

Discover the true hardware specs of the Nintendo Wii by yourself just by reading and following the official links provided here.

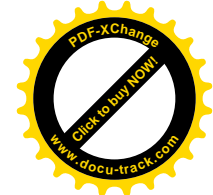
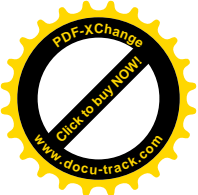
Hello there:

The information provided by this document has nothing to do with spying; everything you will find here is official information that was gathered from the homepages and links that come from the companies related with Nintendo into bringing up the Wii hardware system. It's true that that many questions that were done to these companies, like NEC and Mosys, were not answered directly, but through their homepages they provide enough information to determine which technology does the Nintendo Wii use, the type of memory used in the eDRAM and the architecture functionality; and of course, how the Wii can compete in graphic terms against Sony and Microsoft by taking a different approach.

Since the document is little large, for those of you who do not want to read the full story including the irrefutable proves, I will mention first the key technologies that Nintendo Wii uses; and if you want to continue and see the facts that prove this, you may continue reading:

Wii uses NEC's UX6D macro as eDRAM (is a 1T-SRAM-Q macro using MIM2 technology instead of the traditional FAC). Wii doesn't use standard 1T-SRAM macro since is not cost effective and uses more material and steps for its production, not to mention that Mosys doesn't support these macros since 90nm introduction as can be confirmed in the Mosys available macros section of their homepage; and not even 1T-SRAM-Q is supported on 90nm process and further shrinking technologies, only MIM macros are supported. Plus, if you go to Wikipedia and check the 1T-SRAM macros(the ones that include the overhead since without it we are just talking about the memory bank without the logic circuits) sizes at 90nm and the Mbits that they can hold in mm²(in um² only bits are specified) , then use the simple "rule of three" math and you will not even obtain something near to 24Mbytes employing 1T-SRAM-Q as the macro and the largest chip die on Hollywood, which measures 94.5mm²; suggesting by this that Wii must be using something cooler than 1T-SRAM-Q.

So for those of you who still believe all what [Matt Casamassina](#) and Maxconsole say about the Wii system, I suggest you find your own answers through the official documentation and the links provided here; there's only one topic in which these guys could be right and that's the clock speed of the GPU, the CPU and the eDRAM memory speed, that's if the speeds provided by them were measured using an special device for this purpose, and of course that if neither the CPU nor the GPU can be over clocked, since their info is based on the early SDK from Nintendo that were distributed when not even the Hollywood chip was finished by then, neither in the E32006 nor in June 2006 when Mosys and NEC announced their agreement with Nintendo.



Wii has either 41MB of eDRAM or 53.7MB depending on which of the two dies inside the Hollywood is the eDRAM and which is the Graphics Chip SoC; my guess is that 'vegas' chip of 72mm² is the eDRAM and that 'napa' that measures 94.5mm² is the Graphics Chip SoC. The claim that Wii only has 24MB is based on rumors or maybe early development kits, and I am sure that even the latest development kits won't show you the Nintendo Wii real credentials like the Wii SDK 2.1, which shows double amount of main memory instead of 64MB so that Wii true under wares are not exposed. But the numbers I have given are based not only in the fact that Wii uses UX6D macro from NEC as eDRAM, but also in simple calculations done with the rule of three using data provided by NEC about the UX6D memory and power consumption on their homepage. Just for introduction, the NEC UX6D macro has 3 platforms, CB-90L destined for handhelds mainly and which speed can go up to 200MHz, the CB-90M destined for electronics and performance and can go up to 366mhz consuming 1.8nw per gate, and the CB-90H which seems to be like the last one but consumes 2.6nw per gate and can run at higher frequencies than the CB-90M, not to mention that is main market are servers.

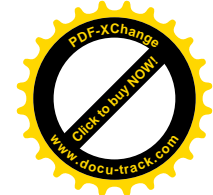
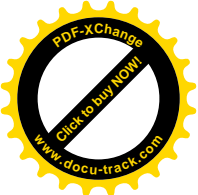
Wii Hollywood's Graphics chip is a GPGPU and not a conventional GPU and this can be deduced easily by just looking at the redistribution of the hardware component like GDDR3 of main RAM instead of 1T-SRAM technology as the GameCube did, the so unpowered CPU of the Wii, the so narrow bandwidth among the Hollywood, the Broadway and main RAM, as well as the latency problems from this last one.

The reported power consumption of the Wii is 53 watts at best and not only 19 watts as reported, since those reports are based using games that do not even consume a half of the energy that the Wii power supply can provide(53 watts) and even using GameCube ports like Zelda Twilight Princess.

The Nintendo Wii is like a notebook destined for gaming.

Wii developers and studios are the ones to blame as Factor 5 had stated before, since they have no intention into squeezing the Wii system since that would force them into learning new stuff like special programming for GPGPU, which differs a little from normal GPU, and since Microsoft and Sony's console systems follow the same path in the past consoles did in order into bringing up nice graphics, adding more horse power mainly in the CPU department and the main RAM , as well as the bandwidth, to keep up with the GPU requirements, they prefer to choose the easy path and develop in an Integrated Graphics environment instead of the Dedicated Graphics Environment offered in the Wii thus saving time development. On the other hand, maybe developer and studios are lazier than we thought and even ignore what the Wii really is, and even not taking into account that the use basic development kits, those that Nintendo gave up for free before the E3 and the Nintendo Wii system was finalized.

Wii games will never catch up Ps3 and '360 games if they are developed the same way as this last one, since Wii true power relies in almost only the



Hollywood Graphics instead of the whole system as stated by their displacement mapping patents. So, the only way for a Wii game to compete against a '360 or PS3 games in graphics is by forcing the studios and developers into learning how the TEV system works, as well as learn how to do Graphics using GPGPU techniques (there a good collections of books on this topic for this purpose).

Wii GPGPU is based on either an ATI Radeon or Mobility Radeon video card of the x1000 family; and since the Hollywood wasn't finished even in June of 2006 when the interview with Mosys and NEC took place, is very likely that it's performance can be comparable to an early ATI Mobility Radeon x1900 with less clock speed, pipelines and execution threads. The last claim can be proved by looking at games that support HDR like Metroid Prime 3 and even HDR + antialiasing like Monster Hunter 3, Gladiator, The Grinder, etc.

Wii can do 720p and even 1080p with its high amount of eDRAM, not taking into account the eDRAM cache included in the GPGPU Soc, but since developers have not yet understand the Wii system, that won't happen in the short term and I really doubt Nintendo to go up to 1080p, maybe 720p but not the latest resolution, and let's not forget that Nintendo has voiced through its president that they don't see the need into supporting high definition resolution on Nintendo Wii seems most their customers do not care. So if you want at least 720p, start claiming or do something that would change the mind of the game industry at the grade that no online games are allowed if they do not support 720p at least(jajaja, this in such an aggressive move isn't).

Wii employs MEMS technology and for achieving the game play offered by the Wii remotes at low cost between \$5 to \$10 dollar for a single chip per Wii mote.- [\[http://www.memsnet.org/mems/applications.html\]](http://www.memsnet.org/mems/applications.html). The Nintendo Wii also includes 2 Broadcom's blue tooth chip to allow the communication between the console and the wireless Wii remote:

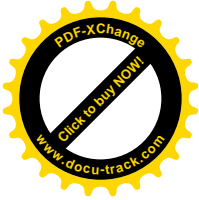
<http://www.broadcom.com/press/release.php?id=854744>

Nintendo announces MEMS technology for Wii:

[\[http://www.edn.com/article/CA6333419.html\]](http://www.edn.com/article/CA6333419.html)

Even if the new Graphics Chip of the Nintendo Wii might include a DSP, I really doubt it to be huge since Wii doesn't support more than Dolby Prologic II, and even if it did support Dolby Digital, I really doubt that would make a lot difference in the Sound Processor size, and let's not forget that even the integrated DSP of GameCube's Flipper did not even occupy the 1/30 space of the Flipper's die.- [\[http://www.seagatech.com/gamecube/overview/\]](http://www.seagatech.com/gamecube/overview/)

And is my guess, since GameCube used only 16MB of normal DRAM for sound purposes, that the DSP inside the Hollywood doesn't use 1T-SRAM, most probably uses the auxiliary GDDR3 RAM, since there are 64MB available and the bandwidth and the speed of this RAM surpasses a lot what the 16MB of DRAM offered in GameCube. Plus, since Nintendo Wii is taking into account the GameCube design, they surely will not use eDRAM memory for sound, this would be not just a waste, but also dumbness; then again, since the eDRAM is



ultra fast, maybe with only 1MB will do, jajajaj, and I am not taking into account new audio compression technologies like mp4; sorry for reminding those who use Wii for hearing music and cannot longer here MP3 since Nintendo wants all of us to use MP4.

As for the Samsung Elpida S1616AGTA SDRAM, I am not sure of its purpose, but from what I have read so far, it is possible that is used for the Wii DVD drive according to the next article coming from Samsung:

<http://www.elpida.com/pdfs/pr/2005-02-15e.pdf>

Ok enough of Introductions, let's begin with the technical part of this document (the rest of the document centers in the Hollywood GPGPU architecture and the memory provided by NEC(UX6D); I won't get into any more details about the MEMS technology and the sound processor:

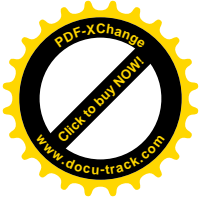
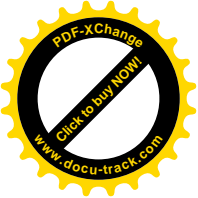
First of all let's talk about Hollywood (which is supposed to be a GPU but might be in reality a GPGPU). I went through wiibrew to learn about the wii hardware and saw the images as well the documentation you have about it. What caught my was the tow dies that you have named 'vegas' (graphics drawing circuit) which measures $9 \times 8 \text{ mm} = 72 \text{ mm}^2$, and 'napa' (the high speed DRAM of mossy's) measuring $13.5 \times 7 \text{ mm} = 94.5 \text{ mm}^2$. With this information I started exploring how to get the available memory in 'napa'; first thing I did is tried to see which type of 1T-SRAM and discovered that the implemented technology is MIM2 structure from NEC at Yamagata factory, it is not necessary to use reverse engineering to prove this because if you go through the next links everything will be clear.

IGN report on wii: <http://gear.ign.com/articles/713/713254p1.html>

According to the article, Nintendo had selected NEC Electronics to provide 90-nanometer CMOS-compatible embedded DRAM technology for the forthcoming Wii console(June 2006). The new LSI chips with eDRAM will be manufactured on NEC's 300-millimeter production line at Yamagata. While no clock speeds or really juicy info was included in the release, the news does bring up a variety of interesting points.

There are also other interesting points here: like the mention of MIM2 structure on EDRAM implementations(since third quarter of 2005) and the revelation that NEC selected MoSys as the DRAM macro design partner for the "Wii devices," due to the fact that MoSys is quite familiar with implementing 1T-SRAM macros on NEC's eDRAM process. Now, NEC said 1T-SRAM macro from Mosys right, but by this is not stating the use of the first generation 1T-SRAM technology, if we want to confirm which one is using we just have to either call Mosys or go through its homepage and find it ourselves. I have already done this last option to save you effort.

Mosys:<http://www.mosys.com/Products/1T-SRAM-Available-Macros.aspx>



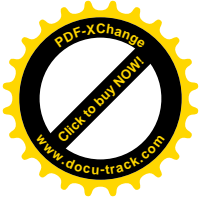
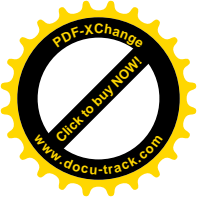
Easy isn't it, here we see that each shrinking technology has its own set list of the available macros, their cell type, etc. Now go to the very end of the table, which kind of macros do you see at 90nm, you can see only 3 and all of them are of MIM cell type, not even the so well known Q-cell(from 1T-SRAM-Q) is mentioned. As you can see Q-cell is only available for macros designed at 130nm; so why their quad density technology, which requires almost 50% less space than the Planar(1T-SRAM and 1T-SRAM-R technologies) and almost 50% less expensive is not available at 90nm, could it be that it has become obsolete and MIM is even better?. Well, for my surprise I found this articles in which Taiwan Semiconductor Manufacturing Company is involved.

TSMC (the manufacturer) produces 1T-MIM since 3rd quarter of 2005:
[\[http://www.tsmc.com/download/english/a05_literature/Emb_HDM.pdf\]](http://www.tsmc.com/download/english/a05_literature/Emb_HDM.pdf)
[\[http://www.tsmc.com/download/english/a05_literature/90nm_Brochure.pdf\]](http://www.tsmc.com/download/english/a05_literature/90nm_Brochure.pdf)

We can learn 3 things from these articles, 1T-MIM IP is better than 1T-Q by requiring almost 50% less size against this one and that the densities vary from 0.21um² to 0.23um² per bit cell(meaning that capacity is measured in bits/um²) and that this 1T-MIM is a 1TQ(1T-Q) IP with lees masks thanks to MIM(Metal Insulator Metal architecture). With all this in mind, I figured out that NEC and TSMC have their own implementation of MIM over 1T-Q(1TQ).

***** Wii memory type *****

With all the above information 1 thing is clear, wii uses 1T-SRAM-Q using not FAC(Folded Area Capacitor for reducing area) but MIM2 from NEC(macro size for this is similar to that of TSMC, you will confirm this later). There is no point into doubting this since MIM2 technology was available since the 3rd quarter of 2005, and the agreement among Nintendo,Mosys and NEC happened in second quarter of 2006, and if you still doubt, there is no standard 1T-SRAM(nor 1T-SRAM neither 1T-SRAM-R) at 90nm process as you saw in the Mosys page in the section of available macros. It's true that the only foundry motioned in their page is TSMC, but since NEC and TSMC have their own MIM technology, and that TSMC doesn't support other types of 1T-SRAM that are not 1T-MIM(as can be seen in the TSMC links provided) due to cost effective production(most probably and the fact that 1T-SRAM planar has become obsolete not only because of it uses more materials in construction, but also because it takes more process steps to produce), NEC certainly will be following the same route. Then again, if you all think that Nintendo is stingy, the only way you will be right is by accepting the fact that they are using 1T-SRAM-Q with MIM-2 capacitor, and even if you change your mind, there's no way Wii uses the same 1T-SRAM technology that Gamecube used, since it's obsolete, not cost effective and not even supported at 90nm manufacturing process. NEC obviously have their own design based on Mosys macro designs at 90nm(as reported by IGN), the macro that they are using on Wii is obviously UX6D(this is covered below).



Well then, with the above information is clear that Nintendo is using MIM2 over the latest 1T-SRAM technology available at 90nm, but what about the possible densities and speed of the eDRAM provided by NEC. If we check again the IGN article we will see a tiny image with the title 'NEC's roadmap towards 55nm eDRAM', in which we can see the macro releases with their respective year and shrinking technology. UX6D is mentioned through 2004 and 2006 with 0.22um² and made at 90nm; as might have guessed, our next step consists in making our way through NEC Electronics homepage can find the UXD6 macro.

NEC Electronics MIM2:

1.- In the first article we can view the Key Technologies for eDRAM Cells table of NEC :

[\[http://www.eu.necel.com/process/edramprocess.html\]](http://www.eu.necel.com/process/edramprocess.html)

2.- NEC's UX6D macro:

[\[http://www.necel.com/process/en/edramoptions.html\]](http://www.necel.com/process/en/edramoptions.html)

3.- NEC's Cell based libraries of the CB-90 platform

[\[http://www.necelam.com/asics/cb90.html\]](http://www.necelam.com/asics/cb90.html)

[\[http://www.eu.necel.com/pdf/A17023EE9V0PF00.PDF\]](http://www.eu.necel.com/pdf/A17023EE9V0PF00.PDF)

[\[http://www.necel.com/process/en/edram.html\]](http://www.necel.com/process/en/edram.html)

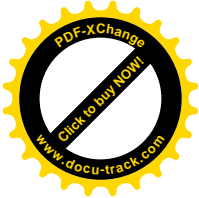
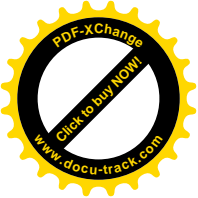
Before we continue I most mention where I cover the Wii Hollywood architecture:

4.- Wii GPU Soc, either 'vegas' or 'napa' is in reality a GPGPU based on the ATI, either Radeon or Mobility, x1000 family.

1.- In the first article we can view the Key Technologies for eDRAM Cells table, and we can see that only UX6D(CB-90)is mentioned at 90nm with 1Mb in 0.22mm²(this size includes the overhead) which is the same as saying that a macro has 1 bit per 0.22um².

Here you can check 1T-SRAM previous technologies: [\[http://en.wikipedia.org/wiki/1T-SRAM\]](http://en.wikipedia.org/wiki/1T-SRAM). You may be wondering way there are two sizes like: 1T-SRAM-Q bit cell 0.28mm² and 1T-SRAM-Q 0.55mm² with overhead and also that if both can hold 1Mbit. I found the answer in this other article from a conference that mosys did to talk about the evolution of their macro designs:

[\[http://www.bjic.org.cn/01zttq/2003wdz/forum/Mark-Eric%20Jones_PPT.ppt\]](http://www.bjic.org.cn/01zttq/2003wdz/forum/Mark-Eric%20Jones_PPT.ppt)



As you can see, the bit cell must be referring to just the capacitor size(since it only mentions it's dimensions) and the macro size must be the whole circuit(due that it mentions it's dimensions and the Mbits in the format Xmm2/Mb); but well, this should have been clear in the IGN link report. In the table with the macro release list starting from 2002 to 2007.

**** wii macro memory revealed *****

UX6D is a macro based on 1T-SRAM-Q at 90nm and by replacing the FAC for NEC's MIM2 technology. Since the only kind of eDRAM available at 90nm is UX6D and uses MIM-2(dielectric material is ZrO2) and not MIM(dielectric material is Ta2O5) from its previous generation at 130nm; what IGN reported it's true, even if they don't mention the use of UX6D as macro design on the wii explicitly(they rather preferred to expose it in the Nec's macro release table available in their report).

Don't forget to read the Material Advantages section in the link, since I have not figure out yet what they mean by "ZrO2's high dielectric constant"(does this mean that it has almost no refreshing compared to normal SRAM?).

So if both NEC and TSMC use their own technology of MIM structure, and as you saw in the previous articles that 1T-MIM is a derivate of 1TQ macro(0.55mm2/Mbit) measuring between 0.21mm2/Mbit to 0.23mm2/Mb, then UX6D at 0.22mm2 is the full macro that can contain 1Mb; of course that this may change a little depending on which of the three types of CB-90(for in the UX6D context) is being used and the MHz; but my guess, according to what I have read so far, is that the die size is almost constant and the only things that change are the MHz and the power consumption, more MHz means more power consumption, and less MHz means less power consumption on the die.

*****Wii NEC macro memory*****

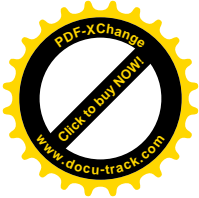
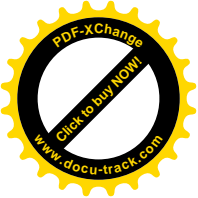
Wii uses UX6D technology available in the CB-90 platform.

Well before continuing, based on this let's see how much memory the 'napa' die(94.5mm2) has:

$$0.22 \text{ mm}^2 \text{ for } 1\text{Mb then } 1\text{mm}^2 \text{ has } 1/0.22 \quad 1\text{mm}^2 = 4.5454\text{Mb}$$

$$94.5\text{mm}^2 = 429.54\text{Mb} \quad 94.5\text{mm}^2 = 42.54\text{Mb}/8 \quad 94.5\text{mm}^2 = 53.69 \text{ Megabytes}$$

Then again, there are doubts about what is the Hollywood chip that NEC produces ('vegas' or 'napa') since there were reports (maybe speculations, not sure) suggesting the possibility that NEC only made one of the two chips('vegas' or 'napa') and that other manufacturer, most possibly TSMC due that they also offer MIM technology and also produce macros for Mosys(as can be seen in the available macros link from Mosys homepage)



[\http://www.eetasia.com/ART_8800416636_499495_NT_d5864bc5.HTM

]

I must admit that even I consider the possibility that NEC made one of the chips and TSMC the other, since it seems TSMC offers better cost-effective production. I also have my doubts of which of the two dies in the Hollywood is the EDRAM and which other is the GPU SoC. For me it would be more ideal if 'napa' was the GPU SoC and 'vegas' the UX6D eDRAM due to their respective area sizes and the claim from Maxconsole that the eDRAM runs at 486mhz, which is like suggesting that the UX6D eDRAM is based on the CB-90H(which consumes more power than the CB-90M), but do not confuse, I am not saying that everything that Maxconsole says is true, but if the speed was really measured with a special device, then maybe we should consider the possibility that we are misunderstanding the identity of the GPU Soc and eDRAM inside the Hollywood(you will soon find out that if napa(the supposed eDRAM measuring 94.5mm²) runs at 486mhz then it should be the GPU since if it was the eDRAM it would be an UX6D of CB-90H type, which produces a lot of heat compared to the CB-90M; then again, maybe there was a misunderstanding and 'vegas' (72mm²) was meant as the eDRAM and napa(92mm²) the GPU SoC, so even using CB-90H, the power consumption of the eDRAM+power consumption of the rest of the system hardware would not surpass the 53 watts that Wii can use(check the power adapter supply of the Wii and you will confirm that Wii can only consume 53 watts).

$$1\text{mm}^2 = 4.5454\text{Mbits} \quad \text{then} \quad 72\text{mm}^2 = 40.9086\text{MB}$$

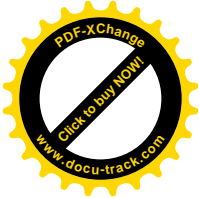
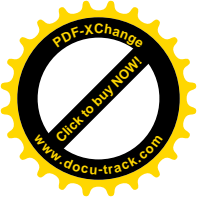
From what I have read so far in NEC's page and in particular.- [\[http://www.necel.com/process/en/edram.html\]](http://www.necel.com/process/en/edram.html). I have deduced that the area size of an UX6D macro doesn't change(0.22mm²/Mbit), but the MHz and power consumption are dependant one from the other. In here is also mentioned that the access speed starts at 250Mhz(most probably high speed performance category since in the third link from NEC CB-90L can go up to 200Mhz) at 0.9v in the worst case with initial latency of 1ns.

Ok, we all know that many sources claim that Wii uses standard 1T-SRAM macro at 90nm, either 1T-SRAM or 1T-SRAM-R, but that's impossible since their sizes at 90nm are way too big to fit either the 'vegas' or 'napa' die; if you through Wikipedia.- [\[http://en.wikipedia.org/wiki/1T-SRAM\]](http://en.wikipedia.org/wiki/1T-SRAM) you will confirm that an 1T-SRAM macro (the one with overhead) at 90nm can hold 1.1Mbits per mm², so:

$$\text{If } 1.1\text{mm}^2 = 1\text{Mbit} \quad \text{then} \quad 94.5\text{mm}^2 = 85.909090\text{Mbits}(\text{Mb})$$

$$\text{In Megabytes: } 85.909090\text{Mbits}/8\text{bits} = 10.74\text{Megabytes}(\text{MB})$$

As you can clearly see, even taking the largest die 'napa' as the eDRAM doesn't even give us the supposed 24MB of eDRAM of total memory of the system, which suggest that this info provided by Max Console in the Topic 'We know a lot you don't ' is nothing more than a fake. Even with 1T-SRAM-Q macro (with overhead) would give you an inferior result:



1T-SRAM-Q macro can hold 1Mbit per 0.55mm², so at 94.5mm² we would get:
21.477MB < 24MB

Which means that Wii is using a technology that surpasses the 1T-SRAM-Q limits, like NEC's UX6D macro (1T-SRAM-Q using MIM2 technology instead of FAC) that can hold 1Mbit per 0.22mm² or TSMC 1-TMIM macro which can hold 1Mbit between 0.21mm² to 0.23mm²(the specific size depends on the purpose of the macro like high density or high performance).

As you saw earlier, NEC technology using the latest 1T-SRAM macros from Mosys on their MIM2 process makes the macros (known as UX6D) small enough that even using the 'vegas' die of the Hollywood, which has 72mm², will give us almost 41Mbytes of eDRAM, something that not even the 1T-SRAM-Q can do with 94.5mm².

You are still doubting, not to worry, just read this and even an skeptical person will no doubt that all what I have said until now is fact.:
[\[http://www.necel.com/magazine/en/vol_0039/vol_0039.pdf\]](http://www.necel.com/magazine/en/vol_0039/vol_0039.pdf)

Once you read it you find out that the article is like suggesting what 'vegas'(the supposed GPU Soc inside Hollywood) could have, but it uses as an example the flipper of the GameCube, it also suggests that it had 24Mbits, but that today's UX6D could easily replace the half die of the Flipper with 256Mbits(32MB). Flipper's die was about 110mm², so in 55mm² you can store 32MB.

Remember that UX6D is 0.22mm² for 1Mb. Then let's do the next:

$$1/0.22 = 4.545454\text{Mb in } 1\text{mm}^2 \quad 4.545454/8 = 0.5681\text{MB/mm}^2$$

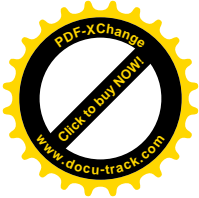
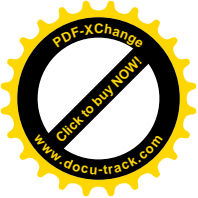
$$1\text{mm}^2/x = 32\text{MB}/55\text{mm}^2 = 0.58181\text{MB/mm}^2$$

So isn't 0.58181MB/mm² = 0.5681MB/mm² approximately. And We are suggesting 110mm² die for flipper, but if in reality was 112mm², that would give us more approximation.

But well, I hardly doubt Nintendo would put that much memory inside the GPU, probably just 6MB occupying 10.5615 mm² of the die for 'vegas' of course. Although, if the GPGPU SoC results to be 'napa' then maybe the amount of cache could go up to 10Mbytes in 17.6mm².

Now then, which speed would be convenient for the 'napa'(the supposed eDRAM)?
To solve this question I used as an example the eDRAM of the Xbox 360(which is a NEC's UX6 10MB in 70mm²). The eDRAM has a speed of 300Mhz and the GPU clock is of 500Mhz.

Xbox 360 hardware specs:



[<http://amdvsintel.com/article/65-nm-gpus-for-xbox-360-in-production-xbox-540-coming-in-2009-68195.html>]

NEC confirms agreement with Microsoft into making the eDRAM:

[<http://news.teamxbox.com/xbox/8126/Xbox-360-Embedded-DRAM-Spec-Confirmed/>]

Xbox 360 eDRAM speed 300mhz:

[<http://www.gamersindia.com/2008/02/05/take-your-pick-is-it-the-xbox-360-or-the-playstation-3-for-you/>]

Xbox 360 uses NEC UX6(not the same as UX6D used on Wii) technology for the eDRAM:

[<http://www.eetimes.com/news/latest/showArticle.jhtml?articleID=161600192>]

So considering that the Hollywood GPU(GPGPU explained later) runs at 243Mhz(maybe 300MHZ with over clocking not sure if possible but if it is then this speed would be the most adequate to me), if we were using the same type of memory like the Xbox 360 eDRAM(UX6), we would need something between 200 and 250Mhz(of course I am basing this in what they did in the Xbox 360 design) for good performance, but since we are using UX6D(4ns latency), we need to consider the latency(even if low) and I would go for between 250Mhz and 320Mhz(if it runs at 300Mhz).

Emulation hardware for Gamecube and Boot mode on GameCube.-

[http://www.isplash.de/koteshi/gcn/GCN_Newsletter4.PDF]

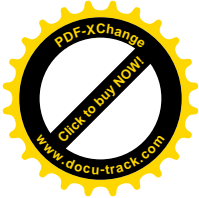
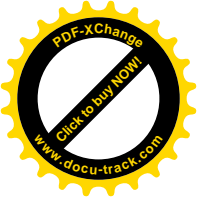
Before I continue, I must say that I consider 54MB a little too much, since we are talking about the beta eDRAM around and that Wii may support the latest generation available of S3TC compression technology, for me 40MB of eDRAM is enough, considering that Xbox 360 only has 10MB of eDRAM and the rest is GDDR3 for main RAM. With this I am suggesting that 'vegas' might be in reality the eDRAM and 'napa' the GPU Soc, of course that I am not sure, but that's the approach I would have taken if I were Nintendo.

*****Facts covered by now*****

We have covered two facts by now: Wii Hollywood has more eDRAM than 24MB and that it most likely be an UX6D of the CB-90M rather than a CB-90H due to the low power consumption of this first one.

2.- This one has has a small introduction to the UXD6 macro, its platform(CB-90) and its available eDRAM options. Please do not confuse the part where Mosys says that A 15 x 15mm die can incorporate as much as 256 Mb as an example for UX6D, since this is referring to UX6 and later then talks about the improvement using MIM2. Do not forget that is 0.22mm²/Mbit and also what we read in- [http://www.necel.com/magazine/en/vol_0039/vol_0039.pdf]

3.- Our third article shows us the in cell based libraries the CB-90 platform. There are three types: CB-90L, CB-90M and CB-90H; from these options I think



that CB-90M was Nintendo's choice since CB-90L is mostly applied for mobile battery-powered applications and CB-90H consumes 2.6 nW/MHz/gate compared to 1.8 nW/MHz/gate. But since both CB-90M and CB-90H are destined for high performance, any of them could have been purchased by Nintendo depending on the Wii eDRAM speed and low power requirements.

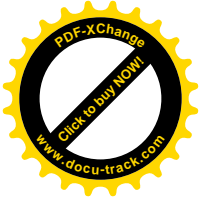
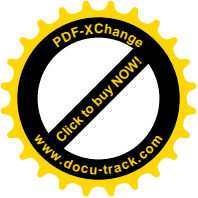
Here you can see a table specifying the features of CB-90M and CB-90H: [<http://www.eu.necel.com/pdf/A17023EE9V0PF00.PDF>] and here we can see some interesting points like cB-90M has 404K useable gates/mm2: [<http://www.necelam.com/asics/cb90.html>]

With this information and what.- [<http://www.necelam.com/asics/cb90.html>] has to say "Cost Efficient CB-90M: With its high density (404K usable gates/mm2) and efficient use of die area, the CB-90M library offers key advantages for cost-sensitive products such as digital consumer electronics", I am almost sure that Wii uses the CB-90M option, since is cost effective and I really doubt Nintendo would need frequencies higher than 320Mhz due to the low latency chips and considering that the GPU(GPPU explained later) may be running at 243mhz(most likely 300mhz if there is over clocking option or 486mhz as stated by Maxconsole if the GPU SoC was the 'napa' die),.I do not consider the CB-90L since it doesn't seem destined for high performance, it's market are the portable devices like cell phones and they run under 200mhz, when the 1T-SRAM for Gamecube had a speed approximately of 324MHz, even considering the latency improvement, the CB90L would be not only a bad choice, but also maybe unavailable since NEC would tell the Nintendo hardware designers of the poor performance of this one, and since Nintendo's goal is performance, well, you get it .

Note: I am taking into account only the MHz speeds of the GPU, CPU and the eDRAM claimed by Maxconsole since it seems that these one can be measured by special devices, then again this depends in if the source is based in this measurements or just speculations; for now I will consider them as options, but what respects to the eDRAM memory, the GPU technology and other related info are no other thing than fake, just by logic even a teenager of only 18 years could conclude this by only reading the Wii specs vs. GameCube specs and the fact that the sizes(except for the GPU) are similar and Wii is done at 90nm and GameCube at 180nm, making the possibility of reducing the GameCube hardware at almost 4x and for lees cost production; do not forget that the Wii eDRAM memory type has been proven to be UX6D not just justified by official info coming from NEC and Mosis(Mosis doesn't support either standard 1T-SRAM macro nor 1TSRAM-Q at 90nm and further), but also by simple math done following NEC's information on the UX6D macro(MIM2 technology), and let's not forget that the results obtained were so closed and logical to be ignored.

[<http://www.xbox.com/es-MX/support/getstarted/manual/xbox360/xbox360estec.htm>]

vegas = 72mm2 napa= 94.5mm2



I did the calculations based on this and the provided information in [<http://www.eu.necel.com/pdf/A17023EE9V0PF00.PDF>] and ended with:

Let's start with 'napa' being the supposed eDRAM

Employing CB-90M

$(404K \times 94.5mm^2)/1000 = 38.178M$ gates; which is less than the 100M gates limit.

$$1.8(1000^{(-3)}) * 250mhz * 38.178M \text{ gates} = 17.18 \text{ watts}$$

$$1.8(1000^{(-3)}) * 300mhz * 38.178M \text{ gates} = 20.61 \text{ watts}$$

$$1.8(1000^{(-3)}) * 366mhz * 38.178M \text{ gates} = 25.1442 \text{ watts}$$

So for every 50Mhz there's an increment of power consumption of 3.43 watts for the CB-90M with 38.178M gates. Of course this is by considering the possibility that the eDRAM was made with the maximum gates it can have per mm². The only thing we know about CB-90H is that consumes 2.6 nw/MHz/gate (more than CB-90M) and that is destined to applications that require a lot high end computing and for broadband communications, I really don't see the need for it, but then again I could be wrong and since NEC doesn't provide the maximum number of gates per mm² (I have tried to find the info everywhere but with no luck) I cannot make clear deductions, but if we suppose it can hold as much as the CB-90M does, then:

Employing CB-90H

$(404K \times 94.5mm^2)/1000 = 38.178M$ gates; which is less than the 100M gates limit.

$$2.6(1000^{(-3)}) * 250mhz * 38.178M \text{ gates} = 24.816 \text{ watts}$$

$$2.6(1000^{(-3)}) * 300mhz * 38.178M \text{ gates} = 29.77884 \text{ watts}$$

$$2.6(1000^{(-3)}) * 300mhz * 38.178M \text{ gates} = 29.77884 \text{ watts}$$

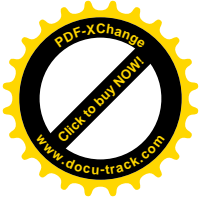
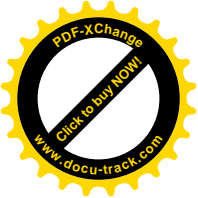
$$2.6(1000^{(-3)}) * 366mhz * 38.178M \text{ gates} = 36.33018 \text{ watts}$$

According to Maxconsole, eDRAM speed of 486MHz

$$2.6(1000^{(-3)}) * 486mhz * 38.178M \text{ gates} = 48.242 \text{ watts}$$

Now let's make the assumption that 'vegas' would be the eDRAM:

Employing CB-90M



$(404K \times 72mm^2)/1000 = 29.1M$ gates; which is less than the 100M gates limit.

$$1.8(1000^{(-3)}) * 250mhz * 29.1M \text{ gates} = 13.1 \text{ watts}$$

$$1.8(1000^{(-3)}) * 300mhz * 29.1M \text{ gates} = 15.714 \text{ watts}$$

$$1.8(1000^{(-3)}) * 366mhz * 29.1M \text{ gates} = 19.17108 \text{ watts}$$

Employing CB-90H

$(404K \times 72mm^2)/1000 = 29.1M$ gates; which is less than the 100M gates limit.

$$2.6(1000^{(-3)}) * 250mhz * 29.1M \text{ gates} = 18.915 \text{ watts}$$

$$2.6(1000^{(-3)}) * 300mhz * 29.1M \text{ gates} = 22.7 \text{ watts}$$

$$2.6(1000^{(-3)}) * 300mhz * 29.1M \text{ gates} = 27.7 \text{ watts}$$

According to Maxconsole, eDRAM speed of 486MHz

$$2.6(1000^{(-3)}) * 486mhz * 29.1M \text{ gates} = 36.77 \text{ watts}$$

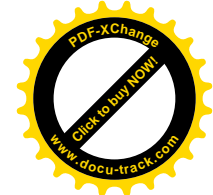
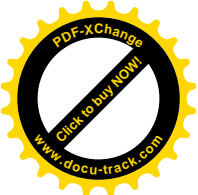
The overall results make the CB-90H choice pretty unlikely, meaning that the eDRAM should be CB-90M type and thus suggesting that the speed cannot be beyond 366Mhz. I am basing this assumption considering the fact that Gamecube consumed something around 39 watts(don't know the game in which the info is based but I doubt the possibility of being one of the best in the graphical department as Resident Evil 4) and 53 watts and that Wii is following a similar approach(just look at the AC adapter details). Now then, since Nintendo Wii looks to resemble a laptop, we should also consider that laptops are supposed to consume a maximum between 45 and 50 watts, but if you want to see proof than you should check the next links.

Gamecube power consumption: [<http://www.estarland.com/product29320.html>]

Laptops qualified by Energy Star.-

[http://www.eu-energystar.org/downloads/database_archive/db_laptop_archive_obsolete_2006-2007end.pdf]

Of course that if 'vegas' of 72mm² was the eDRAM, then even using CB-90H at 486Mhz, the power consumption would be only of 36.77 watts, leaving enough room of power consumption for the rest of the system since there would still be 16.23 watts free(Wii Broadway and the 64MB of GDDR3 consume almost nothing).



So, considering Energy Star as a norm and that the maximum power consumption of the Wii would be 48.242+GPU+CPU+GDDR3+Nand Flash+wifi+... watts(while playing online) , which obviously surpasses the 53 watts that the AC adapter provides, of course this is considering 'napa' as the eDRAM, but if the eDRAM was 'vegas' then power consumption would be 36.77+GPU+CPU+GDDR3+Nand Flash+wifi+... <53 watts since the CPU is based on a ppc 750CL, which consumes 2.7 watts at 600mhz, 5.6 watts at 900mhz and 9.6 watts at 1ghz and since the Broadway on Wii runs at 729mhz, I can't imagine it consuming more than 3.5 watts (not taking into account that since it is an optimized 750CL, maybe power consumption might be even lower at the point that over clocking at 900mhz would require less than 5 watts), since wifi might require something like 8.3 watts since wii standby+wifi requires 9.6 watts and standby alone just consumes 1.3 watts, and the Wii for the DVD drive, since Nintendo's goal is low power consumption, my guess it will consume no more than 3 watts, I have included links with proves:

PPC 750cL:

[http://es.wikipedia.org/wiki/PowerPC_G3]

[[https://www-01.ibm.com/chips/techlib/techlib.nsf/techdocs/38356BF4A2CE57F68725720400632685/\\$file/Power_Architecture_Sept2007.pdf](https://www-01.ibm.com/chips/techlib/techlib.nsf/techdocs/38356BF4A2CE57F68725720400632685/$file/Power_Architecture_Sept2007.pdf)]

Wiiconnect24:

[<http://en.wikipedia.org/wiki/WiiConnect24>]

GDDR3 and a DDR2 module of 2GB and 800mhz using less than 1.6 watts:

[<http://en.wikipedia.org/wiki/GDDR3>]
[http://www.valueram.com/datasheets/KHX8500D2_2G.pdf]

Couldn't get into my hands any details regarding GDDR3 latency problems, but since it is based in DDR2, I borrowed the next links so that you can make approximate comparison.

[http://www.xbitlabs.com/articles/memory/display/core2duo-memory-guide_4.html]

[<http://ixbtlabs.com/articles2/mainboard/ddr2-800-am2.html>]

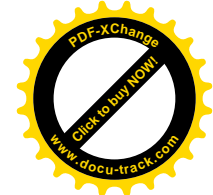
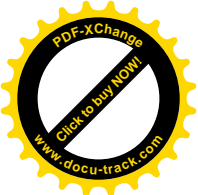
[http://www.tensilica.com/uploads/white_papers/SOC_Memory_Tensilica.pdf]

[<http://www.ece.umd.edu/class/enee759h.S2005/references/DRAM-Systems.pdf>]

[<http://www.hardwaresecrets.com/article/168>]

DVD drive power consumption(not the Wii DVD but an example of how much could it be consuming according to Nintendo's overall goal)

[<http://www.tomshardware.com/reviews/hardware-components,1685-15.html>]



ATI Radeon x1000 family power consumption (I will explain later why I took these cards as example in the GPGPU topic) :

1.-[<http://www.tomshardware.com/reviews/geforce-radeon-power,2122-6.html>]

2.-[<http://www.notebookcheck.net/ATI-Mobility-Radeon-X1600.2163.0.html>]

I couldn't find information details about the power consumption of the ATI Mobility Radeon x1000 family, but since the Radeon X1600 XT (256 MB GDDR3) consumes almost 43 watts my guess is that the mobility version should consume something around 15 and 20 watts taking into account the GDDR3 and maybe 13 to 18 watts without it; I couldn't find detail information about the power consumption, but I am basing this assumption taking into desktop ATI Radeons (not even Mobility) examples like Radeon X1950 GT (256 MB), which according to our first link in the ATI Radeon x1000 family consumes around 69.2 watts at full load (taking into account the 256MB of GDDR3 memory) and let's not forget that the ATI Hollywood wasn't ready neither at the E3 2006 event nor when NEC and Mosys announced their agreement with Nintendo (June 2006) and this card was launched on August 23, 2006; and since there's no information of when ATI Hollywood was finished for mass production, only that it had to be between June 2006 and some weeks before the launch of the Nintendo Wii, which was first in the United States on November 19, 2006; and since the ATI x1900 is an optimized x1800, specially in the power consumption department, then one of the GPU Soc of the ATI Mobility Radeon x1900 series could fit the Hollywood GPU SoC by reducing the speed, the number of texture units, the number of max threads, the pixel shaders (do not know the equivalent in Wii or GameCube TEV). More likely employ the ATI Mobility Radeon x1800 and improve just the power consumption like the x1900, they could also make use of strained silicon in the to improve performance like the x1700 did against the x1600 and without the need of sacrificing power consumption and also reduce the speed, the number of max threads and texture units also.

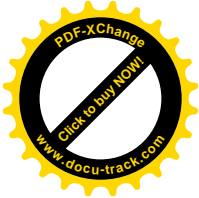
Just fist your eyes in this.-

ATI Radeon x1000 family, die size, texture units and other technical data:
[<http://techreport.com/articles.x/9310/1>]

ATI Radeon x1000 family idle power consumption and full load details:
[<http://www.tomshardware.com/reviews/geforce-radeon-power,2122-6.html>]

Remember, the above ATI cards are not Mobility versions

Since Nintendo took their time to finish Hollywood, my guess is that we cannot take an ATI Mobility Radeon (or Radeon) of the x1000 family as the base, my guess is that they tried to implement all of the good features of each of them, starting from the x1700 (better performance at less power consumption than x1600) to the x1900.



Why I think this way, simple. The ATI Radeon x1600 has 4 texture units and the x1800 has 16 of them, 512 max threads vs. 128 from x1600, 16 pixel shaders vs. 12, etc; both made with 90nm technology, but the x1600 occupies 132mm² and the x1800 263mm²; and since 'napa' or 'vegas' chips from the ATI Hollywood could be the GPGPU, the size for it would be either 72mm² or 94.5mm². Plus, we mustn't forget that the respective die sizes of both ATI Radeons (x1600 and x1800) may include the area occupied by the memory, which in these cards is has to be 256MB(GDDR3 or DDR2) or more. But well, as you may have noticed, the increase of features in the x1800 increased the die size, so by decreasing them(x1600 runs at 600mhz clock speed) we could make fit one of the two dies of Hollywood. But for being more specific, my guess is that Wii graphics chip may got a power between the ATI Mobility Radeon x1700 and the x1800; but the performance would be maybe near the x1900 thanks to changes in the type of memory that is used, and other tweaks like only adding the necessary number of texture units and pipelines.

Don't think that the more pipelines means necessarily better performance, since ATI has admitted it themselves in the next link:

[\[http://www.tomshardware.com/reviews/graphics-beginners-2,1292-5.html\]](http://www.tomshardware.com/reviews/graphics-beginners-2,1292-5.html)

So, why do I think that Wii has the power between an ATI Mobility Radeon x1700 and ATI Mobility Radeon x1800. That's easy, due that Wii Hollywood may have 8 pipelines with one texture unit in each of them according to High Voltage(could be more since this is what the engine allows but I don't see that necessary and if you read the last article you may agree too):

[\[http://wii.ign.com/articles/867/867498p2.html\]](http://wii.ign.com/articles/867/867498p2.html)

Ok, now here I have more specific data for the ATI Radeon x1600, Mobility x1600 and Mobility x1700:

Radeon x1600

[\[http://products.howstuffworks.com/ati-radeon-x1600-pro-256mb-graphics-card-review.htm\]](http://products.howstuffworks.com/ati-radeon-x1600-pro-256mb-graphics-card-review.htm)

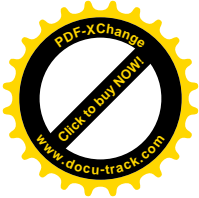
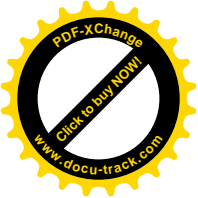
Mobility x1600

[\[http://www.notebookcheck.net/ATI-Mobility-Radeon-X1600.2163.0.html\]](http://www.notebookcheck.net/ATI-Mobility-Radeon-X1600.2163.0.html)

Mobility x1700:

[\[http://www.notebookcheck.net/ATI-Mobility-Radeon-X1700.2157.0.html\]](http://www.notebookcheck.net/ATI-Mobility-Radeon-X1700.2157.0.html)

As you can see, the x1600 Mobility Radeon It's like it's desktop counterpart but with 450mhz of max clock speed instead of the 500mhz core speed of the x1600 desktop version, and maybe one to another feature to make it fit in a medium size notebook. So we we do the same for Wii Hollywood but employing an an ATI Radeon x1700(I know that this one only has notebook version, but the difference between this and the Mobility Radeon x1600 is the



performance thanks to the strained silicon, so this can apply in a desktop version too) and reduce features like the clock speed (GPGPU of Wii runs at 243mhz or maybe 300mhz at best with over clocking) then the 132mm²(probably less since they don't specify if they take into account the space occupied by the memory of 256MB of GDDR3) could be reduced at a size that might fit the area of vegas or napa and even leave space for cache,

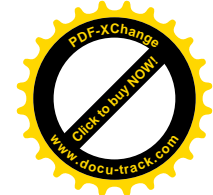
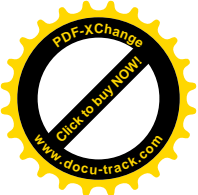
Let's not forget either napa or vegas can be eDRAM or the GPU, until now I haven't found concrete information of which of these dies is the GPGPU SoC. Team Twizers thinks that 'napa' is the supposed eDRAM (they think) and others that the 'vegas' is the eDRAM like:

[\[http://www.pcvconsole.com/features/consoles/wii/\]](http://www.pcvconsole.com/features/consoles/wii/)

I think that Team Twizers think the way they do since they consider that the eDRAM is composed of 1T-SRAM (they ignore the fact that is 1T-SRAM-Q done with MIM2 technology and known as UX6D) and not UX6D, but as we covered that topic before, it's impossible!, 1T-SRAM is not the latest 1T-SRAM technology implementation (as they stated in an interview about their memory technology to be used as well in GameCube; technology!, not macro!), is not cost effective compared to the last technology available only at 90nm and further (all other types of macro like 1T-SRAM-R and even 'Q' are discontinued in the line production according to their page of available macros) and occupies a lot of area compared to their macros with MIM technology.

Since if we consider vegas as the eDRAM that would give us almost 41MB of eDRAM instead of almost 54MB, but I consider that amount of memory more than enough, since obviously Nintendo has implemented S3TC compression technology as they did on GameCube, due that maybe without it, games that make use of it would be incompatible when you tried to play them in the Wii; allowing them to compress high quality textures at almost 6:1 ratio. That's a lot don't you think? So my guess is that 'napa' is the GPPU Soc. Maybe they also think that 'vegas' is the GPGPU Soc and 'napa' the eDRAM to show respect to the power level of this characters of DBZ (jajajaj!).

So, taking this approach, my guess is that also the GPGPU Soc of the Hollywood has at least 6MB (but no more than 10MB) as cache (twice of what GameCube had), why, to allow 720p (HD not full HD). Is true that I have no proof of this, is just what an idea, but I do not doubt for any second that Wii can do 720p, one thing is that they allow it and the other that it can; I think that sometime around (when developers truly start to understand the potential of Wii architecture, maybe a year from now) they will allow it. Nintendo never said that Wii can't do 720p, they just said that 480p would be their standard (standard!, not max!) and even not much time from now they were asked again about releasing a Wii version, and they said that if they see a need to implement HD on Wii (current Wii for those who do not know how to interpret lines) they will surely do it, but Nintendo customers don't seem interested right now. But that of course in the next generation HD will be a norm. So if you want HD on Wii, I suggest you start to pressure Nintendo, like no online support for games that



are not HD (jajaja!, this would be a devastating move in order to make them understand).

A page which suggests that napa is the GPU (of course that the rest of the info is fake and we have proved it with official info and calculations that give us results that approach a lot to reality to be ignored):

[<http://www.pcvconsole.com/features/consoles/wii/>]

So if napa is the GPGPU and has a 94.5mm² die, then by taking 11mm² we would have 6MB of UX6D macro, leaving us with 83.5mm², and if we take 18mm², we would have 10.22MB leaving 76.5mm² for the GPGPU.

Now, even if the Wii GPGPU SoC has not the same amount of number of pipelines as the ATI Radeon x1900 or the x1800, the number of pipelines not always determines the true power and performance that a video card can deliver according to ATI.

The pipeline myth: [<http://www.tomshardware.com/reviews/graphics-beginners-2,1292-5.html>]

ATI Radeon HD 4350 power consumption and speed

1.- [<http://www.sysopt.com/features/graphics/article.php/3778251>]

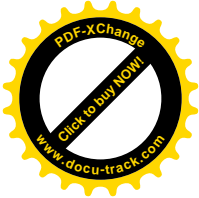
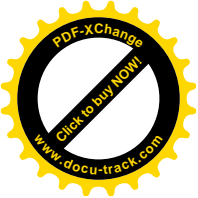
2.- [<http://au.shopping.com/xPF-AMD-Amaze-ATI-HD4350-512MB-GDDR2-Core-Clock-600MHz-Memory-Clock-800MHz-Dual-Link-DVI-HDCP-HDTV-HD>]

Since the ATI Mobility Radeon was made with low power consumption in mind, then it's approach should be close to the last example above, and since the Hollywood GPU die is most probably running between 243 and 300mhz, instead of 450mhz like the x1600 or 475mhz like the x1700 mobility versions(I will later explain why I used this video cards as examples), and using UX6D as eDRAM, which consumes more power than GDDR3 but has better latency performance and is less than 256MB(meaning that the whole eDRAM die in Hollywood a lot of more heat than the GDDR3 die in the ATI mobility Radeon x1600 or x1700).

So I think that the GPU could consume something like 10 to 13 watts running at 243 or 300mhz respectively. Since there are many ATI Mobility Radeon HD version that go so far and consume 12 to 15 watts running at very high speed clocks.

So the only option that doesn't fit is the CB-90H with the eDRAM being 'vegas', but the rest of the options are quiet possible.

CB-90H with 'vegas' as de EDRAM. 486mhz-



eDRAM(36.77watts)+GPU(10-12 watts)+GDDR3(1 watts) < 53watts but
+wiiconnect24 > 53 watts

CB-90H with 'vegas' as the eDRAM.300mhz-
eDRAM(22.7watts)+GPU(10-12 watts)+GDDR3(1 watts) < 53watts but
+wiiconnect24 < 53 watts

CB-90M with vegas as the eDRAM 486mhz-
eDRAM(25.4567 watts)+ GPU(10 watts)+GDDR3(1 watts) < 53watts and
+wiiconnect24(8.3 watts) < 53 watts

CB-90M with vegas as the eDRAM 300mhz-
eDRAM(15.714 watts)+ GPU(10 watts)+GDDR3(1 watts) < 53watts and
+wiiconnect24(8.3 watts) < 53 watts

Now napa:

CB-90H with napa as the eDRAM 486mhz
eDRAM(48.242 watts)+ GPU(10 watts)+GDDR3(1 watts) < 53watts
and + wiiconnect24 > 53watts

CB-90H with napa as the eDRAM 300mhz
eDRAM(29.77884 watts)+ GPU(10 watts)+GDDR3(1 watts) < 53watts
and + wiiconnect24 < 53watts

CB-90M with napa as the eDRAM 486mhz
eDRAM(33.40 watts)+ GPU(10 watts)+GDDR3(1 watts) < 53watts
and + wiiconnect24 < 53watts

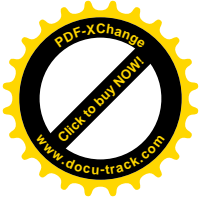
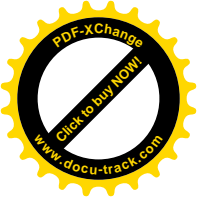
CB-90M with 'napa' as the eDRAM and running 300mhz.-
eDRAM(20.61 watts)+ GPU(10 watts)+GDDR3(1 watts) < 53watts
and + wiico61ect24 < 53watts then 243mhz fits too.

The 243mhz speed is valid in either CB-90H for 'vegas' being the eDRAM or CB-90M for either 'vegas' or 'napa' as the eDRAM.

We may not be sure of who of the tow dies in the Hollywood is the eDRAM and which is the GPU SoC, but I still believe that 'napa' is the GPU Soc and 'vegas' the eDRAM at 250 or 300mhz speed and CB-90M type due that I couldn't confirm the quantity of gates per mm2 for the CB-90H and we only made calculations assuming that CB-90H has the same number of gates per mm2 as the CB-90M does, and also considering that NEC states that the CB-90M is their cost effective option of the three versions(words that are like music for Nintendo).

DDR2 power consumption 4GB only 2 watts and die size of 64MB DDR2 is normally only 7.21mm2.-

[\[http://www.crucial.com/pdf/Crucial_energy_efficient_memory.pdf\]](http://www.crucial.com/pdf/Crucial_energy_efficient_memory.pdf)



[\[http://www.eetindia.co.in/ARTICLES/2005SEP/B/2005SEP01_STOR_TA.pdf?SOURCES=DOWNLOAD\]](http://www.eetindia.co.in/ARTICLES/2005SEP/B/2005SEP01_STOR_TA.pdf?SOURCES=DOWNLOAD)

Now you may say.-"With this you have just thrown down everything said earlier, since Wii only consumes between 16 and 19 watts on game". True and not, since this reports are based using games like Wii Sports and Zelda Twilight Princess(Gamecube port) which hardly stress the hardware, and let's not forget that the basic, yes basic development kits(given out for free by Nintendo) only use 24MB of the total eDRAM(approximately 53.69MB) and also take into account that Gamecube had 24MB of main ram plus only 3MB of embedded RAM, so if Wii has 53.69MB in the Hollywood die('napa') and has around 4ns latency in contrast to the 10ns from the previous installment, the bandwidth would be that high that I could state that with only 10MB of the 53.69MB are more than enough to do games like those; and this is not taking into account that the CPU and the GPU would be lazing around most of the time(and the fact that if the wii CPU is a modified ppc 750CL the power consumption would be 50% more efficient not 20% as IBM claimed long time ago, just. Go here:

The PowerPC 750CL:

[\[http://www.tomshardware.com/news/ibm-powerpc-lowpower,3591.html\]](http://www.tomshardware.com/news/ibm-powerpc-lowpower,3591.html)

So let's see:

94.5mm² = 53.69MB Then 42.2425mm² = 24MB

$(404K \times 42.2425mm^2)/1000 = 17.07M$ gates; which is less than the 100M gates limit.

CB-90M:

$1.8(1000^{-3}) \text{ watts} * 250\text{mhz} * 17.07M \text{ gates} = 7.6815 \text{ watts}$

$1.8(1000^{-3}) \text{ watts} * 300\text{mhz} * 17.07M \text{ gates} = 9.2178 \text{ watts}$

$1.8(1000^{-3}) \text{ watts} * 486\text{mhz} * 17.07M \text{ gates} = 14.933 \text{ watts}$

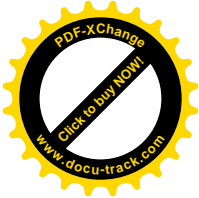
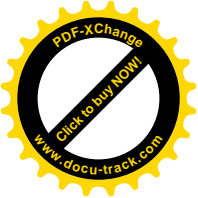
CB-90H:

$2.6(1000^{-3}) \text{ watts} * 250\text{mhz} * 17.07M \text{ gates} = 11.0955 \text{ watts}$

$2.6(1000^{-3}) \text{ watts} * 300\text{mhz} * 17.07M \text{ gates} = 13.3146 \text{ watts}$

$2.6(1000^{-3}) \text{ watts} * 486\text{mhz} * 17.07M \text{ gates} = 21.570 \text{ watts}$

And since Zelda isn't more than a port from Gamecube to Wii, I doubt it would be using a lot from 'napa' since Gamecube made it with just 24 MB of 1T-SRAM(the standard one made at 180nm) main memory and with 3MB of embedded eDRAM in the Flipper. Since Wii has more embedded memory, Wii's Zelda Twilight Princess version won't suffer bandwidth problems as



Gamecube's did when the 3MB embedded in the Flipper were not enough for storing textures.

Zelda Twilight princess using 3MB embedded in the GPU Soc + 24MB of eDRAM, supposing that the eDRAM and the embedded memory on the GPU Soc are both made with UX6D macro(CB-90M type) .

$$42.245/8 = 5.2806\text{mm}^2 \quad \text{due that } 24\text{MB}/8 = 3\text{MB}$$

$$27\text{MB} = 42.245\text{mm}^2 + 5.2806\text{mm}^2$$

$$27\text{MB} = 47.5256\text{mm}^2$$

$(404\text{K} \times 47.5256\text{mm}^2)/1000 = 19\text{M}$ gates; which is less than the 100M gates limit.

$$1.8(1000^{-3}) \text{watts} * 250\text{mhz} * 19\text{M gates} = 8.55 \text{watts}$$

$$1.8(1000^{-3}) \text{watts} * 300\text{mhz} * 19\text{M gates} = 10.26 \text{watts}$$

$$1.8(1000^{-3}) \text{watts} * 486\text{mhz} * 19\text{M gates} = 16.621 \text{watts}$$

+ a portion of the Wii mem2(GDDR3 64MB) power consumption and the CPU power consumption = ?

Now let's see if the eDRAM on the Hollywood could be UX6D macro based on CB-90H type(we will suppose that it can also have 404K gates per mm2 as the CB-90M). Let's see now considering the possibility that Wii's version of Zelda Twilight requires something around 10MB of eDRAM:

$$94.5\text{mm}^2 = 53.69\text{MB} \quad \text{Then } 42.2425\text{mm}^2 = 24\text{MB}$$

$$\text{And } 17.6010\text{mm}^2 = 10\text{MB}$$

$(404\text{K} \times 17.601\text{mm}^2)/1000 = 7.111\text{M}$ gates; which is less than the 100M gates limit.

$$1.8(1000^{-3}) \text{watts} * 250\text{mhz} * 7.111\text{M gates} = 3.2 \text{watts}$$

$$1.8(1000^{-3}) \text{watts} * 300\text{mhz} * 7.111\text{M gates} = 3.84 \text{watts}$$

$$1.8(1000^{-3}) \text{watts} * 486\text{mhz} * 7.111\text{M gates} = 6.22\text{watts}$$

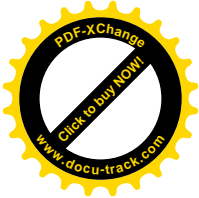
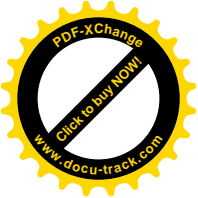
$$94.5\text{mm}^2 = 53.69\text{MB} \quad \text{Then } 42.2425\text{mm}^2 = 24\text{MB}$$

$$\text{And } 17.6010\text{mm}^2 = 10\text{MB}$$

$(404\text{K} \times 17.601\text{mm}^2)/1000 = 7.111\text{M}$ gates; which is less than the 100M gates limit.

$$2.6(1000^{-3}) \text{watts} * 250\text{mhz} * 7.111\text{M gates} = 4.622 \text{watts}$$

$$2.6(1000^{-3}) \text{watts} * 300\text{mhz} * 7.111\text{M gates} = 5.546 \text{watts}$$



$2.6(1000^{(-3)}) \text{ watts} * 486\text{mhz} * 7.111\text{M gates} = 8.985 \text{ watts}$

[<http://en.wikipedia.org/wiki/GPGPU>]
[<http://www.mathematik.uni-dortmund.de/~goeddeke/gpgpu/tutorial.html>]
[http://www.m3xbox.com/GPU_blog/?tag=floating-point]
[<http://www.freshpatents.com/-dt20090625ptan20090160867.php>]
[http://www.tomshardware.com/reviews/render-farm-node_2340-6.html]
[<http://pharr.org/matt/NeopticaWhitepaper.pdf>]

Hope all this made you understand that Wii cannot consume even less power than a laptop does, but if you feel lazy enough to not even do the math of the above, then I have something really simple for people like you; just check the AC power adapter of your Wii and look at the power consumption that can provide... 53 watts right?

Want to know why Xbox 360 and PS3 consume like:

During DVD playback	During HD(720p not 1080p) playback
Xbox.- 126.6 watts	146.4 watts
PS3 .- 175 watts	186 watts

HD gameplay:

[<http://www.hardcoreware.net/reviews/review-356-2.htm>]

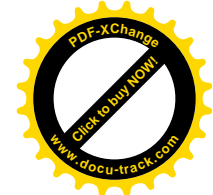
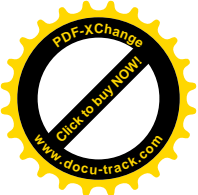
Sorry for not providing standard, HD and full HD during playing, but I couldn't find the info on that for all three settings to see comparison differences. But since we are talking about real time graphics I am sure that power consumption would change a lot depending on the setting and the game.

Ok, I know that in section for I will explain why Wii's GPU is in reality a GPGPU, but even tough we haven't reached that part I need you to go read it and then return to this point.

Now that you have confirmed that Wii has a GPGPU, lets continue:

So, if Nintendo Wii has so much potential, why is it that not many games show it?

The answer is simple, developers even today tend to think in an integrated graphics environment than in dedicated graphics, thus forcing the CPU cores and the main Ram(Xbox 360 eDRAM is used only for resolution, frame rate and antialiasing, not graphics). And this is also one of the reason that hold back good games on Wii, since the Wii clearly was made in a GPGPU architecture in mind, not to mention that the developers don't want to study the TEV features and start to cry when they don't get shaders, it's pretty obvious that games made relying in the CPU won't achieve good results. If studios and developers don't want to dig the Wii specific design, then why you develop for console systems instead of PC games? . Now, the TEV on the Wii is similar to



the GameCube, hasn't more than 7 years been more than enough to even learning the basics?

Plus, GPGPU programming is a bit different from traditional game programming, so, even though a GPGPU design is more efficient and powerful, developers will have to study new things, then by launching powerful consoles in the CPU area, developers would not have to worry about this new tool in order to achieve pretty graphics instead of complicating their existence in learning new things. Of course that the side effect would come into the need of more bandwidth among CPU+RAM+GPU, a powerful multicore CPU in order to achieve calculations, required by the GPU, fast enough to keep up with the GPU demands, etc.

Nintendo decided not to go through the same path as Sony and Microsoft when opting for a powerful and efficient GPGPU design, of course, this displeases studios and developers, since they don't want to learn anything new, is like they almost want the food in the plate. At the other hand, maybe studios and developers are even lazier than we thought and haven't discovered what Wii really is.

I really ignore how much ignorance and dumbness is required to not even achieve something that even persons like me, who have nothing to do in neither hardware design nor game development, could figure out just by reading official documentation and by using 'simple rule of three' for calculation demonstrations, when most of those who belonged to the graphics department are supposed to know things like integral equations. Now, it's not my intention to insult the developers or studios, but we have been waiting for almost 2 years and they still launch crappy games, and excusing themselves by telling that they concentrated most of their efforts on the Wii controller, but when one tries a game from them you can clearly see that all said it's excuse and crap, even early games like DBZ Budokai Tenkaichi 3 have better implementation of the wii remote than most of the games that launch until today.

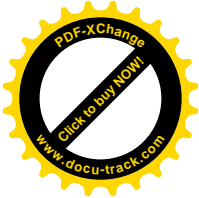
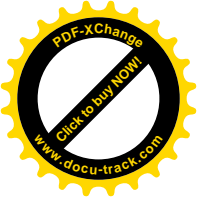
Just because gamers are excited into trying new things doesn't give them the right to laze around and sell not even a Gamecube quality game as a Wii game; It's true that most of the Wii audience are not hardcore gamers, but it is also true that the audience was at least expecting something.

Factor 5 talks about the Wii:

<http://www.safeforwork.net/index.php/1000110A/f67fd130bbd203d1367571ae339ecd79a8005234a1ca4be593969e9d699dccc44791e4b8c8abffed93068266079c703ef26a011fdd2ba110a3ba0fc48a919d91005a3a04f86ba2fc26d66cc1dd818380>

Do you really think 24MB of embedded memory is enough reason to express 'WOW'(even taking into account S3TC)?

No, of course not, but if there were like 50MB of it embedded and using S3TC I would surely feel the same way since we would have not only high bandwidth, but also there wouldn't be so much need of using the main RAM as an storing location for the GPU, thus reducing the overhead with the CPU.



(Tribute to the Nostalgia Critic)

So what's wrong with developers and studios?

What's right with them?.That's the short answer.

If you come to think that Wii has a GPGPU and a lot of eDRAM(53.7 or 40.1MB depending on who of the tow dies is the eDRAM) you will understand why the CPU and the mem2 don't have good specs.

*****What have we covered by now*****

We have covered the eDRAM type (UX6D most likely the CB-90M) and the most likely amount of memory on the 'napa' and 'vegas' using official information and why reports on the Wii power consumption are that low.

4.- Nintendo Wii made in a GPGPU architecture:

*****Nintendo's last secret is the GPGPU architecture on the Wii*****

Ok, now the moment we have been waiting so long, proves that demonstrate that the Wii Hollywood GPU is in reality a GPGPU and why the developers or their owners haven't squeeze it's potential until today.

There are 7 key points that made me think and believe that the Nintendo Wii had GPGPU architecture instead of just a normal GPU

1.-The low specs of the CPU compared to what Gekko meant to Gamecube.

2.-Placing as main RAM only 64MB of GDDR3 instead of the latest and cheapest, yes cheapest 1T-SRAM technology (either UX6D from NEC or 1T-MIM from TSMC) considering that GDDR3 is a lot more cheaper and consume far less energy at the grade that even 128MB sounds to low;

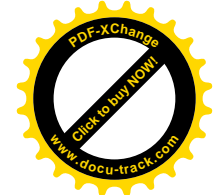
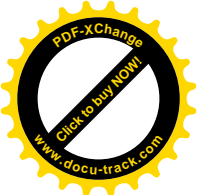
3.-The IGN report which mentioned that Wii would use the latest 1T-SRAM macro technology and manufactured by NEC using MIM2(the only mosys macro made with mim2 is 1T-SRAM-Q and is called UX6D) as eDRAM for Hollywood,.

4.-The interview with Ubisoft about the Nintendo Wii specs.

5.-ATI mentioning that what we have seen on Wii so far is just the 'tip of the iceberg'.

6.-The displacement mapping patent made by Nintendo and discovered in December of the 2005 year.

7. - Factor 5's commentary that their engine for Wii could do, in graphical terms, what the Lair PS3 Engine did and more.



[\[http://www.kevinwafer.com/bbs/viewtopic.php?f=36&t=91\]](http://www.kevinwafer.com/bbs/viewtopic.php?f=36&t=91)

Now, while I was investigating NEC profiles, I also was looking into which of the ATI Radeon or Mobility Radeon video cards the Hollywood could be based on and so then I remembered an interview that Ubisoft(developer of Red Steel) developers had regarding the Wii hardware. I searched all over the internet and found out that many sites had a copy of the interview but with banned details(which was officially banned by request of Ubisoft); fortunately I found a site that still holds the details. I needed this not due that I didn't remember the info provided back then, I needed this just in case you don't remember.

[\[http://www.avforums.com/forums/wii/351759-wii-specs-ubisoft-paris-interview-gives-glimpse-wii-specs.html\]](http://www.avforums.com/forums/wii/351759-wii-specs-ubisoft-paris-interview-gives-glimpse-wii-specs.html)

I read it and since this wasn't the first time the info sounded familiar. Now I am not saying that the info is 100% correct, since probably that's the information probably provided by a SDK(luckily not one of those early SDK's that were distributed for free from Nintendo to various companies; around 1000 of them if my memory doesn't fail). But it can provide us interesting info like:

Interview:

XP: Although I cannot give you exact numbers at this time I can give you a rough idea about the power of the machine. I would compare the graphics chip to somewhere between the ATI Radeon X1400 and the Radeon X1600, and the CPU to between the AthlonXP 2400+ and the AthlonXP 3000+.

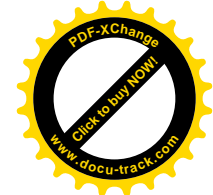
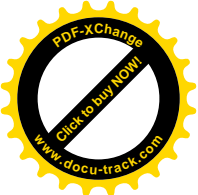
XP: I cannot say how much memory the Wii has, but its running at 650mhz.

XP: Red steel will have 4x Ant aliasing and 8x Anisotropic Filtering.

XP: The hardware is totally free of bottlenecks, nothing is slowing us down.

XP: Quite a few interesting things with physics in both Red Steel and in Rayman. We've got ragdoll in Red Steel for example.

Before continuing, why would Nintendo request Ubisoft to banned this information, and lets amateur people like those from Maxconsole, who do not even know how to do a simple copy-paste-modification, to public info that at first look is obvious to be nothing more than discrimination. Just think, Gamecube made at 180nm, at 90nm would reduce its size to 4x, employing UX6D would require memory shortened by 3x suing normal 1T-SRAM and 5x of those 3x using either 1T-MIM or UX6D, making it 10x, since



UX6D macro is 0.22mm²/Mbit and 1T-SRAM macro (1T-SRAM memory cell with overhead) is 1.1mm²/Mbit; also take into account the changes in manufacturing process technology. So then, does the info provided by Them makes sense?

And also, just come to think, Gamecube's last list price before being discontinued was about \$79 with digital port out and Nintendo still got profit from sales(probably only 10 dollars, poor them), that means that cost production at 180nm, yes 180nm would be around \$50, how much would a Gamecube cost at 90nm then, it would be like \$16.7, and if we use the new memory UX6D but provide the same amount for Gamecube(3MB only) ; that would make Gamcube cost production to less than \$12. Jajaja, ok, let's not take into account that the power supply would reduce its price that much, so my guess is that Gamecube would be about \$20.

[<http://en.wikipedia.org/wiki/1T-SRAM>]

[<http://www.nforcershq.com/wii-costs-nintendo-158-to-make/>]

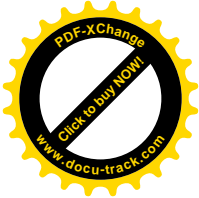
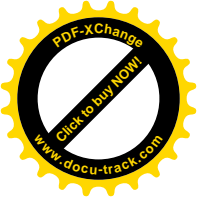
So we know that Wii manufacturing cost + ensambling and all is about \$158, and the additional components that Wii has in contrast to Gamecube like Wifi, USB 2.0 and the MEMS technology(makes possible the interaction with the Wiimode and the games) cannot make so much impact in the production cost. Even if wiimode is included in the production it cannot cost more than \$15 since they want to make profit at \$39.9(back then in 2006 of course) for them and of course with the ones who he made the agreement patents.

[<http://knol.google.com/k/hani-hisham-tawfik/a-glimpse-at-mems/2ufdlj2yc019u/10#>]

[<http://www.electroiq.com/index/display/nanotech-article-display/297676/s-articles/s-small-times/s-volume-7/s-issue-4/s-features/s-mems-infrastructure-advancements-drive-services-shift.html>]

*****Returning to what Ubisoft said*****

Of course that since they are using an SDK, this values are not accurate since SDK like the the Wii SDK 2.1(covered later) tend to do tricks like increasing the main memory of the Wii to 2x so developers can make clumsy(fam) code and the SDK manages the resources when one compiles, making sure that the true Wii hardware is not exposed. So I would guess that the memory runs at 300Mhz if the UX6D is a CB-90M platform and 486MHz if the UX6D belongs to the CB-90H platform and also that if the eDRAM is the die of only 72mm² instead of the other that has 94.5mm² .due that if the twisted option would consume nearly 49 watts only in the eDRAM, and so there wouldn't be enough power consumption room for the rest of the system since Wii can go up t 53 watts, no matter how power efficient the rest of the system may be.



Other interesting point mentioned in the article is the comparison of the GPU between the ATI Radeon x1300 and x1600. Sincerely I find really hard this taking this video cards as the base for the development of the Hollywood when there were better options by then and cheaper like the ATI Mobility Radeon x1700, which has improvements over the x1600 thanks like power consumption and performance thanks to the application of strained silicon.

The above information is like suggesting that the Wii GPU in in reality a GPGPU architecture. Just come to think. Many people argue that the CPU of the Wii is a joke, and it may be, but that also makes question ourselves why?

We know from previous generations that a good CPU is required in order to keep up with the GPU, since the this last one has to ask the CPU certain tasks that the GPU doesn't normally handle. Another curious thing is that they moved the location of the ultra fast 1T-SRAM(MIM2 in this case) memory inside the Hollywood and decided to have a GDDR3 memory as the main RAM and also as external RAM for the Hollywood, but I am for sure that the job of the GDDR3 was not made to be another main memory of the Hollywood, it must have other purposes.

People keep on today that wii is a simple over clocked Gamecube, but that's impossible just by looking at the architecture.

Well, let's concentrate in what is important right now. Why the design changed like this?. Why have the 1T-SRAM (napa) implementation inside the Hollywood and locate 64Mbytes of Quimoda GDDR3 as external and main memory. It's true that GDDR3 is less expensive and has better clock rate, but the latency is way too big, like between 11 and 15 ns CAS# latency(tcl):

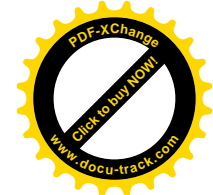
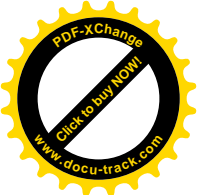
[\[http://ixbtlabs.com/articles2/mainboard/memdb-chaintech-apogee-gt-ddr2-800-plus.html\]](http://ixbtlabs.com/articles2/mainboard/memdb-chaintech-apogee-gt-ddr2-800-plus.html)

[\[http://ixbtlabs.com/articles2/mainboard/ddr3-rmma-page1.html\]](http://ixbtlabs.com/articles2/mainboard/ddr3-rmma-page1.html)

[\[http://www.oempcworld.com/support/RAM_Technical_Perspective.htm\]](http://www.oempcworld.com/support/RAM_Technical_Perspective.htm)

With the info provided at those links, we can clearly see that incrementing the speed of the memory will only result in more latency drawbacks, and since Gamecube had nearly no cas latency, it only had tCK and tCL(6.2 ns and 10 ns respectively), I can't imagine the GDDR3 more operating at more than 500 maybe 600Mhz, since Mosys 1T-SRAM main memory operated at at 324mhz with sustantabile latency of 10ns or less.

[\[http://images.google.com.mx/imgres?imgurl=http://www.seagatech.com/gamecube/overview/flipper_die.jpg&imgrefurl=http://www.seagatech.com/gamecube/overview/&usq=__GuyrcLjoBMTLqm2zfa-63VB6wZU=&h=237&w=240&sz=18&hl=es&start=13&um=1&tbnid=VoCbgz9B10PQAM:&tbnh=109&tbnw=110&prev=/images%3Fq%3DGamecube%2Bflipper%2B162%2Bmhz%26hl%3Des%26sa%3DX%26um%3D1\]](http://images.google.com.mx/imgres?imgurl=http://www.seagatech.com/gamecube/overview/flipper_die.jpg&imgrefurl=http://www.seagatech.com/gamecube/overview/&usq=__GuyrcLjoBMTLqm2zfa-63VB6wZU=&h=237&w=240&sz=18&hl=es&start=13&um=1&tbnid=VoCbgz9B10PQAM:&tbnh=109&tbnw=110&prev=/images%3Fq%3DGamecube%2Bflipper%2B162%2Bmhz%26hl%3Des%26sa%3DX%26um%3D1)



While the 1T-SRAM (MIM2) has 4 ns but is not CAS# latency, is tck and for tac has 5.5 ns:

[\[http://www.necelam.com/process/edram.html\]](http://www.necelam.com/process/edram.html)

[\[http://www.necelam.com/process/edramaccess.html\]](http://www.necelam.com/process/edramaccess.html)

It's clear that Wii was made with a Dedicated Graphics design in mind, since the main RAM doesn't provide neither the enough memory, nor the efficiency to even run Gamecube games like Resident Evil 4, Star Wars Rogue Squadron, Zelda Twilight without the efficiency of the 24MB of 1T-SRAM as main RAM running at above the 300mhz, of course this is assuming that Hollywood didn't have eDRAM(54Megabytes of napa). If Nintendo did really want to create graphics relying mainly in what the CPU can do, then he would have placed a minium of 256MB of GDDR3 running at a speed which wouldn't affect the latency that much (most probably 500mhz), put something like 15MB of either UX6D or 1T-MIM as eDRAM and increasing the CPU speed at 2ghz, so that the price of the Wii wouldn't differ that much from the current Wii. But since Nintendo wanted (even if they don't want to admit it may be due that they are waiting the appropriate time, like when Microsoft announces the project Natal) a powerful console without sacrificing performance and an unbeatable launch price, they opted on taking this path.

2.-Ok, which could be the ATI video card in which the Hollywood is based (it's not the flipper, ATI already stated it, wii GPU from the ground up).

All we know is that Mosys and Nec are collaborating, so, we investigate in their respective pages we will end up with an uncommon name.

TSMC?

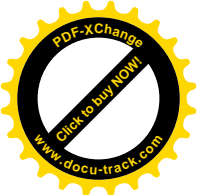
Remember that some time there was a rumor that Nintendo disclosed the production of one of the LSI chips in the Hollywood. Well my guess is that it had to be the 'vegas' since in the NEC page you will find no info about ATI and their video cards, most of the time they talk about the eDRAM memory, but not that they made the 'vegas' SOC. And since TSMC started to produce the ATI Radeon and Mobility Radeon video cards of the x1300 to x1800 families, I suppose that Nintendo chosed them, since moving the production to NEC would not be most effective enough and TSMC is already familiar with ATI.

TSMC are the ones who own the fabs of production for the 1T-MIM at 90nm.

So went through their page and found:

[\[http://www.tsmc.com.tw/tsmcdotcom/PRListingNewsAction.do?action=detail&newsid=1647&newsdate=2005/09/26\]](http://www.tsmc.com.tw/tsmcdotcom/PRListingNewsAction.do?action=detail&newsid=1647&newsdate=2005/09/26)

[\[http://www.phoronix.com/scan.php?page=article&item=442&num=13\]](http://www.phoronix.com/scan.php?page=article&item=442&num=13)



[\[http://www.reghardware.co.uk/2006/09/24/ati_unveils_mobile_gpu_updates/\]](http://www.reghardware.co.uk/2006/09/24/ati_unveils_mobile_gpu_updates/)

As you see we have three possible candidates according to the articles

ATI Radeon X1300 die size:

[\[http://forums.overclockzone.com/forums/archive/index.php/t-112488.html\]](http://forums.overclockzone.com/forums/archive/index.php/t-112488.html)

ATI Radeon x1600:

Since it only measure 132mm² and had a price list of \$ 159,doubted it would have to be the ATI Radeon x1600:

At first I thought that it had to be the x1800, but the size and price are not affordable \$449. Then I remembered that there are laptop versions:

ATI Mobility Radeons:

So I went again on Google and searched them; of course I also verified that they were manufactured by TSMC.

[\[http://www.phoronix.com/scan.php?page=article&item=442&num=13\]](http://www.phoronix.com/scan.php?page=article&item=442&num=13)

[\[http://www.reghardware.co.uk/2006/09/24/ati_unveils_mobile_gpu_updates/\]](http://www.reghardware.co.uk/2006/09/24/ati_unveils_mobile_gpu_updates/)

ATI Mobility Radeon x1600:

[\[http://www.notebookcheck.net/ATI-Mobility-Radeon-X1600.2163.0.html\]](http://www.notebookcheck.net/ATI-Mobility-Radeon-X1600.2163.0.html)

[\[http://ati.amd.com/products/mobilityradeonX1600/index.html\]](http://ati.amd.com/products/mobilityradeonX1600/index.html)

[\[http://ati.amd.com/products/mobilityradeonx1600/specs.html\]](http://ati.amd.com/products/mobilityradeonx1600/specs.html)

[\[http://hothardware.com/Articles/ATI%2DMobility%2DRadeon%2DX1600%2DPrview1/\]](http://hothardware.com/Articles/ATI%2DMobility%2DRadeon%2DX1600%2DPrview1/)

[\[http://www.legitreviews.com/article/272/1/\]](http://www.legitreviews.com/article/272/1/)

--memory may vary according to vendor

ATI Mobility Radeon x1700:

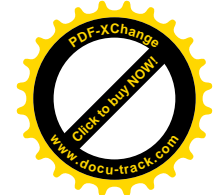
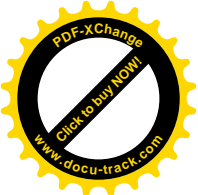
[\[http://www.notebookcheck.net/ATI-Mobility-Radeon-X1700.2157.0.html\]](http://www.notebookcheck.net/ATI-Mobility-Radeon-X1700.2157.0.html)

[\[http://ati.amd.com/products/mobilityradeonx1700/index.html\]](http://ati.amd.com/products/mobilityradeonx1700/index.html)

[\[http://ati.amd.com/products/MobilityRadeonx1700/specs.html\]](http://ati.amd.com/products/MobilityRadeonx1700/specs.html)

[\[http://www.elitebastards.com/index.php?option=com_content&task=view&id=155&Itemid=29&limitstart=1\]](http://www.elitebastards.com/index.php?option=com_content&task=view&id=155&Itemid=29&limitstart=1)

ATI Mobility Radeon x1800:Way to expensive, like \$249 at lunch so I do not consider it(even though this is not cost production but still think that it would be a little expensive anyway).



[http://en.wikipedia.org/wiki/Comparison_of_ATI_graphics_processing_units]

Since Ati Radeon x1300 is not much expensive, its die is too small and doesn't have good performance, I must decline this option:

ATI Radeon x1800 and its mobility version are too way expensive.

That lives us with ATI Mobility Radeon x1600 and the x1700.

the x1600 had a price of \$159 dollars at lunch and a die of (I found it and lost it sorry!) of something that might fit the destined area in a medium size notebook for a video card(including its integrated memory).

So I observed that the mobility x1700 should be the one, because is almost a mobility x1600 but with better performance, almost the same price and low power thanks to strained silicon(things Nintendo seeked for the wii and it was available since beginning 2006).

I am not saying that the Hollywood is a clone of the mobility radeon x1700, just that if I were them this would be my option due to the affordable price(price is different for vendor than consumer) power consumption and performance.

Now,, what do this cards have to do with a GPGPU anyway?

Just check GPGPU ATI x1000 family in Wikipedia :

[<http://en.wikipedia.org/wiki/Radeon>]

[http://www.neoseeker.com/Articles/Hardware/Reviews/ati_radeon_x1800_x1600preview/]

[<http://blogs.amd.com/play/2008/11/05/the-gpgpu-chronicles/>]

You can also read this:

[<http://transporter-game.googlecode.com/files/RealtimeHDRImageBasedLighting.pdf>]

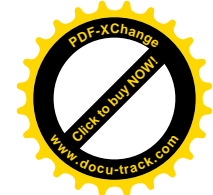
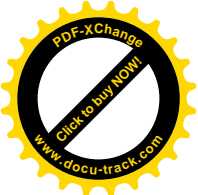
You may say, no, it cannot be because Wii cannot do HDR+AA.

Think again, cause capcom denies that.- proof:

[<http://news.vgchartz.com/news.php?id=3996>]

And there may be other examples like high voltage Gladiator and the Grinder, cursed mountain, silent hill shattered memories, Dead Space Extraction.

Ok, back to ATI:



If we were Nintendo I am sure that the best option of all these video cards would be the ATI Mobility Radeon x1700 due to its low cost and better performance over the x1600 without the sacrifice of more power consumption. This is quite possible since the ATI Hollywood for Wii wasn't ready even when NEC announced their relationship with Nintendo in producing eDRAM for Wii(June 2006) and the most of the Mobility Radeons entered mass production before the end of 2005. So why it took so long to finish the design, possibly due that they wanted to optimize the design and make it more GPGPU appealing.

So the only doubt left would be the die size of the ATI Mobility Radeons so we could compare them with Hollywood, unfortunately I only was able to found that specific information for the desktop version(ATI Radeon) and not the notebook one(Mobility), but since notebook version are supposed to be smaller, and there are even different sizes for the notebooks, depending weather the notebook is of 'small size', 'medium size' or 'large size'.

ATI Radeon die size(not Mobility version)

[<http://techreport.com/articles.x/8864/3>]

[<http://en.thethirdmedia.com/pc/200601/20060125104453.shtm>]

Clock speed and, memory and power(less than 1volt to operate for the Mobility) compared to the Mobility Radeon x1600

[<http://hothardware.com/Articles/ATI-Mobility-Radeon-X1600-Preview1/?page=2>]

GPU - This is the BIGGEST performance bottleneck when playing games. If you have a slow GPU, it doesn't matter how fast your CPU is, it'll make no difference. Games these days have pushed all graphical processing from the CPU to the GPU. That's why this is #1 in the list.

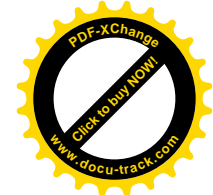
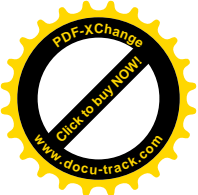
As you can see, the ATI Radeon x1600 has a die size of 132mm²(including the memory which can apparently range from a minium of 128 to 256MB or 512MB) and a speed starting from 500 to almost 600mhz. So by only reducing the specs, like reducing the number of transistor clock speed, and the controller bus maybe, I am sure we could make an x1600 in just maybe 52mm² and the rest for memory(18mm² for 10MB). But for me would be easier to use the ATI Mobility Radeon versions of the ATI x1000 family as platform for the Wii GPGPU design, since ATI Mobility Radeon versions are already smaller than the desktop ones. It's a pity I couldn't get into my hands information about the die size of any of the Mobility versions of the ATI x1000 family, the only thing I know is that the x1600 and x1700 are destined for notebooks of medium size.

[<http://www.hardwaresecrets.com/article/230>]

wii launch date November 19:

[<http://en.wikipedia.org/wiki/Wii>]

ATI Hollywood:



[\[http://en.wikipedia.org/wiki/Hollywood_\(graphics_chip\)\]](http://en.wikipedia.org/wiki/Hollywood_(graphics_chip))

ATI ring bus memory technology:

[\[http://enthusiast.hardocp.com/article/2005/10/05/ati_radeon_x1000_family_preview/5\]](http://enthusiast.hardocp.com/article/2005/10/05/ati_radeon_x1000_family_preview/5)

Nintendo confirms E3 2006 wii not final:

<http://www.gamedaily.com/articles/features/nintendo-confirms-gamecube-housing-for-wii-at-e3/68959/?biz=1>

Review of the best ATI Mobility Radeon Cards for gaming in notebook:

[\[http://www.notebookreview.com/default.asp?newsID=3056\]](http://www.notebookreview.com/default.asp?newsID=3056)

Ok, we have covered Ubisoft's speech and ATI's relationship with TSMC on their video card lineup production at the end of 2005 and their GPGPU capabilities. Now follows the Nintendo patents on the Displacement mapping technique.

Nintendo patents on Displacement mapping:

[\[http://www.joystiq.com/2005/12/11/nintendo-patents-in-displacement-mapping-discovered/\]](http://www.joystiq.com/2005/12/11/nintendo-patents-in-displacement-mapping-discovered/)

[\[http://www.kevinwafer.com/bbs/viewtopic.php?f=36&t=91\]](http://www.kevinwafer.com/bbs/viewtopic.php?f=36&t=91)

Now if we analyze the first patent, there is a mention of dot-product computation units, which give the capability of doing floating point calculations so that the GPU won't need to request the CPU on doing operations like floating point calculations that the first GPU couldn't do on their own.

[\[http://iccd.et.tudelft.nl/2008/proceedings/427saleh.pdf\]](http://iccd.et.tudelft.nl/2008/proceedings/427saleh.pdf)

[\[http://www.doublecode.com/nintendo-revolution/2005_12_01_archive.php\]](http://www.doublecode.com/nintendo-revolution/2005_12_01_archive.php)

This is not a GPU, it's a GPGPU:

[\[http://users.design.ucla.edu/~acolubri/processing/glgraphics/home/gpgpu.html\]](http://users.design.ucla.edu/~acolubri/processing/glgraphics/home/gpgpu.html)

[\[http://en.wikipedia.org/wiki/GPGPU\]](http://en.wikipedia.org/wiki/GPGPU)

[\[http://en.wikipedia.org/wiki/GPGPU\]](http://en.wikipedia.org/wiki/GPGPU)

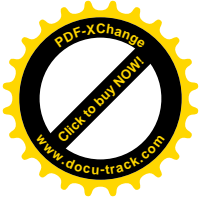
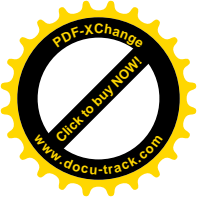
[\[http://www.mathematik.uni-dortmund.de/~goeddeke/gpgpu/tutorial.html\]](http://www.mathematik.uni-dortmund.de/~goeddeke/gpgpu/tutorial.html)

[\[http://www.m3xbox.com/GPU_blog/?tag=floating-point\]](http://www.m3xbox.com/GPU_blog/?tag=floating-point)

[\[http://www.freshpatents.com/-dt20090625ptan20090160867.php\]](http://www.freshpatents.com/-dt20090625ptan20090160867.php)

[\[http://www.tomshardware.com/reviews/render-farm-node,2340-6.html\]](http://www.tomshardware.com/reviews/render-farm-node,2340-6.html)

[\[http://pharr.org/matt/NeopticaWhitepaper.pdf\]](http://pharr.org/matt/NeopticaWhitepaper.pdf)



I feel a little bit sorry for homebrew developers, since it seems that Nintendo has made the Wii impenetrable against reverse engineering, but if they think that they have uncovered all what wii has to offer, maybe they should read the next link and also remember that programs that lie on what the hardware system has inside have been around for a long time, and as long as you do not give the proper credentials, the system won't give you the full details and access:

Seems Wii is impenetrable against reverse engineering:

[\[http://www.graphicshardware.org/previous/www_2006/presentations/Shi-DRMGPU-gh06.ppt\]](http://www.graphicshardware.org/previous/www_2006/presentations/Shi-DRMGPU-gh06.ppt)

Change System properties of the computer:

[\[http://www.windows-help-central.com/change-system-properties-logo.html\]](http://www.windows-help-central.com/change-system-properties-logo.html)

Any doubts regarding the meaning of CAS latency or tcl tck can be found here:

Your desire information is located right on the middle of the page.

[\[http://www.oempcworld.com/support/RAM_Technical_Perspective.htm.-\]](http://www.oempcworld.com/support/RAM_Technical_Perspective.htm.-)

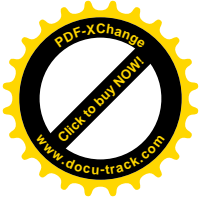
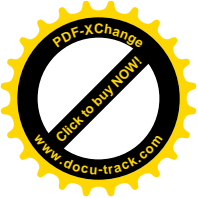
And don't think this is the only thing that made me think this way, no! There is plenty of room for other facts as irrefutable as how did I deduce

Ok, so if Wii's Hollywood is a GPGPU and has an incredible amount of eDRAM + technologies like S3TC, a compression technology that Gamecube used and that without it surely games that used it would not be compatible with Wii, why there are so many poor quality games in what graphics is concerned?

Simple answer:

Reason 1.- The only reason of why many Wii games don't show Wii's power credentials lies in that they do not support shaders natively, so you have to use custom shaders and define your own; though this is annoying, it also gives more flexibility and makes possible to achieve better graphics with optimized shaders.

Reason 2.- Another reason that may explain why most companies and developers don't want to make games based on the Wii system could make the porting to other systems like 360 and ps3 almost impossible, yes, you got right, porting games from Wii to 360 or PS3 would be really difficult, but not because 360 or PS3 are not powerful, is because the Wii works entirely different, reason why almost everyone develops poor quality Wii games that also have as target HD systems.



I am not deducing this, it's true, but if you don't want to believe, maybe you should ask Capcom or Peter More.

Capcom interview:

[\[http://www.1up.com/do/newsStory?cld=3175141\]](http://www.1up.com/do/newsStory?cld=3175141)

And let's not forget that many games done on HD systems are down converted to Wii, which means that developers only make an engine that makes compatible the software on an HD system to Wii and they later just drop down graphics, resolution, textures, etc; so obviously this will lead to a poor quality game.

Peter More on Wii graphics:

[\[http://wii.kombo.com/article.php?artid=13926\]](http://wii.kombo.com/article.php?artid=13926)

I certainly think that Nintendo's approach was the right choice, but also dangerous, since even when Nintendo stocked with the DVD to not enter in the Blue ray vs. HD-DVD format, it didn't have other option into deciding on who to side in the GPGPU vs. multicore Graphics War .

I also have saved this last comment. Even if until this point you think that Hollywood cannot be GPGPU architecture, even with the patents on displacement mapping mentioning the dot-unit and all, so then, why did Nintendo acquire PhysX SDK license from Nvidia to employ it on the Wii?

[\[http://www.worldofgothic.com/gothic4/?go=g4glossary\]](http://www.worldofgothic.com/gothic4/?go=g4glossary)

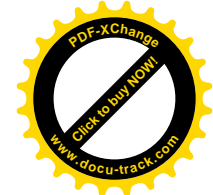
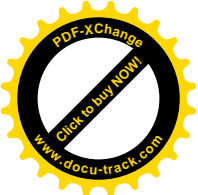
Why Hollywood chip wasn't ready until the 3d quarter of 2006, when the ATI X1000 family, Radeon and Mobility ones, entered in production at the end of 2005.?

Why the Nintendo patents of displacement mapping mention specialized hardware and dot-product computation units, and the reduction of the strain on the CPU(almost like suggesting that CPU's work will almost not be related to graphics)?

And why would Nintendo base the development of the Hollywood's 'vegas' chip (the GPU Soc probably) on Flipper design when there were technologies that were even cheaper, available and in production line-up like the ATI Mobility Radeon x1700 using strained silicon. If Nintendo intended into taking shortcuts, wouldn't this be the best choice?

Why is it that if we make some tweaks to an ATI Radeon x1700 we could end up with a die size pretty near to the 'vegas' die?

Even if ATI said that Hollywood was being made from the scratch, that doesn't mean that they wouldn't use existent technologies, they just meant that they wouldn't use the same design.



So, in conclusion, we not only know that Wii Hollywood is a GPGPU design, but we also know the most possible video card in which it based its development; The winner for me would be the ATI Mobility Radeon x1700 due to its performance over the x1600 without the sacrifice of power consumption, the low cost, it's small die size (medium notebook type) and availability; of course that since the Hollywood entered in production much later than this design, they had time to optimize it even more to make it truly and advanced GPGPU and maybe add features from the ATI Mobility Radeon x1800.

Hope the information provided was able to clear your minds and see the reality.

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