

January 2010 - b

SORTES: Software for embedded and real-time systems

- 1) The elements of a linked list include a pointer to the next element in the list and a pointer to a data structure.

You are asked to implement in C a *filtered* linked list. Filtered means here that an element is inserted in the list if and only if it satisfies a requirement verified by some function associated to the list when the list is initialised.

You must provide the C code to define

- a structure called `f_list` including a pointer to the first element of the list and a pointer to the filtering function (taking `my_data` as parameter and returning TRUE if the requirements are satisfied and FALSE if not);
- a structure called `f_elem` including a pointer to the next element of the list and a pointer to the data structure of type `my_data`.

You must also provide the declaration and the definition of the following functions:

- `f_list_init`: receives a filtering function as parameter and creates an empty filtered list
- `f_list_insert`: receives as parameters a `f_list` and a `my_data`. If accepted by the filter, the `my_data` is added at the end of the list. The function returns TRUE if the data is accepted and inserted, else FALSE

The implementation must work with any type of data and any filter.

- 2) Represent in ASG the behaviour of an authenticated dhcp relay. The behaviour is similar to a classical dhcp relay, but it will only accept authenticated MAC addresses. Therefore the relay will include an authenticator. When the relay receives a DHCP discovery message from an unauthenticated client, the dhcp relay ignores it but warns the authenticator (its behaviour must be included in the asg diagram too). The latter sends an EAP-Request/identity message to the client. The client answers with an EAP-Response/identity with its identity. The authenticator forwards this message to an Authentication server. This answers with an EAP-Request/challenge message that the authenticator forwards to the client. The client answers with an EAP-Response/challenge that the authenticator also forwards to the Authentication server. The latter answers with an EAP-Success or an EAP-Failure message that is forwarded to the client. In case of success the client is remembered as authenticated and his next attempt to start a dhcp transaction will be accepted like by a plain dhcp relay. Do not forget time-outs where appropriate.
- 3) In the microchip tcp-ip stack, the microchip engineers have chosen to only use interrupts when the timer overflows. Discuss this choice. What would have been the advantages and inconvenients of using interrupts for other events (which ones) or to not use interrupts at all ?
- 4) What do you recommend to cope with faults in an ATM machine and why.

duration: 3 hours, with open books and notes.