



An Coimisiún um
Rialáil Cumarsáid
Commission for
Communications

The Economic and Societal Impacts of Network Incidents

A foundational study by DotEcon and
Analysys Mason

Information Notice

Reference: ComReg 23/59
Version: Final
Date: 04/07/2023

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1.1 Introduction

- 1.1 Electronic Communications Services (“ECS”) are a key component of economic activity across our economy and facilitate social and economic interaction between individuals, businesses, and government services. The evolution of telecommunication networks has transformed how we communicate, work and consume digital services. Take-up of high-speed broadband services has created significant productivity gains, broadened labour market participation and yielded environmental benefits. However, these benefits depend on a network’s reliability.
- 1.2 Network incidents can impact consumer experience and our experience of fixed and mobile connectivity. Of course, Ireland is not unusual; as network incidents occur right across Europe. The European Union Agency for Cybersecurity (“ENISA”) reports that there were 168 significant incidents of network failure across 26 Member States¹ and two European Free Trade Area countries in 2021², accounting for 5,106 million user hours lost, or almost 14 million user hours per day.
- 1.3 The Electronic Communication Networks (“ECN”) which carry these important services are collectively comprised of a complex series of interconnected elements and functions that work cohesively to provide the end user with the seamless voice and data connectivity that we value. Failure of any one of these elements can affect network performance;, negatively impacting consumers, business productivity and economic activity more generally. Depending on circumstances, such as scale, duration, and location, the impact to society and the economy can be considerable on occasion.
- 1.4 The Commission for Communications Regulation (“ComReg”) plays an important role in facilitating market information.. ComReg commissioned DotEcon Ltd, along with Analysys Mason, to assess the economic and societal impacts arising from network incidents in Ireland. While similar studies have been conducted in other utilities (e.g., energy), this foundational study is one of the first to assess network incidents in telecommunications, the results of which will help inform any future research.
- 1.5 ComReg is pleased to publish “*The Economic and Societal Impacts of Network Incidents*” (Document 23/59a) (“DotEcon/Analysys Mason Report”) which uses detailed data sources (See Section 1.4 below) to assess network incidents in Ireland. It also helps ComReg meet its functions under Part 2 (“Security of Networks and Services”) of the Communications Regulation and Digital Hub Development Agency Act of 2023.

¹ ComReg must also submit each year a summary report to the Minister, the European Commission and ENISA on incidents notified to it. The last such report was lodged with ENISA and the summary statistics are presented in Chapter 4 of Document [22/44](#).

² <https://www.enisa.europa.eu/publications/telecom-security-incidents-2021>

1.2 Key Findings

1.6 There are seven key findings, each of which are discussed in detail below, followed by some conclusions and next steps:

- network incidents can happen for a variety of reasons;
- there are no typical outages and outages vary across the population;
- while network incidents are rare, some consumers are impacted more than others;
- additional investment could be justified but would be difficult to target;
- using a back-up service may fail to alleviate network incidents when they arise;
- operators are limited in the extent to which they can repair large scale incidents; and
- most consumers consider price, speed and coverage to be more important than reliability when choosing a provider.

I. Network incidents can happen for a variety of reasons

1.7 Users reasonably expect to be able to access services with minimal disruption. However, network incidents that impact the experience of the end user can occur for a variety of reasons and include:

- weather and natural phenomena: storms, wind, high temperatures, fog, snow and ice, and solar storms;
- third party damage: including damage to physical infrastructure, vehicular impact, fibre cuts and cable damage;
- malicious acts: Telephony Denial of Service (“TDoS”) attacks, Distributed Denial of Service (“DDoS”) attacks, cable theft, vandalism, and sabotage;
- power outages due to weather, insufficient protection of mains supply, no or insufficient back-up power and poor maintenance of back-up power; and
- system failures including but not limited to hardware and software failure; insufficient redundancy; inadequate procedures and deficient supervision of both own and outsourced staff.

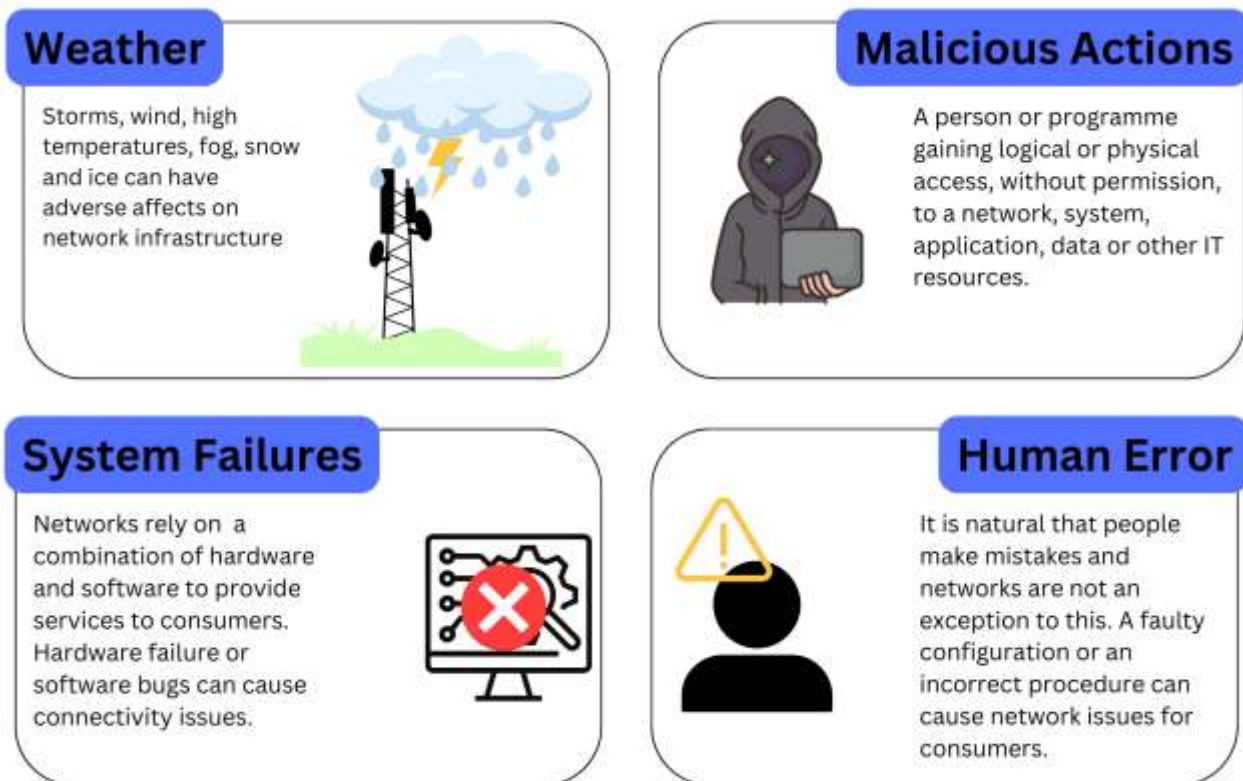


Figure 1: How network incidents can happen

II. There are no typical outages and outages vary across the population

1.8 Happily , network outages are relatively rare. However, when they do occur, consumers' individual experiences can vary greatly. Abstracts such as, average number of outages or number of hours lost by the average household, while useful, can sometimes mask a complex picture; where network outages are unequally spread across the customer population. Prevalence of outages depends on consumer characteristics, network technology, as well as location-specific factors. The geographical pattern of fixed broadband outages is therefore both complex and multifaceted:

- heavier internet users and those working from home are, unsurprisingly, most exposed to network outages;
- fibre and cable services are much more reliable than the older copper-based services and satellite broadband (users of services over copper networks report experiencing an average of 45 hours of outage per year, against 16 hours for fibre users);
- the reliability gap between legacy copper-based services and other

technologies is greatest in rural areas and also in areas with significant high wind exposure;

- more diversity in backhaul networks³ is associated with lower reported rates of outage;
- areas with a less reliable electrical power supply tend to have more broadband outages.

1.9 The variation in user experience highlights the need not just to consider the average experience of consumers, but also to focus on those customers most impacted by outages.

III. While network incidents are rare, some consumers are impacted more than others

1.10 Most consumers report experiencing some form of network outage on either their home broadband or mobile service at some point in the last year. However, there are more significant impacts being experienced by a minority of disproportionately impacted consumers. For both mobile and broadband services, of all the total hours of outage occurring across the country, nearly the entirety falls on about 20% of consumers experienced across the entire population.

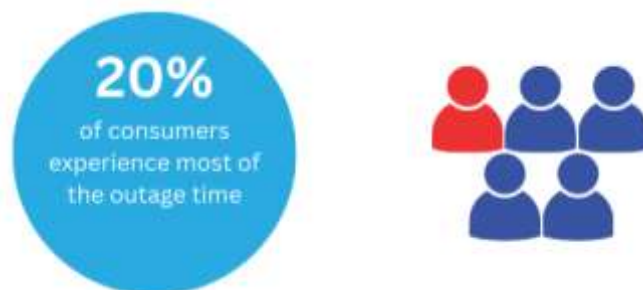


Figure 2: Outage hours concentrated on minority of customers

1.11 Consumers who have experienced some form of network outage tend to be homeworkers, heavy internet users and those whose connectivity is delivered over copper.

1.12 Homeworkers are particularly exposed to connectivity problems, due to their extended period online and have only limited opportunities to delay their activities to a time when a connection is available. The impacts on homeworking are not only due to the direct impact of the actual disruption, but also from avoiding working at home in the first place due to the *perceived* risk of connections being unreliable (i.e., they

³ The backhaul portion of the network comprises the intermediate links between the access and core network.

would have worked from home had their connection been more reliable).

IV. Additional investment could be justified but would be difficult to target

- 1.13 Whilst services are generally reliable, there is unmet demand for additional reliability, particularly for those consumers who experience network incidents the most (typically copper users, heavy users, and homeworkers). Indeed, about half of the lost benefit to consumers is due to homeworkers, even though they only comprise about 30% of respondents. The unmet demand for additional reliability (based on stated consumer preferences) that would avoid outages across all households is estimated at about €160m per annum. To put this in context, DotEcon considers that the private benefits⁴ from households alone could justify an investment in securing reliability in the order of €2bn⁵.

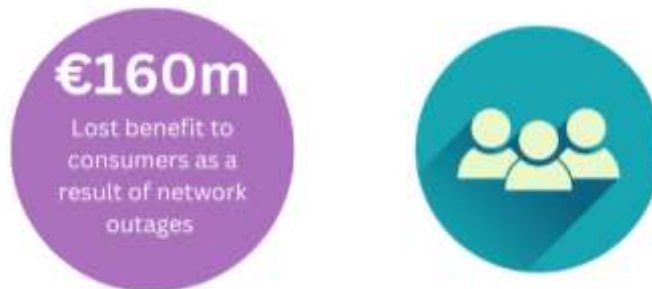


Figure 3: €160m lost benefit to consumers

- 1.14 However, the need for additional service reliability is concentrated amongst a minority of customers spread right across the general population. Therefore, it would be difficult for operators to target any reliability investments they might make, specifically at those consumers who would value such services the most. It follows that any widescale investment to increase service reliability for a small minority of customers could result in inefficiencies, particularly as the average customer is largely satisfied with existing reliability.

V. Using a back-up service may fail to alleviate network incidents when they arise

- 1.15 Approximately two-thirds of respondents reported using their mobile phone as a back-up to their home broadband connection. However, only one-third of these considered that the mobile broadband connection provided a comparable broadband experience. Another method some consumers use to support their connectivity requirements is to have a dedicated backup service to be used when there is a

⁴ External effects are not captured in the willingness to pay of households for connectivity, as they are either economy-wide benefits that are not factored in by households, or non-market benefits. These include productivity, labour market, environmental, labour market, and social inclusion benefits. DotEcon estimate that there could be productivity growth benefits of around 0.3 to 3 times the cost of the investment; and employment benefit could be around 2 to 6 times the cost of the investment.

⁵ assuming a 5% real interest rate with a 20-year life.

network outage for a primary service and such services are offered by some mobile operators. Looking at the pattern of outages across both time and locations, there is evidence of a positive correlation in outages across different networks. Therefore, contracting a secondary service from a provider may not provide an adequate backup.



Figure 3: Customers use mobile to back up fixed services

- 1.16 A primary and secondary/back-up service failing simultaneously, is likely due to common drivers (such as storms) but also due to shared infrastructure used by both fixed and mobile networks. As with any network, there is a trade-off between cost efficiency and reliability. So while shared infrastructure lowers costs for operators, especially in Irish rural areas where customer density is low, it can come at the cost of an adequate back-up provision when networks fail. Maintaining truly resilient connectivity, requires independent and separately located infrastructure to avoid exposure to common risks. DotEcon observes that there is a high degree of overlap between areas that have a raised risk of failure of both mobile and fixed networks.
- 1.17 Therefore, while a secondary service can alleviate impacts arising from a network incident, its benefits can be limited due to common risks of failure. It is important therefore that consumers are not *oversold* the reliability of back up solutions.

VI. Operators are limited in the extent to which they can repair large scale incidents

- 1.18 Minor incidents are experienced by the vast majority of consumers. To their credit, operators typically deal with such incidents relatively quickly, mitigating any harm that might arise. However, when multiple incidents occur at the same time (as might happen for example after a large weather event such as a storm), there are discernible limitations on the speed at which these can be addressed. This is because operators can only have so many resources on standby to repair faults, and it can be difficult to access more resources (e.g., equipment and labour) at short notice, for the rare large-scale events. Predictably, data on outages suggests that operators' resources for clearing incidents are conservatively provided, rather than dimensioned to deal with worse case scenarios. So, where large scale events occur, the rate at which network connectivity can be restored is limited.

VII. Most consumers consider price, speed and coverage to be more important than reliability when choosing a provider

- 1.19 There may be scope for some intervention to improve consumer information through sharing the results of regular reliability surveys. Such surveys offer the advantage of being able to gauge directly the outages experienced by consumers and then pool this data, correcting for differences in usage and locational factors. However, it would be a considerable exercise if the intent was to provide relevant comparative information about different providers' relative performance. DotEcon maintains that it is not obvious that such an intervention would have any material effect on competitive incentives to dimension additional service reliability. This is because service reliability does not strongly influence switching decisions, based on consumer stated preferences.
- 1.20 Service reliability is at best placed third, a good distance behind price and speed in terms of factors considered by consumers when choosing a provider. Of course, and as we have outlined, a small minority of consumers are most affected by incidents and these attach most weight to reliability. But, even if such consumers could be provided information about the service reliability of different operators, it is not certain switching would occur and its overall impacts on market outcomes seems likely be minimal .

1.3 Conclusions and Next Steps

- 1.21 While all consumers experience some form of network outage, large network incidents which can cause significant consumer disruption are happily relatively rare. However, there are asymmetric impacts and network incidents impact some consumers much more than others. The reasons for this are multifaceted but primarily relate to:
- Where consumers are located (urban/rural);
 - How they use connectivity (e.g., homeworking/heavy usage); and
 - What type of infrastructure used (e.g., copper, fibre, cable satellite).
- 1.22 Currently, there are already ongoing investments that seem likely to improve reliability going forward, including:
- the planned Copper Switch Off Program⁶ will see copper wire replaced with fibre optic-based networks. This will have much higher broadband capacity and is an important national (Digital Connectivity Strategy⁷) and EU objective. The ubiquitous availability of very high-capacity networks will provide for high

⁷ [gov.ie](http://www.gov.ie) - Consultation on the Digital Connectivity Strategy (www.gov.ie)

bandwidth and a greater range and increased reliability of services for end users;

- the rollout of the National Broadband Plan⁸ will ensure households in the rural intervention area have access to higher capacity and reliable broadband. This should also improve the provision of backhaul infrastructure nationally;
- with the continuing rollout of 5G nationally – which brings with it more reliability by design, will come an improvement in the reliability of mobile networks. ComReg has recently assigned 470 MHz of harmonised spectrum rights, which represents a 46% increase in the harmonised spectrum assigned for the provision of WBB services in Ireland. This will greatly enable operators to provide improved and more reliable services⁹; and
- satellite internet (which also showed lower rates of reliability) is constantly developing and more advanced satellite services are currently being introduced which should offer higher reliability (e.g., recently launched Low Earth Orbit (“LEO”) satellite constellations which offer communication services).

1.23 ComReg will continue to monitor network incidents in line with its statutory functions, obligations and duties. ComReg may also revisit this report, once some of the ongoing investments discussed above can be realised. In this way, the report provides an important foundation for the future, providing as it does an initial baseline against which any future research could be assessed.

1.24 Separately, ComReg has published proposals for the introduction of a customer charter, including transparency and information with regard to outages and repairs. Please see Chapter 6.7 of ComReg Document No. 23/14¹⁰ for further information.

1.25 ComReg is happy to receive any observations. These should be sent to marketframeworkconsult@comreg.ie, clearly marked – “Observations on DotEcon/Analysys Mason Report 23/59a”.

1.4 Data collection

1.26 This foundational study takes a data-based view of network incidents, collating various data sources, including:

- A national survey of 1,826 individuals undertaken by B&A¹¹, asking about their experience and perception of network outages and their responses to them;

⁸ [Welcome to National Broadband Ireland - NBI](#)

⁹ [Multi Band Spectrum Award 2022 \(MBSA2\) | Commission for Communications Regulation \(comreg.ie\)](#)

¹⁰ [ComReg Document 23/14](#)

¹¹ Behaviour & Attitudes (B&A) is an independent research & insight company.

- Data helpfully provided by the ESB Networks (“ESBN”) on the occurrence of electrical power outages at different locations;
- Data over a three-year period sourced from Downtdetector¹² including crowdsourced user reports of outages in various ECN and Over-The-Top (“OTT”) services at a fine time resolution;
- A review of publicly available data on the locations of major network infrastructure conducted by Analysys Mason, was used to create a metric for the diversity of backhaul network connectivity by area;
- CSO data on the economic and social characteristics of different geographic areas;
- Weather data (via Met Éireann) measuring the prevalence of strong wind and flooding events at different locations over time.

1.27 This detailed data allows the study to provide a comprehensive, bottom-up view of network incidents in Ireland and consumers’ actual experiences of same.

¹²Downtdetector is part of Ookla, which provides network intelligence and connectivity insights on a commercial basis.