Operators are looking for ways to free up cash flow for re-investment. Operators can reduce recurring maintenance and operations costs with measurable quick payback projects to fund future programs or contribute to EBITA growth KPIs. As well, operators can consolidate assets to address shifting technology, acquisitions and strategic partnerships, positioning the network to grow or evolve to the target architectures.

Operators are looking for better ways to improve end-to-end Quality of Experience (QoE) to reach network performance KPIs. Specific root causes (including new application and device behaviors) may be hidden from the assurance layer or not well understood, or existing service provider resources may already be too busy with existing projects. Exclusive wireless and best-in-class fixed probes and tools are available today which, when coupled with a complete set of end-to-end network expertise, can assess and analyze flows down to the subscriber and device, and can offer guaranteed business results.

Finally, operators are trying to leverage the existing asset base to improve utilization and performance to address the data traffic explosion without increasing capital intensity.

This white paper introduces the opportunity for operators to optimize the existing network to reduce costs, thereby freeing up cash flow for re-investment, to improve end-to-end QoE to reach network performance KPIs, and to do more with their existing asset base in order to improve utilization and performance to address explosive data growth.
<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction</td>
</tr>
<tr>
<td>2</td>
<td>Current situation</td>
</tr>
<tr>
<td>3</td>
<td>Alternatives</td>
</tr>
<tr>
<td>4</td>
<td>Discussion</td>
</tr>
<tr>
<td>5</td>
<td>Optimization delivers results</td>
</tr>
<tr>
<td>6</td>
<td>Conclusion</td>
</tr>
<tr>
<td>6</td>
<td>What to look for?</td>
</tr>
<tr>
<td>7</td>
<td>Authors</td>
</tr>
</tbody>
</table>
Introduction

Much traffic has moved off the legacy networks but most of the infrastructure is still in place. Voice switch utilization is beginning to drop below 50% as subscribers drop their fixed lines and move onto mobile or IMS infrastructures. Frame relay and ATM ports are beginning to drop below 50% utilization as enterprise subscribers shift from frame relay to Ethernet access, and more aggregation or transport traffic is moved onto newer IP/Ethernet infrastructures.

The decline in fixed subscribers, as shown in Figure 1, correlates with a decline in revenue making strong mobile revenue growth essential to overall revenue growth. In a growing trend, larger operators may make more than half of their revenues from mobile, while most operators may make more than half of their operating income from mobile.

Broadband ARPU growth, the current revenue driver, is trending flat to negative as competitive pressures increase (see Figure 2). Data growth continues to outpace revenue growth, increasing OPEX pressures and impacting QoE. Several regions of the world will transfer more mobile data per month in 2014 than they did for the entire year of 2008 with mobile computing devices with embedded cellular/4G modems representing more than 52% of global mobile data traffic by 2014 (ABI Research 2009).

Coupled with a maturing mobile market with declining subscriber growth, operators will experience more challenges in achieving KPIs that are focused on earnings growth, subscriber QoE and capital intensity reduction.
Costs in a service provider environment are sticky. It’s often difficult for a service provider to identify the cost drivers inside the organization and it’s not uncommon for internal business cases to show greater than 2 years payback period for optimization projects. In the OPEX breakdown shown in Table 1, from a typical Tier-1 operator, support, leases, backhaul, maintenance and OA&M are key OPEX drivers.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Service Platform</td>
<td>0.9%</td>
<td>0.2%</td>
<td>0.4%</td>
<td>1.4%</td>
<td>3.0%</td>
<td>1.0%</td>
<td></td>
<td>5.0%</td>
<td>20.1%</td>
<td>6.9%</td>
</tr>
<tr>
<td>RAN</td>
<td>0.6%</td>
<td>1.7%</td>
<td>1.5%</td>
<td>5.1%</td>
<td>6.0%</td>
<td></td>
<td></td>
<td>5.0%</td>
<td>20.1%</td>
<td></td>
</tr>
<tr>
<td>Core</td>
<td>0.1%</td>
<td>0.1%</td>
<td>0.8%</td>
<td>1.7%</td>
<td>2.2%</td>
<td></td>
<td></td>
<td>1.0%</td>
<td>5.9%</td>
<td></td>
</tr>
<tr>
<td>New Transmission</td>
<td>0.7%</td>
<td>1.1%</td>
<td>0.4%</td>
<td>3.6%</td>
<td>1.8%</td>
<td></td>
<td></td>
<td>1.0%</td>
<td>8.9%</td>
<td></td>
</tr>
<tr>
<td>Legacy Transmission</td>
<td>0.1%</td>
<td>0.7%</td>
<td>0.4%</td>
<td>2.5%</td>
<td>1.9%</td>
<td></td>
<td></td>
<td>1.0%</td>
<td>6.7%</td>
<td></td>
</tr>
<tr>
<td>Site Facilities</td>
<td>0.2%</td>
<td>2.5%</td>
<td>0.5%</td>
<td>0.3%</td>
<td>0.4%</td>
<td>30.0%</td>
<td>2.6%</td>
<td>36.8%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>15.0%</td>
<td></td>
<td></td>
<td></td>
<td>15.0%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>2.5%</td>
<td>2.5%</td>
<td>4.4%</td>
<td>3.8%</td>
<td>15.0%</td>
<td>14.9%</td>
<td>15.0%</td>
<td>30.0%</td>
<td>11.6%</td>
<td>100%</td>
</tr>
</tbody>
</table>

New applications are consuming more resources and are behaving contrary to current traffic models, creating dynamic stress on the network. In a 2009 Tier-1 case study, high unidirectional flows from a small group of subscribers resulted in higher than planned consumption of wireless signaling and airtime resources. This behavior was hidden from the existing assurance layer until congestion occurred in the network.

New devices are consuming more resources and are behaving contrary to current traffic models. In a 2009 Tier-1 case study, a specific brand of smart phone device accounted for only 6% of the total data volume but consumed 26% of the total airtime because it consumed 52% of the signaling resources. Traffic models will need to change.

Where Ethernet is available for backhaul networks, service providers are focusing on operational issues such as service availability (QoS, latency, jitter) and synchronization to improve subscriber QoE. Where Ethernet service is not readily available, service providers are leveraging existing backhaul investments while planning their migration to IP/Ethernet. The alternatives usually include optimization or utilizing data off-load. Key considerations include:

- density of 2G or 3G deployments
- level of copper or fiber penetration
- support for legacy 2G/3G base stations
- cost or time to modify process and systems including engineering, purchasing, OSS integration and training
In the start of a growing trend, service providers are re-structuring their organization models to promote mobile-fixed convergence. In two Tier-1 organizations, wireless organizations are now responsible for marketing, base stations and MTSOs, while central fixed groups are responsible for fixed-mobile transport and the fixed-mobile core.

In the PSTN footprint, it’s not uncommon to find voice switches running at 50% or less capacity. Due to the organizational structure in most operators, the site power and utility budget may be separate from the maintenance budget. Equipment power consumption and site cooling now make up the largest cost component of running legacy PSTN switches.

In response to the maturing markets, larger operators are evaluating acquisitions to boost subscriber growth. As a defensive move, smaller operators are evaluating strategic partnerships to drive scale and capital efficiency. Both trends are driving a consolidation and evolution of the network footprint.

**Alternatives**

The three most common alternatives include:

- do nothing
- optimize the existing network assets
- transform the network by migrating existing legacy networks to a High Leverage Network™ architecture based on IP/MPLS

The do-nothing alternative, which usually means trying to increase revenues to address the earnings growth difficulties by adding new overlays on existing architectures, does not scale and increases complexity. In a Tier-1 example, the marginal cost of adding a new subscriber exceeded the marginal revenue. Most overlays attract additional OSS and operational overhead.

Optimization means reducing costs, improving QoE, increasing utilization and improving performance. It can payback in as little as three months and frees up cash for re-investment with a shorter sales cycle. Typically, optimization can decrease total OPEX by 5% to 10% per year.

Lastly, migration from legacy networks can reduce costs by 30%. However developing an internal business case and justification to management to make the major capital investment tends to be slow and complex. Furthermore, the implementation cycle for migration is longer, ranging from 1-2 years.
Discussion

Optimization starts with a straightforward and comprehensive view or assessment of the end-to-end network performance and utilization using network probes and complex software tools (see Figure 3).

The end-to-end audit includes wireless traffic monitoring down to the device and subscriber level, fixed traffic monitoring, node statistics and QoS counters. A follow-up traffic profile analysis will correlate the benchmarked network against the projected traffic forecast identify factors affecting QoE and highlight utilization opportunities in the network.

The follow-up recommendations identify the alternatives available to the customer, the costs and the financial as well as QoE benefits. Finally, the best path is implemented.
**Optimization delivers results**

The brief sampling of customer case studies below demonstrate the impact optimization can have on an operator's network.

**Case 1**

In this first example, the challenge from the customer was to reduce the costs and improve the utilization of the legacy fixed PSTN legacy network (see Figure 4). The scope of work included an assessment and analysis to benchmark the network and identify the best alternatives, trunk and line migration, switch de-growth, physical line moves, circuit pack removal and end-to-end program management.

The resulting business case analysis forecasted a NPV of $27M over 5 years with positive cash flows in year 2. The key savings drivers included power for the PSTN equipment, power to cool the PSTN equipment locations, maintenance and administration, and finally, spares. The budget line owners for PSTN maintenance and power/utilities may have different reporting lines. A services consultant can assist in putting together an end-to-end business case to identify and then implement the opportunity to free up cash flow for re-investment.

**Case 2**

“I’m paying millions of dollars per year to my equipment vendor in maintenance, and I have the feeling that I’m paying for equipment that hasn’t been used for years” (Anonymous). In this example, the scope of work included an audit, inventory and analysis of 2500 data network elements using best in class tools and probes. The analysis identified three major design areas for equipment consolidation including excess blade removal. The key savings driver included maintenance savings and equipment re-use in planned expansions (see Figure 5).

The resulting business case forecast a first year cash savings of $719K with a $2.4M cash savings per year each year thereafter.
Case 3
Revisiting a previous example from earlier in the paper, new applications created dynamic stresses in the network. In this Tier-1 example, an assessment revealed the root cause, determined to be approximately 1000 subscribers playing a bandwidth-hungry computer game on mobile computing devices with attached modems, manifested as congestion in the core.

Hidden from the assurance layer, the unidirectional flows (see Figure 6) resulted in higher consumption of wireless signaling and airtime resources. In this example, the approximately 1000 subscribers accounted for 30% of total unidirectional flows.

Figure 6. Unidirectional flows decreasing subscriber QoE

Case 4
In this final example, a customer was preparing for a network extension in Africa but needed to remove existing congestion issues and size the extension to the forecast traffic needs. The scope of work included an assessment on the radio (parameters, frequency-plan updates) and the core network, and optimization to remove bottlenecks.

The resulting business case analysis demonstrated a savings of 200K€ per year, an 8% increase in call efficiency, and the ability to increase subscribers by 10% without increasing capital intensity.

Conclusion
Optimization delivers results. In a market with declining fixed revenues, mobile ARPU not able to bridge the revenue gap and radically increasing bandwidth driving OPEX increases, optimization can:

• reduce costs with quick payback projects, thereby freeing up cash flow for re-investment
• improve end-to-end QoE to reach network performance KPIs
• do more with the existing asset base in order to improve utilization and performance

What to look for?
Look for a partner that can bring wireless and wireline probes and tools to assess the radio network down to the subscriber and device level as well as the fixed network.
The partner should bring “whole product” expertise to each optimization project. Whole product means that they understand the target or future network architectures and will ensure investment efficiency. As well, whole product means that they understand how each optimization project fits into the network and IT infrastructure and can build upon successive projects.

Lastly, the partner should bring a complete toolbox of network technology expertise. As an example, potential partners that lack a complete IP/MPLS toolbox may try to steer operators towards a VLAN architecture, although the QoS and traffic management capabilities of MPLS would ensure investment efficiency.

Authors

John Bernard
John Bernard is a manager within the Alcatel-Lucent Service Group supporting global services strategy and solution development. John has twenty plus years experience within the telecom industry and has held a number of senior positions at PictureTel, 3COM, Lucent, and Alcatel-Lucent creating global telecom solutions. He is currently supporting Alcatel-Lucent's strategy and development efforts toward eco-sustainability, cost transformation and overall business transformation solutions.

Tim Broschuk
Tim Broschuk works in Alcatel-Lucent Services Business Group as Director of Sales Support within the Network and System Integration division in Ottawa, Canada. Tim's broad background includes roles in marketing, business operations, product line management, R&D and manufacturing operations. He is currently working with Alcatel-Lucent's sales teams throughout the world to accelerate the market introduction of business impacting integration services.

Patricia Doane
Patricia M. Doane is a services marketing manager for Alcatel-Lucent in Naperville, IL. Pat's areas of expertise include software and services sales and marketing, sales training and digital media. She has a B.S. degree in Communications & Secondary Education from University of Illinois at Urbana-Champaign, and M.S. degrees in Communications and Clinical Psychology from Northwestern University in Evanston, IL and Benedictine University in Lisle, IL respectively.

Marc Jadoul
Marc Jadoul is Marketing & Communications Director in Alcatel-Lucent's Network & System Integration division, supervising the business division's messaging and communications activities. Marc has 20 years experience in the ICT sector. Since he joined Alcatel in 1992, he has held several management positions in research & innovation, product, solution and portfolio management, marketing, communications, strategy, market and business development, and solutions consulting for fixed and mobile service providers worldwide.

Márcio Nespatti
Márcio Nespatti works in Alcatel-Lucent Corporate Strategic Marketing team as a director for the Cost Transformation Marketing Program. Márcio's background includes senior roles in marketing, sales and product management both in the consumer as well as the infrastructure side of the telecommunications business in Latin America, Europe, Asia and now North America. He currently oversees global program execution to position Alcatel-Lucent as a leader in the practice of identifying customer's main cost drivers and proposing solutions that help transform hidden costs in additional free cash flow.