ECS 235B Module 10
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, …)
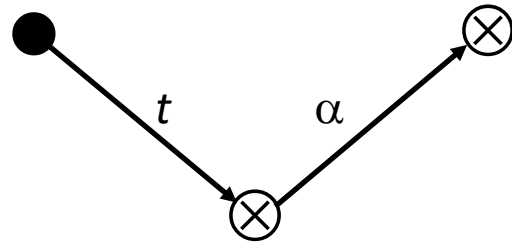
⊗   don't care (either a subject or an object)

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

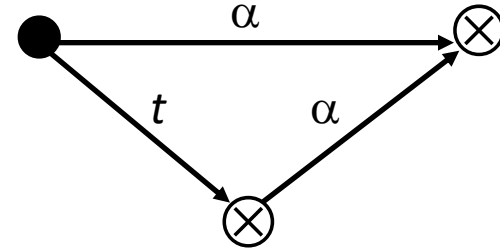$G \vdash^* G'$ apply a sequence of rewriting rules (witness) to G to get G'
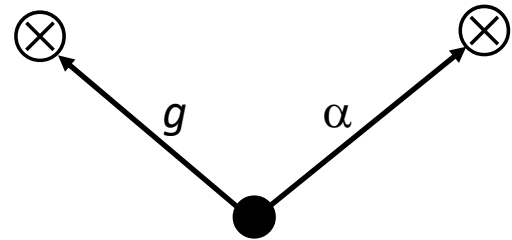
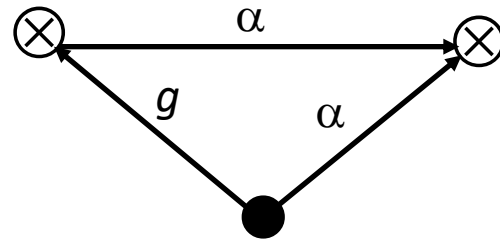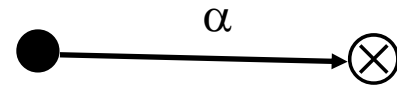$R = \{\, t, g, r, w, \dots \,\}$ set of rights

Rules

take

grant

More Rules

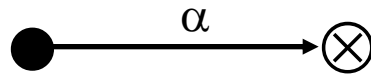create

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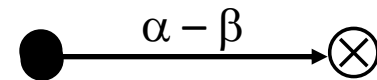
These four rules are called the *de jure* rules

Symmetry
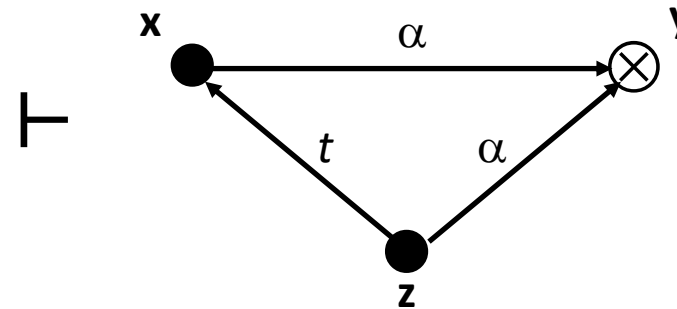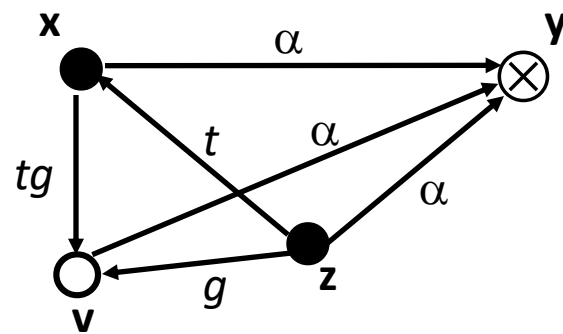
1. **x** creates (*tg* to new) **v**
2. **z** takes (*g* to **v**) from **x**
3. **z** grants (α to **y**) to **v**
4. **x** takes (α to **y**) from **v**

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 $\{\vec{t^*}\vec{g}\} \cup \{\nu\}$
  - 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 $\{\vec{t^*}\} \cup \{\nu\}$
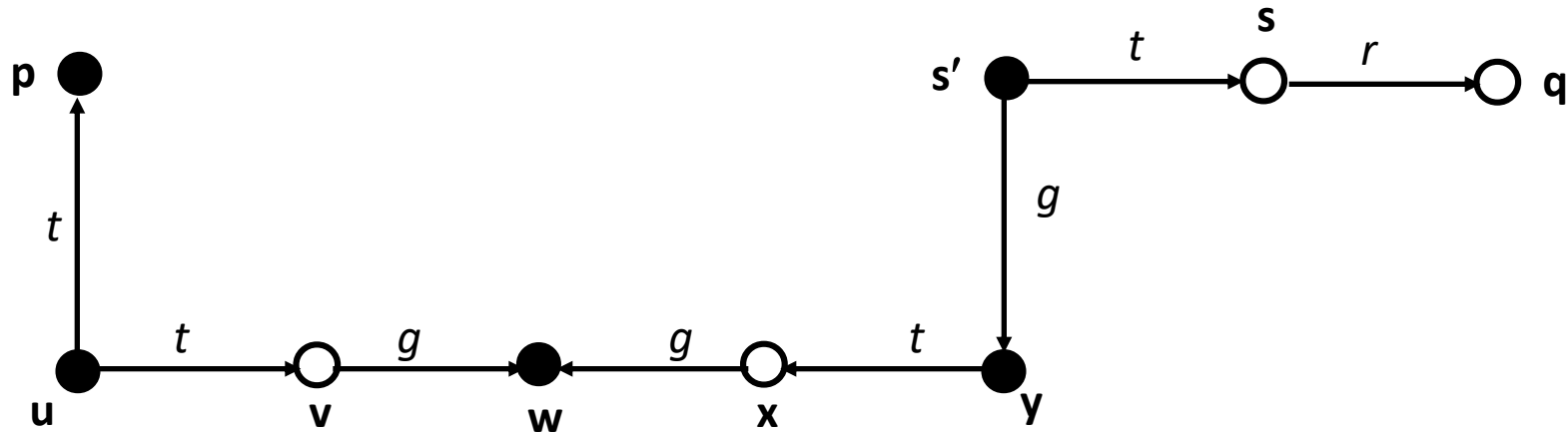 - Means **x** can acquire any rights **y** has

Bridges

- bridge: *tg*-path between subjects **x**, **y**, with associated word in
$$\{\ \overrightarrow{t}*,\ \overrightarrow{t}*,\ \overrightarrow{t}*\overleftarrow{g}\ \overleftarrow{t}*,\ \overrightarrow{t}*\overrightarrow{g}\ \overleftarrow{t}*\ \}$$
  - 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 ν)
- terminal span   **s′s** (associated word $\vec{t}$)

Quiz

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

1. ●——*t*——○——*t*——○——*g*——●
   u   v   w   x

2. ●——*t*——●——*g*——●——*g*——●
   a   b   c   d

3. ●——*t*——○——*t*——○←——*g*——●
   u   v   w   x