chapter five
living the digital world

The telecommunications industry began as a digital-only world. The dots and dashes of the electronic telegraph that "made the world one", in Arthur C. Clarke's oft-cited phrase[1], were not only digital in nature; they were also generated by the "digits" of an army of telegraph operators around the world. Between the invention of the telephone, in 1876, and the development of the first digital switch, exactly 100 years later[2], the telecommunications industry took an analogue detour. But rapid innovation over the last few decades indicates that the digital world is firmly back on track.

5.1   Challenges to the digital world

5.1.1   Getting there

So what are the challenges to the digital world? The first, and most obvious challenge, is to complete the process of network digitisation.

- The process of digitisation in the fixed-line telecommunications industry, which began in 1976, is now more or less complete, at least in the inter-urban and international network, as the last analogue exchanges are phased out.[3]

- In the mobile communications industry, digital systems have slowly taken over, starting with the first GSM network in Finland in 1991 (figure 5.1). Many analogue networks have now been closed down altogether.

- The internet has always been, in essence, a digital network but the use of dial-up modems in the access network is still based on analogue technology. internet subscribers are slowly migrating from narrowband to broadband (figure 5.2) on both fixed and mobile networks.

Even the broadcasting industry is slowly shifting towards digital technologies, in both transmission and reception, as broadcasters prepare for the digital switchover, planned for completion by 2015 in many parts of the world.[4] Although the transition from the analogue to the digital world is far from complete, the direction of change is clear and irreversible.

The transition to entirely digital networks is also associated with the transition to fully IP-based networks, in which Internet Protocol (IP) forms the *lingua franca* for all data exchange. To use a linguistic comparison, digitisation means that the whole world is using the same script (ones and zeros) and migration to IP means that the whole world is speaking the same language. The analogue "Tower of Babel"[5] is slowly being dismantled.

The fact that different types of devices (e.g. computers, mobile handsets, MP3 players etc) are able to "speak" to each other in the same language should make interchange of data much easier. It also makes it possible to use single devices for multiple services. Thus, the desktop computer can become the hub of a home-entertainment centre, the mobile handset can be used as a video, and an audio playback device or television set provides a link to the global internet.

Figure 5.1: Digital replacing analogue
Analogue and digital cellular mobile phones, 1990-2000, worldwide

Mobile cellular subscribers worldwide, in %

Mobile cellular subscribers worldwide, in millions
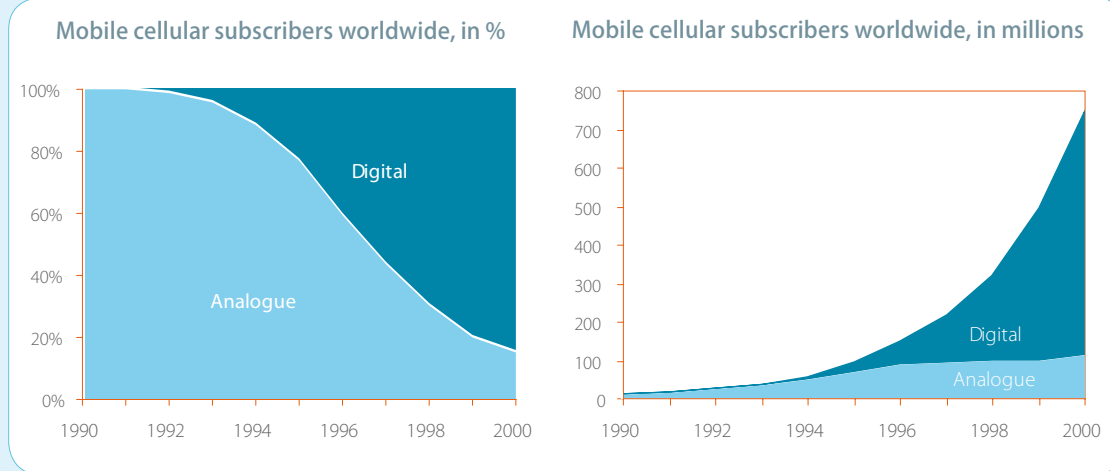
Source: ITU Information Society Statistics Database

5.1.2 Ease of use

As devices become more complex and offer an ever-widening array of functions, there is a risk of a corresponding loss in terms of "ease of use". Certain important parts of the user base are particularly sensitive to ease of use, especially older users or users with only limited digital literacy. Often, single purpose devices outperform multi-purpose devices in the marketplace and many of the more advanced functions available on a particular device go unused by the majority of users. Thus, a continuing challenge for operators and service providers will be to ensure that, while seeking to exploit the apparently limitless opportunities of the digital world, they do not lose sight of the need to keep things simple.

There is a learning process involved in any new technology. The pioneering users of broadband, for instance, often struggled to get their "plug'n play" systems to work, and even today, setting up a domestic wireless network is far from straightforward. Ease of use may also be compromised, for instance, in trying to make systems more secure and free from spam, spyware and viruses. And if the digital world is to grow beyond the educated digerati, it will be necessary to focus attention on ensuring that a maximum number of people can use technology with a minimum amount of training.

5.1.3 Regulatory consistency

A third challenge to the digital world, at least for policy-makers and regulators, lies in ensuring regulatory consistency. Fast-paced technological change means that regulatory policy must adapt rapidly, but regulators must also remain conscious of the original rationale for regulation. For example:

- Traditional definitions applied to tele-communications, computing and broadcasting were often service-specific (e.g. telephone calls were delivered over the public switched telephone network) or device-specific (e.g. television broadcasts were received on TV sets). These strict definitions no longer hold true. For instance, telephone calls can also be delivered over the internet or over a cable TV network, while television can also be received on a mobile phone or a computer. Thus, there is a need to aim for technological neutrality when making definitions or issuing licences, to the extent possible.

- When applying competition policy to the ICT sector, it is first necessary to define the addressable market, and to understand the level of substitutability between services and network. This is becoming harder to do due to convergence and increased complexity. For instance, a few years ago, it may have

been sufficient to define the cellular mobile market as a single market for the purposes of measuring significant market power (SMP). Now, however, in measuring SMP, it is often important to differentiate, for instance, between call origination and call termination markets, and also to take into account the level of substitutability between cellular mobile and other advanced wireless services, such as WLAN or WiMAX.

- Timing is a critical regulatory issue, particularly in deciding when an infant industry is becoming a mature one, or when a former monopoly market has become a competitive one. These decisions relate to when regulation should be imposed and when forbearance should be exercised.

- Licensing is also a complex issue. The example of the wireless communication market, which has shifted from scarcity-driven policies (e.g. auctioning licences) to abundance-driven policies (e.g. license-exempt spectrum), illustrates this point quite nicely: many countries have been left in a

situation in which companies operating in license-exempt spectrum (e.g. WiMAX) are now offering services which are almost fully substitutable for those that are offered by companies operating in parts of the spectrum for which huge prices have been paid at auction, and for which licences stretch many years into the future.

5.1.4   The security and privacy balance

A fourth challenge for living the digital world is how to strike the right balance between security and privacy. In reality, the optimal balance is likely to vary between different countries and between individuals. In an ideal world, the two concepts ought not to be in opposition in that good security reinforces privacy and *vice versa*. But, in practice, what might be beneficial for national or corporate security is not necessarily so for privacy and data protection.

Figure 5.2: Broadband replacing narrowband
Internet subscribers, by type of connection, 1995-2005

Internet subscribers worldwide, in %

Internet subscribers worldwide, in millions
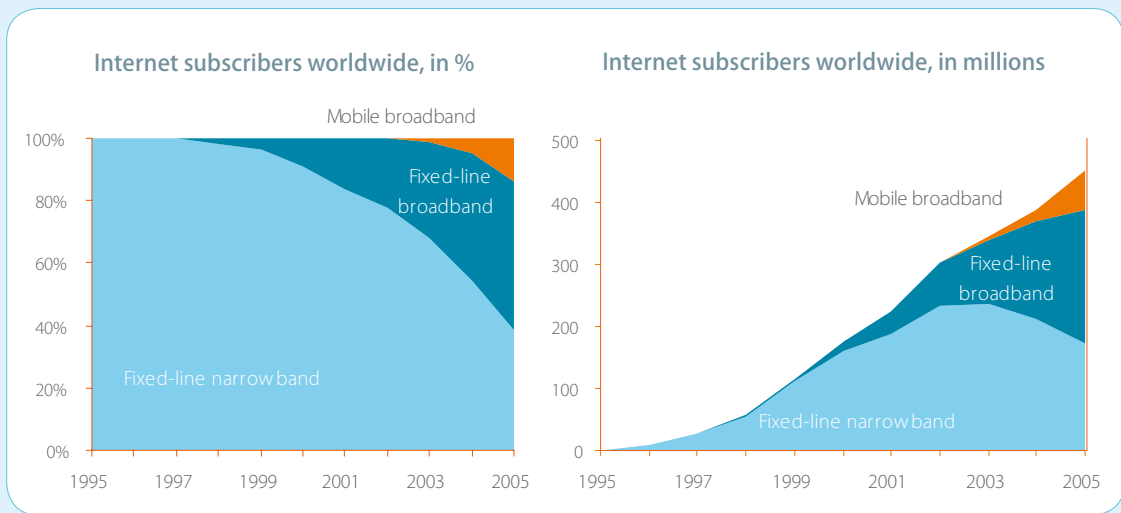
Note: The figures for "fixed-line narrowband" also include some business users on leased lines, but this is only a fractional proportion of the total. The vast majority of subscriptions in this category are dial-up internet users. "Narrowband mobile" internet subscribers are not shown because data on subscriber numbers is not widely available (few mobile service provider require users to take out a separate subscription to access the internet).

Source: ITU Information Society Statistics Database

The world changed on 11 September 2001, after the bombing of the World Trade Centre in New York. Governments around the world became much more concerned with their ability to monitor the electronic lives of their citizens, residents and visitors. The amount of personal information generated in electronic form (phone calls, phone records, e-mails, SMS and so on) has grown exponentially, and this is making effective surveillance harder. Nevertheless, using modern data mining tools, it is possible to combine information from many different sources to build up a detailed picture of the movements and habits of an individual person.

This practice of "profiling" can be used to identify potential terrorists. But it can also be used, as a powerful commercial tool, for developing targeted marketing. It is possible, for instance, to combine location-based information (e.g. from mobile phone use) with information about the use of credit cards for purchases, to gain an idea of when and where to send targeted messages to a potential customer. Any time we use an electronic device, or give out our phone number or e-mail address to a friend, we are surrendering a little bit of our own privacy. If we have confidence in the way that information is captured, stored and used, and by whom, then giving up security in return for added protection, or for more relevant advertising, is a trade-off we are willing to make. But once our trust in electronic networks is impaired, then all aspects of our lives are at risk. In particular, as shown in chapter four, our digital identity may be more vulnerable than we think.

5.1.5   Content without frontiers

A fifth challenge is to determine, at a global level, what kind of "frontiers" we may wish to maintain in the digital world that would mirror, or reinforce, those of the physical world. Each society has its own "red line" over what is considered acceptable behaviour and what is not. Some of those red lines are absolute, in all societies, like the abhorrence of child pornography, genocide or murder. But many of those red lines are relative or country-specific: for instance, over questions like whether it is acceptable to gamble online, to criticise a member of a royal family or ruling elite, what differentiates

a terrorist from a freedom-fighter, when "free speech" becomes "hate speech" and so on.

Convergence, in the digital world, is bringing together two quite different regulatory cultures on a collision course: on the one hand, the "content-regulated" culture of the broadcasting sector, and on the other hand the "carrier regulated" culture of telecommunications. When we add to this the "regulation is treated as interference" culture of the internet, it is a potentially explosive mix.

In the early days of the internet, it was trendy to say that cyberspace was a world without borders and that notions of national sovereignty were outdated and did not apply to the internet. In practice, frontiers are deeply embedded in our *zeitgeist*. Far from disappearing, borders in cyberworld have tended to become reinforced over time. In the early days, for instance, the geographical domain name of an e-mail address or a website was the only guide available for understanding the location of a user, and in the case of generic top-level domains (like *.com* or *.edu*) this was not a reliable guide. Now, more sophisticated techniques, based for instance on the geographic allocation of IP addresses or the location of e-commerce services, can be used to locate a user.

The ability to localise a user has encouraged rather than deterred the use of the internet as a medium for commerce. For the broadcasting and entertainment industry, in particular, with its complex system of national and regional rights and release dates, the ability to offer services (like music or video on demand) to certain parts of the world while excluding others, and to offer differential pricing, has encouraged rights holders to put their material online for the first time.[6] However, there are already many semi-legal websites that stream live television channels from around the world onto the internet as well as many less-legal sites that offer copyrighted material for download on demand. Equally, it is now possible to "place-shift" as well as time-shift television viewing–for instance by taking a video stream received at home and viewing it elsewhere in the world via the internet.[7] Nevertheless, the concept of "television without frontiers"[8] remains an elusive one at the global level, and there are many that are content for it to remain that way.

5.1.3 Create, access, utilise and share

A final challenge for living the digital world is to extend the benefits that it might bring to all the world's inhabitants. In the words of the *Geneva Declaration of Principles* of the World Summit on the Information Society (WSIS), the aim is to build an Information Society where "everyone can create, access, utilise and share information and knowledge".[9] WSIS has raised the bar of public expectations by arguing that not only should everyone have the ability to access and utilise information and knowledge, but also to create and share it. This marks a shift from an essentially one-way information society—which used the medium of television and radio as a form of mass communication—to an interactive information society, in which consumers become content creators in their own right.

Even in developed countries, we are still a long way from achieving this goal of full interactivity. Access networks, such as those based around DSL technologies, are typically asymmetric with a greater capacity to download than to upload. But as we shift from DSL towards fibre to the home, we are returning to the symmetric network structure that characterised the first telegraph and telephone networks. In developing countries, network asymmetry is less of an issue because there are still large territories and populations that have only limited service and in which any capability greater than the 19.2 kbit/s available on a 2G mobile connection would be a distant dream. The telegraph may have "made the world one" from the perspective of spreading information to all regions of the world, simultaneously; but the internet and other more modern ICTs are not yet sufficiently widespread to "make the world one", in that not everyone is able to create, access, utilise and share information.

5.2 A day in the digital world

The duration of a typical day in most cultures has remained unchanged since about 2000 BC, when the Sumerians put in place the sexagesimal (base sixty) system we use today, making each day twenty-four hours in length.[10] For the average Sumerian, a typical day might have involved building and maintaining basic shelter, hunting for food and making basic tools. A twenty-four hour period for today's human may not be that different: home improvement and gardening, cooking or finding a restaurant, downloading software tools. But, the advent of digital technologies has greatly changed the way in which we communicate and carry out mundane tasks. Digitization has certainly helped us in accomplishing tasks quickly and more efficiently, but the digital phenomenon goes much further than that.

Digital technology is fast becoming indispensable. In the future, it may be entirely integrated into daily life, to the point that it may no longer seem appropriate to refer to 'digital technology' as a detached and discrete entity. As such, it might "disappear" into the very fabric of life, much like electricity, which is simply taken for granted. In the future, sensors embedded in clothing or under skin, for instance, might be able to communicate important medical information to healthcare professionals. In the home, devices could take on multiple roles, allowing users to move seamlessly from one environment to another (e.g. from home to work) while staying connected to the same network. With all these possibilities, digital technology goes a long way in addressing humankind's long-standing struggle against space and time.

In order to gain a glimpse of what a truly digital life might be like, and for a bit of fun, boxes 5.1 and 5.2 explore what a typical 'digital day' might mean, at home and at play, at some unspecified time in the future.

5.3 Digital dreams

This report has looked at how the physical world of atoms is increasingly overlapping and colliding with the cyberworld of bits and bytes. It has looked at how human lives are being changed, and new habits are being formed, through advances in digital technologies.

Box 5.1: Digital days, digital daze
24 digital hours@home

Sensing the increasing intensity of the sunlight, Kim's curtains open, and the bedroom radio switches itself on. He awakes and taps the screen next to his bed, activating his house assistant—K-152, a humanoid robot. In his morning daze, Kim selects his breakfast from the images on the screen, and goes for a shower. In the kitchen, K-152 opens the refrigerator and puts the breakfast packet into the microwave oven. The RFID tag on the wrapping tells the oven how long to heat the contents. K-152 has been "learning" to make the coffee that Kim prefers. After a series of failed attempts, it is gradually mastering it. It is also learning to "cook" by downloading recipes online, which contain instructions for robots to make hot meals, based on the ingredients available in the refrigerator.

While showering, Kim watches the news projected onto the shower wall. While brushing his teeth, Kim stands on the scale and places his ring finger in a health check-up device. From the initial scan, Kim feels fit and healthy, but the scale disagrees and his weight is displayed in accusing red numbers on the mirror: 5kg overweight. He jumps off the scale quickly, but at the back of his mind he is aware that he has pre-programmed the scale to inform the refrigerator. It's a decision that he took jointly with his girlfriend who is also on a diet. As a result, chocolate bars and candy will not be replenished until Kim's weight reduces. He will have to find a grocery store in the street, and that's becoming increasingly difficult as most people do their grocery shopping online.

Kim enters the kitchen and his breakfast is already on the table, steaming hot. K-152 greets him in Mandarin, as programmed. By downloading interactive audio files from the internet, K-152 can practice conversations in several languages with Kim every morning. After some basic phrases, Kim sips the coffee and almost spits it out. There is no sugar in it. Apparently, K-152 has also been informed about the extra 5kg. While Kim tries to enjoy the rest of his breakfast, his dog Fabo runs into the kitchen. It wags its tail and begs for food but Kim ignores it, knowing that the dog food dispenser can take care of that. Nevertheless, Fabo is very entertaining and Kim quickly shoots a video clip of him, to upload later to *Vids4me*. His videos are already attracting a large number of downloads.

At 9:00am, Kim heads to his study to start work, but first he uses his mobile device to check on Maiko and Ade, his virtual world friends, who are spending all their money at the virtual mall. Suddenly, Kim receives an alarm call from the house monitoring system. With two clicks on his keypad, the site of the alarm call is revealed: downstairs, Fabo has spilt his breakfast. K-152 does not have the functionality to sweep up small objects like dog food, so Kim sends the vacuum cleaner to clean up the mess, and orders the food dispenser to give another portion to Fabo.

Over his lunch of celery sticks and low-fat tofu, Kim signs in to *YourPlace* on the web in order to update his personal profile and to upload some short video clips for his close friends to view. He is something of an amateur film-maker and often modifies clips of existing films to make them funny or thought-provoking. Kim often submits them to the video website *Vids4me*, and the videos have received consistently high ratings from viewers. If only he could convert his film-making hobby into a new career ⋯

In the early days of the internet, it was possible to order goods and services (e.g. books, flight tickets) for delivery off-line. Later it became possible to order those same goods and services for delivery online (e.g. downloading the full text of a book or purchasing an e-ticket for a flight). Now, it is possible even to consume those goods and services online. An online persona might buy a short- e-book to put on a digital bookshelf in their digital home to share

with guests, or use an e-ticket to gain access to a subscription-controlled part of the digital world. These digital goods can even be paid for by "work" done in the digital world, for instance, by viewing advertising, or trading other digital goods. For the moment, the real economic value of the market for digital goods is quite tiny, but it is growing faster than any real world economy. These three stages of transition of the e-commerce market—from

Box 5.2: Digital days, digital daze
24 digital hours@play

Sam Yi usually works until 5pm, when she begins to receive picture messages from her friends, discussing where to eat and socialise in the evening. Sam Yi and their friends always opt for the restaurant that offers the most attractive special offers and menu for that day as well (discount vouchers can be downloaded to their mobile devices). Kim, her best friend, always has good ideas and the two of them usually go to the restaurant of his choice. Sam Yi leaves her apartment and heads for the subway. By changing her status from "At Home" to "Away" on her mobile device, the central server in Sam Yi's house turns off the lights and locks the windows and doors. It also begins monitoring the house so it can send reports to Sam mobile device if anything should happen during her absence.

Entering the subway network, Sam Yi points her RFID-enabled mobile phone "wallet" to the gate, which automatically opens and debits her account. Using the train's Wi-Fi internet access, she visits her regular MyWorld haunt—her Myroom inside her own Myhome. Sam Yi enjoys the anonymity of the cyberspace environment, and has used this opportunity to create a unique persona that is more outgoing and daring than she is in real life, and which offers more excitement. Her new persona, a young actor, has made lots of virtual friends, and Sam Yi's close MyWorld friends or 'buddies' often drop by her virtual home at this time of the afternoon. Sam Yi has a special relationship with these buddies and receives alerts when they update their 'Myhompies' – a combination of a photo gallery, message board, guest book, and personal bulletin board.

Sam Yi is not especially proficient as a computer user but this does not stop her from being able to buy items for her virtual space. Sam Yi uses "walnuts"—a digital currency—to spend on paintings to furnish her digital home, and music tracks to entertain her guests. Her virtual persona has a rather limited wardrobe, and Sam Yi resolves to spend some Walnuts on clothes for him for the new season. Getting off the train, Sam Yi walks past City Hall where she witnesses a large protest against the new higher fare structure for road pricing that has recently been introduced—some tolls have more than doubled in price overnight, causing a lot of resentment. She records the moment using her mobile phone's camera, and uses the phone's browser to upload the video to XYZ.video, a 'citizen journalism' news website.

She sees a teenage boy leaning against a wall, listening to internet radio and chatting on a mobile instant messenger program. People have gradually begun to talk less in public, switching instead to other modes of communication such as multimedia messages. Before getting to the restaurant, Sam Yi places a bet on the *Mobilottery*, a state-run online gambling website. Sam Yi is not expecting much, but she certainly hopes to get rich one day, and in the meantime the "walnuts" she receives as an incentive to play the lottery help her to finance the lavish lifestyle of her digital persona.

Source: ITU

Image source: sxc.hu (mai05)

off-line delivery, to online delivery to purely digital goods—have taken shape in less than a decade. They are mirrored by an equally rapid evolution in other online activities—such as voice over IP, video on demand, music downloads, social networking and so on. These changes are being driven, on the one hand, by the increased availability of bandwidth and mobility and, on the other hand, by changing user habits and preferences.

Ultimately, the digital world is a user-driven one in which consumers who are not happy with a particular service provider or website can easily switch to another. It is a footloose world, with a very low cost of switching for users and a relatively low cost of entry for service providers. It is a world in which traditional barriers to communication, like geography and social class, disintegrate. What is more, users can now actively participate in creating their own services and content. In the physical world, the height of most people's ambition is to find proper employment, develop a hobby, purchase a home of one's own, decorate it to reflect a chosen lifestyle, and fill it with their friends and family. We can now do all this in the digital world, too. So, perhaps, digital dreams are not so different, after all.

Endnotes for Chapter five

1　See Clarke, Arthur C. (1992) "How the world was one: Beyond the global village", Bantam Books, NY.

2　Although there are always arguments about who comes first, AT&T's 4ESS exchange, first installed in Chicago in 1976, is generally accepted as the world's first digital switch. See the "History of network switching" (at www.att.com/history/nethistory/switching.html).

3　Although the inter-urban exchange network is now more or less fully-digital around the world, the access network remains largely analogue. For instance, most telephone handsets are analogue, as are most of the world's fax terminals and dial-up modems. But handsets are slowly being replaced by digital models and fax terminals and modems are in abeyance, as e-mail and broadband take their place, respectively.

4　The ITU Regional Radio Conference for Region 1 (Europe and Africa) plus Iran concluded in June 2006 with agreement on a harmonized series of dates for the switchover to digital broadcasting, rather than analogue. See "Digital broadcasting set to transform the world's communication landscape by 2015", ITU press release (available at www.itu.int/newsroom/press_releases/2006/11.html).

5　In the biblical book of *Genesis*, chapter 11, the story of the Tower of Babel is used to illustrate the creation of many different races and languages scattered across the world.

6　As an example, in September 2006, UEFA has launched a view-on-demand service offering a number of different packages of material from European Champion's League football matches, including packaged highlights and pay-per-view live matches (see www.uefa.com). This has been done in conjunction with the broadcast rights holders in each separate member country.

7　Place-shifting is available, for instance, by using a Slingbox (see www.slingmedia.com). Another example is the "Venice Project", planned by the co-founders of *Kazaa* and *Skype* (Niklas Zennstrom and Janus Friis), which is expected to apply peer-to-peer filesharing technology to video content (see http://featured.gigaom.com/2006/10/05/five-questions-with-skype-co-founder-janus-friis/).

8　"Television without frontiers" is the title of an EU Directive adopted in 1989. It has now been updated in the proposed new EU Audiovisual Media Services Directive.

9　See WSIS Outcome Documents (at www.itu.int/wsis/documents/doc_multi.asp?lang=en&id=2316|0). This particular phrase appears in para 1 of the *Geneva Declaration of Principles,* adopted on 12 December 2003.

10　The Sexagesimal System based on the number 60: 60 seconds in a minute, 60 minutes in an hour, 24 hours in a day—all divisible by six (see http://en.wikipedia.org/wiki/Time).