TrustedBSD Project Update

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Introduction

- TrustedBSD Project started in April, 2000
- Goals to provide
  - Infrastructure for advanced security services
  - Advanced security functionality
- Accomplished a lot in six years
- Updates on recent activities
  - MAC Framework discussions
  - Audit implementation
  - NFSv4 ACLs

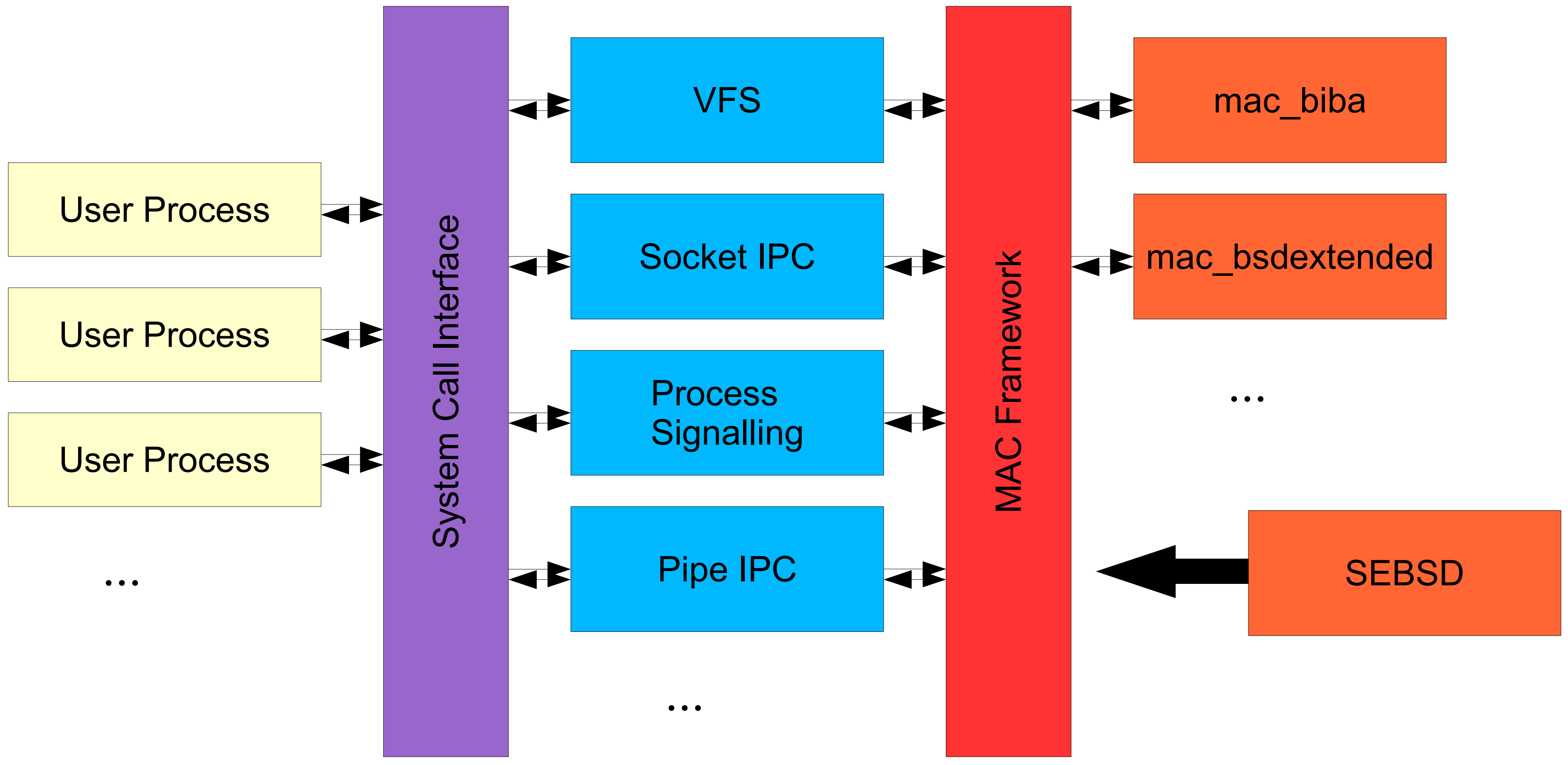
TrustedBSD Feature List Reminder

- Infrastructure
  - OpenPAM, NSS, UFS1 EAs, UFS2, GEOM, GBDE
  - Access control cleanup
- Stuff
  - TCP syncache, TCP syncookies, TCP TW
- Features
  - ACLs
  - MAC Framework, MAC policies
  - Audit

TrustedBSD MAC Framework Retrofit Discussion Summary

- Extensible kernel access control mechanism
- TrustedBSD MAC Framework merged in 2002
  - Followed two years of DARPA-funded R&D
- We now have significant real-world experience
  - At least half a dozen significant third party security policies written
- Time to review situation, and decide whether architecture meets needs going forward
  - If we haven't learned anything, we weren't trying

Overused Slide on MAC Framework Architecture



Proposals on Table

- Options MAC in GENERIC
  - Requires very careful look at performance
  - Locking, memory allocation model revision
- Broad range of syntactic cleanup
  - Entry point naming consistency, etc.
- IPv6, IPSEC support
  - Prototype labeling and access control explored
- Revised extensible label mechanism
- Integration with Audit

Additional MAC Framework Issues

- Entry points for system call entry/exit to allow system call wrappers
- Provide infrastructure for MAC policy modules desirable
  - Increasing number of third party moduls
  - Not desirable/possible to put all in src

Larger Directional Changes

- Allow plugging of current DAC/privilege models
  - UNIX DAC (permission/ACLs)
  - UNIX superuser
  - UNIX IPC protections
  - UNIX inter-process access control
- Revised system privilege model
  - Suser to... ?

Retrofit Schedule

- Goal to ship moderate revisions to MAC Framework kernel interfaces in 7.0
  - That means 12-18 months to shake out
  - Sounds about right
- Will require third party vendors to update their MAC modules
  - Mostly syntactic changes, but should help with module structure
- Helping hands welcome!

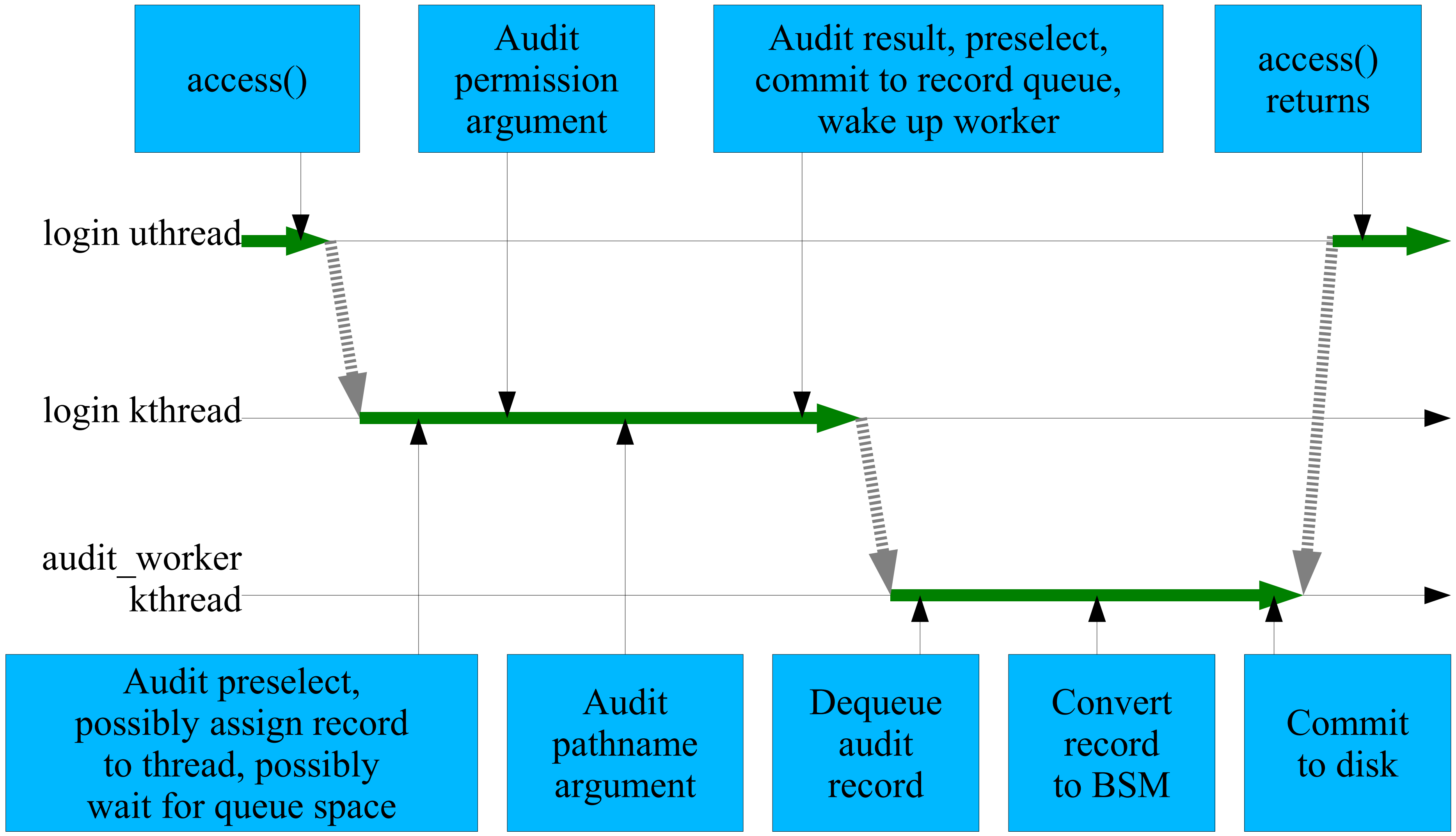
TrustedBSD Audit

- Last year, I told you about exciting new feature
  - Well, it took a bit, but it's there now :-)
- Security event audit
  - Derived from open source Apple audit code
    - Implemented by McAfee Research
  - Fine-grained, configurable, reliable security logging
  - Produce post-mortem trails, as well as live event streams for intrusion detection and analysis
  - Meets requirements for CAPP evaluation

Audit High Level Design Traditional Features

- Token-stream BSM log format
  - De facto industry standard API/file format from Sun
- Records describing security-relevant events
  - Many system calls
  - Authentication, system management, etc
- Reliable trail
  - Bounded loss in the presence of failure, fail-stop support, etc.

Sample Audit Control Flow


access()
Audit permission argument
Audit result, preselect, commit to record queue, wake up worker
access() returns
login uthread
login kthread
audit_worker kthread
Audit preselect, possibly assign record to thread, possibly wait for queue space
Audit pathname argument
Dequeue audit record
Convert record to BSM
Commit to disk

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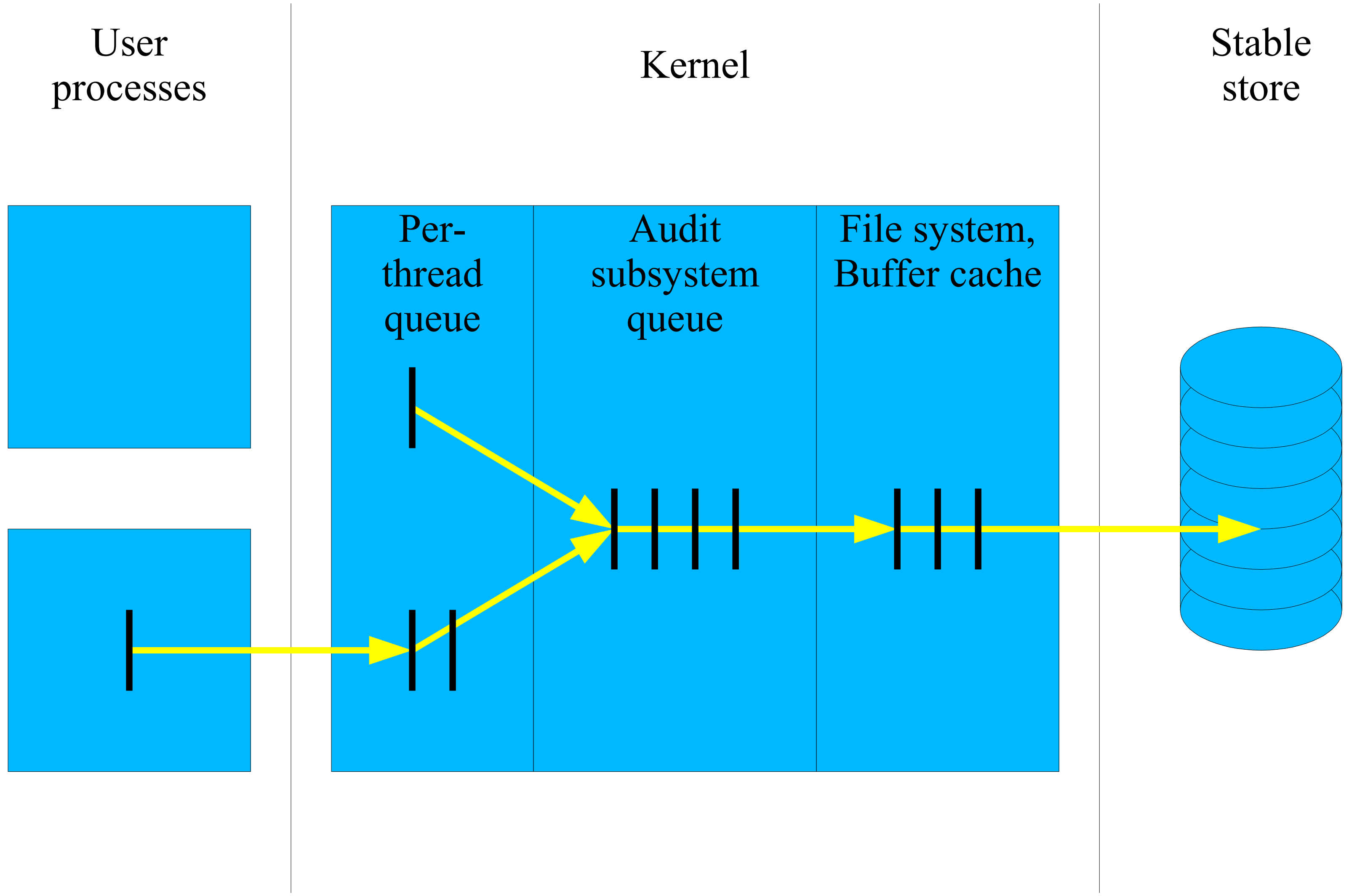
TrustedBSD Audit Implementation Less Traditional

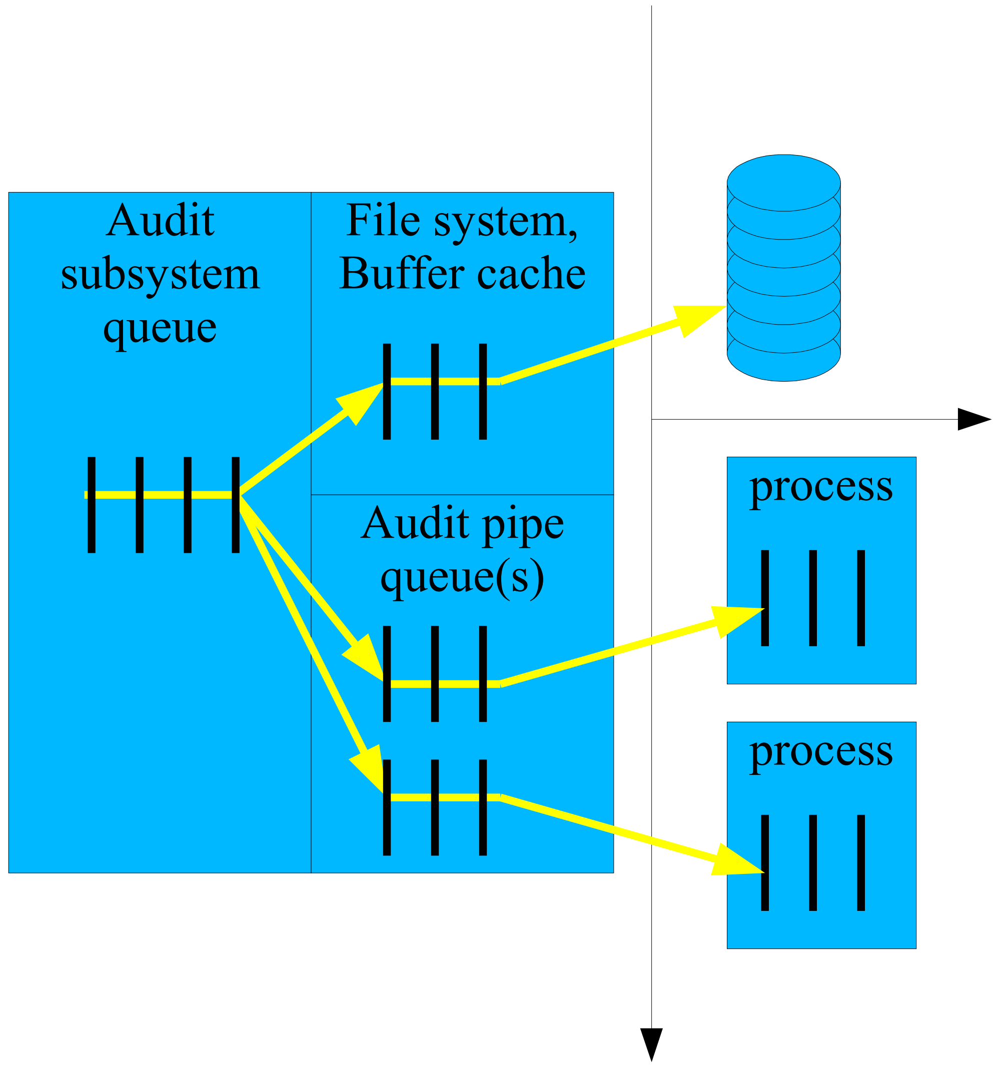
- Classic motivation for including Audit is trusted system evaluation
  - All decent protection profiles require security audit
- More immediate reason is intrusion detection
  - Changes focus of implementation
  - Still want reliable, configurable, fine-grained
  - Also want concurrent stream delivery to processes
  - Want per-stream configuration
- Audit pipes

Audit Queuing



Audit Pipes

- Audit pipes provide live record feed
  - Lossy queue
  - Discrete audit records
  - Independent streams
  - Independent preselection



Audit Event Daemon

- Want to support pluggable analysis and processing services
- Auditeventd
  - Shared library modules
  - Amortizes parsing costs for token stream
  - Common configuration format
- No modules currently, but easy to write
  - Module presented with a series of parsed token arrays containing event circumstances, arguments

Audit Summary

- Audit now largely merged to CVS HEAD (7.x)
  - Some areas of further work required
    - Additional system call auditing (ACLs, EAs, MAC, ...)
    - Additional application auditing (management tools)
- Plan to merge to RELENG_6 for 6.2
  - Not quite yet, but soon
- Feature work still going on
  - Audit pipes especially
  - Interested in multi-trail support

NFSv4 ACLs

- Current TrustedBSD ACLs based on POSIX.1e
  - Obvious choice at implementation time
  - Less obvious choice now
- NFSv4 ACLs are essentially Windows ACLs
  - Notionally similar, semantically quite different
- Mapping from POSIX.1e to NFSv4 is terrible
  - Internet draft reads “It can be done”
  - Between the lines, “But don't”

Tentative Strategy

- Surprisingly, Apple has made NT ACLs fit behind POSIX.1e API
  - But not POSIX.2c command line tools
- Sun also exploring NFSv4 ACLs in ZFS
  - Also investing in improving POSIX.1e mapping
- Create parallel ACL implementation
  - kern_acl.c -> subr_acl.c, subr_acl_posix1e.c
  - Add subr_acl_nfsv4.c
- UFS flag will specify desired ACL model

Lots of Open Questions

- What to do about command line tools?
  - Will need to look in detail at Apple, Sun choices
- What to do about APIs?
  - New ACL_TYPE_?
  - Take this opportunity to roll struct acl format to support longer ACL lengths?
  - Will require compatibility system calls
- Application adaptation needs to be done also
- NFSv4 server/client integration also desirable!

NFSv4 ACL Status

- Have read the NFSv4 RFC
  - Rather non-specific, “See NT”
  - Asked on mailing list, two days later Sun posted draft with proposed semantics
- Have started breaking out ACL code into parts
- Started on system call compatibility
- Help wanted