Community Grant Program Reports

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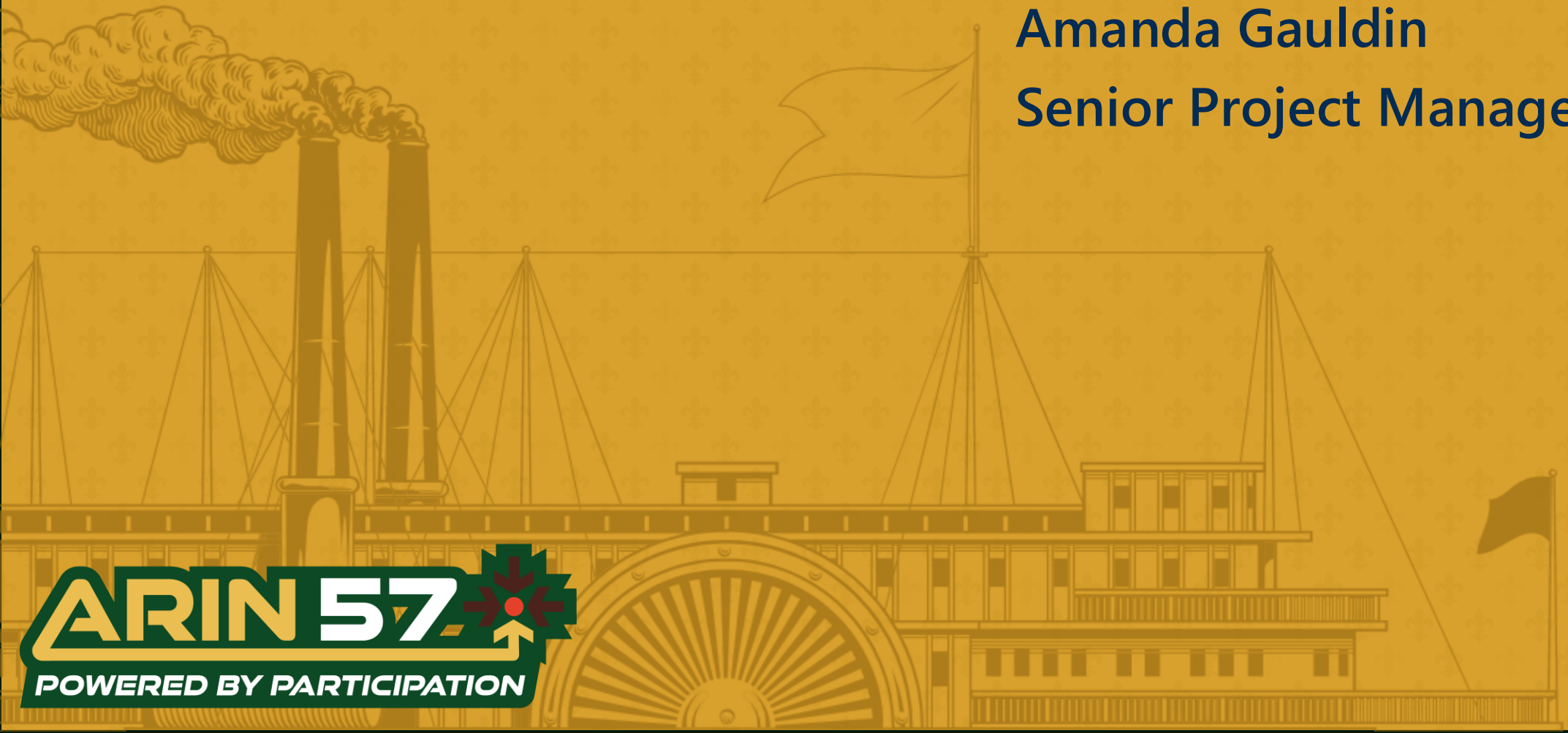
Senior Project Manager



ARIN 57
POWERED BY PARTICIPATION

Facts about the Community Grant Program

Launched in 2019 to support initiatives that improve the overall Internet industry and user environment.

Since then, **26 projects** have been funded at USD$320,975

ARIN Community Grant Program

Organizations receiving funding include:

- *DNS-OARC*
- *CaribNOG*
- *Virtual School of Internet Governance*
- *Diplo Foundation*
- *Saatvik Advisors*
- *Network Time Foundation*
- *Internet2*
- *FullCtl*

2025 Community Grant Program Recipients

Network Time Foundation	Internet2	20C
Augmenting GNU AutoGen to Support Hugo Markdown as a Documentation Stanza Markup Format	IPv6 Test Pod	From Raw to Ready: Visualizing RDAP with RegCtl

Do You Have a Project in Mind?

Do you have a goal or project in mind that aligns with ARIN's mission and strategic goals?

We'd love to see your application!

www.arin.net/grants

Projects must fit into **one or more** of the following categories:

- Internet technical improvements
- Registry processes and technology improvements
- Informational outreach
- Research

Applications are open now through 14 June
The call for the Grant Selection Committee is open until Friday!

Next up .. Grant Reports!

Markdown Integration for GNU AutoGen

2025 ARIN Community Grant

Interim Report

NETWORK TIME FOUNDATION

Over Four Decades of Evolution

The NTP Project has been shipping code and documentation releases since 1982.

1982: READMES

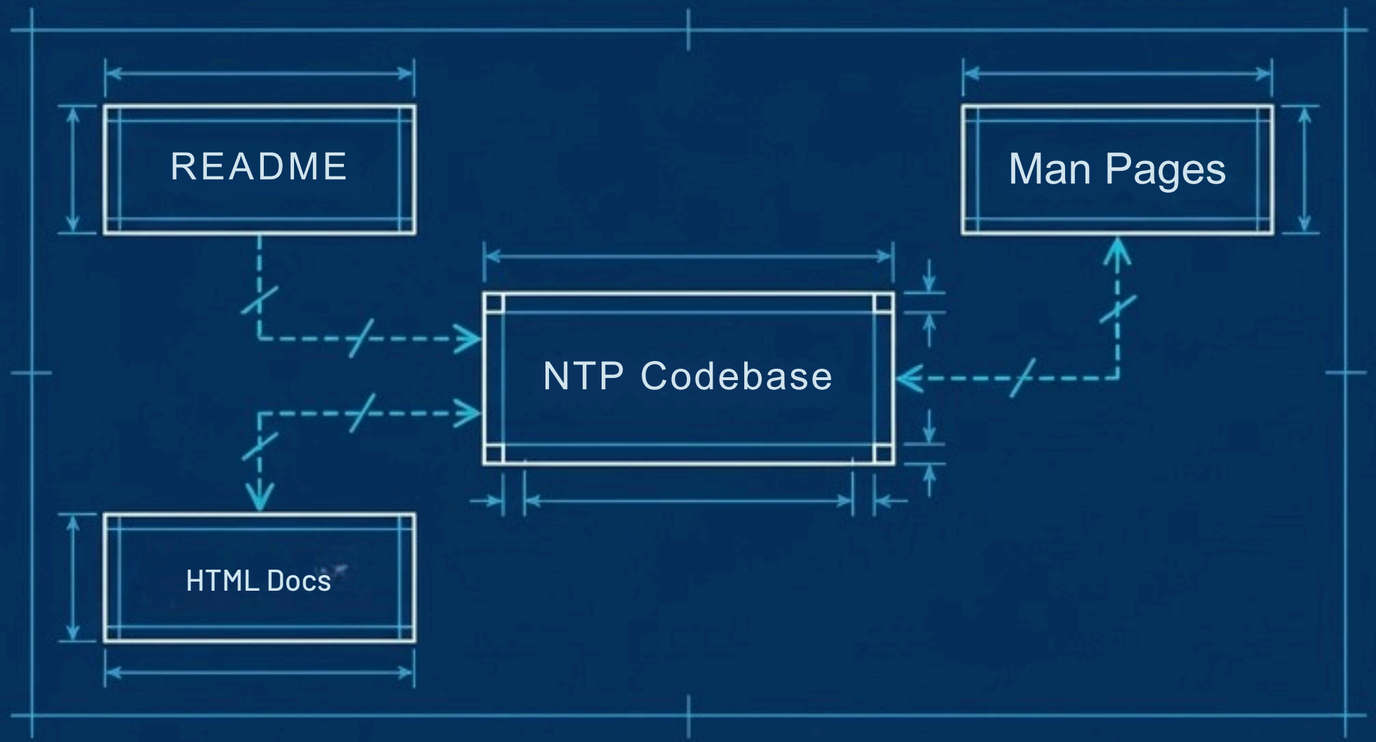
Mid-90s: Adds HTML directory

2009: Adds AutoGen-generated man pages

The Fragmentation Challenge

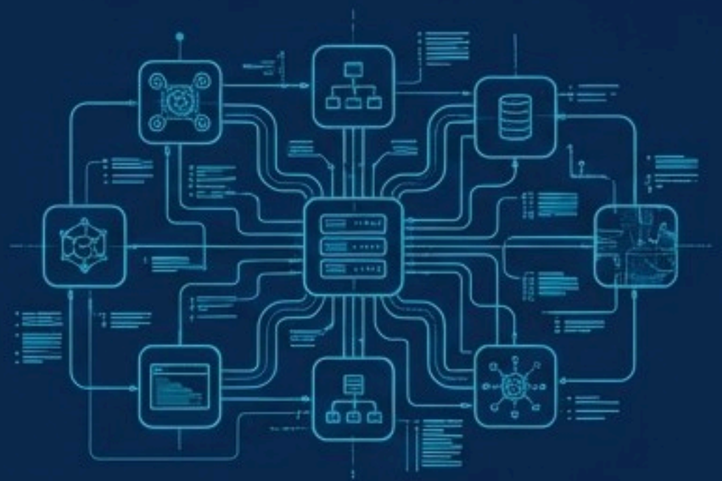
Independent documentation silos are problematic:

- Very difficult to keep documentation silos consistent
- Inefficient framework to make multiple output formats

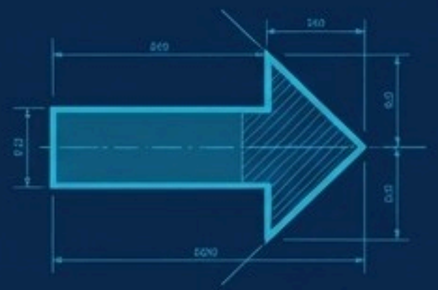


The 2021 Infrastructure Pivot

- NTF transitioned project websites to Hugo in 2021
- Legacy software was resource-intensive and needed frequent security patching

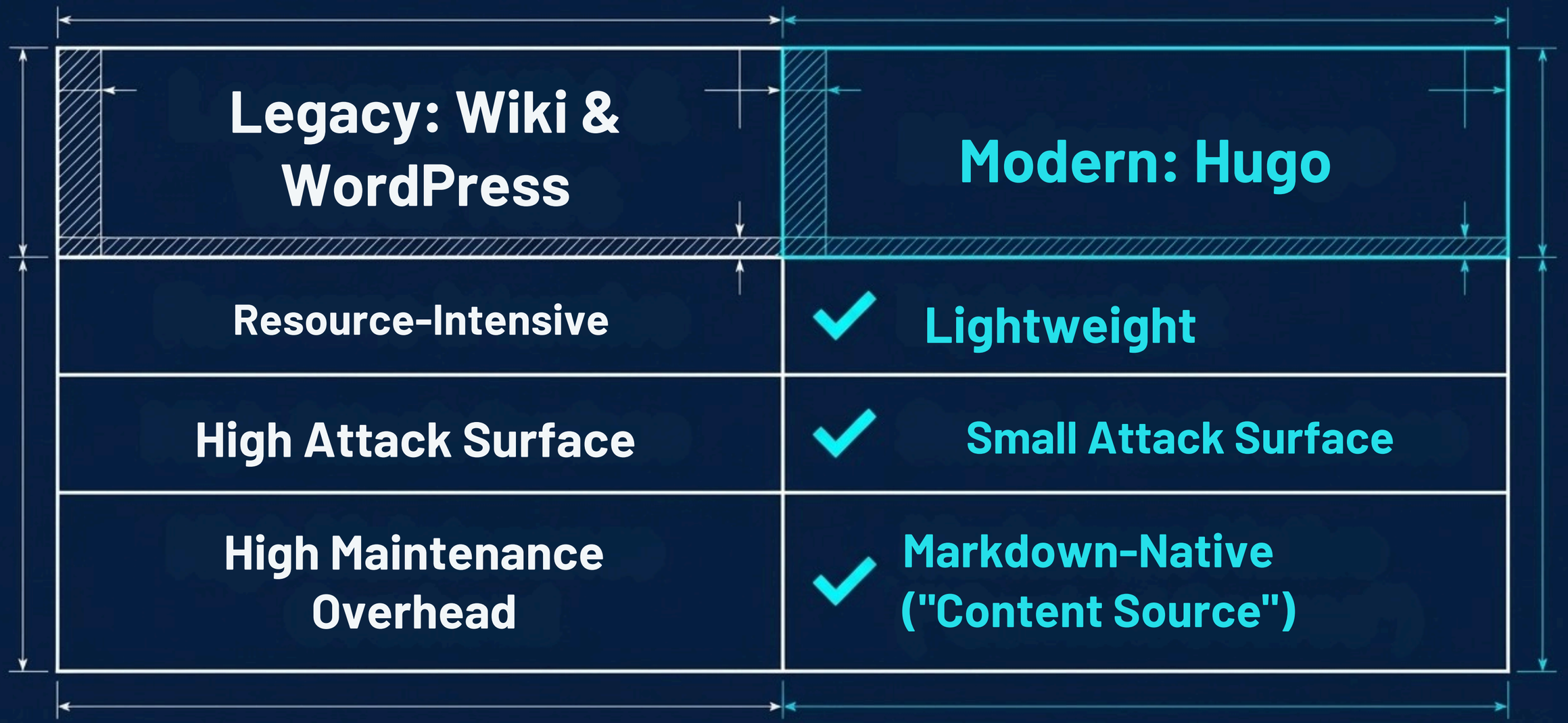


Legacy Server Architecture



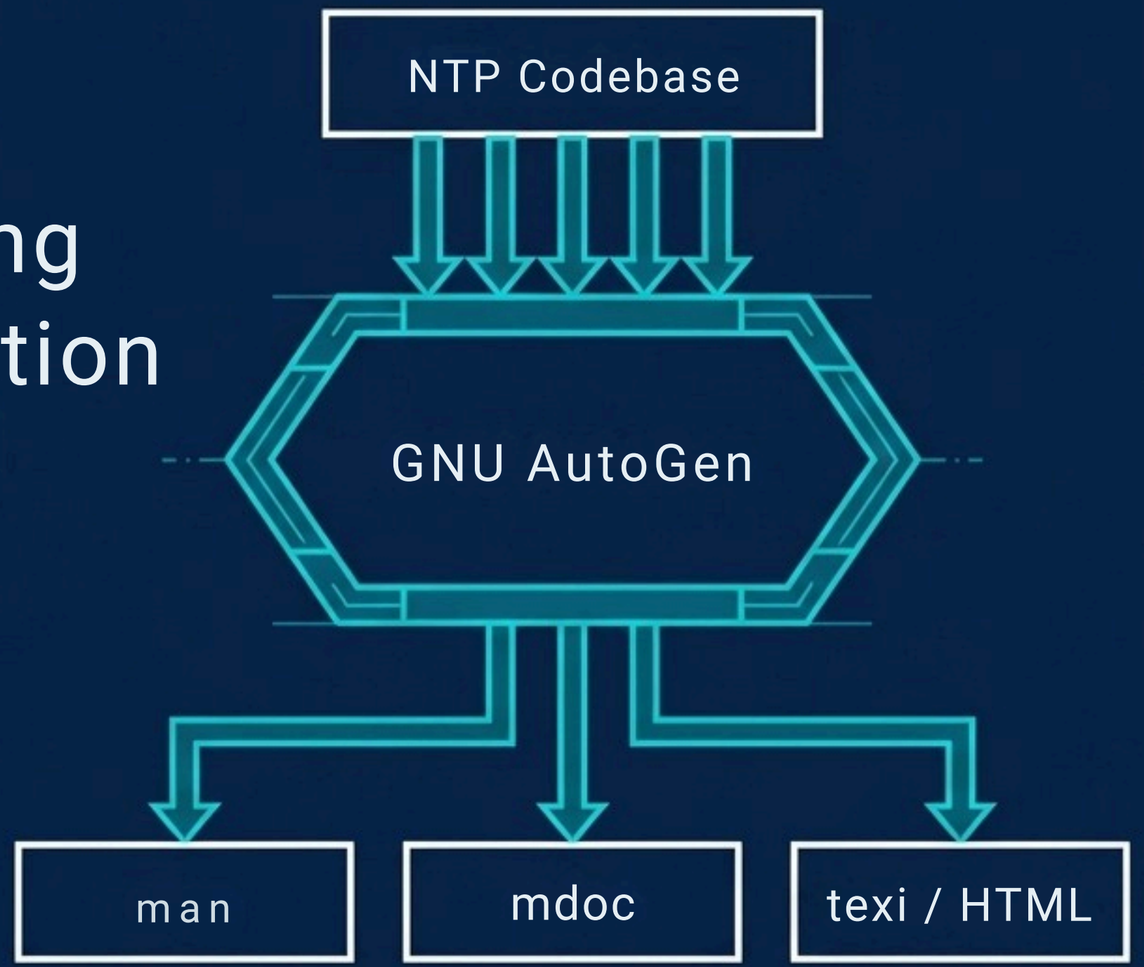
Hugo Architecture

Benefits of Modernization



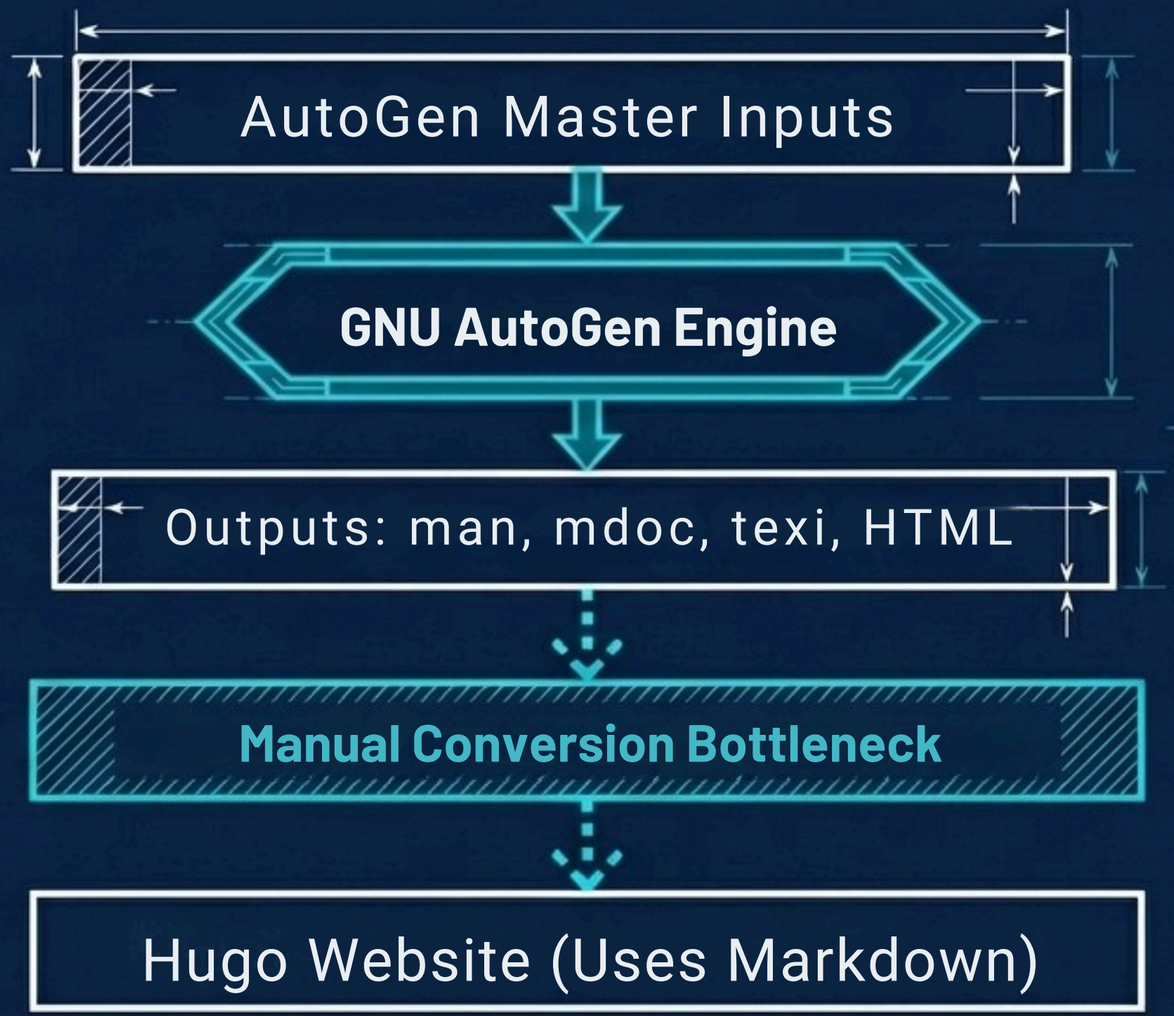
Centralizing with GNU AutoGen

- Easily handles complex command line processing
- Centralizing documentation avoids bitrot



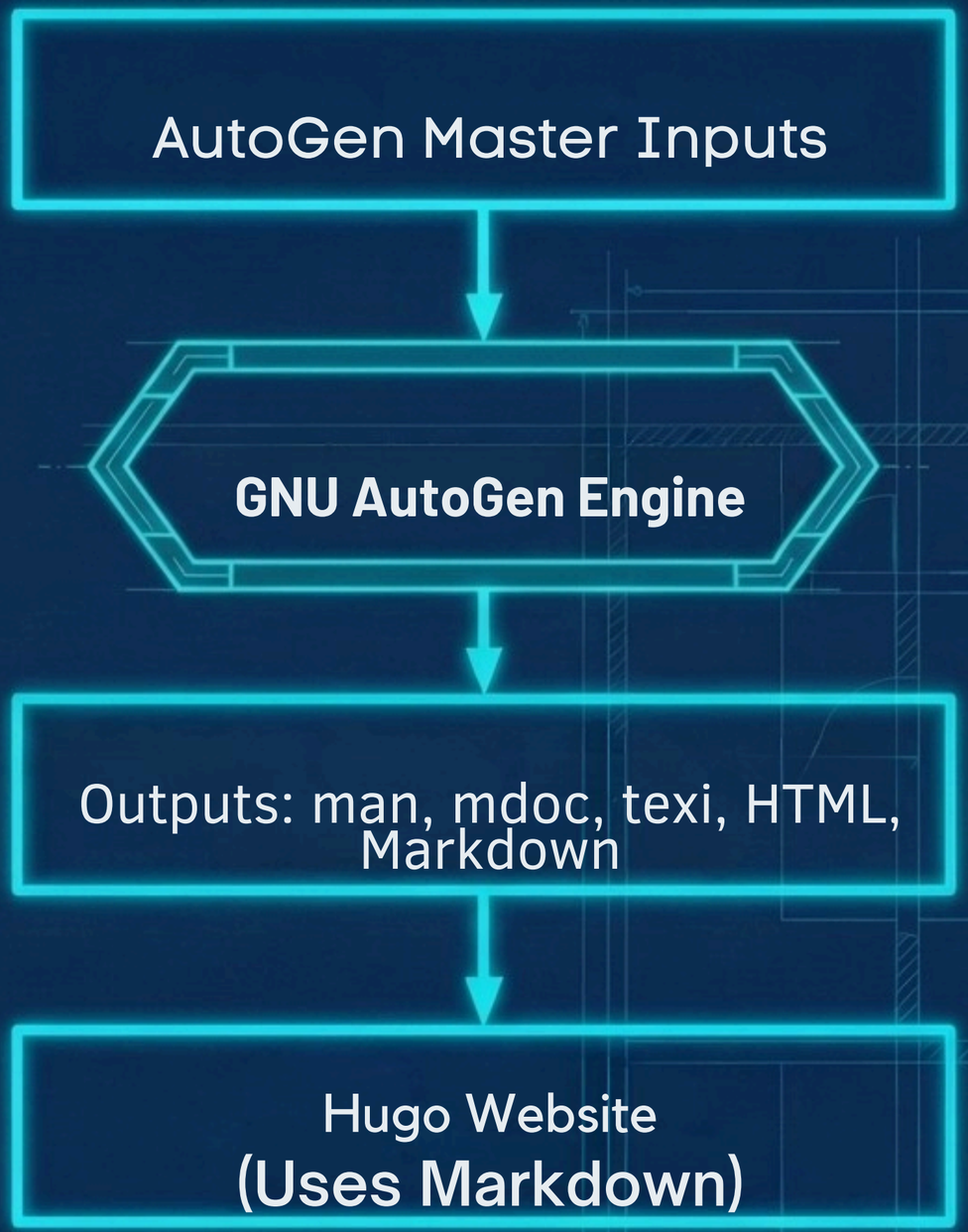
The Current Integration Bottleneck

- Hugo uses Markdown
- Manual conversion creates an unsustainable bridge between generated docs and the website.



The ARIN Grant Solution

- Adds native Markdown generation directly to GNU AutoGen.
- Allows arbitrary release documentation to live seamlessly on the website.

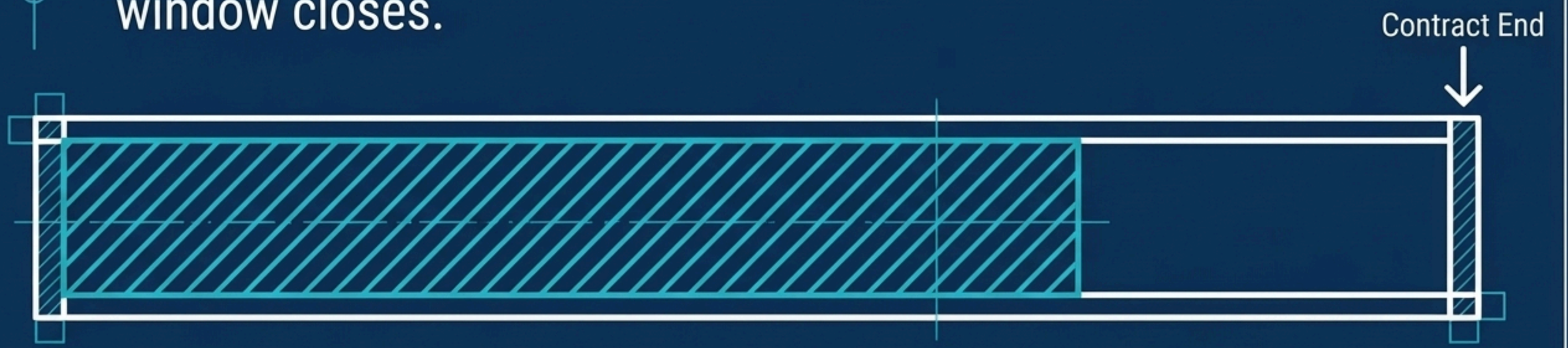


Phase 1 Identification is Complete

- [x] **Translation scripts mapped**
- [x] Markup tags identified
- [x] Picked first target documentation files
- [x] AutoGen build system changes located

Path to Final Delivery

- Immediate goal: Implement translators to/from Markdown.
- As we progress, document areas that need future attention.
- We are on-track for successful delivery before the contract window closes.



A Unified Future for NTF

- Paves the way to a complete upgrade of the NTP and other NTF project documentation.
- Thank you, ARIN, for this Community Grant that supports the NTF ecosystem.

https://nwtime.org | info@nwtime.org

NETWORK TIME FOUNDATION

internet2.edu

IPv6 Test Pod

April 2026 Update

James Harr
Network Software Architect
Internet2

ABOUT INTERNET2

High-Speed National Research & Education Network (NREN)

- US Optical and Packet backbone
- 46 POPs around the US
- 100GE / 400GE connections to connectors/members
- International peerings to other NRENs
- I2PX - Internet2 Peering Exchange - cloud/commercial peerings
- L2VPN & L3VPN solutions

InCommon / Trust & Identity

- Federated single sign on across members
- eduroam - WiFi roaming across R&E institutions

Community

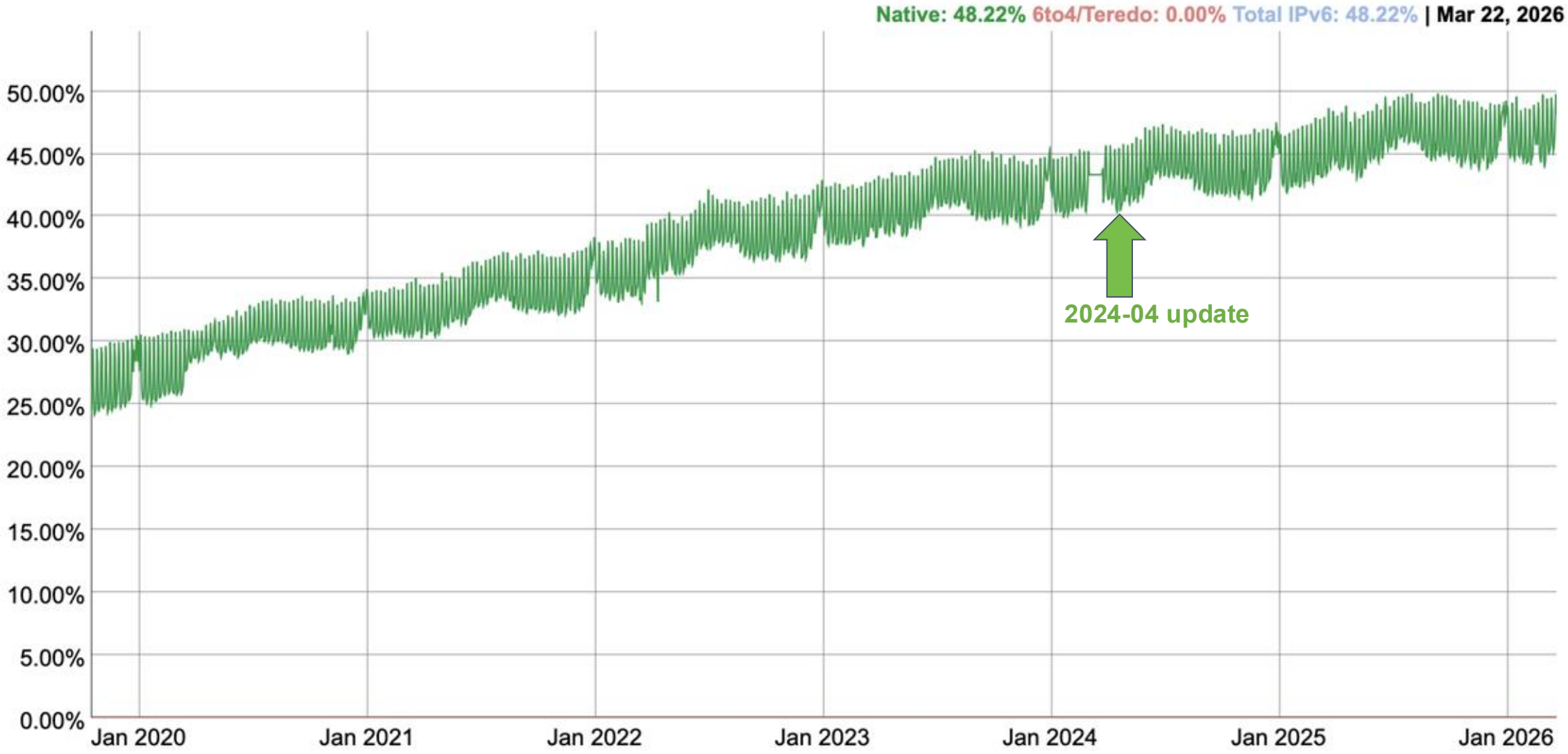
- Member-run non-profit organization

AGENDA

1. State of IPv6
2. IPv6-only Networks
3. IPv6 Pod Project
4. Current Project Status

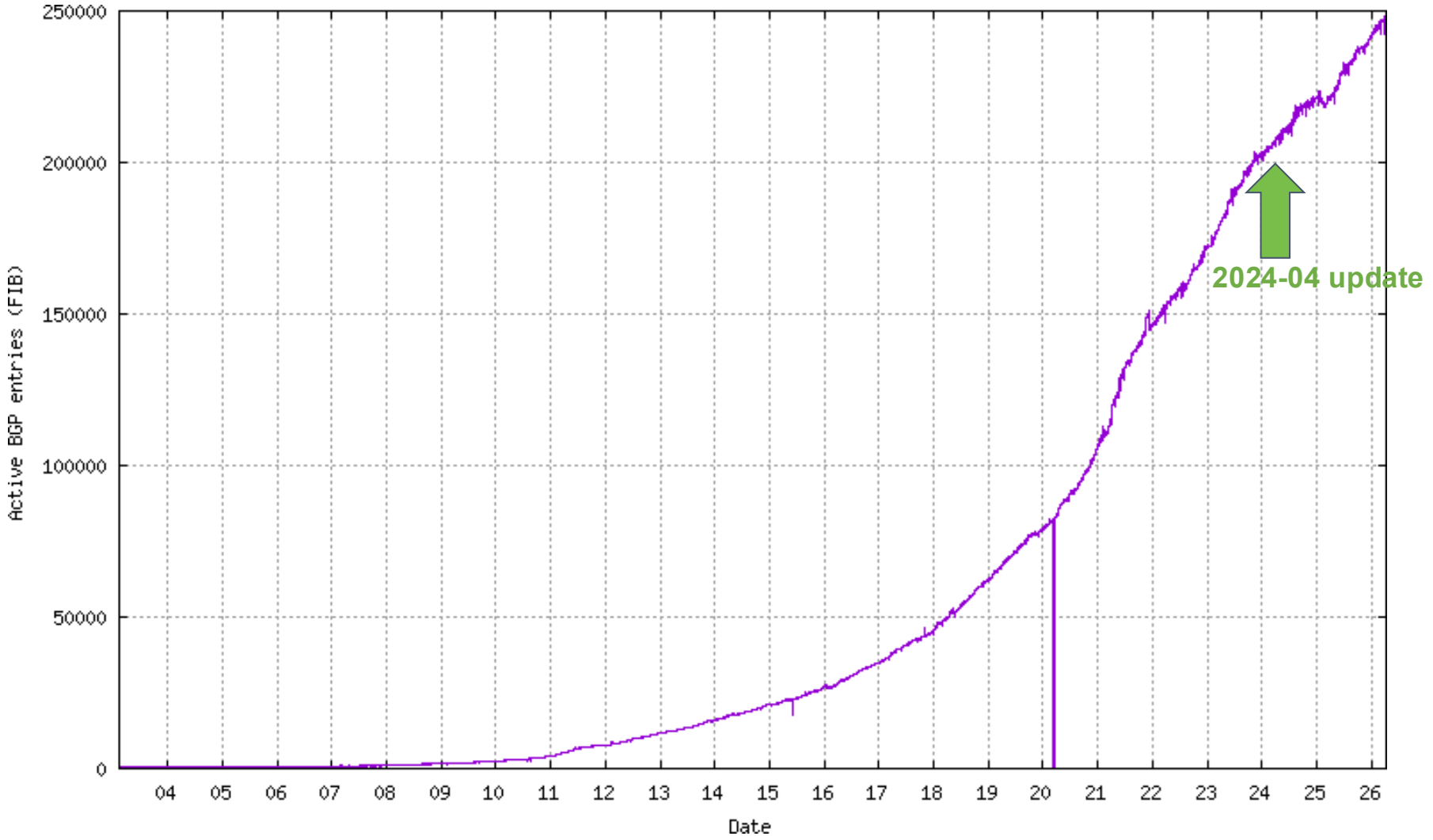
State of IPv6

IPv6 Adoption - by Traffic [Google]



Source: https://www.google.com/intl/en/ipv6/statistics.html

IPv6 Prefix Advertisements [Potaroo]



Source: https://bgp.potaroo.net/v6/as2.0/index.html

IPv6 Activity

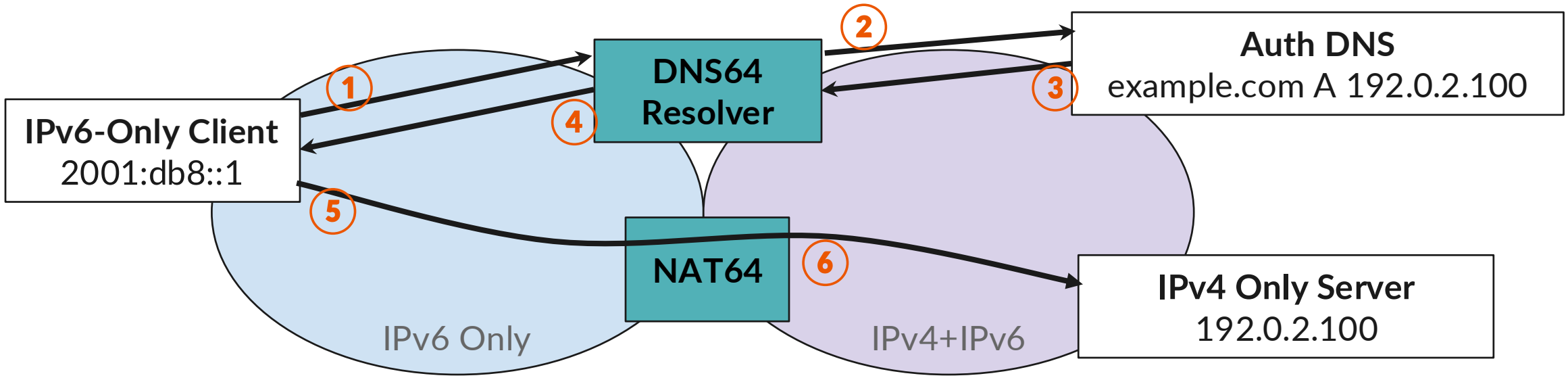
- Strong progress in CLAT + DHCP108 support
  - **Windows 11 CLAT** private preview - Nov 2025
  - **Linux Network Manager CLAT** support
- Strong progress in the IETF
  - **draft-ietf-v6ops-6mops** - IPv6-mostly Networks: Deployment and Considerations
  - **draft-ietf-v6ops-claton** - 464XLAT Customer-side Translator (CLAT): Node Behavior and Recommendations
  - **draft-ietf-6man-slaac-renum** - Improving the Robustness of Stateless Address Autoconfiguration (SLAAC) to Flash Renumbering Events
  - Many other refinements and clarifications in process of being standardized

IPv6 ~~Only~~ Mostly networks

Why IPv6-Only?

- **Dual-Stack** was never the end-game
  - Hides problems [Happy Eyeballs]
  - Management complexity [2x address pools, 2x firewall policies, etc]
  - Troubleshooting complexity [did it fail because of v4 or v6 policies?]
- **Single-Stack IPv6** - this is the target
  - Promotes simpler
  - Load on transition tech [NAT64] will decrease over time
  - How do we get there?

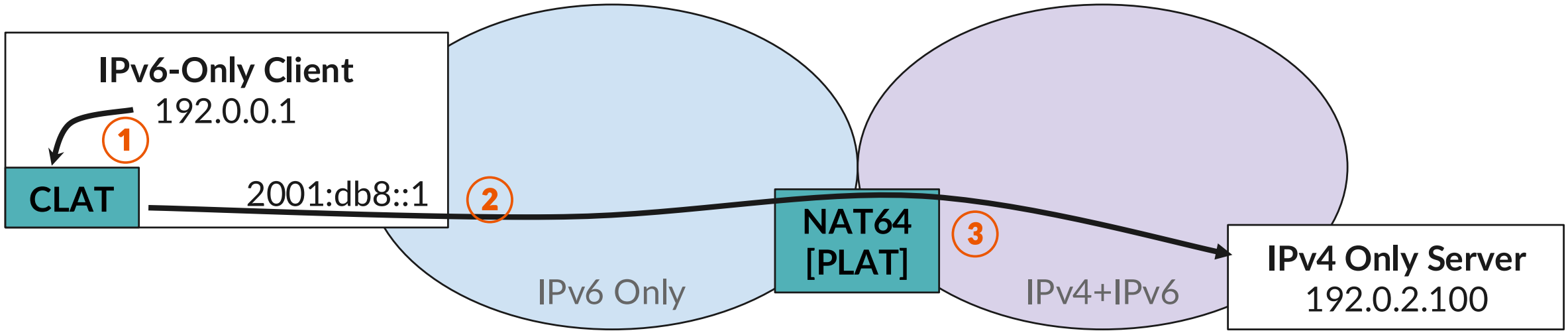
Accessing IPv4 with NAT64 / DNS64



4 DNS64 synthesizes response -- **example.com AAAA 64:ff9b::192.0.2.100**

6 Client traffic to **64:ff9b::192.0.2.100** routed through NAT64 appliance, translated to IPv4

Accessing IPv4 with 464XLAT



1. Client connects to IPv4-only resource through **CLAT**
2. **CLAT** translates to IPv6, connects to **64:ff9b::192.0.2.100**
3. Traffic to **64:ff9b::192.0.2.100** routed through **NAT64 / PLAT** appliance, translated to IPv4

"IPv6 Mostly"

DHCP Option 108 - IPv6 only Preferred

- IPv4 is **disabled** if client OS understands this option
- IPv4 is left **enabled** if client OS doesn't understand

Allows a fallback to dual-stack

Client OS Support for 464XLAT

iOS	**Supported**
Android	**Supported**
macOS	**Supported**
Windows	**Supported on LTE only** Expanded CLAT support **coming to Win11**; Private beta concluded
Linux	**Options on the way** **NetworkManager 1.58 [release tbd]**, clatd, nat64 kernel module
FreeBSD / OpenBSD	**Supported in PF**, but "configure yourself"

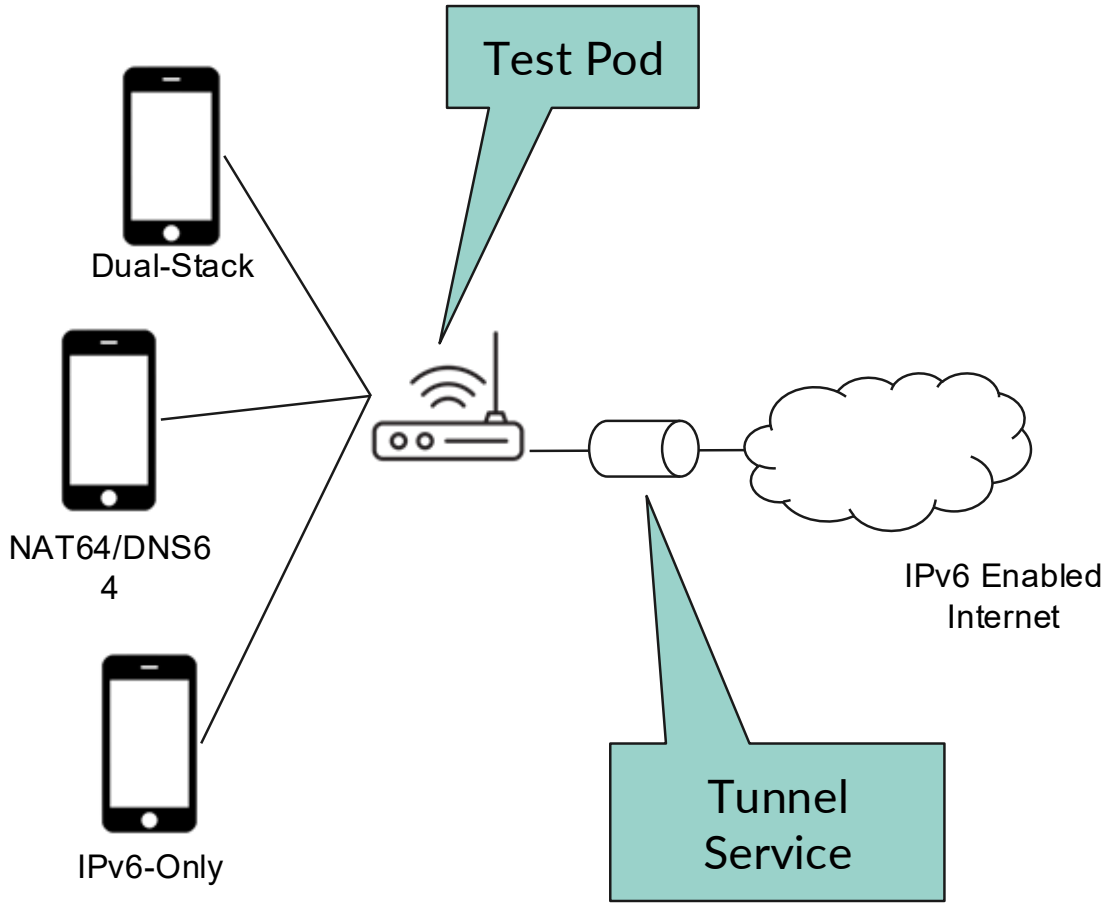
IPv6-Pod Project

Getting an IPv6-mostly lab setup

1. **Understand** all the **options**
2. Get **access to IPv6**
3. Piece together a solution with a **mix of equipment**
    a. NAT64 - not well supported in lower end platforms
    b. DNS64 - independent server/container
    c. PREF64 - may not be supported in NOS that supports NAT64
    d. DHCPv4 Option 108
4. Setup **multiple test environments**
    a. Dual Stack
    b. DNS64 + NAT64
    c. NAT64 + PREF64
    d. NAT64 + PREF64 + DHCPv4 Option 108
    e. IPv6-Only
5. Still do your **day job**

IPv6 Test Pod

- $16,000 ARIN Community Grant
  - Follow-on from $7,000 grant in 2023
- Target making client-side testing easy
- Inexpensive device (<$150)
- Creates 3+ wifi+wired networks for testing: dual-stack, nat64, ipv6-mostly, ipv6-only
- Uses an a tunnel for IPv6
- Service includes tunnel termination
- Comes pre-configured, plug-in and go
- Distributed at no-cost to participant
- Inspired by RIPE ATLAS project



Target Audience

- **Software Developer** - Wants to test a client-side app in a v6-only environment. The back-end infrastructure is supposed to be configured, but happy eyeballs and a dual-stacked server may be hiding problems.
- **IT Support** - Has a set of applications they want to test for an IPv6-only environment, but the rest of the organization doesn't have time/resources to set up the test bed.
- **Network Engineer** - Who has been asked to research NAT64/DNS64; lab environment setup would take days/weeks

Project Updates

Accomplishments

- Windows CLAT testing
- NetworkManager CLAT testing
- HPN-SSH Happy Eyeballs support
- 2025 ACM Internet Measurement Conference (IMC)

Timeline

2023 grant period

- 20+ devices distributed

2025 grant period

- 45 units to applicants and have
- 20 lined up for delivery in April

Beyond

- Long term support of IPv6 tunnel
- Redistribute devices

Ways to Participate

- ipv6-pod.info - Submit an application for a test pod
- Mail list - https://lists.internet2.edu/sympa/info/ipv6-pod-announce
- Direct Contact jharr@internet2.edu

Thank You

- From Raw to Ready: Visualizing RDAP with RegCtl

ARIN Community Grant Program

grizz@20c.com

Agenda

- Our Work
- The problem
- What regCtl does
- What the Grant delivered
- Current Status
- Demo

regCtl

Our Work

- Fullctl - Modern, Modular, Unix philosophy Automation & Workflow services github.com/fullctl
- Pioneering Solutions
  - RTBH Systems: First IX fabric with RTBH - unitedix.net/tech
  - Python RDAP: the de facto RDAP query tool - github.com/20c/rdap
  - NEW! Open Pipes - A community approach to building & operating IX's openpipes.net

The Problem

Registry data today is:

- inconsistent across RIR implementations
- difficult to read for humans
- fragmented across multiple sources
- mostly accessible through CLI tools or raw JSON

For many operators, researchers, and educators this creates a barrier to understanding Internet registry data.

Our Goal: make RDAP data easier to explore and understand.

What regCtl does

It normalizes RDAP responses across registries, providing:

- consistent data structure
- normalized entities
- unified object views
- API access

Supported objects include:

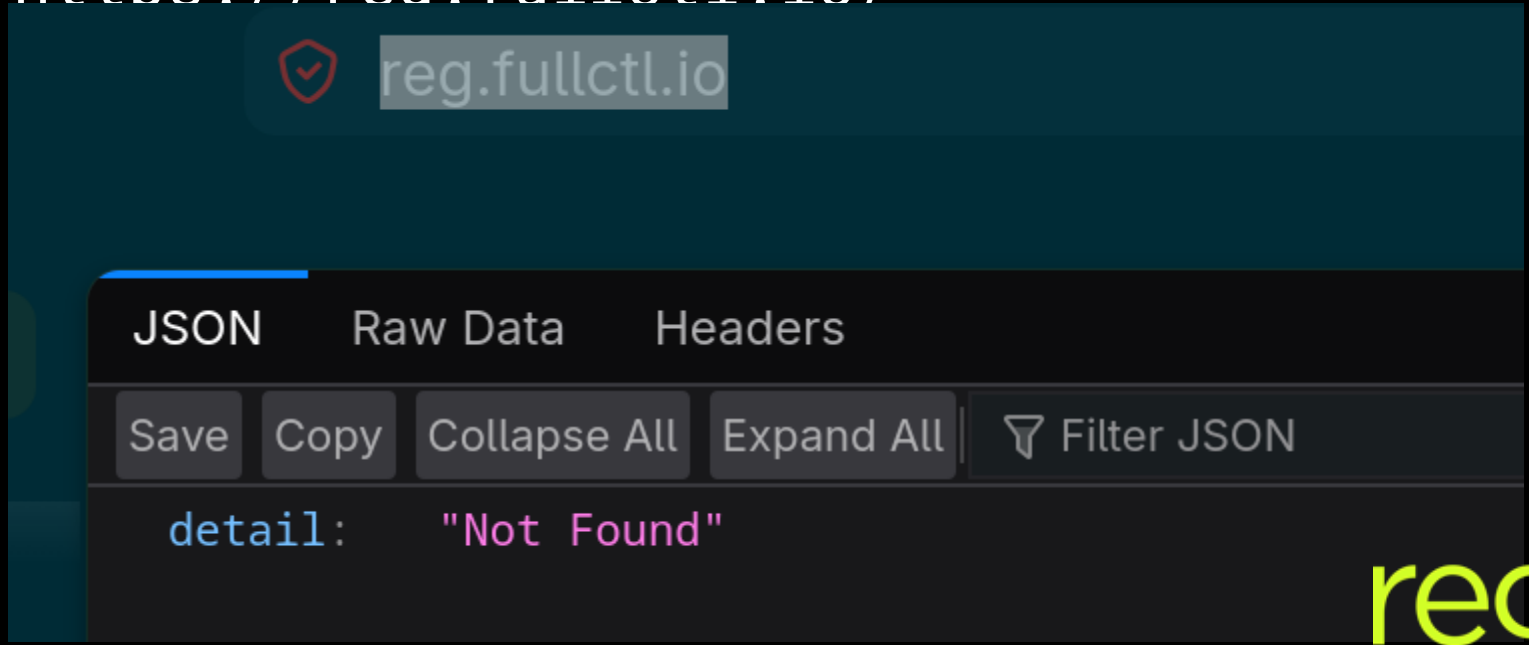
- ASNs
- IP prefixes
- Domains
- organizations

But until now it has mainly been used via command line or API.

regctl

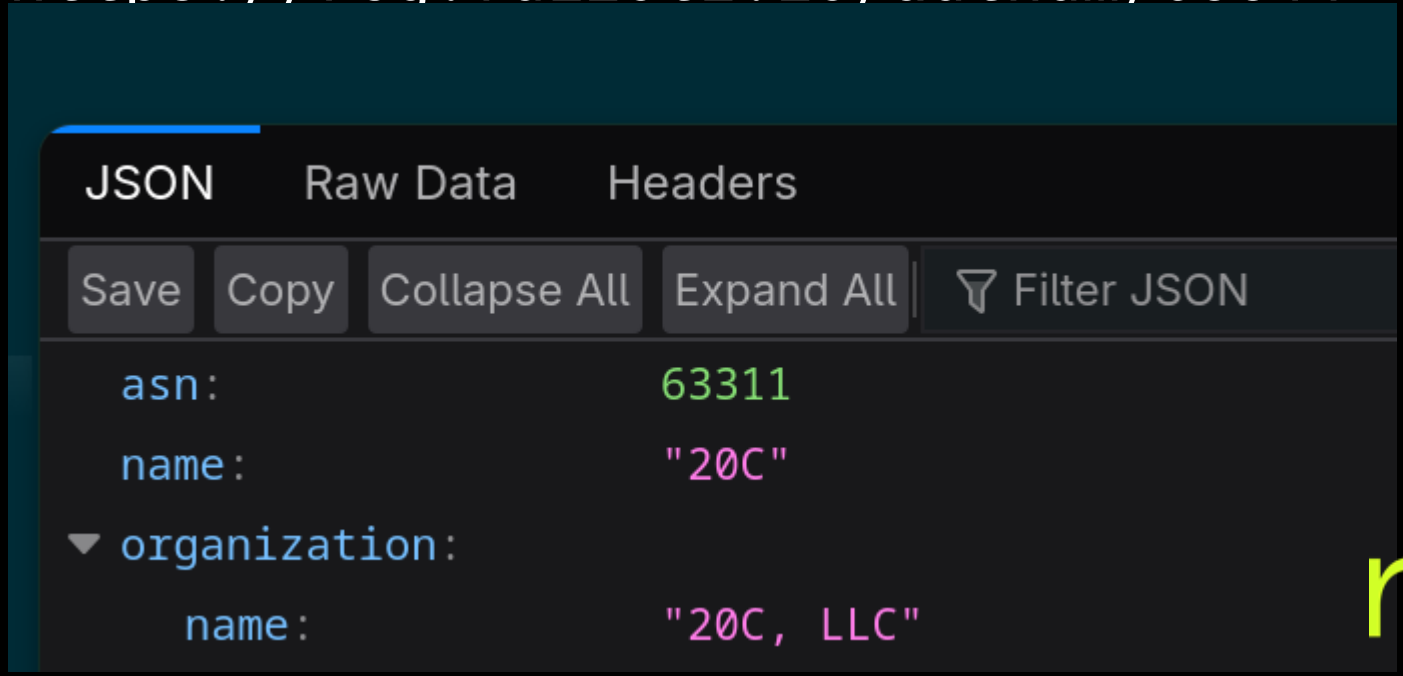
What regCtl does

https://reg.fullctl.io/



What regCtl does

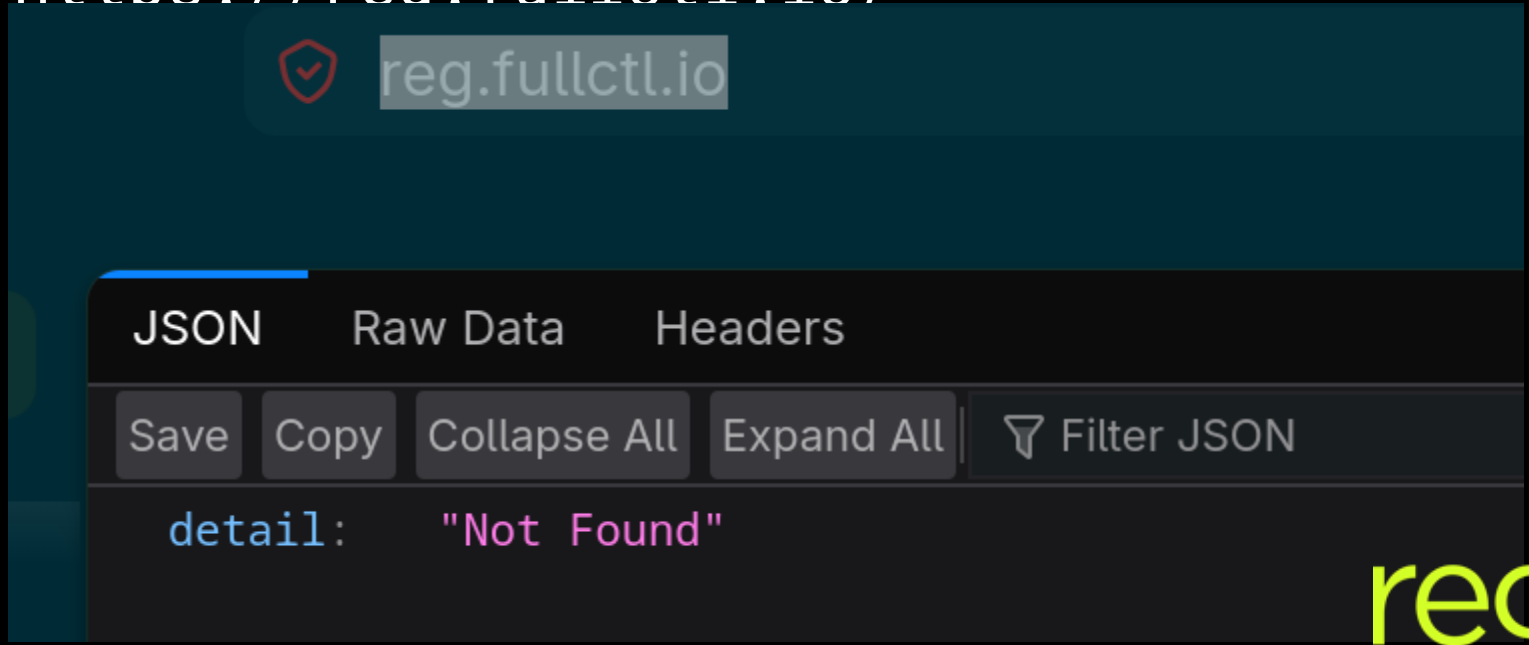
https://reg.fullctl.io/autnum/63311



regctl

What regCtl does

https://reg.fullctl.io/

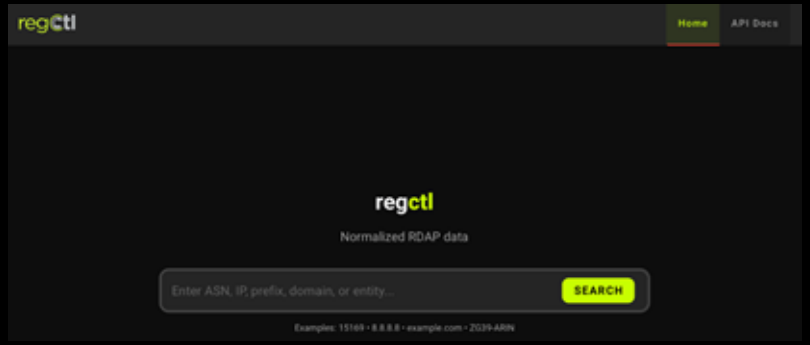


What This Grant Delivered

This ARIN Community Grant funded development of a modern web interface for regCtl.

The interface provides:

- search by ASN, IP, prefix, or domain
- normalized registry data views
- contextual explanations of RDAP fields
- consistent formatting across registries



The tool is:

- open source
- publicly accessible
- designed for operators, researchers, educators, et al

Current Status

The tool is now live and functional.

Current status:

- frontend interface deployed
- regCtl API integrated
- normalized object views implemented
- public demo environment available

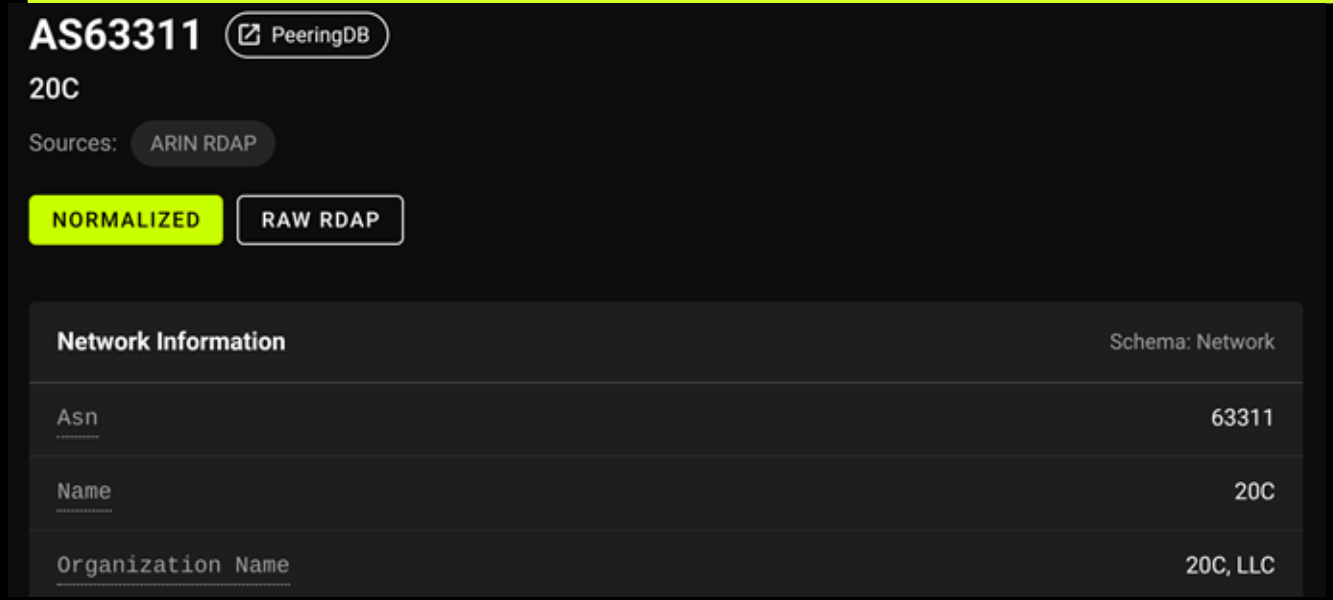
The team is currently working on:

- UI refinements
- additional data presentation improvements
- feedback from early users

regctl

What regCtl does

https://arin57.dev5.20c.com/autnum/63311



Demo

A live demo is available at: https://arin57.dev5.20c.com/

We'll now do a short walkthrough showing

- searching for a resource
- viewing normalized RDAP data
- navigating relationships between objects

regctl

Thank you for your time…

Feedback welcome hello@20c.com