

6.1040 · software studio · fall 2022

a design exploration

Daniel Jackson & Arvind Satyanarayan

introduction

plan for today

explore a seemingly simple design puzzle
a problem with Zoom's meeting list

opportunity to practice conceptual design
purposes, principles, decoupling

discovering a deeper problem
conceptual confusion has impacts

The need itself is a perceived lack,
something that is missing.

Needfinding is thus a paradoxical
activity—what is sought is a
circumstance where something is
missing.

Zoom's
meeting list
problem

The screenshot shows the Zoom desktop application interface. At the top, there is a navigation bar with icons for Home, Chat, Phone, Meetings (which is selected), Contacts, More, and a user profile picture. Below the navigation bar, there are tabs for Upcoming and Recorded meetings, with an 'Upcoming' tab being active. A 'My Personal Meeting ID (PMI)' icon is visible. The main content area displays a meeting invite for 'Daniel Jackson's Meeting' scheduled for Wednesday, Oct 12, from 8:00 PM - 8:30 PM. The host is Daniel Jackson, and the meeting ID is 973 8730 6219. There are buttons for Start, Copy Invitation, Edit, and Delete. Below these buttons is a 'Join from a Room' button and a link to 'Show Meeting Invitation'. On the left side of the main content area, there are sections for 'Recurring' meetings (labeled '6.1040 Zoom Meetings') and 'Advisees', both hosted by Daniel Jackson with meeting IDs partially obscured. At the bottom, there is a section for 'Alloy Board' also hosted by Daniel Jackson.

Upcoming Recorded +

My Personal Meeting ID (PMI)

Wed, Oct 12

Daniel Jackson's Meeting

8:00 PM - 8:30 PM
Host: Daniel Jackson
Meeting ID: 973 8730 6219

Recurring

6.1040 Zoom Meetings

Host: Daniel Jackson
Meeting ID: 973 8730 6219

Advisees

Host: Daniel Jackson
Meeting ID: 973 8730 6219

Alloy Board

Host: Daniel Jackson

Daniel Jackson's Meeting

8:00 PM - 8:30 PM

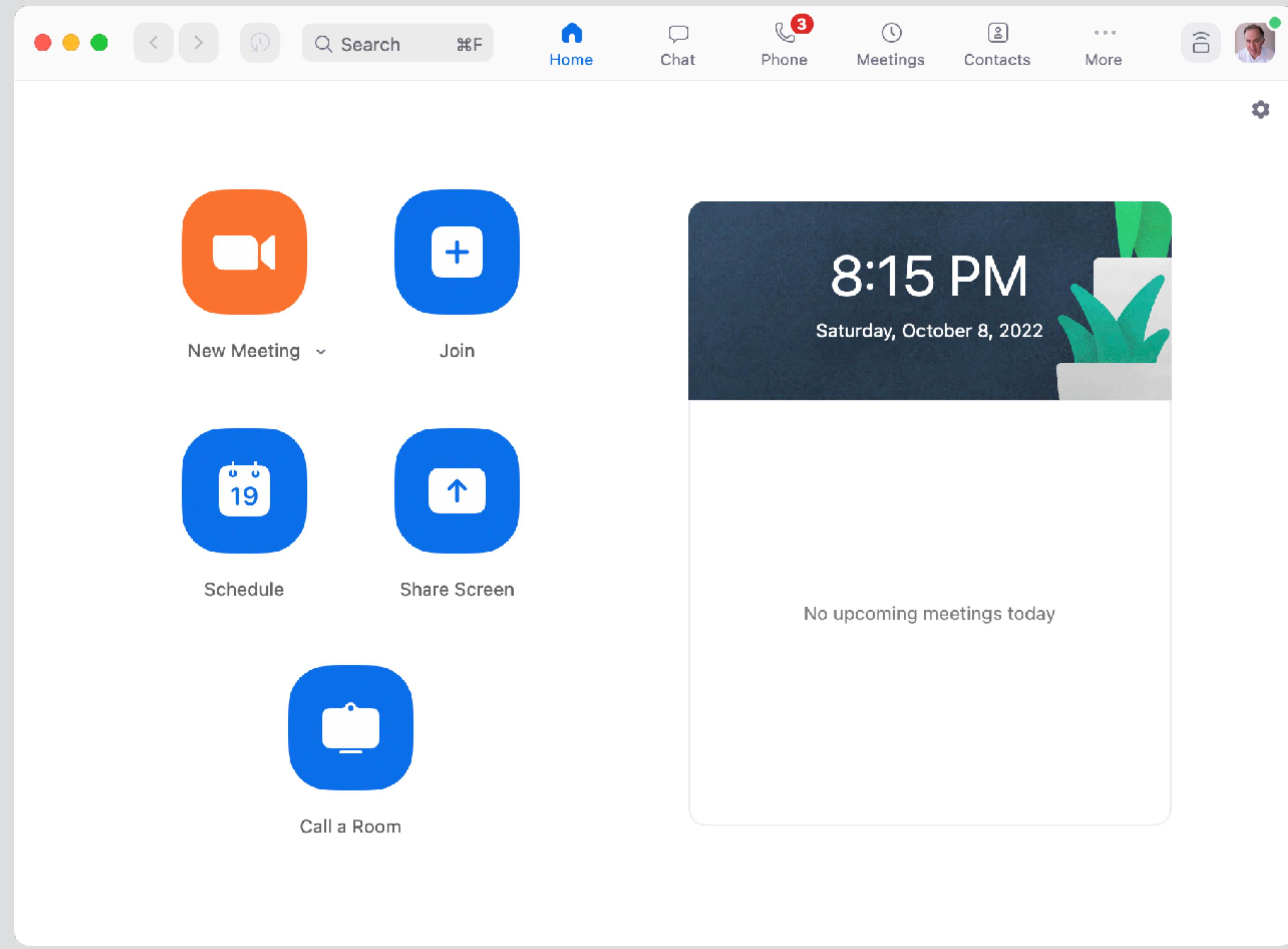
Host: Daniel Jackson

Meeting ID: 973 8730 6219

Start **Copy Invitation** **Edit** **Delete**

Join from a Room

Show Meeting Invitation



The image shows the Zoom mobile application interface. At the top, there is a navigation bar with icons for back, forward, search, and various app functions. Below the navigation bar, there are three main sections: a video camera icon labeled "New Meeting", a calendar icon labeled "Schedule", and a "Call a Room" icon. The central part of the screen displays a large button labeled "Join Meeting". Below this button is a dropdown menu titled "Meeting ID or Personal Link Name". A list of recent meetings is displayed, each with a title and a meeting ID. The list includes:

| Meeting Title | Meeting ID |
|--------------------------------|---------------|
| Daniel Jackson's Meeting | 971 370 6112 |
| Daniel Jackson: Schedule a... | 828-088-0861 |
| Daniel Jackson's Zoom Mee... | 971 6207 5062 |
| Cybersecurity for Technical... | 971 3212 3025 |
| Cabinet Meeting | 842 704 8767 |
| Daniel Jackson's Zoom Mee... | 971 0132 7131 |
| Daniel and Mohamed | 842 704 6750 |
| SDG meeting | 876 7088 1003 |
| CSAIL Cabinet mtg | 971 7205 3003 |
| Editorial Board, September | 971 0232 1103 |

At the bottom of the list, there is a blue link labeled "Clear History". To the right of the list, there is a small graphic of a smartphone displaying the text "PM" and "October 8, 2022". Below the list, the text "Meetings today" is visible.

so what's missing?

upcoming meetings

only those scheduled by you with Zoom client
doesn't include recurring meeting, even if right now

recurring meetings

only those scheduled by you with Zoom client

recent meetings

only the ten most recent

calendar integration

doesn't detect all events with Zoom URLs
if modify meeting in Zoom, adds copy to calendar

limitations

a typical frustrating scenario

someone invites you to a meeting by email
doesn't attach a calendar invitation
so not in calendar or in Zoom app meeting window
have to search through emails to find it!

even if the meeting is recurring

if more than ten ago, not in recents either

even if you created the meeting

but didn't mark as recurring, despite reusing it

scenarios

why does
this matter?

some history



Skype
initially P2P (2003)
Microsoft (2013)



FaceTime
Apple (2010)



Google Hangouts
in Google+ (2011)
own product (2013)
Duo replaces (2016)



Zoom
Eric Yuan (2013)



Google Meet
launched (2017)
absorbs Duo (2022)



Microsoft Teams
TypeScript! (2017)



New conversation

Time to upgrade to Google Chat

Starting November 1, 2022, Hangouts on the web will redirect to Chat on Web. We recommend moving to Chat now. [Learn more](#)

Go to Google Chat



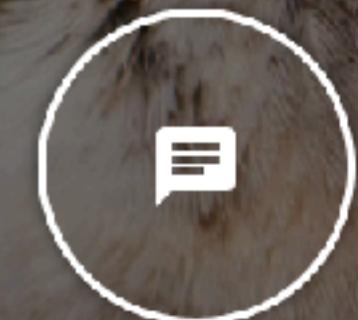
Danilo Zava

11/25/19

You were in a video call

Hi, Daniel!

Get started by calling or messaging a friend below.



MESSAGE

S

concept VideoCall

purpose video connection between multiple users placed like traditional phone call

principle host calls another user; host can add more parties to call; parties hangup

actions

call (from, to: User): Call
add (c: Call, from, to: User)
hangup (c: Call, u: User)



concept VideoMeeting

purpose video connection that multiple participants can join asynchronously

principle host creates a meeting obtaining an id; [at planned time] host starts call with id; others join with id; host ends call

actions

create (u: User): MeetingID
start (u: User, m: MeetingID)
join (u: User + Endpoint,
m: MeetingID)
leave (u: User + Endpoint,
m: MeetingID)
end (u: User, m: MeetingID)

zoom's competitive advantages

VideoMeeting concept

much easier to set up calls, especially for non-hosts
other parties don't need to be online and logged in

high quality video

showed all participants at once
scaled to large number of participants
excellent adaptation to bandwidth limitations

usability

installation very easy, few clicks required

now Google & Microsoft closing gap on all these advantages, and Google especially has strong calendar integration

zoom: making installs easy



FEDERAL TRADE COMMISSION
PROTECTING AMERICA'S CONSUMERS

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For Your Information

FTC Gives Final Approval to Settlement with Zoom over Allegations the Company Misled Consumers about Its Data Security Practices

February 1, 2021



Tags: [Consumer Protection](#) | [Bureau of Consumer Protection](#) | [deceptive/misleading conduct](#) | [Coronavirus \(COVID-19\)](#) | [Privacy and Security](#) | [Consumer Privacy](#) | [Data Security](#) | [Tech](#)

The Federal Trade Commission finalized a settlement with Zoom Video Communications, Inc., over [allegations it misled consumers](#) about the level of security it provided for its Zoom meetings and compromised the security of some Mac users.

UNITED STATES OF AMERICA
BEFORE THE FEDERAL TRADE COMMISSION

COMMISSIONERS:

Joseph J. Simons, Chairman
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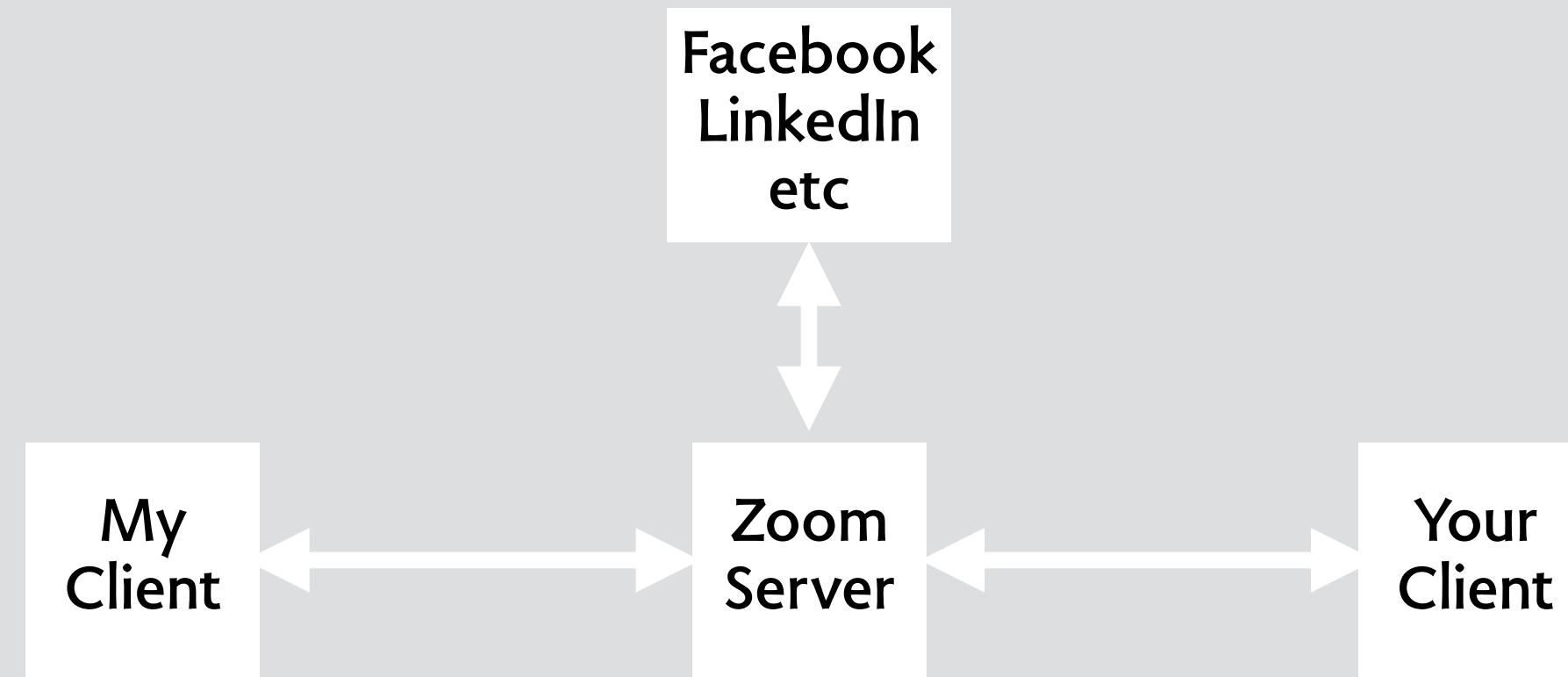
In the Matter of

ZOOM VIDEO COMMUNICATIONS, INC.,
a corporation, d/b/a ZOOM.

FILE No. 192 3167

**AGREEMENT CONTAINING
CONSENT ORDER**

end-to-end encryption?



end to end encryption: server not in trusted base

turned out to be a misrepresentation: just encrypted links

worse: trusted base included Facebook et al

zoom: end-to-end really did matter

Zoom Executive Accused of Disrupting Calls at China's Behest

U.S. prosecutors have charged a company executive based in China with conspiring to terminate online meetings about the Tiananmen Square massacre.



The federal case is a fresh black eye for a company that has seen demand for its services skyrocket during the pandemic. Mark Lennihan/Associated Press

By [Nicole Hong](#)

Published Dec. 18, 2020 Updated Feb. 26, 2021



WANTED BY THE FBI

XINJIANG JIN

Conspiracy to Commit Interstate Harassment; Unlawful Conspiracy to Transfer Means of Identification



DESCRIPTION

Aliases: Jin Xinjiang, Julien Jin

Date(s) of Birth Used: January 1, 1981

Hair: Black

Build: Medium

Race: Asian

Nationality: Chinese

Place of Birth: Hangzhou, Zhejiang Province, China

Eyes: Brown

Sex: Male

Occupation: Software Engineer

Languages: Chinese

Zoom's
recurring
problem

mit.zoom.us

SOLUTIONS PLANS & PRICING CONTACT SALES RESOURCES REQUEST A DEMO 1.888.799.8854 SUPPORT

zoom SCHEDULE JOIN HOST WHITEBOARD NEW

Profile

Meetings

Webinars

Personal Audio Conference

Phone

Personal Contacts

Whiteboards NEW

Recordings

Settings

Analytics & Reports

Account Profile

Zoom Learning Center

Attend Live Training

Video Tutorials

Knowledge Base

← Back to Meetings

Schedule Meeting

Topic

+ Add Description

Recurring meeting **Meet anytime**

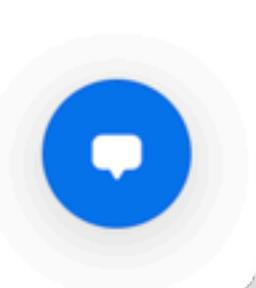
Recurrence

Meeting ID Generate Automatically Personal Meeting ID 242 315 0083

Template

Security Passcode
Only users who have the invite link or passcode can join the meeting

Waiting Room
Only users admitted by the host can join the meeting



Scheduling recurring meetings

Last Updated: October 6, 2022

Zoom allows you to schedule meetings with multiple occurrences, so that each occurrence uses the same [meeting ID](#) and settings. You can schedule these meetings in daily, weekly, and monthly increments. You can also set a recurring meeting to be used at any time. Meeting IDs for recurring meetings expire 365 days after the meeting was last started.

For more info on scheduling meetings in general and all of the meeting settings, see our documentation on [scheduling meetings](#).

Notes:

- For a better experience, see the Zoom add-on for [Google Calendar \(web or mobile\)](#) or [Outlook \(desktop or web\)](#) if you use one of these calendar services to schedule meetings.
- Recurring meetings with a fixed recurrence patterns (daily, weekly, monthly) cannot be scheduled with your [Personal Meeting ID \(PMI\)](#) since your PMI is reserved so that you can start or schedule a meeting at anytime, similar to a no-fixed-time recurring meeting.
- When scheduling a recurring meeting in Google Calendar or in Outlook, the resulting Zoom meeting will always be created as a no-fixed-time recurring meeting. The resulting calendar event can then be scheduled with whichever recurrence pattern you choose, but that recurrence pattern will not be reflected on the Zoom side.
- Meetings can have up to 50 recurring sessions, so if you need more than 50 recurrences, use the [No Fixed Time](#) option.

The following instructions provide steps on scheduling recurring meetings in the Zoom desktop client and then adding them to either your Google Calendar or the Outlook desktop.

[Give Feedback](#)



How to understand Meeting ID

The [meeting ID](#) is the meeting number associated with a scheduled meeting. All Zoom meetings have a unique meeting ID that are included in the meeting's invitation text.

Important information regarding Meeting IDs:

- You can start your meeting at any time after you scheduled it.
- Non-recurring meeting ID will expire **30 days** after the meeting was scheduled or last started; the meeting will expire after the date it was scheduled and not on the date it was scheduled for. You can also restart the same meeting ID within 30 days.
- A recurring meeting ID will expire **365 days** after the meeting is started on the last occurrence. You can re-use the meeting ID for future occurrences.

"non-recurring"

can recur forever, if within 30 days of last one

"recurring"

up to 50 times, expires 365 days after last (?)

"no-fixed-time recurring"

can have >50 recurrences

"recurring": multiple meetings?

"restarting": it's all one meeting?

some
concept
designs

simplifying meeting types

"non-recurring"

can recur forever, if within 30 days of last one

"recurring"

up to 50 times, expires 365 days after last (?)

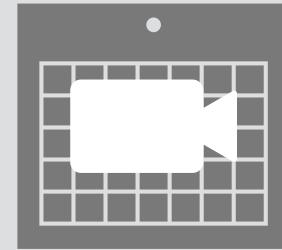
"no-fixed-time recurring"

can have >50 recurrences

how to simplify
expirations and limits?
meetings with and without times?

is there an overloading here?

is the Zoom meeting an incoherent mix of two concepts?



concept ScheduledVideoMeeting

purpose enabled video connection between multiple users at planned time

principle host schedules meeting; host and users join at time of meeting; host ends



concept ZoomMeeting

purpose video connection that multiple participants can join asynchronously

principle host creates a meeting obtaining an id; [at planned time] host starts call with id; others join with id; host ends call



concept VideoChannel

purpose always open connection for ad hoc interactions amongst multiple participants

principle host creates channel; participants join and leave whenever they like

split Zoom meeting into two concepts?



concept VideoMeeting

purpose video connection that multiple participants can join asynchronously

principle host creates a meeting obtaining an id; later, host starts call with id; others can then join call using that id; host ends call

actions

create (u: User): MeetingID

start (u: User, m: MeetingID)

join (u: User + Endpoint,
m: MeetingID)

leave (u: User + Endpoint,
m: MeetingID)

end (u: User, m: MeetingID)

expire (m: MeetingID)

expire after N uses or
X days after last use: removes
dependence on scheduling



concept Calendar[Link]

purpose coordinate shared events with planned date/time

principle you make a calendar, make an event at given date/time, add to calendar, and get a reminder when about to happen

actions

makeCalendar (...): Calendar

makeEvent (ds: **set** Date,

title: String, link: Link): Event

add (c: Calendar, e: Event)

delete (c: Calendar, e: Event)

change (e: Event, ds: **set** Date,

title: String, link: Link)

remind (c: Calendar, e: Event)

what to put in meeting state?



concept VideoMeeting

state

id: Meeting -> **one** MeetingID

host: Meeting -> **one** User

title: Meeting -> **one** String

pastSessions: Meeting -> **set** Session

start: Session -> **one** Date

end: Session -> **lone** Date

let session have start date
but no end date

actions

create (u: User, title: String): MeetingID

start (u: User, m: MeetingID)

join (u: User + Endpoint, m: MeetingID)

leave (u: User + Endpoint, m: MeetingID)

end (u: User, m: MeetingID)

expire (m: MeetingID)

enriching the data model

sessions not strictly necessary

what functions might they support?

when do sessions start and end?

specify in terms of actions

what invariants hold on state?

in particular, uniqueness constraints?

how to redesign upcoming meetings with our new split concepts?

The screenshot shows the Zoom desktop application interface. At the top, there's a navigation bar with icons for Home, Chat, Phone, Meetings (which is highlighted in blue), Contacts, More, and a user profile picture. Below the navigation bar, the main content area has tabs for 'Upcoming' (selected) and 'Recorded'.

On the left side, there's a sidebar with sections for 'My Personal Meeting ID (PMI)', 'Wed, Oct 12', 'Recurring', '6.1040 Zoom Meetings', 'Advisees', and 'Alloy Board'. Each section lists the host (Daniel Jackson) and meeting ID.

The right side of the screen displays a detailed view of a meeting for 'Daniel Jackson's Meeting' scheduled from 8:00 PM - 8:30 PM. It shows the host (Daniel Jackson), meeting ID (973 8730 6219), and four action buttons: 'Start', 'Copy Invitation', 'Edit', and 'Delete'. There's also a 'Join from a Room' button and a link to 'Show Meeting Invitation'.

MY MEETINGS

My Personal Meeting

Meeting ID: 973 8730 4444

CSAIL Seminar

Host: Daniela Rus
Meeting ID: 973 1234 0095

MY UPCOMING EVENTS

Wed, Oct 12

Meeting with Arvind

8:00 PM - 8:30 PM
Host: Arvind Satyanarayan
Meeting ID: 973 8730 6219

6.1040 Lecture

2:30 PM - 4:00 PM
Host: Daniel Jackson
Meeting ID: 973 8730 6220



New meeting...

Import meeting...



New event...

Import event...

Delete event...

Change dates/times...

Share event...

what kinds of objects are these?

my meetings are VideoMeeting.Meeting

my upcoming are Calendar.Event

where is this state stored?

my upcoming: in this user's calendar

my meetings? not in VideoMeeting

what known concept might work here?

and how would it enrich the UX?

Reminder, Bookmark, Contact, ...?

how are recent meetings
handled? how do you restart
a recent meeting?

how are recent meetings handled?

option #1: sync

synchronize leaving a meeting with adding entry to my meetings

option #2: manual

have list of recent events and offer action to add to my meetings

when Meeting.leave (u, m) **also** Contact.add (u, m.host, m)

MY MEETINGS



My Personal Meeting

Meeting ID: 973 8730 4444

MY UPCOMING EVENTS

Wed, Oct 12

Meeting with Arvind

8:00 PM - 8:30 PM

Host: Arvind Satyanarayan

Meeting ID: 973 8730 6219

MY RECENT EVENTS

Design review

5:00 PM



6.1040 Lecture

2:35 PM



Group meeting

yesterday



Add to meetings...

Schedule event...

what familiar concept is this?

designing recent calls concept



concept RecentCalls [Contact]

purpose let people track calls that they participated in

principle when you participate in a call, and it ends, the call is added to your recent call list

state

calls: User -> **set** Call

with: Call -> **one** Contact

start, end: Call -> **one** Date

actions

start (u: User, c: Contact, d: Date)

end (u: User, c: Contact, d: Date)

delete (u: User, c: Contact, at: Date)

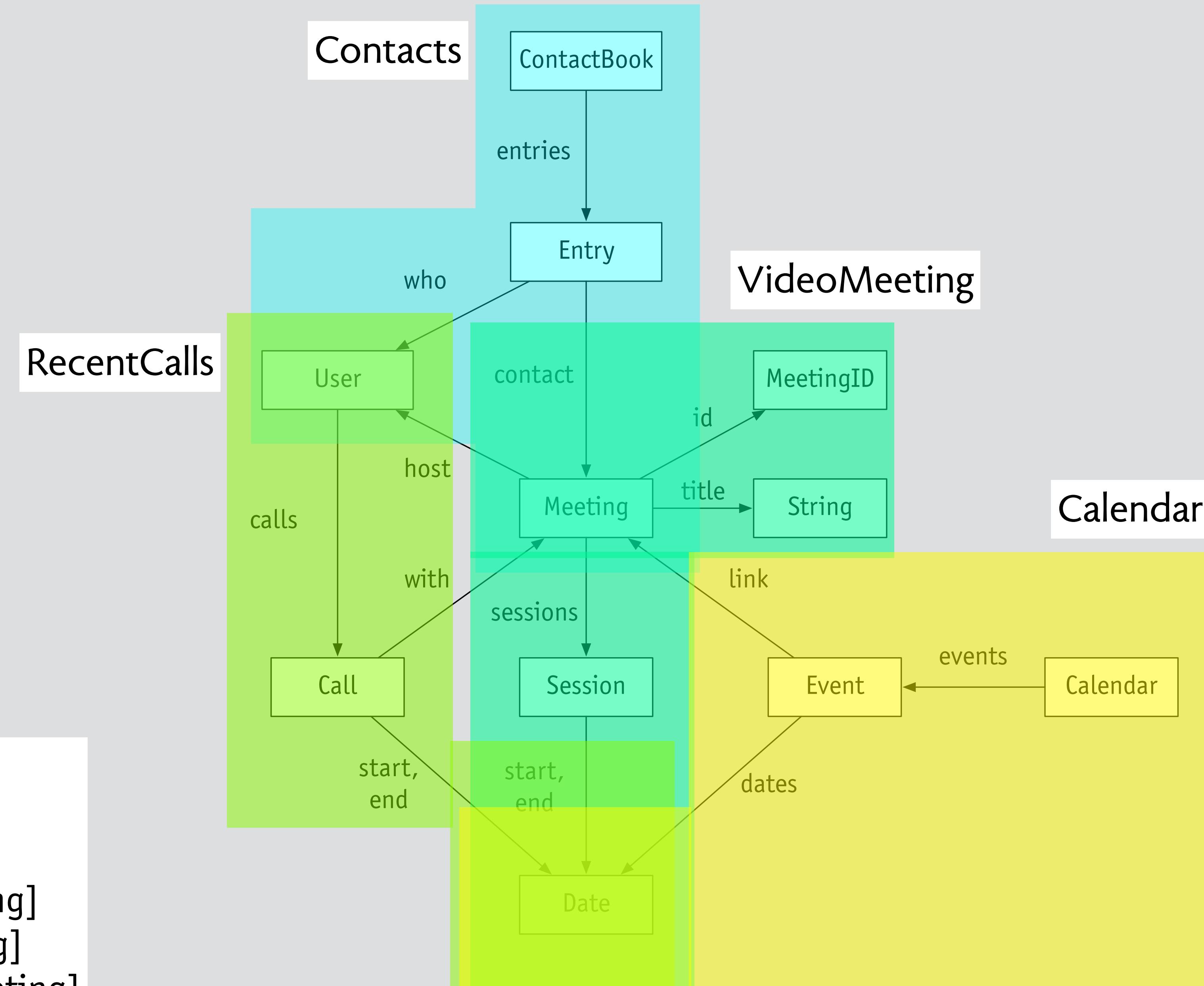
app Zoom concepts

VideoMeeting

Calendar [VideoMeeting.Meeting]

Contact [VideoMeeting.Meeting]

RecentCalls [VideoMeeting.Meeting]



design
review

MY MEETINGS

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concept design principles

specificity: redundant, overloaded?

synchronization: automation?

independence: and generic too

efficacy: scenarios not supported?

simplicity: streamlined, benefits?

revisiting the concept split

assumed split of ZoomMeeting into
VideoMeeting (without any scheduling)
Calendar (without any Zoom specifics)

nice features

support Zoom's two styles: scheduled and ad hoc
allowed relatively clean design of meeting list

but what about join restrictions?

can limit "join before host" to time before scheduled start

and what if host modifies meeting?

changes start time or title

consider unified concept?

store schedule with meeting
when you received meeting id, can fetch schedule

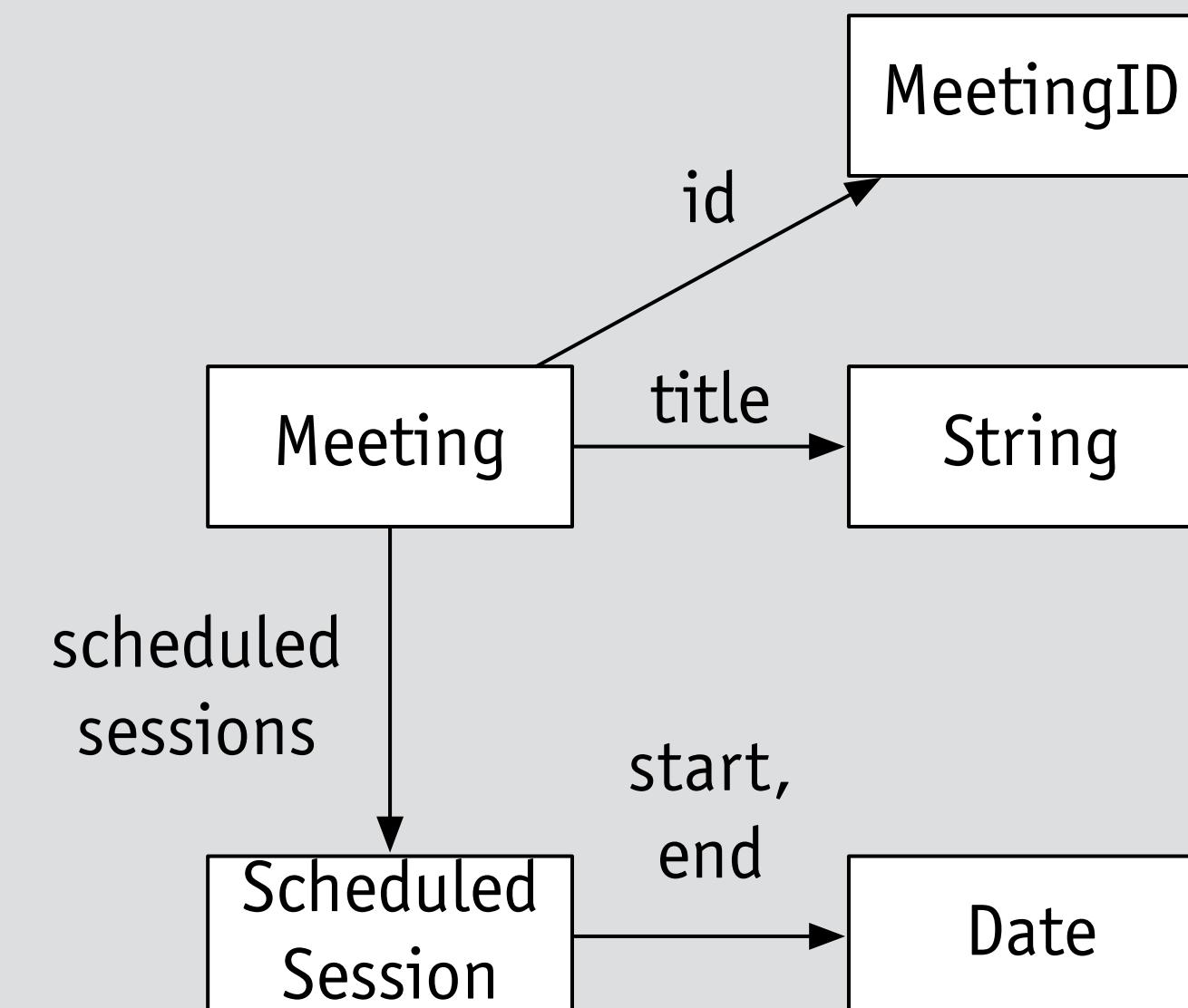
How to enable join before host for an individual meeting

[Windows | macOS](#)

Allow participants to join before host

Allow participants to join the meeting before the host arrives

Participants can join 5 minutes before start time ▾



sadly this won't work...

two scheduled instances
of my personal meeting
with the same meeting id

The screenshot shows the Zoom desktop application interface. At the top, there's a navigation bar with Home, Team Chat, Phone, Meetings (which is selected), Contacts, More, and a user profile. Below the navigation bar, there are tabs for Upcoming and Recorded, with Upcoming being selected. A large blue callout box highlights the 'Upcoming' tab and the meeting ID '0083'. The main content area displays two scheduled meetings under the 'Today' section:

- Daniel Jackson's Zoom Meeting #1**
10:30 AM - 11:00 AM
Host: Daniel Jackson
Meeting ID: 0083
- Daniel Jackson's Zoom Meeting #2**
1:30 PM - 1:31 PM
Host: Daniel Jackson
Meeting ID: 0083

Below these, there's a 'Recurring' section:

- 6.1040 Zoom Meetings**
Host: Daniel Jackson
Meeting ID: 989 1464 1356

On the right side of the screen, a separate window titled 'My Personal Meeting ID (PMI)' is open, showing the same meeting ID '0083' and providing options to Start, Copy Invitation, Edit, or Join from a Room.

takeaways

today's story

started with a simple but egregious “misfit”
meeting list in Zoom is not a coherent concept
efficacy lacking for most common scenarios
potential showstopper for Zoom’s future

a proposed design
split ZoomMeeting into two concepts
factoring out scheduling to allow flexible UX

but discovered a deeper issue with ZoomMeeting
awkward hybrid of VideoChannel & ScheduledVideoMeeting

