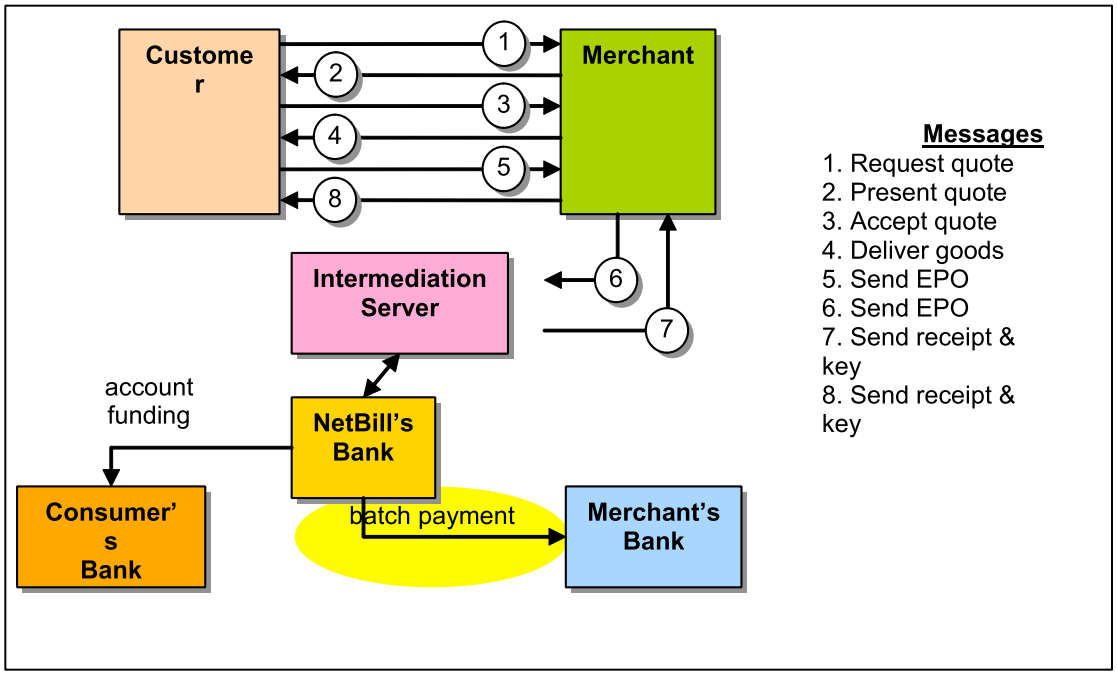
Assignment – BDI/FIPA

CPSC 601.68/599.68 F11

The object of assignment one is to prove the NetBuy protocol (see Figure 1) correct. Of course, to prove it correct, you will have to write it down formally. You will translate the informal protocol from Figure 1 into the FIPA-compliant (FIPA 2002) BDI architecture, and then using the FIPA semantics for the performatives, you will prove the given assertions.



Part 1: naïve protocol

I have given you the start of the proof below. Given the premises show at the start of the proof, you are to show it is reasonably possible that

$$B_c\ \text{image}(x, x') \wedge B_c\ \text{key}(x,\text{key12}).$$

That is, the customer believes (is in possession of) that the image[1] of product x is x', and that the customer believes (is in possession of) the key (key12) for product x. In other words, the customer can get the product and the key to the product.

We assume the customer has the correct mental attitude to request the quote, and the customer intends to get the quote, and that the customer believes the merchant can supply the quote, and that the merchant believes

[1] The *image* of a product is the actual executable program for that product.

that product x costs $100, and that the merchant believes that image of x is x', and that the server believes that the key for x is key12.[2]

1. FP(<m inform(c,quote(x,?))>) [c\m] //given
2. Ic quote(x,?)
3. B_c Agent (m, <m inform(c,quote(x,?))>) //given
4. B_c Agent (m, <m inform(c,image(x,?))>) //given
5. B_m quote(x,$100) //given
6. B_m image(x, x') //given
7. B_s key(x,key12) //given

8. <c request(m, <m inform(c,quote(x,?))>)> //The costumer requests the quote because he intends to achieve the RE of the request; ("intending to achieve the RE property", RE of 3, 2)

Proof obligation (Feasibility Preconditions) for 8:

9. FP: FP(<m inform(c,quote(x,?))>) [c\m] ∧
   B_c Agent (m, <m inform(c,quote(x,?))>) ∧
   ¬ B_c I_m Done (<m inform(c,quote(x,?))>) // 8, def request

   a. FP(<m inform(c,quote(x,?))>) [c\m] // 1
   b. B_c Agent (m, <m inform(c,quote(x,?))>) // 3
   c. ¬ B_c I_m Done (<m inform(c,quote(x,?))>) // expression not found (closed world hypothesis)
   d. <a> /\ <b> /\ <c>
      QED

10. RE: Done (<m inform(c,quote(x,?))>) //8, 9, def of request

11. I_m Done (<m inform(c, quote(x,?))>) //merchant decides to adopt the intention to quote x from 10
12. B_c I_m Done (<m inform(c, quote(x,?))>) // customer chooses to believe from 10

13. <m inform(c, quote(x, $100))> //m performs his intention from 10; unify with 5

Proof obligation for 13:

14. FP: B_m quote(x, $100) /\
    ¬ B_m(Bif_c quote(x, $100) ∨ Uif_c quote(x, $100)) // 13, def of inform

    a. FP: B_m quote(x, $100) //12

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[2] Note that you may need to make up some additional premises to solve this proof, but make sure they are reasonable and justified.

b. ¬ B_m(Bif$_c$ quote(x, $100) ∨ Uif$_c$ quote(x, $100)) // neither disjunct can be derived from above (closed world hypothesis)
c. <a> /\ <b>
QED

15. RE: B_c quote(x, $100) // 13, 14, def of inform

16. B_c quote(x, $100) // customer chooses to believe the quote from 15

17. <c request(m, <m inform(c, image(x,?))>)> // based on 16, customer decides to request x
…
18. <m inform(c, image(x, x'))>
...
19. <c inform(m, EPO(c, x, $100)>
…
20. <m inform(s, EPO(c, x, $100)>
…
21. <s inform(m, key(x, key12))>
…
22. <m inform(c, key(x, key12))>
…

To assist you, the above partial proof is given to you as a Word file, assnBDItemplate.doc or the pages file assnBDItemplate.pages.

Part 2: using an offer

In part 1, the formal protocol assumes a lot about *quote*. We can do better, and actually define the semantics of *quote*. After all, when a merchant is sending a quote, it's just offering to give the customer the key for x if the customer first sends the EPO to the merchant:

<m propose (c , <m inform(c, key(x, ?k))>, <c inform(m, EPO(c, x, ?p))>)>

You might be concerned that this doesn't mention anything about the customer requesting (and receiving) the image for x, but it should be obvious that customer can do that at anytime. A customer can always download a "trial version" of the software, but he can't use it (beyond the limits of the trail version) without the key. So we don't really have to worry about this in the *propose* above.

Since we don't actually use *quote*, the "given" predicates will be a bit different for this part:

1. B_c Agent (m, quote(x,?)) // given
2. B_m price(x, $100) // given
3. price(?x, ?p) → EPO(?c, ?x, ?p) // given

4. B_m image(x, x') // given
5. B_s key(x,key12) // given

Again you will prove:

$$B_c \text{ image}(x, x') /\backslash B_c \text{ key}(x,\text{key12})$$

References

FIPA (2002). FIPA Communicative Act Library Specification. Document number SC00037J, Document store TC Communication, Foundation for Intelligent Physical Agents, Geneva. 2002.

M. Sirbu (1997). Credits and debits on the Internet. *IEEE Spectrum*, 34(2):23-29, 1997.