Portable Frontends

Hoisting the Application out of the Component

Diagrams

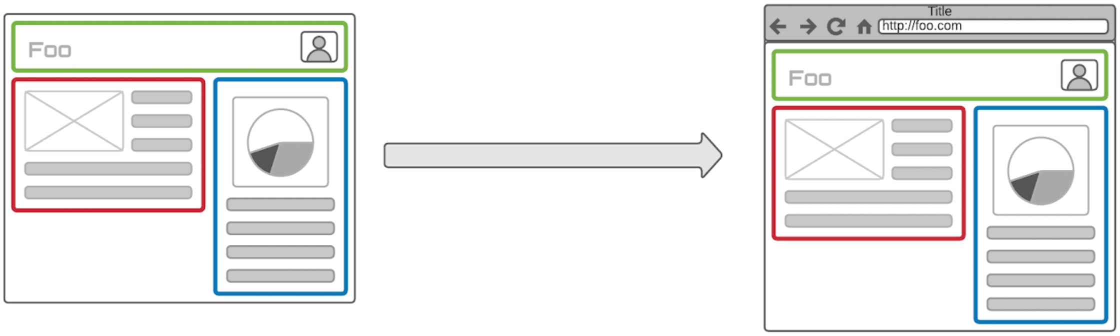
Hello. My name is Josh Cox, a staff engineer on Llama Pod. Our pod is responsible for program configuration; in addition to the activity and exercise services, we own an application named Configurator, which is a content management system that gives Physical Therapists and Health Coaches the ability to modify… or configure… base Activity Plans and user-specific Activity Plans.

Today I'm going to be talking about portable frontend assets. I'm convinced that a strategy of hoisting application details out of components unlocks a huge amount of flexibility when sharing components. If done intentionally, this process helps to define layers within the frontend with well defined interfaces that, in turn, can also be exposed to enable engineering consumers to easily build concept-specific user interfaces.

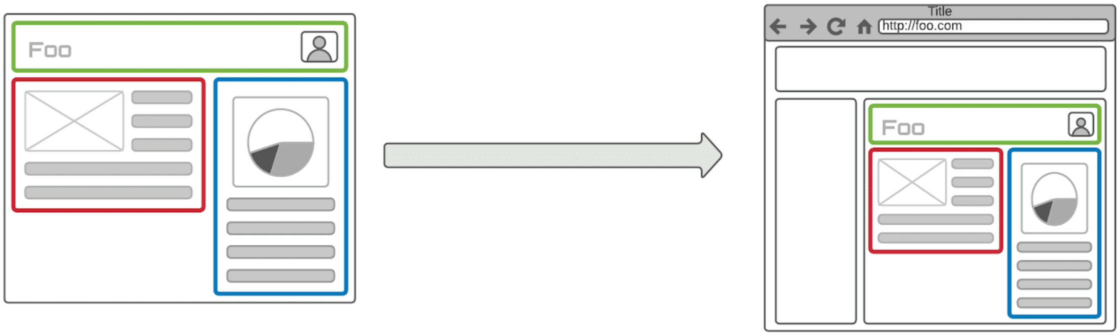
But first… What do I mean by 'Portable'?

Portable means "able to be transferred from one machine or system to another." In the context of this talk, an application that is portable is one that is "able to be rendered in more than one application". There are three use-cases that I'm targeting in this talk.

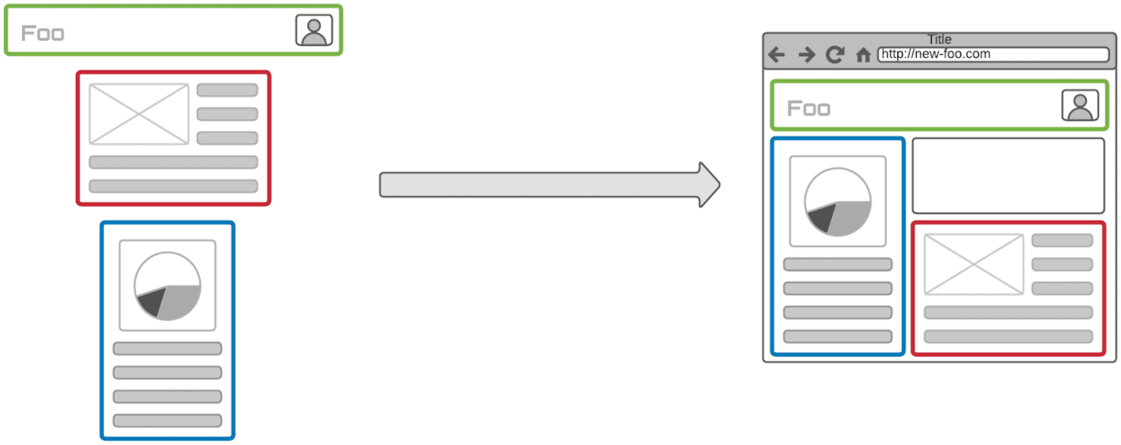
Stand up the application by itself



Embed the application within another application (shallow embedding)



Implement custom workflows and user interfaces (deep embedding)



An application's discrete sub-components can be imported and stitched together to form new workflows and user interfaces.

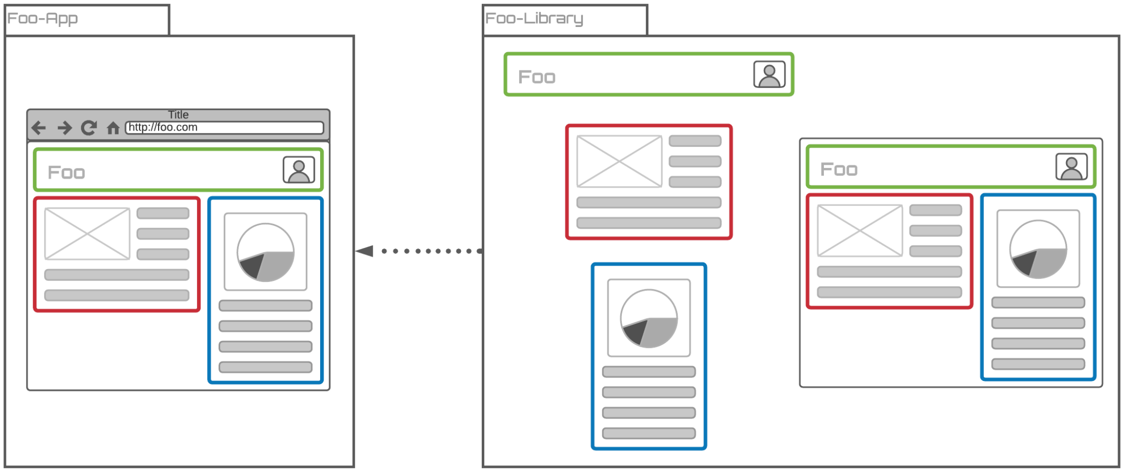
Don't assume how consumers will use your code

By developing in a manner that enables each of the three scenarios above, there are no high-level assumptions about how a consumer embeds applications or imports and uses components. In my experience, there often seems to be a consumer somewhere and they're always doing something weird to load an application (or pieces of it) into their own application. By following some rules, we can *enable* our consumers. We can expose both a high-level application that can be stood up alone or embedded within other applications with minimal effort. We can expose a library of contextually-significant reusable components that can be used to seamlessly integrate our domain/context into others.

To achieve the portability displayed above, we don't need to change much. This can be achieved by using concepts and dependencies that we already have. So let's dive in.

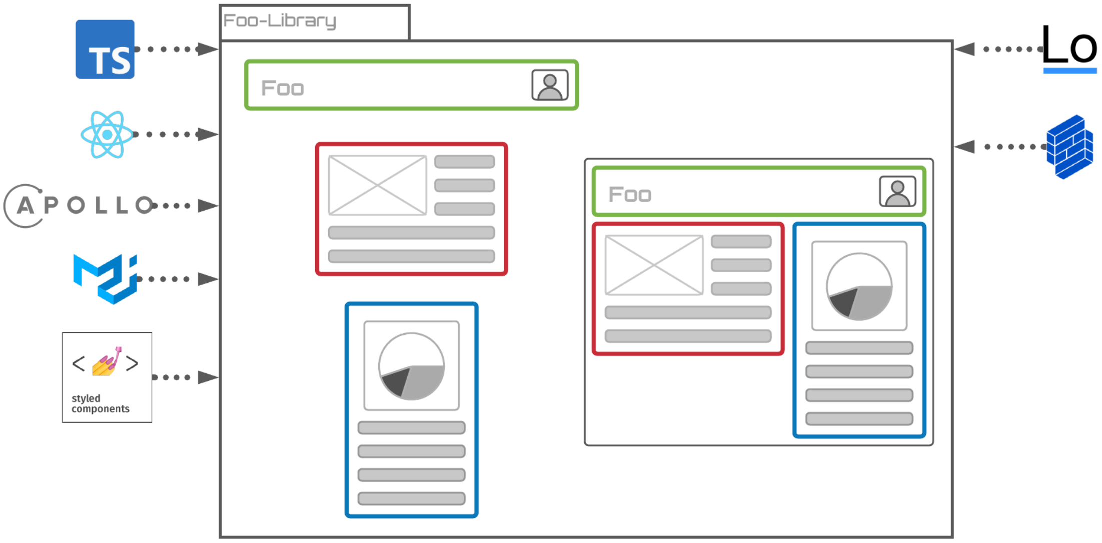
Expose the Sum & its Parts

The process of building an application generally is a process of creating a rich library of components, internal to the application. This includes hooks, Providers, UI Components, and more. Make them public. Expose an application *and* a library of components and utilities that can be used to build similar applications.



Building this library has positive consequences other than just enabling consumers. Notably, it's ideal for rendering in isolated environments (Storybook, unit testing).

Evaluate Dependencies



Every dependency has a compatibility cost when it comes to portability, some more than others. On the left, there are dependencies that either define or have an effect on the environment (TypeScript, React, etc); we'll call these 'prerequisites' - any environment that this library will be used in ought to satisfy these requirements. On the right, there are dependencies (lodash, formik) that can be used internally within components (operating as black boxes), hidden from consumers. Leaking data from internal dependencies is not recommended.

Prerequisites need to be relatively consistent across all applications. If maintenance is a concern, static analysis can be used to audit versioning of common dependencies. The remainder of this talk assumes a consistent environment made up of the dependencies listed on the left.

A Note on Peer Dependencies

Dependencies that define or affect the environment are often listed in a package's Peer Dependencies, a concept in NPM that is used to specify that a dependency will be provided by the target environment. Peer Dependencies may or may not be the best choice, depending on the version of NPM.

Peer Dependencies in NPM v4-v6

Peer Dependencies in NPM v4-v6 are not enforced by anything but a warning message and are not automatically installed when running *npm install*. Because of this, people often will add peer dependencies to the dev dependencies to ensure that peers are installed for local development. Unfortunately, linking multiple local packages together causes duplicate npm modules of the peer dependencies. This sometimes necessitates extra configuration (generally, aliasing a dependency's name to a specific location/version in a bundler).

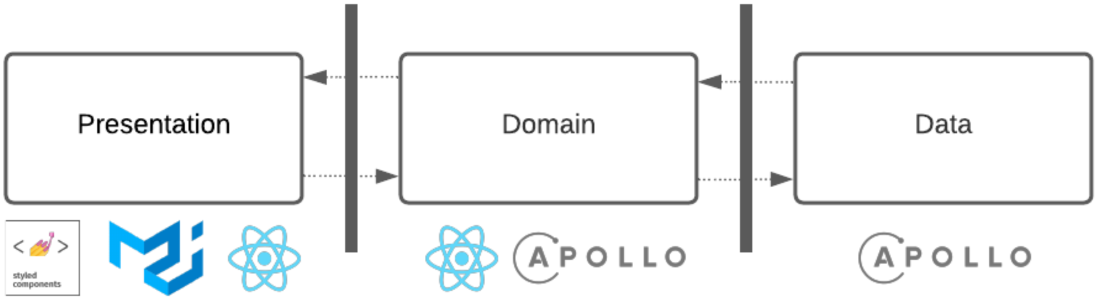
While peer dependencies work in a pinch, I believe when exploring the idea of distributing frontend resources across packages that it's prudent to forego peer dependencies in favor of legitimate dependencies with versions that we have consensus upon (like React, UI Libraries, etc). Using real dependencies enforces version ranges and ultimately fails faster when encountering incompatible dependencies.

Peer Dependencies in NPM v7

NPM made significant changes to Peer Dependencies in v7 (RFC 0025). The changes introduced in v7 include automatically installing peer dependencies as well as blocking installation when peer dependencies have upstream dependency conflicts.

The Layers of an Application

We established earlier that the plan is to break down the application into sub-components that will be exposed as a library. The first step is to slice up the application into layers that have general responsibilities within the application. A common pattern is to divide the frontend into three general layers: presentation, domain, and data (see Presentation Domain Layering, Apollo Client-side Architecture).

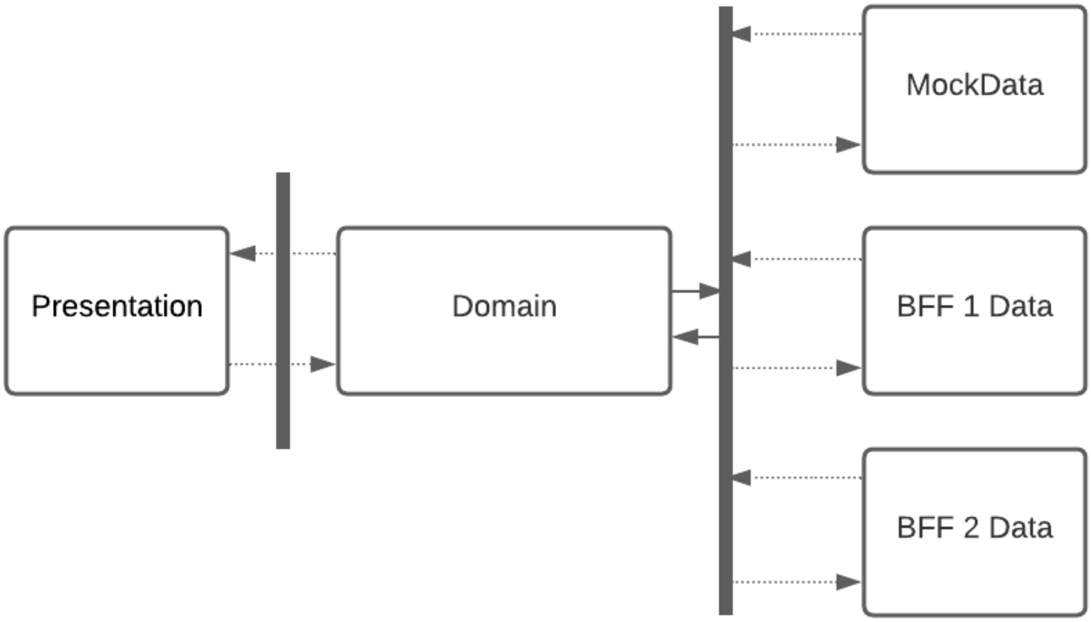


An application that has been organized into discrete layers that only communicate through well-defined interfaces.

- Allows for focusing scope of attention to one layer, independent of other concerns
- Layers can be substituted, so long as the interface matches

Data

The data layer is a set of functions or utilities that are responsible for accessing and editing the underlying model (a frontend API). This API is utilized by the domain to pull data into the application from outside.



Since the data API has a well-defined interface, it can be swapped out for an alternative data layer so long as the contract is fulfilled. This can be done when testing or developing the Domain and/or the Presentation to create a mock version of the application that isn't connected to any real data source. Alternatively, one could implement a new data layer that utilizes a different data source. This allows us to switch out one BFF for another and also unlocks the ability to use the Presentation & Domain in an entirely different application.

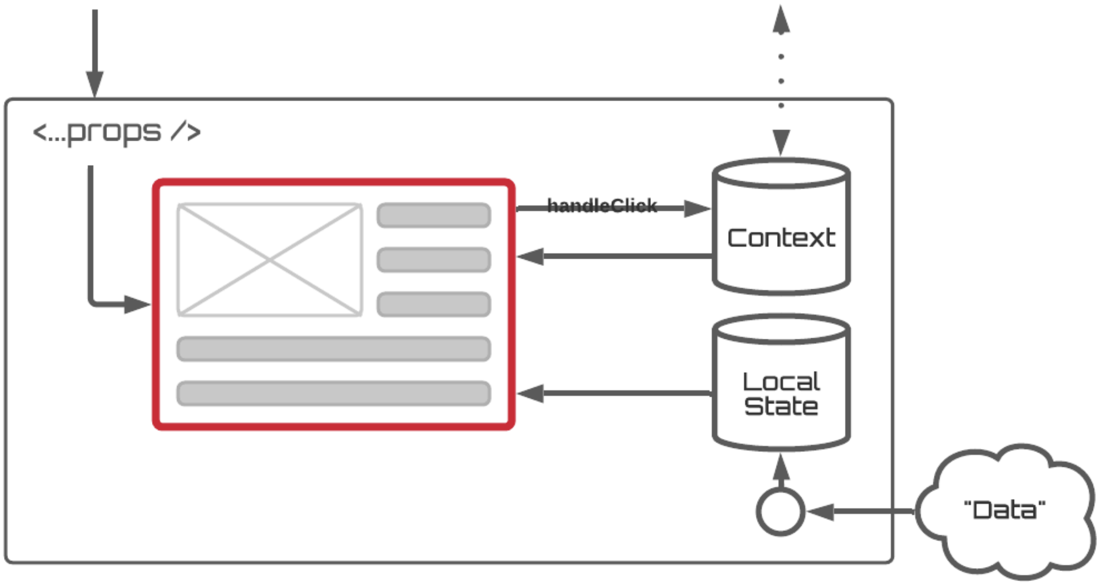
Presentation

The presentation layer is responsible for displaying a user interface. It's a collection of components that are free from outside context. Data and behaviors are passed (injected) into the component via props. State that is strictly local to the component belongs in the component, but state that is outside the scope of the component is passed into the component via props. Hoisting state, data, and behavior out of a component leaves a component that is purely UI.

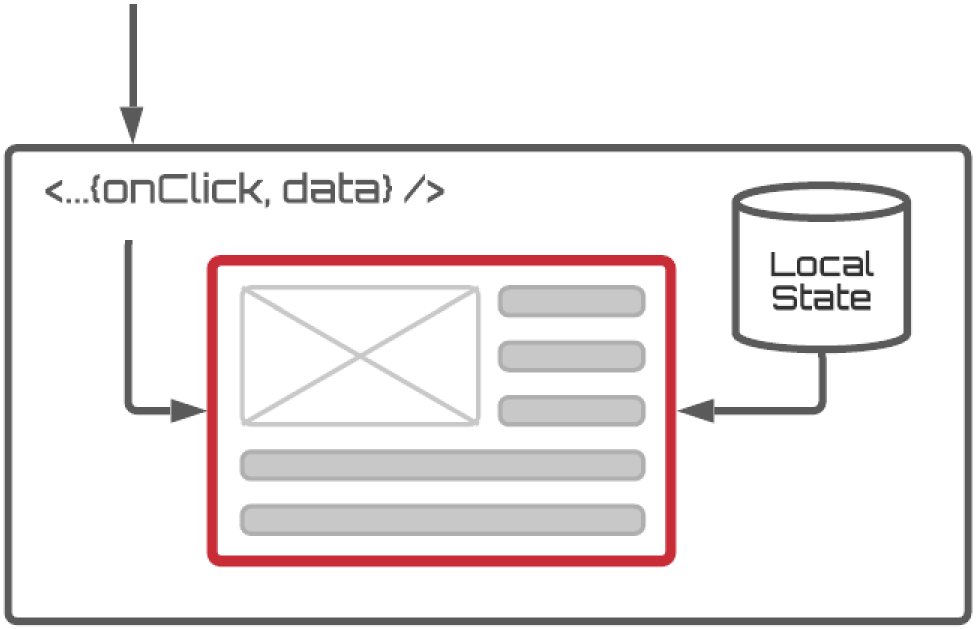
Context-free components have several benefits. They can be used in any application or library with matching prerequisites, they compose well, and their isolated nature lends well to testing.

Hoisting the Application out of the Component

Follow these steps to factor out an application-free component.



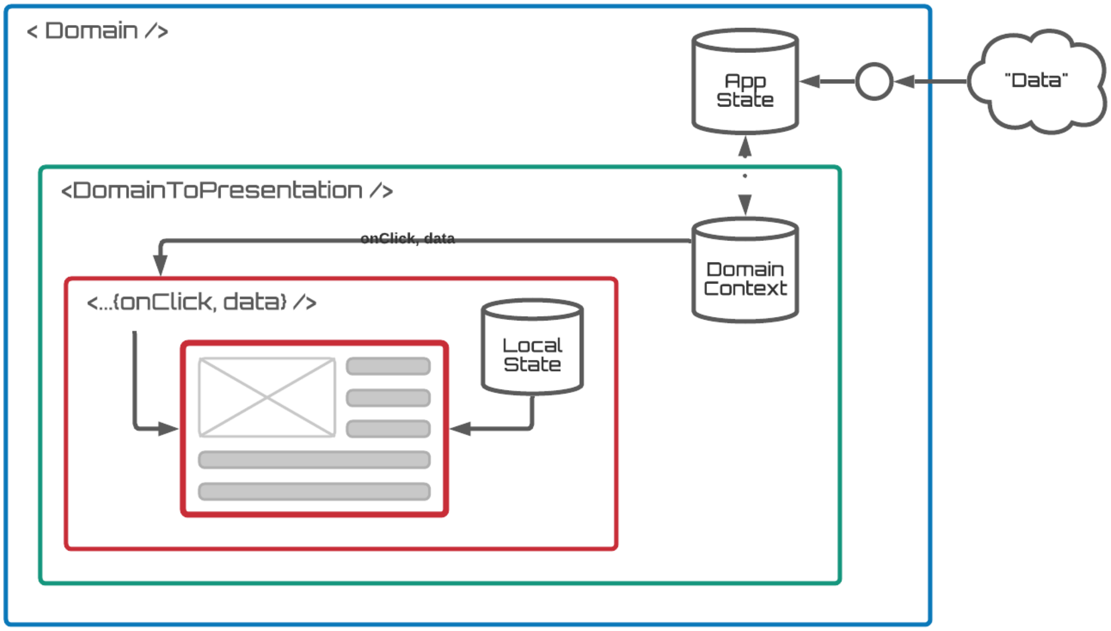
1. Determine external dependencies within the component
    a. State that is not local (Context, hooks, etc)
    b. Data that is fetched from a network resource
    c. Handlers that affect state that is not local or make network requests
2. Refactor the component to receive these dependencies as props
    a. Handlers passed in as functions (ex. onDuplicateProgression, onDeleteExercise)
    b. Data and state passed in as… data.
3. Refactor the parent to pass in the data and behavior.



Domain

The Domain forms the brains of the application. So far, we've described the Data and Presentation layers, both of which are unable to *do* anything. The Presentation needs to be told what data to display and how to handle interactions. The Data API needs to be called. The Domain is the layer that “glues” the Data and Presentation together to create a cohesive application.

The Domain has access to the Data API and uses it to populate the application's state. A component connects the domain to the presentation by providing the data to be rendered and handlers for UI interactions that affect the application state.



Summary

That's it for a general overview. The idea here is to create a rich frontend ecosystem that is consistent and portable (within our ecosystem). We've discussed three scenarios for rendering user interfaces: standalone, embedding, and custom integration. We discussed how exposing the sum of the application and its parts, the subcomponents, sets consumers up for any of those three scenarios. We've briefly touched on dependencies and how we might synchronize or trim them to ensure a consistent environment from application to application. And finally, we discussed a method of layering the frontend such that layers can be independently exposed from the application library. I hope you enjoyed the talk. Any questions?