NSCOM01

UDP-Based Application Protocols

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USER DATAGRAM PROTOCOL

- **The User Datagram Protocol (UDP) is a connectionless transport protocol used in TCP/IP networks**
- **Considered as a 'bare-bones' protocol that provides only the essential capabilities needed to transport a data segment between applications**
- **Features:**
  1. Unreliable – datagrams are not acknowledged
  2. No congestion control mechanism- datagrams sent as quickly as possible
  3. Stateless – Server does not keep track of status and session information of a client. Each request-response exchange with a client is treated as an independent transaction
  4. Unordered delivery – datagrams do not contain any sequencing information

WHEN TO USE UDP

- **Connectionless services are commonly used with applications where occasional data loss is tolerable in exchange for reduced protocol overhead:**
  1. Inward Data Collection – periodic sampling of data sources such as sensors or automatic self-test reports from network equipment
  2. Outward Data Dissemination – message broadcasting to nodes or distribution of data to a network
  3. Request – Response – query-based applications that use a transaction service provided by a single server where a single request-response is typical
  4. Real-time applications – applications with a degree of redundancy or real-time requirement e.g. voice, telemetry

APPLICATION PROTOCOLS

- **Several well-known application protocols use UDP as transport protocol to support their operations:**
  - System Logging Protocol
  - Network Time Protocol
  - Domain Name System
  - Dynamic Host Configuration Protocol
  - Trivial File Transfer Protocol
  - Simple Network Management Protocol

SYSLOG

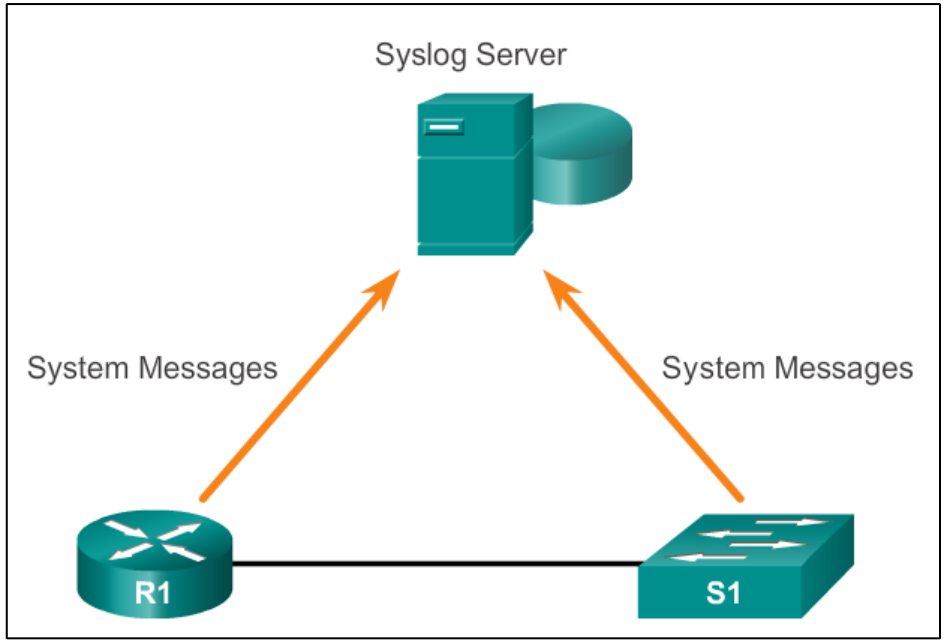
System Logging Protocol

INTRODUCTION TO SYSLOG

- **Monitoring an operational network is necessary**
  - Manage the network
  - Report network usage
  - Report any errors / problems that occur during operation
- **Information collection allows network administrators to collect event reports from devices for monitoring and future analysis.**
  - Provide trail of device activity
  - Early failure or operational error detection
  - Security incident detection and investigation
  - Project future growth
  - Regulatory compliance
  - Etc.

INTRODUCTION TO SYSLOG

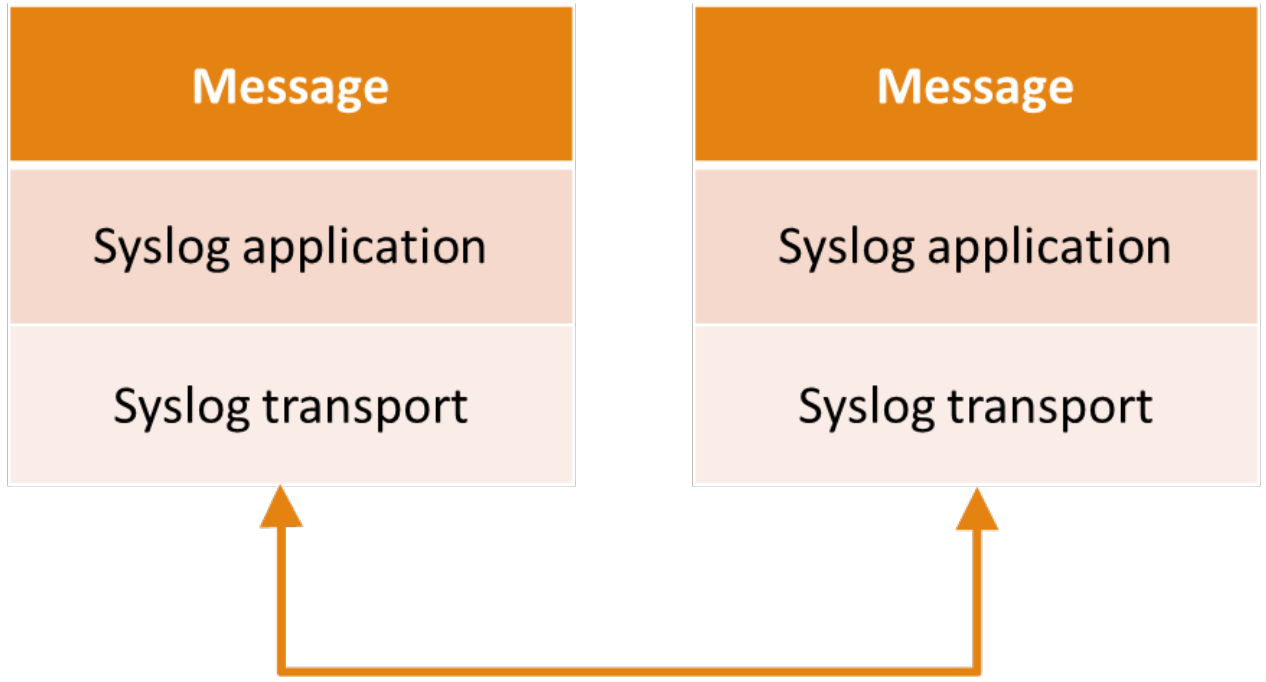
- **Syslog is a protocol that provides a to collect event notification messages from devices**
  - To a log file stored locally on the device,
  - Across the network to a socket on a remote logging server
- **Defines a common message format to allow a method of interpreting messages from devices from different vendors**
- **Protocol is described in RFC 3164 then later replaced by the proposed standard RFC 5424**



SYSLOG ARCHITECTURE

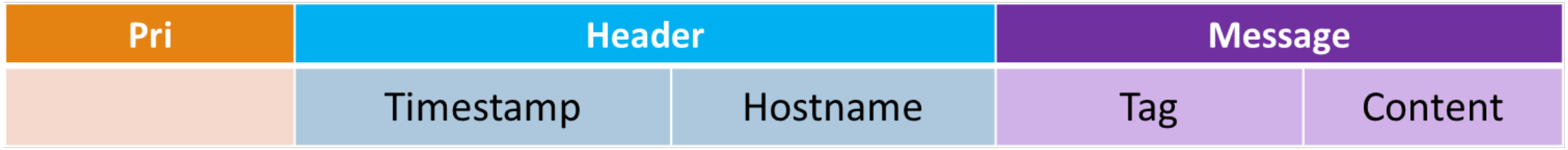
❑ Syslog utilizes three layers:

- "syslog content" is the management information contained in a syslog message.
- The "syslog application" handles generation, interpretation, routing, and storage of syslog messages.
- The "syslog transport" puts messages on the wire and takes them off the wire through a chosen transport layer protocol.



SYSLOG MESSAGE FORMAT (RFC3164)

- **Syslog messages are at least 480 bytes in length**
- **Messages contain the following:**
  - Pri – Message priority enclosed in <>
  - Header – Essential message details
  - Message Text - message details using a free-format content customized according to manufacturer of device



SYSLOG MESSAGE PRIORITY

- Syslog message priority facility code represents the type of program or component that generated the message
- Priority = facility_code * 8 + severity level

Code	Keyword	Description
0	kern	Kernel messages
1	user	User-level messages
2	mail	Mail system
3	daemon	System daemons
4	auth	Security/authentication messages
5	syslog	Messages generated internally by syslogd
6	lpr	Line printer subsystem
7	news	Network news subsystem
8	uucp	UUCP subsystem
9	cron	Clock daemon
10	authpriv	Security/authentication messages
11	ftp	FTP daemon
12	ntp	NTP subsystem
13	security	Log audit
14	console	Log alert
15	solaris-cron	Scheduling daemon
16–23	local0 – local7	Locally used facilities

SYSLOG MESSAGE PRIORITY

- Syslog message severity represents criticality of messages
- Lower number indicates more critical event

Level	Severity	Description
0	Emergency	System is unusable
1	Alert	Action must be taken immediately
2	Critical	Critical conditions
3	Error	Error conditions
4	Warning	Warning conditions
5	Notice	Normal but significant conditions
6	Informational	Informational messages
7	Debug	Debug-level messages

SYSLOG MESSAGE FORMAT (RFC3164)

- **Header**
  - Timestamp - Mmm dd hh:mm:ss fomat
  - Hostname – hostname or IP address
- **Message**
  - Tag – contains process name and sometimes process ID, terminated by a non-alphanumeric character
  - Content – message body
- **Example**

```
<34>Oct 11 22:14:15 mymachine su: 'su root' failed for lonvick on /dev/pts/8
```

SYSLOG MESSAGE FORMAT (RFC5424)

- **Syslog messages are at least 480 bytes in length**
- **Messages contain the following:**
  - Header – ASCII encoded containing mandatory and essential information about a message, very structured in format
  - Structured Data – mixed ASCII and UTF-8 encoded containing key-value pairs providing more details regarding a message.
  - Message Text - free-format content customized according to manufacturer of device

SYSLOG HEADER FIELDS

- **Priority – Comprises a facility code and severity level, enclosed in <> computed in the same way as RFC 3164**
- **Version – currently 1**
- **Timestamp – When the message was generated. Uses YYYY-MM-DDThh:mm:ss.sTZD format (Example: 1994-11-05T08:15:30-05:00 or 1994-11-05T13:15:30Z)**
- **Hostname – machine that sent the message identified using its fully qualified domain name (FQDN), IP address or hostname**
- **Application Name - identifies the device or application that originated the message.**

Header						
Priority	Version	Timestamp	Hostname	Application Name	Process ID	Message ID

SYSLOG HEADER FIELDS

- **Process ID - process name or process ID associated with a syslog system**
- **Message ID – Identified the message type – commonly used for filtering purposes at the collector**

Sample:

```
<165>1 2003-10-11T22:14:15.003Z mymachine.example.com
evntslog 12875 ID47 [exampleSDID@32473 iut="3"
eventSource="Application" eventID="1011"] BOMAn
application event log entry...
```

SYSLOG MESSAGE TEXT

- **Message text is an optional field containing ASCII or UTF-8 encoding (when preceded by characters 'BOM'**

Sample:

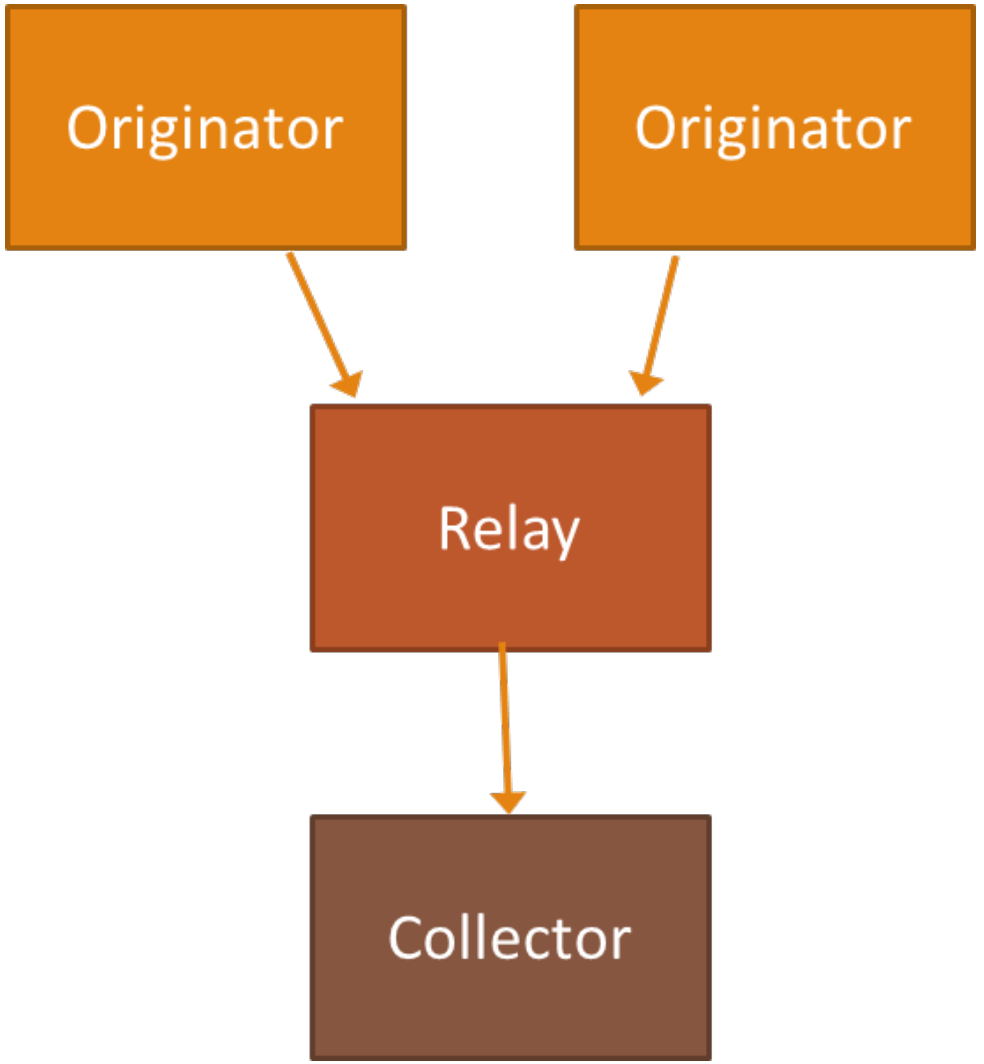
```
<165>1 2003-10-11T22:14:15.003Z mymachine.example.com
evntslog 12875 ID47 [exampleSDID@32473 iut="3"
eventSource="Application" eventID="1011"] BOMAn application
event log entry...
```

SYSLOG DEPLOYMENT

❑ Functionalities

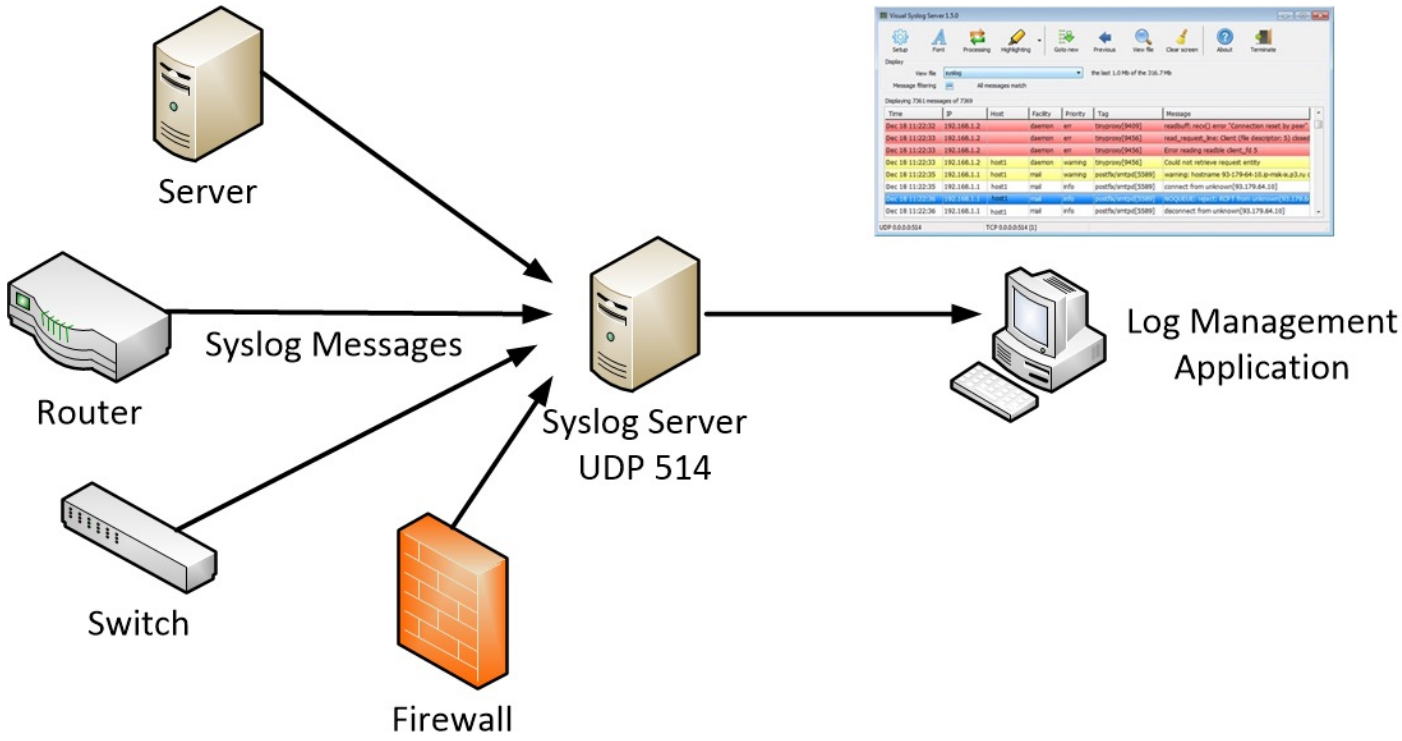
- An "originator" or “sender” generates syslog content to be carried in a message.
- A "collector" gathers syslog content for further analysis.
- Optional "relays" accept messages from originators or other relays and sending them to collectors or other relays.

❑ All 3 functionalities may reside on the same physical system



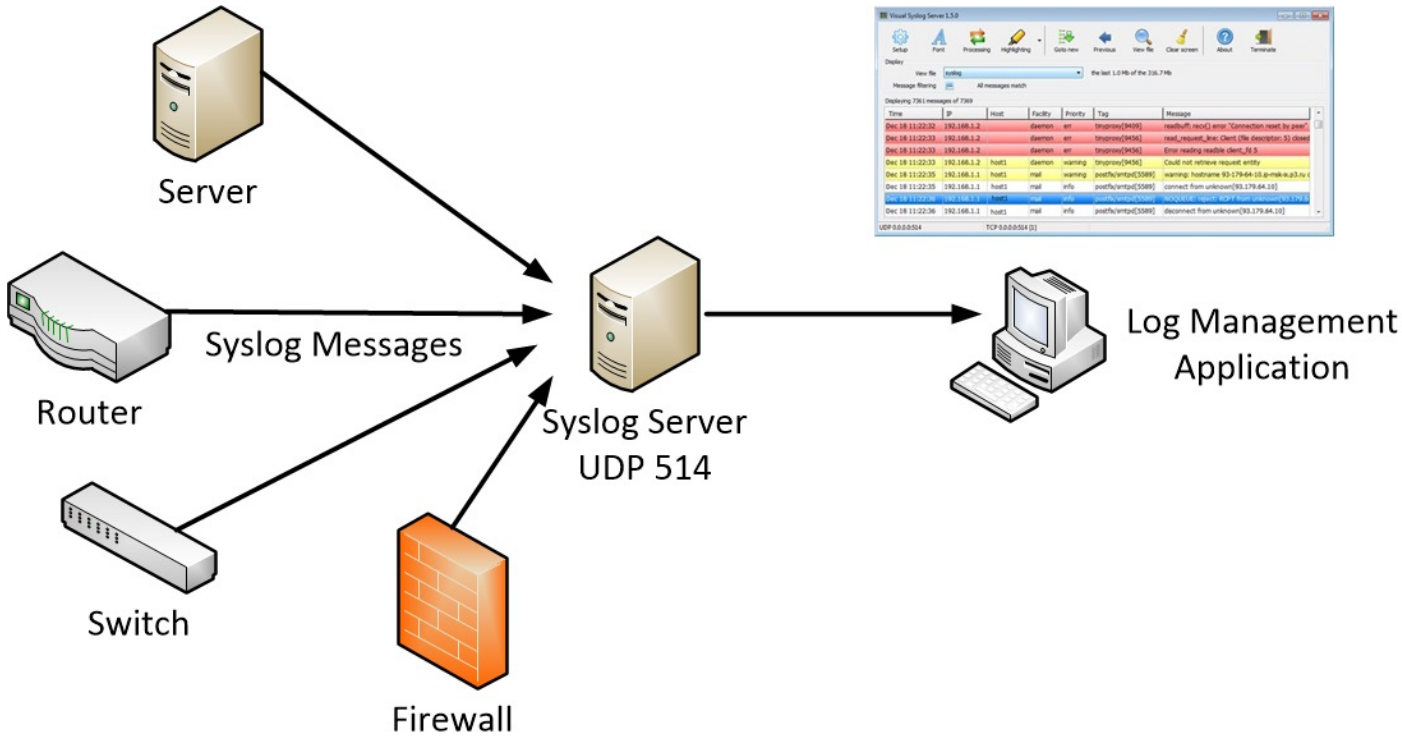
TYPICAL DEPLOYMENT SCENARIO

- Originators may be any network capable device with logging functionality
- Collector is a syslog server application listening on UDP port 514
- Syslog server process is a software that consolidates received log entries for network administrators to access for review through a user-friendly interface



TYPICAL DEPLOYMENT SCENARIO

- Optional relays may be placed between originator and collector, commonly for filtering based on severity, message ID, etc
- Originators may send to 1 or more relays or collectors, and relays/collectors may receive from 1 or more originators



LIMITATIONS

- **Although a proposed standard exists, a large number of devices still use the 3164 format (now classified as an obsolete RFC)**
- **Communication is simplex only. Messages are sent without acknowledgments hence message loss and dropping due to rejected content is possible**
- **No congestion control – Possible to overwhelm the collector**
- **No authentication – Possible to collect crafted and replayed messages**
- **No confidentiality – Messages sent in plain text**
- **If these features are needed for reliable and secure logging:**
  - Syslog over TCP (reliability) – RFC 6587
  - Syslog over TLS (security) – RFC 5425

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