AIORI 1

Internet Standards, Measurement &
Research Engagement Platform

Workshops | Hackathon | Symposium

Winter 2024

GENESIS SPARK

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THE IDEA

Future leadership in Internet requires a foundation of sustained technology advances that can enable the development of more capable, reliable, and lower-cost Internet technologies to achieve Internet Resilience goals.

Internet technology development foundation is needed to enhance readiness of new use cases, mitigate the technological risks initiating from the design of internet, improve the quality of Internet for all, and thereby contribute to better overall Internet penetration.

The foundational work is happening through creating workshops, hackathons, symposiums and has been wrapped under the umbrella of AIORI I which benefits all the stakeholders.

Partners

Host Institution Support

Local event management

- Accommodation for resource persons
- Banners and local promotions
- Conference Hall for 50 participants, Food, AV, Lab with Internet facility

IEEE IC IAYP Support

- Strategy development
- Coordination and execution
- Sponsor outreach
- Joint certification
- Participant screening and registration

IIFON Support

- Providing the AIORI Internet Measurement Platform (IMN) for Hackathon
- Managing the Hackathon program
- Travel support for two resource persons per workshop

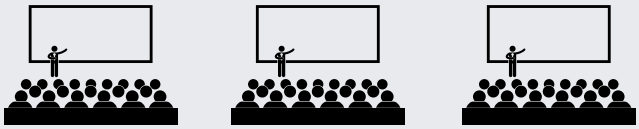
AIORI 1 – AT A GLANCE

Internet Standards, Measurement & Research Engagement Platform

Plan

Execution

1



Workshops

- 5 Locations
- 250 Participants

2

Remote

HACKATHON

Finale

- 2 Months
- 23 Teams
- 5 Problem Statements from (RFC 9606, 9411)
- 9 Teams
- 2 days
- 5 Finalists
- IIT Guwahati
- 2 Winning Teams

3

APSIMSS

Asia Pacific Symposium on Internet Measurement, Security & Standards

- 4 Tracks
- 20 Speakers
- IIT Guwahati

IETF Contributors

- 2 Winning Teams Participating IETF 122 Hackathon

1 WORKSHOPS

This workshop was designed to equip the aspiring engineers and faculties with the knowledge and skills to build the future of the internet. The workshops covered a comprehensive range of topics, providing a strong foundation on Internet engineering and standards principles. Following the workshops, participants were provided with the opportunity to apply their newfound knowledge in a thrilling hackathon.

portal.aiori.in/hackathon

Organized By IAYPC 2024 - IEEE India Council in collaboration with India Internet Foundation, NIXI with Host Partner Institutions

Organizing Team

Anand Raje
(Program Coordinator)
CTO, India Internet Foundation, Industry Member, IAYPC 2024 - IEEE India Council

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Assistant Professor, Department of EEE, St. Joseph's College of Engineering, Chennai Academia Member, IAYPC 2024 - IEEE India Council

Dr. Ruchika Gupta
Professor, Department of CSE, Chandigarh University, Punjab
Secretary - IAYPC 2024 - IEEE India Council

WORKSHOPS
REGIONAL VENUE SELECTION PROCESS

The Process

The workshop selection process consisted of seven steps and ran from July 01, 2024 to August 30, 2024. In its first edition, the committee opted for a zone-wise venue selection approach, identifying five geographic zones in India: East, West, North, South, and Northeast.

1. Submission of Expression of Interest for Regional Venues
2. Screening of Regional Venues
3. Announcement of Final Regional Venues
4. Announcements of Regional Workshop dates
5. Call for Participation in Standards Workshop
6. Last Date for Participants to Register in the AIORI Portal
7. Announcement of Final List of Participants in Each Regional Venue

Selected Regional Venues

18-SEP-24
CHENNAI

19-SEP-24
MUMBAI

21-SEP-24
DELHI

24-SEP-24
KOLKATA

26-SEP-24
GUWAHATI

EASTERN WORSHOP

St. Joseph College of Engineering, Chennai, Tamil Nadu

Key Speakers

18th Sep 2024

WESTERN WORSHOP

Sardar Patel Institute of Technology, Mumbai, Maharashtra

Key Speakers

19th Sep 2024

NORTHERN WORSHOP

Sharda University, Greater Noida, UP

Key Speakers

21st Sep 2024

EASTERN WORSHOP

Heritage Institute of Technology, Kolkata, West Bengal

Key Speakers

24th Sep 2024

NORTH-EASTERN WORSHOP

Assam Royal Global University, Guwahati, Assam

Key Speakers

26th Sep 2024

2 HACKATHON

A unique hackathon opportunity which enables the participants learning key nuances of Internet standards development process and its open source implementation in SDOs, like IETF. The hackathon brings both remote and physical hackathon experiences implementing global practices.

Remote

- 23 Teams
- 69 Participants
- 16 Universities
- 5 Problems
- 6 Weeks

Finale

- 9 Teams
- 27 Participants
- 7 Universities
- 2 Days
- 2 Winners

HACKATHON
PEOPLE BEHIND

Organizing Team & Mentors

Anand Raje
CTO, India Internet Foundation, Industry Member, IAYPC 2024 - IEEE India Council

Dr. John Jose Associate Professor, Department of CSE, IIT Guwahati, Vice-Chair, IEEE India Council

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Debayan Mukherjee
Research Associate
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Senior Cybersecurity Engineer
Bridge System and Service

Jury Members

Anupam Agrawal
Chair
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Dr. Indrajit De
Professor, IEM
Advisor, IIFON

Dr. Sundeep Oberoi
IIT Bombay

Speakers

Prof. T Venkatesh,
IIT Guwahati

Dr. John Jose , IIT Guwahati, Vice-Chair, IEEE India Council

Amrita Chowdhury,
Director, CCAOI

Mr. Abhijan Bhattacharyya,
TCS

Dr. Ratnajit Bhattacharjee, IIT Guwahati

Dr. Indrajit De
Professor, IEM
Advisor, IIFON

HACKATHON
THE STAGES

Problem Statements

1. Designing a Tool for Querying DNS Resolver Information **(RFC 9606)**
2. Automating Service Binding Discovery for Multi-Service Environments **(RFC 9461)**
3. Intrusion Detection/Prevention System (IDS/IPS) Throughput and Latency Benchmarking **(RFC 9411)**
4. Stateful vs. Stateless Filtering Performance Comparison **(RFC 9411)**
5. Measurement of Power Consumption in NSDs During High Load Traffic **(RFC 9411)**

Teams running for Hackathon

23 Registered Teams

10 Selected Teams

Teams	Problem Statement	Status
SecureNet Innovator	#3	Winner
Red Relay	#1	Winner
Throughput Thieves	#4	Finalist
Cyber Wizards	#3	Finalist
RAGNAROK	#3	Finalist
TEAM CARBONO	#5	Remote and Finale
Aarambh	#1	Remote and Finale
GeekBuddies	#3	Remote and Finale
Net Ninjas	#4	Remote and Finale
Bits	#1	Remote only

HACKATHON
THE WINNERS

Team:
SecureNet Innovators

Team Members:
- Nabhonil Bhattacharjee
- Sampurna Pyne and
- Raja Karmakar

Problem Statement: 3
Intrusion Detection/
Prevention System (IDS/IPS)
Throughput and Latency
Benchmarking, RFC 9606

Implementation:

Developed an end-to-end solution to reproducibly measure KPIs like latency, throughput, accuracy, etc while maintaining a controlled and contained environment, by producing pre-profiled network scenarios like regular traffic profile, attack traffic profile, high-load profile, etc

Team:
Red Relay

Team Members:
- Debarghya Bhattacharya
- Aditya Ghosh
- Dipankar Basu

Problem Statement: 1
Designing a Tool for Querying DNS
Resolver Information, RFC 9411.

Implementation:

Developed a web-based tool to visualise RESINFO DNS Record and compare various DNS servers on their Answers, DNSSEC implementation, etc, all at once.

3 APSIMSS

About

APSIMSS (**Asia Pacific symposium on Internet Measurement Security and Standards**) aimed to engage a diverse audience, including students, researchers, practitioners, and industry professionals from India and the Asia-Pacific region. The symposium was held in conjunction with the prestigious **IEEE ANTS Conference**, fostering interdisciplinary collaboration and knowledge exchange.

Detailed Agenda: https://portal.aiori.in/aiori-1/

At a Glance

When and where	18 December 2024 Indian Institute of Technology Guwahati (IIT Guwahati) , Assam, India
Participation in Numbers	Participants – 70+ Virtual Engagement – 170+
Theme	Internet Measurement, Security and Standards
Sessions	• Inaugurals • AIORI Showcase • Round table on Internet Standards and India's participation • Hackathon Team Presentations • Keynote Address 1 : Internet Measurement • Keynote address 2 : Internet Security and evolving technology. • Hackathon Valedictory Session
Objective	To bring together individuals from industry, academia and government to initiate a conversation on Internet Measurements, Security and Standards.
Key Takeaways	1. Internet Measurement as an AIORI initiative is required for the country and the initial efforts should be scaled upon to include different services on Internet and many more locations for measurement. 2. Work on Evolving cryptographic standards and transition to new protocols to create a more secure and reliable communication over internet 3. Increased participation from India in Global bodies like IETF, ICANN, APNIC, and others and interdisciplinary collaboration including participation and hosting of IETF in India.

APSIMSS
KEY DIGNITARIES

Shri Sushil Pal, Joint Secretary – IG Division, MeitY (Online)

Dr. Sundeep Oberoi, IIT Bombay

Mr. Samiran Gupta, Vice President, Stakeholder Engagement– APAC, ICANN

Mr. Geoff Houston, Chief Scientist, APNIC

Dr. Devesh Tyagi, CEO, NIXI (Online)

Dr. Tej Pratap, VC, Sri Sri University

Prof. Devendra Jalihal, Director, IIT Guwahati

Prof. Goutam Paul, ISI Kolkata

Prof. Charru Malhotra, IIPA

Mr. Deep Singh (Catla ISP)

Dr. Pimmy Gandotra, TSDSI

Dr. Ratnajit Bhattacharjee, IIT Guwahati

Anupam Agrawal, Chair, IIFON

Anand Raje, CTO, AIORI

SESSION
INAUGURALS

The inaugural session set the tone for APSIMSS 2024, with opening remarks from Mr. Anupam Agrawal, Chair, IIFON

Key Messages

Shri Sushil Pal, Joint Secretary, MeitY, a Leader in Digital Governance and Policy Innovation, presented virtually. Shri Pal shared his valuable insight on how AIORI Project is a “milestone for India’s role in internet governance” and the importance for more focus on internet measurement, security, and standards. He further stressed on India’s participation in Global forums and platforms and contributing to global bodies such as IETF, ICANN and APNIC and how it remains a top priority for the Government

Prof. Devendra Jalihal, Director, IIT Guwahati shared his perspective on India’s transition to a predominantly wireless access country and importance of standardization. He shared how India’s idea of low mobility large cell was adopted by the world. He mentioned the overall requirement of even lower latencies across our nation

Prof. Sukumar Nandi of IIT Guwahati highlighted the challenges of transitioning from IPv4 to IPv6 in India, emphasizing the need for seamless coexistence, user feedback, and ISP data to enhance service quality. He stressed the role of robust internet governance in addressing security concerns and advocated for active participation in hackathons to advance internet standards and foster a secure digital future.

SESSION
INAUGURALS

Shri Devesh Tyagi, CEO, NIXI, Leading Internet Governance and Digital Innovation in India, shared his thoughts on the growth of the digital world and increasing accessibility of Internet even in rural areas. He explained AIORI's infrastructural aspect and how it is contributing with monitoring and benchmarking and data that drives the government towards making informed decisions regarding internet governance, infrastructure and digital incubation initiatives.

Mr. Samiran Gupta, Vice President, Stakeholder Engagement, and Managing Director, Asia Pacific for ICANN, highlighted ICANN's role in improving the security, stability, and resilience of the internet, with specific projects on domain metrics and analysing maliciously registered domains.

Dr. Sundeep Oberoi, IIT Bombay shared three key insights from the Internet's evolution. Firstly, he stressed the need for adaptive methodologies to manage large-scale internet demands. Secondly, he highlighted the importance of robust global standards, noting that the success of the Internet is rooted in these standards, and the lack of interoperability represents a missed opportunity. Lastly, he advised India to actively participate in global forums to effectively influence policy decisions

Professor Taj Partap, Sri Sri University highlighted the growing role of the Internet, even in rural areas, where terms like "network" have become part of everyday vocabulary. He emphasized the need to incorporate modern technological skills, such as IoT and AI, into skill training programs, in line with India's educational policy. Additionally, he stressed the importance of building robust internet infrastructure across the country and the pivotal role universities play in preparing the workforce for an evolving tech landscape.

SESSION
ROUND TABLE ON STANDARDS

Speakers

Dr. Sundeep Oberoi
IIT Bombay

Dr. Ratnajit Bhattacharjee IIT Guwahati

Prof. Rabinarayan Satpathy
Sri Sri University

Mr. Deep Singh Catla
ISP

Dr. Pimmy Gandotra
TSDSI

Key Takeaways

The round table discussion on ICT Standards and India's Participation highlighted the need for a stronger role in global standardization efforts, addressing ground challenges, and leveraging growth opportunities. The Key takeaways are as follows:

- Academic researchers contribute significantly to defining technical standards globally and there is a significant lag in India. Increasing the participation of academia in standardization will ensure adaptability to diverse policy contexts and support the evolving digital landscape.

- Standardization is crucial for better data handling, reduced latency, and cybersecurity. The ISP sector's growth is hindered by poor adherence to standards. More coordinated policy efforts are needed to align industry practices with global standards.

- Encouraging students by providing support to contribute to ICT standards through hackathons and International Standards Development forums.

- Focus on integrating standardization efforts in emerging areas like IoT and rural broadband so that the

SESSION
KEYNOTES

Keynote 1 : Internet Measurements
Mr. Geoff Huston, Chief Scientist APNIC

The key points discussed by Mr. Geoff Huston were focused on increased IPv6 adoption and enhanced DNS security in India. He also mentioned how routing security is crucial in preventing malicious routing and India saw a huge push towards secure BGP routing with cryptographic signatures. Despite such measures, it is a concern to ensure active usage of these adoptions. He emphasized on the role of ads as it provides a way to measure internet usage on massive scale as virtually every internet user encounters these online advertisements. The massive reach enables us for large scale internet measurement research.

Keynote 2 : Internet Security
Dr. Goutam Paul, Associate Professor CSRU, ISI

Dr. Goutam Paul's speech pointed towards impact of quantum computing and cryptographic standards and migration to new standards involving PQC Migration that involves the process of transitioning from traditional cryptographic algorithms (e.g., RSA) to post-quantum algorithms. He also spoke on adapting systems and networks to accommodate new, quantum-resistant algorithms and how India and globally PQC systems are becoming critical in their infrastructure with ongoing efforts to integrate these systems into real world networks.

SESSION
AIORI Project Showcase

Mr. Anand Raje, CTO, AIORI started the AIORI showcase with an overview on the AIORI program and its components, supported by MeitY and NIXI and implemented by India Internet Foundation.

Technical Components

Anycast Testbed: A private cloud computing environment, deployed across India, it focuses on DNS research. The AIORI testbed helps in end to end measurements and evolving as a protocols development and troubleshoot testbed.

Anchor Network: SBC (Single Board Computer) based measurement devices deployed in 100 locations across India provide real time data on internet performance, enabling end to end network analysis. It's helpful in measuring from user locations.

These efforts combine to create a standard Internet measurement and standards development platform that can be used for troubleshooting, protocol testing and real-time monitoring. The second phase of AIORI focuses more on user experience and protocol development and testing platforms.

https://portal.aiori.in

References:

1. An Edge Computing Architecture for Internet Measurement Network to Measure and Analyze Protocol Data https://doi.org/10.1007/s42979-023-02267-1
2. The Internet Measurement Network (AIORI-IMN) https://doi.org/10.1109/I3CS58314.2023.10127255

SESSION
AIORI Project Showcase

The AIORI program aims to address this gap by providing accessible infrastructure for both researchers and industry stakeholders. The workshop and hackathon are to promote and sensitize this topic regarding Internet Measurement, Security and Standards.

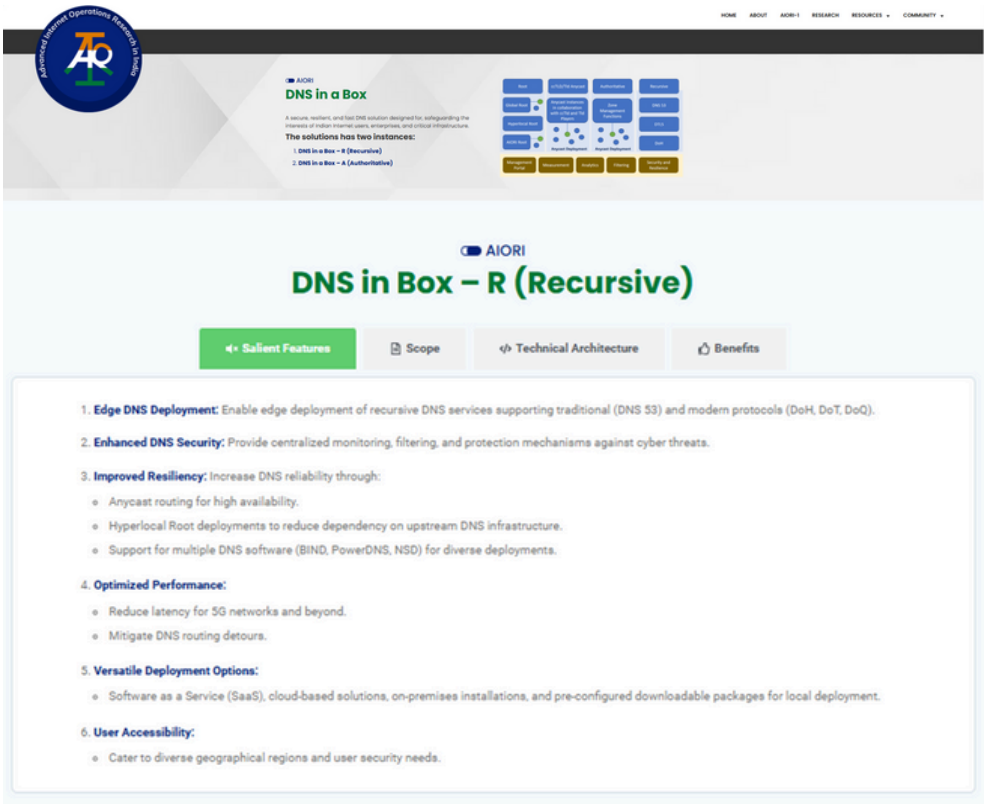
The AIORI program represents a significant initiative to improve internet measurement, security, and standards in India, with a focus on building a community-driven research network and tackling future challenges such as post-quantum cryptography and DNS resilience. The program's efforts aim to empower researchers, ISPs, and enterprises to enhance the overall quality and security of the internet infrastructure in India.

Call for Academic Institutions in India to collaborate

We need Internet engineering professionals who understand and work at the core of Internet infrastructure. As we transition into a fully digital society, it's essential to establish research and innovation centers focused on foundational Internet engineering. While AI and digital platforms depend on robust systems and networks, our progress in Internet standards development is lagging. If left unaddressed, this gap may lead to digital dependency on external entities, risking digital colonialism. Some of the key benefits in engaging with us:

- **Empowering Future Engineers and professionals** with hands-on skills in Internet infrastructure using AIORI-IMN platform, cybersecurity, and protocol engineering, enhancing employability and technical leadership in the Internet engineering domain.
- **Internet Measurement Hub** to research and remediate on Internet resiliency and availability issues for disaster prone regions.
- **Building Industry-Academia Collaboration** which will help Foster partnerships with industry, government, and international research organizations to bring cutting-edge practices and industry insights into academic research and curriculum.
- **Establishing a premier hub** for research, innovation, and capacity-building in Internet technologies, measurement, Critical Internet Infrastructure, standards, and cybersecurity within India.
- **Supporting Digital Transformation** in India by driving initiatives and innovations that support the nation's goals for secure, scalable, and inclusive Internet infrastructure, with particular focus on rural and underserved regions.

AIORI PRODUCT SHOWCASE
DNS IN A BOX & MOBILE APP



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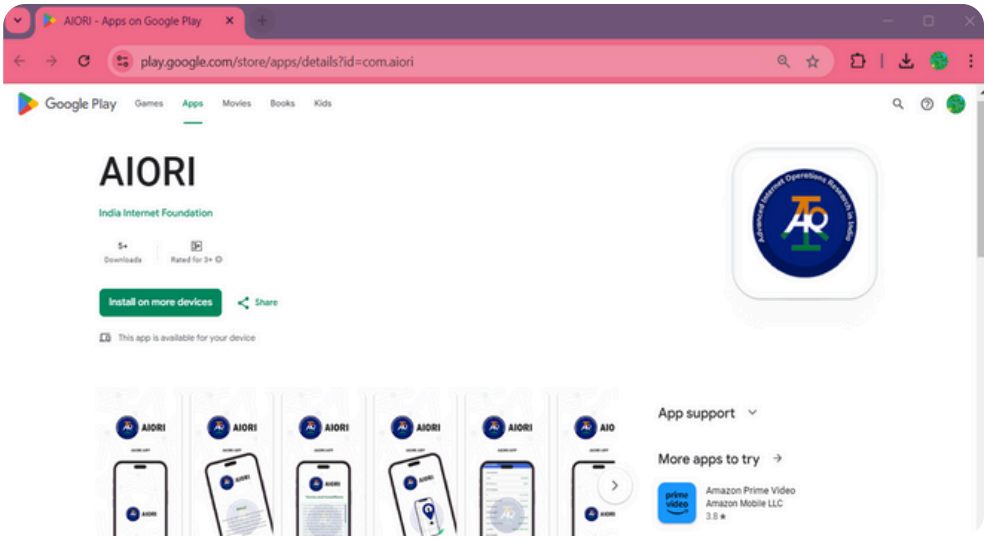
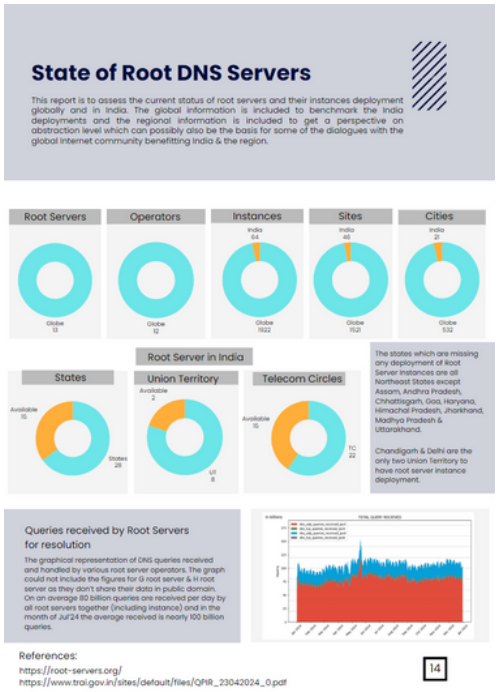


AIORI PRODUCT SHOWCASE
STATE OF INTERNET REPORT



4 IETF 122 HACKATHON PARTICIPATION

About

The AIORI-IMN team and AIORI 1 Hackathon winners worked on implementing RFC 8250 in AIORI-IMN platform and participated in IETF 122 hackathon as champions.

Project: Evaluating the Performance of Different DNS Server Software Implementations with PDM using AIORI IMN measurement platform

Presentation: https://datatracker.ietf.org/meeting/122/materials/slides-122-hackathon-sessd-evaluating-the-performance-of-different-dns-server-software-implementations-with-pdm-using-aiori-imn-measurement-platform-01

The Team

Objectives:

1. Implement RFC 8250 IPv6 Destination Option in AIORI-IMN platform.
2. Analyze the performance of different DNS Servers
3. Implementation - Linux module and eBPF, Scapy contribution (Client), PDM Python Package for DNS measurement
4. Setup of IPv6 DNS Testbed and making scenarios of traffic to measure and analyze.

Repos:

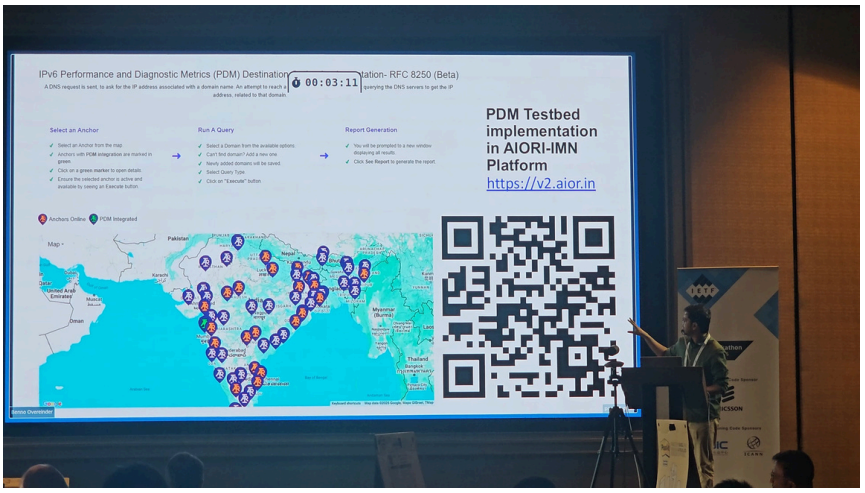
- https://github.com/indiainternetfoundation/IPv6PerformanceDiagnosticMetric
- https://github.com/indiainternetfoundation/py_measure_dns
- https://github.com/secdev/scapy/pull/4695

URLs:

1. AIORI Portal : https://portal.aiori.in
2. PDM Implementation: https://v2.aior.in/PDM

4 IETF 122 HACKATHON PARTICIPATION

Glimpses from IETF 122 Hackathon



AIORI 1
PARTNERS AND SUPPORTERS

NIXI

IEEE INDIA COUNCIL

IFON
India internet Foundation

भारतीय प्रौद्योगिकी संस्थान गुवाहाटी
Indian Institute of Technology Guwahati

IEEE ANTS™

Internet Society
India Kolkata Chapter

HERITAGE INSTITUTE OF TECHNOLOGY
KOLKATA

SARDAR PATEL INSTITUTE OF TECHNOLOGY

SHARDA UNIVERSITY
Beyond Boundaries
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AIORI - An Internet Measurement Platform

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