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Using DECnet-Ultrix/Internet Gateway for Electronic Mail

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USING DECNET-ULTRIX/INTERNET GATEWAY FOR ELECTRONIC MAIL

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ABSTRACT

This paper describes the experience CERN has obtained by using the DECnet-Ultrix/Internet Gateway for electronic mail (hereafter called Ultrix Gateway) as the preferred gateway between MAIL-11 and Internet mail (SMTP). It will describe the problems found with the gateway and which solutions we have developed to overcome the problems.

INTRODUCTION TO THE MAIL ENVIRONMENT AT CERN

CERN, the European Laboratory for Particle Physics, is located across the border of Switzerland and France near Geneva. The laboratory is operating a number of mail gateways for the HEP (High Energy Physics) Community. As well as providing connectivity between different mail systems in use across the CERN site, the gateways allow mail exchange with the collaborating physicists in their home institutes throughout Europe, North America and the rest of the world. Mail is exchanged between diverse machines attached to the CERN LANs including VAX/VMS, VAX/ULTRIX, RISC/ULTRIX, UNIX, IBM/VM and Apollos. The mail protocols in use are MAIL-11, Simple Mail Transfer Protocol (SMTP), Batched SMTP, RSCS, UUCP, X.400 P1 with Domain Defined Attributes and X.400 P1 with Standard Attributes.

CERN uses a large system of Ethernets interconnected by a FDDI (Fibre Distributed Data Interface) ring as a general network infrastructure. Apart from that CERN also uses a system of Token Rings for the accelerator control system. On the general network infrastructure, a number of different protocols are used, including DECnet, TCP/IP, LAT, Novell Net. The DECnet comprises approx. 800 nodes at CERN plus approx. 1000 nodes at other sites in Europe and the US. The TCP/IP network comprises approx. 1800 nodes at CERN and CERN has also recently been connected to the Internet through a 1.5Mbit/sec line between CERN and Cornell in the US.

The present mail gateway system consists of four different machines, two running VAX/VMS and two running Ultrix. On the Ultrix machines we are using the Sendmail program [1] (Sendmail is a general address rewriting and mail routing program). Up to the Ultrix Gateway we have been using a public-domain program called PMDF [2] as the gateway between MAIL-11 and SMTP. This program runs on a dedicated microVAX-II under VAX/VMS v5.3-1. The program uses batch-queues extensively and it requires a fair amount of regular intervention due to blocking messages, hanging batchjobs etc. On the contrary we see very few problems with Sendmail.

We have been looking therefore for a product which was running under Ultrix, interfacing to Sendmail and which could provide the gateway between MAIL-11 and SMTP. One obvious candidate was the DECnet-Ultrix/Internet Gateway running on our dedicated DECsystem3100. This paper describes the experiences we have gained by testing and putting the gateway into production.

HOW DOES THE ULTRIX GATEWAY WORK ?

The Ultrix Gateway is a program which can gateway messages between the MAIL-11 protocol from DEC used on DECnet and the Simple Mail Transfer Protocol (SMTP) used on TCP/IP networks.

The gateway consists of two programs: **Mail11v3**, which gateways between Sendmail -> MAIL-11, and **Mail11dv3**, which gateways MAIL-11 -> SMTP. It is necessary to make the distinction here between SMTP

and Sendmail, because Mail11dv3 can deliver messages to any program, which speaks SMTP to it, whilst Mail11v3 only can accept messages from Sendmail (in fact only DEC's version of Sendmail). This is caused by the fact that the DEC version of Sendmail uses a extended and undocumented version of SMTP (ESMTP). The reason for this will be explained later.

Mail11v3 is called as a mailer in the Sendmail configuration file and mail11dv3 is started by a DECnet connection request for object 27 (mail11).

MAIL-11 is a master/slave mail exchange protocol, which is implemented by the VMSmail program on VAX/VMS. It is both the master and the slave, while under Ultrix mail11v3 is the master and mail11dv3 is the slave.

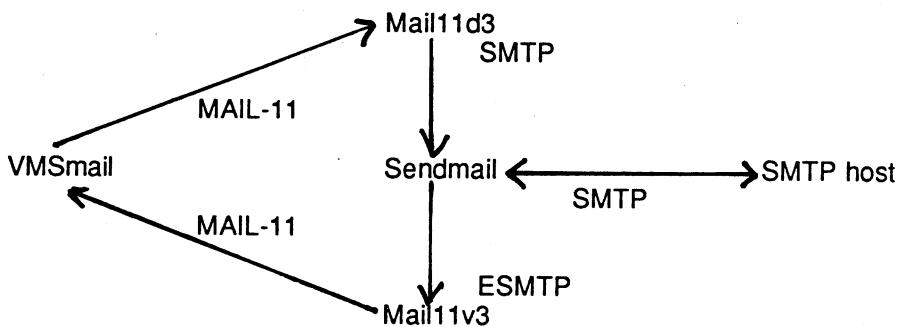The relationship between the program and protocols is described in figure 1.

<u>Figure 1</u>

In the explanation the following syntax will be used (figure,note).

Mail11dv3 (Slave)

Mail11dv3 is activated by a DECnet connection request to object 27 (2,1). DECnet-Ultrix starts Mail11dv3 and it exchanges configuration data with the master (2,2).

At note (2,3) you can see that the master is a VAX/VMS based program, in this case VMSmail (OS = 7).

Mail11dv3 connects to the Sendmail program (2,4) and exchanges information with it, as laid down in the SMTP protocol (2,5).

At the end DECnet-Ultrix kills the Mail11dv3 process (2,6).

(2,1)   7276 dnet_spawner: Connect from VSCOMB::JENST for object 27 (mail11)
(2,2)   7276 mail11dv3: Master Mail's Config
        7276 mail11dv3: Version: 3.1.0
(2,3)   7276 mail11dv3: OS type: 7
        7276 mail11dv3: Options: NONE
        7276 mail11dv3: Modes: Carbon_Copy
        7276 mail11dv3: Slave (US) Mail's Config
        7276 mail11dv3: Version: 3.1.0
        7276 mail11dv3: OS type: 18
        7276 mail11dv3: Options: NONE
        7276 mail11dv3: Modes: Carbon_Copy
(2,4)   7276 mail11dv3: >>> 220 dxcsjr.cern.ch Jens Trier Rasmussens Sendmail 5.57/Ultrix3.0-C ready at Thu, 31 May 90 10:20:13 +0200

```
(2,5)     7276 mail11dv3: <<< HELO VSCOMB.DECnet MAIL11D_V3
          7276 mail11dv3: >>> 250 dxcsjr.cern.ch Hello VSCOMB.DECnet MAIL11D_V3, pleased to meet you
          7276 mail11dv3: <<< ONEX
          7276 mail11dv3: >>> 200 Only one transaction
          7276 mail11dv3: <<< MAIL From:<vscomb::jenst>
          7276 mail11dv3: >>> 250 <vscomb::jenst>... Sender ok
          7276 mail11dv3: <<< RCPT To:<jenst>
          7276 mail11dv3: >>> 250 <jenst>... Recipient ok
          7276 mail11dv3: <<< DATA
          7276 mail11dv3: >>> 354 Enter mail, end with "." on a line by itself
          7276 mail11dv3: <<< NOOP Dumping Headers
          7277 sendmail: AA07277: message-id=<9005310820.AA07277@dxcsjr.cern.ch>
          7276 mail11dv3: Largest received: BufferSize = 0, RecordSize = 15
          7277 sendmail: AA07277: from=<vscomb::jenst>, size=113, class=0
          7276 mail11dv3: >>> 250 Ok
.(2,6)    69 dnet_spawner: Process exit (PID 7276).
          7279 sendmail: AA07277: to=<jenst>, delay=00:00:07, stat=Sent
```

Figure 2

Mail11dv3 uses the SMTP connection to Sendmail in a different way than the normal use. Normally a SMTP connection is opened, the mail is delivered and the connection is closed within 2 to 3 minutes depending on the size of the message. With Mail11dv3, the time between opening the connection and sending the message itself can be very long.

The reason for this is the interactive non store-and-forward nature of MAIL-11. When a VMSmail user on VAX/VMS wants to send a message to another user on another VAX/VMS host, VMSmail opens the DECnet connection immediately after the user has entered the To: field and the connection remains open until the user leaves the VMSmail editor with CTRL-Z. This is done so that the user is sure that the message can be delivered. In order for Mail11dv3 to emulate this behaviour, it opens the SMTP connection to Sendmail immediately after it receives the DECnet connection request for the mail11 object. In this way the SMTP connection is open as long as it takes the VMSmail user to compose his/her message.

Mail11v3 (Master)

Mail11v3 is activated by the Sendmail program as a mailer in the Sendmail configuration file. When it has been activated it connects with SMTP to the Sendmail program which started it (3,1).

After the successful connection Mail11v3 and the Sendmail program exchange two special Digital undocumented SMTP commands: MULT and HEAD (3,2) and (4,1).

MULT tells Sendmail to give the master a status for each recipient of the message to come. HEAD tells Sendmail to give Mail11v3 a peak of the To:, Cc: and From: fields of the message. This is done in order to let Mail11v3 tell the slave at the other end during connection establishment if the message has a Cc: field or not (4,2). These special commands are the reason why Mail11v3 only can communicate with the DEC version of Sendmail.

Mail11v3 also tests the content of the message to see if it is a normal text message or e.g. a DECwrite document (3,3).

Only after this does Mail11v3 try to establish a DECnet connection to the remote slave (3,4). As you can see from note (3,5) there is a bug in the slave part of the VMSmail program, which makes it exchange wrong configuration data, in fact it just copies what it receives.

As you can see from note (3,6) this message had a Cc: field (mode carbon_copy).

After that the message is delivered to the recipient and the master writes some statistics.

The following output is obtain by calling the Ultrix mail program with the -v option:

```
          220 Mail-11_V3.0 DECnet-ULTRIX Mail-11 Mailer
(3,1)     >>> HELO dxcsjr.cern.ch
          250 Mail-11_V3.0 DECnet-ULTRIX Mail-11 Mailer
```

```
.(3,2)    >>> MULT
          250 Ok, will give multiple status for DATA.
(3,2)     >>> HEAD
          354 Ok, give me a sneak peak at the message
          >>> .
.(3,3)    210-SIMPLE_MESSAGE capsar message type "text".
          250 Thanks, come again!
          >>> MAIL From:<jenst>
(3,4)     210-Version: 3.1.0
(3,5)     210-OS type: 18
          210-Options: User_Notify
(3,6)     210-Modes: Block_Mode Carbon_Copy
          210-Requested Record Format: 2
          210-Requested Record Attributes: 0x2
          210-
          210-Version: 3.1.0
          210-OS type: 18
          210-Options: User_Notify
          210-Modes: Block_Mode Carbon_Copy
          210-Block mode blocking factor: 1
(3,4)     250 Connected to node vscomb
          >>> RCPT To:<dimou>
          250
          >>> DATA
          354 Send me the message, follow by a '.' by itself.
          >>> .
          210-Statistics:
          210-   Total Message Bytes: 4
          210-   Total Record Count: 1
          210-   Total Block Count:  1
          250 Delivered to Recipient.
          >>> QUIT
          250 DECnet-ULTRIX Mail11 exiting.  Come Again.
```

Figure 3

The following output is provided in the syslog file, if mail11v3 has been configured to provide it. How to do that will be explained later.

```
          12210 sendmail: AA12210: message-id=<9006061008.AA12210@dxcsjr.cern.ch>
          12210 sendmail: AA12210: from=jenst, size=60, class=0
          12211 mail11v3: From: jenst, FullName: "Jens Trier Rasmussen", DestNode: vscomb
          12211 mail11v3: <<< HELO dxcsjr.cern.ch
(4,1)     12211 mail11v3: <<< MULT
(4,1)     12211 mail11v3: <<< HEAD
(4,2)     12211 mail11v3: Header - To: dxcsjr::jenst
(4,2)     12211 mail11v3: Header - Cc: vscomb::dimou
(4,2)     12211 mail11v3: Header - Full-Name: Jens Trier Rasmussen
          12211 mail11v3: <<< MAIL From:<jenst>
          12211 mail11v3: <<< RCPT To:<dimou>
          12211 mail11v3: <<< DATA
          12211 mail11v3: <<< QUIT
          12210 sendmail: AA12210: to=dimou@vscomb.dnet, delay=00:00:12, stat=Sent
          12210 sendmail: AA12210: to=jenst@dxcsjr.dnet, delay=00:00:14, stat=Sent
```

Figure 4

WHAT HAVE WE LEARNED DURING OUR TEST OF THE GATEWAY ?

When we began the test of the gateway we knew about 3 limitations, which could or could not have an effect on our use of the gateway.

The gateway uses an extended and undocumented version of SMTP to talk to Sendmail (Ultrix version).

This could not affects us directly, since we are using the DEC version of Sendmail, but could affects us indirectly, because we could not use the gateway with another version of Sendmail.

To:, Subject:, Cc: and From: header fields could not be longer than 512 bytes because this is the limit set by record sizes in DECnet (and therefore by VMSmail).

This problem is fixed by DEC with a patched version of Mail11v3 (date 14/12/89), which truncates all lines going out. It truncates Header fields to 512 bytes and data lines to 1023 bytes.

Sendmail can not handle quoted strings.

This is fixed in the DEC version of Sendmail.

After having conducted the test we discovered other limitations/problems:

Mail11v3 will only transfer the RFC822 header fields which have a MAIL-11equivalent, e.g. To:, From:, Subject: and Cc:. All other header fields will be removed.

The problem can be fixed in Mail11v3 by using a unsupported and undocumented configuration option.

MAIL-11 To: fields, on incoming messages from a VMSmail user, can contain VAX/VMS logicals and distribution lists e.g. @file.dis.

When Mail11dv3 receives such fields the message gets delivered to the right recipient, but the To: field contains the untranslated logical or the distribution list.

If Mail11v3 sends to two users on the same host, where one of the users has a forward to the other user, Mail11v3 hangs.

This can be fixed by configuring Mail11v3 in the Sendmail configuration file in such a way that it cannot deliver to multiple users on the same host in one transaction (by removing the m flag).

Mail11v3 crashes when To: fields are very long, e.g. distribution lists.

The crash is related to the use of the undocumented and unsupported DEBUG and TRACE configuration options to Mail11v3. If these are used, Mail11v3 dies when it tries to write the To: field to the syslog file. The problem is in the syslog library routine. Running without TRACE and DEBUG avoids the crashes.

When sending large distribution lists (To: header with ca. 5000 bytes) Mail11v3 garbles the resulting message in VMSmail. The original Subject: field is put in the To: field, the original To: field is lost and the original message is put in the Subject: field.

The problem is partly solved when the patched version of Mail11v3 is used because it truncates the length of the To: field to 512 bytes. The truncation is not done intelligent, which can cause problems for Sendmail.

Buffer size limitations in Sendmail. The version of Sendmail distributed by DEC has a limitation in buffer size on the header fields. The exact value of the limit is not known.

Communication of operating system version from VMSmail. When Mail11v3 establishes a connection with the mail object on a DECnet-VAX node they exchange information about which version of the MAIL-11 protocol they are using, which operating system they run under, which options and modes are going to be used. VMSmail on VAX/VMS up till and including VAX/VMS 5.3 has a bug in the slave side, which just echoes the master's operating system information. Because of this, Mail11v3 cannot distinguish to which implementation of MAIL-11 it is talking. This results in the fact that Mail11v3 cannot present the From: address to the VMSmail slave in the right way on all systems. It works on VMSmail, but it is wrong on Ultrix systems using DECnet-Ultrix.

A solution is to treat DECnet-Ultrix nodes in a special way on the gateway and sending mail to these nodes via SMTP, instead of MAIL-11.

Mail11v3 supports 3 styles of addressing DECnet nodes. Mail11v3 supports the normal name style, where the actual DECnet address is looked up in the DECnet database. Furthermore is supports the numeric style, both the composite numeric format (area x 1024 + node number) and the style area.node.

Mail11v3 does not support the Reply-To: field in a message.

VMSmail has a built-in limitation of a maximum record size of 255 bytes when forwarding mail to another DECnet node.

WHAT HAVE WE DONE IN ORDER TO SET UP A SERVICE ?

Customization of Mail11v3

As described above, it is possible to customize the configuration of Mail11v3 by using unsupported and undocumented parameters. One of these parameters is mail11v3.Trailers, which makes Mail11v3 append all the non-MAIL-11 header fields in the RFC822 message to the message body. The text dividing the message body and the RFC822 headers is controlled by the parameter mail11v3.TrailerHeader, which by default, is the string "===== RFC822 headers =====".

A list of these parameters is provided in appendix 1.

Error handling for Mail11v3.

Mail11v3 operates with two kinds of errors: fatal and temporary. Fatal errors are errors which have a very low probability to be corrected within a given period as opposed to temporary errors, which have a high probability of being corrected. As a consequence, such messages, which cannot be delivered due to a temporary error, will stay in the queue and will be retried with a given interval for a given period of time. By default the interval is 20 minutes and the period is 3 days.

The distinction between fatal and temporary errors is based on the file /usr/lib/dnet_shared/Mail11v3.fatal, which contains the errors Mail11v3 should treat as fatal. These errors includes No such node, Node is unknown and No such user.

As our DECnet is so large and with a complex interconnections we often see errors caused by improperly setup DECnet configuration, unstable data communication links or improperly setup VAX/VMS accounts. Errors of these types are e.g. "Invalid login information at remote node" and "Remote node is not currently reachable".

These types of errors are treated by Mail11v3 as temporary. Due to our high traffic we would like to treat these errors as temporary, but with a higher interval between the retries. In Sendmail it is not possible to set the retry interval per message, but per queue. We have therefore created another Sendmail queue ("The slow queue"), where the retry interval is set to 1 hour.

In order to move the messages from the normal queue to the slow queue we have developed a C-shell script, which searches through the normal queue for messages which have received the error statuses we are looking for. These messages are moved to the slow queue and a warning message explaining the probable cause of the error is returned to the sender. The messages are not moved the first time the error status is seen, but they stay in the normal queue for an hour. This is done because our main VAXcluster is very heavily loaded and therefore sometimes we cannot deliver the messages to it in the first try.

Apart from the above change in the treatment of errors we have changed some of the errors that Mail11v3 treats as temporary to be treated as fatal. These includes "Invalid device name..", "Mail object unknown at remote node" and "Diskquota exceeded". Messages which receive these error statuses, are returned to the sender with a warning explaining the probable cause of the error. We have decided to include "Diskquota exceeded" as a fatal message, even if it means that the recipient does not receive his message, because we have a huge traffic coming from distribution lists of varying content which is not directly linked with high energy physics.

Change of DECnet parameters

Because the gateway has a high traffic to our central VAXcluster which is very over-loaded, we have had to change some of the DECnet parameters. In particular we have changed the outgoing timer and the inactivity timer to 60 seconds in order to increase the probability that the remote DECnet node can accept the DECnet connect request.

Furthermore, due to the high traffic going through the gateway we have changed the DECnet parameter maximum links to 50.

In order to always have the most up-to-date information about DECnet nodes, each night the DECnet node database is copied from our central VAXcluster.

Change of Sendmail parameters

In order to support the high traffic, two of the Sendmail operational parameters have been changed. The parameters are "x", which sets the load average where Sendmail will queue the messages instead of trying to send them directly, and "X", which sets the load average where Sendmail refuses SMTP connections. We have set the values to 8 for "x" and 15 for "X".

Due to Mail11dv3 different use of SMTP to Sendmail (as mentioned earlier) is has been necessary to increase the Sendmail operational parameter "r", which sets the read timeout value on a SMTP connection. It has been set to 1 hour, but we still see evidence that this value is too low (SYSERR: net timeout: Connection timed out in the syslog file).

Change of syslog loglevel

In order to obtain more information from Mail11v3 and Mail11dv3, the general syslog log level has been raised to 9 (set in the /etc/syslog.conf file).

Monitoring of the Slow queue

In order to be able to list the messages in the Slow queue, a program has been developed which provides the same information as the mailq program does for the normal Sendmail queue.

REFERENCES

[1]   SENDMAIL: AN INTERNETWORK MAIL ROUTER
        ULTRIX-32 Supplementary Documents
        Volume III System Managers
        DEC order number AA-BG68TA-TE

[2]   System Manager's Guide to PMDF-822 V3.0
        Ned Freed, Computing Services, Harvey Mudd College
        Mark Vasoll, Computer Science Department, Oklahoma State University
        9-JUL-1988

APPENDIX 1

Unsupported and undocumented features in mail11v3 and mail11dv3

Mail11v3 and mail11dv3 reads the following files at startup and commands in these files can control the behaviour of the programs. The syntax of the commands depends on if it is the VAX or the RISC version The commands described here relate to the DECnet-Ultrix version 3.0 for Mail11dv3 and for the version of Mail11v3 dated 14/12/89.

The startup files are /usr/lib/dnet/defaults/Dnetrc.required, /usr/lib/dnet/defaults/Dnetrc.defaults, /usr/lib/dnet/defaults/UserDnetrc and /usr/lib/dnet_shared/mail11v3.fatal

In order to write all the extra information to the syslog it is necessary to raise the syslog general loglevel to 9 (in /etc/syslog.conf).

Following is a list of commands. Not all of them are understood, there is no documentation available. Where we were able to work out the effect of a command, a description is given.

The commands which control **mail11v3** are:

mail11.Trailers <on/off> (VAX, RISC). Controls whether mail11v3 will take the RFC822 header fields which cannot be mapped to MAIL-11 header fields, and puts them at the end of the message body delimited from the message body by a line, the contents of which are controlled by mail11.TrailerHeader (VAX) or mail11v3.TrailerHeader (RISC).

mail11.TrailerHeader <string> (VAX) mail11.TrailerHeader <string> (RISC). Setting this string causes the string to be the delimiter between RFC822 headers and the message body. Default string is ===== RFC822 headers ====.

mail11.FakeCC <on/off>

mail11.BlockMode <on/off> (VAX) mail11v3.BlockMode <on/off> (RISC). Controls whether mail11v3 will accept block mode mail messages, e.g.executable files.

mail11.RFC-Headers <on/off> (VAX) mail11v3.RFC-Headers <on/off> (RISC)

mail11.Secure <on/off>

mail11.Trace <on/off>. Controls whether mail11v3 writes its part of the SMTP conversation with Sendmail to the syslog omitting the replies from Sendmail.

mail11.Debug <on/off>. Controls whether debug is set on the SMTP conversation with Sendmail. Gives a little more information in the syslog and some configuration information for the MAIL-11 protocol on stderr (if Sendmail was called with the verbose option).

mail11.Verbose <on/off>. Controls whether mail11v3 will output statistics to stderr (if Sendmail was called with the verbose option).

mail11.VMSBarfChars (VAX) mail11v3.VMSBarfChars (RISC)

mail11.SupportDDIF <on/off> (VAX) mail11v3.SupportDDIF <on/off> (RISC). Controls whether mail11v3 will accept to send DDIF/DOTS documents.

mail11.ForceDDIF (VAX) mail11v3.ForceDDIF (RISC)

mail11.TruncateToVms (VAX) mail11v3.TruncateToVms (RISC)

mail11.TruncateAlways (VAX) mail11v3.TruncateAlways (RISC)

mail11.TruncateLength (VAX) mail11v3.TruncateLength (RISC)

The commands which control **mail11dv3** are:

mail11d.GatewayAccess <on/off> (VAX) mail11dv3.GatewayAccess <on/off> (RISC). Controls whether mail11dv3 will accept messages destinated for non-local users.

mail11d.GatewayCharacters <string> (VAX) mail11dv3.GatewayCharacters <string> (RISC). If a recipient address contains any of the gatewayCharacters and GatewayAccess is off, then the mail is rejected with the error message that mail cannot be gatewayed through this node.

mail11d.TalkSMTPto <host> (VAX) mail11dv3.TalkSMTPto <host> (RISC). Controls whether mail11dv3 will talk SMTP to the local host or to <host>.

mail11d.AcceptHeaders <on/off> (VAX) mail11dv3.AcceptHeaders <on/off> (RISC)

mail11d.AcceptBlockMode <on/off> (VAX) mail11dv3.AcceptBlockMode <on/off> (RISC). Controls whether mail11dv3 will accept block mode mail messages, e.g. executable files.

mail11d.AcceptCCfield <on/off> (VAX) mail11dv3.AcceptCCfield <on/off> (RISC)

mail11d.AcceptNodePrefixed <on/off> (VAX) mail11dv3.AcceptNodePrefixed <on/off> (RISC). Allows the master side of a MAIL-11 exchange to prepend its node name on the From: field. Ultrix does not request this option. The feature is intended to allow DECnet-DOS machines to pretend the mail is coming from a node to which they can actually receive replies.

mail11d.DomainStyleFrom <on/off> (VAX) mail11dv3.DomainStyleFrom <on/off> (RISC). Controls whether mail11dv3 uses u@h or h::u in addresses.

mail11d.QuoteGateway (VAX) mail11dv3.QuoteGateway (RISC)

mail11d.AcceptDDIF <on/off> (VAX) mail11dv3.AcceptDDIF <on/off> (RISC). Controls whether mail11dv3 will accept DDIF/DOTS documents.

mail11d.Trace <on/off>. Controls whether mail11dv3 writes the SMTP conversation with Sendmail, MAIL-11 configuration options and statistics to the syslog.

mail11d.Debug <on/off>. Has no effect.