目标闪存烧写功能。

图1并行烧写多个目标器件

USB hub

Target   Target   Target
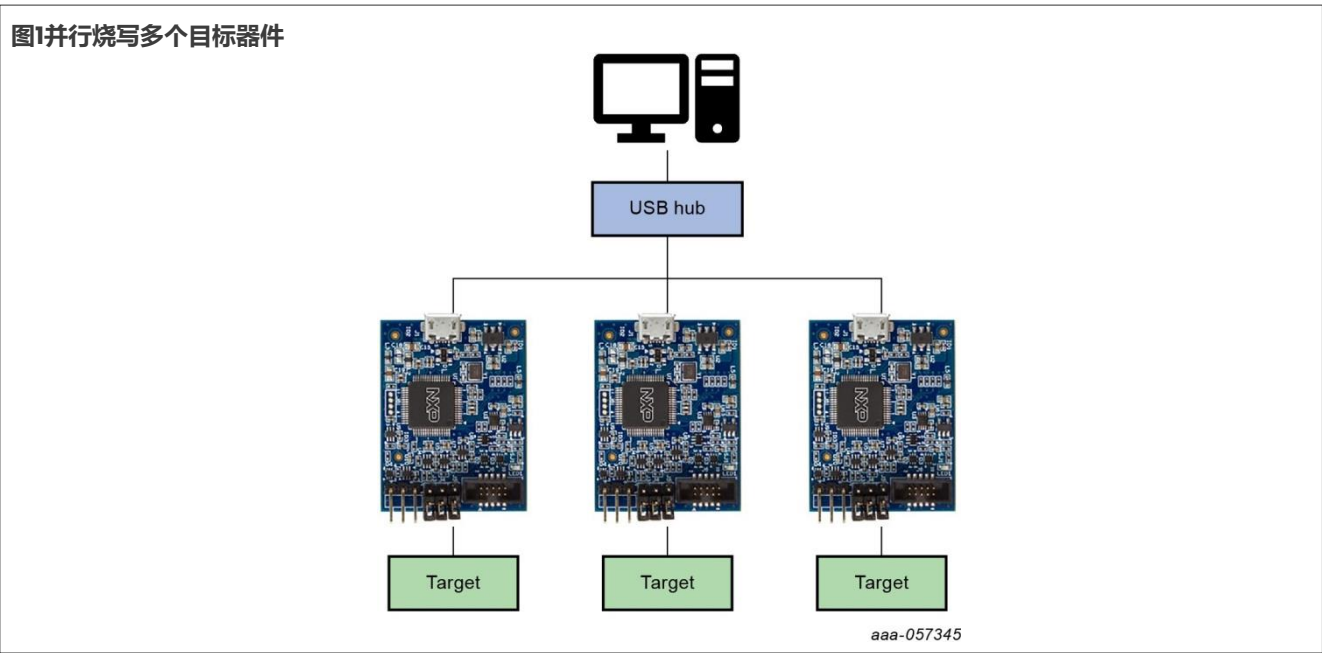
aaa-057345
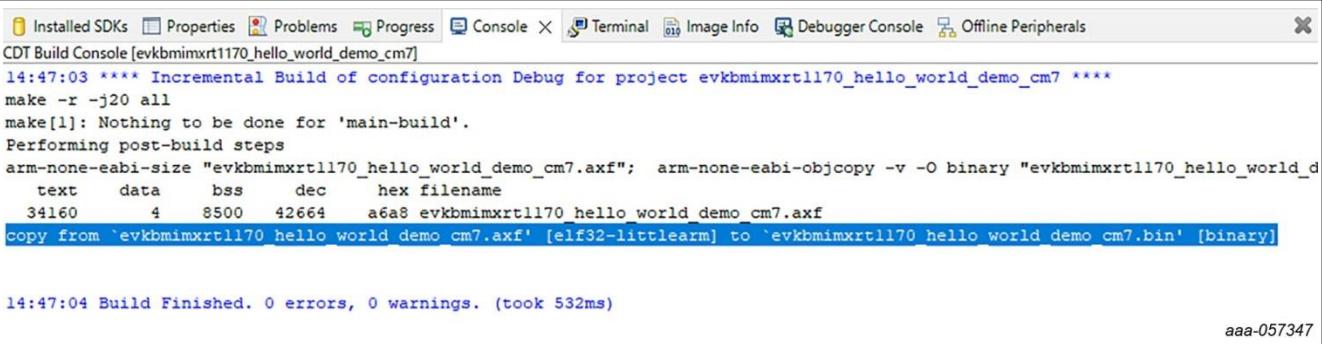
3   在MCUXpresso IDE中创建二进制映像

通过MCUXpresso IDE编译生成的二进制映像文件可以直接下载到各个目标器件。为了在构建后直接生成二进制映像文件，可在构建设置中取消对以下命令的注释：`arm-none-eabi-objcopy -v -O binary` `"${BuildArtifactFileName}"` `${BuildArtifactFileBaseName}.bin`，如图2所示。

技术文档反馈
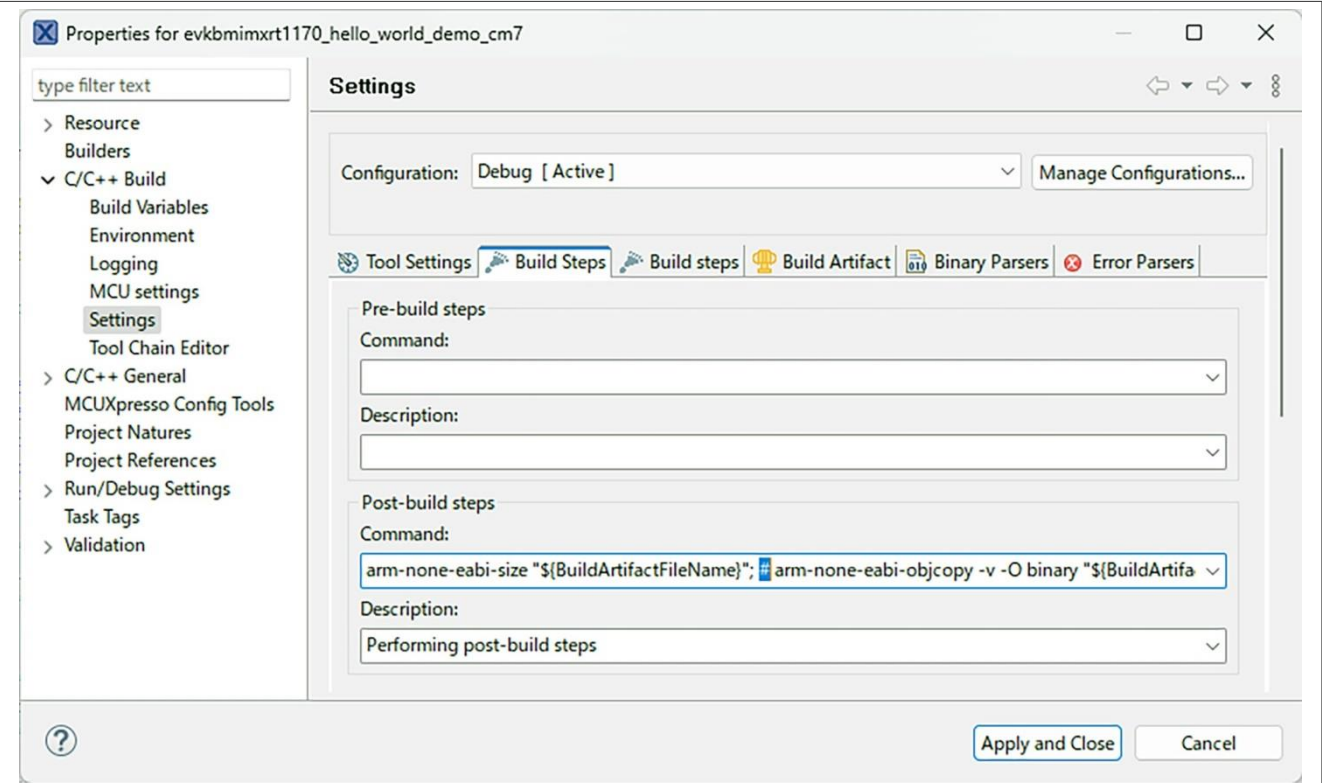
图2 构建后设置

可以确保该二进制映像是由可执行文件生成的，如图3所示。

图3 由ARM可执行格式文件生成的二进制映像

4 LinkServer脚本

LinkServer需要执行一些脚本来并行处理多个MCU-Link目标器件。本节将介绍本文涉及的两个批处理文件：*program_all_probes.bat*和*program_probe.bat*。

首先，使用一个名为`probelist`的底层命令来显示连接到主机的所有探头信息：

```
C:\nxp\LinkServer_1.5.30\binaries>redlinkserv --commandline
redlink>probelist
Index = 1
Manufacturer = NXP Semiconductors
Description = MCU-LINK on-board (r0E2) CMSIS-DAP V3.133
```

AN14402

用户指南

本文件中提供的所有信息均受法律免责声明的约束。

第1.0版— 2024年10月18日

© 2024 NXP B.V. 版权所有。

技术文档反馈

3 / 8

```
Serial Number = FDNX2FVTNFTVJ
VID:PID = 1FC9:0143
Path = 0002:000a:00
redlink>exit
```

如果想要在主机上识别多个探头中的某一个，请使用该探头对应的序列号。

可以通过识别探头来烧写目标器件。下面给出了一个示例：

```
C:\nxp\LinkServer_1.5.30>LinkServer flash --probe FDNX2FVTNFTVJ MIMXRT1176xxxxx:MIMXRT1170-EVK load
 --addr 0x300
00000 C:/Users/<userID>/Downloads/evkbmimxrt1170_hello_world_demo_cm7.bin --erase-all
INFO: Exact match for MIMXRT1176xxxxx:MIMXRT1170-EVK found
INFO: Selected device MIMXRT1176xxxxx:MIMXRT1170-EVK
…
…
Wc: VTOR = 0x30002000
Wc: Set DEMCR = 0x010007F1
Wc: ============= END SCRIPT ===========================
```

注：为了优化，可以省略--erase-all。

在批处理文件program_all_probes.bat中，使用`probelist`来获取各探头的序列号，并以新进程的方式
启动批处理文件脚本*program_probe.bat*。

以下是一个示例脚本：

```
set DOWNLOAD_BIN=./evkbmimxrt1170_hello_world_demo_cm7.bin
set LINKSERVER_BIN=C:/nxp/LinkServer_1.5.30
(
    echo probelist
    echo exit
) | "%LINKSERVER_BIN%/binaries/redlinkserv" --commandline | findstr "Serial Number" >probelist.txt

for /f "tokens=4 delims= " %%A in (probelist.txt) do
    ( echo Probe %%A found.
    start program_probe.bat %%A "%DOWNLOAD_BIN%" %LINKSERVER_BIN%
    timeout 3 > nul
)
```

通过运行批处理脚本文件*program_probe.bat*，可以实现擦除、烧写和验证已识别到的目标器件中的闪存。示例
脚本如下所示：

```
%3/LinkServer flash --probe %1 MIMXRT1176xxxxx:MIMXRT1170-EVKB load    --addr 0x30000000 %2 --erase-
all   > probe_%1.log 2>&1
%3/LinkServer flash --probe %1 MIMXRT1176xxxxx:MIMXRT1170-EVKB verify --addr 0x30000000 %2
    >> probe_%1.log 2>&1
exit 0
```

5 运行演示工程

要运行该演示工程，请执行以下步骤：

1. 在主机上安装 LinkServer 1.5.30 版。
2. 使用 USB 线缆将主机与任意数量的 RT1170-EVKB 的 OpenSDA USB 端口连接。
3. 运行批处理文件脚本 *program_all_probes.bat*。

脚本运行时，会自动检测所有的探头，并打开同样数量的新窗口，如图4所示。

以下是同时连接多个探头的示例脚本：

```
>program_all_probes.bat
Probe F0NU2JRCKEWYT found.
Probe FDNX2FVTNFTVJ found.
Probe 0P0NJTEBAJR1G found.
```


aaa-057348

图 4. 每个探头都会打开一个新窗口

在完成擦除、烧写和校验操作后，这些窗口会自动关闭。相应的日志会保存在./ probe_{serial number}.log文件中。如果演示工程运行无报错，则表明验证成功。

观察结果：在本实验中，当同时连接三个目标器件时，并行烧录比串行烧写快了约三倍，如表1所示：

表1. 串行烧录与并行烧录对比

烧录方式	处理时间[s]
串行	424
并行	150

6 结论

MCU-Link与LinkServer可用于并行烧写多个目标器件。这个方案也可以扩展到MacOS或Linux等其他平台。

7 Note about the source code in the document

Example code shown in this document has the following copyright and BSD-3-Clause license:
Copyright 2024 NXP Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

AN14402

用户指南

本文件中提供的所有信息均受法律免责声明的约束。

第1.0版－ 2024年10月18日

© 2024 NXP B.V. 版权所有。

技术文档反馈

5 / 8

1. Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
2. Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
3. Neither the name of the copyright holder nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED BY THE COPYRIGHT HOLDERS AND CONTRIBUTORS "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE COPYRIGHT HOLDER OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

8 修订历史

表2总结了对本文档的修订情况。

表2. 修订历史

文档编号	发布日期	说明
AN14402 v.1.0	2024年10月18日	首次公开发布

AN14402

用户指南   第1.0版 — 2024年10月18日

本文件中提供的所有信息均受法律免责声明的约束。

© 2024 NXP B.V. 版权所有。

技术文档反馈

6 / 8

Legal information

Definitions

Draft — A draft status on a document indicates that the content is still under internal review and subject to formal approval, which may result in modifications or additions. NXP Semiconductors does not give representations or warranties as to the accuracy or completeness of information included in a draft version of a document and shall have no liability for the consequences of use of such information.

Disclaimers

Limited warranty and liability — Information in this document is believed to be accurate and reliable. However, NXP Semiconductors does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information. NXP Semiconductors takes no responsibility for the content in this document if provided by an information source outside of NXP Semiconductors.

In no event shall NXP Semiconductors be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory.

Notwithstanding any damages that customer might incur for any reason whatsoever, NXP Semiconductors' aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the Terms and conditions of commercial sale of NXP Semiconductors.

Right to make changes — NXP Semiconductors reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

Suitability for use — NXP Semiconductors products are not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or equipment, nor in applications where failure or malfunction of an NXP Semiconductors product can reasonably be expected to result in personal injury, death or severe property or environmental damage. NXP Semiconductors and its suppliers accept no liability for inclusion and/or use of NXP Semiconductors products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

Applications — Applications that are described herein for any of these products are for illustrative purposes only. NXP Semiconductors makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Customers are responsible for the design and operation of their applications and products using NXP Semiconductors products, and NXP Semiconductors accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the NXP Semiconductors product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

NXP Semiconductors does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using NXP Semiconductors products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). NXP does not accept any liability in this respect.

Terms and conditions of commercial sale — NXP Semiconductors products are sold subject to the general terms and conditions of commercial sale, as published at https://www.nxp.com.cn/profile/terms, unless otherwise agreed in a valid written individual agreement. In case an individual agreement is concluded only the terms and conditions of the respective agreement shall apply. NXP Semiconductors hereby expressly objects to applying the customer's general terms and conditions with regard to the purchase of NXP Semiconductors products by customer.

Export control — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from competent authorities.

Suitability for use in non-automotive qualified products — Unless this document expressly states that this specific NXP Semiconductors product is automotive qualified, the product is not suitable for automotive use. It is neither qualified nor tested in accordance with automotive testing or application requirements. NXP Semiconductors accepts no liability for inclusion and/or use of non-automotive qualified products in automotive equipment or applications.

In the event that customer uses the product for design-in and use in automotive applications to automotive specifications and standards, customer (a) shall use the product without NXP Semiconductors' warranty of the product for such automotive applications, use and specifications, and (b) whenever customer uses the product for automotive applications beyond NXP Semiconductors' specifications such use shall be solely at customer's own risk, and (c) customer fully indemnifies NXP Semiconductors for any liability, damages or failed product claims resulting from customer design and use of the product for automotive applications beyond NXP Semiconductors' standard warranty and NXP Semiconductors' product specifications.

HTML publications — An HTML version, if available, of this document is provided as a courtesy. Definitive information is contained in the applicable document in PDF format. If there is a discrepancy between the HTML document and the PDF document, the PDF document has priority.

Translations — A non-English (translated) version of a document, including the legal information in that document, is for reference only. The English version shall prevail in case of any discrepancy between the translated and English versions.

Security — Customer understands that all NXP products may be subject to unidentified vulnerabilities or may support established security standards or specifications with known limitations. Customer is responsible for the design and operation of its applications and products throughout their lifecycles to reduce the effect of these vulnerabilities on customer's applications and products. Customer's responsibility also extends to other open and/or proprietary technologies supported by NXP products for use in customer's applications. NXP accepts no liability for any vulnerability. Customer should regularly check security updates from NXP and follow up appropriately.

Customer shall select products with security features that best meet rules, regulations, and standards of the intended application and make the ultimate design decisions regarding its products and is solely responsible for compliance with all legal, regulatory, and security related requirements concerning its products, regardless of any information or support that may be provided by NXP.

NXP has a Product Security Incident Response Team (PSIRT) (reachable at PSIRT@nxp.com) that manages the investigation, reporting, and solution release to security vulnerabilities of NXP products.

NXP B.V. — NXP B.V. is not an operating company and it does not distribute or sell products.

Trademarks

Notice: All referenced brands, product names, service names, and trademarks are the property of their respective owners.

NXP — wordmark and logo are trademarks of NXP B.V.

AN14402

用户指南   第1.0版－ 2024年10月18日

本文件中提供的所有信息均受法律免责声明的约束。

© 2024 NXP B.V. 版权所有。

技术文档反馈

7 / 8

目录