# 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 would like to bridge 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: 1) resource allocation in network virtualization/softwarization; 2) routing and spectrum allocation in optical networks; 3) artificial intelligence in network management.

## 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 |
| | GPA: 3.81/4.00 |

## Employment history

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|---|---|---|
| Oct. 2020 – present | 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
   (a) Funding agency: JSPS Grant-in-Aid for Early-Career Scientists
   (b) Duration: Apr. 2021 – Mar. 2023
   (c) Role: Principal Investigator
   (d) Amount: 4,290,000 JPY

## Services

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

## 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*

[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*, 2021. (Accepted)

[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*, early access, May 2021, doi: 10.1109/TNSM.2021.3079937.

[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*, early access, Apr. 2021, doi: 10.1109/TNSM.2021.3075458.

[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*, early access, Apr. 2021, doi: 10.1109/TNSM.2021.3076511.

[J19] **F. He** and E. Oki, "Master and slave controller assignment with optimal priority policy against multiple failures," *IEEE Transactions on Network and Service Management*, early access, Mar. 2021, doi: 10.1109/TNSM.2021.3 064646.

[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 impor-

tance," *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 system using interleaved 3D-stacked DRAM," *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*

[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)*, 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)*, 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*, 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)*, 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)*, 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)*, 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 Communica-

*tions (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)