The Marketplace of User Interface Real Estate

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Graphical User Interface Assets

- The UI assets can be different according to the interface features.
  - Typical assets are screen regions, audio channels and input devices.

- Each asset is characterized by properties that make it more or less suitable for the application needs.

- Moreover, some assets can result more appealing than others.
  - For instance, eye tracking studies have proved that the upper-left quadrant gets more the user attention.

- Applications do not know the number and qualities of assets at design time.
Coordinate a GUI

- Coordination of GUIs

- Cooperative approach:
  - Model-View-Controller

- Question: Is cooperation necessary in order to coordinate the User Interface?
Resource Allocation

- A logic to assign a discrete set of resources to a set of agents

- Strategies:
  - Cooperative
  - Supervised
  - Optimized
  - Competitive
Key Idea

- A competitive approach in analogy to financial and stock markets

- User Interface is regarded as a set of discrete resources (assets)

- Each application holds a credit used to gain control of UI assets for a limited time

- Useful applications are rewarded by receiving back credits
A Reference Model

- When the asset is released it goes on the market for sale (A).

- Bidders make an assessment and decide which proposals to make bid on (B).

- Marketplace run the auction, deciding the winner and collecting the credits.

- Taxes and auction revenues are given to the Regulator (C).

- Credit is collected by the Regulator according to the user interaction (D).

- The Regulator redistributes credits, on the basis of two main policies (E):
  - Capitalism: the more applications are used, the more they receive capital gains
  - Welfare State: for assisting application with a lower credit availability.
Auction

- **Auction vs Out-of The-Counter (OTC)**

- **Types of Auction:**
  - Open Ascending Price (English) auction, where participants bids each against one another;
  - Open Descending Price (Dutch) auction, where auctioneer starts from a high initial asking price that is lowered until there is a participant who accepts the ask price;
  - First-Price Sealed-Bid (FPSB) auction, where participants make a simultaneous bid without knowing the bids made by the others;
  - Sealed-Bid Second-Price (Vickrey) auction, similar to FPSB but the winner pays the second highest bid plus an increment.
Market Features and Rules (1)

- Application can express a high/normal level of interest for an asset.

- The minimum asset ask price is determined by considering bids on the asset within a time interval.

- Holding taxes should be related to the asset value the application gained the control for.

- Two or more winning bids can have the same value.
Market Features and Rules (2)

- The capital revenue should be distributed among all applications, in order to give to each participants enough credits to gain assets in the future, but preventing application from monopolizing assets.

- Bankruptcy is an event inevitable in every financial system.

- The system can register inflation and deflation trends in the asset prices.

- Capital growth should be limited, in order to avoid a liquidity crisis in the market.
Emerging Behavior

- **Goal:**
  - to provide a set of usable applications to the user.

- **Rationale: Satisfaction of needs**
  - user aims at interacting with applications
  - applications have been designed and implemented in order to deliver functionalities to the user
  - each application attempts in isolation to capture the user attention gaining the control of parts of the user interface
  - for this reason, applications are ready to compete and pursue their goal
  - the application gains some space in the UI, it is able to interact with the user.
  - if an application results as useful to the user, it will produce a capital gain,
  - more useful applications will gain more chances to acquire resources
Example: Applications

3 Applications:

- **Media Player**
  - Selection List
  - Video Display
  - Control Panel

- **Mailer**
  - Login Dialog
  - Message List
  - Message Window
  - Compose Dialog

- **Instant Messenger**
  - Contact List
  - Chat Dialogs
Example: GUI assets and allocation

- Display split in 4 regions
- Regions are able to expand when not required
- Applications respond to events
  - Selection of new video
  - New mail message
  - New contact on-line
  - ...
- Regions are dynamically assigned to applications

**Figure 2. The UI real estate.**
Example: Scenario 1/4

- The user is watching a video
- The user requires to control the video volume and timeline
Example: Scenario 2/4

- A new mail message arrives in the mailbox
- The user get access to the message
- The user reply to the message
Example: Scenario 3/4

- Meanwhile the user is composing the message, a new instant message arrives.
- The user starts to chat.
Example: Scenario 3/4

- A new message arrives
- The user read briefly and close the message
Conclusions

Findings:
- Cooperation is not required
- Competition is an alternative
- Needs and resources can be a drive

Open questions:
- How to choose a winning strategy
- How to test applications
- How to decompose the UI in components
- How to self-rule the market
- How to assign credits
- ... 

Figure 4. Application capital time series.
Future Directions

- **On going:**
  - Developing a prototype
  - Identifying basic bidding strategies

- **Future:**
  - Experimentation of Econometric tools
  - Application to other resource mgt. problems
  - Definition of design guidelines
An Interesting Question

- **Efficient Market Hypothesis (EMH):**
  - prices on traded assets already reflect all known information, and rapidly change to reflect new information

- **Is EMH met by the UI Market?**
  - YES,
    - Indipendent Application Behavior
    - Robust Interface Evolution
  - NO,
    - A certain level of cooperation is required

- **How can we assure the EMH?**
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