ASI Technology Summit Q4 2021
Micron: Harnessing the Next-Generation of Computing

0:09
The cue for ASI Technology Summit today we have micron joining us with a special focus on DDR five Memory and I know from our session yesterday already had Intel introduced and kick off their 12 gen processors.

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one of the features of the processor was the capability to support DDR five Memory.

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So, this is a perfect follow on session to what we had yesterday.

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And so we're going to be really excited to hear from our presenters from Micron to talk to us and tell us all about the great features of DDR five, of which there are many.

0:47
So you're going to hear a lot of new stuff today that you probably haven't heard before, learn a lot about the features of this new, new memory. Before we do that, and before we get that kicked off, there's a couple of things that I have to announce from yesterday.

1:02
First, we had some prizes that we were given away. We gave away a notebook yesterday, and I want to announce the winner of that.

1:10
And in addition to the Notebook, you know, we had really great attendance yesterday. We had over 250 people attending yesterday's session, so it was a great turnout and I really want to thank you guys for that.

1:23
And I want to give out some additional $50 gift card just for special. Thank you for all you guys that are that are attending this event.

1:31
So, the $50 gift cards go to Sonny Kuang, Jack Sue, Kevin Teter, Ben Warren, and Sandy Zimmer. So congratulations to all of you.

1:45
for the $50 gift card, I'll be e-mailing you guys give you the details on how we're going to get those cards to you.

1:52
For the notebook, which I know, everybody wants to make sure, hey, didn't forget the notebook.

1:57
The notebook, congratulations to Logan binoche, so login, I hope I got your name right, but congratulations to you. You're the winner of our 15.6 notebook.

2:08
So we got great prizes to give away today as well, and we'll talk about that at the end of the presentation.

2:15
But here in just a second, I want to kick everything off and turn things over to David Frum Micron. So I'll give David a little warning to unmute himself.

2:24
So, just as a reminder for you guys.

2:26
If you want to submit questions for this session, go ahead and do that through the questions box there.

2:33
Question window there on your goto Webinar meeting menu box so it's just open that you can type in your questions and I'll be able to monitor those and and get those over to Karthik, the Micron team to get those answered.

2:48
So, type in the questions as we're going through and we'll get those asked and answered.

2:54
So, without further ado, I'm gonna go ahead and introduce ASI's account Manager, David Lefstein, let David, go ahead and kick us off.

3:04
Awesome, thank you so much, Kent, Thank you, Shelly. Thank you to ASI. These summits have been fantastic. We really appreciate the partnership here, and the timing of this one is, is great. So we're very excited to introduce two of our leading experts on our crucial DVR five in memory product, Karthik and Jake, Without further ado. So you guys, thank you guys very much for the time today.

3:30
All right. Can you guys hear me OK?

3:36
We can hear you great.

3:38
OK, Fantastic. Well, thank you so much for taking the time to join us in today's session. Jake and I couldn't be more excited to talk to you all about a crucial DDR five product.

3:50
And let's get started.

3:55
So, a quick view of what we're going to talk about today.

4:00
First off, we wanted to get started out with the State of ..., and what are some of its limitations with scaling for the next gen CPUs.

4:11
And then, we're going to talk about some things to consider when choosing PDR five. There are some important notes that Brad, David did actually touch upon today's session.

4:24

We'll talk a little bit more in depth today, then What are some of the benefits of TDR five? So why why choose the phi?

And then followed closely by what are some of the features are crucial ...

products, that we also launched on October 27 and alignment with Intel's launch of their new elderly like CPUs. And then we're going to talk a little bit about the different social media for the whole product.

And then finally, we'll close out the session.

Why, by the day and Google?

Take a look at videos that we put together that summarizes everything that we will be talking about today. And what are some of the next steps that you can take to get yourself more, the product and about the CDFI technology?

Karthik, just really quick, you're just breaking up a little bit, So maybe you can move the microphone a little closer, or you move a little closer to your computer mic, and let's, let's try that, but you're breaking up just just slightly a little.

Sure. Can you hear me now, OK?

That's better, Yeah, OK.

All right, So, what is the State of TDR for?

Well, we have already seen that: customer experiences have always pushed the boundaries of the computing needs and with more and more demanding needs of customer experiences and evolving needs.

These processing needs are actually skyrocketing and one of the ways to tackle these demanding needs as the workloads evolve is the CPU core count increasing. And that's what we've seen with our next generation CPU from Intel.

And DDR for Memory technology has reached its limit.

What we mean by that is that, when the CPU core count increases, the memory, bandwidth or available per CPU core, actually starts to decline.

Meaning, as to CPU, core count scales, the DDR for memory technology cannot.

6:51
So, basically, PDF format technology has reached its limit, it cannot scale for the next generation of CPUs, which are required for the skyrocketing demands of the evolving customer demands and workloads of the next generation.

7:09
So, that's why we have our next gen memory, crucial DDR five, that are required for the next gen CPUs from intel.

7:17
So, what, how, how does ...

7:21
five it scale with the next gen CPUs? So, for example, the memory architecture of ...

7:29
is very different and superior to D D or four compared to V D O four such dead.

7:37
The launch speeds of 4800 megabytes per second can provide up to 87% more effective bandwidth, compared to DDR four.

7:47
And if you remember, ... for our Standard ... product actually maxed out at 3200 megatons per second. And DVR five specification actually Start, said, 30, 200. So even at the theoretical speed of 30 to 100 mega chrysler's for silicon, ...

8:06
memory product can potentially provide up to 36% more bandwidth.

8:13
And if you're wondering if this is your first time sharing about the term bandwidth, and that's being torn out a lot, especially since GDL launched bandwidth is simply too important.

8:26
How much data can you transfer from point A to point B in a given point in time?

8:32
So, if you were to imagine bandwidth as water, pipe and and, if the diameter of the pipe had increased, you could transfer actually more water in the same amount of time. and that's what DDR five is all about.

8:46
The memory architecture is so different and ..., or you could actually transfer, are, are more data in the same amount of time, more data in the same amount of time, or are in the same amount of data in less time.

9:05
So, that said, what are some future possibilities of DDI for, how can it scale?

9:10
So we expect EFI future CDFI products to scale all the way up to 8400 mega chrysler's per second.

9:19

And in terms of module the entity, it can scale all the way up to 128 gigabytes in a single module.

9:26
So, that's a quick summary of what are the scaling possibilities of TDL five and what are some scaling limitations of BP or for technology?

9:41
All right.

9:42
Let's talk about some things to consider when choosing video or high.

9:46
So we we heard from HLS today that their latest cochin integral process can support TDR for MD five.

9:57
Not both at the same time, so what this really means is that you can either adopt DD of four or DDR five technology for the new Intel CPUs. So, what it really means is that if you want to adopt DDR five technology for the new CPUs, you will have to buy a ... motherboard and the DDR memory.

10:19
And if you want to adopt the DDR for technology for then you should be used to adopt.

10:25
Customers will have to buy a PDF form on the board and a DVR for memory, and there are some reasons behind it and we'll talk about it in the in the As I put it in the slide.

10:38
So, Aye.

10:41
We can see from the picture right there, that the notch position is actually different four G or four and DDR memory. Even though, the bolt actually have the same amount of pin count, so the pin assignments are different the notch positions different.

10:57
and on top of it, the DDR for memory product operates at a voltage of 1.2, financial DDR phi, operator the voltage of 1.1.

11:09
And moreover, the power management used to be managed on the motherboard with the ... technology.

11:16
but with DDR five, the power management has actually moved onto the module.

11:21
So, because of how these changes have evolved with the memory architecture, customers cannot choose to adopt boat amendment technologies onto a CPU. They have to adopt either one of those. and if they were to adopt ..., they will have to buy a DVD or five specific motherboard. And we expect most vendors to provide multiple vendors to provide both options

for the new CPU. So, there will be a DVR for version of the new motherboards, an idea, apply version of the new motherboards.

11:56
So DDS find memory, in conclusion, is not backwards compatible, with PDF form motherboards.

12:03
So that's a quick summary of things to consider when choosing PDF file, because like let's pause right now, are there any questions about that? We went through a lot of information there.

12:16
Unfortunately, can probably be very confusing for customers. Are there any questions?

12:22
Yes, Well, we have a question in more. They're asking about Intel on 12 Jan processors seems to have limited the memory to 128 gigabyte per system.

12:35
And I don't know if you guys know anything about that. Maybe that's what they've set or lack of being able to test anything beyond that today, or if that's actually the limitation of the 12 10 Processor.

12:52
So, I'm going to take that one.

12:55
Yes. Yes. Please go ahead.

12:56
So, I would say it has not been published to us, That DDR five has a limitation of 128 gigabyte as it.

13:07
The way it works with launch, though, is the first component density of ...

13:12
is 16 gigabit, which means, in a client application, you know, a desktop or a laptop, you, can build up to 32 Gigabyte modules.

13:21
And, for the DDR five motherboards, they will have up to four slots.

13:26
And so, I believe that's where that number is coming from, is right now, with the DDI, five motherboards, and the 12th Gen Processor.

13:33
The highest density, individual module is 32 gigabyte, therefore.

13:37
For slot motherboard, the highest density you can achieve on a client application is 128 gigabytes.

13:44

As DDS technology matures and we get into higher component densities that, you know, 32 gigabyte, uh, max density will go up, and systems will be unable to handle more than that, but as it is right now, I think that's what they're saying is right now, the mass density you can get in your PDF system is 128 gigabytes if you have the right motherboard.

14:08
Does that help answer the question?

14:10
I think that that's perfect, thank you. Also, in looking at the images that you guys have of the DDR four and the DDR five Memory module, for my own mental clarification, if you can tell me which one is the DDR four, in which one is the DDR five And then. If I, as a user, if I know, could I install these incorrectly?

14:34
Like if I flip to one of those around, could I accidentally install it in in the Memory slot?

14:42
So, I'll answer it this way, You can install anything with a hammer.

14:45
So, yes, it's possible. Please don't. So, follow the guide rails, follow the notch position. Make sure you're putting the right technology and the right motherboard.

14:57
Nothing is impossible with a hammer.

15:03
Modules. Yes. Go ahead and explain which, which is which.

15:08
Sure, sure. So, again, to answer that question, the most cool looking black PCB modules that you see on the top, that's crucial DDR five. And as you can see from the picture, there are additional components that you see at the top of the module. Those are some of the new components that are being added, to the DDR memory Technology, as to what makes it possible. So that's where the power management and all that hub, sites and then beneath that says, use your mouse to circle that area just people, don't worry.

15:43
Now that circuitry there is new.

15:47
then, and then the, the bottom picture where we have the green PCB module that DVR for memory product and this is an example of a 16 gigabyte DDI five.

15:59
So far, eight chips at the front for in the left and the right, and then similarly, on the DDR for also, this is the 16 gigabyte module, four on the left, for chips, or for the names on the left and putting them on the right.

16:13

As you can see visually, the notch position is certainly different. There are more differences as well, physically, but I don't want to get into the weeds right now, and then very simply you have a white and blue label on the video for land with the PDF file.

You have the black and the Blue label, And if you pay close attention to the labels over here, you will see it is called out as a DVR five Newton. On the picture and in the bottom picture, designate it as a PDF for Good.

It might be tiny, but, yeah, it is up there.

And that was actually part of our strategy Sorry. Go ahead.

No, no, go ahead, I'm sorry. I'm just That was part of aside from Black, just looks cool, and hope, you guys give us a big thumbs up for going with Black PCBs.

But that was just, there's actually a strategy behind it to differentiate ... five with a different color PCB.

Because no pin count wise, if you just look at the pins are both 288 pin.

So you can do, your customers can easily think, they're compatible than they are not 288 pin is just a coincidence.

They are very different memory technologies, and so that's another advantage of doing using a black PCB for ..., is that the module looks very different for Crucial DVR five.

So, I'm going to have another question.

Well, we have some questions coming in about, like, performance and latency, and I'm going to hold off on those, because I have a feeling you might be covering that as we move forward, but let me just ask this one more question.

Since you're talking about voltage and power management and those kind of things, does this improve heat dissipation, is DDR five?

run it lower heat's and things like that?

Then maybe DVR four.

Sure. I'll take this one, and then please jump in as well as just what, What do you, What are your thoughts on this.

18:23
This is our standard genetic, crucial DDI product and the product.

18:29
And this is what we launched on October 27, at 8, 16, and 32 gigabyte modules.

18:36
And they all are, will be providing speech delivering a speech of 4800 megatons was the second.

18:44
Now, we don't see a need of heaps, but it is what this prior standard ... speed, crucial, ... products.

18:55
However, we are continuing to assess system tunnels, module two modules, space constraints, to see if he's British will be needed for future crucial ... products.

19:06
Now, we understand the, the perception of why these questions come because these are blazing fast speech that we have not previously seen before in a mainstream product. These speeds have been previously possible only through exchange performance memory, which Typically cabbage seeds produced. So, we do understand the nature of the question, but we don't see a need for heat spread as for this product.

19:32
Jake, any thoughts to add?

19:34
Yeah. I think you touched on it.

19:35
I mean, know, when we add components, I mean, we all know voltage regulation circuitry on the motherboard generates heat.

19:42
Heat means you have to dissipate the heat. And so, you have large heat sinks. Yeah, sounds on the motherboard that dissipate. all that.

19:48
And so with these new components, yes, it's correct. There will be more heat generation on the module, but like Karthik touched on.

19:54
We do not see that breaching any thermal boundaries and therefore no need for heat spread out right now.

20:00
Also hate spiders that they can be tricky you put each spider on and you put for dams, you know, together.

20:08
Then, yes, you're dissipating heat.

20:10

But you're also limiting the in-between dim Airflow capability and so it's it's a tricky balancing act of if we leave more space, there's more room for the heat to be transferred out of that portion of the motherboard. Whereas, if we close that off with heat spreaders, sometimes I can cause.

20:30
Unintended effects. So, it's something we're constantly analyzing, like Karthik said, at 4800. We don't believe we will need a heat spreaders, so we have no plans for that right now.

20:43
So, Does that help answer the question, Kent? Alright, great.

20:45
Why don't we go ahead and It does, yeah, thank you, So, why don't we go ahead and keep moving forward and we'll keep taking questions, you guys keep sending them in and we'll, we'll get them ask as we go through or at the end, but why don't we go ahead and see what's next OK, Sounds Good.

21:06
Let's keep trying and now, let's talk about why DDR five, Why? Why choose ... for which for the new 12 Chen intel Core processors?

21:21
Well, the flesh benefit that users or customers are going to experience is hastert everything.

21:28
Of course, your overall system performance is maximized.

21:31
What, specifically application wise, what, what can you see? You could actually see faster load times of programs, faster processing and computing challenge. Any refresh that might happen within an application could be faster.

21:48
So, for customers who are editing pictures, videos are rendering AKT videos, multiple videos at the same time.

22:01
Opening up multiple browser tabs, those are all very good examples of how they will see the benefits or the performance of a crucial EFI product.

22:12
And, and also, customers could actually multitask more and that multitasking will be much more responsive compared to a DDR poor memory product and without sacrificing your system performance.

22:30
So you can actually have more applications open and simultaneously work between them, without creating any sort of system lag or without slowing down your system.

22:41
So so everything your system performance is maximized for the new Intel CPUs and your multitasking ability or productivity is significantly improved compared to adopting a duty of for technology for the New Intel CPUs.

22:58
So, if we go back to the point that we discussed earlier.

23:03
If you look at the theoretical speed of 30 to 100 and capacity of five and DVR for DDR fi, theoretically, provides more than 36% over to ... four.

23:16
And at the launch excuse a party at 100 megapixels per second, DDR flying, provides up to 87% more effective bandwidth, then BDR four.

23:26
So, when I say effective bandwidth, what it means is that it's not the theoretical bandwidth that you just see in benchmarking conditions.

23:34
But it's actually real-world conditions can work that you could use, those could potentially see.

23:41
So, uh, we, there are more benefits of ... for which we will cover more in the coming slides. We're going to be talking about some operating voltages and some channel architecture differences, which you will find more useful in terms of benefits of ....

24:03
But these are the high levels, blazing fast speeds national bandwidth influential video for operational efficiency, channel efficiency, D, So the three big things or takeaways or benefits of CDFI memory over TDL.

24:20
So that's, that's a quick overview of the benefits of CDFI.

24:26
Jake, anything that you would like to add on this one?

24:32
No, you're good. Like you said, we're going to dive deeper into what theoretical bandwidth actually means or what those improvements are subtle.

24:38
Well, we'll get deeper into that, I'm sure there'll be a few questions there.

24:41
OK, OK, Sounds good.

24:45
All right, we looked at some benefits. Now, let's talk about features and some product information.

24:52
So, as I said earlier, we launched our crucial DDR five, at 8, 16, and 32 gigabyte dense obese. And all are operating are delivering speeds of 4800 mega transfers per second.

25:07
They operate at a voltage of 1.1 volts and backed by a limited lifetime warranty.

25:13

And, as you can see from the pictures, since the beginning are crucial DDR ... product has a stunning black b.c.d..

25:20

So, you could actually color match your builds. Our customers could color match the bills when, when they have all black PCB motherboards, or even all black PCB colored, graphics cards.

25:37

And you have 50% improvement over speeds compared to .... So, that's the 50 bushel more, 1.5 times more data rate compared to ...

25:49

and the brand, with, which is nearly twice at the lunch, the launch ... provides nearly twice the bandwidth of ... at 3200 megabytes per second.

26:04

And here's some of the details that we actually will be talking about more in the coming slides. But just at the very high level, the bush length of the pipe is twice that of TDR for. We also have twice the amount of banks and bank groups compared to .... We also have two independent, 32 bit channels per module.

26:27

And then, we also have our on module probably management, which historically has been managed on the motherboard.

26:33

PGR four Norway does move down to managers, the public on the module itself.

26:40

Then, we have on de ECC feature at the component level.

26:45

What it really does is that it provides long term stability or stability for the technology in the long term.

26:54

And this is not to be confused with the system level and the connection you could get, for example, from Silver DRAM product, which is so typically seen in several applications that is provided. Those memory, products on modules provide data correction code at the system level. This is not to be confused with that on day ECC. It's just built into the memory technology itself.

27:24

And it's just part of what ... and what are the DFA product.

27:29

Then additionally, and the icing on the cake for the crucial ... product is that we have x.m.p.p.

27:38

three support for the New Intel CPUs.

27:40

And what it really is is that it is provided for recovering memory performance in the event of, let's say, a system level down clocking.

27:52
two slower memory speeds.

27:54
So, for example, there are certain instances you could possibly see where the memory speeds could fall below, the advertized speed of 4800 mega Drive was pushkin.

28:06
And in those events, customers can simply go through a couple of steps and push the memory back to the jetlag speeds of 4800 bagger translates per second. So, this is extremely easy way of recovering limited performance in those instances.

28:27
So, this is a quick view of why D D R.

28:32
Pi is so much better technology than DDR for, so, as we are being seen from the beginning, DDR five, it's just not faster than ....

28:44
It's much better memory topology.

28:47
So, we will be talking more on it, but this is just a high level view of product information and some of the features that we have included without Crucial DVR.

29:00
So, I think really, really quick, just some question. We have some questions on the ECC.

29:05
Since you're just talking about that, I don't want to get too far away from the SEC topic that we could kind of forget.

29:13
What we were just discussing but the on die ECC is available, or that comes on all DDR. Memory module.

29:24
Correct, correct.

29:26
Correct, OK, that feature will be On any Memory Windows ... product. Yes.

29:33
So, then, when I want to one correction there, sorry, I think you and I haven't had a chance to talk about this much.

29:39
So, the onda ECC is actually an optional spec within genetics.

29:46

It's not absolutely required, for DDR five now, based on where all the memory vendors are and, you know, looking at it, and Micron has chosen to take advantage of that, because eventually, it will be lead needed.

We can't comment on other vendors at whether or not they're using that, but for Micron for crucial products, we are enabling that feature at the component level.

So, just something to keep in mind there. It's not 100% guaranteed for all vendors.

So, is this ECC this on day ECC is really?

It's necessary for the larger, higher density, DDR fi is that where somebody might get into maybe not including ECC if it sound like an eight gig module or something like that.

They some memory manufacturer might opt not to have it.

But when you get to the larger capacities, like 32 and 128, that's where you really need that on die ECC.

Yes, and no, actually really doesn't have anything to do with the module.

The total module density other than, you know, the more drams you have than the higher the likelihood of a potential failure.

It's actually it's unique.

It's inside each D ram component, so, like you said, as we continue to scale to 85 and get to even higher density components, 24 Gigabit 32 gigabit 64 gigabit in order to get those higher densities process, technology has to continue to advance and we're reaching the point in DDR five, where we're getting to the process geometries where you just have to have on the ECC to correct those errors that can happen. So.

Now, to your point, eight gigabyte modules have less DRAM.

So it's certainly possible that a memory vendor could say, well, because I only have four chips on this module, I'm not going to enable it for this module, and only save it for higher densities.

But again, it's a component level feature, so, for me, I don't see the advantage in doing that, it's either, or don't use it. Whenever you're using that particular component, and for Micron or Crucial, the decision has been where we're going to take advantage of it and include it on all our products.

31:57
Then eventually there will be DDR five true ECC memory like you would have for a server.

32:05
Yes. So that's a very important distinction here is that when we talk about the ECC, we're talking about a feature internal to the DRAM component.

32:14
The module form factor, however, like Karthik is showing here, the ...

32:18
it is still a non ECC you down which means at the system level the end of the relationship between the memory controller and this crucial DDR five module is still. There is no error correction at the system level.

32:30
Just like in DVR for today. And eventually we'll see ... ...

32:34
those modular form factors do allow for system level error correction between the memory controller and the modules for this launch over the product we're talking about. Today is a non ... that is built with ... components that do have on on the ECC enabled inside each individual to your app component.

32:58
Does that make sense?

33:00
Yeah, yeah.

33:01
It makes perfect sense, and as as you're explaining, I'm also reading other questions, and I'm, I'm wondering as I'm decipher and one of these questions. They're kind of asking, you know, the DDR five has on Di ECC memory and DDR four does not have this feature.

33:23
So, where's that value of the on die ECC That's preventing.

33:29
Errors that may have occurred on DDR or is there some measurement that you guys have done that shows.

33:35
You know, hey, with DDR five and this new feature, you have, no, this, many less errors, or it improves reliability, or it.

33:45
Um, how do you translate that to a consumer? Right, translate that value.

33:52
It's a good question.

33:54
Micron does not publish any, any data about, rely, about reliability, um, you know, on our website, or anything on any reliability metrics, error rates, anything like that, The biggest thing

I'll say about on the ICC is it allows the memory technology continued to continue to scale to smaller process geometries and higher densities add.

34:16
So, you know, where we're at right now with module densities, the same as EDF, ..., five, basically the same module densities.

34:25
Yes.

34:26
Right now you could see that if you were, if data was provided to show the failure rates and failure tapes, the DDR four versus the five, would likely be a difference. Because D D R five is able to correct some of the errors, it's not able to correct all of them. So, it'd be a difference in the type.

34:42
And, you know, if you do a kind of a parade or chart, the charts look different.

34:47
But overall, from a system standpoint, from a platform stability, platform reliability, there's really no differences right now that using this feature allows us to basically, you know, check it out, make sure everything's functioning right, so that we can continue to scale to higher densities later on.

35:06
OK, so let me ask just a couple more questions then we'll, we'll, we'll move on.

35:12
But basically on, on the ECC, you will have ECC Enterprise level memory and it will be denoted as being ECC meaning system level, ECC.

35:26
That's all things that we're familiar with and and understand, right?

35:29
So, Nos.

35:32
Yep. Those products are on our roadmap, and they will launch in conjunction with the platforms that support those module form factors.

35:39
So nonie ... is by no means the only DDR five form factor. It's just the first.

35:44
We have as non ECC yesterday was coming. We'll have ...

35:47
, all the standard form factors, as the platform has launched that, are able to support those, OK. So, now, this one is this one is really important. I'm glad the customer asked this question. because they're saying that some of the V 690 motherboards specifically state that they do not support ECC memory.

36:11

So, does that mean that micron on Die ECC is not supported by that motherboard?

36:21
So on the ECC is in inside the component, what that spec is referring to is an ....

36:28
And so what it's basically saying is if you blow if you put in an ECC, you did something with 9 or 18 DRAM components, you'll either not boot or it's it's a waste because that ECC component will not be used because that system that platform has not been enabled for the Memory controller to run error correction at the system level and at the module level.

36:50
It's that Whether or not ECC eudemus support it has no bearing on on the ECC running internal to the D Ram Components?

36:59
There's no link between those two.

37:03
Yeah! Great! I! yeah I definitely wanted to make sure we got that could that? Harrison?

37:08
Very good question and it's very low ECC system level ECC completely different than on Die ECC.

37:19
Correct and ... is what's new. We've never had that in DDR technology system level ECC.

37:26
that's always been there and some we've always had ECC ... LR Dams, there's always been that.

37:31
That feature if you install the right macho the right form factor into the platform supports the SEC calculations. So exactly like you're seeing in this case you have a platform that an SEC union will sit.

37:44
And it supports a UDI form factor. But the platform does not support the ECC function. So you'll either not boot or your ECC buying ECC memory. And ECC module is a waste. So there's no change with TDR five to how that's been always been running. So, you know system level ECC. We're not trying to create a new term here that's the way it's always been a system level ECC for DVR technology.

38:10
So maybe, you know, for me like what, what's good uh, I guess the advantage of having on die ECC verse, system level, ECC, high level, but, yeah, high level?

38:32
Well, there's really, no, there's not really a comparison because there are two different plus, there are kind of two different platforms to different use cases, You know, I, if you're dealing with a high reliability application, high or high reliability platform, you know, something that you cannot go down, cannot handle any memory error. Then you need system level ECC, whether that's an ... or an LR down.

38:56
You know, ..., those are different platforms ECC you down there's a little bit of crossover, but, um, you're kinda comparing apples and oranges from an expectation of the memory technology.

39:07
Amen.

39:09
So, that, I don't know if that doesn't answer your question, but that's it.

39:14
That's the only, I guess, that's the caution I have with that kind of question, is if you're not comparing, like for like, necessarily, right.

39:24
Alright.

39:24
Well, these are, these are great questions, and we're getting some really, really good clarification, so, definitely keep sending in the questions, why don't we go ahead and and keep moving forward with their presentation, Karthik and we'll save some questions for the end.

39:41
Yeah, I would probably say, I mean, Karthik hasn't listed here, I mean, on the ICC is an important part of the DDR five Technology. I don't mean to dismiss it, but I would say, as you're working with your customers.

39:52
What's more important is, know, the higher bandwidth, two extra purslane, 2 X 2 X, the bank roofs, independent, subchannels, everything. That's making the DDS five interface better.

40:03
On the ICC is another feature that is great.

40:06
It helps the memory technology continue to scale to higher densities, but the story, about DDR five, like Karthik said it's not just faster, It's better, and it's all those double that's double that double that it's all everything that DDS has done to make the channel architecture better. That's where I would focus with your customers.

40:26
Back to you Thank you, Jake.

40:27
Yeah, of course. Thank you.

40:31
All right, Now, let's get into some details as to line the line differences between ....

40:39
So, start off, starting off at the top, just the color right there the visual differences.

40:48
Crucial DT R Phi will be in black PCBs and the four will be and continue to be in the green BCB color speed.

40:59

We launched DDR 5 at 4800 megatons was the second, future speech will be higher, could scale to much higher speeds. And DDR for Technology actually maxed out at 3200. So, that's that's the maximum speed for a standard ..., Crucial DDR poor product. So, right there, that's a 50% faster speed improvement over DT of or at 3200 mega trends with a second.

41:29

So, blazing speech. So that's, what's the key.

41:34

one of the key benefits that that you could possibly highlighter to your customers and then we also have extra support.

41:42

Well, crucial DDR phi. So this one will be unique to each memory window you're in the market.

41:49

Crucial DDL. Ford does not have this feature.

41:52

And once again, just to re-emphasize this, the x.m.p.p.

41:57

support is actually important and easy performance recovery in the a situation where there is a system level down clogging optic memory of your customers. There's no way to slower speeds. So we have more Q&A about this feature, available on ... dot com.

42:16

So you're more than welcome to take a look at it, or I can also follow this information to Kent maybe after this meeting, that you could all kinda sit in, know more about this feature.

42:28

Because we really think that this X and B support feature for performance recovery will be of extreme value for your customers that are experiencing doubt locking of their memory and certain events, so that's that.

42:45

Then, I have received a few questions about latency so far from silicon partners. So I thought I would address this up in front.

42:54

So, the cache latency has actually increased compared to ....

43:00

So, ...

43:02

at 3200 megawatts per second has a cache latency of 22, when I saw the launch speed of DDR 5 at 4800 megatons per second, as a calculated 0 40.

43:15

So, yes, that is an increase in task latency.

43:19

But if you have had a chance to look at crucial in microns precision on how we see latency is that it's not the complete picture to evaluate the performance or the capability of our memory product, because it's only looking at one half of the picture. What we really should be looking at is the true latency, up a memory product, that takes into account both the memory speed and the cache latency.

43:50
So, to quote, Jake, what we always advice to our customers is, that, you buy the highest speed, or highest performing platform, and memory module.

44:03
And then depending on your budget, you can choose what memory product you want that, gives you the best cache latency, because the reducing the cache latency can actually get expensive. So, that's, that's really up to the users or customers, this preference, as to how much they're willing to pay for that.

44:23
But for the standard crucial DDR five product, it actually has true latency of 16 point 6 6 7 nanoseconds, which is approximately two nanoseconds more than that crucial DDL poor product.

44:39
So that, that being said, now let us look at the module densities, the crucial CDFI product launched at 8, 16 and 32 gigabyte module densities.

44:52
As Jake said, all of these use 16 gigabit based I didn't use to build these modules. Now, crucial video for has full starts module, crucially deal for marginal densities, start from four gigabyte and then also has 8 and 68, 16 32 gigabyte options. So, four gigabyte.

45:15
It's no longer, Oh, part of the it's it's four gigabyte is not part of the crucial to the five.

45:23
Or even any DDR memory Technology, because with a 600 gigabit based diet, you can really build a four gigabyte module. So, the module density actually starts at eight gigabyte, so that's a key difference that you could be interested on, your customers, could be interested.

45:40
And the next two points that I want to talk about is the operating voltage on the problem management.

45:46
We talked about this in the earlier slides, DDR five operates at 1.1 and has an on module, power management system.

45:55
Why as compared to that the ... product and our motherboard power management system and operates at 1.2 volts.

46:05
So, the key benefit here is that, the crucial details phi is speculation, because it operates at a slightly lower operating voltage. And, of course, having the polar management system on the

module is much more cleaner way to, to route power. So, it actually has improved or signaling as well for the memory module.

46:30

So, that's, that's one key benefit here. Narrow touch point that you could potentially a highlighter, your customers and moving on, this pin count and notch position is all something that we've talked about in our earlier slides. DDR poor has 208 sorry, 288 pins.

46:50

...

46:51

five, Just as a coincidence, has the same number of compounds, but the pin assignments are different and the actual the notch position is also different.

47:01

So, you could, um, install a DVR fi memory product only in a compatible DDR fine motherboard put them in windows you can use.

47:13

You could not install a DDR high memory in a DVR for motherboard. So, that's a very clear distinction.

47:20

Of course, like Jake said, jokingly, if you try to install a diagram, pick something, either the motto Porta or the new product, so that's, that's a key thing.

47:31

Let's, will we have some more differences between the two limited technologies, and this is the most interesting one.

47:41

So, as you heard from Jake and me from the beginning blazing speed and national bandwidth, that's what DDI five is all about.

47:49

How is that massive bandwidth possible? What, what is it that that makes it possible. So, it's all it all comes down to the channel architecture.

47:59

So, what ... for, we only had 1 unified 64 bit channel, but on crucial DDR five, you have 2 independent 32 bit channels. So, having this duality mode, it's almost like having a dual channel, memory mode, but on the module itself.

48:20

So, having the two independent channels provides more concurrent operations to happen, and then you also have increased length, which is twice the d.p.o. for the amount of bank and the bank groups are also twice that of duty, or four.

48:38

So there's also one other something to point out.

48:43

Is that because you have more number of banks and the number of bank groups, the refreshing scheme or the ... technology has improved significantly. So in a memory refresh happens. Typically, all banks are locked during the refresh process, but the ... And apply it with more banks available.

49:05
What happens is that only one bank point bank group is actually log while the rest of the banks are still accessible during the refresh.

49:15
So, again, what it enables, they said more kind of go into operations and all of these combined is work that makes that channel architecture of CDFI product significantly improved or superior over the four product.

49:33
So, this is what, is this one of the main features that we, we have stayed in France since the beginning.

49:43
If you look at the waterpipe example that I quoted earlier, faster memory just means that the faster. The water is just moving faster, but not just undead, purple TTF.

49:56
I, actually, the bandwidth has actually increased. So, it's not just faster, It's much better than ... for, so, hence, the title. And then, lastly, we also have the ... feature. That's that's available on a crucial DVR byproduct.

50:13
As she said, it's just one long stay in long term scalability and stability, and that just enables for future.

50:23
Remember your products and geometry, as Jake said.

50:27
So, that's an in-depth look of, some of the additional, just would be ... five.

50:33
And the ones on the right side are the, the key benefits that you would, you could possibly focus on educating your customers.

50:44
So, if I were to go back to the previous slide, blazing Fast, Speeds, Performance Recovery up to Jeddah speech.

50:54
..., and Improved signaling compared to ...

50:57
four, and National bandwidth improvements over crucial Duty Airport.

51:02
So, these are some of the key benefits of Crucial DVR five, compared to a crucial duty or four.

51:08

Now, that said, going back to one of the points, where we talked about both make technology so possible.

51:17
With the 12 ... processors, you cannot, of course, adopt what limited technology. You have to choose one over the other.

51:25
And because each Momi technology needs its own multiple design, customers have to choose which technology to adopt for the needle CPUs.

51:37
And because of all these differences and the benefits, the customers could benefit could get by adopting BDR fighting over DT therefore, We think customers have incredible value and can benefit a lot more by attacking DDR five technology for the new CPUs.

51:56
Basically, what we are trying to say is that if you are already investing in the new CPUs, your customers are investing in the neonatal CPUs, you might as well invest in a crucial ... product to maximize the full potential of kunduz should be you.

52:12
Because if you do, if your customers do choose to about video for member technology, which is totally fine, but you're just not maximizing, the potential option is for you. Your CPU could actually do more if customers were to adopt the crucial DVR five.

52:27
So that's a quick look at the differences between crucial to your phi by DT or four.

52:32
So we talked a lot in these two slides. So let me take a quick pause here to see if there are any questions.

52:42
Yeah, we, we have a lot of questions. I hope we actually have enough time to get through everything. But quick question, Let's kinda talk gaming for a second. And over clocking, can you, over clock these modules, especially since they don't have heat spreaders on them or, or that feature, what about over clock?

53:03
We, we do not recommending we do not recommend over clogging our standard genetic, crucial ... Product because doing so, will void the warranty. And, as you already stated, in the question, you can, these products do not have heat spreaders on them, they're not designed for over clogging, so we wouldn't recommend products.

53:27
Do you see crucial, have an aversion down the road that might include the capability of over clocking?

53:35
And maybe adding heat spreaders is not only a way to kinda, you know, demonstrate the difference in the value, and kind of showcase the high-end capability of the product that we see something like that coming down the road.

53:50

Um, for this standard, jetted, crucial ...

53:55

product, in the future, um, for these tend to be some D speeds.

54:02

Again, we don't see a need for heat spreader.

54:05

But for future standard genetic, crucial DVR five products, we are continuously accessing, as Jake said, the heat dissipation and the Airflow around the module when installed in the system. And if and when, they will need huge bonus. As, as Jake said, his presence is one thing, but that could also limit Airflow. So we'd love to look at all of that for the crucial CDFI products.

54:32

So, I have a question that relates to this, to this slide that I'm looking at. And I gotta admit, I'm not technically savvy enough to potentially ask this question, but, I'm gonna go off the deep end and ask it anyway. And hope maybe you guys don't understand. I'm gonna read exactly as a customer, type it in, but they're asking, you know, Do you expect the motherboard manufacturers to use?

54:55

two by banks or 2 by 2 banks or total of four Dimmed?

55:00

Do you have any insight into that?

55:05

Jake, would you like this one?

55:08

To buy two banks.

55:11

Can do you know if they're referring to two dams for a channel, or if they're talking about the independent 32 bit channels, any more contexts there?

55:19

I just kinda read the question, as it was, so, OK.

55:24

I mean, the way, you know, everything we're listing here are the independent 32 bit channels, the double the burst length, double the banks, double the bank groups. That's, that's part of the DDR five Architecture.

55:34

And so, probably the way I would answer that question is not the Board vendors will not have the freedom to uniquely determine which of these features they will use. They will be using all of them. That's how you interface with DVR five, is sort of the two, independent, 32 bit channels instead of 164 bit channels.

55:52

So, I would say, yes, I expect all motherboard vendors to support all of these features.

55:58
Because it's inherent to how you communicate with CDFIs.

56:06
To add subject statement, it's just like on the ECC.

56:11
We are building on crucial ... products with these features that you're just looking on the screen. So it's not like what vendors can choose, which one they want to adopt or something. It's just built into the components and that makes up the CDFI product.

56:31
Kent, I think you had Mentioned, there was a question on latency, and I know car, they talked about latency. Do you want to touch should we touch on that for a minute?

56:39
You can. I mean, me exactly at, what about the latency, on DDR five. So I know you guys went over that, but it's definitely a good topic and good question.

56:51
Yeah.

56:52
I would, I mean, because I, you know, if you look at this chart, you're probably thinking, Wow, latency went up for 85, what the heck?

56:59
That's not right. That's the wrong direction. Latency should go down, right.

57:02
And, you know, the biggest thing with DDR five is, if you're talking about, you know, OK, I'm going to talk about speed right now, And then I'm talking about latency. If you look at those two specs, OK speeds going up by 50%.

57:14
Latency is going up by about, you know, 20%, Well, we don't want latency to go up, that's bad, so do you get five is bad, know, you gotta, you gotta take yourself a bigger, higher level speed. There's latency, there's banks, bankruptcy refresh schemes, you know, all these different ways.

57:31
All these different points about the architecture of memory.

57:33
And when you aggregate all of that up, with DDR five, because the channel architecture is improved, we have 232 bit channels instead of a single 64.

57:43
We've got so many different ways to access the memory with more banks, more bank groups and improve refresh schemes. It turns out that DDR five is still higher performance even with longer latency. I know that sounds counter-intuitive, but it's true.

57:56

Mean, like Karthik touched on, when we took DDR five, and we down clocked it. Why would you ever do that? But we did it to see, and it's got an experiment, we down clock, that thanks to 3200 and compared it against TDR for.

58:08
And at the same speed, PGR, five delivered, 36%, 36 37 percent more bandwidth effective bandwidth DDR for at the same speed.

58:19
And so, know, you're gonna, you're gonna have customers, because ... latency is a big thing, especially in the gaming world. You're gonna have customers that focusing on, that ... latency and say, Yes, I've got longer with latency. That's bad.

58:30
I don't want ..., But you gotta look at the bigger picture.

58:34
Do you have five channel the architecture Everything about? It is so much better than it overcomes and exceeds the performance at EDF or even with the longer latency cycle?

58:46
Great.

58:48
So we're kind of at the top of the hour. I don't know if you have any more slides. you wanted to, you wanted to cover, But we're kind of at the top of our hour, we've had a lot of really great questions.

59:00
They'd get asked, but if you wanted to go ahead and wrap up the, this session, and then we'll close everything out.

59:08
So everybody, if you can hang with us for just a few more minutes, we'll, we'll get everything wrapped up and share everyone on with our day.

59:16
Chart. What I could do is, if everyone has two minutes, I'm going to skip this slide as to why from crucial?

59:23
If everyone has a couple of more minutes, we can quickly look at this video. It's about two minutes, and then they can wrap up.

59:29
This is the last slide?

59:31
OK, OK, good.

59:33
Yeah.

59:36
Show this reviews.

59:43
Can everyone hear the audio?

59:47
We can't hear the audio, unless you play it through your computer speakers, and we can pick it up on your microphone.

59:55
Oh, OK, one moment.

1:00:02
OK?

1:00:21
Oh.

1:00:25
I believe the audio is not going to play out just how I'm telling them from Michael and so on. So we're just gonna play out of the audio, OK, but still, you'll get all of the message, It's just music and tobacco.

1:03:00
All right, That is it.

1:03:03
Great. That that's all I have for today, and for next steps.

1:03:07
We're not just really, we're not really going to talk about any of this, just, I just wanted to leave it as an action item for anyone who's willing to dig deep, still, what we want, what we think about Benchmarking video for a video, And what we think about memory, ..., technology, being adopted in the marketplace.

1:03:29
That is all we had for today.

1:03:31
Thank you so much, everyone.

1:03:34
So, um, really quick, everybody on the call. I'm, I'm gonna ask one special favor here and I will reward you guys by throwing some extra raffle drawings on the list for tomorrow.

1:03:48
So, hang with us for a few more minutes here, because I would like to give Micron an opportunity to at least talk about why Micron, right? I think that's a really important thing, and I didn't want you guys to have to skip over that.

1:04:03
So, for everybody, if you can just hang with us for a few more minutes, I'll throw some extra $50 raffle cards into the drawing for tomorrow. So we'll give everybody an extra opportunity to try to win something.

1:04:14

But I would like to give you guys just a couple minutes to really talk about why micron I think this is important, microns, a critical partner of ASI. So, give us a couple of minutes of the why Micron?

1:04:34
Fantastic.

1:04:35
Thank you, so, I'm very excited to be talking about why a crucial micron, specifically to the crucial D R five product.

1:04:46
Now, we have our crucial EGFR product in the stunning black PCB.

1:04:51
So its customers would too do a new DDR five build.

1:04:57
They could color match their memory motherboard and graphics cards. Because all products, PC components have pretty much moved on to an all black PCB. Gone are the days where each PC component being in different colors, but we are seeing these industry trends catching up.

1:05:17
So we, we actually believe the Black PCB will truly be crowd pleaser and with the x.m.p.p. support that we are providing, for a crucial DDR five, for easy performance recovery, customers could save from buying more or even expensive memory to get just the genetic speech that we advertized in our product.

1:05:40
And on Moreover, for customers who are wondering, well, we get it. That DDR five needs a specific DDR five compatible motherboard, like how do I find it?

1:05:53
Now, the motherboard manufacturers are also under the adult sales of borgo until number 4 6 0 AM Pacific time. So, as we get more information from multiple vendors, please keep checking our crucial advice or tool and the link is provided right.

1:06:10
If not, you're more than welcome to visit crucial dot com slash DDR five.

1:06:15
We will keep updating our product pages are crucial website webpages to provide more information for our customers and our partners to find the right motherboard for experiencing the high performance of crucial DDR fiber.

1:06:35
Now, that's product specific values as to why choose my con, crucial, uh, and in general, for any crucial branded micron products and products.

1:06:48
Micron has been a memory experts in the semiconductor industry for over 43 years. And we are one of the three major data manufacturers in the whole world, and the only one headquartered in

the US And crucial is the consumer brand of micron. And we ourselves have about 25 plus years of experience in developing and bringing consumer memory and storage products to the market.

1:07:16
So, our memory products are backed up by our limited lifetime warranty. Because just a unique collaboration between micron and crucial, we are able to squeeze every ounce of performance from more limited products without compromising reliability.

1:07:36
And we also have stringent pre market testing with our motherboard vendors and partners.

1:07:43
So, every crucially Delphi product has been tested and validated with every top tier motherboard manufacturing you could find in the market and they all work just fine.

1:07:53
That's why we keep repeating ourselves. That crucial ... product has a micron quality. That's just to the reliability that you can definitely trust.

1:08:03
We, you also have access to product information like what you saw today. We have product flyers and more product digital assets, like pictures, videos that you just saw.

1:08:15
You also have opportunities for training with our product experts, like checking myself, and even more, if needed.

1:08:23
And we have our award winning customer support teams ready to help you and your customers as and when needed. And you will get access to an expedient sales network and get one-on-one assistance with them.

1:08:38
And you'll also get better pricing, consistent inventory or supply from a trusted, expedience, DRAM, original data manufacturer in the semiconductor industry.

1:08:49
So that's a quick look at why consider buying crucial DVM five micron.

1:08:56
Thank you so much for everyone for your time extra time going into the process.

1:09:00
All right. Thank you, Karthik, that was, that was very, very beneficial and helpful. So I appreciate you taking a minute to go over that for us.

1:09:08
So for everybody on the line, I know there's still some questions in here, and we'll make sure that we get those over to karthik's team. And we'll get these answered.

1:09:17
I see a lot of questions about motherboards, and different things like that that maybe karthik and Jake are not the right people to answer, but we will get answers to these questions that you guys submitted in.

1:09:29
And as a reminder for joining us today and staying with us through to the end, You're automatically entered into the raffle drawing for a chance to win the Apple i-pod Plus.

1:09:40
Because we went over, we're going to throw some extra $50 rappel rappel cards, Add it.

1:09:46
So, you know, I'll do a bunch of those that will announce the winners of those tomorrow for our session tomorrow. So I wanna be sure to invite everybody back for day three, which will be tomorrow at 11 o'clock.

1:09:58
We have Toshiba size. Very excited about this, too. She those are new authorized partner or hard drive. Or starting a franchise relationship with Toshiba.

1:10:09
Want to make sure that everybody joins us tomorrow to get information on their hard drive products and allow ASI to introduce you all to our newest manufacturer Partner Toshiba, so join us tomorrow for that at 11. And with that, I'm going to go ahead and never end everything since we ran over. Look forward to seeing you all tomorrow, Karthik, Jake. David, thank you so much for joining us today, and do the presentation. We really appreciate it. Lots of great question. Thanks, everyone.

1:10:39
Thank you, everyone, again.

Transcripts are automatically generated.