

Quill: A Collaborative Design Assistant for Cross Platform Web Application User Interfaces

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How mobile-ready are corporate websites?

- “Only 20% FTSE 100 corporate sites have mobile optimised content”
 - Nicola Thompson, Head of standards services, Magus, July, 2012
 - <http://slidesha.re/ZdyLjl>
- UK companies not ready for mobile internet
 - Two-thirds of companies in the FTSE 100 have websites that are difficult to use on smartphones, a study shows.
 - Robert Cookson, Financial Times, 2 January 2013
 - <http://on.ft.com/Zp4UZI>
 - “FTSE 100 companies are not mobile-ready and are wasting millions of pounds on internet advertising by sending visitors to websites that do not work as users expect them to,” said Jonathan Bass of Incentivated
 - Domino’s Pizza, one of the pioneers of online fast-food sales in the UK, reported in September that purchases from mobile phones were growing at almost 50 per cent a year and accounted for nearly a fifth of its online sales.



It's only going to get worse...

- Increasing variety of devices
 - Desktop, mobile, tablets, connected TVs
 - Regular and ultra high resolution displays
- Coming soon
 - Multi-screen applications
 - In the living room and in the office
 - Cars
 - Dashboard displays, smart phones, heads up displays, multimodal interaction, and concerns over ensuring driver safety
 - Wearable devices
 - Smart watches and glasses
 - Sports and healthcare

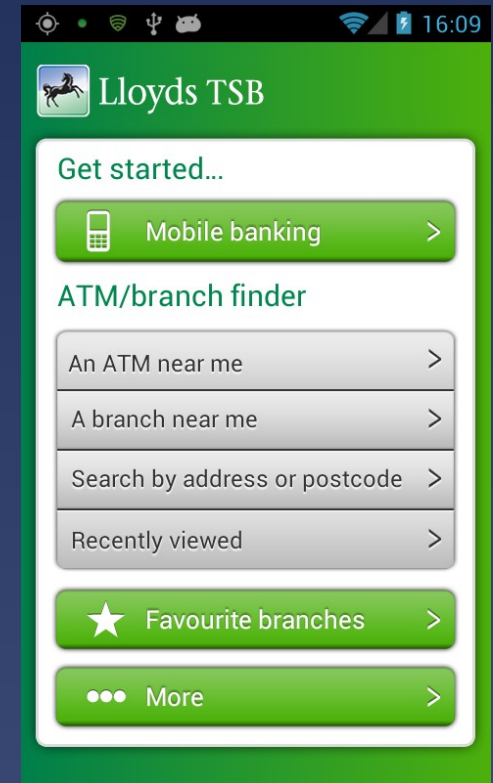
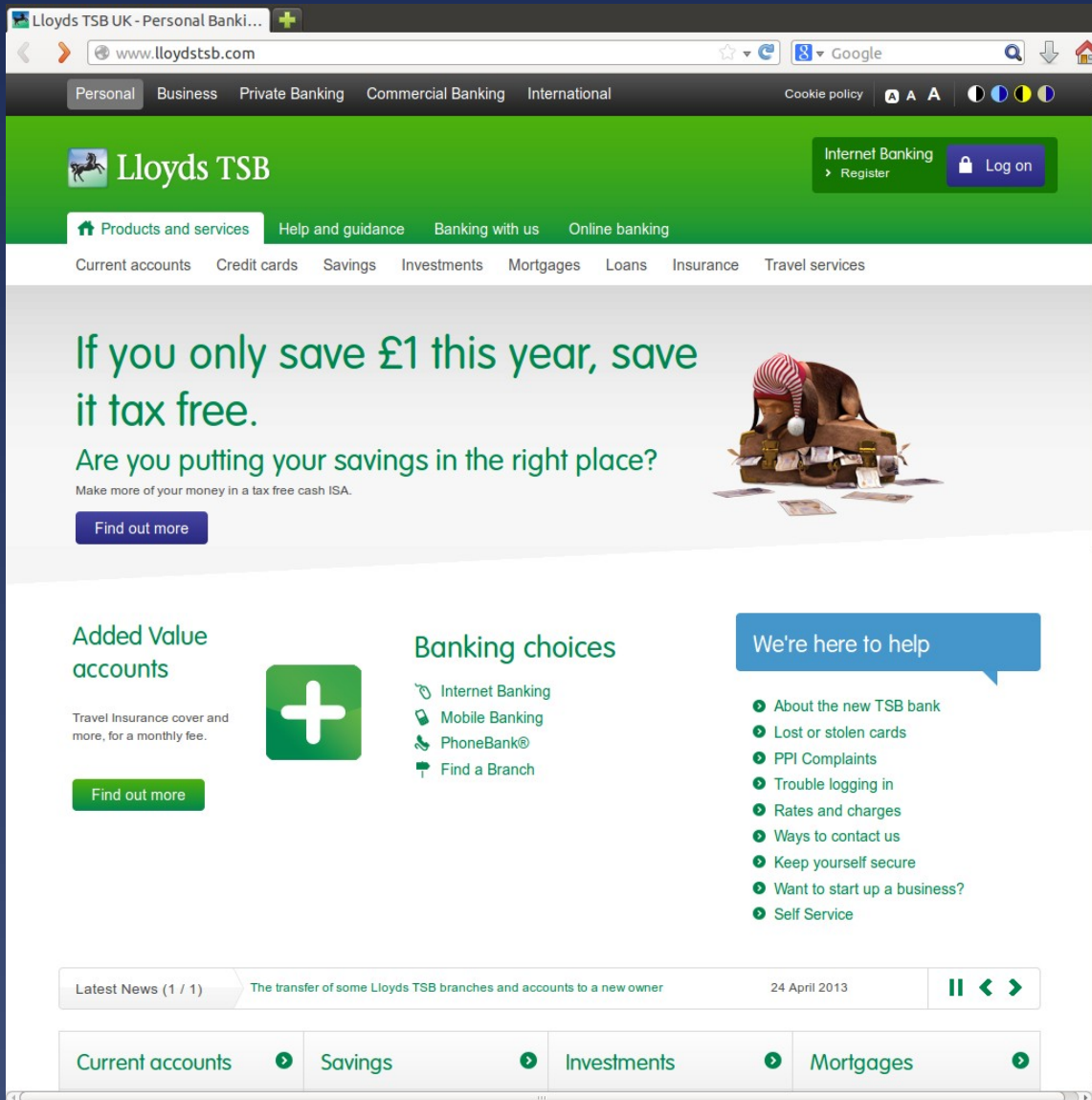


Why Web Apps?

- Current practice is to use web sites for desktop, and native apps for other platforms
- Developers need to learn new programming languages and SDKs for each platform
- Web technologies reduce the cost and increase the reach!
- Save time and money by avoiding app stores!
 - Keep all of your income
- Responsive Design techniques
- But need for better developer tools!

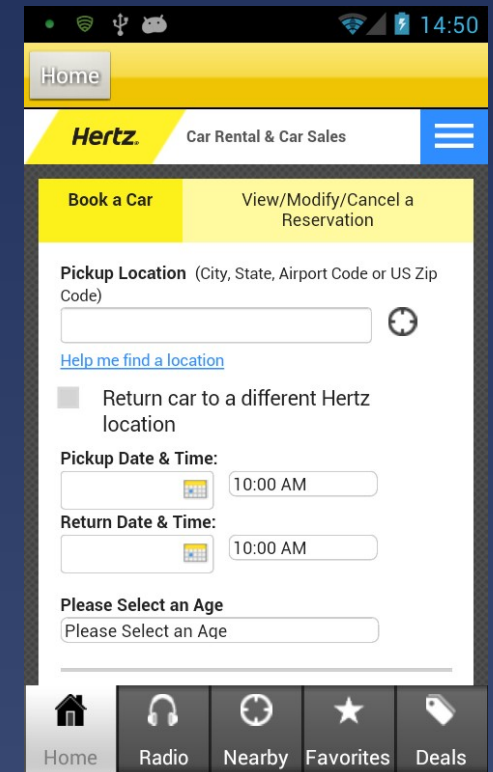
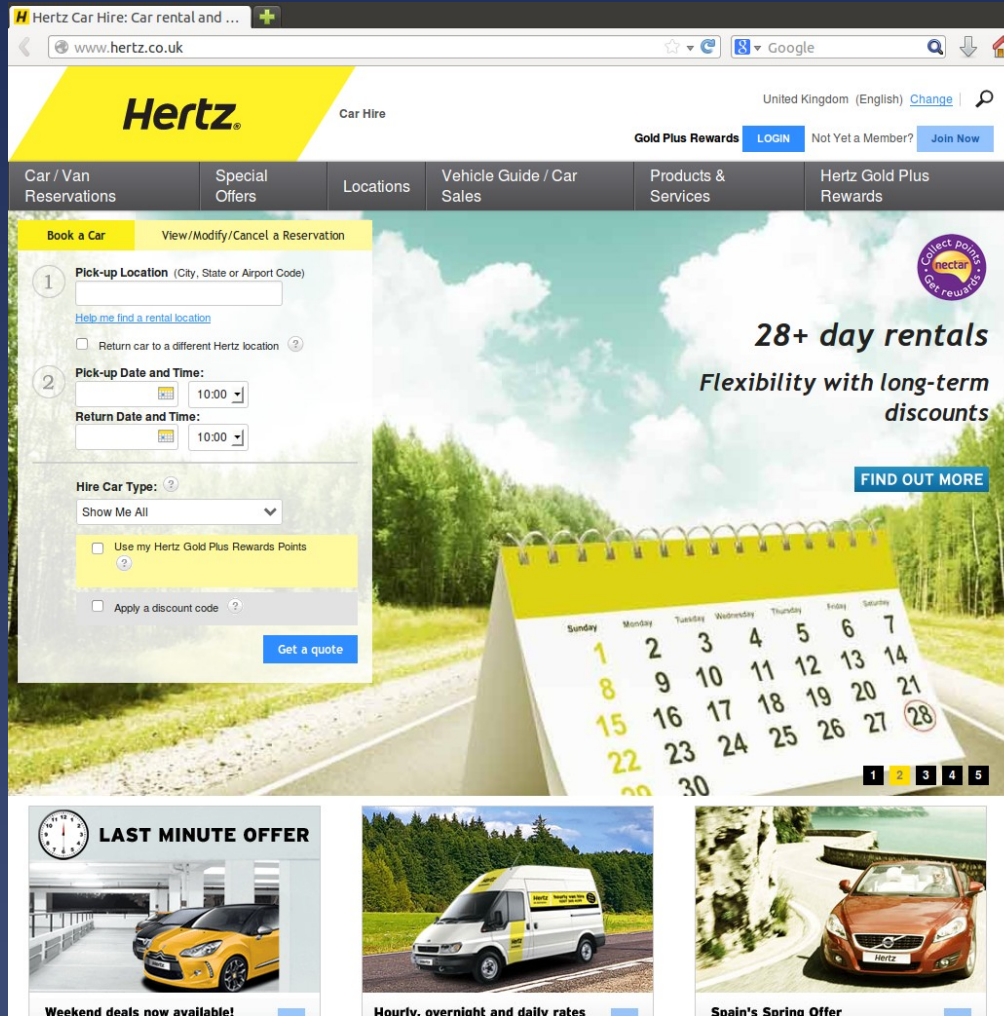


Desktop vs Phone



Captured from mobile App

Desktop vs Phone



Captured from mobile App

Desktop vs Phone

The screenshot shows the Hertz website on a desktop browser. The URL is www.hertz.co.uk/rentacar/reservation/vehicles. The page features a navigation menu with options like 'Car / Van Reservations', 'Special Offers', 'Locations', 'Vehicle Guide / Car Sales', 'Products & Services', and 'Hertz Gold Plus Rewards'. The main content area is titled '2. Choose a Car' and displays a list of vehicle options. Each option includes a car image, a brief description, and two pricing columns: 'Pay at Location' and 'Pre-Pay Online'. The options shown are:

- Mini, 2-3 Door, Manual, No Aircon** (MBMN): Kia Picanto or similar. 4 Passengers, 2 Small Suitcase, Manual Transmission, 54 miles/gallon. Prices: 119.10 GBP (Pay at Location) and 105.40 GBP (Pre-Pay Online).
- Economy, 2-4 Door, Manual, Aircon** (ECMR): Vauxhall Corsa or similar. 4 Passengers, 1 Large Suitcase, 2 Small Suitcase, Manual Transmission, Air Conditioning, 51 miles/gallon. Prices: 122.70 GBP (Pay at Location) and 108.60 GBP (Pre-Pay Online).
- Compact, 4-5 Door, Manual, Aircon** (CDMR): Ford Focus or similar. 5 Passengers, 2 Large Suitcases, 1 Small Suitcase, Manual Transmission. Prices: 133.10 GBP (Pay at Location) and 117.80 GBP (Pre-Pay Online).

A 'Your Itinerary' sidebar on the right shows pickup and return times and location.

The screenshot shows the Hertz mobile app interface. The top navigation bar is yellow with a 'Home' button. Below it, there's a 'Sort Vehicle By:' dropdown set to 'Original Order'. The main content area displays three vehicle options, each with a car image, a brief description, and a price with a 'Pay Later' or 'Pay Now' button:

- Compact, 4-5 Door, Manual, Air** (CDMR): 140.96 GBP (or 214.82 USD). Pay Later button.
- Compact, 2-4 Door, Automatic, Air** (CCAR): 206.65 USD. Save 8.17 USD. Pay Now button.

The bottom navigation bar includes icons for Home, Radio, Nearby, Favorites, and Deals.

Captured from mobile App

Desktop vs Phone

Available Extras

Add	Item Description	Quantity	Price
<input type="checkbox"/>	Infant Child Seats For infants less than one year and under 20 lbs or 9kg More Details	1	54.00 GBP Max Per Rental
<input type="checkbox"/>	NeverLost® and Bluetooth Satellite Navigation System provides turn-by-turn directions. If your pickup and return location are not the same you may be charged a surcharge fee More Details	1	90.00 GBP Max Per Rental
<input type="checkbox"/>	Booster Car Seats For children weighing 40-100 lbs or 18-45kg More Details	1	21.00 GBP Max Per Rental
<input type="checkbox"/>	Child Seats Forward facing for children weighing 20-40 lbs (8-18kg) up to 40 inches (101cm) in height. More Details	1	54.00 GBP Max Per Rental

Your Itinerary:

Pick Up time
Mon, 20 May, 2013 at 10:00

Return time
Fri, 24 May, 2013 at 17:00

Pickup and Return Location.
Leeds Bradford Airport
[View Details...](#)

Discounts:
No Affiliations

Arrival Information:
No Arrival Information

Your Vehicle:

Compact, 4-5 Door, Manual, Aircon, CDMR
(C) Ford Focus or similar
[More Details](#)

Payment method: Pay at Location

Breakdown of mandatory items included in rate
1 week

- Location Service Charge
- Collision Damage Waiver
- Theft Protection
- Vehicle Licensing Fee and Road Tax
- Tax and other charges

Submit

Convenience Options

NeverLost® GPS

75.00
GBP Max Per Rental

Safety Options

Booster Seat

17.50
GBP Max Per Rental

Home Radio Nearby Favorites Deals

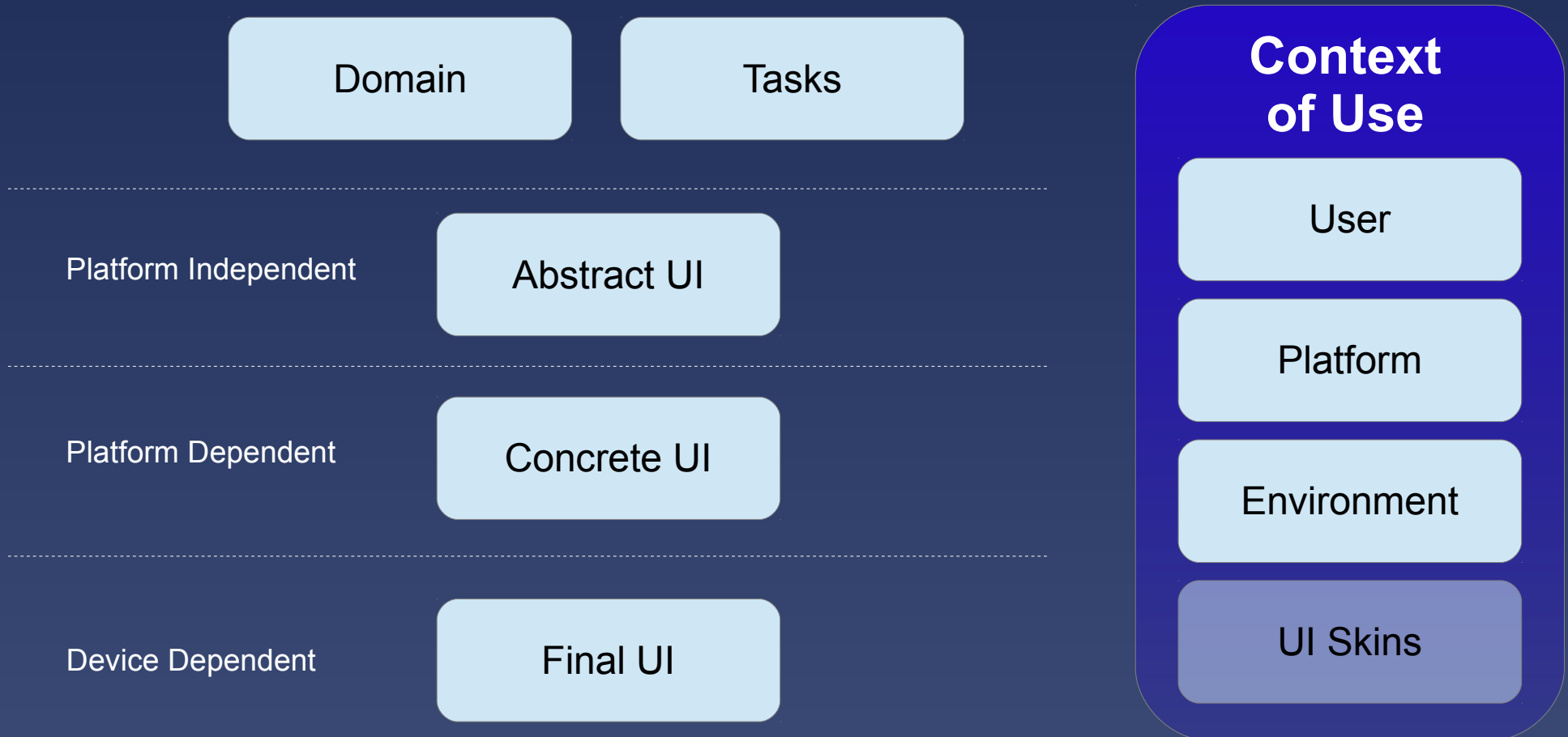
Captured from mobile App

Design Process

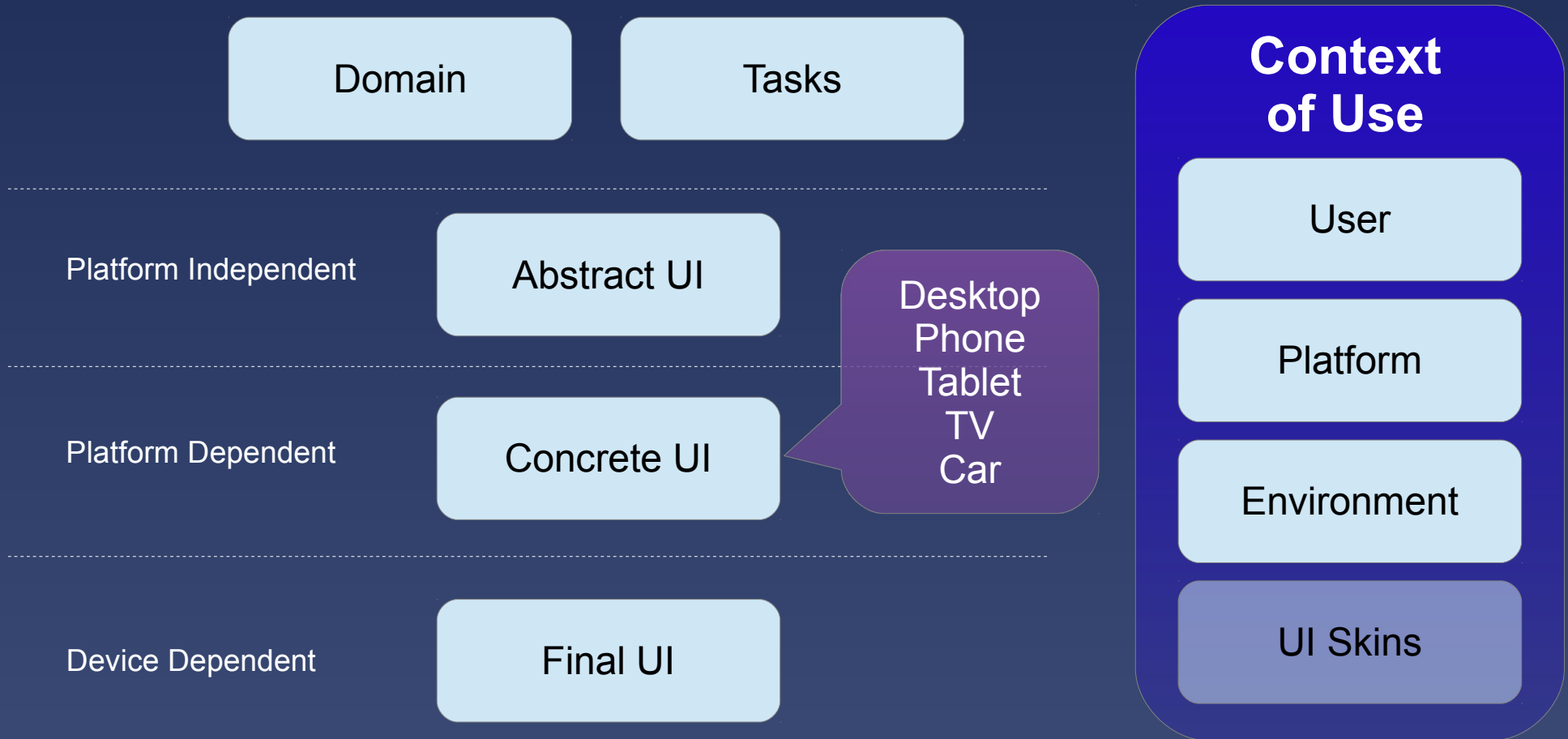
- Agree on the business requirements
- Map them into domain and task models
- Use automated design tool to generate rough design proposals for each target platform
- Adjust the design to suit your taste
- Apply a UI skin and generate the final UI for each class of device
- Review and adapt until done!



Abstraction Layers



Abstraction Layers



Abstraction Layers



Distinguish between normal and advanced features

Abstraction Layers

Domain

Tasks

Context of Use

User

Platform

Environment

UI Skins

Platform Independent

Abstract UI

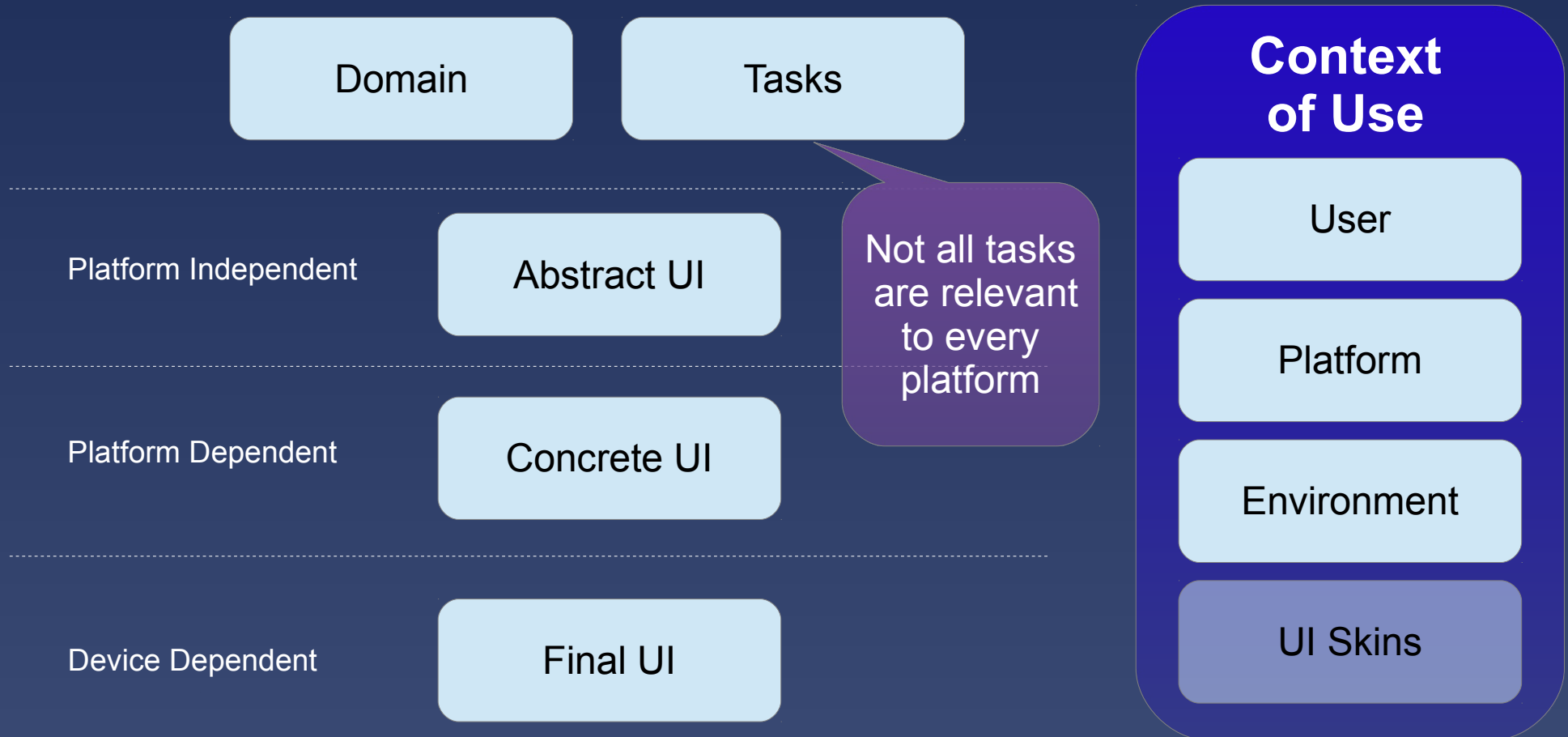
Platform Dependent

Concrete UI

Device Dependent

Final UI

Abstraction Layers



Quill

- Open Source, HTML5 based design tool
- Expert system generates proposals via a search of the design space
 - You select which one you prefer
- You can adjust the design at each layer of abstraction
- Your changes are considered as constraints and propagated to reduce the size of the search space as Quill looks for consistent designs
 - Quill synchronizes changes across layers and platforms
 - Ensures that the UI remains consistent across devices

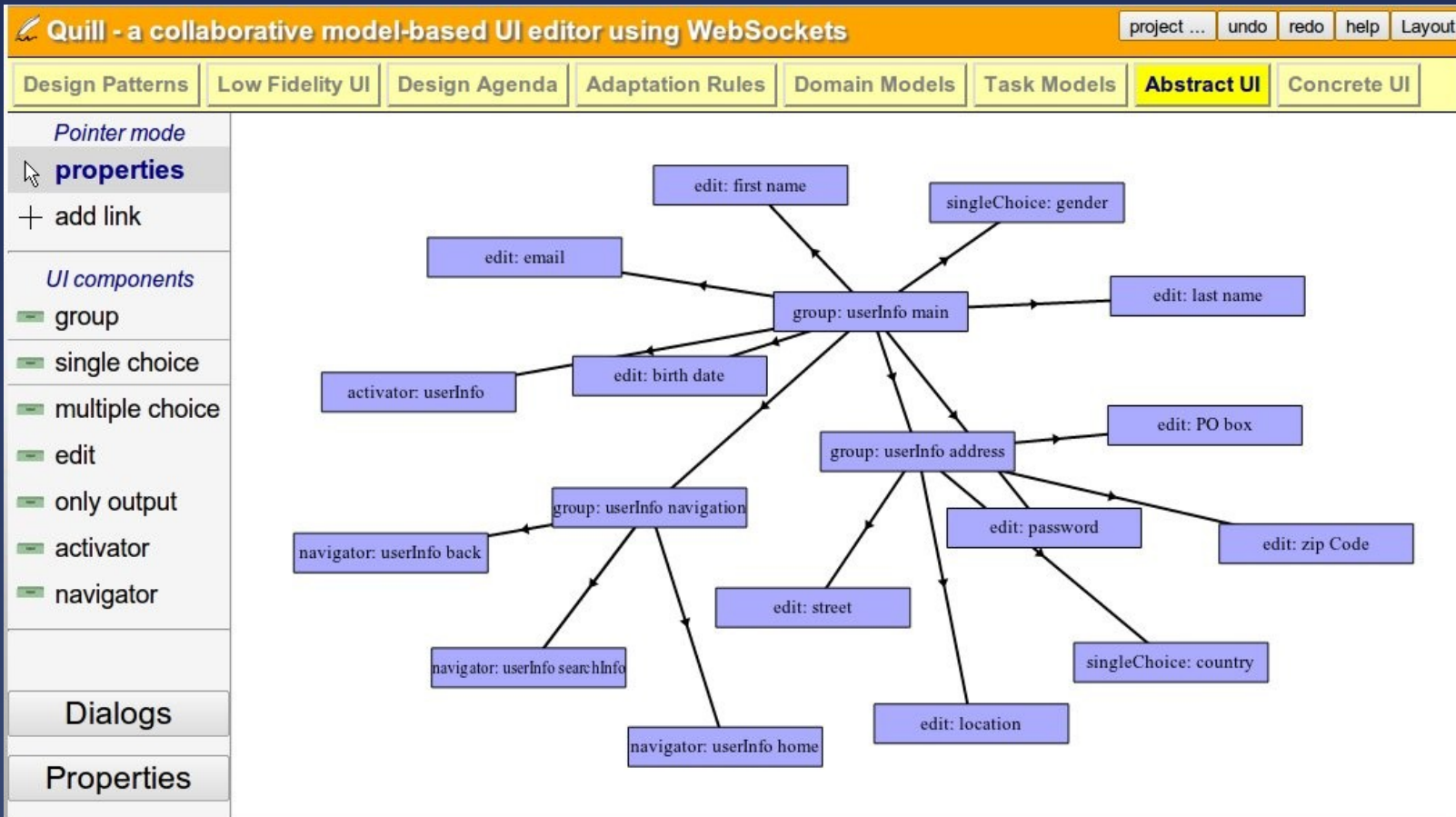


Quill

The screenshot shows the Quill web editor interface. The title bar reads "Quill - a collaborative model-based UI editor using WebSockets" and includes a "project ..." dropdown, "undo", "redo", "help", and "Layout" buttons. The main menu has tabs for "Design Patterns", "Low Fidelity UI", "Design Agenda", "Adaptation Rules", and "Do...". Below the menu, there are tabs for device types: "desktop", "phone", "tablet", "television", "automotive", and "vocal". The "tablet" tab is selected. On the left, a sidebar lists "UI components" (heading, normal text, text box, text area, drop down, radio button, check box, button) and "Layout containers" (vertical, horizontal, grid box). A "Prebuilt Assemblies" section is also visible. A dialog box titled "Project: Serenoa M18 Demo" is open, showing "Selected platforms for the concrete UI:" with a list of checkboxes: desktop (checked), phone (unchecked), tablet (checked), television (unchecked), automotive (unchecked), and vocal (unchecked). At the bottom, a disclaimer states: "This is work in progress, and currently just a proof of concept for basic editing actions. Will add web sockets support later for sync with server, and real-time revision control for concurrent editing. Big question is understanding how to support a broad range of design intents other than basic UI, and how these map to pages on different kinds of devices. Adding adaptation rules should then come naturally."

Early demo <http://www.w3.org/2012/quill/>

Quill - Abstract UI models



Quill - Concrete UI models

The screenshot displays the Quill application interface. At the top, the title bar reads "Quill - a collaborative model-based UI editor using WebSockets" with menu items for "project ...", "undo", "redo", "help", and "Layout". Below the title bar is a navigation bar with tabs for "Design Patterns", "Low Fidelity UI", "Design Agenda", "Adaptation Rules", "Domain Models", "Task Models", "Abstract UI", and "Concrete UI".

The main workspace is divided into two panes. The left pane, titled "UI components", lists various UI elements under three categories: "UI components", "Layout containers", and "Prebuilt Assemblies". The right pane, titled "Concrete UI", shows a preview of these components for a "tablet" device. The preview includes a heading, regular text, a single-line text box, a multi-line text box with a drag-to-resize tool, a list of radio buttons, a checked checkbox, a button, and a dropdown control.

UI components

- H** heading
- normal text
- text box
- text area
- drop down
- radio button
- checkbox
- button

Layout containers

- vertical
- horizontal
- grid box

Prebuilt Assemblies

- map

Concrete UI

desktop | phone | **tablet** | television | automotive | vocal

This is heading

Some regular text used for explanatory purposes

a single line text entry box

a multi-line text box with a drag to resize tool

```
The quick brown fox jumps over  
the lazy dog
```

- slow
- medium
- fast
- a check box

a regular button

The following is a drop down control that has just been selected

click to edit label

Domain Models

- Notation inspired by WebIDL
- Parsed into JavaScript Object model
- Annotated with
 - Relevancy conditions
 - Validity constraints
 - Default values
 - Call outs to handlers

```
@import "clauses"  
@import "vehicles"
```

```
interface customer {  
  first_name string;  
  last_name string;  
  email email_address;  
  phone phone;  
  young_driver boolean;  
  marketing_opt_in boolean;  
}
```

```
interface card {  
  type {MasterCard, VISA, AMEX};  
  number string;  
  expiry_month month;  
  expiry_year year;  
}
```

```
interface itinerary {  
  pickup_date date_time;  
  return_date date_time;  
  pickup_location location using find_location();  
  return_to_origin boolean;  
  return_location location using find_location();  
  pay {now, at_location};  
  #relevant return_location !return_to_origin  
  #default return_location pickup_location  
}
```

Task Models

- High level
 - Independent of UI details
- Hierarchy of tasks
 - Task - sub-tasks
 - Normal/advanced tasks
- Ordering constraints
 - One task enabling another
 - Unordered tasks
 - Task preconditions

```
task "make a reservation" {
  task "Customer details" using customer;
  enables {
    task "Pick up and return" {
      task "pick up details" {
        concurrent {
          task "find rental location" using
            itinerary.pickup_location;
          task "enter date and time" using
            itinerary.pickup_date;
          task "Return to pickup location" using
            itinerary.return_to_origin;
        }
      }
    }
  }
  task "return details" {
    concurrent {
      task "find location" using itinerary.return_location
        #precondition !itinerary.return_to_origin;
      task "enter date and time" using
        itinerary.return_date;
    }
  }
  task "Pay now or at pickup" using itinerary.pay;
}
task "pick car model" using agreement.vehicle;
task "Choose extras" using extras;
task "Review and book" using agreement;
}
```

Abstract UI Models

- Platform independent
- Generated from domain and task models
 - Bindings to interfaces defined in domain model
 - Annotated to express constraints, e.g. relevancy

```
group "make a reservation" {
  group "Customer details" {
    select customer.first_name;
    select customer.last_name;
    select customer.email;
    select customer.phone;
    select customer.young_driver;
    select customer.marketing_opt_in;
  }
  group "Pick up and return" {
    group "pick up details" {
      select "find rental location"
        itinerary.pickup_location;
      select "enter date and time" itinerary.pickup_date;
      select "Return to pickup location"
        itinerary.return_to_origin;
    }
    group "return details" {
      select "find location" itinerary.return_location
        #precondition !itinerary.return_to_origin;
      select "enter date and time" itinerary.return_date;
    }
    select "Pay now or at pickup" itinerary.pay;
  }
  group "pick car model" {
    using agreement.vehicle;
  }
  group "Choose extras" {
    using extras;
  }
  group "Review and book" {
    using agreement;
  }
}
```

Quill's Architecture

- Models held in the cloud
 - Node.js based processor
- Direct manipulation interface in browser
 - HTML5 Canvas for graphical models
 - Force directed layout (charges and springs)
 - Uses `window.requestAnimationFrame()` for smooth animation
 - Plan to combine with hierarchical Voronoi cells for tree models
- Changes to models transmitted in text format over web sockets
 - Live editing through near real-time revision control
- A work in progress, with deadline of September 2013



Constraint Propagation

- Decision points - where human designer can force a given choice
 - e.g. decisions on layout and sub-dialogs
- Some things follow naturally from domain/task model
 - Changes to abstract or concrete UI that effect domain/task models
- Relationships across abstraction layers
 - Abductive Reasoning
 - If you know certain facts and also that certain relationships hold true, then it is possible to infer additional facts that must be true if the relationship is to hold
 - Formalized as combination of relational joins and unification
 - Demo <http://www.w3.org/2013/01/abduction/>
 - Replaces lots of event-condition-action rules



Developer Survey - Quotes

- Yes, I believe that models are very relevant and useful but the lack of "easy to use" applications, "easy to draw models" puts a certain level of resistance of using this tools from part of developers"
- ... if the model-based approach is directly responsible for the generated code and any changes in the code automatically reflects in the model then it would be extremely relevant to have this kind of approach in my development phase. The model would give me a macro approach to my application helping me to quickly understand what the application is doing...
- ... maintaining the docs and the code in a disjoint manner makes me waste some of the time [...] given that the coding sometimes needs to be changed to work
- I'm not sure models could be used in our domain: UIs are very complex and uses custom widgets.



Related Work

- EU FP7 Serenoa project
 - Context aware model-based user interfaces
 - <http://www.serenoa-fp7.eu/>
- W3C Model-Based UI Working Group
 - Standardizing task models and abstract UI
 - <http://www.w3.org/2011/mbui/>
- Responsive Design, e.g.
 - <http://www.w3.org/2013/Talks/responsive-design.pdf>
- This talk and associated short paper
 - <http://www.w3.org/2013/Talks/quill-slides-www2013.pdf>
 - <http://www.w3.org/2013/Talks/quill-paper-www2013.pdf>

