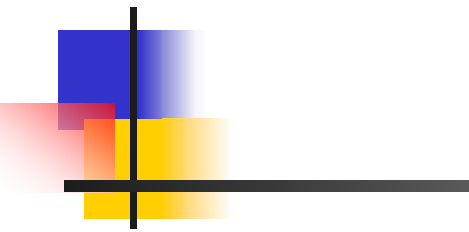
Type Enforcement Rules and Macros



Security Policy Development Primer for Security Enhanced Linux

(Module 7)

Tresys Technology

Security Enhanced Linux

Overview of Type Enforcement Rules

- Set of policy rules that specify relationships between types
  - i.e. the type enforcement policy
- Several different rules
  - somewhat evolved and changed over past year
  - challenge for those working with older systems
- TE rules in a policy can be numerous
  - for example in sample policy:
    - > 27,000 type `allow' rules
    - > 1,000 `type_transition' rules

A Primary Goal of a TE Policy

- Define access control for given programs (i.e., a domain)
- Some of the motivations/reasons governing decisions
  - program protection
    - prevent interference/modification of program's resources
  - least privilege
    - limit program to minimal access rights necessary
  - limit error propagation
    - side effects of errors contained within the domain access rights
  - all of which leads to greater security assurance
    - significantly less chance of exposure to vulnerability
- Roles associate users with domains (not the TE policy)
  - some domain types designed for users rather than programs

Other Goals for a TE Policy

- Self-protection
  - kernel protects itself and its resources
  - protect the policy itself
- Enforce other Mandatory policies
  - information flow
  - domain isolation
  - guard applications (controlled information flow)
- All focused on domain (program) access
  - not users!

TE Access Vector Rules Syntax

- rule_name src_types tgt_types : classes permissions ;
  - access vector (AV) rules
    - allow grant access
    - neverallow TE assertions
    - auditallow log when access granted
    - dontaudit (NEW) don't log access denied
    - auditdeny (replaced by dontaudit)
  - types (source and target)
    - one or more type or type attribute identifiers, or
      - `*' means all types
      - keyword `self' in target (same as source, including multiples)
    - `~' can be used for complement of specified type/attrib set
    - with more than one identifier, list enclosed in braces `{ }'
      - { type1_t type2_t typeN_t attribute }

TE Access Vector Rules Syntax

- rule_name src_types tgt_types : classes permissions ;
  - classes
    - one or more defined object classes
    - `*' and `~' may be used
    - multiple classes enclosed in braces `{ }'
  - permissions
    - one or more permissions defined for the specified class(es)
    - all permissions must be valid for all object classes specified
    - `*' and `~' may be used
    - multiple permissions enclosed in braces `{ }'
    - if multiple rules specify same source-target-class, then
      - allow, auditallow, dontaudit, auditdeny (old): union of all permissions used

Type Allow Rule

- Grants source type(s) access to target type(s)
  - no access granted by default
  - granular access specification
    - object classes & permissions

allow user_t bin_t:file {read getattr lock execute ioctl execute_no_trans };
- allow user_t domain type read and execute access to bin_t files
- with or without a transition

allow user_t self : process * ;
- allow user_t domain types all access to itself

allow userdomain shell_exec_t : file { read getattr lock execute ioctl };
- allow types with userdomain attribute read/execute to shell_exec_t files
- but only with a domain transition (i.e., no exec_no_trans access)

Neverallow Rule

- States invariants for the policy
  - no allow rule may violate any invariant
  - if so policy will not compile
- Not included in running system
  - enforced by checkpolicy when compiling policy

neverallow passwd_t ~{ bin_t sbin_t ld_so_t } : file execute_no_trans ;

- passwd_t domain may never execute without a domain transition, files of any types other than bin_t, sbin_t and ld_so_t

neverallow domain ~domain : process transition ;

- no domain type (`domain' is an attribute) may transition to a new type unless the new type is also a domain type

Type Audit Rules

- auditallow
  - log when access is TE allowed
- dontaudit (new)
  - do not audit when access is denied
    - default is to audit denies
    - used to eliminate expected access denies
- auditdeny (old)
  - replaced by dontaudit
  - no longer supported

A Look at Macros

- Sample policy uses m4 macros
  - provides easier-to-use abstractions
  - not intrinsic to SE Linux policy language
- Global macros: ./policy/macros/global_macros.te
- Object class macro examples

  file_class_set { file lnk_file sock_file fifo_file chr_file blk_file }

  notdevfile_class_set { file lnk_file sock_file fifo_file }
    - be careful! you might include objects not intended (e.g., devices)
- Permission macro examples

  rx_file_perms {read getattr lock execute ioctl }

  r_dir_perms {read getattr lock search ioctl }

Type Transition Rule

- Specified default type for new object; two forms:
  - default process transition
  - default type for new file objects
- Syntax

  type_transition src_types tgt_types : class default_type ;
  - src_type & tgt_types: may use `*' and `~', and sets of types
  - default_type: single type
  - class governs which rule form
    - process → domain transition
    - file related object → default object type

Type Transition Rule

type_transition src_type tgt_type : process default_type ;

- default transition form
- unless otherwise requested, when process with src_type executes file with tgt_type, the process will have default_type domain
  - if allowed by TE policy

type_transition src_type tgt_type : file-related default_type ;

- default object type form
- unless otherwise requested, when process with src_type creates new file related object (e.g., file, dir) in a directory of tgt_type, the new object will have default_type
  - if allowed by TE policy

Type Transition Rule Examples

type_transition userdomain passwd_exec_t:process passwd_t;

- domain transition
- causes domains with userdomain attribute to transition to passwd_t when executing passwd_exec_t programs by default

type_transition passwd_t tmp_t :
{ file lnk_file sock_file fifo_file } passwd_tmp_t;

- default file type
- when passwd_t process creates new file system objects in a tmp_t directory (e.g., /tmp), those new files will have passwd_tmp_t type
- common technique to protect a domain's temporary files

More on Macros

- All from global_macros.te, sample follows
- domain_trans
  - grants permission for a domain transition
- domain_auto_trans
  - domain_trans plus type_transition rule
- file_type_trans
  - grants permission to specify new object type
- file_type_auto_trans
  - file_type_trans plus type_transition rule
- can_exec
  - permission to execute a file type without a transition

Warning on Using Macros

- Be careful not to overuse macros
  - may provide more access than intended
- every_domain macro
  - name implies required for every domain
  - does provide a pragmatic set of access
  - but may be too permissive for some domains
    - allows network access (can_network macro)
    - read access to many, many types
    - execute shared libraries

Other TE Rules

- type_change
  - provides guidance to security-aware applications
    - via security_change_sid() system call
  - used by system daemons for relabeling
- type_member
  - currently unsupported
- clone
  - no longer supported
  - use macros instead

Walk-through Example

QUESTIONS?