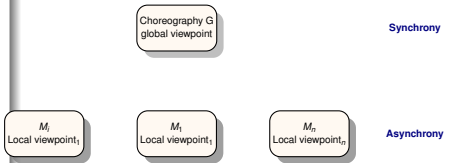
“Top-down”

Quoting W3C

“Using the Web Services Choreography specification, a contract containing a global definition of the common ordering conditions and constraints under which messages are exchanged, is produced that describes, from a global viewpoint [...] observable behaviour of all the parties involved. Each party can then use the global definition to build and test solutions that conform to it. The global specification is in turn realised by combination of the resulting local systems [...]”



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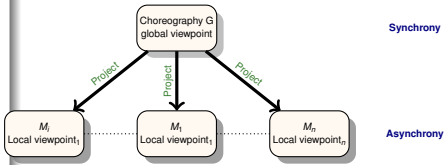

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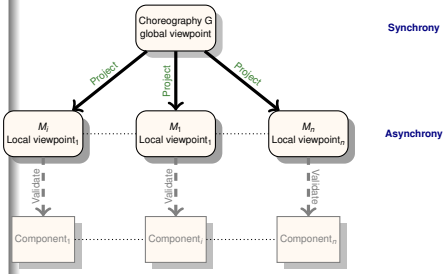

“Top-down” & “Bottom-up”

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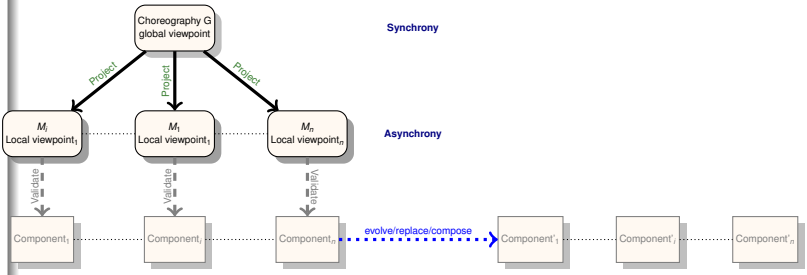

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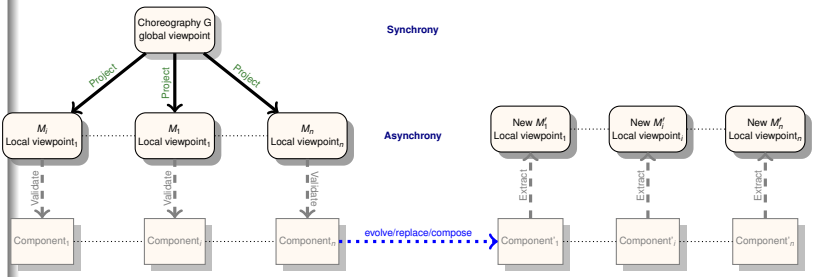

bottom-up

Extract from each component its local viewpoint, combine the local view points in a choreography...if that makes sense [?]

“Top-down” & “Bottom-up”

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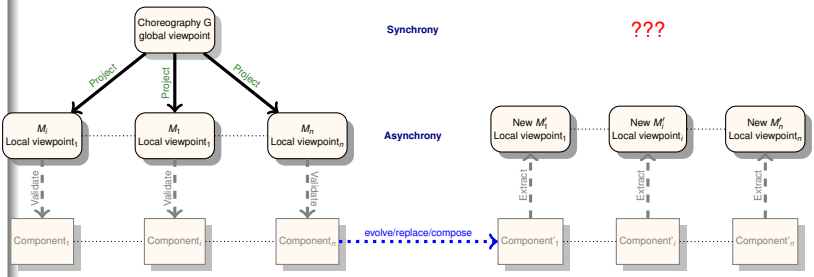

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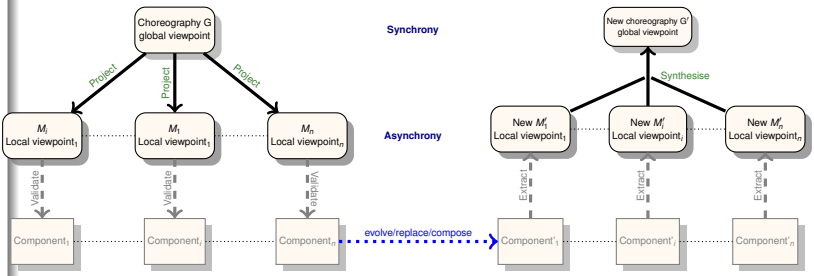

bottom-up

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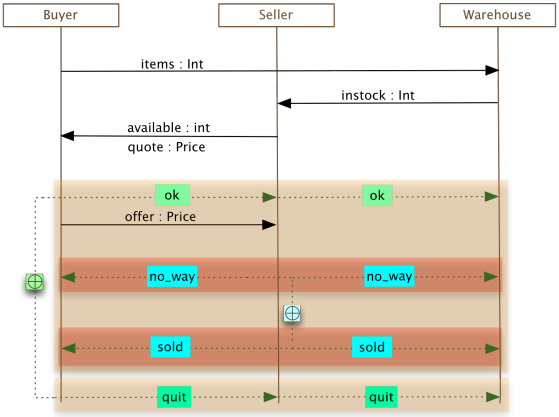
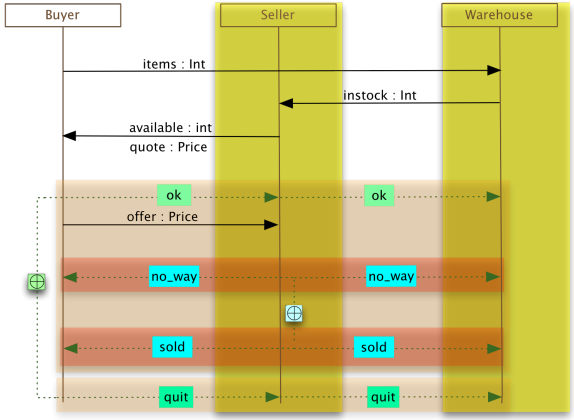
An intuitive account...



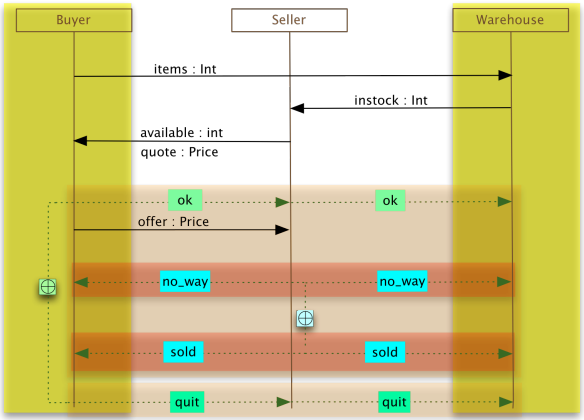
Global viewpoint

An intuitive account...



Projecting on buyer

An intuitive account...



Projecting on seller

Some considerations

Things are more complex:

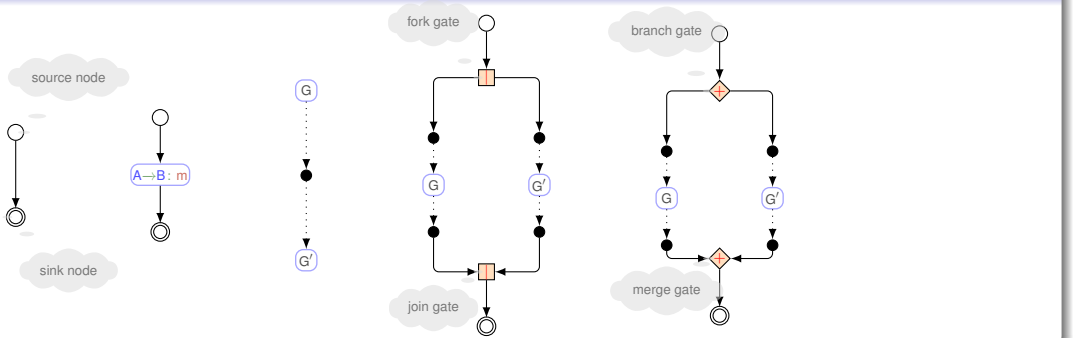
- recursion/iteration
- not all global viewpoints “make sense”
  (e.g., constraints on values passing)
- interactions are “atomic” at global level, but not at local level
- ...

Desiderata

- progress (graceful termination or no-deadlock)
- no orphan messages
- no unspecified reception
- ...

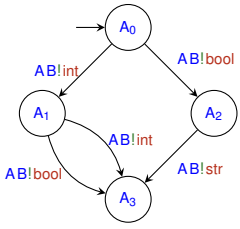
Global views, intuitively

g-choreographies [?]

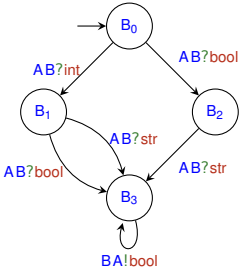


Local views, intuitively

Communicating systems [?]



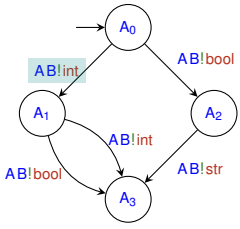
A

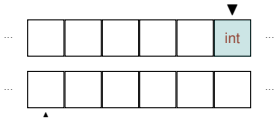


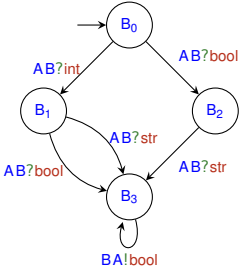
B

Local views, intuitively

Communicating systems [?]







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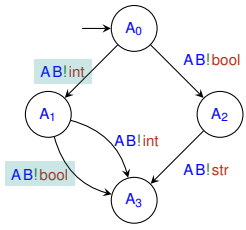

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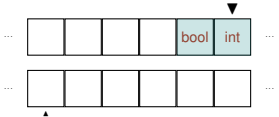

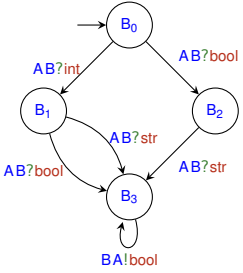

B

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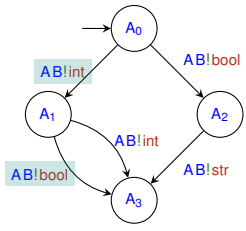

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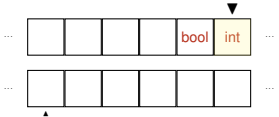

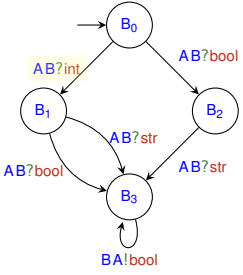

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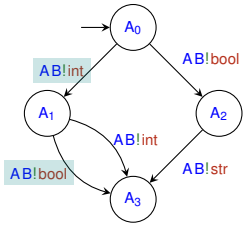

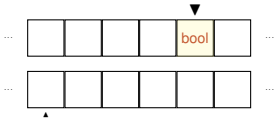

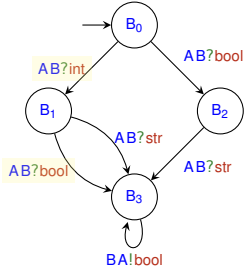

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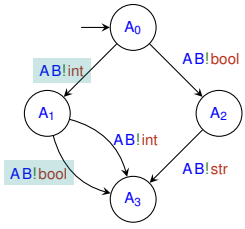

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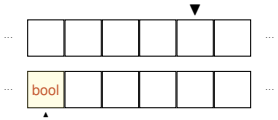

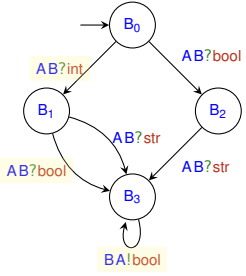

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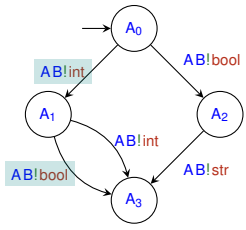

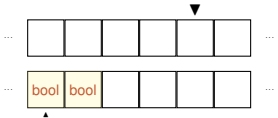

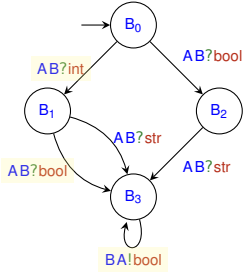

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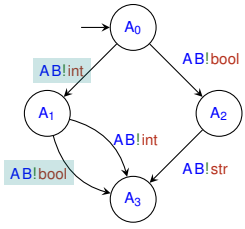

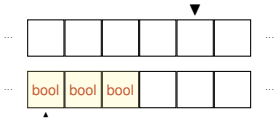

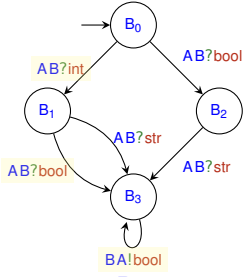

Well-formedness, intuitively

To G or not to G?

Ehm...in a distributed choice $G_1 + G_2 + \cdots$

- there should be one active participant
- any non-active participant should be passive decides which branch to take in a choice

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Def. A is active when it locally decides which branch to take in a choice

Def. B is passive when

- either B behaves uniformly in each branch
- or B "unambiguously understands" which branch A opted for through the information received on each branch

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Well-branchedness

When the above holds true for each choice, the choreography is well-branched. This enables correctness-by-design.

Class test

Figure out the graphical structure of the following terms and for each of them say which one is well-branched

- $G_1 = A{\to}B : \text{int} + A{\to}B : \text{str}$
- $G_2 = A{\to}B : \text{int} + (\text{o})$
- $G_3 = A{\to}B : \text{int} + A{\to}C : \text{str}$
- $G_4 = \left(\begin{array}{l} A{\to}C : \text{int}; A{\to}B : \text{bool} \\ + \\ A{\to}C : \text{str}; A{\to}C : \text{bool}; A{\to}B : \text{bool} \end{array} \right)$

Projecting g-choreographies

Projecting g-choreographies

Technicalities

- Functions $\_\downarrow_A$ yield the projection of g-choreographies on the participant A as triplets (M, q_0, q_e) with q_0 and q_e initial and terminal states respectively
- If G_1 and G_2 are sub-terms of G then states of $G_1 \downarrow_A$ and of $G_2 \downarrow_A$ are disjoint; for this we define $(M, q_0, q_e) \otimes \mathbf{1}$ which transforms each state q of M in $(q, 1)$ (and likewise for $(M, q_0, q_e) \otimes \mathbf{2}$)

Base cases

$$G\downarrow_A = \begin{cases} \rightarrow (q_0) \rightarrow & \text{if } G = (o) \text{ or } G = B \rightarrow C : m \\ \rightarrow (q_0) \xrightarrow{AB!m} (q_e) \rightarrow & \text{if } G = A \rightarrow B : m, \text{ with } q_0 \neq q_e \\ \rightarrow (q_0) \xrightarrow{BA?m} (q_e) \rightarrow & \text{if } G = B \rightarrow A : m, \text{ with } q_0 \neq q_e \end{cases}$$

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Sequential composition

$$G_1 ; G_2 \downarrow_A = \left(M_1 \sqcup \left\{ {}^{q_e^1}/_{q_0^2} \right\} M_2, q_0^1, q_e^2 \right)$$

where $(M_1, q_0^1, q_e^1) = G_1 \downarrow_A \otimes \mathbf{1}$
and $(M_2, q_0^2, q_e^2) = G_2 \downarrow_A \otimes \mathbf{2}$

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Choice

$$\mathsf{G}_1 + \mathsf{G}_2 \downarrow_{\mathsf{A}} = \left(\left\{ {}^{q_e^2}/_{q_e^1} \right\} M_1 \sqcup \left\{ {}^{q_0^1}/_{q_0^2} \right\} M_2, q_0^1, q_e^2 \right)$$

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Parallel composition

$$\mathsf{G}_1 \mid \mathsf{G}_2 \downarrow_{\mathsf{A}} = \left(M_1 \times M_2, (q_0^1, q_0^2), (q_e^1, q_e^2)\right)$$

where $(M_1, q_0^1, q_e^1) = \mathsf{G}_1 \downarrow_{\mathsf{A}} \otimes \mathbf{1}$
and $(M_2, q_0^2, q_e^2) = \mathsf{G}_2 \downarrow_{\mathsf{A}} \otimes \mathbf{2}$