STORAGE DEVELOPER CONFERENCE

SDC 23

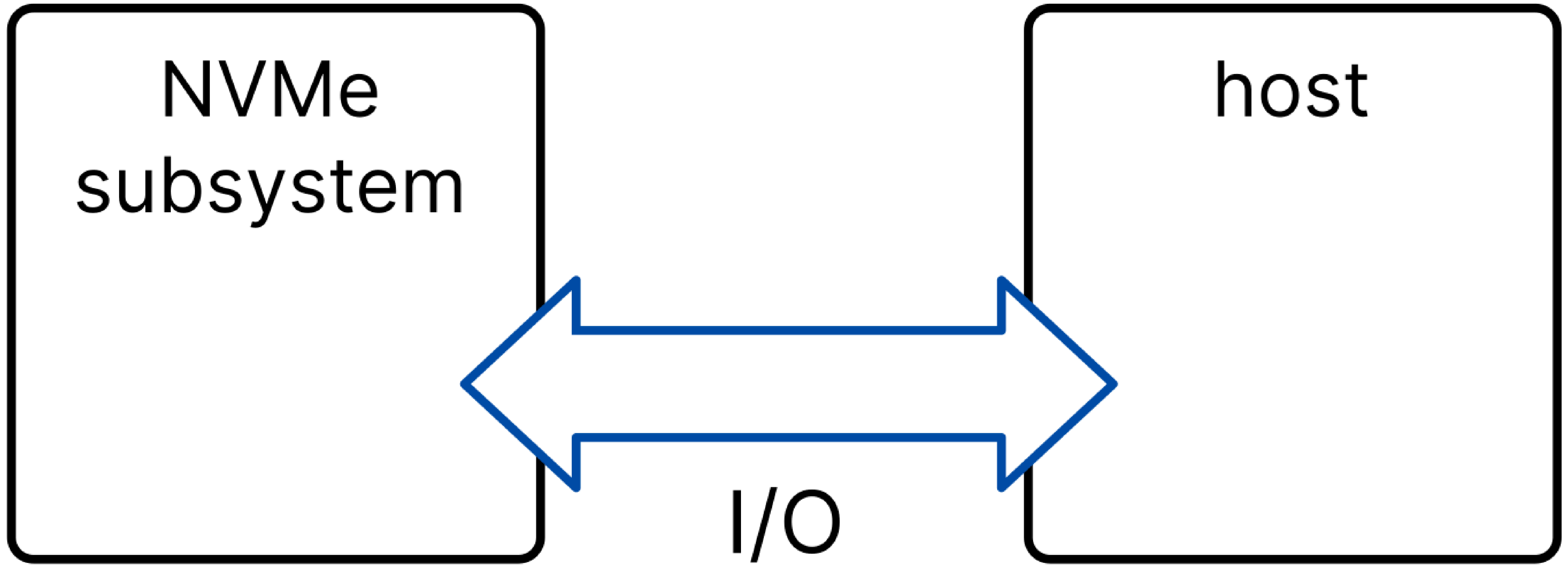
BY Developers FOR Developers

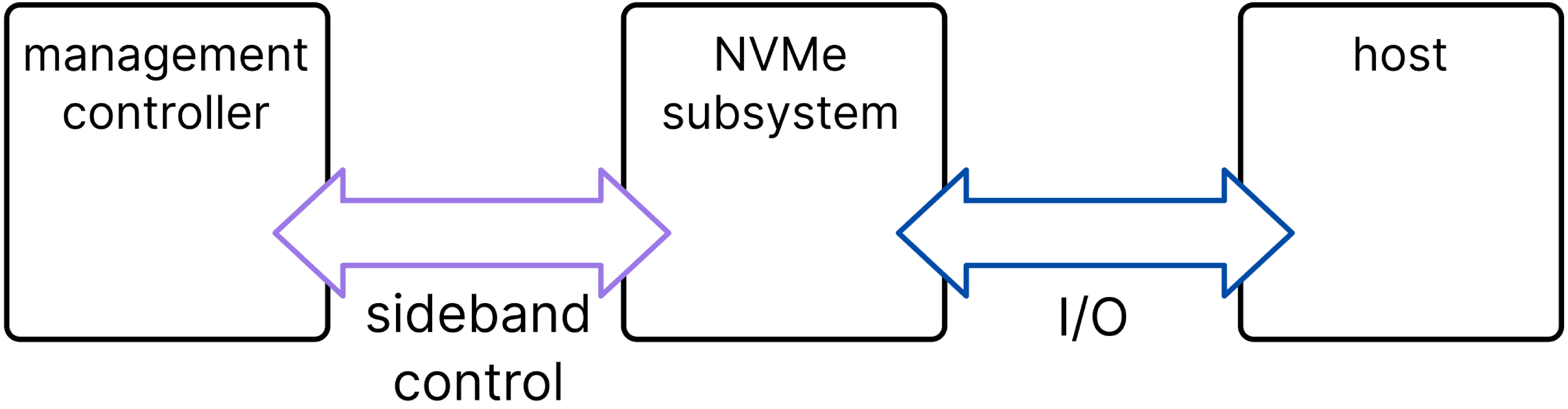
Implementing Out-of-Band Open Source Management using Swordfish

Jeremy Kerr
Code Construct

or: A tale of many standards

Out-of-band management


NVMe subsystem
host
I/O


management controller
NVMe subsystem
host
sideband control
I/O

OoB management

- FRU inventory
- device monitoring
- device control
- firmware management

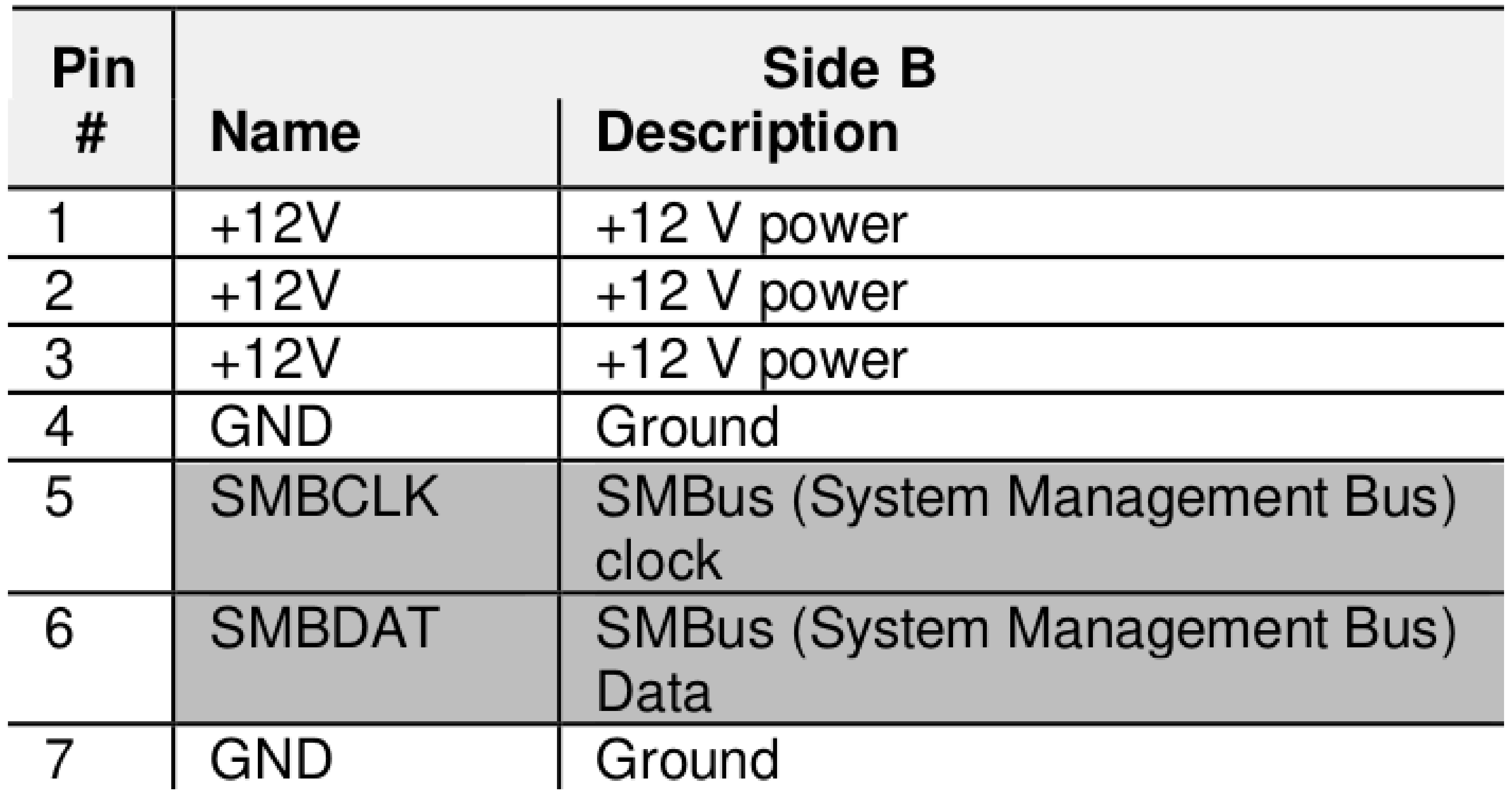
OoB management

- FRU inventory
- device monitoring
- device control
- firmware management
- actual IO ?

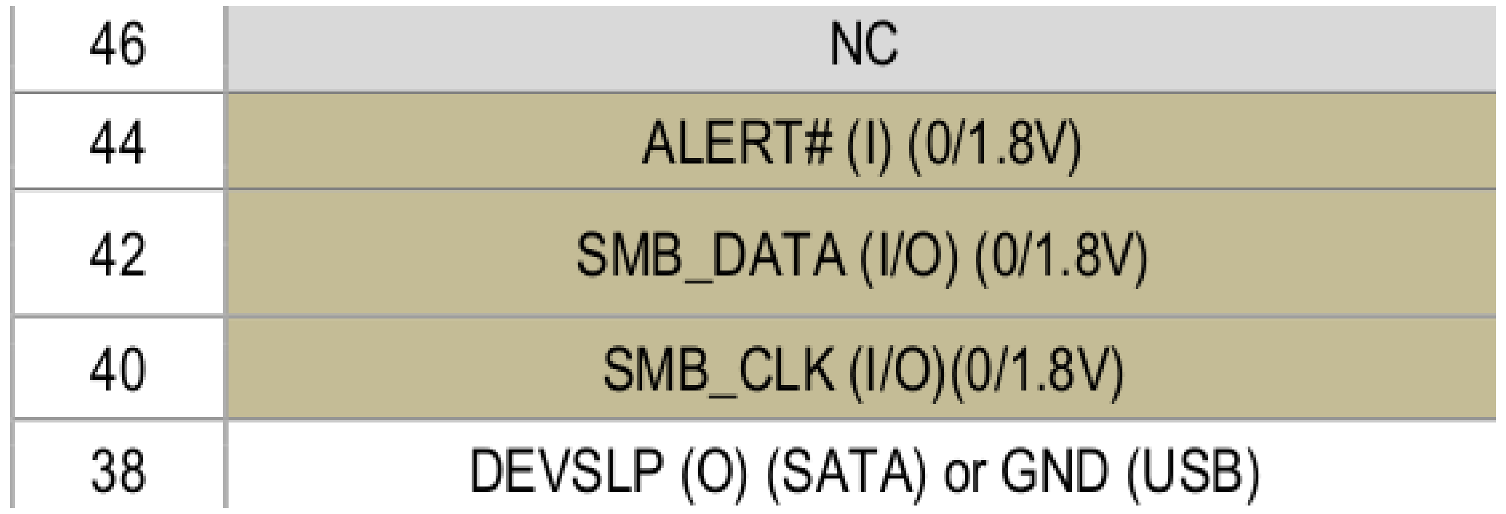
OoB management

- FRU inventory
- device monitoring
- device control
- firmware management
- ~~actual IO~~ (please, no)

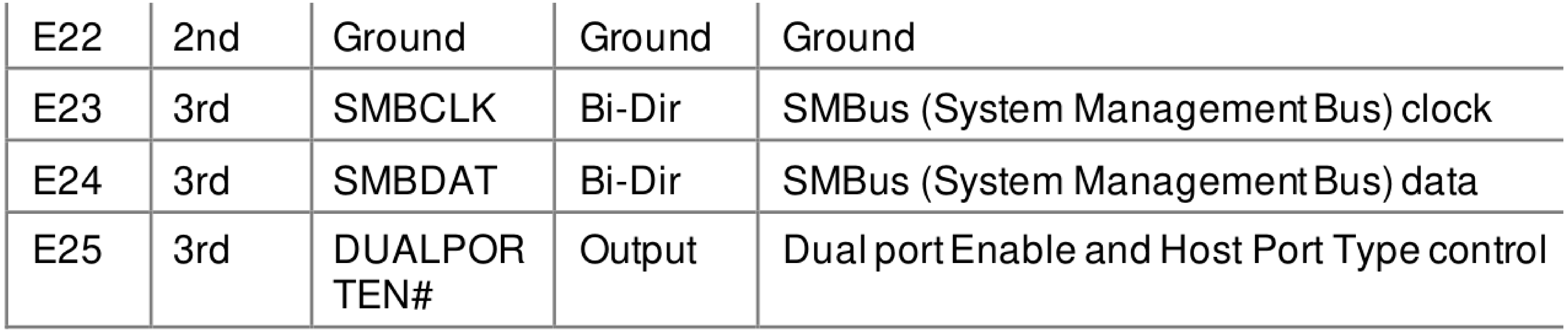
Physical layer



Pin #	Side B	
	Name	Description
1	+12V	+12 V power
2	+12V	+12 V power
3	+12V	+12 V power
4	GND	Ground
5	SMBCLK	SMBus (System Management Bus) clock
6	SMBDAT	SMBus (System Management Bus) Data
7	GND	Ground

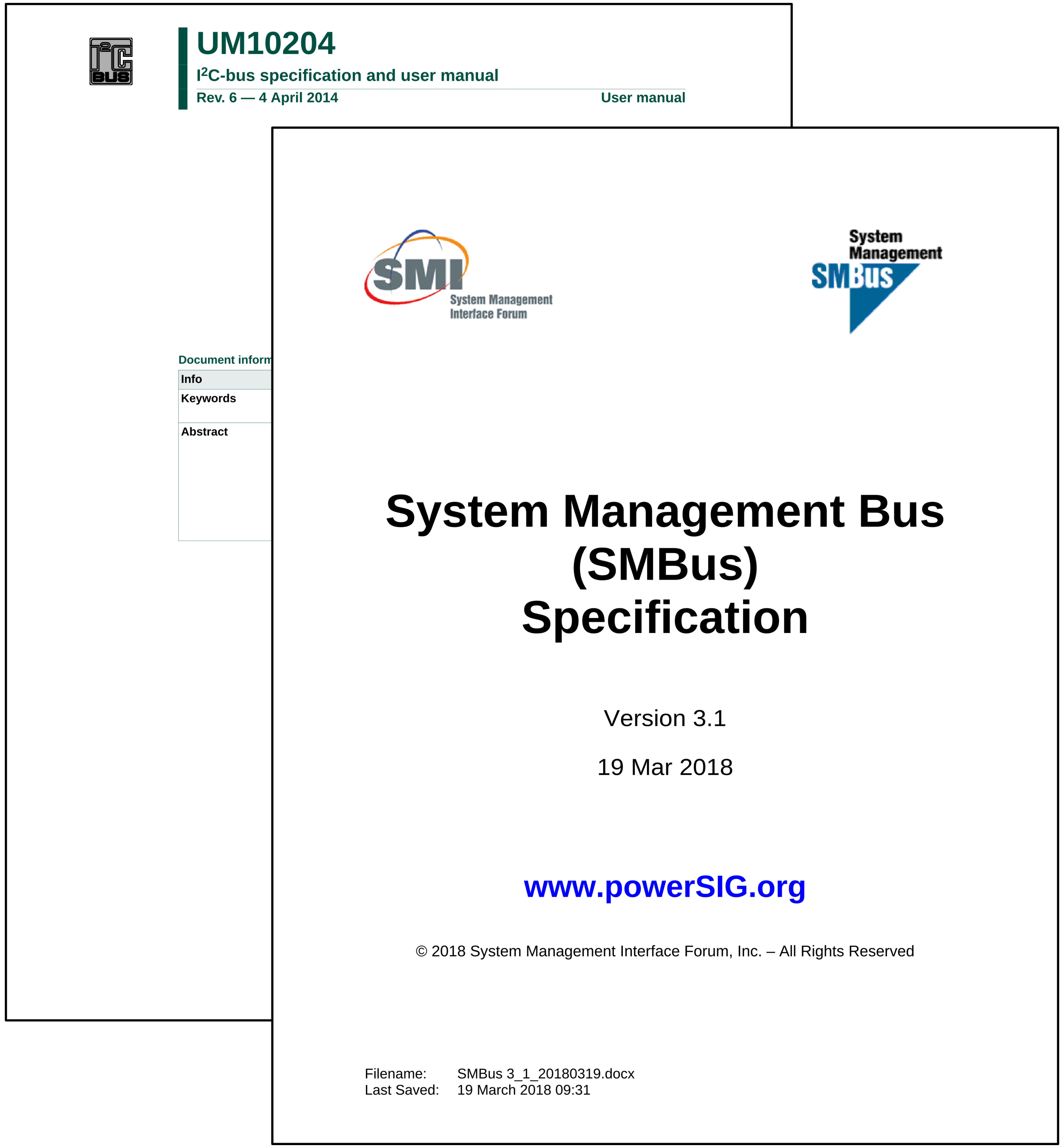


46	NC
44	ALERT# (I) (0/1.8V)
42	SMB_DATA (I/O) (0/1.8V)
40	SMB_CLK (I/O)(0/1.8V)
38	DEVSLP (O) (SATA) or GND (USB)



E22	2nd	Ground	Ground	Ground
E23	3rd	SMBCLK	Bi-Dir	SMBus (System Management Bus) clock
E24	3rd	SMBDAT	Bi-Dir	SMBus (System Management Bus) data
E25	3rd	DUALPORTEN#	Output	Dual port Enable and Host Port Type control

SMBus / i2c



UM10204

I^{2}C-bus specification and user manual

Rev. 6 — 4 April 2014 User manual

Document inform

Info
Keywords
Abstract

System Management Bus (SMBus) Specification

Version 3.1

19 Mar 2018

www.powerSIG.org

Filename: SMBus 3_1_20180319.docx
Last Saved: 19 March 2018 09:31

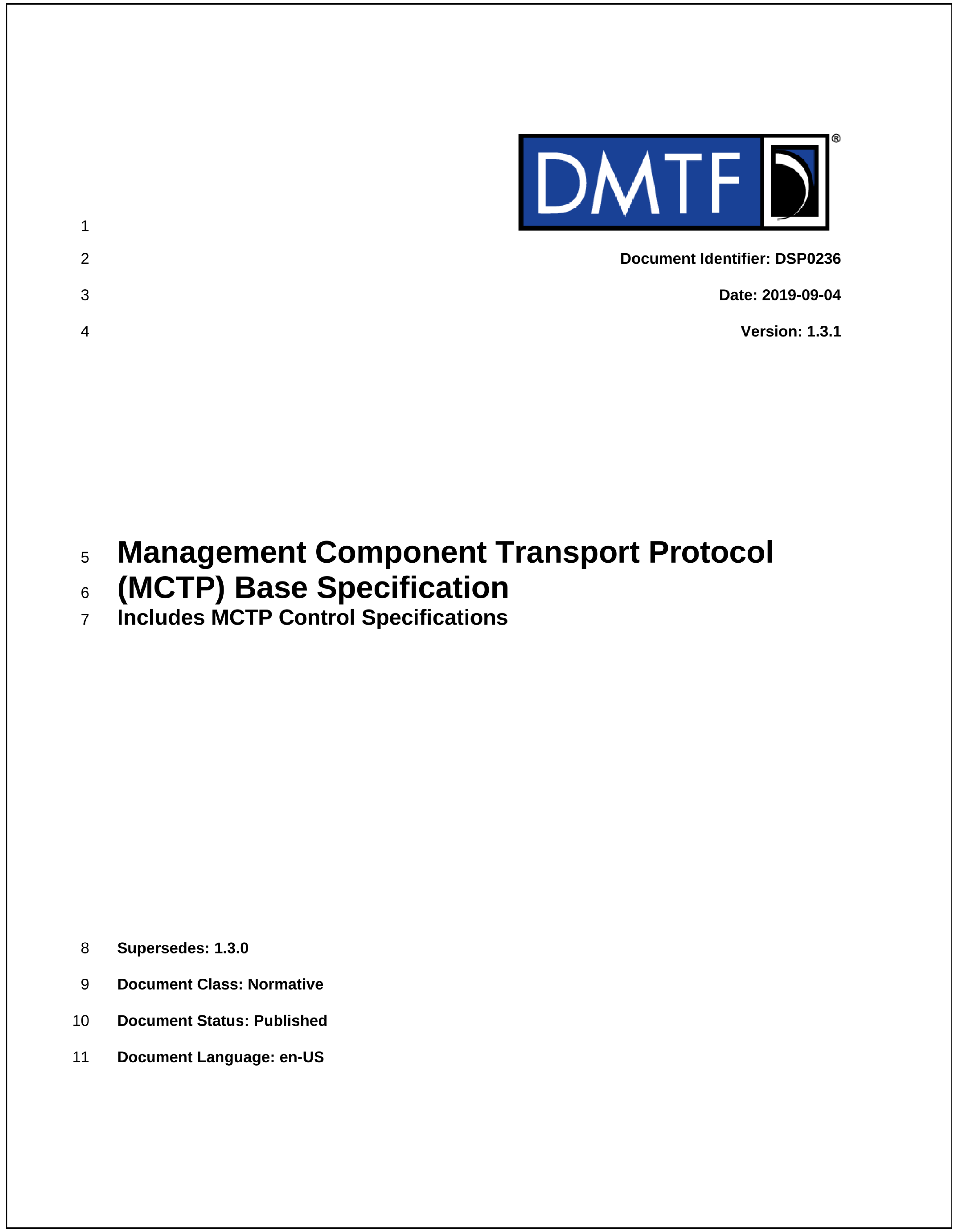
```
# i2cdetect -y 5
     0  1  2  3  4  5  6  7  8  9  a  b  c  d  e  f
00:          -- -- -- -- -- -- -- -- -- -- -- -- --
10: -- -- -- -- -- -- -- -- -- -- -- -- -- 1d -- --
20: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
30: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
40: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
50: -- -- -- 53 -- -- -- -- -- -- -- -- -- -- -- --
60: -- 61 -- -- -- -- -- -- -- -- -- -- -- -- -- --
70: -- -- -- -- -- -- -- --
```

addr r/w	
3a	i2c payload

At this level:

- FRU data
- "basic" management

MCTP



Document Identifier: DSP0236

Date: 2019-09-04

Version: 1.3.1

Management Component Transport Protocol (MCTP) Base Specification

Includes MCTP Control Specifications

Supersedes: 1.3.0

Document Class: Normative

Document Status: Published

Document Language: en-US

Document Identifier: DSP0237

Date: 2020-04-06

Version: 1.2.0

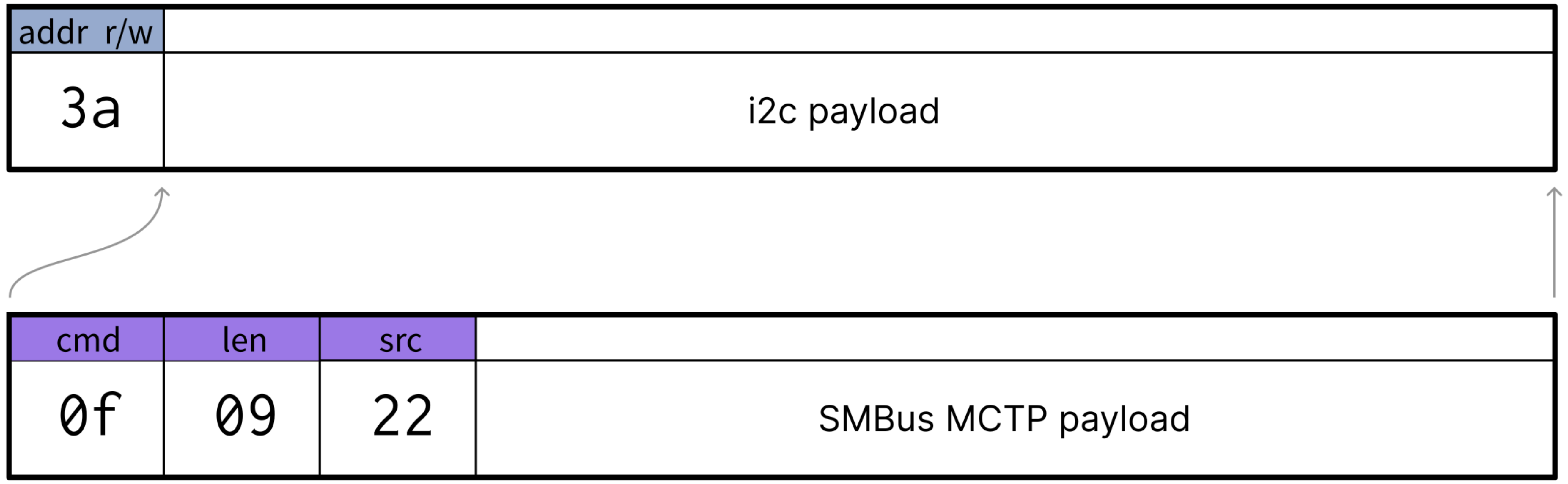
Management Component Transport Protocol (MCTP) SMBus/I2C Transport Binding Specification

Supersedes: 1.1.0

Document Class: Normative

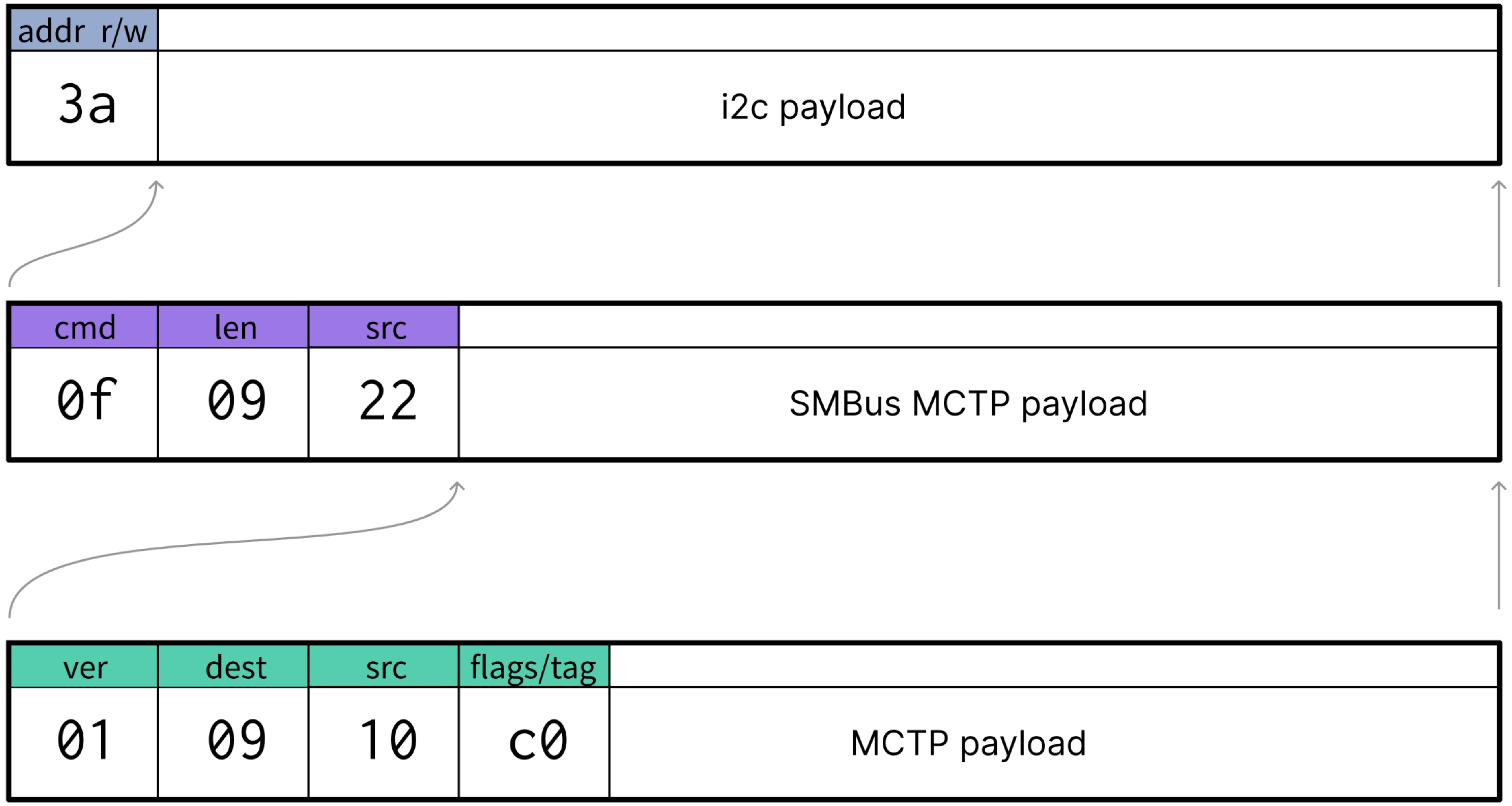
Document Status: Published

Document Language: en-US



addr r/w	
3a	i2c payload

cmd	len	src	
0f	09	22	SMBus MCTP payload



addr r/w	
3a	i2c payload

cmd	len	src	
0f	09	22	SMBus MCTP payload

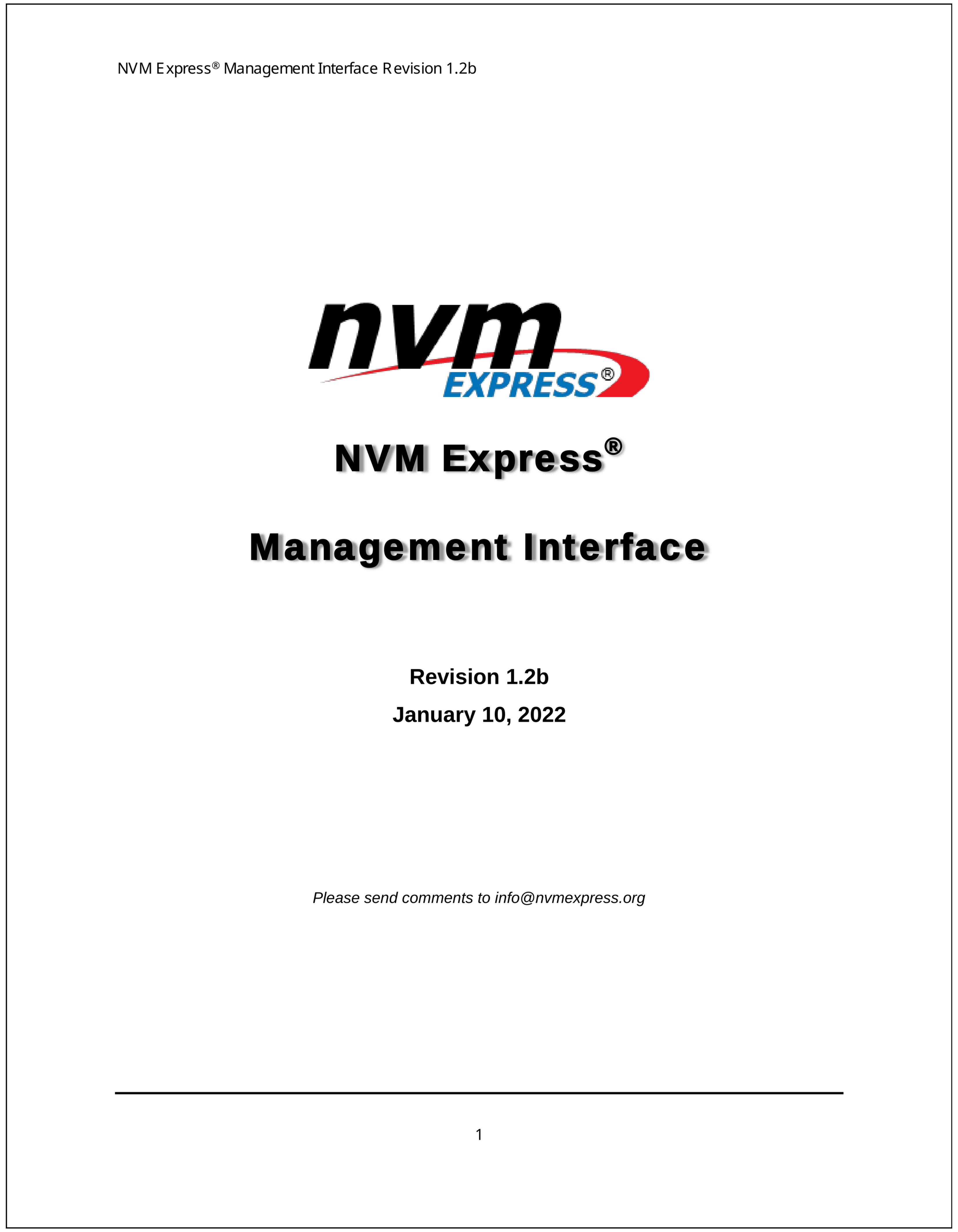
ver	dest	src	flags/tag	
01	09	10	c0	MCTP payload

Open implementation

- Linux kernel MCTP stack
- MCTP command-line utility

  github.com/CodeConstruct/mctp

NVMe-MI



NVM Express® Management Interface Revision 1.2b

NVM Express®

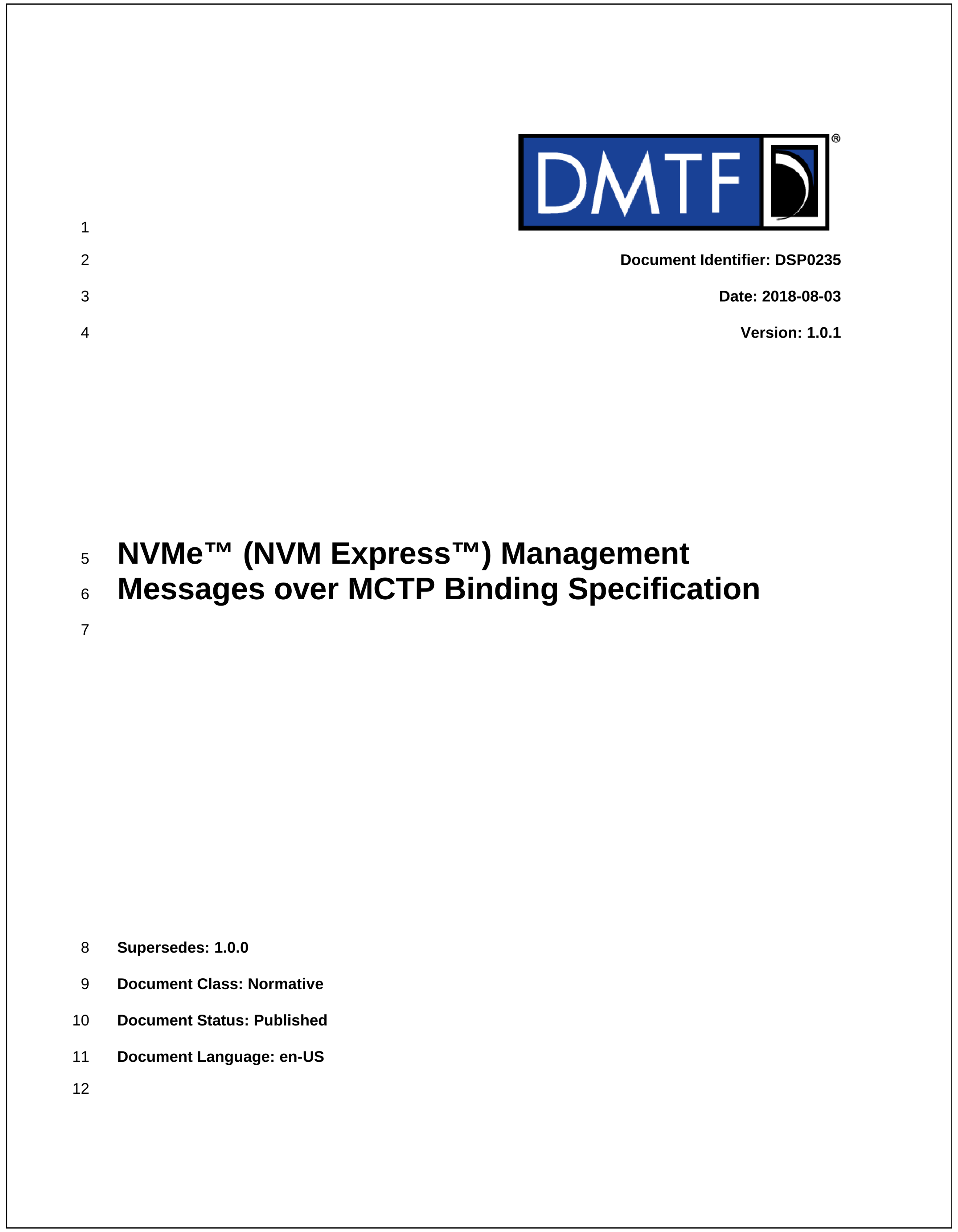
Management Interface

Revision 1.2b

January 10, 2022

Please send comments to info@nvmexpress.org

1



Document Identifier: DSP0235

Date: 2018-08-03

Version: 1.0.1

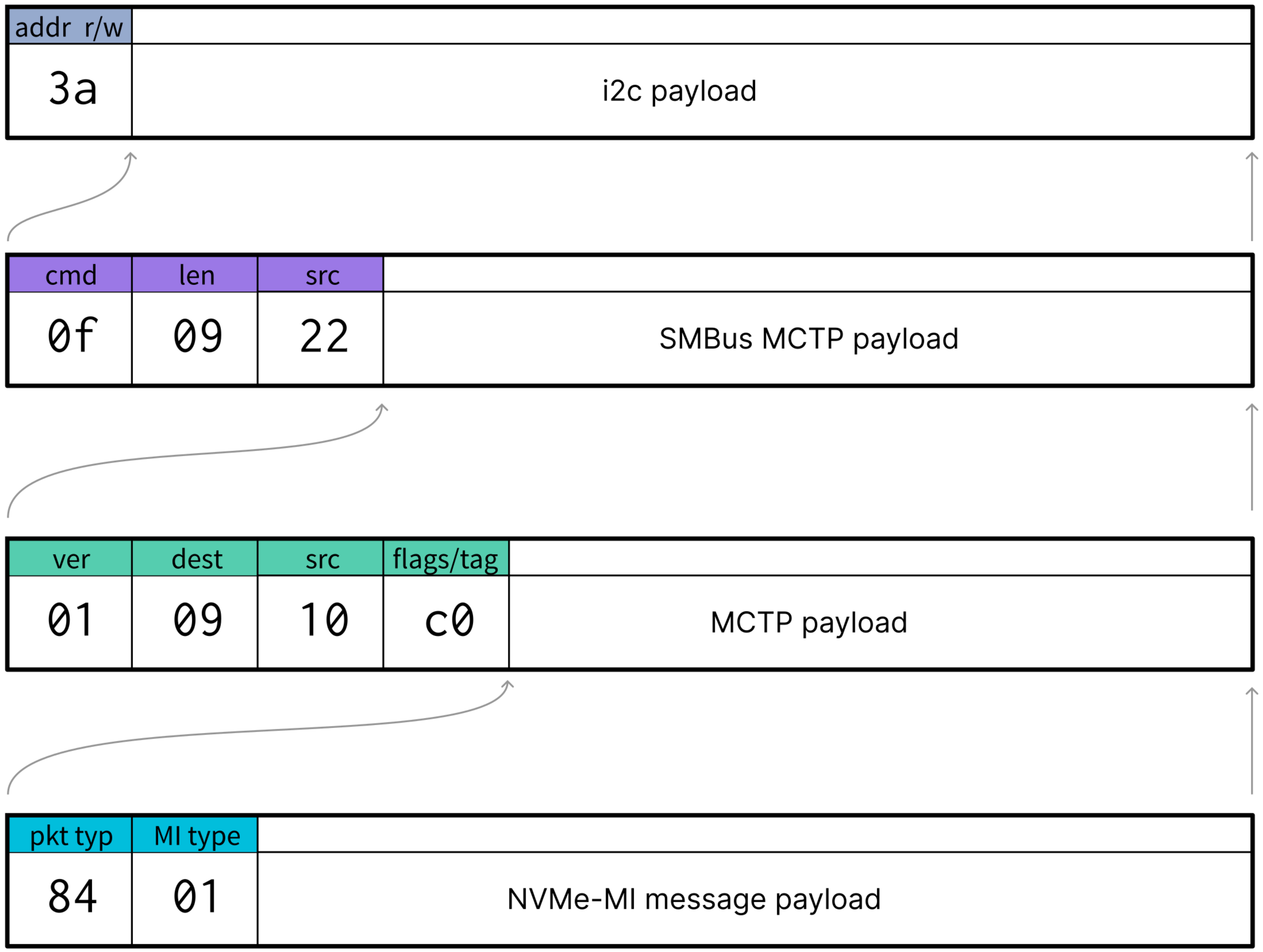
NVMe™ (NVM Express™) Management Messages over MCTP Binding Specification

Supersedes: 1.0.0

Document Class: Normative

Document Status: Published

Document Language: en-US



addr r/w	
3a	i2c payload

cmd	len	src	
0f	09	22	SMBus MCTP payload

ver	dest	src	flags/tag	
01	09	10	c0	MCTP payload

pkt typ	MI type	
84	01	NVMe-MI message payload

NVMe-MI command sets

- MI commands
- NVMe Admin commands
- PCIe commands (!!)

At this level:

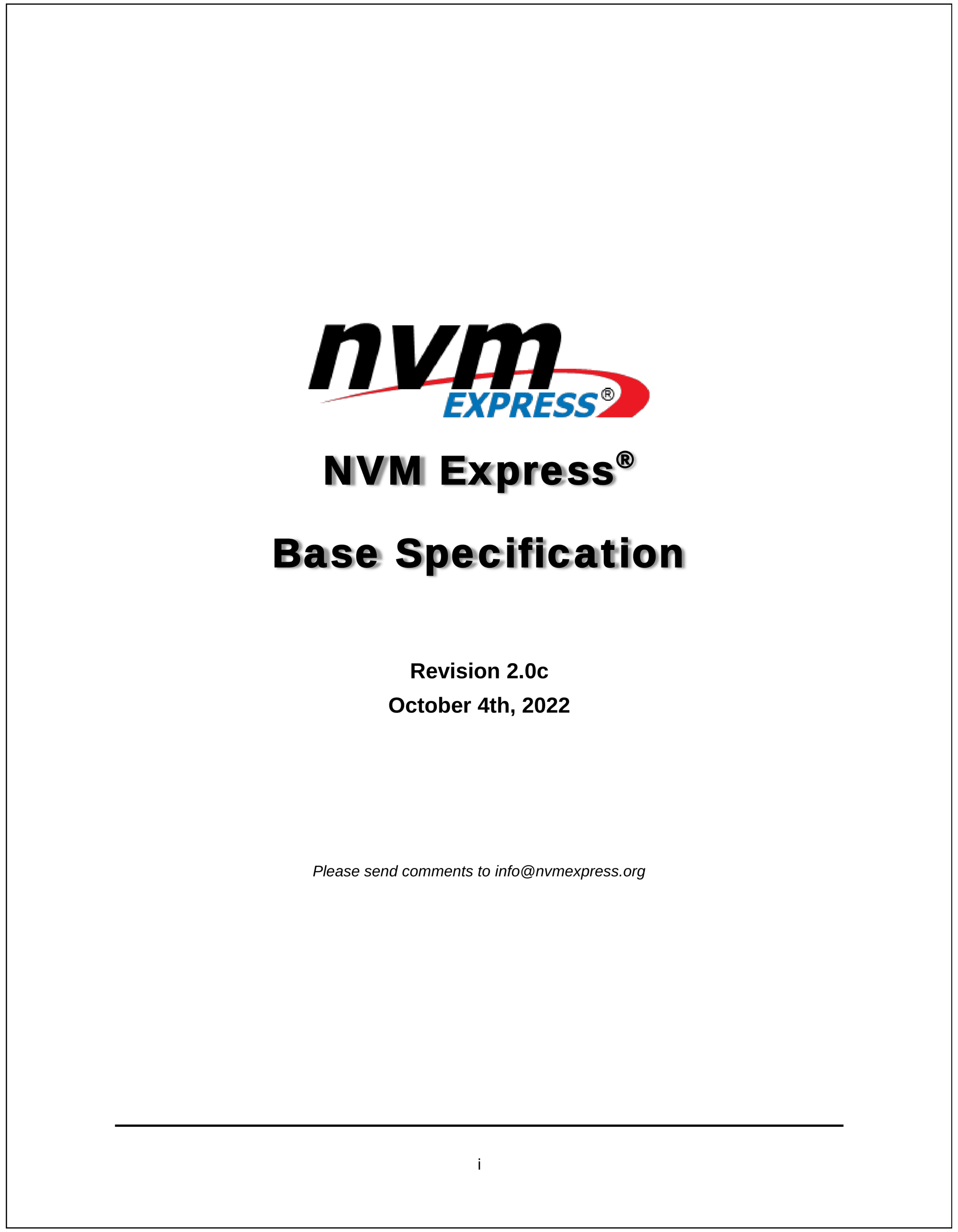
- Comprehensive inventory data
- Subsystem & controller health

Open implementation

- NVNe-MI protocol library: `libnvme-mi`

  github.com/linux-nvme/libnvme

NVMe



NVM Express®

Base Specification

Revision 2.0c

October 4th, 2022

Please send comments to info@nvmexpress.org

```
$ nvme id-ctrl mctp:1,9
NVME Identify Controller:
vid       : 0xccde
ssvid     : 0x0123
sn        : 5314F9222890
mn        : Code Construct NVMe device
fr        : CC000002
rab       : 3
ieee      : 00a075
cmic      : 0
mdts      : 10
```

```
$ nvme fw-log mctp:1,9
Firmware Log for device:mctp:1,9
afi  : 0x1
frs1 : 0x3130303030304343 (CC000001)
frs2 : 0x3230303030304343 (CC000002)
```

```
$ nvme fw-download mctp:1,9 --fw firmware-CC000003.bin
Firmware download success
```

At this level:

- Full NVMe Admin functions, over sideband interface

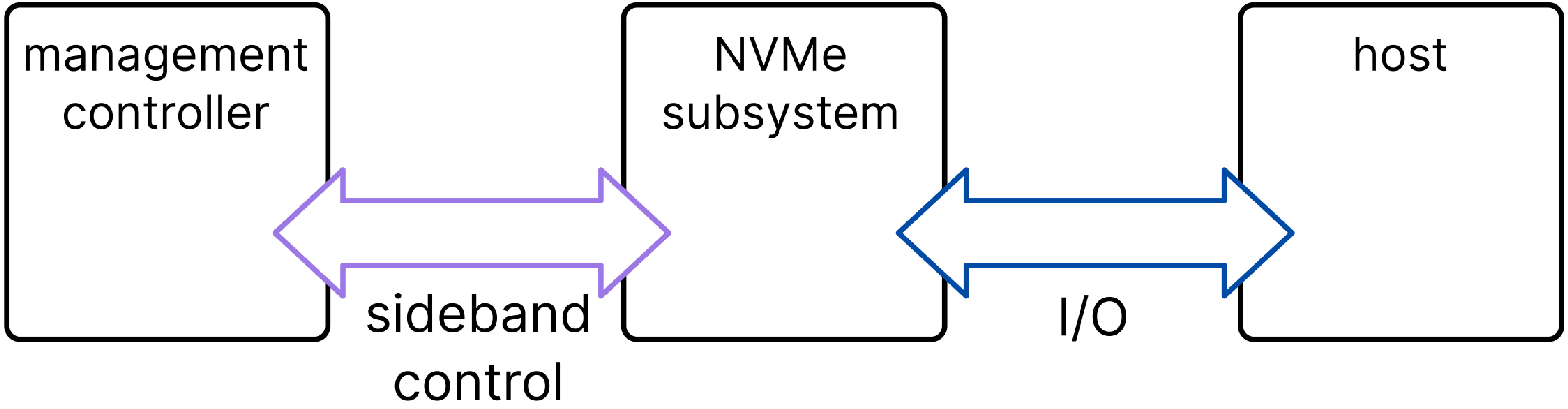
Open implementation

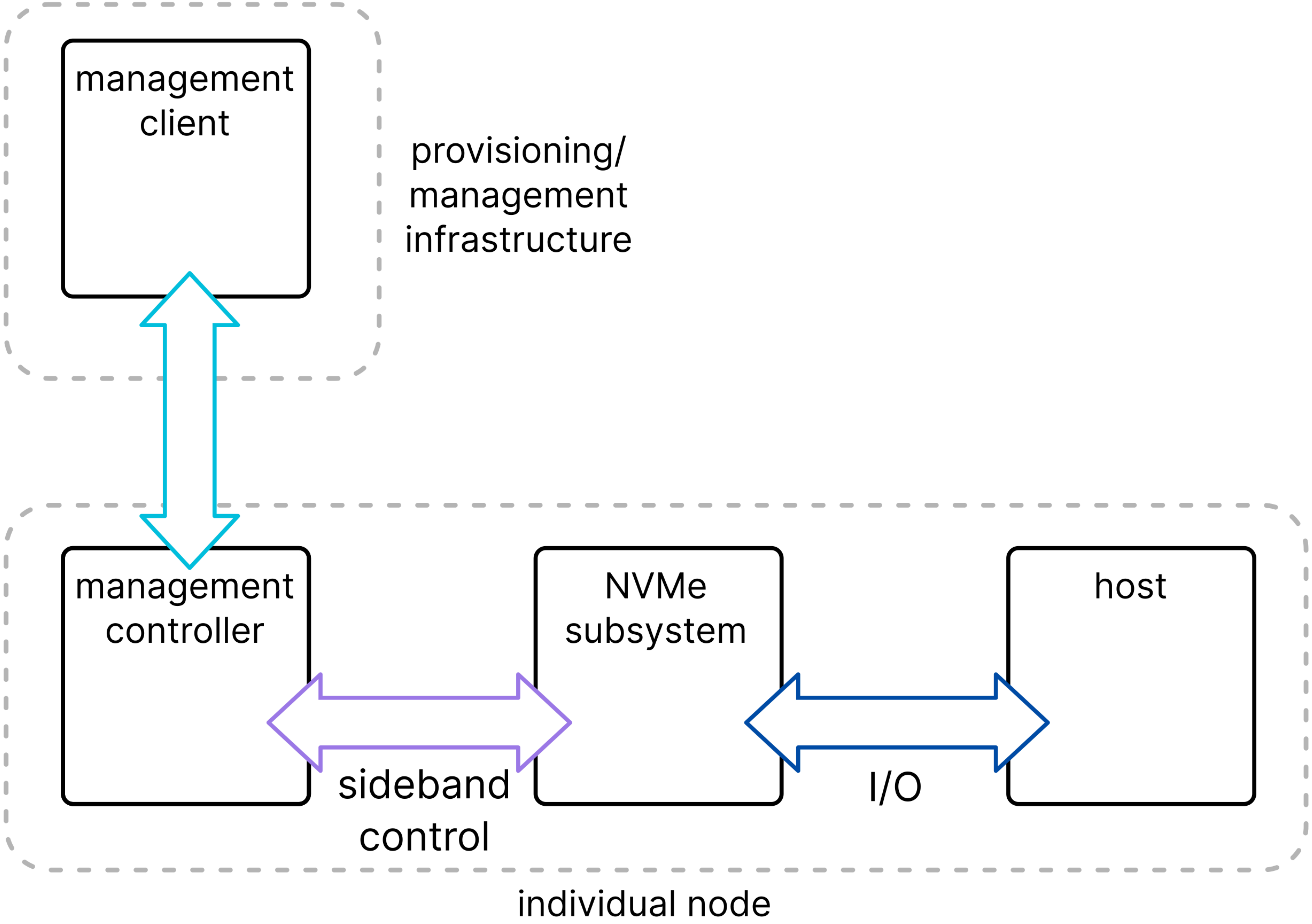
- Core NVMe protocol library: `libnvme`

  github.com/linux-nvme/libnvme

- `nvme` utility

  github.com/linux-nvme/nvme-cli


management controller
NVMe subsystem
host
sideband control
I/O


management client
provisioning/ management infrastructure
management controller
NVMe subsystem
host
sideband control
I/O
individual node

Swordfish

SNIA

Swordfish™

Swordfish Scalable Storage Management API Specification

Version: 1.2.5a

Abstract: The Swordfish Scalable Storage Management API defines a RESTful interface and a standardized data model to provide a scalable, customer-centric interface for managing storage and related data services.

SNIA Standard

This document has been released and approved by the SNIA. The SNIA believes that the ideas, methodologies, and technologies described in this document accurately represent the SNIA goals and are appropriate for widespread distribution. Suggestion for revision should be directed to http://www.snia.org/feedback/.

Last Updated: 20 June 2023

Swordfish

- REST API, allowing remote access to NVMe objects

Recent additions

- Security send / security receive interface
- Namespace format descriptions
- Namespace management in progress

At this level:

- Full NVMe Admin functions, accessible to management infrastructure

Open implementation

- OpenBMC NVMe sensors:

  github.com/openbmc/dbus-sensors

Recommendations

- i2c layout considerations
- Spec compliance
- MCTP implementation verification
- Consider security implications

Resources

- SNIA SSM
- codeconstruct.com.au/docs/
- github.com/linux-nvme/