

TRIAL EVALUATION

(HRADEC KRÁLOVÉ – PARDUBICE)

VERSION: 1.01

Document Changes

Version	Date	Chapter	Change Description	Change done by
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1 General Description

This document provides an evaluation of 2G/3G consolidation trial which comprises two clusters:

- district Hradec Králové
- district Pardubice

The consolidation trial is based on 2G/3G MORAN functionality and is worth mentioning that all paragraphs below provides an evaluation for partial operations which preceded NDN.

2 Network Quality KPI

2.1 HK Cluster evaluation by SLA KPIs

2G_HK cluster	Week 36 (1 Sep 14)	Week 51 (15 Dec 14)	delta
Voice Call Setup Success Rate 2G	99.34	99.43	0.09%
Voice Call Drop Rate 2G	0.44	0.38	13.64%
Data Call Setup Success Rate 2G	98.04	98.31	0.28%
Data Call Drop Rate 2G	1.72	1.27	26.16%

All 2G KPIs fulfilled SLA target. We can see an improvement after cluster swap.

3G_HK cluster	Week 36 (1 Sep 14)	Week 51 (15 Dec 14)	delta
Voice Call Setup Success Rate 3G	99.86	99.86	0.00%
Voice Call Drop Rate 3G	0.19	0.16	15.79%
Data Call Setup Success Rate 3G	99.93	99.92	-0.01%
Data Call Drop Rate 3G	0.73	0.66	9.59%

All 3G KPIs fulfilled SLA target. We can see an improvement regarding drop rate KPI. The rest of KPIs are at the similar level.

Below you may find a short summary regarding open and closed problems between O2 and T-Mobile (status as of January 20th, 2015).

Cell SLA KPIs

- 12 still open
- 6 closed / solved via optimization

Network SLA KPIs

- 1 still open
- 1 closed / solved via optimization

2.2 PU Cluster evaluation by SLA KPIs

2G_PU cluster	Week 36 (1 Sep 14)	Week 51 (15 Dec 14)	delta
Voice Call Setup Success Rate 2G	99.28	99.59	0.31%
Voice Call Drop Rate 2G	0.47	0.31	34.04%
Data Call Setup Success Rate 2G	97.96	98.77	0.83%
Data Call Drop Rate 2G	1.76	1.78	-1.14%

All 2G KPIs fulfilled SLA target. There is no improvement for Data Call Drop Rate KPI. The root cause is probably due to migration to Abis over IP. At first we have harmonized the cell parameter settings (N3101.GCELLSTANDARDOPTPARA) with O2. The problem is being analyzed together with O2 and Huawei.

3G_PU cluster	Week 36 (1 Sep 14)	Week 51 (15 Dec 14)	delta
Voice Call Setup Success Rate 3G	99.87	99.83	-0.04%
Voice Call Drop Rate 3G	0.17	0.19	-11.76%
Data Call Setup Success Rate 3G	99.39	98.22	-1.18%
Data Call Drop Rate 3G	0.89	0.45	49.44%

Data Call Setup Success Rate didn't fulfilled SLA target. The problem is being analyzed. The rest of KPIs are at the similar level or better.

Below you may find a short summary regarding open and closed problems between O2 and T-Mobile (status as of January 20th, 2015).

Cell SLA KPIs

- 12 still open
- 8 closed / solved via optimization

Network SLA KPIs

- 2 still open
- 2 closed / solved via optimization

chapter author: Rudolf Brejcha

2.3 Drive test KPIs

2.3.1 HK Cluster drive test SLA KPIs

Voice KPIs	Before value	After value	R. Delta	Traffic Light
Call setup success rate [%]	99.34%	99.43%	+0.09%	OK
Call success termination rate [%]	99.57%	99.50%	-0.07%	IN LIMIT
Average speech quality [MOS]	4.03	4.00	-0.75%	NOT OK
Data KPIs	Before value	After value	R. Delta	Traffic Light
Data Session Setup Success Rate [%]	94.80%	98.60%	+3.85%	OK
Data Success Termination Rate [%]	100.00%	99.60%	-0.40%	IN LIMIT
Average Data transfer rate FTP DL [Mbit/s]	7131	7837	+9.01%	OK
Average Data transfer rate FTP UL [Mbit/s]	1595	1523	-4.76%	IN LIMIT

The Drive test based KPIs Before/After Swap are comparable with exception of **small degradation of TMCZ MOS speech quality**. At O2 network it was observed a decrease of average UL throughput.

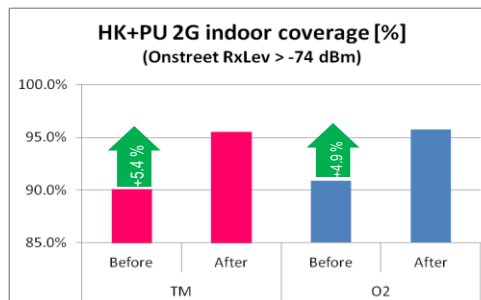
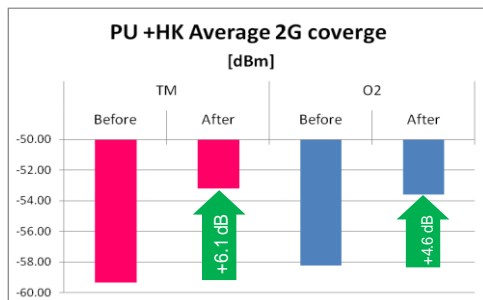
2.3.2 PU Cluster drive test SLA KPIs

Voice KPIs	Before value	After value	R. Delta	Traffic Light
Call setup success rate [%]	98.77%	98.01%	-0.77%	IN LIMIT
Call success termination rate [%]	98.16%	98.79%	+0.64%	OK
Average speech quality [MOS]	4.03	4.05	+0.50%	OK
Data KPIs	Before value	After value	R. Delta	Traffic Light
Data Session Setup Success Rate [%]	85.40%	99.40%	+16.39%	OK
Data Success Termination Rate [%]	100.00%	100.00%	+0.00%	OK
Average Data transfer rate FTP DL [Mbit/s]	6484	7365	+13.59%	OK
Average Data transfer rate FTP UL [Mbit/s]	1769	2169	+22.61%	OK

All TMCZ statistics improved or are in a range of degradation acceptable limit.

2.3.3 2G drive tests – signal coverage changes

- Both T-Mobile and O2 improved 2G coverage, T-Mobile gained 1.5dB more than O2
- Nevertheless a lot of places with significant coverage decrease were identified as well
- Customer complaints concentrated in areas with coverage loss are confirmed by measurement
- Highest coverage loss: Chlumec, Přelouč, Sezemice, Ostřetín/Veliny (solved), parts of HK**

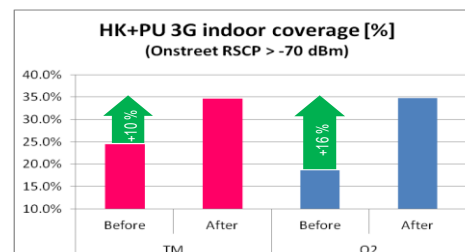
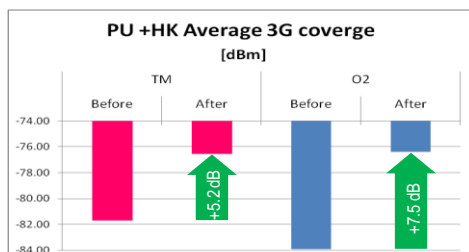


TMCZ 2G coverage change: +6.1 dB, indoor coverage +5.4 %

TO2 2G coverage change: +4.6 dB, indoor coverage +4.9 %

2.3.4 3G drive test – signal coverage changes

- Both T-Mobile and O2 improved 3G coverage, O2 gained 2.3 dB more
- Nevertheless a lot of places with significant coverage decrease were identified as well
- O2 used to have worse 3G coverage in the area, consolidation accounts higher benefits for O2
- Remarkable increase of 3G indoor coverage >10 %**



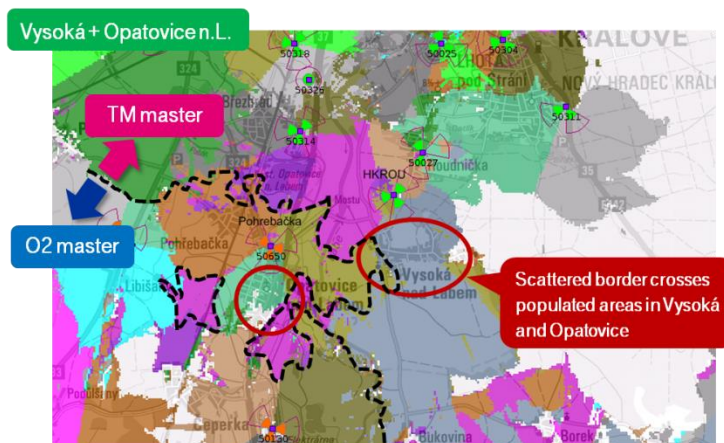
TMCZ 3G coverage change: +5.2 dB, indoor coverage +10 %

TO2 3G coverage change: +7.5 dB, indoor coverage +16 %

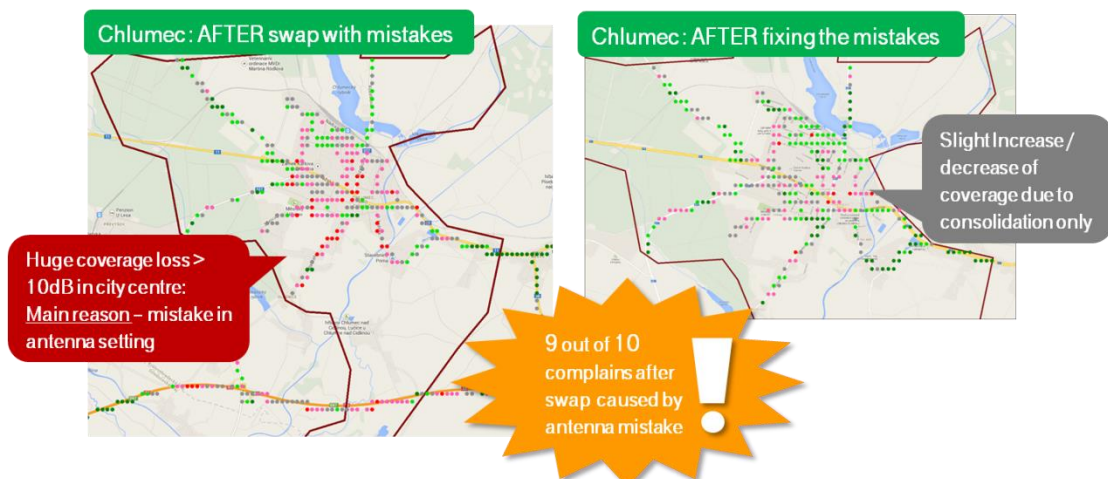
2.3.5 Drivetest & Optimization Findings

Following important findings have been collected during more detailed drivetest evaluation and consequent cluster optimization:

- Network behaviour on master/visitor border is rather poor, especially at indoor locations, where due to missing bestserver UE often performs ping-pong reselection between network operated by different master providers. This results often LAU/RAU procedures which significantly reduces 3G data throughput and MTC setup success rate (user availability) on 2G and 3G. This problem is known from previous Icebreaker project.
- Villages Vysoká nad Labem and Opatovice nad Labem have been evaluated as the most critical part of the boarder between HK and PU clusters with lot of customer complains coming out of there. **As the minimal solution proposal has been identified reconnection of site 50650 Pohrebacka back to T-Mobile master network (HK cluster).** As the best solution another 2 to 4 sites need to be reconnected from O2 to TM network – for optimal performance on whole boarder and especially D11 highway
- Learning: Master/visitor boarder must be optimized even during planning phase and placed out of populated areas. From the same reason **it is highly recommended to prevent inhomogeneous consolidation based on islands etc.**



- Mistakes in antenna parameters (wrong tilts, azimuth, crossed sectors) **may lead to huge coverage losses and cause high portion of customer complains.** Such mistakes significantly decrease customer experience from consolidation. **For instance in Chlumec nad Cidlinou wrong antenna setting was reason for 90% of received customer complains.** Only in 10% of cases consolidation itself was identified as the mason.



chapter author: Radek Penížek, Josef Fencel

2.4 Customer Complaints

Processing and evaluation of customer complaints and disorders has been performed by RAN planning team.

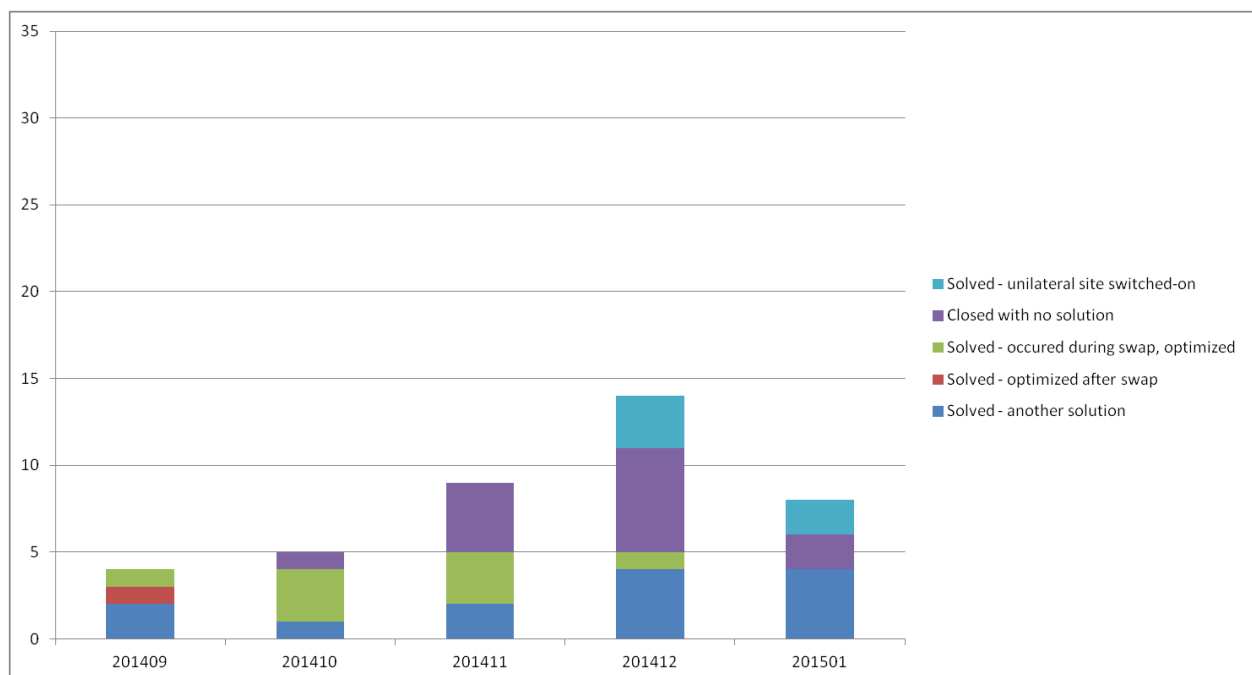
The total number of all complaints was originally expected to be high but the reality is surprisingly lower. **Number of the complaints does not exceed 35 cases per month and per the cluster. This amount is comparable to the situation prior the consolidation project.** Despite this, and it is evident from the attached graphs below, the number of the complaints in the cluster Pardubice is several times larger than in the cluster Hradec Králové **which may indicate that in the Pardubice cluster is a network of a lower quality.**

Unfortunately, Service excellence and RAND team representatives, under pressure of marketing department, decided to reconnect several previously turned off sites. This, however, led to the situation where not all possibilities were realistically tried and declaration of objective conclusions cannot be easily done.

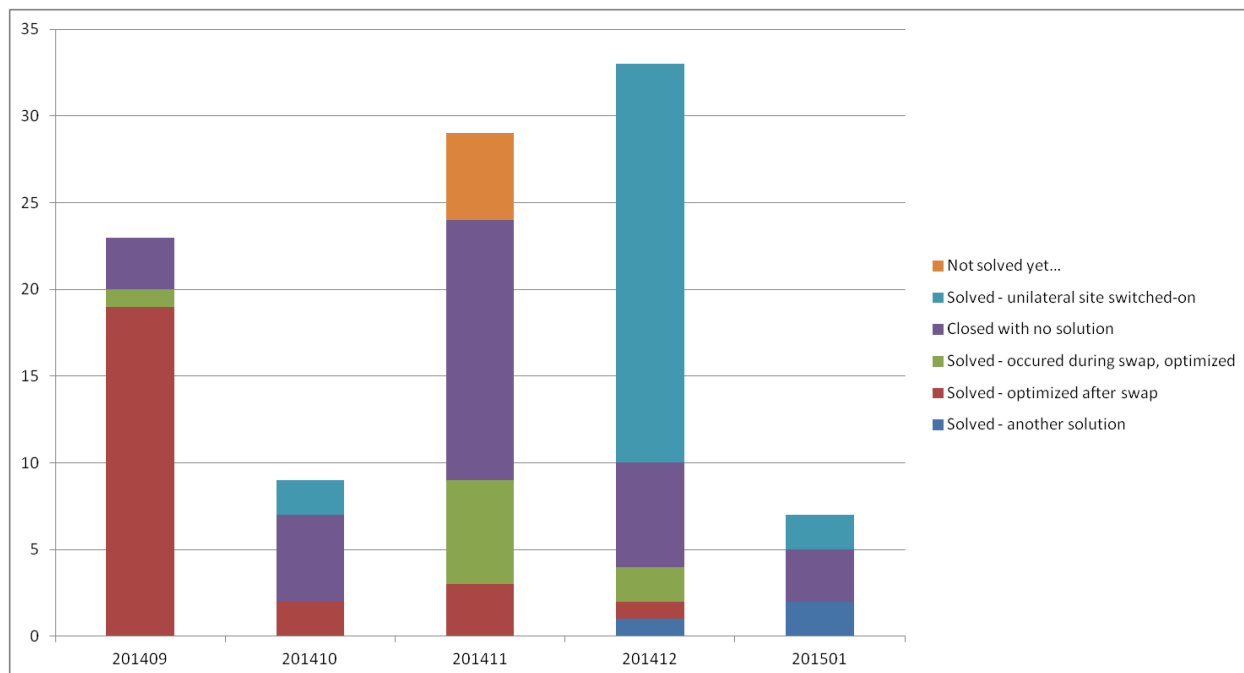
General output:

- O2 does not solve the registered complaints (according to available information). Their financial department rigorously enforces minimum consolidation factor which is also a valid and enough argument for rejecting complaints. RAN planning further conjectures that O2 inadequate coverage areas with unilateral customer solutions.
- TMCZ is working on a "waiting list" - in a consolidated network all areas will be specified where a real drop of coverage and signal quality is expected. In agreement with the NM team, marketing and newly a finance department, that list will be ranked according to relevance, and even in some cases cluster consolidation factor will be increased and several sites will be added to the Common grid. "Waiting list" so fairly and objectively will help to meet potential customer complaints to prevent them. O2 does not share this approach.

HK cluster complaints (NDN TvT: 23.9.2014, NDN Trial: 1.12.2014)



PU cluster complaints (NDN TvT: 25.9.2014, NDN Trial: 3.12.2014)



chapter author: Petr Olšovský

3 Operation

3.1 Incident Management

Incident Management final setup process and exchange of tickets is not yet integrated therefore trial verified only the ability to monitor sites (which are in the responsibility of the Master). **TT exchange between T-Mobile and O2 is based on email communication of maintenance center specialists.** Outages entering into information flow systems for informing business are therefore time consuming and may experience a delay with high possibility of failure to record outages at all.

In common operation, IM process accumulated problems with naming convention of sites. TMCZ takes name from O2 for cross-sites which is from the perspective of our current terminology illogical and impractical. Operation strongly recommends adding names sites as standard T-Mobile name. All systems which work with site names are ready for both names (i.e. T-Mobile and O2).

Final setup of IM process information exchange is planned to be implemented in Q3 2015.

Configuration management is also not fully functional until now. Configuration items are not properly updated due to incomplete data in NetCracker. Configuration Management is a base stone for all other processes (IM, ChM, PrM)

chapter author: Jiří Růžička

3.2 Site Access

All site details related to the respective site location (e.g. site entry etc.) are in the Site Book. All these site details are important for FLM and T-Mobile employees. **Tools which are supposed to automatically synchronize all the site details do NOT work and Huawei staff have problems with a manual update (i.e. time constraints, difficult seeking of the details,..).** There is only one way how to exchange the information between T-Mobile and O2 - call or e-mail. All other things e.g. entry via SMS, access list work fine.

chapter author: Josef Majer

3.3 Site Integration

The site integration is split into two parts - **2G** and **3G**

The integration started with 3G technology which should be completed one week before the NDN. 2G swap/consolidation happened in one cluster in one night (NDN).

The most painful problem was with the quality of suppliers and their task made behind agreed schedule. T-Mobile staff was made to put an extra support effort due to ignorance of processes and standards from the contractors.

During the NDN it was/is possible to get On-Air up to 10 sites per hour based on assumption of co-operation at least four specialists from T-Mobile OPS and 10 groups of contractors in the field. This can lead to 80 sites per night in one grid. The procedure and system will dramatically changed during next cluster, no reusing of O2 HW and new feature "Abis over IP".

Before second NDN it was necessary to check completely all transmission path against path loop at the site endpoint which greatly sped up and helped the night switchover. It was the main finding coming from the first NDN.

All HW Integration can be done in advance.

Meet deadlines condition to continue as planned; otherwise it must move milestones according to the current delay.

Mis-matched sectors and large number of errors on new or from warehouse reuse HW.

It is necessary to clarify and consolidate the process of change management to set clear rules and responsibilities. For each activity it is ideal to have one HPSM ticket.

Recommendations for further clusters: Do not touch the Network during Friday in terms of changes in the real network. There is a big probability of site outage till Monday.

When replacing the 3G network it is necessary to respect the following rules

- Swap/Switch off site is needed at the latest at 13:00
- Get site back in service 15:00 at the latest - the supplier shall finish completely all HW change and handover site to configuration specialists from both sides for final parameter setup till EOB.

chapter author: Jiří Růžička

3.4 Abloy exchange

To access cross-sites, key sets were exchanged (sets include all types of keys used by the particular operator). We have exchanged 30 key sets so far. This quantity of key sets is not sufficient. For that reason we are negotiating to increase the number by another 30.

The trial showed that both operators insist on having unified system of keys on sites in their Master area according to their standards. No final agreement has been reached yet. Both Parties aim to replace original locks for locks of our standard at cross-sites, invariably after consolidations of individual sites (approximately a week after NDN).

chapter author: Pavel Šibrava

3.5 Site Revisions at Cross-sites

Each Party is obliged to define an extent of site revisions of cross-site. There are certain site revisions required by Czech law (e.g. electro revisions, lightning revisions etc.). It is mandatory to exchange original site revision documents (for given cross-site) in order to define the extent of revisions. However it is very painful and complicated process to get all those documents from the original site owner (documents are either in paper form only or in digital form only – it is a mess!)

If the Party will not receive those documents, Party will not be able to define the extent and perform required site revision - a penalty may be applied by the legal authorities.

chapter author: Josef Majer

4 Planning & Acquisition

4.1 Transport Planning

There were some issues during the transmission planning process but those were not fundamental.

One of the issues was a missing HW-cross for 2G technology which was supposed to be delivered by the contractors. We shall unify the process of providing connectivity for 2G, 3G and LTE. **Transmission lines were not checked during the trial. There were six line failures (for that reason it is mandatory to check each and every transmission line before NDN starts).**

We have also spent a lot of time in order to raise required tickets at HPSM. A solution is being discussed.

Last note refer to transmission planning process. There are 3 different planning processes for 2G, 3G and LTE. In the end we shall have only one unified process. This is the way we prefer to go.

chapter author: Vilo Dudáš

4.2 RAN Planning

The RAN planning team solved many problems during the Trial. Many of them managed to solve or deal with alternative solutions, some of them are still to be solved and some due to certain reasons can not be solved at all. Problems are divided into internal issues, problems related to Huawei planning and problems related to O2. In the following text there is also indicated how problems could be avoided (see symbol ➤).

4.2.1 Internal issues

4.2.1.1 IT systems and tools

Access network planning is very heavily dependent on the quality and performance of used SW. Systems, which are usually expected to facilitate the work, do not work well for us.

First of all, it is necessary to mention planning and inventory system NetCracker - which has a very complicated data model and is based on a different architecture in compare to its predecessor, which explains the need for input of undue amounts of data and many times slower response. It is also necessary to mention the quite frequent outages related to the fact that the system was recently installed and is not fully tuned yet. Finally, the user's knowledge and experience are naturally very small, while the system is much more difficult and less comfortable.

More or less similar negative experiences have been observed with other systems in use, such as CA Clarity or HPSM. Again, due to their visible over-complexity, unnecessarily high amount of customizations ultimately resulting in a very low response rate, these applications are almost unusable. In addition to all these systems are poorly integrated or are not integrated at all.

- It is more than advisable to avoid implementations or upgrades of enterprise IT systems during major projects such as the consolidation of 2G/3G networks. If are such implementations necessary, then it is essential to deliver a system that provides at least the same functionality as the original system should, retain all the necessary outputs and reports (e.g. NetCracker lacks a single coherent planning view) and simplify the usage.
- IT is necessary to ensure already existing interfaces and to deliver new ones between systems, thereby avoiding the need to enter the same data more times in two or more different systems.

- System responses must be quick. It is not acceptable if the work in the system outbalances the real expert work. The systems are intended to serve as support tools, they are not allowed to use majority of users working hours.
- Detailed user documentation must be also supplied by all implementation projects; it must at least provide information how to operate the system, which data are required, in what format and why it should be entered.
- The basic question is, whether the implementation of packaged products from reputable SW vendors with a high degree of customization is really so much more convenient than in-house developed, precisely tailored and perfected over the years ones. And furthermore, if it is indeed high productivity advantage for specialized applications of multi-tier architecture, whether it is necessary to always insist on thin-client (web based) application instead of thick-one (fat client). Ease of maintenance, development and system expandability should be always compared with the usability from a user perspective, with comfort and/or user response on the other hand.
- Change management process in TMCZ should be simpler and shorter. Time for delivery minor modifications, extensions or new application reports should be considerably shorter.

4.2.1.2 Data exchange

A special chapter must be paid to supporting tools and processes to exchange data between TMCZ and O2. From the RAN planning perspective it concerns mainly so called D1 data set that is mandatory, and no consolidation can be done without that at all (information about the consolidated areas, sites, sectors and cells including all radio parameters).

We have to admit that the preparation of these tools and processes was absolutely underestimated on the TMCZ side. The application was delivered with a delay, with a limited functionality, and that was even not fully functional. Although it should work automatically, then all exchanges of data were performed manually with a significant intervention of people from IT, suppliers and from RAN planning team. Obviously introduction of many errors and data inconsistencies was caused by that, e.g. the data was not replicated correctly, sites information was sometimes duplicated, some plans were not approved and the configuration items were not promoted to the incident management system and others.

However, on the O2 side problems were observed, too. As same as TMCZ, O2 quite often provided TMCZ with an incorrect or incomplete data. As a major problem but we could see that the scope of the exchanged data, as of the direction from TMCZ to O2, as well as from O2 to TMCZ, was completely defined by TMCZ. This led to disproportionate delays or even some data was not delivered at all, which was found too late, closely to NDN or even based on customer complaints.

- The key processes, systems and/or applications must be thoroughly analyzed, must be discussed with all interested in stakeholders, must be described in detail and these documents must be approved prior to implementation. IT experts must use their empathy and be able to recognize and understand even imperfectly specified requirements. Before deploying applications into production of course an intensive testing must be done.
- The time to develop and deliver software should be noticeably shorter. Promised dates must be kept.

4.2.1.3 Other internal issues

Trial clearly showed that outsourcing of planning team was not a lucky decision. Several specific mistakes and problems in delivery are itemized deeply in the chapter devoted to problems with Huawei planning; only problem with the responsibilities split, accountability for outcomes and the possibility to control the planning processes is discussed here.

Huawei planning as a separate entity from TMCZ is not bound by any binding regarding delivery dates; RAN planning failed to change this setting. Acceptance team was cancelled in past, control should only

be performed at random. But the question is, how objectively planning outputs can be monitored and verified by RAN planning quality team. Such an arrangement has been introduced by Vltava project.

There exists another way how to manage better and control an external planning entity here. A complete outputs check must be done, which is of course very difficult and requires a lot of internal resources, and even with all the effort cannot treat any errors, but only the formal ones or only that visible at a first sight. Although this approach is far better than the one mentioned in chapter above, responsibility for planning is still very controversial and difficult.

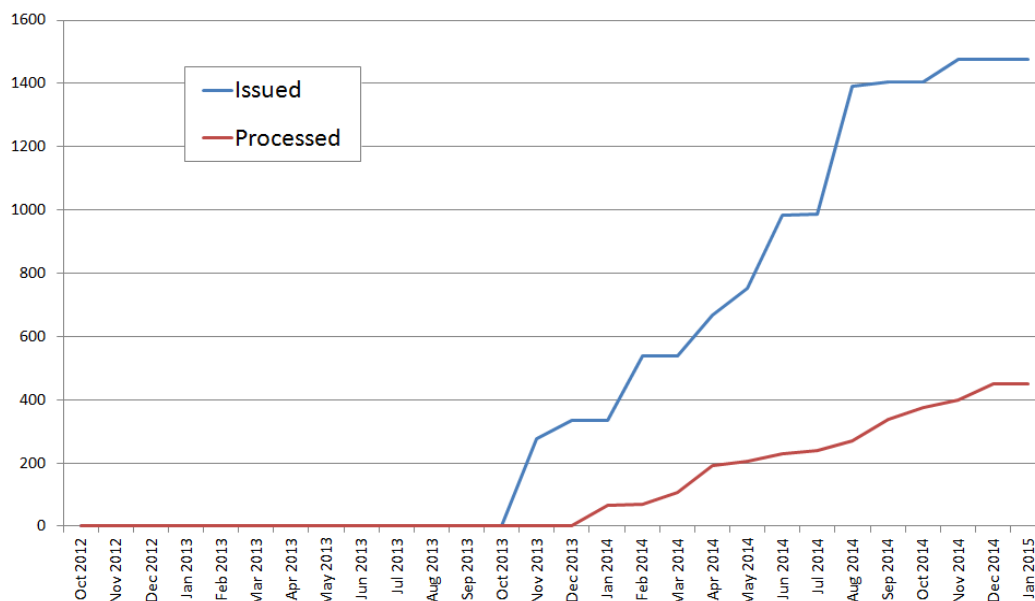
- If a full responsibility for any action (here, specifically planning) is required, then this action must be managed internally, or must be allowed 100% inspection and given the power to control external team members and to make decisions, too. There are no internal resources available to perform 100% quality check at this moment.

4.2.2 Huawei planning problems

Cooperation with Huawei Planning (HuaP) has been very complicated. Difficult communication and inability to control leads to many problems that occurred during the trial, and appear to continue throughout the whole Checker project:

- The new requirements or changes are communicated very slowly, reaction rates and projection of it in outputs occurs with disproportionate delay
- HuaP fails to comply with the terms, certain deliverables occur with a lag, the terms are not binding, earlier delivery cannot be enforced
- HuaP fails to keep the TMCZ planning principles (i.e. the rules, how to plan the access network, which antenna to select, which parameters to set and to what values, how to deal with common situations)
- HuaP does not exhibit responsibility for the overall result, separately works on isolated sites, does not come with suggestions, waits for solution design provided by TMCZ
- In the spring 2014 HuaP signaled a lack of resources, so the preplanning of Common Grid was transferred to internal NM team. Order towards Huawei has been cancelled; denominated savings is approx. 8 million CZK. The lack of resources is probably still responsible for increasing delay, which is evident in the graph of orders processed over all issued ones

Number of issued and processed tasks



- HuaP has not understood the split between preplanning (done by NM team) and the planning, or successfully denies it. Even though the HuaP is paid for planning, HuaP does not fully provide TMCZ with that what is the scope of the planning package.
- Neighbour planning is not perfect. The number of initial handovers is small, some intersystem ones are missing. This reflects the inexperience of some HuaP newcomers and lack of their regional knowledge.
- HuaP does not comply with the regional competence and planners' knowledge required by TMCZ.
- HuaP does not reflect on repeated complaints and criticisms. Does not learn from any mistakes, no information is shared.
- Huawei is not capable enough to motivate their employees, leaving experienced planners take out the know-how to the competition. The newcomers are not able to deliver the expected quality of outputs.

Confidence in HuaP proclaimed by TMCZ management is no more acceptable while there is any chance how to check and measure its performance and where only some build KPIs can be used here.

- The only solution of this situation could be insourcing of planning back to TMCZ or any other form of direct tasking and management performed by TMCZ. Streamline and accelerate communication, together with the transfer of responsibility is a prerequisite for any success.
- Neighbour planning requires a thorough revision in NM team, the more effective direct planning in the NM team without any further checks is under consideration

4.2.3 O2 planning related problems

Our current partner in the consolidation project has developed his unique planning procedures and practices while building its network for many years. As same as the TMCZ did. It should be no surprise that O2 radio planning (hereinafter O2P) challenges some TMCZ RAN planning approaches now.

Many of the O2 principles is not formalized in any way from the perspective of TMCZ and is not under comparable control, which should be (and actually it is) demonstrated by a lower quality of their network.

RAN planning challenged these problems during the project:

- Within the consolidation O2P went on planning principles presented by TMCZ, however, has problems with their actual compliance. Non-compliance loose angles (optimization of the network in the future at no additional cost could be complicated or even impossible), incorrect tilt settings (cell broadcast far and lead to unwanted interferences), unusual inter-sector angles (adjacent sectors are too intertwined) belongs to the most often unacceptable results
- O2P repeatedly got into trouble with resources. Substantial shift in the delivery date of Common Grid was caused by that (originally planned in September 2014, now to be finished in January 2015). Some O2P employees prosecute to deliver outputs on time, ignore common agreements, do not participate in appointments.
- Amount of shared data and information is not enough - In addition to the raw planning data contained in Dx files more information should be exchanged as much as possible, e.g. about the history of sites, their limitations (conservationists, authorities, owners), technical documents (minutes of surveys, SARs), still photos, site books (esp. containing information how to reach the site), etc.
- O2P claimed one missing sector covering its key customer shortly after NDN (HKPRE). Although presented by TMCZ detailed analysis the current configuration is optimal and negotiated for a long time, in the end O2 asked TMCZ for turning this sector on again.
- O2P elegantly rid of its age-old problem with the site in the center of Hradec Králové (HKVEZ). Despite of TMCZ defiance this inextensible and unpromising site was included in the Common grid. TMCZ will now have to deal with its complicated reimbursement (difficult acquisition)

- Some O2 built sites differ from their plans based on several on-site checks performed. Planning data were obtained using data D1 interchange. It is not clear whether it is a coincidence, the only exception, or whether it is the much bigger problem.
- Communication and information sharing between TMCZ and O2 would be even easier if the site names use the same naming convention, and if it is possible to share a common database of radio parameters, same planning tools and processes.

For these problems and lessons learned thus follows:

- Both planning teams must continuously evolve their effort to respect the agreed planning principles. They were repeatedly presented and adopted recently at a joint workshop with representatives of TMCZ, O2 and Huawei planning after the Trial.
- It is required to communicate deep to the lowest levels, planners need to exchange as much information and documentation as possible.
- A common agreement that should solve problems for possibly missing coverage areas in advance was done. No later than two months before the NDN planning data will be exchanged using D0 format and the design will be mutually approved, final configuration of all the shared sites in the network will be fixed. Potential supplementary coverage will be delivered by small or nano cell solutions.
- Despite of the declared project partnership is no doubt that we remain competitive companies. The main RAN planning task is to effectively prevent all odds and unfairness.
- A full consistent check of all sites in the Trial is required: what was planned, actually built, configured, and finally switched on-air will be examined.
- An ideal solution for consolidation would be to create a joint venture company

chapter author: Petr Olšovský

4.3 Capacity planning and DCS1800

There were 1TRX cells (all O2 sites) and vast majority were overloaded. An agreement was made in order to remove the overload - minimum 2TRX per operator/cell across the whole network.

4.3.1 Single DCS cells

All single band cells shall be dismantled. An exception may be on the borders (O2 shall give an estimation, T-Mobile has no extra requirements) and some quality cells – such cells have to be prepared to be switched to 900MHz band (e.g. HKCHL cell in the trial area).

4.3.2 Dual cell sites 900/1800 MHz with single BCCH

All cells in the trial are installed with max. 4 TRX. Therefore capacity can be covered by GSM900 TRXs and DCS can be dismantled.

1. If, once, the site is rebuilt (change of rack, antenna place is needed, etc.) all TRXs shall be equipped with MRFUD (4TRX per operator)
2. Low cost solution: if there is no need to change the cabinets, antenna, the old DRFU 900/1800 can cope with all the traffic (e.g. 2 TRX 900MHz + 2 TRX 1800MHz per operator). HW modernization may be postponed assuming traffic migration to 3G, LTE.

DCS layer are allowed to be planned based on real traffic needs – the verification shall happen after consolidation. This will secure that the investments will be justified.

chapter author: Petr Hobza

4.4 RAN Acquisition

Acquisition activities comprise two main parts

- a) preparation of documentation which defines part of real estates which will be affected by the technology of consolidated base stations
- b) re-negotiation of existing contracts

Target of the activity is divided into two main goals

- a) conclude sharing contracts
- b) achieve savings on rents

An assumption and expectation were to conclude sharing contracts in the shortest possible time and achieve savings (required by management). **Expected time to conclude contracts were 6 months as a maximum assuming 30% discount from the original rent.** Due to fact that real estates will be used by both Parties, above required conditions resulted into several complications:

- at problematic locations the negotiations may last up to 12 months
- achieved discount were lower than expected

Suggested solutions: careful selection of locations where the consolidation may be realized by reusing an existing contract as well as a compromise on target savings.

Acquisition data from Trial:

Owner	Number of sites in Trial	Sharing contract concluded	Achieved discount
T-Mobile	82	56 of 82 (localities realized on existing contracts)	81000 CZK of yearly rent (avg. 1500 CZK per site - 2,2%)

chapter author: Luděk Seidler

5 Finance

5.1 Site Dismantle

It is necessary to analyze the shutdown of sites first and to determine when the deinstallation is possible to begin. A procedure, which starts 4 weeks before NDN, was developed to deal with it. Attributes, such as CS solution, optics, notice period, the amount of rent, etc. are taken into account. Consequently tasks for the release of site dismantle are sent to HUAWEI.

In HK + PU there were 69 sites for shutdown. Currently (as of end of January 2015) there are 30 tasks submitted to SD. Dismantling of the cluster HK + PU will be done by HUAWEI. Currently (01/2015) TMCZ is preparing a tender to seek a vendor for providing site dismantle due to an objective concern that Huawei may not be able to handle the anticipated volume of site dismantle in other clusters. It is also due to the cost which is currently too high.

It is also necessary to adjust the issuing of the technology dismantle projects into individual technologies on sites so that OFF sites in database would not contain technology "OnAir".

An important chapter in the project checker was the reciprocal re-sale of HW. This proved to be so administratively complicated that in other clusters we will be re-selling only the antenna system. This will have a negative impact on logistics.

In order to be able to use HW from shutdown sites, which we need to consolidate more flexibly, we proceeded to use the so-called direct relocation. We will have to take measures so that HUAWEI supplies the required data in time and in required quality. HUAWEI supplied the data very late and in poor quality for the trial.

chapter author: Pavel Šibrava

6 Construction

6.1 Standard Review

Basically there are no fundamental site standard modifications required. Trial showed no need to modify agreed standards (active, passive). For sure, there will be some development in the future however in these days there is no need for that.

The battery backup and PSU according to agreed standard were not applied within trial area during the consolidation. It has been agreed to implement it within trial cluster after the consolidation (i.e. till May 2015). From 2015 onwards all consolidated sites shall reflect the standard for battery and PSU before NDN will start.

chapter author: Josef Trojan, Josef Majer, Luděk Seidler

7 Conclusion

Findings (Top 8)

- Quality impact:** The quality of delivery of our partners, i.e. Huawei and O2, is NOT at expected level!
 - Huawei:** Vast majority of consolidated site within the cluster were built incorrectly (i.e. not in line with valid SD documentation) – **wrong antenna tilt/azimuth, crossed sectors etc.**
 - O2:** missing Dx data, not finished site grid (“svatá tabulka”) and also O2 has had a problem to follow already AGREED rules and principles.
Real quality impact of such build delivery mistakes is described in chapter 2.3.5
- Cost&Quality impact:** **The consolidation factor 60% seems NOT to be sufficient.** Hradec Králové cluster is being operated at 62% consolidation factor. Higher consolidation factor requires more sites in the grid, i.e. higher cost needed (site rent, technology, ...).
- Cost impact:** Reciprocal HW re-sale (as agreed within Checker contract) is NOT possible due to O2 administrative problem (only antenna system will be resold). **This will have a negative impact on logistics and also Checker business case** (higher cost required to deinstall O2 HW at own cost and install new T-Mobile HW).
- Cost impact:** Site Acquisition within HK cluster delivered 2% savings compared to original site rent. The “savings” do NOT meet required target defined by management, i.e. to save 30% compared to original site rent.
- Quality impact:** In average there is both 2G and 3G gain visible however **certain places suffer from high signal loss.** This finding is in line what was anticipated before the clusters were consolidated. Certain signal loss cannot be improved because **there is no appropriate site nearby.** This may lead to customer complaints (e.g. director of IKEM who complained as soon as we consolidated 1st 3G site – complaints were legitimate – 3G signal disappeared because of missing 3G site).
- Quality impact:** **All 100% (and that means really all sites, not only 90 or 95%) sites** shall be secured for the consolidation otherwise it is very difficult to consolidate such clusters.
- Quality impact:** **Site naming convention (OSS site names) does not follow the mutual agreement** between the Parties. In other words, O2 does not follow the convention contrary to T-Mobile. It is mandatory to AGREE and also to FOLLOW unified site naming convention.
- Quality impact:** T-Mobile cannot use Vodafone towers to house the technology. This may influence and influences to deliver 100% sites per agreed site grid.

Learning

- There is NOT sufficient acceptance process at TMCZ side** which naturally leads to planning and build supply quality issues. Random checks at several O2/T-Mobile locations showed a high error rate in comparison with the site documentation or with the network inventory data. **More intensive acceptance check is required to keep the quality at acceptable level!**
- IT tools, **i.e. NetCracker and T-Mobile – O2 B2B GW**, were supposed to be delivered on the 1st of August 2014 however current official date for the Tools delivery is September 9th, 2015 (**slipped more than one year**).

3. **It is feasible to bring 80 sites On-Air up per NDN** however the contractors shall follow all agreed milestones otherwise the figure above cannot be guaranteed.
4. **It is mandatory to check each and every transmission line which will be impacted by the consolidation before NDN starts** otherwise we might face a “dead” line. This would lead to serious problems during NDN (e.g. there were 6 transmission lines during trial NDN).
5. **It is highly necessary to prevent not homogeneous consolidation** (islands of non consolidated sites within the cluster) and to prevent boarder between master & visitor from populated areas.

OTHER

- 3G Data Call Setup Success Rate at Pardubice region (O2 Master) didn't fulfilled SLA target however this is caused due to wrong parameter settings and/or capacity problems. This can be justified since T-Mobile personnel must learn 3G Huawei technology first (the learning comes as “learning by doing”). Other clusters are expected to follow agreed SLA KPI due to gathered knowledge from the first cluster Pardubice (see chapter 2.1, 2.2).
- Number of the complaints does not exceed 35 cases per month and per the cluster. This amount is comparable to the situation prior the consolidation project. However the number of the complaints in the cluster Pardubice is several times larger than in the cluster Hradec Králové which may indicate that in the Pardubice cluster is a network of a lower quality. T-Mobile has decided to build 2G unilateral sites prior to NDN in order to minimize expected signal loss in certain region places (this decision is valid for Bohemia only. Moravia shall be also considered – to be decided at later stage). See chapter 2.4.
- Incident Management final is not functional yet - **TT exchange between T-Mobile and O2 is based on email communication of maintenance center specialists**. Configuration management is also not fully functional. Configuration items are not properly updated due to incomplete data in NetCracker (see chapter 3.1.)
- There are certain site revisions required by Czech law (e.g. electro revisions, lightning revisions etc.). It is mandatory to exchange original site revision documents (for given cross-site) in order to define the extent of revisions. If the Party will not receive those documents, Party will not be able to define the extent and perform required site revision - a penalty may be applied by the legal authorities (see chapter 3.5).
- Site Book - tools which are supposed to automatically synchronize all site details do NOT work and Huawei staff have problems with a manual update (i.e. time constraints, difficult seeking of the details, ...). See chapter 3.2.
- Site dismantle tender is being triggered in order to both minimize dismantle cost and also due to anticipation that Huawei would not handle such a high volume of sites to dismantle (see chapter 5.1).
- Huawei planning resources were insufficient yielding into visible delay in deliveries. The trend of processed tasks does not follow TMCZ demands. O2 repeatedly got into trouble with resources, too. See chapter 4.2.

STESKY OTCE VLASTI

It is clear the network which has been developed and optimized for many years cannot be rebuilt within only several months and provide the same qualitative parameters in compare to the original network.

chapter author: Miloslav Pejchal