|  |  |  |  |
| --- | --- | --- | --- |
| 1 | 00:00:00,100 --> 00:00:00,559 | 喂 |  |
| 2 | 00:00:00,559 --> 00:00:02,475 | 各位领导 各位专家 |  |
| 3 | 00:00:02,475 --> 00:00:04,243 | 各位来宾朋友 |  |
| 4 | 00:00:04,278 --> 00:00:05,240 | 早上好 |  |
| 5 | 00:00:07,160 --> 00:00:07,840 | RISC-V |  |
| 6 | 00:00:08,581 --> 00:00:11,300 | 这几年在国内外非常流行 |  |
| 7 | 00:00:12,303 --> 00:00:13,620 | 那么从本质上讲 |  |
| 8 | 00:00:13,940 --> 00:00:17,125 | RISC-V它是一个计算机的体系架构 |  |
| 9 | 00:00:17,485 --> 00:00:20,165 | 它是软件和硬件的一个接口 |  |
| 10 | 00:00:21,000 --> 00:00:23,185 | 那从学科的角度来讲 |  |
| 11 | 00:00:23,485 --> 00:00:25,525 | 这个东西非常的古老 |  |
| 12 | 00:00:26,825 --> 00:00:27,459 | 这张图 |  |
| 13 | 00:00:28,085 --> 00:00:30,850 | IBM在六十年代 |  |
| 14 | 00:00:30,850 --> 00:00:32,950 | 就开始了体制架构的研发 |  |
| 15 | 00:00:33,356 --> 00:00:36,256 | IBM360到今天为止还能用 |  |
| 16 | 00:00:36,370 --> 00:00:37,534 | 是一个非常 |  |
| 17 | 00:00:37,534 --> 00:00:39,170 | 非常成功的案例 |  |
| 18 | 00:00:39,590 --> 00:00:41,370 | 当然后面我们有X86 |  |
| 19 | 00:00:41,631 --> 00:00:42,696 | 有ARM |  |
| 20 | 00:00:42,696 --> 00:00:44,845 | 这是大家都非常清楚的 |  |
| 21 | 00:00:45,340 --> 00:00:48,153 | 那么RISC-V相对来讲就年轻很多 |  |
| 22 | 00:00:48,537 --> 00:00:50,737 | 2010年这个时候 |  |
| 23 | 00:00:50,737 --> 00:00:52,965 | RISC-V才开始在【】研发 |  |
| 24 | 00:00:53,143 --> 00:00:56,565 | 那么15年随着SIFive的成立 |  |
| 25 | 00:00:56,834 --> 00:00:59,065 | 随着RISC-V基金会的成立 |  |
| 26 | 00:00:59,365 --> 00:01:02,105 | RISC-V真正进入了产业界 |  |
| 27 | 00:01:02,245 --> 00:01:03,225 | 当时还在美国 |  |
| 28 | 00:01:03,505 --> 00:01:06,005 | 那国内那就更晚了 |  |
| 29 | 00:01:06,225 --> 00:01:07,130 | 到2017年 |  |
| 30 | 00:01:07,130 --> 00:01:08,990 | 交大这个研讨会 |  |
| 31 | 00:01:09,021 --> 00:01:11,068 | 业界才知道了RISC-V |  |
| 32 | 00:01:11,603 --> 00:01:14,823 | 到了18年国内才有IP 【】开始 |  |
| 33 | 00:01:15,025 --> 00:01:17,905 | 才是真正的进入国内的产业界 |  |
| 34 | 00:01:18,356 --> 00:01:21,825 | 所以RISC-V其实是非常年轻的一个现象 |  |
| 35 | 00:01:22,412 --> 00:01:25,209 | 那么RISC-V这么年轻 |  |
| 36 | 00:01:25,215 --> 00:01:27,337 | 但是它的学科这么老 |  |
| 37 | 00:01:28,730 --> 00:01:32,150 | 这么老的学科现在能够焕发出青春 |  |
| 38 | 00:01:32,310 --> 00:01:33,353 | 让大家来追捧 |  |
| 39 | 00:01:33,730 --> 00:01:34,730 | 一定是有原因的 |  |
| 40 | 00:01:35,165 --> 00:01:38,250 | 这个呢我认为这个是历史的必然 |  |
| 41 | 00:01:38,465 --> 00:01:40,221 | 是产业界的选择 |  |
| 42 | 00:01:40,678 --> 00:01:41,800 | 为什么这么说呢 |  |
| 43 | 00:01:43,990 --> 00:01:45,390 | 摩尔定律大家非常熟悉了 |  |
| 44 | 00:01:45,391 --> 00:01:47,934 | 它的它的这个终止 |  |
| 45 | 00:01:47,934 --> 00:01:50,370 | 或者它的这个演进的缓慢 |  |
| 46 | 00:01:50,410 --> 00:01:52,671 | 这是不可 不可否认的 |  |
| 47 | 00:01:52,671 --> 00:01:53,910 | 无论从哪个参数 |  |
| 48 | 00:01:54,165 --> 00:01:55,150 | 每一点来看 |  |
| 49 | 00:01:55,150 --> 00:01:57,745 | 摩尔定律都是走向了终止 |  |
| 50 | 00:01:58,590 --> 00:02:01,085 | 那么现在做先进工艺的公司 |  |
| 51 | 00:02:01,265 --> 00:02:02,805 | 或者【】厂越来越少 |  |
| 52 | 00:02:03,305 --> 00:02:05,853 | 能够做起先进工艺的 |  |
| 53 | 00:02:06,237 --> 00:02:09,550 | 【】芯片设计公司也是非常的少 |  |
| 54 | 00:02:09,610 --> 00:02:10,368 | 越来越少 |  |
| 55 | 00:02:10,851 --> 00:02:11,481 | 所以呢 |  |
| 56 | 00:02:11,725 --> 00:02:14,028 | 这个做先进工艺 |  |
| 57 | 00:02:14,028 --> 00:02:16,743 | 成为一个有钱人的俱乐部 |  |
| 58 | 00:02:18,334 --> 00:02:18,954 | 那么 |  |
| 59 | 00:02:19,903 --> 00:02:21,061 | 因为这个原因 |  |
| 60 | 00:02:21,061 --> 00:02:23,204 | 所以依靠 |  |
| 61 | 00:02:23,204 --> 00:02:27,020 | 依靠工艺进步来取得芯片进步 |  |
| 62 | 00:02:27,240 --> 00:02:29,120 | 这个事情已经慢慢终止了 |  |
| 63 | 00:02:30,931 --> 00:02:34,240 | 那么我们反观我们国内的IC产业 |  |
| 64 | 00:02:34,860 --> 00:02:36,040 | 过去十年 |  |
| 65 | 00:02:36,140 --> 00:02:39,160 | 应该说国内产业取得了巨大的发展 |  |
| 66 | 00:02:39,880 --> 00:02:41,034 | 但它依靠什么呢 |  |
| 67 | 00:02:41,034 --> 00:02:42,760 | 它依靠【】的进步 |  |
| 68 | 00:02:43,155 --> 00:02:45,737 | 依靠IP 依靠EDA |  |
| 69 | 00:02:46,162 --> 00:02:48,055 | 那么这三个领域 |  |
| 70 | 00:02:48,115 --> 00:02:51,075 | 它技术和商业的成熟 |  |
| 71 | 00:02:51,395 --> 00:02:53,535 | 给中国半导体带来了巨大的红利 |  |
| 72 | 00:02:54,200 --> 00:02:55,080 | 这是好事儿 |  |
| 73 | 00:02:55,680 --> 00:02:56,540 | 我们可以发展 |  |
| 74 | 00:02:56,900 --> 00:02:57,686 | 但是呢 |  |
| 75 | 00:02:57,686 --> 00:02:59,060 | 我们发现 突然发现 |  |
| 76 | 00:02:59,918 --> 00:03:02,640 | 哎 这个红利你可以有 |  |
| 77 | 00:03:03,220 --> 00:03:04,611 | 我也可以有 A公司可以有 |  |
| 78 | 00:03:04,611 --> 00:03:05,460 | B公司也可以有 |  |
| 79 | 00:03:06,056 --> 00:03:06,800 | 那么最后呢 |  |
| 80 | 00:03:06,801 --> 00:03:08,640 | 大家做做产品同质化 |  |
| 81 | 00:03:09,200 --> 00:03:11,580 | 竞争呢只能靠降低成本 |  |
| 82 | 00:03:12,060 --> 00:03:14,903 | 最后这样的结果就是说是很难 |  |
| 83 | 00:03:15,037 --> 00:03:16,454 | 做大 做强 |  |
| 84 | 00:03:16,730 --> 00:03:17,710 | 大家都很辛苦 |  |
| 85 | 00:03:19,710 --> 00:03:21,210 | 那么如果说摩尔定律 |  |
| 86 | 00:03:21,210 --> 00:03:23,230 | 这个终结啊是一个缓慢的过程 |  |
| 87 | 00:03:23,950 --> 00:03:26,310 | 我们整个业界现在是面临着 |  |
| 88 | 00:03:26,531 --> 00:03:28,791 | 更短期的challenge就是产能 |  |
| 89 | 00:03:29,800 --> 00:03:32,160 | 以及对先进工艺的把握 |  |
| 90 | 00:03:33,271 --> 00:03:35,380 | 那么我们说一句大白话 |  |
| 91 | 00:03:35,740 --> 00:03:37,520 | 也就说你如果是个芯片公司 |  |
| 92 | 00:03:37,800 --> 00:03:40,540 | 你可能没有足够的钱可以做芯片 |  |
| 93 | 00:03:40,785 --> 00:03:42,245 | 做 做先进工艺 |  |
| 94 | 00:03:42,765 --> 00:03:44,496 | 那么如果你有钱了 |  |
| 95 | 00:03:44,496 --> 00:03:45,785 | 投资方给你很多钱 |  |
| 96 | 00:03:46,385 --> 00:03:48,275 | 你也许拿不到现金红利 |  |
| 97 | 00:03:48,275 --> 00:03:49,428 | 人家给你 |  |
| 98 | 00:03:49,762 --> 00:03:50,985 | 你万一拿到了 |  |
| 99 | 00:03:51,537 --> 00:03:52,317 | 没什么产能 |  |
| 100 | 00:03:52,355 --> 00:03:54,775 | 给你一个给一个工程批就完事了 |  |
| 101 | 00:03:54,776 --> 00:03:56,070 | 那就等着 |  |
| 102 | 00:03:56,070 --> 00:03:58,155 | 好 你什么都拿到了 |  |
| 103 | 00:03:58,156 --> 00:04:00,755 | 最后发现做出来的东西没有竞争力 |  |
| 104 | 00:04:00,935 --> 00:04:01,715 | 没有市场 |  |
| 105 | 00:04:03,050 --> 00:04:06,070 | 也就是说我们以前这个时代 |  |
| 106 | 00:04:06,310 --> 00:04:09,365 | 我们依靠着工艺进步的时代 |  |
| 107 | 00:04:09,365 --> 00:04:10,230 | 结束了 |  |
| 108 | 00:04:10,650 --> 00:04:14,150 | 我们的时代到了以架构创新的时代 |  |
| 109 | 00:04:20,450 --> 00:04:21,450 | 另外一个现象 |  |
| 110 | 00:04:21,570 --> 00:04:25,050 | 也就是说我们的全球数字化是惊人的 |  |
| 111 | 00:04:25,310 --> 00:04:27,468 | 十年前我们想到今天吗 |  |
| 112 | 00:04:27,818 --> 00:04:30,170 | 那么今天也是想不到十年前 |  |
| 113 | 00:04:30,635 --> 00:04:31,711 | 十年以后 |  |
| 114 | 00:04:31,711 --> 00:04:33,875 | 我们到底会发生什么样的状况 |  |
| 115 | 00:04:34,462 --> 00:04:35,535 | 那么大家有没有想过 |  |
| 116 | 00:04:35,535 --> 00:04:37,335 | 说过去十年跟以后十年 |  |
| 117 | 00:04:37,635 --> 00:04:39,300 | 我们数据的成长率是多少 |  |
| 118 | 00:04:39,300 --> 00:04:40,235 | 比例是多少 |  |
| 119 | 00:04:40,800 --> 00:04:41,960 | 其实每年是以 |  |
| 120 | 00:04:42,480 --> 00:04:45,640 | 将近40%的增长率在增长 |  |
| 121 | 00:04:45,840 --> 00:04:47,860 | 这是一个非常可怕的数字 |  |
| 122 | 00:04:48,800 --> 00:04:50,946 | 那么随着像5G |  |
| 123 | 00:04:50,946 --> 00:04:52,760 | 像AI这种技术的成熟 |  |
| 124 | 00:04:53,070 --> 00:04:55,362 | 这催生了很多应用场景 |  |
| 125 | 00:04:55,362 --> 00:04:56,750 | 比如说汽车 |  |
| 126 | 00:04:56,910 --> 00:04:58,665 | 比如说数据中心 比如说IoT |  |
| 127 | 00:04:58,890 --> 00:05:02,070 | 这些都是以前没有的应用场景 |  |
| 128 | 00:05:02,950 --> 00:05:05,915 | 那么以前一颗芯片可以拿出来 |  |
| 129 | 00:05:05,916 --> 00:05:07,062 | 可以走遍天下 |  |
| 130 | 00:05:07,062 --> 00:05:08,995 | 我芯片为王 我做了 |  |
| 131 | 00:05:09,055 --> 00:05:09,695 | 你用就是了 |  |
| 132 | 00:05:10,293 --> 00:05:11,675 | 那么今后呢 |  |
| 133 | 00:05:11,675 --> 00:05:13,036 | 这个现象 |  |
| 134 | 00:05:13,036 --> 00:05:14,965 | 这个慢慢会被取代了 |  |
| 135 | 00:05:15,205 --> 00:05:18,745 | 芯片呈现一个多元的趋势 |  |
| 136 | 00:05:19,025 --> 00:05:21,005 | 也就是说在这个应用场景里面 |  |
| 137 | 00:05:21,045 --> 00:05:22,365 | 每一个应用场景 |  |
| 138 | 00:05:22,485 --> 00:05:25,161 | 它都可以养活一款 |  |
| 139 | 00:05:25,161 --> 00:05:26,445 | 甚至多款的芯片 |  |
| 140 | 00:05:27,770 --> 00:05:29,450 | 我们看一下苹果的例子 |  |
| 141 | 00:05:29,550 --> 00:05:30,610 | 苹果自己做芯片 |  |
| 142 | 00:05:31,028 --> 00:05:32,330 | 那么它的结果是什么 |  |
| 143 | 00:05:33,070 --> 00:05:35,008 | 苹果的硬件的毛利 |  |
| 144 | 00:05:35,265 --> 00:05:36,730 | 是他竞争对手 |  |
| 145 | 00:05:36,731 --> 00:05:40,440 | 像HP DELL两倍到三倍毛利 |  |
| 146 | 00:05:41,260 --> 00:05:42,183 | 那么净利就 |  |
| 147 | 00:05:42,183 --> 00:05:43,556 | 那不知道多少了 |  |
| 148 | 00:05:44,043 --> 00:05:46,120 | 另外一个例子是谷歌 |  |
| 149 | 00:05:46,480 --> 00:05:49,012 | 谷歌自己研究研发了TPU |  |
| 150 | 00:05:49,012 --> 00:05:49,940 | 来做训练 |  |
| 151 | 00:05:50,481 --> 00:05:53,385 | 那么同时谷歌也可以去买【】的 |  |
| 152 | 00:05:53,605 --> 00:05:54,505 | 训练的solution |  |
| 153 | 00:05:55,365 --> 00:05:56,585 | 这个相比较之下 |  |
| 154 | 00:05:56,945 --> 00:06:00,505 | 谷歌自研的只有去购买成本的百分之四十 |  |
| 155 | 00:06:01,640 --> 00:06:04,300 | 所以在这些业务领域里面 |  |
| 156 | 00:06:04,753 --> 00:06:05,996 | 这个自己做芯片 |  |
| 157 | 00:06:05,996 --> 00:06:07,100 | 不是一个情怀 |  |
| 158 | 00:06:07,520 --> 00:06:09,900 | 它是给商业公司带来巨大的利益 |  |
| 159 | 00:06:10,360 --> 00:06:13,540 | 这就是为什么现在这么多车厂 |  |
| 160 | 00:06:13,820 --> 00:06:15,028 | 这么多数据中心 |  |
| 161 | 00:06:15,028 --> 00:06:17,680 | 纷纷下海做芯片的原因 |  |
| 162 | 00:06:20,818 --> 00:06:22,003 | 那么RISC-V |  |
| 163 | 00:06:22,003 --> 00:06:24,100 | 就是在这个背景下出现了 |  |
| 164 | 00:06:24,368 --> 00:06:26,309 | RISC-V10年出现呢 |  |
| 165 | 00:06:26,480 --> 00:06:29,360 | 应该说它本身这件事情是个偶然 |  |
| 166 | 00:06:29,580 --> 00:06:32,195 | 当时就是一个教授带着学生 |  |
| 167 | 00:06:32,315 --> 00:06:34,515 | 他可以做也可以不做 |  |
| 168 | 00:06:34,515 --> 00:06:37,255 | 但是RISC-V出现以后 |  |
| 169 | 00:06:37,335 --> 00:06:38,381 | 它的发展 |  |
| 170 | 00:06:38,381 --> 00:06:39,455 | 它的繁荣 |  |
| 171 | 00:06:40,015 --> 00:06:41,295 | 它是必然的 |  |
| 172 | 00:06:41,750 --> 00:06:44,030 | 因为这个是产业选择的一个结果 |  |
| 173 | 00:06:45,240 --> 00:06:46,310 | 那么对于Python |  |
| 174 | 00:06:46,490 --> 00:06:47,650 | 当时一直在说 |  |
| 175 | 00:06:47,990 --> 00:06:49,990 | DSA【】 |  |
| 176 | 00:06:50,450 --> 00:06:51,350 | 也就是这个意思 |  |
| 177 | 00:06:51,590 --> 00:06:53,107 | 因为我们到了一个 |  |
| 178 | 00:06:53,110 --> 00:06:55,593 | 架构决定芯片成败的时代 |  |
| 179 | 00:06:56,135 --> 00:06:58,535 | 那选择了RISC-V意味着什么呢 |  |
| 180 | 00:06:58,815 --> 00:07:01,655 | 选择了RISC-V就是选择创新的自由 |  |
| 181 | 00:07:01,975 --> 00:07:04,295 | 创新的自由包括商业上的自由 |  |
| 182 | 00:07:04,535 --> 00:07:05,875 | 也包括技术上的自由 |  |
| 183 | 00:07:06,395 --> 00:07:08,090 | 商业上自由呢大家简单理解啊 |  |
| 184 | 00:07:08,090 --> 00:07:08,975 | 就是开源 |  |
| 185 | 00:07:09,395 --> 00:07:10,437 | 其实开源 |  |
| 186 | 00:07:10,437 --> 00:07:12,762 | 远远不只是说是 |  |
| 187 | 00:07:12,762 --> 00:07:13,695 | 零成本 |  |
| 188 | 00:07:13,775 --> 00:07:14,554 | 低成本 |  |
| 189 | 00:07:14,554 --> 00:07:17,095 | 开源意味着技术的平民化 |  |
| 190 | 00:07:17,175 --> 00:07:17,895 | 草根化 |  |
| 191 | 00:07:18,410 --> 00:07:21,030 | 开源意味着社区的繁荣 |  |
| 192 | 00:07:21,290 --> 00:07:22,670 | 开源还意味着 |  |
| 193 | 00:07:22,910 --> 00:07:25,070 | 大家可以在一个共同的基础上 |  |
| 194 | 00:07:25,230 --> 00:07:26,785 | 做自己的竞争力 |  |
| 195 | 00:07:26,785 --> 00:07:27,950 | 做自己的差异化 |  |
| 196 | 00:07:28,170 --> 00:07:31,030 | 所以开源它的含义是很深的 |  |
| 197 | 00:07:31,825 --> 00:07:33,285 | 还有就是技术上的自由 |  |
| 198 | 00:07:33,484 --> 00:07:36,845 | 那么RISC-V发明者非常的有先见 |  |
| 199 | 00:07:37,125 --> 00:07:38,996 | 他没有采取 |  |
| 200 | 00:07:38,996 --> 00:07:40,825 | ARM x86这种 |  |
| 201 | 00:07:41,231 --> 00:07:43,025 | 这个指定期的开发的模式 |  |
| 202 | 00:07:43,375 --> 00:07:44,755 | 它是一个汉化的 |  |
| 203 | 00:07:45,203 --> 00:07:47,171 | 那么以后来者 |  |
| 204 | 00:07:47,171 --> 00:07:49,555 | 可以按照你的需求 |  |
| 205 | 00:07:49,815 --> 00:07:52,395 | 对指令集进行排列组合 |  |
| 206 | 00:07:52,675 --> 00:07:54,778 | 在你的行业里面进行 |  |
| 207 | 00:07:54,778 --> 00:07:56,875 | 这个最佳的设计 |  |
| 208 | 00:07:57,153 --> 00:08:01,180 | 那么这就是RISC-V真正的一个魅力所在 |  |
| 209 | 00:08:06,206 --> 00:08:07,221 | 那么我现在 |  |
| 210 | 00:08:07,221 --> 00:08:09,910 | 你要问我那么RISC-V挺好开源 |  |
| 211 | 00:08:10,278 --> 00:08:12,085 | 那么以后有什么趋势呢 |  |
| 212 | 00:08:12,085 --> 00:08:13,230 | 我讲四个趋势啊 |  |
| 213 | 00:08:13,606 --> 00:08:15,340 | 那第一个呢是RISC-V的 |  |
| 214 | 00:08:15,775 --> 00:08:19,875 | 这个处理器将成为SoC IP的标配 |  |
| 215 | 00:08:20,555 --> 00:08:24,095 | 特别是在中低端的应用场景 |  |
| 216 | 00:08:24,737 --> 00:08:25,341 | 那么以后呢 |  |
| 217 | 00:08:25,344 --> 00:08:28,574 | 可以想象在多种应用场景 |  |
| 218 | 00:08:28,635 --> 00:08:31,475 | 将出现很多很多的RISC-V处理器 |  |
| 219 | 00:08:31,895 --> 00:08:34,895 | 比如说IoT MCU的 连接的 |  |
| 220 | 00:08:34,955 --> 00:08:36,955 | 安全的 嵌入式处理器的 |  |
| 221 | 00:08:37,095 --> 00:08:39,675 | 甚至有一些小一点的AP方面 |  |
| 222 | 00:08:40,195 --> 00:08:44,135 | 会出现大量的不同商业模式的IP |  |
| 223 | 00:08:44,515 --> 00:08:46,515 | 这模式有开源了 |  |
| 224 | 00:08:46,515 --> 00:08:47,635 | 有商业的 |  |
| 225 | 00:08:47,715 --> 00:08:48,755 | 也有自研的 |  |
| 226 | 00:08:48,755 --> 00:08:50,235 | 假设你是一个研究机构 |  |
| 227 | 00:08:50,275 --> 00:08:51,615 | 假设你是个教育机构 |  |
| 228 | 00:08:51,736 --> 00:08:53,453 | 也完全可以用开源的核 |  |
| 229 | 00:08:53,453 --> 00:08:54,871 | 给学生做项目 |  |
| 230 | 00:08:55,131 --> 00:08:56,525 | 做科研等等 |  |
| 231 | 00:08:56,918 --> 00:08:58,650 | 那如果你是需要支持的 |  |
| 232 | 00:08:58,730 --> 00:09:00,650 | 你需要紧密的合作伙伴 |  |
| 233 | 00:09:00,650 --> 00:09:01,510 | 你需要roommate |  |
| 234 | 00:09:01,918 --> 00:09:03,855 | 那你可以选择付费 |  |
| 235 | 00:09:04,250 --> 00:09:06,225 | 那如果你是实力非常强 |  |
| 236 | 00:09:06,445 --> 00:09:07,405 | 你可以自研 |  |
| 237 | 00:09:07,645 --> 00:09:08,954 | 你可以按照 |  |
| 238 | 00:09:08,954 --> 00:09:10,445 | 你自己的需求来定制 |  |
| 239 | 00:09:10,537 --> 00:09:12,117 | 你自己的RISC-V AP |  |
| 240 | 00:09:12,445 --> 00:09:15,465 | 所以这里面这些IP将会繁荣 |  |
| 241 | 00:09:15,725 --> 00:09:18,145 | 这样以后将会有很多的开发者 |  |
| 242 | 00:09:18,387 --> 00:09:20,447 | 开发人员这个数量巨大 |  |
| 243 | 00:09:20,606 --> 00:09:23,045 | 那么技术软件也将会非常的丰富 |  |
| 244 | 00:09:25,240 --> 00:09:27,001 | 第二个是DSA |  |
| 245 | 00:09:27,001 --> 00:09:28,720 | DSA将迎来春天 |  |
| 246 | 00:09:29,043 --> 00:09:30,423 | DSA到底是什么呢 |  |
| 247 | 00:09:30,423 --> 00:09:33,542 | 我这里有张动图给大家稍微解释一下 |  |
| 248 | 00:09:33,981 --> 00:09:35,960 | RISC-V有一个基础指令集 |  |
| 249 | 00:09:36,884 --> 00:09:38,030 | 这个已经有了 |  |
| 250 | 00:09:38,496 --> 00:09:40,221 | 那么扩展指令集 |  |
| 251 | 00:09:40,696 --> 00:09:43,365 | 这些呢是随着时间的变化 |  |
| 252 | 00:09:43,365 --> 00:09:44,570 | 不断增加的 |  |
| 253 | 00:09:44,670 --> 00:09:46,053 | 目前大概有这些 |  |
| 254 | 00:09:46,053 --> 00:09:47,130 | 可能也有遗漏 |  |
| 255 | 00:09:47,634 --> 00:09:50,812 | 那么RISC-V它的beauty在于呢 |  |
| 256 | 00:09:51,135 --> 00:09:52,635 | 你如果作为一个商业公司 |  |
| 257 | 00:09:52,875 --> 00:09:56,253 | 你可以做自己的定制指令器 |  |
| 258 | 00:09:56,678 --> 00:09:58,256 | Xa Xb |  |
| 259 | 00:09:58,256 --> 00:09:59,440 | 如果你很厉害 |  |
| 260 | 00:09:59,441 --> 00:10:01,090 | 你可以把它变成一个 |  |
| 261 | 00:10:01,090 --> 00:10:02,560 | 扩展自己的标准扩展 |  |
| 262 | 00:10:02,837 --> 00:10:04,300 | 那也可以自己用 |  |
| 263 | 00:10:04,300 --> 00:10:06,040 | 作为一个商业公司 |  |
| 264 | 00:10:06,200 --> 00:10:09,260 | 你可以在这里做排列组合 |  |
| 265 | 00:10:09,850 --> 00:10:11,290 | 选取你的技术层级 |  |
| 266 | 00:10:11,290 --> 00:10:12,369 | 选取你的扩展层级 |  |
| 267 | 00:10:12,750 --> 00:10:15,110 | 加上你的定制化层级 |  |
| 268 | 00:10:15,290 --> 00:10:18,470 | 真正成为你的【】 |  |
| 269 | 00:10:19,453 --> 00:10:20,955 | 那A公司可以这样子 |  |
| 270 | 00:10:21,421 --> 00:10:24,903 | 那么B公司可以是这样子 |  |
| 271 | 00:10:25,415 --> 00:10:30,174 | 其实RISC-V【】或者是富人 |  |
| 272 | 00:10:30,355 --> 00:10:34,155 | 整个业界来进行多种DSA的设计 |  |
| 273 | 00:10:34,650 --> 00:10:37,630 | 那么DSA设计将迎来繁荣时代 |  |
| 274 | 00:10:39,559 --> 00:10:41,284 | 那第三个趋势呢 |  |
| 275 | 00:10:41,590 --> 00:10:43,630 | 它是一个应用 |  |
| 276 | 00:10:43,930 --> 00:10:45,981 | 决定软件和芯片的 |  |
| 277 | 00:10:45,981 --> 00:10:47,590 | 这么一个时代的到来 |  |
| 278 | 00:10:48,090 --> 00:10:50,065 | 那刚才讲了我们应用场景很多 |  |
| 279 | 00:10:50,065 --> 00:10:52,590 | 应用场景对于解决方案有什么要求 |  |
| 280 | 00:10:52,875 --> 00:10:54,115 | 要求其实也很简单 |  |
| 281 | 00:10:54,535 --> 00:10:55,778 | 它开发要便捷的 |  |
| 282 | 00:10:55,778 --> 00:10:57,195 | 编程要快速的 |  |
| 283 | 00:10:57,335 --> 00:10:59,295 | 成本要低 迭代要快 |  |
| 284 | 00:10:59,915 --> 00:11:01,128 | 它至于说你 |  |
| 285 | 00:11:01,128 --> 00:11:03,455 | 下面底层是用RISC-V还是用ARM |  |
| 286 | 00:11:03,715 --> 00:11:04,935 | 还是用x86 |  |
| 287 | 00:11:05,095 --> 00:11:06,775 | 其实它的考虑是第二位的 |  |
| 288 | 00:11:07,225 --> 00:11:08,359 | 这不是最主要的 |  |
| 289 | 00:11:08,359 --> 00:11:09,825 | 主要还是前面的事情 |  |
| 290 | 00:11:10,665 --> 00:11:12,485 | 那么RISC-V是什么东西呢 |  |
| 291 | 00:11:12,486 --> 00:11:14,865 | RISC-V是特别适合这样子要求 |  |
| 292 | 00:11:15,045 --> 00:11:16,945 | 因为它的创新在于架构 |  |
| 293 | 00:11:17,740 --> 00:11:19,160 | 所以对下面的要求来讲 |  |
| 294 | 00:11:19,220 --> 00:11:20,520 | 软件跟硬件来讲 |  |
| 295 | 00:11:21,540 --> 00:11:23,159 | RISC-V它【】是 |  |
| 296 | 00:11:23,159 --> 00:11:26,120 | 软件和硬件的相互绑定 |  |
| 297 | 00:11:26,509 --> 00:11:28,300 | 深度 深度优化 |  |
| 298 | 00:11:29,771 --> 00:11:31,190 | 那么 以后我们做芯片 |  |
| 299 | 00:11:31,191 --> 00:11:33,910 | 不是说我去看这个芯片它怎么样 |  |
| 300 | 00:11:33,911 --> 00:11:36,390 | 而是说这个系统本身加起来 |  |
| 301 | 00:11:36,570 --> 00:11:39,730 | 能够给应用提供什么样的体验 |  |
| 302 | 00:11:40,318 --> 00:11:43,750 | 那现在业界上非常成功的就是Apple的【】 |  |
| 303 | 00:11:44,850 --> 00:11:47,650 | 【】这个芯片本身看上去不怎么样 |  |
| 304 | 00:11:47,831 --> 00:11:50,490 | 但是放在系统里面运营的非常好 |  |
| 305 | 00:11:50,670 --> 00:11:52,350 | 所以它是一个典型的 |  |
| 306 | 00:11:52,545 --> 00:11:56,105 | 一个软件和芯片深度绑定 |  |
| 307 | 00:11:56,106 --> 00:11:57,025 | 相互优化 |  |
| 308 | 00:11:57,065 --> 00:11:59,645 | 为应用做定制的一个案例 |  |
| 309 | 00:12:03,450 --> 00:12:05,415 | 第四个趋势 |  |
| 310 | 00:12:05,415 --> 00:12:07,793 | RISC-V进军数据中心 |  |
| 311 | 00:12:08,606 --> 00:12:11,010 | 今年早些时候有一个投资机构叫【】 |  |
| 312 | 00:12:11,470 --> 00:12:13,750 | 他发表了以后全球十年 |  |
| 313 | 00:12:13,990 --> 00:12:15,970 | 这个可投资的领域空间 |  |
| 314 | 00:12:15,971 --> 00:12:16,870 | 就提到了RISC-V |  |
| 315 | 00:12:17,330 --> 00:12:18,670 | 它有一个惊人的预言 |  |
| 316 | 00:12:19,065 --> 00:12:21,185 | 也就是说到了2030年 |  |
| 317 | 00:12:21,730 --> 00:12:23,990 | RISC-V和ARM best |  |
| 318 | 00:12:24,565 --> 00:12:25,775 | 数据中心服务器 |  |
| 319 | 00:12:25,775 --> 00:12:28,065 | 将占到全球市场的 |  |
| 320 | 00:12:28,212 --> 00:12:29,048 | 70% |  |
| 321 | 00:12:29,725 --> 00:12:30,603 | 今年多少 |  |
| 322 | 00:12:31,306 --> 00:12:32,065 | 几乎是没有的 |  |
| 323 | 00:12:33,285 --> 00:12:34,215 | 也就是说 |  |
| 324 | 00:12:34,215 --> 00:12:36,005 | 我们有个非常大的空间 |  |
| 325 | 00:12:36,245 --> 00:12:39,806 | 今天x86【】的服务器 |  |
| 326 | 00:12:39,806 --> 00:12:41,365 | 是占92% |  |
| 327 | 00:12:41,625 --> 00:12:45,005 | 它会降到30%以上 30%以下 |  |
| 328 | 00:12:46,037 --> 00:12:47,451 | 那么到2030年呢 |  |
| 329 | 00:12:47,634 --> 00:12:50,585 | ARM和RISC-V的处理器将成为标准 |  |
| 330 | 00:12:50,880 --> 00:12:54,000 | 它将成为低成本计算的标准 |  |
| 331 | 00:12:55,040 --> 00:12:56,400 | 那我们看一下这个市场 |  |
| 332 | 00:12:56,401 --> 00:12:58,820 | 到2030年这个服务器市场 |  |
| 333 | 00:12:59,037 --> 00:13:02,096 | 将达到一千五百亿美金 |  |
| 334 | 00:13:02,096 --> 00:13:03,800 | 到一千六百亿美金这么个市场 |  |
| 335 | 00:13:04,160 --> 00:13:07,980 | 如果RISC-V加上ARM有70%的市场 |  |
| 336 | 00:13:08,520 --> 00:13:12,040 | 这个前景可期待非常可期待 |  |
| 337 | 00:13:12,225 --> 00:13:13,934 | 那有人问说那都是ARM的 |  |
| 338 | 00:13:13,934 --> 00:13:14,834 | 你这个是RISC-V |  |
| 339 | 00:13:14,834 --> 00:13:16,745 | 其实呢 从服务器 |  |
| 340 | 00:13:16,746 --> 00:13:19,340 | 从数据中心的角度来看 |  |
| 341 | 00:13:19,990 --> 00:13:22,045 | ARM虽然比RISC-V早了几年 |  |
| 342 | 00:13:22,085 --> 00:13:24,525 | 但实际上还在同一个起跑线上面 |  |
| 343 | 00:13:24,800 --> 00:13:25,946 | 所以从这个角度来讲 |  |
| 344 | 00:13:25,946 --> 00:13:27,740 | RISC-V大有可为 |  |
| 345 | 00:13:31,340 --> 00:13:32,640 | 下面给大家汇报一下 |  |
| 346 | 00:13:32,920 --> 00:13:34,003 | 我们赛昉科技 |  |
| 347 | 00:13:34,003 --> 00:13:36,500 | 在做RISC-V里面做了什么事儿 |  |
| 348 | 00:13:37,246 --> 00:13:38,809 | 那么赛昉科技呢 |  |
| 349 | 00:13:38,809 --> 00:13:40,320 | 是在我们市一个【】 |  |
| 350 | 00:13:40,540 --> 00:13:42,180 | 是2018年8月成立的 |  |
| 351 | 00:13:42,850 --> 00:13:45,428 | 那么业界都是很多的误会 |  |
| 352 | 00:13:45,761 --> 00:13:48,131 | 我认为我们是SiFive公司的子公司 |  |
| 353 | 00:13:48,421 --> 00:13:49,260 | 其实完全不是 |  |
| 354 | 00:13:49,400 --> 00:13:50,787 | 我们跟SiFive |  |
| 355 | 00:13:50,940 --> 00:13:53,220 | 是完全是两个独立的公司独立运营 |  |
| 356 | 00:13:53,730 --> 00:13:55,390 | 所以在大概两个礼拜以前 |  |
| 357 | 00:13:55,391 --> 00:13:56,510 | 突然有一天说 |  |
| 358 | 00:13:56,750 --> 00:13:58,012 | 这个媒体爆出来说 |  |
| 359 | 00:13:58,012 --> 00:14:00,150 | Intel要收购SiFive |  |
| 360 | 00:14:00,530 --> 00:14:02,837 | 所以我花了好几天的时间 |  |
| 361 | 00:14:04,196 --> 00:14:05,050 | 跟大家解释 |  |
| 362 | 00:14:05,230 --> 00:14:07,050 | 大多数人都是跟我讲 |  |
| 363 | 00:14:07,631 --> 00:14:09,793 | 祝贺 祝贺徐总被收购了 |  |
| 364 | 00:14:10,076 --> 00:14:11,812 | 我说 没有我的事儿 |  |
| 365 | 00:14:11,812 --> 00:14:13,375 | 这个真没我的事儿 |  |
| 366 | 00:14:13,376 --> 00:14:15,115 | 他们还不相信说你不就是SiFive |  |
| 367 | 00:14:15,116 --> 00:14:16,995 | 其实不是 真不是 |  |
| 368 | 00:14:17,075 --> 00:14:21,295 | 所以我们赛昉科技是完全一个独立的 |  |
| 369 | 00:14:21,435 --> 00:14:24,175 | 本土的 基于RISC-V的生态公司 |  |
| 370 | 00:14:24,393 --> 00:14:25,725 | 我们做了些什么事儿 |  |
| 371 | 00:14:26,625 --> 00:14:29,728 | 我们过去一年重磅发布了 |  |
| 372 | 00:14:29,728 --> 00:14:31,425 | 三个重要的产品 |  |
| 373 | 00:14:31,565 --> 00:14:34,325 | 左边倒三角是一个产业链 |  |
| 374 | 00:14:34,525 --> 00:14:36,143 | 最底层是一个指令集 |  |
| 375 | 00:14:36,143 --> 00:14:37,005 | 当然是RISC-V |  |
| 376 | 00:14:37,462 --> 00:14:40,735 | 上面基于RISC-V IP核GRP和芯片 |  |
| 377 | 00:14:40,975 --> 00:14:43,612 | 基于芯片有软件等系统 |  |
| 378 | 00:14:44,025 --> 00:14:45,955 | 那么我们算法科技 |  |
| 379 | 00:14:46,175 --> 00:14:48,435 | 过去一年发布了三个是什么样的东西呢 |  |
| 380 | 00:14:48,690 --> 00:14:50,310 | 第一是IP核 |  |
| 381 | 00:14:50,559 --> 00:14:53,143 | 我们发布了天枢IP核 |  |
| 382 | 00:14:53,143 --> 00:14:55,988 | 这是全球性能最高的 |  |
| 383 | 00:14:55,988 --> 00:14:57,971 | RISC-V的IP核 |  |
| 384 | 00:14:59,240 --> 00:15:00,481 | 然后呢 我们也发布了 |  |
| 385 | 00:15:00,481 --> 00:15:02,805 | 惊鸿7100芯片平台 |  |
| 386 | 00:15:02,965 --> 00:15:04,225 | 这是全球首款 |  |
| 387 | 00:15:04,225 --> 00:15:04,985 | 这个发布比较早 |  |
| 388 | 00:15:04,986 --> 00:15:06,165 | 去年九月份就发布了 |  |
| 389 | 00:15:06,360 --> 00:15:07,620 | 是第一款 |  |
| 390 | 00:15:07,800 --> 00:15:10,420 | 基于RISC-V的人工智能视觉处理平台 |  |
| 391 | 00:15:11,180 --> 00:15:13,000 | 基于这个视觉处理平台 |  |
| 392 | 00:15:13,001 --> 00:15:15,120 | 我们发布了星光开发板 |  |
| 393 | 00:15:15,680 --> 00:15:19,540 | 那么星光开发板是一款实用型的 |  |
| 394 | 00:15:19,803 --> 00:15:20,680 | 微型计算机 |  |
| 395 | 00:15:21,300 --> 00:15:22,325 | 那我们来看一下 |  |
| 396 | 00:15:22,325 --> 00:15:23,060 | 简单介绍一下 |  |
| 397 | 00:15:23,061 --> 00:15:24,840 | 这是三个产品 |  |
| 398 | 00:15:24,840 --> 00:15:27,020 | 那么这个是天枢的内核 |  |
| 399 | 00:15:27,260 --> 00:15:30,060 | 先说这个是完全是一个高性能的设计 |  |
| 400 | 00:15:30,990 --> 00:15:34,630 | 它是12级流水线 乱序执行 超标量设计 |  |
| 401 | 00:15:34,755 --> 00:15:37,115 | 它的亮点是速度在7nm |  |
| 402 | 00:15:37,635 --> 00:15:39,375 | 可以超过3.5GHz |  |
| 403 | 00:15:39,975 --> 00:15:42,235 | 这个是非常非常不错的一个数字 |  |
| 404 | 00:15:42,930 --> 00:15:45,590 | SPECint2006超过30 |  |
| 405 | 00:15:46,490 --> 00:15:48,793 | 可能另外它支持了RVV1.0 |  |
| 406 | 00:15:48,793 --> 00:15:49,870 | 和支持虚拟化 |  |
| 407 | 00:15:50,050 --> 00:15:53,430 | 所以这么一个核以后是在数据中心 |  |
| 408 | 00:15:53,510 --> 00:15:54,410 | 在通讯 |  |
| 409 | 00:15:54,975 --> 00:15:56,159 | 在人工智能方面 |  |
| 410 | 00:15:56,159 --> 00:15:57,715 | 应该有广泛的应用 |  |
| 411 | 00:16:00,330 --> 00:16:01,824 | 今天 应该今天吧 |  |
| 412 | 00:16:01,824 --> 00:16:04,150 | 我们的余红斌博士 |  |
| 413 | 00:16:04,190 --> 00:16:07,330 | 赛昉科技CTO将为大家详细解读 |  |
| 414 | 00:16:07,471 --> 00:16:10,150 | 这款处理器是怎么处理的 |  |
| 415 | 00:16:10,430 --> 00:16:11,253 | 怎么设计的 |  |
| 416 | 00:16:12,703 --> 00:16:15,265 | 欢迎大家参加 |  |
| 417 | 00:16:15,631 --> 00:16:18,059 | 还有一个是惊鸿7100 |  |
| 418 | 00:16:18,059 --> 00:16:18,891 | 这是个芯片 |  |
| 419 | 00:16:19,321 --> 00:16:21,480 | 这是在去年宣布的 |  |
| 420 | 00:16:21,481 --> 00:16:22,600 | 是基于TSMC |  |
| 421 | 00:16:23,171 --> 00:16:25,640 | 28nm的一个高性能的 |  |
| 422 | 00:16:25,871 --> 00:16:27,523 | 【】 |  |
| 423 | 00:16:27,843 --> 00:16:29,390 | 那么它的特点呢 |  |
| 424 | 00:16:29,390 --> 00:16:31,515 | 它的性能非常强大 |  |
| 425 | 00:16:31,555 --> 00:16:33,368 | 它有高性能的RISC-V核 |  |
| 426 | 00:16:33,412 --> 00:16:34,521 | 【】 |  |
| 427 | 00:16:34,615 --> 00:16:36,775 | 有人工智能的引擎在里面 |  |
| 428 | 00:16:37,120 --> 00:16:39,265 | 还有编解码视频编解码 |  |
| 429 | 00:16:39,265 --> 00:16:40,700 | 除了这个以外 |  |
| 430 | 00:16:40,800 --> 00:16:42,160 | 它接口非常丰富 |  |
| 431 | 00:16:42,460 --> 00:16:45,506 | 所以非常适合做各种各样的应用 |  |
| 432 | 00:16:46,740 --> 00:16:49,212 | 第一个应用就是星光板 |  |
| 433 | 00:16:49,750 --> 00:16:51,870 | 这是这个是实物照片 |  |
| 434 | 00:16:51,871 --> 00:16:53,059 | 这个星光板呢 |  |
| 435 | 00:16:53,059 --> 00:16:55,510 | 是我们在4月份已经第一批 |  |
| 436 | 00:16:55,510 --> 00:16:57,270 | 交付给客户 |  |
| 437 | 00:16:57,690 --> 00:17:01,370 | 客户在开源社区这引起了很大的反响 |  |
| 438 | 00:17:02,731 --> 00:17:04,225 | 那么同时呢 |  |
| 439 | 00:17:04,225 --> 00:17:06,380 | 我们交付开源社区的同时 |  |
| 440 | 00:17:06,381 --> 00:17:09,280 | 我们也交付给了国内的很多合作方 |  |
| 441 | 00:17:09,281 --> 00:17:11,320 | 所以基于这个新模板 |  |
| 442 | 00:17:11,440 --> 00:17:13,840 | 我们将适配多种操作系统 |  |
| 443 | 00:17:16,900 --> 00:17:19,980 | 星光这个卫星虽然是技术专场 |  |
| 444 | 00:17:20,040 --> 00:17:22,500 | 应该是在24号 有3小时 |  |
| 445 | 00:17:22,740 --> 00:17:23,940 | 也欢迎大家参加 |  |
| 446 | 00:17:26,260 --> 00:17:27,038 | 那么最后呢 |  |
| 447 | 00:17:27,039 --> 00:17:28,862 | 我这里想说就是开源 |  |
| 448 | 00:17:29,190 --> 00:17:31,459 | 开源社区因为星光板的关系 |  |
| 449 | 00:17:31,712 --> 00:17:35,380 | 我们跟开源社区有了比较亲密的接触 |  |
| 450 | 00:17:35,580 --> 00:17:36,680 | 那也有些感想 |  |
| 451 | 00:17:37,030 --> 00:17:39,210 | 我们交付这个板子时间并不久 |  |
| 452 | 00:17:39,296 --> 00:17:42,187 | 就两个月吧 两个月可能达不到 |  |
| 453 | 00:17:42,830 --> 00:17:46,130 | 在两个月中间我们收到了大量的反馈 |  |
| 454 | 00:17:46,510 --> 00:17:47,530 | 大量的上传 |  |
| 455 | 00:17:48,645 --> 00:17:52,143 | 远远超出我们的希望 |  |
| 456 | 00:17:52,287 --> 00:17:55,456 | 所以开源社区是一个藏龙卧虎的地方 |  |
| 457 | 00:17:55,985 --> 00:17:58,065 | 里面的人实力非常强 |  |
| 458 | 00:17:58,380 --> 00:18:00,753 | 里面的理念也非常的执着 |  |
| 459 | 00:18:03,062 --> 00:18:05,680 | 那在这个取得了这么多反馈 |  |
| 460 | 00:18:05,681 --> 00:18:08,180 | 取得这么多软件开发成果的同时 |  |
| 461 | 00:18:08,760 --> 00:18:10,260 | 也有点美中不足 |  |
| 462 | 00:18:10,678 --> 00:18:11,378 | 是什么呢 |  |
| 463 | 00:18:12,140 --> 00:18:14,920 | 开个社区 参与方基本上都是欧美的 |  |
| 464 | 00:18:15,580 --> 00:18:18,689 | 我们国内的参与方非常少 |  |
| 465 | 00:18:18,689 --> 00:18:19,780 | 不是没有 |  |
| 466 | 00:18:19,781 --> 00:18:21,540 | 非常感谢有参与方 |  |
| 467 | 00:18:23,005 --> 00:18:25,600 | 开源其实是没有国界的 |  |
| 468 | 00:18:25,668 --> 00:18:27,445 | 开源社区没有说 |  |
| 469 | 00:18:27,805 --> 00:18:30,645 | 国内的开源社区或者是国外的开源社区 |  |
| 470 | 00:18:30,925 --> 00:18:32,605 | 其实是一个统一的社区 |  |
| 471 | 00:18:33,350 --> 00:18:36,430 | 但是我们国内的整个业界对于 |  |
| 472 | 00:18:36,750 --> 00:18:38,790 | 开源社区的影响力 |  |
| 473 | 00:18:39,150 --> 00:18:41,737 | 话语权非常的小 |  |
| 474 | 00:18:42,493 --> 00:18:48,620 | 所以我想如果我可以我们跟各个合作方 |  |
| 475 | 00:18:48,780 --> 00:18:49,680 | 跟各位一起 |  |
| 476 | 00:18:49,960 --> 00:18:53,020 | 能够借助这个星光板这作为一个载体 |  |
| 477 | 00:18:53,900 --> 00:18:56,940 | 不仅是可以推动RISC-V生态的发展 |  |
| 478 | 00:18:57,780 --> 00:19:01,000 | 而且借助这个板子我们来推动 |  |
| 479 | 00:19:01,760 --> 00:19:04,140 | 开源的文化的发展 |  |
| 480 | 00:19:04,141 --> 00:19:06,720 | 这一点可以和前面的 |  |
| 481 | 00:19:07,360 --> 00:19:09,400 | 李先生在报告现场呼应 |  |
| 482 | 00:19:10,612 --> 00:19:12,712 | 我们到了开源2.0的时代 |  |
| 483 | 00:19:13,412 --> 00:19:14,937 | 那我们公司的口号 |  |
| 484 | 00:19:14,937 --> 00:19:16,835 | 源于开源 高于开源 |  |
| 485 | 00:19:17,235 --> 00:19:17,895 | 回馈开源 |  |
| 486 | 00:19:18,535 --> 00:19:21,875 | 赛昉科技我们是希望致力于 |  |
| 487 | 00:19:22,875 --> 00:19:25,355 | 基于开放的RISC-V |  |
| 488 | 00:19:25,684 --> 00:19:28,557 | 构建一个闭环的商业模式 |  |
| 489 | 00:19:29,071 --> 00:19:29,675 | 谢谢大家 |  |