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)

\[ G \vdash_x G' \quad \text{apply a rewriting rule } x \text{ (witness) to } G \text{ to get } G' \]

\[ G \vdash^* G' \quad \text{apply a sequence of rewriting rules (witness) to } G \text{ to get } G' \]

\[ R = \{ t, g, r, w, \ldots \} \quad \text{set of rights} \]
Rules

take

grant

\[\begin{align*}
t &\quad \alpha \\
g &\quad \alpha \\
\alpha &\quad t \\
\alpha &\quad g
\end{align*}\]
More Rules

create \[ \bullet \quad \vdash \quad \bullet \alpha \]  
remove \[ \alpha \quad \vdash \quad \alpha - \beta \]

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

1. \(x\) creates (\(tg\) to new) \(v\)
2. \(z\) takes (\(g\) to \(v\)) from \(x\)
3. \(z\) grants (\(\alpha\) to \(y\)) to \(v\)
4. \(x\) takes (\(\alpha\) 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 $\{ \overrightarrow{t^*g} \} \cup \{ v \}$
  - 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 $\{ \overrightarrow{t^*} \} \cup \{ v \}$
  - Means $x$ can acquire any rights $y$ has
Bridges

• bridge: $tg$-path between subjects $x$, $y$, with associated word in
  \[ \{ t^*, t^*, t^g t^*, t^g t^* \} \]
  • Rights can be transferred between the two endpoints
  • It is *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 t)