

# Haskell Arrows Application

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18th Meeting

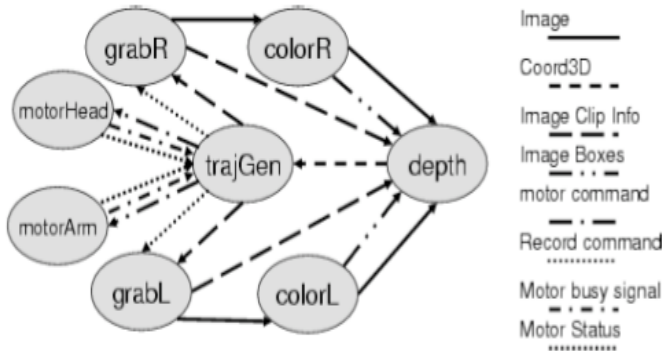
## Outline

- 1 **Using Arrows to Compose Parallel Process**
  - Example
- 2 **Using Arrows to Generate GUI**
  - Example
  - Basic Concepts
- 3 **Haskell XML Toolbox - Processing RDF documents**

## Using Arrows to Compose Parallel Process (2007)

- Develop an embedded DSL into Haskell supporting the composition of processes (HPorter)
  - 1 Higher degree of type safety
  - 2 Dynamic reconfiguration of processes
  - 3 Portability across operating systems

## Using Arrows to Compose Parallel Process : Example



## Using Arrows to Compose Parallel Process : Example - Arrows Code

```
> vision :: Proc ((Rec,CClip),(Rec,CClip)) ((Image,Image),Coord3D)
> vision = (grabR >>> (first colorR)) *** (grabL >>> (first colorL))
>         >>> (arr \ (((imR,bR),cR),((imL,bL),cL))->
>             (((imR,imL),(bR,bL)),(cR,cL))) >>> ndepth
>
> reach :: Proc () ()
> reach = loop ((motorHead *** motorArm) *** (vision >>> (arr snd))
>             >>> trajGen >>> (arr \ ((a,b),c) -> (a,(b,c))))
```

## Using Arrows to Generate GUI (2001)

- Develop a GUI library in Haskell (Fruit) – Just a prototype
- Formal model (denotational) of graphical user interfaces

## Basic Concepts

- Signal : a function from time to value

$$\textit{Signal } \alpha = \textit{Time} \rightarrow \alpha$$

- Signal Transformer : a function from signal to signal

$$\textit{ST } \alpha \beta = \textit{Signal } \alpha \rightarrow \textit{Signal } \beta$$

- Event Source : a function that produce event occurrences at discrete points in time

$$\textit{ES } \alpha = \textit{Signal } (\textit{Maybe } \alpha) = \textit{Time} \rightarrow (\textit{Maybe } \alpha)$$

## Basic Concepts

- Graphical User Interface GUI : an interactive graphical user interface component

$$\text{type GUI } a \ b = (\text{GUIInput}, a) (\text{Picture}, b)$$

where :

$$\text{type GUIInput} = (\text{Maybe Kbd}, \text{Maybe Mouse})$$

- Additional Combinators (Layout Combinators)

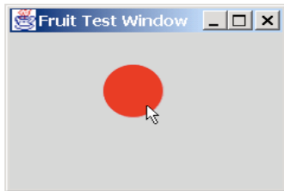
$$\text{aboveGUI} :: \text{GUI } b \ c \rightarrow \text{GUI } d \ e \rightarrow \text{GUI } (b, d) \ (c, e)$$

$$\text{besideGUI} :: \text{GUI } b \ c \rightarrow \text{GUI } d \ e \rightarrow \text{GUI } (b, d) \ (c, e)$$

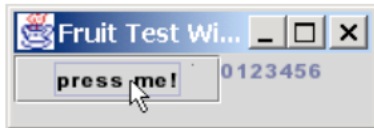


## Using Arrows to Compose Parallel Process : Example

- 1 A red ball that follows the mouse



- 2 Dynamic label



## Haskell XML Toolbox - Processing RDF documents (2007- 2009)

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