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PRIVATE 5G in INDUSTRY 4.0

— hype vs reality, and where the market goes from here

by James Blackman
RCR Wireless

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Starting at the edge – the Industry 4.0 ecosystem is building AI and 5G on localised compute, and then meshing it into other local-area private and wide-area public infrastructure; this is the story of how the 5G part is going.
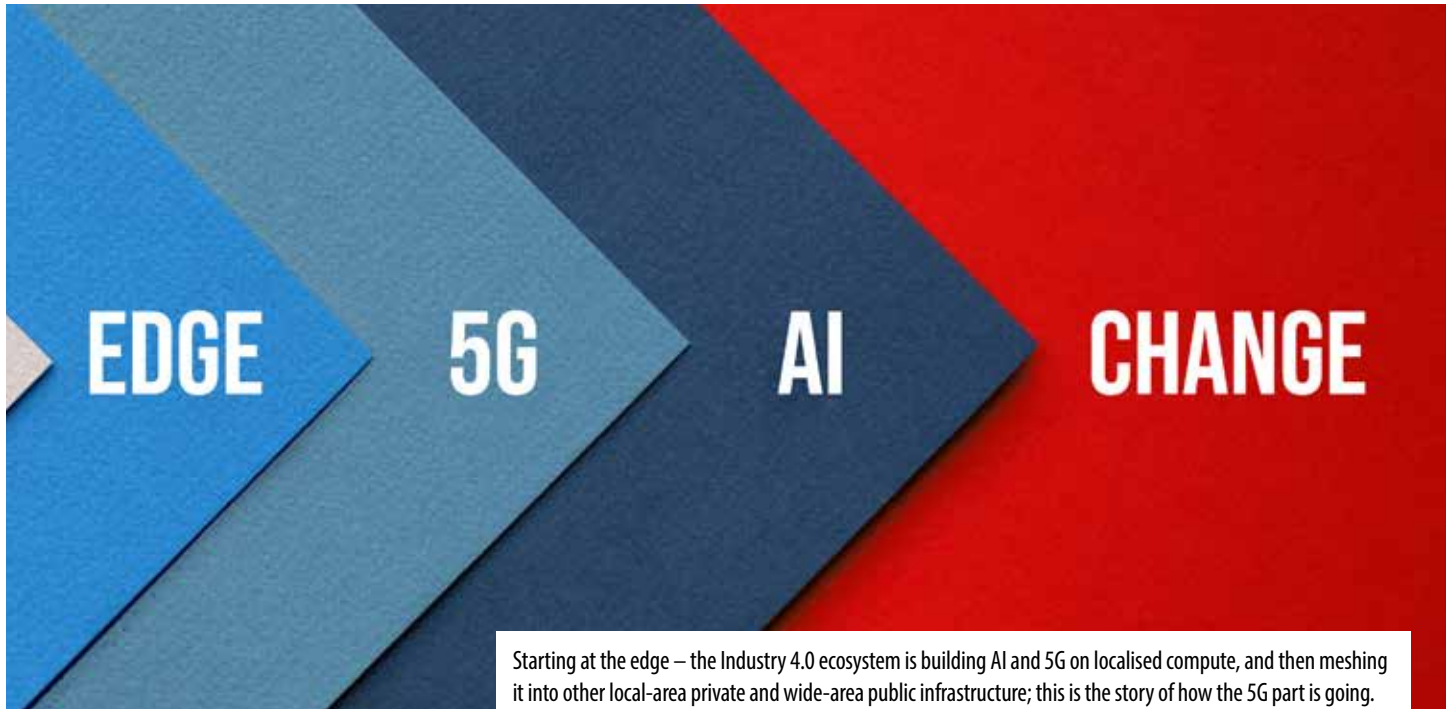
The private 5G market is spooked, apparently. Figures from Analysys Mason predict bountiful growth over the next five years (4,000 to 60,000 total deployments; $1 billion to $9 in annual spend), but also say that the market will have failed by the end of the period because it has "not reached its potential". But is that potential, *really*? Or is it hype? Or is it just a narrow view of the market? Because every calculation and forecast out there – which disagree about the details but agree about the message ('growth') – surely takes its cue from a market review commissioned by Nokia five years ago which says the addressable market for private 5G might stretch to 14 million industrial venues.

Let's pause on that 14-million figure for a moment. It was mapped-out by Harvard University to count-out Nokia's industrial targets – which have become the industry's targets. Ten million factories, three million warehouses, 50,000 mines, or *something-like*; plus everywhere else in Industry 4.0 (see graphic, page right) – it captures the epic sweep of the industrial sector, and the grand promise of industrial revolution. It is a perfect explanation of why the market is

so buzzed, and also why it is so hyped. For context, there are only (!) seven million macro radio sites in the world, as deployed by mobile operators in public networks – and that double-sized 14 million figure counts just venues, not radios.

And so yeah: 4,000 out of 14 million is not very much (0.0003 percent; and not even), and abject failure by most measures. And it is the same no matter whose numbers you choose, nor how they are counted. Berg Insight says there were 2,900 private LTE/5G networks (including trials and proofs) at the end of 2023, and there will be 11,900 in 2028. The Global mobile Suppliers Association (GSA) counted 1,384 enterprises with at least one commercial-scale (€100,000-plus) private LTE/5G network at the start of 2024, based on shared vendor data. Test company Spirent, with its own market review, settles on about 1,200 commercial private LTE/5G installations globally, excluding activity in China.

"There are thousands in China, but they are

14m
(venue sites) –
addressable market
for private cellular
Source: Nokia

7m
(cell sites) –
existing market
for public cellular
Source: Nokia

not necessarily clear-cut private," comments Stephen Douglas, head of market strategy at Spirent. Revenue figures are equally hard to discern. *What to believe? Who to believe?* Again, Analysys Mason says annual spending on private LTE/5G will reach $9.2 billion in 2028, an 800 percent rise over five years.

SNS Telecom & IT, based out of Dubai, says spending will hit $6.4 billion by 2026, an 18 percent compound yearly jump over the period. ABI Research predicts a much bigger revenue opportunity: $50 billion (five times the Analysys Mason forecast) per year by 2030 – and that's just for private 5G.

The total market, including private LTE (4G), will be worth significantly more – "roughly twice as much", it says. "By 2030/31, we will reach a turning point, where private 5G takes over from 4G as the dominant cellular-based enterprise networking technology," comments Leo Gergs, principal analyst at ABI Research. But even such top-end forecasts are drops-in-the-ocean compared to Nokia's original 14-million count, and the revenues

that would go against it. Analysys Mason notes an annual spend of $9.2 billion would be less than five percent (and $50 billion would be less than 25 percent) of its own forecast spend on public networks in the same timeframe.

As such, it is easy to see why the private networks game might be perceived as a failure, thus far. "The market will not have reached its potential," writes Analysys Mason. But it says, as well, that interest "remains high despite the relatively modest long-term opportunity", and it agrees broadly with ABI Research that the LTE/5G tipping point in the enterprise space will come at the end of the decade. Almost half (47 percent) of private networks will be based on 5G in 2028, it says; the rest will be LTE systems, reducing in proportion from about three quarters (75 percent) of total deployments in 2022. "Interest in private 5G is high but… devices and costs have held back adoption," it says.

Ah, devices and costs; of course. We will come back to these. But Analysys Mason

"The [private 5G] market will not have reached its potential… Private networks will provide a small boost to operators' enterprise revenue… For established network vendors, it represents useful incremental revenue. For start-up vendors, even a market of just a few billion US dollars is hugely attractive."

*Ibraheem Kasujee,
Senior Analyst,
Analysys Mason*

5G — share of private cellular networks in 2022

4G

5G — share in 2028 Analysys Mason

4G
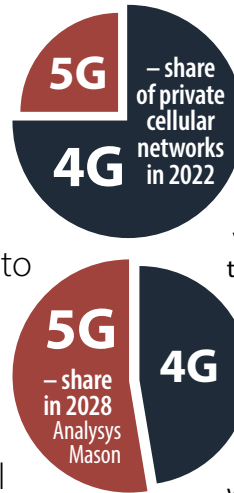
also explains-away the market's progress from different points-of-view – for traditional mobile operators, but also for legacy and startup equipment vendors (Nokia and Ericsson, notably, versus Celona, Athonet/HPE, plus others). "Private networks will provide a small boost to operators' enterprise revenue," it says. Meanwhile, legacy vendors will consider the income as "useful incremental revenue" and newbies will consider "even a market of just a few billion dollars is hugely attractive". This is an important perspective, and should be considered when assessing the various responses in this article.

HYPE TENSIONS

But the hype-fallout, as the promise outruns the reality, has appeared to create genuine panic in the supplier market – because the sales numbers do not reflect the impetus that vendors had expected, or else, maybe, just because it is too much like hard work.
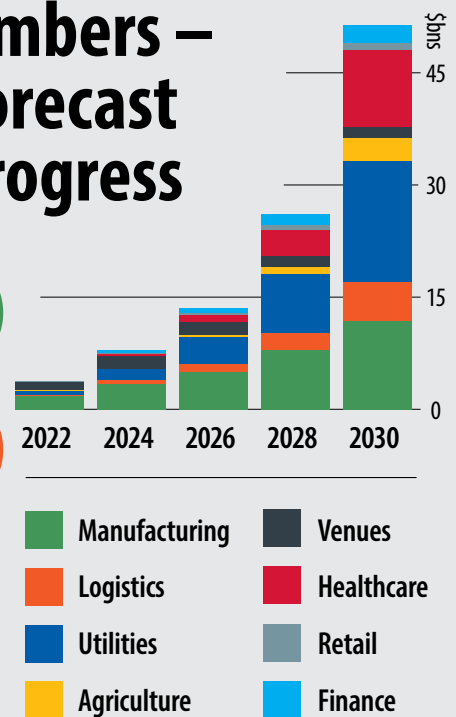
Total private 4G/5G market in numbers – potential size, forecast value, current progress

INDUSTRY	SITES
Industrial / manufacturing	10.71m
Warehouses (logistics)	3.3m
Hospitals / labs	263k
Utilities (water)	140k
Mining	54k
Transport venues / ports	50k
Power generation	47.6k
Military bases	10k
Oil and gas	8k
TOTAL	14.58m

Potential size (left) – Nokia's seminal market-sizing from five years ago, as spectrum was liberalised for enterprises and Nokia launched its DAC product; the count focuses squarely on Industry 4.0. (Source: Nokia / Harvard University)

Current deployments (right) – numbers vary wildly, mostly depending on whether P4G/5G deployments include proofs and trials; note all calculations exclude China. (Sources: listed right)

Projected value (far right) – the top-end forecast for revenue predicts $50 billion per year by 2030, which is five-times what others say. (Source: ABI Research)

4,000 - Analysys Mason

2,900 - Berg Insight

1,384 - GSA

1,200 - Spirent

$bns

2022　2024　2026　2028　2030

- **Manufacturing**
- **Logistics**
- **Utilities**
- **Agriculture**
- **Venues**
- **Healthcare**
- **Retail**
- **Finance**

It is anecdotal, and rather colourful, but the off-record mood at Mobile World Congress in Barcelona in late February (2024) was a dark one, full of rumour and intrigue, and desperate looks – as if no one is quite sure of the road ahead, and some are heading for the skids (see news, page 6, that Casa Systems and Airspan Networks have hit the skids, lately; see also pages 28-30). Speaking ahead of MWC (and not at it), Celona said the wheels have locked for some firms, and the road has cleared for a few others.

Responding to a direct question about whether opportunist suppliers have started to flee the private 5G game as it slumps into a 'trough of disillusionment' (to use Gartner parlance), Rajeev Shah, co-founder and chief executive at Celona, says: "That's fair; at the peak of the hype cycle, there were lots of players that thought they had a role to play, and which contributed to all the noise. Pretty much everyone was coming at it, saying, 'this is my growth area', and putting out press releases. But the enterprise market has spoken and… that long list has become a short list of players; and realistically, at this point, that list comprises Nokia, Ericsson, and ourselves."

He adds: "So the amount of noise has reduced, because the number of people making it has reduced – because their systems don't cut it." So *who* has dropped out, then? Shah does not want to name names (and the news cycle has since revealed some of them; again, see page 6). But then his list-of-three excludes some major ones – including big cloud providers like AWS and Microsoft that made a splash a couple of years back, a number of bit-part radio and core providers selling via big integrator brands, plus a swarm of noisy CBRS players offering related services, a hatful of niche specialists, and a handful of major IT/OT operatives. Shah plays a straight bat: "I just think a lot of companies have not got the traction that we have."

What does he make of the likes of Cisco and HPE, coming at it from an IT angle? Surely the new HPE-plus-Athonet (plus-Juniper) looks like the kind of enterprise-friendly (*Wi-Fi friendly*) system that Celona likes to talk about? He responds: "I mean, the [Juniper]

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Rajeev Shah,
Chief Executive,
Celona

acquisition is still fresh. But, yes, I was expecting HPE and Cisco to be harbingers of the future; more than anyone else. And they may still be. I expect them to do something in this space, given their strong enterprise DNA. And we see them sporadically, but I suspect they are in a development cycle, building out their portfolio at this point." But he's not interested to say much more, and that's the end of the conversation about vanishing rivals.

The idea of a three-horse race is preposterous, of course, even if the private 5G supplier market is starting to mutate in the post-hype era. The message about HPE/Athonet

is probably a better explanation of how the sector is developing, still, and might be taken with equivalent logic about the likes of AWS and Siemens, say, where they are waiting for the technology to develop in opposite directions to address low- and high-end enterprise markets separately. Certainly, the line from Athonet at MWC is about rising sales. "We've gained more share, done more deployments," responds Gianluca Verin, chief executive at the Italian firm, talking about his company's acquisition by HPE a year ago.

He goes on: "We have maintained the promise to look after our customers. Which is not always the case after an acquisition." So what is Verin's view of the mood in the private 5G camp, more generally – *because there is this nagging sense, even just at this show, that the hype is out of hand, and there's a reckoning of sorts in the offing*? He responds: "The market was overestimated, one or two years ago – so there is some down-sentiment. But as always with technology, it goes up and down, and the people that make it work, like ourselves, ensure that it goes slowly but relentlessly upwards – until the day that it's all-up and it shows its power. We are close to that moment now."

There is a reminder, as well, of HPE's grand scheme to combine its Athonet and Aruba businesses to make 5G and Wi-Fi into a single network proposition. "Wi-Fi and 5G will be combined somehow in different roles. But 5G will not go away," says Verin, before he reverts to the core sales narrative about why private 5G matters – and why the hype is real. "Because enterprises have needs that are not being addressed in any other way. We see completely new applications emerging… So the market is good, and there to be conquered. It has the attention of the top people in so many industries. The people that understand this technology understand how it can change things."

FLAGSHIP WINS
Pending integration with Wi-Fi makes clear the private 5G market is not static, nor finished – and that definitive conclusions about sales and superiors are premature. But a step removed from the equipment

makers, and the unique jeopardy they may or may not face, there is another noisy rank of 'vendors' interfacing directly with enterprises and comprised mostly of system integrators and specialist providers, plus certain progressive operators lately, and a glut of large IT resellers potentially. They represent the default sales channel for private 5G, and proclaim to "understand this technology", or talk like they do. And if you want the flipside-story about how the hype is real then they will tell it.

Japan-based NTT DATA, selling enterprise 5G from Celona and Cisco (plus Nokia in more *ad-hoc* fashion), claims a "$500 million pipeline of opportunities with some of the world's most disruptive brands". For reference, it quotes Global Market Insights that the private 5G market will reach $42 billion in global revenue by 2032, up by 40 percent from 2024 and roughly in line with ABI's top-end forecast. Its own research says 86 percent of firms are "gearing up". It has a new two-way sales deal with Schneider Electric to bundle private 5G with the French firm's 'modular data centre' (EcoStruxure) product – like a data-centre in a shipping container, with power and climate controls, and so on.

NTT has been installing 5G all across Schneider Electric's 'smart factories' in the US. The two companies have just deployed their joint system at a 30-hectare multi-tenant industrial campus at Marienpark Berlin, in the German capital. NTT reels-off big-ticket Industry 4.0 wins with chemicals companies Albemarle and LyondellBasell in the US, auto-maker BMW in Germany (and maybe in the US, if NTT is involved in BMW's new 5G plant there), and Cologne and Frankfurt airports in Germany, plus a couple of others for good measure (the City of Las Vegas, the RAI Amsterdam). "We go after large-site / multi-site verticals," says Parm Sandhu, in charge of enterprise 5G at the firm.

"Anything over 500,000 square feet, $5 billion in turnover, and $50 million in annual IT spend," he adds. NTT is most interested in, and 5G is most successful in, mega-sized industrial setups, the message goes. Sandhu

The NTT 'sales pipe' – $500m – for new private 4G/5G sales (says NTT)

The FT ' sales pipe' – $500m – for new private 4G/5G sales (says FT)

"We go after... anything over 500,000 square feet and $5 billion in turnover. That's the sweet spot. That's where private 5G shines – where it translates into significant ROI savings... We're seeing double-digit million-dollar deals. They take time and effort, for sure; but they are coming in."

Parm Sandhu,
Group Vice President of Enterprise 5G Products and Services.
NTT DATA

BMW – among global SI NTT's major Industry 4.0 wins in 2023/24, along with Frankfurt Airport (below); US SI Future Technologies (right) also claims major growth. (Images: BMW/ Frankfurt Airport)

cites discrete and process manufacturers as key targets, plus "large-scale" logistics in seaports and airports. "That's the sweet spot," he says. "That's where private 5G shines – where it translates into significant ROI savings. Because it provides cost-efficient coverage in complex environments, plus quality-of-service and support for mission-critical applications. We are starting to see double-digit million-dollar deals. They take time and effort, for sure; but they are coming in."

NTT is not the only one. IBM spinoff Kyndryl has talked in these pages before about scaling 5G to multiple sites at Dow Chemical and CP Chem, among a bunch of unnamed references. US system integrator Future Technologies (FT, in number-quote above), a Nokia favourite with a lower profile (but a wide influence, and a hand in the certain above-mentioned Kyndryl integrations), said in January it had secured "several multi-million dollar" wins among Fortune 100

and 500 industrial firms, and a $150 million pipeline of new sales. At press, it issued a note about taking $14 million of orders from the US energy sector in 2023; in conversation, it says it might go vertical-by-vertical through its spiralling 2023 win-totals, as well.

So, is this hype? Or is this real business? Because the boots-on-the-ground in Industry 4.0 are delivering, in notable volume. Peter Cappiello, chief executive at Future Technologies, reflects: "It's frustrating to see these companies put out statements about pilots they're selling. I mean, we're getting paid to do these; they are real networks. We're private; we have no debt. Lots of other companies [which talk about enterprise deployments] have raised capital, and don't even have enterprise customers. We're doing network transformation with customers we've worked with for years. We've been doing private cellular for 14 years – so we're way more mature than most others."

He lists a bunch of customer references (which must remain private, he says) and it reads-back like a who's-who of stateside early-adopter industrialists in the private LTE/5G sector – to the point, almost, that its fingerprints appear like they are across most serious private networks in the US. It includes factories, refineries, mines, ports, army bases, plus a bunch of others. He says: "We have gone from a regular $30-$40 million pipeline, to burst it over the $150 million mark. And you know, we've been around for 25 years; some of these others talk about their pipelines, and it's nonsense. But we are adding seven figures to it every week – because we have this proven methodology."

What methodology? It is worth hearing him out just because the implication is that, away from the hype and bluster, parts of the private 5G market have settled on a deliberate process to scope the problem, articulate the value, and deploy the solution. Cappiello explains: "We get introduced, we get the idea, we retrieve the blueprint: vendor X for the radio, vendor Y for the core; or maybe X for both. We look at the use cases, we look at the devices; and then we set up a 30-minute call where I present a couple slides about

On the edge – Casa, Airspan face trouble

Seems those sketches of Spain were about right (see page 28). At press, US-based core network provider Casa Systems had filed for Chapter 11 bankruptcy in a court in Delaware, and agreed a deal at the same time to sell its 5G network assets to Canadian outfit Lumine Group for an undisclosed fee. At the same time, US radio network supplier Airspan Networks said it had extrapolated itself from a bankruptcy tangle in the same Delaware court after agreeing a $95 million bailout with Fortress Investment to eliminate its debt.

Casa Systems, which was selling its Axyom system via Verizon Business, among others, initiated voluntary bankruptcy proceedings to achieve "value-maximizing sales of its businesses". Lumine Group acquired Nokia's device management business for €185 million in late 2023. Meanwhile, it has also entered into a "stalking-horse" deal to sell its cable business to an affiliate of Canada broadband services firm Vecima Networks.

Airspan's "prepackaged" Chapter 11 arrangement will enable it to enter into a 'restructuring support agreement' with Fortress Investment, plus other investors, to the tune of $53 million in debt-or-in-possession (DIP) financing, rising to $95 million. This will be sufficient to wipe its slate clean of "all existing funded debt", it said. It expects to start again in "30-45 days" as a private company majority-owned by Fortress, plus affiliates.

the company, and then handover to the former CTO of Georgia-Pacific to walk through a series of live use cases and applications in our own living lab."

Some context, here: Cappiello recruited Gary Hill from US pulp-and-paper manufacturer Georgia-Pacific four years ago as chief operating / innovation officer with a brief to "build a living lab". Future Technologies has invested about $2 million in the site, says Cappiello. "Because use-cases are what drives this," he explains. Hill has the right profile, he says; at Georgia-Pacific, Hill effectively ranked among the top manufacturing customers for Intel, Verizon, AWS. "This stuff matters to customers – that someone on our side has worked on their side." He goes on: "So we say, 'Right, we are going to show you what we do'. And we show them a 5G core network, and they see it and they get it."

He replays the conversation: "'Oh, it's a server,' they say. 'Yep, and the core is a telco workload'. 'Okay. I got it.' Okay, so good; and then we show simple carpeted use cases, like some Zebra tablets and scanners. They're like, 'Right, yeah; we have them, too'. *Okay; yeah; we're tracking*. And so we show them the training space, three 25-person classrooms; we show them the training towers. We explain that our goal is to train them, and enable them. And then we show them all these high-runner use cases – connected worker, remote worker, with every device you can imagine; a HoloLens running Tactile, RealWear running Librestream. They're like, 'Okay. We like that.'

"And then, we have an IoT health sensor running AI/ML, and a 5G AMR running around in the background. But we also have a conveyor belt with a Cognex camera connected on fibre. '*But I thought you're selling us 5G*?' And we say: 'No; in this environment, we have everything. Because you have everything. We have wired, because you have wired. We have Wi-Fi, because you have Wi-Fi. We have fixed-wireless broadband and public cellular.' Because this is like a blue-collar lab. There are no white lab coats. We're not trying to show what's possible in 2030. 'You're a real business,'

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All of which says that, even with just 0.0003 percent of the addressable market covered, private LTE/5G is finding its mark with certain enterprises; it says that resellers like Future Technologies, plus NTT and others – plus equipment vendors like Nokia and Celona, and others – can explain its value to enterprises in language they understand, and make its value stick. It is not hype, then, that cellular has a job to do in large enterprise venues; the question is just how much of a job it has, in how much of the market. And if you want a glimpse of the future, of how 5G finds its groove beyond the Industry 4.0 vanguard, then you could do worse than ask a test company. Which is what we did.

MIDDLE MARKET

Across the workbenches at UK-based Spirent, the clearest trend is for smaller and simpler systems, says Stephen Douglas, the firm's head of strategy. "We're seeing lower-cost, smaller-footprint private networks-in-a-box, particularly in North America; and development of capabilities so they can be deployed in an automated fashion." The point is to jettison functions, reduce costs, and automate complexity – and thereby to open new markets. The ambition is to make private 5G accessible to more than just big firms with deep pockets, with which it has tended to find a natural home until this point. "The supply industry wants to sell to smaller businesses," he says.

Smaller businesses – as in the mass-market? Douglas qualifies his previous statement. "Well, probably less-small sized and more medium-sized, at this point," he says. "[But] there has been a whole change in mindset – from slow and complex 5G installations to lighter-touch 5G offerings, comprising just a few radio cells and a stripped-back core network, with only the network functions that you actually need, rather than all

"There has been a whole change in mindset – from slow and complex 5G installations to lighter-touch 5G offerings, comprising just a few radio cells and a stripped-back core network, with only the network functions you actually need."

Stephen Douglas, Head of Market Strategy, Spirent

In the bag – 5G is getting smaller, as with this offering from Athonet

the stuff that goes into a public network." This is the line from Verizon Business, also, which has refocused and retooled its global sales operation ('5G acceleration' team) over the last 18 months, and is suddenly hoovering up 'mid-market' sales in the US.

Jennifer Artrley, in charge of the edge-5G enterprise team at the US operator, comments: "We have closed as many private network instances in the US mid-market to date in 2024 as we did all of last year. The funnel has more than doubled; the late stage opportunities in the funnel have more than tripled. We are out there, and I am adding salespeople to the team." Of course, that sum – as many sales in a quarter of 2024 as in four quarters of 2023 – might just be four-times not-very-much. But the headcount in Artley's unit stands at 250-odd, up from about 150 in early 2023, and Verizon Business is in the game – mostly, perhaps surprisingly – via the US "middle-market".

In other words, even as deep-pocketed global enterprises ($5 billion firms with $50 million budgets, say) kick the tyres on complex Industry 4.0 integrations, as a precursor to mass-market adoption, Verizon Business is switching on light-touch LTE/5G in small- and mid-sized firms (SMEs) in shared-access CBRS airwaves and localised tranches of its own spectrum. It is not supposed to go like this, of course; the mass market is supposed to follow the early market, and the early private-5G market was supposed to be about production-line pyrotechnics in Industry 4.0. "Honestly, we'd written-off that part of the market. We just didn't think the SME sector was the right target for private networks."

The fact the SME market *is* the right target, already – in sales, latterly, and in test, presciently – suggests the hype has substance. Back to Douglas, who says the test products in the Spirent labs do more than just strip-back technology and abstract complexity into automation software; vendors are bundling in edge compute hardware and application software, as well, he says. This is Nokia's strategy with its MXIE system, built to run Industry 4.0 apps next to the core

Myths and legends – three lies the 5G sector tells (and wants to take back)

Ask Future Technologies – which appears, directly or indirectly, to have its fingerprints across every-other big private 5G deployment in the US – about the hype in the market, and it will tell you straight that it is a distraction and a bother, which is making work for a business that has been selling private networks for 15 years already. "I'm a bit frustrated by companies putting out statements about pilots they're selling – or subsidizing or givingh away for free," reflects Peter Cappiello, chief executive at the US-based system integrator.

"It makes it difficult for customers to differentiate those data points from the ones we provide – which are fully-funded production projects. It is misinformation, which inhibits the growth of the market. The variability in data makes it difficult for customers to feel confident in the technology and, therefore, slows down adoption. A lot of retraining needs to happen when we talk with current and prospective clients. The market would really benefit from more concrete examples of success, versus hype – especially as it matures and starts to scale."

Future Technologies, a Nokia favourite in the US, was selling private networks for a decade already before CBRS spectrum was liberalised for shared usage, and equivalent mid-band tranches were released in Europe and elsewhere. It has a raft of Industry 4.0 references, which it is happy to discuss but reluctant to name. But, without much prompting, Cappiello offers up three lies (myths) the industry tells, which should be debunked right away.

The following commentary is all his.

Background image: 123rf

1 | 5G is a future-tech (for the AI-gen)

"**The myth**: that private 5G is for futuristic enterprise use cases, as per all of the innovative and trendy applications that industry folks like to show – such as generative AI. **The truth**: that the production networks going into industrial enterprises already are completely practical in their nature, designed to power use cases like connected-worker and industrial-automation. This is not future stuff; these networks are live in enterprise venues now, and geared for workable solutions and rapid returns. The rest is for tomorrow; what matters most is how 5G can drive change today."

2 | 5G is a usurper-tech (to kill Wi-Fi)

"**The myth**: that private 5G will kill Wi-Fi; that this is a zero-sum game – 5G versus Wi-Fi. Enterprises tell us that vendors have told them that it's one or the other; private 5G or Wi-Fi. This is a lie; it is just not the case. **The truth**: that private 5G and Wi-Fi will coexist, each supporting their own unique use cases. The same goes for fibre; the same goes for public cellular and low-power IoT. It is an 'and' decision, not an 'or' decision. 5G isn't everything, but there are very good reasons for it – for control, coverage, advanced use cases; or just for the physics."

3 | 5G is a total-tech (without limits)

"**The myth**: that private 5G is unbeatable and unbreakable; that it offers boundless coverage and boundless capacity. The values that get tossed around range a huge amount, and set the wrong expectations. **The truth**: that private 5G is a hostage to physics, just like every technology, and just that the supplier market should trade in the truth, and not just pass around lab-based ideals, or made-up metrics, about 5G performance, and instead provide realistic values (coverage per radio, capacity per radio, for example) that an enterprise will be able to assess and rely upon."

network, as well as with its multi-layered private 5G connectivity portfolio (see below), set to be bolstered (post-summer) by a new 'ultra-compact' version of its Digital Automation Cloud (DAC) product.

The Finnish vendor wants an early shot at the mass market, composed mainly of SMEs, forming the engine room of the global economy. The statistics are hard to judge, but the Small Business Administration (SBA) says SMEs make up 99 percent of all private businesses and 47 percent of the private workforce in the US; the numbers tell the same story in most 'industrial' nations. "We said 14 million [industrial] sites – which is one million large sites, two or three million mid-sized ones, and everything else is small or very small," explains Stephane Daeuble, responsible for enterprise solutions marketing in Nokia's enterprise division. "So we need to tap into those markets."

The 'ultra-compact' DAC product, as yet unnamed, will support a couple of radios, and compete with Wi-Fi in small venues. Its DAC Compact version, launched last year, supports up to four radios in small-to-mid sized indoor venues (up to 20,000 square metres). The original DAC solution, which has fuelled most of Nokia's sales, supports up to 100 cells in campus setups (over 20,000 square metres). The DAC portfolio is complemented by its macro-sized Modular Private Wireless (MPW) product for wide-area projects, and micro-sized Perimeter Network (NPN) product, which fits in a bag (like Spirent's test cases) and is customised and resold by specialist partners. (See right.)

In reality, Nokia's sales lens is still trained on bigger enterprises; it is just that these firms want a lighter-touch solution to flow-into their smaller sites. But logic says the mass SME market will follow in Nokia's Industry 4.0 offensive, as it will for its rivals, and the hype will gain credence again. Daeuble says: "More and more large companies ask us for smaller sites. We've done their large sites and we've done their medium sites, and they're now asking us to cover 2,000 small distribution centres with the same solution… Or they say, 'Okay, we've done the 40 big ports; I want to do the next

"Fourteen million sites – that's one million large ones, three million medium ones, and everything else is small… Large companies are now asking us for smaller sites. We've done their large and medium sites, and they want 5G in 2,000 small distribution centres"

Stephane Daeuble,
Head of Solutions
Marketing,
Nokia Enterprise

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99%
of US private firms are SMEs
Source: SBA

Macro to micro – Nokia's portfolio

1 | MPW (MODULAR PRIVATE WIRELESS)		
Wide-area MNO-grade P4G/P5G	Coverage / density: >100k m2 in/out; 100k users	Large regions / districts / campuses

2 | DAC PW (DIGITAL AUTOMATION CLOUD)		
Campus-area LSE-grade P4G/P5G	Coverage / density: >20k m2 in/out; 100 cells / X users	Mid/large enterprise campuses

3 | DAC PW COMPACT		
Local-area SME-grade P4G/P5G	Coverage / density: <20k m2 in/out; 4 cells / X users	Small/mid enterprise campuses

4 | DAC PW 'ULTRA COMPACT' (NAME TBC)		
Local-area SME-grade P4G/P5G	Coverage / density: >5k m2 in/out; 2 cells / X users	Very small/ small venues.

5 | NPN (NOKIA PERMITER NETWORK)		
Portable / temporary P4G/P5G	Coverage / density: >3.5k m2 outdoor; 1 cell / 800 users	Custom; for public safety / defense

60 medium-sized ports, and then the next 200 small-sized ports'. But they want something cheaper."

He adds: "Those markets were not very aware of private wireless before, or willing to do much with it. But now we can present them with a single radio and a single blade, and cover the entire [small-sized] port." The sense is Nokia is out on its own; but the word from the test labs is that rivals are readying similar options. "Certainly this trend for bundling is coming into the test arena," says Douglas. In ways, the bent for simplification is a direct response almost to the stop-start progress in the manufacturing sector, the original Industry 4.0 poster child for private 5G. It is not quite; it is a natural evolution and logical response to scale the technology in the mass market.

FACTORY COMPLEX
But manufacturing is hard, notes Douglas, and private 5G remains a developing technology, which, as yet, does not quite deliver sufficient features or confidence for manufacturing companies to fully get behind. That will happen, but it will take time, the message goes. "It is a more complex environment; the use cases are more challenging. A lot are dependent on Release 16 and 17 feature sets; and Release 16 features only started to come available to equipment makers last year; 17 will come this year. So there is a time lag in manufacturing; and an issue, as well, because of the focus on smartphones and [then on] CPE units… We are only now starting to see proper focus on industrial devices."

There is a rush of interest in RedCap for industrial IoT, he notes; but again, it is a future technology, which does not hold enough immediate value for manufacturing companies, generally, to scale their private 5G experiments into loaded multi-site systems. "RedCap is not really going to be available in the market for another year, at best. So manufacturing is stuck in trial-mode, to a greater extent – just because of the availability of technology," he says. And because

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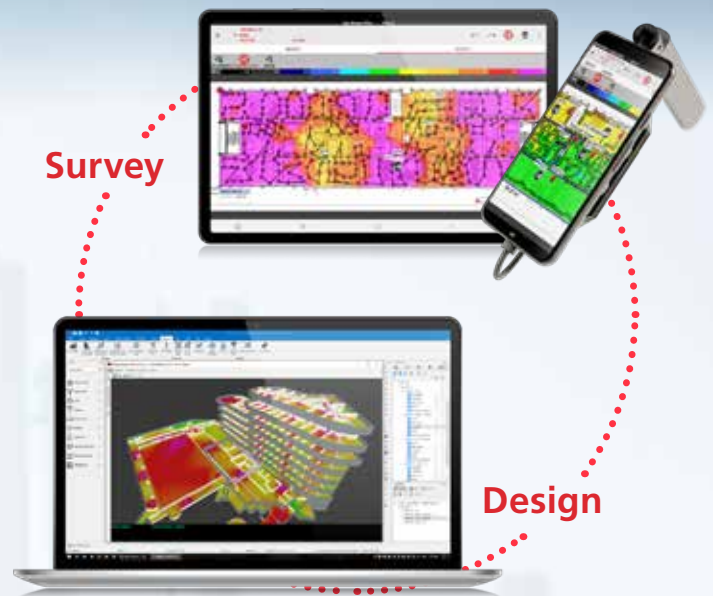
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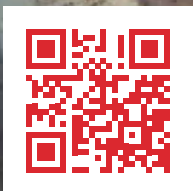
LET'S TALK!

of the difficult terrain in manufacturing, also; all good for test companies, it would appear. But Verizon Business, as part of its own strategy-shift, has recategorised manufacturing as a "horizon-two/three opportunity".

Arvin Singh, recruited as global head of 5G solutions and innovation in late 2022 as Artley's private 5G unit paused to take stock, reflects: "The team had been looking at all these complex areas – all this manufacturing with robotics, and so on. Which is exciting. But there is a roadmap and a sales cycle, and a whole ecosystem that goes with it. So frankly, Industry 4.0 has lagged two-to-three years behind the hype on private networks. And the mission Jen (Artley) tasked us all with 18 months ago was to land-and-expand – without losing sight of those horizon-two/three possibilities. The question was: what can we do now to get in the game?"

As discussed, its way into the game, three years after it first planted its flag in foreign soil with Associated British Ports, and 18 months after it took its own organisational structure in hand, has been via the US 'mid-market'. Which is not to say Verizon Business has eschewed big-ticket Industry 4.0 affairs for "mom-and-pop" deals in CBRS spectrum. *I mean, that can't be right, surely* – when there is a chance, suddenly, to set up as a 5G provider to businesses in any market (spectrum permitting) in the world? "Not at all," responds Artley. "We run the whole gamut. We're finding applications for more basic CBRS deployments, but the most exciting opportunities are in global enterprise."

She offers up its multi-core installation at an Audi test track in Germany, to duplicate global network conditions at a single site, as an example. "That was a long development cycle because we were working to see what was possible. And what's possible is pretty phenomenal." Coverage of the Audi setup can be found on the *RCR Wireless* website; the conversation skips to other (uncited) deals, and to how the company's "land-and-expand" motto translates to large enterprises. "In the mid-market, it means volume –

Pharmaceuticals – Verizon, like others, has found that 5G is an easier sale in process manufacturing than in discrete manufacturing; it has also seen an uptick in 'mid-market' sales through late 2023 / early 2024. (Image 123rf)

"[That deployment] is 15 million square feet and 30 buildings; 1,800 radios and one network. It is the whole campus, expanded from a small-scale setup at a different location. And it wants to know how to expand to the 80 countries it is in – because it wants one [network] topology, consistently."

Jennifer Artley,
Senior Vice President, 5G
Acceleration,
Verizon Business

getting lots of wins on the board. In global enterprise, it is about selling the first location, and then expanding the use cases on top, or else expanding to more locations."

Verizon Business sold its first private LTE/5G network to an oil and gas refinery in August, she says; it sold five more to the same customer in October, and seven more in December. "They see the benefit, and want more of it – and so it scales geographically. Similarly, she tells how a pharmaceutical company, another industrial 'first' for the team, has taken a private LTE/5G network from Verizon Business in the last few months, and returned "two months later" with a much more complex brief. "It is a more complex network, and a more complex solution," she says. "And more complex than the oil and gas example."

She adds some colour. "It is 15 million square feet and 30 buildings; 1,800 radios and one network. It is the whole campus, expanded from a small-scale setup at a different location." Are those deployments in America, or in Europe or elsewhere? "They are in the US. But that pharmaceutical company, for example, wants to know

Twinned and tweaked – five principles of good private 5G network design

Good 5G is bad 5G without careful network design – especially with private 5G in complex enterprise venues. This is the line (see full interview, pages 22-24) from Nazim Choudhury, director of market development at iBwave Solutions, which sells design software for all enterprise network technologies. His message is that network design should be deliberate and careful, and keep the business outcome as its 'north star'. Below, Choudhury sets out five principles of good network design; all the comments are his.

Background image: 123rf

1 | DEFINE (applications and scalability)
– Prioritize current needs
"Focus on immediate use cases the private network will address. This ensures your initial investment delivers tangible results."
– Plot long-term vision
"Outline the strategic future use cases for the network. This will help you plan for expansion and ensure your initial design decisions support future growth."
– Populate app roadmap
"Create a plan that stacks use cases over time, clearly laying out the steps needed to add complexity and value incrementally."

2 | EVALUATE (architecture, integration)
– Survey radio environment
"Analyze the RF environment to understand sources of interference, signal blockages, and optimal equipment placement."
– Define system architecture
"Assess the overall architecture, including integration with existing systems, security requirements, and capacity planning."
– More haste, less speed
"Proactive planning saves costs by reduc-
ing rework, minimizing equipment needs, and streamlining deployment."

3 | DESIGN (technology and solutions)
– Focus on business outcomes
"Prioritize the outcomes and performance metrics over technologies (such as targeting specific latency and bandwidth)."
– Avoid 'shiny object' syndrome
"Recognize that the newest, most hyped technology may not necessarily be the optimal fit for your specific needs."
– Keep tech options open
"Consider a range of technologies, including Wi-Fi 6/6E and CBRS where applicable, to determine the most cost-effective solution for each use case."

4 | DEPLOY (phased and focused)
– Target value zones
"Identify the initial areas where the private 5G network will provide the most immediate ROI; begin with areas where 5G's benefits are most impactful, and gradually expand to areas with less immediate need."
– Take careful steps
"Build a roadmap to extend the network in phases, aligning with the strategic plan for new use cases and applications."
– Make a digital twin
"Create a detailed digital twin of your physical environment, including buildings, infrastructure, and key assets."

5 | SIMULATE (optimize and expand)
– Test and predict
"Use the digital twin to simulate network scenarios, optimize coverage, and predict issues. Envision how different tech works together to ensure an effective network."
– Use data insights
"Make informed decisions about design and tech choices based on insights from the twin. Add technologies in a simulated environment to avoid re-design."
– Maximize ROI
"Use the digital twin to validate changes and drive improvement. Simulate and oprtimize how investments in new tech impact performance."*

how to expand to the 80 countries it is in – because it wants one [network] topology, consistently." In a market that has found upwards- and outwards-scalability (applications and premises) difficult over several years, these deployments represent real two-way expansion – and tell of a licensed operator embracing unlicensed spectrum in global markets.

But while they are prime examples of private LTE/5G at-scale, they are not what you might call *conventional* manufacturing – as in the kind of discrete assembly-line discipline that gets conflated with Industry 4.0 in popular legend.

Indeed, the conclusion from this anecdotal, mostly uncited, rush of sales is that (discrete) manufacturing is a hard-sell for private 5G, and that any disillusionment in the wider market is probably because of this; plus that the impossible task to make an undercooked version of industrial 5G relevant to manufacturers has forced the vendor market to look elsewhere. Which is what has happened. Precipitated by the anti-complexity trend, 5G has landed in other climes. "Most growth over the last 12 months has not been in manufacturing, but in seaports, public venues, and the government and defence sector," says Douglas. "And it has mostly been to provide coverage to large campus areas."

This is echoed by everyone. For perspective: Nokia, which claims an almost-50 percent (GSA) share of the private LTE/5G market, has 710 customers (at March 2024); half (49 percent) are mostly for legacy wide-area MPW networks, which pre-date its DAC assault on liberalised 'vertical' bands. They are, to a greater extent, in the government and utilities sectors, where macro LTE/5G is still required. About a quarter (23 percent) are in manufacturing and a fifth (20 percent) are in transport/logistics; both markets have grown from nothing four years ago, when the DAC system was introduced. But the fastest growth, says Nokia, is not in discrete (parts and assembly) manufacturing – where the hype has focused – but in process (ingredients and recipes) manufacturing.
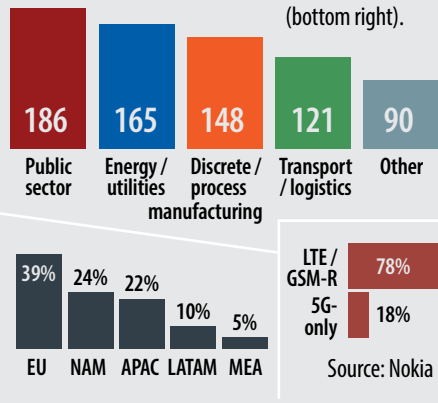
In other words, it is in the making of bev-

Game of two halves – discrete manufacturing, like automotive production (above), is the poster-child for Industry 4.0, but it is waiting to an extent on future 5G releases; whereas process manufacturing, like food and beverage (left), has simpler demands that 5G meets now (Images: Volkswagen, 123rf)

Market perspective

Indicative – Nokia is the leading private 4G/5G vendor by share, and its stats (below) show: manufacturing, notably process manufacturing, is catching up fast on legacy public and energy sector sales (top); most activity is in Europe and America (bottom left); and that most is also 4G-based (bottom right).

Public sector	Energy / utilities	Discrete / process manufacturing	Transport / logistics	Other
186	165	148	121	90

EU	NAM	APAC	LATAM	MEA
39%	24%	22%	10%	5%

LTE / GSM-R	78%
5G-only	18%

Source: Nokia

erages, petrochemicals, pharmaceuticals, and so on, plus in seaports and airports (logistics) – rather than in the more iconic production of vehicles and machinery. Daeuble says: "We ignored some markets – like process manufacturing, which splits into a dozen segments – where our stuff makes lots of sense, and brings lots of value. Because they're less advanced in terms of automation, say. So we've put a lot of focus on that and we are getting a lot of big deals." High-profile clients like BASF, Chevron Phillips, and Dow Chemical fall into this basket. "But we have 10 new markets this year as well," he adds. "Which shows we are covering new ground."

RAPID RETURNS

To an extent, all of this – simpler systems, newer verticals – is being combined in the post-hype private 5G era with clear-

er thinking. The business of private 5G is quicker, all of a sudden, in terms of both the sale and return, says Douglas. "We have seen really rapid returns-on-investment. A number of end users – our customers' customers – are posting an ROI in six months on a small set of targeted use cases. So you don't need hundreds of use cases anymore to justify why you are doing it. With a low-cost implementation and a couple of use cases, the return can be very quick." But the biggest breakthrough in the Industry 4.0 game is just that the supplier market is match-fit, now.

He says: "Enterprises have had this day-one impression that cellular is really expensive. And maybe it's a historical thing; where they've engaged previously, and come away with this idea that cellular is five or six times the cost of Wi-Fi. Which just isn't the case. And I don't think the vendor community communicated that very well. Maybe because the operator community, in particular, wasn't at a stage, and in a good place, where it could demonstrate how to achieve the ROI. It is much better at that now – because the ecosystem is working better, and these lighter-weight solutions are coming into the market." But is it match-fit, *really*? Is that the difference?

Certainly, by its own account, Verizon Business has changed-up and limbered-up; other operators will have tuned-up, too. But the rest of the supplier market, comprising a *right-on* range of long-sighted equipment makers and laser-focused specialist integrators, know their Industry 4.0 onions very well and have worked the channels for years. Something else has changed in the background, to reorder the foreground – while the industry frets about procrastination in front-line manufacturing. And the thing that has changed, besides simpler 5G systems, is that the industry has hit on a killer app. And – *get this* – it is called connectivity. *Shock, horror; exclamation point.*

Back to Shah at Celona, who comments: "I am alarmed that easily 80 percent of deployments are just about providing connectivity to people. Literally, these refineries have these small pockets of Wi-Fi, and then abso-

"One hundred percent. Nokia is right... The great challenge was to find the trigger case... Connected-worker is the catalyst. It has taken away a lot of speculation – which goes back to the hype. Otherwise you're searching for these fancy use cases. All of that has gone away – because it's as easy as workers-need-connectivity.."

Rajeev Shah,
Chief Executive,
Celona

People matter most – 'connected worker' (much more than 'remote worker') is the trigger case to bankroll private 4G/5G network deployments (Image: 123rf)

lutely nothing. It's kind of funny to go there; they have these golf carts to take them around, and these weird speed limits of 17 miles per hour, and they take a notebook and pen and tour about, and then return to these pockets of Wi-Fi to do data entry. And they are telling us that, one in five times, they make a mistake – and so they have to go all the way back in this golf cart, record

the data, and then return again to get a Wi-Fi signal. And it's completely inefficient."

It's weird, as well, because Nokia tells almost exactly the same tale a couple of weeks earlier, when relating the origin story for its new generative AI prototype, MX Workmate, which attaches to its DAC and MXIE systems as a kind of industrial chatbot for factory workers. "In terms of product deployment, the easiest use cases to implement are the ones that focus on human workers," says Daeuble. "Because they have the most impact." He explains how the whole project started after observing a worker in a client factory go to retrieve a part, only to return again for a pallet loader to do the heavy lifting. "We were like, 'Isn't that where you need automatic dispatch of an AGV?'"

He adds: "And then we got with Bell Labs, and put two-and-two together – to have an AI engine figure things out, and an LLM to converse'. And then you're like, 'Okay, the pieces fit." He reasons, as well, that "the most successful apps meet a fundamental need", and that private 5G generally finds its mark, initially, just with team-comms apps. It is the same logic, whether for the base-level network or the top-level application: manual processes are made impractical by smart connectivity and clever software. The ROI sum flows from that. "Because humans in charge of complex machines can call a remote expert – versus having a bloke walk 20 miles every day with a sack of books."

The conversation with Nokia is played back to Celona. "Exactly. One hundred percent. Nokia is right," responds Shah. "Once you connect the worker and deploy the network, then it's easy to layer-in IoT use cases. Because you have the network, and it's paid for. The great challenge with all these IoT / OT applications was to find that trigger case to justify the investment. Connected-worker is the catalyst. It has taken away a lot of the speculation – which goes back to the point about the hype. Otherwise you're searching for these very fancy use cases – with augmented and virtual reality, and whatever. But all of that has gone away – because it's as easy as workers-need-connectivity."

Singh at Verizon Business says the same,

as well, talking about how 5G has found its métier outside of a strict Industry 4.0 footprint. "In most cases, to start with, it's a coverage need, getting into the basics and starting with a small footprint," he says. "And then expanding [use cases] in the same physical environment or expanding to multiple sites." And so, even as his company scales "horizon-two/three" projects in oil-and-gas and pharmaceutical production (and discrete manufacturing is pushed to a horizon three/four schedule), plus in a bunch of ports, many of his company's 'land-and-expand' gigs are in so-called 'carpeted verticals'– in retail, offices, venues.

He responds: "Yes. It's less of a rugged conversation, more of a carpeted one. There are lots of sort-of corporate next-gen campus networks [to start with, in industry, too]. But it's modular – so you add capabilities all the time." The point, in the end, is that the original Industry 4.0 hype around 'smart' factories – captured in the imagination as 'lights-out' automotive manufacturing, as the sharpest application in the sexiest discipline – still holds; it is just on pause. Industrial 5G capabilities and devices are in the works, and will come available (starting post 2025, in flow by 2030; see the below graphic for the 3GPP release schedule) and gain sufficient trust that hard-nosed Industry 4.0 (discrete manufacturing) scales serious-sized systems.

BLAME GAME

And in the meantime, there is good business to write with big-sized firms elsewhere and mid-sized firms everywhere – the story goes. So on one hand, the hype is probably

Team sport – there is a late realisation that 5G is not the only piece of the Industry 4.0 puzzle. (B/ground image: 123rf)

justified in the general and long term insofar as private 5G has a grand (yet unknowable) role in a 'fourth' industrial revolution. And on the other, the hype is completely screwy in the specific and short term on the grounds that total market sales are still slow, however big the little victories for individual suppliers, and most private 5G deployments are not about AI whizz-bangery, at all – and hardly about 5G, actually. Most deployments and sales are LTE-based (just take a look at the Nokia figures on page 14). "Everyone wants 5G," says Cappiello at Future Technologies.
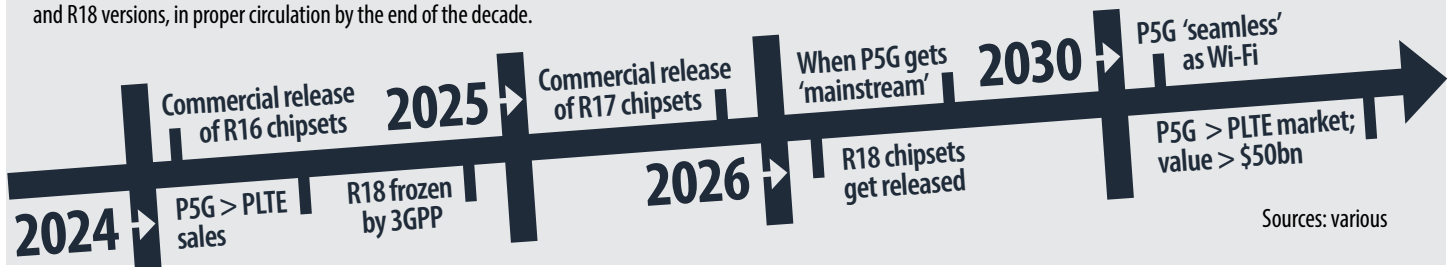
"But industrial companies have Apple devices with support for Band 48 – so they need LTE in there." He describes a back-and-forth conversation where customers have to

square the marketing promise about future 5G releases with the coal-face reality about existing ones before they commit to a deal. "We spend so much time on this. It's almost like too much common sense," he reflects. Indeed, the hype machine has coughed-up a hot mess of half-truths for resellers to unravel. But there is a clear sense that some kind of order has been restored, or realised, as well. Is the disillusionment because a developing technology has been blamed for the stop-start failure in manufacturing?

And is the difference, now, that the industry has just moved on – in the knowledge there is enough in it to address other opportunities, while it matures? Shah responds: "It goes a level deeper. The people making the robots and headsets for these fancier use

The industrial 5G schedule – 'seamless' post-2030

A long road for Industry 4.0 – Release 16 (R16) chips, just available, bring important Industry 4.0 features, but not like R17 and R18 versions, in proper circulation by the end of the decade.

2024 P5G > PLTE sales — Commercial release of R16 chipsets — R18 frozen by 3GPP — **2025** Commercial release of R17 chipsets — **2026** When P5G gets 'mainstream' — R18 chipsets get released — **2030** P5G 'seamless' as Wi-Fi — P5G > PLTE market; value > $50bn

Sources: various

cases all say the same thing: but is there a critical mass of 5G networks? They know it is the right technology, but they need the networks before they put it into their products. It's chicken-and-egg; but it is a virtuous cycle, as well, right? Enterprises are justifying the investment because of this connected-worker case, and then going to their robotics companies to say, 'We have the 5G network, and we want the 5G equipment.'"

It goes the other way, too. Celona is now selling private 5G systems to enterprises via AGV manufacturers; it has sold three in the last two months, it says. It will not be the only one. The wheel is turning; the chicken and the egg will appear together, at some point. Some version of the hype will be real.

SERVICE GUARANTEED
The other aspect, referenced already, is that the cultural approach to selling digital-change has shifted, notably among mobile operators. Asked if closer alignment of its 5G, IoT, and edge componentry in its new structure has helped Verizon Business to better-design enterprise solutions, Artley responds: "It's less about that. I mean, it's a lot about that. But it is really about business outcomes."

She explains: "We've gone from selling technology to having conversations that bring OT and IT together. And that's a skillset; that's a unique skill-set that a lot of general core [network] sellers don't have. The ability to engage with customers in a different kind of conversation – that's what has accelerated this." Which is about zeroing-in on ROI, ultimately. Indeed, ROI is the proof-point for all the other market trends and sales victories discussed in this piece already, including about scaling 5G upwards and outwards with new applications and new sites, and migrating 5G across into new sectors and down into new segments.

But it is also about effectively mapping use cases to KPIs to business outcomes to SLAs for the first time. "It bodes well for the future, and how the market scales," comments Douglas at Spirent, who has seen progress with KPIs/SLAs across the company workbenches as 5G systems are integrated

'Ecosystem linkage' – the big opportunity for telcos

Want to know what's happening, and also what's about to happen, in telecoms? You could do much worse, and also not much better, than to ask a well-placed test and measurement firm, running the rule over all the latest telecoms technologies from all the biggest telecoms vendors and operators. And you could do hardly any better at all than to get Stephen Douglas, head of market strategy at Spirent, on the blower. Which is what *RCR Wireless* did, when tasked with assessing the state of the private 5G market, in early 2024, particularly as it interfaces with Industry 4.0.

UK-based Spirent has a close eye on the private networks market, and a burgeoning private-networks business. "It's a growth area," says Douglas. "Our traditional 5G business is huge; we've got something like 3,100 engagements globally, right across the ecosystem. And that's continuing. A big part of it is the move to standalone 5G (SA); that's the driver in the 5G space. But private 5G is certainly a growth sector; and it is strategic too."

He explains: "We are most excited about the ecosystem linkage. It brings us into the enterprise space as well, which opens new opportunities. Because it's not just about cellular anymore. Enterprises want security, as well; things like enterprise SASE (secure access service edge). So how do you test and validate that? And where Spirent has traditionally tested smartphones on 5G systems, it is now being asked about cameras, for example, requiring a specific quality-of-experience. So the ecosystem is growing

> "It brings us into the enterprise space, which opens new opportunities. Because it's not just about cellular anymore... So how do you test and validate [those other things]? Where we have traditionally tested smartphones, we are now being asked about cameras, say. The ecosystem is growing [with private 5G]."
>
> **Stephen Douglas,**
> **Head of Market Strategy,**
> **Spirent**

[with private 5G]. That's the trajectory, but it is still early."

Indeed, such reflection on the private opportunity for Spirent tells as much about the broader shift and progress in this niche subset of the telecoms market – about nascent development, related services, ecosystem building. The point about "ecosystem linkage" can be applied to every telco-side player in the Industry 4.0 equation. It is a good intro as well to Douglas' view of the state of the private 5G market – to follow in a separate article. But first, he draws on Spirent's "own customer engagements and independent market analysis" to offer a view of how the market has scaled over the past few years, since spectrum has started to be liberalised for enterprises in certain countries. ●

with "applications around performance". As per Artley's comments, the supply-side is engaged with the buying-side in earnest at last about 'business outcomes' and 'business value'. It is no longer just selling technology, in other words, but rather looking to 'solve' problems. But for this, and *to get paid*, it needs to prove it can hold up its end of the bargain.

As such, the private 5G community is working with the likes of Spirent to test how to match network KPIs – as delineated by business applications, as dictated by business outcomes, as determined by business problems – to vendor SLAs. "Enterprises don't care about radio networks; they care about business outcomes, related to operational efficiencies and productivity gains, and things like that," says Douglas. "That value discussion has completely changed. It is about how you map those outcomes back into the network. That's where the bridge is, and what we are seeing more and more. Which is why these SLA-oriented use cases are emerging."

Interestingly, he says the disjunct previously was not just about a failure of language on the part of vendors; the buyers, on the enterprise side, struggled to articulate accurately and reasonably what they wanted from 5G, as well. Spirent ran a survey with telecoms consultancy STL Partners about 18 months ago to figure out what enterprises would actually pay for SLAs. "The thing we found was that a lot of them have really unrealistic views about the network performance they actually need. A lot of industrial enterprises, particularly, didn't have any real evidence that they needed this kind of heightened network performance. It was just a gut feeling."

The research discovered industrial firms, paying heed to the hype, wanted 'five-nines' (99.999 percent) reliability, he says – "when the baseline was a best-effort network that could barely do two-nines". Douglas goes on: "And it went the other way, too; a lot of telcos, say, were pushing these incredibly low latencies; when most enterprises don't need latencies anywhere

"We generally talk with clients about more than one use case. Because one use case never drives the answer. Maybe the client thinks they can do it all with the innovation-band. But as the business case builds, they need licensed spectrum."

Jefferson Wang
Chief Strategy & Growth
Officer, Cloud First,
Accenture

near as low. What they really want is a window of latency, or reliable latency, so they can guarantee a service does not go outside of a median latency range – which networks can deliver already today; just not very consistently. That exercise identified a gap between what is expected and what is needed."

PARTNERSHIP APPROACH
Again; the price of all the hype. It is good news for test companies like Spirent, pre-

sumably. "There is a period now where it all has to be tested," he says, half-joking that operators should take the chance to dictate the terms, before it all unravels. "The problem is a lot of their existing networks are best-effort, and they don't have clear metrics in place. So they don't know what they need. And the telcos haven't been very good at educating them. I mean, I'd almost argue that telcos should go in there and tell them exactly what they need from their networks. They should take the lead. Because if they wait for an answer, they'll get the wrong one – and the whole process will slow down."

He adds: "But it's just an infancy thing; where the market is right now. I am not worried; it won't stop the growth." Indeed, the weirdest thing about the hype-fallout in the private 5G space, as 2024 settles down, is how half the market is rattled by its failure and half is buoyed, and almost serene, by its progress. It goes back to the comment at the start by Analysys Mason that contentment in private 5G is more down to the profile of the vendor itself. But something that was striking at MWC 2024 when discussing channel strategies was the total absence of the kind of alpha sales talk that afflicted the industry just 12 months prior. Not a single mobile operator talked about 'priming' the sales channel; most talked about a mob-handed approach with vendors, integrators, and hyperscalers.

Some, like Verizon Business, are relaxed enough even to acknowledge a lack of deep familiarity with enterprise clients, and to say it would easily stand behind big integrator-consultancy firms when squaring up to them. "It is very old thinking," responds Artley, when quizzed about the old telecoms cliché (*hype?*) about 5G as the king-tech in Industry 4.0, and the role of operators to 'prime' its sale. "When I got to Verizon [in 2021], guess what the talk was; 'We are going to prime'. But we don't have the [customer] relationships. We can't say we 'own' the customer, or even that we 'know' it, really. We probably know part of it, but we need partnerships to maximise

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INTELLIGENCE ON ALL THINGS WIRELESS

Emerging technologies such as AI are increasingly capturing the attention of all stakeholders, as vital tools to drive use cases and the adoption of private networks, but the question remains:

Will private 5G meet expectations with the aid of new technologies and deliver proof of concept?

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roots-to-market."

It seems like a striking *volte-face* over 12 months. But Douglas is not quite having it; it was only ever a-lot-of-talk, he says, and not representative of the real channel dynamic. He responds: "That whole prime-thing was a bit of an illusion, to be honest. Most engagements involve operators and integrators, side-by-side at the same level. One might shake on the top-level contract, but there are lots of equal partners at the table. And really that ecosystem was already established; I think you're just seeing more of it. Maybe some of them are backing off, in terms of shouting about leadership and domination. But they've realised this is a big market, and there's enough to go around."

But "backing-off", even just in *banterous* discussion with the press, suggests a more careful and modest approach. Douglas goes on, hitting on a couple of other interesting points, *firstly* about the importance of public spectrum on the global scene, and therefore of the oft-maligned global carrier set: "The operators have a role, sometimes forgotten, because it all comes down to spectrum access. And in many cases, these deals cross into countries where there isn't any 'vertical' spectrum for enterprises. So it remains heavily dependent on operators, globally. But, yes, it is a team sport." Briefly, because there is not enough room (left) in this article, public 5G, and slicing of it, is back on the table.

When the private 5G industry was more squarely focused on all-edge systems in *conventional* Industry 4.0, it seemed like mobile operators were being edited out of the 5G picture in the enterprise market. But as its focus has broadened to capture opportunities in parallel sectors, and as it has sought to connect supply chains between fixed industrial sites, and while on-prem factory installations are generally stuck in-trial, mobile operators have been painted back in. This is another post-hype trend, getting louder – that nationally-available public 5G spectrum will be increasingly brought-to-bear on the enterprise market, and that mobile operators will increasingly

"Private cellular is this top layer. Because in our minds, we're layering over the top of what the enterprise already has. We're not replacing stuff. We're adding a network to do something very specific."

Peter Cappiello,
Chief Executive,
Future Technologies

Networks, layered

6	Private Cellular – 4G / 5G
5	IoT – SCADA / LPWAN
4	Wi-Fi – Mesh / Traditional
3	Broadband – M/wave / P2MP
2	Wired – Fibre / Ethernet
1	Public Cellular – 4G / 5G

show their teeth.

This is what the likes of Verizon say, of course. But it is also what the likes of Accenture say – and the former has acknowledged in these pages that it will defer to the latter on the 'prime' handshake, on the assumption that Industry 4.0 takes a chain of handshakes to work. Jefferson Wang, in charge of strategy (and private 5G) in Accenture's 'cloud-first' division, says: "If the client wants a reliable on-prem network, and they want to do video, say, then you bring in an operator – because you want localised higher-band spectrum. But equally, there are opportunities just with mid-band coverage in certain countries with industrial spectrum."

Despite the hullabaloo about mid-band spectrum liberalisation for enterprises in certain 'western' markets, the global scene is very different, the argument goes, and national mobile operators remain the gatekeepers of 5G airwaves. Which is the China story in a nutshell, of course – as alluded to by Douglas at the start. There is a suggestion, as well, that all-edge industrial 5G systems, completely hived-off from the public internet, and hyped-up like the like-list model for private 5G a couple of years back, are actually quite niche. Wang comments: "The thing is, we are generally talking with clients about more than one use case. Because one use case never drives the answer."

He goes on: "Maybe the client thinks they can do it all with innovation-band spectrum. But generally, as the business case builds, they need licensed spectrum, as well. I mean Verizon, say, has incredible spectrum holdings in the low, mid, and high [bands]. It is really good at pre-certifying radios and devices onto its spectrum – which is a major part of the whole thing." US-based integrator Future Technologies says the same, in line with the multi-tech reality it has created in its 'living lab'. Cappiello comments: "Private cellular is an *and* decision, not an *or* decision. 5G isn't everything. But there are reasons to add it – for control, for advanced use cases, for coverage, just for the physics."

He shows a sales slide (see below, left), which stacks all the different enterprise technologies – LoRaWAN on top of Wi-FI, on top of fixed broadband, fibre, public cellular. He says: "We show private cellular as this top layer. Because in our minds, we're layering over the top of what the enterprise already has. We're not replacing stuff. We're adding a network to do something very specific." The point is internet-connected public cellular is there, or thereabouts, just like internet-connected Wi-Fi and internet-separated LoRaWAN; it is just a question of how to divvy-up use-cases across a wealth of networking technologies, and what to put on a shiny-new private 5G system.

APPLICATION ECONOMY

The *second point* which Douglas makes (seven paragraphs ago; and which will see us home) is an allusion to the bigger prize that may yet develop out of this new 5G love-in – where everyone plays a part. Because the ultimate goal of the "team sport" of Industry 4.0 is to spring a new application economy in the enterprise market, and to somehow share the spoils. For telecoms, the great opportunity is about "ecosystem linkage", says Douglas, particularly with a relatively untapped market for business content – and to deliver in the enterprise space what it failed, so fantastically, to deliver in the consumer space. "The private networks market really needs an app store for each vertical," says Douglas.

"The problem is that developers have been left out in the cold, a little bit. Which is unfortunate… The application ecosystem is the only real weakness [with collaboration in the market]; that's the gap. None of the players have been able to foster a developer community to serve each vertical with bespoke applications. Which means it becomes a sort-of custom job, every engagement. It is really just about engagement with developers, in each vertical. But the telco industry is not very good at that. It develops these great networks, and thinks everyone will just develop stuff; and they don't. I'm intrigued to know how the

Boots on the ground – in the end, success in Industry 4.0 comes with industrial contact and knowhow (Image: 123rf)

network API initiative goes."

He adds: "At the same time, as more private networks are deployed, that ecosystem will develop. It's a problem just with the maturity of the tech, right? Because it's still not finished. And if you're going to

> "The last industrial revolution took 50-100 years. So we don't think Industry 4.0 will be much faster – maybe 30-50 years. I mean, the pace is still quick, but it is linear growth. It will take a long time to get to 14 million sites. The whole industry has only done 4,000-5,000, maybe. But you know, we are seeing 20-30 percent growth, and we are just fine with that."

Stephane Daeuble,
Head of Solutions Marketing,
Nokia Enterprise

develop something, you want it to scale globally. But I'm reasonably positive. 2024 will be a turning point because a lot of Release 16 / 17 equipment will come online, and because of this ripple effect from mega markets like China, which is probably 18 months ahead of North America, if not even two years ahead."

And really, there's the whole hype story, right there – such a brilliant destination, and yet such a long road; but also a journey that is gathering pace, probably.

The last word goes to Nokia, just because it has earned the right, and because its perspective is telling. "We were always surprised by the projected hockey-stick curve," explains Daeuble. "When we started in this market, we compared the last industrial revolution, which took 50-100 years. So we don't think Industry 4.0 will be very much faster – maybe 30-50 years. I mean, the pace is still quick, but it is linear growth. It will take a long time to get to 14 million sites. The whole industry has only done 4,000-5,000, maybe. But you know, we are still seeing 20-30 percent growth, and we are just fine with that. It gives time to innovate, as well. The reality is we are in it for the long run." ●

Good 5G is bad 5G with poor 5G design – especially in enterprise

So says iBwave Solutions, suggesting as well that quality has slipped in private 5G as rival vendors rush simpler releases

You can have the best 5G network in the world, and make it into the worst; or, at least, you can render it as completely ordinary without much effort, and maybe totally useless. This is the warning from Nazim Choudhury, director of market development at Canada-based iBwave Solutions. His point, as one might expect, given his company's interest in network planning, is that good infrastructure design is half the battle, especially when deploying so-called carrier-grade or critical-grade cellular networks. "It is not like stringing up a bunch of Wi-Fi access points," he says.

Which is how many customers and suppliers have approached the discipline in the enterprise space, where cellular has found a new footing lately with a flurry of mid-band spectrum liberalisation for enterprises in certain geographies and a bunch of in-band tech features for enterprises in new 5G releases. "The way with Wi-Fi is to survey and plan and design, all at once. Whereas cellular requires pre-planning, and then surveying, and then optimisation. There are more variables; it takes much more co-ordination. If you take the Wi-Fi approach, you're going to run into issues."

There were major issues a couple of years back, if we recall, with private 4G/5G test networks in Industry 4.0 venues. There was a lot of messing around, right – to get a steady LTE signal inside an assembly on a manufacturing floor, for example, or to stabilise the uplink channel on a video feed?

Background image: 123rf

"Yes, exactly," responds Choudhury. "And we were part of some of those trials – except they brought us in post-deployment, after things had gone wrong. And, you know, we showed them that, with proper planning, the outcomes can be much better."

He adds: "Some of these private 4G/5G trials have failed because of improper planning – because they have taken a more Wi-Fi-centric approach, thinking they can just throw up these access points almost anywhere." Indeed, he suggests the sort of easy shop-window sales – which certain hyperscalers, notably, sought to pioneer from disparate core and radio parts a few years ago; which have gone quiet in the meantime – effectively imposed a do-it-

yourself Wi-Fi design ethos on the more rarefied task of cellular radio engineering.

"Some offered very minimal planning – like you could just order based on square-footage. And that approach hasn't been successful because the market understands now that planning is crucial," he says. "You can have the best small cell, with the best specs and the best ratings, and put it in the wrong place. You won't get the best from it unless it is planned properly. Poor radio placement – because it is enclosed, or because of the setting or signal interference – means a poor network. It means you don't benefit from the technology, even if it is best-in-class."

Large-scale outdoor macro networks are

one thing; smaller micro-campus installations, indoors and outdoors in complex industrial venues, are another. The sale of private 5G networks in the Industry 4.0 sector, which actually perform as they are supposed to, is a much gnarlier business. For starters, there are a bunch of other access technologies already in play, including Wi-Fi and Bluetooth (invariably), and also the likes of LoRaWAN and RFID (very often). The bands are different, but switching and segmentation of devices is a planning-phase consideration.

But mostly, the clank and boom of Industry 4.0 just messes with cellular propagation. "Think of all the metal surfaces and heavy machinery that will impact the signal," says Choudhury. His firm started in the in-building DAS market in 2003, with a plan, hatched by its founders, veterans of Telus and Bell, to standardise network design tools, as used variously by network operators, vendors, and integrators. "From there, and as we were adopted by the Canadian and American carriers, it just started to evolve – from a documentation tool to a design tool, to a network simulation tool."

Choudhury continues: "And with modelling, you have to understand all the different materials that impact signal propagation and transmission losses – in all different frequencies in all different environments. That's how it grew; and the tier-one carriers wanted live data points, and so we partnered with different collection tools. Which all go into help with network planning – to define the network, manage the costs, and show the benefits of pre-planning versus doing it on the fly, almost, like in the Wi-Fi scenario."

Again, the kind of pre-planning afforded by iBwave's software is critical for complex 4G/5G installations in enterprise venues, argues Choudhury. Anecdotally, he tells about recent experiences with 5G deployments for "very big events and big facilities" in the US, whether as private instances using CBRS spectrum or as public/private projects using carrier airwaves, or some combination of both. "You really need to

"The biggest issue in the private networks space right now [is] they're taking this Wi-Fi approach [so] it's plug-and-play [and] very little design [is needed]. It means the engineered design process gets pushed to the side – because a ribal is coming out with a rival product in two weeks."

Nazim Choudhury,
Director of Market Development,
iBwave Solutions

pre-plan these 50,000 square-foot deployments. You can't just plan-as-you-go like with a Wi-Fi network."

The latest version of the iBwave network planner-scanner integrates 5G with 4G and Project 25 (P25) network planning capabilities. The Montreal-based firm launched separate private-networks software in 2022 to help US enterprises dovetail their local-area private Wi-Fi and LTE/5G designs in CBRS spectrum in a single platform. The new version incorporates this, too. The app works with a handheld PRiSM Scanner device from Epiq Solutions, which attaches to

a regular smartphone.

It means enterprises and public-safety organisations, plus network operators and system integrators, can use the firm's mobile app for faster and cheaper network surveys, it reckons. Choudhury says: "The key thing is that we are taking a technology-agnostic approach. It doesn't matter if the network is Wi-Fi 6 or 7, or 4G or 5G; it's about what's best for the enterprise use cases – especially with private networks. Often, mostly, it's a hybrid solution – mmWave in the warehouse, and Wi-Fi in the conference rooms. All these technologies are just part of the toolbox."

He adds: "Our software provides a roadmap, of sorts, so the network can be simulated and advanced with all of these technologies as the use cases develop. It doesn't matter if it's cellular, Bluetooth, RFID even; what matters is that the right technology gets deployed for the right use case, and the whole system is future-proofed. It creates a digital twin, which evolves with the network. So you know what's going on inside the facility all the time. And so a year down the line, when you have a use case for AI cameras in the halls, you have a live replica to know where to put them."

But there are interesting dynamics in play right now in the private 5G market, he suggests, borne from escalating competition between vendors, which are – ironically, to an extent – looking to ape Wi-Fi kit sales with smaller off-the-shelf systems. It means the more careful engineering of traditional cellular systems, perhaps made to appear like over-engineering in the box-shifting enterprise space, has been lost, he argues. "The problem is it's a very competitive market, all these players are bringing out quick and easy solutions."

He explains: "That's the biggest issue in the private networks space right now. They're taking this Wi-Fi-centric approach. It's plug-and-play, so very little design [is supposed to be needed]; you just order them like access points. And it means the whole engineered design process gets pushed to the side – because a competitor is coming out with a rival product in two

weeks. It's gone from a couple of weeks of design and months of optimisation to something that can be designed in two days. So it's about finding a fine balance between accurate enough and fast enough."

This hyper-release schedule is damaging vendors' brands, he says. "Their reputations have been impacted by improper design – because their products weren't designed properly. These best-in-class products haven't been performing. That's what we hear from the OEMs. But at the same time, they're not willing to wait two weeks to design this. So they're looking for us to support them to get the designs done in two days instead of two weeks." The pressure is coming from the operator community, as well, he says.

"The carriers want to know how to make it faster, too. 'We're trying to sell private networks in a competitive environment now,' they say." In particular, they are pushing quick-sale private 5G to the retail sector, he suggests. "All these Walmarts and retail stores, and such." The challenge is for iBwave to solve, as well. The supply-market is rushing because the demand-market is rising, the message goes. But it is also because the demand-market says so. Enterprises want simpler cellular networks, which are not hard to build and manage.

"It's what we've been trying to address, also through different software applications. So, how do we become accurate enough and fast enough?" The implication is that enterprises should be trained, to some extent, along with integrators, and even operators and vendors; but the network planning tools, as provided by the likes of iBwave, should also be intuitive, too. At the end of last year, the company introduced a 'stencil library' of Industry 4.0 computer design (CAD) elements, to drop into network schematics.

It describes them as "user-defined templates of frequently used markups, images, 3D materials, and objects" – things that directly require or impact the cellular signal in the enterprise venue. Instead of modelling elements every time, designers can simply drag the objects onto a floor plan,

Background image: 123rf

> "We're launching different products to help speed-up deployments. We're continuously evolving because it's a problem for us to solve: how to go from two weeks to two days? So that's the push in our roadmap and technology."
>
> *Nazim Choudhury,*
> *Director of Market Development,*
> *iBwave Solutions*

and store them in a library for easy access. "That's an example of how we're trying to innovate. You have all these Industry 4.0 stencils – of materials, machinery, things like AMRs and AGVs; and that could save two hours just there," says Choudhury.

He adds: "We're launching different products to help speed-up deployments. We're continuously evolving because it's a problem for us to solve: how to go from two weeks to two days? So that's the push in our roadmap and technology." Does AI hold the answer? Is AI something that, from an engineering point of view, iBwave expects to utilise in serious fashion? Defi-

nitely, he says. "AI/ML has a pivotal role. There are so many functionalities that could support us, especially in these different Industry 4.0 environments – to get to two days, or whatever."

As well, the company is looking to make more its network twin service – so the original simulation is a living and breathing reflection of the physical enterprise network, which can be tweaked to get sight of future infrastructure scenarios, to support future applications and workloads. Choudhury doesn't want it to be called a service. He says: "It is more of an outcome, from the design [service]. You use the design tool and you get a digital twin. That's the first part; the second is that it plays in a larger ecosystem of digital twins."

The point is to connect the network twin to the whole enterprise twin, and have them play off each other. He goes on, and finishes up: "For it to be a true digital twin, it needs to be interoperable with different systems. So we developed an API to pull impactful information into other platforms – so it helps to support that real live replica of the whole venue. And there is certainly a way for AI to help there – with automatic scaling, anomaly detection, predictive maintenance. That offers huge value to enterprises. It is something we are looking at." ●
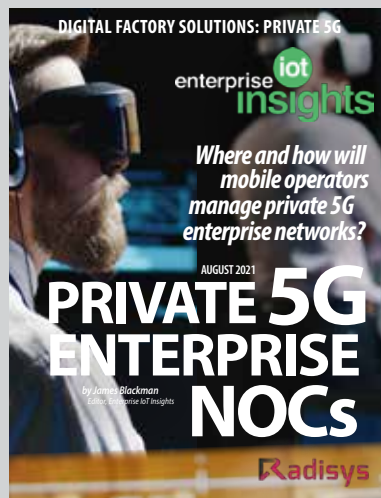
Five easy pieces – how to get a tune out of Industry 4.0

A rough guide to digital-change componentry, and a sensible way to think about devising an Industry 4.0 system that hits the mark.

This is not a definitive guide; this is not an exact science. But the logic is plain – to present a sensible way to think about devising an Industry 4.0 system that hits the mark. Because, when novel technology is brought to market by excitable marketing and desperate sales, enterprises can find they are sold a dream of digital change only to buy a nightmare of technological complexity, and of wasted effort. Which plays with the mind, screws with the picture, messes with the market – and makes the urgent drive to build a sustainable economy that bit harder.

Which no one wants. The best advice is to be deliberate about the whole Industry 4.0 scheme, of course. Enterprises should plan carefully, and execute clearly, and measure at every turn. They should be narrow with their immediate focus and expansive with their grand vision; and they should be flexible, brave, opportunistic – to join the dots between. The below bullets do not present a definitive digital architecture. *How could they?* They present certain big tech elements, and leave the rest for the appointed system integrator; mostly, they just present a way to think about Industry 4.0.

Because it's not an exact science, but it's not rocket science, either. It's *Five Easy Pieces*, like in the movie – a book of music to master before tackling more complex compositions. And like the movie – *kind of, at a stretch* – it's about a cultured drifter in a blue-collar shirt trying to make sense of the world, and ready

When novel technology is brought to market by excitable marketing and desperate sales, enterprises can find they are sold a dream of digital change only to buy a nightmare of technological complexity, and of wasted effort. Which plays with the mind, screws with the picture, messes with the market – and makes the urgent drive to build a sustainable economy that bit harder.

to ask stupid questions. *What do you mean you don't make side orders of toast?*

1 | AN ORIGINAL PROBLEM
If it's not broke, don't fix it. But of course, everything is broken – insofar as everything could be better. The trick, at the outset, is to identify a problem or a set of problems that might be solved with good data insights – plus some new digital wizardry, perhaps. Are environmental targets tough? Are operations inefficient? Are margins tight? Are wages high? What is the problem, and where is it? Where can improvements be made, and how – just by monitoring and adjusting processes, or by introducing brand
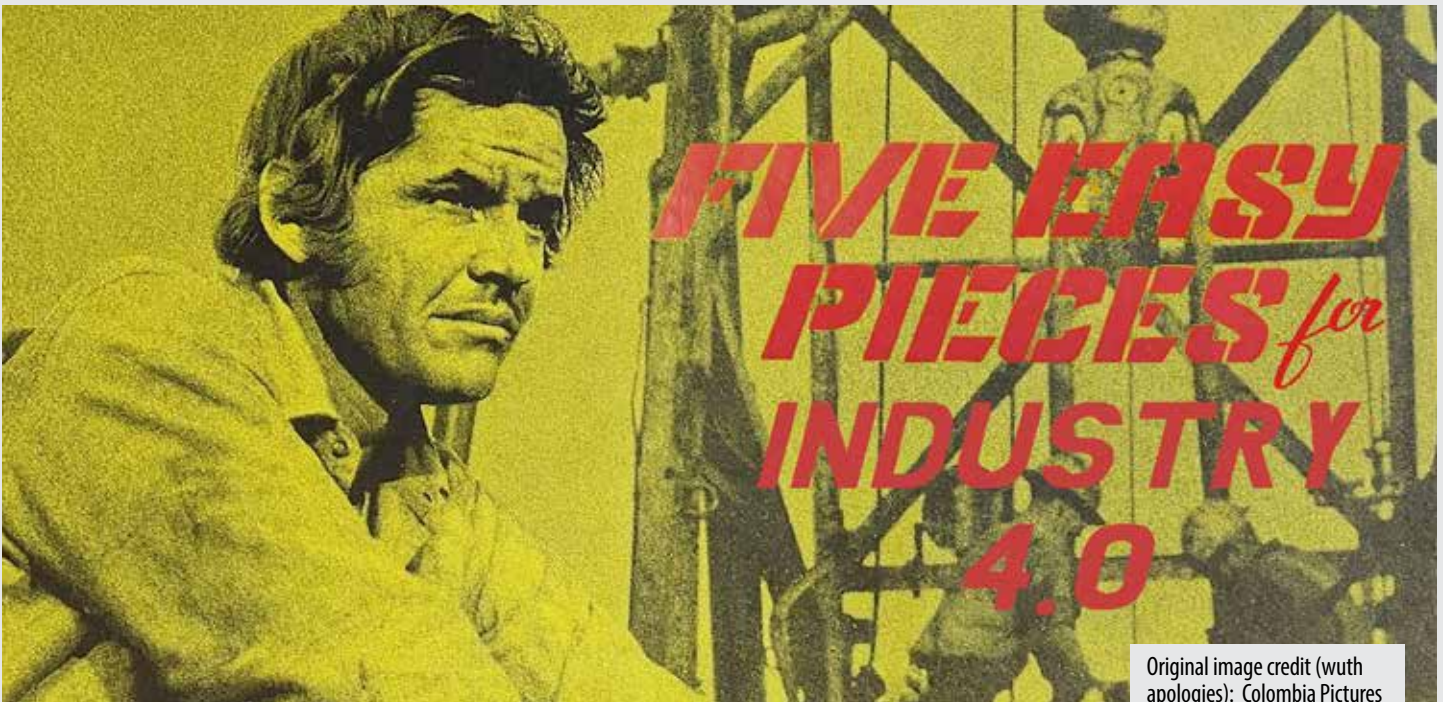
new machinery and systems?

This sharp focus must be placed in a wider context. What's the big idea? What does the business look like in five years? How has it changed? How might new digital tech re-imagine its operations and processes – and ultimately its products and services? This future-gazing might come first, or be well-defined; it depends how urgent the original problem is, and how forward-thinking or deep-in-the-mire the management is. But clearly, what starts in splendid isolation must sooner or later be integrated and expanded – into company-wide digital transformation.

2 | A BUSINESS CASE
The original problem should eventually precipitate an initial solution, which should be costed and funded. There is some flip-flopping here, because the solution will invariably define the digital apparatus required to deliver it, as described below – which will, in turn, inform the investment case. And these elements will likely be revised or reduced, which means the scope of the starter solution may also change. But this is a fundamental part of the Industry 4.0 design process to bash-out a solution that delivers value, and a proof that can be readily multiplied.

Again, the point is to identify a first problem and design a first solution, and to re-work the process until the two tally in a suitable business equation where the investment is bearable and the return is discernible, and also scalable – in terms of productivity or efficien-

cy gains, environmental compliance, security or safety standards, or some combination of these. A note, too, about measurement (which might have existed as a sixth bullet in this article, if it didn't break the number count in the headline): always, value must be tracked and scored to keep the balance.

3 | A CAPABLE NETWORK

These are the two big-ticket tech blocks in the digital landscape: the connectivity and computing infrastructure. They are the foundational elements of the Industry 4.0 system. But they each present a mad range of options. The key is to keep the above decisions in mind – about the original problem and the initial solution, and about the ultimate vision and the final goal, and to work out how to prove the initial use case and when to bankroll the whole shebang. Because networks and servers come in all different flavours, in all different places.

Is the system for standalone apps like environmental monitoring? Is it for two-way sensors for on/off machine controls and anomaly alerts? Is it for high-fidelity robots and cameras with edge analytics? How much rides on the connection – *vis-a-vis* business

blackouts, production losses, safety risks? Is the public cloud an option, or does latency and security mean the data stays on site? The answers to these questions will determine whether new-fangled 5G or patched-up Wi-Fi suits, or if some LoRa/BLE/RFID combo will cut it, as well as where the compute goes.

4 | A DATA PLATFORM

Similarly, and of course, the IoT makeup will be governed by the starter solution, and informed by the scope of the final project. What sensors are required? Are they to be strung-up on a separate network for people counting, security access, virus detection? Are they to be retrofitted to ancient machinery to monitor levels and flows, or wear and tear? Are they to be introduced in brand new equipment, such as autonomous guided vehicles and mobile robots (AGVs and AMRs), or integrated otherwise into factory lines on real-time production schedules?

And once the sensor network is pulling live data from the operating environment, where does it go, what does it do, and how is it rendered? You need an IoT platform, which ingests data from an analytics system in a compute engine in the cloud, and from an-

other one that lives on-site. And this IoT platform, via its upstream repositories, should be able to draw data across any requisite IT/OT protocol, and render it on-time in a usable dashboard – which brings total visibility and control to staff on the shopfloor.

5 | A COLLABORATIVE PARTNER

Industry 4.0 is an iterative process – across all the design, build, scale, and run phases. And it takes a village, as the cliche goes; it is a speculative pursuit, and a team sport, and a long game. Whichever supplier is selected to 'prime' the project should be comfortable (!!!) to recognise its own strengths and weaknesses, and confident to bring in the correct partners alongside – and not just old mates from old jobs, but specialists that will bring new value every time.

Is this the most important part? No, the problem solving at the start is the most important bit; but collaborative co-creation is the thread in everything, from diagnosis to treatment to rehabilitation. It is probably worth asking, across the table from big-talking Industry 4.0 suppliers, whether they can pull together a team to devise a bespoke solution for your business. ●

Sketches of Spain (MWC) – basket cases, blood baths and *bitching*

Or, a barroom sting in Barcelona – and how the market got spooked by the hype, and turned up at MWC in a weird Mexican stand-off

Note: this article is opinion/editorial piece, which is also rather colouful; it was written, bleary-eyed, post MWC in late February. But it also captures the mood in the private 5G camp in the post-hype era – plus some of it has come to pass (see page 6).

How do you write a story you can't tell? When the real plot, outside of the corporate narrative, can't be revealed? Normally, you sit on the bank and watch the river flow – until the water rises and the bodies float by. But what if this dastardly talk says that the levee's burst? Well then, you rough it up and make it up, and you *project* – and tell a joke that would make you laugh, if it wasn't so black. It goes like this: a mobile operator in pin-stripes, a radio engineer in a billowing jacket, and a software startup in a fitted suit walk into a rust-belt dive-bar and lay their money down.

Except this is not the whole scene. The operator is nervous, and steps back; a venture firm in slacks picks up the tab for his squeeze. There are chancers along the bar and 'industrialists' in the back, with sleeves rolled up and pool cues in their hands. Gamblers in lounge suits lean over the balcony, and regulars in plaid shirts hunch forward in their seats. In this long saloon bar, snaking through the halls of MWC last week, one thing is clear: there will be blood. It's a stand-off and a stitch-up. Fade to red.

MWC was electric; the mood in the

Image: 123rf

Private 5G is a busted flush right now for lots of firms; like the final card, the one that pays out, is the wrong suit. Or that the card is right, and the payout is wrong. Because the hype said otherwise. Just like in IoT. It was like the penny dropped at MWC, and the new prospectors in IoT-town started behaving strangely. Bang, bang, bang, the story went: this vendor is dead

private 5G camp was febrile. Something is about to give. It was in the air – not on the stages or the stands, but in the busy back rooms; in briefings and counter-briefings, over half-eaten sandwiches and half-written deals. It was carried on coffee breath, and revealed in furrowed brows. Everyone looked desperate – except maybe the *boys from the county hell* (at the George Payne on Wednesday night). And what did they all say? What was the best story out of MWC, which might be gleaned from the *hush-hush* and the hear-say?

It was that private 5G is a busted flush right now for lots of firms; like the final card, the one that pays out, is the wrong suit. Or that the card is right, and the payout is wrong. Because the hype said otherwise. Just like in IoT (and every-*thing*). It was like the penny dropped at MWC, and the new prospectors in IoT-town started behaving strangely. *Bang, bang, bang,* the story went: this vendor is dead (or will be); that vendor is dead (or should be); their gear is *whack*, their targets are missed, their jobs are gone; jeopardy, skulduggery, and broken dreams everywhere you look.

It was like an old country song – tragic and hilarious at the same time. Because who in their right minds is still in this digital-change game – in the complex business of industrial revolution and the complicated sale of industrial IoT – for easy money? How long did the last industrial revolution take? Even if this one is amped-up on AI, how long will the paranoid control-freaks of industry

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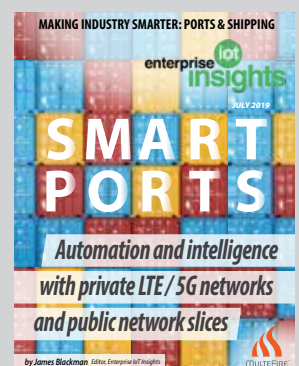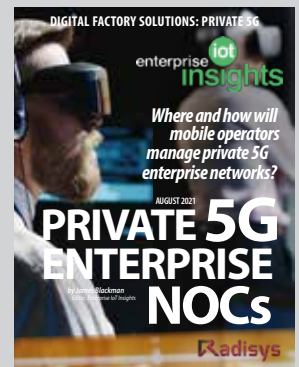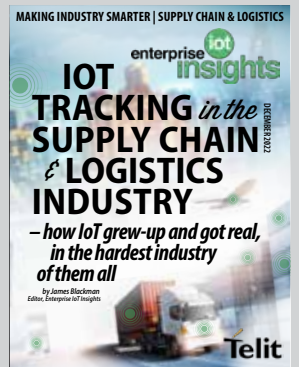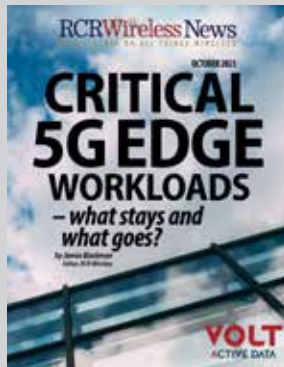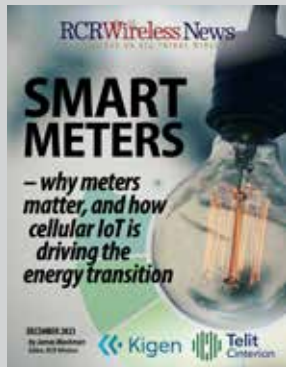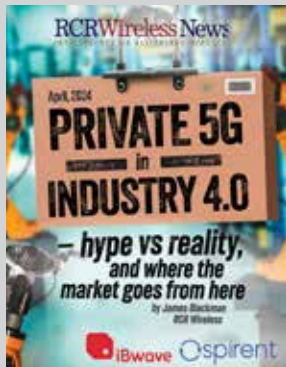
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take to upgrade billion-pound production systems? Twenty years of instrumenting the world, and where is the money in IoT? Just look in their faces; disgruntled to be down in the weeds, and not lying in clover.

We've been writing in these pages like the IoT market *has it sussed*, and probably it does – but only because it accepts, generally, that it takes loads of time and loads of work. Which is why the high rollers have mostly bailed; and why events like IoT Stars last Monday night in Barcelona sound like an echo chamber for minor engineering victories – when the world is on fire. The lesson from low-power IoT for high-power IoT (private 5G) is that you might solve a problem for the customer (and the planet), but that nothing is easy – and the spoils are shared.

It is a team sport and a speculative pursuit; which is why the absence of talk at MWC about 'priming' 5G supplies into Industry 4.0 shows progress. But there isn't a pot of gold. Industrial IoT is a basket case, by its nature – the idea to plug common telemetry into every system in every

enterprise in every industry. So maybe the high-stakes venture *schmucks* in private 5G should get their coats and quit the scene – just like they've quit IoT. Except of course, 5G is different – as a globally standardised cellular-based technology being made into a cloud-friendly IT technology. 5G is anyone's game, suddenly.

For developers, and therefore for consumers and enterprises, it is just another internet pipe, albeit one with high-fidelity wireless mobility features – which, when married with distributed and optimised compute resources, will bring opportunities to deliver unique services. Which will drive new digital change of all sorts. This is the bigger industry narrative at MWC, of course – as it always is. But small-scale private-versions of 5G networks offer a testbed for many of these new advances, as well as for a new economy of enterprise applications.

So then, money and power – in the cellular industry, but also and increasingly in adjacent big-ticket tech sectors – mark-out 5G as the IoT alumnus *most likely to suc-*

ceed. But there is a geopolitical capitalist stitch-up, too. Because even as the levee breaks and the bodies float by, on a gusty swell of market hype (and also desperate parenting, sharp practice, bad luck), there are moves in the background by America Inc. to nationalise 5G supply lines into critical industries at home, and to monopolise them abroad as well.

Which is why HPE will probably buy this company, and Dell will buy that one; and why the California boys' club – in cahoots at an imaginary saloon bar in a blue-collar town, and mob-handed at champagne receptions on Barcelona rooftops – will provide the main competition. And the Europeans, which navigated this frontier town, will be nowhere, either co-opted into this american fiction, or else occupied with baggy-suited 5G sales for double-breasted 5G services (which may yet find their mark for better-effort wide-area enterprise comms).

But in the end, in this western fling, the sharpest dressers will probably be the sharpest shooters. ●

Enterprise, enterprise, enterprise – MWC is not a telco show, anymore, and 5G is not a telco story

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2023 EDITORIAL CALENDAR

APRIL 2024

The new space race – NTN standaridzation and commercialization
If cellular systems are to reach ubiquitous terrestrial coverage, that means going where no cellular techn has gone before: into space. Early services which integrate satellite-based cellular, such as emergency texting, are set to launch in 2024. But the challenges of equipment survivability and providing connectivity from space are daunting. *RCR Wireless* explores cellular in the final frontier.

Telco AI – strategies and use cases on the road to closed loop automation
It seems quite evident that AI, both generative and more classical, is going to change the way all industries work. For mobile network operators, AI seems like the tool that will finally turn data into insights that influence how networks and designed, deployed and managed with a laser focus on creating internal value evidenced by TCO and transferring that value to customers with new types of on-demand services.

APRIL 30 | TEST & MEASUREMENT FORUM

MAY 2024

Securing the enterprise edge – how to secure mission-critical private 5G networks for Industry 4.0
Private networks at the edge are becoming increasingly prevalent. This report takes a deep dive into the critical considerations surrounding the security of private 5G networks. It also evaluates the security implications of choosing between cellular and Wi-Fi technologies for enterprise networks.

MAY 28 | PRIVATE NETWORKS FORUM

JUNE 2024

Network slicing reality check – anyway you slice it
It has been a slow roll but green shoots around network slicing are starting to spring up? Looking back, why'd it take so long to get to where we are today (still quite ealry in the game), and is network slicing going to jumpstart operator revenue growth? If so, how and when?

JUNE 11 | TELCO AI FORUM

JULY 2024

Open RAN in 2024 – how to scale a brownfield open RAN network
Open RAN has long been described as a journey, with the first steps focused purely on disaggregating hardware and software, then reaggregating it into a function radio system. Now the focus is shifting to more robust implementations that go beyond disaggregation and get into open, cloud-based automation and service differentiation at scale in brownfield networks. With all eyes on the major European multinational operators, will Open RAN in brownfields not just scale but deliver real innovation?