



# ARADIAL RADIUS

## RADIUS Overview

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<http://www.aradial.com>

<http://www.radius-server.com>

<http://www.wifi-radius.com>

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# 1. Product Overview

Aradial is a high performance full-featured RADIUS server. Boasting excellent performance and technological superiority, Aradial is the unquestioned market leader in its class.

Extensive support for: **ISP, Wireless LAN, Mobile Companies.**

The server includes some of the most innovative features available in the market today. It is easy of use, scalable and features a plug-in architecture providing support for almost any new functionality or network element.

Aradial's 100% web-based interface ensures easy connectivity from anywhere. Coupled with a state server that enables to monitor what is happening in the network, in real time, Aradial turns a web browser into the ultimate remote control.

Through an easy to use scripting interface fail over mechanisms can be applied, some resources can be dedicated for particular end users, time of day decisions on network load can be made, and much more.

Using policy algorithms, Aradial can implement rule-based authentication giving a complete manageability of network resources.

Aradial is vendor independent allowing to use Cisco's access servers including Wireless LAN (Aironet series) , Ascend's MAX Series, Lucent's Portmaster, Bay's, Shiva's, any combination of them or any other RADIUS enabled product.

Wireless Security Suite: Extensible Authentication Protocol (EAP), 802.1X, EAP Cisco Wireless (LEAP), Protected EAP (PEAP), EAP-TTLS and EAP-TLS. EAP-SIM and EAP-AKA – can be supported per a project.

Aradial can use its own user database, an external ODBC compliant database or use a LAN user database with Aradial LAN to WAN permissions mapping mechanism, without any duplicate user database hassles.

Support for connection to LDAP, allowing maintaining a single centralized user database.

Additionally, the server's full list of administrative and reporting utilities make it a single point of control.

Aradial's advanced proxy support allows transparent operation in even the most complex of network environments.

Aradial, a powerhouse of features and performance is affordably priced and ready to download for an evaluation today.

### **Reliability and scalability**

Aradial RADIUS is a true performer with Tier 1 (99.997%) reliability and scalability to comfortably support over a million subscribers. Though installed and suited to serve the largest providers, the Aradial RADIUS is high performing and therefore requires low cost hardware, supporting most service providers' requirements on a commercial Pentium machine.

### **Web based administration**

Aradial RADIUS turns the web browser into a remote control. The server can be accessed from anywhere in the world over secure SSL, with no client side installation whatsoever. All that is needed is a web browser in order to configure RADIUS settings from anywhere, view all currently online sessions, modify the subscriber record, and more.

### **Support for the latest RFCs**

Aradial software supports the latest RADIUS RFCs, supporting xDSL services, vendor specific attributes and a host of other features such as predefined attribute check lists. Aradial's experience in the RADIUS and billing market means that you are guaranteed a solution that will continue evolving into the future.

Aradial Radius is compliant with the following RADIUS RFCs:

- RFC 2433 -- MS Chap
- RFC 2548 -- Microsoft Vendor-Specific RADIUS Attributes
- RFC 2579 -- MS Chap V2
- RFC 2865 -- Remote Authentication Dial-In User Service (obsoletes RFC 2138; updated by RFC 2868)
- RFC 2866 -- RADIUS Accounting (obsoletes RFC 2139; updated by RFC 2867)
- RFC 2809 -- Compulsory Tunneling via RADIUS
- RFC 2867 -- Accounting Modification for Tunnel
- RFC 2868 -- RADIUS Attributes for Tunneling Support
- RFC 2869 -- RADIUS Extensions

- RFC 2882 -- NAS Requirements: Extended RADIUS Practices
- RFC 2619 and 2621 and 2571 -- Radius Authorization and Accounting SNMP
- RFC 3172 -- RADIUS and IPv6
- RFC 4679 -- DSL Forum Vendor-Specific RADIUS Attributes
- RFC 3748, 3579, 3580 -- Extensible Authentication Protocol (EAP)
- RFC 2716 -- EAP TLS Authentication Protocol
- RFC 3575 -- IANA Considerations for RADIUS
- RFC 3576 -- Packet-of-disconnect (PoD) and change-of-authorization (CoA)
- RFC 3172 -- RADIUS and IPv6

### **Full support for Secure Wireless RADIUS**

Hot Spot Server for wireless includes an integrated RADIUS server that is particularly suited for the security and authentication requirements of wireless based network including:

EAP based authentication – EAP-MD5, EAP-TLS, EAP-TTLS, PEAP, LEAP

EAP-SIM and EAP-AKA – for supporting wifi offloading

MAC Address based authentication

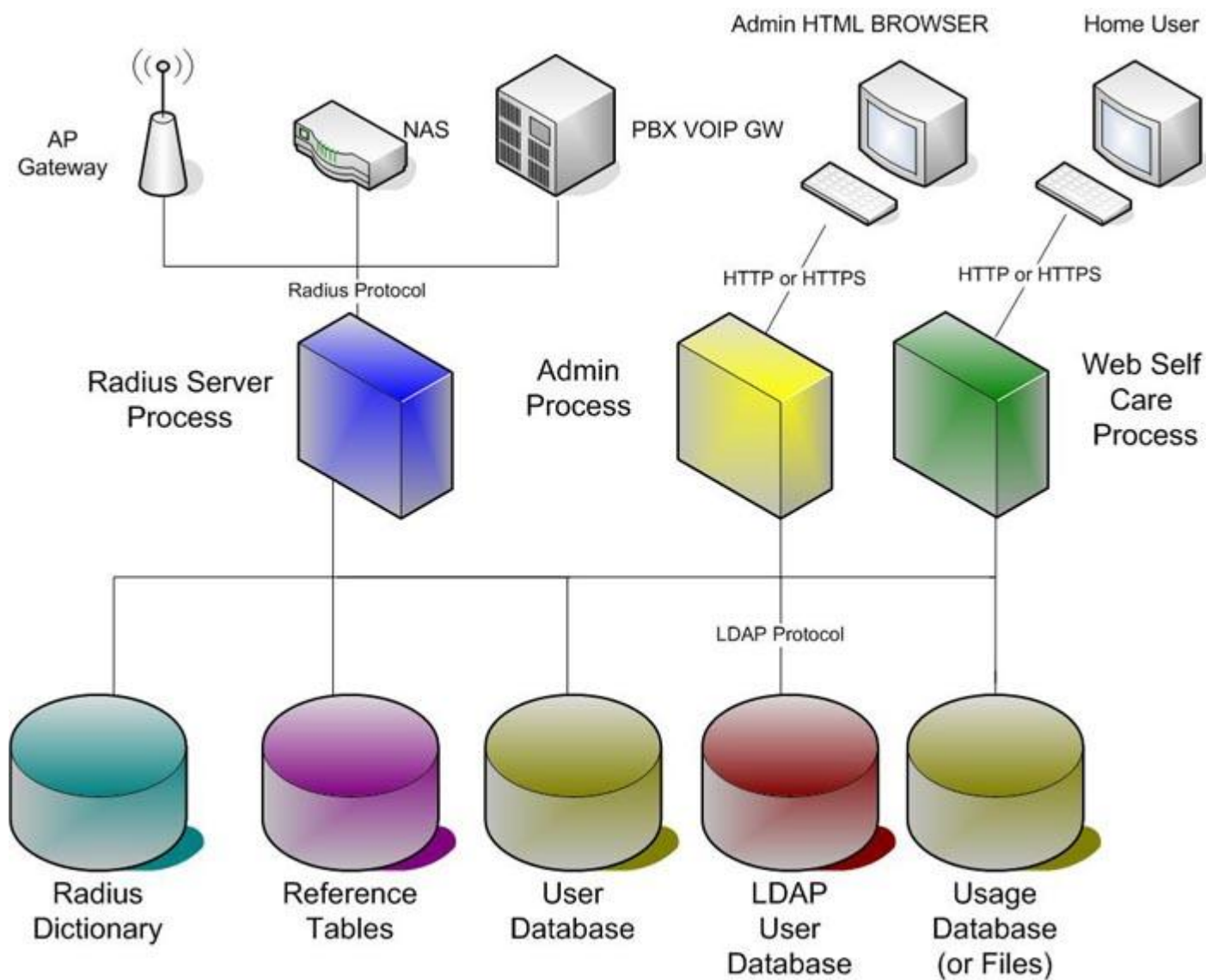
IEEE 802.1x based WEP security

### **Additional standards support for extension module**

These are additional modules that are supported by Aradial AAA:

- Wimax Forum NWG 1.3/1.4
- Wimax Prepaid application
- Diameter Protocol RO/RF and Gy/Gx
- Diameter SWx for Wifi offloading
- HSS option
- PDSN prepaid application

## 2. Architecture





Aradial RADIUS server is based on the following technologies:

- Written in C++/C
- Multi Process and Multithreaded technologies
- 100% Web based UI
- Portable code: Unix and Windows
- High performance Radius servers
- RDBMS

Aradial has several modules:

1. **Admin Process - Web based administration** – using a web browser the administrator can change the Aradial configuration in real-time and affect the server.

The admin can do the following:

- a. Configure the NAS
- b. Configure all the server parameters (e.g. threads, database connections,).
- c. User groups and user database – hold the user profiles.

Aradial support customizable permission hierarchy for administrators.

2. **RADIUS server process** – This is the main process that handles incoming and outgoing RADIUS requests.

- a. Support all standard RADIUS attributes.
- b. Configurable NAS models using dictionary files ('Radius Dictionaries'). This includes 3GPP Mobile VSA.
- c. Authentication and Authorization using Oracle/RDBMS user database or LDAP or both as failover (if one fails try the second).
- d. Write accounting to Oracle database/RDBMS or Files or both.

- e. The RADIUS server is multithreaded. A separate configuration for Authentication threads and Accounting threads.
- f. Has a plug-on policy algorithm to alter the standard behavior of the server. The algorithm can use database queries and all the requests data.
- g. Perform proxy request towards external RADIUS or in different protocols to external systems (using the Policy algorithms).
- h. Perform IP Addresses allocations.
- i. Support standard RADIUS SNMP MIB and generates SNMP TRAPS.

## Aradial RADIUS Basic Features

### AAA standards

Supported standards:

- RFC 2865 -- Remote Authentication Dial-In User Service
- RFC 2866 -- RADIUS Accounting
- RFC 2882 -- NAS Requirements: Extended RADIUS Practices
- RFC 2619 and 2621 -- Radius Authorization and Accounting SNMP
- RFC 2869 -- RADIUS Extensions
- RFC 2284 -- Extensible Authentication Protocol (EAP)

### CDMA2000 and Mobile IP support

Support using CDMA2000 and Mobile IP specific RADIUS dictionaries.  
Supporting PDSN for CDMA2000.

### Authorization policy support

Out of the box support for authorization based on time of day, caller ID. A Checklist mechanism allows to accept/reject an authorization based on any RADIUS attribute on the access requests. Aradial flexible policy mechanism allows implementing of authorization policies for additional non-user specific parameters like any RADIUS attribute (like location), or other parameters, provided they are available to the RADIUS server.

An embedded TCL scripting language (configuration) can be used for the above without coding.

### **Authorization policy support (2)**

Support for authorization based on time bank and mega byte bank, account status, password lockout mechanism. Other user specific, non profile parameters can be added using the flexible policy algorithm mechanism, using TCL scripts or C++ shared libraries.

### **Data stores**

Support for the following user policy databases: Oracle, SQL Server, or LDAP.

### **Catalog management**

New services can be added using Aradial implementation. The service definition includes static authorization parameters, while personalized authorization parameters are flexibly defined as part of the user profile.

### **IP address management**

Aradial provides out of the box support for IP pool management.

### **Record format**

Every RADIUS attribute can be written to the usage detail records. All attributes are defined using dictionaries. There is a default dictionary and vendor specific dictionaries. The dictionaries can contain native RADIUS attributes or vendor specific attributes (VSA's).

### **Record editing**

The format of the usage detail records (CDR's) is defined using a configurable text file. Therefore, it is possible to define specifically which attributes will be written to the CDR files.

### **Prepaid capabilities**

The RADIUS server cannot proactively interrupt a session. It is the network element responsibility to monitor the user usage and call the RADIUS server for re-authentication for each quota. The RADIUS server can allocate duration or volume quota from a duration or volume bank. For a full prepaid, integration with a online charging billing system is required (prepaid system).

### **Fraud management**

Support for limiting the number of concurrent simultaneous sessions at the user or group level. The limit may be to a single session or to a specified number of concurrent sessions. Support for password lockout. Support for authorizing a user based on his caller ID

### Record standards

Comma delimited files and flexible text file format defined by a configuration template. Also CDRs can be written to a relational database. Using the internal scripting language the records can be written to any format.

### File format

Support for flat files or flat XML files using a flexible text file format.

### Usage interface

Aradial rely on the mediation/billing system to pull the CDR files. FTP or socket transfer of CDRs can be developed in customization.

### Accounting flexibility

The accounting can be customized using the flexible policy algorithms or the embedded TCL scripting language (can format the output).

### Revenue assurance

Ability to write the usage records to record stores simultaneously: text CDR files and a relational database for backup.

### Interfaces and APIs

Standard interfaces described in a previous item (AAA standards).

We have the following customer management API's:

- a. Using HTTP
- b. Using TCP/IP provisioning.
- c. Using CGI API.
- d. Customized - you can request an API and we will provide it.

### Hardware and OS

Hardware supported: Intel and Sun Sparc

System software: Windows, Linux and Solaris.

### Architecture scalability

Aradial supports vertical scalability using multi-threaded architecture and providing linear scalability. Horizontal scalability is supported using multi server deployment of Aradial.

### Solution performance

- Aradial can support millions of users in one Oracle database or LDAP server.
- Millions of concurrent sessions.
- The performance depends on the database performance and storage.
- Using Oracle native OCI API and reuse of statements.
- Special treatment to partition the accounting log into separate tables (also the native Oracle 9i partitioning can be used)
- All the reference data is cached in the memory of the server.

For partial performance data sheet please see datasheet at the end.

### Interoperability

Successful Integration with iPass and GRIC and many other RADIUS vendors (RADIUS proxy).

### Monitoring and management

- Monitoring of active sessions.
- RADIUS server statistics.
- Full management and administration capabilities using a web based user interface.
- SNMP monitoring based on RFC 2619 and 2621.

### Uptime and availability

- Ability to perform online load (reconfiguration without restart) of major configuration elements (like NAS definitions, user group definitions). Several parameters will require a restart.
- Database high availability using Oracle RAC.
- AAA server high availability using multi process deployment.

### Logging

- Support for multiple log topics (like Severe, Warning, Info, Debug, SQL Info, Etc.).
- Ability to configure each log topic separately. Also ability to reconfigure without restart of the server.
- Logs can be written to the following targets: local files, NT event log or Syslog.

Sample text log format:

```
12/11/2004 20:13:18 Receive: Request from host 127.0.0.1 code=1, id=2, length=49
12/11/2004 20:13:18 User-Name = "DemoUser1"
12/11/2004 20:13:18 Password = "\92r\91W\1d>@\c3\cc+\a0\0f\18na"
12/11/2004 20:13:18 Sending Code=2, Id=2 to 127.0.0.1
12/11/2004 20:13:18 User-Service-Type = Framed-User
12/11/2004 20:13:18 Framed-Protocol = PPP
12/11/2004 20:13:18 Framed-Address = 255.255.255.254
12/11/2004 20:13:18 Framed-Netmask = 255.255.255.255
12/11/2004 20:13:18 Class = "Svc=1"
```

### Reporting

Online Statistics:

1. Online Graphs: Daily, Weekly, Monthly, Yearly, and all time average.
2. Different Types: Logins, Simultaneous Sessions, and Time Used
3. Different Axis: By Group, By NAS and Total
4. Full SNMP support.

Online Sessions: View all Online Sessions with detailed information of UserID, IP, Online time, Origin and more.

Admin Reports:

1. Administrator Reports delivered to you by Email on a daily, weekly or monthly basis.
2. Different Report Types: Summary, Top Ten Users and Group.

### Fault tolerance

The Radius server is stateless, where all session data is stored in a relational database (active sessions and IP pools). The use of Oracle Real application cluster enables the fault tolerance.

Database storage will use RAID and virtual storage for H/A (EMC or Veritas).

Using 3<sup>rd</sup> party monitoring and keep alive tools from EMC, Veritas, Next Nine, etc.

Each Radius server can be configured to use **two** database connections; if one fails the other would be used.

### Fault management

- Full SNMP support for the Radius server.
- Implementation of RFC 2619, 2621 (RADIUS-AUTH-SERVER-MIB and RADIUS-ACC-SERVER-MIB).
- Supports sending TRAPS to the network administration tool via SNMP.

## 3. Aradial Features & Benefits

Aradial provides a rich set of features covering almost any aspect of remote access, security integration and interoperability issues. Below are highlights from version 3.0 features.

### Radius

<b><u>RADIUS Server</u></b>
<b>Feature:</b> Fully featured, high performance Radius Server.
<b>Benefits:</b> <ol style="list-style-type: none"><li>1. Fully integrated system.</li><li>2. Central User Management.</li><li>3. Works seamless with all other features.</li></ol>
<b><u>NAS/Proxy Templates</u></b>
<b>Feature:</b> Define NAS templates with IP wildcards and shared secret.
<b>Benefits:</b> Faster configuration and easier maintenance.
<b><u>AAA</u></b>

**Feature:**

Support for RFCs 2138 and 2139 for Radius Authentication, Authorization and Accounting (AAA).

Wireless LAN security support: **EAP**

**Benefits:**

Vendor independent support including Ascend, Bay Networks, Cisco, 3Com, Shiva Microsoft and more.

**Proxy and Roaming**

**Feature:**

Advanced Proxy support including static forwarding and DNS forwarding (Roaming).

**Benefits:**

1. Deploy multi branch servers that can service each other.
2. Use central user database for multi site setups.
3. Outsource Remote Access while maintaining control over users, groups, permission and billing, or provide outsourced Remote Access.

**Policy Algorithms and External API**

**Feature:**

1. Customizable handling flow for each RADIUS message type
2. Flow is made of a chain of RADIUS algorithms



3. Core algorithms supplied with the product  
Authentication & Authorization algorithm
4. Several accounting algorithms
5. Proxy algorithm
6. New algorithms can be developed using C++ shared libraries.

**Benefits:**

Policy Algorithms can help you connect the Radius server to External Servers or External Database.

**TCL Policy Algorithms**

**Feature:**

1. Customizable handling flow for each RADIUS message type
2. TCL is embedded into the Radius Server as a scripting language
3. New algorithms can be developed using TCL language.

**Benefits:**

Very simple message handling in scripts.

**User Metering Support/Limit Enforcement**

**Feature:**

4. Using Special Policy Algorithm.
5. Connected to a define External Database.

6. Define **accumulators** per user, Duration and Megabyte.
7. When authorizing the user check if the accumulator has been depleted.
8. Send **Session-Timeout** attribute to limit the session time.
9. In accounting, deduct the amount of usage in real-time.

**Benefits:**

Aradial will enforce the credit limitations, defined in the External Billing system.

**Multiple Dictionaries**

**Feature:**

Use our database of over 30 vendor specific dictionaries, which may be easily customized for your special configuration, or create your own set of dictionaries.

**Benefits:**

Take full advantage of vendor specific RADIUS attributes to tailor your setup to your needs.

## Accounting and User Database

### **Accounting**

#### **Feature:**

The accounting Data can be sent either to text files that can be configured in a template file or database logging.

There is a special mechanism to partition the database tables to be separated per month.

### **User Database: Groups and Users**

#### **Feature:**

Groups hierarchy was added to this product for users.

Group has a profile for its users: IP Pool to use, Multilink, maximum loggings per group, maximum simultaneous loggings.

Each user belongs to a group that contains information about his general profiles and can override it.

## Remote Access

<b><u>Predefined Network Services</u></b>
<b>Feature:</b> Predefined services for PPP/SLIP/Telnet. You can easily add and modify services tailored for your setup.
<b>Benefits:</b> No need to learn RADIUS RFCs and attributes in order to add new services. Saves time and money.
<b><u>IP Pools</u></b>
<b>Feature:</b> Allocate Pools of IPs for all Access servers.
<b>Benefits:</b> Centralized IP management. Saves time for setup maintenance and saves valuable resources.
<b><u>Callback</u></b>
<b>Feature:</b> <ol style="list-style-type: none"><li>1. Define a callback number per user.</li><li>2. Allow Automatic Callback to Caller ID.</li></ol>
<b>Benefits:</b> <ol style="list-style-type: none"><li>1. Enhance Security and bare the call cost.</li><li>2. Control number allowed to be call backed (avoid long distance</li></ol>

charges).

3. Saves time and money for setup and maintenance of all users numbers (trade off with callback extra security).

### **CallerID**

#### **Feature:**

1. Enhance Security and bare the call cost.
2. Define a CallerID numbers per user.
3. Define ID templates with wildcards.
4. Allow Automatic Callback to Caller ID.

#### **Benefits:**

1. Enhance Security and bare the call cost.
2. Control number allowed to be callbacked (avoid long distance charges).
3. Saves time and money for setup and maintenance of all users numbers (trade off with callback extra security).

### **Concurrent Sessions Control**

#### **Feature:**

1. Limit the number of sessions a user may have at the same time, on per user or per group basis.
2. Limit the numbers of sessions off all users from a specific group may have at the same time.

#### **Benefits:**

1. Avoid misuse of your system by users who distribute their passwords.

- |   |
|---|
| 2. Have more control over group accounts. |
|---|

## Administration

<b><u>Web Interface</u></b>
<b>Feature:</b> Full Web Interface, supports all 3rd and 4th generation Web browsers (Netscape Navigator and Internet Explorer)
<b>Benefits:</b> <ol style="list-style-type: none"><li>1. Administer from anywhere.</li><li>2. Low learning Curve for interface - Saves Time and money.</li></ol>
<b><u>Native Web Server Integration</u></b>
<b>Feature:</b> Native Web Servers Support by either ISAPI, NSAPI or CGI.
<b>Benefits:</b> <ol style="list-style-type: none"><li>1. Integrate with existing Web servers.</li><li>2. Fast and safe.</li><li>3. Better security - By using your web server you may impose limitations on who is able to access the web interfaces (IP allow, deny).</li></ol>
<b><u>Tiered Access</u></b>

**Feature:**

Password protected Administration. Define Permissions for each operation.

**Benefits:**

1. Secure Access to administrative operations.
2. Delegate Administrative tasks to co-Admins

**(\*) Web Self Care Interface**

**Feature:**

Allows users to login and handle there account.

1. Update there users information.
2. Change password.
3. View session report.

## SNMP Support

<b><u>SNMP Support</u></b>
<b>Feature:</b>  Full SNMP support for the Radius server.  Implementation of RFC – 2619, 2621  RADIUS-AUTH-SERVER-MIB  RADIUS-ACC-SERVER-MIB  Supports sending TRAPS to the network administration tool via SNMP.
<b>Benefits:</b>  Monitor & Diagnose performance in real-time. Optimize system by spotting network bottlenecks. Support for Decisions.



## Reposts & Statistics

<b><u>Online Statistics</u></b>
<b>Feature:</b> <ol style="list-style-type: none"><li>1. Online Graphs: Daily, Weekly, Monthly, Yearly, and all time average.</li><li>2. Different Types: Logins, Simultaneous Sessions, and Time Used</li><li>3. Different Axis: By Group, By NAS and Total</li><li>4. <b>Full SNMP support.</b></li></ol>
<b>Benefits:</b> <p>Monitor &amp; Diagnose performance in real-time. Optimize system by spotting network bottlenecks. Support for Decisions.</p>
<b><u>Online Sessions</u></b>
<b>Feature:</b> <p>View all Online Sessions with detailed information of UserID, IP, Online time, Origin and more.</p>
<b>Benefits:</b> <p>Monitor your system in real-time.</p>
<b><u>Admin Reports</u></b>
<b>Feature:</b> <ol style="list-style-type: none"><li>1. Administrator Reports delivered to you by Email on a daily, weekly or monthly basis.</li></ol>

2. Different Report Types: Summary, Top Ten Users and Group.

**Benefits:**

Have all the information you need delivered to you even when you are out of the office.

## Special Features

### Event Scripting

**Feature:**

Run batch scripts with user parameters when user is added, removed, de-active, re-active or when user change password.

**Benefits:**

1. Open web sites, email accounts and provide additional services.
2. When user changes his password through the web, all other password are changed as well.

### Customize Interface

**Feature:**

You may customize the interface for the administrator, user and new user using a simple HTML editor.

**Benefits:**

1. Use custom made pages and scripts to best fit your special needs.
2. Write you own user interface to be accessed through the web.

### **Fault Tolerant**

#### **Feature:**

1. Run in a primary/backup environment of servers.
2. Mirror the backend database.
3. Use alternate database SQL Server and Oracle

#### **Benefits:**

No single point of failure.  
Achieve maximal availability of your system.

### **Extra Security**

#### **Feature:**

1. Enable timed account lockout when maximal password attempts is reached.
2. Four password encryption methods to choose from.
3. Wireless LAN security Protocols

#### **Benefits:**

Enhanced Security of your system.

### **Extensive Logging**

#### **Feature:**

1. Fast configuration to log anything form severe errors to a debug level into text files.
2. Highly integrated with Windows NT Event Viewer, for logging all Information, Warning, and Severe reports.

**Benefits:**

1. No Unknown Errors. By turning on a higher level of logging, you may immediately see what is wrong.
2. Centralized logging environment. See logged events as you see them under any other Windows NT application.

**Batch Administration**

**Feature:**

Batch user administration handles thousands of users automatically.

**Benefits:**

Save time when needed to do batch changes or routine administration for a large amount of users.

## 4. Performance

- Aradial can support millions of users in one MS SQL or Oracle database or LDAP server.
- Millions of user's sessions.
- The performance depends on the database performance and storage.
- Using Oracle native OCI API and reuse of statements.
- Special treatment to partition the accounting log into separate tables (also the native Oracle 9i and 10g, 11 partitioning can be used and MS SQL partitioning)
- All the reference data is cached in the memory of the server.

<b>Performance</b>	<p>Tested with 10M users in the database in Cisco labs in USA.</p> <p><b><u>Authorization has one request from the NAS:</u></b> Access-Request, Access-Accept</p> <p>Medium: 1950 per/sec on 1 CPU Quad core Windows or Linux High: 27,000 per/sec on 2 CPU <b>iCore 7</b> Windows 2008 with MS SQL server 2008.</p> <p><b><u>AAA- Authorization and Accounting Requests: (3 messages)</u></b></p> <p><b><u>Sending Accounting records to Database</u></b> High: 10,000 per/sec on 2 CPU <b>iCore 7</b> Windows 2008 with MS SQL server 2008. Including 3000 Dynamic IP allocations</p>
<b>Latency</b>	<b>Latency:</b> 5-30 msec (95% less that 50msec).
<b>Http Server</b>	Thin client (3rd/4th generation web browser) served by either proprietary or ISAPI compatible web server.