

IIT Madras
ONLINE DEGREE

Modern Application Development - I
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Components of an App

Hello, everyone, and welcome to this course on Modern Application Development.

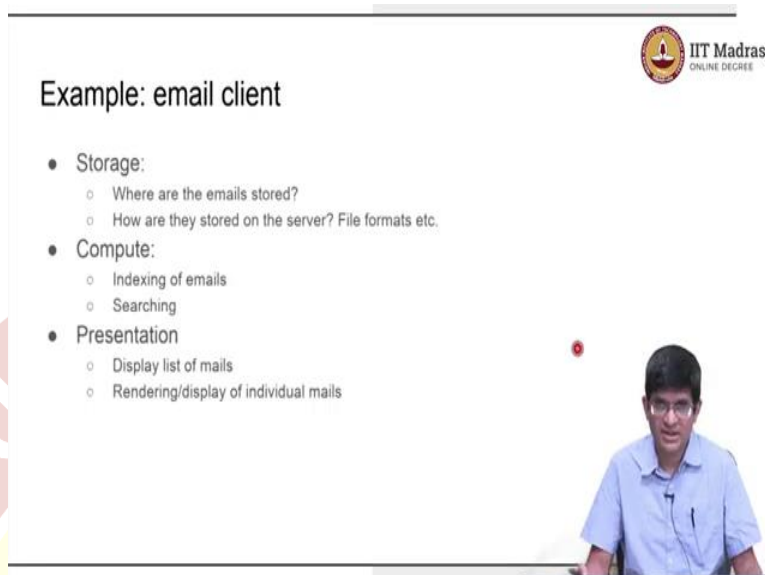
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So, let us look briefly at the components of an application. So, I am going to use the term app and application sort of interchangeably from now onwards. And what exactly are the kinds of apps that we will develop as part of this course; we will look into those a little bit further later on. For now, I want to understand what are the components? Or in other words, what kind of things are we trying to bring together when we implement an app.

And the main things that we will again be looking at in considerable detail later; are storage, which basically means there is some data corresponding to the app that needs to be stored somewhere, and is then manipulated in some form. Computation, which essentially involves how are we manipulating this data? What exactly are we doing with it? And the presentation, how do we show this data to the user?

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Example: email client

- **Storage:**
 - Where are the emails stored?
 - How are they stored on the server? File formats etc.
- **Compute:**
 - Indexing of emails
 - Searching
- **Presentation**
 - Display list of mails
 - Rendering/display of individual mails

To understand those words, a little better, let us take the example of an email client. After all, pretty much everyone doing this course has some experience with email. You have used some kind of a browser or other email client, in order to send email, receive email, look at a list of emails that you have, delete some of them, archive some of them, and move them into folders, various other tasks.

So, in the context of the components that we just discussed, the first one would be storage. Where are these emails stored? Are they stored on your laptop or on your desktop? Or are they stored somewhere in the cloud? Now, personally, I for one, use Gmail. And what that means is that my emails are now stored in the cloud, on servers hosted by Google. How are they stored on the server? Frankly, I do not know.

Google has got some kind of formats they use that are suited for their purposes. And what are their purposes? they need to be able to retrieve all emails that belong to me, show them to me, and also help to sort of search through them if necessary. So, some kind of indexing, some kind of finding out what are the keywords in all the emails also needs to be done at their end. They need to do a few things; they need to make sure that I only see emails that were sent to me, not to someone else.

So, how do you sort of separate things out? Do you create one database, pore all emails into it and just index based on the “to address” or do you have sort of separate databases for each

person? Do you put things into folders? Do you use file systems? How does Google do it? Frankly, I do not know. How would it be stored on a local application? It depends on the application you are using.

So, outlook, for example, uses some kind of proprietary format, where mails are all sort of clubbed together into a large file, which is also indexed like a database. Other things like Thunderbird will probably use either the maildir or mbox protocols, which are more text based, and in that sense, are probably easier to migrate from one client to another. But the point is that the problem needs to be solved. How do you stop?

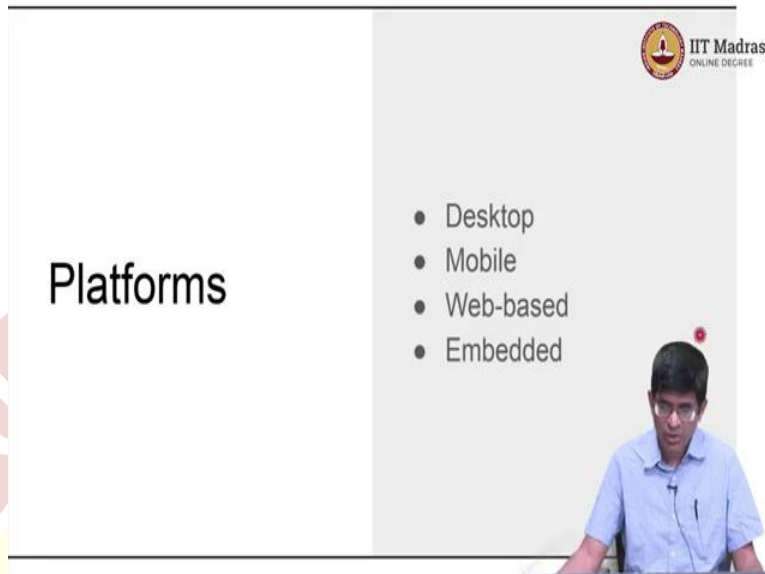
The next question is, what kind of computations do we need to do? Because after all, email looks like there is no real computation involved. After all somebody sent me an email, I want to read it, and maybe I want to reply to it. But there is some kind of computation, which in the case of email would primarily be what I said, the indexing of the emails. So, Google does this thing where they basically create an index of all the emails that a given person has received.

And the purpose of that is so that whenever you search, let us say that you want to find out all emails that came to you from your friend, you type in that friend's email address, it quickly searches through and shows you all the emails that came from that person, you want to search for emails that were sent to you in March of 2021. Sure, you can put in a filter for that, and you should be able to get those quite fast.

So, that is something that happens behind the scenes. A lot of indexing happens behind the scenes, but when you actually ask for a search to be conducted, it needs to actually perform some computation on the fly. So, that would be what we call the business logic. It actually needs to do some manipulation of the data in order to generate the final presentation. And the presentation is not just “take the text of the email and throw it onto the screen”. It needs to format it, it needs to render and display individual emails in a way that is nice to read.

You might also want to see lists of emails. How many emails have I got today? How many are unread? How many are from so and so. Each of those is a list that it needs to create. All of those fall under the presentation part of the application.

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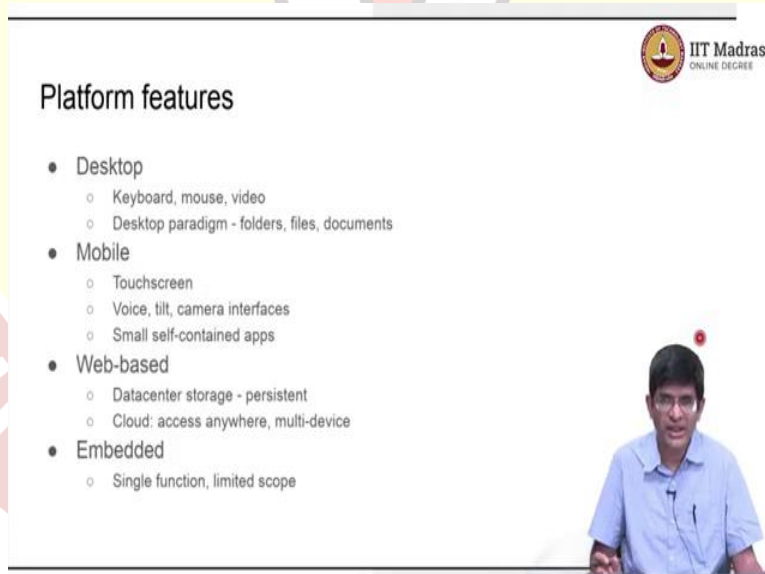


The slide is titled "Platforms" in a large, bold, black font. To the right of the title is a bulleted list of platform types. In the bottom right corner, there is a small video inset showing a man in a light blue shirt speaking. The IIT Madras logo is in the top right corner.

- Desktop
- Mobile
- Web-based
- Embedded

A brief word about platforms, like I already said, we have the desktop, mobile, web based. And we could also have so-called embedded platforms.

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The slide is titled "Platform features" in a bold, black font. It contains a bulleted list of platform types, each with its own sub-bulleted list of features. In the bottom right corner, there is a small video inset showing the same man in a light blue shirt speaking. The IIT Madras logo is in the top right corner.

- Desktop
 - Keyboard, mouse, video
 - Desktop paradigm - folders, files, documents
- Mobile
 - Touchscreen
 - Voice, tilt, camera interfaces
 - Small self-contained apps
- Web-based
 - Datacenter storage - persistent
 - Cloud: access anywhere, multi-device
- Embedded
 - Single function, limited scope

So, we already looked at some of these briefly before. But just to, sort of quickly recap, what are the main features that distinguish one platform from another? A desktop would typically have things like keyboard video mouse, and it uses the desktop paradigm, by paradigm I basically mean, the set of concepts that are involved in understanding how something works, some way of understanding a problem.

So, the desktop paradigm means that, how do we understand what is meant by a desktop. And in our case, primarily, that means we are now thinking in terms of folders, files that go into folders, documents that are created or edited in various ways, things like that; because we are trying to recreate the metaphor of an actual physical desktop. But now inside your computer.

Now, mobile has a slightly different paradigm. The main thing that changes over there is that your keyboard, video, mouse have changed, keyboard and mouse have been replaced by a touchscreen. The video has been replaced by a relatively small form factor display, it is still a video display, but the size is now different.

But now there are new interfaces, there is voice, there could be tilt, there could be camera, there could be the gyroscope, or magneto meters. A whole bunch of different interfaces that did not exist in laptops. And typically, given the constraints you want to go for small self-contained apps. Web based, as I said, is one of the things that we will be primarily looking at. The storage would primarily be in a data center, where it is made persistent.

And the one sort of big motivating factor behind web-based apps is the notion of access anywhere. And the whole idea of the cloud, the fact that if your data is on the cloud, you could be at home, you could be at work, you could be traveling to another country, and you should still be able to access exactly the same information, even if you lost your laptop, or broke your phone. And finally, one thing that we did not look at earlier is the so-called embedded platforms. And what I mean by embedded is, these are single function limited scope devices.

So, nowadays, in fact, we do not even see digital cameras, everybody has a camera, but it is just part of their phone. Whereas, for several years in between there was the notion of a digital camera whose only purpose was to take photos, save them onto a flash drive, and connect up with a PC to transfer those files back into your computer for sorting or storage or deletion as you might like.

Now, the camera could do only that, it was pretty much a single function device, it could take pictures, and it was specialized at doing that, it was very good at it. Another example would be a typical use of a watch, a watch, for example, displays time, it might also have a timer, or maybe a couple of other applications associated with it, but that would be pretty much it. Nowadays, of

course that has changed. Digital cameras are just part of your phone, and the phone can do a lot more than just taking pictures.

Nowadays, even a watch has changed. You have a smartwatch, and you are no longer restricted to just seeing the time, you could probably even at a pinch, there have actually been attempts to write code on watches, extremely painful, but it is more proof of concept than anything else. So, having said that, embedded devices still exist. And some of the classic examples are, for example, these smart refrigerators or smart microwave ovens or smart TVs even.

Not all of them have the full set of interfaces of an Android phone; they might have only some of the apps associated with that just what is required for its functionality. So, a fridge might allow you to for example, just connect up with the grocery store and place orders for what you need next, or it might allow you to control what is the settings inside the fridge. We will again not really be spending much time on such embedded devices. Like I said, the main focus of this course is ultimately going to be web based.

