Solaris 10

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What's UP?

- DTrace – Dynamic Tracing
- N1 Grid Containers (a.k.a Zones)
- Greenline/ Service Management Facility
- Fault Management Architecture
- AMD64
- Solaris 10 Networking
- Network Performance Futures
- Java Desktop System - JDS
- Zetabyte File System – ZFS
- Project Janus
- Open Source
- Useful Information

Solaris 10 Design Principles

- Performance
- Security
- Reliability
- Availability
- Managebility
- Sevicability
- Platform Neutrality

Dynamic Tracing –
Performance Bottleneck Buster

- Breakthrough approach for tuning
  - Power tool for real-time analysis, diagnosis
- Safe and comprehensive
  - Non invasive, little overhead, easy to use
  - One view into both system and application level
  - Over 30,000 data monitoring points
- Designed for live use on production systems
  - No need to force failure, then do postmortem debug
  - No need to re-create the problem on test systems
  - No need to run different, slow, instrumented OS in production
- Reduced costs
  - Solutions found in minutes or hours, not days or weeks
  - Optimized apps: **cases of 3-30x speedups already seen**

Why Dynamic Tracing?

- Well-defined techniques for debugging *fatal*, *non-reproducible* failure:
  - Obtain core file or crash dump
  - Debug problem *postmortem* using mdb(1), dbx(1)
- Techniques for debugging *transient* failures are much more ad hoc
  - Typical techniques push traditional tools (e.g. truss(1), mdb(1)) beyond their design centers
  - Many transient problems cannot be debugged at all using extant techniques

Exploring DTrace

- DTrace is available to the public starting in Solaris Express 11/03:

  http://www.sun.com/software/solaris/solaris-express

- BigAdmin has a page and discussion forum dedicated to DTrace:

  http://www.sun.com/bigadmin/content/dtrace

- The DTrace AnswerBook is available for public download there as well

N1 Grid Containers (Zones)

- Basic concept: isolated execution environment *within* a Solaris instance
- Includes resource, security, failure isolation
- Lightweight, flexible, efficient
- One OS to manage
- Components:
  - Resource management (CPU, memory, ...)
  - Security/namespace isolation (*zones*)

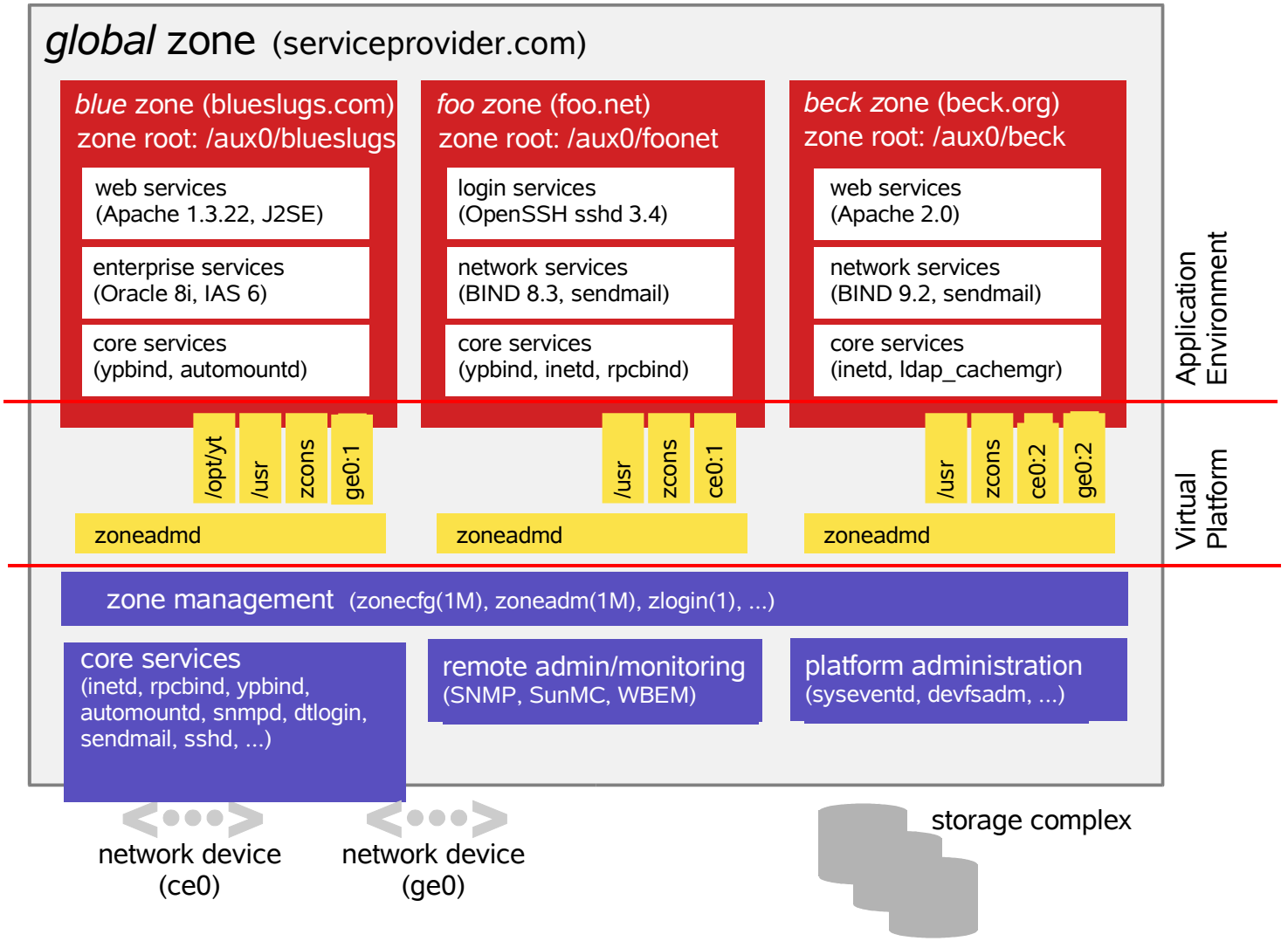
N1 Grid Containers (Zones)

- Provides virtualized OS services that look like different Solaris instances
- Isolates applications from each other
- Hides the details of the underlying OS
- Provides almost arbitrary granularity in isolationg and/or sharing resources
- Application environment is compatible for existing programs.

When to deploy Zones

- Hostile and untrustworthy applications
  - Example: Two webservers each binding to port 80
  - Untrusted software that should be isolated
- Data center consolidation
  - Multiple databases with different administrators
- Hosting
  - Consolidate many small customers onto a server giving some or all of them the root password
- Software development
  - A cheap way to simulate a set of production systems, test software installation, etc.

Grid Containers Block Diagram

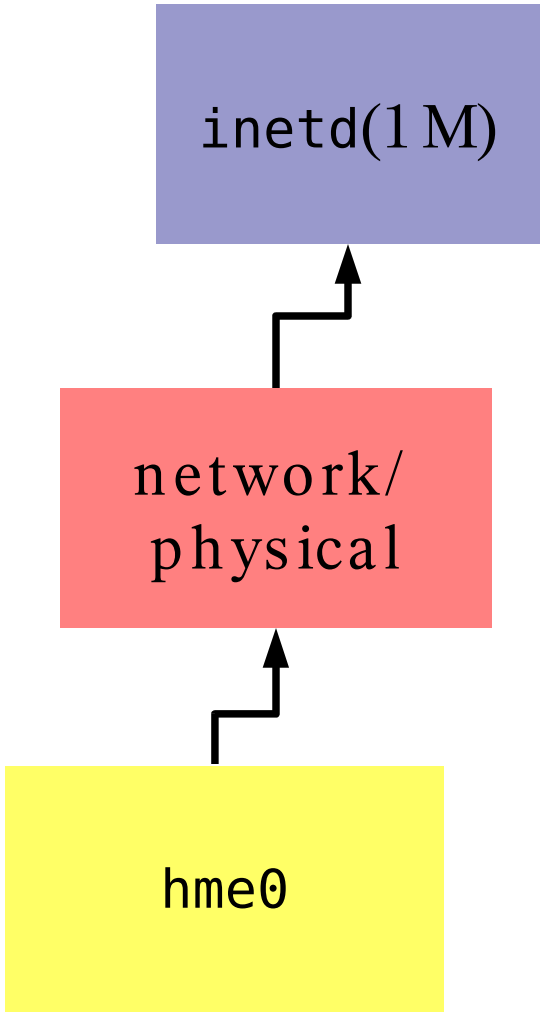


Greenline

- Problem:
  - Ad hoc mechanisms for managing services:
    - /etc files
    - Rc scripts
- Solution:
  - Framework for service management
    - Repository for configuration data
    - Administrative enable/disable controls
    - Fine-grained access control
  - Link between applications and FMA

    Automated single-node restart

What's a Greenline service?

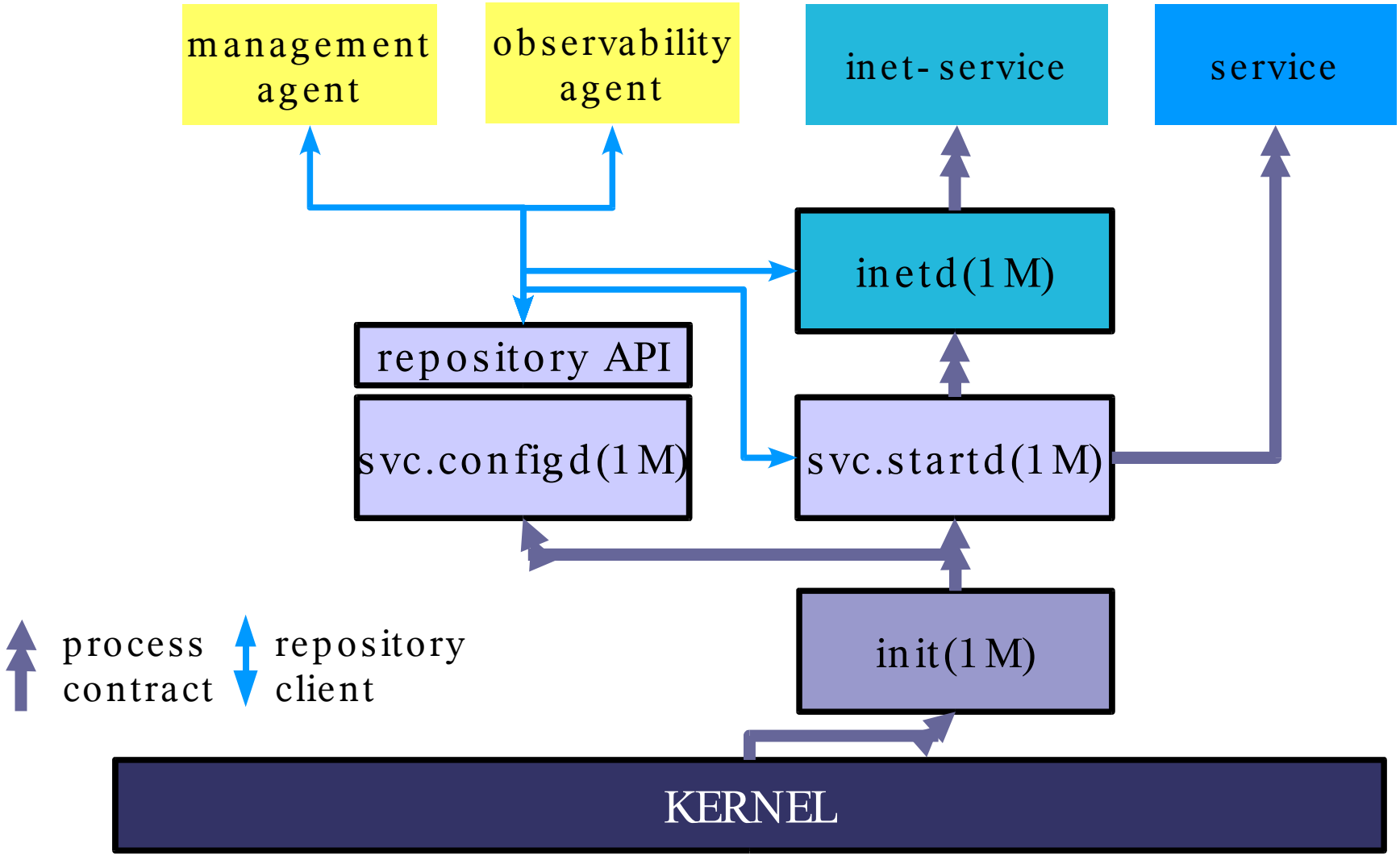


- A persistently-running application
- A named instance of the service entity schema:
  - Start, stop, restart, health/status service methods
  - Properties (bundles)
  - Restart relationship(s)
- Example: Internet restarter service
  - `init.d` code → method
  - `inetd.conf` → properties
  - `rc.d` order → milestone dependency

Start-up and configuration

Today		Tomorrow
/dev/* network interfaces	low-level devices	device services
/etc/inittab /etc/init.d/* /etc/rc?.d/* /etc/inet/inetd.conf	invocation, termination	service methods service dependencies milestones
/etc/system /etc/default/* /etc/inet/* /etc/hostname* /etc/dhcp/* /etc/ppp/*	properties	service properties
file system permissions	security	entity authorizations delegated roles security profiles
NSS backends local files	repository	DSS datastores local cache

Architecture schematic



Predictive Self Healing –
Online Recovery with Automated Services

- Breakthrough approach to service availability
  - Error detection & aggregation, auto recovery
- Reduced downtime
  - Components proactively offlined before failure
  - Automatic service restart
  - Diagnosis & mitigation in milliseconds, not hours
- Reduced complexity
  - Simplified error reporting
  - All system & service interdependencies recorded and correlated
- Reduced costs
  - Reduced system downtime, increased utilization
  - Higher server-to-administrator ratio

Predictive Self Healing – Phase 1

- Solaris FMA infrastructure and Fault Manager:
  - New tools for admins, ops, and service
  - New structured log files for telemetry data
  - Live diagnosis updates without reboots
- Standardized fault messaging agent
- Messages linked to new customer web site
- Automatic service restart (Service Manager)
- Diagnosis for UltraSPARC-III, IV CPU and Memory
- Automatic CPU and memory retire
- Improved software resilience to I/O failures

Solaris/AMD64

- Native 64bit architecture for AMD64/Opteron
- 64bit execution on some Intel processors
- Will also run 32bit binaries as Solaris Sparc
- Will run 32bit Linux binaries under Janus

Java Desktop System - JDS

- Integrates desktop and user productivity tools in one component:
  - Gnome 2.6
  - Mozilla 1.7
  - Evolution 1.4.6
  - StarOffice 7 PP3
  - APOC 1.0
  - Xorg xserver (X11r6.7)

Network Performance

- Turn performance into competitive advantage for SMI, partners and customers
  - Add performance to Solaris' reputation for quality and reliability
  - Strong horizontal and vertical scalbility
  - Robust out of the box performance
- Improve network performance over 25%
- Optimize TCP/IP with respect to each other
- Optimized the IP Classifier

Performance Strategy

- Partner with ISVs, IHVs, and customers to understand and address performance issues
- Focus on improving whole stack and application performance
  - Utilize micro/macro benchmarking and customer workloads
- Exploit emerging HW technology while being platform agnostic
  - Multithreaded (e.g CMP, SMT, CMT), SSE2, 64-bit AMD, etc.
  - 10 GbE, TOE, iSCSI, RDMA, Crypto Offload, etc.
- Leverage synergy between organizations within Sun to drive integrated performance

Solaris 10 : Key Network Technologies

- FireEngine: Overall TCP/IP performance enhancement
- MultiData: Bulk data throughput
- Better Zerocopy support (ftp server faster by 30%)
- SCTP: Support for the protocol itself and the sockets API
- Fully deployable IPv6
- Wanboot: Remote boot machine using HTTP/HTTPS
  - Does not require DHCP
  - Works across firewall
- Leadville : Fibre channel on x86

FE - IP Classifier

- Use a connection classifier early in IP for incoming packet
- The connection structure ('connp') contains all the necessary information:
  - The CPU/squeue on which the packet needs to be processed
  - The string of functions necessary to process the packet

Network Performance Futures

- Nemo:
  - Dynamic switching between interrupt and polling
  - 10Gbps NIC support
  - Vlan and Trunking support for the masses
  - Far easier to create drivers
- NCA merge to FireEngine (NL7C)
- UDP performance (yosemite)
- TOE and other offload support
- Asynchronous socket support
- SIP - proxy, redirect and registrar servers
- Diameter and RTP ....

Nemo: GLD v3

- Next version of GLD (for Sparc and x86)
- Trunking, vlan, dynamic polling, chaining support
- High performance framework
- Large segment offload support
- Will make writing device driver a breeze

Dynamic Filesystem (ZFS)

- Pooled storage
  - Completely eliminates the antique notion of volumes
  - Does for storage what VM did for memory
- End-to-end data integrity
  - Historically considered “too expensive”
  - Turns out, no it isn't
  - And the alternative is unacceptable
- Everything is transactional
  - Keeps things always consistent on disk
  - Removes almost all constraints on I/O order
  - Allows us to get huge performance wins

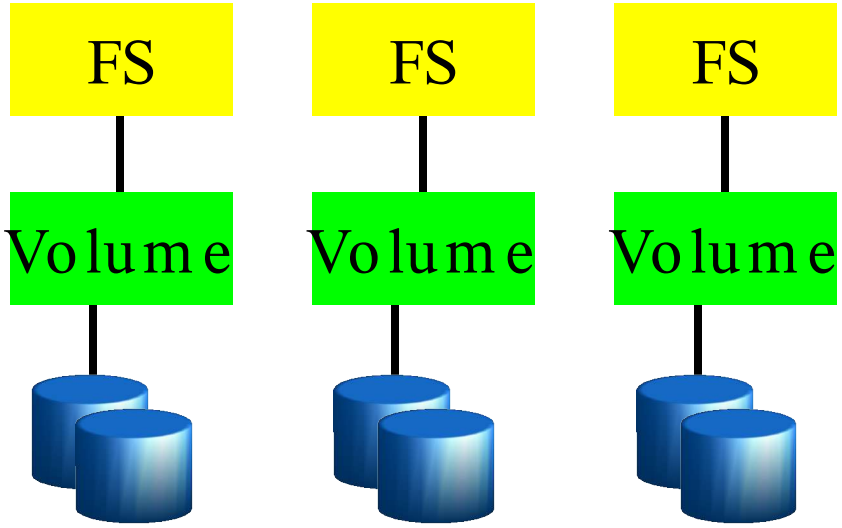
FS/Volume vs. ZFS

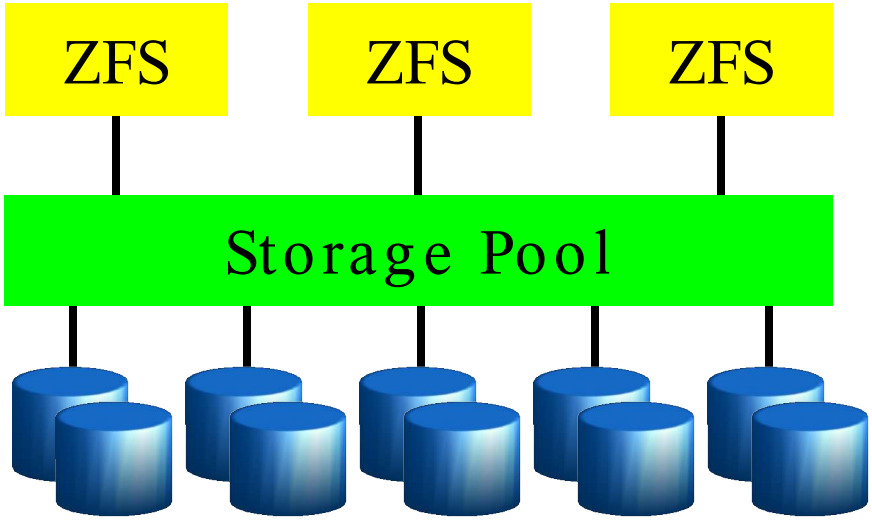
Traditional Volumes

- Abstraction: virtual disk
- Partition/volume for each FS
- Grow/shrink by hand
- Each FS has limited bandwidth
- Storage is fragmented, stranded

ZFS Pooled Storage

- Abstraction: malloc/free
- No partitions to manage
- Grow/shrink automatically
- All bandwidth always available
- Pool allows space to be shared






FLY

Project Janus – Linux Binary Compatibility

- Run Linux applications natively on Solaris x86
- Stand-alone executables require no additional support
- Available in Solaris 10 update 1

Open Source

- More integration of Open Source software into Solaris
- More of Solaris introduced into the Open Source community
- Community developers soon can contribute to Solaris

Useful Information

- http://www.sun.com/bigadmin/xperts/
- http://www.sun.com/bigadmin/features/articles/meet_architects.html
- http://www.sun.com/bigadmin/content/dtrace

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Soon, at a location near you

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Questions?

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