Juno 2 Meeting Slides

Task 5: Slice-Aware Service Restoration with Recovery Trucks for Optical Metro-Access Networks

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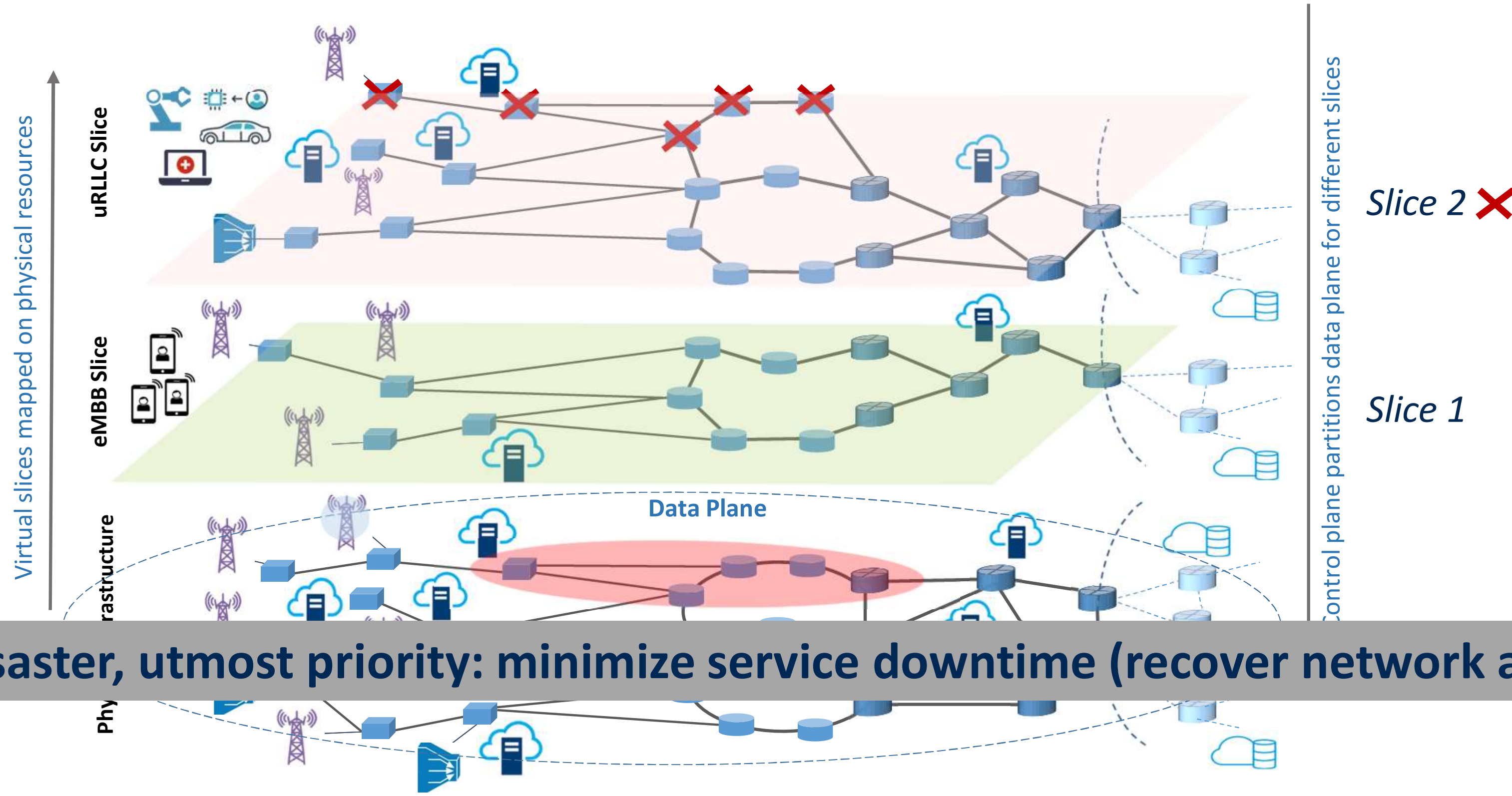
Task 5: Accomplished work



After disaster, utmost priority: minimize service downtime (recover network asap)

Task 5: Accomplished work

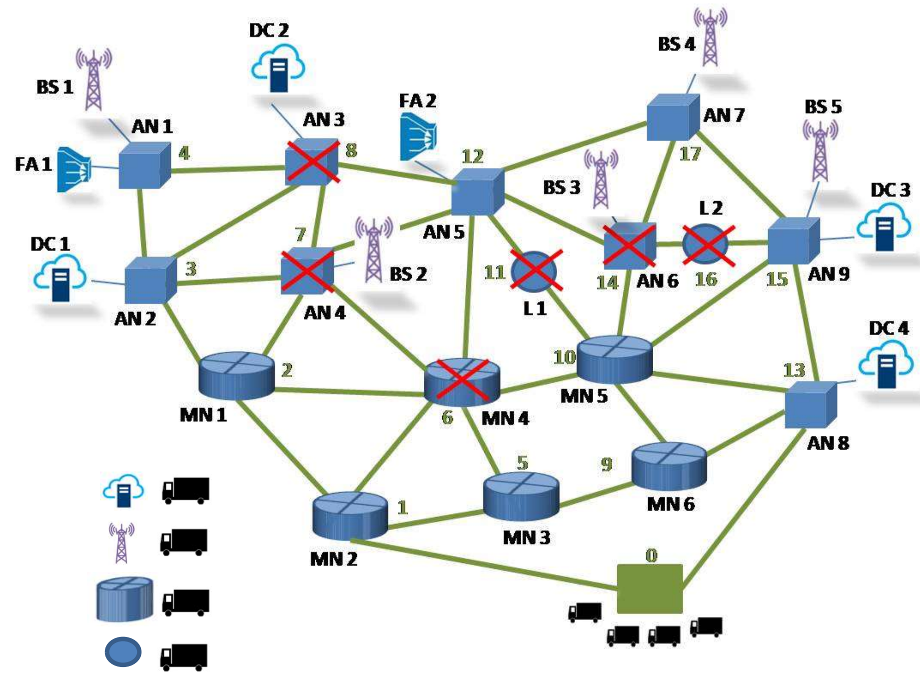
- Dynamic slice re-provisioning may not be possible with available/surviving resources and considering locality of services (e.g., coverage area of a base station) and limited network redundancy

- In post-disaster phase, recovery trucks can provide both repair and temporary relief/service while repair work is going on (unlike general network recovery)

- Developed a “slice-aware” routing and deployment strategy for heterogeneous recovery trucks to heterogeneous failure sites (**Globecom’19**)

Task 5: Accomplished work

- *Given*: Network topology, set of network slices, set of failed nodes, set of recovery trucks
- *Output:* Routes for recovery trucks
- *Objective*: Minimize service disruption penalty of slices
- *Solution Approach:* Mathematical model (MILP)



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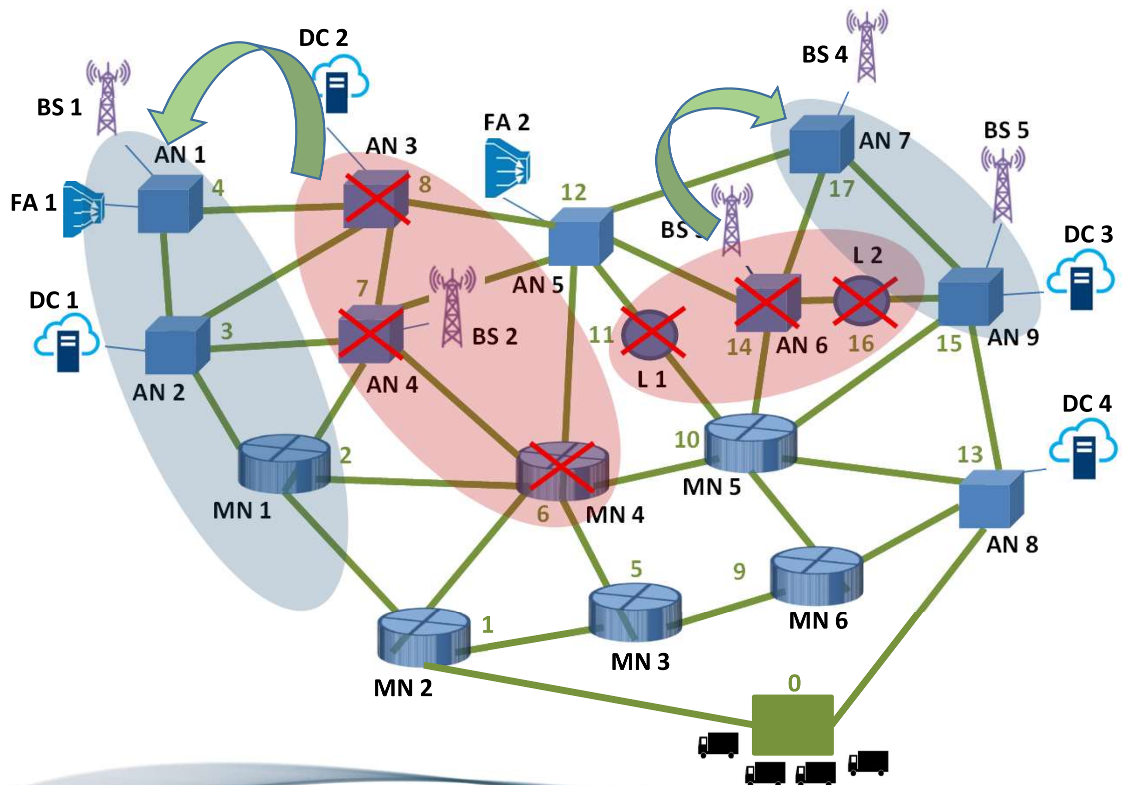
Task 5: Tentative future work

- We have considered the slice requirements to stay constant throughout the time and the phases (pre-disaster and post-disaster), however
  - In post-disaster phase, it is possible that due to the disaster, mobile users move from the disaster affected areas to other areas and hence user demands in those other areas will increase
  - Depending on the disaster scenario, a slice may require additional resources for specialized services (e.g., emergency medical services)
  - Also demands can increase/decrease based on peak hour and off-peak hour and hence, resources may need to be adjusted accordingly
  - Flash Crowds

Task 5: Tentative future work



Focus shifting from red area to blue area

- *Increase in user demands*
  - e.g., require more radio resources
- *Increase in specialized service requirements*
  - e.g., require more computation resources

Task 5: Tentative future work

- QoS requirements, SLAs, and demands of network slices may vary over time
  - Since network slices operate on same physical infrastructure, an elastic allocation of resources is required to optimally allocate/de-allocate a portion of available resources to each slice to avoid resources shortage
    - For example, as demands in one network slice increases, more computational resources can be allocated to that network slice and vice-versa

Flexibility of slice configuration gives a leverage in the post-disaster phase

Task 5: Tentative future work

- Consider updated post-disaster slice requirements

- Implement elastic resource allocation through the recovery trucks
  - Currently, a recovery unit is deployed for the duration required for full repair of the component (full repair work may take several hours while other services may be more crucial at that time)
    - A truck is deployed only for the duration required to meet the current demand
    - Deploy the necessary unit to another network component which requires additional resources at that time window (given that no other unit is available) - halt the current repair work if needed
    - Ensure minimum service availability first - deploy first where service is completely disrupted

    - Suitable scenario for FAU implementation (not associated with repair)

Task 5: Tentative future work

- Develop heuristic models for flexible deployment of recovery trucks based on updated slice requirements
  - Find the routes and schedules for the recovery trucks
  - Consider periodic updates or event-based?
  - Require real-time updates and communication among the trucks and the central depot – feasible in post-disaster phase?
  - Working control plane? - important for slice reconfiguration
  - Slices should be resilient to congestion, failure, etc. of another slice
    - Since the slices share common physical resources, if one slice overloads (i.e., requires/consumes more resources), other slices may be affected

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