

Challenges with 5G Networks a Base for Critical Infrastructure

Mobil Agenda; fagseminar: "5G sikkerhet "

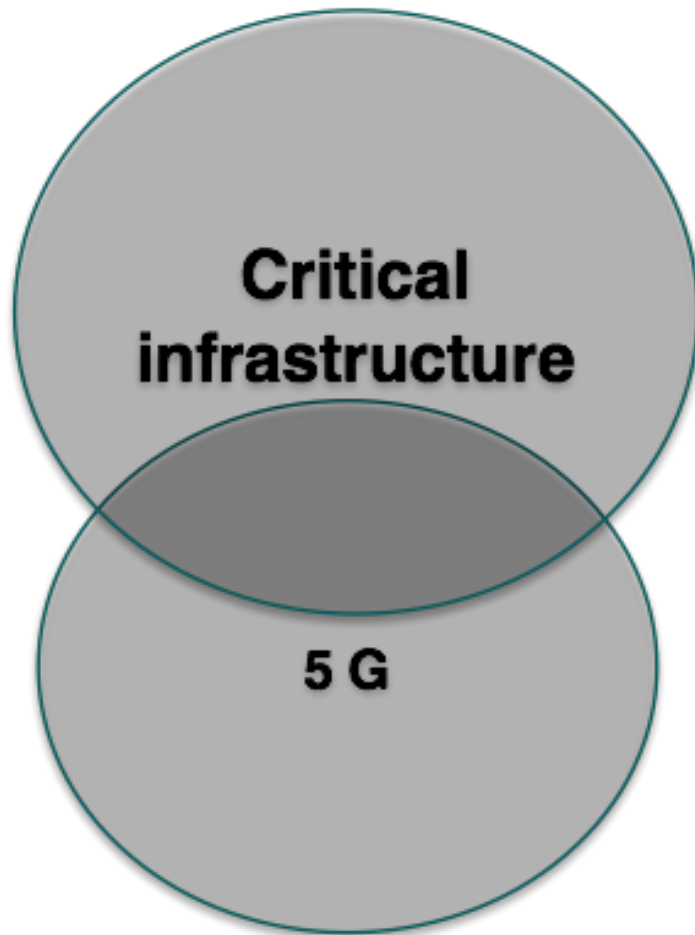
2019-06-13

Bjarne E. Helvik

Department of Information Security and Communication Technology



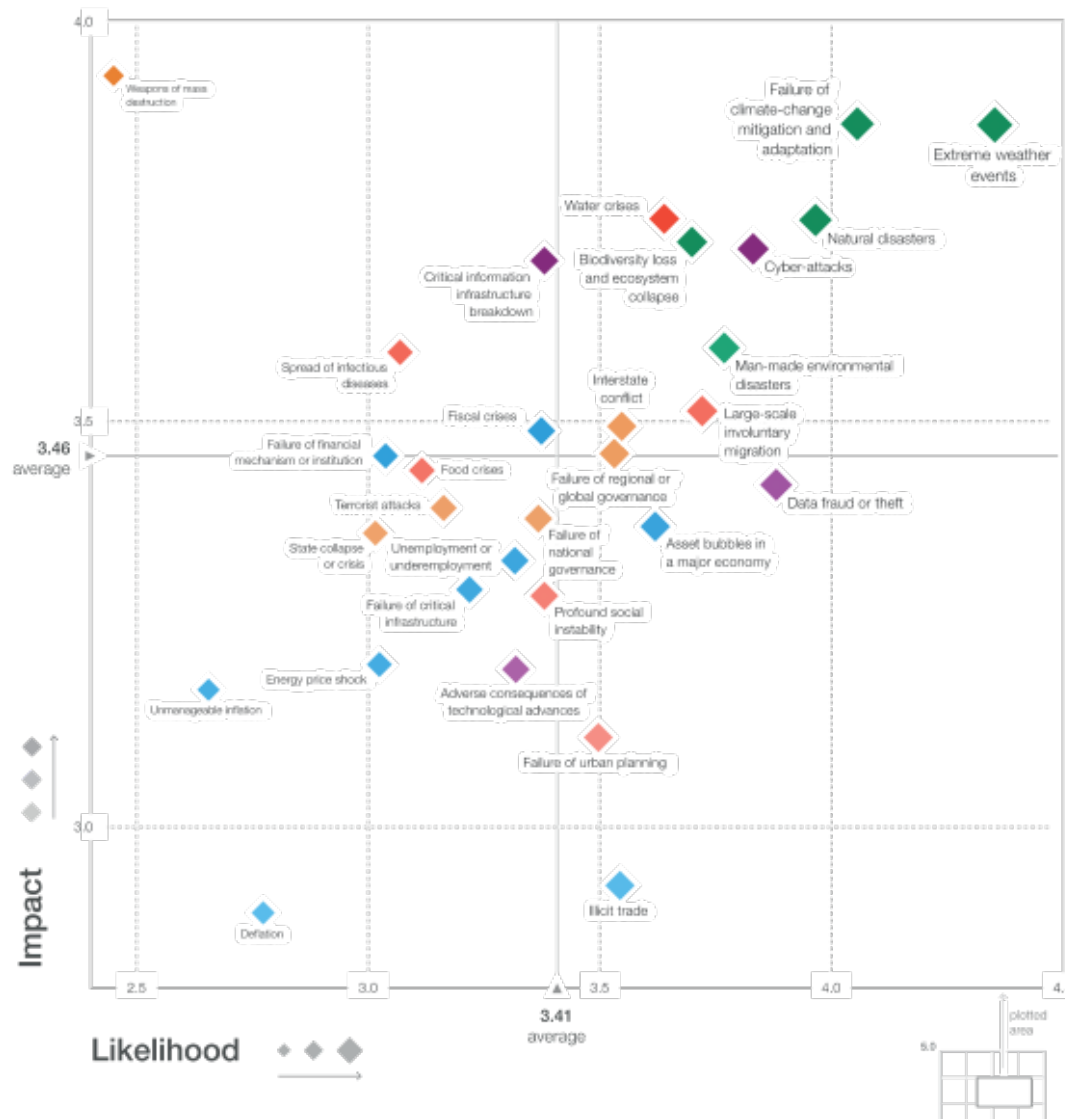
Threats from the environment



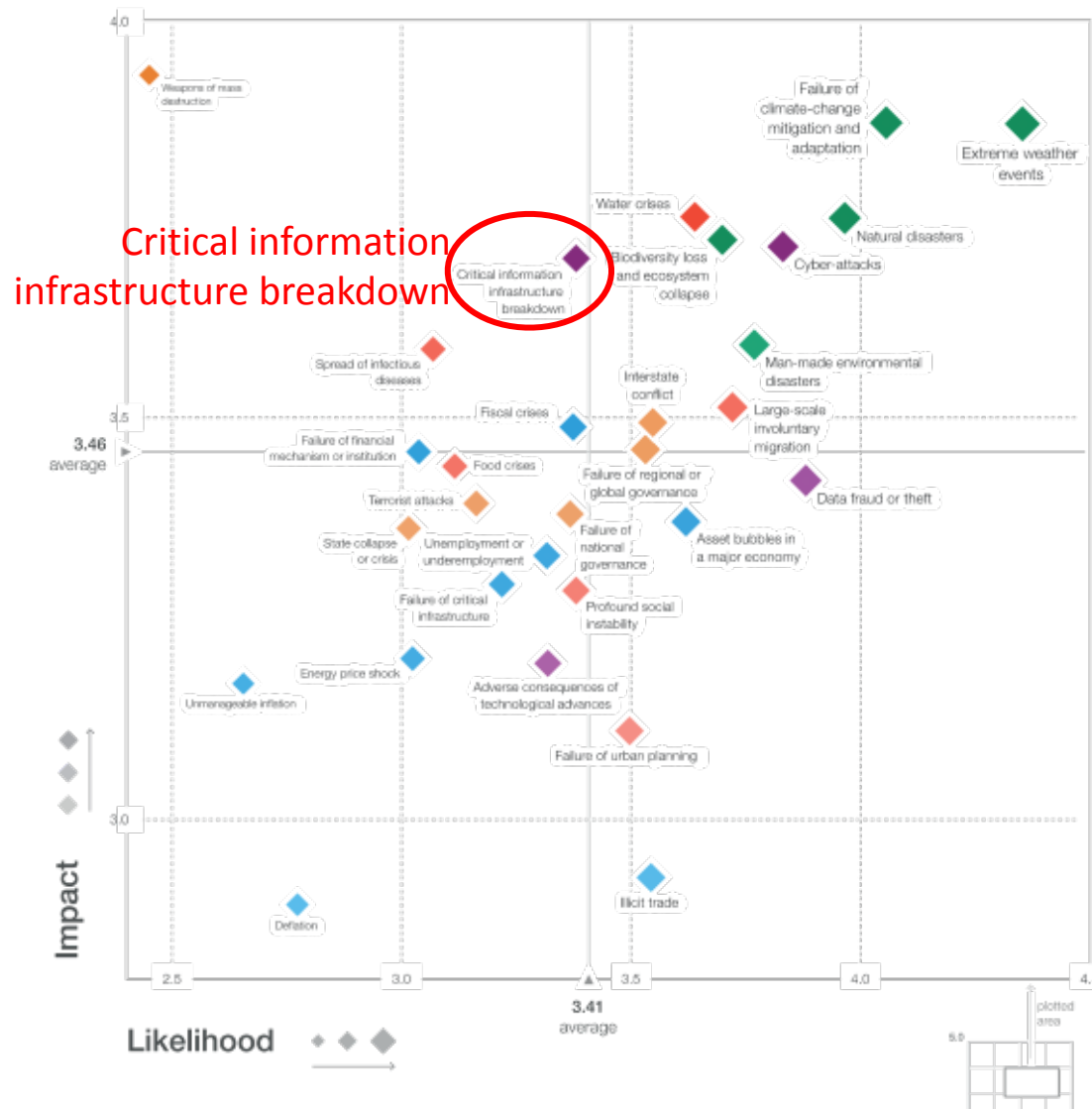
ICT system threats



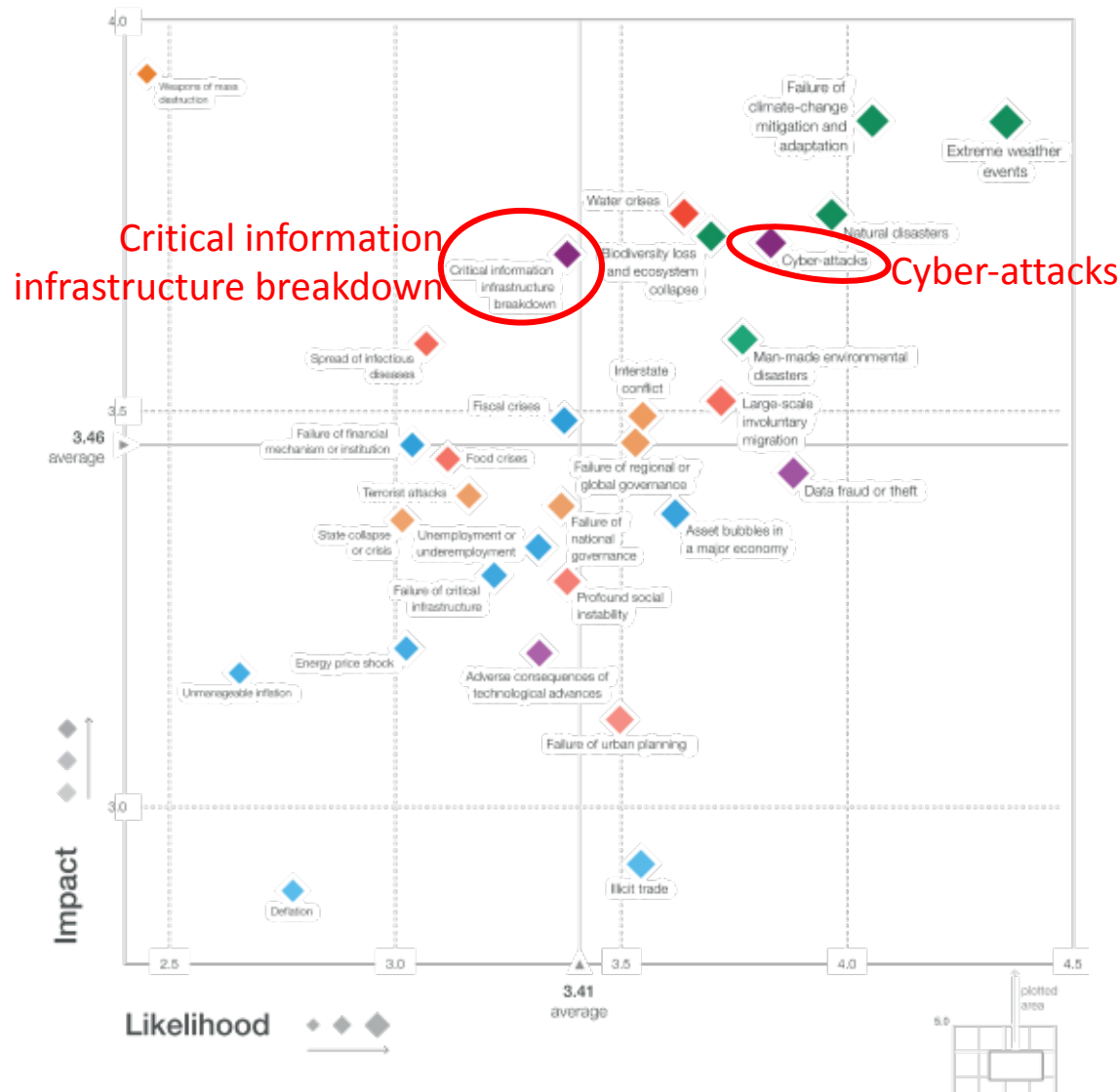
The «pre 5G» Perceived Global Risks Landscape 2019

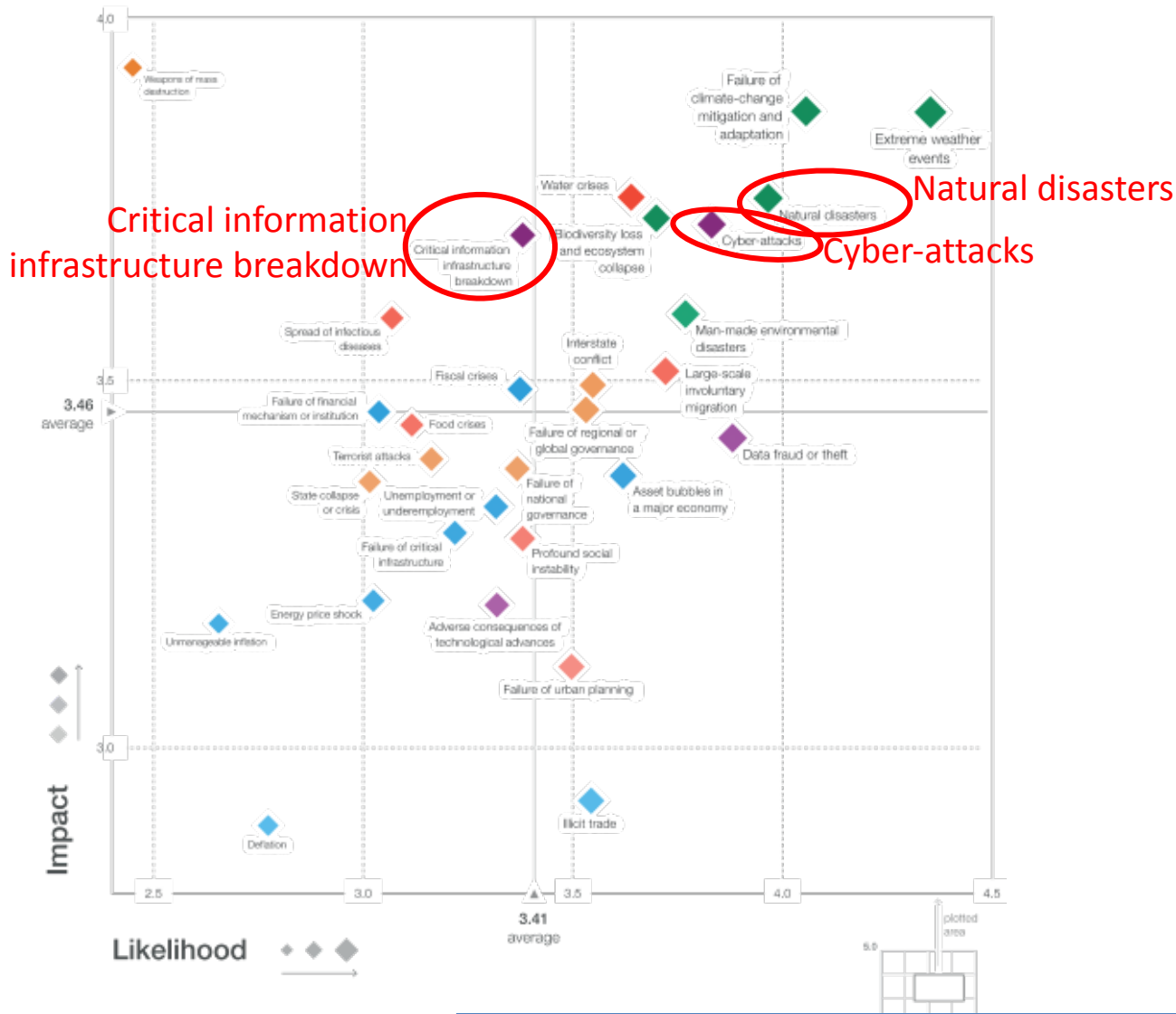


The «pre 5G» Perceived Global Risks Landscape 2019



The «pre 5G» Perceived Global Risks Landscape 2019





Trigger activities

- Co-op with various partners in SDN, VNF an 5G
- CleanSky
 - Robust cloud service provisioning and management
- Resilient Communication Services Protecting End-user Applications from Disaster-based Failures
 - Large-scale natural disasters
 - Technology-related disasters
 - Malicious human activities
 - ...
- Centre for Intelligent Electricity Distribution
 - Risk assessment in the future distribution system
 - ...
- Norwegian Center for Critical Infrastructures Cyber Security (NORCICS); SFI application



Vision for the “2020 network”

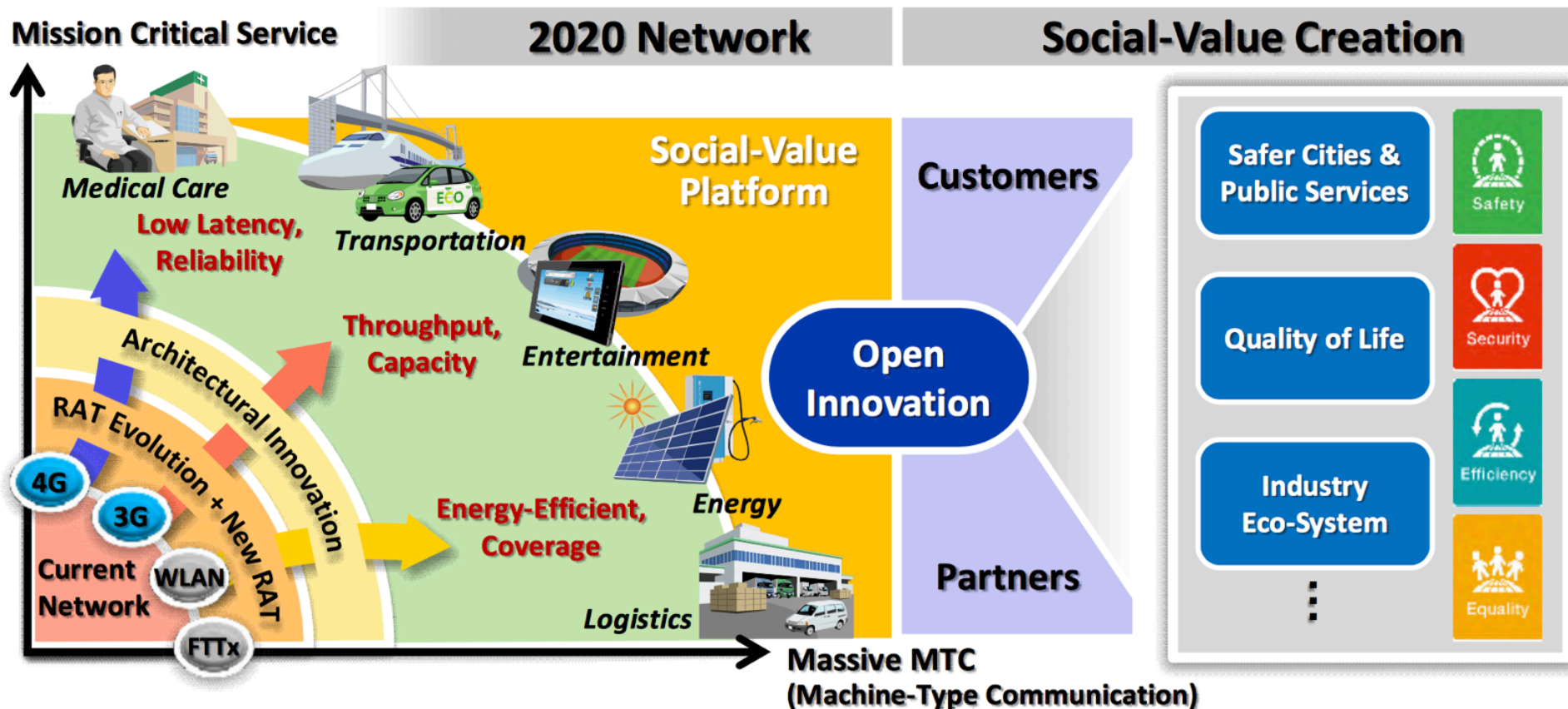
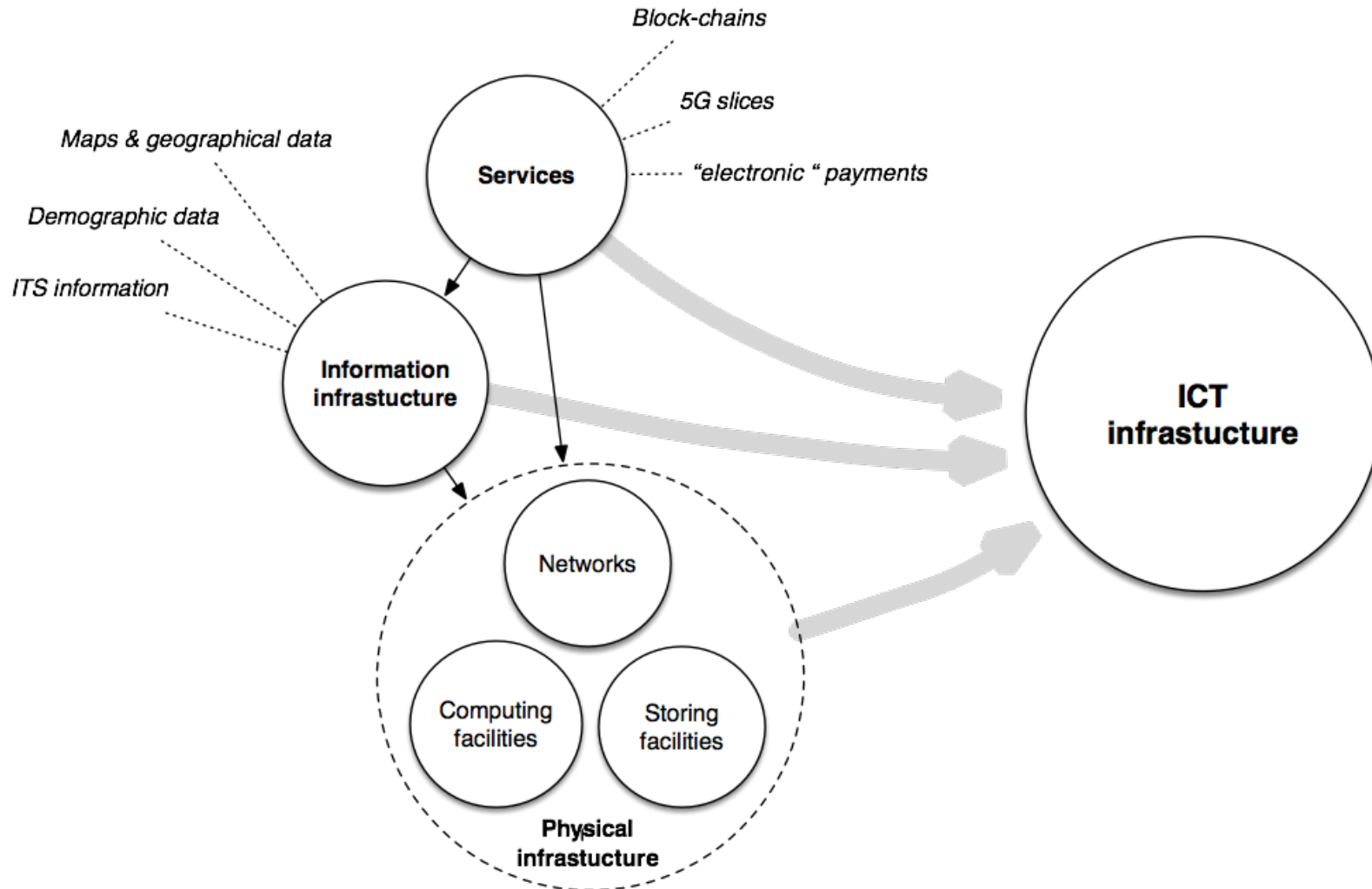


Figure 1. NEC's vision for the “2020 network”

NEC. Network evolution toward 2020 and beyond (white paper), 2015.

ICT infrastructure also encompasses information and services



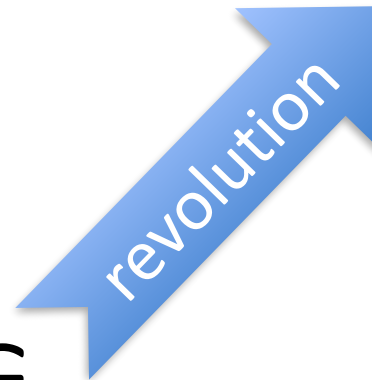
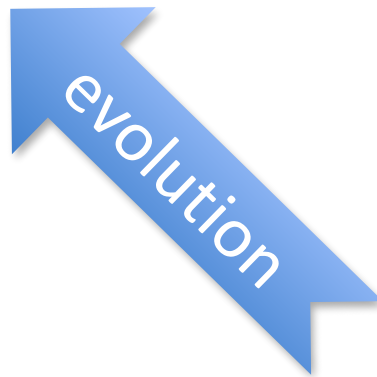
Providing Wireless access

Significantly improved performance in the radio access network

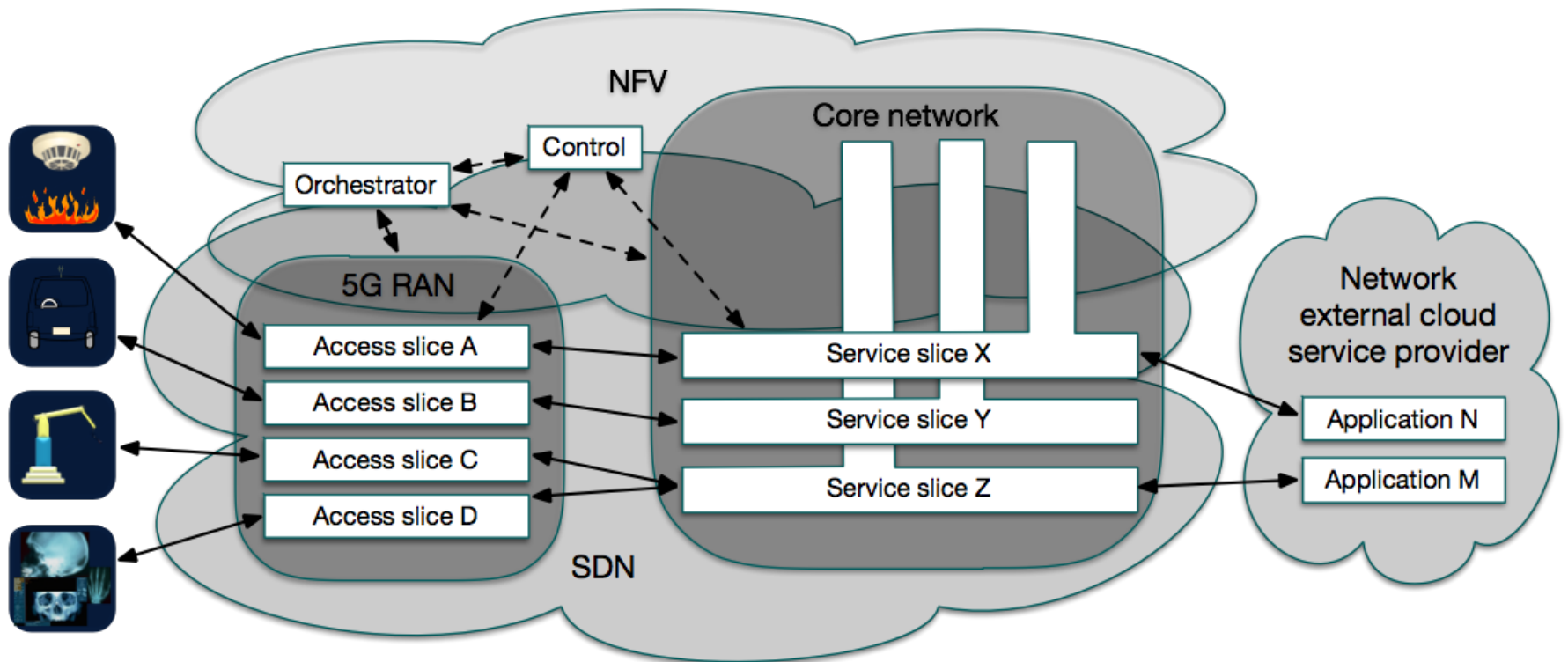
- heterogenous cell structure,
- new radio interfaces
- mmWave, MIMO, ...

Providing the ICT infrastructure support

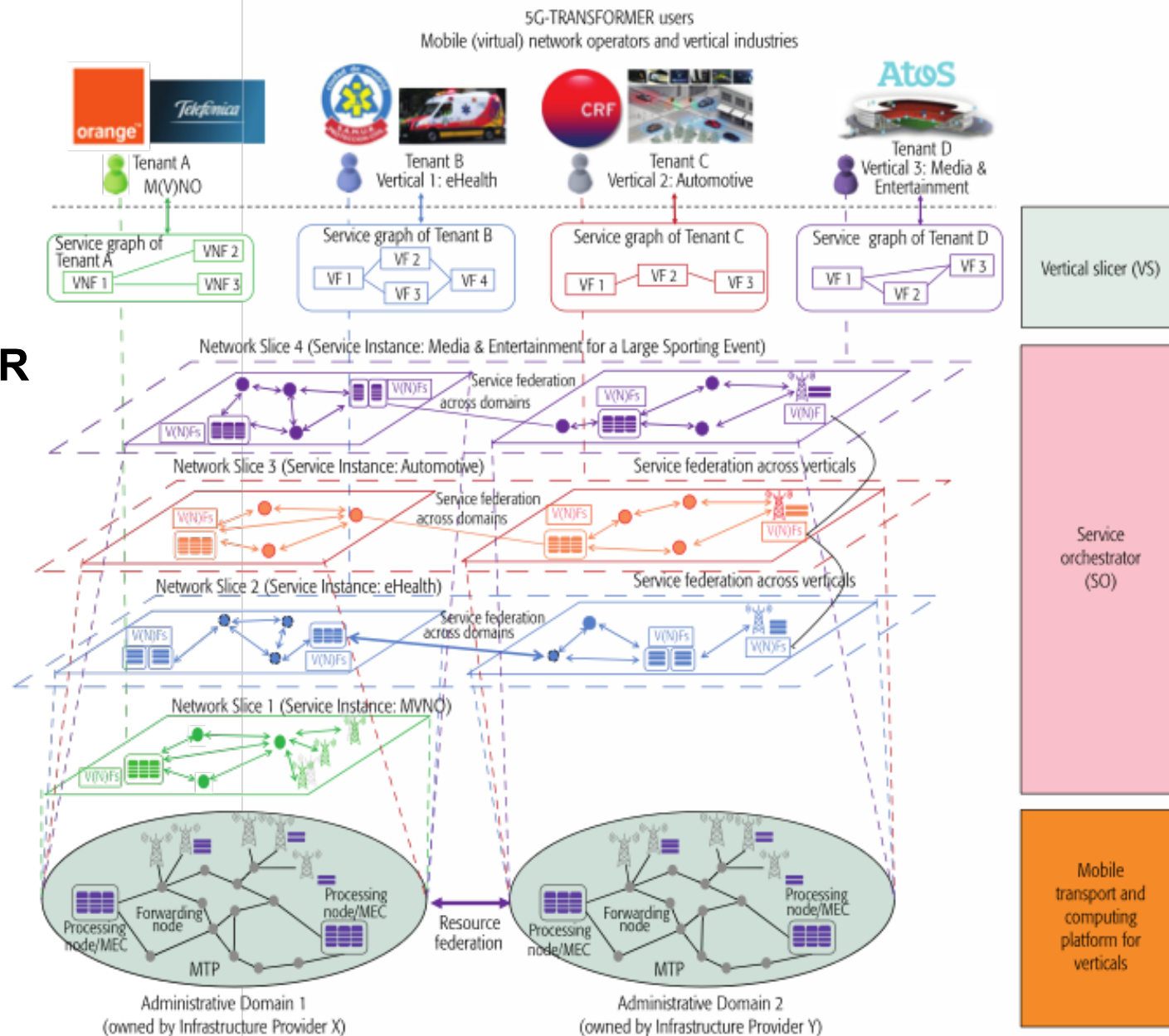
- Virtualizing of network internal and external functions (SDN, VNF)
- Use of «clouds»
- Verticals – slices; adapted to customer and service
- Multi-tenant and multi-domain == tighter integration between heterogenous actors
- Orchestration and management



5 G

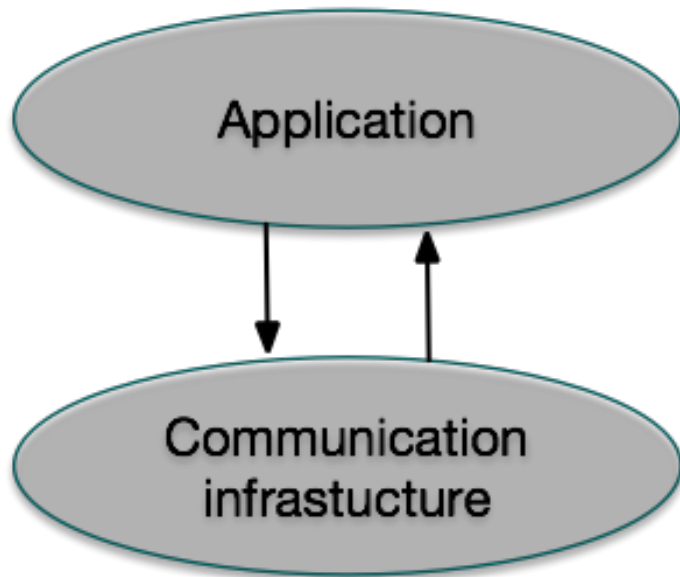


5G-TRANSFORMER concept

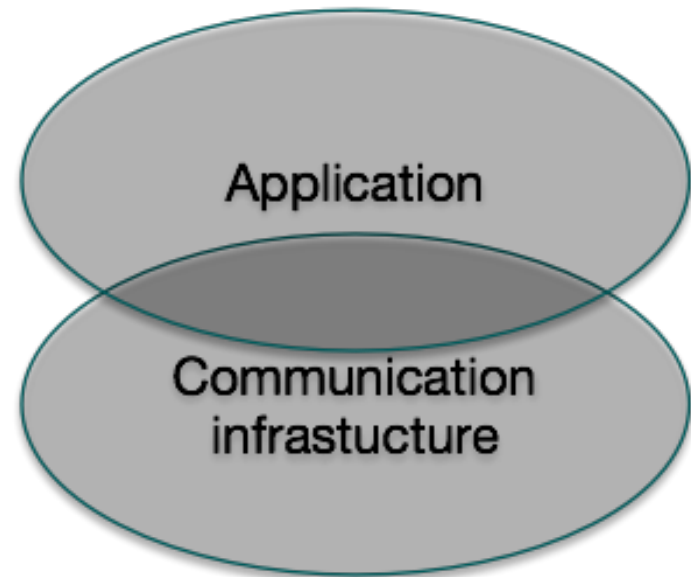


A. de la Oliva & al., 5G-Transformer: Slicing and orchestrating transport networks for industry verticals. IEEE Communications Magazine, 56(8):78–84, August 2018.

Change in service delivery paradigm

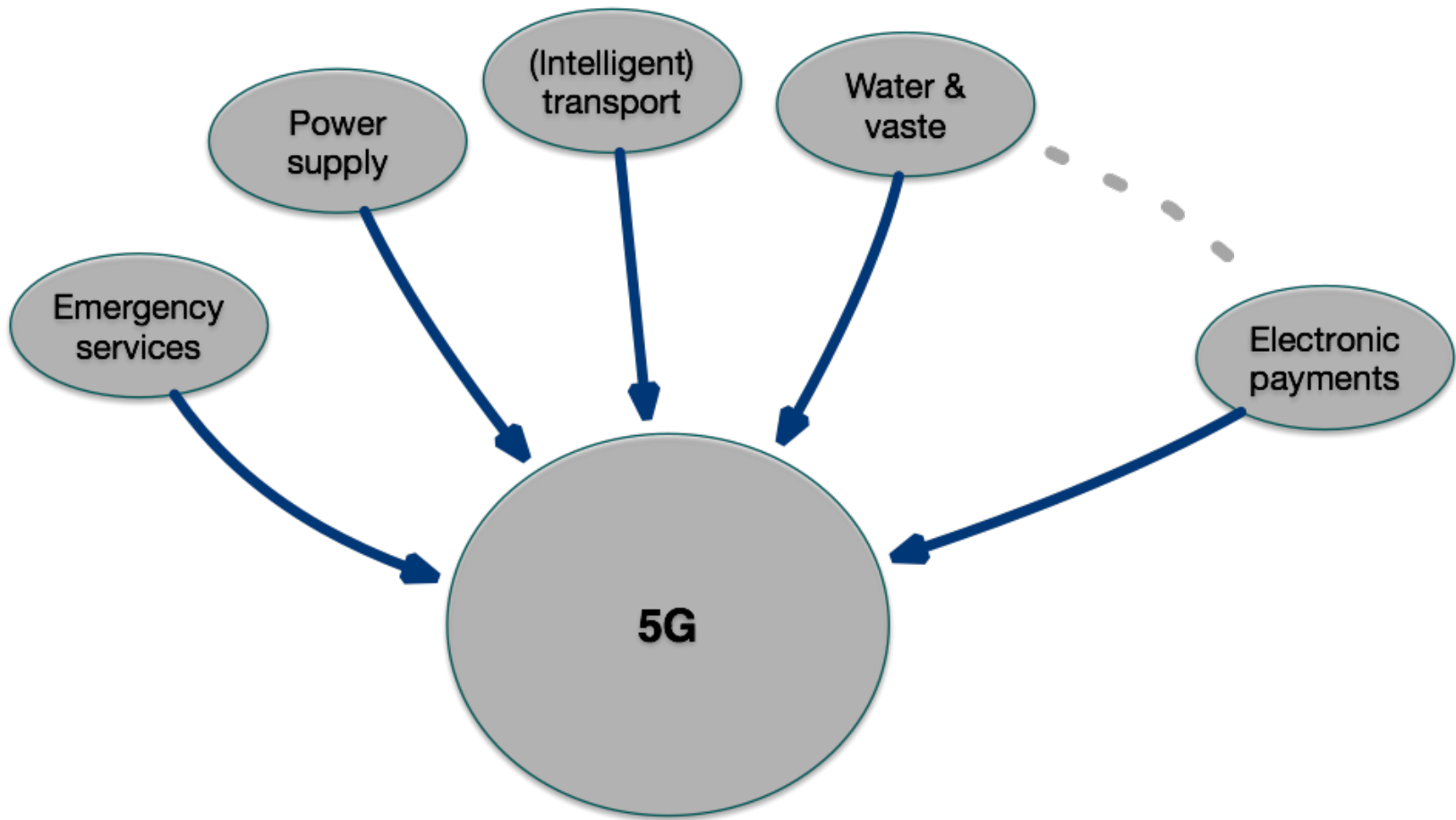


a) To-days relation



b) 5G integrates the application into the communication infrastructure

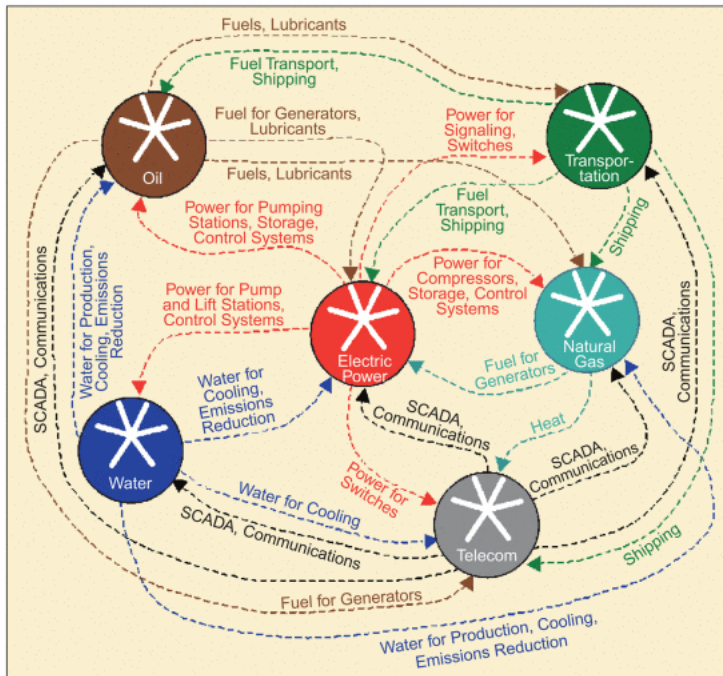
5G becomes the carrier of “all” critical infrastructures



There are tough requirements

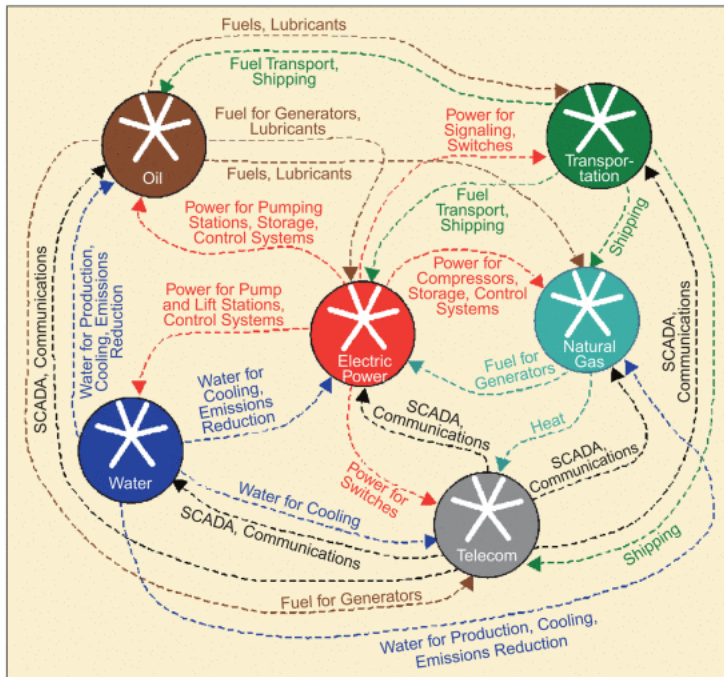


Critical infrastructure interdependencies

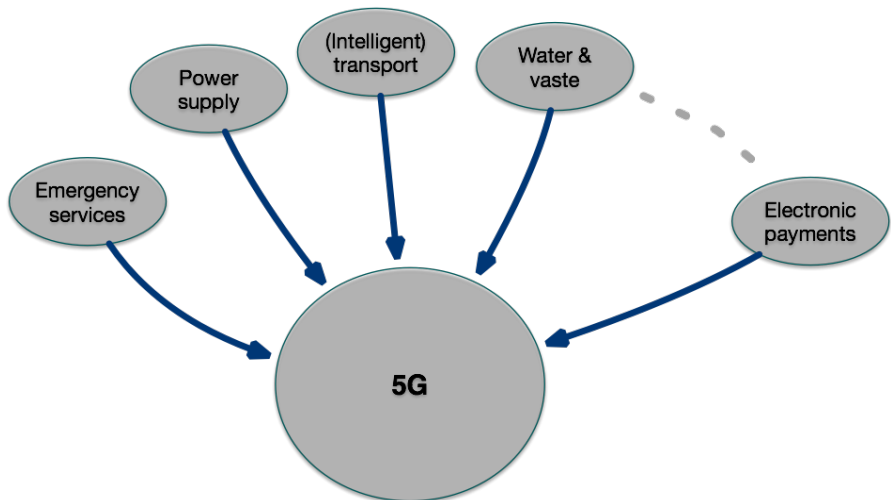
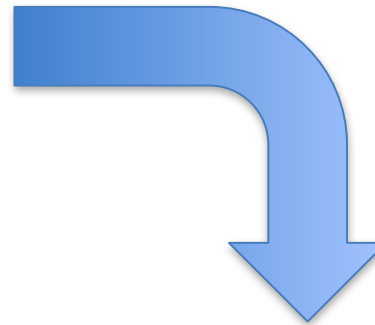


S.M. Rinaldi, J.P. Peerenboom, and T.K. Kelly.
Identifying, understanding, and analyzing critical infrastructure interdependencies.
Control Systems, IEEE, 21(6):11–25, 2001.

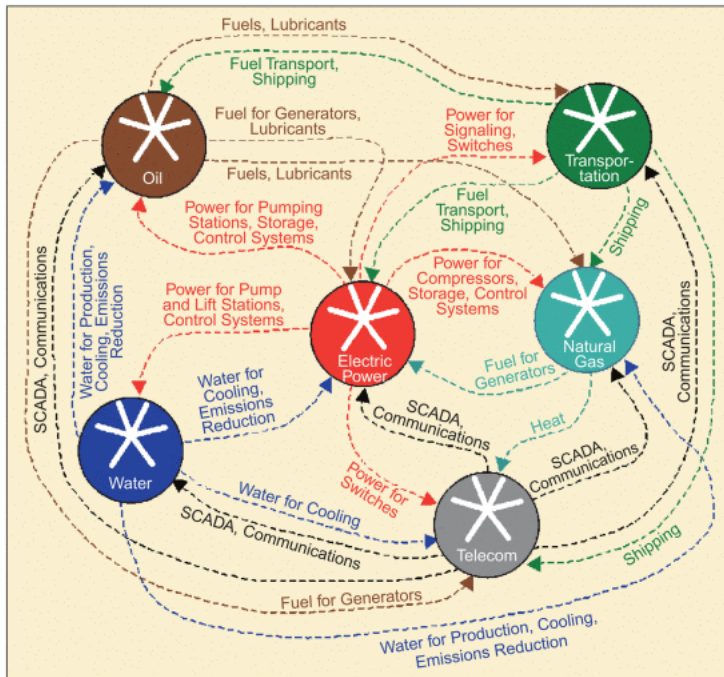
Critical infrastructure interdependencies



S.M. Rinaldi, J.P. Peerenboom, and T.K. Kelly.
Identifying, understanding, and analyzing critical infrastructure interdependencies.
Control Systems, IEEE, 21(6):11–25, 2001.

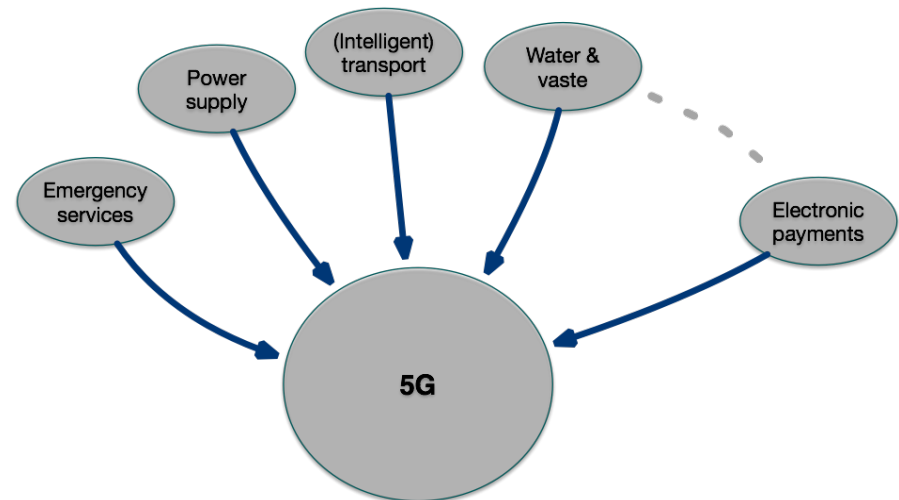
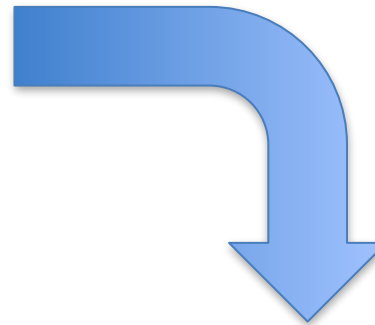


Critical infrastructure interdependencies

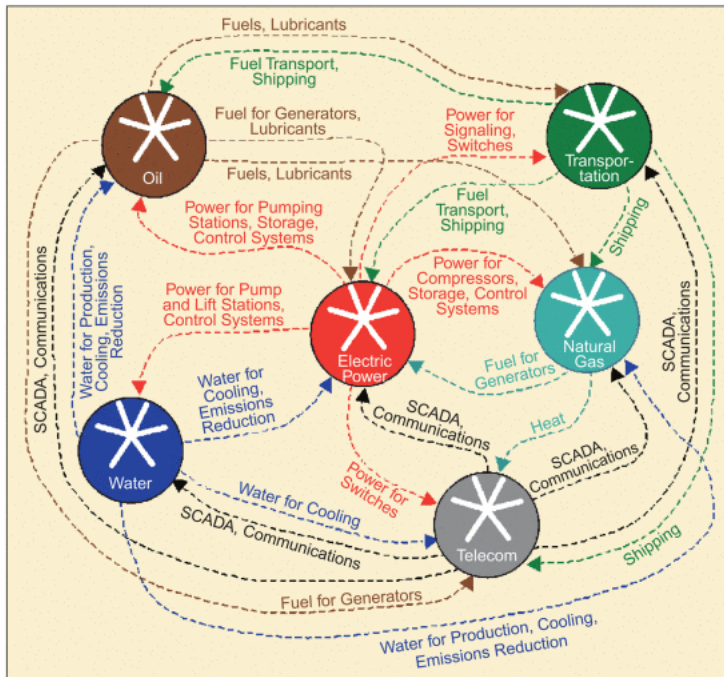


S.M. Rinaldi, J.P. Peerenboom, and T.K. Kelly.
Identifying, understanding, and analyzing critical infrastructure interdependencies.
Control Systems, IEEE, 21(6):11–25, 2001.

- Common ICT platform

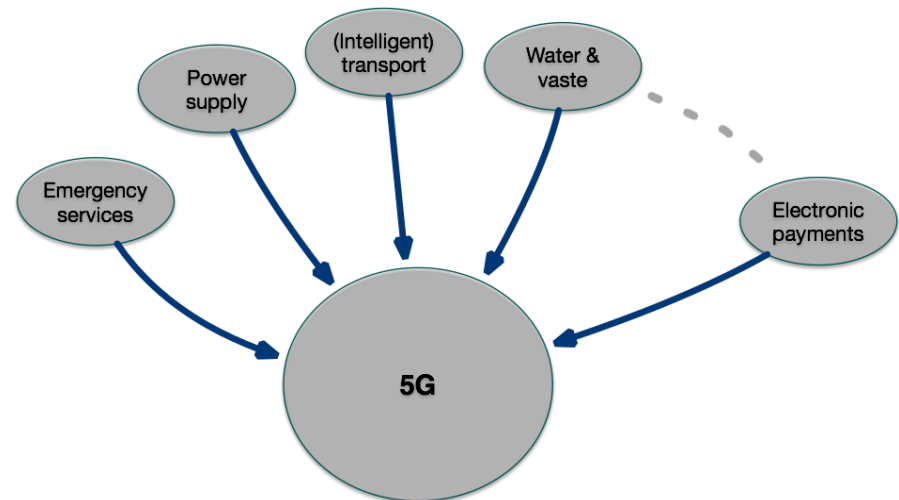
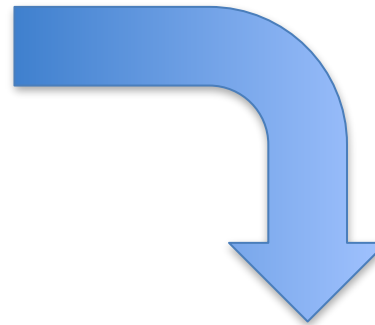


Critical infrastructure interdependencies

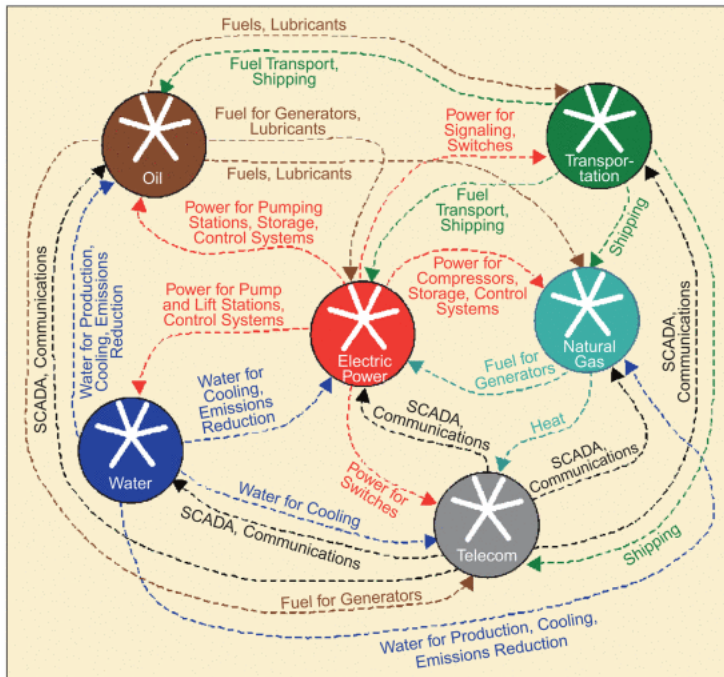


S.M. Rinaldi, J.P. Peerenboom, and T.K. Kelly.
Identifying, understanding, and analyzing critical infrastructure interdependencies.
Control Systems, IEEE, 21(6):11–25, 2001.

- Common ICT platform
- Tight interconnectedness

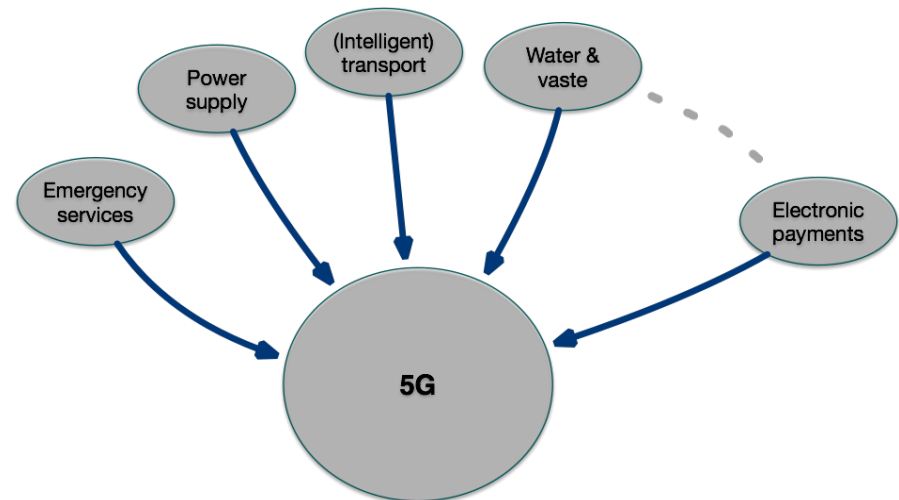
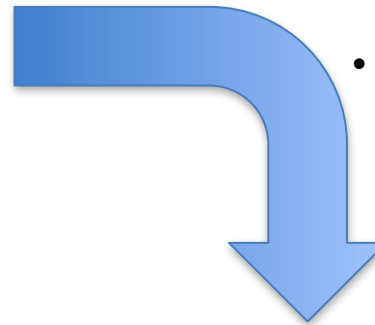


Critical infrastructure interdependencies

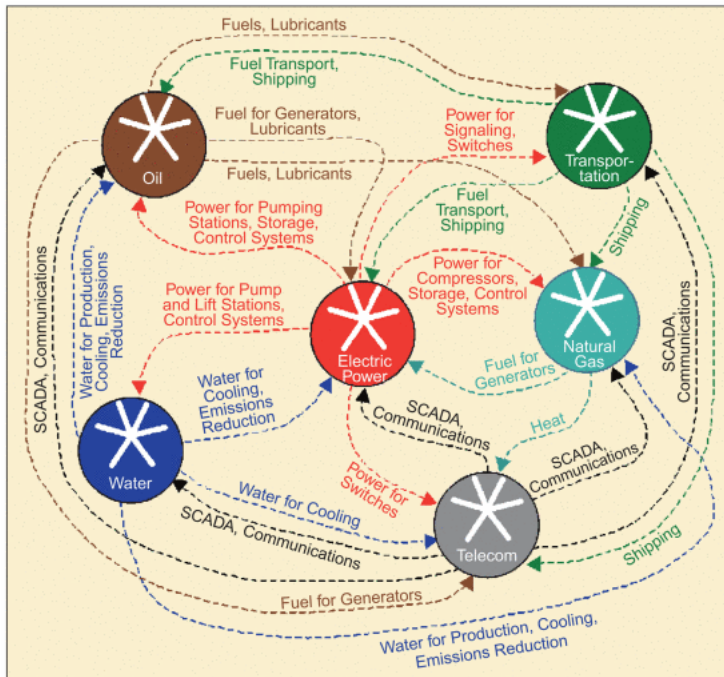


S.M. Rinaldi, J.P. Peerenboom, and T.K. Kelly.
Identifying, understanding, and analyzing critical infrastructure interdependencies.
 Control Systems, IEEE, 21(6):11–25, 2001.

- Common ICT platform
- Tight interconnectedness
- Short/no lead times

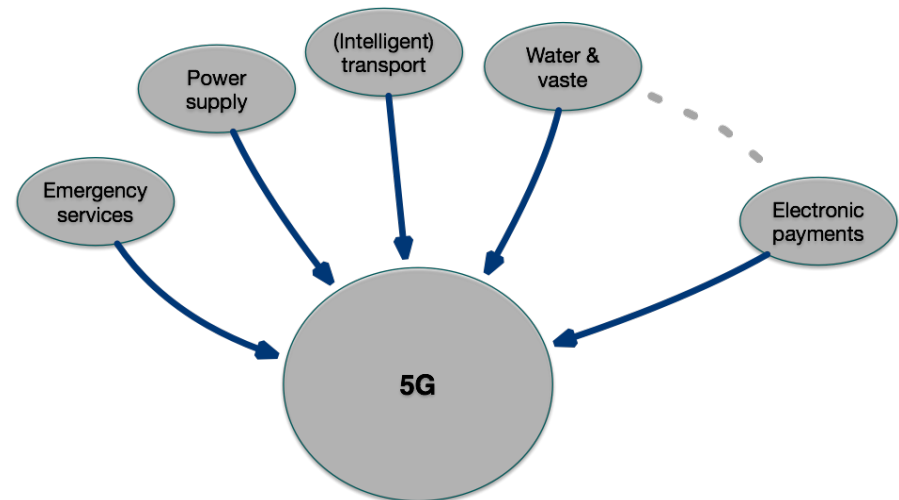
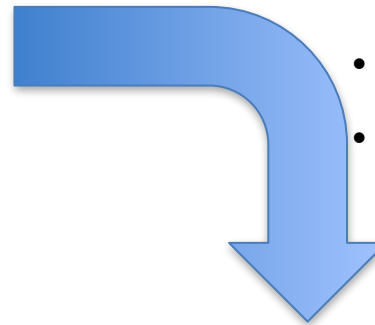


Critical infrastructure interdependencies

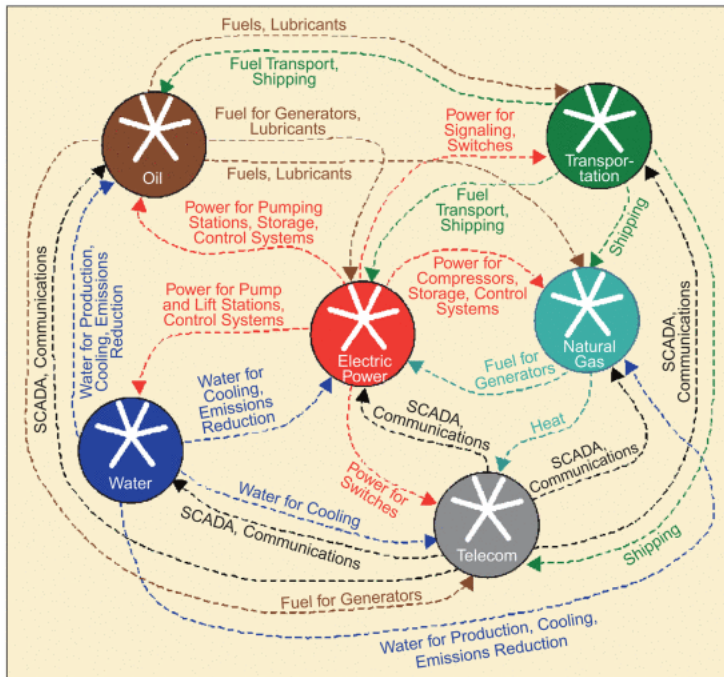


S.M. Rinaldi, J.P. Peerenboom, and T.K. Kelly.
Identifying, understanding, and analyzing critical infrastructure interdependencies.
Control Systems, IEEE, 21(6):11–25, 2001.

- Common ICT platform
- Tight interconnectedness
- Short/no lead times
- Less transparency

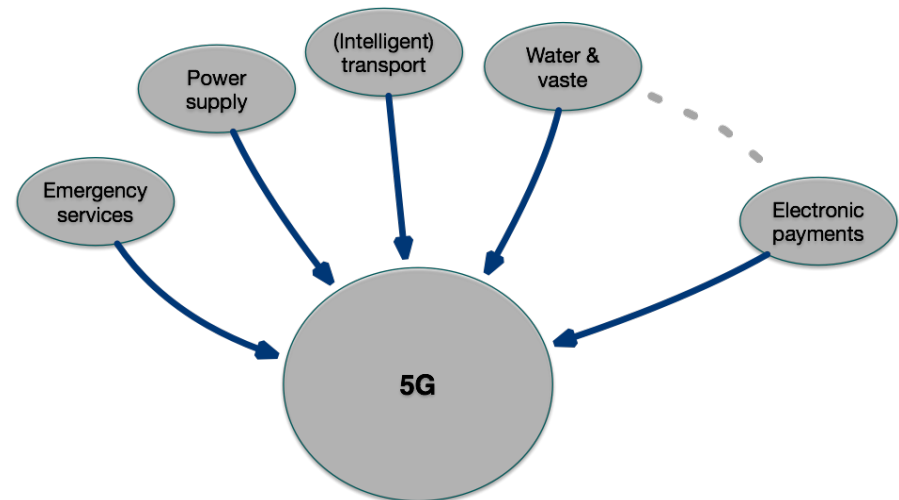
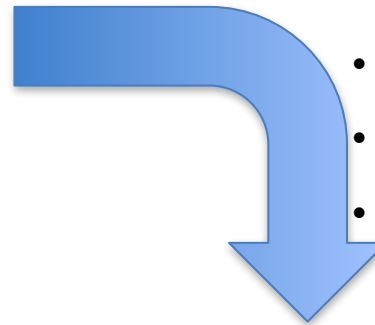


Critical infrastructure interdependencies

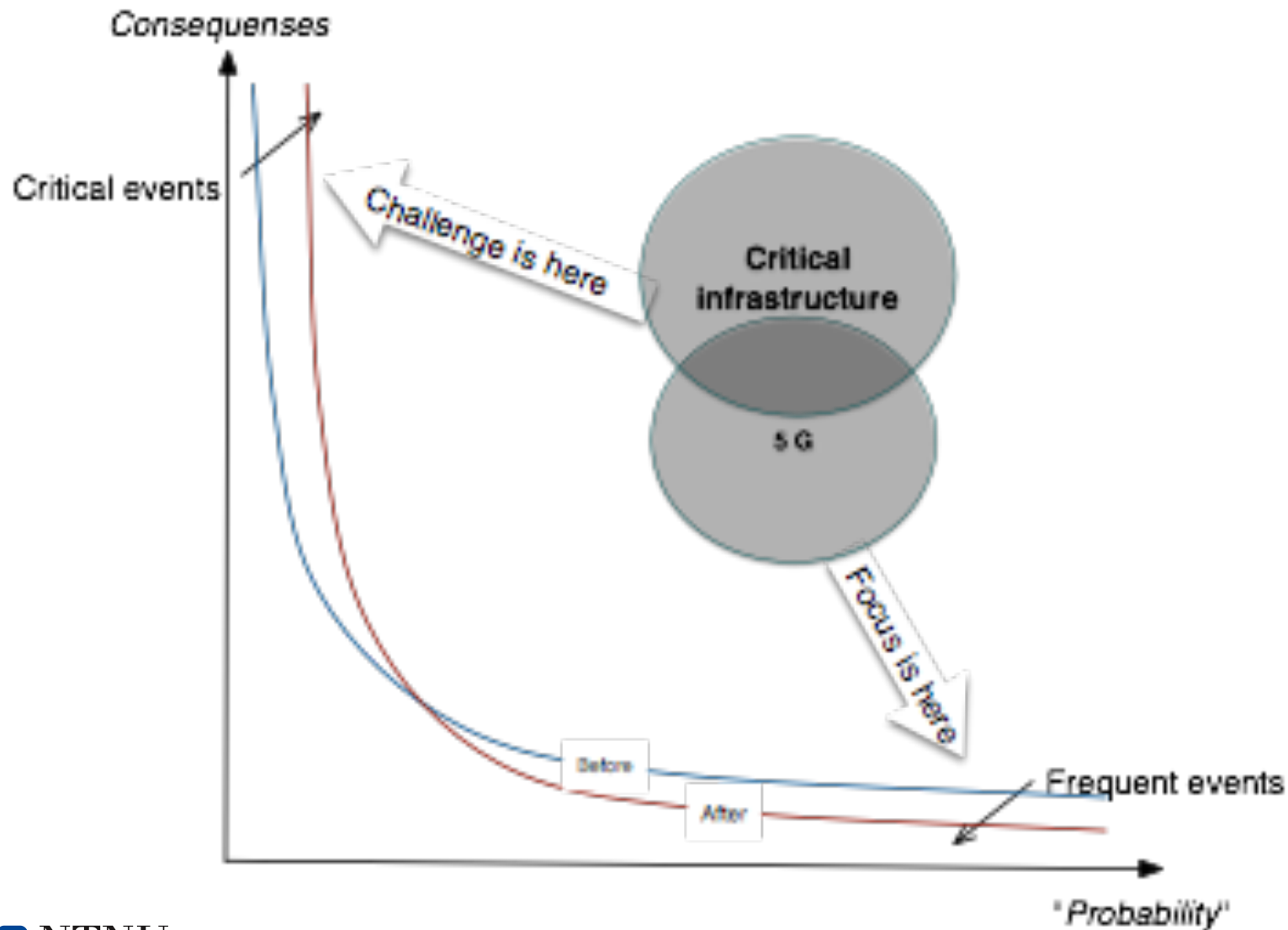


S.M. Rinaldi, J.P. Peerenboom, and T.K. Kelly.
Identifying, understanding, and analyzing critical infrastructure interdependencies.
 Control Systems, IEEE, 21(6):11–25, 2001.

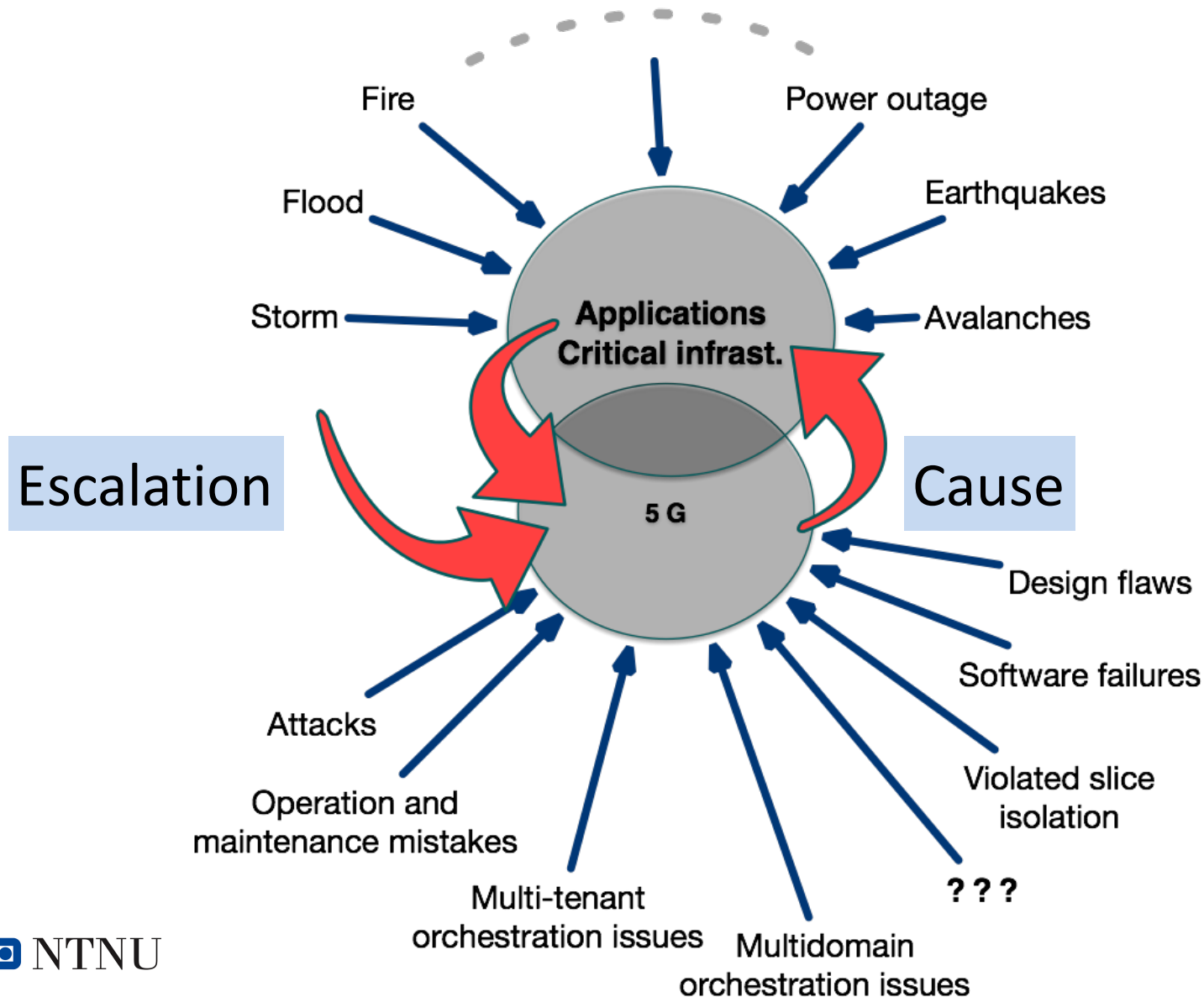
- Common ICT platform
- Tight interconnectedness
- Short/no lead times
- Less transparency
- Increased complexity

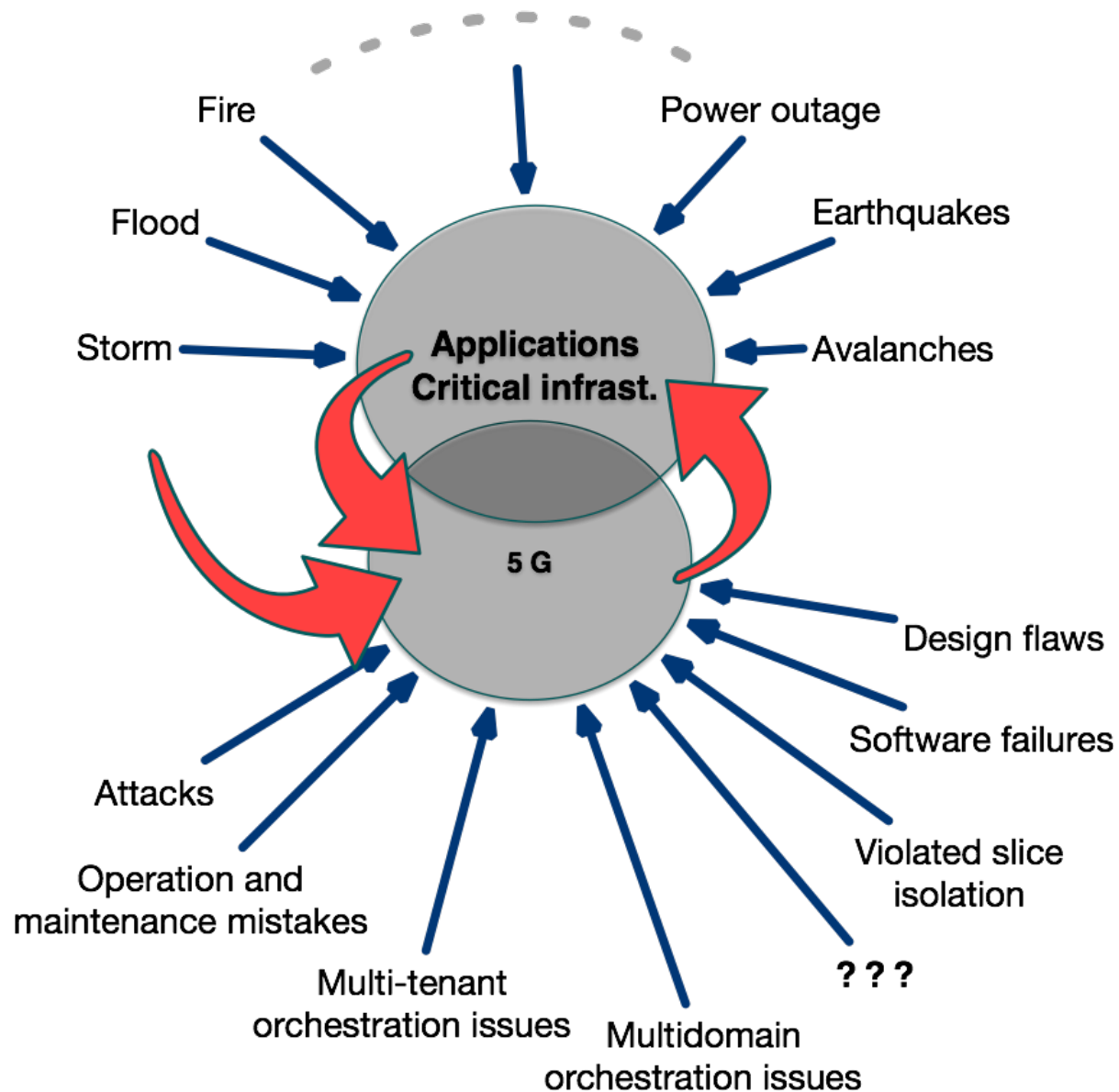


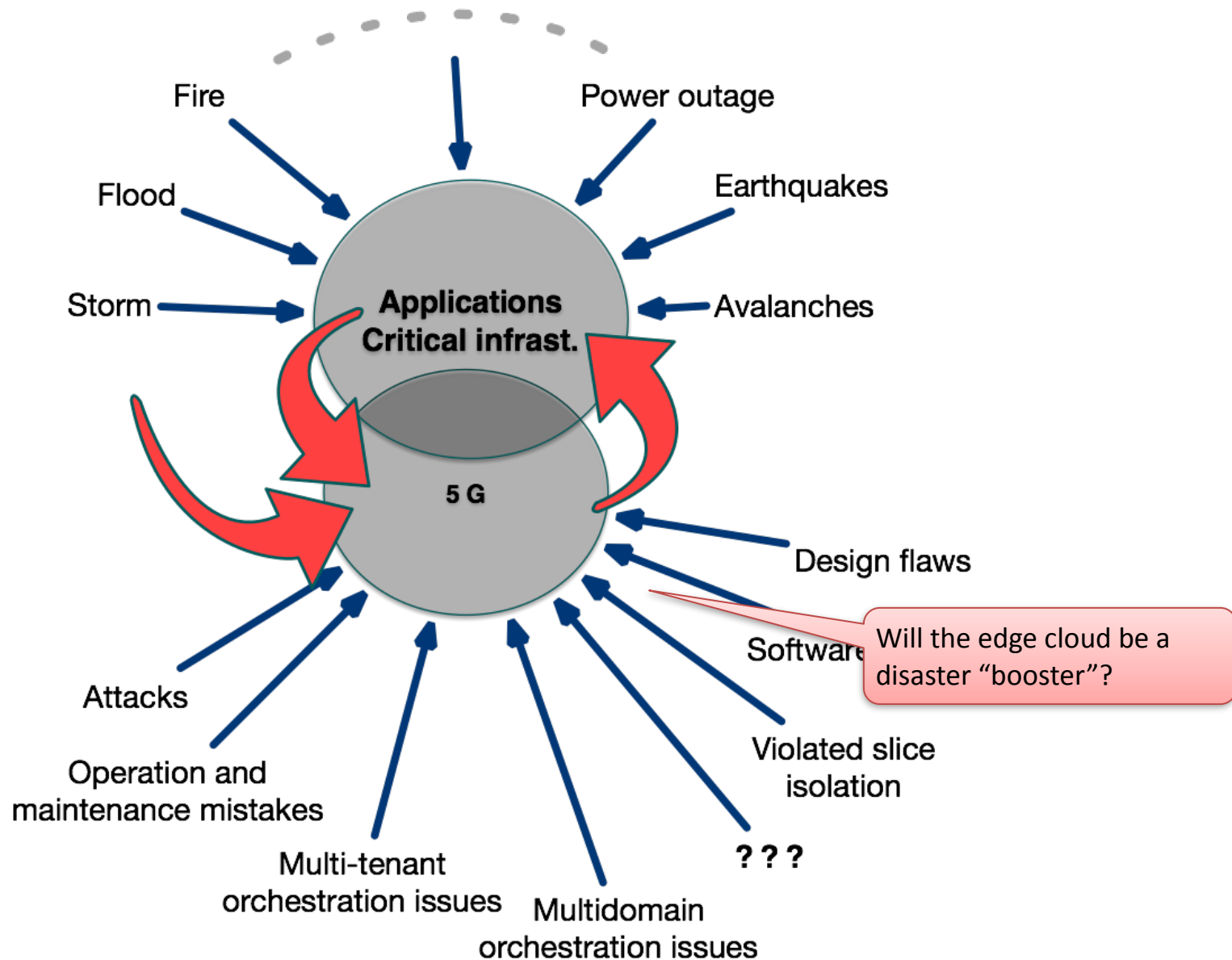
Shift in risk

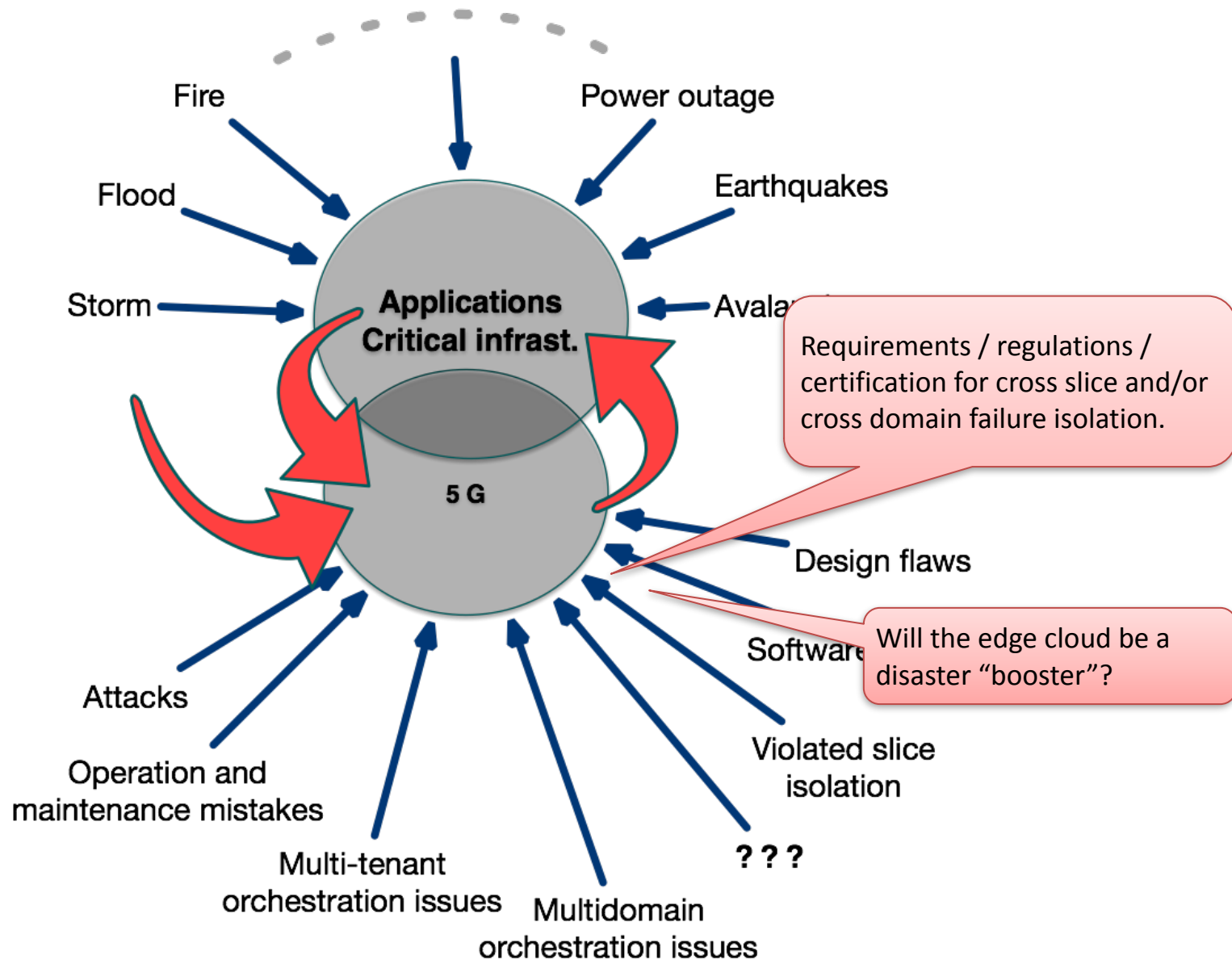


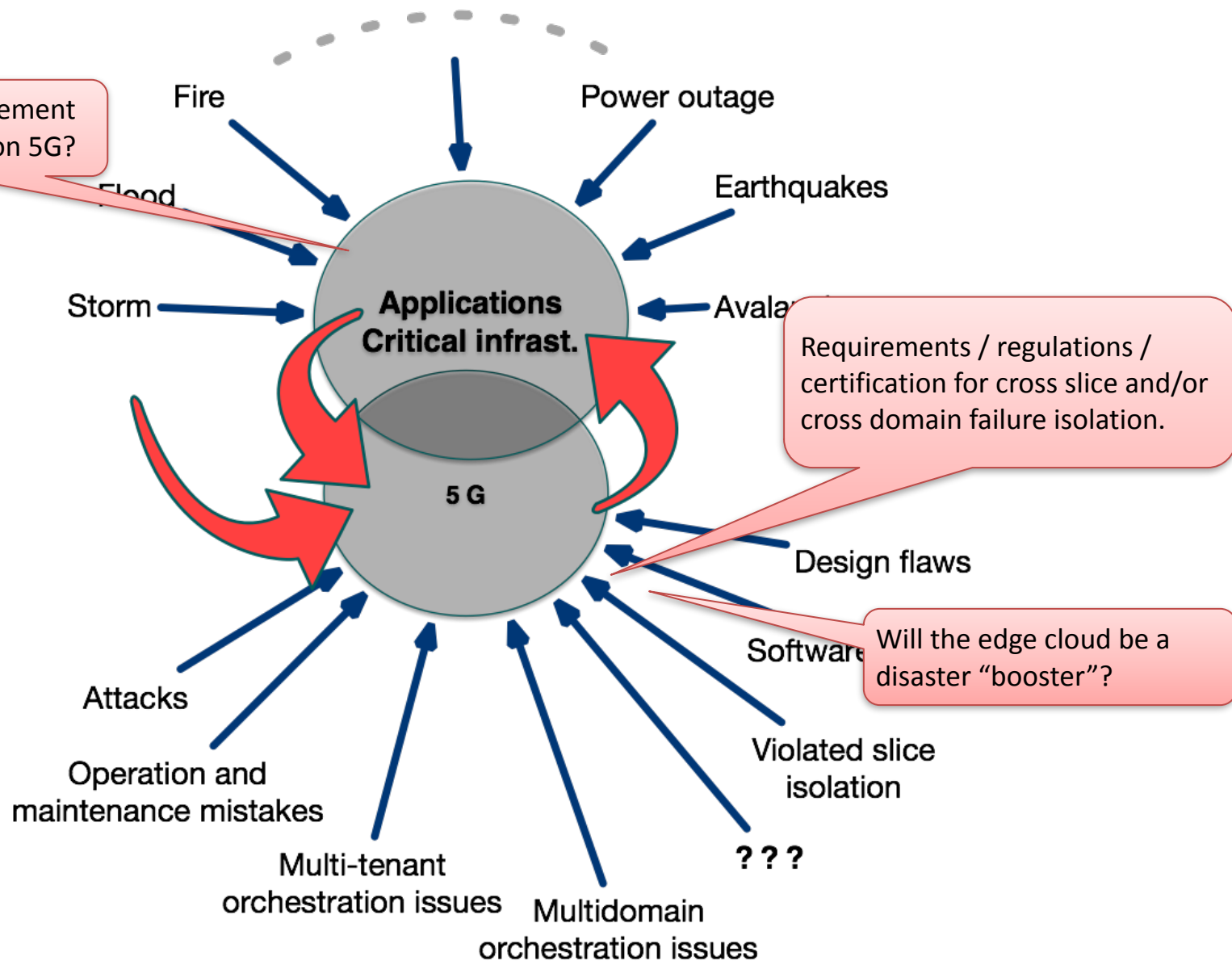
5G a disaster accelerator?

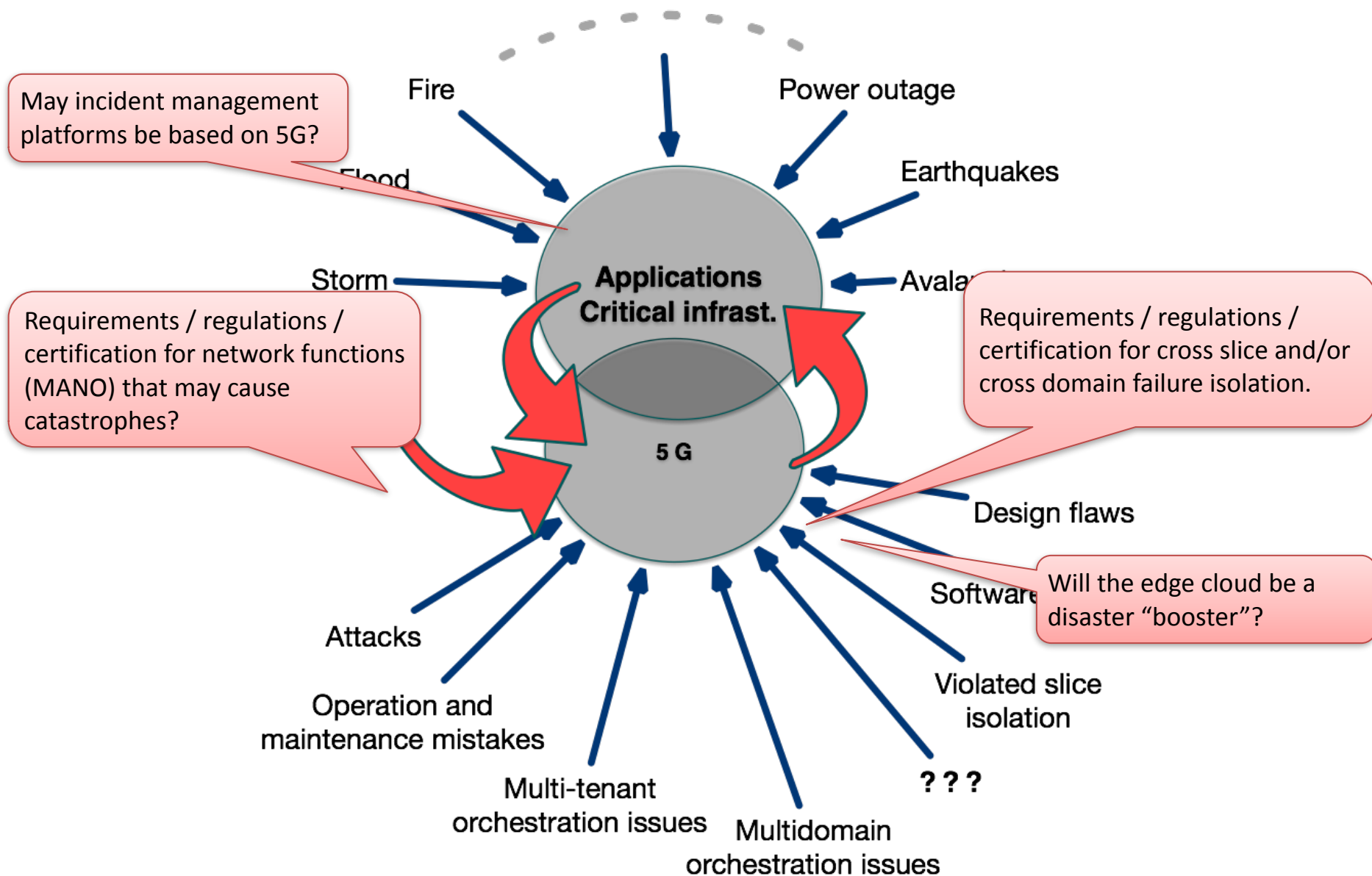


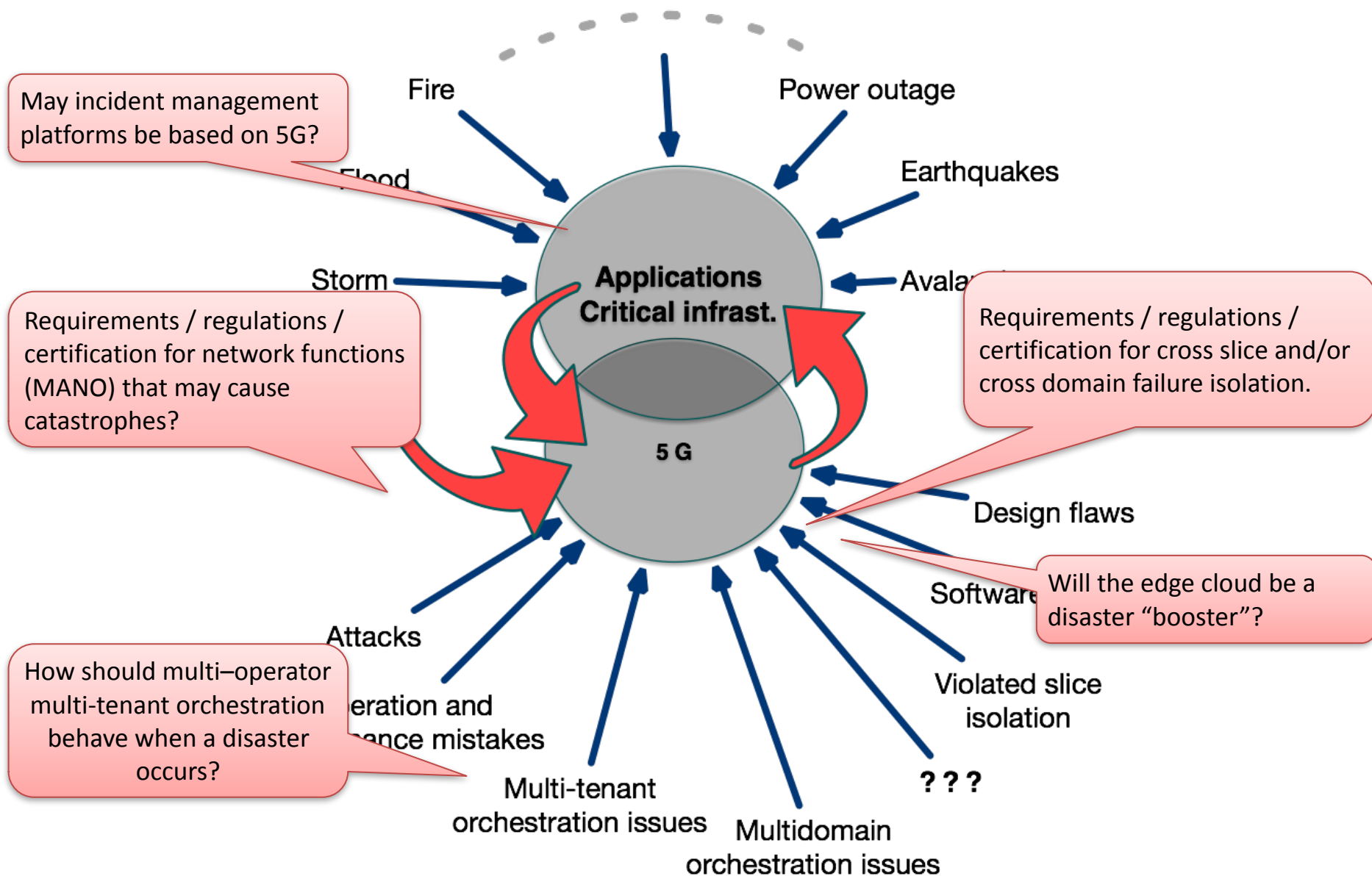


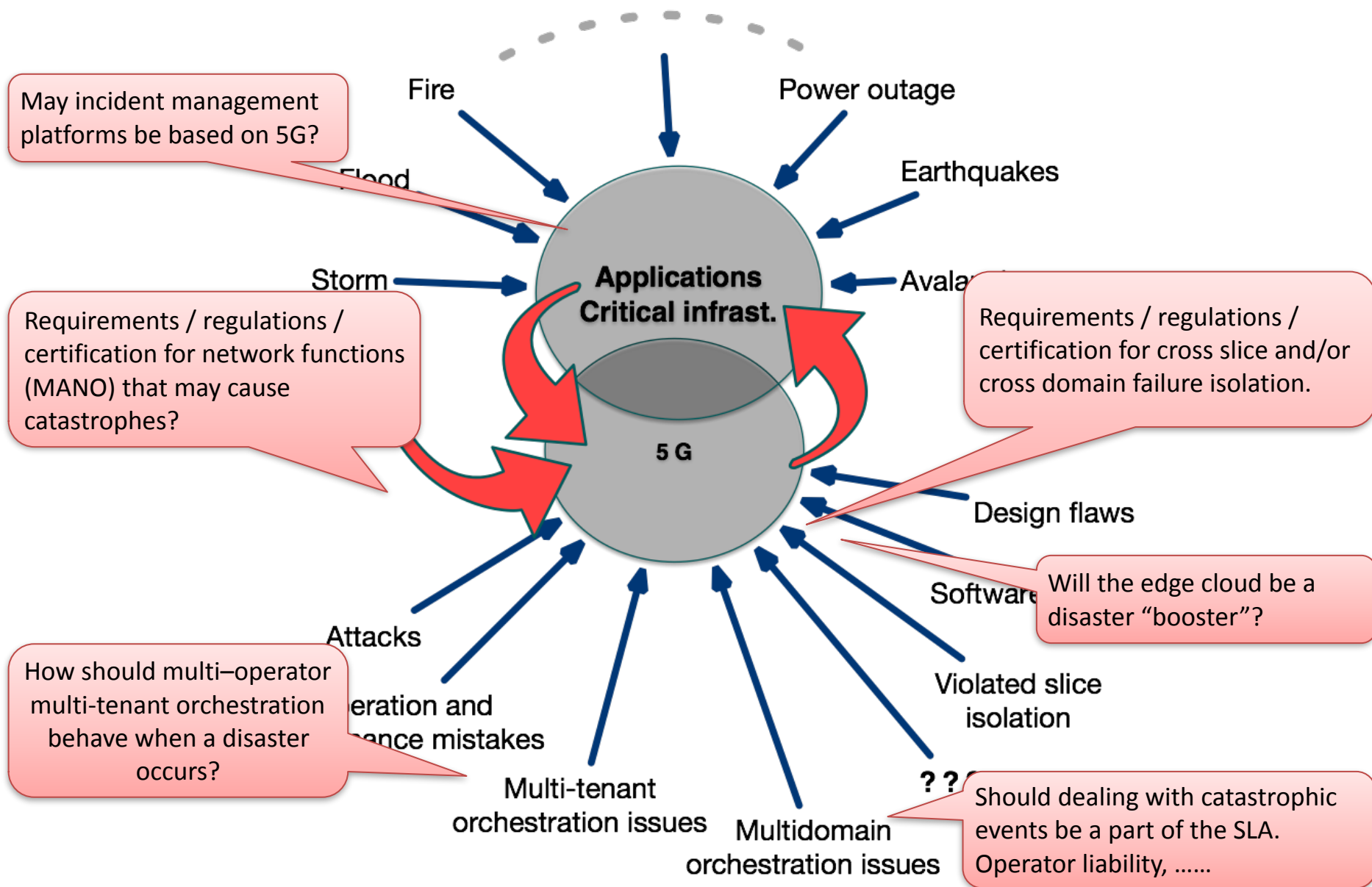


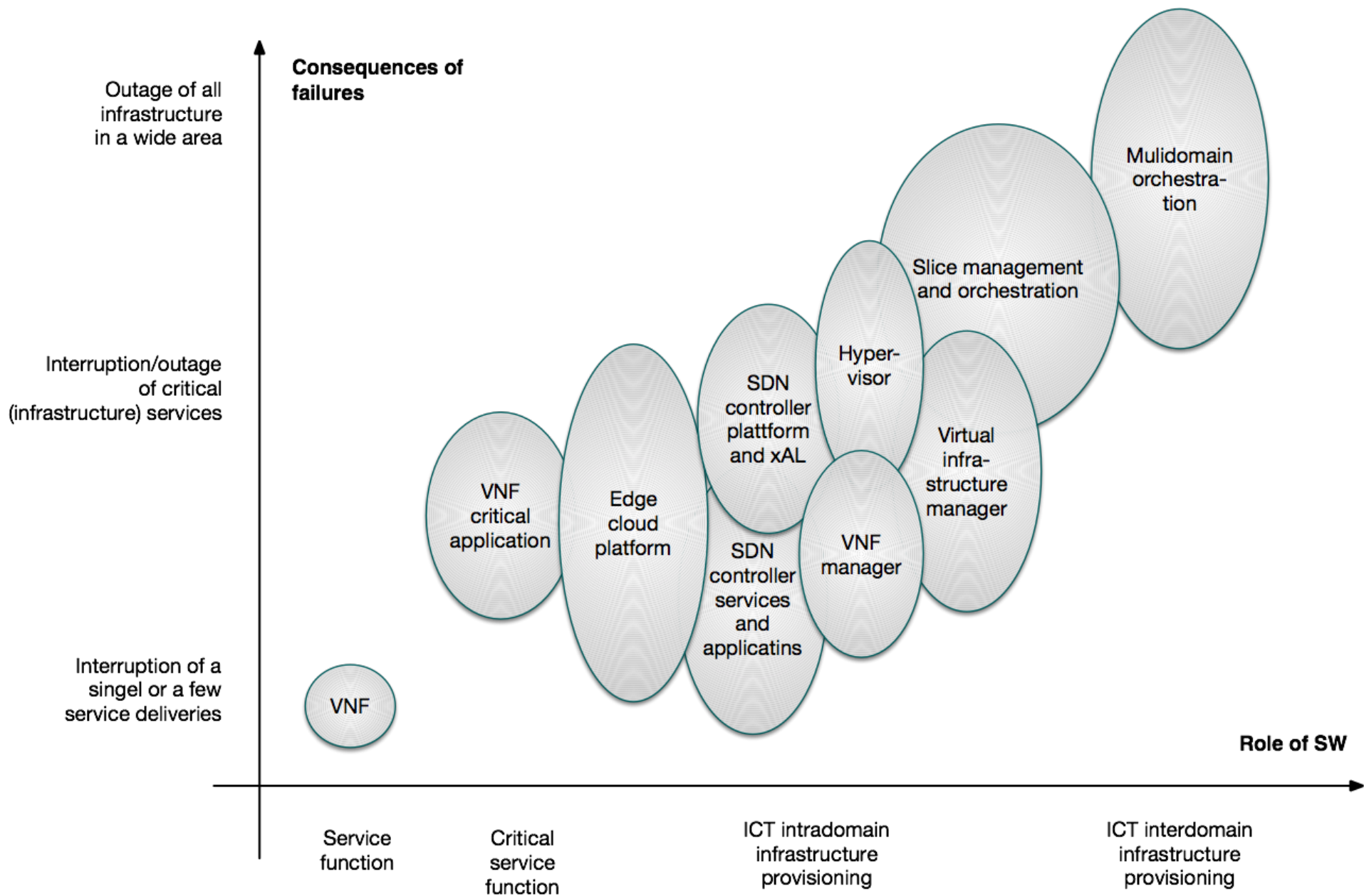


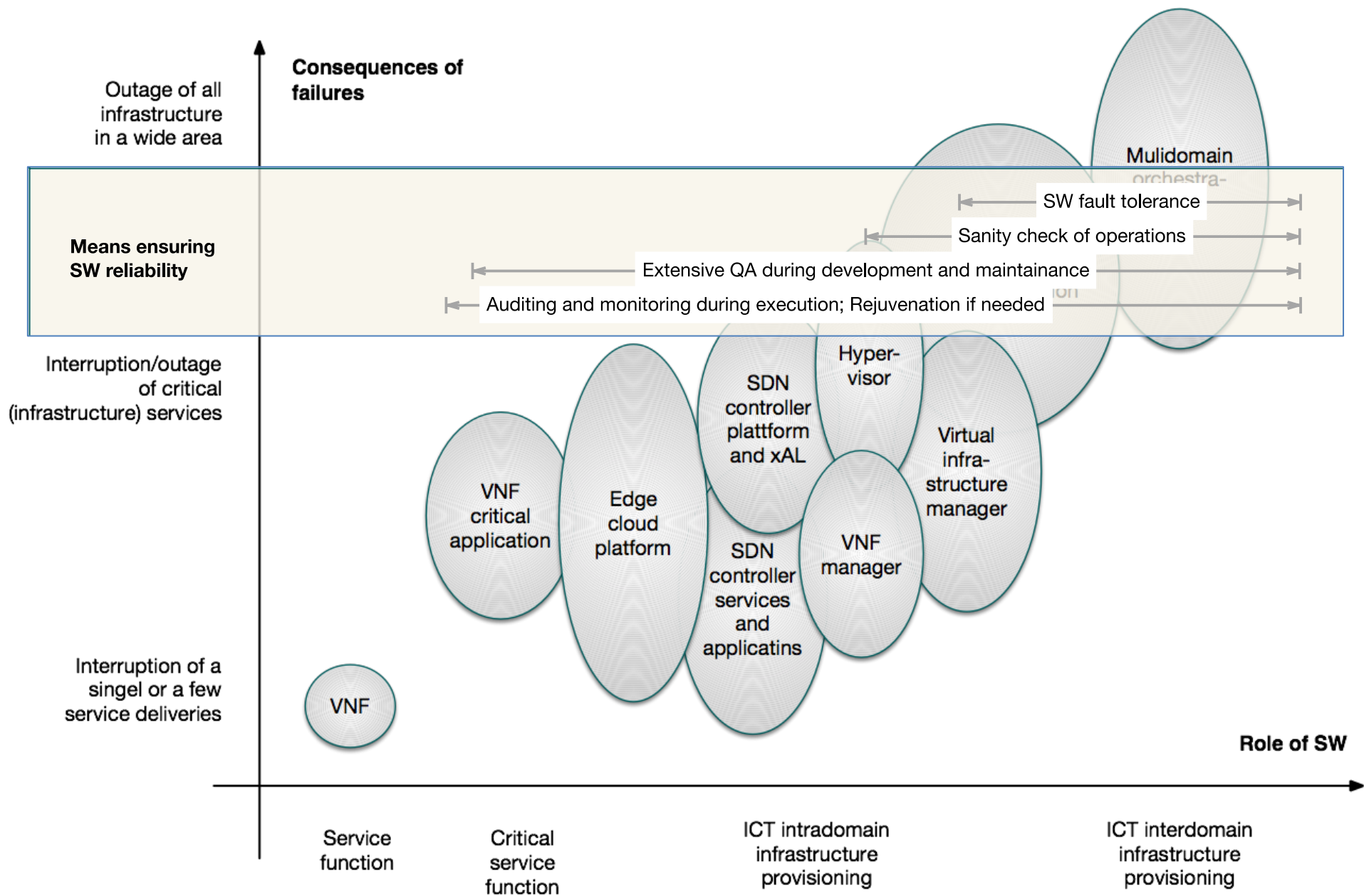


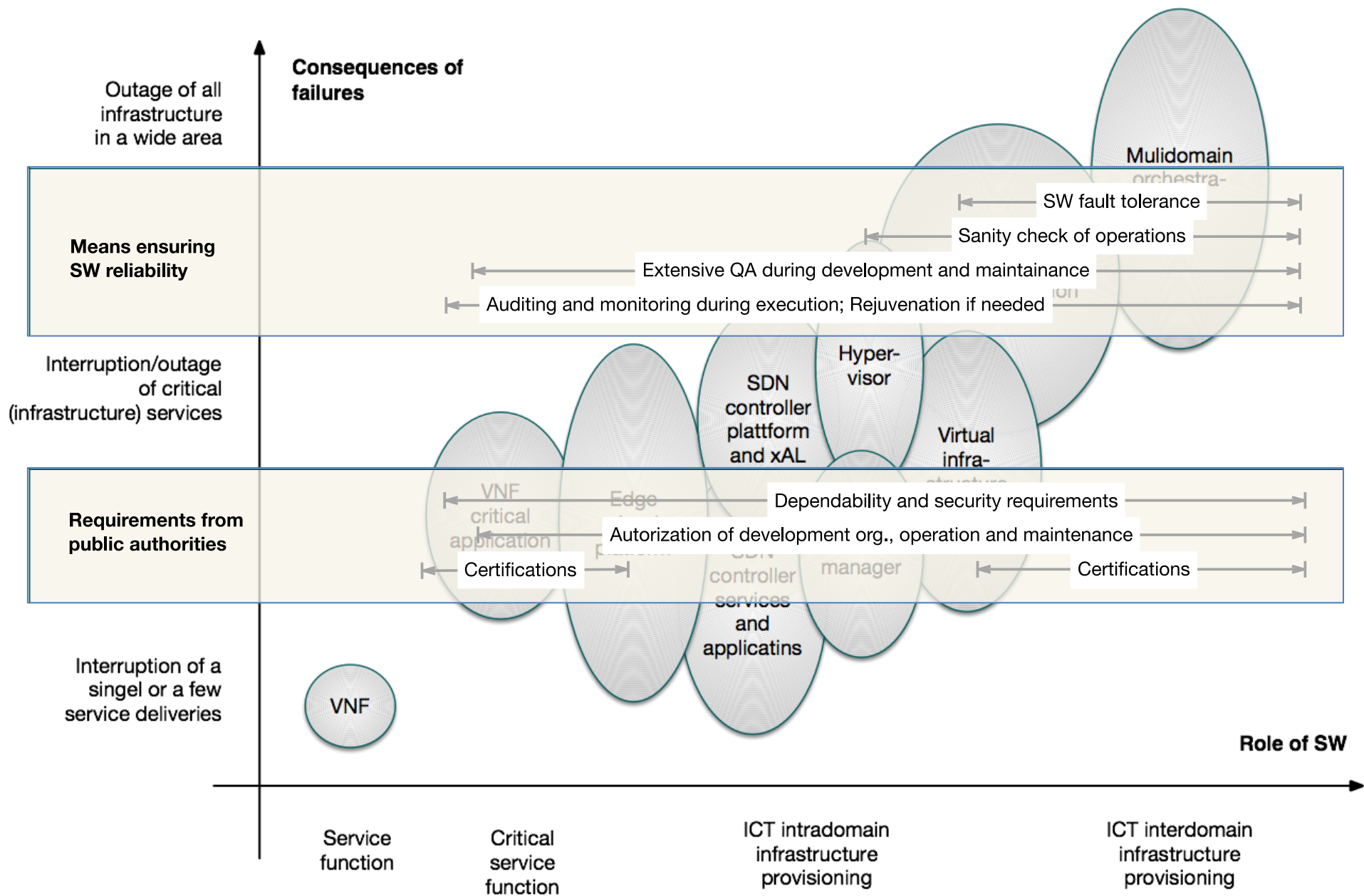












A unpretentious indicative Google scholar search

- **5G "critical infrastructures"**
 - Empirical comparison of virtualized and bare-metal switching for SDN-based 5G communication in critical infrastructures
 - Preventive maintenance of critical infrastructures using 5G networks & drones
 - Network slicing for critical communications in shared 5G infrastructures-an empirical evaluation
- **5G disaster**
 - Towards efficient disaster management: 5G and Device to Device communication
 - On the disaster resiliency within the context of 5G networks: The RECODIS experience
 - Challenges of 5G Usability in Disaster Management
 - On the disaster resiliency within the context of 5G networks
 - Robust Device-to-Device 5G Cellular Communication in the Post-Disaster Scenario
 - FINDER: A D2D based critical communications framework for disaster management in 5G
 - Post-disaster 4G/5G Network Rehabilitation using Drones: Solving Battery and Backhaul Issues
 - Green Base Station Using Robust Solar System and High Performance Lithium ion battery for Next Generation Wireless Network (5G) and against Mega Disaster

Main takeaways

Main takeaways

The conception that 5G may be

- a vehicle for infrastructure outage propagation
- the cause of infrastructure outages

Main takeaways

The conception that 5G may be

- a vehicle for infrastructure outage propagation
- the cause of infrastructure outages

is not paid significant attention.

Main takeaways

The conception that 5G may be

- a vehicle for infrastructure outage propagation
- the cause of infrastructure outages

is not paid significant attention.

Main takeaways

The conception that 5G may be

- a vehicle for infrastructure outage propagation
- the cause of infrastructure outages

is not paid significant attention.

The risk scenario will be significantly changed.

Main takeaways

The conception that 5G may be

- a vehicle for infrastructure outage propagation
- the cause of infrastructure outages

is not paid significant attention.

The risk scenario will be significantly changed.

Main takeaways

The conception that 5G may be

- a vehicle for infrastructure outage propagation
- the cause of infrastructure outages

is not paid significant attention.

The risk scenario will be significantly changed.

The challenge should be addressed in design, regulations and operation