M.I.T. Laboratory for Computer Science

V.2.LNI PROTOTYPE DESIGN AND IMPLEMENTATION PLAN

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This document records the current plan for local network hardware implementation. For reference, the currently running prototype network is referred to as the V.1 network, and the PDP-11 local network interface is referred to as the V.1.LNI. The production version of the network is referred to as the V.2 network and the corresponding network interface, the V.2.LNI, is divided into three components: V.2.LNI.X, the transmission system; V.2.LNI.CTL, the central logic of the network interface; and V.2.LNI.INT, the packet buffer and host interface logic.

The V.2 network is incompatible with the V.1 network in three ways: 1) it operates at a higher data rate, 2) it uses a different modulation technique, and 3) the hardware recognized packet formats are different. These changes are the consequence of design simplification and improvements resulting from the experience of implementing the V.1 network. Corresponding software changes for the PDP-11 and VAX are confined to the driver module, and are thought to be modest in scope.

The organization of the V.2.LNI is modular, anticipating a variety of implementations. Two such implementations are scheduled, for the Nu Terminal and for the PDP-11 UNIBUS. In both implementations, one DEC-style two-high card will contain V.2.LNI.X and V.2.LNI.CTL, a single cable connector out to the ring net, and an edge connector with an interface to V.2.LNI.INT, which appears as a second card. In the case of the Nu Terminal, V.2.LNI.INT is a partially filled two-high card that interfaces to the nu-bus. In the case of the PDP-11 Unibus, V.2.LNI.INT is a four high (quad) card containing an M.I.T. designed full-duplex Direct Memory Access (DMA) interface.

There are enough differences between the V.1.LNI and the V.2.LNI that the V.2.LNI will be first implemented in wire wrap to allow for field changes after implementation. After confidence is gained in the design, later versions may be transferred into printed circuit board form, and at that time the overall modularization may require review, as details of the production version of the Nu Terminal become clearer.

Following is a description of the tasks to be completed:

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0. Document overall plan for V.2.LNI: general shape, data formats, nature of interfaces, target schedule, probable cost estimates.

1. Initial design of V.2.LNI.X. A logic design for the repeater/receiver/transmitter/clock synchronizing system to be completed and documented. This design will be used as the basis for tasks 2 and 3. Dependencies: none known.

2. Planning for laboratory checkout of V.2.LNI.X design. A document will be prepared detailing a series of laboratory experiments. These experiments include: a) establishing firm figures on maximum usable data rate versus cable length for at least two cable types, using the proposed "Manchester code" modulation scheme. b) checking the proposed input/output phase resynchronization scheme for sensitivity to noise and crystal frequency differences, and to verify that phase jitter is not cumulative in successive repeaters. Dependencies: task 1.

3. Carry out and writeup results of the experiments defined in task 2. Dependencies: availability of test equipment from rental suppliers, task 2.

4. Final design of V.2.LNI.X. The design of task 1 will be revised in light of experience gained from performing task 3. This final design will include all applicable hazard protection, and will be reverified in the laboratory. Dependencies: task 3.

5. Complete the state table design and logic diagrams of the input state machine for V.2.LNI.CTL. Dependencies: none known. Completed 25 May.

6. Design an output state machine comparable to the input state machine for V.2.LNI.CTL. Dependencies: task 5.

6a. Failure mode definition. For planned packet format and transmission system, define failure modes that will be detected by hardware. Dependencies: decision on packet format.

7. Completely document the design of V.2.LNI.CTL, including the input and output state machines and the interface between V.2.LNI.CTL and V.2.LNI.INT. Dependencies: task 6, 6a.

8. Develop layout for wire-wrap version of V.2.LNI.CTL and V.2.LNI.X, including wire list. Dependencies: decision on physical format of board, task 7.

9. Build and checkout one copy of V.2.LNI.CTL and V.2.LNI.X. Dependencies: availability of parts, esp. LS TTL. Availability of PLA burner, task 8.

10. Develop V.2.LNI.INT for nu-bus. Design to be reviewed by nu-bus design team for acceptability and reasonableness. Dependencies: availability of nu-bus specifications.

11. Develop layout/wire list for V.2.LNI.INT for nu-bus. Dependencies: decision on physical format of boards, task 10

12. Construct and checkout one copy of V.2.LNI.INT for nu-bus. Dependencies: availability of parts, task 11.

13. Review available PDP-11 DMA design for applicability and changes required to adapt to V.2.LNI.CTL interface; develop modified design. Dependencies: completion of checkout of PDP-11 DMA.

14. Develop layout/wire list for V.2.LNI.INT for PDP-11. Dependencies: task 13.

15. Build and checkout one copy of V.2.LNI.INT for PDP-11. Dependencies: availability of parts, task 14.

16. Checkout integration of V.2.LNI.INT and V.2.LNI.CTL, using L.C.S. PDP-11/15. Dependencies: software driver for PDP-11, tasks 9, 15.

17. Construct second copy of V.2.LNI.INT and V.2.LNI.CTL, and checkout in PDP-11/15. Dependencies: availability of parts, task 16.

18. Checkout V.2.LNI between two PDP-11's. Dependencies: software drivers and checkout programs, task 17.

19. Construct 8 copies of V.2.LNI.CTL and 5 copies of V.2.LNI.INT for PDP-11. Dependencies: availability of parts, task 18.

20. Install V.2 network in parallel with V.1. network, connecting PDP-11's. Dependencies: task 19.

21. As soon as V.2 network seems equally reliable to V.1, cut over to it. Dependencies: task 20.

22. Checkout integration of V.2.LNI.CTL and V.2.LNI.INT for nu-bus. Dependencies: availability of nu-bus machine and software drivers, tasks 12, 9.

23. Construct 2 copies of V.2.LNI.INT for nu-bus. Dependencies: availability of parts, task 22.

24. Write documentation package to permit manufacture of both versions of V.2.LNI. Dependencies: tasks 18, 23.