MultiNet TCP/IP
for
VAX/VMS
Update

L. Stuart Vance

Copyright © 1990, 1991 TGV, Inc.
MultiNet TCP/IP for VAX/VMS Update

- Multi-protocol networking services (TCP/IP, CHAOSnet, PUP) for VAX/VMS computer systems
- Currently shipping *MultiNet V2.2*
- Single kit for VMS V4.5 - V5.4
- All DEC supported VAX/VMS configurations
Device Support

Ethernet

- All Digital controllers
- CMC ENP family in link mode
- Excelan/Novell EXOS family (except BI board) in link mode
- Interlan NI1010
- Xerox 2.94 Mbps Ethernet

Other Technologies

- NSC Hyperchannel
- Shared Proteon proNET-10, 80
- X.25 - ACC 5250/6250
- T1/HDLC - ACC 5100/6100
- DMR-11, DMV-11 (IP over DDCMP)
- SLIP - using any VMS terminal line
**DECnet Interoperability**

- DECnet over IP; encapsulates DECnet datagrams in UDP datagrams (appears to DECnet as a point-to-point link between DMR-11 interfaces)

- IP over DECnet
  - Kernel implementation — transmits IP datagrams over a DECnet link in the networking kernel by calling NETDRIVER at the ALTSTART entry point
  - Dbridge
    * Transmits IP datagrams over a DECnet link via a user process using $QIO reads/writes
    * Interoperable with WIN/TCP and Fusion Dbridge implementations
Installation

• VMSINSTAL - painless
  — 99% of configurations supported
  — 15 minutes or less on most newer systems

• Configuration utilities
  — Handle all aspects of network configuration and operation
  — Perform sanity checks to ensure viable configuration
  — Automatically generate all startup command files

• Utilities:
  • Network/devices
  • Services
  • Remote printer queues
  • DECnet over IP
  • Client and Server NFS
MultiNet Services

• Although servers may listen on their own for service requests, the Master Server provides an easier way of invoking services.

• Inbound connection requests handled by Master Server (configured by the server configuration utility).

• Accepts or rejects connection; if it accepts, it either:
  — Performs the service internally, or
  — Creates a server process and passes the connection on SYS$INPUT, SYS$OUTPUT, ...

• Can restrict access on source host or net address on a per-service basis.

• Keep an audit trail of attempted, accepted, and rejected requests on a per-service basis.

• Sites can provide locally written Auditing code.

• Internal servers may be linked in or dynamically loaded from shareable images.
**Domain Name Server**

- BIND 4.8.1 + Partial Asynchronous Zone Transfers
- Runs internal to Master Server
- NSLOOKUP provided
- If Domain Name System (DNS) query fails, or DNS not enabled, lookups use host tables compiled using a perfect hashing scheme

**Routing Protocols**

- GATED 1.9.1.7
- Runs internal to Master Server
- Supports RIP, EGP, HELLO
Telnet

- Direct connection between VMS terminal driver and network kernel
  - Overhead about the same as a DZ-11
  - No process involved, so no context switching

- Virtual terminals supported

- Negotiations
  - Terminal type (SMG)
  - Window size
  - Baud rate
  - Flow control (negotiated local by default)
  - TN3270 automatic recognition

- No inherent limit on number of incoming connections; customer running with 150 connections into a VAX 6230

- Optional switches to bypass newer option negotiation features for compatibility with other broken Telnet implementations (antique-mode)
**FTP**

- Hybrid server
  - Initially runs internal to Master Server
  - When USER and PASS are received, LOGINOUT is invoked to validate, initialize, and run the FTP server process
- Supports all VMS security features:
  - ACLs (not just UIC ACLs)
  - Accounting
  - Auditing
  - Breakin detection and evasion
  - Security alarms
- Runs SYLOGIN.COM, LOGIN.COM
- Creates FTP_SERVER.LOG file in login directory with log of transactions
- **STRU O VMS**
  - Transparent VMS-VMS transfer of all VMS file types
  - Automatically negotiated
  - Fast, no reformatting needed
- Record structure also supported
- **Performance:**
  - MicroVAX II can saturate DEC Ethernet interfaces
SMTP

- Uses VMS Mail foreign protocol interface: SMTP\%"user@node"
- Enqueueing done with VMS server queue (using VMS queue management)
- MX support
- Tries all IP address found via "A" records until successful
- Incoming and outgoing mail enqueued (allows incoming mail to be forwarded to an unavailable DECnet node)
- MM-32 user interface bundled with MultiNet
- VMS Mail SET FORWARD and SET PERSONAL-NAME supported
- Supports outbound cluster (or organizational) alias
- PMDF supported as alternative (fully functional email gateway)
DECwindows over TCP/IP

- DECwindows over TCP/IP support provided by emulation of the VMS/ULTRIX Connection (UCX) $QIO interface.

- Looked into using DECwindows transport layer interface, but decided to do UCX $QIO emulation as a more general solution (to support other applications written to run over UCX).
BSD "r" Services

- RLOGIN — remote terminal protocol
- RSHELL/REXEC — remote command execution
- RCP — remote copy protocol
- RMT — remote access to VMS tape drives
- Each uses "r" services authentication
  (HOSTS.EQUIV and .RHOSTS)
Remote Printing

- LPD protocol client and server
  - Integrated with VMS queueing system
  - UNIX machines can print on VMS printers
  - VMS systems can print on UNIX printers via a VMS print queue (symbiont and spooled pseudo-device)

- Stream-mode symbiont sends print jobs directly to remote TCP port (useful for printers connected to terminal servers)

- Controlled by printer configuration utility

- Supports VMS accounting

- User definable `/etc/printcap` to VMS print queue attribute mapping
**RPC Services and NFS Server**

- Full UNIX filesystem semantics mapped to VMS filesystem
- Respects VMS diskquotas
- VMS text files are converted to UNIX stream format for access from NFS clients
- Cache to mask VMS bottlenecks
- Supports all ODS-2 VMS volumes:
  - Shadow sets
  - Bound volumes
  - DFS served disks
- Very high performance
  - Multi-threaded so performance not degraded by multiple clients
  - Runs in the kernel, so no process context overhead involved
  - Uses a special XDR serializer
NFS Client

- Transparent file access to NFS servers from VAX/VMS systems
- Emulates Files-11 ODS-2 XQP, presenting virtually all of the VMS file system semantics
- Supports arbitrary RMS file/record types with text files mapped to RMS Stream_LF record type
- Performance, even with majority of code in process for debugging, is good (within a factor of 3 of a local disk)
**NETCONTROL**

- Allows privileged users to control servers running internal to the Master Server
- Can be used to control both local and remote machines (using *MultiNet* security features)
- MULTINET NETCONTROL /HOST=TGV.COM NFS RESTART
Diagnostics

- PING – uses ICMP packets to determine reachability, packet loss, round trip timing

- TRACEROUTE – trace route of a host through an IP network

- TCPDUMP – Ethernet protocol analysis
Programming Support

- Shareable 4.3BSD UNIX compatible socket library
- Programmer's kit separately installed (MNETLIB)
- Hardcopy Programmer's Guide and extensive online HELP information
- MultiNet $QIO (compatible with WIN/TCP), EXOS compatible $QIO, and UCX compatible $QIO interfaces supported
- RPC programming library
Miscellaneous Features

- FINGER
- WHOIS client
- NETSTAT
- SYSTAT
- TFTP
- BOOTP
- RARP
- NTP
- TALK/NTALK
- BBOARD
- RUSERS
- RWALL
- REMIND
- CHARGEN
- DAYTIME
- TIME
- DISCARD
- ECHO
- RPCQUOTA
**MultiNet  Futures**

- Kerberos
  - ticket server  — klist
  - kinit  — kdestroy
    — Kerberized Telnet and FTP
- ALL-IN-1/Message Router to SMTP gateway capability
- VMS NFS Client to VMS NFS Server support
- Performance enhancements in NFS Client and Server
**MultiNet Futures**

- Support for booting diskless Sun workstations and DECstations

- Full support for VAX-11 C runtime socket library (run UCX applications unmodified over *MultiNet*)

- GATED V2.0 - EGP, RIP, HELLO, BGP

- BIND 4.8.3

- POP2 Mail Server (possibly more)
MultiNet Futures

- select() supported in *MultiNet* socket library
- ISODE — OSI applications over TCP/IP
- XVVIEW toolkit and OPEN LOOK Window Manager under VAX/VMS and DECwindows
- SNMP network management station under VAX/VMS
- Command line recall and editing !!!