Quo vadis, 5G?

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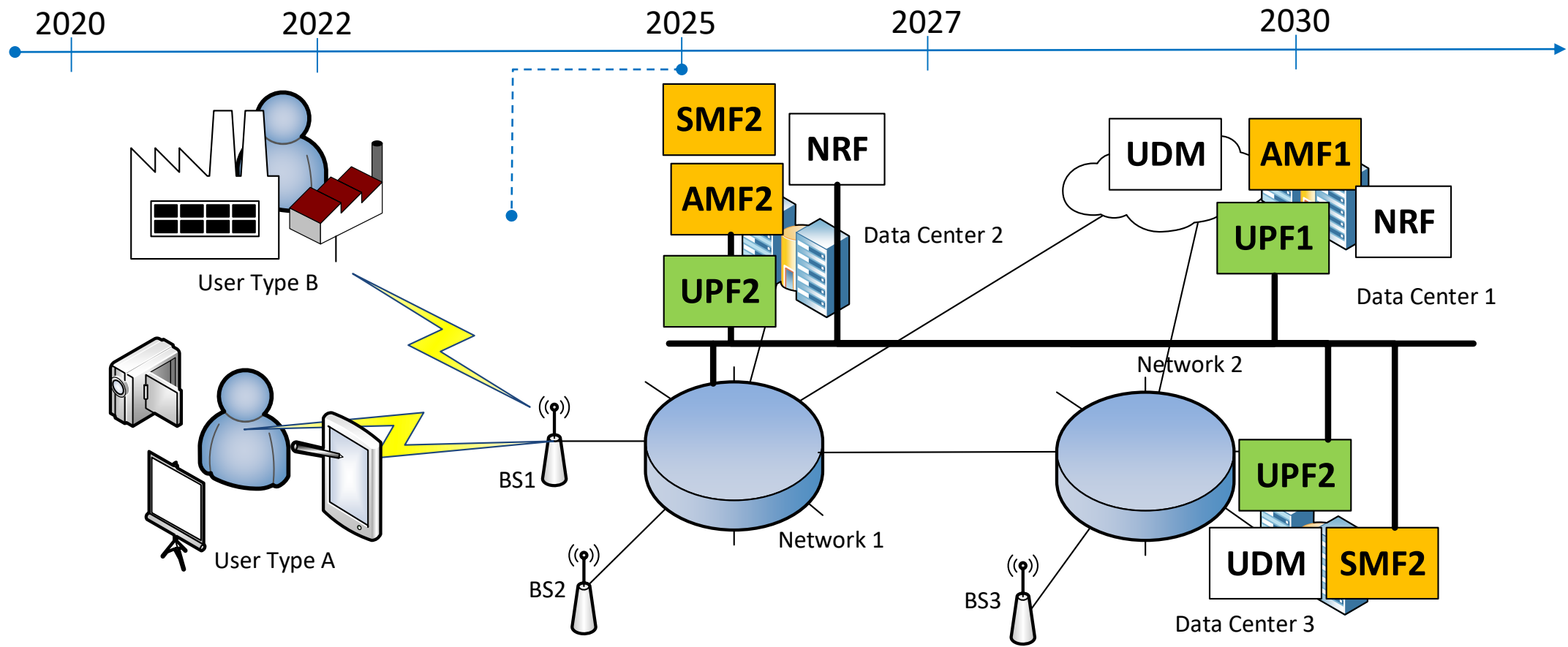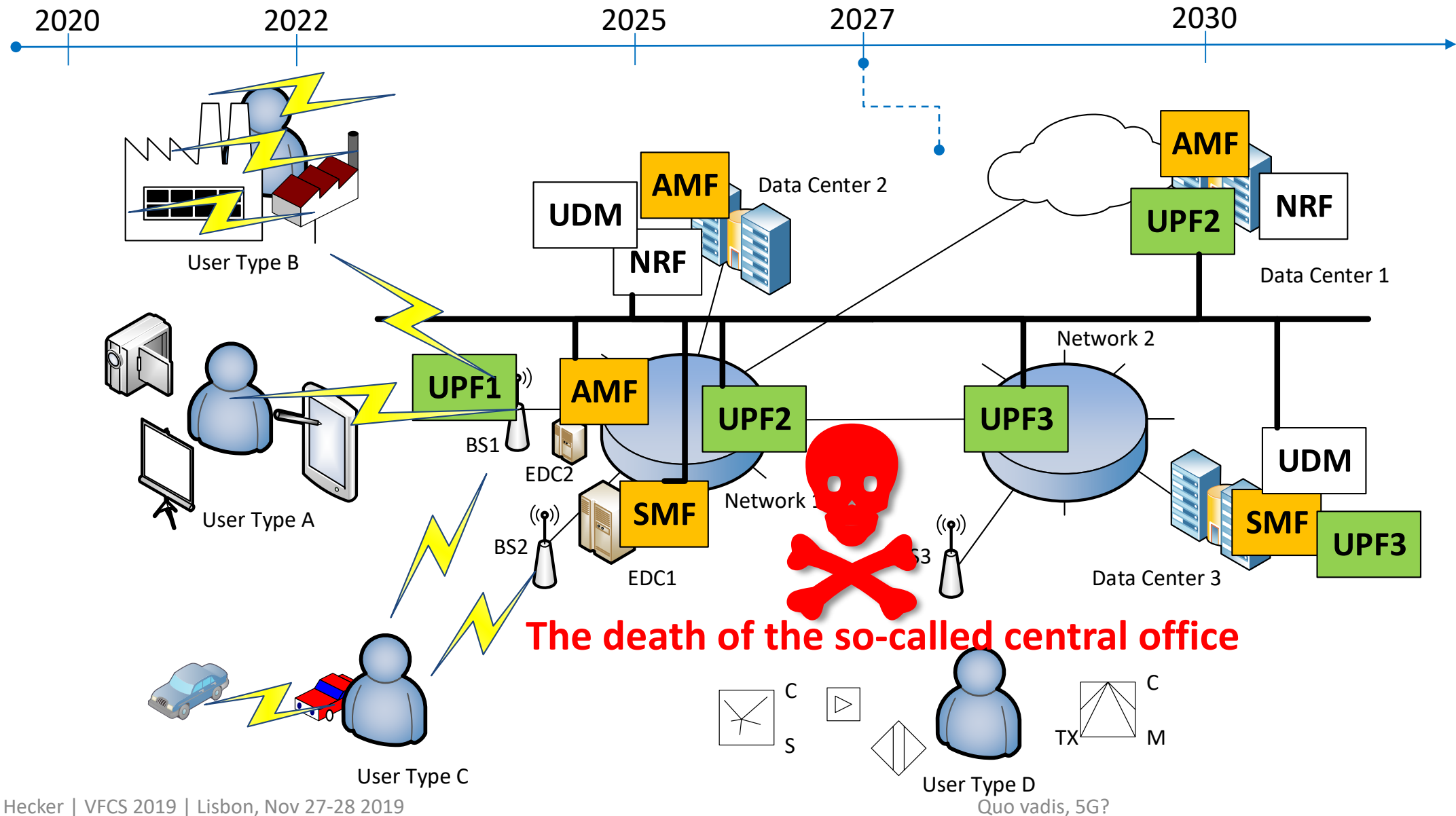
Operational mobile network evolution

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The death of the so-called central office
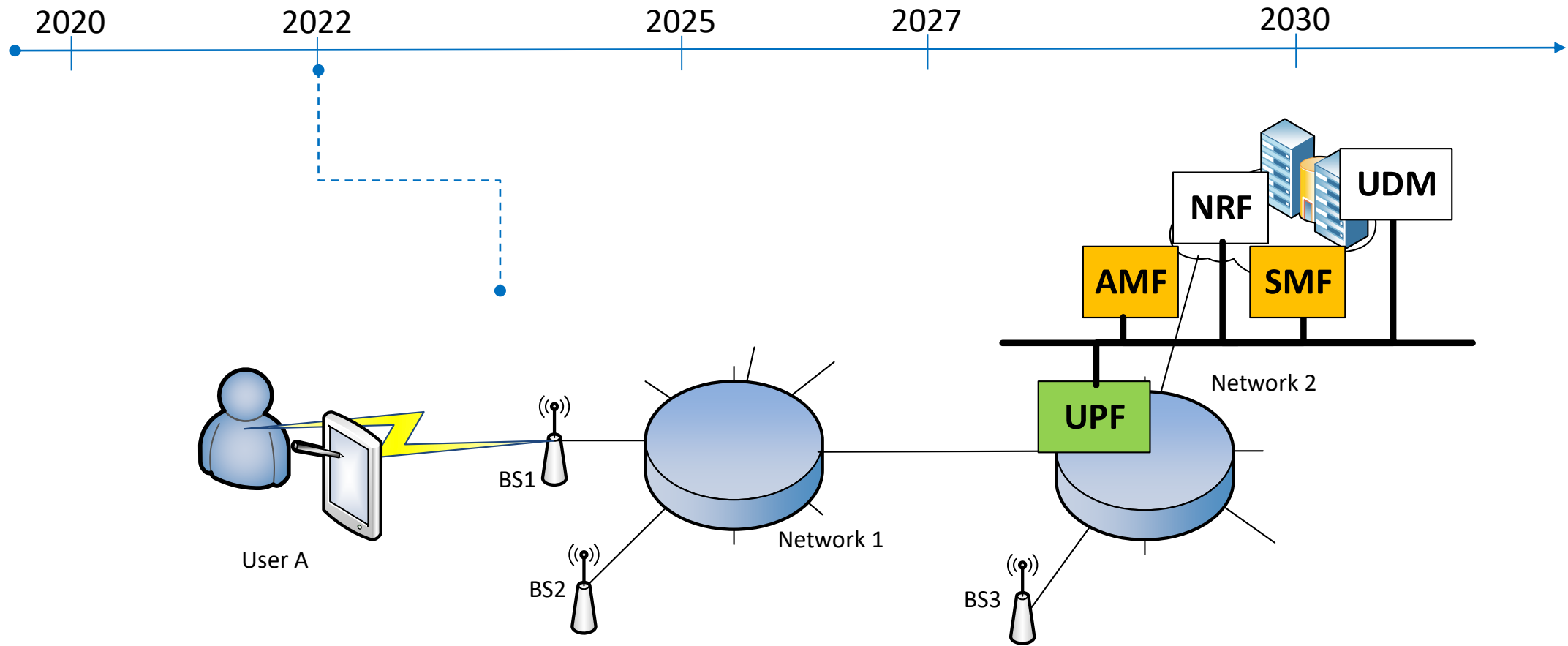
What should the future mobile system achieve?

2020   2022   2025   2027   2030

Service flexibility

Currently:
- Flexibility contradicts efficiency
- Efficiency thwarts correctness
- Correctness limits flexibility

None of these are fundamental

⭐ **Future Mobile System**

Resource efficiency

Execution correctness
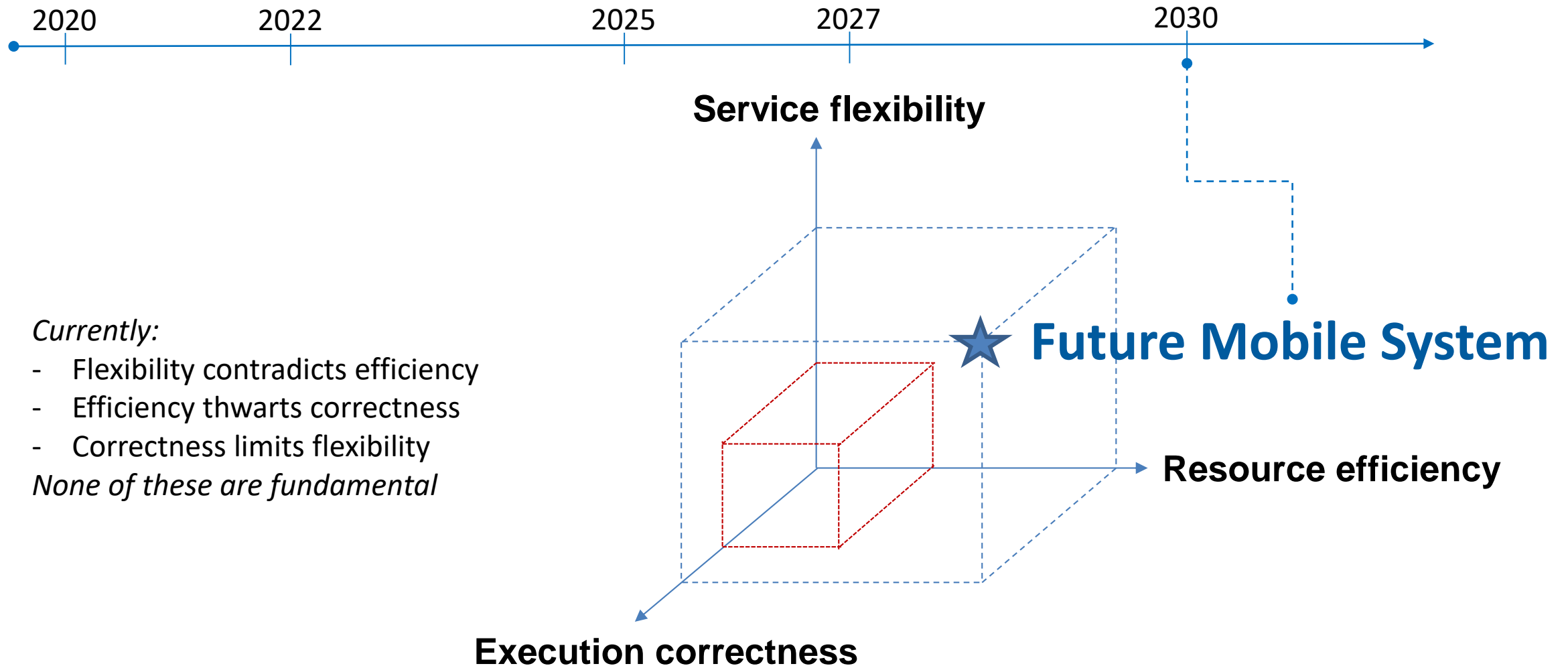
Extending Service Flexibility
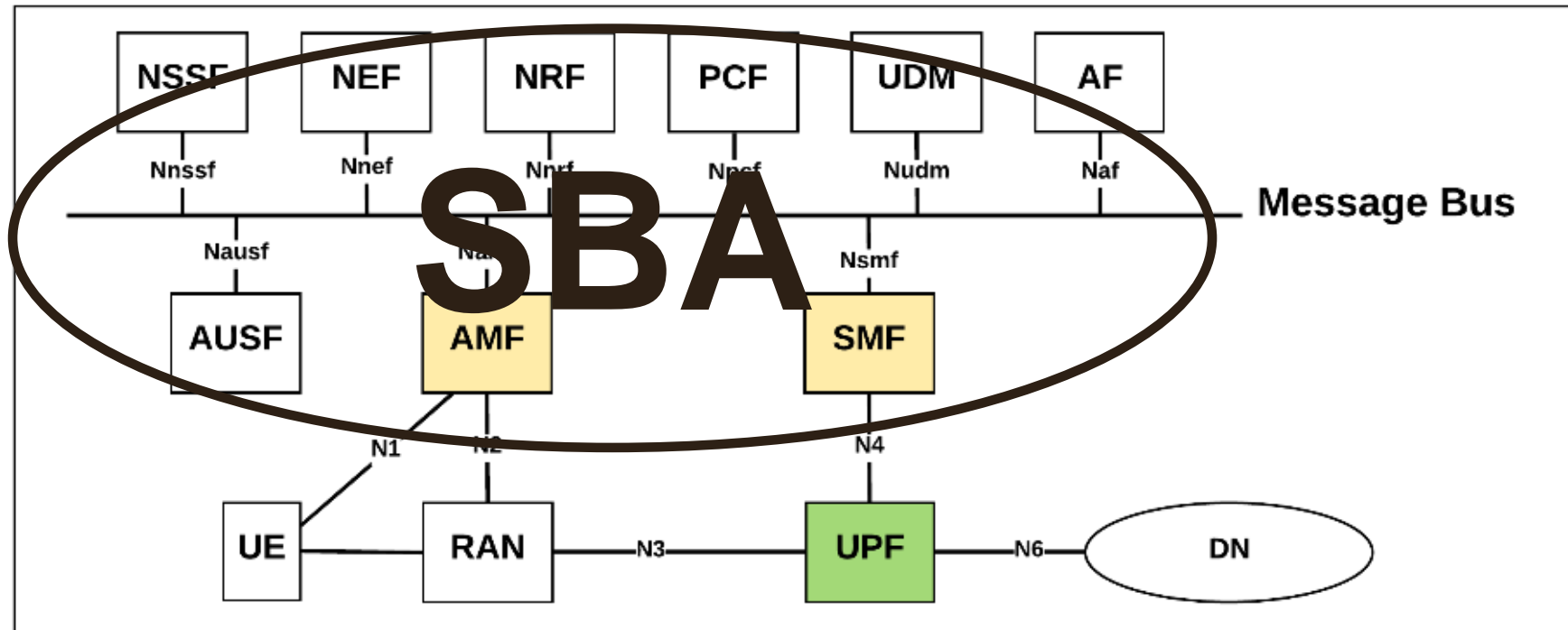
What ultimately matters is the service provided to the end user, not to the operator
➜ We need to finally switch to a fully user-centric paradigm

Improving Resource Efficiency

How to dynamically
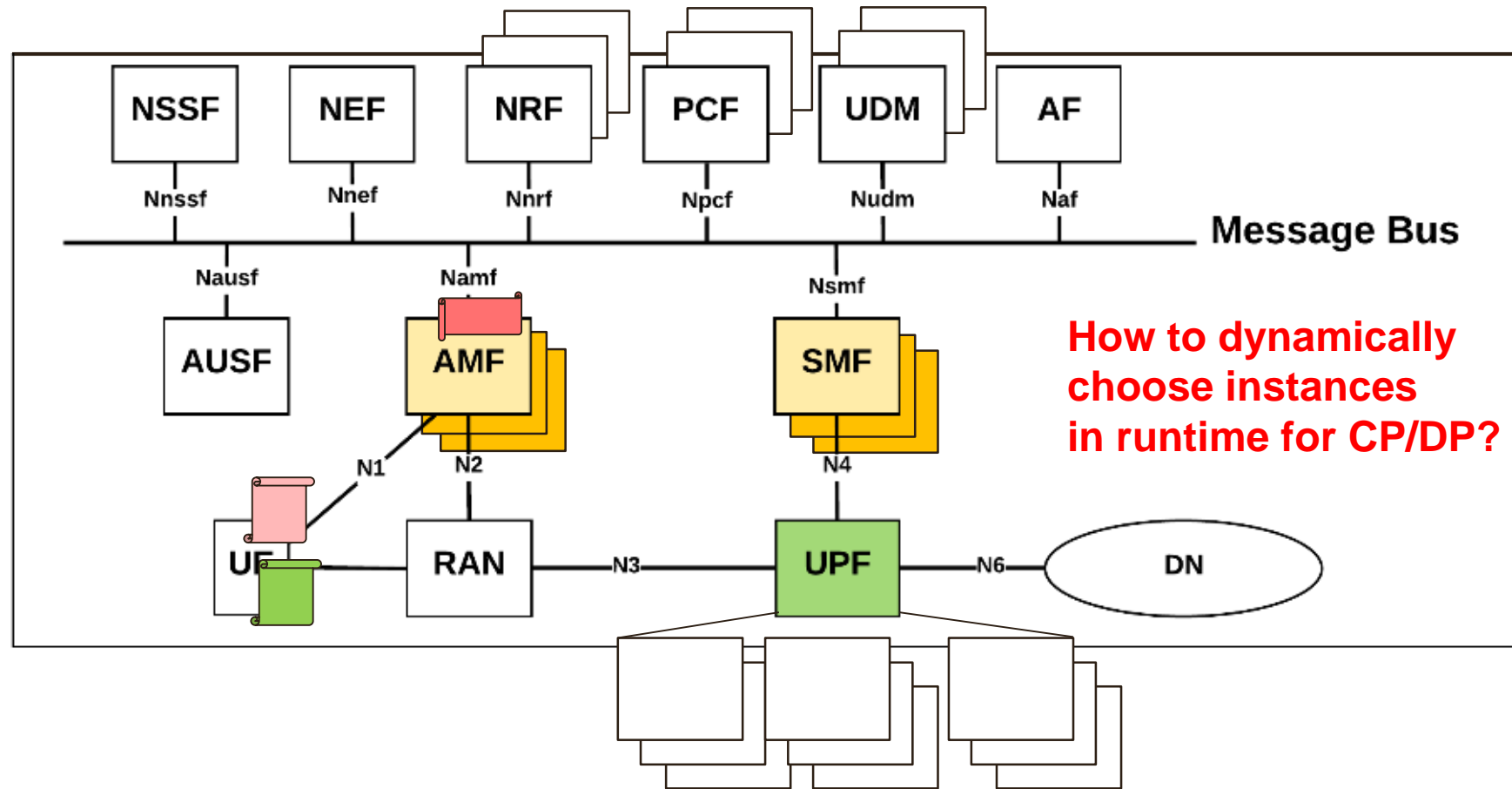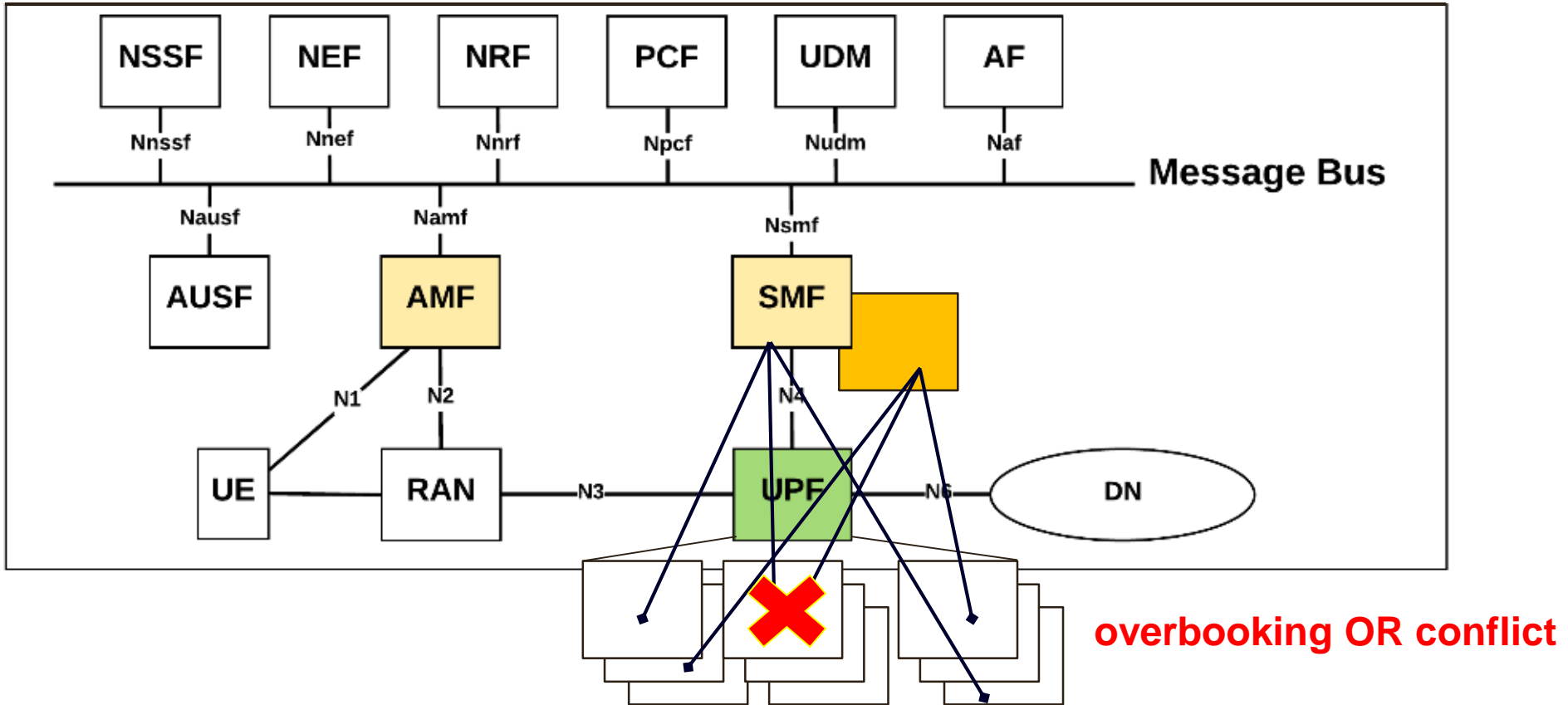choose instances
in runtime for CP/DP?

Planning approaches are not suitable here
➔ Non-local runtime scheduling is a fundamental problem to be solved

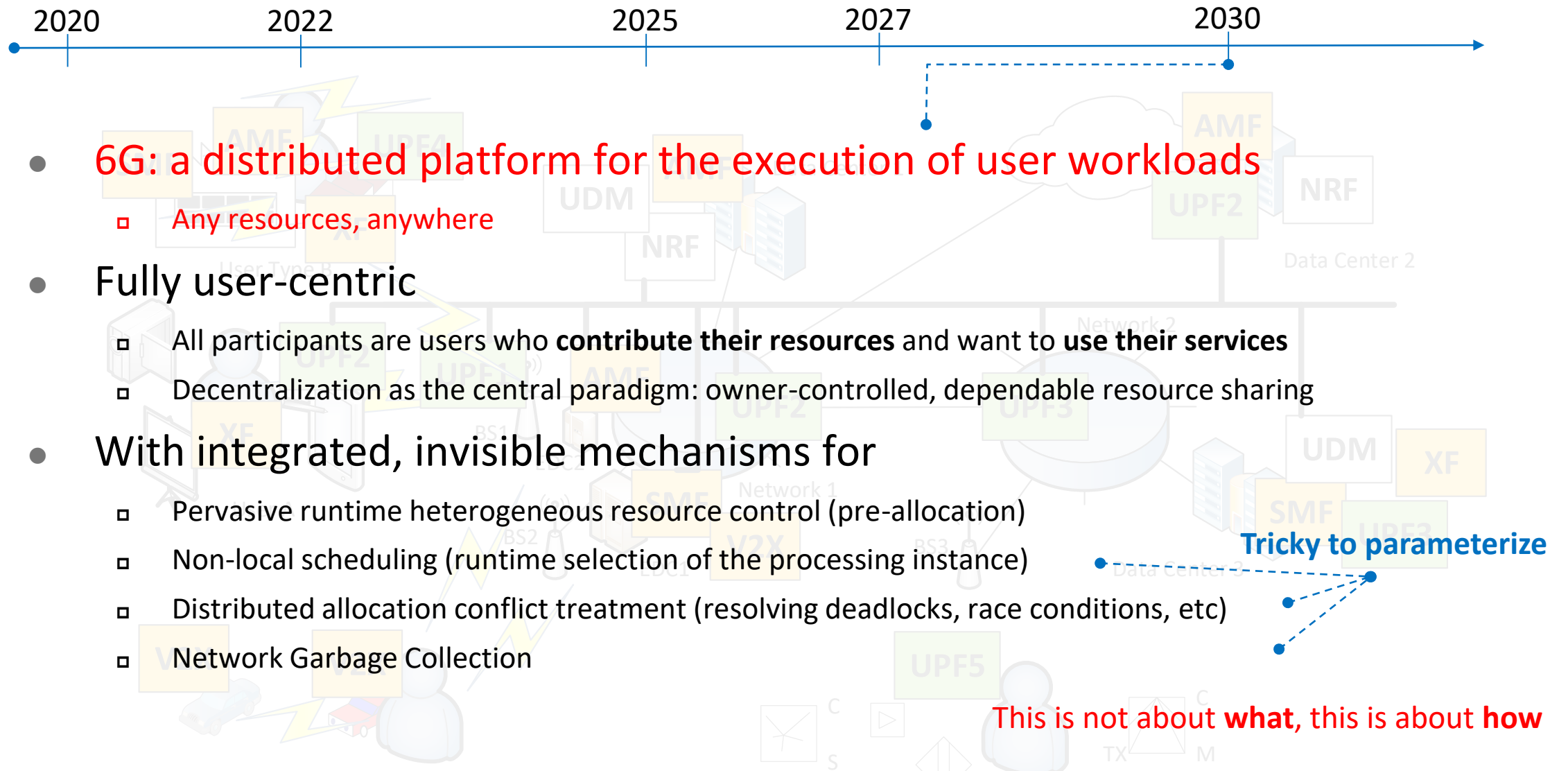# Guaranteeing Execution Correctness

Like in distributed databases, we will need conflict free E2E allocations
➔ **Need distributed, network-suitable mechanisms for resource allocations**

How to conceive of 6G?

2020   2022   2025   2027   2030

- 6G: a distributed platform for the execution of user workloads
  - Any resources, anywhere

- Fully user-centric
  - All participants are users who **contribute their resources** and want to **use their services**
  - Decentralization as the central paradigm: owner-controlled, dependable resource sharing

- With integrated, invisible mechanisms for
  - Pervasive runtime heterogeneous resource control (pre-allocation)
  - Non-local scheduling (runtime selection of the processing instance)
  - Distributed allocation conflict treatment (resolving deadlocks, race conditions, etc)
  - Network Garbage Collection

Tricky to parameterize

This is not about **what**, this is about **how**

6G = AI as a Service

- We can come up with mechanisms for each of these areas

- Problem: these are usually use-case dependent

- Solution: AI

```
while there is improvement
    - export mutable parameters to a learning agent as current policy π
    - receive from agent a new candidate policy π′
    - apply π′, measure improvement, send feedback to the agent
```

- However, note that this AI should be for *all users* and *different applications*

➔ 6G = AI as a Service

  ▫ Towards "AI sockets"

  ▫ Available at any point in the future system

  ▫ Implementation-agnostic

```
create_new_model(parameters)
                destroy model()
       supply_data (vector X)
             inference(state_x)
      apply_learning(vector_x)
```

Conclusion

- ## If 5G was about slicing, 6G should be all about fusion

  - Fusing Local and Global; Clouds and Networks (in-compute networking, in-network compute);

    User Resources; User Equipment and Network; Wireless, Optical and Fixed domains

  - Fusing sciences: distributed systems and networking, artificial intelligence and networking

- ## If 5G was about connecting *things* to *brains*, 6G should become the brain

  - System-scientific approach required

  - We need several instrumentations of AI; again, not limited to operators

  - We need different models, federated AI, but also fully distributed AI
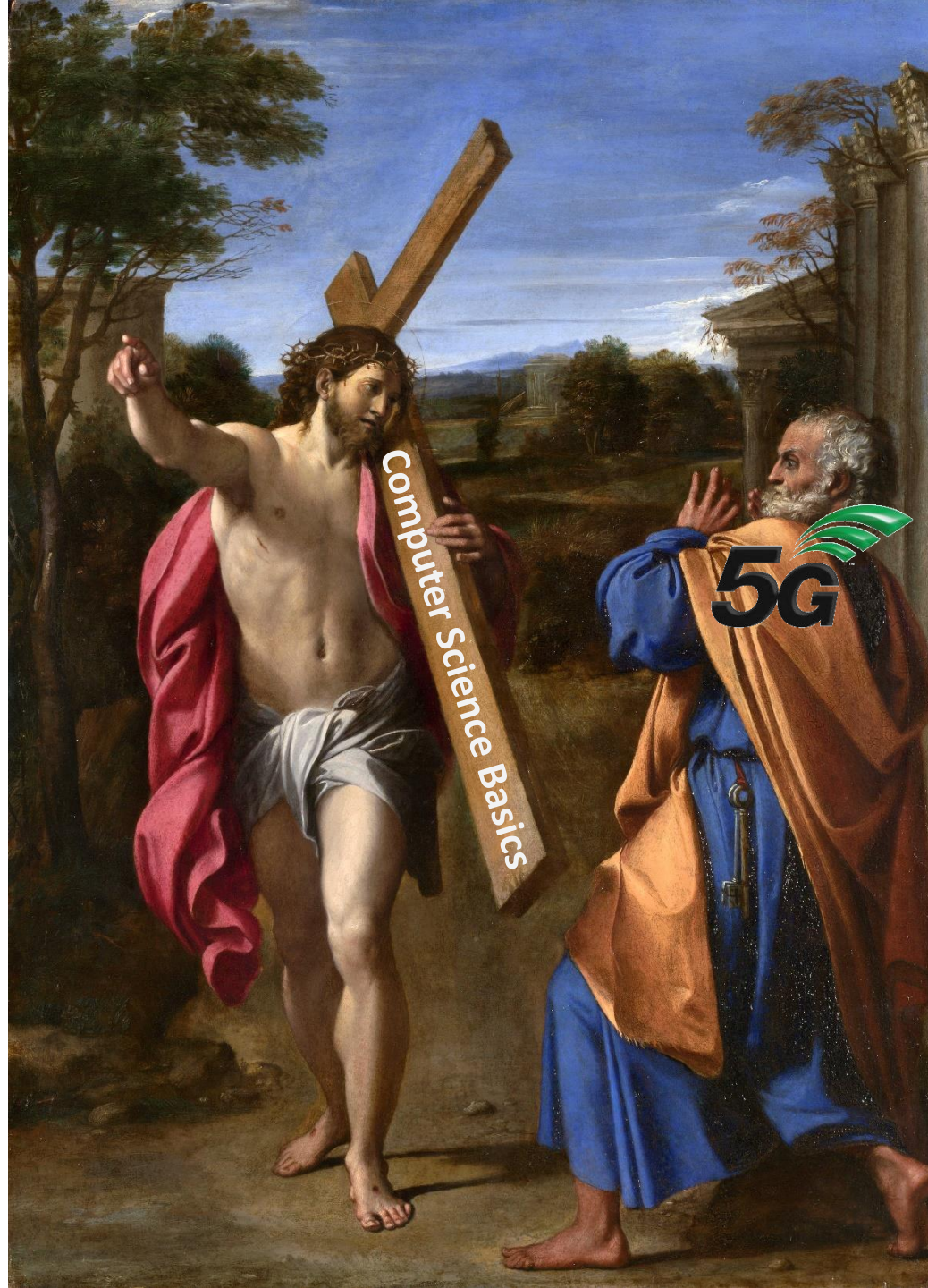
References

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THANK YOU

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