Aplicações interativas para a TV digital brasileira

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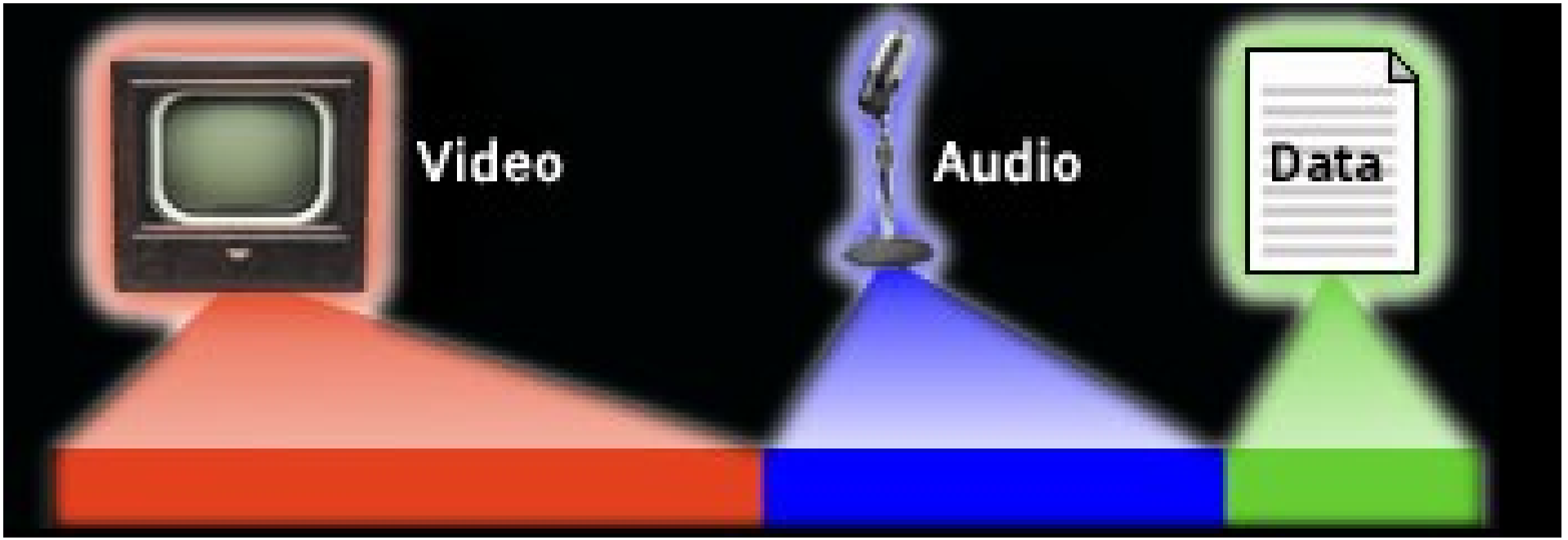
Digital TV



NCL – Nested Context Language

- XML language for multimedia synchronization
  - scripted with *Lua*
- Focus on interactive applications for Digital TV:
  - Declarative language for the Brazilian system
  - ITU-T recommendation for IPTV services

A simple example

```
<ncl>
   <port component="main"/>

   <media id="main" src="main.mpeg">
      <area id="main_info" begin="30s"/>
   </media>
   <media id="info" src="info.png"/>

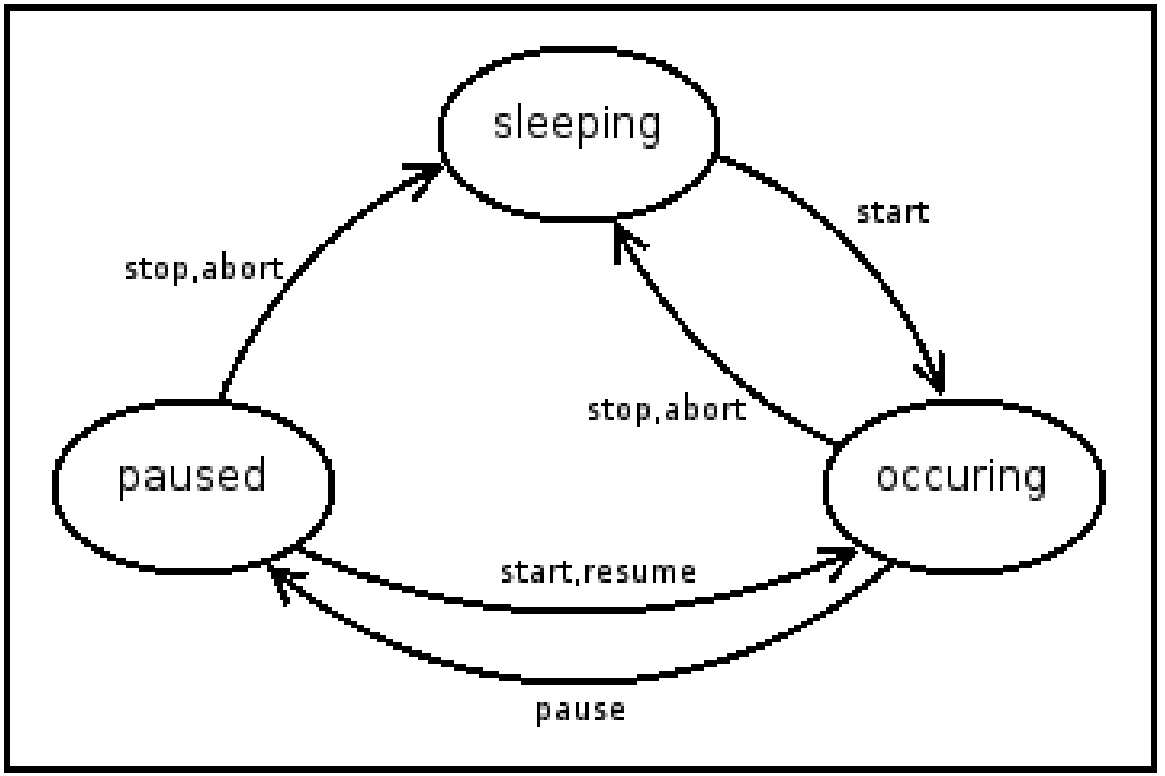
   <link>
      <bind role="onBegin"
            component="main"
            interface="main_info"/>
      <bind role="start"
            component="info"/>
   </link>
</ncl>
```

Objects Interfaces

- Used as synchronization points
- Content Anchors:
  - information units (frames, pixels, words, ...)
  - `<area>` element
- Properties:
  - (transparency, duration, sound level, ...)
  - `<property>` element

Relating Objects

- Transitions on interfaces' state machines



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```

NCL + Lua = **NCLua**

- Requirements:
  - Few modifications in the languages
  - Strict borderline between them
    - different teams
  - Orthogonal integration
    - *(no side-effects)*

NCLua

- Are <media> nodes
  - Complete code separation
- Communicate through events
- Have no access to the document structure
- Have custom semantics for its interfaces
  - properties and areas

Additional Lua modules

- event
  - Bi-directional communication
- canvas
  - Graphical primitives

Event-driven paradigm

- Main Loop
- Dispatcher
- Queue
- Handlers
- Generator
- Events

Event-driven paradigm

- Only one event is handled at a time
- Processing must be fast
- Inversion of control
- Lua is appropriate:
  - tables
  - closures
  - co-routines

The `event` module

- `event.register(f)`
  - `function (evt) ... end`
- `event.post(evt)`
- `event.unregister(f)`
- `event.timer(ms, f)`

Event classes

- Communication with NCL
  - class: 'ncl'
  - type: 'presentation', 'attribution'
  - action: 'start', 'stop', 'abort', ...
  - label/name: 'fim', 'fase1', 'counter', ...

```
{class='ncl', type='presentation', action='start'}
```

Event classes

- Remote control
  - `class: 'key'`
  - `type: 'press', 'release'`
  - `key: 'RED', 'A', '1', ...`

```
{ class='key', type='press', key='RED' }
```

Example 1 – Execution model

- Three NCLua nodes are started
  - The first does not handle events
  - The second notifies its natural end when started
  - The third creates a 3 seconds timer and notifies its natural end
- Buttons to identify NCLua's states

Example 2 – Clicks counter

- The “Click it” button appears on screen
- We want to count the number of times the user clicks the button

- In pure NCL: exponential number of links
- With Lua: a property for the counter

Example 3 – A simple game

- Interaction with the remote control
- The user should move the monkey to the banana
- The button “You win” is shown on screen

Canvas module

- The global `canvas` represents the NCLua region

- `canvas:new(img_path)`
- `canvas:attr*()  -- Size, Color, Font`
- `canvas:draw*(x,y) -- Rect, Line, Text`
- `canvas:compose(x, y, other)`

Conclusion

- Minimalist API, basic primitives
  - Specification is small and succinct
  - Small implementation
- Mechanism vs Policy
  - Does not impose a programming style
  - Abstractions in pure Lua
  - Players and native applications in Lua

Thanks!

http://www.telemidia.puc-rio.br
http://www.ncl.org.br