Intro / opening arguments

1. International perspective
2. Comparative to UK
3. Critical of the community – but the TECH community, of which I am part
4. We have FAILED the CC user community
5. ESN is a move in the right direction, but the ultimate solution uses **all** available networks
6. ESN is a pseudo-government operator. What will they do when Vodafone offers competing "mission critical" grade services? How will ESN stop subscribers migrating there?
7. I will argue that the reasons we said "NO WAY" earlier are evaporating as tech, and the marketplace, advances. They are legacy concerns. Old thinking.
8. It doesn't matter how good your service layer is if your transport layer sucks
9. I'll be talking in general, but using critical broadband as my exemplar

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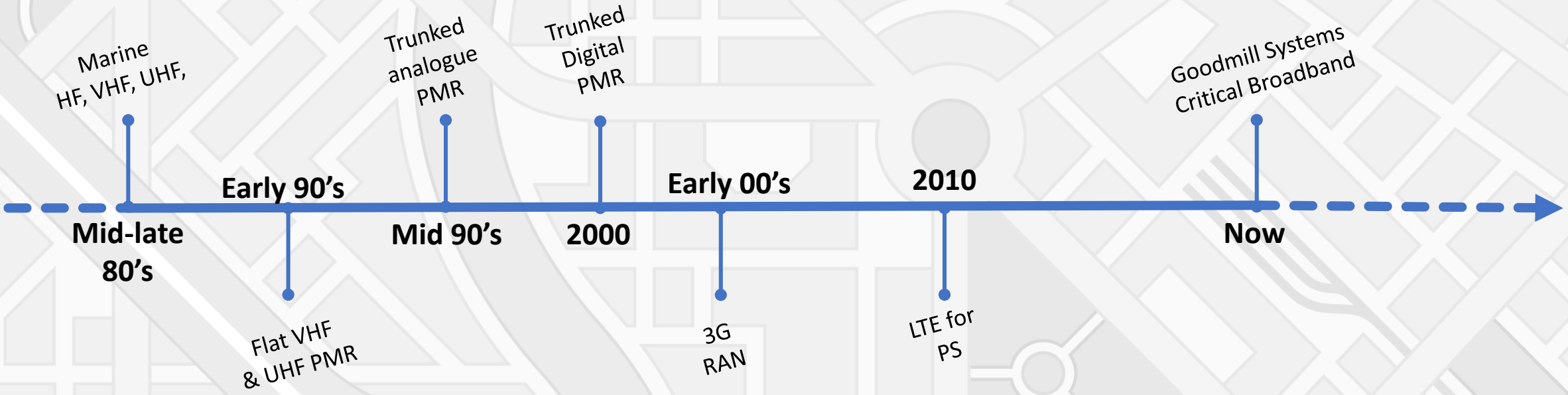
The Changing Model for Bringing Technology To The Public Sector

Ged Robinson
Goodmill Systems

Quick professional history

- 30 years in telecoms – almost all of that in critical & public safety comms

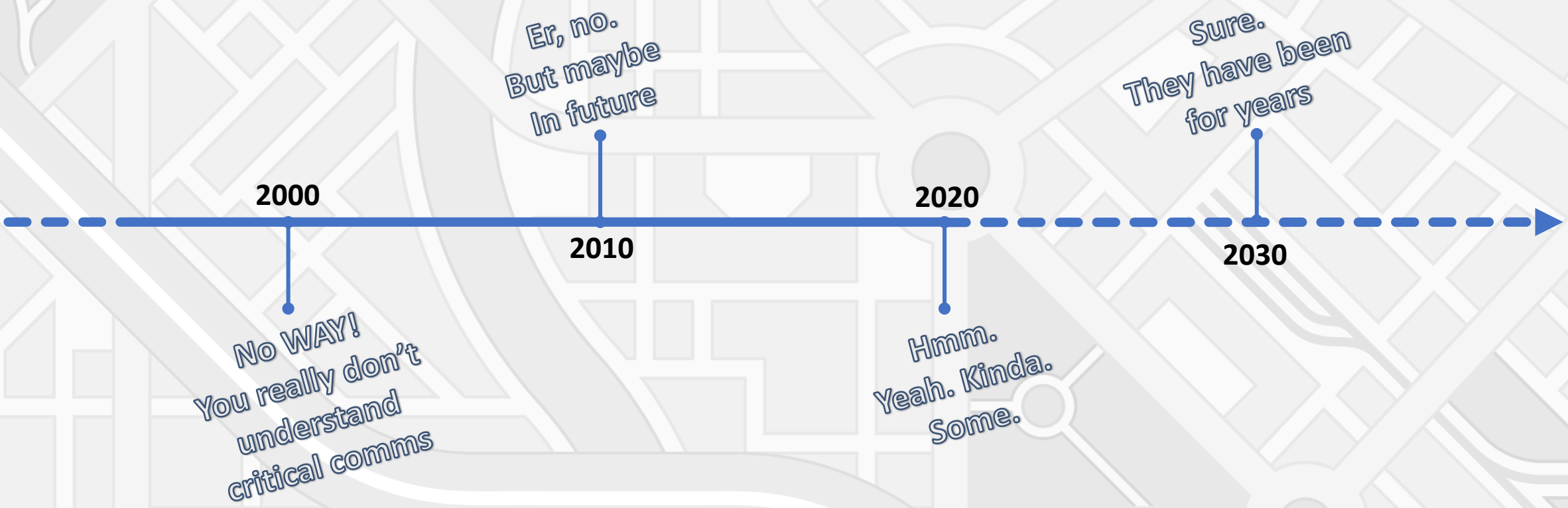


Let’s set the context with a simple question

- Can Vodafone (for example) satisfy the comms needs of police, fire and ambulance users?

Consider the question as if for 20 years ago, 10 years ago, today, and 10 years in the future

Can Vodafone satisfy the comms needs of police, fire and ambulance users?



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Can Vodafone satisfy the comms needs of police, fire and ambulance users?

There are many different recipes to bake a Radio Network

We can choose which one we want based on our specific needs and tastes

But ALL of them need two basic ingredients…

Money

Spectrum

No matter which radio technology we want to build, we will need a good supply of both spectrum and money

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Radio Network Ingredients - Availability

- Unfortunately both spectrum and money are in short supply. Certainly on national network scales

- Even in the traditionally luxurious Middle East these are both substantially harder to get our hands on than previously

- In Europe and North America both are already extremely rare, often unavailable to individual public sector authorities. Only on nationalized, centrally curated basis

Money

- 3GPP technology iterates rapidly, compared with traditional dedicated technologies we have been used to
- Asset lifetimes are down, from more than 10 years to less than 5 years. Or even less
  - A TETRA network might last nominally 20 years with one mid-life technology upgrade
  - Early LTE networks are only ~5 years in service and already have had complete core swapouts
  - Radio networks
    - Rapidly evolving feature sets, e.g., MIMO, CA, massive CA, HetNet, SON, CoMP, high-order QAM, 5G support
    - Base stations last only a few years before they're obsolete hardware
  - Terminal obsolescence
    - Terminals become unmaintainable due to spares unavailability in ~3 years or less
    - By contrast there are 12+ year aged TETRA handsets out there still being used
- And support policies of the tier-1 vendors effectively force operators to upgrade frequently
  - Or risk being out of support

Money

- Radio networks need to be much denser = many more sites, due to band propagation characteristics
  - And this is even before we consider indoor coverage!

- We started our transition from narrowband voice to broadband data radio technologies at a bad moment in history
  - The bottom had fallen out of the world economy due to the sub-prime crisis
  - And then the oil price crashed less than 5 years later

These networks are expensive, and they iterate very quickly
The public purse isn't used to this rate of spend
And it's being stressed

Spectrum

- Public authorities are for the first time in direct competition with the open marketplace for really valuable resource
  - Not just “operationally” valuable, or “technically” valuable
  - But “valuable” in Dollars and Euros and Pounds and Riyals

- We aren’t trying to claim strange, hard-to-monetize portions of the spectrum anymore.

We are trying to grab large portions of prime real-estate
No-one, not even regulators, wants to give it to us

What has a migration to mass market technology meant for professional users?

- We chose, *wisely*, to leverage the benefits of a mass-market technology
- But there are unintended consequences and costs of getting on the mass-market bandwagon
- There are big, financially powerful players on that bandwagon.
- And we don't get to sit in the driving seat

The traditional CAPEX based, dedicated-network model is struggling, and we believe it's inevitably dying

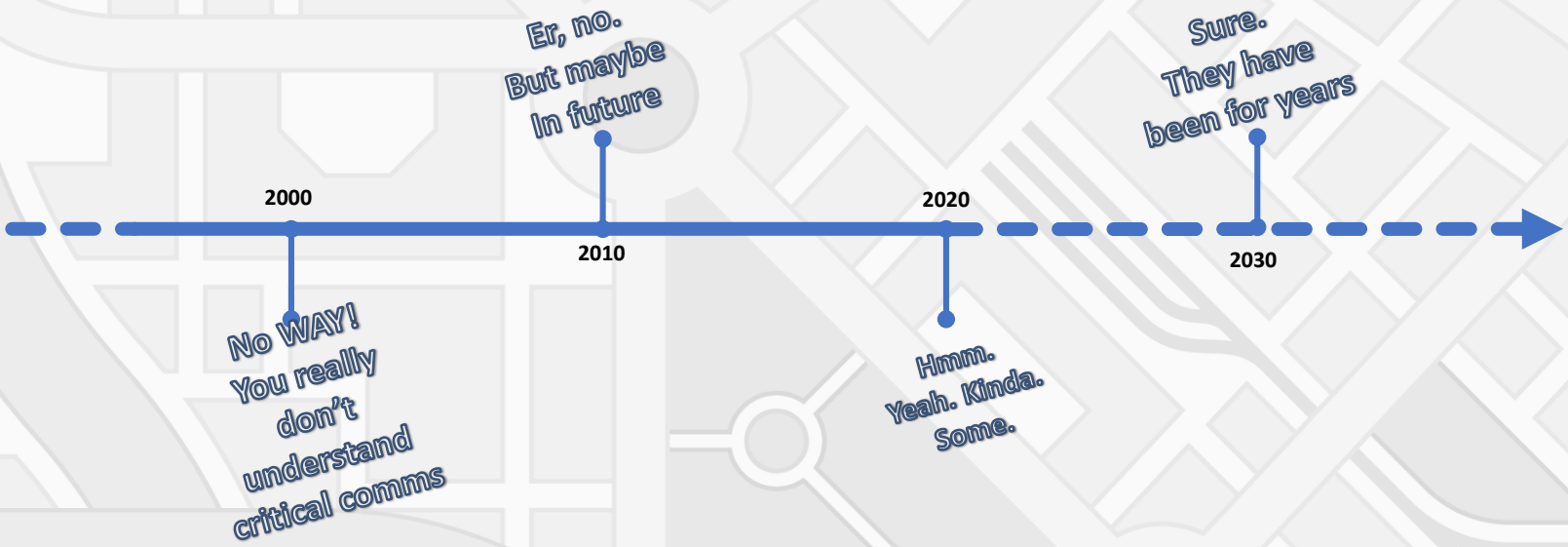
So why did we say, “No WAY!” in 2000?

In 2014 I gave a presentation at LTE MENA in which I described concerns and shortcomings of commercial MNO’s providing critical services.

My main concerns **at that time** were:

- Management Control & Visibility
- Offered Services
- Security
- Capacity
- Coverage
- Resilience

So what’s been changing?



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Management Control & Visibility

- This is essentially ‘customer confidence’
  - “Does this supplier understand me?” and “Do they take me seriously?”
- It’s a simple matter of business appetite
  - In Europe Airwave, Virve and Astrid did it as pseudo-government operators
- Commercial MNOs now have an appetite for this market segment
  - We see them with Enterprise Business Development teams, seriously addressing these customers and markets. Educating themselves.
- Vodafone and EE can surely do it if they want to
  - They will bring the ruthless efficiency of the profit motive and open marketplace
  - With a free choice users will opt for “good enough” at a fraction of the cost of “excellent”
  - *My personal opinion; the pseudo-government operators will not be able to match the MNO’s in an open marketplace*
    They will only survive if they are able to shield themselves with laws and regulation

Business confidence is building to farm-out critical telecommunications
Just like fleet management, facilities, power provision, fuel. All are critical
There is nothing *special* about telecommunications which makes it *“un-outsourceable”*

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Offered Services

- This is the high-profile work being done by TCCA & 3GPP and industry, and being championed by the community at large
- We can all see the road ahead is clear now
- LTE and its successor generations will offer all needed services, at the needed grade of criticality.
  - Today it doesn't quite
  - But it will
- This is an active work-in-progress

On one side this is the most complex; technologically speaking
But on the other side it's the simplest; we **will** see this happen
It's a work-in-progress

Security

- Traffic-in-transit is routinely protected now with industry de-facto standard authentication and encryption
  - There's nothing really challenging about this now from a technical point of view
- Metadata was always a bit more tricky
  - Subscriber activity, geo-location, mobility data & CDR's, etc.
  - But dedicated cores, RAN sharing architectures and good Personnel Security mitigate this hugely
- Personnel Security
  - Dedicated, ringfenced teams can be established in public operators
  - Public Operators have been doing this for government for years anyway, e.g., Lawful interception and tracing

Like Offered Services, Security is well on the way to being fully addressed

Capacity –vs- Coverage

- This has always been a techno-economic mismatch between MNO's and dedicated network operators:
  - Dedicated operator → maximum coverage, low-mean utilization, unpredictable traffic peaks and high resource over-provision
  - MNO → Selective coverage, high utilization, predictable traffic patterns and optimized resource provision
- Blending these opposing drivers has always been a challenge

Capacity

- MNO's don't want to over-provision too much – it breaks their business and planning models
- But critical users need to **know** that when they need 400% mean utilization, unpredictably, anywhere, anytime, they get it
- Rapid deployment units aren't really rapid enough
- But technology is providing solutions, for example:
  - LTE-A and 5G throughput rates are making PS capacity demands less & less challenging to satisfy
  - PS fleets are insignificant in size for any MNO
  - Network Slicing; available as a bolt-on with 4G and baked-in with 5G
    - *Imagine the Control Room commander being able to seize bandwidth & elevate his subscriber privileges, immediately and on-demand, when he needs it*
  - Truly useful, advanced, responsive and granular QoS solutions are becoming a reality

Capacity and capacity management will gradually become less and less of a challenge

Coverage + Resilience = Availability ; The last remaining major challenge

- Coverage is not as easy as capacity – it's very expensive to build more sites
- Initiatives like RAN sharing exist but are false solutions in the critical comms context because they don't address the crucial challenge – resilience
- National roaming is obviously unsuitable for high-end, genuinely critical connectivity
- It is expensive and difficult to build any single network to the coverage and resilience expected by critical users
  - Individual MNO's suffer very high-profile outages. Several in the last year alone in the UK
  - Hardening networks is a major expense
- Resilience is one of the most significant obstacles to an MNO fully addressing all the needs of highly critical community

Using multiple, separate and partially overlapping networks can raise availability without crippling levels of investment on infrastructure

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How to delivery critical broadband with reasonable cost?

- Use multiple access networks and even multiple access technologies
- Add some “Transport layer mobility”
  - Access network abstraction
    - “Hide” the complexity of the underlying network(s) and technologies from the endpoints and applications
  - Session Persistence
    - Make sure that ongoing connections are protected from and survive the switching between access networks

Use multiple networks

Protect the higher-layers

Make it look like a single IP pipe

How to delivery critical broadband with reasonable cost?

- Advanced Radio Network Awareness
  - The radio packet network is unlike the fixed packet network
  - Just plugging some LTE radio modems into a standard router simply doesn't work well. We know this absolutely.
  - An LTE network might be drawn as an IP cloud on a PowerPoint presentation
    - *But that doesn't mean it behaves like ethernet*
    - You **must** take account of the special challenges which the wireless network presents

The broadband IP router **must be** wireless-optimized
Standard router behavior does not handle the wireless environment well

Shifting paradigms and changing expectations

- Our entire landscape has changed in the last 20 years
  - Competition for spectrum
  - Access to finances and project funding
  - Technical maturity and expectations of our end-users
  - What is technologically possible
    - What was once possible only for big multinationals with 1000's of people is now accessible technology to startups and SME's

Things have changed

We will not be able to deliver next-generation critical technologies by applying legacy thinking and legacy development & delivery methods

A prediction – the far long-term future of critical communications

- Consolidation and Convergence. The golden rules. They always happen.
- Just like rail and energy provision
  - Both began as private, for-profit and enterprise-dedicated systems
  - Telecommunications will transform similarly into national infrastructure, satisfying all needs from domestic to critical users
- The multi-network, multi-operator connectivity paradigm will dominate
  - And it's already accepted in some places

It's not imaginable that in 50 years our successors will still be building dedicated networks for different user groups

This transition has already been triggered

In conclusion…

- The single-contract, single-vendor, monolithic project model is being existentially challenged. We believe it's dying already.
- Future technology provision in this segment will increasingly be fragmented; a patchwork of components and pieces
- The broadband connection is the *transport layer* foundation on which you build your mobile applications
- You need to base your entire data deployment on a solid foundation
- Get the transport layer right:
  - ✓Don't rely on any single broadband network
  - ✓Insulate the higher layers from the effects of the multiple radio networks
  - ✓Combining multiple networks together with good performance is not trivial to do properly; make sure your solution is truly wireless-optimized

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email

ged.robinson@goodmillsystems.com

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