

OpenBMC Update

Gunnar Mills

IBM



OpenBMC

Agenda

OpenBMC Overview

OpenBMC Today

Release Content

Redfish on OpenBMC

Community Forums

Get Involved

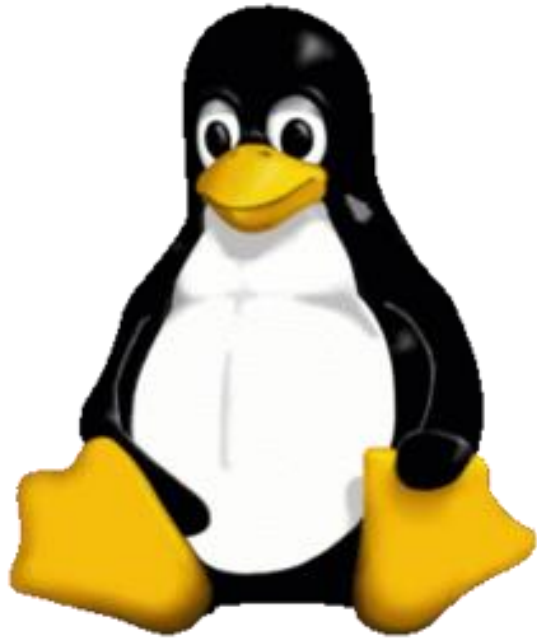


OpenBMC

- Open Source Baseboard Management Controller (BMC) firmware
- Linux Foundation Project
- Companies with layers include: Arm, Aspeed, Facebook, Google, IBM, Intel, Inspur, Lenovo, Mellanox, Microsoft, Nuvoton, Qualcomm, Yado
- Underlying technologies
 - Yocto Project
 - D-Bus
 - Systemd

History

- 2014 - Out of a Facebook hackathon an open BMC firmware stack named OpenBMC
- 2015 - IBM collaborates with Rackspace on an open BMC firmware stack also named OpenBMC
- These projects were similar in name and concept only
- March 2018 - OpenBMC becomes a Linux Foundation Project converging
- Technical steering committee formed to guide the project
- Agreed upon path to a unified OpenBMC community



Project Charter and Linux Foundation

- Lightweight, flexible charter (five pages)
- Apache 2.0 license for code contributions (with clause for exceptions)
- CC BY 4.0 license for documentation
- Requires execution of corporate or individual contributor license agreement to contribute
- https://www.openbmc.org/wp-content/uploads/sites/62/2018/03/charter_openbmc_02142018.pdf
- Linux Foundation owns project trademarks, DNS registrant, and GitHub organization owner

Technical Steering Committee

- Members
 - Brad Bishop (IBM)
 - Sai Dasari (Facebook)
 - Sagar Dharia (Microsoft)
 - James Mihm (Intel)
 - Supreeth Venkatesh (Arm)
 - Nancy Yuen (Google)
- Community contributions drive project direction
- Provide resolution at last resort
- <https://github.com/openbmc/docs#technical-steering-committee>
- Voting outlined in project charter

Project Contributors & Maintainers

Contributors

- Most important role
- Code submissions
- Peer review
- Testing
- Documentation
- Project process and infrastructure

Maintainers

- Responsible for day to day code maintenance
- Guides contributors and their contributions towards project standards
- Shared across companies in many repositories
- ~30 maintainers

OpenBMC March 2018

87

66

16

3

0

Contributors

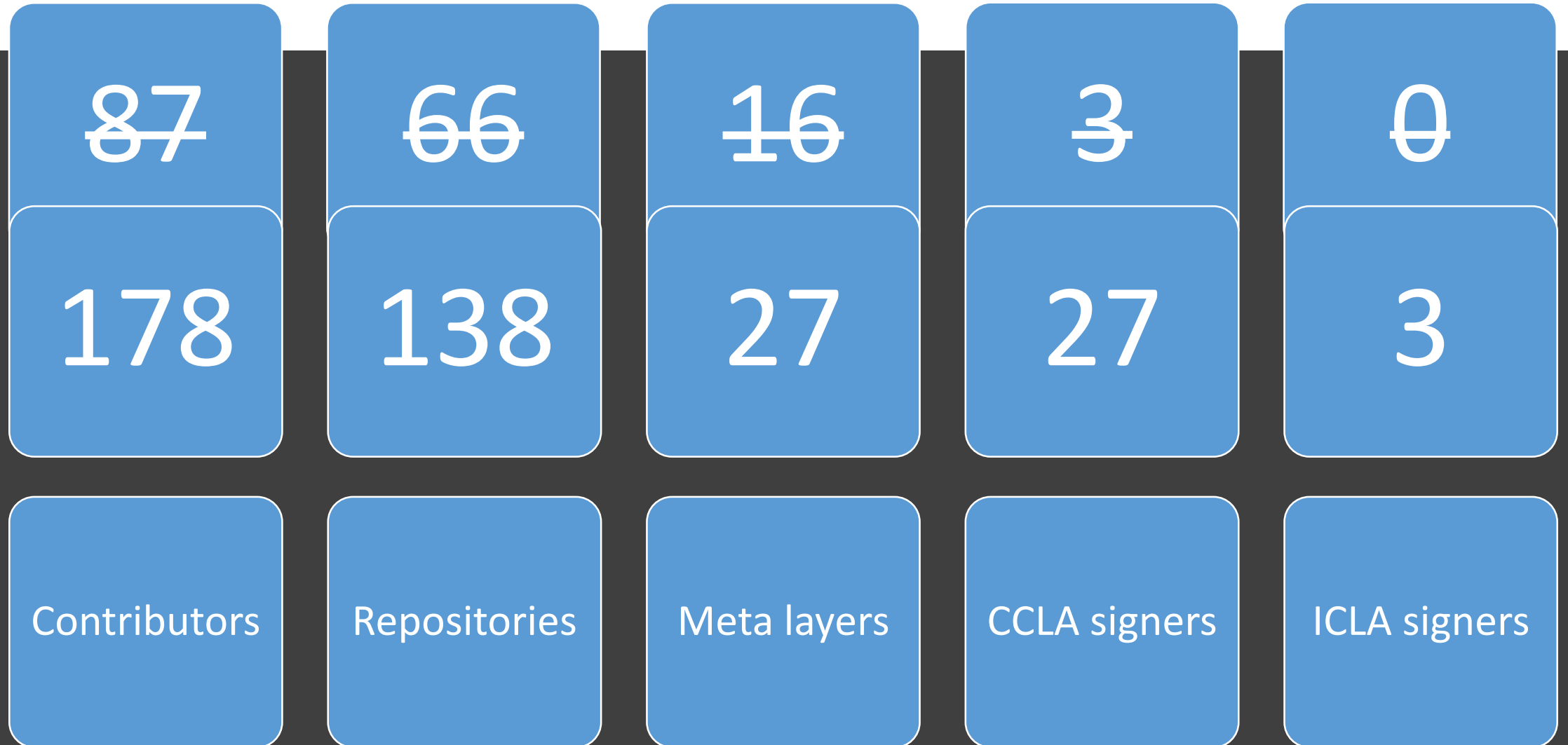
Repositories

Meta layers

CCLA signers

ICLA signers

OpenBMC Today



OpenBMC today

528

- Email list subscribers

438

- People who starred openbmc/openbmc

290

- Forks of openbmc/openbmc

86

- IRC members

Gerrit						status:open		
Subject		Status	Owner	Assignee	Repo	Branch	Updated	Size
☆	PEL: Enhance the real PEL test	—	🧑‍🔧 Matt Spinler	—	openbmc/phosphor-logging	master	2:21 PM	XS
☆	PEL: Initialize PrivateHeader fields in ctor	—	🧑‍🔧 Matt Spinler	—	openbmc/phosphor-logging	master	2:20 PM	XS
☆	Move ast2600 to use hard float call convention	—	👤 Vernon Mauery	—	openbmc/meta-aspeed	master	2:16 PM	XS
☆	intel-ipmi-oem: srcrev bump df5e327122..9ce789fc28	—	🌐 Andrew Geissler	—	openbmc/meta-intel	master (autobump)	2:04 PM	XS
☆	Add indicator led asserted tests for system and power supply units	—	🔧 Marissa Garza	—	openbmc/openbmc-test-automation	master (LED)	2:01 PM	M
☆	Update the user management design document	—	🌐 Tom Joseph	🌐 T Rajeswaran	openbmc/docs	master	1:55 PM	S
☆	Update PFR ProvisiongStatus from bool to enum type	—	🌐 AppaRao Puli	—	openbmc/docs	master	1:54 PM	S
☆	Refactor Set Firmware Update Mode command	—	🌐 AppaRao Puli	—	openbmc/intel-ipmi-oem	master	1:53 PM	M
☆	ipmi-blob-tool: srcrev bump 958f1ce952..00f39b8403	—	🌐 Andrew Geissler	—	openbmc/meta-phosphor	master (autobump)	1:50 PM	XS
☆	bmcweb: srcrev bump 698654b618..c94ad49bc7	—	🌐 Andrew Geissler	—	openbmc/meta-phosphor	master (autobump)	1:48 PM	XS
☆	PEL: SRC callouts subsection object	—	🧑‍🔧 Matt Spinler	—	openbmc/phosphor-logging	master	1:45 PM	L
☆	PEL: MRU callout SRC substructure	—	🧑‍🔧 Matt Spinler	—	openbmc/phosphor-logging	master	1:38 PM	M
☆	dbus-sensors: srcrev bump 9a25ed407c..4ebf6af787	—	🌐 Andrew Geissler	—	openbmc/meta-phosphor	master (autobump)	1:35 PM	XS
☆	Updated the close session to close any session	—	🌐 Gade-RajasekharReddy	—	openbmc/phosphor-net-ipmid	master (depends 23418)	1:30 PM	M
☆	<u>stop overriding DISTRO_FEATURES in phosphor-base</u>	—	🌐 Andrew Geissler	—	openbmc/meta-phosphor	master	1:29 PM	XS
☆	REST software priority set using boolean value	—	👤 George Keishing	—	openbmc/openbmc-test-automation	master	1:28 PM	XS
☆	GPIO Monitor with multiple lines and libgpiod	—	🌐 Vijay Khemka	—	openbmc/phosphor-gpio-monitor	master	1:27 PM	L
☆	Update openbmc-systemd.md link	—	🌐 Gunnar Mills	—	openbmc/phosphor-state-manager	master	1:25 PM	XS
☆	Removed power operation tests as power page is fully changed	—	👤 Rahul Maheshwari	—	openbmc/openbmc-test-automation	master	1:24 PM	M
☆	Update openbmc-systemd.md link	—	🌐 Gunnar Mills	—	openbmc/phosphor-dbus-interfaces	master	1:23 PM	XS
☆	Code update and verify Applytime persistency	—	🌐 Sushil Singh	—	openbmc/openbmc-test-automation	master (Firmware Update)	1:23 PM	S
☆	Propose an IPMI and Redfish chassis control design	—	🌐 Jason Bills	—	openbmc/docs	master	1:21 PM	M
☆	Multiple BMC images update at same time	—	🌐 Sushil Singh	—	openbmc/openbmc-test-automation	master	1:21 PM	S
☆	entity-manager: srcrev bump 4acdc54d46..c48e0ef5d4	—	🌐 Andrew Geissler	—	openbmc/meta-phosphor	master (autobump)	1:19 PM	XS
☆	ipmi-blob-tool: srcrev bump 958f1ce952..cc4ef0c5a4	—	🌐 Andrew Geissler	—	openbmc/meta-phosphor	master (autobump)	1:05 PM	XS

OpenBMC Community Releases

- Release every 6 months following Yocto releases
- 2.6
 - February 2019
 - First release as Linux foundation community
- 2.7
 - August 2019
- 2.8
 - May 2020
- 2.9
 - Nov 2020
 - Propose content now

2.7.0



bradbishop tagged this 22 days ago · [309 commits](#) to master since this tag

OpenBMC version 2.7.0

```
$ ipmitool -H $host -U root -P $password -I lanplus sdr elist
BootProgress      | 03h | ok | 34.2 |
OperatingSystems  | 05h | ok | 35.1 |
AttemptsLeft      | 07h | ok | 34.1 |
occ0              | 08h | ok | 210.1 | Device Disabled
occ1              | 09h | ok | 210.2 | Device Disabled
PowerSupplyRedun  | 0Bh | ok | 34.3 | State Asserted
p0_core0_temp     | 11h | ns | 208.2 | Disabled
cpu0_core0        | 12h | ok | 208.1 | Presence detected
p0_core1_temp     | 14h | ns | 208.4 | Disabled
cpu0_core1        | 15h | ok | 208.3 | Presence detected
p0_core2_temp     | 17h | ns | 208.6 | Disabled
cpu0_core2        | 18h | ok | 208.5 | Presence detected
p0_core3_temp     | 1Ah | ns | 208.8 | Disabled
cpu0_core3        | 1Bh | ok | 208.7 | Presence detected
p0_core4_temp     | 1Dh | ns | 208.10 | Disabled
cpu0_core4        | 1Eh | ns | 208.9 | Disabled
p0_core5_temp     | 20h | ns | 208.12 | Disabled
cpu0_core5        | 21h | ns | 208.11 | Disabled
p0_core6_temp     | 23h | ns | 208.14 | Disabled
cpu0_core6        | 24h | ok | 208.13 | Presence detected
p0_core7_temp     | 26h | ns | 208.16 | Disabled
cpu0_core7        | 27h | ok | 208.15 | Presence detected
```

witherspoon33-Y111UF81T0KJ
w33.aus.stglabs.ibm.com

Server health >
Good

Server power >
Running

Data last refreshed
Oct 23, 2019 4:38:42 PM CDT

OpenBMC

witherspoon33-Y111UF81T0KJ
w33.aus.stglabs.ibm.com

Server health >
Good

Server power >
Off

Data last refreshed
Oct 23, 2019 4:35:44 PM CDT

Log out

Refresh

Success!
SNMP settings have been saved.

SNMP settings

Set the Simple Network Management Protocol (SNMP) with a host name or IP address and a port.

Managers

HOST NAME OR IP ADDRESS

PORT

192.17.192.14

161

Add manager

Serial over LAN console

Access the Serial over LAN console

The Serial over LAN (SoL) console redirects the output of the server's serial port to a browser window on your workstation.

```
istep 4.29
istep 4.30
istep 4.31
istep 4.32
istep 4.33
istep 4.34
istep 5.1
istep 5.2
SBE starting hostboot

--- Welcome to Hostboot hostboot-cdc14bc/hbicore.bin ---

11.66603|secure|SecureROM valid - enabling functionality
11.94871|secure|Booting in non-secure mode.
29.40950|Booting from SBE side 0 on master proc=00050000
29.55216|ISTEP 6.5 - host_init_fsi
30.38838|ISTEP 6.6 - host_set_ipi_parms
30.69492|ISTEP 6.7 - host_discover_targets
31.96607|HWAS|PRESENT> DIMM[03]=AAAAA0000000000
31.96608|HWAS|PRESENT> Frc0[05]=B800000000000000
31.96609|HWAS|PRESENT> Core[07]=FF7FBFFB7FF0000
```

Open in new tab

2.6 functionality

2.7 Functionality

Kernel 5.3

KVM over IP

Multiple User
Management

Partial
PLDM/MCTP
support

Python
removal

Redfish

Virtual Media

Yocto 2.7
“Warrior”

2.7 Redfish Functionality

Firmware
Update

Inventory

Logging

Network

Partial
Certificates

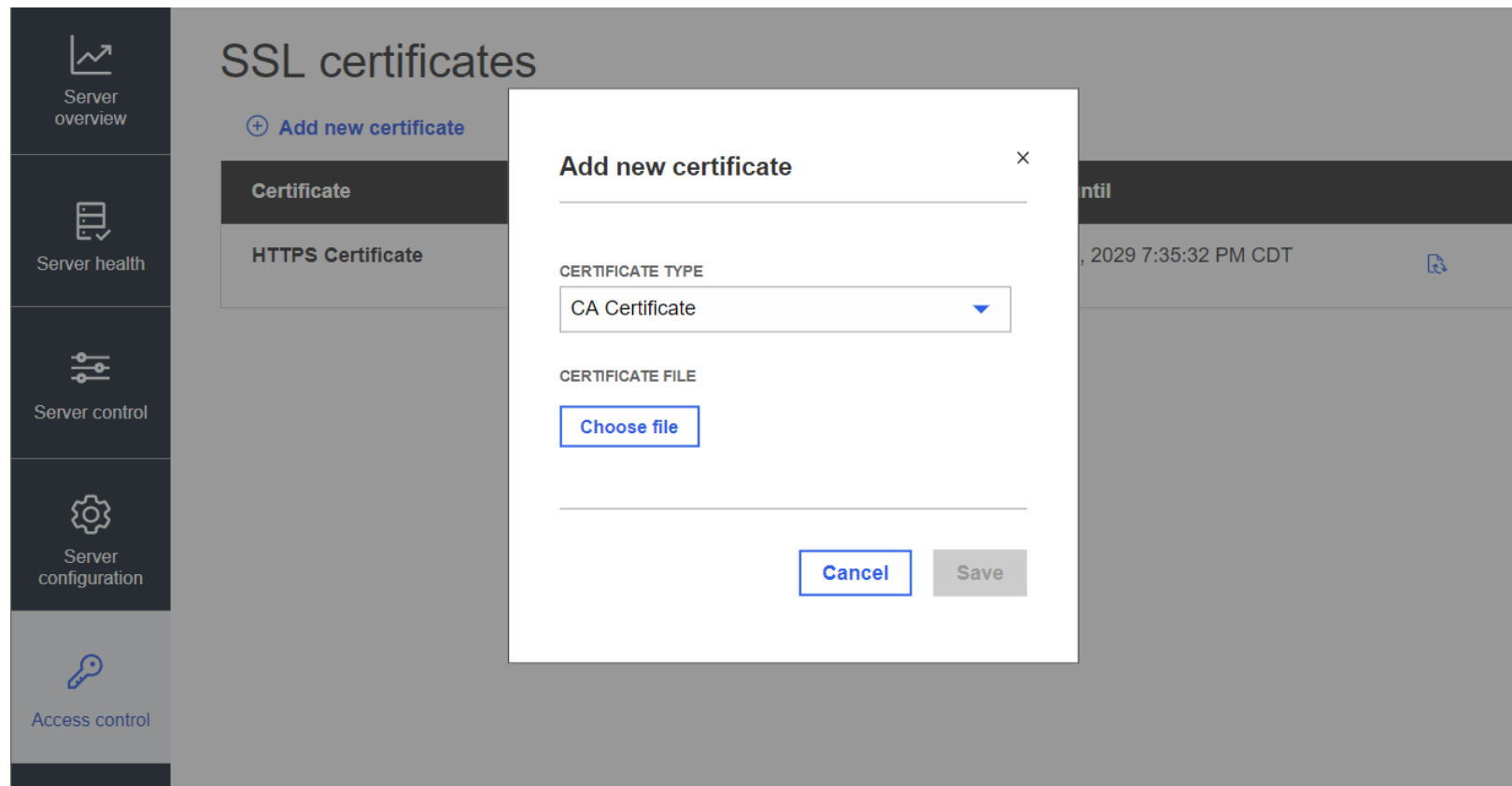
Power &
Thermal

State
Management

Time
Management

User
Management

SSL certificate panel using Redfish API





2.8 Functionality

Full Certificate Management

LDAP

Kernel update

MCTP/PLDM

Yocto 3.1

Redfish Event Service

Redfish Storage & Drives

Redfish Subscription Collection

Redfish Telemetry Service



Server
overview



Server health



Server control



Server
configuration



Access control

LDAP

Configure LDAP settings and manage role groups.

Settings

- ☒ **Enable LDAP authentication**
LDAP authentication must be enabled to modify role groups.

- ☒ Secure LDAP using SSL

CLIENT CERTIFICATE VALID UNTIL:
none available

[Go to SSL certificates](#)

SERVICE TYPE

- ☐ Open LDAP
☐ Active directory

SERVER URI

BIND DN

BIND PASSWORD

Show

BASE DN

USER ID ATTRIBUTE (OPTIONAL)

GROUP ID ATTRIBUTE (OPTIONAL)

Reset

Save



OpenBMC's Redfish Implementation

- Bmcweb
 - "Do everything" embedded webserver
 - Configurable
 - Authentication middleware
 - Virtual media, KVM
 - Redfish
 - Transposes D-Bus interfaces to REST
 - Static file hosting for Web Interface
 - Async
- Replaces phosphor-rest-server
- Uses Boost::Beast
- Adding translation layer
 - Means changes to our D-Bus API do not impact users

- ← Up
- Status
- Changes
- Build with Parameters
- Rebuild Last
- Build Graph
- Robot Results

Build History
 trend

×

#1708-witherspoon--9.3.21.42

Oct 30, 2019 2:10 PM

#1707-witherspoon--9.3.86.161

Oct 30, 2019 1:53 PM

#1706-witherspoon--9.3.86.161

Oct 30, 2019 1:31 PM

#1705-witherspoon--9.3.86.161

Oct 30, 2019 1:08 PM

#1704-witherspoon--9.3.86.161

Oct 30, 2019 12:46 PM

#1703-witherspoon--9.3.86.161

Project Redfish-Service-Validator

Full project name: OpenBMC-Dev/test/common/Redfish-Service-Validator

Target BMC IP, credentials and run robot DMTF Redfish-JsonSchema-ResponseValidator test suite against it. To target BMC using <https://github.com/DMTF>



Last Successful Artifacts

- [ConformanceHtmlLog_10_30_2019_183120.html](#) 2.05 MB [view](#)
- [ConformanceLog_10_30_2019_183120.txt](#) 12.67 MB [view](#)



Recent Changes



Latest Robot Results:

	Total	Failed	Passed	Pass %
Critical tests	1	1	0	0.0
All tests	1	1	0	0.0

- [Browse results](#)
- [Open report.html](#)
- [Open log.html](#)

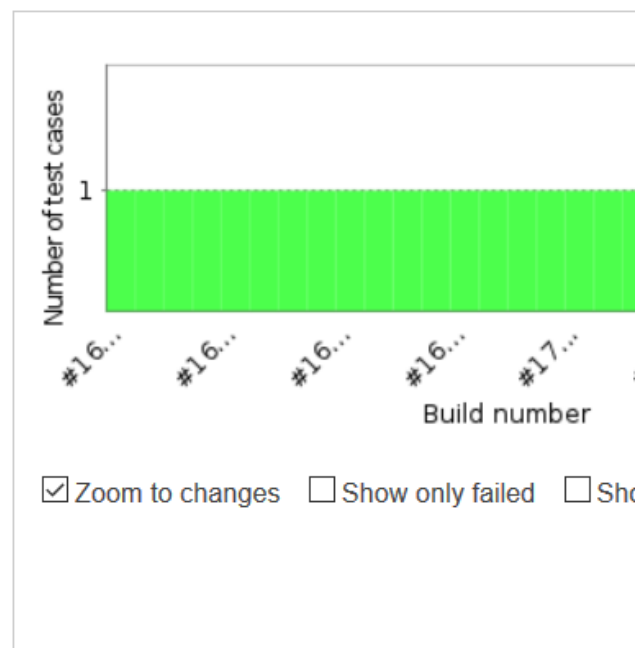
Upstream Projects

[OpenBMC-Dev](#) » [test](#) » [HW](#)

Permalinks

- [Last build \(#1708-witherspoon--9.3.21.42\)](#), 1 min 18 sec ago
- [Last stable build \(#1706-witherspoon--9.3.86.161\)](#), 40 min ago
- [Last successful build \(#1706-witherspoon--9.3.86.161\)](#), 40 min ago
- [Last failed build \(#1707-witherspoon--9.3.86.161\)](#), 18 min ago

Robot Framework Tests T







Moving OpenBMC Interfaces to Redfish

- 2.7 release – August 2019
 - Properties that were already in the Redfish. Very little OEM.
- Today web Interface and openbmctool use both D-Bus REST API and Redfish
- Work with the Redfish forum to get new properties and schemas added
- Eventually will move away from exposing D-Bus API
- Excited to move to something standard

Local user management

 [Account policy settings](#)

[+ Add user](#)

Username	Privilege	Account status		
root	Administrator	Enabled		
Gunnar	Administrator	Enabled		

▼ [Hide privilege role descriptions](#)

	Admin	Operator	User	Callback
Configure components managed by this service	✓			
Configure manager resources	✓			
Update password for current user account	✓	✓	✓	
Configure users and their accounts	✓			
Log in to the service and read resources	✓	✓	✓	

Getting involved

Mailing list: <https://lists.ozlabs.org/listinfo/openbmc/>

IRC: #openbmc (freenode.net)

OpenBMC Docs: <https://github.com/openbmc/docs>

Gerrit Code Review: <https://gerrit.openbmc-project.xyz>

Website: <https://www.openbmc.org/>

GitHub Issue Tracker(s): <https://github.com/openbmc/>

openbmc / docs

Unwatch

49

Unstar

45

Fork

85

Code

Issues 6

Pull requests 0

ZenHub

Projects 0

Wiki

Security

Insights

Settings

OpenBMC Documentation

Edit

openbmc

cheatsheet

documentation

getting-started

Manage topics

366 commits

1 branch

0 releases

52 contributors

CC-BY-4.0

Branch: master

New pull request

Create new file

Upload files

Find file

Clone or download

vijaykhemka code-update: Update manifest file ... Latest commit #75a111 28 days ago		
code-update	code-update: Update manifest file	7 days ago
designs	Redfish resource supplement for PFR	22 days ago
development	Update development guide to use new SDK file name	8 days ago
logo	Adding OpenBMC Logo files	last year
meetings	Remove OpenBMC Community Meeting	2 months ago
release	OpenBMC Release Notes	2 months ago
security	Docs: Document network security considerations	3 months ago
style	add .clang-format exemplars	last year
userguide	userguide: update path to code-update	11 months ago
CONTRIBUTING.md	Clarify language on non-public resources	16 days ago
LED-architecture.md	Fix up LED-Architecture.md	8 months ago
LICENSE	Add Creative Commons 4.0 LICENSE	last year
MAINTAINERS	MAINTAINERS: Update my email and IRC	last year
Makefile	userguide: update path to code-update	11 months ago
README.md	docs: Update TSC representative for Microsoft	6 months ago
REDFISH-cheatsheet.md	Firmware update method via TFTP and ImageURI	3 months ago
REST-cheatsheet.md	REST-cheatsheet: Fix typo	7 months ago
anti-patterns.md	anti-patterns: use cli11 instead of custom parser	7 months ago
cheatsheet.md	cheatsheet: MACHINE is available by default	3 months ago
code-of-conduct.md	Add first version of community Code of Conduct	11 months ago

August 2019 Archives by thread

- Messages sorted by: [subject] [author] [date]
- [More info on this list...](#)

Starting: *Thu Aug 1 01:36:00 AEST 2019*

Ending: *Sat Aug 31 21:26:10 AEST 2019*

Messages: 634

- [exposing device-tree populated eeproms in FruDevice](#) *Patrick Venture*
 - [exposing device-tree populated eeproms in FruDevice](#) *James Feist*
- [GUI workgroup - this Wednesday Jul 31 at 10AM CST](#) *Derick*
- [entity-manager exposing eeproms](#) *James Feist*
 - [entity-manager exposing eeproms](#) *Patrick Venture*
 - [entity-manager exposing eeproms](#) *Patrick Venture*
- [CVE-Tool build issues in Open BMC project](#) *Chittari Pabba*
- [How to switch pcie/ocp Nics for ncsi](#) *Lei YU*
- [\[PATCH net-next 2/2\] net: phy: broadcom: add 1000Base-X support for BCM54616S](#) *Tao Ren*
- [\[PATCH net-next 1/2\] net: phy: broadcom: set features explicitly for BCM54616S](#) *Tao Ren*
 - [\[PATCH net-next 1/2\] net: phy: broadcom: set features explicitly for BCM54616S](#) *Tao Ren*
 - [\[PATCH net-next 1/2\] net: phy: broadcom: set features explicitly for BCM54616S](#) *Heiner Kallweit*
- [\[PATCH v1 0/2\] add NPCM7xx EMC 10/100 Ethernet driver](#) *Avi Fishman*
 - [\[PATCH v1 1/2\] dt-binding: net: document NPCM7xx EMC 10/100 DT bindings](#) *Avi Fishman*
 - [\[PATCH v1 1/2\] dt-binding: net: document NPCM7xx EMC 10/100 DT bindings](#) *Rob Herring*
 - [\[PATCH v1 2/2\] net: npcm: add NPCM7xx EMC 10/100 Ethernet driver](#) *Avi Fishman*
 - [\[PATCH v1 2/2\] net: npcm: add NPCM7xx EMC 10/100 Ethernet driver](#) *David Miller*
 - [\[PATCH v1 2/2\] net: npcm: add NPCM7xx EMC 10/100 Ethernet driver](#) *Willem de Bruijn*
 - [\[PATCH v1 2/2\] net: npcm: add NPCM7xx EMC 10/100 Ethernet driver](#) *Avi Fishman*
 - [\[PATCH v1 2/2\] net: npcm: add NPCM7xx EMC 10/100 Ethernet driver](#) *Willem de Bruijn*
- [\[PATCH\] ARM: dts: aspeed: fp5280g2: Fix power-supply addr](#) *John Wang*
- [\[PATCH v1 0/2\] spi: add NPCM FIU controller driver](#) *Tomer Maimon*
- [\[PATCH v1 1/2\] dt-binding: spi: add NPCM FIU controller](#) *Tomer Maimon*
- [\[PATCH v1 2/2\] spi: npcm-fiu: add NPCM FIU controller driver](#) *Tomer Maimon*
- [Integrate collectd with OpenBMC](#) *Kun Yi*
 - [Integrate collectd with OpenBMC](#) *Brad Bishop*
 - [Integrate collectd with OpenBMC](#) *Kun Yi*
 - [Integrate collectd with OpenBMC](#) *Brad Bishop*
 - [Integrate collectd with OpenBMC](#) *Nancy Yuen*
- [Small help on trivial issue](#) *Vijay Khemka*
 - [Small help on trivial issue](#) *Lei YU*
 - [Small help on trivial issue](#) *vishwa*
 - [Small help on trivial issue](#) *Vijay Khemka*
 - [Small help on trivial issue](#) *Kun Yi*
- [Vijay Khemka shared "obmcdev" with you](#) *Vijay Khemka (via Dropbox)*
 - [Vijay Khemka shared "obmcdev" with you](#) *Vijay Khemka*
- [Reminder: Purchase tickets for OpenBMC Hackathon @ OSFC 9/3-6](#) *Nancy Yuen*
- [\[Potential Spoof\] Small help on trivial issue](#) *Vijay Khemka*
- [Calculate BMC MAC address from NCSI NIC's base MAC](#) *Tao Ren*

Submitting a Patch: Step by Step

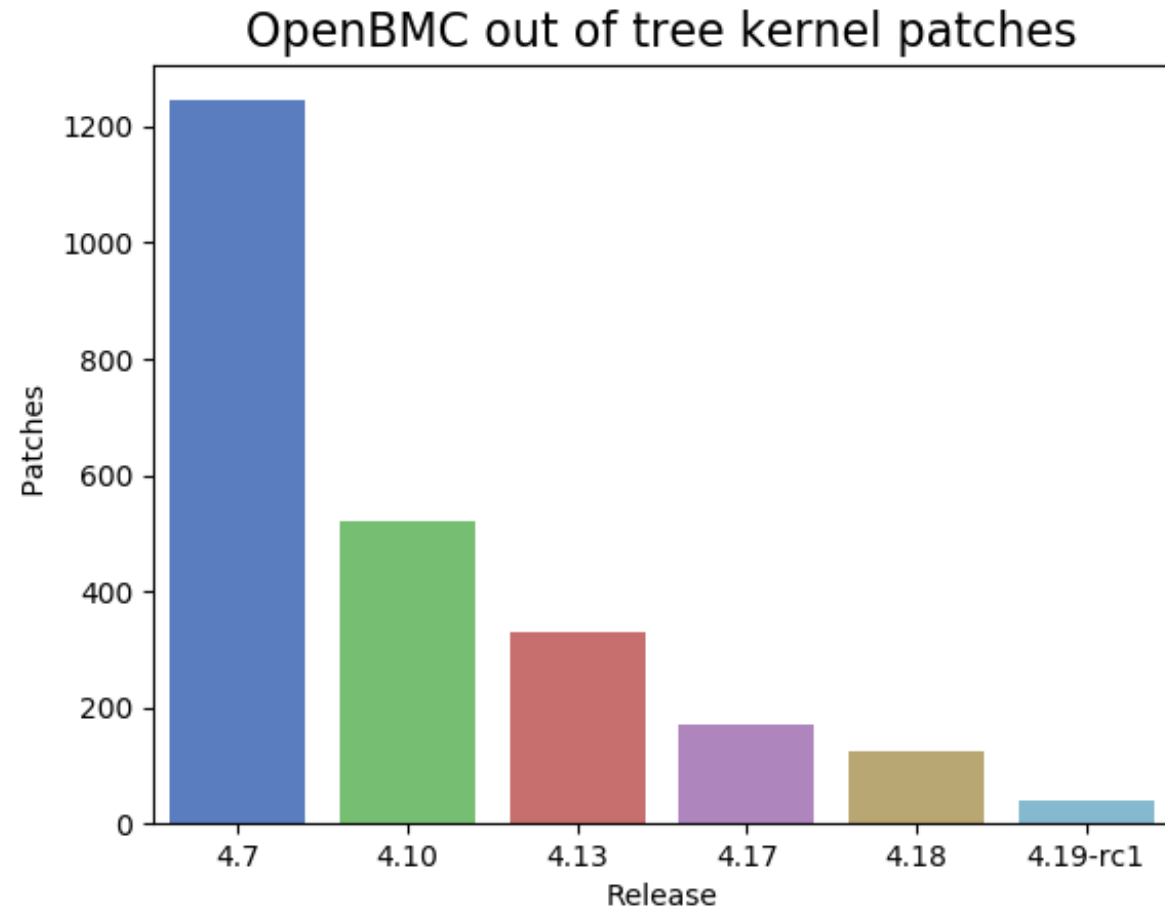
- Learn to use Git
- Open a GitHub Account for Gerrit authentication
- Clone a project from Gerrit (not GitHub!)
- Make changes, test, and commit
- Read and apply the contributing rules,
<https://github.com/openbmc/docs/blob/master/CONTRIBUTING.md>
- Add your peers to the list of reviewers for you patch
- Don't be afraid. The community will help! Ask for help on IRC.

Submitting a Linux Patch: Step by Step

- Understand the long term goal is to eliminate OpenBMC U-Boot and Linux forks
- Learn how to use Git
- Subscribe to the mailing list
- Clone the OpenBMC Linux kernel from <https://github.com/openbmc/linux>
- Make changes, test, and commit
- Read and apply rules at <https://github.com/openbmc/docs/blob/master/kernel-development.md>
- Refer to previously submitted patches on the OpenBMC mailing list or LKML for examples
- Submit your patch following <https://github.com/openbmc/docs/blob/master/kernel-development.md>

Upstream Communities

- OpenBMC participates in upstream communities
- Upstream Communities
 - Linux
 - Yocto
 - Systemd



Misc

- Code of Conduct
 - <https://github.com/openbmc/docs/blob/master/code-of-conduct.md>
- Security Mailing List
 - <https://lists.ozlabs.org/listinfo/openbmc-security/>
- Reporting security issues
 - <https://github.com/openbmc/docs/blob/master/security/how-to-report-a-security-vulnerability.md>

```
{
  "@odata.context": "/redfish/v1/$metadata#Manager.Manager",
  "@odata.id": "/redfish/v1/Managers/bmc",
  "@odata.type": "#Manager.v1_3_0.Manager",
  "Actions": {
    "#Manager.Reset": {
      "ResetType@Redfish.AllowableValues": [
        "GracefulRestart"
      ],
      "target": "/redfish/v1/Managers/bmc/Actions/Manager.Reset"
    }
  },
  "DateTime": "2019-10-30T20:09:22+00:00",
  "Description": "Baseboard Management Controller",
  "EthernetInterfaces": {
    "@odata.id": "/redfish/v1/Managers/bmc/EthernetInterfaces"
  },
  "FirmwareVersion": "2.8.0-dev-707-gcae294d-dirty",
  "GraphicalConsole": {
    "ConnectTypesSupported": [
      "KVMIP"
    ],
    "MaxConcurrentSessions": 4,
    "ServiceEnabled": true
  },
  "Id": "bmc",
  "Links": {
    "ManagerForChassis": [
      {
        "@odata.id": "/redfish/v1/Chassis/chassis"
      }
    ],
    "ManagerForChassis@odata.count": 1,
    "ManagerForServers": [
      {
        "@odata.id": "/redfish/v1/Systems/system"
      }
    ],
    "ManagerForServers@odata.count": 1,
    "ManagerInChassis": {
      "@odata.id": "/redfish/v1/Chassis/chassis"
    }
  }
}
```

```
{
  "@odata.context": "/redfish/v1/$metadata#ProcessorCollection.ProcessorCollection",
  "@odata.id": "/redfish/v1/Systems/system/Processors/",
  "@odata.type": "#ProcessorCollection.ProcessorCollection",
  "Members": [
    {
      "@odata.id": "/redfish/v1/Systems/system/Processors/cpu0"
    },
    {
      "@odata.id": "/redfish/v1/Systems/system/Processors/cpu1"
    },
    {
      "@odata.id": "/redfish/v1/Systems/system/Processors/gv100card0"
    },
    {
      "@odata.id": "/redfish/v1/Systems/system/Processors/gv100card1"
    },
    {
      "@odata.id": "/redfish/v1/Systems/system/Processors/gv100card2"
    },
    {
      "@odata.id": "/redfish/v1/Systems/system/Processors/gv100card3"
    },
    {
      "@odata.id": "/redfish/v1/Systems/system/Processors/gv100card4"
    },
    {
      "@odata.id": "/redfish/v1/Systems/system/Processors/gv100card5"
    }
  ],
  "Members@odata.count": 8,
  "Name": "Processor Collection"
}
```

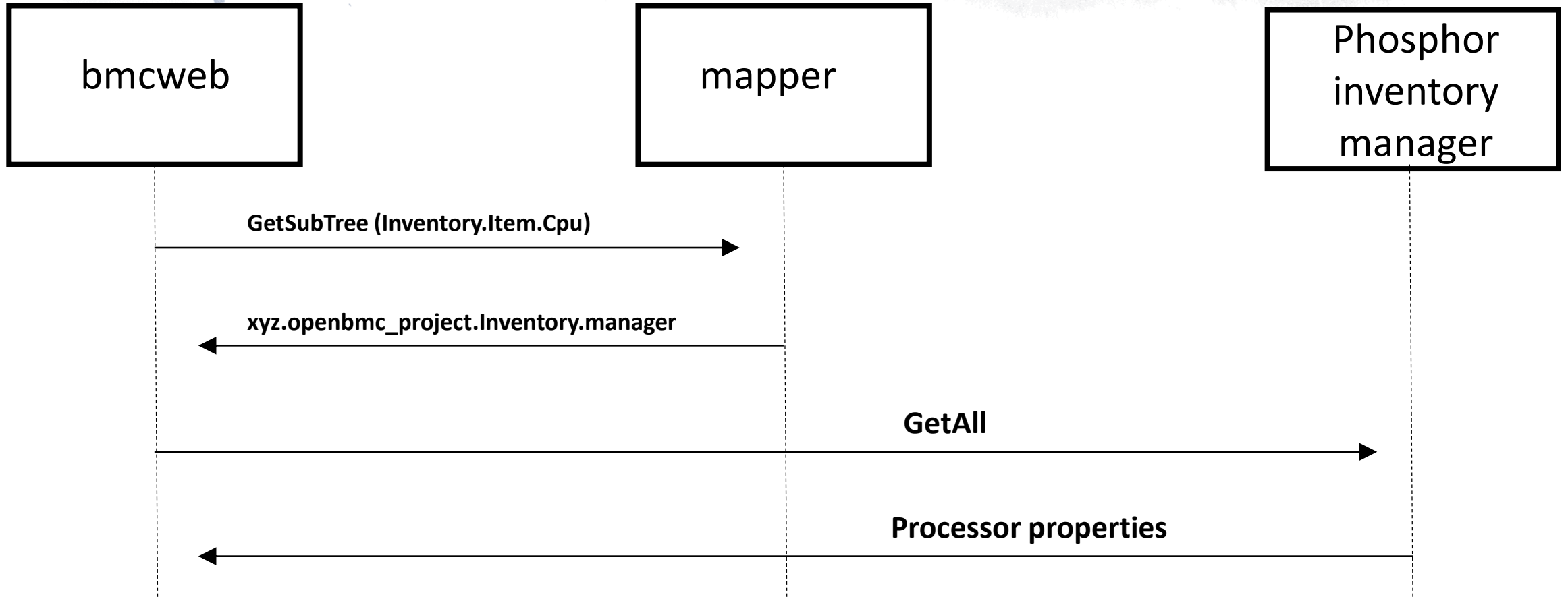
Demo of OpenBMC and Redfish on OpenBMC



OpenBMC

Backup

Object Mapper



```
dbus-send --system --print-reply \
--dest=xyz.openbmc_project.ObjectMapper \
/xyz/openbmc_project/object_mapper \
xyz.openbmc_project.ObjectMapper.GetSubTree \
string:"/" int32:0 array:string:"xyz.openbmc_project.Inventory.Item.Cpu"
method return time=1567567965.616423 sender=:1.23 -> destination=:1.148 serial=3
932 reply_serial=2
  array [
    dict entry(
      string "/xyz/openbmc_project/inventory/system/chassis/motherboard/cpu0"
      array [
        dict entry(
          string "xyz.openbmc_project.Inventory.Manager"
          array [
            string "org.freedesktop.DBus.Introspectable"
            string "org.freedesktop.DBus.Peer"
            string "org.freedesktop.DBus.Properties"
            string "xyz.openbmc_project.Inventory.Decorator.Asset"
            string "xyz.openbmc_project.Inventory.Decorator.Cacheable"
            string "xyz.openbmc_project.Inventory.Decorator.Replaceable"
            string "xyz.openbmc_project.Inventory.Decorator.Revision"
            string "xyz.openbmc_project.Inventory.Item"
            string "xyz.openbmc_project.Inventory.Item.Cpu"
            string "xyz.openbmc_project.State.Decorator.OperationalStatus"
          ]
        )
      ]
    )
  ]
)
```

```
dbus-send --system --print-reply \  
--dest=xyz.openbmc_project.Inventory.Manager \  
/xyz/openbmc_project/inventory/system/chassis/motherboard/cpu1 \  
org.freedesktop.DBus.Properties.GetAll string:""  
method return time=1567569558.219323 sender=:1.14 -> destination=:1.168 serial=1338  
reply_serial=2  
array [  
  dict entry(  
    string "Functional"  
    variant boolean true  
  )  
  dict entry(  
    string "PrettyName"  
    variant string "PROCESSOR MODULE"  
  )  
  dict entry(  
    string "Present"  
    variant boolean true  
  )  
  dict entry(  
    string "Version"  
    variant string "22"  
  )  
  dict entry(  
    string "FieldReplaceable"  
    variant boolean true  
  )  
]
```