

Fujun He

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Research interest

My research interest lies in modeling and algorithm design for communication and computer networks. At a high level, I work on bridging the theoretical approaches and the practical applications. My goal is to achieve reliable, cost-effective, flexible, scalable, and intelligent networks by leveraging techniques from optimization, queueing theory, graph theory, and machine learning. Recently, my work focuses on network virtualization/softwarization, optical networks, and artificial intelligence for network control.

Education

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| Oct. 2017 – Sept. 2020 | Ph.D. in Informatics
Kyoto University, Kyoto, Japan
Supervisor: Prof. Eiji Oki |
| Sept. 2014 – June 2017 | M.E. in Optical Engineering
University of Electronic Science and Technology of China, Chengdu, China
Supervisor: Prof. Yong Liu |
| Sept. 2010 – July 2014 | B.E. in Electronic Science and Technology
University of Electronic Science and Technology of China, Chengdu, China |

Employment history

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| Oct. 2020 – Apr. 2022 | Program-Specific Researcher | Kyoto University, Kyoto, Japan |
| Oct. 2017 – Sept. 2020 | Research Assistant | Kyoto University, Kyoto, Japan |

Visiting

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| July 2016 – Aug. 2016 | Visiting student | Hong Kong Baptist University, Hong Kong, China |
| Apr. 2015 – Mar. 2016 | Exchange student | The University of Electro-Communications, Tokyo, Japan |

Grants

1. Robust Optimization for Resource Allocation in Cloud Providers
Funding agency: JSPS Grant-in-Aid for Early-Career Scientists
Grant number: [21K17733](#)
Duration: Apr. 2021 – Mar. 2024
Role: Principal Investigator
Amount: 4,290,000 JPY

Services

1. **Reviewer:** IEEE/ACM Transactions on Networking (ToN), IEEE Transactions on Network and Service Management (TNSM), IEEE Communications Letters, IEEE Access, IEEE NetSoft 2021, IEEE/IFIP NOMS 2022
2. **TPC member:** IEEE NetSoft 2021, IEEE/IFIP NOMS 2022

Awards

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| 2020 | IEEE ComSoc Student Grant at IEEE ICC |
| 2019 | Excellent Paper Award at IEEE HPSR |

Invited talks

1. F. He, "Resource allocation in network virtualization," Departmental Colloquium CCE, Kyoto University, Kyoto, Japan, Oct. 2019.

Publications

Journal papers

- [J33] **F. He** and E. Oki, "Shared protection-based virtual network embedding over elastic optical networks," *IEEE Transactions on Network and Service Management*, early access, May 2022, doi: 10.1109/TNSM.2022.3178350.
- [J32] S. Yanase, **F. He**, H. Taka, and E. Oki, "Migration model for distributed server allocation," *IEICE Transactions on Communications*, 2022. (Accepted)
- [J31] M. Ito, **F. He**, K. Yokouchi, and E. Oki, "Robust optimization model for primary and backup capacity allocations against multiple physical machine failures under uncertain demands in cloud," *IEICE Transactions on Communications*, 2022. (Accepted)
- [J30] M. Ito, **F. He**, and E. Oki, "Backup resource allocation of virtual machines for probabilistic protection under capacity uncertainty," *IEICE Transactions on Communications*, advance online publication, Jan. 2022, doi: 10.1587/transcom.2021EBP3144.
- [J29] M. Zhu, **F. He**, and E. Oki, "Resource allocation model against multiple failures with workload-dependent failure probability," *IEEE Transactions on Network and Service Management*, early access, Dec. 2021, doi: 10.1109/TNSM.2021.3135906.
- [J28] Y. Zhang, **F. He**, and E. Oki, "Service mapping and scheduling with uncertain processing time in network function virtualization," *IEEE Transactions on Cloud Computing*, early access, Dec. 2021, doi: 10.1109/TCC.2021.3132008.
- [J27] Y. Zhang, **F. He**, and E. Oki, "Service chain provisioning with sub-chain-enabled coordinated protection to satisfy availability requirements," *IEEE Transactions on Network and Service Management*, early access, Nov. 2021, doi: 10.1109/TNSM.2021.3124920.
- [J26] S. Yanase, **F. He**, and E. Oki, "Approximation algorithms to distributed server allocation with preventive start-time optimization against server failure," *IEEE Networking Letters*, vol. 3, no. 4, pp. 191–195, Dec. 2021.
- [J25] M. Zhu, **F. He**, and E. Oki, "Optimization model for primary and backup resource allocation with workload-dependent failure probability," *IEEE Transactions on Network and Service Management*, vol. 19, no. 1, pp. 452–471, Mar. 2022.
- [J24] R. Kang, **F. He**, and E. Oki, "Virtual network function allocation in service function chains using backups with availability schedule," *IEEE Transactions on Network and Service Management*, vol. 18, no. 4, pp. 4294–4310, Dec. 2021.
- [J23] M. Ito, **F. He**, and E. Oki, "Robust optimization model for probabilistic protection with multiple types of resources," *IEEE Transactions on Network and Service Management*, vol. 18, no. 4, pp. 4711–4729, Dec. 2021.
- [J22] M. Zhu, **F. He**, and E. Oki, "Optimization model for multiple backup resource allocation with workload-dependent failure probability," *IEEE Transactions on Network and Service Management*, vol. 18, no. 3, pp. 3733–3752, Sept. 2021.
- [J21] **F. He** and E. Oki, "Backup allocation model with probabilistic protection for virtual networks against multiple facility node failures," *IEEE Transactions on Network and Service Management*, vol. 18, no. 3, pp. 2943–2959, Sept. 2021.
- [J20] R. Kang, **F. He**, and E. Oki, "Robust virtual network function allocation in service function chains with uncertain availability schedule," *IEEE Transactions on Network and Service Management*, vol. 18, no. 3, pp. 2987–3005, Sept. 2021.
- [J19] **F. He** and E. Oki, "Main and secondary controller assignment with optimal priority policy against multiple failures," *IEEE Transactions on Network and Service Management*, vol. 18, no. 4, pp. 4391–4405, Dec. 2021.
- [J18] **F. He**, T. Sato, B. C. Chatterjee, T. Kurimoto, S. Urushidani, and E. Oki, "Robust optimization model for primary and backup resource allocation in cloud providers," *IEEE Transactions on Cloud Computing*, early access, Jan. 2021, doi: 10.1109/TCC.2021.3051018.
- [J17] **F. He** and E. Oki, "Unavailability-aware shared virtual backup allocation for middleboxes: a queueing approach," *IEEE Transactions on Network and Service Management*, vol. 18, no. 2, pp. 2388–2404, June 2021.
- [J16] Y. Hirano, **F. He**, T. Sato, and E. Oki, "Preventive start-time optimization to determine link weights against probabilistic link failures," *IEEE Transactions on Network and Service Management*, vol. 18, no. 2, pp. 2275–2293, June 2021.
- [J15] R. Kang, **F. He**, T. Sato, and E. Oki, "Virtual network function allocation to maximize continuous available time of service function chains with availability schedule," *IEEE Transactions on Network and Service Management*, vol. 18, no. 2, pp. 1556–1570, June 2021.
- [J14] R. Fujita, **F. He**, and E. Oki, "Analytical model of middlebox unavailability under shared protection allowing multiple backups," *IEICE Transactions on Communications*, advance online publication, Mar. 2021, doi: 10.1587/transcom.2020EBP3176.

- [J13] S. Yanase, S. Masuda, **F. He**, A. Kawabata, and E. Oki, "Heuristic approach to distributed server allocation with preventive start-time optimization against server failure," *IEICE Transactions on Communications*, advance online publication, Feb. 2021, doi: 10.1587/transcom.2020EBP3145.
- [J12] R. Fujita, **F. He**, and E. Oki, "Shared backup resource assignment for middleboxes considering server protection capabilities," *Computer Networks*, vol. 186, no. 107734, pp. 1-15, Feb. 2021.
- [J11] T. Korikawa, A. Kawabata, **F. He**, and E. Oki, "Packet processing architecture with off-chip last level cache using interleaved 3D-stacked DRAM," *IEICE Transactions on Communications*, vol. E104-B, no. 2, pp. 149-157, Feb. 2021.
- [J10] T. Sato, **F. He**, E. Oki, T. Kurimoto, and S. Urushidani, "Experiment and availability analytical model of cloud computing system based on backup resource sharing and probabilistic protection guarantee," *IEEE Open Journal of the Communications Society*, vol. 1, pp. 700-712, 2020.
- [J9] T. Sawa, **F. He**, A. Kawabata, and E. Oki, "Algorithms for distributed server allocation problem," *IEICE Transactions on Communications*, vol. E103-B, no. 11, pp. 1341-1352, Nov. 2020.
- [J8] T. Korikawa, A. Kawabata, **F. He**, and E. Oki, "Packet processing architecture using last-level-cache slices and interleaved 3D-stacked DRAM," *IEEE Access*, vol. 8, pp. 59290-59304, 2020.
- [J7] R. Fujita, **F. He**, T. Sato, and E. Oki, "Shared backup resource assignment for middleboxes," *Optical Switching and Networking*, vol. 37, 2020.
- [J6] Y. Hirano, **F. He**, T. Sato, and E. Oki, "Backup network design against multiple link failures to avoid link capacity overestimation," *IEEE Transactions on Network and Service Management*, vol. 17, no. 2, pp. 1254-1267, June 2020.
- [J5] Y. Zhang, **F. He**, T. Sato, and E. Oki, "Network service scheduling with resource sharing and preemption," *IEEE Transactions on Network and Service Management*, vol. 17, no. 2, pp. 764-778, June 2020.
- [J4] T. Sawa, **F. He**, T. Sato, B. C. Chatterjee, and E. Oki, "Defragmentation with reroutable backup paths in toggled 1+1 protection elastic optical networks," *IEICE Transactions on Communications*, vol. E103-B, no. 3, pp. 211-223, 2020.
- [J3] **F. He**, T. Sato, and E. Oki, "Optimization model for backup resource allocation in middleboxes with importance," *IEEE/ACM Transactions on Networking*, vol. 27, no. 4, pp. 1742-1755, Aug. 2019.
- [J2] T. Korikawa, A. Kawabata, **F. He**, and E. Oki, "Carrier-scale packet processing architecture using interleaved 3D-stacked DRAM and its analysis," *IEEE Access*, vol. 7, pp. 75500-75514, 2019.
- [J1] B. C. Chatterjee, **F. He**, E. Oki, A. Fumagalli, and N. Yamanaka, "A span power management scheme for rapid lightpath provisioning and releasing in multi-core fiber networks," *IEEE/ACM Transactions on Networking*, vol. 27, no. 2, pp. 734-747, Apr. 2019.

Conference papers

- [C49] H. Taka, **F. He** and E. Oki, "Service placement and user assignment in multi-access edge computing with base-station failure," in *Proceedings of IEEE/ACM International Symposium on Quality of Service (IWQoS)*, Online, June 2022. (Acceptance rate = 24.3%)
- [C48] N. Kita, **F. He** and E. Oki, "Unavailability-aware backup allocation model for middleboxes with two-stage shared protection," in *Proceedings of IEEE International Conference on Network Softwarization (NetSoft)*, Milan, Italy, June 2022.
- [C47] K. Yokouchi, **F. He** and E. Oki, "Backup resource allocation model with two-stage probabilistic protection," in *Proceedings of IEEE International Conference on Network Softwarization (NetSoft)*, Milan, Italy, June 2022.
- [C46] J. Zhang, **F. He**, and E. Oki, "Service deployment on shared virtual network functions with flow partition," in *Proceedings of IEEE International Conference on Communications (ICC)*, Online, May 2022.
- [C45] R. Kang, **F. He**, and E. Oki, "Resilient virtual network function allocation with diversity and fault tolerance considering dynamic requests," in *Proceedings of IEEE/IFIP Network Operations and Management Symposium (NOMS)*, Online, Apr. 2022.
- [C44] M. Zhu, **F. He**, and E. Oki, "Robust function deployment against uncertain recovery time with workload-dependent failure probability," in *Proceedings of IEEE Consumer Communications & Networking Conference (CCNC)*, Online, Jan. 2022.
- [C43] K. Akahoshi, **F. He**, and E. Oki, "Service deployment model with virtual network function resizing," in *Proceedings of IEEE Global Communications Conference (Globecom)*, Online, Dec. 2021.
- [C42] M. Zhu, **F. He**, and E. Oki, "Demonstration of reliable resource management controller in Kubernetes," in

- Proceedings of 17th International Conference on IP + Optical Network (iPOP)*, Online, Sept. 2021. (Demo)
- [C41] **F. He** and E. Oki, “Robust virtual network function deployment against uncertain traffic arrival rates,” in *Proceedings of IEEE International Conference on Network Softwarization (NetSoft)*, Online, June 2021. (Full paper acceptance rate = 20.2%)
 - [C40] M. Zhu, R. Kang, **F. He**, and E. Oki, “Implementation of backup resource management controller for reliable function allocation in Kubernetes,” in *Proceedings of IEEE International Conference on Network Softwarization (NetSoft)*, Online, June 2021. (Demo)
 - [C39] R. Kang, M. Zhu, **F. He**, and E. Oki, “Implementation of virtual network function allocation with diversity and redundancy in Kubernetes,” in *Proceedings of IFIP Networking Conference*, Online, June 2021. (Demo)
 - [C38] S. Horimoto, **F. He**, and E. Oki, “Delay-aware backup resource allocation with probabilistic protection for network services,” in *Proceedings of IEEE International Conference on High Performance Switching and Routing (HPSR)*, Online, June 2021.
 - [C37] R. Kang, **F. He**, and E. Oki, “Resilient resource allocation model in service function chains with diversity and redundancy,” in *Proceedings of IEEE International Conference on Communications (ICC)*, Online, June 2021.
 - [C36] Y. Zhang, **F. He**, and E. Oki, “Availability-aware service chain provisioning with sub-chain-enabled coordinated protection,” in *Proceedings of IFIP/IEEE International Symposium on Integrated Network (IM)*, Online, May 2021.
 - [C35] M. Ito, **F. He**, and E. Oki, “Robust optimization for probabilistic protection with primary and backup allocations under uncertain demands,” in *Proceedings of 17th International Conference on the Design of Reliable Communication Networks (DRCN)*, Online, Apr. 2021.
 - [C34] M. Zhu, **F. He**, and E. Oki, “Load balancing model under multiple failures with workload-dependent failure probability,” in *Proceedings of 17th International Conference on the Design of Reliable Communication Networks (DRCN)*, Online, Apr. 2021.
 - [C33] R. Kang, M. Zhu, **F. He**, T. Sato, and E. Oki, “Design of scheduler plugins for reliable function allocation in Kubernetes,” in *Proceedings of 17th International Conference on the Design of Reliable Communication Networks (DRCN)*, Online, Apr. 2021. (Demo)
 - [C32] M. Zhu, **F. He**, and E. Oki, “Multiple backup resource allocation with workload-dependent failure probability,” in *Proceedings of IEEE Global Communications Conference (Globecom)*, Online, Dec. 2020.
 - [C31] M. Ito, **F. He**, and E. Oki, “Robust optimization for probabilistic protection with multiple types of resources in cloud,” in *Proceedings of IEEE 8th International Conference on Cloud Networking (CloudNet)*, Online, Nov. 2020.
 - [C30] R. Kang, **F. He**, and E. Oki, “Optimal virtual network function placement in chains using backups with availability schedule,” in *Proceedings of IEEE 8th International Conference on Cloud Networking (CloudNet)*, Online, Nov. 2020.
 - [C29] M. Zhu, **F. He**, and E. Oki, “Optimal primary and backup resource allocation with workload-dependent failure probability,” in *Proceedings of 11th International Conference on Information and Communication Technology on Convergence (ICTC)*, Online, Oct. 2020.
 - [C28] S. Yanase, **F. He**, and E. Oki, “Heuristic approach to distributed server allocation with preventive start-time optimization against server failure,” in *Proceedings of 11th International Conference on Information and Communication Technology on Convergence (ICTC)*, Online, Oct. 2020.
 - [C27] R. Kang, **F. He**, T. Sato, and E. Oki, “Demonstration of service function chain allocation with network service header,” in *Proceedings of 16th International Conference on IP + Optical Network (iPOP)*, Online, Sept. 2020.
 - [C26] E. Oki, T. Sawa, **F. He**, T. Sato, and B. C. Chatterjee, “Performance of hitless defragmentation with rerouting for quasi 1+1 protected elastic optical networks,” in *International Conference on Transparent Optical Networks (ICTON 2020)*, Online, July 2020. (Invited paper)
 - [C25] **F. He** and E. Oki, “Load balancing model against multiple controller failures in software defined networks,” in *Proceedings of IEEE International Conference on Communications (ICC)*, Online, June 2020. **IEEE ComSoc Student Grant**
 - [C24] R. Fujita, **F. He**, and E. Oki, “Shared backup resource assignment for middleboxes considering server capability,” in *Proceedings of IEEE International Conference on High Performance Switching and Routing (HPSR)*, Online, May 2020.
 - [C23] S. Masuda, **F. He**, A. Kawabata, and E. Oki, “Distributed Server Allocation Model with Preventive Start-Time Optimization Against Single Failure,” in *Proceedings of IEEE International Conference on High Performance Switching and Routing (HPSR)*, Online, May 2020.

- [C22] **F. He** and E. Oki, "Unavailability-aware shared virtual backup allocation model for middleboxes," in *Proceedings of IEEE/IFIP Network Operations and Management Symposium (NOMS)*, Online, Apr. 2020.
- [C21] Y. Zhang, **F. He** and E. Oki, "Network service mapping and scheduling under uncertain processing time," in *Proceedings of IEEE/IFIP Network Operations and Management Symposium (NOMS)*, Online, Apr. 2020.
- [C20] R. Kang, **F. He**, T. Sato, and E. Oki, "Demonstration of network service header based service function chain application with function allocation model," in *Proceedings of IEEE/IFIP Network Operations and Management Symposium (NOMS)*, Online, Apr. 2020. (Demo)
- [C19] M. Ito, **F. He**, and E. Oki, "Robust optimization model for probabilistic protection under uncertain virtual machine capacity in cloud," in *Proceedings of 16th International Conference on the Design of Reliable Communication Networks (DRCN)*, Online, Mar. 2020.
- [C18] **F. He**, T. Sato, and E. Oki, "Survivable virtual network embedding model with shared protection over elastic optical network," in *Proceedings of IEEE 7th International Conference on Cloud Networking (CloudNet)*, Coimbra, Portugal, Nov. 2019.
- [C17] Y. Hirano, **F. He**, T. Sato, and E. Oki, "Preventive start-time optimization to determine link weights against multiple link failures," in *Proceedings of IEEE 7th International Conference on Cloud Networking (CloudNet)*, Coimbra, Portugal, Nov. 2019.
- [C16] T. Sawa, **F. He**, A. Kawabata, and E. Oki, "Polynomial-time algorithm for distributed server allocation problem," in *Proceedings of IEEE 7th International Conference on Cloud Networking (CloudNet)*, Coimbra, Portugal, Nov. 2019.
- [C15] R. Kang, **F. He**, T. Sato, and E. Oki, "Virtual network function allocation to maximize continuous available time of service function chains," in *Proceedings of IEEE 7th International Conference on Cloud Networking (CloudNet)*, Coimbra, Portugal, Nov. 2019.
- [C14] T. Sawa, **F. He**, T. Sato, B.C. Chatterjee, and E. Oki, "Defragmentation considering link congestion in toggled 1+1 path protected elastic optical networks," in *Proceedings of 24th OptoElectronics and Communications Conference/Photonics in Switching and Computing (OECC/PSC)*, Fukuoka, Japan, July 2019.
- [C13] Y. Zhang, **F. He**, T. Sato, and E. Oki, "Optimization of network service scheduling with resource sharing and preemption," in *Proceedings of IEEE International Conference on High Performance Switching and Routing (HPSR)*, Xi'an, China, May 2019. **Excellent paper award**
- [C12] T. Korikawa, A. Kawabata, **F. He**, and E. Oki, "Packet processing architecture with off-chip llc using interleaved 3D-stacked DRAM," in *Proceedings of IEEE International Conference on High Performance Switching and Routing (HPSR)*, Xi'an, China, May 2019.
- [C11] R. Fujita, **F. He**, T. Sato, and E. Oki, "Optimization of backup resource assignment for middleboxes," in *Proceedings of IEEE International Conference on High Performance Switching and Routing (HPSR)*, Xi'an, China, May 2019.
- [C10] **F. He**, T. Sato, and E. Oki, "Probabilistic protection model for virtual networks against multiple facility node failures," in *Proceedings of 15th International Conference on IP + Optical Network (iPOP)*, Kanagawa, Japan, May 2019.
- [C9] Y. Zhang, **F. He**, T. Sato, and E. Oki, "Flexible scheduling approach for network services in virtual networks," in *Proceedings of 15th International Conference on IP + Optical Network (iPOP)*, Kanagawa, Japan, May 2019.
- [C8] **F. He**, T. Sato, and E. Oki, "Master and slave controller assignment model against multiple failures in software defined network," in *Proceedings of IEEE International Conference on Communications (ICC)*, Shanghai, China, May 2019.
- [C7] **F. He**, T. Sato, and E. Oki, "Backup resource allocation model for virtual networks with probabilistic protection against multiple facility node failures," in *Proceedings of 15th International Conference on the Design of Reliable Communication Networks (DRCN)*, Coimbra, Portugal, Mar. 2019.
- [C6] T. Sawa, **F. He**, T. Sato, B.C. Chatterjee, and E. Oki, "Defragmentation using reroutable backup paths in toggled 1+1 path protected elastic optical networks," in *Proceedings of 24th Asia-Pacific Conference on Communications (APCC)*, Ningbo, China, Nov. 2018.
- [C5] **F. He**, T. Sato, and E. Oki, "Optimization model for backup resource allocation in middleboxes," in *Proceedings of IEEE 7th International Conference on Cloud Networking (CloudNet)*, Tokyo, Japan, Oct. 2018.
- [C4] T. Sato, **F. He**, E. Oki, T. Kurimoto, and S. Urushidani, "Implementation and testing of failure recovery based on backup resource sharing model for distributed cloud computing system," in *Proceedings of IEEE 7th International Conference on Cloud Networking (CloudNet)*, Tokyo, Japan, Oct. 2018.
- [C3] Y. Hirano, **F. He**, T. Sato, and E. Oki, "Backup network design scheme for multiple link failures to avoid

overestimating link capacity,” in *Proceedings of IEEE International Conference on High Performance Switching and Routing (HPSR)*, Bucharest, Romania, June 2018.

- [C2] **F. He**, T. Sato, B. C. Chatterjee, T. Kurimoto, S. Urushidani, and E. Oki, “Robust optimization model for backup resource allocation in cloud provider,” in *Proceedings of IEEE International Conference on Communications (ICC)*, Kansas City, USA, May 2018.
- [C1] T. Korikawa, A. Kawabata, **F. He**, and E. Oki, “Carrier-scale packet processing system using interleaved 3D-stacked DRAM,” in *Proceedings of IEEE International Conference on Communications (ICC)*, Kansas City, USA, May 2018.

Technical reports and local workshop papers (no peer review)

- [W2] **F. He**, T. Sato, and E. Oki, “Backup resource allocation model against multiple controller failures in software defined network,” at *Photonic Network Workshop*, Otaru, Japan, Aug. 2019.
- [W1] **F. He**, T. Sato, B. C. Chatterjee, T. Kurimoto, S. Urushidani, and E. Oki, “Mix integer linear programming model for backup resource allocation in cloud provider,” at *Photonic Network Workshop*, Kobe, Japan, July 2018.

Patents

- [P3] T. Korikawa, A. Kawabata, E. Oki, and **F. He**, “Packet processing device and its memory access control method and program,” Japan Patent No. P2021-018510A, Feb. 2021. (In Japanese)
- [P2] T. Korikawa, A. Kawabata, E. Oki, and **F. He**, “Information processing device and its memory access control method and program,” Japan Patent No. P2021-018509A, Feb. 2021. (In Japanese)
- [P1] T. Korikawa, A. Kawabata, E. Oki, and **F. He**, “Packet processing device and its memory access control method,” Japan Patent No. P2019-200698A, Nov. 2019. (In Japanese)