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Study on Advanced Non-Public Networks and Their Interworking

S1-240033

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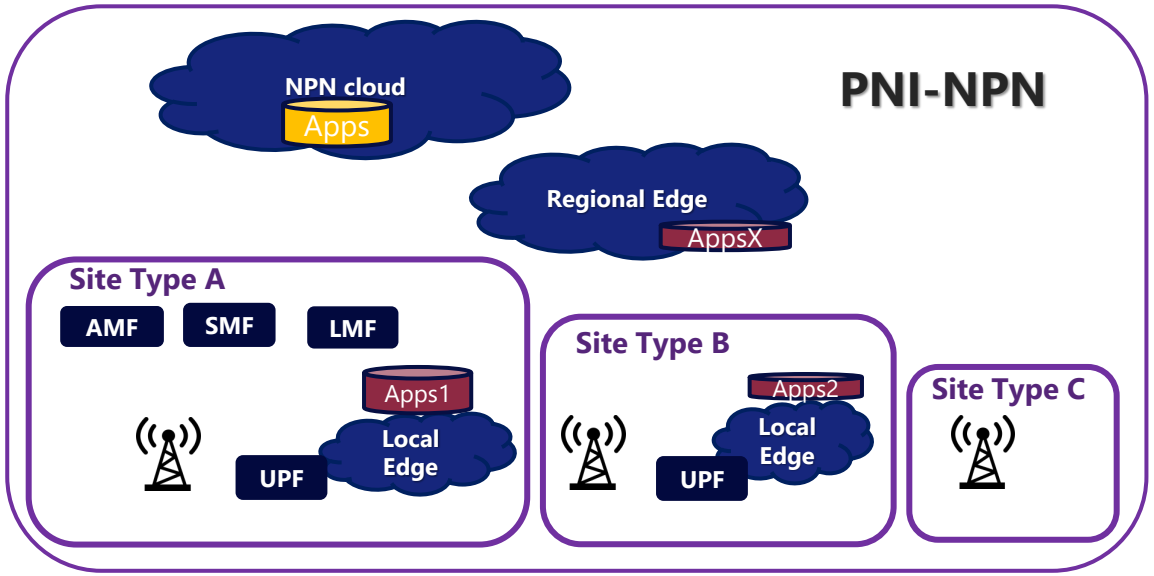
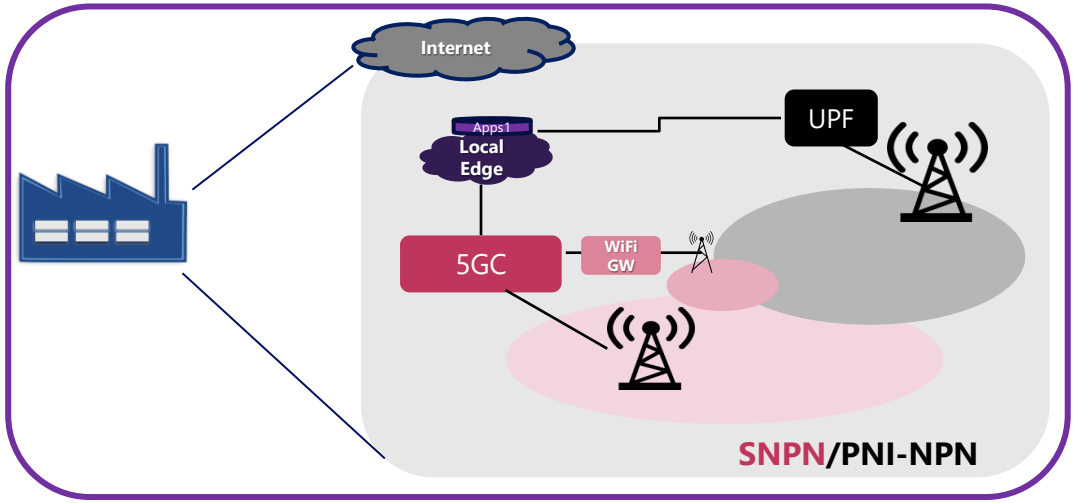
Main Goals

- **Target study area: Public-network-integrated NPNs**
  - Enable a more diverse deployment models of industry-tailored public-network-integrated private networks (PNI-NPNs)
    - e.g. flexible realisation of PNI-NPNs employing distributed services between on-site, regional edge and cloud locations



- **Target study area: Interworking between different types of NPNs**
  - Enable interworking between SNPNs and PNI-NPNs to increase reliability, provide service continuity and improve QoS generally using 3GPP and non-3GPP access

UEs with single and multiple subscriptions and appropriate radio capabilities to be considered



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Current Challenges

- **Existing specifications on PNI-NPNs do not address all their requirements**
  - Deployment options are confined to either MNO-hosted or slice-based deployment
  - While slicing enables the creation of customised networks, the focus is on the separation of customers, security aspects, and meeting specific service requirements > limited functionality to manage a slice flexibly in a multi-domain scenario
  - A flexible way of selecting a serving (control/data plane) network functions based on specific functionality, reliability requirements, user's security profile, load, signalling latency/geographical location and other aspects is lacking
- **Absence of requirements on interworking between SNPNs and PNI-NPNs**
  - Stage 1 specifications go some way to address such scenarios for NPN subscribers, BUT…
  - Roaming and handover between SNPNs and PLMNs generally are currently explicitly excluded from the (Stage 2) specifications
  - Dual 3GPP access of Rel-19 does not extend to SNPN networks
  - Interworking with non-3GPP access mainly targeting offload and distribution of traffic

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Objectives

- Study PNI-NPNs and requirements for a flexible selection of a serving (control/data plane) network function(s) across multi-operator domains
- Study requirements on interworking between different types of NPNs using 3GPP only, as well as 3GPP and non-3GPP accesses to increase reliability, provide service continuity & improve other aspects of QoS
  - NOTE 1: The use cases from TR 22.841 should also be considered.
  - Identify the technical impediments to handover between SNPN and PNI-NPN in a defined locality
- Identify the resulting Stage 1 impact on NPNs, network slicing, security, network exposure and charging

NOTE 2: UEs with single and multiple subscriptions and appropriate radio capabilities to be considered

NOTE 3: The proposed concept of distributed device and user trust (S1-233028) can be taken into account.

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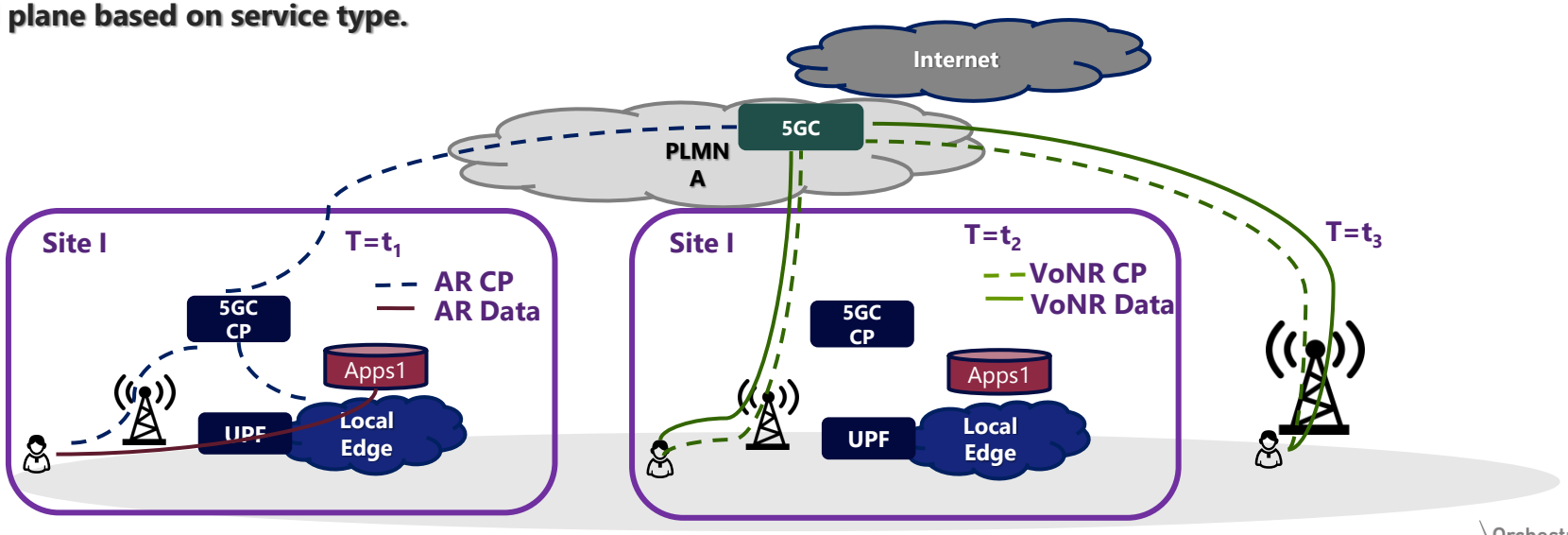
Example Use Case – Control Plane selection based on service

- Multiple sites of a logistics company use PNI-NPN for 5G connectivity
  - Different sites provide different applications and house different network and application functions
  - PNI-NPN operator has an agreement with PLMN operator A to provide coverage and required functionality extending beyond the company's sites
- Site I is a large site providing local edge infrastructure, 5G RAN and control plane functionality (e.g. AMF, SMF, PCF, LMF) to reduce latency and ensure efficient policy provisioning
- Bob is an employee of the company is at site I, tasked with overseeing and assisting in arranging items and packing tasks for a new delivery
  - He is using an AR-enabled smart glasses (or AR HMD) equipped with 5G connectivity
  - The local AR system provides digital information on items, order details and other information, onto his field of view; Localization ensures accurate positioning of virtual annotations and guidance cues
  - His job also involves visiting different sites and he uses VoNR calls to update managers or customers on order status, delivery updates, etc.
- Outcome: The PNI-NPN and PLMN operators enable selection of network resources that allows Bob to
  - use local 5GC and AR services and experience lowest possible latency
  - use PLMN 5GC for VoNR to ensure best mobility support between the sites
- **Example Potential Requirement: Subject to agreements between PNI-NPN and PLMN operators, 5GS shall enable flexible selection of user plane and a part or the entire control plane based on service type.**



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Benefits

- **Enabling more diverse deployment models to meet industry-tailored PNI-NPNs – benefiting both private networks and PLMNs**
  - Flexible realisation of PNI-NPNs across multi-operator domains
  - Improved integration with different edge deployments with services distributed between on-site, regional edge and cloud locations
- **Enabling better interworking between different types of NPNs for**
  - Improved system reliability & other QoS aspects
  - Better radio resource utilisation
- **Promotes support for more flexible and dynamic Service Level Agreements in 6G**

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