We adapt. You succeed.

Staged Evolution of Integrating with Redfish

Interacting with hardware resources from a software perspective

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Redfish Integration / Usage

Agenda

- Introduction
- Redfish overview from an Open Source software person’s context
- Then, an evolving progression of
  - Accessing the Redfish API and Data Model contents
  - Start manipulating the target hardware to match what the overall use case requires
  - Leveraging all the pieces for an end-to-end deployment / solution

Overview of Redfish

From a software person’s context

- Yet another way to access a Baseboard Management Controller (BMC)
  - Bonus points
    - Superset of functionality compared to IPMI
    - Standardized approach across hardware partner platforms
- Provides / utilizes a REST API approach
  - Bonus points
    - Lots of possible ways to integrate
    - Composable, converged, hybrid-IT option to extend the software defined data center concept
    - Feels almost cloud-native like: a versioned API approach to manage the hardware that software lands upon

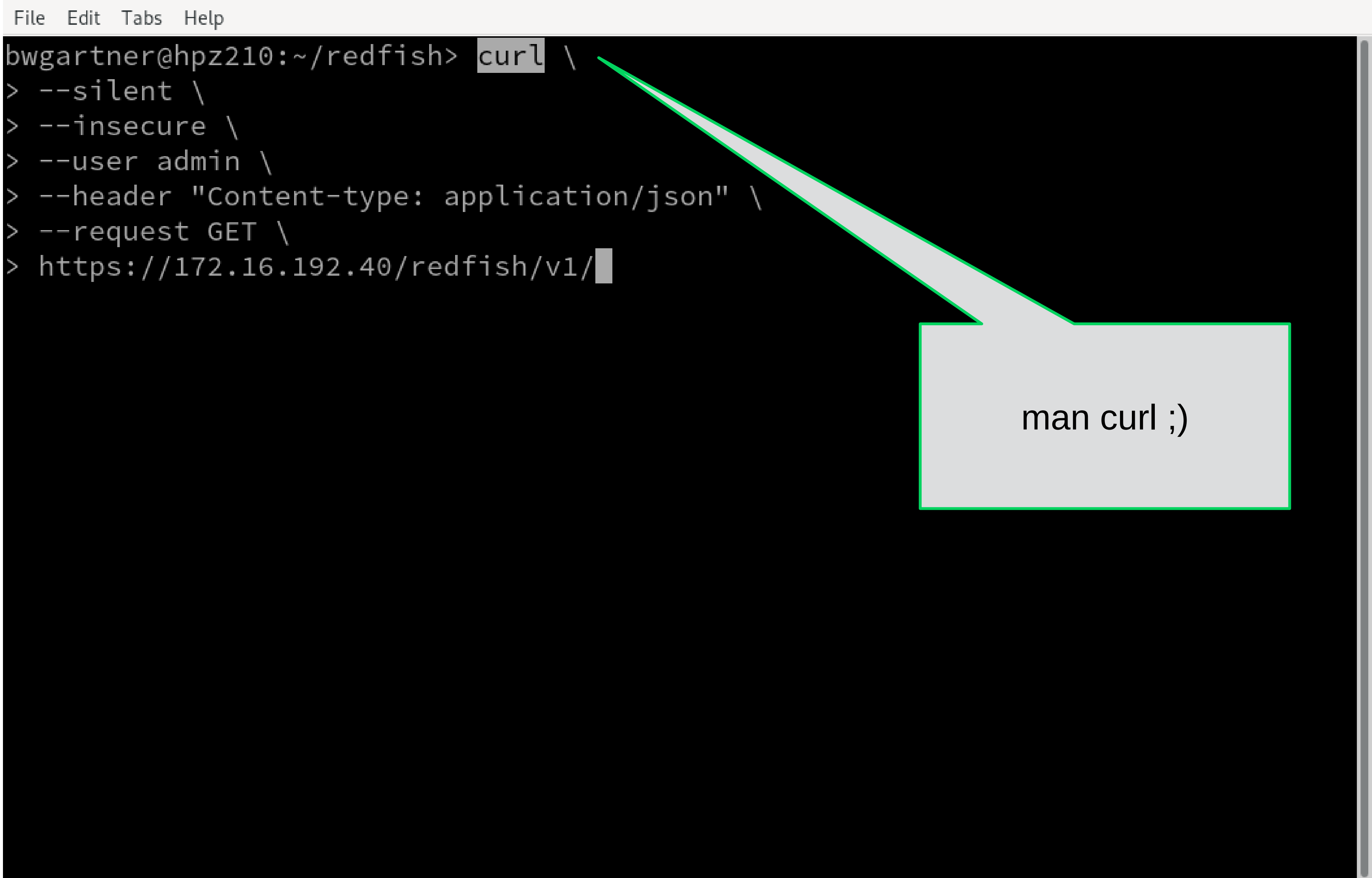
First steps

1st steps : accessing the API/Data Model

Start simple

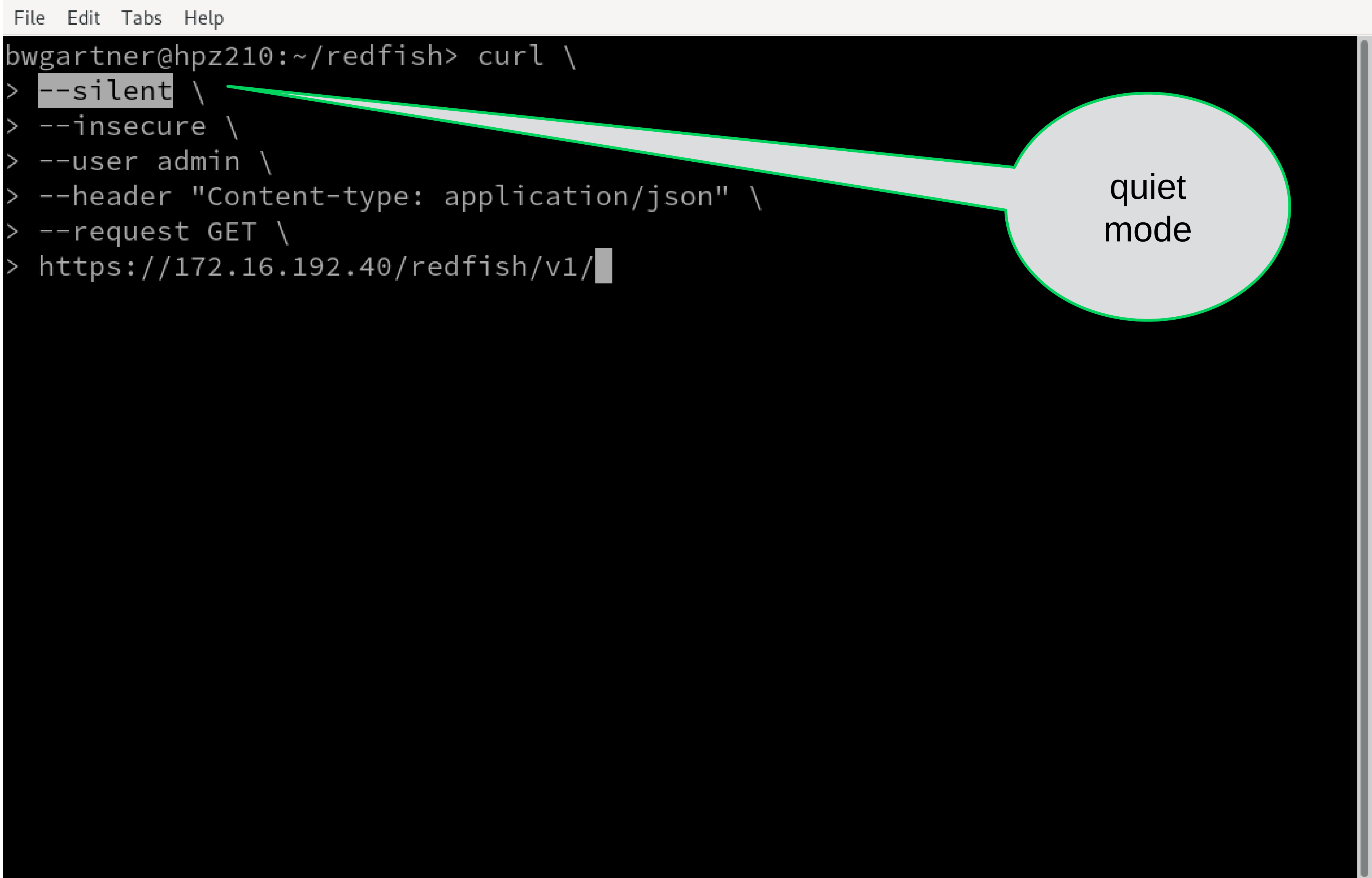
- Via curl, interactive to scripted CLI walk through
  - literally started with a Google “linux redfish curl examples” search
    - Setup curl options
    - Validated access URL and credentials
    - Formatted output into readable (JSON)
    - Explored a subset of the data model
    - Scripted a poll across several systems

Accessing the Redfish API



```
bwgartner@hpz210:~/redfish> curl \
> --silent \
> --insecure \
> --user admin \
> --header "Content-type: application/json" \
> --request GET \
> https://172.16.192.40/redfish/v1/
```

man curl ;)



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> --request GET \
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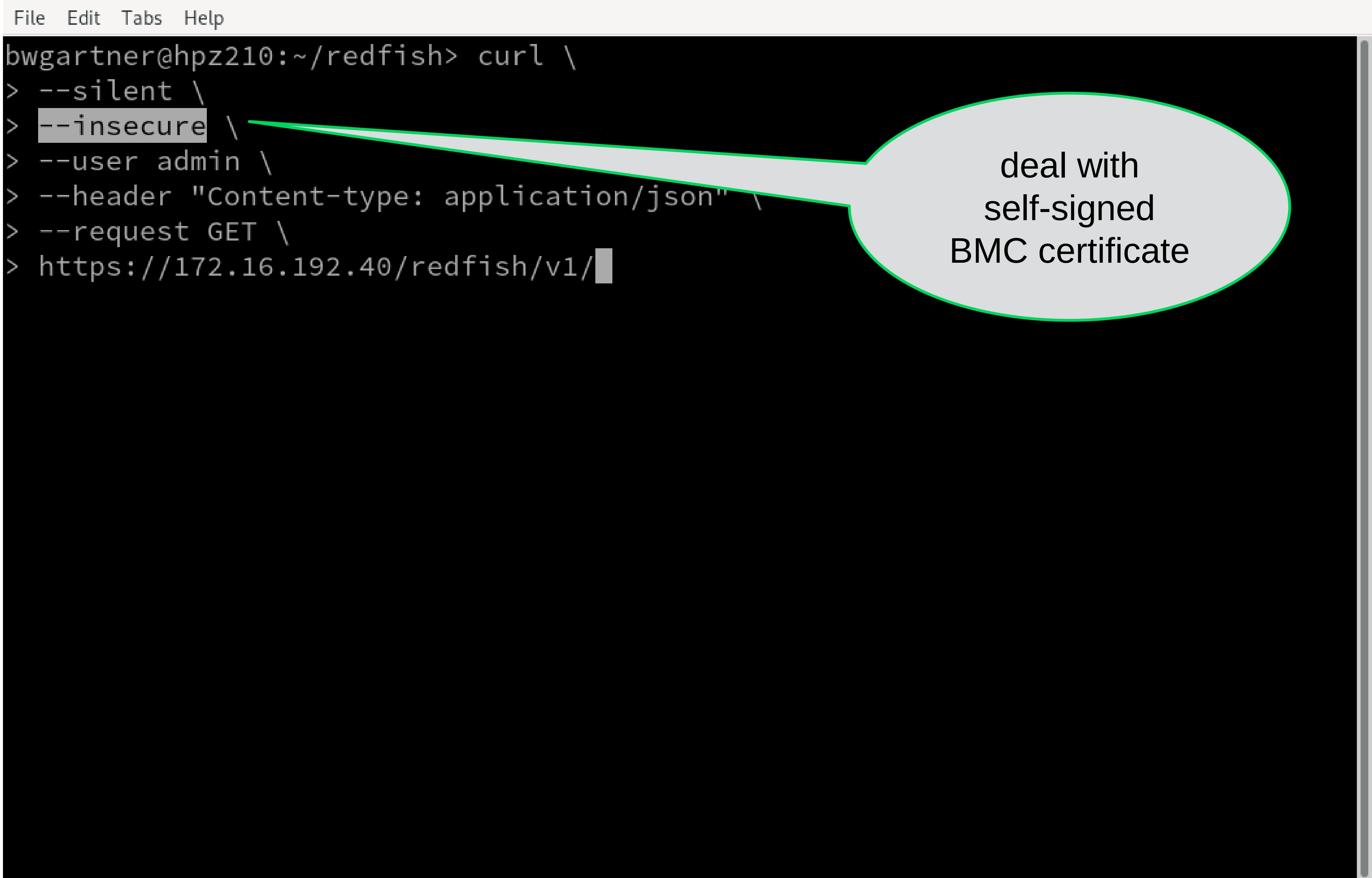
```

quiet mode



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> --silent \
> --insecure \
> --user admin \
> --header "Content-type: application/json" \
> --request GET \
> https://172.16.192.40/redfish/v1/
```
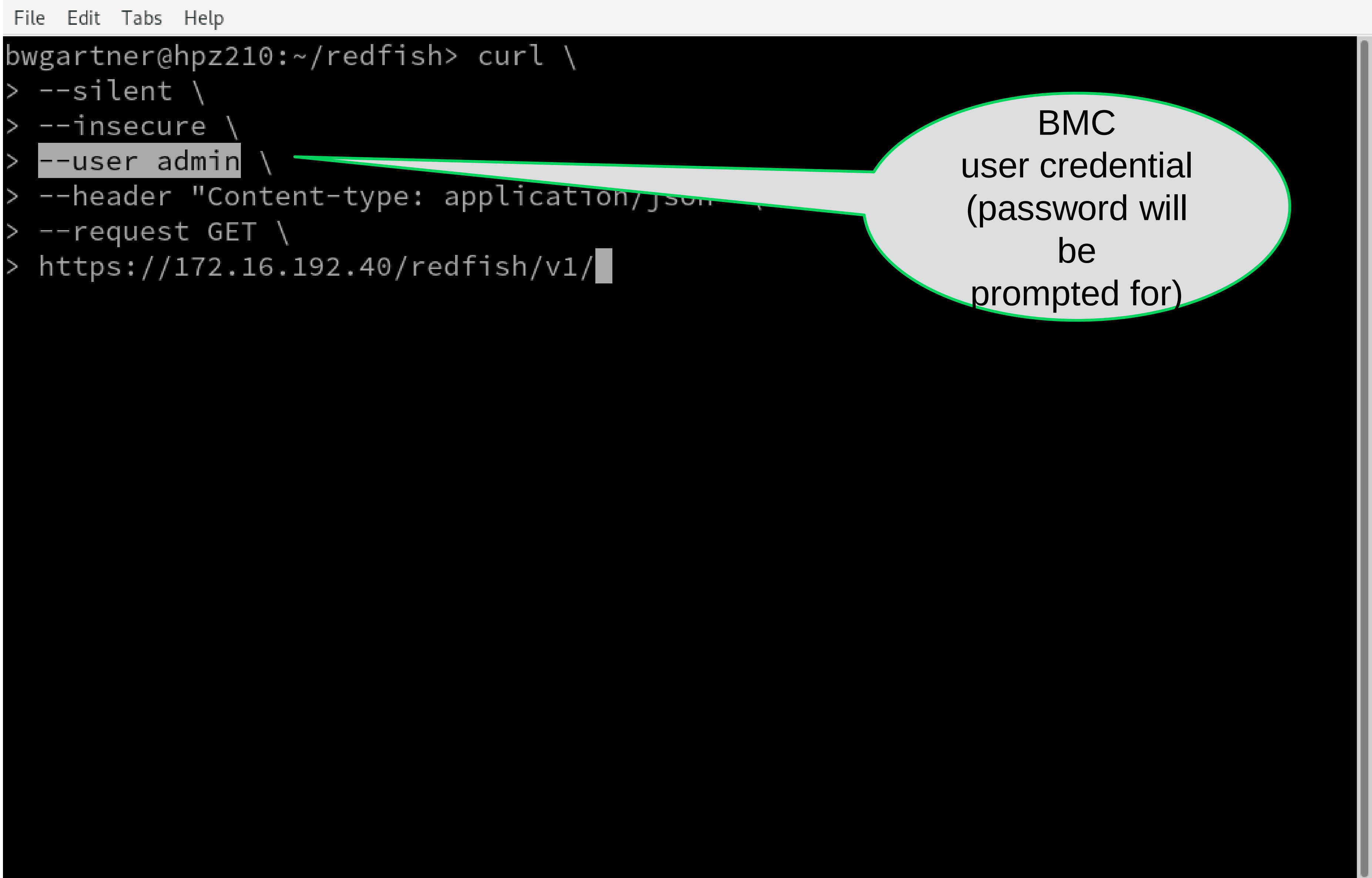

deal with
self-signed
BMC certificate



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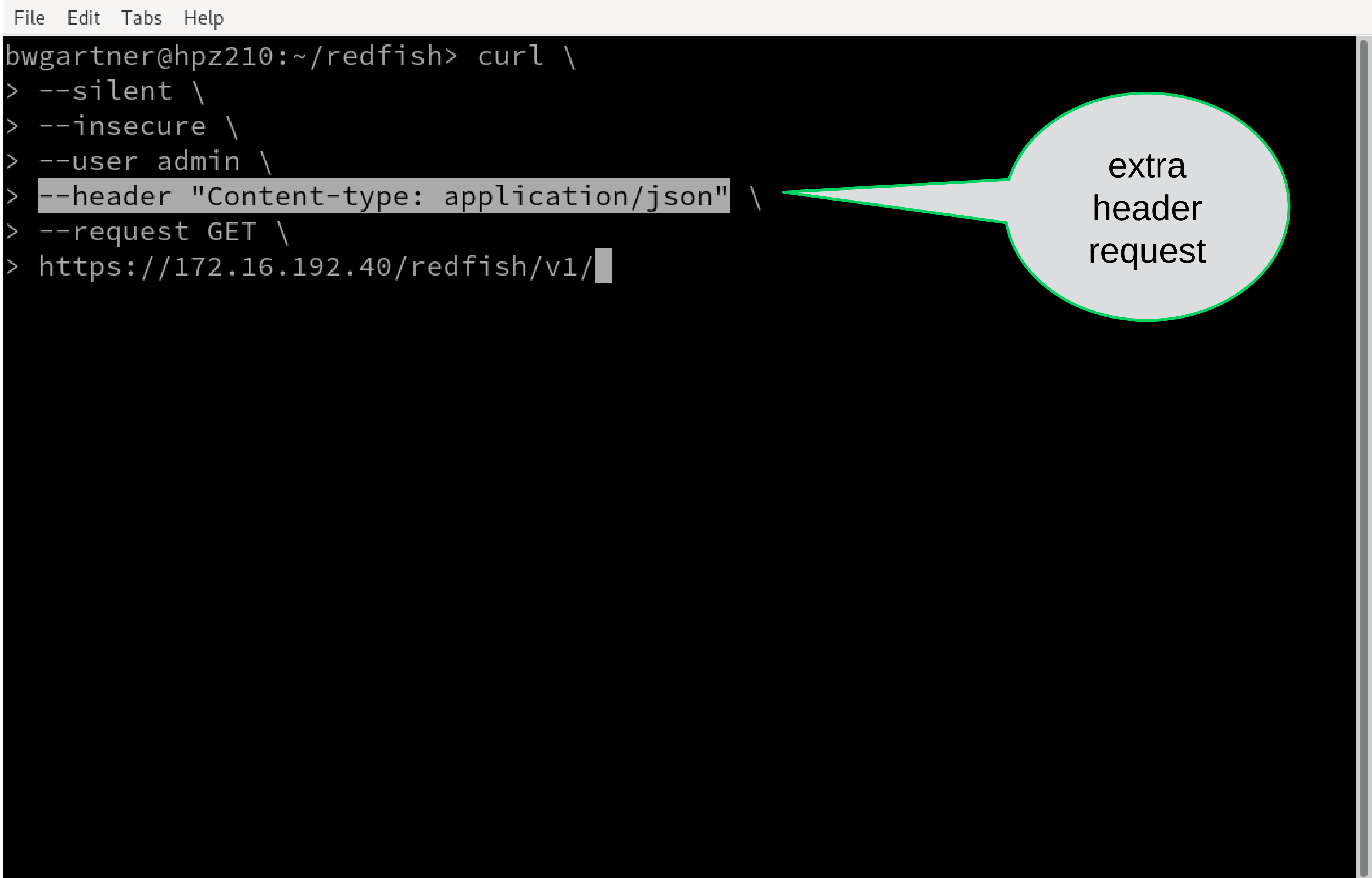
> --silent \
> --insecure \
> --user admin \
> --header "Content-type: application/json \
> --request GET \
> https://172.16.192.40/redfish/v1/
```

BMC
user credential
(password will
be
prompted for)



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> --silent \
> --insecure \
> --user admin \
> --header "Content-type: application/json" \
> --request GET \
> https://172.16.192.40/redfish/v1/
```
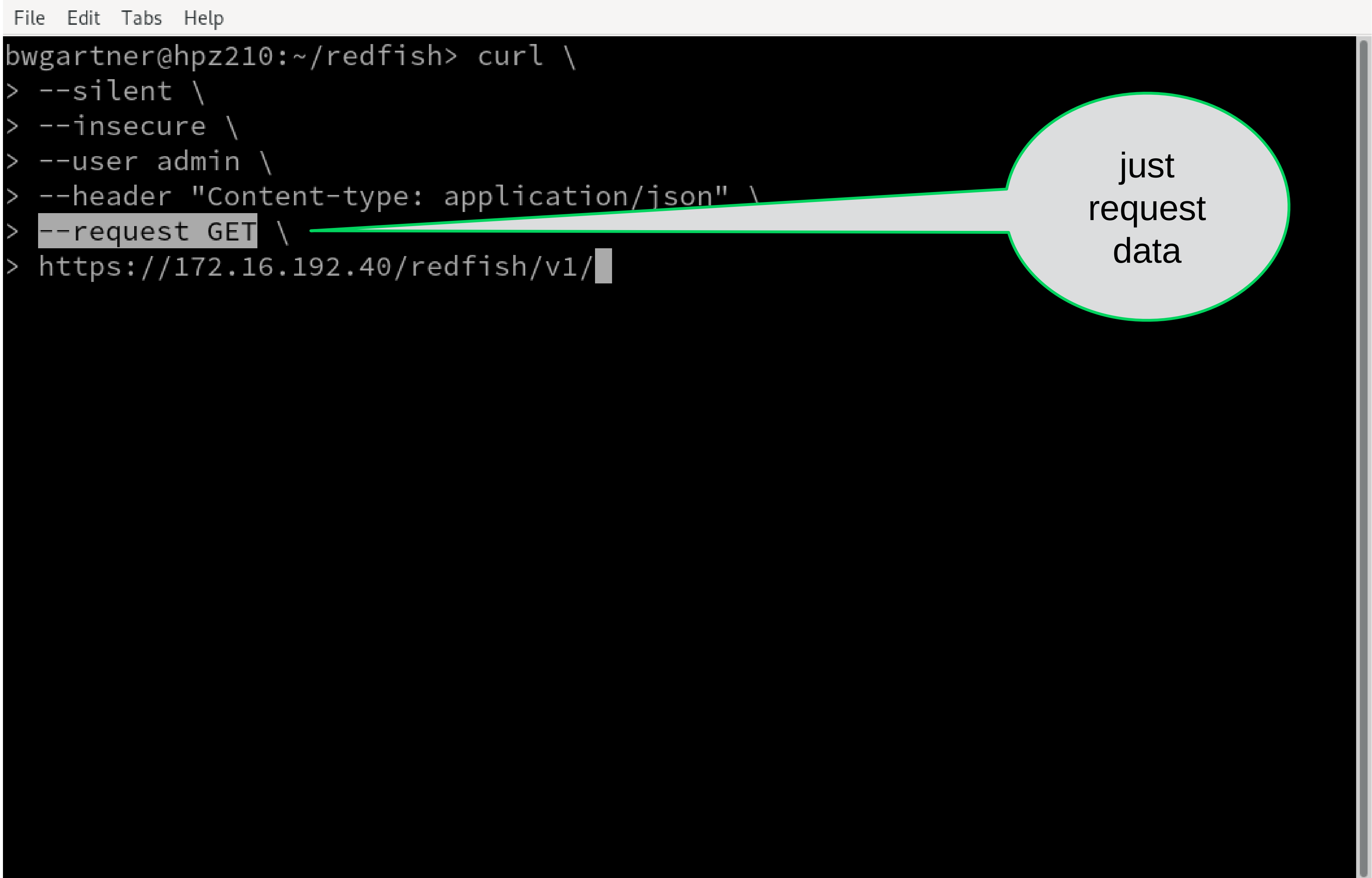

extra header request



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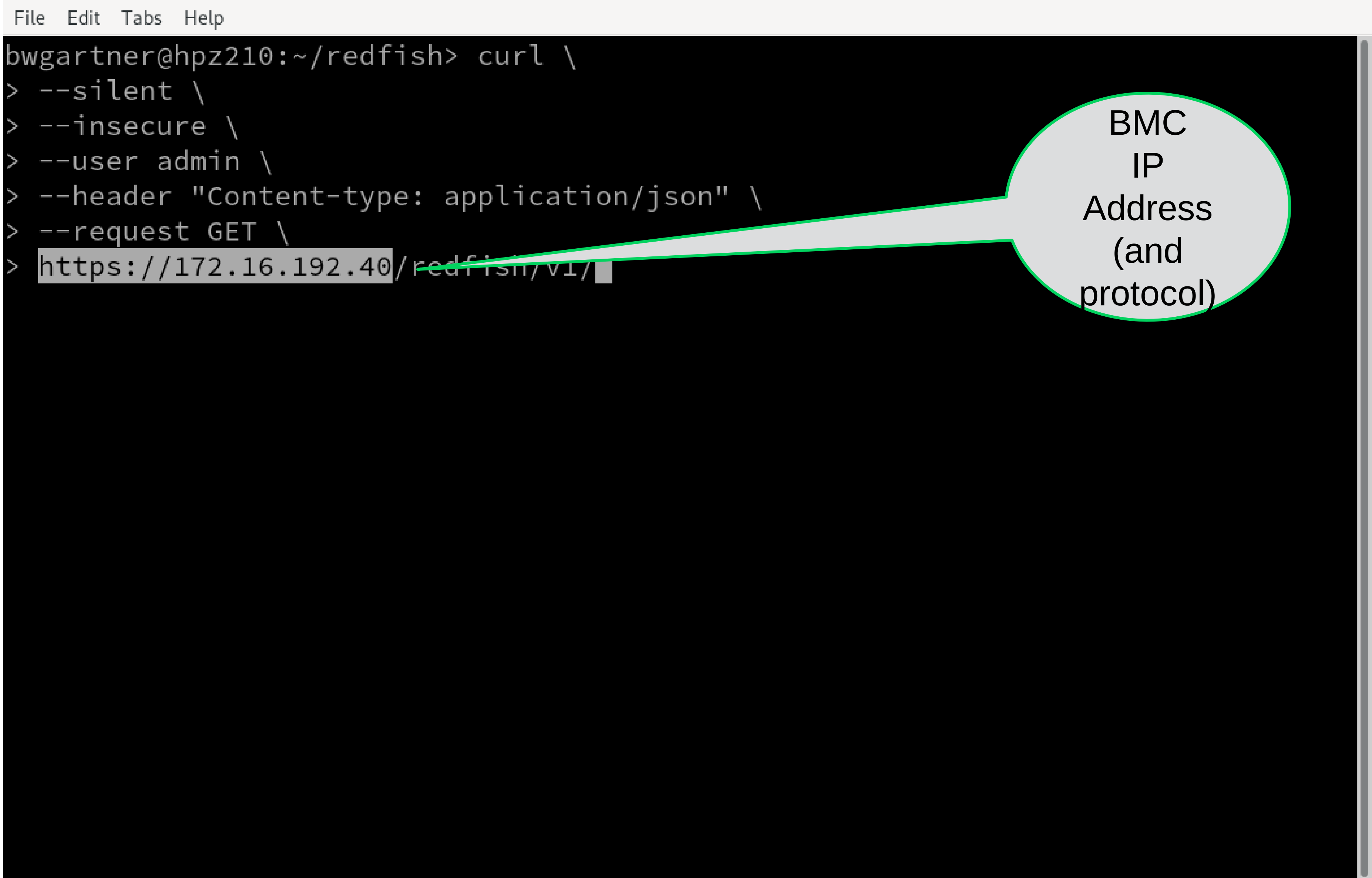
> --silent \
> --insecure \
> --user admin \
> --header "Content-type: application/json" \
> --request GET \
> https://172.16.192.40/redfish/v1/
```

just request data



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> --silent \
> --insecure \
> --user admin \
> --header "Content-type: application/json" \
> --request GET \
> https://172.16.192.40/redfish/v1/
```
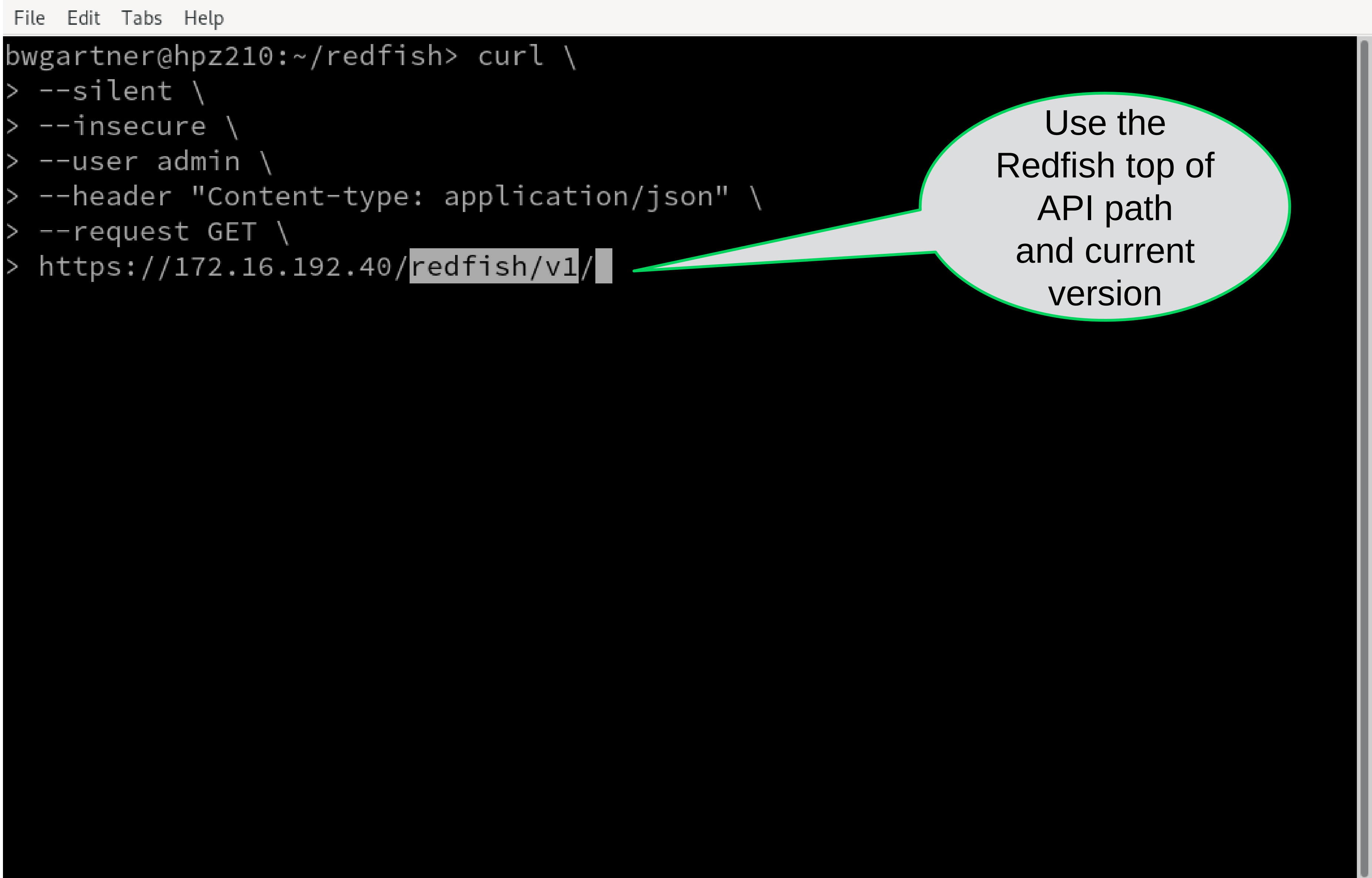

BMC
IP
Address
(and
protocol)



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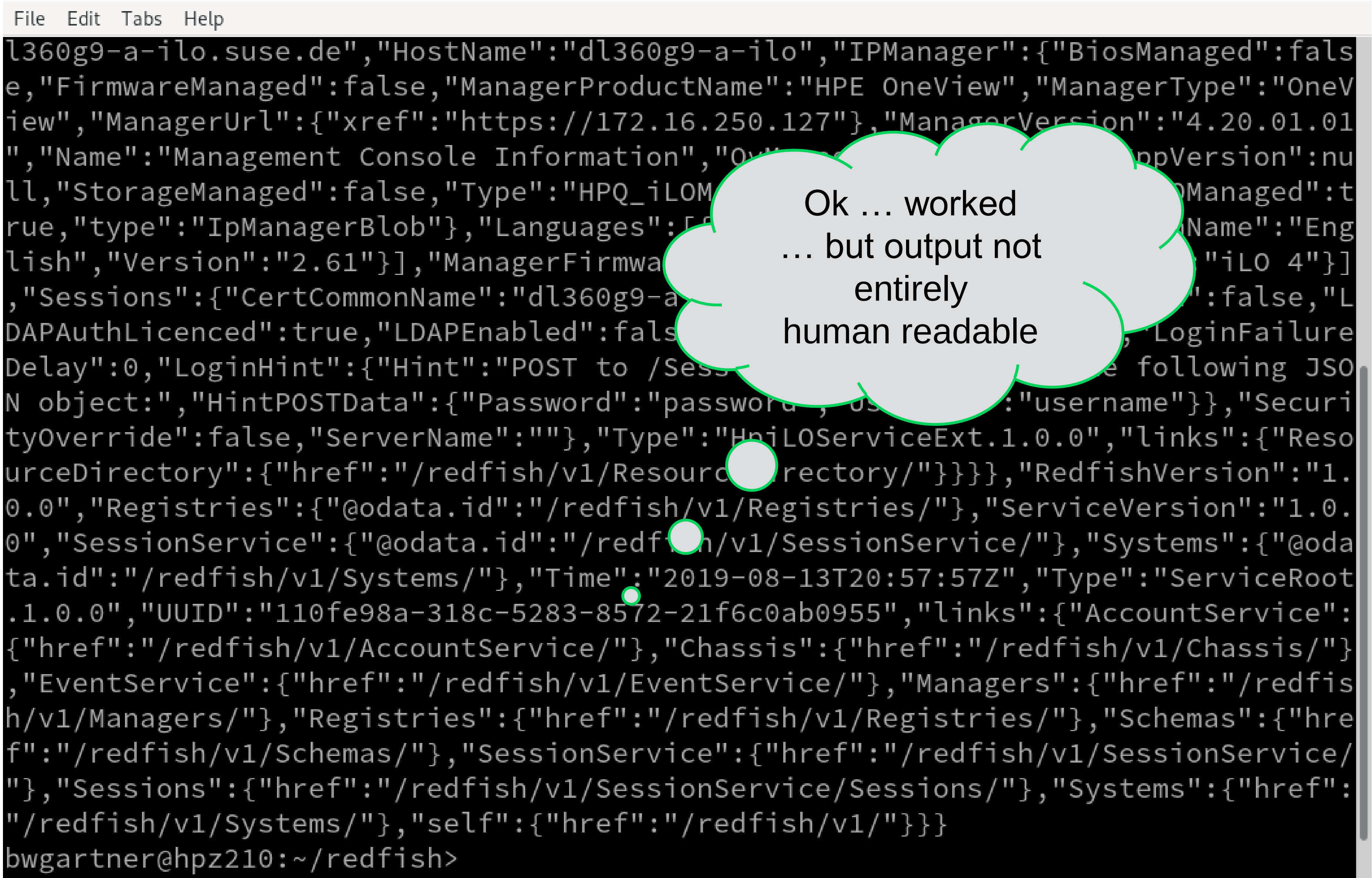
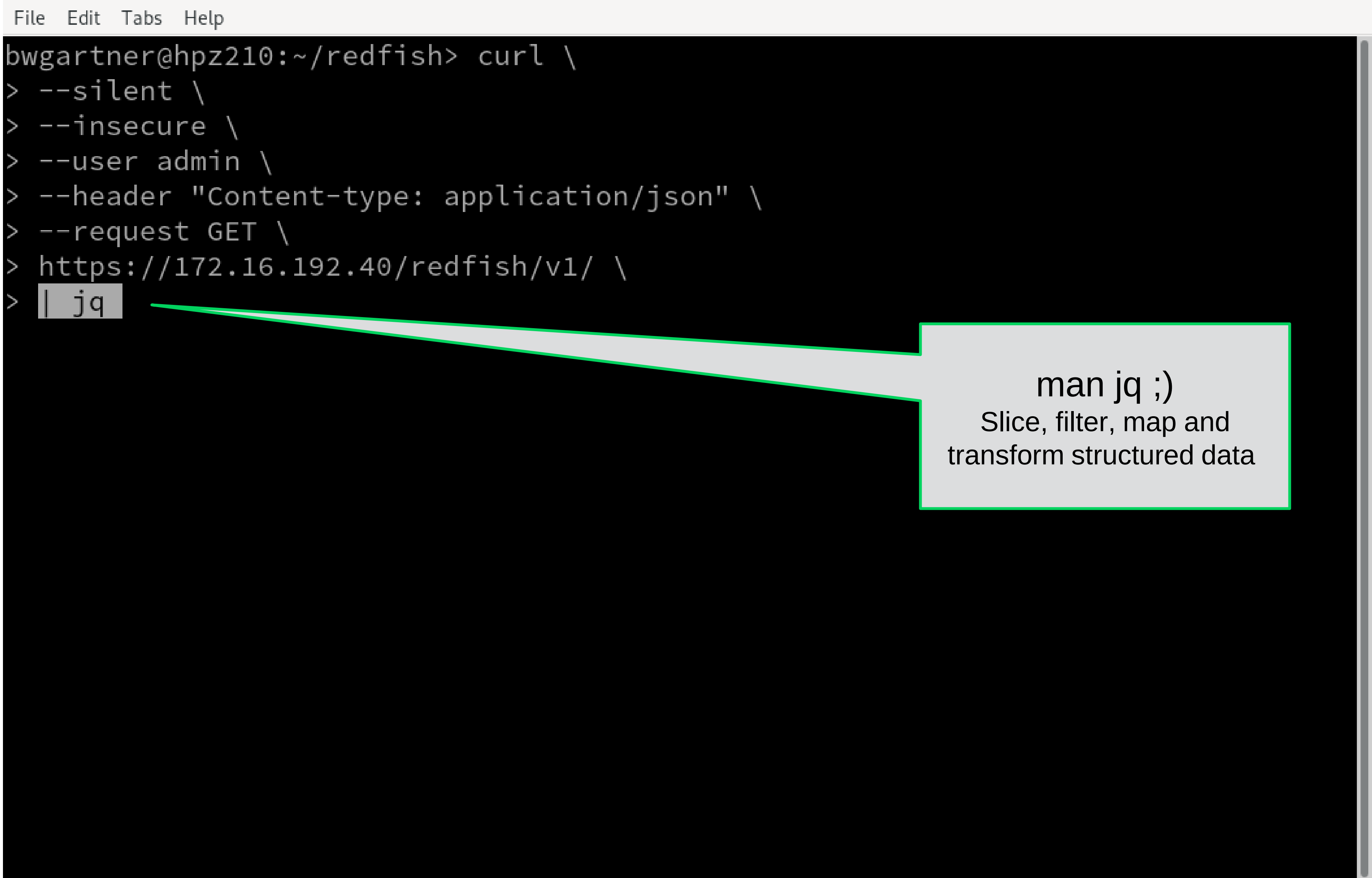
> --insecure \
> --user admin \
> --header "Content-type: application/json" \
> --request GET \
> https://172.16.192.40/redfish/v1/
```

Use the Redfish top of API path and current version



```
l360g9-a-ilo.suse.de","HostName":"dl360g9-a-ilo","IPManager":{"BiosManaged":fals
e,"FirmwareManaged":false,"ManagerProductName":"HPE OneView","ManagerType":"OneV
iew","ManagerUrl":{"xref":"https://172.16.250.127"},"ManagerVersion":"4.20.01.01
","Name":"Management Console Information","Ov                          ppVersion":nu
ll,"StorageManaged":false,"Type":"HPQ_iLOM                              Managed":t
rue,"type":"IpManagerBlob"},"Languages":[                               Name":"Eng
lish","Version":"2.61"}],"ManagerFirmwa                                 "iLO 4"}]
,"Sessions":{"CertCommonName":"dl360g9-a                                ":false,"L
DAPAuthLicenced":true,"LDAPEnabled":fals                                "LoginFailure
Delay":0,"LoginHint":{"Hint":"POST to /Sess                        e following JSO
N object:","HintPOSTData":{"Password":"password"               :"username"}},"Securi
tyOverride":false,"ServerName":""},"Type":"HpiLOServiceExt.1.0.0","links":{"Reso
urceDirectory":{"href":"/redfish/v1/Resourc  rectory/"}}}},"RedfishVersion":"1.
0.0","Registries":{"@odata.id":"/redfish/v1/Registries/"},"ServiceVersion":"1.0.
0","SessionService":{"@odata.id":"/redf  h/v1/SessionService/"},"Systems":{"@oda
ta.id":"/redfish/v1/Systems/"},"Time":"2019-08-13T20:57:57Z","Type":"ServiceRoot
.1.0.0","UUID":"110fe98a-318c-5283-8572-21f6c0ab0955","links":{"AccountService":
{"href":"/redfish/v1/AccountService/"},"Chassis":{"href":"/redfish/v1/Chassis/"}
,"EventService":{"href":"/redfish/v1/EventService/"},"Managers":{"href":"/redfis
h/v1/Managers/"},"Registries":{"href":"/redfish/v1/Registries/"},"Schemas":{"hre
f":"/redfish/v1/Schemas/"},"SessionService":{"href":"/redfish/v1/SessionService/
"},"Sessions":{"href":"/redfish/v1/SessionService/Sessions/"},"Systems":{"href":
"/redfish/v1/Systems/"},"self":{"href":"/redfish/v1/"}}}
bwgartner@hpz210:~/redfish>
```

Ok … worked
… but output not
entirely
human readable



```
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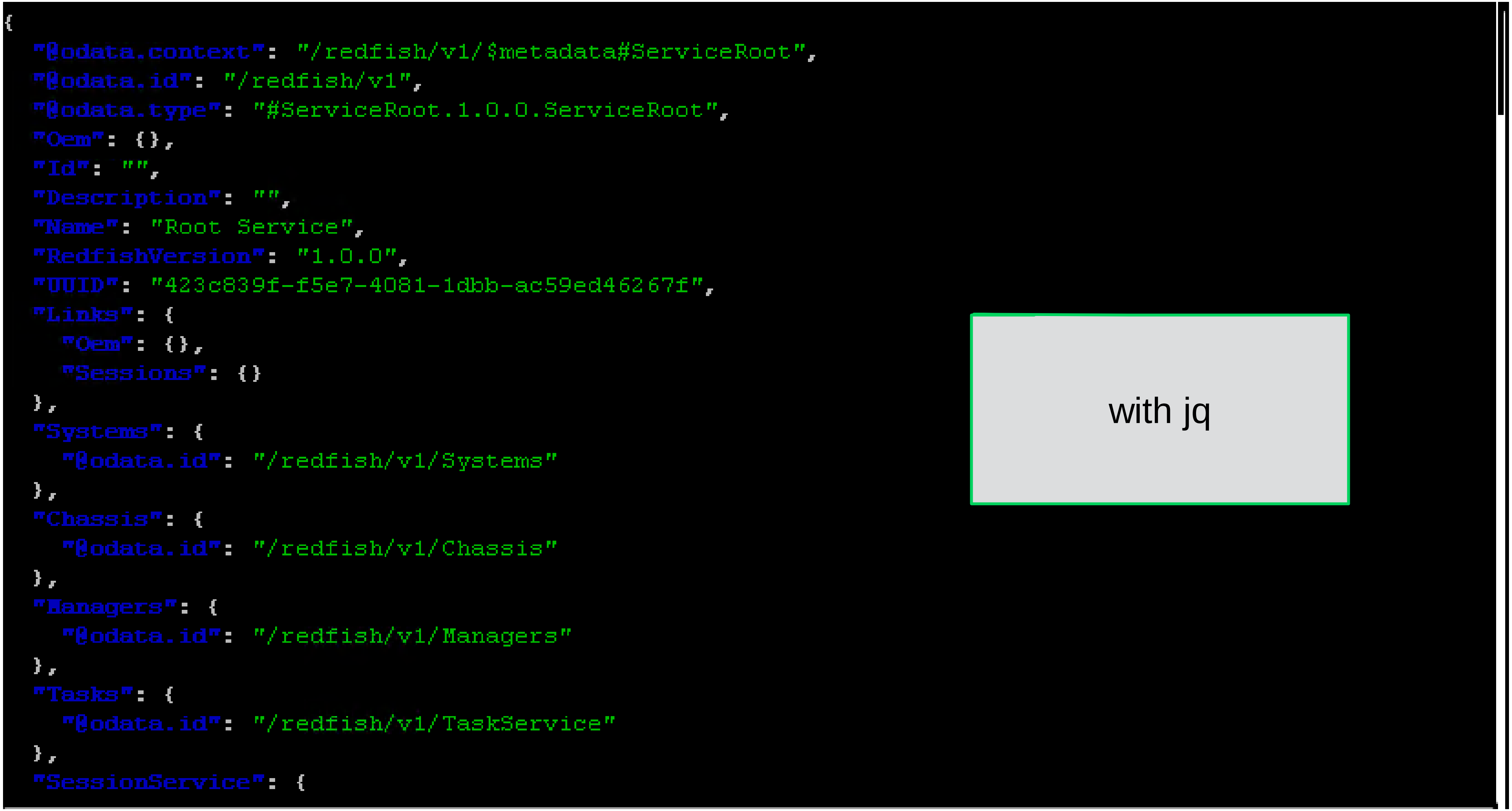
> --silent \
> --insecure \
> --user admin \
> --header "Content-type: application/json" \
> --request GET \
> https://172.16.192.40/redfish/v1/ \
> | jq
```

man jq ;)

Slice, filter, map and transform structured data



```
{
  "@odata.context": "/redfish/v1/$metadata#ServiceRoot",
  "@odata.id": "/redfish/v1",
  "@odata.type": "#ServiceRoot.1.0.0.ServiceRoot",
  "Oem": {},
  "Id": "",
  "Description": "",
  "Name": "Root Service",
  "RedfishVersion": "1.0.0",
  "UUID": "423c839f-f5e7-4081-1dbb-ac59ed46267f",
  "Links": {
    "Oem": {},
    "Sessions": {}
  },
  "Systems": {
    "@odata.id": "/redfish/v1/Systems"
  },
  "Chassis": {
    "@odata.id": "/redfish/v1/Chassis"
  },
  "Managers": {
    "@odata.id": "/redfish/v1/Managers"
  },
  "Tasks": {
    "@odata.id": "/redfish/v1/TaskService"
  },
  "SessionService": {
```

with jq

Cheat-sheet : 1/2 - Know you environment

```
BMC_IP=172.16.30.1
BMC_USER=ADMIN
BMC_PASS=ADMIN
# Install redfishtool (CLI)
git clone https://github.com/DMTF/Redfishtool.git
cd Redfishtool/ python3 redfishtool.py -r ${BMC_IP} -u ${BMC_USER} -p ${BMC_PASS} Systems -F
for BMC_IP in 10.0.1.11 10.0.1.12 10.0.1.13; do
   python3 redfishtool.py -r ${BMC_IP} -u ${BMC_USER} -p ${BMC_PASS} Systems -F | jq .SerialNumber
   python3 redfishtool.py -r $BMC_IP -u $BMC_USER -p $BMC_PASS Systems -F | jq .IndicatorLED
Done
python3 redfishtool.py -r $BMC_IP -u $BMC_USER -p $BMC_PASS Chassis list
python3 redfishtool.py -r $BMC_IP -u $BMC_USER -p $BMC_PASS Chassis -I 1
python3 redfishtool.py -r $BMC_IP -u $BMC_USER -p $BMC_PASS Chassis -I HA-RAID.0.StorageEnclosure.0

python3 redfishtool.py -r $BMC_IP -u $BMC_USER -p $BMC_PASS Systems -F | jq .UUID
python3 redfishtool.py -r $BMC_IP -u $BMC_USER -p $BMC_PASS Systems -F | jq .IndicatorLED

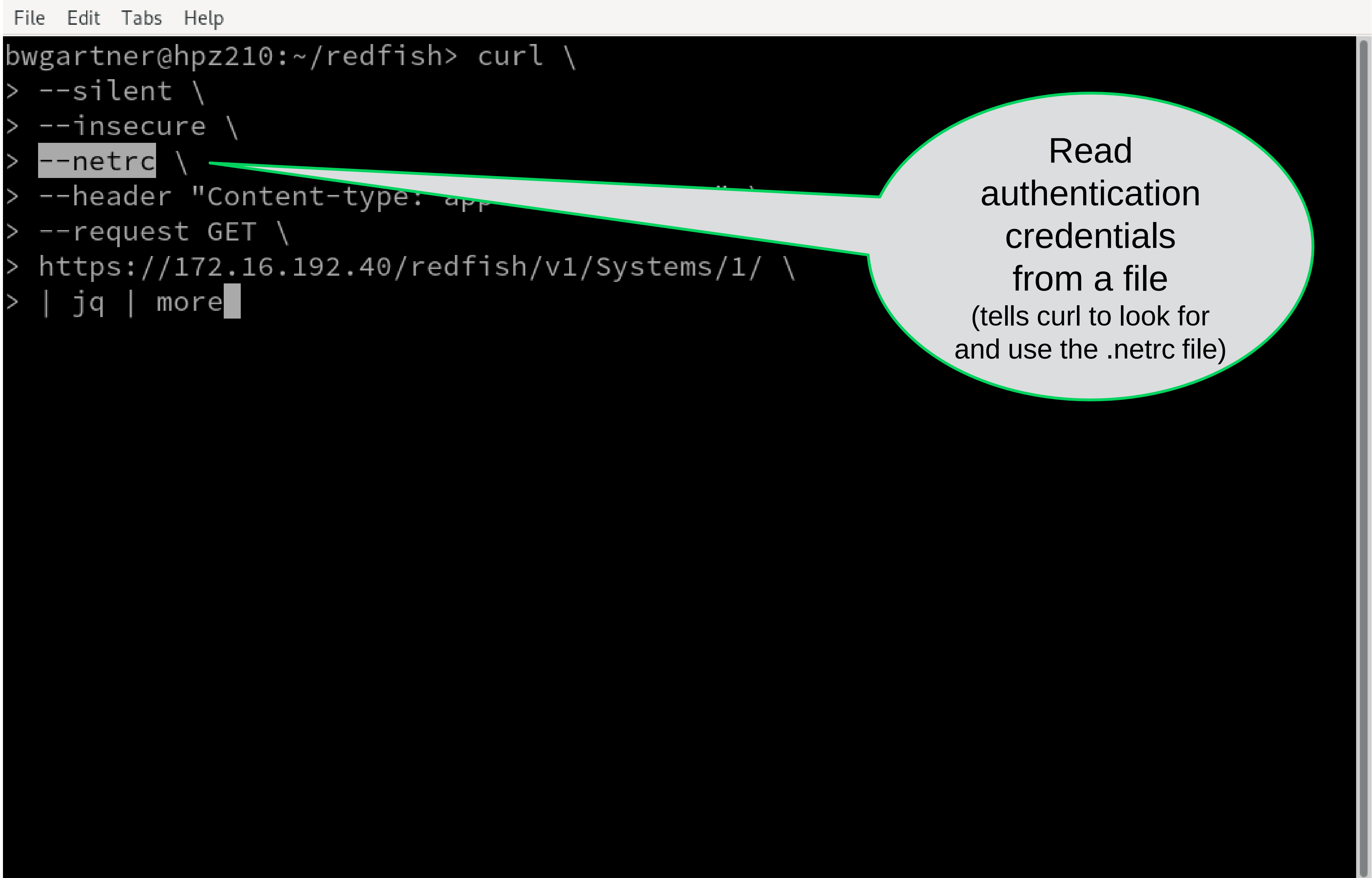
python3 redfishtool.py -r $BMC_IP -u $BMC_USER -p $BMC_PASS Chassis -I 1 setIndicatorLed Off

BMC_IP=$(dig +short node1.example.com)
unset https_proxy
```

Cheat-sheet : 2/2 - Game is opened

```
# get firmware versions
# BMC
python3 redfishtool.py -r ${BMC_HOST} -u ${BMC_USER} -p ${BMC_PASS} Managers -F | jq .FirmwareVersion
curl -s https://${BMC_IP}/redfish/v1/Managers/1/ -k -u ${BMC_USER}:${BMC_PASS} | jq .FirmwareVersion
# BIOS python3 redfishtool.py -r ${BMC_HOST} -u ${BMC_USER} -p ${BMC_PASS} Systems -F | jq .BiosVersion
curl -s https://${BMC_IP}/redfish/v1/Systems/1/ -k -u ${BMC_USER}:${BMC_PASS} | jq .BiosVersion
# System manufactor
curl -s https://${BMC_IP}/redfish/v1/Systems/1/ -k -u ${BMC_USER}:${BMC_PASS} | jq .Manufacturer
# System model
curl -s https://${BMC_IP}/redfish/v1/Systems/1/ -k -u ${BMC_USER}:${BMC_PASS} | jq .PartNumber
# get serial curl -s https://${BMC_IP}/redfish/v1/Systems/1 -k -u ${BMC_USER}:${BMC_PASS} | jq .UUID
curl -s https://${BMC_IP}/redfish/v1/Systems/1 -k -u ${BMC_USER}:${BMC_PASS} | jq .SerialNumber
curl -s https://${BMC_IP}/redfish/v1/Chassis/1 -k -u ${BMC_USER}:${BMC_PASS} | jq .SerialNumber
# get CPU information curl -s https://${BMC_IP}/redfish/v1/Systems/1/Processors/1 -k -u ${BMC_USER}:${BMC_PASS} | jq .Model
curl -s https://${BMC_IP}/redfish/v1/Systems/1/Processors/1 -k -u ${BMC_USER}:${BMC_PASS} | jq .TotalCores
curl -s https://${BMC_IP}/redfish/v1/Systems/1 -k -u ${BMC_USER}:${BMC_PASS} | jq .ProcessorSummary.Count
# ram total
curl -s https://${BMC_IP}/redfish/v1/Systems/1 -k -u ${BMC_USER}:${BMC_PASS} | jq .MemorySummary.TotalSystemMemoryGiB
# ram modules
curl -k -u ${BMC_USER}:${BMC_PASS} -s https://${BMC_IP}/redfish/v1/Systems/1/Memory | jq ".Members | length"
# get BMC settings
curl -s https://${BMC_IP}/redfish/v1/Managers/1/EthernetInterfaces/2 -k -u ${BMC_USER}:${BMC_PASS} | jq .IPv4Addresses[0].Address
# get Health
curl -s https://${BMC_IP}/redfish/v1/Chassis/1 -k -u ${BMC_USER}:${BMC_PASS} | jq .Status.Health
# get IndicatorLED curl -s https://${BMC_IP}/redfish/v1/Systems/1 -k -u ${BMC_USER}:${BMC_PASS} | jq .IndicatorLED
# fan mode curl -s https://${BMC_IP}//redfish/v1/Managers/1/FanMode -k -u ${BMC_USER}:${BMC_PASS} | jq .Mode
# storageb curl -s https://${BMC_IP}/redfish/v1/Systems/1/SimpleStorage/1 -k -u ${BMC_USER}:${BMC_PASS} | jq .Devices[].Model
# raid
curl -s https://${BMC_IP}/redfish/v1/Chassis/HA-RAID.0.StorageEnclosure.0 -k -u ${BMC_USER}:${BMC_PASS} | python -m json.tool
curl -s https://${BMC_IP}/redfish/v1/Chassis/HA-RAID.0.StorageEnclosure.0/Drives/Disk.Bay.0 -k -u ${BMC_USER}:${BMC_PASS} | python -m json.tool
curl -k https://BMC_IP/registries/BiosAttributeRegistry.v1_0_0.json | python -m json.tool
curl -s https://BMC_IP/redfish/v1/Chassis/1/Thermal -k -u ADMIN:ADMIN | python -m json.tool
# power consumption
curl -s https://${BMC_IP}/redfish/v1/Chassis/1/Power/ -k -u ${BMC_USER}:${BMC_PASS} | jq .PowerControl[].PowerConsumedWatts
curl -s https://${BMC_IP}/redfish/v1/Chassis/1/Power/ -k -u ${BMC_USER}:${BMC_PASS} | jq .PowerControl[].PowerMetrics.AverageConsumedWatts
```

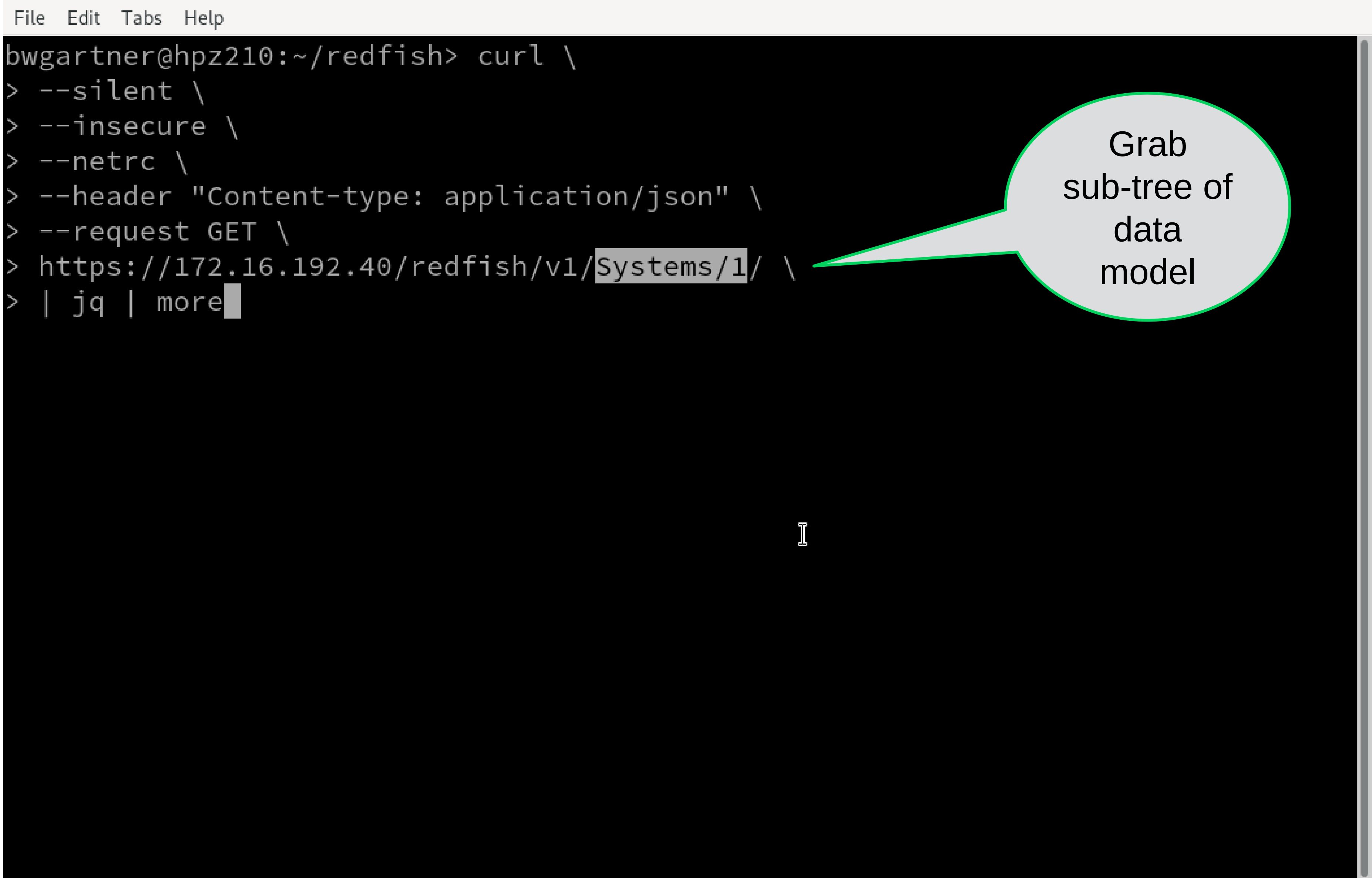
Exploring the Data Model



```
bwgartner@hpz210:~/redfish> curl \
> --silent \
> --insecure \
> --netrc \
> --header "Content-type: app
> --request GET \
> https://172.16.192.40/redfish/v1/Systems/1/ \
> | jq | more
```

Read authentication credentials from a file

(tells curl to look for and use the .netrc file)



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> --silent \
> --insecure \
> --netrc \
> --header "Content-type: application/json" \
> --request GET \
> https://172.16.192.40/redfish/v1/Systems/1/ \
> | jq | more
```
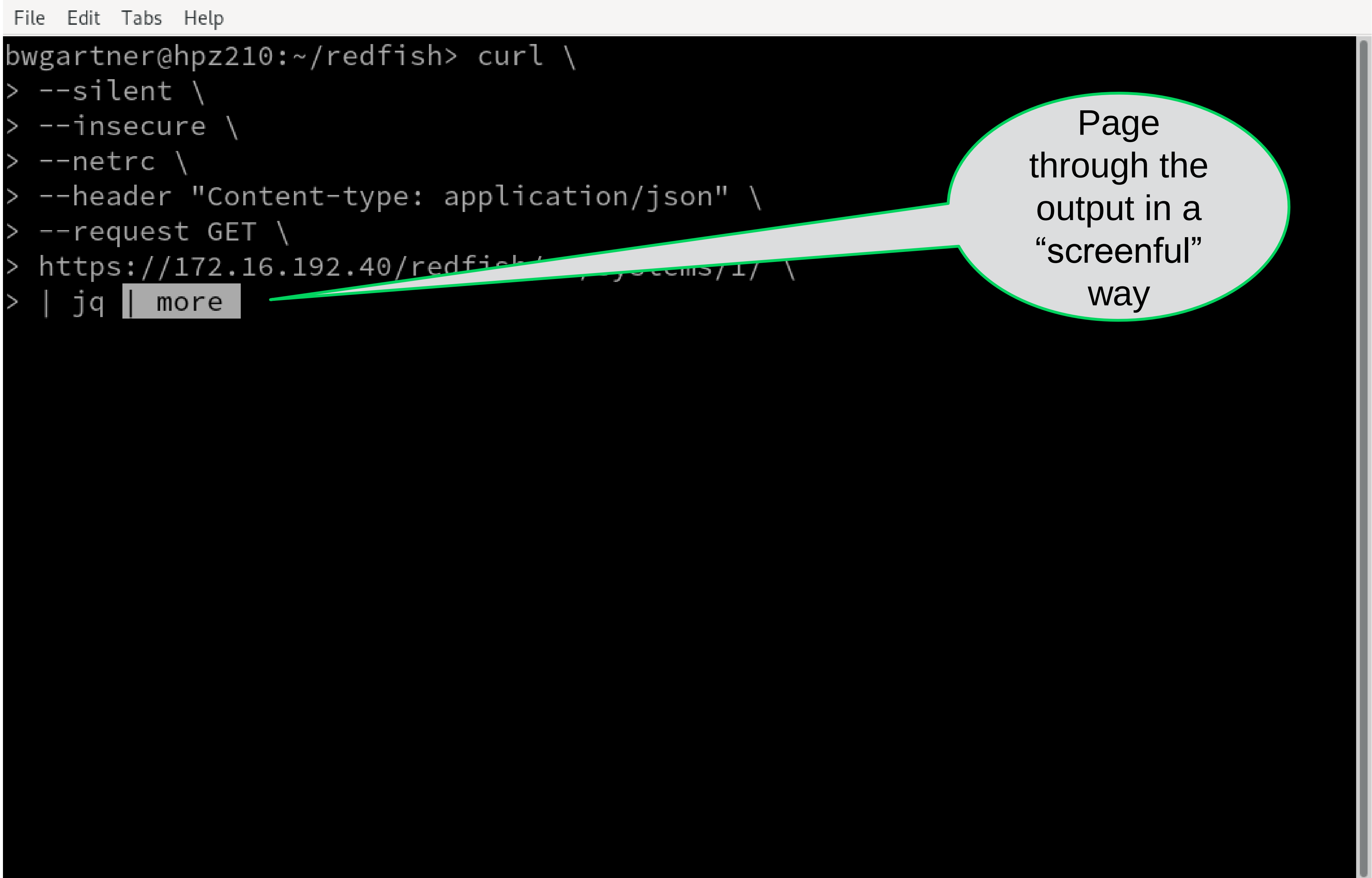

Grab sub-tree of data model



```
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> --silent \
> --insecure \
> --netrc \
> --header "Content-type: application/json" \
> --request GET \
> https://172.16.192.40/redfish/[illegible]/Systems/1/ \
> | jq | more
```
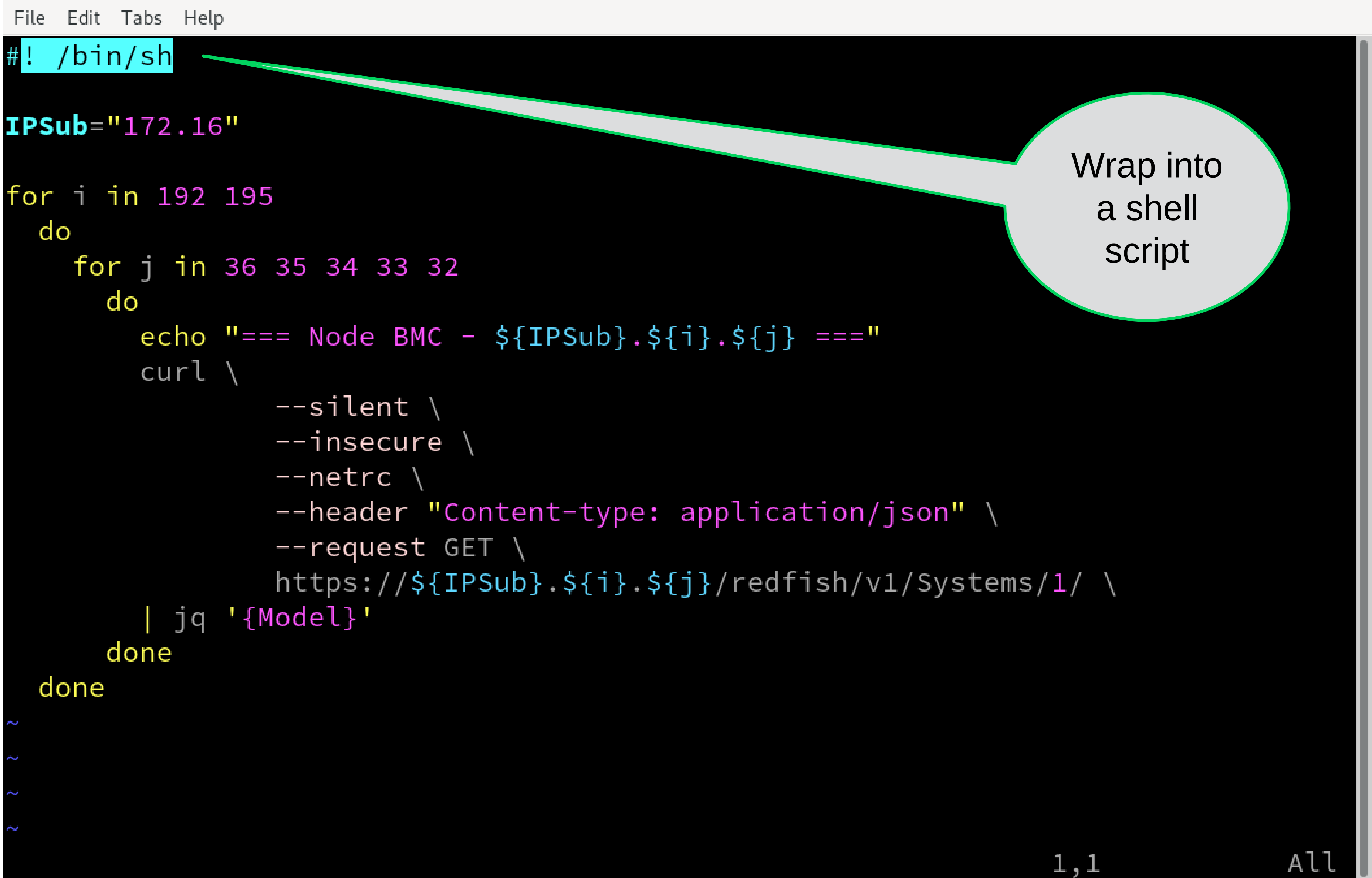
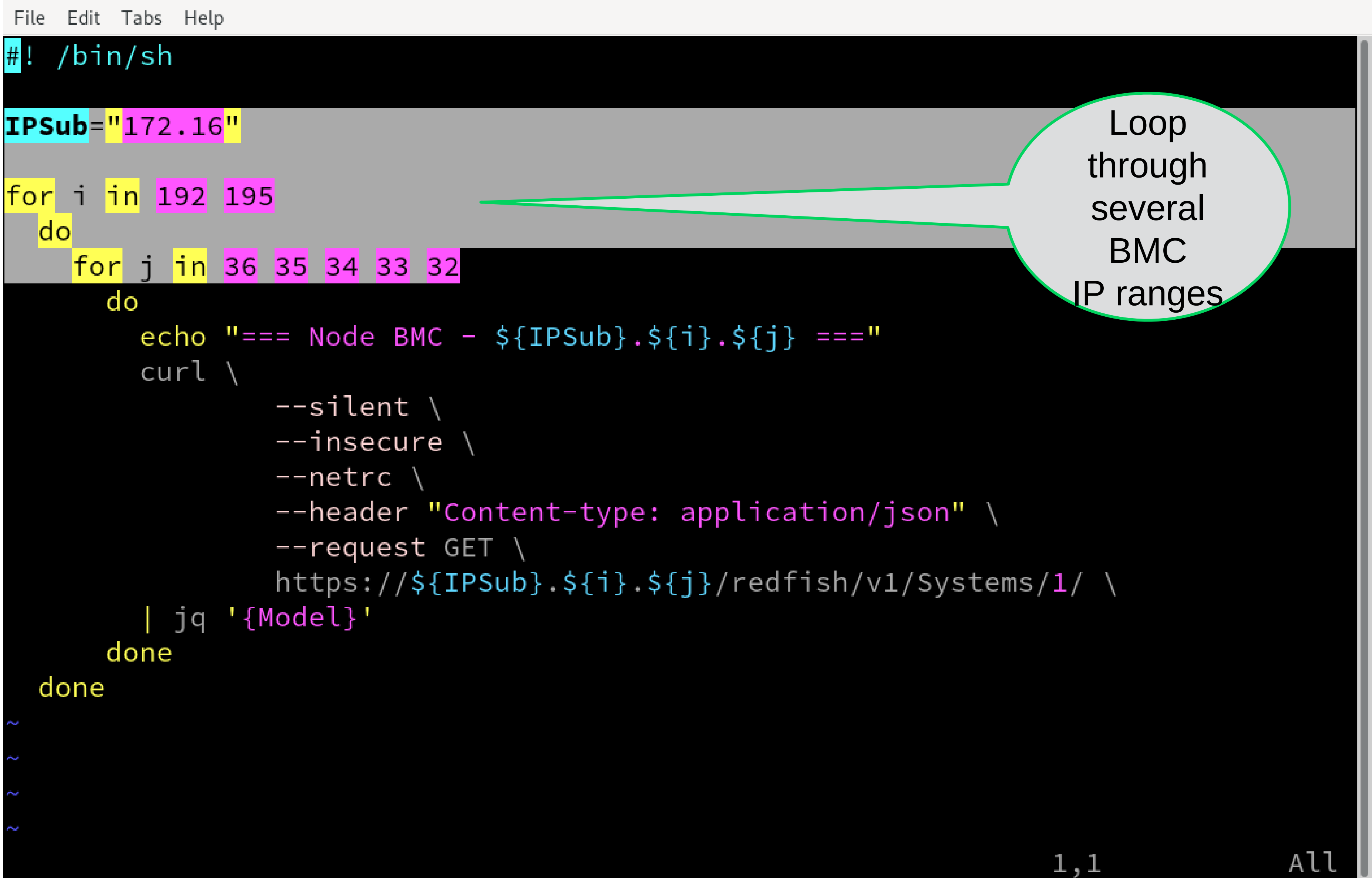

Page through the output in a “screenful” way

Simplified Scaling of Information Gathering



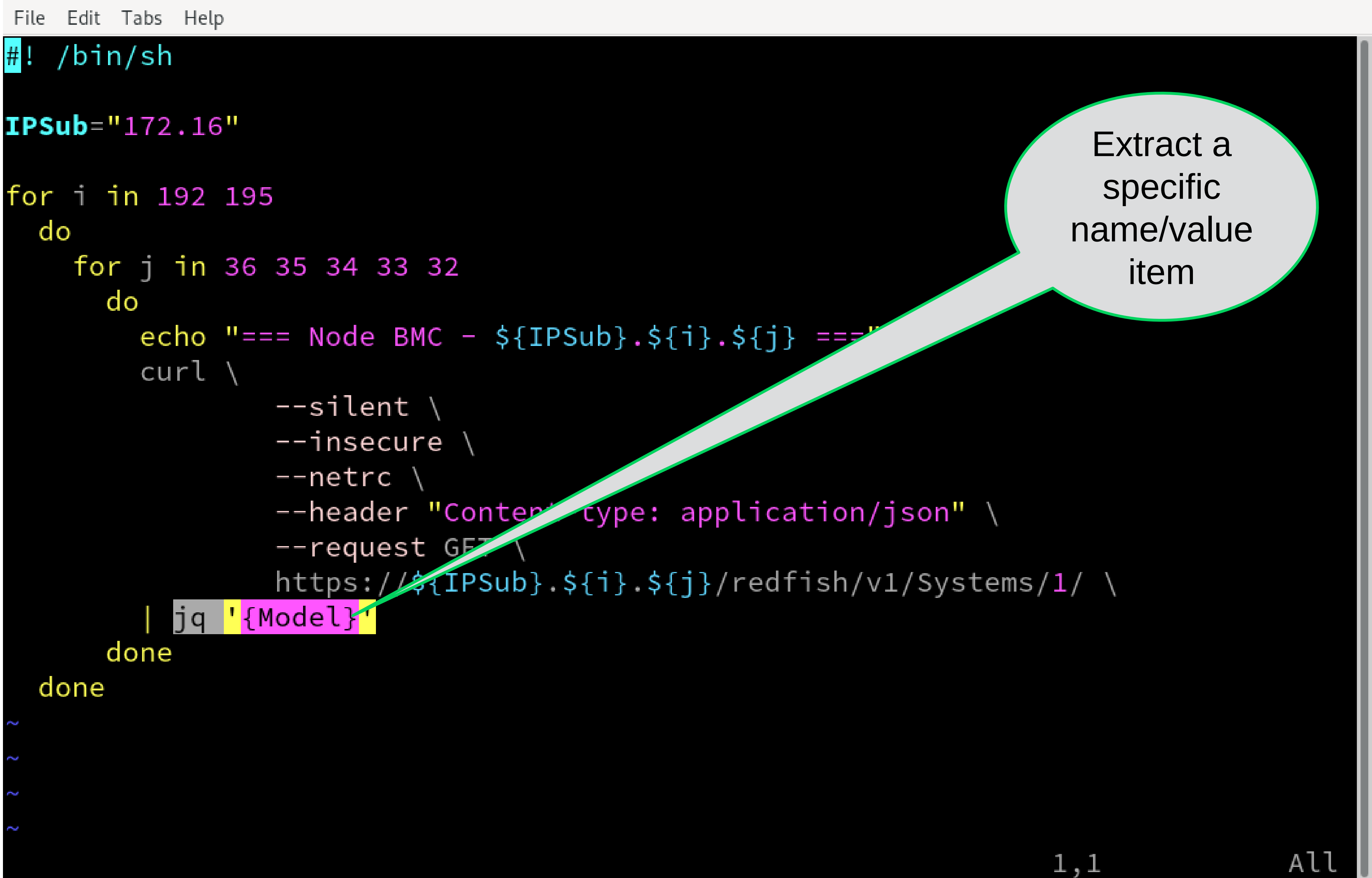
```
#! /bin/sh

IPSub="172.16"

for i in 192 195
  do
    for j in 36 35 34 33 32
      do
        echo "=== Node BMC - ${IPSub}.${i}.${j} ==="
        curl \
                --silent \
                --insecure \
                --netrc \
                --header "Content-type: application/json" \
                --request GET \
                https://${IPSub}.${i}.${j}/redfish/v1/Systems/1/ \
        | jq '{Model}'
      done
  done
~
~
~
~
                                                                   1,1           All
```

Wrap into a shell script



```
#! /bin/sh

IPSub="172.16"

for i in 192 195
  do
    for j in 36 35 34 33 32
      do
        echo "=== Node BMC - ${IPSub}.${i}.${j} ==="
        curl \
                --silent \
                --insecure \
                --netrc \
                --header "Content-type: application/json" \
                --request GET \
                https://${IPSub}.${i}.${j}/redfish/v1/Systems/1/ \
        | jq '{Model}'
      done
  done
~
~
~
~
                                                                   1,1           All
```

Loop through several BMC IP ranges



```
#! /bin/sh

IPSub="172.16"

for i in 192 195
 do
  for j in 36 35 34 33 32
   do
    echo "=== Node BMC - ${IPSub}.${i}.${j} ==="
    curl \
        --silent \
        --insecure \
        --netrc \
        --header "Content-type: application/json" \
        --request GET \
        https://${IPSub}.${i}.${j}/redfish/v1/Systems/1/ \
    | jq '{Model}'
   done
 done
~
~
~
~
                                                            1,1           All
```

Extract a specific name/value item

Other possible calls

Of course, a lot more ways this can be also exercised

- Redfish API
- Exploring Data Model
  - Redfish Developer Hub (see Mockups)
- Programmatic Interfaces
  - Language bindings : C, Javascript, Powershell, Python, Ruby, …
  - DevOps : Ansible, Chef, Nagios, Puppet, ...

Additional references

Homework exercises left for the reader

- Dell-related
  - Knowledge Base - Redfish
- Fujitsu
  - iRMC Redfish API Specifications
  - Redfish White Paper
- HPE-related
  - iLO RESTful API
  - iLO RESTful API Explorer
- Intel
  - Redfish, RESTful and x-UEFI
- Lenovo-related
  - xClarity Controller Redfish REST API
- Supermicro
  - Server Management (Redfish API)
- ...

2nd step

Understand the target

Helping the hardware-challenged (aka software folks)

- Beyond the on-line Mockups ...
  - Visit GitHub openStack/python-redfish
    - git clone
      - Install a container run-time engine
      - In dmtf/mockup*, build, run, use the container
  - Homework left as an exercise for the reader
    - You can install (from src, PyPi, or packages the redfish-client)

New tools

Other techniques and/or target resources ...

SUSE Manager / Uyuni

- Opensource software management solution
- Leverages Saltstack, and starting development of a Redfish integration - openSUSE/redfish
  - Query/select/configure + de-configure/de-select/return to a known state
  - The hardware needed to match the desired software workloads as part of the overall deployment lifecycle
    - *salt-call redfish.set_property IndicatorLED “Blinking”* … (or “Off”)

Terraform

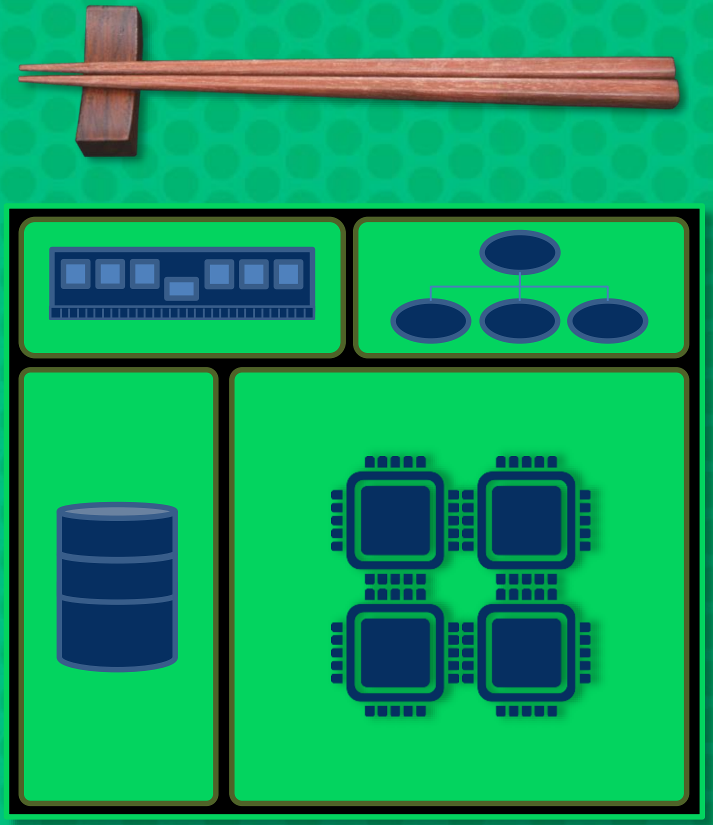
- Starting to leverage this technology, which matches quite well with the underlying infrastructure
  - restapi provider to interact with Redfish
  - terraform-provider-oneview overlay that works with the HPE Composable Infrastructure APIs

More choices

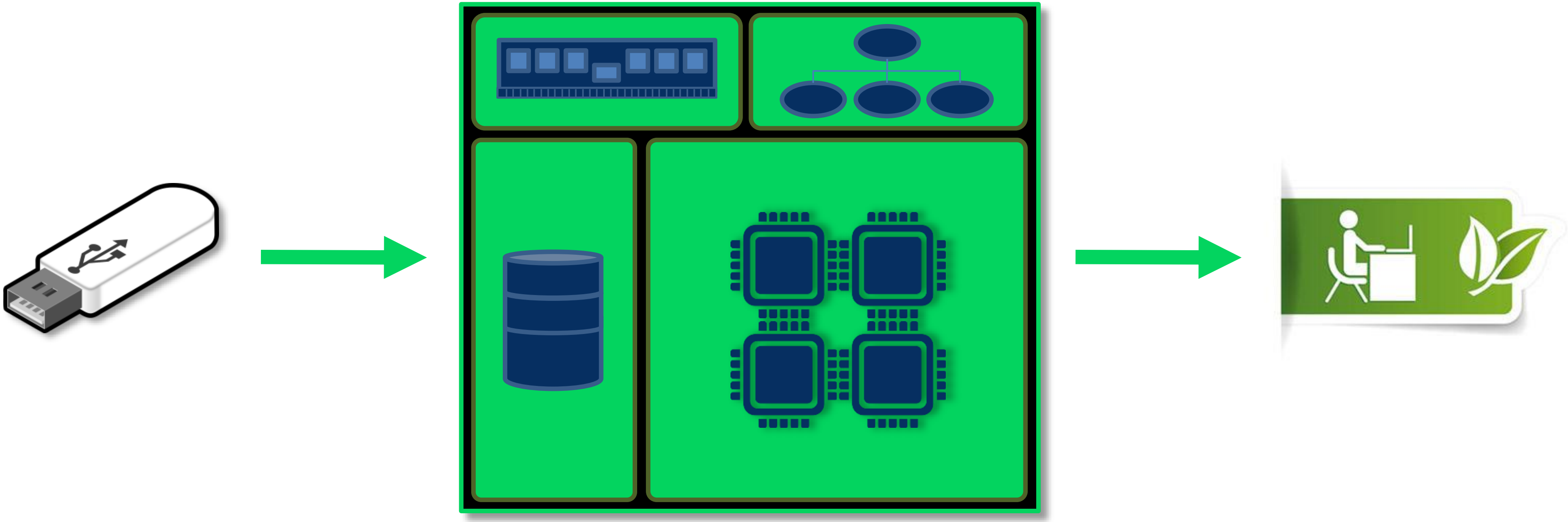
Continually exploring some new and some existing options

- In the end, the true value proposition of open source for users is “freedom of choice”
  - So with the trends of
    - Software-Defined Infrastructure
    - Migration to Infrastructure-as-Code
    - Cloud-Native computing principles (everything is really an API/version)
  - Providing choices in each matrix element and layer approach is highly desirable

The Bento Project



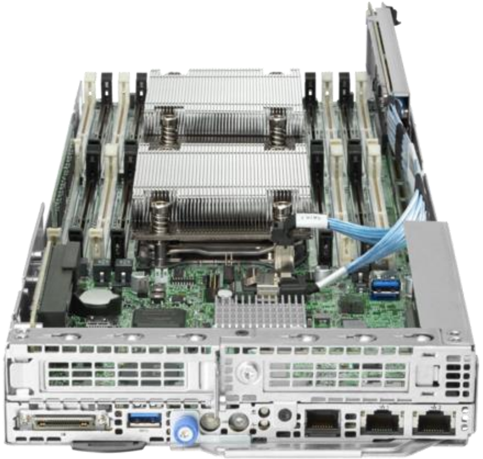
Bento : manage end-to-end deployment



DMTF Redfish SUSE KVM ceph kubernetes CLOUD FOUNDRY

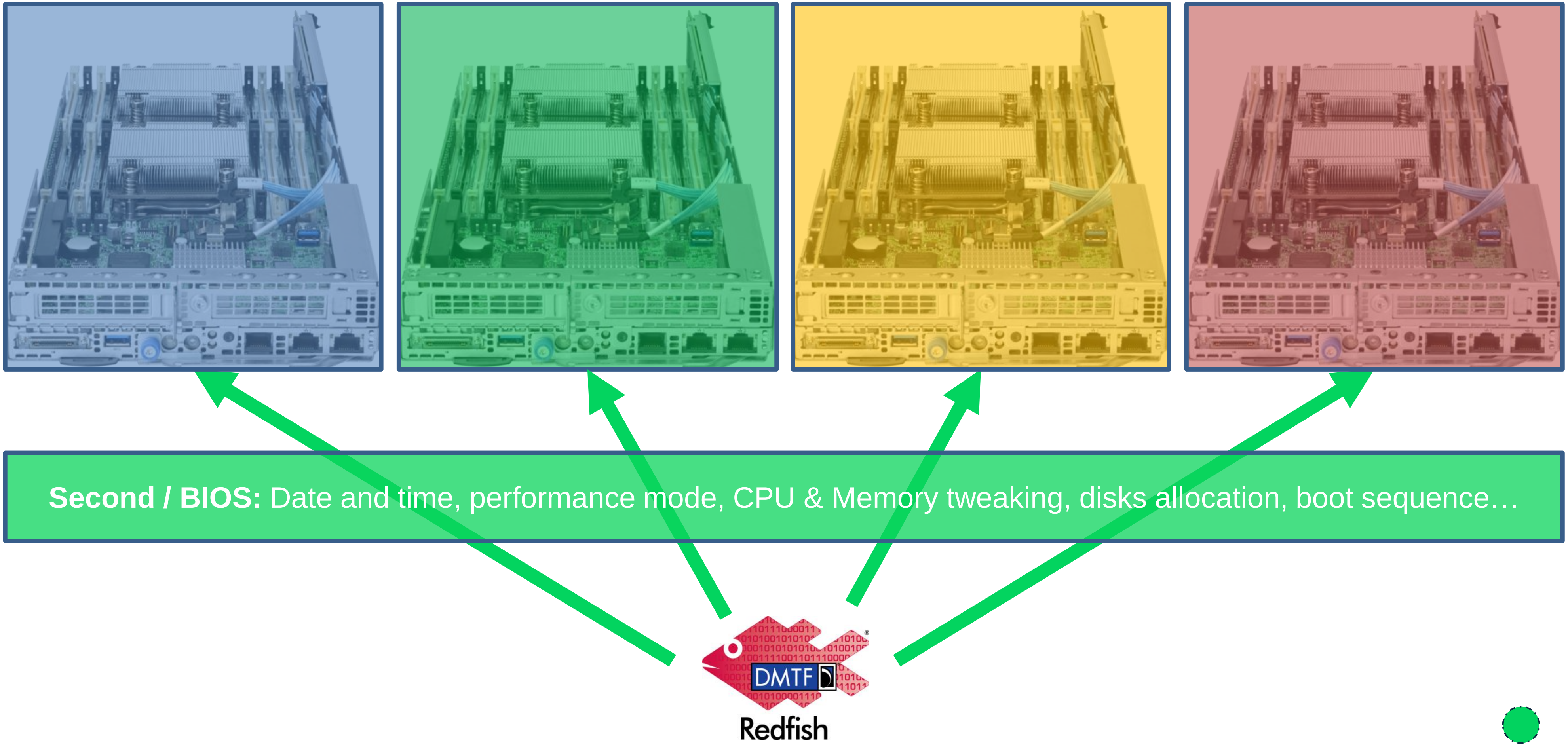
Hardware: HPE Apollo 2000 + 4 x XL170r

+ 4x



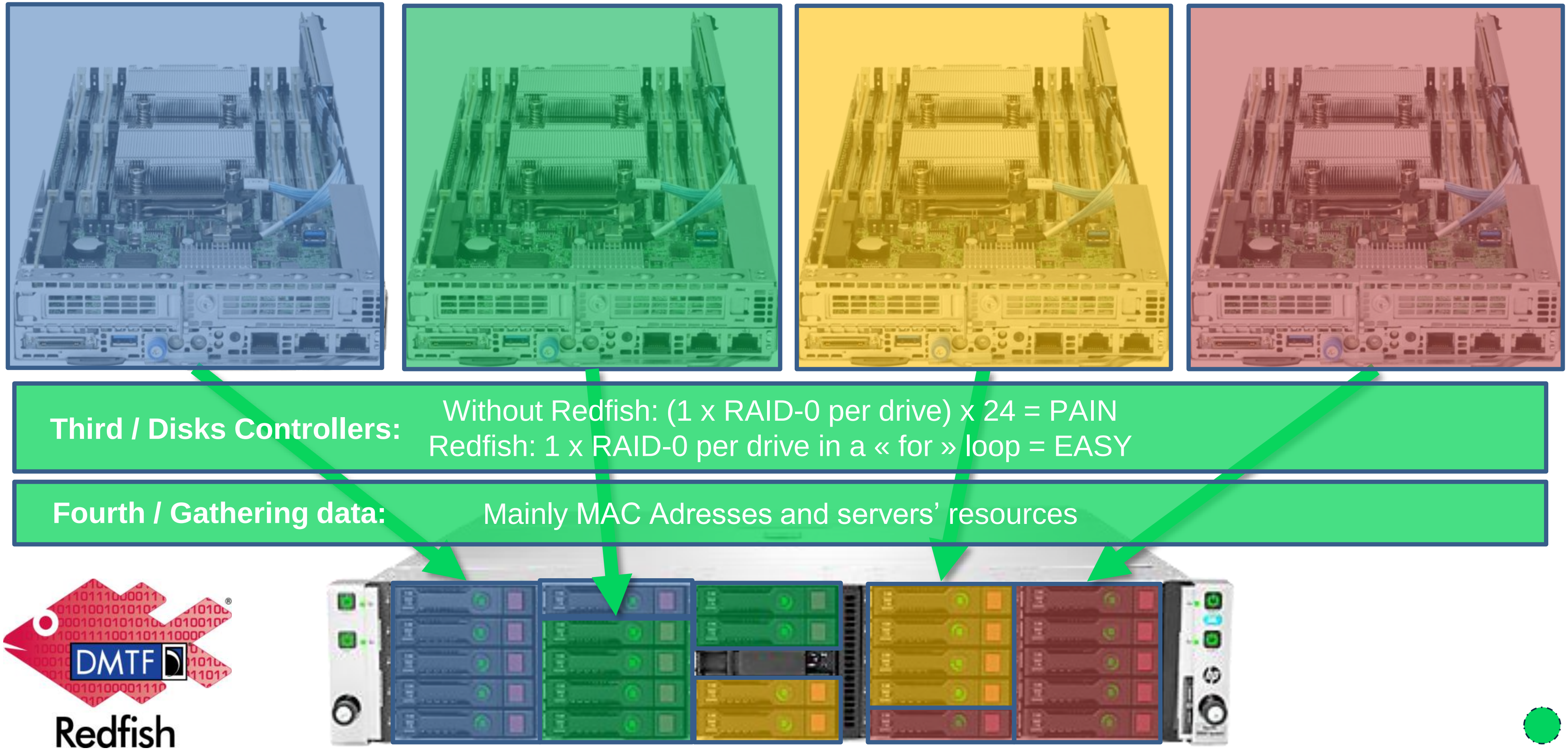
Rack your servers then connect power & network
First / BMC: update & setup the iLO interfaces

Redfish: BIOS’ easy mass setup



Second / BIOS: Date and time, performance mode, CPU & Memory tweaking, disks allocation, boot sequence…

Redfish: Ceph’s easy mass controllers setup



Third / Disks Controllers: Without Redfish: (1 x RAID-0 per drive) x 24 = PAIN
Redfish: 1 x RAID-0 per drive in a « for » loop = EASY

Fourth / Gathering data: Mainly MAC Adresses and servers’ resources

Redfish: Thank you

Redfish usage for this deployment is done.
It will be back for platform monitoring and lifecycle.

We can now use our scripts and software automation for:
Bare-metal automated deployment with a prepared USB key > Each node becomes a SLES KVM
KVM automation > Nodes are populated with VMs enveloppes using a CSV file
NTP / DNS / DHCP setup > Each node gets a VM deployed for such a role
Ceph cluster deployment > Using VMs (careful, support warning!)
Kubernetes cluster & registry deployment > Linked to the Ceph cluster
(optional) Cloud Foundry deployment > Based on kubernetes deployment

Summary

So interesting to explore / discover / leverage

- Redfish integration is an ever expanding utility / frontier
- Allows boundary crossing from developers to operations and across the classic IT silos
- ~~Game~~ Meet On!

Questions

We adapt. You succeed.

Thank You

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