CI Plus 2.0 the future for content protection or a standard that is too late to the party?

What is it?

Common Interface Plus (CI Plus) or just Common Interface (CI) as it originally was, has been around for over a decade as a means to offer platform independent content protection for broadcast TV. On paper the standard is ideal from a consumer's perspective, allowing you to buy an off-the-shelf TV or STB and then buy the CAM (Conditional Access Module) for the particular Operator's service that you want to access. If you want to change Operator service, there's no need to get a new TV or STB, just change the CAM. Over time, the standard has evolved to meet the changing requirements for protecting first SD TV transmissions (CI), then HD (CI Plus), and more recently 4K content (CI Plus ECP). The standard has also widened its scope beyond traditional broadcast delivered TV, enabling the CAM to be used to descramble IP delivered content as well.

Figure 1: PCMCIA CI Plus CAM module in a TV.

To encourage Operator adoption of CI Plus, the standard offered a means for Operators to present their own branded interface and content discovery portal. The technology that enabled this was a CAM resident application which would be signalled as available when a user navigated to one of the Operator's channels. The user could then choose to launch it, similar to a red button interactive broadcast application. The CI Plus CAMs also provided a mechanism whereby IP services could be delivered to legacy devices, with the CAMs having direct network connections and being able to receive and decode the IP content directly and transform it into a

format a legacy TV or STB could present.

Figure 2: SmartDTV WiFi enabled CAM for Mediaset Premium.

So, the CI Plus a wonderful thing for both consumers and Operators, but if CI Plus is so great, why isn't it dominating the market for content protection? Why, despite being in almost every TV in Europe, aren't all Operators using it and why don't more STB manufacturers look to adopt it?

Why isn't it more widely used?

Well, there are several reasons why everyone isn't using CI Plus today. Firstly, the PayTV market has historically been STB based, as it provides Operators with a platform with which they can completely control the end user experience and roll out new features to attract new subscribers. Yet, this comes at a price of the STB hardware and software, having to manage the installation process, returns, customer support etc, So, why did Operators not leap at the chance to adopt CI Plus. CI Plus would mean that they could use any off-the-shelf STB or TV which the consumer would buy through standard retail channels, and all the Operator had to do was make sure CAMs were available for its service.

Part of the reason was that STB vendors weren't keen to adopt the PCMCIA form factor CAM modules, as they were an expensive interface which eroded their margins. TV manufacturers had little choice as legislation was passed in Europe that compelled TV manufacturers to adopt the standard for all of their products. A knock-on effect of this legislation, was that TV manufacturers required different variants of their chassis for Europe vs the rest of the world, which was far from ideal in the manufacturers eyes, but at least it was a level playing field with all manufacturers have to comply.

Even though every new TV, in Europe at least, would have a CI Plus interface, Operators still resisted the temptation to ditch their STBs. Although CI Plus enabled an Operator to deliver an encrypted service direct to a TV, it didn't enable an Operator to control the end user experience. Yes, CI plus had the concept of CAM resident applications, but these only allowed the Operator to tweak the look 'n' feel of the interface when a user browsed to their channels. It didn't help that until relatively recently the CAM resident Apps were MHEG based, which are tricky to author, and don't provide a huge scope for

the Operator to truly differentiate. The move to HbbTV based CAM resident Apps does improve things, but the Operator is still limited in what they can do to control the end platform. Indeed, this is a topic within HbbTV who are introducing new OppApp (Operator Application) extensions to enabled Operators to have more control over the end user experience.
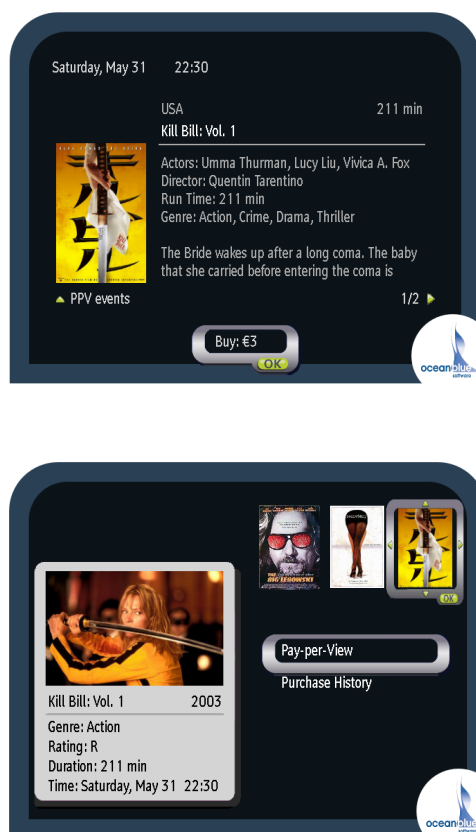

Figure 3: CAM Resident App Pay Per View Example. Only limited control over the end-user experience is available.

In addition, if you wind back the clock to the earlier days of CI/CI Plus, DVR was the new feature that everyone wanted. At the time TVs weren't able to support such a feature directly, and the only option for Operators looking to offer DVR capabilities to their subscribers was an STB.

The plight of CI/CI Plus with Operators was exacerbated by the fact that, by its very nature, is an open standard. New features have to be agreed by all contributing partners before they can be adopted, which takes time, sometimes a long time. It's then harder for an Operator to be first to market with a new compelling feature that is going to attract subscribers. Returning to the DVR example; DVR was only standardised in CI Plus in version 1.4 of the standard, where CAMs were specified to be able to handle multiple streams for record and playback. Before then, anyone wanting to use CI/CI plus on a DVR would require separate CAMs for watching one stream while recording another, which was expensive and hard to explain to the consumer.

During the early days of the CI/CI Plus standard, another influence on its uptake was the fact that the majority of the proprietary Conditional Access (CA) companies also had their own middleware offerings; Nagra had two biggest. As well as offering the content protection, they also offered the middleware to enable the advanced features that use it, such as DVR. As

such, the CA vendors offered a more complete package that enabled Operators to bring new features to market quicker and help drive subscriber uptake.

The last reason why Operators didn't flock to CI Plus as a means of protecting their premium services was security. The original CI standard, which admittedly was only designed to protect SD content, once the CAM decrypted the content, it transmitted it in-the-clear to the MPEG Soc for decode and display. The CA vendors were able to capitalise on such weaknesses when dealing with Operators and Content Owners. As CI evolved into CI Plus, and HD content was introduced, such weaknesses were corrected, but the CA vendors remained one step ahead introducing more secure, and "better" solutions. Furthermore, the CA vendors were the ones that shouldered the liability should their solution be hacked. In the case of CI/CI Plus the onus is on the device manufacturer, which in the case of a major 'A' brand may provide some reassurance to content owners, but they may be less willing to entrust their premium content to smaller, no-name, TV/STB manufacturers, even if the solution has to be formerly certified.

Accordingly, most of the big Operators stay wedded to their STBs. However, CI/CI Plus has had success, mainly with small to mid-sized Operators largely across Europe, but also as far afield as India and Uzbekistan. Uptake in Europe comes from users having access to a range of overlapping PayTV services via satellite, and there being market demand for a swappable solution such as CI Plus. So, it's not that CI Plus hasn't been a success, it's just that it hasn't lived up to its full potential with it still being avoided by the larger Operators.

CI Plus 2.0

So, what is CI Plus 2.0 and will it improve on the fortunes of CI/CI Plus. Firstly, CI Plus 2.0 is not new, the standard was published in 2015/16 by the DVB, but it hasn't yet been ratified by the CI Plus Limited Liability Partnership (LLP). This means that the standard could technically still change, and manufacturers have therefore been reluctant to adopt it. However, over the past 12 months the picture has started to change, and the cause of that change we'll come to in a minute.

Before that, back to CI Plus 2.0, and what is it? Well the most significant development is the move away from the PCMCIA form factor to a USB based form factor. USB is now standard on all TVs and STBs, and it removes the need for large (read expensive) PCMCIA connectors. This also enables TV manufacturers to have a truly global chassis, rather than having to have dedicated European sets, and reduces the cost barrier for STB manufacturers

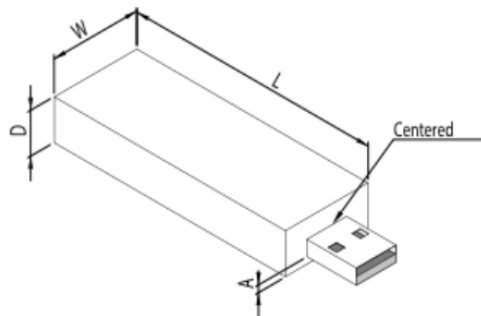looking to adopt CI Plus 2.0. So good news all round.

Figure 4: USB form factor CAM

UHD Content Protection

In addition to the physical changes, CI Plus 2.0 also incorporates additional security enhancements for 4K UHD content. These security enhancements have also been added to the conventional CI Plus 1.4 standard as the Enhanced Content Protection (ECP) specification addendum, but they make most sense when combined with the new USB form factor. The ECP security enhancements mandate the use of a Trusted Execution Environment (TEE) to protect all secrets related to the CI Plus decryption process, a hardware root of trust and a secure video path on the MPEG decoder. Again, ECP can be used with the legacy PCMCIA form factor CI Plus CAMs, but only newer TV/STB chipsets will have support MPEG SoCs with a TEE and hardware root of trust, so older TV sets will not be able to use it.

TV Key ™

Interest in CI+ 2.0 has been picking up over the past 12 months, largely in response to Nagra's TV Key ™ initiative.

Figure 5: Nagra's TVKey™ USB CAM..

TV Key™ is essentially a USB form factor CAM, but rather than being based on open standards it uses proprietary Nagra technology within the CAM, paired with a Nagra hardware root of trust embedded in the MPEG Soc. Mstar and Novatek have partnered with Nagra to deliver the first TV MPEG SoCs to support TV Key, and Samsung is the first TV manufacturer to demonstrate a compliant TV. TV Key™ is similar to CI Plus 2.0 but is based on proprietary Nagra technology rather than an open standard. Note, it's worth pointing out that if another CA vendor wanted to produce a TV key of their own, they either have to ask the MPEG SoC (System On Chip) vendors to include their own technology in their chipsets, or license Nagra's. Accordingly, there is now increased interest in CI Plus 2.0 from device manufacturers and chipset vendors, keen to support a single open standard rather than multiple proprietary ones. Indeed, noises from the CI Plus LLP would indicate that they are in the process of taking steps to formally ratify the CI Plus 2.0 standard.

CI Plus 2.0 Place In The Market

So, is the future bright for CI+ 2.0 or will it lose out to proprietary standards such as TVKey ™, or the, so far unmentioned, elephant in the room, DRM?

The traditional operator market has been disrupted by IP based services such as Netflix, Amazon, and similar OTT video suppliers, all of whom use DRM to protect their valuable content. In the early days DRM was purely software based and compared to tradition CA, not that secure. That said, being an IP based system, you always had the added benefit of knowing what anyone using the service was watching at any given time. Over time though, DRM systems such as Playready, Widevine, etc., have all developed and today support all the features required to protect 4K content including a hardware root of trust, using a secure video path, etc. Moreover, thanks to the Common Encryption (CENC) standard, it is possible to encrypt content once, send it to multiple devices, and enable it to be decrypted by a range of different vendors DRM solutions, so true interoperability.

So, on the surface CI Plus 2.0, doesn't appear to have any advantages over DRM. However, what CI Plus 2.0 does enable is for low-cost TV manufacturers, who don't have the internal software expertise, relationship with the DRM

suppliers, or margins to integrate DRM solutions into their platforms. They are then able to have a product offering that, with the addition of a CI Plus 2.0 CAM, enables user to experience IP delivered 4K content. The low-cost TV manufacturers don't have to worry about the complex security requirements as it is all taken care of by the CI Plus 2.0 CAM and MPEG SoC. There is still a significant demand for low cost supermarket branded TVs, so it is a not insignificant market for CI Plus 2.0.

Furthermore, there is still a place for CI Plus 2.0 in the Operator market. IP services such as Netflix, and Amazon Prime, are gaining increased market share, and many traditional Operators now offer OTT services. Those services fall into two categories, on-demand and catch-up content that complements the Operators core broadcast services, and a separate dedicated IP service offering, designed to target customers that don't want to sign up to long term, expensive agreements and are attracted by the Netflix model of low cost, no tie-in, rolling monthly contracts. In the IP world CI Plus 2.0 has a roll to play with low-cost TV. In addition, there are still large parts of the world that don't have good IP infrastructure, and rely on broadcast delivery for their TV services, but would be interested in a pay-as-you-go model. Currently Operators have no way of engaging

with this part of the market as they are not willing to supply expensive STB equipment if the consumer is going to cancel after 3 months. However, if a consumer is able to go out and buy a CI Plus 2.0 CAM that can be easily connected to a conventional TV or STB and provides consumers with access to additional PayTV channels for a minimal one-off payment for the CAM, followed by a low cost, rolling monthly fee, then one would think that there would be a market for such a service offering. Indeed, the uptake of Operator based IP service such as Sky's NowTV™, show there is a market for such an offering.

Finally, there is also a place for CI+ 2.0 in the Free-To-Air market, although that may sound counter-intuitive. As 4K becomes more widespread, traditional FTA broadcasters will want to offer it to the consumers, so as not to lose market share to Pay-TV and IP services. However, but they will not be able to transmit 4K content in-the-clear. Accordingly, the service will need to be protected in some manner, and consumers will need a device to decrypt the transmissions. It's not feasible for all commercial and Public Service Broadcasters (PSB) to start offering STBs or similar devices, so a CI Plus 2.0 based solution is the most viable option. Those consumers that want access to UHD FTA content would be required to purchase a CI Plus 2.0 CAM for a one-off fee.

So, the future for CI Plus 2.0 could be bright, but it does require that TV and STB Manufacturers adopt the standard. TV manufacturers are likely to adopt CI Plus 2.0 once silicon chip vendors offer compliant devices. TV manufacturers are compelled, in Europe at least, to adopt CI Plus in their chassis. If nothing else, CI Plus 2.0 allows the TV manufacturers to use a standard USB socket, already present on all modern TVs, and drop the PCMCIA interface, thus saving money. Moreover, it allows them to have a single world-wide chassis, rather than something specifically tailored

for the European market, which is another efficiency saving. Accordingly, economics will drive TV manufacturers to adopt the standard. Chip vendors are likely to make the necessary changes to support CI+ 2.0 in their STB chips as well as many do already support CI plus, even if it's not widely used, and with some already adopting TV™ Key, there is clear interest in supporting a USB form factor CAM.

For STB Manufacturers, again the USB form factor will help with the margins of STB manufacturers and should help with adoption rates. That said, STB manufacturers face another economic barrier to CI Plus support compared with TV set makers, which is the cost of certification. Certification is performed by an CI Plus LLP approved test house and it usually requires manufacturers a couple of attempts to get things completely right and pass a device, which manufacturers must budget for. Moreover, the 3rd party test kits that are available to enable manufacturers to use during product development and maximise their chances of passing formal certification are not cheap. TV manufacturers can amortise these costs over hundreds of thousands, if not millions, of devices they produce in total. For smaller STB manufacturers looking to produce a few tens of thousands, low margin, units of CI Plus enabled STBs, the

cost of the test kit and certification can actually make the business case unviable and endanger the entire project. Accordingly, the economics of the certification process ideally need reviewing if CI Plus 2.0 is to be adopted more widely by smaller scale STB manufacturers.

What About OBS?

So, what does OBS think is the future of CI Plus 2.0? There is definitely a market there for low-cost TV manufacturers who can't afford, or don't have the relationships and technical know-how to support DRM in their products and want to offer consumers access to UHD IP content. Similarly, CI Plus 2.0 is an enabler for consumers wanting Netflix style, Pay-as-you go, access to Operator content, but don't have a high-speed internet connection, and as a means of protecting UHD FTA content. In addition, we can see that small to mid-sized operators that can't afford to invest in their own premium STBs with advanced features, could look to go direct to the consumers device with a CI Plus 2.0 CAM solution. Add to that, that it is highly likely TV manufacturers will switch to the standard, purely for the economic benefits it provides, then CI Plus 2.0 will definitely have a place in the market.

OBS has been a long-term supporter of CI Plus, developing and advancing its CI Plus Host stack as the standard evolved. We are already seeing revived interest from our customer

base in a CI Plus 2.0 solution and we will look to be ready to support device manufacturers with a CI Plus 2.0 enabled Host stack.

For further information please contact info@oceanbluesoftware.co.uk.