Smart Router:
The Gateway to Next-Gen Services

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Predicting the future may be folly but preparing for it is vital. With the growing consensus that the network edge is about to play a much bigger role in service delivery, operators need strategies now to prevent rivals from taking a lead and internet giants from locking them out of providing next-generation services.

Operators know that providing a passive conduit and competing on broadband speed alone will be a race to the bottom on price. Triple and quad play bundling reduces churn, but it won't turn the tide.

We can speculate whether smart Wi-Fi, advanced security, VPNs, smart home, rapid updates or pre-emptive diagnostics will be the next big opportunity. But what's not in doubt is that an agile platform will be a must-have if operators are going to rapidly exploit that opportunity and future-proof their strategy.

The answer may already be in the room. The broadband router is a prize asset ubiquitous in the home and business network and, crucially, one which has the potential to offer serious competitive advantage for operators keen to stem churn and create new value-added services. There is a business case and timelines for deploying Smarter Routers with key functionality such as VoIP lines, Door Control or monitored security which could be quicker for business customers than for consumers.
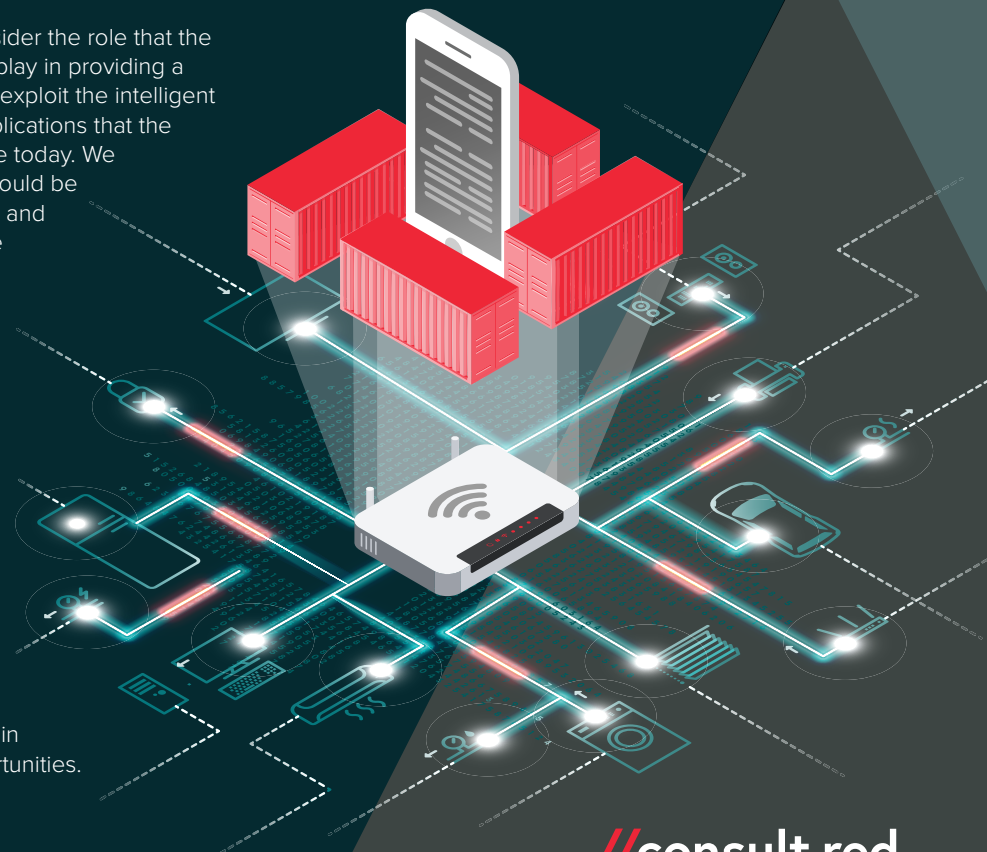
A useful analogy is the evolution of the mobile phone. For a decade before the arrival of the iPhone the handset was a fixed function device much like the router. Making the smart phone a software platform with support for a myriad of applications revolutionised its use and its business case. Apps enabled an array of value-add and new revenue generating opportunities from video and games to smart home, security and many more.

Whether you're defending market share or looking for new revenue streams, developing an intelligent, agile platform is a must-have to unlock a new wave of services. Could the 'smart' router similarly unlock a wave of innovation leading to a slew of new and improved services – this time with the network operator in charge?

In this paper we will consider the role that the broadband router might play in providing a platform for operators to exploit the intelligent edge. We outline the applications that the smart router can enhance today. We will also consider what would be required of the hardware and software to support more agile and configurable capabilities.

We talk about the role of containerisation as a key enabler for operators to innovate the router. The paper will explain how cutting-edge containerisation technology provides a way for operators to dynamically deploy services on their router stack and take a greater stake in emerging revenue opportunities.

> **Whether you're defending market share or looking for new revenue streams, developing an intelligent, agile platform is a must-have to unlock a new wave of services.**

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// Broadband Router:
Gateway to the intelligent edge

The edge is already complex, consisting of a myriad of devices and gateways interacting through new and established wired and wireless technologies. One of them is the humble broadband router.

As it stands, the network and cloud generally bypass the router. It plays a very limited role in service delivery other than terminating the pipe. Service providers (other than the operator) have no access to the device and its potential. But could this be transformed if the broadband router were to become the primary hub for the intelligent edge in the home and office?

At first glance broadband and 5G fixed wireless may seem like competing technologies, but the 5G edge is not in the home and does not control the Wi-Fi that is used throughout the home. Even for a fixed wireless deployment the smart router has a role to play.

A prime example is BT and EE home Wi-Fi service BT Halo 3+ which pairs with the Smart Hub 2 router and automatically connects to the EE mobile network for backup, should broadband connection fail. BT is marketing the broadband service as "unbreakable".

Utilising both 5G and Wi-Fi edge will gift operators the ability to co-ordinate services across both networks. For instance, giving a customer a seamless smart home experience even when using a combination of 5G and Wi-Fi devices.

No one disputes that Wi-Fi is going to be a huge part of our internet future. For most homes and small offices the router is the edge. Logically exploiting the Wi-Fi edge should at very least be a catalyst for exploration. Using edge technology to deploy an intelligent service component at the edge of the network means the router can become an active part of a service rather than just passively enabling connectivity.

Key takeaways

• For most homes and small offices the router is the Wi-Fi edge

• Logically, exploiting the router as the home edge should be a catalyst for exploration

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// Attributes of the router at the edge

If the broadband router is to play a role in delivering new services it needs to offer something not available in the cloud – fortunately the broadband router's position as a secure managed edge of network device, does give it some unique benefits.

Consider some of the unique attributes of the router at the network edge:

Data Reduction:

The router can provide intelligent filtering of data coming from a home or small business network. This avoids irrelevant data being sent to the cloud – reducing the burden on the contended WAN bandwidth, saving cloud processing and storage resources. For example, Edge Analytics can be used to help remote diagnostics. Fine grain network traffic information is collected and analysed in the router. The cloud only needs be involved when an issue is detected. This all helps to reduce operating costs, Total Cost of Ownership (TCO) and can also reduce the impact on the environment.

Latency:

For many applications the round trip of data to the cloud introduces delays that make services unresponsive and also introduce dependency on the quality of connection. The higher the data streaming rate the more these problems are exacerbated. Local connectivity and applications that are implemented on compute nodes in the home or office provide lower latency that can improve the customer experience and maintain service independent of cloud connectivity. These benefits can make functions such as burglar alarms, audio distribution and multi-user live gaming much more compelling.

Privacy:

Strict regulations such as GDPR rightly govern the use and transfer of personal data (including biometric and image data). These regulations also dictate restrictions of transmission of certain data across country boundaries. Customers want companies to treat their data correctly, and the adverse publicity from privacy breaches can seriously damage brands. Processing data locally on the router, so that it never leaves the home reduces the privacy risk, simplifies regulatory compliance and gives customers peace of mind.

Security:

The router already plays a vital role in securing the home network [as a firewall] but often only protects the network from external threats. The router is also uniquely placed to protect the network from internal threats such as detecting rogue and compromised devices. Once a compromised device is detected, the router could isolate the device preventing it from malicious activities and inform the customer so they can take action. In fact, for devices that are no longer supported by the manufacturer network, threat monitoring may be the only way to detect and secure them.

Monitoring and Vigilance:

The router is also well placed to implement parental controls or at least enforce part of a parental control service. In addition to security, actively monitoring the home network can bring other benefits such as easy installation. New devices can be detected by the router and under customer control, secure protocols can allow the new device to be safely, conveniently added to the network and configured. Customers value the convenience a pro-active installation experience, without recourse to confusing SSIDs, forgotten passwords or WPS.

> Having intelligence at the edge rather than in the cloud can lower operational costs needed to deliver a service.

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// Attributes of the router at the edge

Autonomy:

In some use cases it's vital that a certain level of functionality can be maintained even when the broadband connection is down. An interrupted connection should not result in a complete inability to use the controlled access. For example, monitoring access to a secure door and recording a log in the cloud can be useful. It is critical that should the cloud connection be interrupted the door can still be opened locally. Autonomy introduces a range of necessary local functionality such as buffering of logged data, as well as clean recovery of the cloud loop when the connection is restored. Using microservices to download the appropriate intelligence to the router enables a level of functionality to be maintained even when the broadband connection is down.

Cost:

Having intelligence at the edge rather than in the cloud can lower operational costs needed to deliver a service. Edge intelligence can reduce the data bandwidth, compute, connectivity and storage costs for a negligible impact on the router's purchase or running costs. Data reduction reduces cloud operations, reducing the extent to which resources need to scale up and down.

Sustainability:

Moving intelligence to the broadband router supports the drive to sustainability, as the energy footprint of conveying data to the cloud and then processing data can be significantly reduced by dealing with the data at the router. As an 'always on' device the broadband router is designed to be very power efficient, typically consuming <5W even under full load. The more functionality that can be extracted from this 5 Watts the more energy will be saved elsewhere.

Emerging Intelligence:

The smart router could also act as the central hub for emerging developments in a range of technologies. Wireless technologies are evolving to provide more intelligence around usage and even directionality of communication. Wi-Fi presence is an emerging technology whereby Wi-Fi analytics are used to detect the presence of people in the home. Bluetooth direction finding can chart the trajectory of a Bluetooth device as it moves. This has applications from burglar alarms to telecare.

Key takeaways

- The router holds a unique place at the network edge
- It offers clear benefits today and is ready for applications tomorrow
- A platform for new services and operational savings can only be realised with a smart router

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// Value creation opportunities

The broadband router offers some unique benefits but unless these can be translated to new, enhanced services or operational savings there is little incentive for operators to invest in its smart transformation.

Let's consider the services that operators offer today that are enabled by embedding intelligence into the router. These are services that a smart router could deploy and maintain in a more convenient, scalable and cost-effective way.

Smart Wi-Fi:

Many operators have embraced the notion that although they sell broadband the customer is buying Wi-Fi. They offer whole-home Wi-Fi with guarantees of availability around the home. This uses intelligent mesh technology whereby strategically placed repeaters cleverly collaborate to provide a seamless service throughout the home. The intelligence for these services generally lives in the cloud provided by Plume, AirTies and others. But these services need an intelligent agent in the router to send back the Wi-Fi analytics, monitor for new network devices and implement routing. These agents are often a custom integration with each router's software stack.

Network Segregation:

Nowadays many routers offer public, guest and, of course, home networks. In the future this could be extended to applications such as a kid's network – with extra controls and filtering or a home office network with VPN and QoS. Obviously, these functions require additional intelligence in the router.

Security:

Operators have been offering security services for a while, blocking spam, malicious websites and much more. But enhanced security services need local agents in the router to monitor the home network. Providers such as CuJo and Irdeto (Trusted Home) need to integrate these agents with each router stack. The security argument alone makes the case for containerisation incredibly powerful. Containerising the built-in and downloaded services that the operator offers maintains the security and integrity of their devices. Services are isolated from each other so the impact of compromises is limited. Further, monitoring with timely updates of these services means security can be maintained or even enhanced when threats come to light.

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// Value Creation Opportunities

Diagnostics:

Analytics on the WAN and Wi-Fi connections enable operators to resolve customer issues in a timely way and potentially pre-emptively, saving call time and truck rolls. Flexible diagnostics through downloadable monitoring services will enable the operator to continually improve their diagnostics and to deploy targeted monitoring to address specific issues. Ultimately, this leads to a more reliable service. Using the smart capabilities of the router to implement flexible and dynamic diagnostics can help operators reduce operational costs and increase the customer net promoter score (NPS).

Network Speed Test:

Regulators having been taking a tough line on claimed verses achieved broadband speeds. Operators have been incorporating independent network speed tests into their routers as an impartial verification that they can use as evidence with the regulator. This functionality is ideally suited to being a downloadable service deployed on a smart router as and when needed.

Other Services:

iinclude WAN failover whereby the router will use a mobile network connection in the event of a broadband outage; and printer sharing where the router will make a printer available to other users of a network. Some operators have built VoIP stacks into their routers to offer traditional telephony services over broadband, while others have added VPN clients to support additional privacy and home office connections. With PSTN switch off imminent, dynamically provisioning VOIP on routers could be an attractive option for customers as they migrate from POTS to VoIP.

The integration overhead with fixed function routers

Deploying services as outlined [above] requires a bespoke integration of a service component with every router stack, and typically also with every OEM's variant of that stack. This is a significant barrier to easy implementation of new services. If the barrier to entry was reduced, then providers of services such as security, VPN or parental control would have more incentive to work with operators on offering their service in conjunction with a broadband router. Often services need to work across multiple devices, in multiple situations. Having access to the right service, with the right brand, adds value to the offer and is a win-win for customer and operator.

Key takeaways

- Operators are adding intelligence to routers to enable new highly successful services

- These are generating or retaining revenue either directly, via a service charge or indirectly, via reduced churn and lower operating costs

- Innovation is stifled by the cost and complexity of current models

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// Operators at the centre of the smart home

The smart router has a number of unique advantages ready for the operator to exploit:

**Simplified Customer Experience:**

The proliferation of gateway boxes (such as Hive, Nest or Hue) stacked next to the broadband router is not only unappealing to the user but increasingly complex to set-up, secure, update and control. Each comes with its own smart phone application controlling just part of the system.

The operator is well placed to solve these issues. Gateway boxes can be replaced by microservices running on the router. Fewer boxes mean less clutter, less power, less cost and less landfill all while simplifying the customer experience.

Managed Service:

The operator's established position as a trusted provider of broadband connectivity is a strength to be leaned into. By working with multiple providers, the operator can offer the customer a wide choice from key brands and provide a common point (in the cloud) ensuring products interoperate and can be controlled centrally.

Operators can further leverage their unrivalled experience in monitoring and maintaining home networks including Wi-Fi analytics to offer ongoing support to customers. Using the router's smart capabilities to implement flexible and dynamic diagnostics can help customers manage their smart home. This 'sticky' service has the potential to increase the customer net promoter score (NPS).

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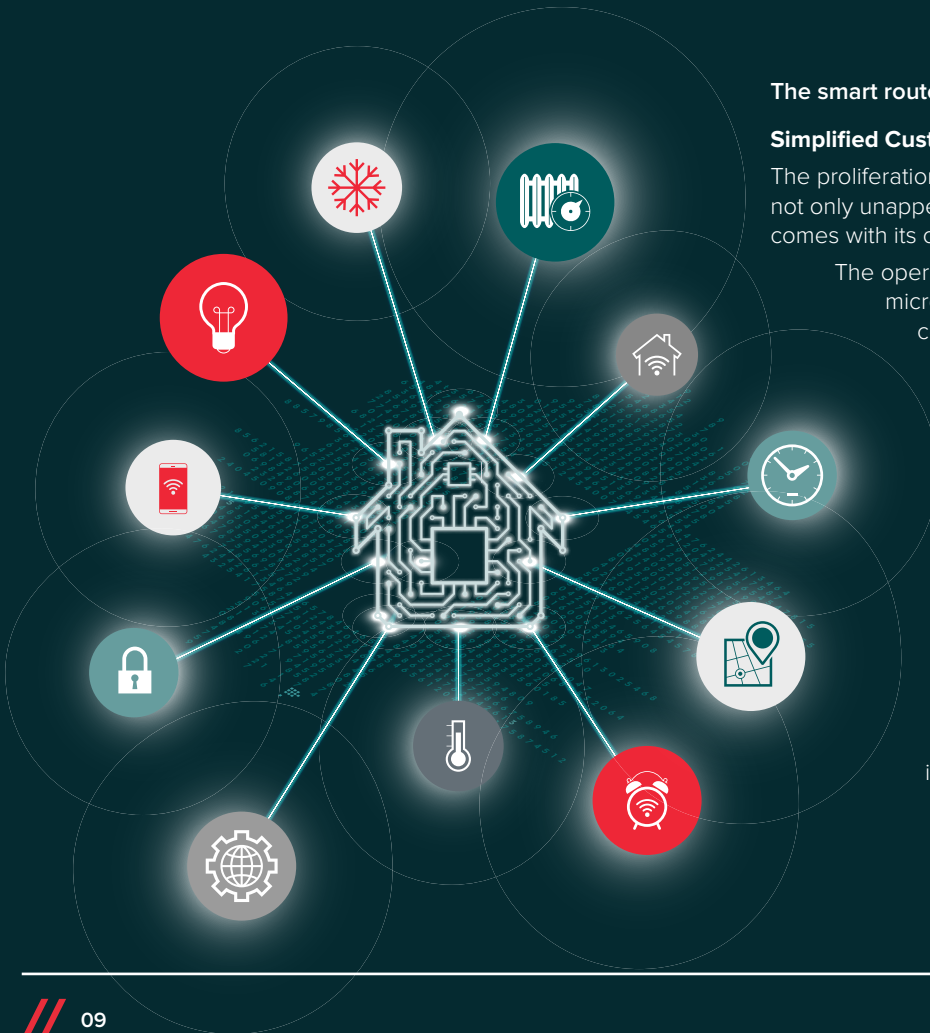
// Operators at the centre of the smart home

Smart Grid:

As we move our energy supply to renewables and adopt electric vehicles it is going to be increasingly difficult to balance supply and demand. However, the smart home has a role to play in the form of Firm Frequency Response (FFR). Participants in this scheme turn-off non-essential devices in response to fluctuations in the mains frequency. This keeps the grid stable and provides a financial incentive for users. However, the technology is only viable if the latency between detection and response is minimal. FFR requires a monitoring period of 0.2s or faster, with a resolution of 0.01Hz and absolute error of less than 1000ppm. A system that balances out these would need to be similar in speed. This rules out a round trip to the cloud and means the intelligence must be hosted locally and have access to a low latency in home network. The smart router is well placed to solve both problems.

Taking OpenSync to the next level

Today businesses are very successfully delivering services over the internet without the need to involve the broadband router and it's hard to imagine why this would change for the vast majority of services. On the odd occasion where the broadband router must be involved, such as for smart Wi-Fi or security or auto-install, then technologies such as OpenSync are employed to move the brain of the router to the cloud.

OpenSync is a great technology but it does have some limitations. For instance, because the router to OpenSync mapping is one-to-one there's no simple way to share an OpenSync connection across multiple services . This means that every time an operator wants to add a new smart Wi-Fi or security service they need to undertake a cloud-to-cloud integration in order to share the OpenSync controlled router. Whereas a smart router could support multiple co-operating clients.

Operators are hampered by a fragmented estate of fixed function routers sourced from a range of OEMs. Deploying new features such as OpenSync on routers now is an arduous task. Firmware upgrades need to be arranged, tested and deployed for all router variants. This is a costly and slow undertaking which has to be repeated every time a new feature is added, or an existing feature is updated – the net effect is a drag on innovation. If the router is to become a versatile platform for service delivery, then this estate will need to harmonise on a common software solution.

Key takeaways

- Save power, protect privacy, provide autonomy, absorb gateway boxes and much more
- Unlocking versatility requires a common software solution
- The current bespoke integration approach is expensive, slow and not scalable: this is constraining the customer offer

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// The innovation ecosystem

Operators have tightly controlled their networks to be as lean and efficient as possible. In contrast, the likes of Amazon with its cloud infrastructure and Microsoft and Google with their operating systems, have opened up to third party investment at scale. They created an innovation environment and an ecosystem that has enhanced the value of the core platform.

A rich stream of opportunities based on AI, cloud, IoT and 5G will be created at the network edge and it is the global tech giants which are poised to take control. There is a risk that the mistakes of the previous couple of decades in telecommunications will be replayed. Google and Amazon are directly targeting the home network with initiatives such as Amazon Sidewalk and Google WiFi, deploying voice as the user interface.

If operators are to capitalise by enhancing their offer with new services at the edge it requires a conceptual and cultural shift as much as a technological one. This is that they can build an open environment on top of their network assets, to nurture an innovation ecosystem for start-ups and third parties. The value in stemming churn alone should not be underestimated.

Prime mover advantage

Flexibility and security within the home network is sought after by service providers and essential for end users. However, most operators are currently stuck with a fragmented device estate where updates are challenging to implement and may even necessitate truck roles. Creating an agile platform and standardising the deployment and management of third-party software within a containerised environment will break the cycle of legacy cost and low margin and usher in a new business model.

Some service providers are already making good progress with this approach. Comcast's Xfinity Home integrates their security camera solution along with products from Honeywell, Yale, ecobee, Lifx and many other suppliers. They've shown that providing a single overarching application increases engagement compared with deployments with just the supplier's own application and they are selling millions of devices. But this is a land grab and the opportunity won't last forever.

Opening up to third party innovation

Even the most pioneering internet companies recognise that third parties, and in particular start-ups, are a vital source of innovation. Their 'innovate or die' approach makes them ideal path finders. It makes no sense for established corporations to duplicate the investment, disruption and attrition they offer.

By building an innovation ecosystem around the smart router the operator will benefit from early engagement, strategic influence and future insights. Most importantly it adds huge value to their customer offer for a relatively small investment.

To be successful the ecosystem will need to deliver on some key criteria

A Route to Revenue - there needs to be a reason to invest.

Scale – the more routes to revenue, the more that revenue can scale and the more investment the ecosystem is enjoying from the wider community then the more attractive the ecosystem is.

Ease of Engagement – there needs to be an easy, open and low-cost way to get started, with technology that will complement or accelerate their innovation.

The operator community is well placed to fulfil these criteria and they have the added benefit of dominating the network edge which is primed for investment and rapid growth. But the smart router needs a technical solution that appeals to innovators and is easy to engage with. It also needs a rallying point where the technology can be developed, standardised and the community can grow and be heard.

Operators can transform the hardware router from a dumb termination of the broadband pipe to an agile platform. But this head start could be quickly overrun by global internet giants. Recognising that the common broadband router has enormous potential to deliver new services or enhance existing ones at the Wi-Fi edge is one thing. Unleashing its potential is another.

Key takeaways

- A smart router can be the open platform to attracting a wealth of third party investment
- Operators are highly skilled at deploying new technologies at scale
- To innovate at 'internet' speed the operator community will need an innovation ecosystem

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// Closing the gap between network and router

In order to turn a fixed function device into an application platform the router needs to go through a similar technology transition to that of the mobile phone. Cloud services, software defined networks and edge computing are combining to enable this transition. In these architectures the edge device does not host a customer facing application but instead operates as a compute node running a nano or microservice that leverages the device position in the network to deliver a vital part of the overall service.

The containerised microservices that power the cloud and enable network virtualisation have generally been the preserve of enterprise servers or specialised network equipment. But in recent years advances in embedded processing power and extremely lightweight containerisation technologies have enabled microservices on numerous embedded devices.

The Comcast and Liberty Global-backed RDK have taken the technology a step further. It has developed an extremely lightweight implementation that uses OCI (Open Container Initiative) images to be compatible with hypervisors and orchestration technologies used by the cloud and network virtualisation. This development significantly closes the gap between the network and router as an edge device.

By moving compute power, data storage and management on the edge, data can be collected, analysed and then acted on locally without needing to cross the network to a central data centre or cloud. There are a growing number of sensors and devices that are always-on and continually sending more and more data – and super-fast, high capacity 5G will only see this sharply increase. Much of this locally generated data will be used primarily to generate local decisions. With the intelligent edge, these devices can predictably make automated or real-time responses in milliseconds.

Key takeaways

- Microservice application models offer ease of deployment, scalability and innovation
- Kubernetes, the open-source container orchestration platform, hugely successful in network virtualisation, is available to connect the router to the cloud.

The Comcast and Liberty Global-backed RDK have taken the technology a step further.

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// Embedded Containerisation
– the key enabler to transforming the router

When considering a technology to form the basis of a smart router the obvious candidates include: the network virtualisation technology that operators are already deploying into their network, a proven microservice technology that will integrate seamlessly with the cloud or an adaption of an established application environment with its huge community of contributors.

In fact, there is already a quiet revolution happening in this regard. Two of the key players in open-source router stack software are aiming to accelerate development of its fixed function into an application platform.

The RDK (Reference Design Kit), which is backed by Comcast and Liberty Global, have been evaluating technologies to enhance their broadband router software stack, known as RDK-B. It will repurpose a container-based technology currently used in their video stack. The technology is known as Downloadable Application Containers (DACs) and provides a way to dynamically deploy services on their router stack.

Meanwhile, The prpl Foundation, whose members include Vodafone, BT, T-Mobile, Verzion and Orange, have a similar proposal called Life Cycle Management (LCM). Both initiatives intend to dynamically deploy, run and remove services from the router stack.

RDK and prpl Foundation understand the importance of scale and are in discussions about adopting a common approach based on proven DACs technology. After all, OEMs such as Technicolor and Kaon, as well as software providers like Jungo and Inango, are offering proprietary smart router solutions. But their lack of scale means they have had limited impact on the industry. Wide scale adoption will need a standardised approach. This is recognised by the Broadband Forum and prpl Foundation who are collaborating on Life Cycle Management (LCM) and remote management of containers.

Flexibility and security within the home network is sought after by service providers and is essential for end users. Creating a containerised environment and standardising the implementation and management of third-party software within a container will allow these much-needed abilities to be accomplished in an extremely secure way.

Key takeaways

- The security argument alone makes the case for containerisation incredibly powerful

- Operators can transform the router into an agile platform by creating a containerised environment

- Containerisation is lightweight, optimised for embedded applications and compatible with cloud

Two of the key players in open-source router stack software are aiming to accelerate development of its fixed function into an application platform.

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// The simplicity and power of DACs

Downloadable Application Containers (DACs) is a powerful and extremely lightweight technology optimised for embedded applications. It builds upon and leverages the Open Container Initiative (OCI) suite of standards to bundle, deploy and run containerised services. Containers were originally developed as a lightweight alternative to virtualisation and are widely used in the cloud, enterprise and even personal computers and they underpin technologies such as Docker and Kubernetes.

Broadband routers use the Linux Operating System and this has supported container technology for over 10 years. Containers are already widely used in advanced embedded devices such as smart phones, smart TVs and STBs. However, DACs takes this a step further and has been heavily optimised for embedded applications, enabling containers to be used on devices with very constrained resources - even legacy devices.

Placing a service or application in a container means you can precisely and securely control the other systems it can interface with and the resources such as memory, CPU, storage and network bandwidth, etc. it can use. This is vital if services are to be deployed to routers without compromising performance or security.

Powerful as DACs technology is, alone it is not enough to create the smart router. The services within the container need a standard way to interface with the router's local resources (such as Wi-Fi) and with remote infrastructure. For instance, a VPN service will need a way to open a network connection to establish the VPN link and a way to check credentials with a remote authentication server. If a container is to be universally deployable on any smart router (in the same way that an Android application can run on any Android phone) then the north bound and south bound APIs the container uses to interface with the local and remote resources will need to be standardised. Thankfully, RDK and prpl are in the ideal position to do this and prpl and Broadband Forum are already collaborating on standard APIs for utilising both local and remote resources.

Another important area of activity is Life Cycle Management where a standard way to provision, start, stop and upgrade containers is being defined.

Containerisation offers a complementary alternative to a single code base approach. If the OEMs implement a router stack that supports a standard container with standard north and south APIs then new features can be developed once and deployed to all routers without involving the OEMs and without updating the entire router stack. This speeds up deployment, reduces the test burden, delivers operational savings and accelerates innovation. Even existing technologies such as OpenSync will benefit from being deployed in this way. The ability to independently deploy and update components, whether microservices in the cloud or applications on a smart phone, is vital for any enterprise wanting to deliver UpToDate features and services at speed. This will be a vital attribute for the smart router too.

An edge service will very rarely exist in isolation. Generally, the edge component will form part of a wider service infrastructure, most of which is hosted in the cloud. With this in mind, DACs has been architected to be compatible with the cloud. By using the standardised OCI container format, orchestration technologies such as Kubernetes can deploy containers to both the cloud and edge to provision an entire end user service or application.

Key takeaways

- Key industry players are converging on a technical solution based on RDK DACs
- DACs is proven, optimised for embedded devices and cloud compatible
- Containerisation is the solution to market fragmentation and scaling

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// Conclusion

The router's unique place in the home and business networks means it can save power, protect privacy, provide autonomy, absorb gateway boxes and much more. These benefits are a springboard for new services and operational savings and they can only be realised by creating an innovation environment and ecosystem at the network edge that enhances value for the operator.

Telcos hold the keys to a prize asset already ubiquitous in the home and office. The broadband router is established as a secure managed edge of network device. Existing and new containerised services that are present in the cloud can migrate the Smarter Router transforming them from fixed function terminal into a smart router with the potential to deliver significant competitive advantage for operators seeking agility, innovation and security.

Agility: Future proof and build versatility into your business model.

Innovation: Unlock a wealth of value from emerging technologies at the network edge.

Secure: Add a myriad of features to enhance services or deliver new functionality with everything locked inside its container.

The beauty is that the same technical solution –
Smart Router – can be the platform to serve all those needs.

Challenges, outcomes and partnerships

It will take time for operators to upgrade their routers to this new stack. But the outcome will be an estate where new services, enhancements or diagnostics can be deployed instantly to individual customers. We can speculate whether smart Wi-Fi, advanced-security, VPNs, smart home, rapid updates or pre-emptive diagnostics will be the next big opportunity. But what's not in doubt is that an agile platform will be a must-have if operators are going to rapidly exploit that opportunity. Developing the hardware has to be a pre-cursor to capitalising on this future.

In fulfilling this new role, the router will inevitably be more sophisticated and therefore more expensive. However, with increasing silicon capabilities in newer and cheaper packages there must be a business case for the router's new role at the edge. This may be based on applications that improve the customer experience of the networked home or that provide services in a new and more customised way. The result is a smart router that helps build a more compelling service experience to attract and retain customers. The power of managing privacy, latency, security and autonomy at the edge will be identified as offering unique capabilities to services and applications.

Doing nothing is not an option

The router could become a key part of the edge infrastructure and play a role in improved customer experience and access to new services from operators. Containerisation and open-source approaches such as RDK-B could be central to this new role. However, it requires a shift away from the view of the router as a simple termination device.

Innovating to develop the smart router could unlock a raft of new revenue generating services and place operators at the heart of the smart home for decades to come. Or will operators look on, as the internet giants and others continue to build lucrative services over their infrastructure?

To paraphrase Abraham Lincoln, "The most reliable way to benefit from the future is to prepare for it." At Consult Red, we welcome the discussion.

Consult Red – the DACs experts

Consult Red has been instrumental in bringing container technology to embedded devices. They have worked together with Sky, Comcast, Liberty Global and others to add production quality support for standards compliant containers technology into the RDK-V open-source project. Consult Red's CTO, Rahul Mehra chairs the RDK special interest group for DACs. This technology is deployed in over 10M devices – where it's used to deploy applications and facilitate incremental upgrades to service components in a modular manner. Consult Red are now adding DACs capability to the RDK-B router stack.

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