

Communications & Integration

Session 3b:
Emmanuel Cerqueira | UK Power Networks

The Flexible Plug and Play solution has a number of key technical pillars

Smart devices

Communication
Infrastructure

Smart application
(ANM)

System Integration
IEC 61850

System integration = deployment of ICT-based smart devices and the smart application within the communication infrastructure in such a way that they can interact to deliver the functionality of the Flexible Plug and Play solution

ICT deployment: key requirements for 'Flexible Plug and Play' success

Reliability

Poor reliability would cause unnecessary DG curtailment

Scalability

Need to facilitate numerous generation connections in one area over time

Ease and speed of installation

Easy commissioning to deliver fast connection with less risk of error or failure

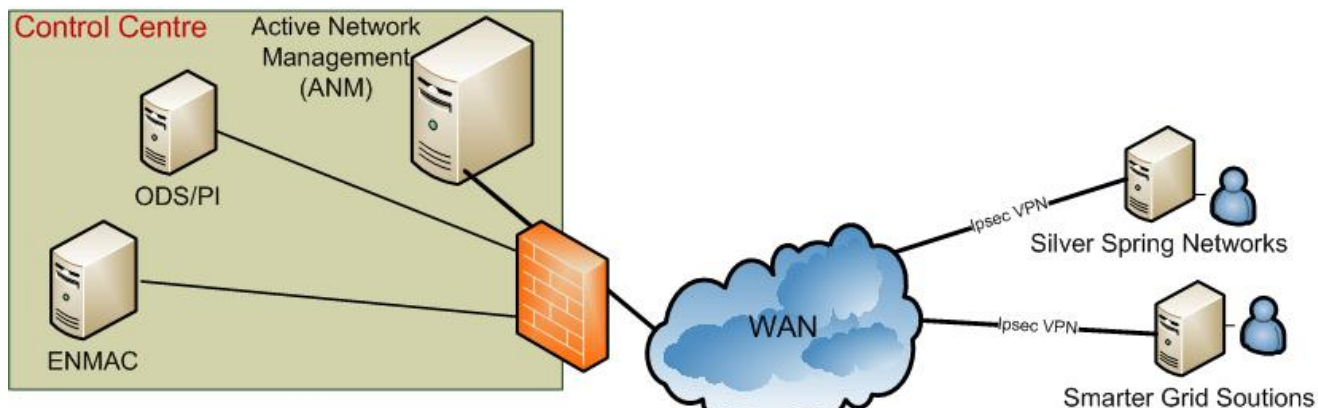
Repeatability

Clear commissioning process for efficiency and effectiveness

Interoperability

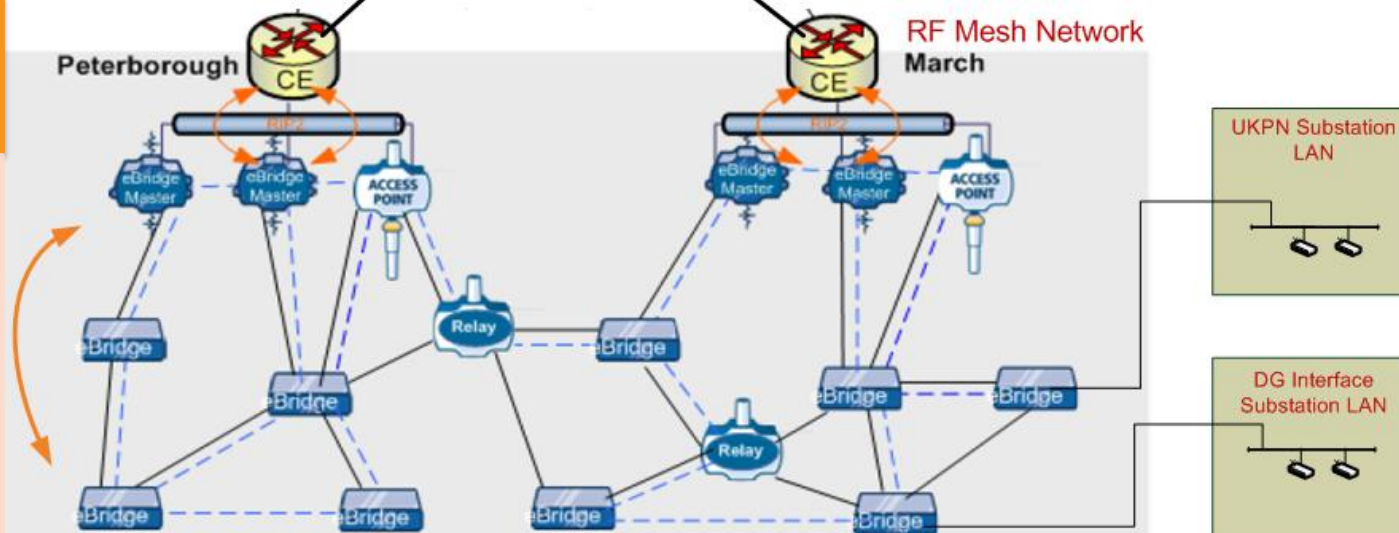
Integration of multiple smart devices

Flexible Plug and Play has chosen an RF mesh communication solution



Key features

- Self Healing
- IP-based
- Peer-to-peer
- Dynamic routing



The trial outcomes have matched the requirements for deployment of an ICT-based solution

Infrastructure reliability

- Stress tests and simulated traffic have been trialled
- Data flows have been optimised

IP based protocols Interoperability

- IEC 61850, SNTP and DNP3 have been implemented

Plug and Play features

- Clear commissioning process defined including surveys, for ease of future expansion

High level of security

- Controls have been implemented to provide an enhanced level of security

The chosen communication solution proved fit for purpose

Test Criteria	Target	Result	Relevance
Data success rate	> 90%	> 99%	Notification on exception
Latency - Round Trip Time	< 1s	Average 300ms	heart-beat message every 10 seconds
Data Throughput	> 25kbps	From 20kbps to 200kbps	18kbps calculated for all the devices
Route Diversity (neighbours)	2	3.1	Optimal radio coverage
Failover (lost relay)	< 5 minutes	1 minute	ANM Fail safe settings

Learning from ICT deployment: communications network monitoring and reporting is key

Cause of failure

- Dynamic network routing not fully operational

Impact

- Intermittent failures of remote RF mesh nodes and higher communication latencies due to sub-optimal or conflicting routings

Actions

- Removal of route summarisation and addition of specific filter rules in the WAN
- Additional Ethernet switch deployed to support Master Failover Protocol

Learning

- Requirement to constantly monitor the infrastructure from end to end with adequate reporting processes
- Trouble shooting process implies close cooperation of various stakeholders

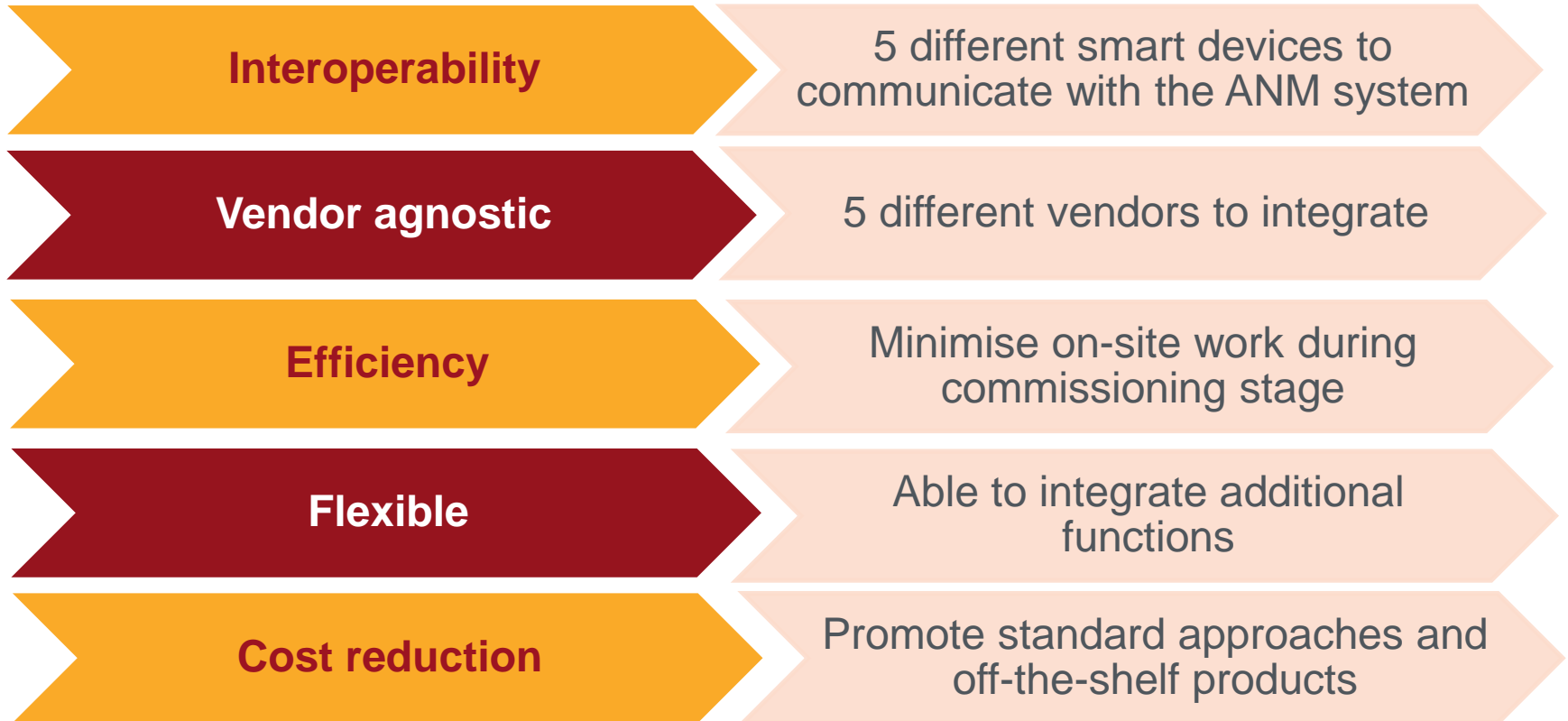
Learning from ICT deployment: RF mesh communications was an effective solution for FPP

RF mesh infrastructure with the canopy approach was a scalable solution

Availability of the communications was found to be the highest priority performance indicator for the overall ANM system, and self healing mechanisms improved the resilience

The overall communication architecture needed to be optimally designed and thoroughly tested, because the network is only as strong as its weakest link

System Integration activities aimed to demonstrate multi-vendor interoperability using IEC 61850



System integration using IEC 61850 was a significant challenge

Limited pre-existing internal skills and experience in the implementation of the IEC 61850 standard

IEC 61850 not widely used outside the substation to enable communication between field devices and centralised applications

The implementation of MMS protocol over a low bandwidth medium such RF mesh was a first of its kind.

Learning from system integration using IEC 61850: test in the lab before commissioning

Interoperability

All smart devices have been tested in the lab to demonstrate interoperability

Vendor agnostic

Vendor provided conformance certificates for IEC 61850

Efficiency

The use of an integration lab enabled the commissioning time to be reduced significantly

Flexible

Existing substation devices were upgraded to integrate IEC 61850 server capability

Cost reduction

Configuration time has been reduced

System integration with IEC 61850 is an efficient way to integrate Smart Grid technologies

The integration platform is an important asset for more rapid and successful commissioning of new smart technologies

System integration in this context is a new role for a DNO

IEC 61850 requires upfront investments before savings can be achieved in configuration and commissioning stages

Key achievements of Flexible Plug and Play



Engaged with 50+ DG developers
→ Interviewed 20



Commissioned RF mesh wireless
network for wide area comms



Trialled two DG access principles:
LIFO and Pro-rata capacity quota



Integrated and commissioned smart
devices across 12 sites



Made 40 connection offers:

- 15 accepted, 54.4MW enabled,
£44m savings



Installed and commissioned first
quad-booster at 33kV



Developed analysis tool for
investment options in DG
dominated networks



Deployed IEC 61850 for
interoperability between solution
components

Successful deployment of new commercial arrangements and interoperable smart grid components to deliver faster and cheaper DG connections

For more information visit ukpowernetworks.co.uk/innovation