Introduction to Modern Application Development Prof. Tanmai Gopal Department of Computer Science and Engineering Indian Institute of Technology, Madras

Module - P4 Lecture - 10 Server Side Programming and Introduction to HTML and CSS

Hi all. Welcome to module - P4. In this module, we will be adding a few more pages to our web app and by doing that exercise we will learn little bit about server side programming and getting an introduction to HTML and CSS.

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С	ontents	
Obje	ective:	
1. 2. 3.	Understand server-side programming to make different UP Intro to HTML, CSS Intro to server-side templating	il.s
Top	ics:	
1. 2. 3. 4.	URL based routing Creating new HTML pages HTML, CSS fundamentals <a> Inks: The Real Thing That Makes The Internet Work	
oducti	m ta Medern Application Development	Dr Ganzai Rains (117 Madrae), Tanzai Gopel (Hanara

Our objective in this course is to understand how server side programming works and how we make different URLs and handle those different URLs. We will also try to learn the fundamentals of HTML and CSS. And we will be introducing the concept of server side templating which in the feature we will lead as onto databases.

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This entire module is structured around a very simple task. The task is that we want to make a few simple web pages, and we want to publish those pages on our web app by making it accessible on certain URLs.

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URL	Example Page	
coco98.hasura-app.io	My profile page	
coco98.hasura-app.io/arcticle-one	My first article	
coco98.hasura-app.io/article-two	My second article	
cocco98.hasura-app.io/article-three	My third article	

So, if you look at my web app which is coco98.hasura-app.io, the final target is to have three modes of URLs available slash article one, slash article two, and slash article three.

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This is how we will proceed. We will add URLs for each web page, and we will first test; if URLs are working, and we are able to serve some responses on them.

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To do this, we have to understand how URLs based routing works. If you remember from module p1, when we are using http server and I mentioned that we could we used Apache and nginx as well, we notice that they were pre configured that they would take any input URL and convert that into a filepath. The would search for that file within the same directory that they were running in or they were configure to use and then they would try to serve the file from that path if it is available. We are going to do something similar, but we are going to write the logic of what happens when you are going to particular URL.

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Let us see how that happens.

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I first go to my console. I go to my code console

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Now this is where we left off last time, where I made some changes on the server side to my HTML file, and then I made some changes from a local computer and then I deployed this site, this is where we lets left out last time.

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The first thing that we want to is add three URLs and search test responses from this URLs. Head to your server dot js 5, your server dot js 5 is the file that is actually executed and it is the source code of your web server. Let us quickly try to read the source code of this web server to understand what is happening.

In the first three lines, we were importing certain software packages. These are very commonly used libraries express is the library that is used for us to create the web server, so that we do not have to do the work of learning how to listen on a port or handling a stiff connections. We use the library Morgan to help us output logs of a servers that we know what request are coming to a server, and how we are responding.

The next few lines - line number 8, 12, and 16 are lines of code that are handling specific URLs. So, for example, here we have app dot get slash, and when a get request is made to slash, this function should execute. In on line number 12, we have app dot get slash u y slash file dot c s s, which says that if this URLs is requested a get request is made to this URL this function is executed.

And similarly on line 16, if this particular URL path is requested, this function will execute. So, what would these functions do the first one if the browser or a client makes a request to the URL path slash, we use the send file function to pick up the file UI slash index dot HTML which is available to us. And we send the content of that file. Similarly, when UI slash dot style dot CSS is requested, we send of that file; and when the images requested we send of the image. Let us see how this works in action.

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So, I restart my server, we will wait for the server to start.

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So, if I click on inspect element, like we had last time.

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And I had to the network tab.

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And I refresh the page again. You will see that three requests are made; and if you look at these three requests.

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The first request is the first request is to our domain slash

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The second request is to slash UI slash dot file dot CSS.

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And the third request is to slash ui slash (Refer Time: 04:45) png.

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In fact, it is also making a request to a java script file slash ui slash main dot js, but we do not have any server side code that handles this URL, which is why the server is responding with the 404, which means that this URL path was not found or not handled by a web server. We will correct this part of a web server, when we come to client side java script in the next few modules.

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So, now that we have understood how pages making a request and how a current web serves file is working.

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Let us quickly add 3 more URL handling functions. Article one, and if article one URL is requested, and there are the semicolon here, and if the article 1 URL is requested, I will correctly just reply with article one requested and will be served here. And I put a semicolon; I am going to copy these lines. And I am going to write article 2, article 3 right. So, we were at 3 more URL handlers, and we are sending test responses, these are

just plain test responses, these are not HTML responses. Let us come it and restart a server.

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Just simple things to notice while a programming, if you are making errors when you write code, for example, if I do this, you will see a small icon that pops up here that arise to help you saying that your syntax seems to be incorrect or it is warning that your syntax is incorrect. For example, if you do this and you do not have a closing bracket, you will see another kind of an error right. So, use these as guides when a programming. Our application has been restarted.

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Let us go and refresh this page unless had to slash article 1.

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And you can see that the article 1, we are getting a response here.

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Let us check out article 2, and you seeing article 2.

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Let us switch this out to article 3, and you seeing article 3. So, all three URLs seem to be working great.

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So, now that we have our URLs and we are able to serve responses on those URLs. We need to make simple web pages and then ultimately, we will serve these web pages from on URLs. So, how do we make a web page? The language at the browser understands to be able to show your web page is HTML and CSS. The browser can understand these two languages HTML and CSS, and render them to create web pages the way we use them on the internet. Let us understand this in a little more detail.

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HTML is a language (not a programming language) to help you convey the structure in your content to a software (like the browser) How will a software be able to understand how you want to structure your content? Writing your content in a way, deliberately designed to help machines (software) understand layout is called <u>'markup'</u> Personal This is some personal information about me. Perfessional This is a list of my work experiences: Company A: Worked as some very seriously 2: Company B: Worked without seriousness Professional This is some personal information without seriousness Professional This is some very without seriousness Professional This is some very the performance very seriously Professional This is some very the performance very the	How does HTML	work?	8
Personal This is some personal information about me. Professional information about me	 HTML is a language (not a p to a software (like the brows How will a software be able Writing your content in a way is called <u>'markup'</u> 	rogramming language) to help you o er) to understand how you want to struct y, deliberately designed to help mach	convey the structure in your content ture your content? nines (software) understand layout
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HTML is a language; it is not really a programming language. And the purpose of HTML is to convey the structure that content has; it is means for like any language, like any human to computer language, it is a language that is meant to be written by humans, and to be understood by software. Whenever a language is understood by software, the language will have what is called is syntax, it will have a very particular and a very definite structure. And this structure is something that can be automatically understood by the machine or by the browser, and converted into a visual display.

Let us look at an example how HTML works. On the left most side on this box, you see that there is some content written; this is content that would typically go on to profile page. And you can notice this content is just text; this is not the way we would like to display content on the profile page. We would like to display it like how we have on the right here. So, how do we, how do we help the browser understand that this text has to be displayed in this way right. To do this, we use the language HTML.

And so let us look at what the HTML looks like, the first thing that we do is we say h 1 personal slash h 1. So, this part is used to represent that h 1 is starting, and so it is a star heading the content of the heading which is text which is personal. And then we say slash h 1 which is meant to say end the heading.

Similarly, we start a paragraph we put the content here, and we end the paragraph. Then we start a new heading, professional and we end the heading; we start a paragraph, we end the paragraph. Then we start order list - ol is intend to represent order list. So, we start an order list, and we end the order list here. The first element in that list is your first professional experience; the second element of that list is the second experience. So, this is how we moved from text to HTML and the browser understood the HTML and can displayed like this.

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g how should it be styled? What is th ? uits and add more styling & formatting u Personal	he visual meaning of that structure?
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But if you think about it, we actually did not tell the browser how to make the content look we help the browser understand what the sections of vertex star. So, we said that this text has many sections, the first section is the heading, the next section is a paragraph, then there is another heading then there is a paragraph and there is an order list. But how does the browser know what an order list is, how does the browser know that you know this heading should be displayed in a larger font size, it should be bold, it should have more spacing or how does the browser know that there is a list that should be a little bit of space on the left. And then there should be I there should be one and then there should be another pieces space here, how does the browser know this.

And we call this styling right, this is not structure; this is style. And the browser understands style using a language called CSS, but even if you do not specify a custom style for what a heading is, all browsers have lot of defaults. And the browser renders and the browser renders particular structure elements with some default styling. So, for example, by default, the browser will represent a heading in this particular way. The browser will represent the heading paragraph in this particular way, lists in this particular way.

Suppose we want to customize these default strike, you would you would write in a language called CSS and in this CSS language you will specify what the styling for the structure element is. And so, here we have a (Refer Time: 11:15) CSS, and the CSS

language which is very different from the HTML language; it says that for the h 1 element apply this styling, for the p element apply this styling, for the body element apply this styling. Let us see where they look like.

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By default the browser was converting this HTML into this visual rendering, but if we apply this CSS where we have seeing h 1 should have a text decoration underline. The p paragraph should have a font color gray and the entire body which is everything that is around the HTML should be a background white.

And so we if we apply this CSS the browser will not render your HTML like this, but it will render the HTML like this, and here you can see that more style is being applied the heading is underlined. It is still has the default styling which is bold and larger font size, but it also has an underline. So, it our CSS added to the default CSS the browser had. Similarly, the paragraph as colored gray, but the original defaults of the browser in the way then does the paragraph goes preserved and we did not modify the way the list is render.

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So, now let us actually add some HTML files and let us add our c article pages.

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So, once again I head to the console.

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I have to add a new page. So, I can add a new page by directly going onto github. So, go to data github.

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I go to the UI folder.

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I say create new file and I will name my file article one dot HTML, and I m just going to put in some data because we will actually edit these files in a consoles that is a HTML.

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Let saves the file here.

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Let us go back to our console.

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Let us refresh the console. So, you can see that article already HTML is appeared here as well let us click on this and let us start editing our content.

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So, whenever you writing a HTML file, and you always write the tag HTML, and you close the HTML file here. The first thing that you will do is add head type and here we will write the title. The title of the page is the bit that appears here; this is the title and that the part that appears on the tag that is we will say title. Article one (Refer Time: 13:46).

And now we will start writing the body the body is the bit of HTML that is actually displayed here. This is the body right. So, in the body, we will first have header. So, we will write home and then we will then let us put horizontal line right that is a horizontal line that we are putting. So, our first section is a division, which contains h a link. So, a link back to the home page right which is represented by the URL slash, and after that we have a horizontal line. After which I will have a heading. So, I will give it h 3 and I will say article 1.

I then want to have a section that displays the date. So, I will say the date is September 5, 2016. I will add another section from my HTML page and this is where I will start actually writing the content. This is the content for my first article and I am going to this copy paste this few times. And let me have a few more paragraphs in fact, so just aligned this little bit it is very good practice to have formatic code. So, then this helps other people read your code, cool. So, we have article one dot HTML which is some texts here. Let us link this to our server file.

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So, I go to our sever file and instead of written in text, I will now written article once, I am going to copy paste this line and I am going to replace it here.

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And I will rename index dot HTML to article one dot HTML and let us see if everything works.

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So, I commit these files, I go to my tab, and I will go to the page article one. Let us refresh this.

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And see; wait for our server to start.

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And there we go. So, we have our first HTML page that is ready.

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You can see that right click on the home link.

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I will go back to the home page. And otherwise, I have may add to content you can see this is the heading there is little bit of a space here and then there are paragraphs. And whenever I create a paragraph element, the default styling of the browser is automatically is updating that paragraph space.

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What we also do it to our HTML file is that we will add a special tag. So, we will add this special tag and this tag is for mobile browsers.

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So, that mobile browsers do not display a website in a way that is zoomed out and you do not have to zoom in to give this website on mobile list will automatically work on mobile browsers, and we will understand how will works on later on.

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So, this is my HTML file, I am going to commits this again, so that is saved to github project. Now let us go ahead and add some more files.

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So, I go back to github. Let us quickly add some more files.

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I am going to say create new file article-two. html. So, here we have article-two.html. And I am just going to copy the content from my original article, paste it here. I will change the content article-two. Let this article-two, which is the content for my second article. Let us save this file. (Refer Slide Time: 17:52)

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And let us quickly create a new file.

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Let say article-three.html.

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Copy, paste this data; and which this is my third article, I change the date here, and there we go, I just got my third HTML page.

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I save this. Let us refresh our console.

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So, you gets there you got 3 files here. Let us makes sure that the URLs can serve these. So, I am again going to copy paste this line right and change this to article-two.html and change this line and make it article-two.html. Let us save this and let us it is starts our browser. (Refer Slide Time: 19:01)



Let us head to article-two. And check if the things are working. Wait a little bit for a server to restart. And there we go there, we have article-two.

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Let us go to article three and we have article-three contact method article, you can see the title here.

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So, we added 3 HTML files and 3 different URLs.

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Now, let us write some CSS and try to make our site look a little better.

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Once again I head back to the console.

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And I am going to go to article one dot html.

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So, what I would like to do on my page.

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And let us look at the page article one. So, here we have article one. Now what I would like to do to make this page look better and I going to center the content little bit, this is too wide. I am also going to change the colors a little bit and change the font also.

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Let us quickly look at how we do that. So, I can add CSS to my HTML document by creating a style tag, and then writing contents here the style stag. So, the first thing that I want to do is put the whole thing in a section. Let us do this; let us put that in here, and let us give this particular section a class name, so a classes just a kind of tag that you can attach, and I will call this container.

Now, instead so now what I will do is I will say take the dot, take the container element which is referred to is dot container and give it a maximum width of 800 pixels right and I want to center it. So, I will say center it automatically from the slides, give it in automatic margin on the left and right hand sides, so that the content scheme centered. I also want the color to be kind of a gray and I no want the color to be black. And most importantly I would like the font to be a Sanserif font right. Let us execute these changes and see what that looks like.

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So, I restart my server and there we go. So, I have this it is already looking a little neater, because I can read my content more easily.

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So, I want to figure out how to make this neater. So, I will first make these changes inside my inspect elements itself. Let us look at container and I think I should add a little bit of a gap on the top. So, may be 60 pixels for gap. The color is little too dark, so let us too lights, let us find a slightly better color, there we go and all right.

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So, that makes my page look a little neater.

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And let us just a resize a browser to see what it would look like on mobile. So, on mobile there is a little bit of a gap that is appearing that is not there on the slides. Let us go to our container and make sure that it has a little bit of padding on the left and the right hand side. So, I am going to say padding left of about 20 pixels, and padding right of about 20 pixels. This makes it a little easier to observe or look at content on mobile on the mobile browser.

And let us resize this back to see; if everything is good, things are looking fine. So, I am going to take this CSS that I had in inspected element. And I am going to take this and seamlessly copy paste it back into my code.

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So, there we go. It is align this to make it look a little better, there is nothing uglier to program with an (Refer Time: 23:01) code, cool.

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So, I have done this, let us commit and restart. Wait for it to restart. And let us start a server again. And we have article-one that is working. So, now, I will have to go apply these changes on the other articles as well.



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So, I will have to go to article two and copy paste these changes. And I have to go article three and also copy paste them. And once I do that I will have the same styling that is apply to article one, two and three. So, when we are copying this styling, we will have to also modify the HTML to add this sort of container elements, so that we can style a container element.

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Finally, at the end of this write, we have achieved our goal of having created 3 URLs and having 3 pages, and having a little bit of styling on them as well.

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For example, we are going to have article-one or article-two and there article-three. And we have 3 pages in this style them.

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Now if you observed I was I was copy pasting throughout the session, I was copy pasting the HTML I was copy pasting lines and server dot js and I was even copy pasting this CSS information. So, how can we avoid writing so much called the goal of a good programmer; is always to write the least amount of code possible.

You should never repeat functionality by adding by repeating code; and apart from the aesthetically not very elegant, this is also potentially harmful. You guys should read up little bit on the internet about what is called the dry principle - the d r y principle; and why a repeating code here could be potentially harmful.

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So, we have three specific areas where we you want to reduce the code written, common CSS, common HTML and common lines in server dot js. Let us see how we do this.

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So, I go back to my code console. And I have already copied. So, I go back to my coding console. The first thing that I am going to do is removing this CSS, and moved it into separate files. So, I am going to take this CSS content.

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And I am going to put it in style dot CSS. I am going to align this little bit. I will press shift tab to align that, and what I will do is now obviously, because I am using style dot CSS, I have to refer to this style file inside my HTML code.

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So, I am going to take this line which is linking the file.

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And I am going to add it to. So, there we remove that CSS let us call article-three, and we can copy that line of code.

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So, all of them are now referring to the same CSS file. So, this is called a link element and a link element allows us to link this CSS file in the HTML code. Let us save this, so that is one change that we made. Let us make another change to reduce the HTML that we are writing, and this is going to be little complicated, so watch carefully.

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The first thing that I want to do is understand that the HTML content right is mostly common.

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What is differing is the title, the heading, the date and the content right. So, what I am going to do is I am going to create a series of objects in my server dot js file.

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So, I am going to create that content, and I am going to make in java script, a java script object. Inside this object, I will have something called title of the page and the title of the page is, I then have a heading, and we choose article-one. I have a date, which is September 5, 2016. I have the content, which is fairly large.

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So, I will go back to article one take, all this content copy this.

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And let us put this into a server js file. Now you can so you that as I am getting a lot of java script error because my line is spread across multiple lines; and so in java script you want to have a string that expands multiple line, use back code instead of single code. So, I use a back code and this allows me to write multiline string.

So now we have an object that has content right and this is the content for I am going to call it article one. So, we have we have a content. What we want to do is inject this data into a common HTML template. Let us make another object called HTML template and this is again a multiline string.

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And let us copy this HTML.

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We have to copy that. Let us remove the portions that are common, so I am going to delete this. And I am going to replace this with content.

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I am going to replace this part with the date going to replace this part with heading; I am going to replace this part with title right. So, these are the portions that will come through my java script object, and they injected into the HTML. So, now, this is a special feature of java script that allows us to create a string that has variables in the middle; however, these variables do not actually exist because there is no variable call title heading date and content yet. So, what we actually have to do is create a function called create template and this function will take a data object right.

And let us look at here. So, this is a function that has a data object. And let us create the variables to makes sure that these variables exists. So, we have title which is equal to data dot title, we have date which is again coming from data, we have heading which comes from data dot heading. And we also have content which come from data dot content. So, assuming that the create template function gets an object that contains title, date, heading and content, we will be able to create this string that contains the entire HTML and then lets to return HTML template. So, this will now written by the function.

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So, I shall go to article one and it instead of doing a send file, I am going change this back to just a send create template, and I am going to give it the content object that I had which was article one right. So, as you can see the article one object is here.

the first is in the

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So, I have the article one object here; I use the article one object and give it to the create template function, the create template function takes that object extracts the right variables from it, create a string, returns the string and then that is string is sent back in a send request. Let us save all of this work.

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So, we have article one working. If you notice the background has been applied which was a gray background which was a part of the CSS file that we refer to.

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So, we have seen that the background file was light grey. Let us remove the background color element here. And now since we already added padding top; we have two options, we can either let the body merging top remain or change the margin top on our container element. Let us change this to 60 pixels that it applies on all pages and let us remove the term here right, save this. Now we have done this for article 1.

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So, now we do not need the article-one dot HTML file anymore, right.

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Let us do this same exercise for the rest of our functions. So, what we will have to do is create more data objects.

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Let us change this little bit and lets create an object called articles right and the articles object is an object, which contains. And then we have so the idea is now to happen article two which will accept an object and then a article 3 which will also be an object and let us close this here right.

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So, now what we would like to do is write this data, copy this data; and said article two right we can change our content here and here and change the date to may be 10th to reduce the lot of content on this that it says the content for my second article right. So, pay attention to the error block here, where it saying that my syntax is wrong. And it should not be an equal to, it should actually be a colon because we inside an object right.

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So, I am going to take this for article 2; and make this article 3; article 3 and 15 is the content on third article.

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So, now, I have three article objects. Let us compress this and you can see that I have an articles object, which contains article-one, article-two, article-three. The question now is how we are going to avoid writing these lines of code. And so we are going to do a smart thing which is replace this that the parameter called article name. If I use a colon here in the root matching and this is a feature of the express frame work that if I use a colon and enter a name this will try to match this particular part of the path and convert that into a variable, so that means, now the article name will be article hyphen one.

So, this is what is going to happen. I am going to use this property to output the right article object. So, I am going to say articles of article name right. So, now, what will happen is if I do articles of article name, this content will be the content object for article one right, this should work. However, our URLs are article hyphen one and article hyphen two, but our object names are different. Let us change these object name quickly and so you put article-one, article-two and article-three.

The names are corresponding with the article names; I can use this to get rid of this code as well. So, I need the article name value to extract this article name, I will have to write article name is equal to that dot params dot article name. So, this is how I am able to extract this parameter. This is again a functionality that is provided to me by the express framework, and this allows me to extract the article name and use that article name to index into the articles object, and then create the template from that, save this. (Refer Slide Time: 36:05)



So, I have article-one.

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That loads that is changes to article-two. Article-two also working and you can see the new date.

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And let us go to article-three and we can see that the article-three is working as well.

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And we reduce the lot of code from our server dot js file and we actually do not need these files anymore.

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Let us go back to web app account, let us go to article one and let us actually delete this file.

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Let us say commit lets go to article-two, delete article-three, we would not need this file anymore. Refresh our console.

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So, we reduced our code and automated the URL mapping converted that into the reference inside an object.

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Used the data inside that object to create the right HTML string and then serve that HTML string as a response.

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10	ts of stuff to learn!
LU	
Refe	rences to help you understand what we did more clearly:
1)	HTML <style></style>

So, this was an extremely heavy module because not only that we take a lot of our concepts and apply them, but we also wrote a lot of specific code. And there are many times in this video, when you would have not seen these different programming elements and so I have listed out a bunch of references that you guys should refer to and use to understand the kind is step that we did.

Just too quickly read those out we use the style tag for we use the style tag, some CSS, and you can read up little more about how CSS selectors work. The CSS selectors what allows us to select the right HTML element is to modify. We also use the link tag to link our CSS; we can actually use a link tag to link many other things apart from a CSS. We should also read up a little bit about CSS and this guy from Mozilla is a nice place to read up on CSS.

we also used multiline strings and template strings which is the new java script language feature and gives us back quotes. The back quote characters typically to the left of a one on your keyboard, and you might not have used it very often. We also used URL parameterization, which is a way to extract a part or a route or URL in express and convert that into a variable that can be used in code. So, read upon these things to help you understand how we wrote the code that we wrote today.

Also, while you are writing code you might have to iterate quite frequently, because very often you will be making small, small mistakes that you will only catch after you deploy

a code. So, I would recommend that you actually try to set up the local development environment, because that will help you iterate much faster. Please refer to the previous module to understand how to set up a local development environment.

There are lots of guides in the internet to help you set up the environment on Linux, or Windows or Mac and use those guides in fact just as a quick note. A lot of time when you do application development, most of the latest information is something that you will have to find yourself online.

And for example, the reference is that I gave for installing something on Mac is something that might change 6 month later or 1 year later and because these things are moving so quickly. We as developers have to get use to searching for the content on the internet, used to collaborating with a community and reading and learning by ourselves on the internet. So, please do not give up or lose hope and things are not working for you, if you are not able to set get up or if you are getting functions errors, do a lot of research, be persistence, search for things in Google, ask questions in the forum and you eventually get your environment working for a you.

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In the next module, we are going to be learning what client side java script, which is java script that executes on the browser not java script that is executing on the server. And we will also learn how to write our own API, and we will actually implement our own API end point.