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The economic benefits of sharing government communications networks

How multiple public sector organizations can reduce OPEX through network sharing

Strategic White Paper

As they look for ways to modernize information and communications technology (ICT) infrastructures, many governments have upgraded or are considering upgrading their Time Division Multiplexing (TDM)-based networks to packet-based technology, such as Internet Protocol/Multi-Protocol Label Switching (IP/MPLS). One of the advantages an IP/MPLS network offers is the ease with which the network can be securely shared by multiple government entities and public service providers. Recognizing the potential benefits network sharing offers, Nokia Bell Labs conducted an extensive analysis of possible sharing scenarios to quantify short and long term economic advantages and the impact network sharing will have on service for all organizations involved. The analysis confirmed that there are many cases where a shared public network makes good business sense for all parties involved. A government network service provider can generate revenue from network sharing to defray operating costs, while government owned entities will benefit from lower telecom costs and get access to advanced, more reliable, redundant and secure services.

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An opportunity for network sharing

Momentous changes in the way public organizations share information and communicate are putting sustained pressure on state and local governments to find innovative ways to modernize ICT infrastructures. The variety and volume of data and multimedia traffic that must be exchanged on a regular basis within each department and agency, with other departments and agencies and with the public have created higher expectations for the networks that serve them. At the same time, government organizations at all levels are faced with increasing budget constraints that require them to do more with less. While more stringent environmental regulations have created a need to control and reduce energy consumption.

As a result, many states are looking for ways to leverage the full capabilities of the latest networking technologies to enable more efficient, cost-effective operations and improve the quality of public services. The most visible example of this trend is evident in the public safety domain.

Realizing the inefficiencies created by the lack of interoperability, many countries have set aside a portion of the available radio spectrum to create national public safety networks that will support more advanced multimedia information sharing by public safety agencies at the national, state and local level. Efforts in the U.S. are focused around the FirstNet™ initiative, a single nationwide wireless network that will leverage LTE technology in a dedicated frequency band[1]. In preparation of this effort, current voice-centric Land Mobile Radio (LMR) systems are evolving towards a more data-centric world where existing services are complemented and will eventually be replaced by IP-based multimedia applications. This will greatly improve the efficiency of first responders before, during and after a crisis.

Moving towards a shared network

Beyond public safety, some governments have embarked on network transformations engineered to support everything they do. To fulfill government operating requirements, support existing legacy services and enable more bandwidth-hungry IP-based applications, aging TDM-based infrastructures have been transformed to all-IP communication networks based on IP/MPLS technology. As demonstrated by a similar evolution which took place in the telecom service provider market, IP/MPLS provides the performance, scalability, reliability and operating efficiencies government organizations need[2].

However, the applications and services on most of these networks do not use the full capabilities the network provides. As a result, these governments are looking for ways to take advantage of the efficiency and performance gains

1. For more information on FirstNet, see www.firstnet.gov/network
2. For a detailed discussion of the advantages of IP/MPLS, see the Nokia white paper “Mission-Critical Communication Networks for Public Safety”

their new networks offer. To reap the full operational and financial benefits, they are now considering the option of enabling multiple public organizations to share their new IP-based networks.

Recognizing the potential benefits network sharing offers to state governments, Nokia Bell Labs conducted an extensive analysis of possible sharing scenarios. The study focused on understanding real-life use cases, short and long term economic advantages, as well as the impact network sharing will have on service for all parties involved. The results show that, in addition to delivering higher performance for all departments and agencies on the network and reducing overall operating costs, governments can realize revenues from network sharing to defray operating costs. At the same time they can reduce networking costs significantly for all parties involved.

Given the benefits to governments with existing IP-based infrastructures, those planning to embark on a transformation process may also be interested in considering sharing options as they plan their deployments. By doing so at the start of the process, they can optimize network design and business models for network sharing.

Understanding network sharing challenges

The ever-increasing need for more effective public service operations can only be met with networks that can support everything from citizen access to information to enhanced emergency response based on mobile interoperability and multimedia data. To meet the demand for advanced applications and services, aging infrastructures must be transformed to ensure sustainable, reliable, anytime connectivity for public service employees, agencies and citizens alike.

A shared government service network must be highly robust with an architecture that is poised to grow and expand. It should be able to scale in size and grow in capacity by using available network assets, including microwave spectrum and optical fiber. The network should also support a flexible range of point-to-point and multipoint virtual private networks (VPNs) for TDM, Ethernet and IP services to meet the application needs of different organizations. At the same time, the network must maintain agreed quality of service (QoS) levels for all organizations at all times.[3]

Networks based on IP/MPLS technology address these requirements. But, beyond technology, there are specific challenges that governments must address when moving to a shared network.

3. For a detailed discussion of the benefits of a shared network, see the Nokia white paper “Delivering A Public Sector Shared Architecture”.

The loss of control challenge

Moving from a dedicated network to a shared network will create legitimate concerns for the different departments and agencies being asked to share a network. Most will be concerned about losing control of their communication services. Many will also be concerned about the privacy and security of their data on a single network, but many solutions already exist to address these concerns.

The legal challenge

By becoming a network operator for multiple departments and agencies, a government organization must behave as a telecom service provider. It must offer commercial-like services based on service level and QoS agreements. Therefore, the government must ensure it has the right to provide this level of service and that it is working within the guidelines, rules and regulations outlined by the relevant telecom regulatory authority.

The financial challenge

But the most important obstacle governments must overcome is financial. The move from a dedicated network to a shared network must be based on sound fiscal benefits. Therefore, governments must demonstrate the financial viability of such a project, which is the focus of this paper.

Defining possible network sharing scenarios

To better understand the ultimate benefits of network sharing at the state level, Nokia Bell Labs developed a baseline profile of a typical, installed, state-wide wireless IP/MPLS network designed to support multiple departments or agencies. For the purposes of the analysis, it was assumed that this network was already operating with:

- More than 100 nodes
- Routing provided by Nokia IP/MPLS routers
- Network endpoints connected to the routers via Gigabit Ethernet

It was also assumed that current traffic on this network was leaving significant excess capacity in the network and that the state might want to share with:

- A state agency currently using high-throughput MPLS VPN service across the whole state from a service provider for most of its communication needs and connecting most of its locations to the MPLS VPN service over T1 or Gigabit Ethernet connections
- A public service agency (Agency #1) currently using high throughput T1 access to a service provider's MPLS VPN service for all its regional communication needs

- A second public service agency (Agency #2) currently using a private low-speed 900 MHz radio system and a combination of a service provider's 3G and LTE wireless services for its regional communication needs for various applications, including connectivity to sensors and its mobile workforce.

Based on these assumptions, Nokia Bell Labs developed a business case for migrating traffic from the existing networks each agency was using to the state-owned and shared network via point-to-point wireless connections. It was assumed that the links to the shared network would be made with 5.8 GHz unlicensed spectrum with up to 150 Mb/s capacity per connection. The assumption of point-to-point wireless access links was used only as an example of access technology. The business case methodology used in the study can still apply if another access technology is used. The final results will differ based on the difference in costs between the technology used and the cost of the point-to-point wireless access assumed for the study.

On the business side of the study, it was assumed that the capital expenditure (CAPEX) required to migrate traffic from each agency location to the shared network node would be $10,500 per connection. It was also assumed that the organization migrating its traffic would pay for each connection, rather than the state, and that these costs would be covered by loans each agency would take from a commercial bank. Furthermore, it was assumed that each organization would repay these loans within three years. The state would charge a discount of 20 percent off the agency's current networking expenses for the links migrated to the state network. For the first three years, the charges would be discounted by the state to account for the agency's loan payments.

The business cases for each scenario were structured around:

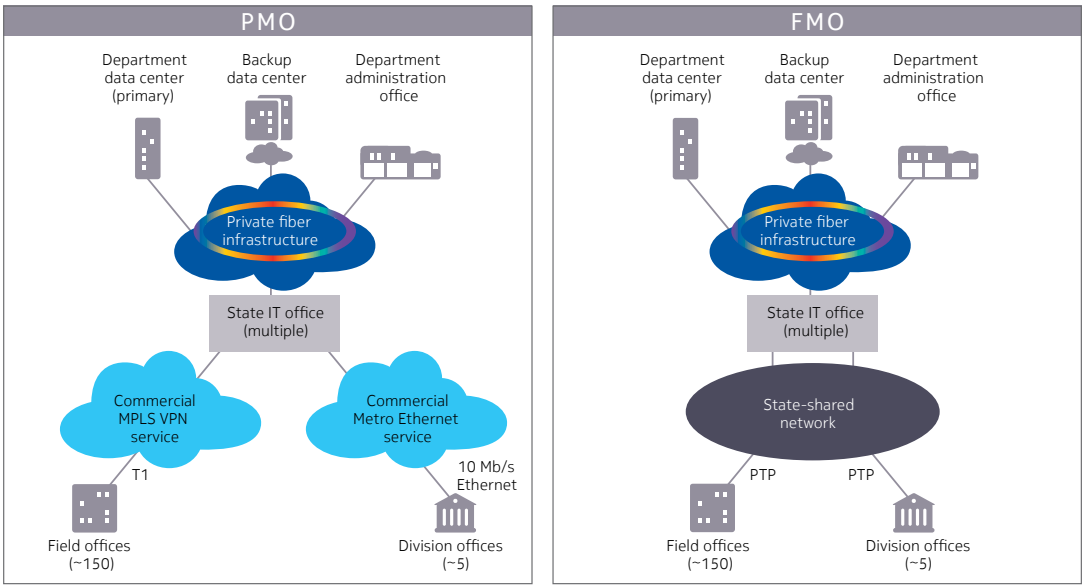
- Qualitative and quantitative analysis of each agency's network requirements based on its present mode of operation (PMO)
- A forecast of the shared public safety network's potential CAPEX and operational expenditure (OPEX) evolution based on future traffic and service requirements
- Quantitative analysis of each agency's financials over a seven year period based on a comparison of its PMO and expected future mode of operation (FMO)

The focus of the analysis was on computing the financial benefits of migrating from a service provider's network to the state's shared services network. It was further assumed that that the reliability, security, and performance of the access connections would be at least as good as the ones provided by a service provider. In actual implementations, the financial results may vary depending on the actual access costs. The sensitivity analysis included in this paper will provide a view into the effect of thee variations on Net Present Value (NPV).

Business Case Analysis #1: A state agency

For the first business case analysis, Nokia Bell Labs created an operating profile of a hypothetical state agency with multiple field offices across a state connected to an administration center over a service provider network. Under its PMO, the agency connects to a central private network operated by the state's IT office. At the backend, the main center connects to the state IT office over an existing private fiber infrastructure (Figure 1).

Figure 1. Hypothetical state agency PMO and FMO comparison



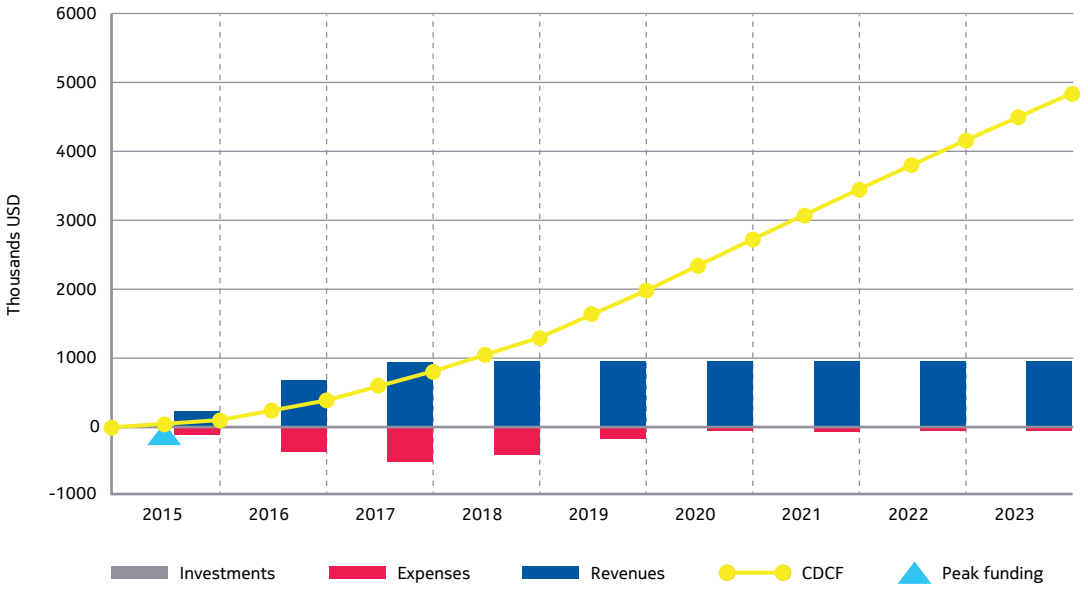
With this PMO, the analysis revealed that the number of T1 links required for the field offices and the 10Mb/s Ethernet links from the division offices would be the largest and most significant expense for the network. By migrating to a shared network FMO this cost could be eliminated. Field offices would connect to the administration center over the shared network via 5.8 GHz PTP connections (Figure 1). A minimum of two PTP connections would be required between the shared network and the IT locations to ensure reliability. These multiple links to the IT offices could, possibly, share the traffic load generated by the field offices.

It was also assumed that the data rate of one link between the central state IT office and the shared network would be sufficient to support the total data requirements of all field offices, but additional connections could be added if needed. The fiber connection between the main center and the central state IT office would remain unchanged.

Benefits to the state

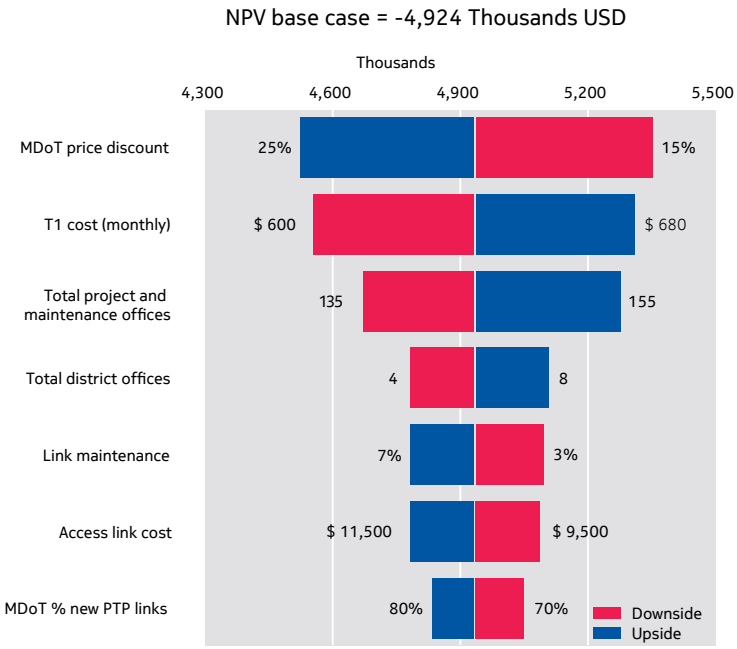
The Nokia Bell Labs analysis built on the PMO and FMO assumptions for this scenario revealed a very positive business case for a state targeting a shared network to a government agency with similar requirements (Figure 2). Based on the assumptions, the state can see a positive return on its investment in the first year and increasing over seven years. This is because replacing the cost of the T1 links with a discounted rate makes the shared public network attractive. And by enabling network sharing on a network engineered to support critical applications, a state could provide service at the same or higher level the agency had under its PMO.

Figure 2. A shared network strategy targeted at a state agency shows a positive return for the state



Even after factoring in the 20 percent discount offered by the state on the cost of each link for three years, the Nokia Bell Labs analysis shows a NPV to the state of approximately about $5 M over seven years (Figure 3).
In addition, the sensitivity analysis shows that the amount of the discount applied has the most impact on NPV and is the key to improving margins for the state compared to other variables. For example, if the state decides to increase the discount to make it attractive to the state agency with the corresponding reduction in the NPV.

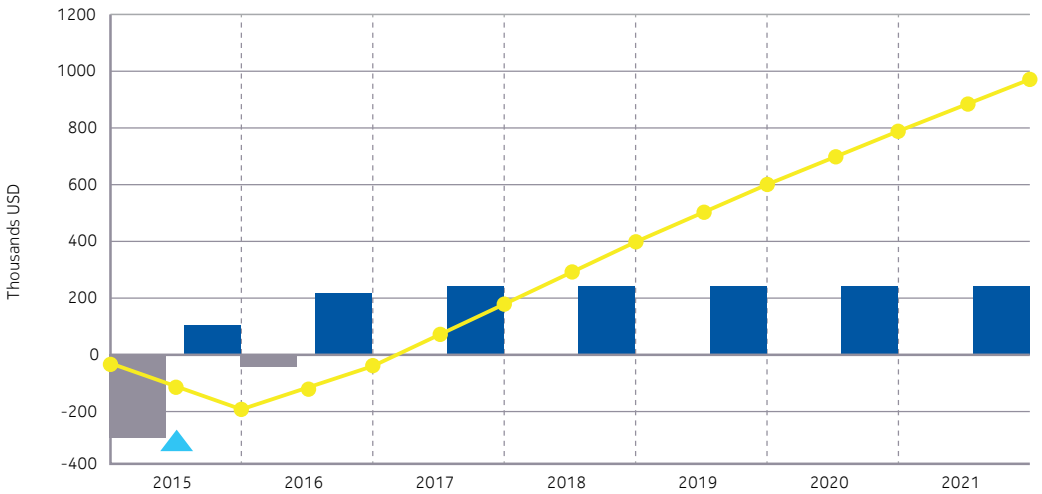
Figure 3. NPV analysis of variables for the state agency business case



Benefits to the state agency

Nokia Bell Labs also concluded that a state agency with similar communications needs would find a shared wireless network to be highly competitive against T1 and 1o Mb/s links from a service provider. Therefore, migration to a shared FMO makes good business sense for such state agencies. It provides significant cost savings to an agency with a similar PMO and a return on investment (ROI) in just over two years (Figure 4).

Figure 4. Shared public service network business case for a state agency with similar requirements



The Nokia Bell Labs scenario predicted that 50 percent of the state agency's field locations would migrate to the FMO in the first year and that the remaining sites would make the switch in the second year. The agency's average CAPEX for each deployed link was set at the study's standard $10,500 per link, while the average OPEX for each link was calculated to be $623 per month. Furthermore, it was also assumed that some field offices would be collocated, so only one PTP link would be required for these offices and that this would reduce the number of PTP links required to service all offices by 25 percent. The state would continue to provide the state agency with a 20 percent discount for each new link.

By migrating all network traffic to a shared public service network under the assumptions made for this scenario, Nokia Bell Labs calculated that a state agency with similar requirements would see a:

- NPV of approximately $1 M over seven years
- Internal Rate of Return (IRR) of 69 percent[4]
- Discounted Payback Period (DPP) of just over two years
- Total savings on overall communications costs of approximately $1.1 million over seven years

Business Case Analysis #2: Public service agency #1

Nokia Bell Labs applied the same process to an analysis of a potential business case for a hypothetical public service agency (Agency #1) currently using high-throughput MPLS T1 VPN service supporting traffic for its applications. Agency #1 operates in a part of the state with only a few locations requiring communication. For this analysis, the operating profile was structured around multiple business offices and field offices (Figure 5). Under the PMO, Nokia Bell Labs assumed that several field offices and business offices are connected over a private fiber infrastructure. However, some locations are connected via a service provider's MPLS T1 VPN service. It was also assumed that offices that are not connected will eventually use the same T1 links used under the PMO.

Once again, the analysis revealed that the T1 links for the field offices and business offices that use a service provider network represent the largest and most significant cost for the agency (Figure 6). Therefore, migrating these offices to a shared public service network would produce significant cost

4. IRR is the discount rate often used in capital budgeting that makes the net present value of all cash flows from a particular project equal to zero. Generally speaking, the higher a project's internal rate of return, the more desirable it is to undertake the project. As such, IRR can be used to rank several prospective projects a firm is considering. Assuming all other factors are equal among the various projects, the project with the highest IRR would probably be considered the best and undertaken first.

savings. Connections to the shared network for these sites would be made via 5.8 GHz PTP connections (Figure 6), while the sites connecting into the agency's private fiber infrastructure would remain unchanged

Figure 5. Hypothetical Agency #1 PMO and FMO comparison

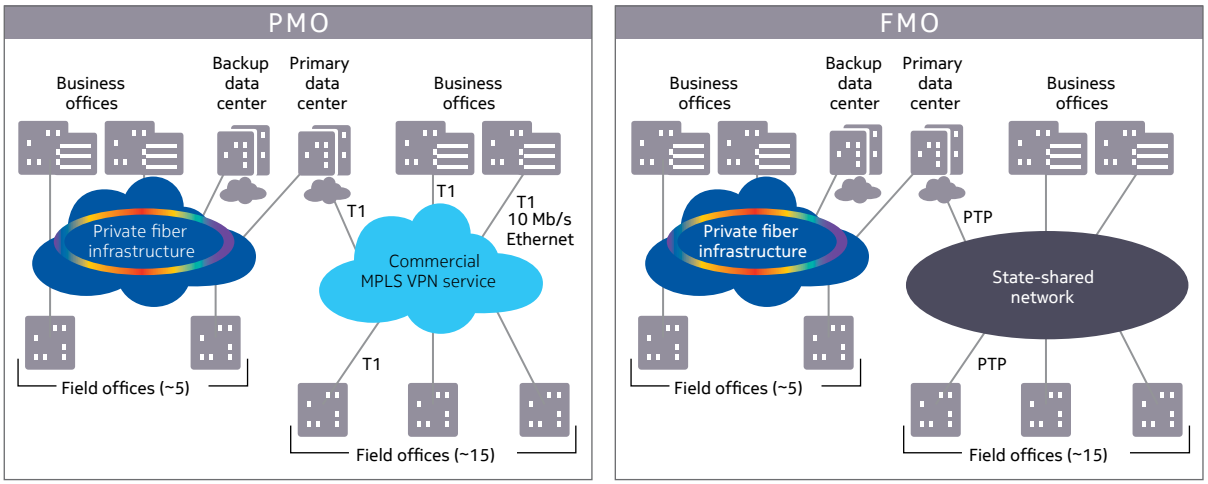
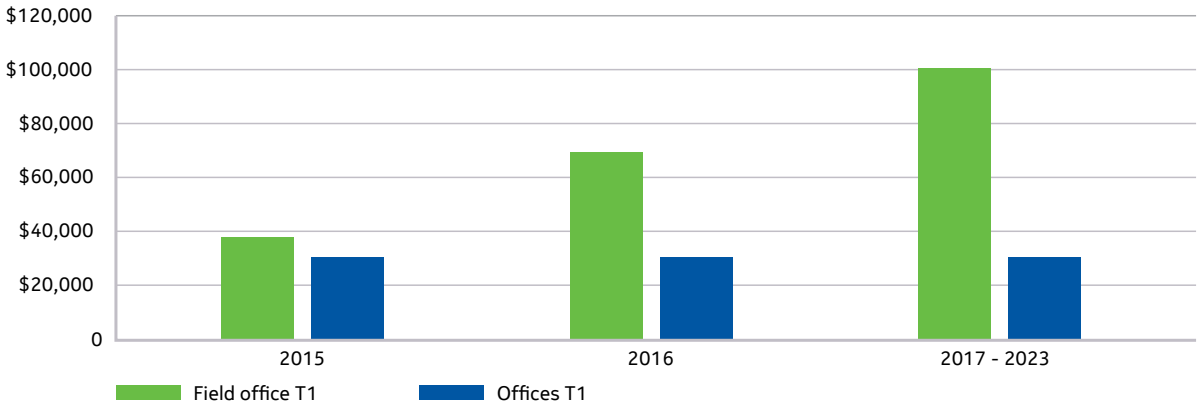


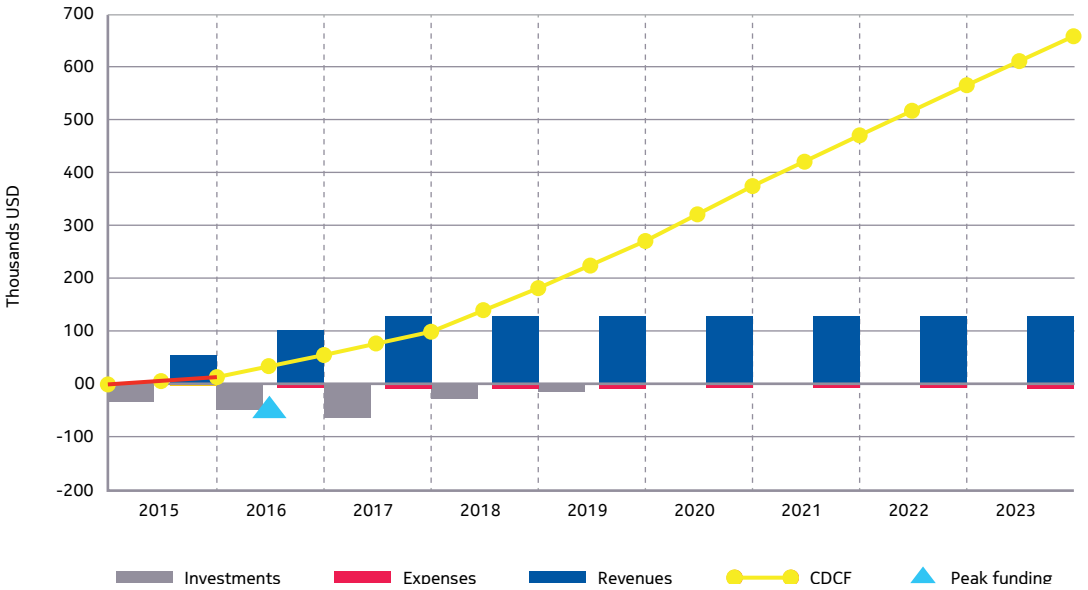
Figure 6. T1 costs for business offices and substations are the largest and most significant expense under the PMO profile



Benefits to the state

For the state, the results of this business case analysis were similar to those revealed by the state agency analysis. The PMO and FMO assumptions led to a very positive business case for a state targeting a shared network to a public service agency with similar requirements (Figure 7).

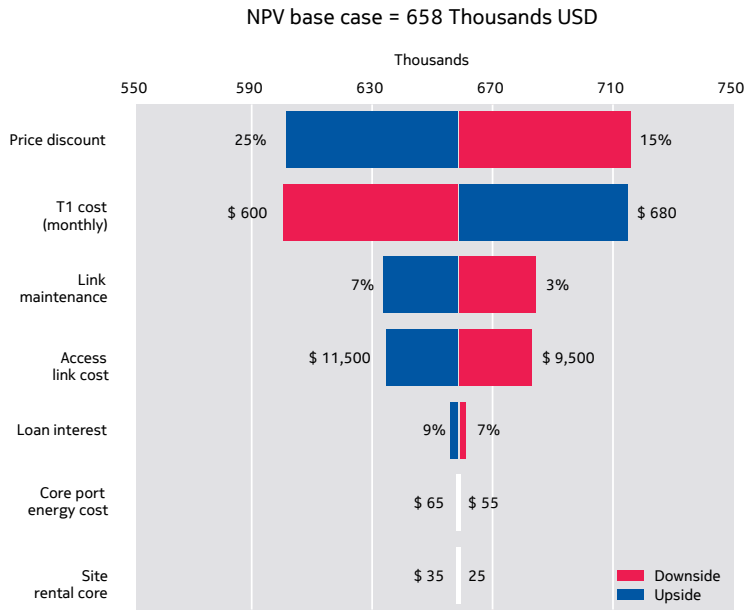
Figure 7. The FMO for Agency #1 reveals a very positive business case over seven years



Under the expected FMO, the state would benefit from leveraging the excess capacity in the network and collect a very positive ROI in the first year and continuing over seven years. Once again, the state could attract a public service agency to the shared network because it provides a highly competitive and more cost-effective wireless alternative to the T1 links that would be needed to connect the agency's business offices and field offices over a service provider network. Plus, because the public network is engineered to support critical applications with a high QoS, it would be easy for the state to attract agency customers looking for a more reliable, available, and scalable solution for their communication needs.

Likewise, the analysis showed that the business case for a public service agency with these requirements is most affected by the level of discount provided by the state. Based on a discount of 20 percent on the cost of each link, the state would still see a NPV of approximately $700,000 over seven years (Figure 8).

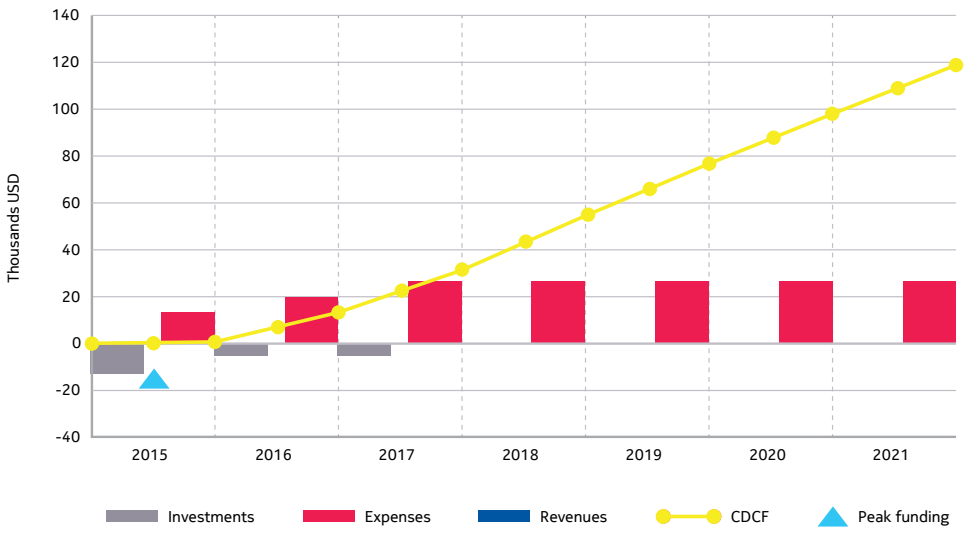
Figure 8. NPV analysis of variables for the Agency #1 business case



Benefits to the public service agency

As with the state agency analysis, Nokia Bell Labs calculations revealed that a shared public network would provide a more cost-effective option for public service Agency #1 compared to using a service provider's infrastructure and T1 links. Therefore, migration to a wireless shared public services FMO makes good business sense for a public service agency with a similar operating structure (Figure 9).

Figure 9. Shared public service network business case for a public service agency currently using T1 links



Nokia Bell Labs assumed that the Agency #1 would migrate its field offices not connected to its fiber infrastructure in stages. Based on the standard CAPEX of $10,500 and a monthly OPEX of $623 per month for each deployed link, it predicted five field offices would connect to the shared network in the first year, four would connect in the second year, and the remaining offices would migrate to the shared network in the third year.

By migrating all network traffic to a shared network under the assumptions made for this scenario, Nokia Bell Labs calculated that a public service agency with similar requirements would see a:

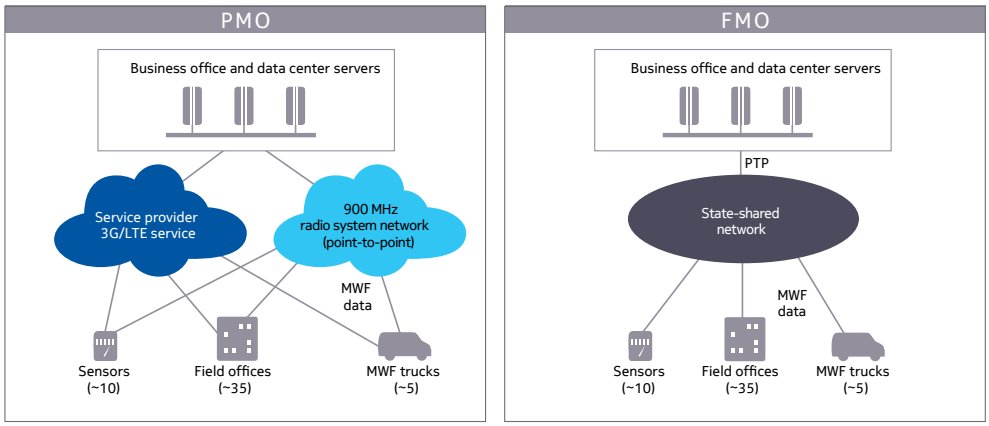
- NPV of approximately $100,000 over seven years
- IRR of 167 percent
- DPP of just under 1 year
- Total savings on overall communications costs of approximately $190,00 over seven years

Finally, Nokia Bell Labs concluded that the shared network option would deliver more benefits to the public service Agency #1 if the traffic to/from the field offices continued to grow on the network after migration.

Business Case Analysis #3: Public service agency #2

Nokia Bell Labs also created a business case analysis for another public service agency (Agency #2) currently using a private low-speed 900 MHz radio system and a combination of 3G links from service providers for its regional communications, including data communication with a mobile workforce and remote sensors. For this analysis Nokia Bell Labs assumed a PMO for the agency based on a 3G (possibly LTE in the future) wireless service provided by a wireless service provider and the 900 MHz service over the agency's private PTP wireless network (Figure 10).

Figure 10. Agency #2 PMO and FMO comparison

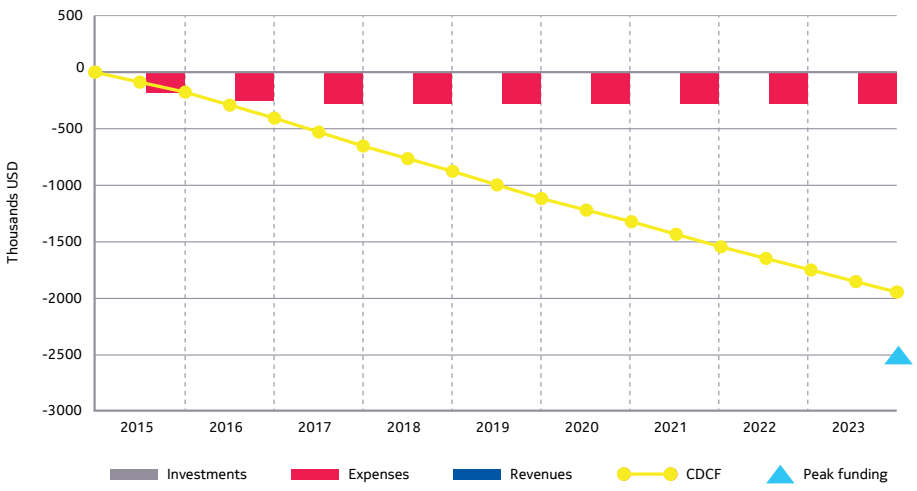


Based on this PMO, the analysis revealed that networking costs for the agency were extremely low. Therefore, migrating the agency's communications traffic to a FMO on a shared network would produce no significant financial benefit for the agency, even with the discount provided by the state for the 5.8 GHz PTP connections during the first three years of a migration.

Benefits to the state

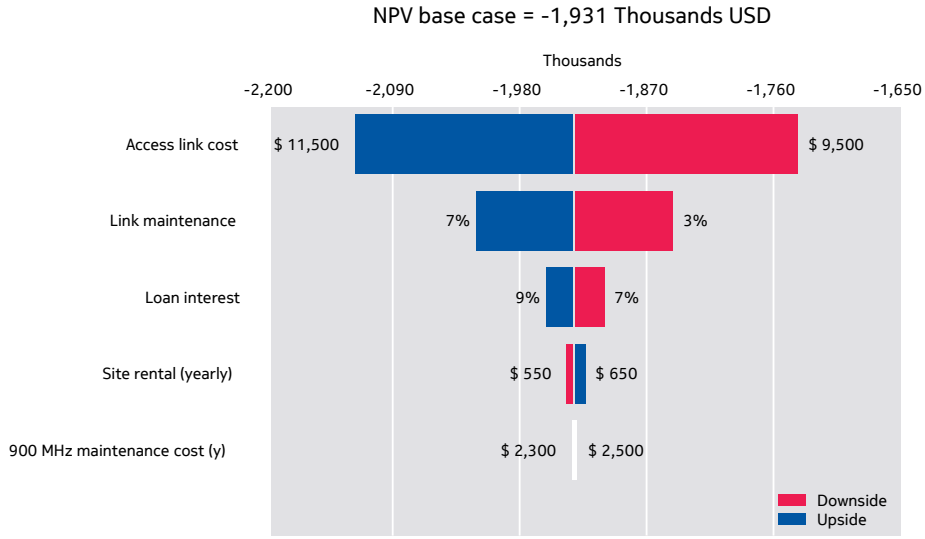
Given the low-cost network design of the PMO for Agency #2, there is no viable business case for a state targeting a shared network to a public service agency with a similar communications infrastructure (Figure 11). The only viable selling points for the state to work with when approaching a similar agency are the inherent reliability, availability, and scalability benefits of a shared network that is specifically engineered to support high QoS for critical applications.

Figure 11. The FMO for Agency #2 does not show a very positive business case over seven years



The main stumbling blocks for a state trying to attract a public service agency with a PMO similar to the one profiled under this analysis are the CAPEX and OPEX costs of the PTP links. Based on the assumptions made to create the profile for Agency #2, these costs remain too high for the low cost infrastructure needed by the agency, even with the 20 percent discount offered by the state over a shared network (Figure 12).

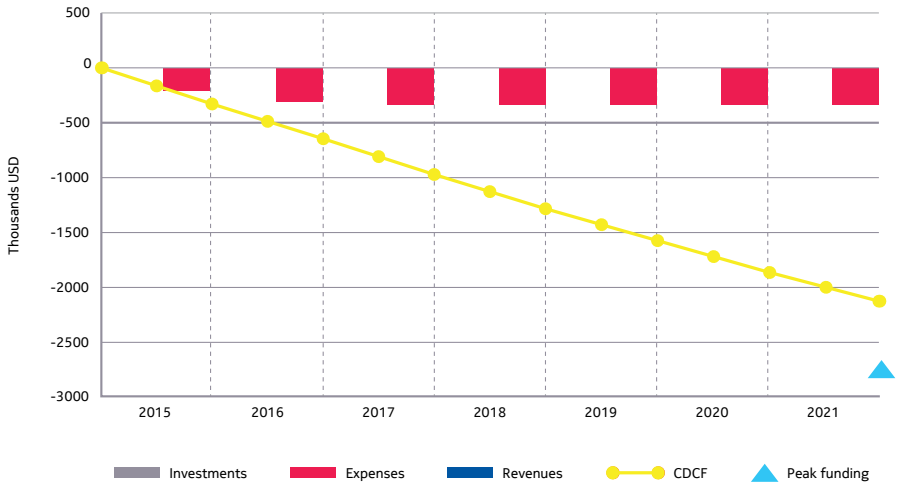
Figure 12. NPV analysis of variables for the Agency #2 business case



Benefits to the agency

As can be expected based on the parameters of the profile assumptions, a public service agency with similar network requirements will not receive any financial benefits that can justify migrating traffic to a shared network (Figure 13).

Figure 13. Shared public service network business case for a public service agency operating with low-speed wireless services



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Conclusion

The Nokia Bell Labs analysis confirmed that data networks owned and operated by a state with significant available capacity can be attractive to many government departments, agencies and other public service organizations (Table 1). Government agencies that are currently dependent on service provider networking with T1 and 10 Mb/s Ethernet access across a state, such as that assumed for the state agency analysis, will see a significant financial incentive from a shared network. More regional agencies with similar high throughput communication needs will also see financial benefits by moving to a shared network. Only agencies with very low connectivity needs served by wireless systems and a combination of 3G and LTE links will not benefit from migrating traffic to a shared network.

Table 1. The benefits of shared government networks

Key Benefits for State Governments	Key Benefits for State Agencies
• Generating additional revenues from state agencies significantly lowers the OPEX needed to manage the network • Fast RoI of less than one year, given low CAPEX needed to support additional traffic from state agencies on an existing network	• Telecom Bill reduced by 20 percent vs commercial service providers • RoI in less than two years • Increased network capacity and availability • Increased scalability to support new bandwidth-hungry applications and systems • Enabled application specific QoS

The analysis also shows that a state with a deployed IP/MPLS wide area network can leverage the network wisely, offer a compelling business case to each agency, and receive a significant return over seven years, even with a discount to each customer on the network for the first three years of operation. Taxpayers will benefit because both the state and other public entities will have much lower OPEX when using shared networks. Plus, network sharing on a public network provides all agencies with increased network availability, access to higher data rates for enriched applications and services, and application-specific QoS that are built into public mission-critical infrastructures. More importantly, a shared network approach allows state governments to recover some of the costs associated with operating an advanced network. In fact, sharing with multiple organizations may allow

some states to recoup all of their investment in the network and continue to operate it without further investments.

By extrapolation, the results point to significant benefits for a state government planning to modernize its legacy TDM-based network by migrating to an IP/MPLS mission critical network — even though it was not the focus of this Nokia Bell Labs analysis. State governments should consider the possibilities of network sharing as they plan their network transformation because it can deliver significant OPEX reductions. Plus, by taking the constraints and needs of network sharing into consideration at the beginning of the process will enable the state governments to optimize the overall network design and architecture of their new networks.

Finally, it should be noted that the Nokia Bell Labs study was based on specific network assumptions. However, in the real world, each use case is unique to the government considering a shared network approach. There are many technical and economic parameters that must be taken into account to determine the exact business impact of network sharing.

Given the importance of the financial motivation for adopting a shared network approach, a custom business case analysis is essential for determining where this approach makes the most sense and for identifying the barriers that must be overcome by the many stakeholders involved in a shared network. Nokia's Bell Labs consulting can help governments with this process. The Bell Labs team understands the technology intimately because Bell Labs helped create it. It understands how the technology affects the economics of a shared network and it can help governments make shared network decisions that will deliver immediate and long term benefits.

Acronyms

CAPEX	Capital expenditure
DPP	Discounted Payback Period
FMO	Future mode of operation
ICT	Information and communication technology
IP/MPLS	Internet Protocol/Multi-Protocol Label Switching
IRR	Internal Rate of Return
LMR	Land Mobile Radio
NPV	Net Present Value
OPEX	Operating expenditure
PMO	Present mode of operation
PTP	Point-to-point

QoS	Quality of service
ROI	Return on investment
SLA	Service level agreement
TDM	Time Division Multiplexing
VPN	Virtual Private Network

Additional Information

White Papers

“Delivering a Public Sector Shared Architecture”, Nokia

“Mission Critical Communications Networks for Public Safety”, Nokia

Links

Click here to find out more about public safety- http://www2.alcatel-lucent.com/government/

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