

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)

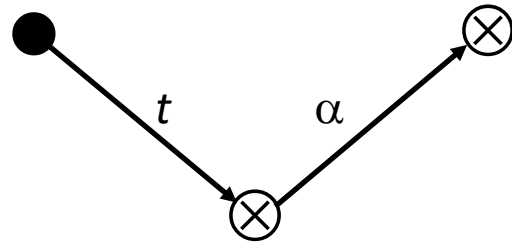
$G \vdash_x G'$ apply a rewriting rule x (witness) to G to get G'

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

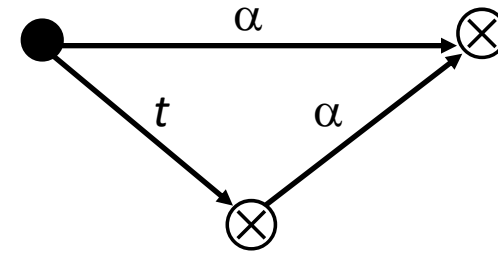
$R = \{ t, g, r, w, \dots \}$ set of rights

Rules

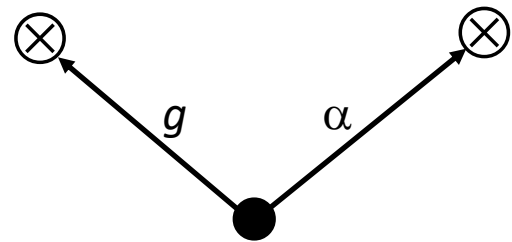
take



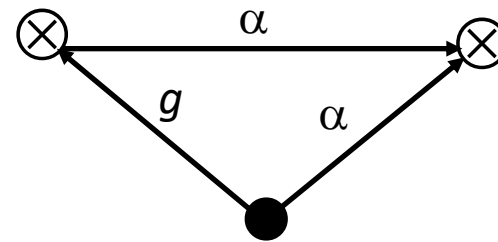
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grant



\vdash

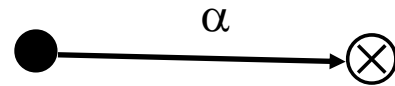


More Rules

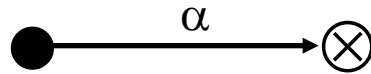
create



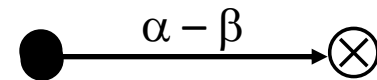
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remove

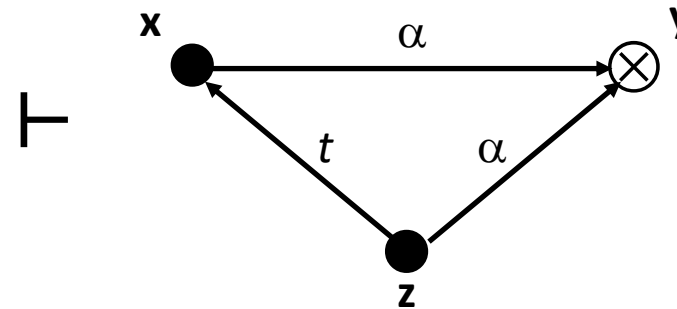
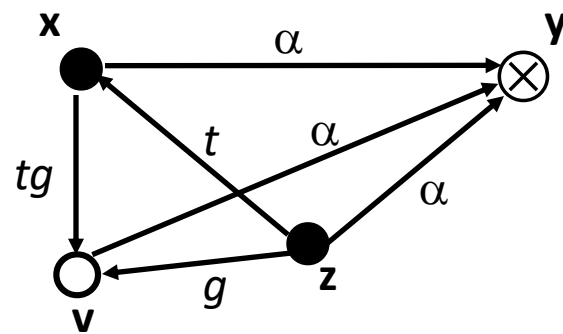


\vdash



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 (α to y) to v
4. x takes (α 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 $\{\vec{t}^* \vec{g}\} \cup \{v\}$
 - 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 $\{\vec{t}^*\} \cup \{v\}$
 - Means **x** can acquire any rights **y** has

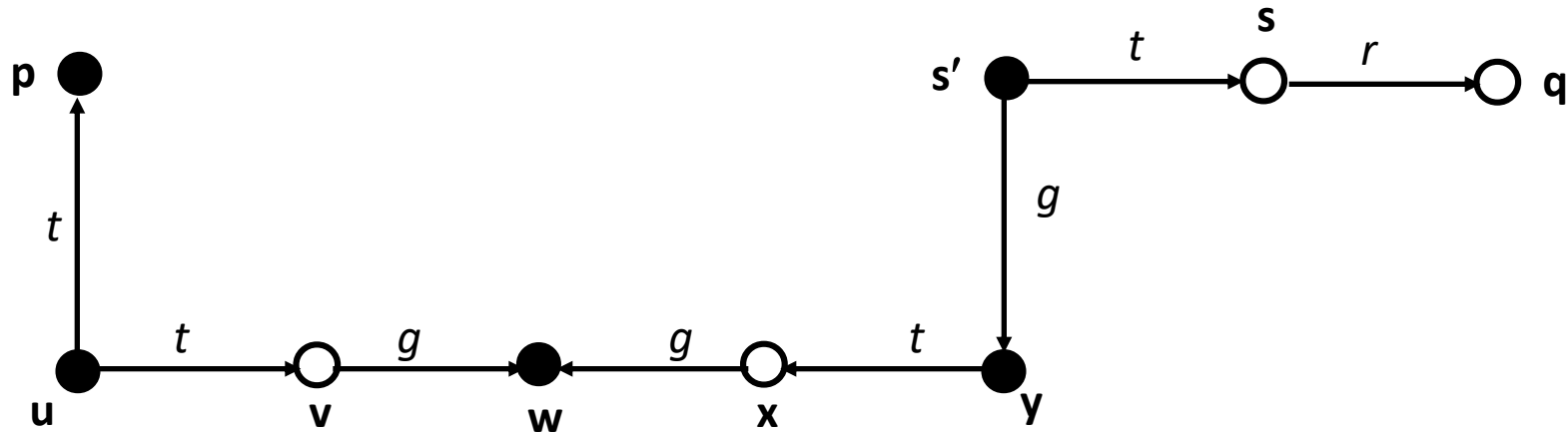
Bridges

- bridge: tg -path between subjects \mathbf{x} , \mathbf{y} , with associated word in

$$\{ \vec{t}^*, \overleftarrow{t}^*, \vec{t}^* \overleftarrow{g} \overleftarrow{t}^*, \vec{t}^* \overrightarrow{g} \overleftarrow{t}^* \}$$

- rights can be transferred between the two endpoints
- *not* an island as intermediate vertices are objects

Example



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

Quiz

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

