DATA OBJECTS: NEW THINGS OR NO-THING MORE THAN *IGNIS FATUUS*?

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ABSTRACT. *English academics have belatedly awoken to the challenge to the law posed by the computer revolution that started in the late twentieth century. Inspired by American jurisprudence, technophile lawyers unfamiliar with the complexities of conceptualising property liberally propose to extend property law concepts to digital files, including a recent attempt to do so by postulating a three-layer model of digital files to enable 'ownership' at the logical layer. Meanwhile, American academics, facing some resistance in the courts, have continued to propound the case for data property. This paper exposes the many dangers of the concept of property within the common law, the failures of recent proposals on both sides of the Atlantic to address the underlying technical workings of computing, and the perils that such ill-considered extensions of property will pose to legal development.*

KEYWORDS: *property law, digital files, virtual objects, tort of conversion*

I. INTRODUCTION

Despite the best efforts of earlier English academics, most notably Sarah Green,[1] the English courts have resisted the temptation to extend property law concepts to the simple and now ubiquitous digital files that the man on the Clapham omnibus encounters every day.[2] More recently, however, a new and novel attempt at extending the law of property to digital files has been postulated by Michels and

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[1] S.C. Green, "Can a Digitized Product be the Subject of Conversion?" [2006] 4 L.M.C.L.Q 568, S. Green and J. Randall, *The Tort of Conversion* (Oxford 2009), 118-128. See also D. Saidov and S. Green, "Software as Goods" [2007] J.B.L. 161.

[2] *Fairstar Heavy Transport N.V. v Adkins* [2013] EWCA Civ 886, [2014] EMLR 12; *Your Response Ltd v Datateam Business Media Ltd* [2014] EWCACiv 281, [2015] Q.B. 41, noted K.F.K. Low, "The Perils of Misusing Property Concepts in Contractual Analysis" (2014) 130 L.Q.R. 547. See also M. Bridge et al, *The Law of Personal Property*, 3rd ed. (London 2021), [8-014].

Millard,[3] which they declare as new things. Drawing upon a three-layered model of a digital file – specifically the (1) physical layer, (2) the logical layer, and (3) the content layer – they propose that English law recognise property rights in digital files at the logical layer. This article serves primarily as a partial reply to Michels and Millard, but we will also briefly address the slightly different case for data property by Grimmelmann and Mulligan from across the Atlantic.[4] Grimmelmann and Mulligan argue for the recognition of data property on the basis of social recognition of data as a discrete thing and urge the extension of torts originally crafted for tangible property to interferences with such things. They do so because of pushback in the case law[5] against the very American case – *Thyroff v Nationwide Mutual Insurance Co*[6] – that Michels and Millard cite in support of their thesis.[7] Although both sets of authors set out a case for data objects/property, Grimmelmann and Mulligan reject Michels and Millard's file metaphor as the appropriate abstraction to attach property rights to "[b]ecause thinghood is social, how things are identified can change depending on what is useful to talk about".[8] Nevertheless, because said social recognition among lay users is very much fuelled by perception, Michels and Millard's model remains relevant to Grimmelmann and Mulligan's thesis.

This reply will appear partial for a few reasons. First, we do not propose to address cryptoassets which are entirely different[9] to the simple but ubiquitous digital files the man on the Clapham omnibus encounters daily. Notably the Law Commission does not recommend conferring property status upon digital files in either its Consultation Paper or Final Report on Digital Assets.[10] Cryptoassets are valuable as ledger entries, not as files. Realising this reveals the sleight of hand on the part of Satoshi Nakamoto when he "solves" the double spending problem – a problem associated with conceptualising digital files as property which transfer results in a copy, hence the doubling – by resorting to a digital ledger entry instead. Both the file and the ledger entry may be *digital* but the similarities end there. A

[3] J.D. Michels and C. Millard, "The New Things: Property Rights in Digital Files?" (2022) 81 C.L.J. 323
[4] J. Grimmelmann and C. Mulligan, "Data Property" (2023) 72 American U. L. Rev. 829.
[5] Grimmelmann and Mulligan, "Data Property", 836-837.
[6] 864 N.E.2d 1272 (N.Y. 2007)
[7] Michels and Millard, "New Things", 347. The cases cited by Grimmelmann and Mulligan go unmentioned.
[8] Grimmelmann and Mulligan, "Data Property", 865.
[9] See, e.g., D. Fox, "Cryptocurrencies in the Common Law of Property" in D. Fox and S. Green (eds.), *Cryptocurrencies in Public and Private Law* (Oxford 2019) and K.F.K. Low and E. Teo, "Bitcoins and Other Cryptocurrencies as Property?" (2017) 9 L.I.T. 235.
[10] Law Commission, *Digital Assets: Consultation paper* (CP 256, 28 July 2022), [6.50], [6.61]. See also Law Commission, *Digital Assets: Final Report* (Law Com No 412, 28 June 2023), [4.87].

successful double spend attack, typically described as a 51% attack within the blockchain context,[11] entails an attacker spending "the same" token twice, but it does not result in a doubling of the ledger entries relating to said token. Such attacks entail an attacker successfully depriving the rightful owner of the said token by reorganising the ledger. This is of course an entirely different outcome to a double spending attack as traditionally conceived in respect of digital files, where the problem presents itself as both the transferor and the transferee possessing the same file. The difference can also be seen when we realise that a participant in a decentralised ledger system can run a full node and thus possess a copy of the entire ledger as a file but not control any ledger entry or conversely, a holder of cryptoassets may not maintain any copy of the ledger at all. As such, Michels and Millard's reliance on authorities relating to cryptoassets to buttress their case for property rights[12] in ordinary digital files is misplaced. Since we argue that simple digital files are not properly regarded as property, it follows also that we find it unnecessary to address their *tertium quid* argument.[13]

We have chosen to forego consideration of cryptoassets not only because they are so dissimilar to regular digital files but also because there is already much ink spilt on the subject.[14] A close study of simple but ubiquitous digital files is in much shorter supply: apart from Michels and Millard's article, one would have to go back to Sarah Green's works[15] more than a decade ago to find detailed academic analyses under English law. Moreover, there are practically no countervailing views apart from a small

[11] Cf. Angela Walch, "Deconstructing 'Decentralisation'" in Chris Brummer (ed), *Cryptoassets: Legal, Regulatory, and Monetary Perspectives* (Oxford 2019) 57-58. Note that the percentage of control required to reorganise ledger entries will depend on the particular consensus protocol. Ethereum, which relies on proof of stake as opposed to Bitcoin's proof of work, is susceptible to a 34% attack: O. Kharif, "Ethereum Centralization Debate Rages on After Much-Hyped Upgrade" (23 September 2022), *Bloomberg*.

[12] Michels and Millard, "New Things", 341.

[13] Cf. K.F.K. Low, "Cryptoassets and the Renaissance of the *Tertium Quid*" in C. Bevan (ed), *Edward Elgar Handbook on Property Law and Theory* (Edward Elgar, forthcoming).

[14] See, e.g., Fox, "Cryptocurrencies in the Common Law of Property"; Low and Teo, "Cryptocurrencies as Property?"; M. Solinas, "Bitcoiners in Wonderland: Lessons from the Cheshire Cat" [2019] L.M.C.L.Q. 431; J. Sarra and L. Gullifer, 'Crypto-Claimants and Bitcoin Bankruptcy: Challenges for Recognition and Realization' (2019) 28 International Insolvency Review 233; D. Fox, "Digital Assets as Transactional Power" (2022) 1 J.I.B.F.L. 3; T. Chan, "The Nature of Property in Cryptoassets" (2023) 43 L.S. 480; R. Stevens, "Crypto Is Not Property" (2023) 139 L.Q.R. 615; P. Watts and K.F.K. Low, "The Case for Cryptoassets as Property", in S. Agnew and M. Smith (eds), *Law at the Cutting Edge* (Hart forthcoming); J. Grower, "Better Left to the Legislature? Notes on a Nagging Doubt Over the Legal Recognition of Cryptoassets" in S. Agnew and M. Smith (eds), *Law at the Cutting Edge* (Hart forthcoming).

[15] Green, "Can a Digitized Product be the Subject of Conversion?"; Green and Randall, *The Tort of Conversion*; Saidov and Green, "Software as Goods".

section in a chapter on "Digital Assets" in *The Law of Personal Property*,[16] which does not accord the problem the attention it deserves. Whether or not digital property advocates are persuaded, it is hoped that the technical context in which digital files exist and operate that we set out will allow further debate to follow on firmer technical foundations.

II. THE MANY MEANINGS OF PROPERTY

Property is a dangerous word because it hides many different meanings within a single form.[17] It can mean an *in rem* right, which is an *erga omnes* right over a *res* that is separate from the right[18] or it can simply mean asset or transferable wealth.[19] The former contrasts ownership from obligation. The latter includes obligation as property[20] – after all, the classical thing in action is the *in personam* contractual right.[21] The legal flaw in Michels and Millard's analysis can be seen from their classification of property rights following their initial acknowledgement of property's *erga omnes* effect. Their acknowledgment suggests that they regard property rights as *in rem* rights distinguishable from *in personam* rights so that we may extrapolate from their Figure 3 as follows.

[16] Bridge et al, *The Law of Personal Property*, [8-013]-[8-019].
[17] See, e.g., G.L. Gretton, "Ownership and its Objects" (2007) 71 *The Rabel Journal of Comparative and International Private Law* 802, B. McFarlane and S. Douglas, "Property, Analogy and Variety" (2022) 42 O.J.L.S. 161, and K.F.K Low and M. Hara, "Cryptoassets and Property" in S. van Erp and K. Zimmermann (eds.), *Edward Elgar Research Handbook on EU Property Law* (forthcoming).
[18] S. Douglas and B. McFarlane, "Defining Property Rights" in J. Penner and H. Smith (eds.), *Philosophical Foundations of Property Law* (Oxford 2013).
[19] B. Rudden, "Things as Thing and Things as Wealth" (1994) 14 O.J.L.S. 81. See also J. Penner, "On the Very Idea of Transmissible Rights" in J. Penner and H. Smith (eds.), *Philosophical Foundations of Property Law* (Oxford 2013). Cf. R. Goode, "What is Property?" (2023) 139 L.Q.R. 1.
[20] J. Penner, "Property Rights" in M. Gilbert, J. Helmreich and G. Sreenivasan (eds), *Palgrave Handbook on the Philosophy of Rights* (Palgrave, forthcoming).
[21] Cf. Low, "The Renaissance of the *Tertium Quid*".

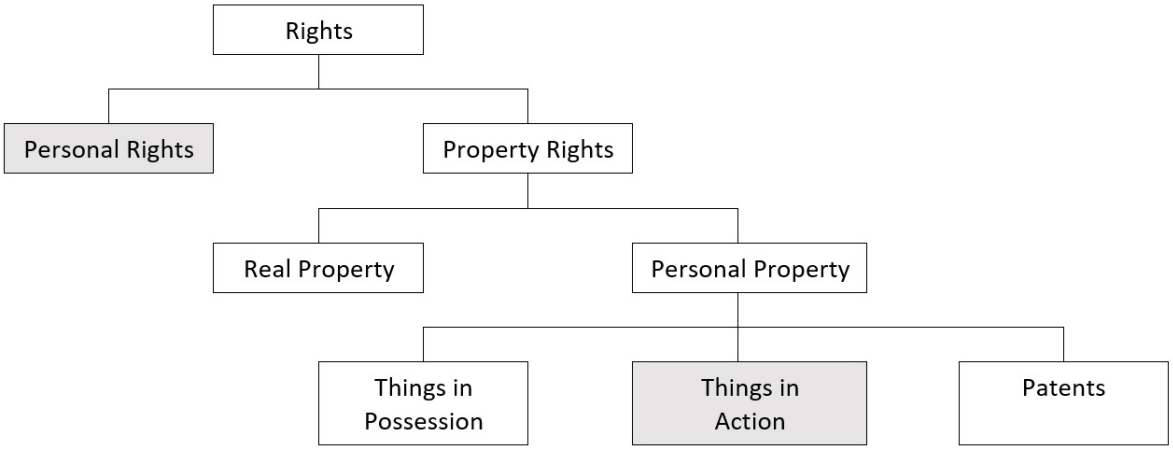

Figure 1. The dangers of a mixed classification.

The problem with this classification is that it mixes up the two different conceptions of property, with the result that the classification is distorted or bent.[22] *In personam* contractual rights appear twice in the classification, once as personal rights contradistinguished from property rights, but then again as a thing in action under property rights. The problem is that near the top of Michels and Millard's taxonomy, property is ownership but as one moves downwards, property metamorphosises into mere "asset", enabling a chose in action to be (property as asset) *and* not to be (property as ownership).

Grimmelmann and Mulligan's thesis suffers from a similar flaw to Michels and Millard's. They criticise German law's rejection of property in intangible "things" as unconvincing.[23] Supposedly, German law defines its "property law (*Sachenricht*) to cover only physical (*körperliche*) objects."[24] But this "conceptual formalism" is supposedly disproven by the existence of other legal systems – including the French civil law – "that do treat intangibles as property".[25] What they, like Michels and Millard, fail to notice is the conceptual (and semantic) confusion among many of the legal systems that do. German

[22] Cf. P. Birks, "Definition and Division: A Meditation on *Institutes* 3.13" in P. Birks (ed), *The Classification of Obligations* (Oxford 1997) 1, 21.
[23] Grimmelmann and Mulligan, "Data Property", 842.
[24] Grimmelmann and Mulligan, "Data Property", 842.
[25] Grimmelmann and Mulligan, "Data Property", 843-844.

Pandectist systems[26] strenuously (and we suggest logically) differentiate between *in rem* rights (properly regarded as *Sachenricht*) and *in personam* rights. The Germans employ a different word to describe the concept of property as asset: *Gegenstände*, which as Gretton observes comprises both tangible property (*körperliche Gegenstände*) or things (*Sachen*) as well as intangible property (*unkörperliche Gegenstände*) or rights (*Rechte*).[27] Common lawyers often confuse the two concepts since we use a singular word to describe both and fall for the fallacy of property syllogism:[28]

> A premise of the argument is that a particular type of right (such as a chose in action, an intellectual property right or a beneficial interest under a trust) is the same type of right as a right to a tangible asset and must therefore be protected in the same way.

In doing so, we project an imaginary object into existence when none is necessary. As Crossley Vaines explained more than half a century ago:[29]

> Choses in possession are tangibles, choses in action intangibles: they are not rights over intangibles; the intangible thing or *res incoporalis* is the right itself.

We could (loosely) say we own an intangible right but that adds nothing to the expression that we *have* said right. Not so with tangibles where owning and having convey different meanings. Essentially, tangible property is concerned about rights *over* things whereas intangible property is concerned with rights *as* things.[30] For the former, the rights *must* be *erga omnes*[31] in order for control over the thing to be exclusive and hence proper to the right holder. After all, "the word 'property' reflects its semantically correct root by identifying the condition of a particular resource as being 'proper' to a particular person."[32] For intangibles (or rights *as* things), no such logic follows so that *in personam* contractual

[26] These would include the legal systems of East Asia such as China, Japan and South Korea: see, e.g., K.F.K. Low and Y.-C. Wu, "The Characterisation of Cryptocurrencies in East Asia" in D. Fox and S. Green, *Cryptocurrencies in Public and Private Law* (OUP 2019) 199; Low and Hara, "Cryptoassets and Property".
[27] Gretton, "Ownership and its Objects" 819.
[28] MacFarlane and Douglas, "Property, Analogy and Variety", 161-162.
[29] J. Crossley Vaines, *Personal Property* (4th edn, Butterworths 1967) 14.
[30] Low and Hara, "Cryptoassets and Property".
[31] Reflected in strict trespassory rules.
[32] K. Gray and S.F. Gray, "The Idea of Property in Land" in S. Bright and J. Dewar (eds), *Land Law: Themes and Perspectives* (OUP 1998) 15, 15-16.

rights were classified as property (as things in action) long before the economic torts evolved.[33] Nevertheless, as the law deals in rights, there can be no property without rights. Thus, Watts and Low argue that absent legal recognition, cryptoassets are simply not property in the legal sense of the same but once recognised, they necessarily carry rights so that there is nothing in theory to stop them from being regarded as things in action, contrary to the Law Commission's analysis.[34] If you try to invent property without rights, as the Law Commission proposes, all you do is spell rights in reverse as wrongs: the rights remain created, merely obscured from view.

But a richer vocabulary alone will not ensure conceptual clarity. The French, like the Germans, possess a rich vocabulary that in theory should allow them to distinguish between *biens* (assets) and *chose* (thing) but they are far less fastidious about maintaining conceptual clarity.[35] In one extreme example highlighted by Gretton, a French scholar "[o]n a single page … writes of 'choses incorporelles', 'droits incorporels', 'biens incorporels', 'biens immatériels' and 'propriétés incorporelles'."[36] It is thus hardly surprising that Grimmelmann and Mulligan find that "[u]nder French law, intangible objects can be treated as movable property by action of law (*meubles par determination de la loi*), a category that includes 'non-material objects such as copyright, patent rights, shares in a company, goodwill, life annuities (*rentes*), and other rights related to movable property such as pledges and bailees' interests.'"[37] Perhaps nowhere is the confusion between the two different conceptions of property more clearly demonstrated than their reference to Louisiana's civil code which includes as incorporeal things obligations.[38] If obligations (*in personam* rights) are things, then it follows that things cannot here mean *in rem* rights.

Disentangling Michels's and Millard's mixed taxonomies, and distinguishing between property as ownership and property as assets, what we get instead is the following.

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[33] Low, "The Renaissance of the *Tertium Quid*".
[34] Watts and Low, "The Case for Cryptoassets as Property". See also Kelvin FK Low, "Third Things or Sixth Sense? I See Ideational Objects" in Paul Babie and Mark Giancaspro (eds), *Private Law and Digital Assets* (Springer, forthcoming).
[35] Gretton, "Ownership and its Objects", 810-815.
[36] Gretton, "Ownership and its Objects", 846, citing Frédéric Zenati, "*Pour une rénovation de la théorie de la propriété*" (1993) 92 Rev. trim. Dr. civ. 306, 311.
[37] Grimmelmann and Mulligan, "Data Property", 843.
[38] Grimmelmann and Mulligan, "Data Property", 843.

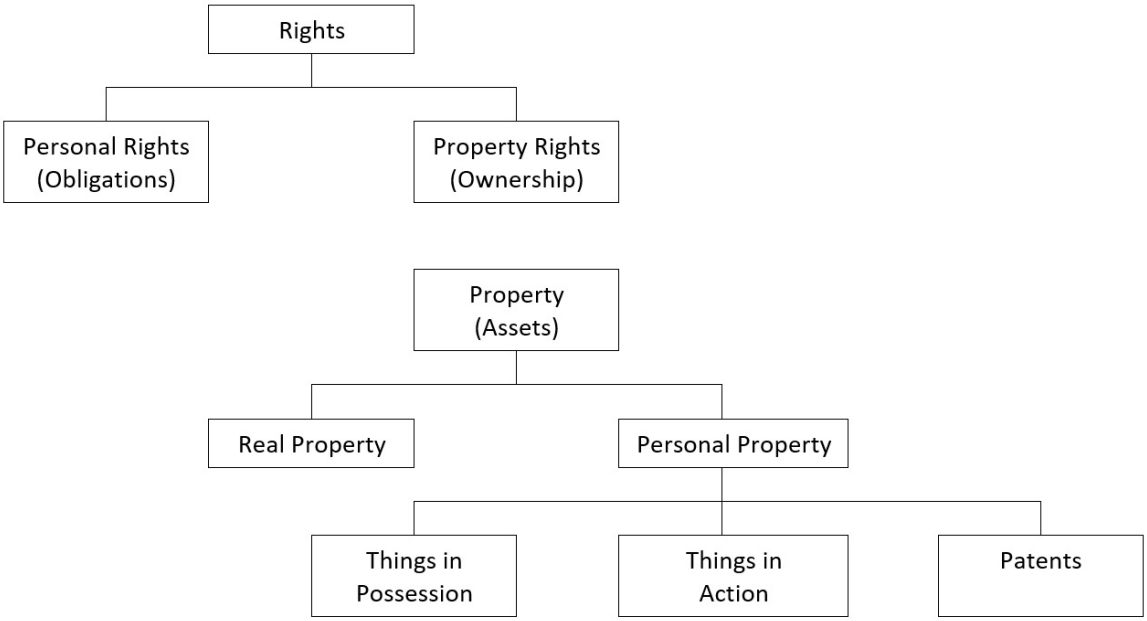

Figure 2. Two separate taxonomies, not one.

The "asset" conception of property is often associated with a fascination with value, a common misconception[39] which both Michels and Millard[40] as well as Grimmelmann and Mulligan[41] make. However, "[j]ust as all that glitters is not gold, not everything that is valuable is the subject of a property right".[42] The beguiling glimmer that surrounds the case for digital files as new things is as misleading as *ignis fatuus*,[43] better known as *will-o'-the wisp*. Like that phenomenon, belief in property in digital files "never lacks the support of ocular testimony, and is never discredited by failure to observe a corresponding reality."[44] As Stevens recently explained:[45]

> In the loft in my home, gathering dust, are boxes of 'artwork' created by my offspring when they were small children. None of this has any economic value at all. I would

[39] Cf. Goode, "What is Property?".
[40] Michels and Millard, "New Things", 347.
[41] Grimmelmann and Mulligan, "Data Property", 857-858.
[42] K.F.K. Low and D. Llewelyn, "Digital Files as property in the New Zealand Supreme Court: innovation or confusion?" (2016) 132 L.Q.R. 394, 396.
[43] Latin for foolish flame.
[44] W.W. Newell, "The *Ignis Fatuus*, Its Character and Legendary Origin" (1904) 17 The Journal of American Folklore 39, 44.
[45] Stevens, "Crypto is Not Property", 617. See also K.F.K. Low, "The Emperor's New Art: Cryptomania, Art and Property" (2002) Conv. 382, 399-402.

> have to pay someone to take it away. I still have a right to it that may be transferred. Some transferable rights may not only have no economic value but a negative one. A right to land that is subject to onerous economic clean-up costs may be something you have to pay another to take on. Indeed, for insolvency lawyers, the ability of a liquidator of a company to disclaim onerous *property* (i.e. rights that have negative value) is important. The most common commercial example of such transferable rights with negative value are leasehold interests where the market has fallen, so that the rent payable is now above the market rate.
>
> 'Realisable commercial value' is not a necessary condition of 'property'.

Nor is it sufficient.

III. A "TEST" OF PROPERTY?

It is perhaps of little surprise that one significant differentiation between Michels and Millard's thesis and that of Grimmelmann and Mulligan's is the centrality (or lack thereof) of the infamous *Ainsworth* criteria set out by Lord Wilbeforce. The former builds upon *Ainsworth*, the latter ignores it. According to Lord Wilberforce:[46]

> Before a right or an interest can be admitted into the category of property, or of a right affecting property, it must be (1) definable, (2) identifiable by third parties, (3) capable in its nature of assumption by third parties, and (4) have some degree of permanence or stability.
>
> [numbering added]

It is difficult to see how Grimmelmann and Mulligan's highly amorphous conception of data property by social recognition can satisfy limbs (1) or (2) of *Ainsworth*, making it difficult to see how their thesis can be accommodated under English law. The problem for Michels and Millard, however, is that they

[46] *National Provincial Bank Ltd v Ainsworth* [1965] 1 AC 1175, 1248.

appear to have built upon quicksand as Lord Wilberforce's test has been famously criticised as circular by Gray and Gray: [47]

> The difficulty with this orthodox understanding of proprietary quality is, of course, that it is riddled with circularity: the definition of proprietary character becomes entirely self-fulfilling. If naively we ask which entitlements are 'proprietary', we are told that they are those rights which are assignable and enforceable against third parties. When we then ask which rights these may be, we are told that they comprise, of course, the entitlements which are traditionally identified as 'proprietary'. It is radical and obscurantist nonsense to formulate a test of proprietary quality this way. There is, moreover, an irreversible tautology in supposing that proprietary status emanates from some criterion of 'permanence' or 'stability'. … Durability of entitlement cannot be both the *cause* and the *effect* of proprietary quality.

Michels and Millard acknowledge the Grays' criticism of *Ainsworth*, [48] but try to downplay its seriousness by adding the qualifier "somewhat". [49] It has been suggested by some commentators that *Ainsworth* may be rehabilitated as some sort of guide[50] or framing device[51] rather than a strict test but so downgraded, its value is much reduced, especially as others[52] have noted that his Lordship is more accurately read as setting out necessary rather than sufficient conditions of proprietary status.

Perhaps influenced by these criticisms, Michels and Millard add two additional criteria to *Ainsworth*'s four, drawn from the literature: property must also be (5) excludable; [53] and (6) rivalrous. [54] Both

[47] Gray and Gray, *Elements of Land Law*, 97. See also K.F.K. Low, "Trusts of Cryptoassets" (2021) 34 T.L.I. 191, 193.
[48] Gray, "Property in Thin Air", 293; K. Gray and S. Gray, *Elements of Land Law*, 5th ed. (Oxford, 2009), 97.
[49] Michels and Millard, "New Things", 326.
[50] Watts and Low, "The Case for Cryptoassets as Property".
[51] Bridge et al, *The Law of Personal Property*, [4-009].
[52] Stevens, "Crypto is Not Property", 622. Cf. Michels and Millard, "New Things", 342.
[53] Drawn from K. Gray, "Property in Thin Air" (1991) 50 C.L.J. 252, 268-270.
[54] Drawn from T. Cutts, "Crypto-property?, Response to Public Consultation by the UK Jurisdiction Taskforce" (2019), LSE Policy Briefing 36, 3, available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3406736 (last accessed 19 December 2022).

additional criteria are problematic, at least as Michels and Millard apply them. Starting first with excludability, Michels and Millard argue:[55]

> A party with practical control over a digital file can exclude others from accessing it. In some cases, such exclusion seems unjust and contrary to the parties' reasonable expectations. Property rights can help resolve such conflicts.

But if property is invoked to override practical control when exclusion is seen to be unjust or contrary to the parties' reasonable expectations, how is this criterion any less circular than the four in *Ainsworth*? This is so especially when their basis for conferring property on the "owner" of a file is control to begin with. The thesis smacks of having one's cake and eating it: practical control sometimes confers property but is sometimes constrained by it.

Furthermore, based on their description of rivalrousness, Michels and Millard appear to equate rivalrousness with scarcity but this is not correct.[56] The scarcity of a proprietary resource is what tends to drive disputes but scarcity and rivalrousness are distinct if sometimes related features of property as assets. Consider contractual obligations. A contracting party is generally free to enter into a theoretically infinite number of obligations. In that sense, contractual obligations as things in action are not necessarily scarce. Yet they are rivalrous even if they are plentiful because *legal* control over any *particular* contractual right is conferred on the counterparty to that contract and that counterparty alone.

It can thus be seen that Michels and Millard's six-criteria test of property is beset with problems. But what perhaps bodes even more ill for their analysis, to which we now turn, is that digital files cannot even clearly pass the bar they set for themselves.

IV. THE DIFFICULTIES WITH THE THREE-LAYERED MODEL OF A DIGITAL FILE

Michels and Millard posit a three-layer model (MM model) that they use to describe and analyse a digital file.

[55] Michels and Millard, "New Things", 344.
[56] Michels and Millard, "New Things", 328, citing Fox, "Cryptocurrencies in the Common Law of Property, [6.22].

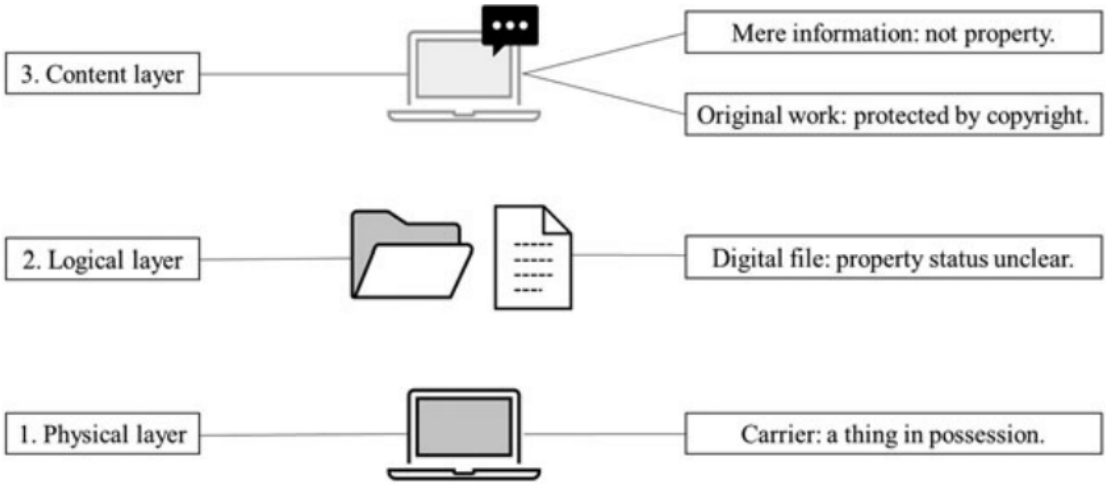

Figure 3. Michels's and Millard's three-layer model of digital files.[57]

They argue that in the MM model, data in the "content layer" is "mere information and not property", but data in the "logical layer" is not mere information. But this argument is seriously flawed, in no small part because their model is "a simplified representation of reality."[58] If the true complexity of the reality is more meticulously examined, what we find is that Michels and Millard's thesis is as flawed in its technical fundamentals as it is in its legal premises. Grimmelmann and Mulligan seem to dispense with a technical model of data property altogether, preferring a flexible, social model of the same. According to them:[59]

> Computer users' intuition to think about files as objects is not a coincidence; the use of terms like 'files' and 'folders' encourages computer users to think about data units of information, like pieces of paper that can be organized in folders in a filing cabinet. As some would say, the design and function of a computer helps construct our understanding of files as things. In this case, that construction was largely intentional, to facilitate computer users' manipulation and use of computer data.

Therefore, although they do not explicitly rely on the MM model, their social model is built upon the same (misguided) intuition that the MM model beguiles many end users into seeing and thus believing.

[57] Michels and Millard, "New Things", 332.
[58] Michels and Millard, "New Things", 329.
[59] Grimmelmann and Mulligan, "Data Property" 842.

Unfortunately, although the metaphorical files and folders facilitated the average layperson's adaptation to computer use, computer files and folders do *not* behave like physical files or folders. This difference between perception and reality is mostly irrelevant to the average end user in their day-to-day interactions with these ubiquitous machines but not so for legal analysis.[60] Accordingly, however desirable it may be to construct "a legal solution that is consistent with how laypersons regard and treat and asset … over one that is not so consistent",[61] such solutions cannot contradict reality so far as property law is concerned[62] since a legal system that purported to treat something as rivalrous when it is not would quickly find itself in disrepute. It is thus to reality that we turn.

A. Human Perception is Not Reality

The first problem is that the MM model is predicated on the relevance of human perception or user intervention in the logical layer to characterise information in the digital file as property. The MM model asserts that the operating system (OS) and user interface (UI) at the logical layer – the "perceptual cyberspace"[63] – allow a human user to create, control, "perceive and interact *with* the file as a virtual object"[64] (emphasis added). By contrast, the MM model describes the digital file at the content layer as comprising information "*for* human perception"[65] (emphasis added).

The MM model mistakenly relegates the UI to the logical layer and excludes it from the content layer. While the UI is necessary to enable information in a "digital file" to be communicated to the human user as images, texts, sounds and so on, through various dedicated applications such as image viewers, video and music players, and text editors, it is not confined only to the OS, as the MM model appears to suggest. While modern day OSes provide a graphical UI (GUI) for their users,[66] applications operating in the content layer may either use UI templates afforded by the OS or they may generate and manage their own UIs to present information to the user.[67]

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[60] Orin S Kerr, "The Problem of Perspective in Internet Law" (2003) 91 Geo LJ 357.
[61] Watts and Low, "The Case for Cryptoassets as Property".
[62] Cf Kerr, "Perspective in Internet Law".
[63] Michels and Millard, "New Things", 331.
[64] Michels and Millard, "New Things", 331.
[65] Michels and Millard, "New Things", 331.
[66] A. Silberschatz, P.B. Galvin and G. Gagne, *Operating System Concepts*, 10th ed. (Hoboken 2018), 56.
[67] Wikipedia, "Graphical user interface", https://en.wikipedia.org/wiki/Graphical_user_interface.

Furthermore, this characterisation overemphasises the human element. Information in a digital file does not cease to be information if there is no UI in the logical layer or application in the content layer to enable a human target to "perceive and interact" with it. For example, system events,[68] which are program states exchanged as information *between programs*, are crucial for enabling and coordinating a modern multitasking and multiprocessing platform. And anti-virus signatures that enable anti-virus software to scan and correctly identify viruses and other malware,[69] are intended to be acted on *by software*, rather than human agents.

The MM model makes no mention of human perception when storing a digital file in the physical infrastructure layer. The MM model relies upon ocular testimony to support its case for property at the logical layer, just as it relies upon our ostensible failure to observe the corresponding reality at the physical infrastructure layer for its absence. As Bridge et al observed:[70]

> In the same way as any other media, information stored digitally in a computer requires a medium. However, unlike traditional media, the medium itself is often hidden from view (often within a computer chassis) and poorly understood, unlike the application of oil on canvas, which is both immediately visible and legally understood to entail the legal concept of *accessio*.

Nonetheless, it would be incorrect to assume that human perception never played any part when a digital file is stored at the physical infrastructure layer e.g. on a carrier. For instance, punch cards were once widely used throughout much of the 20th century in the data processing industry for human input, storing data input, recording and reading data output, and programming computers.[71] Today, the punch card is still used in some mechanical looms, knitting machines, melotropes, and voting machines. The *Bush v Gore* litigation turned on the voting officials' varying characterisation of chads – holes as markings on voting cards.[72] Modern looms, knitting machines, music players and voting machines work just as well

[68] Wikipedia, "Event-driven architecture", https://en.wikipedia.org/wiki/Event-driven_architecture (defining an event as a significant change in state).
[69] Wikipedia, "Antivirus software", https://en.wikipedia.org/wiki/Antivirus_software.
[70] Bridge et al, *The Law of Personal Property*, [8-006]
[71] Wikipedia, "Punched card", https://en.wikipedia.org/wiki/Punched_card.
[72] *Bush v. Gore*, 531 US 98 (2000).

with data storage devices that store information not humanly perceptible without dedicated devices to retrieve and access such data,[73] but this necessity raises the spectre of data rot.[74]

Requiring human perception to characterise a digital file also raises subjective questions as to the required degree and extent of human intercession. For instance, data such as error logs may be stored in a form more suitable for system use (referred to as a dump) though exceptionally they may be recovered for human access.[75] Thus, lawyers representing the UK Post Office were excoriated for failing to retrieve and make available to the defendant sub-postmasters and mistresses prosecuted for false accounting and theft of funds, the error logs of the Post Office's Horizon computer system, which would have demonstrated that accounting discrepancies were caused by faulty programming of the Horizon system.[76]

In sum, the distinction made by the MM model, which relies on human perception to argue that data in the "content layer" is "mere information and not property", but data in the "logical layer" is not mere information, is misconceived.[77] This reliance on human perception is technically irrelevant to how a digital file is used, and likewise calls into question the Michels and Millard's conclusion that a digital file in the "logical layer" should be conferred property characteristics, specifically rights *erga omnes*, even as against the owner of the medium upon which the data is recorded. The same reliance by Grimmelmann and Mulligan on the users of a social platform believing in digital files as things is similarly misplaced. Witness, for example, the debacle over the rights to social media posts of deceased users on shared platforms, where the platforms have the ostensible right to delete these accounts and

[73] Cf. *White-Smith Music Publishing Co. v Apollo Co*., 209 US 1, 28 S.Ct. 319, 52 L.Ed. 655 (1908) (holding that a piano roll was not a copy of the musical composition because it was not in a form that others, except perhaps for a very expert few, could perceive). See Wikipedia, "Piano roll", https://en.wikipedia.org/wiki/Piano_roll and Wikipedia, "MIDI", https://en.wikipedia.org/wiki/MIDI.

[74] D. Pogue, "Should You Worry About Data Rot?" (26 March 2009), *The New York Times*: "The second aspect of data rot is actually finding the machines to read them. And that is a real problem. If you think of the 8-track tape player, for example, basically the only way you can find 8-track cartridges is in a flea market or a garage sale."

[75] Silberschatz, Galvin and Gagne, *Operating System Concepts*, 66.

[76] *Bates v Post Office Ltd (No. 6 Horizon Issues)* [2019] EWHC 3408 (QB).

[77] The MM model harps back to the since long-repudiated view that a work is only copyrightable if it can read by a human reader. See e.g., *Apple Computer, Inc. v Franklin Computer Corp*., 714 F.2d 1240, 1248 (1983); *Computer Edge v Apple Computers* [1986] H.C.R. 19, [1986] F.S.R. 537 (High Court of Australia).

their contents, and absent legislative reform, there is no overriding legal right for the estate of the deceased to have access over such accounts.[78]

B. Data Objects

Because of this misconceived emphasis on a file, we propose a different, and we submit, more technically accurate way to conceptualise data. Although Michels and Millard define a "digital file" as "a collection of information, referred to *by file name* … held on backing store … in order (a) to enable it to persist beyond the time of execution of a single job" (emphasis added),[79] it should be noted that the *Dictionary of Computing* (*Dictionary*) does not define a "digital file", only a "file". Curiously, Michels and Millard also make no reference to the larger term of art, "data", which the *Dictionary* defines as "information, in any form, on which computer programs operate",[80] or "data file", which is a "file containing data … normally organized as sets of records with one or more associated access methods". The *Dictionary* in turn defines a "record" as either "a collection of data handled together in transfers to and from peripheral devices" or "a data structure in which there are a number of named components, called fields, not necessarily of the same type … widely recognized as one of the fundamental ways of aggregating data …"[81] Notably, the first definition of a record as a collection of email records maintained on email servers makes no reference to a "file". The second definition refers to data stored on a "database management system" (DBMS), which organises and manages a body of information based on a data model that is implemented.[82] Examples of database would include inventories, transactions, financial and banking accounts.

It is clear from these definitions that a digital file is *not* the *only* abstract concept of a record of data that is digitally stored. As there is more than one way to conceptualise the storage of data as an object of

[78] The position at common law is governed by contract law rather than property law, and it is so unsatisfactory for the estates of deceased users that various states in the U.S. sought to resolve this by enacting the Revised Uniform Fiduciary Access to Digital Assets Act (RUFADAA). https://www.uniformlaws.org/committees/community-home?CommunityKey=f7237fc4-74c2-4728-81c6-b39a91ecdf22. *See* Kutler, "Protecting Your Online You: A New Approach to Handling Your Online Persona After Death", (2011) 26 Berkeley Tech LJ 1641.
[79] J. Daintith and E. Wright, *A Dictionary of Computing*, 6th ed. (Oxford 2008), under "file".
[80] Daintith and Wright, *A Dictionary of Computing*, under "data".
[81] Daintith and Wright, *A Dictionary of Computing*, under "record".
[82] Daintith and Wright, *A Dictionary of Computing*, under "database management system (DBMS or dbms)".

information, we propose to describe a unit of data stored as a "data object" - "a component that is in some sense self-contained and has an identifiable boundary."[83] The qualification of "in some sense" is significant as we shall see that data objects may be dealt with in smaller fragments than itself. So conceived, a data object thus includes a digital file. It is important to note that our usage of 'data objects' – the expression is not a legal term of art – is different from that of the Law Commission's in its consultation on digital assets.[84] The Law Commission employs the term for the purposes of distinguishing between rivalrous and non-rivalrous digital assets whereas we do so purely descriptively to refer to self-contained digital data that is used or manipulated by a computer system.

V. SYSTEM ARCHITECTURE

To properly understand the relationship between a data object and a digital file, it is necessary to briefly outline the modern-day architecture of computer systems, which are either a single user system or a networked or distributed system.

A. Single User System

The standard view of the architecture of a single-user system is to abstract it into three layers: the hardware layer, the operating system layer, and the application programs layer. Such an architecture is prima facie "designed for *one user* to monopolise its resources" (emphasis added).[85]

[83] Daintith and Wright, *A Dictionary of Computing*, under "object".
[84] Law Commission, *Digital Assets: Consultation paper*, Chap. 5. Cf. Law Commission, *Digital Assets: Final Report*, [3.63].
[85] Silberschatz, Galvin and Gagne, *Operating System Concepts*, 4.

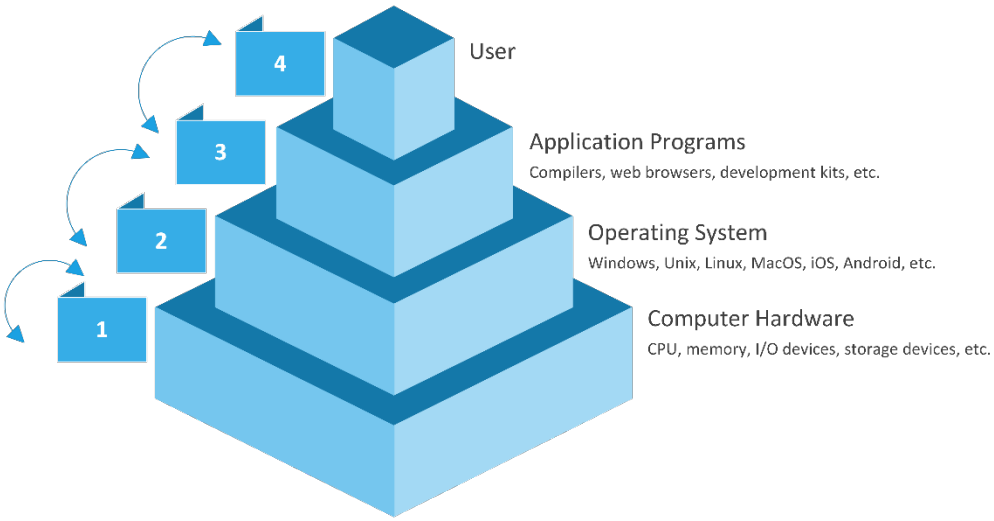

Figure 4. Abstract view of the components of a single-user computer system[86]

In this architecture, the OS is interposed between the hardware and the applications and manages all the hardware resources on the computer system.[87] As the Central Processing Unit (CPU) loads and runs instructions from the main memory (typically random-access memory or RAM), there is a need to store both the instructions and the instruction results onto secondary storage that can hold large quantities of data permanently when power is turned off or lost.[88] The most common secondary-storage devices in use today are hard disk drives (HDDs), non-volatile memory devices (e.g. flash devices that are found in solid state drives (SSDs) and USB drives), CDs, DVDs or Blu-ray disks, and magnetic tapes.[89] The now archaic 5¼" and 3½" floppy disks[90] are also examples of secondary storage.

Because there are different types of secondary storage, a large portion of the OS is dedicated to interacting with and managing the storage and retrieval of data to and from these devices, as part of its input/output management (I/O), to create data objects that are uniform and consistent.[91] To do so, the OS abstracts from the physical properties of its storage devices to define a logical storage unit known

[86] Silberschatz, Galvin and Gagne, *Operating System Concepts*, 4 (adapted).
[87] Silberschatz, Galvin and Gagne, *Operating System Concepts*, 5.
[88] Silberschatz, Galvin and Gagne, *Operating System Concepts*, 30. See also T. Anderson and M. Dahlin, *Operating Systems: Principles & Practice, Volume 4: Persistent Storage*, 2nd ed. (United States 2015), 24.
[89] Silberschatz, Galvin and Gagne, *Operating System Concepts*, at 449-455. See also Bridge et al, *The Law of Personal Property*, [8-006]-[8-009].
[90] Wikipedia, "Floppy disk", https://en.wikipedia.org/wiki/Floppy_disk.
[91] Silberschatz, Galvin and Gagne, *Operating System Concepts*, 14; Anderson and Dahlin, *Operating Systems: Principles & Practice, Volume 4*, 30.

as the file.[92] The file is therefore the smallest allotment of a data object that, as created and managed by the OS, collects and stores related information defined by its creator.[93] It is normally organised into directories and given a filename for ease of access and use as a generally persistent data object.[94]

So understood, the file is a data object created and managed *by the OS*. But the creation of data objects is not exclusive to the OS. For instance, the CPU, the Basic Input Output System (BIOS) or the Unified Extensible Firmware Interface (UEFI) of systems and high-end peripherals residing in the hardware layer may have their own code or even OS. Described as firmware, such code is distinct and separate from the system OS.[95] The firmware can create and manage its own data objects such as code (for updating existing firmware), hardware setup or configuration information, menus, graphics etc. and access and store them on secondary storage such as programmable read-only memory (EEPROM).[96] In modern BIOSes, these data objects are stored as variables or byte-codes and are not separately accessible as files.[97]

Similarly, data objects may be created and managed by application programs on the third layer of the system architecture. Database records as previously mentioned are collections of data objects managed by the DBMS, managed independently of the OS, bypassing the need for files.[98] The smallest data object maintained by a DBMS is a row or a logical record.[99] Windows PC users will undoubtedly be familiar with its internal repository known as the registry, where system and software information, user preferences and security and boot options are separately kept as registry entries.[100] Another example is

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[92] Silberschatz, Galvin and Gagne, *Operating System Concepts*, 29, 529; Anderson and Dahlin, *Operating Systems: Principles & Practice, Volume 4*, 26.
[93] Silberschatz, Galvin and Gagne, *Operating System Concepts*, 29, 530; Anderson and Dahlin, *Operating Systems: Principles & Practice, Volume 4*, 32.
[94] Silberschatz, Galvin and Gagne, *Operating System Concepts*, 29, 529-30; Anderson and Dahlin, *Operating Systems: Principles & Practice, Volume 4*, 32-39. See also Bridge et al, *The Law of Personal Property*, [8-011].
[95] Silberschatz, Galvin and Gagne, *Operating System Concepts*, 21.
[96] Wikipedia, "Unified Extensible Firmware Interface", https://en.wikipedia.org/wiki/Unified_Extensible_Firmware_Interface.
[97] Wikipedia, "Unified Extensible Firmware Interface", https://en.wikipedia.org/wiki/Unified_Extensible_Firmware_Interface.
[98] Silberschatz, Galvin and Gagne, *Operating System Concepts*, 464-465, 539-540, 601; T. Anderson and M. Dahlin, *Operating Systems: Principles & Practice, Volume 1: Kernels and Processes*, 2nd ed. (United States 2015), 37-38.
[99] Wikipedia, "Row (database)", https://en.wikipedia.org/wiki/Row_(database); Silberschatz, Galvin and Gagne, *Operating System Concepts*, 539.
[100] Silberschatz, Galvin and Gagne, *Operating System Concepts*, 871.

the use of distributed file sharing software such as Napster, Grokster or BitTorrent, to reconstitute a file as a complete data object from multiple file fragments held by other users.[101]

For these reasons, it is inaccurate to call data objects found in the "physical layer" or hardware layer digital files. Nor is it usual to describe digital files as being created by application programs or existing in the "content layer" since the management of files is actually done by the OS. Rather, data or information is stored and managed as data objects at the hardware layer, the OS layer *and* the application programs layer.

B. Networked System Architectures

The Internet hardly needs any introduction. It arose from the Arpanet which was developed by the Advanced Research Projects Agency (ARPA) of the US Department of Defence to enable valuable computing resources to be shared between remote computers through packet switching, where data objects are broken up for transmission over a network before reassembly.[102] With the widespread availability of high-bandwidth Internet access, it is commonplace for a computer system to satisfy requests generated by another system by providing high-availability services.[103] This modern use-case is familiar to most users who store and access their data online. The basic implementation is a client-server system architecture where one or more "client" computers send requests across a network to perform actions to retrieve data from, or write data to, another, typically more powerful, computer referred to as the server.[104]

[101] Silberschatz, Galvin and Gagne, *Operating System Concepts*, 43; *MGM Studios Inc. v Grokster*, 125 S.Ct. 2764, 2770-2771 (2005); *Columbia Pictures Industries, Inc. v. Fung*, 710 F.3d 1020, 1026-1027 (9th Cir. 2013).
[102] K. Hafner and M. Lyon, *Where Wizards Stay Up Late: The Origins of the Internet* (New York 1996).
[103] Silberschatz, Galvin and Gagne, *Operating System Concepts*, 19.
[104] Silberschatz, Galvin and Gagne, *Operating System Concepts*, 42-43.

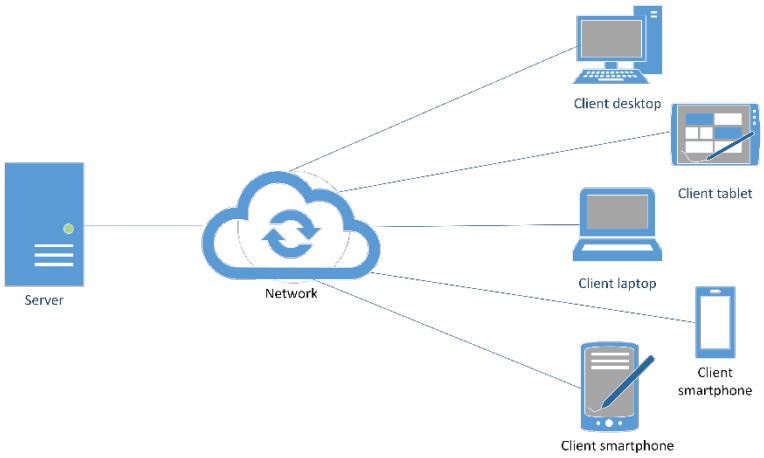

Figure 5. General structure of a client-server system[105]

With peer-to-peer (P2P) computing, clients and servers are indistinguishable from one another, unlike client-server computing.[106] All clients within the P2P system are considered peers, and each may act as either a client or a server, depending on whether it is requesting or providing a service, which includes retrieving and storing data objects.[107] File-sharing services such as Napster, Gnutella and BitTorrent run off P2P system architectures, albeit with implementational differences such as whether or not there is a centralised lookup service.

[105] Silberschatz, Galvin and Gagne, *Operating System Concepts*, 42, Figure 1.22 (adapted).
[106] Silberschatz, Galvin and Gagne, *Operating System Concepts*, 43-44.
[107] Silberschatz, Galvin and Gagne, *Operating System Concepts*, 43-44.

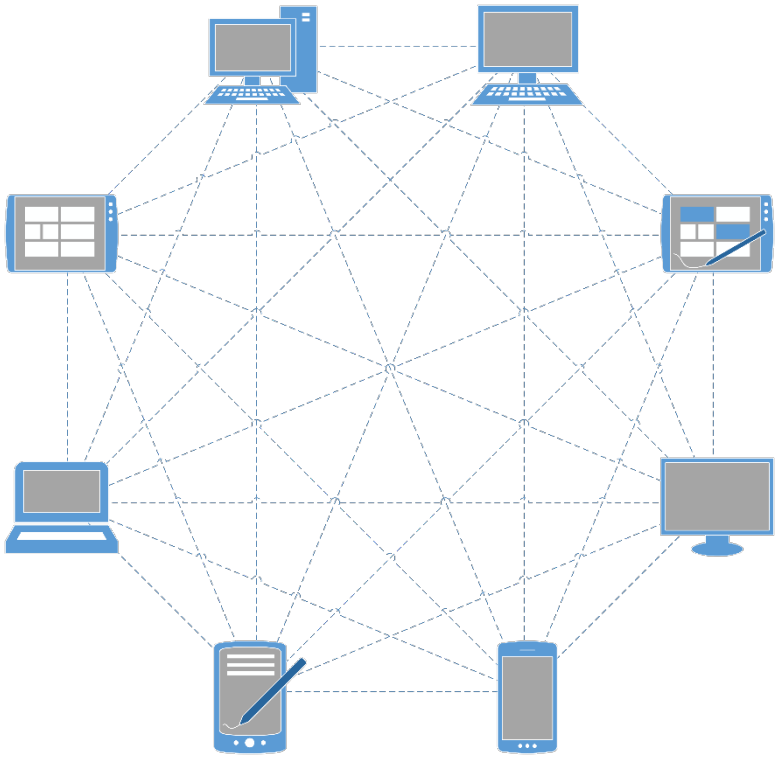

Figure 6. General structure of a P2P system with no centralized server [108]

Improvements in Internet speed and reliability and the ubiquity of Internet connectivity have led to the proliferation of cloud computing services. This is achieved by way of a very sophisticated network system architecture. Through the use of virtual machine monitors (VMMs),[109] thousands of servers and millions of virtual machines with petabytes of storage are connected together and made available for use as computing, storage or application services by anyone via the Internet.[110] But does enabling a near-seamless experience of access to data objects anywhere with an Internet connection entail treating these as real objects and recognising them as objects of property?

[108] Silberschatz, Galvin and Gagne, *Operating System Concepts*, 44, Figure 1.23 (adapted).
[109] Silberschatz, Galvin and Gagne, *Operating System Concepts*, 25 (specialized software that enable multiple OSes to "share" the same piece of hardware, manage their resource use and protect other application and OS from each other). Silberschatz, Galvin and Gagne, *Operating System Concepts*, 35. See also J.L. Hennessy and D.A. Patterson, *Computer Architecture: A Quantitative Approach*, 6th ed. (Cambridge, Massachusetts 2019), 118.
[110] Silberschatz, Galvin and Gagne, *Operating System Concepts*, 44-45.

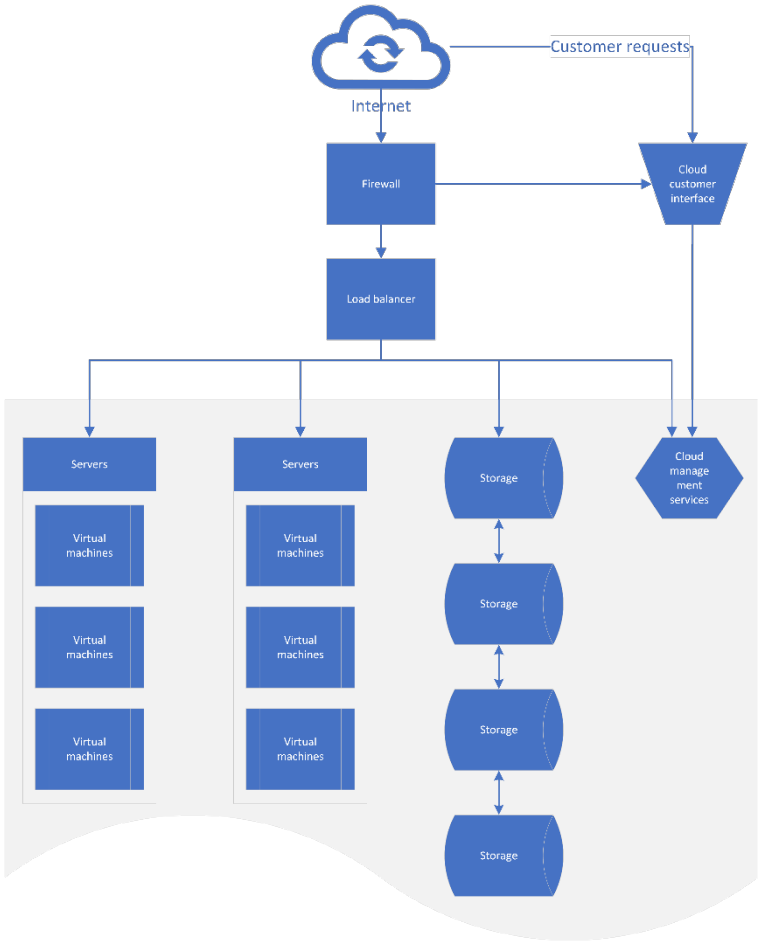

Figure 7. Cloud computing system architecture[111]

V. THE PROPERTIES OF DATA OBJECTS: A DIFFERENT PERSPECTIVE

Despite the similarity in language – data object and object of property – the two concepts are distinct. The former are units of data that are managed by a computer system whereas the latter are the *res* that *erga omnes* rights relate to (property as *in rem* rights). Since the former is essentially comprised of information, it is incapable of being an object of property in any legal system that does not recognise property rights in information. Unlike objects of property, data objects are often not dealt with as a whole,[112] such as when they are packetised and transmitted across networks such as the Internet. This is not to say that contractual or other rights (most notably that of confidence) cannot extend to the

[111] Silberschatz, Galvin and Gagne, *Operating System Concepts*, 45, Figure 1.24 (adapted).
[112] Cf. Daintith and Wright, *A Dictionary of Computing*, under "object" - "a component that is *in some sense* self-contained and has an identifiable boundary."

information comprising data objects which may then themselves be things in action (though it is notable that property here means assets rather in rights *in rem*). Thus, when Rix LJ controversially[113] appeared to suggest that "confidential information is a well recognised species of property, protected by the common law" in *Veolia ES Nottinghamshire Ltd v Nottinghamshire County Council*,[114] his Lordship must have meant that "the *right* to confidential information is a well recognised species of property, protected by the common law as a *thing in action*."[115]

A. Virtual objects at the Operating System layer?

With this understanding of data objects, it is now possible to address Michels and Millard's central thesis, that the law should recognise property rights over *some* data objects (digital files) at the so-called logical layer, which they conceive of as comprising a computer's OS and UI. They support this thesis because they assert that digital files are (1) transferable; (2) unique by virtue of their filename; and (3) access to them can be controlled. As we shall demonstrate, all of these assertions are over-simplified and require qualification.

1. Transferability as separability

According to Michels and Millard, "a digital file is (at least in theory) *separable*, because it *can* be transferred such that the transferor is fully dispossessed of it."[116] This in turn supposedly means that digital files satisfy the third criterion in *Ainsworth*: capable in its nature of assumption by third parties. There are many problems with their statement, resting as it does on theories of separability, transfer, and possession. It is perhaps easiest to begin with the claim of transferability. As Bridge et al explain:[117]

> "What computer users perceive as a transfer of a digital file from one medium to another (or indeed one computer to another, accompanied as it sometimes is by an icon suggesting that something is being transferred) actually involves a two stage process:

[113] T. Aplin, "Confidential Information as Property?" (2013) 24 K.L.J. 172; T. Aplin et al, *Gurry on Breach of Confidence*, 2nd ed. (Oxford 2012), [4.90]-4.100].
[114] [2010] EWCA Civ 1214, [2011] Env. L.R. 12, [111].
[115] Bridge et al, *The Law of Personal Property*, [10-035].
[116] Michels and Millard, "New Things", 333.
[117] Bridge et al, *The Law of Personal Property*, [8-011].

> the first of which creates a duplicate of the file on the new medium, followed by the second, that deletes the file from the original medium." Indeed, deletion typically simply means "transferring" the file to a different folder location, often the computer system's recycle bin. Even emptying a file from a computer system's recycle bin does not delete the actual data itself but rather simply removes the reference to the file from the computer system's master file table, the computer equivalent of a book's table of contents, which is what allows for data recovery even thereafter. Technically, it is only when this freed up space is written over with new data that the deleted data is irrecoverable and can truly be regarded as deleted. The metaphorical nature of file transfers is perhaps most obvious when we consider file transfers within the same medium. Assuming the medium has not been partitioned, it would comprise a single volume, which is "[a] logical unit of data storage." A "transfer" between two folders within the same volume entails no copying or deletion of data at all, which is why such "transfers" are practically instantaneous. Such "transfers" merely effect a change to the logical path location of the file.

As we can see, what computer users experience as a file "transfer" is not a transfer that we experience in the property law sense of the word. This much is admitted by Michels and Millard.[118] When A transfers Blackacre to B, B acquires exactly Blackacre, not a facsimile of the same. As such, property transfers are also not dependent on "transferors" deleting their copies of the property transferred. This is because possession is necessarily rivalrous. If A is in possession of Buttercup the cow, then by definition, B is not. This is not to say that possession is a perfect form of control, since B may dispossess A. But then B would be in possession, and by definition A would not. Although we also speak of possession of knowledge, such possession is non-rivalrous because the object of possession here is simply information, which is non-rivalrous in nature. Possession here simply means to know or to have; there is no necessary exclusionary quality to possession of knowledge. To this, Michels and Millard argue that "[u]nlike mere information, which cannot be removed from a person's mind, a digital file

[118] Michels and Millard, "New Things", 334. See also Grimmelmann and Mulligan, "Data Property", 857-858.

can be deleted from a person's carrier, by issuing a delete command through the device's OS after transfer."[119] But the law of property does not rest on mere possibilities or even probabilities. Property transfers *always* result in dispossession because they are true transfers of possession, a naturally rivalrous state of control, not a mimicry of the same involving copy and delete functions. It is notable also that physical carriers of digital files receive special treatment in the law of intellectual property, where actions for infringement for commercial dealings in unlicensed intellectual works are actually framed as dealings in the media, carriers or objects upon which the works reside.[120]

Although Michels and Millard admit that digital files can be recovered *even after* deletion, they nevertheless claim that, because it would require the services of a data recovery specialist, "for most users, a file is practically irretrievable after it has been deleted at the logical layer."[121] There are two problems with this analysis. First, it is not obvious why the relevant perspective is one of whether a user can personally recover a file. Self-service data recovery software are readily available (some OSes even have recovery services built into them[122]) and third party data recovery services are ubiquitous so surely the relevant perspective should be how readily a user can recover the data irrespective of whether he does so personally or engages a specialist to do so on his behalf. Secondly, even if it were correct for the law to confine itself to the question of whether a user can recover the data *by himself*, this still leaves the awkward case of expert users who can do so. Worse yet, "it would be difficult for outsiders to determine whether [the transferor] has in fact securely deleted the file from her device…" This can raise uncertainty as to whether [the transferor] has actually transferred the file and not just falsely claims to have done so. In sum, compared to tangible assets, "digital files" are "*imperfectly separable*."[123] Michels and Millard's thesis, if accepted, would entail the recognition of digital files as *occasional* property: they would be property if and when they are perfectly separated but cease to be such when a

[119] Michels and Millard, "New Things", 333.
[120] See e.g., Singapore Copyright Act 2021, ss 7(1), 16(2), 24(3), 45, 73, 105, 148; UK Copyright, Designs and Patents Act 1988, c. 48, ss 23, 27, 148; UK Trade Marks Act 1994, s 17; Singapore Trade Marks Act 1998, s 3(2)-(6); UK Patents Act 1977, s 60(1); Singapore Patents Act, s 66(1).
[121] Michels and Millard, "New Things", 334.
[122] See e.g., Microsoft, Recover lost or deleted files, https://support.microsoft.com/en-us/windows/recover-lost-or-deleted-files-7bf065bf-f1ea-0a78-c1cf-7dcf51cc8bfc; Easeus, How to Recover Deleted Files on Mac After Emptied Trash Bin (2023 Tips), https://www.easeus.com/mac-file-recovery/recover-mac-deleted-file-from-trash.html.
[123] Michels and Millard, "New Things", 335.

separation is imperfect. It is difficult to conceive of how such a system would be practicable. Eventually, they seem to give up on this point completely in their conclusion, nothing that "property rights have traditionally applied to objects that are perfectly separable and finite. They might not be the right legal tool to regulate virtual objects which are imperfectly separable and practically infinite."[124]

This concession belies a key point that cuts through all this analysis. This is that a data object in the form of a file created by the OS is a *virtual* object and that file transfers are only *metaphorical* transfers.[125] This virtualisation, as one of the functions of the OS, is designed "to better assist an end user in navigating and using a computer"[126] but one must be wary of treating that which is merely virtual as real lest that which was intended as visual aid leads ironically to mental muddle.

In addition, the processes of creating, accessing, copying, modifying, saving, transferring, and deleting of the file across different types of secondary storage requires the intermediation of the OS.[127] How the OS implements these processes is constrained by the characteristics of the physical device as a storage medium. Michels and Millard's treatment of storage media in computing creates the impression that all media are rewritable when in fact some are not. Consider the humble Compact Disc (CD), which can "either be read only (e.g. CDs or CD-ROMs), recordable (i.e. write once, e.g. CD-Rs), or re-recordable (i.e. rewritable, e.g. CD-RWs)."[128] If a data object such as a movie on a DVD is not rewritable, then it is inseparable from its physical medium. No amount of abstraction by the OS will enable the data object (movie) to be transferred (rather than copied) – even in the dubious copy and delete sense Michels and Millard contemplate – without a transfer of the medium itself.[129]

All the characteristics of the digital file that are allowed by the OS reflect the data object *and* the physical characteristics of the device on which it resides. The properties of the digital file are *exogenous*

[124] Michels and Millard, "New Things", 354.
[125] For the risks of metaphors, see G. Lakoff and M. Johnson, *Metaphors We Live By* (Chicago 1980), 5, 10, 12-13.
[126] Bridge et al, *The Law of Personal Property*, [8-011]
[127] Though not exclusively e.g. manipulation of the data object can be done at the hardware layer or by another OS, which is how modern data forensics is properly conducted. See N. Wilson et al, "Proof: the technical collection and examination of electronic evidence" in S. Mason and D. Seng (eds.), *Electronic Evidence*, 5th ed. (London 2021), [9.72]-[9.77].
[128] Bridge et al, *The Law of Personal Property*, [8-008]
[129] See below.

to the file because it is not an independent object: it is a virtualised representation of the data object by the OS and its creation, use and management are constrained by the OS *and* the physical characteristics of the storage devices. A digital file simply cannot be "transferred" digitally from device A to device B *without* a second, identical but independent copy first being made on device B[130] followed by the deletion of the original copy from device A because this is how data objects are digitally created on physical devices in the first place.[131] In fact, every time a data object is used, it is, by virtue of the architecture of digital technology, copied.[132] If digital files are somehow transferable, the epochal events of the early 2000s when college students started sharing their music files on Napster and Grokster would not have happened.[133] Calling a digital file imperfectly separable gives it a quality it simply does not possess. However desirable it may be to "[align] legal analysis with most users' everyday experience",[134] this simply cannot be done at the expense of contradicting reality.[135]

2. Uniqueness of filename

Michels and Millard assert that digital files satisfy three of the criteria they set out in their six criteria test. Specifically, it supposedly demonstrates that digital files are definable,[136] identifiable by third parties[137] *and* rivalrous.[138] We propose to focus on the criterion of rivalrousness. To support their argument that a digital file is rivalrous, and hence property-like, Michels and Millard rely upon the uniqueness of the filename-path of a file maintained by the OS.[139] But this clearly confuses the naming convention of a file introduced by the OS to facilitate access to the contents of the data object with the

[130] See e.g. L. Lessig, *Code: Version 2.0*, 2nd ed. (New York 2006), 114-115, 173; Silberschatz, Galvin and Gagne, *Operating System Concepts*, 530.
[131] Michels and Millard, "New Things", 334-335.
[132] See e.g., L. Lessig, *Remix: Making Art and Commerce Thrive in the Hybrid Economy* (London 2008), 98-105 (explaining the difference between the use of analogue works and digital works). As Lessig also noted, every copy of a data object also entails copying the whole or part of the data object into the memory buffer of the device accessing the data object. Some OSes even implement a log-structured file system that keeps a log of a copy of the data object that is to be created as a file, to provide for consistency checking and allow for data recovery in the event of data loss on the secondary storage. See Silberschatz, Galvin and Gagne, *Operating System Concepts*, 587-588.
[133] See e.g. Lessig, *Code: Version 2.0*, 173-175.
[134] Michels and Millard, "New Things", 348. Cf. Grimmelmann and Mulligan, "Data Property".
[135] Watts and Low, "The Case for Cryptoassets as Property".
[136] Michels and Millard, "New Things", 332-333.
[137] Michels and Millard, "New Things", 332-333.
[138] Michels and Millard, "New Things", 335.
[139] Michels and Millard, "New Things", 335.

file as the data object itself. Each file has a unique combined path and filename because this filename-directory structure solves the name-collision problem.[140] But one file is not always associated with one filename/path. Both Unix and Windows New Technology File System (NTFS) implement links whereby the same file can be referred to by more than one filename.[141] In fact, links are implemented by the OS to enable *multiple access* to the same file,[142] which contradicts the authors' assertion that digital files with unique filenames are rivalrous. Not only is Michels and Millard's account technically inaccurate, it obfuscates the digital file and its filename. Since their objective is to build a case for property rights in digital files and not filenames, the question should not be whether filenames are rivalrous but whether digital files are.

3. Access Control as excludability

By claiming that, as separate virtual objects, a digital file "can *typically* only be enjoyed by one person at a time", Michels and Millard implicitly acknowledge that digital files can at least *sometimes* be accessed by more than one person at a time, which contradicts their claim that digital files are rivalrous. The reason why there is no visual trespass[143] but there is physical trespass is because the latter but not the former interferes with rivalrous control, being possession. Michels and Millard openly acknowledge that files stored on the cloud[144] may be so accessed by multiple persons, but seeing as this entails a reference to network system architecture, this concession deserves separate attention.[145]

It is noteworthy that in single user system architectures, the OS by default enables a file to be accessed by not just the user but simultaneously by different applications running at the same time.[146] And these

[140] Silberschatz, Galvin and Gagne, *Operating System Concepts*, 544.
[141] Silberschatz, Galvin and Gagne, *Operating System Concepts*, 549; Anderson and Dahlin, *Operating Systems: Principles & Practice, Volume 4*, 39. These could be hard links (multiple file names to the same file) or soft or symbolic links (one hard link to the file and other (symbolic) links translate to the hard link). The MacOS uses a similar concept called "file alias".
[142] Silberschatz, Galvin and Gagne, *Operating System Concepts*, 544; Anderson and Dahlin, *Operating Systems: Principles & Practice, Volume 4*, 38.
[143] *Victoria Park Racing and Recreation Grounds Co Ltd v Taylor* (1937) 58 CLR 479. But exceptionally (and controversially) visual intrusion can amount to nuisance: *Fearn v Board of Trustees of the Tate Gallery* [2023] 2 WLR 339; [2023] UKSC 4.
[144] Michels and Millard, "New Things", fn 66.
[145] See below.
[146] Silberschatz, Galvin and Gagne, *Operating System Concepts*, 533.

applications need not be operated exclusively by the user.[147] Thus many traditional Unix OSes recognise three classifications of users in connection with each file: the owner as the user who created the file, a set of users who are sharing the file and need similar access as a group, and all other users in the system. In Unix systems, each file and directory is associated with three fields – the owner, group, and universe.[148] This means that a standard user who creates a file in his home directory has, as owner, read and write privileges over the file, any member of the group associated with the file can have either read or read/write privileges, and everyone else has read privileges only. Ownership here is again used in the technical, non-legal, sense and simply sets out the technical privileges that a user who creates a file enjoys.

Alternatively, access to a file can be controlled by way of an access-control list (ACL), which is a list of permissions associated with a system resource. Windows NTFS-based OSes use ACLs,[149] and Mac OS X version 10.4 and above and Linux also support ACLs.[150] In Windows NTFS OSes, the ACL implementation is such that during Windows installation, the Administrator account is the first account that is created.[151] The Administrator account has full control of the files, directories, services and other resources on the local computer.[152] In addition to the local user accounts for users of the local computer, Windows NTFS OSes also create the System account, which is used by the OS to give itself full control permissions to all NTFS files.[153] This means that when a file is created by a user on Windows NTFS, it has, at a minimum and by default, three sets of "owners" who have full access to the file: the user (who belongs to the User or Authenticated User group), the Administrator, and the System. For this reason,

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[147] To mediate between multiple processes/users, the OS will implement file locking functionalities such as shared locks and exclusive locks: Silberschatz, Galvin and Gagne, *Operating System Concepts*, 534-536.
[148] Each field consists of three bits rwx: r for read access, w for write access, and x for execution. The default permission for files created by a standard user in his home directory is either rw-r--r-- or rw-rw-r--. See e.g., Wikipedia, "File-system permissions", https://en.wikipedia.org/wiki/File-system_permissions; Quora, "What is the default file permission in Unix?", https://www.quora.com/What-is-the-default-file-permission-in-Unix.
[149] NTFS permissions are grouped into six basic permissions: read, write, list folder contents, read and execute, modify and full control.
[150] Wikipedia, "File-system permissions", https://en.wikipedia.org/wiki/File-system_permissions.
[151] Microsoft, "Local Accounts", 29 Dec 2021, https://docs.microsoft.com/en-us/windows/security/identity-protection/access-control/local-accounts.
[152] Microsoft, "Local Accounts". See also Microsoft, "Take ownership of files or other objects", 29 Oct 2021, https://docs.microsoft.com/en-us/windows/security/threat-protection/security-policy-settings/take-ownership-of-files-or-other-objects. [hereinafter *Microsoft Take ownership*].
[153] Systems software need to access a user file for a variety of purposes, ranging from file system management to optimisation of the system, to checking for viruses and other illicit code embedded in the files, for reasons of security. Microsoft, "Local Accounts".

not every user can access the ACL to change the ACL accounts, groups and file permissions. But the Administrator as the superuser by definition *always* has the ability to set and modify ACLs by setting the privilege policies, creating other local users, and assigning user rights and permissions.[154]

Michels and Millard rely on the *possibility* of access control, drawing upon Green and Randall,[155] to demonstrate that digital files have the characteristic of excludability[156] but this contention is highly problematic. First, they acknowledge that the Green and Randall concept of "digital control" has thus far been rejected by the English courts.[157] But more importantly, this concept of "digital control" as encompassing indirect control where "a person can exclude others from accessing the object"[158] is both technically and conceptually unsound. Technically, if the user were to revoke the Administrator's access to his file, as the Administrator account cannot be deleted or locked out, the Administrator can retake control of local resources by simply changing the user's user rights and permissions.[159] Conceptually, property has always entailed the protection of direct control rather than indirect control so that it is irrelevant how many additional justifying strings one adds to an indirect control bow: the result cannot be property. As Low and Llewelyn explain:[160]

> [I]t is vital to understand that we are, for the purposes of the law of property, concerned with the direct and not indirect control granted by the law. Thus, if someone is the owner of the sole surviving copy of a book the copyright in which has expired, the *physical* control of the book allows the owner de facto to prevent another from copying it even though there is no longer any copyright, which is the *legal* right to prevent copying.

[154] Microsoft, "Take ownership of files".
[155] Green and Randall, *The Tort of Conversion*, 109-111, 120-123.
[156] Michels and Millard, "New Things", 339, 344
[157] Michels and Millard, "New Things", 340.
[158] Michels and Millard, "New Things", 340.
[159] Microsoft, "Local Accounts".
[160] K.F.K. Low and D. Llewelyn, "Digital Files as Property in the New Zealand Supreme Court: Innovation or Confusion?" (2016) 132 L.Q.R. 394, 397.

For rights *in rem* or rights *over* things, property law *supplements* an imperfect form of rivalrous control, being possession. For things in action (property as assets or rights *as* things), the law *creates* said rivalrous control altogether, in the form of the legal right itself.

In sum, contrary to the authors' conclusion that each digital file is rivalrous, modern OS implementations ensure that a file as a data object is *not rivalrous*. In addition to the "owner" as the creator of a file in the OS, multiple users, groups of users, administrators and the OS itself are able to access the file at the same time, mediated by the OS. Nor are digital files properly regarded as excludable via indirect forms of access control. It is clearly infeasible for a user to deny the administrator access to the file, though the user may deny the administrator access to the data object embedded therein by relying on other mechanisms such as password protection and encryption.[161] But a password protected or encrypted file can still be simultaneously copied, accessed or even rewritten as long as the correct OS privileges exist. It is only by focusing on the odd case where "owner" and administrator were one and the same and no other users exist can one begin to build a case for rivalrousness and excludability in terms of access control. But rivalrousness is an absolute and unconditional state of exclusion. If access control is merely conditional, then it is at best nearly rivalrous except the idea of being nearly rivalrous is as nonsensical as the state of being almost pregnant.

4. Sufficient degree of permanence

We do not propose to linger on the test of sufficient degree of permanence. It is a highly problematic criterion but it is pertinent to observe that, on the MM model, a digital file's permanence is a condition inseparable from its carrier.[162] Rather than demonstrate its capacity to be treated as property in its own right, the inseparability of its stability from its medium rather points away from giving a digital file separate property status.

B. Further Complications: Network Architectures

[161] Michels and Millard, "New Things", 340.
[162] Michels and Millard, "New Things", 343.

As badly as the MM model fits the single user computing architecture, it fares even more poorly when applied to network architectures. The basic presumption when a data object is stored for access on a network is that it will be shared. This, after all, was the original point of the precursor to the Internet, the Arpanet, as well as one of the unique advantages of today's cloud computing. It is unclear whether Michels and Millard consider their analysis applicable to the paradigm case of a digital file stored in the cloud. On the one hand, they acknowledge that the "typical" case of single user access cannot be simply applied to such a scenario.[163] On the other hand, without elaborating why their analysis can apply to this more complicated situation, they baldly assert that "while cloud providers own the underlying servers, customers would own the digital files stored in the cloud."[164]

Michels and Millard's appeal to users' ownership of data objects within network architectures is deeply problematic. In the first place, much like within the context of surveillance capitalism, ownership simply serves as a metaphor for control.[165] Property serves a rhetorical role, to underscore the justice of the outcome of allocating control to the user whilst obscuring the circularity of the argument – users should control their data objects because it is their property and it is their property because they should control them. Harris once remarked that the references to possessive pronouns in the literature on self-ownership was childish and the same is true of data. Substituting data for bodies:[166]

> The fact that people deploy possessive pronouns in relation to their [data] is, in itself, no indication of ownership assumptions. "My", "yours", "his" or "hers" may signify a host of relationships which have nothing to do with owning. Even a child will not confuse the sense of "my" as between: "It's my ball!" and "She's my teacher".

Within network architectures, a user's data object simply means a data object uploaded by the user and sometimes not even that, such as when identical data objects have been uploaded by multiple users

[163] Michels and Millard, "New Things", fn 66.
[164] Michels and Millard, "New Things", 350.
[165] S. van Erp, "Management as Ownership of Data" in S. Lohsse, R. Schulze, and D. Staudenmayer (eds), *Data as Counter-Performance – Contract 2.0?* (Oxford 2020) 77.
[166] J.W. Harris, "Who Owns My Body" (1996) 16 O.J.L.S. 55, 65.

which the cloud service providers have deduplicated. All the users will be able to access *their* data object even though perhaps only a single copy of the same may remain on the data server.[167]

The two key reasons for putting data objects on, and accessing them through, a communications network[168] are to enable resource sharing – where a user at one site is able to use the resources at another site,[169] and to enable better reliability – where one site fails in a networked system, the remaining sites can continue operating autonomously.[170] To this end, modern day general-purpose OSes such as Linux, Windows and MacOS and even embedded OSes such as Android and iOS provide an environment where users can access remote resources, and that other users can remotely access local resources.[171] If a user A at site X wishes to access a file hosted by user B at site Y, the OS will provide services to allow for the file to be copied explicitly from the computer representing site Y to the computer at site X.[172] The Internet file transfer protocol (FTP) and its more secure cousin, secure file transfer protocol (SFTP) provide such a mechanism, and basic cloud-based storage applications which Michels and Millard had in mind operate a similar mechanism where similar services are made available through a web link or other sharing mechanism via a graphical interface.[173]

When users store data objects on remote resources, the local OS in conjunction with the distributed OS running on the network abstract the mechanisms such that it *appears* to the user that he is accessing the data object locally. In reality, he is accessing a local *copy* (*or parts thereof*) of the remotely stored data object.[174] It is the distributed OS that is in total control of all the data objects.[175] This includes the process of moving the data objects around on the network across multiple and independent storage devices, replicating multiple copies of chunks of each file across different data services to protect

[167] See e.g., *RecordTV Pte Ltd v MediaCorp TV Singapore Pte Ltd and Others* [2009] SGHC 287, [9] (online recording system determining if single or multiple copies of multiple end-users' recordings were made).
[168] This includes enabling computational speedups and concurrent operations. Silberschatz, Galvin and Gagne, *Operating System Concepts*, 735.
[169] Silberschatz, Galvin and Gagne, *Operating System Concepts*, 734-735.
[170] Silberschatz, Galvin and Gagne, *Operating System Concepts*, 735.
[171] Silberschatz, Galvin and Gagne, *Operating System Concepts*, 750.
[172] Silberschatz, Galvin and Gagne, *Operating System Concepts*, 750-751.
[173] Silberschatz, Galvin and Gagne, *Operating System Concepts*, 751.
[174] Silberschatz, Galvin and Gagne, *Operating System Concepts*, 751-752.
[175] Silberschatz, Galvin and Gagne, *Operating System Concepts*, 751-752.

against component failures,[176] redistributing and rebalancing the file chunks among the data servers to cut down on network congestion and ensure that the network loads are balanced and improve performance, reliability and capacity.[177] Some cloud storage providers also compress and deduplicate data objects to reduce the size of files and remove redundant data, in order to save storage space and cut down on network communication costs.[178] These operations are opaque to the user of the data object. If two or more users of a cloud service upload identical digital files to a service provider, any deduplication process will remove multiple copies of the digital file.[179] Whose digital file then should the law regard the copy remaining as belonging to?

Non-transparent (or at least easily overlooked) compression of digital files may also occur in file "transfers" across networks without involving cloud services. Perhaps most famously, a detective in the Kyle Rittenhouse trial who was unable to "transfer" a video file via Apple's proprietary AirDrop sharing functionality to a defence attorney because the latter used Android devices, ended up emailing the video to them instead but failed to realise that the file was compressed prior to transfer, leading the defence to claim a mistrial.[180] Although Michels and Millard conceive of digital file "transfers" as necessarily creating identical copies, this is simply not always true. As Bridge et al explain:[181]

> A simple copying exercise, with no change between digital formats (e.g. from .jpg to .gif) should be perfect if the computer is functioning perfectly but generation loss can afflict copies, especially where the copying involves a change in format. Even copying without changes in format can introduce bit errors, typically when large quantities of data are being copied at the same time, which is why archivists take especial care to ensure that digital copies are identical to the original digital file, steps

[176] Silberschatz, Galvin and Gagne, *Operating System Concepts*, 759-760. See e.g., Google, "Data and Security", https://www.google.com/about/datacenters/data-security/.
[177] Silberschatz, Galvin and Gagne, *Operating System Concepts*, 760-762, describing Amazon's S3 cloud storage services.
[178] Silberschatz, Galvin and Gagne, *Operating System Concepts*, 757.
[179] See e.g., *RecordTV Pte Ltd v MediaCorp TV Singapore Pte Ltd* [2009] SGHC 287, [9] for a discussion about deduplication technology.
[180] R. Lawler, "Rittenhouse defense requests a mistrial after iPhone Mail app compresses key video evidence" (18 November 2021), *The Verge* at https://www.theverge.com/2021/11/17/22788080/kyle-rittenhouse-drone-video-compressed-iphone-android
[181] Bridge et al, *The Law of Personal Property*, [8-012]

> ordinary users almost never take. "The error rate in a digital channel," known as the bit error rate, is "usually expressed as the number of errors per million bits transmitted."

C. Digital Files as "New Things": Property or Quasi-Property?

Michels and Millard's analysis then takes a curiouser and curiouser twist as they explore the policy implications of their proposal. In the English cases dealing with digital files to date, it is evident that the propertisation of digital files have proven to be a distraction that is not conducive to the proper resolution of a case. Mummery LJ explicitly said as much in *Fairstar Heavy Transport v Adkins*:[182]

> In my view, it is unfortunate that the agreed wording of the preliminary issue introduced an unnecessary complication into the dispute. The reference to a "proprietary right" was a distraction from the centrality of the agency relationship and its legal incidents. No competing claims of third parties are involved. Fairstar's claim is against Mr Adkins. The assertion of a right to inspect and copy the content of the emails on his computer relating to its business affairs arises from the legal incidents of an agency relationship that survive its termination. That question can be decided, as between those parties, without a jurisprudential debate about the legal characteristics of "property", or whether the content of the emails was "information" in which property existed in this case or could exist at all.

In *Your Response Ltd v Datateam Business Media Ltd,*[183] the distraction arguably led to the case being decided wrongly.[184] The case concerned a magazine publisher engaging a database manager to "hold" and maintain its database of subscribers. Dissatisfied with the manager's service, the publisher purported to terminate the contract with one month's notice. Soon thereafter the parties reached an impasse: the manager refused to release the database or provide the publisher with access to it until all outstanding fees were paid whereas the publisher refused to pay those fees until the database was made available to it. The manager argued that it was entitled to a possessory lien on the database until it was

[182] [2013] EWCA Civ 886, [2014] EMLR 12 [46].
[183] [2014] EWCA Civ 281; [2015] Q.B. 41.
[184] Low, "The Perils of Misusing Property Concepts".

paid, an argument that prevailed before the trial judge but discomforted the Court of Appeal. Unconvinced of the analogy between possession (being rivalrous possessory control of tangible objects) and the broader concept of practical control[185] and fearful of "potential unintended consequences",[186] the Court of Appeal allowed the appeal. However, given that the parties were in a contractual relationship, a simple contractual analysis would have supported the trial judge's conclusion albeit for different reasons:[187]

> In the circumstances, without resorting to possessory liens, surely the question as a matter of contract was whether these obligations owing by each party were interdependent or independent. Normally, the courts regard the obligations of each party as interdependent: see, e.g. Peel, *Treitel: The Law of Contract, 13th edn (London: Sweet & Maxwell, 2010), at pp.811–812*. This prima facie preference reflects the courts' inclination not to expose a party, particularly one whose obligation is preceded by its counterparty's performance of its own obligation, "to the risk of having to perform without any security for the performance of the other": see *Treitel, at p.811*. Whilst this presumption may be displaced, the Court of Appeal in *Your Response Ltd v Datateam Business Media Ltd* appears to have reasoned from the wrong presumption. In short, normal contractual principles favour the view that, unless [the publisher] had fully paid [the manager], [the manager's] obligation to "return" the database remained contingent.

To paraphrase Mummery LJ, the unnecessary complication of property distracted the court in *Your Response* from the centrality of the contractual relationship between the parties and its legal incidents.

Michels and Millard suggest that the contractual solution is unavailable in two situations: (1) insolvency; and (2) situations where the digital files were under the control of parties outside the contractual relationship. The former can be quite simply dismissed. Why would a liquidator, whose objective is to maximise distribution of limited assets, bar contractual access to nonrivalrous digital files if the

[185] *Your Response Ltd v Datateam Business Media Ltd* [2014] EWCA Civ 281; [2015] Q.B. 41, [23].
[186] *Your Response Ltd v Datateam Business Media Ltd* [2014] EWCA Civ 281; [2015] Q.B. 41, [41].
[187] Low, "The Perils of Misusing Property Concepts", 551-552.

counterparty were not in breach and thereby increase the number of claims against the insolvent company and hence diminish distributions per creditor? The latter is a more plausible "problem" but is it one really? If, as Michels and Millard suggest, the database manager in *Your Response* had not stored the digital files on its own servers but had subcontracted such storage to a third party, then the publisher would have no direct contractual claim against said third party, typically a cloud service provider. But presumably this would be a risk that the publisher voluntarily undertook in not contractually requiring the manager to personally store said digital files in their contract. If so, it is difficult to understand why the absence of a direct claim should be regarded as problematic. No justification is proffered for why the law ought to protect such a user from a risk voluntarily undertaken.[188]

Even more worrisome is the number of tweaks around the edges of their new property concept Michels and Millard feel is necessary in order to fashion reasonable outcomes in various instances. Consider this example they pose:[189]

> [S]uppose Alice stores a password-protected digital file on Bob's USB stick, without Bob's knowledge. Bob finds the file, cannot open it, and deletes it. Should Bob be liable for damages to Alice?

Clearly discomforted by the idea that the strict liability that typically follows property rights would render Bob liable to Alice, Michels and Millard suggest two solutions, both unsatisfactory. First, they suggest that "Bob's situation could be considered as analogous to that of an involuntary bailee of a tangible object, who has a limited duty of care of the objects which have come into his possession."[190] But English law requires even an "unconscious bailee" to "before dealing with the goods … use what is in all circumstances of the case a sufficient standard of care to ascertain that they are truly his goods."[191] On what basis is Bob supposed to surmise that this strange file that presumably he does not recognise and that he cannot open is "truly his" and thus delete the same? Thus, they propose "[a]lternatively, the proprietary remedies applied to digital assets could make an exception for cases of

[188] Cf. Grimmelmann and Mulligan, "Data Property", 870-874.
[189] Michels and Millard, "New Things", 349.
[190] Michels and Millard, "New Things", 349.
[191] *AVX Ltd v EGM Solders Ltd*, *The Times*, 7 July 1982.

accidental or good faith interference."[192] This solution is even worse, transmuting property into quasi-property. The owner of a digital file would on this account not actually enjoy *erga omnes* rights strictly so-called. The quasi nature of their solution is evident in their conclusion, in which they leave open the possibility that it may be preferable to adopt through legislation "property-like protections through a *sui generis* regime."[193] If the regime is *sui generis*, then it would not be proprietary.

There is an even more troubling problem with the Michels and Millard analysis, which is the possibility that "property rights at the logical layer could clash with existing property rights at the physical layer and in information at the content layer."[194] They set out the problem using the earlier example:[195]

> In the above example, Bob owns the USB stick, but Alice owns the digital file. As a result, Alice's property rights curtail Bob's freedom to do what he wants with his property at the physical layer….
>
> Similarly, property rights at the content layer, such as IP rights, would curtail what owners of digital files can do with their property at the logical layer.

The implications of the MM model are serious. Suppose Bob wishes to sell his storage device and wishes to reformat the same before the sale to ensure that sensitive information recorded on it is completely wiped and inaccessible by the buyer. He would be unable to do so for as long as Alice's file is on the device. Michels and Millard's responses to this problem are unsatisfactory. First, they "expect such cases to be comparatively rare in practice."[196] It is odd that their defence is that such a scenario would be "comparatively rare" when one of their arguments in favour of the necessity of property rights in digital files is that contractual or personal solutions could not operate when digital files come to be on third party media without any relationship between the "owner" of the file and the owner of the media. They then suggest that "it might be more appropriate to address this issue through legislation, than through the courts."[197] But this simply relies on the idea of Parliamentary sovereignty without

[192] Michels and Millard, "New Things", 350.
[193] Michels and Millard, "New Things", 355.
[194] Michels and Millard, "New Things", 350.
[195] Michels and Millard, "New Things", 350.
[196] Michels and Millard, "New Things", 350.
[197] Michels and Millard, "New Things", 350.

offering a principled reason why we should curtail the existing liberties of owners of chattels to destroy or otherwise deal with their chattels, for good, bad, or even no reasons.

Grimmelmann and Mulligan fail altogether even to consider the implications of their model on the existing property rights of chattel owners who find their chattels the medium of someone else's data property. This will often have been with their consent – as would be the case with cloud service providers – but as Michels and Millard's example of Alice and Bob demonstrates, this need not be the case. Even where consensual, such "storage" arrangements can either involve a direct contract between Grimmelann and Mulligan's file owner and the owner of the medium, in which case an adequate solution exists in contract, or it may not, in which case the contractual relations (if any) between the file "owner" and the owner of the medium may be intermediated. But if so, why should the law propertise data so as to extricate the file owner's entirely voluntary arrangement of his own affairs, especially if doing so necessarily impinges on the existing property rights of the owner of the medium? Grimmelmann and Mulligan's proposal also suffers from another complexity. Unlike Michels and Millard, who conceive of any nonconsensual interference with an owner's data file is prima facie a conversion of the same, Grimmelmann and Mulligan would only regard as conversion "the *wrongful deprivation of a person's control over all their instances of the data*."[198] This would mean that if Alice had stored her file with two different cloud providers, both of whom were hacked by different hackers, say Carol and Dan, only the later of the two hackers would be liable in conversion. The earlier hacker would only be liable for trespass according to Grimmelmann and Mulligan, for "*impair[ing] a person's ability to use an instance of data*."[199] Their conceptualisation of data trespass reveals the flaw at the heart of their proposal: their confusion of exclusion and use. In another part in their article, they posit:[200]

> The only way to keep exclusionary control over information as such is to never reveal it to anyone else; three may keep a secret if two are dead. But if we focus on what it means to be able to *use* data, there is another possibility.

[198] Grimmelmann and Mulligan, "Data Property", 854.
[199] Grimmelmann and Mulligan, "Data Property", 855.
[200] Grimmelmann and Mulligan, "Data Property", 851.

Yet this is not how ownership works. As Penner explained, "property rights are not use-rights."[201] Elaborating: [202]

> The right to exclusive possession protects an owner's more or less unregulated liberty to do what they want with their tangible property. But the liberty is essentially negative, in the sense that no one has to assist the owner in pursuing their plans or engaging in various uses. Owning a piano does not entitle you to piano lessons.

The necessity for Grimmelmann and Mulligan to invent data trespass (notably unconsidered by Michels and Millard) may also stem from a peculiar feature of the common law as it has developed across the Atlantic. According to Grimmelmann and Mulligan, the use of another's USB drive without the latter's consent to copy a file in the public domain "doesn't damage the drive or interfere with the owner's own use of it" so that "does not by itself create trespass-to-chattels liability." [203] This is not the experience of the English common law. A host of harmless examples of trespass abound in the English textbooks.[204]

Michels and Millard's problematic *sui generis* property-like regime also provides a good opportunity to consider Henry Smith's modular theory of property law to see if digital files may fare better on a less traditional theory of property. According to Smith, "[m]odular property manages the complexity of human interactions by using exclusionary strategies to treat these interactions as nearly decomposable and by delineating semitransparent boundaries around complementary clusters of attributes." [205] Consider the example of a car, which Smith uses:[206]

> [I]f a car is not mine, I do not need to know who owns it, whether it is subject to a security interest or lease, and so forth, in order to know not to take or damage it.

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[201] Penner, "Property Rights".
[202] Penner, "Property Rights".
[203] Grimmelmann and Mulligan, "Data Property", 875, citing *Restatement (Second) of Torts* §218(c).
[204] Bridge et al, *The Law of Personal Property*, [33-003]. See also M.A. Jones et al (eds), *Clerk & Lindsell on Torts*, 23rd ed. (London 2023), [16-133]: "Although no one ever doubted that a mere handling was enough for liability if physical damage was caused, it was long unclear whether the same applied in the absence of damage. The matter was settled, however, by Butterfield J in *Transco Plc v United Utilities Water Plc*. Workmen repairing water mains mistakenly turned off an underground gas stopcock in the belief that it controlled a nearby water-pipe; despite the lack of any damage to the stopcock, they were held liable in trespass to the owners of the stopcock for the latter's expenses in compensating their customers for the resulting gas outage."
[205] Henry E. Smith, "Property as the Law of Things" (2012) 125 Harv. L. Rev. 1691, 1725-1726.
[206] Smith, "Property as Things", 1703.

The modular theory works most evidently in relation to tangible property: it is notable that most of the examples Smith employs relate to tangible property. But even if one assumes that it can be easily extended to independent intangible property, digital files pose a particular problem because they are *always* embedded upon some physical medium that is already itself an object of ownership. The result is that its propertisation does not facilitate the objective of using property to manage complexity; rather, it *adds* complexity to a pre-existing object of property being the tangible physical medium. The owner of the medium may not know of the existence of the digital file altogether, or being aware of the file, may mistakenly believe that it was his file. Even worse, should he be aware that it is *not* his, he will now need to know who "owns" said file before he can deal with his own property, being the medium, as he wishes. Even if we ignore this clash of the property rights, the resort by Michels and Millard to a *sui generis* property-like regime harkens to the policy-driven realist stick by Hohfeldian stick delineation criticised by Smith in all but name.[207]

It is very difficult to avoid the conclusion that both theses entail working backwards from preconceived idealised outcomes to reverse engineer quasi-property rules rather than making a principled case for treating digital files as property. It is perhaps unsurprising therefore that the Law Commission, in its Consultation Paper on Digital Assets, was unconvinced by the Michels and Millard thesis and proposed not to recognise property rights in digital files per se.[208] Grimmelmann and Mulligan's paper was cited by the Law Commission in its Final Report but not considered in any detail as the Law Commission maintained its view that "the provisional conclusion in our consultation paper that digital files are not, in general, things to which personal property rights can relate remains correct."[209]

VI. CONCLUSION

In their paper, Michels and Millard acknowledge that their test functioned "as a necessary, but not sufficient condition for recognising a property right."[210] Yet, digital files, or as we prefer, data objects, fail to even convincingly meet the criteria they set themselves. It is difficult to resist the conclusion that

[207] Smith, "Property as Things", 1694-1697.
[208] Law Commission, *Digital Assets: Consultation paper*, [6.6]-[6.51].
[209] Law Commission, *Digital Assets: Final Report*, [4.87].
[210] Michels and Millard, "New Things", 342.

Michels and Millard, like Grimmelmann and Mulligan after them through their social recognition theory of data property, overemphasise that which computer users perceive over the reality of how computing actually works and underexplore the technical realities of computing. Modern GUIs and computing language present data objects as virtual objects that create an illusion to computer users that obscures the reality of how computing works. As Grimmelmann and Mulligan accept, this is done in order to make computing more accessible to lay users. But conceptualising digital files as virtual *objects* (as Michels and Millard do) or instantiations of information as data *property* (as Grimmelmann and Mulligan do) creates the impression that information can exist apart from medium as somehow more than mere information and can thus be treated as real objects in a fashion not dissimilar to things in possession. However, closer examination proves that they are really *virtual* objects whose virtuality presents a misleading illusion, much like *ignis fatuus*. These virtual objects make computing more accessible whilst simultaneously making understanding how computers actually work less so. At the heart of both theses lies both a failure to properly account for this latter technical reality and an unfortunately common misunderstanding of the nature of property in its many conceptions. Once both are clarified, the appeal of both models rapidly fade. Perhaps others may build a different case for data objects upon firmer technical foundations bearing in mind how computing actually works; for now, though, the case for digital files as new things and/or data property looks distinctly more like a mirage than an oasis.