ECS 235B Module 7
Take-Grant Model Rules
Take-Grant Protection Model

- A specific (not generic) system
  - Set of rules for state transitions
- Safety decidable, and in time linear with the size of the system
- Goal: find conditions under which rights can be transferred from one entity to another in the system
System

- objects (files, ...)
- subjects (users, processes, ...)
- don't care (either a subject or an object)

$$G \vdash_x G'$$ apply a rewriting rule $x$ (witness) to $G$ to get $G'$

$$G \vdash^* G'$$ apply a sequence of rewriting rules (witness) to $G$ to get $G'$

$R = \{ t, g, r, w, ... \}$ set of rights
Rules

take

grant
More Rules

These four rules are called the *de jure* rules.
Symmetry

1. \( x \) creates \((tg \text{ to new}) \ v \)
2. \( z \) takes \((g \text{ to } v) \) from \( x \)
3. \( z \) grants \((\alpha \text{ to } y) \) to \( v \)
4. \( x \) takes \((\alpha \text{ to } y) \) from \( v \)

Similar result for grant
Islands

• $tg$-path: path of distinct vertices connected by edges labeled $t$ or $g$
  • Call them “$tg$-connected”
• island: maximal $tg$-connected subject-only subgraph
  • Any right one vertex has can be shared with any other vertex
Initial, Terminal Spans

• *initial span* from \( x \) to \( y \)
  • \( x \) subject
  • \( tg \)-path between \( x \), \( y \) with word in \( \{ t^* g \} \cup \{ v \} \)
  • Means \( x \) can give rights it has to \( y \)

• *terminal span* from \( x \) to \( y \)
  • \( x \) subject
  • \( tg \)-path between \( x \), \( y \) with word in \( \{ t^* \} \cup \{ v \} \)
  • Means \( x \) can acquire any rights \( y \) has
Bridges

• bridge: \( tg \)-path between subjects \( x, y \), with associated word in
  \[ \{ \overrightarrow{t^*}, \overrightarrow{t^*}, \overrightarrow{t^*g}, \overrightarrow{t^*}, \overrightarrow{t^*g}, \overrightarrow{t^*} \} \]
  • rights can be transferred between the two endpoints
  • \( not \) an island as intermediate vertices are objects
Example

- islands \( \{ p, u \} \ { w \} \ { y, s' \} \)
- bridges \( uvw; wxy \)
- initial span \( p \) (associated word \( v \))
- terminal span \( s's \) (associated word \( \rightarrow t \))
Quiz

Which of the following, *taken as a whole*, is a bridge, an island, and an initial span?

1. $\begin{align*}
&\text{u} \quad t \quad v \quad t \quad w \quad g \quad x \\
\end{align*}$

2. $\begin{align*}
&a \quad t \quad b \quad g \quad c \quad g \quad d \\
\end{align*}$

3. $\begin{align*}
&\text{u} \quad t \quad v \quad t \quad w \quad g \quad x \\
\end{align*}$