

They are distributed globally through a combination of over 3000 independent dealers and distributors in more than 150 countries so most likely Trish and Kevin have come across these farm equipment.

Ben is a 2004 graduate of the University of Wisconsin-Platteville where he earned a degree in ag business with an emphasis on engineering technology. After graduation he joined AGCO and he currently has global product management responsibilities for field data transfer and machine-to-machine communication.

He is also very involved in industry organizations focused on agriculture data including ag gateway and ag data collection in the agriculture industry electronics foundation among others so I'm going to hand this off to you now, Ben.

Ben Craker: Thanks, gee, I'm just going to do a high-level overview of all the different kind of technologies farms use in the field but first I wanted to kind of start-off with something out of a November 2014 Harvard Business Review article by Michael Porter and James Heppelmann where they kind of talked about the progression of technology in the ag industry going from kind of the machines all the way to the system of systems.

So if do the next quick get a little circle pops-up, this is roughly where I think we are today. We're starting to get smart connected products so as equipment manufacturers we've been building a lot more intelligence into our machines in the past several years.

And now we're to the point where we're starting to build-in cell modems in most of the machines at least for larger production agriculture are coming-out of the factory with some sort of cellular modem or Wi-Fi device built-in to

them from the factory trying to get those connected so we can start moving-out a little bit farther to the right there to get to the system of systems.

So if you go to the next slide, we'll kind of go through what some of these technologies are the different applications that they're all used in so the first little bubble that popped-up there is over the farm office and I think Kevin went through a lot of the different things that farmers use this for just for managing their business and being able to run Websites, reach-out to consumers and things like that.

They also are going to use a lot of connectivity there to manage their operations so I think it was mentioned being able to go-out and shop for different inputs so if they're looking for new seed chemical equipment, things like that, they're going to be doing a lot of research online, looking at different forums, things like that where you really need an Internet connection to be able to do that.

They're also going to be doing those transactions with those different service providers transferring data back and forth to get recommendations. All that's going online now and then just their overall farm management system, most of those are starting to move to the cloud and not be PC-based programs anymore.

So just being able to manage all their operational data, the business system they use to run the farms, things like that, definitely all need some sort of connectivity to make that happen. Go to the next one we'll look at the sprayer over there in the field running around.

Wireless transfer is getting to be pretty important for these types of machines so all the precision technologies that people think about on reducing the

amount of seed and chemical used in the field based on putting just the right amount in the right spot.

You have to get a prescription map out to that machine so it knows where it needs to put what stuff. Historically that's been done with you know, things like SD data cards or USB sticks which are kind of prone to getting lost in the truck or forgetting to, you know, get plugged-in to the terminal.

So that's where we've really started to see this movement towards growers wanting these machines connected and they can wirelessly send those work orders to those machines so they don't have to worry about physically transferring that prescription out to the machine.

The next one is kind of on the other end of that so as you're out in the field with your combine harvesting, you also want to get a record of what yield came-out of which spot in the field so if you're going to do management of multiple different zones at a sub-field level, you need to have the historic yield information to know which part of your field yielded better than others.

You can do infield trials to see how different fertility programs work within that field so that as applied information gets to be pretty important again putting it on a USB stick and hoping that makes it back to the farm office, can sometimes be a little bit risky. There are also a lot of times where there's pretty time-sensitive information needed.

If a farmer is going to do a fall fertilizer application for example, they want to get that data off the combine right away because as soon as that machine's out of the field, the next one's coming-in to put fertilizer out.

To be able to generate that variable rate prescription, they're going to need that yield file so driving a couple of hours back to town with a USB stick so somebody can analyze that and generate that prescription is not real feasible.

But if you can wirelessly transfer that data, you can get a lot more of this stuff done on a lot more timely basis. Going to the next one, we have you can kind of see little irrigation pivot tracks in the field there so a lot of the same stuff happens with the irrigation system.

So as we try to get more efficient in the use of water, you can essentially, you know, begin creating prescription maps for watering different areas of the field at different rates. We're also seeing more (chemigation) where some of the fertilizer or pesticides can be included with the irrigation water.

That needs a work order going out to those so the machine, the pivot or whatever irrigation method they're using knows where to apply different amounts of water and the same thing, you want to have a record then of where that water was applied, how it was used and things like that.

So very similar to the equipment, just those are kind of stationary in the field, they don't really drive around much and additionally to that there's a big monitoring aspect to that so these irrigation pivots are often not very close to civilization.

So having to have somebody drive out to all those, start them up, make sure they're running all right, nothing's broke down, gets to be very time-consuming and expensive for farmers when they're, you know, constantly forced into looking at labor shortages, the ability to hook a telematic system up to one of those to be able to remotely turn it on, monitor how it's

performing and identify any issues without having to send somebody out there is a really big benefit.

The next thing that's called-out there is a GNS correction signal so going forward most of the farm equipment now can actually steer itself in, you know, straight rows down the field. To be able to do that you need to have a correction signal to augment the normal GPS position you get through things like your phone or, you know, your (tom cop).

With this correction signal the machines can drive actually be within one inch of where they're supposed to be but you need a way to get that signal out to those machines.

That's transitioning rapidly to come via a cloud-based platform so you need a cellular connection for that machine to be able to connect with the Internet and get that correction signal to be able to operate at those high levels of guidance accuracy. Next one, so just remote monitoring in general, a lot of the logistics and coordination.

As you can see, there's a lot of different machines out in the field running around so from the farm office, the farmer wants to be able to see where they are, which machines are running low on product in the tank which combines are getting full, need to be unloaded, which machines are low on fuel.

From the AGCO perspective, you know, wanting to support equipment through our dealers. We want to know how many hours are on a machine, is it due for routine maintenance, are there any things that are out of the normal on the operation of that machine where, you know, a potential failure could occur.

The nature of farming's very time-sensitive so being able to instantly get notified that a machine has an issue to be able to get out there and know exactly where it is when you're dispatching service trucks, that's a huge benefit to be able to keep the focus on up-time and reliability on these machines as well as things like terminal mirroring so you can remotely see what an operator's looking at.

If they're having an issue, it might be just a training or coaching activity to make sure they know how to run the terminal in the cab. Same thing for software updates. I think everybody's pretty familiar with that today. Right now you got to drive out to all these machines and Flash in the software on them.

Eventually if we get enough Internet access to them, we could be able to push those updates over there and wirelessly keep those machines up-to-date to help reduce downtime and maintenance. The next one is over at the grain bin there.

Similar story to the irrigation system so a lot of grain dryers and grain bins can be connected to the Internet now so again you can remotely monitor those during the heat of harvest when a lot of grain's coming-in, the dryer is, you know, it's not uncommon for those to run 24 hours a day for, you know, a month or two straight as different grain comes-in.

And a lot of times those aren't located real close to the house either so a farmer has to get up very few hours and go check on those all through the night. If it's connected to the Internet, he can do that from the, you know, the comfort of the app while he's sitting on his Laz-E-Boy at home, makes it a little bit easier to monitor all that.

And not as much time spent driving back and forth to check on things that are going on. Same thing with the truck there, you know, you see in the commercial trucking industry a lot of focus on the logistics on monitoring where trucks are.

Same thing on the farm operation, they want to know where those trucks are if they're waiting in line, if they need to do anything different in the field because the truck isn't going to be back in time to unload a combine.

Next one is the livestock building so as it was mentioned with dairy farms, they have cameras and things to remotely monitor those. Most of the cows now have RFID tags in their collars so you can monitor how much feed and water each cow's getting, how much milk they're producing.

At AGCO through the GSI brand we do swine and poultry building so we can do the same thing to monitor feed consumption, water consumption, the temperature, humidity, basically the HVAC systems within those barns.

So we want to be able to monitor that remotely because again those aren't always located real closely to civilization so you got to have a pretty good drive to go-out and check on those buildings sometimes.

And those systems are often used to monitor for health and other things. You can tell if water consumption goes down. There might be an illness going through the herd or flock so you want to be able to access that information pretty quickly, be able to get to it remotely so those monitoring systems are pretty key to be able to access through the Internet.

The next one is like I mentioned with the equipment side of this, the dealers and other service providers, there's a whole service market that can pop-up

that's just kind of getting started now based on having access to the telemetry data coming from these different machines so you can monitor them, optimize performance, identify any outliers, you know, that can lead to things like operator training or identifying failure issues earlier.

So there's a whole host of services and additional things that can come along simply by having machines connected to the Internet. Next was mentioned I think a little bit with the California study is a lot of the infield IoT sensors so being able to monitor things like weather stations, infield soil probes, measuring the soil temperature and moisture.

You also have people putting cameras out there to monitor vegetation growth, watch for wildlife, all sorts of different uses are coming-up but again that data isn't much good if it's stuck on a USB drive that's in the field and somebody's got to drive-out and retrieve it all the time.

You know, if we can get all those different sensors and things connected to the cloud, you can make a lot more real-time timely decisions especially when you're looking at things that are going to impact the health and yield coming-off that crop and that leads to the next one Number 11 for mobile apps and other field-scouting tools.

The farmer isn't always sitting in his office. He's a lot of times out driving around and checking on all these different operations. They have different service providers doing different scouting operations so again going back to the labor shortage, a guy can go-out to the field, identify there's a bug.

He might now know what bug it is but if he has Internet access, he can take a picture of it with his phone and then send that back to somebody that knows how to identify the bug, the disease or other issue that's going-on in the field



so that can be promptly treated to help protect that yield so just having that coverage as they're out driving around is very important.

Again this is not happening near population centers and finally the last one is just the supply chain interactions. Farmers utilize a big network of different advisors, you know, retailers and other people that do a lot of things and most of the time the farmer has to share data about their operation with those providers to get a recommendation.

So if he wants to follow-up with his seed salesman on which particular variety to plant and at what rate, he's got to be able to get that guy soil samples, historical yield information, fertility information, a lot of different data that's georeferenced in these files that needs to be transferred around.

Again if you're trying to do that over a dial-up connection, it can be pretty challenging and also with the, you know, recent interest in drones we've seen kind of a resurgence of aerial imagery coming-back to look at plant health and growth and monitoring all that.

When you start moving around, you know, two or three centimeter resolution image files over a 200-acre field, those are some pretty big files that you just cannot move on a low-speed connection.

So if you're going to be looking at that and doing analysis and things like that, these service providers need to have access to a pretty good Internet connection to be able to use those cloud tools to be able to pull all this data the farmer has together, run some analysis on it, make a recommendation, generate those prescription maps, then transfer it back out to those machines.

So next slide is just kind of a summary of everything I covered here on all the different tools that either is in the farm office or from the machinery level, require some sort of connectivity to be able to make this all happen in a lot more efficient way for the farmer so that's all I had.

Katherine Bates: Okay, thank you, Ben. Your presentation really shows why broadband access is so important to farmers and in the agriculture industry. I think that we at least at BroadbandUSA I learned a lot knowing now all the different things that need broadband on a farm.

We have some time for questions and comments. If you would like to ask a question, please type it in. We've already gotten a couple so I'm going to direct those to I think is the appropriate person.

One of them is to Kevin about the Broadband Accessibility Act. You mentioned that Farm Bureau was supportive of it. What role did you play in helping to craft or pass the Broadband Accessibility Act in Tennessee?

Kevin Hensley: Yes, we were really supportive of the bill. We lobbied for it. We encouraged our members to you know, encourage their lawmakers to vote for it. Before that there had been other pieces of legislation that weren't as successful, that didn't come from the governor's office that we had been involved in and that we were supportive of.

So everybody kind of knew that as an organization we were supportive of getting broadband in the rural areas but also I mentioned the study that took place about broadband connectivity in rural areas and all across Tennessee.

We really encouraged our members to participate in that and at all our meetings leading-up to that study. We helped promote that study to get that