

# Doug Montgomery

[Douglas.Montgomery@nist.gov](mailto:Douglas.Montgomery@nist.gov)

<https://www.nist.gov/people/doug-montgomery>

## Manager, Internet Technologies Research Group

[LinkedIn](#), [Google Scholar](#), [Research Gate](#)

### Supervisory Computer Scientist: National Institute of Standards and Technology

#### 1986 to Present:

I manage the [Internet Technologies Research Group](#) within the [Communications Technology Laboratory](#) (CTL) of the [National Institute of Standards and Technology](#) (NIST). In that role I provide technical leadership to NIST's current research and standardization efforts in [Trustworthy Networks](#), including Internet infrastructure protection; next-generation Internet technologies (e.g., IoT, IPv6, SDN / NFV); advanced security architectures and technologies (e.g., zero trust networks, applications of AI to network security and robustness); advanced security architectures for next generation wireless (e.g., 5G, O-RAN, 6G); and measurement, modeling, and analysis of behaviors within the critical network infrastructure.

I have been a leader in NIST's research in next-generation network technologies since 1986. While the advanced networking technologies under study have spanned a broad spectrum over my career at NIST (e.g., IP quality of service, Internet telephony, Internet security and key management, robust Internet routing / naming / addressing, mobile systems, programmable networks, optical networking, multi-protocol label switching, service discovery, pervasive computing, IP version 6, public safety communications, congestion control, cloud computing, quantum cryptography, zero trust networks, 5G / O-RAN security), the strategic plan has been consistent: to research and apply advanced test and measurement techniques to improve the quality and timeliness of new networking technologies that address identified national priorities and/or have the greatest potential for fueling broad-based innovation in the Internet.

The goals of our [Trustworthy Networks Research Program](#) are tightly aligned with identified national priorities outlined in the National Cybersecurity Strategy and Implementation Plan, National Strategy to Secure 5G, National Standards Strategy for Critical and Emerging Technology Technologies and Federal Cybersecurity Research and Development Strategic Plan.

The technical work in my group spans a wide range of activities including basic research, design and analysis of consensus standards, development of rapid prototypes, reference implementations and test tools for implementors, publication of guidance documents to foster adoption, design and operation of international conformance and interoperability testing programs to assist deployment.

I serve as the primary external representative for most of these efforts and have represented the work of my group to numerous industry, government, and academic audiences, including congressional committees, inter-agency groups, international governments, VCAT and NRC review panels as well as other agency collaborators. Examples of such interactions include House Science Committee, Federal CIO Council, Federal CIO, OSTP, NITRD, OMB, ONCD, ONDI, GSA, NTIA, FCC, CSRIC, Internet Engineering Task Force (IETF), North American Network Operators Group (NANOG), American Registry for Internet Numbers (ARIN), O-RAN Alliance, ATIS, ISO/IEC.

I current serve as co-chair of the NSTC Networking and Information Technology Research and Development (NITRD) Large Scale Networking Group and member of the executive committee for the Federal IPv6 Task Force as well as a participant in many other US Government inter-agency committees on networked information technology issues.

My management experience as a group leader at NIST includes managing a staff of computer scientists, electrical engineers, mathematicians, and administrative personnel engaged in a wide variety of research and support tasks. In the time that I have been a manager, the projects and programs in my group have been supported by DHS S&T, NSA, LTS, DARPA, NSF, OMB, GSA, NIST ATP, DISA, NIST NAMT, NIST OLES and NIST IMS research funds.

#### Current Areas of Work:

- The [Advanced Security Architectures for Next Generation Wireless](#) project works with mobile wireless, internet and virtual computing industry to improve the security and resilience of emerging designs for 5G / 6G core networks and radio access networks (RANs).
- The [Robust Inter-Domain Routing](#) project includes collaborative research with leading Internet companies to design and standardize technologies to improve the resilience and security of the Internet's global routing system.
- The [Zero Trust Networks](#) project seeks to define the basic principles of zero trust architectures and to develop standards and guidance for their implementation in modern enterprise environments and in the core infrastructure of next generation wireless networks.
- The [Trustworthy Intelligent Networks](#) project works with industry and academia to improve the trustworthiness and applicability of artificial intelligence and machine learning technologies to future networks and distributed systems.
- The [High Assurance Domains](#) project works with the IETF, Messaging Malware Mobile and Anti-Abuse Working Group (MAAWG), Department of Defense and the Federal CIO Council to research and develop new technologies to address key trust and security issues in enterprise networks.
- The [Software Defined and Virtual Networks](#) project works to develop test and measurement techniques to advance the state of the art in network virtualization, network service function chaining, software defined networks, technologies and techniques to address robustness and security of virtualized network services.
- The [Trustworthy Network of Things](#) project works with industry to design, standardize, test and foster adoption of network-centric approaches to protect IoT devices from the Internet and to protect the Internet from IoT devices.
- The [USGv6 Program](#) works with the IETF and Federal CIO community to provide technical leadership in standards profiles, product testing programs, and deployment guidance to foster the global transition to the next generation Internet Protocol (IPv6).
- The [Measurement Science for Complex Information Systems](#) project aims to develop and evaluate a coherent set of methods to understand behavior in complex information systems, such as the Internet, computational grids and computing clouds.

#### Awards:

- **2021 Dept of Commerce Gold Medal** - for outstanding contributions in the design, standardization, and widespread deployment of technologies that resolve critical vulnerabilities in the Internet's routing infrastructure.
- **2021 Dept of Commerce Bronze Medal** - for contributions to the design of the NIST publication review system.
- **2020 New Internet IPv6 Hall of Fame** - [Honored by the IPv6 Forum](#) for leading the [USGv6 Program](#) that provides the technical infrastructure necessary to drive USG adoption of IPv6 Technologies.
- **2020 ITL Best Standards Document Award** - For excellence in publication of the NIST SP 800-189 standard, "[Resilient Interdomain Traffic Exchange: BGP Security and DDoS Mitigation.](#)"
- **2019 Dept of Commerce Bronze Medal** - For technical contributions to DoC/DHS effort on [Enhancing the Resilience of the Internet and Communications Ecosystem Against Botnets and Other Automated, Distributed Threats.](#)

- **2019 Dept of Commerce Bronze Medal** - For leadership in NCCoE public/private collaborations that have advanced the security of national and global network infrastructures.
- **2018 ITL Outstanding Contribution Award** - for contributions to design, analysis, standards, prototyping, and measurement of new technologies to improve the [Robustness of Internet Inter-Domain Routing](#).
- **2018 ITL Outstanding Standards Document Award** - for design and specification of the BGPsec protocol and leading the publication of the International Standard "[BGPsec Protocol Specification](#)," IETF RFC 8205.
- **2013 Dept of Commerce Gold Medal** – Technical leadership in the development of the [USGv6 Program](#) fostering wide scale operational deployment of IPv6 in the USG.
- **2011 Dept of Commerce Gold Medal** – Technical leadership, in collaboration with NTIA, to [deploy DNSSEC](#) at the root of the global DNS.
- **2009 Dept of Commerce Gold Medal** – Technical leadership, in collaboration with GSA, to [deploy DNSSEC](#) in the .gov Top Level Domain.
- **2008 Federal 100 Award** – Technical leadership, in collaboration with OMB, in the [transition to IPv6](#).
- **2008 ITL Best Standards Contribution Award** – NIST SP on [BGP Security](#).
- **2007 ITL Best Journal Paper Award** – Attack Modeling on the [Global Routing System](#).
- **1993 Dept of Commerce Bronze Medal** – Technical leadership in testing frame relay technologies.

#### Prior Employment:

- University of Delaware, Newark DE.
- AAI Inc, Cockeysville MD.
- EMC Controls, Cockeysville MD.

#### Education:

- 1986 MS Computer and Information Sciences, University of Delaware.
  - Concentration in Computer Networking
  - UNIDEL Fellow – Sept 1983 – June 1984.
  - PhD Course Work – Sept 1985 – June 1986.
- 1983 BS Mathematics and Computer Science, Towson University.
  - MHS Computer Science Award – Outstanding Graduate

#### Security Clearances:

- Active Top-Secret Clearance (Dept of Commerce)

#### Select Recent Publications / Specifications:

- **NIST Publications:**
  - Borchert O., Lee K., Sriram K., Montgomery D., Gleichmann P., Adalier M., [BGP Secure Routing Extension \(BGP-SRx\): Reference Implementation and Test Tools for Emerging BGP Security Standards](#), NIST Technical Note 2060, September 2021.
  - Dodson D., Montgomery D., Ranganathan M., Souppaya M., Polk T., [Securing Small-Business and Home Internet of Things \(IoT\) Devices: Mitigating Network-Based Attacks Using Manufacturer Usage Description \(MUD\)](#), NIST Special Publication 800-15, May 2021.
  - Bardhan S., Hatada M., Filliben J., Montgomery D., Jia A., [An Evaluation Design for Comparing Netflow Based Network Anomaly Detection Systems Using Synthetic Malicious Traffic](#), NIST Technical Note, NIST TN-2142, March 2021.
  - Montgomery D., Johnson E., Newcombe M., Winters T., [USGv6 Test Methods: General Description and Validation](#), NIST Special Publication (NIST SP) - 500-281Br1, November 2020.
  - Montgomery D., Johnson E., Newcombe M., Winters T., [USGv6 Test Program Guide](#), NIST Special Publication, NIST SP-500-281Ar1, November 2020.

- Montgomery D., Carson M., Winters T., Newcombe M., Carlin T., [USGv6 Profile](#), NIST Special Publication, NIST SP-500-267Br1, November 2020.
  - Montgomery D., Carson M., Winters T., Newcombe M., Carlin T., [NIST IPv6 Profile](#), NIST Special Publication, NIST SP-500-267Ar1, November 2020.
  - Collaborators: University of New Hampshire Interoperability Laboratory, IPv6 Forum
  - Montgomery D., Nightingale S., Johnson E., Newcombe M., Winters T., [USGv6 Suppliers Declaration of Conformity](#), NIST Special Publication, NIST SP-500-281Ar1s, November 2020.
  - Montgomery D., Frankel S., Carson M., Winters T., Newcombe M., Carlin T., [USGv6 Capabilities Table](#), NIST Special Publication, NIST SP-500-267Br1s, November 2020.
  - Montgomery D., Frankel S., Carson M., Winters T., Newcombe M., Carlin T., [NISTv6 Capabilities Table](#), NIST Special Publication, NIST SP-500-267Ar1s, November 2020.
  - Sriram K., Montgomery D., [Resilient Interdomain Traffic Exchange: BGP Security and DDoS Mitigation](#), NIST SP 800-189, December 2019.
  - Bardhan S., Montgomery D., Filliben J., Heckert A., *A General Methodology for Deriving Network Propagation Models of Computer Worms*, Technical Note (NIST TN)--2035, February 2019.
  - Haag W., Montgomery D., Barker William\_C., Tan A., [Protecting the Integrity of Internet Routing: Border Gateway Protocol \(BGP\) Route Origin Validation](#), NIST Special Publication, NIST-SP-1800-14, July 2018.
- **Standards Specifications:**
    - Sriram K., Lubashev I., Montgomery D., [Source Address Validation Using BGP UPDATES, ASPA, and ROA \(BAR-SAV\)](#), IETF Internet Draft (Standards Track, SIDROPS Working Group), September 2023.
    - Sriram K., Montgomery D., [AS Hijack Detection and Mitigation](#), IETF Internet Draft (Standards Track, SIDROPS Working Group), July 2023.
    - Sriram K., Montgomery D., Haas J., [Enhanced Feasible-Path Unicast Reverse Path Filtering](#), IETF RFC 8704, February 2020.
    - Sriram K., Montgomery D., [Design Discussion and Comparison of Protection Mechanisms for Replay Attack and Withdrawal Suppression in BGPsec](#), IETF Internet Draft, October 2019.
    - Borchert O., Montgomery D., Kopp D., [BGPsec Validation State Signaling](#), IETF SIDROPS Working Group, October 2019.
    - Sriram K., Borchert O., Montgomery D., [Origin Validation Policy Considerations for Dropping Invalid Routes](#), IETF Internet Draft (Standards Track, SIDROPS Working Group), November 2018.
    - Sriram K., Montgomery D., McPherson D., Osterweil E., Dickson B., [Problem Definition and Classification of BGP Route Leaks](#), Internet Engineering Task Force, RFC7908, June 2016.
  - **Journal Publications:**
    - Wang Z., Guo Y., Montgomery D., [Machine Learning-Based Algorithmically Generated Domain Detection](#), Computers and Electrical Engineering, Volume 100, May 2022.
    - Sriram V., Montgomery D., [Design and analysis of optimization algorithms to minimize cryptographic processing in BGP security protocols](#), Computer Communications, volume 106, pages 75-85, July 2017.
    - Sriram K., Montgomery D., Borchert O., Kim O., Kuhn D.R., [Study of BGP Peering Session Attacks and Their Impacts on Routing Performance](#), IEEE Journal on Selected Areas in Communications: Special issue on High-Speed Network Security, Vol. 24, No. 10, pp. 1901-1915, October 2006.
    - Montgomery D., Murphy S., [Toward Secure Routing Infrastructures](#), Security & Privacy, IEEE, vol.4, no.5, pp.84,87, September 2006.
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  - **Conference Publications:**
    - Zha Z., Wang A., Guo Y., Montgomery D., Chen S., [BotSifter: An SDN-based Online Bot Detection Framework in Data Centers](#), IEEE CNS 2019, June 2019.

- Ranganathan M., Montgomery D., El Mimouni O., [Soft-MUD : Implementing Manufacturer Usage Descriptions on Openflow SDN Switches](#), International Conference On Networking, 2019, March 2019.
- Zha Z., Wang A., Guo Y., Montgomery D., Chen S., [Instrumenting Open vSwitch with Monitoring Capabilities: Designs and Challenges](#), ACM SOSR 2018, March 2018.
- Wang A., Guo Y., Chen S., Hao F., Lakshman T.V., Montgomery D., Sriram K., [vPROM: VSwitch enhanced programmable measurement in SDN](#), IEEE ICNP 2017, October 2017.
- Sriram K., Gleichmann P., Kim Y.T., Montgomery D., [Enhanced Efficiency of Mapping Distribution Protocols in Scalable Routing and Addressing Architectures](#), Proceedings of the IEEE ICCCN 2010, Zurich, August 2010.
- Sriram K., Borchert O., Kim O., Gleichmann P., Montgomery D., [A Comparative Analysis of BGP Anomaly Detection and Robustness Algorithms](#), Proceedings of the Cybersecurity Applications and Technology Conference for Homeland Security (CATCH), Washington D.C., March 2009.
- K. Sriram, P. Gleichmann, Y.T. Kim, and D. Montgomery, [Enhanced Efficiency of Mapping Distribution Protocols in Scalable Routing and Addressing Architectures](#), Proceedings of the IEEE ICCCN 2010, Zurich, August 2010.
- J-W Jung, M. Ranganathan, D. Montgomery, H. Kahng, [Performance evaluation of two layered mobility management using mobile IP and session initiation protocol](#), IEEE Globecom 2003, Pg. 1190-1194 vol. 3.
- B. Kim, Y. Cho, J. Lee, Y. Choi, D. Montgomery, [Performance of optical burst switching techniques in multi-hop networks](#), IEEE Globecom 2002, Pg. 2772-2776 vol. 3.
- M. Ranganathan, V. Schaal, V. Galtier, D. Montgomery, [Mobile streams: A middleware for reconfigurable distributed scripting](#), Proceedings IEEE Third International Symposium on Mobile Agents, 1999, Pg 162-175.
- C. Kim, Y. Kim, D. Montgomery, [Fairness-guaranteed per-class-type queueing and hierarchical packet scheduling for DiffServ-aware-MPLS network](#), IEEE Globecom 2004, Pg. 1718-1722 Vol. 3.
- M. Ranganathan, M. Bednarek, D. Montgomery, [A reliable message delivery protocol for mobile agents](#), Springer Berlin/Heidelberg - Agent Systems, Mobile Agents, and Applications, 2000, Pg. 511-543.
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