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SPF Cluster 1 and Cluster 4 workshop

Landscape of NTNs

Janette Stewart

21 November 2024

3GPP non-terrestrial networks (NTNs) are specifications enabling direct to device (D2D) connectivity via satellite (or aerial systems)

- 3GPP Rel-17 was the first 3GPP standard to include NTN capability, standardised in two frequency bands initially:
  - n255 (2 × 34MHz in the L-band)[1] and n256 (2 × 30MHz in the S-band)[1]

- Rel-18/19 will expand NTN specifications to address a wider feature and service set

- NTN D2D use cases might include:
  - remote area coverage for mobile broadband (MBB)
  - NTN-IoT[2]
  - temporary coverage (e.g. public safety/disaster recovery)

[1] Initially 1525–1559MHz (downlink) and 1626.5–1660.5MHz (uplink), and 2170–2200MHz (downlink), 1980–2010MHz (uplink); [2] IoT: internet of things

Two approaches to D2D have emerged: MSS versus MS spectrum

MSS[1] spectrum

- Satellite player uses dedicated MSS spectrum (allocated to MSS use regionally/globally) to provide D2D services
- Players using MSS spectrum include Globalstar, Viasat, EchoStar, Omnispace, Iridium and others

MS[2] spectrum

- Satellite player collaborates with MNO(s)[3] within a market to use the mobile spectrum assigned to the MNO in the satellite payload
- Players using terrestrial spectrum include AST SpaceMobile, Lynk and Starlink D2D

WRC-27 AI 1.12–1.14 to consider additional MSS allocations

ECC working group FM44 is considering D2D requirements

[1] MSS: mobile-satellite service; [2] MS: Mobile Services; [3] MNO: mobile network operator

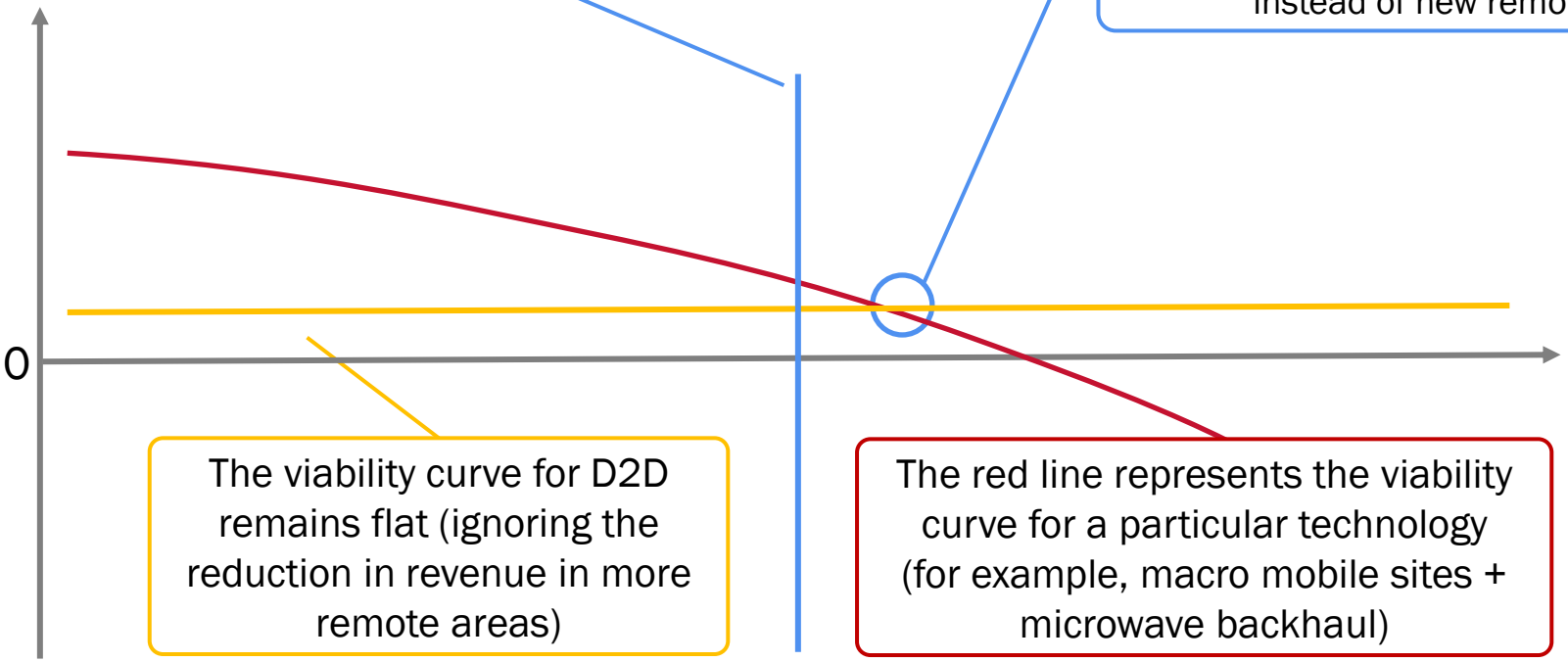
When assessing D2D market demand and use cases, two market segments can be considered

	D2D consumer mobile market	D2D IoT market
Segment 1 "Unconnected"	▪ People living outside MBB coverage (e.g. 3G or better), which can be further sub-divided into people living in areas outside any mobile coverage, and those in areas with 2G coverage only	▪ IoT devices permanently outside terrestrial IoT coverage
Segment 2 "Travelling/ roaming devices"	▪ People living inside MBB coverage (e.g. 3G or better), travelling into areas without MBB coverage (or roam onto the satellite network if terrestrial coverage fails)	▪ Devices which are sometimes inside terrestrial IoT coverage but roam between terrestrial and satellite coverage as their location changes, or if the terrestrial network fails ▪ Devices that require continuous connectivity and may be connected both to terrestrial and satellite networks for resilience reasons

D2D could be a more profitable coverage solution for low-traffic areas, if capacity allows

As population density and the level of traffic increases, D2D stops being a viable alternative to terrestrial mobile coverage, as the capacity available is not enough to support the required amount of traffic. D2D could still supplement terrestrial coverage (provided it can support the required throughput)

Towards, or beyond, the edge of terrestrial coverage, D2D becomes viable. If terrestrial sites have already been deployed, there could be a capex/opex saving by replacing with D2D. Future sites (e.g. due to coverage obligation or government policy) could be via D2D instead of new remote terrestrial sites.



The viability curve for D2D remains flat (ignoring the reduction in revenue in more remote areas)

The red line represents the viability curve for a particular technology (for example, macro mobile sites + microwave backhaul)

Contact details

Janette Stewart

Partner

janette.stewart@analysysmason.com

Tel: +44 (0)20 7395 9000
london@analysysmason.com

linkedin.com/company/analysys-mason

@AnalysysMason

youtube.com/AnalysysMason