

Linux on System z Introducing the Linux Health Checker

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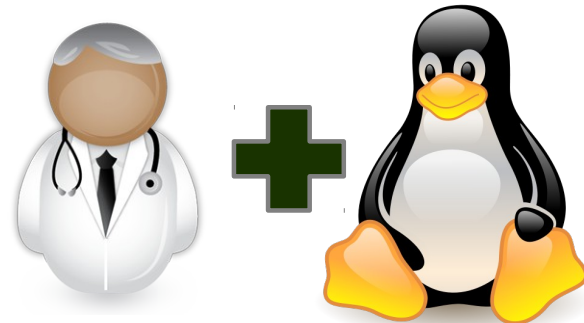
Agenda – Part 1

- ▶ 1. Introducing health checking
- 2. Using the Linux Health Checker
- 3. How to write a check

Introducing health checking

- What is a health check?
 - A process that identifies conditions which may lead to problems
- What is the Linux Health Checker?
 - A tool that performs an automated health check of a Linux system
 - Checks status and configuration
 - Presents report on identified problems

➔ Helps keeping Linux systems healthy (operational)



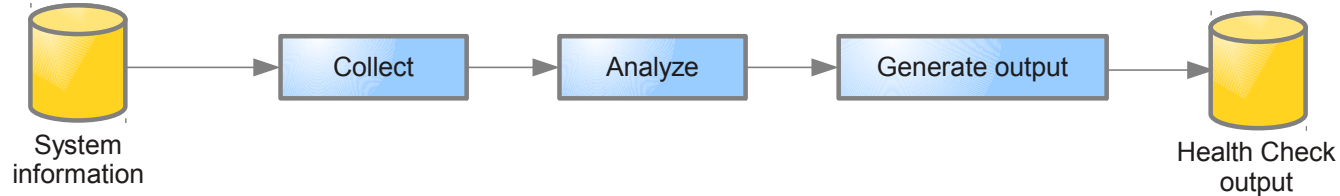
What does it do?

- Example problem classes
 - Configuration errors
 - Deviations from best-practice setups
 - Hardware running at reduced capacity
 - Unused accelerator hardware
 - Single point-of-failures
- Detailed problem report
 - Enable users to *understand* and *solve* problems
 - Make expert knowledge available to wider audience

Goals

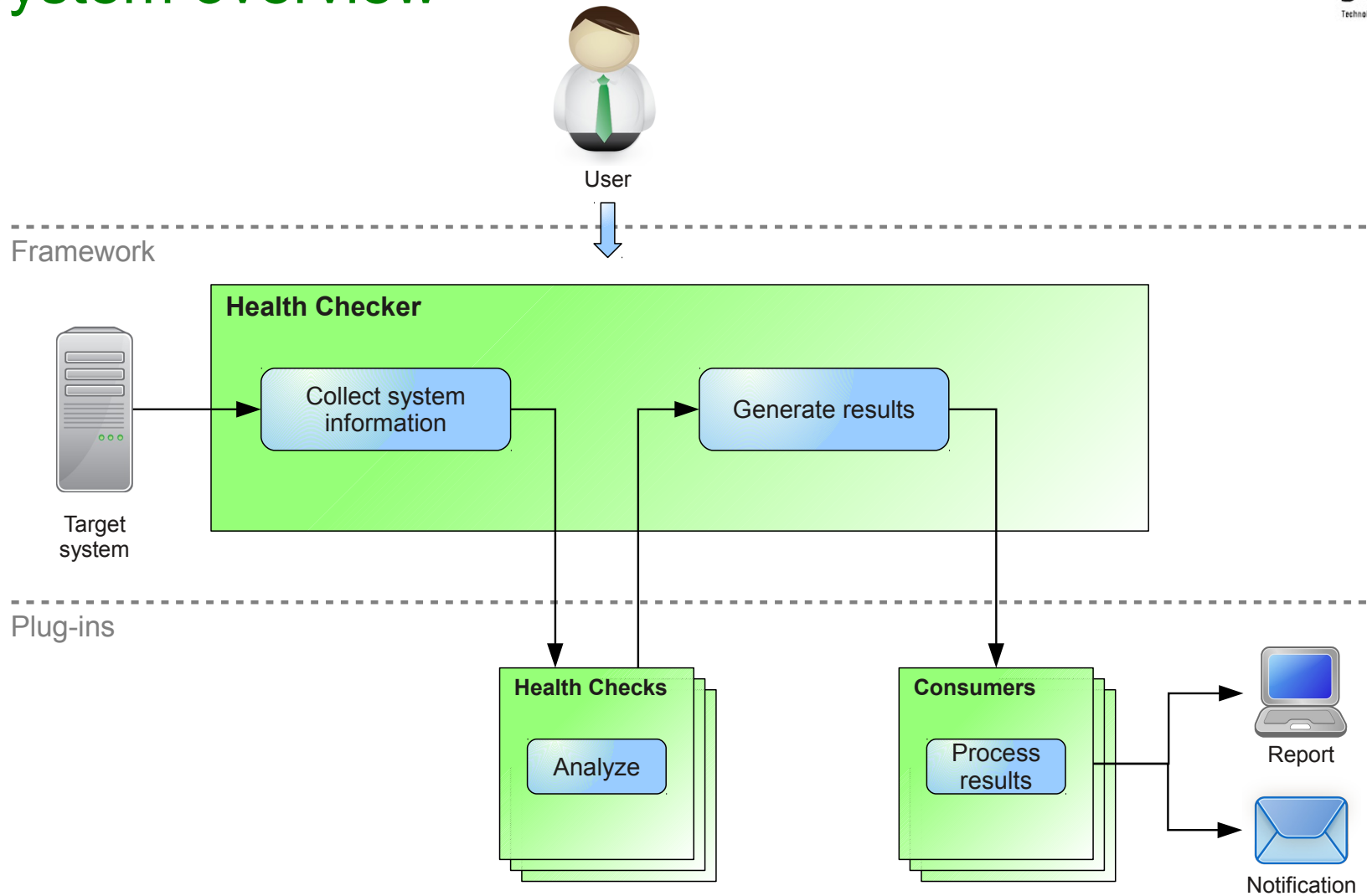
- Ease of use
 - Simple setup: Install and run – no involved configuration
 - Primary tasks easily accessible through command line interface
- Flexibility through Framework/Plug-in concept
 - Health check plug-ins
 - Contain all problem area specific knowledge
 - Consumer plug-ins
 - Handle output processing
 - Extend functionality by adding new plug-ins

Basic approach to health checking



- **Collect system information**
 - File contents, for example `/var/log/messages`
 - Program output, for example `/bin/df`
- **Analyze information**
 - Find relevant data points
 - Compare with best-practice values
- **Generate report**

System overview



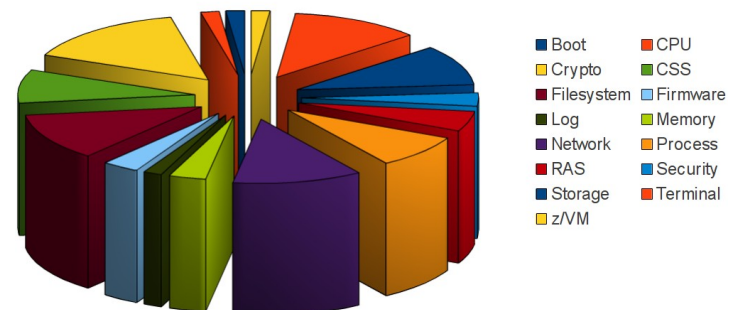
Health checks in version 1.2

61 checks in total (v1.0 had 25):

- Check whether the recommended runlevel is used and set as default
- Check whether the CPUs run with reduced capacity
- Verify System z cryptographic hw support through CCA
- Confirm that CPACF is used
- Verify System z cryptographic hw support for PKCS#11 clear key [...]
- Verify System z cryptographic hw support for PKCS#11 clear key [...]
- Verify System z cryptographic hw support for PKCS#11 secure key [...]
- Verify System z cryptographic hw support for PKCS#11 secure key [...]
- Check whether the path to the OpenSSL library is configured correctly
- Verify System z cryptographic hw support through an OpenSSL stack
- Verify System z cryptographic hw support through an OpenSSL stack [...]
- Identify I/O devices that are in use although they are on the exclusion list
- Check for CHPIDs that are not available
- Identify unusable I/O devices
- Check for an excessive number of unused I/O devices
- Identify I/O devices that are not associated with a device driver
- Verify that the bootmap file is up-to-date
- Identify standard DASD device nodes in the fstab file
- Check if filesystems are skipped by filesystem check (fsck)
- Check file systems for an adequate number of free inodes
- Check for read-only filesystems
- Verify that temporary files are deleted at regular intervals.
- Check file systems for adequate free space
- Confirm that automatic problem reporting is activated
- Check if control program identification displays meaningful Linux names
- Verify that syslog files are rotated
- Check if swap space is available
- Ensure memory usage is within the threshold
- Identify bonding interfaces configured with single network interfaces
- Identify bonding interfaces aggregating qeth interfaces with same CHPID
- Ensure nameserver is listed with correct address
- Check for an excessive error ratio for outbound HiperSockets traffic
- Check the inbound network traffic for an excessive error or drop ratio
- Identify qeth interfaces that do not have an optimal number of buffers
- Identify network services that are known to be insecure
- Ensure processes do not hog cpu time
- Ensure the system is running with optimal load

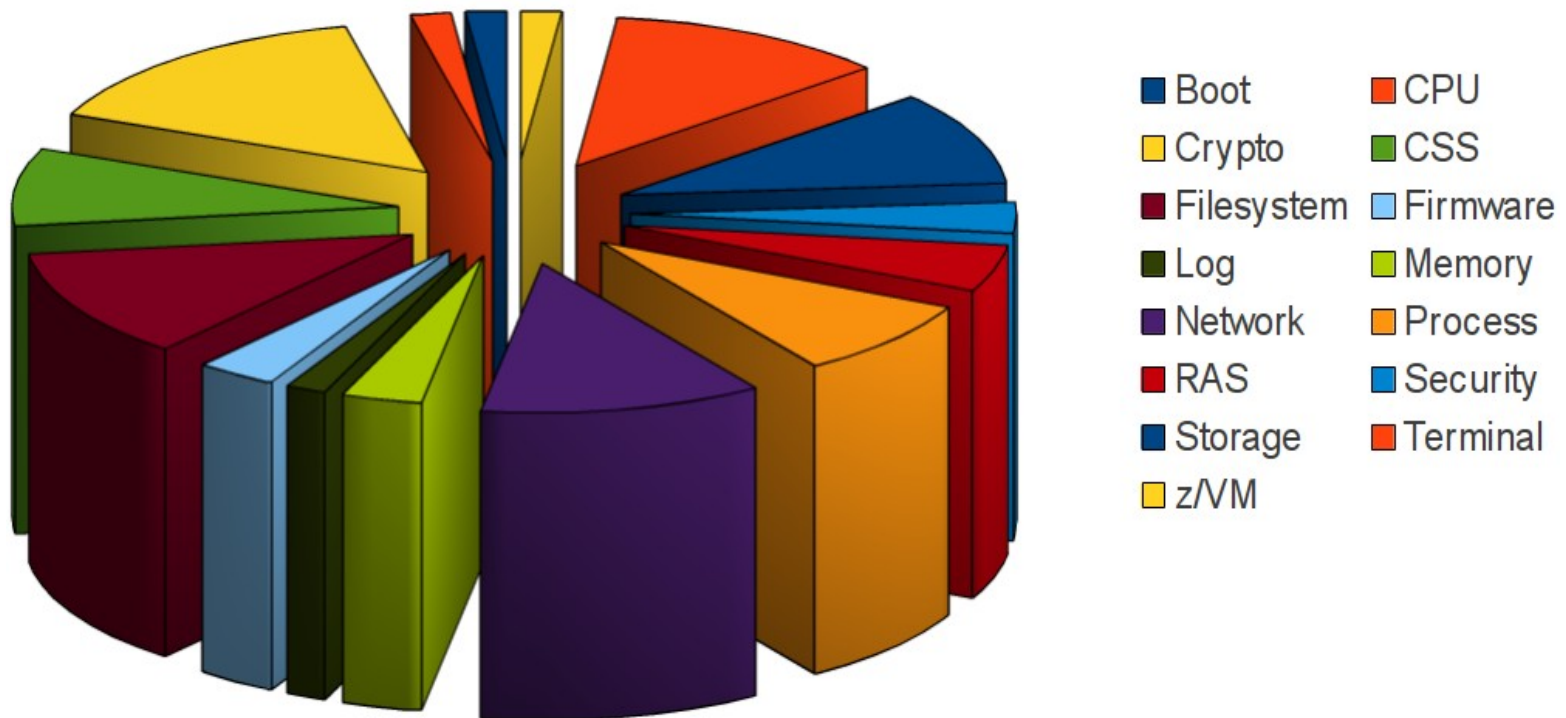
- Check the kernel message log for out-of-memory (OOM) occurrences
- Ensure processes do not hog memory
- Ensure that privilege dump is switched off
- Ensure kdump is configured and running
- Confirm that the dump-on-panic function is enabled
- Ensure that panic-on-oops is switched on
- Confirm that root logins are enabled for but restricted to secure terminals
- Screen users with superuser privileges
- Identify CDL-formatted DASD where metadata area used for storing data
- Confirm 4K block size on ECKD DASD devices
- Check Linux on z/VM for the "nopav" DASD parameter
- Identify active DASD alias devices without active base device
- Identify multipath setups that consist of a single path only
- Identify multipath devices with too few available or many failed paths
- Spot getty programs on the /dev/console device
- Check for current console _loglevel
- Detect terminals with multiple device nodes
- Confirm that all available z/VM IUCV HVC terminals are enabled for logins
- Identify idle terminals
- Identify idle users
- Identify unused terminals (TTY)
- Check privilege classes of z/VM guest VMs on which Linux instances run

Checks by Component



Health checks in version 1.2

Checks by Component



Agenda – Part 2

1. Introducing health checking
- ▶ 2. Using the Linux Health Checker
3. How to write a check

Preparations

- Obtaining the Linux Health Checker
 - Releases: V1.0 released March 2012, V1.2 in February 2013
 - Open source under Eclipse Public License v1.0
 - Download RPM or source package from <http://lnxhc.sourceforge.net>
 - Install using RPM command or `make install`
 - Distribution support in progress
- Requirements
 - Linux
 - Framework should run on *any* hardware platform
 - Health checks may be platform specific
 - Perl 5.8 or later
 - Additional Perl modules which are usually part of default installation

First health check run

```
[user@lnxhost ~]$ lnxhc run
Collecting system information
Running checks (12 checks)
CHECK NAME                                HOST                                RESULT
=====
boot_zipl_update_required ..... lnxhost                            SUCCESS
css_ccw_availability ..... lnxhost                            SUCCESS
css_ccw_chpid ..... lnxhost                            SUCCESS
css_ccw_no_driver ..... lnxhost                            SUCCESS
css_ccw_unused_devices ..... lnxhost                            EXCEPTION-LOW

>EXCEPTION css_ccw_unused_devices.many_unused_devices(low)
  Of 4664 I/O devices, 4659 (99.89%) are unused

fs_disk_usage ..... lnxhost                            SUCCESS
mm_oom_killer_triggered ..... lnxhost                            SUCCESS
net_hsi_tx_errors ..... lnxhost                            NOT APPLICABLE
ras_dump_on_panic ..... lnxhost                            EXCEPTION-HIGH

>EXCEPTION ras_dump_on_panic.no_standalone(high)
  The dump-on-panic function is not enabled

sec_services_insecure ..... lnxhost                            SUCCESS
sys_sysctl_call_home ..... lnxhost                            NOT APPLICABLE
sys_sysinfo_cpu_cap ..... lnxhost                            SUCCESS

10 checks run, 2 exceptions found (use 'lnxhc run --replay -V' for details)
```

Interpreting output

- A potential problem was found

```
css_ccw_unused_devices ..... lnxhost                EXCEPTION-LOW  
  
>EXCEPTION css_ccw_unused_devices.many_unused_devices (low)  
  Of 4664 I/O devices, 4659 (99.89%) are unused
```

- Full exception ID
 - `css_ccw_unused_devices.many_unused_devices`
- Exception severity
 - `low`
- Exception summary
 - Of 4664 I/O devices, 4659 (99.89%) are unused

Getting more details

```
[user@lnxhost ~]$ lnxhc run -V css_ccw_unused_devices
```

CHECK NAME	HOST	RESULT
css_ccw_unused_devices	lnxhost	EXCEPTION-LOW

```
>EXCEPTION css_ccw_unused_devices.many_unused_devices(low)
```

SUMMARY

Of 4664 I/O devices, 4659(99.89%) are unused

EXPLANATION

The number of unused (offline) I/O devices, 4664 (99.89%) of a total of 4659, exceeds the specified threshold. During the boot process, Linux senses and analyzes All available I/O devices, including unused devices. Therefore, unused devices unnecessarily consume memory and CPU time.

SOLUTION

Use the "cio_ignore" feature to exclude I/O devices that you do not need from being sensed and analyzed. Be sure not to inadvertently exclude required devices. To exclude devices, you can use the "cio_ignore" kernel parameter or a command like this:

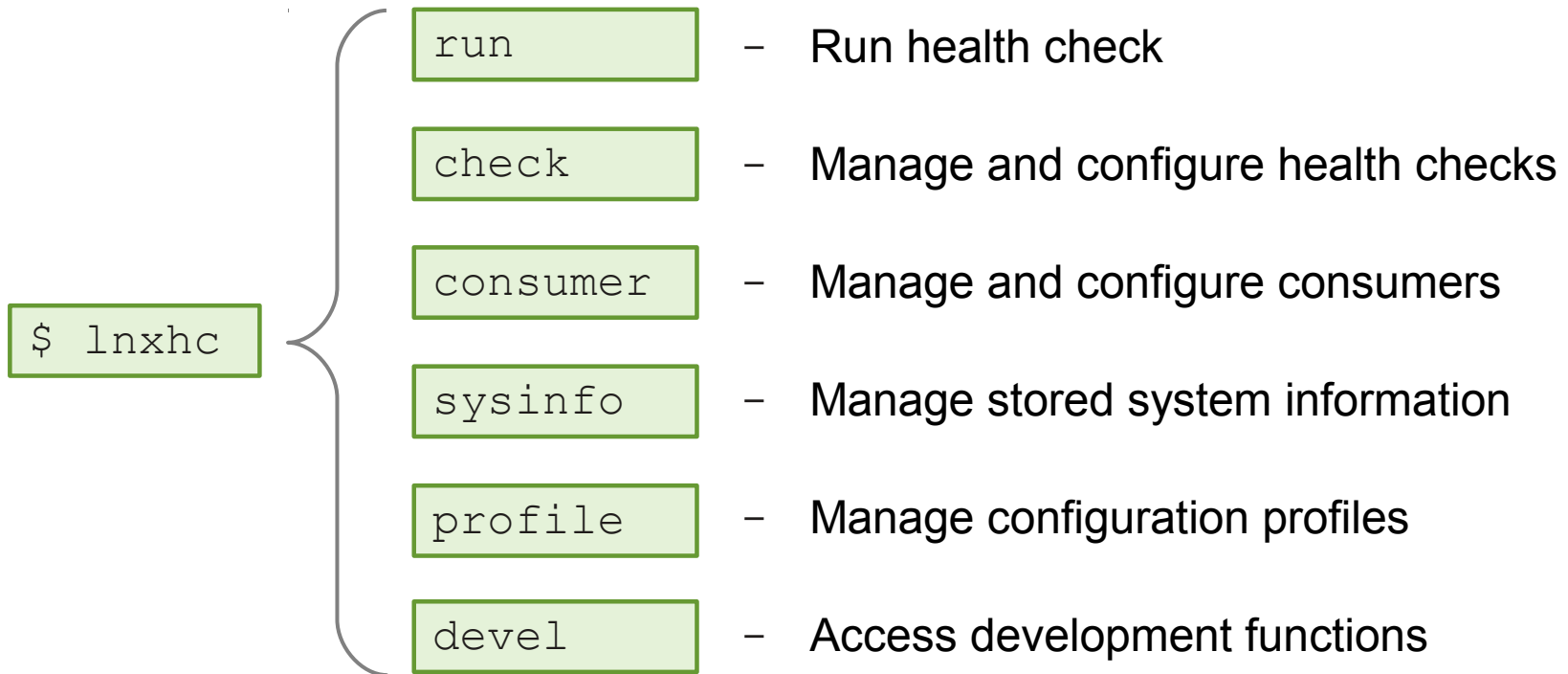
```
echo "add <device_bus_id>" > /proc/cio_ignore
```

where <device_bus_id> is the bus ID of an I/O device to be excluded.

REFERENCE

For more information about the "cio_ignore" feature, see the section about the "cio_ignore" kernel parameter in "Device Drivers, Features, and Commands".

Additional functions



Viewing health check information

```
[user@lnxhost ~]$ lnxhc check --info fs_disk_usage
```

```
Check fs_disk_usage (active)
=====
```

Title:

```
Check file systems for adequate free space
```

Description:

```
Some applications and administrative tasks require an adequate amount of free space on each mounted file system. If there is not enough free space, these applications might no longer be available or the complete system might be compromised. Regular monitoring of disk space usage averts this risk.
```

Exceptions:

```
critical_limit=high (active)
warn_limit=low (inactive)
```

Parameters:

```
critical_limit=95
File system usage (in percent) at which to raise a high-severity exception.
Valid values are integers in the range 1 to 100.
```

```
Default value is "95".
```

```
...
```

Modifying health check properties

- Activation state
 - Specifies if a check should be performed during health check run

```
[user@lnxhost ~]$ lnxhc check fs_disk_usage --state inactive
Setting state of check 'fs_disk_usage' to 'inactive'
Done.
```

- Parameter values
 - Values defined by health checks
 - Enable users to customize certain aspects of the health check

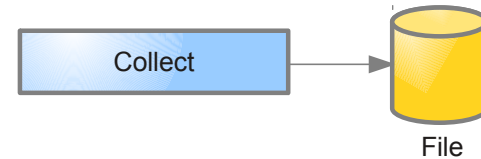
```
[user@lnxhost ~]$ lnxhc check --param fs_disk_usage.critical_limit=99
Setting value of parameter fs_disk_usage.critical_limit to '99'
Done.
```

- See man page for full list of properties
 - `man lnxhc_properties.7`

Advanced health checking modes

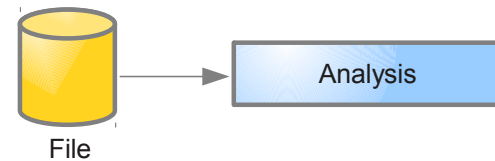
- Collect data to file

```
lnxhc sysinfo --collect --file lnxhost.sysinfo
```



- Analyze from file

```
lnxhc run --file lnxhost.sysinfo
```

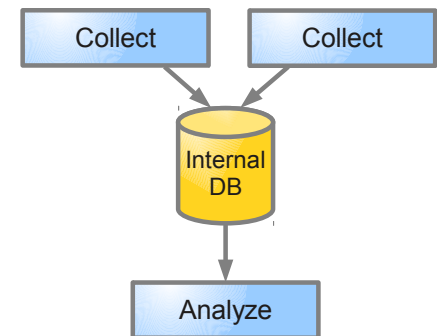


- Analyze from remote host

```
ssh user@remote lnxhc sysinfo -c -f - | lnxhc run -f -
```

- Analyze from multiple hosts

```
lnxhc sysinfo --clear
ssh user@remotel lnxhc sysinfo -c -f - | lnxhc sysinfo --merge -
ssh user@remote2 lnxhc sysinfo -c -f - | lnxhc sysinfo --merge -
...
lnxhc run --current
```



Agenda – Part 3

1. Introducing health checking
2. Using the Linux Health Checker
- ▶ 3. How to write a check

Example idea

- What to check?
 - Value of sysctl setting `panic_on_oops` should be '1'
- Why?
 - “Kernel oops” = severe kernel error
 - Indication that the kernel can no longer be trusted
 - Kernel will continue anyway if `panic_on_oops` is '0'
- How to check

```
[user@lnxhost ~]$ cat /proc/sys/kernel/panic_on_oops  
0
```

- Solution

```
[user@lnxhost ~]$ echo 1 > /proc/sys/kernel/panic_on_oops
```

Implementation without framework

- Check program 'check.sh'

```
#!/bin/bash

FILENAME="/proc/sys/kernel/panic_on_oops"
PANIC_ON_OOPS=`cat $FILENAME`

if [ "$PANIC_ON_OOPS" -eq 0 ] ; then
    echo "The panic-on-oops setting is disabled"
    echo "Enable it using 'echo 1 > /proc/sys/kernel/panic_on_oops'"
    exit 1
fi

exit 0
```

- Sample output

```
[user@lnxhost ~]$ ./check.sh
The panic-on-oops setting is disabled
Enable it using 'echo 1 > /proc/sys/kernel/panic_on_oops'
```

Writing checks for the Linux Health Checker framework

- One directory per check
 - Directory name is check name
- Files for
 - Meta data
 - Text
 - Check program

```
panic_on_oops  
├── definitions  
├── descriptions  
├── exceptions  
└── check
```

Definitions file

- Contains data about the health check

```
[check]
author = user@host
component = system
```

```
[sysinfo panic_on_oops]
file = /proc/sys/kernel/panic_on_oops
```

```
[exception no_panic_on_oops]
severity = high
```

- Meta-data
- System information
 - Files, command output, etc.
- Exceptions
 - ID and severity
- Optional parameters

Descriptions file

- Contains health check and parameter descriptions

```
[title]
Ensure that panic-on-oops is enabled
```

```
[description]
The panic-on-oops setting ensures that a
Linux instance is stopped if a kernel
oops occurs.
```

- Check title
- Basic check description
- Description of parametersOptional parameters

Exceptions file

- Contains problem report text
- References exception specified in definitions file through label

```
[summary no_panic_on_oops]
The panic-on-oops setting is disabled
```

```
[explanation no_panic_on_oops]
Without the panic-on-oops setting, a
Linux instance might keep running after
an oops.
```

```
[solution no_panic_on_oops]
Use the following command to enable the
panic-on-oops setting
```

```
echo 1 > /proc/sys/kernel/panic_on_oops
```

```
[reference no_panic_on_oops]
See kernel documentation on panic-on-oops
setting.
```

- Problem summary
- Explanation
 - Why is this a problem?
- Solution
 - Step-by-step instruction
- Reference for further reading
 - If available

Check program

- Implements health check analysis logic

```
#!/bin/bash

FILENAME=$LNXHC_SYSINFO_panic_on_oops
PANIC_ON_OOPS=`cat $FILENAME`

if [ "$PANIC_ON_OOPS" -eq 0 ] ; then
    echo "no_panic_on_oops" >> $LNXHC_EXCEPTION
fi

exit 0
```

- Access system information
- Analyze and report exception
- Indicate result code
 - 0 = Success
 - 64 = Missing dependency
 - Other = Run-time error

Putting it all together

```
[user@lnxhost ~]$ lnxhc run -V ./panic_on_oops
Collecting system information
Running checks (1 checks)
CHECK NAME                                HOST                                RESULT
=====
panic_on_oops ..... lnxhost           EXCEPTION-HIGH

>EXCEPTION panic_on_oops.no_panic_on_oops (high)

SUMMARY
  The panic-on-oops setting is disabled

EXPLANATION
  Without the panic-on-oops setting, a Linux instance might
  keep running after an oops.

SOLUTION
  Use the following command to enable the panic-on-oops setting
  echo 1 > /proc/sys/kernel/panic_on_oops

REFERENCE
  See kernel documentation on panic-on-oops setting.
```

- If it doesn't work, add more “-V”s
 - Increase level of verbosity to help debugging

Wrap-up

- To implement a check
 - Create a directory
 - Add files
 - Meta-data
 - Text files
 - Check program
 - Run/debug until it works
- Health check creation dialog

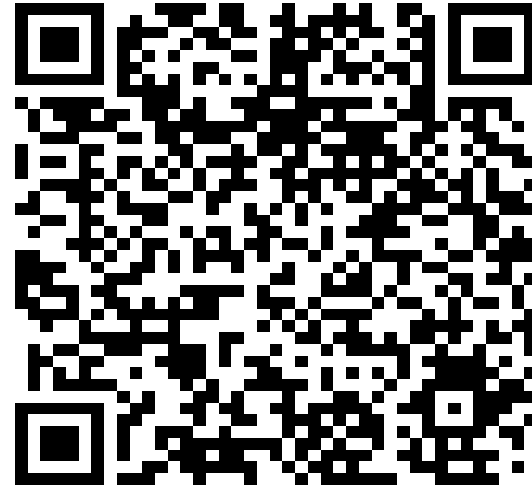
```
lnxhc devel --create-check my_check
```

- Creates template files based on dialog input

Further reading

- Man pages
 - Once installed use 'apropos lnxhc' to list man pages
 - Also available on the web: <http://lnxhc.sourceforge.net/manpages.html>
- User's Guide
 - <http://lnxhc.sourceforge.net/documentation.html>
- Main web page
 - <http://lnxhc.sourceforge.net/>
- Mailing list
 - Open for questions, comments, ideas, code contributions, etc.
 - lnxhc-list@lists.sourceforge.net

Questions?



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