640k
Should be Enough
For Anybody

Peter Tribble

Theoretical Astrophysicist
Systems Administrator
OpenSolaris Governing Board
Inveterate Tinkerer

> Tribblix

- Based on illumos
- Built from scratch
- SVR4 packaging
- Zones
- Desktops
- Flexible - Retro - Steampunk

The fantasy

640k should be enough memory for anybody

(misattributed to Bill Gates)

The Reality

Oracle Solaris 11.3
System Requirements

Memory

2GB or more

Disk Space

Package Group	Recommended Minimum Disk	Installation Types
solaris-large-server	9GB	Automated Installer Text Installer
solaris-small-server	8GB	Automated Installer
solaris-minimal-server	6GB	Automated Installer
solaris-desktop	13GB	Live Media

Where did it all go wrong?

> Baseline Numbers

- Solaris 2.5 – 16M
- Solaris 8 - 64M
- Solaris 10 (no zfs) – 256M
- OpenSolaris - 1GB
- Tribblix live boot – 256M
- Tribblix standard install - 768M
- Tribblix running desktop - 512M

Different requirements

- Boot from media (live)
  - Root archive loaded as ramdisk
  - /usr via clofi
- Installation
  - As live, but copy everything
  - And usually with ZFS involved
- Normal operation
  - Minimal boot archive
  - Load from disk on demand

Minimisation

- (Aside: these compress 3x on the ISO)
- Root archive
  - Remove software
  - Single architecture (32-bit)
  - To 90M, from 160M
  - Is UFS, so memory efficient
- solaris.zlib - /usr
  - Remove software, 32-bit
  - To 171M, from 301M

The real culprit

ZFS

VS

UFS

UFS installation

- Night vs Day
- Goes Like Greased Lightning
- Regular install flies at 256M
- Minimised install flies at 192M
- Installation chokes at 160M
- Nobody* supports UFS root
- Zones and IPS require ZFS

*except Tribblix, that is

Regular Boot

- Resize in VirtualBox…
- No X11 here, just console
- Turn off unnecessary services
- Fine at 128M
- Swapping at 120M
- Dead at 112M
- Ought to do better?

Minimisation

- Boot archive – just enough kernel to mount /
- But it was still 80M
  - It can be UFS or HSFS
  - Depending on whether it finds mkisofs
- UFS – fixed size, way too large
- HSFS – just the size you need
- Rebuilt to be 17M – big win!

Eventually, the wall...

Full Boot in

88MB

!

But I want

MORE

(um, less...)

What else can go?

- Assuming we scrap cron, fmd, ssh, etc
- SMF is the biggest contributor
  - ~20M in all
- Idea: no SMF, just use init
  - And init will just launch a shell
- Yes, it does work
  - Although SMF is hardcoded into init
  - Opens up whole new vistas for research

The final wall...

Minimal Boot in

64MB

!

Sidebar

Docker

Unikernels

JEOS

Library Operating Systems

DCOS

OS equivalent of microservices

OSv

Conclusion

If you want to run on tiny
systems, then you need to
sacrifice ZFS

and IPS

And maybe SMF

References

http://ptribble.blogspot.co.uk/2015/09/how-low-can-tribblix-go.html

http://ptribble.blogspot.co.uk/2015/10/minimal-viable-illumos.html