readme.md for @push.rocks/smartradius

A TypeScript RADIUS server and client library with full RFC 2865/2866 compliance for network authentication, authorization, and accounting (AAA).

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Install

Install via npm or pnpm:

```
npm install @push.rocks/smartradius
# or
pnpm add @push.rocks/smartradius
```

Usage

This module provides a TypeScript-based RADIUS (Remote Authentication Dial-In User Service) server and client implementation. RADIUS is a networking protocol that provides centralized Authentication, Authorization, and Accounting (AAA) management for users who connect and use a network service.

What is RADIUS?

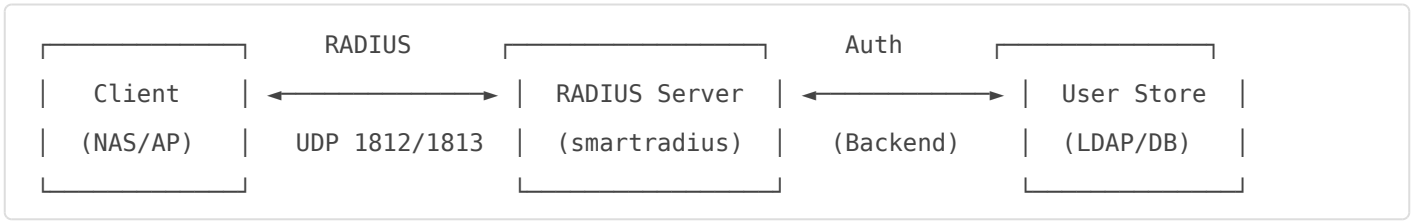
RADIUS is an industry-standard protocol used for:

- □□ **Authentication** - Verifying user credentials (username/password via PAP or CHAP)
- □□ **Authorization** - Determining what resources authenticated users can access
- □□ **Accounting** - Tracking network usage for billing, auditing, and statistics

Common Use Cases

- □□ **Enterprise Wi-Fi** - 802.1X authentication for wireless networks
- □□ **VPN Access** - Authenticating remote users connecting via VPN
- □□ **Network Access Control** - Managing who can access network resources
- □□ **ISP Authentication** - Authenticating dial-up and broadband users
- □□ **Device Authentication** - IoT and network device access control

Architecture



Creating a RADIUS Server

```
import { RadiusServer, ERadiusCode } from '@push.rocks/smartradius';

// Create a RADIUS server
const server = new RadiusServer({
  authPort: 1812,        // Authentication port (default)
  acctPort: 1813,        // Accounting port (default)
  bindAddress: '0.0.0.0', // Listen on all interfaces
  defaultSecret: 'shared-secret-with-clients',

  // Authentication handler
  authenticationHandler: async (request) => {
    console.log(`Auth request from ${request.username}`);

    // PAP authentication
    if (request.password !== undefined) {
```

```
      if (request.username === 'testuser' && request.password === 'testpass') {
        return {
          code: ERadiusCode.AccessAccept,
          replyMessage: 'Welcome!',
          sessionTimeout: 3600,
          framedIpAddress: '10.0.0.100',
        };
      }
    }

    // CHAP authentication
    if (request.chapPassword && request.chapChallenge) {
      const { RadiusAuthenticator } = await import('@push.rocks/smartradius');
      const isValid = RadiusAuthenticator.verifyChapResponse(
        request.chapPassword,
        request.chapChallenge,
        'expected-password'
      );
      if (isValid) {
        return { code: ERadiusCode.AccessAccept };
      }
    }

    return {
      code: ERadiusCode.AccessReject,
      replyMessage: 'Invalid credentials',
    };
  },

  // Accounting handler
  accountingHandler: async (request) => {
    console.log(`Accounting ${request.statusType}: session ${request.sessionId}`);
    // Record accounting data to database
    return { success: true };
  },
});

// Start the server
await server.start();
```

```
console.log('RADIUS server running on ports 1812/1813');

// Per-client secrets (optional)
server.setClientSecret('192.168.1.100', 'client-specific-secret');

// Get statistics
const stats = server.getStats();
console.log(`Processed ${stats.authRequests} auth requests`);

// Stop the server
await server.stop();
```

Creating a RADIUS Client

```
import { RadiusClient, EAcctStatusType } from '@push.rocks/smartradius';

// Create a RADIUS client
const client = new RadiusClient({
  host: '192.168.1.1',
  authPort: 1812,
  acctPort: 1813,
  secret: 'shared-secret',
  timeout: 5000,    // 5 second timeout
  retries: 3,       // Retry 3 times
  nasIdentifier: 'my-nas-device',
});

// Connect (binds UDP socket)
await client.connect();

// PAP Authentication
const papResponse = await client.authenticatePap('username', 'password');
if (papResponse.accepted) {
  console.log('PAP Auth successful!');
  console.log('Session timeout:', papResponse.sessionTimeout);
  console.log('Assigned IP:', papResponse.framedIpAddress);
}
```

```
// CHAP Authentication
const chapResponse = await client.authenticateChap('username', 'password');
if (chapResponse.accepted) {
  console.log('CHAP Auth successful!');
}

// Authentication with custom attributes
const customResponse = await client.authenticate({
  username: 'user',
  password: 'pass',
  nasPort: 1,
  calledStationId: 'AA-BB-CC-DD-EE-FF',
  callingStationId: '11-22-33-44-55-66',
});

// Accounting: Session Start
await client.accountingStart('session-001', 'username');

// Accounting: Interim Update
await client.accountingUpdate('session-001', {
  username: 'username',
  sessionTime: 300,       // 5 minutes
  inputOctets: 1024000,   // 1 MB received
  outputOctets: 2048000,  // 2 MB sent
});

// Accounting: Session Stop
await client.accountingStop('session-001', {
  username: 'username',
  sessionTime: 600,
  inputOctets: 2048000,
  outputOctets: 4096000,
  terminateCause: 1,  // User-Request
});

// Disconnect
await client.disconnect();
```

Working with RADIUS Packets Directly

```
import {
  RadiusPacket,
  RadiusAuthenticator,
  RadiusAttributes,
  ERadiusCode,
  ERadiusAttributeType,
} from '@push.rocks/smartradius';

// Create an Access-Request packet
const packet = RadiusPacket.createAccessRequest(1, 'secret', [
  { type: ERadiusAttributeType.UserName, value: 'testuser' },
  { type: ERadiusAttributeType.UserPassword, value: 'testpass' },
  { type: ERadiusAttributeType.NasIpAddress, value: '192.168.1.1' },
]);

// Decode a received packet
const decoded = RadiusPacket.decodeAndParse(receivedBuffer);
console.log('Code:', RadiusPacket.getCodeName(decoded.code));
console.log('Attributes:', decoded.parsedAttributes);

// Verify response authenticator
const isValid = RadiusAuthenticator.verifyResponseAuthenticator(
  responseBuffer,
  requestAuthenticator,
  secret
);

// Encrypt/decrypt PAP password
const encrypted = RadiusAuthenticator.encryptPassword(password, authenticator, secret);
const decrypted = RadiusAuthenticator.decryptPassword(encrypted, authenticator, secret);

// Calculate CHAP response
const chapResponse = RadiusAuthenticator.calculateChapResponse(chapId, password, challenge);

// Create Vendor-Specific Attribute
const vsaAttr = RadiusAttributes.createVendorAttribute(
  9,          // Cisco vendor ID
  1,          // Vendor-specific type
  Buffer.from('cisco-av-pair=value')
```

```
);
```

Supported Features

Authentication (RFC 2865)

- ✅ PAP (Password Authentication Protocol)
- ✅ CHAP (Challenge-Handshake Authentication Protocol)
- ✅ Access-Request, Access-Accept, Access-Reject, Access-Challenge packets
- ✅ Message-Authenticator (HMAC-MD5) for EAP support
- ✅ All standard attributes (1-63) plus EAP attributes (79, 80)

Accounting (RFC 2866)

- ✅ Accounting-Request, Accounting-Response packets
- ✅ Status types: Start, Stop, Interim-Update, Accounting-On/Off
- ✅ Session tracking: time, octets, packets
- ✅ All termination cause codes

Protocol Features

- ✅ Duplicate request detection with response caching
- ✅ Response authenticator verification
- ✅ Configurable timeout and retry with exponential backoff
- ✅ Per-client shared secret management
- ✅ Vendor-Specific Attributes (VSA) support

Enums and Types

```
// Packet codes
enum ERadiusCode {
  AccessRequest = 1,
  AccessAccept = 2,
  AccessReject = 3,
  AccountingRequest = 4,
  AccountingResponse = 5,
  AccessChallenge = 11,
}

// Accounting status types
```

```
enum EAcctStatusType {
  Start = 1,
  Stop = 2,
  InterimUpdate = 3,
  AccountingOn = 7,
  AccountingOff = 8,
}

// Termination causes
enum EAcctTerminateCause {
  UserRequest = 1,
  LostCarrier = 2,
  IdleTimeout = 4,
  SessionTimeout = 5,
  AdminReset = 6,
  // ... and more
}
```

Module Structure

This library is organized into sub-modules for clean separation of concerns:

Module	Description
`ts_shared`	Protocol definitions - RFC enums and core interfaces
`ts_server`	Server implementation - RadiusServer, packet handling, crypto
`ts_client`	Client implementation - RadiusClient with retry logic
`ts`	Main entry point - re-exports everything

RFC Compliance

This implementation follows:

- **RFC 2865** - Remote Authentication Dial In User Service (RADIUS)
- **RFC 2866** - RADIUS Accounting

The RFC specification files are included in the `./spec/` directory for reference.

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