TCO of Disaggregated Telco Networks

> **Disaggregated IP/MPLS networks have >52% saving in TCO over 5 years**
>
> **Opex savings (57%) are marginally higher than capex (50%)**
>
> **Potential for >60% savings in more distributed networks**

At RtBrick we build Tier-1 and Tier-2 disaggregated telco networks. We've learnt a lot about what drives the costs of these networks, compared to traditional networks, and have built our own TCO (Total Cost of Ownership) models – primarily to ensure we are pricing our software competitively.

This paper shares the results of those models, along with sensitivities and tipping points. The results help explain why network disaggregation is the most important shift in telco networks since the arrival of the Internet.

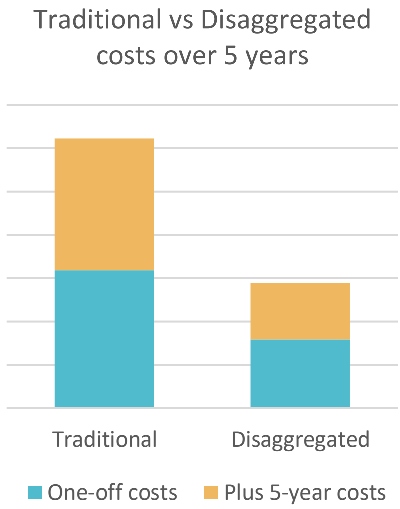
It's important to state that our TCO model is just that – a model. Although all the data is based on real network inputs, we will also be transparent about our underlying assumptions.

Results

TCO for our disaggregated network is 52% less than that of a network built from traditional chasis-based routing systems from established vendors.

	Savings
One-off capex costs	**50%**
5-year opex costs	**57%**
Total Cost of Ownership	**52%**

Significant cost savings are achieved from both the one-off purchase and 5-year operating costs of the network, with a slightly higher reduction in opex costs.



What is a Disaggregated Network?

Before we expand on these savings, let's just consider what we mean by a disaggregated network, and why they have recently become important to telcos. Large-scale carrier IP routing systems have traditionally been built using custom silicon with the software optimised around it. But off-the-shelf silicon now offers similar capabilities on high-volume, low-cost networking chips. This *merchant silicon* is being used to build a new category of powerful low-cost 'bare-metal' switches, ideal for carrier networks.

But, what about the software? Well, that's where companies like RtBrick come in. RtBrick has developed routing software that turns these bare-metal switches into fully functional IP/MPLS routers. The software runs in a container on a Linux operating system on the switch. Separating out the hardware and software like this how the largest cloud-native companies have built their IT infrastructure and is referred to as *disaggregating* the network.
You can use these disaggregated systems to replace many functions within the network, from PE routers to Broadband Network Gateways.

TCO Scope

This study compares a network built from traditional IP/MPLS routers with one built with disaggregated bare-metal switches and RtBrick software. It models a large-scale fixed access network driven by consumer broadband traffic, although we also expect the model's conclusions to be broadly applicable to other carrier routing use-cases. The model includes several different areas of cost, calculated over a 5-year period:

- Capex purchase costs of hardware and software licenses
- Operational maintenance and support costs
- Power consumption

Further considerations that are not included in the calculations will also be discussed later in this paper.

Input Data and Assumptions

Any model is only as good as its input data and assumptions. These TCO comparisons assumed the following:

- Traditional systems Vendor discounts were assumed to be 85% from traditional vendors and 35% from disaggregated vendors. The sensitivity of varying both these discounts and the impact on the TCO savings is expanded on below
- Network service definitions: the complexity of the services offered, such as the number of queues supported, will impact the number of subscribers supported by each piece of equipment. This model assumes a level of complexity typical in Tier-1 telco consumer broadband services
- The disaggregated hardware is commercially available bare-metal switches based on existing network chipsets. The impact of using alternative x86-based platforms is also explored later in this paper
- All systems and PoP designs have redundancy built-in
- Distribution of subscribers assumes that most (80%) are concentrated in large urban PoPs (Points-of-Presence) and a minority (20%) spread over smaller rural PoPs, although this ratio isn't highly sensitive to the results
- Transport and last-mile network costs are considered to be neutral across both scenarios

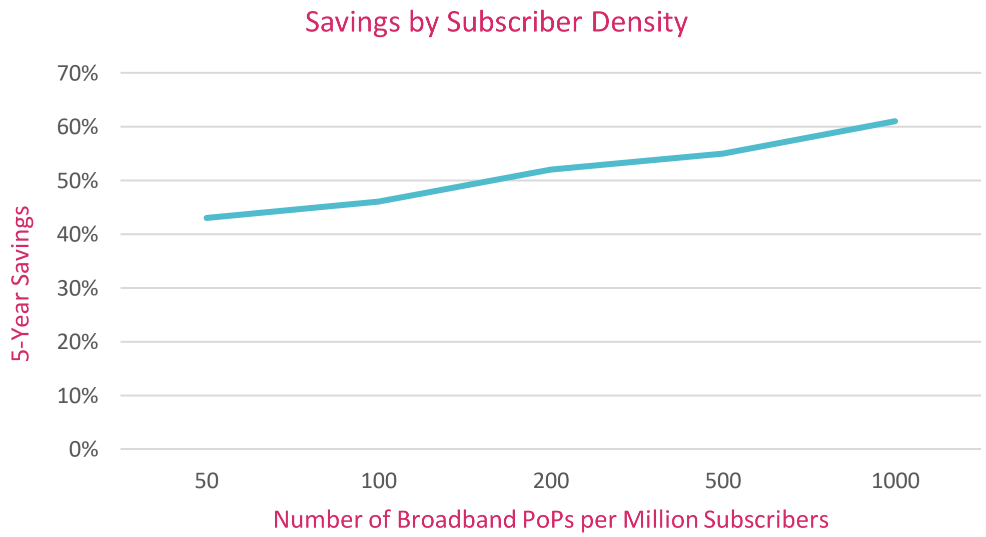
Sensitivity Analysis

Size of network

The standard network size we used was a one million subscriber broadband network. Increasing this to a much larger tier-1 network with many millions of subscribers did not materially affect the savings. Of course, such a network operator might expect to achieve higher levels of discount from vendors, and the sensitivity of vendor discounts is explored separately.

Density of subscribers

The TCO of a disaggregated network is significantly less than a traditional network. But savings increase even further in more distributed networks. This is mostly due to the scalability range of bare-metal-switches, which are able to efficiently support small remote PoPs (Points-of-Presence) as well as large dense PoPs, whereas traditional chassis-based routers are increasingly inefficient when they support small numbers of subscribers.



	Very dense		Typical		Very distributed
Number of broadband PoPs per million subscribers	50	100	**200**	500	1000
5-year saving	**43%**	**46%**	**52%**	**55%**	**61%**

Bandwidth Per Subscriber

The TCO savings remain constant, regardless of bandwidth provided, until the average peak subscriber bandwidth exceeds 24Mbps. At this point savings increase further as more bandwidth is consumed. So, for most consumer broadband scenarios, the costs are driven by the number of subscribers rather than the bandwidth consumed.

List Pricing and Vendor Discounts

As large telcos usually have strong purchasing leverage over their suppliers, comparing list prices is not very accurate when establishing TCO. We varied the discount levels for traditional vendors from 65% to 85% (compared to a constant 30% for disaggregated vendors) and for disaggregated vendors we varied it from 30% to 50% (compared to a constant 85% for traditional vendors). We used lower levels of discount for disaggregated vendors because we expect them to be operating at lower gross margins than traditional vendors.

Traditional vendor discount	85%	80%	75%	70%	65%
Disaggregated vendors' discount	35%	35%	35%	35%	35%
5-year saving	**52%**	**63%**	**70%**	**75%**	**78%**

Traditional vendor discount	85%	85%	85%	85%	85%
Disaggregated vendors' discount	30%	35%	40%	45%	50%
5-year saving	**49%**	**52%**	**56%**	**59%**	**62%**

Disaggregated Platform Choice

The TCO model assumes the use of bare-metal switches for the routing hardware. However, it is possible to use x86 based servers with NIC cards to achieve the same functionality (in fact, RtBrick's own software also runs on x86 servers, as well as bare-metal-switches). The difference in capital cost of the hardware is not that material, but the power consumption costs of x86 processors are significantly higher, resulting in the erosion of all savings compared to traditional systems, and 5-year costs actually being slightly higher.

	5-year saving
Traditional chassis vs. Disaggregated bare-metal switch	**52%**
Traditional chassis vs. x86 based server	**(-4%)**

Additional Factors

There are a number of factors that would affect any real-world case that we didn't include, due to the difficulty in quantifying them or applying them to a model, or the lack of data. Most would improve the case for disaggregated networks even further.

Downsides

The one obvious downside is the cost of change. In practice there would be one-off project costs, retraining and adoption of new working practices. These are hard costs to quantify but most telcos are already committed to adopting these new practices as part of NFV (Network Functions Virtualization) or other cloud initiatives.

Upsides

There are a number of upsides to TCO that haven't been included in this paper:

- Significant operational savings become possible due to standardizing on a single OS (e.g. Linux Ubuntu) across all services and platforms
- Procurement leverage over suppliers will increase as software and hardware can be purchased independently, driving down costs further
- This comparison has been based on static traffic levels and number of subscribers. In practice growth in either dimension will further benefit the case for disaggregated networks.

Lower TCO – and more…

Lower TCO is clearly an important benefit of network disaggregation, but bringing this cloud-native approach to your carrier network brings many other benefits, arguably even more important than the lower costs:

- Control over you own destiny – like any cloud-native, this highly adaptable approach allows you to break free from the service features and timescales imposed by networking vendors, and deploy the services you want, whenever you want them
- Flexibility - you break the hardwiring between platforms and services, enabling re-use of common hardware for new services, and extend the longevity of equipment
- Automation - open interfaces make the whole system easier to automate, with zero-touch-provisioning for rapid deployment of infrastructure, and native telemetry enables an AI approach
- Simple management – Web 2.0 tools, along with RtBrick's own open-source management systems give you visibility and control via a 'single pane of glass' interface

Why don't you get in touch with us to find out more about how disaggregated networks could radically reduce your TCO?

RtBrick is a privately held company, with staff in India, Germany, Austria, Belgium, Netherlands, Romania, UK and the USA. Investors include Deutsch Telekom Capital Partners and Swisscom Ventures.