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SATNET Reconfiguration Plan

May 1979

1. Introduction

This note describes the present hardware configuration of SATNET and the changes expected to take place by about Fall 1979. A major difference between this plan and earlier ones is that parallel operation of experimental and operational gateways has been traded for a substantial reduction in hardware reconfiguration costs. In particular, once LSI-11 gateways are installed, the PDP-11's will be connected as stubs on the LSI-11's for use in internet stream experiments and other developmental use.

Sections 2, 3, and 4 pertain to the Etam Goonhilly and Tanum SIMPs only -- connections to the Clarksburg SIMP are discussed in Section 5.

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2. Present Configuration

Figure 1 shows the SATNET configuration as of June 1979, which contains two major changes to the configuration existing prior to this time: the 'ARPANET Direct Connection', and MOS Gateway software.

ARPANET Direct Connection

The first major change involves the use of SATNET to provide an IMP-IMP communication link between the London TIP and either NORSAR or SDAC, replacing the path formerly used between London-Norsar-SDAC.(1) This SATNET path is referred to as the ARPANET Direct Connection. A FDX terrestrial circuit between London and Goonhilly connects an IMP-IMP modem interface on the London TIP to a host modem interface on the Goonhilly SIMP (identified as *1 in Figure 1). Similarly, a terrestrial circuit connects the NORSAR TIP and Tanum SIMP (*2), and the SDAC IMP and Etam SIMP (*3). By use of a software switch in the SIMPs (controlled from the NCC at BBN), SATNET can be used to provide an IMP-IMP path between either London and Norsar (using *1 and *2), or between London and SDAC (using *1 and *3). While the

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(1) The 9.6 Kbps circuit previously used between London and Norsar is scheduled to be removed during June 1979.

more direct *1*3 path is normally preferable, the *1*2 path may
be used in the near term to allow completion of new satellite
hardware at Etam.

(SATNET can also be used to provide an IMP-IMP path between
Norsar and SDAC in the event of line 41 failures, by use of *2*3
and the Tanum-Etam path. Only one of the three possible paths
can be used at a time, however, because of the present inability
of the IMP program to multiplex more than one IMP-IMP path
through a single physical port.)

To accomplish this direct IMP-IMP connection through SATNET,
special software has been implemented in the SIMPs. (Except for
some timing parameters, no changes have been made to the IMP
program; each IMP believes it has a standard 'phone company'
circuit connecting it to its neighbor). The special SIMP
software consists of a host I/O driver which prefixes SATNET
message leaders to packets arriving from the IMP lines and
removes the leaders prior to delivery, using pre-determined
addresses in the leaders (each IMP host port on SATNET is
assigned a unique SATNET address). Once their SATNET leaders are
prefixed, the packets are treated the same as messages arriving
from other SATNET hosts, with all SATNET services available to
the packets. Currently a simplex stream is automatically set up
by the special software for each port, providing a FDX

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one-satellite-hop service (when *1*3 is used) similar to that
provided by the previous ARPANET 9.6 Kbps path to London.

MOS Gateway Software

The second major change now in effect is the replacement of
the ELF-based gateway software in the PDP-11's with MOS-based
gateway (MOS-G) software. Measurements made on the ELF-based
system during past SATNET experiments revealed severe throughput
bottlenecks, with a maximum achievable throughput of about eight
packets per second. In contrast, when the gateway was run with
MOS and the RTP software modified to send message leaders in the
first data packet (rather than separately), measurements using a
50 Kbps circuit between the BBN PDP-11 and Etam SIMP gave a
throughput of about 43 packets per second (using approximately
1000 bit packets), which is reasonably close to the maximum link
capacity. The MOS software configuration includes datagram
SATNET access and RTP, and has about 10K words of buffer space
(the total program plus buffer space is limited by MOS to about
28K words). Figure 2 shows the present PDP-11 "Internet Config"
associated with Etam, Goonhilly, and Tanum in Figure 1.

During this phase of the reconfiguration transition, speech
demonstrations which might be required will be accomplished by
reloading the involved PDP-11's with the ELF operating system,
and the ELF-based gateway, and LPCM speech software.

3. UCL Port Expander

The next hardware change will consist of adding an LSI-11 ARPANEt host port expander (PE) at UCL, probably about August 1979. Figure 3 shows the configuration with the PE installed. Several internet hosts will be able to access the IMP, and by use of appropriate ARPANET destination addressing cause packets to be sent either back through the PE to the PDP-11 gateway or to CONUS ARPANET via the SATNET direct connection shown in Figure 1.

4. LSI-11 Gateway Configuration

This step consists of transferring the MOS-G software system to an LSI-11, expected to take place about the end of summer 1979. At this time the feasibility of running the port expander software of Figure 3 in the same LSI-11 as the gateway will be determined. Depending on the results, the configuration of either Figure 4 or 5 will be used at UCL. One of these configurations (possibly without the port expander capability) will also be placed in operation at BEN as the internet connection to the Etam SIMP in this same time period. The schedule for reconfiguration of the NDRE internet connection to the Tanum SIMP has not yet been established.

(Note: Because of the limited core space available in the LSI-11, the possibility of upgrading these installations with

LSI-11/23 hardware is presently under consideration, along with an associated expansion of MOS memory space capabilities.)

The LSI-11 gateway will be connected to the SIMP at each site by removing the ACC VDH-11 interface hardware from the PDP-11, repackaging it in a separate cage, and connecting it to the LSI-11 by use of a Unibus Adapter Card in the LSI-11 (the VDH-11 will also be able to be replugged to the PDP-11 if desired). This configuration allows existing SIMP interface hardware to be used without change, and greatly reduces total system costs associated with installation of the LSI-11 gateways.

The VDH Reliable Transmission Package (RTP) software will, at least initially, be transferred from the PDP-11 to the LSI-11 along with the other MOS-based gateway software. Once in operation with SATNET, throughput measurements will be made -- if the RTP software is found to prevent attainment of required performance levels, the use of other protocol options with the VDH interface hardware will then be considered. These options include implementation of a Host-SATNET error control mode defined to augment the existing SATNET acceptance/refusal flow control protocol, or possibly not using any link error control (end-end error control must in any case be used for reliable transmission across SATNET).

The connection of the PDP-11 to the LSI-11 in Figures 4 and
5 will use the existing DMA-11 Distant Host hardware interface on
each PDP-11. The software interface to be used within the LSI-11
is still under investigation, and will be oriented towards the
use of the PDP-11 to carry out functions associated with the
internet stream setup protocol currently being defined.

5. COMSAT Configuration

An LSI-11 SATNET 'demo terminal' will be located at COMSAT
Plaza in Washington D.C. for use in SATNET experiments and
demonstrations. This LSI-11 will access the Clarksburg SIMP via
the PDP-11 gateway currently connected to that SIMP. If the
PDP-11 can be relocated to COMSAT Plaza (not yet determined), the
LSI-11 will be connected to the DMA-11 interface on the PDP-11,
and the latter's VDH-11 interface used with a long-distance line
to connect to the SIMP. If the PDP-11 cannot be relocated, a
pair of ACC Error Control Units (ECU's) will be used with the
long-distance line between the LSI-11 and PDP-11.

In either case, the LSI-11 will use ARPANET 1822 message
leaders to access the PDP-11 gateway. To allow use of SATNET
streams and group addressing by the LSI-11, a new internet header
option is to be defined which will allow a source to pass a
SATNET stream ID or group address in data messages to the
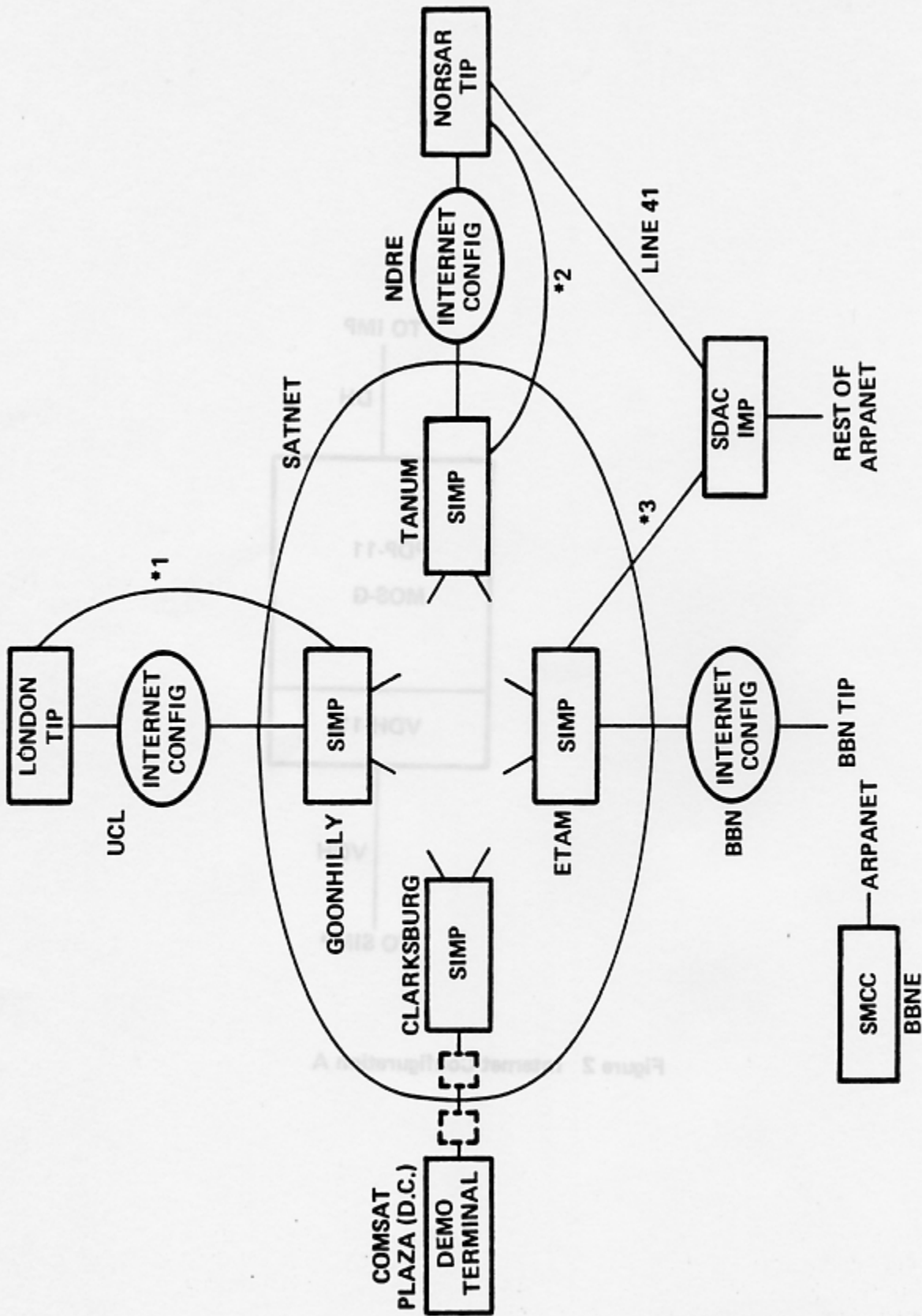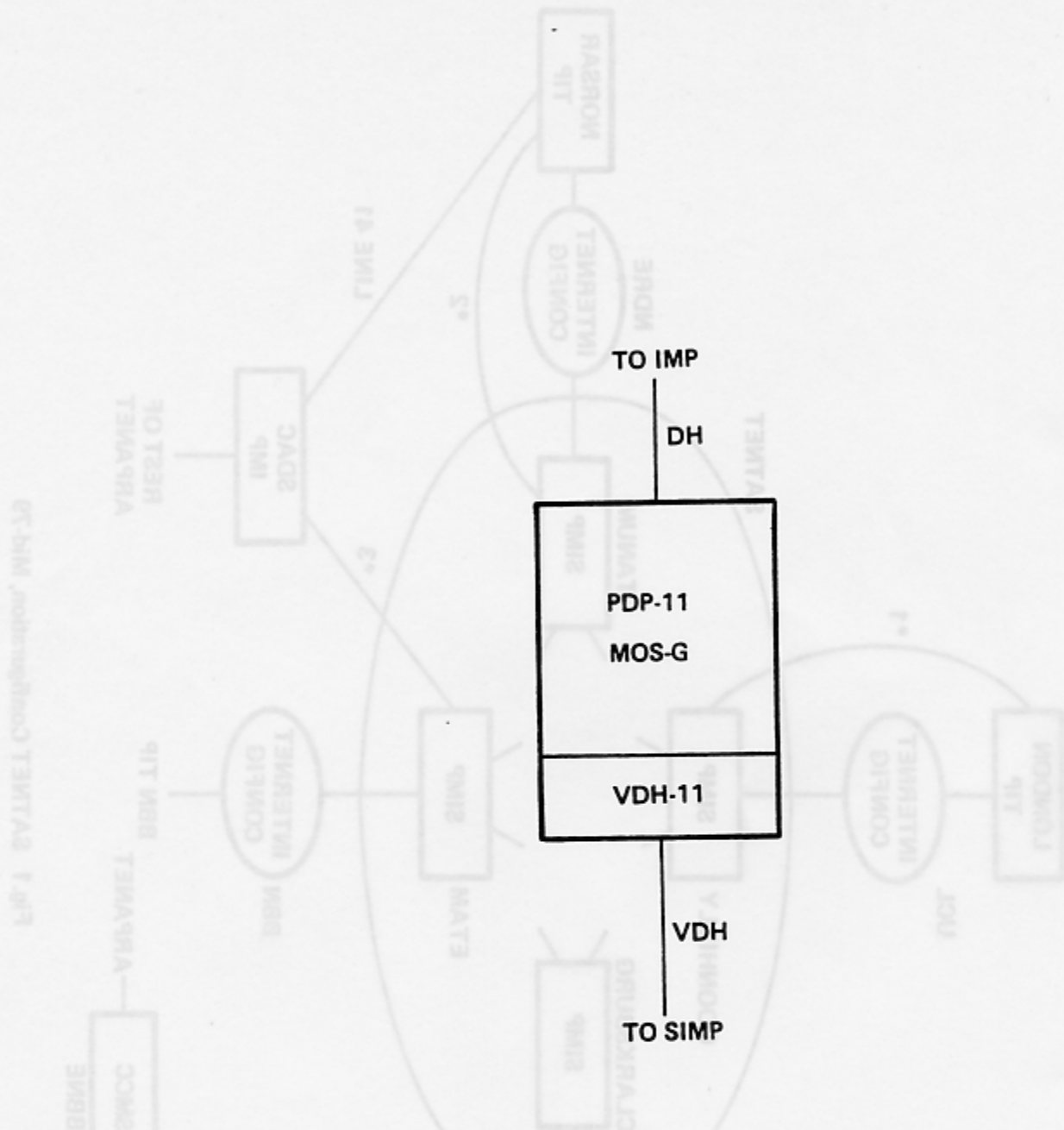gateway, with the gateway mapping the option information into the

local SATNET message leader it generates. To allow stream setups
to be handled for internet sources, SIMP software will be changed
to allow either local or internet datagram setup messages.
(Because of implementation constraints in the SIMPs, only version
2.5 internet headers will be supported for the setup function
initially.)

Fig.1 SATNET Configuration, Mid-79

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TO IMP

DH

PDP-11

MOS-G

VDH-11

VDH

TO SIMP

Figure 2   Internet Configuration A

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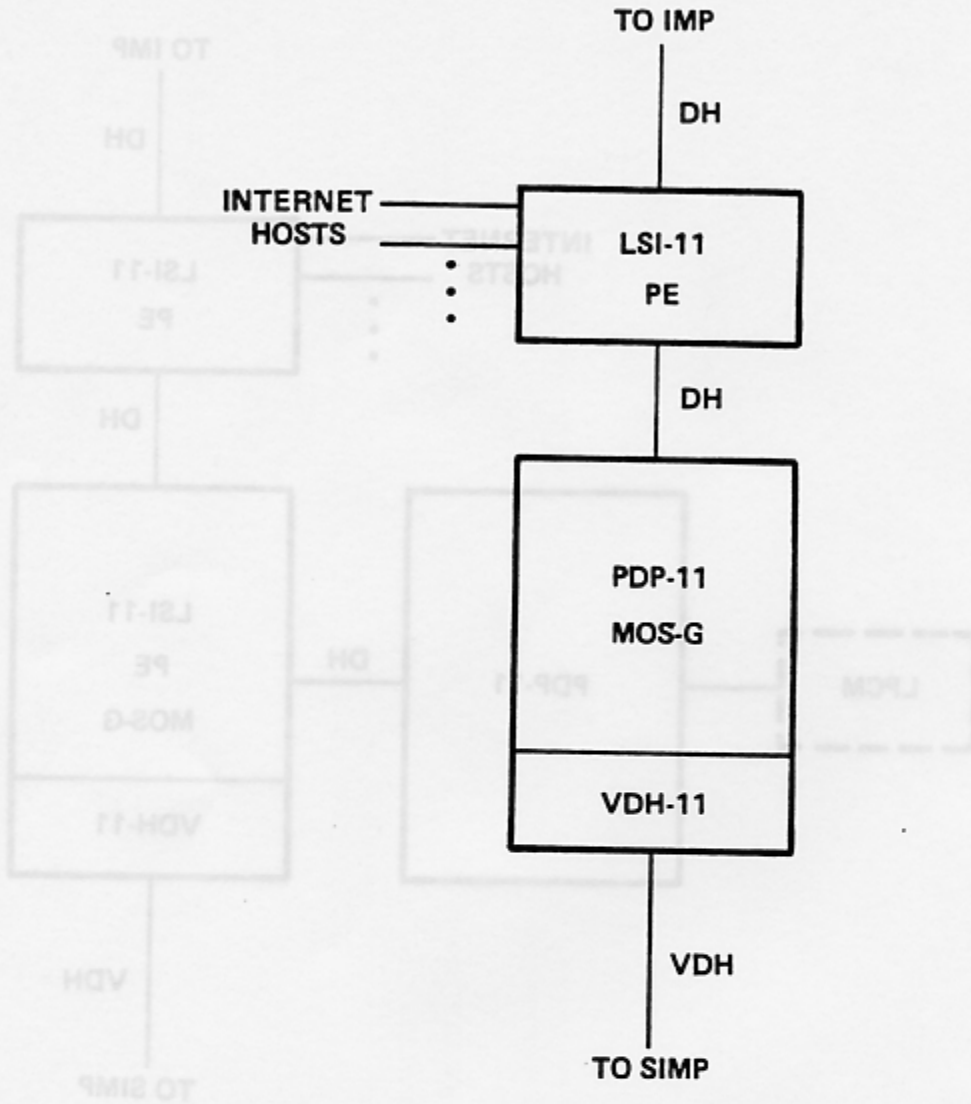
Figure 3   Internet Configuration B

TO IMP

DH

INTERNET ──┐
HOSTS ──┐ │
        │ │   LSI-11
        • │   PE
        •
        •

DH

LSI-11
                                PE

LPCM ──── PDP-11 ──DH── MOS-G

VDH-11

VDH

TO SIMP
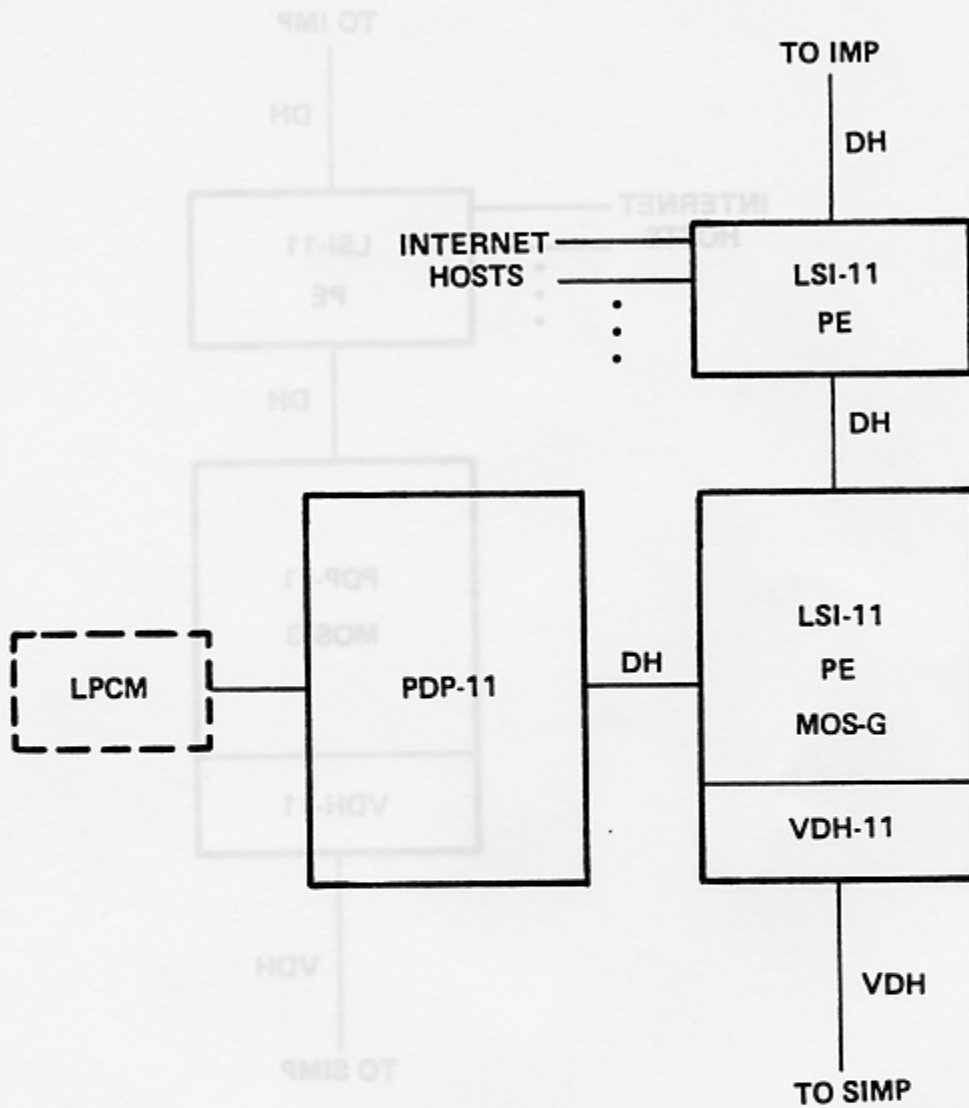
Figure 4   Internet Configuration C

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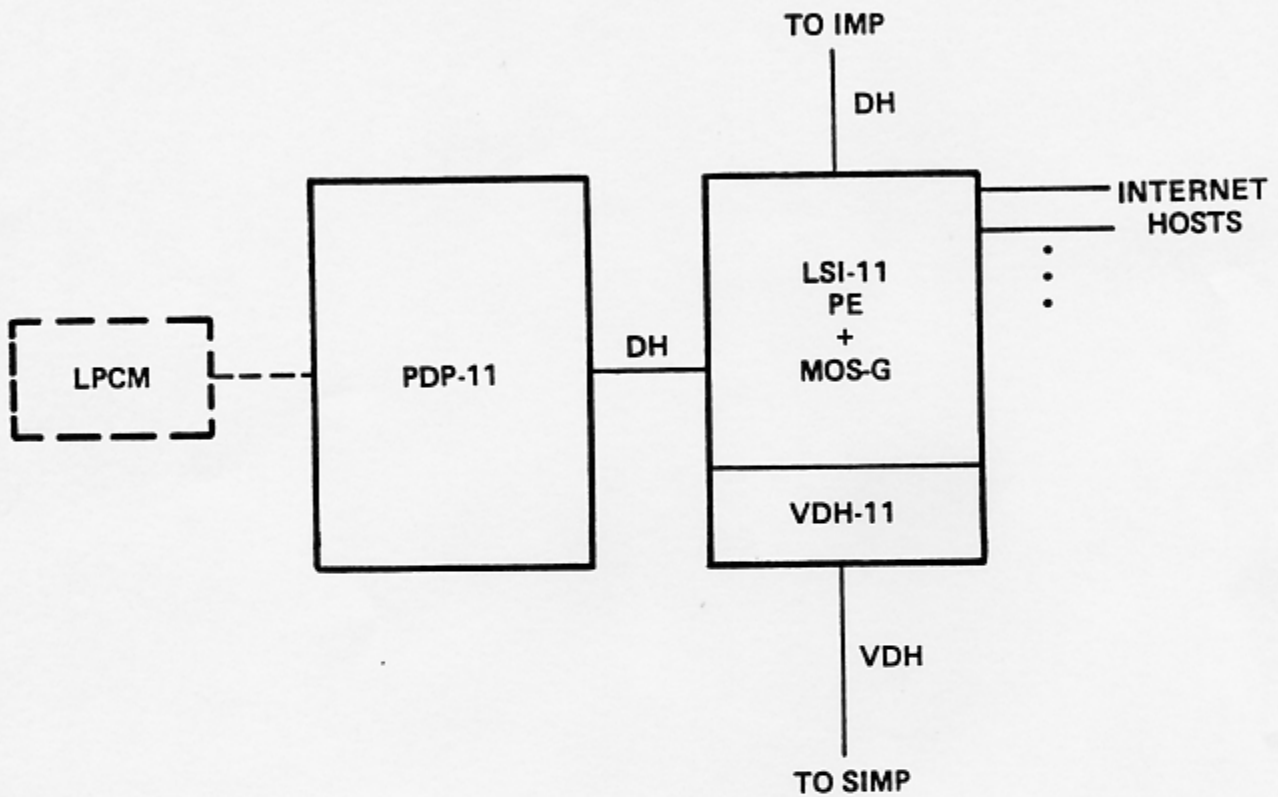
TO IMP

DH

LPCM

PDP-11

DH

LSI-11
PE
+
MOS-G

INTERNET
HOSTS

VDH-11

VDH

TO SIMP

Figure 5   Internet Configuration D