

Introduction

The N-Squared Advanced Call Distribution (N2ACD¹) software product is a comprehensive freephone/premium number call-control solution for network operators in both NGN SIP and PSTN INAP/CAMEL networks.

N2ACD enables both operators and self-managing customers to design, deploy, schedule, and report on call control flows for service numbers. The user-friendly N2ACD Flow Editor provides safe, guided visual design of standard call control features. The Administration GUI provides a pure-web service management GUI for access and configuration control.

For esoteric one-off services and for operator-specific and management functions, a sandboxed Lua scripting environment is also provided.

The system supports authentication and authorization via OAuth providers such as AzureAD or Keycloak, or alternatively via MS ActiveDirectory or LDAP. The extensible reporting framework provides built-in and site-local reports for system administrators and end-users.

Product Integration

When integrated with the N-Squared Simple Number Services (N2SNS²) product, N2ACD gains freephone number portability, to either process in-network calls or redirect out-of-network tollfree calls to the appropriate other owning operator.

For IVR interaction, N2ACD may be integrated with one or more Specialized Resource Function (SRF) nodes, including the SIP-trunked N-Squared Service Resource Platform (N2SRP³).

Call Control Flow Editor

The N2ACD Flow Editor is a fully web-enabled voice call control flow design tool.

Within the Flow Editor, users can design how a freephone call will be routed, using inputs such as caller location, the current date/ time, speed dials, “Follow Me” and many other service features.

When integrated with an external SRF, the Flow Editor supports user interaction via announcements and digit collection for menus and other user input such as postcodes, PINs, extension numbers, etc.

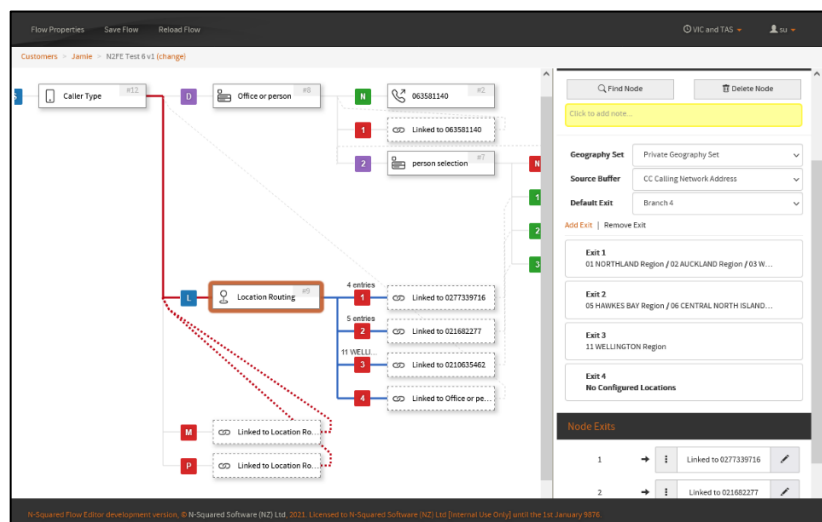


Figure 1 An example call-control flow being edited.

¹ <https://nsquared.nz/product/n2acd.html>

² <https://nsquared.nz/product/n2sns.html>

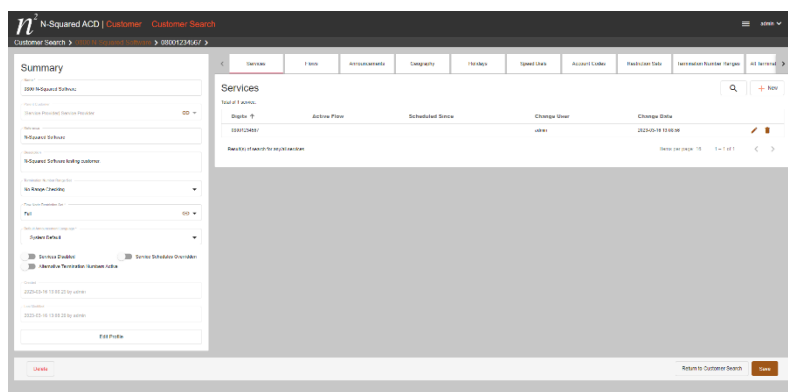
³ <https://nsquared.nz/product/n2srp.html>

Service Configuration

The N2ACD Flow Editor & Administration GUI together allow Telco staff, wholesalers/resellers, and self-managing customers to manage their own BAU activities, for:

- Service number ownership, customer hierarchy.
- Flow design, assignment, and scheduling.
- Geography definitions for location routing, including postcode-level mapping.
- Holiday definitions for day-of-year routing.
- Speed dial tables, account codes, and “Follow Me” numbers.
- Barred/allowed number lists and special number handling.
- Announcement, DTMF menus, and digit collection features.

The N2ACD Flow Editor may be deployed with customized branding, allowing operators to white-label for individual wholesalers' operational platforms.



Login and access can be via external authentication and authorization server, e.g. LDAP, OAuth, or Active Directory.

Figure 2 – Customer management GUI

The flexible hierarchical customer definition structure allows telcos and wholesalers to manage their own customers, but also allows for customers to be granted the right to (partly or fully) self-manage.

Flexible Deployment Architecture

N2ACD can be deployed on-site in a Linux VM environment, or as a cloud-based virtualized solution.

N2ACD runtime service nodes can be freely deployed as a N+1, N+2, 2N, etc. The configuration may include geographically and/or logically redundant node groups with each service node operating independently against a full local database replicated from the primary SMS.

The N2ACD management node with its administration GUI may be deployed with a co-located database on a single node, or with its database functions split off into a separate database environment. This gives the operator flexibility in their preferred database management paradigm.

The underlying PostgreSQL database is deployed as a primary node with PostgreSQL replica sets, allowing N2ACD management operations to be executed with multiple layers of redundancy across each node function. This provides full hot standby in this case of disaster.

For front-facing access, the N2ACD Flow Editor may be deployed co-located on the SMS node, or segregated into a DMZ or cloud-hosting as fits the Telco operator's existing security strategy.

This diagram shows a typical N2ACD with hot-standby management node and all-active service nodes. This deployment is designed for Tier One uptime, with geography redundancy for disaster recovery:

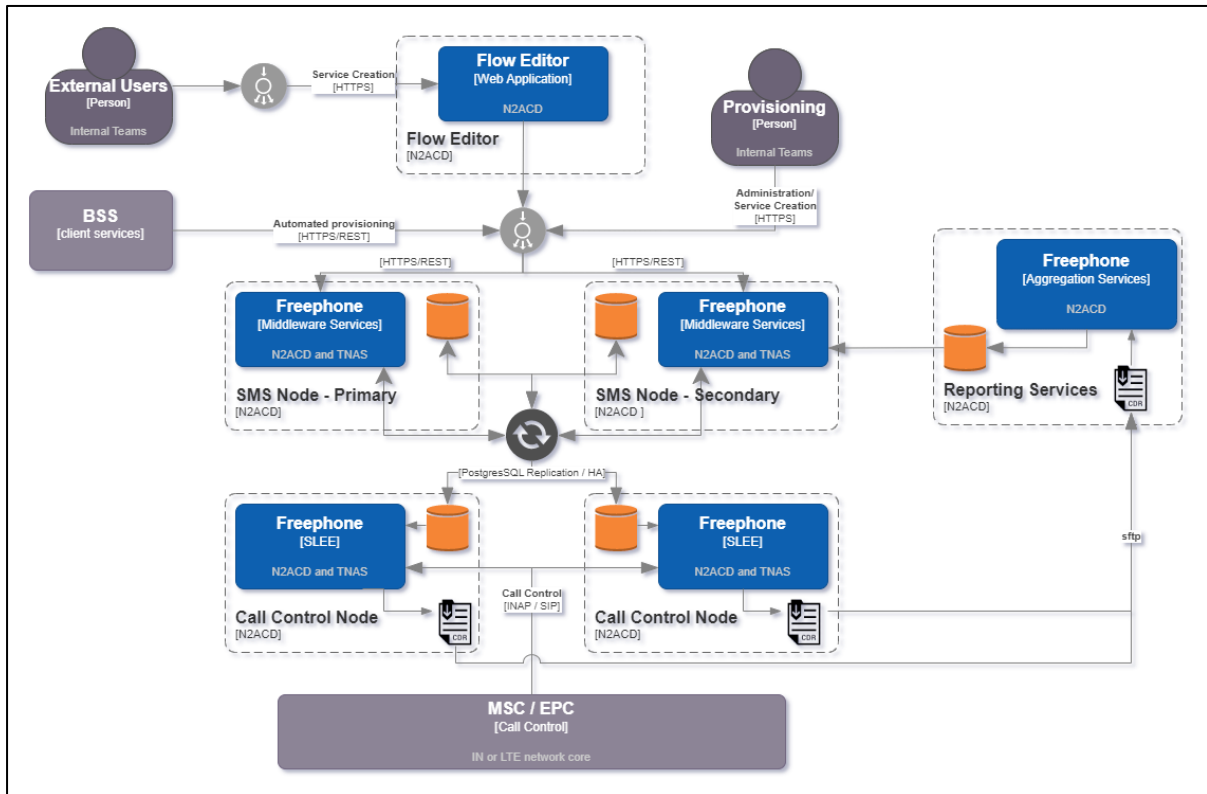


Figure 3 - N2ACD Architecture (HA deployment model)

Dashboard, Reports & CDRs

N2ACD includes a configurable dashboard which provides a single point of access to statistics, reports, and call/event data records (CDRs and EDRs).

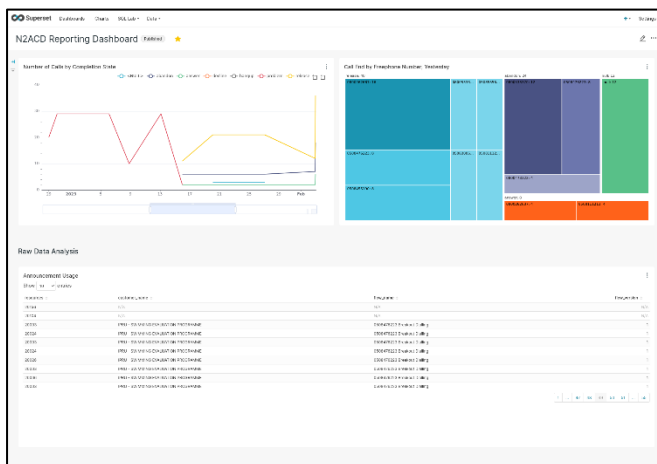


Figure 4 - Example dashboard

OSS & BSS

The N2ACD service presents a comprehensive HTTP REST API for integration with BSS middleware endpoints. Customer, service number, and flow creation can be integrated with 3rd party systems such as existing CRM and portal environments for the provisioning and management of freephone services.

Telco staff, resellers, and authorized self-managing customers can view their own call logs, announcement playback statistics, flow node usage, etc.

The text-format CDRs provide deeper insight into traffic patterns. These can be downloaded for more detailed off-line analysis.

Custom Flow Scripts

The N2ACD Flow Editor provides support for the vast majority of toll-free and premium-number in-network call distribution control flows.

However, for those unusual scenarios, N2ACD provides mechanisms for freeform, hand-designed flows written in the Lua scripting language, using N2ACD's documented call control API.

Typical uses are:

- Custom one-off flows, or
- Globally defined, operator-specific pre-call screening logic, or
- Globally defined, operator-specific number portability processing, or
- Globally defined, operator-specific tariff features, e.g. using FCI or SCI.

To support these custom flows, the GUI can be configurably enhanced with arbitrary custom profile fields associated with some, or all customers.

Run-Time Framework

N2ACD is built on N-Squared's proven N2SVCD⁴ platform. N2SVCD runs as an IN SLEE/SIP-AS environment. The operational web GUI provides:

- Real-time node management
- Dynamic tracing hooks.
- Statistics and activity.

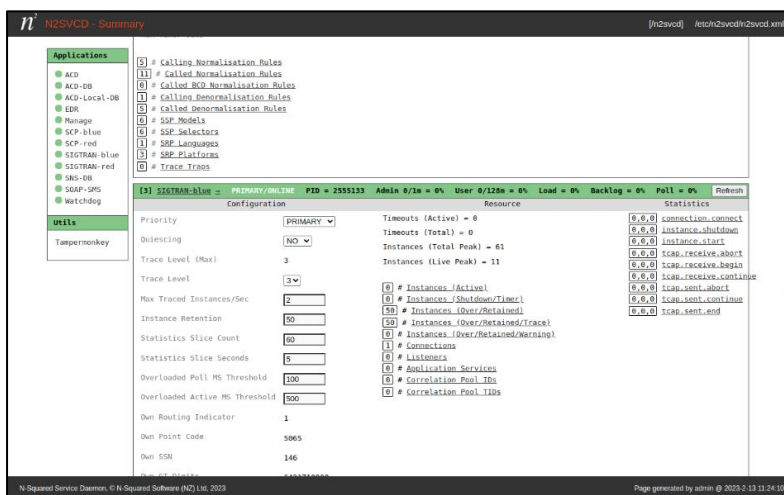


Figure 5 - The N2SVCD operational management GUI

Protocol Conformance

For protocol compatibility statements applicable to the SIP and the INAP/CAMEL implementations of N2ACD, please refer to the separate Protocol Conformance Specification documents:

- N-Squared N2SIP SIP-SDP-RTP PCS 2022-02 (or later)
- N-Squared N2SCP CAMEL-INAP PCS 2022-03 (or later)
- N-Squared N2SVCD SIGTRAN-TCAP PCS 2021-03 (or later)

⁴ https://www.nsqared.co.nz/files/n2svcd/technical_guide/