

# **Common Interface Language (CIL) Reference Guide**

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## 1 CIL Information

1. The statement definitions are those found in the source from: `git clone https://bitbucket.org/jwcarter/secilc.git` dated 21st May '14.
2. Not all possible alternate statement permutations are shown, however there should be enough variation to work out any other valid formats. There is also an example `policy.cil` file shown in the [Appendix](#).
3. The MLS components on contexts and user statements must be declared even if the policy does not support MCS/MLS.
4. The CIL compiler will not build a policy unless it also has as a minimum: one `allow` rule, one `sid`, `sidorder` and `sidcontext` statement.
5. The role `object_r` must be explicitly associated to contexts used for labeling objects. The original `checkpolicy` (8) and `checkmodule` (8) compilers did this by default - CIL does not.
6. Be aware that CIL allows `class` statements to be declared in a namespace, however the policy author needs to note that applications (and the kernel) generally reference a class by its well known class identifier (e.g. `zygote`) however if declared in a namespace (e.g. `(block zygote (class zygote (...)))` or `(block zygote (class class (...)))`) it would be prefixed with that namespace (e.g. `zygote.zygote` or `zygote.class`). Unless the application / kernel code was updated the class would never be resolved, therefore it is recommended that classes are declared in the global namespace.
7. Where possible use `typeattribute`'s when defining source/target `allow` rules instead of multiple `allow` rules with individual `type`'s. This will lead to the generation of much smaller kernel policy files.
8. The <http://userspace.selinuxproject.org/trac/wiki/CilDesign> site explains the language however some of the statement definitions are dated.

### 1.1 Declarations

Declarations may be named or anonymous and have three different forms:

1. Named declarations - These create new objects that introduce a name or identifier, for example:
  - `(type process)` - creates a type with an identifier of `process`.
  - `(typeattribute domain)` - creates a `typeattribute` with an identifier of `domain`.
  - `(class file (read write))` - creates a class with an identifier of `file` that has read and write permissions associated to it.

The list of declaration type statement keywords are: `block`, `optional`, `common`, `class`, `classmap`, `classmapping`, `sid`, `user`, `role`, `roleattribute`, `type`, `classpermission`, `classpermissionset`, `typeattribute`, `typealias`, `tunable`, `sensitivity`, `sensitivityalias`, `category`, `categoryalias`, `categoryset`, `level`, `levelrange`, `context`, `ipaddr`, `macro`, `polycyap`
2. Explicit anonymous declarations - These are currently restricted to IP addresses where they can be declared directly in statements by enclosing them within parentheses e.g. `(127.0.0.1)` or `(::1)`. See the [Network Labeling Statements](#) section for examples.
3. Anonymous declarations - These have been previously declared and the object already exists, therefore they may be referenced by their name or identifier within statements. For example the following declare all the components required to specify a context:

```
(sensitivity s0)
(category c0)
(role object_r)

(block unconfined
  (user user)
  (type object)
)
```

now a `portcon` statement can be defined that uses these individual components to build a context as follows:

```
(portcon udp 12345 (unconfined.user object_r unconfined.object ((s0) (s0(c0)))))
```

## 1.2 Definitions

Statements that build on the objects, for example:

- `(typeattributeset domain (process))` - Adds the type 'process' to the typeattribute 'domain'.
- `(allow domain process (file (read write))))` - Adds an allow rule referencing domain, process and the file class.

Definitions may be repeated many times throughout the policy. Duplicates will resolve to a single definition during compilation.

## 1.3 Symbol Character Set

Symbols (any string not enclosed in double quotes) must only contain alphanumeric `[a-z A-Z]` `[0-9]` characters plus the following special characters: `\. @=/_-$%@+!|&^:`

However symbols are checked for any specific character set limitations, for example:

- Names or identifiers must start with an alpha character `[a-z A-Z]`, the remainder may be alphanumeric `[a-z A-Z]` `[0-9]` characters plus underscore `[_]` or hyphen `[-]`.
- IP addresses must conform to IPv4 or IPv6 format.
- Memory, ports, irqs must be numeric `[0-9]`.

## 1.4 String Character Set

Strings are enclosed within double quotes (e.g. `"This is a string"`), and may contain any character except the double quote (`"`).

## 1.5 Comments

Comments start with a semicolon `;` and end when a new line is started.

## 1.6 Namespaces

CIL supports namespaces via containers such as the `block` statement. When a block is resolved to form the parent / child relationship a dot `.` is used, for example the following allow rule:

```
(block example_ns
  (type process)
  (type object)
  (class file (open read write getattr))

  (allow process object (file (open read getattr)))
)
```

will resolve to the following kernel policy language statement:

```
allow example_ns.process example_ns.object : example_ns.file { open read getattr };
```

## 1.7 Global Namespace

CIL has a global namespace that is always present. Any symbol that is declared outside a container is in the global namespace. To reference a symbol in global namespace, the symbol should be prefixed with a dot '.' as shown in the following example:

```

////////////////////////////////////
; This example has three namespace 'tmpfs' types declared:
;   1) Global .tmpfs
;   2) file.tmpfs
;   3) other_ns.tmpfs
////////////////////////////////////

; This type is the global tmpfs:
(type tmpfs)

(block file
  ; file namespace tmpfs
  (type tmpfs)
  (class file (open read write getattr))

  ; This rule will reference the local namespace for src and tgt:
  (allow tmpfs tmpfs (file (open)))
  ; Resulting policy rule:
  ; allow file.tmpfs file.tmpfs : file.file open;

  ; This rule will reference the local namespace for src and global for tgt:
  (allow tmpfs .tmpfs (file (read)))
  ; Resulting policy rule:
  ; allow file.tmpfs tmpfs : file.file read;

  ; This rule will reference the global namespace for src and tgt:
  (allow .tmpfs .tmpfs (file (write)))
  ; Resulting policy rule:
  ; allow tmpfs tmpfs : file.file write;

  ; This rule will reference the other_ns namespace for src and
  ; local namespace for tgt:
  (allow other_ns.tmpfs tmpfs (file (getattr)))
  ; Resulting policy rule:
  ; allow other_ns.tmpfs file.tmpfs : file.file getattr;
)

(block other_ns
  (type tmpfs)
)

```

Should the symbol not be prefixed with a dot, the current namespace would be searched first and then the global namespace (provided there is not a symbol of that name in the current namespace).

## 1.8 Expressions

Expressions may occur in the following CIL statements: **booleanif**, **tunableif**, **classpermissionset**, **typeattributeset**, **roleattributeset**, **categoryset**, **constrain**, **mlsconstrain**, **validatetrans**, **validatetrans**

CIL expressions use the **prefix** or Polish notation and may be nested (note that the kernel policy language uses postfix or reverse Polish notation). The syntax is as follows, where the parenthesis are part of the syntax:

```

expr_set = (name ... | expr ...)
expr = (expr_key expr_set ...)
expr_key = and | or | xor | not | all | eq | neq | dom | domby | incomp | range

```



The number of `expr_set`'s in an `expr` is dependent on the statement type (there are four different classes as defined below) that also influence the valid `expr_key` entries (e.g. `dom`, `domby`, `incomp` are only allowed in constraint statements).

<b>expr_key</b>	<b>classpermissionset roleattributeset typeattributeset</b>	<b>categoryset</b>	<b>booleanif tunableif</b>	<b>constrain mlsconstrain validatetrans mlsvalidatetrans</b>
<b>dom</b>				<b>X</b>
<b>domby</b>				<b>X</b>
<b>incomp</b>				<b>X</b>
<b>eq</b>			<b>X</b>	<b>X</b>
<b>ne</b>			<b>X</b>	<b>X</b>
<b>and</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>
<b>or</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>
<b>not</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>
<b>xor</b>	<b>X</b>	<b>X</b>	<b>X</b>	
<b>all</b>	<b>X</b>	<b>X</b>		
<b>range</b>		<b>X</b>		

1. The `classpermissionset`, `roleattributeset` and `typeattributeset` statements allow `expr_set` to mix names and exprs with `expr_key` values of: `and`, `or`, `xor`, `not`, `all` as shown in the examples:

This example includes all `fs_type` type entries except `file.usermodehelper` and `file.proc_security` in the associated `typeattribute` identifier `all_fs_type_except_usermodehelper_and_proc_security`:

```
(typeattribute all_fs_type_except_usermodehelper_and_proc_security)

(typeattributeset all_fs_type_except_usermodehelper_and_proc_security
  (and
    (and
      fs_type
      (not file.usermodehelper)
    )
    (not file.proc_security)
  )
)
```

The `cps_1` `classpermissionset` identifier includes all permissions except `load_policy` and `setenforce`:

```
(class security (compute_av compute_create compute_member check_context load_policy ↔
  compute_relabel compute_user setenforce setbool setseccparam setcheckreqprot ↔
  read_policy))

(classpermission cps_1)

(classpermissionset cps_1 (security (not (load_policy setenforce))))
```

This example includes all permissions in the associated `classpermissionset` identifier `security_all_perms`:

```
(class security (compute_av compute_create compute_member check_context load_policy
  compute_relabel compute_user setenforce setbool setseccparam setcheckreqprot
```

```

    read_policy)
)

(classpermission security_all_perms)

(classpermissionset security_all_perms (security (all)))

```

2. The **categoryset** statement allows **expr\_set** to mix names and **expr\_key** values of: **and**, **or**, **not**, **xor**, **all**, **range** as shown in the examples.

Category expressions are also allowed in **sensitivitycategory**, **level**, and **levelrange** statements.

3. The **booleanif** and **tunableif** statements only allow an **expr\_set** to have one name or **expr** with **expr\_key** values of **and**, **or**, **xor**, **not**, **eq**, **neq** as shown in the examples:

```

(booleanif disableAudio
  (false
    (allow process device.audio_device (chr_file_set (rw_file_perms)))
  )
)

```

```

(booleanif (and (not disableAudio) (not disableAudioCapture))
  (true
    (allow process device.audio_capture_device (chr_file_set (rw_file_perms)))
  )
)

```

4. The **constrain**, **mlsconstrain**, **validatetrans** and **mlsvalidatetrans** statements only allow an **expr\_set** to have one name or **expr** with **expr\_key** values of **and**, **or**, **not**, **all**, **eq**, **neq**, **dom**, **domby**, **incomp**. When **expr\_key** is **dom**, **domby** or **incomp**, it must be followed by a string (e.g. **h1**, **l2**) and another string or a set of names. The following examples show CIL constraint statements and their policy language equivalents:

```

; Process transition: Require equivalence unless the subject is trusted.
(mlsconstrain (process (transition dyntransition))
  (or (and (eq h1 h2) (eq l1 l2)) (eq t1 mltrustedsubject)))

```

```

; The equivalent policy language mlsconstrain statement is:
;mlsconstrain process { transition dyntransition }
;    ((h1 eq h2 and l1 eq l2) or t1 == mltrustedsubject);

```

```

; Process read operations: No read up unless trusted.
(mlsconstrain (process (getsched getsession getpgid getcap getattr ptrace share))
  (or (dom l1 l2) (eq t1 mltrustedsubject)))

```

```

; The equivalent policy language mlsconstrain statement is:
;mlsconstrain process { getsched getsession getpgid getcap getattr ptrace share }
;    (l1 dom l2 or t1 == mltrustedsubject);

```

## 1.9 Name String

Used to define **macro** statement parameter string types:

```

(call macro1 ("__kmsg__"))

(macro macro1 ((string ARG1))
  (typetransition audit.process device.device chr_file ARG1 device.klog_device)
)

```

Alternatively:

```
(call macro1("__kmsg__"))

(macro macro1 ((name ARG1))
  (typetransition audit.process device.device chr_file ARG1 device.klog_device)
)
```

## 1.10 self

The `self` keyword may be used as the target in AVC rule statements, and means that the target is the same as the source as shown in the following example:.

```
(allow unconfined.process self (file (read write)))
```

# 2 Policy Configuration Statements

## 2.1 mls

Defines whether the policy is built as an MLS or non-MLS policy by the CIL compiler. There **MUST** only be one `mls` entry in the policy otherwise the compiler will exit with an error.

Note that this can be over-ridden by the CIL compiler command line parameter `-M true|false` or `--mls true|false` flags.

### Statement definition:

```
(mls boolean)
```

### Where:

<code>mls</code>	The <code>mls</code> keyword.
<code>boolean</code>	Set to either <code>true</code> or <code>false</code> .

### Example:

```
(mls true)
```

## 2.2 handleunknown

Defines how the kernel will handle unknown object classes and permissions when loading the policy. There **MUST** only be one `handleunknown` entry in the policy otherwise the compiler will exit with an error.

Note that this can be over-ridden by the CIL compiler command line parameter `-U` or `--handle-unknown` flags.

### Statement definition:

```
(handleunknown action)
```

### Where:

<code>handleunknown</code>	The <code>handleunknown</code> keyword.
<code>action</code>	A keyword of either <code>allow</code> , <code>deny</code> or <code>reject</code> . The kernel will handle these keywords as follows: <code>allow</code> unknown class / permissions. This will set the returned AV with all 1's. <code>deny</code> unknown class / permissions (the default). This will set the returned AV with all 0's. <code>reject</code> loading the policy if it does not contain all the object classes / permissions.

**Example:**

This will allow unknown classes / permissions to be present in the policy:

```
(handleunknown allow)
```

## 2.3 polycap

Allow policy capabilities to be enabled via policy. These should be declared in the global namespace and be valid policy capabilities as they are checked against those known in libsepol by the CIL compiler.

**Statement definition:**

```
(polycap polycap_id)
```

**Where:**

polycap	The polycap keyword.
polycap_id	The polycap identifier (e.g. open_perms).

**Example:**

These set two valid policy capabilities:

```
; Enable networking controls.
(polycap network_peer_controls)

; Enable open permission check.
(polycap open_perms)
```

## 3 Container Statements

### 3.1 block

Start a new namespace where any CIL statement is valid.

**Statement definition:**

```
(block block_id
  cil_statement
  ...
)
```

**Where:**

block	The <code>block</code> keyword.
block_id	The namespace identifier.
cil_statement	Zero or more valid CIL statements.

**Example:**

See the `blockinherit` statement for an example.

### 3.2 blockabstract

Declares the namespace as a 'template' and does not generate code until instantiated by another namespace that has a `blockinherit` statement.

#### Statement definition:

```
(block block_id
  (blockabstract template_id)
  cil_statement
  ...
)
```

#### Where:

block	The <code>block</code> keyword.
block_id	The namespace identifier.
blockabstract	The <code>blockabstract</code> keyword.
template_id	The abstract namespace identifier. This must match the <code>block_id</code> entry.
cil_statement	Zero or more valid CIL statements forming the abstract block.

#### Example:

See the `blockinherit` statement for an example.

### 3.3 blockinherit

Used to add common policy rules to the current namespace via a template that has been defined with the `blockabstract` statement.

#### Statement definition:

```
(block block_id
  (blockinherit template_id)
  cil_statement
  ...
)
```

#### Where:

block	The <code>block</code> keyword.
block_id	The namespace identifier.
blockinherit	The <code>blockinherit</code> keyword.
template_id	The inherited namespace identifier.
cil_statement	Zero or more valid CIL statements.

#### Example:

This example contains a template `client_server` that is instantiated in two blocks (`netserver_app` and `netclient_app`):

```
; This is the template block:
(block client_server
  (blockabstract client_server)

  ; Log file labeling
  (type log_file)
  (typeattributeset file_type (log_file))
  (typeattributeset data_file_type (log_file))
```

```

    (allow process log_file (dir (write search create setattr add_name)))
    (allow process log_file (file (create open append getattr setattr)))
    (roletype object_r log_file)
    (context log_file_context (u object_r log_file low_low))

; Process labeling
(type process)
(typeattributeset domain (process))
(call app_domain (process))
(call net_domain (process))
)

; This is a policy block that will inherit the abstract block above:
(block netclient_app
; Add common policy rules to namespace:
(blockinherit client_server)
; Label the log files
(filecon "/data/data/com.se4android.netclient/.*" file log_file_context)
)

; This is another policy block that will inherit the abstract block above:
(block netserver_app
; Add common policy rules to namespace:
(blockinherit client_server)

; Label the log files
(filecon "/data/data/com.se4android.netserver/.*" file log_file_context)
)

```

### 3.4 optional

Declare an **optional** namespace. All CIL statements in the optional block must be satisfied before instantiation in the binary policy. **tunableif** and **macro** statements are not allowed in optional containers. The same restrictions apply to CIL policy statements within **optional**'s that apply to kernel policy statements, i.e. only the policy statements shown in the following table are valid:

<b>allow</b>	<b>auditallow</b>	<b>booleanif</b>	<b>dontaudit</b>
<b>typepermissive</b>	<b>rangetransition</b>	<b>role</b>	<b>roleallow</b>
<b>roleattribute</b>	<b>roletransition</b>	<b>type</b>	<b>typealias</b>
<b>typeattribute</b>	<b>typechange</b>	<b>typemember</b>	<b>typetransition</b>

#### Statement definition:

```

(optional optional_id
  cil_statement
  ...
)

```

#### Where:

<b>optional</b>	The <b>optional</b> keyword.
<b>optional_id</b>	The <b>optional</b> namespace identifier.
<b>cil_statement</b>	Zero or more valid CIL statements.

#### Example:

This example will instantiate the optional block `ext_gateway.move_file` into policy providing all optional CIL statements can be resolved:

```
(block ext_gateway
  .....
  (optional move_file
    (typetransition process msg_filter.move_file.in_queue file msg_filter.move_file. ←
      in_file)
    (allow process msg_filter.move_file.in_queue (dir (read getattr write search ←
      add_name)))
    (allow process msg_filter.move_file.in_file (file (write create getattr)))
    (allow msg_filter.move_file.in_file unconfined.object (filesystem (associate)))
    (typetransition msg_filter.int_gateway.process msg_filter.move_file.out_queue file
      msg_filter.move_file.out_file)
    (allow msg_filter.int_gateway.process msg_filter.move_file.out_queue (dir (read ←
      write search)))
    (allow msg_filter.int_gateway.process msg_filter.move_file.out_file (file (read ←
      getattr unlink)))
  ) ; End optional block
  .....
) ; End block
```

### 3.5 in

Allows the insertion of CIL statements into a named container (**block**, **optional** or **macro**). This statement is not allowed in **booleanif** or **tunableif** statements.

#### Statement definition:

```
(in container_id
  cil_statement
  ...
)
```

#### Where:

in	The in keyword.
container_id	A valid <b>block</b> , <b>optional</b> or <b>macro</b> namespace identifier.
cil_statement	Zero or more valid CIL statements.

#### Example:

This will add rules to the container named `system_server`:

```
(in system_server
  (dontaudit process secmark_demo.dns_packet (packet (send recv)))
  (allow process secmark_demo.dns_packet (packet (send recv)))
)
```

## 4 Call / Macro Statements

### 4.1 call

Instantiate a **macro** within the current namespace. There may be zero or more parameters passed to the macro (with zero parameters this is similar to the **blockinherit** (**call**) / **blockabstract** (**macro**) statements).

Each parameter passed contains an argument to be resolved by the **macro**, these can be named or anonymous but must conform to the parameter types defined in the **macro** statement.

**Statement definition:**

```
(call macro_id [(param ...)])
```

**Where:**

<code>call</code>	The <code>call</code> keyword.
<code>macro_id</code>	The identifier of the <code>macro</code> to be instantiated.
<code>param</code>	Zero or more parameters that are passed to the macro.

**Example:**

See the `macro` statement for an example.

**4.2 macro**

Declare a macro in the current namespace with its associated parameters. The macro identifier is used by the `call` statement to instantiate the macro and resolve any parameters. The call statement may be within the body of a macro.

Note that when resolving macros the callers namespace is not checked, only the following places:

- Items defined inside the macro
- Items passed into the macro as arguments
- Items defined in the same namespace of the macro
- Items defined in the global namespace

**Statement definition:**

```
(macro macro_id [(param_type param_id) ...])
  cil_statements
  ...
)
```

**Where:**

<code>macro</code>	The <code>macro</code> keyword.
<code>macro_id</code>	The <code>macro</code> identifier.
<code>param_type</code>	Zero or more parameters that are passed to the macro. The <code>param_type</code> is a keyword used to determine the declaration type (e.g. <code>type</code> , <code>class</code> , <code>categoryset</code> ). The list of valid <code>param_type</code> entries are: <code>type</code> , <code>typealias</code> , <code>role</code> , <code>user</code> , <code>sensitivity</code> , <code>sensitivityalias</code> , <code>category</code> , <code>categoryalias</code> , <code>categoryset</code> (named or anonymous), <code>level</code> (named or anonymous), <code>levelrange</code> (named or anonymous), <code>class</code> , <code>classpermission</code> (named or anonymous), <code>ipaddr</code> (named or anonymous), <code>block</code> , <code>name</code> (a string), <code>classmap</code>
<code>param_id</code>	The parameter identifier used to reference the entry within the macro body (e.g. ARG1).
<code>cil_statement</code>	Zero or more valid CIL statements.

**Examples:**

This example will instantiate the `binder_call` macro in the calling namespace (`my_domain`) and replace ARG1 with `appdomain` and ARG2 with `binderservicedomain`:

```
(block my_domain
  (call binder_call (appdomain binderservicedomain))
)
```



```
(macro binder_call ((type ARG1) (type ARG2))
  (allow ARG1 ARG2 (binder (call transfer)))
  (allow ARG2 ARG1 (binder (transfer)))
  (allow ARG1 ARG2 (fd (use)))
)
```

This example does not pass any parameters to the macro but adds a `type` identifier to the current namespace:

```
(block unconfined
  (call add_type)
  ....

  (macro add_type ()
    (type exec)
  )
)
```

This example passes an anonymous and named IP address to the macro:

```
(ipaddr netmask_1 255.255.255.0)
(context netlabel_1 (system.user object_r unconfined.object low_low)

(call build_nodecon ((192.168.1.64) netmask_1))

(macro build_nodecon ((ipaddr ARG1) (ipaddr ARG2))
  (nodecon ARG1 ARG2 netlabel_1)
)
```

## 5 Default Object Statements

These rules allow a default user, role, type and/or range to be used when computing a context for a new object. These require policy version 27 or 28 with kernels 3.5 or greater.

### 5.1 defaultuser

Allows the default user to be taken from the source or target context when computing a new context for the object `class` identifier. Requires policy version 27.

**Statement definition:**

```
(defaultuser class_id default)
```

**Where:**

<code>defaultuser</code>	The <code>defaultuser</code> keyword.
<code>class_id</code>	A single previously declared <code>class</code> or <code>classmap</code> identifier, or a list of previously declared <code>class</code> or <code>classmap</code> identifiers enclosed within parentheses.
<code>default</code>	A keyword of either source or target.

**Example:**

When creating new `binder`, `property_service`, `zygote` or `memprotect` objects the `user` component of the new security context will be taken from the source context:

```
(class binder (impersonate call set_context_mgr transfer receive))
(class property_service (set))
(class zygote (specifyids specifyrlimits specifycapabilities specifyinvokewith ←
  specifyseinfo))
```

```
(class memprotect (mmap_zero))

(classmap android_classes (android))
(classmapping android_classes android (binder (all)))
(classmapping android_classes android (property_service (set)))
(classmapping android_classes android (zygote (not (specifycapabilities))))

(defaultuser (android_classes memprotect) source)

; Will produce the following in the binary policy file:
;; default_user binder source;
;; default_user zygote source;
;; default_user property_service source;
;; default_user memprotect source;
```

## 5.2 defaultrole

Allows the default role to be taken from the source or target context when computing a new context for the object **class** identifier. Requires policy version 27.

```
(defaultrole class_id default)
```

### Where:

defaultrole	The defaultrole keyword.
class_id	A single previously declared <b>class</b> or <b>classmap</b> identifier, or a list of previously declared <b>class</b> or <b>classmap</b> identifiers enclosed within parentheses.
default	A keyword of either source or target.

### Example:

When creating new binder, property\_service or zygote objects the **role** component of the new security context will be taken from the target context:

```
(class binder (impersonate call set_context_mgr transfer receive))
(class property_service (set))
(class zygote (specifyids specifyrlimits specifycapabilities specifyinvokewith ←
    specifyseinfo))

(defaultrole (binder property_service zygote) target)

; Will produce the following in the binary policy file:
;; default_role binder target;
;; default_role zygote target;
;; default_role property_service target;
```

## 5.3 defaulttype

Allows the default type to be taken from the source or target context when computing a new context for the object **class** identifier. Requires policy version 28.

### Statement definition:

```
(defaulttype class_id default)
```

### Where:

---



---

defaulttype	The defaulttype keyword.
class_id	A single previously declared <code>class</code> or <code>classmap</code> identifier, or a list of previously declared <code>class</code> or <code>classmap</code> identifiers enclosed within parentheses.
default	A keyword of either <code>source</code> or <code>target</code> .

**Example:**

When creating a new `socket` object, the `type` component of the new security context will be taken from the `source` context:

```
(defaulttype socket source)
```

## 5.4 defaultrange

Allows the default level or range to be taken from the source or target context when computing a new context for the object `class` identifier. Requires policy version 27.

**Statement definition:**

```
(defaultrange class_id default range)
```

**Where:**

defaultrange	The defaultrange keyword.
class_id	A single previously declared <code>class</code> or <code>classmap</code> identifier, or a list of previously declared <code>class</code> or <code>classmap</code> identifiers enclosed within parentheses.
default	A keyword of either <code>source</code> or <code>target</code> .
range	A keyword of either <code>low</code> , <code>high</code> or <code>low-high</code> .

**Example:**

When creating a new `file` object, the appropriate `range` component of the new security context will be taken from the `target` context:

```
(defaultrange file target low_high)
```

## 6 User Statements

### 6.1 user

Declares an SELinux user identifier in the current namespace.

**Statement definition:**

```
(user user_id)
```

**Where:**

user	The user keyword.
user_id	The SELinux user identifier.

**Example:**

This will declare an SELinux user as `unconfined.user`:

```
(block unconfined
  (user user)
)
```

## 6.2 userrole

Associates a previously declared `user` identifier with a previously declared `role` identifier.

### Statement definition:

```
(userrole user_id role_id)
```

### Where:

<code>userrole</code>	The <code>userrole</code> keyword.
<code>user_id</code>	A previously declared SELinux <code>user</code> identifier.
<code>role_id</code>	A previously declared <code>role</code> or <code>roleattribute</code> identifier.

### Example:

This example will associate `unconfined.user` to `unconfined.role`:

```
(block unconfined
  (user user)
  (role role)
  (userrole user role)
)
```

## 6.3 userlevel

Associates a previously declared `user` identifier with a previously declared `level` identifier. The `level` may be named or anonymous.

### Statement definition:

```
(userlevel user_id level_id)
```

### Where:

<code>userlevel</code>	The <code>userlevel</code> keyword.
<code>user_id</code>	A previously declared SELinux <code>user</code> identifier.
<code>level_id</code>	A previously declared <code>level</code> identifier. This may consist of a single <code>sensitivity</code> with zero or more mixed named and anonymous <code>category</code> 's as discussed in the <code>level</code> statement.

### Example:

This example will associate `unconfined.user` with a named `level` of `systemlow`:

```
(sensitivity s0)
(level systemlow (s0))

(block unconfined
  (user user)
  (userlevel user systemlow)
  ; An anonymous example:
  ; (userlevel user (s0))
)
```

```
)
```

## 6.4 userrange

Associates a previously declared **user** identifier with a previously declared **levelrange** identifier. The **levelrange** may be named or anonymous.

### Statement definition:

```
(userrange user_id levelrange_id)
```

### Where:

<code>userrange</code>	The <code>userrange</code> keyword.
<code>user_id</code>	A previously declared SELinux <b>user</b> identifier.
<code>levelrange_id</code>	A previously declared <b>levelrange</b> identifier. This may be formed by named or anonymous components as discussed in the <b>levelrange</b> statement and shown in the examples.

### Example:

This example will associate `unconfined.user` with a named **levelrange** of `low_high`, other anonymous examples are also shown:

```
(category c0)
(category c1)
(categoryorder (c0 c1))
(sensitivity s0)
(sensitivity s1)
(dominance (s0 s1))
(sensitivitycategory s0 (c0 c1))
(level systemLow (s0))
(level systemHigh (s0 (c0 c1)))
(levelrange low_high (systemLow systemHigh))

(block unconfined
  (user user)
  (role role)
  (userrole user role)
  ; Named example:
  (userrange user low_high)
  ; Anonymous examples:
  ; (userrange user (systemLow systemHigh))
  ; (userrange user (systemLow (s0 (c0 c1))))
  ; (userrange user ((s0) (s0 (c0 c1))))
)
```

## 6.5 userbounds

Defines a hierarchical relationship between users where the child user cannot have more privileges than the parent.

Notes:

- It is not possible to bind the parent to more than one child.
- While this is added to the binary policy, it is not enforced by the SELinux kernel services.

### Statement definition:



<code>selinuxuser</code>	The <code>selinuxuser</code> keyword.
<code>user_name</code>	A string representing the GNU/Linux user name
<code>user_id</code>	A previously declared SELinux <code>user</code> identifier.
<code>userrange_id</code>	A previously declared <code>userrange</code> identifier that has been associated to the <code>user</code> identifier. This may be formed by named or anonymous components as discussed in the <code>userrange</code> statement and shown in the examples.

**Example:**

This example will associate `unconfined.admin` user with a GNU / Linux user "admin\_1":

```
(block unconfined
  (user admin)
  (selinuxuser admin_1 admin low_low)
)
```

**6.8 selinuxuserdefault**

Declares the default SELinux user. Only one `selinuxuserdefault` statement is allowed in the policy. Note that the `userrange` identifier is required even if the policy is non-MCS/MLS.

**Statement definition:**

```
(selinuxuserdefault user_id userrange_id)
```

**Where:**

<code>selinuxuserdefault</code>	The <code>selinuxuserdefault</code> keyword.
<code>user_id</code>	A previously declared SELinux <code>user</code> identifier.
<code>userrange_id</code>	A previously declared <code>userrange</code> identifier that has been associated to the <code>user</code> identifier. This may be formed by named or anonymous components as discussed in the <code>userrange</code> statement and shown in the examples.

**Example:**

This example will define the `unconfined.user` as the default SELinux user:

```
(block unconfined
  (user user)
  (selinuxuserdefault user low_low)
)
```

**7 Role Statements****7.1 role**

Declares a role identifier in the current namespace.

**Statement definition:**

```
(role role_id)
```

**Where:**

<code>role</code>	The <code>role</code> keyword.
<code>role_id</code>	The <code>role</code> identifier.

**Example:**

This example declares two roles: `object_r` in the global namespace and `unconfined.role`:

```
(role object_r)

(block unconfined
  (role role)
)
```

## 7.2 roletype

Authorises a `role` to access a `type` identifier.

**Statement definition:**

```
(role role_id type_id)
```

**Where:**

<code>roletype</code>	The <code>roletype</code> keyword.
<code>role_id</code>	A single previously declared <code>role</code> or <code>roleattribute</code> identifier.
<code>type_id</code>	A single previously declared <code>type</code> , <code>typealias</code> or <code>typeattribute</code> identifier.

**Example:**

This example will declare `role` and `type` identifiers, then associate them:

```
(block unconfined
  (role role)
  (type process)
  (roletype role process)
)
```

## 7.3 roleattribute

Declares a role attribute identifier in the current namespace. The identifier may have zero or more `role` and `roleattribute` identifiers associated to it via the `typeattributeset` statement.

**Statement definition:**

```
(roleattribute roleattribute_id)
```

**Where:**

<code>roleattribute</code>	The <code>roleattribute</code> keyword.
<code>roleattribute_id</code>	The <code>roleattribute</code> identifier.

**Example:**

This example will declare a role attribute `roles.role_holder` that will have an empty set:

```
(block roles
  (roleattribute role_holder)
)
```



## 7.4 roleattributeset

Allows the association of one or more previously declared `role` identifiers to a `roleattribute` identifier. Expressions may be used to refine the associations as shown in the examples.

### Statement definition:

```
(roleattributeset roleattribute_id (role_id ... | expr ...))
```

### Where:

<code>roleattributeset</code>	The <code>roleattributeset</code> keyword.
<code>roleattribute_id</code>	A single previously declared <code>roleattribute</code> identifier.
<code>role_id</code>	Zero or more previously declared <code>role</code> or <code>roleattribute</code> identifiers. Note that there must be at least one <code>role_id</code> or <code>expr</code> parameter declared.
<code>expr</code>	Zero or more <code>expr</code> 's, the valid operators and syntax are: (and (role_id ...) (role_id ...)) (or (role_id ...) (role_id ...)) (xor (role_id ...) (role_id ...)) (not (role_id ...)) (all)

### Example:

This example will declare three roles and two role attributes, then associate all the roles to them as shown:

```
(block roles
  (role role_1)
  (role role_2)
  (role role_3)

  (roleattribute role_holder)
  (roleattributeset role_holder (role_1 role_2 role_3))

  (roleattribute role_holder_all)
  (roleattributeset role_holder_all (all))
)
```

## 7.5 roleallow

Authorise the current role to assume a new role.

Notes:

- May require a `roletransition` rule to ensure transition to the new role.
- This rule is not allowed in `booleanif` statements.

### Statement definition:

```
(roleallow current_role_id new_role_id)
```

### Where:

<code>roleallow</code>	The <code>roleallow</code> keyword.
<code>current_role_id</code>	A single previously declared <code>role</code> or <code>roleattribute</code> identifier.
<code>new_role_id</code>	A single previously declared <code>role</code> or <code>roleattribute</code> identifier.

**Example:**

See the `roletransition` statement for an example.

**7.6 roletransition**

Specify a role transition from the current role to a new role when computing a context for the target type. The `class` identifier would normally be `process`, however for kernel versions 2.6.39 with policy version  $\geq 25$  and above, any valid class may be used. Note that a `roleallow` rule must be used to authorise the transition.

**Statement definition:**

```
(roletransition current_role_id target_type_id class_id new_role_id)
```

**Where:**

<code>roletransition</code>	The <code>roletransition</code> keyword.
<code>current_role_id</code>	A single previously declared <code>role</code> or <code>roleattribute</code> identifier.
<code>target_type_id</code>	A single previously declared <code>type</code> , <code>typealias</code> or <code>typeattribute</code> identifier.
<code>class_id</code>	A single previously declared <code>class</code> or <code>classmap</code> identifier.
<code>new_role_id</code>	A single previously declared <code>role</code> identifier to be set on transition.

**Example:**

This example will authorise the `unconfined.role` to assume the `msg_filter.role` role, and then transition to that role:

```
(block ext_gateway
  (type process)
  (type exec)

  (roletype msg_filter.role process)
  (roleallow unconfined.role msg_filter.role)
  (roletransition unconfined.role exec process msg_filter.role)
)
```

**7.7 rolebounds**

Defines a hierarchical relationship between roles where the child role cannot have more privileges than the parent.

Notes:

- It is not possible to bind the parent role to more than one child role.
- While this is added to the binary policy, it is not enforced by the SELinux kernel services.

**Statement definition:**

```
(rolebounds parent_role_id child_role_id)
```

**Where:**

<code>rolebounds</code>	The <code>rolebounds</code> keyword.
<code>parent_role_id</code>	A single previously declared <code>role</code> identifier.
<code>child_role_id</code>	A single previously declared <code>role</code> identifier.

**Example:**

In this example the role `test` cannot have greater privileges than `unconfined.role`:

```
(role test)

(unconfined
  (role role)
  (rolebounds role .test)
)
```

## 8 Type Statements

### 8.1 type

Declares a type identifier in the current namespace.

**Statement definition:**

```
(type type_id)
```

**Where:**

type	The type keyword.
type_id	The type identifier.

**Example:**

This example declares a type identifier `bluetooth.process`:

```
(block bluetooth
  (type process)
)
```

### 8.2 typealias

Declares a type alias in the current namespace.

**Statement definition:**

```
(typealias typealias_id)
```

**Where:**

typealias	The typealias keyword.
typealias_id	The typealias identifier.

**Example:**

See the `typealiasactual` statement for an example that associates the `typealias` identifier.

### 8.3 typealiasactual

Associates a previously declared `typealias` identifier to a previously declared `type` identifier.

**Statement definition:**

```
(typealiasactual typealias_id type_id)
```

**Where:**

<code>typealiasactual</code>	The <code>typealiasactual</code> keyword.
<code>typealias_id</code>	A single previously declared <code>typealias</code> identifier.
<code>type_id</code>	A single previously declared <code>type</code> identifier.

**Example:**

This example will alias `unconfined.process` as `unconfined_t` in the global namespace:

```
(typealias unconfined_t)
(typealiasactual unconfined_t unconfined.process)

(block unconfined
  (type process)
)
```

**8.4 typeattribute**

Declares a type attribute identifier in the current namespace. The identifier may have zero or more `type`, `typealias` and `typeattribute` identifiers associated to it via the `typeattributeset` statement.

**Statement definition:**

```
(typeattribute typeattribute_id)
```

**Where:**

<code>typeattribute</code>	The <code>typeattribute</code> keyword.
<code>typeattribute_id</code>	The <code>typeattribute</code> identifier.

**Example:**

This example declares a type attribute domain in global namespace that will have an empty set:

```
(typeattribute domain)
```

**8.5 typeattributeset**

Allows the association of one or more previously declared `type`, `typealias` or `typeattribute` identifiers to a `typeattribute` identifier. Expressions may be used to refine the associations as shown in the examples.

**Statement definition:**

```
(typeattributeset typeattribute_id (type_id ... | expr ...))
```

**Where:**

<code>typeattributeset</code>	The <code>typeattributeset</code> keyword.
<code>typeattribute_id</code>	A single previously declared <code>typeattribute</code> identifier.
<code>type_id</code>	Zero or more previously declared <code>type</code> , <code>typealias</code> or <code>typeattribute</code> identifiers. Note that there must be at least one <code>type_id</code> or <code>expr</code> parameter declared.
<code>expr</code>	Zero or more <code>expr</code> 's, the valid operators and syntax are: <code>(and (type_id ...) (type_id ...))</code> <code>(or (type_id ...) (type_id ...))</code> <code>(xor (type_id ...) (type_id ...))</code> <code>(not (type_id ...))</code> <code>(all)</code>

**Examples:**

This example will take all the policy types and exclude those in appdomain. It is equivalent to `~appdomain` in the kernel policy language.

```
(typeattribute not_in_appdomain)

(typeattributeset not_in_appdomain (not (appdomain)))
```

This example is equivalent to `{ domain -kernel.process -ueventd.process -init.process }` in the kernel policy language:

```
(typeattribute na_kernel_or_ueventd_or_init_in_domain)

(typeattributeset na_kernel_or_ueventd_or_init_in_domain
  (and
    (and
      (and
        (domain)
        (not (kernel.process))
      )
      (not (ueventd.process))
    )
    (not (init.process))
  )
)
```

## 8.6 typebounds

This defines a hierarchical relationship between domains where the bounded domain cannot have more permissions than its bounding domain (the parent).

Requires kernel 2.6.28 and above to control the security context associated to threads in multi-threaded applications. Note that an **allow** rule must be used to authorise the bounding.

**Statement definition:**

```
(typebounds parent_type_id child_type_id)
```

**Where:**

typebounds	The typebounds keyword.
parent_type_id	A single previously declared <b>type</b> or <b>typealias</b> identifier that is the parent domain.
child_type_id	A single previously declared <b>type</b> or <b>typealias</b> identifier that is the bound (child) domain.

**Example:**

In this example the `httpd.child.process` cannot have file (write) due to lack of permissions on `httpd.process` which is the parent. It means the child domain will always have equal or less privileges than the parent:

```
(class file (getattr read write))

(block httpd
  (type process)
  (type object)

  (typebounds process child.process)
  ; The parent is allowed file 'getattr' and 'read':
  (allow process object (file (getattr read)))
```

```

    (block child
      (type process)
      (type object)

      ; However the child process has been given 'write' access that will be denied.
      (allow process httpd.object (file (read write)))
    )
  )
)

```

## 8.7 typechange

The type change rule is used to define a different label of an object for userspace SELinux-aware applications. These applications would use **security\_compute\_relabel** (3) and **typechange** rules in the policy to determine the new context to be applied. Note that an **allow** rule must be used to authorise the change.

### Statement definition:

```
(typechange source_type_id target_type_id class_id change_type_id)
```

### Where:

typechange	The typechange keyword.
source_type_id	A single previously declared <b>type</b> , <b>typealias</b> or <b>typeattribute</b> identifier.
target_type_id	A single previously declared <b>type</b> , <b>typealias</b> or <b>typeattribute</b> identifier.
class_id	A single previously declared <b>class</b> or <b>classmap</b> identifier.
change_type_id	A single previously declared <b>type</b> or <b>typealias</b> identifier that will become the new type.

### Example:

Whenever **security\_compute\_relabel** (3) is called with the following parameters:

```
scon=unconfined.object tcon=unconfined.object class=file
```

the function will return a context of:

```
unconfined.object:object_r:unconfined.change_label:s0
```

```

(class file (getattr read write))

(block unconfined
  (type process)
  (type object)
  (type change_label)

  (typechange object object file change_label)
)

```

## 8.8 typemember

The type member rule is used to define a new polyinstantiated label of an object for SELinux-aware applications. These applications would use **avc\_compute\_member** (3) or **security\_compute\_member** (3) with the **typemember** rules in the policy to determine the context to be applied. The application would then manage any required polyinstantiation. Note that an **allow** rule must be used to authorise the membership.

### Statement definition:

```
(typemember source_type_id target_type_id class_id member_type_id)
```

**Where:**



typemember	The typemember keyword.
source_type_id	A single previously declared <code>type</code> , <code>typealias</code> or <code>typeattribute</code> identifier.
target_type_id	A single previously declared <code>type</code> , <code>typealias</code> or <code>typeattribute</code> identifier.
class_id	A single previously declared <code>class</code> or <code>classmap</code> identifier.
member_type_id	A single previously declared <code>type</code> or <code>typealias</code> identifier that will become the new member type.

**Example:**

Whenever `avc_compute_member` (3) or `security_compute_member` (3) is called with the following parameters:

```
scon=unconfined.object tcon=unconfined.object class=file
```

the function will return a context of:

```
unconfined.object:object_r:unconfined.member_label:s0
```

```
(class file (getattr read write))
```

```
(block unconfined
  (type process)
  (type object)
  (type change_label)

  (typemember object object file member_label)
)
```

## 8.9 typetransition

The type transition rule specifies the labeling and object creation allowed between the `source_type` and `target_type` when a domain transition is requested. Kernels from 2.6.39 with policy versions from 25 and above also support a 'name transition' rule, however this is not allowed inside conditionals and currently only supports the file classes. Note that an `allow` rule must be used to authorise the transition.

**Statement definition:**

```
(typetransition source_type_id target_type_id class_id [object_name] default_type_id)
```

**Where:**

typetransition	The typetransition keyword.
source_type_id	A single previously declared <code>type</code> , <code>typealias</code> or <code>typeattribute</code> identifier.
target_type_id	A single previously declared <code>type</code> , <code>typealias</code> or <code>typeattribute</code> identifier.
class_id	A single previously declared <code>class</code> or <code>classmap</code> identifier.
object_name	A optional string within double quotes representing an object name for the 'name transition' rule. This string will be matched against the objects name (if a path then the last component of that path). If the string matches exactly, the <code>default_type_id</code> will then become the new type.
default_type_id	A single previously declared <code>type</code> or <code>typealias</code> identifier that will become the new type.

**Examples:**

This example shows a process transition rule with its supporting `allow` rule:

```
(macro domain_auto_trans ((type ARG1) (type ARG2) (type ARG3))
  ; Allow the necessary permissions.
  (call domain_trans (ARG1 ARG2 ARG3))
```

```
    ; Make the transition occur by default.
    (typetransition ARG1 ARG2 process ARG3)
)
```

This example shows a file object transition rule with its supporting **allow** rule:

```
(macro tmpfs_domain ((type ARG1))
  (type tmpfs)
  (typeattributeset file_type (tmpfs))
  (typetransition ARG1 file.tmpfs file tmpfs)
  (allow ARG1 tmpfs (file (read write execute execmod))))
)
```

This example shows the 'name transition' rule with its supporting **allow** rule:

```
(macro write_klog ((type ARG1))
  (typetransition ARG1 device.device chr_file "__kmsg__" device.klog_device)
  (allow ARG1 device.klog_device (chr_file (create open write unlink)))
  (allow ARG1 device.device (dir (write add_name remove_name)))
)
```

8.10 typepermissive

Policy database version 23 introduced the permissive statement to allow the named domain to run in permissive mode instead of running all SELinux domains in permissive mode (that was the only option prior to version 23). Note that the permissive statement only tests the source context for any policy denial.

Statement definition:

```
(typepermissive source_type_id)
```

Where:

typepermissive	The typepermissive keyword.
source_type_id	A single previously declared <b>type</b> or <b>typealias</b> identifier.

Example:

This example will allow SELinux to run the `healthd.process` domain in permissive mode even when enforcing is enabled:

```
(block healthd
  (type process)
  (typepermissive process)

  (allow ...)
)
```

9 Class and Permission Statements

9.1 common

Declares a common identifier in the current namespace with a set of common permissions that can be used by one or more **class** identifiers. The **classcommon** statement is used to associate a **common** identifier to a specific **class** identifier.

Statement definition:

```
(common common_id (permission_id ...))
```

**Where:**

<code>common</code>	The <code>common</code> keyword.
<code>common_id</code>	The <code>common</code> identifier.
<code>permission_id</code>	One or more permissions.

**Example:**

This common statement will associate the `common` identifier 'file' with the list of permissions:

```
(common file (ioctl read write create getattr setattr lock relabelfrom relabelto append ↵
  unlink link rename execute swapon quotaon mounton))
```

## 9.2 classcommon

Associate a `class` identifier to a one or more permissions declared by a `common` identifier.

**Statement definition:**

```
(classcommon class_id common_id)
```

**Where:**

<code>classcommon</code>	The <code>classcommon</code> keyword.
<code>class_id</code>	A single previously declared <code>class</code> identifier.
<code>common_id</code>	A single previously declared <code>common</code> identifier that defines the common permissions for that class.

**Example:**

This associates the `dir` class with the list of permissions declared by the `file` `common` identifier:

```
(common file (ioctl read write create getattr setattr lock relabelfrom relabelto append ↵
  unlink link rename execute swapon quotaon mounton))

(classcommon dir file)
```

## 9.3 class

Declares a class and zero or more permissions in the current namespace.

**Statement definition:**

```
(class class_id (permission_id ...))
```

**Where:**

<code>class</code>	The <code>class</code> keyword.
<code>class_id</code>	The <code>class</code> identifier.
<code>permission_id</code>	Zero or more permissions declared for the class. Note that if zero permissions, an empty list is required as shown in the example.

**Examples:**

This example defines a set of permissions for the `binder` class identifier:

```
(class binder (impersonate call set_context_mgr transfer receive))
```

This example defines a common set of permissions to be used by the `sem` class, the `(class sem ())` does not define any other permissions (i.e. an empty list):

```
(common ipc (create destroy getattr setattr read write associate unix_read unix_write))

(classcommon sem ipc)
(class sem ())
```

and will produce the following set of permissions for the `sem` class identifier of:

```
(class sem (create destroy getattr setattr read write associate unix_read unix_write))
```

This example, with the following combination of the `common`, `classcommon` and `class` statements:

```
(common file (ioctl read write create getattr setattr lock relabelfrom relabelto append ↔
  unlink link rename execute swapon quotaon mounton))

(classcommon dir file)
(class dir (add_name remove_name reparent search rmdir open audit_access execmod))
```

will produce a set of permissions for the `dir` class identifier of:

```
(class dir (add_name remove_name reparent search rmdir open audit_access execmod ioctl read ↔
  write create getattr setattr lock relabelfrom relabelto append unlink link rename ↔
  execute swapon quotaon mounton))
```

## 9.4 classorder

Defines the order of `class`'s. This is a mandatory statement. Multiple `classorder` statements declared in the policy will form an ordered list.

**Statement definition:**

```
(classorder (class_id ...))
```

**Where:**

<code>classorder</code>	The <code>classorder</code> keyword.
<code>class_id</code>	One or more <code>class</code> identifiers.

**Example:**

This will produce an ordered list of "file dir process"

```
(class process)
(class file)
(class dir)
(classorder (file dir))
(classorder (dir process))
```

## 9.5 classpermission

Declares a class permission set identifier in the current namespace that can be used by one or more `classpermissionsets` to associate one or more classes and permissions to form a named set.

**Statement definition:**

```
(classpermission classpermissionset_id)
```

**Where:**

<code>classpermission</code>	The <code>classpermission</code> keyword.
<code>classpermissionset_id</code>	The <code>classpermissionset</code> identifier.

**Example:**

See the `classpermissionset` statement for examples.

**9.6 classpermissionset**

Defines a class permission set identifier in the current namespace that associates a class and one or more permissions to form a named set. Nested expressions may be used to determine the required permissions as shown in the examples. Anonymous `classpermissionset`s may be used in av rules and constraints.

**Statement definition:**

```
(classpermissionset classpermissionset_id (class_id (permission_id | expr ...)))
```

**Where:**

<code>classpermissionset</code>	The <code>classpermissionset</code> keyword.
<code>classpermissionset_id</code>	The <code>classpermissionset</code> identifier.
<code>class_id</code>	A single previously declared <code>class</code> identifier.
<code>permission_id</code>	Zero or more permissions required by the class. Note that there must be at least one <code>permission</code> identifier or <code>expr</code> declared).
<code>expr</code>	Zero or more <code>expr</code> 's, the valid operators and syntax are: (and (permission_id ...) (permission_id ...)) (or (permission_id ...) (permission_id ...)) (xor (permission_id ...) (permission_id ...)) (not (permission_id ...)) (all)

**Examples:**

These class permission set statements will resolve to the permission sets shown in the kernel policy language `allow` rules:

```
(class zygote (specifyids specifyrlimits specifycapabilities specifyinvothewith ←
    specifyseinfo))

(type test_1)
(type test_2)
(type test_3)
(type test_4)
(type test_5)

; NOT
(classpermission zygote_1)
(classpermissionset zygote_1 (zygote
    (not
        (specifyinvothewith specifyseinfo)
    )
))
(allow unconfined.process test_1 zygote_1)
;; allow unconfined.process test_1 : zygote { specifyids specifyrlimits specifycapabilities ←
    } ;

; AND - ALL - NOT - Equiv to test_1
(classpermission zygote_2)
```

```
(classpermissionset zygote_2 (zygote
  (and
    (all)
    (not (specifyinvokewith specifyseinfo))
  )
))
(allow unconfined.process test_2 zygote_2)
;; allow unconfined.process test_2 : zygote { specifyids specifyrlimits specifycapabilities ←
  } ;

; OR
(classpermission zygote_3)
(classpermissionset zygote_3 (zygote ((or (specifyinvokewith) (specifyseinfo)))))
(allow unconfined.process test_3 zygote_3)
;; allow unconfined.process test_3 : zygote { specifyinvokewith specifyseinfo } ;

; XOR - This will not produce an allow rule as the XOR will remove all the permissions:
(classpermission zygote_4)
(classpermissionset zygote_4 (zygote (xor (specifyids specifyrlimits specifycapabilities ←
  specifyinvokewith specifyseinfo) (specifyids specifyrlimits specifycapabilities ←
  specifyinvokewith specifyseinfo))))

; ALL
(classpermission zygote_all_perms)
(classpermissionset zygote_all_perms (zygote (all)))
(allow unconfined.process test_5 zygote_all_perms)
;; allow unconfined.process test_5 : zygote { specifyids specifyrlimits specifycapabilities ←
  specifyinvokewith specifyseinfo } ;
```

9.7 classmap

Declares a class map identifier in the current namespace and one or more class mapping identifiers. This will allow:

- 1. Multiple `classpermissionsets` to be linked to a pair of `classmap` / `classmapping` identifiers.
- 2. Multiple `classs` to be associated to statements and rules that support a list of classes: `typetransition`, `typechange`, `typemember`, `rangetransition`, `roletransition`, `defaultuser`, `defaultrole`, `defaulttype`, `defaultrange`, `validatetrans`, `mlsvalidatetrans`

Statement definition:

```
(classmap classmap_id (classmapping_id ...))
```

Where:

<code>classmap</code>	The <code>classmap</code> keyword.
<code>classmap_id</code>	The <code>classmap</code> identifier.
<code>classmapping_id</code>	One or more <code>classmapping</code> identifiers.

Example:

See the `classmapping` statement for examples.

9.8 classmapping

Define sets of `classpermissionsets` (named or anonymous) to form a consolidated `classmapping` set. Generally there are multiple `classmapping` statements with the same `classmap` and `classmapping` identifiers that form a set of different

`classpermissionset`'s. This is useful when multiple class / permissions are required in rules such as the `allow` rules (as shown in the examples).

#### Statement definition:

```
(classmapping classmap_id classmapping_id classpermissionset_id)
```

#### Where:

<code>classmapping</code>	The <code>classmapping</code> keyword.
<code>classmap_id</code>	A single previously declared <code>classmap</code> identifier.
<code>classmapping_id</code>	The <code>classmapping</code> identifier.
<code>classpermissionset_id</code>	A single named <code>classpermissionset</code> identifier or a single anonymous <code>classpermissionset</code> using <code>expr</code> 's as required (see the <code>classpermissionset</code> statement).

#### Examples:

These class mapping statements will resolve to the permission sets shown in the kernel policy language `allow` rules:

```
(class binder (impersonate call set_context_mgr transfer receive))
(class property_service (set))
(class zygote (specifyids specifyrlimits specifycapabilities specifyinvokewith ←
    specifyseinfo))

(classpermission cps_zygote)
(classpermissionset cps_zygote (zygote (not (specifyids))))

(classmap android_classes (set_1 set_2 set_3))

(classmapping android_classes set_1 (binder (all)))
(classmapping android_classes set_1 (property_service (set)))
(classmapping android_classes set_1 (zygote (not (specifycapabilities))))

(classmapping android_classes set_2 (binder (impersonate call set_context_mgr transfer)))
(classmapping android_classes set_2 (zygote (specifyids specifyrlimits specifycapabilities ←
    specifyinvokewith)))

(classmapping android_classes set_3 cps_zygote)
(classmapping android_classes set_3 (binder (impersonate call set_context_mgr)))

(block map_example
    (type type_1)
    (type type_2)
    (type type_3)

    (allow type_1 self (android_classes (set_1)))
    (allow type_2 self (android_classes (set_2)))
    (allow type_3 self (android_classes (set_3)))
)

; The above will resolve to the following AV rules:
;; allow map_example.type_1 map_example.type_1 : binder { impersonate call set_context_mgr ←
    transfer receive } ;
;; allow map_example.type_1 map_example.type_1 : property_service set ;
;; allow map_example.type_1 map_example.type_1 : zygote { specifyids specifyrlimits ←
    specifyinvokewith specifyseinfo } ;

;; allow map_example.type_2 map_example.type_2 : binder { impersonate call set_context_mgr ←
    transfer } ;
;; allow map_example.type_2 map_example.type_2 : zygote { specifyids specifyrlimits ←
    specifycapabilities specifyinvokewith } ;
```



```
;; allow map_example.type_3 map_example.type_3 : binder { impersonate call set_context_mgr ↵
} ;
;; allow map_example.type_3 map_example.type_3 : zygote { specifyrlimits ↵
specifycapabilities specifyinvokewith specifyseinfo } ;
```

## 10 Access Vector Rules

### 10.1 allow

Specifies the access allowed between a source and target type. Note that access may be refined by constraint rules based on the source, target and class (`validatetrans` or `mlsvalidatetrans`) or source, target class and permissions (`constrain` or `mlsconstrain` statements).

#### Rule definition:

```
(allow source_id target_id|self classpermissionset_id ...)
```

#### Where:

<code>allow</code>	The <code>allow</code> keyword.
<code>source_id</code>	A single previously defined source <code>type</code> , <code>typealias</code> or <code>typeattribute</code> identifier.
<code>target_id</code>	A single previously defined target <code>type</code> , <code>typealias</code> or <code>typeattribute</code> identifier. The <code>self</code> keyword may be used instead to signify that source and target are the same.
<code>classpermissionset_id</code>	A single named or anonymous <code>classpermissionset</code> or a single set of <code>classmap/classmapping</code> identifiers.

#### Examples:

These examples show a selection of possible permutations of `allow` rules:

```
(class binder (impersonate call set_context_mgr transfer receive))
(class property_service (set))
(class zygote (specifyids specifyrlimits specifycapabilities specifyinvokewith ↵
specifyseinfo))

(classpermission cps_zygote)
(classpermissionset cps_zygote (zygote (not (specifyids))))

(classmap android_classes (set_1 set_2 set_3))

(classmapping android_classes set_1 (binder (all)))
(classmapping android_classes set_1 (property_service (set)))
(classmapping android_classes set_1 (zygote (not (specifycapabilities))))

(classmapping android_classes set_2 (binder (impersonate call set_context_mgr transfer)))
(classmapping android_classes set_2 (zygote (specifyids specifyrlimits specifycapabilities ↵
specifyinvokewith)))

(classmapping android_classes set_3 cps_zygote)
(classmapping android_classes set_3 (binder (impersonate call set_context_mgr)))

(block av_rules
  (type type_1)
  (type type_2)
  (type type_3))
```

```

    (type type_4)
    (type type_5)

    (typeattribute all_types)
    (typeattributeset all_types (all))

; These examples have named and anonymous classpermissionset's and
; classmap/classmapping statements
    (allow type_1 self (property_service (set)))          ; anonymous
    (allow type_2 self (zygote (specifyids)))             ; anonymous
    (allow type_3 self cps_zygote)                        ; named
    (allow type_4 self (android_classes (set_3)))         ; classmap/classmapping
    (allow all_types all_types (android_classes (set_2))) ; classmap/classmapping

;; This rule will cause the build to fail unless --disable-neverallow
;   (neverallow type_5 all_types (property_service (set)))
    (allow type_5 type_5 (property_service (set)))
    (allow type_1 all_types (property_service (set)))
)

```

## 10.2 auditallow

Audit the access rights defined if there is a valid allow rule. Note: It does NOT allow access, it only audits the event.

### Rule definition:

```
(auditallow source_id target_id|self classpermissionset_id ...)
```

### Where:

auditallow	The auditallow keyword.
source_id	A single previously defined source <b>type</b> , <b>typealias</b> or <b>typeattribute</b> identifier.
target_id	A single previously defined target <b>type</b> , <b>typealias</b> or <b>typeattribute</b> identifier. The <b>self</b> keyword may be used instead to signify that source and target are the same.
classpermissionset_id	A single named or anonymous <b>classpermissionset</b> or a single set of <b>classmap/classmapping</b> identifiers.

### Example:

This example will log an audit event whenever the corresponding **allow** rule grants access to the specified permissions:

```

(allow release_app.process secmark_demo.browser_packet (packet (send recv append bind)))

(auditallow release_app.process secmark_demo.browser_packet (packet (send recv)))

```

## 10.3 dontaudit

Do not audit the access rights defined when access denied. This stops excessive log entries for known events.

Note that these rules can be omitted by the CIL compiler command line parameter **-D** or **--disable-dontaudit** flags.

### Rule definition:

```
(dontaudit source_id target_id|self classpermissionset_id ...)
```

**Where:**

dontaudit	The dontaudit keyword.
source_id	A single previously defined source <code>type</code> , <code>typealias</code> or <code>typeattribute</code> identifier.
target_id	A single previously defined target <code>type</code> , <code>typealias</code> or <code>typeattribute</code> identifier. The <code>self</code> keyword may be used instead to signify that source and target are the same.
classpermissionset_id	A single named or anonymous <code>classpermissionset</code> or a single set of <code>classmap/classmapping</code> identifiers.

**Example:**

This example will not audit the denied access:

```
(dontaudit zygote.process self (capability (fsetid)))
```

## 10.4 neverallow

Never allow access rights defined. This is a compiler enforced action that will stop compilation until the offending rules are modified.

Note that these rules can be over-ridden by the CIL compiler command line parameter `-N` or `--disable-neverallow` flags.

**Rule definition:**

```
(neverallow source_id target_id|self classpermissionset_id ...)
```

**Where:**

neverallow	The neverallow keyword.
source_id	A single previously defined source <code>type</code> , <code>typealias</code> or <code>typeattribute</code> identifier.
target_id	A single previously defined target <code>type</code> , <code>typealias</code> or <code>typeattribute</code> identifier. The <code>self</code> keyword may be used instead to signify that source and target are the same.
classpermissionset_id	A single named or anonymous <code>classpermissionset</code> or a single set of <code>classmap/classmapping</code> identifiers.

**Example:**

This example will not compile as `type_3` is not allowed to be a source type for the `allow` rule:

```
(class property_service (set))

(block av_rules
  (type type_1)
  (type type_2)
  (type type_3)
  (typeattribute all_types)
  (typeattributeset all_types ((all)))

  (neverallow type_3 all_types (property_service (set)))
  ; This rule will fail compilation:
  (allow type_3 self (property_service (set)))
)
```

## 11 Conditional Statements

### 11.1 boolean

Declares a run time boolean as true or false in the current namespace. The `booleanif` statement contains the CIL code that will be in the binary policy file.

#### Statement definition:

```
(boolean boolean_id true|false)
```

#### Where:

<code>boolean</code>	The <code>boolean</code> keyword.
<code>boolean_id</code>	The <code>boolean</code> identifier.
<code>true   false</code>	The initial state of the boolean. This can be changed at run time using <code>setsebool (8)</code> and its status queried using <code>getsebool (8)</code> .

#### Example:

See the `booleanif` statement for an example.

### 11.2 booleanif

Contains the run time conditional statements that are instantiated in the binary policy according to the computed boolean identifier(s) state.

`call` statements are allowed within a `booleanif`, however the contents of the resulting macro must be limited to those of the `booleanif` statement (i.e. `allow`, `auditallow`, `dontaudit`, `typemember`, `typetransition`, `typechange` and the compile time `tunableif` statement)).

#### Statement definition:

```
(booleanif boolean_id | expr ...)
  (true
    cil_statements
    ...)
  (false
    cil_statements
    ...)
)
```

#### Where:

<code>booleanif</code>	The <code>booleanif</code> keyword.
<code>boolean_id</code>	Either a single <code>boolean</code> identifier or one or more <code>expr</code> 's.
<code>expr</code>	Zero or more <code>expr</code> 's, the valid operators and syntax are: <code>(and (boolean_id boolean_id))</code> <code>(or (boolean_id boolean_id))</code> <code>(xor (boolean_id boolean_id))</code> <code>(eq (boolean_id boolean_id))</code> <code>(neq (boolean_id boolean_id))</code> <code>(not (boolean_id))</code>
<code>true</code>	An optional set of CIL statements that will be instantiated when the <code>boolean</code> is evaluated as <code>true</code> .
<code>false</code>	An optional set of CIL statements that will be instantiated when the <code>boolean</code> is evaluated as <code>false</code> .

**Examples:**

The second example also shows the kernel policy language equivalent:

```
(boolean disableAudio false)

(booleanif disableAudio
  (false
    (allow process mediaserver.audio_device (chr_file_set (rw_file_perms)))
  )
)

(boolean disableAudioCapture false)

;;; if(!disableAudio && !disableAudioCapture) {
(booleanif (and (not disableAudio) (not disableAudioCapture))
  (true
    (allow process mediaserver.audio_capture_device (chr_file_set (rw_file_perms)))
  )
)
}
```

**11.3 tunable**

Tunables are similar to booleans, however they are used to manage areas of CIL statements that may or may not be in the final CIL policy that will be compiled (whereas booleans are embedded in the binary policy and can be enabled or disabled during run-time).

Note that tunables can be treated as booleans by the CIL compiler command line parameter `-P` or `--preserve-tunables` flags.

**Statement definition:**

```
(tunable tunable_id true|false)
```

**Where:**

tunable	The <b>tunable</b> keyword.
tunable_id	The <b>tunable</b> identifier.
true   false	The initial state of the <b>tunable</b> .

**Example:**

See the **tunableif** statement for an example.

**11.4 tunableif**

Compile time conditional statement that may or may not add CIL statements to be compiled.

**Statement definition:**

```
(tunableif tunable_id | expr ...)
  (true
    cil_statements
    ...)
  (false
    cil_statements
    ...)
)
```

**Where:**

tunableif	The <b>tunableif</b> keyword.
tunable_id	Either a single <b>tunable</b> identifier or one or more <b>expr</b> 's.
expr	Zero or more <b>expr</b> 's, the valid operators and syntax are: (and (tunable_id tunable_id)) (or (tunable_id tunable_id)) (xor (tunable_id tunable_id)) (eq (tunable_id tunable_id)) (neq (tunable_id tunable_id)) (not (tunable_id))
true	An optional set of CIL statements that will be instantiated when the <b>tunable</b> is evaluated as <b>true</b> .
false	An optional set of CIL statements that will be instantiated when the <b>tunable</b> is evaluated as <b>false</b> .

**Example:**

This example will not add the range transition rule to the binary policy:

```
(tunable range_trans_rule false)

(block init
  (class process (process))
  (type process)

  (tunableif range_trans_rule
    (true
      (rangetransition process sshd.exec process low_high)
    )
  ) ; End tunableif
) ; End block
```

## 12 Constraint Statements

### 12.1 constrain

Enable constraints to be placed on the specified permissions of the object class based on the source and target security context components.

**Statement definition:**

```
(constrain classpermissionset_id ... expression | expr ...)
```

**Where:**

constrain	The <b>constrain</b> keyword.
classpermissionset_id	A single named or anonymous <b>classpermissionset</b> or a single set of <b>classmap/classmapping</b> identifiers.



expression	<p>There must be one constraint expression or one or more expr's. The expression consists of an operator and two operands as follows:</p> <pre>(op u1 u2) (role_op r1 r2) (op t1 t2) (op u1 user_id) (op u2 user_id) (op r1 role_id) (op r2 role_id) (op t1 type_id) (op t2 type_id)</pre> <p>where:</p> <pre>u1, r1, t1 =Source context:user, role or type u2, r2, t2 =Target context:user, role or type</pre> <p>and:</p> <pre>op :eq neq role_op :eq neq dom domby incomp user_id :A single user identifier. role_id :A single role or roleattribute identifier. type_id :A single type, typealias or typeattribute identifier.</pre>
expr	<p>Zero or more expr's, the valid operators and syntax are:</p> <pre>(and expression expression) (or expression expression) (not expression)</pre>

### Examples:

Two constrain statements are shown with their equivalent kernel policy language statements:

```
;; constrain { file } { write }
;;      (( t1 == unconfined.process  ) and ( t2 == unconfined.object  ) or ( r1 eq r2 ));
(constrain (file (write))
  (or
    (and
      (eq t1 unconfined.process)
      (eq t2 unconfined.object)
    )
    (eq r1 r2)
  )
)

;; constrain { file } { read }
;;      (not( t1 == unconfined.process  ) and ( t2 == unconfined.object  ) or ( r1 eq r2 ));
(constrain (file (read))
  (not
    (or
      (and
        (eq t1 unconfined.process)
        (eq t2 unconfined.object)
      )
      (eq r1 r2)
    )
  )
)
```

## 12.2 validatetrans

The `validatetrans` statement is only used for file related object classes where it is used to control the ability to change the objects security context based on old, new and the current process security context.

### Statement definition:

```
(validatetrans class_id expression | expr ...)
```

### Where:

<code>validatetrans</code>	The <code>validatetrans</code> keyword.
<code>class_id</code>	A single previously declared <code>class</code> or <code>classmap</code> identifier.
<code>expression</code>	<p>There must be one constraint expression or one or more <code>expr</code>'s. The expression consists of an operator and two operands as follows:</p> <pre>(op u1 u2) (role_op r1 r2) (op t1 t2) (op u1 user_id) (op u2 user_id) (op u3 user_id) (op r1 role_id) (op r2 role_id) (op r3 role_id) (op t1 type_id) (op t2 type_id) (op t3 type_id)</pre> <p>where:</p> <pre>u1, r1, t1 =Old context:user, role or type u2, r2, t2 =New context:user, role or type u3, r3, t3 =Process context:user, role or type</pre> <p>and:</p> <pre>op :eq neq role_op :eq neq dom domby incomp user_id :A single user identifier. role_id :A single role or roleattribute identifier. type_id :A single type, typealias or typeattribute identifier.</pre>
<code>expr</code>	<p>Zero or more <code>expr</code>'s, the valid operators and syntax are:</p> <pre>(and expression expression) (or expression expression) (not expression)</pre>

### Example:

A validate transition statement with the equivalent kernel policy language statement:

```
; validatetrans { file } ( t1 == unconfined.process );

(validatetrans file (eq t1 unconfined.process))
```

## 12.3 mlsconstrain

Enable MLS constraints to be placed on the specified permissions of the object class based on the source and target security context components.

### Statement definition:

```
(mlsconstrain classpermissionset_id ... expression | expr ...)
```

**Where:**

mlsconstrain	The mlsconstrain keyword.
classpermissionset_id	A single named or anonymous <b>classpermissionset</b> or a single set of <b>classmap/classmapping</b> identifiers.
expression	<p>There must be one constraint expression or one or more expr's. The expression consists of an operator and two operands as follows:</p> <pre>(op u1 u2) (mls_role_op r1 r2) (op t1 t2) (mls_role_op l1 l2) (mls_role_op l1 h2) (mls_role_op h1 l2) (mls_role_op h1 h2) (mls_role_op l1 h1) (mls_role_op l2 h2) (op u1 user_id) (op u2 user_id) (op r1 role_id) (op r2 role_id) (op t1 type_id) (op t2 type_id)</pre> <p>where:</p> <pre>u1, r1, t1, l1, h1 =Source context:user, role, type, low level or high level u2, r2, t2, l2, h2 =Target context:user, role, type, low level or high level</pre> <p>and:</p> <pre>op :eq neq mls_role_op :eq neq dom domby incomp user_id :A single user identifier. role_id :A single role or roleattribute identifier. type_id :A single type, typealias or typeattribute identifier.</pre>
expr	<p>Zero or more expr's, the valid operators and syntax are:</p> <pre>(and expression expression) (or expression expression) (not expression)</pre>

**Example:**

An MLS constrain statement with the equivalent kernel policy language statement:

```
;; mlsconstrain { file } { open }
;;      (( l1 eq l2 ) and ( u1 == u2 ) or ( r1 != r2 ));

(mlsconstrain (file (open))
  (or
    (and
      (eq l1 l2)
      (eq u1 u2)
    )
    (neq r1 r2)
  )
)
```

## 12.4 mlsvalidatetrans

The `mlsvalidatetrans` statement is only used for file related object classes where it is used to control the ability to change the objects security context based on old, new and the current process security context.

### Statement definition:

```
(mlsvalidatetrans class_id expression | expr ...)
```

### Where:

<code>mlsvalidatetrans</code>	The <code>mlsvalidatetrans</code> keyword.
<code>class_id</code>	A single previously declared <code>class</code> or <code>classmap</code> identifier.
<code>expression</code>	<p>There must be one constraint <code>expression</code> or one or more <code>expr</code>'s. The expression consists of an operator and two operands as follows:</p> <pre>(op u1 u2) (mls_role_op r1 r2) (op t1 t2) (mls_role_op l1 l2) (mls_role_op l1 h2) (mls_role_op h1 l2) (mls_role_op h1 h2) (mls_role_op l1 h1) (mls_role_op l2 h2) (op u1 user_id) (op u2 user_id) (op u3 user_id) (op r1 role_id) (op r2 role_id) (op r3 role_id) (op t1 type_id) (op t2 type_id) (op t3 type_id)</pre> <p>where:</p> <pre>u1, r1, t1, l1, h1 =Source context:user, role, type, low level or high level u2, r2, t2, l2, h2 =Target context:user, role, type, low level or high level u3, r3, t3 =Process context:user, role or type</pre> <p>and:</p> <pre>op :eq neq mls_role_op :eq neq dom domby incomp user_id :A single user identifier. role_id :A single role or roleattribute identifier. type_id :A single type, typealias or typeattribute identifier.</pre>
<code>expr</code>	<p>Zero or more <code>expr</code>'s, the valid operators and syntax are:</p> <pre>(and expression expression) (or expression expression) (not expression)</pre>

### Example:

An MLS validate transition statement with the equivalent kernel policy language statement:

```
;; mlsvalidatetrans { file } ( l1 domby h2 );

(mlsvalidatetrans file (domby l1 h2))
```

### 13 Multi-Level Security Labeling Statements

Because there are many options for MLS labeling, the examples show a limited selection of statements, however there is a simple policy that will build shown in the `levelrange` section.

#### 13.1 sensitivity

Declare a sensitivity identifier in the current namespace. Multiple `sensitivity` statements in the policy will form an ordered list.

**Statement definition:**

```
(sensitivity sensitivity_id)
```

**Where:**

sensitivity	The sensitivity keyword.
sensitivity_id	The <code>sensitivity</code> identifier.

**Example:**

This example declares three `sensitivity` identifiers:

```
(sensitivity s0)
(sensitivity s1)
(sensitivity s2)
```

#### 13.2 sensitivityalias

Declares a sensitivity alias identifier in the current namespace. See the `sensitivityaliasactual` statement for an example that associates the `sensitivityalias` identifier.

**Statement definition:**

```
(sensitivityalias sensitivityalias_id)
```

**Where:**

sensitivityalias	The sensitivityalias keyword.
sensitivityalias_id	The <code>sensitivityalias</code> identifier.

**Example:**

See the `sensitivityaliasactual` statement.

#### 13.3 sensitivityaliasactual

Associates a previously declared `sensitivityalias` identifier to a previously declared `sensitivity` identifier.

**Statement definition:**

```
(sensitivityaliasactual sensitivityalias_id sensitivity_id)
```

**Where:**


<code>sensitivityaliasactual</code>	The <code>sensitivityaliasactual</code> keyword.
<code>sensitivityalias_id</code>	A single previously declared <code>sensitivityalias</code> identifier.
<code>sensitivity_id</code>	A single previously declared <code>sensitivity</code> identifier.

**Example:**

This example will associate sensitivity `s0` with two sensitivity alias's:

```
(sensitivity s0)
(sensitivityalias unclassified)
(sensitivityalias SystemLow)
(sensitivityaliasactual unclassified s0)
(sensitivityaliasactual SystemLow s0)
```

**13.4 sensitivityorder**

Define the sensitivity order - lowest to highest. Multiple `sensitivityorder` statements in the policy will form an ordered list.

**Statement definition:**

```
(sensitivityorder (sensitivity_id ...))
```

**Where:**

<code>sensitivityorder</code>	The <code>sensitivityorder</code> keyword.
<code>sensitivity_id</code>	One or more previously declared <code>sensitivity</code> or <code>sensitivityalias</code> identifiers..

**Example:**

This example shows two `sensitivityorder` statements that when compiled will form an ordered list. Note however that the second `sensitivityorder` statement starts with `s2` so that the ordered list can be built.

```
(sensitivity s0)
(sensitivityalias s0 SystemLow)
(sensitivity s1)
(sensitivity s2)
(sensitivityorder (SystemLow s1 s2))

(sensitivity s3)
(sensitivity s4)
(sensitivityalias s4 SystemHigh)
(sensitivityorder (s2 s3 SystemHigh))
```

**13.5 category**

Declare a category identifier in the current namespace. Multiple category statements declared in the policy will form an ordered list.

**Statement definition:**

```
(category category_id)
```

**Where:**

<code>category</code>	The <code>category</code> keyword.
<code>category_id</code>	The <code>category</code> identifier.

**Example:**

This example declares a three `category` identifiers:

```
(category c0)
(category c1)
(category c2)
```

**13.6 categoryalias**

Declares a category alias identifier in the current namespace. See the `categoryaliasactual` statement for an example that associates the `categoryalias` identifier.

**Statement definition:**

```
(categoryalias categoryalias_id)
```

**Where:**

categoryalias	The categoryalias keyword.
categoryalias_id	The <code>categoryalias</code> identifier.

**13.7 categoryaliasactual**

Associates a previously declared `categoryalias` identifier to a previously declared `category` identifier.

**Statement definition:**

```
(categoryaliasactual categoryalias_id category_id)
```

**Where:**

categoryaliasactual	The categoryaliasactual keyword.
categoryalias_id	A single previously declared <code>categoryalias</code> identifier.
category_id	A single previously declared <code>category</code> identifier.

**Example:**

Declares a category `c0`, a category alias of `documents`, and then associates them:

```
(category c0)
(categoryalias documents)
(categoryaliasactual documents c0)
```

**13.8 categoryorder**

Define the category order. Multiple `categoryorder` statements declared in the policy will form an ordered list. Note that this statement orders the categories to allow validation of category ranges.

**Statement definition:**

```
(categoryorder (category_id ...))
```

**Where:**

categoryorder	The categoryorder keyword.
category_id	One or more previously declared <code>category</code> or <code>categoryalias</code> identifiers.

---

**Example:**

This example orders one category alias and nine categories:

```
(categoryorder (documents c1 c2 c3 c4 c5 c6 c7 c8 c9))
```

**13.9 categoryset**

Declare an identifier for a set of contiguous or non-contiguous categories in the current namespace.

Notes:

- Category expressions are allowed in `categoryset`, `sensitivitycategory`, `level`, and `levelrange` statements.
- Category sets are not allowed in `categoryorder` statements.

**Statement definition:**

```
(categoryset categoryset_id (category_id ... | expr ...))
```

**Where:**

categoryset	The <code>categoryset</code> keyword.
categoryset_id	The <code>categoryset</code> identifier.
category_id	Zero or more previously declared <code>category</code> or <code>categoryalias</code> identifiers. Note that there must be at least one <code>category_id</code> identifier or <code>expr</code> parameter declared.
expr	Zero or more <code>expr</code> 's, the valid operators and syntax are: (and (category_id ...) (category_id ...)) (or (category_id ...) (category_id ...)) (xor (category_id ...) (category_id ...)) (not (category_id ...)) (range category_id category_id) (all)

**Examples:**

These examples show a selection of `categoryset` statements:

```
; Declare categories with two alias's:
(category c0)
(categoryalias documents)
(categoryaliasactual documents c0)
(category c1)
(category c2)
(category c3)
(category c4)
(categoryalias spreadsheets)
(categoryaliasactual spreadsheets c4)

; Set the order to determine ranges:
(categoryorder (c0 c1 c2 c3 spreadsheets))

(categoryset catrange_1 (range c2 c3))

; Two methods to associate all categories:
(categoryset all_cats (range c0 c4))
(categoryset all_cats1 (all))
```



```
(categoryset catset_1 (documents c1))
(categoryset catset_2 (c2 c3))
(categoryset catset_3 (c4))

(categoryset just_c0 (xor (c1 c2) (documents c1 c2)))
```

13.10 sensitivitycategory

Associate a **sensitivity** identifier with one or more **category**'s. Multiple definitions for the same **sensitivity** form an ordered list of categories for that sensitivity. This statement is required before a **level** identifier can be declared.

Statement definition:

```
(sensitivitycategory sensitivity_id categoryset_id)
```

Where:

sensitivitycategory	The sensitivitycategory keyword.
sensitivity_id	A single previously declared <b>sensitivity</b> or <b>sensitivityalias</b> identifier.
categoryset_id	A single previously declared <b>categoryset</b> (named or anonymous), or a list of <b>category</b> and/or <b>categoryalias</b> identifiers. The examples show each variation.

Examples:

These sensitivitycategory examples use a selection of **category**, **categoryalias** and **categoryset**'s:

```
(sensitivitycategory s0 catrange_1)
(sensitivitycategory s0 catset_1)
(sensitivitycategory s0 catset_3)
(sensitivitycategory s0 (all))
(sensitivitycategory unclassified (range documents c2))
```

13.11 level

Declare a **level** identifier in the current namespace and associate it to a previously declared **sensitivity** and zero or more categories. Note that if categories are required, then before this statement can be resolved the **sensitivitycategory** statement must be used to associate categories with the sensitivity.

Statement definition:

```
level level_id (sensitivity_id [categoryset_id])
```

Where:

level	The level keyword.
level_id	The <b>level</b> identifier.
sensitivity_id	A single previously declared <b>sensitivity</b> or <b>sensitivityalias</b> identifier.
categoryset_id	A single previously declared <b>categoryset</b> (named or anonymous), or a list of <b>category</b> and/or <b>categoryalias</b> identifiers. The examples show each variation.

Examples:

These level examples use a selection of **category**, **categoryalias** and **categoryset**'s:

```
(level systemLow (s0))
```

```
(level level_1 (s0))
(level level_2 (s0 (catrange_1)))
(level level_3 (s0 (all_cats)))
(level level_4 (unclassified (c2 c3 c4)))
```

### 13.12 levelrange

Declare a level range identifier in the current namespace and associate a current and clearance level.

#### Statement definition:

```
(levelrange levelrange_id (low_level_id high_level_id))
```

#### Where:

levelrange	The <code>levelrange</code> keyword.
levelrange_id	The <code>levelrange</code> identifier.
low_level_id	The current level specified by a previously declared <code>level</code> identifier. This may be formed by named or anonymous components as discussed in the <code>level</code> section and shown in the examples.
high_level_id	The clearance or high level specified by a previously declared <code>level</code> identifier. This may be formed by named or anonymous components as discussed in the <code>level</code> section and shown in the examples.

#### Examples:

This example policy shows `levelrange` statement and all the other MLS labeling statements discussed in this section and will compile as a standalone policy:

```
(handleunknown allow)
(mls true)

; There must be least one set of SID statements in a policy:
(sid kernel)
(sidorder (kernel))
(sidcontext kernel unconfined.context_1)

(sensitivitycategory s0 (c4 c2 c3 c1 c0 c3))

(category c0)
(categoryalias documents)
(categoryaliasactual documents c0)
(category c1)
(category c2)
(category c3)
(category c4)
(categoryalias spreadsheets)
(categoryaliasactual spreadsheets c4)

(categoryorder (c0 c1 c2 c3 spreadsheets))

(categoryset catrange_1 (range c2 c3))
(categoryset all_cats (range c0 c4))
(categoryset all_cats1 (all))

(categoryset catset_1 (documents c1))
(categoryset catset_2 (c2 c3))
(categoryset catset_3 (c4))
```

```

(categoryset just_c0 (xor (c1 c2) (documents c1 c2)))

(sensitivity s0)
(sensitivityalias unclassified)
(sensitivityaliasactual unclassified s0)

(sensitivityorder (s0))
(sensitivitycategory s0 (c0))

(sensitivitycategory s0 catrange_1)
(sensitivitycategory s0 catset_1)
(sensitivitycategory s0 catset_3)
(sensitivitycategory s0 (all))
(sensitivitycategory s0 (range documents c2))

(level systemLow (s0))
(level level_1 (s0))
(level level_2 (s0 (catrange_1)))
(level level_3 (s0 (all_cats)))
(level level_4 (unclassified (c2 c3 c4)))

(levelrange levelrange_2 (level_2 level_2))
(levelrange levelrange_1 ((s0) level_2))
(levelrange low_low (systemLow systemLow))

(context context_2 (unconfined.user object_r unconfined.object (level_1 level_3)))

; Define object_r role. This must be assigned in CIL.
(role object_r)

(block unconfined
  (user user)
  (role role)
  (type process)
  (type object)
  (userrange user (systemLow systemLow))
  (userlevel user systemLow)
  (userrole user role)
  (userrole user object_r)
  (roletype role process)
  (roletype role object)
  (roletype object_r object)

  (class file (open execute read write))

  ; There must be least one allow rule in a policy:
  (allow process self (file (read)))

  (context context_1 (user object_r object low_low))
) ; End unconfined namespace

```

### 13.13 rangetransition

Allows an objects level to transition to a different level. Generally used to ensure processes run with their correct MLS range, for example `init` would run at `SystemHigh` and needs to initialise / run other processes at their correct MLS range.

#### Statement definition:

```
(rangetransition source_id target_id class_id new_range_id)
```

**Where:**

rangetransition	The rangetransition keyword.
source_type_id	A single previously declared <a href="#">type</a> , <a href="#">typealias</a> or <a href="#">typeattribute</a> identifier.
target_type_id	A single previously declared <a href="#">type</a> , <a href="#">typealias</a> or <a href="#">typeattribute</a> identifier.
class_id	A single previously declared <a href="#">class</a> or <a href="#">classmap</a> identifier.
new_range_id	The new MLS range for the object class that is a previously declared <a href="#">levelrange</a> identifier. This entry may also be defined as an anonymous or named <a href="#">level</a> , <a href="#">sensitivity</a> , <a href="#">sensitivityalias</a> , <a href="#">category</a> , <a href="#">categoryalias</a> or <a href="#">categoryset</a> identifier.

**Examples:**

This rule will transition the range of `sshd.exec` to `s0 -s1:c0.c3` on execution from the `init.process`:

```
(sensitivity s0)
(sensitivity s1)
(sensitivityorder s0 s1)
(category c0)
...
(level systemlow (s0)
(level systemhigh (s1 (c0 c1 c2)))
(levelrange low_high (systemlow systemhigh))

(rangetransition init.process sshd.exec process low_high)
```

**13.14 mlsconstrain**

This is described in the [Constraints](#) section.

**13.15 mlsvalidatetrans**

This is described in the [Constraints](#) section.

**14 Context Statement**

Contexts are formed using previously declared parameters and may be named or anonymous where:

- Named - The context is declared with a context identifier that is used as a reference.
- Anonymous - They are defined within the CIL labeling statement using user, role etc. identifiers.

Each type is shown in the examples.

**14.1 context**

Declare an SELinux security context identifier for labeling. The range (or current and clearance levels) **MUST** be defined whether the policy is MLS/MCS enabled or not.

**Statement definition:**

```
(context context_id (user_id role_id type_id levelrange_id))
```

**Where:**

<code>context</code>	The <code>context</code> keyword.
<code>context_id</code>	The <code>context</code> identifier.
<code>user_id</code>	A single previously declared <code>user</code> identifier.
<code>role_id</code>	A single previously declared <code>role</code> identifier.
<code>type_id</code>	A single previously declared <code>type</code> or <code>typealias</code> identifier.
<code>levelrange_id</code>	A single previously declared <code>levelrange</code> identifier. This entry may also be defined by anonymous or named <code>level</code> , <code>sensitivity</code> , <code>sensitivityalias</code> , <code>category</code> , <code>categoryalias</code> or <code>categoryset</code> as discussed in the <a href="#">Multi-Level Security Labeling Statements</a> section and shown in the examples.

**Examples:**

This example uses a named context definition:

```
(context runas_exec_context (u object_r exec low_low))
(filecon "/system/bin/run-as" file runas_exec_context)
```

to resolve/build a `file_contexts` entry of (assuming MLS enabled policy):

```
/system/bin/run-as -- u:object_r:runas.exec:s0-s0
```

This example uses an anonymous context where the previously declared `user` `role` `type` `levelrange` identifiers are used to specify two `portcon` statements:

```
(portcon udp 1024 (test.user object_r test.process ((s0) (s1))))
(portcon tcp 1024 (test.user object_r test.process (system_low system_high)))
```

This example uses an anonymous context for the first and named context for the second in a `netifcon` statement:

```
(context netif_context (test.user object_r test.process ((s0 (c0)) (s1 (c0)))))
(netifcon eth04 (test.user object_r test.process ((s0 (c0)) (s1 (c0))))) netif_context)
```

## 15 SID Statements

### 15.1 sid

Declares a new SID identifier in the current namespace.

**Statement definition:**

```
(sid sid_id)
```

**Where:**

<code>sid</code>	The <code>sid</code> keyword.
<code>sid_id</code>	The <code>sid</code> identifier.

**Examples:**

These examples show three `sid` declarations:

```
(sid kernel)
(sid security)
(sid igmp_packet)
```

## 15.2 sidorder

Defines the order of **sid**'s. This is a mandatory statement when SIDs are defined. Multiple `sidorder` statements declared in the policy will form an ordered list.

### Statement definition:

```
(sidorder (sid_id ...))
```

### Where:

<code>sidorder</code>	The <code>sidorder</code> keyword.
<code>sid_id</code>	One or more <b>sid</b> identifiers.

### Example:

This will produce an ordered list of "kernel security unlabeled"

```
(sid kernel)
(sid security)
(sid unlabeled)
(sidorder (kernel security))
(sidorder (security unlabeled))
```

## 15.3 sidcontext

Associates an SELinux security **context** to a previously declared **sid** identifier.

### Statement definition:

```
(sidcontext sid_id context_id)
```

### Where:

<code>sidcontext</code>	The <code>sidcontext</code> keyword.
<code>sid_id</code>	A single previously declared <b>sid</b> identifier.
<code>context_id</code>	A previously declared <b>context</b> identifier or an anonymous security context ( <b>user role type levelrange</b> ), the range <b>MUST</b> be defined whether the policy is MLS/MCS enabled or not.

### Examples:

This shows two named security context examples plus an anonymous context:

```
; Two named context:
(sid kernel)
(context kernel_context (u r process low_low))
(sidcontext kernel kernel_context)

(sid security)
(context security_context (u object_r process low_low))
(sidcontext security security_context)

; An anonymous context:
(sid unlabeled)
(sidcontext unlabeled (u object_r ((s0) (s0))))
```

## 16 File Labeling Statements

### 16.1 filecon

Define entries for labeling files. The compiler will produce these entries in a file called **file\_contexts** (5) by default in the `cwd`. The compiler option `[-f|--filecontext <filename>]` may be used to specify a different path or file name.

#### Statement definition:

```
(filecon "path" file_type context_id)
```

#### Where:

filecon	The <code>filecon</code> keyword.																		
path	A string representing the file path that may be in the form of a regular expression. The string must be enclosed within double quotes (e.g. <code>"/this/is/a/path(/.*)"?</code> )																		
file_type	<p>A single keyword representing a file type in the <code>file_contexts</code> file as follows:</p> <table> <tr> <th>keyword</th><th>file_contexts entry</th></tr> <tr> <td>file</td><td>--</td></tr> <tr> <td>dir</td><td>-d</td></tr> <tr> <td>char</td><td>-c</td></tr> <tr> <td>block</td><td>-b</td></tr> <tr> <td>socket</td><td>-s</td></tr> <tr> <td>pipe</td><td>-p</td></tr> <tr> <td>symlink</td><td>-l</td></tr> <tr> <td>any</td><td>no entry</td></tr> </table>	keyword	file_contexts entry	file	--	dir	-d	char	-c	block	-b	socket	-s	pipe	-p	symlink	-l	any	no entry
keyword	file_contexts entry																		
file	--																		
dir	-d																		
char	-c																		
block	-b																		
socket	-s																		
pipe	-p																		
symlink	-l																		
any	no entry																		
context_id	<p>The security context to be allocated to the file, which may be:</p> <ul style="list-style-type: none"> <li>A previously declared <code>context</code> identifier or an anonymous security context (<code>user role type levelrange</code>), the range <b>MUST</b> be defined whether the policy is MLS/MCS enabled or not.</li> <li>An empty context list represented by <code>()</code> can be used to indicate that matching files should not be re-labeled. This will be interpreted as <code>&lt;&lt;none&gt;&gt;</code> within the <b>file_contexts</b> (5) file.</li> </ul>																		

#### Examples:

These examples use one named, one anonymous and one empty context definition:

```
(context runas_exec_context (u object_r exec low_low))

(filecon "/system/bin/run-as" file runas_exec_context)
(filecon "/dev/socket/wpa_wlan[0-9]" any u:object_r:wpa.socket:s0-s0)
(filecon "/data/local/mine" dir ())
```

to resolve/build `file_contexts` entries of (assuming MLS enabled policy):

```
/system/bin/run-as -- u:object_r:runas.exec:s0
/dev/socket/wpa_wlan[0-9] u:object_r:wpa.socket:s0
/data/local/mine -d <<none>>
```

### 16.2 fsuse

Label filesystems that support SELinux security contexts.

#### Statement definition:



```
(fsuse fstype fsname context_id)
```

**Where:**

fsuse	The fsuse keyword.
fstype	A single keyword representing the type of filesystem as follows: <ul style="list-style-type: none"><li>task - For pseudo filesystems supporting task related services such as pipes and sockets.</li><li>trans - For pseudo filesystems such as pseudo terminals and temporary objects.</li><li>xattr - Filesystems supporting the extended attribute security.selinux. The labeling is persistent for filesystems that support extended attributes.</li></ul>
fsname	Name of the supported filesystem (e.g. ext4 or pipefs).
context_id	The security context to be allocated to the network interface. A previously declared context identifier or an anonymous security context (user role type levelrange), the range MUST be defined whether the policy is MLS/MCS enabled or not.

**Examples:**

The context identifiers are declared in the file namespace and the fsuse statements in the global namespace:

```
(block file
  (type labeledfs)
  (roletype object_r labeledfs)
  (context labeledfs_context (u object_r labeledfs low_low))

  (type pipefs)
  (roletype object_r pipefs)
  (context pipefs_context (u object_r pipefs low_low))
  ...
)

(fsuse xattr ex4 file.labeledfs_context)
(fsuse xattr btrfs file.labeledfs_context)

(fsuse task pipefs file.pipefs_context)
(fsuse task sockfs file.sockfs_context)

(fsuse trans devpts file.devpts_context)
(fsuse trans tmpfs file.tmpfs_context)
```

**16.3 genfscon**

Used to allocate a security context to filesystems that cannot support any of the fsuse file labeling options. Generally a filesystem would have a single default security context assigned by genfscon from the root (/) that would then be inherited by all files and directories on that filesystem. The exception to this is the /proc filesystem, where directories can be labeled with a specific security context (as shown in the examples).

**Statement definition:**

```
(genfscon fsname path context_id)
```

**Where:**


genfscon	The genfscon keyword.
fsname	Name of the supported filesystem (e.g. rootfs or proc).
path	If fsname is proc, then the partial path (see examples). For all other types this must be '/'.
context_id	A previously declared <b>context</b> identifier or an anonymous security context ( <b>user role type levelrange</b> ), the range <b>MUST</b> be defined whether the policy is MLS/MCS enabled or not.

**Examples:**

The **context** identifiers are declared in the file namespace and the genfscon statements are then inserted using the **in** container statement:

```
(file
  (type rootfs)
  (roletype object_r rootfs)
  (context rootfs_context (u object_r rootfs low_low))

  (type proc)
  (roletype object_r proc)
  (context rootfs_context (u object_r proc low_low))
  ...
)

(in file
  (genfscon rootfs / rootfs_context)
  ; proc labeling can be further refined (longest matching prefix).
  (genfscon proc / proc_context)
  (genfscon proc /net/xt_qtaguid/ctrl qtaguid_proc_context)
  (genfscon proc /sysrq-trigger sysrq_proc_context)
  (genfscon selinuxfs / selinuxfs_context)
)
```

## 17 Network Labeling Statements

### 17.1 ipaddr

Declares a named IP address in IPv4 or IPv6 format that may be referenced by other CIL statements (i.e. netifcon).

Notes:

- CIL statements utilising an IP address may reference a named IP address or use an anonymous address, the examples will show each option.
- IP Addresses may be declared without a previous declaration by enclosing within parentheses e.g. (127.0.0.1) or (:::1).

**Statement definition:**

```
(ipaddr ipaddr_id ip_address)
```

**Where:**

ipaddr	The ipaddr keyword.
ipaddr_id	The IP address identifier.
ip_address	A correctly formatted IP address in IPv4 or IPv6 format.

**Example:**

This example declares a named IP address and also passes an 'explicit anonymously declared' IP address to a macro:

```
(ipaddr netmask_1 255.255.255.0)
(context netlabel_1 (system.user object_r unconfined.object low_low))

(call build_nodecon ((192.168.1.64) netmask_1))

(macro build_nodecon ((ipaddr ARG1) (ipaddr ARG2))
  (nodecon ARG1 ARG2 netlabel_1))
```

**17.2 netifcon**

Label network interface objects (e.g. eth0).

**Statement definition:**

```
(netifcon netif_name netif_context_id packet_context_id)
```

**Where:**

netifcon	The <code>netifcon</code> keyword.
netif_name	The network interface name (e.g. wlan0).
netif_context_id	The security context to be allocated to the network interface. A previously declared <code>context</code> identifier or an anonymous security context ( <code>user role type levelrange</code> ), the range MUST be defined whether the policy is MLS/MCS enabled or not.
packet_context_id	The security context to be allocated to packets. Note that these are defined but currently unused as the <code>iptables</code> (8) SECMARK services should be used to label packets. A previously declared <code>context</code> identifier or an anonymous security context ( <code>user role type levelrange</code> ), the range MUST be defined whether the policy is MLS/MCS enabled or not.

**Examples:**

These examples show named and anonymous `netifcon` statements:

```
(context context_1 (unconfined.user object_r unconfined.object low_low))
(context context_2 (unconfined.user object_r unconfined.object (systemlow level_2)))

(netifcon eth0 context_1 (unconfined.user object_r unconfined.object levelrange_1))
(netifcon eth1 context_1 (unconfined.user object_r unconfined.object ((s0) level_1)))
(netifcon eth3 context_1 context_2)
```

**17.3 nodecon**

Label network address objects that represent IPv4 or IPv6 IP addresses and network masks.

IP Addresses may be declared without a previous declaration by enclosing within parentheses e.g. (127.0.0.1) or (:::1).

**Statement definition:**

```
(nodecon subnet_id netmask_id context_id)
```

**Where:**

nodecon	The <code>nodecon</code> keyword.
subnet_id	A previously declared <code>ipaddr</code> identifier, or an anonymous IPv4 or IPv6 formatted address.
netmask_id	A previously declared <code>ipaddr</code> identifier, or an anonymous IPv4 or IPv6 formatted address.
context_id	A previously declared <code>context</code> identifier or an anonymous security context ( <code>user role type levelrange</code> ), the range MUST be defined whether the policy is MLS/MCS enabled or not.

**Examples:**

These examples show named and anonymous `nodecon` statements:

```
(context context_1 (unconfined.user object_r unconfined.object low_low))
(context context_2 (unconfined.user object_r unconfined.object (systemlow level_2)))

(ipaddr netmask_1 255.255.255.0)
(ipaddr ipv4_1 192.168.1.64)

(nodecon netmask_1 ipv4_1 context_2)
(nodecon (255.255.255.0) (192.168.1.64) context_1)
(nodecon netmask_1 (192.168.1.64) (unconfined.user object_r unconfined.object ((s0) (s0 (c0 ←
))))))
```

## 17.4 portcon

Label a udp or tcp port.

**Statement definition:**

```
(portcon protocol port context_id)
```

**Where:**

portcon	The <code>portcon</code> keyword.
protocol	The protocol keyword <code>tcp</code> or <code>udp</code> .
context_id	A previously declared <code>context</code> identifier or an anonymous security context ( <code>user role type levelrange</code> ), the range MUST be defined whether the policy is MLS/MCS enabled or not.

**Examples:**

These examples show named and anonymous `portcon` statements:

```
(portcon tcp 1111 (unconfined.user object_r unconfined.object ((s0) (s0 (c0)))))
(portcon tcp 2222 (unconfined.user object_r unconfined.object levelrange_2))
(portcon tcp 3333 (unconfined.user object_r unconfined.object levelrange_1))
(portcon udp 4444 (unconfined.user object_r unconfined.object ((s0) level_2)))
(portcon tcp 5555 (unconfined.user object_r unconfined.object (systemlow level_3)))
```

## 18 Xen Statements

See the "[XSM/FLASK Configuration](http://xenbits.xen.org/docs/4.2-testing/misc/xsm-flask.txt)" document for further information (<http://xenbits.xen.org/docs/4.2-testing/misc/xsm-flask.txt>)

## 18.1 iomemcon

Label i/o memory. This may be a single memory location or a range.

### Statement definition:

```
(iomemcon mem_addr | (mem_low mem_high) context_id)
```

### Where:

iomemcon	The iomemcon keyword.
mem_addr   (mem_low mem_high)	A single memory address to apply the context, or a range of addresses. The entries must consist of numerics [0-9].
context_id	A previously declared <b>context</b> identifier or an anonymous security context ( <b>user role type levelrange</b> ), the range MUST be defined whether the policy is MLS/MCS enabled or not.

### Example:

An anonymous context for a memory address range of 0xfebe0-0xfebff:

```
(iomemcon (1043424 1043455) (unconfined.user object_r unconfined.object low_low))
```

## 18.2 ioportcon

Label i/o ports. This may be a single port or a range.

### Statement definition:

```
(ioportcon port | (port_low port_high) context_id)
```

### Where:

ioportcon	The ioportcon keyword.
port   (port_low port_high)	A single port to apply the context, or a range of ports. The entries must consist of numerics [0-9].
context_id	A previously declared <b>context</b> identifier or an anonymous security context ( <b>user role type levelrange</b> ), the range MUST be defined whether the policy is MLS/MCS enabled or not.

### Example:

An anonymous context for a single port of :0xecc0:

```
(ioportcon 60608 (unconfined.user object_r unconfined.object low_low))
```

## 18.3 pcidevicecon

Label a PCI device.

### Statement definition:

```
(pcidevicecon device context_id)
```

### Where:

pcidevicecon	The pcidevicecon keyword.
device	The device number. The entries must consist of numerics [0-9].
context_id	A previously declared <code>context</code> identifier or an anonymous security context ( <code>user role type levelrange</code> ), the range MUST be defined whether the policy is MLS/MCS enabled or not.

**Example:**

An anonymous context for a pci device address of 0xc800:

```
(pcidevicecon 51200 (unconfined.user object_r unconfined.object low_low))
```

## 18.4 pirqcon

Label an interrupt level.

**Statement definition:**

```
(pirqcon irq_level context_id)
```

**Where:**

pirqcon	The pirqcon keyword.
irq_level	The interrupt request number. The entries must consist of numerics [0-9].
context_id	A previously declared <code>context</code> identifier or an anonymous security context ( <code>user role type levelrange</code> ), the range MUST be defined whether the policy is MLS/MCS enabled or not.

**Example:**

An anonymous context for IRQ 33:

```
(pirqcon 33 (unconfined.user object_r unconfined.object low_low))
```

## A Example CIL Policy

This is the example `policy.cil` file taken from the CIL compiler source code.

```
(type bin_t)
(type kernel_t)
(type security_t)
(type unlabeled_t)
(handleunknown allow)
(mls true)

(policycap open_perms)

(category c0)
(category c1)
(category c2)
(category c3)
(category c4)
(category c5)
(categoryalias cat0)
(categoryaliasactual cat0 c0)
(categoryset cats01 (c0 c1))
```

```

(categoryset cats02 (c2 c3))
(categoryset cats03 (range c0 c5))
(categoryset cats04 (not (range c0 c2)))
(categoryorder (cat0 c1 c2 c3))
(categoryorder (c3 c4 c5))

(sensitivity s0)
(sensitivity s1)
(sensitivity s2)
(sensitivity s3)
(sensitivityalias sens0)
(sensitivityaliasactual sens0 s0)
(sensitivityorder (s0 s1 s2 s3))

(sensitivitycategory s0 (cats03))
(sensitivitycategory s1 cats01)
(sensitivitycategory s1 (c2))
(sensitivitycategory s2 (cats01 cats02))
(sensitivitycategory s2 (range c4 c5))
(sensitivitycategory s3 (range c0 c5))

(level low (s0))
(level high (s3 (range c0 c3)))
(levelrange low_high (low high))
(levelrange lh1 ((s0 (c0)) (s2 (c0 c3))))
(levelrange lh2 (low (s2 (c0 c3))))
(levelrange lh3 ((s0 cats04) (s2 (range c0 c5))))
(levelrange lh4 ((s0) (s1)))

(block policy
  (classorder (file char dir))
  (class file (execute_no_trans entypoint execmod open audit_access))
  (common file (ioctl read write create getattr setattr lock relabelfrom
    relabelto append unlink link rename execute swapon
    quotaon mounton))
  (classcommon file file)

  (classpermission file_rw)
  (classpermissionset file_rw (file (read write setattr setattr lock append)))

  ;; (classpermission loop1)
  ;; (classpermissionset loop1 ((loop2)))
  ;; (classpermission loop2)
  ;; (classpermissionset loop2 ((loop3)))
  ;; (classpermission loop3)
  ;; (classpermissionset loop3 ((loop1)))

  (class char (foo))
  (classcommon char file)

  (class dir ())
  (classcommon dir file)

  (classpermission char_w)
  (classpermissionset char_w (char (write setattr)))
  (classpermissionset char_w (file (open read setattr)))

  (classmap files (read))
  (classmapping files read
    (file (open read setattr)))
  (classmapping files read
    char_w)

```

```

(type auditadm_t)
(type console_t)
(type console_device_t)
(type user_tty_device_t)
(type device_t)
(type getty_t)
(type exec_t)
(type bad_t)

;; (allow console_t console_device_t file_rw)
(allow console_t console_device_t (files (read)))

(boolean secure_mode false)
(boolean console_login true)

(sid kernel)
(sid security)
(sid unlabeled)
(sidorder (kernel security))
(sidorder (security unlabeled))

(typeattribute exec_type)
(typeattribute foo_type)
(typeattribute bar_type)
(typeattribute baz_type)
(typeattribute not_bad_type)
(typeattributeset exec_type (or bin_t kernel_t))
(typeattributeset foo_type (and exec_type kernel_t))
(typeattributeset bar_type (xor exec_type foo_type))
(typeattributeset baz_type (not bin_t))
(typeattributeset baz_type (and exec_type (and bar_type bin_t)))
(typeattributeset not_bad_type (not bad_t))
(typealias sbin_t)
(typealiasactual sbin_t bin_t)
(typepermissive device_t)
(typebounds device_t bin_t)
;; (typebounds bin_t kernel_t)      ;; This statement and the next can be used
;; (typebounds kernel_t device_t) ;; to verify that circular bounds can be found
(typemember device_t bin_t file exec_t)
(typetransition device_t console_t files console_device_t)

(roleattribute exec_role)
(roleattribute foo_role)
(roleattribute bar_role)
(roleattribute baz_role)
(roleattributeset exec_role (or user_r system_r))
(roleattributeset foo_role (and exec_role system_r))
(roleattributeset bar_role (xor exec_role foo_role))
(roleattributeset baz_role (not user_r))

(rangetransition device_t console_t file low_high)
(rangetransition device_t kernel_t file ((s0) (s3 (not c3))))

(typetransition device_t console_t file "some_file" getty_t)

(allow foo_type self (file (execute)))
(allow bin_t device_t (file (execute)))

;; Next two rules violate the neverallow rule that follows
;; (allow bad_t not_bad_type (file (execute)))
;; (allow bad_t exec_t (file (execute)))

```



```

(neverallow bad_t not_bad_type (file (execute)))

(booleanif secure_mode
  (true
    (auditallow device_t exec_t (file (read write)))
  )
)

(booleanif console_login
  (true
    (typechange auditadm_t console_device_t file user_tty_device_t)
    (allow getty_t console_device_t (file (getattr open read write append)))
  )
  (false
    (dontaudit getty_t console_device_t (file (getattr open read write append)))
  )
)

(booleanif (not (xor (eq secure_mode console_login)
  (and (or secure_mode console_login) secure_mode ) ) )
  (true
    (allow bin_t exec_t (file (execute)))
  )
)

(tunable allow_execfile true)
(tunable allow_userexec false)

(tunableif (not (xor (eq allow_execfile allow_userexec)
  (and (or allow_execfile allow_userexec)
    (and allow_execfile allow_userexec) ) ) )
  (true
    (allow bin_t exec_t (file (execute)))
  )
)

(optional allow_rules
  (allow user_t exec_t (bins (execute)))
)

(dontaudit device_t auditadm_t (file (read)))
(auditallow device_t auditadm_t (file (open)))

(user system_u)
(user user_u)
(user foo_u)
(userprefix user_u user)
(userprefix system_u user)

(selinuxuser name user_u low_high)
(selinuxuserdefault user_u ((s0 (c0)) (s3 (range c0 c3))))

(role system_r)
(role user_r)

(roletype system_r bin_t)
(roletype system_r kernel_t)
(roletype system_r security_t)
(roletype system_r unlabeled_t)
(roletype system_r exec_type)
(roletype exec_role bin_t)
(roletype exec_role exec_type)

```

```

(roleallow system_r user_r)
(rolebounds system_r user_r)
(roletransition system_r bin_t file user_r)

(userrole foo_u foo_role)
(userlevel foo_u low)
(userrange foo_u low_high)

(userrole system_u system_r)
(userlevel system_u low)
(userrange system_u low_high)
(userbounds system_u user_u)

(userrole user_u user_r)
(userlevel user_u (s0 (range c0 c2)))
(userrange user_u (low high))

(sidcontext kernel (system_u system_r kernel_t ((s0) high)))
(sidcontext security (system_u system_r security_t (low (s3 (range c0 c3)))))
(sidcontext unlabeled (system_u system_r unlabeled_t (low high)))

(context system_u_bin_t_l2h (system_u system_r bin_t (low high)))

(ipaddr ip_v4 192.25.35.200)
(ipaddr netmask 192.168.1.1)
(ipaddr ip_v6 2001:0DB8:AC10:FE01::)
(ipaddr netmask_v6 2001:0DE0:DA88:2222::)

(filecon "/usr/bin/foo" file system_u_bin_t_l2h)
(filecon "/usr/bin/bar" file (system_u system_r kernel_t (low low)))
(filecon "/usr/bin/baz" any ())
(filecon "/usr/bin/aaa" any (system_u system_r kernel_t ((s0) (s3 (range c0 c2)))))
(filecon "/usr/bin/bbb" any (system_u system_r kernel_t ((s0 (c0)) high)))
(filecon "/usr/bin/ccc" any (system_u system_r kernel_t (low (s3 (cats01)))))
(filecon "/usr/bin/ddd" any (system_u system_r kernel_t (low (s3 (cats01 cats02)))))
(nodecon ip_v4 netmask system_u_bin_t_l2h)
(nodecon ip_v6 netmask_v6 system_u_bin_t_l2h)
(portcon udp 25 system_u_bin_t_l2h)
(portcon tcp 22 system_u_bin_t_l2h)
(genfscon - "/usr/bin" system_u_bin_t_l2h)
(netifcon eth0 system_u_bin_t_l2h system_u_bin_t_l2h) ;different contexts?
(fsuse xattr ext3 system_u_bin_t_l2h)

; XEN
(pirqcon 256 system_u_bin_t_l2h)
(iomemcon (0 255) system_u_bin_t_l2h)
(ioportcon (22 22) system_u_bin_t_l2h)
(pcidvicecon 345 system_u_bin_t_l2h)

(constrain (files (read)) (not (or (and (eq t1 exec_t) (eq t2 bin_t)) (eq r1 r2))))
(constrain char_w (not (or (and (eq t1 exec_t) (eq t2 bin_t)) (eq r1 r2))))

(constrain (file (read)) (or (and (eq t1 exec_t) (neq t2 bin_t) ) (eq u1 u2) ) )
(constrain (file (open)) (dom r1 r2))
(constrain (file (open)) (domby r1 r2))
(constrain (file (open)) (incomp r1 r2))

(validatetrans file (eq t1 exec_t))

(mlsconstrain (file (open)) (not (or (and (eq l1 l2) (eq u1 u2)) (eq r1 r2))))
(mlsconstrain (file (open)) (or (and (eq l1 l2) (eq u1 u2)) (neq r1 r2)))
(mlsconstrain (file (open)) (dom h1 l2))

```

```

(mlsconstrain (file (open)) (domby l1 h2))
(mlsconstrain (file (open)) (incomp l1 l2))

(mlsvalidatetrans file (domby l1 h2))

(macro test_mapping ((classpermission cps))
  (allow bin_t auditadm_t cps))

(call test_mapping ((file (read))))
(call test_mapping ((files (read))))
(call test_mapping (char_w))

(defaultuser (file char) source)
(defaultrole char target)
(defaulttype (files) source)
(defaultrange (file) target low)
(defaultrange (char) source low-high)
)

(macro all ((type x))
  (allow x bin_t (policy.file (execute))))
)
(call all (bin_t))

(block z
  (block ba
    (roletype r t)
    (blockabstract z.ba)))

(block test_ba
  (blockinherit z.ba)
  (role r)
  (type t))

(block bb
  (type t1)
  (type t2)
  (boolean b1 false)
  (tunable tun1 true)
  (macro m ((boolean b))
    (tunableif tun1
      (true
        (allow t1 t2 (policy.file (write))))
      (false
        (allow t1 t2 (policy.file (execute))))))
  (booleanif b
    (true
      (allow t1 t2 (policy.file (read))))))

  (call m (b1))
)

(in bb
  (tunableif bb.tun1
    (true
      (allow bb.t2 bb.t1 (policy.file (read write execute))))))

```