





Computational issue for access networks — Computation offloading and transaction in 5G and beyond

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Convergence of computation and communication

Computing and communicating will be anywhere in 5G and beyond

Computing services (IoT, fintech, AI, etc.)

Computing resources (device, edge, cloud)

Communication networks (5G, 6G, Wi-Fi, etc.) 🗠 💫 🔒 🌜 🖓 🖓 🛣 🔟 🖻



Computing services deployed in edges or clouds for data processing and management (PaaS or SaaS)



Underlying computing infrastructures in devices, edges (MEC) and clouds (IaaS)



Customized data communication and computing awareness enhanced by new tech. (IPv6+, SRv6+, etc.)

laaS: Infrastructure as a service PaaS: Platform as a service SaaS: Software as a service

MEC: Multi-access Edge Computing SR: Segment Route SDN: software-defined network



Computation offloading for access networks



MEC: Multi-access Edge Computing IDC: Internet Data Centre

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Scenario A: Access network offloads computing tasks toward edges and/or clouds

Offloading schedules based on capabilities of computation (energy cost, speed, volume, task, etc.) and communication (bandwidth, time delay, jitter, packet loss, determinacy, etc.)





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Computation offloading for access networks (cont.)



MEC: Multi-access Edge Computing IDC: Internet Data Centre Scenario B: Multiple access networks may offload computing task toward the same edges and/or clouds



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5Gⁿ[±] * * ± K

Computation offloading while single operator



MEC: Multi-access Edge Computing IDC: Internet Data Centre Scenario C: Access network, computing resources & services are managed by a single operator



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Computation offloading while single operator (cont.)

Devices (in local area networks)



Issues to be considered:

- A single operator usually has limited general strength to establish and operate whole of computing resources & services in edges and/or clouds for access networks;
- It is a natural strategy for them to keep open and invite third parties to participate relevant businesses;
- In this case, how to guarantee the data security and PII privacy and regulatory compliance, and let the participants trust the operation.

MEC: Multi-access Edge Computing IDC: Internet Data Centre PII: Personal Identifiable Information Scenario C: Access networks, computing resources and services are managed by a single operator



5Gⁿ_{it * * ± K}

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Computation offloading while multiple operators



MEC: Multi-access Edge Computing IDC: Internet Data Centre Scenario D: Access networks, computing resources & services are established and managed by multiple operators respectively



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5Gⁿ[±] * * ± K

Computation offloading while multiple operators (cont.)

Devices (in local area networks)



Issues to be considered:

- Multiple operators usually mean multiple dealmakers for computation offloading management;
- If adopting multiple dealmakers, how to guarantee the offloading is efficient, effective and fair ?
- New technologies (such as AI, blockchain), tools and strategies should be introduced to enhance the offloading scheduling.

MEC: Multi-access Edge Computing IDC: Internet Data Centre Scenario D: Access network, computing resources & services are established and managed by multiple operators respectively



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5Gⁿ¹¹ * * * * * *

A more trustworthy computation offloading framework



CS: computing service, APP: application, SDN: software-defined networking



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Standardization activities and suggestions



ITU-T Y.2501 (2021): Computing power network – Framework and architecture ITU-T Y.CNC-TP-arc: Requirements and functional architecture of transaction platform in CNC network (formerly CPN)



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Standardization activities and suggestions (cont.)

Standardization activities

SG2

 ITU-T M.rcpnm: Requirements for Computing Power Network Management ···

SG11:

 ITU-T Q.CPN: Signaling requirements for Computing power Network ···

SG13:

- ITU-T Y.2501 (2021): Computing Power Network framework and architecture
- ITU-T Y.ARA-CPN: Computing power authentication scheduling architecture ···

SG17:

 ITU-T TR.cpn-col-sec: Security consideration of collaboration of multiple computing power networks ···



Security issues of collaboration of C3



From draft ITU-T TR.cpn-col-sec (SG17)

C3: Convergence of Communication and Computation



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Standardization suggestions

- Keep close collaboration among the study groups involved in this topic, liaisons or new JCA;
- Consider the security, privacy and trust issues and standardization of convergence of communication and computation;
- Share best practices of convergence of communication and computation in 5G and beyond.

C3: Convergence of Communication and Computation



5Gⁿ_{it * * ± K}

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