Correspondence

The livelock-free protocol of the Cambridge Ring

Dear Sir,
The short note titled 'Two livelock-free protocols for slotted rings' by J. Pachl[1] uses the Cambridge ring as an example of 'livelock' and proposes two protocols to overcome this problem. The Cambridge ring does not have livelock problems, as may be seen by consulting the Interface Specification.[2]

Historically, although the first prototype of the Cambridge Ring potentially suffered from this problem, the light loading and the delays inserted when a packet was not accepted at its destination prevented it from being other than a potential hazard. About ten years ago livelock was eliminated from the prototype ring and all production models by a slight change to the protocol of the Monitor station. This current protocol is simpler to implement than those suggested in the above paper.

We give below the original and current protocols for the Cambridge ring in so far as they pertain to livelock.

Following Pachl we assume a packet has the two control bits named M and F, which indicate 'not passed monitor' and 'full'.

Station protocol
A station may fill an empty slot and set $M = F = 1$
A station must set $F = 0$ when the used slot returns

Original Monitor station protocol for every passing slot
If $M = 0$ and $F = 1$ then set $F = 0$
Always set $M = 0$

Current Monitor station protocol for every passing slot.
Set $F = M$ then $M = 0$

The correction of packets which have failed to be marked empty by the source is unaffected. A packet which has been filled but which a fault sets to empty before it reaches the Monitor station will have $M = 1$ and $F = 0$ and will be corrected there. If the packet is filled when falsely empty, the livelock starts.

If the error which causes a full packet to be faulted to empty occurs about n stations before the Monitor station, then the current protocol guarantees the livelock will be eliminated in less than n ring revolutions. We show below that the protocol always clears livelocks.

When a slot becomes livelocked, then in its passage from the Monitor station to the Monitor station, it will be set empty at stations S1 and S3 and set full at stations S2 and S4. The stations are positioned round the ring in sequence S1–4. Now consider the next traversal of the slot around the ring.

(*a*) If the slot is not filled then the livelock ends.

(*b*) If the slot is only filled once – after S4 – then the livelock ends.

(*c*) If the slot is only filled once – before S4 – then S4 sets empty and the monitor sets full, thus freeing the livelock.

(*d*) If the slot is set full twice say at S5 and S6, then S6 follows S4 and is closer to the Monitor station, but the livelock continues.

Thus while the livelock continues, the second filling station gets closer to the Monitor, and when it 'passes' the livelock is cleared.

Yours faithfully

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References

1. J. Pachl, Two livelock-free protocols for slotted rings, *The Computer Journal*, **31** (5), 474–476 (1988).
2. *Cambridge Ring 82*, *Interface Specifications*, edited W. P. Sharpe and A. R. Cash, p. 61, SERC, London.

Announcement

27–29 June 1990
IEE International Conference on Expert Planning Systems

Brighton

Call for Papers

Synopses are now requested for the IEE International Conference on Expert Planning Systems which will be held in Brighton from 27 to 29 June 1990.

The Conference is intended for all those with an interest in, or responsibility for, planning in business, engineering, finance or other environments in which complexity is present. The aim of the Conference is to provide an environment in which technological developments can be exposed to critical scrutiny from a broad community of planning professionals and their business managers. It is hoped that the Conference will enable bridge-building to take place among this community and between it and the developers of technological aids. The latter includes decision-support systems, knowledge-based systems and other relevant computer-based planning tools.

Scope

- AI planning techniques (including descriptions of search, plan representation and theory).
- Problem categorisation (embracing requirements definitions, goal definition, action identification, action sequencing, plan scheduling, resource allocation and plan expedition).
- Domain generalisation (examples may involve any of the following; project planning, robot planning, job-shop scheduling, factory planning, strategic business planning, and tactical planning).
- Description of applications (including identifying the suitability of a problem for AI treatment, techniques and tools adopted, experiences with problems encountered in implementation, business or system integration issues involved, pay-offs expected or experiences in the course of application).

Papers are invited which will explore recent developments in methods of planning, with particular reference to automated aids and the impact of knowledge-based systems. There will be three main themes to the Conference in which papers will be grouped by three different dimensions, as follows.

(1) Level of planning (strategic, technical or operational).

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Anyone wishing to offer a contribution should submit a synopsis of approximately 1,000 words before 5 May 1989 to: Conference Services, IEE, Savoy Place, London WC2R 0BL, tel: 01-240-1871, ext. 222.