SUNNY: From Models to Interactive Web Apps for (almost) free

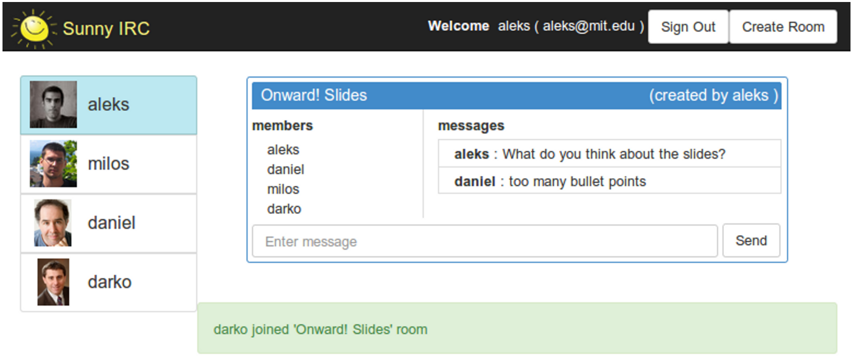
Aleksandar Milicevic
Daniel Jackson
{aleks,dnj}@csail.mit.edu

Milos Gligoric
Darko Marinov
{gliga,marinov}@illinois.edu

Onward! 2013
Indianapolis, IN

A simple web app: Sunny IRC

custom-tailored internet chat relay app



Sunny IRC

Welcome aleks (aleks@mit.edu)

Sign Out | Create Room

- aleks
- milos
- daniel
- darko

Onward! Slides (created by aleks)

members

- aleks
- daniel
- milos
- darko

messages

aleks : What do you think about the slides?

daniel : too many bullet points

Enter message | Send

darko joined 'Onward! Slides' room

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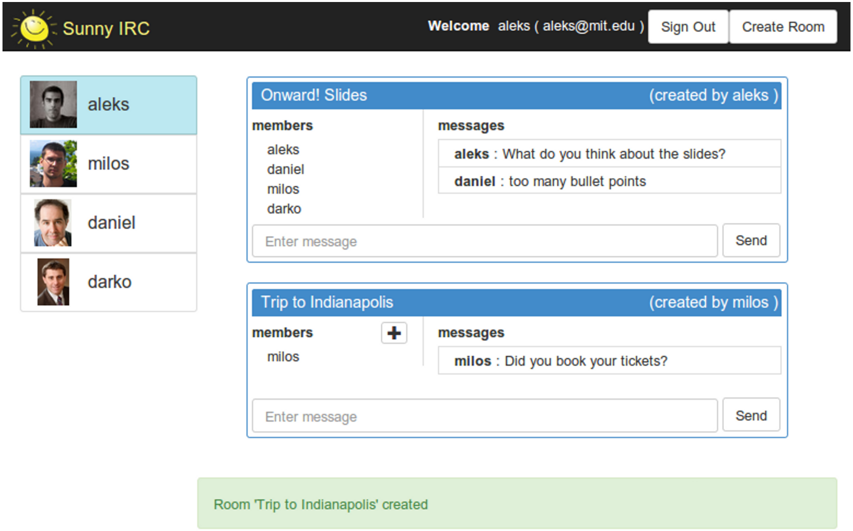

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members: aleks, daniel, milos, darko

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aleks : What do you think about the slides?

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Trip to Indianapolis (created by milos)

members: milos

messages

milos : Did you book your tickets?

Room 'Trip to Indianapolis' created

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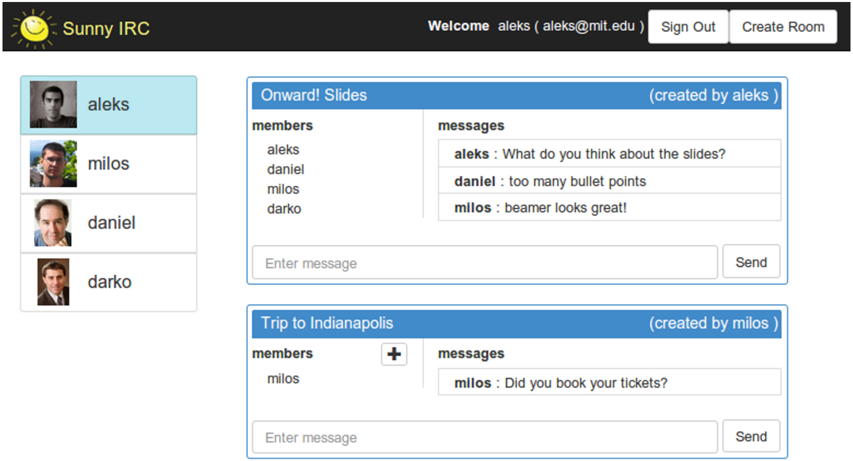

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milos : Did you book your tickets?

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MDD: how far can it get us?

exercise:

sketch out a model (design, spec)
for the Sunny IRC application

Sunny IRC: data model

```
record User < WebUser do
  # inherited fields
  #   name: String,
  #   email: String,
  #   pswd_hash: String,
end
```

```
record Msg do
  refs text: Text,
       sender: User
end
```

```
record ChatRoom do
  refs name: String,
       members: (set User)
  owns messages: (set Msg)
end
```

- record-like data structures with typed fields
- automatically persisted

Sunny IRC: machine model

```
machine Client < WebClient do
  # inherited fields
  #   auth_token: String
  refs user: User
end
```

```
machine Server < WebServer do
  # inherited fields
  #   online_clients: (set WebClient)
  owns rooms: (set ChatRoom)
end
```

- generic network architecture
- machines are records too ($\Longrightarrow$ persisted, have fields)
- assumes certain (standard) properties of web severs and clients

Sunny IRC: event model

```
event JoinRoom do
  from   client: Client
  to     serv:   Server
  params room:   ChatRoom

  requires     { !room.members.include?(client.user) }
  ensures      { room.members << client.user }
  success_note { "#{client.user.name} joined '#{room.name}' room" }
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- core functionality of the system
- other IRC events: `CreateRoom`, `SendMsg`
- included library events: CRUD operations, user Auth events

Modeling done. What next?

challenge

how to make the most of this model?

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goal

make the model executable as much as possible!

Traditional MVC Approach

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  - → write a matching DB schema
  - → turn each record into a resource (model class)
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- to make it interactive:
  - → decide how to implement server push
  - → keep track of who's viewing what
  - → monitor resource accesses
  - → push changes to clients when resources are modified
  - → implement client-side Javascript to accept pushed changes and dynamically update the DOM

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in SUNNY:

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online_users.html.erb

```
<div class="list-group">
<% server.online_clients.user.each do |user| %>
  <%= img_tag_for user %>
  <div class="... <%= (user == client.user) ? 'me' : '' %>">
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<% end %>
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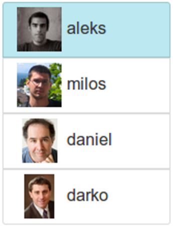
```



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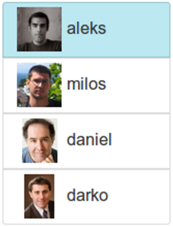

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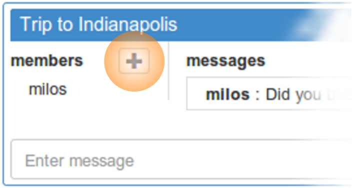

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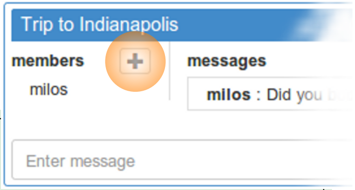

milos : Did you

room_members.html.erb

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<% unless chat_room.members.member?(client.user) %>
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          data-trigger-event="JoinRoom"
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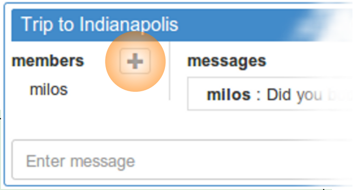
Trip to Indianapolis
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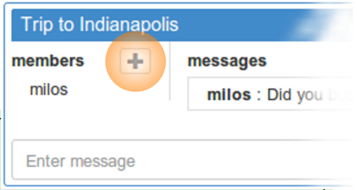

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demo

- responsive GUI without messing with javascript

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implement user status messages

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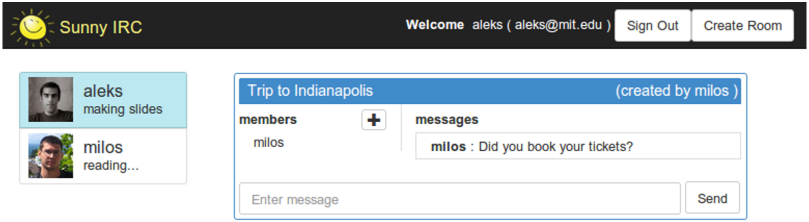

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forbid changing other people’s data

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- declarative and independent from the rest of the system
- automatically checked by the system at each field access

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restrict Client.user.when do |c|
  c != client && c.user.status == "busy"
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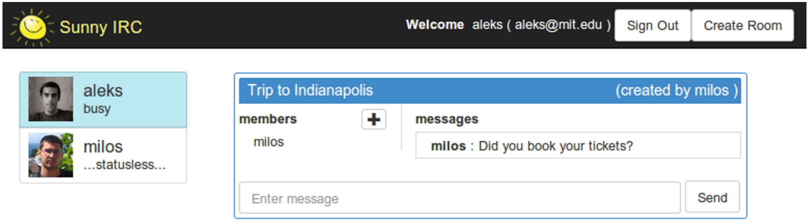
no GUI templates need to change!

Demo: defining access policies independently



Welcome aleks (aleks@mit.edu)

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busy

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Trip to Indianapolis (created by milos)

members
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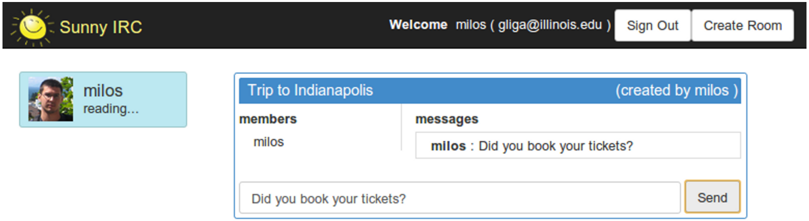
Enter message



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Did you book your tickets?

More cool policy examples

- private messages: message text starts with @username

```
@desc = "filter out messages that start with '@' but not '@#{client.user.name} '"
filter ChatRoom.messages.reject do |room, msg|
  msg.sender != client.user &&
    msg.text.starts_with?("@") &&
    !msg.text.starts_with?("@#{client.user.name} ")
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- private rooms: if room name starts with "private", show messages to members only

```
@desc = "if room name starts with '#private', show messages only to members"
restrict ChatRoom.messages.when do |room|
  !room.members.include?(client.user) &&
    room.name.starts_with?("#private")
end
```

SUNNY IRC: what was hard?

HTML & CSS for GUI templates

- least fun, most tedious

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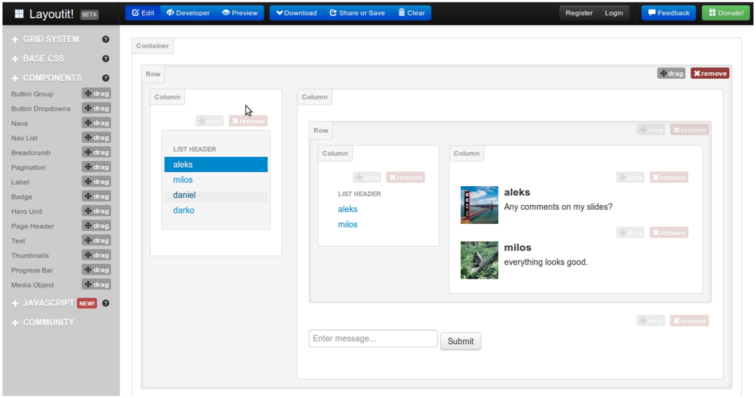
- **future work**: the SUNNY approach lends itself to MBUI builders



Related Model-Driven Technologies

scaffolding (as in Rails)

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- in SUNNY
  - → first-class models, interpreted at runtime
  - → the SUNNY modeling language is embedded in standard Ruby
  - → no code generation needed beforehand
  - → the models are the running code (reduces the paradigm gap)

Related “Web 3.0” Technologies

Meteor

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    - addresses software design questions
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  → another implementation of SUNNY could be built on top of Meteor

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- sequential semantics of a distributed system
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- generic model-based UI builder
- formal analysis, verification, model checking, model-based testing

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Thank You!

SUNNY: coming for holidays 2013