IT. Beyond default. GISA®

Ganeti usage @GISA

Mini GanetiCon 2017

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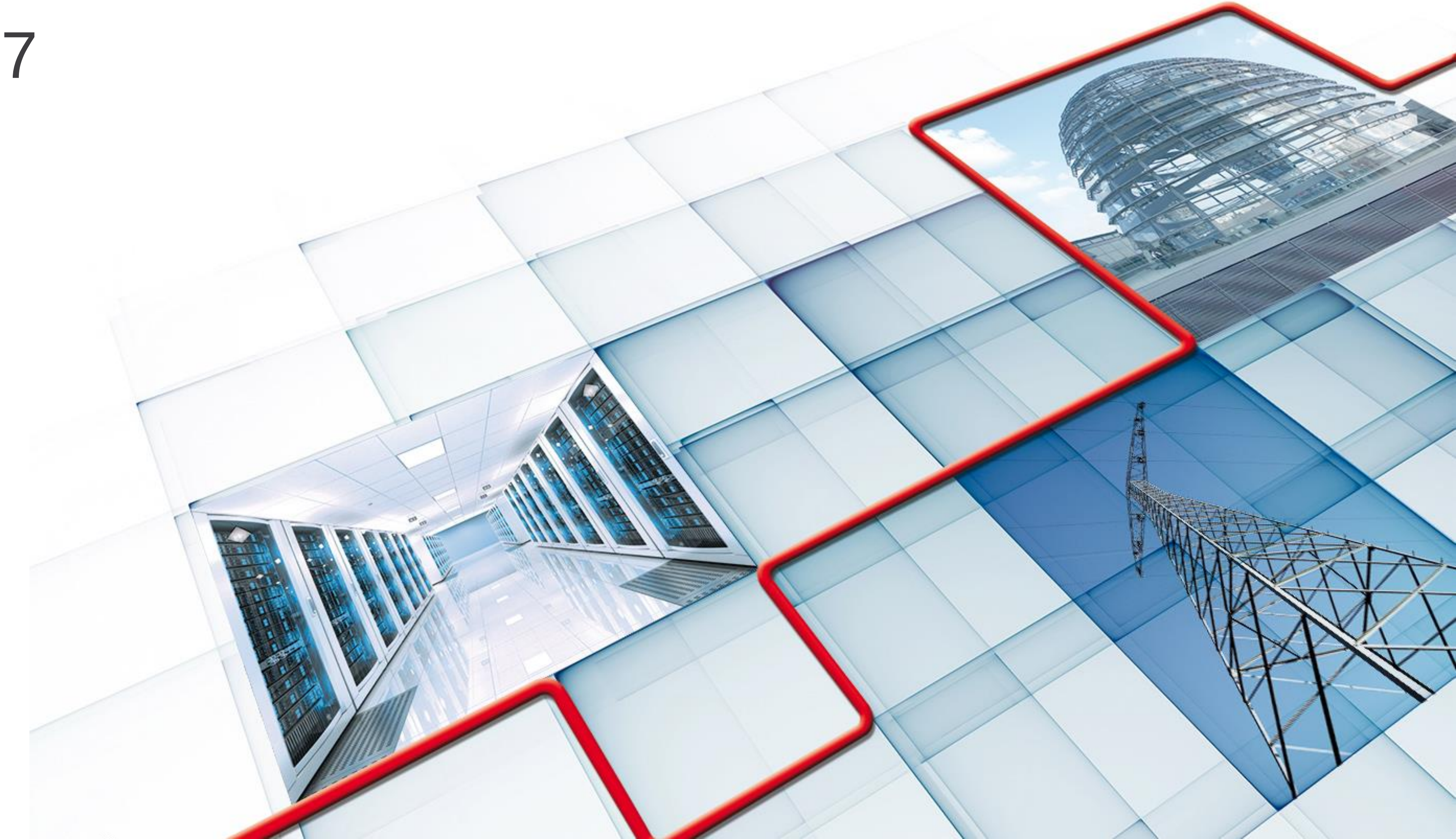

Topics

1 Introduction

2 Ganeti @GISA

3 build from source

4 OS interface based on libguestfs

5 simple webconsole

6 hooks (online grow, anti-spoof)

7 future of Ganeti

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Introduction

GISA

- owning two datacenters, located in germany, ISO27001 and BSI certified
- IT outsourcing provider
  - managed services: complete stack of infrastructure, servers, OS, applications (i.e. SAP, no Ganeti yet ☺)
  - or reduced stack: manage parts (i.e. the application) on your own
  - 24x7 operation / service desk / everything in-house / from a single source (no subcontractors)
  - historic background: energy industry and public sector

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  - historic background: energy industry and public sector

me, myself and I

- 18+ years linux admin, 5+ years @GISA
- since debian lenny (ganeti-1.2) „Ganeti included“
- sascha.lucas@gisa.de

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some stats

- 5 clusters (two bigger, two 2-node, a 2-node test-cluster)
- SLES based (like RHEL, but from Novell)
  - Ganeti-2.9 and 2.14 build from source for SLES-11 and SLES-12
  - from source means: latest release + “diff to git stable-2.X head”

some stats

- 5 clusters (two bigger, two 2-node, a 2-node test-cluster)
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what	„big“ cluster #01	„big“ cluster #03
number of nodes	12	14
number of instances	132	53
total vCPUs assigned to instances (be/vcpus)	636	491
total RAM assigned to instances (be/memory)	2407GiB	9166.4GiB
total disk space assigned to instances (disk.sizes)	19269.6GiB	47898.6GiB

our setup

- typical node hardware
  - 2x 10G ethernet (LACP/bonding)
  - 12 Core blade, 256GB RAM → sharedfile (NFS)
  - 16 Core rackmount, 512GB RAM, 16x1.2TB disk → DRBD
  - 40 Core rackmount, 1536GB RAM → blockdev (FC-SAN)

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  - 40 Core rackmount, 1536GB RAM → blockdev (FC-SAN)
- KVM hypervisor
  - `security_model: pool` (using grnet‘s nss-uidpool) and `use_chroot: True`
  - `disk_cache: none`
  - `migration_bandwidth: 625` (=5Gb/s) and `migration_downtime: 300`
  - no `kernel_path` (Bootloader+Kernel/initrd from inside VM)
  - `serial_console: True`
  - `vhost_net: True` and `vnet_hdr: True`

our setup (continued)

- multi cluster: `mac prefix: aa:00:xx` (where xx=cluster number)

  @VM

```
$ ip l l dev eth0
2: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP mode DEFAULT group default qlen 1000
    link/ether aa:00:03:86:85:ab brd ff:ff:ff:ff:ff:ff
                     ^^
               VM is at cluster 03 (handy for dynamic grouping with ansible)
```

our setup (continued)

- multi cluster: `mac prefix: aa:00:xx` (where xx=cluster number)

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```
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                     ^^
               VM is at cluster 03 (handy for dynamic grouping with ansible)
```
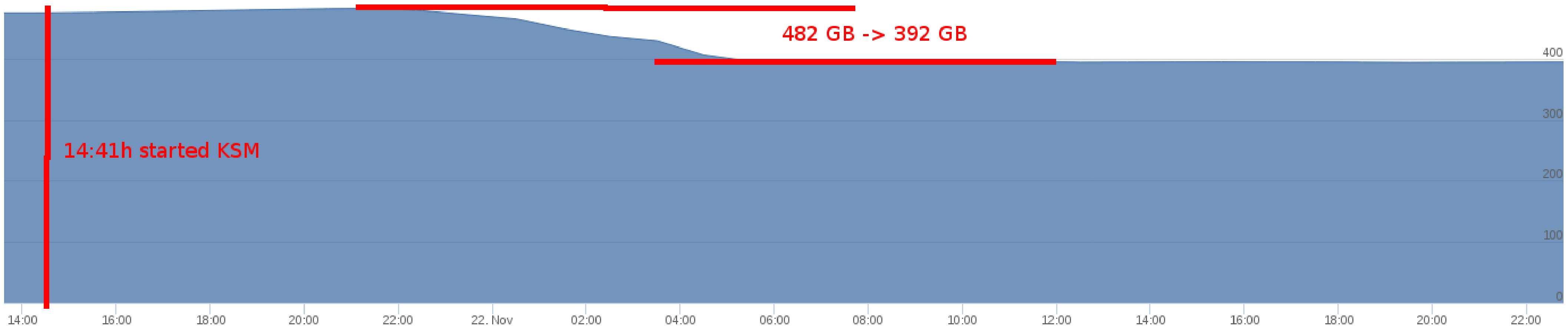

- DRBD
  - `net-custom: --max-buffers 8000 --max-epoch-size 8000` (sufficient for 160MB/s)
  - `disk-barriers: bf` and `meta-barriers: True` (use only with battery backed write cache)
  - `dynamic-resync: False und disk-custom: --c-plan-ahead 0` (disable dynamic resync)
  - `resync-rate: 150000` (~0.5TB/h)
  - the `noop` I/O scheduler on the host and guest
- OS-Interface: based on libguestfs (later more)
- bridged networking (VLANs)

memory oversubscribtion (KSM)

- `echo 1 > /sys/kernel/mm/ksm/run` is sufficient
  - fedora has ksm-tuned: will run KSM only and more aggressive when node memory is exhausted
  - example 512GB node:



- even more possible with: compressed swap (zswap?), and swap to SSD

current conversions (cluster #01)

- SLES → Ubuntu, because:
  - ganeti und DRBD is included

    Have you noticed that Ganeti is no longer in Ubuntu? It vanished with artful / 17.10.

    ???
  - no subscription fee
  - enough Ubuntu workloads

- sharedfile → DRBD, because:
  - better cluster scale-out (add or remove nodes to scale disk capacity and performance)
  - the only way for storage migration (change old hardware with new one)

past conversions (cluster #03: LXC → KVM)

past goal: LXCs as VMs → will work, but limitations and additional effort doesn’t outweigh benefits

- benefits: near bare metal performance (network, memory bandwidth)
- limitations: isolation frameworks are diverse/complex or incomplete (cgroups, capabilities, namespaces, …)
- additional effort
  - work around limitations: (NFS mounts, Ganeti + additional disks)
  - understand apparmor (i.e. for mounting NFS inside LXC)
  - like in a VM you need an init-system (something which starts your services and your tools / your costumers can handle)
  - sysv-init (systemd?) fails without CAP_SYS_ADMIN → fix system initialization scripts (mostly disable)

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building Ganeti from source

how to get the right Haskell requirements (compiler, libraries)

- download an install the right version of the Haskell platform (suiting to the desired Ganeti version):

  https://www.haskell.org/platform/prior.html

  2014 (7.8.3) for Ganeti 2.14

  ?2015 (7.10.3) for Ganeti 2.15+?

- install all needed Haskell libraries:

```
cabal install --only-dependencies cabal/ganeti.template.cabal --flags="confd mond metad"
```

- meet python dependencies / configure / make / install

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Options for the OS interface

- popular OS interfaces: ganeti-instance-debootstrap, ganeti-os-noop, snf-image

- What’s wrong with ganeti-instance-debootstrap?
  - it runs in the context of the node/kernel and is doing potentially “bad things” like mkfs, sfdisk, grub-install etc.

- snf-image does it right: encapsulate the instance customisation inside a (helper) VM
  - in cloud environments you want to enable the user to further customize the VM (user scripts etc.)
  - but snf-image is bound to debian based distros, what to do with SLES?

- my solution: libguestfs (part of libvirt), 5 years ago
  - essentially it is a qemu-VM with an API
  - many bindings (shell interface, python, C, …)
  - should work on any distro (SLES and Ubuntu confirmed)

your own OS interface based on libguestfs in 8 steps (bash)

1. get your OS-Image on the instance disk
2. start the helper VM
3. get the distro and version
4. remove SSH host keys
5. remove persistent NIC names
6. set hostname
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8. stop the helper VM

```
dd if=/path/to/NFS/${OS_VARIANT}.img \
           | dd of=${DISK_0_PATH}
```

Or

```
curl ${URL}?os=${OS_VARIANT} \
           | dd of=${DISK_0_PATH}
```

Or

```
qemu-img convert ${URI} ${DISK_0_PATH}
```

THIS IS Node CONTEXT !

If `${DISK_0_PATH}` is wrong, you lose.

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```
eval $(/usr/bin/guestfish --listen -a ${DISK_0_PATH} -i)
```

again:

THIS IS Node CONTEXT !

If `${DISK_0_PATH}` is wrong, you lose.

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```
# the disk with /
rootdev=/dev/sda1 or rootdev=/dev/vg/root

distro="$(${GFR} -- inspect-get-distro ${rootdev})"
major_v="$(${GFR} -- inspect-get-major-version \
        ${rootdev})"
```

- `GFR=/usr/bin/guestfish --remote=${GUESTFISH_PID}`

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```
for i in $(${GFR} -- glob-expand /etc/ssh/ssh_host_'*')
do
        ${GFR} -- rm ${i}
done
```

- `GFR=/usr/bin/guestfish --remote=${GUESTFISH_PID}`

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```
upnr=/etc/udev/rules.d/70-persistent-net.rules
tmp="$(${GFR} -- is-file ${upnr})"
if [[ "${tmp}" = "true" ]]; then
      ${GFR} -- rm ${upnr}
fi
```

- `GFR=/usr/bin/guestfish --remote=${GUESTFISH_PID}`

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```
case ${distro} in
ubuntu)
  ${GFR} -- write /etc/hostname "${INSTANCE_NAME%%.*}";;
sles)
  ${GFR} -- write /etc/HOSTNAME "${INSTANCE_NAME}";;
esac
```

- `GFR=/usr/bin/guestfish --remote=${GUESTFISH_PID}`

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- `GFR=/usr/bin/guestfish --remote=${GUESTFISH_PID}`

```
netcfg=$(mktemp)

if [[ ${distro} = ubuntu ]]; then

cat << EOF > ${netcfg}
# The loopback network interface
auto lo
iface lo inet loopback

# The primary network interface
auto eth0
iface eth0 inet static
  address ${NIC_0_IP}
  netmask ${NIC_0_NETWORK_SUBNET##*/}
  gateway ${NIC_0_NETWORK_GATEWAY}
EOF

${GFR} -- upload ${netcfg} /etc/network/interfaces

fi
```

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- `GFR=/usr/bin/guestfish --remote=${GUESTFISH_PID}`

```
netcfg=$(mktemp)
if [[ ${distro} = sles ]]; then
        cat << EOF > ${netcfg}
BOOTPROTO='static'
BROADCAST=''
ETHTOOL_OPTIONS=''
IPADDR="${NIC_0_IP}/${NIC_0_NETWORK_SUBNET##*/}"
MTU=''
NAME='Ethernet Card 0'
NETMASK=''
NETWORK=''
REMOTE_IPADDR=''
STARTMODE='auto'
USERCONTROL='no'
EOF

${GFR} -- \
  upload ${netcfg} /etc/sysconfig/network/ifcfg-eth0

${GFR} -- write /etc/sysconfig/network/routes \
  "default ${NIC_0_NETWORK_GATEWAY} - -“
fi
```

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```
${GFR} -- exit
```

- `GFR=/usr/bin/guestfish --remote=${GUESTFISH_PID}`

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- put this steps in the create function of the Ganeti OS interface
- further customisations steps are usual:
  - generate new UUIDs (filesystems, LVM-PVs and VGs, machine-id)
  - remove users
  - set passwords (i.e. root)
  - delete logs, temp files, histories, coredumps, blkid-tab, ca-keys/certificates, cron-spool, kerberos keys, mails, …
  - firewall rules

- `GFR=/usr/bin/guestfish --remote=${GUESTFISH_PID}`

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simple webconsole using novnc

- somehow (periodically?) generate a HTML page from the output of

```
gnt-instance list -o name,pnode,network_port,hv/vnc_bind_address --no-headers
```

- containing links for every instance with vnc_bind_address set

```
<a href="./cgi-bin/ganeti-simple-webconsole.cgi
      ?node=${pnode}&vnc_port=${vnc_port}&ws_port=$(( vnc_port + OFFSET ))
      &cluster=${cluster}>${name}</a>
```

- simple CGI webserver on master to serve this HTML-Page, the CGI-script, and NOVNC
- the CGI script uses parameters to launch:

```
websockify --daemon --wrap-mode=exit ${ws_port} -- \
    ssh -o … -L "${ws_port}":127.0.0.1:"${vnc_port}" "${node}" sleep 10s
```

- and redirect the browser to NOVNC which in turn uses the WS

```
<meta http-equiv="Refresh" content="0;
url=http://${cluster}:${PORT}/novnc/vnc_auto.html?host=${cluster}&port=${ws_port}" />
```

simple webconsole using novnc (continued)

advantage

- console can be served from the master-node (cluster-name / -IP as single point of contact)
- vnc_bind_address 127.0.0.1 can be used (no VNC auth necessary)

improvements

- used webserver is python built-in → real webserver with HTTPS/WSS and authentication
- the CGI script allows “tunnelling” (through SSH and WS) of every requested port
  - check for a “safe” port range?
  - better use websockify tokens (>=v0.7): client knows the token, server maps to host and port
- serve the HTML and WS from the same server/port to use authentication also for the WS
- CGI-script could implement console-ACL by mapping instance tags to users/groups
- use hooks to start/stop webserver with the master-role

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grow an instance disk online (with a hook)

- grow with Ganeti:

  `gnt-instance grow-disk --no-wait-for-sync some.vm 0 1G`

- implemented as disk-grow-post.d hook
- Connect to the qemu HMP socket on the instance primary node

  `socat STDIO UNIX-CONNECT:/var/run/ganeti/kvm-hypervisor/ctrl/${GANETI_INSTANCE_NAME}.monitor`

- identify the disk by UUID: `info block`

  Compare with `$GANETI_INSTANCE_DISK0_UUID`

- inform qemu and guest about the new size: `block_resize ${disk_id_qemu} ${new_size}`
  - `new_size=$GANETI_POST_INSTANCE_DISK0_SIZE`
  - `disk_id_qemu` from above, something like `hotdisk-fb3a86d3-pci-4`
- safe with DRBD, plain, blockdev; with sharedfile new_size must match exactly, or qemu will adjust to the new size (may even shrink the disk)
- Demo?

Network security (anti spoofing)

- use ebtalbes to
  - stop IP, MAC and ARP-Spoofing
  - but still allow QEMU-ARP-like announcements (i.e. for live migration)

- implemented as instance-start-post.d and instance-stop.pre-d (needs the tapX of the instance)
  - tapX not available in hook ENV → use `/var/run/ganeti/kvm-hypervisor/nic/some.vm/0`
  - Ganeti hasn’t allocated a tapX in phase start-pre and stop-post
  - ruleset https://libvirt.org/firewall.html clean-traffic
  - support for live migration pending

- costs performance?

- Demo?

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wishes and ideas for the future of Ganeti

for users

- make releases 2.16/2.17
  - https://github.com/ganeti/ganeti/issues/292 (RSA instead of DSA keys -> fails inUbuntu 16.04)
- push/hold Ganeti to/in Ubuntu/Debian
- a proper website (maybe) some wiki with guides for common setups, problems, solutions
  - high quality → should work out of the box

for devs

- try to make contribution easy (like in ansible), but keep quality

features we would like

- more on (automatic) HA
- storage live migration (qemu block-mirror?)
- ESI openstack-cinder?
- like ESI an external network interface would be nice (if SDN is more used)

Thanks

Q&A

past conversions (cluster #03: LXC → KVM)

past goal: LXCs as VMs → will work, but limitations and additional effort doesn’t outweigh benefits

- limitations: isolation frameworks are diverse/complex or incomplete
  - access to block devices is granted by maj:min number → not static per instance
  - /proc/{meminfo,uptime,stats,diskstats} are from the host → vmstat, sar, free, uptime, snmpd all „lie“

    lxcfs: „Upgrading LXCFS without breaking running containers”[3]
  - /proc/sys (aka sysctl) is partial namespaced (net) → otherwise mounted „special“ (lxc.mount.auto)
  - CAP_SYS_ADMIN „is overloaded“[2] but needed for mount inside LXC (i.e. NFS) → mitigate with apparmor
  - cgroup v1 „seems to present a number of inconsistencies and a lot of chaos“[1] (cgroup v2 in linux-4.5)
  - a container reaching mem-limit? → host will swap until death, killing all other LXCs