

MANAGEMENT BY DELEGATION: NETWORK MANAGEMENT FOR THE REAL WORLD



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Today's Networks



- **Complex Networks**
 - **Environment**
 - » **Multi-platform**
 - » **Geographically-dispersed**
 - » **Multiple Sites**
 - **Network Requirements**
 - » **Installation**
 - » **Configuration**
 - » **Operation**
 - » **Maintenance**
 - » **Capacity planning**

Today's Tools

- **Either overly general or highly focused monitoring devices**
 - Proprietary, expensive platforms
 - Passive monitors with limited network control
 - Not consolidated, combined or complementary
 - Require significant operator intelligence

Today's Tools (cont'd)

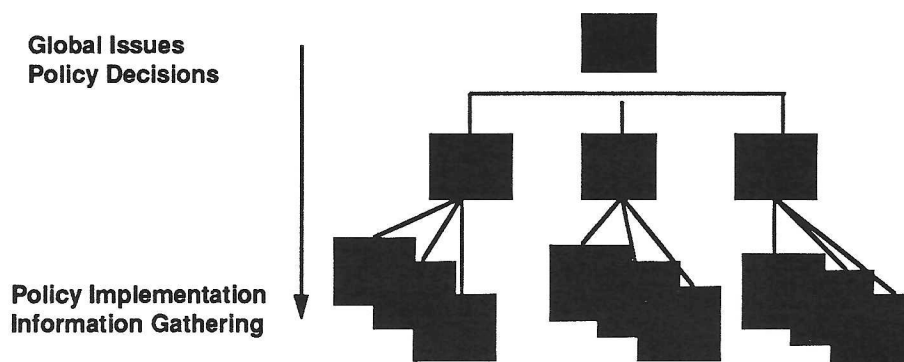
- **General purpose Network Management Stations**
 - Graphics-based MIB browsers
- **Protocol Analyzers**
 - Require substantial human interpretation
 - Necessary and useful devices

Today's Need

- **Actively monitor traffic**
- **Actively probe network devices**
- **Make meaningful interpretation of information gathered**
- **Act on that interpretation**
- **Consolidate network analysis software**
- **Allow proactive interaction**
- **Less human intensive**
- **Treat network as a whole; not collection of separate machines**

Management by Delegation

Traditional Business Model



Management by Delegation (cont'd)



- **Direct application to management of networks**
- **Superior or upper level global control and command**
 - Execution of intelligent applications
 - Coordination and remote operation of multiple lower level probes
 - Set performance goals
 - Global allocation of resources

Management by Delegation (cont'd)



- **Subordinate or lower level probes actively investigate and manipulate devices**
 - Receive delegated authority
 - Operate autonomously
 - Report back to superior
 - Operates when network is broken or partitioned

What's Needed?



- **Automated approach to Network Analysis**
 - **Command and Control engine**
 - **Delegated and localized authority**
 - **Proactive intervention**
 - **Self-repair**

Results



- **More stable and reliable networks**
- **Cost effective network maintenance**
- **Less human intervention**
- **More predictable network behavior**

Development Process



Step 1

- **Perfect capable tools**
 - Actively investigate networks
 - Gather and store meaningful data

Step 2

- **Create automated infrastructure**
- **Deploy NetScript**
- **Delegate automatic authority**
 - Management by Delegation
 - Management by Exception

Current Approach



- **Requires costly personnel**
 - Qualified people are expensive
 - Hard to find
 - Mundane tasks
 - Cannot be used by the masses
- **Requires costly tools**
 - Workstations
 - Software

Empirical's Mission



- **Create network tools that are**
 - Intelligent
 - Consolidated
 - Complementary
 - Easy-to-Use
 - Cost-effective

NetScript



- **Control programming language**
 - Language to create desired control
 - Easily and directly interpreted
 - Governs lower level operation
 - May express simple or complex actions
 - Capable of running in parallel with other scripts

Network Configuration Database

- Network population and topology
- NetScript reads and writes information to and from Database
- Probe detects configuration changes
- Consolidated by control and command consoles
- Used to generate configuration files
- Operators use for inquiries and changes

NetScript Example

- Detect misbehaving host
- Attempt to correct
- If correction fails, detach
- Inform Network Manager

Minimum System Requirements

- MS-DOS v5.0
- 80386 16 MHz
- 640K RAM
- 1MB Hard disk space
- VGA or Monochrome display adapter
- Internal/external Ethernet adapter
- Additional Recommendations
 - Mouse
 - Color Monitor

Evolution of Network Management

- Step 1
 - Extend local human-agent operated control
- Step 2
 - Make devices resident on network
- Step 3
 - Develop multiple levels of network delegation
 - Create easy-to-use user interface

Summary



- **Effective tools require effective practical testing**
- **No tool is adequate for all needs**
- **Support for major network protocols**
 - TCP/IP
 - IPX
 - SNMP
 - DECnet
 - NFS...