Fujun He

Email: fujunhe@ieee.org Website: fujunhe.github.io

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

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 GPA: 3.81/4.00

Employment history

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

Visiting

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

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

[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)