@push.rocks/smartvpn

Documentation for @push.rocks/smartvpn

- readme.md for @push.rocks/smartvpn
- changelog.md for @push.rocks/smartvpn

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A high-performance VPN solution with a **TypeScript control plane** and a **Rust data plane daemon**. Enterprise-ready client authentication, triple transport support (WebSocket + QUIC + WireGuard), and a typed hub API for managing clients from code.

□□ **Noise IK** mutual authentication — per-client X25519 keypairs, server-side registry □□ **Triple transport**: WebSocket (Cloudflare-friendly), raw **QUIC** (datagrams), and **WireGuard** (standard protocol) □□ **ACL engine** — deny-overrides-allow IP filtering, aligned with SmartProxy conventions □□ **PROXY protocol v2** — real client IPs behind reverse proxies (HAProxy, SmartProxy, Cloudflare Spectrum) □□ **Per-transport metrics**: active clients and total connections broken down by websocket, QUIC, and WireGuard □□ **Hub API**: one `createClient()` call generates keys, assigns IP, returns both SmartVPN + WireGuard configs □□ **Real-time telemetry**: RTT, jitter, loss ratio, link health — all via typed APIs □□ **Unified forwarding pipeline**: all transports share the same engine — TUN (kernel), userspace NAT (no root), or testing mode □□ **Destination routing policy**: force-target, block, or allow traffic per destination with nftables integration ⚡ **Handshake-driven WireGuard state**: peers appear as "connected" only after a successful WireGuard handshake, and auto-disconnect on idle timeout

Issue Reporting and Security

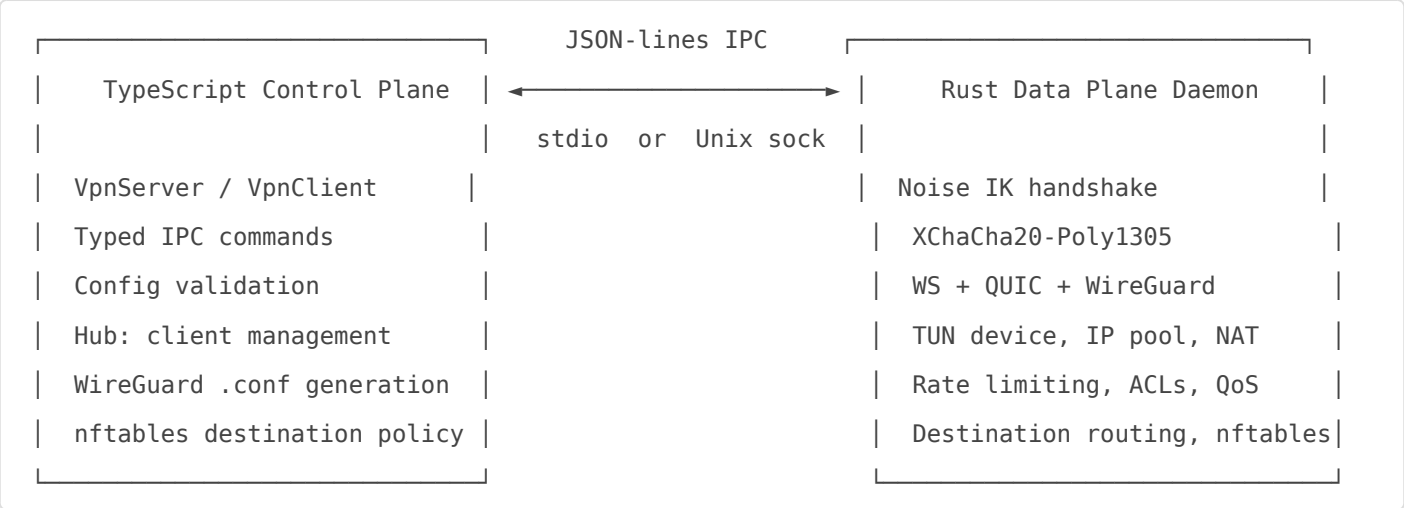
For reporting bugs, issues, or security vulnerabilities, please visit community.foss.global/. This is the central community hub for all issue reporting. Developers who sign and comply with our contribution agreement and go through identification can also get a code.foss.global/ account to submit Pull Requests directly.

Install □□

```
pnpm install @push.rocks/smartvpn
# or
npm install @push.rocks/smartvpn
```

The package ships with pre-compiled Rust binaries for **linux/amd64** and **linux/arm64**. No Rust toolchain required at runtime.

Architecture



Split-plane design — TypeScript handles orchestration, config, and DX; Rust handles every hot-path byte with zero-copy async I/O (tokio, mimalloc).

IPC Transport Modes

The bridge between TypeScript and Rust supports two transport modes:

Mode	Use Case	How It Works
stdio	Development, testing	Spawns the Rust daemon as a child process, communicates over stdin/stdout
socket	Production	Connects to an already-running daemon via Unix domain socket, with optional auto-reconnect

```
// Development: spawn the daemon
const server = new VpnServer({ transport: { transport: 'stdio' } });

// Production: connect to running daemon
const server = new VpnServer({
  transport: {
    transport: 'socket',
```

```
    socketPath: '/var/run/smartvpn.sock',
    autoReconnect: true,
    reconnectBaseDelayMs: 100,
    reconnectMaxDelayMs: 5000,
    maxReconnectAttempts: 10,
  },
});
```

Quick Start □□

1. Start a VPN Server (Hub)

```
import { VpnServer } from '@push.rocks/smartvpn';

const server = new VpnServer({ transport: { transport: 'stdio' } });
await server.start({
  listenAddr: '0.0.0.0:443',
  privateKey: '<server-noise-private-key-base64>',
  publicKey: '<server-noise-public-key-base64>',
  subnet: '10.8.0.0/24',
  transportMode: 'all',       // WebSocket + QUIC + WireGuard simultaneously (default)
  forwardingMode: 'tun',      // 'tun' (kernel), 'socket' (userspace NAT), or 'testing'
  wgPrivateKey: '<server-wg-private-key-base64>', // required for WireGuard transport
  enableNat: true,
  dns: ['1.1.1.1', '8.8.8.8'],
});
```

2. Create a Client (One Call = Everything)

```
const bundle = await server.createClient({
  clientId: 'alice-laptop',
  serverDefinedClientTags: ['engineering'],  // trusted tags for access control
  security: {
    destinationAllowList: ['10.0.0.0/8'],        // can only reach internal network
    destinationBlockList: ['10.0.0.99'],           // except this host
```

```
    rateLimit: { bytesPerSec: 10_000_000, burstBytes: 20_000_000 },
  },
});

// bundle.smartvpnConfig  → typed IVpnClientConfig, ready to use
// bundle.wireguardConfig → standard WireGuard .conf string
// bundle.secrets         → { noisePrivateKey, wgPrivateKey } — shown ONCE
```

3. Connect a Client

```
import { VpnClient } from '@push.rocks/smartvpn';

const client = new VpnClient({ transport: { transport: 'stdio' } });
await client.start();

const { assignedIp } = await client.connect(bundle.smartvpnConfig);
console.log(`Connected! VPN IP: ${assignedIp}`);
```

Features

Enterprise Authentication (Noise IK)

Every client authenticates with a **Noise IK handshake** (`Noise_IK_25519_ChaChaPoly_BLAKE2s`). The server verifies the client's static public key against its registry — unauthorized clients are rejected before any data flows.

- Per-client X25519 keypair generated server-side
- Client registry with enable/disable, expiry, tags
- Key rotation with `rotateClientKey()` — generates new keys, returns fresh config bundle, disconnects old session

Triple Transport

Transport	Protocol	Best For
WebSocket	TLS over TCP	Firewall-friendly, Cloudflare compatible

Transport	Protocol	Best For
QUIC	UDP (via quinn)	Low latency, datagram support for IP packets
WireGuard	UDP (via boringtun)	Standard WG clients (iOS, Android, wg-quick)

The server runs **all three simultaneously** by default with `transportMode: 'all'`. All transports share the same unified forwarding pipeline (`ForwardingEngine`), IP pool, client registry, and stats — so WireGuard peers get the same userspace NAT, rate limiting, and monitoring as WS/QUIC clients. Clients auto-negotiate with `transport: 'auto'` (tries QUIC first, falls back to WS).

□□ Per-Transport Metrics

Server statistics include per-transport breakdowns so you can see exactly how many clients use each protocol:

```
const stats = await server.getStatistics();

// Aggregate
console.log(stats.activeClients);       // total connected clients
console.log(stats.totalConnections);    // total connections since start

// Per-transport active clients
console.log(stats.activeClientsWebsocket);   // currently connected via WS
console.log(stats.activeClientsQuic);        // currently connected via QUIC
console.log(stats.activeClientsWireguard);   // currently connected via WireGuard

// Per-transport total connections
console.log(stats.totalConnectionsWebsocket);
console.log(stats.totalConnectionsQuic);
console.log(stats.totalConnectionsWireguard);
```

WireGuard connection state is handshake-driven — registered WireGuard peers do NOT appear as "connected" until their first successful WireGuard handshake completes. They automatically disconnect after 180 seconds of inactivity or when boringtun reports `ConnectionExpired`. This matches how WebSocket/QUIC clients behave: they appear on connection and disappear on disconnect.

□□ ACL Engine (SmartProxy-Aligned)

Security policies per client, using the same `ipAllowList` / `ipBlockList` naming convention as `@push.rocks/smartproxy`:

```
security: {
  ipAllowList: ['192.168.1.0/24'],          // source IPs allowed to connect
  ipBlockList: ['192.168.1.100'],            // deny overrides allow
  destinationAllowList: ['10.0.0.0/8'],      // VPN destinations permitted
  destinationBlockList: ['10.0.0.99'],        // deny overrides allow
  maxConnections: 5,
  rateLimit: { bytesPerSec: 1_000_000, burstBytes: 2_000_000 },
}
```

Supports exact IPs, CIDR, wildcards (`192.168.1.*`), and ranges (`1.1.1.1-1.1.1.100`).

□□ PROXY Protocol v2

When the VPN server sits behind a reverse proxy, enable PROXY protocol v2 to receive the **real client IP** instead of the proxy's address. This makes `ipAllowList` / `ipBlockList` ACLs work correctly through load balancers.

```
await server.start({
  // ... other config ...
  proxyProtocol: true,                          // parse PP v2 headers on WS connections
  connectionIpBlockList: ['198.51.100.0/24'],     // server-wide block list (pre-handshake)
});
```

Two-phase ACL with real IPs:

Phase	When	What Happens
Pre-handshake	After TCP accept	Server-level `connectionIpBlockList` rejects known-bad IPs — zero crypto cost
Post-handshake	After Noise IK identifies client	Per-client `ipAllowList` / `ipBlockList` checked against real source IP

- Parses the PP v2 binary header from raw TCP before WebSocket upgrade
- 5-second timeout protects against stalling attacks
- LOCAL command (proxy health checks) handled gracefully
- IPv4 and IPv6 addresses supported
- `remoteAddr` field on `IVpnClientInfo` exposes the real client IP for monitoring
- **Security**: must be `false` (default) when accepting direct connections — only enable behind a trusted proxy

□□ Destination Routing Policy

Control where decrypted VPN client traffic goes — force it to a specific target, block it, or allow it through. Evaluated per-packet before per-client ACLs.

```
await server.start({
  // ...
  forwardingMode: 'socket', // userspace NAT mode
  destinationPolicy: {
    default: 'forceTarget',                    // redirect all traffic to a target
    target: '127.0.0.1',                       // target IP for 'forceTarget' mode
    allowList: ['10.0.0.0/8'],                 // these destinations pass through directly
    blockList: ['10.0.0.99'],                  // always blocked (deny overrides allow)
  },
});
```

Policy modes:

Mode	Behavior
`'forceTarget'`	Rewrites destination IP to `target` — funnels all traffic through a single endpoint
`'block'`	Drops all traffic not explicitly in `allowList`
`'allow'`	Passes all traffic through (default, backward compatible)

In **TUN mode**, destination policies are enforced via **nftables** rules (using `@push.rocks/smartnftables`). A 60-second health check automatically re-applies rules if they're removed externally.

In **socket mode**, the policy is evaluated in the userspace NAT engine before per-client ACLs.

□□ Socket Forward Proxy Protocol

When using `forwardingMode: 'socket'` (userspace NAT), you can prepend **PROXY protocol v2 headers** on outbound TCP connections. This conveys the VPN client's tunnel IP as the source address to downstream services (e.g., SmartProxy):

```
await server.start({
  // ...
  forwardingMode: 'socket',
  socketForwardProxyProtocol: true,  // downstream sees VPN client IP, not 127.0.0.1
```

```
});
```

□□ Packet Forwarding Modes

SmartVPN supports three forwarding modes, configurable per-server and per-client:

Mode	Flag	Description	Root Required
TUN	`'tun'`	Kernel TUN device — real packet forwarding with system routing	□ Yes
Userspace NAT	`'socket'`	Userspace TCP/UDP proxy via `connect(2)` — no TUN, no root needed	□ No
Testing	`'testing'`	Monitoring only — packets are counted but not forwarded	□ No

```
// Server with userspace NAT (no root required)
await server.start({
  // ...
  forwardingMode: 'socket',
  enableNat: true,
});

// Client with TUN device
const { assignedIp } = await client.connect({
  // ...
  forwardingMode: 'tun',
});
```

The userspace NAT mode extracts destination IP/port from IP packets, opens a real socket to the destination, and relays data — supporting both TCP streams and UDP datagrams without requiring `CAP_NET_ADMIN` or root privileges.

□□ Telemetry & QoS

- **Connection quality**: Smoothed RTT, jitter, min/max RTT, loss ratio, link health (`healthy` / `degraded` / `critical`)
- **Adaptive keepalives**: Interval adjusts based on link health (60s → 30s → 10s)
- **Per-client rate limiting**: Token bucket with configurable bytes/sec and burst
- **Dead-peer detection**: 180s inactivity timeout (all transports)

- **MTU management**: Automatic overhead calculation (IP+TCP+WS+Noise = 79 bytes)
- **Per-transport stats**: Active client and total connection counts broken down by websocket, QUIC, and WireGuard

□□ Client Tags (Trusted vs Informational)

SmartVPN separates server-managed tags from client-reported tags:

Field	Set By	Trust Level	Use For
`serverDefinedClientTags`	Server admin (via `createClient` / `updateClient`)	□ Trusted	Access control, routing, billing
`clientDefinedClientTags`	Client (reported after connection)	⚠ Informational	Diagnostics, client self-identification
`tags`	*(deprecated)*	—	Legacy alias for `serverDefinedClientTags`

```
// Server-side: trusted tags
await server.createClient({
  clientId: 'alice-laptop',
  serverDefinedClientTags: ['engineering', 'office-berlin'],
});

// Client-side: informational tags (reported to server)
await client.connect({
  // ...
  clientDefinedClientTags: ['macOS', 'v2.1.0'],
});
```

□□ Hub Client Management

The server acts as a **hub** — one API to manage all clients:

```
// Create (generates keys, assigns IP, returns config bundle)
const bundle = await server.createClient({ clientId: 'bob-phone' });

// Read
const entry = await server.getClient('bob-phone');
const all   = await server.listRegisteredClients();
```

```
// Update (ACLs, tags, description, rate limits...)
await server.updateClient('bob-phone', {
  security: { destinationAllowList: ['0.0.0.0/0'] },
  serverDefinedClientTags: ['mobile', 'field-ops'],
});

// Enable / Disable
await server.disableClient('bob-phone'); // disconnects + blocks reconnection
await server.enableClient('bob-phone');

// Key rotation
const newBundle = await server.rotateClientKey('bob-phone');

// Export config (without secrets)
const wgConf = await server.exportClientConfig('bob-phone', 'wireguard');

// Remove
await server.removeClient('bob-phone');
```

□□ WireGuard Config Generation

Generate standard `.conf` files for any WireGuard client:

```
import { WgConfigGenerator } from '@push.rocks/smartvpn';

const conf = WgConfigGenerator.generateClientConfig({
  privateKey: '<client-wg-private-key>',
  address: '10.8.0.2/24',
  dns: ['1.1.1.1'],
  peer: {
    publicKey: '<server-wg-public-key>',
    endpoint: 'vpn.example.com:51820',
    allowedIps: ['0.0.0.0/0'],
    persistentKeepalive: 25,
  },
});
// → standard WireGuard .conf compatible with wg-quick, iOS, Android
```

Server configs too:

```
const serverConf = WgConfigGenerator.generateServerConfig({
  privateKey: '<server-wg-private-key>',
  address: '10.8.0.1/24',
  listenPort: 51820,
  enableNat: true,
  natInterface: 'eth0',
  peers: [
    { publicKey: '<client-wg-public-key>', allowedIps: ['10.8.0.2/32'] },
  ],
});
```

□□ System Service Installation

Generate systemd (Linux) or launchd (macOS) service units:

```
import { VpnInstaller } from '@push.rocks/smartvpn';

const unit = VpnInstaller.generateServiceUnit({
  binaryPath: '/usr/local/bin/smartvpn_daemon',
  socketPath: '/var/run/smartvpn.sock',
  mode: 'server',
});
// unit.platform    → 'linux' | 'macos'
// unit.content     → systemd unit file or launchd plist
// unit.installPath → /etc/systemd/system/smartvpn-server.service
```

You can also call `generateSystemdUnit()` or `generateLaunchdPlist()` directly for platform-specific options like custom descriptions.

□□ Events

Both `VpnServer` and `VpnClient` extend `EventEmitter` and emit typed events:

```
server.on('client-connected', (info: IVpnClientInfo) => {
  console.log(`${info.registeredClientId} connected from ${info.remoteAddr} via
${info.transportType}`);
});
```

```
server.on('client-disconnected', ({ clientId, reason }) => {
  console.log(`${clientId} disconnected: ${reason}`);
});

client.on('status', (status: IVpnStatus) => {
  console.log(`State: ${status.state}, IP: ${status.assignedIp}`);
});

// Both server and client emit:
server.on('exit', ({ code, signal }) => { /* daemon process exited */ });
server.on('reconnected', () => { /* socket transport reconnected */ });
```

Event	Emitted By	Payload
`status`	Both	`IVpnStatus` — connection state changes
`error`	Both	`{ message, code? }`
`client-connected`	Server	`IVpnClientInfo` — full client info including transport type
`client-disconnected`	Server	`{ clientId, reason? }`
`exit`	Both	`{ code, signal }` — daemon process exited
`reconnected`	Both	`void` — socket transport reconnected

API Reference □□

Classes

Class	Description
`VpnServer`	Manages the Rust daemon in server mode. Hub methods for client CRUD, telemetry, rate limits, WireGuard peer management.
`VpnClient`	Manages the Rust daemon in client mode. Connect, disconnect, status, telemetry.
`VpnBridge<T>`	Low-level typed IPC bridge (stdio or Unix socket). Handles spawn, connect, reconnect, and typed command dispatch.

Class	Description
`VpnConfig`	Static config validation and JSON file I/O. Validates keys, addresses, CIDRs, MTU, etc.
`VpnInstaller`	Generates systemd/launchd service files for daemon deployment.
`WgConfigGenerator`	Generates standard WireGuard `.conf` files (client and server).

Key Interfaces

Interface	Purpose
`IVpnServerConfig`	Server configuration (listen addr, keys, subnet, transport mode, forwarding mode, clients, proxy protocol, destination policy)
`IVpnClientConfig`	Client configuration (server URL, keys, transport, forwarding mode, WG options, client-defined tags)
`IClientEntry`	Server-side client definition (ID, keys, security, priority, server/client tags, expiry)
`IClientSecurity`	Per-client ACLs and rate limits (SmartProxy-aligned naming)
`IClientRateLimit`	Rate limiting config (bytesPerSec, burstBytes)
`IClientConfigBundle`	Full config bundle returned by `createClient()` — includes SmartVPN config, WireGuard .conf, and secrets
`IVpnClientInfo`	Connected client info (IP, stats, authenticated key, remote addr, transport type)
`IVpnServerStatistics`	Server stats with per-transport breakdowns (activeClientsWebsocket/Quic/Wireguard, totalConnections*)
`IVpnConnectionQuality`	RTT, jitter, loss ratio, link health
`IVpnMtuInfo`	TUN MTU, effective MTU, overhead bytes, oversized packet stats
`IVpnKeypair`	Base64-encoded public/private key pair
`IDestinationPolicy`	Destination routing policy (forceTarget / block / allow with allow/block lists)
`IVpnEventMap`	Typed event map for server and client EventEmitter

Server IPC Commands

Command	Description
`start` / `stop`	Start/stop the VPN listener
`createClient`	Generate keys, assign IP, return config bundle
`removeClient` / `getClient` / `listRegisteredClients`	Client registry CRUD
`updateClient` / `enableClient` / `disableClient`	Modify client state
`rotateClientKey`	Fresh keypairs + new config bundle
`exportClientConfig`	Re-export as SmartVPN config or WireGuard `.conf`
`listClients` / `disconnectClient`	Manage live connections
`setClientRateLimit` / `removeClientRateLimit`	Runtime rate limit adjustments
`getStatus` / `getStatistics` / `getClientTelemetry`	Monitoring (stats include per-transport breakdowns)
`generateKeypair` / `generateWgKeypair` / `generateClientKeypair`	Key generation
`addWgPeer` / `removeWgPeer` / `listWgPeers`	WireGuard peer management

Client IPC Commands

Command	Description
`connect` / `disconnect`	Manage the tunnel
`getStatus` / `getStatistics`	Connection state and traffic stats
`getConnectionQuality`	RTT, jitter, loss, link health
`getMtuInfo`	MTU and overhead details

Transport Modes □□

Server Configuration

```
// All transports simultaneously (default) — WS + QUIC + WireGuard
{ transportMode: 'all', listenAddr: '0.0.0.0:443', wgPrivateKey: '...', wgListenPort: 51820 }

// WS + QUIC only
{ transportMode: 'both', listenAddr: '0.0.0.0:443', quicListenAddr: '0.0.0.0:4433' }

// WebSocket only
```

```
{ transportMode: 'websocket', listenAddr: '0.0.0.0:443' }

// QUIC only
{ transportMode: 'quic', listenAddr: '0.0.0.0:443' }

// WireGuard only
{ transportMode: 'wireguard', wgPrivateKey: '...', wgListenPort: 51820, wgPeers: [...] }
```

All transport modes share the same `forwardingMode` — WireGuard peers can use `'socket'` (userspace NAT) just like WS/QUIC clients.

Client Configuration

```
// Auto (tries QUIC first, falls back to WS)
{ transport: 'auto', serverUrl: 'wss://vpn.example.com' }

// Explicit QUIC with certificate pinning
{ transport: 'quic', serverUrl: '1.2.3.4:4433', serverCertHash: '<sha256-base64>' }

// WireGuard
{ transport: 'wireguard', wgPrivateKey: '...', wgEndpoint: 'vpn.example.com:51820', ... }
```

Cryptography □□

Layer	Algorithm	Purpose
Handshake	Noise IK (X25519 + ChaChaPoly + BLAKE2s)	Mutual authentication + key exchange
Transport	Noise transport state (ChaChaPoly)	All post-handshake data encryption
Additional	XChaCha20-Poly1305	Extended nonce space for data-at-rest
WireGuard	X25519 + ChaCha20-Poly1305 (via boringtun)	Standard WireGuard crypto

Binary Protocol □□

All frames use `[type:1B][length:4B][payload:NB]` with a 64KB max payload:

Type	Hex	Direction	Description
HandshakeInit	`0x01`	Client → Server	Noise IK first message
HandshakeResp	`0x02`	Server → Client	Noise IK response
IpPacket	`0x10`	Bidirectional	Encrypted tunnel data
Keepalive	`0x20`	Client → Server	App-level keepalive (not WS ping)
KeepaliveAck	`0x21`	Server → Client	Keepalive response with RTT payload
Disconnect	`0x3F`	Bidirectional	Graceful disconnect

Development □□

```
# Install dependencies
pnpm install

# Build (TypeScript + Rust cross-compile)
pnpm build

# Run all tests
pnpm test

# Run Rust tests directly
cd rust && cargo test

# Run a specific TS test
tstest test/test.flowcontrol.node.ts --verbose
```

Project Structure

```
smartvpn/
├── ts/                          # TypeScript control plane
│   ├── index.ts                 # All exports
│   ├── smartvpn.interfaces.ts   # Interfaces, types, IPC command maps
│   ├── smartvpn.plugins.ts      # Dependency imports
│   ├── smartvpn.paths.ts        # Binary path resolution
```

```
│   ├── smartvpn.classes.vpnserver.ts
│   ├── smartvpn.classes.vpnclient.ts
│   ├── smartvpn.classes.vpnbridge.ts
│   ├── smartvpn.classes.vpnconfig.ts
│   ├── smartvpn.classes.vpninstaller.ts
│   └── smartvpn.classes.wgconfig.ts
├── rust/                      # Rust data plane daemon
│   └── src/
│       ├── main.rs            # CLI entry point
│       ├── server.rs          # VPN server + hub methods
│       ├── client.rs          # VPN client
│       ├── crypto.rs          # Noise IK + XChaCha20
│       ├── client_registry.rs # Client database
│       ├── acl.rs             # ACL engine
│       ├── proxy_protocol.rs  # PROXY protocol v2 parser
│       ├── management.rs      # JSON-lines IPC
│       ├── transport.rs       # WebSocket transport
│       ├── transport_trait.rs # Transport abstraction (Sink/Stream)
│       ├── quic_transport.rs  # QUIC transport
│       ├── wireguard.rs       # WireGuard (boringtun)
│       ├── codec.rs           # Binary frame protocol
│       ├── keepalive.rs       # Adaptive keepalives
│       ├── ratelimit.rs       # Token bucket
│       ├── userspace_nat.rs   # Userspace TCP/UDP NAT proxy
│       ├── tunnel.rs          # TUN device management
│       ├── network.rs         # IP pool + networking
│       ├── telemetry.rs       # RTT/jitter/loss tracking
│       ├── qos.rs             # Priority queues + smart dropping
│       ├── mtu.rs             # MTU + ICMP too-big
│       └── reconnect.rs       # Exponential backoff + session tokens
├── test/                      # Test files
├── dist_ts/                   # Compiled TypeScript
└── dist_rust/                 # Cross-compiled binaries (linux amd64 + arm64)
```

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changelog.md for @push.rocks/smartvpn

2026-03-31 - 1.17.1 - fix(readme)

document per-transport metrics and handshake-driven WireGuard connection state

- Add README examples for getStatistics() per-transport active client and total connection counters
- Clarify that WireGuard peers are marked connected only after a successful handshake and disconnect after idle timeout
- Refresh API and project structure documentation to reflect newly documented stats fields and source files

2026-03-31 - 1.17.0 - feat(wireguard)

track per-transport server statistics and make WireGuard clients active only after handshake

- add websocket, quic, and wireguard active-client and total-connection counters to server statistics
- register WireGuard peers without marking them active until handshake/data is received, and remove them from active clients on expiration or idle timeout
- sync WireGuard byte counters into aggregate server stats independently of active client presence and expose new statistics fields in TypeScript interfaces

2026-03-31 - 1.16.5 - fix(rust-userspace-nat)

improve TCP session backpressure, buffering, and idle cleanup in userspace NAT

- apply proper bridge-channel backpressure by reserving channel capacity before consuming smoltcp TCP data
- defer bridge sender initialization until the bridge task starts and track TCP session activity timestamps
- cap per-session pending TCP send buffers at 512KB and abort stalled sessions when clients cannot keep up
- add idle TCP session cleanup and switch NAT polling to a dynamic smoltcp-driven delay

2026-03-31 - 1.16.4 - fix(server)

register preloaded WireGuard clients as peers on server startup

- Adds configured clients from the runtime registry to the WireGuard listener when the server starts.
- Ensures clients loaded from config can complete WireGuard handshakes without requiring separate peer registration.
- Logs a warning if automatic peer registration fails for an individual client.

2026-03-31 - 1.16.3 - fix(rust-nat)

defer TCP bridge startup until handshake completion and buffer partial NAT socket writes

- Start TCP bridge tasks only after the smoltcp socket becomes active to prevent server data from arriving before the client handshake completes.
- Buffer pending TCP payloads and flush partial writes so bridge-to-socket data is not silently lost under backpressure.
- Keep closing TCP sessions alive until FIN processing completes and add logging for dropped packets when bridge or route channels are full.

2026-03-31 - 1.16.2 - fix(wireguard)

sync runtime peer management with client registration and derive the correct server public key from the WireGuard private key

- Register, remove, and rotate WireGuard peers in the running listener when clients are added, deleted, or rekeyed.

- Generate client WireGuard configs with the public key derived from the configured WireGuard private key instead of reusing the generic server public key.
- Handle expired WireGuard sessions by re-initiating handshakes and mark client state as handshaking until the tunnel becomes active.
- Improve allowed IP matching and peer VPN IP extraction for runtime packet routing.

2026-03-30 - 1.16.1 - fix(rust/server)

add serde alias for clientAllowedIPs in server config

- Accepts the camelCase clientAllowedIPs field when deserializing server configuration.
- Improves compatibility with existing or external configuration formats without changing runtime behavior.

2026-03-30 - 1.16.0 - feat(server)

add configurable client endpoint and allowed IPs for generated VPN configs

- adds serverEndpoint to generated SmartVPN and WireGuard client configs so remote clients can use a public address instead of the listen address
- adds clientAllowedIPs to generated WireGuard configs to support full-tunnel or split-tunnel routing
- updates TypeScript interfaces to expose the new server configuration options

2026-03-30 - 1.15.0 - feat(vpnserver)

add nftables-backed destination policy enforcement for TUN mode

- add @push.rocks/smartnftables dependency and export it through the plugin layer
- apply destination policy rules via nftables when starting the server in TUN mode
- add periodic nftables health checks and best-effort cleanup on server stop
- update documentation for destination routing policy, socket transport mode, trusted client tags, events, and service generation

2026-03-30 - 1.14.0 - feat(nat)

add destination routing policy support for socket-mode VPN traffic

- introduce configurable destinationPolicy settings in server and TypeScript interfaces
- apply allow, block, and forceTarget routing decisions when creating TCP and UDP NAT sessions
- export ACL IP matching helper for destination policy evaluation

2026-03-30 - 1.13.0 - feat(client-registry)

separate trusted server-defined client tags from client-reported tags with legacy tag compatibility

- Adds distinct serverDefinedClientTags and clientDefinedClientTags fields to client registry and TypeScript interfaces.
- Treats legacy tags values as serverDefinedClientTags during deserialization and server-side create/update flows for backward compatibility.
- Clarifies that only server-defined tags are trusted for access control while client-defined tags are informational only.

2026-03-30 - 1.12.0 - feat(server)

add optional PROXY protocol v2 headers for socket-based userspace NAT forwarding

- introduce a socketForwardProxyProtocol server option in Rust and TypeScript interfaces
- pass the new setting into the userspace NAT engine and TCP bridge tasks
- prepend PROXY protocol v2 headers on outbound TCP connections when socket forwarding is enabled

2026-03-30 - 1.11.0 - feat(server)

unify WireGuard into the shared server transport pipeline

- add integrated WireGuard server support to VpnServer with shared startup, shutdown, status, statistics, and peer management
- introduce transportMode 'all' as the default and add server config support for wgPrivateKey, wgListenPort, and preconfigured peers
- register WireGuard peers in the shared client registry and IP pool so they use the same forwarding engine, routing, and monitoring as WebSocket and QUIC clients
- expose transportType in server client info and update TypeScript interfaces and documentation to reflect unified multi-transport forwarding

2026-03-30 - 1.10.2 - fix(client)

wait for the connection task to shut down cleanly before disconnecting and increase test timeout

- store the spawned client connection task handle and await it during disconnect with a 5 second timeout so the disconnect frame can be sent before closing
- increase the test script timeout from 60 seconds to 90 seconds to reduce flaky test runs

2026-03-29 - 1.10.1 - fix(test, docs, scripts)

correct test command verbosity, shorten load test timings, and document forwarding modes

- Fixes the test script by removing the duplicated verbose flag in package.json.
- Reduces load test delays and burst sizes to keep keepalive and connection tests faster and more stable.
- Updates the README to describe forwardingMode options, userspace NAT support, and related configuration examples.

2026-03-29 - 1.10.0 - feat(rust-server, rust-client, ts-interfaces)

add configurable packet forwarding with TUN and userspace NAT modes

- introduce forwardingMode options for client and server configuration interfaces

- add server-side forwarding engines for kernel TUN, userspace socket NAT, and testing mode
- add a smoltcp-based userspace NAT implementation for packet forwarding without root-only TUN routing
- enable client-side TUN forwarding support with route setup, packet I/O, and cleanup
- centralize raw packet destination IP extraction in tunnel utilities for shared routing logic
- update test command timeout and logging flags

2026-03-29 - 1.9.0 - feat(server)

add PROXY protocol v2 support for real client IP handling and connection ACLs

- add PROXY protocol v2 parsing for WebSocket connections, including IPv4/IPv6 support, LOCAL command handling, and header read timeout protection
- apply server-level connection IP block lists before the Noise handshake and enforce per-client source IP allow/block lists using the resolved remote address
- expose proxy protocol configuration and remote client address fields in Rust and TypeScript interfaces, and document reverse-proxy usage in the README

2026-03-29 - 1.8.0 - feat(auth,client-registry)

add Noise IK client authentication with managed client registry and per-client ACL controls

- switch the native tunnel handshake from Noise NK to Noise IK and require client keypairs in client configuration
- add server-side client registry management APIs for creating, updating, disabling, rotating, listing, and exporting client configs
- enforce client authorization from the registry during handshake and expose authenticated client metadata in server client info
- introduce per-client security policies with source/destination ACLs and per-client rate limit settings
- add Rust ACL matching support for exact IPs, CIDR ranges, wildcards, and IP ranges with test coverage

2026-03-29 - 1.7.0 - feat(rust-tests)

add end-to-end WireGuard UDP integration tests and align TypeScript build configuration

- Add userspace Rust end-to-end tests that validate WireGuard handshake, encryption, peer isolation, and preshared-key data exchange over real UDP sockets.
- Update the TypeScript build setup by removing the allowimplicitany build flag and explicitly including Node types in tsconfig.
- Refresh development toolchain versions to support the updated test and build workflow.

2026-03-29 - 1.6.0 - feat(readme)

document WireGuard transport support, configuration, and usage examples

- Expand the README from dual-transport to triple-transport support by adding WireGuard alongside WebSocket and QUIC
- Add client and server WireGuard examples, including live peer management and .conf generation with WgConfigGenerator
- Document new WireGuard-related API methods, config fields, transport modes, and security model details

2026-03-29 - 1.5.0 - feat(wireguard)

add WireGuard transport support with management APIs and config generation

- add Rust WireGuard module integration using boringtun and route management through client/server management handlers
- extend TypeScript client and server configuration schemas with WireGuard-specific options and validation
- add server-side WireGuard peer management commands including keypair generation, peer add/remove, and peer listing
- export a WireGuard config generator for producing client and server .conf files
- add WireGuard-focused test coverage for config validation and config generation

2026-03-21 - 1.4.1 - fix(readme)

preserve markdown line breaks in feature list

- Adds trailing spaces to the README feature list so each highlighted capability renders on its own line.

2026-03-19 - 1.4.0 - feat(vpn transport)

add QUIC transport support with auto fallback to WebSocket

- introduces a transport abstraction in the Rust daemon so client and server can operate over WebSocket or QUIC
- adds dual-mode server configuration with websocket, quic, and both transport modes plus QUIC idle timeout and listen address options
- adds client transport selection with auto mode that attempts QUIC first and falls back to WebSocket
- adds QUIC certificate hash pinning support and required Rust dependencies for QUIC and TLS
- updates TypeScript interfaces, config validation, tests, and documentation to cover the new transport modes

2026-03-17 - 1.3.0 - feat(tests,client)

add flow control and load test coverage and honor configured keepalive intervals

- Adds end-to-end node tests for client/server flow control, keepalive exchange, connection quality telemetry, rate limiting, concurrent clients, and disconnect tracking.
- Adds load testing with throttled proxy scenarios to validate behavior under constrained bandwidth and repeated client churn.
- Updates the Rust client to pass configured keepaliveIntervalSecs into the adaptive keepalive monitor instead of always using defaults.

2026-03-15 - 1.2.0 - feat(readme)

document QoS, telemetry, MTU, and rate limiting capabilities in the README

- Expand the architecture and feature overview to cover adaptive keepalive, telemetry, QoS, rate limiting, and MTU handling
- Update client and server examples to show new APIs such as getConnectionQuality(), getMtuInfo(), setClientRateLimit(), and getClientTelemetry()
- Add TypeScript interface documentation for connection quality, MTU info, enriched client statistics, and per-client telemetry

2026-03-15 - 1.1.0 - feat(rust-core)

add adaptive keepalive telemetry, MTU handling, and per-client rate limiting APIs

- adds adaptive keepalive monitoring with RTT, jitter, loss, and link health reporting to client statistics and management endpoints
- introduces MTU overhead calculation and oversized-packet handling support, plus client MTU info APIs
- adds token-bucket rate limiting with configurable default limits and server management commands to set, remove, and inspect per-client telemetry
- extends TypeScript client and server interfaces with connection quality, MTU, and client telemetry methods

2026-02-27 - 1.0.3 - fix(build)

add aarch64 linker configuration for cross-compilation

- Added rust/.cargo/config.toml to configure linker for target aarch64-unknown-linux-gnu
- Sets linker to 'aarch64-linux-gnu-gcc' to enable cross-compilation to ARM64

2026-02-27 - 1.0.2 - fix()

no changes detected - no code or content modifications

2026-02-27 - 1.0.1 - fix(release)

bump patch version (no code changes)

- No changes detected in the provided git diff
- Current package.json version is 1.0.0
- Recommend patch bump to 1.0.1 to create a release/trivial update

2026-02-27 - 1.0.0 - initial release

Initial commit creating the project repository and baseline files.

- Initial project scaffold and configuration
- Repository initialized with base files and metadata