# 11扩展比特币

**Scaling Bitcoin**

Bitcoin Meetup at Paralelni Polis; Prague, Czech; March 2016

Video Link: <https://www.youtube.com/watch?v=bFOFqNKKns0>

## 11.1扩展的故事

**Stories of Scaling**

Today, I’m going to talk about scaling. A lot of you probably have noticed that there is a very interesting debate in bitcoin today about how to scale bitcoin. That’s the topic I want to address, not from a technical perspective but from a broader perspective, to try to understand what it means to scale.

今天，我要讨论扩展问题。

很多人可能已经注意到，今天关于比特币有一个非常有趣的争论：如何扩展比特币。

这是我想讨论的话题，不是从技术角度，而是从更广阔的角度，试图理解扩展是什么意思。

### 11.1.1 Usenet将摧毁互联网

**Usenet Will Destroy the Internet**

Gather around and we will talk about a long time ago. It was 1989 and the internet was dial-up. Not just the connection of users to the internet; in most cases, the backbones to the internet were dial-up. Between universities, between research stations, there were a few permanent high-speed connections — 256 kilobits, 512 kilobits. But the internet was mostly dial-up. Email had not yet really started to take hold, but there was a special place on the internet called Usenet. Usenet was a system of discussion groups where you could post a message in text and other people would see it and then they would respond.

围过来，我们来谈论很久以前。1989年，互联网还是拨号上网。

不仅仅是用户与互联网的连接，在多数情况下，骨干网到互联网也是拨号上网。

在大学之间，在研究站之间，有一些永久的高速连接，256千比特，512千比特。

但互联网主要是拨号上网。email还没有开始流行，但在互联网上有一个特殊的地方，Usenet（新闻组）。

Usenet是一个讨论小组的系统，你可以用文本发布信息，其他人会看到它，然后他们会做出回应。

This was not instant messaging. This was slow messaging because, in order for Usenet to work, all of the messages had to be transmitted via dial-up systems and propagated from node to node in a system called store and forward. You would post a message and it would take between 24 and 48 hours to reach everyone. Then, they could respond and it would take 24 to 48 hours for you to see their response. Today, we would compare that to trying to communicate with Matt Damon on Mars, like in The Martian movie.

这不是即时通讯。这是慢消息，因为，为了使Usenet工作，所有的消息都必须通过拨号系统传输，并在一个称为“存储转发”的系统中从节点传播到节点。

你发布一个信息，它需要24到48个小时才能到达每个人。

然后，他们可以做出反应，你需要24到48个小时才能看到他们的反应。

今天，我们将它比作与火星上的人交流，就像在火星电影中那样。

At that moment, there was a big conversation among the engineers of the internet because Usenet was getting very popular and it was getting very big. Kilobytes and then megabytes of text information needed to be transmitted. At first, it would take about 30 minutes on a dial-up connection to get all of the Usenet messages for a day. Then, as the system became more popular, more messages meant more data and more time. Soon, it was taking one hour, two hours, and three hours. And the experts predicted the end. They said, if you draw a point at where we are today and another at where we were six months ago, and connect them in a line, very soon it will take 26 hours to transmit one day’s messages and then we have a problem because we only have 24.

那时，互联网工程师之间发生了一场很大的讨论，因为Usenet越来越受欢迎，开始变得越来越大。

需要传输的文本信息开始是千字节，后来到了兆字节。

起先，在拨号连接上需要大约30分钟才能获得一天的所有Usenet消息。

然后，随着这个系统越来越流行，更多的消息意味着更多的数据和更多的时间。很快，就要花一个小时，两个小时，三个小时。

专家预测：完蛋了。他们说，如果你画一个点是我们今天所在地方，另一个点是我们六个月前所在地方，把它们连接起来，很快就需要26小时来传输一天的信息，那么我们就有了一个问题，因为我们只有24小时。

So, what happens then? The internet will collapse! Clearly, it can’t scale. It won’t possibly scale.

那么，接下来会发生什么呢？互联网将会崩溃！

显然，它无法提供规模。它不可能提供规模。

### 11.1.2 Alt组将摧毁互联网

**Alt Groups Will Destroy the Internet**

At the time, there were two parts to Usenet. There was the regular part of Usenet, which contained very carefully structured groups for academic discussions, and then there was another little part of Usenet called the alt, the alternative groups. The alt was optional. As a Usenet provider, you could carry alt if you wanted to but you didn’t have to. The really interesting providers offered the alt groups. Of course, all of the interesting stuff was in the alt groups: some of the early amazing groups, alt.folklore.computers, alt.security, and of course, like everything else that’s been driving scale on the internet, alt.sex.

当时，Usenet有两个部分。Usenet的普通部分，它包含了非常仔细的结构化的学术讨论组；另一小部分叫做alt，即备选组。alt是可选择的。作为一个Usenet提供商，如果你愿意，你可以支持alt，但也可以不支持。真正有趣的供应商支持了alt组。当然，所有有趣的东西都是在alt组：一些早期惊人的群体，alt.foklore.computers, alt.security，当然，就像所有在互联网上驱动规模的其它东西一样，也有alt.sex。

These alternative groups, being optional, were the focus of this great debate. Should we carry them? Because at this point we started seeing the world’s first spam. I remember receiving the first spam. It was a message by a couple of lawyers that was posted to every Usenet group. You did not do that. That was not cool. A thousand people told them it was not cool. That was the first internet backlash.

这些备选组是这场大辩论的焦点。我们应该提供它们吗？

因为在这时，我们开始看到世界上第一个垃圾邮件。我记得收到的第一个垃圾邮件。这是两个律师发布的一个消息，发布到了每个Usenet组。你没有那样做。那并不酷。一千个人告诉他们，这并不酷。这是第一次互联网抵制。

The discussion was, do we carry alt groups? Because if we carry alt groups, the internet will surely melt down and there is no way it could ever scale. If this becomes popular, people will discuss more, and if they discuss more, we won’t have enough capacity to deal with this data. This conversation lasted for more than two years. There were a few brave service providers that carried the alt groups, and they used massive hard drives—huge 5MB hard drives. Again, the main idea was, if you take the where-we-are-here and where-we’re-going-up-there, we hit a wall.

讨论的是，我们是否支持alt组？因为如果我们支持alt组，互联网肯定会毁掉，而且没有办法提供规模。如果这变得流行起来，人们会更多地讨论，如果他们讨论得更多，我们就没有足够的能力来处理这些数据。这次讨论持续了两年多。有一些勇敢的服务提供商支持了alt组，他们使用了巨大的硬盘驱动器，巨大的5MB硬盘。再一次，主要的想法是，如果你想的是“我们现在在这儿”和“我们要上到那儿”，那么我们就会撞到墙上。

So, the internet couldn’t scale. That was the basic beginning of the scaling issue on the internet. It couldn’t scale, wouldn’t scale, clearly. Many people wrote their Ph.D. theses on why it wouldn’t scale.

因此，互联网无法提供规模。这是互联网上扩展问题的开始。

它不能提供规模，不能清晰地提供规模。许多人写了他们的博士论文，关于为什么它不能扩展。

But of course, the thing is, networks don’t scale. Networks fail to scale. Some networks fail to scale gracefully for decades, and those are the ones that succeed.

但当然，问题是，网络没有提供规模。网络没能提供规模。

有些网络几十年来没能优雅地扩展规模，而那些是成功的网络。

Eventually, we solved the Usenet problem. Digital connections were upgraded, more systems connected with leased lines and direct connections. Dial-up was gradually replaced by leased lines. People started investing in the infrastructure and we could comfortably carry Usenet. Then, people started using email. And the scaling problem returned.

最后，我们解决了USsenet问题。数字连接被升级，更多系统使用租用线路和直接连接进行连接。

拨号上网逐渐被租用线路取代。人们开始投资基础设施，我们可以舒适地使用Usenet。

然后，人们开始使用电子邮件。扩展问题回来了。

### 11.1.3电子邮件和附件将摧毁互联网

**Email and Email Attachments Will Destroy the Internet**

As email became popular, it started replacing and eclipsing the size of Usenet. Now, we had an even bigger problem because people wanted to communicate directly. Now, a message didn’t take 24 hours, it took two hours to cross the internet, which meant that people started having real-time conversations—well, near real-time. Email use exploded. And again, the internet couldn’t scale because if you look at where email is today and where it was six months ago and draw a line, we cannot scale. The internet will melt down. People wrote more Ph.D. theses about how the internet would die under the load of email and never scale.

随着电子邮件的普及，它开始取代和超越Usenet的大小。

现在，我们遇到了一个更大的问题，因为人们想要直接交流。

现在，一个消息不需要24个小时，只需要两个小时就能穿越互联网，这意味着人们开始实时对话，近乎实时。电子邮件使用爆发。再一次，互联网无法提供规模，因为如果你看看“今天的电子邮件所在地方”和“六个月前所在的地方”，画一条线，我们无法提供规模。互联网将会崩溃。人们写了更多的博士论文，关于互联网如何在电子邮件的重压下死亡，无法扩展。

Gradually, we started optimizing. We solved the email problem. And when I say "we,” I was just watching because I was a 16-year-old who didn’t know what the hell was going on. But we as people, as humanity, we solved the problem. We scaled it. The internet failed to scale for Usenet and it succeeded to scale for Usenet so that it could fail to scale for email. Then, it succeeded in scaling for email, so some smartass went and invented MIME, multimedia internet messages, which meant that you could attach things to email. These attachments were 10 times the size of the text because people started sending bigger things, like drawings and pictures and of course, once again, sex.

渐渐地，我们开始优化。我们解决了电子邮件问题。当我说“我们”，我只是观察，因为我是一个16岁的孩子，不知道到底发生了什么。

但是我们作为人类，解决了这个问题。我们把它的规模做大了。互联网未能为Usenet提供规模，它成功地扩展了Usenet，所以，它也未能为电子邮件提供规模。然后，它成功地扩展了电子邮件，所以，一些聪明的人发明了MIME，多媒体互联网消息，这意味着你可以把东西附加到电子邮件上。这些附件是文本大小的10倍，因为人们开始发送更大的东西，比如图片，当然，还有性。

So, we could scale for email but not for email attachments. Everybody was up in an uproar: "We’re never going to be able to scale for email attachments. The internet will surely melt down!” Then we solved it. Until some British guy, Sir Tim Berners Lee (who then was just Tim) invented the web. Now, you could put the pictures into frames.

因此，我们可以为电子邮件提供规模，但没能为电子邮件附件提供规模。

每个人都在大吵大闹：“我们永远无法为电子邮件附件提供规模。互联网一定会崩溃！”

然后，我们解决了。直到一个英国人，Tim Berners Lee发明了web。

现在，你可以把图片放入框框里了。

### 11.1.4 Web将摧毁互联网

**The Web Will Destroy the Internet**

It was about 1992 when I downloaded and ran the first web browser, NCSA Mosaic, at my university lab. We gathered together three or four friends. We worked for hours to get NCSA Mosaic downloaded and compiled and installed. Then, we launched it and we visited the web. All of it. I can say a sentence not many people can say: In 1992, I visited the entire web in an afternoon. Both sites. Because there were two. I visited both sites, and I thought, Oh my God. This is going to be huge! The internet will never scale. And just imagine what you could do with sex on the web! Of course, this became the scaling application, as we all know. It has been driving internet development since the beginning, but we don’t talk about that in polite company.

1992年，我下载和运行了第一个web流浪器，NCSA Mosaic，在大学实验室。

我们聚集了三四个朋友。我们花了好几个小时来下载、编译、安装这个浏览器。

然后，我们启动它，我们访问了网络。所有这些。我可以说一句并不是很多的人可以说的话：1992年，我在一个下午访问了整个web。两个网站。因为只有两个。我访问了这两个网站，我想，天哪。这将是巨大的！互联网永远无法提供规模。只用想象一下你在网上用性可以做的事情吧！当然，正如我们所知，这变成了大规模的应用。它从一开始就推动了互联网的发展，但我们不会在上流公司谈论这个。

The internet was failing to scale for the web. People said, "We can never do all of these images and hypertext documents. It will totally fail to scale.” And more Ph.D. theses were written and more discussions were had. The internet was still failing to scale. But by now, it had been failing to scale for more than a decade, very gracefully, very successfully.

互联网没能为web提供规模。人们说：“我们永远不能做所有这些图像和超文本文件。永远无法提供这样规模。”还写了更多的博士论文，进行了更多的讨论。互联网仍然不能提供规模。但到目前为止，它已经有超过超过10年不能提供规模，非常优雅地，非常成功地。

### 11.1.5 VOIP将摧毁互联网

**VOIP Will Destroy the Internet**

Then, someone invented Voice Over IP. Some other people decided, why don’t we just replace the entire phone system with the internet? That was a crazy idea. The phone companies then started this massive campaign to inform us of why packet-switched networks could never carry voice. They said, really, the true quality approach to voice was always going to be hierarchical switch networks owned by national monopoly telecom companies because the internet couldn’t possibly scale to carry the world’s phone calls.

然后，有人发明了IP电话。有些人认为，为什么我们不用互联网替换整个电话系统呢？

这是个一个疯狂的想法。然后电话公司开始了这个大规模战役，告诉我们为什么分组交换网络永远不能承载语音。他们说，实际上，真正的语音质量方法总是在由国家垄断的电信公司所拥有的分级交换网络上，因为互联网不可能提供承载世界电话的规模。

Those same phone companies (the ones still in business) now route all of their phone calls over the internet. First, they didn’t want the internet on their phone networks. Then, they allowed the internet on their phone networks. Then, they built their phone networks on top of the internet.

那些相同的电话公司（现在还在营业）现在通过互联网路由他们所有的电话。

起先，他们不想让互联网在他们的电话网络上。

然后，他们允许互联网在他们的电话网络上。

最后，他们在互联网上建立了自己的电话网络。

### 11.1.6 猫视频将摧毁互联网

**Cat Videos Will Destroy the Internet**

Then, we started sending videos. And then the internet couldn’t scale again because YouTube was going to melt down the internet. Clearly, we needed some content quality and filtering because we can’t allow every idiot to go and publish a video about their cat. They said, "There are already a thousand cat videos. If you draw a line from how many cat videos there were yesterday to how many cat videos there are today and if you extrapolate, by the end of this decade, there will be a billion cat videos on the internet!” Which is exactly what happened.

然后，我们开始发送视频。然后互联网再次无法提供规模，因为YouTube将要摧毁互联网上。

显然，我们需要一些内容质量和过滤，因为我们不能允许每个白痴去发布一个关于他的猫的视频。

他们说：“已经有一千张猫视频了。如果你看看昨天有多少猫视频，今天有多少猫视频，你可以推断出，在这个十年结束的时候，将会有十亿个猫视频在互联网上出现。”说的完全的相同的话。

### 11.1.7网飞将摧毁互联网

**Netflix Will Destroy the Internet**

When Netflix came along, we saw the same mistake. In 1992, when I visited the first website, my thought was, Wow, TV is so dead because one day we will be able to transmit movies instantaneously. If you go and say that to a respectable network researcher in 1992, they call you an idiot. Because, clearly, if we had Netflix in 1992, a single video stream to a single user would melt down the entire internet. Yet, here we are today. By the way, the internet is failing to scale for Netflix and all of the other companies that are doing live video. It will continue to fail to scale incrementally and gracefully. Soon, we’ll be doing Oculus Rift holographic 3D, 4K, VR. Then, it will really fail to scale. People will still write Ph.D. theses on why the internet is about to melt down.

当网飞（Netflix）出现的时候，我们也看到了同样的错误。

1992年，当我访问第一个网站时，我的想法是，哇，电视要死了，因为有一天我们将能够瞬间传送电影。

如果你在1992年对一个网络研究员这么说，他会叫你白痴。

因为，很明显，如果网飞出现在1992年，到一个用户的一个视频流就能摧毁整个互联网。

然而，今天我们就在这里。顺便说一下，互联网无法为网飞和其它正在进行视频直播的公司提供规模。

它将不能继续递增和优雅地提供规模。很快，我们将做Oculus Rift holographic 3D, 4K, VR。

那时，它真的无法提供规模。人们仍然会写博士论文，关于互联网为什么要被摧毁。

But we scaled. Now, we do 3D video and 4K video.

但是我们扩展了缩放了。现在，我们做3D视频和4K视频。

## 11.2规模是一个运动的目标

**Scaling is a Moving Target**

Scaling is a moving target. Scale defines the edge of today’s capabilities. As it moves forward, capability increases. The reason for this is really simple: it’s because scale is not a goal to achieve; it is a definition of what you can do with the network today. The moment you increase the capacity, the very definition of what you can do with a network today changes because somebody says, “Hang on a second. You mean I can now do x, which has 10 times more demand than what I did before? Let’s do some of that." And then, you fail to scale again.

规模是一个运动的目标。规模定义了今天的能力边缘。当它向前移动时，能力在增强。

原因很简单：因为规模不是要实现的目标；它定义了你用今天的网络能做什么。

当你增加了能力时，你用今天的网络能做什么的定义是改变了，因为有人会说：“等一下，你的意思是我现在能做x了，它比我以前的做的东西多多10倍的需求？让我们来做一些吧。”然后，你再次没能提供规模。

Bitcoin is failing to scale. If we’re really lucky, bitcoin will continue to fail to scale gracefully for 25 years, just like the internet. The very same types of companies that then were saying the internet can never work for all of the email, it can never work to do quality voice calls, it can never work to do quality video, are now making the same kind of corporate arguments about why bitcoin can never do retail payments, it can never do Visa scale, it can never do global scale, and if it’s actually adopted, it will collapse. Right now, there are a dozen people writing their Ph.D. theses on how bitcoin will fail, has failed, is dying, was dead, and has died again.

比特币没能提供规模。如果我们真的幸运的话，比特币将继续有25年持续不能提供规模，就像互联网一样。

同一类型的公司然后说，互联网永远不能为所有的电子邮件工作，它永远不能做高质量的语音通话，它永远不能做高品质的视频，现在是相同的公司争论：为什么比特币永远不能做零售支付，它永远达不到Visa的规模，它永远不能做全球性的规模，如果它被采用了，它将会崩溃。现在，有一些人在写他们的博士论文，关于比特币将如何将要失败、已经失败、濒临死亡、死掉、再次死掉。

There is a beautiful site called bitcoinobituaries.com where you can read the pronouncements of the death of bitcoin since 2009 — regularly, like clockwork every three to six months, major newspapers, scientists, etc., saying, "That’s it. Bitcoin is dead." In fact, this has now become an amazing recruitment opportunity because all you have to do is wait for people to hear that bitcoin died, the CEO of Bitcoin was arrested, or bitcoin was shut down by Putin, and then, four months later, someone says, "You know there are some interesting new applications on bitcoin." And they go, “Bitcoin is still there?"

有一个漂亮的网站，名为bitcoinobituaries.com，在那里，你可以读到自2009年以来，比特币的死亡声明，定期的，就像时钟一样，每隔三到六个月条，主要的报纸、科学家等会说：“就是这样。比特币已经死了。”事实上，这已经成为一个惊人的招聘机会，因为你所要做的就是等待人们听到比特币死了，比特币的CEO被逮捕，或比特币被普京关闭，然后，四个月后，有人说：“比特币上有一些有趣的新应用。”他们就去了，“比特币还在啊？”

“Bitcoin is still there” is the marketing slogan of this community. If we can just keep doing “bitcoin is still there,” people are surprised, they’re confounded. It doesn’t match their expectations. It’s not possible that bitcoin is still there because very serious people with very serious titles, working for very rich companies, told them that bitcoin was not going to be there. But bitcoin is still there, because we are failing to scale gracefully.

“比特币还在啊”是这个社区的营销口号。

如果我们能继续做“比特币还在啊”，人们就会感到惊讶，他们感到困惑。这与他们的期望不符。

比特币不可能还在，因为非常严肃的人，有非常严肃的头衔，为非常富有的公司工作，告诉他们比特币不会有了，但我们无法优雅地提供规模。

### 11.2.1交易费优化和扩展

**Fee Optimization and Scaling**

When we fail to scale during a stress test or a capacity test, when the network is flooded with transactions, what happens? Some users experience a terrible situation. They do a transaction with a 0.1 millibit fee like they’ve always done, and it takes three days to confirm. During that time, they’re freaking out, especially if they’re new users. Because new users assume that the money has left their account (there are no accounts in bitcoin) and is en route to the destination account (again, there are no accounts in bitcoin), and therefore is somewhere in limbo in between. The money is really still in their account; it’s just that their wallet says it hasn’t been confirmed yet. It’s either at the source or at the destination, atomically with one transaction. There is no intermediate state. It can’t be in limbo because bitcoin doesn’t transmit, it settles.

当我们在压力测试或容量测试中没能提供规模时，当网络充斥着交易时，会发生什么？

一些用户经历了可怕的情况。他们用0.1 millibit交易费做了一个交易，就像他们一直做的那样，花了三天才得到确认。在这段时间里，他们很害怕，特别是如果他们是新用户。因为新用户认为钱已经离开他们的账户（在比特币中没有账户），并且在去目的账户的途中（同样，比特币中没有账户），因此在两者之间是一种不稳定的中间状态。钱还在他们的账户里，只是他们的钱包说还没有被确认。它在源或目的中，交易具有原子性（注：要么成功，要么不成功）。没有中间状态。它不可能处于不稳定的中间状态，因为比特币不是传输，而是结算。

We experience these sudden problems, and some wallets behave intelligently and they increase their fees, sometimes by 100 percent. What this means is instead of it costing 4 cents to send a global transaction in seconds anywhere around the world with full censorship resistance and open innovation and open access to everyone, it takes 8 cents to send that transaction! Clearly, this is an indication, together with the people who waited three days to confirm their transaction, that bitcoin is surely dead now. And some of the developers say, "Oh, I give up. Bitcoin is dead." The newspapers write, "Bitcoin is dead. Transactions are not going through."

我们遇到这些突然的问题，一些钱包有智能行为，它们增加了交易费，有时增加100%。

这意味着不是花费4美分在全球发送了一笔交易，需要花了8美分来发送该交易。

显然，这是一个迹象，连同那些等待三天确认交易的人，比特币现在肯定已经死了。

一些开发人员说：“哦，我放弃了。比特币已经死了。”

报纸写道：“比特币已经死了。交易没有通过。”

Transactions are going through. They went through for me. I was running a wallet that was intelligent; it was doing its transaction-fee calculations. What happens in the aftermath of this capacity crunch? We get better wallets.

交易正在进行中。它们会帮助我。

我在运行一个智能的钱包，它在做交易费计算。

在这次产能危机之后，会发生什么？我们会得到更好的钱包。

That’s really the essence of a dynamic system responding to pressure because, as we get better wallets, these better wallets calculate fees more correctly. And it’s a lot easier to jam the network if there are a lot of dumb wallets doing 0.1 millibit fees, but then, all you have to do is do 0.11 millibit fees and you are king of the hill. Because the other idiots didn’t update and jammed the network with their transactions. But if they’re able to do 0.12 millibits, now you’ll have to do 0.13. Now, we’re in a race, and before you know it, you’re spending 0.5 millibits, oh dear, on a transaction which of course, if you’re a legitimate user, is nothing. If you’re trying to jam the network, it starts getting really expensive, really fast.

这就是一个动态系统应对压力做出反应的本质，因为，当我们有了更好的钱包时，这些更好的钱包能更准确地计算交易费。如果有很多愚蠢的钱包做了0.1 millibit交易费，那么就很容易堵塞网络，但是，你要做的就是做0.11 millibit交易费，你是山丘之王。因为其它白痴没有更新，用他们的交易堵塞了网络。但是如果他们能做0.12 millibit，现在你必须做0.13 millibit。现在，我们在进行一场竞赛，在你知道它之前，你花了0.5 millibit，哦，亲爱的，在一个交易中，如果你是一个合法的用户，那就不值什么。但如果你想堵塞网络，它开始变得非常昂贵，非常快。

## 11.3垃圾交易、合法交易、非法交易

**Spam Transactions, Legitimate Transactions, Illegitimate Transactions**

Which brings up an interesting question: What is a spam transaction? What is a legitimate transaction? What is an illegitimate transaction? There are two ways to answer this. One is a paternalistic, top-down approach that says, this is what is allowed, this is what is not allowed, and by making a list, we will prevent the network from filling to capacity. But that breaks the fundamental capability of bitcoin, which is net neutrality. Bitcoin doesn’t care who the sender or the receiver is, what the application is, what the value of the transaction is. All it cares about is, did you pay the fee? If you paid the fee, your transaction is legitimate by definition because you thought it was legitimate enough to attach that fee. The very act of paying the fee legitimizes the transaction. If we start making decisions about what is spam and what is not, we are now choosing the future of bitcoin and constraining it into a set of applications that we can imagine. The brilliant person who creates the application we can’t imagine—that may look like spam to us—doesn’t get carried across the network because we made a top-down decision to say that transaction is illegitimate.

这引出了一个有趣的问题：什么是垃圾交易？什么是合法交易？什么是非法交易？

有两种方式来回答这个问题。

一种是家长式的自上而下的方法，他说这是允许的，这是不允许的，并且通过制定一个列表，我们将阻止网络被这些容量填充。

但这打破了比特币的基本能力，即网络中立性。比特币不关心发送者和接收者是谁、应用程序是什么、交易的价值。它关心的是，你付了交易费吗？如果你支付了交易费，你的交易就是合法的，因为你认为附加了那个交易费它就是足够合法了。支付交易费的行为使交易合法化。

如果我们开始决定什么是垃圾和什么不是，我们现在选择了比特币的未来，限制它为一组我们可以想象的应用程序。我们无法想象创造这个应用程序的聪明人，它可能看起来像是垃圾，它不被网络支持，因为我们作出了自上而下的决定，说那个交易是非法的。

The other way to do this is to say, how about we use a market to solve this problem. We have a market. We have a currency. Use the market to solve this problem: allow the market to establish the minimum fee that meets the requirements of supply through the miners and their need to propagate blocks fast, and the demand of the users for the applications they care about. If you pay the fee, your transaction is legitimate. There is no spam transaction. There is no such thing as an illegitimate transaction. There are only transactions that did get mined and transactions that didn’t have enough fee to get mined.

另一个方法是，我们如何利用市场来解决这个问题。

我们有一个市场。我们有一种货币。利用市场来解决这个问题：允许市场决定最低限度的交易费，它满足矿工的供应需求和快速传播区块的需求，以及用户对他们所关心的应用的需求。

如果你支付了交易费，你的交易是合法的。没有垃圾交易。没有非法交易这样的事情。只有被开采的交易，以及因为没有足够交易费而未被开采的交易。

## 11.4无法提供规模的几十年

**Decades of Failing to Scale**

This is how bitcoin is going to play out. This is not going to be solved; we will have the scaling discussion every year for decades into the future, hopefully. Every year, we will fail to scale for the next application and succeed to scale for the previous ones. As soon as we do better, people will invent new applications and we will fail to scale again.

这就是比特币的发展方式。这不会得到解决，我们希望每年都能讨论扩展，在未来持续几十年。

每年，我们都无法为下一个应用提供规模，并成功地为以前的应用提供规模。

只要我们做得更好，人们就会发明新的应用，我们将再次无法提供规模。

The internet: failing to scale gracefully for 25 years. Bitcoin: let’s keep failing to scale gracefully, and bitcoin is not yet dead.

互联网：25年来都未能优雅地提供规模。

比特币：让我们继续无法优雅地提供规模，比特币还没有死掉。

Thank you.