A more-than-just-technical

history of broadcast monitoring

By Simen K. Frostad, Chairman, Bridge Technologies

As our CEO Roger Blakeway is retiring Broadband Journal it seemed timely to ask Simen Frostad, Chairman of Bridge Technologies to look back in order to look forward. Here he identifies some of the big questions as we progress further in our ability to extract meaning from monitored data.

Simen K. Frostad, Chairman of Bridge Technologies

Simen founded Bridge Technologies in 2004 with the goal of creating solutions that would simplify the transition to IP.

Prior to Bridge, Simen developed the first nonlinear sports editing facility during the 1994 Winter Olympics; built the first multi-camera hard disk recording system for episodic drama production in 1998; and created the world's first IP/MPLS contribution network for Scandinavian sports coverage.

Simen's in-depth knowledge, 35+ years of industry experience and understanding of the end-to-end broadcast process as well as the enabling technologies has seen him play a leading role in making the future of the broadcast industry possible.

Where to begin?

When I was tasked with writing something on the subject of 'the history of monitoring' I felt a little daunted. Not because of a lack of knowledge or enthusiasm for the subject – anybody who has ever caught me over a cigar and a glass of champagne at IBC knows I can wax lyrical on the topic for hours. But more because tailoring it to an audience, even a technical one, is a tricky job.

As members of SCTE, many of you are likely to be broadband engineers. In which case, you know the topic of monitoring – at least in the field of broadband - as well as I do. You've been in the trenches for the same length of time as I have, you've watched the troops advance, seen the colours change. Telling you how monitoring has evolved in the broadband industry would be little more than preaching to the converted.

But those of you familiar with the work of Bridge Technologies know that we carry a heavy focus on the monitoring of broadcast over IP. And there's a chance that you know significantly less about the history of monitoring in that field: it's a history that spans over 100 years, but its convergence with IP monitoring is something that has only occurred in the last two decades.

But the big question is, is it a history you want or need to know? If I start rattling on about Marconi, Megawatts, Transport Stream Analytics, Frequency Bands, RF carriers, packets and headends – well look, you are snoring already.

How then to tackle the topic? Why had I been tasked with this mission? Why does a history of broadcast monitoring – and its convergence with broadband monitoring - actually matter?

And the more I thought about it, the more I realised that it matters for the same reason that any account of history matters. Seeing where we've been helps us to know where we are going. But I don't just mean where we're going technologically. Indeed, technology is one particular area where historical analysis is actually a fairly poor predictor for future direction – disruptive innovation means technology

doesn't always tend to follow the same predictable pattern as, say, social behaviour.

No, instead I wanted to look at how the history of broadcast and broadband – and of 'monitoring' (broadly defined) - has impacted us socially, politically and even perhaps philosophically. How technology has intermeshed with these elements in the past, and therefore how might it continue to shape our futures; not just in the way that we interact with the piece of technology in front of us, but the way that we interact with each other.

Bits and bytes, wrongs and rights

Now of course, as leaders in the field of network monitoring, if you ask us to write an article about the history of broadcast monitoring, we may geek out on the technical details – the way in which waves, bits, bytes, packets are all 'monitored' as they make their journey from one place to another, using whatever infrastructure was in use at the time.

But sometimes, it is important for engineers to take a step back. These technological processes – fascinating as they are – are in reality just a means to an end. What is even more inspiring than the technology itself is what it facilitates. Every member of SCTE – regardless of their function – is ultimately united in one aim: human communication. Every day, our efforts all contribute to a singular purpose; disseminating content around the world that informs, entertains, educates, enriches, enlightens, and brings us closer together.

This means that the conceptual content we work with is, in reality, as important to consider as the technological container that it comes wrapped in. And it turns out that the process of monitoring one is inherently bound with the other.

But before we dig into those juicy discussions of purpose and meaning, I can't escape the mission I've been tasked with completely. If we want to discuss all the exciting conceptual things about how monitoring broadcast content might shape our lives, then first I need to give you a little bit of a chronological rundown of the history of broadcast, if only to show you just how far we've come.

The (non-existent) history of broadcast monitoring

For us at Bridge, our love affair with IP has a very particular broadcast flavour to it. We saw it coming a long time ago, and our commitment has been vindicated, because we are now very much in the era of broadband as broadcast.

But of course, once upon a time, broadcast was a very separate concept indeed. It occupied its own space. You could tell a joke about how a broadcast engineer and a broadband engineer walked into a pub and… well actually, you couldn't, because in the days of Marconi, broadband engineers were mere twinkles in their fathers' eyes. Broadband simply wasn't a thing yet.

This means we need to give you broadband engineers a quick rundown of basic broadcast history.

So how did you go about monitoring a broadcast in the good old days? By good old days I mean the halcyon 1980s of course; life was simpler - and more complicated - for lots of reasons.

Well, you didn't really.

Of course there were ways to check if your network was performing, but these were inelegant, 'brute force' operations. In

essence, all you could do was saturate the airwaves and map the RF distribution you were achieving. Forget needing a specialty receiver to check signal qualities, you could practically feel it in your gold teeth. But how many kilowatts could you really afford to throw at the situation? Monitoring simply wasn't a priority – and what did it matter anyway: if Jane in Weston Avenue, Surrey wasn't receiving Eastenders in all its full-colour glory, you could guarantee she'd quickly be on the phone telling the BBC about it. At worst, you'd lose her to ITV for an hour or two.

In theory, of course, the setup of an analogue network was much more straightforward than today's systems; there were really only two things that could go wrong, thereby further reinforcing the view that monitoring broadcast quality didn't carry much value or importance. Either the broadcast antenna wasn't working, or alternatively, you as the viewer had a problem with your box, in which case – well, poor you, basically. Your options were to fiddle with your antenna a bit and decorate it liberally with aluminum foil, give the box a good whack, or call out the engineer.

And if the problem was with the antenna, then broadcasters tended to take a 'show must go on' attitude. Broadcast quality was considered to be a much lower priority than making sure the broadcast got out. If the content was there, that's what viewers cared about – they'd endure a lot of snow and distortion to get it.

Of course, you could also afford to wait to perform your fix, because broadcast networks were full of much more 'downtime'. Imagine, turning on the TV and finding… no content. Nothing to watch! These days that simply wouldn't fly - the 24/7 approach of modern broadcast means there's no 'suitable' time to fix things. But back then, you could afford to endure a system problem for a few hours, before pulling things apart at the midnight hour.

It is also worth remembering that audiences back then had much longer attention spans and far lower expectations; these were the days of 3 terrestrial TV channels, routine power cuts, frequent industrial action and crossed telephone lines. You couldn't even go shopping on a Sunday back then. It was a different, much slower time.

Of course, in reality, the 'it can only be broken in one of two places' mentality was highly simplistic. Tracing errors within the station carried its own issues – was it simply user error, had somebody cued a tape wrong, or had a bird decided to build a nest in a particularly inconvenient place?

And then outside of the station, any number of things could be happening. Individual faults in user equipment would affect whether single viewers suffered problems, but bad weather could impact transmission of a signal for whole neighbourhoods. This at least was temporary and largely unavoidable, so you

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just had to ride it out, but sometimes unexpected sources could provide a permanent disruption for whole sections of the audience. Where to start figuring out where these came from, or how to fix them?

It's apparent, just from this little overview of the 'early days', how incredibly unsophisticated the entire process was. And that is not to throw any shade at all on the engineers of the time – they were doing clever and often progressive things with the technology, but set in the context of today, they were effectively trying to engineer systems using pointy sticks and heavy rocks. Whether you were yourself in engineering back then, or simply an avid TV viewer, you are of course all too familiar with the frustrations of disrupted TV. When you consider it by the standards of modern audiences, it's simply astounding the level of compromised service we accepted with just a shrug. We'd endure snowy screens, audio hiss, or simply a complete broadcast blackout just as the exciting bit of the plot was coming up.

We all got used to seeing test cards on our screens apologising for 'slight technical difficulties' and audiences would wait patiently for their programme to come back on.

But what's particularly interesting is that actually, your satisfaction as a viewer wasn't even really a primary concern. The monitoring of network performance that did take place actually had a far more logistical function.

Pay to play

You don't need me to explain to you the radio spectrum, and the idea that it constitutes a very small sand pit in which a lot of people want to play. Air space was a limited resource (well, it still is, but it matters slightly less). Which means that somebody needed to take control of who was going to get to use it, and how.

Thus, the government became involved with the regulation of radio waves, allocating frequencies and ensuring that these marks were not overstepped. In the US, this involved the creation of the FCC (the Federal Communications Commission). Whilst nominally this initially existed purely to allocate

bandwidths and ensure these weren't impinged upon (almost like packets of land), the ambit of their power quickly expanded to cover what could be broadcast by those lucky enough to receive a licence. Sections 9 and 11 of the 1927 Radio Act stated that "the licensing authority . . . [shall] determine that the public interest, convenience, or necessity would be served by the granting [of a broadcast licence]" and became some of the most debated and contested words in American legal history. Something initiated as a purely technical RF frequency monitoring component quickly expanded to become a deeply political, social and commercial bone of contention.

Similar things were occurring in the UK. How many of you chose to rebel against 'the system' by tuning into Radio Caroline in 1964? As a pirate radio station broadcast from international waters, its aim was to provide an alternative to the monopoly that the BBC held over the waves and – more particularly – rebel against the heavy control that record companies held over 'official' radio stations.

Again, monitoring the purely technical (RF bandwidth, regions, timing allocations and even broadcast quality requirements) moved from being an exercise in practical engineering, to one that had deep rooted ideological concepts underpinning it: impacting who could broadcast, who could receive that broadcast and the fundamental nature of the content within.

Engineering: truly its own realm?

It is this idea that I think is so interesting and important to explore. The process of setting technical standards and monitoring them had, in effect, brought in the idea of monitoring content by the back door.

But that was a different age then, right? Our revolutionary IP transition changes everything, surely? The idea of resource scarcity has just about gone out of the window. The bandwidth available for the transmission of content is more than sufficient for everybody to be getting in on the game. No longer do we have a handful of radio stations fighting to divide up their access by bandwidth, geographies and broadcast times (and having enough commercial weight behind them to meet required

technical broadcast specifications and infrastructure barriers to entry). Now, anybody who wants to say something - be it through Podcast, YouTube channel or something else entirely - has the ability to. The lack of need for regulation and monitoring over the physical, logistical and technical elements of broadcast in theory also closes down the door for regulation over the fundamental content contained within those broadcasts. The IP revolution in the field of broadcast represents the biggest potential democratisation of content imaginable.

And yet…

Here we are. Operating in a world where the content we are receiving is decidedly undemocratic. Where the policing and control of content is less overt, but still pervasive. It may be the case that governments themselves exercise less legislative control (though it's still there), but somehow in a world of potentially limitless information, we still find ourselves accessing and consuming only a narrow fraction of it.

This is arguably our choice as consumers. Maybe we just really like cat memes? But many argue that the regulation of content remains – it's just that now the gatekeepers are commercial, rather than political entities (though there's still a decidedly political flair to the way they choose to operate - and whom they choose to influence). The technological, social, political and commercial are all intertwined in a confusing, hopelessly knotted ball of string.

When quantitative becomes qualitative

The above argument pertains to all forms of technological advancement. But our field is monitoring, and that specifically may have a fundamental role to play in determining not just how content reaches us, but what content reaches us.

It is all too easy for us to sit removed from the situation and hold up our hands, saying 'it's none of my business. I'm just monitoring the numbers. We're not regulating the content of the internet, we're just keeping it running nice and smooth'. And indeed, that is all we are really doing. In the field of monitoring, we deal with the quantitative.

But we already know that the very reason for engaging with that quantitative data is because it paints us a qualitative picture. Registering the movement of packets – mere ones and zeros – translates into information about the quality of broadcast that the audience is receiving. We view objective data and can from that discern a significant amount about the subjective experience of the viewer. And we can do this on a real-time, automated basis, covering millions of users, channels and broadcast streams.

So what else can monitored data tell us? The answer is potentially limitless. Both within the wider industry and specifically at Bridge, we gain a greater mastery of 'making meaning' from abstract data on a daily basis. We produce intuitive information that allows people to make real decisions about what they are doing with their networks. Those decisions are often technical. But they're frequently commercial. They can be social. And they might be political.

That first breakthrough

So we've established that data – analysed effectively and presented intuitively – provides information, but the way in which this is deployed can be – not to be too melodramatic about it – a force for good, or a force for evil.

At the moment, monitoring within the field is most definitely a force for good. Indeed, I remember the first time I had that concrete feeling that we were on the right path, when I thought 'By Jove, I think we've got it'.

I'd foreseen the importance of IP, staked a lot on it and this was in effect my first 'proof of concept', where everything I'd

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believed in, materialised in front of us. It was 2004, and down in the South of Norway a group of stakeholders were all pushing forward on what was – at the time – a pretty progressive and ambitious IPTV project. A Swedish company called Kreatel were manufacturing the set-top boxing, and Tandberg were delivering the headend. A very large and very famous company were operating as the systems integrator and the network guys were also an equally large big player.

Long story short, their system didn't work.

What followed was a lot of finger pointing. A lot of buck passing. Huge numbers of indignant 'it can't be us, our systems always work' emails circulated. Round and round the arguments went. Meanwhile, a lot of customers were very unhappy and didn't have any TV to watch.

Cue Bridge turning up with a portable analyser. We placed it close to the source, and we moved it back and back along the network until the problem was identified. Where was the problem? To avoid some red faces I'll keep that one close to my chest, but the point is what could have taken weeks to unravel at considerable cost was now completed in just half a day.

Real-time analytics had in fact completely changed the entire game. Prohibitive expense prevented an investigation in the past; now, it has literally become cheaper to know. Building in this knowledge right from the start heads off problems long before they occur.

It was then I knew for certain that the real-time, automated nature of our monitoring solutions allows for broadcasters to provide a highly reliable, usable and cost-effective broadcast to audiences – on a scale that once would have been unthinkable, both logistically and in terms of commercial viability. Companies benefit because they gain competitive advantage and reduce operating costs, audiences benefit because they have a vastly improved QoS and QoE.

Social responsibility

As net neutrality debates continue to rage we may need to ask ourselves what other ways monitored data might end up being used. Will it be used to monitor who gets what, when? Will it

be used to control or limit who gets what, when? What kind of information are we comfortable in extracting from data, and how do we want it be used?

Perhaps even more important than those questions is – is it our job to care? It is easy to think as engineers that what we create and develop sits in glorious isolation from the context in which it is used; that what can be done on a technical level is a question for 'us', and what they choose to actually do with it - what should be done - relates to 'them'. But in reality, technology is driven by social and political norms and changes, but also drives them in turn. Do we need to keep that in mind as we push the boundaries of IP forward? Or do we just keep grinding away on the purely technical, leaving the politicians and the public and the social scientists to make the 'big' decisions?

Few of us could claim that our business practices have a political agenda – indeed, even as I write about the intertwined nature of sociology, politics and technology, I'm not trying to break the system, push an agenda or create a revolution. Overt politicism for businesses is rarely wise, and I couldn't even pretend to have drawn any fixed conclusions to many of the rhetorical questions I've posed throughout. I have no intention to make any statements about 'right' or 'wrong'.

I just think that from an intellectual point it's fascinating to take a step back and review the technological progress we've made, and then try and map that against the sociological and political changes we've experienced. Which is the chicken? Which is the egg? Which is the master and which is the slave? It is possible our innovations - be they in monitoring or in any other sphere of technological progress - have been driven by the demand for them. It is also possible, though unlikely, that they have arisen out of a vacuum and in turn gone on to inspire and facilitate fundamental changes in the social sphere.

And if we can even begin to get a handle on those questions in relation to the progresses we've secured in the past, then what can we possibly predict about our future?