# RADIUS

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# REMOTE AUTHENTICATION DIAL-IN USER SERVICE (RADIUS)

- *Why* is RADIUS needed?
- *What* is RADIUS?
- *How* does RADIUS work?
- *Who* does RADIUS?
- *Where* can you find out more about RADIUS?



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# WHY IS RADIUS NEEDED?

- Dial-In desireable but Security a must
- Scalability
- Single Point of Administration
- Way to Link Network Access Servers and Authentication Methods



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# WHAT IS RADIUS?

- UDP/IP based Protocol for a Network Access Server (NAS) to communicate with a database server of authorized users
- Authentication
- Authorization
- Accounting (optionally)
- Simple, Flexible, Scalable, Reliable



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# HOW DOES RADIUS WORK?

- NAS prompts dial-in user for Username, Password
- NAS encrypts Password and sends that and Username to RADIUS server in an *access-request* packet
- RADIUS server looks up Username in database, confirms Password, and sends back packet with one of 3 responses:
    - *access-accept* (and includes authorization information)
    - *access-reject* (with optional message)
    - *access-challenge* (with optional message and state)
- If NAS receives *access-challenge* it may prompt the user for additional information and send another *access-request* to the RADIUS server, including the state attribute sent in the *access-challenge*
- Works with PAP, CHAP



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# WHO DOES RADIUS?

- Originally written by Steve Willens of Livingston Enterprises and distributed freely
- Many other NAS and smart card vendors supporting or adopting RADIUS
- RADIUS Working Group formed at 32nd IETF to document it as a standards-track RFC



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# WHERE CAN YOU FIND OUT MORE?

- ftp://ftp.livingston.com/pub/radius/
  - current Internet-Drafts
  - archive of ietf-radius mailing list
- ietf-radius-request@livingston.com
  - Mailing list for RADIUS Working Group
  - To join, send email with "`subscribe`" in body
- cdr@livingston.com
  - To contact RADIUS Working Group Chair and Document Editor, Carl Rigney
- ftp://ftp.livingston.com/pub/le/radius/
  - RADIUS 1.16 server source
  - white paper with more information
- info@livingston.com
  - For more information on Livingston Enterprises
- resume@livingston.com
  - Just in case you were curious



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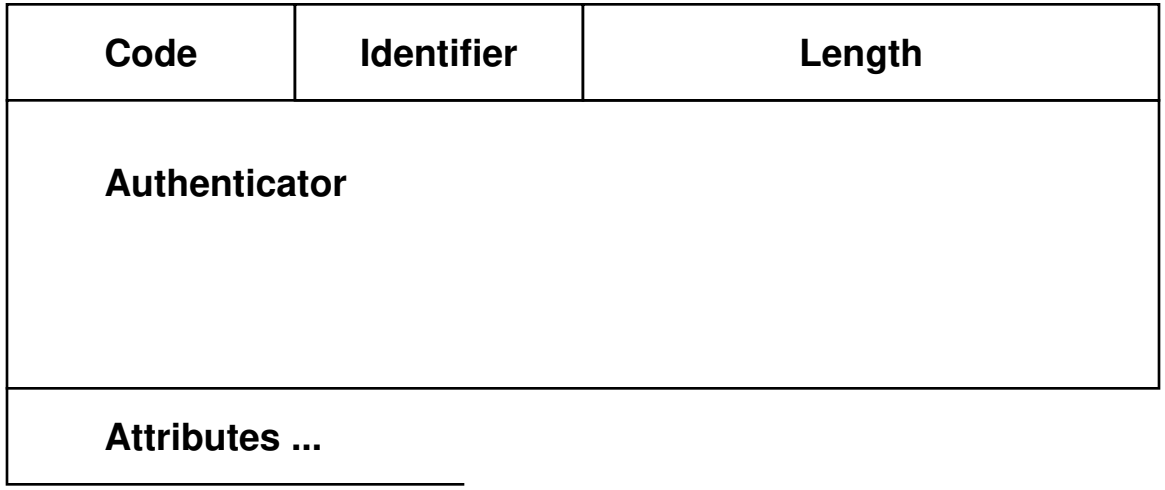
# RADIUS PACKET




Code = **ACCESS-REQUEST**
**ACCESS-ACCEPT**
**ACCESS-REJECT**
**ACCOUNTING-REQUEST**
**ACCOUNTING-RESPONSE**
**ACCESS-CHALLENGE**



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# ATTRIBUTES

| Type | Length | Value... |
|---|---|---|

- Type, Length, Value (TLV) 3-tuple
- Types of Attributes
  - 1- 63 likely to be used in RFC
  - 64-191 to be used for future expansion if necessary
  - 192-223 reserved for experimental use
  - 224-240 reserved for implementation specific use within a server
  - 241-255 reserved
- Length = 2-255 including 2 octets for Type and Length fields
- Four kinds of Values
  - string - 0-253 octets
  - ipaddr - 4 octets in network byte order (also used for IPX Net Numbers)
  - integer - 32 bit value in big endian order (high byte first)



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# ATTRIBUTE TYPES

**User-Name**
**User-Password**
**CHAP-Password**
**NAS-IP-Address**
**NAS-Port**
**Service-Type**
**Framed-Protocol**
**Framed-IP-Address**
**Framed-IP-Netmask**
**Framed-Routing**
**Filter-Id**
**Framed-MTU**
**Framed-Compression**
**Login-IP-Host**
**Login-Service**
**Login-Port**
**Reply-Message**
**Callback-Number**
**Callback-Id**
**Framed-Route**
**Framed-IPX-Network**
**State**
*Class*
*Vendor-Specific*
**Session-Timeout**
**Idle-Timeout**
**Termination-Action**
**Called-Station-Id**
**Calling-Station-Id**
*NAS-Identifier*
*Proxy-State*
*CHAP-Challenge*
**NAS-Port-Type**



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# ACCOUNTING ATTRIBUTE TYPES

**Acct-Status-Type**
**Acct-Delay-Time**
**Acct-Input-Octets**
**Acct-Output-Octets**
**Acct-Session-Id**
**Acct-Authentic**
**Acct-Session-Time**
*Acct-Input-Packets*
*Acct-Output-Packets*
*Acct-Terminate-Cause*



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# INSTALLATION OF RADIUSD 1.16

- Implementation vs. Protocol
    - Data Dictionary is just a method of Implementation
- /etc/radiusd
- /etc/raddb/
- /usr/adm/radacct/



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# /etc/raddb

- *clients* shared secrets
- *dictionary* defines attributes and values for users file
- *logfile* errors and warning messages
- *users* user authentication/authorization information



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# /etc/raddb/dictionary

```
ATTRIBUTE       User-Name           1       string
ATTRIBUTE       Password            2       string
ATTRIBUTE       CHAP-Password       3       string
ATTRIBUTE       Client-Id           4       ipaddr
ATTRIBUTE       Client-Port-Id      5       integer
ATTRIBUTE       Login-Service       15      integer

VALUE           Login-Service       Telnet     0
VALUE           Login-Service       Rlogin     1
VALUE           Login-Service       TCP-Clear  2
```



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# /etc/raddb/users

```
# PPP user with address Assigned by NAS
#
Peg     Password = "ge55gep"
        User-Service-Type = Framed-User,
        Framed-Protocol = PPP,
        Framed-Address = 255.255.255.254,
        Framed-Compression = Van-Jacobsen-TCP-IP,
        Framed-Filter-Id = "student",
        Framed-MTU = 1500
#
# Login User to default host
#
DEFAULT  Password = "UNIX"
         User-Service-Type = Login-User,
         Login-Service = Rlogin
```



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# /usr/adm/radacct/*pmname*/detail

- Start of Service Record

```
Wed Jan 10 14:24:02 1996
        Acct-Session-Id = "1C000011"
        User-Name = "nancy"
        Client-Id = 149.198.1.18
        Client-Port-Id = 14
        NAS-Port-Type = ISDN
        Acct-Status-Type = Start
        Acct-Authentic = RADIUS
        Called-Station-Id = "5557422"
        User-Service-Type = Framed-User
        Framed-Protocol = PPP
        Framed-Address = 149.198.15.1
        Acct-Delay-Time = 0
```



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- End of Service Record

```
Wed Jan 10 15:38:42 1996
        Acct-Session-Id = "1C000011"
        User-Name = "nancy"
        Client-Id = 149.198.1.18
        Client-Port-Id = 14
        NAS-Port-Type = ISDN
        Acct-Status-Type = Stop
        Acct-Session-Time = 4483
        Acct-Authentic = RADIUS
        Acct-Input-Octets = 140158
        Acct-Output-Octets = 28723318
        Called-Station-Id = "5557422"
        User-Service-Type = Framed-User
        Framed-Protocol = PPP
        Framed-Address = 149.198.15.1
        Acct-Delay-Time = 0
```



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# PAP and CHAP Authentication

- PAP ID and Password sent as RADIUS User-Name and User-Password

- CHAP is more complicated:
  1. NAS generates CHAP Challenge and sends to dial-in user
  2. user sends back CHAP ID and challenge response
  3. NAS sends RADIUS *access-request* packet to server with challenge as authenticator, CHAP ID as User-Name, challenge response as CHAP-Password (3)
  4. RADIUS server uses User-Name to look up password (which must be in cleartext), encrypts authenticator with that using MD5 and compares result to CHAP-Password
  5. If they match, server sends back *access-accept*, otherwise sends back *access-reject*



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