

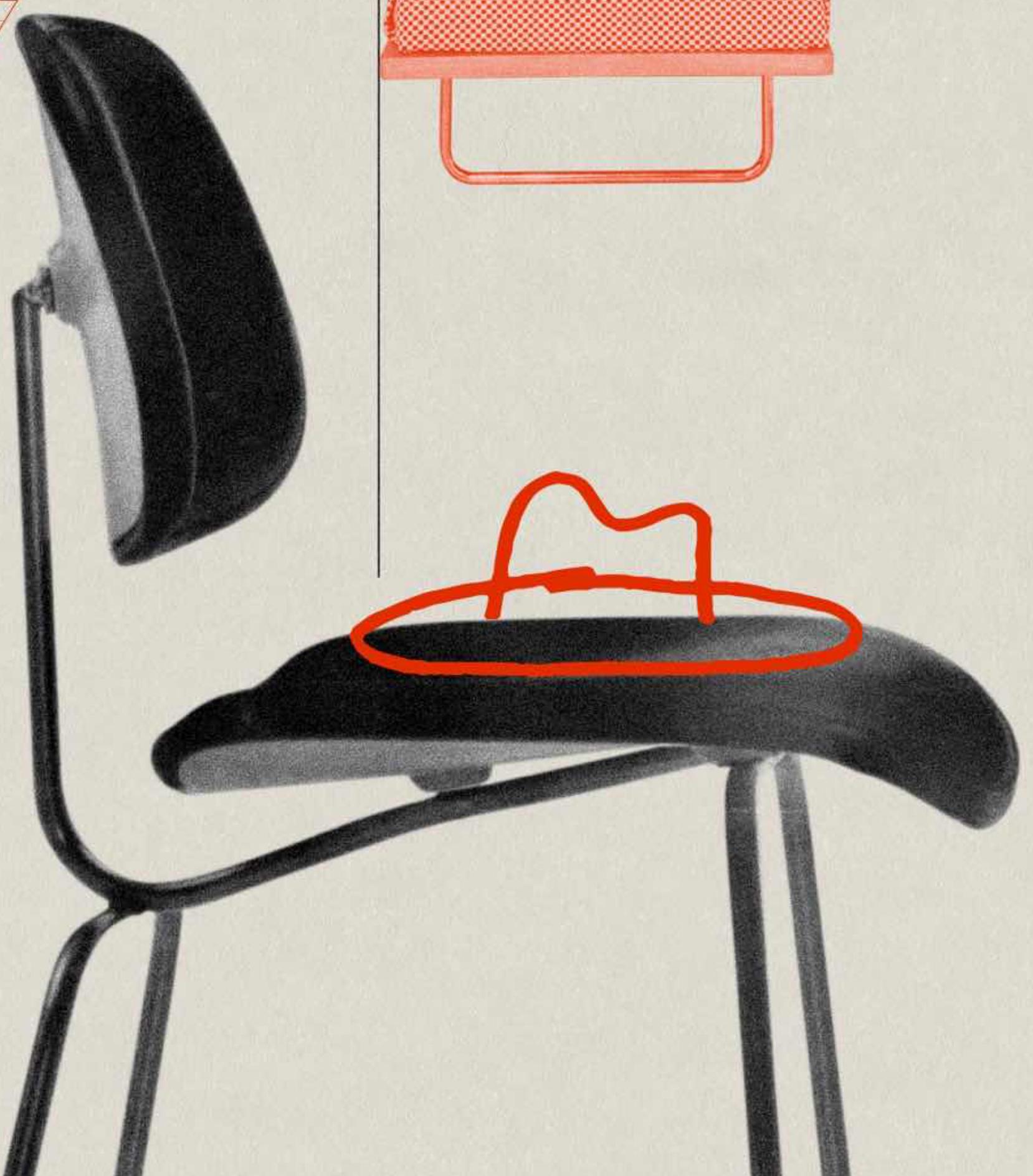
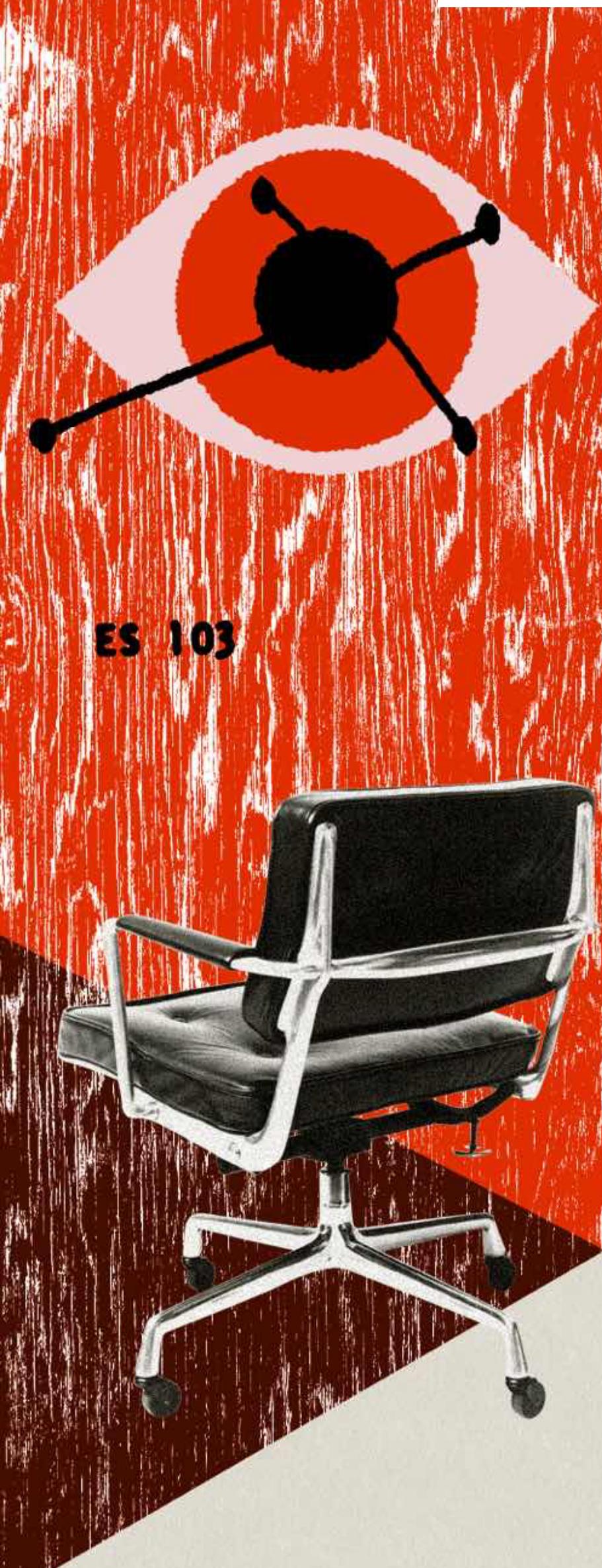
# designing concepts

Daniel Jackson · Autodesk Oslo Workshop · August 25-26, 2025

on details

Charles Eames Ray Eames 13721

The details are not details. They make the design. Charles Eames



# what kind of behavioral details?

*for online bookstore, eg*

## **details to include**

steps the user takes  
system responses to the user  
data the user gives & gets

buy a book  
book gets delivered  
address, arrival estimate

## **details to exclude**

coding & algorithmic details  
distribution, replication, etc  
internal steps

order id has checksum  
orders on separate server  
request to warehouse

## **also UI independent**

layout & styling of pages  
navigation between pages  
“micro-steps”

# UI-dependent questions: important but not conceptual

## Terra - Eataly Boston

★ 4.5 (3940) • \$31 to \$50 • Contemporary Italian

Overview Experiences Popular dishes Photos

### About this restaurant

Charming Lively Good for special occasions

Located on the third floor of Eataly Boston, Terra is a unique restaurant inspired by earth and fire. The dining room centers around a wood-burning Italian grill, where the Terra culinary team cooks raw ingredients over burning flames, allowing the...

[Read more](#)

### Experiences

#### Brunch at Terra

Aug 22, 2024 - Jan 28, 2026

Every Saturday and Sunday from 11AM-4PM, indulge in our brunch menu featuring all your favorites...with an Italian...

how many steps  
to enter data?

should available  
slots be red?

Make a reservation

2 people

Jun 13, 2025

7:00 PM

Select a time

6:00 PM\*

6:15 PM\*

8:00 PM\*

9:00 PM\*

+1,000 pts

+1,000 pts

Notify me

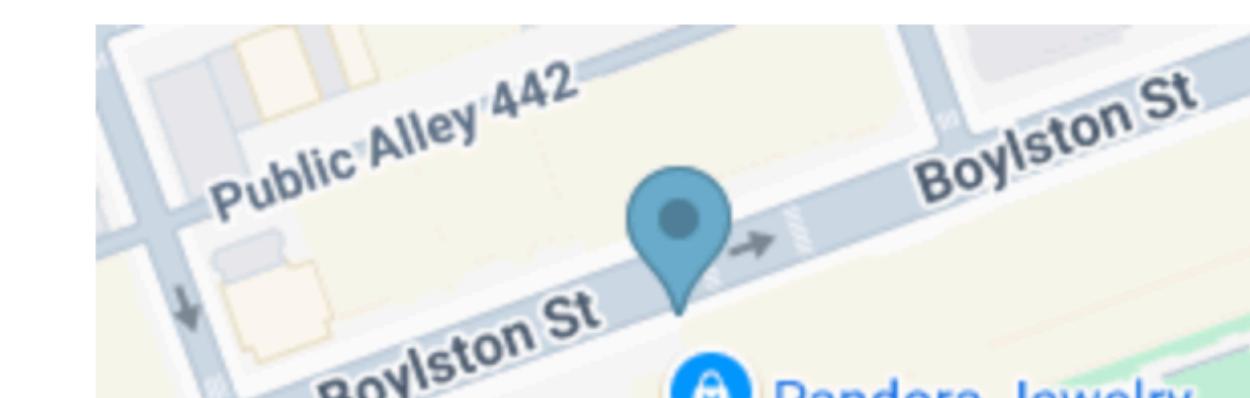
Booked 110 times today

You're in luck! We still have 4 timeslots left

Experiences are available. [See details](#)

Additional seating options

is this helpful?



# why postpone UI-dependent details?

**they're a lot of work**

we need to tend to  
more basic things first

**they can be a distraction**  
color of slots before we've  
decided that we have slots?

**want to judge a UI**  
projects concepts well?  
then need pure concepts

**shared understanding**  
between UX & engineering  
capturing the overlap

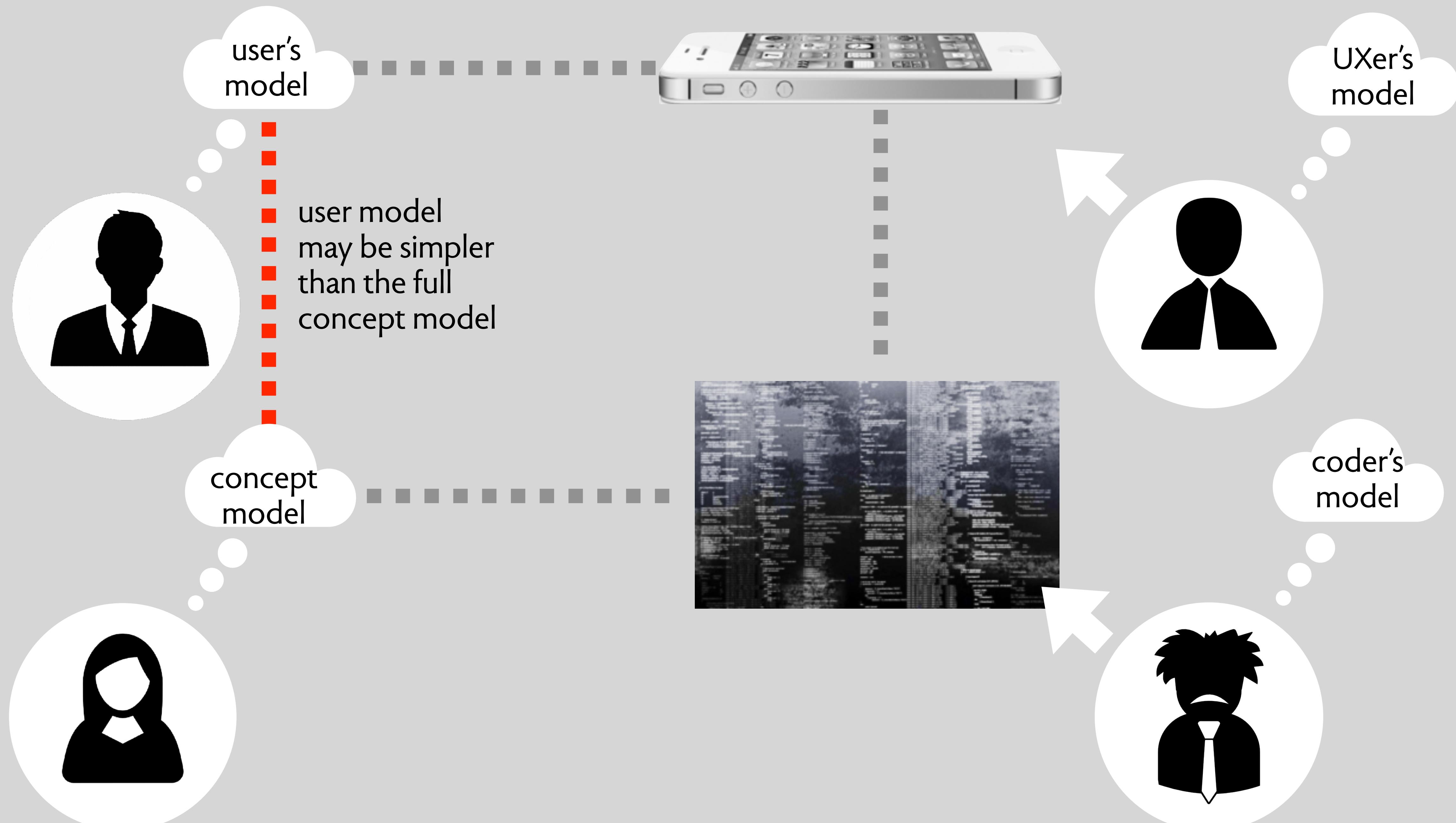
**what this doesn't mean**

can't sketch UI ideas  
during concept design  
often helpful to concretize

# which steps are concept actions?

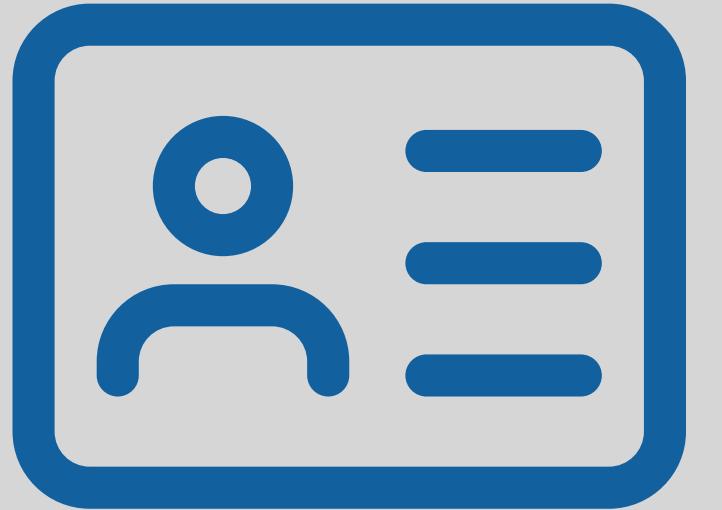


# many models playing different roles



a full example  
a reservation concept

# how to design a concept



**pick a name**  
specific to function  
but for general use



**describe purpose**  
why design or use it?  
value to stakeholders



**tell story**  
a simple scenario  
of how it's used

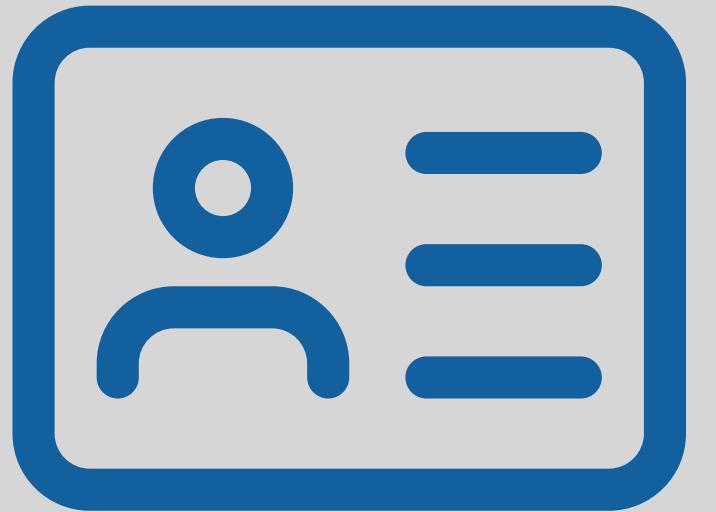


**list actions**  
by user or system  
key steps, not UI



**specify state**  
what's remembered  
enough for actions

# picking a name



**pick a name**  
specific to function  
but general enough

Restaurant

RestaurantReservation

OpenTableReservation

Reservation



# describing a purpose



**describe purpose**  
why design or use it?  
value to stakeholders

reducing wait time for tables



maximizing use of available tables

making money for reservation service

tracking occupancy patterns

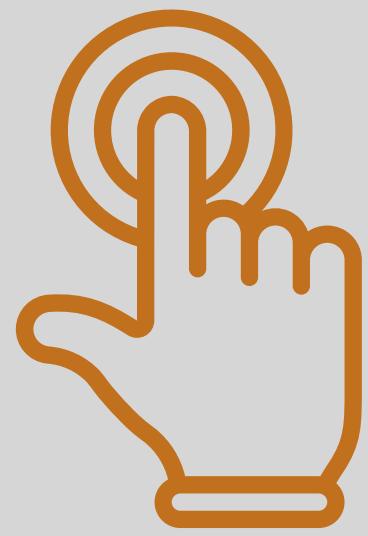
# telling the story

the restaurant makes slots available at various times; a diner reserves for a particular time, and then can be assured of being seated at that time



**tell story**  
a simple scenario  
of how it's used

# listing actions



**list actions**  
by user or system  
key steps, not UI

select date  
select time  
click reserve

no! these are  
all low-level  
UI interactions

login  
search for restaurant  
review restaurant

no! these belong  
to other concepts

let's return to our  
story for hints:

the restaurant makes  
slots available at various  
times; a diner reserves for  
a particular slot, and then  
can be assured of being  
seated at that time

createSlot  
reserve  
seat



what other actions  
might be needed?

cancel

noShow

deleteSlot

# defining action arguments

createSlot

reserve

seat

cancel

noShow

deleteSlot

createSlot (time)

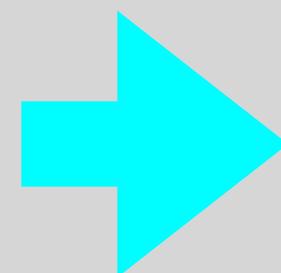
reserve (user, time): reservation

seat (reservation)

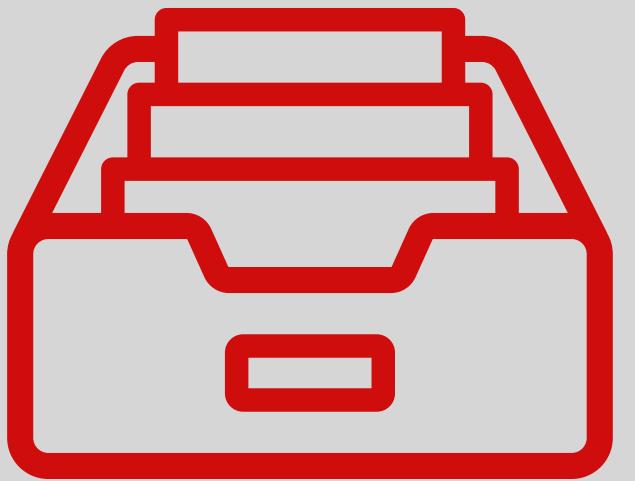
cancel (reservation)

noShow (reservation)

deleteSlot (slot)



# devising the state



**specify state**  
what's remembered  
enough for actions

a set of Slots with  
a Time  
a set of Reservations with  
a User  
a Slot

# defining the actions

## state

a set of Slots with  
a Time  
a set of Reservations with  
a User  
a Slot  
a seated Flag

## actions

createSlot (time)

### effect

creates a fresh slot for the time

reserve (user, time): reservation

### requires

some slot at this time not yet reserved

### effect

creates & returns a fresh reservation  
associates it with user and the slot

“precondition”  
what's true of state before

“postcondition”  
relates state after to before

seat (reservation)

### requires

reservation is for about now

### effect

marks reservation as seated

# explaining state notation

## state

a set of Slots with  
a Time

a set of Reservations with  
a User  
a Slot  
a seated Flag

this means each slot has a property  
called *time* that is a Time

this means each reservation has a property  
called *seated* that is a Flag

**state**

a set of Slots with

a Time

a set of Reservations with

a User

a Slot

a seated Flag

**actions**

createSlot (time)

**effect** creates a fresh slot for the time

reserve (user, time): reservation

**requires** some slot at this time not yet reserved

**effect** creates & returns a fresh reservation

associates it with user and slot

seat (reservation)

**requires** reservation is for about now

**effect** marks reservation as seated

initially

slot	time

res	user	slot	seated

createSlot (July 4, 2025 at 7pm)

slot	time
s0	July 4, 2025 at 7:00pm

res	user	slot	seated

reserve (u1, July 4... 7pm): r0

slot	time
s0	July 4, 2025 at 7:00pm

res	user	slot	seated
r0	u1	s0	FALSE

seat (r0)

slot	time
s0	July 4, 2025 at 7:00pm

res	user	slot	seated
r0	u1	s0	TRUE

# putting it all together



**pick a name**  
specific to function  
but for general use



**describe purpose**  
why design or use it?  
value to stakeholders



**tell story**  
a simple scenario  
of how it's used  
including setup



**list actions**  
by user or system  
key steps, not UI



**specify state**  
what's remembered  
enough for actions

**concept** RestaurantReservation

**purpose** reducing wait time for tables

**principle** the restaurant makes slots available at various times; a diner reserves for a particular time, and then can be assured of being seated at that time

**state**

a set of Slots with  
a Time

a set of Reservations with  
a User  
a Slot  
a seated Flag

**actions**

`createSlot (time)`

**effect** creates a fresh slot for the time

`reserve (user, time): reservation`

**requires** some slot at this time not yet reserved

**effect** creates & returns a fresh reservation

associates it with user and slot

`seat (reservation)`

**requires** reservation is for about now

**effect** marks reservation as seated

# your turn: designing a URL shortening concept

🔗 Shorten a long URL

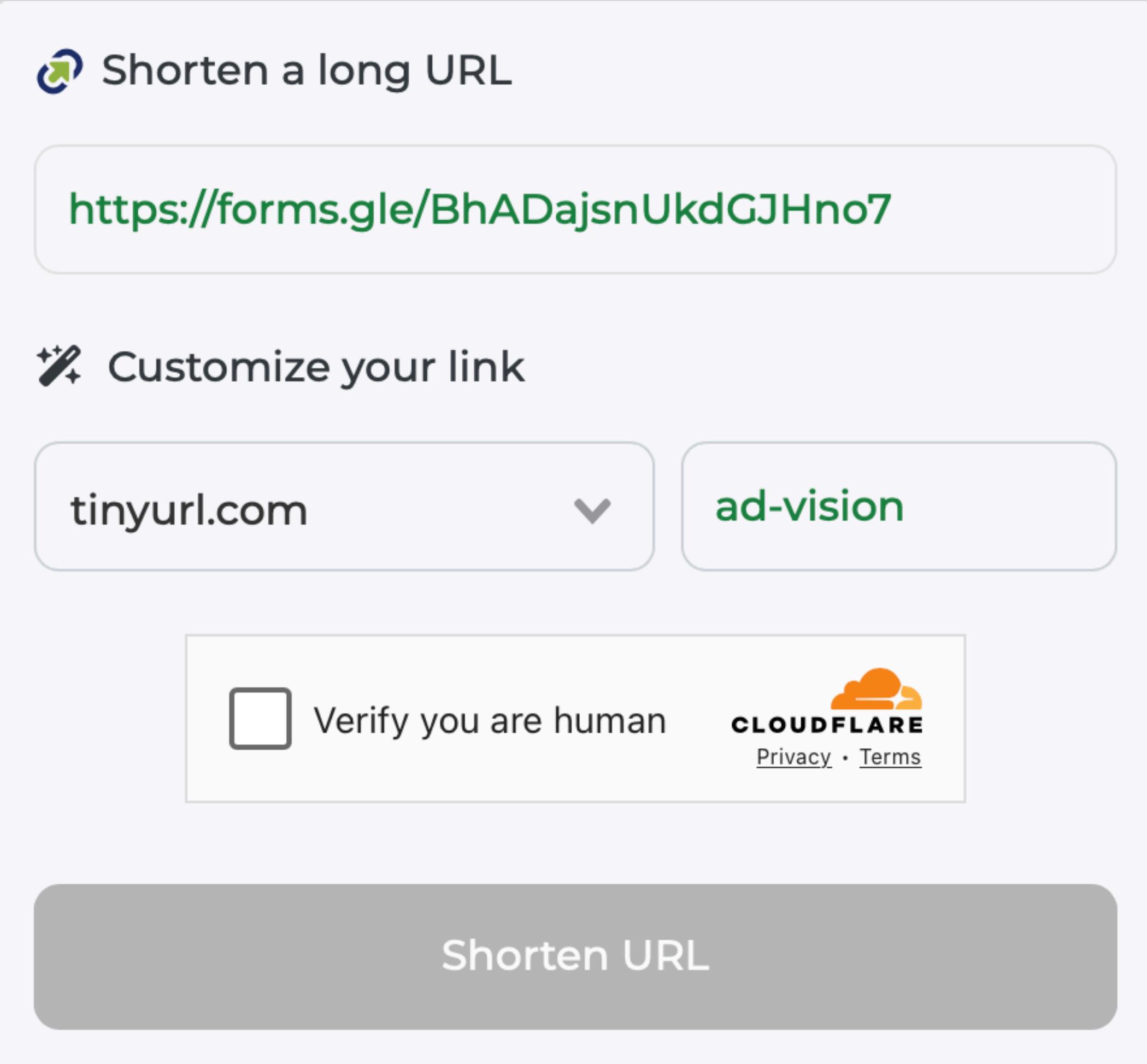
<https://forms.gle/BhADajsnUkdGJHno7>

📝 Customize your link

tinyurl.com  ad-vision

Verify you are human CLOUDFLARE Privacy • Terms

**Shorten URL**



**define the core concept**  
for a URL shortener like tinyurl  
consider simple enhancements

**elements of your concept**  
name, purpose, principle  
then actions, then states

**for each action**  
say how it updates the state

# one possible solution

**concept** UrlShortening

**purpose** shorter or more memorable way to link

**principle** after create generates a short url, lookup will return the original url

**state**

- a set of Shortenings with
  - a targetUrl String
  - a shortUrl String

**actions**

register (shortUrlBase, targetUrl: String): (shortUrl: String)

**effect** pick any shortUrl of the form shortUrlBase/foo that has not been used  
return it and create a shortening for it

lookup (shortUrl: String): (targetUrl: String)

**requires** some shortening with shortUrl  
effect returns targetUrl corresponding to it

delete (shortUrl: String)

**requires** some shortening with shortUrl  
**effect** removes the shortening

state invariants  
aka integrity constraints

# designing invariants for concepts

## **concept** PasswordSession

### **state**

a set of Users with  
a username String  
a password String

### *invariants?*

at most one user with a given username

### *what goes wrong if violated?*

## **concept** RestaurantReservation

### **state**

a set of Slots with  
a Time  
a set of Reservations with  
a User  
a Slot  
a seated Flag

at most one reservation for a given slot

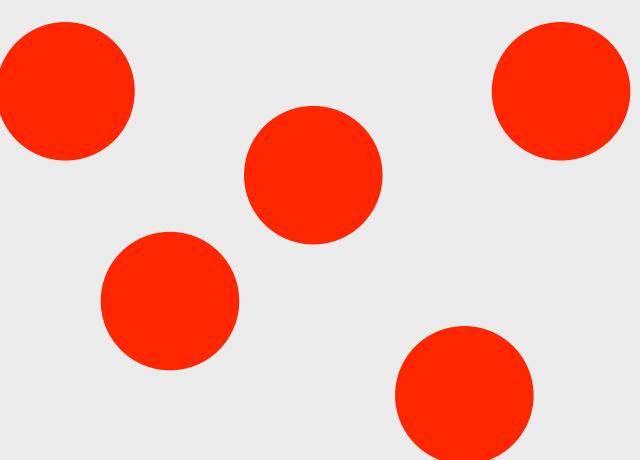
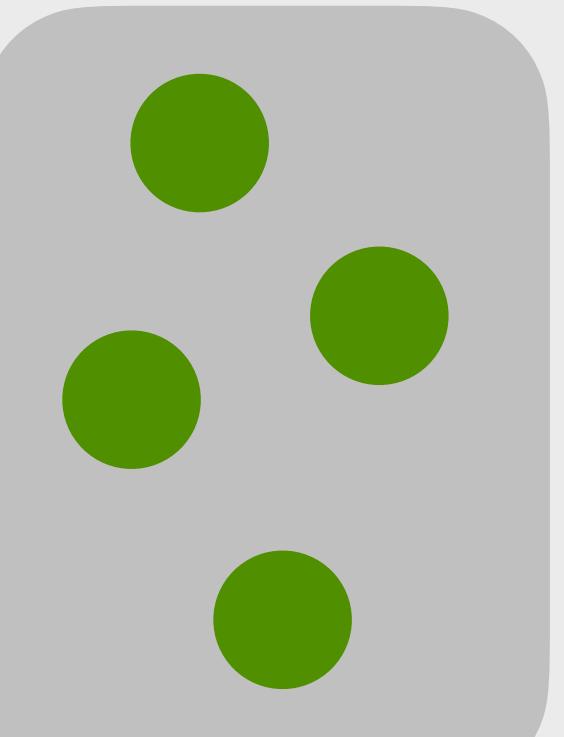
at most one reservation for a given user

reservation not seated if slot time before now?

# classifying states

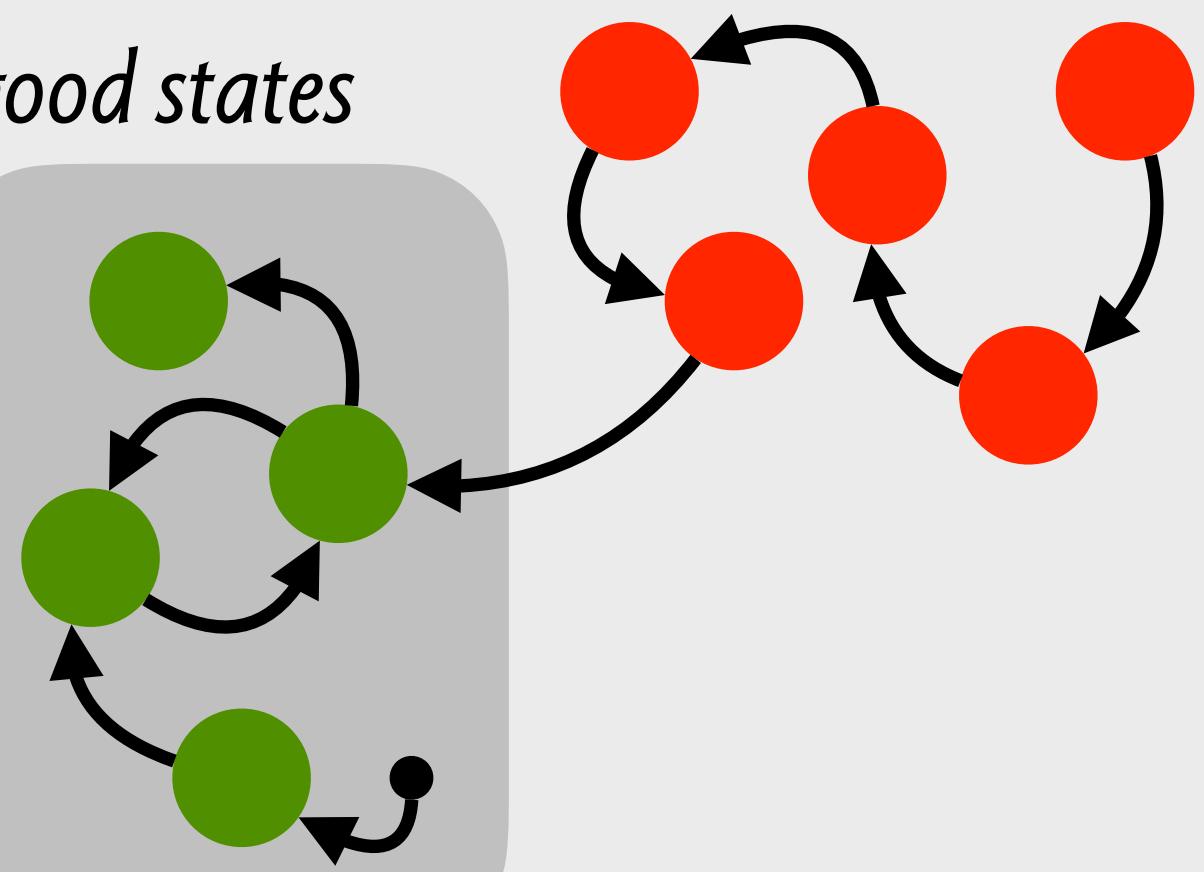
*all states*

*good states*



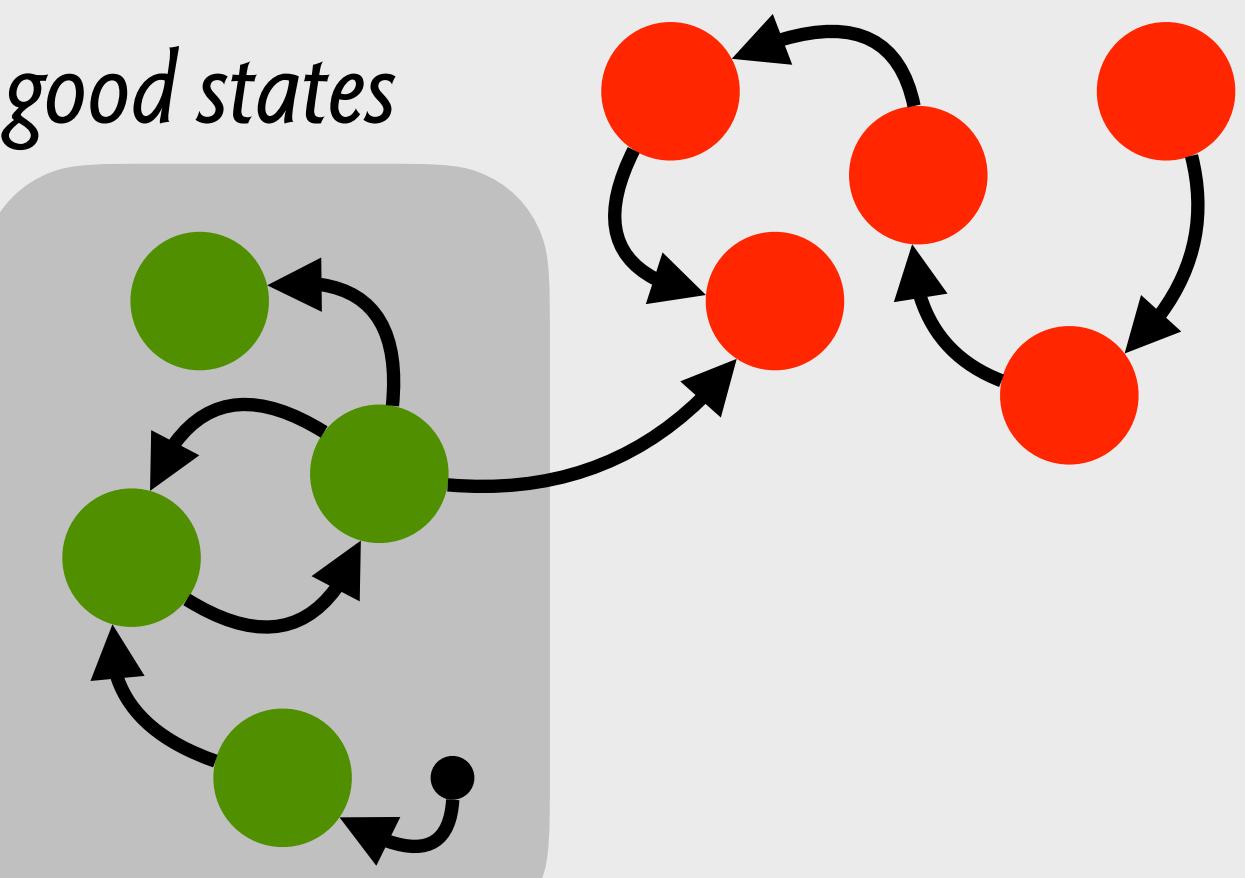
# a safe design

*all states*



# an unsafe design

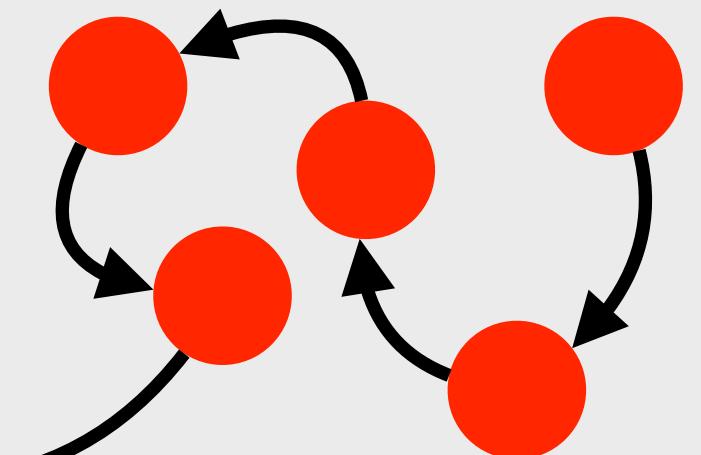
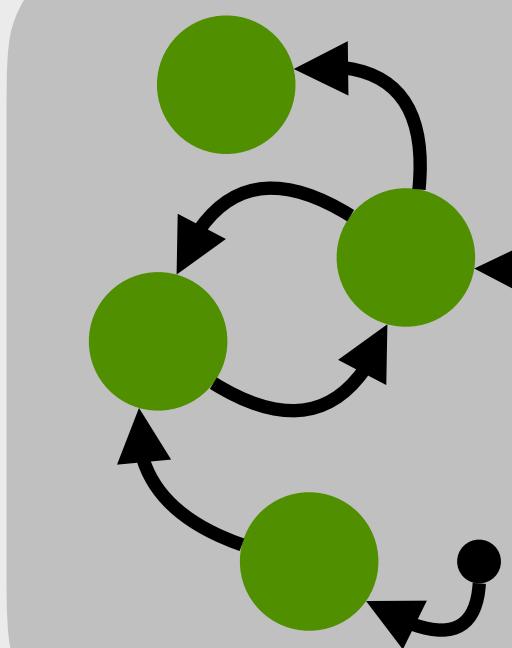
*all states*



# inductive reasoning strategy

*all states*

*good states*



**what we want to avoid**  
reasoning about all scenarios  
complicated and tedious!

**a better approach**

reasoning about steps taken by actions

- (1) check that the initial state is good
- (2) and no action goes from a good to a bad state

# applying inductive reasoning to reservation concept

## concept RestaurantReservation

### state

a set of Slots with  
a Time

a set of Reservations with  
a User  
a Slot  
a seated Flag

### actions

createSlot (time)

**effects** creates a fresh slot for the time

reserve (user, time): reservation

**requires** some slot at this time not yet reserved

**effects** creates & returns a fresh reservation

associates it with user and slot

seat (reservation)

**requires** reservation is for about now

**effects** marks reservation as seated

*the invariant we want to check*

at most one reservation for a given slot

*check that the invariant holds in initial state*

initially, no reservations



*check each action preserves invariant*



only the reserve action modifies set of reservations

reserve action ensures slot is not reserved

did your URL shortener have any invariants?

states & data models  
getting more precise

# simplifying the state

## concept RestaurantReservation

### state

a set of Slots with

a Time

a set of Reservations with

a User

a Slot

*before, we represented like this*

slot	time
s0	July 4, 2025 at 7:00pm

res	user	slot
r0	u1	s0

*here's a simpler, more atomized representation*

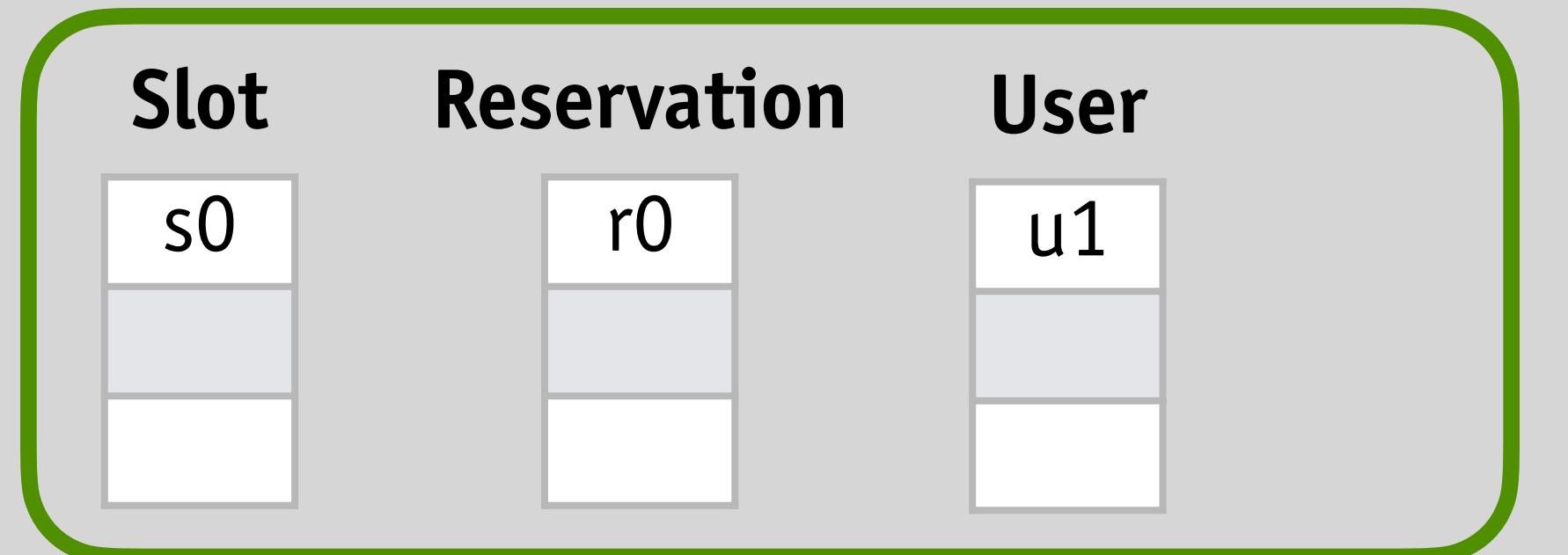
Slot	Reservation	User
s0	r0	u1

**these are SETS**

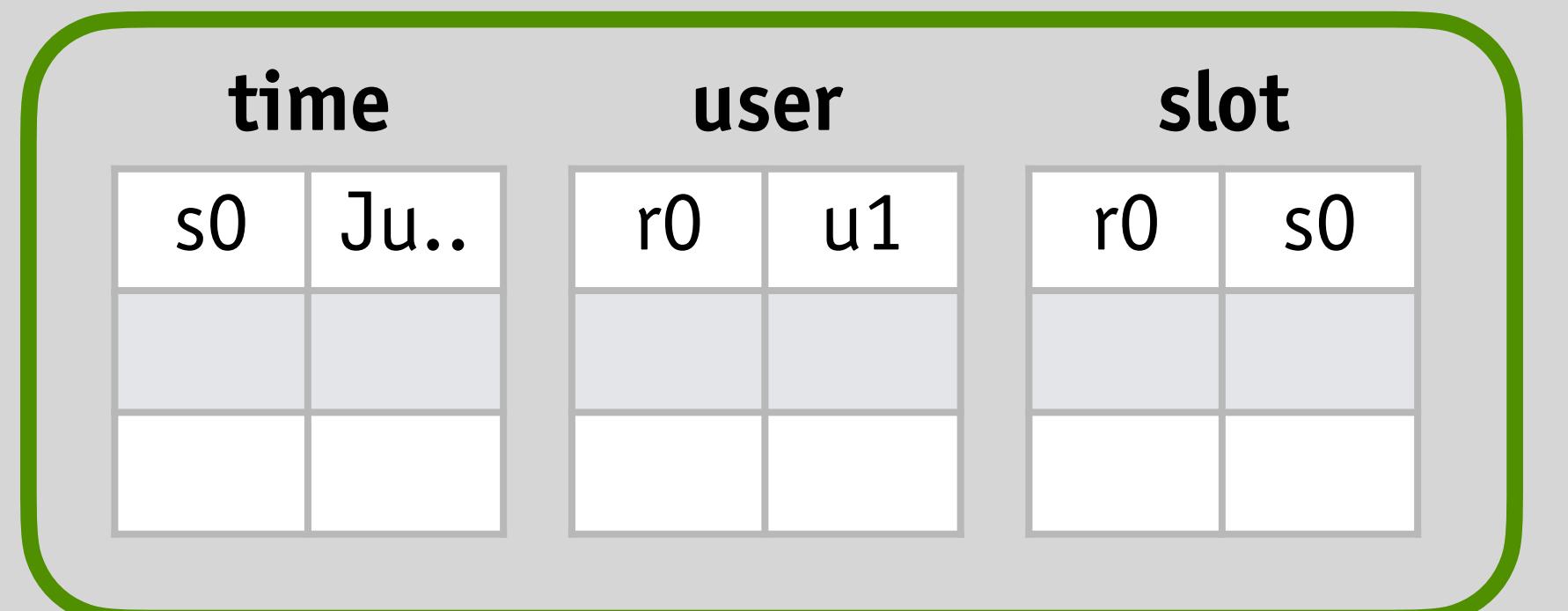
time	user	slot
s0	Ju..	r0
		u1
		s0

**these are BINARY RELATIONS**

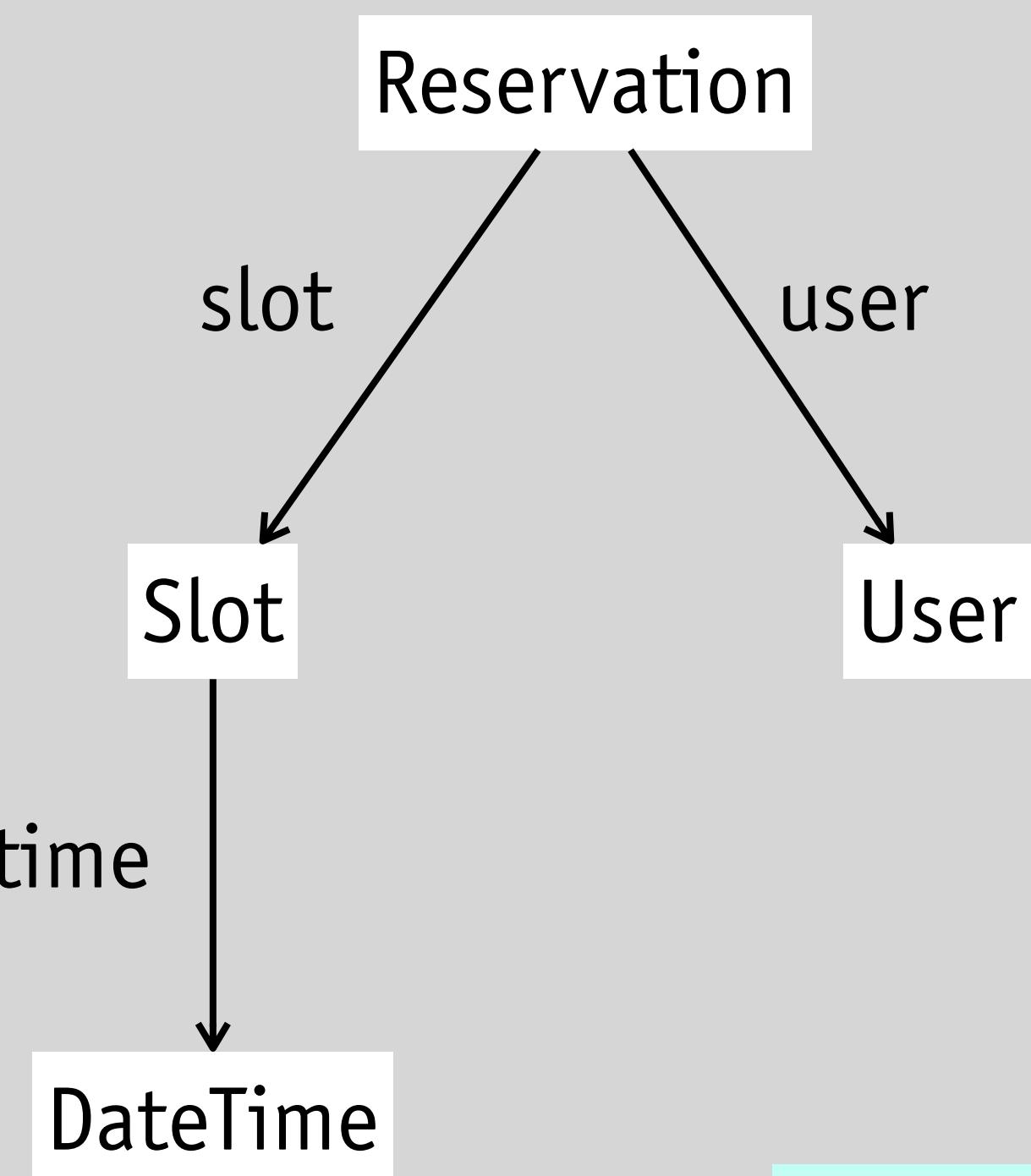
# a diagrammatic form



**these are SETS**



**these are BINARY RELATIONS**



**why kind of set is DateTime?**

a set of built-in values

**what are the values of Slot, eg?**

they're identifiers

# about this notation

**states can be represented as just sets & binary relations**

never need tables with more than two columns

**this allows a nice diagrammatic representation**

this is the “entity relationship diagram”

**there are no objects here**

a slot is just an identifier associated with a time etc

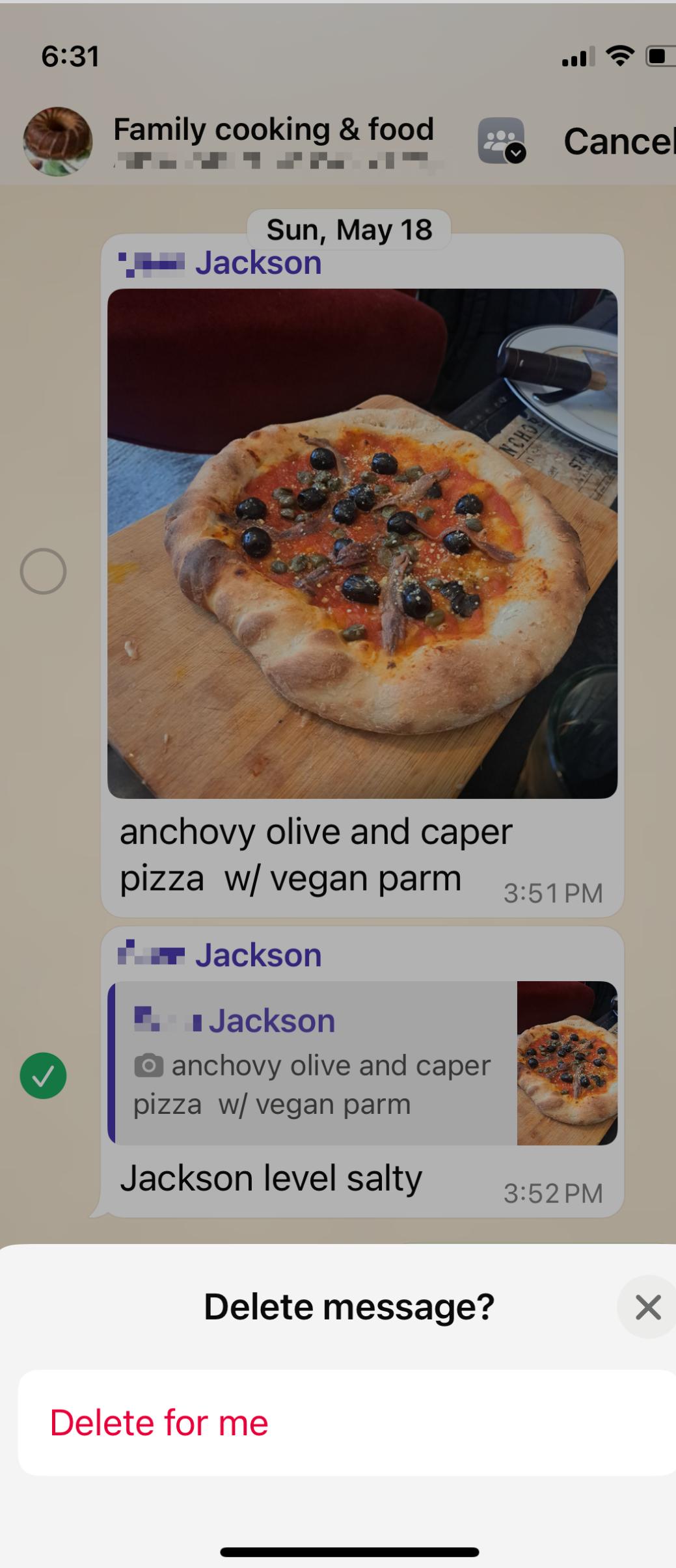
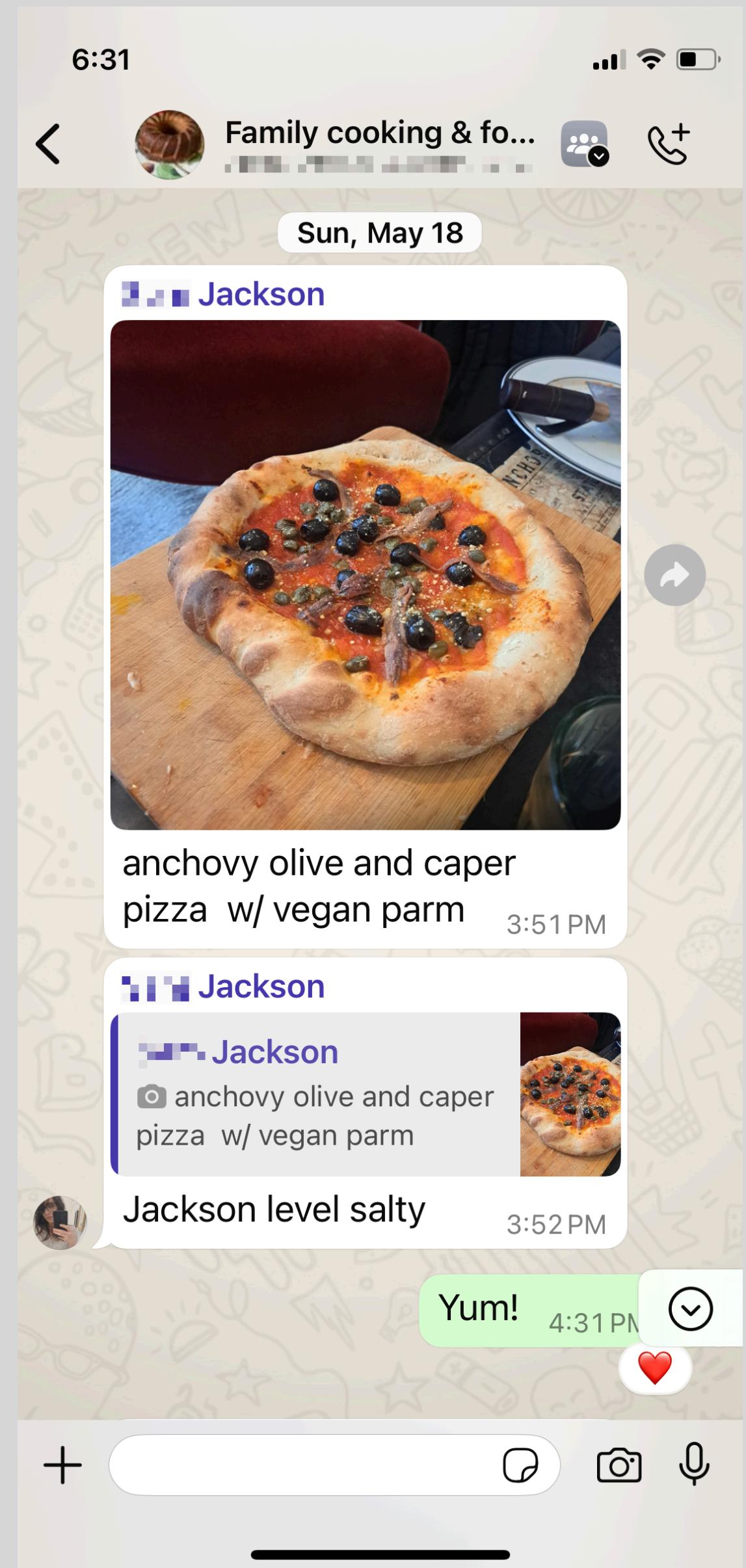
not a composite object (but could be implemented as one)

**why this model helps**

succinct and precise, brings clarity during design

easily translated into code (and database schemas etc)

# your turn: designing state for WhatsApp



**some features shown here**  
sent & received messages  
replies to messages  
deleting messages

**why might group members see different messages?**  
only see messages when member  
you can “delete for me”

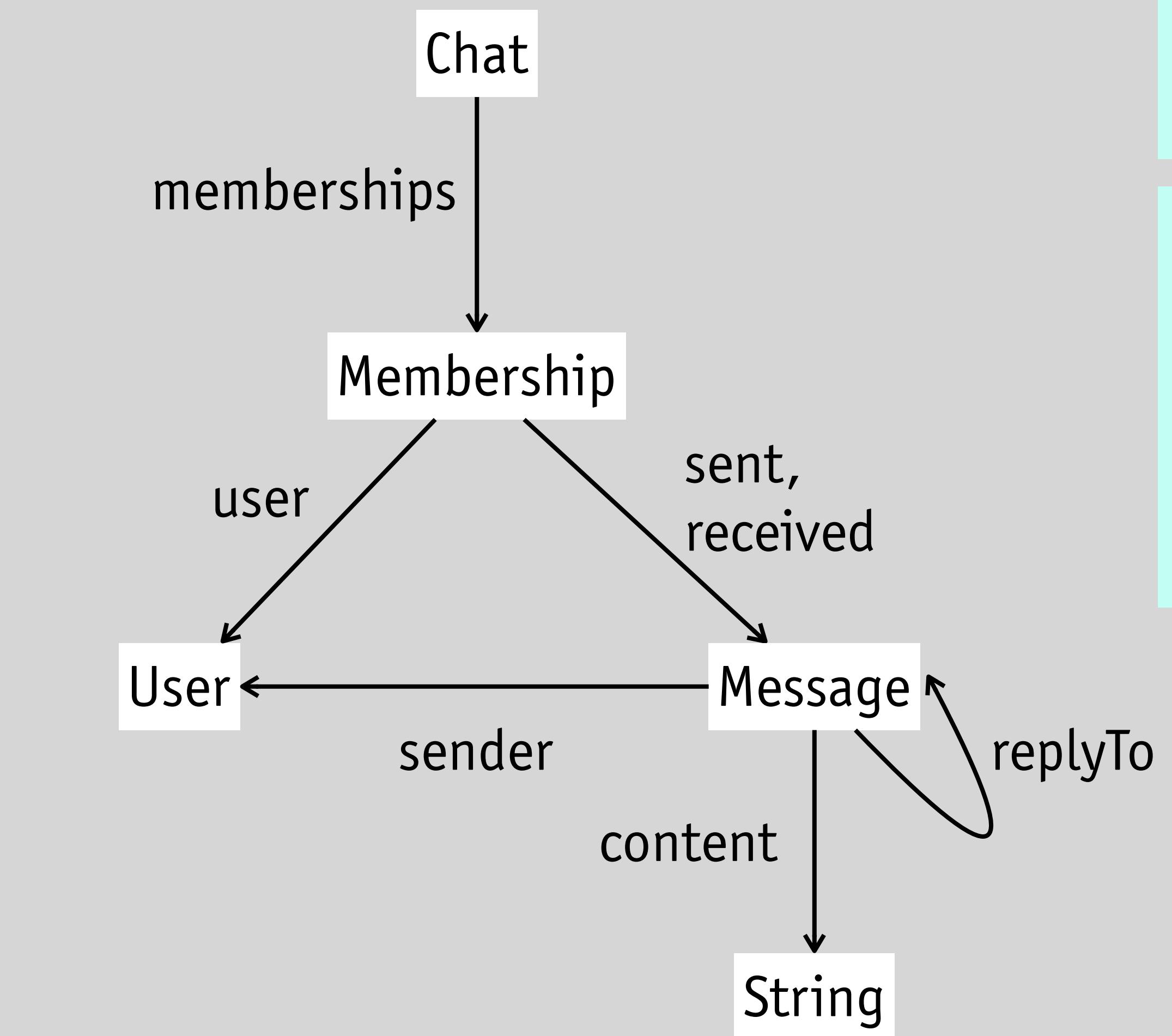
can you define the state of  
WhatsApp's **GroupChat** concept?  
use a diagram or text

# a possible solution

**concept** GroupChat

**state**

a set of Chat with  
a set of Memberships  
a set of Memberships with  
a User  
a sent set of Messages  
a received set of Messages  
a set of Messages with  
a sender User  
a content String  
an optional replyTo Message



**why memberships vs. users as members?**

user has different messages in each chat

**why sender if have user's sent messages?**

user may have deleted message others still see

heuristics  
for states & actions

# do you have enough actions?

**is purpose/value delivered?**

note that have info in state may be enough

**have you covered the whole life cycle?**

is there an initial setup? a winding down?

**are there ways to undo previous actions?**

or to compensate if erroneous?

**do all nouns have create, update, delete?**

for associated state?

seat action?

create slots?

unseat?

cancel reservation?

change reservation?

**Make a reservation**

2 people

Jun 9, 2025

7:00 PM

Select a time

6:00 PM\*

6:45 PM\*

7:00 PM\*

7:15 PM\*

+1,000 pts

9:00 PM\*

Notify me

+1,000 pts

🔥 Booked 107 times today

Experiences are available. [See details](#)

FTA Additional seating options

**concept Reservation  
actions reserve...**

# do you have a rich enough state?

**can you support all your actions?**

determine if allowed, and generate results

**should you track history?**

remember completions, deletions, undos?

**what info about action occurrence?**

maybe also who did it? when?

table sizes?

retain after seat?

by vs. for?  
time of reservation?

**Make a reservation**

2 people

Jun 9, 2025

7:00 PM

Select a time

6:00 PM\*

6:45 PM\*

7:00 PM\*

7:15 PM\*

+1,000 pts

9:00 PM\*

Notify me

+1,000 pts

🔥 Booked 107 times today

Experiences are available. [See details](#)

Additional seating options

**concept** Reservation

**actions** createSlot, reserve, cancel,  
seat, unseat, no-show, ...

## check your understanding

**When a concept has stronger state invariants... (select all that apply)**

- (a) User behavior will generally be more constrained
- (b) The concept will be easier to implement
- (c) More input validation will generally be needed

two folder  
concepts

# a simple folder concept

alvaro

## concept SimpleFolder

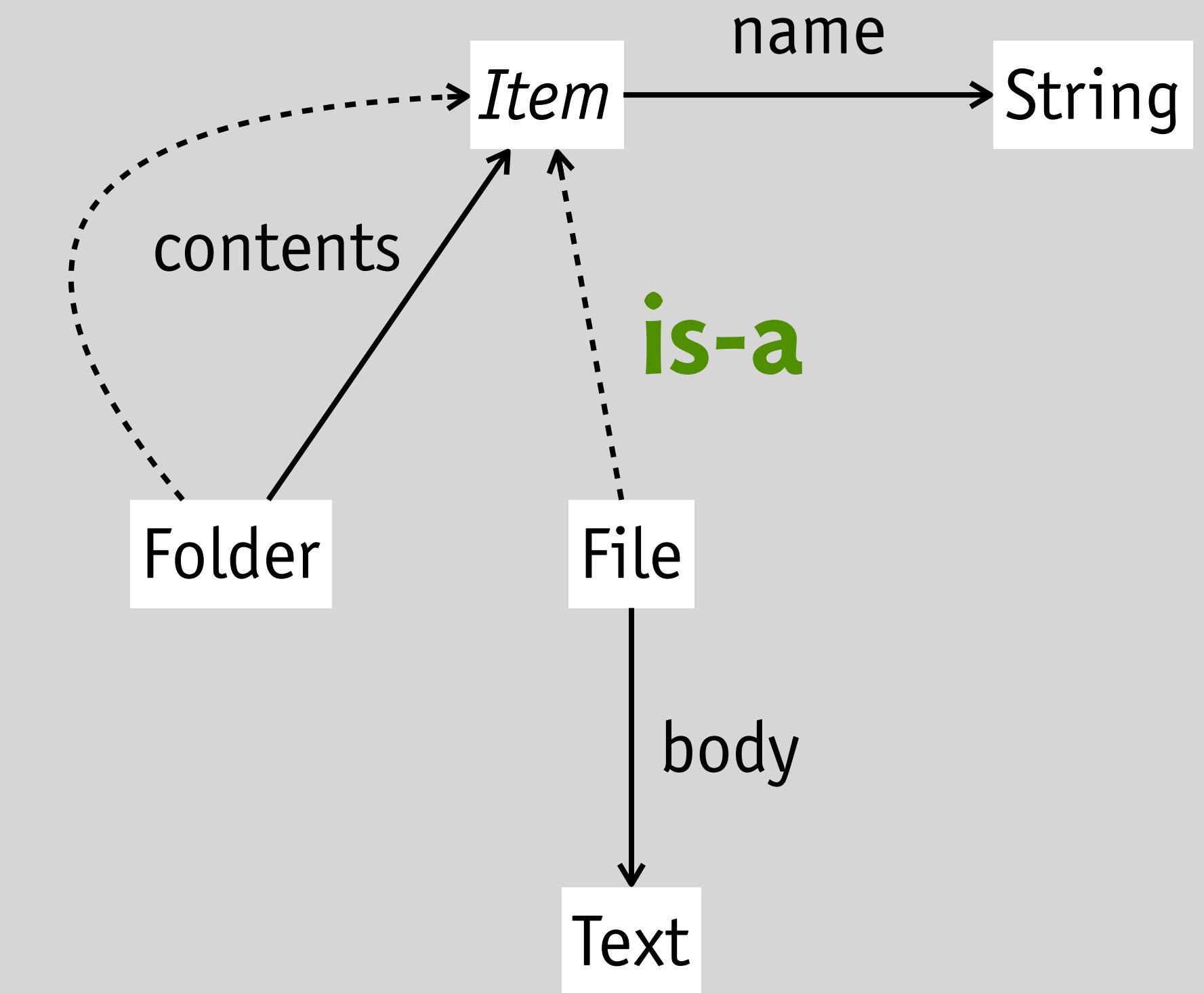
### state

a set of Folders with  
a name String  
a contents set of Files or Folders  
a set of Files with  
a name String  
a body Text

concept design is fun to learn

...

readme



**diagram introduces a new trick**  
an arrow for is-a (aka subset)  
allowing sets for generalization

# what invariants?

alvaro

**concept** SimpleFolder

**state**

a set of Folders with  
a name String  
a contents set of Files or Folders  
a set of Files with  
a name String  
a body Text

readme

concept design is fun to learn

...

*some invariants*



every file belongs to a folder



no folder contains itself (directly or indirectly)



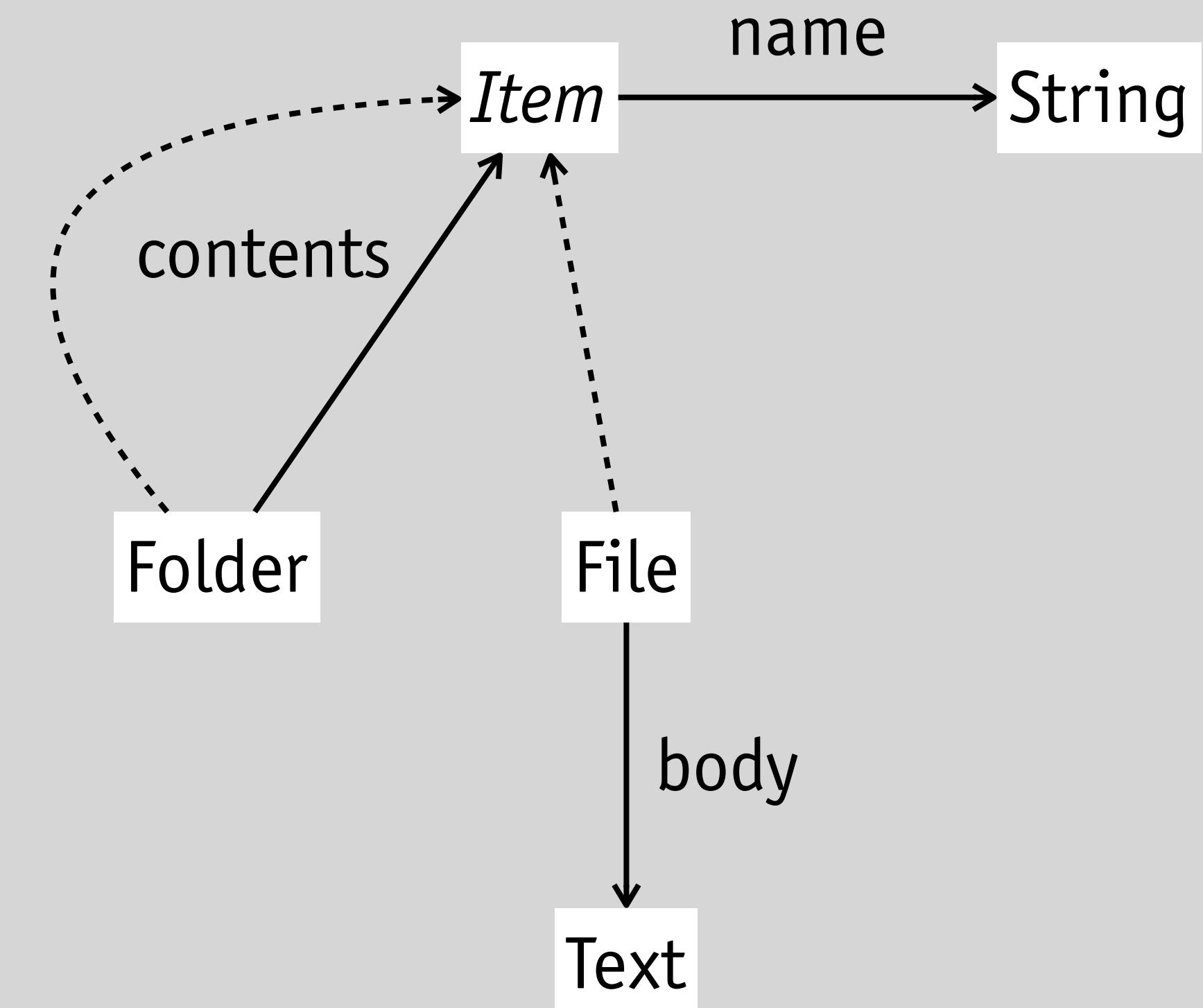
some root folder contains all others (directly or indirectly)



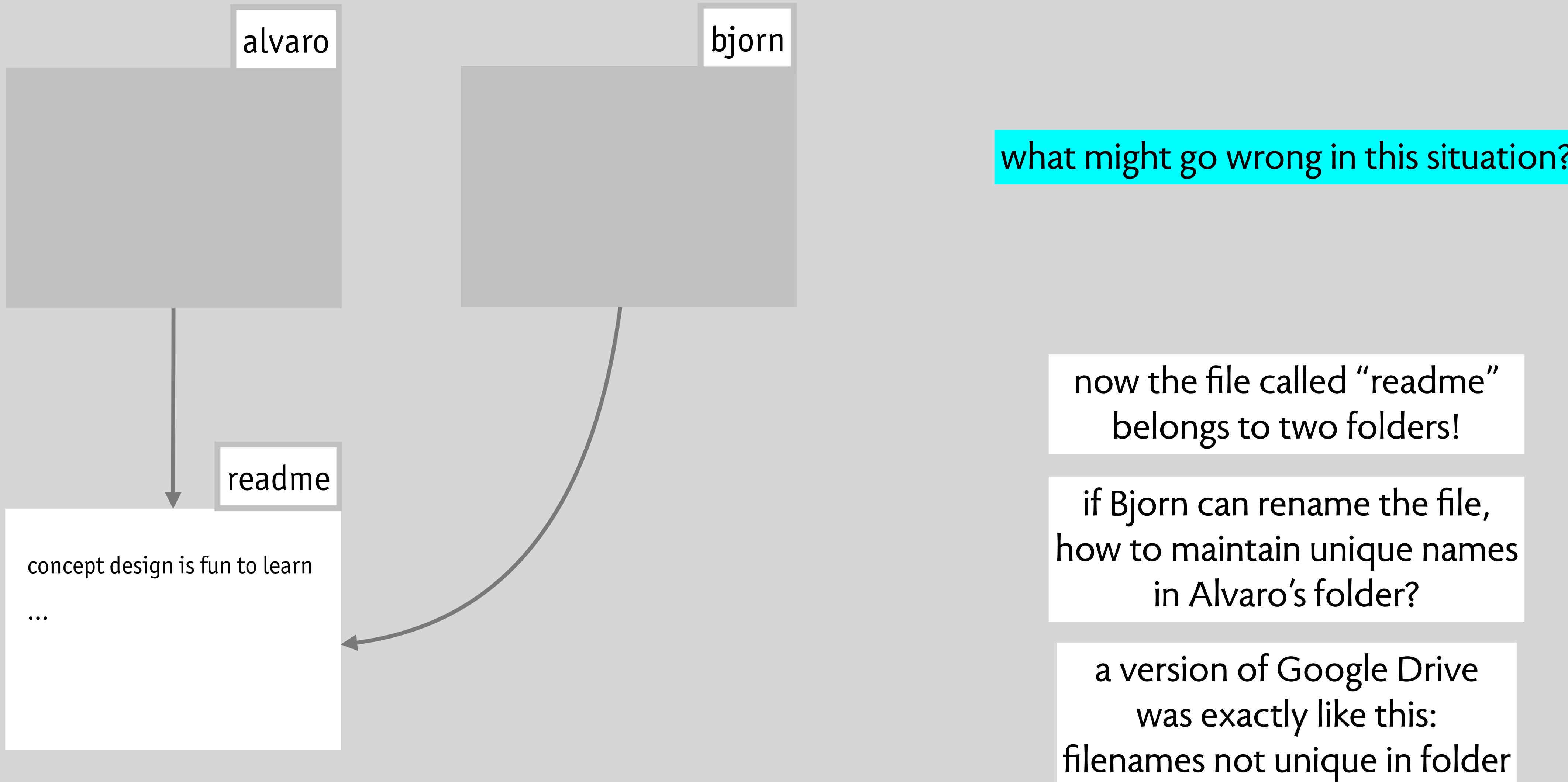
each file or folder belongs to at most one folder



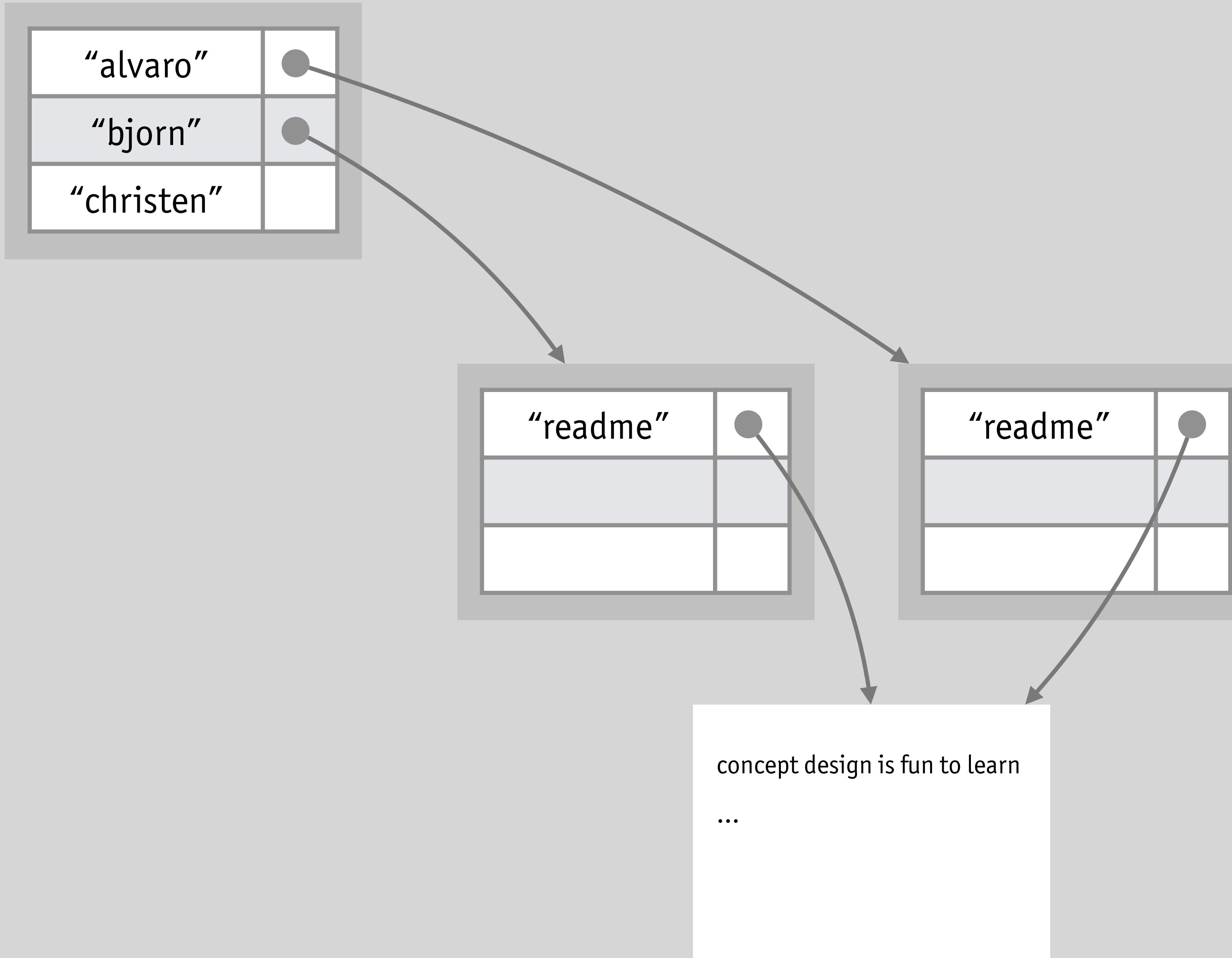
no two contents of a folder have the same name



# suppose alvaro shares a file with bjorn



# an alternative design: the Unix directory concept



**concept** UnixDirectory

**state**

a set of Directories with  
a set of Entries  
a set of Entries with  
a name String  
an item Directory or File  
a set of Files with  
a body Text

# the state of the Unix directory concept

## concept UnixDirectory

### state

a set of Directories with  
  a set of Entries  
  a set of Entries with  
    a name String  
    an item Directory or File  
  a set of Files with  
    a body Text

### *some invariants*



every file belongs to a directory



no directory contains itself (directly or indirectly)



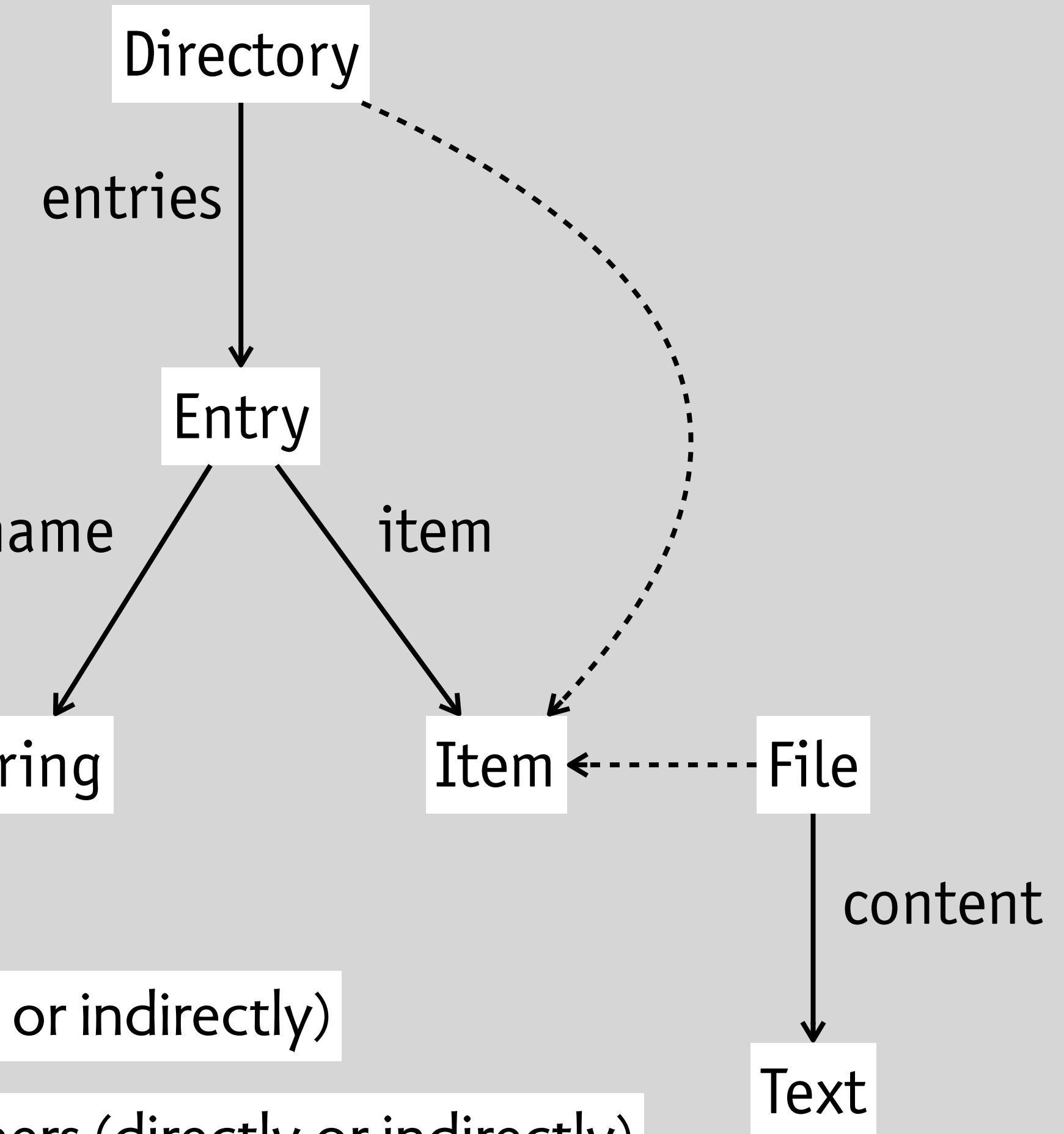
some root directory contains all others (directly or indirectly)



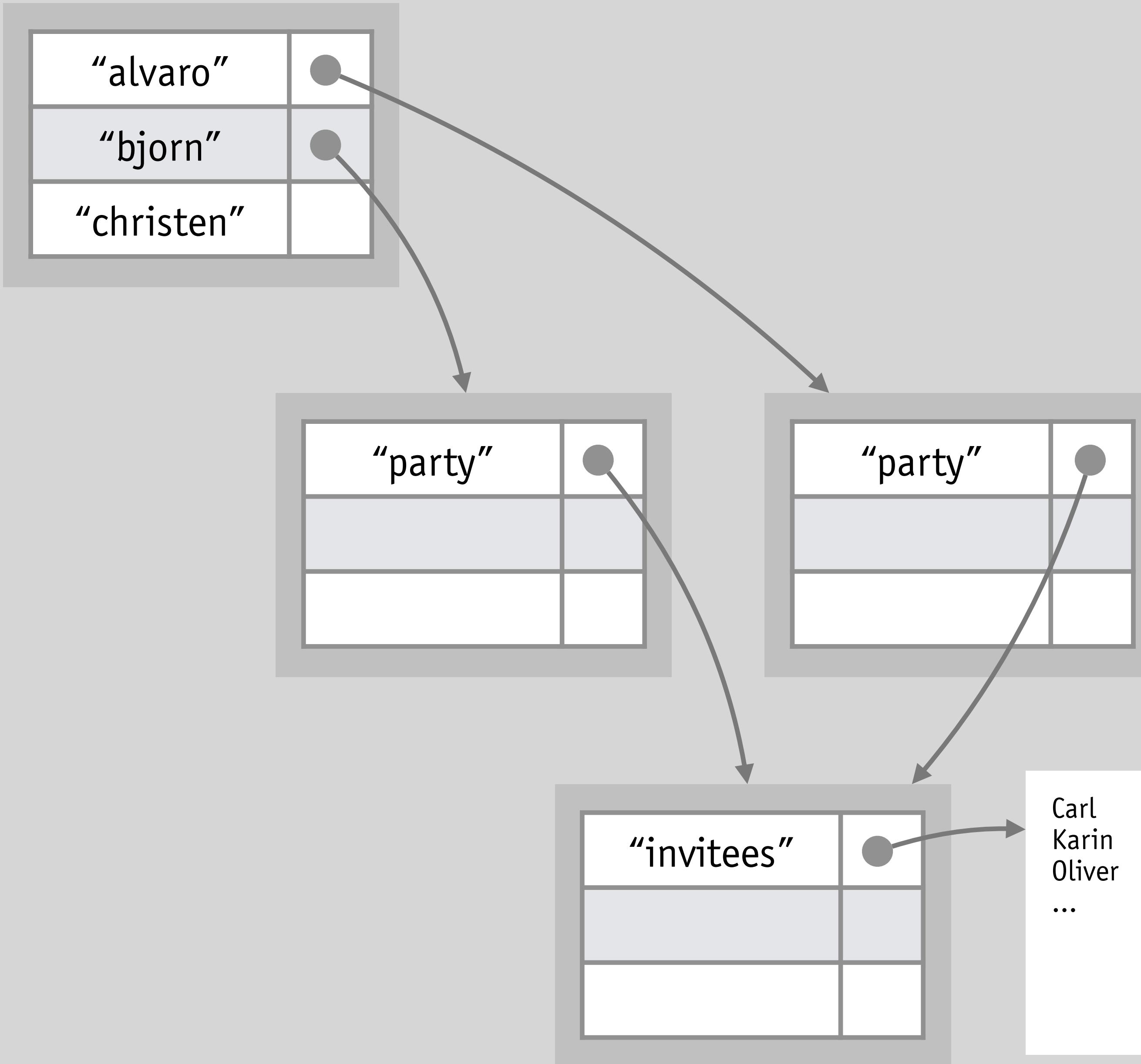
each file or directory belongs to at most one directory



no two contents of a directory have the same name



# how is this for the user?



**names unique within a directory**  
can use paths to identify files & directories

**any user can change a name**  
only need to check uniqueness locally

what might go wrong in this situation?

**changing name of shared directory**  
affects owner's name *sometimes*

**deletion removes an entry not an item**  
so might still be reachable!

# a fine distinction with major impacts

alvaro

**name is property of item**  
could be factored out  
into another concept!

**rename acts on item**

rename (f: File or Folder, n: String)

readme

concept design is fun to learn

...

“alvaro”	
“bjorn”	
“christen”	

“readme”	

**name qualifies link**  
belongs to entry  
not to the item itself!

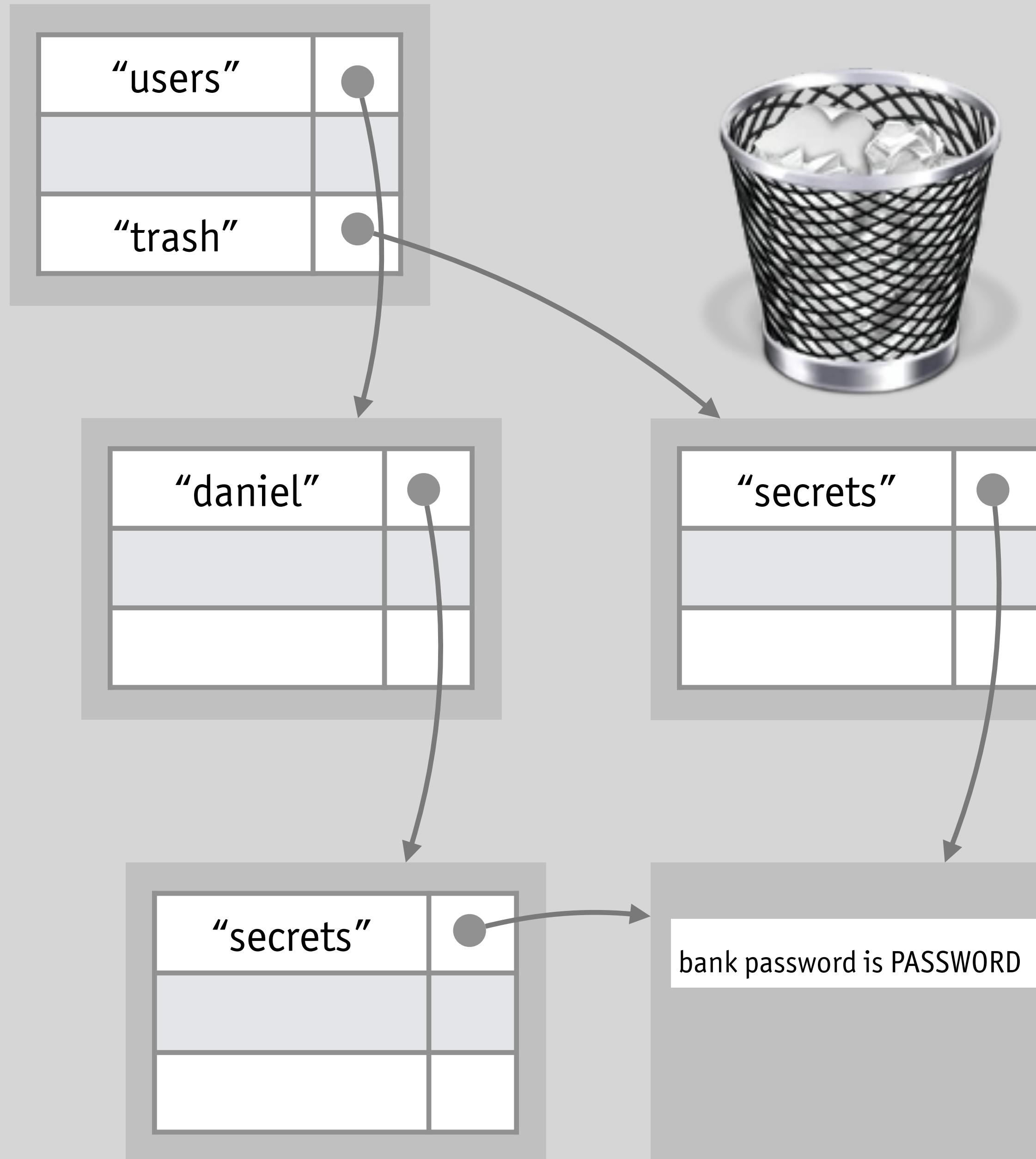
**rename acts on directory**

rename (f: File or Dir, in: Dir, n: String)

concept design is fun to learn

...

# a unix puzzle: what happens when trash is emptied in this case?



takeaways

**choosing details**  
underlying behavior, not user interface

**behavior = states + actions**  
a classical model, used by OOP too

**actions**  
requires (when) & effects (what)

**state models**  
relations, diagrams and invariants