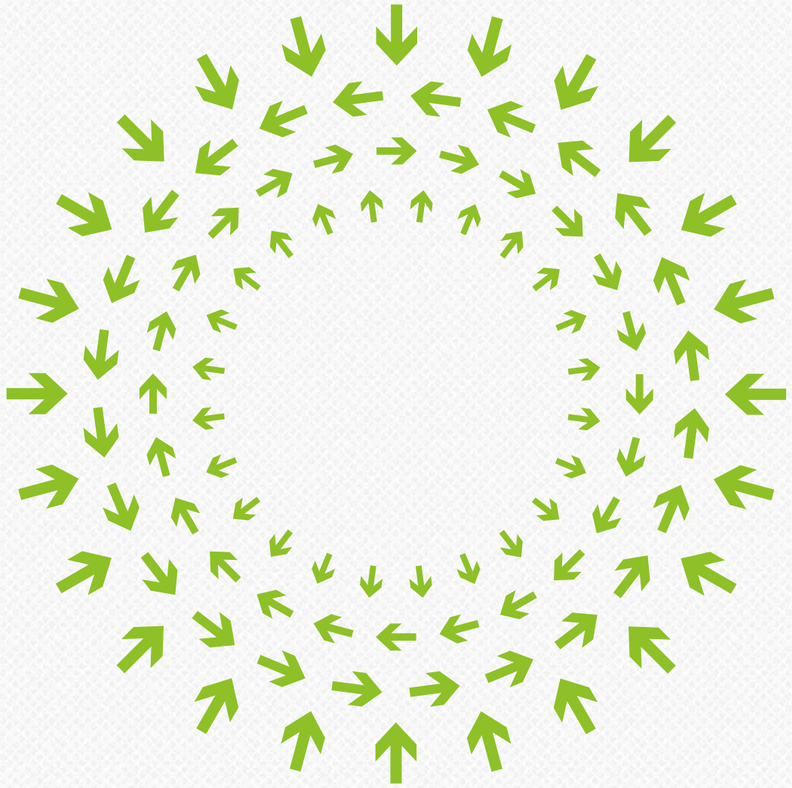

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Compute Summit

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HPM.1 Firmware Update

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Status

1. The OCP Hardware Management subcommittee is collecting requirements for firmware update.
2. This presentation is a subset of the what was presented at the OCP Hardware Management workshop on October 1, 2013
3. HPM.1 has not been chosen as the firmware update method

Agenda

1. Goal
2. HPM.1 Overview
3. Patents

Goals

Goal

- Provide a uniform Firmware update process which updates Flash, FPGAs, Crosspoint switches, etc for all internet enabled hardware in an OCP rack.
- Requirements
  - Patent Free
  - Open Source implementation
  - Operating System Independent
  - Does not require physical access to hardware

Goal

- The target hardware for the firmware update ranges from the simplest device to the most complex.
  - Power Distribution units
  - Servers (this OCP working group)
  - RAIDs
  - Ethernet, Fiber Channel and Infiniband switches

HPM.1 Overview

HPM.1 Overview

- Define by PICMG in 2007 for Telcos
  - HPM.1 is one of 45+ PICMG specs developed in last 20 years
  - Available for purchase, $100, at www.picmg.org
- 300+ companies supported the spec
  - Alcatel, AMD, Cisco, Fujitsu, Huawei, IBM, Lucent, Nokia, Sun....
- Of the 4 IPMI Promoters (they control the IPMI spec)
  - Intel, HP and NEC supported HPM.1
  - Dell did not vote, not a PICMG member

HPM.1 Open Source

- Open source C++ implementation of the RMCP client was published in 2007 by Kontron and present in ipmitool.
- No open source implementation of what the BMC would execute.

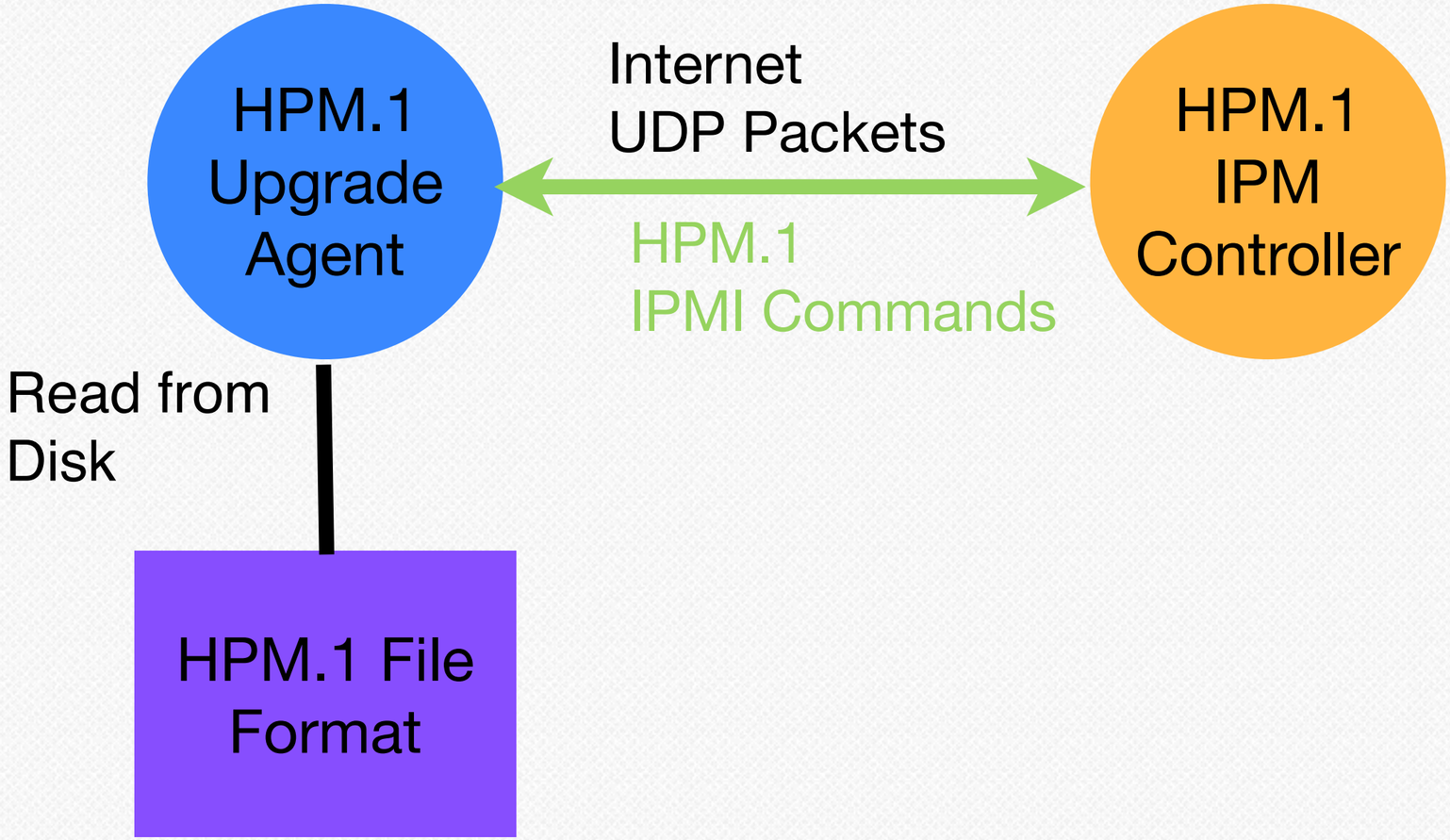
HPM.1 Vendors

- Telco Hardware
  - AdvanTech, Kontron, Emerson Network Power (old Motorola Computer Group), Radisys
- Data Center Hardware
  - None as of January 2014
- BMC Software Vendors
  - Pigeon Point Systems

HPM.1 Specification

- HPM.1 is small
  - 66 pages long
  - 184 Numbered requirements
- Defines 4 functional areas
  - Firmware image file format
  - IPMI Commands
  - IPM Controller requirements(software in the server)
  - Upgrade agent (software outside the server. ipmitool

HPM.1 Functional Areas



HPM.1 File Header

- Upgrade agent identifies file using Manufacture, Device and ProductID from IPMI Command “Get Device ID”
- Revision number
  - Mandatory two bytes. Format is X.Y
  - Optional trailing 3 bytes. Any format.
  - Each action containing firmware may have it’s own free form version number

Image Signature

Device ID

Manufacturer ID

Product ID

Image create time

Image Capabilities

Components

Self test timeout

Roll back timeout

Inaccessible timeout

Earliest compatible

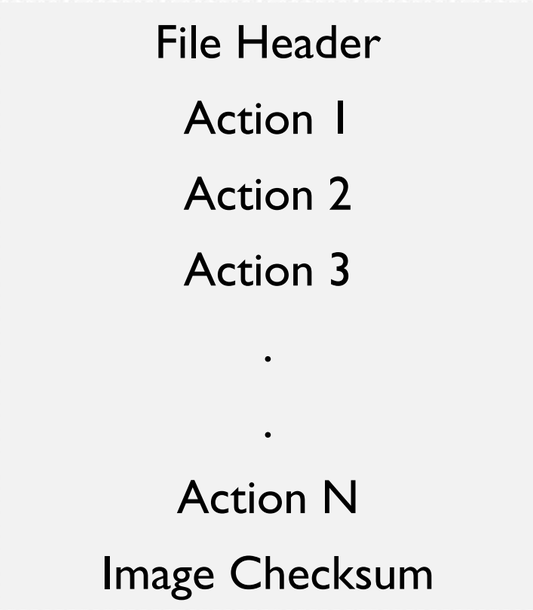
Revision of file

OEM Info

Header checksum

HPM.1 File Format

- File is not sent as a single image
- Each action is sent by itself to IPM Controller
  - A single image can contain a mix of x86, ARM, FPGA, etc firmware each as an action.
  - Actions move the sequencing of update process from DC operators to HW vendors.
  - An action may take seconds or many minutes
- An action operates on one of eight devices
- Action can be one of Backup/Prepare/Upload firmware
- A device can be operated on by multiple actions
- Actions may contain different firmware architectures
- Actions can contain a self test ← Big Win



HPM.1 IPMI Commands

Command Name	Mandatory/Optional
Get target upgrade capabilites	M
Get component properties	M
Abort firmware upgrade	O
Initiate upgrade action	O/M
Upload firmware block	M
Finish firmware upload	M
Get upgrade status	O/M
Activate firmware	M
Query self-test results	O/M
Query rollback status	O/M
Initiate manual rollback	O/M

O/M- the command may be mandatory depending of fields in “Get Component Properties” or IPM implementation. See the spec for details.

HPM.1 IPMI Commands

- There are only five IPMI commands necessary for minimal HPM.1 support.
- I estimate that 70% of existing monolithic servers, RAIDs, Switches using IPMI RMCP can be firmware upgraded to support HPM.1. No hardware changes necessary

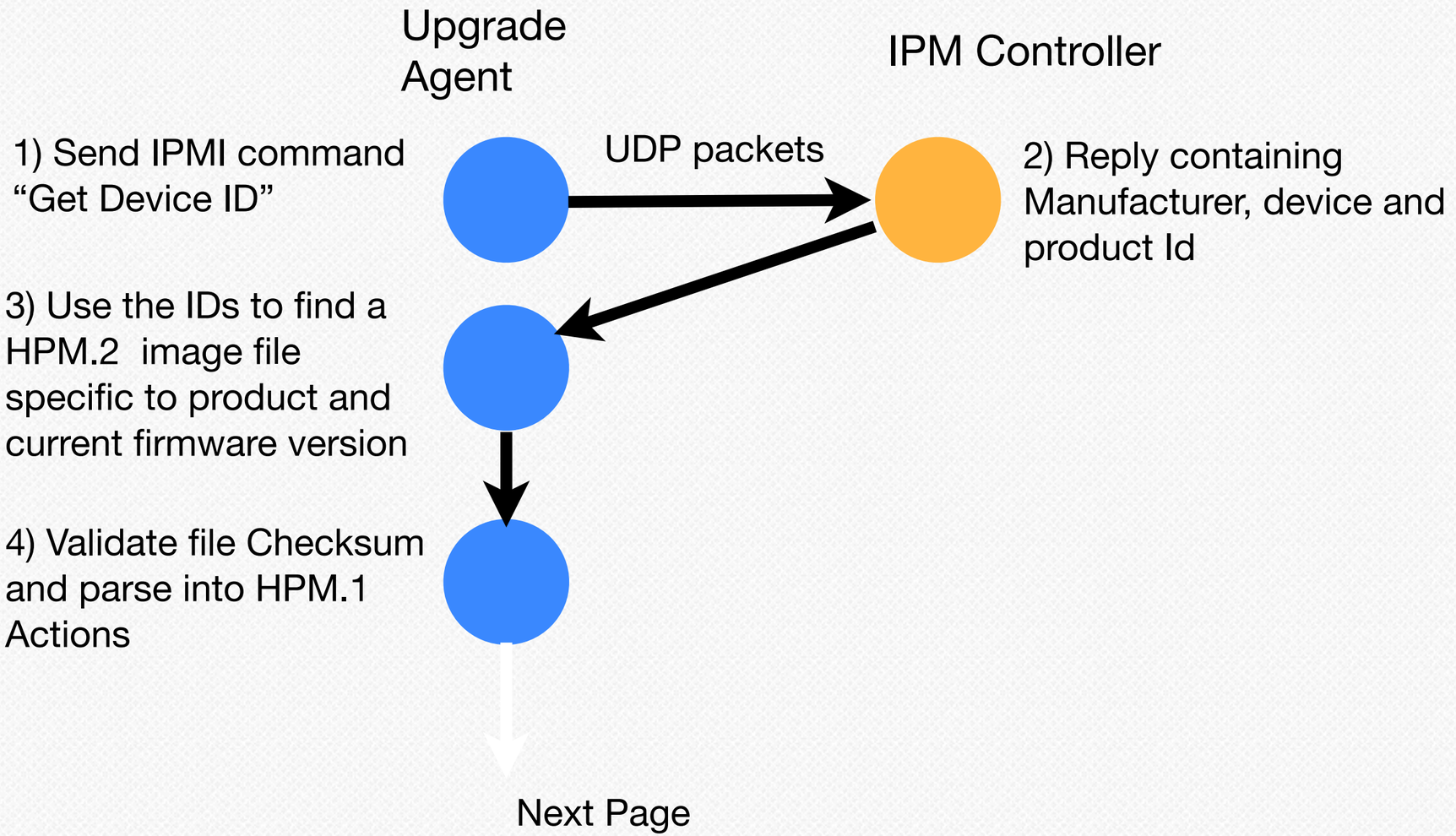
HPM.1 Upgrade Agent

- Runs outside the server/Raid/Switch and communicates with an IPM Controller using IPMI RMCP packets(UDP protocol)
- Uses same security, authentication and integrity as all other IPMI commands
- Responsible for finding HPM.1 image and sending to to IPM Controller
- An Upgrade agent my dynamically create the upgrade image.

HPM.1 IPMI Controller

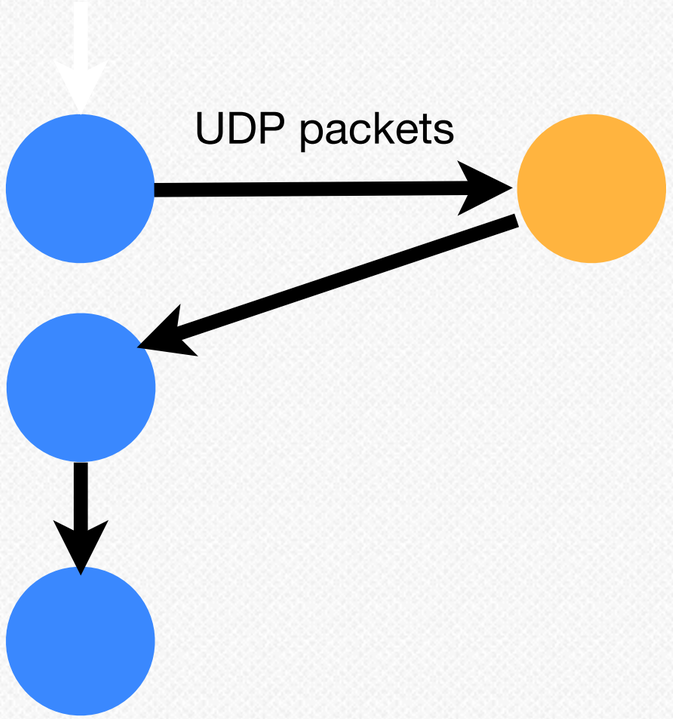
- Contained in the server/RAID/Switch
- Received HPM.1 Actions which prepare the device for upgrade, write firmware to storage or test the firmware.
- Executes HPM.1 rollback functions to recover from when the firmware test fails

Upgrade Process



Upgrade Process

5) Send HPM.1 Action to IPM Controller



6) Execute HPM.1 Action. Execute self test if present and send status code.

7) Examine status code. If OK and there are more action go to Step 5. Fail goto step 8.

8) Exit

Patents

HPM.1 Patent Status

- To my knowledge HPM.1 does not infringe on any patents in any country
- Since the introduction of HPM.1 in 2007 there have been no allegations that it infringes on any patent

NetApp Patent

- The patent 7,484,084 January 27, 2009 by Network Appliances requires:
  - A BMC
  - A NIC with DMC(to send the firmware image to memory)
  - A host operating system
- Firmware update procedures must be designed so they do not infringe
- HPM.1 does not need a Host OS. No provision in ‘084 patent for upgrading firmware without a Host OS

Avoiding ‘084

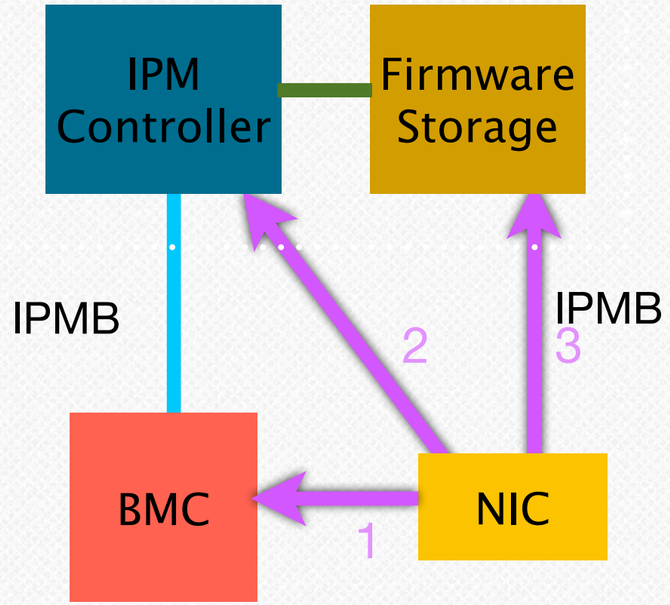
- Monolithic servers using a Disposable OS and a NIC doing DMA of the firmware may infringe
- Monolithic servers updating firmware with a Disposable OS have both BMC and an Host OS fulfilling 2 of the ‘084 requirements
- Only thing missing is a NIC that does DMA
- It may be possible to avoid ‘084 when a DMA enabled NIC is present but it is hard

Firmware update without HPM.1

- You can design around ‘084 with or without HPM.1
- ‘084 mandates a BMC
- Options
  - Each node has a IPM Controller not a BMC
  - Don’t implement one of the required features from IPMI 2.0 Table 3-1
  - Don’t have an Operating System present

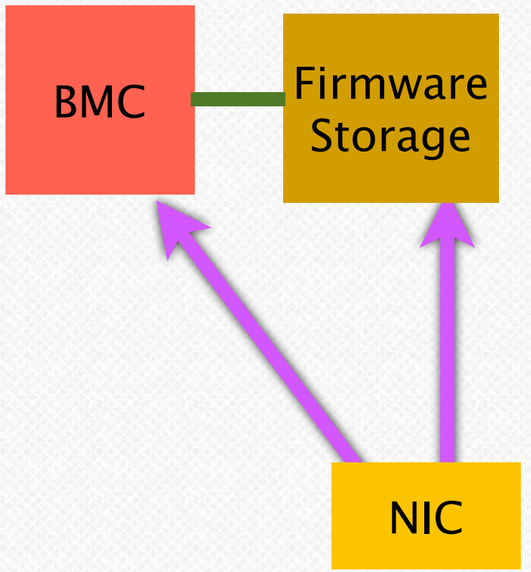
HPM.1 is not necessary to avoid ‘084

No BMC on Node. Uses IPM Controller



Firmware update with HPM.1

- Design around ‘084 with or without HPM.1
- Each node has a IPM Controller not a BMC
- Nodes share a physical or logical NIC that can DMA firmware into storage, RAM or the BMC



Questions ?

Ask on the OCP HW Management reflector