

Responsive Choice in Mobile Processes

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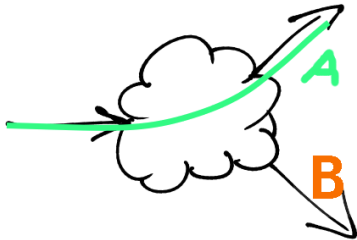
¹Joint work with António Ravara

Choices

Choice

Definition (Selection $A \vee B$)

I will either behave like A or like B



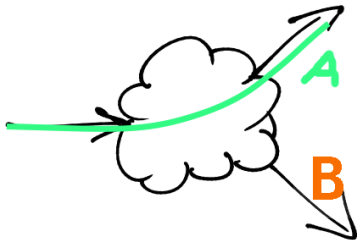
Definition (Branching $A + B$)

You can make me do A or B

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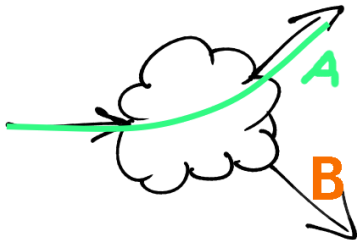
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Definition (Branching $A + B$)

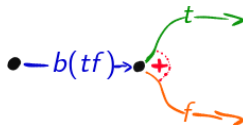
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Choice Examples (I)

- Data Encodings

$$b := \text{True} \stackrel{\text{def}}{=} !b(tf).\bar{t}$$

$$b := \text{False} \stackrel{\text{def}}{=} !b(tf).\bar{f}$$



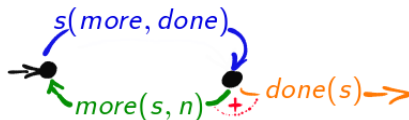
$$\text{If } b \text{ Then } P \text{ Else } Q \stackrel{\text{def}}{=} \bar{b}(\nu tf).(t.P + f.Q)$$

Choice Examples (II)

- Client-Server Conversations

$$\bar{p}(\nu s).s(\text{more}, \text{done}).\overline{\text{more}}(\nu s, 2).$$

$$s(\text{more}, \text{done}).\overline{\text{more}}(\nu s, 5).$$

$$s(\text{more}, \text{done}).\overline{\text{done}}(\nu s).s(x).\overline{\text{print}}\langle x \rangle$$


$$! p(s).\bar{p}_0\langle 1, s \rangle \quad | \quad ! p_0(t, s).\bar{s}(\nu \text{more}, \text{done}).$$

$$(\text{more}(s, n).\bar{p}_0\langle t \times n, s \rangle + \text{done}(s).\bar{s}'\langle r \rangle)$$

Liveness

Liveness Properties

Definition (Activeness p_A)

I am soon ready to receive (send) at p

$$\begin{aligned}
 \overline{\text{print}}_A \models & \bar{p}(\nu s).s(\text{more}, \text{done}).\overline{\text{more}}(\nu s, 2). \\
 & s(\text{more}, \text{done}).\overline{\text{more}}(\nu s, 5). \\
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 \end{aligned}$$

Liveness Properties

Definition (Responsiveness p_R)

If I get (send) a message from (to) *you* at p , I'll obey p 's protocol

$$\bar{p}_R \not\equiv \bar{p}(\nu s).s(\text{more}, \text{done}).\overline{\text{more}}(\nu s, 2). \\ s(\text{more}, \text{done}).\overline{\text{more}}(\nu s, 5).$$

$s(\text{more}, \text{done}).0$

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$s(\text{more}, \text{done}).\mathbf{0}$

Causality

Dependencies

Definition (Dependency $X \triangleleft Y$)

I'll give you X if you give me Y .

$$(\bar{t}_A \vee \bar{f}_A) \triangleleft (b_{AR} \wedge a_{AR}) \quad \models \quad \bar{a}(\nu t' f').(t'.\bar{b}\langle tf \rangle + f'.\bar{f})$$

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Type System

Type System

Our type system:

- Takes: A process P , and channel types Σ

$$P : \bar{a}(\nu t' f').(t'.\bar{b}\langle tf \rangle + f'.\bar{f})$$

$$\Sigma : \{a : \text{Bool}, b : \text{Bool}, t : (), f : ()\}$$

- Produces: A *correct* logical formula Ξ describing P

$$\Xi : (\bar{t}_A \vee \bar{f}_A) \triangleleft (b_{AR} \wedge a_{AR})$$

- is Decidable
- is Compositional

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Summary

Type Language		Process Behaviour
Selection & Branching	$A \vee B, p + q$	Choice
Activeness & Responsiveness	ρ_A, ρ_R	Liveness
Dependencies	$\gamma \triangleleft \varepsilon$	Causality

Type System:

- Decidable
- Sound
- Compositional
- Constructs Logical Formulæ

Thank you!



More info:

- <http://maxime.gamboni.org/>