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Practical Technical Design Considerations for Active Network Management

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Active Network Management

- Defined in the Active Network Management Good Practice Guide as

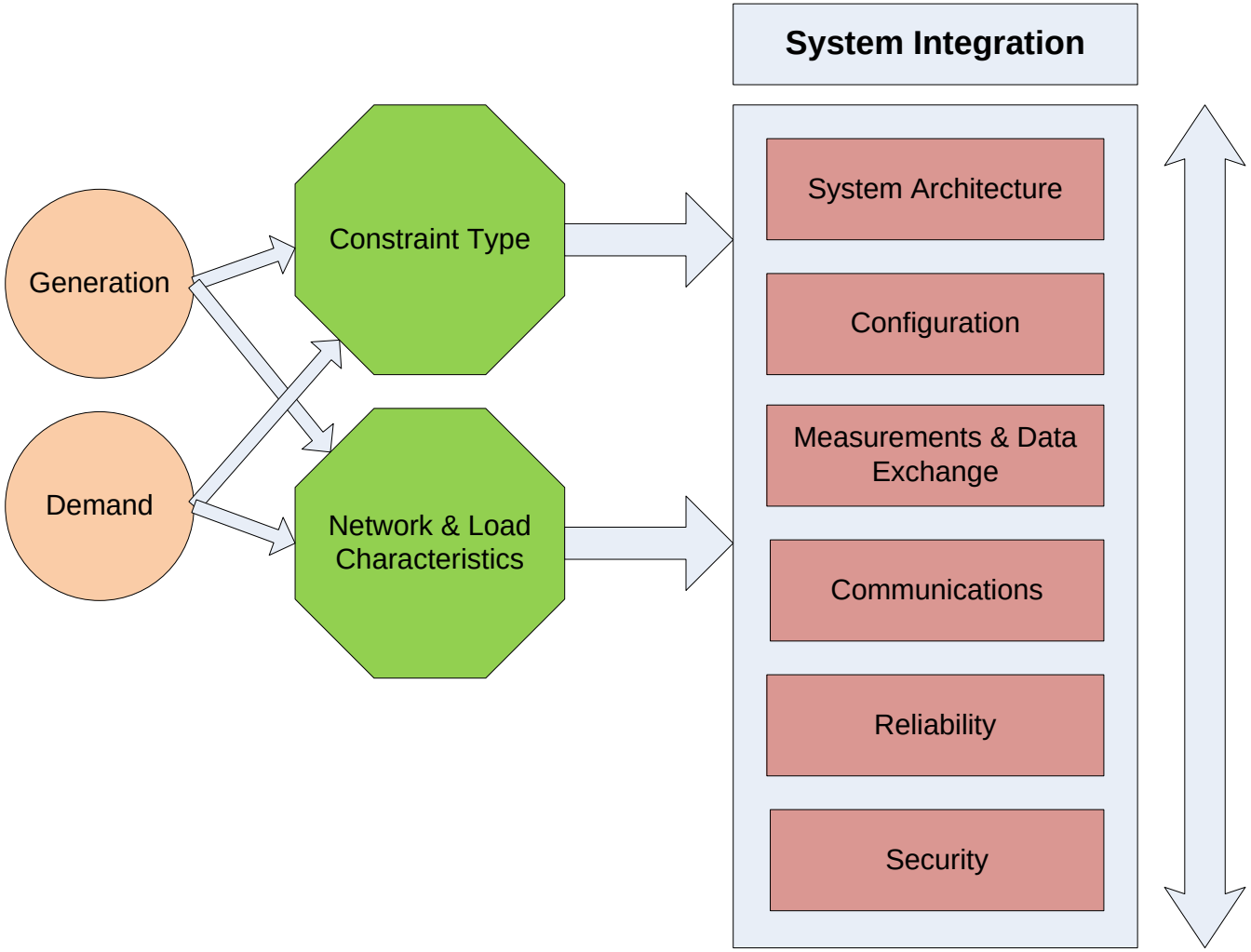
  “Using flexible network customers autonomously and in real-time to increase the utilisation of network assets without breaching operational limits, thereby reducing the need for reinforcement, speeding up connections and reducing costs”

- Proven as an effective means of managing network capacity to connect greater volumes of low carbon generation and demand

Technical Design Considerations

- Over-arching technical design of ANM determined by:
  1. Constraint type and network & load characteristics
  2. Requirements for system integration – including system architecture, configuration, measurements & data exchange, communications, reliability and security

Technical Design Considerations



Constraint Type

- Constraints usually either:
  - *Thermal* due to exceeding equipment thermal ratings; or
  - *Voltage* due to exceeding statutory voltage levels
- Techno-economic optioneering to select efficient solution
- Could ANM feasibly address the identified constraint?

Network Type & Load Characteristics

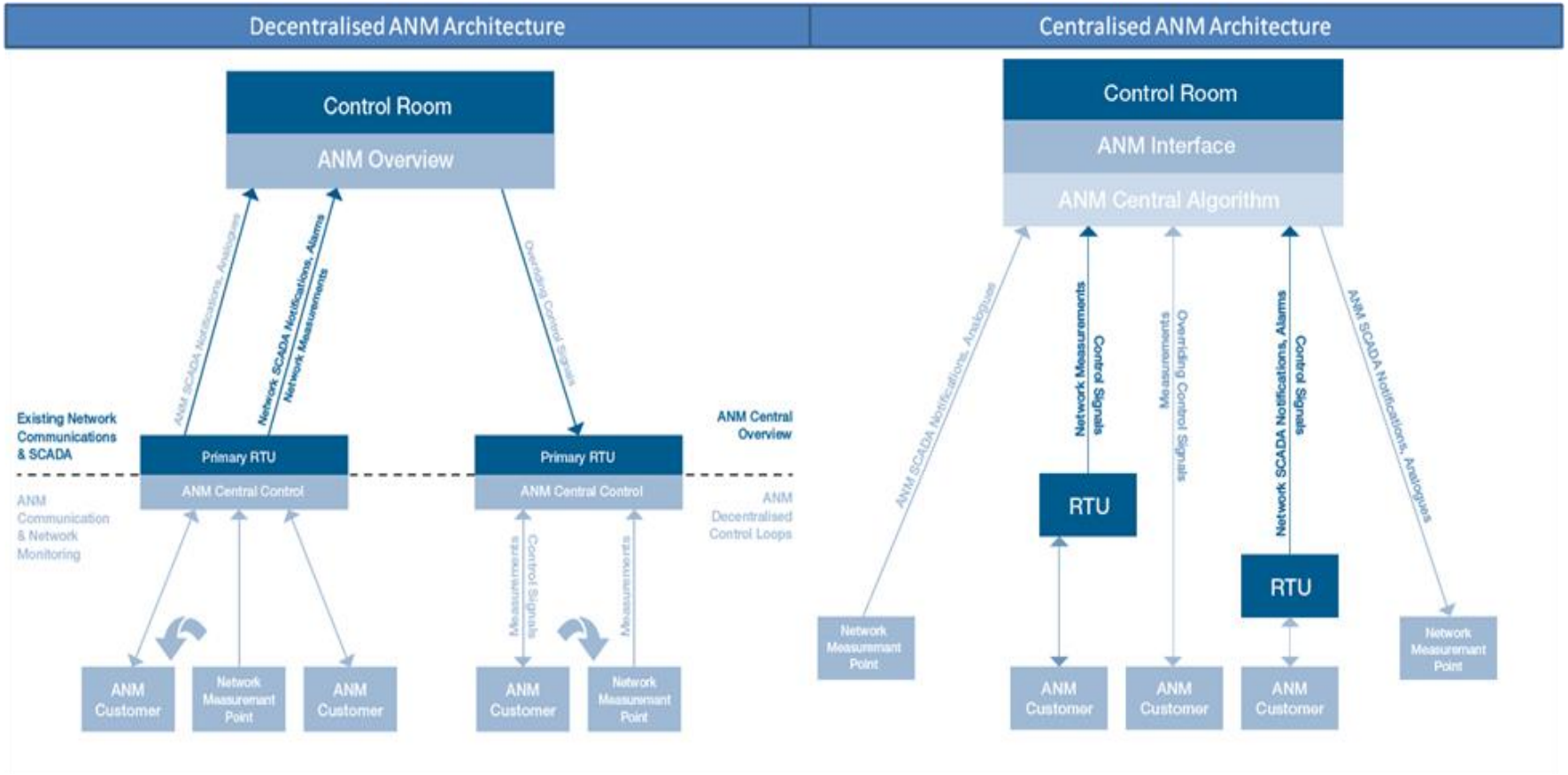
- Is the network urban or rural?
  - Urban network may be suited to a centralised scheme
  - Rural network may be more suited to a decentralised approach
  - Meshing and interconnection will determine monitoring and control aspects of ANM

- What load is contributing to the constraint?
  - Generation
  - Demand
  - Important to determine level of controllability

System Integration
ANM System Architecture

- Over-arching technical architecture of ANM is either:
  - *Centralised* – managed from the central control room
  - *Decentralised* – managed on remote devices on the network
  - *Hybrid* – a combination of the two where nested decentralised systems are managed overall by a centralised ANM system

System Integration
ANM System Architecture



Functional Specifications
Configuration (Algorithm Design)

- Designed to enable adaption to a range of network conditions based on real-time analysis of network behaviour and comparison with constraints
- Recognise commercial rules of access for connected customers
- Update with network changes e.g. new customers, network configurations
- Execute appropriate actions, including failsafe modes

Functional Specifications
Measurements & Data Exchange

- Measurement locations consider area of constraint, controllable loads and network configuration
- Controllable loads monitored directly
- Network parameters measured in critical constraint locations
- Data collation dependent on architecture
- Any interaction with the transmission system defined to ensure interactions between ANM and balancing actions are understood and managed

Functional Specifications
Communications

- Communications are critical to ANM system operation
- Communications architecture dependent on ANM system architecture – centralised or decentralised
- Generally consistent with existing SCADA and network management system
- Technical specifications should include inputs, outputs, data resolution and polling, protocols

Functional Specifications
Reliability

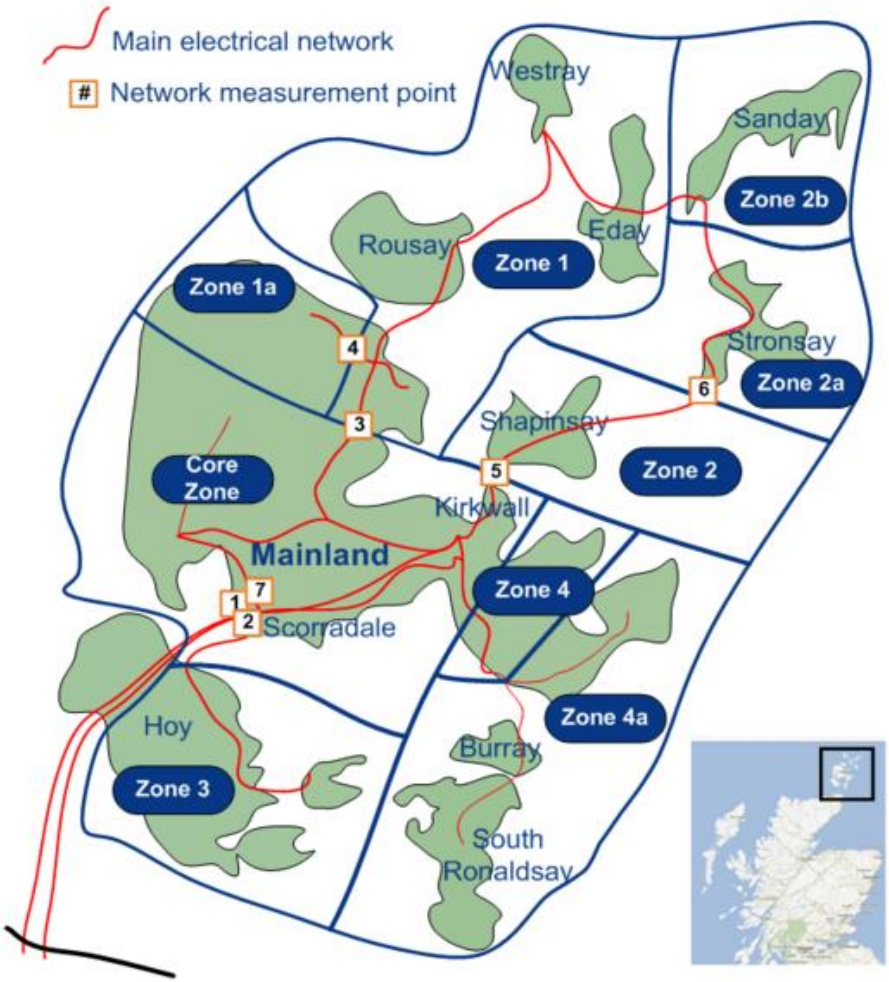
- Level of reliability dependent on customer type, total curtailment required and network characteristics
- Large industrial load will be more reliable than domestic customers at responding to control signals

Functional Specifications
Security

- Failsafe modes are critical to both ANM and network safety
- Failsafe modes include loss of communications, unresponsive loads, ANM system failure and wider network failures
- Cybersecurity is a big concern with third parties potentially having access to network management systems

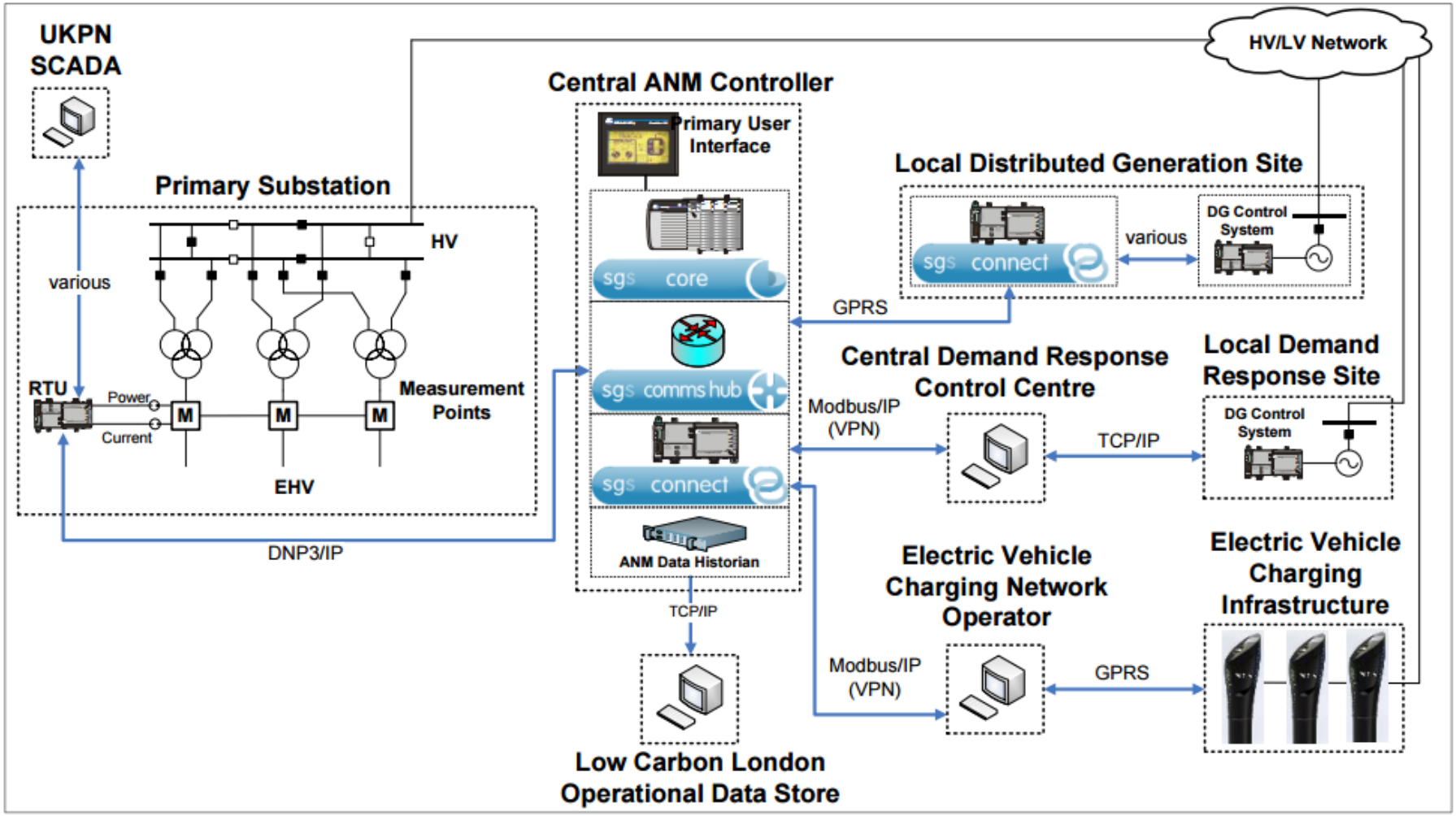
Case Studies

Orkney ANM Scheme



Case Studies

Low Carbon London



Case Studies
Nice Grid Project

- Part of Grid4EU project
- Network constrained at a single 400kV entry point and local generation cannot meet peak demand in winter
- Centralised controller optimises generation, consumption and storage in real-time through monitoring and assessment of power flows and forecasting
- Achieved 10-20% reduction in power consumption at peak times

Future Outlook for ANM

- Successful implementation across UK DNOs
- Focus now on roll-out from innovation to business as usual
- Technical and commercial considerations to be addressed going forward
  - Visibility of ANM to transmission networks
  - Evolution of technology e.g. convergence of communications on a common standard (IEC 61850)
  - Development of industry regulations and standards