COMARCH TECHNOLOGY REVIEW

CONSOLIDATED BSS

OSS/BSS DATA ANALYTICS

NETWORK CONSOLIDATION FOR M&A

SDN/NFV-READY FULFILLMENT

OMNI-CHANNEL EXPERIENCE

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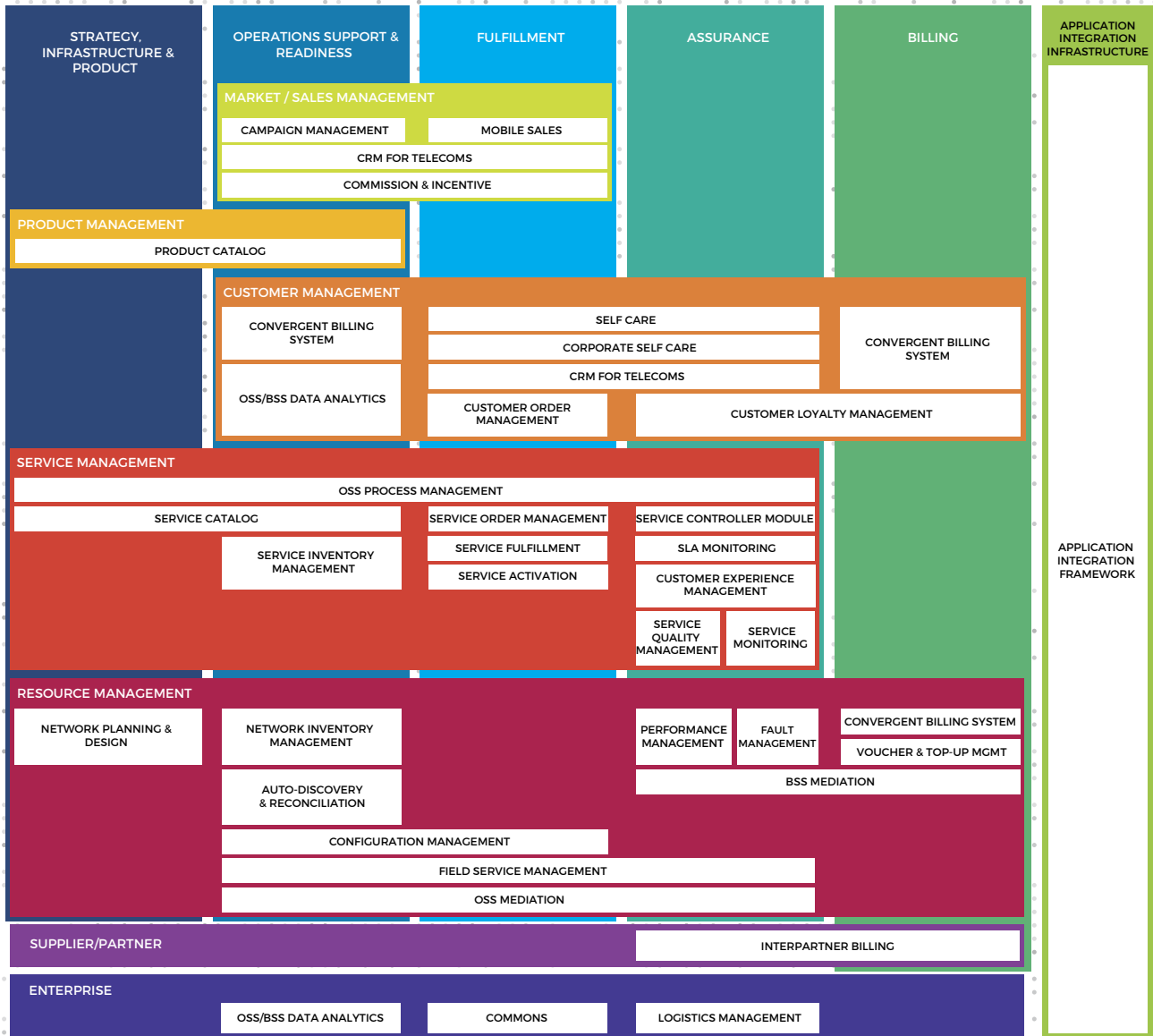IMPROVING QUALITY AND SAFETY OF IOT SERVICES WITH MACHINE LEARNING

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MARKET / SALES MANAGEMENT

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- MOBILE SALES
- CRM FOR TELECOMS
- COMMISSION & INCENTIVE

PRODUCT MANAGEMENT

- PRODUCT CATALOG

CUSTOMER MANAGEMENT

- CONVERGENT BILLING SYSTEM
- SELF CARE
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- CRM FOR TELECOMS
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- SERVICE CATALOG
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- BSS MEDIATION
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- FIELD SERVICE MANAGEMENT
- OSS MEDIATION

SUPPLIER/PARTNER

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- OSS/BSS DATA ANALYTICS
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APPLICATION INTEGRATION FRAMEWORK

LETTER
FROM THE EDITOR

MAŁGORZATA SIWIEC
Marketing Director
Telecommunications Business Unit
Comarch

According to analysts, telecoms are optimistic about potential revenues that could be generated from digital services. Some CSPs even expect this segment to account for 25% of their revenues by 2020 (Source: EY). But such optimistic results will not be achieved effortlessly.

In theory, telecom operators are ideally placed to become market leaders in the provision of digital services, because of their network infrastructure, strong brands and a developed customer base. However, legacy IT environments cannot fully support every service idea, customer and product information is scattered among dozens of BSS/OSS, and significant financial and time investments needed to launch new offers, seem to stand in the way.

The first prerequisite of any digital transformation is to become "agile". This means operators need to consolidate existing legacy BSS/OSS and automate business processes to decrease operational costs. The article on BSS transformation shows how consolidating a siloed BSS architecture enables CSPs to lower OPEX, shorten time to market, and enhance customer experience. Another process cost optimization is driving is network consolidation, so in this issue we also present a time – and cost-saving approach to merger and acquisition processes in telecommunications.

How a telco engages with their customers is no less important than managing costs. To compensate for falling revenues, operators have to understand true customer needs, as only then will they be able to maintain the loyalty of demanding digital consumers. A true omnichannel experience that may transform the service and shopping experience of telecom customers requires a 360-degree customer view, a single product catalog, and the ability to build personalized offers.

But adjusting to customer expectations has to be based on information, which is why a crucial element of a digital strategy is to become data-driven. Analytical solutions empower CSPs, providing huge sets of data and reports about how best to utilize them. Thus, in this issue you will learn how OSS/BSS data analytics and customer experience management can contribute to building integrated customer-focused operations. In two other articles, we also focus on ensuring high quality of service in M2M.

Digital service providers must be able to offer any service via any network. With the emergence of NFV/SDN technologies and self-organizing networks, telecoms now face the challenge of managing multiple kinds of infrastructures in a unified manner, which requires modern OSS tools. In this issue, we look at ways of integrating SON with OSS, and at how virtualized networks enable telcos to use the "fail fast" philosophy to experiment with new services and speed up the innovation cycle. We also shed some light on how a cloud-native approach can make it easier for telecoms to maintain and evolve their OSS.

This magazine is only a starting point on the subject of digital transformation. I also encourage you to visit our recently launched website: http://digitaltransformation.comarch.com

COMARCH TECHNOLOGY REVIEW

THE MILESTONES OF DIGITAL TRANSFORMATION

BRING YOUR BSS & OSS TOGETHER TO FACE THE CHALLENGES OF THE DIGITAL ERA

Over the past years, telecom companies have been implementing various BSS and OSS applications, to meet the demands of the market. This has led to IT environments built of dozens of separate, often even overlapping systems.

Today this has become the main challenge for telecom companies standing on the threshold of the digital era. The list of issues resulting from inconsistent, patchy BSS/OSS architectures includes lack of efficient information flow between the systems, information about the customers and products being scattered among various applications, delays in introducing new technologies and service types, long service delivery times, and insufficient network and service quality.

Communication service providers need to consolidate and simplify their BSS/OSS architectures and automate crucial business processes, to be able to offer any kind of service to any type of customer. An agile IT environment ensures greater business efficiency, higher competitiveness, shorter service delivery times and customer loyalty.

Learn more at:

DIGITALTRANSFORMATION.COMARCH.COM

COMARCH

CONSOLIDATED
BSS

OSS/BSS DATA
ANALYTICS

NETWORK
CONSOLIDATION
FOR M&A

SDN/NFV-READY
FULFILLMENT

OMNI-CHANNEL
EXPERIENCE

SON-OSS
INTEGRATION

M2M / IOT
ECOSYSTEM

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NEWSFLASH

Comarch supports Telefónica Germany with consolidation and unification of network inventory management

In March 2015, Comarch launched a network inventory management consolidation and unification project at Telefónica Germany, after Telefónica acquired the German E-Plus Group. Comarch OSS solutions will help to build a central technology data hub and provide a comprehensive view of the network, which will be used both inside and outside of the company.

The main goal of this project is to manage the consolidation and unification of Inventory Management for all technologies: RAN (Radio Access network), Transport, Core and Fixed Access network, within the new company.

Marcus Thurand, VP Network Operations at Telefónica Germany, said: *"Comarch Next Generation Network Planning helped us to start planning the target network and realize our first network consolidation activities almost immediately after the merger approval. Moreover, with this powerful solution we were able to plan the target network within two months, in an efficient process engaging only Telefónica employees. Telefónica Germany and the Comarch project team cooperated closely and intensively. We greatly appreciate the flexibility and professionalism of the Comarch team."*

He adds: *"Choosing Comarch for the OSS consolidation of network inventory was a logical consequence of the*

successful project. We are still happy with the trustful co-operation and the achievements in several OSS projects."

Vodafone Germany and Comarch reach the next significant milestone in comprehensive next generation service assurance project

Comarch, the official vendor of the Next Generation Service Assurance and Service Quality Management platform for Vodafone

Germany, completes a new release of the project with its Comarch GIS Platform Suite.

The fifth release of the Vodafone Germany-Comarch project, first launched in 2009, brings major changes in the project scope and enables further improvements to the experience of Vodafone's customers. The new extensions to the system provide the operator with tangible business benefits – they will increase user experience significantly and have a major impact on internal Network Operations Center processes. The latest system developments will allow the root cause of a problem to be identified faster, and analysis to be improved. This will translate directly into better resolution times of all detected failures, and therefore to greater customer satisfaction.

Vodafone launched its Next Generation Service Assurance OSS consolidation and transition program with Comarch in 2009. Comarch service assurance solutions have helped Vodafone transform traditional network-centric fault management into customerfocused, pro-active service assurance.
The project, initially addressed to Vodafone Germany, has been extended and now also embraces Vodafone structures in the Czech Republic and the Netherlands.

By replacing its legacy Fault & Service Management system, Vodafone Germany has reduced capital expenditure (CAPEX) by 47% and operational expenditure (OPEX) by 68%. The transformation also guarantees to lower the cost of future OSS integrations by at least 30%. Monitoring the network in the context of Comarch Service Quality Management provides capabilities to focus on customer satisfaction. The solution has now been completed, with the inclusion of an interface-rich Comarch GIS Platform suite allowing spatial data to be collected, processed, edited and deleted according to the INSPIRE directive, and enabling network services to be shared in the SOA model. Vodafone provides services for converged products (mobile, fixed and cable) and plans to monitor these services and products using Comarch NGSA.

Markus Böhler, Group Manager, Vodafone, says:
"We are very satisfied with the delivery and functionalities of release 5. Maintenance downtime was realistic and well prepared. The GeoView is a real benefit for our monitoring teams, especially for our Service and Customer Monitoring teams. We expect to further enhance our customer experience with the use of those new features."

STC awards Gemalto and Comarch to implement new IoT connectivity platform serving Saudi market with M2M application

Saudi Telecom Company (STC), the largest telecommunication services provider in the Middle East and North Africa and the leading operator within the Kingdom of Saudi Arabia, has selected Gemalto, the world leader in digital security, and Comarch, a global powerhouse specialized in the design, implementation and integration of advanced IT services and software, to implement IoT connectivity management platform. New Platform is expected to provide STC with competitive edge in the IoT and digital service space in addition to create new proposition for different market sectors.

Telecommunication and ICT services are evolving and Saudi Arabia is facing big demand for IoT and digital services. New platform will enable STC to extend its growth through the introduction of products and services to attract different Players in the internet of things echo systems using of Mobile, Fixed networks and other access capacity and to provide new innovative solution to increase revenues and market share.

Comarch announces technology partnership for M2M and IoT with Nokia

Comarch has forged a technology partnership in the fields of Machine to Machine (M2M) and Internet of Things (IoT) with Nokia.

The companies will work in the domains of connectivity management platforms as well as vertical applications services for key industries, using Comarch's broad experience in the area of M2M and its extensive IoT offer. The platforms will complement Nokia's existing IoT ecosystem to help form complete, end to end IoT solutions that will be offered to telecom and other industries worldwide.

We're keen to bring the cooperation between Comarch and Nokia to the next level. The broad scope of the agreement reflects our vast investment in software and hardware around IoT for various industries such as e-health, low energy devices and automotive over the last year, said Mariusz Lasek, Comarch Technologies CEO.

IoT applications are being rapidly developed all over the world. Nokia has the expertise and innovation strength to set up the necessary ecosystems, and believes firmly in open collaboration with partners to build future applications across industries, said Thorsten Robrecht, head of Advanced Mobile Networks Solutions at Nokia.

The Comarch M2M Platform enables mobile operators to provide managed connectivity in multi-national, multi-level and multi-operator environments. The system has been implemented by major European mobile

operators, including the Telekom Austria Group. The solution is recommended in numerous reports by analyst companies, such as Berg Insight and Gartner, and received the Pipeline Innovation Award for Innovation in Connectivity in 2013.

T-Mobile Austria selects Comarch to evolve and consolidate network inventory

Comarch has been selected by T-Mobile Austria as the provider of their new, consolidated Next Generation Network Inventory solution. The project aims to provide the operator with an end to end view of the whole network in a light, web-based interface.

T-Mobile Austria, the second largest mobile telecommunications provider in Austria with more than 4 million customers, will implement Comarch Network Inventory with a web-based user interface, to get a comprehensive view of their network and be able to manage it more efficiently. Comarch will be responsible for the system's implementation and integration. Comarch Auto-Discovery & Reconciliation module will also be implemented to ensure automated handling of any discrepancies between the data in T-Mobile's inventory system and the real state of their network.

Being the core of T-Mobile's network management domain, Comarch Network Inventory will ultimately also help the operator improve network planning, assurance and fulfilment processes, which will translate to higher quality of service and a better experience of their customers.

They say your decisions are as good as your information. This is why we believe

that superb network management and planning starts with the accuracy of the inventory data. A modern inventory tool, like Comarch Network Inventory, will therefore not only help us see the complete view of our network in a single place. Ultimately it will also help us optimize network investment plans, improve our reporting, resolve any network issues faster and in the end – improve our customer experience. This is why for this strategic project we decided to choose Comarch, who have been our partner for years and have a good history of cooperating with the T-Mobile Group in various countries – says Athanasios Avgeridis, SVP Operations Technology at T-Mobile Austria.

Comarch has been a partner for the T-Mobile Group since 2006. Throughout the years various projects have been realized in both the BSS and the OSS domain for the Group's subsidiaries in various European countries, including Germany, Austria and Poland. The Next Generation Network Inventory project carried out with T-Mobile Austria is the next step towards strengthening the cooperation between both groups.

Comarch helps Telefónica Germany automate network optimization by integrating an innovative Cellwize's SON solution with their network management environment

In December 2015, Comarch launched the SON Integration Box in coopeation with Cellwize as an extension of

the company's inventory project at Telefónica Germany.

The new integrated solution is helping Telefónica to automate the optimization of their multi-technology and multi-vendor radio network, by ensuring data consistency in the network and all the supporting tools.

In 2015, Telefónica Germany appointed Comarch as the business partner to help consolidate their legacy OSS in the service fulfillment domain. Cooperation in this area between the companies started in March 2015, with the aim of supporting Telefónica in managing the consolidation and unification of inventory management for all network domains, including radio access, transport, core and fixed access network. The ultimate goal was to consolidate network management processes in the network merger project, arising from Telefónica's acquisition of the E-Plus Group in Germany. The first stage of the inventory consolidation project was commercially launched in December 2015.

As an extension of this cooperation, Telefónica launched a Self-Organizing Network (SON) project, in which Comarch and Cellwize worked cooperatively in integrating Cellwize's SON solution with Telefónica's OSS environment. The main goal of the SON project is to increase the network quality and to automate network optimization for Telefonica's multi-layer and multi-vendor radio network. SON Integration Box ensures data consistency within the network, as well as between the network and the supporting OSS tools. The Integration Box distributes the network optimization events executed by Cellwize SON (amounting to tens of thousands per day) to the surrounding OSS environment. In addition to feeding the SON system with inventory data, the integrated solution provides capabilities to control network changes and visualize discrepancies in network settings, while also supporting system users in triggering corrective actions. In this way Telefónica can benefit from automated network optimization processes without decreasing its level of control over the network.

Comarch SON Integration Box is based on Comarch Network Inventory acting as a central data hub, with the addition of Comarch Configuration Management, Comarch Auto-discovery and Reconciliation, and Comarch OSS Mediation to integrate with the environment. The whole project was completed in less than six months, as a fully managed service solution hosted in the Comarch Data Center in Dresden, Germany.

Marcus Thurand, VP Network Operations at Telefónica Germany, said: *"Comarch has been a trusted and established partner of the Telefónica Group for years. We are glad we can also cooperate on our latest SON integration project. Not only is it very innovative and challenging, but we also expect it to bring real business benefits in the form or decreasing network management costs and improving the quality of service. Thanks to the combined Comarch and Cellwize experience and knowledge we managed to integrate the new SON solution successfully, quickly and efficiently. The SON Integration Box enables us to extend the level of automation for network optimization in a controlled, step by step manner. Now we are able to improve our operational efficiency and network quality all at the same time."*

MEDIA BROADCAST appoints Comarch as its official BSS provider

Comarch will support MEDIA BROADCAST, Germany's largest service provider for the broadcast and media industry, in the introduction of paid, digital DVB-T2 TV services through a reseller network and a web shop app. MEDIA BROADCAST currently delivers content via a DVB-T network to 7.6 million German households serving public and commercial broadcasters.

Comarch Smart BSS allows MEDIA BROADCAST to optimize the setup by using a single platform that combines CRM, a web shop, billing, voucher management, the product catalog, and service activation. The potential for fast deployment, easy customization and competitive total cost of ownership (TCO) played a decisive role in MEDIA BROADCAST's choice of the Comarch Smart BSS solution.

"We decided to choose Comarch as our partner for this exciting project because we believe that Comarch Smart BSS, combined with high quality support, maintenance, software and cloud services, will help us manage BSS processes efficiently. This in turn will enable MEDIA BROADCAST to launch and deliver the ultimate DVB-T2 service quickly to the German market," – says Wolfgang Breuer, Chief Executive Officer, MEDIA BROADCAST.

Comarch BSS solutions will be implemented at MEDIA BROADCAST as a software as a service model. The whole project includes the construction of a data center in Dresden, Germany, backed up by a disaster recovery center in Krakow, Poland. Implementation takes place in three stages, with the first completed in December 2015 and the last due to end in September 2016.

MEET US AT INDUSTRY EVENTS WORLDWIDE

Amsterdam
8-12 September 2016

International Broadcasting Convention

Listen to our presentation on Comarch Smart BSS as End-to-End solution for modern TV-, Internet – and Voice – Business Platforms.

Munich
20-22 September 2016

Mobile Edge Computing Congress

Come listen to our presentation on "Mobile Edge Computing – business opportunities and potential for Telecom Operators". Do not miss the chance to visit our stand #21.

Dubai
26–27 September 2016

Teleco Days

Comarch as a Gold Sponsor will be exhibiting at TelecoDays 2016 in Dubai. Meet our experts in our booth in the exhibition lounge and listen to our expert Bartłomiej Kordas, Product Manager talking about Digital Transformation in terms of improved customer satisfaction: how telecom operators can increase market share and create an omnichannel experience for their customers.

The Hague
11-14 October 2016

SDN & OpenFlow World Congress

Discover how Comarch OSS solutions support SDN and NFV technologies and how they can help you consolidate multiple network devices.

London
17–19 October 2016

SON Conference

Come along to our presentation "OSS transformation around SON functionalities" at 10:20am on Tuesday 18th September!

London
18-20 October 2016

Broadband World Forum

Come and listen to our presentation on "How to be Able to Experiment with New Customer Services, by Adopting NFV/SDN Paradigms" at 2pm on day 2, and visit our stand at number C45!

Singapore
20-21 October 2016

CEM in Telecoms World Summit 2016

Listen to the presentation of Comarch's Wojciech Dziunikowski at 12pm on Day 1, where you will learn about best practices and a recommended approach to managing customer experience in telecommunications.

London
3 November 2016

OSS in the Era of SDN & NFV

Listen to our presentation and don't miss the chance to talk to our experts at the event to find out how our SDN/NFV solutions can help you make the most of network virtualization.

Utrecht
10-11 November 2016

Smart Connect

Learn about Comarch IoT and M2M solutions and listen to our experts in the roundtable discussion.
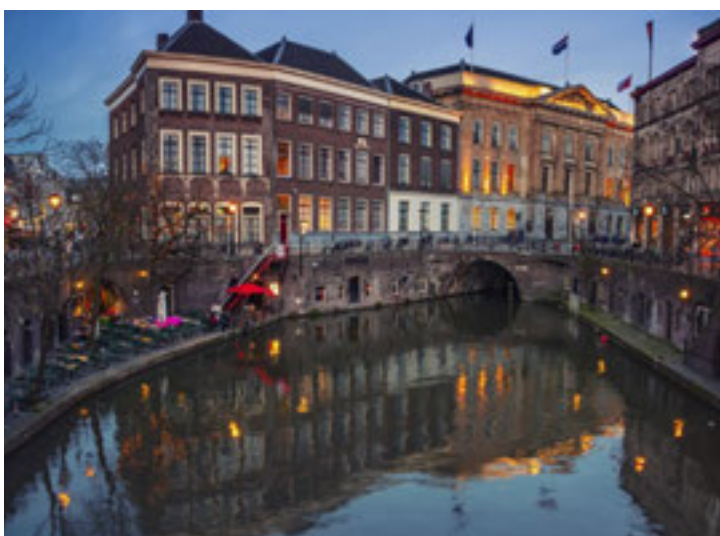
Moscow
22–23 November 2016

B/OSS Forum

Come by our stand #7 for a brief chat about Comarch portfolio and stay tuned for more info about our presentation

Rio de Janeiro
23 November 2016

BSS & OSS Latin America

Visit our stand and listen to our presentation on the 20th September at 14:40.

Comarch in the Middle East: A Strong Vision, Global Expansion

In an interview with Telecom Review[1], Professor Janusz Filipiak, founder, president and CEO of Comarch, shared his vision of the company's growth in the Middle East and his thoughts on the future of the IT industry.

In 1993, two years after receiving the title of professor, you founded Comarch, a software company. What brought you there?

Prof. Janusz Filipiak: I've already been active within the field of advanced technologies for nearly forty years now. I have cooperated with CNET France Telecom laboratories in Paris, was acting director of the Teletraffic Research Centre at the University of Adelaide in Australia and worked in laboratories in the USA and Canada. Having published more than one hundred papers on data communication in IEEE Transactions on Communications, the IEEE Journal on Selected Areas in Communications, Operations Research and six books, I believe I can call myself an expert in the field of telecommunications. What was my motivation to start a company? I would call it putting knowledge into practice and creating something big and meaningful, with an ambitious goal of expanding globally.

What did the beginnings of Comarch look like?

JF: I founded the company with some of my most talented students from one of the best technology universities in Poland. It all started in a small classroom we rented from the university. We were maybe 15 people with poor equipment, but a strong vision and incredible motivation. It seemed impossible at first, but it all went so quickly. That is probably why we're often being compared to the Silicon Valley start-ups.

You said Comarch was born as a student start-up. How much has the company grown since then?

JF: Comarch increased in size four-hundredfold in the course of 22 years and is still experiencing dynamic growth, both in income and in the number of employees and agencies worldwide.

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[1] Republished from "Telecom Review"

Today we employ more than 5000 first-class programmers, computer scientists and other professionals in both business and technology. The company's academic background and high respect for education is still key for us – all of our employees are graduates from the best Polish and foreign universities. Comarch has been recognized as a strong market player by the biggest IT analyst companies, such us Gartner, Analysys Mason and Berg Insight. We have subsidiaries in more than 40 countries and consequently develop our own R&D department, made up of high-end IT engineers. Comarch's total gross revenue amounted to 270 million Euro in 2015.

More than 300 million mobile subscribers around the world are served by Comarch OSS/BSS, and 215 million people are members of loyalty programs implemented by Comarch.

We work for some of the biggest communication service providers in the world, such as Telefónica, Deutsche Telekom, BT, KPN, Orange, Vodafone, E-Plus Gruppe, ViaSat and MTC. Our clients trust both our know-how and innovative solutions from the Customer Experience Management, M2M / IoT, Data Analytics, and SDN/NFV domains.

And how does the Middle East region fit into this strategy of growth?

JF: We've been constantly present in the Middle Eastern countries since 2004 and our importance in these markets has been growing since.

Dubai was on our radar from the very beginning. In the past few months we have expanded the team in our local office, to support the needs of our customers in the region even better. We are already working with such renowned brands in the region as Etihad, RTA, Dubai Airports, Etisalat and other local companies, and we consider each project a rewarding and stimulating challenge.

I feel our strategy of innovation, high R&D investments and orientation towards the future is a great fit for the reality of Gulf Cooperation Council (GCC) countries. Also, because of the fact that Comarch is a relatively young company, and as around half of the population in the Middle East is aged below 28, this translates into very high use of social media and a remarkable openness to new technologies.

What makes local companies trust Comarch?

JF: We are a family company – my wife and I hold more than 69 percent of the overall number of votes at the general meeting of Comarch SA, while my son and daughter manage our subsidiaries in the USA and in Switzerland. Companies in the Middle East also rely strongly on family values, which is a solid foundation for business conversations.

Customers in the Middle East value the fact that we take full responsibility for the software we sell, which gives us a very

competitive time to market and allows our consultants to solve any problem or reshape any functionality, whenever needed. The fact that we deliver BSS/OSS solutions that are flexible and configurable also allows our customers to co-create them with us, in order to best suit their unique needs.

And probably the third pillar of trust is our high focus on innovation – in a city such as Dubai this goes a long way. Comarch has very recently been awarded the most innovative BSS/OSS Provider prize for its activity in the Middle East and future cooperation and this has boosted our credibility in the region even more. We're currently running some exciting projects here in Dubai and they will, without any doubt, shortly contribute to improving the quality of life of the city residents.

Have you been to Dubai many times already?

JF: Yes, because of the nature of our business, I travel a lot, to meet customers and employees in other countries where Comarch is active. I'm extremely fond of visiting this place; I've been here several times already.

Dubai is a perfect spot to discuss and develop disruptive trends, such as Smart City technologies or the Internet of Things. Besides, I believe that Expo 2020 will set unprecedented standards in the domain.

In fact, during my trips to Dubai I often think that there is in a way a parallel between this city and Comarch. Dubai was once small, but now it is a major business hub and a global city with a unique entrepreneurial climate – almost like Comarch, which grew from a start-up into a big IT enterprise. Comarch has been compared to the Silicon Valley start-ups, while Dubai is without any doubt the Silicon Valley of the Middle East...

It just seems that Dubai is the perfect place for business.

So what are your plans for the coming years?

JF: I am sure we need to follow our strategic direction of organic growth. This has proven to be very efficient in the last couple of years and I think we should keep to this path. I believe our strategy of geographical expansion, will also pay off. Now that we have branches in all the major markets in the world we are able to do business even faster and better than before.

Aside from expanding geographically, we are currently investing a lot in developing new, very innovative products responding to the current needs of telecoms companies worldwide. And I am confident that our investments in solutions related to Big Data, the Internet of Things, telemedicine, loyalty management and our strong focus on knowledge and innovation, will pave the road to the success of our business.

Launching Innovative TV Services in Austria with Comarch Smart BSS

INTERVIEW WITH DOMINIQUE LOEPFE, PROJECT MANAGER AT ORS / SIMPLI SERVICES

Comarch: What did the process of transition from DVB-T to DVB-T2 in Austria look like?

Dominique Loepfe: This was a step by step approach. We started by testing our systems in Austria´s southernmost county called Carinthia, putting a lot of effort into keeping residents informed about what was happening, without overwhelming them with technical details. The process involved enhancing our transmitters with T2 capable systems, as in most of the areas we still transmit DVB-T2 and DVB-T for the main ORF channels. Then we launched an attractive campaign to encourage people to switch to the new television standard. This functionality was implemented into the wholesale, webshop and CRM systems.

In the end, the direct retail market was the biggest driver, and brought in the highest number of customer registrations.

Following our success in Carinthia, we applied the lessons learned there to Tirol and Vorarlberg, starting our campaign at the beginning of 2015. Transition is still taking place in Salzburg and Upper Austria, and in the autumn we are planning to move into Vienna and Lower Austria. This latter will be the biggest transition of the entire project, and we expect to get more than 100,000 registrations within a very short period of time. It means that the BSS system must operate at full capacity, as any failure in the system would cause big problems in the transition process

What challenges have emerged as a result of this transition for the ORS group, especially from the business perspective?

DL: The biggest challenge has been to inform the people about what is happening, at the right time. Every viewer will need new equipment to be able to continue receiving terrestrial television. To this end, we created specific campaigns offering additional HD channels, free of charge, with their new hardware. For example, viewers who take advantage of free registration can watch up to four HD channels for free, and can obtain their set-top boxes and modules at a discount during transition. There are other special discounts on offer during registration too.

Put simply, we offer a straightforward registration process, with the aim of making the switch to DVB-T2 as attractive as possible for customers.

How did the Comarch team address these challenges?

DL: The Comarch team has been fully involved in this digital switch over (DSO) project because they are responsible for configuring all the necessary functionalities into the wholesale portal, webshop and CRM Application

Since we have many registrations within a short time period of time, especially when the campaign is running, system performance is critical, in terms of overall operation and capacity. Any lack of performance will result in complaints from the retailers.

Security ranks alongside performance, since the wholesale portal is the key sales channel for this transition. Working with Comarch, we implemented specific functionalities to make this portal as efficient and secure as possible.

What features of Smart BSS implemented in simpliTV support its use by DVB-T2 operators?

DL: We have implemented the campaign functionalities in the webshop and wholesale portal. CRM is needed to migrate free registration into the simpliTV product.

What are the prospects for business development?

DL: As mentioned above, our next big project is the digital switch over in Vienna. We are expecting many registrations from this stage of the transition. Those who sign up will form our customer base in regard both to future business and to establishing and developing the simpliTV brand in Austria.

About ORS / simplitv

ORS was founded in early 2005, originating from ORF's Broadcast Engineering. 60 percent of it is owned by ORF and 40 percent by Medicur Sendeanlagen GmbH which, in turn, is part of Raiffeisen group. In 2012, simpli services GmbH & Co KG, a subsidiary of ORS, was founded for the dissemination of the DVB-T2 TV product simpliTV. In 2015, ORS comm acquired a stake in the video on demand platform Flimmit. In recent years, ORS group has evolved from a transmitter network operator into a "Digital Content Gateway" and as a reliable partner, guarantees perfect "content transport" via cable, IP, satellite and antenna.

> **"** With a successful history of previous cooperation, Comarch was a natural choice of a business partner to grow our business with. Aside from offering high-quality BSS tools, they showed great flexibility in meeting our business requirements. The wide range of professional services, from hosting to daily operations management, takes a huge burden off our company and enables us to focus on the core of our business, while the cooperation and pricing model we established with Comarch lets us flexibly develop our business without too many risks.

kpn

Comarch B2B Solution is tailored for managing all processes related to the business customer segment. It enables providing various selling strategies to each company size, delivering and supporting large numbers of customized products and services, managing service level agreements (SLAs) and handling of complex fulfillment processes.

The solution is built around Comarch BSS tools: billing, customer management and self-care, with the addition of product catalog and service fulfillment.

Thanks to the possibility to implement in a hosted managed services model, with usage-based pricing and Comarch KPIs in key areas, the solution ensures optimized costs and improved business customer experience.

RESULTS

CAPEX / OPEX reduction thanks to full outsourcing

Minimized investment risks thanks to usage-based pricing

Improved customer experience thanks to self-service and personalized offers

BSS Transformations – a World of New Challenges and Opportunities

BARTŁOMIEJ KORDAS | BSS PRODUCT MANAGER

H ow to transform business support systems to become a Service Provider of Everything

New digital services, IoT and M2M mean ever more complex telecom product and service portfolios, often built in cooperation with partners from vertical markets, such as health, automotive, utilities and others. "Service Providers of Everything" must learn how to handle this, as traditional revenue streams are either declining, stagnating, or will begin declining in the near future, as shown below.

Either route requires the highest degree of simplification and agility, as OTT players require from CSPs the ability to adapt and introduce new services extremely quickly. New, complex offerings, often bundled with services from verticals, must be released in a matter of days, existing offers may be retired, and service providers have to follow market trends without overwhelming the customer. Last but not least, and because services are delivered

> " Communication service providers (CSPs) must be able to react to market demands quickly and without significant changes in IT systems. If they really want to surf the "Fourth Wave" (digital services), they must compete with OTT players or try to collaborate with them.

in partnership, the right settlement process must be in place. Accurate invoices must be issued to customers and the partners that deliver service bundle components.

How Solid is the Foundation?

Communication service providers may own the infra-structure or OSS/BSS systems, as well as widely recognized brands. Customers trust them because of their long-lasting billing relationship, and they can position themselves as the winners in the digital world as long as they can operate and innovate at the speed required by the market.

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> *On the one hand there is a strong need for new network technologies, such as SDN/NFV 1. On the other hand, smart business support systems that drive innovation are required.*

Many CSPs, including the largest network operators, still depend on siloed legacy systems, where separate stacks support market and / or customer segments. These systems can and should be consolidated, and the main factors driving this are:

- Poor time to market: it is difficult to achieve high speed in service launching and delivery, even for offers within a single silo. This is due to architecture complexity, risks or expected ROI obstacles to innovation. Having a single system allows innovative offers to be created and launched in a much shorter time.

- Operational efficiency and customer satisfaction: in the siloed, legacy environment, operational staff must switch between different systems to serve the customer. For the customer this means waiting and drives churn, while for the employee the result is low performance and frustration. Consolidated BSS helps improve both workforce performance and customer experience.

- Maintenance and development: Capital expenditure (CAPEX) and operational expenditure (OPEX) suffer significantly from lack of BSS consolidation, and upgrades to the newest software versions in siloed systems are extremely difficult and risky because of the amount of instances to be upgraded and the level of customization in in place. Consolidated BSS means easier maintenance and deployment, which translates directly into lower OPEX and CAPEX.

One BSS is the Answer

Integrated, harmonized and industry standard-based BSS/OSS architecture addresses these challenges. Some organizations may opt for consolidation of services, with separate stacks for specific customer segments, while others will choose complete integration. The largest operators may even have one BSS/OSS stack shared between multiple countries.

The selected approach depends on each company's business organization and culture. In some cases, serving large customers via a separate silo may be more efficient. For large corporate customers, the CSP may assign a dedicated customer service agent, or whole structures may be dedicated to enterprise customers.

This also applies to IT, especially front-end applications. For instance self-service systems designed for business customers should be capable of handling mass offer changes, dedicated reporting capabilities etc.
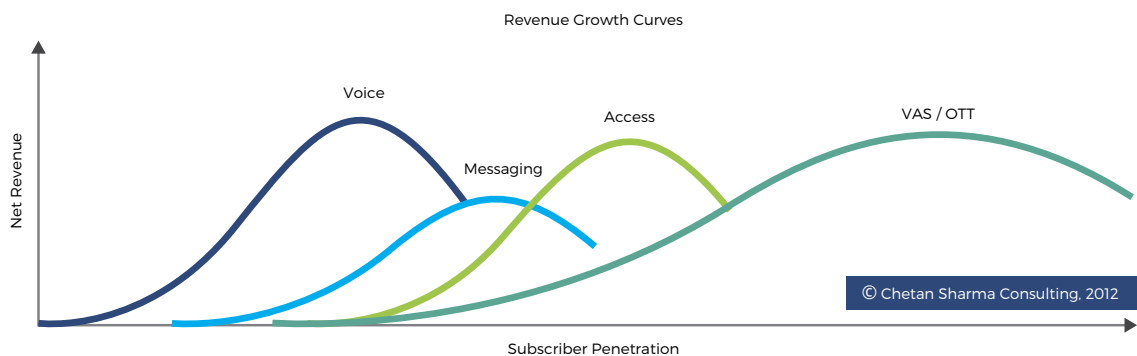

Fig. 1. Mobile Fourth Wave (Source: Chetan Sharma Consulting, 2012)

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1 The SDN/NFV technology and the recommended approach for CSPs to its introduction in a step-by-step manner are widely described in other Comarch white papers: The Business Potential of NFV/SDN for Telecoms and Software Defined Networking: How BSS/OSS Tools Can Help Unleash Innovation, http://bit.ly/2c44aU5

Comarch BSS Transformations – Selected Business Cases

One of Comarch's Tier One customers in Scandinavia chose a more radical approach to transformation, with no silo and all services and customer segments in a single BSS/OSS. The project began with consolidation of IT systems across three countries, initially limited to business customers. The scale of the challenge was enormous, as it involved three mature organizations, each with their own business processes and IT architectures, and three different networks. To make future operations even smoother, residential (B2C) services were added.

The solution built around Comarch Product and Service Catalogs, enabling catalog-driven Customer Order Management and Fulfillment, was the key to success.

Time to market for new services, with consistent and central business processes and IT systems across the whole organization, was significantly shortened, and human time required for the order-to-delivery process reduced by 90%.

Another example is from the Benelux area, where a Tier One CSP chose Comarch for the transformation of business support systems for enterprise customers. The project represented a multi-country challenge, with scattered legacy BSS to be replaced with a consolidated solution, with a strong focus on CAPEX and OPEX reduction, in parallel with Net Promoter Score (NPS) improvement. The result was a huge success, measured by a 56% increase in CSP Promoters among the operator's large, strategic customers. The solution and transformation process proved themselves for the operator's largest customers, which had strong requirements for tailored services and dedicated SLA agreements. The size of the installed base was increased tenfold without significant architectural changes being made, proving stability and scalability.

One BSS: How to Get There?

The change requires a long-lasting and challenging transformation process, especially for large organizations where legacy systems have been developed and customized for decades. There are two main stages to a BSS transformation. The first one, usually carried out internally, is changing the way of thinking and operating within the organization. The second involves the transformation of business processes and consolidation of IT systems.
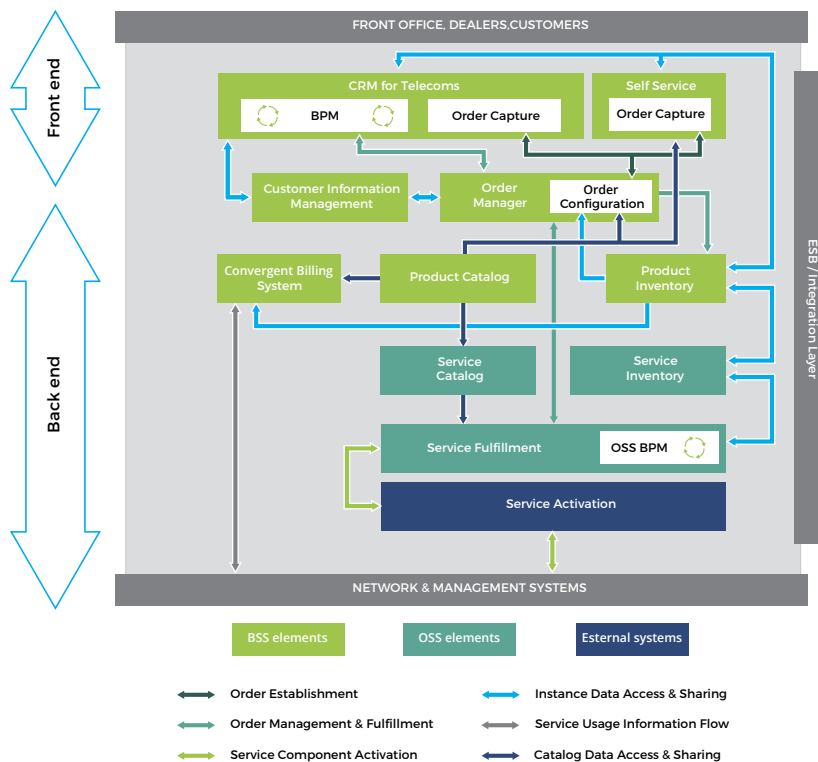

Fig. 2. Comarch solution for a Scandinavian Tier 1 CSP

Digital transformation is the goal, but do not lose sight of legacy. Legacy transformation can help fund innovation and can enable differentiation — local presence.

Depending on the complexity of IT architecture and business processes, the consolidation process is usually spread over time. Existing legacy systems may be marked for immediate replacement (they block innovation, so should be transformed first), freeze (no further development, only maintenance), or fit for purpose (already transformed, or no need for transformation).

For a CSP it's important to choose an experienced partner and the right IT solution for the second stage. The solution should support the most common industry processes, without the need for customization. Such results are guaranteed by Comarch's catalog-driven Order Management.

Why Choose Comarch for a Partner in Your Next BSS Transformation

With vast experience in many complex telecom transformation processes, a complete portfolio ready to meet the demands of today's world, and testimonials not only from the telecommunication sector but also from verticals

such as retail, finance, banking, automotive, public sector, healthcare, transport and logistics, Comarch is the right partner for your next BSS transformation.

We offer order management and fulfillment processes fully driven by definitions in a central product and service catalog, trusted and proven convergent billing to support all possible types of services in real time, modern self-service tools to let your customers manage themselves and the necessary know-how to support the transformation. Comarch bases its telecommunication solutions on off the shelf products that are fully integrated and ready to be deployed by the same partner that built them, and has been improving them ever since.

A harmonized and consolidated BSS/OSS environment is clearly a demand of the digital, customer-centric world. The stakes seem high, but, with the right plan and partner, the transformation process can be executed smoothly. The reward is increased performance and efficiency, improved customer service, seamless interactions with customers and partners, and optimized time to market for new offers.

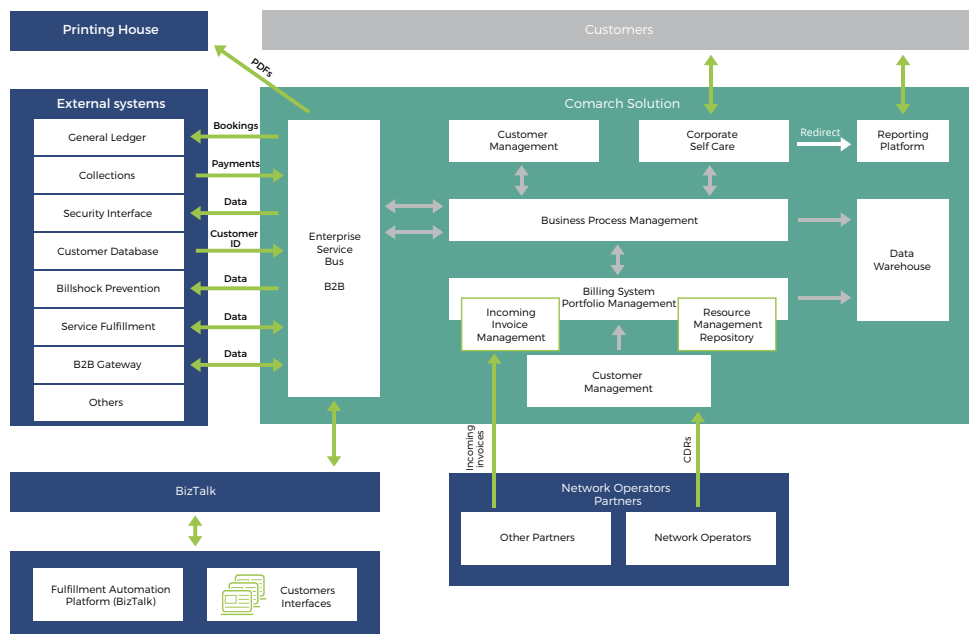*Use external innovation. Use co-creation. Customization is the enemy of efficiency.*

Fig. 3. Comarch solution for a Benelux Tier 1 CSP

Applying an Omnichannel Strategy in Telecommunications

BARTŁOMIEJ KORDAS | BSS PRODUCT MANAGER

U sing more than one channel is nothing new.

Twentieth century retailers such as Sears were successfully delivering their goods via both mail order catalogs and physical stores. Online ordering let retailers switch to a multichannel strategy, while social media platforms have become full self-service channels.

Multichannel or Omnichannel?

Multichannel focuses on launching additional channels to serve customers, very often with different departments using different technologies to execute different strategies for each channel. Omnichannel is about seamless customer experience, regardless of the channel. Customers can choose the most convenient channel, and switch to any other channel within a single transaction without repeating actions

The number of channels is the same in the multichannel and omnichannel approaches, but omnichannel puts the customer at the center and introduces seamless communication across the channels.
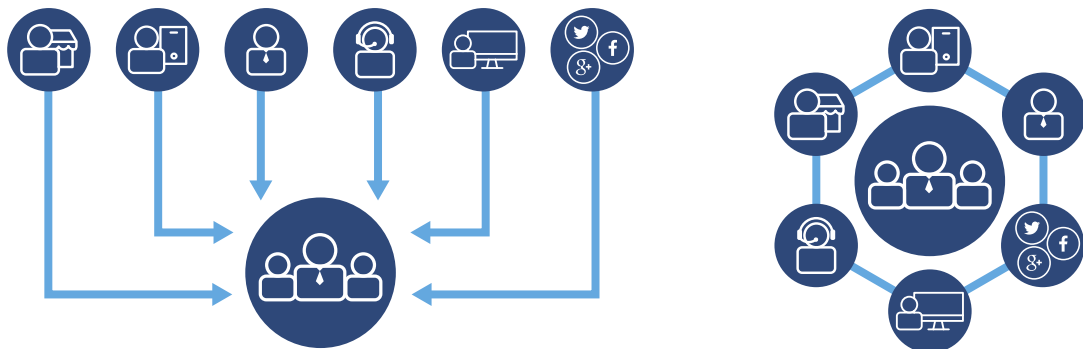
Fig. 1. The Difference Between Omnichannel and Multichannel

What is an Omnichannel Strategy?

Several elements are needed to describe a true omnichannel strategy, but the key pillars are consistent customer information and identification across channels, combined with channel switching.

Omnichannel in Telco – Why Now and What are the Benefits?

Implementing an omnichannel strategy in telecoms must take into account this industry's complicated order management processes and the strong customer focus required for data analysis that will lead to successful recommendations. yet, regardless of the complications, omnichannel is the only possible approach for a telecoms company that wishes to stay on top and be ready for the future.

TMF's Omnichannel Introductory Guide[1] suggests that benefits can include reduced churn and improved NPS (due to better service provision), lower operating expenditure (the cost of a single customer contact via an online service is less than $0.1, compared to more than $12 via a call center), improved internal efficiency (thanks to automated processes), and increased business (up to 18 per cent, according to Analysys Mason). In addition, Northstream found that omnichannel CRM could save mobile operators $4.6 billion.

Key Features of a True Omnichannel Solution

Channel choice and channel switching

A customer may see an ad for a new offer on Facebook, then be redirected to an e-shop. After comparing the offer with others, the customer may contact the call center, finalize their order online, and collect in the store, all with no need to repeat any action. The same rules should apply to service. A customer who starts a complaint via Twitter should be able to complete registration of their grievance using the same channel, and then to choose how to track the status of their complaint (for example, by contact with a call center, or via a different online channel). Crucially, the customer must receive consistent information, without having to repeat actions.

Access to consistent customer data – a 360-degree view

To assure a truly seamless channel switch, activity of every customer in every channel must be available to agents in other channels, as well as to the customers themselves. A 360-degree customer view, accompanied by big data analytics, helps agents deliver customer service consistently. If a customer calls to complain of recurring dropped calls while travelling by train, a call center agent should already be aware of the issue and be able to propose a solution. A complete customer view requires not only integration of data from various systems but also a single customer identity, as some customers are represented by self-service username, CSP customer number and social media identifiers, among others.

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[1] https://www.tmforum.org/resources/standard/ig1125-omni-channel-introductory-guide-r15-0-1/

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Implementing an omnichannel strategy in telecoms must take into account this industry's complicated order management processes and the strong customer focus required for data analysis that will lead to successful recommendations.

Contextual customer experience

The omnichannel strategy should be adjusted to the specific purpose of each channel, and all channels should be tuned according to specific stages of a customer journey. The strategy should also be influenced by the type of service a given customer is using, or their recent history of interaction with the CSP. In this respect, post-sales servicing is at least as important as online shopping, because it increases loyalty, decreases churn and boosts sales in the long run.

Product catalog management

Product catalog is a key part of any omnichannel solution, and must be capable of synchronizing consistently across all channels while acknowledging that some instances are specific to one.

Personalization and recommendations

Recommendations focus on presenting the right offer to every prospective or existing customer, while personalization is about "live" interaction based on customer behavior and service status. The latter can also take into account factors relating to specific actions and stages in the customer journey.

Two Ways to Implement an Omnichannel Strategy

There are two approaches to implementing an omnichannel strategy.

The first is to build a separate IT layer over the existing architecture, which often means maintaining a legacy backend divided into silos, thus making it impossible for omnichannel to be implemented fully. For example, it may exclude switching between channels while shopping for new services, because some business processes may remain channel specific. Advantages of this method are that it simplifies the introduction of new channels, usually includes a unified shopping cart functionality and a common commercial product catalog, requires much less time and effort than more radical approaches, and can be efficient, depending on existing IT architecture.
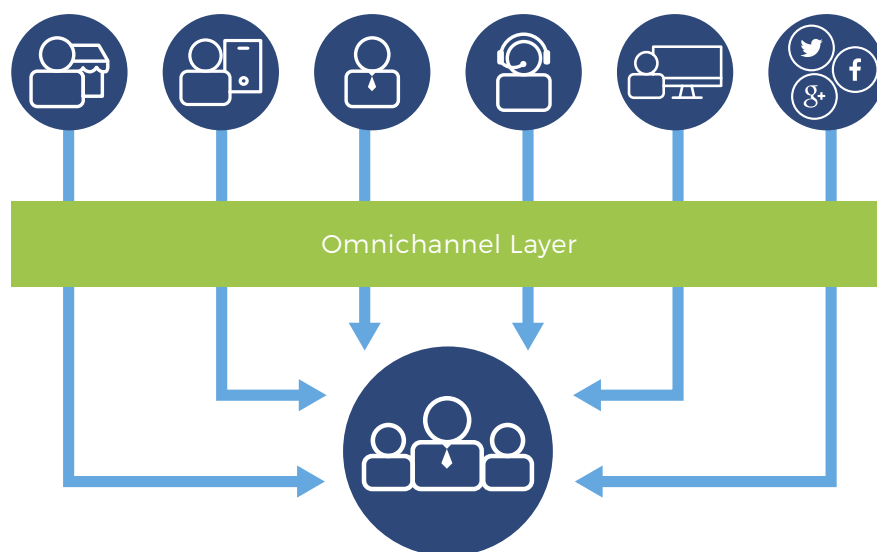

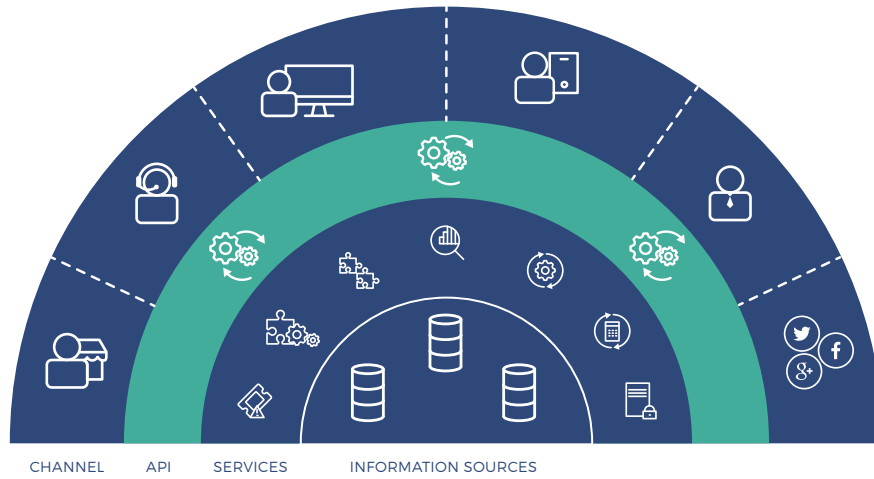Fig. 2. Multichannel with an Omnichannel Layer

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Fig. 3. Logical Layers of Comarch Omnichannel

CHANNEL   API   SERVICES   INFORMATION SOURCES

Another strategy is to build from the ground up, transform legacy BSS tools, and introduce a fully harmonized, layered architecture. The most important feature of this approach is clear separation of the frontend and backend layers. The service layer includes common product catalog, billing, recommendations, analytics and business processes. It is the latter that constitute the essential element, as shared business logic supports channel switching during a single task, because it executes the same process. Shared information sources ensure that all channels access the same data. The backend is exposed to frontend channels via a RESTful API layer.

The Comarch Approach to Omnichannel – Business Processes Shared by all Channels

Comarch builds its software using the more comprehensive omnichannel approach, which makes our BSS solutions omnichannel by nature. We have long understood that sharing business processes across all channels is a key to building great customer experience. One example is the architecture created for a Tier 1 customer in the Benelux area, where customer management, self-service, e-mail and third party self-service portals are served by a shared layer of business processes. The APIs to business processes are exposed to external channels, allowing for switching to occur naturally.
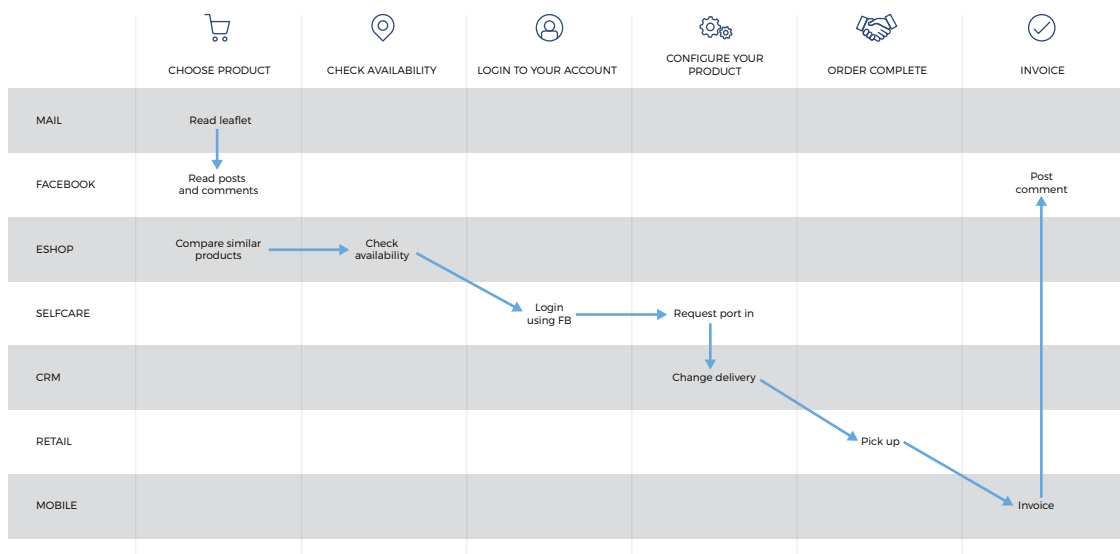

Fig. 4. Guided Commerce Journey in an Omnichannel Solution

Is Omnichannel a "Must-have" for Telecom Operators?

AGNIESZKA CZULAK | BSS CONSULTANT

When the omnichannel approach was first brought up 2007 to 2010 (depending on different sources), everybody was very enthusiastic about it.

Nowadays it is still highly popular, with many active supporters of omnichannel marketing, customer care, sales and operations, but there are also those who perceive it as a mere buzzword that has little to do with reality.

The available source material about the use of omnichannel in telecommunications concentrates on theory and vision, without showing too many case studies of its practical implementation. Omnichannel enthusiasts emphasize that it can significantly transform and improve the experience of CSP customers, becoming a real game changer on the digital market. The opponents, on the other hand, say that telecoms are not properly equipped to follow through with the implementation of omnichannel strategies, that brands spread themselves too thin across multiple channels, leaving consumers unsatisfied.

A Telecom Customer Journey Without Omnichannel

In order to answer these questions, imagine that you woke up today in a new apartment, having relocated to a new country for business purposes. You want to keep in touch with family and friends but not via data roaming, so you start checking the fixed and mobile offers from local providers. You find an interesting offer on the internet: a "quad-play" package with internet, television, telephony and mobile services, delivered by Rapid Telecom. After you fill in your personal data and other details into an online form and click "submit", a pop up window informs you that you need to go to the operator's physical store to finalize the order. Work commitments mean you have to wait until the weekend to have this face to face conversation.

When you arrive to the store, the assistant asks you to once again provide all your personal data and describe the details of your selected offer, including details and options, in order to start the ordering process. The options available at the store seem to be different to those you saw online (for example, no VoD).The order is stopped and the assistant calls the service desk for more details. The service desk needs to register all your personal data and subscription details for reporting reasons. After answering yet another set of questions, your order for the "quad-play" package with VoD is placed, with the set-top box due to be delivered to your office address. Although the whole process ended successfully, you still leave the store disappointed and angry that placing a simple order took two hours.

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Unfortunately, not many telecom providers are finding the time to provide a true omnichannel experience. Marketing is there, but internal processes are falling behind.

Two days later the parcel still hasn't arrived, so you call the contact center to check the delivery status. The gent tells you that they are unable to track the delivery progress in their IT system, nor do they have a Facebook page or a self-service customer portal where you could raise a ticket.

Two weeks later, after finally receiving your set-top box, you want to start using the new services. A few days later you notice that your internet connection is too slow, so you contact the call center once again to modify your internet speed. It takes half an hour to process all the changes, because the previous subscription needs to be terminated before a new one can be started.

By this stage, you already know that Rapid Telecom is not a provider you would recommend to your friends, due to time-consuming customer care and ordering processes.

The Added Value of Omnichannel in Telecommunications

Today's consumers are always on the go. They move from city to city, country to country, for business or personal purposes. They are used to 24/7 services, and they don't

have time to go to a point of sale or "hold the line" for a long time before reaching a call center agent. The frustrating experience presented above could be improved by adopting an omnichannel approach, which ensures that all offers, sales and customer service processes, on any device and in any channel, are integrated.

Shoppers require a seamless ordering process, whether they are buying through a website, via a mobile app, or in a physical store. According[1] to Optymize, eight out of 10 consumers use three or more channels to reach their carrier for customer service. This is why the offer presented in every sales channel (website, social media, web shop, etc.) needs to be consistent, complete with all available options and clear pricing. Activation of services, based on various technologies, often delivered by multiple providers and sold in one bundle, needs to be smooth and seamless to your clients.

Customer journeys have become dynamic, as shoppers often jump from one channel to another, perhaps starting an order process online and finalizing in store. The relationship between the consumer and the CSP (communication service provider) has evolved to become much more personal than it used to be. This is why, in order to be able to respond to market requirements, telecoms companies need to be able to adapt their offers to the way subscribers consume services, and to their habits. Customers also expect to be able to interact directly with other users via forums, social media and other information exchange platforms, which is something each service provider should provide. Furthermore, customers require consistent service, and expect agents to have instant access up to date and centralized data, stored securely.

From the CSP's perspective, the increasing variety of subscriptions, falling ARPU (average revenue per user), and the necessity to achieve consistency in responses across multiple channels all require increased customer service automation. Gartner[2] suggests that, by 2020, 25% of customer service and support operations will integrate virtual customer assistants that simulate conversation or include chatbots in the messaging apps.

This helps customers and companies to save time and money by enabling faster, easier and more accurate customer self-service. Thus, the direct benefits of delivering omnichannel support can include greater customer satisfaction, richer and longer-lasting relationships, and the increased loyalty of customers who receive efficient support.

[1] Omni-Channel Trends in Wireless Telecom and the Impact on Sales Operations,
     http://optymyze.com/learning/sales-performance-white-papers/11-omni-channel-trends-in-wireless-telecom-sales-operations/
[2] Eight High-Value CRM Projects for Great Customer Service Right Now, Gartner, 19 July 2016

Where are Telecoms Companies on the Road to Omnichannel?

Over the last decade, the retail, banking and service industries have experienced a revolution towards omnichannel. Telecoms companies lagged behind, but they may now be on the way to catching up. The business priorities of telecom companies seem already defined – keeping up with customer needs and the technological progress are on top of the list. Unfortunately, not many telecom providers are finding the time to provide a true omnichannel experience. Marketing is there, but internal processes are falling behind.

Many telco departments seem more overwhelmed than excited with the omnichannel challenge. Reasons for this attitude include misinformation about the extent of required changes, false assumptions that it is better to focus on new sales, customer service provision being unaligned with consumer expectations, and so on. Now Interact[3] surveyed 54 of the leading US and European telcos, and found that, although many companies have invested in modern contact channel technologies (such as online chat or offering callback as an option), they aren't using online consumer data to improve the customer experience, e.g. by offering personalization of the offered services. Call center agents still don't have any real-time insight into their customers' online journeys. Furthermore, very few telcos suggest the best contact channels to their customers in a proactive manner (for example, by proposing that new services are ordered directly via self-care,

without having to call customer care). Customers are often forced to seek out information via one channel, then jump to another to finalize their transactions.

Another mistake is to apply a multichannel approach instead of omnichannel. In this case, contact centers are able to interact with customers via different phone-based and digital tools such as email, web chat or social media, including channels typical for both self-service and assisted service. However, each interaction is very often treated separately, rather than as one in a series of connected steps. In consequence, they have limited influence on the overall customer experience.

It seems, however, that CSPs have recently matured and started to provide a unified offer across all channels, to improve the coordination of marketing actions, and to make new offers more visible, both online and in store. Operations, such as seamless service activation, easy subscription package modification, and consistent customer support to cover inquiries related to services and new technologies, remain to be improved.

Internal decisions can also influence a telecom company's success or failure in terms of customer service. For example, social media engagement can be managed by the marketing team, by a dedicated social media team, or by the customer service team (focused on omnichannel customer service). It is usually the latter approach that brings the highest level of customer satisfaction.

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[3] The illusion of digital success in the telecommunications industry, Now Interact, 2016

Towards True Omnichannel

Let's turn the clock back. You woke up today in a new apartment. You checked your e-mails and found a message about a "quad-play" offer, so you logged in to an e-shop using your social media account, to check the details. After discussing the pros and cons with the community of users, and having checked similar offers, you decided to order the full package. All the steps in this process are automated, so you need provide only personal data. You do not have to wait for postal delivery of the set-top box, as you can collect it today at the store and start using internet and TV this evening. Confirmation of your subscription, including the data you provided, is visible in the mobile app. If you need to modify the service, you can do so in just a few clicks via your smartphone. Customer care agents at Rapid Telecom can see all information about your customer journeys, because all data is synchronized intelligently.

Based on our market study, it is key for CSPs to provide a real omnichannel experience to customers, who need to feel that their time is valued, that they can order personalized services, and that they will get a response to their inquires via their chosen channel. The omnichannel strategy needs to be applied not only to sales or marketing, but, even more importantly, to internal and external processes that need to follow customer journeys. In order to satisfy increasingly demanding customers, and to remain competitive, omnichannel is a must. Telecoms companies, though, must back up their willingness to adopt this approach by making real changes.

How Telecoms Can Become Pro-Active in Managing Customer Experience with Integrated BSS/OSS Analytics

WOJCIECH DZIUNIKOWSKI | HEAD OF INTEGRATED ASSURANCE & ANALYTICS PRODUCT MANAGEMENT

Customer experience is one of the main battlefields in the competitive telecommunications market.

Communication service providers (CSPs) face over the top (OTT) players, mainly from the IT world, which are usually very flexible in adapting to the market. Mobile applications provided by companies such as Facebook are light, easy to use and force constant customer interaction with the service provider. Compared to them, an SMS sent by a CSP about a new promotion, seems to be quite modest.

But telecoms companies are well positioned, as they provide access to the network. They have a multi-channel footprint, a direct billing relationship with their customers, and access to detailed information about them. CSPs could position themselves as a value-adding middleman in the increasingly complex market.
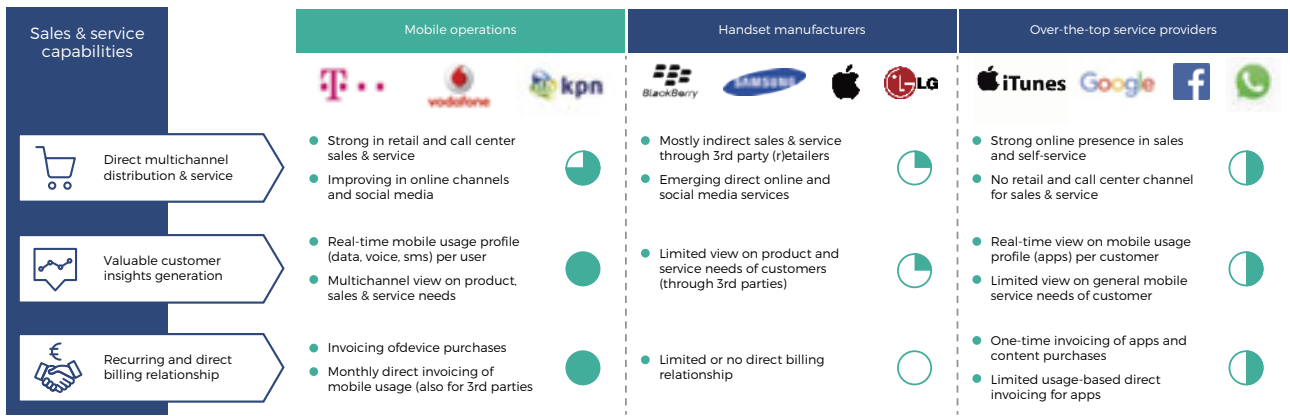
Fig. 1. CSP Position on the Market. Source: (Capgemini Consulting Analysis Christiaan Langezaal, Hugo de Vries, 2012)

[1] Capgemini Analysis, Christiaan Langezaal, Hugo de Vries, 2012

Understanding Customer Journeys

It is necessary to understand how each customer inter-acts with the CSP. This process is called the customer journey. CSPs worldwide have launched a number of projects addressing customer experience throughout the whole customer journey. Many of these projects are focused on marketing-related customer experience goals, but the key customer experience asset is the net-work, the first touchpoint for every subscriber using any service based on mobile connectivity. As such, operators have a detailed insight into how their customers use the network, their behavior patterns, their location at a given time, and their needs.

Customer Experience – Touchpoints

In defining customer experience, ITU-T states: "Quality of Experience is the overall acceptability of an application or service, as perceived subjectively by the end-user, and includes the complete end to end system effects (client, terminal, network, services, infrastructure, etc.). Overall acceptability may be influenced by user expectations and context."

By monitoring the effects of all touchpoints CSPs can avoid overall customer experience being negatively affected by the failure of one component.

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> As the level of customer satisfac-tion can be influenced significantly by even a single negative experi-ence during the whole customer journey, there is a high risk that over-investing in one area only (for example, network or sales / mar-keting touchpoints) will not bring the desired results

They can also react quickly and pro-actively to solve any problem that does arise.

Quite often, initiatives to improve customer experience address sales or marketing touchpoints only, without taking into account the network. This is because most tel-ecom companies are organized into traditional verticals, preventing efficient cooperation between departments, which hinders the ability to address customer experience holistically.

Customer satisfaction can be influenced significantly by even one negative experience, so there is a high risk that over-investing in one area only will not bring the desired results. This is especially important when considering complex business ecosystems, such as smart cities and the automotive industry, in which CSPs play a crucial role.
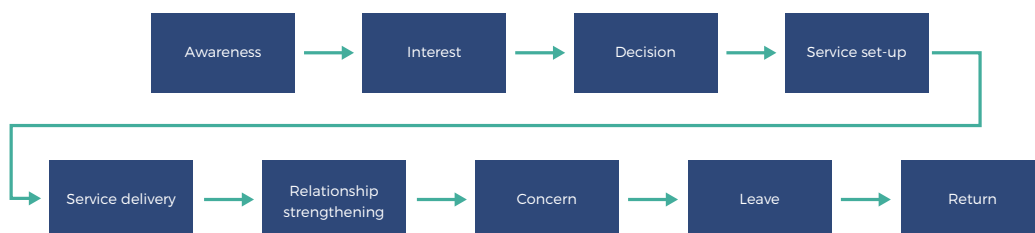

Fig. 2. Customer Journey – High Level View

Your Network – the First and Most Important Touchpoint

Ensuring great customer experience is crucial for CSPs, as it enables them to differentiate themselves positively in a competitive field, and to strengthen the trust of their subscribers. They can capitalize on being the first touchpoint for all services, thus increasing customer loyalty, reducing churn, and securing revenues.

Herzberg's motivation-hygiene theory can be successfully adopted to analyze customer satisfaction in the telecoms arena. According to this theory, two types of factors impact the NPS:

- Hygiene factors

- Motivators

In this context, the telecom network is the "hygiene" factor. So focusing on sales touchpoints at the expense of the network results in an incomplete customer experience picture. The customer visits sales touchpoints because they need to access a network offering high quality service and at the lowest price. The network is therefore the first and crucial touchpoint in respect of improving customer satisfaction.

For customers, the "hygiene" factor means having continuous access to network services, so initiatives focused on improving motivators are useless if this basic element is not assured. Unfortunately, failures happen. From the customer perspective it doesn't matter what caused a problem, and an outage in one service component can change the perception of the whole service bundle. The result of this could be that competitors will exploit your weakness – at your expense.

Pro-activeness is Key

The network is the first touchpoint for any customer in the process of service delivery, so gathering data straight from the network lets CSPs predict potential issues and react before they affect customers. Any other touchpoints enable only a reactive approach. Pro-active detection of network problems enables CSPs to take action even before the customer uses another touchpoint, and it is only achievable via comprehensive, real-time analysis of data from the network.

Time to Break the Silos

A couple of years ago, CSPs started switching from separate network operation centers (NOCs) for each technology to service-oriented operations centers (SOCs) that integrated organization units and toolsets. Neither model was satisfactory; in order to become truly customer-focused, network and service quality tools needed to undergo another evolution – in the direction of integrated assurance supported by OSS/BSS data analytics.
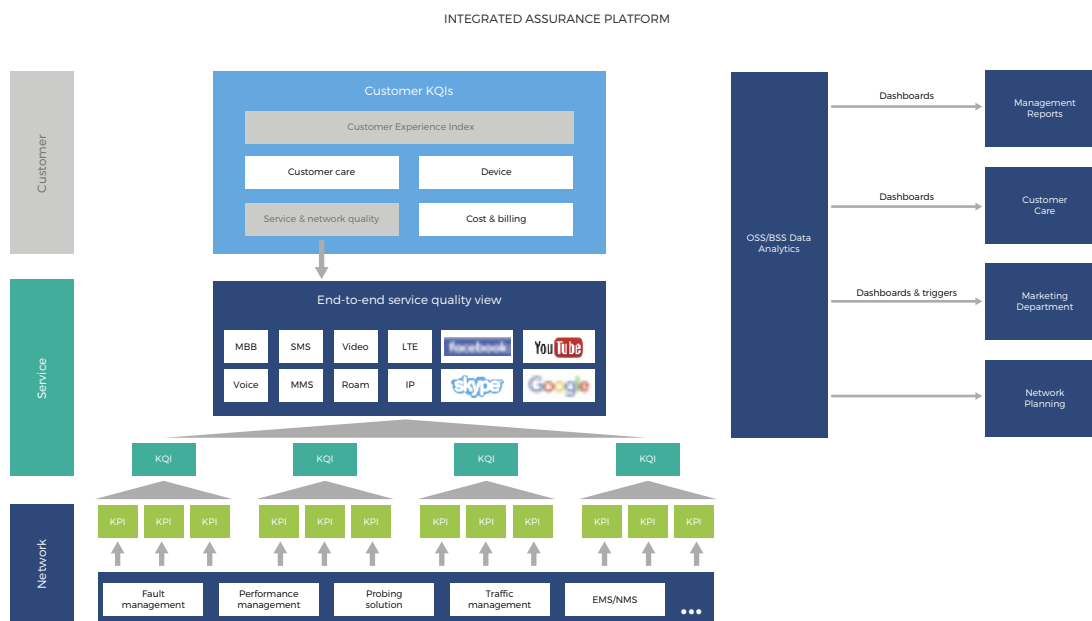
INTEGRATED ASSURANCE PLATFORM

Fig. 3. Integrated Assurance

Integrated Assurance – Paving the Way for the Customer Experience of the Future

The evolution from NOCs to SOCs was a step forward, but even after implementing the SOC concept, telecoms IT environments are often organized in silos. This makes it impossible to monitor customer experience holistically.

The next step will be the establishment of service excellence centers (SECs), in which experts from different domains will collect, interpret and utilize a broader set of information from different sources. This will support the whole lifecycle of the customer-network interaction, and should take into account information related to customer segmentation in order to prioritize network incidents and their resolution accordingly, and to provide more consistent input that will allow network planning departments to prioritize spending.

The ultimate step towards achieving these goals is implementing a comprehensive integrated assurance platform. This kind of modern BSS/OSS solution provides an integration point between data coming from a number of traditional assurance domains (performance management, service quality management, fault management, and SLA monitoring), and enriches it with data from BSS domains, such as customer care, CRM, or billing.

Gather Information in Real Time with OSS/BSS Data Analytics

A comprehensive OSS/BSS data analytics system is a crucial part of an integrated assurance platform, as it enables the analysis of data both from the network and from other OSS/BSS sources. By correlating all this information, such a solution can produce comprehensive, real-time analysis and invaluable insight into customer perception of services. This includes but is not limited to:

- Current subscriber location

- Early detection of problems with accessing basic services (voice, data and SMS)

- Early detection of problems with accessing other services (such as supporting services and VoD)

- Problems with accessing OTT services (such as no access to Facebook, etc.)

This kind of real-time information can be used to trigger marketing actions such as generating and sending vouchers to compensate for problems, and sending information to a customer via an SMS or a mobile application.

Data can also be used to generate summary reports, which can serve to prioritize network planning activities and identify and solve hidden problems with the configuration of a given device or the network, for example:

- Service availability statistics

- Service utilization statistics

- Subscriber movement patterns

- Device battery consumption

- Other reports, such as service utilization locations

"

Integrated assurance supported by an OSS/BSS data analytics solution is one of the key building blocks required to improve the overall Net Promoter Score (NPS) or Customer Satisfaction (CSAT)

CSPs are Evolving to Succeed, and Comarch is Keeping Pace

Comarch Integrated Assurance supported by Comarch's OSS/BSS Data Analytics solution meets all the requirements of modern customer experience management tools, as described above.

Comarch OSS/BSS Data Analytics processes data from the telecommunications network in real time, combines it with information from external systems, and aggregates it. Thus, the system can provide invaluable insight into customer perception of the services provided. Based on the aggregated data, Comarch OSS/BSS Data Analytics suggests specific actions, which can also be carried out automatically.

Learn more about Comarch OSS/BSS Data Analytics at:
http://www.comarch.com/telecommunications/products/oss-bss-data-analytics/

Show Your Customers you Really Care with Customer-Focused Integrated Operations

DIOGO DOTTA | OSS CONSULTANT

In order to meet the demand for data services in the 21st century, mobile and fixed communications technologies have evolved at a rate never observed before.

Nowadays a smartphone is a commodity item, fiber connections at home with speeds reaching 100Mbps have become quite common, and the LTE technology is well-established in many large urban centers, reaching speeds of 50Mbps. Technology has re-shaped today's "connected consumers". People now depend on mobile data services for many of their daily activities (such as ordering food, reading eBooks or organizing transport),

and complex actions (for example, smartphone-controlled field service management). Such a high dependence comes with increased expectations about the quality and availability of services, and with the competition always just one click away, the ability to meet these expectations will determine who wins on the competitive telecoms market.
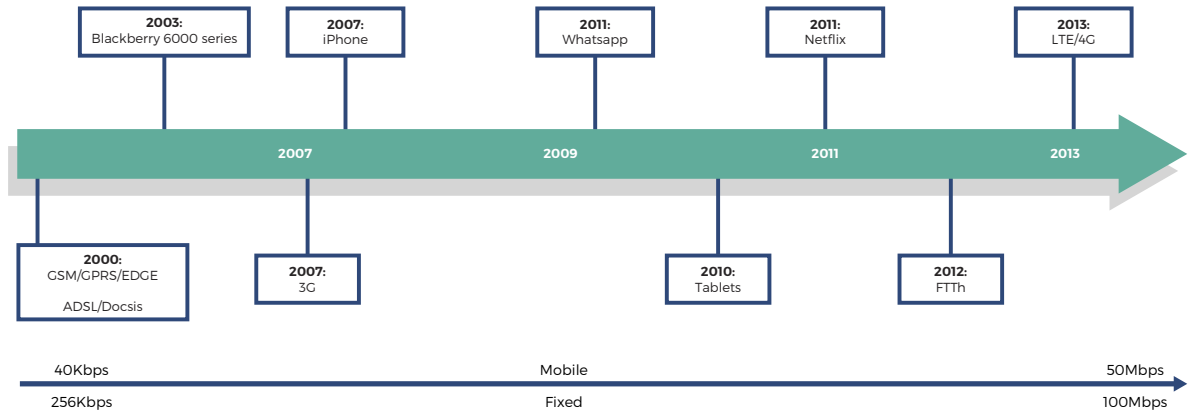
2003: Blackberry 6000 series	2007: iPhone	2011: Whatsapp	2011: Netflix	2013: LTE/4G

	2007	2009	2011	2013

2000: GSM/GPRS/EDGE ADSL/Docsis	2007: 3G	2010: Tablets	2012: FTTh

40Kbps	Mobile	50Mbps
256Kbps	Fixed	100Mbps

Fig. 1. The Evolution of Telecommunications in the 21st Century

The Red Queen Effect

Communications service providers (CSPs) have invested billions of euro on network upgrades in order to offer their customers the latest technologies. As every telecom operator was doing this, everyone had to do it in order to remain competitive. This is called the "Red Queen effect", a term derived from Lewis Carroll's Through the looking-glass, in which the Red Queen says, "It takes all the running you can do, to keep in the same place".

Beating "the Red Queen" – i.e. getting ahead of competitors, is one of the greatest challenges faced by CSP executives, in addition to meeting the constantly evolving customer expectations.

Meeting Customer Expectations

In light of such challenges customer experience emerged as a discipline, with the goal of improving the satisfaction of individual customers across various points of interaction with the CSP. The sum of interactions across all touchpoints creates the overall customer experience. These interactions begin when the customer first hears of a product, and continues throughout the purchasing process, service usage, and post-sales customer care.

Each interaction gives a telecom operator an opportunity to create a positive customer experience, by appealing to its subscribers' rational and emotional needs, which in turn results in increased customer loyalty. On the other hand, these interactions can also be a source of customer dissatisfaction, leading ultimately to churn. Focusing on true customer experience has been a major change of focus in CSP strategies, which have now evolved from network-centric to customer-centric.

B/OSS Evolution: Customer-Focused Integrated Architectures

Following technology advances, business and operation support systems had to be adapted or deployed to accommodate new products and services. In addition, a decade of mergers and acquisitions mean the biggest telecoms companies are now faced with chaotic B/OSS environments, consisting of multiple systems, often with overlapping functions.

This results in customer care being broken into silos, each dealing with a specific product/technology, giving the

customer the impression that there are many different companies within one (e.g. fixed broadband services, mobile services, enterprise services, etc.). The consequence, according to a report from the American Customer Satisfaction Index, is that CSPs have a poor reputation in terms of service compared to other industries.

Comarch proposes a maturity-evolution operations model in a four-step approach, where network-centric operations are defined as the most immature operations model, and integrated customer-focused operations are the most mature – and therefore the most desirable.

CUSTOMER EXPERIENCE iNTERACTIONS

Appeals to rational and emotive needs
and contributes to higher customer loyalty

Multiple sales channels

Customized offers accounting to customer behavior

High-speed data connection

Earned extra loyalty program points and benefits

"Data-free" social media access

Personalized assistance - Quickly resolved the issue

CUSTOMER EXPERIENCE LIFECYCLE

HIGHER CUSTOMER LOYALTY

PERCEPCION OF THE CUSTOMER EXPERIENCE

DESTROYS CUSTOMER VALUE

Promotions | Purchase | Activation | Utilization | Billing | After Sales Support | Loyalty

Off-the-shelf products not aligned with Customers expectations or real needs

Problem with Coverage

Several failed attempts to get customer support

Wrong Bills

Problems with service activation

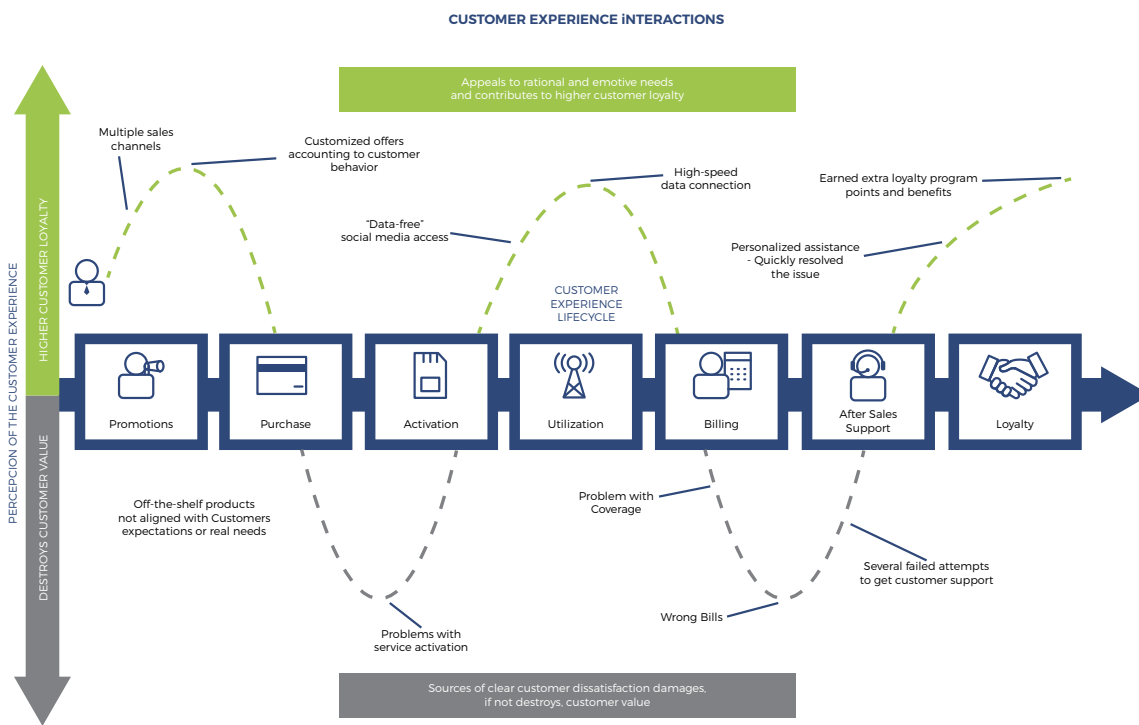Sources of clear customer dissatisfaction damages, if not destroys, customer value

Fig. 2. End to End Customer Journey

Network-focused Operations

In network-focused operations, the aim is to monitor resources, but not customer perspectives. Additionally there is lack of integration between business and operation processes and systems. The first level of support is unable to view customer problems and has no integrated view of products and services. Only massive network outages trigger automated IVR (Interactive Voice Response) messages. Operations centers are usually split according to technology and, for example, customer segment, which requires skilled operators for each vendor / technology / service and hinders automation.

Developing Operations

These focus on services instead of resources. Incidents can be filtered and classified by level of impact on the service. The first level of support can view SLA compliance and proactively notify corporate customers about service issues using automated trouble ticketing (OSS to TT integration). For retail customers, notifications for specific service failures can be set, but they are limited to "affected-only" users. Operations are usually split only at the technology / service level.

VIP-focused Operations

Customer dimensioning is added to the equation, enabling operations centers to track services in the customer context. Integration between business and operations support systems allows customers and classes of customers to be identified, enabling CSPs to differentiate levels of service quality at support and service levels. The first level of support is able to seamlessly identify technical and billing issues and provide VIP customers with a quick and accurate resolution to their issues. With higher automation levels and well-defined processes, operations centers may pro-actively monitor customer services, notify customers and provide assistance even before receiving complaints.

Customer-focused Integrated Operations: Comarch's Approach

Comarch proposes an innovative approach aimed at transforming customer experience through evolution of Network Operations Centers. The concept relies on predictive models with the application of advanced B/OSS data to identify and fix network problems before they are noticed by customers. Big data analytics give CSPs a bird's eye view of customer segments and behavior.

Customer-Focused Integrated Operations is an innovative approach for the evolution of the Network Operations Centers with the main target of **transforming Customer Experiance**.

4 INDUSTRY LEAD

3 MATURE

2 DEVELOPING

1 IMMATURE

CUSTOMER-FOCUSED INTEGRATED OPERATIONS

- Focus on monitoring Customers
- Advanced application of B/OSS Data Analytics
- Fully integrated Customer 360° view
- Visibility of Customers by behavior and segments
- Full integration between BSS and OSS processes
- Dedicated dashboards based on the same platform

VIP-FOCUS SERVICE FOCUS

- Customer dimension visible in SOC
- Focus on monitoring of services in the context of customers
- Deeper integration between BSS and OSS processes
- B/OSS Data Analytics, Information Mgmt., SLA monitoring, in place
- Proactive monitoring

NETWORK FOCUS

- Defined service models
- Focus on monitoring of services
- No Customer dimension in SOC
- Limited integration betwee BSS and OSS processes
- Integration between TT and OSS

NETWORK FOCUS

- Focus on monitoring of resources
- No Customer dimension in NOC
- No integration between BSS and OSS processes/systems
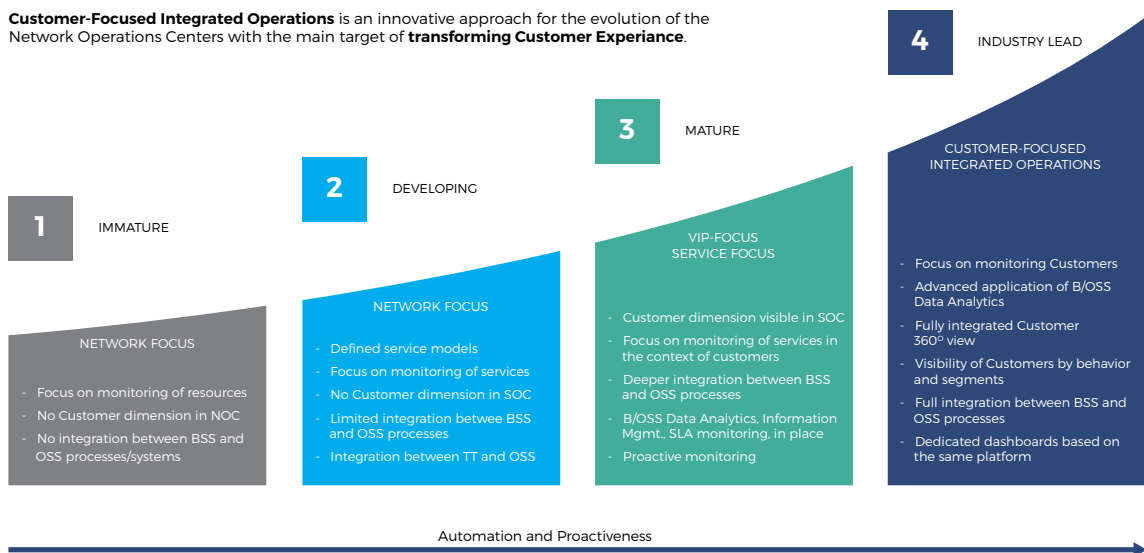
Automation and Proactiveness

Fig. 3. Operations Maturity Evolution – the Comarch Approach

Breaking down customers into segments based on their behavior is very important, as each customer segment has a different level of expectations. For example, someone who buys a premium bundle expects to be treated better than a pre-paid user. A fully integrated customer view (360˚) provides the first line of support with a complete view of all customer products and services, along with billing statements and history of complaints and devices, enabling the CSP to deliver fully customized support.

Dedicated dashboards for marketing, planning and executive areas provide valuable data for creating personalized offers, defining expansion priorities and even driving corporate investments.

Comarch offers a complete set of IT solutions to help CSPs evolve their Network Operations Centers into Customer-Focused Integrated Operations, supporting them at every step of the journey:

Customer-Focused Integrated Operations is an innovative approach for the evolution of the Network Operations Centers with the main target of **transforming Customer Experiance**.
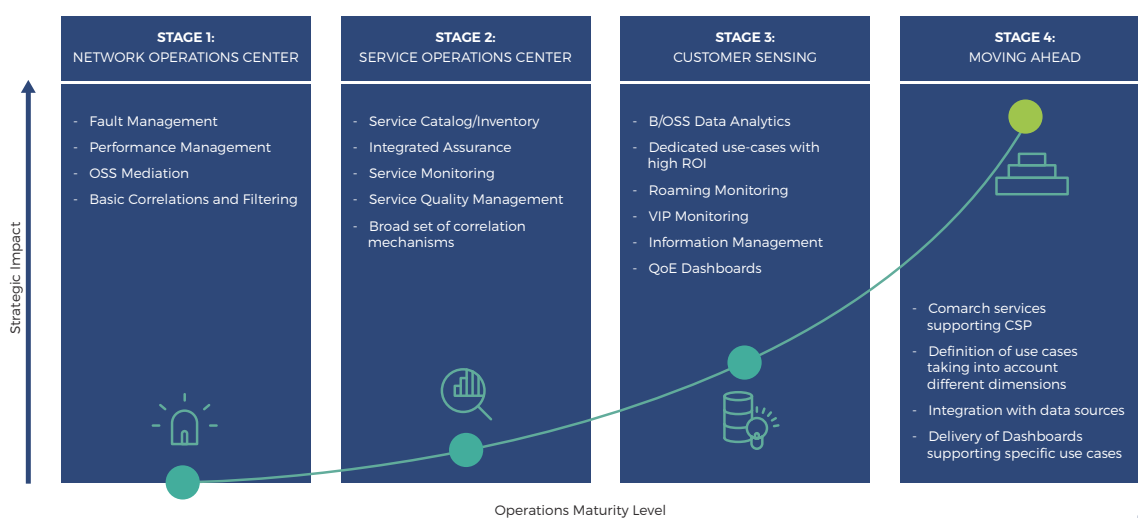
Fig. 4. Comarch Solutions for Operations Evolution

Comarch OSS Mediation, Fault Management and Performance Management work as enablers and data sources for the upper layers in OSS architecture. Any inconsistencies in the information delivered by this layer impact the efficiency of service monitoring at the customer level. Comarch offers a fully integrated OSS framework, including basic filtering and correlations of alarms, traps and network events, facilitating the identification of incident causes, speeding up resolution time and optimizing resources.

In the second stage of the process, Comarch Network Inventory and Service Catalog work as indispensable

sources of information for service modeling, enabling advanced topological correlations, service monitoring, service impact analysis and service quality management.

Delivering great customer experience starts with the quality of communication services and with addressing network-related customer expectations. Adding the customer perspective to service monitoring is the first step for any CSP seeking a clear view of the real quality of its services. Comarch VIP Monitoring is the perfect starting point for CSPs aiming to deliver the next level of customer experience for the top revenue generating subscribers.

When combined with Comarch Roaming Monitoring, VIP Monitoring enables CSPs to monitor VIP services dynamically, and to guarantee VIP clients undisrupted access to all services.

Including the customer perspective in service monitoring centers is an important step, but it is not enough to elicit a disruptive effect. It is also important to take into account that a customer has different expectations of service quality depending on the type of service, the context in which the service is being used or even their emotional state.

> "
> *The Customer – Focused Integrated Operations approach takes into account multiple dimensions in the analysis of customer experience, to provide the CSP with information on the true perception of services by each customer as an individual.*

The approach recommended by Comarch (Customer-Focused Integrated Operations)takes into account multiple dimensions in the analysis of customer experience, to provide the CSP with information on the true perception of services by each customer as an individual.

Each type of service has its own characteristics, so specialized monitoring and testing solutions, integrated into a service assurance platform, are essential for each one of them.

Through integration with customer complaint databases, CRM and customer care systems, it is possible to know e.g. if a customer has raised a complaint related to a specific service, and how many times they have complained. A customer who has already complained is much more sensitive to technical issues or service interruptions, so their quality thresholds can be adjusted accordingly. As not every customer will communicate the experienced issues to their service provider, thresholds should also be adjusted automatically, based on the history of quality measurements for each specific customer, considering all of their services as a whole.

Maintaining high quality for a single service is not enough. Even if a given CSP delivers the highest quality for a specific customer's mobile service, issues affecting the home internet, TV, or even a relative's mobile service may lead the customer to moving to the competition.

All these issues can be tackled with Comarch Customer Experience Management solution. Comarch is also open for integrations with other specialized solutions focused on monitoring specific communications services. The key business value of such an approach is to have one single source of information about all the services used by a specific customer, regardless of the service type.

The first CSP to deliver a fully personalized end to end customer experience and meet customer expectations will stand out as the one that really cares about customers as individuals. In short, it will beat the Red Queen.

How to Save Time and Money on Telecom Network Merger & Acquisition Processes: A Smart Approach to Network Consolidation

MATEUSZ CIEŚLAK | OSS & SON PRODUCT MANAGER

Why are Network Consolidations so Popular?

For telecom companies, the introduction of new technologies no longer translates directly into increased sales and profits. Improved operational effectiveness is therefore sought through savings, resulting in an increasing number of merger& acquisition processes.

The main goals behind a decision to consolidate networks usually include:

- Easier access to new sites and infrastructure

- Rapid increase in the number of customers

- Getting ahead of competitors

- Network cost reduction

- Long-term increase in assets revenue

And Then They Wait...

Any intention to merge telecoms companies has to be approved by the National Regulatory Authority, and in some cases also by similar institutions acting internationally. Such approval usually takes at least nine to twelve months to obtain, and due diligence means that companies cannot legally share any business or technical information until a positive decision is obtained.

This waiting period, though, does not have to be time wasted.

The due diligence process is usually the most crucial, as it influences the next stages and can determine the level of benefits to be achieved later.
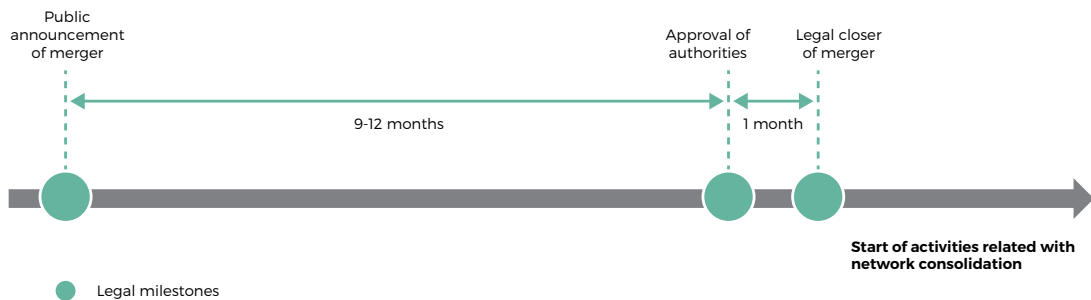
Fig. 1. Due Diligence Timeline in an M&A Process

When companies decide to consolidate their networks, there are many legal and organizational aspects to consider. A public announcement of the M&A is usually followed by three main stages, as presented below:

Fig. 2. Main Phases of a Network Consolidation Process

The due diligence process is usually the most crucial, as it influences the next stages and can determine the level of benefits to be achieved later.

Making the Most of the Due Diligence Stage

A typical scenario requires engineers and managers from each company to cease their daily activities and form consolidation teams, which sign non-disclosure agreements (NDAs) limiting the exchange of information. In this situation the consolidation teams uses their own, incompatible OSSes. Moreover, they cannot provide any output without using sensitive information, so legal responsibility lies with each of the team members. Because of the NDAs, information cannot officially be exchanged and operational activities (establishing KPIs, preparing the selection process, etc.) cannot be started, thus there can be no progress during the due diligence phase.

An alternative, smarter scenario recommended by Comarch, allows CSPs to make the most of due diligence time. Comarch delivers its own network management solutions, acting as a trusted third party in the merger so that engineers and managers from the companies involved in the M&A process can prepare the consolidated network rules within consolidation teams. Here, the NDAs are very clear. They are signed by each operator with a trusted third party, moving legal responsibility to Comarch as a trusted partner.

Network Consolidation – the Comarch Approach

Comarch has experience as a trusted third party in M&A processes, so can help any telecom company involved in mergers or acquisitions achieve a clear business architecture and responsibility matrix. Comarch supports the project with ready-made, established IT solutions, and business and technical consultancy.

The solution is typically commissioned by the "buying" operator, but Comarch signs specific NDAs with each party. This provides an assurance that all legal requirements are met.
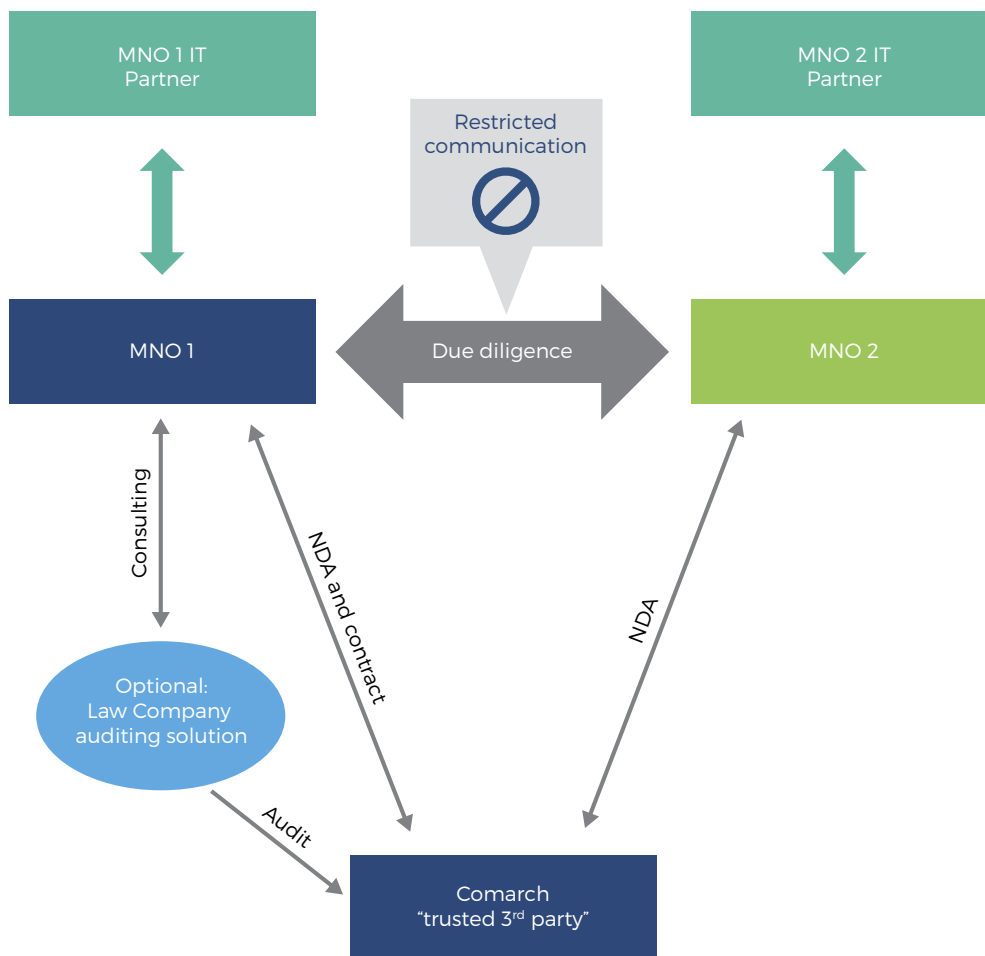
Fig. 3. Legal Framework Architecture

The Network Consolidation for M&A solution is based on Comarch's next generation OSS tools. Core modules include Resource & Network Inventory, Planning Framework (with Radio, Transport and Core technology packs), Geographical Information System (GIS), Mediation, Reporting, and a Business Process Management engine for managing data and workflows. The Pairing and Rating module has been developed specifically for network planning.

Comarch Network Consolidation for M&A provides easily configurable processes with embedded technological logic and validations, where benchmarks for network resources can be calculated. All decisions can be viewed in table, report, or geographical format. The tool supports all radio technologies (2G/3G/4G) and market-used logical and physical transport layers.

Each operator can feed network data into the Comarch solution, so that future network states can be planned without any due diligence rules being broken.

Comarch provides migration from each operator's legacy OSS systems, with all data from each operator stored in one database but inaccessible to the other party.

Network consolidation only runs smoothly when consolidation rules are agreed upon and adhered to. The Comarch Network Consolidation solution means upfront business processes can be used to:

- Select sites to be reconfigured or removed, using pairing and rating configurable algorithms (during duediligence)

- Begin, monitor and validate rollout plans, ensuring data synchronization with legacy OSS tools (after closure of the merger)

All those processes are easily pre-configured in the solution.

Isolation of data continues until a positive decision arrives from the regulatory authority. After that, with a one-click action by a system administrator, engineers from each operator can access the merged data in one tool.

Once data migration is complete, sites pairing and rating starts. The selection of sites to stay in the newly merged network is supported with predefined rules and planning engine. Customer network engineering guidelines, which are later used in site selection, can be defined. The results of each step are presented clearly, and the decision for each location can be changed at any time. Radio and transport network benchmarks providea final trade-off between network quality and costs when decisions are being made about the selection of a specific site. Several iterations with different settings yield the best possible result.

The network consolidation process template is defined with the following steps:

- Pairing and rating network elements/sites algorithm for location/working area (semi-automatic or automatic)

- Radio planning verification

- Transport planning verification

- Real estate/civil works verification

- Veto management (sub-process for managing the concerns raised by any affected team)

- KPI calculation and reports for the consolidated network

Comarch can legally verify the completeness of the data from both sides, before M&A approval is received. It can also verify the feasibility of planned network rules.

Even after approval and the start of the network consolidation rollout process, the operators are still separate organizations with separate OSS environments. A network consolidation solution acts as a central common network data hub used throughout the process to manage all the dependencies between network consolidation activities. This ensures that the consistency and quality of network data are maintained, and that network design decisions are properly verified. Such a solution allows network consolidation activities to start even before IT / OSS consolidation.

An example of a due diligence process schedule using the Comarch network consolidation solution is presented below.
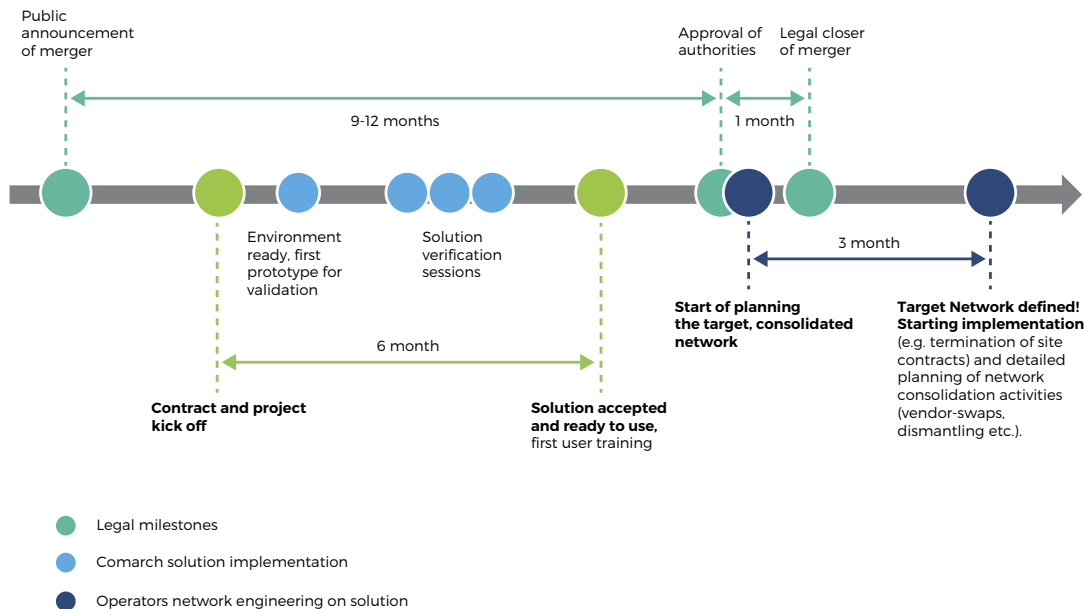

Fig. 4. A Sample schedule of a due diligence process with the Comarch Network Consolidation Solution

The solution can be delivered in a Managed Service model, with Comarch's radio / transport / core experts supporting the negotiation of rules. Thus, Comarch delivers M&A know-how, taking responsibility for site selection rules, and helping with technical consultancy regarding network issues and other aspects of consolidation. More M&A activities can be outsourced to Comarch, saving more time and money.

Comarch Network Consolidation for M&A delivers a plan for sites and network infrastructure, grouped in technological and business packages and presented in the right order for implementation. Comarch Network Inventory can be used as a reference for exchanging network data between parties, not only during the due diligence stage, but also in the rollout phase. Network consolidation for M&A is usually a source of rollout plans, distributed automatically via interfaces/reports to the respective divisions or subcontractors, according to configured rules. The solution ensures that all dependencies between the consolidation activities are properly managed, and that the impact of network changes on subscribers is reduced to a minimum.
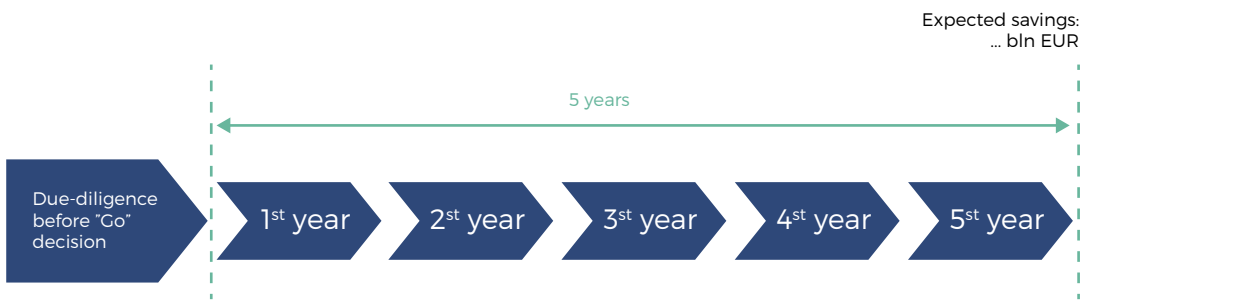
Expected savings:
... bln EUR

5 years

Due-diligence before "Go" decision | 1st year | 2st year | 3st year | 4st year | 5st year

Fig. 5. Due diligence schedule with expected savings starting after five years
(without the Network Consolidation Solution)

Expected savings:
... bln EUR

5 years

Due-diligence before "Go" decision | 1st year | 2st year | 3st year | 4st year | 5st year
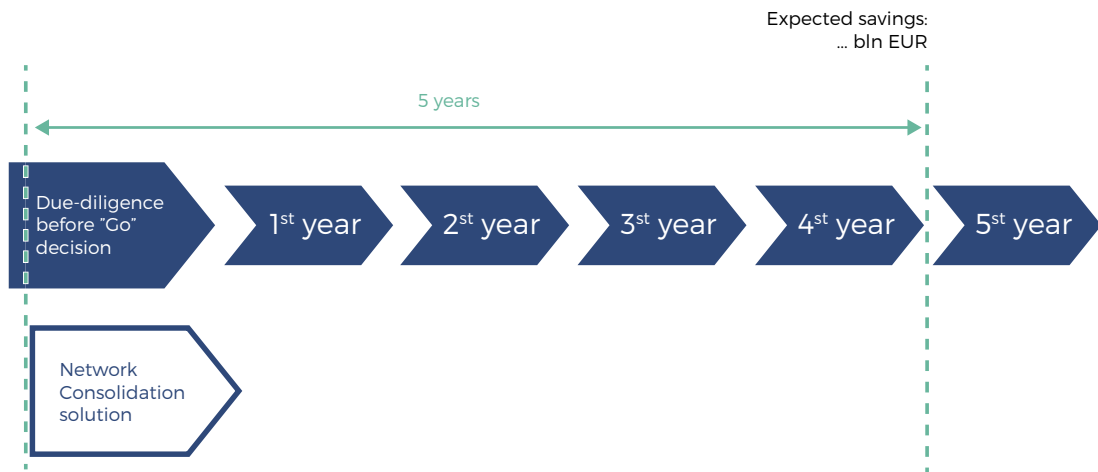
Network Consolidation solution

Fig. 6. Due diligence schedule with expected savings starting after four years
(Comarch Scenario – with the Network Consolidation solution)

Comarch Network Consolidation for M&A optimizes target network preparation, and simplifies and unifies network rollout in a transparent manner.

A merger and / or acquisition process usually assumes expected savings to be delivered within a specific time. With the Comarch solution, rollout can start immediately after approval is received, so shareholders can achieve the expected savings up to a year earlier than they would without a network consolidation solution.

CLASSIC APPROACH	COMARCH APPROACH
"Secret" consolidation teams (quasi-legal, unclear NDAs)	Cooperation with a trusted third party (clear NDA)
All information exchange forbidden	Information exchange legal, but only via a trusted third party
Operational actions start only when approval is granted	Target network selection rules prepared in advance
Legacy tools and users remain separate, in each organization	Tools ready with overlaying unified solution and trained usersLack of unified tools prepared
Lack of unified tools prepared	Interfaces to synchronize legacy OSSes established, running and ready to go

Learn more about Comarch Network Consolidation for M&A at:
http://www.comarch.com/telecommunications/solutions/network-consolidation-for-m-a/

How Adopting NFV/SDN Technology Enables Telecoms to Experiment with New Customer Services

ŁUKASZ MENDYK | OSS & SDN/NFV PRODUCT MANAGER

From a business perspective, the effectiveness of NFV/SDN is measured by its influence on operational and business efficiency rather than on technical specifications. Boosting service innovation and reducing time to market are good examples of where NFV/SDN can be assessed from the customer service perspective.

In fact, the terms "time to market" and "boosting innovation" have been replaced by "fail fast", which itself has trickled down from the over the top players (OTTs) such as Google, Apple and the like. This new term by no means suggesting "failure" per se; rather, it is about how communication service providers (CSPs) can transform their mindset so that they are not afraid – and have nothing to lose – by experimenting with new services in order to find out what works for customers and what needs fine tuning. In short, "fail fast" means being able to put new ideas to the test quickly, and avoid risking huge costs if they don't work.

"

The "fail fast" model enables tele-com operators to experiment with new services, to test them quickly, and, if they work, to monetize them rapidly, thus speeding up the innovation cycle significantly. This is in fact the most important expectation from NFV/SDN.

So how does "fail fast" fit in with NFV/SDN?

First of all, SDN/NFV simplification is about shifting to software-based networks combined with model-driven orchestration and life-cycle management.
With model-driven orchestration you can define a model for new services, which may then be tested quickly.

Model-driven End to End Orchestration

"Orchestration" is probably one of most overused terms in marketing materials and technical descriptions of new technologies and concepts for managing modern networks. Yet, regardless of what it means (or is supposed to mean) in other contexts, it needs to be clearly defined in terms of

NFV MANO (Management and Orchestration) specification.

To understand "orchestration" in this context, it must be viewed in the broader context of reducing time to market. In the scope of a virtualized, software-defined network, this means adopting the "fail fast" model that enables telecom operators to experiment with new services, to test them quickly, and, if they work, to monetize them rapidly, thus speeding up the innovation cycle significantly. In fact NFV/SDN network transformation that does not deliver in this respect could hardly be called successful.
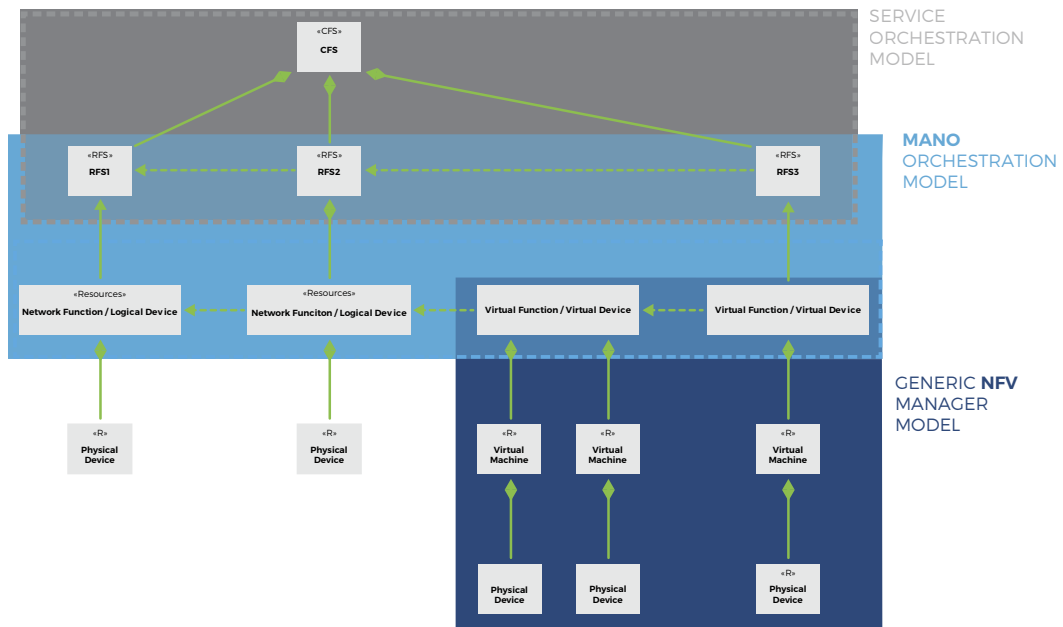

Fig. 1. Service Orchestration vs. NFVI-O vs. Generic VNF Manager

[1] For more information on the TMF SID and theCFS-RFS-R model please refer to:
    http://inform.tmforum.org/wp-content/uploads/2014/05/Implementing-the-SID-v1dot0b-Chapters-1-through-3.pdf

If the real value of "orchestration" can be found in reducing time to market and enabling operators to experiment with new services, it means that the model in question has to be catalog-driven.

Such a system should enable new services to be defined from the perspectives of customer value, implementation, and technical capabilities. In addition, the model needs to enable collaboration between people of different skills and even mindsets, so that product managers, who concentrate on the value that any technology can bring to the customer, can work with engineers, who usually take the opposite view. This means that the model managed in the catalog should have at least two abstraction layers, one defining the customer perspective and the other tackling technical aspects, with each mapped to the other. For anyone familiar with the TMF SID (Information Framework) model, this should suggest the CFS-RFS-R model, the adoption of which could be a successful way of transforming BSS/OSS systems towards managing hybrid networks. In fact, the outline concept suggests using catalog-driven OSS to manage NFV "natively", as a natural extension of the RFS-R model to the virtual domain, rather than introducing NFV MANO as a completely separate "silo".

The NFV concept must be mapped onto the TMF SID CFS-RFS-R model. Starting from the bottom, virtual network functions (VNFs) and physical network functions (PNFs) correspond to logical resources from the TMF SID model. VNFs and PNFs modeled in a unified manner as logical resources differ in implementation details, as PNFs are hosted by a dedicated physical resource, while VNFs should be hosted by a virtual machine, a hypervisor, and finally by a commodity blade (physical resource). Having VNFs and PNFs modeled as (logical) resources, the ETSI NFV Network Service should be understood as a TMF SID Resource Facing Service (RFS) composed from VNFs and PNFs. Finally, customer facing services (CFS) can be constructed from resource facing services (RFS), which act as "building blocks", with CFS then used to create products and offers.

So, with VNFs (and PNFs) on-boarded to the catalog as resources, engineers may define each RFS (technical services corresponding to NFV network services), and

product managers can use these to innovate in the customer facing service space and thus introduce new products to the market.

- Service orchestration driven by CFS-RFS decomposing

- NFV orchestration driven by RFS-R (VNF,PNF)

- VNF instalation driven by R->R (logical resource-> VMs->hypervisors->blades in NFVIPoP)

This concept is depicted in Figure 1, which assumes employing an OSS catalog-driven fulfillment solution which, prior to the advent of NFV/SDN technology, could orchestrate a traditional network using CFS-RFS-R modeling and is adapted to orchestrate a hybrid network.

Model-driven Life-cycle Management – Experimenting with Many Service Versions

Because model-driven orchestration enables model-driven life-cycle management, it means you can launch new services quickly, by introducing a new model into the service and product catalogs and then having this model drive the orchestration to enable the delivery and management of the new services.

It also means that you can introduce new versions of existing services, in order to fine-tune them. In addition, it allows you to experiment with new services or versions, without any impact on the existing services. This means you can introduce new versions safely, and offer them to early adopters on a small scale before thinking about rolling them out and retiring existing services. Lacking such a capability has in fact been the major factor preventing CSPs from introducing new services quickly, due to fear of failures that may impact millions of customers and thus damage the business.

From the technology point of view, NFV/SDN enables network functions (VNFs and SDN controller applications) in different software versions to co-exist in the production environment.

"

True freedom to experiment with new ideas requires the ability to introduce not only new services but also new versions of services, in order to finetune those you have already defined. Another important aspect is the ability to "experiment" with new services or versions, without any impact on the existing services, which already bring in money

But it is essential to be able to manage versions of network functions in the context of the correct version of a customer service. It is also important that, when instantiating a new service for early adopters, an "experimental" version of VNFs should be in place. When an established service is being mass-delivered to customers, the well-tested version would be used to avoid disruption being caused by the new service or version.

In order for telecoms providers to manage service lifecycles efficiently and be able to introduce new services faster, they must be able to model a new service easily, without coding or even heavy scripting. This is especially true as new services may require collaboration between engineers and product managers – who, as we have already noted, have different perspectives.

That's why catalog-based modeling with GUI (graphical user interface) for product managers, who are not technical, is so important (Figure 2).

The idea assumes that VNF vendors should provide the VNF descriptors in YANG or any modeling language,

which can be parsed and on-boarded into the service catalog in such a way that the new VNF version can be managed as a component in the catalog. Similarly, partners' network services could be on-boarded as high level service components (ETSI Network Services modeled as TMF RFS). The main assumption is that a non-technical product manager, who should concentrate more on the technology's value to the customers than on the technology itself, can easily create new customer services.

Summary

From the business perspective, NFV/SDN adoption allows CSPs to experiment with new services and thus reduce the innovation cycle. In other words, NFV/SDN should enable new services to be introduced faster and cheaper. By adopting the "fail fast" mindset, new services can be tested and fine-tuned without risk. The key to this is model-driven orchestration and a catalog-managed lifecycle in which new models and versions can easily be created without the need for heavy scripting.
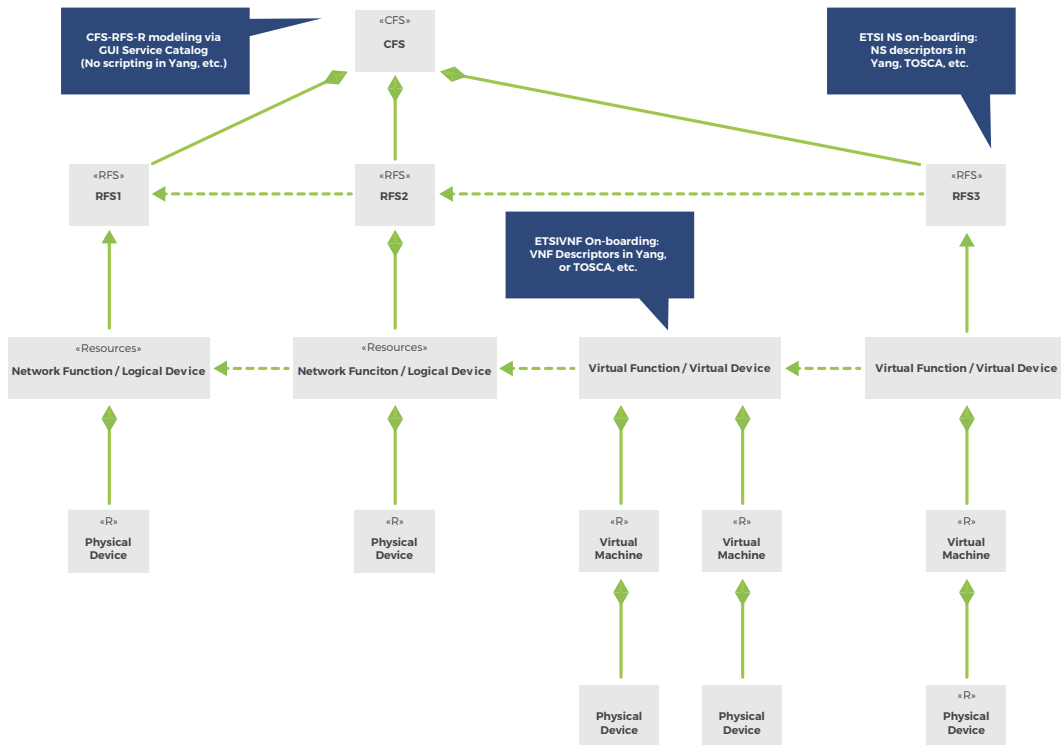

Fig. 2. Catalog-based lifecycle management – avoiding „YANG" or other script-based coding

Switching to Cloud-Native OSS

PIOTR KUCIA | OSS PRODUCT MANAGER

O **perations support systems (OSS) are complex, highly customized products that deliver many functionalities, require constant enhancements, and must demonstrate high stability.**

Traditionally, it has taken months to deliver large systems. As well as building and configuring software and setting up hardware, environment-specific customizations were required for different customers' systems in which only some parts were automated. As well as the time involved in changing even one part of the system, such a process is prone to downtime and errors.

The cloud-native concept, aimed at launching complex IT systems in IaaS (infrastructure as a service) and PaaS (platform as a service) cloud environments, addresses these inefficiencies. Regardless of whether the system will run in a private, hybrid or public cloud, the rules are simple – the system must be modular, with fully automated setup and maintenance. OSS could draw from this concept, enabling delivery of modular solutions at a previously unavailable pace.

The cloud-native approach can be defined as a set of patterns that makes it easier to develop, release, maintain and evolve complex IT systems. This approach can be characterized by three high-level patterns: microservices, DevOps (development and operations) and Continuous Delivery.

Microservices

The first aspect taken into account in the cloud-native approach is the application architecture. According to the cloud-native concept, software should be divided into independent components that handle certain business capabilities. This pattern, known as microservice architecture, is believed to be the key for good adoption of software in a cloud environment. It is an evolution of Service Oriented Architecture (SOA).

A microservice architecture typically includes:

- Domain Driven Design that recommends delivering every business capability in a single dedicated service.

- Lightweight communication protocols, typically HTTP RESTful interfaces and technology independent messaging protocols (such as AMQP). Well-defined APIs are the key to achieving real benefits. Services must be treated as black boxes that can be relatively easily replaced or improved, without impacting the overall system.

Microservice elements of Comarch OSS include technology agnostic communication channels and standardized APIs, based on the best possible patterns.

There are many advantages of microservice architectures. The approach enables agility, allowing faster service delivery, reducing uncertainty, and limiting the accumulation of legacy components. Scaling software becomes easier, because components are typically stateless and can be replicated independently. It is even possible to perform rollouts with zero downtime.

However, the pattern has its downsides. The distributed nature of the software makes maintenance harder, and there are operational challenges relating to communication, architecture management, service deployment, monitoring, etc. Orchestration process and monitoring capability improvements are necessary in order to maintain system health and fulfill SLAs, so the DevOps and Continuous Delivery patterns are also mandatory.

In Comarch's OSS Suite the microservice architecture increases the ability to develop software concurrently, reduces the risks associated with changes by limiting them to the services that need them, and allows

elements to be reused so that new capabilities can be provided faster. Microservice elements of Comarch OSS include technology agnostic communication channels and standardized APIs, based on the best possible patterns.

Continuous Delivery

Continuous Delivery reduces the risks inherent in maintaining large software products, allows delivery of a stable product at almost any time, and facilitates incremental updates on staging and production environments. Software can be installed in test environments for verification and approval by product owners and customers, thus accelerating the delivery process and shortening the development lifecycle.

Automation is a key aspect of this approach. The process (building source code, preparing deployment units and deploying software) is chained using established tools and routines into continuous integration and delivery pipelines.

Chaining tools include Jenkins / Atlassian Bamboo (for scheduling and chaining jobs and custom scripts) or tools that perform fully automatic installation in development and test environments on a daily basis.

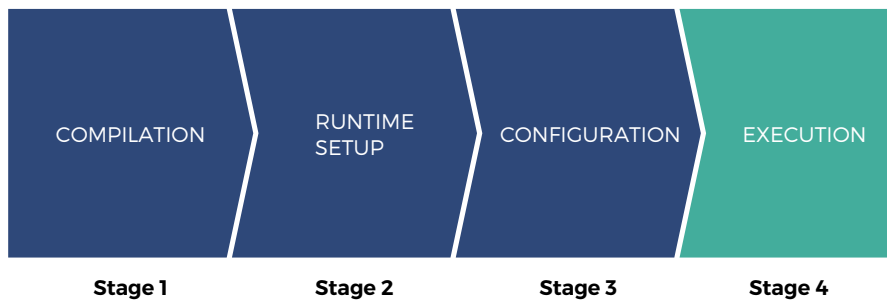The first stage is compilation and unit testing that produces binary artifacts from source code.

Fig. 1. Continuous Delivery

Next, deployment is prepared. Depending on the technologies, this can consist of preparation of app server binaries or software containerization.

The third stage is configuration of the software, depending on a given environment. Environment variables are set, and the appliances that depend on the environment type are prepared. This stage can include, for example, importing test data into the testing environment, setting up external systems, etc.

Execution is the final stage. This is where upgrades and test environments are developed, and where upgrades are scheduled for production.

In Comarch's OSS Suite, the process is performed multiple times a day, creating a fully working environment based on the most recent successful builds. A constantly evolving process of automation includes software builds and environment setup, and is responsible for unit testing, smoke testing and integration testing of the whole OSS.
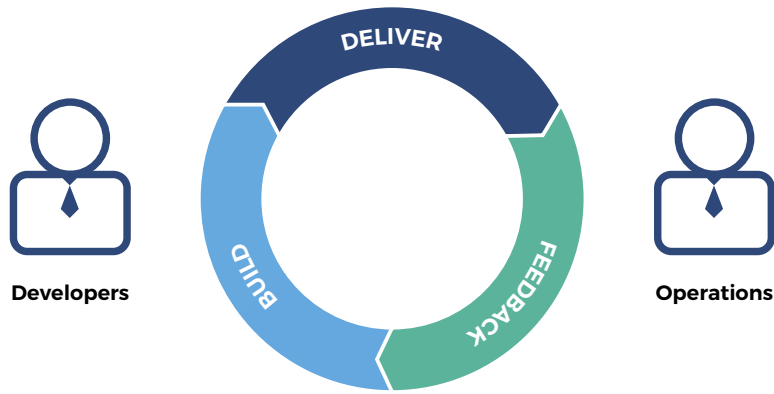
Fig. 2. DevOps Feedback Loop

DevOps

DevOps methodologies are aimed at standardizing, automating and improving collaboration in the process of software production and delivery. The pattern extends Continuous Delivery by improving the efficiency of collaboration between development and operations departments. Feedback loops at every stage enable faster and more agile deployments and more stable software.

Comarch realizes DevOps in its OSS, by focusing on further automation of network-related processes, with gradual adjustments aimed at simplifying installation processes in any environment. Simple automation is just the starting point for realizing an orchestration concept in which the whole platform becomes the key controller that orchestrates execution flows. Aside from process automation, monitoring is another important element of DevOps. Large sets of services must be controlled in the most autonomous way possible, in order to reduce costs. Useful capabilities include centralized logging services and monitoring components, to ensure high availability and security.

Containers – The Key to Automation

Cloud-native software must be ready for deployment with minimal or no human intervention. Emerging container technologies such as Docker provide a solid foundation for this.

Unlike virtual machines, containers are just a means of packaging, delivering and deploying components. Containers don't simulate the hardware on which an operating system runs, but use the host's kernel to operate. They are lightweight, platform independent, and provide a single artifact that can run on any environment. Fast deployment, similar to a regular process startup, offers new provisioning capabilities. Services can be scaled and healed in fractions of a second, much faster than on virtual machines. Such solutions open up new possibilities in terms of modularizing applications, and containers can run on almost any environment.
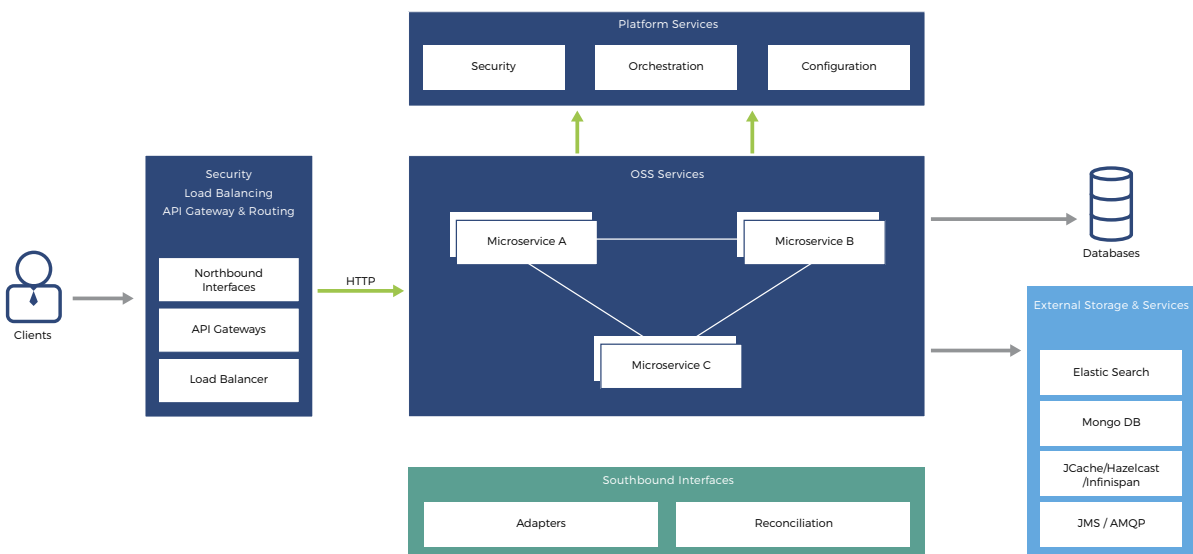

Fig. 3. DevOps Feedback Loop

Application components packaged in containers also allow repeatability. The same container is used to develop, test and run software, helping to ensure that, when something works in a test environment, it will work in production too.

> *The cloud-native approach changes the traditional way of thinking about OSS, enabling agile platforms that can simplify and organize the way in which components communicate, define how they should evolve to ensure the best performance, and standardize APIs that can be reused.*

Without proper orchestration, though, containers are no more than misused kernel sandboxes. They must be controlled externally by tools that can unleash their capabilities. Orchestration engines such as Docker Swarm, Kubernetes and Apache Mesos are examples of how the realm of orch estration tools is growing. They help resolve issues such as provisioning, network configuration and discovery, related to managing large sets of containers.

The Value of Public Interfaces

The cloud-native approach changes the traditional way of thinking about OSS, enabling agile platforms that can simplify and organize the way in which components communicate, define how they should evolve to ensure the best performance, and standardize APIs that can be reused.

Public OSS interfaces make it possible to create new system functions and capabilities. Services can be composed together, chained or extended to add value to the OSS without impacting the overall system. Without public interfaces, service composition is harder and riskier, because unpublished interfaces are often unstable and frequently change without notice. The modularity of OSS allows its capabilities to be scaled, upgraded and replaced, independently and without downtime.

Comarch OSS Platform

The fine-grained modularity of Comarch OSS components promotes re-using many system functions, so the same service can be used in many different contexts. It includes platform services and OSS product services that handle functionalities common for several OSS products. Modularization with technology agnostic APIs enable access to OSS capabilities that cannot be accessed externally in monolithic systems.

Comarch OSS offers basic services for delivering typical functionalities required by applications and business-level services. It includes an authentication and authorization service, which provides security capabilities for the whole OSS system and integration with external security mechanisms and standards, a service registry, a configuration service, a scheduler service, a data export service, a centralized log repository service, etc, many using open source solutions such as Apache ZooKeeper or Keycloak Single Sign On.

The stateless nature of Comarch OSS components ensures high network availability and self-healing capabilities, which can be multiplied to achieve service redundancy and basic load balancing.

Summary

Cloud-native is an approach to application development that makes complex systems such as OSS easier to maintain and evolve. The concept can be characterized by three aspects, covering the entire process of software development and delivery. These are architecture (microservices), automation (continuous delivery) and cooperation (DevOps)

Comarch OSS products are aligned with those concepts, thanks to platform and architectural cohesion. This allows OSS to operate in the cloud, and provides agility in a rapidly evolving IT environment.

Integrating SON Functionalities into the Complex OSS World

MATEUSZ CIEŚLAK | OSS & SON PRODUCT MANAGER

> **S** ON (self-organizing networks) is not just a buzz-word, but an essential part of mobile network operators' (MNO) operational support systems (OSS).

Using human engineering skills to manage networks ended with the introduction of 4G technologies, and full manual management of telecom networks is now simply impossible.

There are two main groups of SON solutions: distributed SON (d-SON) and centralized SON (c-SON). The first is typically an add-on, delivered with hardware from a RAN equipment vendor. It used to support only the automatic neighbor relations feature, and was vendor specific. But today's MNOs usually have at least three RAN vendors, which would require three separate, non-synchronized d-SON solutions, so this model was quickly replaced by c-SON solutions covering all vendors and technologies. In this article the term SON will refer mostly to c-SON.

SON tools are advertised as self-standing, solving all radio performance issues. This is true, but they often create new problems at the same time. This is because SON can't operate independently of other existing OSS applications, especially when network elements are being changed in parallel.

These SON tools usually deal only with neighbors and reselection optimization. But managing a telecom network, even if only limited to its optimization, involves many tasks that have to be run periodically or on an ad-hoc basis. Thus, SON still has to be supported by planning and configuration management tools.

Transforming Your OSS

In a typical OSS environment, inventory data, infrastructure plans, network plans and events related to network actions are exchanged between dozens of tools.

These environments have been developed organically to handle crucial network-related processes, and they work intensively and constantly. This means that the successful introduction of an independent SON tool relies on careful synchronization. A SON can change the states of network elements as often as once every 15 minutes, so planning tools, preparing their operations at the same time, simply can't keep up, meaning they no longer reflect the real network status. Application chains typically rely on network status, which is disrupted when SON changes are performed so often.

To keep OSS applications running in an ecosystem disrupted by SON, mobile operators need a solution that will provide full synchronization between the two.
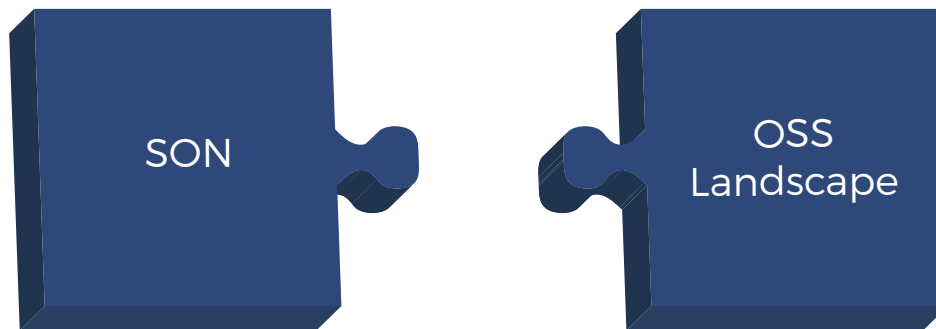
Fig. 1. SON Solution Implemented in a Non-compliant OSS Environment

What's Missing in SON Tools?

Lack of SON plan history & change tracking

SON vendors need to gain the trust of operators whose networks they will change, so trial-based confidence building is essential. Yet SON solutions still do not allow changes to be tracked and rolled back.

Limited monitoring and controlling capabilities

SON tools are focused on delivering a few proven algorithms running on a small number of carefully selected parameters. Monitoring and controlling all other network managed objects and parameters is, however, missing.

No SON provisioning for smaller vendors

SON tools usually concentrate on products delivered by the biggest hardware vendors. MNOs, however, can't switch all their suppliers simply because a particular SON solution does not support some network elements.

Mobile backhaul issues

SON tools optimize objects such as cells, reselections, and neighbors. The standardization process has moved mobility management capabilities closer to the radio nodes, first by introducing Iur interfaces between radio network controllers (RNC), and then, with the emergence of 4G technology, through the establishment of X2 interfaces between eNodeBs.

A SON can manage and optimize neighbors efficiently and directly, but management of Iur and X2 interfaces is often left to d-SON functions, which again raises vendor-specific hardware issues.

SON Implementations – the Comarch Approach

Comarch's SON Integration Box resolves most of the above-mentioned issues. It is built from Comarch

OSS Suite modules (some of them optional), including Network Inventory , Mediation, Authentication Service, Log Repository, Task Scheduler, Configuration Management & Reconciliation, Fault Management and OSS Console GUI.
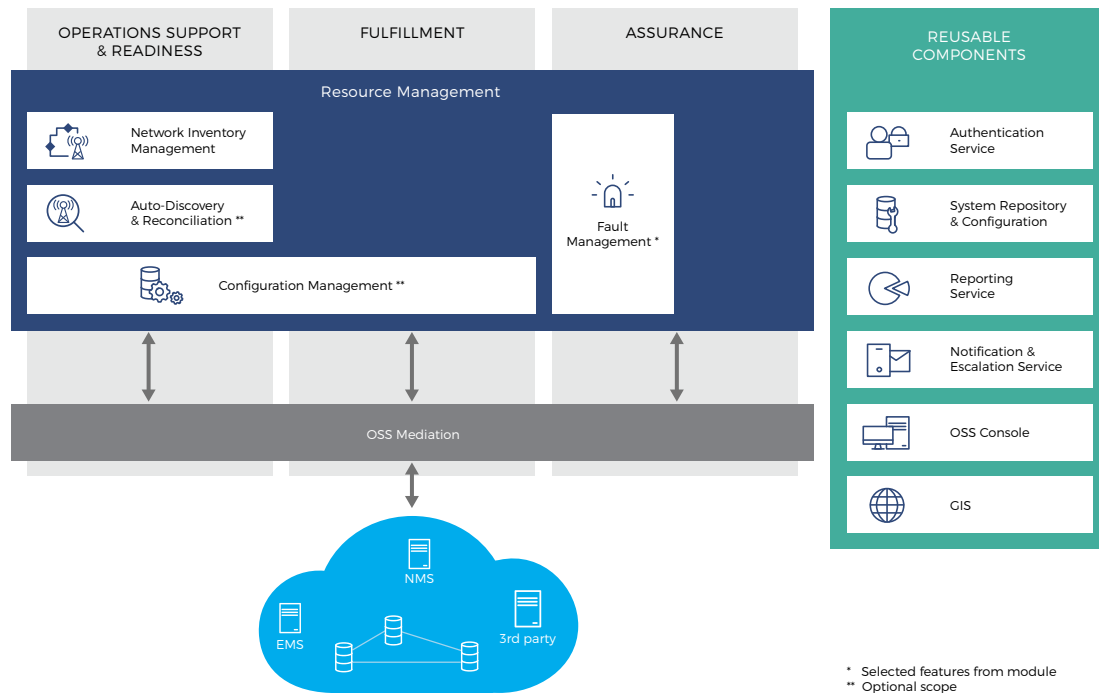

Fig. 2. Figure Comarch OSS Modules used in the SON Integration Box

The solution is responsible mainly for integrating centralized SON tools with the existing OSS. As a central hub for the exchange of various types of data, it aggregates SON plans and dispatches them to different tools. It also provides physical network information to SON. Data is gathered from multiple external sources and pre-processed for SON usage. Additionally, SON Integration Box can manage neighbor whitelists and blacklists, and fetch all SON-related events and alarms for assurance purposes, acting as a mediation and filtering mechanism for fault management systems, usually via an SNMP interface.

Comarch SON Integration Box comes with three optional

features: RAN network audits with auto-corrections, provisioning SON plans using configuration management in network management systems where vendor hardware is not supported, and optimizing the transport network based on SON actions.

Users don't need to log in to Integration Box to perform any actions, as the system runs automatically. The console (GUI) is used only to control and configure adapter settings or reports, and is managed by admins / super-users. Radio network planners can use the GUI for actions applying to selected additional or optional features. All other actions are automated.
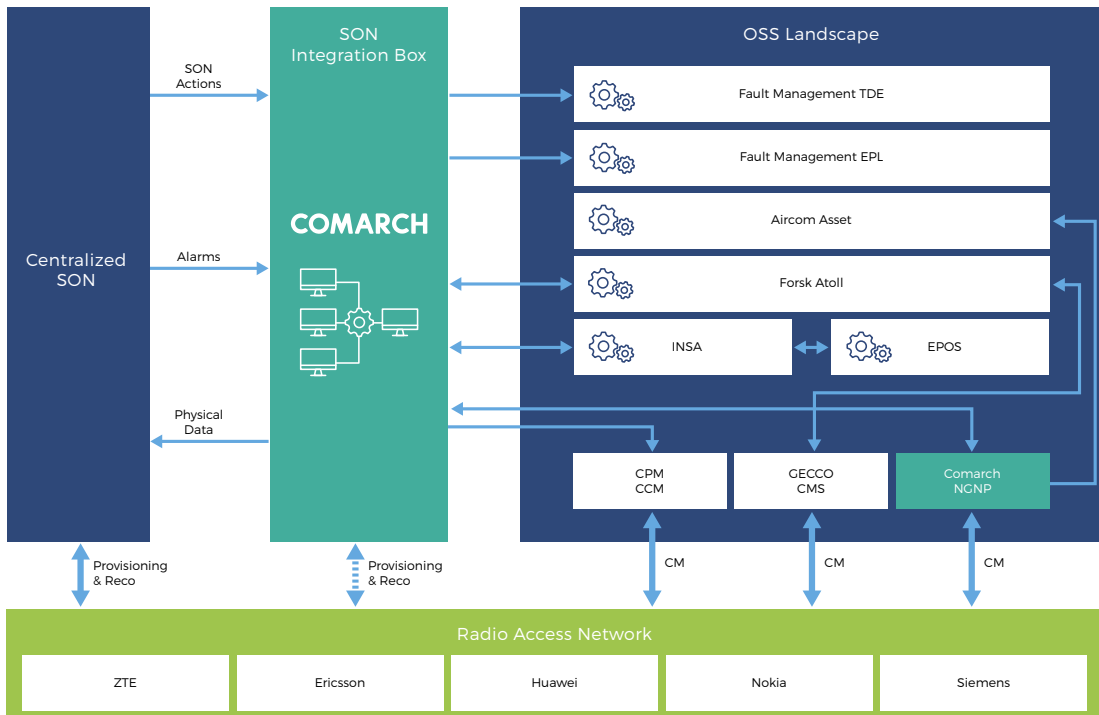
Fig. 3. Sample OSS Architecture with Comarch SON Integration Box

The solution's core features relate mostly to managing data exchange between centralized SON and third party systems or network elements. A SON tool plans actions, which are simultaneously provisioned directly to RAN elements and delivered to the Integration Box. Those actions are stored in the Integration Box database, processed, and distributed to OSS applications. The Comarch solution can also be used to provision SON

plans for specific RAN vendors or technologies, even those not supported by SON.

All data flows into and from Integration Box are maintained by Comarch's OSS Mediation module, using dedicated interfaces. Fetching and dispatching data is based on an internal inventory framework.
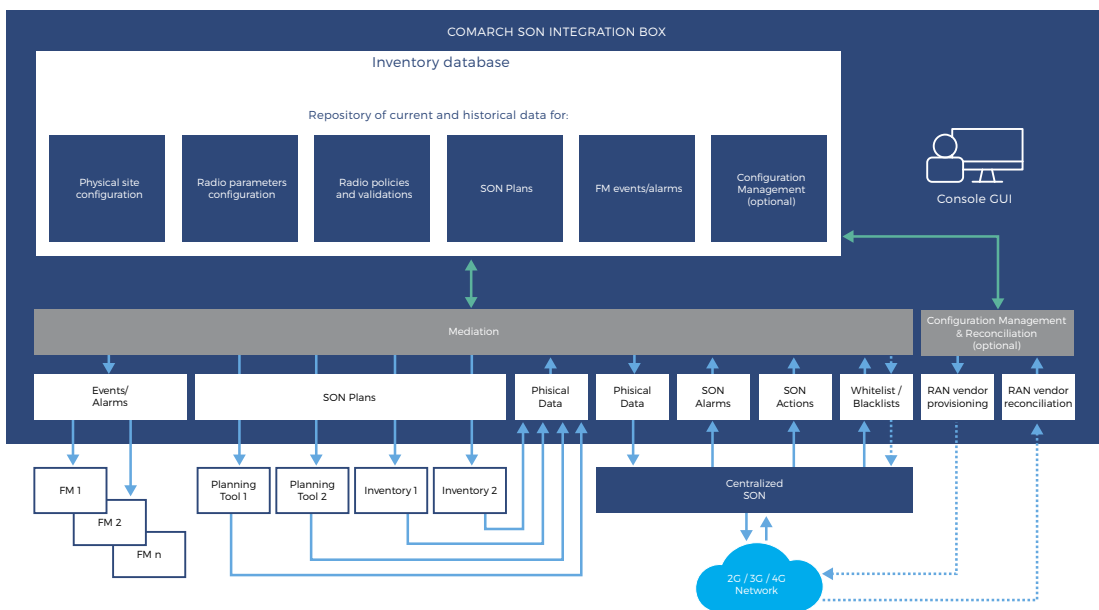

Fig. 4. Data Flows in the Comarch SON Integration Box

How to Enhance SON Capabilities with Comarch's SON Integration Box

Aside from its core function, Comarch SON Integration Box also provides the "missing capabilities" of SON tools.

Track and roll back

Comarch SON Integration Box is based on an inventory database that stores the history of all SON plans and allows operators to identify problems and roll back SON-related changes if something goes wrong.

Network audits

Full network audit capabilities provide deep insight into default values for the network parameters of all RAN managed objects, regardless of vendor. The Integration Box allows parameters to be modified and provisioned, even those not usually monitored and processed. The built-in scheduler can be used to trigger periodical network audits, aimed at correcting parameters or reporting discrepancies. All this is done in full synchronization with an SON tool.

Configuration management for smaller SON vendors

Comarch's SON Integration Box, in combination with Configuration Management, extends SON capabilities to hardware from all (even smaller) vendors. The solution can use automatic mediation to decompose SON plans and dispatch SON actions to network elements provided by any supplier. The process is transparent for end users (done by automatic mediation rules).

Transport optimization

The unique value of the Comarch SON Integration Box lies in its mobile backhaul capabilities. The solution supports SON tools with optimization of the transport layer, automatically detecting mobile backhaul interface dependencies and applying corrections directly to network elements. Actions can also be triggered by SON requests to provision, correct or delete Iur or X2 interfaces.

7 Reasons to Choose Comarch SON Integration Box

1. Quick implementation of SON

2. Enhancement of core SON capabilities

3. Ready to use rules and policies prepared by an experienced team (former RAN experts)

4. Painless integration of SON and OSS

5. Automation of SON processes within the whole OSS environment

6. A scalable solution with easily activated modules

7. Short time to market, thanks to re-using a ready-made library of interfaces to existing applications (performance management, fault management, planning, inventory, etc.)

Comarch SON Integration Box for SON – Case Study

Comarch has implemented the SON Integration Box at a Tier 1 European carrier with around 40 million subscribers, where uncontrolled and unmonitored SON had created unacceptable network quality issues.

CHALLENGES:

- Inconsistencies between data in the network and the planning tools

- Lack of protection against unauthorized changes in the network carried out by SON algorithms in OSS configuration management tools

- Unmanaged dependencies within a multi-domain, multi-technology and multi-vendor network

RESULTS:

- Automated network optimization for the multi-layer, multi-vendor radio network

- More than 400,000 2G/3G/4G cells covered

- Managed network quality thanks to ensuring data consistency between the network and supporting OSS tools

- Up to 100k changes per day on network elements processed through the solution

- Synchronization provided on nine types of northbound interfaces

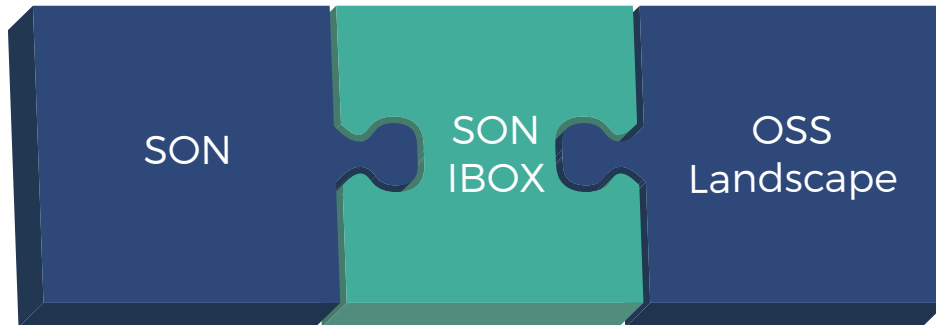- All SON-related alarms and events aggregated, processed and distributed to Fault Management tools

Fig. 5. Comarch SON Integration Box – Merging SON Solutions with Legacy OSS

Summary

Business continuity should be undisrupted as new tools are added to a legacy OSS environment. SON vendors are responsible for delivering the most efficient optimization features. They do not focus on how OSS will operate after implementation.

Comarch cares about the wider picture, providing comprehensive solutions for complex OSS worlds. Whichever vendor supplies your SON solution, Comarch can make it run smoothly in any environment.

For more about Comarch OSS solutions visit:
telecoms.comarch.com

It's Time to Focus on Quality of Service in the IoT

WOJCIECH MARTYNIAK | M2M/IOT PRODUCT MANAGER

> **M** obile customers have become very demanding. They constantly search for a better price, a more reliable connection, or higher quality.

Machines, in a way, are similar. Maybe the price factor is not as important to them as it is to people, but high quality is a must. Without appropriate quality of service, data transmission can't be established and the whole device system can collapse – a battery for a given piece of equipment can get lost or rebooting can take too long, resulting in loss of connection and leading to a serious device or process malfunction.

What Does Quality Mean in IoT?

For some industry verticals these potential issues can be marginalized, for others not. The biggest problem is that there is no universal definition of quality, nor one point of

its measurement, nor one understanding of its meaning for customers. On top of that, Quality of Service in the Internet of Things (IoT) has not yet been well identified.

The IoT is very diverse. It is present in so many industry verticals, such various areas, that it is impossible to apply a "one size fits all" approach. Customers in the healthcare sector have very different needs to those in the automotive industry. The differences between verticals can be seen not only in their requirements related to service efficiency and availability, but also in the potential influence of any malfunction on their operations. For example, if a heart monitoring device reboots fifteen times a day, transmission of data related to a patient's health is heavily disrupted, which can't happen as it can

be life-threatening. IoT service quality means something different for each industry, but in general it comes down to a reliable, constant connection, real-time device operation of the device, and efficient online monitoring and fault detection. Business customers operating in the IoT with their specific devices often do not even know that measuring service quality is possible, or that so many KPIs can be monitored and that any device can be fixed before something serious happens.

That is why an IT solution for telecom operators and enterprises offering IoT services to various vertical markets should be able to answer the specific needs of each vertical.

The Specifics of Modern IoT Services

A service in IoT is not composed of connectivity on its own (such an approach has been long gone), so IoT service providers need to build service bundles composed of applications, devices, support, consultancy and connectivity.

A modern, end to end IoT proposition must therefore take into account some way of measuring real experience and performance at the point of connectivity, as well as the device and application usage – the foundation of the IoT service. The KPIs collected from a given device and the used or embedded SIM card can then be correlated with network measurements, ensuring the highest quality of monitoring. This results in the IT system performing the right actions, with the aim of improving and ensuring

the quality of the IoT service and the related SLA, and of providing an actionable analytics capability to IoT customers.

> *A modern, end to end IoT proposition must take into account some way of measuring real experience and performance at the point of connectivity, as well as the device and application usage – the foundation of the IoT service.*

Why Real-time Actionable IoT Analytics?

Actionable, real-time analytics provide IoT suppliers with thorough knowledge about their customers, the services they are using, their devices, processes, and much more. Such functionality can show real performance as statistics associated with correct or erroneous functioning of the equipment, mobility analytics including the density and trajectories of SIM card movements, consumption analysis of different service types presented in a variety of settings (including temporal and spatial), and KPIs in relation to SLAs.
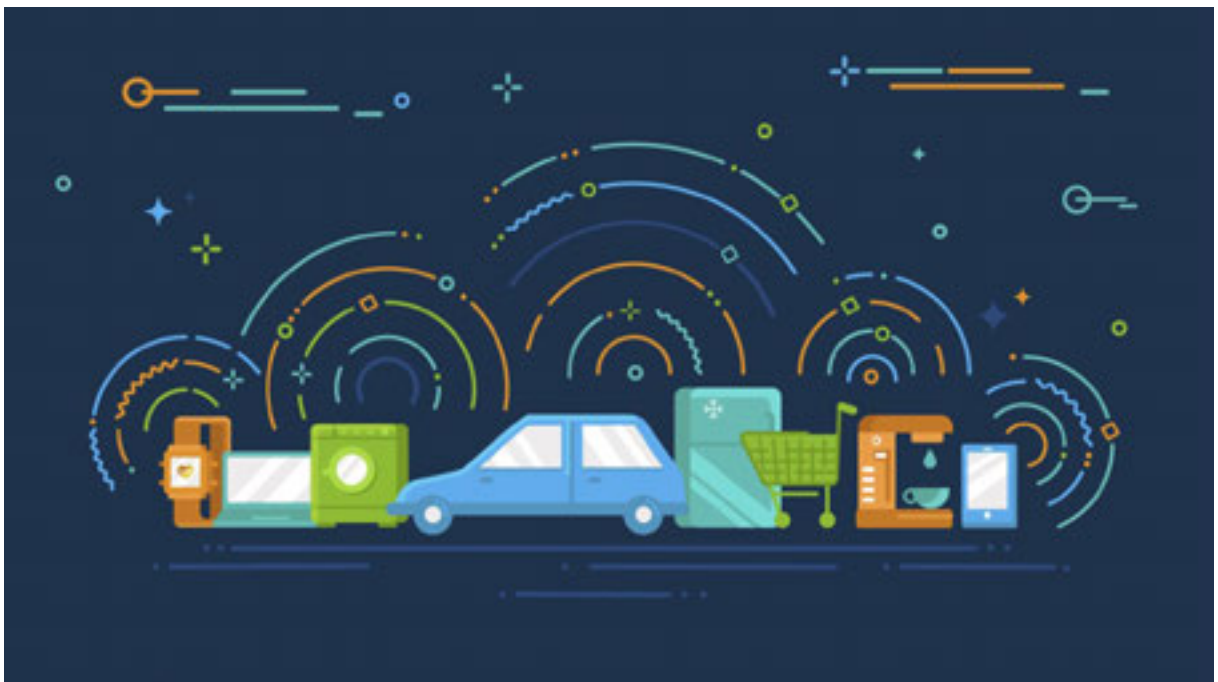
An innovative and unique way to collect KPIs related to devices and applications is to deploy device application software (an "agent") and SIM / eSIM applets, acting as collection applications and allowing service providers to retrieve the relevant KPIs that complement network-based measurements (such as probes, service control modules or other data sources).

A modern IoT platform should enable this kind of monitoring and analysis, to allow service providers to monitor the cellular connectivity of static and mobile objects within different verticals in real time from the device perspective. Such an IT system should also provide instant access to information about the network status,

and perform analyses in order to highlight problems immediately, by ensuring a rich set of data is available and accessible at any time.

The Various Expectations of IoT Customers

Customers from the healthcare sector expect their IoT solutions to provide information about anomalies, especially in situations when device behavior is different than expected, when the time to service after a device reboot is too long, or even when the battery level is low.
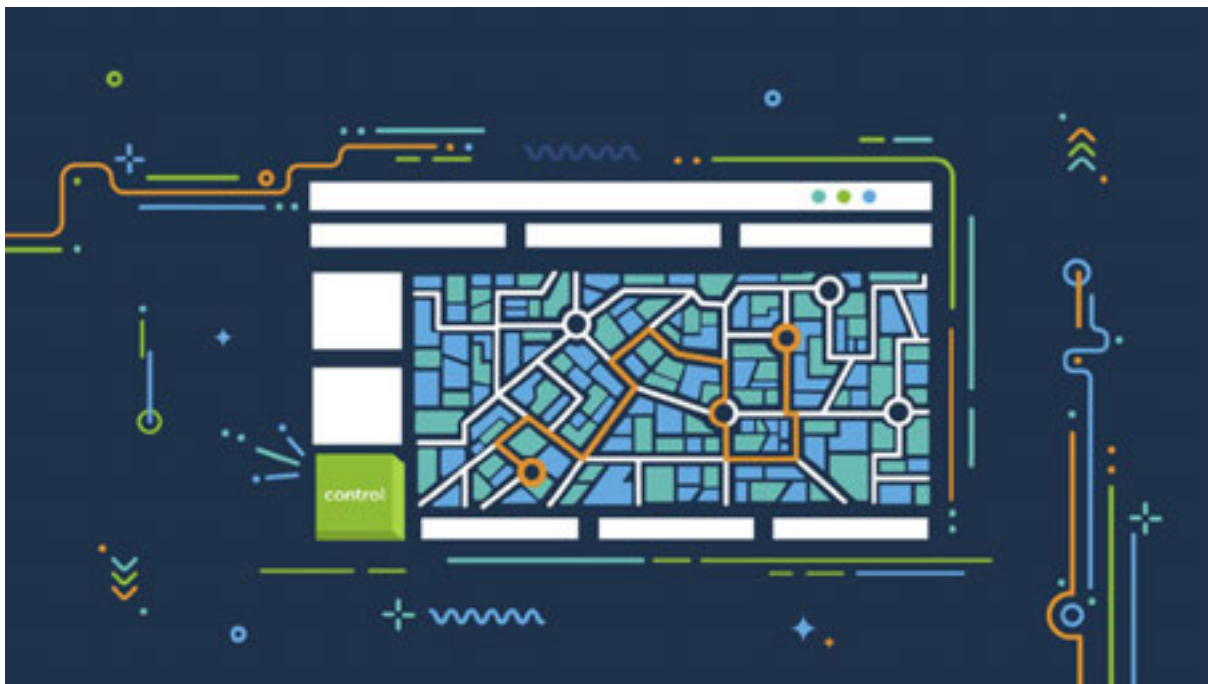
By comparison, the needs of the automotive industry are very different. For these customers, the most useful data would be related to the location of a given SIM card, (including geolocation beyond cell ID), its mobility, information on battery level, or the software version installed on a given device being changed without permission.

In smart metering, useful information delivered by an IoT solution could contain details of the meter itself, the number of reboots occurring per day, the time to service after each reboot, the placement of the meter and the KPIs coming from connectivity (such as zero sessions, sessions that were too long or even erroneous behaviors, e.g. when a hundred of machines is alive but one of them is taking too long to connect).

Modern IoT Solutions – a Win-win for IoT Providers and Customers

An IoT real-time actionable analytics solution enables mobile network operators to enhance their network service quality and reduce the risk of connectivity issues for their IoT customers. Such an IT tool enables the correlation of data collected from connectivity, IoT devices and applications, and includes analytics capabilities, which brings unique value to the service providers, as well as to their IoT customers.
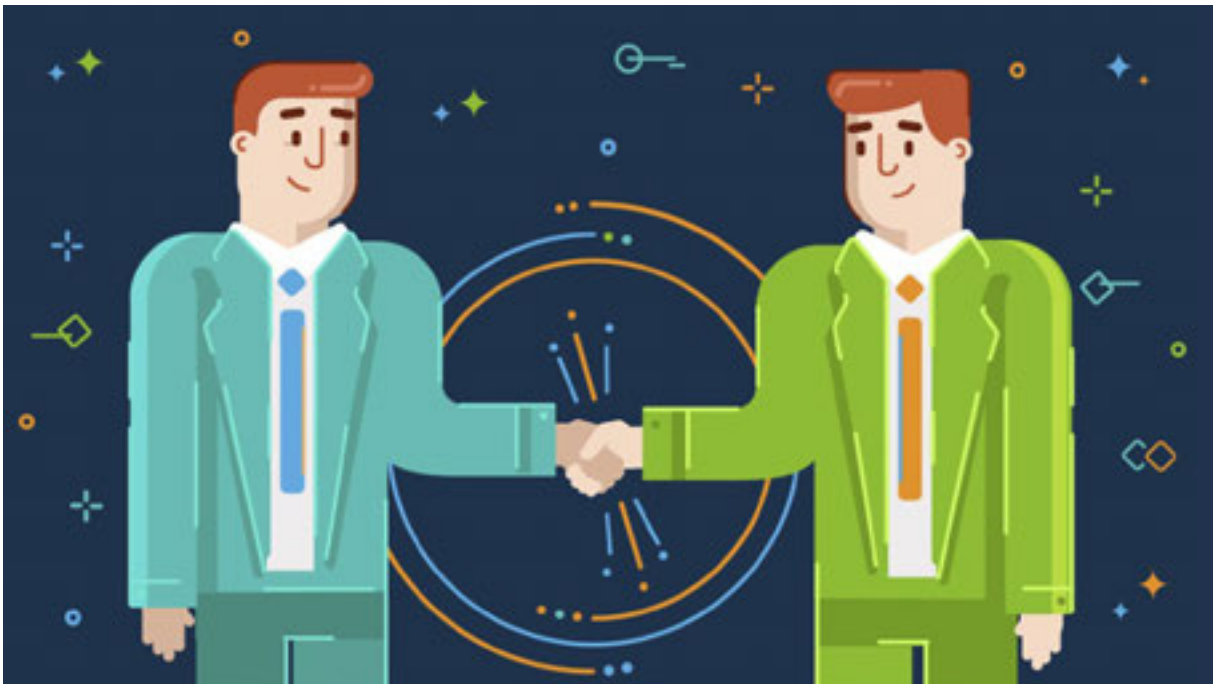
The operators can generate additional revenues by selling premium services with guaranteed highest quality, offer reliable connectivity to prevent customer churn, and provide best in class customer service. On the other hand, such an IoT solution empowers IoT customers with information about real device experience and performance, as measured at the point of connectivity, with predictive actions and maintenance and the opportunity to limit the cost of service level agreements significantly.

Summarizing, Quality of Service in IoT is still a green field area. Many operators are selling various quality levels as options (SLA) in their tariff plans, but such proposals usually offer access to 24-hour consulting services, without any real-time analytics or monitoring. Solutions such as Comarch M2M Platform with Quality of Service in IoT enable communication service providers to get one step ahead of the competition and to meet the expectations of today's IoT customers.

Improving Quality and Safety of IoT Services with Machine Learning

IZABELA SMIETANA | SOFTWARE ENGINEER, M2M R&D DEPARTMENT
MARIUSZ GRZYBACZ | SOFTWARE ARCHITECT, M2M R&D DEPARTMENT

The M2M/IoT (R)evolution

Gartner predicts that in 2020 there will be approximately 21 billion connected devices and even now there are already almost as many devices in the Internet of Things (IoT) as there are people. The current growth rate estimated by Gartner is more than 5 million devices a day.

Most telecom operators are already offering IoT-related services and they are now facing many new challenges related to quality of service and security. These challenges can be overcome by using modern IT platforms that allow the efficient sale and management of M2M/IoT services.

Machine Learning

Machine learning is a sub-field of artificial intelligence. The concept of programming machines in a way that makes them able to discover new knowledge and improve their modus operandi is not new – it dates back to the 1950s.

Modern open source software allows the execution of machine learning algorithms effectively, using faster processors and cheaper memory. Telecom operators increasingly use these solutions to analyze information they collect from many sources.

Fig. 1. Comarch M2M Actionable Analytics: Time Histogram of Data Volume
Transferred by M2M Devices

M2M Data Anomalies

Detecting anomalies has numerous applications in very different areas – from diagnostics of aircraft engines to detecting cyber-attacks.

An anomaly is defined as a data pattern that differs from the rest of the data or from what is expected. In temporary data, such a deviation is considered as an event – which can be regarded as positive or negative. The availability of relevant data determines what types of anomalies can be detected.

Anomalies found in data ingested from M2M connectivity platform may include:

- The absence or over-activity of the device, other than normal intervals between the activities,

- Deviations from expected service usage for the device type,

- Unexpected device mobility changes – especially visible in cases where the device should be stationary (e.g. ATM) or should expose large mobility (truck),

- Authentication problems – an increased number of signaling messages related to device authentication,

- Excessive use of network signaling and absence of use of paid services – it could indicate some kind of fraud,

- Unexpectedly high activity of devices in a specific location

By analyzing the data collected through diagnostic applets installed on SIM cards, we can perform much deeper analysis of potential problems, which can uncover issues related to signal strength, battery function and device state.

These are only a few examples, and problems can be a result of a combination of factors.

Fig. 2. Comarch M2M Actionable Analytics: Devices with Top Deviations to the Mean Value

Anomaly Detection Process

Data ingestion and management

Data from M2M Connectivity platform are supplied to the next stages of analysis, using the Apache Kafka message broker. Historical data used in the initial steps of the process are stored in Parquet files and made available for an analysis engine based on Apache Spark. An exploratory analysis allows to better understand the nature of the data. It is carried out using Elasticsearch and a web application that is responsible for visualization of the aggregated data. It is also possible to perform ad-hoc SQL queries and many other operations offered by Apache Spark, using the interactive Apache Zeppelin tool (in this case data are stored in the Parquet files in a Hadoop Distributed File System).
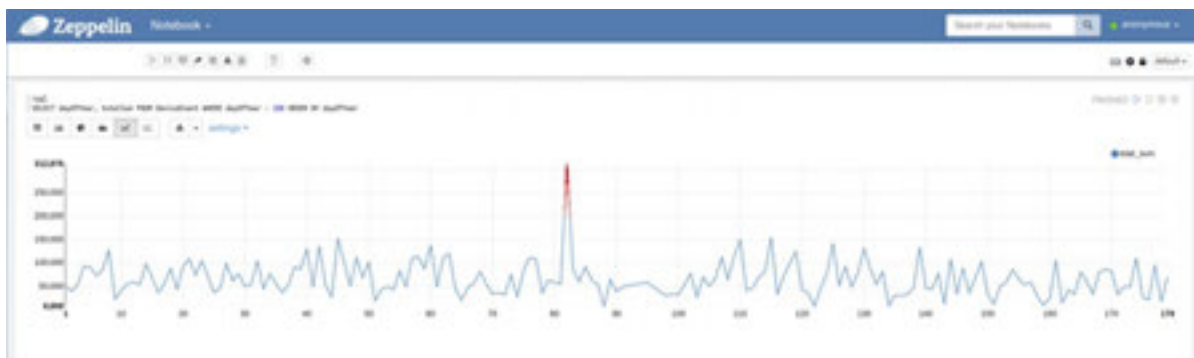

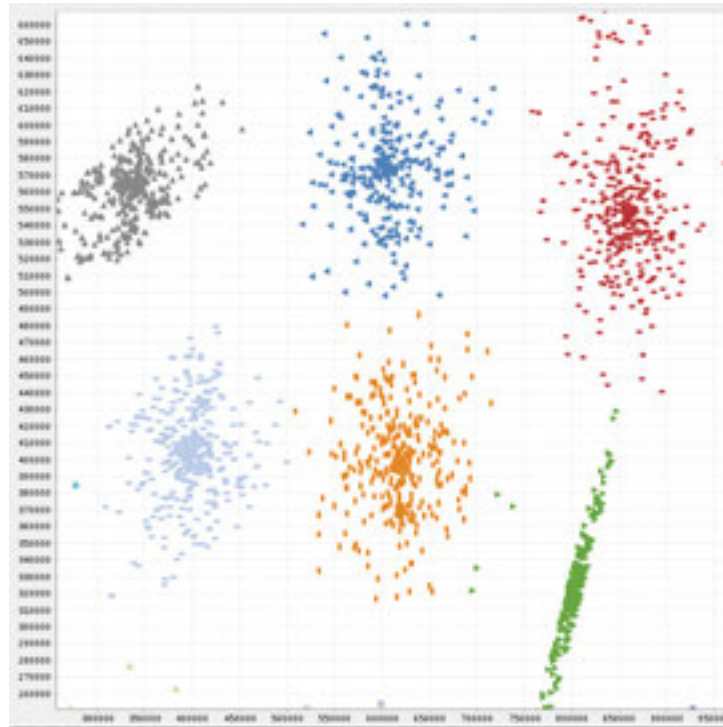Fig. 3 . Analyzing M2M Data with Apache Zeppelin

Fig. 4. Clustering Visualization after Applying Dimensionality Reduction

Detecting Anomalies in M2M Data

The solution is designed to detect previously unknown anomalies. The system analyzes stream data, collected near real-time from many different devices with various behavior patterns, while also being able to access some historical data.

Apache Spark provides a number of ready-made machine learning algorithms, and can operate on large volumes of data in a scalable way. Taking into account the multidimensional nature of the analyzed data, its volume, time of building machine learning model and the ease of use of the algorithm, k-means clustering seems to be the best approach. It groups data based on the distance between a specific vector of features and a computed cluster center (centroid).

Preparing Feature Vectors

Comarch M2M Actionable Analytics prepares an aggregated record for each device, describing service usage and mobility for a selected weekly period. These extracted features are then normalized to a common range.

Building a Machine Learning Model

Next k-means algorithm is run to build machine learning model specifically for each device type. Such models consist of multiple separated data clusters, represented by centroids. Each particular cluster describes some behavior pattern. This stage is repeated several times, so that the resulting model contains only information related to normal behavior. Some patterns assigned to the smallest clusters gets removed from the model during each iteration, as they may represent anomalous activities undesirable in the subsequent processing step.

Streaming Data Processing

Streaming data (i.e. data generated continuously by many data sources), with records representing device activities are divided into moving time windows. Each record is assigned to one cluster, using the model and the distance to the nearest cluster centroid.

Then the system decides whether a given record may represent an anomalous device:

■ Vectors at the greatest distance from the cluster centroid are treated as most different from other devices

■ Assigning the record to a new, different cluster which indicates a change in device behavior.

A detected anomaly is recorded in Comarch M2M ction-able Analytics and can cause an alarm notification. To avoid excessive reporting, alarms are generated only for a certain number of major anomalies, to a level that can be handled by human operators. A similar anomaly in a large number of devices is treated as a single group for alarm purposes.

Fig. 5. Distance Distribution of Data Points from Nearest Centroid

Summary

There are more and more connected devices worldwide, which poses new challenges for telecom operators in ensuring high quality of M2M services and their proper security. Comarch M2M Actionable Analytics, a valuable addition to the Comarch M2M Platform, addresses those challenges.

The advantage of anomaly detection based on machine learning is that it allows identification of previously unknown issues that may be responsible for quality problems and security threats. This enables service providers to eliminate negative anomalies and prevent future ones. As the process is based on streaming data, potential problems can be detected and solved faster and pro-actively. Thanks to using the best Open Source components (Apache Spark, Apache Kafka) the solution can operate on huge volumes of data in a scalable way.

Comarch M2M Platform with Actionable Analytics

Comarch M2M Platform is relevant for multi-national, multi-level and multi-operator environments in industries such as automotive, consumer electronics, FMCG, energy & utilities, finance & banking, healthcare, manufacturing, public services, security, and transport & logistics.

Comarch M2M Platform is a solid foundation IT system that has been implemented by major European mobile operators. Comarch M2M is recommended in numerous reports and received the Pipeline Innovation Award for Innovation in Connectivity in 2013.

Comarch M2M Actionable Analytics complements the platform's functionality with a rich set of analytical tools. It allows not only to explore and visualize the collected data but also to automatically detect any anomalies, based on machine learning algorithms.

Learn more about Comarch M2M Actionable Analytics at: http://m2maa.comarch.com/

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20-21 September 2016

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A unique networking event for Comarch customers focused on digital transformations in telecommunications, finance and services industries.

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Informa and Comarch present: Making the shift from telecom operator to digital service provider

Join Comarch and leading Scandinavian telco representatives as they discuss how consolidation, data analytics, network virtualization, M2M & IoT and cloud based OSS can lead this fundamental network transformation.

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Join the first Comarch event for Brazilian telcos and learn more about approaching NFV/SDN, SON and CEM in telecommunications, among other topics.

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Comarch Telecom Brunch

After a successful Netherlands edition, the Brussels edition will focus on "Digital Transformation: the door to success" as a main topic, gathering telecoms from the Benelux region in a unique networking event.

COMARCH

ABOUT COMARCH

Comarch is a provider of complete IT solutions for telecoms. Since 1993 the company has helped CSPs on 4 continents optimize costs, increase business efficiency and transform BSS/OSS operations. Comarch solutions combine rich out-of-thebox functionalities with high configurability and are complemented with a wide range of services. The company's flexible approach to projects and a variety of deployment models help telecoms make networks smarter, improve customer experience and quickly launch digital services, such as cloud and M2M. This strategy has earned Comarch the trust and loyalty of its clients, including the world's leading CSPs: Vodafone, T-Mobile, Telefónica, E-Plus, KPN and MTS.

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