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Flexible Mandatory Access Control (FMAC)

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Agenda

- Design Goals
- Early Stages
- Timeline of Completed Tasks
- Implementation
- Examples
- Next Steps
- Community
- Q&A

Design Goals

- Bring the Flask architecture and type enforcement (TE) to the OpenSolaris™ Operating System
- Complement existing Solaris™ security mechanisms
- Preserve existing Solaris APIs
- Provide Flask-compatible APIs
- Specify a single policy for a system

Early Stages

- Provide project foundation
  - Create opensolaris.org project page and `fmac-discuss` discussion list
  - Set up Mercurial project repository
  - Create code contribution charter
- Provide development foundation
  - Discuss initial design concepts on list
  - Integrate Flask/TE v15 into ONNV
  - Add process and file context support
  - Add library and utility support

Timeline of Completed Tasks

- Project proposal submitted 02/14/2008
- Project proposal approved 02/14/2008
- Project site created 03/04/2008
- Press release 03/13/2008
- Jonathan Schwartz blog 03/25/2008
- Alpha 1 source code drop 05/02/2008
- System call support 06/20/2008
- Process context support 07/10/2008

Implementation – Utilities

- checkpolicy
- loadpolicy
- getenforce
- setenforce
- setfiles
- pcon

Implementation – libc Interfaces

- security_load_policy()
- security_compute_av()
- security_check_context()
- security_getenforce(), security_setenforce()
- is_fmac_enabled()
- getcon(), getpidcon()
- getexeccon(), setexeccon()
- getprevcon()
- freecon()

Implementation – /etc/system Options

- set fmac_enabled = [0,1]
- set fmac_enforcing = [0,1]
- set fmac_default_policy_file = "/etc/security/fmac/ss_policy"

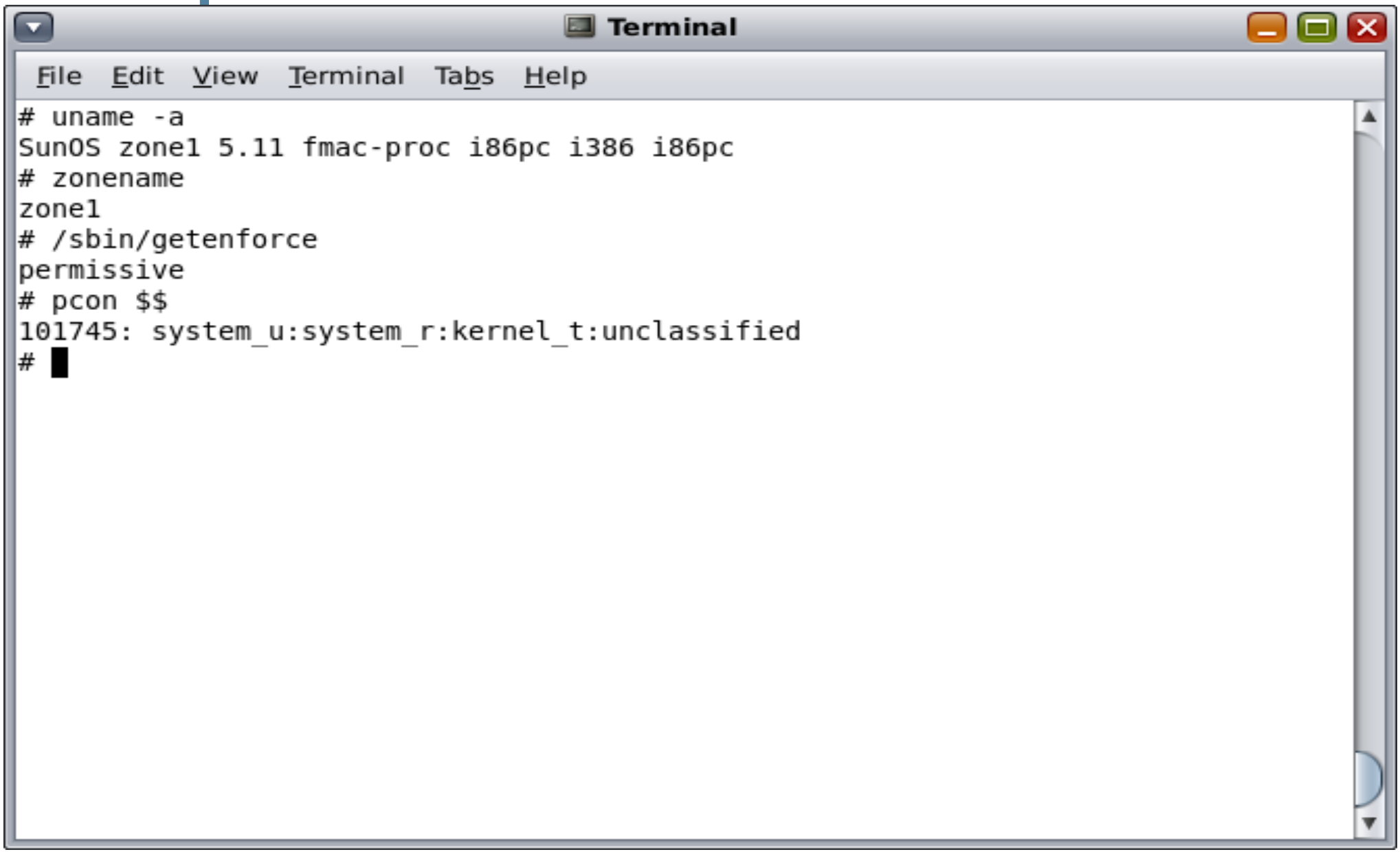
Implementation – Boot Flags

- `-p [disabled|enforcing|permissive]`

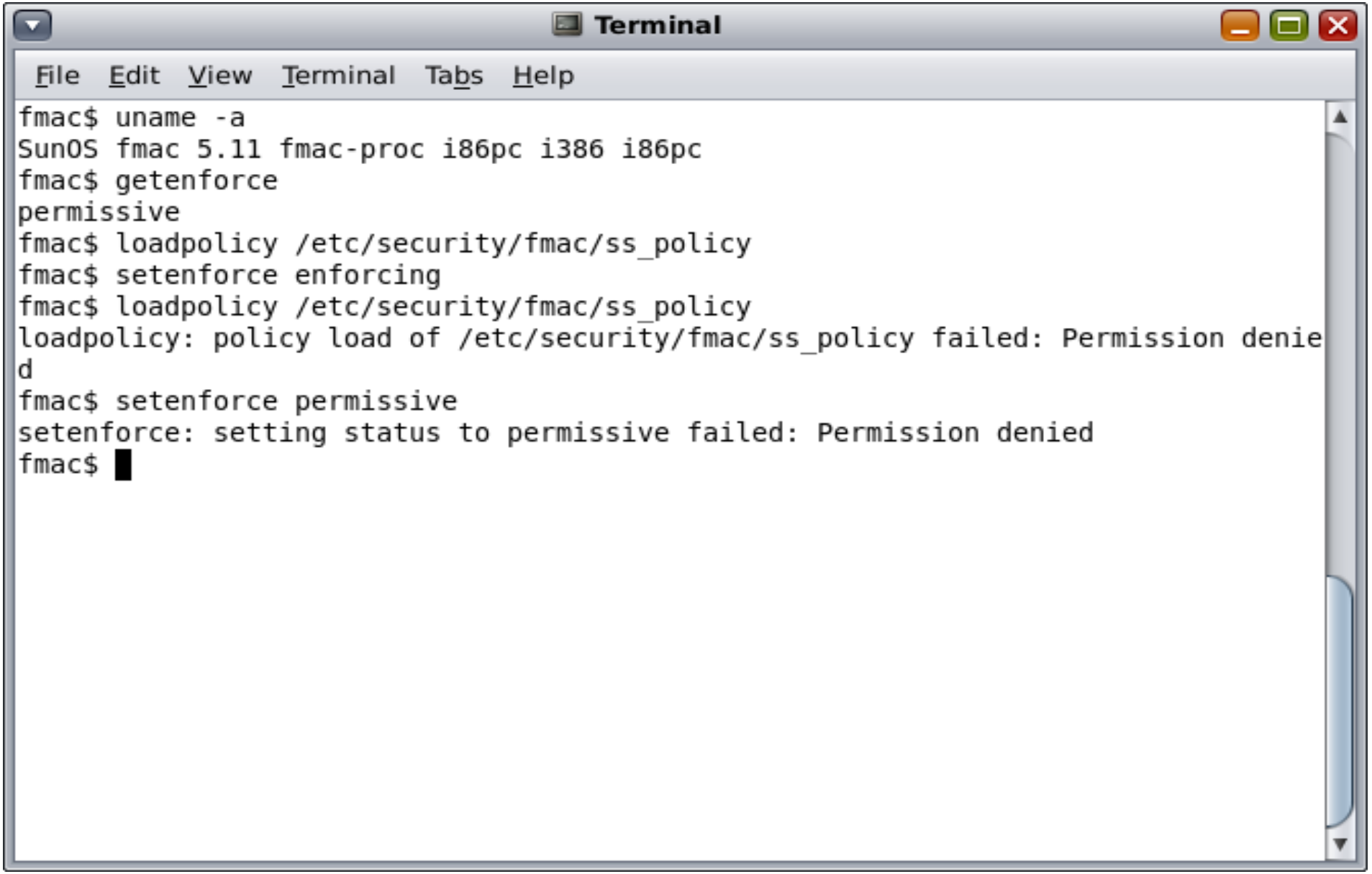
Implementation – Source Structure

- `usr/src/head/fmac`
  - User header files
- `usr/src/common/fmac`
  - Code shared by user-space and the kernel
- `usr/src/cmd/fmac`
  - FMAC-specific commands e.g., `checkpolicy`
- `usr/src/uts/common/sys/fmac`
  - FMAC-specific kernel header files
- `usr/src/uts/common/fmac`
  - Kernel files

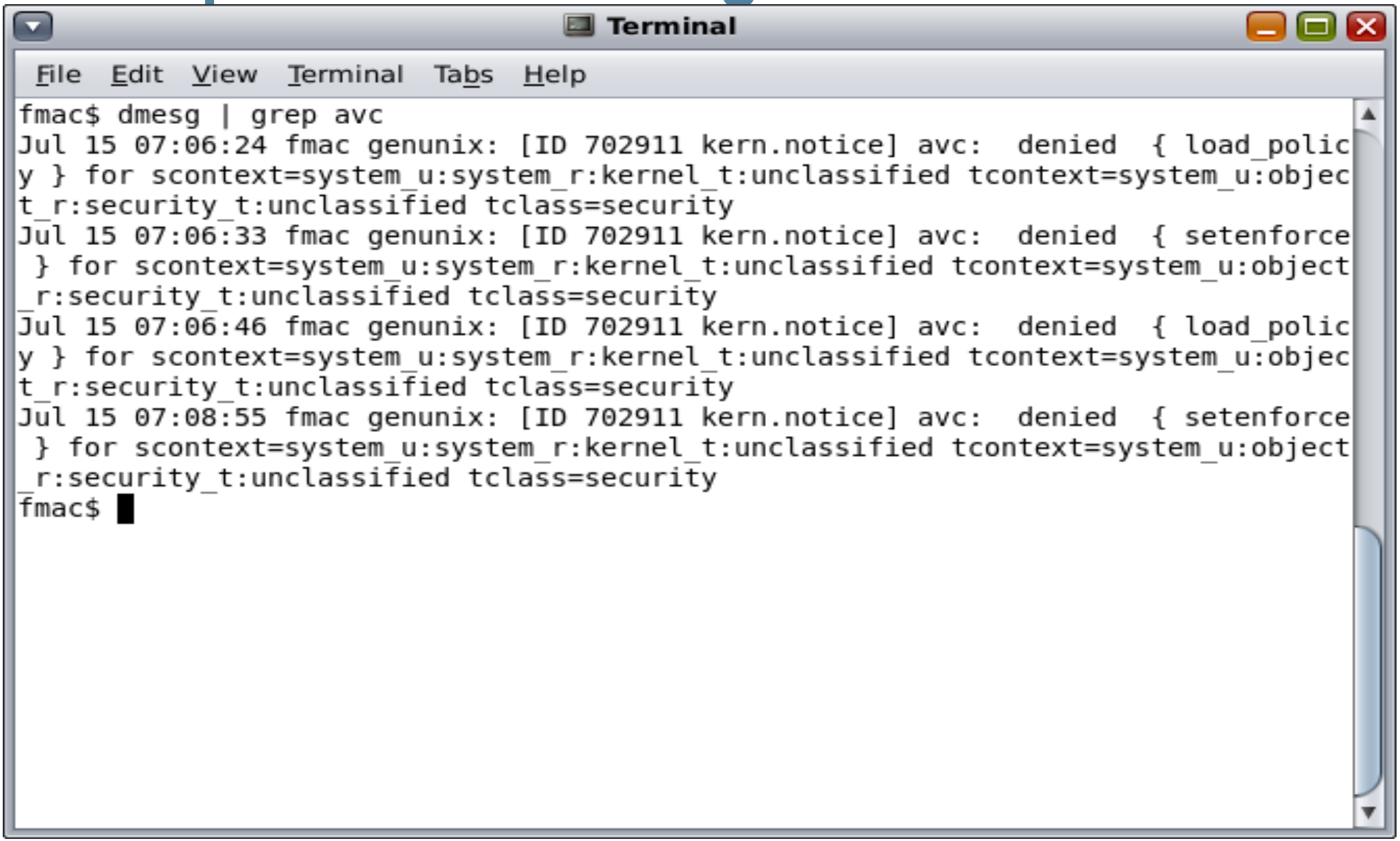
Example – Process Contexts



Example – Policy Enforcement



Example – AVC Messages



Example – Truss Output

Terminal

File Edit View Terminal Tabs Help

```
101547: getcon("system_u:system_r:kernel_t:unclassified") = 0
101547: getexeccon("")                                    = 0
101547: setexeccon("root:user_r:user_t")                  = 0
101547: getexeccon("root:user_r:user_t:unclassified")     = 0
101547: getpidcon(1, "system_u:system_r:kernel_t:unclassified") = 0
101547: getpidcon(0, "system_u:system_r:kernel_t:unclassified") = 0
101547: is_fmac_enabled()                                 = 1
101547: security_getenforce()                             = 0
101547: security_setenforce(0)                            = 0
101547: security_check_context("root:user_r:user_t")      = 0
101547: security_compute_av("root:user_r:user_t", "root:user_r:user_t", 2, 32, 0
x0804725C) = 0
~
~
~
~
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~
```

Example – dtrace

Terminal

File Edit View Terminal Tabs Help

```
# ./fmacsyscall.d
dtrace: script './fmacsyscall.d' matched 25744 probes
CPU FUNCTION
  0  -> fmacsys                                  101692
  0    -> fmacsys_getcon                         101692
  0      -> prfind                               101692
  0      <- prfind                               101692
  0      -> crgetsecid                           101692
  0      <- crgetsecid                           101692
  0      -> crgetsecid                           101692
  0      <- crgetsecid                           101692
  0      -> avc_has_perm_audit                   101692
  0        -> avc_has_perm_ref_audit             101692
  0          -> avc_lookup                       101692
  0          <- avc_lookup                       101692
  0        <- avc_has_perm_ref_audit             101692
  0      <- avc_has_perm_audit                   101692
  0      -> security_sid_to_context              101692
  0        -> sidtab_search                      101692
  0        <- sidtab_search                      101692
  0        -> context_struct_to_string           101692
  0          -> mls_compute_context_len          101692
  0            -> ebitmap_cmp                    101692
  0            <- ebitmap_cmp                    101692
```

Source Example – Ubiquity

Terminal

File Edit View Terminal Tabs Help

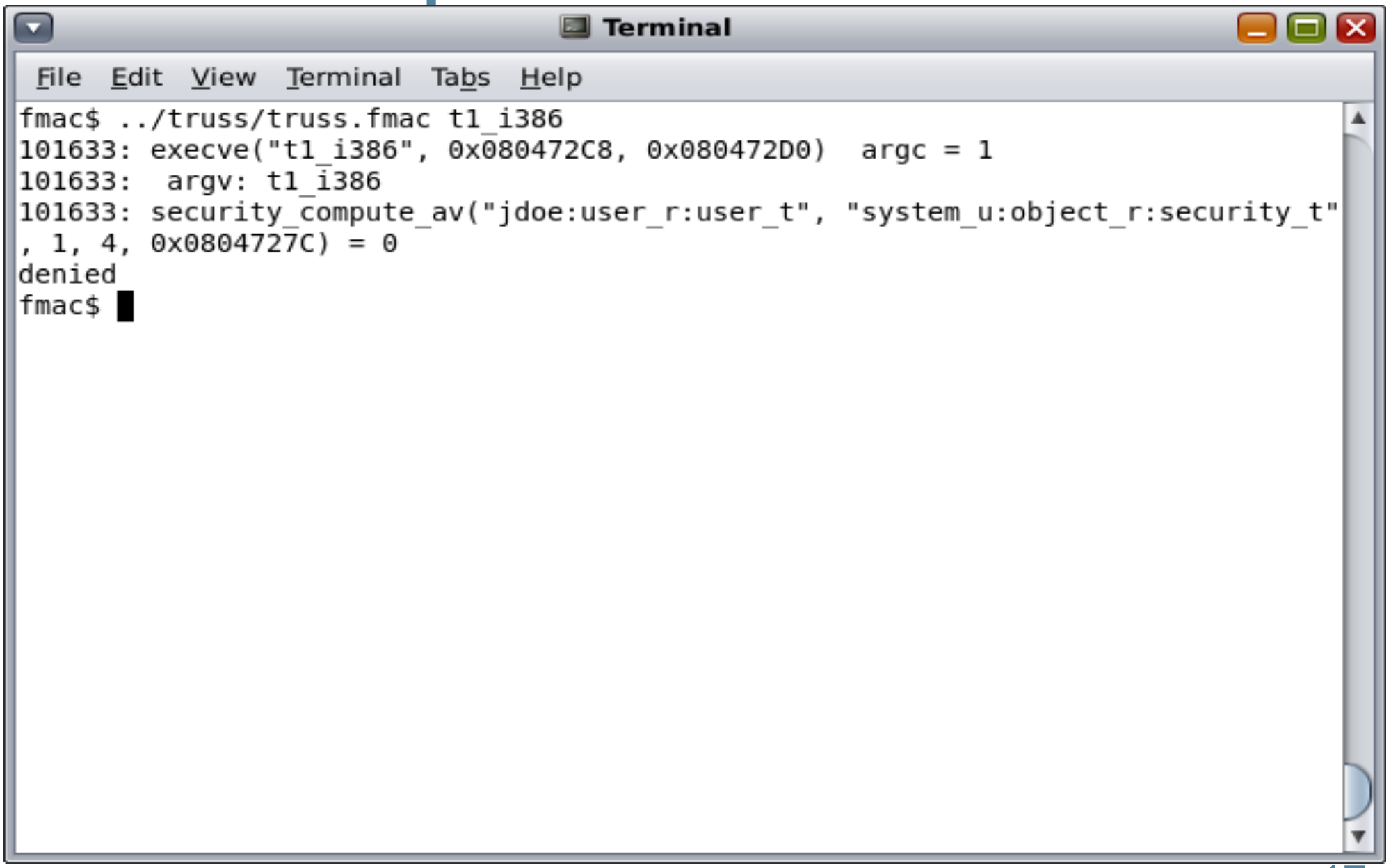
```
#include <fmac/fmac.h>
#include <sys/fmac/flask.h>
#include <sys/fmac/av_permissions.h>
#include <stdio.h>

int
main(int argc, char *argv[])
{
        struct av_decision      avd;

        if (security_compute_av("jdoe:user_r:user_t",
            "system_u:object_r:security_t", SECCLASS_SECURITY,
            SECURITY__COMPUTE_AV, &avd)) {
                perror("security_compute_av failed");
                return 1;
        }
        if (SECURITY__COMPUTE_AV & avd.allowed)
                printf("allowed\n");
        else
                printf("denied\n");

        return 0;
}
```

Source Example – Run Under Truss



Next Steps

- Rebase to ONNV 93+
- Add file context support
- Continue to expand library and utilities
- Hook AVC into Solaris audit system
- Continue with design discussions on list
  - Zones
  - Networking
  - Labeling
  - RBAC convergence
  - Improved policy and system usability

Community

- FMAC is a community project
- We would like to align and share
- Contributors welcome in any and all areas
- Lots of interesting work to do
- Join us:
  - http://opensolaris.org/os/project/fmac/
  - fmac-discuss@opensolaris.org (list membership required)

Questions?

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Thank you!

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