INDRAPRASTHA INSTITUTE *of*
INFORMATION TECHNOLOGY DELHI
(State University established by Govt. of NCT of Delhi)

Recommendation Letter for Mr. Neelanjan Sarkar
(To whomsoever this may concern)

I am very happy to recommend Neelanjan Sarkar, an exceptional final-year B.Tech student at IIIT Delhi, for a position on your Networking and Security Team. As Neelanjan's project supervisor, I worked closely with him and my PhD student, Jithin, on a research project re-evaluating the feasibility of Voice over IP (VoIP) over the Tor anonymization network. Neelanjan's technical brilliance, analytical precision, and outstanding contributions to this project make him an ideal candidate for a role in networking and security, where his skills in protocol analysis, performance optimization, and privacy-preserving systems will shine.

Our project extended prior work (published in Proceedings on Privacy Enhancing Technologies, 2020) that deemed Tor unsuitable for VoIP, citing latency and TCP limitations, with bandwidth as the presumed bottleneck. Neelanjan's work overturned this view with remarkable insight. Through extensive measurements, he discovered that high jitter variance, a metric overlooked by earlier studies, was the primary cause of degraded Perceptual Evaluation of Speech Quality (PESQ) scores. This critical finding shifted the focus to jitter-induced audio distortions, identifying a key performance bottleneck. Neelanjan's ability to pinpoint this through rigorous data analysis was a standout achievement, showcasing his potential to tackle complex networking challenges.

Neelanjan made solid technical contributions to the project, besides honing his skills for future endeavors. He mastered the Tor network, configuring circuits to route VoIP traffic while navigating anonymization constraints. He expertly handled the Session Initiation Protocol (SIP) to establish VoIP calls over Tor, demonstrating a deep understanding of signaling and real-time transport mechanisms. His analysis of TCP/IP packet behavior to trace jitter's impact on PESQ revealed a sophisticated grasp of network protocols. Using tools like iperf and ping, he measured bandwidth and latency with precision, ensuring our experiments were robust. These skills—spanning anonymization networks, protocol stacks, and performance measurement—are directly applicable to designing and securing high-performance networks.

Neelanjan also explored the impact of geolocation on VoIP performance, hypothesizing that endpoints farther from most Tor relays faced increased congestion, worsening jitter and PESQ. He validated this through experiments across diverse caller-callee locations, covering over 500,000 calls in 12 months. His findings on optimizing relay selection for latency-sensitive applications highlight his ability to address real-world networking issues, such as path optimization and congestion management. This work, grounded in large-scale data, underscores his readiness for roles requiring scalable, secure network solutions.

Neelanjan's collaboration and work ethic were equally strong. He worked seamlessly with Jithin, proposing sharp hypotheses, refining experiments, and presenting clear, data-driven findings. His rapid mastery of complex topics like Tor's architecture and VoIP protocols was remarkable, reflecting a drive to learn and innovate. Neelanjan's knack for turning raw data into actionable insights was pivotal to our project's success, a skill that will translate well to teams focused on network performance and security.

Neelanjan's expertise is tailor-made for a networking and security role. His experience debugging performance bottlenecks, analyzing protocols, and working with anonymization systems equips him to enhance low-latency, secure communication systems. His focus on privacy-preserving VoIP aligns with the need for robust, secure network architectures. His ability to handle large-scale measurements and derive meaningful insights positions him to excel in data-driven environments where network reliability and security are paramount.

I wholeheartedly endorse Neelanjan for a position on your team. He is a rare talent whose technical depth, problem-solving skills, and collaborative spirit will make an immediate impact. Please contact me at for further details. I am confident Neelanjan will excel in advancing your mission to build cutting-edge networking and security solutions.

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