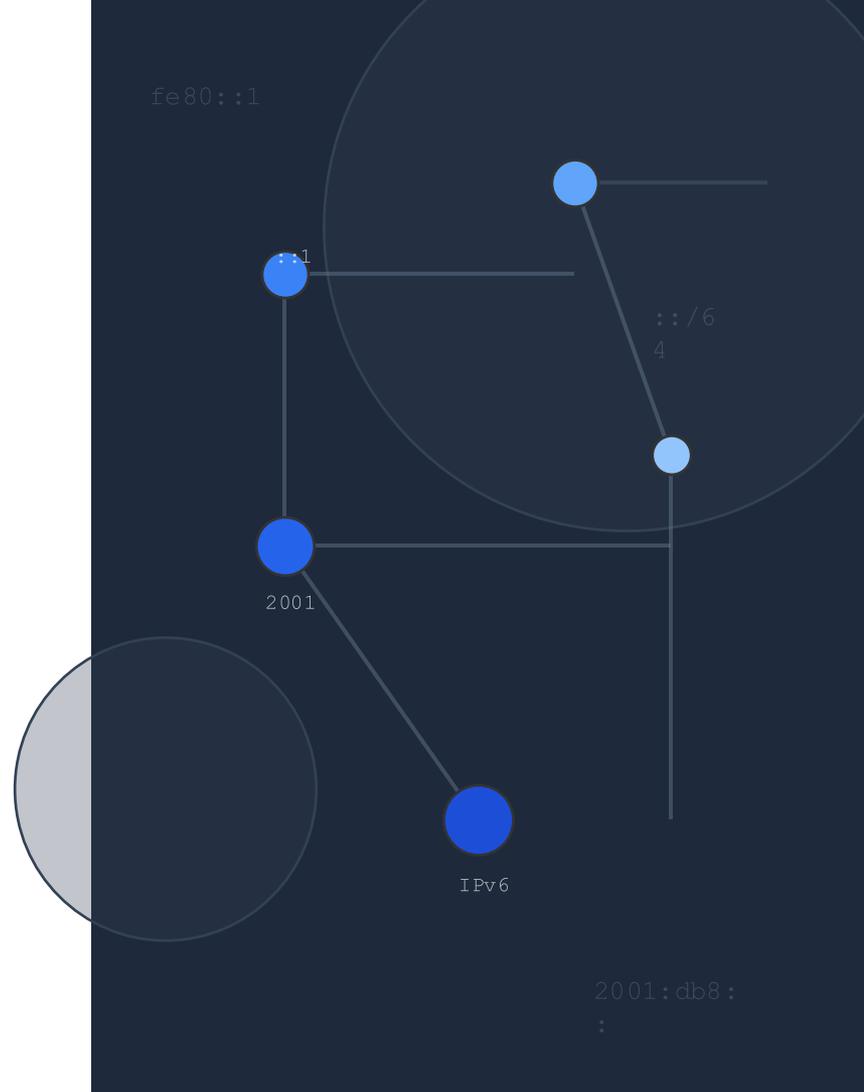


Universitas Islam Indonesia

Generative AI for IPv6 Renumbering

Technical Barriers or Organizational Readiness?

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The IPv6 Challenge

Protocol Comparison

Why the transition creates cognitive overload for overload for engineers:

IPv4	IPv6
192.168.1.1	2001:0db8:85a3:0000:0000:8a2e:0370:7334
Easy to memorize Short decimal format	Cognitively demanding 128-bit hexadecimal addresses
Familiar format Standard since 1983	Complex groupings Requires new mental models

Key Challenges



Cognitive Limitations

Human brain has limited capacity for retaining long, complex hexadecimal sequences in working memory.



Inefficient Configuration

Manual configuration is extremely time-consuming and highly prone to typographical errors.



Psychological Barriers

Network engineers face "fear of complexity," leading to avoidance behaviors and task abandonment.



Resource Gaps

Organizations lack specialized training infrastructure and resources to bridge the skills gap.

Research Questions

RQ1

Cognitive Load

Does generative AI reduce the cognitive workload experienced by network engineers during the complex IPv6 renumbering process?

RQ2

Technical Performance

How does AI-assisted configuration compare to traditional manual methods in terms of error rates and time-on-task efficiency?

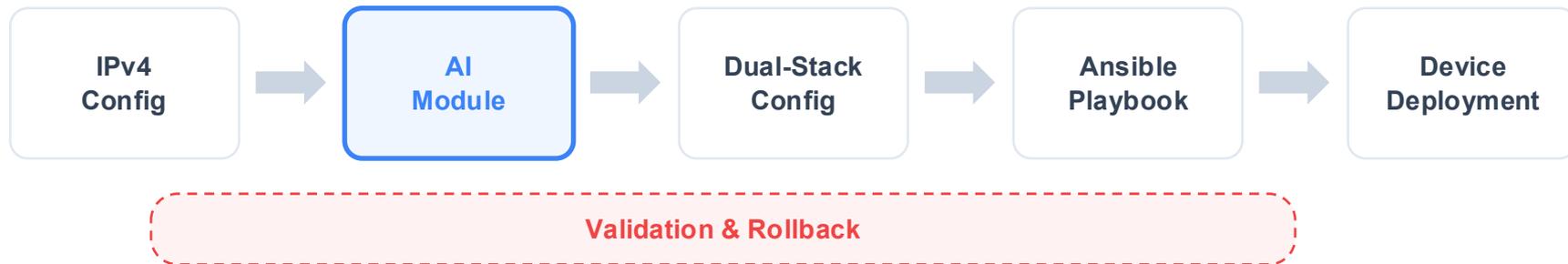
RQ3

Organizational Readiness

Do technical improvements from AI tools directly translate into organizational readiness for broader IPv6 adoption?

Our Solution: Net AI Copilot

System Architecture



Key Features

Intelligent Conversion

Automatically converts legacy IPv4 configurations into compliant dual-stack (IPv4/IPv6) setups.

Automated Rollout

Generates ready-to-run Ansible playbooks, eliminating manual command-line entry.

Safety Mechanisms

Built-in configuration validation checks and automatic rollback triggers for error prevention.

Engineer Interface

User-friendly web dashboard designed specifically for network engineers' workflows.

Research Design: Three-Phase Evaluation

Phase	Method	Sample	Purpose
Experiment 1	Configuration Test	n=7	Knowledge assessment (75 items across 15 topics)
Experiment 2	Interactive Simulation	n=7	Practical skills evaluation (12 network devices)
Observation	Survey Study	N=50	Organizational readiness & demographic analysis

Within-Subjects Experimental Design

Each participant served as their own control to account for individual skill variance:

Condition A

Traditional Manual Method



Condition B

AI-Assisted (Net AI Copilot)

Key Finding #1: Cognitive Workload

-65%

EXPERIMENT 1 REDUCTION

71.50 → 25.26 (Total Workload)

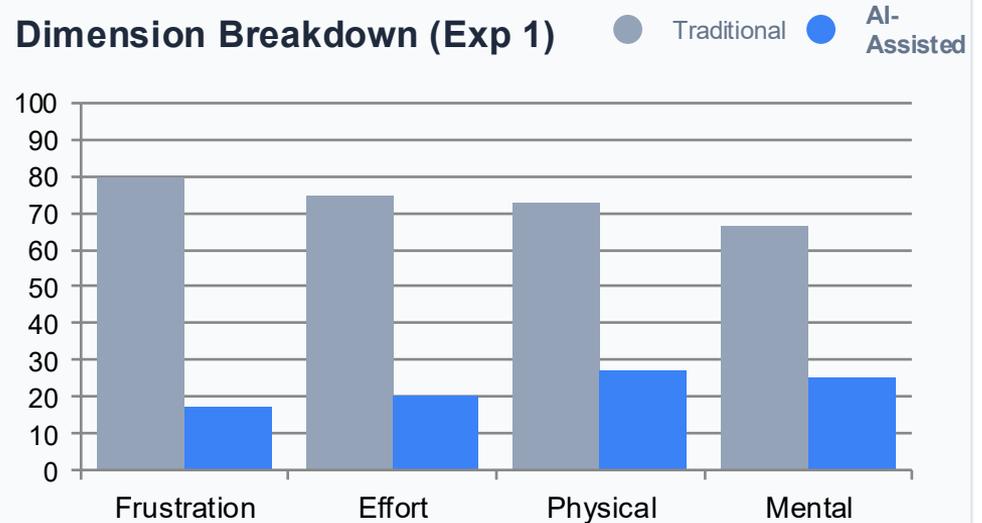
Significant Drop

-72%

EXPERIMENT 2 REDUCTION

77.41 → 21.43 (Total Workload)

Dimension Breakdown (Exp 1)



Frustration

-78%

Effort

-72%

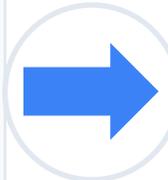
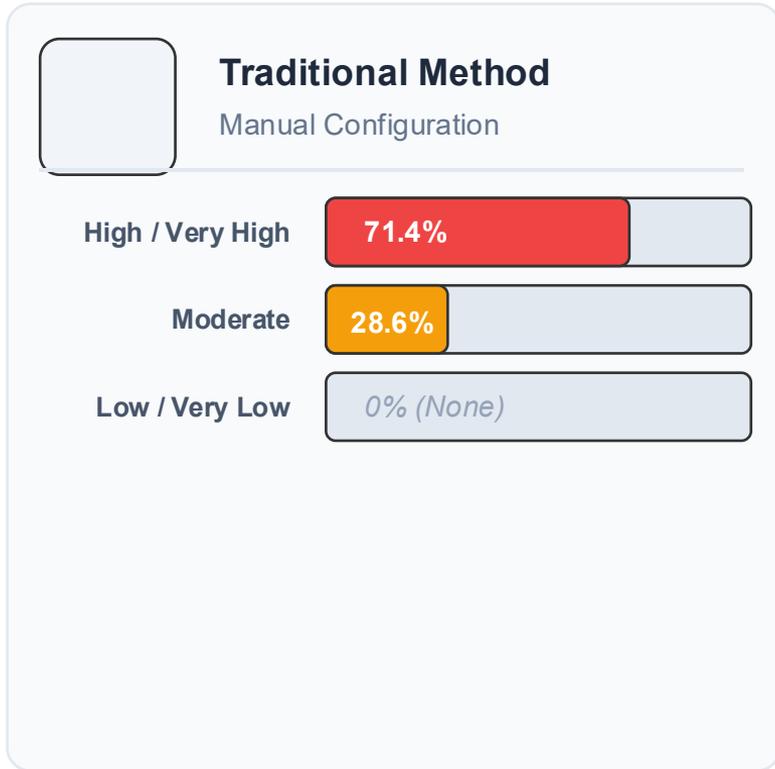
Physical

-63%

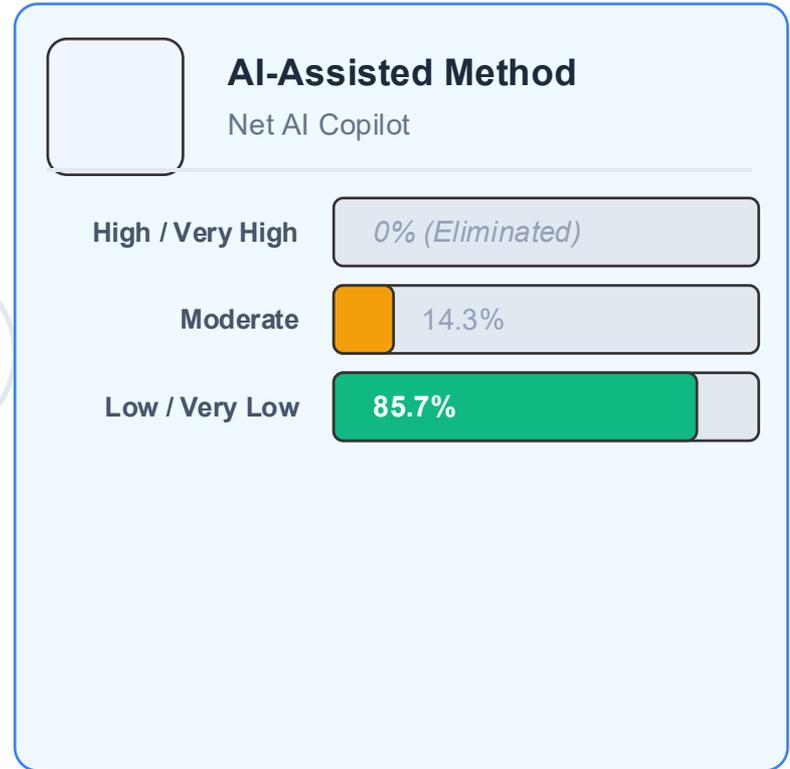
Mental

-62%

Workload Category Shift



DRAMATIC
SHIFT



Key Finding #2: Task Completion Time

1

Experiment 1

Configuration Test (Per Response)

Traditional Method

170.08 s

AI-Assisted

5.43 s

TIME REDUCTION

Extraordinary Speedup

96.8%

2

Experiment 2

Full Simulation (12 Devices)

Traditional Method

~9.4 Hours

~565 min

AI-Assisted

~96 Seconds

~1.6 min

TIME REDUCTION

Order of Magnitude Shift

99.7%

Task Abandonment Eliminated



Completion Success

Participants finishing all tasks

Traditional Method

71.43%

AI-Assisted

100%

SUCCESS RATE

Full Completion

100%



Surrender Rate

Tasks abandoned due to frustration

Traditional Method

28.57%

Frustration Point

AI-Assisted

0%

No Abandonment

FRUSTRATION BARRIER

Psychological Obstacle

ELIMINATED

Key Finding #3: Configuration Accuracy

Metric / Device Type	Traditional	AI-Assisted	Improvement
EXPERIMENT 1: CONFIGURATION TEST (KNOWLEDGE)			
Mean Accuracy Score	65.31%	100%	53.1%
EXPERIMENT 2: INTERACTIVE SIMULATION (PRACTICAL)			
Router, Switch, Server, PC	100%	100%	Parity
Firewall Configuration	71.43%	100%	Error Free

The "Complexity Gap" Eliminated

While traditional methods achieve parity on standard devices, error rates spike on complex security configurations. AI-Assisted configuration maintained 100% accuracy even on the most difficult tasks (Firewalls), effectively eliminating the "complexity penalty" that affects human engineers.

Design-Reality Gap Analysis

Gap Points by Dimension



Gap Score (Higher = More Risk)

Critical Risk Zone

All assessed dimensions exceed the 40-point threshold, indicating a high probability of implementation failure without significant intervention.

40+

HIGH RISK THRESHOLD

Heeks' ITPOSMO Framework

- Critical Gap (>50)
- Severe Gap (40-50)
- Low Risk (<20)

The Training Paradox

Mission vs. Reality

Support for IPv6 Adoption

64 pp
Gap



Metric: Staff received training

Belief in AI Utility

50 pp
Gap



Metric: Current AI investment

Support for AI Pilot

62 pp
Gap



Metric: Budget actually allocated

The Execution Crisis

Organizations want to adopt,
but lack the capacity
to execute.

IMPLICATION:

Without bridging the ~58 point average gap between strategic intent and operational reality, technical tools like Net AI Copilot cannot be effectively deployed.

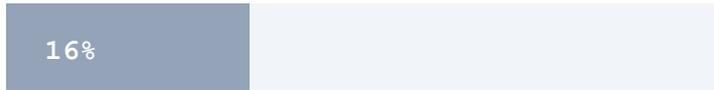
Hidden Barriers: Cognitive vs. Explicit



Prevalence of Barriers

Survey Response (N=50)

Resistance to Change (Explicit)



Fear of Complexity (Cognitive)



PREVALENCE RATIO

Cognitive > Explicit

2.9x



The Real Obstacle

Psychological vs. Political

The data reveals that the dominant barrier is not political resistance or policy, but a deep-seated psychological fear of technology they don't fully understand.

Political Barriers (Visible)



Psychological Barriers (Hidden)



CORE INSIGHT: Target the Mindset

Psychology

■ SYNTHESIS

Triangulated Findings Summary

RQ1: Cognitive

Generative AI dramatically reduces mental workload.

Engineers shift from high-stress cognitive processing to supervisory roles.

EVIDENCE (NASA-TLX)

↓ 65-72% Load Reduction

Effect size: $d = 1.18 - 1.88$

RQ2: Technical

Task efficiency improves by orders of magnitude.

Eliminates task abandonment barriers completely.

EVIDENCE (PERFORMANCE)

⚡ 97-99% Faster Time

✓ 0% Abandonment vs 28%

RQ3: Organization

Organizational readiness lags behind technical capability.

Training and vision gaps prevent effective adoption.

EVIDENCE (GAP ANALYSIS)

⚠ 42-56 Point Gaps

High Risk Zone (>40 points)



CORE INSIGHT

Technical solutions are necessary but not sufficient.

Success requires bridging the gap between AI capability and organizational capacity.

Key Takeaways

01



AI Works

Demonstrated 65-72% workload reduction and 97-99% time savings. Crucially, AI assistance resulted in zero task abandonment compared to nearly 30% failure rates with manual methods.

02



But Organizations Aren't Ready

Despite technical success, organizations face training infrastructure gaps, significant resource misalignment, and a disconnect between strategic vision and execution capabilities.

03



Success Requires Both

Technical solutions are necessary but not sufficient. Effective adoption requires pairing AI deployment with dedicated staff training, organizational investment, and change management.

Conclusion

"Technical Barriers or Organizational Readiness?"

**Both, but Organizational Readiness
is the Bottleneck.**

V

AI Works Effectively

Tools can solve the technical complexity challenges.

B

Absorption Capacity

Organizations cannot yet absorb these solutions.

!

The 56-Point Gap

Training deficiency is the single most critical barrier.

*

Parallel Investment

Success requires investing in both tools AND people.

Thank You

C

Tool Demo

Explore Net AI Copilot live:

ipv6.codakarta.com

D

Open Science

All experimental data & materials are publicly available.

@

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