REPORT ON ESA D2D WORKSHOP 2024

December 2024

CONTENT

CONTEXT AND OBJECTIVES

Direct-to-device (D2D) connectivity holds the promise of a new era of mass-market satellite connectivity. With the potential to reach smartphones in the pockets of billions of consumers around the globe, as well as all other mobile devices – from vehicles to machinery to planes – D2D may help close connectivity gaps and generate billions of euros in the process. So far, a number of high-profile ventures, predominantly by non-European satellite operators, mobile network operators and handset makers, are introducing early variants of D2D solutions.

Developing and deploying D2D services globally and in Europe entails significant commercial and technical challenges, complex to navigate and bound by international regulatory roadmaps. In this context, ESA is currently scoping a D2D initiative designed to support European and Canadian industry at large to develop end-to-end capabilities, up to into in-orbit-validation (IOV) of systems and services.

This workshop gathered key industry and decision makers to collectively:

- Discuss the case for D2D deployment in Europe (use cases, benefits, cost of inaction).
- Debate the pros and cons of various delivery models and resulting technical requirements.
- Identify success factors and formulate recommendations to decision makers.

Over 120 participants representing over 80 entities from 18 countries attended the event, with representatives of the full D2D value chain with Mobile Network Operators (MNO), Satellite Network Operators (SNO), satellite primes, satellite subsystems and equipment suppliers, terrestrial network providers, device chipset suppliers, user communities (automotive, safety services), European Commission, regulators (national and ITU), R&D and academics, startup and venture capital investors. This document reports the main findings from the discussions organised in four separate panels addressing respectively Use cases & strategic aspects, business case & service delivery models, regulatory aspects and technical/technology aspects.

For the purpose of focussing the discussions, the scenario discussed during the workshop mainly addressed satellite solutions operating in the so called “FR1” band (below 6 GHz) with direct connections to smart phones and any other devices.

FIVE TAKEWAYS

European user communities express the need for D2D connectivity; closing the business case will require federation on both the demand and supply side, public funding and consolidation beyond Europe.

- D2D services are increasingly appealing to consumers who are becoming less and less tolerant of service interruptions. Similarly, business verticals (e.g. automotive) and government services (e.g. Public Protection and Disaster Relief (PPDR)) expect and request continuous, ubiquitous, resilient and secure coverage over Europe. PPDR representatives recalled that “connectivity is a lifeline” and that resilient connectivity is an insurance policy worth paying for with regards to increasing geopolitical and climatic risks. As such, **D2D is regarded as a real opportunity to provide a truly ubiquitous and resilient connectivity coverage**. D2D also inherently carries broad socio-economic benefits, in particular related to European secure and sustainable digital infrastructures at large, a point of the Digital Decade Policy of the European Union.

- In Europe, on the demand side, **no single user vertical is sufficient, on its own, to close the business case for a European D2D solution**. Substantiating it will require demand aggregation on the European and worldwide market. On the supply side, **collaborative and innovative business models, mutualisation of investment and capabilities across the TN and NTN value chain, win-win collaboration between private and public players are all needed in order to afford the deployment and commercial delivery of European D2D systems in a cost-effective way**. In particular, public co-funding and investment are considered key catalysers for the development of European D2D systems and services and for triggering synergies of demand across the different markets.

Safety, security and geopolitical aspects call for D2D alternatives over Europe

- **Representatives of demand and supply both emphasised the need for multiple D2D service provider alternatives.** In particular, European actors would all benefit from the **inherent advantages of a competitive market environment**, enabling lower costs and better-quality services.

- **Mobile connectivity is a pillar for the economy and the delivery of critical governmental services;** therefore, European users will be best served with the availability of European D2D services alongside those provided by non-European systems. This will respond to **critical requirements in terms of safety and security**.

- In light of such requirements for Europe's sovereign and secure connectivity, **IRIS² evolution of services may include D2D. Preparatory work must start now**.

The regulatory framework needs to be clarified to develop future systems

- Two paths may be exclusively or simultaneously pursued to enable the delivery of D2D services over Europe: the use of the space spectrum (MSS) and/or the use of terrestrial spectrum (MS) by space systems.

- With regards to the **use of the terrestrial spectrum for D2D**, the European landscape is **fragmented and the question of cross border** interference and co-existence/operations between TN and NTN systems deserves further investigation:
  - **Europe-wide D2D operating in terrestrial bands would likely need some spectrum harmonisation** or be **restricted to specific bands** already harmonised for specific verticals (e.g. railway, PPDR),
  - nonetheless, **some European countries are considering regulations** to allow **D2D using terrestrial spectrum**.

- With regards to **the use of space spectrum for D2D**,
  - the **MSS 2 GHz "S band"** is a highly valuable spectrum band and **a prime candidate for future D2D service in Europe**,
  - **Europe needs to decide the way forward for the S band** licensing regime currently ending mid-2027.

- Overall, the regulatory framework **needs to be clarified and stabilised in Europe** to provide a regulatory long-term vision for D2D services in Europe and **allow D2D service value chain actors to plan the development of solutions.** Important decisions are expected at the World radio Conference 2027.

- **Other regulatory aspects** also need to be considered related to **competition law, lawful interception, national licensing regimes, coverage and other types of obligations**.

Cost-effectiveness through standards and technology innovation

- Although not all emerging D2D initiatives currently comply to open standards, a common consensus is that **D2D must leverage on the 3GPP standards** to ensure economically **viable scaling up** of D2D systems and services by:
  - **bringing the cost down**,
  - **giving a medium/long term perspective to manufacturers,**
  - **avoiding vendor lock-in**

- **European companies have high technical competences**, including most of the capabilities for designing and producing D2D systems. Many provide key technologies to non-European D2D systems.

- However, **in the current industrial and commercial landscape**, **European industry needs to catch up by investing in innovative low-cost space technologies**, in a timely manner.

- The requirements for **cost-effective high-volume production of large space antennas** and **stackable high-power platforms** are **considered challenging** for the current European industry state-of-the-art**.**

- The s**tandardisation of building blocks** will contribute to **lowering industrialisation costs,** including the **space-compatible chipsets** (e.g. for on-board gNodeB). **Standards will also help tackle the fragmentation of the space supply eco-system, which is** a barrier to industrial efficiency and excellence.

- The D2D payloads will also **require operational RF frequency agility** to operate in different bands in different parts of the world.

- Considering the deployment of current D2D systems worldwide, and in order to take a position on the emerging market, it is **important for any new D2D service offering to start quickly with less demanding cases** such as narrow band applications (IoT, messaging, …)**.**

- **D2D solutions roll-out should take an incremental approach** to adapt to the uncertainties but **with scalability of such D2D solutions engineered from the start.**

- **Investment into longer-term space technologies is needed now.**

A call to federate European actors and test, demonstrate and validate

- Through difference prisms, all four panels observed the **fragmentation of the European eco-system** in the various aspects of:
  - **user communities** and associated business cases and value chains
  - **industrial actors**, across the terrestrial and space industries,
  - **spectrum utilisation,**
  - **regulations at large,**
  - **Institutional support.**

- It was strongly suggested to **encourage collaborative work to federate** the needs, the solutions and regulations to enable:
  - **aggregating requirements** from different markets,
  - **innovative business models,**
  - **collaborative partnership** across the value chains,

- develop a **co-ordinated European position on spectrum and other regulated domains,**
- **mutualisation of capabilities, infrastructure and funding,**
- **more effective institutional support** to emergence of D2D,
- **a diverse, competitive ecosystem** of European industrial space suppliers of D2D solutions,
- **optimised and economically viable approach** to a progressive roll out of D2D solutions and services,

- The communities across the D2D value chain also clearly expressed the **need of demonstrating and testing D2D systems and services** in order to:
  - **federate different actors** in common experimentations and demonstrations,
  - prove **technological solutions,**
  - **support** the elaboration and validation of **regulatory rules through real life tests**,
  - **generally increase confidence** and unlock investments.

CONCLUSION - A CALL FOR ACTION FROM ESA

Discussions concluded that in the current highly challenging satellite communication context, institutional support, particularly from ESA, will be a vital enabler for the successful emergence of highly competitive European D2D solutions. Collaboration across the ecosystem emerged as a recurring theme and there were many calls for ESA to act primarily to federate the actors across the value chain and address:

- user needs aggregations,
- innovative collaborative business cases,
- elaboration of innovative and competitive systems,
- identification and development of key space and ground technologies for both short and medium term,
- experimentations, such as spectrum sandboxes, ground/in orbit test and demonstrators to accelerate the development of D2D space and ground technologies in shared testing environments, and promote interoperability in a context of standardisation.

The ESA team will take stock of the key findings from the discussions during the event to define an impactful ESA initiative.

ACKNOWLEDGEMENTS

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CONTACT

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